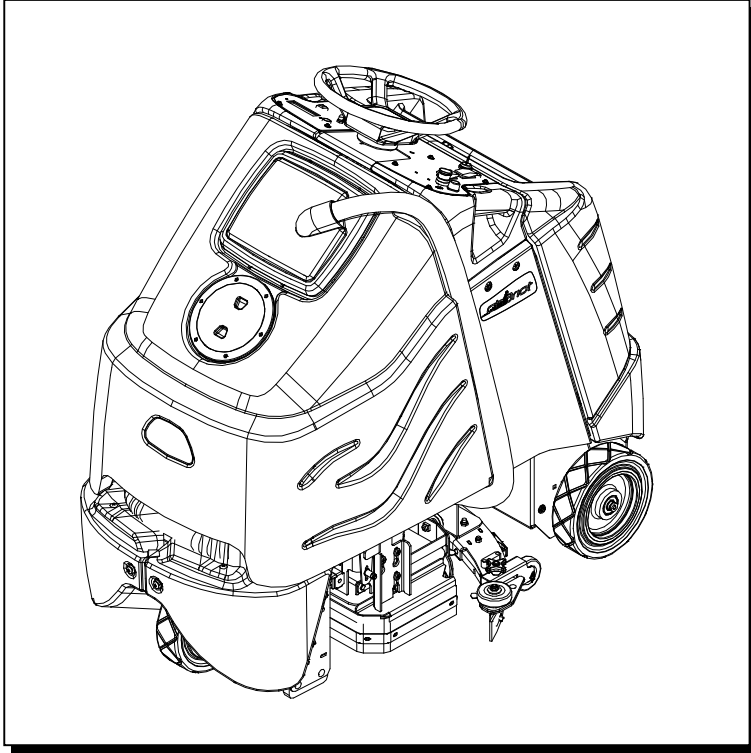


# chariot



## iSCRUB



Operating Instructions (ENG)

<b>MODELS:</b>	<b>CS24</b> 10060210	<b>CSE24</b> 10060250	<b>CS24SP</b> 10060220
	<b>CSX24</b> 10060270	<b>CSXE24</b> 10060290	<b>CSE24SP</b> 10060260
	<b>CSXEO24</b> 10060300		



IPX4

**QUEST**® ... for Continuous Improvement.  
Windsor's Quality Management System is Certified ISO 9001.

*Read these instructions before using the machine*



86037660 05/27/08

PRV NO. 980228

## **MACHINE DATA LOG/OVERVIEW**

<b>MODEL</b> _____
<b>DATE OF PURCHASE</b> _____
<b>SERIAL NUMBER</b> _____
<b>SALES REPRESENTATIVE #</b> _____

<b>YOUR DEALER</b>
<b>Name:</b> _____
<b>Address:</b> _____
<b>Phone Number:</b> _____

### **OVERVIEW**

The Chariot Scrubber is a battery powered, stand-on, hard floor scrubber intended for commercial use. The appliance applies a cleaning solution onto a hard floor, scrubs the floor with brushes or pads, and then vacuums the soiled water back into the recovery tank.

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# HOW TO USE THIS MANUAL

This manual contains the following sections:

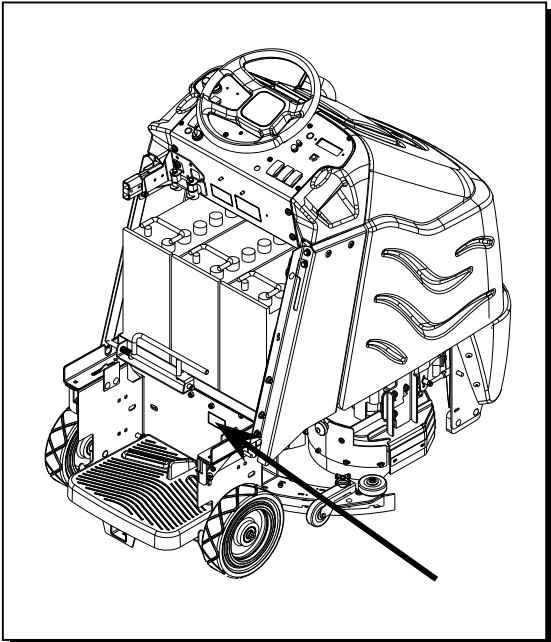
- HOW TO USE THIS MANUAL
- SAFETY
- OPERATIONS
- MAINTENANCE
- PARTS LIST

The HOW TO USE THIS MANUAL section will tell you how to find important information for ordering correct repair parts.

Parts may be ordered from authorized Windsor dealers. When placing an order for parts, the machine model and machine serial number are important. Refer to the MACHINE DATA box which is filled out during the installation of your machine. The MACHINE DATA box is located on the inside of the front cover of this manual.

MODEL _____
DATE OF PURCHASE _____
SERIAL NUMBER _____
SALES REPRESENTATIVE # _____

The model and serial number of your machine are located below the battery compartment of the machine.



The SAFETY section contains important information regarding hazard or unsafe practices of the machine. Levels of hazards are identified that could result in product or personal injury, or severe injury resulting in death.

The OPERATIONS section is to familiarize the operator with the operation and function of the machine.

The MAINTENANCE section contains preventive maintenance to keep the machine and its components in good working condition. They are listed in this general order:

- Batteries
- Scrub Brushes
- Adjusting Squeegee
- Service Schedule
- Machine Troubleshooting

The PARTS LIST section contains assembled parts illustrations and corresponding parts list. The parts lists include a number of columns of information:

- **REF** – column refers to the reference number on the parts illustration.
- **PART NO.** – column lists the part number for the part.
- **PRV NO.** - Reference No.
- **QTY** – column lists the quantity of the part used in that area of the machine.
- **DESCRIPTION** – column is a brief description of the part.
- **SERIAL NO. FROM** – If this column has an (\*) and a Reference number, see the SERIAL NUMBERS page in the back of your manual. If column has two asterisk (\*\*), call manufacturer for serial number. The serial number indicates the first machine the part number is applicable to. The main illustration shows the most current design of the machine. When a boxed illustration is shown, it displays the older design.
- **NOTES** – column for information not noted by the other columns.

**NOTE:** If a service or option kit is installed on your machine, be sure to keep the KIT INSTRUCTIONS which came with the kit. It contains replacement parts numbers needed for ordering future parts.

**NOTE:** The number on the lower left corner of the front cover is the part number for this manual.

# IMPORTANT SAFETY INSTRUCTIONS

**When using an battery powered appliance, basic precaution must always be followed, including the following:**

**READ ALL INSTRUCTIONS BEFORE USING THIS MACHINE.**



**To reduce the risk of fire, electric shock, or injury:**

**Use only** indoors. Do not use outdoors or expose to rain.

**Use only** as described in this manual. Use only manufacturer's recommended components and attachments.

If the machine is **not working properly**, has been dropped, damaged, left outdoors, or dropped into water, return it to an authorized service center.

**Do not** operate the machine with any openings blocked. Keep openings free of debris that may reduce airflow.

This machine **is not** suitable for picking up hazardous dust.

**Machine can cause a fire** when operating near flammable vapors or materials. Do not operate this machine near flammable fluids, dust or vapors.

***This machine is suitable for commercial use, for example in hotels, schools, hospitals, factories, shops and offices for more than normal housekeeping purposes.***

Maintenance and repairs **must be done** by qualified personnel.

If foam or liquid comes out of machine, **switch off immediately**.

**Disconnect** battery before cleaning or servicing.

Before the machine is discarded, the batteries **must be removed** and properly disposed of.

Make sure all warning and caution labels **are legible and properly attached** to the machine.

**During operation**, attention shall be paid to other persons, especially children.

**Before use** all covers and doors shall be put in the positions specified in the instructions.

**When leaving unattended**, secure against unintentional movement.

**The machine shall only** be operated by instructed and authorized persons.

**When leaving unattended**, switch off or lock the main power switch to prevent unauthorized use.

**Only chemicals recommended** by the manufacturer shall be used.

**This appliance has been designed** for use with the brushes specified by the manufacturer. The fitting of other brushes may affect its safety.

**Do not** use on surfaces having a gradient of over 10% (6 degrees).

## SAVE THESE INSTRUCTIONS

## HAZARD INTENSITY LEVEL

The following symbols are used throughout this guide as indicated in their descriptions:

### HAZARD INTENSITY LEVEL

There are three levels of hazard intensity identified by signal words -**WARNING** and **CAUTION** and **FOR SAFETY**. The level of hazard intensity is determined by the following definitions:



**WARNING** - Hazards or unsafe practices which COULD result in severe personal injury or death.



**CAUTION** - Hazards or unsafe practices which could result in minor personal injury or product or property damage.

### **FOR SAFETY: To Identify actions which must be followed for safe operation of equipment.**

Report machine damage or faulty operation immediately. Do not use the machine if it is not in proper operating condition. Following is information that signals some potentially dangerous conditions to the operator or the equipment. Read this information carefully. Know when these conditions can exist. Locate all safety devices on the machine. Please take the necessary steps to train the machine operating personnel.

### **FOR SAFETY:**

**DO NOT OPERATE MACHINE:**

Unless Trained and Authorized.

Unless Operation Guide is Read and understood.

In Flammable or Explosive areas.

In areas with possible falling objects.

### **WHEN SERVICING MACHINE:**

Avoid moving parts. Do not wear loose clothing; jackets, shirts, or sleeves when working on the machine. Use Windsor approved replacement parts.



**Batteries emit hydrogen gas. Explosion or fire can result. Keep sparks and open flame away. Keep solution tank in raised position when charging. Keep sparks and flames away from the batteries. Do not smoke around batteries.**



**Disconnect batteries before working on machine. Only qualified personnel should work inside machine. Always wear eye protection and protective clothing when working on or near batteries. Avoid skin contact with the acid contained in the batteries.**



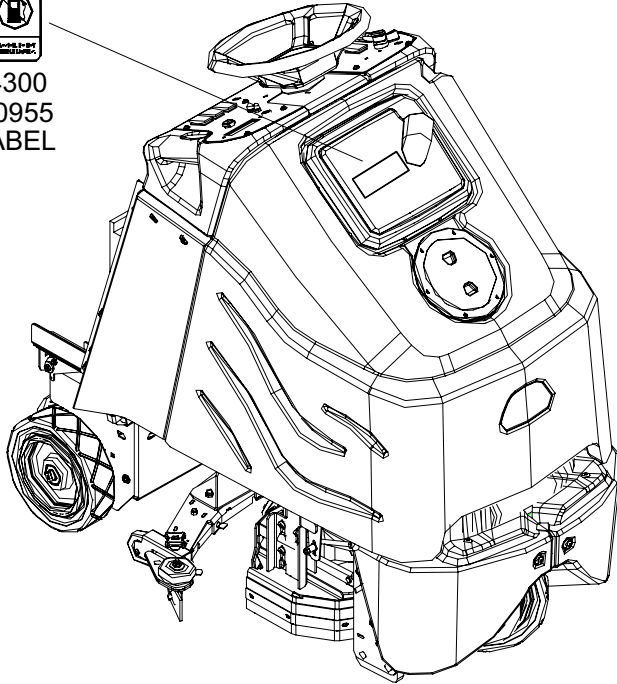
**Never allow metal to lie across battery tops.**

## SAFETY LABEL LOCATION

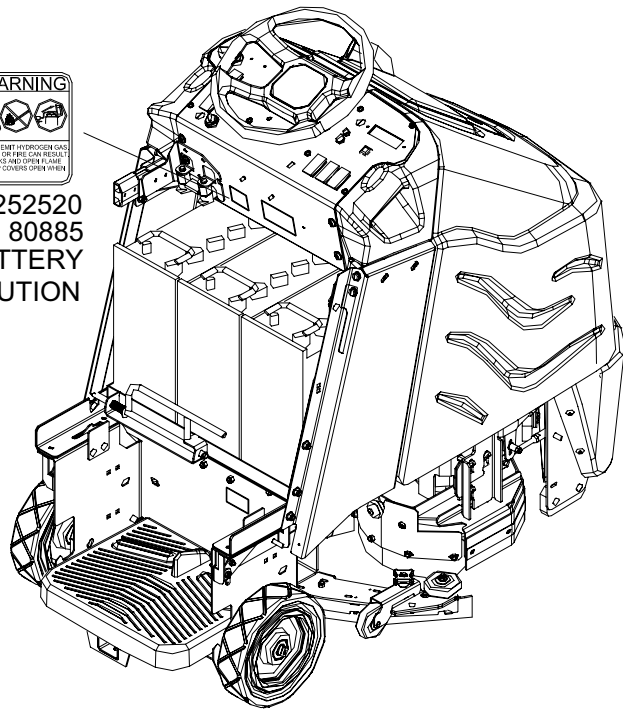
*NOTE: These drawings indicate the location of safety labels on the machine. If at any time the labels become illegible, promptly replace them.*



86244300  
PRV NO. 500955  
WARNING LABEL



86252520  
PRV NO. 80885  
BATTERY  
CAUTION



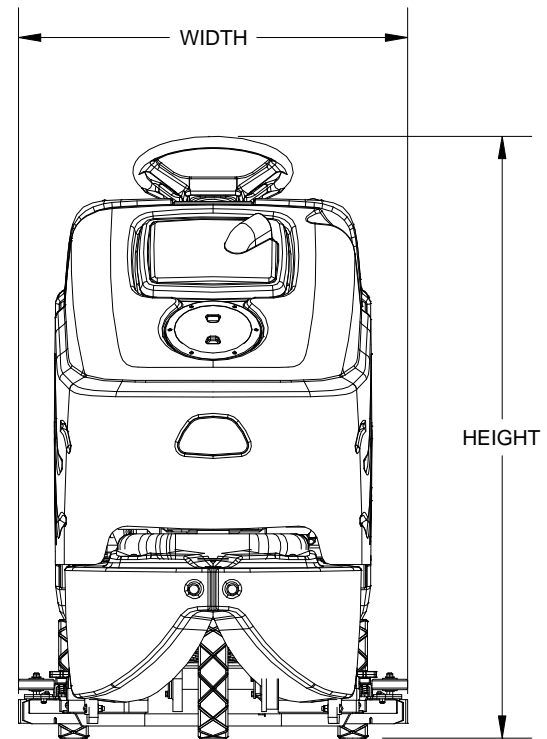
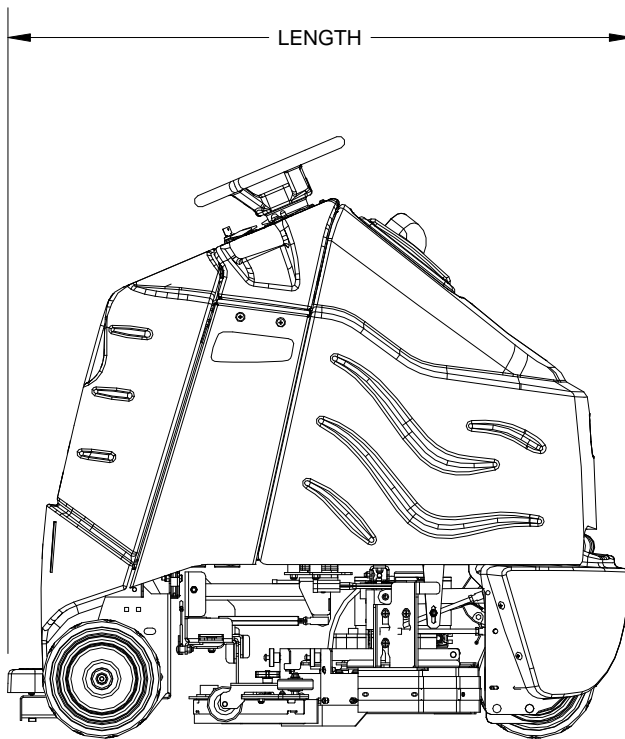
## TECHNICAL SPECIFICATIONS

ITEM	DIMENSION/CAPACITY
Nominal power	2100 W
Rated Voltage	36 Volts DC
Rated Amperage	58 amps
Batteries	3 X12 Volt 195-215 AH @ 20 hr. rate
Battery Compartment Dimensions	21 in. x 16 in. x 17 in. tall (533mm x 406mm x 432mm)
Scrub Brush Motors - Disk Machine	2 x .3 HP (190 W)
Scrub Brush Motors - Cylindrical Machine	2 x .75 HP (560 W)
Vacuum Motor(s)	.75 HP (560 W)
Maximum flow rate of vacuum motor	77.0 cfm (36.4 liters per second)
Maximum suction of vacuum motor	81.8 inches of water (20.3 kPa)
Propelling Motor	.75 HP (560 W)
Mass (GVW)	1245 lbs (565 kg)
Weight empty without batteries	535 lbs (243 kg)
Solution Control	1.3 GPM pump, fully variable with automatic shut-off in neutral
Solution capacity	25 gal (95 L)
Recovery capacity	25 gal (95 L)
Scrub brush diameter - Disk Machine	12 inch (305 mm)
Scrub brush diameter - Cylindrical Machine	6 inch (152 mm)
Scrub brush pressure	0-150lbs (0-667N)
Scrub brush speed - Disk Machine	300 rpm
Scrub brush speed - Cylindrical Machine	800 rpm
Tires	10 in. (254mm) Solid Scrubber Compound
Foundation Pressure	104 psi (715 Kpa)
Maximum Speed	3.5 miles/hour (5.6 Km/hour)
Theoretical Coverage	24,200 ft <sup>2</sup> /hr @ 2.5 mph with 2 in. overlap
Frame Construction	Powder coated steel
Brake	Electrical parking brake, sets automatically whenever operator steps off platform or engages emergency stop.
Minimum aisle u-turn width	56 in. (1425 mm)
Maximum rated climb and descent angle	7.5 degrees



## TECHNICAL SPECIFICATIONS

ITEM	MEASURE
Height	50.6 inches (1285 mm)
Length	52.5 inches (1330 mm)
Width without squeegee	26.5 inches (670 mm)
Width of squeegee - Disk Machine	32.7 inches (830 mm)
Width of squeegee - Cylindrical Machine	29 inches (737 mm)
Width of scrub path - Disk Machine	24 inches (610 mm)
Width of scrub path - Cylindrical Machine	23 inches (585 mm)



### SPECIAL NOTES:

The sound pressure level at the operator's ear was measured to be 68 dBA. This was a nearfield, broad-band measurement taken in a typical industrial environment on a tile floor. This appliance contains no possible source of impact noise. The instantaneous sound pressure level is below 63 Pa.

