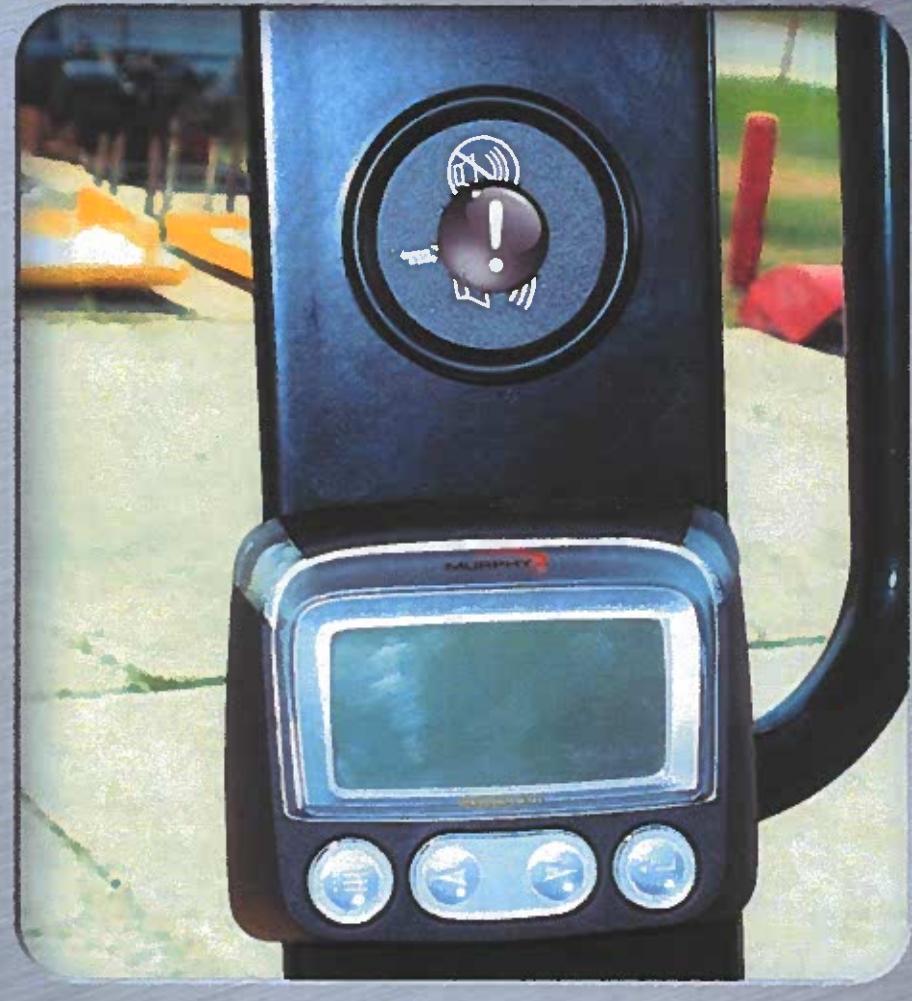


Instrumentation

Audible Alarm

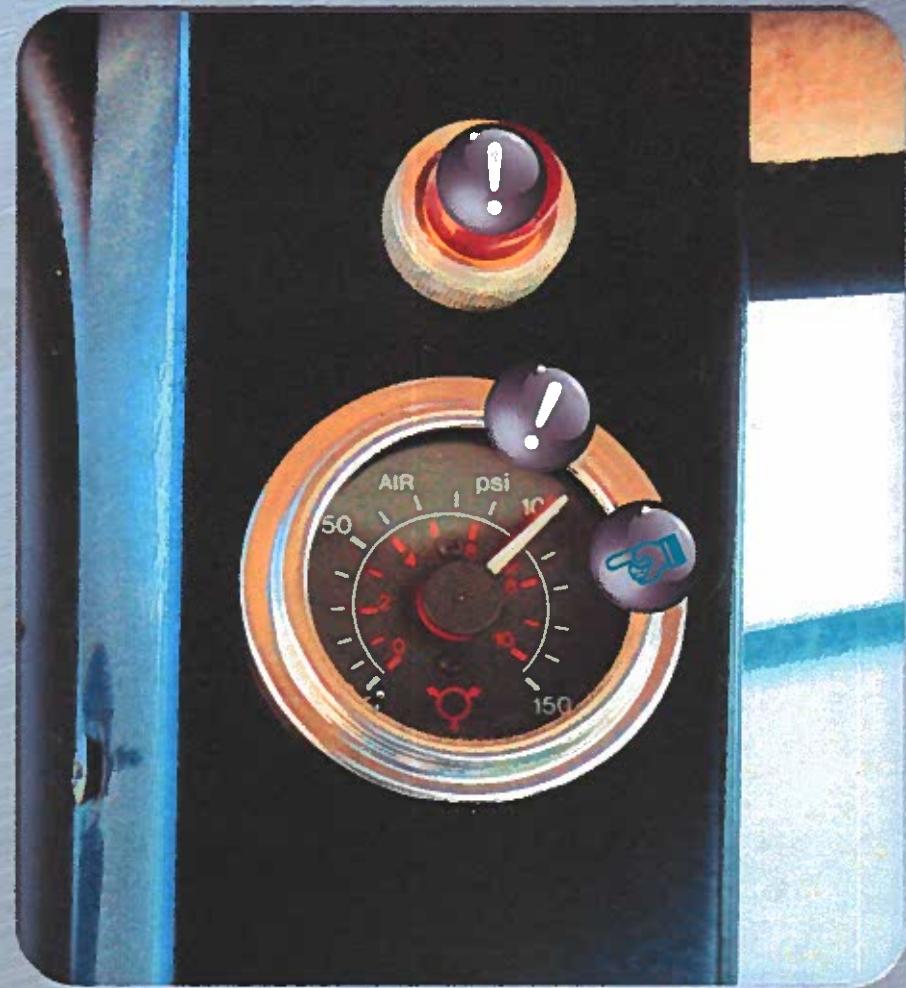
- Audible alarm sounds when the Murphy panel detects a fault.
- The operator may have to scroll through various Murphy panel screens for the details about the alarm.



Instrumentation

Dual Air Pressure Gauge

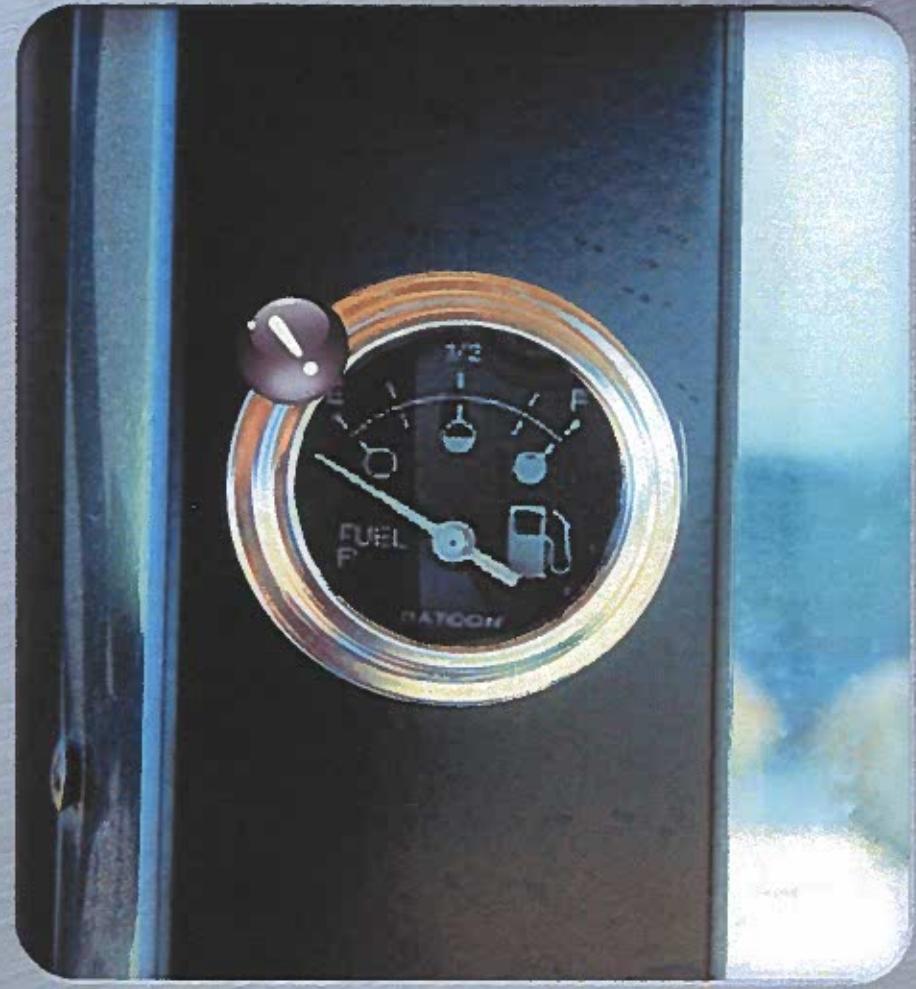
- Indicates the air pressure in the brake system.
- Low Air Pressure Light indicates when the air pressure is under 65 psi (4.5 bar), buzzer also sounds.
- Dual Air Pressure Gauge minimum 90 psi (6.2 bar)
- Normal 110 to 125 psi, (7.5 bar to 8.2 bar)
- Green – front system.
- Red – rear system.



Instrumentation

Fuel Level Gauge

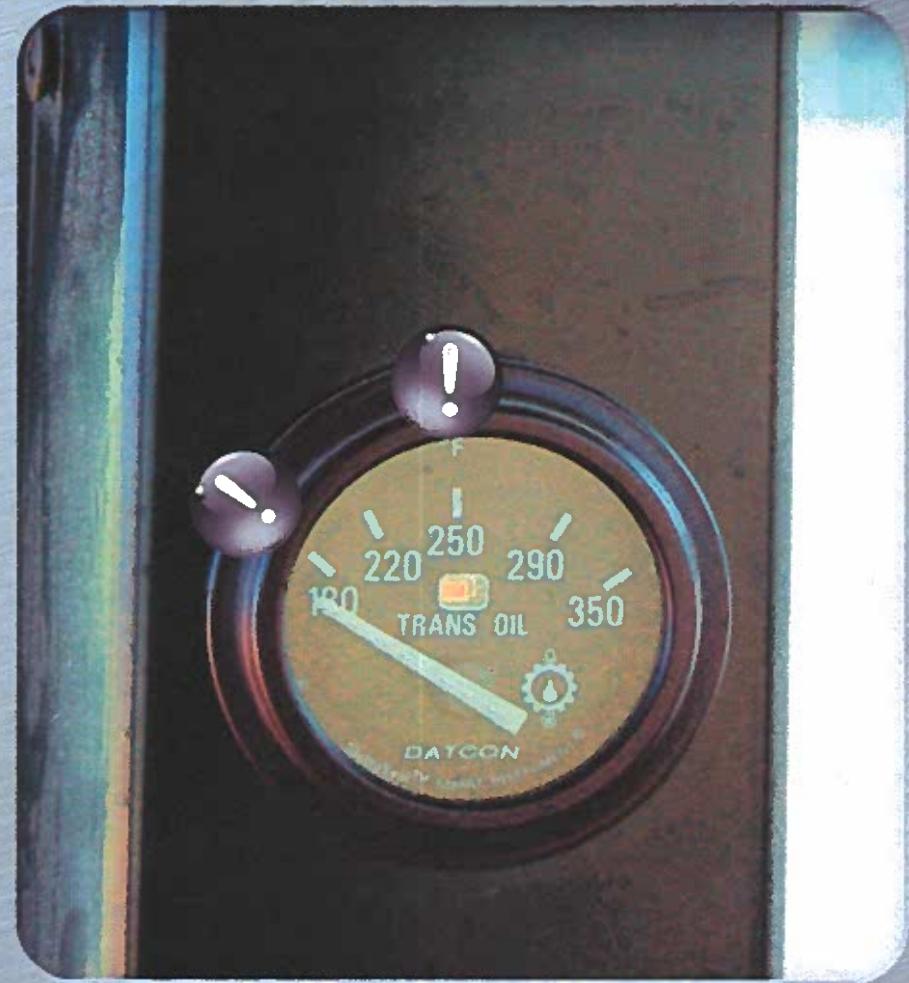
- Indicates the amount of fuel in the tanks.
- E doesn't mean enough.



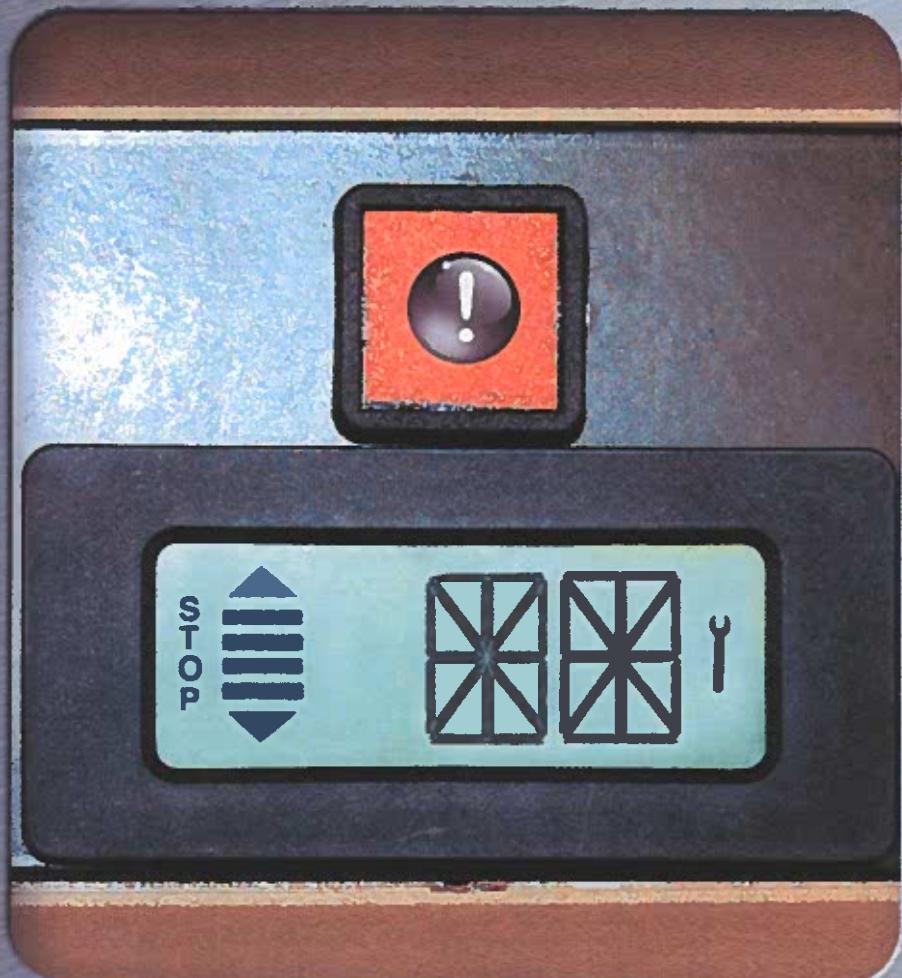
Instrumentation

Transmission Oil Temp Gauge

- Indicates the transmission oil temperature.
- Minimum is 140° F (60° C)
- Operating is 150° F (65° C)
- Maximum is 212° F (100° C)
- Exception is 248° F (120° C)
for 5 minutes only!



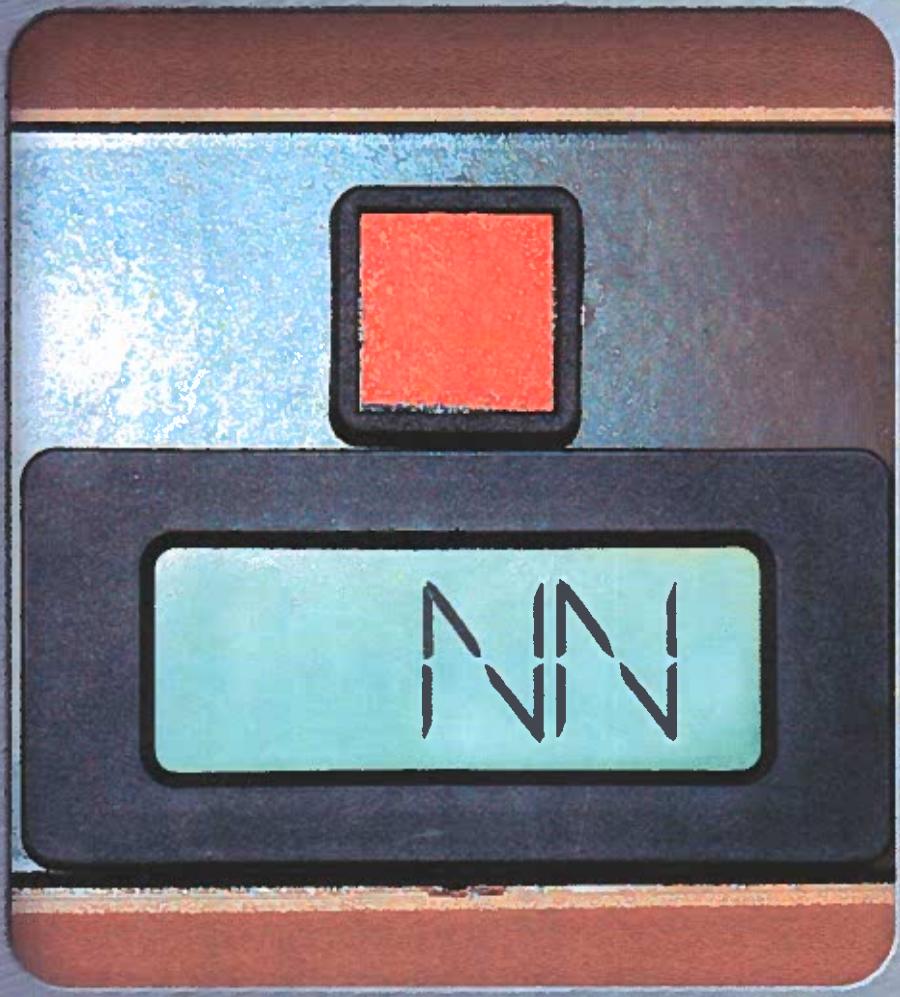
Instrumentation



ZF Display

- Indicates the transmission gear selection, travel direction and service codes.
- If the Check Transmission Light does not come on during the bulb test, or stays on, or comes on during operation a fault code exists in the system.
- Stop the vehicle as soon as possible, do not restart until the fault has been corrected!

