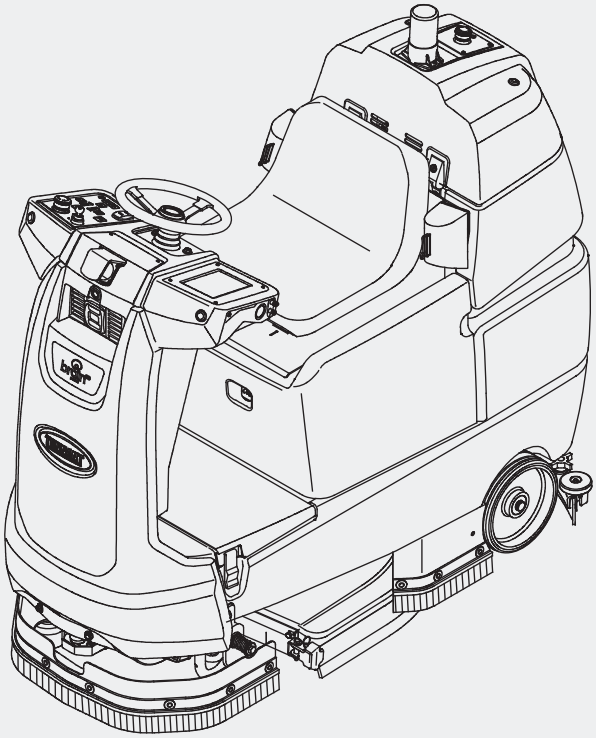
# T7AMR

## (Battery)

## Rider-Scrubber Operator Manual



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**9018134**
**Rev. 00 (10-2018)**

## INTRODUCTION

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 machine 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, used components such as batteries and fluids in an environmentally safe way according to local waste disposal regulations. Always remember to recycle.

**MACHINE DATA**

Please fill out at time of installation for future reference.

Model No. – _____

Serial No. – _____

Installation Date – _____

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## INTRODUCTION

This operator manual contains information to allow for quick start−up of the new Tennant T7AMR Scrubber, powered by BrainOS. This document may be periodically revised. This T7AMR Scrubber, can be used in manual mode or as self−driving, robotic scrubber. Use in robotic (autonomous) mode requires a subscription to Brain Corp's Autonomy Services. It is important to follow all provided instructions and warnings. Failure to adhere to instructions could result in damage to the machine and injury.

The T7AMR is a commercial floor scrubber powered by BrainOS software. The Brain−enabled scrubber is capable of functioning in either manual or robotic (autonomous, self−driving) modes. When in robotic mode, the Brain−enabled scrubber is driven by the BrainOS navigation software. This product may be covered by one or more patents or pending patent applications. See www.braincorporation.com/patents for details. Discrete portions of this product were made possible by open source software. Please see www.braincorp.com/open−source−attributions/ for details.

## INTENDED USE AND PRECAUTIONS

The T7AMR is an industrial/commercial robotic rider scrubber machine. It is designed exclusively to wet scrub both rough and smooth hard surfaces (concrete, tile, stone, synthetic, etc). This machine can be operated in either robotic mode (without operator) or manual mode (with operator). This machine is intended for indoor use only. Do not use this machine on soil, grass, artificial turf, or carpeted surfaces. This machine is not intended for use on public roadways. Do not use this machine other than described in this Operator Manual. Only use recommended accessories. The T7AMR Scrubber, powered by BrainOS, should only be used by trained operators in controlled, restricted environments approved by Brain Corp/Tennant Company.

Additional training materials may be provided as to the intended use of the T7AMR Scrubber, and it should only be used in accordance with such training. Use the machine in approved environments in accordance with the Autonomous Navigation Software End User License Agreement (EULA). Approved environments shall also be limited to cleaning areas with adequate cellular communication signals permitting cellular data communication with the machine to enable periodic safety-related updates not less than monthly.

The operator is responsible for the use of each Brain−enabled T7AMR Scrubber in both manual and robotic mode. Each operator must be mindful to use the machine in accordance with its intended use and precautions at all times. Operators will not engage in any of the following conduct or activities with respect to the Autonomy Services or BrainOS:

- Transmission of any software or other materials that contain any viruses, worms, trojan horses, defects, spyware, spiders, screen−scrapers, or other items of a destructive or disruptive nature;
- The machine onboard cameras may capture images of people who happen to be in its surrounding. There may be local laws of operation relating to use of technology with cameras. Please comply with all applicable laws, including using signage or obtaining consents as required;
- Exploitation of the Autonomy Services, BrainOS, or the Brain−enabled scrubber hardware in any unauthorized manner, including by trespassing or burdening server or network capacity or infrastructure;
- Framing, mirroring, or reselling any part of the Autonomy Services or BrainOS without written authorization from Brain Corp;
- Unauthorized collection of user information; or
- Attempting to deliberately damage the Autonomy Services or BrainOS, or undermine the legitimate operation of the Autonomy Services or BrainOS.

# CONTENTS

## IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

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

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

**FOR SAFETY: To identify actions that 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: Batteries emit hydrogen gas. Explosion or fire can result. Keep sparks and open flame away. Keep covers open when charging.**

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

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

**This machine is equipped with technology that automatically communicates over the cellular network. This machine is equipped with BrainOS software that is accessible via the BrainOS User Interface (UI) Touch Screen.**

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

**FOR SAFETY:**

1. Do not operate machine:
   - Unless trained and authorized.
   - Unless operator manual is read and understood.
   - Under the influence of alcohol or drugs.
   - In Manual Mode: While using a cell phone or other types of electronic devices.
   - Unless mentally and physically capable of following machine instructions.
   - With brake disabled.
   - Without filters in place or with clogged filters.
   - If it is not in proper operating condition.
   - In areas where flammable vapors/liquids or combustible dusts are present.
   - In outdoor areas. This machine is for indoor use only.
   - In areas that are too dark to safely see the controls or operate the machine.
   - In areas with possible falling objects.
   - With pads or accessories not supplied or approved by Tennant. The use of other pads may impair safety.
2. Before Starting Machine:
   - Check machine for fluid leaks.
   - Make sure all safety devices are in place and operate properly.
   - Check brakes and steering for proper operation.
   - In Manual Mode: Adjust seat and fasten seat belt (if equipped).
3. When using machine in manual mode:
   - Use only as described in this manual.
   - Use brakes to stop machine.
   - Reduce speed when turning.
   - Go slowly on inclines and slippery surfaces.
   - Do not scrub on ramp inclines that exceed 7% grade or transport (GVWR) on ramp inclines that exceed 10.5% grade.
   - Drive slowly through doorways and narrow openings.
   - Be cautious of the squeegee near bystanders and obstacles.
   - Keep all parts of body inside operator station while machine is moving.
   - Always be aware of surroundings while operating machine.
   - Use care when reversing machine.
   - Keep children and unauthorized persons away from machine.
   - Do not allow machine to be used as a toy.
   - Do not carry passengers on any part of the machine.
   - Always follow safety and traffic rules.
   - Report machine damage or faulty operation immediately.
   - Follow mixing, handling and disposal instructions on chemical containers.
   - Place proper floor cleaning signage in areas where the machine is operating and people are present, in accordance with standard floor cleaning practices.
   - Follow site safety guidelines concerning wet floors.

4. While machine is operating in robotic mode:
   - Use only as described in this manual.
   - Remove key from ON/OFF key switch to prevent unauthorized use without disrupting robotic route.
   - Do not attempt to ride machine.
   - Do not grab steering wheel or put hands or arms through the holes of the steering wheel. Steering wheel may move rapidly and unexpectedly while in robotic mode.
   - Do not operate machine in environments requiring fail−safe performance (areas where machine failure could lead to personal injury or property damage).
   - Guard sudden drops, stairs, escalators, or moving platforms in area of machine operation with a physical barrier.
   - Do not use ladders, scaffolds, or other temporary constructed structures in area of machine operation.
   - Only scrub flat, hard surfaces of 0% incline.
   - Do not leave electrical cords or low profile items (anything having a height of less than 10 cm from ground) in area of machine operation.
   - Always operate machine in manual mode when going into elevators or through automatic doors. Robotic routes should never include going into elevators or through automatic doors.
   - Keep children and unauthorized persons away from machine.
   - Do not allow machine to be used as a toy.
   - Do not carry passengers on any part of the machine.
   - Always follow safety and traffic rules.
   - Report machine damage or faulty operation immediately.
   - Follow mixing, handling and disposal instructions on chemical containers.
   - Place proper floor cleaning signage in areas where the machine is operating and people are present, in accordance with standard floor cleaning practices.
   - Follow site safety guidelines concerning wet floors.
5. Before leaving or servicing machine:
   - Stop on level surface.
   - Turn off machine and remove key.
6. When servicing machine:
   - All work must be done with sufficient lighting and visibility.
   - Keep work area well ventilated.
   - Avoid moving parts. Do not wear loose clothing, jewelry and secure long hair.
   - Block machine tires before jacking machine up.
   - Jack machine up at designated locations only. Support machine with jack stands.
   - Use hoist or jack that will support the weight of the machine.
   - Do not push or tow the machine without an operator in the seat controlling the machine.
   - Do not push or tow the machine on inclines with the brake disabled.
   - Do not power spray or hose off machine. Electrical malfunction may occur. Use damp cloth.
   - 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.
   - Disconnect battery connections before working on machine.
   - Do not pull on battery charger cord to unplug. Grasp plug at outlet and pull.
   - Do not use incompatible battery chargers as this may damage battery packs and potentially cause a fire.
   - Do not charge frozen batteries.
   - Inspect charger cord regularly for damage.
   - Avoid contact with battery acid.
   - Keep all metal objects off batteries.
   - Use a non-conductive battery removal device.
   - Use a hoist and adequate assistance when lifting batteries.
   - Battery installation must be done by trained personnel.
   - Follow site safety guidelines concerning battery removal.
   - All repairs must be performed by trained personnel.
   - Do not modify the machine from its original design.
   - Use Tennant supplied or approved replacement parts.

When servicing machine (continued)
- Wear personal protective equipment as needed and where recommended in this manual.

**For Safety: wear hearing protection.**

**For Safety: wear protective gloves.**

**For Safety: wear eye protection.**

**For Safety: wear protective dust mask.**

7. When loading/unloading machine onto/off truck or trailer:
   - Drain tanks before loading machine.
   - Lower scrub head and squeegee before tying down machine.
   - Block machine tires.
   - Use ramp, truck or trailer that will support the weight of the machine and operator.
   - Do not drive on a slippery ramp.
   - Use caution when operating on a ramp.
   - Use winch. Do not push the machine onto/off the truck or trailer unless the load height is 380 mm (15 in) or less from the ground.
   - Do not load/unload on ramp inclines that exceed 15.8% grade.
   - Turn off machine and remove key.
   - Use tie-down straps to secure machine.

The following safety labels are mounted on the machine in the locations indicated. Replace damaged/missing labels.

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


**Located on seat panel.**

**WARNING LABEL - Flammable materials or reactive metals can cause explosion or fire. Do not pick up.**

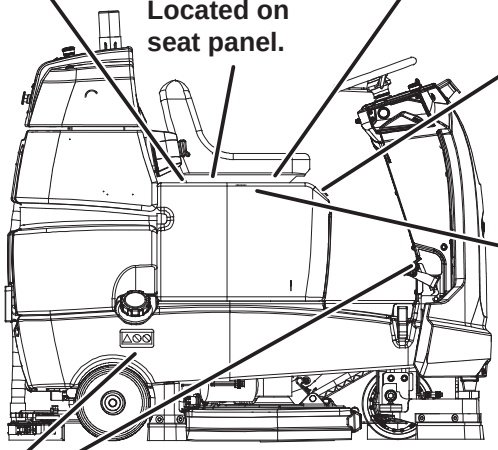

**Located on seat panel.**

**FOR SAFETY LABEL - Read manual before operating machine.**

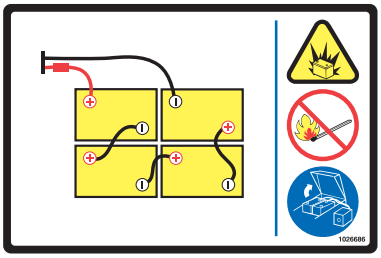

**Located on seat panel.**

**FOR SAFETY LABEL - Electrical components, use grounding strap before opening panel.**

**Located on electrical panel under the seat.**

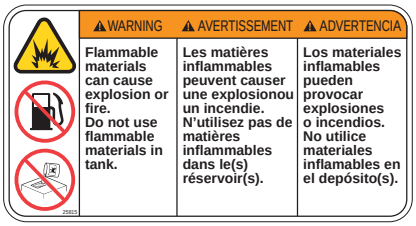


**WARNING LABEL - Batteries emit hydrogen gas. Explosion or fire can result. Keep sparks and open flame away. Keep covers open when charging**



**Located on bottom of seat panel.**

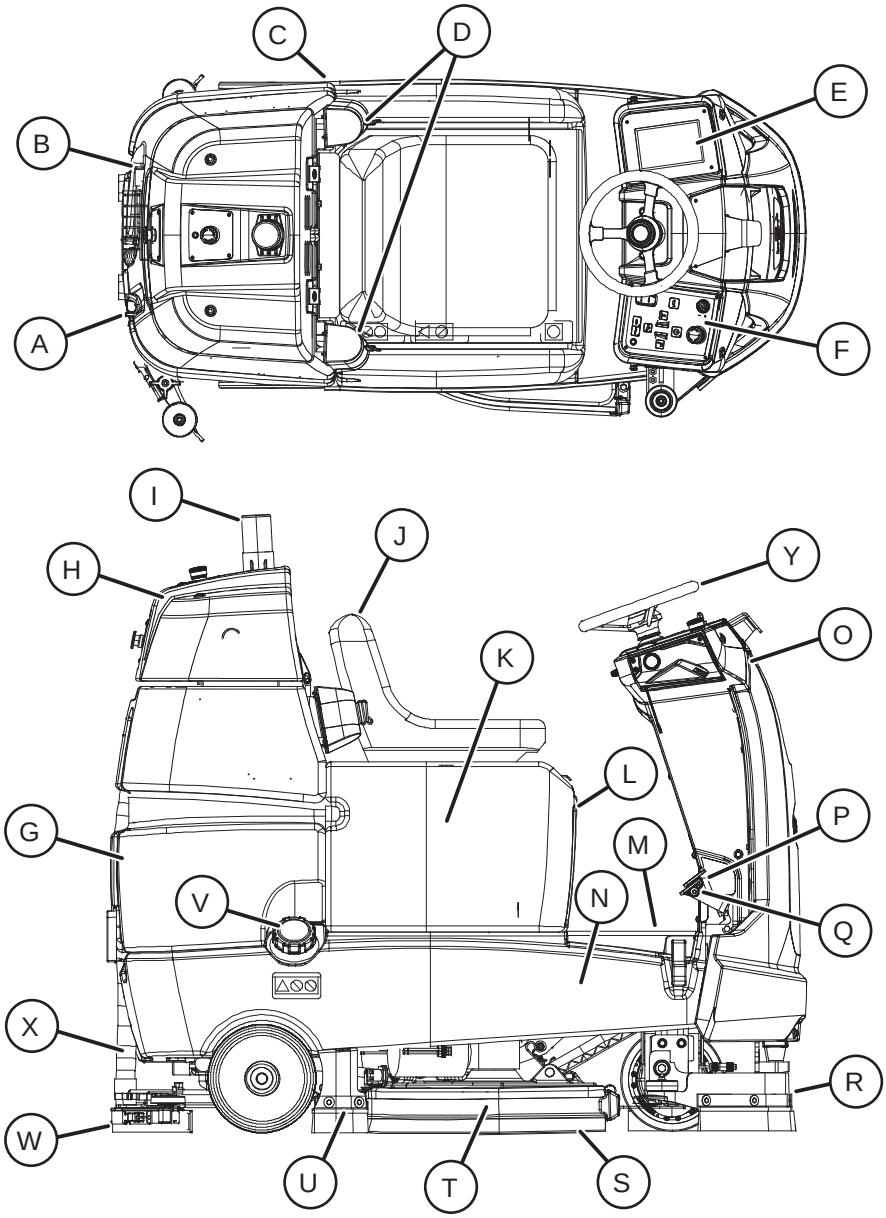
**WARNING LABEL - Flammable materials can cause explosion or fire. Do not use flammable materials in tank**




**Located under the solution fill port and next to foot pedals.**

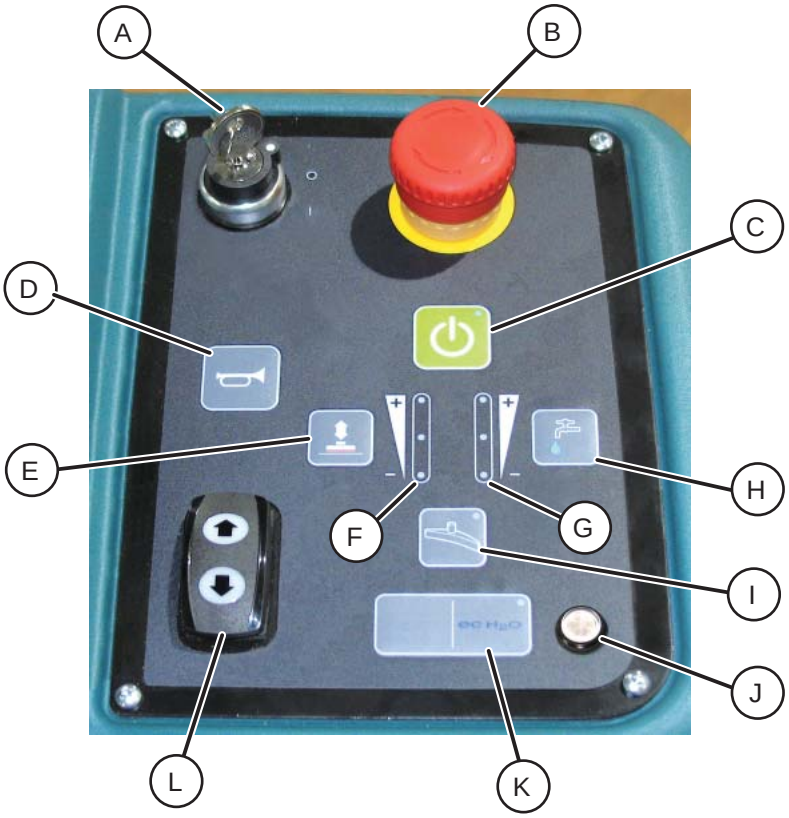
# OPERATION

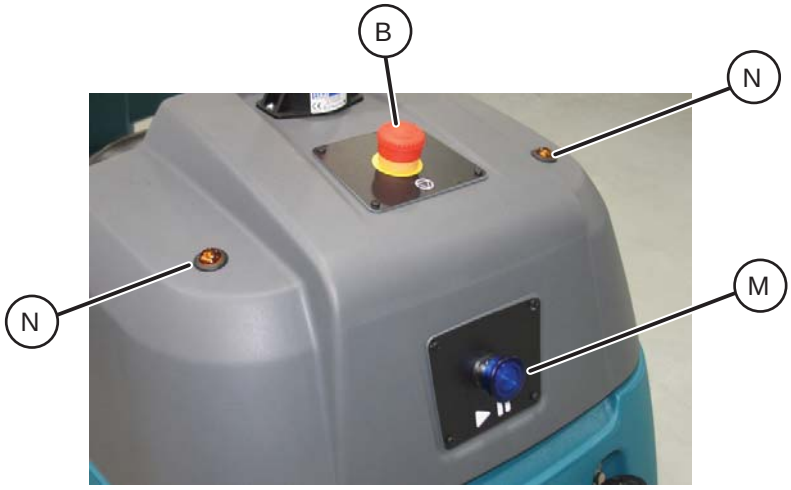
## MACHINE COMPONENTS




A. Recovery tank drain hose
B. Solution tank drain hose
C. Left perimeter guard
D. Retractable straps (Anti-Joyride)
E. User Interface (UI) touchscreen
F. Control panel
G. Recovery tank
H. Recovery tank cover
I. Flashing light
J. Operator seat
K. Batteries
L. Battery charging connector
M. Solution tank front cover
N. Solution tank
O. Sensor panel
P. Brake pedal
Q. Propel pedal
R. Front perimeter guard
S. Side squeegee
T. Scrub head
U. Right perimeter guard
V. Solution tank fill cap
W. Rear squeegee
X. Squeegee vacuum hose
Y. Steering wheel

## CONTROLS AND INSTRUMENTS




A. ON/OFF key switch
B. Emergency Stop Button (located on control panel and back of machine)
C. 1-Step button
D. Horn button
E. Brush pressure button
F. Brush pressure indicator lights
G. Solution flow indicator lights
H. Solution flow button
I. Vacuum fan/squeegee button
*J. ec-H2O* system indicator light (option)
*K. ec-H2O* system on/off button (option)
L. Directional switch
M. Blue start/pause button
N. Signal lights (Rear)

## CAMERAS AND SENSORS


A. Sensors - Upper LIDAR
B. Signal lights (Front)
C. Sensors – Front 2D camera
D. Sensors – Front 3D camera
E. Sensors - Side 2D camera (located on each side of machine)
F. Sensors - Side 3D camera (located on each side of machine)
G. Sensors - Lower LIDAR

## MACHINE SETUP

### ATTACHING SQUEEGEE ASSEMBLY

1. Stop machine on a level surface.
2. Turn the machine *ON/OFF key switch* off.

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

3. Place the rear squeegee under the squeegee mount bracket and fasten with the two knobs.
4. Connect the vacuum hose to the squeegee assembly. Loop the hose as shown using the hose clip provided.