The weighted root mean square acceleration at the operator's arms was measured to be below  $2.5\text{m/s}^2$ . This was a tri-axial, third-octave-band measurement made during normal operation on a composite tile floor. The measurement and related calculations were made in accordance with ANSI S3.34-1986.

This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety. Children should be supervised to ensure that they do not play with the appliance.

## **HOW THIS MACHINE WORKS**

The Chariot® is a battery powered, self-propelled, hard floor scrubber intended for commercial use. The appliance applies a cleaning solution onto a hard floor, scrubs the floor with brushes, and then vacuums the soiled water back into the recovery tank.

The machine's primary systems are the solution system, scrub system, recovery system, and operator control system.

The function of the solution system is to store cleaning solution and deliver it to the scrub system. The solution system consists of the solution tank, strainer, pump, valve and controls. The solution tank stores cleaning solution (water and detergent) until it is delivered to the scrub system. The strainer protects the pump from debris. The valve automatically prevents solution flow unless the scrub brushes are turned on and the machine is being propelled. The solution control switch controls the amount of cleaning solution delivered to the scrub system by controlling the amount of time the pump is on.

The function of the scrub system is to scrub the floor. The disk scrub system consists of two rotary type disk scrub brushes, motors, scrub deck skirt, lift actuator and controls. The brushes scrub the floor as the motors drive the brushes. The brush drive hubs allow the scrub brushes to follow irregularities and changes in the floor without losing contact with the floor. The scrub deck skirts control the cleaning solution on the floor so that the squeegee can pick it up. The one touch/brush switch controls the motors and lift actuator to turn the motors on and lower the deck, or turn the motors off and raise the deck. The brush pressure switch controls the down pressure on the scrub deck.

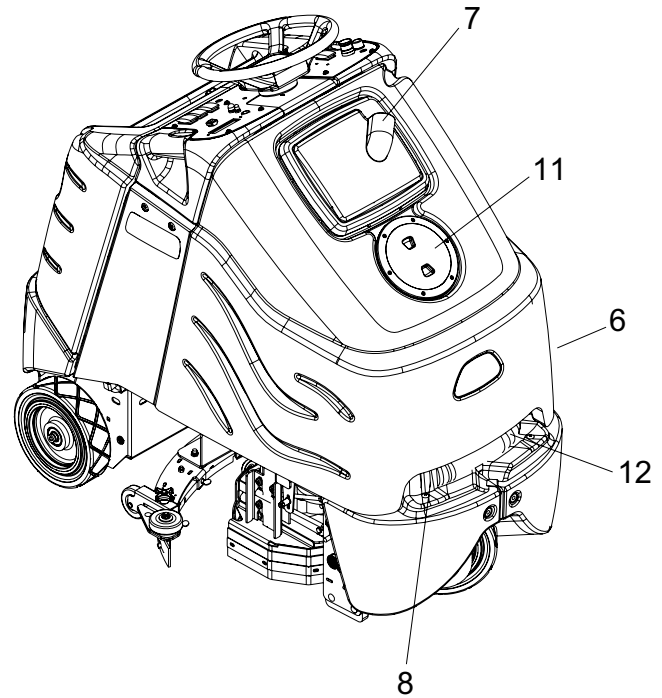
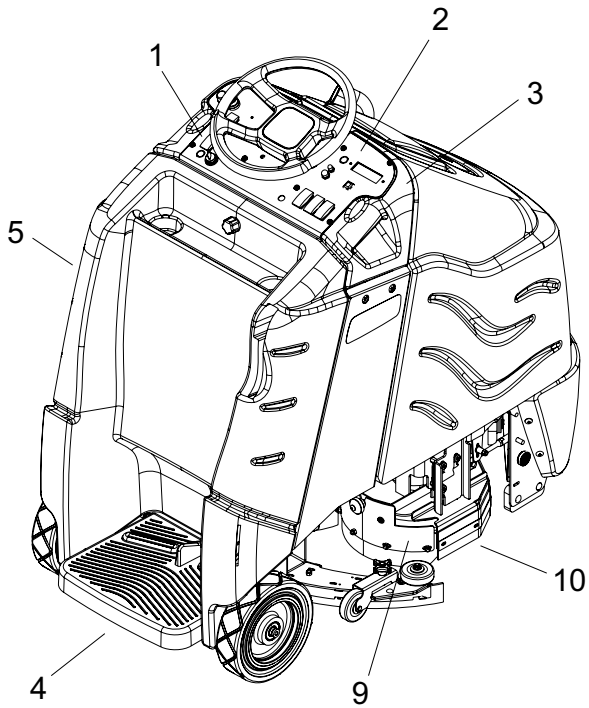
The scrub plus system consists of two cylindrical type brushes, motors, scrub deck side squeegees, hopper, lift actuator, and controls. The cylindrical scrub head is designed to eliminate debris that may be caught in the squeegee while scrubbing. Water is applied to the first scrubbing brush turning in a clockwise rotation when viewed from the right side of machine. The first brush scrubs dirt and debris between the brushes. The second scrubbing brush, turning in a counter clockwise rotation, picks up debris and throws it into a removable hopper. Water is allowed to drain out the hopper into the squeegee path where it is recovered from the floor.

The scrub deck side squeegees control the cleaning solution on the floor so that the squeegee can pick it up. The brush pressure switch controls the motors and lift actuator to turn the motors on and lower the deck, or turn the motors off and raise the deck. The brush pressure switch also controls the down pressure on the scrub deck.

The function of the recovery system is to vacuum the soiled water back into the recovery tank. The recovery system consists of the squeegee, vacuum motor, float ball filter, recovery bag and controls. The squeegee wipes the dirty solution off the floor as the machine moves forward. The vacuum motor provides suction to draw the dirty solution off the floor and into the recovery bag. The float ball filter protects the vacuum fan from debris and foam. The recovery bag stores the dirty solution.

The function of the operator control system is to control the direction and speed of the machine. The directional control system consists of the direction control switch, throttle pedal, operator presence pedal, speed control switch, drive reset switch, emergency stop/brake switch, steering wheel, propel controller, and drive wheel. The directional control switch signals forward or reverse direction. The controller interprets signals from the throttle pedal to command the drive wheel to propel or slow the machine. The drive reset switch is to make sure the operator is on platform before machine will propel. The operator presence pedal is to make sure the operator keeps both feet safely on platform while driving. The steering wheel points the drive wheel in the direction desired by the operator. The parking brake automatically engages when the operator steps off the platform. The emergency stop/brake can be used to hold the machine on slopes.

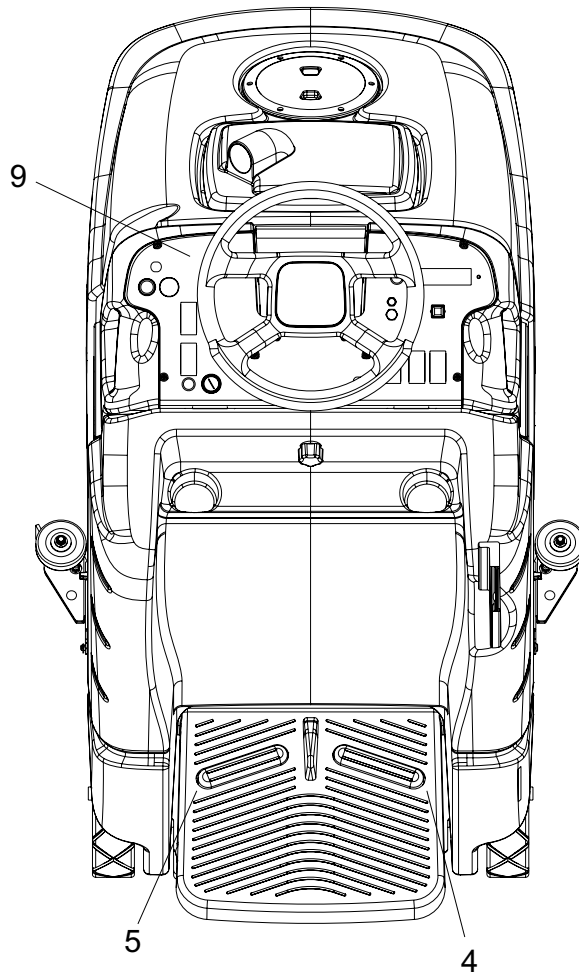
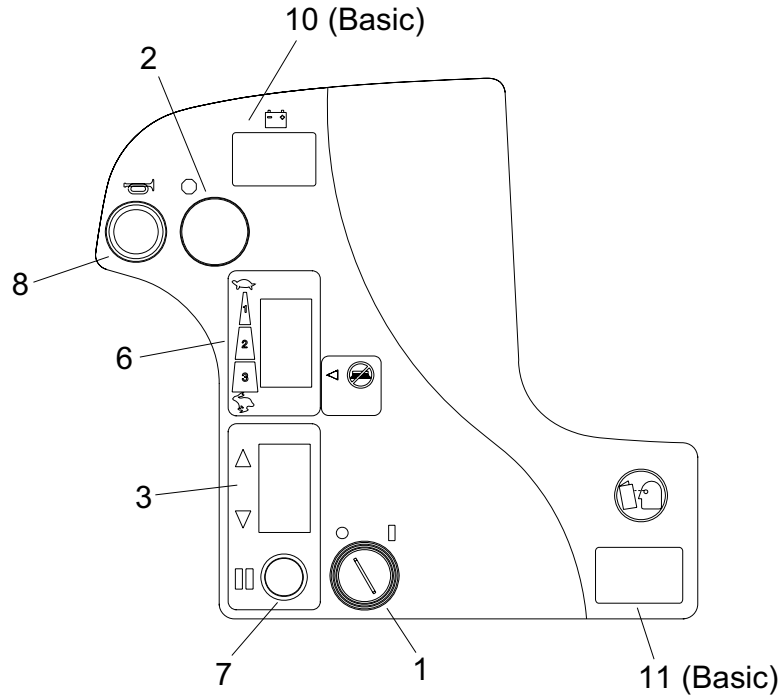
## COMPONENTS



1. Control Panel-Drive
2. Control Panel-Scrub
3. Control Housing
4. Pedal Platform
5. Rear Cover
6. Tank

7. Recovery Dome
8. Recovery Drain Hose
9. Scrub Deck Aqua-Mizer
10. Scrub Deck Skirts/Side Squeegees
11. Solution Cover
12. Solution Drain Hose

# DRIVE CONTROLS



- |                                       |   |
|---------------------------------------|---|
| 1. <i>Key Switch</i>                  | 7. <i>Drive Reset Button</i>                        |
| 2. <i>Emergency Stop/Brake Switch</i> | 8. <i>Horn Button</i>                               |
| 3. <i>Directional Control Switch</i>  | 9. <i>Steering Wheel</i>                            |
| 4. <i>Throttle Pedal</i>              | 10. <i>Battery Discharge Indicator (Basic Only)</i> |
| 5. <i>Operator Presence Pedal</i>     | 11. <i>Hour Meter (Basic Only)</i>                  |
| 6. <i>Speed Control Switch</i>        |   |
- 

### 1. KEY SWITCH

Controls the power for machine functions.

To turn the machine power on, rotate key clockwise.

To turn the machine off, rotate key counterclockwise.

**Deluxe Only:** When the key is turned on the battery symbol will flash while the system runs self-diagnostics and returns scrub deck and squeegee to their raised positions, if necessary. The controller will not respond to other commands until this routine is complete.

### 2. EMERGENCY STOP/BRAKE SWITCH

This safety feature is designed to cut all power to the machine at any time and apply parking brake.

To shut the machine power off, push the Emergency Stop Switch, this will also engage the parking brake and cause the machine to stop immediately.

To reset the machine, rotate the switch clockwise.

### 3. DIRECTIONAL CONTROL SWITCH

Controls the direction of travel of the vehicle. The position of the switch indicates direction of travel.

To travel forward, press the top of the switch.

To travel in reverse, press the bottom of the switch.

### 4. THROTTLE PEDAL

Controls the speed of the vehicle within the speed control setting selected. Pressing the pedal causes the machine to travel in the direction selected by the Directional Control Switch.

To increase speed, increase pressure on the pedal.

To decrease speed, decrease pressure on the pedal.

### 5. OPERATOR PRESENCE PEDAL

This safety feature is designed to ensure that the operator has their left foot on pedal platform whenever machine is moving. The operator must have left foot on Operator Presence Pedal for machine to move.

## ***DRIVE CONTROLS***

### **6. SPEED CONTROL SWITCH**

Controls the maximum speed of the machine. There are two setting intended for scrubbing, speeds 1 and 2. Speed 3 is recommended for transport only, not scrubbing.

To increase speed, press the top of the switch.

To decrease speed, press bottom of the switch. Speeds can be adjusted at any time, whether machine is moving or not.

**Basic:** The position of the switch indicates speed setting.

**Deluxe:** The display indicates speed setting. When the key is turned on the controller will automatically adjust the speed to setting 2.

### **7. DRIVE RESET SWITCH**

This safety feature is designed to ensure safe engagement of propel drive. Each time the machine power is turned on, and each time an operator steps on to the platform, the Drive Reset Switch must be pushed before machine will propel.

### **8. HORN BUTTON**

The horn is activated by pressing the horn button.

### **9. STEERING WHEEL**

The steering wheel turns the front wheel causing the machine to change direction.

## 10A. BATTERY CHARGE LEVEL INDICATOR-BASIC

Indicates the charge level of the batteries.

The meter display is divided into 10 vertical bars. Bars illuminated on the far right indicate full charge. Bars flashing near the left side indicate the batteries should be recharged. Further operation of the machine could damage the machine or the batteries.

When the machine is left overnight with less than a full charge, the display may initially indicate a full charge. It will also indicate a full charge if the batteries are disconnected, then reconnected. After a few minutes of operation the meter will give the correct charge level.

## 10B. BATTERY CHARGE LEVEL INDICATOR-DELUXE

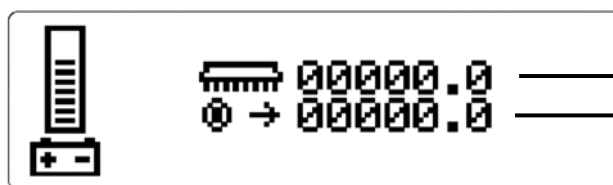
The battery meter can be viewed at the left side of either information screen 1 or information screen 2. The level of battery charge is indicated by the horizontal bars in the battery meter box. When the batteries require charging, the icon will flash and a battery inhibit icon will appear on the right side of either information screen. Scrub and solution functions that are running when the battery inhibit icon appears will be automatically shut off. It is not possible to restart scrub functions while the battery inhibit is displayed. The controller reserves enough battery charge to allow pick-up of residual water and transport back to a charging station.



## 11A. HOUR METER-BASIC

Records the number of hours the machine has been in operation. This information is useful in determining when to service the machine.

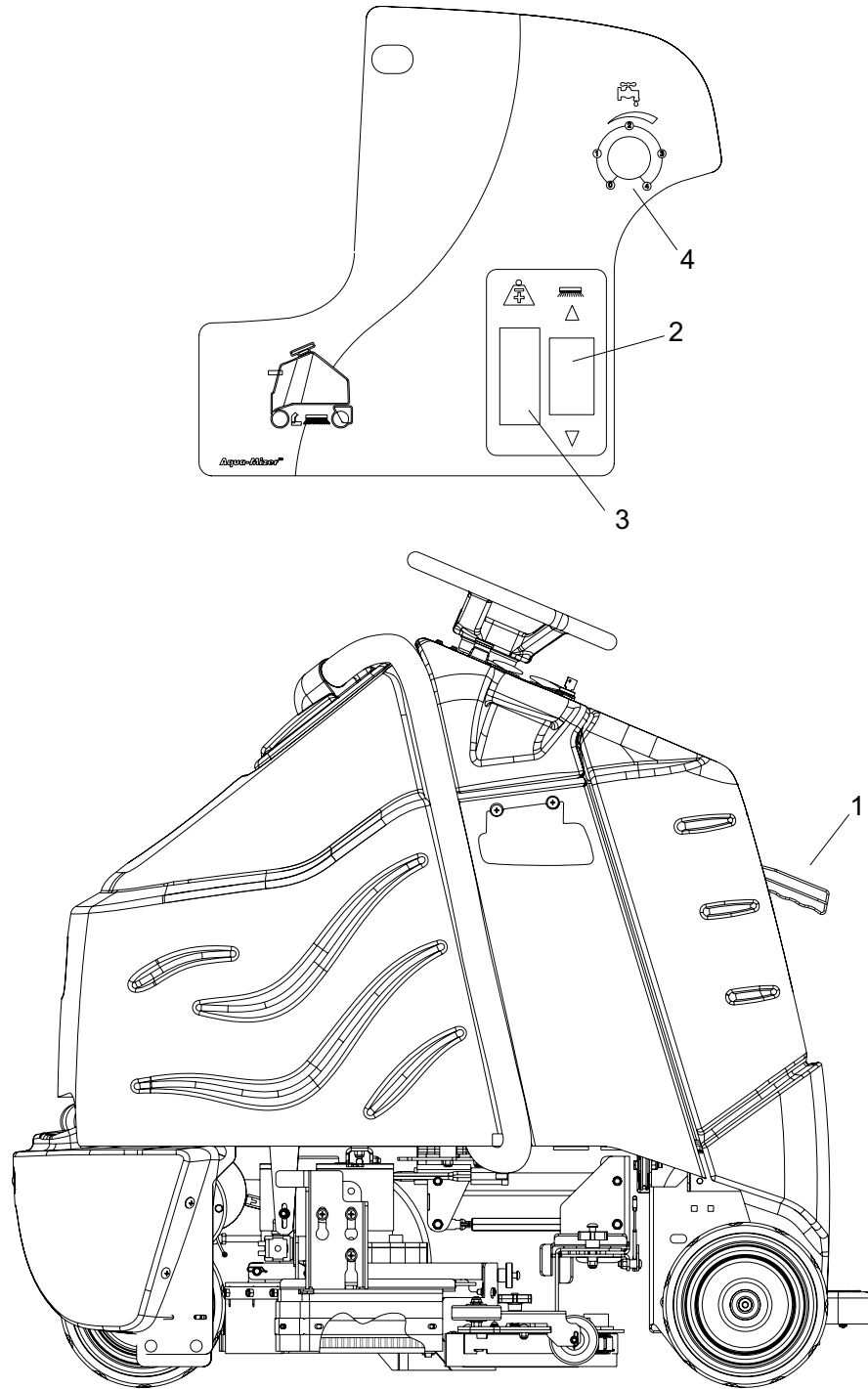
## 11B. HOUR METER-DELUXE



Brush Run Time:  
Records the time spent with the brushes running and gives true brush motor time.