Instrumentation



ZF Display

- Not Neutral
- Neutral
- Low Oil Temp
- Automatic Forward
- Manual Forward



Operation



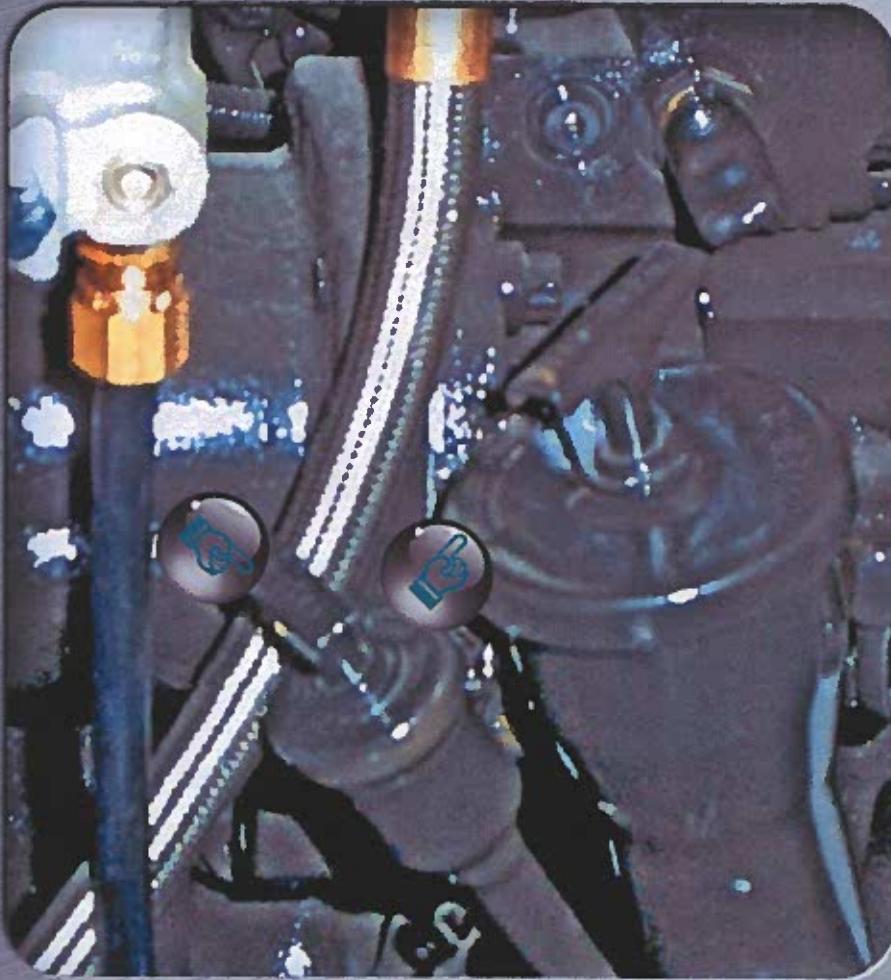
Operation – Daily Checks



Walk Around

- Walk around the vehicle checking for;
- Fluid leaks
- Loose wheels and tire pressure
- Body damage

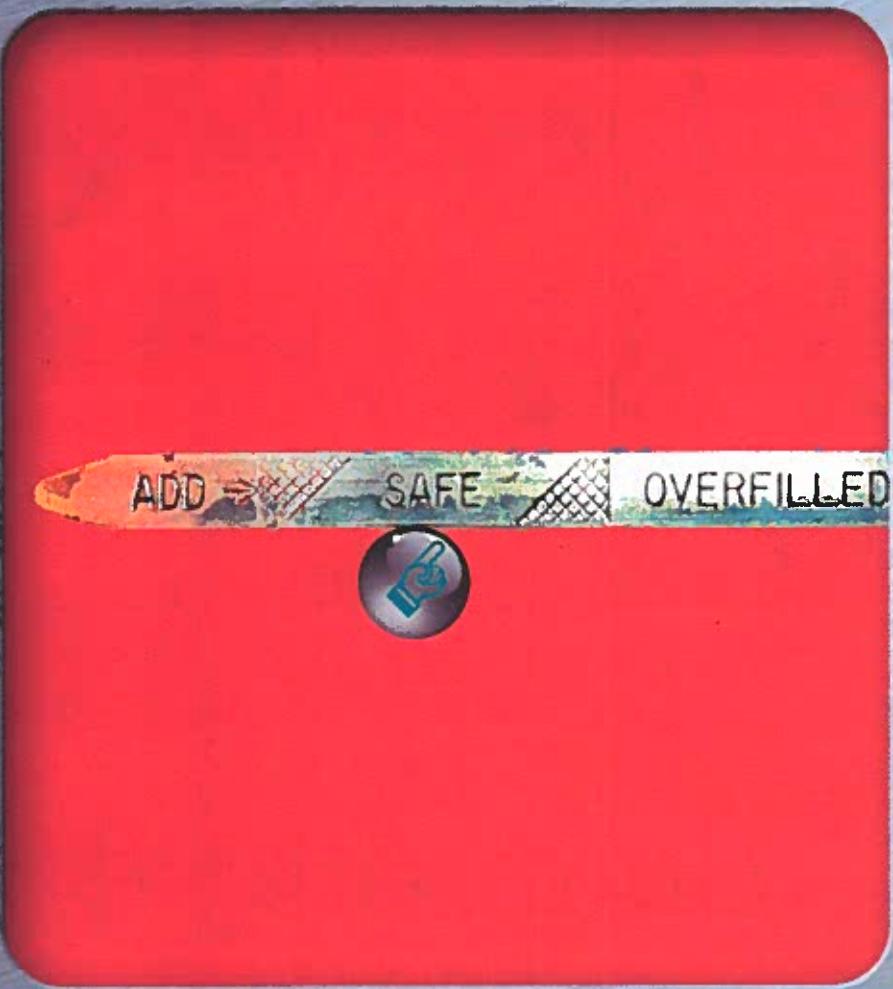
Operation – Daily Checks



Engine Oil Level

- Check the engine oil level after the engine has stopped for 20 minutes.
- This allows enough time for the oil to drain back into the oil pan.
- Remove the dipstick, wipe it clean, then reinsert fully.
- Remove the dipstick again and check the oil level reading.

Operation – Daily Checks



Engine Oil Level

- The oil level should be in the safe crosshatched area on the dipstick.
- If the oil level is low, add the correct grade of oil through the oil fill tube.
- Add sufficient amount of oil to bring the level up to the top of the crosshatched area.

Operation – Daily Checks



Fuel/Water Separator

- The unit is located on the left hand frame rail.
- Open the drain valve thumb screw to drain any water accumulation.
- Rotate the knurled screw counter clockwise to open valve, clockwise to close.

Operation – Daily Checks



Fuel/Water Separator

- Do not drain an excessive amount of fuel out or re-priming the fuel system may be required to get engine started.

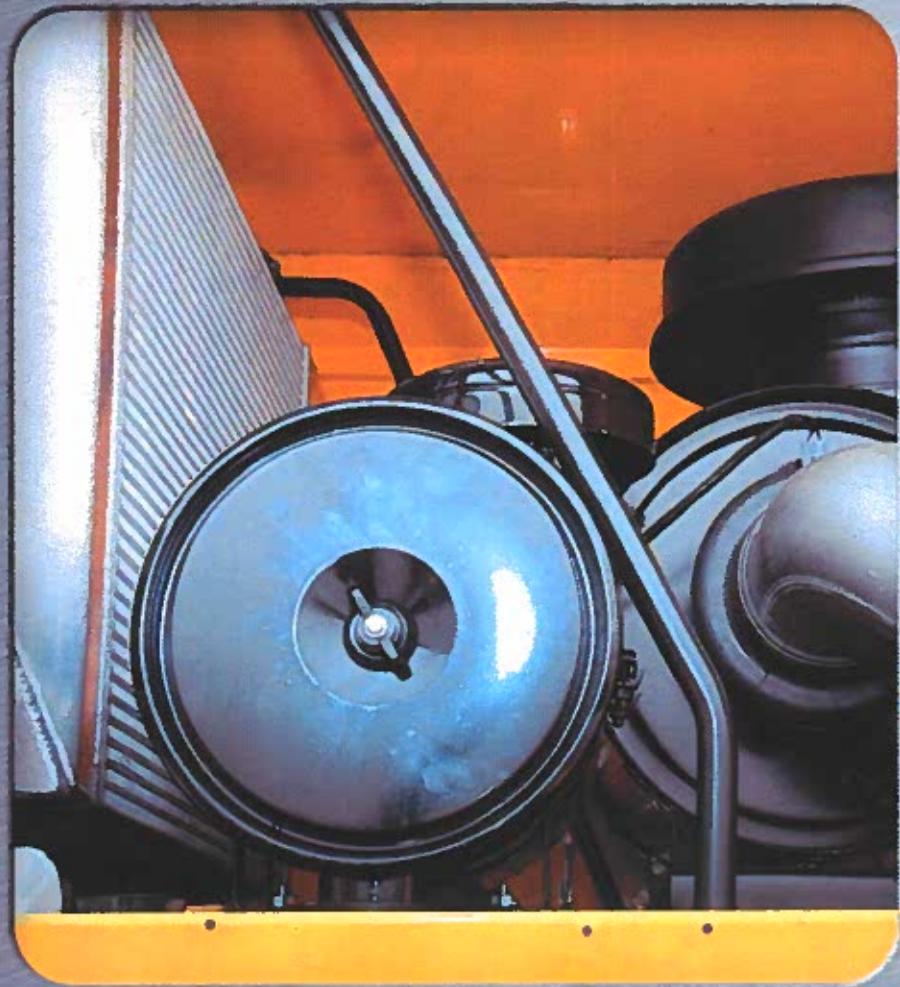
Operation – Daily Checks



Air Intake

- Change the air intake selection when seasons change.
- Select either the appropriate Winter or Summer settings on air cleaner assembly.

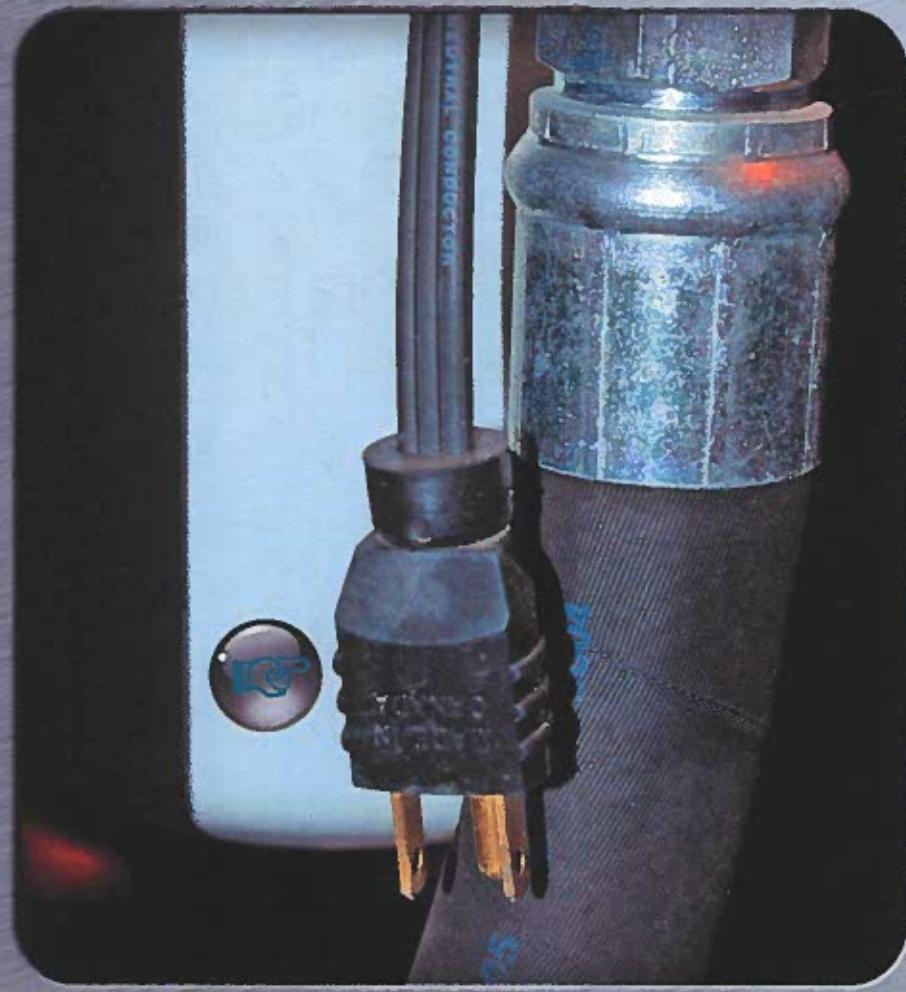
Operation – Daily Checks



Air Cleaner

- Air cleaner is equipped with a dirt ejector valve.
- Squeeze the flaps to eject trapped material.

Operation – Daily Checks



Engine Block Heater

- Plug in the engine block heater when temperature is below 10° F (-12° C).

Operation – Daily Checks

Drive Belt

- Check the drive belts when the engine is stopped.
- Check the drive belt for cracks, frays and damage.
- Drive belt is self tensioning, however they should deflect 1/2 inch (12 mm) when pushed firmly.



Operation – Daily Checks

Drain Air Reservoirs

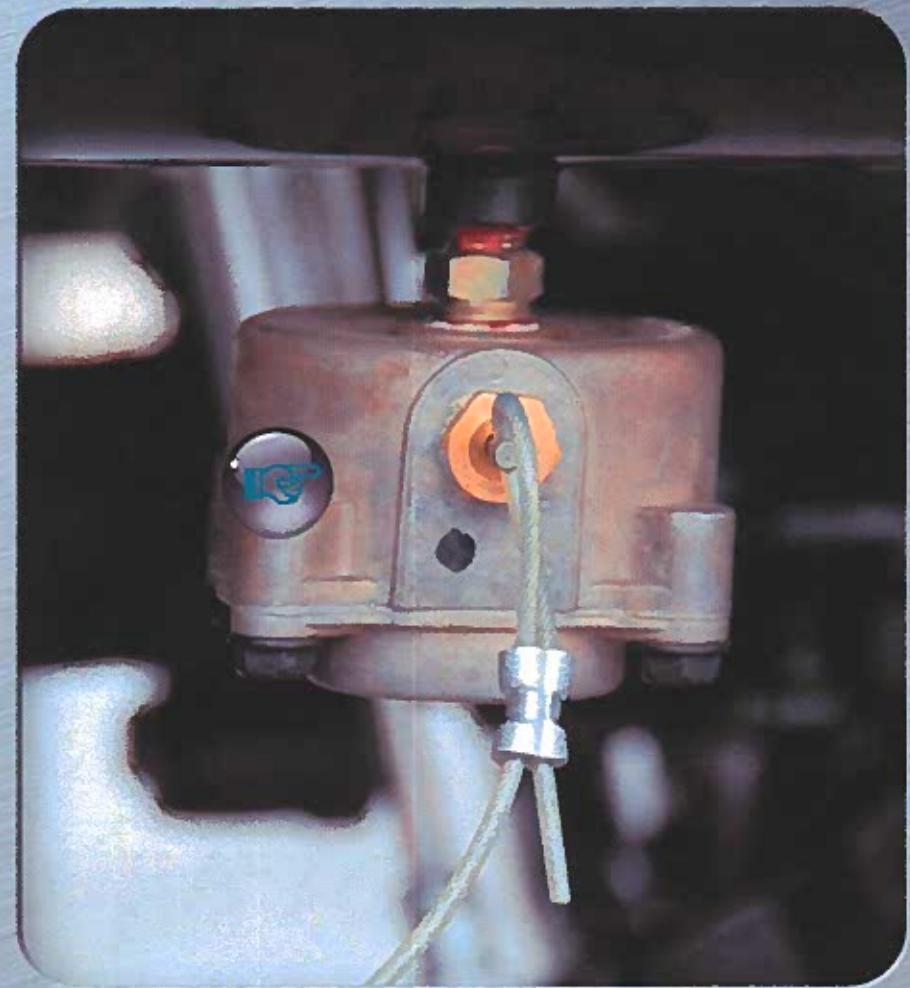
- There are three receivers on the vehicle.
- Two supply tanks are located on the outside of the right frame rail.
- The third tank is located inside the frame, under the cab.



