

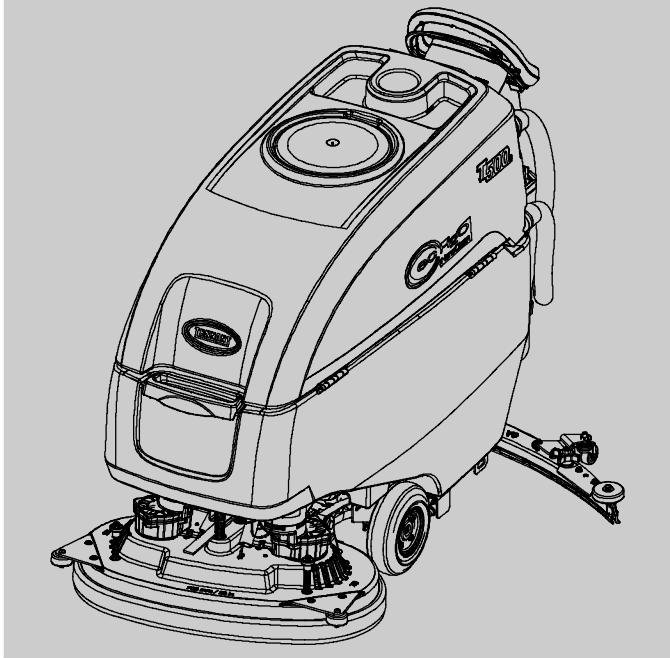


# T500e

Walk-Behind Floor Scrubber

English **EN**

Operator Manual



Tennant True® Parts  
IRIS® a Tennant Technology  
Insta-Fit™ Adapter  
Smart-Fill™ Automatic Battery Watering



**North America / International**



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9015506  
Rev. 01 (02-2017)



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## INTRODUCTION

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This manual is furnished with each new model. It provides necessary operation and maintenance instructions.



**Read this manual completely and understand the machine before operating or servicing it.**

This machine will provide excellent service. However, the best results will be obtained at minimum costs if:

- The machine is operated with reasonable care.
- The machine is maintained regularly - per the maintenance instructions provided.
- The machine is maintained with manufacturer supplied or equivalent parts.

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### PROTECT THE ENVIRONMENT

Please dispose of packaging materials and used machine components such as batteries in an environmentally safe way according to your local waste disposal regulations.



Always remember to recycle.

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## INTENDED USE

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The T500e walk-behind floor scrubber is intended for commercial use, for example in hotels, schools, hospitals, factories, shops, offices and rental businesses. It is designed to scrub hard floor surfaces (concrete, tile, stone, synthetic, etc.) in an indoor environment. This machine is not intended for cleaning carpets or sanding wood floors. Use only recommended pads/brushes and commercially available floor cleaning detergents. Do not use this machine other than described in this Operator Manual.

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## MACHINE DATA

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Please fill out at time of installation for future reference.

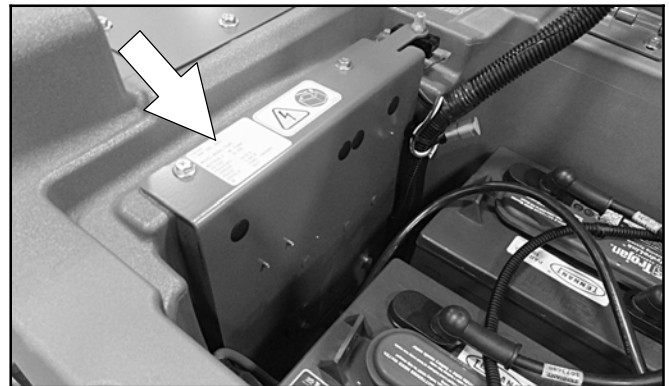
Model No. - \_\_\_\_\_

Serial No. - \_\_\_\_\_

Installation Date - \_\_\_\_\_

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## SERIAL NUMBER LABEL LOCATION



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## UNCRATING MACHINE

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Carefully check machine for signs of damage. Report damages at once to carrier. Contact distributor or Tennant for missing items.

To uncrate the machine, remove straps, wheel blocks and shipping brackets. Using the supplied ramp carefully back the machine off the pallet. Make sure scrub head is in the raised position.

**ATTENTION: Do not remove machine from pallet without using ramp, machine damage may occur.**

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**PO Box 1452**  
**Minneapolis, MN 55440**  
**Phone: (800) 553-8033**

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## IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

---

The following warning precautions are used throughout this manual as indicated in their description:

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

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

The following information signals potentially dangerous conditions to the operator. Know when these conditions can exist. Locate all safety devices on the machine. Report machine damage or faulty operation immediately.

**⚠ WARNING:** To Reduce the Risk of Fire, Explosion, Electric Shock or Injury:

- Read manual before operating machine.
  - Do not use or pick up flammable materials or reactive metals.
  - Do not use near flammable liquids, vapors or combustible dusts.
- This machine is not equipped with an explosion proof motor. The electric motor will spark upon start up and during operation which could cause a flash fire or explosion if machine is used in an area where flammable vapors/liquids or combustible dusts are present.
- Batteries emit hydrogen gas. Explosion or fire can result. Keep sparks and open flame away when charging.
  - Disconnect battery cables and charger cord before cleaning and servicing machine.
  - Do not charge batteries with damaged cord. Do not modify plug.

If the charger supply cord is damaged or broken, it must be replaced by the manufacturer or its service agent or a similarly qualified person in order to avoid a hazard.

- Do not use outdoors. Store indoors.
- Spinning pad/brush, keep hands away.

**WARNING:** This machine contains chemicals known to the state of California to cause cancer, birth defects, or other reproductive harm.

**IRIS Telemetry** - This machine may be equipped with technology that automatically communicates over the cellular network. If the machine will be operated where cell phone use is restricted because of concerns related to equipment interference, please contact a Tennant representative for information on how to disable the cellular communication functionality.

**FOR SAFETY:**

1. Do not operate machine:
  - Unless trained and authorized.
  - Unless operator manual is read and understood.
  - Unless mentally and physically capable of following machine instructions.
  - Under the influence of alcohol or drugs.
  - While using a cell phone or other types of electronic devices.
  - If not in proper operating condition.
  - In outdoor areas. This machine is for indoor use only.
  - In areas where flammable vapors/liquids or combustible dusts are present.
  - With pads or accessories not supplied or approved by Tennant. The use of other pads may impair safety.
  - In areas with possible falling objects.
  - In areas that are too dark to safely see the controls or operate machine.
2. Before operating machine:
  - Check machine for fluid leaks.
  - Make sure all safety devices are in place and operate properly.
3. When operating machine:
  - Use only as described in this manual.
  - Report machine damage or faulty operation immediately.
  - Wear closed-toe, non-slip work shoes.
  - Reduce speed when turning.
  - Go slowly on inclines and slippery surfaces.
  - The machine may only be operated on gradients up to 2%.
  - Follow site safety guidelines concerning wet floors.
  - Follow mixing, handling and disposal instructions on chemical containers.
  - Do not carry passengers on machine.
  - Use care when reversing machine.
  - Keep children and unauthorized persons away from machine.
  - Do not allow machine to be used as a toy.
4. Before leaving or servicing machine:
  - Stop on level surface.
  - Set the parking brake, if equipped.
  - Turn off machine and remove key.

**5. When servicing machine:**

- Disconnect battery connection and charger cord before working on machine.
- All work must be done with sufficient lighting and visibility.
- All repairs must be performed by trained personnel.
- Use Tennant supplied or approved replacement parts.
- Do not modify the machine from its original design.
- Block machine tires before jacking machine up.
- Jack machine up at designed locations only. Support machine with jack stands.
- Use hoist or jack that will support the weight of the machine.
- Avoid moving parts. Do not wear loose clothing or jewelry and secure long hair.
- Do not disconnect the off-board charger's DC cord from the machine's receptacle when the charger is operating. Arcing may result. If the charger must be interrupted during charging cycle, disconnect the AC power supply cord first.
- Do not use incompatible battery chargers as this may damage battery packs and potentially cause a fire hazard.
- Inspect charger cord regularly for damage.
- Keep work area well ventilated.
- Avoid contact with battery acid.
- Keep all metal objects off batteries.
- Do not power spray or hose off machine. Electrical malfunction may occur. Use damp cloth.
- Use a hoist or adequate assistance when lifting batteries.
- Battery installation must be done by trained personnel.
- Only use distilled water when filling the automatic battery watering tank.
- Wear personal protection equipment as needed and where recommended in this manual.

**6. When loading/unloading machine onto/off truck or trailer:**

- Drain tanks before loading machine.
- Use a ramp that can support the machine weight and operator.
- The machine may only be operated on gradients up to 2%.
- Lower the scrub head and squeegee before tying down machine.
- Turn machine off and remove key.
- Set parking brake (if equipped).
- Block machine wheels.
- Use tie-down straps to secure machine.



For Safety: wear protective gloves.



For Safety: wear eye protection.

**SAFETY LABELS**

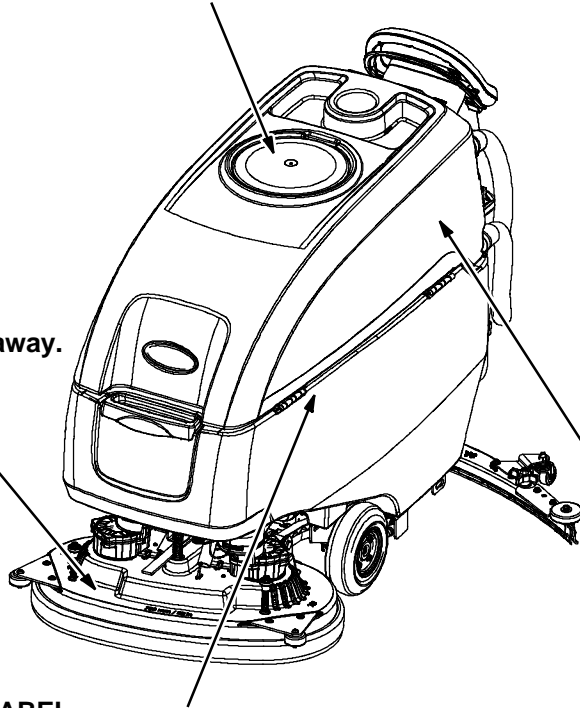
The safety labels appear on the machine in the locations indicated. Replace labels if they are missing or become damaged or illegible.

**WARNING LABEL** - Located on recovery tank cover.

<b>⚠ WARNING</b>	<b>⚠ AVERTISSEMENT</b>	<b>⚠ ADVERTENCIA</b>
	<p><b>TO REDUCE THE RISK OF FIRE, EXPLOSION, ELECTRICAL SHOCK, OR INJURY:</b></p> <ul style="list-style-type: none"> <li>• Read manual before operating machine.</li> <li>• Do not use or pick up flammable materials.</li> <li>• Do not use near flammable liquids, vapors or combustible dusts.</li> <li>• Batteries emit hydrogen gas. Explosion or fire can result. Keep sparks and open flame away when charging.</li> <li>• Disconnect battery cables and charger plug before servicing machine.</li> <li>• Do not charge batteries with damaged cord.</li> <li>• Do not use outdoors. Store indoors.</li> </ul>	<p><b>POUR RÉDUIRE LES RISQUES D'INCENDIE, L'EXPLOSION, DE CHOC ELECTRIQUE OU DE LESSURE:</b></p> <ul style="list-style-type: none"> <li>• Lisez le manuel avant d'utiliser la machine.</li> <li>• N'utilisez pas ou ne ramassez pas de matériaux inflammables.</li> <li>• N'utilisez pas près de liquides, vapeurs ou poussières inflammables.</li> <li>• Les batteries émettent de l'hydrogène gazeux. Risque d'incendie et d'explosion. Évitez toute étincelle et toute flamme nue lors de la charge des batteries.</li> <li>• Débranchez les câbles des batteries et le cordon du chargeur avant l'entretien de la machine.</li> <li>• Ne chargez pas les batteries avec un cordon endommagé.</li> <li>• N'utilisez pas à l'extérieur. Entrez-la à l'intérieur.</li> </ul>
		<p>1215281</p>



**WARNING LABEL - Spinning brush. Keep hands away.**  
Located on scrub head.



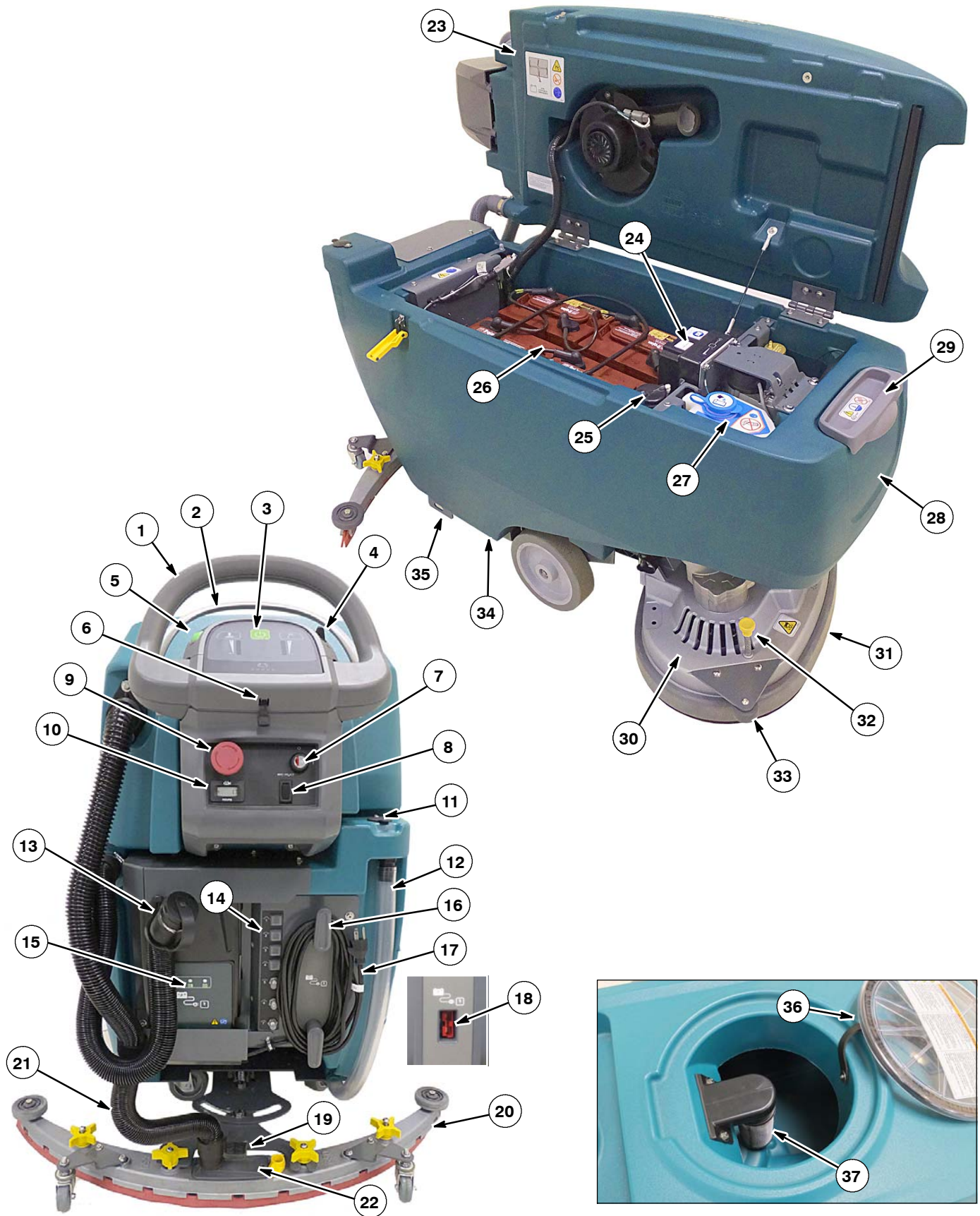
**WARNING LABEL - Batteries emit hydrogen gas. Explosion or fire can result. Keep sparks and open flame away when charging.**  
Located on bottom side of recovery tank.