Traction Motor Time:  
Records the time spent propelling the machine and gives true traction motor time.

## SCRUB CONTROLS-BASIC AND CYLINDRICAL



- 
- |                               |                             |
|-------------------------------|-----------------------------|
| 1. Squeegee Lift Lever        | 3. Brush Pressure Indicator |
| 2. Scrub Deck Actuator Switch | 4. Solution Control Knob    |



# **SCRUB CONTROLS-BASIC-CYLINDRICAL**

## **1. SQUEEGEE LIFT LEVER**

Raises and lowers the squeegee, and turns the vacuum motor on and off.

To lower squeegee and start vacuum motor, lift the lever from its raised position.

To raise squeegee and stop vacuum motor, lift the lever from its lowered position.

## **2. ACTUATOR SWITCH**

Raises and lowers the scrub deck, turns the scrub brush motors on and off, and adjusts the amount of brush/pad pressure to the floor.

To lower the scrub deck, turn on scrub brush motors, and/or increase brush pressure, press the bottom of the switch.

To raise the scrub deck, turn off scrub brush motors, and/or decrease brush pressure, press the top of the switch.

## **3. BRUSH PRESSURE INDICATOR**

The brush pressure indicator corresponds to the amp draw of the scrub brush motors to tell how hard the motors are working. The blue zone indicates medium or proper brush pressure. The red zone indicates heavy or excessive brush pressure. Operating in the red zone may cause the brush circuit breakers to trip.

## **4. SOLUTION CONTROL KNOB**

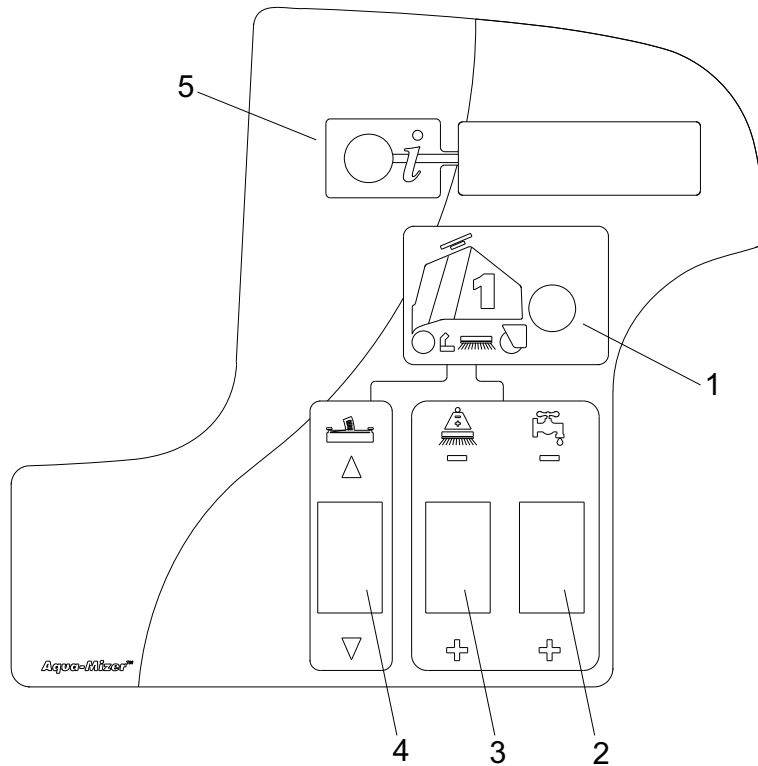
Controls solution flow to scrub deck

To increase flow, rotate knob clockwise.

To decrease flow, rotate knob counterclockwise.

If the brush motors are turned off or the throttle pedal is in neutral, the flow is automatically interrupted until the motors are turned on again. This feature prevents unintentional draining of the solution tank and allows the operator to adjust the solution flow to the scrub deck without resetting each time the scrubbing operation is interrupted.

## SCRUB CONTROLS-DELUXE



1. One Touch Switch
2. Solution Control Switch
3. Brush Pressure Switch
4. Vacuum/Squeegee Switch
5. Display Toggle Switch

### 1. ONE TOUCH SWITCH

This switch controls the scrub brushes and vacuum all in one touch.

To start scrubbing, press the one touch switch. The brush drive motors will turn on, the scrub deck will lower to the "light scrub" position, the solution will flow at "one bar" rate, the squeegee will lower and the vacuum will turn on. The information display window will show which functions are operating. If the throttle pedal is in the neutral position for more than two seconds the brushes and solution flow will stop. If the one touch switch is activated without brushes installed, the brush motors will stop, the scrub deck will rise, and the brush pressure indicator will display error code 9000.

To stop scrubbing, press the one touch switch. The brush drive motors will turn off, the scrub deck will raise the solution flow will stop, the squeegee will raise after a 15 second delay, and the vacuum motor will turn off. This delay is to clear the vacuum hose of recovered solution.

## 2. SOLUTION CONTROL SWITCH

This switch controls the amount of solution flow to the scrub deck. The information screen will show the solution setting. There are 4 different flow settings.

To increase the solution flow, press the bottom of the solution control switch (+).

To decrease solution flow, press the top of the switch (-).

If the brush motors are turned off or the throttle pedal is in neutral, the flow is automatically interrupted until the motors are turned on again, or the throttle pedal is pressed down. This feature prevents unintentional draining of the solution tank and allows the operator to adjust the solution flow to the scrub deck without resetting each time the scrubbing operation is interrupted.

## 3. BRUSH PRESSURE SWITCH

This switch controls the amount of brush pressure to the floor. The information display screen will show the amount of pressure. There are 4 different pressure settings.

To decrease the amount of down pressure, press the top of the brush pressure switch (-).

To increase the amount of down pressure, press the bottom of the brush pressure switch (+).

## 4. VACUUM/SQUEEGEE SWITCH

This switch independently controls the vacuum motor and squeegee position.

To start the vacuum motor and lower the squeegee to the floor, press the bottom of the switch.

To raise the squeegee and turn off the vacuum motor, press the top of the switch. The squeegee will raise after a 15 second delay, and the vacuum motor will turn off 15 seconds later, in order to clear vacuum hose of recovered solution.

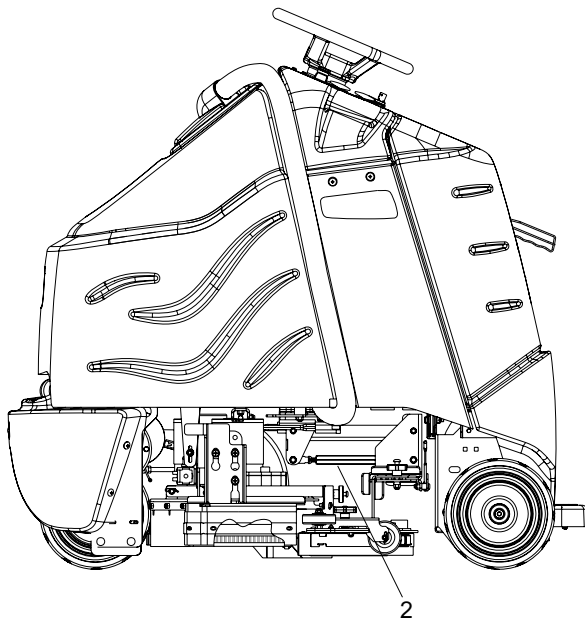
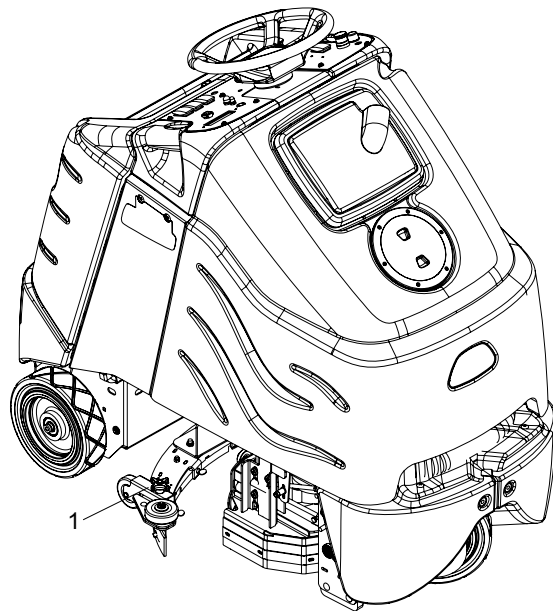
## 5. DISPLAY TOGGLE SWITCH

The display toggle switch allows you to change the information displayed screen. Two screens are available.

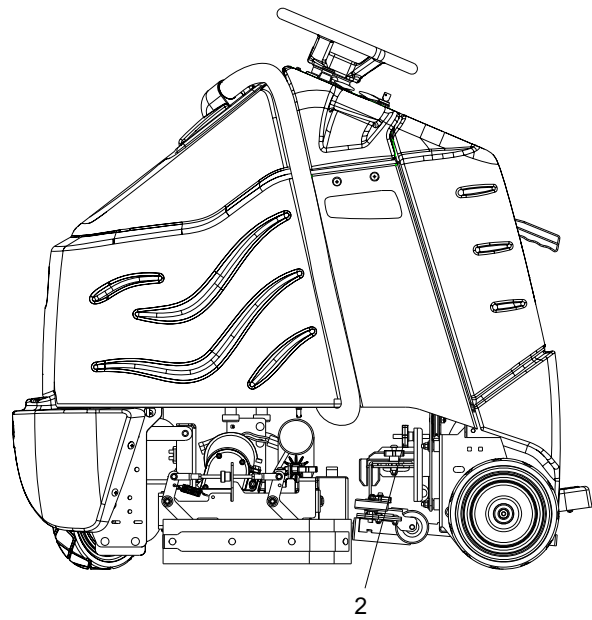
Screen 1 displays battery charge level, speed setting, brush pressure setting and solution flow setting, as well as animated scrub brush and vacuum icons when these functions are engaged.

Screen 2 displays battery charge level and hour meters. Hours are displayed for brush run time and traction motor time.

## SCRUB CONTROLS-SQUEEGEE



DISK SCRUBBER



CYLINDRICAL SCRUBBER

---

1. *Squeegee Deflection Adjustment Knobs*

2. *Squeegee Pitch Adjustment Rod*

## 1. SQUEEGEE DEFLECTION ADJUSTMENT KNOBS

Adjusts the deflection along the entire length of the squeegee.

To increase squeegee blade deflection, turn the two knobs at the ends of the squeegee counterclockwise.

To decrease squeegee deflection, turn the two knobs at the ends of the squeegee clockwise.

## 2. SQUEEGEE PITCH ADJUSTMENT ROD (DISK SCRUBBER)

Adjusts the deflection at the ends of the squeegee.

To increase squeegee blade deflection at the ends, turn rod counterclockwise.

To decrease squeegee blade deflection at the ends, turn rod clockwise.

## SQUEEGEE PITCH ADJUSTMENT KNOB (CYLINDRICAL)

Adjusts the deflection at the ends of the squeegee.

To increase squeegee blade deflection at the ends, turn knob counterclockwise.

To decrease squeegee blade deflection at the ends, turn knob clockwise.

# **MACHINE OPERATION**

## **PRE-RUN MACHINE INSPECTION**

Do a pre-run inspection to find possible problems that could cause poor performance or lost time from breakdown. Follow the same procedure each time to avoid missing steps.

**NOTE:** See maintenance section for pre-run machine inspection checklist items.

## **STARTING MACHINE**

**NOTE:** Perform pre-run machine check before operating machine.

**FOR SAFETY: Before starting machine, make sure that all safety devices are in place and operating properly.**

1. The operator should be on the pedal platform with their left foot on the operator presence pedal. The throttle pedal must be in the neutral position.
2. Turn the machine power on by turning key switch clockwise to the "ON" position.
3. Check the position of the Directional Control Switch to make sure the machine will travel in the direction intended.
4. Press the Drive Reset Switch.
5. Press lightly on the throttle pedal with right foot.

## **EMERGENCY STOP PROCEDURES**

1. Release the throttle pedal by lifting right foot.
2. Turn machine power off with key switch, by turning key switch counterclockwise.
3. If an electrical problem is suspected, push in emergency stop button. This will also engage the parking brake and cause the machine to stop immediately.

# MACHINE OPERATION

## FILLING SOLUTION TANK

**FOR SAFETY:** Before leaving or servicing machine; stop on level surface, turn off machine and remove key.

1. Turn the machine power off.
2. Remove solution cover.
3. Fill the solution tank with clean water, leaving enough room for the required amount of cleaning solution. The solution tank capacity filled to fill inlet is 25 gallons (95 liters). The water must not be hotter than 140° F (60°C) to prevent damage to the tank.
4. Measure the chemical into the solution tank. Liquid chemicals should be added to the solution tank after filling with water. Dry chemicals should be thoroughly mixed before being added into solution tank. Commercially available, high alkaline floor cleaners, are suitable for use in the solution system.

**NOTE:** Read the chemical manufacturers recommended proportion instructions.

5. Replace solution tank cover.

**⚠ WARNING:** Flammable materials can cause an explosion or fire. Do not use flammable materials in the tanks.

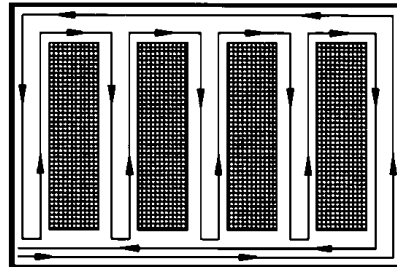
## NORMAL SCRUBBING

Plan the scrubbing pattern in advance. The longest track is around the perimeter of the area to be cleaned. For efficient operation, the runs should be the longest possible without turning, stopping, or raising or lowering scrub deck/squeegee.

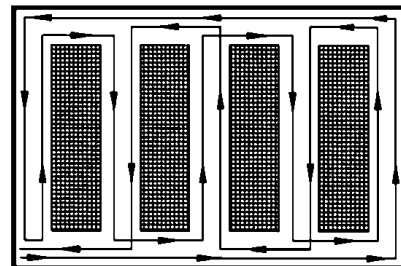
In order to achieve the best possible results, the area which is to be cleaned should be swept before scrubbing. Large debris, strings and wire must be removed to prevent being caught in brushes or squeegee.

If the machine is allowed to stand in neutral with the scrub deck down for more than 2 seconds, the solutions flow stops and brush motors stop. If either forward or reverse travel is selected, the solution flow will continue in the same setting and the scrub brush motors will continue in their same setting once movement of machine begins. Overlap the brush path and avoid transporting over previously cleaned areas.

## INEFFICIENT SCRUBBING PATH



## RECOMMENDED SCRUBBING PATH



# MACHINE OPERATION

## TO BEGIN SCRUBBING

**When operating the machine around people, pay close attention for unexpected movement. Use extra caution around children.**

**Flammable liquids and/or reactive metals can cause explosions or fire! Do not pick up.**

1. Place left foot on operator presence pedal. Throttle pedal must be in neutral position.
2. Turn machine power on.
3. Check position of Directional Control Switch to ensure that machine is set to travel in direction intended.
4. Press the Drive Reset Switch.

### 5. BASIC AND CYLINDRICAL

Lower the squeegee.

Lower the scrub deck to floor.

### DELUXE

Press the one-touch switch (#1) on the control panel. The brush motors will start, the scrub deck will lower to the light scrub position, the solution will begin to flow, the squeegee will lower to the floor and the vacuum motors will start.

6. Drive machine forward to begin scrubbing.

**NOTE:** Shut machine off immediately if water or foam is expelled from the machine.

7. Adjust the speed of the machine, solution flow and scrub brush pressure as necessary.

**NOTE:** Once solution flow rate is set it is not necessary to shut off solution when stopping scrubbing. Solution flow is automatically shut off when brush motors stop. When brush motors are activated, flow automatically resumes.

## PRIMING PUMP

If the solution system has gone dry or has been unused for a period of time, it may be necessary to follow the pump priming procedure.

1. Fill solution tank.
2. Loosen, but do not completely remove the strainer bowl. Solution should flow out of the strainer. If it does not, check the strainer screen inside the solution tank. Insure it is clear of debris. Tighten the strainer bowl.
3. Disconnect the squeegee hose from the recovery dome.
4. Begin normal scrubbing and set the solution flow to maximum setting. Solution flow should begin within 2 minutes.
5. Connect squeegee hose to recovery dome.
6. Adjust the speed of the machine, solution flow and scrub brush pressure as necessary.



## TO STOP SCRUBBING

### 1. BASIC AND CYLINDRICAL

Raise the scrub deck, turn off scrub brushes.

Raise squeegee, turn off vacuum.

### DELUXE

Press the one-touch switch (#1) on the control panel. The brush motors will stop and the scrub deck will rise to the park position. After 15 seconds the squeegee will raise, and 15 seconds later the vacuum motor will turn off. This delay is to clear the vacuum hose of recovered solution.