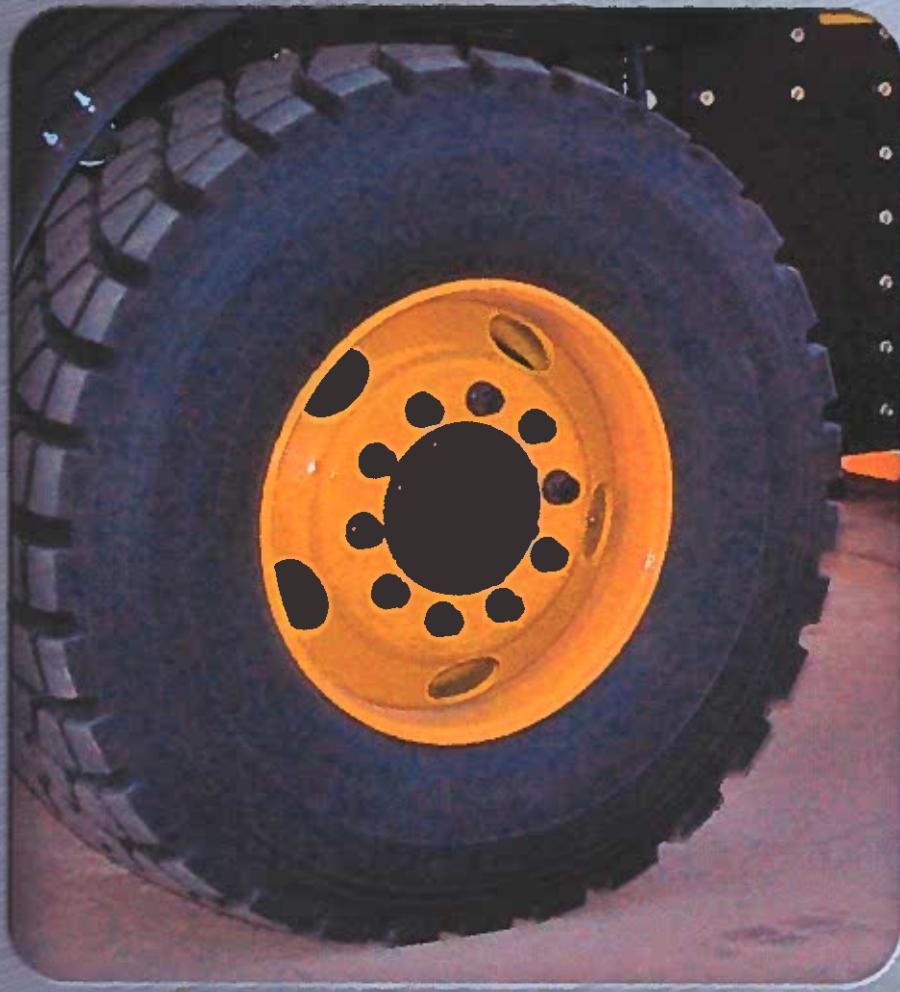
Operation – Daily Checks

Drain Air Reservoirs

- Each tank is equipped with drain valves.
- Drain each reservoir to drain any water accumulation.
- Pull down on each cable to open the valves.



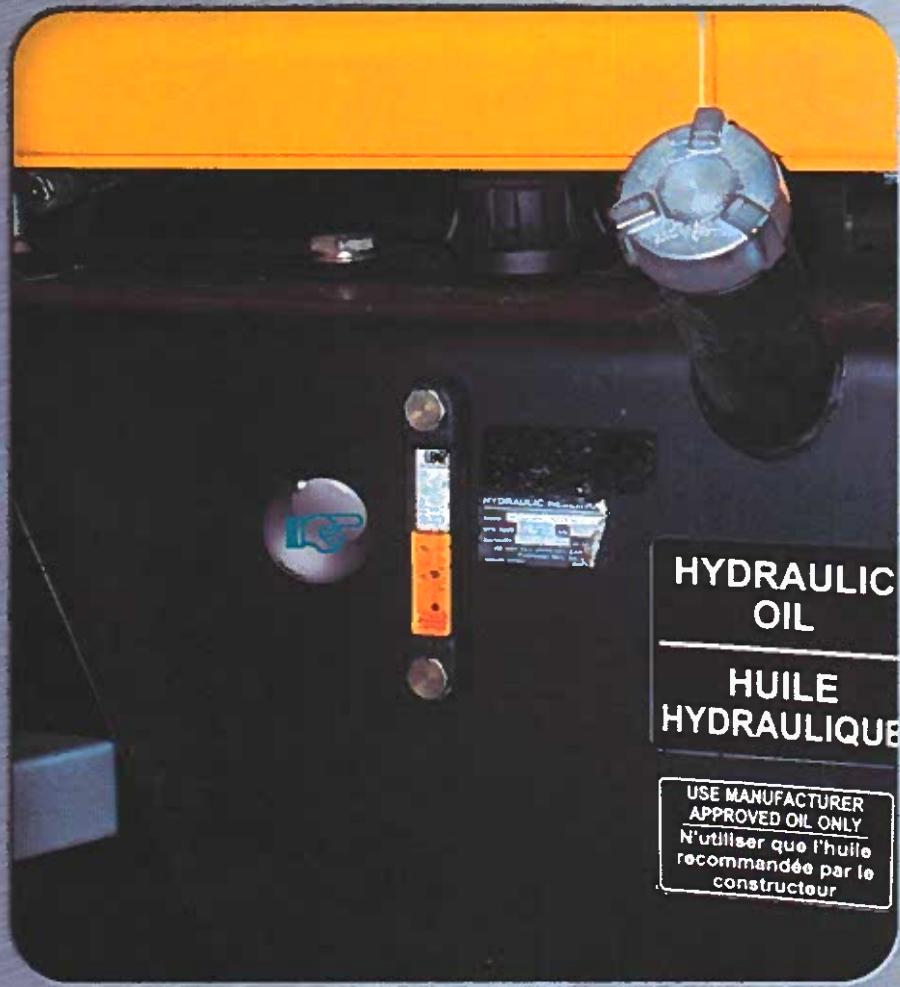
Operation – Daily Checks



Tires & Wheels

- Tire pressure front and rear is 110 psi (7.58 bars).
- Wheel nut torque 450 to 500 ft/lbs (610 to 675 Nm).

Operation – Daily Checks



Hydraulic Oil Level

- The reservoir is located along the left frame.
- Level should be visible in the sight glass near the middle range.
- Cold level is lower than halfway point on the glass. Hot level is higher than halfway point.
- If necessary add hydraulic fluid at the cap.

Operation – Daily Checks



Hydraulic Oil Level

- The sight glass has a built in thermometer.
- This indicates the operating temperature of the hydraulic oil.
- Operating 149° F (65° C)
- Maximum is 180° F (82° C)

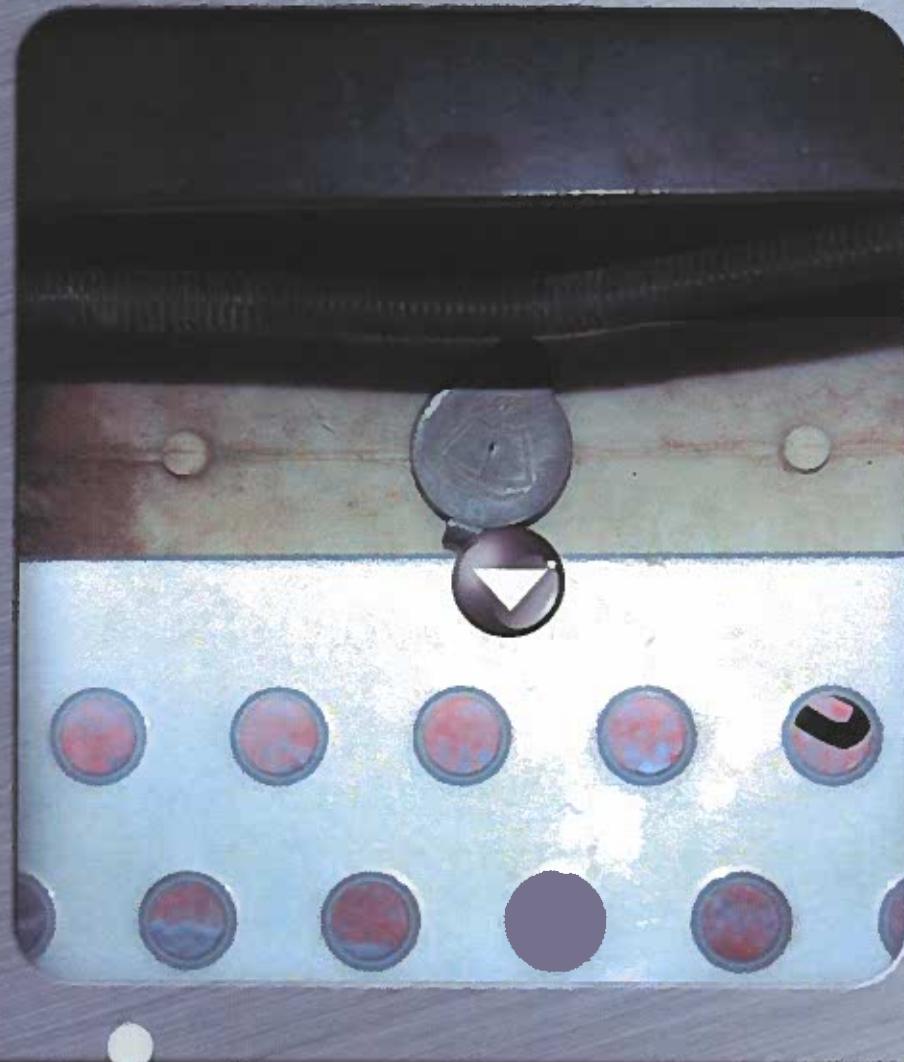
Operation – Daily Checks

Engine Coolant Level

- Inspection point is on top of the engine enclosure.
- Check the coolant level after the engine is stopped for 20 minutes to allow the coolant to cool.
- Remove the cap and check the coolant level.
- Add coolant if the coolant level is lower than one inch below the neck.



Operation – Daily Checks



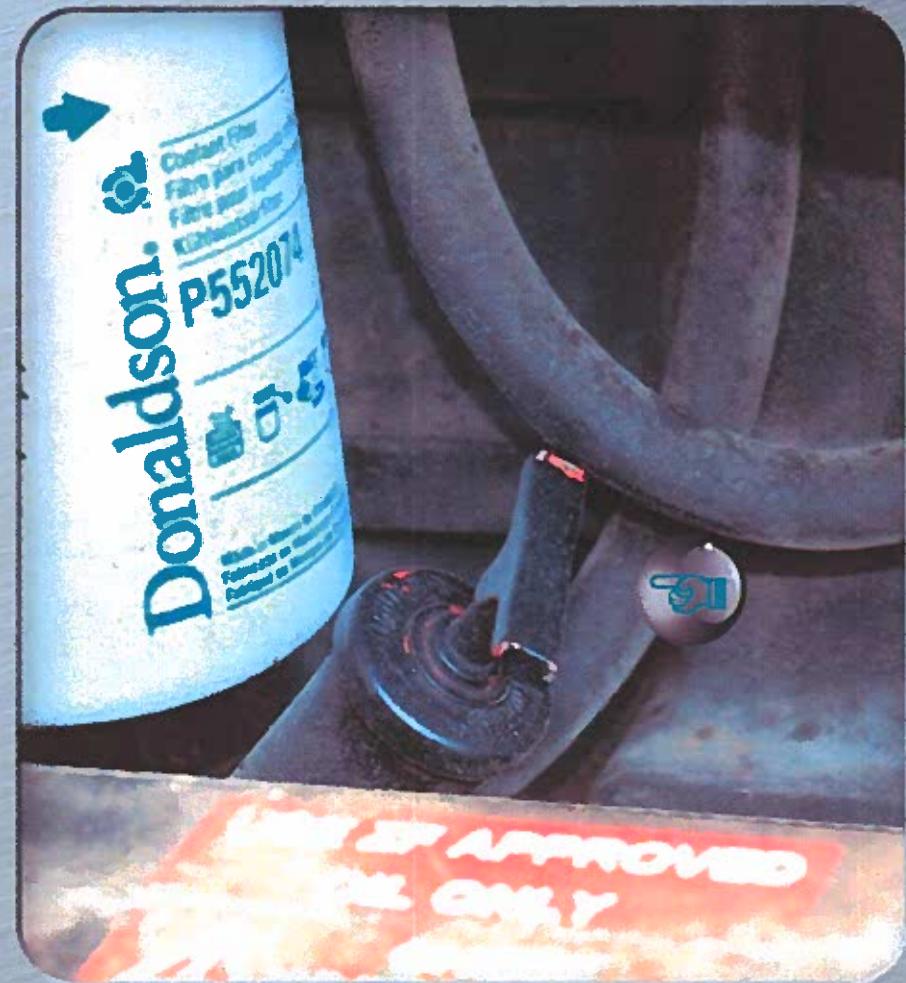
Washer Fluid Level

- The reservoir is located behind the plow push frame below the hinged walkway.
- Raise the walkway to the forward position and visually inspect the washer fluid level.
- To add windshield washer solvent, open the cap.

Operation – Daily Checks

Transmission Oil level

- During the cold start phase, run the engine about 2 – 3 minutes at idling speed.
- Then remove the dipstick, wipe the dipstick clean and reinsert fully, remove the dipstick and check the oil level reading.
- The cold oil level dipstick reading must be near the cold mark.



Operation – Daily Checks

Transmission Oil level

- The hot oil level check must be carried out with the operating temperature between 176° F (80° C) to 194° F (90° C).
- Then remove the dipstick, wipe the dipstick clean and reinsert fully, remove the dipstick and check the oil level reading.
- The hot oil level dipstick reading must be in the hot zone.



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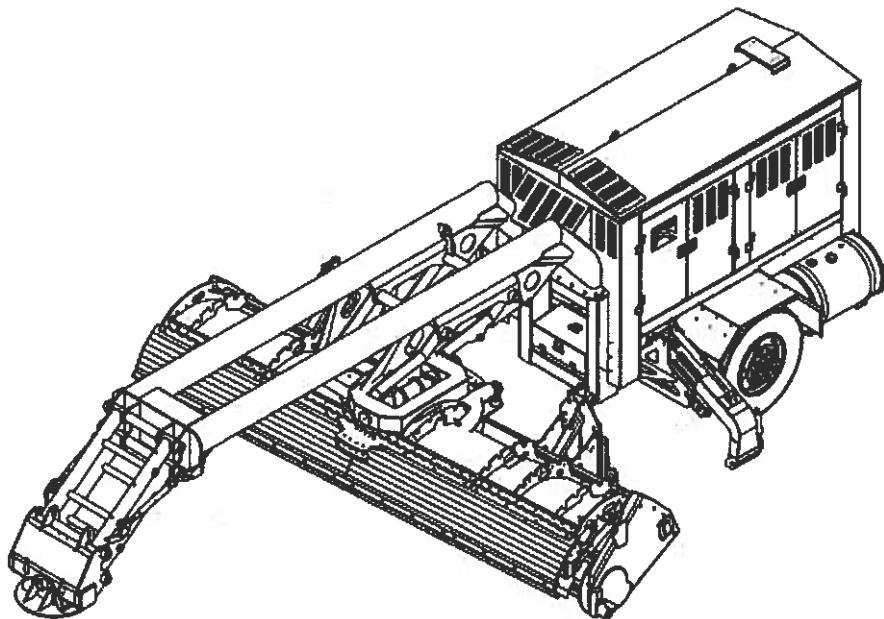
AIRPORT

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MODEL TOW5220 SNO-SAW™ RUNWAY BROOM

OPERATION AND MAINTENANCE MANUAL



ORIGINAL ISSUE
REV —
JANUARY 27, 2011

REVISION HISTORY

Rev	By	Approved	Date	Revision Summary
—	JRJ	CR	January 27, 2011	Initial issue.

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SAFETY NOTES AND WARNINGS

NOTE: Appropriate maintenance methods and operation procedures are required for safe, reliable operation of the unit as well as for the safety of operators and servicing technicians.

This manual provides general and specific directions for the operation of the Wausau Equipment Company, TOW5220 Runway Broom.

AVOID ACCIDENTS

Most accidents, whether they occur in industry, on the farm, at home, or on the highway, are caused by the failure of some individual to follow simple and fundamental safety rules or precautions. For this reason, recognizing the real cause and doing something about it before the accident occurs can prevent most accidents.

Regardless of the care used in the design and construction of any type of equipment, there are many conditions that cannot be completely safe-guarded against without interfering with reasonable accessibility and efficient operation.

A careful operator is the best insurance against an accident. The complete observance of one simple rule would prevent many thousand serious injuries each year. That rule is:

NEVER ATTEMPT TO CLEAN, OIL, OR ADJUST A MACHINE WHILE IT IS IN MOTION.

NATIONAL SAFETY COUNCIL

Wausau Equipment Company, Inc. cannot anticipate every possible circumstance that might involve a potential hazard. Anyone deviating from the instructions provided must first establish that personal safety, system, and/or vehicle integrity is not compromised. Throughout this manual, Dangers, Warnings, Cautions, and Notes provide specific guidelines for the safe and proper operation and service of the equipment.

- **DANGER:** Indicates an imminently hazardous situation, which, if not avoided, **WILL** result in death or serious injury.
 - **WARNING:** Indicates a potentially hazardous situation, which, if not avoided, **COULD** result in death or serious injury.
 - **CAUTION:** Indicates a potentially hazardous situation, which, if not avoided, **MAY** result in minor or moderate injury and property damage. It may also be used to alert against unsafe practices.
 - **NOTE:** Highlights information that is beneficial while following a procedure or to avoid an unwanted situation.

This information is furnished to prevent damage to equipment and/or injury to personnel. Be fully aware of the dangers inherent to heavy equipment operation and snow removal.

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ILLUSTRATIONS

For pictorial clarity, some illustrations in this manual may show shields, guards, or plates open or removed. Under no circumstance should this equipment be operated without these devices securely fastened in place.

PERSONAL SAFETY

- Keep clothing and limbs away from moving parts.

OPERATION SAFETY

WARNING

Equipment operated improperly or by untrained personnel can be dangerous. Familiarize yourself with the location and proper use of all controls. Inexperienced operators should receive instruction from someone familiar with the equipment before being allowed to operate the machine.

Safety is dependent upon the awareness, concern, and prudence of those who operate or service the equipment. Never allow minors to operate any equipment.

