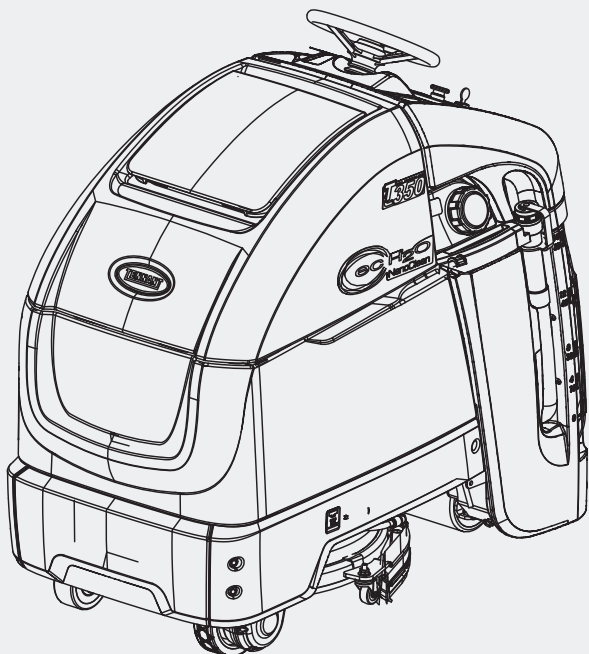




T350

Stand-On Rider Scrubber

English **(EN)** Service Information Manual



Hygenic® Fully cleanable Recovery Tank
TennantTrue® Parts
IRIS® a Tennant Technology
Pro-Panel® Controls
Smart-Fill™ Automatic Battery Watering
Insta-Click™ Magnetic Disk



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www.tennantco.com/manuals

9016422
Rev. 00 (12-2017)



INTRODUCTION

This manual is available for 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.



PROTECT THE ENVIRONMENT



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

Always remember to recycle.

INTENDED USE

The T350 stand-on rider floor scrubber is intended for commercial use, for example in hotels, schools, hospitals, factories, shops, offices and rental businesses. It is designed to scrub hard floor surfaces (concrete, tile, stone, synthetic, etc.) in an indoor environment. This machine is not intended for cleaning carpets. Use only recommended pads/brushes and commercially available floor cleaning detergents. Do not use this machine other than described in the Operator Manual.

MACHINE DATA

Please fill out at time of installation for future reference.

Model No. - _____

Serial No. - _____

Installation Date - _____

SERIAL NUMBER LOCATION



UNCRATING MACHINE

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

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

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

ATTENTION: Due to the center of gravity being higher (making it easier to tip machine) for machines without batteries installed, use care when uncrating the machine if it does not have batteries installed. Install batteries before moving machine from pallet.

Tennant Company

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Minneapolis, MN 55440

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www.tennantco.com

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Specifications and parts are subject to change without notice.

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CONTENTS

Contents	3	ec-H2O Water Conditioning Cartridge	
Safety Precautions	6	Replacement	43
General Information.....	10	Machine Jacking	44
Component Locator	10	Jacking Up The Front Of The Machine	45
Machine Components	11	Jacking Up The Rear Of The Machine	45
Electrical Schematic Symbols.....	12	Pushing, Towing, And Transporting	
Electrical Schematic.....	13	The Machine.....	46
Operational Matrix.....	18	Pushing And Towing The Machine	46
Fastener Torque	19	Transporting The Machine	46
SAE (Standard).....	19	Storing Machine	47
Metric	19	Freeze Protection.....	47
General Machine Dimensions/		Machine Troubleshooting.....	49
Capacities/Performance	20	Troubleshooting.....	52
General Machine Dimensions/		Faults And Warnings.....	52
Capacities/Performance	21	On-Board Battery Charger Service	
Machine Dimensions	22	Indicator Codes	58
Maintenance.....	24	ABW (Automatic Battery Watering)	
Maintenance Chart.....	25	System Icon Indicator Codes.....	58
Machine Maintenance.....	26	ec-H2O Nanoclean Icon Faults.....	59
Yellow Touch Points	26	Off-Board Charger Error And Fault Codes....	61
After Daily Use	26	Onboard Battery Charging On	62
After Weekly Use	28	Batteries Fail To Charge / Reduced Run	
After Every 50 Hours Of Use	29	Time (Onboard Charger)	63
After Every 100 Hours Of Use	29	Off Board Battery Charging On.....	64
After Every 200 Hours Of Use	29	Batteries Fail To Charge / Reduced	
Electric Motors	29	Run Time (Off Board Charger)	65
Batteries.....	30	Power Up On	66
Maintenance-Free Batteries.....	30	Machine Failed To Power Up	67
Flooded (Wet) Lead-Acid Batteries	30	Propel Subsystem.....	68
Checking Connections / Cleaning	30	Machine Failed To Propel.....	69
Charging Batteries	31	Scrub Motor On.....	70
Battery Charger Settings.....	32	Scrub Motor Failed To Turn On.....	71
Changing On-Board Battery Charger		Scrub Head Lift Actuator	72
Settings (Pro-Membrane Model)	32	Scrub Head Failed To Lift / Lower.....	73
Hydrolink® Battery Watering System		Vacuum Fan On	74
(Trojan® Battery Option)	34	Vacuum Fan Failed To Turn On	75
Smart-Fill Automatic Battery Watering		Solution Control On (Conventional)	76
(Option)	35	Solution Control Failed To Turn On	
Battery Compartment Drain Valve.....	35	(Conventional)	77
Brush And Pad Replacement.....	36	Solution Control On (ec-H2O).....	78
Replacing Brush(es) Or Pad(s) On		Solution Control Failed To Turn On	
Pro-Panel Machines.....	36	(ec-H2O).....	79
Replacing Brush(es) Or Pad(s) On		SE (Severe Environment) On	80
Pro-Membrane Panel Machines.....	38	SE (Severe Environment) Failed To	
Squeegee Blade Replacement	39	Turn On.....	81
Replacing Squeegees On Machines		ABW 2.0 (Automatic Battery	
With 20 In. (500 mm) Scrub Heads	39	Watering 2.0) (Option)	82
Replacing Squeegees On Machines		ABW 2.0 (Automatic Battery	
With 24 In. (600 mm) Scrub Heads.....	41	Watering 2.0) System Failed To	
		Turn On	83

i-Drive Testing (Universal Schematic)	84	Installing / Routing The Recovery Tank Drain Hose And The Vacuum Hose	150
i-Drive Testing Procedure	85	Installing / Routing The Recovery Tank Drain Hose And The Vacuum Hose	152
Can Open Network Issues	86	Removing / Installing The Water Solenoid Valve.....	154
Connector Fully Seated.....	86	Connecting Hoses To PTC (Push-To-Connect) Fittings.....	155
Pin Fully Seated	86	Disconnect Hoses From PTC (Push-To-Connect) Fittings.....	156
Network Resistance	86	Control Modules / Controls	158
Displaying Fault Codes / Warnings (Pro-Panel Machines Only)	87	Removing / Installing The Control Module.....	158
Entering The Manual Mode (Pro-Membrane Panel Machines Only)	88	Removing / Installing The i-Drive Module.....	160
Entering The Manual Mode (Pro-Panel Machines Only)	89	Removing / Installing The Control Panel	162
Service.....	92	Removing / Replacing The Control Panel Control Board	163
Service Diagnostics Tool.....	92	Replacing The Speed Knob	164
Programming A New Interface Module.....	92	Removing / Installing The Green Go Pedal / Operator Presence Pedal	166
Updating The Machine Firmware	95	Removing / Installing The On-Board Battery Charger	170
Programming The i-Drive Module	98	Options.....	172
Reconfiguring The Machine After New Hardware / Option Installation	100	Smart-Fill ABW (Automatic Battery Watering) System Maintenance (Option)	172
Accessing Support Documentation	102	Replacing The ABW Controller	173
Changing The Off-Board Battery Charger Settings.....	104	ABW Pump Is Timing Out (1 Minute)	174
Cleaning Systems	105	ABW Overfills The Batteries.....	174
Removing / Installing The Shrouds	105	Replacing The ABW In Tank Pump	175
Removing / Installing / Adjusting The Steering Cables.....	106	Removing / Installing The ec-H2O Solution Pump (Option).....	176
Removing / Installing The Front Drive Wheel Assembly	118	Removing / Installing The ec-H2O Module (Option).....	177
Removing / Installing The Drive Motor Carbon Brushes	120	Removing / Installing The ec-H2O Dispenser Pump (Option).....	177
Removing / Installing The Rear Wheel Assembly.....	124	Servicing The ec-H2O Module (Option)	178
Removing / Installing / Replacing The Scrub Head Assembly.....	126	SE (Severe Environment) Group Maintenance (Option).....	180
Removing / Installing The Scrub Head Motor Carbon Brushes.....	130	Removing / Installing The Detergent Pump Assembly / Detergent Metering Potentiometer	181
Replacing The 500mm / 600mm 3-Lug Scrub Head Components.....	132	Removing / Installing The Detergent Metering Liquid Level Sensor	182
Replacing The 500mm / 600mm Magnetic Scrub Head Components	136		
Removing / Replacing The Actuator.....	140		
Adjusting The Squeegee Assembly	144		
Removing / Installing The Vacuum Fan	146		
Removing / Replacing The Vacuum Fan Carbon Brushes	148		
Installing The Vacuum Fan Carbon Brushes	148		

SAFETY PRECAUTIONS

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

- Read manual before operating machine.
- Do not use or pick up flammable materials or reactive metals.
- Do not use near flammable liquids, vapors or combustible dusts.

This machine is not equipped with an explosion proof motor. The electric motor will spark upon start up and during operation which could cause a flash fire or explosion if machine is used in an area where flammable vapors/liquids or combustible dusts are present.

- Batteries emit hydrogen gas. Explosion or fire can result. Keep sparks and open flame away when charging.
- Disconnect battery cables and charger cord before cleaning and servicing machine.
- Do not charge batteries with damaged cord. Do not modify plug.

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

- Do not use outdoors. Store indoors.

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

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

FOR SAFETY:

1. Do not operate machine:
 - Unless trained and authorized.
 - Unless operator manual is read and understood.
 - Unless mentally and physically capable of following machine instructions.
 - Under the influence of alcohol or drugs.
 - While using a cell phone or other types of electronic devices.
 - With brake disabled.
 - If not in proper operating condition.
 - With pads or accessories not supplied or approved by Tennant. The use of other pads may impair safety.
 - In outdoor areas. This machine is for indoor use only.
 - In areas where flammable vapors/liquids or combustible dusts are present.
 - In areas that are too dark to safely see the controls or operate the machine.
 - In areas with possible falling objects.
 - Do not place weights or heavy objects on the operator presence pedal and/or green go pedal.
2. Before Starting Machine:
 - Check machine for fluid leaks.
 - Make sure all safety devices are in place and operate properly.
 - Check steering for proper operation.
3. When using machine:
 - Use only as described in this manual.
 - Do not pick up burning or smoking debris, such as cigarettes, matches or hot ashes.
 - Go slowly on inclines and slippery surfaces.
 - Follow site safety guidelines concerning wet floors.
 - Do not scrub on inclines that exceed 9% grade or transport on inclines that exceed 9% grade.
 - Do not turn on inclines or ramps.
 - Reduce speed when turning.
 - Keep all parts of body inside operator station while machine is moving.

- Always be aware of surroundings while operating machine.
 - Always allow head clearance when going through doorways, low ceilings, and overhangs.
 - Drive slowly through doorways and narrow openings, especially with the dual disk model as squeegee extends beyond width of machine.
 - Do not access the video / help screens while the machine is moving. (Pro-Panel)
 - 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.
 - Report machine damage or faulty operation immediately.
 - Follow mixing, handling and disposal instructions on chemical containers.
 - Follow site safety guidelines concerning wet floors.
4. Before leaving or servicing machine:
- Stop on level surface.
 - Turn off machine and remove key.
5. 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 controlling the machine.
 - Do not push or tow the machine on inclines with the brake disabled.
 - Do not power spray or hose off machine near electrical components.
 - Disconnect battery connections and charger cord before working on machine.
 - Do not use incompatible battery chargers as this may damage battery packs and potentially cause a fire.
 - Inspect charger cord regularly for damage.
 - Do not plug in charger if prongs are wet.
 - Open recovery tank to vent batteries if temperature is above 80°F/27°C when charging batteries.
- Do not disconnect the off-board charger's DC cord from the machine receptacle when the charger is operating. Arcing may result. If the charger must be interrupted during charging, disconnect the AC power supply cord first.
 - Avoid contact with battery acid.
 - Always follow site safety rules when disposing battery compartment liquid.
 - 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 protective gloves.



For Safety: wear eye protection.

6. When loading/unloading machine onto/off truck or trailer:
- Drain tanks before loading machine.
 - Use a ramp that can support the machine weight and operator.
 - Do not drive on a slippery ramp.
 - Do not operate the machine on a ramp incline that exceeds an 18% grade level.
 - Use a winch if ramp incline exceeds an 18% grade level.
 - Lower scrub head and remove squeegee before tying down machine.
 - Block machine tires.
 - Tie machine down to truck or trailer.

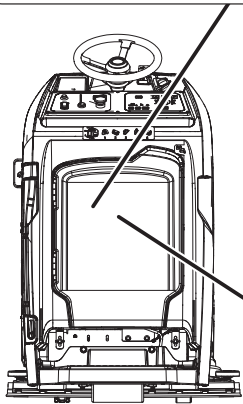
SAFETY PRECAUTIONS

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

WARNING LABEL - Located on access panel.

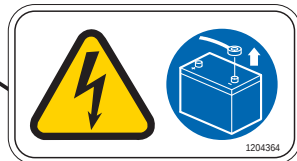
	⚠ WARNING	⚠ AVERTISSEMENT	⚠ ADVERTENCIA
	TO REDUCE THE RISK OF FIRE, EXPLOSION, ELECTRICAL SHOCK, OR INJURY: • Read manual before operating machine. • Do not use or pick up flammable materials. • Do not use near flammable liquids, vapors or combustible dusts. • Batteries emit hydrogen gas. Explosion or fire can result. Keep sparks and open flame away when charging. • Disconnect battery cables and charger plug before servicing machine. • Do not charge batteries with damaged cord. • Do not use outdoors. Store indoors.	POUR RÉDUIRE LES RISQUES D'INCENDIE, L'EXPLOSION, DE CHOC ÉLECTRIQUE OU DE LESSURE: • Lisez le manuel avant d'utiliser la machine. • N'utilisez pas ou ne ramassez pas de matériaux inflammables. • N'utilisez pas près de liquides, vapeurs ou poussières inflammables. • Les batteries émettent de l'hydrogène gazeux. Risque d'incendie et d'explosion. Évitez toute étincelle et toute flamme nue lors de la charge des batteries. • Débranchez les câbles des batteries et le cordon du chargeur avant l'entretien de la machine. • Ne chargez pas les batteries avec un cordon endommagé. • N'utilisez pas à l'extérieur. Entrezposez-la à l'intérieur.	PARA REDUCIR EL RIESGO DE INCENDIO, EXPLOSION, CHOQUE ELECTRICO, O LESIONES: • Lea el manual antes de utilizar la máquina. • No utilice ni recoja materiales inflamables. • No utilice la máquina cerca de líquidos, polvos o vapores inflamables. • Las baterías emiten hidrógeno. Peligro de incendio o explosión. Mantenga la máquina alejada de chispas y llamas cuando se esté cargando. • Desconecte los cables de la batería antes de realizar el servicio a la máquina. • No cargue las baterías si el cable está dañado. • No utilice la máquina al aire libre. Guárdela en un lugar cerrado.

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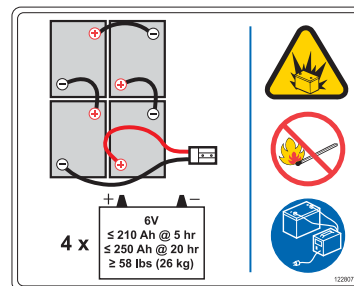
WARNING LABEL - Electrical hazard. Disconnect battery cables before servicing machine.

Located on on-board battery charger mounting plate.



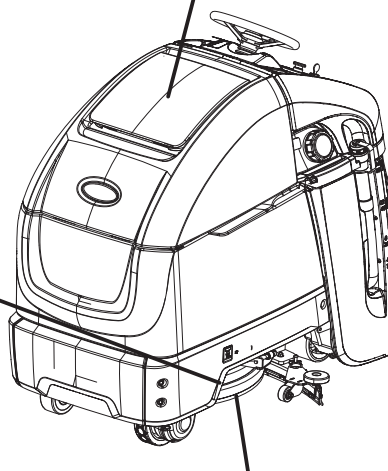
WARNING LABEL - Batteries emit hydrogen gas. Explosion or fire can result. Keep sparks and open flame away when charging.

Located on bottom of recovery tank.



WARNING LABEL - Spinning brush. Keep hands away.

Located on top of scrub head.



WARNING LABEL - Magnetic Field Hazard. Magnetic pad driver/brush can be harmful to those with pacemakers or medical implants.

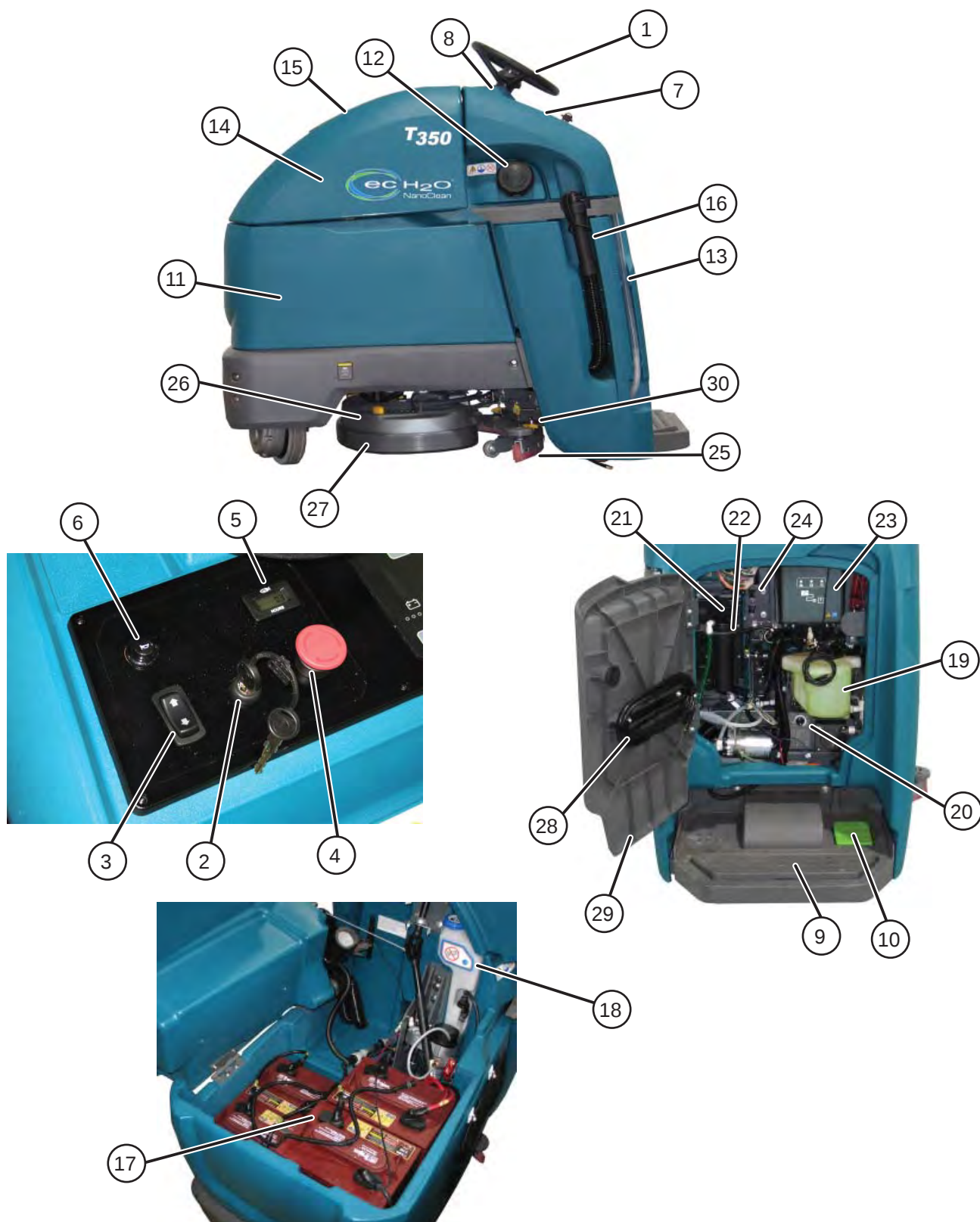
Located on Insta-Click magnetic pad driver/brush.



GENERAL INFORMATION

GENERAL INFORMATION

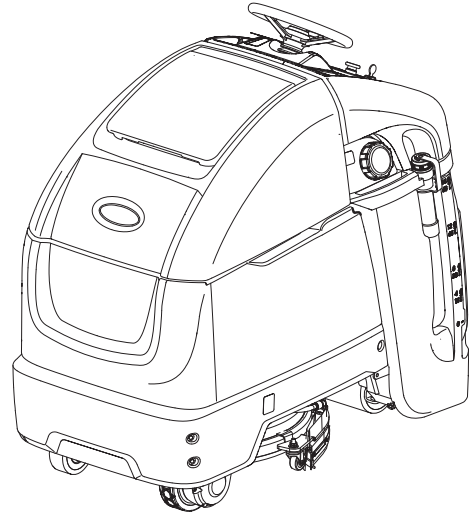
COMPONENT LOCATOR



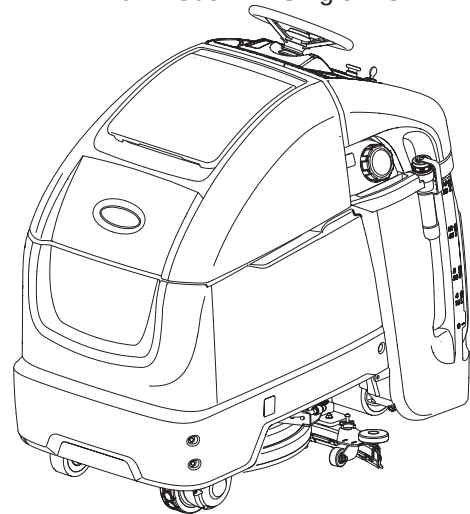
MACHINE COMPONENTS

1. Steering Wheel
2. Key switch
3. Forward / Reverse switch
4. Emergency shut-off button
5. Hour meter
6. Horn button
7. Control panel
8. Speed knob
9. Operator presence pedal
10. Green go pedal
11. Solution tank
12. Solution tank fill port
13. Solution tank level / drain hose
14. Recovery tank
15. Recovery tank cover
16. Recovery tank drain hose
17. Battery compartment
18. Automatic battery watering tank (option)
19. Severe Environment detergent tank (option - with ec-H2O option only)
20. Detergent mixing ratio knob (option - with ec-H2O option only)
21. ec-H2O module (option)
22. ec-H2O water conditioning cartridge (option)
23. On-board battery charger (option)
24. Circuit breaker panel
25. Squeegee assembly
26. Scrub head
27. Scrub head skirt
28. On-board battery charger power cable
29. Access panel
30. Double scrub caster knob

SCRUB HEAD TYPES



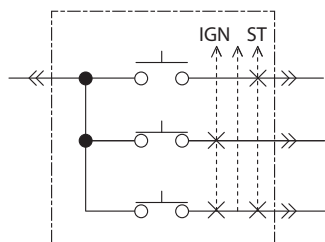
20 in. 500 mm Single Disk



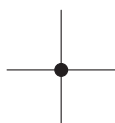
24 in. / 600 mm Dual Disk

GENERAL INFORMATION

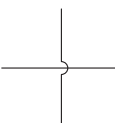
ELECTRICAL SCHEMATIC SYMBOLS



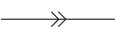
Key Switch



Connected



Not Connected



Connector



Energized



Adaptor Harness



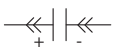
Notes



Assembly



AC Plug



Capacitor



Battery



Circuit Breaker



Fuse



Diode



Single Continuation Tab



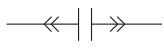
Double Continuation Tab



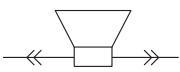
Relay Coil



N.C. Relay Contacts



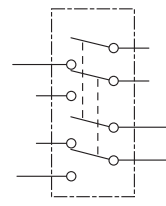
N.O. Relay Contacts



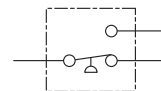
Horn or Alarm



Light



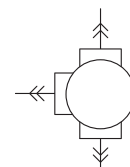
DPDT Switch



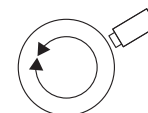
Pressure Switch



Motor



3 Phase AC Induction Motor



Motor Encoder



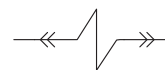
Sensor
(Variable Resistor)



Momenary Switch N.O.



Contact Switch N.C.