2. Allow the throttle pedal to return to neutral.
3. Turn machine power off.

**FOR SAFETY: Before leaving or servicing machine: stop on level surface, turn off machine and remove key.**

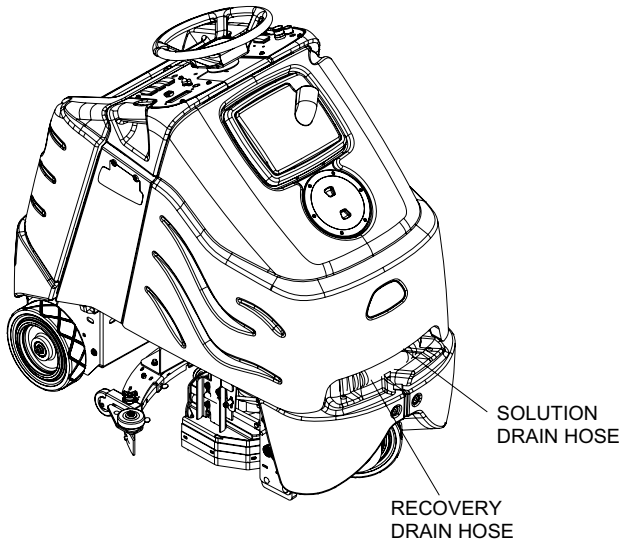
## DOUBLE SCRUB

For floors which are heavily soiled or have thick accumulations of floor finish may not clean sufficiently with one pass. In these cases it will be necessary to double scrub.

To double scrub, make the first pass over the surface being cleaned with the squeegee up, vacuum off, the solution on, Aqua-Mizer removed and brushes down. This allows the solution to stay in contact with the soil while loosening the surface accumulation with the brushes. Allow time for the first application to stay in contact with the floor. Length of time between the first and second pass depends on amount of accumulation and the type of chemical being used. A second scrubbing with the squeegee down and again the solution and brushes on will further loosen soil. The additional application of solution will further assist the difficult cleaning job.

**FOR SAFETY: When using machine, go slow on inclines and slippery services.**

## MACHINE OPERATION



### EMPTYING AND CLEANING TANKS

1. Park the machine next to a floor drain. Drain hoses are at the front of the machine.
2. Turn the machine power off.

### RECOVERY TANK

1. Pull the large drain hose from under the front of the tank. Unscrew cap, then lower hose in direction of the drain. Do not stand in front of end of hose. Recovered solution will come out with force.
2. Remove the recovery tank dome. Flush the recovery bag out with clean water. Do not use water hotter than 140°F (60°C) to clean tank. Damage may occur.
3. Clean debris from dome basket.
4. Clean off the float shut-off system and inspect for free movement of float. The float shut-off system is located in the rear of the recovery tank.
5. Replace the drain cap and secure drain hose under tank.
6. If machine is to be stored, leave the recovery tank dome off.

### SOLUTION TANK

1. Pull recovery drain hose out to expose the solution drain hose.
2. Pull the solution drain hose from under front of the tank. Unscrew the T-handle on plug enough to loosen plug, then lower hose in direction of drain. Slowly remove plug from drain hose.
3. Remove the solution tank cover.
4. Flush the solution tank out with clean water and run several gallons of clean water through systems. Do not use water hotter than 140°F (60°C) to clean tank. Damage may occur.

**NOTE:** Never allow solution to remain in tank. Damage to tank, seals and valves could occur.

Tuck drain hose under tank and secure with recovery drain hose by tucking it under tank.

**NOTES:**

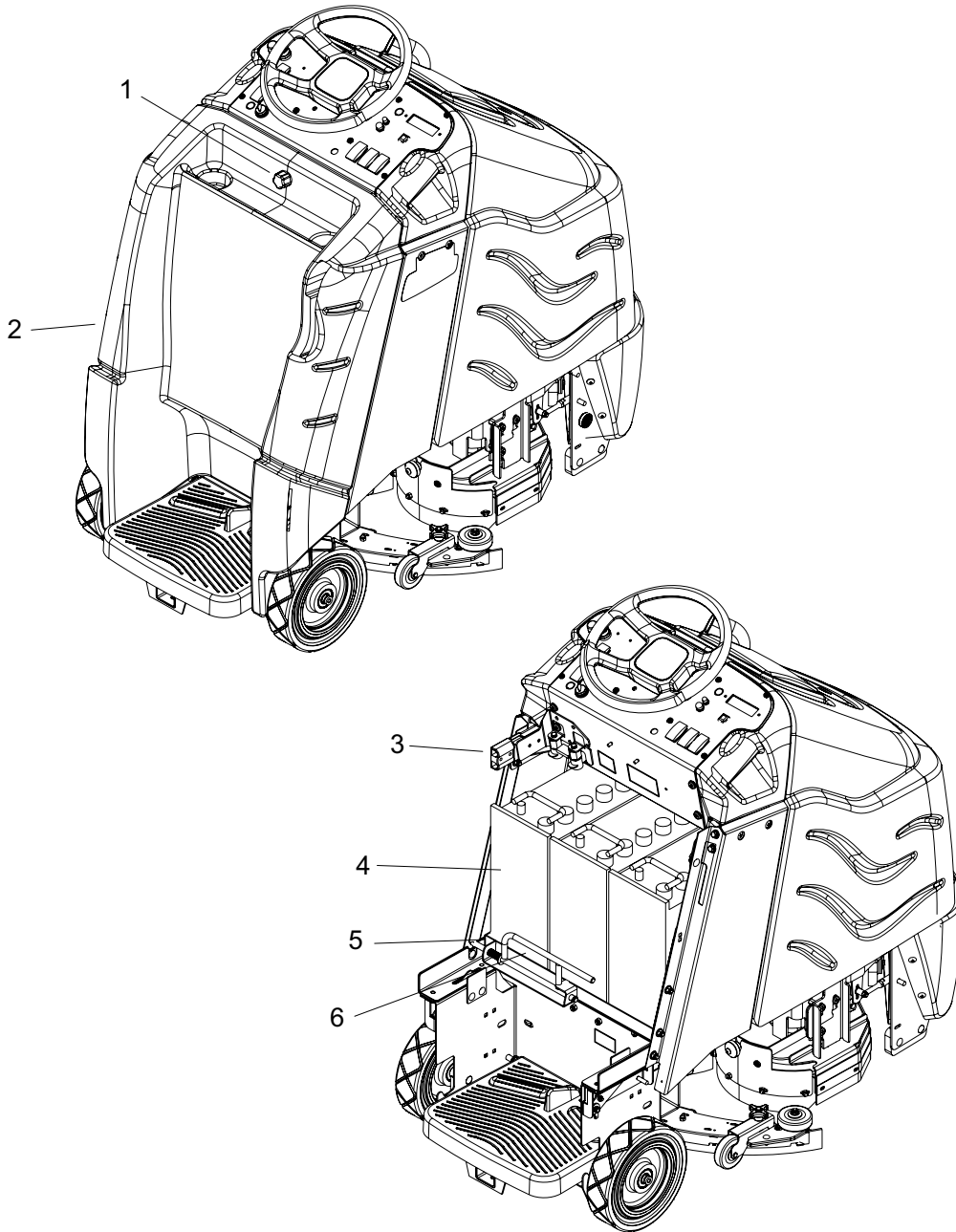
# MAINTENANCE

## SERVICE SCHEDULE

MAINTENANCE	BEFORE EACH WORK PERIOD	AFTER EACH WORK PERIOD	50 HRS	100 HRS	200 HRS
Check water level of batteries after charging; add distilled water if necessary. (Wet cell only)	*				
Check that dome and cover seal tightly.	*				
Visually check for damaged or worn tires.	*				
Check brushes or pads for proper installation.	*				
Check vacuum hose connections.	*				
Check that squeegee is securely attached and properly adjusted.	*				
Check for securely attached drain hoses, plug and cap.	*				
Check both pedals, brake and steering for proper operation.	*				
Clean out recovery tank and dome basket.		*			
Clean and inspect float shutoff.		*			
Clean out solution tank and filter, check flow.		*			
Clean and inspect solution filter strainer.		*			
Run vacuum motors to dry.		*			
Clean brushes or pads and check wear.		*			
Clean squeegee blades and check wear.		*			
Clean outside of tanks, check for damage.		*			
Store with dome off tank.		*			
Charge batteries.		*			
Clean off top of batteries.			*		
Check battery cells with hydrometer. (Wet cell only)			*		
Inspect scrub deck skirts and Aqua-Mizers.			*		
Clean solution strainer inside tank.			*		
Check battery connections are tight.			*		
Clean battery cases and battery compartment.				*	
Clean and check drive tension chain for wear and tension.				*	
Check parking brake.					*
Clean chains, cables and pulleys for squeegee lift.					*
Clean pivot points on squeegee and scrub deck.					*
Check all motors for carbon brush wear.					*
Check motor commutators.					*
Check steering chain tensioner.					*

**NOTE:** Traction drive, wheels and batteries should be serviced based on traction drive hour meter (Deluxe). The scrub brush hour meter should be used for all other service schedule items.

## MAINTENANCE-BATTERIES



- 
- |    |                                  |    |                           |
|----|----------------------------------|----|---------------------------|
| 1. | <i>Rear Cover Retainer Knob</i>  | 4. | <i>Batteries</i>          |
| 2. | <i>Rear Cover</i>                | 5. | <i>Battery Tray</i>       |
| 3. | <i>Battery Connector-Machine</i> | 6. | <i>Battery Tray Latch</i> |

## MAINTENANCE-BATTERIES

### BATTERIES (WET CELL ONLY)

The batteries provide the power to operate the machine. The batteries require regular maintenance to keep them operating at peak efficiency.

The machine batteries will hold their charge for long periods of time, but they can only be charged a certain number of times. To get the greatest life from the batteries, charge them when their charge level reaches 25% of a full charge. Use a hydrometer to check the charge level.

Do not allow the batteries to remain in a discharged condition for any length of time. Never expose a discharged battery to temperatures below freezing. Discharged batteries will freeze causing cracked cases. Do not operate the machine if the batteries are in poor condition or if they have a charge level below 25% (specific gravity below 1.155).

Keep all metallic objects off the top of the batteries, as they may cause a short circuit. Replace worn or damaged cables and terminals.

Check the electrolyte level in each battery cell before and after charging the batteries. Never add acid to the batteries, use distilled water. Do not allow water level to fall below the battery plates. Portions of plates exposed to air will be destroyed. Do not overfill. Keep plugs firmly in place at all times.

 **CAUTION:** When servicing machine, avoid contact with battery acid.

 **WARNING:** Batteries emit hydrogen gas. Explosion or fire can result. Keep sparks and open flame away. Keep covers open when charging.

 **WARNING:** Wear eye protection and protective clothing when working with batteries.

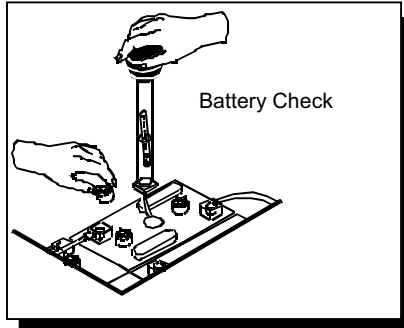
 **WARNING:** Charge batteries in a well ventilated area.

### BATTERY MAINTENANCE

1. When cleaning the batteries, use a solution of baking soda and water. Do not allow the cleaning fluid to enter the battery cells, electrolyte will be neutralized.
2. Maintain the proper electrolyte level in each battery cell. If a cell should accidentally overflow, clean immediately.
3. Wipe off the top of the batteries at least once a week.
4. Test battery condition with a hydrometer at least once a week.
5. Ensure that all connections are tight and all corrosion removed.
6. Every 4 to 6 months, remove that batteries from the machine and clean the battery cases and battery compartment.

## CHECKING BATTERY SPECIFIC GRAVITY

Use a hydrometer to check the battery specific gravity.



### CHECKING GRAVITY

- A. Hydrometer
- B. Battery

**NOTE:** Do not take readings immediately after adding distilled water, if the water and acid are not thoroughly mixed, the reading may not be accurate.

Check the hydrometer readings against this chart.

SPECIFIC GRAVITY @ 80°F (27°C)	BATTERY CONDITION
1.265	100% CHARGED
1.225	75% CHARGED
1.190	50% CHARGED
1.155	25% CHARGED
1.120	DISCHARGED

**NOTE:** If the readings are taken when the battery electrolyte is any temperature other than 80°F (27°C), the reading must be temperature corrected.

To find the corrected specific gravity reading when the temperature of the battery electrolyte is other than 80°F (27°): Add (+) to the specific gravity reading 0.004 (4 points), for each 10°F (6°C) above 80° (27°C).

Subtract (-) from the specific reading 0.004 (4 points), for each 10°F (6°C) below 80°F (27°C).

## CHARGING BATTERIES

**CAUTION:** When servicing machine, avoid contact with battery acid.

**WARNING:** Batteries emit hydrogen gas. Explosion or fire can result. Keep sparks and open flame away. Keep covers open when charging.

**WARNING:** Wear eye protection and protective clothing when working with batteries.

**WARNING:** Charge batteries in a well ventilated area.

Use a 36 volt, 20 amp maximum output DC charger which will automatically shut off when the batteries are fully charged.

1. Stop the machine in a clean, well ventilated area next to the charger.
2. Turn "OFF" machine.

**FOR SAFETY:** Before leaving or servicing machine; stop on level surface, turn off machine and remove key.

3. Remove rear cover, unplug batteries from machine, unlatch battery tray and pull out to expose batteries.

**WARNING:** Batteries emit hydrogen gas. Explosion or fire can result. Keep sparks and open flame away. Keep covers open when charging.

4. Check the electrolyte level in each battery cell. Before charging, add just enough distilled water to cover the plates. After charging is complete, add just enough distilled water to bring up the level to the indicator ring. If the water level is too high before charging, normal expansion rate of the electrolyte may cause an overflow resulting in a loss of battery acid balance and damage the machine.

## MAINTENANCE-BATTERIES

5. Replace the battery caps, and leave them in place while charging.
6. Unplug the battery connector from the machine.

**FOR SAFETY: When charging, connect the charger to the batteries before connecting the charger to the AC wall outlet. Never connect the charger to the AC wall outlet first. Hazardous sparks may result.**

7. Plug the charger connector into the battery connector. Connect the charger AC plug to a wall outlet. The charger gauge should indicate that the batteries are charging.
8. When the batteries are fully charged, disconnect the charger from the AC wall outlet, then disconnect the charger from the batteries.
9. Connect the batteries to the machine connector.
10. Check the electrolyte level. It should be up to the indicator ring. If necessary, add distilled water.
11. Install the rear cover.

## CHANGING BATTERIES

Stop the machine in a clean area next to the charger. Turn off machine.

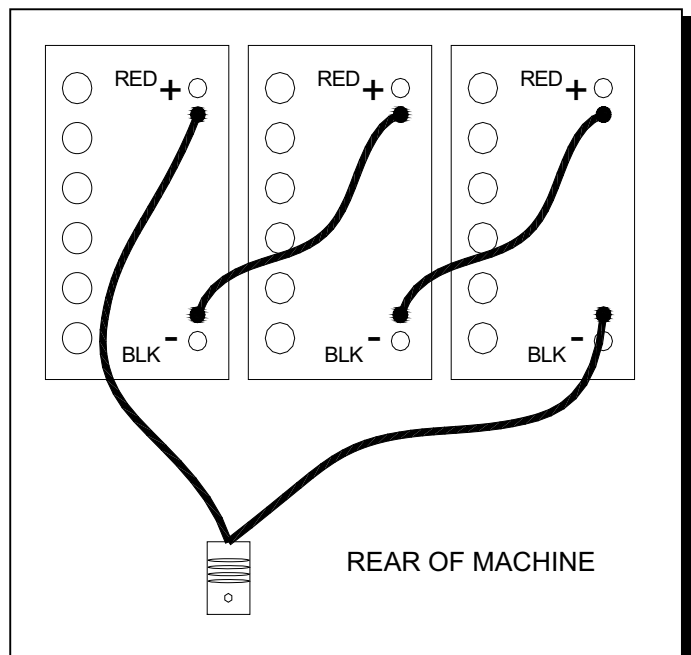
**FOR SAFETY: Before leaving or servicing the machine; stop on level surface, turn off machine and remove key.**

1. Remove the rear cover.
2. Disconnect battery pack from machine.
3. Unlatch battery tray from machine and pull out to expose batteries.
4. Use the proper size open end wrench to disconnect main ground wire first and secure cable terminal away from batteries.
5. Disconnect main positive lead and secure cable terminals away from batteries.
6. Loosen both terminals on each jumper cable and remove one at a time.
7. Prepare a suitable site to place the batteries.

