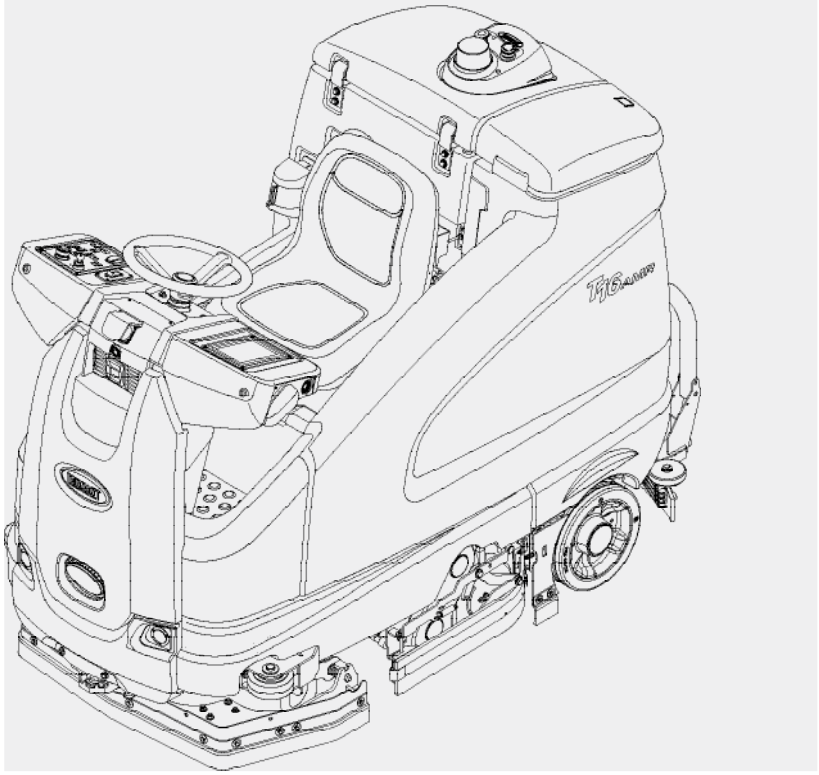
T16AMR

(Battery)

Rider-Scrubber

English (EN)

Operator Manual



Hygenic Fully® Cleanable Tanks
TennantTrue® Parts

Powered by LITHIUM-ION

ec H2O® NanoClean

Europe

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www.tennantco.com/manuals

9021277
Rev. 03 (3-2024)

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.

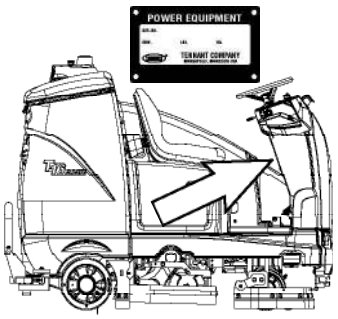
MACHINE DATA

Please fill out at time of machine install for future reference.

Model No. - _____

Serial No. - _____

Installation Date - _____



Tennant N.V.
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europe@tennantco.com

www.tennantco.com

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INTRODUCTION

This operator manual contains information to allow for quick start−up of the new Tennant T16AMR Scrubber, powered by BrainOS. This document may be periodically revised. This T16AMR 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 T16AMR is an industrial floor scrubber powered by BrainOS software. The BrainOS−powered scrubber is capable of functioning in either manual or robotic (autonomous, self−driving) modes. When in robotic mode, the BrainOS software enables autonomous navigation. 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 T16AMR is an industrial 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 T16AMR 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 T16AMR 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 the BrainOS−powered T16AMR Scrubber in both manual and robotic mode. As the machine begins robotic operation, observe scrubbing performance to ensure that all components are functioning properly. 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

Introduction 2
Introduction 3
Intended Use And Precautions....3
Contents 4
Important Safety Instructions - Save These Instructions 7
Operation....11
Machine Components 11
Controls And Instruments....12
Cameras And Sensors 13
Installing Batteries....14
Flooded/Sealed Lead-Acid Batteries....14
Battery Specifications....14
Lithium-Ion Battery (4 Pack)....15
Operation Of Controls 16
Directional Switch....16
Adjusting Backup Alarm Volume 16
Propel Pedal....16
Brake Pedal....16
Operating Lights Switch 17
Seat Support Arm....17
Operator Seat....17
Rear Squeegee Guard....17
Setting Scrub Modes....18
Setting *Ec-H2o* Button 18
Ec-H2o Solution Flow Setting 18
Setting Solution Flow (Conventional Scrubbing) 19
Emergency Stop Buttons 20
Machine Hour Meter....21
Ec-H2o System Indicator Light 21
Blue Start/Pause Button....21
Blue Pedestrian Light 22
User Interface (Ui) Touchscreen 22
Battery Discharge Bar....23
Roc: Robot Operations Center (Brainos Software) 23
Brainos Software Updates 24
How The Machine Works....25
Ec-H2o Scrubbing System....26
Conventional Scrubbing 26
Brush Information....27
Machine Operation....28
Pre-Operation Checklist 28
While Operating The Machine (Robotic Mode/Manual Mode)....29
While Operating The Machine (Robotic Mode Only) 29
Filling The Solution Tank 30
Ec-H2o Scrubbing 30
Conventional Scrubbing Mode 30
Scrubbing - Manual Mode....31
Double Scrubbing....33
Water Pickup Mode (No Scrubbing)....34
Scrubbing - Robotic Mode 35
Establish Home Markers 35
Logging Into Brainos 36
Access Control / No-Pin Workflow 37
Changing Region / Language 38
Enable/Disable Machine Preferences 39
Positioning The Machine At The Home Marker 41
Teaching A New Route (Brainos Software)....42
Connecting A Phone With The Roc....47
Running One Or More Robotic Cleaning Routes (Brainos Software) 49
Autonomous Route History 55
Learning Center 56
Assist Messages During Robotic Operation....56
Excessive Fast Stop Assists 56
Deleting Routes....57
Draining And Cleaning The Tanks....60
System Messages....63
Alerts - Manual Mode 63
Assists - Robotic Mode 65
System Errors (Robotic Mode / Manual Mode) 71
Lidar Sensor / Camera Errors 71
Machine Troubleshooting....75
Ec-H2o System....76
Maintenance....77
Maintenance Chart....78
Yellow Touch Points 80
Lubrication 80
Steering Gear Chain 80
Rear Squeegee Casters....80
Batteries....81
Flooded (Wet) Lead-Acid Batteries 81
Checking The Electrolyte Level....81
Checking Connections / Cleaning 81
Lithium-Ion Battery 82
Battery Power Button / Battery Discharge Indicator 82

Charging The Batteries 83
To Charge Lead-Acid Batteries 84
To Charge Lithium-Ion Batteries With 33a (1200w) Charger 85
To Charge Lithium-Ion Batteries With 90a Fast Charger (220v) 86
Manual Battery Watering System 88
Circuit Breakers And Fuses 90
Circuit Breakers 90
Fuses 90
Electric Motors 90
Cameras And Sensors 91
Front And Side 2d And 3d Cameras 91
Upper And Lower Lidar Sensors 91
Scrub Brushes 93
Replacing Cylindrical Scrub Brushes 93
Ec-H2o System 95
Ec-H2o Water Conditioning Cartridge Replacement 95
Reset Timer For New Cartridge. 96
Squeegee Blades 97
Replacing (Or Rotating) The Rear Squeegee Blades 97
Replacing Or Rotating The Side Squeegee Blades 100
Leveling The Rear Squeegee 101
Adjusting Rear Squeegee Blade Deflection 102
Skirts And Seals 103
Solution Tank Seal 103
Recovery Tank Seals 103
Left Perimeter Guard, Right Perimeter Guard, And Front Perimeter Guard 103
Belts 104
Tires 104
Pushing, Towing, And Transporting The Machine 104
Pushing Or Towing The Machine 104
Transporting The Machine 105
Jacking Up The Machine 107
Storage Information 108
Freeze Protection 108
Specifications 109
General Machine Dimensions / Capabilities 109
General Machine Performance 109
Power Type 110
Tires 110
Conventional Scrubbing 110
Ec−H2o System 110
Machine Dimensions 111

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: Lead-acid 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.



ESCALATOR WARNING: Always place a cone or other physical barrier at escalator entrances and exits before teaching or running routes.

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. Avoid operating machine in areas where other equipment that may be sensitive to electromagnetic noise is located.

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.
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% / 4° grade or transport (GVWR) on ramp inclines that exceed 8.75% / 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. When using machine in robotic mode:
   - Use only as described in this manual.
   - As the machine begins robotic operation, observe scrubbing performance to ensure that all components are functioning properly.
   - Remove the key from the ON/OFF key switch without turning it to the off position. This will not disrupt the robotic route and prevents it from being stolen or lost.
   - 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 with 2% or less incline.
   - Do not operate machine in low traction environments (ice, oil, etc...).
   - 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.
   - The operator needs to stop the machine in the event of a facility emergency (facility shutdown, fire alarm, tornado, etc..).
   - Do not operate machine with other manually controlled vehicles unless the operators are trained to operate safely around other autonomous machines.
   - Do not operate machine in areas with other autonomous machines.
   - 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.
   - Plug the off-board charger into a properly rated outlet only.
   - 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 disconnect battery connections while machine is charging. Machine electrical damage may occur.
   - 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.
- 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.

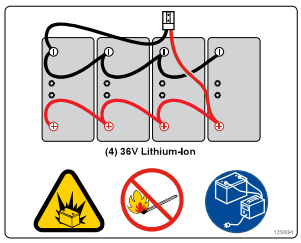
7. When using Lithium-ion Battery model:
   - Lithium batteries are designed exclusively for specific Tennant machine applications. Do not install battery pack in unapproved machines.
   - Dispose of battery in accordance with local regulations. Contact Tennant Service.
   - Contact Tennant Service or your local regulatory authorities for proper transporting instructions of lithium−ion batteries.
   - Disconnect battery cable connector, battery management system (BMS) connector and charger cord before working on machine.
   - Use only OEM approved battery charger supplied with lithium−ion battery.
   - Do not expose battery to temperatures below −22°F (−30°C), above 140°F (60°C).
   - Do not use machine immediately after long−term extreme temperature storage. Before use, return battery module temperature range to 50°F (10°C)~95°F (35°C)
   - Do not operate or store battery in hazardous environment (electrically charged, humidity, extreme temperatures and magnetic fields).
   - Do not expose battery to flame or plasma.
   - Do not drop, crush or subject battery to impact, as it may cause battery to heat up or catch fire.
   - Do not put battery in fire or water to avoid battery explosion.
   - Do not touch battery with wet hand, avoid electric shock.
   - Stop using or charging the battery immediately if battery has abnormal temperature, leakage or other abnormal conditions.
8. When loading/unloading machine onto/off truck or trailer:
   - Use ramp, truck or trailer that will support the weight of the machine and operator.
   - Drain tanks before loading machine.
   - Do not drive on a slippery ramp.
   - Use caution when operating on a ramp.
   - Do not load/unload on ramp inclines that exceed 12.3% / 7° grade.
   - Lower scrub head and squeegee before tying down machine.
   - Turn off machine and remove key.
   - Block machine tires.
   - 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 on models equipped with wet lead acid (flooded)



Located under seat panel on models equipped with Lithium-Ion batteries (4 pack).

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

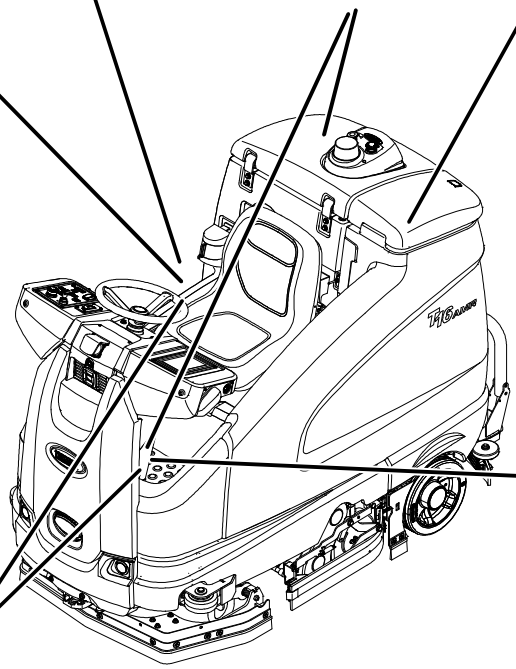


Located on underside of recovery tank cover and on electrical panel.

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



Located on underside of solution tank cover.



FOR SAFETY LABEL - Read manual before operating machine.



Located on electrical panel.

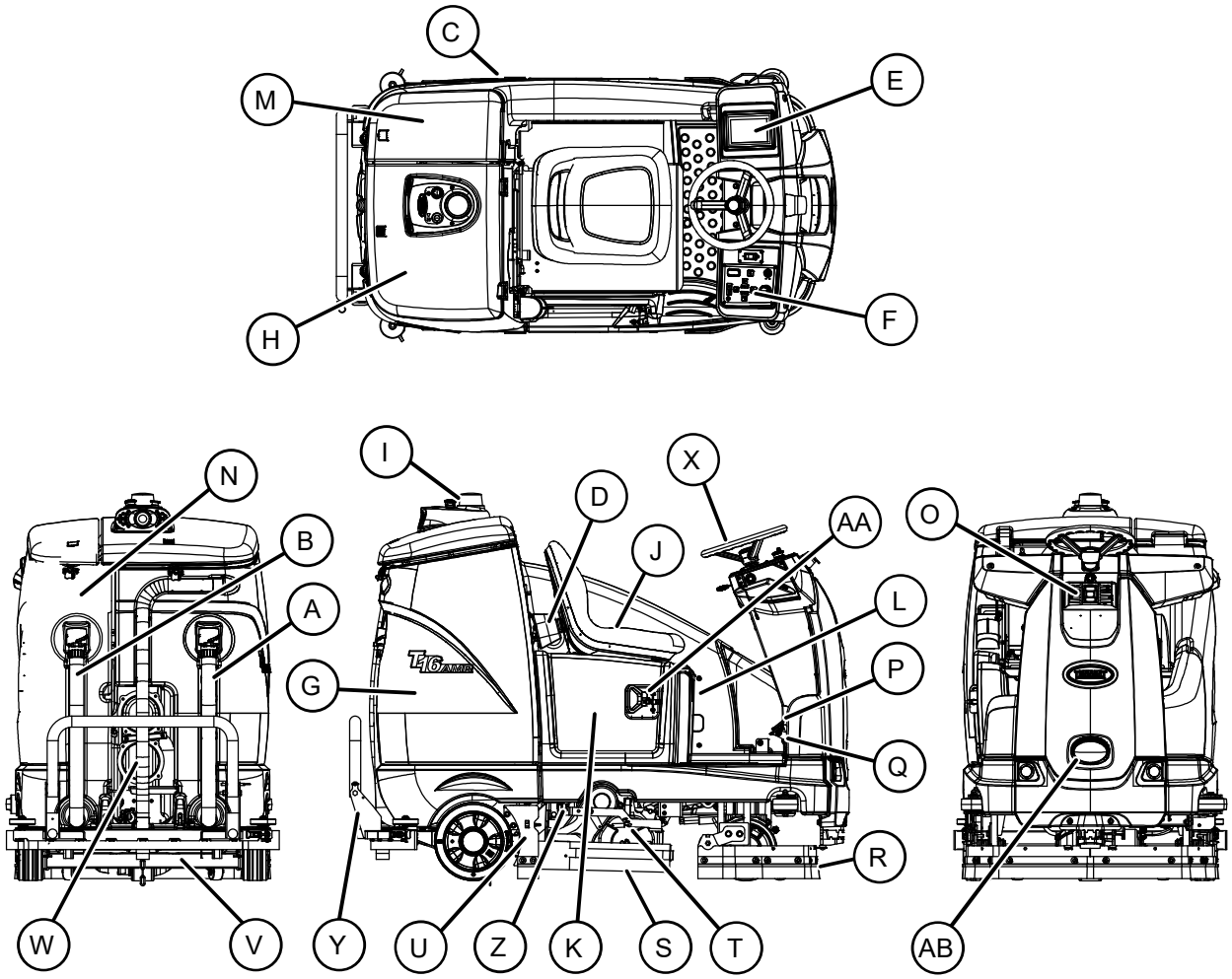
FOR SAFETY LABEL - Electrical components, use grounding strap before opening panel.



Located on seat panel and electrical panel.

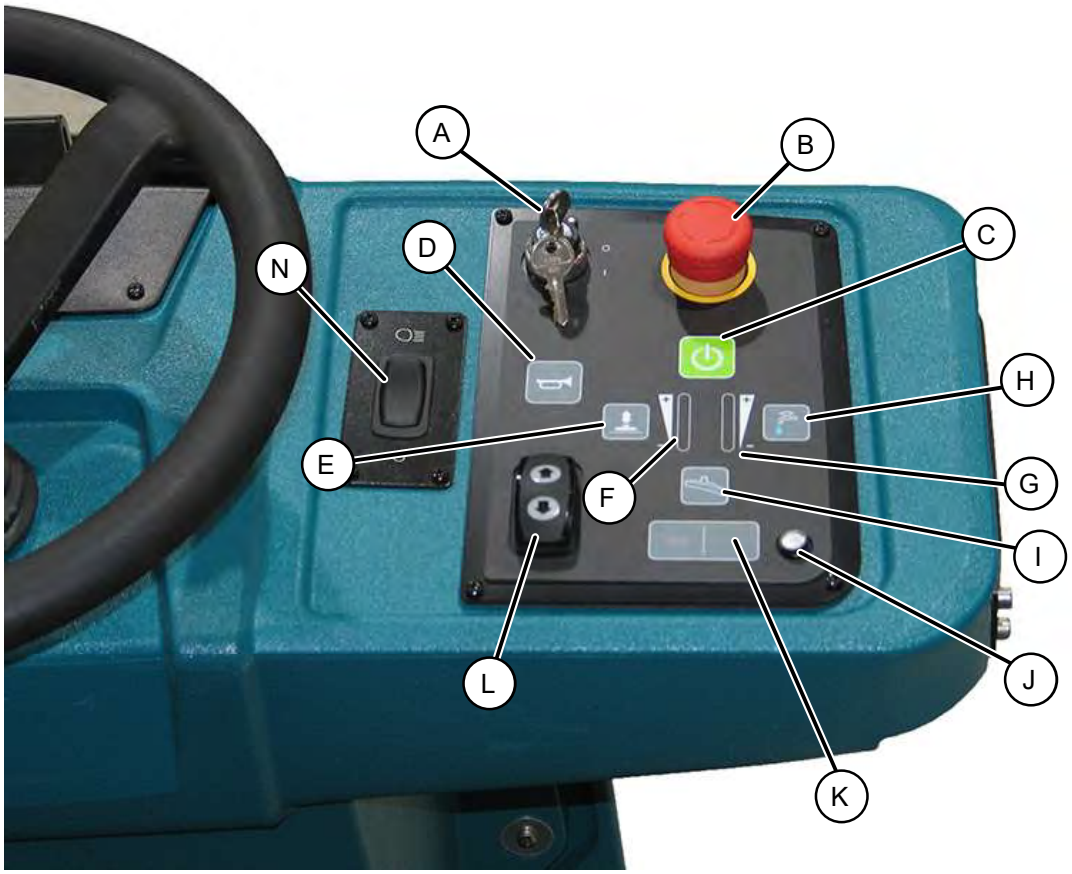
OPERATION

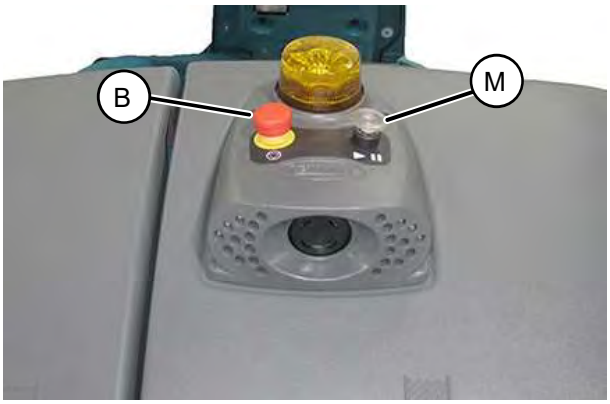
MACHINE COMPONENTS

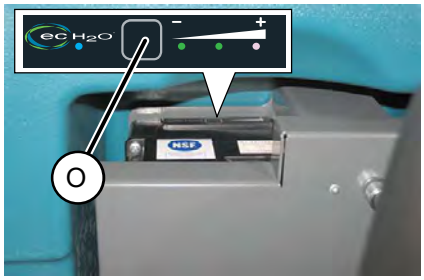


A. Recovery tank drain hose
B. Solution tank drain hose
C. Left perimeter guard
D. Retractable strap (Anti-Joyride)
E. User Interface (UI) touchscreen
F. Control panel
G. Recovery tank
H. Recovery tank cover
I. Backup alarm / flashing light
J. Operator seat
K. Batteries
L. Battery charging connector (Flooded lead battery only)
M. Solution tank 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. Rear squeegee
W. Squeegee vacuum hose
X. Steering wheel
Y. Rear squeegee guard
Z. Debris tray
AA. Battery charging connection (Lithium-ion battery)
AB. Blue pedestrian light

CONTROLS AND INSTRUMENTS

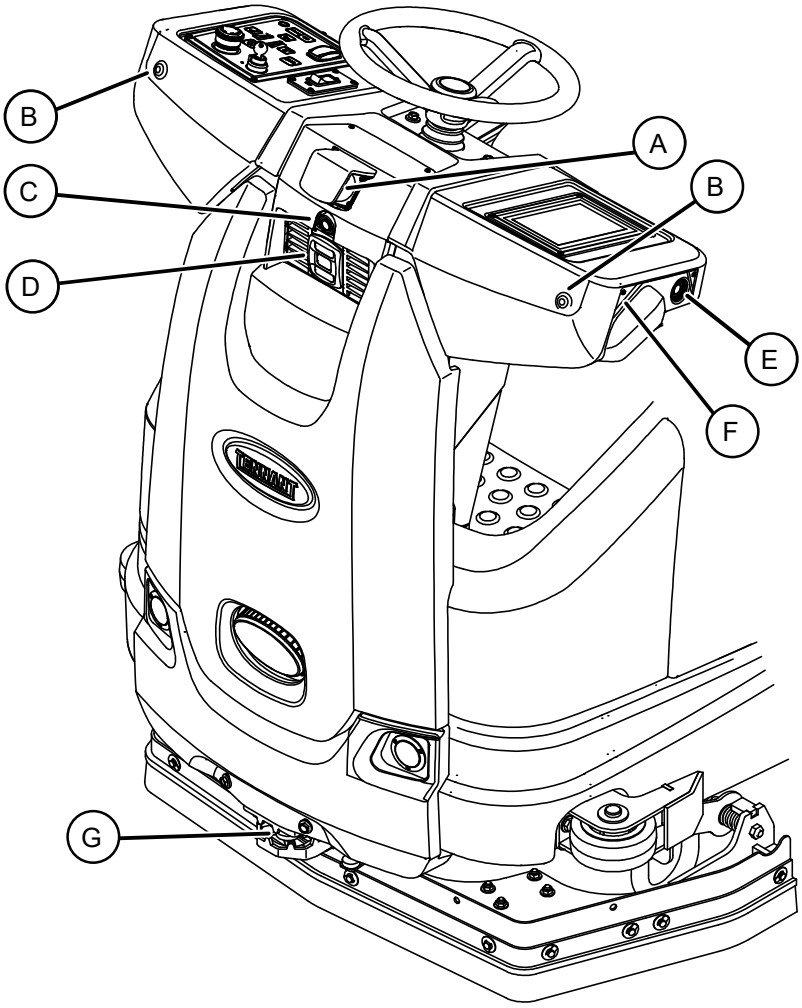






A. ON/OFF key switch
B. Emergency Stop Button (located on control panel and back of machine)
C. 1-Step button
D. Horn button
E. Brush pressure button
F. Brush pressure indicator lights
G. Solution flow indicator lights
H. Solution flow button (Conventional scrubbing)
I. Vacuum fan/squeegee button
J.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

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

INSTALLING BATTERIES

FLOODED/SEALED LEAD-ACID BATTERIES

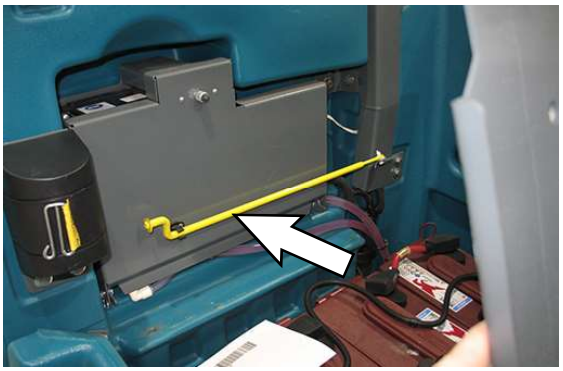
WARNING: Fire Or Explosion Hazard. Batteries Emit Hydrogen Gas. Keep Sparks And Open Flame Away. Keep Battery Hood Open When Charging.

