

SERVICE BOOKLET

**PowerBoss**<sup>®</sup>  
The Power of Clean

# NAUTILUS

PB450DSL, PB450GAS, PB450LPG

Training

Trouble Shooting

Adjustments



REVISED 11/14

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# TECHNICAL SPECIFICATIONS

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## TECHNICAL SPECIFICATIONS

Model Nautilus Rider Scrubber/Sweeper

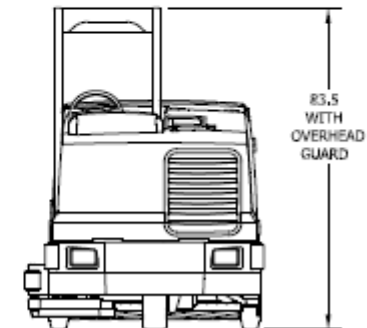
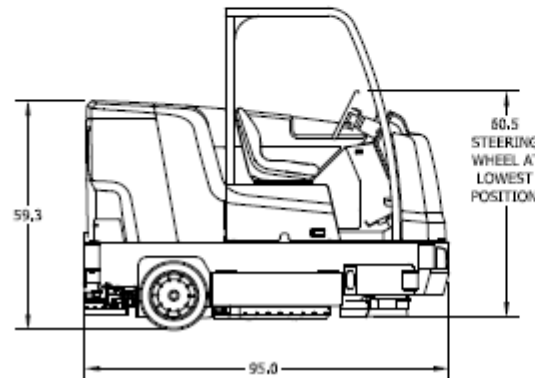
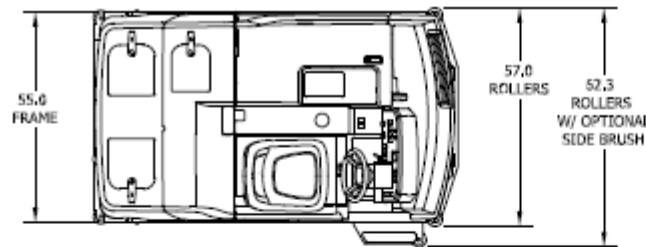
Model No. PB450DSL, PB450GAS, PB450LPG

### General Machine Specifications

Length: . . . . . 95.00 in  
 Width with side scrub brush retracted: . . 60.50 in  
 Width with side scrub brush extended: . . 65.50 in  
 Height to lowest steering position. . . . . 60.50 in  
 Height w/overhead guard . . . . . 83.50 in  
 Wheelbase: . . . . . 47.75 in  
 Front tires: . . . . . 16 in x 6 in molded  
 Rear tires: . . . . . 18 in x 5 in press on  
 Aisle width U-turn: . . . . . 8 ft - 11.7 in  
 Empty vehicle weight . . . . . 3,250 lbs  
 Gross vehicle weight . . . . . 4,800 lbs  
 Maximum forward speed: . . . . . 7.7 mph  
 Maximum reverse speed: . . . . . 4.0 mph  
 Maximum climb angle (Traveling): . . . . . 10 degrees  
 Maximum climb angle (Scrubbing): . . . . . 8 degrees

### Scrubbing system

Cleaning path (main brushes) . . . . . 45 in  
 Cleaning path (w/optional side brush) . . 60 in  
 Main brush diameter: . . . . . 12 in  
 Main brush length: . . . . . 45 in  
 Main brush speed: . . . . . 425 RPM  
 Main brush force: . . . . . 200 lb - 400 lb  
 Side scrub brush diameter: . . . . . 16 in  
 Side scrub brush speed: . . . . . 200 RPM  
 Solution Tank capacity: . . . . . 105 gal  
 Recovery Tank capacity: . . . . . 105 gal  
 Demister chamber capacity: . . . . . 17 gal  
 (2) Debris trays, total capacity: . . . . . 2.1 cu ft  
 Vacuum fan speed: . . . . . 11,500 RPM  
 Vacuum water lift: . . . . . 35 in



# FEATURES

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## FEATURES

### AIR-MOVING SYSTEM

- Internal sound insulation on vacuum impeller
- Engine area shielded from exhaust air, which is vented at the side of the machine

### ERGONOMICS SYSTEM

- Roomy, open operator compartment for extra comfort
- Toe operated parking brake
- Adjustable, high-back seat
- Power steering and tilt steering wheel
- Unparalleled maintenance accessibility, hinged sides and covers require no tools.

### HYDRAULIC SYSTEM

- Protection for both auxiliary and propulsion pumps using separate 100 mesh suction strainer
- Hydraulic reservoir equipped with site gauge and dip stick for fluid level check and replacement
- Hydraulic filter equipped with color coded pressure gauge to indicate filter replacement

### DRIVE-TRAIN SYSTEM

- Industrial liquid-cooled engine
- Heavy-duty radiator & Tri-phase air cleaner
- Hydraulics protection package
- 4-Core Radiator

### CHASSIS SYSTEM

- Massive One-Piece, unitized 3/16 thick steel frame
- Soft-ride tires

### ENVIRONMENTAL FRIENDLY FEATURES

#### LOWER EMISSIONS

All gas and LP engines meet Tier 3 specifications, catalyst mufflers, diesel operated available, bio-diesel fuel can be used in Kubota engines.

#### SAFER WORK ENVIRONMENT

Orange machines are highly visible to others in the workplace, simple controls reduce operator error. Machine is equipped with a horn and an effective braking system. Some Safety Options available are: Overhead Guard, Backup Alarm, Safety Lights, and Fire Extinguisher.

# SAFETY INFORMATION

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## SAFETY INFORMATION

### IMPORTANT SAFETY INSTRUCTIONS

Operators must read and understand this manual before operating or maintaining this machine.

Do not operate this machine in flammable or explosive areas.

This machine is designed solely for removing dirt, dust and debris in an outdoor or indoor environment. PowerBoss does not recommend using this machine in any other capacity.

The following information indicate a potential hazard to the operator and equipment. Read this manual carefully and be aware when these conditions can exist. Take necessary steps to locate all safety devices on the machine and train the personnel operating the machine. Report any machine damage or faulty operation immediately. Do not use machine if it is not in proper operating condition.

### FOR SAFETY DURING OPERATION

Keep hands and feet clear of moving parts while machine is in operation.

Make sure all safety devices are in place and operate properly. All covers, doors and latches must be in place, closed and fastened before use.

During operation, attention should be paid to other persons in the work area and especially if small children are present.

Components can cause an explosion when operated near explosive materials or vapor. Do not operate this machine near flammable materials such as solvents, thinners, fuels, grain dust, etc.

Store or park this machine on a level surface only. To prevent unauthorized use, machine should be stored or parked with the parking brake set and the key removed.

This machine is designed for level operation only. Do not operate on ramps or inclines greater than 14 degrees (24.9% grade).

This machine is not suitable for picking up hazardous dusts.

Use caution when moving this machine into areas that are below freezing temperatures.

# SAFETY INFORMATION

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## SAFETY WHEN SERVICING OR MAINTAINING THE MACHINE

Stop on level surface, set parking brake and turn off machine.

Disconnect the power to the machine when servicing.

Avoid moving parts. Do not wear loose jackets, shirts, or sleeves when working on machine.

Avoid contact with battery acid. Battery acid can cause burns. When working on or around batteries, wear protective clothing and safety glasses. Remove metal jewelry. Do not lay tools or metal objects on top of battery.

Authorized personnel must perform repairs and maintenance. Use PowerBoss supplied replacement parts.

## SAFETY SYMBOLS

Five symbols are used throughout this manual to emphasize various levels of safety information. These symbols and the meaning of each are listed below.

 **DANGER**

To warn of immediate hazards which will result in severe personal injury or death

 **WARNING**

To warn of hazards or unsafe practices which could result in severe personal injury or death.

 **CAUTION**

To warn of hazards or unsafe practices which could result in minor personal injury.

**ATTENTION!**

To warn of practices which could result in extensive equipment damage.

**NOTE:** To direct your attention to important equipment information or special instructions for preventing damage to equipment

Symbols at the top of the list are the strongest warnings. However, all symbols represent important information which should be observed to protect you and others from harm and injury, and to prevent damage to the equipment.

# SAFETY INFORMATION

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## SAFETY DECALS

Decals directly attached to various parts of the unit are highly visible safety reminders which should be read and observed. Make sure the decals are replaced if they become illegible or damaged.

Located in the operator compartment:  
Part Number 3301854



Located on the shroud of the radiator:  
Part Number 3301733





# SAFETY INFORMATION

Located on the engine mount:  
Part Number 3301730



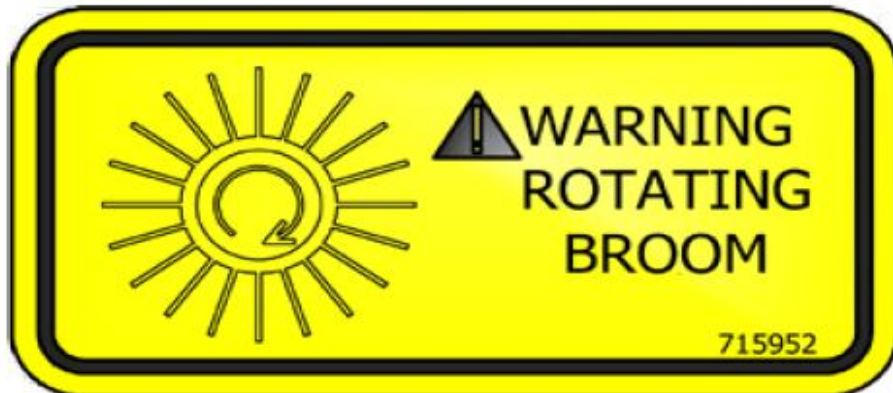
Located on the side:  
Part number 3342978



Located in the operator compartment:  
Part number 3342264



Located behind the main broom doors:  
Part number 715952



# SAFETY INFORMATION

## BASIC POWERBOSS® SAFETY

PowerBoss® scrubbers should never be operated unless:

1. The operator is trained and authorized to operate the equipment and,
2. The equipment is functioning correctly.  
Malfunctioning equipment should be removed from service.

### **DANGER**

Keep cigarettes, matches and all other flame sources away from the machine. Gasoline, LP Gas, and diesel fuels are highly flammable. Lead acid batteries are equally dangerous due to the highly explosive hydrogen gas they emit.

### **WARNING**

Do not operate an LPG powered scrubber when any component in the fuel system is malfunctioning or leaking.

### **WARNING**

**Before starting the engine, make sure that:**

- \* You have read and understood this User Manual
- \* You are securely seated in the operator's seat.
- \* The parking brake is engaged.
- \* The directional control pedal is in neutral.
- \* The throttle is in idle.
- \* Hydraulic controls are in the **OFF** position.

### **WARNING**

**During operation:**

- \* Keep your hands and body clear of moving parts, especially when the bumper is partially or fully raised.
- \* Make sure others in the area stay clear of the machine, equipment, and moving parts.

# SAFETY INFORMATION

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## **WARNING**

When leaving the scrubber unattended:

- \* Place the controls in the **OFF** position.
- \* Set the parking brake.
- \* Shut off the engine.
- \* Remove the key.

## **WARNING**

When servicing or repairing the fuel system:

- \* Work in a properly ventilated area, do not smoke or allow an open flame near the fuel system.
- \* Never bypass safety components unless you are testing them.
- \* Never bypass the fuel filter lock, except when testing them (and always reconnect them after testing).
- \* Wear gloves to disconnect the tank coupling.

## **WARNING**

During cleaning and maintenance:

- \* Always stop the engine and set the parking brake before servicing.
- \* Never use detergents or cleansers that are flammable or combustible.
- \* Never inflate a pneumatic tire without using a safety cage.
- \* Do not attempt any impeller adjustment unless you have shut off the engine. Never place your hands near the intake hoses or inlet when the engine is running.
- \* Always engage the bumper safety arm before servicing the hopper. Do not rely on the gas struts to keep the bumper raised.
- \* Never test for hydraulic hose leaks using your hand or any other part of your body. High pressure leaks can be very dangerous and should only be checked using a piece of paper.

# SAFETY INFORMATION

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**▲ WARNING**

Replace any defective safety components before operating the scrubber.

**▲ CAUTION**

Do not drive with the bumper in the raised position. Driving with the bumper raised increases the risk of damaging the bumper and other hazards.

**▲ CAUTION**

Travel slowly on grades.

**▲ CAUTION**

Place a block or chock behind the wheels when parking on inclines.

**▲ CAUTION**

Use special care when traveling on wet surfaces.

**▲ CAUTION**

Observe all proper procedures for operation and maintenance of the unit, as outlined in this manual.

**▲ CAUTION**

Remain alert at all times to people and equipment in and around your area of operation.

**ATTENTION!**

Never push or tow this machine faster than 1 mph.

**ATTENTION!**

Engage tow valve before towing or pushing.

# TRANSPORTING MACHINE

## TRANSPORTING THE MACHINE

### USING A TRAILER OR TRANSPORT VEHICLE

1. Position the machine on the transport vehicle or trailer and apply the parking brake.
2. Tie the machine down using the tie down bars on both sides of the front corners and behind both rear wheels.

**Note:** Attach the tie downs to the tie down bars only.

### PUSHING OR TOWING THE MACHINE

Before towing or pushing the machine, turn the bypass valve located on the top of the propulsion pump 90 degrees as shown. See Fig. 2.

#### **⚠ CAUTION**

The tow control valve must be turned 90 degrees from the operating position.  
Not turning the tow control valve will cause damage to the pump.

#### **ATTENTION!**

Do not tow or push the machine a distance of more than .5 miles (.80 kilometers) or faster than one mile per hour (1.61 km). Exceeding these restrictions may cause damage to the hydraulic system. If towing will exceed the above restrictions, the rear wheel must be raised or supported by a dolly.

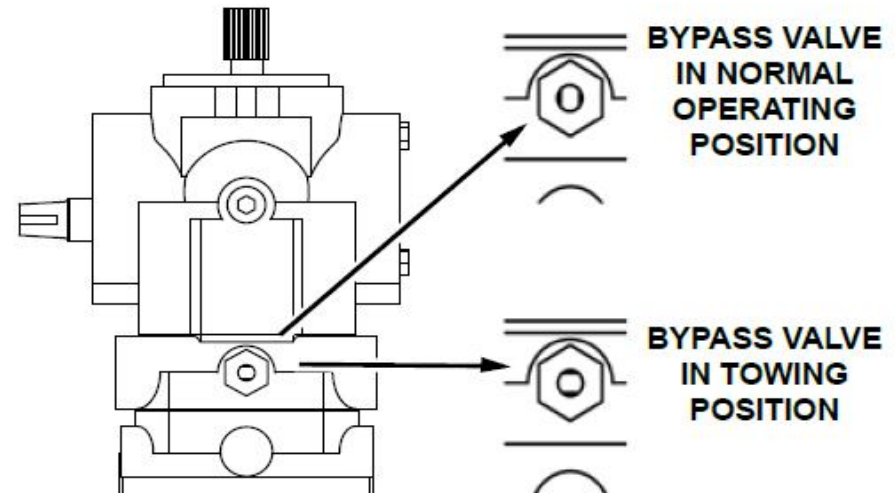


Fig. 2: Bypass Valve locations

## PREVENTATIVE MAINTENANCE

### Introduction

Regular maintenance on your sweeper results in better cleaning, faster cleaning and a prolonged service life for the equipment and components. This section contains the following information to help you give your sweeper the maintenance attention it requires:

- A Scheduled Maintenance Chart
- Preventative Maintenance Instructions for Required Scheduled Maintenance Tasks

Because it is extremely important to your safety, you will see the following **WARNING** repeated throughout this section:

 **WARNING**

**Never attempt to perform any service on the equipment or components until the engine is OFF, the parking brake is LOCKED, and the wheels are CHOCKED.**

# PREVENTATIVE MAINTENANCE



SCHEDULED MAINTENANCE CHART					
FREQUENCY (IN HOURS)					SERVICE (BY MAINTENANCE AREA)
DAILY	50	100	200	500	
<b>ENGINE</b>					
		X			Pressure wash engine <i>NOTE: For additional maintenance requirements, refer to the engine manual.</i>
<b>AIR INTAKE SYSTEM</b>					
X					Empty rubber dust cup of air filter element.
X					Check air filter indicator
	X				Clean air filter. <i>NOTE: Clean more often in dusty conditions.</i>
			X		Replace air filter.
<b>ELECTRICAL SYSTEM</b>					
			X		Clean battery top.
<b>COOLANT SYSTEM</b>					
X					Check coolant level and fill as needed.
	X				Inspect radiator fins and clean as needed.
		X			Blow out radiator fins.