- Read and understand all operating manuals pertaining to operation. It is your responsibility to read this manual and all publications associated with this equipment (engine manual, accessories, and attachments). If the operator cannot read English, it is the owner's responsibility to explain the material contained in this manual to them.
- Learn the proper use of the machine, the location and purpose of all the controls and gauges before you operate the equipment. Working with unfamiliar equipment can lead to accidents. Familiarize yourself with the driving and handling of the machine before actually blowing snow. Practice blowing snow in a non-congested area before on-the-job operations.
- Never allow anyone to operate or service the machine or its attachments without proper training and instructions; or while under the influence of alcohol or drugs. Never work on the machine with components running.
- Wear all the necessary protective clothing and personal safety devices to protect your head, eyes, ears, hands, and feet. Operate the machine only in daylight or in good artificial light.
- Inspect the area where the equipment will be used. Beware of overhead obstructions (low tree limbs, electrical wires, etc.) and underground obstacles. Enter a new area cautiously. Stay alert for hidden hazards.
- Never direct discharge of snow toward bystanders, nor allow anyone near the machine while in operation. Be aware of children playing in snow banks. The owner/operator can prevent and is responsible for injuries inflicted to themselves, bystanders, and damage to property.
- Never operate equipment that is not in perfect working order or is without decals, guards, shields, discharge deflectors, or other protective devices securely fastened in place.
- Never disconnect or bypass any switch.

- Carbon monoxide in the exhaust fumes can be fatal when inhaled. Never operate the engine without proper ventilation.
- Fuel is highly flammable, handle with care.
- Keep the engine clean. Allow the engine to cool before storing and always remove the ignition key.
- Always engage parking brake when leaving machine. Always disengage components when leaving the machine.
- Equipment must comply with the latest federal, state, and local requirements when driven or transported on public roads. Check to be certain all lights are functioning, i.e. turn signal, brake lights, head lights, flasher, etc. Check to be certain back up alarm is working.
- Never use your hands to search for oil leaks. Hydraulic fluid under pressure can penetrate the skin and cause serious injury.
- To prevent tipping or loss of control, do not start or stop suddenly; reduce speed when making sharp turns. Use caution when changing direction on slopes.
- Keep legs, arms and body inside the seating compartment while the vehicle is in motion. Always wear seat belts.
- Clean all glass areas (windows and mirrors) for better visibility. Remember to adjust mirrors when you switch seats.
- Never work under machinery without using approved safety supports.
- Use caution when removing objects such as wire, rope, cable, etc.
- Always use extreme caution when backing up.
- Always travel with the air blast system folded within the chassis to avoid accidental damage.

SAFETY DECALS

For safety decals and information not included here refer to the appropriate Appendix (OEM vendor documentation).

▲ CAUTION

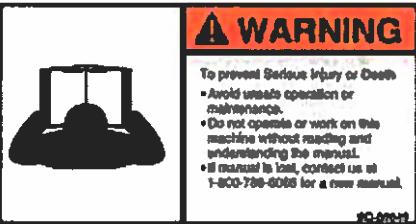
- 1 READ AND UNDERSTAND THE OPERATOR'S MANUAL BEFORE OPERATING.
- 2 DO NOT REMOVE OR MODIFY ANY GUARDS.
- 3 MAKE CERTAIN EVERYONE IS CLEAR BEFORE OPERATING OR MOVING THE MACHINE.
- 4 KEEP HANDS, FERT HAIR AND CLOTHING AWAY FROM MOVING PARTS.
- 5 STOP MACHINE AND LOCKOUT POWER TO ADJUST, SERVICE OR CLEAN.
- 6 EMPTY MACHINE AND LOWER TO TRANSPORT POSITION FOR TRANSPORTING.
- 7 KEEP PEOPLE WELL CLEAR OF WORK AREA.

9C-09868

▲ WARNING



9C-08651



9C-08649



9C-08167

▲ CAUTION



9C-08656

▲ WARNING



9C-08655

ORDERING DECALS

NOTE: If your safety decals are damaged or destroyed, please call us at (800) 788-6066 or (262) 784-6066 and we will provide you with new decals at no charge to you. Use the 9C-XXX part number located in the lower right hand corner of decal or the 9C-XXX number located under the decal, on the left hand side, in this manual.

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SERVICE

Never attempt to clear obstructions or work in broom area while the unit is running. Always stop engine with ignition key off.

Always disconnect battery when:

- Installing new equipment
 - Connecting or disconnecting electrical components
 - Welding
 - Do not use damaged or broken parts
 - Use only authorized parts and components
 - Do not use unapproved lubricants/fluids
 - Cover all exposed openings when removing parts or hoses
 - Do not attempt to remove or disassemble components under pressure (e.g. hydraulic system)
 - A variety of **CAUTION** and **WARNING** labels are located in the cab and on the machine. Operators and service technicians must heed these notices for personal safety and operation.

CAUTION

If a problem occurs, make repairs immediately. Do not continue to operate machine.

By following all instructions in this manual, you will prolong the life of your machine and maintain its maximum efficiency. Adjustments and maintenance should always be performed by a qualified technician. If additional information or service is needed, contact your Wausau Equipment Company, Inc. authorized WAUSAU™ dealer who is kept informed of the latest methods to service this equipment and can provide prompt and efficient service.

DRIVING SAFETY

Observe the following warning to insure maximum performance, avoid equipment damage, and prevent serious personal injury or death.

WARNING

Adding equipment to a vehicle will alter the handling and performance characteristics of the carrier vehicle. These changes may include, but are not limited to, steering, acceptable work and travel speeds, unit weight, center of gravity, fuel consumption, and vehicle wear and tear.

During the original installation, Wausau Equipment Company may install or modify additional equipment to support the broom and air blast units. Any subsequent removal, replacement, or alteration of the unit can result in unpredictable operating characteristics that the Original Equipment Manufacturers of record may not support.

- Do not make sharp turns
- To avoid damage, raise the broom when backing the unit
- Do not exceed 45 mph when sweeping.

It is the operator's responsibility to be familiar with the handling characteristics of the equipment and to discriminate between safe and unsafe practices based on these characteristics and on the environmental conditions at the time of operation.

UNITS INVOLVED IN ACCIDENTS

If a machine is involved in an accident, inspect, and repair it before putting it back into service.

- Replace or repair any damaged parts and components
- Make sure that moving parts are not binding or restricted
- Make sure that attaching hardware is properly fastened and tightened
- Repair any fluid leaks and make sure that fluid levels are full
- Make sure that the broom head and air blast nozzles are free of obstructions

ACRONYMS AND ABBREVIATIONS

The following list contains some of the acronyms and abbreviations used in this manual.

API	American Petroleum Institute
ASTM	American Society of Testing and Materials
°C	Celsius
C.I.D.	Cubic Inch Displacement
ECM	Electronic Control Module
°F	Fahrenheit
FOD	Foreign Objects and Debris
Gal/min	Gallons Per Minute
GVW	Gross Vehicle Weight
Hg	Mercury
hp	Horsepower
km/l	Kilometers Per Liter
kPa	Kilopascal
kph	Kilometer Per Hour
l/min	Liters Per Minute
MPa	Megapascal
mph	Miles Per Hour
Nm	Newton-meter
OEM	Original Equipment Manufacturer
psi	Pounds Per Square Inch
Qts	Quarts
rpm	Revolutions Per Minute
SAE	Society of Automotive Engineers

1. INTRODUCTION

The purpose of this manual is to provide the operator with the information necessary to safely operate this unit. Wausau Equipment Company strongly recommends that personnel thoroughly familiarize themselves with the operation and maintenance information contained in this manual.

Before operating the machine for the first time, sit in the cab and identify the individual controls while reading the description of operation.

Below are brief summaries of the performance data for the broom head:

- Sweeping speed – 0-45 mph (0-72 kph)
- Dual motor end drive – Hydrostatically driven
- Broom speed – 0-720 rpm
- Angles right and left 45° – Electronically controlled stops located at 5 degree increments
- Weight – Centered on frame at all angles
- Side to side oscillation – 8 degrees
- Brush pattern adjustment – Tool-less
- Brush diameters – 46 inch
- Bristles – Poly and/or crimped wire
- Caster tires – 18 x 7 x 8 (16 ply, radials)

Below are brief summaries of the performance data for the trailer:

- Steer axle – 20,000 lbs with ABS air brakes
- Closed loop hydraulic steering – Hitch actuated w/disconnect and auto correct
- Severe duty radial; tires – 315/80R22.5 L
- Hitch – Dual pintle eye or fifth wheel

Below are brief summaries of the performance data for the air blast unit:

- Dual impeller – Left and right hand duct/nozzles
- Air Velocity at nozzle up to 400 mph
- Air Volume at nozzle 22,000 cfm
- Interlocked with broom controls
- Complete sweep path covered by airflow
- Ducts fold in for clearance while transporting
- Minimum of 10 inches of ground clearance required during transport mode

1.1 System Description

The Wausau Equipment Company Towed Runway Broom is built according to the most sophisticated large area clearing techniques. Primary use of the unit is snow removal of up to 3 inches of light snow or 1 inch of slush using a broom attachment. The unit is also used for sweeping Foreign Objects and Debris (FOD) off the runway or tarmac during summer operations. Refer to the appropriate Original Equipment Manufacturer (OEM) documentation, located in the appendices, for operating instructions and information on assemblies not included here.

The unit is powered by a Diesel Engine that provides power for the broom, air blast unit, and hydraulic functions. The broom drive is provided through a hydrostatic system that is driven by infinitely variable flow pumps mounted directly to a two pad pump drive that is mounted to the flywheel housing on the engine. The pumps are controlled electronically from a joystick; located in the operators cab, and control the broom head lift/lower and left/right swing. Two high-speed motors, connected to a planetary reduction gearbox, are mounted within the broom core assembly.

Clearing with the broom is based on a two-stage operation that combines two conventional clearing systems; sweeping, and high speed blowing. The unit has the following main elements:

- Rotating broom incorporating radial wafers (wire and poly) allowing replacement without special tools and maximum efficiency
- Broom suspension with drive motors, slewing and lifting mechanisms
- Operator controlled snow deflector or optional snow shed (dump) hood, automatically adjustable stripper plate, heat exchanger
- High speed air blast unit with right and left hand duct nozzles, and retractable ducts
- Hydraulic adjusting mechanisms and support systems

A separate hydrostatic pump drives the air blast unit with two high speed motors, connected in series. An operator controlled air blast drive disconnect, permits blowing without broom operation. The air blast duct and broom functions (raise, lower, rotate) are hydraulically pressurized from the equipment pump.

1.2 Broom Operation

The broom removes the snow and debris at high speed and directs loose material to the right or left side with the air blast unit. The broom head is driven from the combined flow of two hydrostatic pumps. The combined oil flow is split between two high speed motors connected directly to reduction gear drives. The two high speed motors and reduction gear drives are housed within the end plates of the broom head. The pump and motors are connected with high-pressure hoses to form a closed circuit. The flow of oil, and consequently the rpm of the broom motors, is governed by the piston displacement of the variable pump, which is proportional to the angle of the pump swash plate. The rotation speed of the broom is a variable input that sets the broom speed from 0 to 100% stroke of the pump. This provides a consistent tip speed despite varying bristle length.

1.3 Air Blast Unit Operation

The air blast unit consists of a single or right and left hand impeller assembly that includes outlet ducting and directional nozzles. The impeller assemblies are driven by high speed, closed loop hydrostatic motors. The system has the capacity to be used with or without the broom head as conditions dictate.

Both right and left hand air blast assemblies are mounted to center air duct weldments and attached to the rear frame assembly. In operation, both will discharge in the same direction across the complete sweep path of the angled broom.

During transport, the air blast assemblies retract into the width of the rear frame assembly to avoid accidental damage. A minimum of 10 inches of ground clearance is needed in the transport mode.

1.4 Hydraulic System

The diesel engine power output is transmitted to a multiple output gearbox with a speed-increasing ratio. The output is directly coupled to a bank of hydraulic pumps that drive the broom, air blast, deflector/stripper, cooling fans, and other functions.

All hydraulic systems are served by a single reservoir, located in the engine compartment. Ten micron filters protect the elements in the low pressure and high pressure systems internally in the reservoir. Sensors within the system warn the operator of low oil, high temperature, charge pressure, and everything electronically controlled. In all cases, a fault condition will shut down the system automatically. For safety reasons, several interlocks disable certain functions when other conditions are present, preventing a dangerous or potentially damaging operation of the system.

1.5 Hydrostatic Drive

The hydrostatic drive system is a closed loop hydraulic circuit. The two principle components are the axial piston variable displacement pumps and the variable displacement motor. The pump is mounted directly to the engine and the motor is connected to the broom.

As the engine turns the pump, hydraulic fluid is forced out of the pump. This fluid displacement creates hydraulic pressure that is transmitted to the motor and causes the motor to turn. The greater the fluid displacement, the higher the rpm of the motor. The volume of fluid displaced is directly proportional to the position of the swash plate in the pump.

Both the pump and motor work with axial pistons that push against the swash plate, which sits at an angle to the drive shaft. When the pump rotates, it forces the piston to close, creating a displacement of hydraulic fluid. When the force of the displacement reaches the motor, the fluid forces a closed piston to expand against the motors swash plate to create rotation of the motor shaft. To complete the circuit, when a motor cylinder displaces fluid, it travels through the return line to the pump where closed cylinders are filled with fluid.

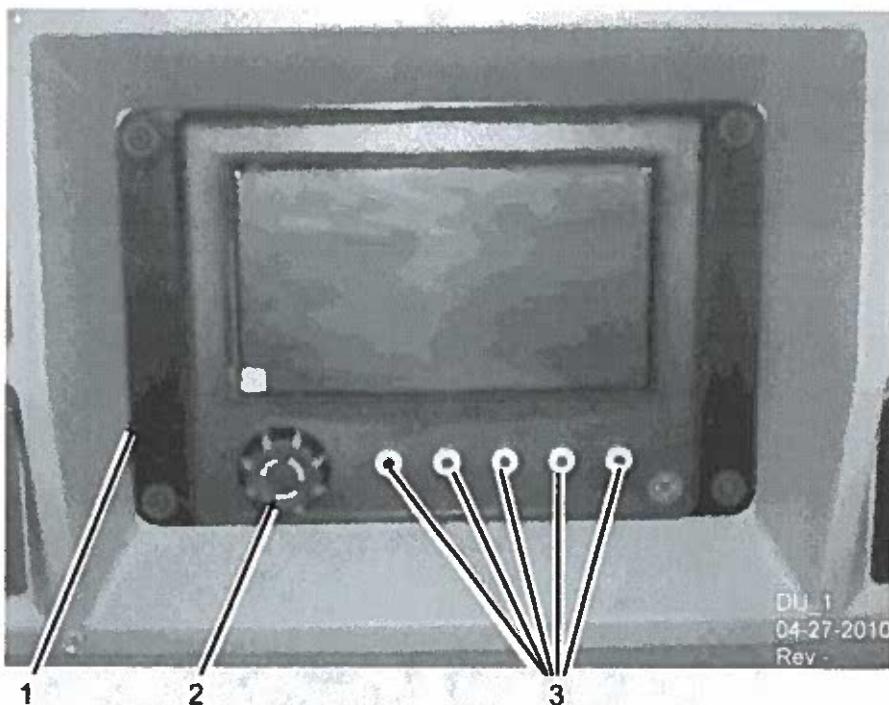
To regulate the speed (rpm) of the motor, the pump has variable displacement. This is accomplished by controlling the angle of the swash plate. The greater the angle, the greater the displacement of the piston between the closed and open positions. When the swash plate is perpendicular to the shaft, no displacement occurs and the motors rpm is zero. A servo-control valve in the pump controls the angle. This valve converts the electrical signal from the BROOM SPEED adjustment, located on the operator's panel, to a hydraulic signal. As the current from the control increases, the valve increases the angle. The amount of displacement in the pump is directly proportional to the current from the control.

Additional components are included in the system for fluid storage, filtration, cooling, pressure balance, flow direction control, and venting. The hydrostatic system for the air blast functions in the same manner as the broom system.

2. CONTROLS

All engine parameters, broom/air blast conditions, faults, and alarms are reported to the operator on a CAN based display unit located above the operator's seat in the center portion of the overhead panel of the cab. The display functions as an operator interface in which modes, speeds, and functions can be controlled by Push/Toggle Button (Item 2) and Selector Buttons (Item 3) integral with the display, see Figure 1.

Figure 1. Display Unit



Item	Description	Notes
	DISPLAY UNIT	
1	DISPLAY UNIT	
2	PUSH/TOGGLE BUTTON	
3	SELECTOR BUTTONS	

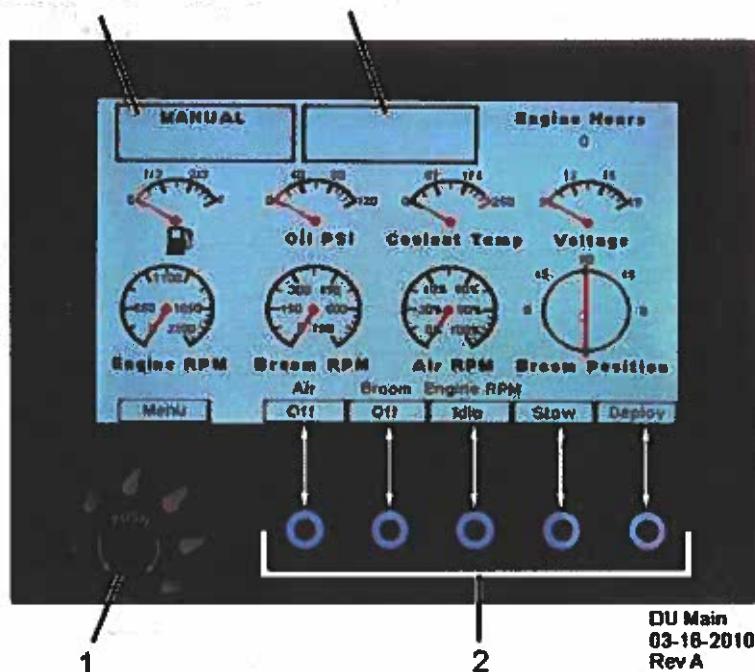
2.1 Main Screen

The main screen displays engine and hydraulic parameters. The system warnings appear in yellow and the system shutdown faults in red. When more than one warning/shutdown appears they will be scrolled on screen in the Engine and Sensor Faults Box as shown in Figure 2.

The operator has the ability to toggle between Air ON/OFF, Broom ON/OFF, Engine IDLE/RUN, Stow, and Deploy (Deploying the Broom Head). The Menu box and Push/Toggle Button will take operator to Main Menu Page, see Figure 7 on Page 9.