   The squeegee deflection is set at the factory. If the squeegee blade needs adjustments, see ADJUSTING REAR SQUEEGEE BLADE DEFLECTION section of this manual.

### INSTALLING BRUSHES/PADS

To install the brushes or pad, see REPLACING DISK SCRUB BRUSHES OR PAD DRIVER or section of this manual.

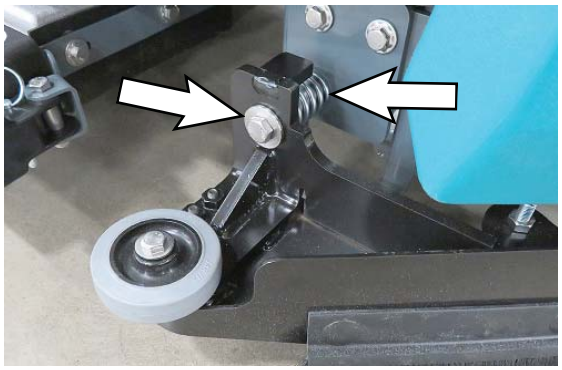
### ATTACHING FRONT PERIMETER GUARD

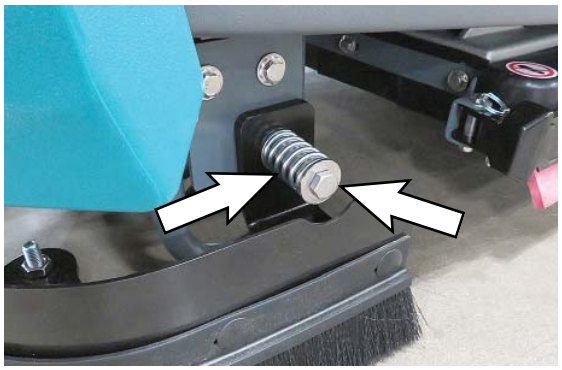
1. Stop machine on a level surface.
2. Turn the machine *ON/OFF key switch* off.

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

3. Place the ront perimeter guard underneath the front of the machine.

4. Install the front perimeter guard onto the front of the machine.





### *ec-H2O* WATER CONDITIONING CARTRIDGE (OPTION)

The *ec-H2O* system is equipped with a water conditioning cartridge. The cartridge is designed to protect the machine's plumbing system from potential scaling. The cartridge is located under the seat.

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

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


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.

*NOTE: 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.*

The *ec-H2O* system indicator light will blink green/red when it is time to replace cartridge.


### FILLING THE SOLUTION TANK

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

The machine is equipped with a fill port at the rear of the machine.

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

**FOR CONVENTIONAL SCRUBBING:** Open the solution tank fill port and partially fill it with water (not to exceed 60°C/140°F). Pour the required amount of detergent into the solution tank according to mixing instructions on the bottle. Then continue filling the solution tank with warm water until the water level is just below the fill port.

**FOR SAFETY: When using machine, follow mixing and handling instructions on chemical containers.**

FOR *ec-H2O* SCRUBBING: Use cool clean water only (less than 21°C/70°F). Do not add any conventional floor cleaning detergents, system failure may result.

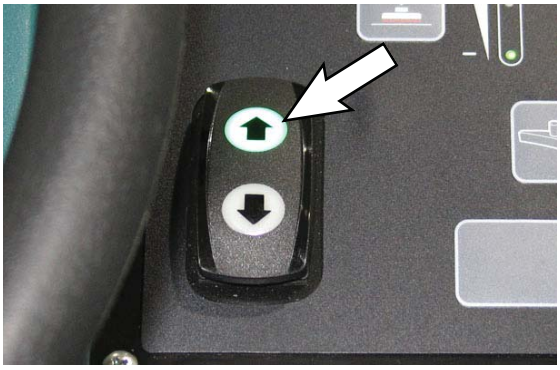
*NOTE: When filling the solution tank with a bucket, make sure that the bucket is clean. Do not use the same bucket for filling and draining the machine.*

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

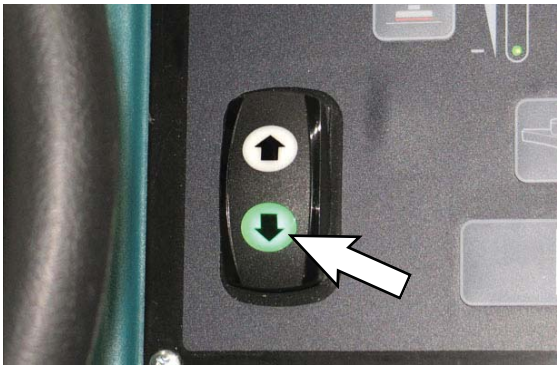
## OPERATION OF CONTROLS

### DIRECTIONAL SWITCH

Press the top of the *directional switch* to move the machine forward. The forward arrow light located at the top of the switch will illuminate when the machine is placed in the forward direction.



Press the bottom of the *directional switch* to move the machine in reverse. The reverse arrow light located at the bottom of the switch will illuminate when machine placed in the reverse direction.



### SETTING SCRUB MODES

Before scrubbing, select the type of scrubbing to be used, *ec-H2O* (option) or conventional scrubbing. Then set the preferred brush pressure, and solution flow settings.

*NOTE: The machine does not save solution flow and brush pressure settings for a robotic route, as cleaning needs may change. Adjust the solution flow and brush pressure settings before pressing the blue start/pause button to begin a robotic route.*

SETTING *ec-H2O* BUTTON

The *ec-H2O button* enables the *ec-H2O* system to come on when the *1-Step button* is on. The light in the button will come on when it is in this mode.

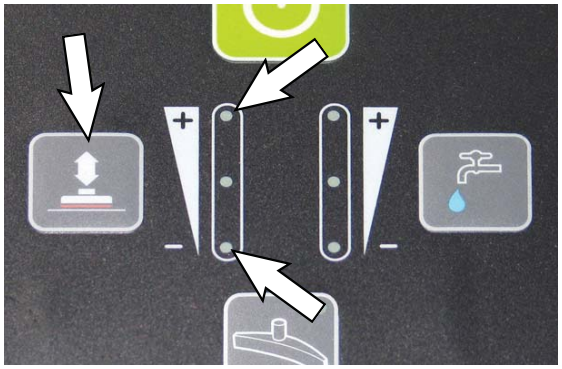
*NOTE: The ec-H2O system indicator light will not turn on until the machine starts scrubbing.*


*NOTE: ec-H2O Models-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.*

## SETTING BRUSH PRESSURE

Under normal conditions, the brush pressure should be set to the minimum setting (the bottom light). Under heavy grime conditions, the brush pressure should be set to the maximum setting (the middle or top lights). Travel speed and floor conditions will affect scrubbing performance.

With the *1-Step button* activated, press the *Brush pressure button* to both increase or increase the brush pressure settings. The brush pressure indicator lights display the current brush pressure setting.

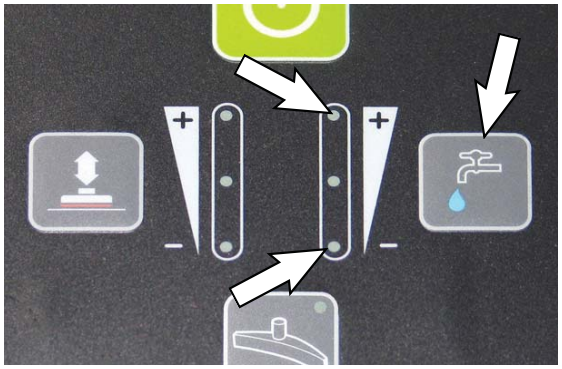


## SETTING SOLUTION FLOW

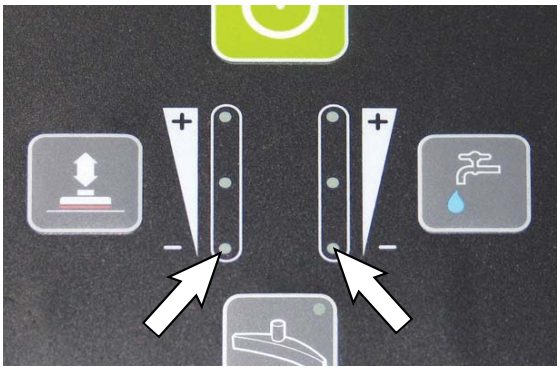
Under normal soilage conditions the solution flow level should be set to the lowest setting (the bottom light). Under heavy grime conditions, the solution flow level should be set to a higher setting (middle or top lights). Travel speed and floor conditions will affect scrubbing performance.

With the *1-Step button* activated, press the *Solution flow button* to both increase or decrease the solution flow. The solution flow indicator lights display the current solution flow setting.

*NOTE: It is recommended that medium or high solution flow levels be used for uncoated or unpolished floors (more porous). This applies to both conventional and ec-H2O scrubbing modes.*

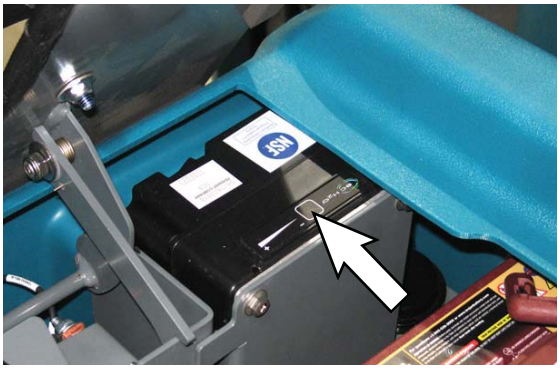


*NOTE: The machine will operate for a longer time if the Brush Pressure and Solution Flow settings are set to lowest setting (bottom lights).*



## *ec-H2O* SOLUTION FLOW SETTING

To adjust the solution flow rate when *ec-H2O* scrubbing, press the *solution flow button* located on the *ec-H2O* module. One LED= low, two LED's=medium, and three LED's= high. The *ec-H2O* module is located under the seat.

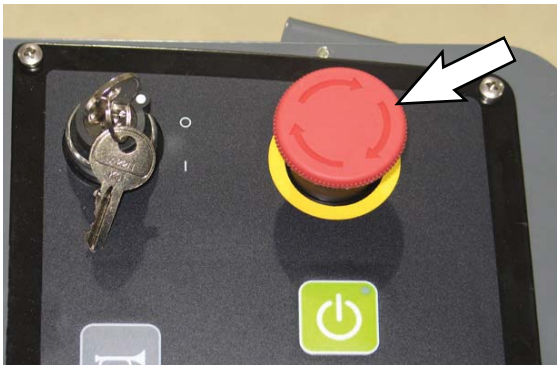


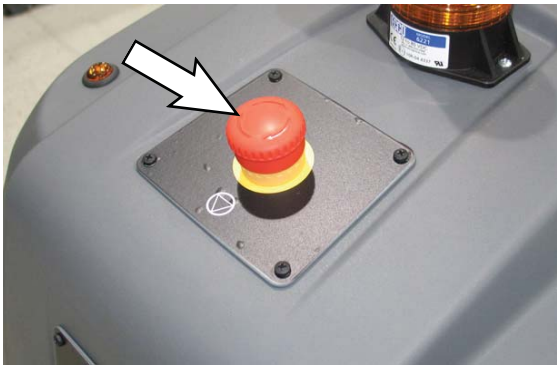
## EMERGENCY STOP BUTTONS

This machine is equipped with two *Emergency Stop buttons*, one on the control panel and one on the back of the recovery tank cover. Use the *Emergency Stop buttons* only in emergency situations, as solution could be potentially released from the squeegee vacuum hose and onto the floor, creating a slipping hazard.

*NOTE: These buttons should not be used for normal stopping, as premature wear to the parking brake and/or drive system may occur.*

Press either *Emergency Stop button* in an emergency to halt the machine power. Twist the same *Emergency Stop button* used to stop the machine to the right to disengage the emergency stop function. Turn the *ON/OFF key switch* to the off position and then to the on position to restart the machine.





If the *Emergency Stop button* is pressed when the machine is running a robotic route, the in-process route is terminated. Restart the machine by turning the engaged *Emergency Stop button* to the right, and then turning the *ON/OFF key switch* off and back on. Drive the machine to the desired home location code to be scanned, select the desired route, and press the *blue start/pause button* to begin the robotic route.

## MACHINE HOUR METER

The *hour meter* records the number of hours the machine has been operated. This information is useful for servicing the machine. The *hour meter* is located underneath the operator seat and next to the circuit breakers.


## *ec-H2O* SYSTEM INDICATOR LIGHT

*NOTE: The ec-H2O system indicator light will not illuminate until the machine starts scrubbing.*

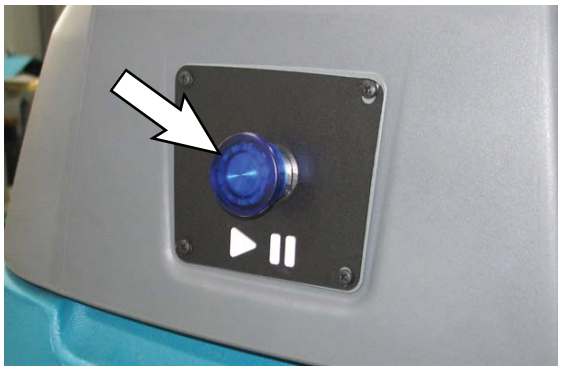
| *ec-H2O* SYSTEM INDICATOR LIGHT CODE | CONDITION |
|---|---|
| Solid green | Normal operation |
| Blinking green/red | Water conditioning cartridge expired. Replace cartridge |
| Solid or blinking* red | Contact Tennant service representative |

If the *ec-H2O system indicator light* begins to blink green/red, the water conditioning cartridge needs to be replaced (See *ec-H2O* WATER CONDITIONING CARTRIDGE REPLACEMENT).


**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 indicator light code clears.*

## BLUE START/PAUSE BUTTON

The machine is equipped with a *blue start/pause button* on the back that is used to start a robotic route or pause an in-process robotic route. When a saved navigation route is selected on the *UI touchscreen*, the *blue start/pause button* flashes. When pressed to start the route in robotic mode, the *blue start/pause button* stops flashing and remains consistently illuminated during robotic operation. The *blue start/pause button* is off when operating the machine in manual mode.



When a saved navigation route is selected on the *UI touchscreen*, press the flashing *blue start/pause button* to begin running the route in robotic mode. If necessary, approach the machine from behind and press the *blue start/pause button* again to pause the in-process robotic route. The machine stops moving forward and the scrub brush stops rotating. The vacuum remains on for a short time to pick up remaining solution and then turns off.

The machine can be driven manually when a robotic route is paused. This may be necessary if there is an obstacle that the machine is unable to maneuver around on its own. The navigation software will keep track of the current machine location within the route and allows the route to be resumed. Press the *blue start/pause button* again to resume the robotic route.

## USER INTERFACE (UI) TOUCHSCREEN

The *User Interface (UI) touchscreen* located to the left of the steering wheel. The *UI touchscreen* provides a system login screen, access to all the machine robotic operation controls, battery, solution tank, and recovery tank alerts. When a maintenance task requires immediate attention, an alert is triggered and appears on the *UI touchscreen*.

When the machine is turned on, the BrainOS software will automatically initialize. Once initialized, a security pin must be entered to access BrainOS software and use its robotic functionality.

BATTERY DISCHARGE BAR

The *battery discharge bar* displays the charge level of the batteries.


When the batteries are fully charged, the *battery discharge bar* is completely filled. As the batteries discharge, the *battery discharge bar* moves from the right to the left.

When the battery is low, an alert is triggered and displays on the *UI touchscreen*. All scrubbing functions are stopped, but the machine can still be driven. Recharge the batteries. See CHARGING THE BATTERIES in the MAINTENANCE section.

*NOTE: Do not charge batteries more often than necessary. Excessive charging could reduce the life of the batteries. It is best to charge the batteries only when alerted that the battery needs charging. See BATTERIES in the MAINTENANCE section.*

ROC: ROBOT OPERATIONS CENTER (BrainOS Software)

The BrainOS software provides access to the Brain Corps Robotic Operations Center, also known as the ROC. The ROC is a cloud-based robot operations center, managed by Brain Corp. technicians, that enhances the machine abilities by providing monitoring and analytics. The ROC is connected via a 4G LTE modem and does not require user interaction to connect. New versions of the software are automatically uploaded to the machine without disrupting service or operator interaction.


The *ROC indicator* is located on the *UI touchscreen* status bar. When the indicator is orange, the machine is successfully connected to the ROC. If the indicator is gray, the ROC is not connected and cannot be paired with a cell phone.

## HOW THE MACHINE WORKS

The scrub components of the machine are a solution tank, scrub brushes or pads, a squeegee, a vacuum fan, and a recovery tank.

The buttons on the control panel control the machine scrubbing functions. The *1-Step button* turns the preset scrub functions on and off. The *ec-H2O button* (option) enables the *ec-H2O NanoClean* (electrically converted water) system. The *vacuum fan/squeegee button* turns the vacuum fan on/off and raises and lowers the squeegee. The brush pressure buttons control the scrub brush pressure, and the solution buttons control the solution flow.

The steering wheel controls the path of the machine travel. The *directional switch* controls the forward or reverse direction of the machine. The propel pedal controls the speed of the machine. The brake pedal slows and stops the machine.

*NOTE: The amount and type of soilage play an important role in determining the type of brushes or pads to use. For specific recommendations, see the BRUSH INFORMATION section of this manual or contact a Tennant representative.*

The machine is equipped with BrainOS software that is accessible via the *User Interface (UI) touchscreen*, also known as the *UI touchscreen*. BrainOS technology offers a robotic mode feature that provides the ability for the machine to perform floor cleaning by following one of the saved navigation routes without direct, real-time operator control. The machine can only operate in robotic mode in areas where cleaning routes have been taught and saved. The *UI touchscreen* allows an operator to teach a new cleaning route, run an existing cleaning route robotically, access triggered alert messages, and more. It also provides constant visibility to current battery life and ROC connection status.