# PREVENTATIVE MAINTENANCE



SCHEDULED MAINTENANCE CHART					
FREQUENCY (IN HOURS)					SERVICE (BY MAINTENANCE AREA)
DAILY	50	100	200	500	
<b>LUBRICATION POINTS</b>					
				X	Lubricate steering cylinder rod end.
				X	Lubricate steering fork.
			X		Lubricate scrub head lift arm bearings
				X	Hood Latches & Hinges Lubricate type - oil
<b>IMPELLER</b>					
X					Check for hydraulic fluid leaks from hoses and motor.
<b>HYDRAULIC SYSTEM</b>					
X					Check hydraulic reservoir gauge and fill as needed.
				X	Replace breather cap filter element.
				X <sup>1</sup>	Replace hydraulic fluid and filter
X					Check function of directional control pedal (hydrostatic transmission) and adjust as needed.
				X	Clean hydraulic fluid strainer in reservoir.
	X				Inspect hydraulic oil cooler fins and clean as needed (if so equipped).
		X			Blow out hydraulic oil cooler fins with compressed air (if so equipped).
Notes: 1. Replace as indicated by hydraulic filter gauge.					



# PREVENTATIVE MAINTENANCE



SCHEDULED MAINTENANCE CHART					
FREQUENCY (IN HOURS)					SERVICE (BY MAINTENANCE AREA)
DAILY	50	100	200	500	
<b>SWEEPING COMPONENTS</b>					
X					Inspect brushes for wear and remove strings and debris from bristles and drive assembly.
	X				Scrub head front & rear wear and damage, adjust or replace as needed.
				X	Perform brush taper pattern test and adjust if needed.
					Replace main scrub brushes as needed: Main Brushes needs to be replace if bristles are 1/2" in length or less.
<b>STEERING</b>					
	X				Check for leaks.
<b>PARKING BRAKE</b>					
			X		Check for proper functioning and adjust as needed.
<b>WHEELS AND TIRES</b>					
X					Visually inspect for wear and damage. Repair or replace as needed.
	X				Check and tighten lug nuts. (torque to 100 ft.-lbs)
<b>MISCELLANEOUS</b>					
				X	Inspect latches and hinges. Tighten and lubricate as needed.
			X		Check anti-static strap on rear wall of broom chamber for damage or excessive wear. Replace as needed.

## PREVENTATIVE MAINTENANCE INSTRUCTIONS

### ENGINE

Maintenance requirements and service instructions for your Scrubber/Sweeper engine are outlined in the following parts of this Maintenance Section:

- Air Intake System
- Electrical System
- Fuel System
- Coolant System
- Lubrication System

All basic maintenance tasks are listed with their recommended frequencies on the Planned Maintenance Chart in this manual. Important additional engine maintenance requirements and instructions are explained in the Engine Supplemental Catalog which comes with your machine.

### **WARNING**

Never attempt to perform any service on the equipment or components until the engine is **OFF**, the parking brake is **LOCKED**, and the wheels are **CHOCKED**.

## AIR INTAKE SYSTEM

### Check Air Filter Service Indicator

The air filter service indicator shows when to change the air filter element. Check the indicator on a daily basis. The red indicator gradually becomes visible as the air filter elements load with dirt. It is not necessary to change the air filter elements until the red indicator reaches the top of the service indicator and locks into position.

1. Lift engine cover
2. Inspect air filter service indicator.

**Note:** The indicator may return to the nonviable position when the engine is shut off. To check, reset indicator and turn on the engine, if it locks in visible position again clean or change element.

### Air Filter Element Removal

1. Turn off the engine and set the parking brake.
2. Lift the engine top cover and side door.
3. Locate the air filter and loosen the retaining clamp.
4. Remove the dust cup.
5. Pull the rubber plug out of the dust cup and empty the contents.
6. Pull the air filter elements out of its housing.

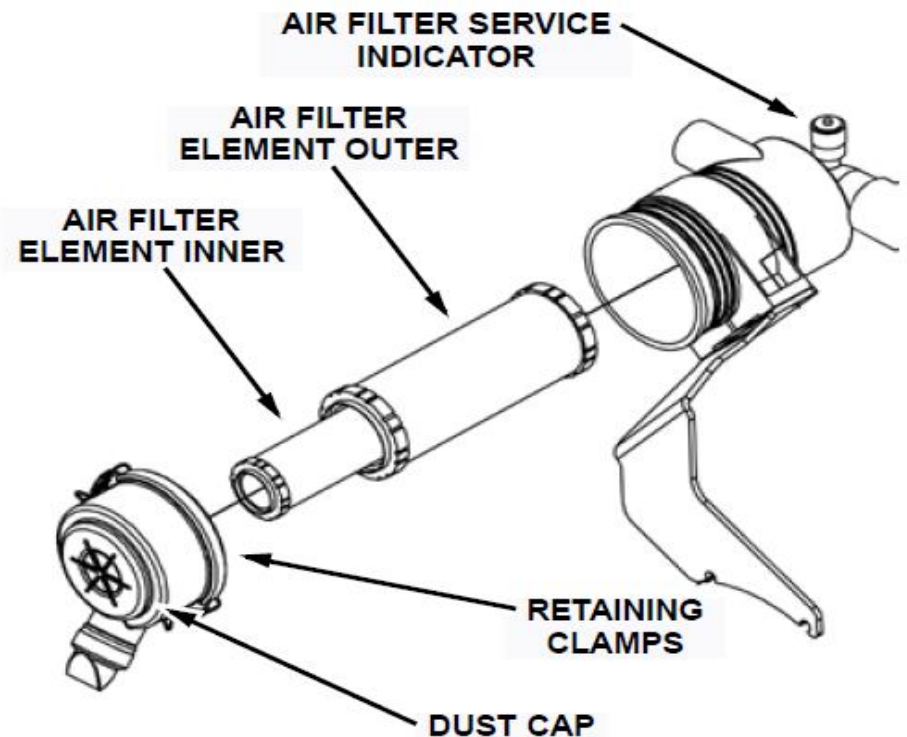


Fig. 1: Air Intake System

## Air Filter Cleaning

1. Once you have removed the air filter elements, empty the dust cup and clean the interior of the air filter housing.
2. Use an air hose to blow out the air filter elements. Air pressure should be 100 psi or less.

## Air Filter Inspection

1. After you clean the air filter elements, check the elements for holes by passing a light bulb inside it.

## Air Filter Installation

1. Wipe out the air cleaner housing with a damp cloth. Be sure all dirt is removed.
2. Install the cleaned replacement filter elements so that the fins are at the far end of the housing. Be careful not to damage the fins.
3. Replace the rubber plug in the dust cup.
4. Replace dust cup, being sure embossed word "top" on cup is positioned correctly (up).
5. Tighten the retaining clips.
6. Check the condition of intake hoses and clamps. Close engine top cover and side door.

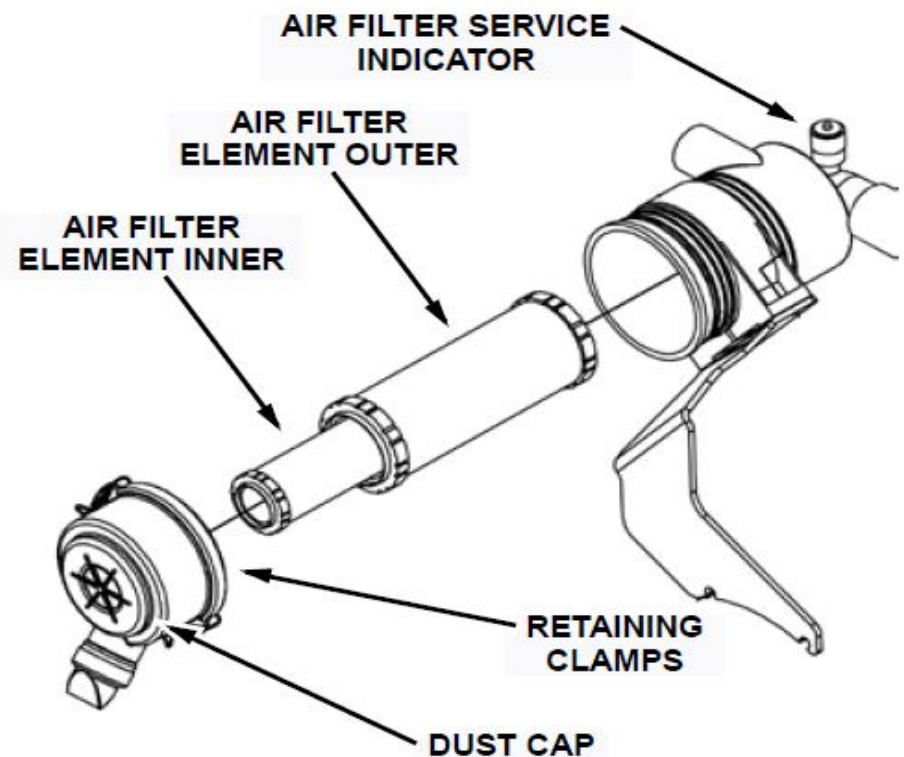


Fig. 1: Air Intake System

## ELECTRICAL SYSTEM

### Battery Cleaning

1. Combine baking soda and water in a strong solution.
2. Brush the solution over the battery top, including terminals and cable clamps. Make sure the solution does not enter the battery.
3. Using a wire brush, clean the terminal posts and cable clamps.
4. Apply a thin coating of petroleum jelly to the terminals and cable clamps.

### Battery Replacement

 **CAUTION**

Remove the negative battery cable before you remove the positive battery cable. This is done to prevent accidental electrical shorting which can result in personal injury.

1. Disconnect the negative (-) cable and then the positive (+) cable.
2. Remove the battery.
3. Install the new battery.
4. Connect the positive (+) battery cable first, then the negative (-) cable.

## LUBRICATION POINTS

### Steering Fork Bearings

The steering fork bearings are located above the front wheel.

### Rear Wheel Bearings

Repack the rear wheel bearings every 400 hours of operation using Lubriplate EMB grease and replace damaged seals.

### Squeegee Caster Bearings

Lubricate the squeegee caster bearings every 100 hours using Lubriplate EMB grease.

### Scrub Head Lift Arm Bearings

Lubricate the hopper lift bearings every 500 hours with light oil.

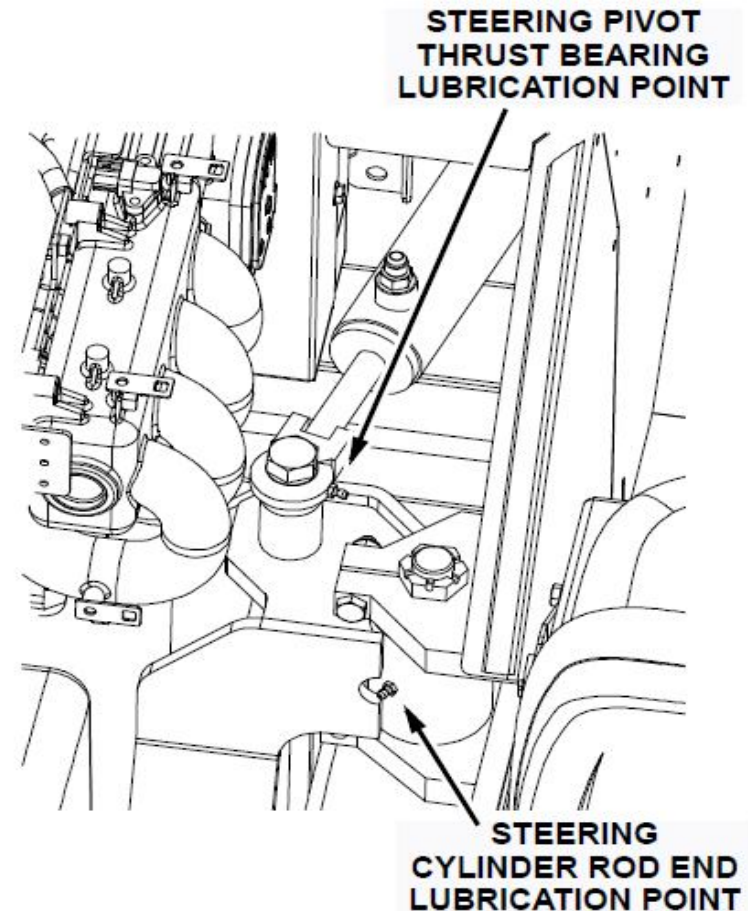


Fig. 1: Lubrication Points

## LATCHES & HINGES

Lubricate the cover hinges every 200 hours of operation with light machine oil. Lubricate the following:

- Front cover, hinges and latches
- Side doors, hinges and latches
- Top cover, hinges and latches
- Scrub head doors

The scrub head lift arm bearings are located on both sides of the machine just above the scrub head. These bearings can be best accessed when the scrub head is in the lowered position.

Lubricate the steering fork bearings every 100 hours using Lubriplate EMB grease.

## STATIC STRAP

A static strap prevents the buildup of static electricity in the machine. The static strap is attached to the frame in front of the left scrub door. Replace the static strap if it is damaged or no longer touches the floor.

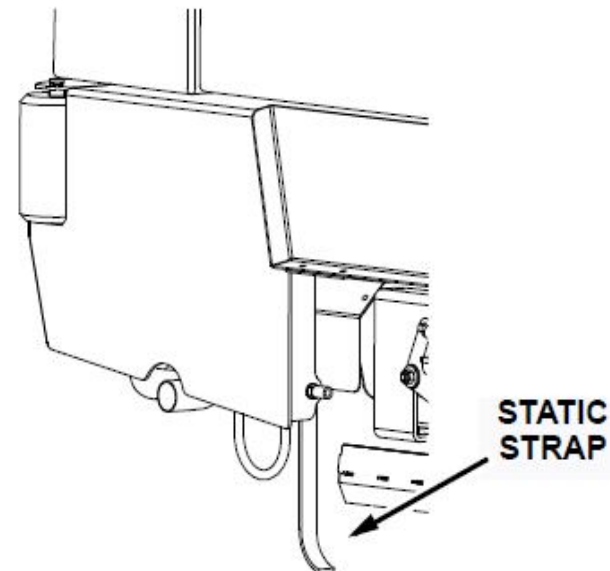


Fig. 1: Static Strap

## HYDRAULIC SYSTEM

### Hydraulic Fluid Reservoir

The hydraulic fluid reservoir is located behind the right side door under the operator seat. (See Fig. 1)

**Note:** The reservoir fill cap has a built-in breather and dip stick. Replace the cap every 100 hours of operation.

**Note:** The hydraulic oil filter contains a replaceable element. Replace the filter element every 100 hours of operation.

The reservoir has a sight gauge to quickly view if there is a sufficient amount hydraulic oil in the reservoir tank to run the machine. Check daily and add hydraulic oil as needed.

When the machine is cool unscrew the fill cap and check the fluid level on the attached dip stick. The fluid level should be between the high and low markers. The cap should be screwed down hand tight and unscrewed to get a proper oil level reading. Add or remove hydraulic fluid as needed.

### ⚠ CAUTION

**DO NOT OVERFILL HYDRAULIC RESEVOIR TANK!  
DO NOT USE TRANSMISSION FLUID!**

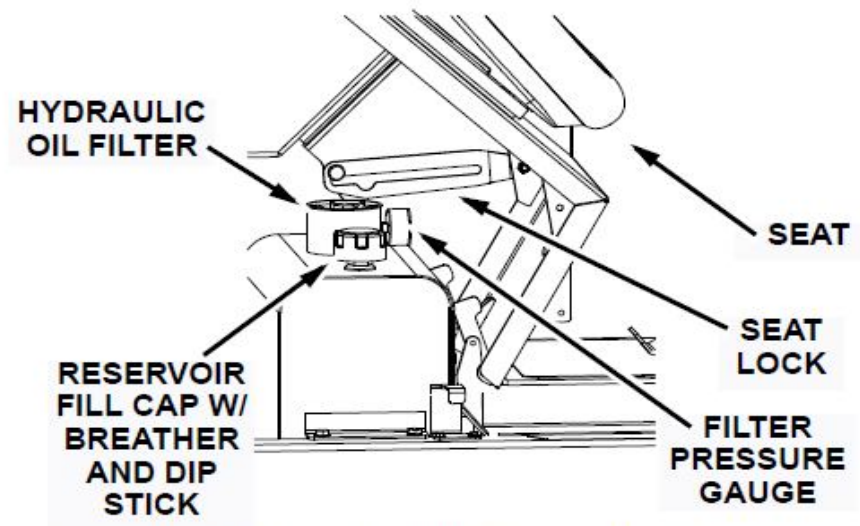


Fig. 2: Hydraulic Fluid Reservoir location



Fig. 3: Hydraulic Fluid Gauges



# PREVENTATIVE MAINTENANCE

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## ⚠ CAUTION

PowerBoss, Inc. **RECOMMENDS USING:**

**Megaflow® AW HVI Hydraulic Oil 32 or EQUIVALENT!**

### Hydraulic Fluid Viscosity Specifications for (Megaflow® AW HVI Hydraulic Oil 32)

cSt @ 40° C (104° F): 32.0

cSt @ 100° C (212° F): 6.0

### Changing the Hydraulic Fluid

1. Turn off the engine and engage the parking brake.
2. Place a drain pan under the reservoir tank.
3. Remove the drain plug, unscrew with 5/16" hex head wrench, located on the bottom of the reservoir and allow the fluid to drain.
4. Discard the fluid in an approved manner, then replace and retighten the drain plug.
5. Remove the fill cap located on top of the reservoir and fill the reservoir with the recommended hydraulic fluid: (Megaflow® AW HVI Hydraulic Oil 32 or equivalent).

