Electronic Service Manuals

This electronic document is provided as a service to our customers. We do not create the contents of the information contained in this document. Should you have detailed questions pertaining to the information contained in this document, you may contact Michco, or the manufacturer which provided the original information in this electronic deliverable. Michco's only part in this electronic deliverable was the electronic assembly process. By providing this manual on line we are not guaranteeing parts availability.

You may contact Michco through the following methods:
Phone (517) 484-9312 or (800) 331-3339
2011 N. High St. -- Lansing, Michigan -- 48906
Fax: (517) 484-9836
Email: CustServe@Michco.com
Web site: www.Michco.Com
Parts Web site: www.FloorMachineParts.Com

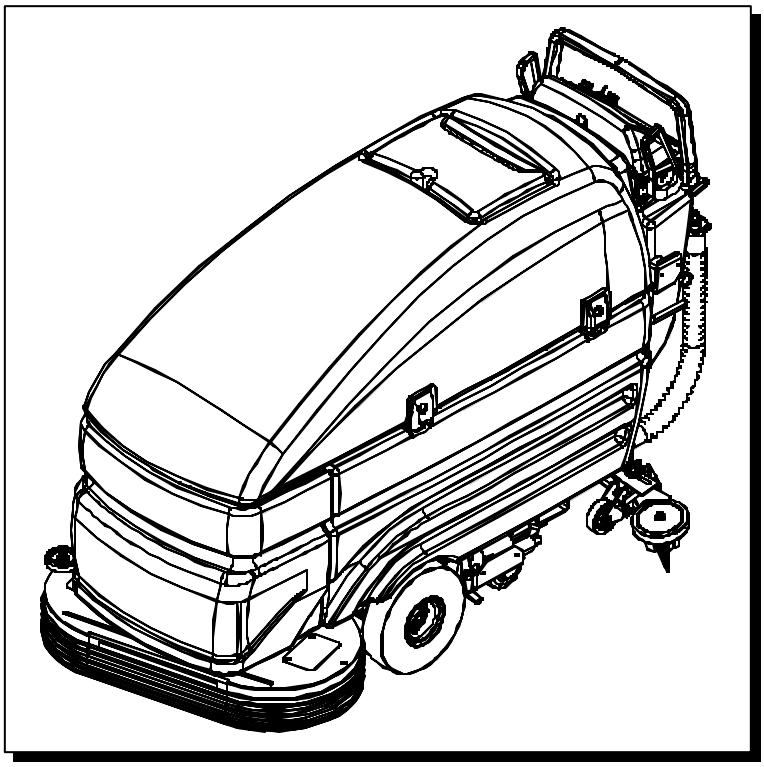
Order Parts on Line at:
www.FloorMachineParts.Com

Directly to Parts & Service:
By Email: **Shop@Michco.com**
By Fax: (517) 702-2041
By Voice: Use numbers above.

Serving the Cleaning Industry Since 1922

SABER-SX

WALK BEHIND SCRUBBER



Operating Instructions

MODELS: ***SX28***
SX34
SX34SP

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

CE
IPX4

Read these instructions before using the machine

W

98739 11/08/01

MACHINE DATA LOG/OVERVIEW

MODEL _____

DATE OF PURCHASE _____

SERIAL NUMBER _____

SALES REPRESENTATIVE # _____

DEALER NAME _____

OPERATIONS GUIDE NUMBER _____

PUBLISHED _____

YOUR DEALER

Name: _____

Address: _____

Phone Number: _____

OVERVIEW

The Saber SX 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 or pads, and then vacuums the soiled water back into the recovery tank.

TABLE OF CONTENTS

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 _____

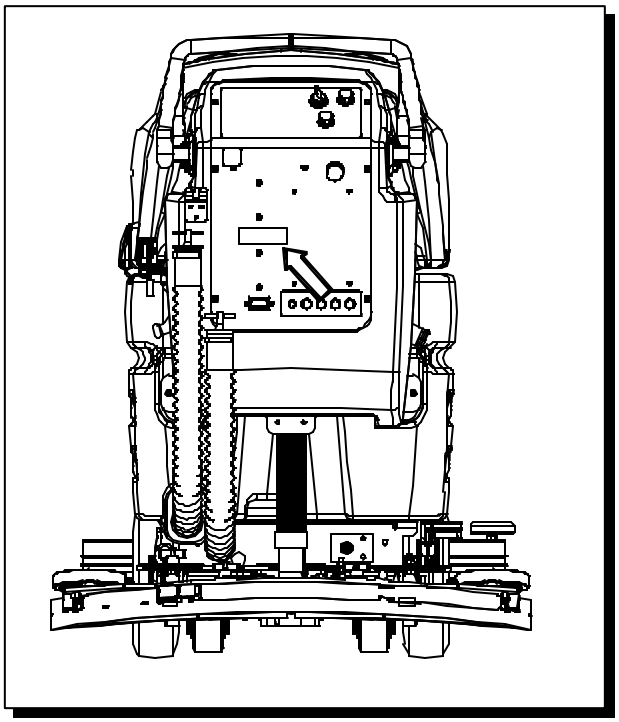
SALES REPRESENTATIVE # _____

DEALER NAME _____

OPERATIONS GUIDE NUMBER _____

PUBLISHED _____

The model and serial number of your machine is on the back panel 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
- Cylindrical Scrub System
- 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.
- **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** – column indicates the first machine the part number is applicable to. When the machine design has changed, this column will indicate serial number of applicable machine. The main illustration shows the most current design of the machine. The boxed illustrations show older designs. If column has an asterisk (*), call manufacturer for serial number.
- **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.

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.

⚠ WARNING: **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.

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

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

! CAUTION

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.

! WARNING

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.