Home location codes must be permanently installed before the machine can be used in robotic mode. A home location code is a unique code identifier that the machine scans to determine its current location, as well as any routes that have been saved to that specific home location code. The machine is designed to work with up to 10 home location codes. Each home location code can store up to 6 routes for a total of 60 routes.

### CONVENTIONAL SCRUBBING

Water and detergent from the solution tank flow to the floor through a solution valve. The brushes use the detergent and water solution to scrub the floor clean. As the machine propels forward, the squeegee wipes the dirty solution from the floor. The suction created by the vacuum fan then draws the dirty solution from the squeegee into the recovery tank.

### *ec-H2O* SCRUBBING SYSTEM (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.

The *ec-H2O* system can be used with all double scrubbing applications.

*NOTE: Do not enable the ec-H2O system with conventional cleaning detergents in the solution tank. Drain, raise and refill the solution tank with only clear cool water before operating the ec-H2O system. Conventional cleaning detergents/ restorers may cause failure to the ec-H2O solution system.*

## BRUSH INFORMATION

For best results, use the appropriate brush or pad for the 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.*

**Polypropylene brush** - General purpose polypropylene bristles lift lightly compacted dirt without scuffing high-gloss coated floors.

**Nylon brush** - Softer nylon bristles are recommended for scrubbing coated floors. Cleans without scuffing.

**Super AB brush** - Nylon fiber with an abrasive grit to remove stains and compacted dirt  Aggressive action on any surface. Performs well on buildup, grease, or tire marks.

**Stripping pad (Brown)** - For stripping of floor finish to prepare the floor for recoating.

**Scrubbing pad (Blue)** - For medium to heavy-duty scrubbing. Removes dirt, spills, and scuffs.

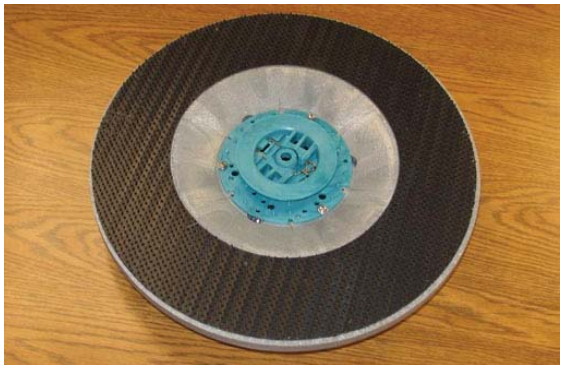
**Buffing pad (Red)** - For light duty scrubbing without removing floor finish.

**Polishing pad (White)** - For maintaining highly polished or burnished floors.

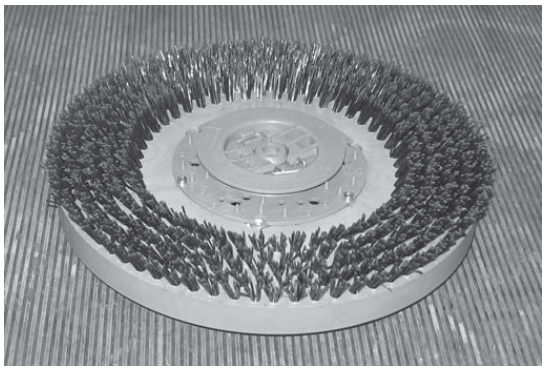
**High productivity stripping pad (Black)** - For aggressive stripping of heavy finishes or sealers, or for very heavy duty scrubbing. This pad can only be used with the grip pad driver, not the tufted pad driver.

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

**Grip pad driver** - The grip-face backing allows pads to be fully used and holds pads in place without penetrating the pad. The spring-activated centering device works with all Tennant pads and allows for fast, easy pad replacement.



**Tufted pad driver** - Standard pad driver has short bristles, or “tufts,” on the back to hold the pad in place. This driver works with all Tennant pads except the black high productivity pad.



## MACHINE OPERATION

### PRE-OPERATION CHECKLIST

- ☐ Check the machine for fluid leaks.
- ☐ Check the battery fluid and charge level.
- ☐ Check the tank cover seals for damage and wear.
- ☐ Clean the vacuum fan inlet filter.
- ☐ Check the condition of the scrubbing brushes. Remove any string, banding, plastic wrap, or other debris wrapped around them.
- ☐ Check the squeegees for damage, wear and for deflection adjustment.
- ☐ Check the left perimeter guard, right perimeter guard, front perimeter guard, and perimeter guard bristles for debris, damage, and wear. Be sure the left perimeter guard is closed and secured closed with the clevis pin.
- ☐ Check the vacuum hose for debris or blockage.
- ☐ Drain and clean the recovery tank.
- ☐ Check the brakes and steering for proper operation.
- ☐ Check the service records to determine maintenance requirements.
- ☐ Check the front and side 2D and 3D cameras and the upper and lower LIDAR sensors for dirt, dust, and smudges. Use provided microfiber cloth to clean all cameras and LIDAR sensors.
- ☐ Check the horn, headlights, taillights, safety lights, and audible alarms (if equipped).
- ☐ **For *ec-H2O* Scrubbing:** Ensure that all conventional cleaning agents are drained and rinsed from the solution tank.
- ☐ **For *ec-H2O* Scrubbing:** Ensure that the solution tank is filled with clear cool water only.

**WHILE OPERATING THE MACHINE (ROBOTIC MODE/MANUAL MODE)**

Pick up oversized debris before scrubbing. Pick up wire, string, twine, large pieces of wood, or any other debris that could become wrapped around or tangled in the brushes.

Drive as straight a path as possible. Avoid bumping into posts or scraping the sides of the machine. Overlap the scrub paths by several centimeters (a few inches).

Avoid turning the steering wheel too sharply when the machine is in motion. The machine is very responsive to the movement of the steering wheel. Avoid sudden turns, except in emergencies.

Adjust the machine speed, brush pressure, and solution flow as required when scrubbing. Use the minimal brush pressure and solution flow settings as possible.

If poor scrubbing performance is observed, stop scrubbing and refer to MACHINE TROUBLESHOOTING.

Perform the Daily Maintenance Procedures after scrubbing (see MACHINE MAINTENANCE).

Drive the machine slowly on inclines. Use the brake pedal to control machine speed on descending inclines. Scrub with the machine up inclines rather than down inclines. Do not teach a robotic route on an incline or decline.

**FOR SAFETY: When using machine in manual mode, go slowly on inclines and slippery surfaces.**

**FOR SAFETY: When using machine, place proper floor cleaning signage in areas where the machine is operating and people are present, in accordance with standard floor cleaning practices. Follow site safety guidelines concerning wet floors.**

See Autonomous Navigation Software End User License Agreement (EULA) for further uses and restrictions.

Do not operate machine in areas where the ambient temperature is above 40° C (104° F). Do not operate scrubbing functions in areas where the ambient temperature is below 2° C (38° F).

**FOR SAFETY: When using machine in manual mode, do not scrub on ramp inclines that exceed 7% grade or transport (GVWR) on ramp inclines that exceed 10.5% grade.**

**FOR SAFETY: While machine is operating in robotic mode, only scrub flat, hard surfaces of 0% incline.**

**WHILE OPERATING THE MACHINE (ROBOTIC MODE ONLY)**

This machine should only be used to scrub flat, hard surfaces of 0% incline when operating in robotic mode.

The machine is not designed or intended for use in environments requiring fail-safe performance including, but not limited to, any application where machine failure could lead to personal injury or property damage.

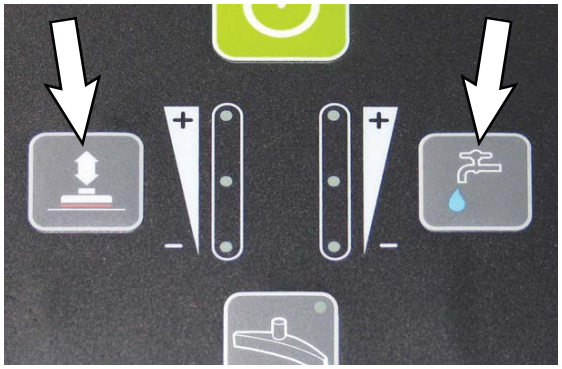
Do not attempt to ride the machine when it is operating in the robotic mode. The machine is equipped with joy ride sensors. If there is an attempt to sit on the seat or hold the steering wheel when operating in the robotic mode, the machine will stop and trigger an alert. The operator is responsible for supervising and monitoring safe operation of the machine.

## SCRUBBING - MANUAL MODE

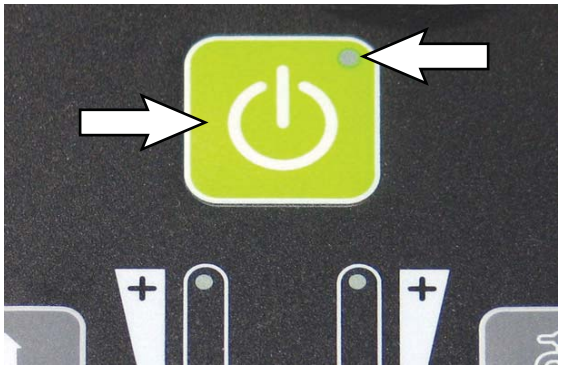
**FOR SAFETY: Do not operate machine, unless operator manual is read and understood.**

1. Turn the *ON/OFF key switch* on.

2. Select the preferred scrubbing settings (See SETTING SCRUB MODES).



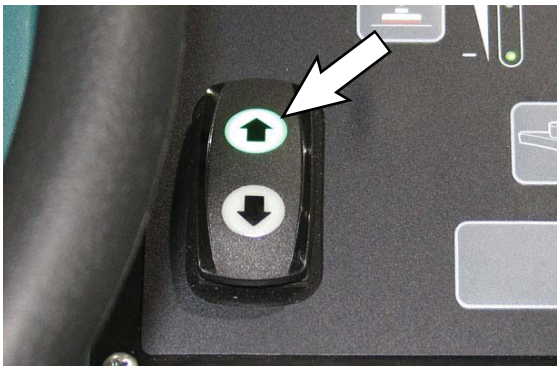
3. Press the *1-Step button*. The light in the button is illuminated. All the preset scrubbing functions will turn on.



*NOTE: DO NOT turn the ec-H2O system on during conventional scrubbing. Conventional cleaning detergents/restorers may cause failure to the ec-H2O solution system. Drain, rinse and refill solution tank with cool clean water before operating the ec-H2O system.*

4. Place the *directional switch* in the direction the machine is to be moved (forward or reverse).

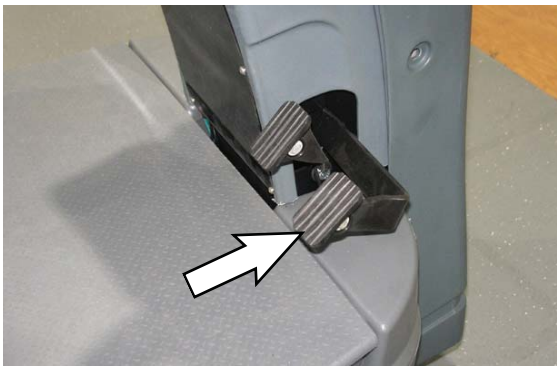
*NOTE: The machine can scrub in both forward or reverse.*



*NOTE: The squeegee automatically raises when the machine is driven backwards. This prevents damaging the squeegee. When the machine is placed in reverse, the vacuum fan will shut off after a short delay.*

5. Press the *propel peda*l to begin scrubbing.

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

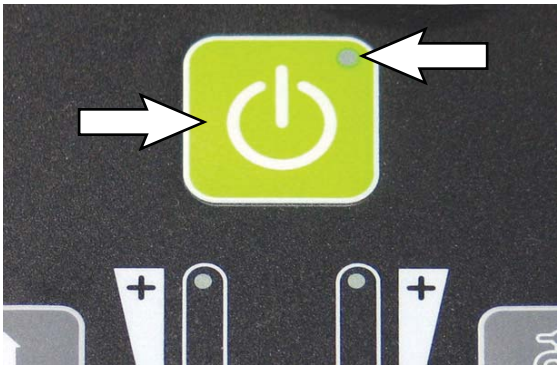


6. Release the *propel pedal* to stop the machine. Scrubbing functions stop and the automatic park brake will engage when the machine stops.

   The *brake pedal* can be used to control the machine if quicker stopping is needed or if operating on an incline. Do not operate machine on inclines exceeding 7% when scrubbing.

**FOR SAFETY: When using machine in manual mode, go slowly on inclines and slippery surfaces.**

7. Press the *1-Step button* to stop scrubbing. The light in the *1-Step button* will turn off and the scrubbing functions will turn off after a short delay.



**DOUBLE SCRUBBING**

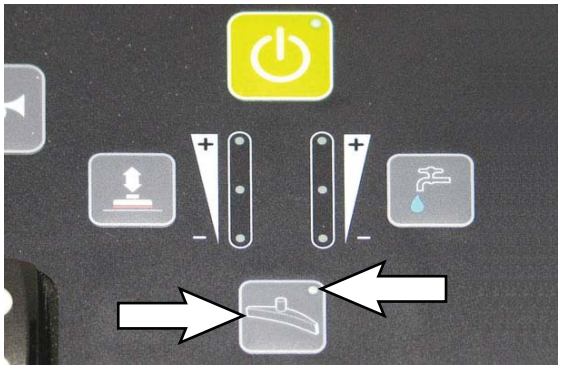
*NOTE: Double scrubbing is available in Manual Mode only.*

For heavily soiled areas, use the double scrubbing method.

Double scrubbing can be performed using the *ec-H2O* SCRUBBING SYSTEM (option) or CONVENTIONAL SCRUBBING methods.

Before double scrubbing, remove the side squeegees to keep them from channeling water while double scrubbing. To remove the side squeegees, lower the scrub head, then pull the pins on the front and rear ends of the squeegees.

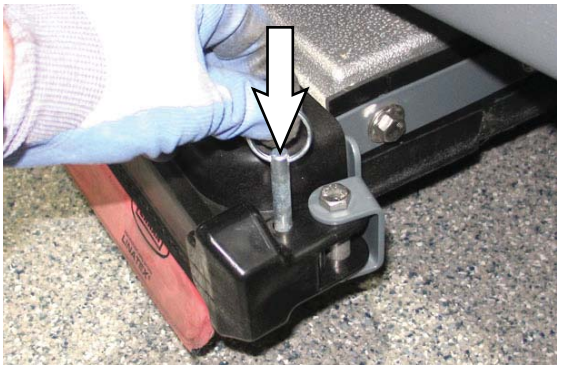
To double scrub, press the *1-Step button*, then the *vacuum fan button*. The light above the v*acuum fan button* will turn off, the squeegee will raise and the vacuum fan will stop operating. Then scrub the area.



Let the cleaning solution set on the floor for 3-5 minutes.

Place the side squeegees back on to the machine before scrubbing the floor the second time.

*NOTE: It is easier to put the side squeegees back on to the machine with the scrub head partially lowered. This allows clearance to install the pins.*



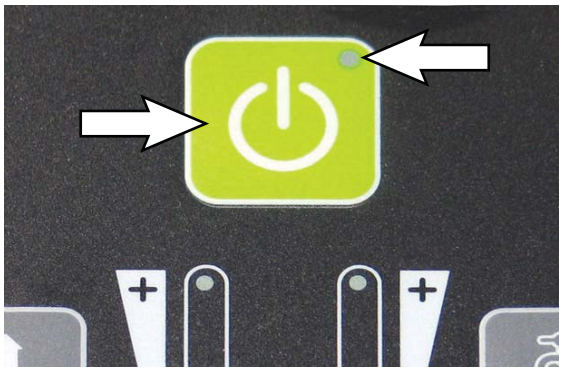
Press the *vacuum fan button* again to lower the squeegee and to turn on the vacuum fan. The light above the *vacuum fan button* will illuminate. Scrub the floor a second time to pick up the cleaning solution.

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

**WATER PICKUP MODE (NO SCRUBBING)**

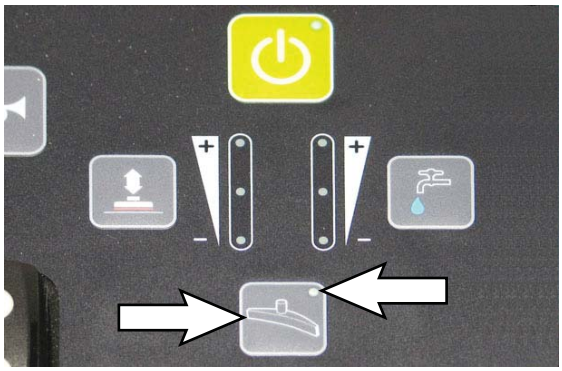
The machine can be used to pick up water or non-flammable liquid spills without scrubbing.

To pick up water or non-flammable liquid spills, check to make sure that the *1-Step button* is not activated. The light in the *1-Step button* must be off.



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

Then press the *vacuum fan/squeegee button*. The light in the *vacuum fan/squeegee button* will illuminate, the squeegee will lower and the vacuum fan will start operating. Then pick up the water or non-flammable liquid spill.



## SCRUBBING - ROBOTIC MODE

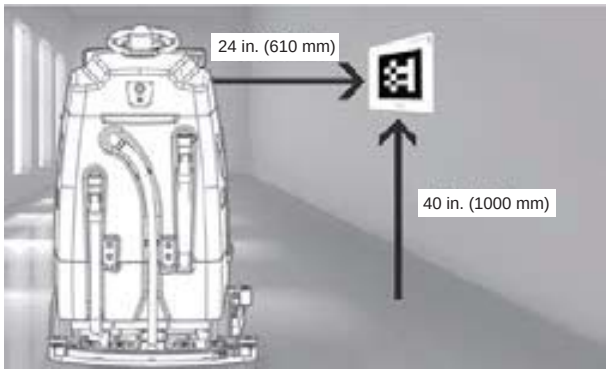
**FOR SAFETY: Do not operate machine, unless operator manual is read and understood.**

### ESTABLISH HOME LOCATION CODES

Home location codes must be permanently installed before using the machine in robotic mode. A home location code is a unique bar code identifier that the machine scans to determine its current location, as well as any routes that have been saved to that specific home location code. The machine is designed to work with up to 10 home location codes, and each home location code can store up to six routes for a total of 60 routes.

Home location codes are used to establish the start and end point of a cleaning route. The number of home location codes needed may vary, depending on the size of the space where the machine will be operating in robotic mode.

- Multiple home location codes may be necessary for large or unusually mapped areas where more than six cleaning routes are needed.
- Establish a unique home location code for each floor of a multi-level building.
- Install home location codes in a permanent location on an open wall or column near commonly cleaned areas that do not change from day-to-day. If the home location code is moved even slightly, the route may not be performed correctly.
- Install home location codes at a height of 40 in. (1000 mm) from the floor.




- Install home location codes so that the machine can easily scan with the camera on its right side at a distance of no less than 24 in. (610 mm).
- Securely affix home location codes to the wall.
- The entire home location code must be clearly visible, not hidden behind furniture or shelving.
- Do not install home location codes near stairways, fire exits, or fire, first aid, or emergency equipment.
- Do not photocopy, laminate, or place home location codes in a glossy sleeve or cover. Doing so may prevent the machine from being able to scan the code.

*NOTE: If a home location code is lost or damaged, contact customer service for a replacement.*

## LOGGING INTO BrainOS

A PIN is required to log in to BrainOS when the machine is initially turned on or after 3 minutes (180 seconds) of no touch activity on the *UI touchscreen*. This is to ensure that only authorized personnel can access and use the BrainOS robotic functionality.