Figure 2. Main Screen

MANUAL/AUTO and
BROOM DIRECTION ENGINE and
SENSOR FAULTS



Item	Description	Notes
	DISPLAY UNIT MAIN SCREEN	
1	PUSH/TOGGLE BUTTON	
2	SELECTOR BUTTONS	1.

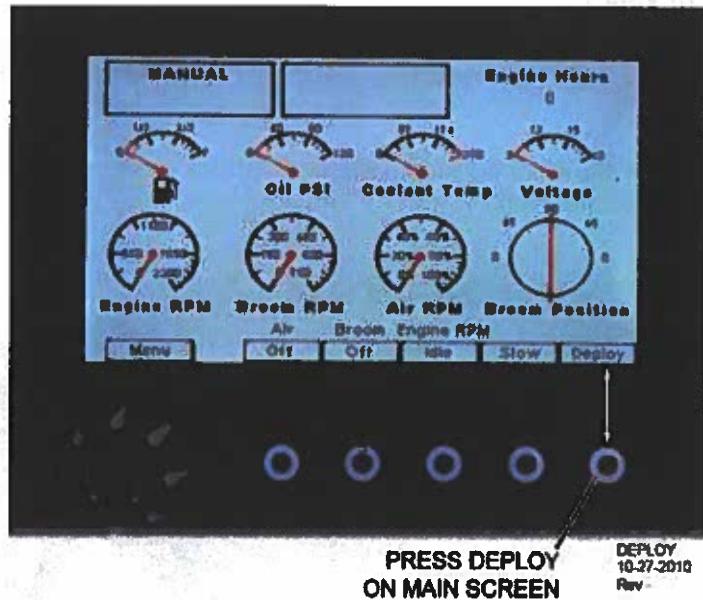
NOTE:

1. Hold Selector Buttons in for approximately 1 second.

2.2 Deploying the Broom Head

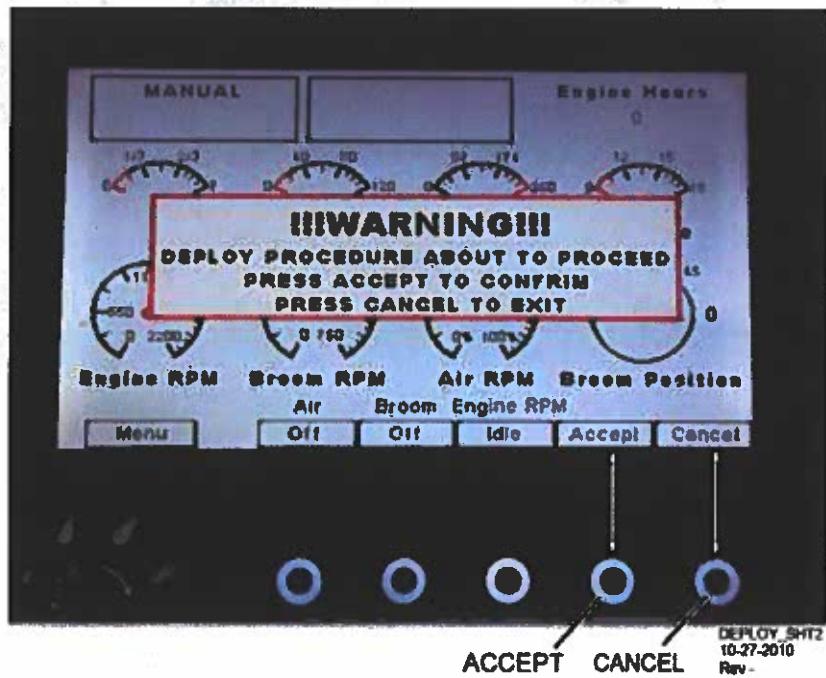
Press selector button for Deploy on the Main Screen to deploy the broom head as shown in Figure 3.

Figure 3. Deploying the Broom Head



Accept or cancel the deployment of the broom head as shown in Figure 4.

Figure 4. Accepting Deployment



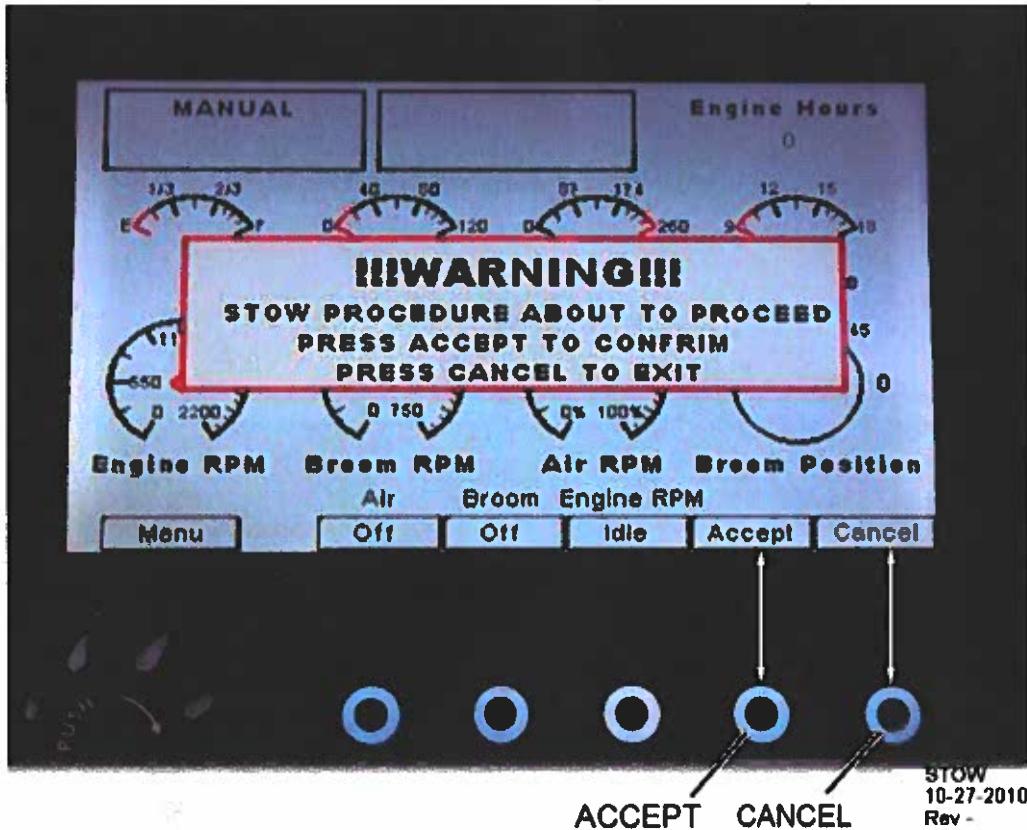
- Wait until the display no longer reads Deploy in the upper left hand corner of Main Screen
- This procedure will last approximately 4 minutes
- When broom is deployed, push broom left on the plow joystick

2.3 Stowing the Broom Head

Before stowing, move the broom head to the furthest left point. Press selector button for Stow on the Main Screen to stow the broom head as shown in Figure 5 and either accept or cancel.

NOTE: If broom stops rotating while stowing, release the truck brake and roll truck forwards or backwards approximately a foot.

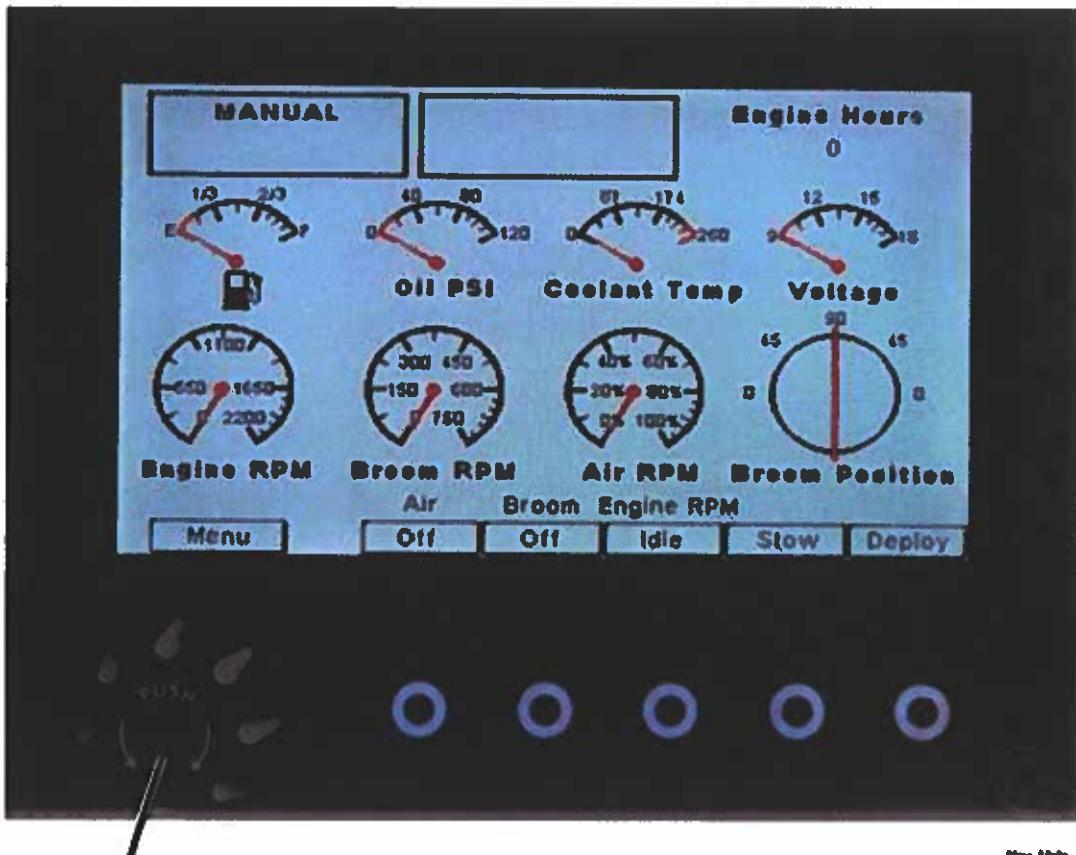
Figure 5. Stowing the Broom Head



2.4 Navigating to Main Menu Page

To navigate to the Main Menu Page, press the Push/Toggle Button in as shown in Figure 6.

Figure 6. Navigating to Main Menu Page

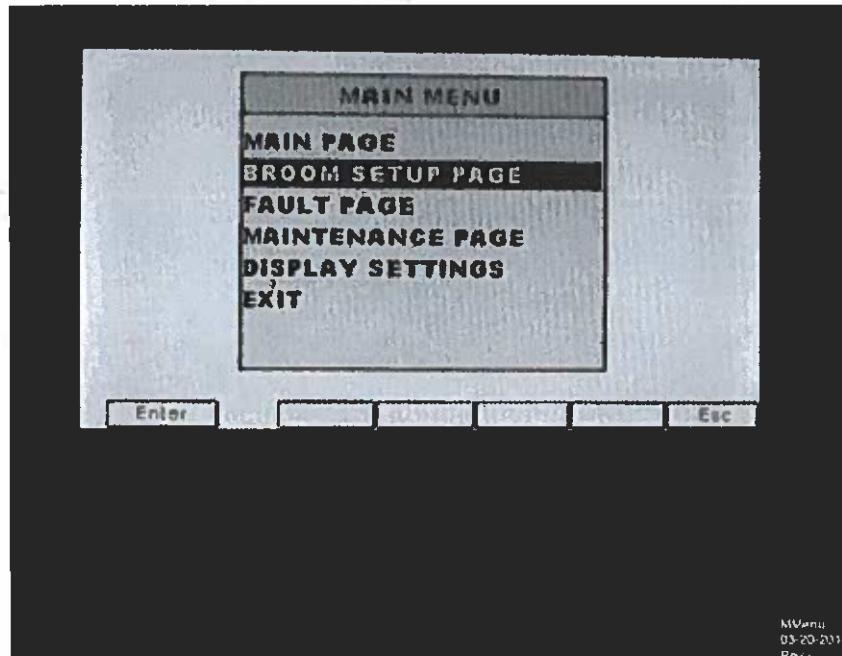


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The Main Menu Page displays Main Page, Broom Setup Page, Fault Page, Maintenance Page, display Settings, and Exit as shown in Figure 7.

Turn the Push/Toggle Button to the right to scroll down to the Broom Setup Page and press Push/Toggle Button in.

Figure 7. Main Menu Page

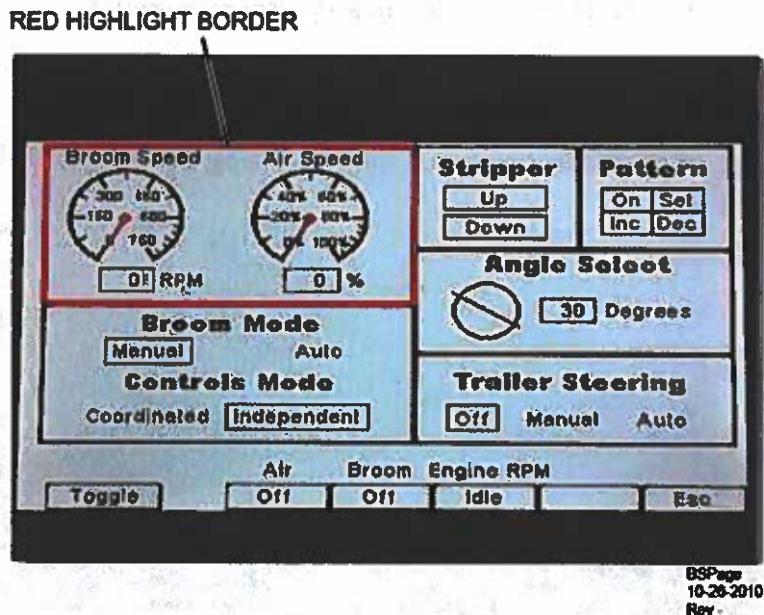


The Broom Setup Page will appear on the screen as show in Figure 8 on Page 10.

2.5 Broom Setup Page

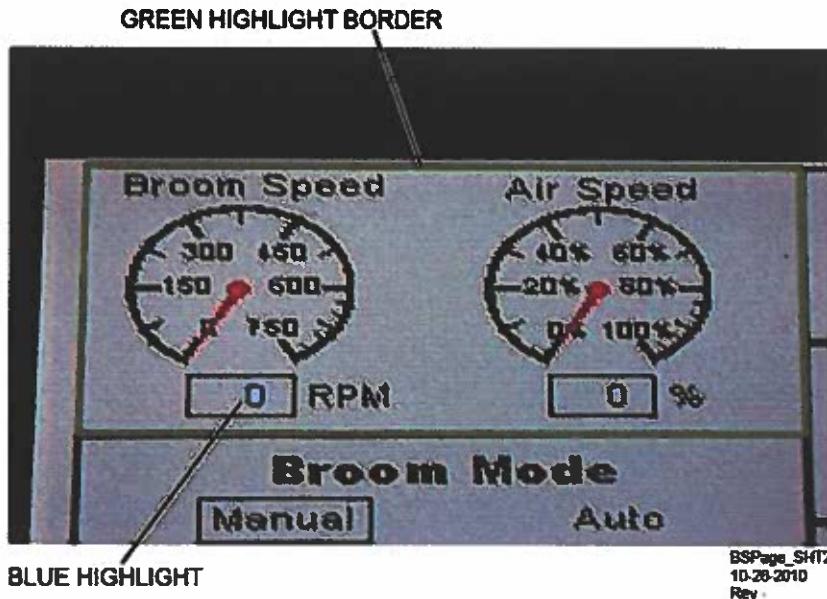
The red highlighted border (box selection) allows navigation on page by turning the Push/Toggle Button as shown in Figure 8.

Figure 8. Broom Setup Page, Red Highlight



Press the Push/Toggle Button again and the border highlight will turn to green (active). Turn the Push/Toggle Button to scroll within the green highlighted box as shown by the blue highlighted "0" in Figure 9.

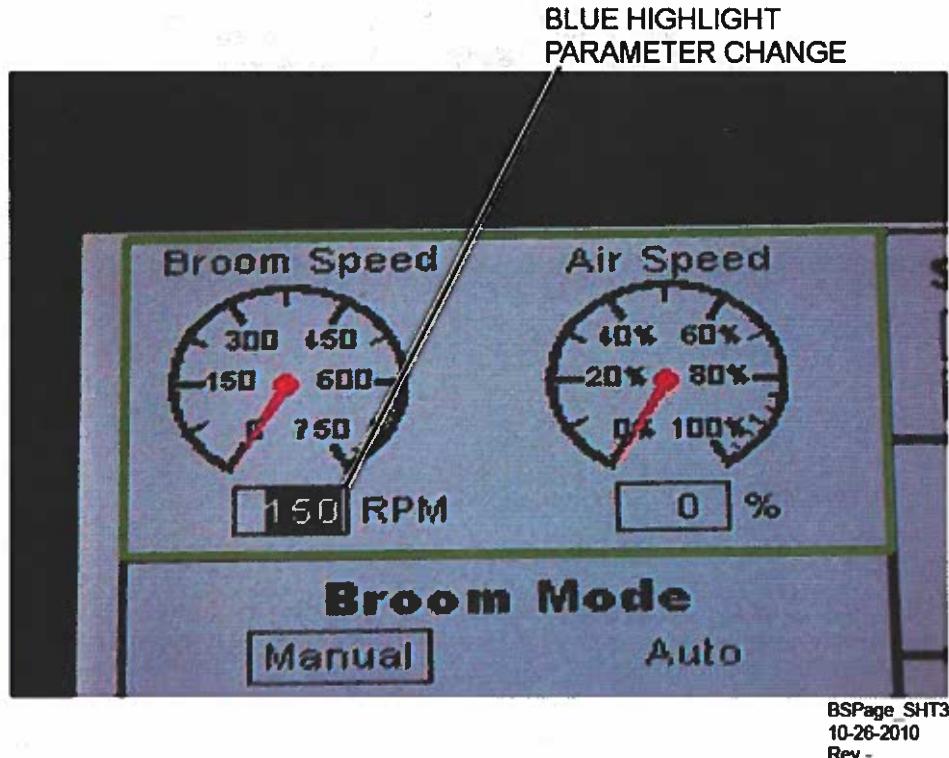
Figure 9. Broom Setup Page, Green Highlight



The blue highlight (change parameters) allows operator to change the input as shown in Figure 10. Once the parameter has been changed press the Push/Toggle Button to set.