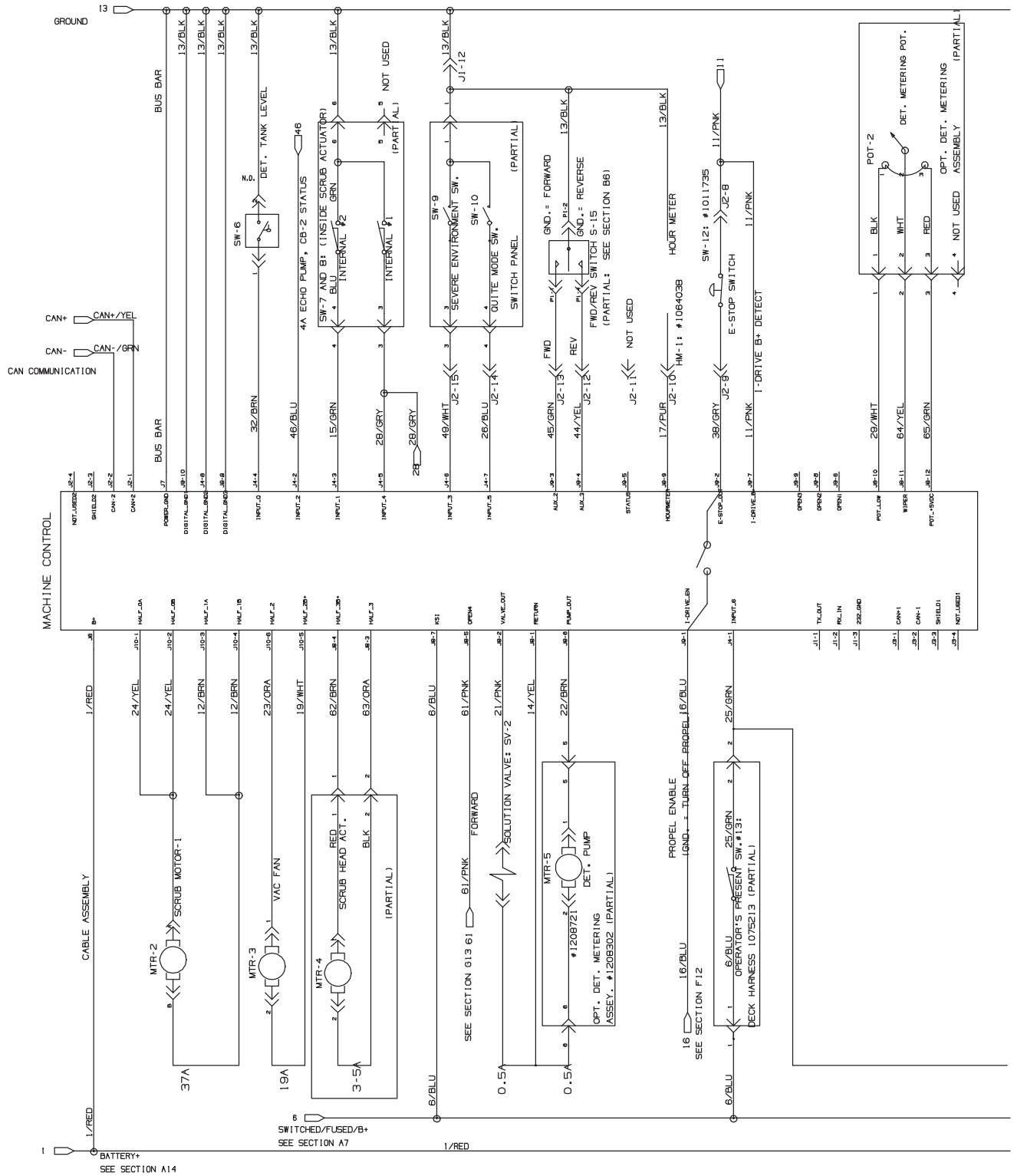


Solenoid Valve

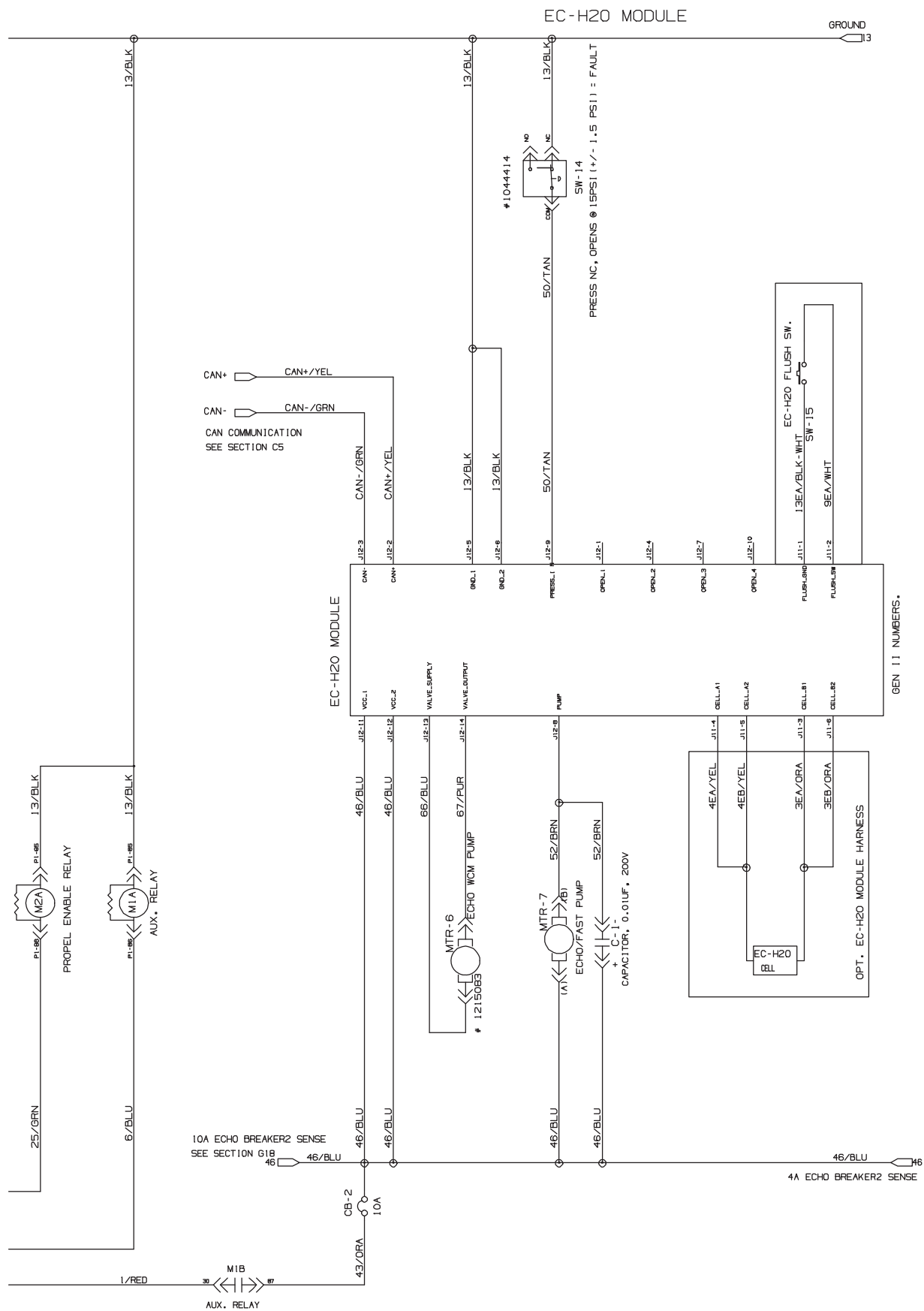
ELECTRICAL SCHEMATIC- PAGE 2

ELECTRICAL SCHEMATIC - PAGE 3

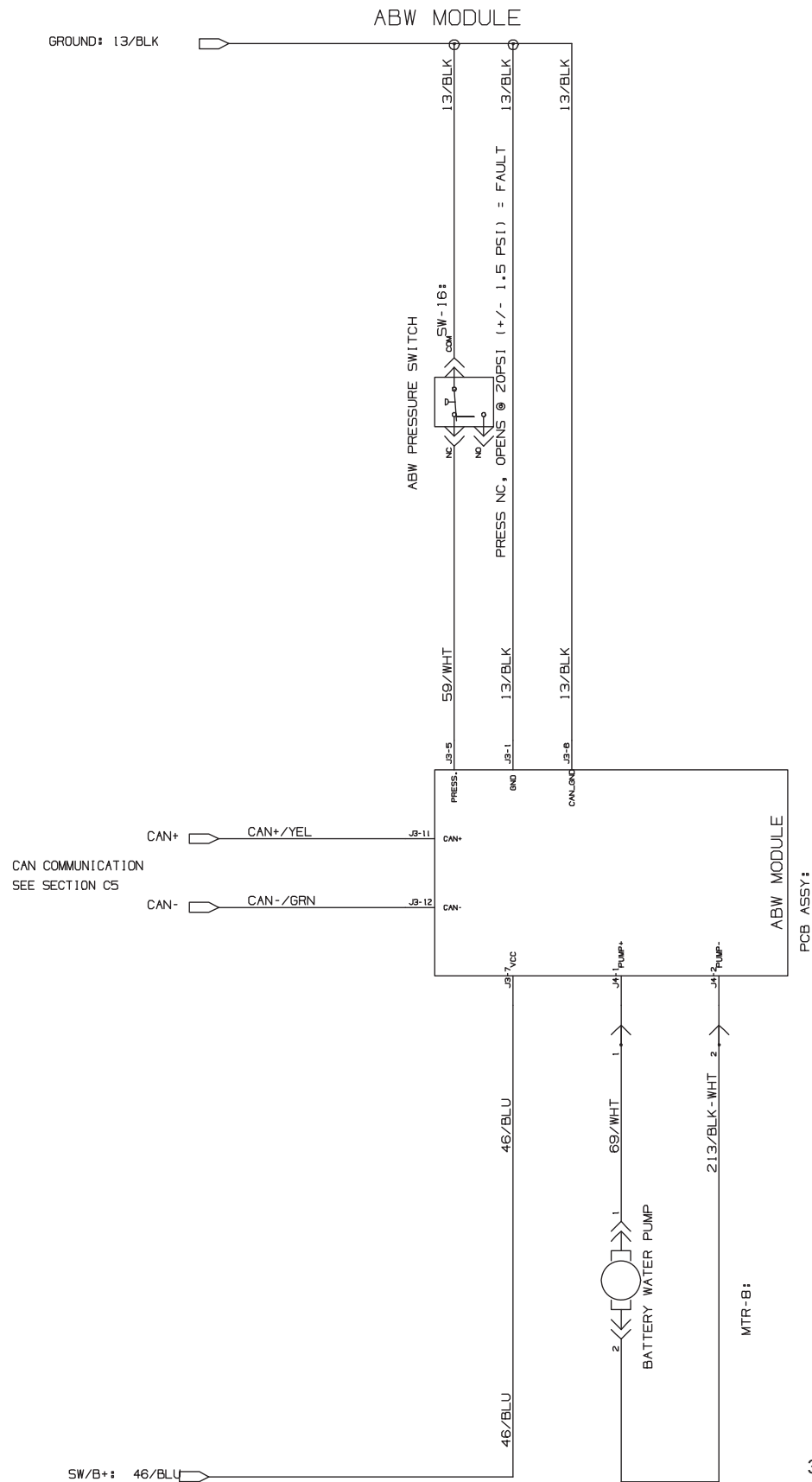
PREMIUM CONTROLLER



ELECTRICAL SCHEMATIC - PAGE 4



ELECTRICAL SCHEMATIC - PAGE 5



GENERAL INFORMATION

OPERATIONAL MATRIX

FUNCTION	ENABLED	DISABLED
Propel	• Key ON (I) • Forward/Reverse Switch In FORWARD or REVERSE • Operator Presence Pedal pressed • Green Go Pedal pressed	• Key OFF (O) • Neutral - Operator Presence Pedal and / or Green Go Pedal released • Propel Motor Controller Fault • Battery Charger ON Interlock
Vacuum Fan	• Key ON (I) • Vacuum Fan Button ON • Scrub Head Lowered - 1-Step	• Key OFF (O) • Vacuum Fan Button OFF • Head Raised - 1-Step • Low Battery Voltage (Wet < 21.9 V, AGM < 22.7 V) • Fault • Battery Charger ON Interlock
Scrub Head Actuator	• Key ON (I) • Scrub Head Lowered - 1-Step	• Key OFF (O) • Neutral - Operator Presence Pedal and / or Green Go Pedal released • Scrub Head Raised - 1-Step • Low Battery Voltage (Wet < 21.9 V, AGM < 22.7 V) • Fault • Battery Charger ON Interlock
Main Scrub Motor	• Key ON (I) • Scrub Head Lowered - 1-Step • Forward/Reverse Switch - FORWARD or REVERSE • Operator Presence Pedal pressed • Green Go Pedal pressed	• Key OFF (O) • Scrub Head Raised - 1-Step • Neutral - Operator Presence Pedal and / or Green Go Pedal released • Low Battery Voltage (Wet < 21.9 V, AGM < 22.7 V) • Fault • Battery Charger ON Interlock
Solution Control (Conventional)	• Scrub Head Lowered - 1-Step • Solution Control ON • Forward/Reverse Switch - FORWARD or REVERSE • Operator Presence Pedal pressed • Green Go Pedal pressed	• Scrub Head Raised - 1-Step • Solution Control OFF • Neutral - Operator Presence Pedal and / or Green Go Pedal released • Low Battery Voltage (Wet < 21.9 V, AGM < 22.7 V) • Fault • Battery Charger ON Interlock
Solution Control (ec-H2O NanoClean - Optional)	• Scrub Head Lowered - 1-Step • Solution Control ON • ecH2O Switch ON • Forward/Reverse Switch - FORWARD or REVERSE • Operator Presence Pedal pressed • Green Go Pedal pressed	• Scrub Head Raised - 1-Step • Solution Control OFF • ecH2O Switch OFF • Neutral - Operator Presence Pedal and / or Green Go Pedal released • Low Battery Voltage (Wet < 21.9 V, AGM < 22.7 V) • ecH2O System Fault • Battery Charger ON Interlock
Severe Environment	• Scrub Head Lowered - 1-Step • Severe Environment ON (30 seconds or continuous) • Forward/Reverse Switch - FORWARD or REVERSE • Operator Presence Pedal pressed • Green Go Pedal pressed • Detergent Tank Not Empty	• Scrub Head Raised - 1-Step • Solution Control OFF • Neutral - Operator Presence Pedal and / or Green Go Pedal released • Detergent Tank Empty • Low Battery Voltage (Wet < 21.9 V, AGM < 22.7 V) • Fault • Battery Charger ON Interlock

GENERAL INFORMATION

FASTENER TORQUE

SAE (STANDARD)

Thread Size	SAE Grade 1	SAE Grade 2 Carriage Bolts	Thread Cutting Thread Rolling	SAE Grade 5 Socket & Stainless Steel	SAE Grade 8	Headless Socket Set Screws	Square Head Set Screws	
4 (.112)	(5) - (6.5)					(4) - (6)		Inch Pounds
5 (.125)	(6) - (8)					(9) - (11)		
6 (.138)	(7) - (9)		(20) - (24)			(9) - (11)		
8 (.164)	(12) - (16)		(40) - (47)			(17) - (23)		
10 (.190)	(20) - (26)		(50) - (60)			(31) - (41)		
1/4 (.250)	4 - 5	5 - 6	7 - 10	7 - 10	10 - 13	6 - 8	17 - 19	Foot Pounds
5/16 (.312)	7 - 9	9 - 12	15 - 20	15 - 20	20 - 26	13 - 15	32 - 38	
3/8 (.375)	13 - 17	16 - 21		27 - 35	36 - 47	22 - 26	65 - 75	
7/16 (.438)	20 - 26	26 - 34		43 - 56	53 - 76	33 - 39	106 - 124	
1/2 (.500)	27 - 35	39 - 51		65 - 85	89 - 116	48 - 56	162 - 188	
5/8 (.625)		80 - 104		130 - 170	171 - 265		228 - 383	
3/4 (.750)		129 - 168		215 - 280	313 - 407		592 - 688	
1 (1.000)		258 - 335		500 - 650	757 - 984		1281 - 1489	

METRIC

Thread Size	4.8/5.6	8.8 Stainless Steel	10.9	12.9	Set Screws
M3	43 - 56 Ncm	99 - 128 Ncm	139 - 180 Ncm	166 - 215 Ncm	61 - 79 Ncm
M4	99 - 128 Ncm	223 - 290 Ncm	316 - 410 Ncm	381 - 495 Ncm	219 - 285 Ncm
M5	193 - 250 Ncm	443 - 575 Ncm	624 - 810 Ncm	747 - 970 Ncm	427 - 554 Ncm
M6	3.3 - 4.3 Nm	7.6 - 9.9 Nm	10.8 - 14 Nm	12.7 - 16.5 Nm	7.5 - 9.8 Nm
M8	8.1 - 10.5 Nm	18.5 - 24 Nm	26.2 - 34 Nm	31 - 40 Nm	18.3 - 23.7 Nm
M10	16 - 21 Nm	37 - 48 Nm	52 - 67 Nm	63 - 81 Nm	
M12	28 - 36 Nm	64 - 83 Nm	90 - 117 Nm	108 - 140 Nm	
M14	45 - 58 Nm	102 - 132 Nm	142 - 185 Nm	169 - 220 Nm	
M16	68 - 88 Nm	154 - 200 Nm	219 - 285 Nm	262 - 340 Nm	
M20	132 - 171 Nm	300 - 390 Nm	424 - 550 Nm	508 - 660 Nm	
M22	177 - 230 Nm	409 - 530 Nm	574 - 745 Nm	686 - 890 Nm	
M24	227 - 295 Nm	520 - 675 Nm	732 - 950 Nm	879 - 1140 Nm	

GENERAL INFORMATION

GENERAL MACHINE DIMENSIONS/CAPACITIES/PERFORMANCE

MODEL	20 in. / 500 mm Single Disk	24 in. / 600 mm Dual Disk
Length	55 in / 1397 mm	55 in / 1397 mm
Width (Body)	26.5 in / 673 mm	26.5 in / 673 mm
Height	49 in / 1245 mm	49 in / 1245 mm
Weight	490 lb / 222 kg	495 lb / 225 kg
Weight (with batteries)	725 lb / 329 kg	730 lb / 331 kg
GVW	1100 lb / 500 kg	
Squeegee width	28.6 in / 727 mm	30.7 in / 780 mm
Solution tank capacity	14.1 gal / 53 L	
Recovery tank capacity	18.4 gal / 70 L	
Severe Environment tank capacity	0.66 gal / 2.5 L	
Automatic battery watering tank capacity	0.48 gal / 1.8 L	
Scrubbing path width	20 in / 508 mm	24 in / 610 mm
Down pressure	62 lb / 28 kg 90 lb / 41 kg	64 lb / 29 kg 91 lb / 41 kg
Scrubbing speed	0.2 - 3.6 mph / 0.32 - 5.8 km/h	
Transport speed	0.2 - 3.6 mph / 0.32 - 5.8 km/h	
Reverse speed	0 - 1.1 mph / 0 - 1.8 km/h	
Productivity rate - estimated actual	24,588 ft ² /hr / 2,287 m ² /hr	30,052 ft ² /hr / 2,795 m ² /hr
ec-H2O productivity rate - est. actual	25,284 ft ² /hr / 2,351 m ² /hr	30,903 ft ² /hr / 2,874 m ² /hr
Aisle turnaround width	60 in / 1524 mm	
Ramp incline for scrubbing	9%	
Ramp incline for transporting (GVWR)	9%	
Ramp incline for loading - empty tanks	18%	
Solution flow rate	Low: 0.15 gpm / 0.57 L/min, Med: 0.35 gpm / 1.32 L/min, High: 0.50 gpm / 1.89 L/min	
ec-H2O solution flow rate	Low: 0.12 gpm / 0.45 L/min, Med: 0.25 gpm / 0.95 L/min, High: 0.35 gpm / 1.32 L/min	
Brush motor(s)	24VDC, 0.87 Hp / 65 kW	
Propel motor	24 VDC, 0.64 Hp / 48 kW, 20A	
Vacuum motor	24 VDC, 0.62 Hp / 46 kW, 19.1A	
Water lift	42 in H2O / 1067 mm	
Water lift Quiet-mode	30 in H2O / 762 mm	
ec-H2O solution pump	24 VDC, 2 A, 1.0 gpm / 3.8 L/min, min open flow	
Severe Environment solution pump	24 VDC, 1.7 A, 2.0 oz/min / 59 ml/min, min open flow	
Automatic battery watering pump	13.5 VDC, 4 A, 0.9 gpm / 3.5 L/min, min open flow	
Machine voltage	24 VDC	
Battery capacity	4-6V 210AH C/20 Wet, 4-6V 240AH C/20 Wet, 4-6V 220AH C/20 AGM	
Total power consumption	1.1 kW	
Battery Charger - on-board	115 - 240VAC, 50/60Hz, 24VDC, 25A	
Battery Charger - smart off-board	85 - 270VAC, 50/60Hz, 24VDC, 650W (27.1A)	

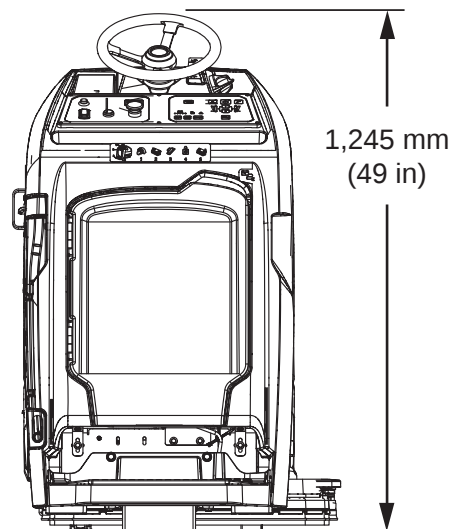
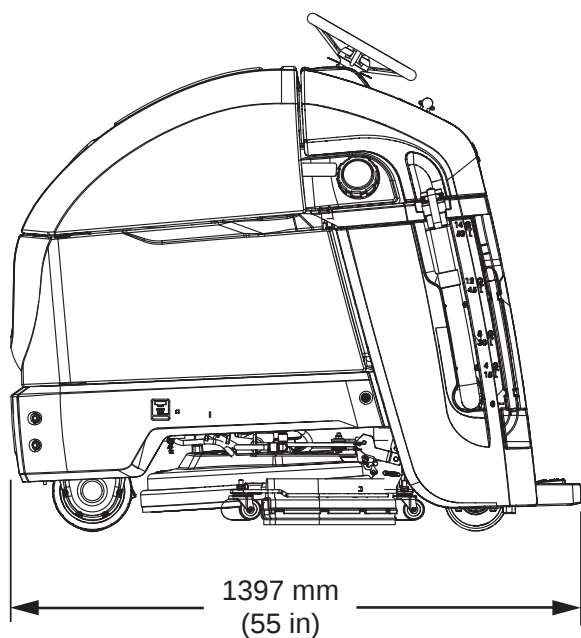
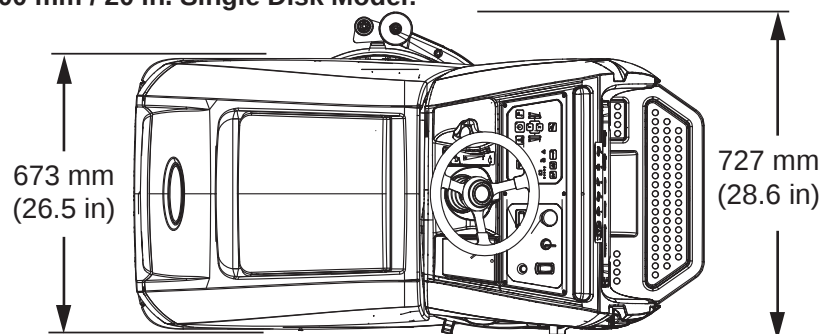
GENERAL MACHINE DIMENSIONS/CAPACITIES/PERFORMANCE

MODEL	20 in. / 500 mm Single Disk	24 in. / 600 mm Dual Disk
Protection grade	IPX3	
Sound pressure level L_{pA}^*	63.7 dBA	64.5 dBA
Sound pressure level L_{pA}^* - Quiet mode	59.7 dBA	61.3 dBA
Sound uncertainty K_{pA}^*	3.0 dBA	3.0 dBA
Sound power level uncertainty L_{pA} - uncertainty K_{pA}^*	82.5 dBA	84.0 dBA
Machine vibration at hand-arm*	<2.5 m/s ²	
Ambient operating temperature	Min: 36° F / 2° C Max: 110° F / 43° C	

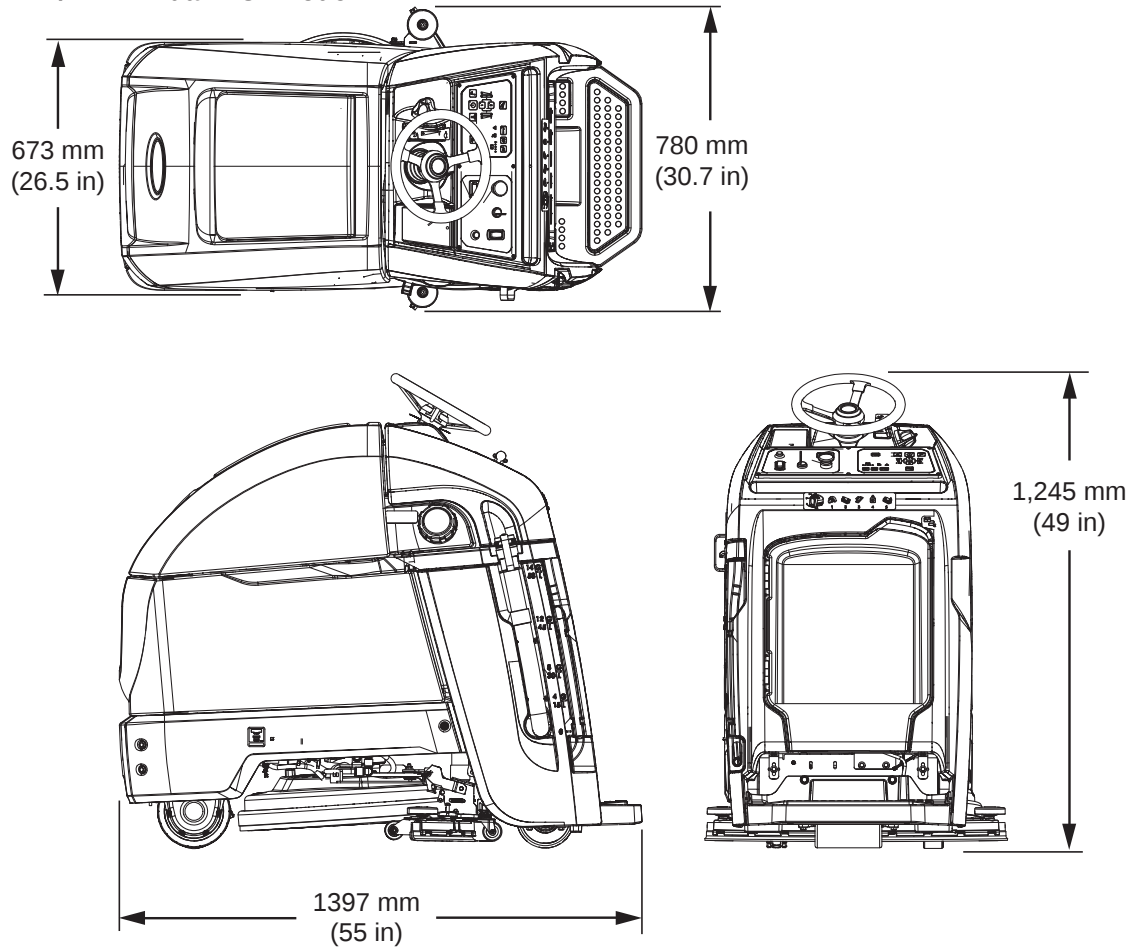
GENERAL INFORMATION

MACHINE DIMENSIONS

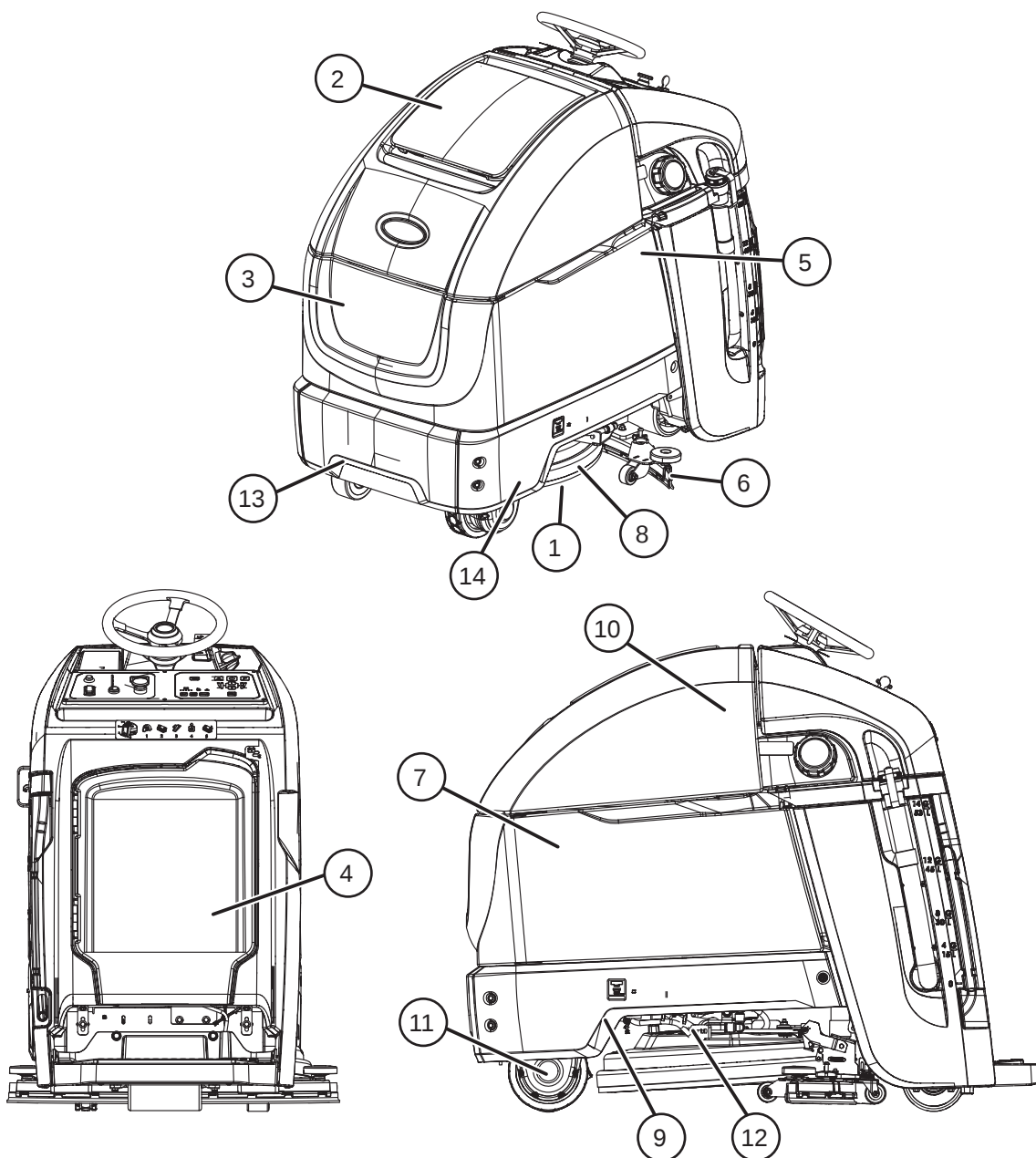
500 mm / 20 in. Single Disk Model:



600 mm / 24 in. Dual Disk Model:



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
Daily	O	1	Pad(s)	Check, flip or replace	
	O	1	Brush(es)	Check, clean	
	O	6	Squeegee	Clean, check for damage and wear	
	O	8	Scrub head skirt	Check for damage and wear	
	O	2	Recovery tank	Drain, rinse, clean float shut-off screen and debris tray	
	O	3	Solution tank	Drain, rinse	
	O	4	Severe Environment tank (option)	Check, refill	CAD
	O	5	Automatic battery watering tank (option)	Check, refill	DW
	O	7	Batteries	Charge if necessary	
Weekly	O	7	Battery cells	Check electrolyte level	DW
	O	7	Battery compartment	Check for liquid	
	O	6	Squeegee assembly drip trap reservoir (dual disk model)	Check. Clean	
50 Hours	O	2	Recovery tank lid seal	Check for wear	
	O	9	Solution tank filter	Remove and clean	
100 Hours	O	7	Battery watering system (option)	Check hoses for damage and wear	
200 Hours	O	7	Batteries, terminals and cables	Check and clean	
	T	13	Steering chain	Lubricate, check tension, and check for damage and wear	GL
	T	14	Steering cable	Check tension. Check for damage and wear	
750 Hours	T	10	Vacuum motor	Replace carbon brushes	
1250 Hours	T	11	Propel motor	Replace carbon brushes	
	T	12	Brush motor(s)	Replace carbon brushes	

MAINTENANCE

MACHINE MAINTENANCE

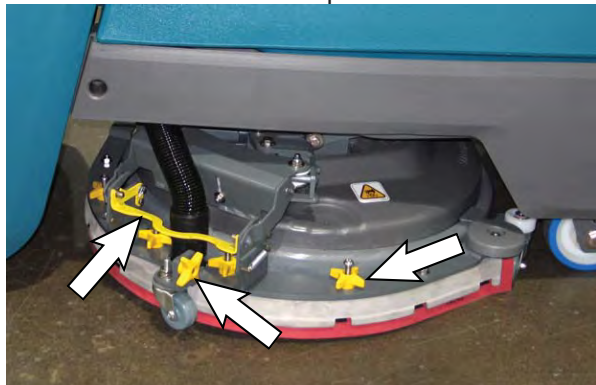
To keep the machine in good working condition, simply perform the following maintenance procedures.

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

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

YELLOW TOUCH POINTS

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



3. Wipe the squeegee blades clean. Inspect blades for wear and damage. Rotate blades if worn. See SQUEEGEE BLADE REPLACEMENT.



4. Clean scrub head skirt. Check for wear and damage. Replace if worn or damaged.



AFTER DAILY USE

1. Turn pad over or replace when worn. See BRUSH AND PAD REPLACEMENT.



2. Replace brushes when they no longer clean effective. See BRUSH AND PAD REPLACEMENT.



5. Drain, rinse out, and clean the recovery tank. See DRAINING TANKS



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

6. Remove the debris tray and empty.



7. Remove and clean the float shut-off screen.



8. Drain and rinse out the solution tank.



9. Severe Environment option - Refill the Severe Environment tank with a recommended cleaning detergent at full concentration. Replace cap.



10. Automatic battery watering option - Refill tank with distilled water. Replace cap.

NOTE: Check for liquid in the battery compartment whenever replenishing the automatic battery watering tank. Drain all liquid from the battery compartment. See BATTERY COMPARTMENT DRAIN VALVE.



MAINTENANCE

11. Charge batteries. See BATTERIES.

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

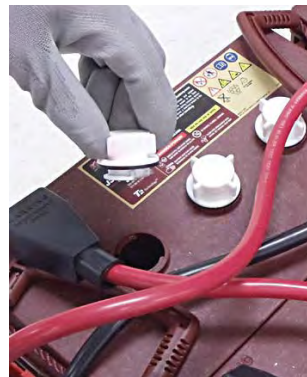
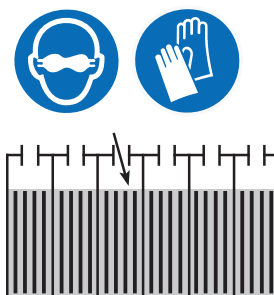
12. Clean the outside surface of the machine with an all purpose cleaner and damp cloth.



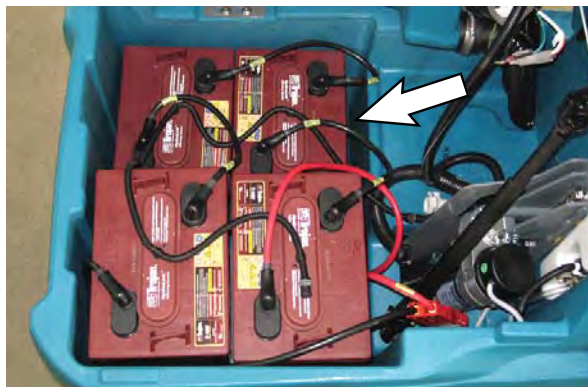
AFTER WEEKLY USE

1. Check the electrolyte level in all batteries. See BATTERIES.

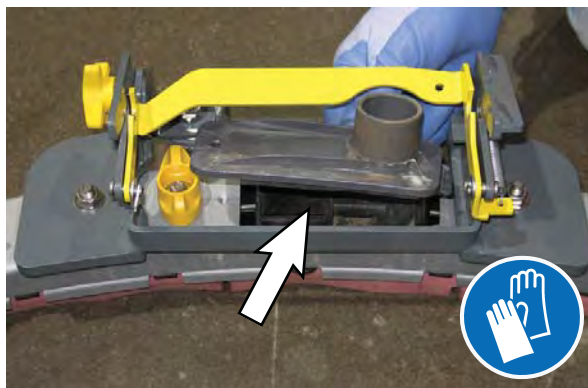
NOTE: If machine is equipped with the automatic or manual battery watering system, See BATTERIES.



2. Check for liquid in the battery compartment. See BATTERY COMPARTMENT DRAIN VALVE.



3. **Machines with 24 in. (600 mm) scrub heads only:** Remove the drip trap cover from the squeegee assembly and clean reservoir.



AFTER EVERY 50 HOURS OF USE

1. Inspect and clean the seal on the recovery tank lid. Replace seal if damaged.



2. Drain solution tank. Remove the solution tank filter and clean screen. Turn the filter bowl counter-clockwise to remove.



AFTER EVERY 100 HOURS OF USE

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

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



AFTER EVERY 200 HOURS OF USE

1. Check batteries for loose battery and clean the surface of the batteries, including terminals and cable clamps to prevent corrosion. See BATTERIES.
2. Check for damage or wear and lubricate the steering chain.

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



3. Check the steering cable for damage or wear. Use tension gauge to check steering cable tension.

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



ELECTRIC MOTORS

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

Carbon Brush Replacement	Hours
Vacuum motor	750
Propel motor	1250
Brush motor(s)	1250

MAINTENANCE

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 proper maintenance. To get the most life from the batteries:

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

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

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

MAINTENANCE-FREE BATTERIES

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

FLOODED (WET) LEAD-ACID BATTERIES

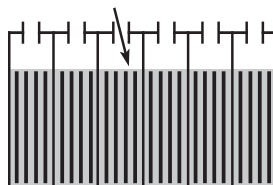
The flooded (wet) lead-acid batteries require routine watering as described below. Check the battery electrolyte level weekly.

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

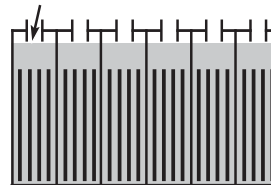
The electrolyte level should be slightly above the battery plates as shown before charging. Add distilled water if low. **DO NOT OVERFILL.** The electrolyte will expand and may overflow when charging. After charging, distilled water can be added up to about 3 mm (0.12 in) below the sight tubes.



Before Charging



After Charging



CHECKING CONNECTIONS / CLEANING

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



CHARGING BATTERIES

The charging instructions in this manual are intended for the battery charger supplied with your machine. The use of other battery chargers that are not supplied and approved by Tennant are prohibited. If your machine is equipped with an off-board battery charger refer to the charger's owners manual for operating instructions. Contact distributor or Tennant for battery charger recommendations if machine is not equipped with charger.

FOR SAFETY: Do not use incompatible battery chargers as this may damage battery packs and potentially cause a fire.

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

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



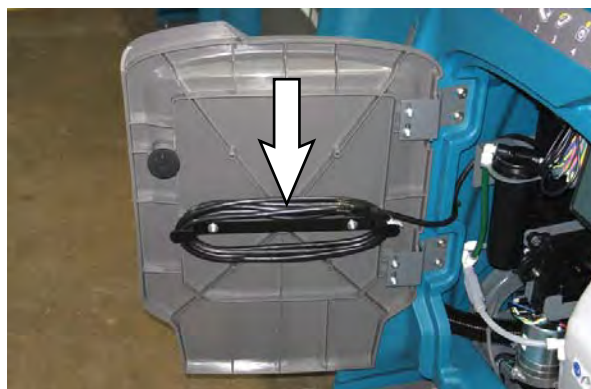
WARNING: Batteries emit hydrogen gas. Explosion or fire can result. Keep sparks and open flame away when charging.

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

FOR SAFETY: When servicing batteries, stop on level surface, turn off machine, and remove key.

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

FOR SAFETY: Open recovery tank if temperature is above 80°F/27°C when charging batteries.



For models equipped with off-board chargers, first connect the charger's DC cord into the machine's battery charge receptacle then plug the AC power supply cord into a properly grounded wall outlet. Refer to the off-board battery charger's owner manual for operating instructions. Do not close the recovery tank on the charger cables when charging with an off-board charger.

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

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

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



Pro-membrane



Pro-panel

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

MAINTENANCE

6. After charging batteries unplug the power supply cord and wrap cord around the cord hooks.

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

BATTERY CHARGER SETTINGS

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

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

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

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

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

OFF-BOARD BATTERY CHARGER:

1. To change the off-board battery charger settings, refer to the off-board charger's owner manual.
2. To reprogram the machine's battery discharge indicator (BDI):

Pro-Membrane Model - Service application software required, contact service.

Pro-Panel Model - See CHANGING THE ON-BOARD BATTERY CHARGER SETTINGS in the SUPERVISOR section for Pro-Panel models.

ON-BOARD BATTERY CHARGER:

Pro-Membrane Model - To change the on-board battery charger settings, service application software required, contact service. As an alternative, the charger profile may be manually changed. See CHANGING ON-BOARD BATTERY CHARGER SETTINGS for Pro-Membrane model. The battery discharge indicator will automatically reprogram to match battery type when the battery charger profile is changed.

Pro-Panel Model - To change the on-board battery charger settings, see CHANGING THE ON-BOARD BATTERY CHARGER SETTINGS in the SUPERVISOR section for Pro-Panel models. The battery discharge indicator will automatically reprogram to match battery selection.

CHANGING ON-BOARD BATTERY CHARGER SETTINGS (Pro-Membrane model)

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

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

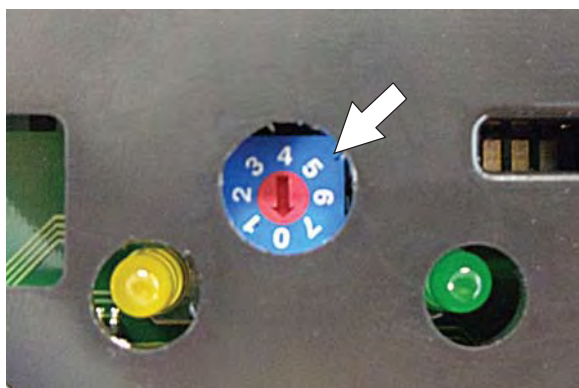
1. Disconnect the battery cable connection at machine.

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

2. Open the access panel to access the on-board battery charger.
3. Carefully peel back the charger display label to access the dial settings.



4. Using a small standard screwdriver, turn the dial to the appropriate battery type according to the following chart.



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

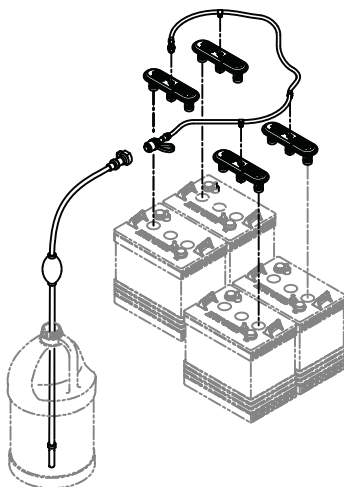
* The CAN-BUS setting, dial position "0", is the software setting that is programmed to match battery type supplied with machine. When the dial is manually changed to a different setting, it should not be reset back to "0" otherwise battery damage may result. Service Application Software is required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

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

MAINTENANCE

HYDROLINK® BATTERY WATERING SYSTEM (Trojan® Battery OPTION)

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

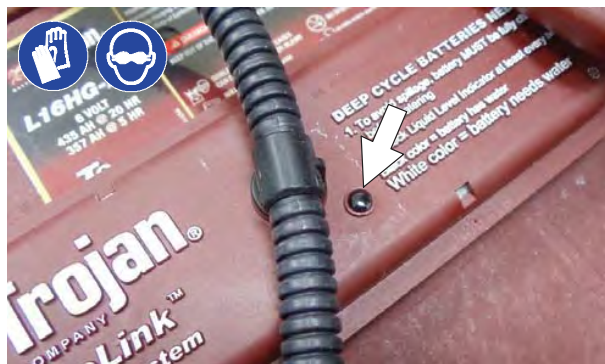


The optional HydroLink battery watering system provides a safe and easy way to maintain the proper electrolyte levels in your batteries. It is designed exclusively for Trojan flooded (wet) lead-acid batteries.

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

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

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



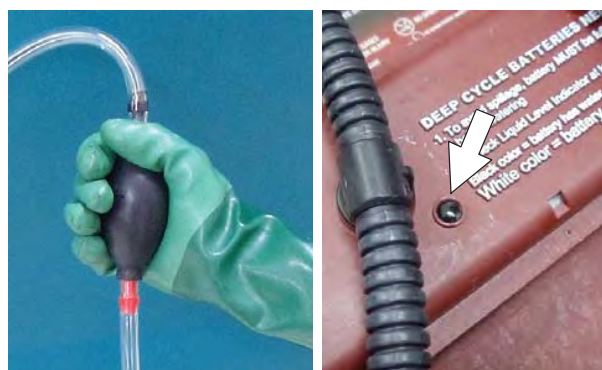
3. Locate the battery fill hose coupler inside the battery compartment. Remove the dust cap and connect the hand pump hose.



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



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



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

SMART-FILL AUTOMATIC BATTERY WATERING (OPTION)

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

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

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

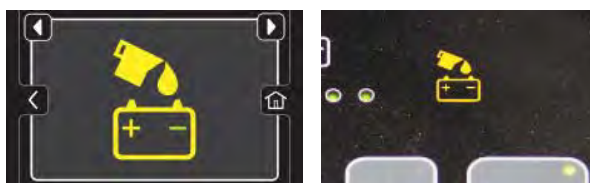


Check the water level in the automatic watering tank periodically. Add distilled water when low.

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



The automatic battery watering indicator also alerts user to add distilled water when tank is empty. See CONTROL PANEL OPERATION for further details.



BATTERY COMPARTMENT DRAIN VALVE

Use the battery compartment drain valve to drain liquid from the battery compartment.

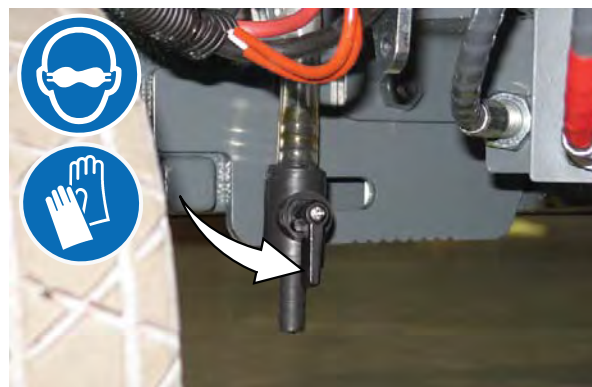
FOR SAFETY: When servicing machine, always follow site safety rules when disposing battery compartment liquid.

1. Position front end of machine over area where battery compartment can be safely drained, turn off the machine, and remove the key.

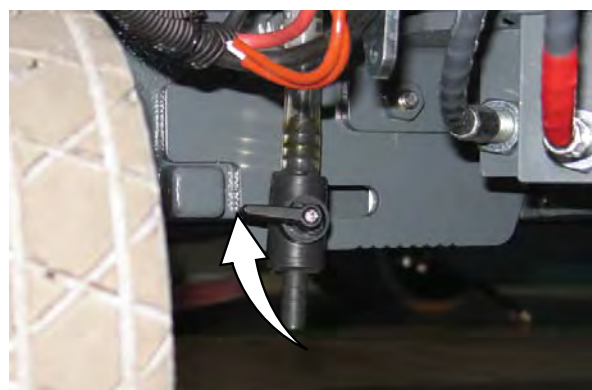
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and remove key.

2. Open the battery compartment drain valve and allow the liquid to drain from the battery compartment:

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



3. Close the battery compartment drain valve after all liquid has drained from the battery compartment.



BRUSH AND PAD REPLACEMENT

Replace the pads when they no longer clean effectively. Replace the brushes when they no longer clean effectively.

Cleaning pads must be placed on pad drivers before they are ready to use. The cleaning pad is held in place with a center disk. Both sides of the pad can be used for scrubbing. Turn the pad over to use the other side.

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

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

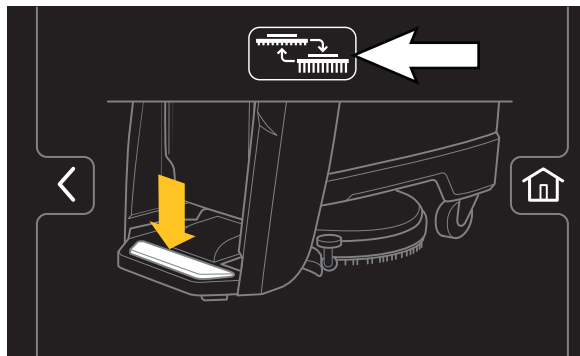
REPLACING BRUSH(ES) OR PAD(S) ON PRO-PANEL MACHINES

1. Stand with both feet on the operator presence pedal (do not press the go pedal), turn the key to the ON position, and press the brush change button to raise the scrub head to the correct level for changing the brush(es) or pad(s).

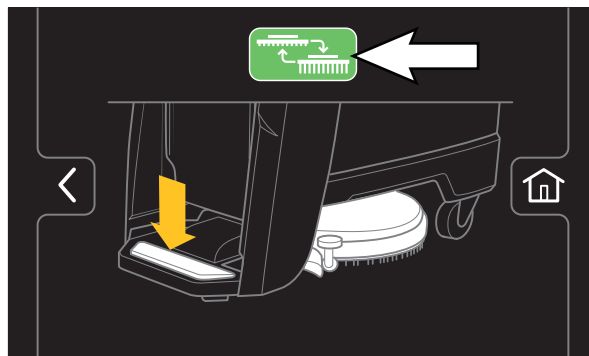


NOTE: Remain standing on the operator presence pedal until the scrub head has moved through the entire range of motion and has stopped moving. Process will be paused if the operator presence pedal is released. Step back onto the operator presence pedal and press brush change button again to continue the process. Turn key switch to OFF position to abort process.

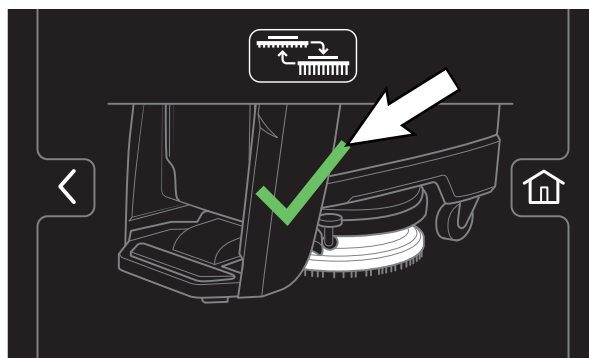
2. Press the brush change button to disengage the brush.



The brush change button will turn green while the scrub head repositions to allow the brush or pad driver to be changed.



3. Wait for the green check mark to appear on the Pro-Panel display.



4. Release the operator presence pedal.

5. **Machines equipped with magnetic brush hubs:** Remove the brush or pad driver from under the scrub head.



WARNING: Magnetic Field Hazard. Magnetic pad driver/brush can be harmful to those with pacemakers or medical implants.



Machines equipped with 3-lug brush hubs: To remove the brush or pad driver, grip the disk and give it a quick turn.



6. **Machines equipped with magnetic brush hubs:** Push the new brush or pad driver under the scrub head and lift the brush or pad driver until the magnet secures the brush or pad to the drive hub.

Machines equipped with 3-lug brush hubs: Position the three lugs into the motor hub slots and give the pad driver / brush a quick counter-clockwise turn to engage hub.

7. Ensure the brush or pad driver is securely mounted on the brush drive hub.

8. Ensure the scrub head skirt is properly positioned on the scrub head.

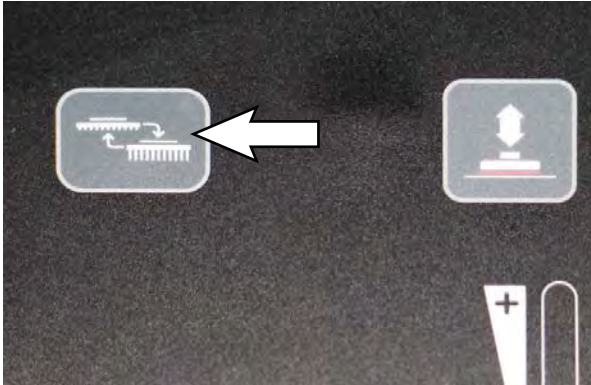


9. Repeat procedure for the other brush or pad driver, if machine is equipped with dual brush scrub head.

MAINTENANCE

REPLACING BRUSH(ES) OR PAD(S) ON PRO-MEMBRANE PANEL MACHINES

1. Stand with both feet on the operator presence pedal (do not press the go pedal), turn the key to the ON position, and press the brush change button to raise the scrub head to the correct level for changing the brush(es) or pad(s).



NOTE: Remain standing on the operator presence pedal until the scrub head has moved through the entire range of motion. Process will be paused if the operating presence pedal is released. Step back onto the operator presence pedal and press the brush change button again to continue the process. Turn key switch to OFF position to abort process.

2. Release the operator pedal when the green LED stops flashing and remains illuminated solid green.
3. **Machines equipped with magnetic brush hubs:** Remove the brush or pad driver from under the scrub head.



WARNING: Magnetic Field Hazard. Magnetic pad driver/brush can be harmful to pacemaker wearers or medical implants.



Machines equipped with 3-lug brush hubs: To remove the brush or pad driver, grip the disk and give it a quick turn.



4. **Machines equipped with magnetic brush hubs:** Push the new brush or pad driver under the scrub head and lift the brush or pad driver until the magnet secures the brush or pad to the drive hub.

Machines equipped with 3-lug brush hubs: Position the three lugs into the motor hub slots and give the pad driver / brush a quick counter-clockwise turn to engage hub.

5. Ensure the brush or pad driver is securely mounted on the brush drive hub.
6. Ensure the scrub head skirt is properly positioned on the scrub head.