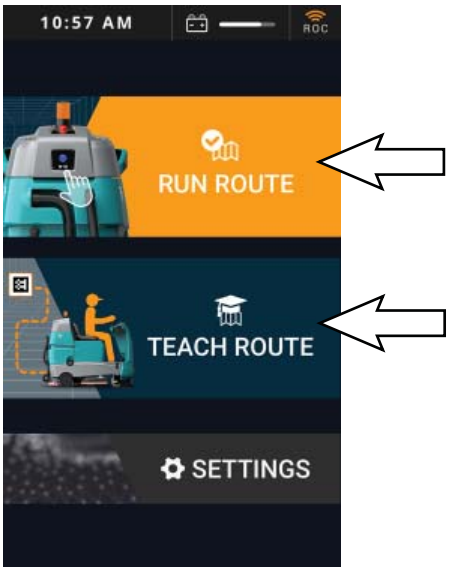
1. Turn the *ON/OFF key switch* on. Allow the BrainOS to start up (approximately 1 minute).
2. Use the *UI touchscreen* keypad to enter security four-digit PIN.


3. Upon successful PIN entry, the *UI touchscreen* displays the main menu.


## POSITIONING THE MACHINE AT THE HOME LOCATION CODE

The machine must be positioned so the right-side 2D camera can scan the home location code. The machine cannot be operated in robotic mode until a home location code is scanned and recognized.

1. Upon successful PIN entry, the *UI touchscreen* displays the main menu. Touch the applicable task (RUN ROUTE or TEACH ROUTE).




2. Drive the machine to the desired home location code, positioning the machine so the right-side camera is no less than 24 in. (610 mm) from the home location code.

3. The machine automatically begins scanning the home location code, as shown on the *UI touchscreen*. If the machine is unable to scan the home location code, the *UI touchscreen* will display an error message with messages how to resolve.



*NOTE: A flashlight can be used in dark and low light areas to help the machine see and scan the home location code.*

*NOTE: Do not stand in front of the machine right-side camera when it is trying to scan the home location code.*

4. If running a route, a **Success! Choose a route to start cleaning** message briefly appears on the *UI touchscreen* after the machine successfully scans the home location code.

   If teaching a route, a **Success! Choose a box to save your route to** message briefly appears on the *UI touchscreen* after the machine successfully scans the home location code.

*NOTE: Do not drive the machine before selecting an option from the UI touchscreen. If the machine is driven after scanning the home location code but before selecting the next option, a warning message will appear on the UI touchscreen stating, Please do not move the robot after homing.*

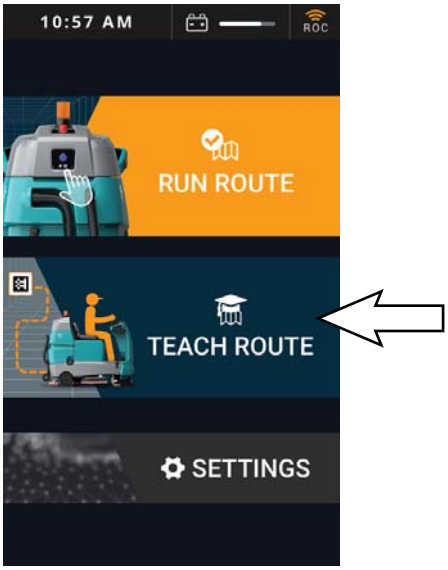
**TEACHING A NEW ROUTE (BrainOS Software)**

*NOTE: The machine can only operate in robotic mode in areas where cleaning routes have been taught and saved.*

*NOTE: A route that takes 1 hour to teach can take the machine up to 2 hours to complete in robotic mode. When operating in robotic mode, the maximum speed is approximately 2.5 mph. Routes longer than 1 hour are not recommended due to water and battery capacity. For best performance, split a large cleaning routes into multiple smaller cleaning routes.*

*NOTE: When teaching machine, avoid teaching routes near sudden drops in floor surfaces, stairs, loading docks, or ramps. Maintain a safe distance of approximately 18 in. (457 mm) from such areas when teaching the machine a new route.*

1. Turn the *ON/OFF key switch* on. Allow the BrainOS to start up (approximately 1 minute).
2. Use the *UI touchscreen* keypad to enter security four-digit PIN.
3. Upon successful PIN entry, the *UI touchscreen* displays the main menu. Touch TEACH ROUTE.

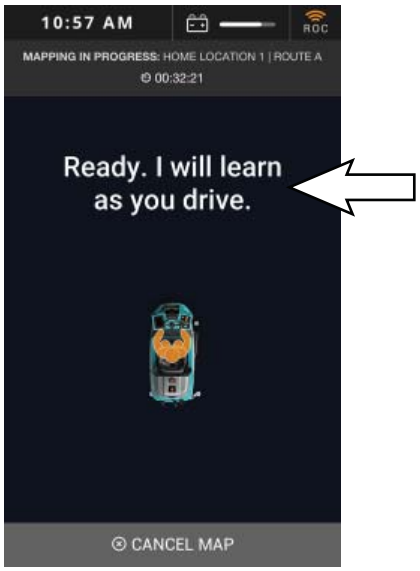



4. Drive the machine to the desired home location code, positioning the machine so the right-side camera is no less than 24 in (610 mm) from the home location code. See POSITIONING THE MACHINE AT THE HOME LOCATION CODE.
5. The machine automatically begins scanning the home location code, as shown on the *UI touchscreen*. If the machine is unable to scan the home location code, the *UI touchscreen* will display an error message with suggestions on how to resolve.
6. A **Success! Choose a box to save your route to.** message briefly appears on the *UI touchscreen* after the machine successfully scans the home location code, followed by a list of all existing and available routes for the scanned home location code.

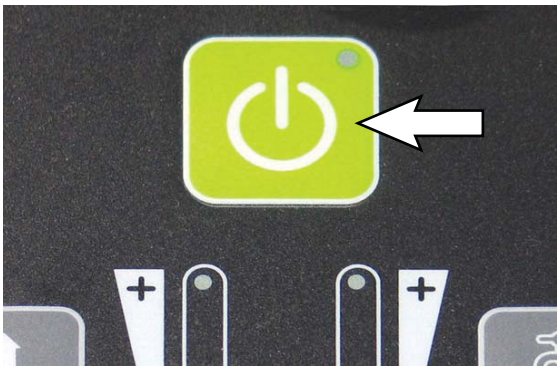

*NOTE: In the above screen routes A and B are already being used for robotic routes. Routes C, D, E, and F are available for new routes.*

*NOTE: If no routes are available, an existing route must be deleted in order to teach a new route. See DELETING ROUTES.*

7. Touch one of the available routes to select. The *UI touchscreen* states **Ready. I will learn as you drive.**

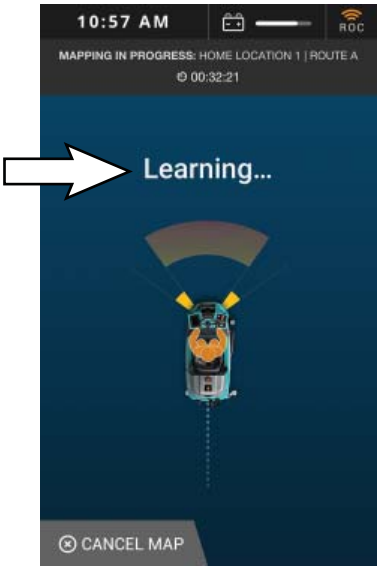



8. Press the *1-Step button* to activate the cleaning systems.



*NOTE: If the 1-Step button is not pressed, the route will be saved with no cleaning systems engaged.*

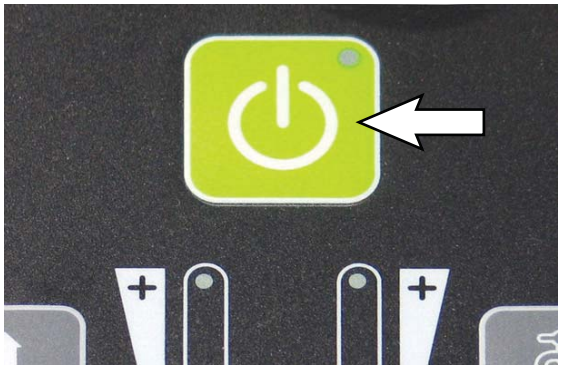
9. Press the *propel pedal* and drive the machine through the entire cleaning route to be saved. As soon as driving begins, the *UI touchscreen* states **Learning...** along with the amount of time spent on the route so far.




*NOTE: Do not teach a route with an incline or decline.*

*NOTE: Do not teach the machine routes that include driving into an elevator or automatic doors.*

*NOTE: When teaching a new route with a non-scrubbable area, press the 1-Step button approximately 120 in (3048 mm) prior to reaching the area to raise the scrub head and squeegee. Press the 1-Step button again to lower the scrub head and squeegee when past the area. The BrainOS navigation software will remember where in the route the cleaning systems were lifted and lowered when operating in robotic mode.*



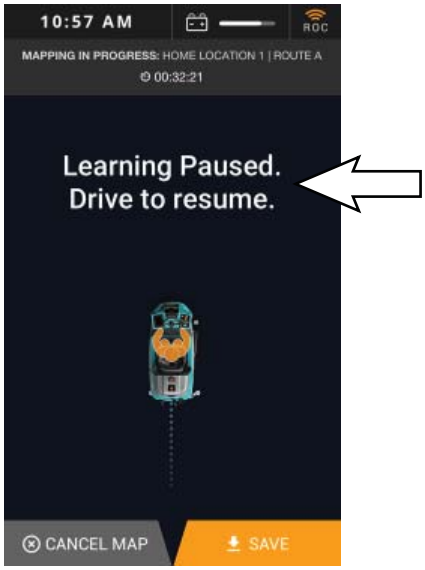
*NOTE: Avoid U-turns. The machine requires a minimum of 120 in (3048 mm) to perform a U-turn.*

*NOTE: Avoid tight corners. The machine requires a minimum of 60 in (1524 mm) to navigate a corner.*

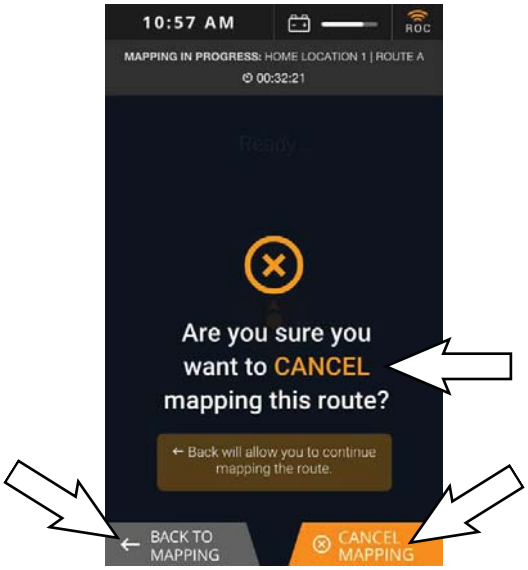
*NOTE: Avoid narrow spaces. The machine requires a width of 48 in (1220 mm) to navigate aisles and between displays.*

**FOR SAFETY: While machine is operating in robotic mode, only scrub flat, hard surfaces of 0% incline.**

10. Once driving stops, the *UI touchscreen* states **Learning Paused. Drive to resume.** with options to SAVE or CANCEL MAP. Touch SAVE to save the new route.




*NOTE: If cancelling the new route, touch CANCEL MAP on the UI touchscreen. The UI touchscreen states* **Are you sure you want to CANCEL mapping this route?** *Touch CANCEL MAPPING to cancel the route and return to the main menu. Touch BACK TO MAPPING to return to the previous screen.*




*NOTE: Touch BACK TO MAPPING to return to the previous screen. Begin driving to resume teaching the new route.*

11. The machine will scan the home location code a second time at the end point of the cleaning route. If the machine does not see the home location code from the right-side camera, the *UI touchscreen* states **Drive to scan my home location.**

*NOTE: A new cleaning route cannot be saved until the machine scans the same home location code a second time in the same physical location.*

12. When in the process of saving, the *UI touchscreen* displays **Saving Route**.


13. When the route is successfully saved, the *UI touchscreen* briefly displays **Success! Route saved.** and then returns to the main menu. The new cleaning route is saved and is now available to run in robotic mode.

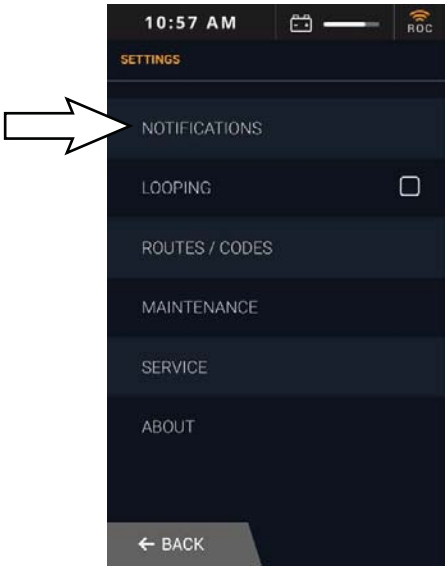

*NOTE: If the UI touchscreen states* **Error 20007 Failed to create a route***, touch Return to Home to return to the main menu. Repeat the entire procedure to teach the cleaning route.*

## PAIRING A PHONE WITH THE ROC

Before running a cleaning route in robotic mode, it is recommended that the operator pair their cell phone to the ROC. When a cell phone is paired to the ROC, the ROC will send SMS or MMS messages to the phone whenever the machine encounters an alert and/or when the route is complete.

To ensure only the on site operator receives alerts from the ROC, only one phone can be paired to the ROC to receive status alerts. A paired phone number is automatically discarded when the machine is turned off or a new phone is paired.

1. Turn the *ON/OFF key switch* on.
2. Touch SETTINGS on the main menu on the *UI touchscreen*. The SETTINGS menu displayed.
3. Touch NOTIFICATIONS.

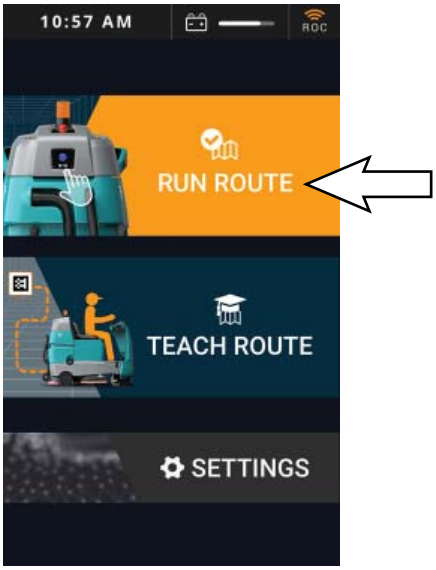



4. Follow the instructions on the *UI touchscreen* to pair a cell phone to the ROC.
5. Pairing is successful when the cell phone receives a confirmation text message.

## RUNNING A ROBOTIC CLEANING ROUTE (BrainOS Software)

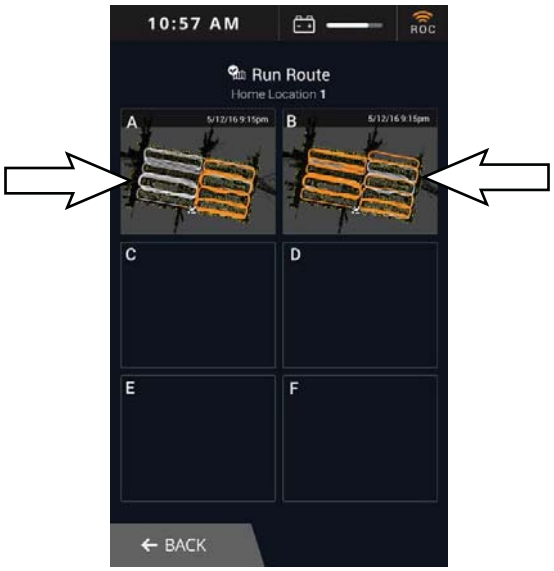
Once one or more cleaning routes have been taught and saved, the machine can be operated in robotic mode. When running a route in robotic mode, pairing a cell phone can be a valuable tool. See ROC: ROBOT OPERATIONS CENTER (BrainOS Software).

1. Turn the *ON/OFF key switch* on.
2. When the main menu appears on the *UI touchscreen*, touch RUN ROUTE.




3. Drive to the desired home location code, positioning the machine so that the right-side camera scans the home location code (See POSITIONING THE MACHINE AT THE HOME LOCATION CODE). The machine automatically begins scanning, as displayed on the *UI touchscreen*.
4. A **Success! Choose a route to run.** is briefly displayed, followed by a list of all existing routes for the scanned home location code.

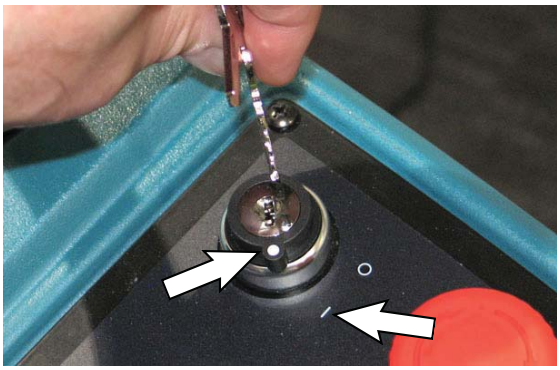
5. Touch the cleaning route to run in robotic mode.




6. If necessary, adjust the scrub settings for the area(s) to be scrubbed. See SETTING SCRUB MODES.

*NOTE: The machine does not save solution flow and brush pressure settings for a robotic route, as these needs may change from day-to-day. Determine cleaning requirements for the area(s) being cleaned and adjust solution flow and brush pressure settings as necessary.*

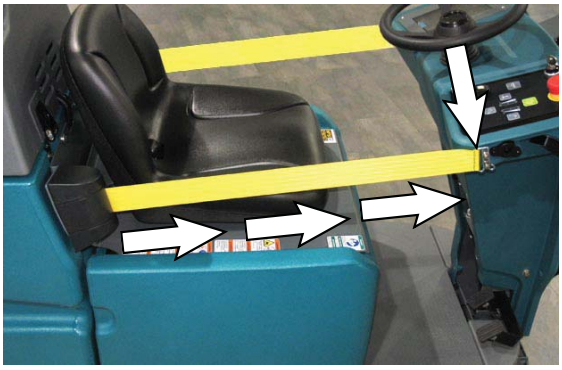
7. Remove the key from the *ON/OFF key switch*.



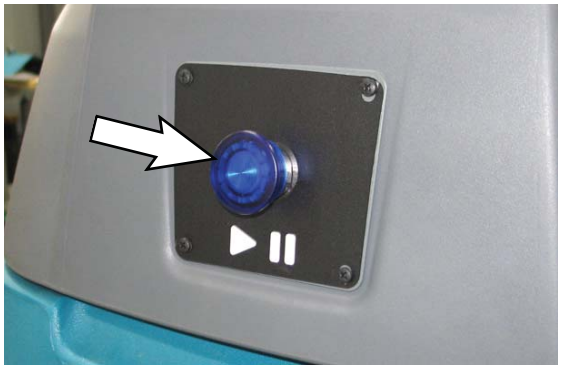
**FOR SAFETY: While machine is operating in robotic mode, remove key from ON/OFF key switch to prevent unauthorized use without disrupting robotic route.**

8. The *UI touchscreen* displays TO START with instructions to **1. Secure the yellow safety straps. 2. Push the blue button in the back.** The *UI touchscreen* also displays a rotating machine image that shows securing the yellow safety straps and highlighting the *blue start/pause button* on the back of the machine.