NOTE: The broom speed was changed from "0" (shown in Figure 9) to 150 RPM (shown in Figure 10)

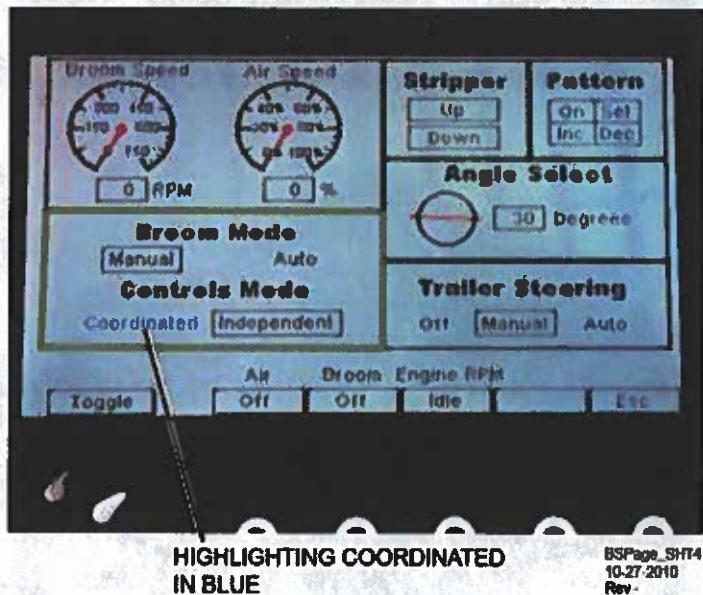
Figure 10. Broom Setup Page, Blue Highlight



2.6 Switching from Auto to Manual and Coordinate to Independent

Highlight the mode needed (Blue) and then press the Push/Toggle Button in for 3 seconds and release. The outlined box will switch to what was selected as shown in Figure 11.

Figure 11. Switching from Auto to Manual and Coordinate to Independent



Select the FAULT PAGE from the MAIN MENU screen to display the fault pages as shown in Figure 12. Each fault screen will show a description of each fault, the number of occurrences and the date of the last occurrence.

Figure 12. Fault Page

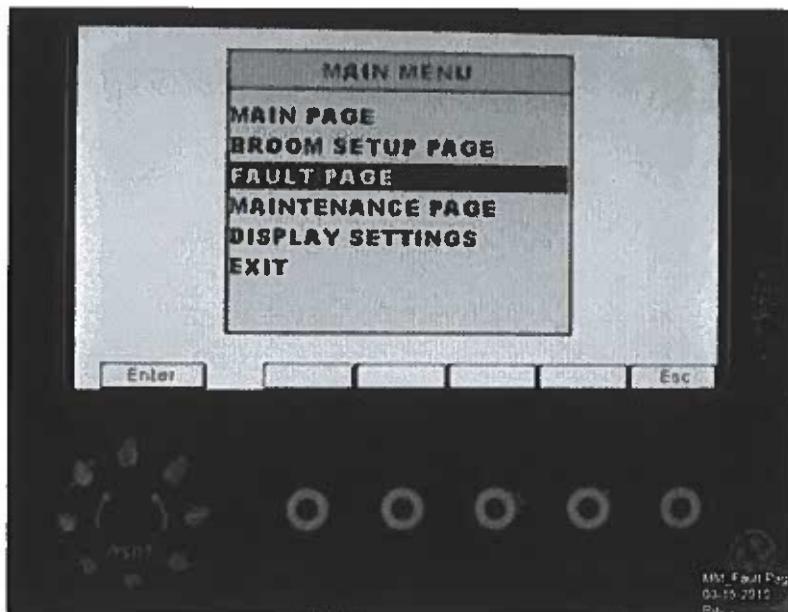


Figure 13. Fault Page 1

FAULT PAGE 1		
Fault	Count	Date Last Seen
High Hyd Oil Temp	0	00 00 00
Broom Angle Sensor	0	00 00 00
Stripper Sensor	0	00 00 00
Caster Sensor	0	00 00 00
Air Blast Charge Filter	0	00 00 00
Broom Charge Filter	0	00 00 00

[] Menu [] Esc

Fault Page 1 contains the following Faults, Count, and Date Last Seen:

- High Hydraulic Oil Temperature
 - Broom Angle Sensor
 - Stripper Sensor
 - Caster Sensor
 - Air Blast Charge Filter
 - Broom Charge Filter

Figure 14. Fault Page 2

FAULT PAGE 2		
Fault	Count	Date Last Seen
Broom PSI Sensor	204	10 08 03
Rotation Left Coil	0	00 00 00
Rotation Right Coil	0	00 00 00
Caster Up Coil	0	00 00 00
Caster Down Coil	0	00 00 00
Broom Speed Coil	0	00 00 00

Menu Esc

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Fault Page 2 contains the following Faults, Count, and Date Last Seen:

- Broom PSI Sensor
- Rotation Left Coil
- Rotation Right Coil
- Caster Up Coil
- Caster Down Coil
- Broom Speed Coil

Figure 15. Fault Page 3

FAULT PAGE 3		
Fault	Count	Date Last Seen
Air Blast Speed	0	00 00 00
Air Blast Up	1	00 00 00
Air Blast Down	1	10 10 02
Engine Run	0	00 00 00
Engine Start	0	00 00 00
Auto Steer	1	10 10 02

Menu Esc

Fault_3
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Page

Fault Page 3 contains the following Faults, Count, and Date Last Seen:

- Air Blast Speed
- Air Blast Up
- Air Blast Down
- Engine Run
- Engine Start
- Auto Steer

Figure 16. Fault Page 4

FAULT PAGE 4		
Fault	Count	Date Last Seen
Enable Steer	1	10.10.02
Stripper Up Coil	0	00.00.00
Stripper Down Coil	2	10.11.02
Air Blast Charge PSI	12	10.16.02
Broom Charge PSI	12	10.10.10
Hydraulic Level	8	10.16.02

Fault Page 4 contains the following Faults, Count, and Date Last Seen:

- Enable Steer
- Stripper Up Coil
- Stripper Down Coil
- Air Blast Charge PSI
- Broom Charge PSI
- Hydraulic Level

Select the DISPLAY SETTINGS from the MAIN MENU screen to display the Lighting Display, Time and Date, Password Settings, and Exit; see Figure 17, Figure 18, Figure 19, and Figure 20.

Figure 17. Display Settings

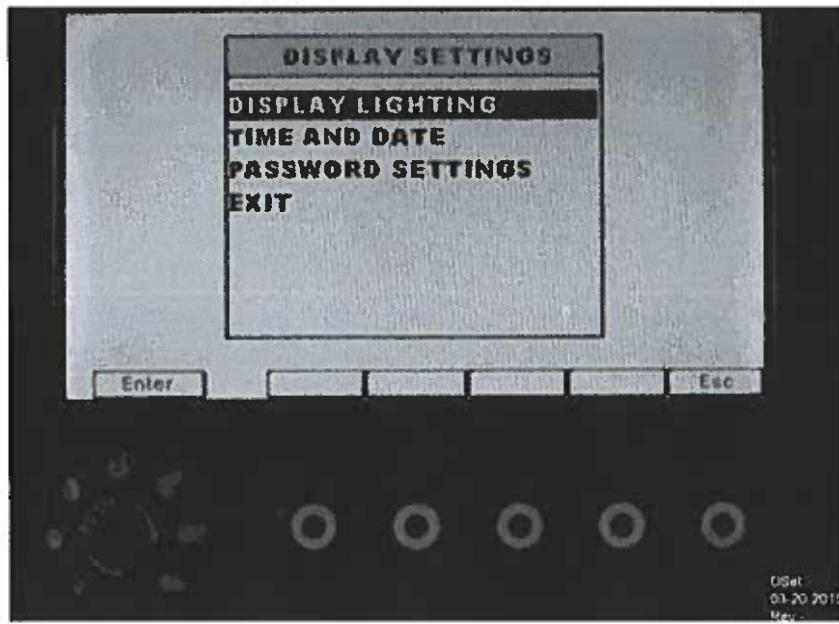


Figure 18. Lighting Display

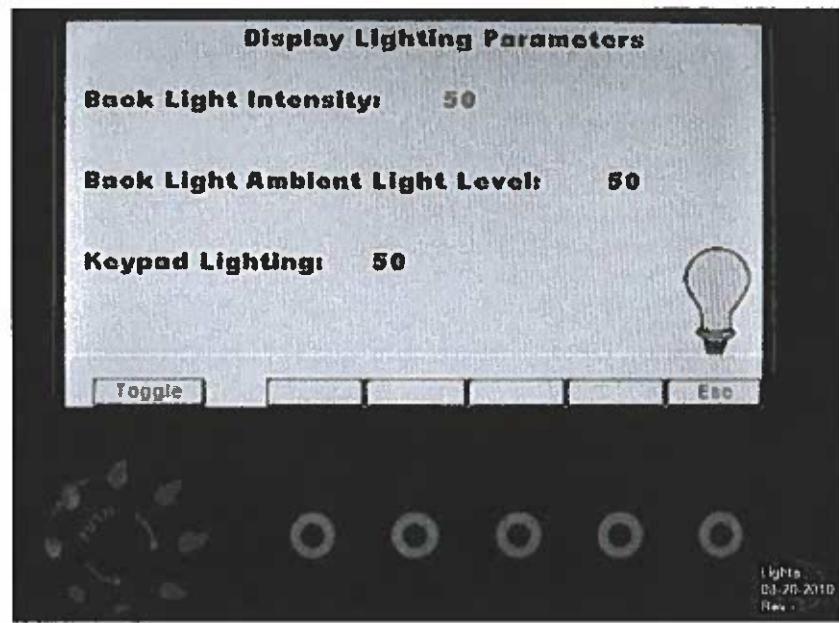


Figure 19. Time and Date

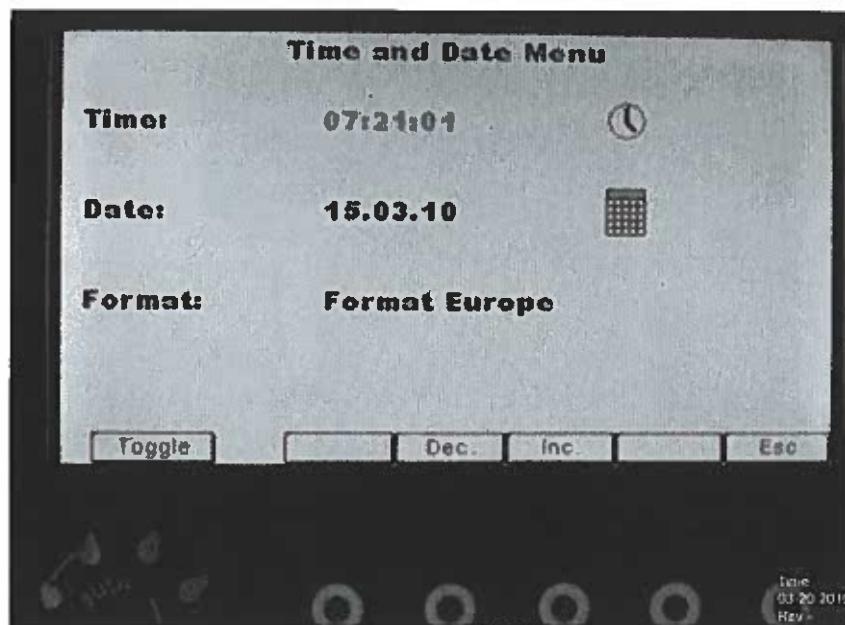


Figure 20. Password Settings

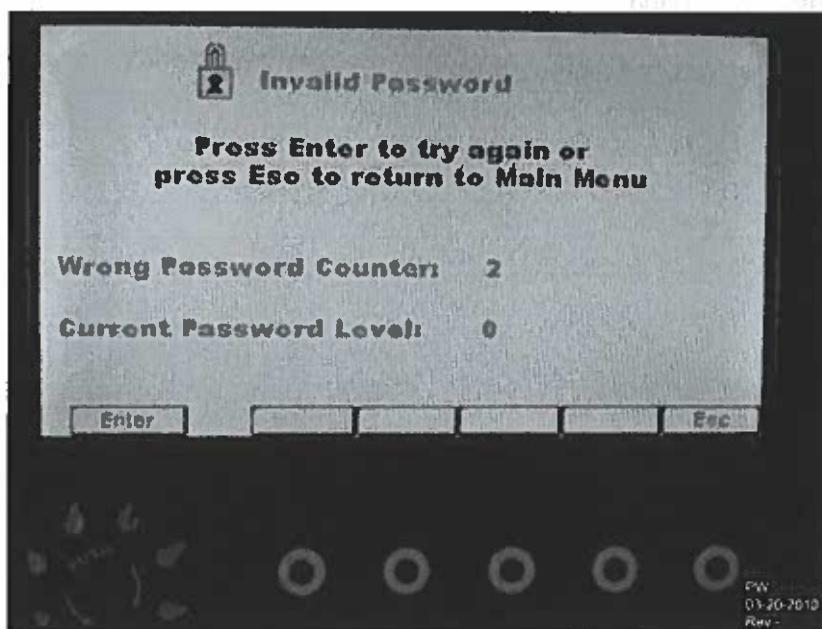
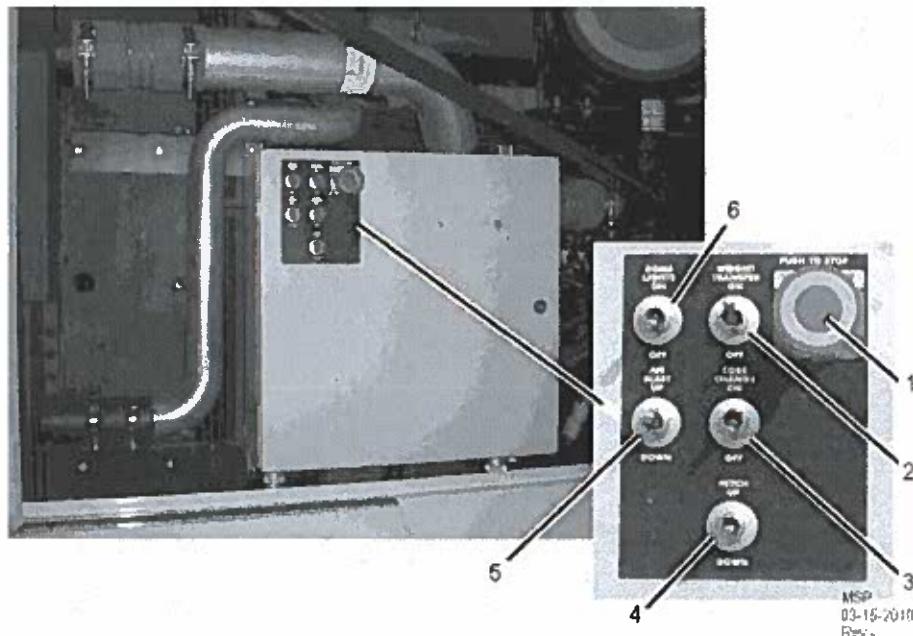


Figure 21. Manual Switch Panel with Emergency Stop

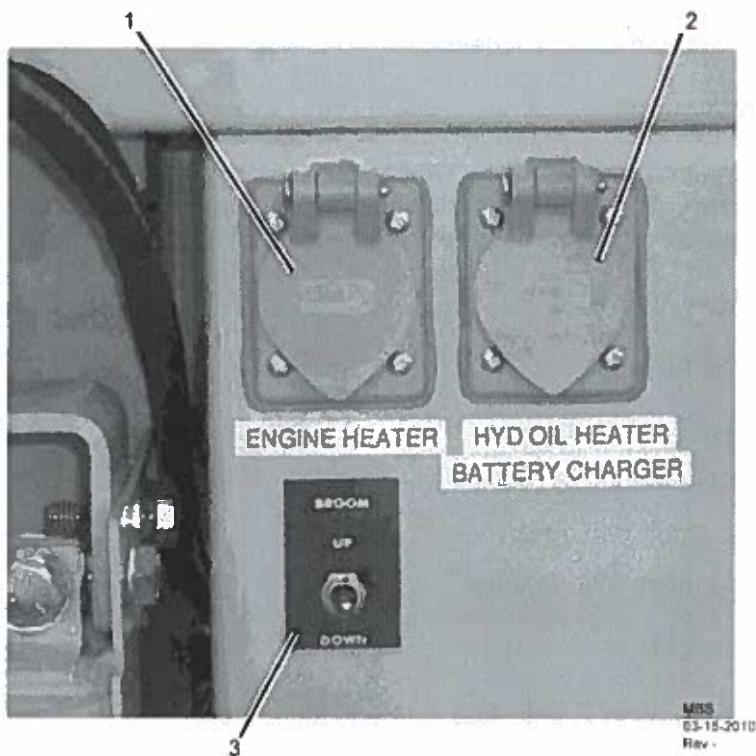


Item	Description	Notes
	MANUAL SWITCH PANEL W/ EMERGENCY STOP	
1	• EMERGENCY STOP	
2	• WEIGHT TRANSFER ON/OFF	1.
3	• CORE CHANGE ON/OFF	
4	• HITCH UP/DOWN	
5	• AIRBLAST UP/DOWN	
6	• DOME LIGHTS ON/OFF	

NOTE:

1. Make sure weight transfer switch is in the ON position.

Figure 22. Manual Broom Switch



Item	Description	Notes
	MANUAL BROOM SWITCH	
1	• ENGINE HEATER PLUG	
2	• HYDRAULIC OIL HEATER AND BATTERY CHARGER PLUG	
3	• BROOM UP/DOWN	1.