**Note:** A minimum of 7 and up to 8 gallons of hydraulic oil is needed to fill the empty reservoir tank to the correct amount. The maximum volume capacity of the hydraulic reservoir tank is 9.9 gallons. Do not fill to this maximum capacity!

6. Visually see if the hydraulic oil level is at or above the sight gauge. Confirm the hydraulic oil level is within the high and low markers on the dip stick. Add or remove hydraulic fluid as needed. (Reference approximate fill line)
7. Verify the fill cap is hand tight to prevent leakage.
8. Start the machine, shut it off, then check for leakage.

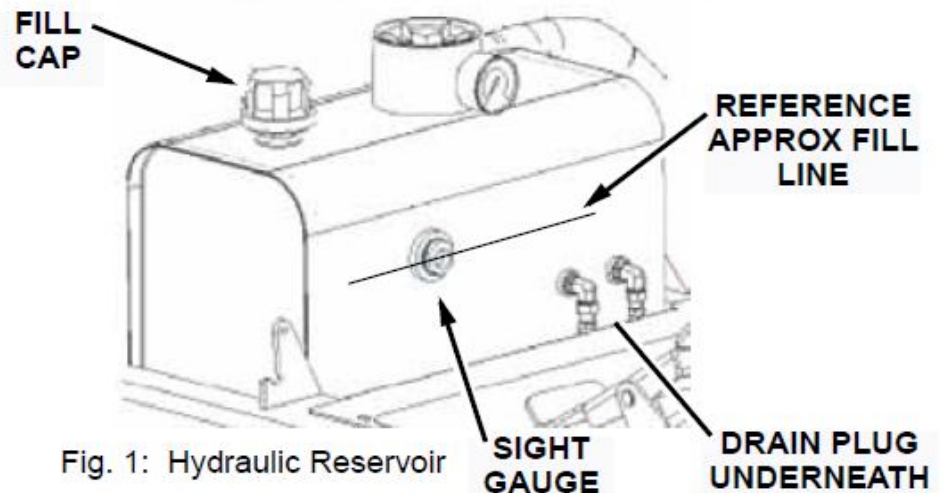


Fig. 1: Hydraulic Reservoir

## Hydraulic Fluid Filter

The reservoir tank has a pressure gauge to monitor hydraulic fluid pressure and to indicate when the hydraulic fluid filter needs to be replaced.

The pressure gauge needle indicates green, yellow, and red pressure zones. When the needle reaches the red pressure zone, the filter needs to be replaced.

**Note:** The pressure gauge should be observed when engine is on. This gauge can be viewed from the sight hole below the operator seat.

## Changing The Hydraulic Fluid Filter

1. Turn off the engine and engage the parking brake.
2. Access the filter by tilting the operator seat forward and engaging the seat lock. The fluid filter will be visible on top of the reservoir tank.
3. Unscrew the filter with an 15/16 wrench, and remove the fluid filter from the top of the reservoir.
4. Screw the new filter in position and tighten with an 15/16 wrench.

**Note:** Do not over tighten.

5. Start the machine, shut it off, then check for leakage.

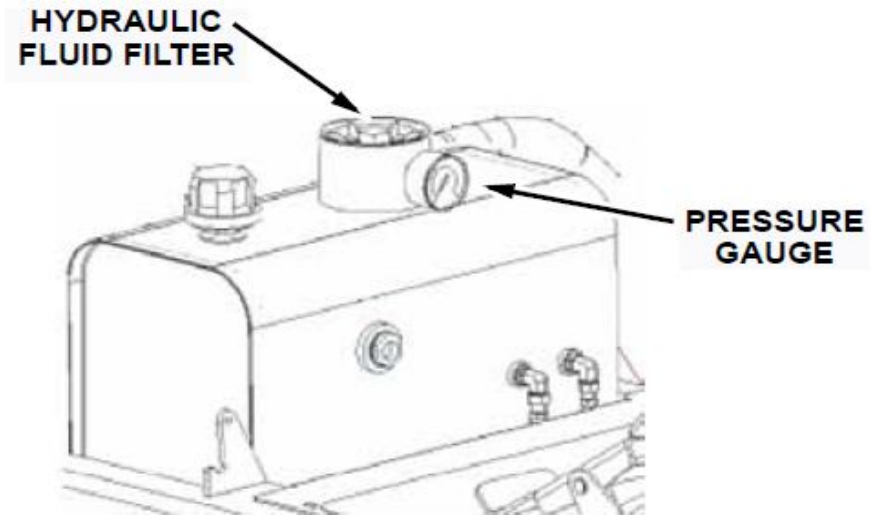


Fig. 2: Hydraulic Filter & Pressure Gauge

## Maintaining Hydraulic Oil Cooler Efficiency

Your machine is equipped with a hydraulic oil cooler, it is integrated with the radiator and utilizes exhausted radiator air from the engine fan to cool the hydraulic fluid.

To maintain its efficiency, periodically blow out the radiator and oil cooler fins with compressed air 100 p.s.i. is maximum.

# PREVENTATIVE MAINTENANCE

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## Adjusting the Propulsion Pump Neutral Setting

If the machine does not remain in neutral when the foot pedal is released the following adjustment is necessary.

### **⚠ WARNING**

Before starting the engine raise the front of the machine with a suitable floor jack so that the drive wheel is lifted off the floor. This will insure that the machine will not move forward or backward while the neutral setting is being adjusted!

1. Raise the front of the machine with a suitable floor jack so that drive wheel is off the floor.
2. Slightly loosen the two bolts holding the Hydroback adjuster plate to the Hydroback mount so that the plates remain in contact but the adjuster plate can move.
3. Start the engine and position the throttle switch to the high speed position.
4. Push the directional control pedal in the forward direction and release, then push the pedal into reverse and release.
5. Note the direction that the drive wheel is rotating when the directional control pedal released.

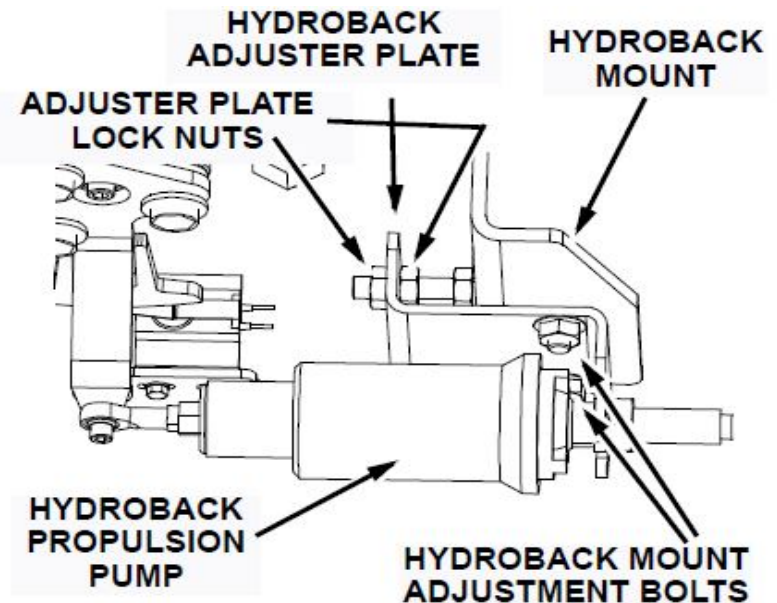


Fig. 1: Hydroback Propulsion Pump

6. **If the drive wheel rotates in the forward direction:** Slowly turn the lock nuts located on either side of the Hydroback adjuster plate so that the adjuster plate is moved to the right.
7. **If the drive wheel rotates in the reverse direction:** Slowly turn the lock nuts located on either side of the Hydroback adjuster plate so that the adjuster plate is moved to the left.

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8. When the drive wheel comes to a complete stop tighten the two lock nuts.
9. Tighten the two fasteners holding the Hydroback adjuster plate to the Hydroback mount.
10. Repeat step 4 above to verify that the neutral position is correctly adjusted. If not repeat steps 1 through 9 above.
11. Turn off the engine and lower the machine to the floor.

Note: The Neutral Switch must be re-adjusted after adjusting the propulsion pump. See the Neutral Sensing Switch section on page 36

## Drive Motor

After the first 50 hours of operation torque the motor shaft nut to 475 ft-lb (644 Nm) dry; 375 ft-lb (508 Nm) lubricated. Repeat this again after each 800 hours of operation.

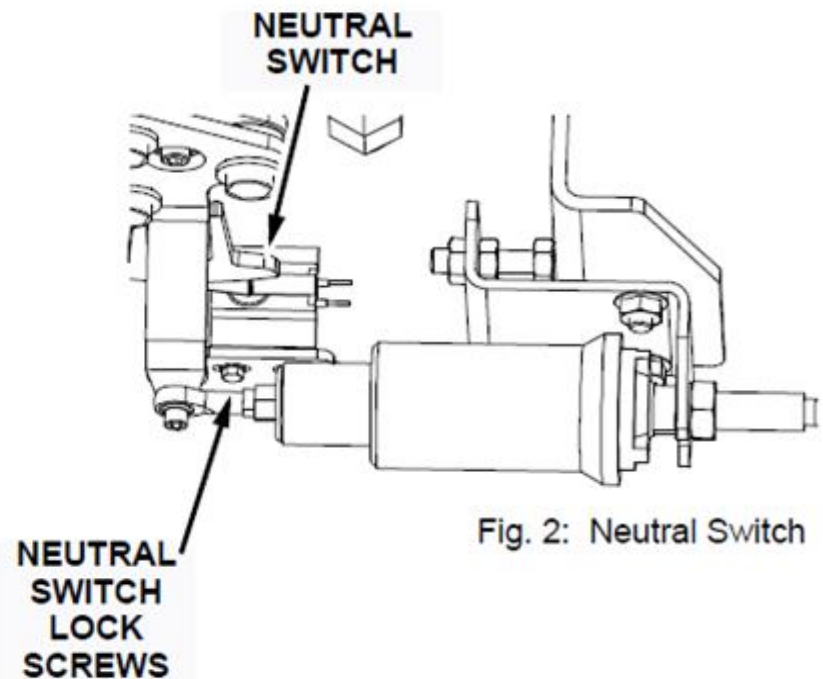


Fig. 2: Neutral Switch

## Checking the Scrub Brush Pattern

For the best results perform the scrub brush pattern tests on a smooth even floor.

**Note:** Chalk or chalk powder applied to the floor will help to show the brush pattern. If chalk is not available allow the brushes to turn on the floor for 1 or 2 minutes. A polished brush pattern will be visible on the floor.

1. Raise the scrub deck.
2. Position the scrub deck over the chalked area.
3. Set the parking brake.

**For Safety:** Before leaving machine, turn off the machine, set the parking brake, and remove the key.

4. Lower the scrub head for 10-15 seconds. Do not allow the machine to move forward or backward.
5. Raise the scrub deck.
6. Release the parking brake and drive the machine away from the chalked area.

7. Check the width and shape of the brush patterns on the floor. If the long edges of the two brush patterns are parallel then a brush pattern adjustment is not required.

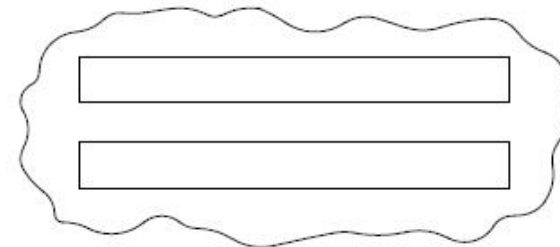


Fig. 1: Brush Pattern Correct

If only one of the scrub brush patterns is tapered then only that brush pattern must be adjusted. If both of the brush patterns are tapered then both brush patterns must be adjusted.

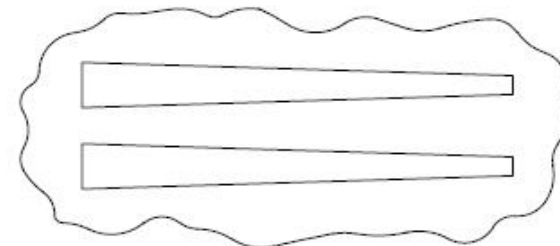


Fig. 2: Brush Pattern Incorrect

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## Adjusting the Scrub Brush Pattern (Taper)

The front scrub brush pattern adjustment is located behind the right side scrub brush door.

The rear scrub brush pattern adjustment is located behind the left side scrub brush door.

1. Raise the scrub brush side door.
2. Release the retaining latch at the rear of the side squeegee mount and swing the side squeegee mount open.
3. Loosen the four pattern adjustment nuts located on either side of the scrub brush idler plate.
4. Raise or lower the scrub brush idler plate as necessary to correct the tapered brush pattern. Raising the idler plate will decrease the brush pattern width on that side of the scrub deck.

**Note:** Lowering the idler plate will increase the brush pattern width on that side of the scrub deck.

5. Tighten the four pattern adjustment nuts.
6. Close and latch the side squeegee mount. The side squeegee mount holds the brush idler plate in place.
7. Check the scrub brush pattern again and readjust if necessary.

The brush patterns should also be the same width. If one is wider than the other then the scrub brush pattern width must be adjusted.

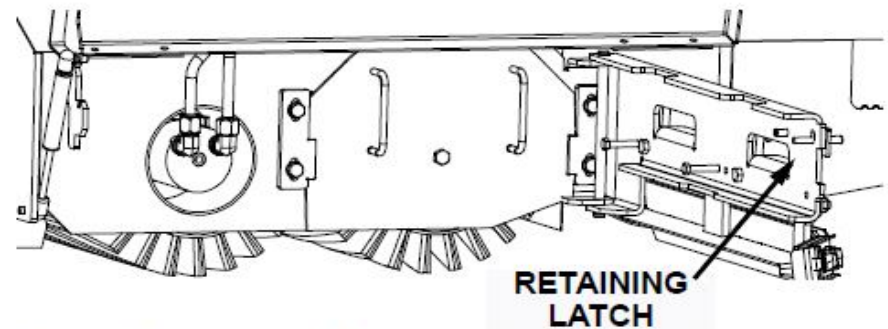


Fig. 1: Retaining Latch location

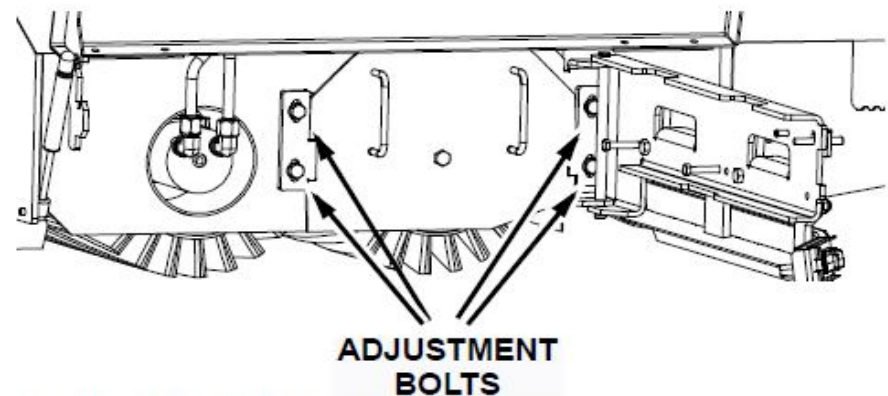


Fig. 2: Adjustment Bolts, location

## Adjusting the Scrub Brush Pattern (Equal width)

The width of the two scrub brush patterns should be equal. If they are not equal the level of the scrub deck must be adjusted front-to-back. (See Fig. 3)

1. Open the two side doors and raise the seat mount.
2. Lengthen or shorten the leveling rods located on each side of the machine above the scrub deck. Lengthening the rods will increase the front scrub brush pattern width. (See Fig. 4)
3. Adjust the leveling rods in equal amounts.
4. Check the scrub brush pattern again and readjust if necessary.