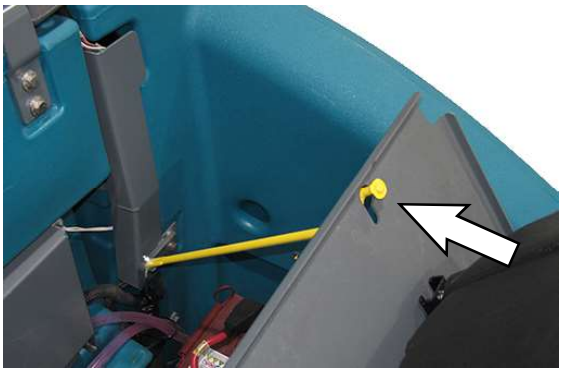
BATTERY SPECIFICATIONS

Six 6-volt deep cycle lead acid batteries.

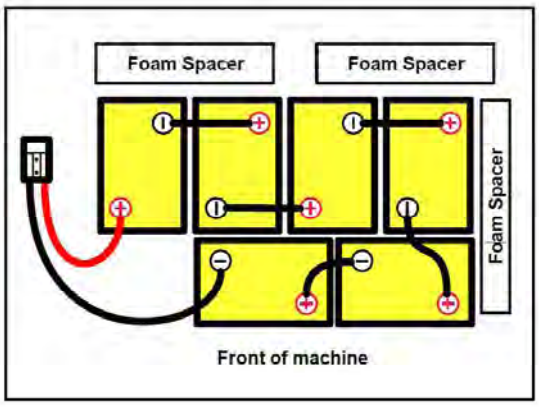
Maximum battery dimensions: 7 In / 177.8 mm W x 11.8 in / 299.7 mm L x 14.5 in / 368 mm H.

1. Park the machine on a level surface and remove the key
2. To engage the seat support arm, lift the seat completely open and insert the seat support arm into the hole in the operator seat plate.





3. With adequate assistance carefully install the batteries into the battery compartment tray and arrange the battery posts as shown. Insert the foam spacers along side the batteries as shown.



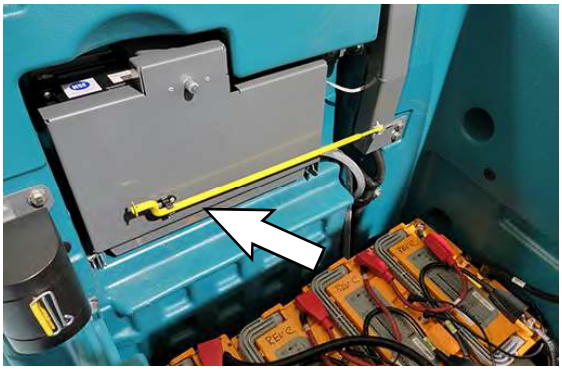
4. Using the supplied battery post boots, connect the cables to the battery posts, RED TO POSITIVE (+) & BLACK TO NEGATIVE (_).

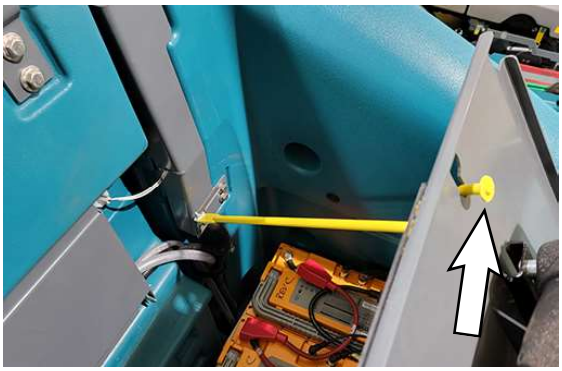
LITHIUM-ION BATTERY (4 PACK)

Lithium-Ion batteries must be charged prior to initial use, see CHARGING THE BATTERIES section of the manual.

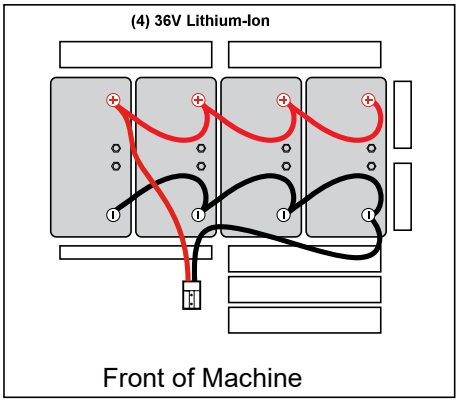
1. Park the machine on a level surface and remove the key

2. To engage the seat support arm, lift the seat completely open and insert the seat support arm into the hole in the operator seat plate.



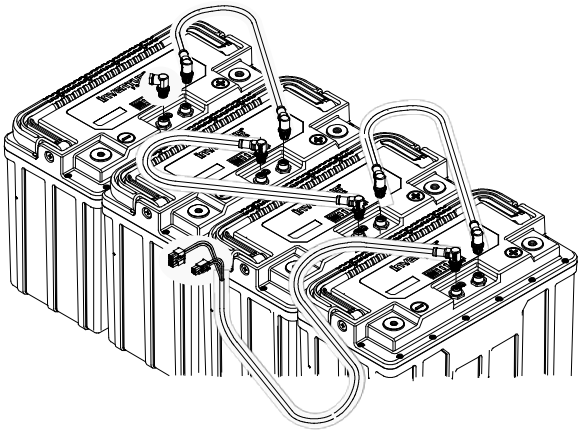


3. With adequate assistance carefully install the batteries into the battery compartment and arrange the battery posts as shown. Insert the foam spacers along side the batteries as shown.

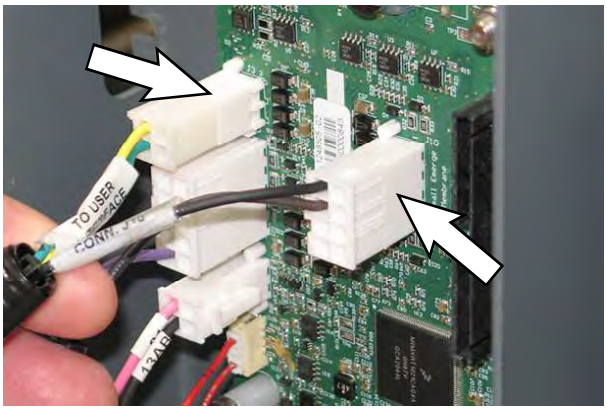


4. Using the supplied battery post boots, connect the cables to the battery posts, RED TO POSITIVE (+) & BLACK TO NEGATIVE (-).

5. Connect the cable assemblies to the communication terminals as shown.



6. Connect the BMS electrical harness to the communication board J3 and J10 terminals.



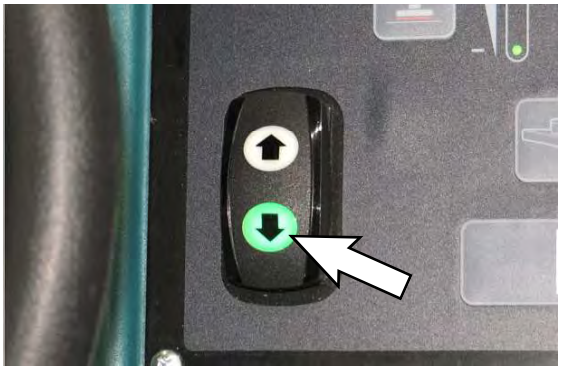
OPERATION OF CONTROLS

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.



NOTE: An audible alarm will sound and hazard light will flash when the Directional switch is placed into reverse and the propel pedal is pressed.

ADJUSTING BACKUP ALARM VOLUME

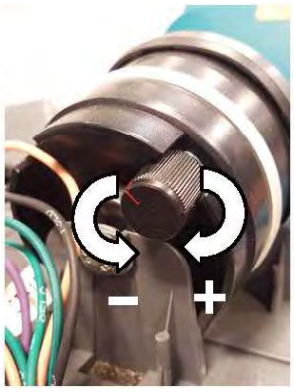
FOR SAFETY: When using machine, follow site safety guidelines concerning backup alarms.

The backup alarm volume can be adjusted from 85-102 dB(A). to adjust the volume, remove the backup alarm cover and turn the volume knob.

Increase volume: Turn the knob clockwise.

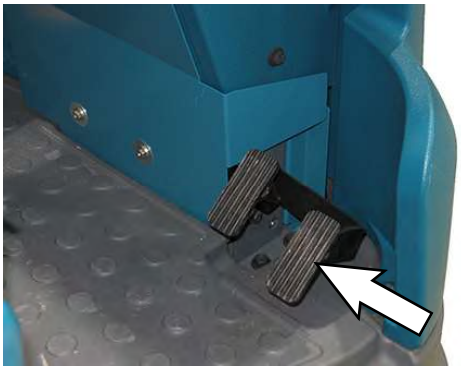
Decrease volume: turn the knob counter-clockwise.





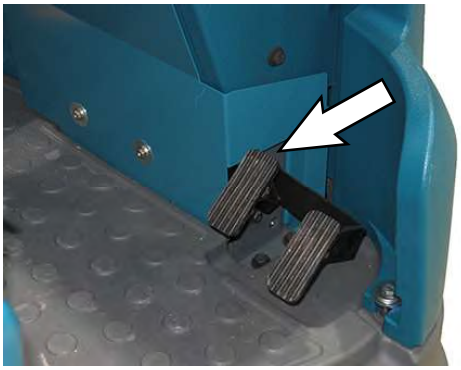
PROPEL PEDAL

Press the *Propel pedal* to move the machine.



BRAKE PEDAL

Press the *Brake pedal* to stop the machine..



OPERATING LIGHTS SWITCH

Press the top of the *operating lights switch* to turn on the operating lights.

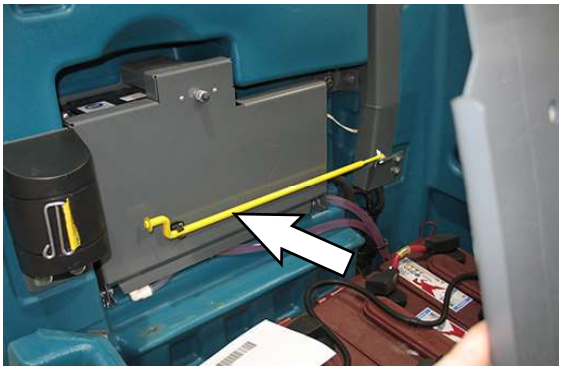
Press the bottom of the *operating lights switch* to turn off the operating lights.

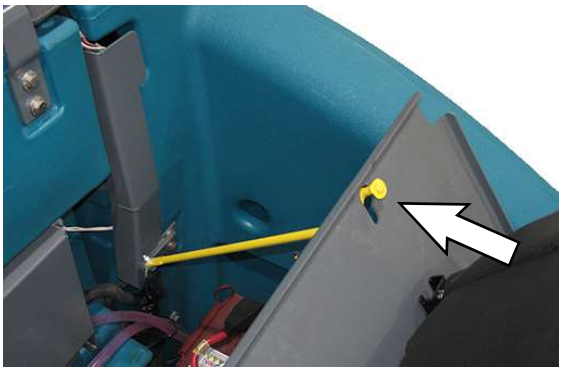


SEAT SUPPORT ARM

The seat support arm holds the seat up to allow access to the batteries and circuit breakers.

To engage the seat support arm, lift the seat completely open and insert the seat support arm into the hole in the operator seat plate.





OPERATOR SEAT

The front-to-back adjustment lever adjusts the seat position.

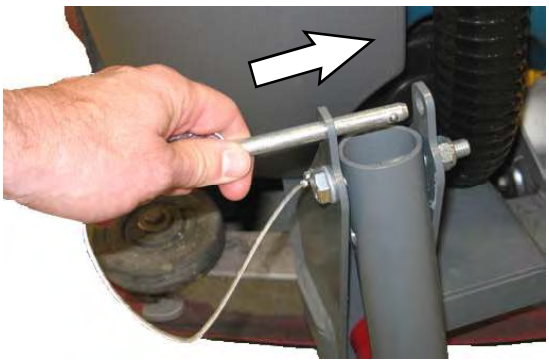


REAR SQUEEGEE GUARD

The rear squeegee protector helps protect the rear squeegee from being damaged.



To engage the rear squeegee protector, pull the pin, lower the protector bar, and reinsert the pin.



SETTING SCRUB MODES

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

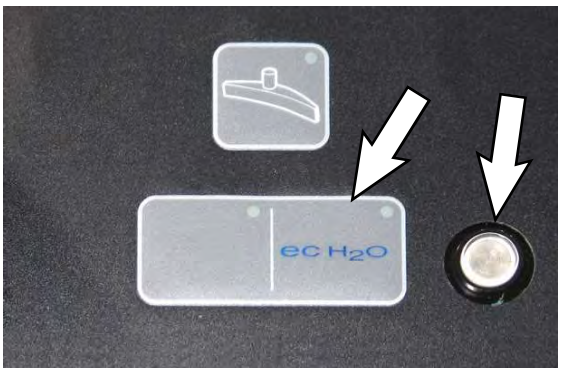
NOTE: The machine is designed to automatically activate the ec-H2O system each time the machine is turned on. Push the ec-H2O button to disable the ec-H2O system for conventional scrubbing.

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/disables 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.

ec-H2O SOLUTION FLOW SETTING

The ec-H2O system is activated each time the key of the machine is turned on.

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 behind the seat..



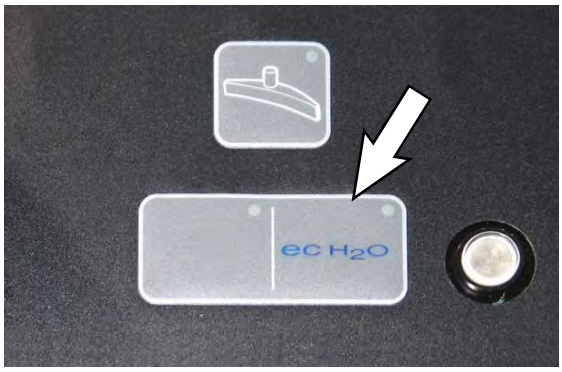
NOTE: It is recommended that medium or high solution flow levels be used for uncoated or unpolished floors (more porous). This applies to both conventional and ec-H2O scrubbing modes.

SETTING SOLUTION FLOW (CONVENTIONAL SCRUBBING)

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.

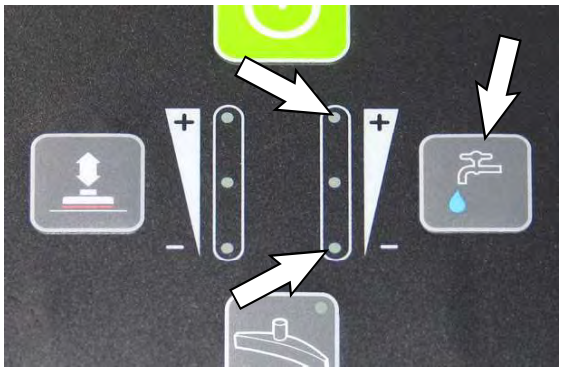
NOTE: The machine is designed to automatically activate the ec-H2O system each time the machine is turned on. Push the ec-H2O button to disable the ec-H2O system for conventional scrubbing.

Press the ec-H2O button to turn off the ec-H20 system to conventional scrub. The light in the ec-H2O button will turn off.



Press the *Solution flow button* on the dash panel 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.

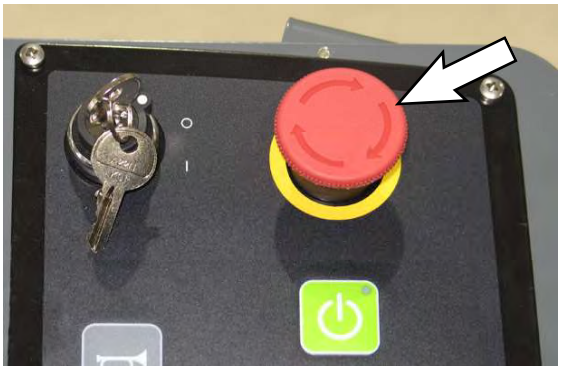


EMERGENCY STOP BUTTONS

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.





Immediately after either *Emergency Stop button* is pushed the Emergency Stop Button Pressed screen will appear on the *UI touchscreen*. Follow the instructions on the *UI touchscreen.*



Twist the *Emergency Stop button* used to stop the machine clockwise to disengage the emergency stop function. The Emergency Stop Button Released screen appears on the *UI touchscreen* immediately after the *Emergency Stop button* is disengaged. Touch OK.



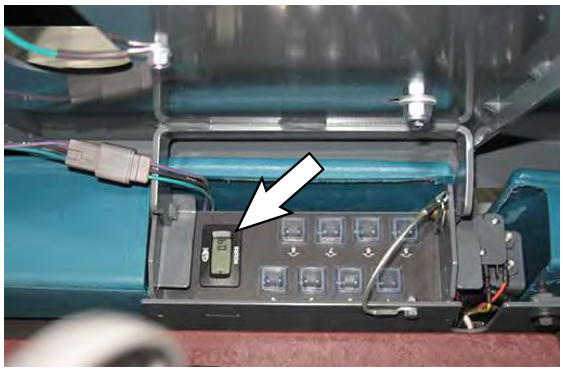
If the *Emergency Stop button* was pressed when the machine was on a robotic route, press the *blue start/pause button* to resume scrubbing in the robotic mode. As the machine begins robotic operation, observe scrubbing performance to ensure that all components are functioning properly.

If the *Emergency Stop button* was pressed when the machine was in the manual mode or when teaching a new route, press the *1-Step button* and resume operating the machine in the manual mode or teaching the new route.

NOTE: When teaching the machine, the 1-Step button must be pressed before beginning to teach the machine after the Emergency Stop button is disengaged. The 1-Step button is automatically turned off when the Emergency Stop button is engaged and must be turned back on to continue teaching the machine.

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

BLUE PEDESTRIAN LIGHT

The blue pedestrian light shines onto the floor in front of the machine to alert pedestrians the machine is near. The blue pedestrian light automatically comes on when the key switch is turned on. Position the blue light so it illuminates far enough out from the machine to adequately alert pedestrians that machine is near.



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*.

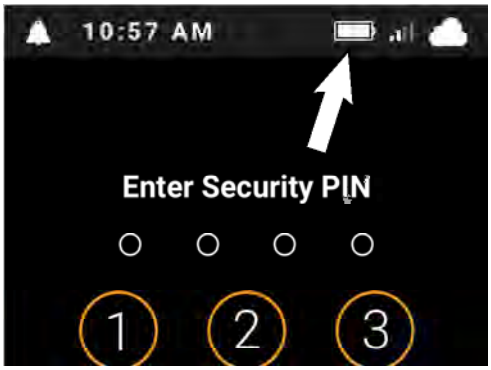


When the machine is turned on, the BrainOS software will automatically initialize. Once initialized, a security PIN (Personal Identification Number) must be entered to access BrainOS software and use its robotic functionality.



BATTERY DISCHARGE BAR

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



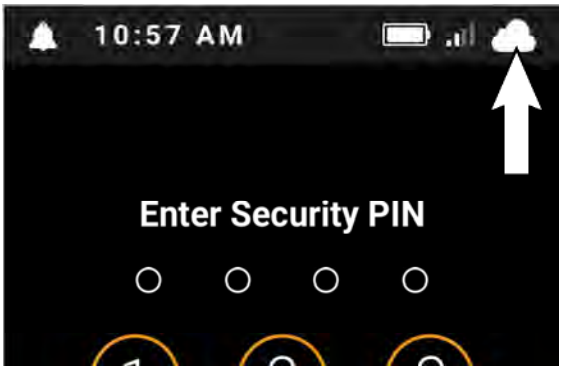
When the batteries are fully charged, the *battery discharge bar* is completely filled. As the batteries discharge, the *battery discharge bar* moves from the right to the left.

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.

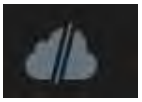
NOTE: Do not charge batteries more often than necessary. Excessive charging could reduce the life of the batteries. It is best to charge the batteries only when alerted that the battery needs charging. See BATTERIES in the MAINTENANCE section.

ROC: ROBOT OPERATIONS CENTER (BrainOS Software)

The BrainOS software provides access to the Brain Corp 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 analysis. 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. The New Update Available screen will appear on the UI touchscreen when the machine can be updated with latest software. See BRAINOS SOFTWARE UPDATES..



The *ROC indicator* is located on the *UI touchscreen* status bar. When the indicator is illuminated, 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.

	
Connected	**Not Connected**

BRAINOS SOFTWARE UPDATES

Over-the-air updates allow new versions of BrainOS software to be downloaded remotely over the built-in modem. This capability ensures that the machine has the latest BrainOS software, which is important for implementing new features and improvements.

It is critical that all machines have the latest version of BrainOS software installed.

When the New Update Available screen displays, follow these steps:

NOTE: Do not drive the machine when a new software update is available, or while the software is being updated.

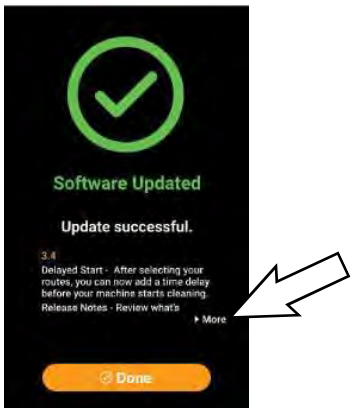
1. Park the machine.
2. On the New Update Available screen, select *Update* to begin the software update.

NOTE: Do not drive the machine after selecting the Update button to begin the software update. The software update must be completed before the machine can be operated.

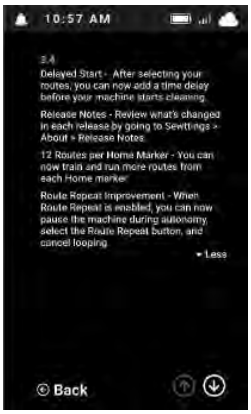




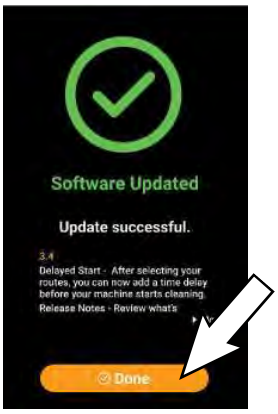
3. When the software update completes, a Update successful message appears along with the software release notes.



4. Touch more to expand the release notes to see what is new in the new update.

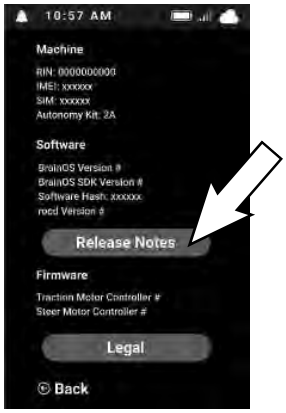


5. Click on *Back* and then select *Done.*



6. To complete the update, restart the machine.

NOTE:If necessary the release notes can be found once logged into the software by selecting Settings > About > Release Notes.



HOW THE MACHINE WORKS

The scrub components of the machine are a solution tank, scrub brushes, 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 machine is designed to automatically activate the ec-H2O system each time the machine is turned on. The *ec-H2O button* enables/disables 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 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 machine can be taught standard cleaning routes or, if enabled, an Area Fill route, where the operator teaches the perimeter of an area and the machine determines the best route to complete cleaning the area. 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.

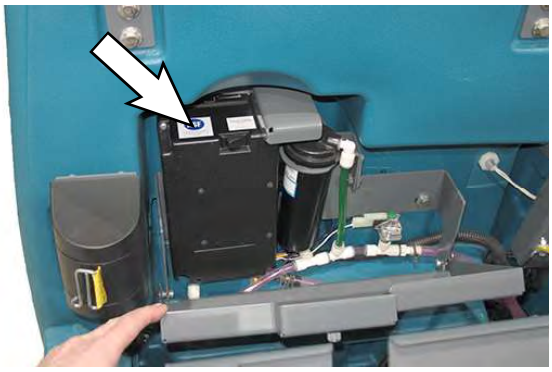
Home markers must be permanently installed before the machine can be used in robotic mode. A home marker is a unique code identifier that the machine scans to determine its current location, as well as any routes that have been saved to that specific home marker. The machine is designed to work with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

ec-H2O SCRUBBING SYSTEM

The machine is designed to automatically activate the ec-H2O system each time the machine is turned on. 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 operate 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.



CONVENTIONAL SCRUBBING

NOTE: The machine is designed to automatically activate the ec-H2O system each time the machine is turned on. Push the ec-H2O button to disable the ec-H2O system for 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.

BRUSH INFORMATION

For best results, use the appropriate brush 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.

Polyester brush − Softer general purpose polyester bristles gently clean while scrubbing. Perfect for sensitive floor surfaces. Polyester does not absorb water so it is preferred **over Nylon in wet applications.**

PolyPro brush − Heavy duty polypropylene bristles provide a more aggressive cleaning performance and can more easily lift compacted dirt, debris, and sand while offering excellent scrubbing performance.