**WARNING LABEL - Electrical hazard. Disconnect battery cables before servicing machine.**  
Located on circuit breaker panel.

# OPERATION

## MACHINE COMPONENTS

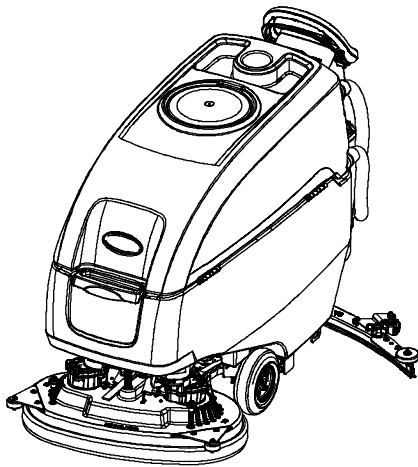




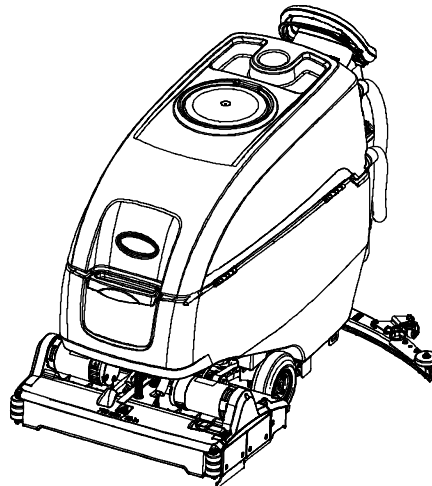
**MACHINE COMPONENTS**

- |  |  |
|--|--|
| 1. Control handle                        | 20. Squeegee assembly                        |
| 2. Control handle start bail             | 21. Squeegee vacuum hose                     |
| 3. Control panel                         | 22. Squeegee debris/drip tray                |
| 4. Forward/Reverse lever                 | 23. Recovery tank                            |
| 5. Speed control knob                    | 24. ec-H2O module (option)                   |
| 6. USB port (Service only)               | 25. ec-H2O water conditioning cartridge      |
| 7. Key switch                            | 26. Battery compartment                      |
| 8. ec-H2O on/off switch (option)         | 27. Automatic battery watering tank (option) |
| 9. Emergency shut-off button             | 28. Solution tank                            |
| 10. Hour meter                           | 29. Solution tank front bucket fill-port     |
| 11. Solution tank rear hose fill-port    | 30. Scrub head                               |
| 12. Solution tank level/drain hose       | 31. Scrub head skirt                         |
| 13. Recovery tank drain hose             | 32. Pad release plunger                      |
| 14. Circuit breaker panel                | 33. Wall rollers                             |
| 15. On-board battery charger             | 34. Parking brake (option)                   |
| 16. On-board battery charger cord hooks  | 35. Transport tie-down bracket               |
| 17. On-board battery charger cord        | 36. Recovery tank lid                        |
| 18. Off-board battery charger receptacle | 37. Recovery tank float shut-off screen      |
| 19. Squeegee lower/lift foot pedal       |  |

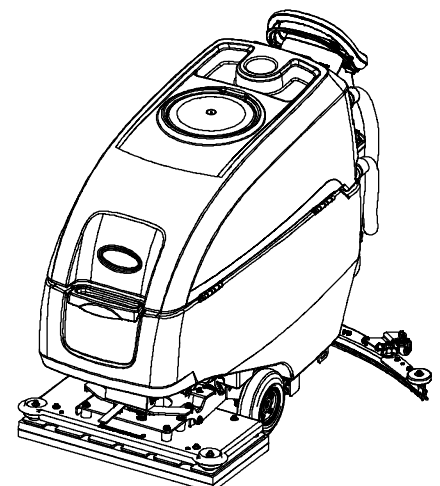
**SCRUB HEAD TYPES**



26 in / 650 mm Dual Disk  
 28 in / 700 mm Dual Disk  
 32 in / 800 mm Dual Disk



28 in / 700 mm Cylindrical Brush



28 in / 700 mm Orbital Pad

# OPERATION

## CONTROL PANEL COMPONENTS



1. 1-Step button
2. Brush pressure button
3. Brush pressure indicator
4. Solution flow button
5. Solution flow indicator
6. Service Indicator
7. Battery discharge indicator (BDI)
8. ec-H2O indicator (option)
9. Automatic battery watering indicator (option)

## MACHINE SYMBOLS

	Read Manual		Parking brake
	Fast speed (drive model)		Automatic Battery Watering Tank (Option)
	Slow speed (drive model)		No detergent (ec-H2O option)
	Forward / Reverse (drive model)		Water temperature (ec-H2O option)
	Key On		Circuit breaker
	Key Off		
	ec-H2O scrubbing (option)		
	Battery charge		
	Do not power spray		

## INSTALLING BATTERIES

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

**FOR SAFETY:** When servicing machine, wear appropriate personal protection equipment as needed. Avoid contact with battery acid.

### BATTERY SPECIFICATIONS

Requires four 6 volt deep-cycle batteries, ≤ 260 Ah @ 20 hr.

Contact distributor or Tennant for battery recommendations.

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

1. Lift the recovery tank to access the battery compartment (Figure 1).



FIG. 1

2. Carefully install the batteries into the battery compartment tray and arrange the battery posts as shown (Figure 2). Position foam spacer between batteries as shown.

**FOR SAFETY:** When servicing machine, use a hoist or adequate assistance when lifting batteries.

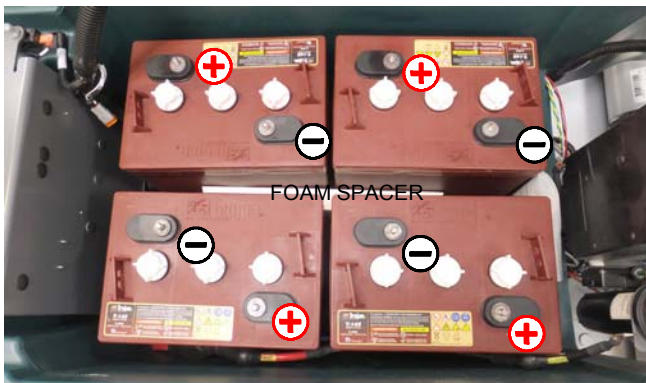


FIG. 2

3. Using the supplied battery post boots, connect the cables to battery posts, RED TO POSITIVE (+) & BLACK TO NEGATIVE (-) (Figure 3).

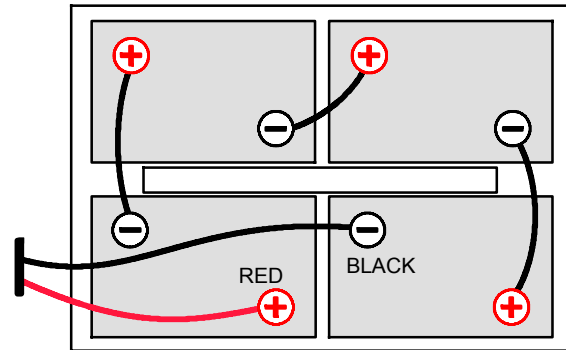


FIG. 3

**IMPORTANT:** Before charging batteries, make sure the battery charger and the machine's battery discharge indicator are properly set for battery type. Failure to properly set will result in battery damage. See **BATTERY CHARGER SETTINGS**.

**ATTENTION:** Do not disconnect battery cables while charger is plugged in, circuit board damage may result.

### ***IRIS® Battery Charging Metrics Notification:***

*Machines equipped with capability to report battery charging data via IRIS are supplied with a charger and set of batteries from the factory. When a battery reaches its end of life and must be replaced, Tennant highly recommends that the same battery type be used to continue to maximize the machines performance. In the event a battery with a different amp hour (AH), type (Flooded, AGM, Gel), or manufacturer is selected for replacement please contact Tennant technical service department for assistance in determining the feasibility of the replacement batteries and if so, selecting the correct charging profile. Availability of IRIS battery metric reporting is not guaranteed with third party supplied batteries.*

## HOW THE MACHINE WORKS

### **Conventional scrubbing:**

When using the conventional scrubbing mode, water and detergent mixture from the solution tank flows to the floor and the rotating brush(es)/pad(s) scrub the floor clean. As the machine moves forward, the squeegee with vacuum suction picks up the dirty solution from the floor into the recovery tank.

### **ec-H2O NanoClean Technology (option):**

When using the ec-H2O NanoClean technology, normal water passes through a module where it is electrically converted into a cleaning solution. The electrically converted water attacks the dirt, allowing the machine to easily scrub away the suspended soil. The converted water then returns to normal water in the recovery tank.

## OPERATION

### BRUSH AND PAD INFORMATION

For best cleaning results use the appropriate brush or pad for your cleaning application. Listed below are brushes and pads and the applications for which each is best suited.

*NOTE: The amount and type of soilage play an important role in determining the type of brush or pad to use. Contact a Tennant representative for specific recommendations.*

#### **Soft nylon bristle scrub brush (White) -**

Recommended for cleaning coated floors without removing finish. Cleans without scuffing.

#### **Polypropylene bristle scrub brush (Black) -**

This general purpose polypropylene bristle scrub brush is used for scrubbing lightly compacted soilage. This brush works well for maintaining concrete, wood and grouted tile floors.

#### **Super abrasive bristle scrub brush (Gray) -**

Nylon fiber impregnated with abrasive grit to remove stains and soilage. Strong action on any surface. Performs well on buildup, grease, or tire marks.

#### **Polishing pad (White) -**

Used to maintain highly polished or burnished floors.

**Buffing pad (Red) -** Used for light duty scrubbing without removing floor finish.

**Scrubbing pad (Blue) -** Used for medium to heavy-duty scrubbing. Removes dirt, spills, and scuffs and leaves surface clean ready for re-coating.

**Stripping pad (Brown) -** Used for stripping of floor finish to prepare the floor for re-coating.

**Heavy duty stripping pad (Black) -** Used for aggressive stripping of heavy finishes/sealers, or very heavy duty scrubbing.

**Surface preparation pad (Maroon) -** Used for very aggressive chemical free removal of floor finish to prepare the floor for re-coating.

**Turf scrubbing pad (Green) -** Used to scrub uneven floor surfaces with crevices, cracks and deep grout lines.

### MACHINE SETUP

#### ATTACHING SQUEEGEE ASSEMBLY

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

1. Lift the squeegee mount bracket to the raised position. Place foot under pedal to lift (Figure 4).



FIG. 4

2. Mount the squeegee assembly to the squeegee mount bracket (Figure 5). Tighten knobs to secure squeegee assembly to bracket.

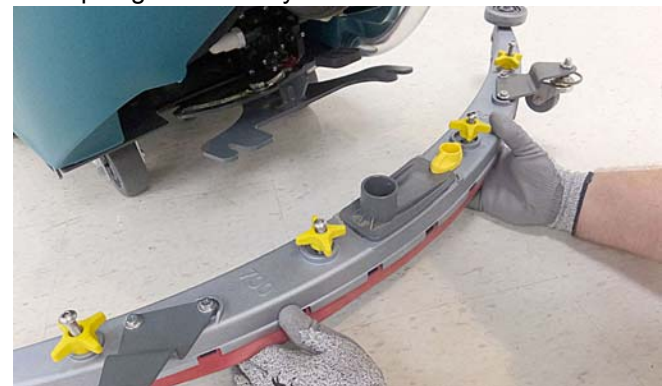


FIG. 5

3. Connect the vacuum hose to the squeegee assembly (Figure 6).

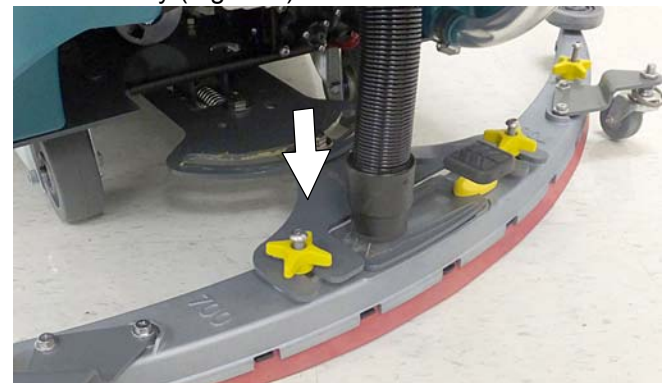


FIG. 6

5. Check the squeegee blades for proper deflection. The blades should deflect as shown (Figure 7).



FIG. 7

6. To adjust the blade deflection, loosen the jam nut and turn the caster hex plate until there is a 1/16" (2mm) space between caster and floor. Re-tighten jam nut and repeat step on other caster (Figure 8).

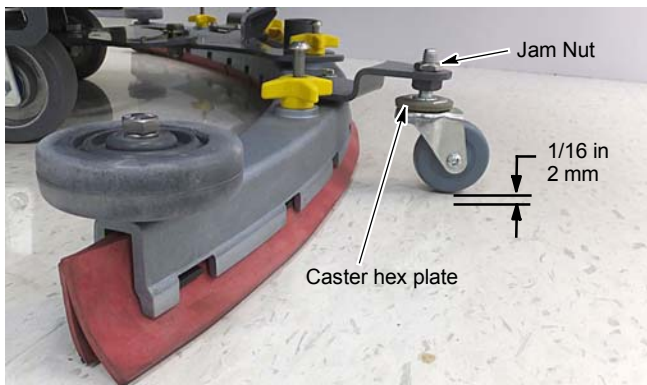


FIG. 8

### INSTALLING DISK BRUSHES/PADS (Disk Scrub Head Model)

1. Raise scrub head off floor and remove key.

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

2. Attach the pad to the pad driver before installing the driver. Secure pad with center-lock (Figure 9).

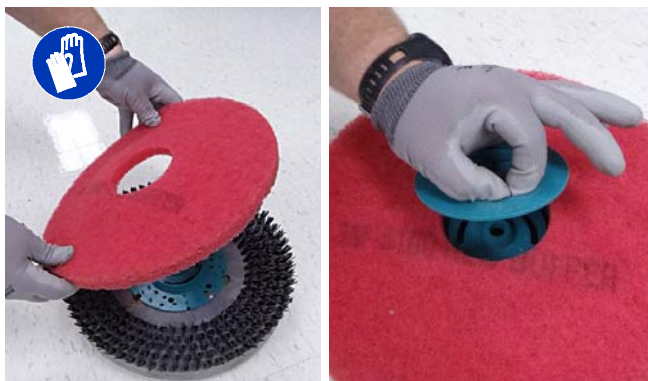


FIG. 9

**FOR SAFETY: Do not operate machine with pads or accessories not supplied or approved by Tennant. The use of other pads may impair safety.**

3. Set the yellow spring clips to the open position to make brush installation easier. Press clips down and outward to set (Figure 10).

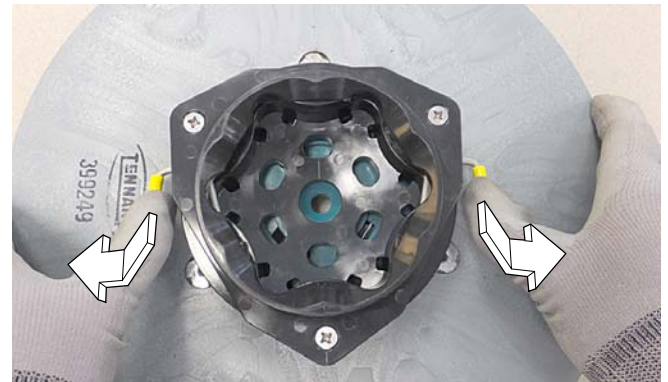


FIG. 10

4. Align the pad driver or brush under the motor hub and push it upward to engage hub (Figure 11). Replace pads or brushes when they no longer clean effectively or when the bristles on the brush disk are worn to the yellow indicator (Figure 11).