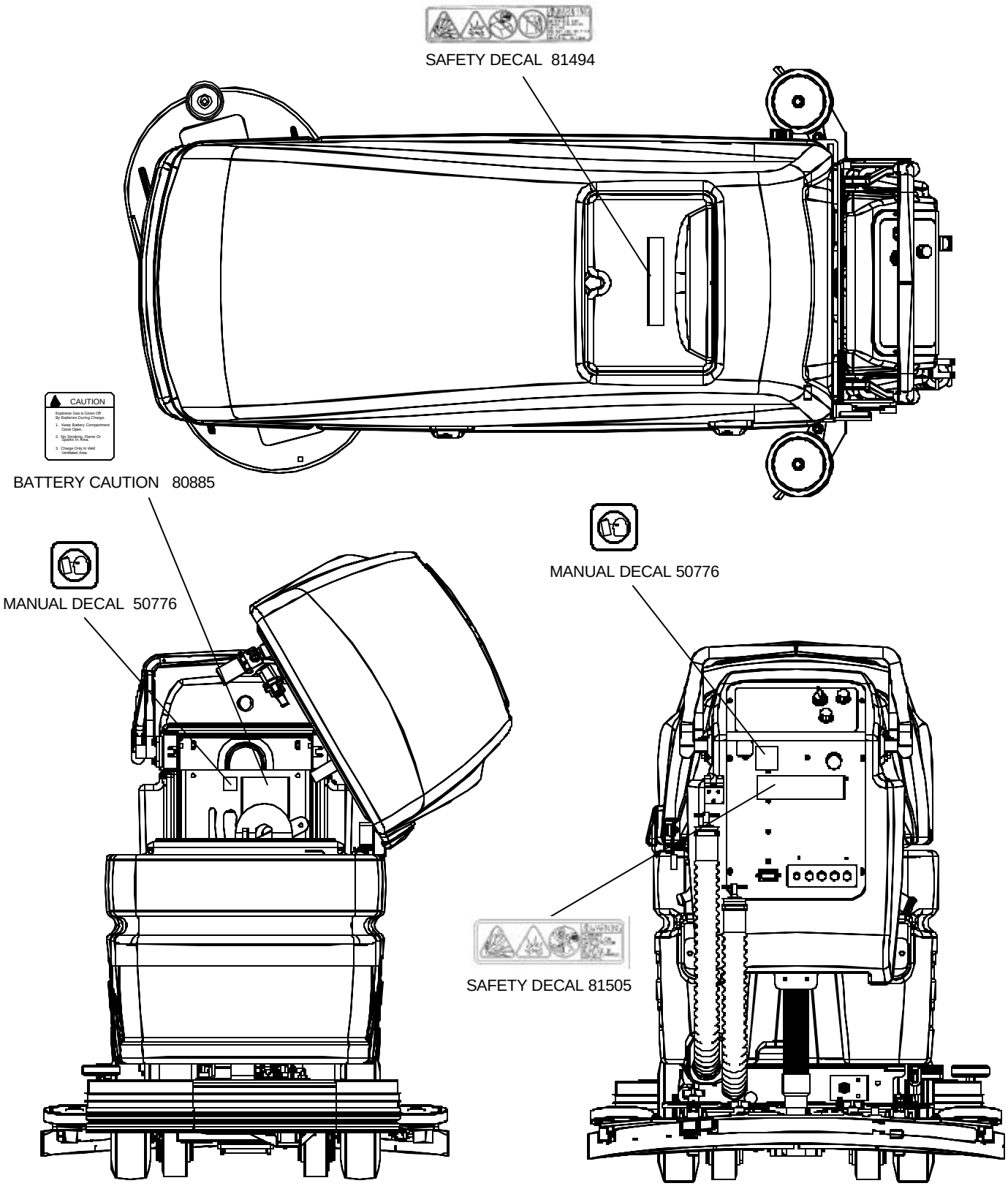
! WARNING

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.

! WARNING

Never allow metal to lie across battery tops.

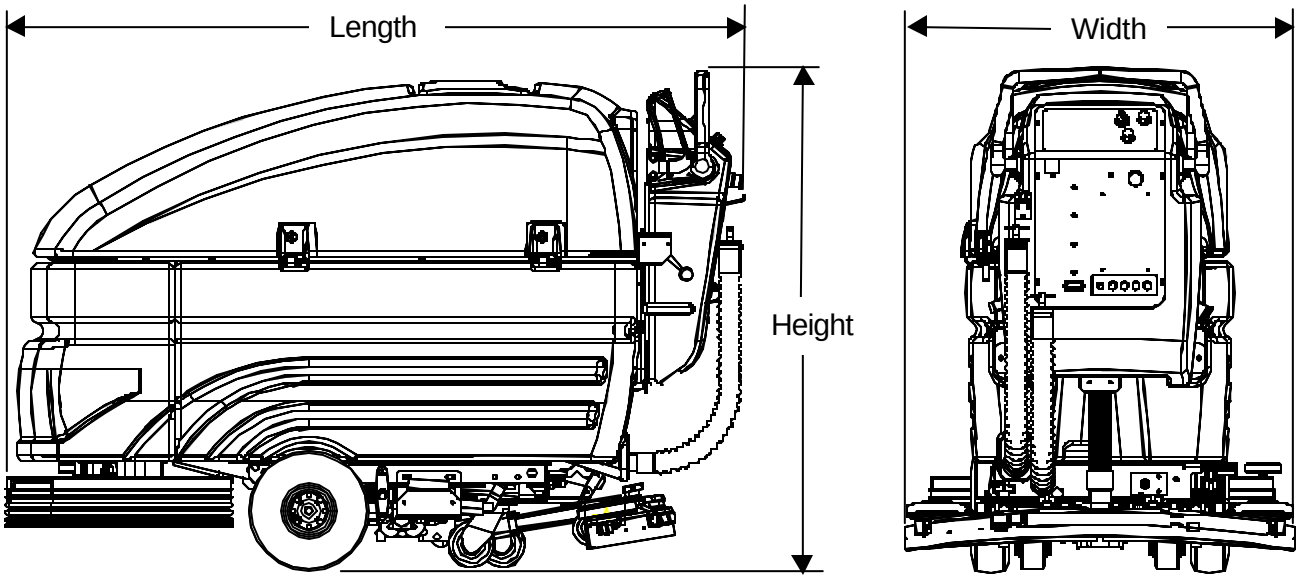
NOTE: These drawings indicate the location of safety labels on the machine. If at any time the labels become illegible, promptly replace them.