9. Pull the yellow safety straps to the front screws on both sides of the machine.

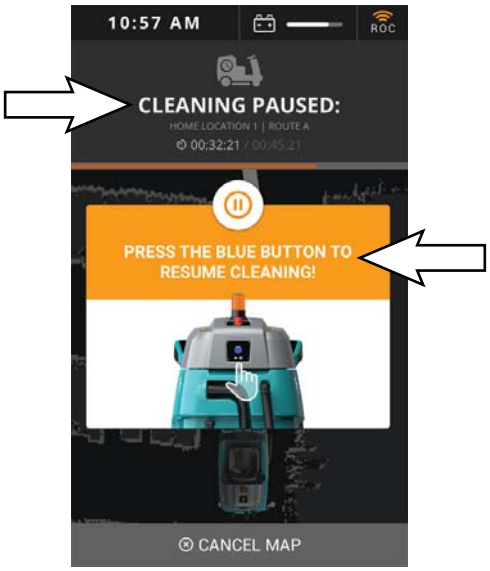


10. Press the flashing *blue start/pause button* to start the robotic route. The yellow warning light flashes and the horn sounds to signal that robotic cleaning is starting.



11. As the machine begins robotic operation, observe scrubbing performance to ensure that all components are functioning properly.

12. If any scrubbing functions need adjustment, press the *blue start/pause button* to pause the machine. The *UI touchscreen* states **Cleaning Paused: Press the blue button to resume cleaning!**




13. Make the necessary adjustments to the brush pressure, solution flow, and squeegees.

14. Press the *blue start/pause button* to resume the route in robotic mode.

15. As the machine runs the route in robotic mode, the *UI touchscreen* states Cleaning in Progress, as well as the machine current location on the cleaning route, amount of time spent on the route, and the total amount of time the route should take in robotic mode.


**FOR SAFETY: While machine is operating in robotic mode, do not grab steering wheel or put hands or arms through the holes of the steering wheel. Steering wheel may move rapidly and unexpectedly while in robotic mode.**

*NOTE: The machine is equipped with joy-ride sensors. If a person attempts to sit on the seat or hold the steering wheel when operating in robotic mode, the machine will automatically stop and trigger an alert.*

16. If an alert is triggered during the robotic route, the machine automatically pauses and the *UI touchscreen* displays the alert along with steps to resolve. If a phone is paired to the ROC, the ROC sends a text message of the alert to the phone. See ALERT MESSAGES.

*NOTE: If the machine repeatedly triggers an alert in the same place on a cleaning route, even when there are no obstructions, there could be an environmental factor such as a reflection causing the machine to sense an obstruction in the cleaning path. For help resolving the issue, contact customer service and provide the home location code number, route letter, area of concern, and pictures of what the machine sees (if possible). Customer service may be able to remotely adjust the route to improve performance.*

17. When the machine completes the robotic route, the *UI touchscreen* displays **CLEANING COMPLETE**, as well as route information, length of time spent on the route, and a map of the route that shows areas cleaned. Touch DONE to return to the main menu.

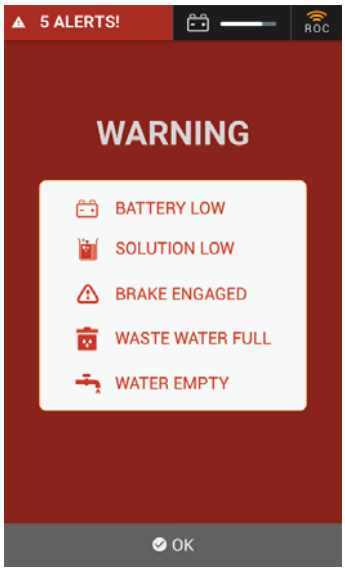
18. Touch RUN ROUTE to select another cleaning route to run in robotic mode (see previous steps).

19. If finished cleaning, drive the machine to a designated parking station, insert the key into the *ON/OFF key switch* and turn the *ON/OFF key switch* off.

### ALERTS DURING ROBOTIC OPERATION

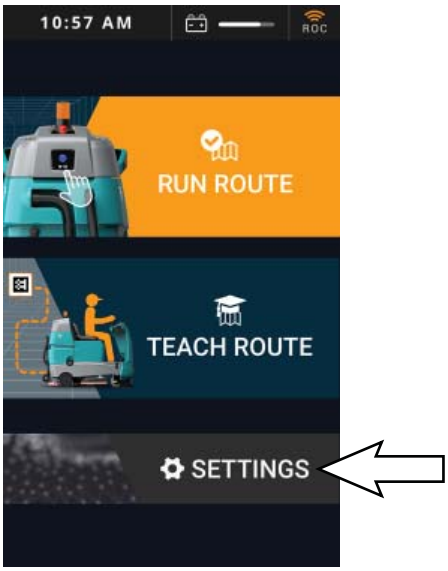
When an alert is triggered during robotic operation, the machine is automatically paused. The *UI touchscreen* displays the triggered alert and steps to resolve the issue. If necessary, the machine can still be manually driven but all scrubber functions are disabled.

If multiple alerts are triggered, the number of alerts appears on the top left of the *UI touchscreen* along with a list of alerts that require attention. See ALERT MESSAGES.

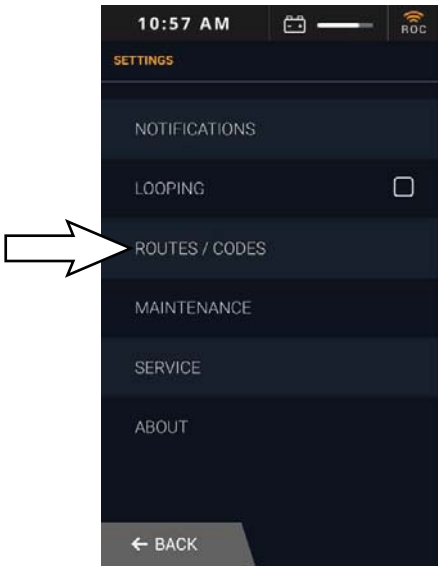


**DELETING ROUTES**

1. Turn the *ON/OFF key switch* on.
2. Touch SETTINGS on the *UI touchscreen* main menu.




3. Touch ROUTES.




4. Drive the machine to the desired home location code, as instructed on the *UI touchscreen* (See POSITIONING THE MACHINE AT THE HOME LOCATION CODE). The machine automatically begins scanning, as displayed on the *UI touchscreen*.
5. All existing routes for the scanned home location code are displayed on the *UI touchscreen*. Touch the route to be deleted. The route will be highlighted and have a check mark to indicate it is selected.


*NOTE: A deleted route cannot be retrieved by the software. If a route is deleted by accident, it must be re-taught (see TEACHING A NEW ROUTE).*

*NOTE: Touch BACK to return to the SETTINGS menu. Touch BACK again to return to the main menu.*

6. Touch DELETE to delete the route.
7. The *UI touchscreen* states **Are you sure you want to DELETE this route?** Touch DELETE again to delete the route.

*NOTE: Touch BACK to return to the list of routes for the scanned home location code. Touch BACK again to return to the SETTINGS menu.*

8. All existing routes for the home location code are displayed. The deleted route no longer appears on the screen.
9. If finished deleting routes for the selected home location code, touch BACK to return to the SETTINGS menu. Touch BACK again to return to the main menu.

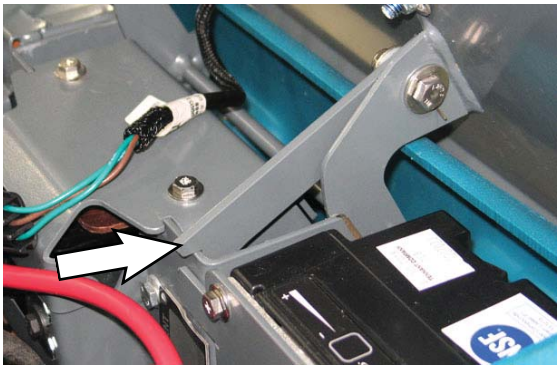
## DRAINING AND CLEANING THE TANKS

When cleaning is finished the recovery tank should be drained and cleaned. The solution tank then can be filled again for additional cleaning.

1. Drive the machine to a solution disposal drain.
2. Turn the machine *ON/OFF key switch* off.

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

3. Tilt the operator seat forward and hook the seat latch into place to hold up the seat.



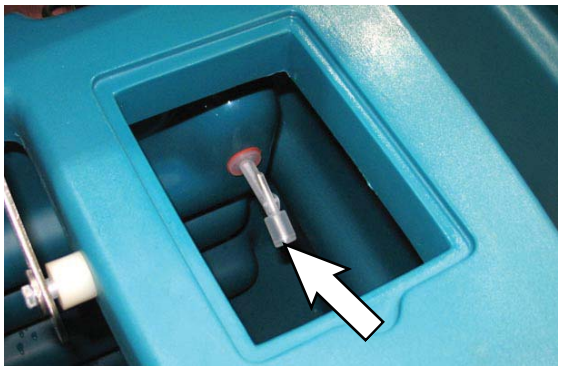
4. Remove the recovery tank drain hose. While holding the hose up, remove the plug, then slowly lower the drain hose to the floor drain or sink.

5. Lift the recovery tank cover. Flush the inside of the recovery tank with clean water.

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

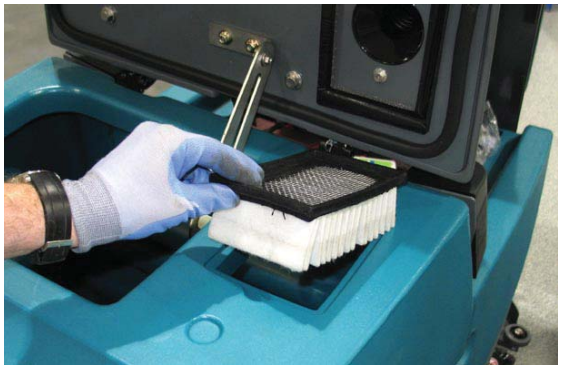
*NOTE: DO NOT use steam to clean tanks. Excessive heat can damage tanks and components.*

6. Rinse the float sensor located inside the recovery tank.



7. Replace the recovery tank drain hose cap and mount the drain hose back onto the mounting clip after the tank is drained.

8. Remove and clean the vacuum fan filter. Clean the filter with a damp cloth or low pressure water hose if dirty. Allow the vacuum fan filter to dry completely before reinstalling it in the machine.

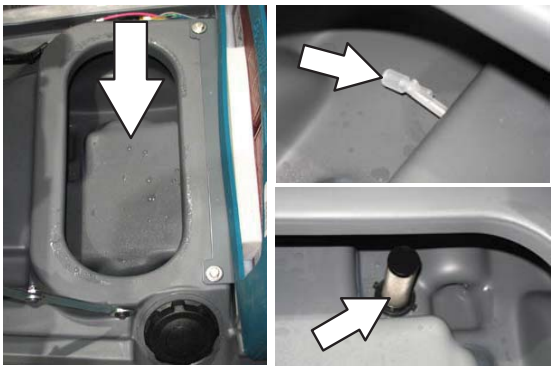


9. Close the recovery tank cover.

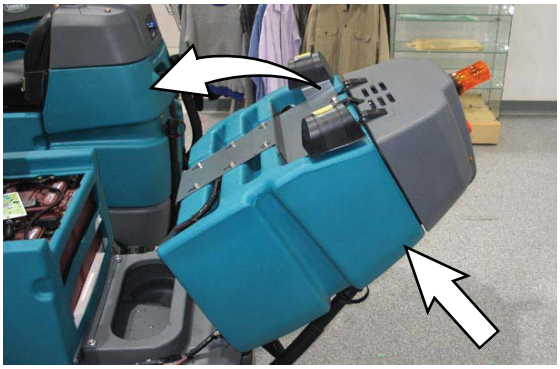
10. Remove the solution tank drain hose. While holding the hose up, remove the plug, then slowly lower the drain hose to the floor drain or sink.

11. Tilt the recovery tank back to access the solution tank. Make sure the recovery tank is empty before tilting.

12. Flush the solution tank and rinse the float sensor located inside the back part of the solution tank. Rinse the screen filter on the bottom of the tank.

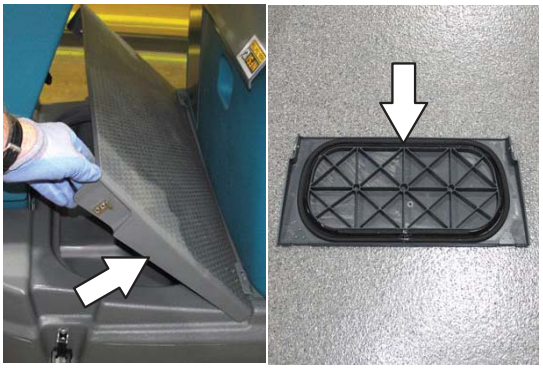


13. Carefully push the recovery tank forward to close the solution tank.



14. Unhook the seat latch and lower the operator seat.

15. Clean the front of the solution tank through the front access port located under the front solution tank cover. Wipe the bottom of the cover and the tank seal before replacing the cover.



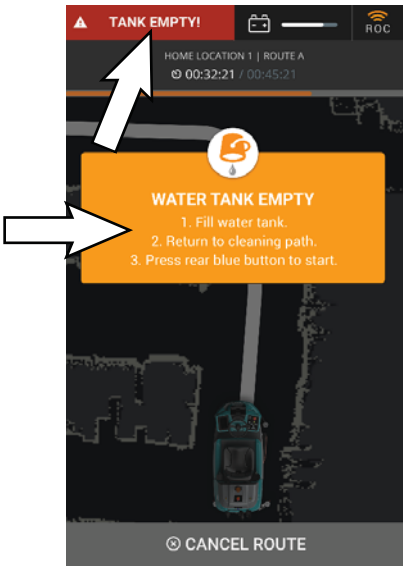
16. Replace the solution tank drain hose cap and mount the drain hose back onto the mounting clip after the tank is drained.

## ALERT MESSAGES

The operator will receive an alert when there is a mechanical/electronic issue with the machine. All scrub functions are disabled when there is an alert.

To reset the alert indicators, turn off the machine and then eliminate the cause of the alert. The alert indicator will reset when the machine is restarted.

Refer to the alert table below to determine the cause and remedy for the alert.




| Alert(s) | Cause(s) | Symbol | Remedy (Displayed on *UI touchscreen)* |
|---|---|---|---|
| RECOVERY TANK FULL * | Recovery tank is full. | | 1. Drain recovery tank.<br>2. Return to cleaning path.<br>3. Press rear BLUE button to start. (Robotic) |
| WATER TANK EMPTY * | Water tank is empty. | | 1. Fill water tank.<br>2. Return to cleaning path.<br>3. Press rear BLUE button to start. (Robotic) |
| BATTERY IS TOO LOW * | Batteries need to be charged. | | 1. Drive to charging station.<br>2. Inspect and charge batteries. |
| PATH IS BLOCKED | Obstacle(s) on cleaning route. | | 1. Make sure the robot's path is clear or drive past any obstacles.<br>2. Press rear BLUE button to start. |
| IMPACT DETECTED | Obstacle(s) on the cleaning route. Machine bumped obstacle(s) along route. | | 1. Make sure the robot's path is clear or drive past any obstacles.<br>2. Inspect the robot.<br>3. If everything is clear, press rear BLUE button to start. |
| ROBOT IS OFF PATH | Machine is off designated scrubbing path. | | 1. Follow the blue arrow and drive to the red path.<br>2. When correct, the path will turn white.<br>3. Press rear BLUE button to start. |
| SENSOR ERROR | Sensor(s) dirty or damaged. | | 1. Inspect/clean robot's sensors for damage or debris.<br>2. Wipe the sensors with microfiber cloth.<br>3. If there are no issues, press the BLUE button in the back to resume. |
| MACHINE ERROR | Steering wheel obstruction. | | 1. Make sure that the steering wheel is free and clear.<br>2. Press the BLUE button in the back to resume. |

** All scrubbing functions stop, but the machine can still be driven. If necessary, press the 1-Step button for an additional minute of operation to pick up standing water or solution.*

| Alert(s) | Cause(s) | Symbol | Remedy (Displayed on the *UI touchscreen)* |
|---|---|---|---|
| 203 TRACTION MOTOR ERROR | Propelling issues. |  | 1. Power off robot<br>2. Disconnect then reconnect the battery.<br>3. Power the robot back on.<br>4. If issue persists, contact customer service. |
| 204 BRUSH ERROR | Damaged brushes.<br>Debris caught in brushes. |  | 1. Inspect brushes/pads for damage or debris. Adjust or replace as needed.<br>2. If there are no issues, press the BLUE button in the back to resume.<br>3. If issue persists, contact customer service. |
| 205 VACUUM ERROR | Obstruction caught inside vacuum hose.<br>Damaged vacuum hose. |  | 1. Inspect vacuum and hose for damage or debris.<br>2. If the hose is clear, press the BLUE button to resume. If the hose is broken, call customer service. |
| 206 SQUEEGEE ERROR | Obstruction caught in squeegee.<br>Damaged or missing squeegee. |  | 1. Inspect squeegee for damage or debris. Adjust or replace as needed.<br>2. If there are no issues, press the BLUE button in the back to resume. (Robotic)<br>3. If issue persists, contact customer service. |
| 207 SCRUB DECK ERROR | Obstruction preventing scrub deck from raising/ lowering. |  | 1. Turn off and inspect machine.<br>2. If there are no issues, press the BLUE button in the back to resume. (Robotic)<br>3. For damage or persistent problems, contact customer service. |
| 208 NO BRUSH ERROR | No brushes installed.<br>Brushes not properly installed. |  | 1. Make sure brushes or pads are properly installed.<br>2. If there are no issues, press the BLUE button in the back to resume. (Robotic)<br>3. If issue persists, contact customer service. |
| SEAT SENSOR TRIGGERED | Person or object on operator seat while machine is in robotic mode. |  | 1. Check that the seat is clear.<br>2. Press rear BLUE button to start. |
| BRAKE ERROR | Electronic/mechanical brake error or issue. |  | Please Contact Customer Service Immediately. |
| ERROR MESSAGE | Generic controller error or issue. |  | Please Contact Customer Service Immediately. |
| THROTTLE ERROR | Electronic/mechanical throttle error or issue. |  | Please Contact Customer Service Immediately. |
| UNKNOWN ERROR | Error(s) of an unknown origin. |  | 1. Turn off and inspect machine.<br>2. Reboot and attempt to operate.<br>3. If issue persists, contact customer service. |