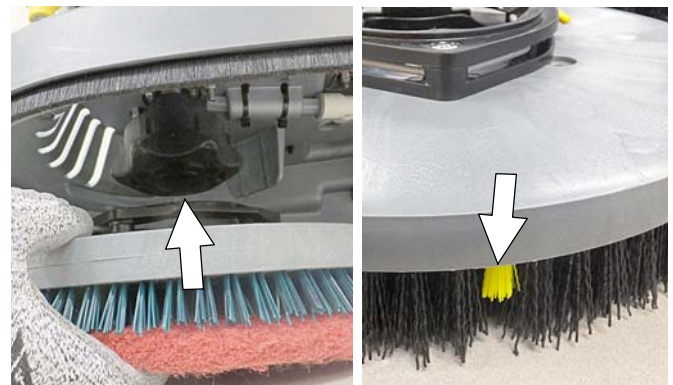


FIG. 11

5. To remove the pad drivers/brushes, raise the scrub head and press down on the yellow pad release plunger (Figure 12). Pad will drop to floor.



FIG. 12

# OPERATION

## INSTALLING ORBITAL PADS (Orbital Scrub Head Model)

(Orbital Scrub Head Model)

For best cleaning performance and to avoid damaging the pad driver plate or floor surface, always use backer pad with working pads (Figure 13).

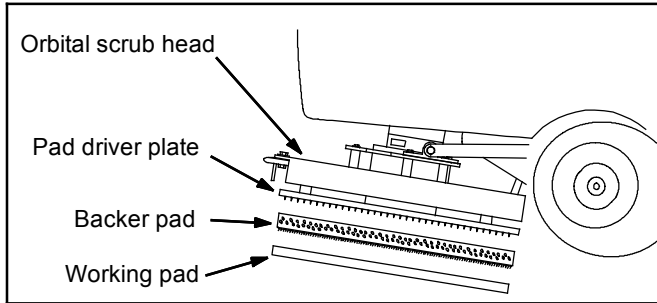


FIG. 13

1. Raise scrub head off floor and remove key.

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

**FOR SAFETY: Do not operate machine with pads or accessories not supplied or approved by Tennant. The use of other pads may impair safety.**

2. Attach backer pad, retaining strips facing downward, to working pad (Figure 14).



FIG. 14

3. Attach the two pads to the bottom of the scrub head (Figure 15). Make sure pad is centered on scrub head.

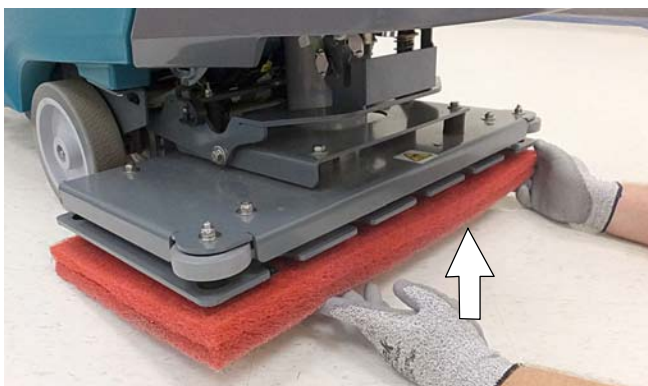


FIG. 15

## INSTALLING CYLINDRICAL BRUSHES (Cylindrical Brush Scrub Head Model)

(Cylindrical Brush Scrub Head Model)

1. Raise scrub head off floor and remove key.

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

2. Unfasten yellow latch and remove the idler plate from the scrub head (Figure 16).



FIG. 16

3. Attach idler plate to brush end with double row of bristles (Figure 17).

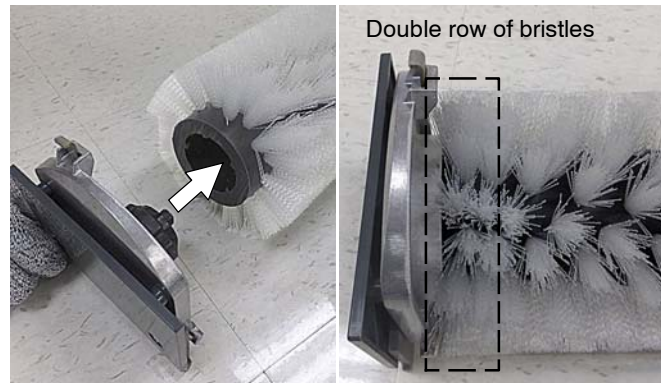


FIG. 17

4. Guide brush onto the drive hub and refasten latch (Figure 18).

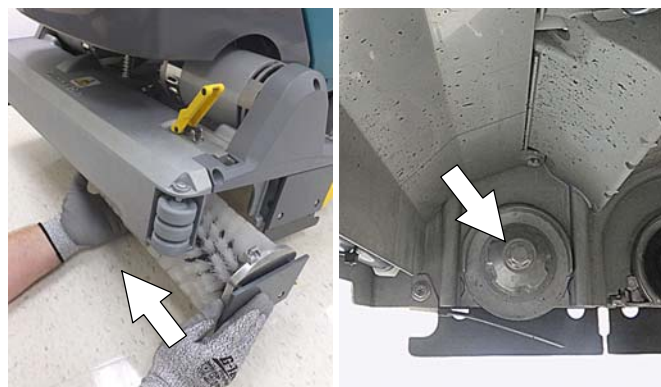


FIG. 18

**FILLING SOLUTION TANK**

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

The machine is equipped with two solution tank fill-port locations. A front bucket fill-port and a rear hose fill-port (Figure 19).



FIG. 19

1. Fill the solution tank with water until level reaches the "3/3" mark on the solution tank drain hose indicator (Figure 20).

**ec-H2O Scrubbing (Option)-** Fill solution tank with only cool clean water (less than 70°F/21°C). Do not add conventional floor cleaning detergents. An ec-H2O system fault will occur if cleaning detergents are added.

**Conventional Scrubbing -** Fill solution tank with water (not to exceed 60°C/140°F). Pour a recommended cleaning detergent into the solution tank according to mixing instructions on the container.

**ATTENTION:** For Conventional Scrubbing, only use commercially approved cleaning detergents. Machine damage due to improper detergent usage will void the manufacturer's warranty.

**⚠ WARNING: Flammable materials can cause an explosion or fire. Do not use flammable materials in tank(s).**

*NOTE: Do not use the ec-H2O system when there are conventional cleaning detergents in the solution tank. Drain, rinse, and refill the solution tank with clear cool water before operating the ec-H2O system. Conventional cleaning detergents will cause an ec-H2O system fault.*



FIG. 20

2. Replace the front and rear fill-port cover after filling solution tank (Figure 21).

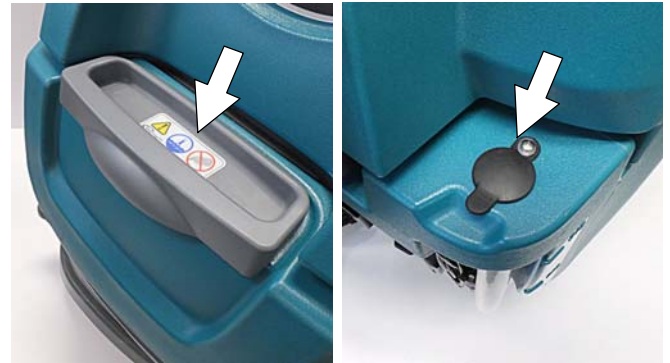


FIG. 21

**FILLING AUTOMATIC BATTERY WATERING TANK (OPTION)**

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

1. Lift the recovery tank to access the automatic battery watering tank (Figure 22). Drain recovery tank before lifting tank.

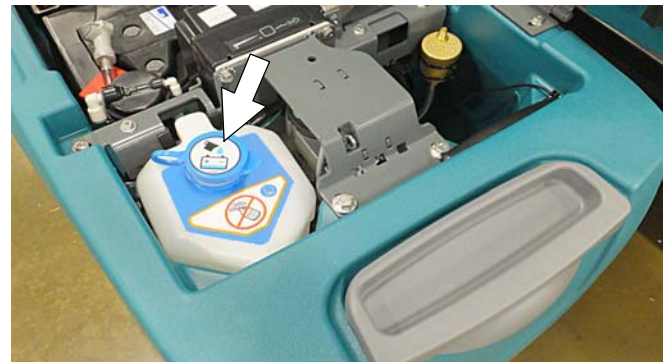


FIG. 22

2. Remove the blue cap from the automatic battery watering tank (Figure 23).
3. Pour distilled water into tank (Figure 23).

**FOR SAFETY: When operating machine, only use distilled water when filling the automatic battery watering tank.**



FIG. 23

## OPERATION

- When the tank needs refilling, the automatic battery watering indicator will alert user to add distilled water (Figure 24). See CONTROL PANEL OPERATION for further details.



FIG. 24

### ec-H2O WATER CONDITIONING CARTRIDGE (ec-H2O MODEL)

The ec-H2O system is equipped with a water conditioning cartridge (Figure 25). The cartridge is designed to protect the machine's plumbing system from potential scaling.

The cartridge is required to be replaced when it reaches its maximum water usage or expiration time on when the cartridge was activated, whichever comes first.

Depending on machine usage a new cartridge can last anywhere from 12 to 24 months.



FIG. 25

The control panel will signal the following code when it's time to replace the cartridge (Figure 26). The ec-H2O icon will begin to blink blue and red. See SERVICE INDICATOR CODES for further details.

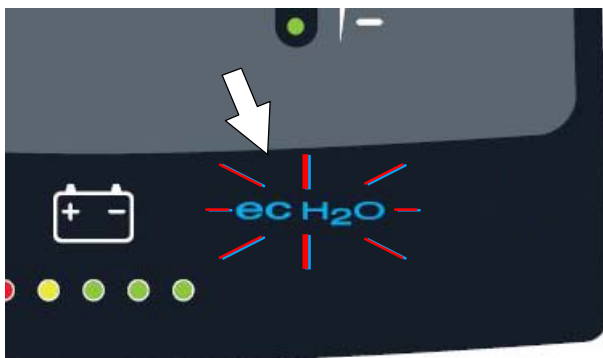


FIG. 26

All cartridges are labeled with a manufacture date. The shelf-life of an un-installed cartridge is one year from manufacture date. For new cartridge replacement, the ec-H2O module timer must be reset. See ec-H2O WATER CONDITIONING CARTRIDGE REPLACEMENT.

**ATTENTION:** During first time use and after replacing the water conditioning cartridge, the ec-H2O system will automatically override the selected solution flow rate for up to 75 minutes.

## CONTROL PANEL OPERATION

### 1-STEP BUTTON

With key turned on, press the 1-STEP button to activate the scrub function (Figure 27). The scrub head will lower to floor. Press button again to stop the scrub function and to raise scrub head.



FIG. 27

### BRUSH PRESSURE BUTTON

Press the brush pressure button to increase or decrease the brush pressure (Figure 28). The brush pressure indicator will display the pressure setting. One LED = Low pressure, two LED's = High pressure.



FIG. 28

**NOTE:** Orbital scrub head model - If brush pressure is set too high for scrubbing conditions, the brush pressure setting will automatically reduce to a lower setting and begin flashing. The flashing LED alerts the operator to reduce the brush pressure setting to prevent brush motor overload.



**SOLUTION FLOW BUTTON**

Press the solution flow button to increase or decrease the solution flow rate (Figure 29). The solution flow indicator will display flow setting. No LED = No flow, One LED = Low flow, two LED's = Medium flow, three LED's = High flow.



FIG. 29

**ec-H2O INDICATOR (Option)**

The ec-H2O system automatically turns on at each key start. A blue ec-H2O indicator will appear on the control panel indicating that the system is activated. To turn off the ec-H2O system, press the ec-H2O switch located below the key switch. The blue ec-H2O indicator will disappear (Figure 30).

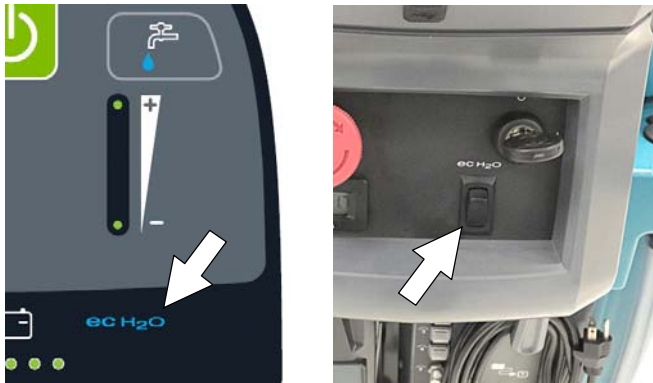


FIG. 30

ec-H2O INDICATOR	CONDITION
Solid blue	Normal operation
Blinking blue/red	Water conditioning cartridge expired. Replace cartridge.
Solid or blinking red	A system fault has occurred. See Service Indicator Codes.

**NOTE:** If a fault occurs to the ec-H2O system, the machine will automatically turn off the ec-H2O system and convert over to conventional scrubbing. The service indicator icon will remain solid red or continue to blink red until the ec-H2O fault is serviced.

**SERVICE INDICATOR**

When the machine or on-board battery charger detects a fault, the service indicator will light up and begin flashing (Figure 31). The battery discharge indicator lights will also flash a fault code. See SERVICE INDICATOR CODES to diagnose machine fault.

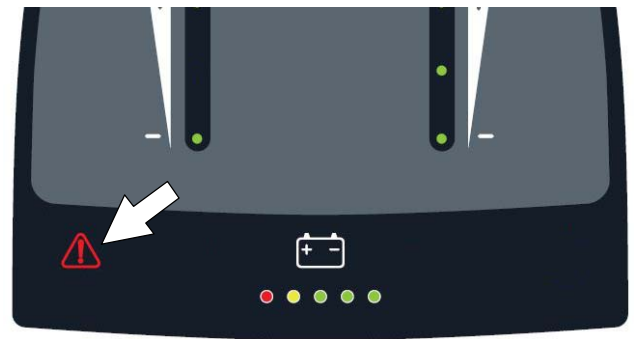


FIG. 31

**BATTERY DISCHARGE INDICATOR**

The battery discharge indicator (BDI) displays the charge level of the batteries while the machine is operating. When the batteries are fully charged, all five indicators are lit (Figure 32). When the discharge level reaches the red light, stop scrubbing and recharge the batteries. When the red light begins to flash, the scrub function will be disabled to protect the batteries from total discharge. The machine will still propel when the red light is flashing. This will allow user to transport the machine to the charging station.

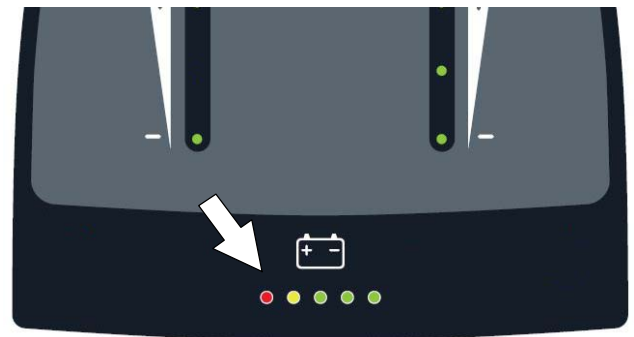


FIG. 32

**AUTOMATIC BATTERY WATERING INDICATOR (Option)**

The automatic battery watering indicator will flash when the battery watering tank is empty and needs refilling (Figure 33).