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

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.

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 rear perimeter guards are 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 rugs, obstructions, and 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 (36° F).

FOR SAFETY: When using machine in manual mode, do not scrub on ramp inclines that exceed 7% / 4° grade or transport (GVWR) on ramp inclines that exceed 8.75% / 5° grade.

FOR SAFETY: While machine is operating in robotic mode, only scrub flat, hard surfaces of 2% or less incline.

To protect the lower LIDAR sensor from being damaged from passersby, shopping carts, etc... always park the machine with the front end facing a wall or barrier.

WHILE OPERATING THE MACHINE (ROBOTIC MODE ONLY)

This machine should only be used to scrub flat, hard surfaces of 2% or less 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.

FILLING THE SOLUTION TANK

ec-H2O SCRUBBING

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

1. Open the solution tank cover.



2. Fill the solution tank with only clean COOL WATER (less than 21° C / 70° F). DO NOT use hot water or add any conventional floor cleaning detergents or an ec-H2O system failure may result. Fill the solution tank with water until the level is approximately 50 mm (2 in) below the indicator tab.

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



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

3. Close the solution tank cover.

CONVENTIONAL SCRUBBING MODE

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

1. Open the solution tank cover.



2. Partially fill solution tank with water (Not to exceed 45° C / 110° F). Pour the required amount of detergent into the solution tank. Continue filling the solution tank with water until the level is 50 mm (2 in) below the indicator tab.

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



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

NOTE: Pour a recommended foam control solution into the recovery tank if excessive foam appears. for specific detergent recommendations, contact a Tennant representative.

3. Close the solution tank cover.

SCRUBBING - MANUAL MODE

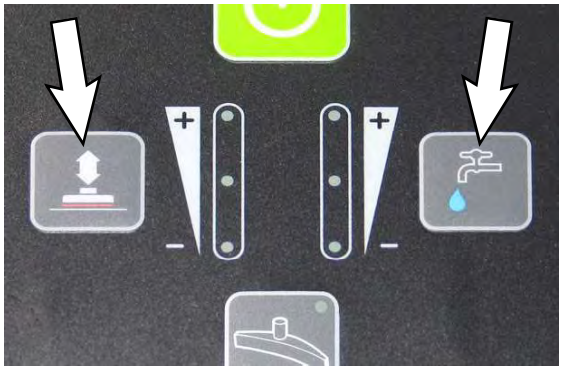
FOR SAFETY: Do not operate machine, unless operator manual is read and understood.

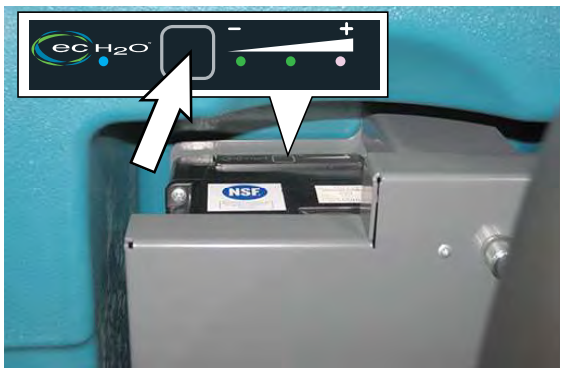
1. Turn the *ON/OFF key switch* on.



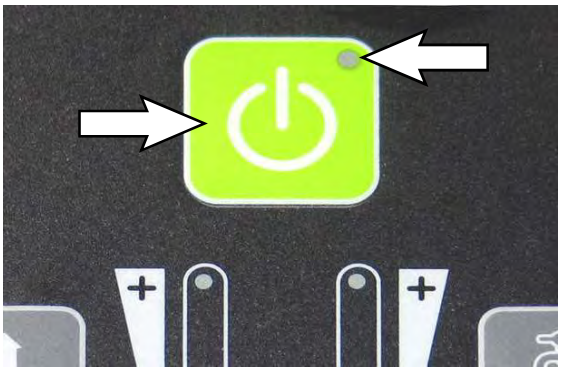
2. Select the preferred scrubbing settings (See SETTING SCRUB MODES).

The machine is designed to automatically activate the ec-H2O system each time the machine is turned on. *Push the ec-H2O button to disable the ec-H2O system for conventional scrubbing.*





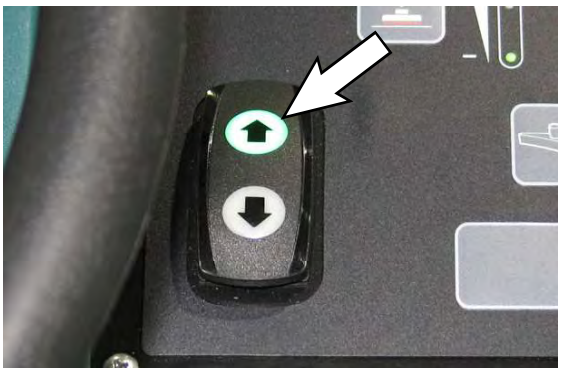
3. Press the *1-Step button*. The light in the button is illuminated. All the preset scrubbing functions will turn on.



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).

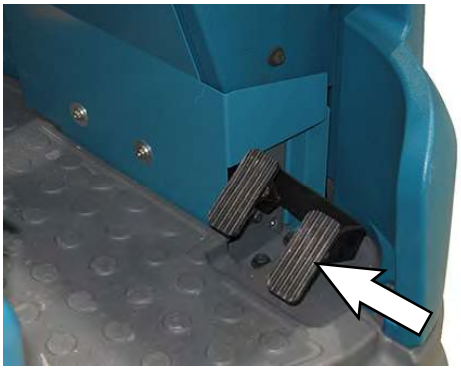
NOTE: The machine can scrub in both forward or reverse.



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 pedal* to begin scrubbing.

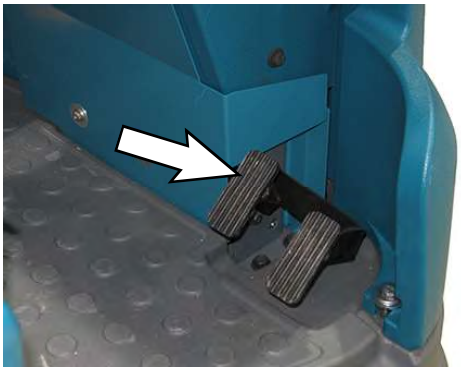
WARNING: Flammable materials or reactive metals can cause an explosion or fire. Do not pick up.



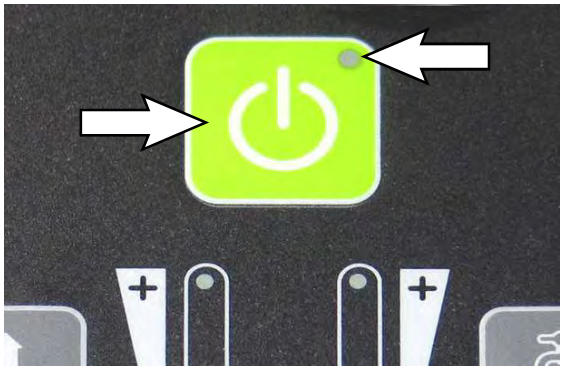
6. Release the *propel pedal* to stop the machine. Scrubbing functions stop and the automatic park brake will engage when the machine stops.

   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% (4°) 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.



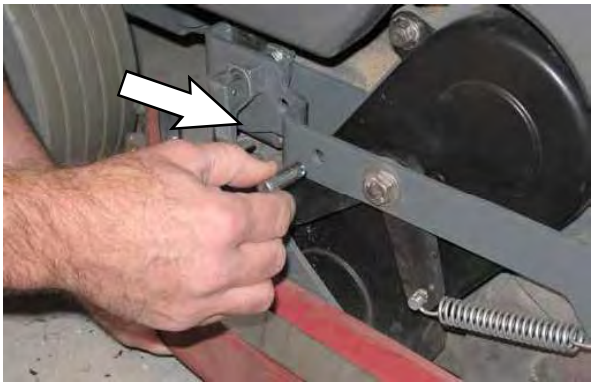
DOUBLE SCRUBBING

*NOTE: Double scrubbing is available in Manual Mode only. **Do Not** operate the machine on an autonomous cleaning route with the squeegee in the raised (double scrub) position.*

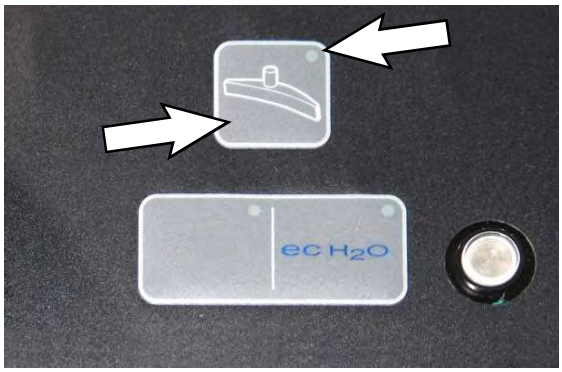
For heavily soiled areas, use the double scrubbing method.

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

To raise the squeegee for double scrubbing, remove the clevis pin from the storage locations. Manually raise both side squeegee assemblies, then reinsert the pin into the holes in the side squeegee brackets.



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.



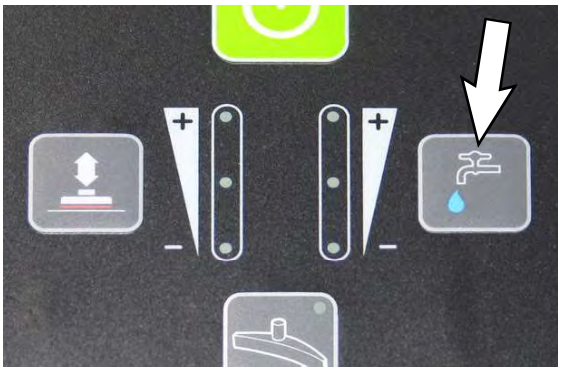
Let the cleaning solution set on the floor for 5-15 minutes.

Before scrubbing the floor a second time, lower the side squeegees.

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.

NOTE: To turn off solution flow when scrubbing the area a second time, turn off the ec-H2O (if in use) and press the conventional solution flow button until all of the lights are turn off.

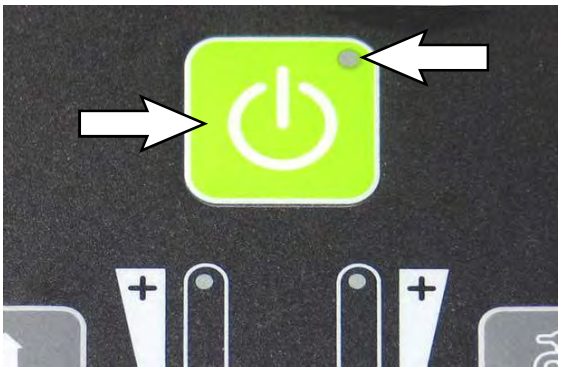


NOTE: Double scrubbing is not recommended in areas where the cleaning solution will run under racks or damage products.

WATER PICKUP MODE (NO SCRUBBING)

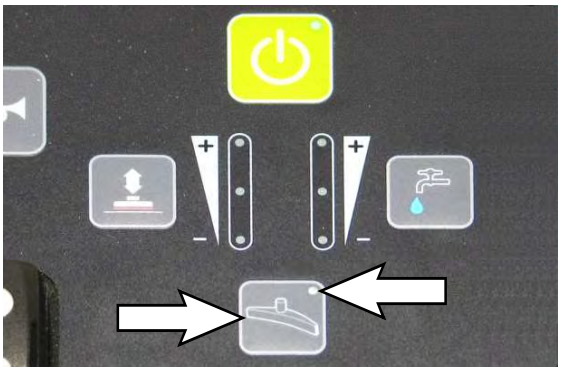
The machine can be used to pick up water or non-flammable liquid spills without scrubbing.

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

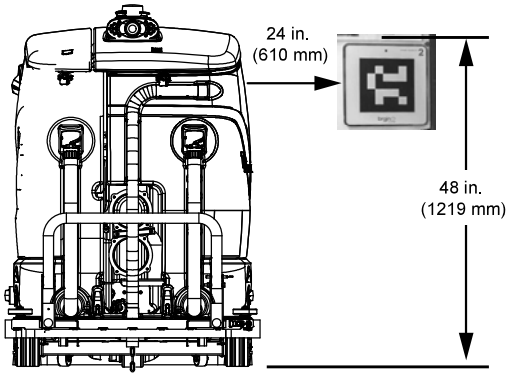
FOR SAFETY: Do not operate machine, unless operator manual is read and understood.

ESTABLISH HOME MARKERS

Home markers must be permanently installed before using the machine in robotic mode. A home marker 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 marker. The machine is designed to work with up to 10 home markers, and each home marker can store up to six routes for a total of 60 routes.

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

- Multiple home markers may be necessary for large or unusually mapped areas where more than six cleaning routes are needed.
- Establish a unique home marker for each floor of a multi-level building.
- Install home markers 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 marker is moved even slightly, the route may not be performed correctly.
- Install home markers at a height of 48 in. (1219 mm) from the floor.



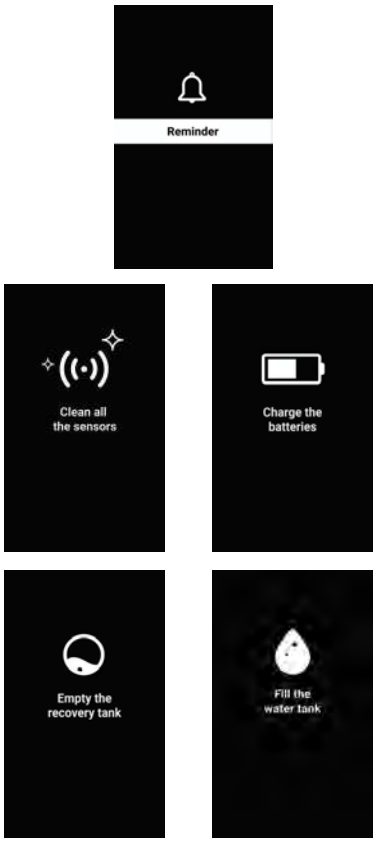
- Install home markers so that the machine can easily scan with the camera on its right side at a distance of no less than 24 in. (610 mm).
- Securely affix home markers to the wall.
- The entire home marker must be clearly visible, not hidden behind furniture or shelving.
- Do not install home markers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

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

LOGGING INTO BrainOS

A PIN (Personal Identification Number) 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. Once the BrainOS loads the UI touchscreen displays a series of maintenance reminders.



3. Read and perform the maintenance reminders.
4. Use the *UI touchscreen* keypad to enter security four-digit PIN (Personal Identification Number).



5. Upon successful PIN (Personal Identification Number) entry, the UI touchscreen displays an Escalator Warning.



6. Read and perform the tasks on the Escalator Warning and then push CONFIRM
7. The *UI touchscreen* displays the main menu.



ACCESS CONTROL / NO-PIN WORKFLOW

The machine is equipped with ACCESS CONTROL that allows a user to set the desired PIN (Personal Identification Number) requirments for accessing the BrainOS screens.

There are three levels of access control: None, Minimum, and Maximum, each with different NO-PIN (Personal Identification Number) access levels.

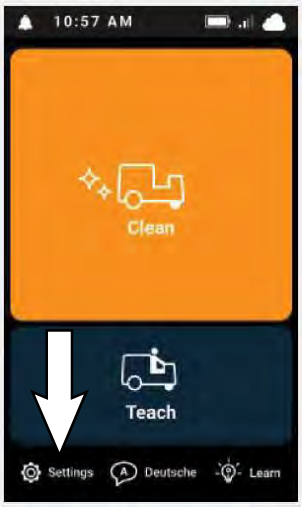
Access Control	NONE	Minimum	Maximum
Teaching	✓	🔒	🔒
Autonomous Cleaning	✓	🔒	🔒
Assist Clearing	✓	✓	🔒
Settings	🔒	🔒	🔒

Depending on the machine install configuration, the machine may have cloud controlled access control enabled on the machine. The cloud control initially sets the machine access level based on the customers needs.

Once a operator gets logged into the Brain OS they can adjust the access level to their needs and the new access level will remain until the machine is powered down where the cloud control level is automatically reset.

NOTE: Machines without cloud control will NOT have the access control level reset when the machine is powered down. The last saved setting will remain once powered up.

1. Touch SETTINGS.



2. Touch ACCESS CONTROL.



3. Touch the desired level of access control.



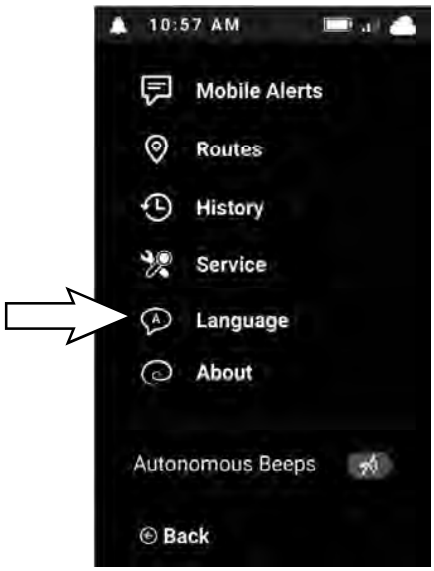
CHANGING REGION / LANGUAGE

The *UI touchscreen* can be set to display a variety of languages. English is the default language.

1. Upon successful PIN (Personal Identification Number) entry, the *UI touchscreen* displays the main menu. Touch SETTINGS or the LANGUAGE icon.



2. Within the SETTINGS menu, touch LANGUAGE.



3. Select the desired language.



4. The menus are now displayed in the selected language.

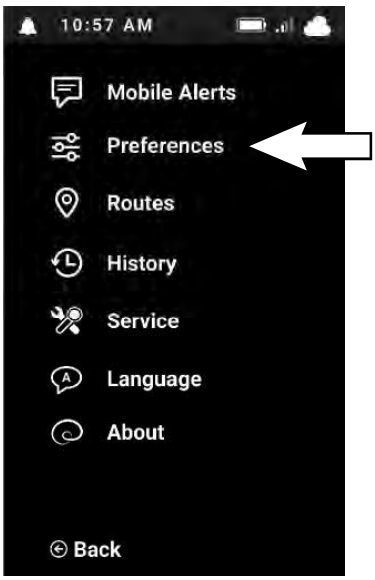
ENABLE/DISABLE MACHINE PREFERENCES

The machine is equipped with optional preferences that can be enabled or disabled depending on the need.These preferences inclue the auto fill, autonomous beeps, and stop & honk features that can be used when teaching a new route.

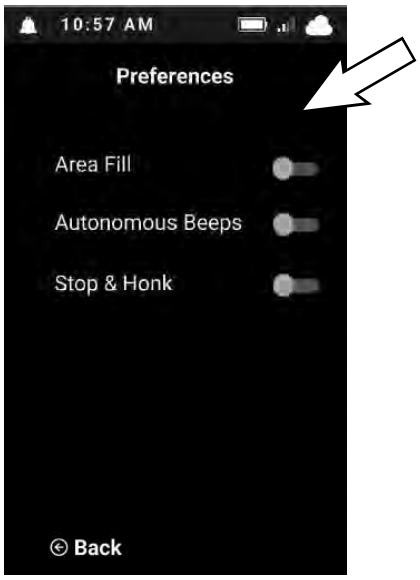
1. Upon successful PIN (Personal Identification Number) entry, the *UI touchscreen* displays the main menu. Touch SETTINGS.



2. Touch preferences.



3. The Preferences screen appears with the option of enabling or disabling machine preferences..

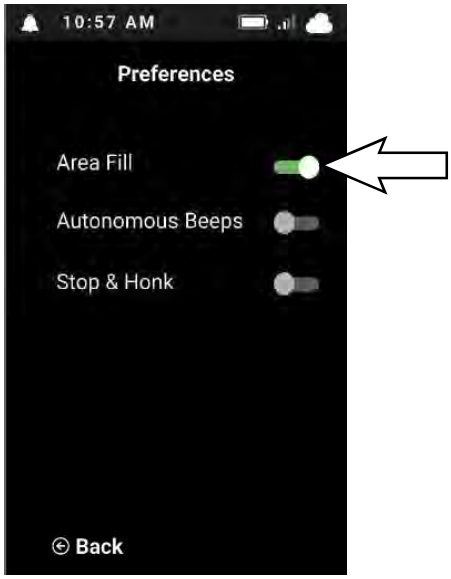


The Area Fill preference allows the operator to create a route around the perimeter of an area to be cleaned. Save the route after teaching the perimeter and the machine automatically cleans the entire area.

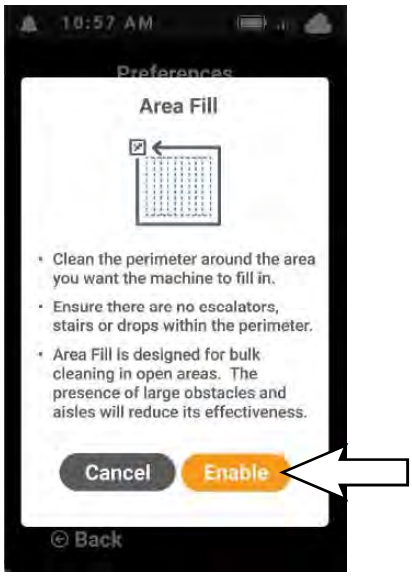
The Autonomous Beep preference can be enabled to have an audible beeping alert every five seconds while running in autonomous mode.

The Stop and Honk preference allows the operator to create stop and honk points along the saved route for auto playback when the saved route is run autonomously.

4. Slide the power button to turn on the desired preference.



5. Touch enable to verify the preference or cancel to keep the preference turned off.



POSITIONING THE MACHINE AT THE HOME MARKER

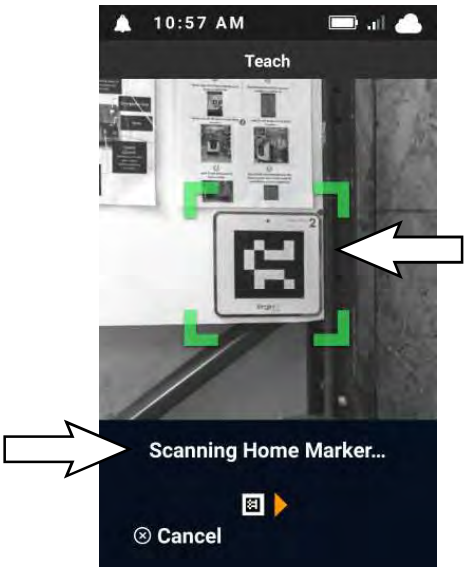
The machine must be positioned so the right-side 2D camera can scan the home marker. The machine cannot be operated in robotic mode until a home marker is scanned and recognized.

1. Upon successful PIN (Personal Identification Number) entry, the *UI touchscreen* displays the main menu. Touch the applicable task (CLEAN or TEACH).



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

3. The machine automatically begins scanning the home marker, as shown on the *UI touchscreen*. If the machine is unable to scan the home marker, 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 marker.

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

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 marker.

   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 marker.

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

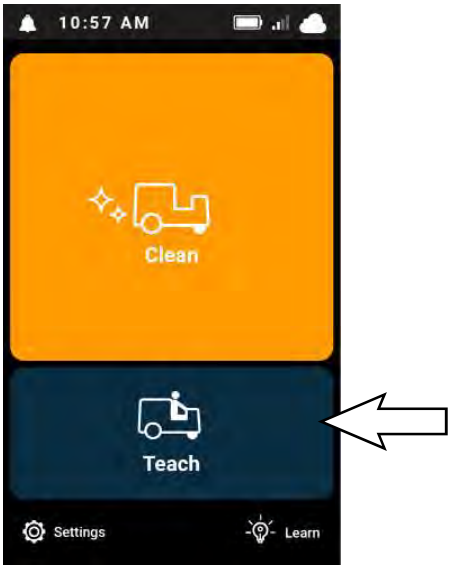
TEACHING A NEW ROUTE (BrainOS Software)

Things to consider before teaching a robotic route:

- The machine can only operate in robotic mode in areas where cleaning routes have been taught and saved.
- The machine can be taught two different types of cleaning procedures, a cleaning *Route* or a cleaning *Area Fill*.
- 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 2.2 mph (3.5 Km/h). Routes longer than 1 hour are not recommended due to water and battery capacity. For best performance, split large cleaning routes into multiple smaller cleaning routes.
- 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.
- Use barriers as needed positioned so they can be detected by machines sensors. The barriers should be 5.5 in. (140 mm) to 8.5 in. (220 mm) from the ground and at least 4 in. (100 mm) or more wide. Make sure multiple barriers are no wider than the width of the machine.
- If a route is taught in an area with obstructions that are later removed, the machine will not clean the areas where the obstructions were previously located.
- Avoid teaching routes in areas with highly polished/reflective surfaces, plexiglass, or reflective black surfaces since such surfaces are difficult for the machine to detect.
- Avoid teaching routes where there is excessive sunlight on the floor surface. Sunlight reflections on the floor surface could adversely affect robotic machine performance.
- Avoid teaching routes in areas with overhanging or protruding objects. These objects may not be detected when the machine is operating or making sharp turns.