*NOTE: Contact a Tennant Service representative for all other fault codes*

## MACHINE TROUBLESHOOTING

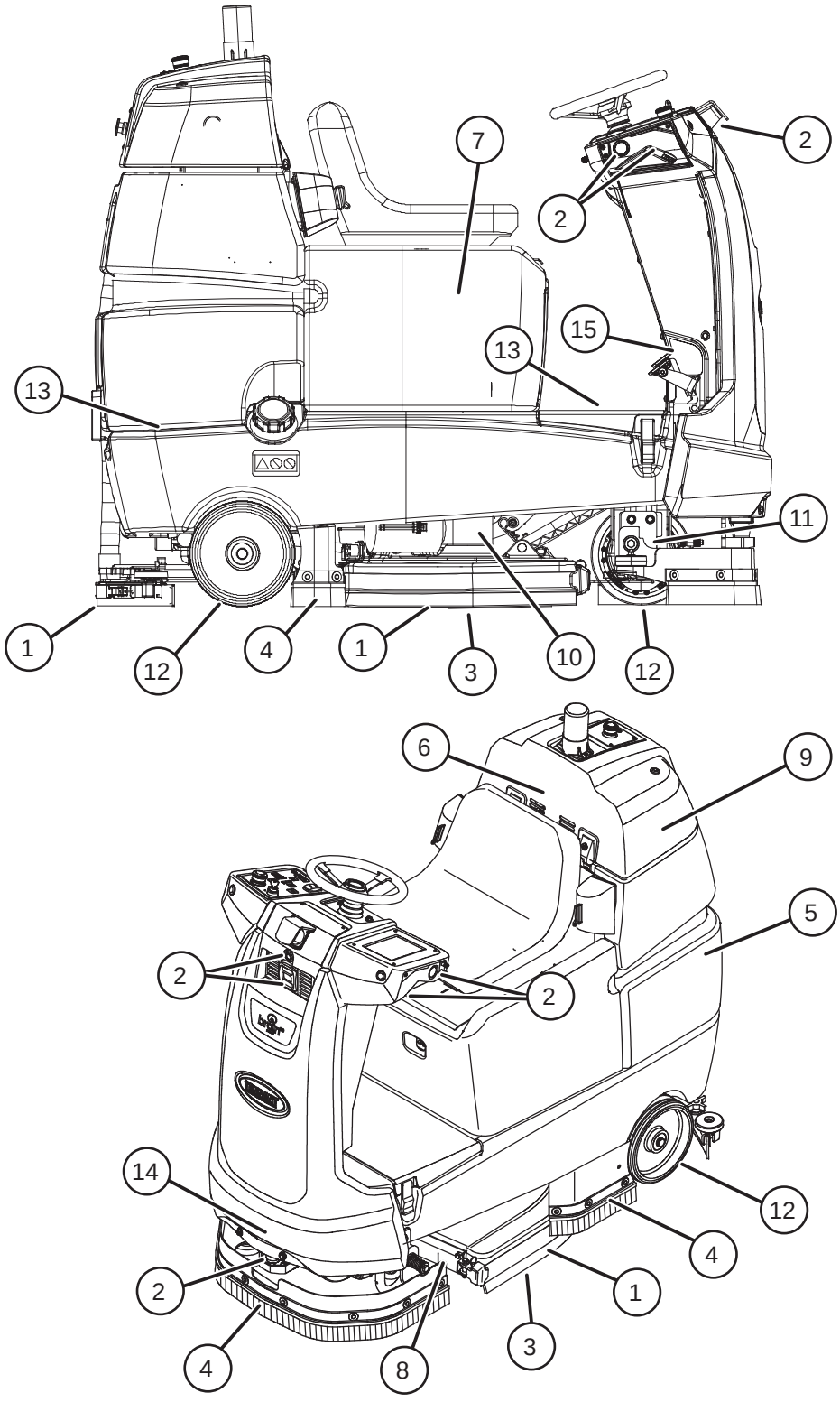
| Problem | Cause | Remedy |
|---|---|---|
| Trailing water-poor or no water pickup | Vacuum fan turned off | Turn vacuum fan on |
| | Worn squeegee blades | Rotate or replace squeegee blades |
| | Squeegee out of adjustment | Adjust squeegee |
| | Vacuum hose clogged | Flush vacuum hoses |
| | Vacuum fan filter dirty | Clean vacuum fan filter |
| | Vacuum fan cover seals worn | Replace seals |
| | Debris caught on squeegee | Remove debris |
| | Vacuum hose to squeegee or recovery tank disconnected or damaged | Reconnect or replace vacuum hose |
| | Recovery tank cover not completely closed | Check for obstructions and close cover |
| Vacuum fan will not turn on | Vacuum fan switch turned off | Turn vacuum switch on |
| | Recovery tank full | Drain recovery tank |
| | Foam filling recovery tank | Empty recovery tank |
| | | Use less detergent |
| | Recovery tank sensor dirty or stuck | Clean or replace sensor |
| Little or no solution flow to the floor (Conventional Scrubbing Mode) | Solution tank empty | Fill solution tank |
| | Solution flow turned off | Turn solution flow on |
| | Solution supply lines plugged | Flush solution supply lines |
| | Clogged solution tank filter | Drain solution tank, remove solution tank filter, clean and reinstall |
| Poor scrubbing performance | *1-Step button* not on | Turn *1-Step button* on |
| | Improper detergent or brushes used | Contact Tennant service representative |
| | Recovery tank full | Empty recovery tank |
| | Solution tank empty | Fill solution tank |
| | Debris caught on scrub brushes or pads | Remove debris |
| | Worn scrub brush | Replace scrub brush |
| | Brush pressure set too light | Increase brush pressure |
| | Low battery charge | Charge batteries until the charger automatically turns off |

***ec-H2O* System**

| Problem | Cause | Remedy |
|---|---|---|
| *ec-H2O* system indicator light blinking green/red | Water conditioning cartridge has expired | Replace cartridge (See *ec-H2O* WATER CONDITIONING CARTRIDGE REPLACEMENT) |
| *ec-H2O* system indicator is red or blinking* red | *ec-H2O* system fault has been detected | Contact Service Center |

*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 indicator light code clears.

# MAINTENANCE



## MAINTENANCE CHART

The table below indicates the Person Responsible for each procedure.

O = Operator.
T = Trained Personnel.

| Interval | Person Resp. | Key | Description | Procedure | Lubricant/ Fluid | No. of Service Points |
|---|---|---|---|---|---|---|
| Daily | O | 1 | Side and rear squeegees | Check, flip or replace | - | 3 |
| | | | | Check deflection and leveling | - | 6 |
| | O | 2 | Front/side 2D and 3D sensors and upper/ lower LIDAR sensors | Check for damage. Clean with provided microfiber cloth | - | 8 |
| | O | 3 | Scrub brushes/pads | Check for damage, wear, debris | - | 2 |
| | O | 4 | Perimeter guards (left, right, and front) | Check for debris, damage, and wear | - | 3 |
| | O | 5 | Recovery tank | Clean tank, screen filter, and float sensor | - | 1 |
| | O | 6 | Vacuum fan filter | Clean | - | 1 |
| Weekly | T | 7 | Battery cells | Check electrolyte level | DW | 3 |
| 50 Hours | O | 8 | Scrub head floor skirt | Check for damage and wear | - | 2 |
| 100 Hours | T | 9 | Vacuum fan and recovery tank seals | Check for damage and wear | - | 3 |
| | O | 13 | Solution tank seals | Check for damage and wear | | 2 |
| | O | 7 | Battery watering system (option) | Check hoses for damage and wear | - | All |
| 200 Hours | T | 7 | Battery terminals and cables | Check and clean | - | 12 |
| | T | 14 | Steering gear chain | Lubricate, check tension, and check for damage and wear. | GL | 1 |
| | T | 15 | Steering u-joint | Lubricate and check for damage and wear. | GL | 1 |
| 500 Hours | T | 6 | Vacuum fan motor(s) | Check motor brushes **(Check every 100 hours after initial 500 hour check)** | - | 1 |
| | T | 10 | Scrub brush motors | Check motor brushes **(Check every 100 hours after initial 500 hour check)** | - | 2 |
| | T | 11 | Propelling motor | Check motor brushes **(Check every 100 hours after initial 500 hour check)** | - | 1 |
| | T | 12 | Tires | Check for damage and wear | - | 3 |

LUBRICANT/FLUID

DW Distilled water
GL SAE 90 weight gear lubricant

## BATTERIES

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

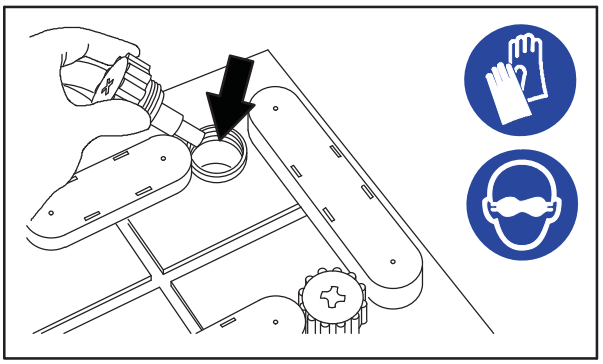
The lifetime of the batteries depends on their proper maintenance. To get the most life from the batteries;

- 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 27°C (80°F) 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.

### CHECKING THE ELECTROLYTE LEVEL

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

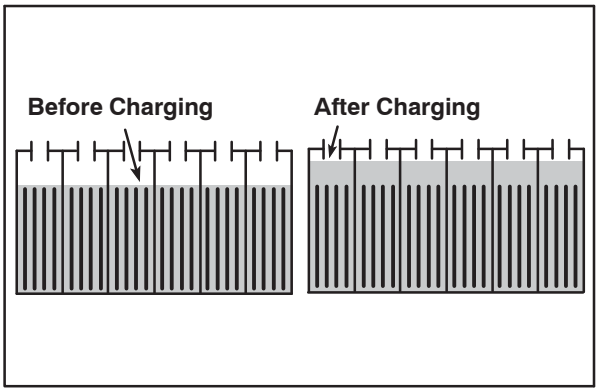
*NOTE: **Do Not** check the electrolyte level if the machine is equipped with a battery watering system.*



08247

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

The electrolyte level should be slightly above the battery plates as shown before charging. 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.




*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, with a strong solution of baking soda and water. Replace any worn or damaged wires. Do not remove battery caps when cleaning batteries.

## CHARGING THE BATTERIES

The charging instructions in this manual are intended for the battery charger supplied with the machine. The use of other battery chargers that are not supplied and approved by Tennant are prohibited. Refer to the charger owners manual for additional information. Contact distributor or Tennant for battery charger recommendations.

**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 the machine.

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

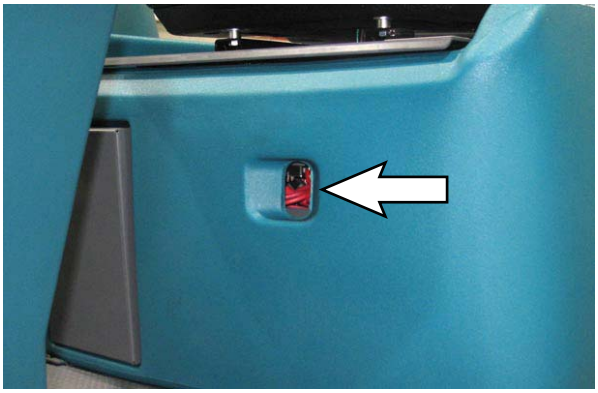
**WARNING: Batteries emit hydrogen gas. Explosion or fire can result. Keep sparks and open flame away. Keep covers open when charging.**

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

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

3. Check the battery electrolyte level weekly before charging. For models equipped with the automatic battery watering system, check electrolyte the level indicators located on the battery covers. Add distilled water as needed.
4. Connect the charger DC cord into the machine battery charge receptacle then plug the AC power supply cord into a properly grounded wall outlet. Refer to the off-board battery charger owners 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.**



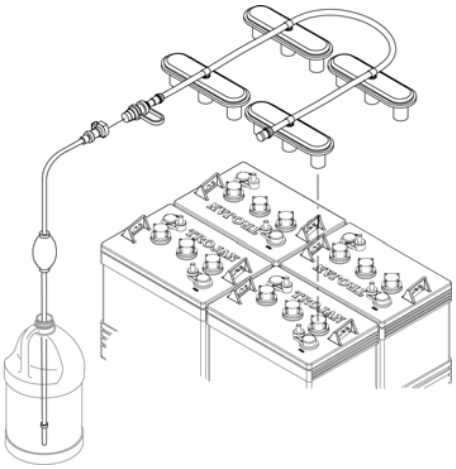
5. The charger will automatically begin charging and shut off when fully charged. The maximum charging cycle may take up to 6-12 hours depending on battery type.

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

6. After charging batteries unplug the AC power supply cord from the outlet before disconnecting the charger from the machine.
7. Disconnect the battery charger from the machine.

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

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



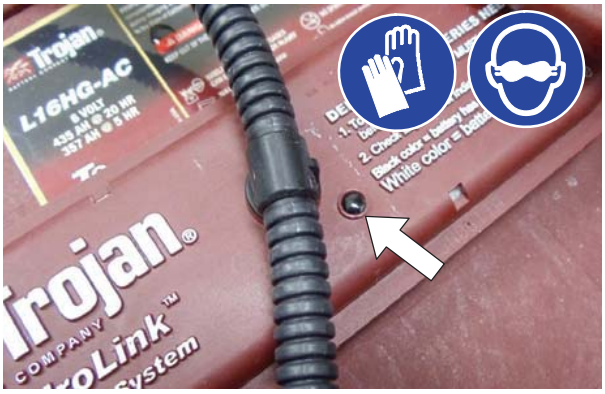
The optional HydroLink battery watering system provides a safe and easy way to maintain the proper electrolyte levels in the batteries. It is designed exclusively for Trojan flooded (wet) lead-acid batteries.

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

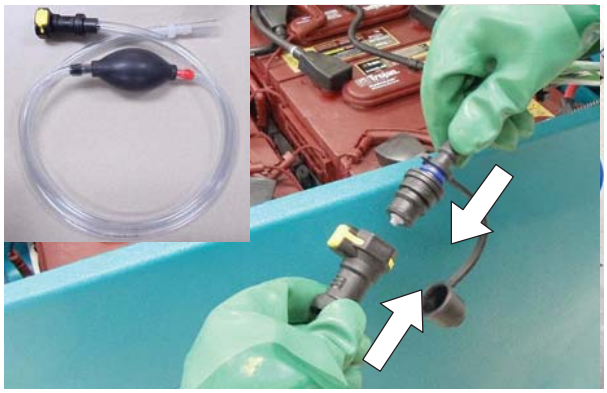
Before using the battery watering system check hoses and connections for damage or wear.

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. If the level indicators are 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.




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



4. Submerge the other end of the hand pump hose into a bottle of distilled water.

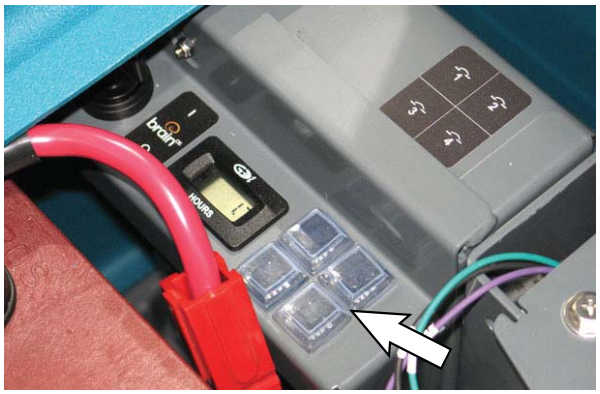

5. Squeeze the bulb on the hand pump hose until firm. The level indicators will turn black when full.


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.

## CIRCUIT BREAKERS AND FUSES

### CIRCUIT BREAKERS

Circuit breakers are resettable electrical circuit protection devices that stop the flow of current in the event of a circuit overload. Once a circuit breaker is tripped, allow breaker to cool and then press the reset button to manually reset the breaker.



If the overload that caused the circuit breaker to trip is still there, the circuit breaker will continue to stop current flow until the problem is corrected.

The circuit breakers are located inside the battery compartment next to the hour meter.

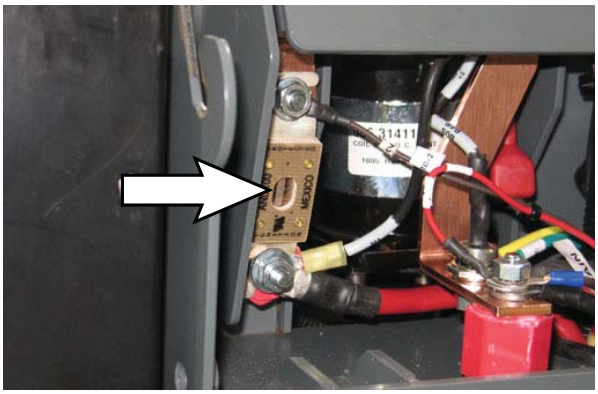
The chart shows the circuit breakers and the electrical components they protect.

| Circuit Breaker | Rating | Circuit Protected |
|---|---|---|
| CB1 | 4 A | Instrument panel - power |
| CB2 | 4 A | Accessories |
| CB3 | 20 A | AMR system |
| CB4 | 10 A | Brain module |

### FUSES

The fuse is a one-time protection device designed to stop the flow of current in the event of a circuit overload. The 100 A fuse is located in the seat support column near the scrub head actuator. The fuse protects the machine controller.

*NOTE: Always replace the fuse with a fuse of the same amperage.*



## ELECTRIC MOTORS

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

The carbon brushes in the vacuum fan motor, the propelling motor, and the scrub brush motors should be inspected after the initial 500 hours of machine operation and then every 100 hours after the initial 500 hours.

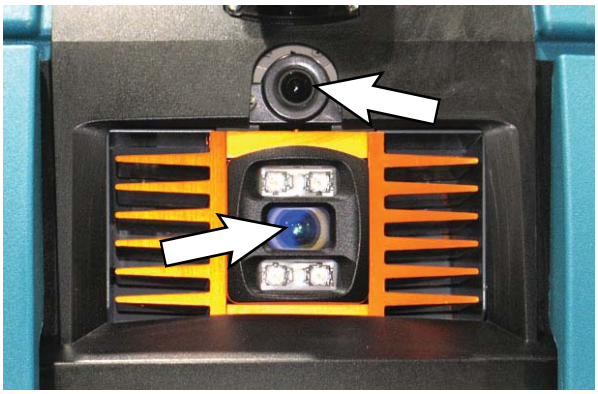
## CAMERAS AND SENSORS

### FRONT AND SIDE 2D AND 3D CAMERAS

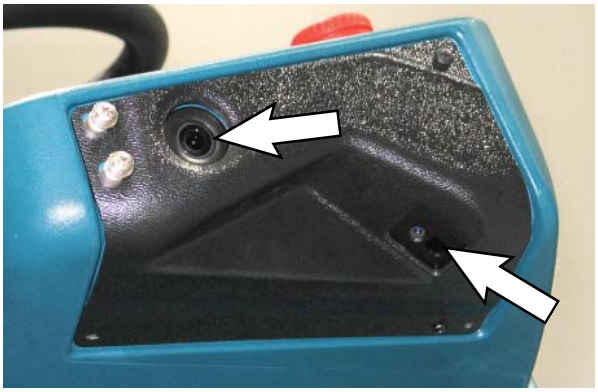
**FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and remove key.**

Check the front and side 2D and 3D cameras for dirt, dust, smudges, and damage daily (or before each robotic run). Debris, streaks, or smudges could deliver false environmental information to the machine. Use the provided microfiber cloth to clean the cameras. Do not apply water to the cameras or the microfiber cloth.

*NOTE: Do not scratch or damage the 2D or 3D camera lenses. Robotic machine performance could be adversely affected if camera lenses are scratched or damaged.*



Side 2D and 3D cameras are located on each side of the machine.



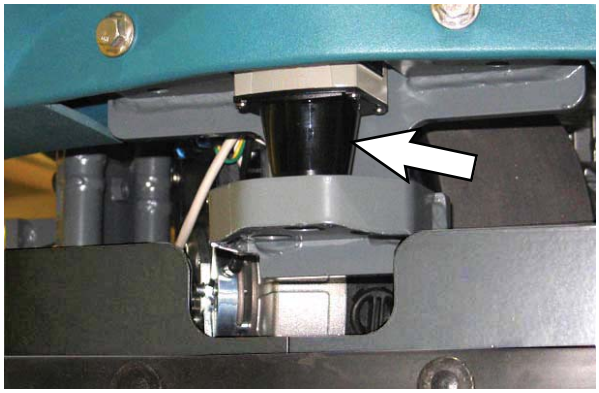
### UPPER AND LOWER LIDAR SENSORS

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

Check the upper and lower LIDAR sensors for dirt, dust, smudges, and damage daily (or before each robotic run). Debris, streaks, or smudges could deliver false environmental information to the machine. Use the provided microfiber cloth to clean the sensors. Do not apply water to the sensors or the microfiber cloth.