To protect the batteries from damage, the machine's scrub function will be disabled after 10 hours of continued use if tank is not refilled. When the indicator flashes rapidly, the scrub function will be disabled. Add distilled water and restart key to clear the flashing indicator. See FILLING AUTOMATIC BATTERY WATERING TANK.

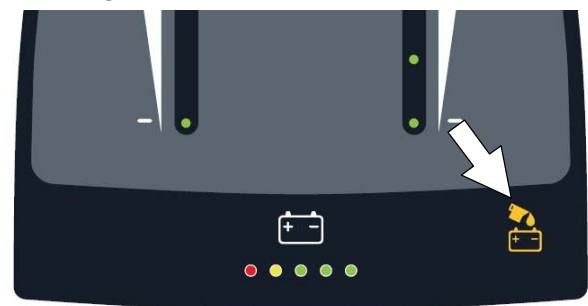


FIG. 33

# OPERATION

## MACHINE OPERATION

**FOR SAFETY: Do not operate machine unless operator manual is read and understood.**

### PRE-OPERATION CHECK LIST

- Sweep area and remove any obstructions.
- Check brushes/pads for wear and damage.
- Check squeegee blades for wear and damage.
- Confirm recovery tank is empty, debris tray is clean and the float shut-off screen is installed and clean.
- Check scrub head skirt for wear and damage.
- Cylindrical brush model - confirm debris trough is empty and clean.
- ec-H2O Scrubbing: Confirm solution tank is filled with clear cool water only.
- ec-H2O Scrubbing: Confirm all conventional cleaning agents/restorers are drained and rinsed from solution tank.
- Check machine for proper operation.

### OPERATING MACHINE

For control panel operating instructions, see CONTROL PANEL OPERATION.

1. Release the parking brake lever, if equipped (Figure 34)
2. Turn the key to the on ( I ) position (Figure 34).

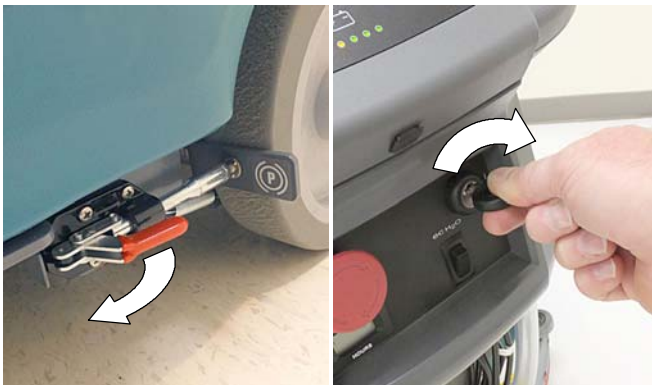


FIG. 34

3. ec-H2O models - The ec-H2O system will automatically turn on at key start up. The ec-H2O indicator will appear on the control panel indicating that the system is activated (Figure 35).

**ATTENTION:** When conventional scrubbing with cleaning detergents in solution tank, make sure to turn off the ec-H2O system by pressing the ec-H2O switch (Figure 35). If cleaning detergent is accidentally cycled through ec-H2O system, a system fault will occur. To clear fault, drain solution tank, add clear water and operate the ec-H2O system to clear fault. If fault repeats, continue to recycle key until fault clears. See SERVICE INDICATOR CODES for further detail.

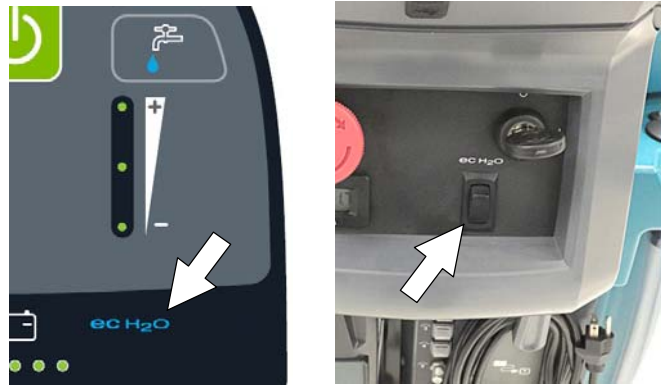


FIG. 35

4. Lower the squeegee assembly to floor by stepping on foot pedal (Figure 36). To raise squeegee assembly, place foot under foot pedal and lift. The vacuum motor will automatically start when squeegee is lowered to floor.

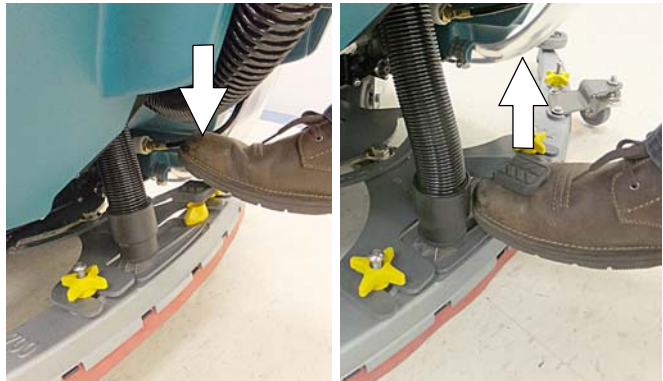


FIG. 36

5. Press the 1-STEP button to activate the scrub function (Figure 37). The scrub head will lower to floor.



FIG. 37

6. Push the directional lever forward to go forward (Figure 38). Pull the lever back to maneuver machine in reverse. Lift squeegee assembly when backing machine.



FIG. 38

7. To begin scrubbing, pull the start bail (Figure 39).



FIG. 39

8. Adjust the scrubbing speed by turning the speed dial to the desired speed (Figure 40).



FIG. 40

9. To stop scrubbing, release the start bail, press the 1-STEP button and raise the squeegee assembly off floor. Turn key off and set parking brake, if equipped.

*NOTE: To pick up any remaining water left on floor after scrub head is raised continue to drive machine forward with squeegee down.*

### EMERGENCY SHUT-OFF BUTTON

Push the emergency shut-off button in the event of an emergency (Figure 41). This red button shuts off all power to machine. To regain power, turn the button clockwise and restart the key.



FIG. 41

### WHILE OPERATING MACHINE

**⚠ WARNING: Flammable materials or reactive metals can cause an explosion or fire. Do not pick up.**

1. Overlap each scrub path by 2 inches/5 cm.
2. Keep machine moving to prevent damage to floor finish.
3. Wipe squeegee blades with a cloth if blades leave streaks.
4. Avoid bumping the machine into posts and walls.
5. When draining and refilling machine, always top off the optional Severe Environment tank with detergent.

**FOR SAFETY: When operating machine, the machine may only be operated on gradients up to 2%.**

6. Pour a recommended foam control solution into the recovery tank if excessive foam appears.

**ATTENTION:** Foam buildup will not activate the float shut-off screen, vacuum motor damage will result.

7. Use the double scrubbing method for heavily soiled areas. First scrub the area with the squeegee up, let solution set for 3-5 minutes, then scrub the area a second time with squeegee down.
8. Orbital Scrub Head Model - Use caution when working near the tile cove (Figure 42) and floor mounted fixtures such as pedestal sinks and other breakable items. Keep the metal scrub head edge away to avoid possible damage.

## OPERATION

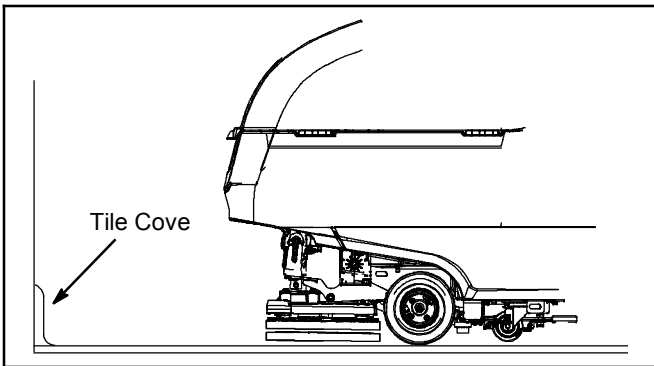


FIG. 42

9. When leaving the machine unattended, park on level surface, turn machine off, remove key and set the parking brake, if equipped.
10. Do not operate machine in areas where the ambient temperature is above 110°F/43°C or below freezing 36°F/2°C.

### CIRCUIT BREAKER PANEL

The machine is equipped with resettable circuit breakers to protect the machine from a current overload (Figure 43). If a circuit breaker trips, disconnect the battery cable connection and reset the breaker by pressing the reset button after the breaker has cooled down. Reconnect the battery cable connection. If the circuit breaker does not reset or continues to trip contact service personnel.



FIG. 43

Circuit Breaker	Rating	Circuit protected
CB1	4 A	Key switch, circuit
CB2	10 A	ec-H <sub>2</sub> O system, automatic battery watering system
CB3	10 A	Scrub head lift actuator
CB4	20 A	Vacuum motor
CB5	25 A	Left brush motor
CB6	25 A	Right brush motor
CB7	60 A	Propel

**FOR SAFETY:** When servicing machine, all repairs must be performed by trained personnel.

### HOUR METER

The hour meter records the number of hours the machine has been operated. Use the hour meter to perform specific maintenance procedures and to record service history (Figure 44).



FIG. 44

### DRAINING TANKS

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

#### DRAINING RECOVERY TANK

Drain and clean the recovery tank after each use.

1. Transport the machine to drain area.
2. For models equipped with drain hose caps, hold the hose upward, remove cap then slowly lower hose to drain. For models equipped with flow control valve drain hose, lower hose and slowly open valve to drain (Figure 45).

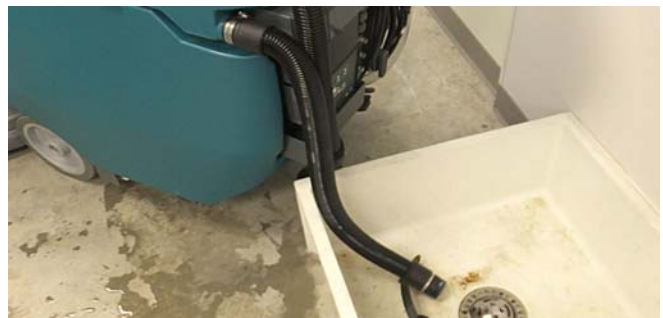


FIG. 45

**NOTE:** When using a bucket to drain the machine, do not use the same bucket to fill the solution tank.

- Remove and clean the float shut-off screen (Figure 46).



FIG. 46

- Rinse out the recovery tank with clean water and wipe clean of any soil residue (Figure 47).



FIG. 47

### DRAINING SOLUTION TANK

Drain the solution tank daily.

- Transport the machine to drain area.

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

- To drain remaining water from solution tank, pull the solution tank level hose from the accessory rail (Figure 48). Firmly reconnect the hose to the accessory rail after draining tank.



FIG. 48

- Rinse solution tank with clean water (Figure 49).



FIG. 49

- Remove the solution tank filter and clean screen after every 50 hours of use (Figure 50). Solution filter is located under machine at rear. Drain solution tank before removing filter.

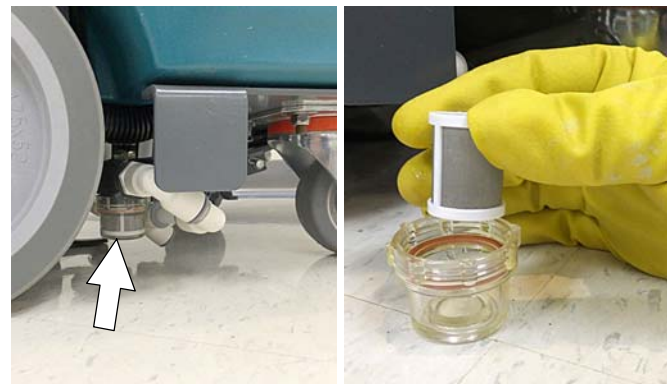
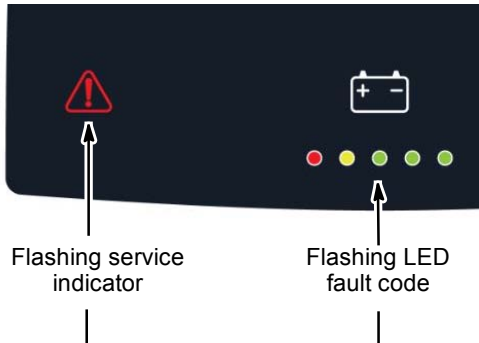


FIG. 50

# OPERATION

## SERVICE INDICATOR CODES

When the machine or battery charger detects a fault, the service indicator will flash. A fault code will be provided to determine problem as described below.

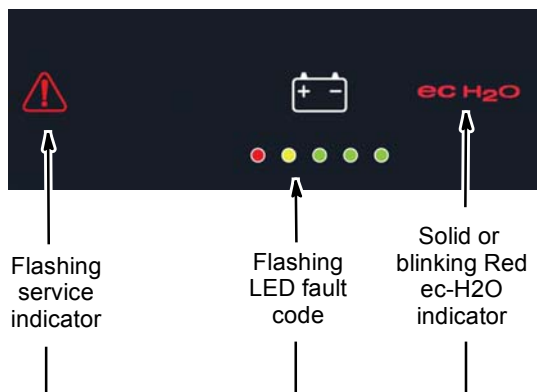


LED Fault Code ☀ = Flashing	CAUSE	SOLUTION
☀ ☀ ☀ ☀ ☀	Emergency shut-off button activated	Release emergency shut-off button and restart machine
• ☀ ☀ • ☀	Head lift actuator relay wiring problem	Check connections. Contact service.
• ☀ • • ☀	Solution valve wiring, connector or control board problem	Check connections. Contact service
• ☀ • ☀ ☀	Solution valve over current.	Contact service
• • ☀ • •	Brush motor relay wiring, connector or control board problem	Contact service
• • ☀ • ☀	Head lift actuator relay wiring, connector or control board problem	Contact service
• • ☀ ☀ •	Propel circuit breaker tripped	Reset circuit breaker. If fault repeats, contact service.
• • ☀ ☀ ☀	Propel motor wiring, connector or control board problem	Contact service
☀ • • • ☀	Propel faults	Restart machine. If fault repeats, contact service.
☀ • • ☀ •	Battery watering pump wiring, connector or control board problem.	Contact service
☀ • • ☀ ☀	Brush motor relay short fault	Check pad for floor type. If fault repeats contact service.
☀ • ☀ • ☀	Start bail is pulled or obstructed before turning machine on.	Release start bail or remove bail obstruction before turning machine on.
☀ • ☀ ☀ •	Battery watering pump board fault ec-H2O pump control board fault	Disconnect battery cable connection and contact service to replace control board.
☀ ☀ • ☀ •	Battery watering system fault	Contact service
• ☀ ☀ ☀ •	Charger communication fault Scrub control board communication fault ec-H2O system communication fault Battery watering CAN fault	Restart. If fault repeats, contact service.

**ON-BOARD BATTERY CHARGER SERVICE INDICATOR CODES**

LED Fault Code ☀= Flashing	CAUSE	SOLUTION
☀ ☀ ☀ • •	Charger error condition. Charger timer exceeded maximum charging time. Interrupts charging cycle.	Contact service Replace batteries
• ☀ ☀ • •	Charger is not connected to battery pack	Check cable connections
• ☀ • • •	Charger overheated	Let charger cool. Move to well ventilated area. Charge batteries in areas with temperatures 80°F/27°C or less. If fault persists, contact service.
• ☀ ☀ ☀ •	Charger communication fault	Restart charger. If fault code persists, contact service.