NOTE:

1. Used to check broom pattern.

2.7 Differential Locks

See Figure 40 on Page 36, (Items 2-4) for details.

2.8 Plow Hitch Lock/Unlock

Items 4A and 4B are momentary controls used to connect/disconnect the hydraulically actuated pins of the Ulti-mate hitch assembly. These controls allow the operator to connect/disconnect the plow from the vehicle without exiting the cab of the vehicle. See Figure 40 on Page 36 for details.

2.9 Parking and Trailer Brake

See Figure 40 on Page 36 for details.

- Pull Parking Brake (Item 5) to apply
- Push Parking Brake (Item 5) to release
- Pull Trailer Brake (Item 9) to apply
- Push Trailer Brake (Item 9) to release

2.10 Power Mirror Control

- Power Mirror Control (Item 7) activates right and left mirror

2.11 Transmission Shift

See Figure 40 on Page 36, (Item 8) for details.

2.12 Underbody Scraper Control

Four position joystick controls under body scraper, if vehicle is so equipped. See Figure 40 on Page 36, (Item 9A) for details.

- UP/DOWN and LEFT/RIGHT

3. OPERATING PROCEDURES

The Wausau Equipment Company TOW5220 Runway Broom provides the following operating systems to accommodate varying operation requirements:

- Sweeping and/or blowing with the broom and/or air blast

3.1 Checklist for Day-to-Day Operations

NOTE: Use the following checklist when starting the machine for day-by-day operations.

- Visually inspect the machine prior to start up
 - Confirm that all required maintenance has been performed
 - Confirm that all fluid levels are filled to the proper levels, refer to Sections 3.2 and 3.3
- Check that the drive belts are properly adjusted and in good condition
- Check that all hoses are in good condition and fittings are tight
- Inspect exterior for damage and/or debris that may be blocking broom
- Check pressure in tires/caster wheels (125-130 PSI)
- Check brakes on caster wheels, must not be able to move freely
- Inspect the broom mechanism for proper rotation
- Check the broom bristles, replace if severely worn, refer to Section 4.4.1
- Make sure proper torque of critical fasteners, such as lug nuts, etc.
- Inspect the batteries and battery cables

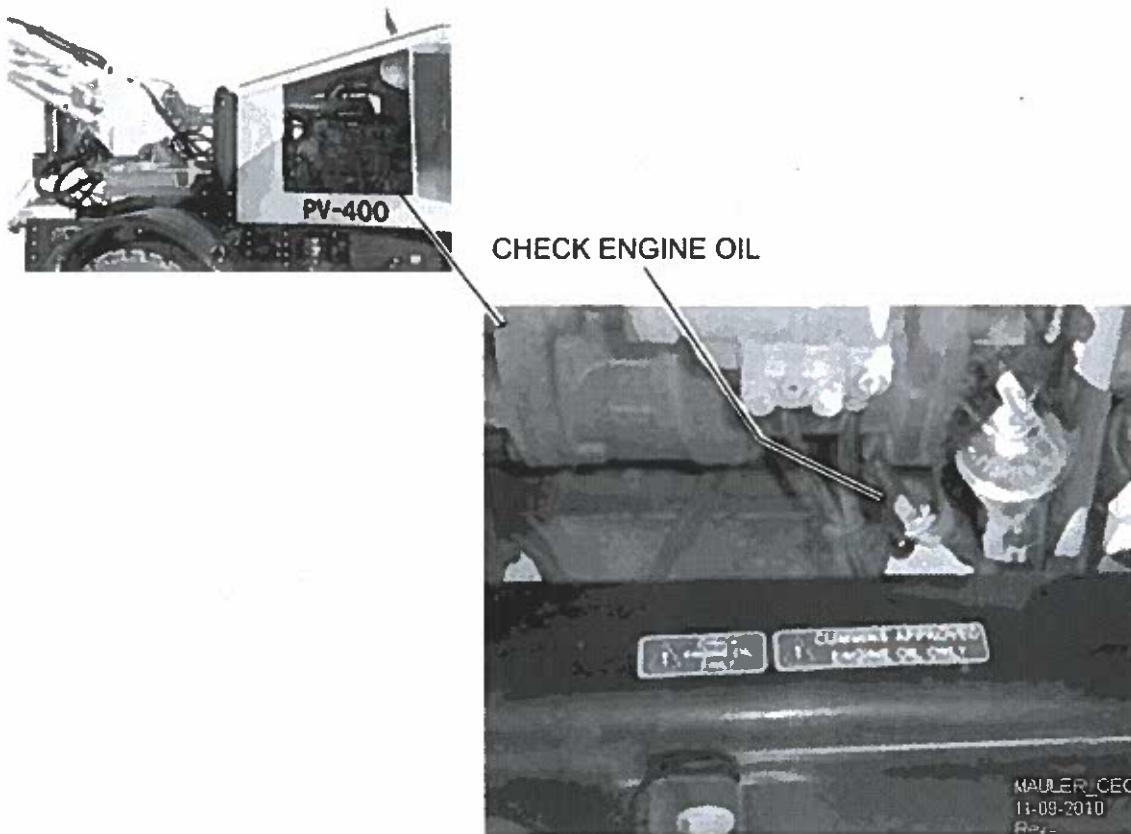
3.2 PV-400 Snow Mauler, Pre-Fluid Check and Visual Inspection

3.2.1 Check Engine Oil

Check the engine oil daily in the PV-400 Snow Mauler as shown in Figure 23 and fill with approved engine oil only.

- Check engine oil as shown, if required add to fill

Figure 23. Snow Mauler, Check Engine Oil

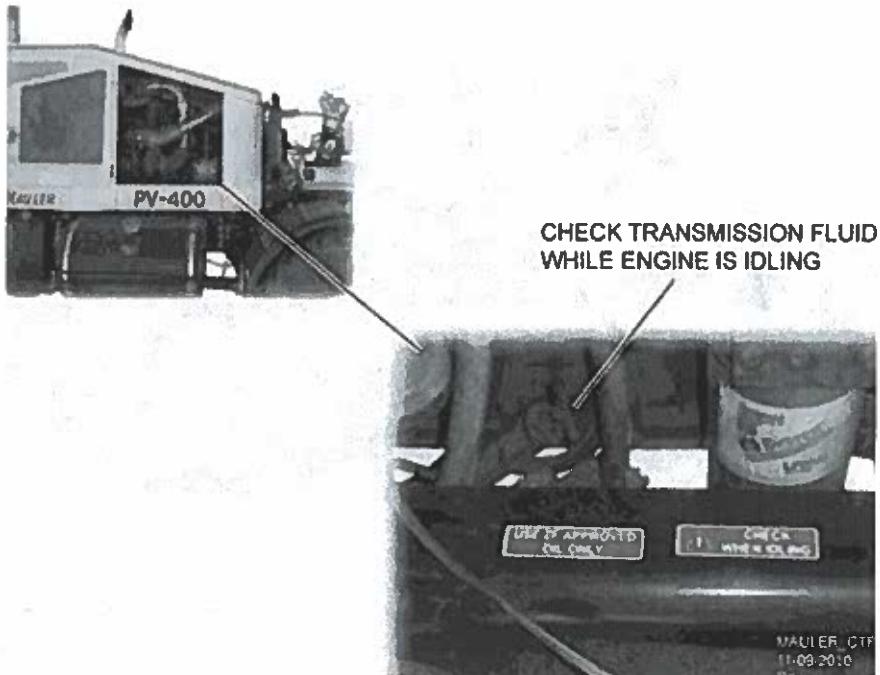


3.2.2 Check Transmission Fluid

Check the transmission fluid daily as shown in Figure 24 on Page 24 and fill with ZF approved oil only.

- With engine at idle check transmission fluid, if required add to fill

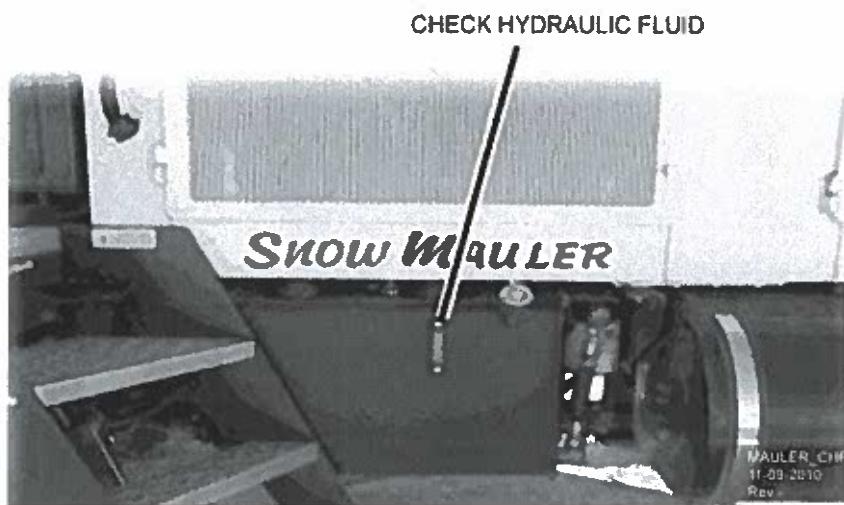
Figure 24. Snow Mauler, Check Transmission Fluid



Check the hydraulic fluid daily as shown in Figure 25.

- Check hydraulic fluid by site glass as shown, site glass must be at a minimum 1/2 full

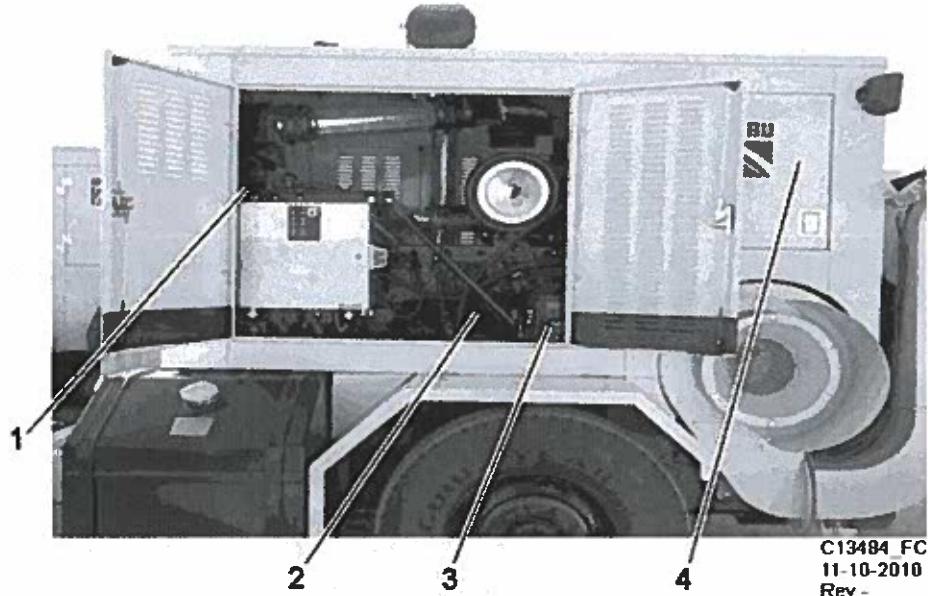
Figure 25. Snow Mauler, Check Hydraulic Fluid



3.3 Tow Behind Fluid Check and Visual Walk Around

Check the fluids daily as shown in Figure 26.

Figure 26. Tow Behind Fluid Check



Item	Description	Notes
	TOW BEHIND FLUID CHECK	
1	• ENGINE COOLANT	
2	• ENGINE OIL	
3	• AUTOMATIC GREASER	
4	• HYDRAULIC FLUID	

Check the engine oil and automatic greaser daily as shown in Figure 27.

- Check engine oil and auto greaser as shown, if required add to fill

Figure 27. Check Engine Oil and Greaser

2 - CHECK ENGINE OIL 3 - CHECK AUTOMATIC GREASER

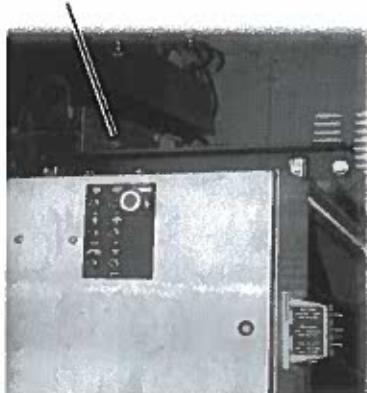


Check the engine coolant and hydraulic fluid daily as shown in Figure 28.

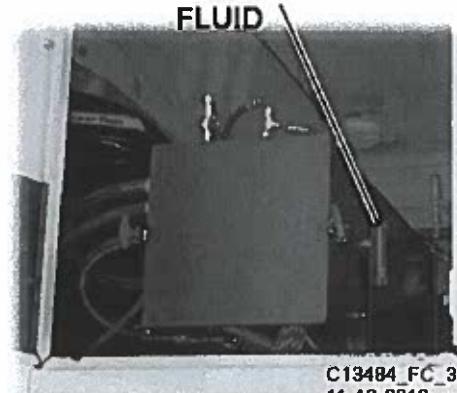
- Check engine coolant by site glass as shown, site glass must appear red, if required add to fill
- Check hydraulic fluid by site glass as shown, site glass must be at a minimum 1/2 full.

Figure 28. Check Engine Coolant and Hydraulic Fluid

1 - CHECK ENGINE COOLANT



4 - CHECK HYDRAULIC FLUID



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Check the gearbox fluid daily as shown in Figure 29. The site glass is located through the access door on the left hand side.

- Check gearbox fluid by site glass as shown, site glass must be at a minimum 1/2 full.

Figure 29. Check Gearbox Fluid



Upon completion of fluid check, walk around the vehicle to check for any damage to the machine and make sure unit is clear of any objects.

CAUTION

If a problem occurs, make repairs immediately. Do not continue to operate machine.

- Turn Master Switch ON

NOTE: The master switch is located inside the access panel on the Snow Mauler, see Figure 30

Figure 30. Snow Mauler Master Switch



3.4 Connecting the Broom

- Back onto fifth wheel plate
- Connect the CAN wire connection from the broom to the truck
- Connect the air brake lines and the trailer plug
- Start broom from Display Unit Main Screen, see Figure 2 on Page 5
- Switch HITCH DOWN from Manual Switch Panel, see Figure 21 on Page 19
- Turn WEIGHT TRANSFER ON from Manual Switch Panel
- Raise broom head and remove broom stand pins
- Move broom stand pins to bottom hole closest to the foot

3.4.1 Placing Broom in Auto Mode

- Press and hold AUTO from Display Unit Main Screen, see Figure 2 on Page 5
- If auto mode is unachievable check to make sure the STOW button is OFF

NOTE: Auto mode will not work when STOW is ON

3.5 Starting the Tow Behind Broom

To start the tow behind broom locate the ignition switch in the upper right hand side of the Snow Mauler, see Figure 31.

Figure 31. Tow Behind Ignition



CAUTION

Do not start the engine under load damage can occur.

- Turn the key switch to the ON position and hold for 5 seconds before turning the key switch to the START position to engage the starter motor, see Figure 32 on Page 29
- Engine will crank. When engine begins running, release switch

NOTE: If engine fails to start within 5 seconds, turn key to OFF position to cycle power, and then attempt to start the engine again.

- Let engine run at idle for 3 to 5 minutes before operating under load, more time may be necessary when the temperature is below 0 °F (-18 °C)

CAUTION

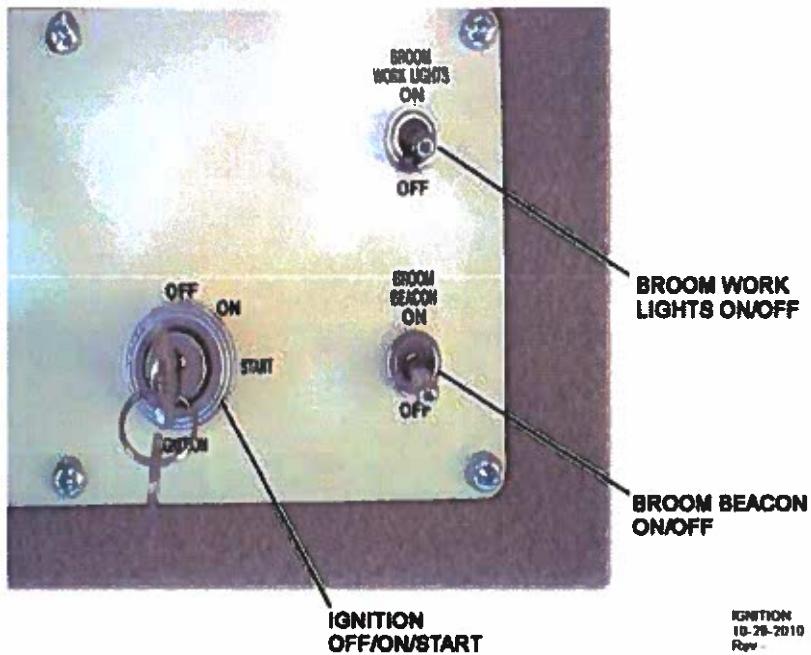
Do not keep the engine at low idle for long periods. Idling for periods longer than 10 minutes can damage the engine.

- If not previously done, raise the broom head. Allow the broom to rotate at low speed to warm up the hydraulic system. After approximately 10 minutes discontinue running the broom.

CAUTION

Failure to allow the hydraulic oil to warm up before placing the machine in a workload condition may cause premature wear and subsequent failure of the hydrostatic pump and motor.

Figure 32. Starting the Engine



After engine is running, turn on broom work lights and/or beacon if needed.