*NOTE: Do not scratch or damage the upper or lower LIDAR sensor surfaces. Robotic machine performance could be adversely affected if sensor surfaces are scratched or damaged.*

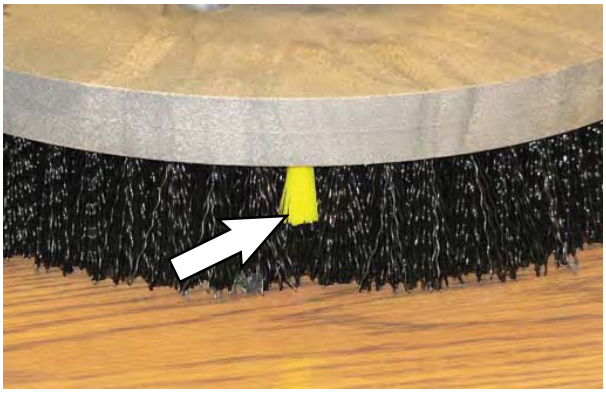
*NOTE: Due to the lower LIDAR sensor being located near the cleaning surface, pay particular attention to ensure the front, side, back, and bottom surfaces are completely clear of all dirt, smudges, and/or other debris. Use a flash light to inspect these sensor surfaces and ensure they are thoroughly cleaned.*



## SCRUB BRUSHES AND PADS

Check scrub brushes daily for wire or string tangled around the brush or brush drive hub. Also check brushes for damage and wear.

Replace the pads when they no longer clean effectively. Replaces the brushes when they no longer clean effectively or when the bristles are worn to the yellow indicator.



Cleaning pads must be placed on pad drivers before they are ready to use. The cleaning pad is held in place by a pad holder.

Cleaning pads need to be cleaned immediately after use with soap and water. Do not wash the pads with a pressure washer. Hang pads, or lie pads flat to dry.

*NOTE: Always replace brushes and pads in sets. Otherwise one brush or pad will clean more aggressively than the other.*

### REPLACING BRUSHES OR PAD DRIVERS

1. Stop machine on a level surface. Make sure the scrub head is in the raised position.
2. Turn the machine *ON/OFF key switch* off.

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

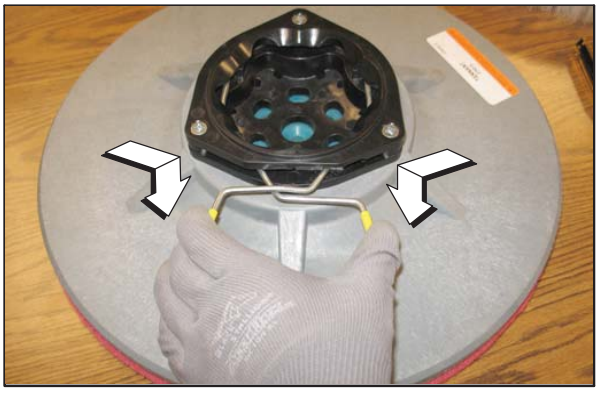
3. When changing the scrub brush located on the left side of the machine only: Remove the pin from the left perimeter guard and open the perimeter guard to access the scrub brush.

4. Pull the pin from the side squeegee retainer pivot.

5. Open the side squeegee retainer pivot toward the front of the machine, then pull the side squeegee toward the rear of the machine to access the scrub brushes or pads.

6. Press the spring clip together with the thumb and index finger. The brush/pad driver will drop off the drive hub. Remove the brush from under the machine.

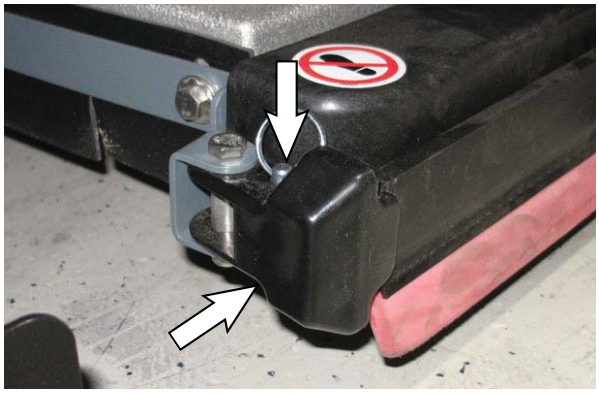
7. Set the yellow spring clip to the open position to make brush installation easier. Press spring clip together and downward to set.



8. Align the pad driver or brush under the motor hub and push it upward to engage hub. Ensure that it is securely mounted onto the motor hub.

9. Close the side squeegee and the retainer pivot, then insert the pin.

*NOTE: Be sure the pin is inserted completely through the bottom.*



10. If the scrub brush located on the left side of the machine was changed/removed: Close and resecure the left perimeter guard.

## REPLACING DISK PADS

1. Remove the pad driver from the machine.
2. Squeeze the spring clip together to remove the center disk.

3. Flip or replace the scrub pad, center the scrub pad on the pad driver. Then reinstall the center disk to secure the pad in place on the pad driver.

4. Reinsert the pad driver into the machine.

## *ec-H2O* SYSTEM

### *ec-H2O* WATER CONDITIONING CARTRIDGE REPLACEMENT

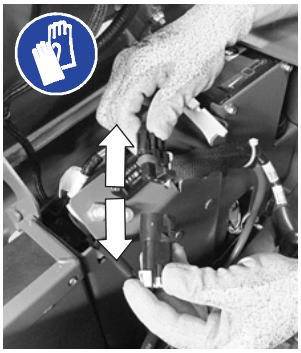
**FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and remove key.**

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, which ever comes first. The *ec-H2O* system indicator light will blink green/red when it is time to replace cartridge.

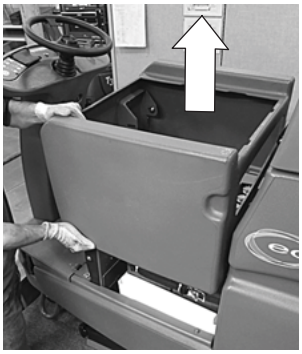
Depending on machine usage, on average, a new cartridge can last anywhere from 12 months for heavy machine usage to 24 months for light machine usage.

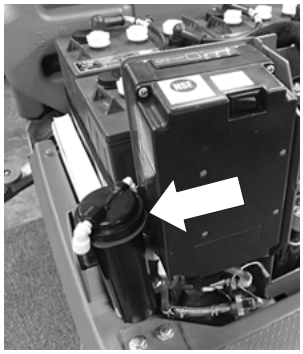
*NOTE: During first time use and after replacing the water conditioning cartridge, the ec-H2O system will automatically override the selected solution flow rate for up to 75 minutes.*

1. Disconnect the wire harness from operator seat and carefully remove seat from machine.

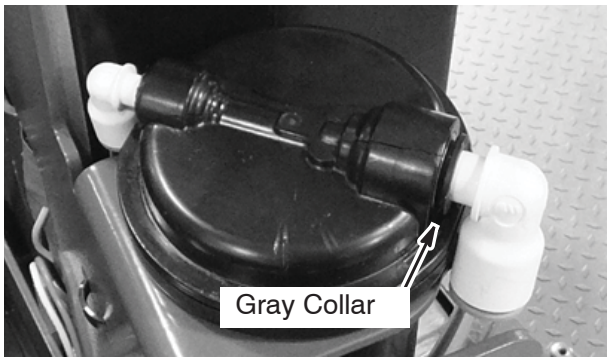


2. Remove the battery compartment shroud from machine to access cartridge.





3. Disconnect the two hose connectors from cartridge by pressing the gray collars inward and pulling the connectors outward. Lift cartridge to remove.

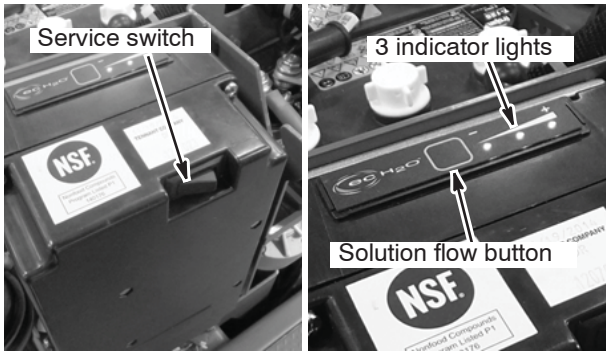



4. Fill in the installation date on the new cartridge label.


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

6. Reset timer for new cartridge.

   Carefully read and understand all steps first before performing procedure.
   a. Turn the *ON/OFF key switch* 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.
   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.
   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.



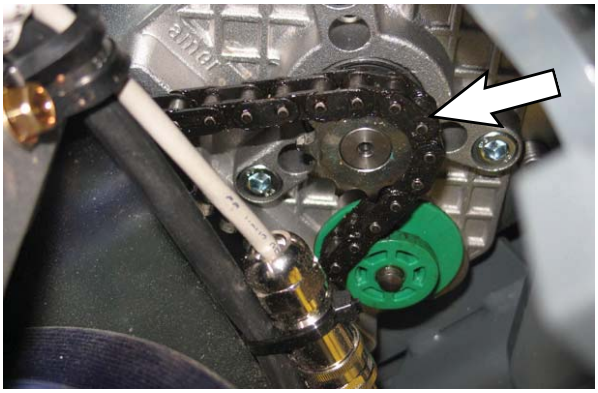

7. Reinstall the battery compartment shroud and operator seat.

## LUBRICATION

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

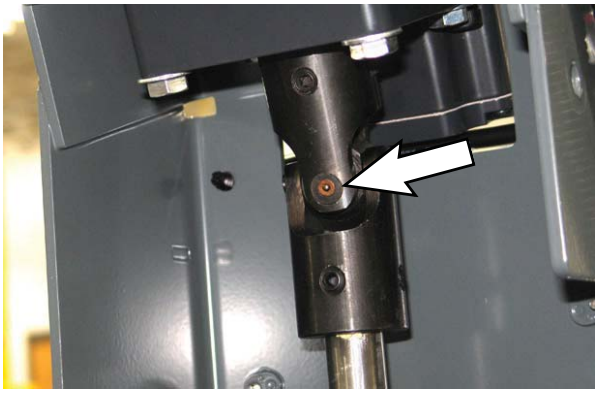
### STEERING GEAR CHAIN

The steering gear chain is located directly above the front tire. Check for damage or wear and lubricate the steering gear chain after every 200 hours.



### STEERING U-JOINT

The steering u-joint is located directly below the steering motor. Check for damage or wear and lubricate the steering u-joint after every 200 hours.



## SQUEEGEE BLADES

Check the squeegee blades for damage and wear daily. When the blades become worn, rotate the blades end-for-end or top-to-bottom to a new wiping edge. Replace blades when all edges are worn.

Check the deflection of the squeegee blades daily or when scrubbing a different type of surface. Check the leveling of the rear squeegee every 50 hours of operation.

The rear squeegee assembly can be removed from the squeegee pivot to prevent damage during transport of the machine.

### REPLACING (OR ROTATING) THE REAR SQUEEGEE BLADES

1. Stop machine on a level surface. Make sure the scrub head is in the raised position.

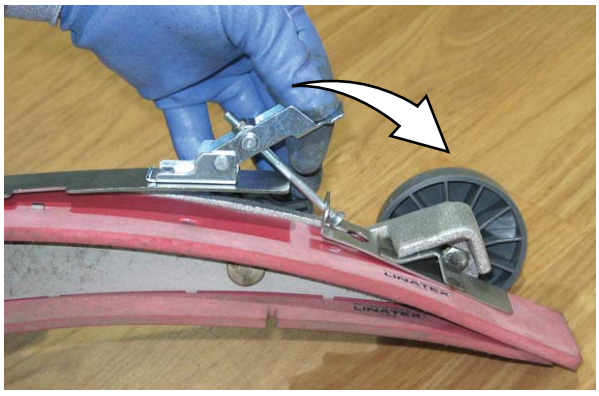
2. Turn the machine ON/OFF key switch off.

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

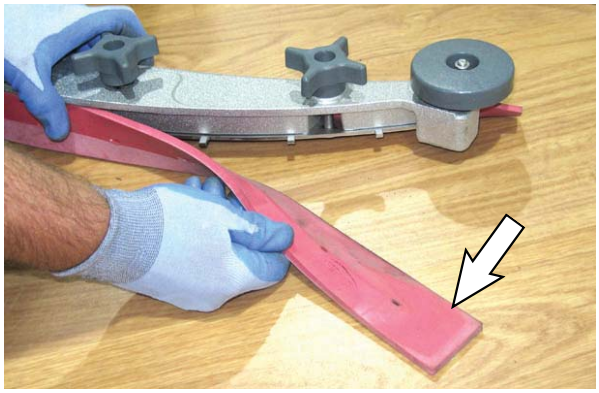
3. Remove the squeegee vacuum hose from the rear squeegee assembly. Then loosen both rear squeegee assembly mounting knobs.

4. Pull the rear squeegee assembly from the machine.

5. Loosen the rear squeegee retaining band tension latch and remove the retaining band.



6. Remove rear squeegee blade from the rear squeegee assembly.



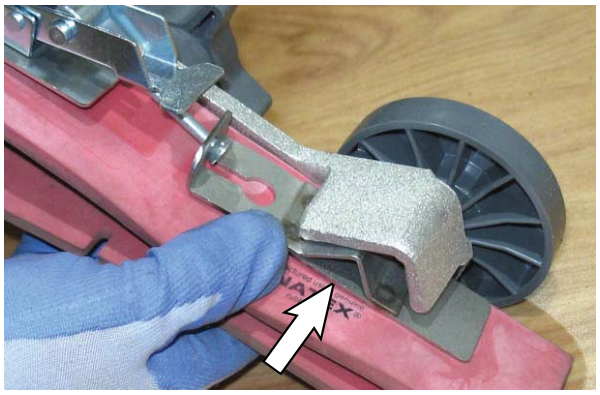
7. Loosen the two outer knobs on the rear squeegee assembly. Remove the front squeegee blade from the squeegee assembly.

8. Install the new front squeegee blade or rotate the existing blade to the new edge. Be sure the holes in the front squeegee blade are hooked onto the tabs on the front blade clamp.

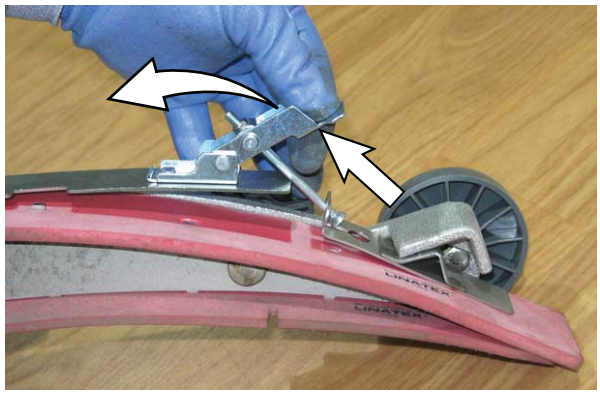
9. Lightly tighten the two outer knobs.

10. Install the new rear squeegee blade or rotate the existing blade to the new edge. Be sure the holes in the squeegee blade are hooked onto the tabs on the squeegee assembly.

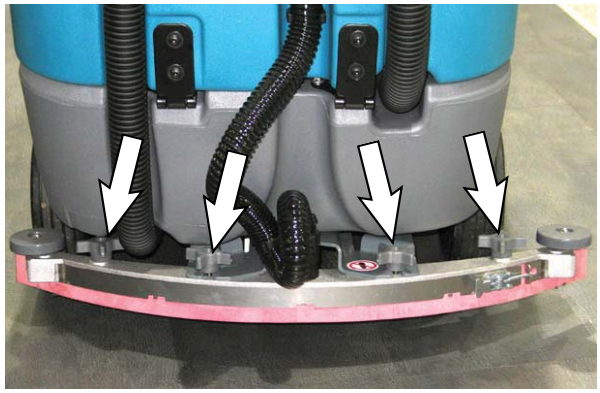

11. Reinstall the rear squeegee retaining band onto the squeegee assembly. Be sure each of the flanges on the retaining band are seated in the cut outs in the rear squeegee assembly.



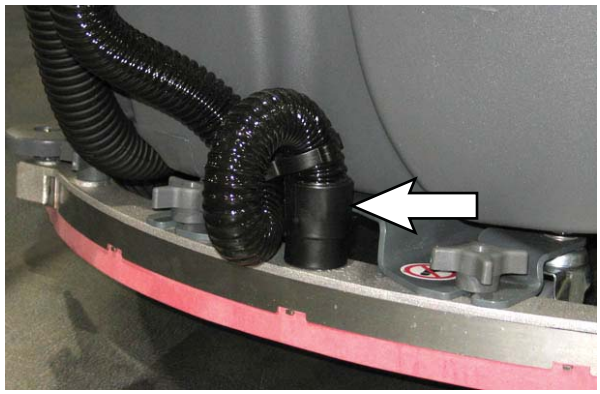
12. Tighten the rear squeegee retaining band tension latch.



13. Reinstall the rear squeegee under the squeegee mount bracket and tighten all four knobs.



14. Reinstall the squeegee vacuum hose onto the rear squeegee assembly.



## REPLACING THE SIDE SQUEEGEE BLADES

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

1. When changing the left side squeegee only: Remove the pin from the left perimeter guard and open the left perimeter guard to access the squeegee.

2. Open the side squeegee.

3. Pull the old side squeegee blade from the side squeegee retainer. Slide the new blade onto the retainer.

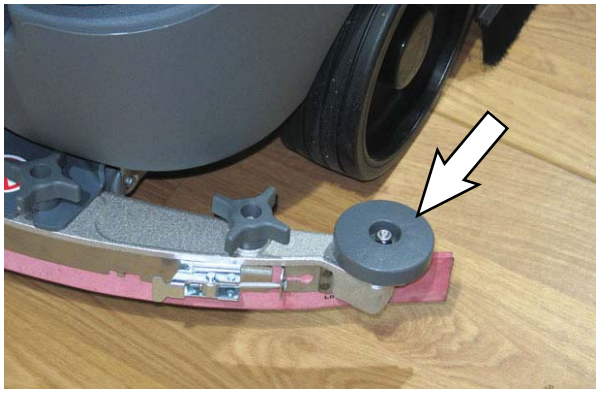
4. Close the side squeegee.

5. If the side squeegee located on the left side of the machine was changed: Close and resecure the left perimeter guard.

## ADJUSTING THE SQUEEGEE GUIDE ROLLER

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

The squeegee guide rollers are located on both ends of the rear squeegee. The rollers guide the squeegee blade end along a wall. Loosen the nut located at the top of the guide roller and move the roller in or out to adjust how close the end of the squeegee blade is to the wall. The squeegee blade end should be further away from the wall when the floor curves up into the wall.



## LEVELING THE REAR SQUEEGEE

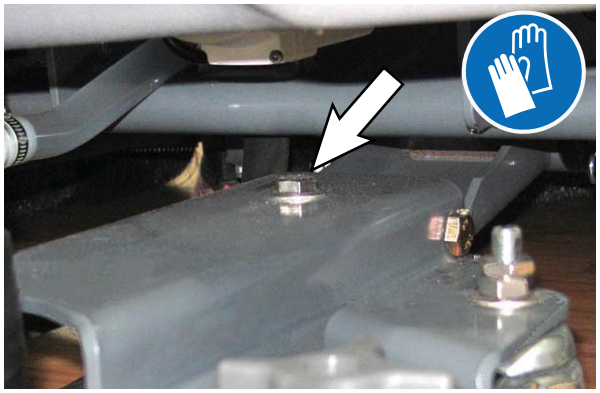
Leveling of the squeegee assures the entire length of the squeegee is in even contact with the surface being scrubbed. Perform this adjustment on an even and level floor.