**ec-H2O SYSTEM SERVICE INDICATOR CODES - OPTION**

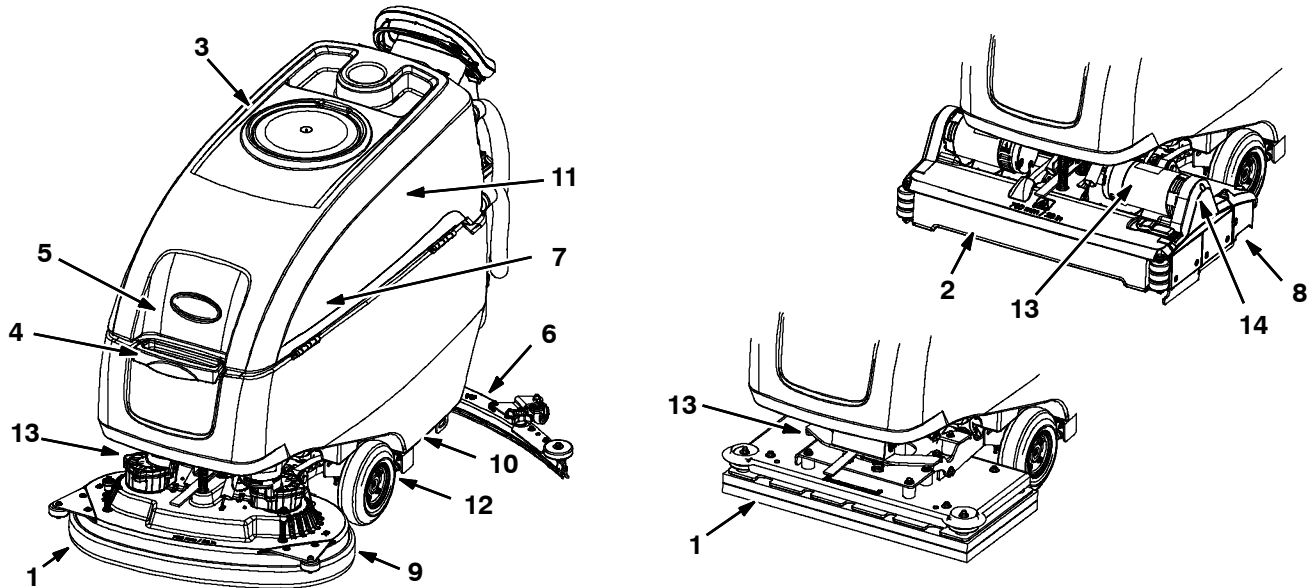


LED Fault Code ☀= Flashing	CAUSE	SOLUTION
• ☀ • ☀ •	ec-H2O pump wiring, connector or control board problem.	Contact service
• ☀ ☀ ☀ ☀ ☀	ec-H2O pump over current	Contact service
☀ • ☀ • •	ec-H2O system breaker tripped ec-H2O pump breaker tripped	Reset circuit breaker. If trip repeats, contact service.
ecH2O indicator solid red	ec-H2O electrical fault	Contact service
ecH2O indicator blinking red*	ec-H2O system water and plumbing fault	Contact service
ecH2O indicator blinking blue/red	Water system conditioning cartridge expired	Replace water conditioning cartridge.

\*Verify if cleaning detergent was added to solution tank. If ec-H2O system was operated with cleaning detergent, drain solution tank, add clear water and operate the ec-H2O system until the fault code clears. If fault repeats, continue to recycle key until fault clears.

# MAINTENANCE

## MAINTENANCE CHART



Interval	Person Resp.	Key	Description	Procedure
Daily	O	1	Pads	Check, flip or replace
	O	1	Brushes	Check, clean
	O	2	Cylindrical brushes	Check, clean
	O	3	Recovery tank	Drain, rinse, clean float shut-off screen and debris tray
	O	4	Solution tank	Drain, rinse
	O	5	Automatic battery watering tank (option)	Check, refill
	O	6	Squeegee	Clean, check for damage and wear
	O	7	Batteries	Charge if necessary
	O	8	Debris trough	Clean
	O	9	Scrub head skirt	Check for damage and wear
Weekly	O	7	Battery cells	Check electrolyte level
	O	6	Squeegee assembly drip trap reservoir	Check, clean
50 Hours	O	2	Cylindrical brushes.	Rotate brushes. Check for wear
	O	2	Cylindrical scrub head	Clean underside of scrub head
	O	3	Recovery tank lid seal	Check for wear.
	O	10	Solution tank filter	Remove and clean
100 Hours	O	7	Battery watering system (option)	Check hoses for damage and wear
200 Hours	O	7	Batteries, terminals and cables	Check and clean
750 Hours	T	11	Vacuum motor	Replace carbon brushes
1250 Hours	T	12	Propel motor	Replace carbon brushes
	T	13	Brush motor	Replace carbon brushes
	T	14	Brush belt	Replace belt

O = Operator T = Trained Personnel



**MACHINE MAINTENANCE**

To keep the machine in good working condition, simply perform the following maintenance procedures.

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

**FOR SAFETY:** When servicing machine wear personal protection equipment as needed. All repairs must be performed by trained personnel

**AFTER DAILY USE**

1. Drain and rinse out the recovery tank (Figure 51). See DRAINING TANKS.



FIG. 51

2. Remove and clean the float shut-off screen (Figure 52).



FIG. 52

3. Drain and rinse out the solution tank (Figure 53).



FIG. 53

4. Disk scrub head - Turn pad over or replace when worn (Figure 54).

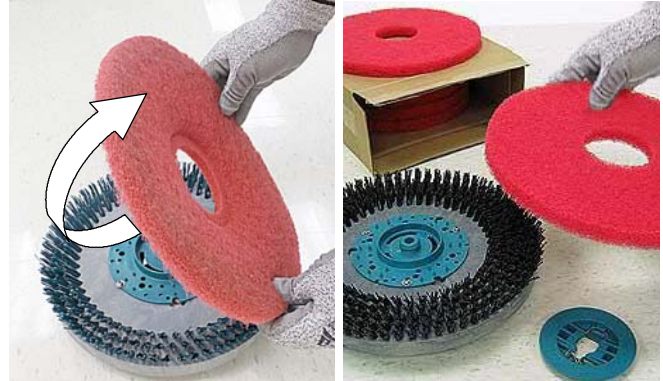


FIG. 54

5. Replace brushes when they no longer clean effectively or when the bristles are worn to the yellow indicator (Figure 55).



FIG. 55

Orbital scrub head - Turn the working pad over or replace when worn (Figure 56).

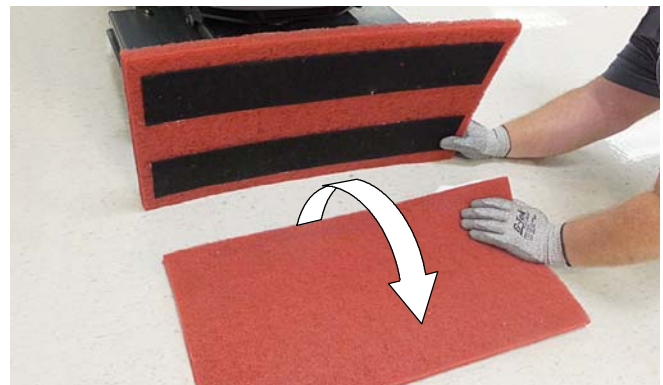


FIG. 56

## MAINTENANCE

6. Wipe the squeegee blades clean. Inspect blades for wear and damage (Figure 57). Rotate blade if worn. See SQUEEGEE BLADE REPLACEMENT.



FIG. 57

7. Clean scrub head skirt. Check for wear or damage (Figure 58). Replace if worn or damaged.



FIG. 58

8. Clean the outside surface of the machine with an all purpose cleaner and damp cloth (Figure 59).

**FOR SAFETY: When servicing machine, do not power spray or hose off machine. Electrical malfunction may occur. Use damp cloth.**



FIG. 59

9. Cylindrical brush scrub head - Remove and clean debris trough (Figure 60).



FIG. 60

10. Automatic battery watering option - Refill tank with distilled water (Figure 61). Replace cap.



FIG. 61

11. Charge batteries (Figure 62). See BATTERIES.



FIG. 62

**ATTENTION: Do not disconnect battery cables while charger is plugged in, circuit board damage may result.**

**AFTER WEEKLY USE**

1. Check the electrolyte level in all batteries (Figure 63). See BATTERIES.

*NOTE: If machine is equipped with the automatic or manual battery watering system, See BATTERIES.*

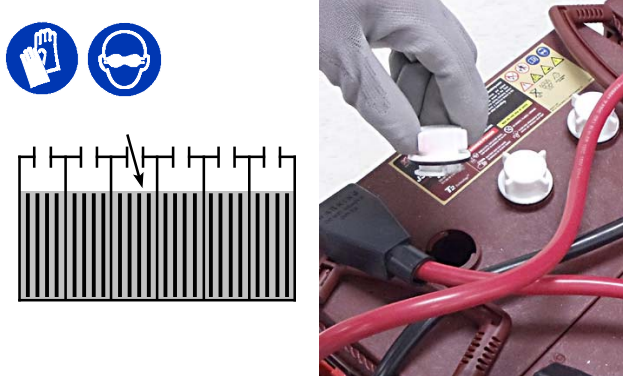


FIG. 63

2. Remove the drip trap cover from the squeegee assembly and clean reservoir (Figure 64).



FIG. 64

**AFTER EVERY 50 HOURS OF USE**

1. Drain solution tank. Remove the solution tank filter and clean screen (Figure 65). Turn the filter bowl counter-clockwise to remove.

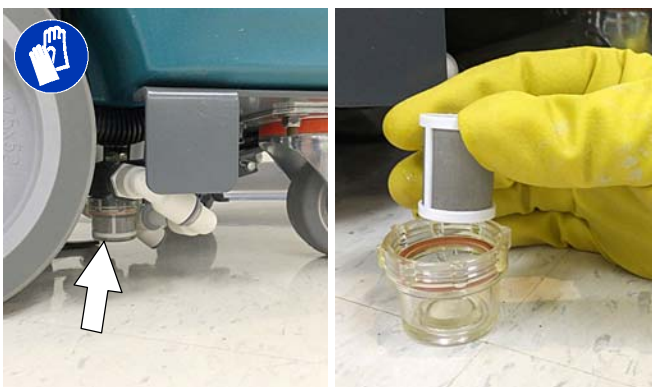


FIG. 65

2. Cylindrical brushes - Rotate brushes from front to rear (Figure 66). Replace brushes when they no longer clean effectively.

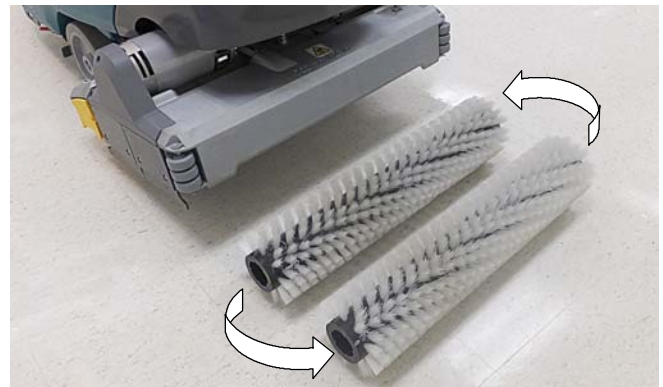


FIG. 66

3. Cylindrical scrub head - Remove debris buildup from underside of scrub head, including the idler plates and drive hubs (Figure 67).

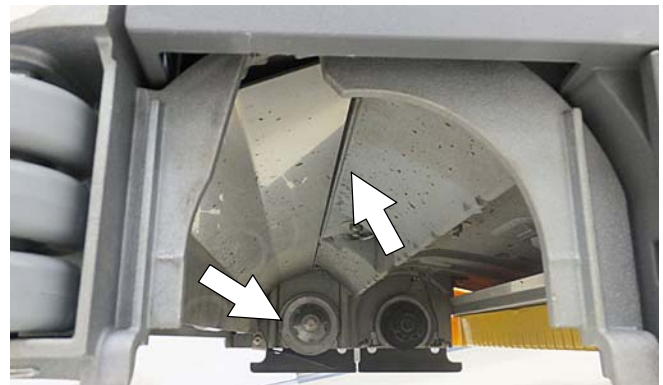


FIG. 67

**AFTER EVERY 100 HOURS OF USE**

If machine is equipped with the optional battery watering system, check hoses for leaks, loose hose connections and for damage or wear (Figure 68). Replace system if damaged.

**FOR SAFETY: When servicing batteries, wear personal protection equipment as needed. Avoid contact with battery acid.**



FIG. 68

# MAINTENANCE

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## ELECTRIC MOTORS

Replace motor carbon brushes as indicated. Contact trained personnel for carbon brush replacement.

Carbon Brush Replacement	Hours
Vacuum motor	750
Propel motor	1250
Disk brush motors	1250
Cylindrical brush motors	1250
Orbital brush motor	1250

## BELTS (Cylindrical Brush Model)

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

Replace belts every 1250 hours. Contact trained personnel for belt replacement (Figure 69).

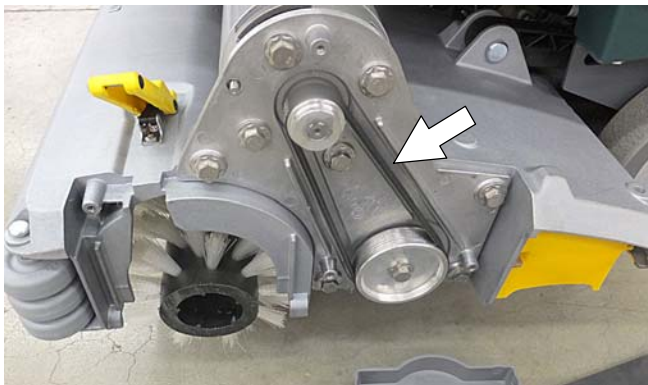


FIG. 69

## BATTERIES

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

The lifetime of the batteries depends on their proper maintenance. To get the most life from the batteries;

- Do not charge the batteries more than once a day and only after running the machine for a minimum of 15 minutes.
- Do not leave the batteries partially discharged for long period of time.
- Only charge the batteries in a well-ventilated area to prevent gas build up. Charge batteries in areas with ambient temperatures 80°F/27°C or less.
- Allow the charger to complete charging the batteries before re-using the machine.
- Maintain the proper electrolyte levels of flooded (wet) batteries by checking levels weekly.

Your machine is equipped with either flooded (wet) lead-acid or maintenance-free (Sealed AGM) batteries supplied by Tennant.

**FOR SAFETY:** When servicing machine, keep all metal objects off batteries. Avoid contact with battery acid.

### MAINTENANCE-FREE BATTERIES

Maintenance-free (Sealed AGM) batteries do not require watering. Cleaning and other routine maintenance is still required.

### FLOODED (WET) LEAD-ACID BATTERIES

The flooded (wet) lead-acid batteries require routine watering as described below. Check the battery electrolyte level weekly.

*NOTE: If machine is equipped with the automatic or manual battery watering system, proceed to the BATTERY WATERING SYSEM instructions.*

The electrolyte level should be slightly above the battery plates as shown before charging (Figure 70). Add distilled water if low. **DO NOT OVERFILL.** The electrolyte will expand and may overflow when charging. After charging, distilled water can be added up to about 3 mm (0.12 in) below the sight tubes.