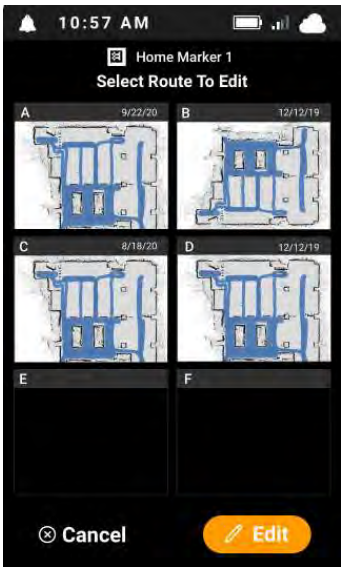
Teaching the machine a new robotic route:

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 (Personal Identification Number).
3. Upon successful PIN (Personal Identification Number) entry, the *UI touchscreen* displays the main menu. Touch TEACH.



4. Drive the machine to the desired home marker, positioning the machine so the right-side camera is no less than 24 in (610 mm) from the home marker. See POSITIONING THE MACHINE AT THE HOME MARKER.
5. The machine automatically begins scanning the home marker, as shown on the *UI touchscreen*. If the machine is unable to scan the home marker, 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 marker, followed by a list of all existing and available routes for the scanned home marker.



7. Touch one of the available routes to select.

NOTE: In the above screen routes A through D are already being used for robotic routes. Route E is available for a new route.

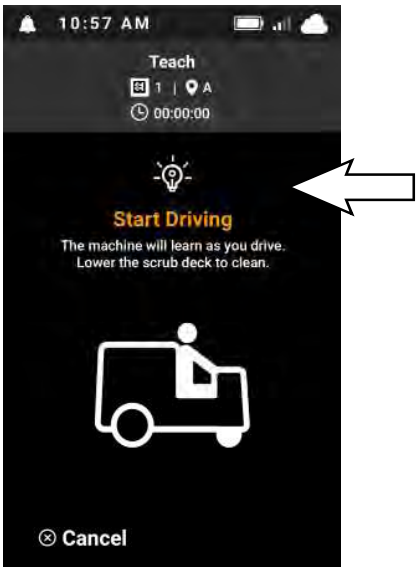
NOTE: If no routes are available, an existing route must be deleted in order to teach a new route. See EDIT / DELETING ROUTES.

8. Select the type of route to teach, a teach and repeat route or Area Fill.

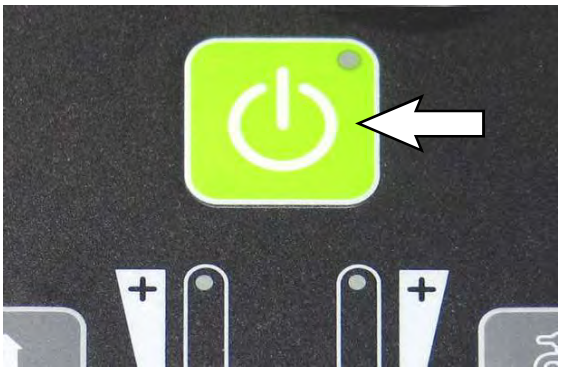


NOTE: If enabled, the Area Fill button allows the operator to create a route around the perimeter of an area to be cleaned. Save the route after teaching the perimeter and the machine automatically cleans the entire area. See ENABLE/ DISABLE MACHINE PREFERENCES section of the manual.

9. The UI touchscreen states **Start Driving. The machine will learn as you drive. Lower the scrub deck to clean.**



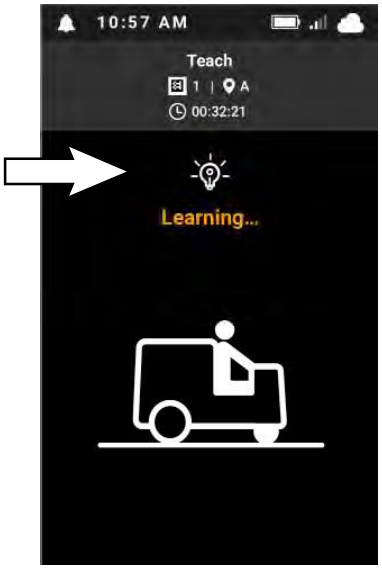
10. Press the *1-Step button* to activate the cleaning systems.



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

NOTE: The machine is designed to automatically activate the ec-H2O system each time the machine is turned on.. Push the ec-H2O button to disable the ec-H2O system for conventional scrubbing.

11. 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.

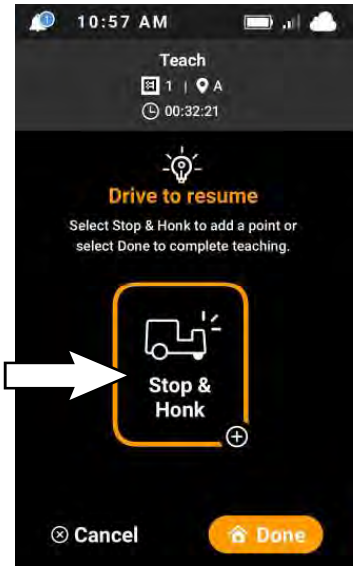


NOTE: Do not teach a route with an incline or decline.

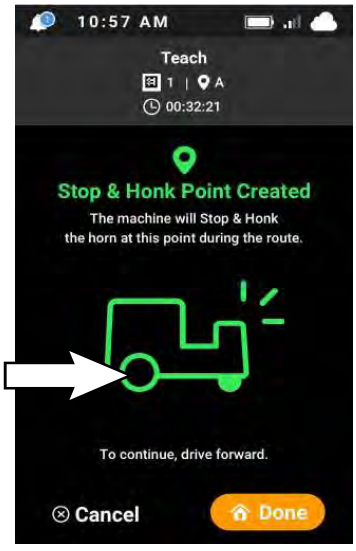
NOTE: Do not teach the machine routes that include driving into an elevator or automatic doors.

If enabled, the machine can save stop and honk points along the saved route for auto playback when the saved route is run autonomously. See ENABLE/DISABLE MACHINE PREFERENCES section of the manual.

12. When driving stops, the UI touchscreen states **Drive to Resume a**nd displays a Stop and Honk button**.** To create a Stop and Honk Point, stop propelling the machine at the desired location. Touch the Stop and Honk button.



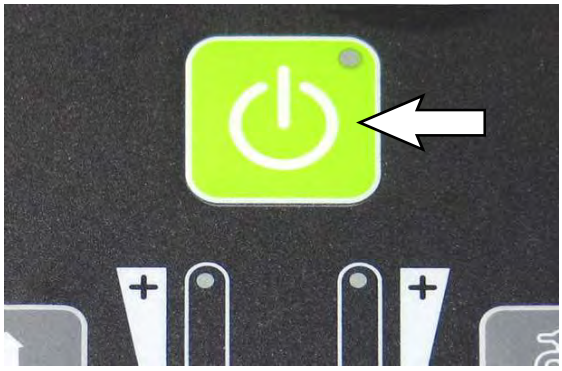
13. The Stop and Honk location is created and stored for playback.



NOTE: A Stop and Honk point must be created for each stop and honk location required per route.

NOTE: Stop and Honk points are not saved on Area Fill perimeter routes.

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 135 in (3430 mm) to perform a U-turn.

NOTE: Avoid tight corners. The machine requires a minimum of 75 in (1900 mm) to navigate a corner.

NOTE: Avoid narrow spaces. The machine requires a width of 57 in (1450 mm) to navigate aisles and between racks.

FOR SAFETY: While machine is operating in robotic mode, only scrub flat, hard surfaces of 2% or less incline.

14. Resume teaching the new route ending it at the home marker or select CANCEL to stop teaching the route.



NOTE: If cancelling the new route, touch CANCEL on the UI touchscreen. The UI touchscreen states **Cancel Teach?** *Touch Yes to cancel the route and return to the main menu. Touch No to return to teaching the new route.*



15. When stopped back at the home marker, touch DONE and the machine will scan the home marker a second time at the end point of the cleaning route. If the machine does not see the home marker 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 marker a second time in the same physical location.

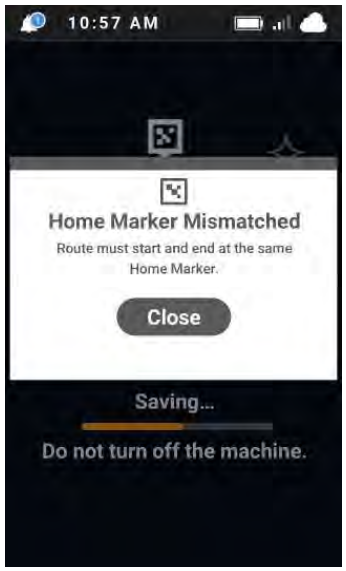
16. When in the process of saving, the *UI touchscreen* displays **Saving...**



NOTE: If the UI touchscreen states **Route Failed to Save***, touch TEACH to repeat the entire procedure to teach the cleaning route.*



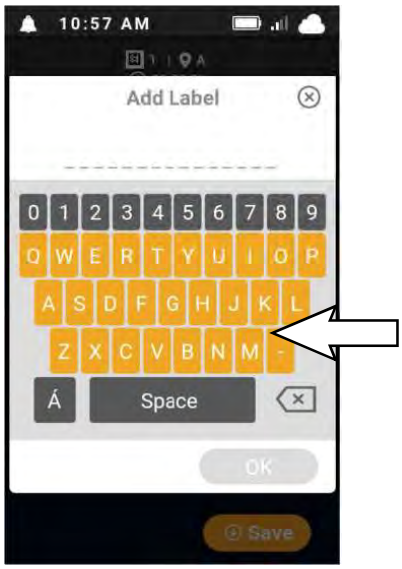
NOTE: If the machine reads an incorrect home location an error will display along with a message instructing what home location to go to.



17. When the route is successfully saved, the UI touchscreen briefly displays a Route Saved screen and then displays the **Add Label** screen. Touch the Add Label button.

NOTE: Selecting SAVE without assigning a label to the route will display the default <NO LABEL>. name to the saved route.

18. Enter a name for the saved route.



NOTE: Route labels can have a maximum of 15 characters.

CONNECTING A PHONE WITH THE ROC

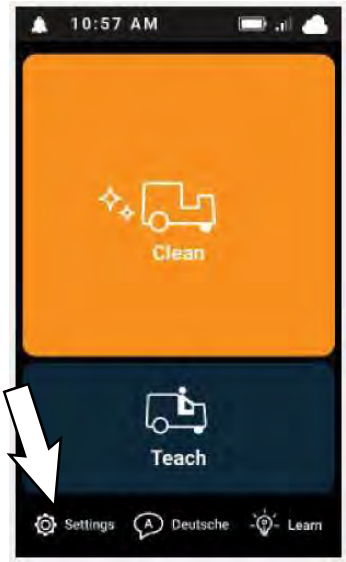
Before running a cleaning route in robotic mode, it is recommended that the operator pair their cell phone to the ROC or connect with the Brian OS Mobile app.

When a cell phone is paired by text message 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.

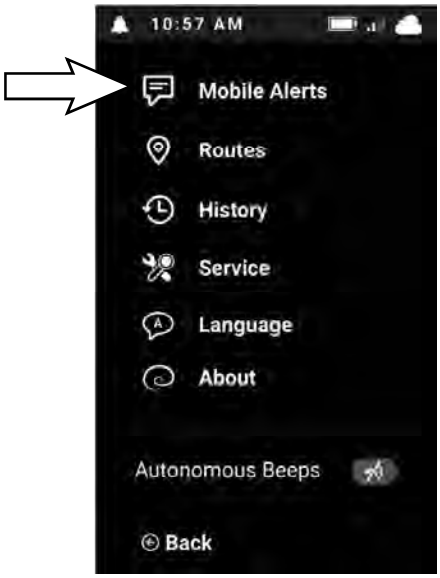
To ensure only the on site operator receives alerts from the ROC, only one phone can be paired to the ROC to receive status alerts. A paired phone number is automatically discarded when the machine is turned off or a new phone is paired.

When connected to the Brain OS mobile app, the ROC will send messages to the app whenever the machine encounters an alert and/or when the route is complete. Connecting to the ROC through the Brain OS mobile app allows multiple users to connect to a machine at the sama time.

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



3. Touch MOBILE ALERTS.



4. Additionally, access to the mobile alerts can be found on the start screen when running a saved route.

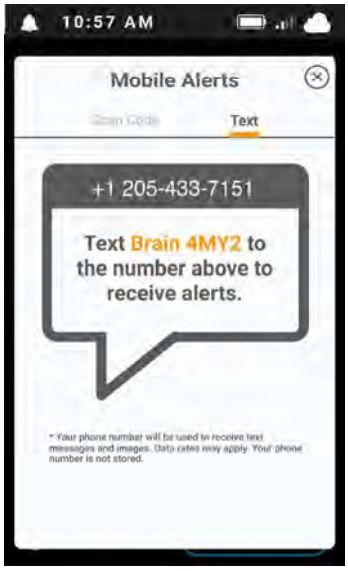


5. Select either the Scan Code tab to download the Brain OS mobile app or the text tab to connect to the ROC via text messaging.



6. Brain OS mobile app: Scan the QR code to install the Brain OS mobile app from the Google Play store or the App store on iOS.

7. Text messaging: Follow the instructions on the *UI touchscreen* to pair a cell phone to the ROC.



8. Pairing is successful when the cell phone receives a confirmation text message.



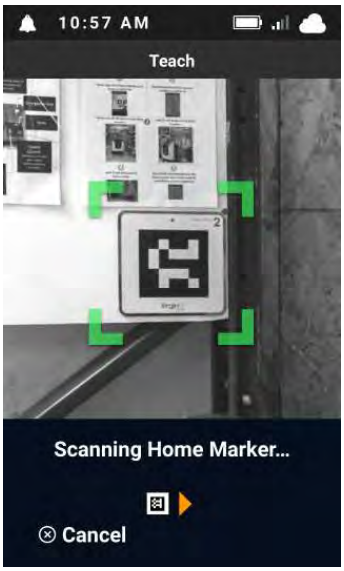
RUNNING ONE OR MORE ROBOTIC CLEANING ROUTES (BrainOS Software)

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. Ensure the squeegee is in the lowered position for scrubbing. Do Not operate the machine on an autonomous cleaning route with the squeegee in the raised (double scrub) position. Lower the squeegee if it is in the raised double scrub position.
2. Turn the *ON/OFF key switch* on.
3. When the main menu appears on the *UI touchscreen*, touch CLEAN.

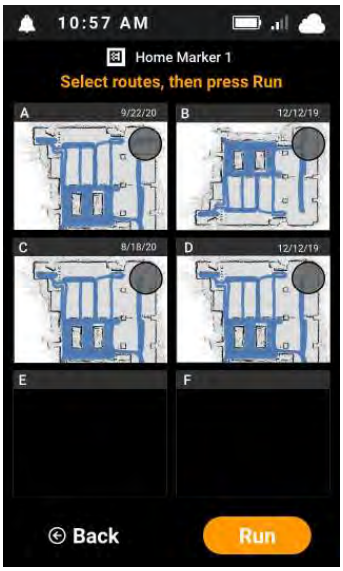


4. Drive to the desired home marker, positioning the machine so that the right-side camera scans the home marker (See POSITIONING THE MACHINE AT THE HOME MARKER). The machine automatically begins scanning, as displayed on the *UI touchscreen*.



5. A **Success!** is briefly displayed, followed by a list of all existing routes for the scanned home marker.

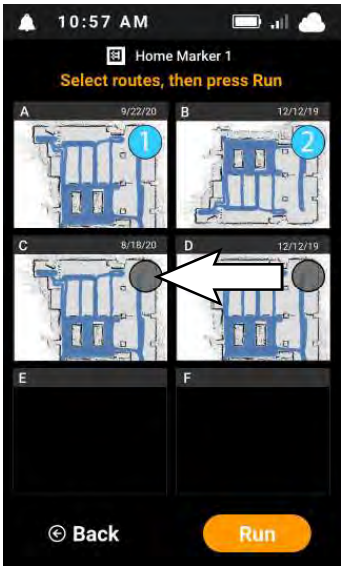




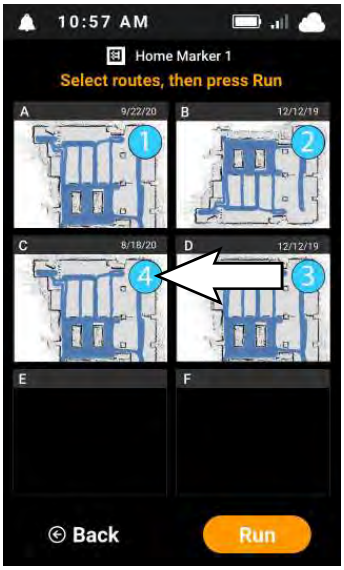
6. Select the cleaning route(s) to be run. The cleaning routes will operate continuously in the order they are selected as displayed in the corner of each selected route.



7. To remove or reorder cleaning routes, deselect a cleaning route by selecting it again. The cleaning route number will grey out and all of the other selected routes will renumber.



8. Select the cleaning route again and it will be added and renumbered as the last route to run.

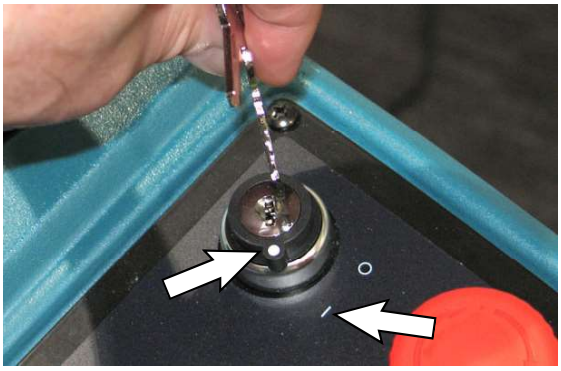


9. If necessary, adjust the scrub settings for the area(s) to be scrubbed. See SETTING SCRUB MODES.

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.

NOTE: The machine is designed to automatically activate the ec-H2O system each time the machine is turned on. *Push the ec-H2O button to disable the ec-H2O system for conventional scrubbing.*

10. Remove the key from the *ON/OFF key switch* without turning the key to the off position. This will not disrupt the robotic route and prevent the key from being stolen or lost.



11. The *UI touchscreen* displays TO START with instructions to **1. Secure the yellow safety strap. 2. Push the Start/Pause button.** 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.



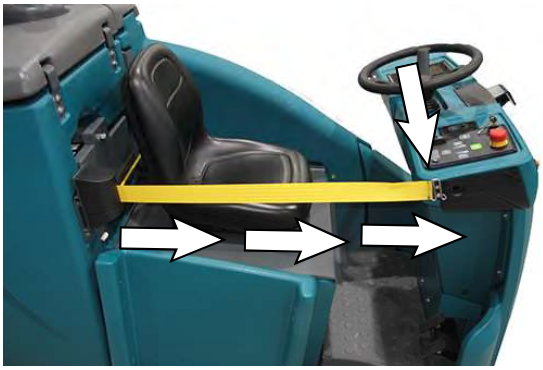
12. If it is necessary to have the machine run the same route(s) multiple times (route looping), select the *loop button*.

NOTE: Both single routes and multiple routes can be chosen to be run multiple times.



13. A screen stating **Repeat On Route(s) will repeat until cancelled.** appears on the screen.

14. Pull the yellow safety strap to the front screws on the machine.

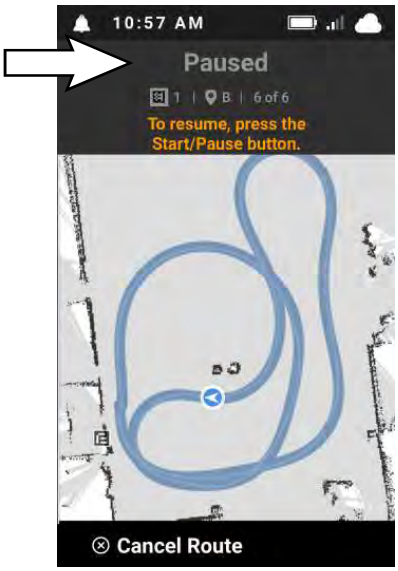


15. Press the flashing *blue start/pause button* to start the robotic route. The yellow warning light flashes and the horn sounds to signal that robotic cleaning is starting.



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

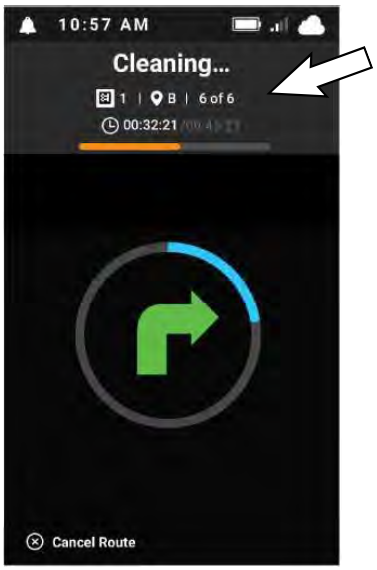
17. If any scrubbing functions need adjustment, press the *blue start/pause button* to pause the machine. The *UI touchscreen* states **Paused: To resume, press the Start/Pause button.**



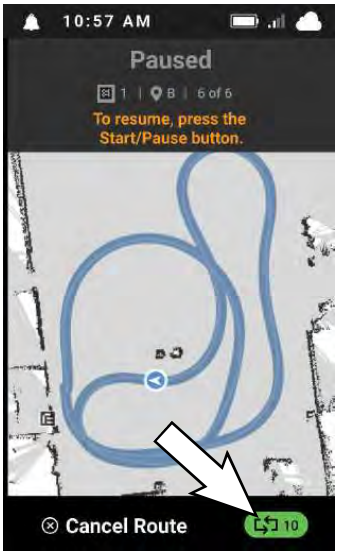
18. Make the necessary adjustments to the brush pressure, solution flow, and squeegees.

19. Press the *blue start/pause button* to resume the route in robotic mode. Observe scrubbing performance to ensure that all components are functioning properly.

20. As the machine runs the route in robotic mode, the UI touchscreen locks and states **Cleaning...**, as well as displaying the direction the machine is traveling, amount of time spent on the route, and the total amount of time the route should take in robotic mode.

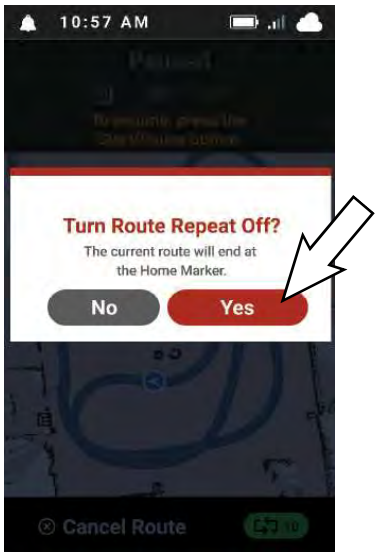


21. If route repeat was selected, the machine will track the number of routes the machine has repeated. To view, press the *blue start/pause button* to pause the machine.



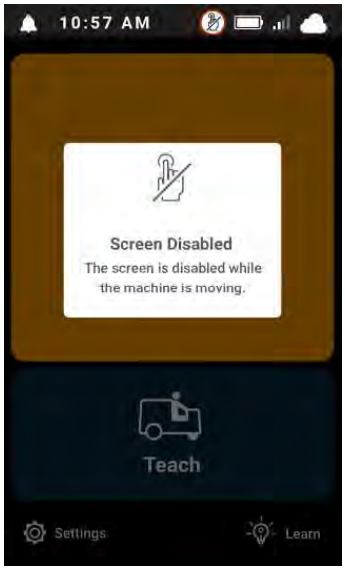
NOTE: Depending on the Access Control setting, a PIN number may be required to access the UI touchscreen.

22. When route repeating is complete, select the route repeat button again to cancel it. Select yes to verify the canceling of Route Repeat.



23. Press the *blue start/pause button* to resume the route in robotic mode. The machine will continue the current route and stop at the home marker.

24. The UI touchscreen becomes disabled during robotic mode. If touched the screen disabled message appears. To regain use of the UI screen, use the *start/Pause button* to pause the machine.



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 assist message.

25. If an assist message is triggered during the robotic route, the machine automatically pauses and the *UI touchscreen* displays the assist message 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 SYSTEM MESSAGES.

NOTE: If the machine repeatedly triggers an assist message 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 marker 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.

26. If the machine has to restart due to an assist message that stopped it, observe scrubbing performance to ensure that all components are functioning properly.

27. When the machine completes the robotic route, the *UI touchscreen* displays **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.



28. If multiple routes were run, use the arrows to navigate to each route complete notification.



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

30. 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.