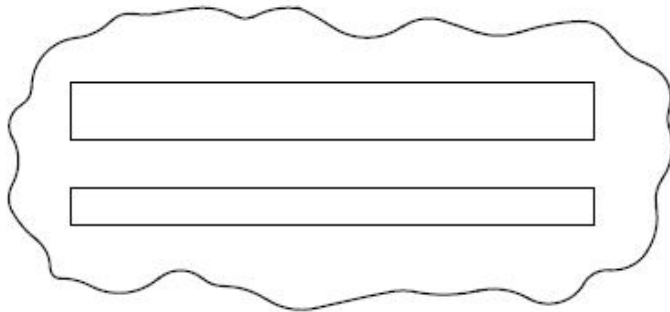


Fig. 3: Brush Pattern (width not equal)

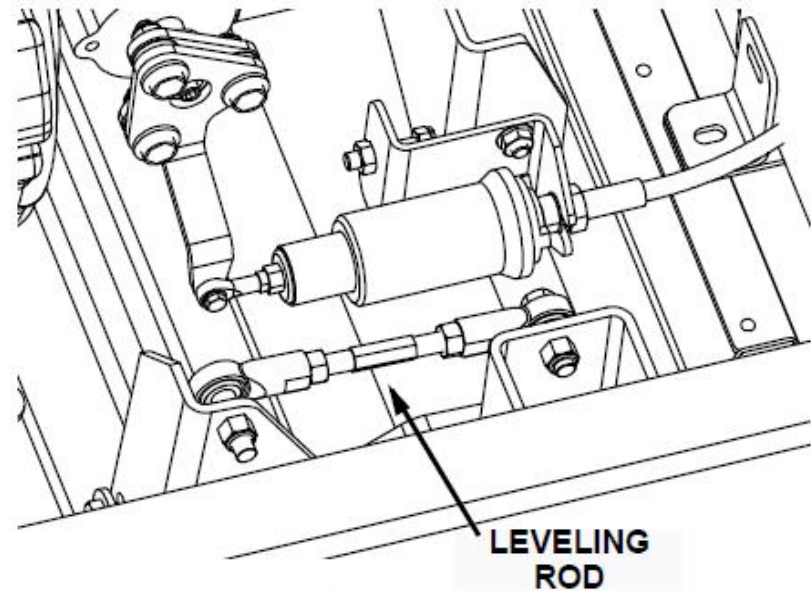


Fig. 4: Leveling Rod location

## SQUEEGEES

The right and left side squeegees control water during turns and channel water toward the center of the machine and into the path of the rear squeegee.

The rear squeegee channels water to the center of the squeegee where it is removed by the vacuum fan.

The optional side scrub brush squeegee channels water to the inside of the right side squeegee.

Check the squeegee blades daily for wear or damage. Replace or rotate the squeegee blades if the edges are torn or worn half-way through the thickness of the blade.

The rear squeegee blades must be adjusted to be level and for correct deflection.

## Checking the Rear Squeegee Blade Flare

Squeegee flare is the amount of curl in the squeegee blade as it drags on the floor while the machine is moving forward. Correct squeegee blade flare is necessary for optimum water pick up. The correct flare adjustment is achieved when the squeegee wipes the floor dry with the least amount of deflection. It is important that this check be performed on an even, level surface.

1. Lower the squeegee.
2. Drive the machine forward approximately 2 ft (0.6m).
3. Set the parking brake.
4. Examine the curl in the squeegee rubber to see that the flare is correct and that it is uniform around the entire back edge of the squeegee blade:



## Adjusting the Rear Squeegee Blade Flare

Be sure that the squeegee assembly is adjusted to level before performing the flare adjustment. It is important that this adjustment be performed on an even, level surface.

**Note:** Raising the squeegee casters increases the squeegee flare, lowering the casters reduces the squeegee flare.

1. Lower the squeegee.
2. Press and hold the idle button located under the key switch.
3. While holding the idle button turn off the engine key switch Set the parking brake.
4. Lift the squeegee assembly up by hand and allow it to rest back down on the floor. The squeegee blade should be standing straight up on the floor with no flair.
5. Loosen the locking knobs on the squeegee casters.
6. Adjust the casters until they clear the floor by 1/4" (6.3mm). Use a 1/4" (6.3mm) thick spacer for this procedure.
7. Check the squeegee flare (See **Checking the Rear Squeegee Blade Flare**).
8. Test the squeegee for water pick up.
9. Make fine adjustments to the caster height for optimum water pick up on the floor surface to be cleaned.

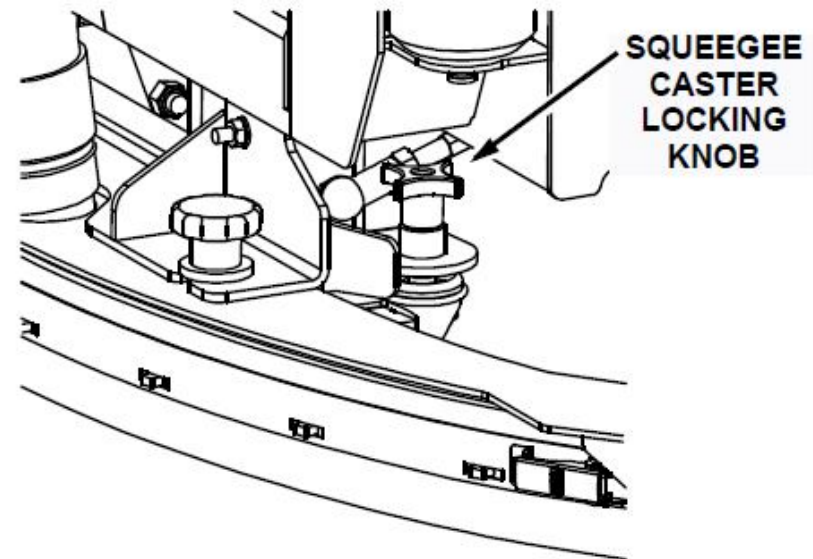


Fig. 1: Adjusting the Rear Squeegee Blade Flair

## Leveling the Rear Squeegee

Leveling the squeegee assembly provides a uniform flare of the squeegee blade. It is important that this adjustment be performed on an even, level surface.

1. Lower the squeegee.
2. Drive the machine forward approximately 2 ft (0.6m).
3. Set the parking brake.
4. Examine the curl in the squeegee rubber around the entire back edge of the squeegee blade.

If the flare is not even across the rear squeegee blade proceed with the following:

5. Locate the two sets of adjustment nuts on the two squeegee adjustment rods.

**Note:** Raising the rear bumper and then lowering the squeegee will provide greater access to the adjusting nuts.

6. To lower the front of the squeegee turn the two adjustment nuts on each adjustment rod rearward (away from the front of the machine).

To lower the rear of the squeegee turn the two adjustment nuts on each adjustment rod forward (toward the front of the machine).

7. Lock the adjustment nuts.
8. If necessary proceed to **Adjusting the Rear Squeegee Blade Flare**.
9. Test the squeegee for water pick up.
10. Re-adjust to level the squeegee if necessary.

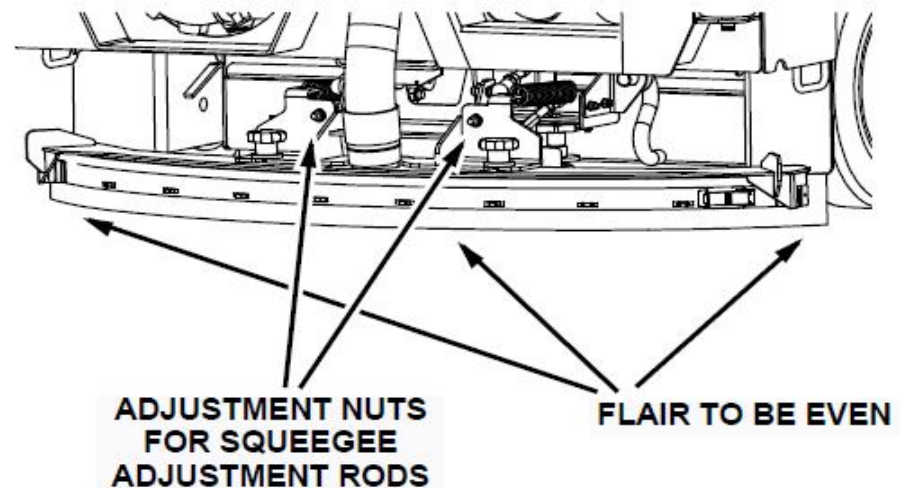


Fig. 2: Leveling the Rear Squeegee

## BRAKES

### Service Brakes

The service brakes are operated by a foot pedal and connecting cables. (See Fig. 1)

Check the service brake adjustment every 200 hours of operation.

### Parking Brake

The parking brake is operated by a locking foot pedal that activates the service brakes. (See Fig. 1)

Check the service brake adjustment every 200 hours of operation.

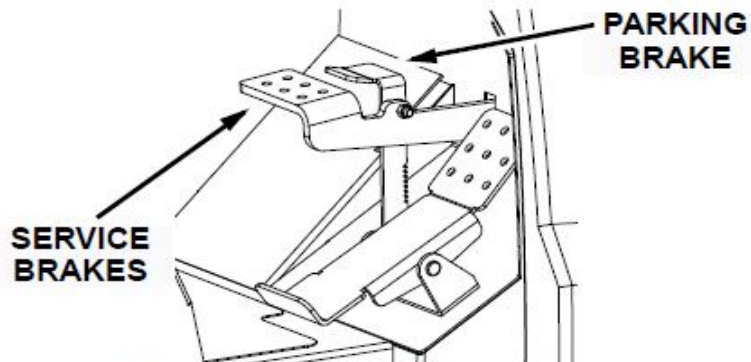


Fig. 1: Service and Parking Brakes

### Adjusting the Brake System

Both the service and parking brake are adjusted during the following cable length adjustment.

The brake cable adjustment is located under the operator compartment floor behind the front cover. (See Fig. 1)

1. Loosen the locking nut on the adjustment hex bar.
2. Adjust the length of the cable by turning the adjustment hex bar.

**Note:** The cable should be adjusted so that there is little play in the brake pedal but not so tight to cause the brakes to drag when the brake pedal is released.

3. Test the brakes and re-adjust if necessary.
4. Tighten the locking nut.

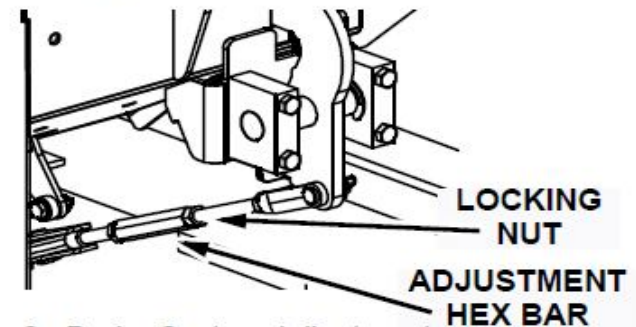


Fig. 2: Brake System Adjustment

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## TIRES

The front and rear tires are solid press-on tires.

Check the tires for damage every 100 hours of operation.

### Changing Solid Tires

**Note:** The procedures that follow apply to SOLID TIRES ONLY!

#### Front Tires

1. Remove the tire from the vehicle by removing the 5 lug nuts.
2. Press the tire from the rim.
3. Press the new tire onto the rim.
4. Reinstall the tire on the machine.
5. Tighten the five wheel lug nuts to 90-110 ft lb (122-149 Nm).

#### Rear Tires

1. Remove the tire from the vehicle by removing the center axle nut.
2. Pull the rear tire straight off of the axle.

3. Remove the inner and outer bearings. Note which is the inner bearing and which is the outer bearing so that they are reinstalled in the same location.
4. Press the tire from the rim.
5. Press the new tire onto the rim.
6. Clean the inner and outer bearing races and bores.
7. Clean the bearings. Inspect the bearings and races for wear, replace if necessary.
8. Grease the bearings with Lubriplate EMB or equivalent.
9. Install the bearings in the wheel. Insure that the bearing seals are seated correctly and being careful not to get any grease on the brake surface or brake pads.
10. Reinstall the tire on the machine by holding the wheel parallel to the side of the vehicle and firmly push it onto the axle.
11. Torque the wheel nut to 100 in-lb (11.3 Nm)
12. Align the hole in the axle with the closest slot on the nut and install the cotter pin.
13. Install the hub cap.

## SENSING SWITCHES

### Adjusting the Neutral Sensing Switch

The Neutral Sensing Switch shuts off and raises the scrub brushes and turns off the solution flow whenever the vehicle is not in motion. When vehicle motion resumes the scrub brushes automatically turn on and lower and the solution flow is turned on.

The Neutral Sensing Switch is a normally open roller switch located below and inboard of the pump centering unit (Hydroback unit).

The switch is activated by a cam attached to the pump centering arm.

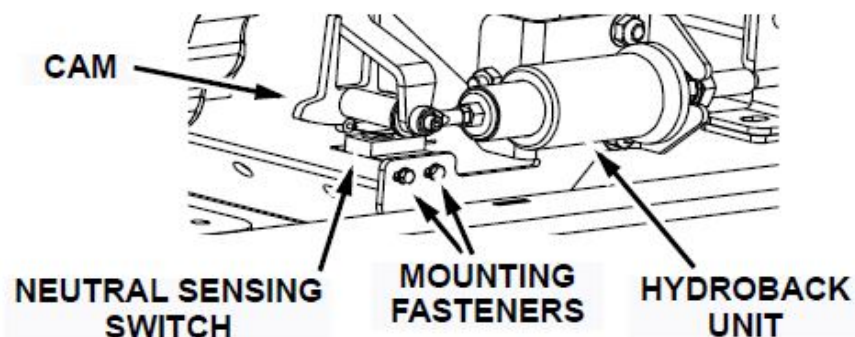


Fig. 1: Adjusting the Neutral Sensing Switch

### Neutral Sensing Switch Adjustment:

**Note:** Hydrostatic transmission neutral must be set before performing this adjustment.

The cable should be adjusted so that there is little play in the brake pedal but not so tight to cause the brakes to drag when the brake pedal is released. (See Fig. 1 & 2)

1. Slightly loosen the neutral switch mounting fasteners so that the switch can be repositioned by hand.

The adjustment can be monitored by listening to the sound of the switch as it opens and closes.

2. Begin the adjustment by moving the switch body so that the roller fits up into the half-round cut out in the cam. This is the neutral position and the switch should be open.

Insure that the switch body is kept level during adjustment.

3. Adjust the switch body so that that a very small amount of pump arm motion will force the roller down and close the switch.

This adjustment should be made while pushing the pump arm slightly forward by hand (towards the front of the vehicle) and then releasing the arm while listening for the switch to close and open.

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It is important that the switch reacts quickly otherwise it will be necessary to drive the vehicle at too high a speed before the brushes become activated.

4. Insure that the switch also closes and opens when the pump arm is pushed slightly to the rear and released.
5. Tighten the switch fasteners and retest.

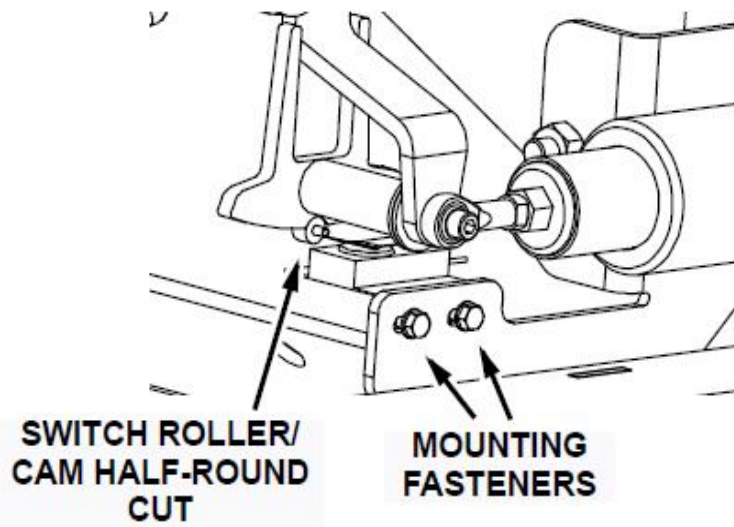


Fig. 2: Roller and Cam Position

## Adjusting the Nautilus Reverse Sensing Switch

To prevent squeegee damage a reverse sensing switch causes the rear squeegee to raise whenever the vehicle moves in reverse. When the vehicle is stopped or resumes forward motion the rear squeegee automatically lowers back to the floor.