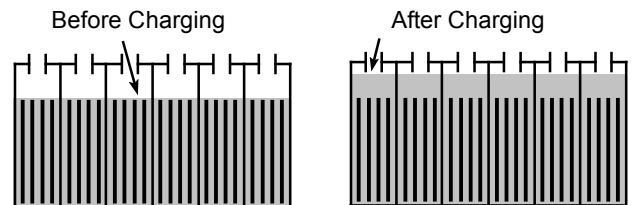
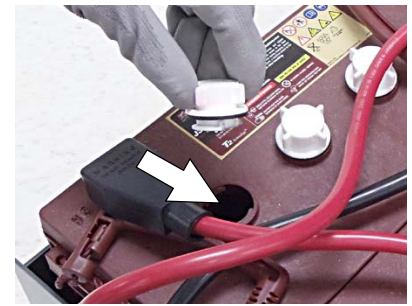


FIG. 70

*NOTE: Make sure the battery caps are in place while charging. There may be a sulfur smell after charging batteries. This is normal.*

### CHECKING CONNECTIONS / CLEANING

After every 200 hours of use, check for loose battery connections and clean the surface of the batteries, including terminals and cable clamps to prevent battery corrosion. Use a scrub brush with a strong mixture of baking soda and water (Figure 71). Do not remove battery caps when cleaning batteries.



FIG. 71

### CHARGING BATTERIES

The charging instructions in this manual are intended for the battery charger supplied with your machine. The use of other battery chargers that are not supplied and approved by Tennant are prohibited.

If your machine is equipped with an off-board battery charger refer to the charger's owners manual for operating instructions. Contact distributor or Tennant for battery charger recommendations if machine is not equipped with charger.

## MAINTENANCE

**FOR SAFETY:** The use of incompatible battery chargers may damage battery packs and potentially cause a fire hazard.

**IMPORTANT NOTICE:** The battery charger is set to charge the battery type supplied with your machine. If you choose to change to a different battery type or capacity (i.e. flooded (wet) lead-acid, maintenance-free, sealed, AGM batteries, etc.), the charger's charging profile must be changed to prevent battery damage. See BATTERY CHARGER SETTINGS.

1. Transport the machine to a well-ventilated area.

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

2. Park the machine on a flat, dry surface, turn off machine and remove key.

**FOR SAFETY:** When servicing batteries, stop on level surface, turn off machine, remove key and set parking brake if equipped.

3. If the machine is equipped with flooded (wet) lead-acid batteries check the battery electrolyte level weekly before charging. For models equipped with the automatic battery watering system, check if the automatic battery water tank needs refilling. Add distilled water if low.
4. For models equipped with an on-board charger, remove the charger's power cord from the storage hooks and plug power cord into a properly grounded wall outlet (Figure 72).



FIG. 72

For models equipped with off-board chargers, first connect the charger's DC cord into the machine's battery charge receptacle then plug the AC power supply cord into a properly grounded wall outlet (Figure 73). Refer to the off-board battery charger's owner manual for operating instructions.

**FOR SAFETY:** Do not disconnect the off-board charger's DC cord from the machine's receptacle when the charger is operating. Arcing may result. If the charger must be interrupted during charging, disconnect the AC power supply cord first.



FIG. 73

5. The charger will automatically begin charging and shut off when fully charged. The maximum charging cycle may take up to 6-12 hours depending on battery type.

On-board battery charger: The battery discharge indicator lights will ripple back and forth during the charging cycle. When all five lights repeatedly flash two times, the charging cycle is complete (Figure 74).



FIG. 74

**ATTENTION:** Do not disconnect battery cables while charger is plugged in, circuit board damage may result.

6. After charging batteries unplug the power supply cord and wrap cord around the cord hooks (Figure 75).

For models equipped with an off-board charger, always disconnect the AC power supply cord first before disconnecting charger from machine (Figure 75).

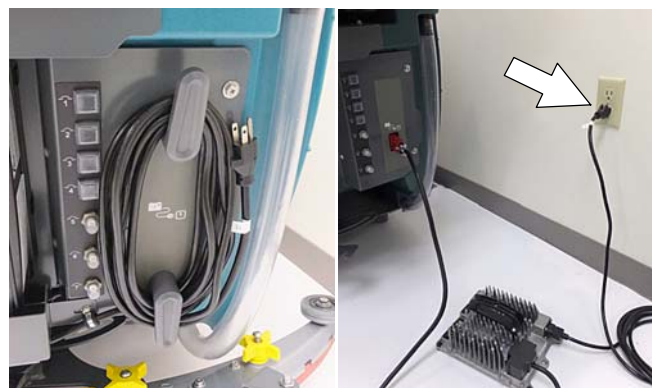


FIG. 75

### BATTERY CHARGER SETTINGS

The battery charger is set to charge the battery type supplied with your machine. If you choose to change to a different battery type or capacity, the charger's charging profile must be changed to prevent battery damage.

The machine's battery discharge indicator (BDI) must also be reprogrammed to match battery type to prevent battery damage and/or short run-time.

*NOTE: For machines shipped without batteries, the battery discharge indicator and the on-board battery charger are set for GEL batteries as the default. If you choose to use a different battery type, the settings must be changed as described as below.*

*NOTE: For machines shipped without batteries and supplied with an Off-Board Charger, the off-board battery charger is set for wet lead-acid batteries from the factory. The machine's battery discharge indicator is set for GEL batteries as the default. The battery discharge indicator must be reprogrammed to match charger settings, contact service.*

**IRIS MODELS:** For models equipped with capability to report battery charging data via IRIS, Tennant recommends using the same battery type. If a different amp hour or battery type is desired, contact Tennant Service Department.

#### OFF-BOARD BATTERY CHARGER:

To change the off-board battery charger settings, refer to the off-board charger's owner manual.

To reprogram the machine's battery discharge indicator (BDI), service application software is required, contact service.

#### ON-BOARD BATTERY CHARGER:

To change the on-board battery charger settings, service application software required, contact service.

As an alternative, the charger profile may be manually changed. See *CHANGING ON-BOARD BATTERY CHARGER SETTINGS*. The battery discharge indicator will automatically reprogram to match battery type when the battery charger profile is changed.

#### CHANGING ON-BOARD BATTERY CHARGER SETTINGS

To manually change the on-board battery charger settings for a different battery type, carefully follow instructions as described below :

*NOTE: The manual method is only an alternative if unable to change setting by use of the Service Application Software performed by Service.*

1. Disconnect the battery cable connection at machine (Figure 76).

**FOR SAFETY: When servicing machine, stop on level surface, turn off machine, remove key and set parking brake if equipped.**

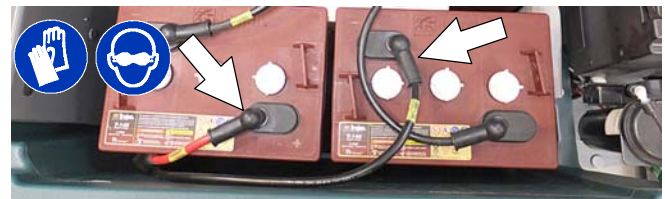


FIG. 76

2. Carefully peel back the charger display label to access the dial settings (Figure 77).

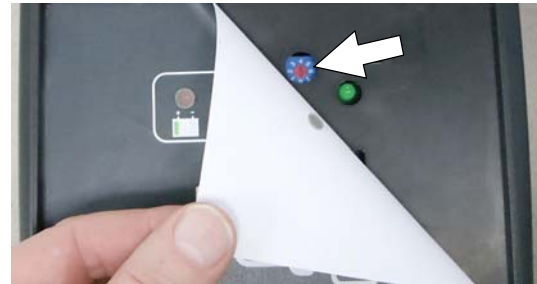


FIG. 77

3. Using a small standard screwdriver, turn the dial to the appropriate battery type according to the following chart (Figure 78).

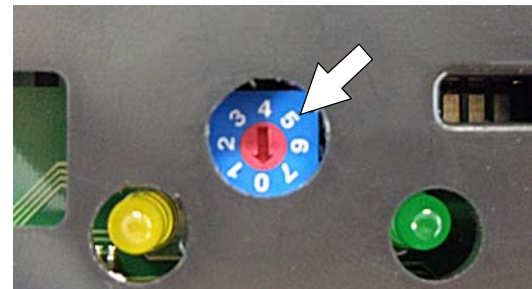


FIG. 78

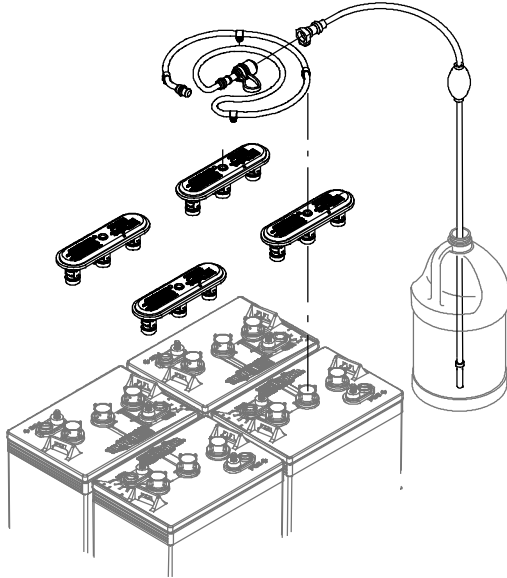
Dial Position	Battery Description Settings with AH Ranges
0	CAN-BUS setting*
1	Wet, Trojan 180-260 AH
2	Wet, Trojan 270-360 AH
3	Wet, Enersys/Tab 200-350 AH
4	AGM, Tianneng 180-260 AH
5	AGM, Discover 200-350 AH
6	Gel, Sonnenschein 80-150 AH

\* The CAN-BUS setting, dial position "0", is the software setting that is programmed to match battery type supplied with machine. When the dial is manually changed to a different setting, it should not be reset back to "0" otherwise battery damage may result. Service Application Software is required to reset dial back to "0". Contact Service.

4. Re-apply the display label.
5. To set the BDI for the new battery type, plug the on-board battery charger cord into an electrical outlet. The machine's software will automatically reprogram the BDI to the new battery type.

## HYDROLINK® BATTERY WATERING SYSTEM (Trojan® Battery OPTION)

The following instructions are for models equipped with the HydroLink battery watering system option.



The optional HydroLink battery watering system provides a safe and easy way to maintain the proper electrolyte levels in your batteries. It is designed exclusively for Trojan flooded (wet) lead-acid batteries.

**FOR SAFETY: When servicing machine, wear personal protection equipment as needed. Avoid contact with battery acid.**

Before using the battery watering system check hoses and connections for damage or wear.

1. Fully charge batteries prior to using the battery watering system. Do not add water to batteries before charging, the electrolyte level will expand and may overflow when charging.
2. After charging batteries, check the battery electrolyte level indicators located on the battery covers (Figure 79). If the level indicator is white add water as described in the following instructions. If the level indicators are black the electrolyte is at the correct level, no water is required.



FIG. 79

3. Locate the battery fill hose coupler inside the battery compartment. Remove the dust cap and connect the hand pump hose (Figure 80).

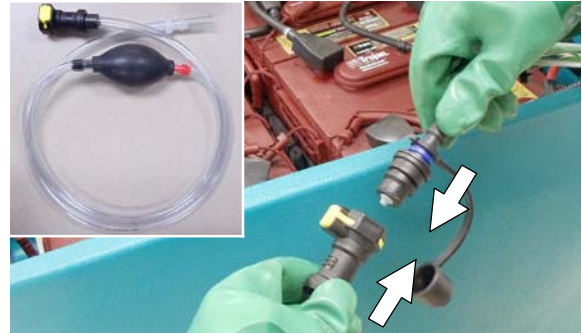


FIG. 80

4. Submerge the other end of the hand pump hose into a bottle of distilled water (Figure 81).



FIG. 81

5. Squeeze the bulb on the hand pump hose until firm (Figure 82). The level indicators will turn black when full.

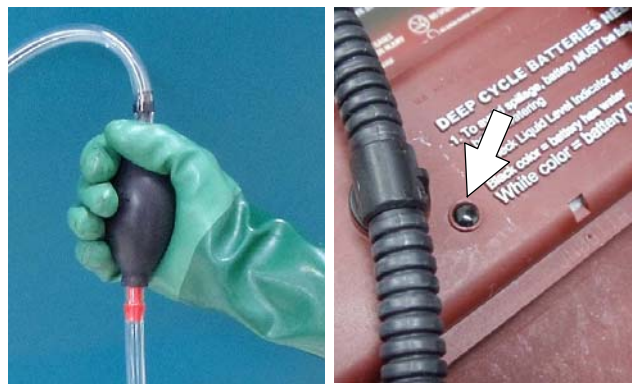


FIG. 82

6. After adding water, replace the dust cap on the battery fill hose and store the hand pump hose inside the machine's battery compartment for future use.



### AUTOMATIC BATTERY WATERING SYSTEM (Trojan® Battery OPTION)

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

The automatic battery watering system is designed to automatically refill the batteries after the machine reaches a limited number of charge cycles. Do not remove battery caps and manually add water to the batteries.

Check the automatic battery watering system for leaks, loose hose connections and for damage or wear. (Figure 83). Replace if damaged.



FIG. 83

Check the water level in the automatic watering tank periodically. Add distilled water when low (Figure 84).

**FOR SAFETY:** When servicing machine, only use distilled water when filling the automatic battery watering tank.



FIG. 84

The automatic battery watering indicator will also alert user to add distilled water when tank is empty (Figure 85). See CONTROL PANEL OPERATION for further details.

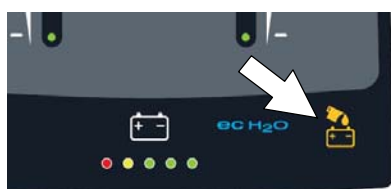


FIG. 85

To store machine equipped with the automatic battery watering system in freezing temperatures, see STORING MACHINE/FREEZE PROTECTION.

### SQUEEGEE BLADE REPLACEMENT

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

Each squeegee blade has four wiping edges. When the blades become worn, simply rotate the blades end-for-end or top-to-bottom for a new wiping edge. Replace blade if all four edges are worn.

1. Remove the squeegee assembly from the machine.
2. Fully loosen the two outside knobs on squeegee assembly. This will separate the spring loaded blade retainer from squeegee frame (Figure 86). To loosen the knobs quickly, squeeze the blade retainer and squeegee frame together.

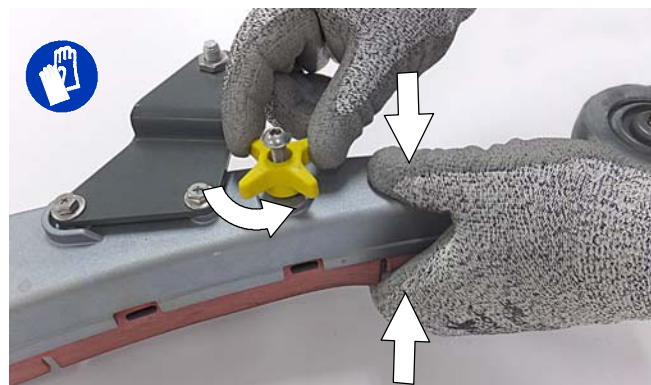


FIG. 86

3. Remove worn blade(s) from the blade retainer (Figure 87).



FIG. 87

## MAINTENANCE

4. Rotate the rear blade to a new wiping edge and reinstall blade (Figure 88). Make sure to align the slots in the blade with retainer tabs.