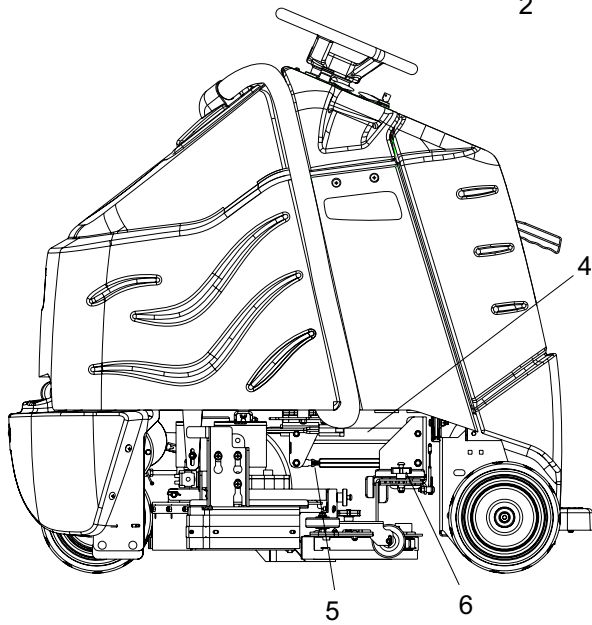
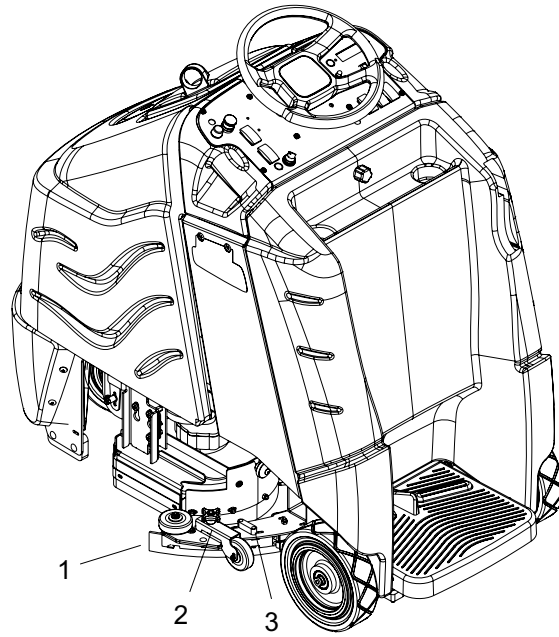


**WARNING:** Attach suitable battery lifting device and lift batteries from the machine.

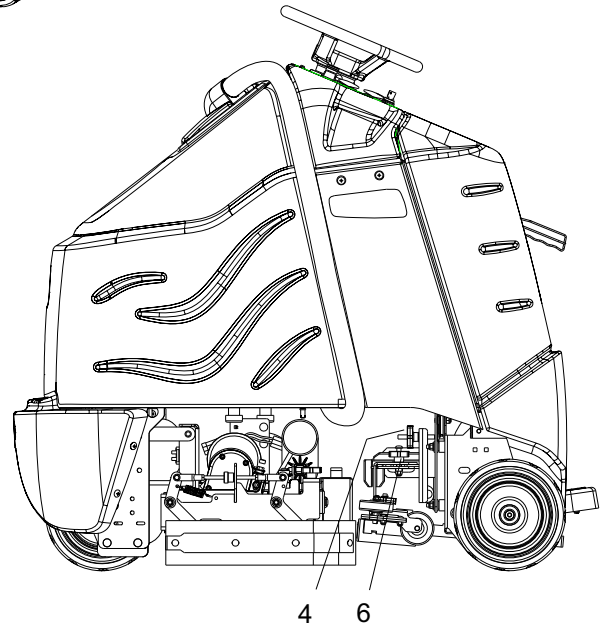
**Batteries are a potential environmental hazard. Consult your battery supplier for safe disposal methods.**







DISK SCRUBBER



CYLINDRICAL SCRUBBER

- 
- |    |   |    |   |
|----|---|----|---|
| 1. | <i>Squeegee</i>                             | 4. | <i>Squeegee Pitch Adjustment Rod/Cylindrical Knob</i> |
| 2. | <i>Squeegee Deflection Adjustment Knobs</i> | 5. | <i>Squeegee Pitch Adjustment Lock Nut</i>             |
| 3. | <i>Squeegee Level Indicator</i>             | 6. | <i>Squeegee Retainer Knob</i>                         |

# MAINTENANCE-SQUEEGEE

## SQUEEGEE BLADES

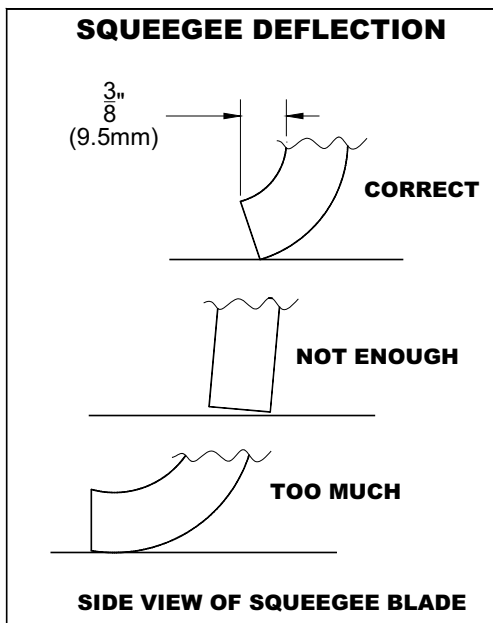
The front squeegee blade allows solution to pass through channels in the blade into the squeegee assembly while maintaining vacuum to provide lift. The front blade has four wear surfaces and can be rotated for extended life. The front blade should not require regular replacement under normal use.

The rear blade wipes the floor to a near dry condition. It is important the rear blade be in good condition to properly do its job. As with the front, each squeegee blade assembly has four wear surfaces for extended service.

Check both the front and rear squeegee blades for damage, wear, and adjustment each day in the pre-run check. Change the front blade if it is torn or has an uneven edge. Change the rear blade if it is less than 1/2 the original thickness.

## ADJUSTING SQUEEGEE

Adjusting the squeegee is a two-part process. First, the squeegee assembly must have correct pitch in order for the squeegee blade to have the same deflection at each tip as well as the center. The rod on the squeegee linkage controls the pitch adjustment. The second adjustment is the deflection. Knobs on each end of the squeegee control this.



## TO REMOVE SQUEEGEE ASSEMBLY

1. With the squeegee in the up position, turn key switch "OFF".
2. Disconnect vacuum hose from squeegee and loosen knob on left side of squeegee lifting carrier.
3. Pull squeegee assembly from the lifting carrier.
4. Inspect or repair as necessary and reinstall.

## TO REPLACE OR ROTATE REAR SQUEEGEE BLADES

1. With the squeegee in the up position, turn key switch "OFF".

**FOR SAFETY: Before leaving or servicing machine; stop on level surface, turn off machine and remove key.**

2. Remove the squeegee assembly from the machine. Unlatch and remove blade retainer strap and remove squeegee blade.
3. Rotate the squeegee to new edge position or replace as required. Each blade has four new edge positions.
4. Install blade on locating pins of squeegee assembly.
5. Install squeegee retainer strap.
6. Fasten and lock latch, adjust latch only tight enough to take up slack in retaining strap.

## TO REPLACE OR ROTATE FRONT SQUEEGEE BLADE

1. With the squeegee in the up position, turn key switch "OFF".
2. Remove the squeegee from the machine. Loosen thumbscrews and remove the retainer strap and squeegee blade.
3. Rotate the squeegee to new edge position or replace as required. Each blade has four new edge positions. When installing the front blade, tighten the center thumbscrew first. Insure that the retainer strap is pressed against the blade before tightening the outer screws.

## MAINTENANCE-SQUEEGEE

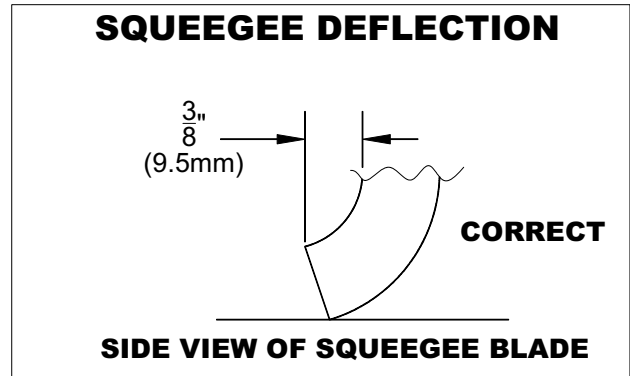
### TO ADJUST SQUEEGEE PITCH

1. Choose a smooth, level surface. Turn "ON" the key switch. Lower the squeegee and drive forward at least 2 feet (60cm.).
2. With the squeegee down, stop the machine. Do not allow machine to roll back.

**FOR SAFETY: Before leaving or servicing the machine; stop on level surface, turn off machine and remove key.**

3. Determine the differences, if any, in deflection of the squeegee blade between each end and the middle. Proper adjustment is obtained when deflection is equal all the way across the squeegee blade. The bubble level should also indicate when the squeegee is adjusted properly. When the air bubble is in the center of the vial, the deflection should be even across the squeegee blade.
4. To decrease the deflection of the squeegee blade at the ends, loosen wing nut and rotate the rod clockwise. To increase the deflection at the ends of the squeegee assembly, rotate the rod counterclockwise knob.
5. Check the deflection of the squeegee blades again. Repeat steps 1 through 4 until the deflection is equal across the entire rear squeegee blade. Tighten wing nut.

### TO ADJUST AMOUNT OF REAR SQUEEGEE DEFLECTION



1. Choose a smooth, level surface. Lower the squeegee and drive forward at least 2 feet (60cm).
2. With the squeegee down, stop the machine. Do not allow machine to roll back.

**FOR SAFETY: Before leaving or servicing machine; stop on level surface, turn off machine and remove key.**

3. Observe the amount of squeegee deflection. It should deflect 3/8 in. (9.5mm) across the entire width of the squeegee.
4. To increase the squeegee deflection, turn the 2 knobs at the squeegee ends counter-clockwise. To decrease the deflection, turn the knobs clockwise.

**NOTE:** The deflection should be consistent along the length of the squeegee. If the deflection varies from end to end the knobs can be adjusted independently to correct the variation.

5. Turn on the key switch. Raise, then lower squeegee assembly. Drive forward at least 2 feet (60cm).
6. Repeat steps 2 through 4 until deflection of 3/8 in. (9.5mm) is reached.

# **MAINTENANCE-SCRUB BRUSHES**

## **SCRUB BRUSHES**

There are four different types of brushes available to cover applications from cleaning heavily soiled floors to polishing. A pad driver is also available to take advantage of the many cleaning pads on the market. Please refer to the following to assist in selecting the proper brush or pad for the work at hand.

## **UNCOATED FLOORS**

**Aggressive Grit** is a nylon fiber impregnated with silicone carbide grit. It grinds away stain, soil, and removes surface material.

**Mild Grit** is a less aggressive silicone carbide grit suitable for cleaning medium soil conditions. Advantages are faster ground speed than nylon bristles on light solid applications.

**Polypropylene** is a general-purpose scrub brush with stiff bristles. Polypropylene works well for maintaining concrete, wood and tile floors.

## **FINISHED FLOORS**

**Nylon** bristles are used in a variety of applications on coated or uncoated surfaces.

**White Pads** (Polishing) are used for dry polishing to achieve a high-gloss appearance, or surface washing on highly polished or burnished floors.

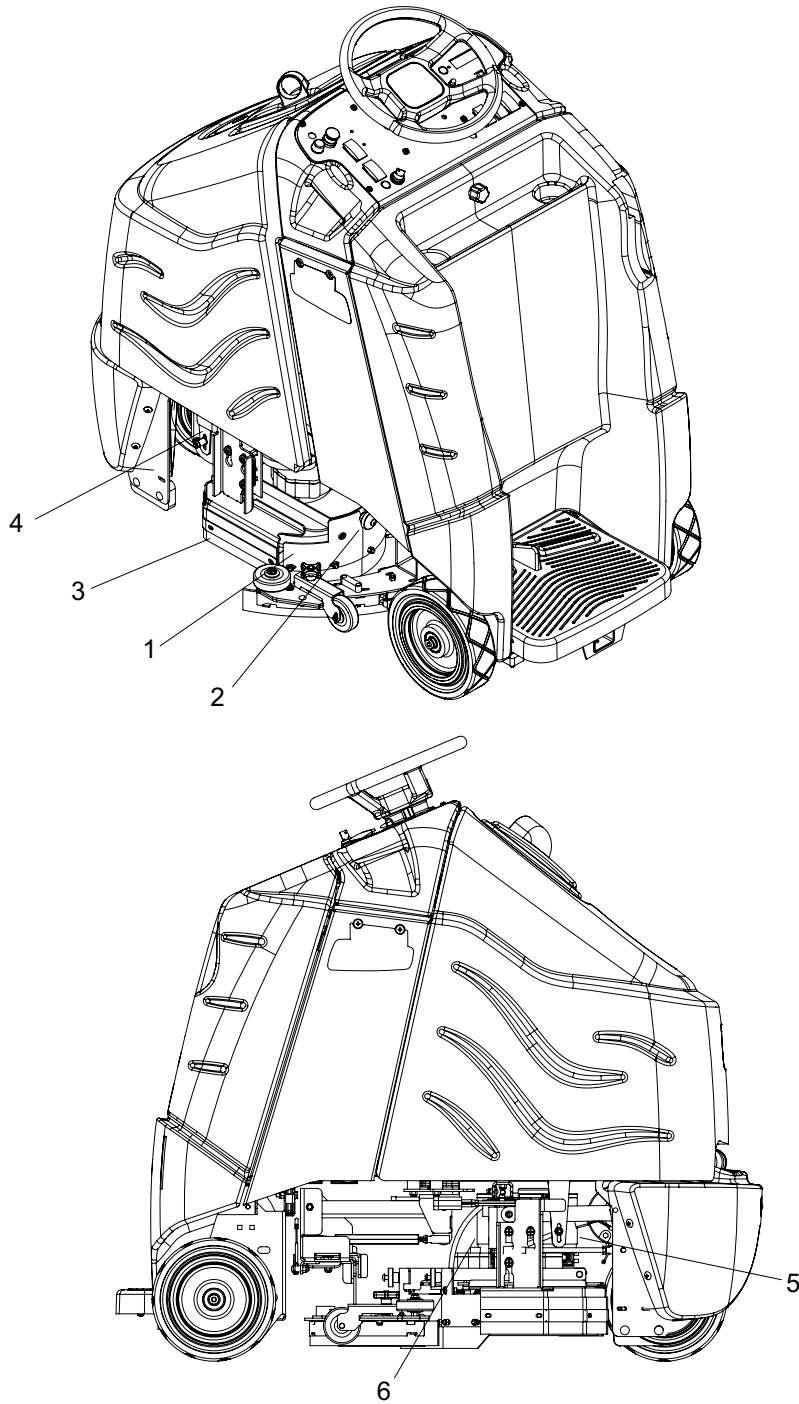
**Red Pads** (Buffing) are used for light-duty scrubbing. When used with a mild detergent they will provide surface cleaning without removing the finish.

**Blue Pads** (Scrubbing) are used for heavy-duty scrubbing and light stripping. The blue pads remove less finish than brown stripping pads, yet will remove black marks, stains and dirt.

**Black Pads** (Stripping) are used for easy and complete removal of old floor waxes/finishes. They will quickly remove ground in dirt, black heel marks, and spills. When used with the proper stripper, this pad leaves the floor clean and ready for finishing.

The scrub brushes should be checked before each days work for wire, string, wear and damage.

## MAINTENANCE-SCRUB DECK – DISK



1. Scrub deck Aqua-Mizer™
2. Aqua-Mizer™ retainer knob
3. Scrub deck skirt

4. Scrub deck skirt stop
5. Scrub brush motor
6. Scrub deck lift actuator

## MAINTENANCE-SCRUB DECK - DISK



**WARNING:** Do not use a pressure washer to clean around the brush motors. Use tap pressure only.

### TO REPLACE SCRUB BRUSH MOTORS

1. With the scrub deck in the raised position, disconnect brush motor wiring connector from harness.
2. Remove skirts from scrub deck to access and remove scrub brushes or pad drivers.
3. Remove Aqua-Mizers™ from scrub deck.
4. Remove retaining bolt, lock washer, flat washer and star drive from brush motor shaft.
5. Remove 4 brush motor mounting bolts located under scrub deck.
6. Lower scrub deck.
7. Remove brush motor.
8. Reverse steps to install.

### BRUSH MOTOR CARBON BRUSH REPLACEMENT

1. Scribe alignment mark on motor barrel to motor cap. Remove two bolts.
2. Remove end cap from motor.  
**NOTE:** Motors contain two wave washers in cap. Do not lose these.
3. Release brush from spring tension. Remove screw connecting brush wire lead to brush holder. Clean brush holder to insure free movement.
4. Retract spring and install new brush. Install connector screw and lead.
5. When all new brushes are installed. Place all in retracted position, held into brush holder by spring tension.
6. Carefully place end cap onto bearing on motor shaft.  
**NOTE:** Use care to assure wave washer alignment.
7. With end cap in partially installed position, release all brushes to contact position with motor commutator.  
**NOTE:** Failure to insure all brushes are released will result in motor failure.
8. Reset end cap and realign with scribe marks on motor barrel. Reinstall the two attach bolts from cap into base.
9. Maintain alignment between motor barrel base and cap.

# MAINTENANCE-SCRUB DECK - DISK

## SCRUB DECK ACTUATOR ADJUSTMENT

**FOR SAFETY: Before leaving or servicing machine, stop on a level surface. Turn off machine.**

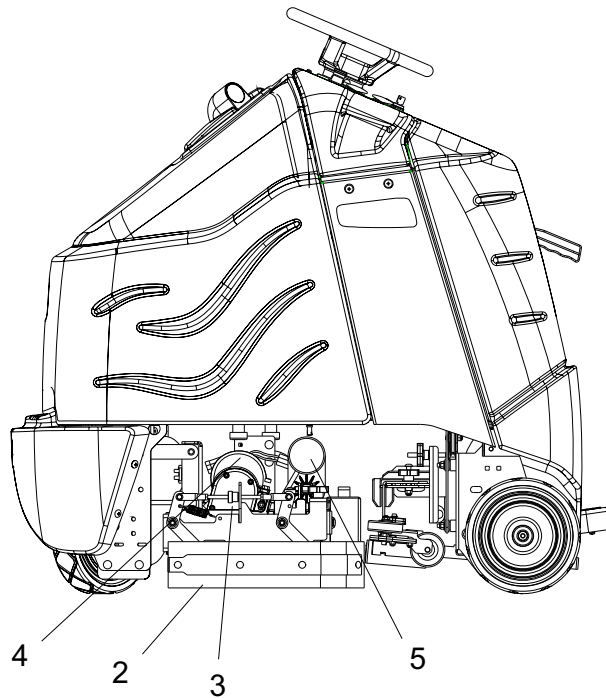
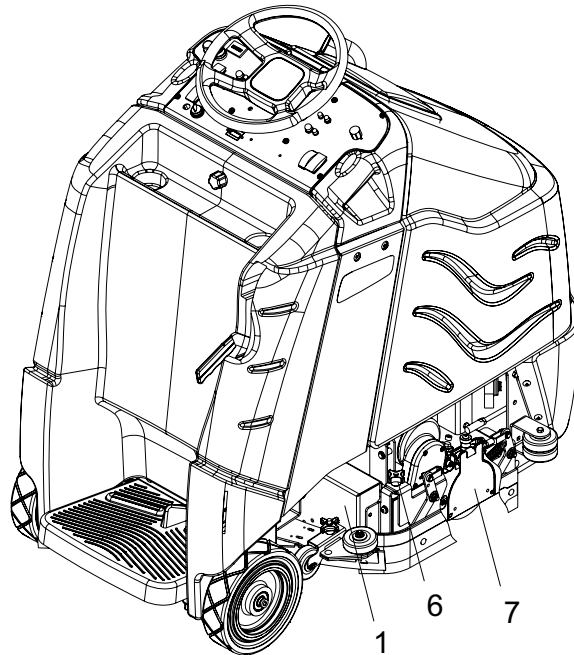
1. Remove the two screws that secure actuator spring plate and pull actuator barrel from stud on actuator spring bracket.
2. Remove clevis pin from upper bracket of actuator.
3. Disconnect actuator from wiring harness.
4. Reverse steps to install.