The neutral sensing switch is a whisker-type switch located below the directional control pedal. The switch is activated by the directional control pedal arm. (See Fig. 3)

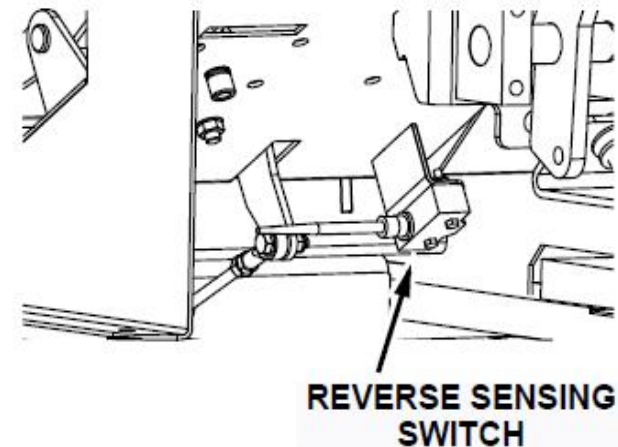


Fig. 3: Reverse Sensing Switch location

## Nautilus Reverse Sensing Switch Adjustment:

**Note:** The heel end of the directional control pedal, when in neutral, must be set to 3/4 inch above the operator compartment floor before performing this adjustment.

1. Slightly loosen the neutral switch mounting fasteners so that the switch can be repositioned by hand. (See Fig. 1)

The adjustment can be monitored by listening to the sound of the switch as it opens and closes.

2. Adjust the switch body so that the switch is already activated when the directional control pedal is in neutral and stays activated when the pedal is pushed in the forward direction. The switch should close immediately upon moving the pedal into the reverse direction. It is important that only a very small amount of reverse pedal movement closes the switch.

It is important that the switch reacts quickly in reverse otherwise the vehicle will have to travel too fast in reverse before the rear squeegee is raised or may not raise at all when moving in reverse at low speed.

3. Insure that the switch activates correctly when the directional control pedal is pushed slightly forward and released and when pushed slightly in reverse and released.
4. Tighten the switch fasteners and retest.

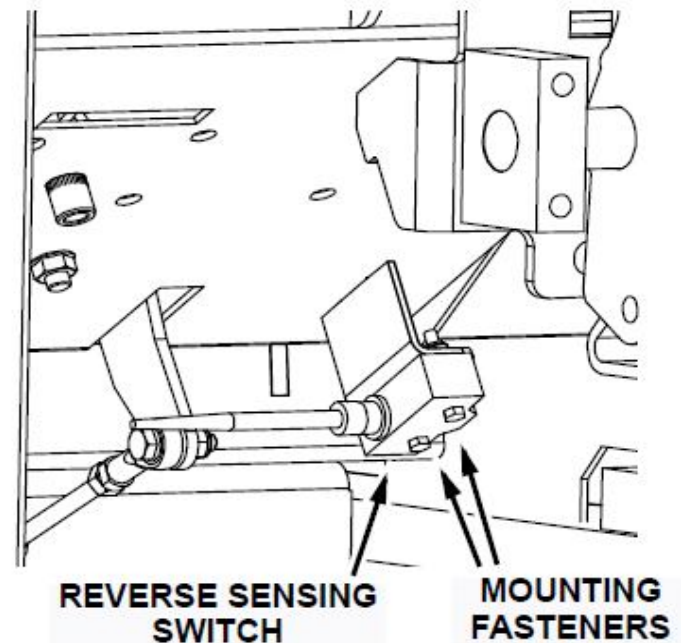


Fig. 1: Reverse Sensing Switch Fasteners

## TROUBLESHOOTING

This section provides information to assist in identifying maintenance trouble and provides possible causes and actions to correct the problem. Many of the solutions require servicing your machine. Service must be preformed by an approved authorized repair station.

TROUBLESHOOTING CHART		
PROBLEM	POSSIBLE CAUSE(S)	SOLUTION(S)
Engine will not start or runs roughly after start.  NOTE: On machines with LPG fuel, also check the following:	Battery dead.	Recharge or replace battery.
	Machine out of fuel.	Refuel
	Fuel filter plugged.	Clean or replace filter.
	Fuel line broken or obstructed.	Blow fuel line out with compressed air.
	Dirty air filter.	Clean or replace air filter.
	Problems with spark plugs, ignition points, ignition coil ignition switch, carburetor, Regulator, wiring harness.	Review engine manual for maintenance and troubleshooting procedures.
	Tank valve not fully opened.	Open the valve slowly.
	Fuel tank type does not match fuel supply.	Use the correct tank type for the fuel supply.
	Fuel tank and lines are covered with frost.	Open shut-off valve slowly to ¼ open, start.
	Defective vacuum lock-off.	Replace or repair.



# TROUBLESHOOTING

TROUBLESHOOTING CHART		
PROBLEM	POSSIBLE CAUSE(S)	SOLUTION(S)
Engine overheats.  NOTE: If coolant loss has not occurred, check for malfunction of the temperature sending unit.	Low coolant level.	Supply coolant.
	Fan blade installed incorrect	Reinstall (pusher type fan)
	Clogged radiator.	Flush radiator.
	Loose fan belt.	Tighten belt.
	Defective thermostat.	Replace thermostat.
Nautilus® moves slowly or does not move.	Parking brake is on.	Release brake.
	Directional control pedal jammed, damaged, or not adjusted properly.	Clear jam or adjust linkage.
	Tow valve in tow position	Move to drive position
	Low hydraulic fluid level.	Add hydraulic fluid.
	Hydraulic fluid temperature too high and too thin caused by excessive load, climbing, high environment temperatures, worn pump, or improper fluid.	Use the proper weight oil for the operation conditions; check pump.
	Hayes coupler failed	Replace
	Other problems with the hydraulics system: pump failure, motor failure, relief valve leaking or stuck open.	See Hydraulics System Problems in this section.
	Tow Valve improperly set.	Turn to correct position.

# TROUBLESHOOTING

TROUBLESHOOTING CHART		
PROBLEM	POSSIBLE CAUSE(S)	SOLUTION(S)
Nautilus® creeps in neutral.	Directional control pedal Neutral Sensing Switch is out of adjustment.	Perform the adjustment procedures.
Brushes do not turn or turn very slowly.	Hydraulic system problem:	See Hydraulics System Problems in this section.
	Motor	
	Control valve	
	Gear pump	
	Relief valve	
	Brush switch not on	Press to on position
	Foot pedal not depressed	Press to forward position
Scrub head will not lower.	Fuse blown.	Replace fuse.
	Loose scrub head switch wires.	Connect wires.
	Loose connection of plug at actuator.	Connect.
	Defective cylinder.	Replace cylinder.
	Defective scrub head switch.	Replace switch.
	Defective solenoid valve.	Replace solenoid valve or coil.

# TROUBLESHOOTING

TROUBLESHOOTING CHART		
PROBLEM	POSSIBLE CAUSE(S)	SOLUTION(S)
Poor water pick-up	Recovery tank is full.	Empty the tank; if foaming badly, change detergent.
	Squeegee worn.	Replace squeegee.
	Debris caught in squeegee or pick-up tube.	Remove debris.
	Leak or clog in hose from impeller.	Repair leak, clear obstruction or replace hose.
	Squeegee out of adjustment.	Adjust squeegee.
	Engine not operating at high speed.	Check Throttle Switch Position
	Impeller failure.	Check and repair.
Solution not being delivered.	Solution tank is empty.	Fill tank.
	Solution flow valve not functioning	Check broom switch & pressure switches @ main pump
	Delivery lines clogged.	Clear lines.
	Fwd/Rev Pedal not depressed	Press pedal

# TROUBLESHOOTING

TROUBLESHOOTING CHART		
PROBLEM	POSSIBLE CAUSE(S)	SOLUTION(S)
Scrubber unit not cleaning the floor.	Brushes worn.	Replace.
	Need different type of brush or detergent.	Use manufacturer's recommended brushes / detergent.
	Debris caught in brush drive mechanism.	Clear obstruction.
	Brushes out of adjustment.	Adjust.
	Brush motor failure.	See Hydraulics System Problems.
Squeegee will not lower.	Loose or defective squeegee switch (on console).	Reconnect wiring or replace switch.
	Loose wire(s) at foot pedal.	Connect.
	Foot pedal switches need adjustment.	Re-adjust cams.
Squeegee will not raise in reverse or by console switch.	Foot pedal switches need adjustment.	Re-adjust cams.
	Defective solenoid valve.	Replace solenoid valve or coil
	No power at valve.	Check fuse

TROUBLESHOOTING CHART		
PROBLEM	POSSIBLE CAUSE(S)	SOLUTION(S)
Scrubber leaving debris.	Hopper full.	Dump hopper.
	Brushes out of adjustment.	Adjust.
	Brushes bristles worn.	Check for wear and adjustment.
	Poor performance of brush drive mechanism.	Check for jam in broom chamber.
	Hopper flaps damaged or missing.	Replace or adjust clearance.
Hydraulic control valve failure	Defective solenoid valve.	Replace solenoid valve or coil.
	Switch failure.	Check for loose or disconnected wires.

# TROUBLESHOOTING

TROUBLESHOOTING CHART		
PROBLEM	POSSIBLE CAUSE(S)	SOLUTION(S)
Hydraulic drive motor failure.	Insufficient oil supply	Fill Reservoir
	Motor leaking.	Replace seals.
	Drive pump coupler failed	Replace
	Key on motor shaft failed	Replace key
	Drive hub failed	Replace
Hydraulic gear pump failure.	Pump leaking.	Replace seals or RR Pump
	Drive coupler failed	Replace
	Gears worn or scored.	Rebuild pump or RR Pump
	Oil supply low.	Check and fill.
	Oil strainer clogged.	Replace strainer (inside reservoir).
	Incorrect oil.	Use recommended viscosity oil.
	Damage due to entry of air into hydraulic system.	Maintain correct hydraulic fluid level in reservoir. Keep suction hose fittings tight..

# TROUBLESHOOTING

TROUBLESHOOTING CHART		
PROBLEM	POSSIBLE CAUSE(S)	SOLUTION(S)
Hydraulic variable displacement pump failure.	Pump leaking.	Replace seals.
	Relief valve(s) stuck.	Clean or replace relief valve(s) at the pump.
	Drive coupling malfunction.	Replace defective gears.
	Control linkage out of adjustment.	Adjust control linkage, check for binding.
	Charge pump gears worn or scored.	Replace defective gears.
	Damage due to entry of air into hydraulic system.	Maintain correct hydraulic fluid level in reservoir. Keep suction hose fittings tight.
Hydraulic system noisy.	Air in system.	Check fluid level in reservoir; check for loose connections or leaks.
	Relief valve dirty or damaged.	Clean or replace.
	Loose suction line.	Tighten fittings.
	Clogged section filter or pump inlet line.	Replace filter, clear line; change fluid in reservoir if dirty and flush system.
	Internal pump or motor damage.	Inspect and repair.

## NAUTILUS MAIN BRUSH AND IMPELLER PRESSURE RELIEF ADJUSTMENTS

These adjustments are necessary if the hydraulic manifolds are supplied with the relief valves set at zero or incorrectly set.

### MAIN BRUSH PRESSURE RELIEF ADJUSTMENT:

- Install an appropriate pressure gauge at the gauge port on the main hydraulic manifold. The gauge port (GA) is located on the left side of the manifold when viewed from the front of the machine.
- Disconnect the electrical connection to the main brush solenoid SV3 located in the lower left manifold port 3.2 (after the first 5 prototypes the 3.2 port location will be embossed as 10). This will block the flow out of the manifold and force the fluid flow to go over the relief valve RV2.
- Loosen the lock nut and unscrew the pressure adjustment screw on the pressure relief valve RV2. This will allow all of the fluid flow to pass at low pressure through the relief valve.
- Start the machine and switch the engine throttle switch to operating (high) speed.
- Turn on the brushes.
- Turn the pressure relief adjustment screw in (clockwise) while monitoring the hydraulic pressure on the pressure gauge.

When the gauge reads 2500 psi (it will vary a little, and that is OK) tighten the adjustment screw lock nut and turn off the engine.

NOTE: Perform the adjustment as quickly as possible. During this set up do not run the machine for an extended period of time after the pressure relief is set as the hydraulic oil will generate excessive heat when going through the pressure relief valve.

- Reconnect the electrical connection to the SV3 solenoid.

This completes the main brush pressure relief adjustment.



## NAUTILUS MAIN BRUSH AND IMPELLER PRESSURE RELIEF ADJUSTMENTS

### IMPELLER PRESSURE RELIEF ADJUSTMENT:

Install an appropriate pressure gauge at the gauge port on the impeller hydraulic manifold. The gauge port (GA) is located on the face of the manifold when viewed from the front of the machine.

In order to force the hydraulic fluid through the relief valve it is necessary to block the flow from the manifold to the impeller.

- Remove the hydraulic hose from the outlet of the hydraulic manifold at port VF OUT located on the top of the manifold and plug (pressure tight) the fitting on the manifold and the end of the hose.
- Loosen the lock nut and unscrew the pressure adjustment screw on the pressure relief valve RV1 located in port 9.2. This will allow all of the fluid flow to pass at low pressure through the relief valve.
- Start the machine and switch the engine throttle switch to operating (high) speed.
- Turn on the impeller.
- Turn the pressure relief adjustment screw in (clockwise) while monitoring the hydraulic pressure on the pressure gauge.

When the gauge reads 2500 psi (it will vary a little, you will probably not get it to read exactly 2500 and that is OK) tighten the adjustment screw lock nut and turn off the engine.

NOTE: Perform the adjustment as quickly as possible. During this set up do not run the machine for an extended period of time after the pressure relief is set as the hydraulic oil will generate excessive heat when going through the pressure relief valve.

- Reconnect the hydraulic hose to the impeller solenoid.

This completes the main brush pressure relief adjustment.

## NAUTILUS SCRUB BRUSH FLOOR PRESSURE ADJUSTMENT

Before the scrub head floor pressure adjustment can be performed the reduction valve at the main hydraulic manifold port 4.1 must be adjusted to 450 psi (The purpose of this valve is to change the variable inlet pressure (approximately 700 psi) to a constant output pressure of 450 psi which is applied to the piston-end of the scrub head lift cylinder. 450 psi is the pressure required to raise the scrub head at full engine rpm).

If this valve has already been adjusted go to "Setting the scrub brush floor pressure controller".

To adjust the reduction valve at port 4.1:

- Install a tee fitting with a gauge port between the main hydraulic hose and the hydraulic manifold at port BLA.
- Attach a suitable hydraulic pressure gauge to the gauge port in the tee fitting.
- Zero the pressure gauge if necessary.
- Loosen the lock nut on the adjustment stud on the reduction valve located on the main hydraulic manifold at port 4.1
- Insure that the green "One-Touch" switch is in the off position.
- Start the engine
- Set the throttle switch to high.
- Turn the reduction valve adjustment stud clockwise until the pressure gauge reads 450 psi.

*(Note: It is not possible to attain 450 psi if the restrictor orifice fitting is not installed at the power steering unit pressure port.)*

- Tighten the reduction valve locknut.
- Verify the pressure reading.
- Turn off the engine.
- Replace the hydraulic hose at port BLA.

## NAUTILUS SCRUB BRUSH FLOOR PRESSURE ADJUSTMENT

### Setting the scrub brush floor pressure controller (proportional valve driver)

The floor brush pressure controller (located on the left front face of the operator console) provides three separate brush floor pressure forces by controlling the hydraulic pressure output of the proportional reduction valve located on the main hydraulic manifold at port 6.1.

This variable output pressure is applied to the rod-end of the scrub head lift cylinder. This variable pressure is balanced against the steady 450 psi provided by the reduction valve (above) to achieve the desired scrub brush floor pressure.

The controller has a left control knob, a right control knob, and an information screen.

The right control knob scrolls between the various setting titles.

The left control knob provides input settings.

Description of the adjustable parameters:

P1 – The low brush floor pressure setting.

P2 – The medium brush floor pressure setting

P3 – The high brush floor pressure setting

P4 – The P4 setting is not used. (Any number input will have no effect.)

J9 – Jog. This is used to simulate a P1 – P3 setting and its effect on the brush pressure in real time. (This does not require an input setting.)

UP - The ramp time required for the output signal to increase by 1 amp.

dn - The ramp time required for the output signal to decrease by 1 amp.

dF – Dither frequency. (Dither is an oscillation feature that eliminates slip stick in the operation of the solenoid.)

di – Display orientation

SA – Save settings

## NAUTILUS SCRUB BRUSH FLOOR PRESSURE ADJUSTMENT

The unit must be on to input settings.

Turning the right control knob scrolls through the parameters listed above.

Turning the left control knob changes the settings of each parameter.

The settings are saved by turning the right control knob to SA and rotating the left control knob one full turn (in either direction).