TECHNICAL SPECIFICATIONS

ITEM	DIMENSION/CAPACITY
Nominal power	2.88 kW
Rated Voltage	36VDC
Rated Amperage	80 Amps
Batteries	6 X 6 Volt 250-305 AH @ 20 hr rate
Scrub Brush Motors	2 X .75 hp (0.56 kW)
Vacuum Motor	.75 hp (0.56 Kw) standard, second motor optional
Propelling Motor	.75 hp (0.56 Kw)
Mass (GVW)	1425 lbs. (646 kg)
Weight empty without batteries	480 lbs. (217 kg)
Solution Control	Gravity feed, fully variable with automatic shut-off in neutral
Solution tank capacity	35 gal. (132 l)
Recovery tank capacity	35 gal. (132 l)
Scrub brush diameter for 28 in. (71 cm) disk scrub head	14 in (35.5 cm)
Scrub brush diameter for 34 in. (86 cm) disk scrub head	17 in (43.0 cm)
Scrub brush diameter for 34 in. (86 cm) cylindrical scrub head	6 in. (15.2 cm)
Scrub brush length for 34 in. (86 cm) cylindrical scrub head	32 in. (81.3 cm)
Scrub brush pressure	0-200 lbs. (0-91 kg)
Scrub brush speed	200 rpm
Tires	2 x 12 in (30.5 cm) pneumatic non-marking standard
Casters	2 X 4 in (10.2 cm) polyurethane solid non-marking
Foundation Pressure (at recommended tire psi)	38 lbs./in ^{2} (267 kPa)
Maximum Speed	3.0 Miles/hour (4.8 km/hour)
Coverage with 28 in. (71 cm) scrub head	34,320 ft^2/hour at 3.0 mph with 2 in. overlap
Coverage with 34 in. (86 cm) scrub head	42,230 ft^2/hour at 3.0 mph with 2 in. overlap
Frame Construction	Welded cold rolled steel and steel plate with epoxy powdercoat finish.
Brakes	Tire lock parking brake, foot activated
Minimum aisle u-turn width with 28 in. (71 cm) disk scrub head	68.5 in. (174 cm)
Minimum aisle u-turn width with 34 in. (86 cm) disk scrub head	71 in. (180 cm)
Minimum aisle u-turn width with 34 in (86 cm) cylindrical scrub head	72 in (183 cm)
Maximum rated climb and descent angle with empty tanks	2%
Maximum rated climb and descent angle with full tanks	2%

ITEM	MEASURE
Height	47 in. (119 cm) maximum
Length with 28 in. (71 cm) disk scrub head	67 in. (170 cm)
Length with 34 in. (86 cm) disk scrub head	69 in. (175 cm)
Length with 34 in. (86 cm) cylindrical scrub head	69.5 in. (177 cm)
Width without squeegee and scrub head	26 in. (66 cm)
Width of squeegee for 28 in. (71 cm) disk scrub head	39.5 in. (100 cm)
Width of squeegee for 34 in. (86 cm) disk scrub head	39.5 in. (100 cm)
Width of squeegee for 34 in. (86 cm) cylindrical scrub head	45.3 in. (115 cm)
Width of scrub path for 28 in. (71 cm) disk scrub head	28 in. (71 cm)
Width of scrub path for 34 in. (86 cm) disk scrub head	34 in. (86 cm)
Width of scrub path for 34 in. (86 cm) cylindrical scrub head	34 in. (86 cm)



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 $2.5 m/s^2$. 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.

HOW THE MACHINE WORKS

The Saber SX 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 directional 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, valve and controls. The solution tank stores cleaning solution (water and detergent) until it is delivered to the scrub system. The strainer protects the valve from debris. The valve is a solenoid type valve, which controls the delivery of cleaning solution to the scrub system. The valve automatically prevents solution flow unless the scrub brushes are turned on and the machine is being propelled. The solution control knob controls the amount of cleaning solution delivered to the scrub system by controlling the amount of time the valve is open.

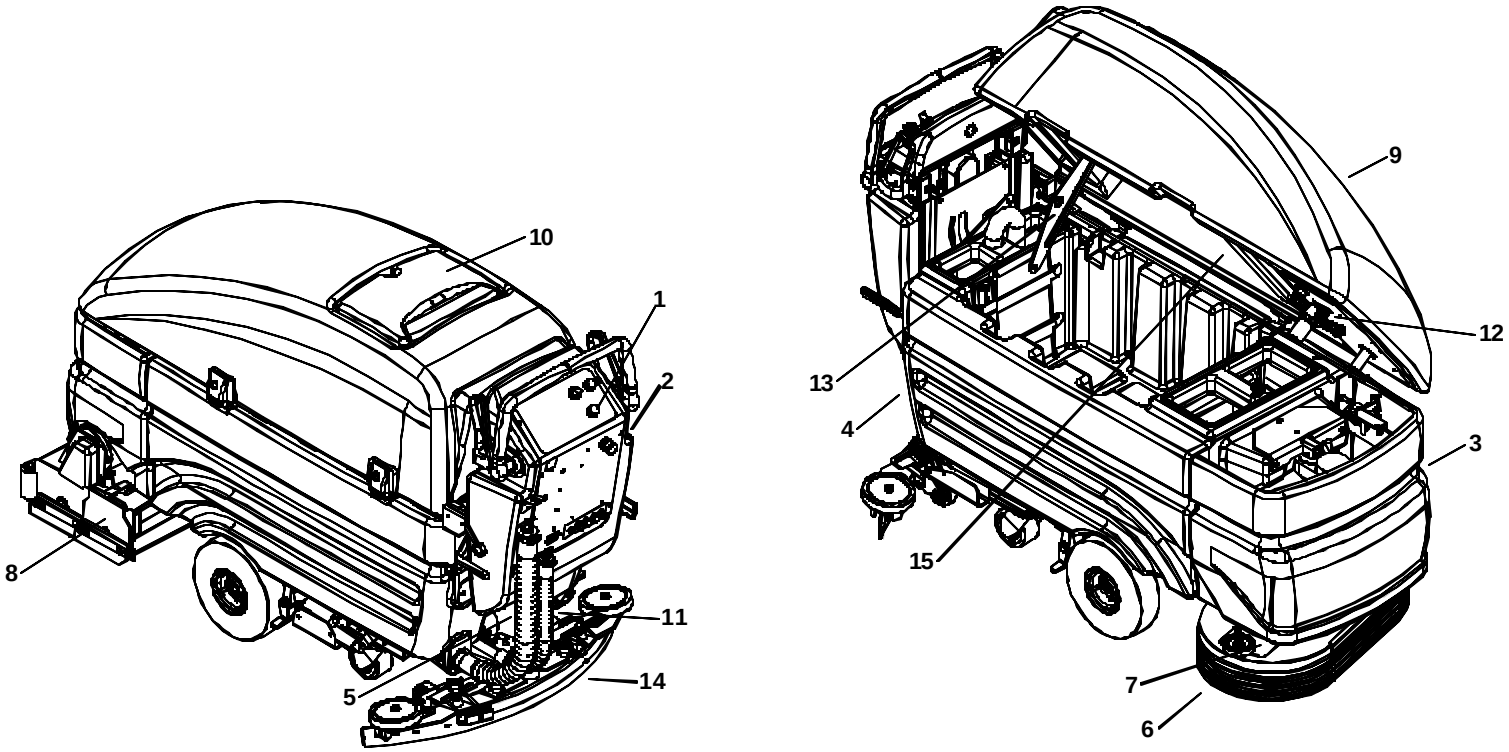
The function of the scrub system is to scrub the floor. There are two types of scrub systems available – disk and cylindrical.