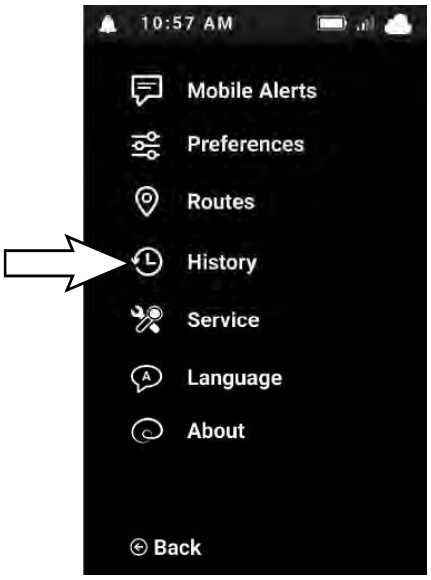
AUTONOMOUS ROUTE HISTORY

The Learning Center contains brief tutorial videos for Daily Maintenance and Periodic Maintenance tasks.

1. Upon successful PIN (Personal Identification Number) entry, the *UI touchscreen* displays the main menu. Touch SETTINGS to go to the SETTINGS menu.



2. Touch HISTORY.



3. A WEEKLY HISTORY screen will appear. Touch the desired route to check the cleaning history.



The home marker number, route, time the route was run, and how long it took the machine to run the route are displayed next to the home marker symbol. The date the route was run appears above the route information. Touch the BACK button to return to the SETTINGS menu.

4. Observe the CLEANING HISTORY screen. The orange portions of the route are the areas of the route that have been cleaned. The white portions are areas that have not been cleaned.



5. When finished checking the cleaning history, touch BACK to return to the SETTINGS menu. Touch BACK again to return to the main menu.

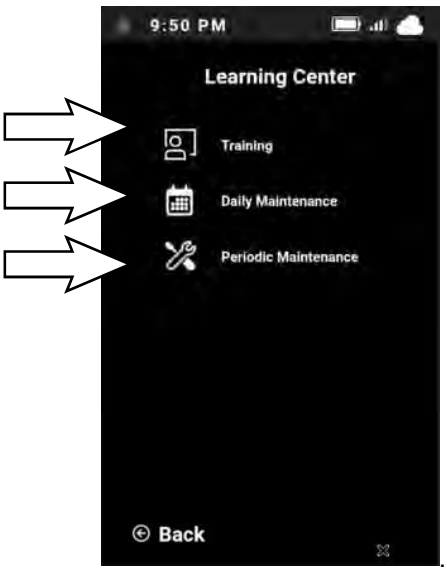
LEARNING CENTER

The Learning Center contains brief tutorial videos for Training, Daily Maintenance, and Periodic Maintenance tasks.

1. On the keypad screen or the main menu. Touch LEARN.



2. Select the desired video from the list of videos.



3. Touch BACK to return to the main menu or keypad screen.

ASSIST MESSAGES DURING ROBOTIC OPERATION

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



EXCESSIVE FAST STOP ASSISTS

A “Fast Stop” is an urgent autononmous stop that is triggered whent he navigation system beleives it cannot avoid other obsticales. Excessive “Fast stops” are typically caused by obstacles that actually don’t exist.

The excessive fast stop assist will provide instructions to the operator to help reduce fast stops.

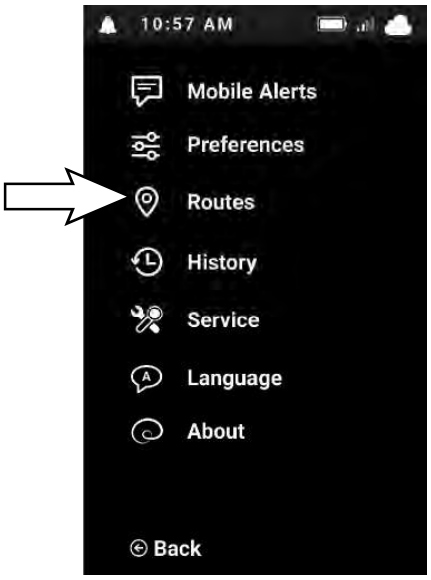


DELETING ROUTES

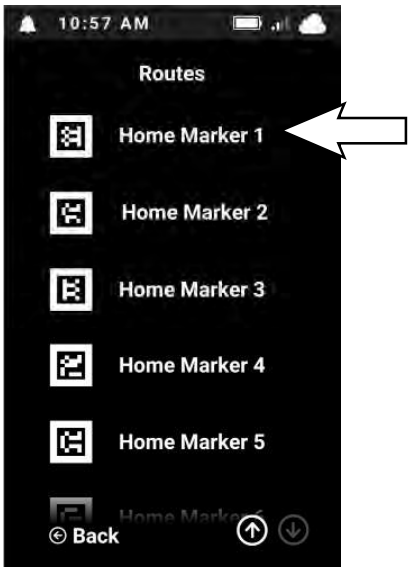
1. Turn the *ON/OFF key switch* on.
2. Touch SETTINGS on the *UI touchscreen* main menu.



3. Touch ROUTES.

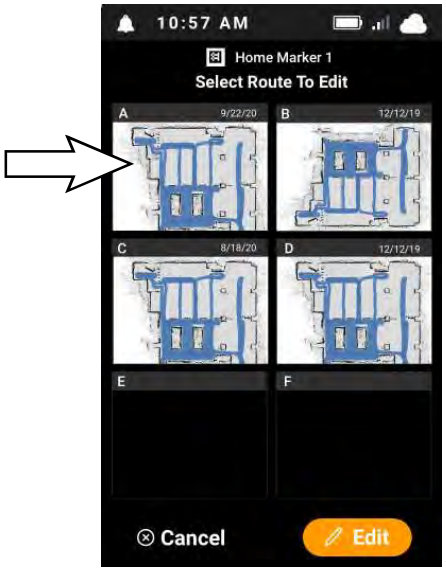


4. Select the desired home location to view the routes available to be edited at that location.



NOTE: If the machine is programmed for multiple home locations the home locations will be listed in chronological order starting from the lowest to the highest on the UI touchscreen.

5. All existing routes for the selected home location are displayed on the *UI touchscreen.* Touch the route to edit.

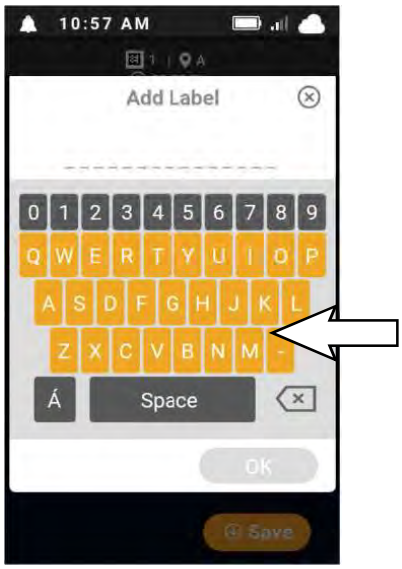


6. Touch ADD LABEL to enter or change a name of a saved route.



NOTE: Selecting SAVE without assigning a label to the route will display the default <NO LABEL>. name to the saved route.

7. Enter a name for the saved route.



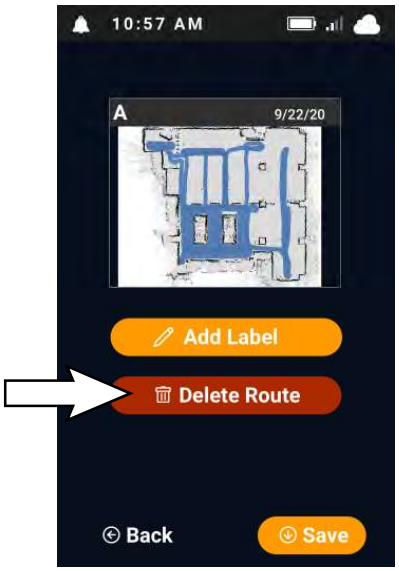
NOTE: Route labels can have a maximum of 15 characters.

8. Touch REMOVE LABEL to remove an assigned name to an existing route.



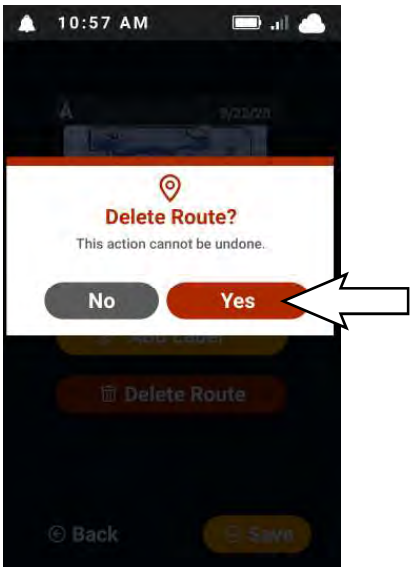
NOTE: When a saved route label is removed the default name <NO LABEL> is assigned to the route.

9. Touch DELETE ROUTE to permanently delete the selected route from the machine.



NOTE: Touch BACK to cancel the route deletion and return to the list of existing routes.

10. Touch YES to confirm the route deletion and permanently delete the selected route.



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 CANCEL to cancel the route deletion and return to the list of routes.

11. All existing routes for the home location are displayed. The deleted route no longer appears on the screen.

12. If finished deleting routes for the selected home marker, touch BACK to return to the SETTINGS menu. Touch BACK again to return to the main menu.

DRAINING AND CLEANING THE TANKS

Drain and clean the recovery tank daily. Clean the outside of the tank with vinyl cleaner.

1. Drive the machine to a solution disposal drain.

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

2. Unhook the recovery tank drain hose from the recovery tank.



3. Hold the drain hose near the floor drain, twist the drain nozzle open, and place the hose near the floor drain.

NOTE: Be sure the drain nozzle is pointed in a safe direction before opening the nozzle.

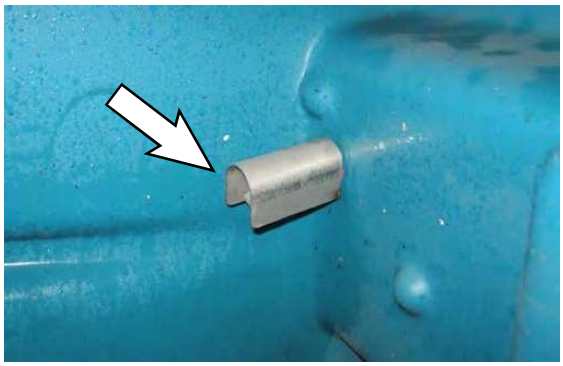


4. If necessary, twist the drain nozzle to another position to adjust the flow rate.



5. Lift the recovery tank cover and flush out the recovery tank with clean water. Rinse the sensor near the top of the tank.





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

6. To prevent leaks, clean the plug portion of the nozzle and the interior of the drain hose cuff.



7. Twist the drain cuff closed and insert the drain hose back into the clip on the recovery tank.



8. Check the vacuum fan inlet filter daily. Clean inlet filter with a damp cloth or hose when dirty. allow filter to completely dry before reinstalling it into the machine.



9. Close the recovery tank cover.

Inspect the solution tank interior for cleaning detergent build up and hard water build up. Proceed to the following step to clean the solution tank if there is evidence of either.

10. Unhook the solution tank drain hose from the solution tank.



11. Hold the drain hose near the floor drain, twist the drain nozzle open, and place the hose near the floor drain.

NOTE: Be sure the drain nozzle is pointed in a safe direction before opening the nozzle.



12. If necessary, twist the drain nozzle to another position to adjust the flow rate.



13. Lift the solution tank cover and flush out the solution tank with clean water.

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

14. To prevent leaks, clean the plug portion of the nozzle and the interior of the drain hose cuff.

15. Twist the drain cuff closed and insert the drain hose back into the clip on the recovery tank.

16. Remove the pin from the right side rear perimeter guard. Lift the guard.



17. Unlatch and open the side squeegee



18. Remove and clean the debris trough. Place the trough back into the scrub head when clean.



19. Close and latch the side squeegee and secure the rear perimeter guard with the pin.

NOTE: The scrub head must be lowered approximately 25 mm (1 in) to remove debris trough.

NOTE: The debris trough can be removed from the right side of the machine only.

SYSTEM MESSAGES

ALERTS - MANUAL MODE

The operator will receive an alert when there is a mechanical/electronic issue with the machine while operating in manual mode. Critical alerts require the operator to stop the machine. Routine alerts will allow the operator to continue operating the machine.



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.

If the machine has to restart due to an alert that stopped it, observe scrubbing performance to ensure that all components are functioning properly.

Alert(s)	Cause(s)	Symbol	Additional Indicator(s)	Remedy (Displayed on *UI touchscreen)*
200 RECOVERY TANK FULL *	Recovery tank is full.	⚠	Solution flow indicator lights and Vacuum fan/ squeegee button LED flash.	1. Drain the recovery tank.
201 WATER TANK EMPTY *	Water tank is empty.	⚠	Solution flow indicator lights and Vacuum fan/ squeegee button LED flash.	1. Inspect and fill the water tank.

Alert(s)	Cause(s)	Symbol	Additional Indicator(s)	Remedy (Displayed on *UI touchscreen)*
203 TRACTION MOTOR ERROR	Propelling issues.		Directional switch LEDs flash.	1. Power off robot 2. Disconnect the battery for 16 seconds. 3. Reconnect the battery cable and turn on the machine. 4. If the issue continues, contact Customer Service.
204 BRUSH ERROR	Damaged brushes. Debris caught in brushes.		Brush pressure indicator lights and 1-Step button LED flash.	1. Inspect brushes/pads for damage or debris. 2.Adjust or replace as needed. 3. If the issue continues, contact Customer Service.
205 VACUUM ERROR	Obstruction caught inside vacuum hose. Damaged vacuum hose.		Vacuum fan/ squeegee button LED flash.	1. Inspect vacuum and hose for damage or debris. 2. If the hose is broken, contact Customer Service.
206 SQUEEGEE ERROR	Obstruction caught in squeegee. Damaged or missing squeegee.		Vacuum fan/ squeegee button LED flash.	1. Inspect squeegee for damage or debris. 2. Adjust or replace as needed. 3. If the issue continues, contact Customer Service..
207 SCRUB DECK ERROR	Obstruction preventing scrub deck from raising/ lowering.		Brush pressure indicator lights and 1-Step button LED flash.	1. Turn off the machine. 2. Inspect the scrub deck for damage. 3. Turn on the machine. 4. If the issue continues, contact Customer Service.
208 NO BRUSH ERROR	No brushes installed. Brushes not properly installed.		Brush pressure indicator lights and 1-Step button LED flash.	1. Make sure brushes or pads are properly installed. 2.If the issue continues, contact Customer Service.
210 PROCESSOR ERROR			N/A	1. Restart the machine. 2. If the issue continues, contact Customer Service.
216 E-STOP ENGAGED	*Emergency Stop button* engaged.**		All LEDs control panel will flash.	1. Inspect the machine and surrounding area. 2. If clear, disengage *Emergency Stop button*.
217 SENSOR CHECK IN PROGRESS	Sensors identified a potential hazard.		N/A	1. Drive the machine 10-15 feet along the route. 2. If the path is clear, press the Start/ Pause button 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.*

***See EMERGENCY STOP BUTTON for Emergency Stop related screens/alerts.*

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

ASSISTS - ROBOTIC MODE

The operator will receive an assist message and the machine will pause when there is a mechanical/electronic issue with the machine while operating in robotic mode. All scrub functions are disabled when an assist message is triggered. The machine can be manually driven with an assist message, but all scrubbing functions are disabled. When a phone is paired to the ROC to receive notifications, a text message of the alert along with the machine location is sent to the paired phone.

Follow the on screen instructions to clear an assist message.



Refer to the assist message table below to determine the cause and remedy for the message.

If the machine has to restart due to an assist message that stopped it, observe scrubbing performance to ensure that all components are functioning properly.

Assists	Cause(s)	Symbol	Additional Indicator(s)	Remedy
100 - 102, STEERING ERROR	Steering electronic/ mechanical issue.		N/A	1. Turn off the machine. 2. Wait 15 seconds. 3. Turn on the machine. 4. If issue persists, contact Customer Service.
103 - 104, 258 PATH IS BLOCKED	Obstacle(s) on cleaning route.		N/A	1. Make sure the robot's path is clear or drive past any obstacles. 2. Press BLUE Start/Pause button to start.
105 - 106, 255 ROBOT IS OFF PATH	Machine is off designated scrubbing path.		N/A	1. Follow the blue arrow and drive to the red path. 2. When correct, the path will turn white. 3. Press rear BLUE Start/Pause button to start.

Assists	Cause(s)	Symbol	Additional Indicator(s)	Remedy
200 RECOVERY TANK FULL *	Recovery tank is full.		Solution flow indicator lights and Vacuum fan/ squeegee button LED flash.	1. Drain recovery tank. 2. Return to cleaning path. 3. Press rear BLUE Start/Pause button to start.
201 WATER TANK EMPTY *	Water tank is empty.		Solution flow indicator lights and Vacuum fan/ squeegee button LED flash.	1. Fill water tank. 2. Return to cleaning path. 3. Press rear BLUE Start/Pause button to start.
203 TRACTION MOTOR ERROR	Propelling issues.		Directional switch LEDs flash.	1. Power off robot 2. Disconnect then reconnect the battery. 3. Power the robot back on. 4. If issue persists, contact Customer Service.
204 BRUSH ERROR	Damaged brushes. Debris caught in brushes.		Brush pressure indicator lights and 1-Step button LED flash.	1. Inspect brushes/pads for damage or debris. Adjust or replace as needed. 2. If there are no issues, press the BLUE Start/Pause button in the back to resume. 3. If issue persists, contact Customer Service.
205 VACUUM ERROR	Obstruction caught inside vacuum hose. Damaged vacuum hose.		Vacuum fan/ squeegee button LED flash.	1. Inspect vacuum and hose for damage or debris. 2. If the hose is clear, press the BLUE Start/Pause button to resume. If the hose is broken, contact Customer Service.
206 SQUEEGEE ERROR	Obstruction caught in squeegee. Damaged or missing squeegee.		Vacuum fan/ squeegee button LED flash.	1. Inspect squeegee for damage or debris. Adjust or replace as needed. 2. If there are no issues, press the BLUE Start/Pause button in the back to resume. 3. If issue persists, contact Customer Service.
207 SCRUB DECK ERROR	Obstruction preventing scrub deck from raising/ lowering.		Brush pressure indicator lights and 1-Step button LED flash.	1. Turn off and inspect machine. 2. If there are no issues, press the BLUE Start/Pause button in the back to resume. 3. If issue continues, contact Customer Service.
208 NO BRUSH ERROR	No brushes installed. Brushes not properly installed.		Brush pressure indicator lights and 1-Step button LED flash.	1. Make sure brushes or pads are properly installed. 2. If there are no issues, press the BLUE Start/Pause button in the back to resume. 3. If issue continues, contact Customer Service.
209 SEAT SENSOR TRIGGERED	Person or object on operator seat while machine is in robotic mode.		N/A	1. Check that the seat is clear. 2. Press rear BLUE Start/Pause button to start.

Assists	Cause(s)	Symbol	Additional Indicator(s)	Remedy
211 THROTTLE ERROR	Throttle electronic/ mechanical issue.		N/A	1. Inspect the throttle. 2. If no issue are found, press the Start/Pause button to resume. 3. If issue continues, contact Customer Service.
212 BRAKE ERROR	Brake pedal electronic/ mechanical issue.		N/A	1. Inspect the brake pedal. 2. If no issue are found, press the Start/Pause button to resume. 3. If issue continues, contact Customer Service.
215 SENSOR CHECK IN PROGRESS	Sensors are scanning the area.		N/A	1. Drive the machine 10-15 feet along the path.. 2. To resume, press the BLUE Start/ Pause button.
216 PATH IS BLOCKED	Obstacle(s) on cleaning route.		N/A	1. Make sure the robot's path is clear or drive past any obstacles. 2. Press rear BLUE Start/Pause button to start.
217 POTENTIAL HAZARD DETECTED	Sensors identified a potential hazard.		N/A	1. Inspect the machine. 2. Make sure the path of the machine is clear or drive past any obstacles. 3. If the path is clear, press the BLUE Start/Pause button to resume.
218 STEERING ERROR	Steering electronic/ mechanical issue.		N/A	1. Turn off the machine. 2. Wait 15 seconds. 3. Turn on the machine. 4. If issue persists, contact Customer Service.
219 PATH IS BLOCKED	Obstacle(s) on cleaning route.		N/A	1. Make sure path is clear. 2. Drive past any obstacles. 3. To resume, press the BLUE Start/ Pause button.
222 PEDAL PRESSED	Pedal has been pressed while in robotic mode.		N/A	1. Make sure the pedal is clear. 2. Press the rear BLUE Start/Pause button.
223, 224, 225, 257 SENSOR ERROR	Dirty, smudged, or damaged sensor(s).		N/A	1. Clean all the sensors with a clean microfiber cloth. 2. Inspect for damage and obstructions. 3. If no issues are found, press the BLUE Start/Pause button to resume.
226, 228 LEFT SENSOR NOT RESPONDING	Dirty, smudged, or damaged sensor(s).		N/A	1. Clean the left sensors with a clean microfiber cloth. 2. Inspect for damage and obstructions. 3. If no issues are found, press the BLUE Start/Pause button to resume.
227, 229 RIGHT SENSOR NOT RESPONDING	Dirty, smudged, or damaged sensor(s).		N/A	1. Clean the right sensors with a clean microfiber cloth. 2. Inspect for damage and obstructions. 3. If no issues are found, press the BLUE Start/Pause button to resume.

Assists	Cause(s)	Symbol	Additional Indicator(s)	Remedy
230, 250, 9010 LEFT SIDE OBSTACLE DETECTED	Obstacle(s) on cleaning route.		N/A	1. Inspect the machine and surrounding area. 2. Drive past any obstacles. 3. If clear, press the Start/Pause button to resume.
231, 251, 9011 RIGHT SIDE OBSTACLE DETECTED	Obstacle(s) on cleaning route.		N/A	1. Inspect the machine and surrounding area. 2. Drive past any obstacles. 3. If clear, press the Start/Pause button to resume.
232 POTENTIAL HAZARD DETECTED	Potential hazard has been detected.		N/A	1. Inspect the machine. 2. Make sure the path of the machine is clear or drive past any obstacles. 3. If the path is clear, press the Start/Pause button to resume.
233 CLIFF DETECTED	Sudden dropoff detected.		N/A	1. Make sure the machine is not operating near stairs or escalators. 2. To resume, press the Start/Pause button.
234-237 MACHINE ERROR	Error detected on the machine.		N/A	1. Turn off and inspect machine. 2. If no issues are found, press the Start/Pause button to resume. 3. If issue continues, contact Customer Service.
239 LOWER LIDAR SENSOR EXCESSIVE FAST STOPS	Dirty, smudged, or damaged sensor(s).			1. Clean all the sensors with a clean microfiber cloth. 2. Inspect for damage and obstructions. 3. If no issues are found, press the BLUE Start/Pause button to resume
242 LEFT 3D CAMERA EXCESSIVE FAST STOPS	Dirty, smudged, or damaged camera			1. Clean all the camera with a clean microfiber cloth. 2. Inspect for damage and obstructions. 3. If no issues are found, press the BLUE Start/Pause button to resume
243 RIGHT 3D CAMERA EXCESSIVE FAST STOPS	Dirty, smudged, or damaged camera			1. Clean all the camera with a clean microfiber cloth. 2. Inspect for damage and obstructions. 3. If no issues are found, press the BLUE Start/Pause button to resume
300, 301 ROBOT IS OFF PATH	Machine is off designated scrubbing path.		N/A	1. Follow the blue arrow and drive to the red path. 2. When correct, the path will turn white. 3. Press rear BLUE Start/Pause button to start.
302 - 309 PATH IS BLOCKED	Obstacle(s) on cleaning route.		N/A	1. Make sure the robot's path is clear or drive past any obstacles. 2. Press rear BLUE Start/Pause button to start.
500 EMERGENCY STOP ENGAGED	Emergency stop button pressed.		N/A	1. Inspect the machine and surrounding area. 2. If clear, release the emergency stop.