### CONTROLLER SETTINGS:

Set P1 to 1.48 A Providing 200 lbs of brush pressure against the floor (415 psi at port BLB)

Set P2 to 1.98 A Providing 300 lbs of brush pressure against the floor (730 psi at port BLB)

Set P3 to 2.18 A Providing 400 lbs of brush pressure against the floor (865 psi at port BLB)

P4 – Not used

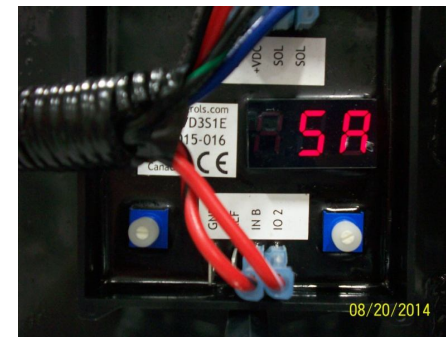
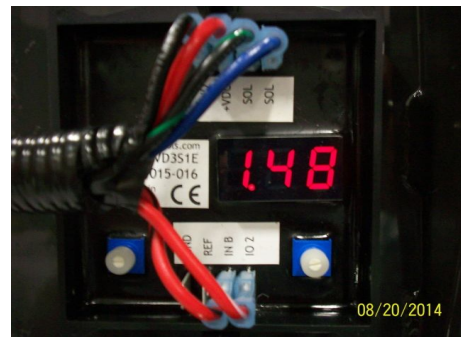
Set UP to 00.5 SEC

Set DN to 00.5 SEC

Set Df (dither) to 250 Hz

dl = screen orientation – no setting should be required.

SA (save settings) – Turn the left control knob one full turn (in either direction).



# ADJUSTMENTS & PROCEDURES WITH OPTIONAL SIDE SCRUB

**PowerBoss**<sup>®</sup>  
The Power of Clean

## NAUTILUS DUAL CONTROLLER ADJUSTMENT FOR MAIN SCRUB BRUSH AND OPTIONAL SIDE SCRUB BRUSH FLOOR PRESSURE ADJUSTMENT.

Before the scrub head floor pressure adjustment can be performed the reduction valve at the main hydraulic manifold port 4.1 must be adjusted to 450 psi (The purpose of this valve is to change the variable inlet pressure (approximately 700 psi) to a constant output pressure of 450 psi which is applied to the piston-end of the scrub head lift cylinder. 450 psi is the pressure required to raise the scrub head at full engine rpm).

If this valve has already been adjusted go to "Setting the scrub brush floor pressure controller".

To adjust the reduction valve at port 4.1:

- Install a tee fitting with a gauge port between the main hydraulic hose and the hydraulic manifold at port BLA.
- Attach a suitable hydraulic pressure gauge to the gauge port in the tee fitting.
- Zero the pressure gauge if necessary.
- Loosen the lock nut on the adjustment stud on the reduction valve located on the main hydraulic manifold at port 4.1
- Insure that the green "One-Touch" switch is in the off position.
- Start the engine
- Set the throttle switch to high.
- Turn the reduction valve adjustment stud clockwise until the pressure gauge reads 450 psi.

*(Note: It is not possible to attain 450 psi if the restrictor orifice fitting is not installed at the power steering unit pressure port.)*

- Tighten the reduction valve locknut.
- Verify the pressure reading.
- Turn off the engine.
- Replace the hydraulic hose at port BLA.

## Setting the main scrub brush floor pressure (Using the dual proportional valve driver)

The dual floor brush pressure controller (located on the left front face of the operator console) provides three separate brush floor pressure forces for the main scrub brushes by controlling the hydraulic pressure output of the SV4 proportional reduction valve located on the main hydraulic manifold at port 6.1. and provides three separate brush floor pressure forces for the side scrub brush by controlling the hydraulic pressure output of the SV9 proportional reduction valve located on the SSB hydraulic manifold at port 6.2.

For the main scrub brushes this variable output pressure is applied to the rod-end of the scrub head lift cylinder. This variable pressure is balanced against the steady 450 psi provided by the reduction valve (above) to achieve the desired scrub brush floor pressure.

For the side scrub brush this variable output pressure is applied to the piston-end of the side scrub head lift cylinder. This variable pressure is balanced against the steady 450 psi provided by the reduction valve (above) to achieve the desired scrub brush floor pressure.

The controller has a left control knob, a right control knob, and an information screen.

The right control knob scrolls between the various setting titles.

The left control knob provides input settings.

Description of the adjustable parameters:

BP1 – The low brush floor pressure setting.

BP2 – The medium brush floor pressure setting

BP3 – The high brush floor pressure setting

BP4 – The BP4 setting is not used. (Any number input will have no effect.)

BJ9 – Jog. This is used to simulate a P1 – P3 setting and its effect on the brush pressure in real time. (This does not require an input setting.)

BUP - The ramp time required for the output signal to increase by 1 amp.

Bdn - The ramp time required for the output signal to decrease by 1 amp.

DF – Dither frequency. (Dither is an oscillation feature that eliminates slip stick in the operation of the solenoid.)

di – Display orientation

SA – Save settings

The unit must be "on" to input settings.

Turning the right control knob scrolls through the parameters listed above.

Turning the left control knob changes the settings of each parameter.

The settings are saved by turning the right control knob to SA and rotating the left control knob one full turn (in either direction).



## DUAL CONTROLLER "B" (MAIN SCRUB BRUSH) SETTINGS:

Set BP1 to 1.48 A Providing 200 lbs of main brush pressure against the floor (415 psi at port BLB)

Set BP2 to 1.98 A Providing 300 lbs of main brush pressure against the floor (730 psi at port BLB)

Set BP3 to 2.18 A Providing 400 lbs of main brush pressure against the floor (865 psi at port BLB)

BP4 – Not used

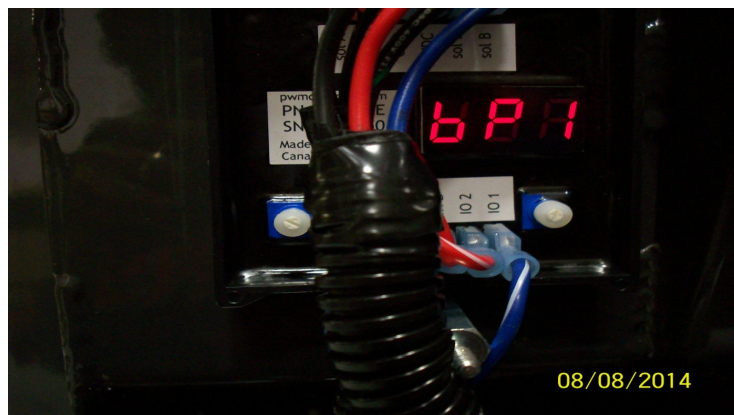
Set BUP to 00.5 SEC

Set BDN to 00.5 SEC

Set Df (dither) to 250 Hz

dl = screen orientation – no setting should be required.

SA (save settings) – Turn the left control knob one full turn (in either direction).





## **Setting the side scrub brush floor pressure (Using the dual proportional valve driver)**

The dual floor brush pressure controller (located on the left front face of the operator console) provides three separate side brush floor pressure forces by controlling the hydraulic pressure output of the proportional reduction valve located on the SSB hydraulic manifold at port 6.2.

This variable output pressure is applied to the piston-end of the side scrub head lift cylinder. This variable pressure is balanced against the steady 450 psi provided by the reduction valve (above) to achieve the desired side scrub brush floor pressure.

The controller has a left control knob, a right control knob, and an information screen.

The right control knob scrolls between the various setting titles.

The left control knob provides input settings.

### **Description of the side scrub brush adjustable parameters:**

The dual controller uses an "A" prefix for the optional side brush settings and a "B" prefix for the Main brush settings.

BP1 through BP4 control the low, medium, and high main scrub brush floor pressure.

These along with BUP, Bdn, and dF parameters should be set using the information shown in the NAUTILUS SCRUB BRUSH FLOOR PRESSURE ADJUSTMENT instructions.

AP1 – The low side brush floor pressure setting.

AP2 – The medium side brush floor pressure setting

AP3 – The high side brush floor pressure setting

AP4 – The P4 setting is not used. (Any number input will have no effect.)

AJ9 – Jog. This is used to simulate a AP1 – AP3 setting and its effect on the side brush pressure in real time. (This does not require an input setting.)

AUP - The ramp time required for the output signal to increase by 1 amp.

Adn - The ramp time required for the output signal to decrease by 1 amp.

dF – Dither frequency. (Dither is an oscillation feature that eliminates slip stick in the operation of the solenoid.)

di – Display orientation

SA – Save settings

The unit must be on to input settings.

Turning the right control knob scrolls through the parameters listed above.

Turning the left control knob changes the settings of each parameter.

The settings are saved by turning the right control knob to SA and rotating the left control knob one full turn (in either direction).

**DUAL CONTROLLER "A" (SIDE SCRUB BRUSH) SETTINGS:**

Set AP1 to 1.60 A Providing 120 lbs of brush pressure against the floor

Set AP2 to 1.70 A Providing 130 lbs of brush pressure against the floor

Set AP3 to 1.85 A Providing 140 lbs of brush pressure against the floor

AP4 – Not used

Set AUP to 00.5 SEC

Set ADN to 00.5 SEC

Set Df (dither) to 250 Hz

dl = screen orientation – no setting should be required.

SA (save settings) – Turn the left control knob one full turn (in either direction).



## **Cylindrical Scrub Brushes ( 2 Required )**

731090	45" Nylon Cylindrical Scrub Brush	Color White / Medium Duty Scrubbing
731091	45" Poly Cylindrical Scrub Brush	Color BLACK / Light Duty Scrubbing
731093	45" 180 Mid Grit Cylindrical Scrub Brush	Color Blue / All Purpose <b>(STANDARD)</b>
731092	45" 80 Grit Med to Heavy	Color Black / Aggressive Scrub Sweep

## **Squeegees**

731102	Rear - Urethane Squeegee	Clear (1) required
731103	Side Squeegee - Urethane	Clear (2) required
731101	Inner Rear - Urethane	Clear (1) required
730644	Side Squeegee - Linatex	RED (2) required <b>(STANDARD)</b>
730787	Inner Rear - Linatex	RED (1) required <b>(STANDARD)</b>
730788	Rear - Linatex	RED (1) required <b>(STANDARD)</b>

## **Side Scrub Brushes**

3313136	16" (40.6 cm) Nylon	
3313128	16" (40.6 cm) Powergrit 46 HDS	
3313126	16" (40.6 cm) Powergrit 80 S/S	
3315385	16" (40.6 cm) Powergrit 120 AGS	
3332545	16" (40.6 cm) Mid-Grit 180	<b>(STANDARD )</b>

## **Side Sweep Broom**

731259	SIDE BROOM 24" POLY
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## **ENGINE ITEMS**

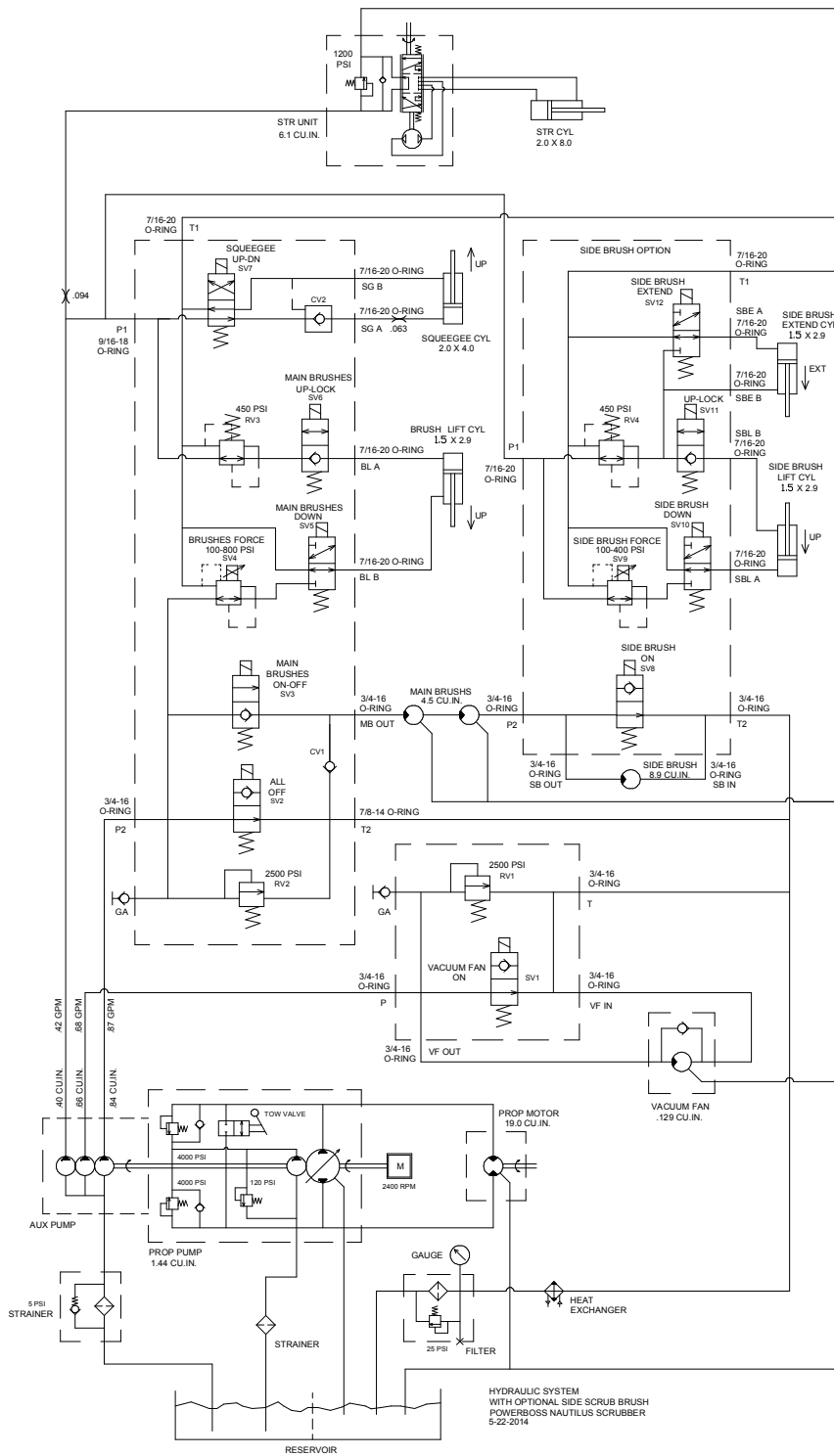
### **(KUBOTA 1605 LP & GAS)**

3321143	AIR FILTER outer(common)
3322572	AIR FILTER-(INNER-RARE ORDERED)
3342209	FILTER,FUEL-GAS ONLY
3344840	OIL FILTER
3344861	SPARK PLUG
3350446	THERMOSTAT-WATER
3332040	THERMOSTAT GASKET

### **(KUBOTA 1505 DSL)**

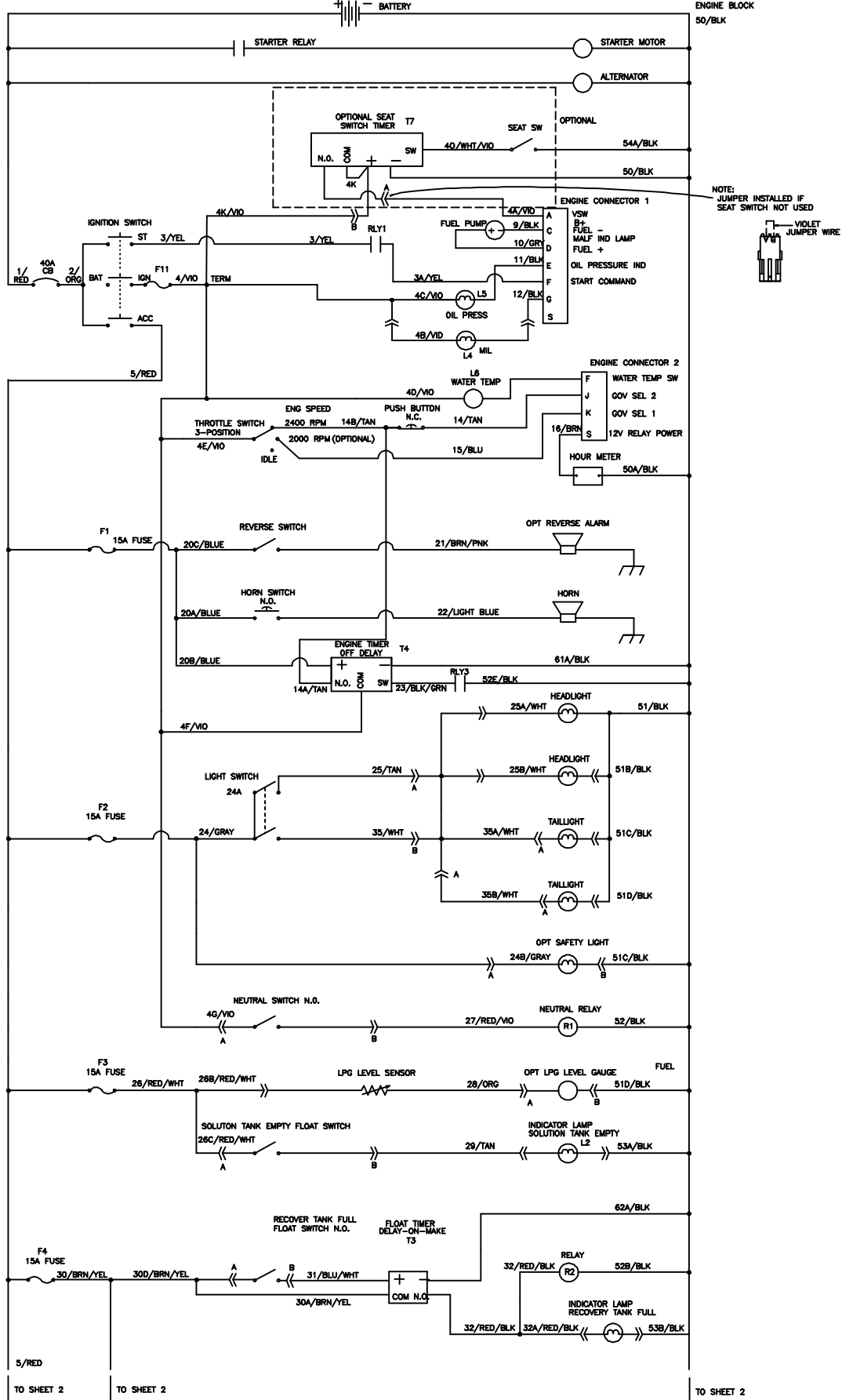
3321143	AIR FILTER outer(common)
3322572	AIR FILTER-(INNER-RARE ORDERED)
3324129	OIL FILTER
3303324	FUEL FILTER
3350446	THERMOSTAT-WATER
3332040	THERMOSTAT GASKET