The disk scrub system consists of two rotary type disk scrub brushes, motors, self-adjusting scrub deck skirt, lift actuator and controls. The brushes scrub the floor and the motors drive the brushes. The brush drive hubs allow the scrub brushes to follow irregularities and changes in the floor without loosing contact with the floor. The self-adjusting scrub deck skirt controls the cleaning solution on the floor so that the squeegee can pick it up. The brush motor/lift 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.

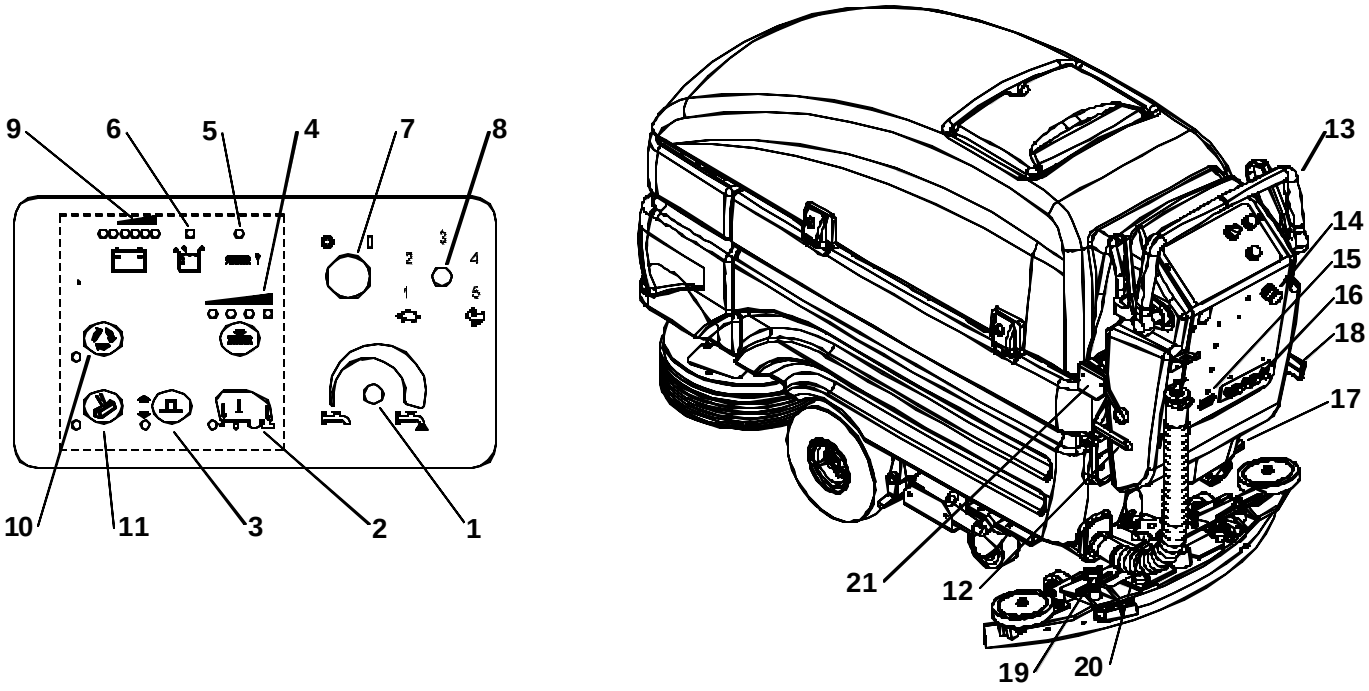
The cylindrical scrub system consists of two rotary cylindrical scrub brushes, motors, debris hopper, lift actuator and controls. The cylindrical scrub head is designed to eliminate debris that may be caught in the squeegee while scrubbing. The brushes scrub the floor and throw debris into the hopper. The motors drive the brushes. The brush motor/lift 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 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, filter, recovery tank 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 tank. The filter protects the vacuum fan from debris and foam. The recovery tank stores the dirty solution. The float switch in the tank activates the recovery tank full indicator and shuts off the vacuum motor.

The function of the directional control system is to control the direction and speed of the machine. The directional control system consists of the directional control lever, switches, speed control knob/potentiometer, controller and transaxle. The directional control lever actuates switches, which signal forward or reverse. The speed control knob actuates a potentiometer, which signals speed. The controller interprets the forward/reverse signals from the switches and the speed signal from the potentiometer to command the transaxle to propel the machine in the direction, and at the speed, desired.