Assists	Cause(s)	Symbol	Additional Indicator(s)	Remedy
508 PATH IS BLOCKED	Obstacle(s) on cleaning route.		N/A	1. Make sure the robot's path is clear or drive past any obstacles. 2. Press rear BLUE Start/Pause button to start.
510 - 514 PATH FOLLOWING ERROR	Machine is off the designated path.		N/A	1. Restart the machine. 2. If issue persists, contact Customer Service.
900 Scanner LIDAR TRIGGERED	Dirty, smudged, or damaged sensor(s).			1. Inspect tower and clean the lidar with a clean microfiber cloth. 2. Reboot the machine. 3. If issue persists, contact Customer Service.
6000, 8100 LOWER SENSOR DIRTY	Dirty, smudged, or damaged sensor(s)		N/A	1. Inspect and clean the lower sensor with a clean microfiber cloth. 2. Reboot the machine. 3. If issue persists, contact Customer Service.
6001, 8200 UPPER SENSOR DIRTY	Dirty, smudged, or damaged sensor(s)		N/A	1. Inspect and clean the upper sensor with a clean microfiber cloth. 2. Reboot the machine. 3. If issue persists, contact Customer Service.
6003 FRONT CAMERA DIRTY	Dirty, smudged, or damaged sensor(s)		N/A	1. Inspect and clean the front camera with a clean microfiber cloth. 2. Reboot the machine. 3. If issue persists, contact Customer Service.
6004, 6005, 8300 - 8500 SENSOR ERROR	Dirty, smudged, or damaged sensor(s)		N/A	1. Clean all the sensors with a clean microfiber cloth. 2. Inspect for damage and obstructions. 3. If no issues are found, press the Start/Pause button to resume.
9001 IMPACT DETECTED	Machine impact detected.		N/A	1. Inspect the machine. 2. Drive past any obstacles. 3./ If clear, press the Start/Pause button to resume.
10000 ROUTE LOST	Robot lost the cleaning path.			1. Drive the machine to the Home Marker. 2. Restart the route.
10001 ROBOT IS OFF PATH	Machine is off designated scrubbing path.		N/A	1. Follow the blue arrow and drive to the red path. 2. When correct, the path will turn white. 3. Press rear BLUE Start/Pause button to start.

Assists	Cause(s)	Symbol	Additional Indicator(s)	Remedy
40004 GYRO ERROR	Gyro mismatch			1. Turn off and inspect the machine. 2. Turn on the machine. 3. If issue persists, contact Customer Service.
40006 STEERING ERROR	Steering electronic/ mechanical issue.		N/A	1. Turn off the machine. 2. Wait 15 seconds. 3. Turn on the machine. 4. If issue persists, contact Customer Service.
40008 TRACTION ENCODER ERROR				1. Inspect the machine. 2. If no issue are found, press the Start/Pause button to resume. 3. If issue continues, contact Customer Service
40009, 90003 VEHICLE CONTROLLER INTERRUPTION				1. Inspect the machine for damage or obstructions. 2. If no issue are found, press the Start/Pause button to resume. 3. If issue continues, restart machine.
50001 POTENTIAL HAZARD DETECTED	Potential hazard has been detected.		N/A	1. Inspect area for ramps, escalators, or potential drops. 2. Drive the machinefurther along the path. 3. To resume, press the Start/Pause button.
60461 CALIBRATION ERROR DETECTED	Machine calibration error detected..		N/A	1. Turn off machine. 2.Contact Customer Service to recalibrate machine.

** 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.*

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

SYSTEM ERRORS (ROBOTIC MODE / MANUAL MODE)

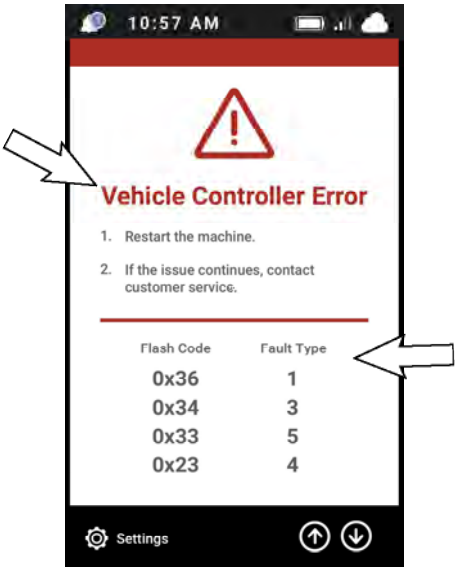
If a System Error code should appear, turn off the machine, wait 15 seconds, and then turn the machine back on. If the system error persists contact Customer Service immediately.



LIDAR SENSOR / CAMERA ERRORS

The operator will receive an error message when there is an issue with the LIDAR sensors or cameras. All robotic scrub functions are disabled when there is a LIDAR or camera related alert.

A Startup Errors screen will appear when there is a LIDAR sensor or camera error that will affect the machine robotic performance. The startup error(s) and associated error code number(s) will be included on the screen along with instructions on how to clear the alert. The machine cannot be operated in the robotic mode until all startup errors are corrected.



Touch the SETTINGS button to proceed to the settings menu.

The settings menu will appear with a STARTUP ERROR! warning in the upper left corner of the screen.

Inspect the LIDAR sensors and cameras for dirt, debris smudges, and damage that could be causing the bootup errors. Clean all dirt, debris smudges from the camera(s)/LIDAR sensor(s). See *CAMERAS AND SENSORS* in the *MAINTENANCE* section. Restart the machine. Contact Customer Service if the problem(s) persist(s).

Refer to the error table below to determine the cause and remedy for the message.

Error Code	Error	Remedy
0, 1, 4, 401, 411, 700, 800	Unknown Error	1. Turn off the machine 2. Wait 15 seconds. 3. Turn on the machine. 4. Contact Customer Service immediately if machine remains inoperable after several restart attempts.
202	Battery low	1. Drive to charging station. 2. Inspect and charge batteries.
501, 504, 20003, 20009	Gyro stuck	1. Turn off the machine 2. Disconnect the battery cable. 3. Wait 15 seconds, and then reconnect the battery cable. 4. Turn on the machine. 5. Contact Customer Service immediately if machine remains inoperable after several restart attempts.
502, 503	Home Marker Scan Error	1. Return to home marker. 2. Scan the home marker again. 3. Do not move the machine until the scan is complete.
509	Flash Firmware Error	1. Reboot the machine. 2. Contact Customer Service immediately if machine remains inoperable after several restart attempts.
20005	Sensor Eror	1. Carefully clean the lower sensor with a clean microfiber cloth and inspect for damage.* 2. Contact Customer Service immediately if machine remains inoperable after several restart attempts.
40007	Steering Calibration Adjustment Needed	1. Drive the machine to the charging station. 2. Turn off machine. 3. Contact Customer Service, include the error code number. This machine will need to be recalibrated.
5001	Uncalibrated	1. Restart machine. 2. Contact Customer Service immediately if machine remains inoperable after several restart attempts.
5004, 5014 5024, 5025 5026	Left 3D Camera Not Responding	1. Carefully clean left 3D camera with a clean microfiber cloth and inspect for damage.* 2. Restart machine. 3. Contact Customer Service immediately if machine remains inoperable after several restart attempts.
5005, 5015 5027, 5028 5029	Right 3D Camera Not Responding	1. Carefully clean right 3D camera with a clean microfiber cloth and inspect for damage.* 2. Restart machine. 3. Contact Customer Service immediately if machine remains inoperable after several restart attempts.
5002, 5003 5006, 5013, 5016, 5030 5031, 5032	Slanted (Upper) LIDAR Not Responding	1. Carefully clean upper LIDAR with a clean microfiber cloth and inspect for damage or obstructions.* 2. Restart machine. 3. Contact Customer Service immediately if machine remains inoperable after several restart attempts. ***
5007, 5017 5033, 5034 5035	Planar (Lower) LIDAR Not Responding	1. Carefully clean lower LIDAR with a clean microfiber cloth and inspect for damage or obstructions.* 2. Restart machine. 3. Contact Customer Service immediately if machine remains inoperable after several restart attempts. ***
5021, 5022 5023	Front 3D Camera Not Responding	1. Carefully clean front 3D camera with a clean microfiber cloth and inspect for damage.* 2. Note whether LEDs on camera are flashing.** 3. Restart machine. 4. Contact Customer Service immediately if machine remains inoperable after several restart attempts.

Error Code	Error	Remedy
5008	Machine not responding.	1. Restart machine.
5010	Odometer Not Responding.	1. Restart machine.
5011	Transformer Not Responding.	1. Restart machine.
5019	Sensors Not Responding.	1. Restart machine.
5036	Sensor Update Error.	1. Restart machine.
20000, 20001, 20006, 20008	Route Error	1. Retrain the route, starting and ending at the same Home Marker.
20002	Route Error	1. Retrain the route to be at least two minutes long.
20004	Route Error	1. Retrain route. 2. Do not drive backwards while training route.
20005	Sensor Error	1. Clean upper sensor with a clean microfiber cloth and inspect for damage.* 2. If no issues found, press the rear Blue button.
20007, 70003	Route Error	1. Route failed to save. 2. Retrain route.
29999	Route failed to save	1. Retrain the route, starting and ending at the same Home Marker.
30000	Communication error	1. Reboot Machine. 2. If issue continues, contact Customer Service.
30001	Error	1. Failed to load route data, try again.
40002	Steering Error	1. Turn off and inspect machine. 2. Reboot Machine. 3. If issue continues, contact Customer Service.
40003	USB Connection Error	1. Turn off and inspect machine. 2. Reboot Machine. 3. If issue continues, contact Customer Service.
40004	Gyro Error	1. Turn off and inspect machine. 2. Reboot Machine. 3. If issue continues, contact Customer Service.
40005	Sensor Error	1. Make sure the machine has room to move. 2. If necessary, drive the machine past any obstacles. 3. If clear, press the rear Blue button.
40006	Steering Error	1. Turn off machine. 2. Reboot Machine.

Error Code	Error	Remedy
40007	Steering Error	1. Turn off machine. 2. Reboot Machine. 3. If issue continues, contact Customer Service.
40008	Traction encoder error	1. Reboot Machine. 2. If issue continues, contact Customer Service
40010	Vehicle controller error	1. Reboot Machine. 2. If issue continues, contact Customer Service
50001	Potential Hazard Detected	1. Inspect the area for ramps, escalators, or potential drops. 2. Drive machine further along path. 3. To resume, press the rear Blue button.
60000 - 60452	Firmware E-Stop Error	1. Reboot Machine. 2. If issue continues, contact Customer Service
60500 - 60503	Lithium Battery System Fault	1. Reboot Machine. 2. If issue continues, contact Customer Service
70002	Route load error	1. Route data failed to load. 2. Try reloading route data.

** NOTE: See CAMERAS AND SENSORS in the MAINTENANCE section for information concerning the cleaning and care for the cameras/LIDARs.*

*** NOTE: LED lights not flashing signify potential maintenance issues with the 3D camera.*

**** NOTE: It may be necessary to provide a close up photograph/video of the LIDAR to send to Customer Service to determine the extent of possible damage or issues causing the LIDAR to be inoperable.*

MACHINE TROUBLESHOOTING

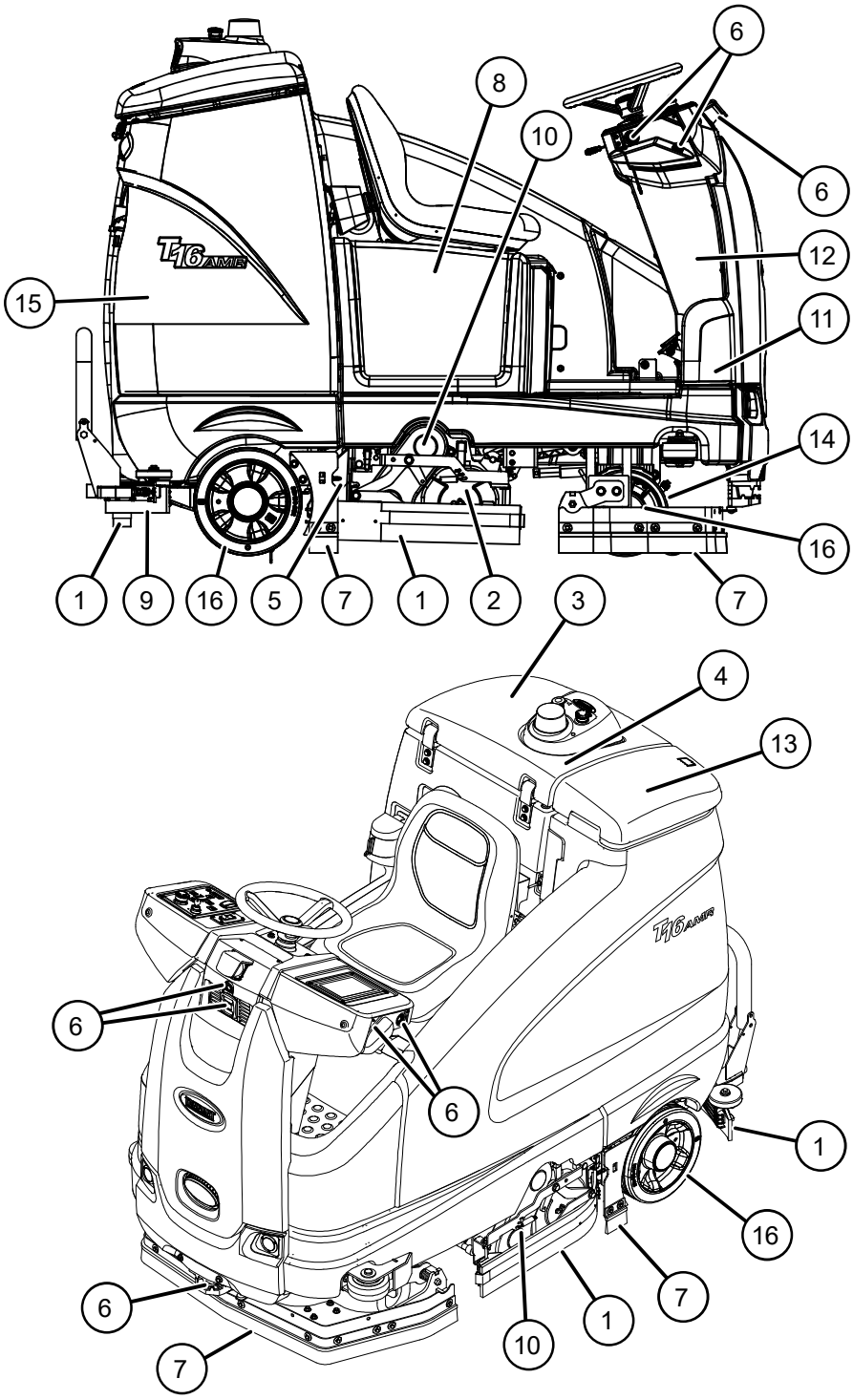
Problem	Cause	Remedy
Trailing water-poor or no water pickup	Vacuum fan turned off	Turn vacuum fan on
	Squeegee in raised double scrub position	Lower squeegee from raised double scrub position
	Worn squeegee blades	Rotate or replace squeegee blades
	Squeegee out of adjustment	Adjust squeegee
	Vacuum hose 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	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	Main brushes	Check for damage, wear, debris	-	2
	O	3	Recovery tank	Clean tank		1
	O	13	Solution tank	Drain and rinse as necessary	-	1
	O	4	Vacuum fan inlet filter	Clean		1
	O	5	Debris tray	Clean		1
	O	6	Front/side 2D and 3D sensors and upper/ lower LIDAR sensors	Check for damage. Clean with provided microfiber cloth.	-	8
	O	7	Perimeter guards (left, right, and front)	Check for debris, damage, and wear	-	3
Weekly	T	8	Battery cells (Lead-acid)	Check electrolyte level (Lead Acid)	DW	3
50 Hours	O	9	Squeegee caster wheel pivot points	lubricate	SPL	4
	O	2	Main brushes	Rotate brushes from front to rear	-	2
100 Hours	T	4	Vacuum fan and recovery tank seals	Check for damage and wear	-	3
	O	13	Solution tank seals	Check for damage and wear		2
	O	8	Battery watering system (option)	Check hoses for damage and wear	-	All
200 Hours	T	8	Battery terminals and cables	Check and clean	-	12
	T	10	Brush drive belts	Check for damage and wear	-	2
	T	11	Steering gear chain	Lubricate, check tension, and check for damage and wear.	GL	1

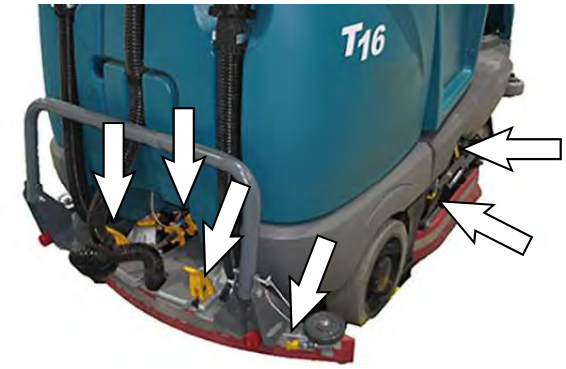
Interval	Person Resp.	Key	Description	Procedure	Lubricant/ Fluid	No. of Service Points
500 Hours	T	15	Vacuum fan motor(s)	Check motor brushes **(Check every 100 hours after initial 500 hour check)**	-	1
	T	16	Tires	Check for damage and wear	-	3
	T	10	Scrub brush motors	Check motor brushes **(Check every 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

LUBRICANT/FLUID

DW Distilled water
SPL special lubricant, Lubriplate EMB grease (Tennant part number 01433-1)
GL SAE 90 weight gear lubricant

YELLOW TOUCH POINTS

This machine features easy to find yellow touch points for simple service items. No tool are required to perform these maintenance items.

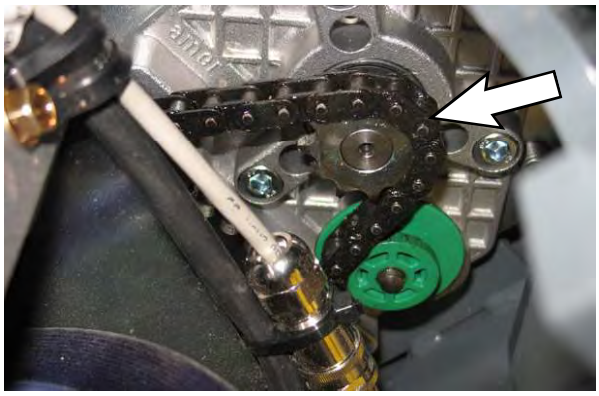


LUBRICATION

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.



REAR SQUEEGEE CASTERS

Lubricate the rear squeegee caster pivot point on each squeegee caster after every 50 hours.



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;

FLOODED (WET) LEAD-ACID 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 27C (80F) or less.

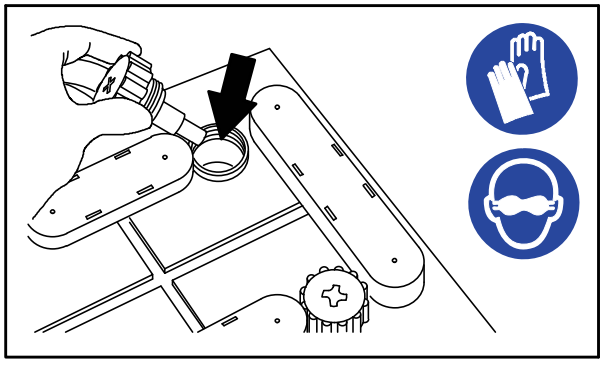
– Allow the charger to complete charging the batteries before re-using the machine.

– 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.

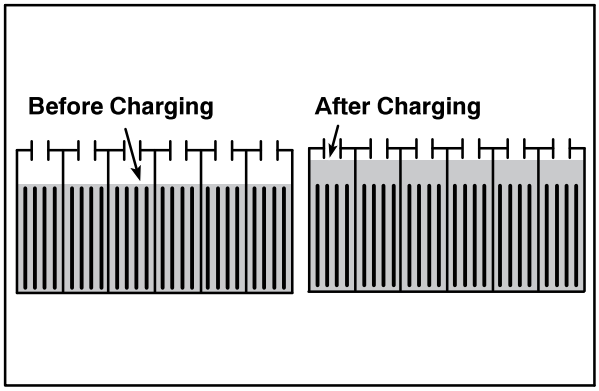
*NOTE: **Do Not** check the electrolyte level if the machine is equipped with a battery watering system.*



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.



LITHIUM-ION BATTERY

The lithium−ion battery pack is a maintenance−free battery protected by a battery management system (BMS). To achieve the maximum battery life, carefully follow the instructions below:

– Lithium-Ion batteries must be charged prior to initial use.

– Carefully follow the Important Safety Instructions section in the manual when using the Lithium−ion Battery Model.

– Only use the lithium−ion battery charger supplied with machine.

– Charge battery pack in well−ventilated areas. For best charging performance, charge the battery pack in temperatures below 80°F/27°C and above 32°F/0°C. Battery pack may shut down and not take a charge in elevated or freezing temperatures.

– It is recommended to only recharge battery pack when discharge indicator level reaches the last bar. Do not store the machine for an extended period if battery is discharged to the last bar, the battery may further discharge to a level that is unrecoverable.

– When the machine shuts down due to a depleted battery pack, do not repeatedly cycle the key switch on and off. This may cause permanent battery pack damage. Recharge battery pack immediately to avoid damage.

– Allow charge cycle to completely charge battery pack.

– Opportunity charging (i.e. partial charge cycle of a half hour or more) is only recommended if discharge level is below 80%.

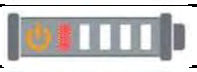
– Do not operate machine in temperatures above 104°F / 40°C or below −4°F / −20°C. Machine may shutdown if exceed these temperatures.

BATTERY POWER BUTTON / BATTERY DISCHARGE INDICATOR

Each Lithuim-Ion battery contains a power button to turn on/off the battery power supply. The battery discharge indicator (BDI) displays the current state of the battery.



To display the battery charge status or fault state (while the batteries are active), press and hold the power button of any battery for **one second**. When the batteries are fully charged, all five green indicators are lit. As the battery discharges, the indicator levels decreases. If the indicators flash red the battery is getting very low. If the indicators display solid red along with green, the battery has a fault. Contact Tennant Service to fix the fault.

LED Indicator Status	Battery State of Charge
	81-100%
	61-80%
	41-60%
	21-40%
	11-20%
	1-10%
	Fault - Contact Tennant Service

To turn off the battery power (while the batteries are active), press and hold the battery power button of any battery for **20 seconds**. The battery discharge indicators will turn off. Turning off one battery will shut down power to all connected batteries. Batteries should be shut down before any service is completed on the battery modules.

To turn on the battery power (when the batteries are shutdown), press and hold the power button on each battery for **5 seconds**. The battery discharge green indicators will illuminate when turned on.

–

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.

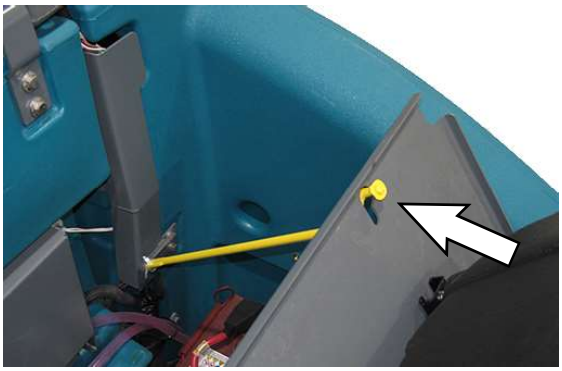
1. Drive the machine to a flat, dry surface in a well−ventilated area.

WARNING: Lead-acid batteries emit hydrogen gas. Explosion or fire can result. Keep sparks and open flame away. Keep covers open when charging.

2. Stop the machine and turn the machine power off.

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

3. Lift the operator seat open, engage the seat support bar.



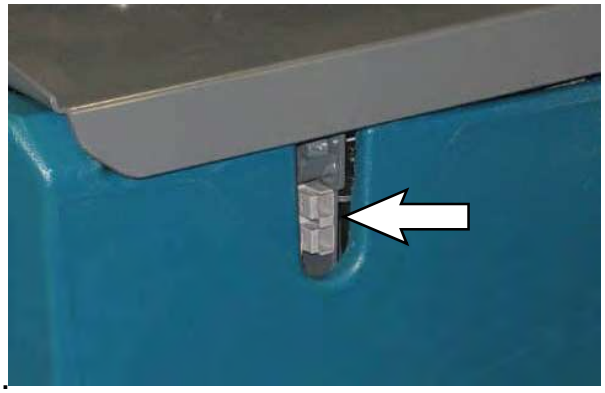
NOTE: Make sure the batteries have the proper electrolyte level before charging. See CHECKING THE ELECTROLYTE LEVEL.

4. Plug the charger AC power supply cord into a properly grounded outlet.

5. On machines equipped with Lithium-ion batteries: Open the remote battery charge connector door.

6. Plug the charger connector into the remote battery charge connector.

Flooded lead-acid battery charge connector:



NOTE: The machine will be disabled until the charge plug is removed from the battery charge connector (Lead acid battery)

Lithium-ion battery charge connector:



NOTE: The machine will be disabled until the charge plug is removed and the remote battery charge connector door is closed and latched (Lithium-ion battery).

FOR SAFETY: Do not disconnect battery connections while machine is charging. Machine electrical damage may occur.

NOTE: If the charger "FAULT CODE:" lights flash when the batteries are plugged into the charger, refer to the charger manufacturer manual for fault code definitions.

TO CHARGE LEAD-ACID BATTERIES



1. Once connected, the Tennant charger will start automatically. When the batteries are fully charged, the Tennant charger will automatically turn off.