The actuator will need to be adjusted when replaced.

### To adjust the actuator:

1. While holding actuator barrel to prevent it from spinning, apply power to the actuator such that it is fully extended. Positive power to white wire, and negative/ground to black. Limit switch within actuator will stop it.
2. Turn barrel out one or more full turns to assure that when it is retracted it will not bind against itself.
3. While holding actuator barrel to prevent it from spinning, apply power to the actuator such that it is fully retracted. Positive power to black wire, and negative/ground to white wire. Limit switch within actuator will stop it.
4. With actuator fully retracted, turn barrel in until it touches the base of the threaded shaft.
5. At the bottomed out position, turn the barrel out **1 full turn**, then enough more to allow connection to lift linkage.
6. Connect actuator to lift linkage.
7. Check travel of actuator during operation.

## MAINTENANCE-SCRUB DECK - CYLINDRICAL



- 
- |                                  |                               |
|----------------------------------|-------------------------------|
| 1. Hopper                        | 5. Scrub deck lift actuator   |
| 2. Blade side squeegee           | 6. Side squeegee removal knob |
| 3. Side squeegee adjustment knob | 7. Brush door                 |
| 4. Scrub brush motor             |                               |



# MAINTENANCE-SCRUB DECK - CYLINDRICAL

## SCRUB HEAD-CYLINDRICAL

The dual cylindrical scrub head is designed to eliminate debris that may be caught in the squeegee while scrubbing. Water is applied to the first scrubbing brush turning in a clockwise rotation when viewed from the right of operator's side of machine. The first brush scrubs dirt and debris between the brushes. The second scrubbing brush, turning in a counter clockwise rotation, picks up debris and throws it into a removable hopper. The larger debris which might catch under the squeegee is collected in the hopper. Water is allowed to drain out the hopper into the squeegee path where it is recovered from the floor.

## MAINTENANCE

The brushes should wear evenly side to side if properly adjusted. Scrub brushes should be exchanged front to back every 50 hours to ensure even wear since the rear brush contacts the floor with more force. It is not necessary to rotate end for end since swapping front to back puts the brushes in the opposite rotation, as well as balancing wear. Scrub brushes should be replaced as a set when bristle length wears to height of yellow PerformAlert™ bristles.

## SCRUB BRUSH REMOVAL

The scrub brushes are removed from the side of the machine. The front is removed from the right side and the rear is removed from the left side.

1. Unscrew the knob and swing side squeegee out about 90°
2. Unscrew knob on side door but do not remove.
3. Pull out on top of door until lip on door clears brush head.
4. Push down on door until hooks on bottom of door are free of scrub head side.
5. Pull out on door with a rocking motion to free idler door from end of brush.
6. Pull brush out with a rocking motion to free brush from drive hub.

## SCRUB BRUSH REPLACEMENT

1. Unscrew the knob and swing side squeegee out about 90°
2. Lift the drive side of the brush. Push brush until a positive stop is felt. The idler plate cannot be installed until the brush is fully seated on the drive hub.
3. Allow brush to drop below scrub deck. Fully insert plate onto brush.
4. Line up bottom hook on idler door with notches on side of scrub head.
5. Slide idler door up until lip rests on top of scrub head.
6. Hand tighten knob to secure door into place.

## TO ADJUST SCRUB DECK SIDE SQUEEGEES

These skirts should be adjusted to 3/8" deflection.

To adjust:

1. Lower scrub deck to floor.
2. Stop machine.
3. Loosen scrub deck skirt stop.
4. Adjust stop such that skirt deflection is about 3/8".

## TO REPLACE SCRUB DECK SIDE SQUEEGEES

These skirts have four wear edges.

To use another edge:

1. Remove each of the scrub deck skirt assemblies.
2. Remove the hardware that retains the blade on each assembly.
3. Flip the blade vertically or horizontally, or both, and replace hardware.
4. Re-install each scrub deck assembly.

# **MAINTENANCE-SCRUB DECK - CYLINDRICAL**

## **DUMPING HOPPER**

The removable hopper is located behind the rear scrub brush. If the hopper becomes full, it will not accept any more debris. Loosen knob on left side squeegee and swing open. Remove the hopper by sliding it out from the operator's left side of the machine. The hopper can then be dumped from the top. Flush the hopper clean with running water.

## **SCRUB DECK ADJUSTMENT**

Scrub deck adjustment consists of two types of adjustments. The first is to insure the individual brushes make the same width pattern end to end. Any tapered brush pattern should be adjusted out. The second is to make the pattern of equal width between front and rear brushes. Unequal patterns are caused by the scrub deck not being parallel to the floor. Proper adjustment is obtained when the contact patterns of the brushes on the floor show two 1" rectangles the width of the brushes. The rectangles should be parallel to each other.

## **TESTING, ADJUSTMENT OF INDIVIDUAL BRUSHES**

1. Move the machine to an unfinished area of floor to avoid marking finish.
2. With water valve off, lower scrub head to floor. Allow brushes to run until automatic shut off occurs. It may be necessary to repeat this step in the same location until a good mark can be seen on the floor. This can be accomplished by touching lightly the throttle pedal to restart the scrub deck without moving the machine.
3. Raise the scrub deck and note the brush patterns on the floor. There should be two rectangles with parallel sides. If the pattern is tapered, proceed as follows.

## **ADJUSTMENT OF INDIVIDUAL BRUSHES**

The brush pattern is adjusted from the motor side only of both brushes.

1. Determine if motor end is to be moved up or down to balance the pattern.
2. Loosen the 3 allen head screws on the end of the housing.
3. Loosen the jam nut on the jack screw and rotate the jack screw to move the motor assembly up or down as needed.
4. Tighten the 3 allen head screws.
5. Tighten the jam nut on the jack screw.
6. Re-test and readjust as necessary.

## **LEVELING THE SCRUB HEAD**

Leveling the cylindrical head is accomplished by adjusting the lower links that attach the deck to the frame. To increase pattern width on rear brush, loosen lock nuts and shorten the lower links by screwing the rod into the threaded ends. To increase pattern width on front brush, lengthen the lower links by screwing the rod out of the threaded ends. After adjustment, be sure to tighten lock nuts.

## MAINTENANCE-SCRUB DECK - CYLINDRICAL

**⚠ WARNING:** *Do not use a pressure washer to clean around the brush motors. Use tap pressure only.*

### TO REPLACE SCRUB BRUSH MOTORS

1. With the scrub deck in the raised position, disconnect brush motor wiring connector from harness.
2. Remove side squeegee assembly.
3. Remove brushes and brush door.
4. Remove aluminum end housing from deck.
5. Separate brush motor with gear box from end housing.
6. Reverse to reassemble.
7. Adjust brush levelness as described in earlier section.

### BRUSH MOTOR CARBON BRUSH REPLACEMENT

1. Scribe alignment mark on motor barrel to motor cap. Remove two bolts.
2. Remove end cap from motor.  
**NOTE:** *Motors contain two wave washers in cap. Do not lose these.*
3. Release brush from spring tension. Remove screw connecting brush wire lead to brush holder. Clean brush holder to insure free movement.
4. Retract spring and install new brush. Install connector screw and lead.
5. When all new brushes are installed. Place all in retracted position, held into brush holder by spring tension.
6. Carefully place end cap onto bearing on motor shaft.  
**NOTE:** Use care to assure wave washer alignment.
7. With end cap in partially installed position, release all brushes to contact position with motor commutator.

**NOTE:** Failure to insure all brushes are released will result in motor failure.

8. Reset end cap and realign with scribe marks on motor barrel. Reinstall the two attach bolts from cap into base.
9. Maintain alignment between motor barrel base and cap.

## **MAINTENANCE-SCRUB DECK - CYLINDRICAL**

### **ACTUATOR SCRUB DECK REMOVAL/REPLACEMENT**

***FOR SAFETY: Before leaving or servicing machine, stop on a level surface. Turn off machine.***

1. Lower scrub deck.
2. Disconnect spring assembly from actuator slide link.
3. Remove the clevis pin retaining the top of the actuator.
4. Remove slide link and actuator as an assembly by removing the two bolts connecting them to the deck through the bushings.
5. Either unthread the actuator main lead screw from the barrel, or remove the two bolts connecting the barrel to the slide link.
6. Reverse for re-installation.

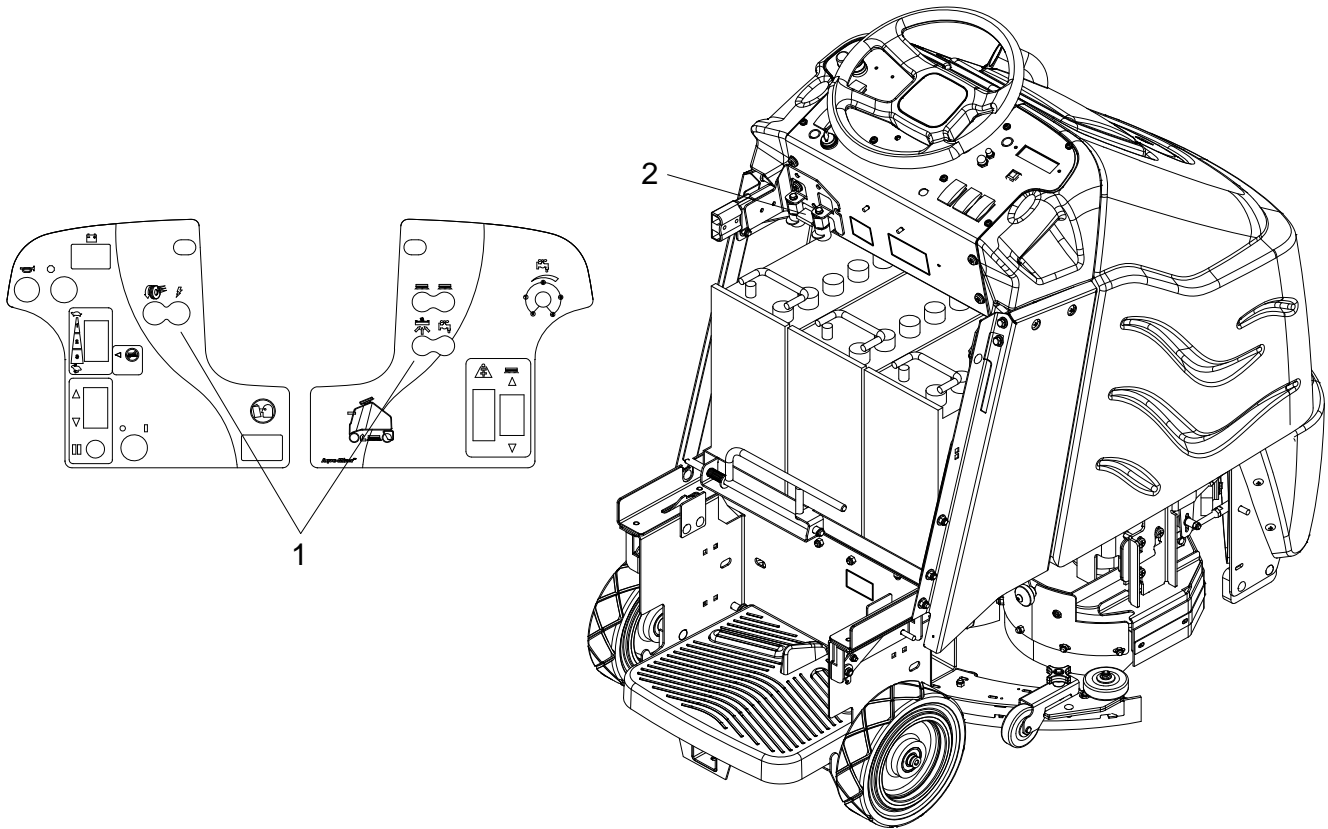
### **SCRUB DECK ACTUATOR ADJUSTMENT**

The actuator will need to be adjusted when replaced.

#### **To adjust the actuator:**

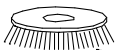
1. While holding actuator barrel to prevent it from spinning, apply power to the actuator such that it is fully extended. Positive power to white wire, and negative/ground to black. Limit switch within actuator will stop it.
2. Turn barrel out one or more full turns to assure that when it is retracted it will not bind against itself.
3. While holding actuator barrel to prevent it from spinning, apply power to the actuator such that it is fully retracted. Positive power to black wire, and negative/ground to white wire. Limit switch within actuator will stop it.
4. With actuator fully retracted, turn barrel in until it touches the base of the threaded shaft.
5. At the bottomed out position, turn the barrel out only enough to allow connection to slide link.
6. Connect actuator.
7. Check travel of actuator during operation.

## MAINTENANCE-CIRCUIT PROTECTION

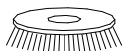


### 1. CIRCUIT BREAKERS (BASIC PANEL SHOWN)

Circuit breakers interrupt the flow of power in the event of an electrical overload. When a circuit breaker is tripped, reset it by pressing the exposed button. If a circuit breaker continues to trip, the cause of the electrical overload should be found and corrected.



18 Amp. Protects the left scrub brush motor.



18 Amp. Protects the right scrub brush motor.



30 Amp. Protects the vacuum motor (Basic only).



30 Amp. Cylindrical  
25 Amp. Disk  
Protects the propel motor.



3 Amp. Protects the machine controls (Basic only).



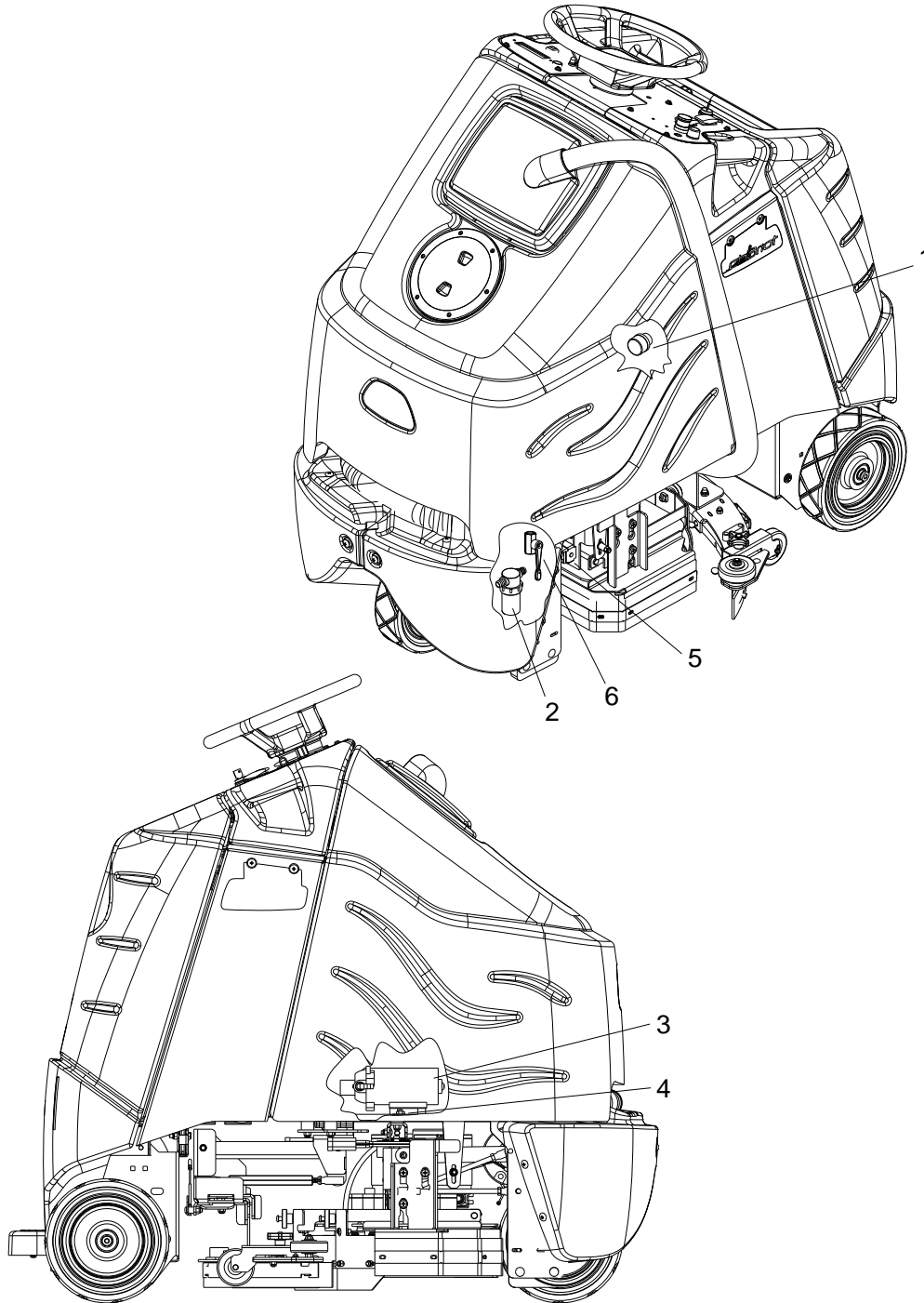
3 Amp. Protects the pump (Basic only).

### 2. FUSE (DELUXE ONLY)

The fuse is a one-time circuit protection device designed to stop the flow of electrical current in the event of an electrical overload. If fuse is blown, it must be replaced.