### O-RING FACE SEAL ASSEMBLY TORQUES AND FFWR

O.D.		SAE DASH SIZE	TUBE SIDE THREAD SIZE	ASSEMBLY TORQUE (+10%-0)			FLATS FROM WRENCH RESISTANCE(FFWR)		
(IN.)	(MM)			IN.-LB	FT.-LB	N-M	TUBE NUTS	SWIVEL AND HOSE	
1/4	6	-4	9/16-18	220	18	25	1/4 TO 1/2	1/2 TO 3/4	
3/8	8,10	-6	11/16-16	360	30	40	1/4 TO 1/2	1/2 TO 3/4	
1/2	12	-8	13/16-16	480	40	55	1/4 TO 1/2	1/2 TO 3/4	
5/8	14,15,16	-10	1-14	-	60	80	1/4 TO 1/2	1/2 TO 3/4	
3/4	18,20	-12	1 3/16-12	-	85	115	1/4 TO 1/2	1/3 TO 1/2	
1	22,25	-16	1 7/16-12	-	110	150	1/4 TO 1/2	1/3 TO 1/2	
1 1/4	28,30,32	-20	1 11/16-12	-	150	205	1/4 TO 1/2	1/3 TO 1/2	
1 1/2	35,38	-24	2-12	-	230	315	1/4 TO 1/2	1/3 TO 1/2	



Y  
X

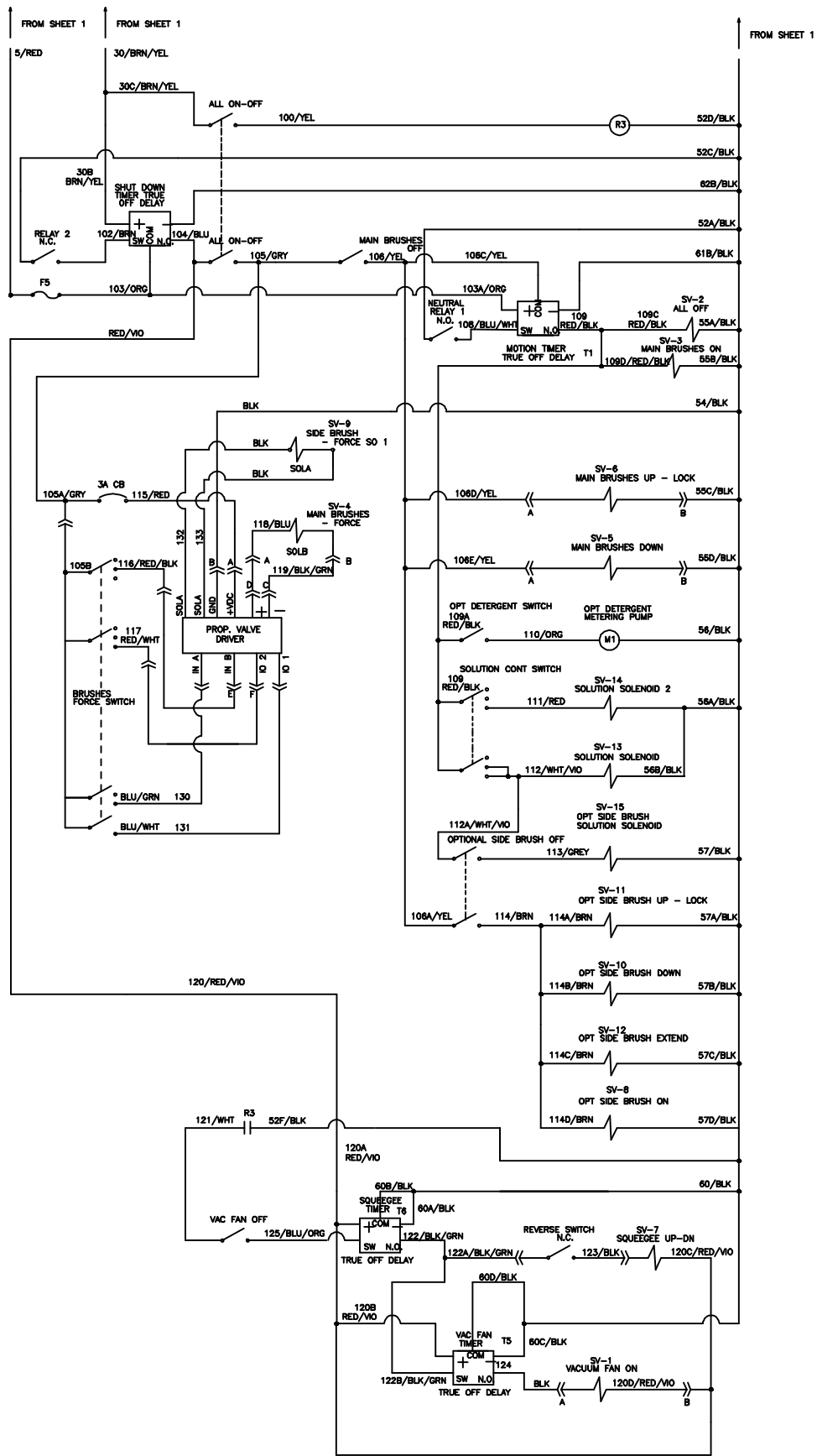
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TITLE VENGEANCE_ELECTRICAL_DIAGRAM_1_OF_2		SCALE NTS
MATERIAL N/A		FINISH N/A
TOLERANCES (UNLESS OTHERWISE SPECIFIED)		REMOVE BURRS AND BREAK SHARP EDGES .005/.020
0-1"	1/16	.000 .005
>1-12"	1/4"	.00 .010
<12"	1/2"	ANGLES 30'
SIZE B	DRAWN BY MB	DATE 12/20/13
CHECKED BY JWP	DATE 12/20/13	
P.N. 745925-1		REV *

REV	E.C.N.	DATE	CHANGE	BY	CHK BY

14NMS U.S. ROUTE 20  
PINEGROVE, IL 60140

SHEET OF



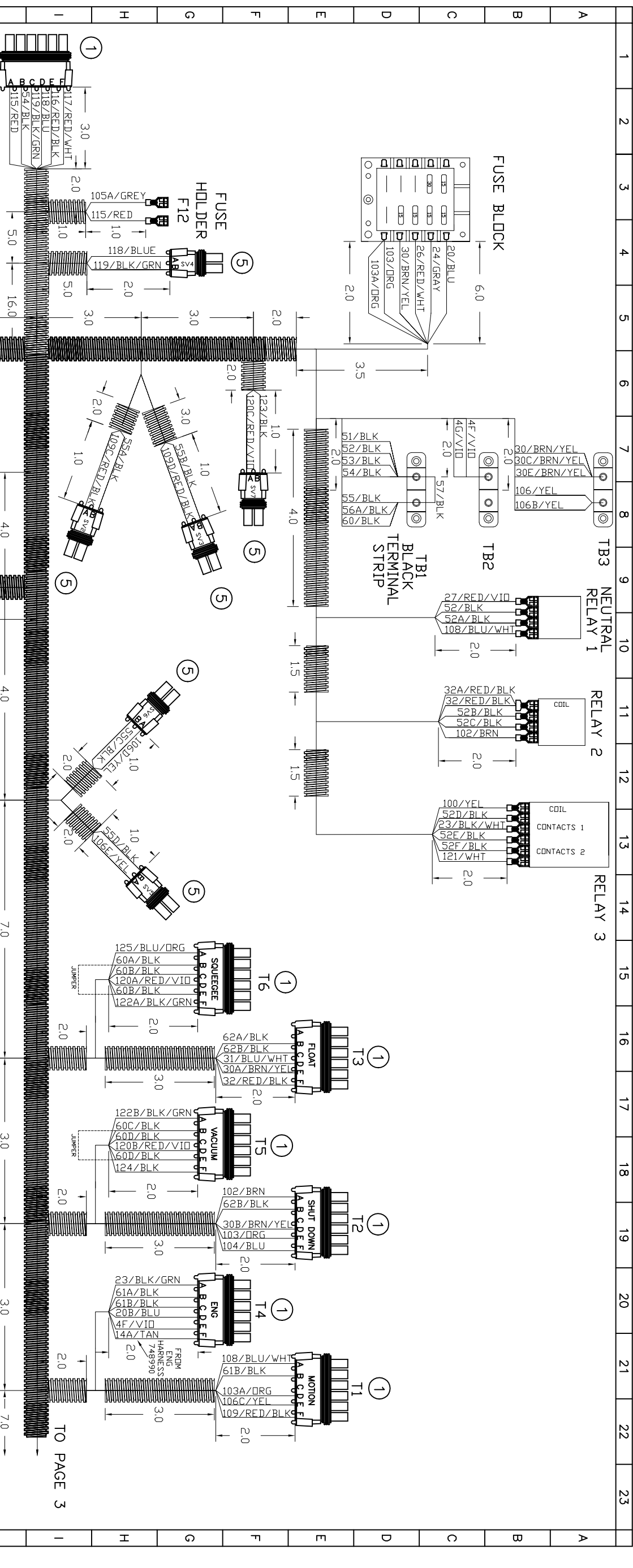
Y  
X

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TITLE <b>VENGEANCE_ELECTRICAL_DIAGRAM_2_OF_2</b>		SCALE NTS
MATERIAL N/A		FINISH N/A
TOLERANCES (UNLESS OTHERWISE SPECIFIED)		REMOVE BURRS AND BREAK SHARP EDGES .005/.020
0-1" ± 1/16	.000 ± .005	SIZE DRAWN BY MB DATE 12/20/13
>1-12" ± 1/4"	.00 ± .010	B CHECKED BY JWP DATE 12/20/13
<12" ± 1/2"	ANGLES ± 30'	

REV	E.C.N.	DATE	CHANGE	BY	CHK BY	14N845 U.S. ROUTE 20 PINEGEE GROVE, IL 60140	P.N. 745925-2	REV *
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WIRE NO.	WIRE COLOR	WIRE GAUGE	FROM	TERMINAL	LOC/SHT	TO	TERMINAL	LOC/SHT
4F	VIOLET	16	VIOLET TERM STRIP	5/16" RING	7B / 1	ENG TIMER	20G / 1	
4E	VIOLET	16	VIOLET TERM STRIP	5/16" RING	7B / 1	NEUTRAL SW CONN	580 / 3	
14A	TAN	16	GOV SEL SW (FROM 748990)	1/4" OC YEL		ENG TIMER	21G / 1	
20	BLUE	16	FUSE BLOCK	1/4" OC	4C / 1	BLUE SPLICE		
20A	BLUE	16	HORN PB	1/4" OC YEL	511 / 3	BLUE SPLICE		
22	BLU/WHT	16	ENG TIMER	12124580	20G / 1	BLUE SPLICE		
23	BLK/GRN	16	HORN PB	1/4" OC	50H / 3			
24	GREY	16	ENG TIMER	12124580	20G / 1			
24A	GREY	16	FUSE BLOCK	1/4" OC	4C / 1	RELAY 3	138 / 1	
24B	GREY	16	FUSE BLOCK	1/4" OC	4C / 1	RELAY 3	34K / 2	
25	TAN	16	LIGHT SW	AMP 60253-2	35K / 2	HEADLIGHT CONNECTOR	58K / 3	
26	RED/WHT	16	FUEL LEVEL CONN	AMP 60253-2	35K / 2	RED/WHT SPLICE	9M / 1	
26B	RED/WHT	16	FUEL LEVEL CONN	AMP 60253-2	35K / 2	RED/WHT SPLICE		
26C	RED/WHT	16	SOL TANK CONN	12124580	630 / 3	RED/WHT SPLICE		
27	RED/VID	16	NEUTRAL SW CONN	12124580	580 / 3	RELAY COIL 1		
29	TAN	16	SOLUTION TANK CONN	12124580	630 / 3	RELAY COIL 1		
30	BRN/YEL	16	FUSE BLOCK	1/4" OC	7A / 1	BRN/YEL TERM STRIP	1060-14-0122	251 / 2
30A	BRN/YEL	16	FLOAT TIMER	12124580	17E / 1	BRN/YEL SPLICE	9A / 1	
30B	BRN/YEL	16	SHUTDOWN TIMER	12124580	19E / 1	BRN/YEL SPLICE		
30C	BRN/YEL	16	ALL OFF SWITCH	AMP 60253-2	43D / 2	BRN/YEL TERM STRIP	5/16" RING	7A / 1
30D	BRN/YEL	16	REC FULL SWITCH CONN	12124580	66M / 3	BRN/YEL SPLICE		
30E	BRN/YEL	16	BRN/YEL TERM STRIP	1/4" RING	7A / 1	BRN/YEL SPLICE		
30F	BRN/YEL	16	VAC OFF SW	AMP 60253-2	40D / 2	BRN/YEL SPLICE		
30G	BRN/YEL	16	BRUSH OFF SW	AMP 60253-2	38D / 2	BRN/YEL SPLICE		
31	BLK/WHT	16	REC FULL SWITCH CONN	12124580	66M / 3	FLOAT TIMER	19E / 1	
31A	BLK/WHT	16	FLOAT TIMER	12124580	66M / 3	FLOAT TIMER	19E / 1	
32	RED/BLK	16	RELAY 2 COIL	12124580	17E / 1	RELAY COIL 2		
32A	RED/BLK	16	RELAY 2 COIL	12124580	17E / 1	RELAY COIL 2		
35	WHITE	16	HEADLIGHT CONN	AMP 60253-2	34K / 2	L1 CONN		
35A	WHITE	16	LIGHT SWITCH	AMP 60253-2	34K / 2	L1 CONN		

LEGEND NUMBER	CONNECTOR MFG. PART #	VENDOR	CONNECTOR
1	12020926		WEATHER PACK 6 POSITION MALE
2	12020827-B		WEATHER PACK 3 POSITION FEMALE
3	12020829-B		WEATHER PACK 3 POSITION MALE
4	12010973		WEATHER PACK 2 POSITION FEMALE
5	12015792		WEATHER PACK 2 POSITION MALE

REV	EC.N.	DATE	CHANGE	BY	CHK

SIZE	DRAWN BY	MB	DATE 03/25/2014
0-1" ± 1/16			
>1-12" ± 1/4"			
<12" ± 1/2"			