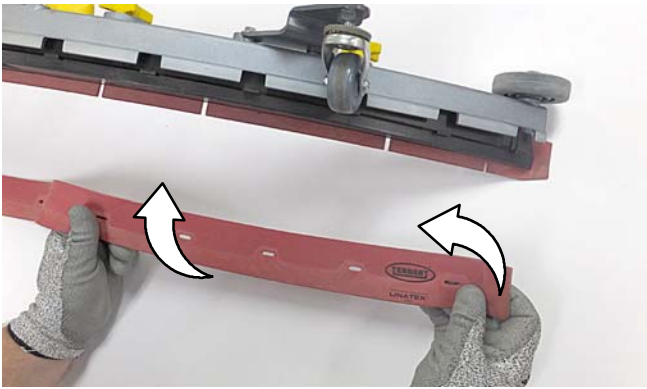


FIG. 88

5. Squeeze the squeegee frame and blade retainer together and re-tighten the two outside knobs (Figure 89).

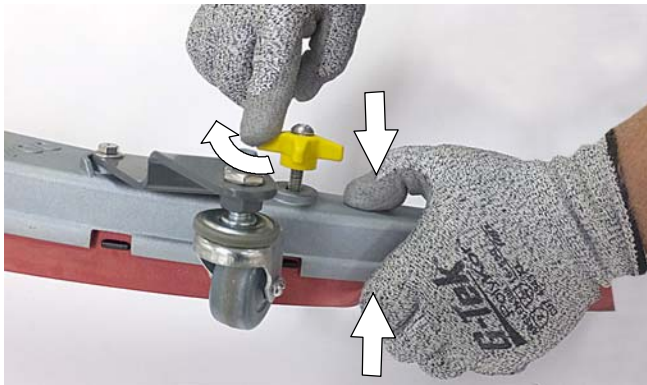


FIG. 89

## ec-H<sub>2</sub>O WATER CONDITIONING CARTRIDGE REPLACEMENT

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

The water conditioning cartridge is required to be replaced when it reaches its maximum water usage or expiration time of when the cartridge was activated, whichever comes first. The control panel will signal a code when it's time to replace cartridge. See CONTROL PANEL OPERATION for further details.

Depending on machine usage, on average, a new cartridge can last anywhere from 12 months for heavy machine usage to 24 months for light machine usage.

**ATTENTION:** During first time use and after replacing the water conditioning cartridge, the ec-H<sub>2</sub>O system will automatically override the selected solution flow rate for up to 75 minutes.

1. Park the machine on a level surface, remove the key and set parking brake, if equipped.
2. Lift the recovery tank to access the ec-H<sub>2</sub>O water conditioning cartridge (Figure 90). Drain recovery tank before lifting tank.

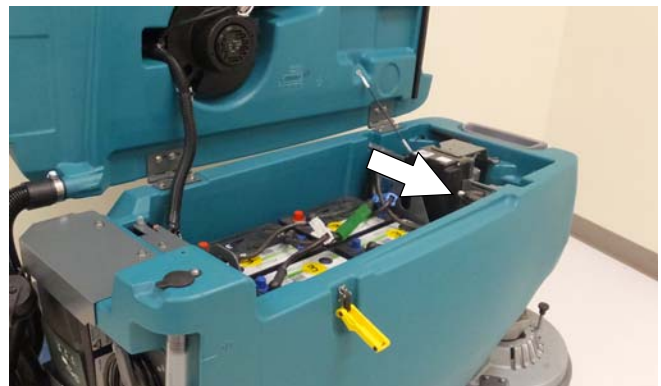


FIG. 90

3. Disconnect the two hose connectors from the top of the cartridge by pressing the gray collars inward and pulling the connectors outward (Figure 91). Lift cartridge to remove.

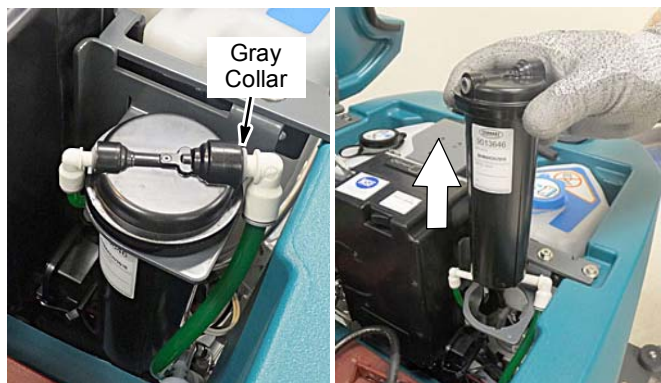


FIG. 91

4. Fill in the installation date on the new cartridge label (Figure 92).

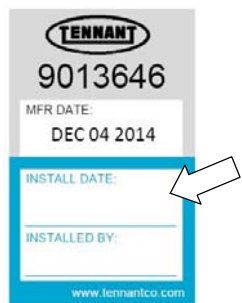


FIG. 92

5. Install the new cartridge and reconnect the two hoses. Make sure the hose connectors are fully inserted into the cartridge.
6. Reset timer for new cartridge.

Carefully read and understand all steps first before performing procedure.

- a. Turn key on.
- b. Press and hold the service switch, located on the ec-H2O module, for 10 seconds. After releasing service switch, the three solution flow indicator lights will begin to (ripple) move back and forth (Figure 93).
- c. Within 5 seconds after releasing the service switch, while the three indicator lights are moving back and forth, quickly press and release the solution flow button located on ec-H2O module (Figure 93).

The three indicator lights will then blink three times to indicate timer has been reset. Repeat process if the three indicator lights do not blink three times.

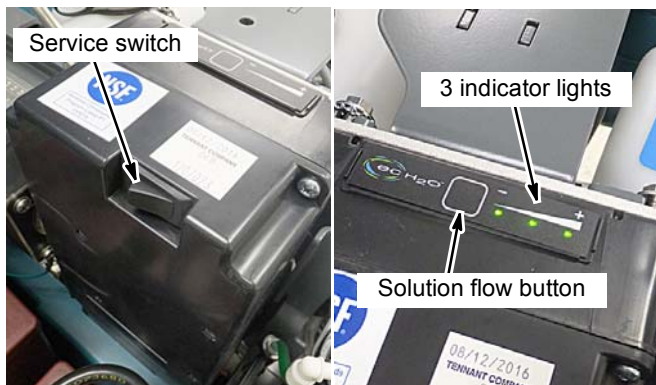


FIG. 93

## MACHINE JACKING

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

Use the designated locations to jack up the machine for service (Figure 94). Empty the recovery and solution tanks and position the machine on a level surface before jacking.

**FOR SAFETY:** When servicing machine, jack machine up at designated locations only. Support machine with jack stands. Use jack or hoist that will support the weight of the machine.

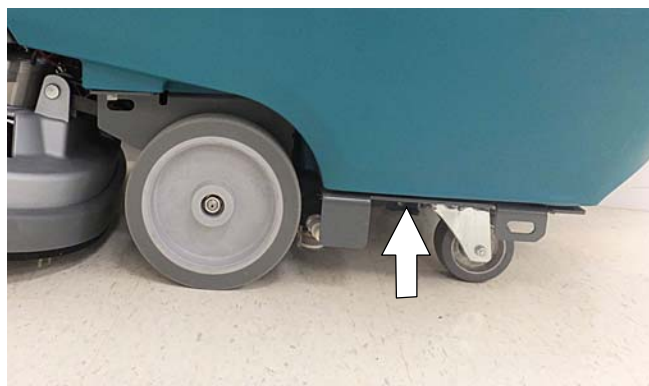


FIG. 94

# MAINTENANCE

## TRANSPORTING MACHINE

When transporting the machine by use of trailer or truck, carefully follow loading and tie-down procedure:

1. Drain tanks, raise the scrub head and the remove squeegee assembly.
2. Carefully load machine in trailer or on truck.

**FOR SAFETY: When loading/unloading, use a ramp that can support the machine weight and operator.**

**FOR SAFETY: When loading/unloading, the machine may only be operated on gradients up to 2%.**

3. Once loaded, position the front of the machine up against the front of the trailer or truck. Lower the scrub head, turn key off and set parking brake, if equipped.
4. Place a block behind each wheel (Figure 95).
5. Using tie-down straps, secure the machine using the four tie-down brackets located on the machine frame (Figure 95). It may be necessary to install tie-down brackets to the floor of your trailer or truck.

**NOTE:** When transporting machine in an open truck or trailer, secure recovery tank lid.

**ATTENTION: Do not use control console area or accessory storage rails for tie-down locations, damage may occur.**

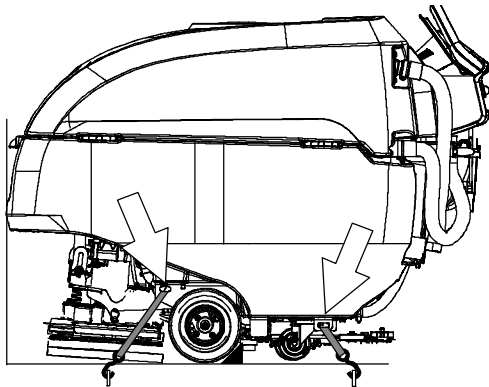


FIG. 95

## STORING MACHINE

The following steps should be taken when storing the machine for extended periods of time.

1. Charge the batteries before storing machine to prolong the life of the batteries. Recharge batteries once a month.
2. Disconnect batteries before storing.
3. Drain and rinse recovery tank and solution tank.
4. Store the machine in a dry area with squeegee and scrub head in the up position.

**ATTENTION: Do not expose machine to rain, store indoors.**

5. Open the recovery tank lid to promote air circulation.
6. If storing machine machine in freezing temperatures, proceed to FREEZE PROTECTION.

**NOTE:** To prevent potential machine damage store machine in a rodent and insect free environment.

## FREEZE PROTECTION

Storing machine in freezing temperatures.

1. Completely drain solution tank and recovery tank.
2. Empty the water from the solution tank filter located under machine. Replace filter (Figure 96).

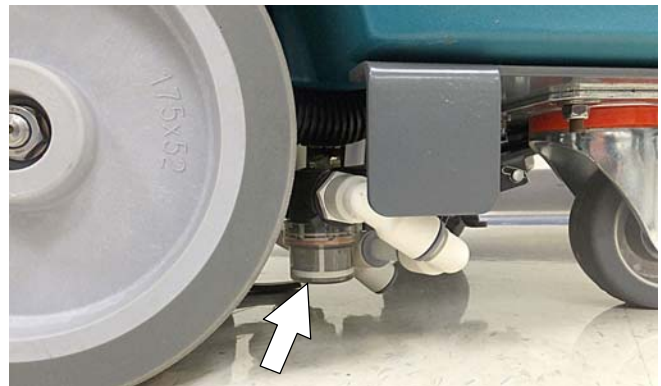


FIG. 96

3. Pour 1 gallon / 4 liters of propylene glycol based recreational vehicle (RV) antifreeze into the solution tank.
4. Models not equipped with ec-H2O system - Turn machine on and operate the solution flow system. Turn the machine off when the antifreeze is visible on the floor.

Models equipped with ec-H2O system - Turn machine and set the solution flow rate on and operate ec-H2O scrubbing to cycle antifreeze through system. Turn machine off when antifreeze is visible on the floor. This may take up to two minutes.

5. Models equipped with optional automatic battery watering tank - Lift tank from machine and empty the water from tank (Figure 97).



**FIG. 97**

Drain remaining water from system by removing the drain hose cap located below the tank (Figure 98). Leave cap off tank when draining system. After draining, replace cap on drain hose.

**IMPORTANT: DO NOT** add antifreeze to the automatic battery watering tank.



**FIG. 98**

6. After storing machine in freezing temperatures, drain any remaining antifreeze from the solution tank. Add clean water to solution tank and to optional detergent tank and operate the machine to flush system.
7. Refill the automatic battery watering tank with distilled water, if equipped.

# MAINTENANCE

## TROUBLESHOOTING

PROBLEM	CAUSE	SOLUTION
Service indicator icon is flashing	Machine or on-board battery charger fault has been detected	See SERVICE INDICATOR CODES
ec-H2O icon is red or flashing red	ec-H2O system fault has been detected	See SERVICE INDICATOR CODES
Machine will not operate	Emergency shut-off button activated	Turn button to reset
	Machine fault detected	See SERVICE INDICATOR CODES
	Batteries discharged	Recharge batteries
	Loose battery cable(s)	Tighten loose cables
	Faulty battery(s)	Replace battery(s)
	Faulty key switch	Contact service
	Faulty start bail switch	Contact service
	Circuit breaker tripped	Reset circuit breaker
On-board battery charger will not operate	Faulty control board	Contact service
	Plug not connected to power supply	Check plug connection
	Batteries over discharged	Replace batteries
	Battery charger fault detected	See SERVICE INDICATOR CODES
	Faulty charger	Replace charger
Machine will not propel	Faulty power supply cord	Replace power supply cord
	Propel fault has been detected	See SERVICE INDICATOR CODES
	Circuit breaker tripped	Reset circuit breaker
	Faulty propel motor or wiring	Contact service
Brush motor will not operate	Worn carbon brushes in motor	Contact service
	Brush motor fault has been detected.	See SERVICE INDICATOR CODES
	Faulty pad motor or wiring	Contact service
	Circuit breaker tripped	Reset circuit breaker
	Worn carbon brushes in motor	Contact service
Vacuum motor will not operate	Broken or loose belt (cylindrical brush model)	Contact service
	Squeegee assembly is raised off floor	Lower squeegee assembly to floor
	Vacuum motor fault has been detected	See SERVICE INDICATOR CODES
	Faulty vacuum motor or wiring	Contact service
Poor scrubbing performance	Circuit breaker tripped	Reset circuit breaker
	Debris caught in brush/pad	Remove debris
	Worn brush/pad	Replace brush/pad
	Incorrect brush pressure	Adjust brush pressure
	Wrong brush/pad type	Use correct brush/pad for application
	Low battery charge	Recharge batteries
	Uneven brush pressure	Scrub head/brushes not level. Contact service
Broken or loose belt (cylindrical brush model)	Contact service	

**TROUBLESHOOTING - Continued**

<b>PROBLEM</b>	<b>CAUSE</b>	<b>SOLUTION</b>
Trailing water - poor or no water pickup	Full recovery tank or excessive foam buildup	Drain recovery tank
	Loose drain hose cap or flow control valve is open	Replace cap or close flow control valve on drain hose
	Worn squeegee blades	Rotate or replace squeegee blades
	Clogged drip trap (Squeegee assembly)	Remove cover and clean
	Clogged squeegee assembly	Clean squeegee assembly
	Loose vacuum hose connection	Secure vacuum hose connection
	Clogged vacuum hose	Flush vacuum hose
	Damaged vacuum hose	Replace vacuum hose
	Clogged float shut-off screen in recovery tank	Clean screen
	Recovery tank lid not completely closed	Check lid for obstructions
	Defective seals on recovery tank lid	Replaced seal
Little or no solution flow	Empty solution tank	Refill solution tank
	Low solution flow rate set	Increase solution flow rate
	Clogged solution tank filter	Clean filter
	Plugged solution supply line	Flush solution supply line
Automatic battery watering tank does not dispense water	Tank is empty	Refill tank
	Faulty float switch	Contact service
	Defective pump	Contact service
	Pump not priming	Contact service
	Faulty control board	Contact service
Short run time	Low battery charge	Charge batteries
	Batteries need maintenance	See BATTERIES
	Defective battery or end of battery life	Replace batteries
	Battery discharge indicator (BDI) programmed incorrectly	See CHARGING BATTERIES
	Faulty charger	Replace battery charger
	Brush pressure set too high	Lower brush pressure
Excessive scrub head noise (Orbital model)	Damaged scrub head isolators	Replace isolators. Contact service