1. ***Control Panel***
2. ***Control Tower***
3. ***Front Cover***
4. ***Recovery Tank***
5. ***Recovery Tank Drain Hose***
6. ***Scrub Head***
7. ***Scrub Brush Access Cover (Disk)***
8. ***Scrub Brush Idler Door (Cylindrical)***
9. ***Solution Tank***
10. ***Solution Tank Cover***
11. ***Solution Tank Drain Hose***
12. ***Solution Strainer***
13. ***Solution Tank Support Arm***
14. ***Squeegee***
15. ***Vacuum Motor***



1. ***Solution Control Knob***
2. ***One Touch Switch***
3. ***Vacuum/Squeegee Switch***
4. ***Brush Pressure Indicator/Switch***
5. ***Brush Circuit Breaker Indicator***
6. ***Recovery Tank Full Indicator***
7. ***Key Switch***
8. ***Speed Control Knob***
9. ***Battery Charge Level Indicator***
10. ***Recycle Switch (Optional)***
11. ***Pump Switch (Optional)***
12. ***Control Panel Height Adjustment Lever***
13. ***Directional Control Lever***
14. ***Emergency Shut-Off Switch***
15. ***Hour Meter***
16. ***Circuit Breakers***
17. ***Parking Brake Pedal***
18. ***Squeegee Lift Lever***
19. ***Squeegee Pitch Adjustment Knob***
20. ***Squeegee Deflection Adjustment Knob***
21. ***Solution Control Lever (For Recycle Option Only)***

1. 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 direction control lever 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.

2. ONE TOUCH SWITCH

Controls the scrub brushes and vacuum.

To start scrubbing, press the switch. The brush drive motors will turn on, the scrub deck will lower to the “light scrub” position, and the vacuum motor will turn on. If machine is equipped with the Auto Squeegee Lift Option, and the squeegee lift handle is in the lowered position, the indicator will light to indicate the scrub brushes are on. This indicator will flash while the scrub deck is lowering, and whenever it is adjusting to brush pressure changes. The Brush Pressure “light scrub” indicator will light, and the Squeegee/Vacuum Indicator will light to show the vacuum motor is on. If the direction control lever is in the neutral position, the brushes will turn off after approximately a 2-second delay. If the One Touch Switch is activated without brushes installed, the brush motors will stop, the deck will rise, and the four Brush Pressure Indicator lights will flash.

To stop scrubbing, press the switch. The brush drive motors will turn off immediately, the scrub deck will rise, the squeegee will rise (if equipped with Auto Squeegee Lift Option), after approximately a 15 second delay, and the vacuum motor will turn off after and additional 15 second delay.

3. VACUUM/SQUEEGEE SWITCH

Controls the vacuum motor, and squeegee position (if equipped with Auto Squeegee Lift Option).

To start vacuum motor, press the switch. If machine is equipped with Auto Squeegee Lift Option, and the squeegee lift handle is in the lowered position, the squeegee will lower also.

4. BRUSH PRESSURE INDICATOR/SWITCH

Controls the amount of brush pressure to the floor. The indicator shows the setting selected.

To change brush pressure, press the switch. Each time the switch is pressed, the brush pressure will increase until it reaches the maximum setting. Then the pressure will return to the minimum setting. If the One Touch Switch is activated without brushes installed, the brush motors will stop, the deck will rise, and the four Brush Pressure Indicator lights will flash. Under normal conditions, the brush pressure should be set at the minimum setting.

5. BRUSH CIRCUIT BREAKER INDICATOR

Indicator will light when one of the scrub brush circuit breakers is tripped.

6. RECOVERY TANK FULL INDICATOR

Indicator will light when float switch indicates a full recovery tank. The indicator will light intermittently as the tank approaches full. After the indicator is on continuously for approximately 70 seconds, the vacuum motor will turn off, and the squeegee will rise (if equipped with Auto Squeegee Lift Option). The vacuum motor will not operate with the recovery tank full indicator light on.

7. KEY SWITCH

Controls the power for machine functions.

To turn machine on, rotate key clockwise.

To turn machine off, rotate key counterclockwise.

FOR SAFETY: Always remove the key when machine is unattended or during service to prevent unauthorized movement.

8. SPEED CONTROL KNOB

Controls the speed of the machine.

To increase speed, rotate knob clockwise.

To decrease speed, rotate knob counterclockwise.

9. BATTERY CHARGE LEVEL INDICATOR

Indicates the charge level of the batteries.

The charge level indicator consists of 6 lights. All 6 lights on indicate a full charge. Only the left two lights on indicates 80% discharge, which is the ideal time to recharge batteries. Only one light on indicates batteries must 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.

10. RECYCLE SWITCH (OPTIONAL)

Controls the solution recycle pump.

To start recycle pump, press the switch.

To stop recycle pump, press the switch.

11. PUMP SWITCH (OPTIONAL)

Controls the pump to operate a scrub wand.

To start pump, press the switch.

To stop pump, press the switch.

12. CONTROL PANEL HEIGHT ADJUSTMENT LEVER

The height of the control panel and tower are adjustable.

To adjust control panel height, pull up on height adjustment lever, move control panel up or down to desired height, then release the lever to lock the control panel in position.

13. DIRECTIONAL CONTROL LEVER

Controls the machine direction, and scrub brushes and solution flow.

To propel machine forward, push the lever forward.

To propel machine backward, pull the lever toward you.

The scrub brushes will not rotate and the solution will not flow to scrub deck with the directional control lever in neutral (except at initial brush start-up, when it will run briefly then stop if lever is in neutral).

14. EMERGENCY SHUT-OFF SWITCH

Shuts off machine.

To shut off machine, push the switch.

To restart machine, rotate the switch clockwise.

15. HOUR METER

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

16. 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.

3 Amp. Protects the machine controls.

30 Amp. Protects the left scrub brush motor.

30 Amp. Protects the right scrub brush motor.

25 Amp. Protects the vacuum motor.

35 Amp. Protects the propel motor.

17. PARKING BRAKE PEDAL

Locks front wheels to prevent unintentional movement.

To set parking brake, push down on the foot pedal.

To release parking brake, pull up on the foot pedal.

18. SQUEEGEE LIFT LEVER

Raises and lowers the squeegee.

To lower the squeegee, lift the lever from its raised position.

To raise the squeegee, lift the lever from its lowered position.

19. SQUEEGEE PITCH ADJUSTMENT KNOB

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.

20. SQUEEGEE DEFLECTION ADJUSTMENT KNOB

Adjusts the deflection along the entire length of the squeegee.

To increase squeegee blade deflection along the entire length, loosen knob, slide bar to left to desired deflection, then tighten knob.

To decrease squeegee blade deflection along the entire length, loosen knob, slide bar to right to desired deflection, then tighten knob.

21. SOLUTION CONTROL LEVER (FOR RECYCLING OPTION ONLY)

Controls solution flow to scrub deck.