7. Repeat procedure for the other brush or pad driver, if machine is equipped with dual brush scrub head.
8. Step back onto the operator presence pedal to allow the machine to complete the brush change cycle.

SQUEEGEE BLADE REPLACEMENT

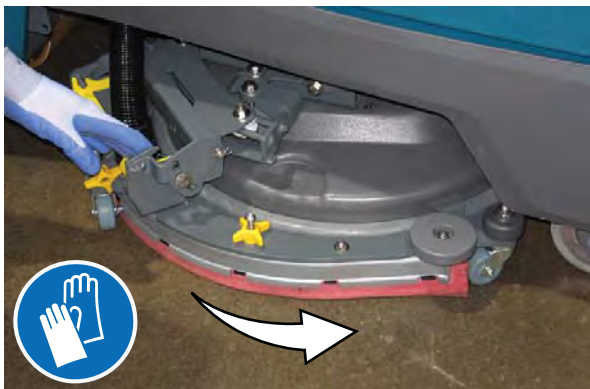
Each squeegee blade has four wiping edges. When the blades become worn, simply rotate the blades end-for-end or top-to-bottom for a new wiping edge. Replace blade if all four edges are worn.

REPLACING SQUEEGEES ON MACHINES WITH 20 IN. (500 MM) SCRUB HEADS

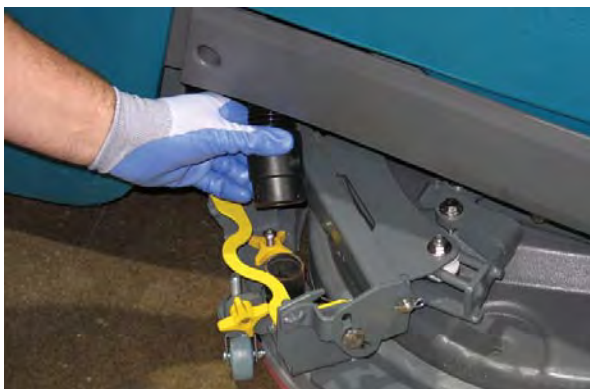
1. Stop the machine and lower the scrub head.

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

2. Rotate the squeegee assembly to the right side of the machine.



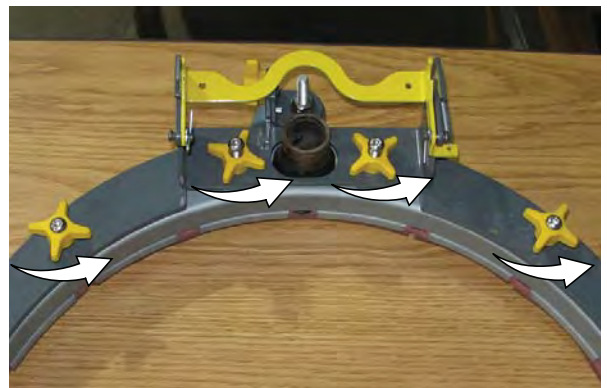
3. Disconnect the vacuum hose from the squeegee assembly.



4. Squeeze the squeegee retainer lever and remove the squeegee assembly from the machine.



5. Fully loosen the four knobs on squeegee assembly. This will separate the spring loaded blade retainer from squeegee frame.

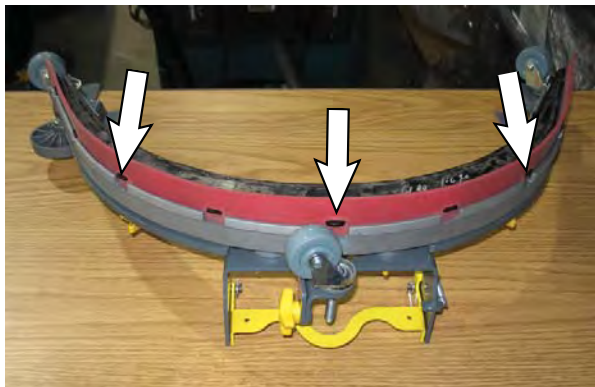


6. Remove worn blade(s) from the blade retainer.



MAINTENANCE

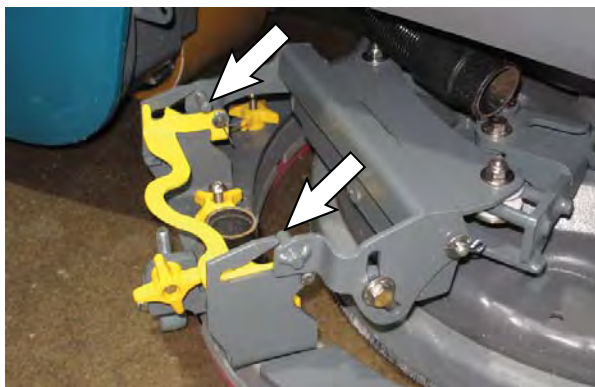
7. Rotate the rear blade(s) to a new wiping edge and reinstall blade(s). Make sure to align the slots in the blade(s) with retainer tabs.



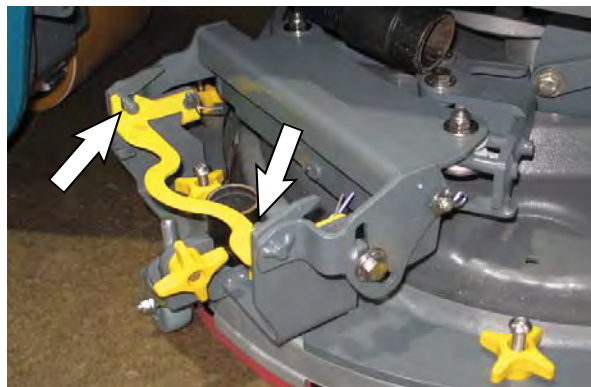
8. Squeeze the squeegee frame and blade retainer together and re-tighten the four knobs.



9. Position the squeegee assembly bracket near the squeegee carriage and align the squeegee carriage pins into the squeegee assembly bracket.



10. Slide the squeegee assembly onto the squeegee carriage until both squeegee carriage pins are secured in the bracket.



11. Be sure both squeegee tabs are positioned above the scrub head skirt.



12. Connect the vacuum hose to the squeegee assembly.

13. Rotate and center the squeegee assembly underneath the machine.



REPLACING SQUEEGEES ON MACHINES WITH 24 IN. (600 MM) SCRUB HEADS

1. Stop the machine and lower the scrub head.

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

2. Rotate the squeegee assembly to the right side of the machine.



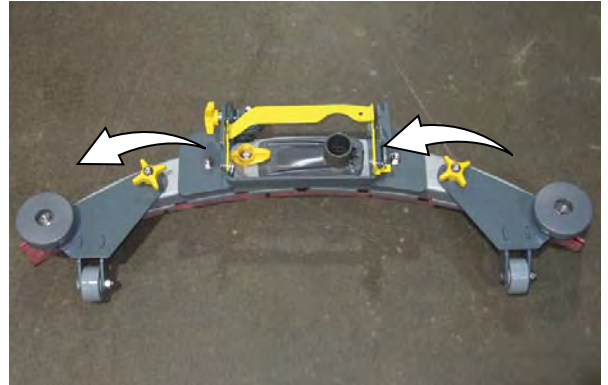
3. Disconnect the vacuum hose from the squeegee assembly.



4. Squeeze the squeegee retainer lever and remove the squeegee assembly from the machine.



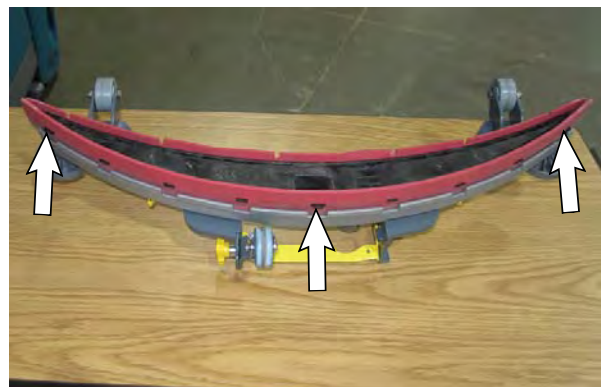
5. Fully loosen the two outside knobs on squeegee assembly. This will separate the spring loaded blade retainer from squeegee frame.



6. Remove worn blade(s) from the blade retainer.

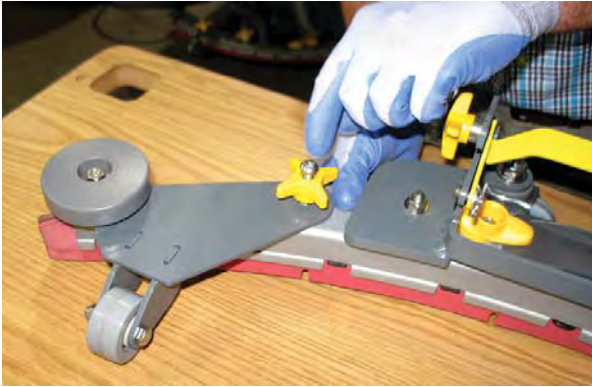


7. Rotate the rear blades to a new wiping edge and reinstall blades. Make sure to align the slots in the blades with retainer tabs.

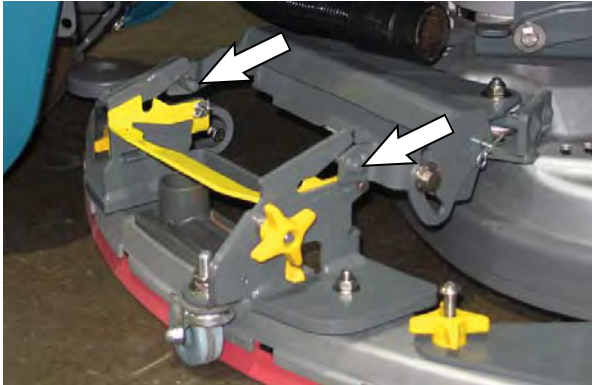


MAINTENANCE

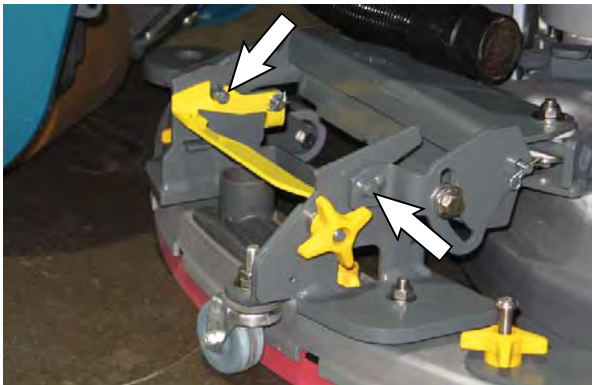
8. Squeeze the squeegee frame and blade retainer together and re-tighten the two outside knobs.



9. Position the squeegee assembly bracket near the squeegee carriage and align the squeegee carriage pins into the squeegee assembly bracket.

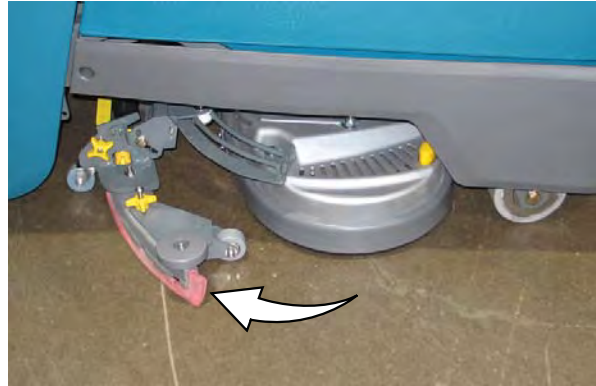


10. Slide the squeegee assembly onto the squeegee carriage until both squeegee carriage pins are secured in the bracket.



11. Connect the vacuum hose to the squeegee assembly.

12. Rotate and center the squeegee assembly underneath the machine.



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 control panel will signal a code when it's time to replace cartridge. See CONTROL PANEL OPERATION for further details.

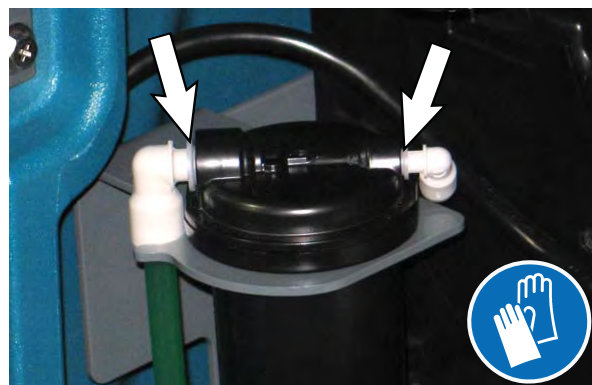
Depending on machine usage, on average, a new cartridge can last anywhere from 12 months for heavy machine usage to 24 months for light machine usage.

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

1. Park the machine on a level surface and remove the key.
2. Open the access door to access the ec-H2O water conditioning cartridge.



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



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



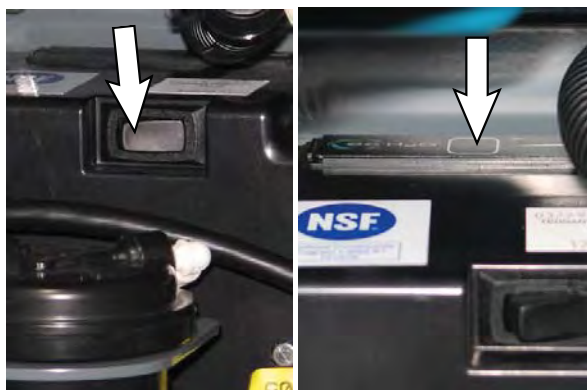
MAINTENANCE

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

Carefully read and understand all steps first before performing the following procedure.

- a. Turn key on.
- b. Press and hold the service switch, located on the ec-H2O module, for 10 seconds. After releasing service switch, the three solution flow indicator lights will begin to (ripple) move back and forth.
- 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.



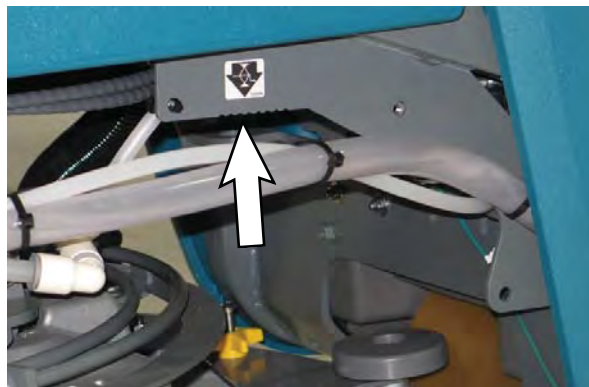
MACHINE JACKING

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

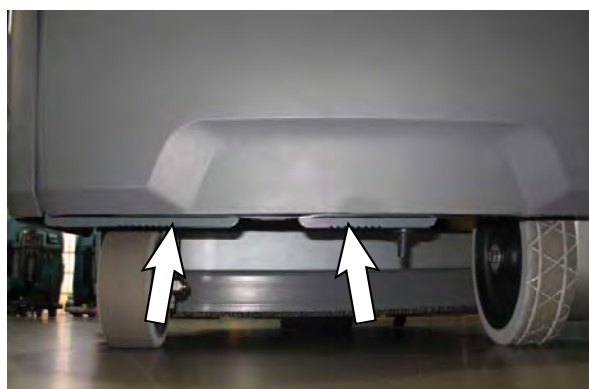
Use the designated locations to jack up the machine for service. Empty the recovery and solution tanks and position the machine on a level surface before jacking.

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

Rear jack point.



Front jack points.



JACKING UP THE FRONT OF THE MACHINE

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

1. Position the steering wheel so the front steering wheel is oriented straight out to the front of the machine.
2. Block the rear wheel.
3. Position a floor jack under the center jack point located at the front of the machine.
4. Use floor jack to raise machine from the floor.



5. Place a jack stand underneath the other jack point and lower the machine onto the jack stand so both the jack stand and floor jack are supporting the weight of the machine.



6. When finished with maintenance, use floor jack to raise machine from jack stand, remove the jack stand from under the machine, and lower the machine to the floor.

JACKING UP THE REAR OF THE MACHINE

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

1. Block both front drive wheels.
2. Rotate the squeegee assembly to the right side of the machine.
3. Remove the lower shroud from the machine.



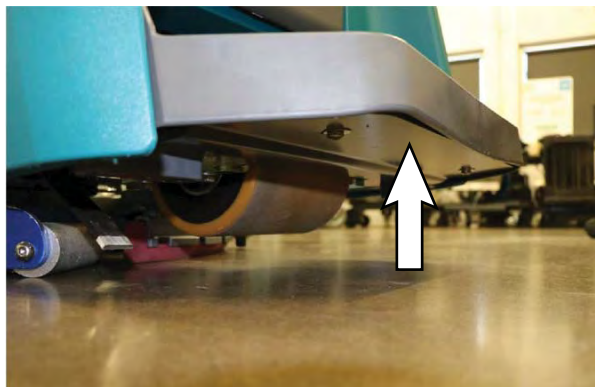
4. Position a floor jack under the tie down / jack point and arrange all hoses / cables so they are not crushed when the machine is jacked up off the floor.



5. Use a floor jack to raise machine from the floor.

MAINTENANCE

6. Place a block of wood underneath the rear of the machine to provide additional support.



7. When finished with maintenance, use floor jack to raise machine from jack stand, remove the block of wood from under the machine, and lower the machine to the floor.
8. Reinstall the lower shroud onto the machine.

PUSHING, TOWING, AND TRANSPORTING THE MACHINE

PUSHING AND TOWING THE MACHINE

FOR SAFETY: When servicing the machine, do not push or tow the machine without an operator controlling the machine.

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

The brake must be disabled before towing or pushing the machine. To disable the brake, insert the tip of a small screw driver between the electronic brake lever and the hub. The machine can move freely when the brake is disabled.



Only push or tow the machine for a very short distance and do not exceed 3.2 kph (2 mph). It

is NOT intended to be pushed or towed for a long distance or at a high speed.

ATTENTION! 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 electronic brake lever and the hub. NEVER operate the machine with the brake disabled.

FOR SAFETY: Do not operate machine with brake disabled.

TRANSPORTING THE MACHINE

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

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

FOR SAFETY: When loading/unloading, use a ramp that can support the machine weight and operator. Do not turn on inclines or ramps. Do not drive on a slippery ramp.

FOR SAFETY: When loading/unloading, Do not operate the machine on a ramp incline that exceeds an 18% grade level. Use a winch if ramp incline exceeds an 18% grade level

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

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

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

STORING MACHINE

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

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

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

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

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

FREEZE PROTECTION

Storing machine in freezing temperatures.

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



3. Pour 1 gallon / 4 liters of propylene glycol based recreational vehicle (RV) antifreeze into the solution tank.

Models equipped with optional Severe Environment detergent tank - Lift tank from machine and empty the detergent from tank. Return tank. Pour a 1/4 gallon / 1 liter of propylene glycol based recreational vehicle (RV) antifreeze into the detergent tank.



MAINTENANCE

4. Models not equipped with ec-H2O system - Turn machine on and operate the solution flow system. Turn the machine off when the antifreeze is visible on the floor.

Models equipped with ec-H2O system and Severe Environment mode - Set the detergent ratio dial to the highest concentration. Turn machine on and set solution flow rate to high. Operate ec-H2O scrubbing and press the Severe Environment button to cycle the antifreeze through both systems. Turn machine off when antifreeze is visible on the floor. This may take up to two minutes.

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

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



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

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

MACHINE TROUBLESHOOTING

Problem	Cause	Solution
Service indicator icon is flashing	Machine or on-board battery charger fault has been detected	See SERVICE INDICATOR CODES
ec-H2O icon is red or flashing red	ec-H2O system fault has been detected	See SERVICE INDICATOR CODES
ec-H2O icon is flashing red and blue	ec-H2O cartridge has reached maximum water usage or expiration	Change ec-H2O cartridge
Machine will not operate	Emergency shut-off button activated	Turn button to reset
	Machine fault detected	See SERVICE INDICATOR CODES
	Batteries discharged	Recharge batteries
	Loose battery cable(s)	Tighten loose cables
	Faulty battery(s)	Replace battery(s)
	Faulty key switch	Contact service
	Faulty green go pedal	Contact service
	Circuit breaker tripped	Reset circuit breaker
	Faulty control board	Contact service
On-board battery charger will not operate	Plug not connected to power supply	Check plug connection
	Batteries over discharged	Replace batteries
	Battery charger fault detected	See SERVICE INDICATOR CODES
	Faulty charger	Replace charger
	Faulty power supply cord	Replace power supply cord
Machine will not propel	Forward / reverse light flashing rapidly	Remove right foot from green go pedal
	Propel fault has been detected	See SERVICE INDICATOR CODES
	Circuit breaker tripped	Reset circuit breaker
	Faulty propel motor or wiring	Contact service
	Worn carbon brushes in motor	Contact service
Brush motor will not operate	Brush motor fault has been detected	See SERVICE INDICATOR CODES
	Faulty pad motor or wiring	Contact service
	Worn carbon brushes in motor	Contact service
	Broken or loose belt	Contact service
Vacuum motor will not operate	Squeegee assembly is raised off floor	Lower squeegee assembly to floor
	Vacuum motor fault has been detected	See SERVICE INDICATOR CODES
	Faulty vacuum motor or wiring	Contact service
Poor scrubbing performance	Debris caught in brush/pad	Remove debris
	Worn brush/pad	Replace brush/pad
	Incorrect brush pressure	Adjust brush pressure
	Wrong brush/pad type	Use correct brush/pad for application
	Low battery charge	Recharge batteries
	Uneven brush pressure	Scrub head/brushes not level. Contact service

MAINTENANCE

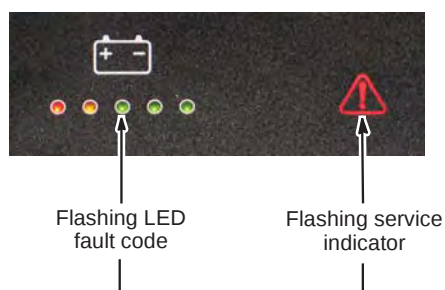
Problem	Cause	Solution
Trailing water - poor or no water pickup	Full recovery tank or excessive foam buildup	Drain recovery tank
	Loose drain hose cap	Replace cap
	Worn squeegee blades	Rotate or replace squeegee blades
	Clogged drip trap (Squeegee assembly)	Remove cover and clean
	Clogged squeegee assembly	Clean squeegee assembly
	Loose vacuum hose connection	Secure vacuum hose connection
	Clogged vacuum hose	Flush vacuum hose
	Damaged vacuum hose	Replace vacuum hose
	Clogged float shut-off screen in recovery tank	Clean screen
	Recovery tank lid not completely closed	Check lid for obstructions
	Defective seals on recovery tank lid	Replaced seal
Little or no solution flow	Empty solution tank	Refill solution tank
	Low solution flow rate set	Increase solution flow rate
	Clogged solution tank filter	Clean filter
	Plugged solution supply line	Flush solution supply line
	ec-H ₂ O pump does not prime	Restart machine and set flow rate to high
Severe Environment tank does not dispense detergent	No detergent	Refill tank
	Faulty float switch	Contact service
	Defective pump	Contact service
	Defective pump potentiometer	Contact service
	Faulty control panel	Contact service
Automatic battery watering tank does not dispense water	Tank is empty	Refill tank
	Defective pump	Contact service
	Pump not priming	Contact service
	Faulty control board	Contact service
Short run time	Low battery charge	Charge batteries
	Batteries need maintenance	See BATTERIES
	Defective battery or end of battery life	Replace batteries
	Battery discharge indicator (BDI) programmed incorrectly	See CHARGING BATTERIES
	Faulty charger	Replace battery charger
	Brush pressure set too high	Lower brush pressure

TROUBLESHOOTING

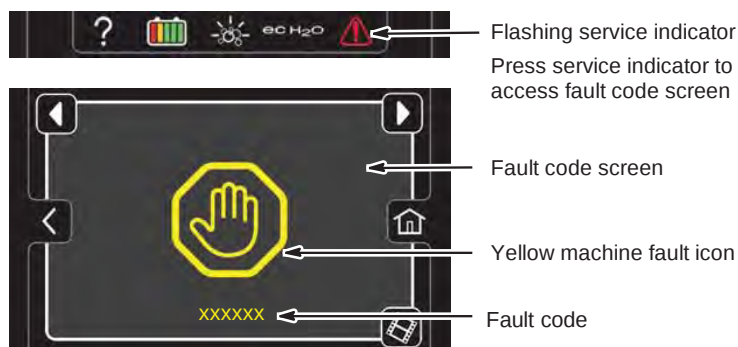
FAULTS AND WARNINGS

When the machine or battery charger detects a fault, the service indicator will flash. A fault code is provided to determine problem. Refer to the Faults and Warnings table for fault codes, conditions, reasons, and correction for the various fault codes.

Pro-Membrane Control Panel (LED)



Pro-Panel Controls (LCD)



LED Fault Code ☀ = Flashing	LCD Fault Code	Fault Condition	Reason	Correction
☀ ☀ ☀ ☀ ☀	0xFFFF0	E-Stop active fault	1. E-Stop pressed. 2. Large white i-Drive connector unplugged. 3. Large white i-Drive connector pin 7 disconnected. 4. i-Drive power wire unplugged. 5. Scrub Controller board connector J9 pin 2 disconnected. 6. Scrub Controller board connector J8 unplugged. 7. Scrub Controller board connector J8 pin 7 disconnected.	1. Key off machine. 2. Press and reset E-Stop button. 3. Key on machine. 4. If fault persists, check harness connections between E-Stop and control module. 5. Replace or repair harness. 6. Replace E-Stop.
● ● ● ☀ ●	0x0201	Actuator Open Warning	Wiring, connector or control board issue on the actuator.	Check connectors and connector pins.
● ● ● ☀ ☀	0x0101	Scrub Motor Open Warning	1. Wiring, connector or control board issue on the scrub motor. 2. J10 connector on scrub controller board unplugged. 3. Scrub controller board power disconnected. 4. Scrub controller in-line power fuse defective/blown. 5. Scrub controller board problem.	Check connections. Scrub controller board gets power from key switch and battery. If connections are good, replace scrub control board.