1. Lower the squeegee and drive the machine forward a few feet.
2. Turn off the machine ON/OFF key switch.

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

3. Look at the deflection of the squeegee over the full length of the squeegee blade.
4. If the deflection is not the same over the full length of the blade, turn the squeegee leveling bolt to make adjustments.

   The squeegee leveling bolt is located directly behind the squeegee suction hose. ***DO NOT*** *disconnect the suction hose from the squeegee frame when leveling squeegee.*



   Turn the squeegee leveling bolt counter-clockwise to increase the deflection at the ends of the squeegee.

   Turn the squeegee leveling bolt clockwise to decrease the deflection at the ends of the squeegee blade.

5. Drive the machine forward with the squeegee down to recheck the squeegee blade deflection if adjustments were made.
6. Readjust the squeegee blade deflection if necessary.

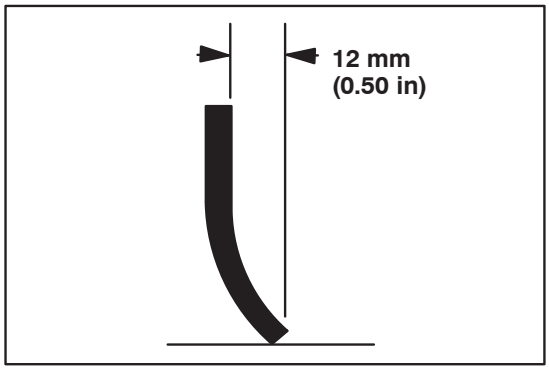
## ADJUSTING REAR SQUEEGEE BLADE DEFLECTION

Deflection is the amount of curl the overall squeegee blade has when the machine moves forward. The best deflection is when the squeegee wipes the floor dry with a minimal amount of deflection.

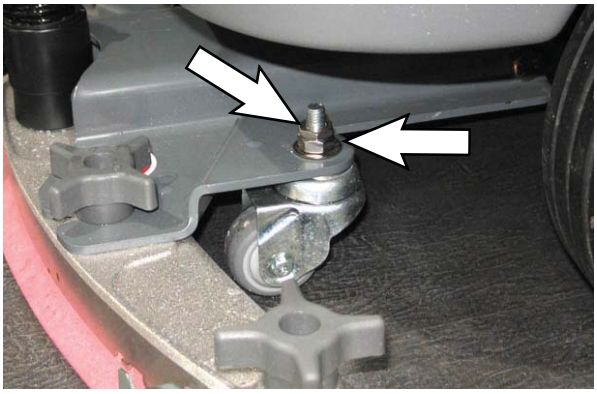
1. Lower the squeegee and drive the machine forward a few meters (feet).
2. Turn off the machine ON/OFF key switch.

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

3. Look at the amount of deflection or “curl” of the squeegee blade. The correct amount of deflection is 12 mm (0.50 in) for scrubbing smooth floors and 15 mm (0.62 in) for rough floors.




4. If the overall squeegee blade deflection needs to be adjusted, loosen the jam nuts on the squeegee casters and adjust the height.



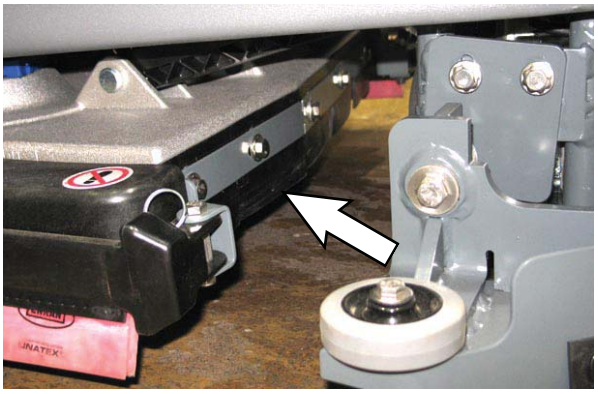
5. Drive the machine forward again to recheck the squeegee blade deflection after adjustments are made.
6. Readjust the squeegee blade deflection if necessary.

## SKIRTS AND SEALS

### SCRUB HEAD FLOOR SKIRT

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

The skirt is located in front of the scrub head. Check the skirt for damage and wear after every 50 hours of operation.



The skirts should clear the floor by 0 to 6 mm (0 to 0.25 in) when the scrub brushes are new and the scrub head is down.

### LEFT PERIMETER GUARD, RIGHT PERIMETER GUARD, AND FRONT PERIMETER GUARD

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

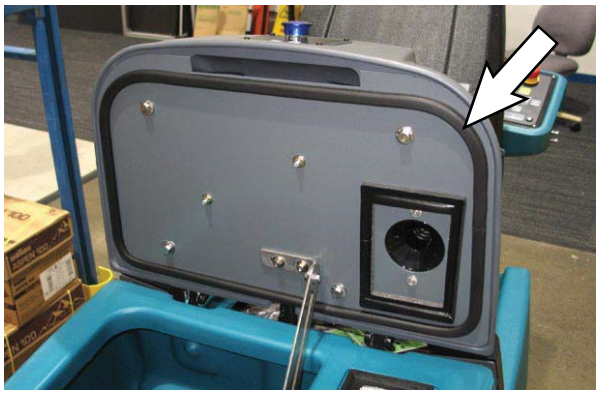
Check the left perimeter guard, right perimeter guard, front perimeter guard, and perimeter guard bristles for debris, damage, and wear daily.

The bristles should lightly touch the floor. Replace damaged and/or worn bristle assemblies.

### RECOVERY TANK SEAL

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

The recovery tank seal is located on the bottom of the recovery tank cover. Check the seal for damage and wear after every 100 hours of operation.

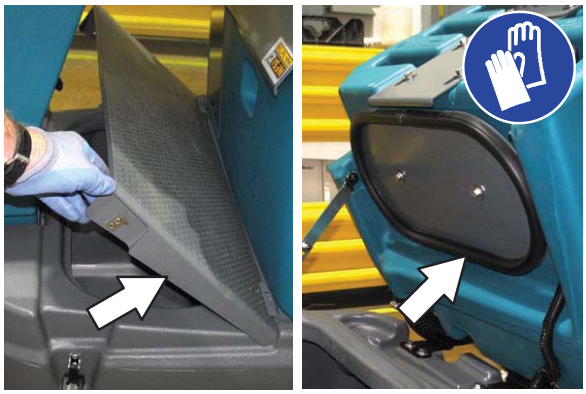


### SOLUTION TANK SEALS

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

There are two solution tank seals. Check the seal for damage and wear after every 100 hours of operation.

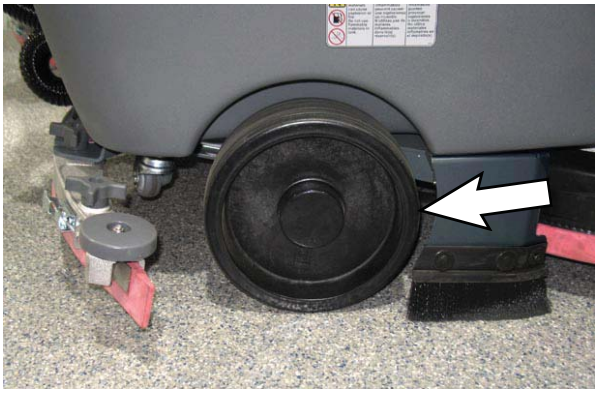
A front seal is located on the bottom of the solution tank cover. A rear seal is located on the bottom of the recovery tank.



## TIRES

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

The machine has three solid rubber tires: one tire is front and two are in the rear. Check the tires for damage and wear after every 500 hours of operation.



## PUSHING, TOWING, AND TRANSPORTING THE MACHINE

### PUSHING OR TOWING THE MACHINE

If the machine becomes disabled, it can be pushed from the front or rear, but only tow it from the front.

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

Before attempting to push or tow the machine, disengage the brake as described below.

To disengage the brake, insert the tip of a small screw driver between the brake release lever and the body of the encoder.

Only push or tow the machine for a very short distance and do not exceed 3.2 kp/h (2 mph). It is NOT intended to be pushed or towed for a long distance or at a high speed.

*NOTE: **Do** **Not** push or tow machine for a long distance or damage may occur to the propelling system.*

Immediately after pushing the machine, remove the screw driver from between the brake release lever and the body of the encoder. NEVER operate the machine with the parking brake disabled.

**FOR SAFETY: Do not operate machine with the brake disabled.**

### TRANSPORTING THE MACHINE

When transporting the machine by trailer or truck, be certain to follow the tie-down procedure below:

1. Raise the squeegee and scrub head.

**FOR SAFETY: When loading/unloading machine onto/off truck or trailer, drain tanks before loading machine.**

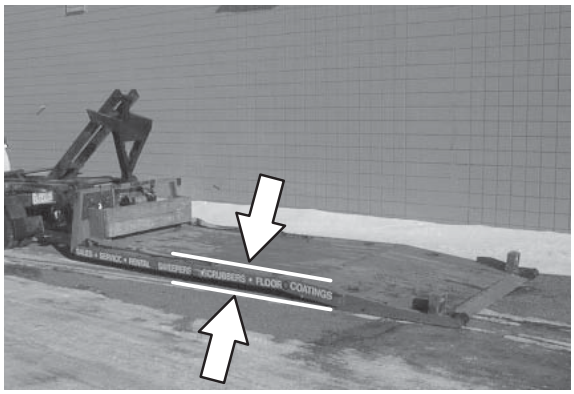
2. Remove the front perimeter guard from the front perimeter guard brackets located at the front of the machine.

3. Position the machine at the loading edge of the truck or trailer.

**FOR SAFETY: When transporting machine, use a recommended ramp when loading/unloading into/off truck or trailer.**

4. If the loading surface is not horizontal or is higher than 380 mm (15 in) from the ground, use a winch to load machine.

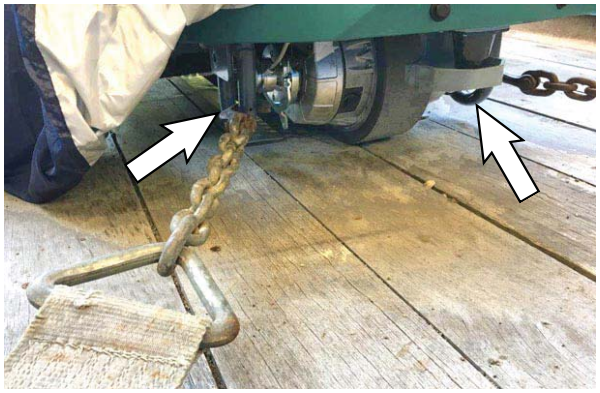
   If the loading surface is horizontal AND is 380 mm (15 in) or less from the ground, the machine may be driven onto the truck or trailer.



**FOR SAFETY: When loading machine onto truck or trailer, use winch. Do not drive the machine onto the truck or trailer unless the loading surface is horizontal AND is 380 mm (15 in) or less from the ground.**

5. Position the machine as close to the front of the trailer or truck as possible. If the machine starts to veer off the center line of the truck or trailer, stop and turn the steering wheel to center the machine.
6. Lower the scrub head and squeegee after the machine is positioned on the trailer or truck.
7. Place a block behind each wheel to prevent the machine from rolling.
8. Route the front tie-down straps through the stabilizer arms and then secure the tie-downs to the trailer or truck to prevent the machine from tipping.

   **Do Not** wrap the tie-down straps around the lower LIDAR sensor or route the tie-down straps over the front of the LIDAR sensor.



*NOTE: It may be necessary to install tie-down brackets to the floor of the trailer or truck.*

**FOR SAFETY: When loading/unloading machine onto/off truck or trailer, use tie-down straps to secure machine.**

9. If necessary, remove the rear squeegee from the machine.
10. Route the rear tie-down straps through the opening at the center part of the rear axle.
11. Stow/secure all parts removed from the machine in a safe place where they will not be lost or damaged.

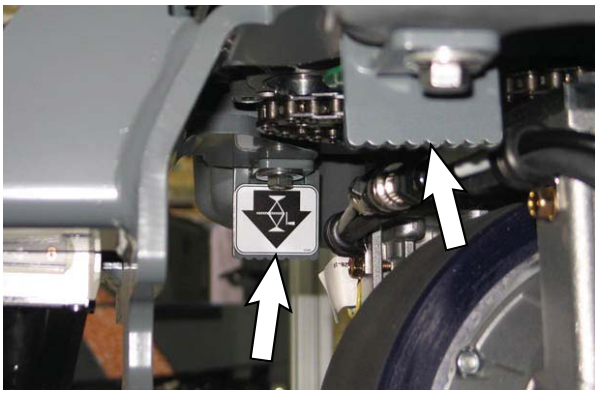
## JACKING UP THE MACHINE

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

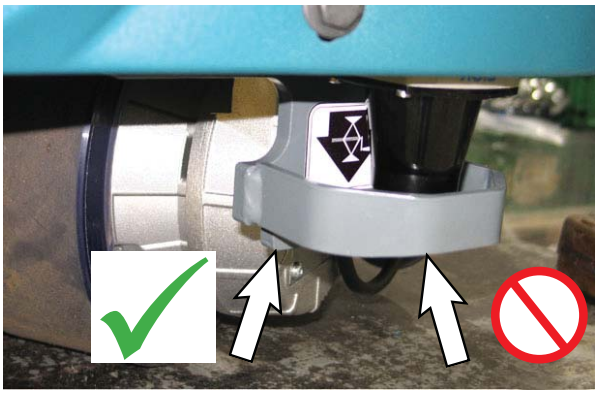
Empty the recovery and solution tanks before jacking the machine.

Remove the front perimeter guard from the front perimeter guard brackets located at the front of the machine before jacking up the front end of the machine.

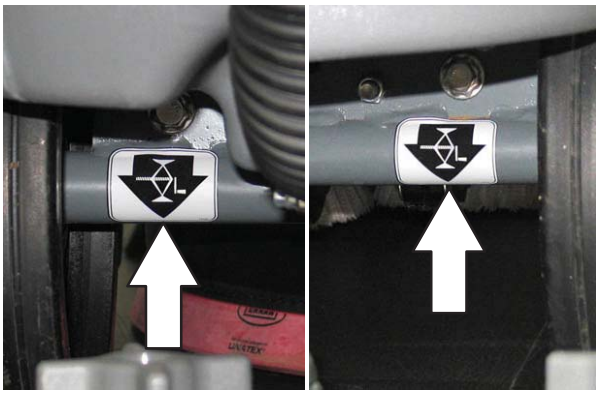
Two front jacking locations are located on the sides of the machine.



A third location at the front of the machine is located on the back of the LIDAR bracket. **Do Not** position the jack or jack stand at the front of the LIDAR bracket.



Rear jacking locations are located on both sides of the machine at the axles.



**FOR SAFETY: When servicing machine, block machine tires before jacking machine up. Use a hoist or jack that will support the weight of the machine. Jack machine up at designated locations only. Block machine up with jack stands.**

## STORAGE INFORMATION

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

1. Drain and clean the solution and recovery tanks. Open the recovery tank cover to promote air circulation.
2. Charge the batteries before storing machine to prolong the life of the batteries. Recharge batteries once a month.
3. Disconnect batteries before storing.
4. Park the machine in a cool, dry area. Do not expose the machine to rain. Store indoors.

### FREEZE PROTECTION

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

1. Drain the solution tank and recovery tank of all water.
2. Pour 2 gallons (8 liters) of full strength Propylene Glycol Based / Recreational Vehicle (RV) antifreeze into the solution tank. Do not dilute.

**FOR SAFETY: Avoid eye contact with antifreeze. Wear safety glasses.**

3. Turn the machine power on and operate the solution flow system. Turn the machine off when the antifreeze appears at the scrub head.

Continue with the freeze protection procedure if machine is equipped with the *ec-H2O* system.

### *ec-H2O* MODELS

Operate machine in the *ec-H2O* mode to cycle antifreeze through *ec-H2O* system.

After storing machine in freezing temperatures, drain any remaining antifreeze from the solution tank. Add clean water to solution tank and operate the machine to flush system.

# SPECIFICATIONS

## GENERAL MACHINE DIMENSIONS / CAPABILITIES

| Item | Dimension / Capacity |
|---|---|
| Length | 1645 mm (65 in) |
| Height (to light) | 1450 mm (57 in) |
| Width/frame | 740 mm (29 in) |
| Width/machine with scrub head | 800 mm (31.5 in) |
| Width/rear squeegee (roller to roller) | 850 mm (33.25 in) |
| Brush diameter | 330 mm (13 in) |
| Scrubbing path width | 650 mm (26 in) |
| Track | 724 mm (28.5 in) |
| Wheel base | 971 mm (31.2 in) |
| Solution tank capacity | 110 L (29 gallons) |
| Recovery tank capacity | 110 L (29 gallons) |
| Demisting chamber | 23 L (6 gallons) |
| Weight/net less batteries | 311 Kg (685 lbs) |
| Weight/with standard battery package | 492 Kg (1085 lbs) |
| GVWR | 714 Kg (1575 lbs) |
| Protection Grade | IPX3 |

| Values determined as per IEC 60335-2-72 | Measure |
|---|---|
| Sound pressure level LpA | 75 dB(A) |
| Sound pressure uncertainty KpA | 3 dB(A) |
| Sound power level LWA + Uncertainty KWA | 94.63 dB(A) + 2.98 dB |
| Vibration - Hand-arm | <2.5 $m/s^2$ |
| Vibration - Whole body | <0.5 $m/s^2$ |

## GENERAL MACHINE PERFORMANCE

| Item | Measure |
|---|---|
| Aisle turnaround (right) | 1732 mm (68 in) |
| Aisle turnaround (left) | 1818 mm (72 in) |
| Travel Speed Forward (maximum) - Manual Mode | 6.4 Km/h (4 mph) |
| Travel Speed Forward (maximum) - Robotic Mode | 4.0 Km/h (2.5 mph) |
| Travel Speed Reverse - Manual Mode Only | 4.0 Km/h (2.5 mph) |
| Maximum rated climb and descent angle with full tanks (Robotic Mode) | 0% |
| Maximum rated climb and descent angle when scrubbing (Robotic Mode) | 0% |
| Maximum rated climb and descent angle with full tanks (Manual Mode) | 10.5% |
| Maximum rated climb and descent angle with empty tanks (Manual Mode) | 15.8% |
| Maximum rated climb and descent angle when scrubbing (Manual Mode) | 7% |
| Maximum ambient temperature for machine operation | 40° C (104° F) |
| Minimum temperature for operating machine scrubbing functions | 2° C (36° F) |

**POWER TYPE**

| Type | Quantity | Volts | Ah Rating | Weight (each) |
|---|---|---|---|---|
| Batteries (heavy duty lead acid) | 4 | 6 | 360@20 hr rate | 44.5 kg (97.5 lb) |

| Type | Use | VDC | kW (hp) |
|---|---|---|---|
| Electric Motors | Scrub brush | 24 | 0.45 kW (0.6 hp) |
| | Vacuum fan | 24 | 0.45 kW (0.6 hp) |
| | Propelling | 24 | 0.85 kW (1.1 hp)S |

| Type | VDC | amp | Hz | Phase | VAC |
|---|---|---|---|---|---|
| Charger (Smart) | 24 | 41.3 | 50/60 | 1 | 100-240 |

**TIRES**

| Location | Type | Size |
|---|---|---|
| Front (1) | Solid | 90 mm wide x 260 mm OD (3.5 in wide x 10 in OD) |
| Rear (2) | Solid | 80 mm wide x 260 mm OD (3.0 in wide x 10 in OD) |

***ec−H2O* SYSTEM**

| Item | Measure |
|---|---|
| Solution pump | 24 Volt DC, 5A, 5.7 LPM (1.5 GPM) open flow, 70 psi bypass setting |
| Solution flow rate | Low: 0.14 gpm |
| | Medium: 0.25 gpm |
| | High: 0.35 gpm |

## MACHINE DIMENSIONS