2. After the charger has turned off, unplug the charger connector from the remote battery charge connector.

ATTENTION: Do not disconnect the charger DC cord from the machine receptacle when the charger is operating. Arcing may result. If the charger must be interrupted during the charging, disconnect the AC supply cord first.

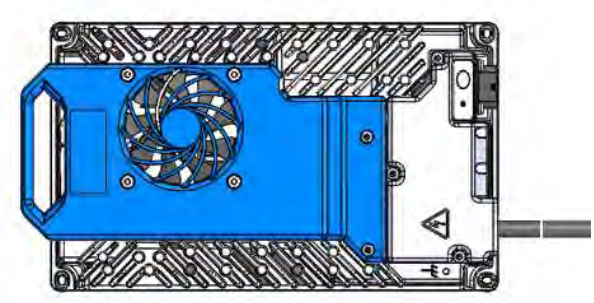
3. Close the operator seat.

The table below shows the status of the battery charger.



Pattern	Description	Comments
LED is OFF	No AC Power Connected	Charger not plugged into the wall
Slow Green Blinking	Charging but batteries are less than 80% State of Charge	Charger displays this LED pattern when first plugged into AC power then LED turns off
Fast GREEN Blinking	Charging but batteries are greater than 80% State of Charge	Normal operation. Allow charger to finish charging
Solid GREEN	Charge Complete	Machine ready for use
Blinking RED	Charger internal failure	Contact Service

TO CHARGE LITHIUM-ION BATTERIES WITH 33A (1200W) CHARGER

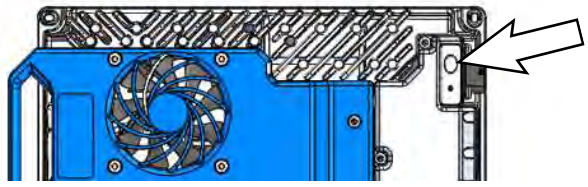


1. Once connected, the Tennant charger will start automatically. When the batteries are fully charged, the Tennant charger will automatically turn off.
2. After the charger has turned off, unplug the charger connector from the remote battery charge connector.

ATTENTION: Do not disconnect the charger DC cord from the machine receptacle when the charger is operating. Arcing may result. If the charger must be interrupted during the charging, disconnect the AC supply cord first.

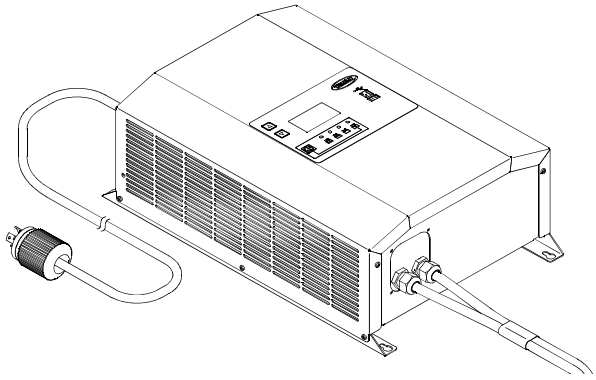
3. Close the operator seat.

The table below shows the status of the battery charger.

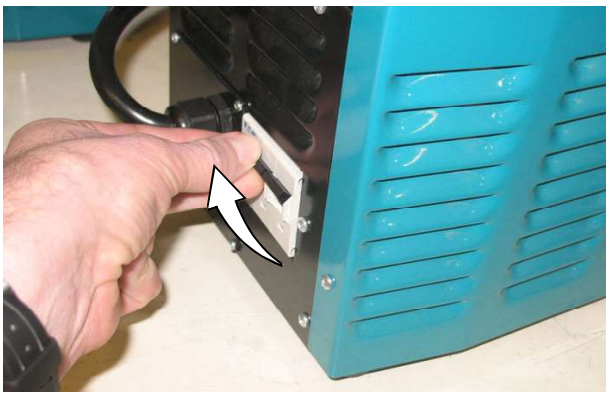


LED Pattern	Description	Comments
LED is OFF	No AC Power Connected	Charger not plugged into the wall
LED flashes RED followed by AMBER for few seconds and Turns OFF (and stays OFF)	AC Power Connected to the charger but No Batteries are connected	Charger not plugged into the wall
Slow Green Blinking (1 second ON; 0.2 second OFF)	Charging but batteries are less than 80% State of Charge	Charger displays this LED pattern when first plugged into AC power then LED turns off
Fast GREEN Blinking (0.4 second ON; 0.1 second OFF)	Charging but batteries are greater than 80% State of Charge	Normal operation. Allow charger to finish charging
Solid GREEN	Charge Complete	Machine ready for use
Rapid AMBER flashing (0.5 second ON; 0.5 second OFF)	Issue with Battery Detected	Contact Service
Solid RED	Charger internal failure	Contact Service

TO CHARGE LITHIUM-ION BATTERIES WITH 90A FAST CHARGER (220V)



1. Turn on the battery charger if required.



NOTE: If there are charger fault codes when the battery is plugged into the battery charger, the fault codes will appear at the bottom of the charger display. Refer to the battery charger manual for fault code definitions

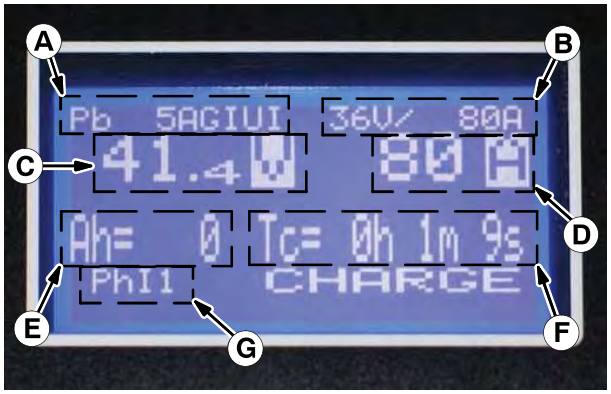


2. Observe the charger display. CHARGE appears on the display when the battery is charging. This is the charger default screen.



NOTE: (Lithium Case Battery Only) The Lithium-Ion Battery Pack's battery management system (BMS) is active for five minutes after the machine cable is disconnected. If the charger is not connected and charging within this five minutes, the BMS will shut off and the charger will not be able to charge. Reconnect the machine cable to the battery pack and remove it again to restart the BMS active period.

Charger Display:



A. Charge profile number

B. Charger rating (Volts and Current)

C. Battery voltage (Volts)

D. Charger current (Amperes)

E. Ampere hours charged

F. Time charged (hours / minutes / seconds)

G. Charging phase (Phase 1 / Phase 2 / Phase 3 / Maintenance)

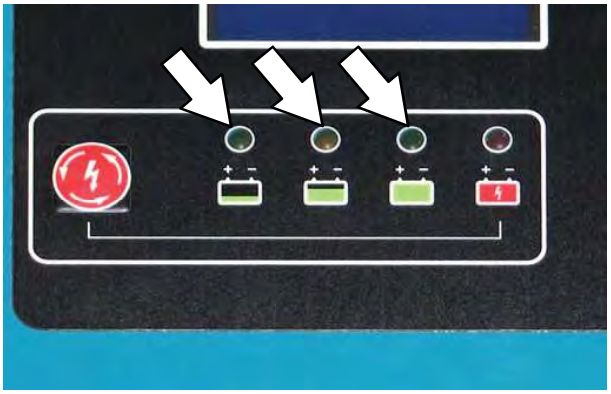
8. If necessary, press the navigation buttons to access additional screens. Press the charger stop / start / enter button to enter selection. The charger will return to the default screen. Refer to manufacturers operator manual for additional information.



NOTE: If the charger cable must be disconnected from the battery before they are fully charged, press the charger stop / start / enter button to stop charging. Be sure STOP appears on the display and the red stop charge light is illuminated before disconnecting the battery charger cable.



9. The charger status indicators will illuminate from left to the right as the battery is charging. COMPLETE will appear in the display, all the charger status indicators will be illuminated, and the Tennant charger will stop charging when the battery is completely charged.



10. After the charger has turned off, unplug the charger connector from the remote battery charge connector.

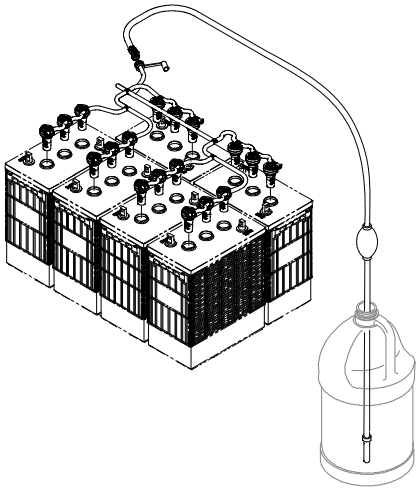
ATTENTION: Do not disconnect the charger DC cord from the machine receptacle when the charger is operating. Arcing may result. If the charger must be interrupted during the charging, disconnect the AC supply cord first.

11. Close the operator seat.

12.

MANUAL BATTERY WATERING SYSTEM

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



The manual battery watering system provides a safe and easy way to maintain the proper electrolyte levels in your batteries. It is designed exclusively for 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.

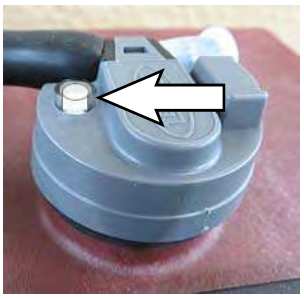
1. Fully charge batteries prior to using the battery watering system. Do not add water to batteries before charging, the electrolyte level will expand and may overflow when charging.
2. After charging batteries, check the battery electrolyte level indicators located on the battery covers.



3. If the level indicator has a low white float add water as described in the following instructions.

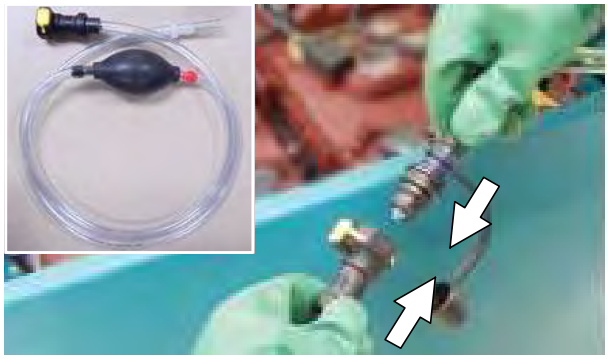


Low Float = Add Water



High Float = Full

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

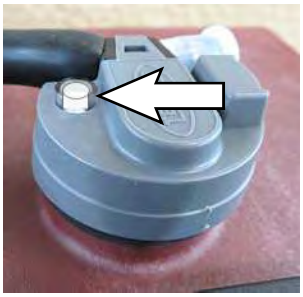


5. Submerge the other end of the hand pump hose into a bottle of distilled water



6. Squeeze the bulb on the hand pump hose until firm. The white float will rise when full.





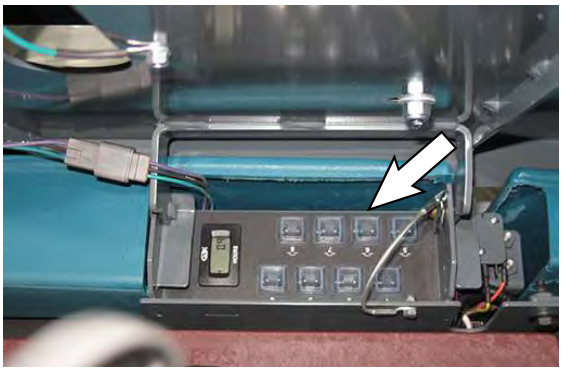
High Float = Full

7. 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	2.5 A	Vehicle Interface board
CB2	2.5 A	Hour meter
CB3	10 A	Brain control module
CB4	10 A	Motor amplifier module
CB5	2.5A	Horn
CB6	2.5A	Reverse alarm
CB7	2.5A	Head lights
CB8	10A	ec-H20

Circuit breaker 20 is located inside the light assembly mounted on top of the recovery tank.

FUSES

Fuses are one-time protection devices designed to stop the flow of current in the event of a circuit overload. Never substitute higher value fuses than specified.

Circuit Protected	Rating	Location
Traction	125A	Near controller
Main controller	150A	Near main contactor
Scrub motor	60A	Main harness
Vacuum	40A	Main harness
Deck Actuator	20A	Main harness
Squeegee fuse	20A	Main harness
Battery interface board (Lithium 4 pack)	2A	Battery harness

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

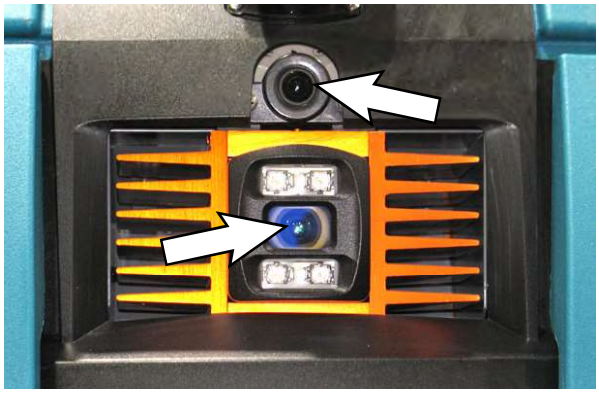
FRONT AND SIDE 2D AND 3D CAMERAS

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 water spots, dirt, dust, smudges, and damage daily (or before each robotic run). Debris, streaks, or smudges could deliver false environmental information to the machine.

Cleaning camera lenses should only be done with microfiber cleaning cloths designed for sensitive optical surfaces (one was included with the home location markers). In extreme cases, a lense cleaning solution formulated for optical polycarbonate lenses may be used. Do not spray camera lenses with solution. If a lens cleaning solution is required, wet the cleaning cloth sparingly - do not spray cleaning solution onto the camera unit.

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.

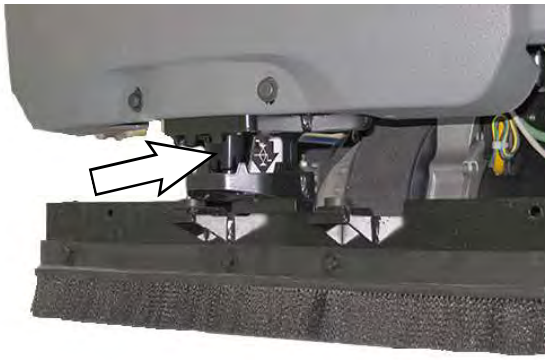
Check the upper and lower LIDAR sensors for dirt, dust, smudges, and damage daily (or before each robotic run). Debris, streaks, or smudges could deliver false environmental information to the machine.

Cleaning LIDAR sensors should only be done with microfi ber cleaning cloths designed for sensitive optical surfaces (one is included with the home location markers). In extreme cases, a lens cleaning solution formulated for optical polycarbonate lenses may be used. Do not spray LIDAR sensors with solution. If a lens cleaning solution is required, wet the cleaning cloth sparingly - do not spray cleaning solution onto the LIDAR sensors.

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 flashlight to inspect these sensor surfaces and ensure they are thoroughly cleaned.



SCRUB BRUSHES

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

Rotate the brushes from front -to-rear after every 50 hours of operation.

Replace the brushes when they no longer clean effectively.

REPLACING CYLINDRICAL SCRUB BRUSHES

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

1. Remove the pin from the rear perimeter guard. Lift the guard.



2. Unlatch and open the side squeegee support door.



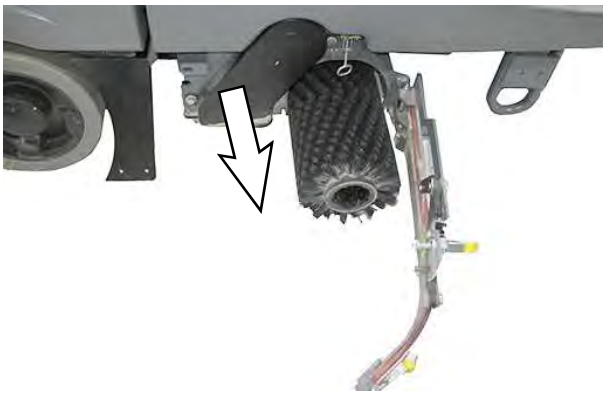
3. Lift the idler plate retainer handle and unhook the retainer ring from the idler plate hook.



4. Remove the idler plate from the scrub head.

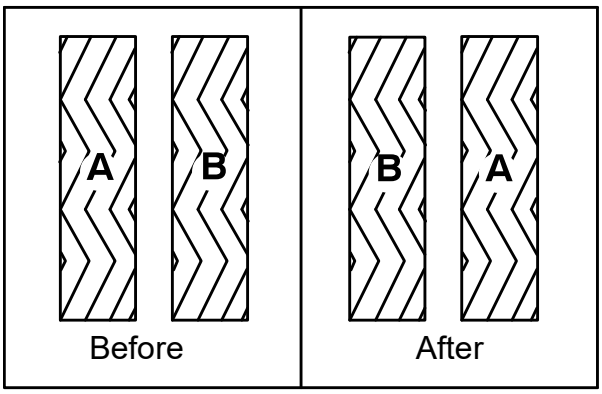


5. Remove the brush from the scrub head.



6. Position the brush with the double row end towards the scrub head opening. Guide the new brush onto the drive hub.

7. If rotating the brushes, always rotate the front with the back so that they wear evenly. they may be rotated end for end as well.



8. Reinstall the idler plate onto the scrub head and secure the idler plate into place with the idler plate retainer.

9. Close and latch the side squeegee and secure the rear perimeter guard with the pin.

10. Repeat for the other brush on the other side of the machine.

NOTE: Do not switch the left or right idler plates or the brushes will need to be readjusted by trained personnel.

ec-H2O SYSTEM

ec-H2O WATER CONDITIONING CARTRIDGE REPLACEMENT

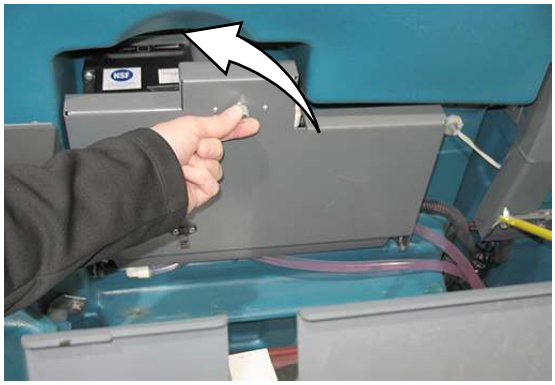
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and remove key.

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.

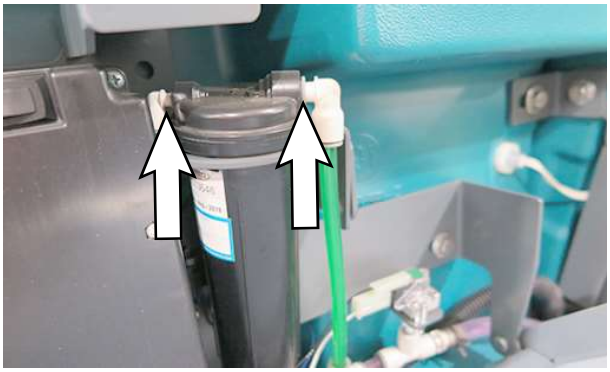
NOTE: During first time use and after replacing the water conditioning cartridge, the ec-H2O system will automatically override the selected solution flow rate for up to 75 minutes.

1. To engage the seat support arm, lift the seat completely open and insert the seat support arm into the hole in the operator seat plate.
2. Turn the ec-H2O compartment cover knob counter clock-wise and open the compartment door.

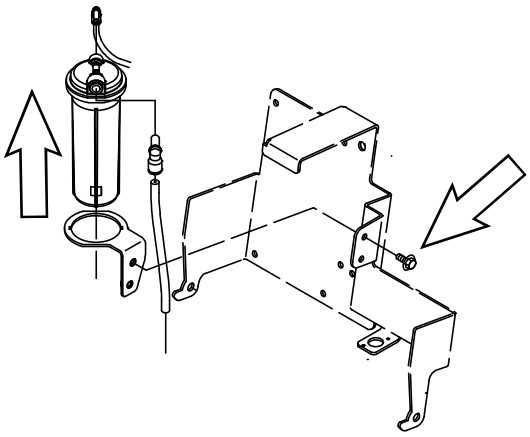




3. Disconnect the two hose connectors from cartridge by pressing the gray collars inward and pulling the connectors outward.



4. Remove the 2 screws securing the cartridge mounting bracket and slide out the expired cartridge.



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

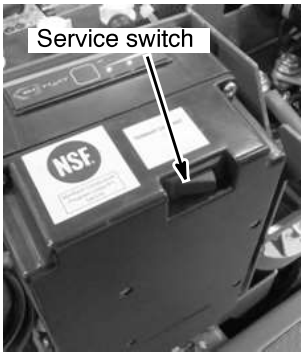


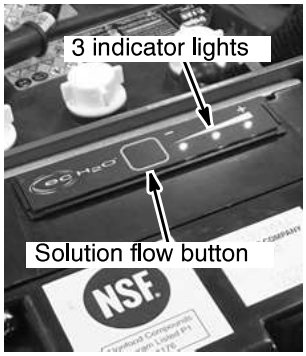
6. Slide the new cartridge into the mounting bracket and replace the 2 screws. Reconnect the two hoses. Make sure the hose connectors are fully inserted into new cartridge.

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. Close the compartment cover and lower seat.

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

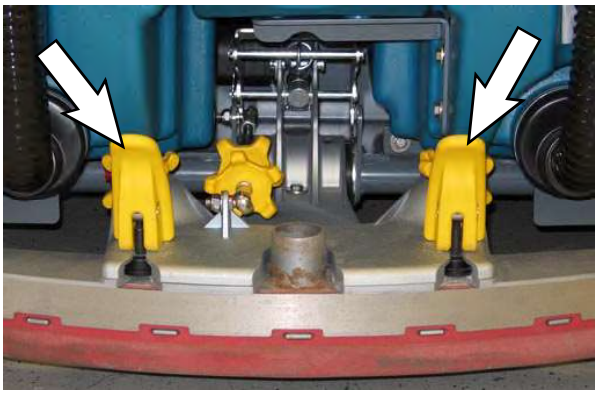
1. Lower the scrub head.

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

2. Disconnect the vacuum hose from the rear squeegee assembly.



3. Loosen both squeegee mounting handles.

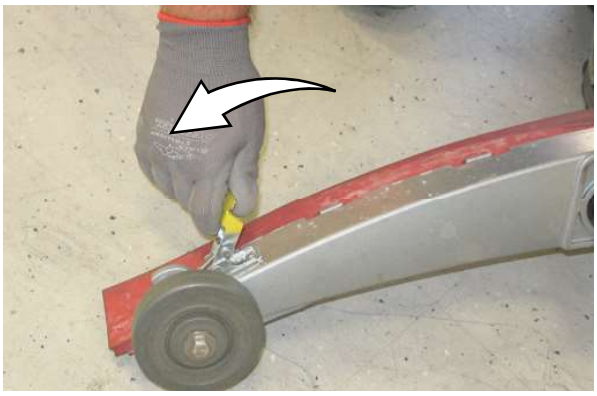




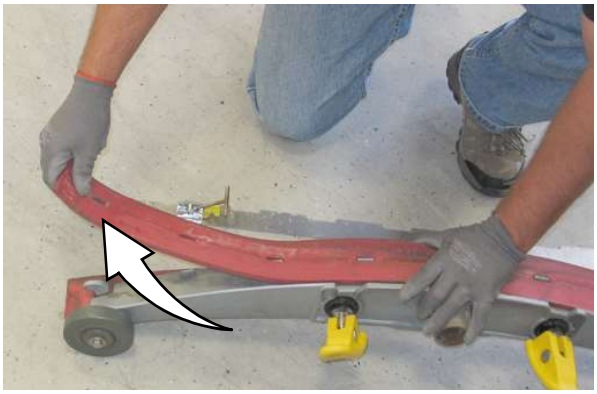
4. Pull the rear squeegee assembly from the machine.



5. Loosen the retainer latch and remove the retainer from the squeegee assembly.



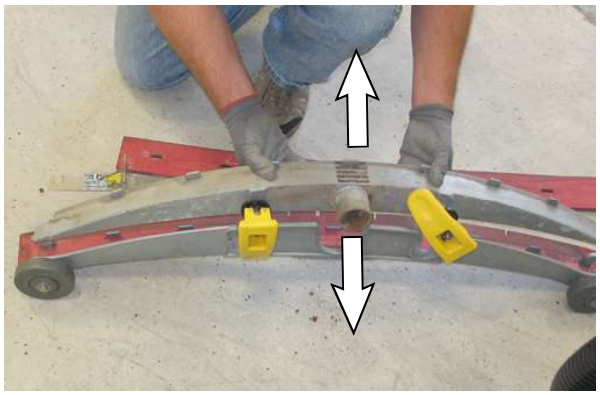
6. Remove the squeegee from the squeegee assembly.