LED Fault Code ☀ = Flashing	LCD Fault Code	Fault Condition	Reason	Correction
● ● ☀ ● ●	0x0501	Vacuum Motor Open Warning	1. Wiring, connector, or control board issue on vacuum. 2. J10 connector on scrub controller board unplugged. 3. Scrub controller board power disconnected. 4. Scrub controller in-line power fuse defective/blown.	Check connections. Board gets power from key switch and battery.
● ● ☀ ● ☀	0x0601	Detergent Pump Open Warning	1. Wiring, connector, or control board issue on detergent pump. 2. Detergent pot connector unplugged. 3. Detergent pot connector Pin 5 or 6 disconnected. 4. Scrub controller board J8 pin 1 or 6 disconnected.	Check connections.
● ● ☀ ☀ ●	0x0910	Propel Breaker Tripped Fault	1. Issue with propel motor, wiring or the i-Drive module. 2. Large white i-Drive connector unplugged. 3. Large white i-Drive connector pin 7 disconnected. 4. i-Drive power wire unplugged. 5. Scrub Controller board connector J9 unplugged and bail activated. 6. Scrub Controller board connector J9 pin 7 disconnected.	Disconnect battery and reset the circuit breaker. Check connections.
● ● ☀ ☀ ☀	0x0901	Propel Motor Open Fault	1. Motor on the propel i-Drive is not connected.	Check connections.
● ☀ ● ● ☀	0x0301	Solution Valve Open Warning	1. Wiring, connector, or control board issue with valve. 2. Scrub controller board connector J8 pin 2 disconnected.	Check connections.
● ☀ ● ☀ ☀	0x0FF00	Software Load Failure	1. Software failed to load correctly.	1. Power cycle machine. 2. If failure persists, reload software.
● ☀ ☀ ☀ ●	0xFF20	Scrub Controller CAN Communication Fault	1. Control boards are not communicating properly. 2. Board lost power (wiring issue). 3. Control board may be damaged.	1. Power cycle machine. 2. No communication with a network module. Use CAN open troubleshooting techniques.
	0x0F103			
	0x0F104			
	0x0B04	Battery Watering CAN Communication Fault	1. Control boards are not communicating properly. 2. Board lost power (wiring issue) 3. Control board may be damaged. 4. ABW connector unplugged (never plugged in). 5. ABW connector pin 11 or 12 disconnected. 6. ABW connector power pin disconnected.	1. Power cycle machine. 2. No communication with a network module. 3. Check connections.

LED Fault Code ☀ = Flashing	LCD Fault Code	Fault Condition	Reason	Correction
☀ ● ● ● ☀	0x0900	Propel i-Drive Generic Fault	1. Generic i-Drive Fault. 2. Large white i-Drive connector pin 2, 8, or 9 disconnected. 3. User Interface speed pot connector unplugged.	Power cycle machine. Check connections.
	0x0903	Propel Communication Lost Warning	1. Large white i-Drive connector pin 5 disconnected. 2. Small white i-Drive connector unplugged. 3. Small white i-Drive connector pin 3 or 4 disconnected. 4. Scrub controller board connector J2 or J8 unplugged. 5. Scrub controller board J9 pin 1 or 2 disconnected. 6. Scrub controller board J8 pin 7 disconnected. 7. Smaller of the two console connectors unplugged. 8. User interface board connector J4 or J9 unplugged.	Power cycle machine. Check connections.
	0x0904	Propel Power Cycle Needed	1. i-Drive just programmed with new parameters. 2. i-Drive unit is faulty.	Power cycle machine. Replace i-Drive.
	0x0905	Propel Current Limit Fault	1. Propel motor drawing too much current.	Power cycle machine.
	0x0920	Propel Speed Control Wiper Warning	1. Propel speed control wiper out of bounds.	1. Check wiring to speed control potentiometer. 2. Power cycle machine. 3. If warning persists, replace speed control potentiometer. 4. Test high and low speed functions.
	0x0921	Propel Speed Control Reference Warning	1. Propel speed control reference incorrect.	Check wiring to speed control potentiometer. Power cycle machine.
	0x0922	Propel Throttle Trip Reference Warning	1. Propel throttle trip reference incorrect.	Check wiring to the bail sensor. Power cycle machine.
	0x0923	Propel High Battery Voltage Warning	1. Battery voltage at propel controller is too high.	Check battery wires going to the i-Drive. Power cycle machine.
	0x0924	Propel High Battery Voltage 2 Warning	1. Battery voltage at propel controller is too high.	Check battery wires going to the i-Drive. Power cycle machine.
	0x0925	Propel Inhibit 1 Warning	1. Propel controller inhibit 1 fault tripped.	Power cycle machine.
	0x0926	Propel Inhibit 2 Warning	1. Propel controller inhibit 2 fault tripped.	Power cycle machine.
	0x0927	Propel Inhibit 3 Warning	1. Propel controller inhibit 3 fault tripped.	Power cycle machine.
	0x0928	Propel Watchdog Warning	1. Propel controller watchdog tripped.	Power cycle machine.
	0x0929	Propel Bad Setting Warning	1. Bad setting was programmed to i-Drive.	Reprogram i-Drive.

LED Fault Code ☼ = Flashing	LCD Fault Code	Fault Condition	Reason	Correction
☼ ● ● ● ☼	0x0930	Propel ROM Check Warning	1. i-Drive memory is corrupted. 2. i-Drive damaged.	Replace i-Drive.
	0x0931	Propel EEPROM Check Warning	1. i-Drive settings are corrupted. 2. i-Drive damaged.	Replace i-Drive
	0x0932	Propel Internal 12V Error	1. i-Drive hardware is damaged.	Replace i-Drive.
	0x0933	Propel Low Battery	1. Battery voltage at propel controller is very low.	Check cables.
	0x0934	Propel Very Low Battery	1. Battery voltage at propel controller is extremely low.	Check cables.
	0x0936	Low Bridge Voltage	1. Power surge on propel module inputs causing damage to i-Drive circuitry.	Replace i-Drive.
	0x0942	Propel Module Internal Temp Sensor	1. Internal propel motor temperature switch has opened. 2. Broken, loose, or disconnected wire on i-Drive P1-6.	Allow motor to cool and key cycle machine to reset. If motor is cool and problem persists, check wiring to i-Drive and check continuity between B- and P1-6 (motor temp switch).
	0x0943	Propel Motor Temp Sensor	1. Internal propel motor temperature switch has opened. 2. Broken, loose, or disconnected wire on i-Drive P1-6.	Allow motor to cool and key cycle machine to reset. If motor is cool and problem persists, check wiring to i-Drive and check continuity between B- and P1-6 (motor temp switch).
	0x0950	Propel Incorrect Profile	Fault occurs when machine has different propel profiles depending on machine configuration. Error message indicates machine configuration is not compatible with selected i-Drive profile configuration. Examples of dependency may include head types, parking brakes, or speed limits.	Check machine configuration and i-Drive profile. In most cases, re-programming dependent configuration parameter will correct situation.
☼ ● ● ☼ ●	0x0906	Propel Motor Short Low Fault	1. Motor connections are shorted to (-) voltage. 2. Higher current draw than hardware design limit.	Check motor wires.
	0x0907	Propel Motor Short High Fault	1. Motor connections are shorted to (+) voltage. 2. Higher current draw than hardware design limit.	Check motor wires.
	0x0B11	Battery Watering Pump Open Warning	1. Wiring, connector, or control board issue on battery watering pump.	Check if battery watering pump is connected to machine harness. Verify pump is operable.

LED Fault Code ☀ = Flashing	LCD Fault Code	Fault Condition	Reason	Correction
☀ ● ● ☀ ☀	0x0103	Scrub Motor Over Current Fault	1. Current draw higher than expected. 2. Higher current draw than hardware design limit.	Verify floor, pad, and down pressure combination are appropriate for machine. Check actuator.
	0x0104	Scrub Motor Over Current 1 Fault	1. Current draw higher than expected.	Verify floor, pad, and down pressure combination are appropriate for machine. Check actuator.
	0x0105	Scrub Motor Over Current 2 Fault	1. Current draw higher than expected.	Verify floor, pad, and down pressure combination are appropriate for machine. Check actuator.
☀ ● ☀ ● ☀	0x0902	Propel High Throttle Fault	1. Green Go Pedal is activated before turning on machine. 2. Green Go Pedal did not release due to obstruction.	Release Green Go Pedal or remove Green Go Pedal obstruction. Power cycle machine. Replace Green Go Pedal switch if damaged or inoperable.
☀ ● ☀ ☀ ●	0x0107	Scrub Motor FET Fault	1. Power/battery issue on startup. 2. Control board problem.	1. Check harness/module power and ground connections. 2. Replace control module.
	0x0207	Actuator Motor FET Fault	1. Control board problem. 2. Power/battery issue on startup.	Replace control board. FET detection includes motor, actuator, detergent pump, vacuum, and battery watering pump.
	0x0307	Valve FET Fault	1. Control board problem. 2. Power/battery issue on startup.	Replace control board.
	0x0507	Vacuum Motor FET Fault	1. Control board problem. 2. Power/battery issue on startup.	Replace control board. FET detection includes motor, actuator, detergent pump, vacuum, and battery watering pump.
	0x0607	Detergent Pump FET Fault	1. Control board problem. 2. Power/battery issue on startup.	Replace control board. FET detection includes motor, actuator, detergent pump, vacuum, and battery watering pump.
	0x0617	Battery Watering Pump FET Fault	1. Control board problem. 2. Power/battery issue on startup.	Replace control board. FET detection includes motor, actuator, detergent pump, vacuum, and battery watering pump.
☀ ● ☀ ☀ ☀	0x0503	Vacuum Over Current Fault	1. Current draw higher than expected.	Check harness and vacuum.
	0x0504	Vacuum Over Current 1 Fault	1. Current draw higher than expected.	Verify vacuum load, damage, and/or usage conditions.
	0x0505	Vacuum Over Current 2 Fault	1. Current draw higher than expected.	Verify vacuum load, damage, and/or usage conditions.
☀ ☀ ● ● ●	0x0506	Vacuum Shorted Load Fault	1. Shorted load condition. 2. Some higher current draw than hardware design limit.	1. Check harness for damage or short between motor and control module. 2. Repair or replace harness if damaged. 3. Check for obstruction in vacuum fan assembly. 4. If not spinning freely, replace vacuum fan.

LED Fault Code ☼ = Flashing	LCD Fault Code	Fault Condition	Reason	Correction
☼ ☼ ● ● ☼	0x0603	Detergent Pump Over Current Fault	1. Current draw higher than expected.	Check harness and pump.
	0x0604	Detergent Pump Over Current 2 Fault	1. Current draw higher than expected.	Verify detergent pump load, damage and/or usage conditions.
	0x0605	Detergent Pump Over Current 1 Fault	1. Current draw higher than expected.	Verify detergent pump load, damage and/or usage conditions.
☼ ☼ ● ☼ ●	0x0606	Detergent Pump Shorted Load Fault	1. Shorted load condition. 2. Higher current draw than hardware design limit.	Check harness, pump, and control boards.
	0x0B01	ABW system timed out	1. System running longer than it should. Pump ends at 1 minute.	Check for leaks in pump housing and battery vents. Check for water in battery tray and on floor around machine. Replace stuck open valves. Check if batteries are defective.
	0x0B13	ABW Pump HW Over Current Fault	1. Current draw higher than expected.	Power cycle machine. Check harness and pump.
	0x0B14	ABW Pump SW Over Current 1 Fault	1. Current draw higher than expected.	Power cycle machine. Check harness and pump.
	0x0B15	ABW Pump SW Over Current 2 Fault	1. Current draw higher than expected.	Power cycle machine. Verify pump load, damage, and/or usage conditions.
	0x0B16	ABW Pump Shorted Load Fault	1. Shorted load condition. 2. Higher current draw than hardware design limit.	Check harness, pump, and control boards.
☼ ☼ ☼ ● ☼	0x0106	Scrub Motor Short Fault	1. Shorted load condition. 2. Some higher current draw than hardware design limit.	Check wire harness. Repair as needed.
☼ ☼ ☼ ☼ ●	0x0102	Scrub Control Board Voltage / Power Loss	1. Scrub Controller board not detecting power. 2. Intermittent control board power loss.	Check wiring and/or in-line fuse for bad connection.
● ● ● ● ☼	0xFFFF	Unknown Fault		
● ☼ ☼ ● ☼	0xF104	Charger Timer Phase I Fault	1. Batteries not able to be charged correctly.	
☼ ☼ ● ☼ ☼	Reserved			

A Service Diagnostics tool is available to provide additional fault detail. See SERVICE DIAGNOSTICS TOOL in the SERVICE section of this manual.

ON-BOARD BATTERY CHARGER SERVICE INDICATOR CODES

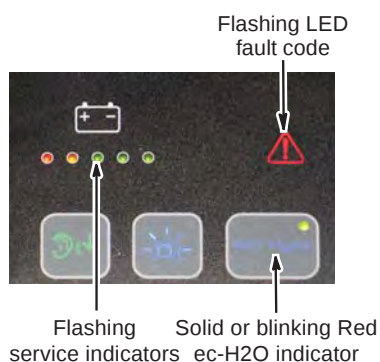
LED Fault Code ☀ = Flashing	LCD Fault Code	Cause	Solution
☀ ☀ ☀ ● ●	0xF100	Charger error condition.	Check charger and battery connections.
● ☀ ☀ ● ☀	0xF104	Batteries unable to charge correctly.	Check charger and battery connections.
● ☀ ☀ ● ●	0xF101	Charger is not connected to battery pack.	Check cable connections. If fault code persists, replace charger.
● ☀ ● ● ●	0xF102	Charger overheated.	Let charger cool. Move to well ventilated area. If fault persists, replace charger.
● ☀ ☀ ☀ ●	0xF103	Charger communication fault.	Power cycle machine. Inspect cables. If fault code persists, replace charger.

ABW (AUTOMATIC BATTERY WATERING) SYSTEM ICON INDICATOR CODES

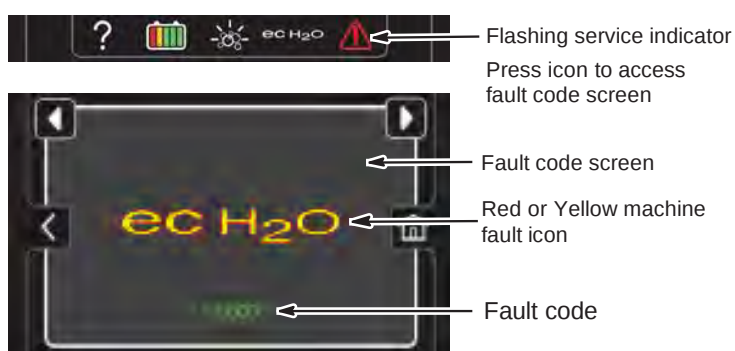
Fault Code ☀ = Flashing	LCD Fault Code	Fault Condition	Cause	Solution
 Slow Flash	0x0B05	Battery Watering Tank Empty	Battery watering tank level is too low to operate correctly.	Refill ABW tank.
 Solid	0x0B06	Battery Watering Plumbing Warning	Attempted to water batteries but batteries did not take water. Batteries full or kinked hose.	Check ABW hoses for kinks / obstructions. Power cycle machine.
 Rapid Flash	0x0B07	Battery Watering Suspend Scrub Lockout	Scrub functions disabled due to ABW tank being empty too long.	Refill ABW tank.

ec-H2O NANOCLEAN ICON FAULTS

Pro-Membrane Control Panel (LED)



Pro-Panel Controls (LCD)



LED Fault Code ☀ = Flashing	LCD Fault Code	Fault Condition	Cause	Correction
● ☀ ☀ ☀ ●	0x0704	ec-H2O CAN Communication Fault	1. Control boards not communicating properly.	1. Check J12-3 and J12-2. 2. Ensure ec-H2O is connected and has power.
● ☀ ● ☀ ●	0x0711	ec-H2O Pump Open Fault	1. ec-H2O control board not detecting current control.	1. Check J12-8, J12-13, and J12-14. 2. Ensure ec-H2O is plugged in and has power.
● ☀ ☀ ☀ ☀	0x0713	ec-H2O Pump Over Current Fault	1. Current draw higher than expected.	1. Verify ec-H2O load / usage conditions. 2. Inspect ec-H2O module / system for damage.
	0x0714	ec-H2O Pump Over Current Fault	1. Current draw higher than expected.	1. Verify ec-H2O load / usage conditions. 2. Inspect ec-H2O module / system for damage.
	0x0715	ec-H2O Pump Over Current Fault	1. Current draw higher than expected.	1. Verify ec-H2O load / usage conditions. 2. Inspect ec-H2O module / system for damage.
☀ ● ● ● ●	0x0707	ec-H2O Pump FET Fault	1. Control board problem. 2. Power / battery issue on start up.	1. Replace ec-H2O control board.
☀ ● ☀ ● ●	0x0703	ec-H2O Circuit Breaker Tripped	1. Circuit breaker tripped.	1. Reset circuit breaker. 2. If fault persists, replace ec-H2O control board.
	0x0712	ec-H2O Circuit Breaker Tripped	1. Circuit breaker tripped.	1. Reset circuit breaker. 2. If fault persists, replace ec-H2O control board.

LED Fault Code ☀ = Flashing	LCD Fault Code	Fault Condition	Cause	Correction
	0x0700	ec-H2O Electrical Fault	ec-H2O module electrical issue(s).	Refer to ec-H2O NanoClean Troubleshooting Guide.
	0x0716			
	0x0717			
	0x0720			
	0x0727			
	0x0741			
	0x0746			
	0x0702	ec-H2O Solution And Plumbing Fault	ec-H2O module solution issue(s).	Refer to ec-H2O NanoClean Troubleshooting Guide.
	0x0708			
	0x0721			
	0x0723			
	0x0726			
	0x0728	ec-H2O Cell Over Regulation	1. Cell current exceeds set point for expected operation. Fault is not totally visible but indicated via a flashing blue light on ec-H2O module.	
	0x0729	ec-H2O Cell Under Regulation	1. Cell Current under set point for expected operation. Fault is not totally visible but indicated via a flashing blue light on ec-H2O module.	
	0x0781	Detergent Tank Empty	1. Detergent tank is empty.	1. Fill detergent tank.
ec-H2O indicator blinking blue/red	0x0707	ec-H2O Water Conditioning Cartridge Expired Warning	1. ec-H2O water conditioning cartridge is expired.	1. Replace ec-H2O water conditioning cartridge.

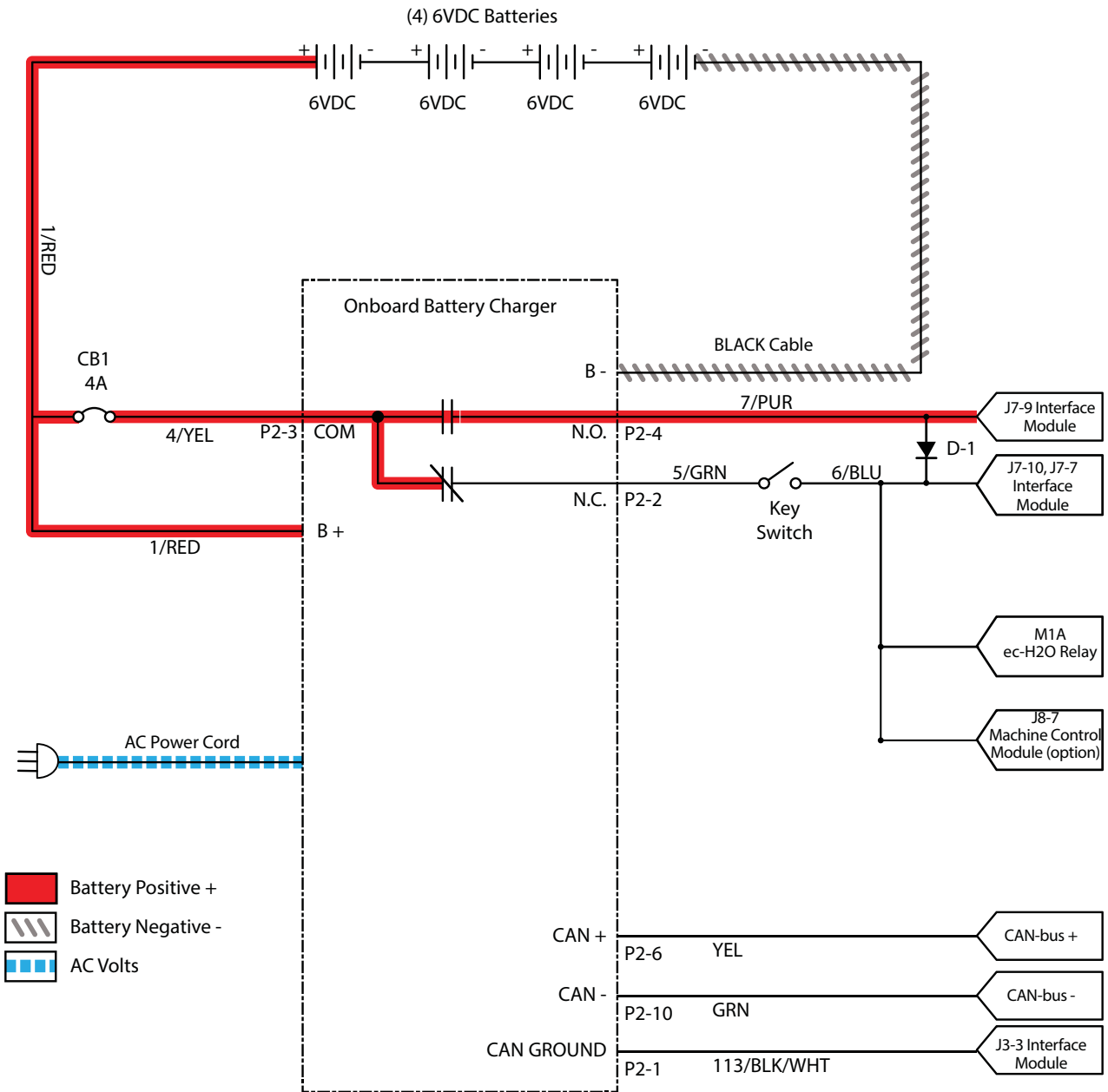
OFF-BOARD CHARGER ERROR AND FAULT CODES

Code	Description	Cause	Solution
E-0-0-1 E-0-2-1	Battery high voltage	1. Wrong battery voltage for charger. 2. Other charger also attached. 3. Resistive battery.	Check battery voltage and cable connections. Check battery size and condition. Error will automatically clear once voltage is in range.
E-0-0-2 E-0-2-2	Battery low voltage	1. Battery disconnected. 2. Battery over discharged.	Check battery voltage and cable connections. Check battery size and condition. Error will automatically clear once voltage is in range.
E-0-0-3	Charge time out caused by battery pack not reaching required voltage within safe time limit. (charge profile dependent)	1. Charger output reduced due to high temperatures. 2. Poor battery health. 3. Very deeply discharged battery. 4. Poorly connected battery.	Operate at lower ambient temperature. Replace battery pack. Check DC connections. Error will clear once charger is reset by cycling DC or AC.
E-0-0-4	Battery could not meet minimum voltage (charge profile dependent)	1. Shorted or damaged cells.	Replace battery pack. Check DC connections. Error will automatically clear once charger is reset by cycling DC or AC.
E-0-0-7	Battery amp hour limit exceeded	1. Poor battery health. 2. Very deeply discharged battery. 3. Poorly connected battery. 4. High parasitic loads on battery while charging	Replace battery pack. Check DC connections. Disconnect parasitic loads. Error will automatically clear once charger is reset by cycling DC or AC.
E-0-0-8	Battery temperature is out of range	1. Possible battery temperature sensor error.	Check temperature sensor and connections. Reset charger. Error will clear once condition has been corrected.
E-0-1-2	Reverse polarity error	1. Battery incorrectly connected to charger.	Check battery connections. Error will clear once condition has been corrected
E-0-1-6 E-0-1-8 E-0-2-6	USB operation failed (software)	1. Software upgrade failure. 2. Script operation failure.	Ensure USB flash drive is properly formatted and reinsert USB flash drive.
E-0-1-7	USB operation failed (hardware)	1. Hardware upgrade failure.	Remove and reinsert USB drive. If condition persists, cycle AC and retry by reinserting USB drive.
E-0-2-3	High AC voltage error (>270VAC)	1. Voltage error.	Connect charger to an AC source that provides stable AC between 85 - 270 VAC / 45-65 Hz. Error will clear once condition has been corrected.
E-0-2-4	Charger failed to initialize	1. Charger has failed to turn on properly	Disconnect AC input and battery for 30 seconds before retrying.
E-0-2-5	Low AC voltage oscillation error	1. AC source is unstable. 2. Undersized generator. 3. Severely undersized input cables	Connect charger to an AC source that provides stable AC between 85 - 270 VAC / 45-65 Hz. Error will clear once condition has been corrected.
F-0-0-1 F-0-0-2 F-0-0-3 F-0-0-4 F-0-0-6	Internal charger fault	1. Internal charger fault.	Remove AC and battery for minimum 30 seconds and retry charger. If it fails again, contact the vehicle or machine manufacturer.

Off-Board Charger Error and Fault Codes table taken from the Delta-Q IC650 Charger Manual.