3.6 Starting the Tow Vehicle (Snow Mauler)

Locate the ignition as shown in Figure 33

- Turn the key switch to the ON position and hold for 5 seconds before turning the key switch to the START position to engage the starter motor
- Engine will crank. When engine begins running, release switch

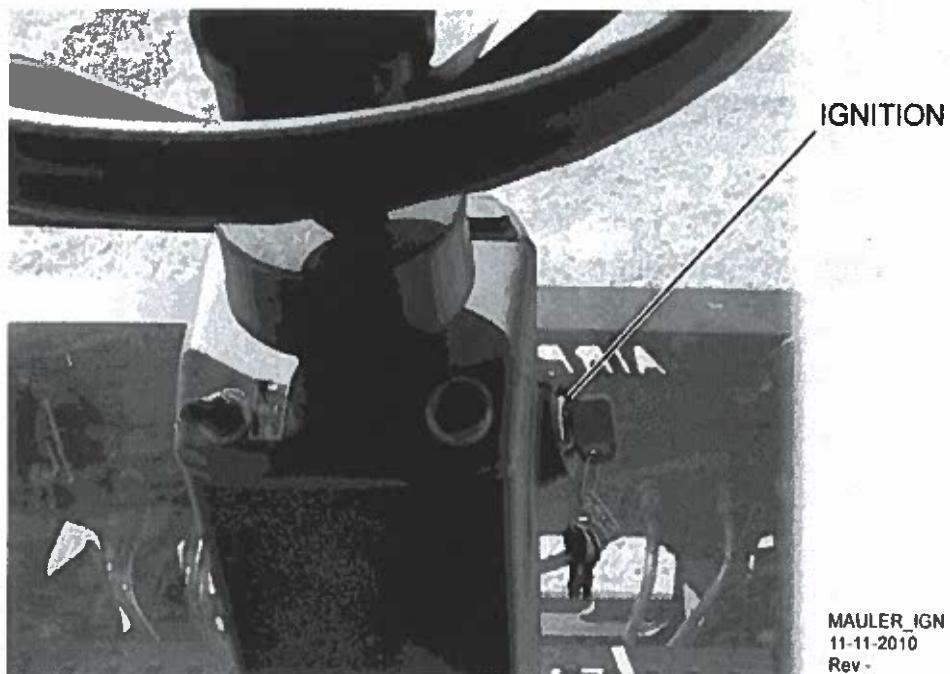
NOTE: If engine fails to start within 5 seconds, turn key to OFF position to cycle power, and then attempt to start the engine again.

- Let engine run at idle for 3 to 5 minutes before operating under load, more time may be necessary when the temperature is below 0 °F (-18 °C)

CAUTION

Do not keep the engine at low idle for long periods. Idling for periods longer than 10 minutes can damage the engine.

Figure 33. Tow Vehicle Ignition



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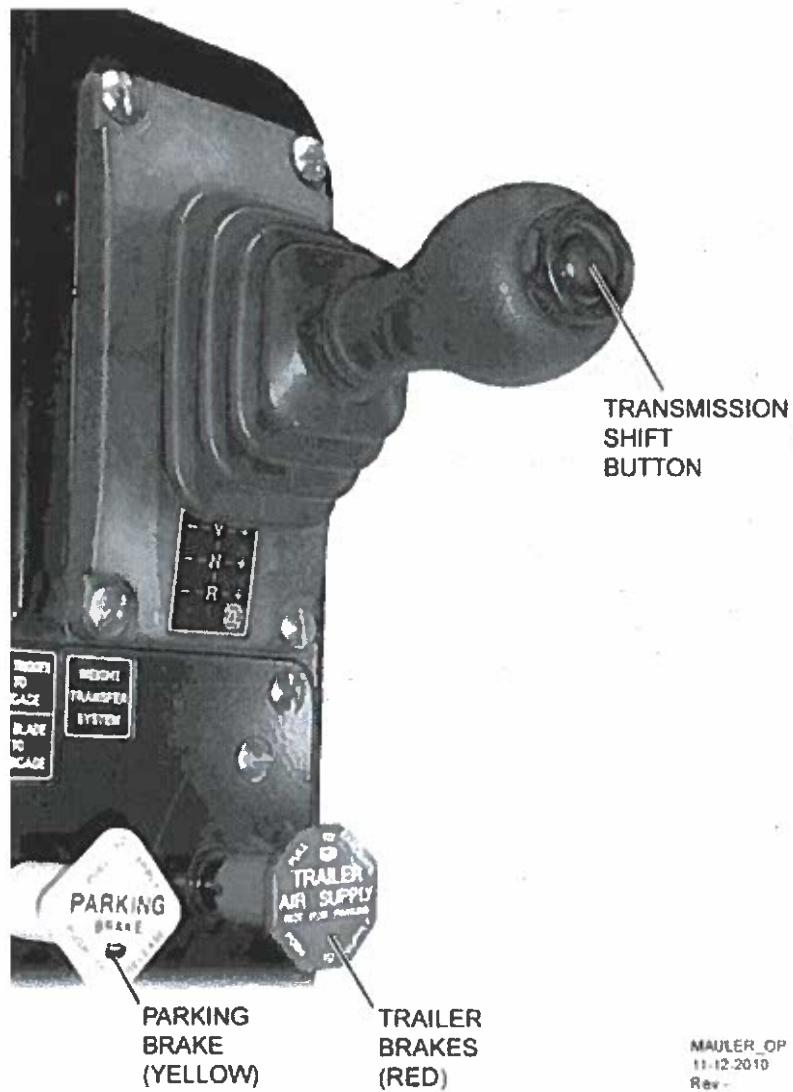
3.7 Driving the Vehicle

The Transmission Shift, Trailer Brakes, and Parking Brake are located to the right of the plow control joystick.

- Pull to release airbrakes and activate service brakes
- Push yellow Parking Brake then red Trailer Brake buttons while holding the brake pedal, see Figure 34
- Push and hold Transmission Shift Button and push lever forward to drive forward and pull lever backwards to reverse

NOTE: Before moving vehicle, lift plow by using the plow control joystick.

Figure 34. Transmission Shift and Brakes

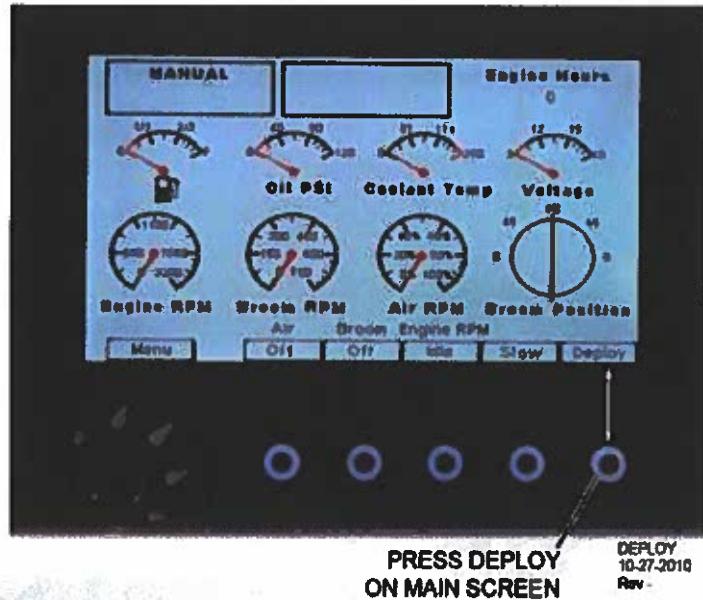


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3.8 Deploying the Broom

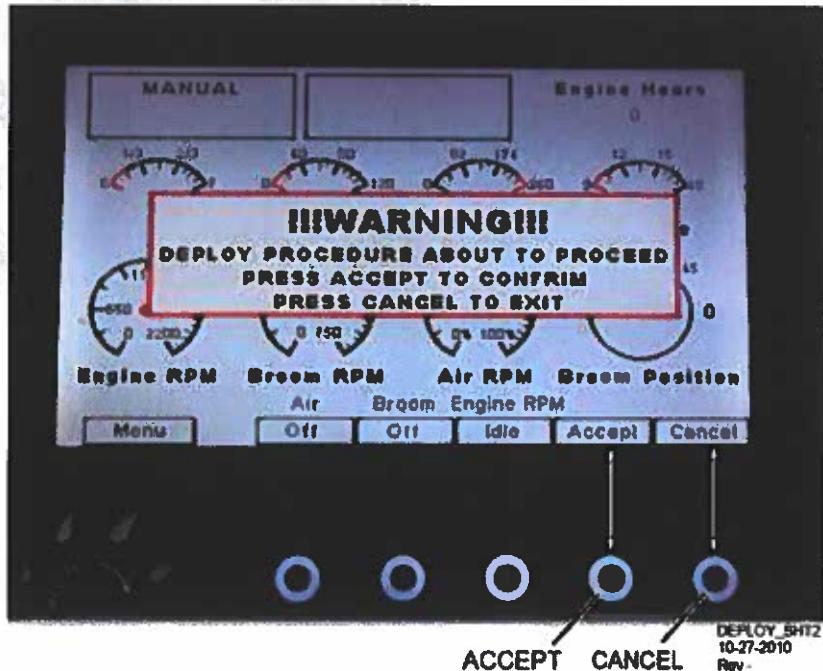
Deploy the broom when stopped and at the operating arena. Press selector button for Deploy on the Main Screen to deploy the broom head as shown in Figure 3.

Figure 35. Deploying the Broom Head



Press selector button to accept or cancel the deployment of the broom head as shown in Figure 4.

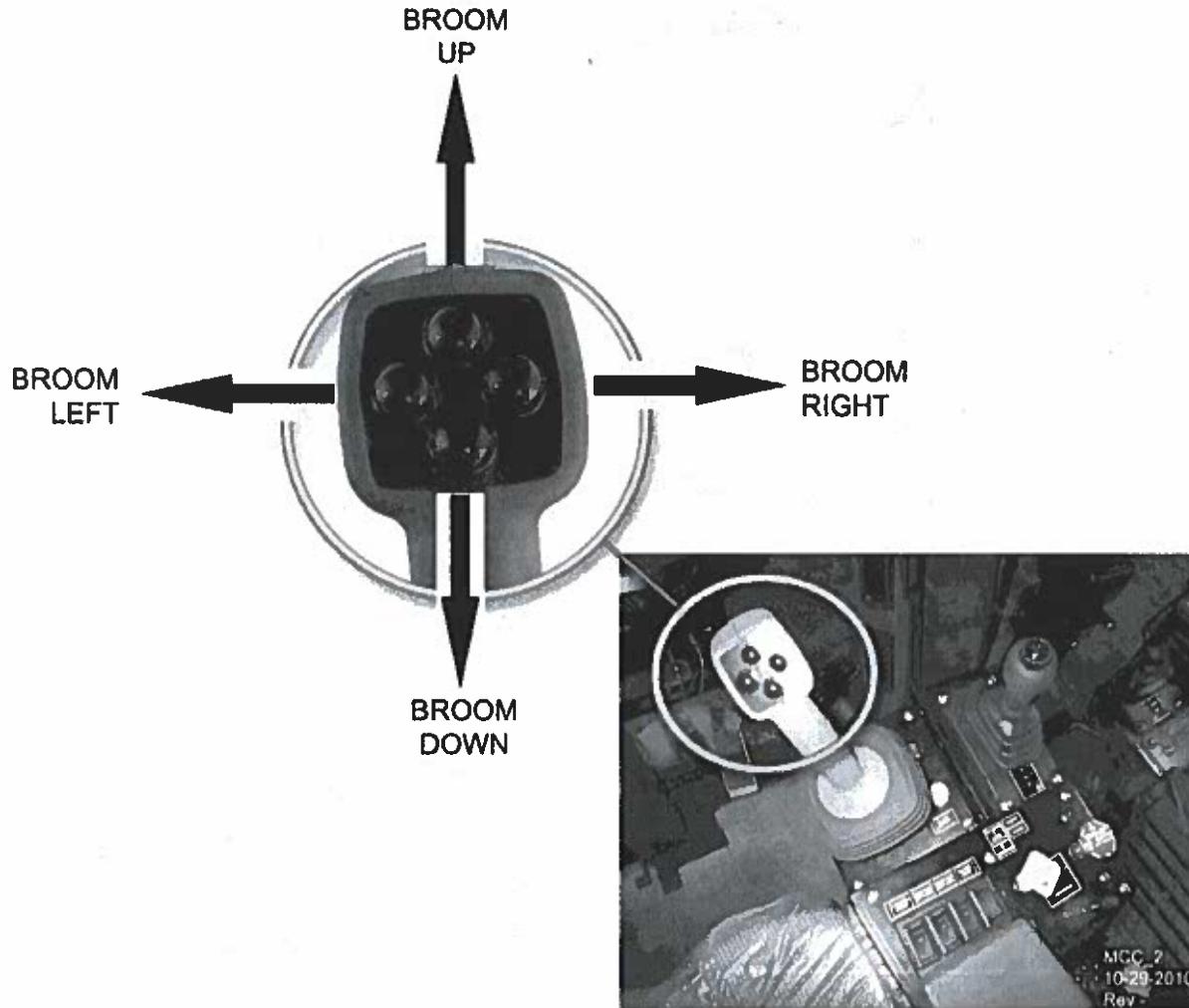
Figure 36. Accepting Deployment



- Wait until the display no longer reads Deploy in the upper left hand corner of Main Screen
- This procedure will last approximately 4 minutes

When broom is deployed, push broom left on the plow joystick

Figure 37. Plow Control Joystick Buttons



3.9 Starting the Broom and Air Blast

- Press the selector button below Broom on the display and hold for one second and release as shown in Figure 38

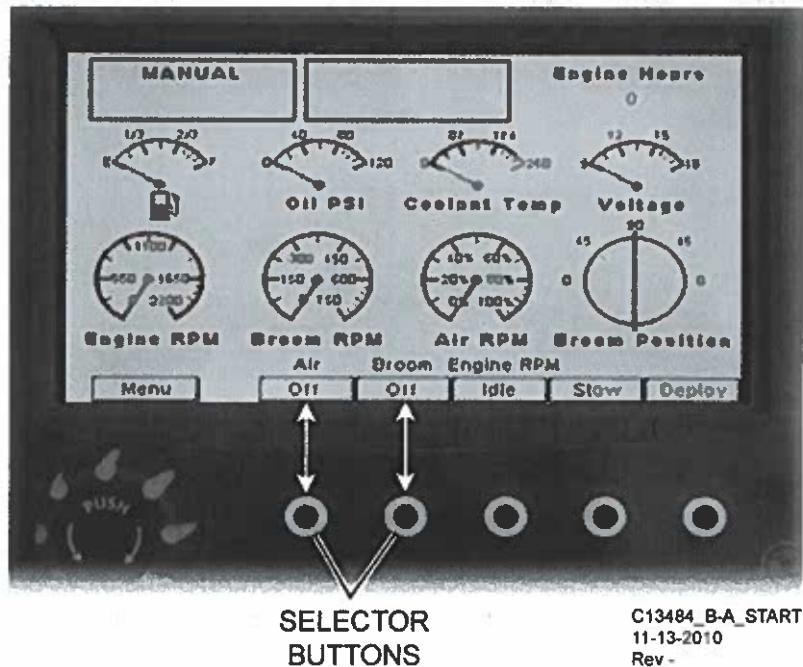
The screen now reads ON and the broom will be rotating.

- To shut broom OFF press the Broom selector button again
- Press the selector button below Air on the display and hold for one second and release as shown in Figure 38

The screen now reads ON and the air blast system will be ON.

- To shut air blast OFF press the Air selector button again

Figure 38. Starting the Broom and Air Blast



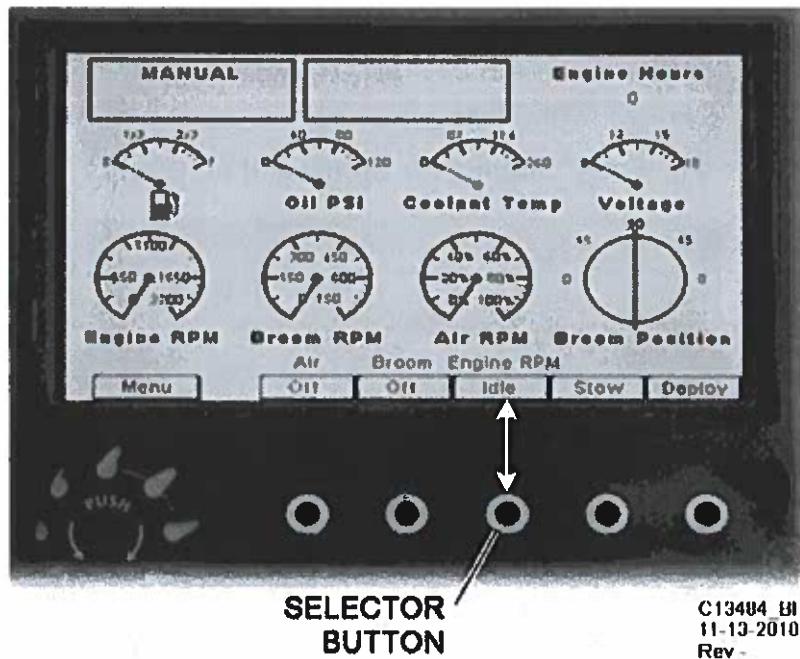
3.10 Broom to Operating Speed

- Press the selector button below Engine RPM on the display and hold for one second and release as shown in Figure 39

The screen now reads Run and the engine will be running at operating speed.

- To bring the engine back down to Idle press the selector button again

Figure 39. Broom to Operating Speed



3.11 Joystick Broom and Plow Control

A selector switch allows operator to activate COORDINATED control of the plow, broom, and air blast. In this mode, all items are commanded from the movement of the Plow Control Joystick (Item 1).

- Push the Joystick left and the plow, broom, and air blast will turn left
- Push the Joystick right and the plow, broom, and air blast will turn right
- Pull Joystick back to raise plow and broom
- Push Joystick forward to lower plow and broom. Pull the trigger on the joystick to activate float mode on the plow

In Coordinate Mode, the four buttons mounted on the top of the joystick remain live and adjustments can be made to the broom and air blast independent of the plow.

The four buttons (Item 9B) located at the top of the Plow Control Joystick control the Broom functions LEFT/RIGHT and UP/DOWN, as shown in Figure 40 on Page 36.