7. Slide both retainers out away from the squeegee assembly.



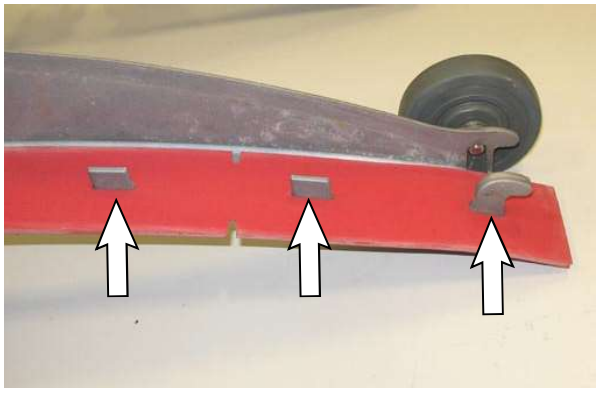
8. Remove the inner frame from the outer frame.



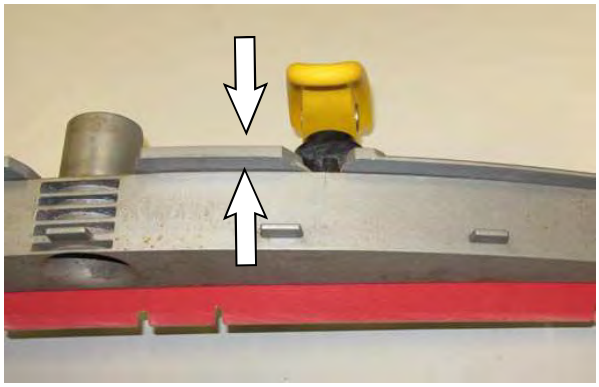
9. Remove the squeegee from the outer frame.



10. Install the rotated or new squeegee blade into the outer frame. Be sure the squeegee is completely slid down onto each tab on the outer frame.



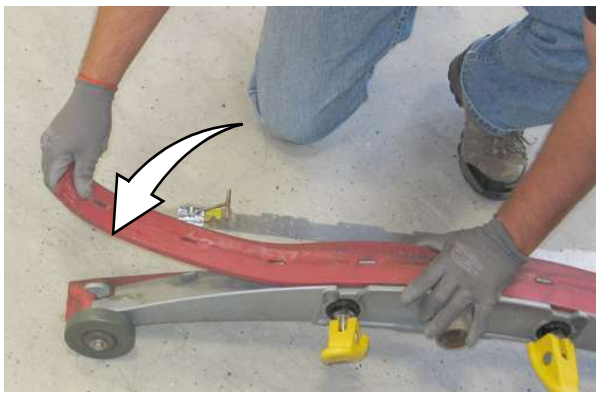
11. Install the inner frame over the squeegee and onto the outer frame. Be sure the inner frame is tight against the top of the outer frame.



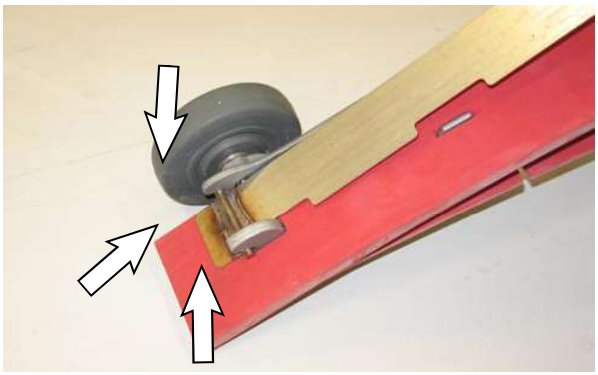
12. Slide both retainers into the squeegee assembly.



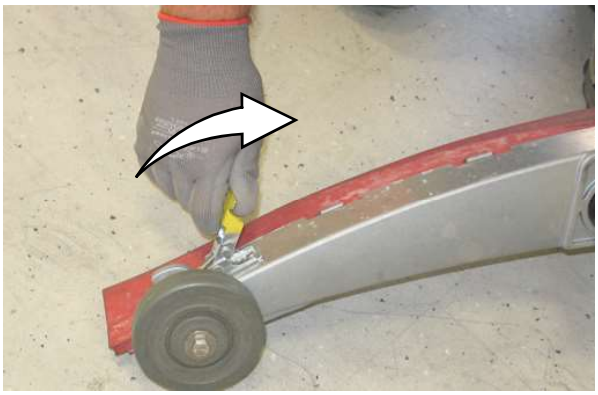
13. Place the rotated or new squeegee blade onto the inner frame. Be sure the squeegee is securely attached on each tab on the inner frame.



14. Insert the hinge end of the retainer into the hooks in the inner frame.



15. Install the retainer along the rest of the squeegee assembly and fasten the latch onto the other end of the squeegee assembly.



REPLACING OR ROTATING THE SIDE SQUEEGEE BLADES

1. If necessary raise the scrub head.

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

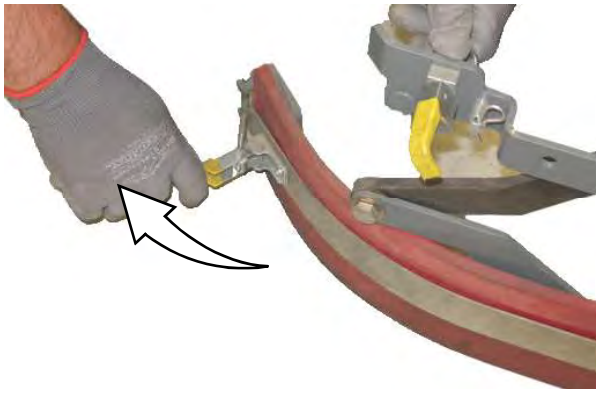
2. Remove the pin from the rear perimeter guard. Lift the guard.



3. Unlatch and open the side squeegee support door.



4. Unhook the retaining band latch from the side squeegee assembly.



5. Remove the retaining band from the side squeegee assembly.

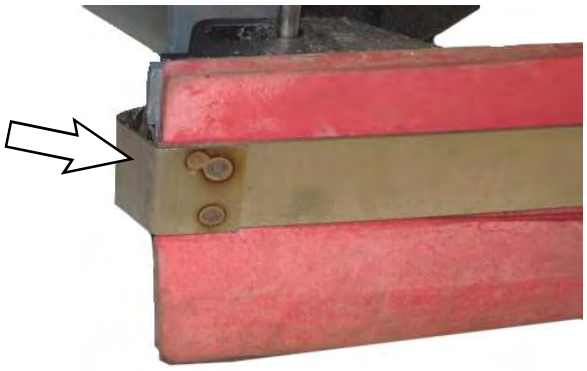


6. Remove the squeegee from the side squeegee assembly.



7. Install the rotated or new squeegee blade onto the side squeegee blade assembly.

8. Hook the retaining band onto the side squeegee assembly.



9. Fasten the retaining band latch onto the side squeegee assembly.

10. Close and latch the side squeegee and secure the rear perimeter guard with the pin.

11. Repeat for the side squeegee on the other side of the scrub head.

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 several meters (feet) forward and slowly bring the machine to a stop.

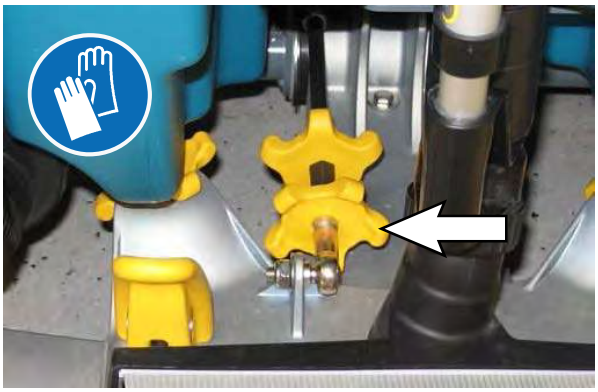
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and remove key.

2. check the squeegee deflection over the full length of the squeegee blade.

3. If the deflection is not the same over the full length of the blade, use the tilt adjust knob to make adjustments.

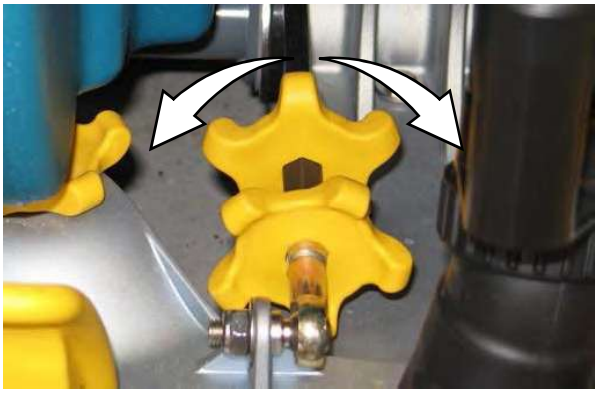
***DO NOT** disconnect the vacuum hose from the squeegee frame when leveling squeegee.*

4. to adjust the squeegee leveling, loosen the tilt lock knob.



5. Turn the squeegee tilt adjust knob counter-clockwise to decrease the deflection at the ends of the squeegee blade.

   Turn the squeegee tilt adjust knob clockwise to increase the deflection at the end of the squeegee blade.



6. Tighten the tilt lock knob.

7. Drive the machine forward with the squeegee down to recheck the squeegee blade deflection if adjustments were made.

8. Readjust the squeegee blade deflection if necessary.

ADJUSTING REAR SQUEEGEE BLADE DEFLECTION

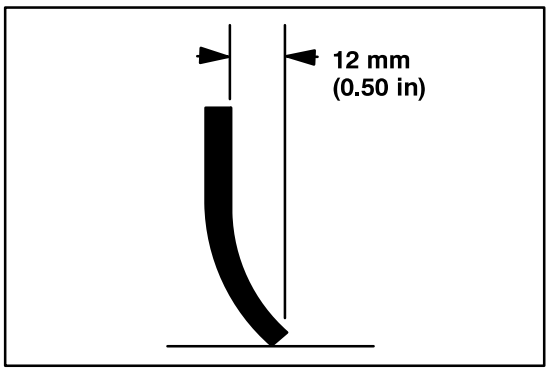
Deflection is the amount of curl the overall squeegee blade has when the machine moves forward. The best deflection is when the squeegee wipes the floor dry with a minimal amount of deflection.

NOTE: Make sure the squeegee is level before adjusting the deflection. See LEVELING THE REAR SQUEEGEE.

1. Lower the squeegee and drive the machine several meters (feet) forward and slowly bring the machine to a stop.

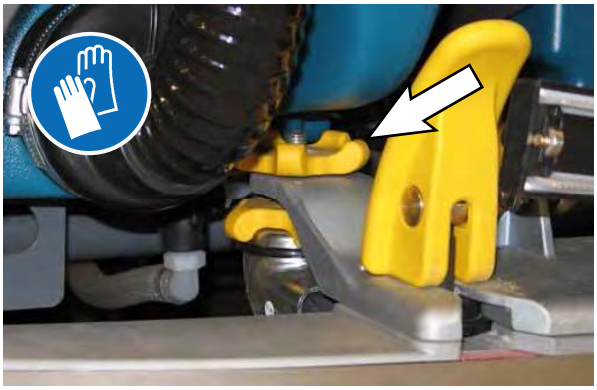
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and remove key.

2. 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.



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3. To adjust the overall squeegee blade deflection, loosen the lock knob.



4. Turn the adjustment knobs counter clockwise to increase deflection or clockwise to decrease deflection.



5. Retighten the lock knob.
6. Drive the machine forward to recheck the squeegee blade deflection.
7. Readjust the squeegee blade deflection if necessary.

SKIRTS AND SEALS

SOLUTION TANK SEAL

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

Check the seal for damage and wear after every 100 hours of operation.



RECOVERY TANK SEALS

Check the seals for damage and wear after every 100 hours of operation.

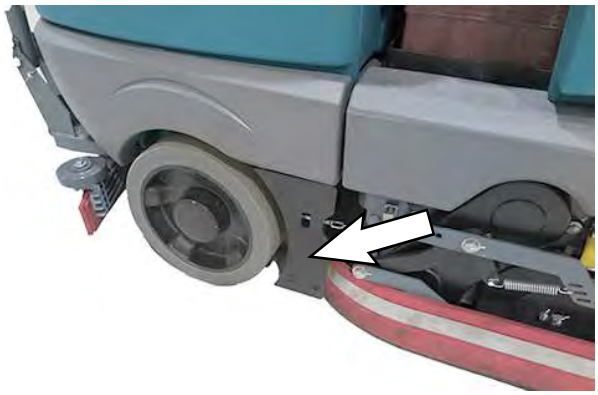


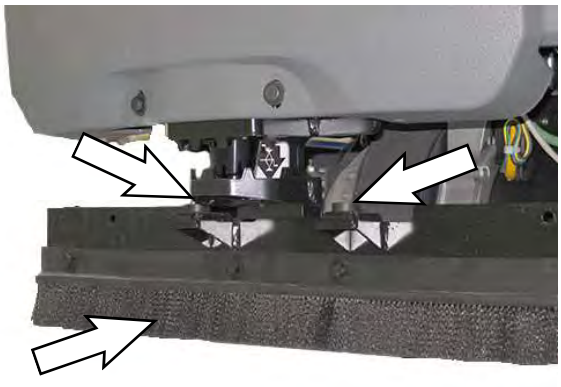
LEFT PERIMETER GUARD, RIGHT PERIMETER GUARD, AND FRONT PERIMETER GUARD

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 and bumpers for debris, damage, and wear daily.





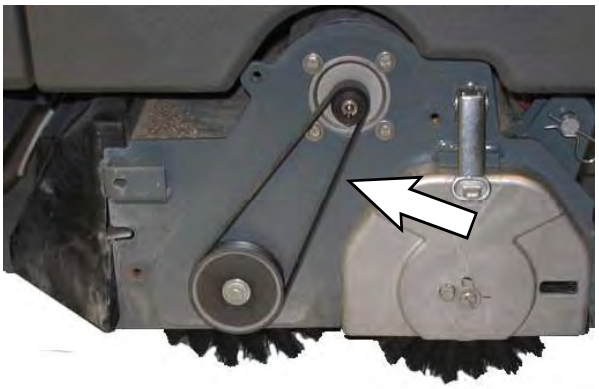


The bristles on the front, left, and right perimeter guard should be slightly off the floor. Replace damaged and/or worn bristle assemblies.

BELTS

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

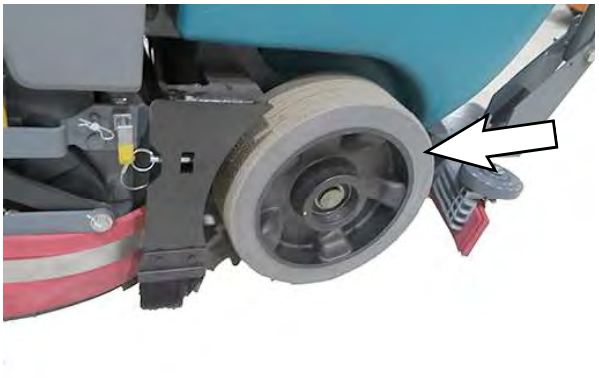
The brush drive belts are located on the cylindrical brush scrub head. Check the belts for damage and wear after every 200 hours of operation.



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 in 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

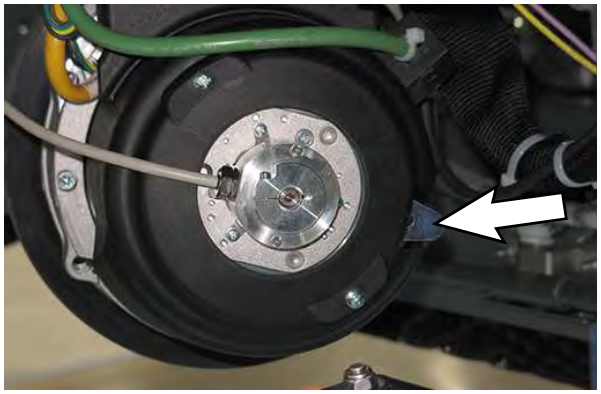
PUSHING OR TOWING THE MACHINE

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

FOR SAFETY: When transporting Lithium-ion Battery Model, contact Tennant or your local regulatory authorities for proper transporting instructions.

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

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

1. Raise the squeegee and scrub head.
2. Remove the rear squeegee from the machine.

NOTE: If necessary, remove the hardware securing the front perimeter guard from the front perimeter guard brackets and remove the front perimeter guard from the machine.

FOR SAFETY: When loading/unloading machine onto/off truck or trailer, use ramp, truck or trailer that will support the weight of the machine and operator.

FOR SAFETY: When loading/unloading machine onto/off truck or trailer, do not load/unload on ramp inclines that exceed 12.3% / 7° grade.

NOTE: The machine ability to climb a ramp is affected by tire wear, ramp surface, weather conditions, and other factors. Trailering should only be performed by personnel trained on how to safely load a machine.

3. Enclosed trailers: Drive the machine onto the trailer or truck.

   Open trailers: Back the machine on to the trailer to ensure that the navigation sensors are protected from any debris such as gravel while the machine is being transported.

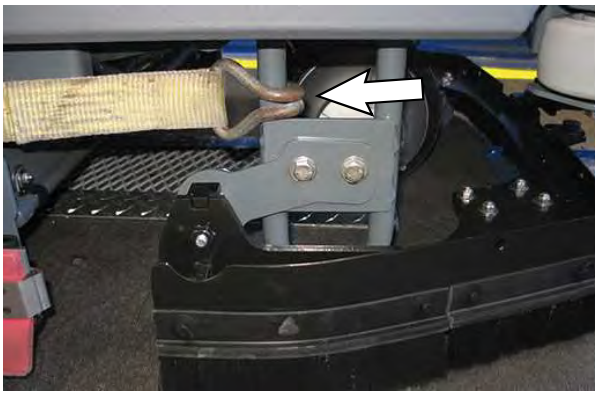
   Position the machine so the weight of the machine is safely distributed and can be safely strapped down to the trailer or truck.



4. Lower the scrub head and squeegee after the machine is positioned on the trailer or truck.
5. Turn off the machine.
6. Place a block behind each wheel to prevent the machine from rolling.

7. Hook the tie-down straps to the stabilizer arms and then secure the tie-downs to the trailer or truck to prevent the machine from tipping. Repeat for other side of machine.

   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.



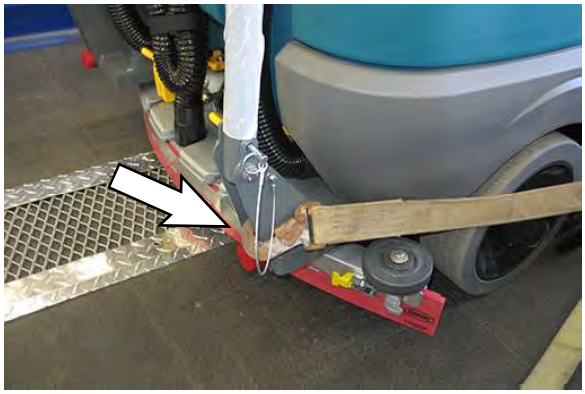


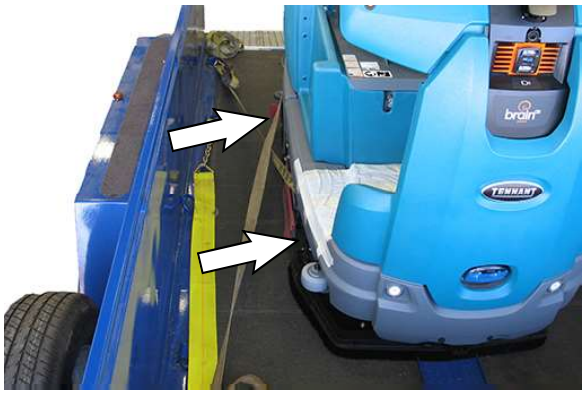
NOTE: Ensure that the lower lidar is protected from any debris such as gravel if the machine is being transported on a flat trailer.

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.

8. Hook the tie down straps to the rear squeegee guard arms and then secure the tie downs to the trailer or truck to prevent the machine from tipping. Repeat for other side of machine.





9. Ensure all tie-down straps are fully tightened and machine is completely secure on the trailer or truck.

10. Stow/secure all parts removed from the machine in a safe place where they will not be lost or damaged.

JACKING UP THE MACHINE

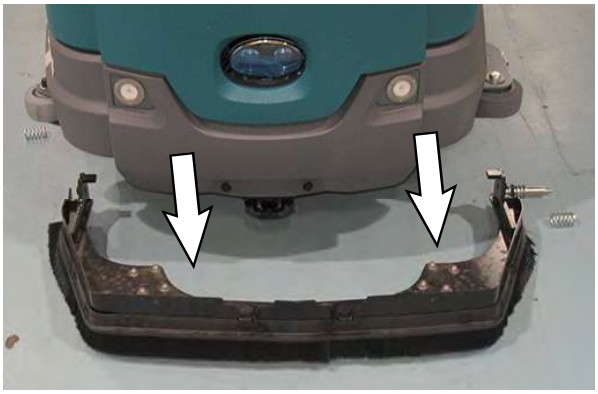
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and remove key.

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.







The front jack location 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.



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. Lithium-Ion batteries: Turn off battery power with the battery power button (4 pack only).
5. Park the machine in a cool, dry area. Do not expose the machine to rain. Store indoors.

FREEZE PROTECTION

FOR SAFETY: When storing Lithium-ion Battery model, do not expose battery to temperatures below -22°F/30°C, above 140°F/60°C. Do not use machine immediately after long term extreme temperature storage. Before use, return battery module temperature range to 50°F/10°C ~95°F/35°C.

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 default ec-H2O solution flow system until antifreeze appears at the scrub head.
4. Turn off the ec-H2O system and continue to operate the conventional solution flow system. Turn off the machine when antifreeze reappears at the scrub head.

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	2030 mm (80 in)
Height (to light)	1475 mm (58 in)
Width/rear squeegee	1070 mm (42 in)
Width/frame rollers	1070 mm (42 in)
Cylindrical scrub brush diameter	205 mm (8 in)
Cylindrical brush length	910 mm (36 in)
Scrubbing path width	910 mm (36 in)
Track	900 mm (35.5)
Wheel base	1091 mm (43 in)
Solution tank capacity	190 L (50 gallons)
Recovery tank capacity	225 L (60 gallons)
Demisting tank	38 L (10 gallons)
Weight/net less batteries	528 Kg (1165 lbs)
Weight/with standard battery package	785 Kg (1725 lbs)
GVWR	1118 Kg (2465 lbs)
Protection Grade	IPX3

Values determined as per IEC 60335-2-72	Measure
Sound pressure level LpA	66 dB(A)
Sound pressure uncertainty KpA	4 dB(A)
Sound power level LWA + Uncertainty KWA	89 dB(A)
Vibration - Hand-arm	<2.50 m/s^2
Vibration - Whole body	<0.50 m/s^2

GENERAL MACHINE PERFORMANCE

Item	Measure
Aisle turnaround (Manual)	2110 mm (83 in)
Aisle turnaround (Autonomous)	3430 mm (135 in)
Travel Speed Forward (maximum) - Manual Mode	6.1 Km/h (3.8 mph)
Travel Speed Forward (maximum) - Robotic Mode	3.5 Km/h (2.2 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)	2% / 1°
Maximum ramp incline for scrubbing - (Robotic mode)	2% / 1°
Maximum ramp incline for transporting (GVWR - Manual mode only)	8.75% / 5°
Maximum ramp incline for loading – Empty (Manual mode only)	12.3% / 7°
Maximum ramp incline for scrubbing - (Manual mode)	7.0% / 4°
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 (flooded lead acid)	6	36	360@20 hr rate	44 kg (98 lb)
Lithium-Ion Batteries (4 pack)	4 in parallel	36	80 Ah / 2.9 kWh	18.6 kg (40.1 lb)

Type	Use	VDC	kW (hp)
Electric Motors	Scrub brush	36	0.75 kW (1.00 hp)
	Vacuum fan	36	0.6 kW (0.8 hp)
	Propelling	36	1.1 kW (1.5 hp)

Type	VDC	amp	Hz	Phase	W	VAC
Charger (Lead-acid)	36	21	45-65	1	756	85-265
Charger, lithium-ion (Fast charging)	36	90	50-60	1	3240	200-240
Charger, lithium-ion (Base charging)	36	33	50-60	1	1200	100-240

TIRES

Location	Type	Size
Front (1)	Solid	90 mm wide x 250 mm OD (3.5 in wide x 10 in OD)
Rear (2)	Solid	102 mm wide x 300 mm OD (4 in wide x 12 in OD)

CONVENTIONAL SCRUBBING

Item	Measure
Solution pump	36 Volt DC, 12.5 LPM (3.3 GPM) open flow
Solution flow rate	Low: 0.5 gpm
	Medium: 1.0 gpm
	High: 1.5 gpm

***ec−H2O* SYSTEM**

Item	Measure
Solution pump	36 Volt DC, 12.5 LPM (3.3 GPM) open flow
Solution flow rate	Low: 0.35 gpm
	Medium: 0.44 gpm
	High: 0.53 gpm

MACHINE DIMENSIONS