To increase flow, push down on lever.

To decrease flow, pull lever up.

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. Turn the machine power on.
2. Release the parking brake.
3. Move the direction control lever in the desired direction.

EMERGENCY STOP PROCEDURES

1. Release the directional control lever.
2. Turn machine power off with key switch.
3. If an electrical problem is suspected push in emergency stop button.
4. Set the parking brake.

NOTE: Turning the key switch off during normal running operation will stop all motors and lift actuators. When the key is turned back on the systems will assume they are in the normal parked mode (scrub deck up, squeegee up, and motors off). Any switch command will send the selected system to the working position regardless of the position it was in when the key switch was turned off. Two touches of the respective switch are required to raise the scrub deck and squeegee and turn off motors. This is normal. No damage to machine will result.

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. Set the parking brake.
3. Remove solution tank cover.
4. Fill the solution tank with clean water, leaving enough room for the required amount of cleaning solution. The solution tank capacity filled to 2" (5cm) from bottom of fill inlet is 35 gallons (132 liters). The water must not be hotter than 140° F (60°C) to prevent damage to the tank.
5. **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.

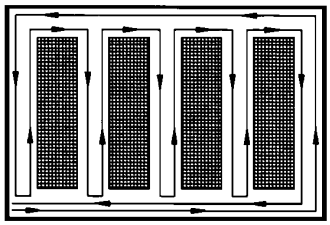
6. Replace solution tank cover.

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

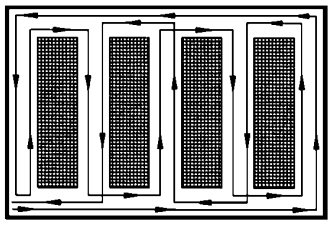
NORMAL SCRUBBING

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

INEFFICIENT SCRUBBING PATH



RECOMMENDED SCRUBBING PATH



TO BEGIN SCRUBBING

! CAUTION

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

! WARNING

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

1. Turn the machine power on.

2. Lower the squeegee.

3. Release the parking brake.

4. Press the one touch switch.

5. Drive machine forward to begin scrubbing.
NOTE: Shut machine off immediately if water or foam is expelled from the machine.

6. 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.

TO STOP SCRUBBING

1. Release the directional control lever.

2. Press the one touch switch.

3. Set the parking brake.

4. Raise the squeegee.

5. Turn the machine power off.

DOUBLE SCRUB

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, 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.**

EMPTYING AND CLEANING TANKS

1. Park the machine next to a floor drain. Drain hose is on left rear corner of the machine.

2. Turn the machine power off and set parking brake.

SOLUTION TANK

1. Unhook the small drain hose from the retainer. Unscrew T-handle on plug enough to loosen plug, then lower hose in direction of the drain. Slowly remove plug from drain hose.

2. Remove the solution tank cover.

3. 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.

4. Replace the drain plug and secure drain hose in bracket.

RECOVERY TANK

1. Unhook the large drain hose from the retainer. Unscrew the T-handle on plug enough to loosen plug, then lower hose in direction of the drain. Do not stand in front of end of hose. Recovered solution will come out with force. Slowly remove plug from drain hose.

2. Raise solution tank to access recovery tank. Make sure the support arm is fully engaged. Flush the recovery tank out with clean water. Do not use water hotter than 140°F (60°C) to clean tank. Damage may occur.

3. Clean off the float switch and check for free movement of float. The float switch is located in the front of the recovery tank.

4. Replace the drain plug and secure drain hose in bracket.

5. If machine is to be stored, leave solution tank in raised position.

BATTERIES

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

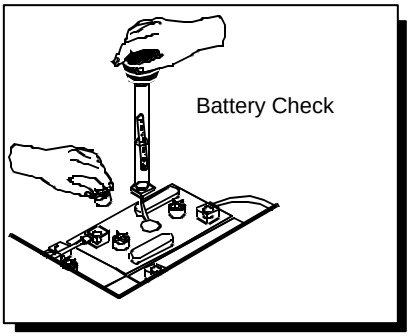
Charge batteries in a well ventilated area.

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).

TO CHARGE THE 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. Leave the solution tank open.

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 and set parking brake.

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

3. Drain solution tank and raise the solution tank and lock the support arm. Make sure the support arm is fully engaged.

⚠ 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.
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. Lower the solution tank.

CHANGING BATTERIES

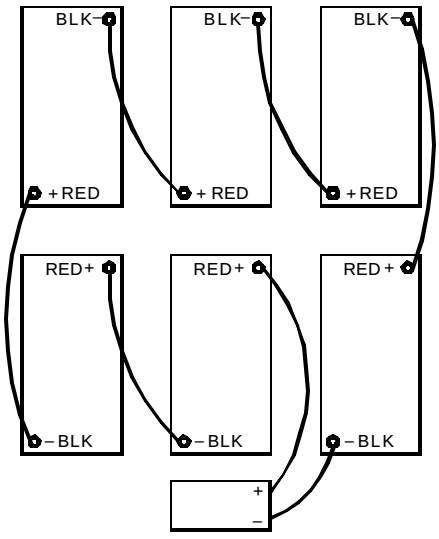
Stop the machine in a clean area next to the charger. Turn off machine.

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

1. Raise the solution tank.
2. Engage solution tank support arm.
3. Disconnect battery pack from machine.
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.
8. Attach suitable battery lifting device and lift batteries from the machine.

! WARNING

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



SCRUB BRUSHES

NOTE: All original equipment brushes are equipped with "Perform Alert©". This feature will tell the operator when it is time to replace the scrub brushes. "Perform Alert©" brushes have pre-trimmed bright yellow tufts to indicate the length of a worn out brush. When the tufts in the scrub brush wear to a length equal to the yellow tufts, the scrub brushes should be replaced.

There are five 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 and further add to the flexibility of the machine. 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.

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

FINISHED FLOORS

Nylon Polish is the softest brush. It will gently clean finished tile or terrazzo floors without removing floor finish or floor material. Used for washing highly polished or burnished 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.

Brown 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. The scrub brushes should be replaced if brush bristles are missing or if yellow Perform Alert © indicates minimum brush length.

REPLACING OR INSTALLING DISK SCRUB BRUSHES

1. With the scrub deck up, turn "OFF" the machine and set parking brake.

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

2. Locate release lever on top of brush or pad driver. Rotate release lever counter-clockwise and the brush/pad driver will release and drop down.