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Date: 14/07/2014)

ONBOARD BATTERY CHARGING ON



**BATTERIES FAIL TO CHARGE / REDUCED RUN
TIME (ONBOARD CHARGER)**

Step	Action	Value(s)	Yes	No
1	• Key ON • Is there a flashing BDI fault or LCD Pro-Panel (option) fault code present?		See FAULTS in TROUBLESHOOTING section of this manual	Proceed to STEP 2
2	• Key OFF • Check AC power supply • Is the rated AC supply voltage present?		Proceed to STEP 3	Check AC supply circuit protection
3	• See BATTERY CHARGER SETTINGS in MAINTENANCE section of this manual and confirm proper charger settings • Is the onboard charger set properly?		Proceed to STEP 4	Reprogram battery charger
4	• Key OFF • Inspect battery and charger cables for damage / corrosion / contamination / terminal problems • Do any of the above conditions exist?		Repair or replace battery / battery charger cables	Proceed to STEP 5
5	• Proceed to STEP 6 for machines equipped with sealed or AGM batteries • Key OFF • Disconnect batteries • Check water level in all battery cells • Are the lead plates submerged?		Proceed to STEP 6	Add distilled water as necessary until lead plates are covered
6	• Key OFF • Use a hydrometer or refractometer to test specific gravity of each cell (Lead-Acid) • Are all battery cells within 0.050 (50 points) specific gravity of each other?		Replace battery charger	Replace battery charger or batteries

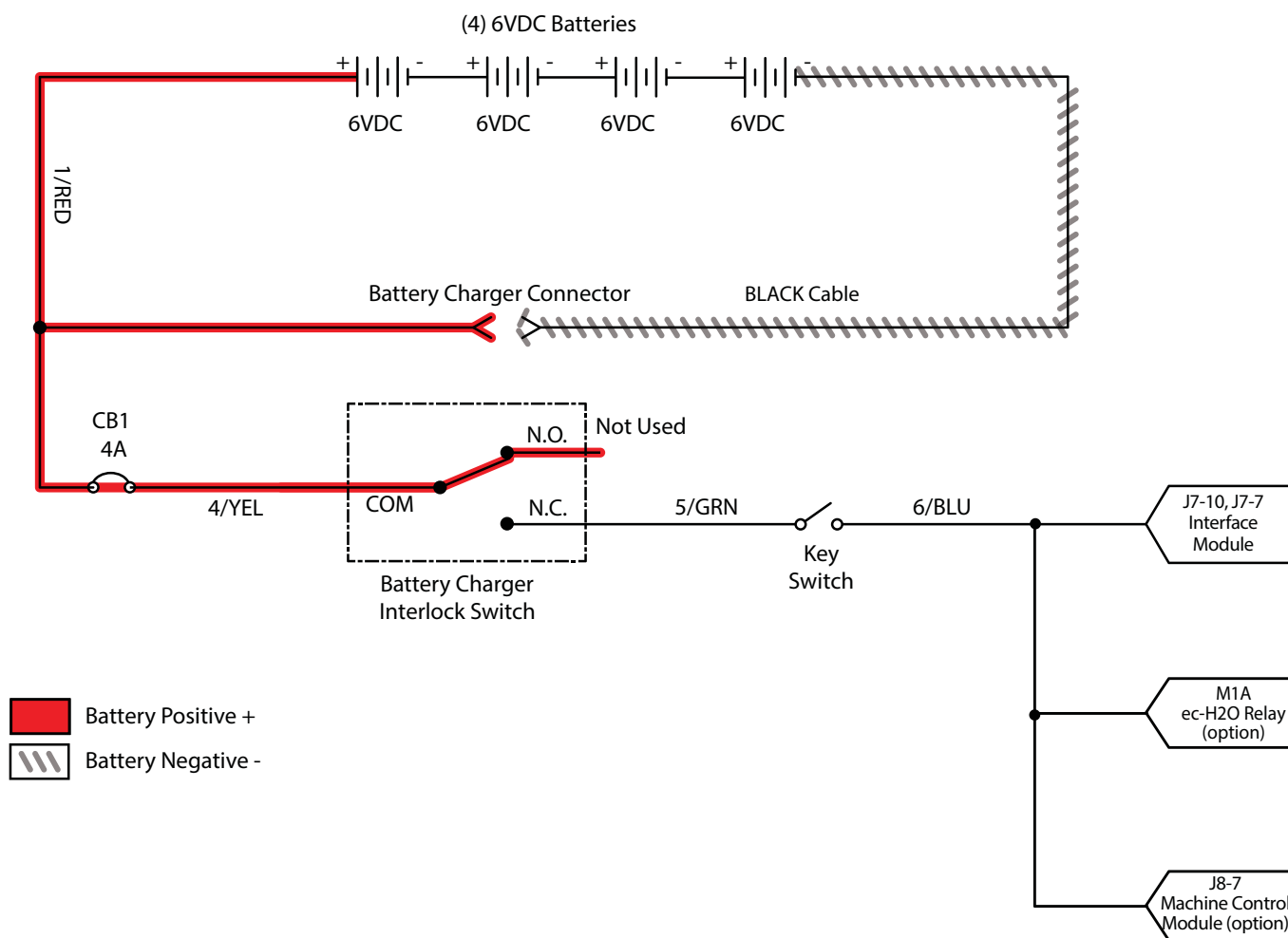
Terms:

AC = Alternating Current

AGM = Absorbed Glass Mat

Specific Gravity = Relative density of a substance compared to water (1.000 specific gravity)

OFF BOARD BATTERY CHARGING ON



**BATTERIES FAIL TO CHARGE / REDUCED RUN
TIME (OFF BOARD CHARGER)**

Step	Action	Value(s)	Yes	No
1	• Key ON • Is there an LCD fault present on the Off Board Charger?		See OFF BOARD BATTERY CHARGER FAULTS in TROUBLESHOOTING section of this manual	Proceed to STEP 2
2	• Key OFF • Check AC power supply • Is the rated AC supply voltage present?		Proceed to STEP 3	Check AC supply circuit protection
3	• Key OFF • Inspect battery and charger cables for damage / corrosion / contamination / terminal problems		Repair or replace battery / battery charger cables	Proceed to STEP 4
4	• Proceed to STEP 6 for machines equipped with sealed or AGM batteries • Key OFF • Disconnect batteries • Check water level in all battery cells • Are the lead plates submerged?		Proceed to STEP 5	Add distilled water as necessary until lead plates are covered
5	• Key OFF • Use a hydrometer or refractometer to test specific gravity of each cell (Lead-Acid) • Are all battery cells within 0.050 (50 points) specific gravity of each other? (Lead-Acid) • AGM - Check battery voltage		Replace battery charger	Replace battery charger or batteries

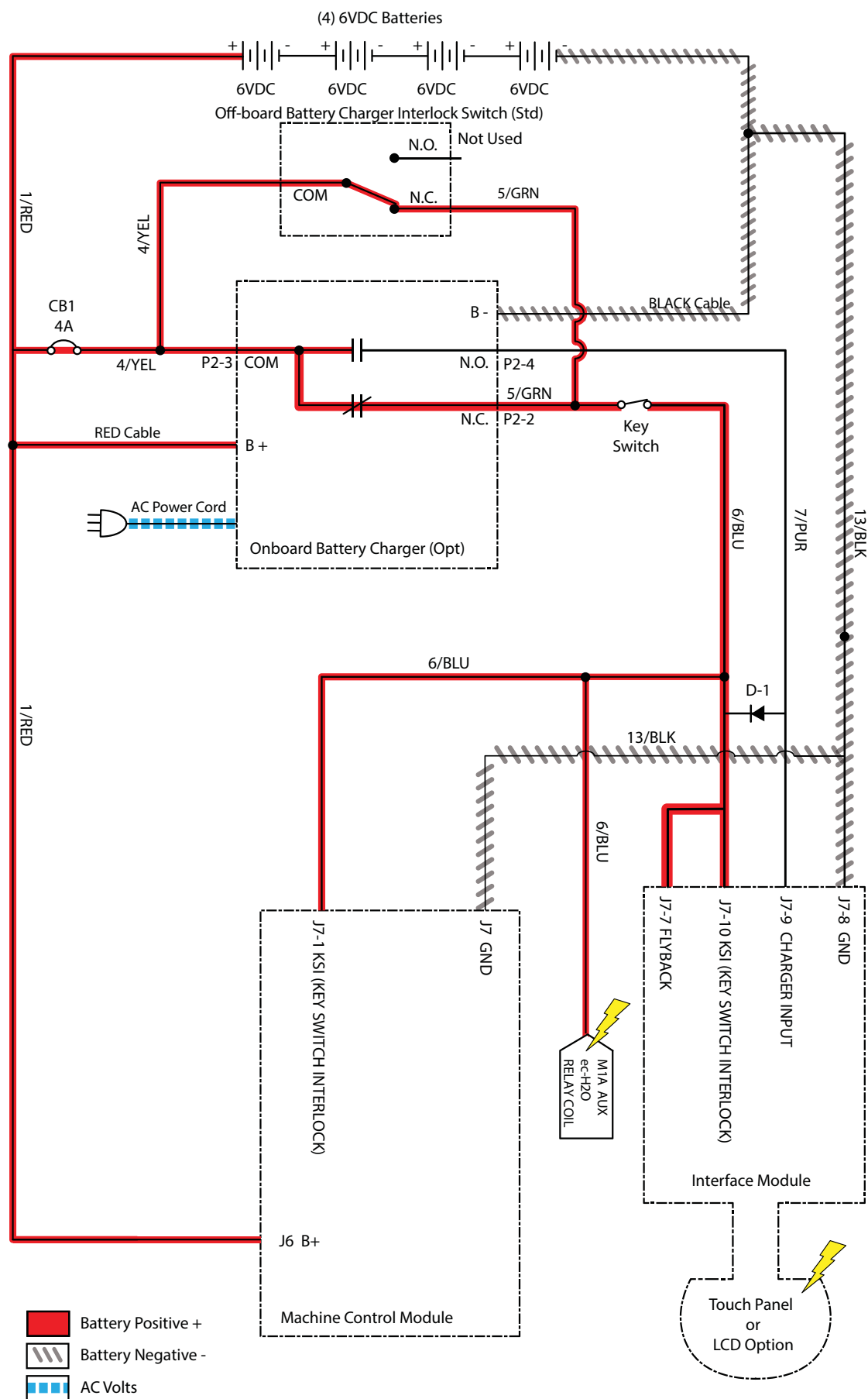
Terms:

AC = Alternating Current

AGM = Absorbed Glass Mat

Specific Gravity = Relative density of a substance compared to water (1.000 specific gravity)

POWER UP ON

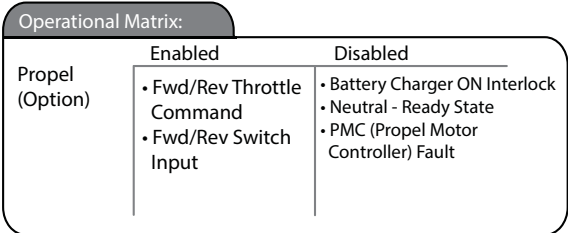


MACHINE FAILED TO POWER UP

Step	Action	Value(s)	Yes	No
1	• Key ON • Use a voltmeter to test the total battery voltage • Is total battery voltage greater than 20 VDC?		Proceed to STEP 2	Recharge batteries and test power-up circuit operation
2	• Key OFF • Firmly press circuit breaker #1 to reset • Are circuit breaker #1 tripped?		Reset and test power-up circuit operation	Proceed to STEP 3
3	• Key ON • Test voltage applied to power-up subsystem as shown on electrical schematic • Are electrical circuits operating as shown on electrical schematic?		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:

VDC = DC Voltage



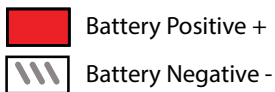
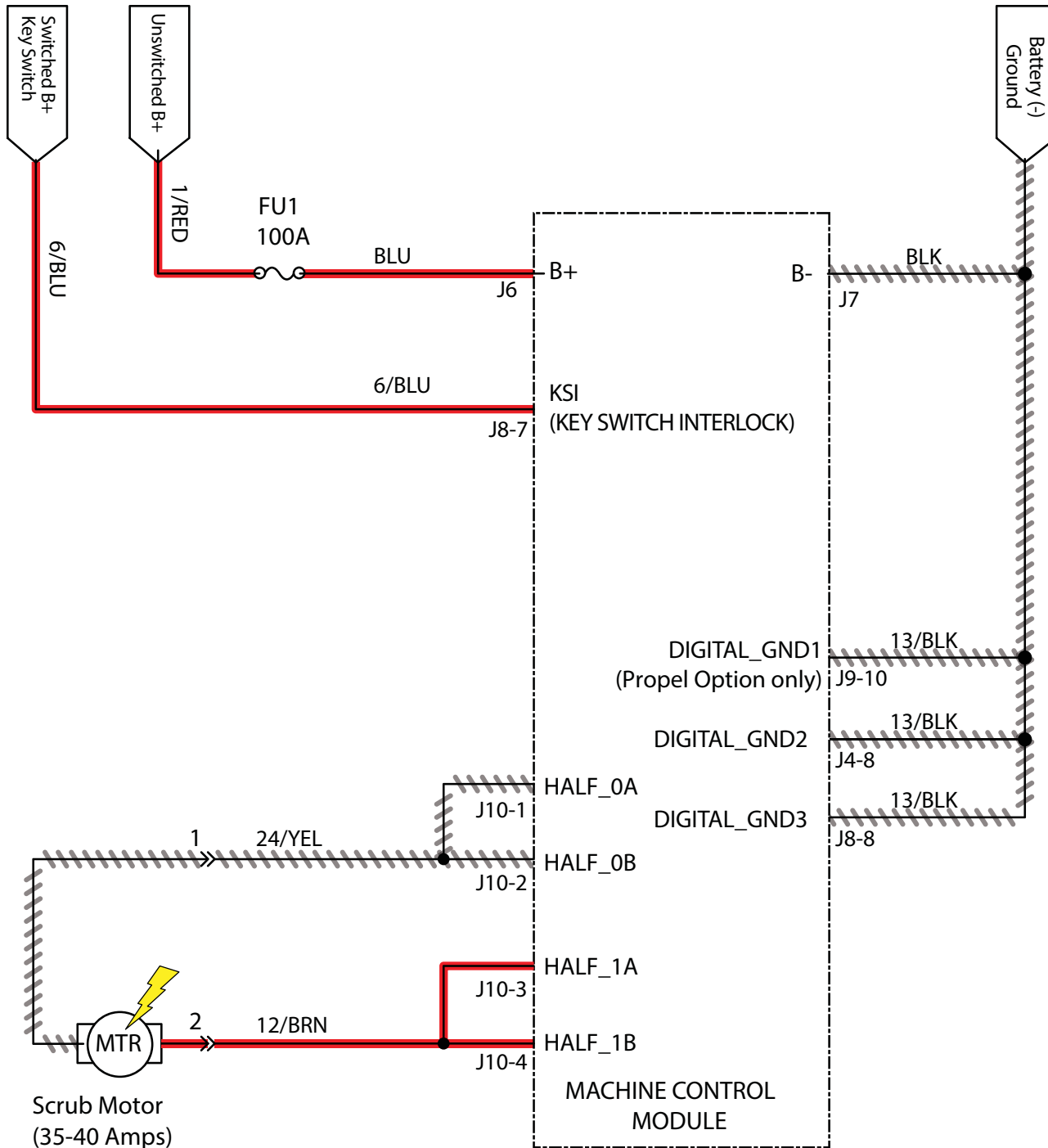
MACHINE FAILED TO PROPEL

Step	Action	Value(s)	Yes	No
1	• Key ON • Enable propel • Is there a flashing BDI fault or LCD Pro-Panel (option) fault code present?		See FAULTS in TROUBLESHOOTING section of this manual	Proceed to STEP 2
2	• Key OFF • Firmly press circuit breaker #3 to reset • Is circuit breaker #3 tripped?		Reset and test power-up circuit operation	Proceed to STEP 3
3	• See SERVICE DIAGNOSTICS TOOL in SERVICE section of this manual and confirm software is properly configured to enable propel • Is software configured properly?		Proceed to STEP 4	Reprogram software
4	• Key OFF • Place machine on blocks so drive wheels are lifted from floor • Key ON • Enable propel • Test voltage applied to propel subsystem as shown on electrical schematic • Are electrical circuits operating as shown on electrical schematic?		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:

BDI = Battery Discharge Indicator

SCRUB MOTOR ON



Operational Matrix:

	Enabled	Disabled
Scrub Motor	- Head Lowered - - Fwd/Rev Throttle Command or Bail Activated on non-Propel models.	- Head Raised - Neutral - Ready State or Bail released on non-propel models. - Low Battery Voltage - Fault - Battery Charger ON Interlock

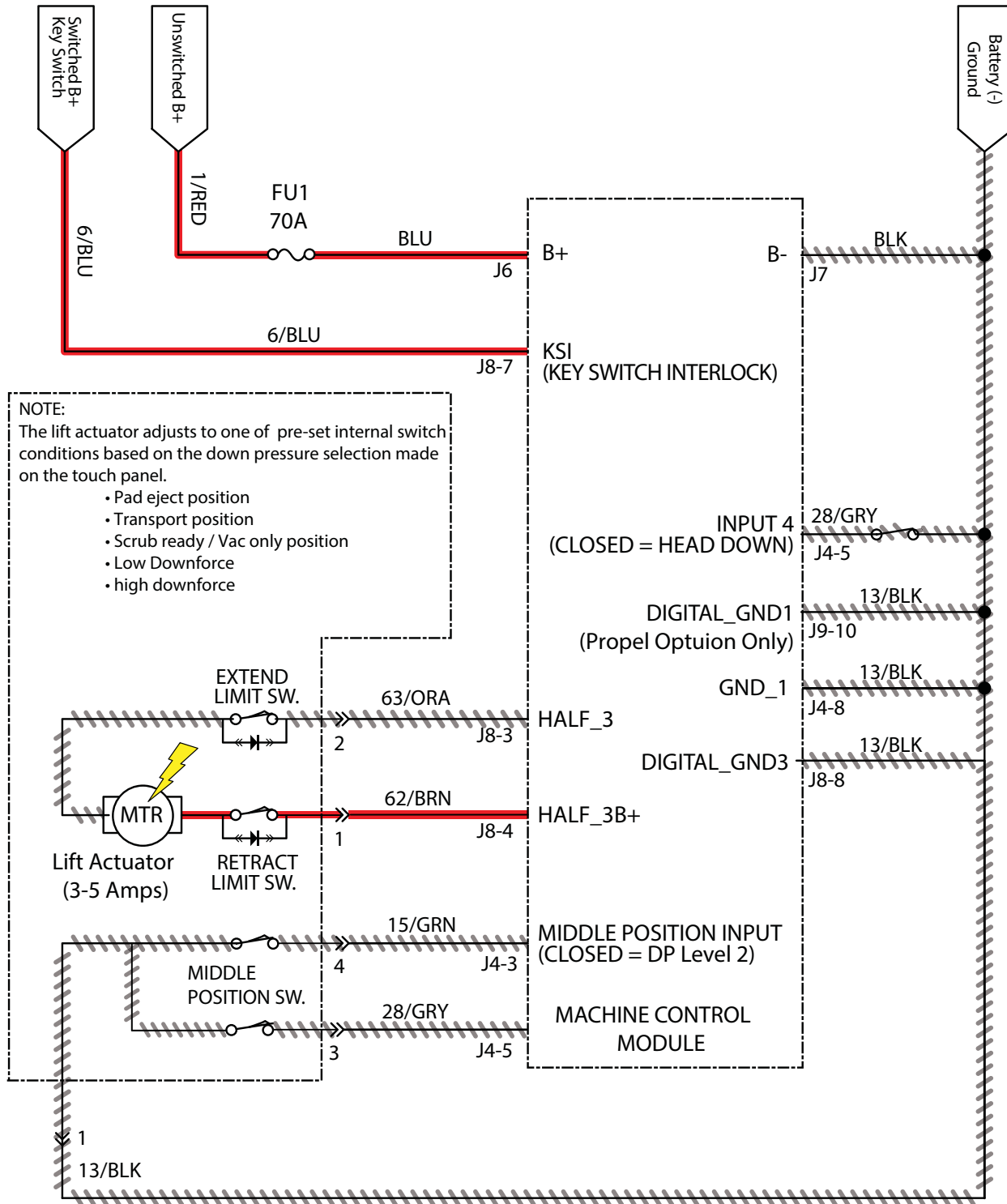
SCRUB MOTOR FAILED TO TURN ON

Step	Action	Value(s)	Yes	No
1	• Key ON • Enable scrub motor • Is there a flashing BDI fault or LCD Pro-Panel (option) fault code present?		See FAULTS in TROUBLESHOOTING section of this manual	Proceed to STEP 2
2	• Key ON • Enable scrub motor • Test voltage applied to scrub motor subsystem as shown on electrical schematic • Are electrical circuits operating as shown on electrical schematic?		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:

BDI = Battery Discharge Indicator

SCRUB HEAD LIFT ACTUATOR



Operational Matrix:

	Enabled	Disabled
Lift Actuator (Option)	• Head Lowered	• Head Raised • Low Battery Voltage • Load Current Fault • Battery Charger ON Interlock

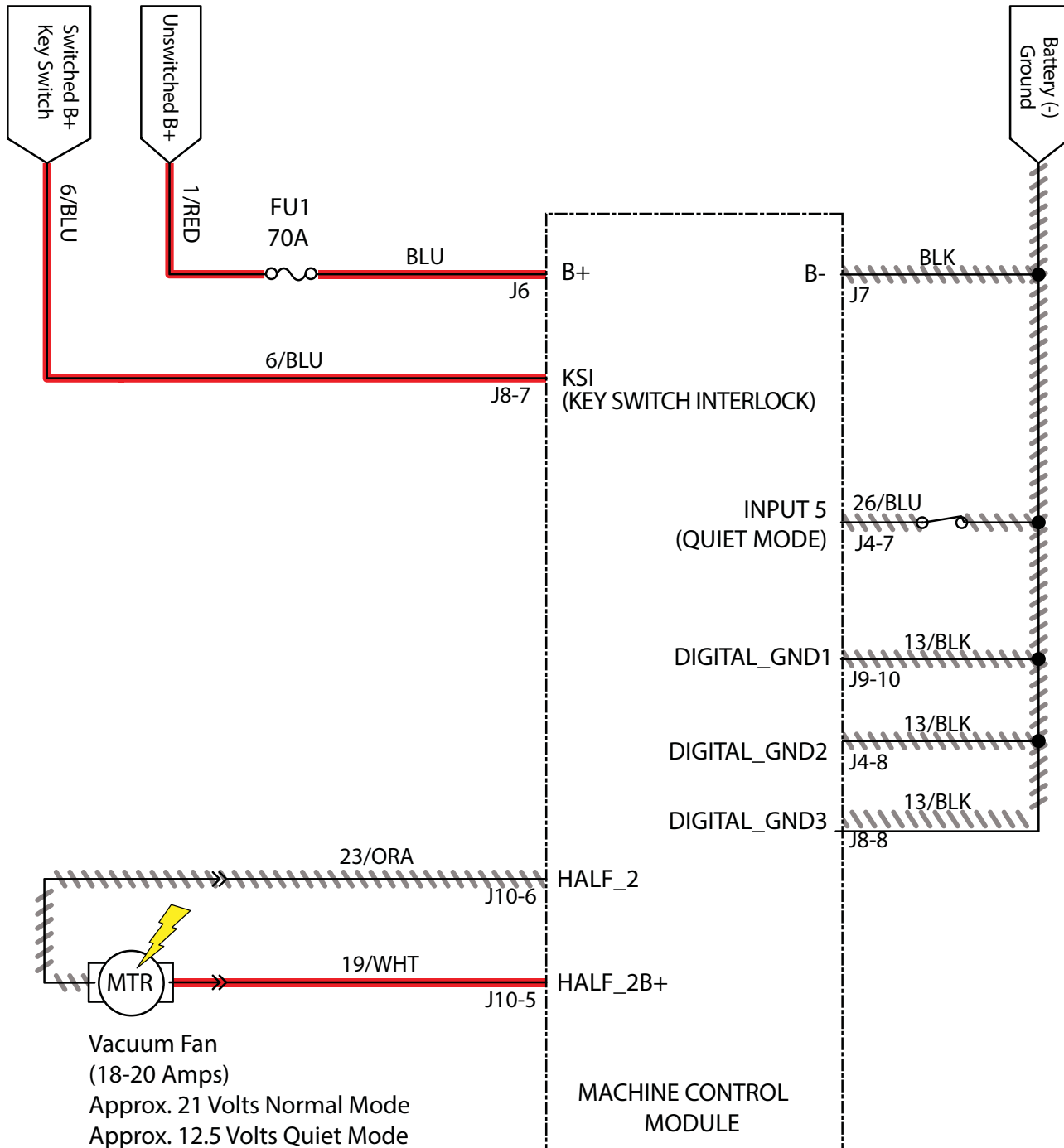
SCRUB HEAD FAILED TO LIFT / LOWER

Step	Action	Value(s)	Yes	No
1	• Key ON • Enable lift actuator • Is there a flashing BDI fault or LCD Pro-Panel (option) fault code present?		See FAULTS in TROUBLESHOOTING section of this manual	Proceed to STEP 2
2	• See SERVICE DIAGNOSTICS TOOL in SERVICE section of this manual and confirm software is properly configured to enable automated down pressure • Is software configured properly?		Proceed to STEP 3	Reprogram software
3	• Key ON • Enable scrub motor • Enable propel • Test voltage applied to actuator subsystem as shown on electrical schematic • Are electrical circuits operating as shown on electrical schematic?		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:

BDI = Battery Discharge Indicator

VACUUM FAN ON



Operational Matrix:

	Enabled	Disabled
Vacuum Fan	Squeegee Lowered	- Squeegee Raised - Low Battery Voltage - Fault - Battery Charger ON Interlock

 Battery Positive +
 Battery Negative -

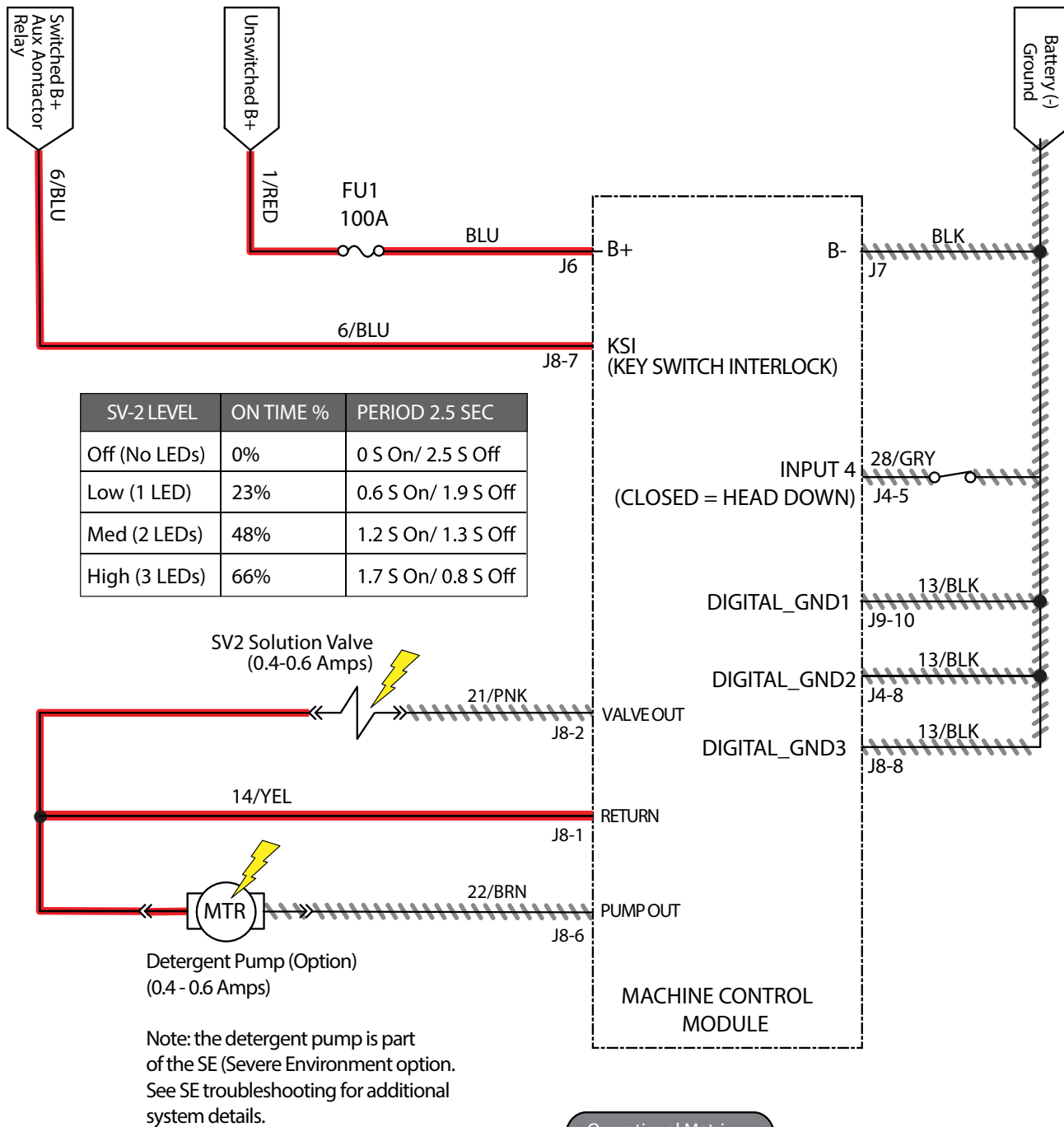
VACUUM FAN FAILED TO TURN ON

Step	Action	Value(s)	Yes	No
1	• Key ON • Enable vacuum fan • Is there a flashing BDI fault or LCD Pro-Panel (option) fault code present?		See FAULTS in TROUBLESHOOTING section of this manual	Proceed to STEP 2
2	• Key ON • Enable vacuum fan • Test voltage applied to scrub motor subsystem as shown on electrical schematic • Are electrical circuits operating as shown on electrical schematic?		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:

BDI = Battery Discharge Indicator

SOLUTION CONTROL ON (CONVENTIONAL)



Operational Matrix:

	Enabled	Disabled
Solution Control (Conventional)	• Head Lowered - • Solution Control ON • Fwd/Rev Throttle Command or Bail activated	• Head Raised • Solution Control OFF • Neutral - Ready State or bail released • Low Battery Voltage • Fault • Battery Charger ON Interlock

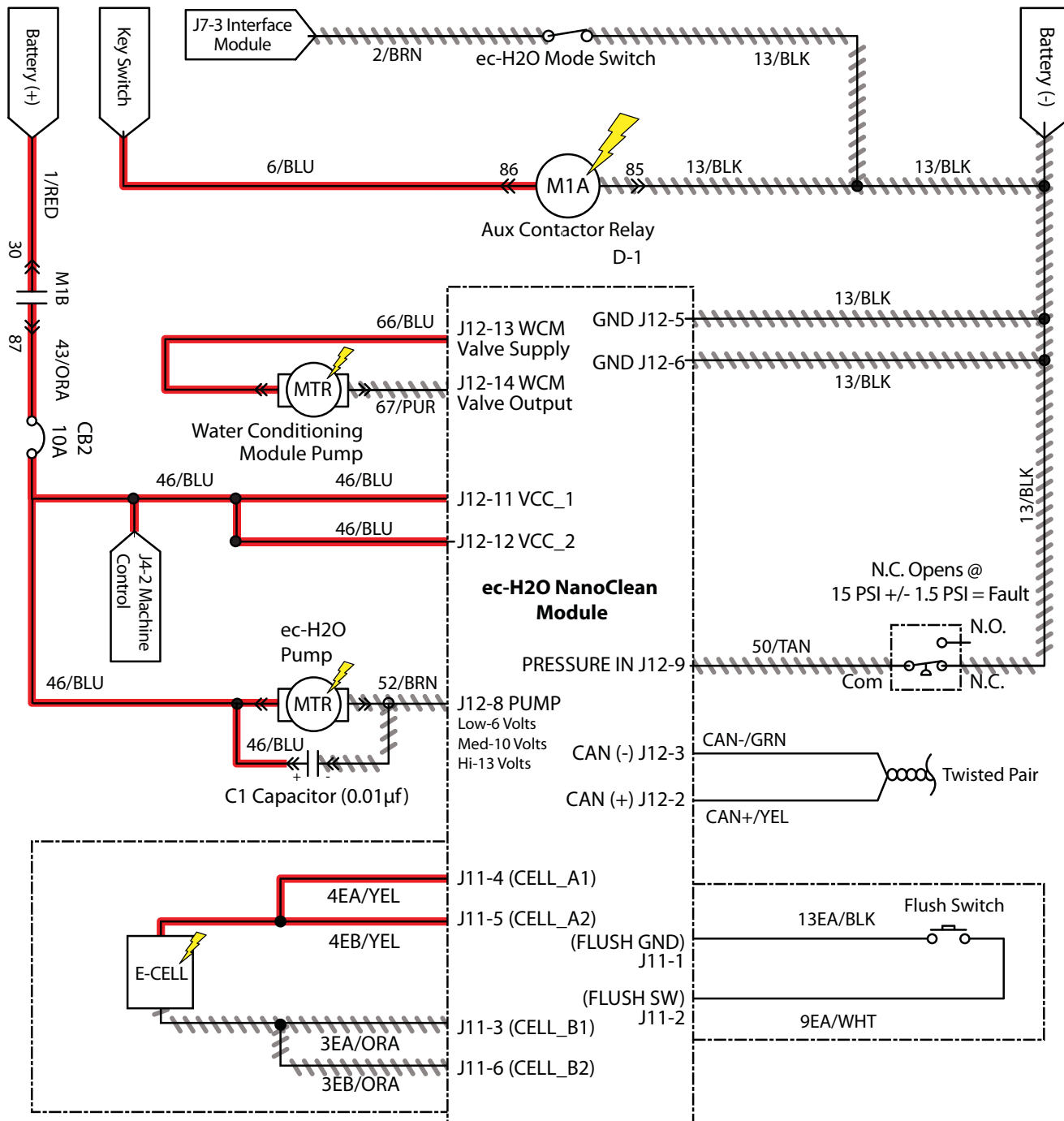
**SOLUTION CONTROL FAILED TO TURN ON
(CONVENTIONAL)**

Step	Action	Value(s)	Yes	No
1	• Key ON • Enable solution control (conventional) • Is there a flashing BDI fault or LCD Pro-Panel (option) fault code present?		See FAULTS in TROUBLESHOOTING section of this manual	Proceed to STEP 2
2	• Key ON • Enable solution control (conventional) • Test voltage applied to solution control (conventional) subsystem as shown on electrical schematic • Are electrical circuits operating as shown on electrical schematic?		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:

BDI = Battery Discharge Indicator

SOLUTION CONTROL ON (ec-H2O)



Operational Matrix:

Solution Control (ec-H2O)

Enabled

- Head Lowered
- Solution Control ON
- ecH2O Switch ON
- Fwd/Rev Throttle Command or Bail activated

Disabled

- Head Raised
- Solution Control OFF
- ecH2O Switch OFF
- Neutral - Ready State or bail released
- Low Battery Voltage
- ecH2O System Fault
- Battery Charger ON Interlock

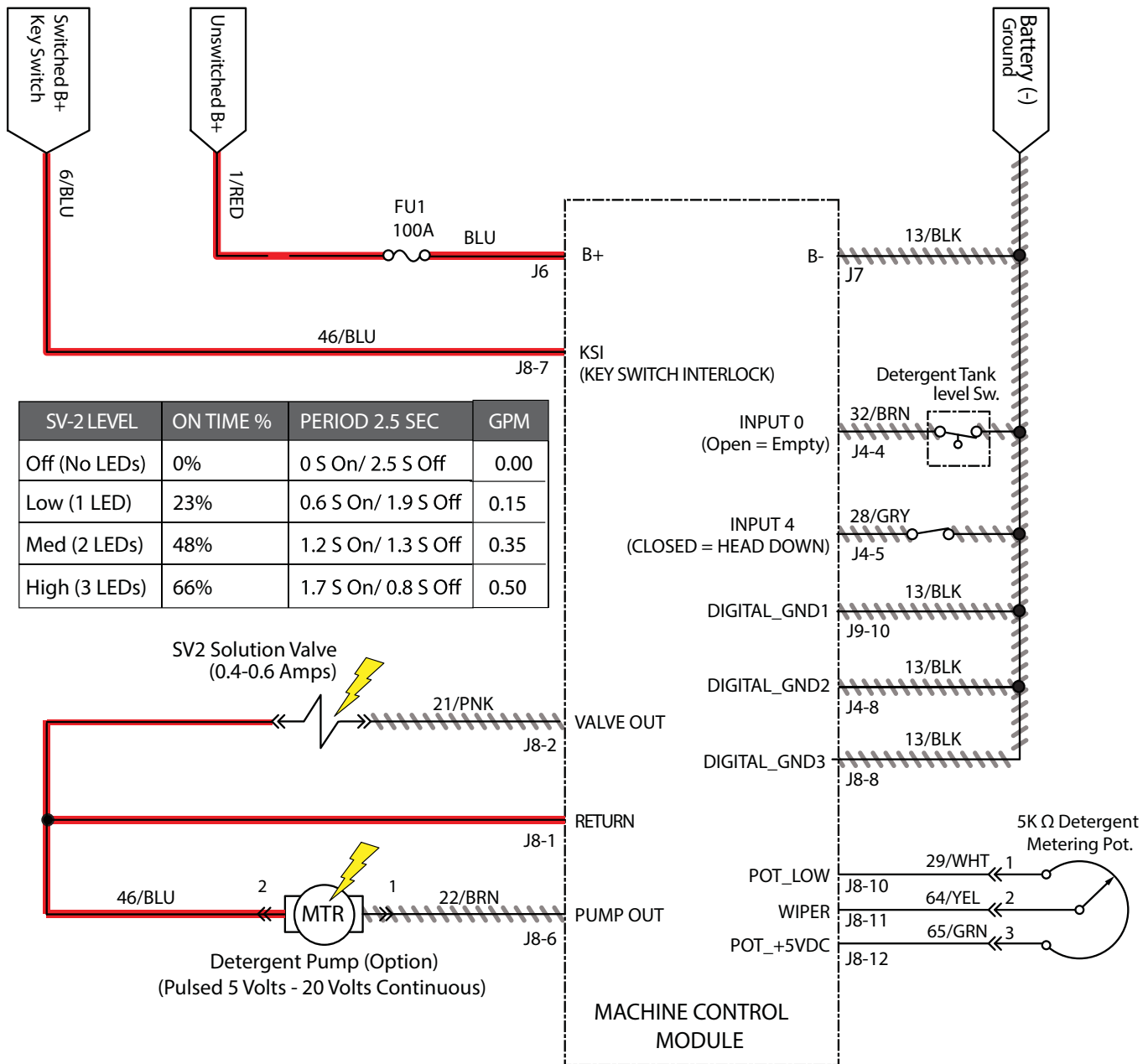
**SOLUTION CONTROL FAILED TO TURN ON
(ec-H2O)**

Step	Action	Value(s)	Yes	No
1	• Key ON • Enable solution control (ec-H2O) • Is there a flashing BDI fault or LCD Pro-Panel (option) fault code present?		See FAULTS in TROUBLESHOOTING section of this manual	Proceed to STEP 2
2	• Key OFF • Firmly press circuit breaker #2 to reset • Is circuit breaker #2 tripped?		Reset and test power-up circuit operation	Proceed to STEP 3
3	• Key ON • Enable solution control (ec-H2O) • Test voltage applied to solution control (ec-H2O) subsystem as shown on electrical schematic • Are electrical circuits operating as shown on electrical schematic?		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:

BDI = Battery Discharge Indicator

SE (SEVERE ENVIRONMENT) ON



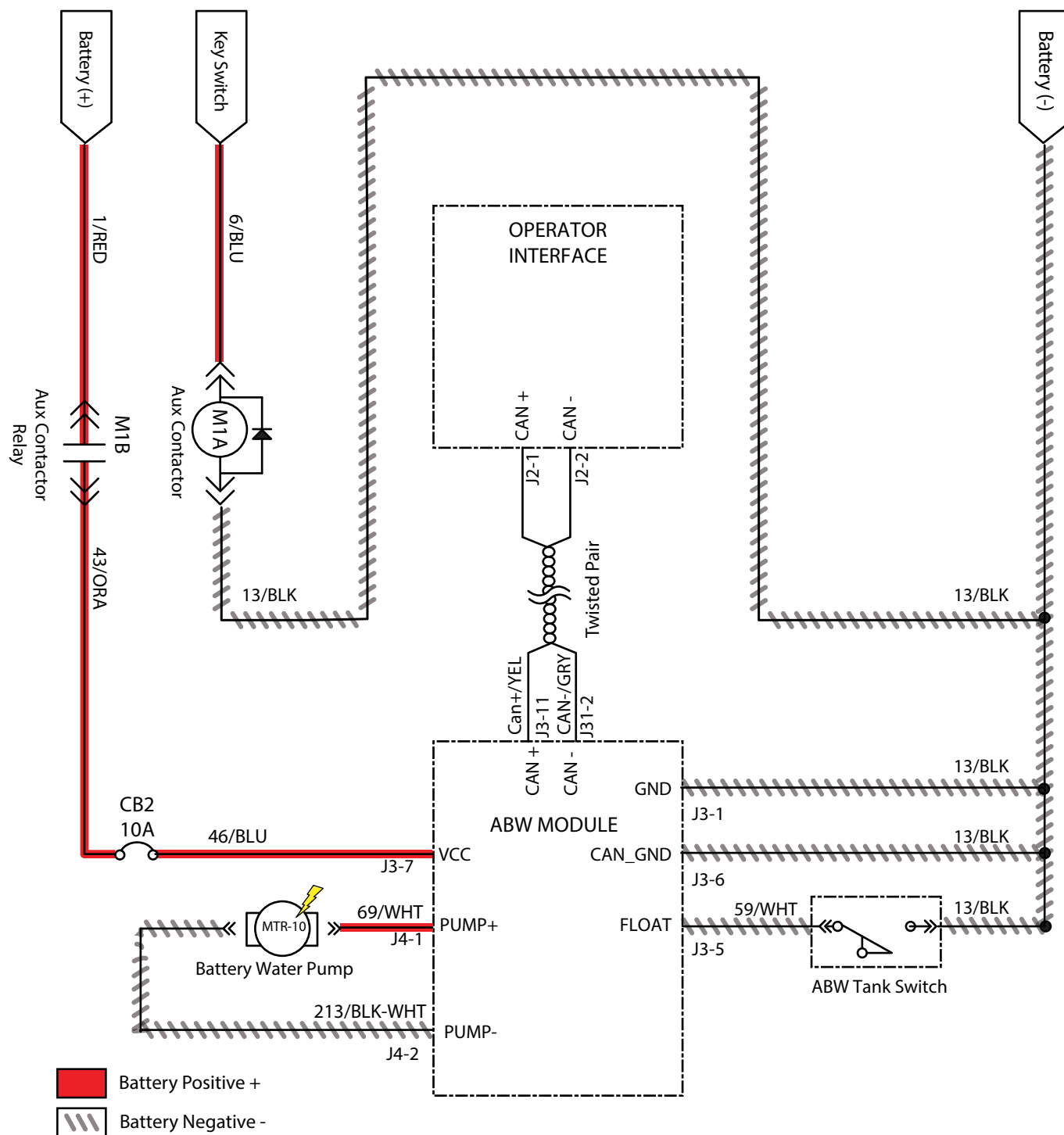
SE (SEVERE ENVIRONMENT) FAILED TO TURN ON

Step	Action	Value(s)	Yes	No
1	• Key ON • Enable SE (Severe Environment) detergent pump • Is there a flashing BDI fault or LCD Pro-Panel (option) fault code present?		See FAULTS in TROUBLESHOOTING section of this manual	Proceed to STEP 2
2	• Key ON • Enable SE (Severe Environment) detergent pump • Test voltage applied to SE subsystem as shown on electrical schematic • Are electrical circuits operating as shown on electrical schematic?		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:

BDI = Battery Discharge Indicator

ABW 2.0 (AUTOMATIC BATTERY WATERING 2.0) (OPTION)



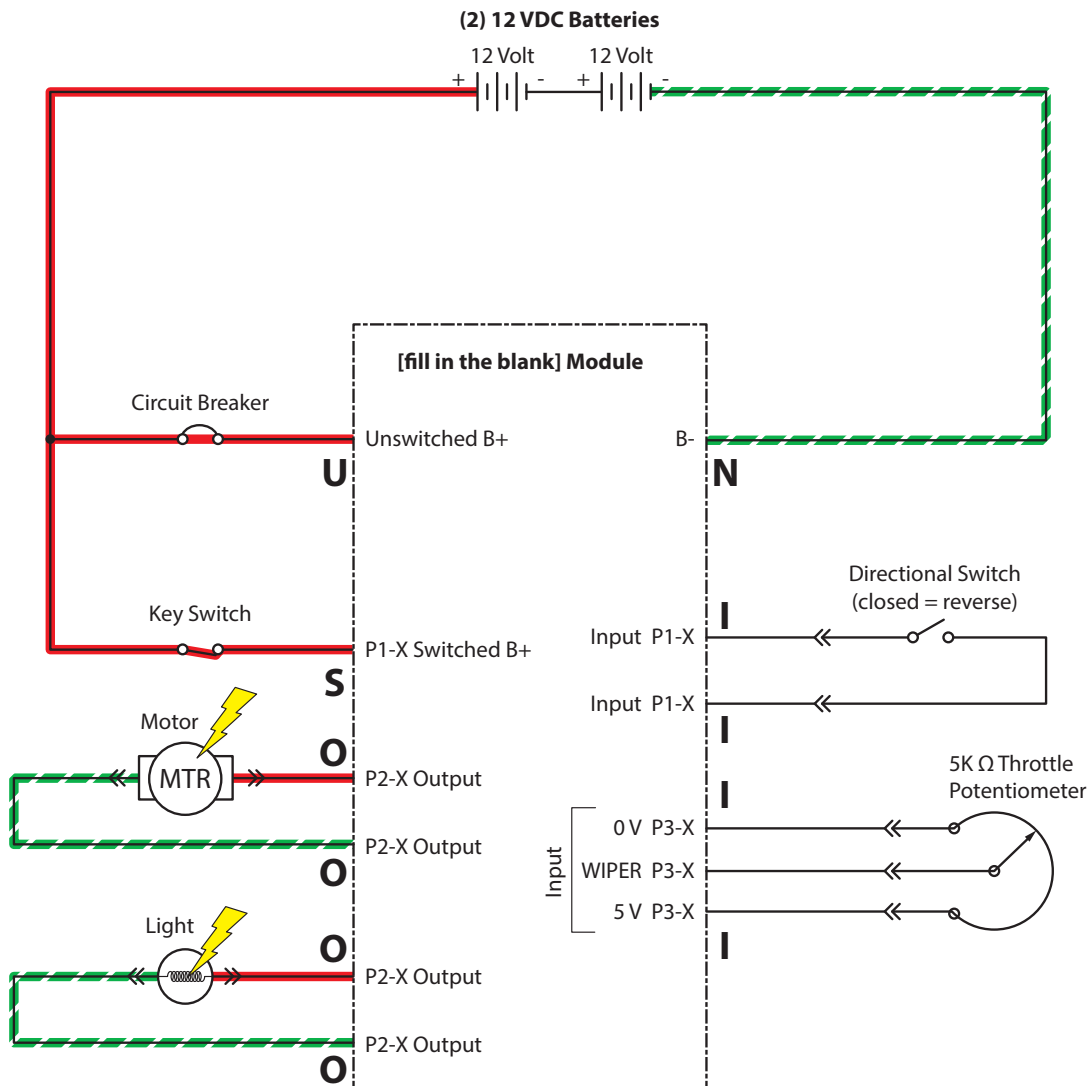
ABW 2.0 (AUTOMATIC BATTERY WATERING 2.0)
SYSTEM FAILED TO TURN ON

Step	Action	Value(s)	Yes	No
1	• Key ON • Enable ABW if previously faulted or operate manually • Is there a flashing BDI fault or LCD Pro-Panel (option) fault code present?		See FAULTS in TROUBLESHOOTING section of this manual	Proceed to STEP 2
2	• Key OFF • Ensure there is water in ABW tank • Operate ABW manually if not priming		Fill ABW tank with water	Proceed to STEP 3
3	• Key OFF • Firmly press circuit breaker #2 to reset • Is circuit breaker #2 tripped?		Reset and test power-up circuit operation	Proceed to STEP 4
4	• Key ON • Test voltage applied to ABW pump subsystem, ABW module, ABW flow sensor, and ABW tank switch as shown on electrical schematic • Are electrical circuits operating as shown on electrical schematic?		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:

BDI = Battery Discharge Indicator

i-DRIVE TESTING (UNIVERSAL SCHEMATIC)



NOTE: The "P1-X" or sometimes "J1-X" format refers to the plug or connector number followed by the pin number within that connector. For example, P1-4 means plug number 1, pin number 4. Use this information to locate and identify proper wires per the actual electrical schematic.

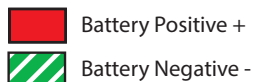
S = Switched (+)

U = Unswitched (+)

N = Negative (-)

I = Inputs

O = Outputs



PMAC021

i-DRIVE TESTING PROCEDURE

Step	Action	Value(s)	Yes	No
1 ✓ Switched (+)*	- Key ON / circuits loaded (preferred) - All electrical components remain connected to wire harness - Use an electrical schematic to identify all switched (+) power supply wires - Is there <i>switched battery voltage</i> (+) applied to circuit board?	Applied voltage must be within 1 volt of actual battery voltage	Proceed to STEP 2	Identify voltage drop location and repair or replace necessary components ¹
2 ✓ Unswitched (+)*	- Key ON / circuits loaded (preferred) - All electrical components remain connected to wire harness - Use an electrical schematic to identify all unswitched (+) power supply wires - Is there <i>switched battery voltage</i> (+) applied to circuit board?	Applied voltage must be within 1 volt of actual battery voltage	Proceed to STEP 3	Identify voltage drop location and repair or replace necessary components ¹
3 ✓ Negative (-)*	- Key ON / circuits loaded (preferred) - All electrical components remain connected to wire harness - Use an electrical schematic to identify all negative (-) / ground supply wires - Is there battery negative (-) applied to circuit board?	Applied voltage must be within 1 volt of actual battery voltage	Proceed to STEP 4	Identify voltage drop location and repair or replace necessary components ¹
4 ✓ Inputs	- Key ON - Manually exercise all input devices and use a multimeter to observe status change - Use an electrical schematic to identify all input circuits - Do all inputs function correctly?		Proceed to STEP 5	Repair or replace necessary input components ¹
5 ✓ Outputs	- Key ON - Disconnect battery and circuit board from wire harness and use a Ohmmeter to test output circuits for open or shorted circuits - Use an electrical schematic to identify all output circuits - Is there an <i>open</i> or <i>shorted</i>² output circuit causing the trouble symptom?		Repair or replace necessary output components ¹	Replace circuit board

¹ Wire harnesses are components

² An open circuit has infinite resistance "O.L.". A shorted circuit has 0 (zero) resistance. Always test through entire circuit.

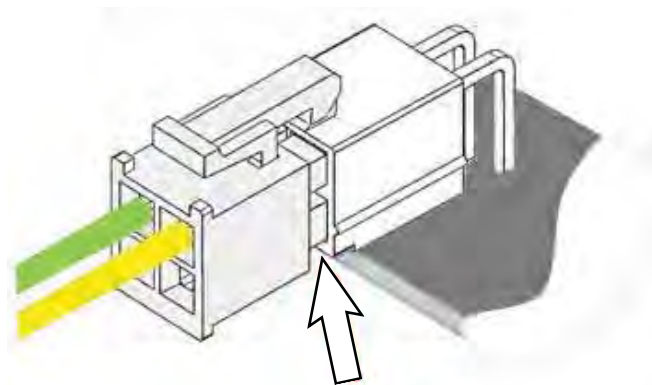
* Switched (+) and Unswitched (+) indicate positive battery voltage applied to circuit board. Negative (-) indicates battery negative (ground) as part of power supply to circuit board.

CAN OPEN NETWORK ISSUES

The following items include procedures to investigate a fault related to a CAN open network.

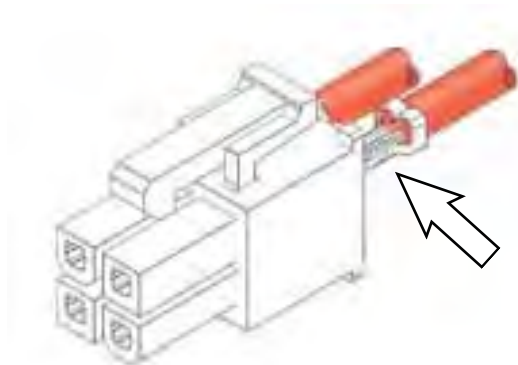
CONNECTOR FULLY SEATED

Each node on the network has a connector for the CAN communication wires. A loose connection could cause a fault code error. Check each board individual to ensure the connectors are fully seated. There may also be other connectors within the harness that should be checked. If the connector is not fully seated, fully seat the connector and power cycle the machine to see if the fault clears.



PIN FULLY SEATED

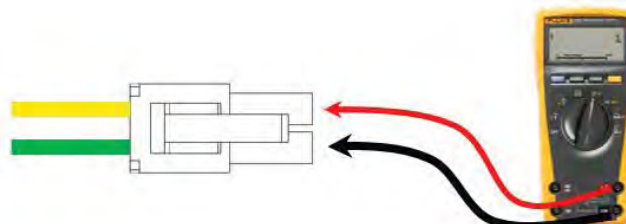
A pin within the harness side of the connector may not be fully seated or may come loose over time causing a fault. If the pin is not fully seated, push it back in and power cycle the machine to see if the fault clears.



NETWORK RESISTANCE

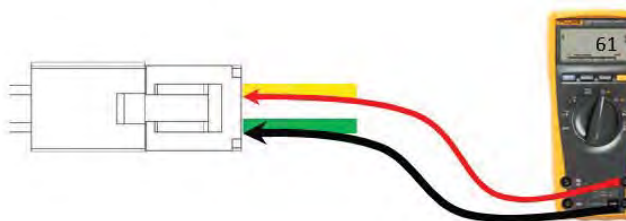
The network resistance must be correct for the network to operate correctly. Depending on which node the measurement is taken at and the method of measurement, the resistance may be one of two values: 121 or 61 Ohms. Any value other than these two means something is wrong with the network.

Method 1



1. Turn off the machine.
2. Locate a CAN node location on the machine.
3. Disconnect the connector containing the CAN wires.
4. Measure the resistance between the green and yellow wires.
5. Depending which nodes are still connected, resistance should be 61 Ohms or 121 Ohms.

Method 2



1. Turn off the machine.
2. Locate a CAN node location on the machine.
3. Carefully push probes into the back of the connector containing the CAN wires.
4. Since the network remains connected in this node, resistance should measure approximately 61 Ohms.

DISPLAYING FAULT CODES / WARNINGS (PRO-PANEL MACHINES ONLY)

SYSTEM REQUIREMENTS: Windows® 7 OS,
Microsoft .NET 4.5 or later, USB to Mini-USB cable.