# SPECIFICATIONS

## GENERAL MACHINE DIMENSIONS/CAPACITIES/PERFORMANCE

MODEL	26 in / 650 mm Dual Disk	28 in / 700 mm Dual Disk	32 in / 800 mm Dual Disk
Length	58.5 in / 1486 mm	59.1 in / 1501 mm	61.1 in / 1552 mm
Width	27.5 in / 700 mm	29.5 in / 750 mm	33.5 in / 850 mm
Height	43.3 in / 1100 mm	43.3 in / 1100 mm	43.3 in / 1100 mm
Weight	320 lb / 145 kg	330 lb / 150 kg	355 lb / 161 kg
Weight (with batteries)	610 lb / 277 kg	620 lb / 281 kg	645 lb / 293 kg
GVW	800 lb / 363 kg	810 lb / 367 kg	835 lb / 379 kg
Squeegee width	38.3 in / 973 mm	41.3 in / 1049 mm	46.6 in / 1234 mm
Solution tank capacity	22.5 gal / 85 L		
Recovery tank capacity	27 gal / 102 L		
Automatic battery watering tank capacity	0.66 gal / 2.5 L		
Scrubbing path width	26 in / 650 mm	28 in / 700 mm	32 in / 800 mm
Down pressure	Low: 65 lbs / 29.5 kg, High: 120 lbs / 54.5 kg	Low: 70 lbs / 32 kg, High: 120 lbs / 54.5 kg	Low: -75 lbs / 34 kg, High: 120 lbs / 54.5 kg
Scrubbing speed	2.5 mph / 4.0 km/h (220 fpm / 67 mpm)		
Transport speed	2.7 mph / 4.4 km/h (240 fpm / 73 mpm)		
Reverse speed	1.6 mph / 2.6 km/h (144 fpm / 44 mpm)		
Productivity rate - estimated actual	20,571 ft <sup>2</sup> /hr / 1911 m <sup>2</sup> /hr	22,286 ft <sup>2</sup> /hr / 2070 m <sup>2</sup> /hr	25,714 ft <sup>2</sup> /hr / 2389 m <sup>2</sup> /hr
ec-H <sub>2</sub> O productivity rate - est. actual	23,124 ft <sup>2</sup> /hr / 2148 m <sup>2</sup> /hr	23,680 ft <sup>2</sup> /hr / 2200 m <sup>2</sup> /hr	27,323 ft <sup>2</sup> /hr / 2538 m <sup>2</sup> /hr
Aisle turnaround width	59 in / 1499 mm	59.6 in / 1514 mm	61.6 in / 1565 mm
Maximum operating gradient	2%		
Solution flow rate	Low: .30 gpm / 1.1 L/min, Med: .40 gpm / 1.5 L/min, High: .50 gpm / 1.9 L/min		
ec-H <sub>2</sub> O solution flow rate	Low: .15 gpm / 0.57 L/min, Med: .22 gpm / 0.84 L/min, High: .30 gpm / 1.14 L/min	Low: .22 gpm / 0.84 L/min, Med: .33 gpm / 1.25 L/min, High: .44 gpm / 1.67 L/min	Low: .22 gpm / 0.84 L/min, Med: .33 gpm / 1.25 L/min, High: .44 gpm / 1.67 L/min
Brush motor	2-24 VDC, 0.75 hp/0.55 kW, 29 A, 220 rpm		
Propel motor	24 VDC, 0.63 hp / 0.48 kW, 20A		
Vacuum motor	24 VDC, 0.46 hp / .34 kW, 14.3 A		
Water lift	34 in / 864 mm		
ec-H <sub>2</sub> O solution pump	24 VDC, 2 A, 1.0 gpm / 3.8 L/min, min open flow		
Automatic battery watering pump	12 VDC, 1.8 A, 0.37 gpm / 1.4 L/min, min open flow		
Machine voltage	24 VDC		
Battery capacity	4-6V 225AH C/20 Wet, 4-6V 260AH C/20 Wet, 4-6V 220AH C/20 AGM		
Total power consumption	66 A nominal / 1.6 kW		
Battery Charger - on-board	115-240VAC, 50/60Hz, 24VDC, 25A		
Battery Charger - smart off-board	85-265VAC, 50/60Hz, 24VDC, 25A		
Protection grade	IPX3		
Sound pressure level L <sub>pA</sub> *	67.4 dB(A)	67.4 dB(A)	67.4 dB(A)
Sound uncertainty K <sub>pA</sub> *	0.8 dB(A)	0.8 dB(A)	0.8 dB(A)
Sound power level uncertainty L <sub>pA</sub> - uncertainty K <sub>pA</sub> *	83.1 dB(A)	83.1 dB(A)	83.1 dB(A)
Machine vibration at hand-arm*	<2.5 m/s <sup>2</sup>		
Ambient operating temperature	Min: 36°F/2°C, Max: 110°F/43°C		

\*Values per IEC 60335-2-72. Specifications are subject to change without notice.



**GENERAL MACHINE DIMENSIONS/CAPACITIES/PERFORMANCE - Continued**

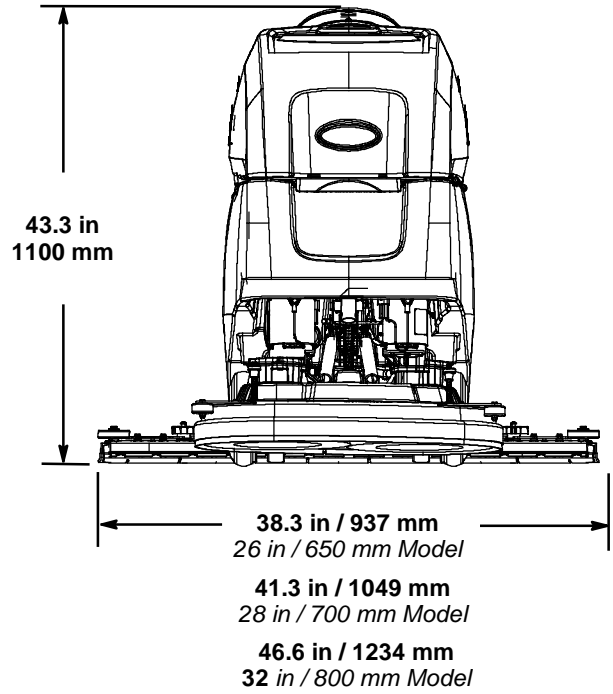
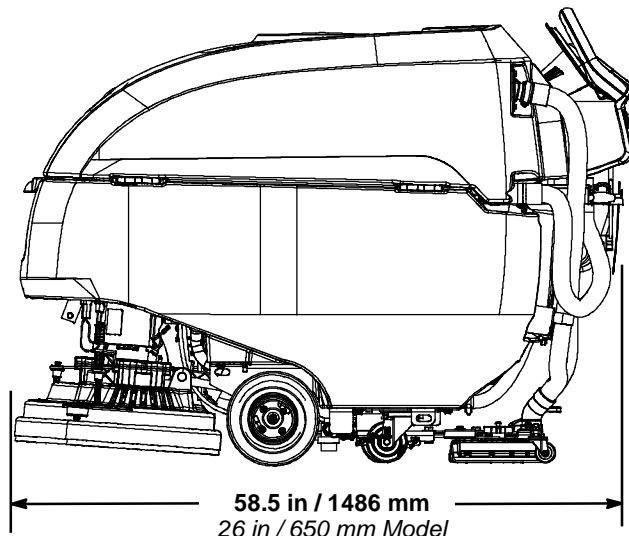
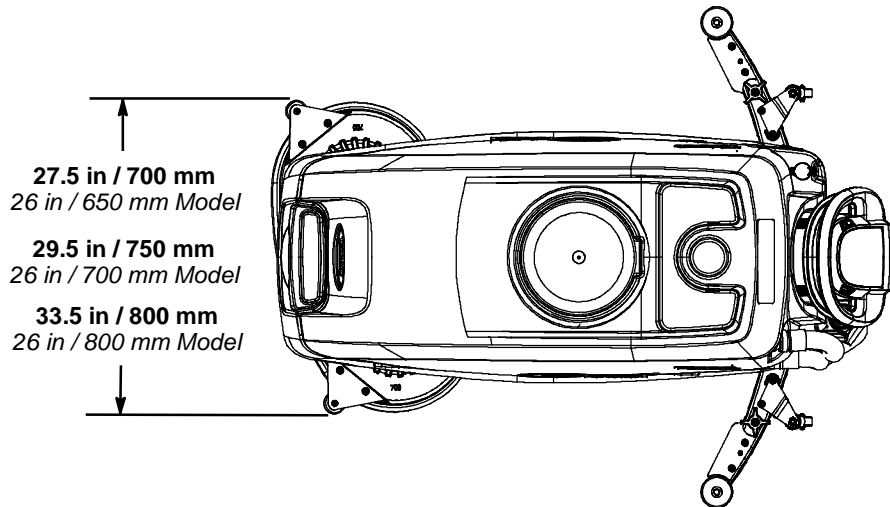
<b>MODEL</b>	<b>28 in / 700 mm Cylindrical Brush</b>	<b>28 in / 700 mm Orbital</b>
Length	59.1 in / 1501 mm	58.5 in / 1486 mm
Width	30.7 in / 780 mm	28 in / 710 mm
Height	43.3 in / 1100 mm	43.3 in / 1100 mm
Weight	370 lb / 168 kg	370 lb / 168 kg
Weight (with batteries)	660 lb / 299 kg	660 lb / 299 kg
GVW	850 lb / 386 kg	850 lb / 386 kg
Squeegee width	46.6 in / 1234 mm	41.3 in / 1049 mm
Solution tank capacity	22.5 gal / 85 L	
Recovery tank capacity	27 gal / 102 L	
Automatic battery watering tank capacity	0.66 gal / 2.5 L	
Scrubbing path width	28 in / 700 mm	
Down pressure	Low: 85 lbs / 38.5 kg High: 120 lbs / 54.5 kg	Low: 110 lbs / 50 kg High: 170 lbs / 77 kg
Scrubbing speed	2.5 mph / 4.0 km/h (220 fpm / 67 mpm)	
Transport speed	2.7 mph / 4.4 km/h (240 fpm / 73 mpm)	
Reverse speed	1.6 mph / 2.6 km/h (144 fpm / 44 mpm)	
Productivity rate - estimated actual	22,286 ft <sup>2</sup> /hr / 2070 m <sup>2</sup> /hr	20,260 ft <sup>2</sup> /hr / 1882 m <sup>2</sup> /hr
ec-H <sub>2</sub> O productivity rate - est. actual	23,680 ft <sup>2</sup> /hr / 2200 m <sup>2</sup> /hr	21,527 ft <sup>2</sup> /hr / 2000 m <sup>2</sup> /hr
Aisle turnaround width	59.6 in / 1514 mm	59 in / 1499 mm
Maximum operating gradient	2%	
Solution flow rate	Low: .30 gpm / 1.1 L/min, Med: .40 gpm / 1.5 L/min, High: .50 gpm / 1.9 L/min	
ec-H <sub>2</sub> O solution flow rate	Low: .22 gpm / 0.84 L/min, Med: .33 gpm / 1.25 L/min, High: .44 gpm / 1.67 L/min	
Brush motor	2-24 VDC, 0.63 hp/0.47 kW, 23 A, 1500 rpm	24 VDC, 0.75 hp/0.55 kW, 28 A, 2200 rpm
Propel motor	24 VDC, 0.63 hp / 0.48 kW, 20A	
Vacuum motor	24 VDC, 0.46hp / .34 kW, 14.3 A	
Water lift	34 in / 864 mm	
ec-H <sub>2</sub> O solution pump	24 VDC, 2 A, 1.0 gpm / 3.8 L/min, min open flow	
Automatic battery watering pump	12 VDC, 1.8 A, 0.37 gpm / 1.4 L/min, min open flow	
Machine voltage	24 VDC	
Battery capacity	4-6V 225AH C/20 Wet, 4-6V 260AH C/20 Wet, 4-6V 220AH C/20 AGM	
Total power consumption	66 A nominal / 1.6 kW	
Battery Charger - on-board	115-240VAC, 50/60Hz, 24VDC, 25A	
Battery Charger - smart off-board	85-265VAC, 50/60Hz, 24VDC, 25A	
Protection grade	IPX3	
Sound pressure level L <sub>pA</sub> *	68.3 dB(A)	66.9 dB(A)
Sound uncertainty K <sub>pA</sub> *	0.8 dB(A)	0.8 dB(A)
Sound power level uncertainty L <sub>pA</sub> - uncertainty K <sub>pA</sub> *	84.3 dB(A)	83.4 dB(A)
Machine vibration at hand-arm*	<2.5 m/s <sup>2</sup>	
Ambient operating temperature	Min: 36°F/2°C, Max: 110°F/43°C	

\*Values per IEC 60335-2-72. Specifications are subject to change without notice.

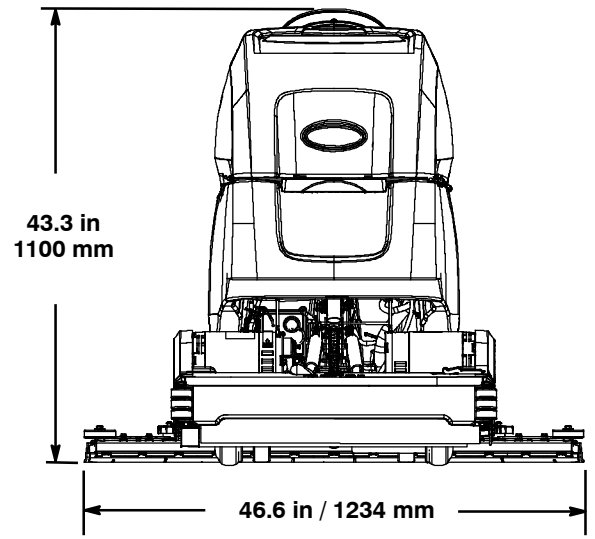
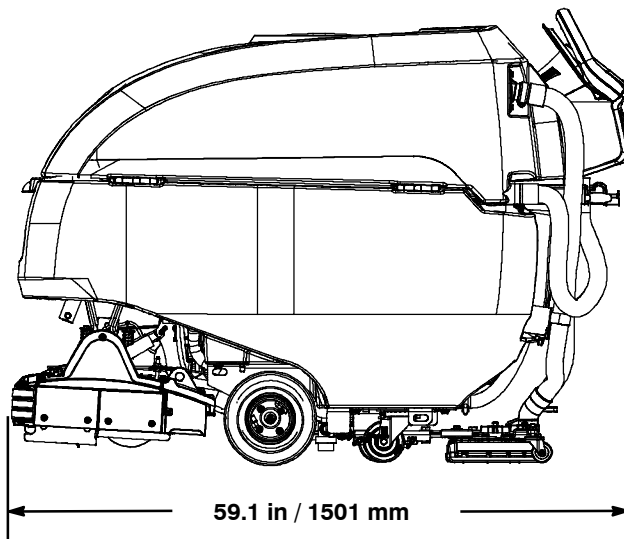
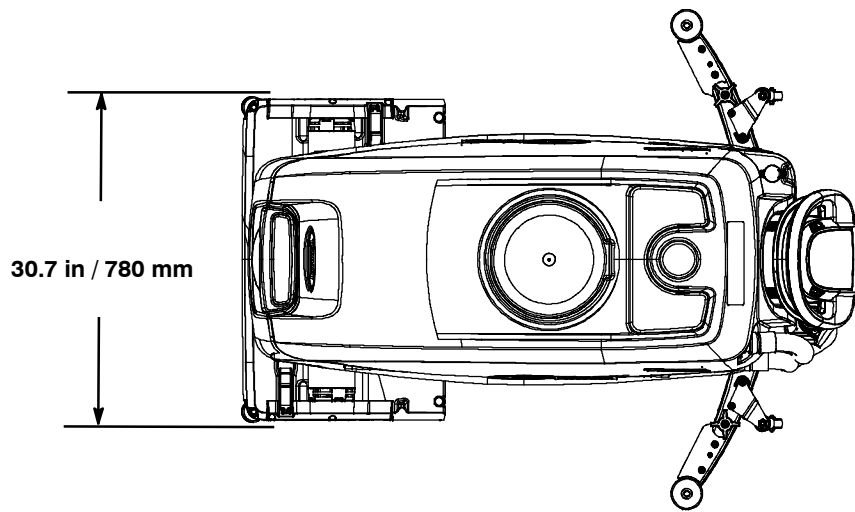
# SPECIFICATIONS

## MACHINE DIMENSIONS

### DUAL DISK MODEL



CYLINDRICAL BRUSH MODEL



# SPECIFICATIONS

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## ORBITAL PAD MODEL