3. To reinstall, center the brush driver under the brush drive hub. Raise until it contacts brush driver assembly. Turn clockwise until release lever plate locks into position.

NOTE: Check that release plate is completely closed and pad/brush is securely attached. Damage to driver or brush could occur.

4. Repeat the procedure for the opposite side of machine.

CYLINDRICAL SCRUB SYSTEM

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 or 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.

The design of the touch panel permits the same automatic operating procedure as the disc machine.

DUMPING HOPPER

The removable hopper is located behind the rear scrub brush. Remove the hopper by sliding it our from the right side of the machine. The hopper can then be dumped from the top or the left side door can be removed to dump debris from the end. The side door is also convenient for flushing the hopper clean.

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. 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 Perform Alert © bristle.

SCRUB BRUSH REMOVAL

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

1. Unlatch idler side door.
2. Pull out on top of door until lip on door clears brush head.
3. Push down on door until hooks on door are free of scrub head.
4. Pull out on door with a rocking motion to free idler door from end of brush.
5. Pull brush out with a rocking motion to free brush from drive hub.

SCRUB BRUSH REPLACEMENT

1. Observe location of drive hub lugs. It is usually easier to position the lugs to the 12 o'clock – 6 o'clock position (vertical) or 9 o'clock – 3 o'clock position (horizontal).
2. Orient brush notches to match the position of the drive hub lugs and slide onto hub.
3. Push brush until a positive stop is felt. The idler plate cannot be installed until the brush is fully seated on the drive hub.
4. Allow idler end of brush to drop below scrub deck. Align lugs on idler hub with notches in brush and fully insert hub into brush.
5. Line up hook on idler door with notches on side of scrub head.
6. Slide idler door up until lip rests on top of scrub head.
7. Latch door into position.

CYLINDRICAL SCRUB

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 the front and rear brushes. Unequal patterns are caused by the scrub deck not being parallel to the floor. Proper adjustments is obtained when the contact pattern of the brushes on the floor shows two approximately 1" (2.5 cm) wide rectangles the length of the brushes.

TESTING ADJUSTMENT OF BRUSHES

1. Move machine to an unfinished area of floor to avoid marking finish.
2. With water valve off, set parking brake, and lower scrub head to floor. Allow brushes to run until automatic shut off occurs. It may be necessary to extend this step in the same location until a good mark can be seen on the floor. This can be accomplished by setting speed control knob to lowest setting and holding direction control lever.
3. Raise the scrub deck and note the brush patterns on the floor. There should be two rectangles with parallel side. If the pattern is tapered, proceed as follows.

ADJUSTMENT OF INDIVIDUAL BRUSHES

Adjustment of individual brushes is accomplished by adjusting idler hub position on door. The mounting hole in the idler hub shaft is eccentrically located such that the idler hub position can be changed by rotating the shaft orientation.

1. Determine if idler is to be moved up or down to balance the pattern.
2. Remove idler door on brush to be balanced.
3. Measure distance of shaft from top of door and record.
4. Loosen hex socket head screw on outside of door.
5. Rotate shaft to new position. Hold shaft in position.
6. Tighten hex socket head screw.
7. Install door on machine.
8. Re-test and re-adjust as necessary.

LEVELING THE SCRUB HEAD

Leveling the cylindrical head is accomplished by adjusting the scrub head lift linkage. The upper lift linkage can be adjusted by loosening the jam nuts at each end of rods and rotating rods to extend or shorten their length. To increase pattern width of front brush, extend linkages. To increase pattern width of rear brush, shorten linkages. Be sure to adjust both linkages equally and to tighten jam nuts after adjustments are complete.

BELT REPLACEMENT

1. Remove scrub brushes.
2. Remove four screws securing broom drive seal and retainer.
3. Slacken belt tension by means of jack bolt under motor.
4. The drive hub may be unscrewed from the inside. Flats are provided on end of pulley shaft to facilitate removal.
5. Place belt on motor pulley then pull down into scrub head.
6. Insert drive hub from inside of scrub head and through lower loop of belt.
7. Screw shaft into side of scrub head.
8. Re-tension belt to deflect 1/8" (3 mm) at center of span when a pressure of 4 (1.8 kg) pounds is applied.
9. Install broom drive seal and retainer.
10. Install scrub brushes.

SQUEEGEE BLADES

There are three sets of front and rear squeegee blades available. There are three different notch patterns and three different colors for varying floor conditions. Linatex squeegees are for industrial settings. See squeegee parts list for part numbers.

The front squeegee blade allows solution to pass through channels in the blade into the squeegee tool while maintaining vacuum to provide lift. The front blade has four wear surfaces and can be rotated for extended life. The red linatex blade has the most notches and is for normal, smooth surfaces. The blue blades has less notches and is for rougher or tiled surfaces. The green blade has no notches and is for very rough floors such as knobby tile or uneven tile. 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 blades there are 3 rear blade options; red linatex, blue and green. Front and rear blades should be color matched. Each squeegee blade 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 ½ the original thickness.

NOTE: An optional rear urethane blade is available for industrial settings that have oil or chemical based products.

ADJUSTING SQUEEGEE

Adjusting the squeegee is a two-part process. First, the squeegee tool must have correct pitch in order for the squeegee blade to have the same deflection at each tip as well as the center. The pitch adjustment is facilitated by the use of a spirit level mounted on the squeegee tool. The second adjustment is the amount of deflection or down pressure on the squeegee. The ideal deflection is conveniently marked by colors on the squeegee tool according to the type of floor and squeegee blade employed.

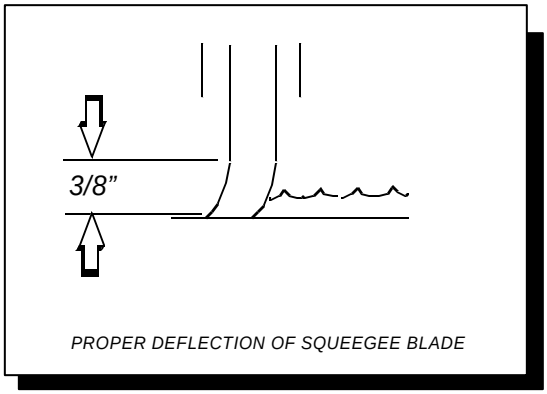
TO ADJUST SQUEEGEE PITCH

1. Choose a smooth, level surface. Turn on the key switch, release the machine parking brake, lower the squeegee and drive forward at least 2 feet (60 cm).
2. With the squeegee down, stop the machine and set the parking brake. Do not allow the machine to roll back.