*The fuse is located inside the battery compartment.*

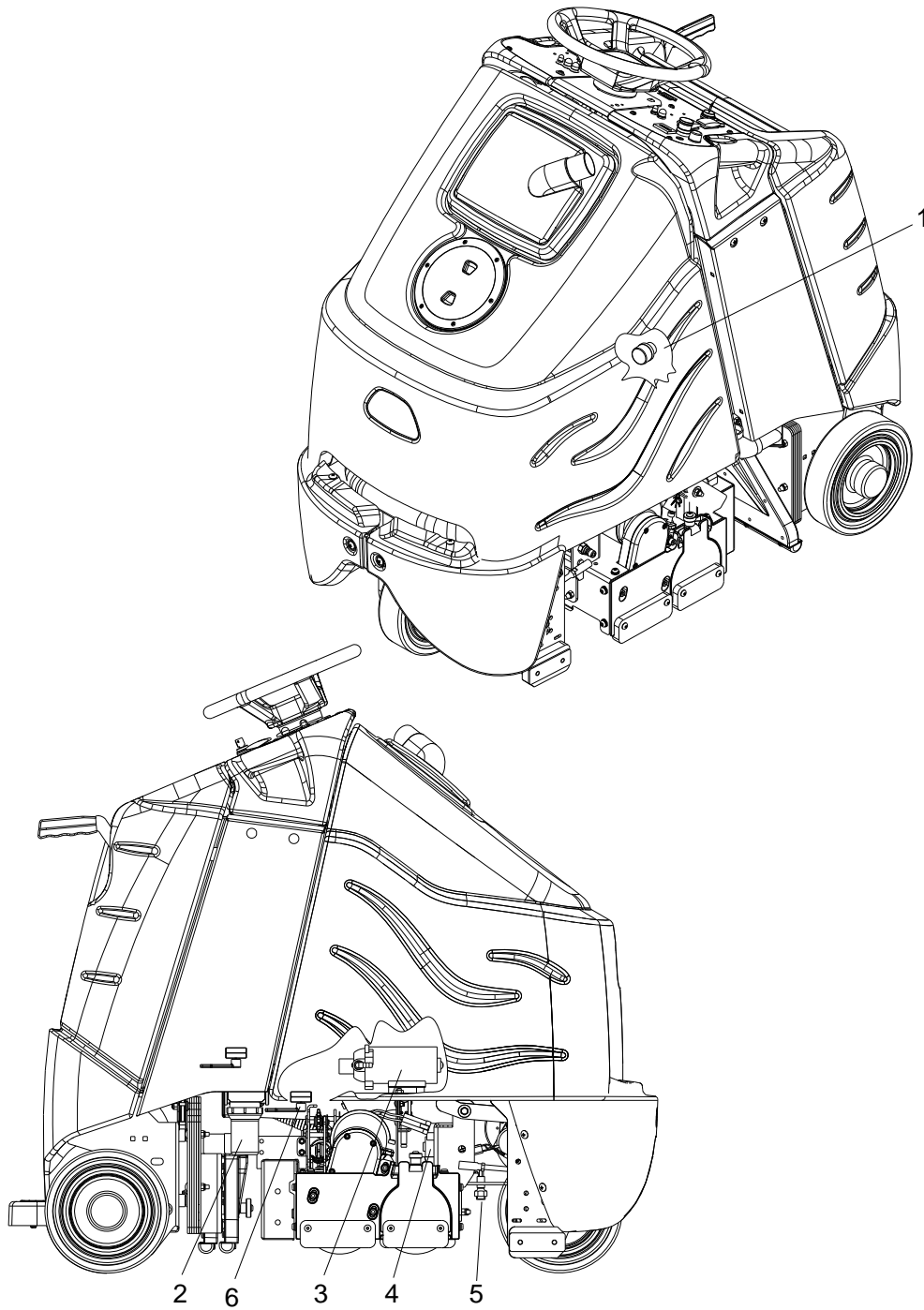
## MAINTENANCE-SOLUTION STRAINER & PUMP - DISK MODELS



1. *Solution Strainer-Coarse*
2. *Solution Strainer-Fine*
3. *Pump*

4. *Pump Mounting Plate*
5. *Solenoid Valve*
6. *Shut-off Valve*

# MAINTENANCE-SOLUTION STRAINER & PUMP-CYLINDRICAL MODELS



- 1. *Solution Strainer-Coarse*
- 2. *Solution Strainer-Fine*
- 3. *Pump*

- 4. *Solenoid Valve*
- 5. *Jets*
- 6. *Shut-off Valve*

# MAINTENANCE-SOLUTION STRAINER & PUMP

## 1. SOLUTION STRAINER-COARSE

Located in bottom of tank. The coarse strainer protects the finer strainer from large debris. If the fine strainer is clean and the pump and solenoid valve are not working, then check the coarse strainer for debris. Drain the solution tank and clean the coarse strainer. To remove the strainer, rotate the strainer counterclockwise. Cleanout the debris from wire mesh and re-assemble.

## 2. SOLUTION STRAINER (FINE) AND SHUT-OFF VALVE

The fine strainer is located in front left corner of machine on disk models and in right rear corner of cylindrical models. The fine strainer protects the pump and solenoid valve from debris. If there is little or no solution flow to the ground, first check to make sure the shut-off valve is open. Next, check the strainer for debris. To remove the strainer, first turn the shut-off valve to the off position. Then, turn the bottom part of the strainer counterclockwise until the bottom is separated. Clean out the debris from the wire mesh and re-assemble. Make sure the O-ring gasket is in place when re-assembled. To resume flow, turn the shut-off valve to the open position.

## 3. PUMP

The pump is located under the tank on the right side of machine. The pump delivers solution from the tank to the scrub deck.

### To repair or replace pump:

1. Remove scrub deck skirts, Aqua-Mizer, and squeegee from machine.
2. Lower scrub deck to gain access to pump mounting plate.
3. Remove screw that secures pump mounting plate to frame.
4. The pump is located under the tank on the right side of machine. The pump delivers solution from the tank to the scrub deck. Pull pump mounting plate forward and down to expose pump.
5. Reverse steps to install.

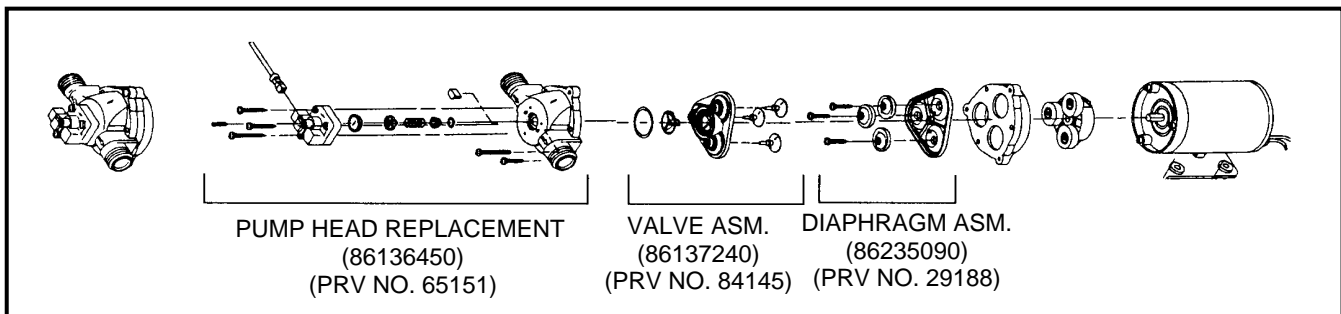
## 4. PUMP MOUNTING PLATE

See graphic representation on previous page.

## 5. SOLENOID VALVE

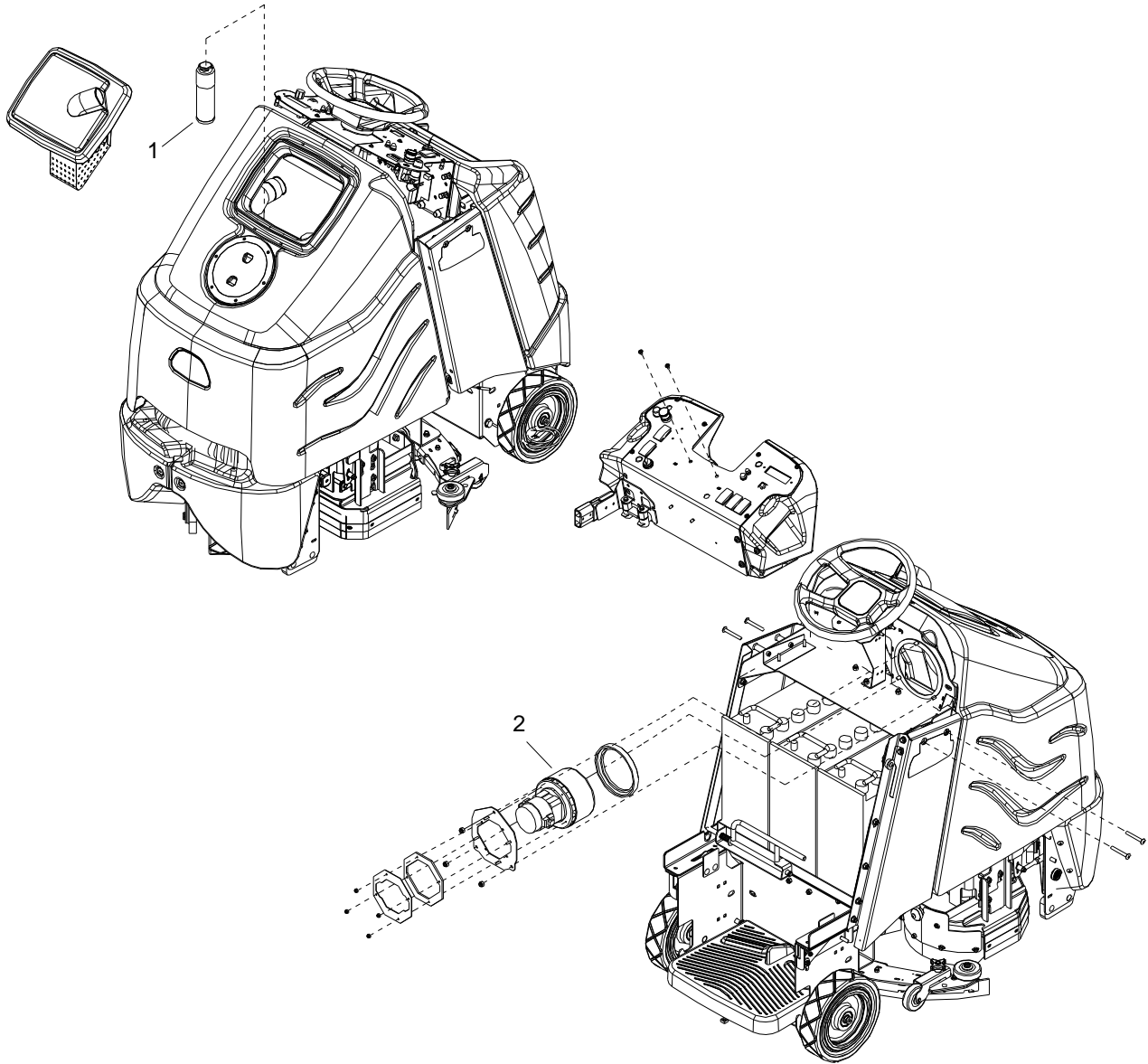
The solenoid valve is mounted on the front of the scrub deck, on left side.

The solenoid valve shuts off solution flow to scrub deck whenever scrubbing stops. To repair or replace solenoid valve, cut cable ties that secure it to deck.





## MAINTENANCE-VACUUM & FLOAT SHUT-OFF



1. *Recovery tank float shut-off*
2. *Vacuum motor*

## MAINTENANCE-VACUUM & FLOAT SHUT-OFF

### RECOVERY TANK FLOAT SHUT-OFF

When water is no longer being vacuumed from the floor and the vacuum fan is operating, the ball float has engaged. The vacuum motor will not vacuum water with recovery tank full. The recovery tank must be drained.

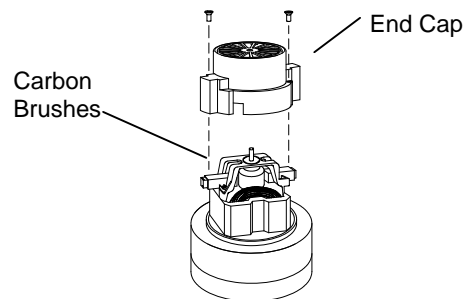
1. The float shut-off screen can be cleaned in or out of the machine.
2. To clean the float shut-off while it is inside the machine wipe material off screen then rinse. Check that the ball is also clean and moves freely.
3. To remove the float shut-off, grasp the screen with one hand and the connected tube with the other. Tilt and pull the float screen assembly to pull it off the barb on the tube.
4. To install, place one hand on the tube, and then tilt and push the float screen assembly over the barb on the tube.

**FOR SAFETY:** before leaving or servicing machine, stop on a level surface, turn off machine and disconnect power.

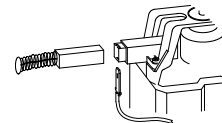
### TO REPAIR OR REPLACE VACUUM MOTOR

1. Remove rear cover from machine.
2. Remove two screws from top of control panel and four screws from sides of control housing.
3. Slide control housing back from tank to expose vacuum motor.
4. Disconnect electrical connector from the vacuum motor.
5. Remove three nuts that secure vacuum motor retaining plate, remove plate and vacuum motor.
6. Reverse steps to install. Make sure that gasket is on vacuum so that vacuum seals against tank

### Vacuum Motor Carbon Brushes

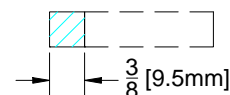


If armature commutator is grooved, extremely pitted or not concentric, the motor will need to be replaced or sent to a qualified service center.



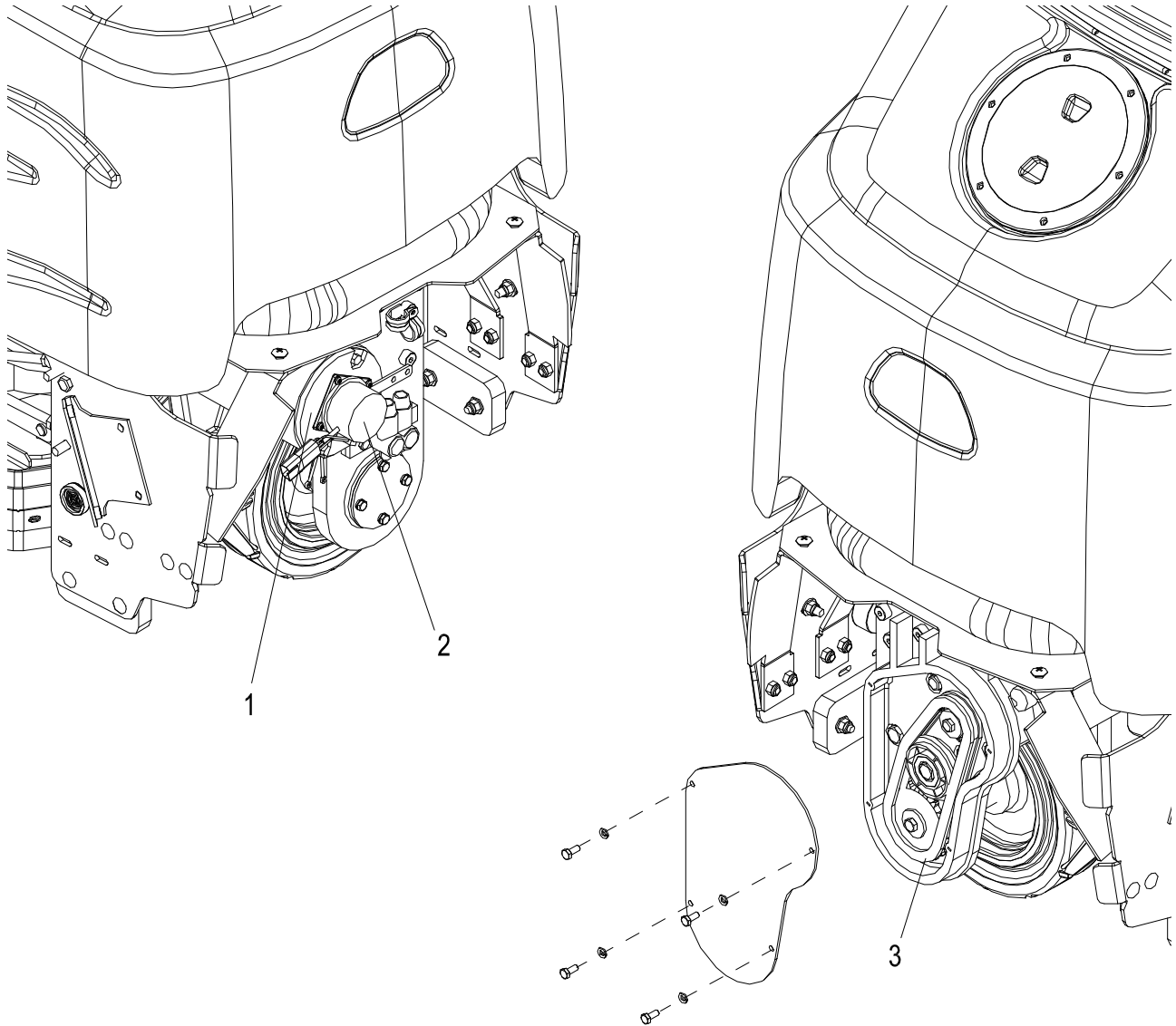
#### **Important:**

*These brushes wear quicker as the length shortens due to increased heat. Spring inside brush housing will damage motor if brushes are allowed to wear away completely.*



Periodically check the length of the carbon brushes. Replace both carbon brushes when either is less than  $\frac{3}{8}$ " (9.5mm) long.

## MAINTENANCE-DRIVE MOTOR & BRAKE



- 
1. *Drive motor*
  2. *Parking brake*
  3. *Drive chain*

# MAINTENANCE-DRIVE MOTOR & BRAKE

## ELECTRIC PARKING BRAKE ENGAGEMENT

**FOR SAFETY:** Before leaving or servicing machine, stop on a level surface, turn off machine and remove key.

### Electric Brake Engagement

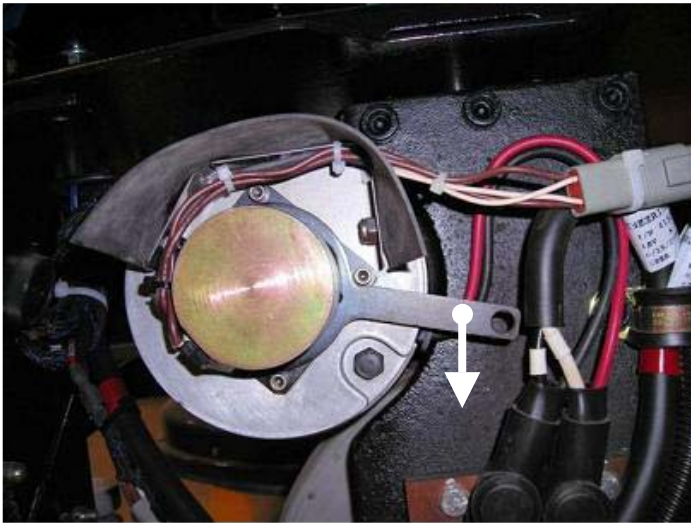
This machine is equipped with an electric parking brake.