**P.N. 748799**

14846 U.S. ROUTE 20  
PHOENIX GROVE, IL 60140

SHEET 1 OF 3

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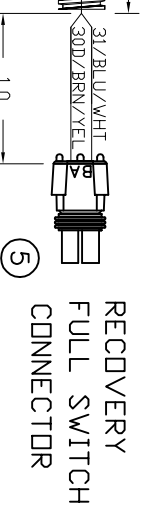
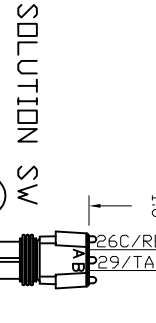
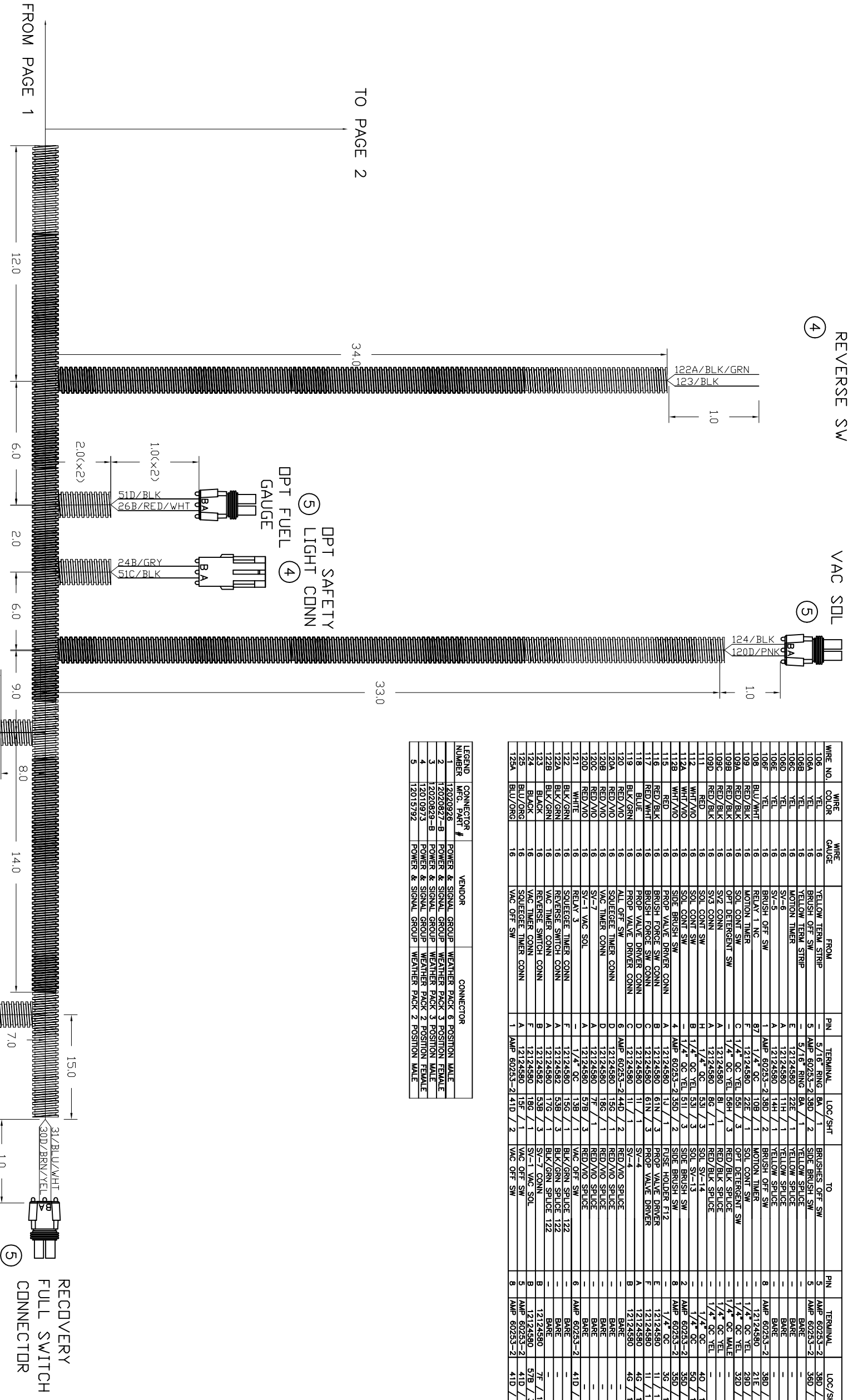
NAUTILUS, MAIN, HARNESS  
 MATERIAL SEE NOTES  
 FINISH SEE NOTES  
 SCALE NTS  
 TOLERANCES (UNLESS OTHERWISE SPECIFIED)  
 DATE 03/25/2014



REVERSE SW (4)  
VAC SOL (5)

WIRE NO.	COLOR	WIRE GAUGE	FROM	PIN	TERMINAL	LOC/SH/T	TO	PIN	TERMINAL	LOC/SH/T
106	YEL	16	YELLOW TRM STRIP	-	5/16" RING	BA / 1	BRUSHES OFF SW	5	AMP 60253-2	380 / 2
106A	YEL	16	BRUSH OFF SW	5	AMP 60253-2	380 / 2	SIDE BRUSH SW	5	AMP 60253-2	360 / 2
106B	YEL	16	YELLOW TRM STRIP	-	5/16" RING	BA / 1	YELLOW SPLICE	-	BARE	-
106C	YEL	16	MOTION TIMER	E	12124580	22E / 1	YELLOW SPLICE	-	BARE	-
106D	YEL	16	SV-6	A	12124580	11H / 1	YELLOW SPLICE	-	BARE	-
106E	YEL	16	SV-5	A	12124580	14H / 1	YELLOW SPLICE	-	BARE	-
106F	YEL	16	BRUSH OFF SW	A	AMP 60253-2	380 / 2	BRUSH OFF SW	8	AMP 60253-2	380 / 2
108	BLU/WHT	16	RELAY 1 NC	87	1/4" OC	10B / 1	MOTION TIMER	-	12124580	21E / 1
109	RED/BLK	16	MOTION TIMER	F	12124580	22E / 1	SOL CONT SW	-	1/4" OC YEL	290 / 2
109A	RED/BLK	16	SOL CONT SW	C	1/4" OC YEL	55 / 3	OPT DETERGENT SW	-	1/4" OC YEL	320 / 2
109B	RED/BLK	16	OPT DETERGENT SW	-	1/4" OC YEL	56H / 3	RED/BLK SPLICE	-	1/4" OC MALE	-
109C	RED/BLK	16	SV3 CONN	A	12124580	8 / 1	RED/BLK SPLICE	-	1/4" OC YEL	-
109D	RED/BLK	16	SV2 CONN	A	12124580	8G / 1	RED/BLK SPLICE	-	1/4" OC YEL	-
111	RED	16	SOL CONT SW	H	1/4" OC	53 / 3	SOL SV-14	-	1/4" OC	40 / 1
112	WHT/VIO	16	SOL CONT SW	B	1/4" OC YEL	53 / 3	SOL SV-13	-	1/4" OC	50 / 1
112A	WHT/VIO	16	SOL CONT SW	-	1/4" OC YEL	51 / 3	SIDE BRUSH SW	2	AMP 60253-2	350 / 2
112B	WHT/VIO	16	SIDE BRUSH SW	4	AMP 60253-2	350 / 2	SIDE BRUSH SW	8	AMP 60253-2	350 / 2
115	RED	16	PROP VALVE DRIVER CONN	A	12124580	1 / 1	FUSE HOLDER F12	-	1/4" OC	35 / 1
116	RED/BLK	16	BRUSH FORCE SW CONN	B	12124580	61N / 3	PROP VALVE DRIVER	E	12124580	11 / 1
117	RED/WHT	16	BRUSH FORCE SW CONN	C	12124580	61N / 3	PROP VALVE DRIVER	F	12124580	4G / 1
118	BLU	16	PROP VALVE DRIVER CONN	D	12124580	61N / 3	PROP VALVE DRIVER	A	12124580	4G / 1
119	BLK/GRN	16	PROP VALVE DRIVER CONN	C	12124580	11 / 1	SV-4	B	12124580	4G / 1
120	RED/VIO	16	ALL OFF SW	6	AMP 60253-2	440 / 2	RED/VIO SPLICE	-	BARE	-
120A	RED/VIO	16	SQUEEGEE TIMER CONN	D	12124580	15G / 1	RED/VIO SPLICE	-	BARE	-
120B	RED/VIO	16	VAC TIMER CONN	D	12124580	18G / 1	RED/VIO SPLICE	-	BARE	-
120C	RED/VIO	16	SV-7 VAC SOL	A	12124580	7F / 1	RED/VIO SPLICE	-	BARE	-
120D	RED/VIO	16	SV-1	A	12124580	57B / 3	RED/VIO SPLICE	-	BARE	-
121	WHITE	16	RELAY 3	-	1/4" OC	13B / 1	VAC OFF SW	6	AMP 60253-2	410 / 2
122	BLK/GRN	16	SQUEEGEE TIMER CONN	F	12124580	15G / 1	BLK/GRN SPLICE 122	-	BARE	-
122A	BLK/GRN	16	REVERSE SWITCH CONN	A	12124580	53B / 3	BLK/GRN SPLICE 122	-	BARE	-
122B	BLK/GRN	16	VAC TIMER CONN	A	12124580	17G / 1	BLK/GRN SPLICE 122	B	12124580	7F / 1
123	BLACK	16	REVERSE SWITCH CONN	B	12124580	53B / 3	SV-7 CONN	B	12124580	57B / 3
124	BLACK	16	VAC TIMER CONN	F	12124580	15G / 1	SV-1 VAC SOL	5	AMP 60253-2	410 / 2
125	BLU/ORG	16	SQUEEGEE TIMER CONN	A	12124580	15F / 1	VAC OFF SW	5	AMP 60253-2	410 / 2
129A	BLU/ORG	16	VAC OFF SW	1	AMP 60253-2	410 / 2	VAC OFF SW	8	AMP 60253-2	410 / 2

LEGEND	CONNECTOR	VENDOR	CONNECTOR
1	12020926		WEATHER PACK 6 POSITION MALE
2	11202087-A		POWER & SIGNAL GROUP WEATHER PACK 3 POSITION FEMALE
3	11202089-B		POWER & SIGNAL GROUP WEATHER PACK 3 POSITION MALE
4	11201097A		POWER & SIGNAL GROUP WEATHER PACK 2 POSITION FEMALE
5	112015792		POWER & SIGNAL GROUP WEATHER PACK 2 POSITION MALE



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TITLE: NAUTILUS, MAIN, HARNESS  
SCALE: NTS

MATERIAL: SEE NOTES  
FINISH: SEE NOTES

TOLERANCES (UNLESS OTHERWISE SPECIFIED):  
0-1" ± 1/16  
1-12" ± 1/32  
>12" ± 1/16  
ANGLES ± 30'

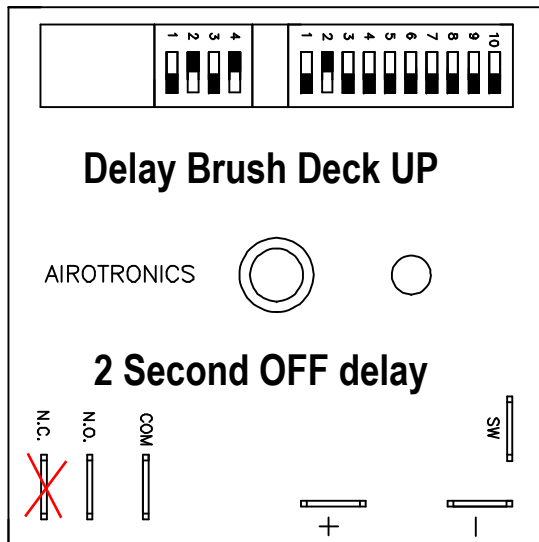
DATE: 03/25/2014  
DRAWN BY: MB  
CHECKED BY: JWP  
DATE: 03/25/2014

14845 US ROUTE 20  
PHOENIX DRIVE, L 80140  
SHEET 3 OF 3

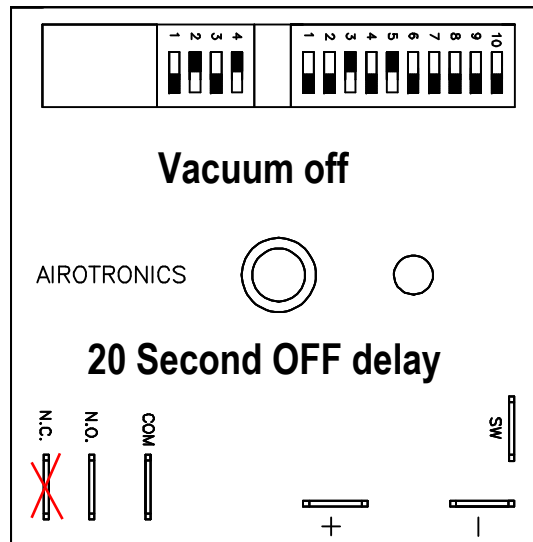
P.N. 748799

# 731224-R Timer Relay Settings

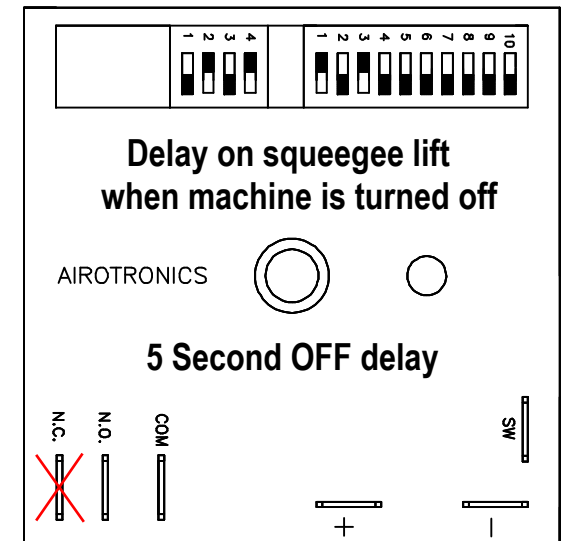
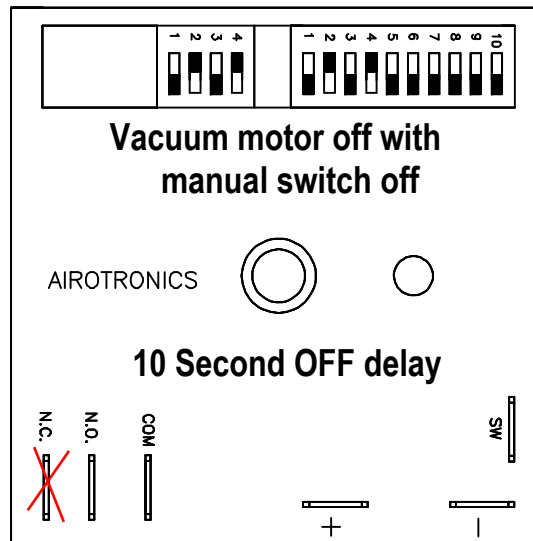
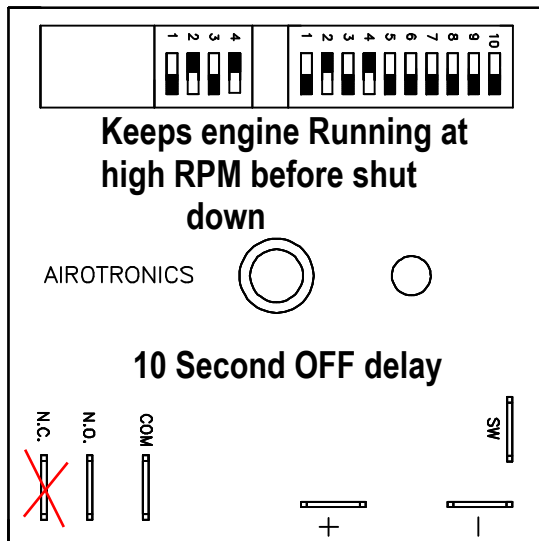
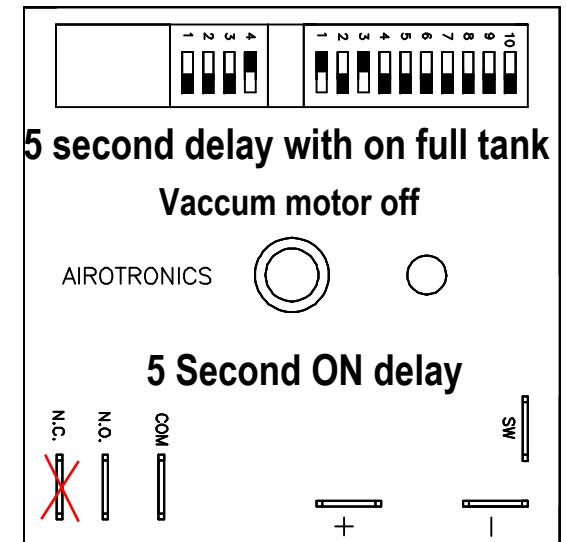
MOTION T1



SHUT DOWN T2



FLOAT T3



ENGINE T4

VAC T5

SQUEEGEE T6

**Green Light = No Output**

**Red Light = Output ON**

**X Terminal not used**

Switches 1 Through 10 Delay Settings

- |                    |                      |                       |
|--------------------|----------------------|-----------------------|
| 1 = 1 second delay | 5 = 16 second delay  | 9 = 256 second delay  |
| 2 = 2 second delay | 6 = 32 second delay  | 10 = 512 second delay |
| 3 = 4 second delay | 7 = 64 second delay  |                       |
| 4 = 8 second delay | 8 = 128 second delay |                       |