FOR SAFETY: Before leaving or servicing 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 tool. This should correspond to the bubble being in the middle position of the spirit level.
4. To decrease the deflection of the squeegee blade at the ends, clockwise turn knob on squeegee trailing arm. To increase the deflection at the ends of the squeegee assembly, turn knob counter clockwise.
5. Again check the deflection of the squeegee blades. Repeat steps 1 through 4 until the deflection is equal across the entire rear squeegee blade.

TO ADJUST SQUEEGEE DEFLECTION



PROPER DEFLECTION OF SQUEEGEE BLADE

1. Choose a smooth, level surface. Lower the squeegee and drive forward at least 2 feet.
2. With the squeegee down, stop the machine and set the parking brake. Do not allow the 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 3/8in (9.5 mm) across the entire width of the squeegee.
4. To adjust the squeegee deflection, loosen knob on the squeegee slide bar.
5. Slide bar to left increases deflection. Sliding bar to right decreases deflection.
6. Tighten knob on squeegee slide bar.
7. Turn on the key switch, release the parking brake. Raise, then lower squeegee assembly. Drive forward at least 2 feet.
8. Repeat steps 2 through 7 until deflection of 3/8 in (9.5 mm) is reached.

TO REPLACE OR ROTATE REAR SQUEEGEE BLADES

1. With the squeegee in the up position, turn off the key switch and set the parking brake.

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

2. Unlock and pull open latch on rear of squeegee tool.
3. Remove blade retainer straps from squeegee tool.
4. Remove squeegee blade from locating pins on squeegee tool and rotate to new position or replace as required.
5. Install blade on locating pins of squeegee tool.
6. Install squeegee retainer straps.
7. Fasten and lock latch. Latch is adjustable. Adjust latch only tight enough to take up slack in retaining strap.

NOTE: Changing of squeegee blades does not always necessitate a readjustment. Refer to section on adjusting squeegee.

TO REMOVE SQUEEGEE ASSEMBLY

1. With the squeegee in the up position, turn off the key switch and set the parking brake.

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

2. Disconnect vacuum hose and loosen the two squeegee retaining knobs.
3. Pull squeegee assembly rearward from the lifting carrier.
4. With squeegee assembly on bench inspect or repair as necessary.
5. To reinstall, align squeegee assembly to lift carrier. Push forward while keeping squeegee level.
6. Tighten knobs.
7. Attach vacuum hose.

TO REPLACE OR ROTATE FRONT SQUEEGEE BLADES

1. With squeegee assembly on bench, release latch securing retainer strap.
2. Remove front retainer strap.
3. Remove squeegee blade from locating pins on squeegee tool and rotate to new position or replace as required.
4. Install blade on locating pins of squeegee tool.
5. Replace front retainer strap.
6. Secure strap by locking latch.

NOTE: Changing of squeegee blades does not always necessitate a readjustment. Refer to section on adjusting squeegee.

SERVICE SCHEDULE

	MAINTENANCE	DAILY	WEEKLY	MONTHLY	ANNUALLY
Before starting the work period	Check battery acid level	*			
	Check vac hose connections	*			
	Clean the squeegee blades	*			
	Inspect brushes or pads for debris: wire string, wear	*			
	Inspect vac fan shut off float screen	*			
End of work period before storing	Drain & rinse tanks	*			
	Raise squeegee assembly	*			
	Raise scrub deck assembly	*			
	Charge the batteries.	*			
	Remove the pad drivers/brushes	*			
	Check the brushes/pads for damage and/or wear	*			
	Clean squeegee blades.	*			
	Clean recovery tank shut off & screen	*			
	Check battery cells w/ hydrometer		*		
	Check solution strainer		*		
	Check pivot points, caster and squeegee for proper lubrication		*		
	Inspect tank and hoses		*		
	Clean tops of batteries and tray			*	
	Check battery cable clamps			*	
	Use a vacuum to remove lint from the motor windings			*	
	Grease casters			*	
	Inspect all motors for carbon motor brush wear				*

PROBLEM	CAUSE	SOLUTION
Poor or no water pick-up	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	Reconnect vacuum hose
	Vacuum hose damaged	Replace vacuum hose
	Vacuum motor inlet filter dirty	Clean or replace inlet filter
	Recovery tank not sealed	Lower solution tank Replace damaged seals
	Foam filling recovery tank	Empty recovery tank Use less or different detergent Use defoamer
Vacuum motor does not run, or runs slowly	Recovery tank full	Drain recovery tank
	Recovery tank float switch dirty	Clean float switch
	Circuit breaker tripped	Reset circuit breaker
	Loose connection	Check motor wires and connections
	Faulty vacuum contractor	Replace contactor
	Worn vacuum motor brushes	Replace brushes, check commutator
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 specialist
	Low scrub brush down pressure	Increase brush pressure
	Low battery charge	Charge batteries
Brush motors do not run, or runs slowly	Circuit breaker(s) tripped	Reset circuit breaker(s)
	Loose connection	Check motor wires and connection
	Faulty brush motor contactor	Replace contactor
	Worn brush motor brushes	Replace brushes, check commutator

PROBLEM	CAUSE	SOLUTION
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 hoses obstructed	Clear obstruction from hose
	Solution solenoid valve obstructed or stuck	Clean or replace
	Vent hole in solution tank lid obstructed	Clear obstruction from vent hole
No power to machine	Battery disconnected	Check all battery cable connections
	Emergency shut-off activated	Reset
	Battery connections corroded	Clean connections
	Faulty main contactor	Replace contactor
	Faulty key switch	Replace switch
Little or no propel	Low battery charge	Charge batteries
	Machine turned on with control handle not in neutral	Allow control handle to return to neutral. Restart
	Wheels spin	Decrease brush pressure
	Controller overheated	Allow cool down period
	Loose connection	Check motor wires and connection