The brake automatically engages and keeps the machine from moving whenever the operator steps off the platform or when emergency stop is engaged.

The brake has a mechanical over-ride that can be engaged so machine can be pushed or towed (slowly).

When the mechanical over-ride is engaged the machine cannot be driven.

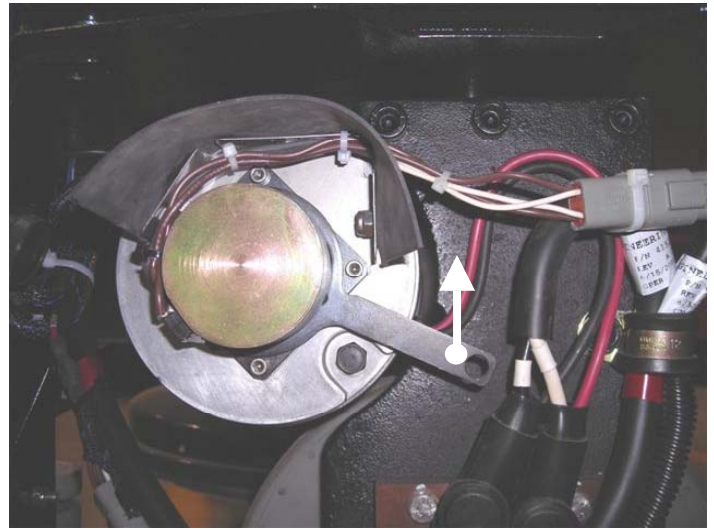
### To engage brake:



1. Mechanical over-ride engaged.  
Machine can be pushed or towed (slowly).
2. Push lever firmly in direction of arrow

**Note:** There is an intermediate stop. Make sure lever is fully in the down position.

### To disengage brake:



1. Mechanical over-ride disengaged  
Machine can be driven.
2. Push lever firmly in direction of arrow.

## MAINTENANCE-DRIVE MOTOR & BRAKE

### DRIVE MOTOR CARBON BRUSH REPLACEMENT

**⚠ WARNING:** Do not use a pressure washer to clean around the motors. Use tap pressure only.

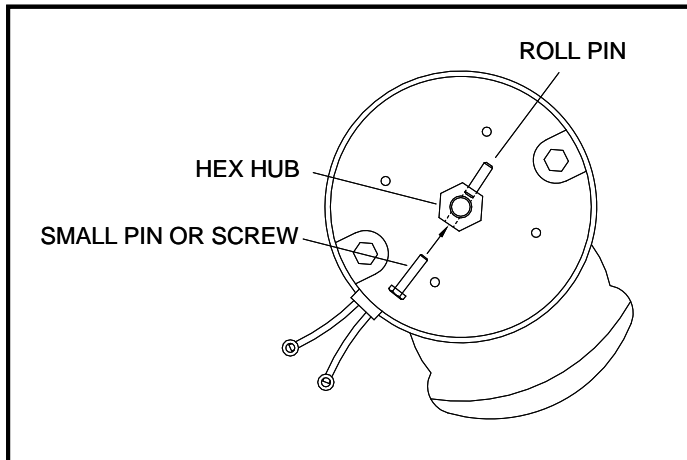
**FOR SAFETY:** Before leaving or servicing machine, stop on a level surface, turn off machine and remove key.

1. Disconnect batteries from machine.
2. Disconnect the electrical connection to the traction motor.

### BRAKE REMOVAL

(Must be done to access carbon brushes)

3. Remove 4 mounting screws and remove brake.
4. Drive roll pin out of the hex hub enough to allow hex hub to slide off shaft. It is recommended that the roll pin be left partially in the hex hub.
5. Remove brush cap.



6. Release brush from spring tension. Remove screw connecting brush wire lead to brush holder. Clean brush holder to insure free movement.

5. Install new brush and reinstall connecting screw and lead.
6. When all new brushes are installed. Place all in retracted position, held into brush holder by spring tension.
7. Carefully replace brush cap.

### Reinstalling:

10. When replacing the hex hub, use a small pin or screw to help align the holes.
11. Drive the pin into the hub and make sure it is flush to the hex surface. The brake will not fit on the hub if the roll pin is protruding from the hub.
12. Replace the hub and use Lock-Tite on the screws.

# MAINTENANCE-BAG REPLACEMENT

## REMOVING BAG

1. Disconnect batteries and make sure parking brake is not overridden.
2. Under left front side of machine loosen hose clamp on recovery dump hose. **Do not remove hose.**



3. Remove Dome and set aside
4. Remove Float cage, loosen screw on elbow and remove elbow.
5. Remove the eight screws and nuts holding the bag clamps and set aside.
6. Remove clamps and set aside.
7. Pull mandrel from bottom of tank. Access can either be from the dirty water side or the clean water side or both. When replacing bag with new one be sure to save mandrel.



## REPLACING BAG

1. Install mandrel in bottom of bag.
2. Place new bag in tank making sure hole for strainer basket is oriented properly.



3. Angle mandrel and bag into tank fitting toward front of machine. Push mandrel into fitting until it bottoms out.
4. Attach bag to top of machine by rolling edge of bag over clamp strips.
5. Replace elbow and float cage.
6. Tighten clamp on bottom of machine.

## MAINTENANCE-TRANSPORTING

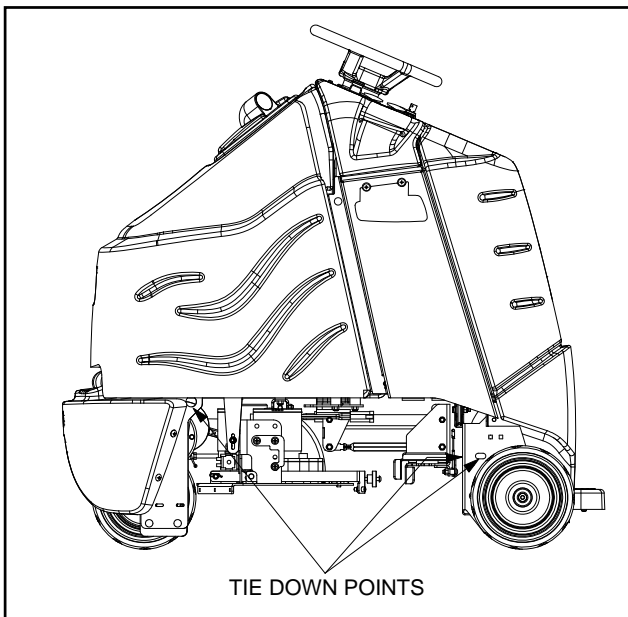
### PUSHING MACHINE

The machine may be pushed for short distances at speeds not to exceed 5 mph. Be careful to avoid damaging machine. The machine may be pushed by hand from the rear.

**NOTE:** To avoid damage caused by regenerative voltage, disconnect traction motor before towing or pushing machine.

### MACHINE TIE-DOWNS

There are two tie points located at front and each side of foot box frame and two at the front side of frame. Tie-down devices must be of the proper type and strength. The combined strength of all tie-downs must be strong enough to lift two times the weight of the machine. Tie-downs must be positioned to prevent the machine from moving forward, backward, or either side to side. Use all four corners of the machine with the tie-downs running out opposite directions. Tie-downs must be attached to the transporting vehicle securely.





### PREPARATION FOR LOADING /UNLOADING TRAILER

Before loading or unloading machine from trailer, remove squeegee, scrub deck, side skirts or side squeegees, Aqua-Mizers and scrub brushes (pads) to eliminate interference with tie-downs. Scrub head must be in the up position before loading.



**NOTE:** When transporting the machine on a trailer or in a truck, in addition to using tie-downs, be sure to set the parking brake, and block the tires to prevent the machine from rolling.

## MACHINE TROUBLESHOOTING

PROBLEM	CAUSE	ERROR CODE DELUXE	SOLUTION
No power to machine	Battery disconnected		Check all battery cable connections
	Emergency shut-off activated		Reset
	Battery cables corroded		Clean connections
	Main fuse blown (Deluxe Only)		Replace fuse
	Faulty key switch		Replace switch
Little or no propel	Low battery charge		Charge batteries
	Machine turned on with pedal not in neutral position		Allow pedal to return to neutral. Restart
	Tripped circuit breaker		Reset circuit breaker
	Wheels spin		Decrease brush pressure
	Controller overheated	7802/7801	Allow cool down period
	Loose motor connection	7800	Check wires and connections from controller to motor
	Faulty throttle circuit or potentiometer	0814	Check wires and connections from throttle to LCD controller and potentiometer resistance
	Faulty drive reset circuit or switch		Check wires, connections and switch
	Faulty operator presence pedal circuit or switch		Check wires, connections and switch
	Faulty platform circuit or switch		Check wires, connections and switch
	Brake over-ride engaged		Disengage brake over-ride
	Faulty brake circuit or over-ride switch		Check wires, connections and switch
Machine does not change speeds	Faulty speed control circuit or switch		Check wires, connections and switch
Forward speed only Reverse speed only	Faulty forward/reverse switch		Replace switch
Poor or no water pickup	Squeegee out of adjustment		Adjust squeegee
	Debris caught on squeegee		Remove debris
	Worn squeegee blades		Rotate or replace squeegee blades
	Vacuum hose clogged		Clear obstruction from hose
	Vacuum hose disconnected from squeegee or recovery tank dome		Reconnect vacuum hose
	Recovery tank float system dirty		Clean float system
	Recovery tank not sealed		Place recovery tank dome on tank. Replace damaged gaskets
	Float-ball shut-off engaged Tank full		Empty recovery tank
	Foam filling recovery tank		Empty recovery tank. Use less or different detergent. Use defoamer.



## MACHINE TROUBLESHOOTING

PROBLEM	CAUSE	ERROR CODE DELUXE	SOLUTION
Vacuum motor does not run, or runs slowly	Circuit breaker tripped (Basic)		Reset circuit breaker
	Faulty vacuum circuit or switch	7700	Check wires, connections and switch
	Worn vacuum motor brushes		Replace brushes, check commutator
Squeegee will not go up/down	Faulty circuit or actuator (Deluxe)		Check wires, connectors and actuator
	Faulty cables or pulleys		Repair/replace cables or pulleys
Poor scrubbing performance	Debris caught in scrub brushes		Remove debris
	Worn brushes or pads		Replace brushes or pads
	Improper detergent, brush or pad used		Contact equipment or application specialists
	Low scrub brush down pressure		Increase brush pressure
	Low battery charge		Charge batteries
Little or no solution flow to the floor	Solution tank empty		Fill solution tank
	Solution flow turned off or set too low		Turn on or increase flow setting
	Solution strainer plugged		Clean solution strainer
	Solution system plumbing obstructed		Clear obstruction from plumbing
	Pump obstructed		Clean or replace pump
	Solution solenoid valve obstructed or stuck		Clean or replace valve
	Solution shut-off valve is closed		Open shut-off valve
	Faulty pump circuit or pump		Check wiring, connections, control board (Basic) and pump.
	Faulty solenoid		Check solenoid valve
Brush motors do not run, or run slowly	Circuit breaker(s) tripped	7600	Reset circuit breaker(s)
	Low battery charge		Charge battery
	Fault brush circuit or motor	7600	Check wires, connections and motor
	Worn brush motor brushes		Replace brushes, check commutator
Scrub deck will not go down/up	Actuator circuit breaker tripped (Basic)		Reset breaker
	Faulty actuator circuit or actuator		Check wires, connections and actuator
Scrub deck goes down, then raises	No brushes or pad drivers on machine	9000	Install brushes or pad drivers
Error code not listed is displayed	Controller detects electrical problem		Contact service technician

## MACHINE TROUBLESHOOTING – DELUXE CONTROLLER FAULT CODES

ERROR CODE DELUXE	PROBLEM	SOLUTION
None	LCD display on, but incomplete	Disconnect batteries and wait 1 minute before re-applying power.
0A01	Power down error	Disconnect batteries and wait 1 minute before re-applying power.
0204	Memory corrupt	Replace controller.
All 080_ codes	Throttle wiring	Check for short or open circuits in throttle wiring.
All 140_ Codes		Check for short circuit between B+ and traction output.
All 310_ Codes	Possible short circuit of motors, auxiliary outputs (headlight, recycle pump, or back-up alarm), wiring or damaged controller	Check for short circuits. If code is present after short circuits are repaired, replace controller.
7500	LCD module communications timeout	Wiring fault on 6-way serial link between controller and display.
7501	LCD module settings corrupt	Disconnect batteries and wait 1 minute before re-applying power.
All 760_ Codes	Brush motor or brush circuit fault	Check for short or open circuits in brush motors or wiring.
All 770_ Codes	Vacuum motor or vacuum circuit fault	Check for short or open circuits in vacuum motor(s) or wiring.
7800	Traction motor open circuit fault	Check for open circuit on propel motor or wiring.
7801	Traction motor overcurrent error	Check for short circuit on propel motor or wiring.
7802	Traction motor in power foldback state	Propel motor current has exceeded current limit for the foldback time.
All 790_ Codes	Emergency stop error	E-stop input active or wiring fault.
9000	Brush current requirement not satisfied	Check that brushes or pads are installed. Check for open circuit in scrub lift actuator, circuit breaker or wiring.

# MACHINE TROUBLESHOOTING- CONTROLLER FAULT CODES

## PROPEL CIRCUIT BOARD TROUBLESHOOTING

Curtis 1228 LED DIAGNOSTICS- Basic and Cylindrical

During normal operation, with no faults present, the status LED is steadily on. If the controller detects a fault, the status LED provides two types of information. First, it displays a slow flash (2 Hz) or a fast flash (4 Hz) to indicate the severity of the fault. Slow-flash faults are self-clearing; as soon as the fault is corrected, the vehicle will operate normally. Fast-flash faults (“.” in Table 2) are considered to be more serious in nature and require that the key switch be cycled to resume operation after the fault is corrected.

After the severity indication has been active for 10 seconds, the status LED flashes a 2-digit fault identification code continuously until the fault is corrected. For example, code “1,4”—low battery voltage—appears as: one LED flash, followed by a pause, then 4 LED flashes, and then repeats.

LED CODE	PROGRAMMER LCD DISPLAY	EXPLANATION	POSSIBLE CAUSE
1,1	THERMAL CUTBACK	over-/under-temperature cutback	<ol style="list-style-type: none"> <li>1. Temperature &gt;92°C or &lt; -25°C.</li> <li>2. Excessive load on vehicle.</li> <li>3. Operation in extreme environments.</li> <li>4. Electromagnetic brake not releasing.</li> </ol>
1,2	THROTTLE FAULT 1	throttle fault	<ol style="list-style-type: none"> <li>1. Throttle input wire open or shorted.</li> <li>2. Throttle pot defective.</li> <li>3. Wrong throttle type selected.</li> </ol>
1,3	SPD LIMIT POT FAULT	speed limit pot fault	<ol style="list-style-type: none"> <li>1. Speed limit pot wire(s) broken or shorted.</li> <li>2. Broken speed limit pot.</li> </ol>
1,4	LOW BATTERY VOLTAGE	battery voltage too low	<ol style="list-style-type: none"> <li>1. Battery voltage &lt;17 volts.</li> <li>2. Bad connection at battery or controller.</li> </ol>
1,5	OVERVOLTAGE	battery voltage too high	<ol style="list-style-type: none"> <li>1. Battery voltage &gt;36 volts.</li> <li>2. Vehicle operating with charger attached.</li> <li>3. Intermittent battery connection.</li> </ol>
2,1	MAIN OFF FAULT	main contactor driver Off fault	<ol style="list-style-type: none"> <li>1. Main contactor driver failed open.</li> </ol>
2,3	MAIN CONT FLTS	main contactor fault	<ol style="list-style-type: none"> <li>1. Main contactor welded or stuck open.</li> <li>2. Main contactor driver fault.</li> <li>3. Brake coil resistance too high.</li> </ol>
2,4	MAIN ON FAULT	main contactor driver On fault	<ol style="list-style-type: none"> <li>1. Main contactor driver failed closed.</li> </ol>

## **MACHINE TROUBLESHOOTING- CONTROLLER FAULT CODES**

LED CODE	PROGRAMMER LCD DISPLAY	EXPLANATION	POSSIBLE CAUSE
3,1	PROC/WIRING FAULT	HPD fault present for >10 sec.	1. Misadjusted throttle. 2. Broken throttle pot or throttle mechanism.
3,2	BRAKE ON FAULT	brake On fault	1. Electromagnetic brake driver shorted. 2. Electromagnetic brake coil open.
3,3	PRECHARGE FAULT	precharge fault	1. Low battery voltage. 2. KSI and throttle turned on at same time.
3,4	BRAKE OFF FAULT	brake Off fault	1. Electromagnetic brake driver open. 2. Electromagnetic brake coil shorted.
3,5	HPD	HPD (High Pedal Disable) fault	1. Improper sequence of throttle and KSI, push, or inhibit inputs. 2. Misadjusted throttle pot.
4,1	CURRENT SENSE FAULT	current sense fault	1. Short in motor or in motor wiring. 2. Controller failure. *
4,2	HW FAILSAFE	motor voltage fault (hardware)	1. Motor voltage does not correspond to throttle request. 2. Short in motor or in motor wiring. 3. Controller failure. *
4,3	EEPROM FAULT	EEPROM fault	1. EEPROM failure or fault.
4,4	POWER SECTION FAULT	power section fault	1. EEPROM failure or fault. 2. Short in motor or in motor wiring. 3. Controller failure.

**NOTES:**

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