Machine software configuration, which is stored in the interface module, must be programmed if the I-Drive or interface modules are replaced or if optional features are installed.

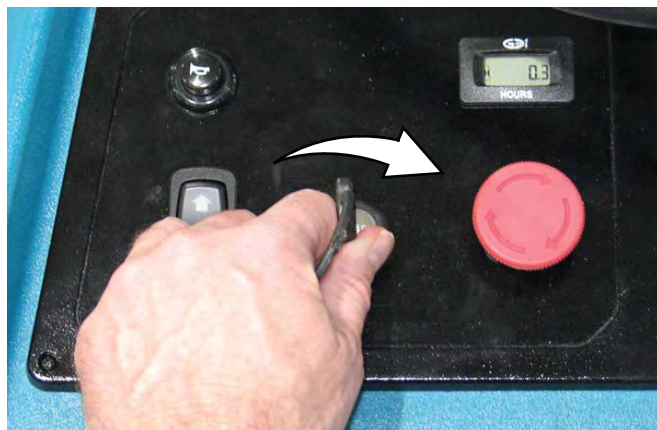
Authorized service providers can download the Service Diagnostics software. Factory-Direct Tennant Service personnel have this software installed on their ServiceLink devices.

The SERVICE DIAGNOSTICS TOOL configures up to seven control modules depending on optional packages. The interface module stores configuration data and communicates via RS232 serial communication with the i-Drive and through a CAN-Bus to all other modules.

1. Connect a USB cable from the computer to the machine.

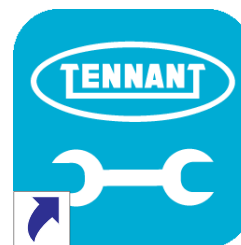


2. Turn the key switch to the ON position.



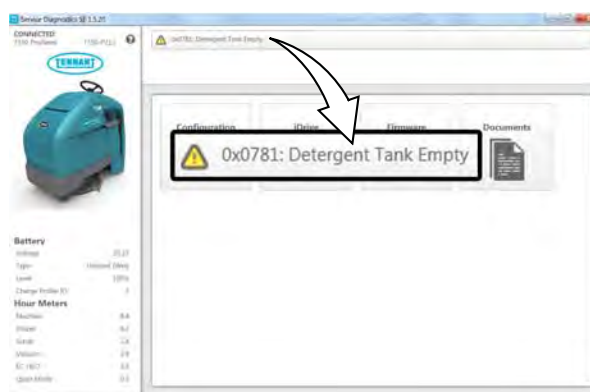
3. Double click the Service Diagnostics desktop shortcut or find the software in All Programs to launch the software.

NOTE: Windows may prompt a restart after installing the machine driver. Decline the restart, close Service Diagnostics, and relaunch Service Diagnostics.



Service Diagnostics

4. Active faults scroll across the top of the home screen.

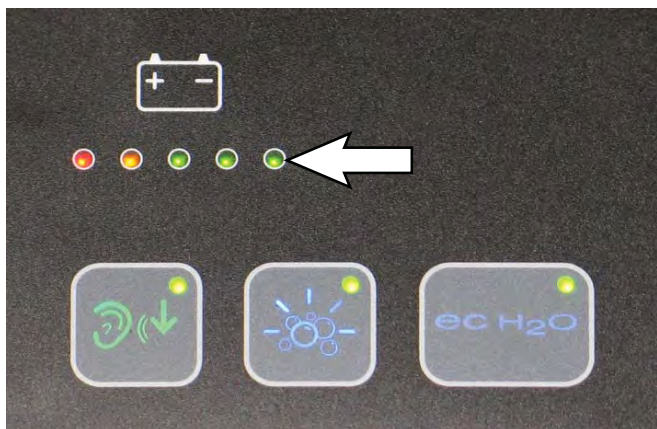
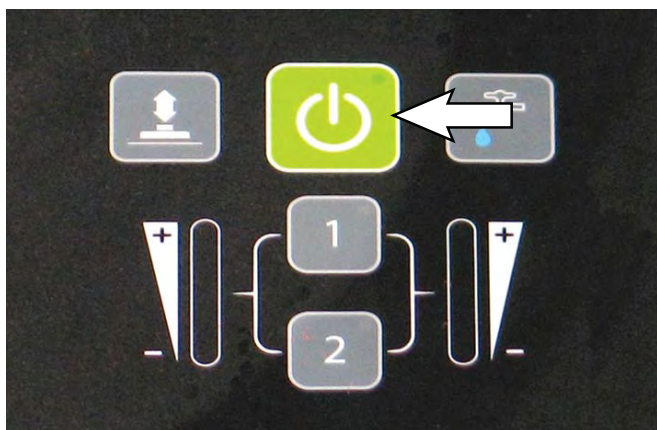


NOTE: Service Diagnostics tool is available to all Tennant Service personnel and authorized distributors. Contact Tennant Field Service for more information.

ENTERING THE MANUAL MODE (PRO-MEMBRANE PANEL MACHINES ONLY)

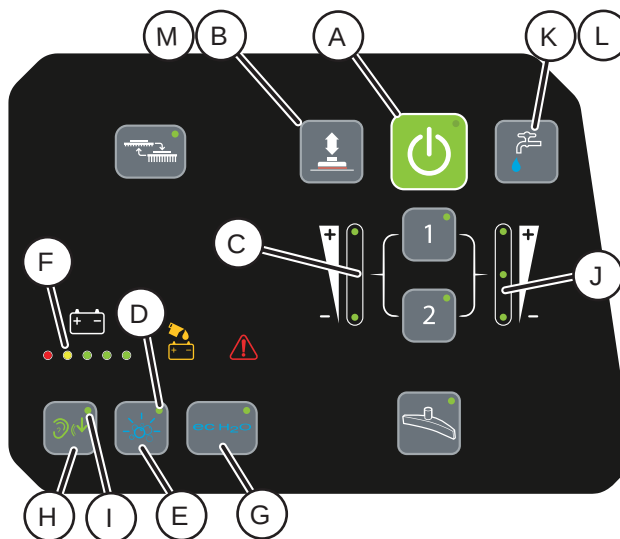
Note: Propel functionality is disabled while the machine is in the manual mode.

1. Turn the key switch to the OFF position.
2. Press and hold the center of the 1-Step button and turn the key switch to the ON position. Continue holding the 1-Step button until the BDI (battery discharge indicator) indicator lights illuminate



3. Release the 1-Step button.

4. Press the applicable button to access the corresponding function. Use the bail to control the actuator. Squeeze the bail to start the actuator and release the bail to stop the actuator.

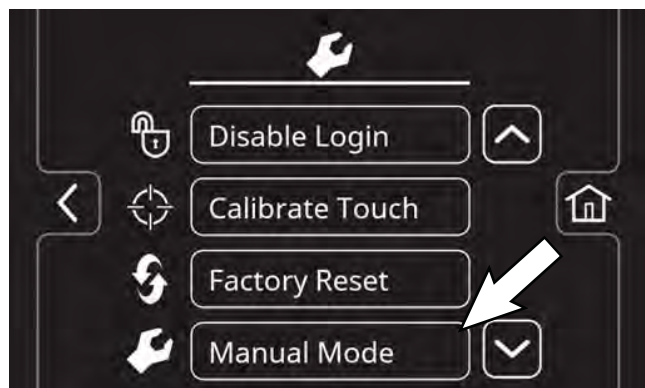


- A. Toggles scrub motor(s) on or off.
 - B. Toggles actuator direction.
 - C. LEDs display actuator direction.
 - D. LED indicates whether severe environment subsystem is active.
 - E. Turns Severe Environment subsystem on or off. Turns off ec-H2O if ec-H2O is enabled.
 - F. Indicates battery discharge level.
 - G. Indicates ec-H2O option is active. Turned on and off from rocker switch on accessory panel.
 - H. Turns the quiet mode on or off.
 - I. LED Indicates quiet mode active setting.
 - J. LEDs display flow rate setting.
 - K. Cycles between four solution flow setting options (Off, 1, 2, 3). When ec-H2O is enabled, ec-H2O will function instead of conventional solution.
 - L. LED indicates if scrub motor(s) are on or off.
 - M. B and L pressed together simultaneously toggle between ABW pump on or ABW pump off.
14. Turn the key switch to OFF position to exit manual mode and return to operating mode

ENTERING THE MANUAL MODE (PRO-PANEL MACHINES ONLY)

Note: Propel functionality is disabled while the machine is in the manual mode.

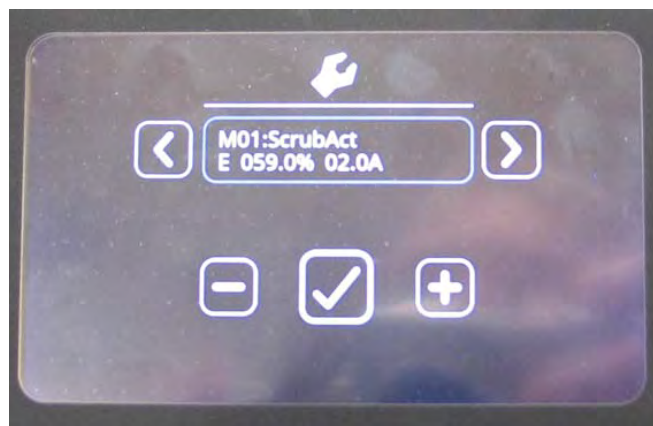
1. Turn the key switch to the ON position.
2. Log in as a service user at the Supervisor Mode log in screen (service user log in code required). When logged in as service user, the Manual Mode button will appear as a selection in the Setting menu.



3. Select Manual Mode from the Setting menu.
4. Use the right arrow button or left arrow button to scroll through the various manual mode screens.

Pro-Panel Manual Mode Screens:

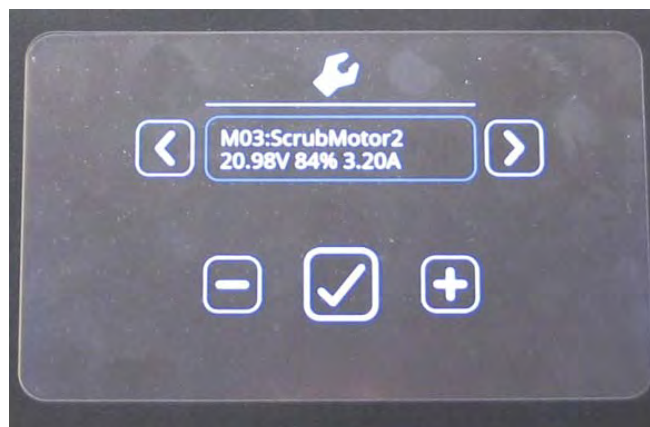
M01: Scrub Actuator: Press the - (minus) button to set the actuator in the retract direction and the + (plus) button to set the actuator in the extend direction. Step on the Green Go pedal to move the actuator. Displays E (extend) or R (retract), the scrub actuator PWM (pulse width modulation) duty cycle, and the motor current.



M02: Scrub Motor 1: Press the - (minus) button to set the actuator in the retract direction and the + (plus) button to set the actuator in the extend direction. Step on the Green Go pedal to move the actuator. Press the check box to turn scrub motor 1 on or off. Displays the average voltage, PWM duty cycle, and motor current.

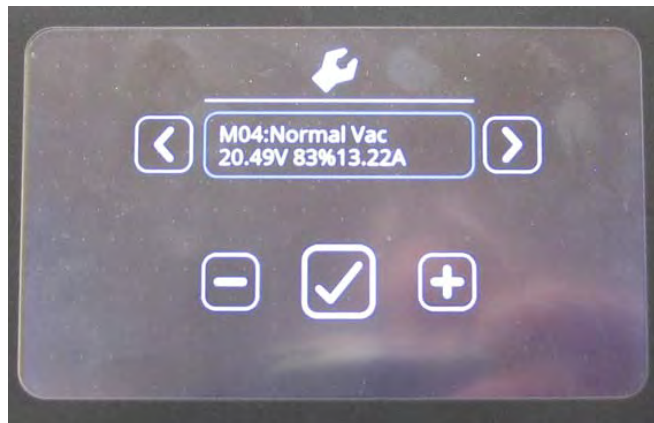


M03: Scrub Motor 2: Press the - (minus) button to set the actuator in the retract direction and the + (plus) button to set the actuator in the extend direction. Step on the Green Go pedal to move the actuator. Press the check box to turn scrub motor 2 on or off. Displays the average voltage, PWM duty cycle, and motor current.

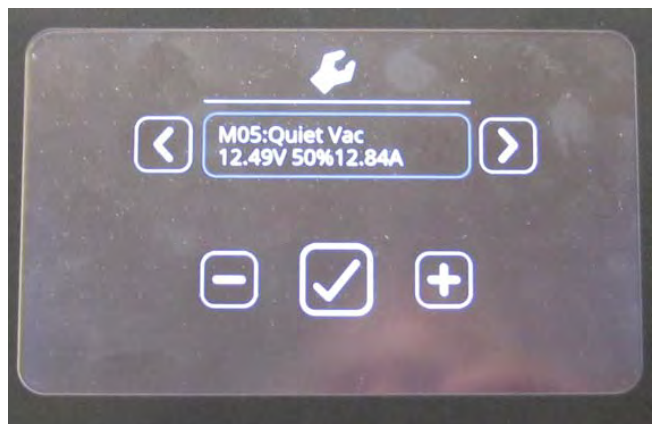


TROUBLESHOOTING

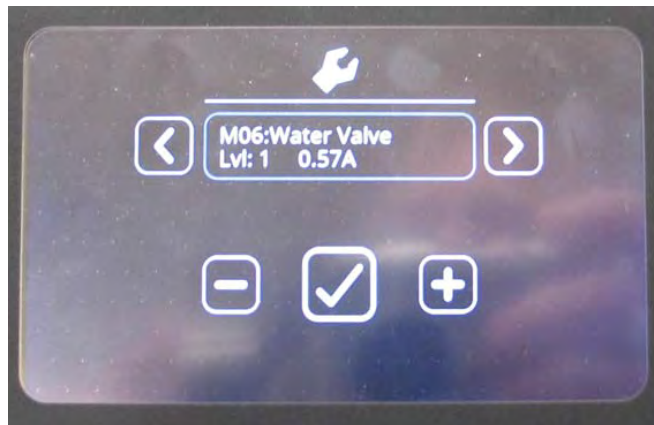
M04: Normal Vac: Press the check box to turn the vacuum motor on or off at normal full speed. Displays the average voltage, PWM duty cycle, and motor current.



M05: Quiet Vac: Press the check box to turn the vacuum motor on or off at reduced speed. Displays the average voltage, PWM duty cycle, and motor current.



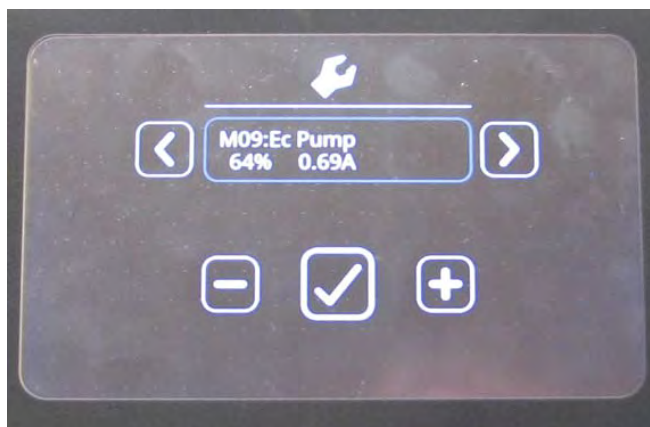
M06: Water Valve: Press the check box to turn the water valve cycling on or off. Press the - button to decrease the water flow setting and the + button to increase the water flow setting. Displays the water flow setting and motor current.



M07: Detergent Pump: Press the check box to turn the detergent pump on or off. Press the - (minus) button and the + (plus) button to change the ec-H2O flow setting (three settings and off). Displays the average voltage, PWM duty cycle, and motor current.



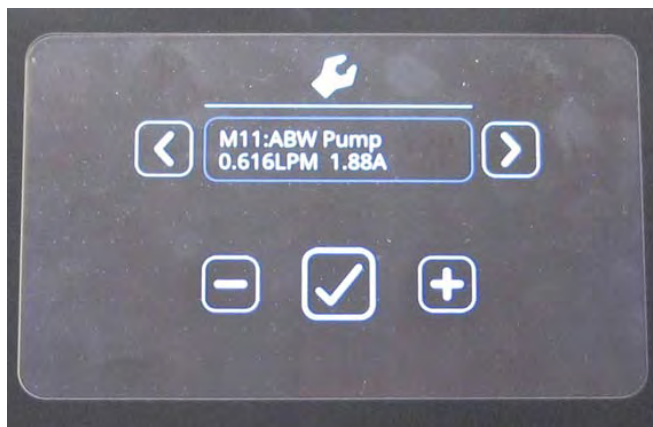
M09: Ec Pump: Press the check box to turn the ec-H2O pump on or off. Press the - (minus) button and the + (plus) button to change the ec-H2O flow setting (three settings and off). Displays the PWM duty cycle and motor current.



M10: Ec Cell: Press the check box to turn the ec-H₂O cell plates on or off. Press the - (minus) button and the + (plus) button to change the ec-H₂O flow setting (three settings and off). Displays the cell PWM duty cycle and cell current



M11: ABW Pump: Press the check box to turn the automatic battery watering pump on or off. Displays the flow meter measured flow rate and motor current.



5. Turn the key switch to the OFF position to turn off the machine and exit the Manual Mode.

SERVICE

SERVICE DIAGNOSTICS TOOL

Machine software configuration, which is stored in the interface module, must be programmed if the i-Drive or interface modules are replaced or if optional features are installed in the field.

Authorized service providers can download the Service Diagnostics software. Factory-Direct Tennant Service personnel have this software installed on their ServiceLink devices.

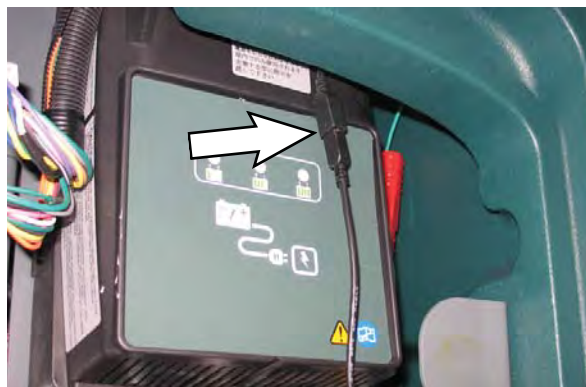
A USB cable connects from the notebook to an external port on the control console (USB to mini USB adapter cable required). The SERVICE DIAGNOSTICS TOOL configures up to seven control modules depending on options. The interface module stores configuration data and communicates via RS232 serial communication with the i-Drive and through a CAN-Bus to all other modules.

- **Interface Module:** The interface module is located in the operator console.
- **Machine Control Module:** The machine control module is located beneath the circuit board mounting heat shrink at the rear of the battery compartment.
- **Propel Module:** The propel module is located at the rear of the solution tank, behind the control module.
- **IRIS Module (option):** The IRIS module is attached to the machine control module as an assembly.
- **Onboard Battery Charger Module (option):** The onboard battery charger is located beneath the plastic cover at the rear of the machine.
- **ec-H2O NanoClean Module (option):** The ec-H2O module is located beneath the recovery tank at the front of the machine.
- **Automatic Battery Watering (ABW) Module (option):** The ABW module is located under the circuit breakers at the rear of the machine.

PROGRAMMING A NEW INTERFACE MODULE

SYSTEM REQUIREMENTS: Windows® 7 Operating System, Microsoft .NET 4.5 or later, USB to Mini-USB cable.

1. Connect a USB cable from a computer to the machine.



2. Turn the key switch to the ON position.

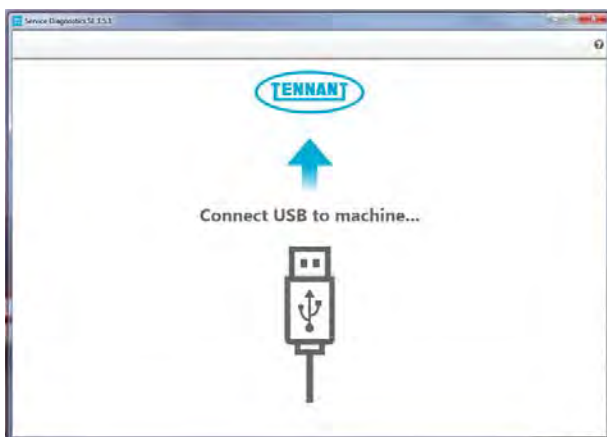


- Double click the Service Diagnostics desktop shortcut or find the software in All Programs to launch the software.

NOTE: Computer may prompt a restart after installing the machine driver. Decline the restart, close Service Diagnostics, and relaunch Service Diagnostics.



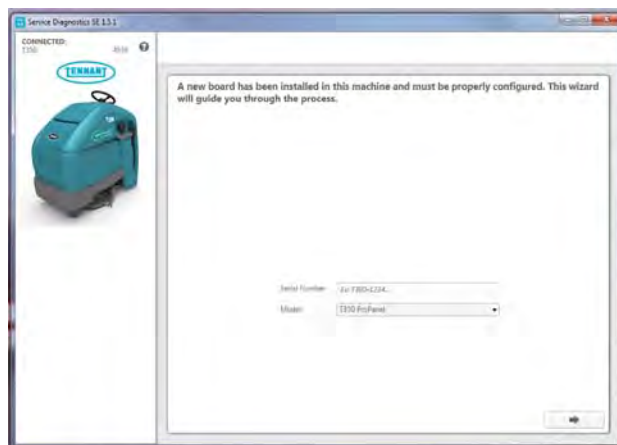
NOTE: Confirm key switch is ON and check USB cable connection to the machine if the screen below appears on the computer screen.



- The Service Diagnostics tool now connects to the control module network.



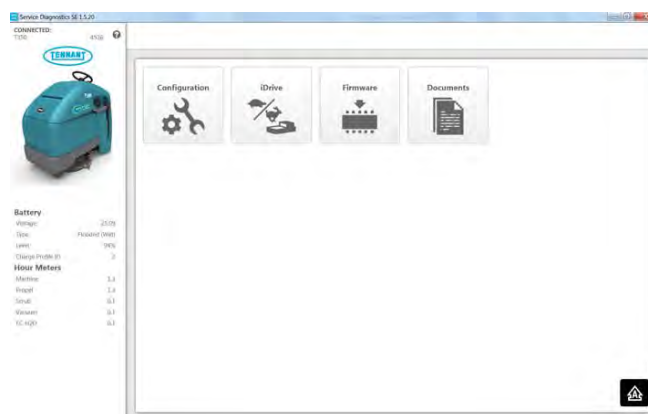
- The Service Diagnostics tool automatically detects a new interface module installation if a new interface module was installed. Enter the model and serial number and then click the arrow button.



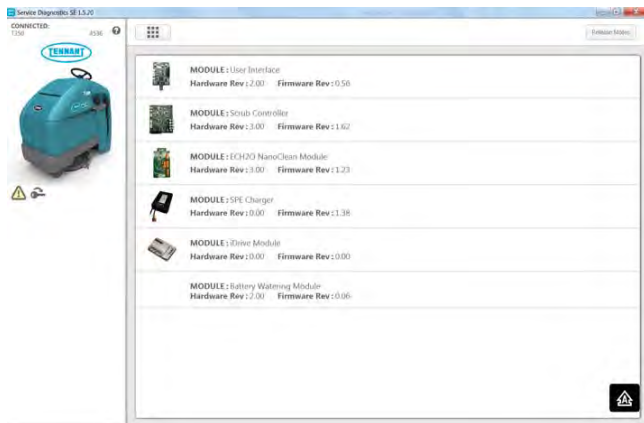
- Inspect the actual machine configuration and match applicable configurations from the drop-down menus and then click on the arrow button.

NOTE: Reconfiguration may take several minutes.

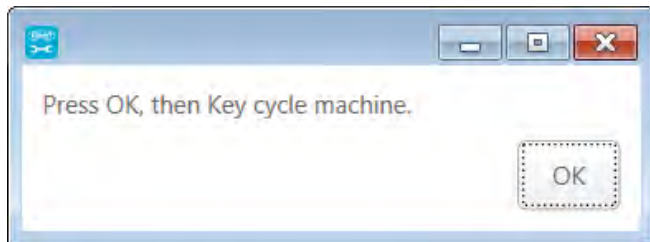
NOTE: Configurations may differ from what is shown, depending on the options / features equipped on the machine. If no interface module was installed, this screen will appear first. First confirm there is no Firmware update available. If a Firmware update is available, the Firmware update should be done first.



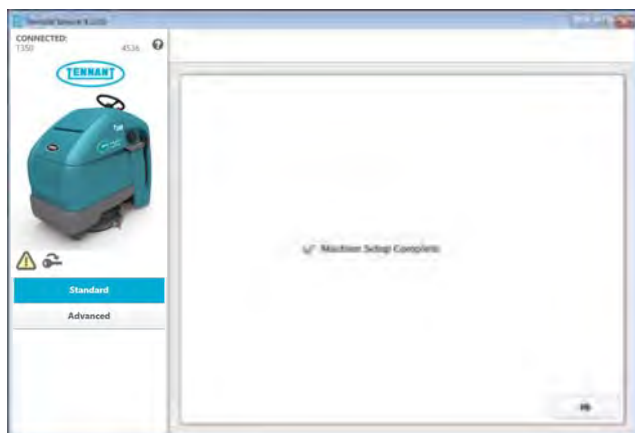
- The programming process begins and all control modules are updated (if applicable).



- The Service Diagnostic tool may prompt to cycle the key switch OFF/ON during the process. If prompted, click the OK button and then cycle the key switch to allow the programming to continue. Do not interrupt process unless prompted to do so.



- Cycle the key switch to save selections after Machine Setup Complete appears on the screen.



UPDATING THE MACHINE FIRMWARE

SYSTEM REQUIREMENTS: Windows® 7 Operating System, Microsoft .NET 4.5 or later, USB to Mini-USB cable.

Machine software configuration, which is stored in the interface module, must be programmed if the i-Drive or interface modules are replaced or if optional features are installed in the field.

Authorized service providers can download the Service Diagnostics software. Factory-Direct Tennant Service personnel have this software installed on their ServiceLink devices.

A USB cable connects from the notebook to an external port on the control console (USB to mini USB adapter cable required). The SERVICE DIAGNOSTICS TOOL configures up to seven control modules depending on options. The interface module stores configuration data and communicates via RS232 serial communication with the i-Drive and through a CAN-Bus to all other modules.

1. Connect a USB cable from the computer to the machine.



2. Turn the key switch to the ON position.



3. Double click the Service Diagnostics desktop shortcut or find the software in All Programs to launch the software.

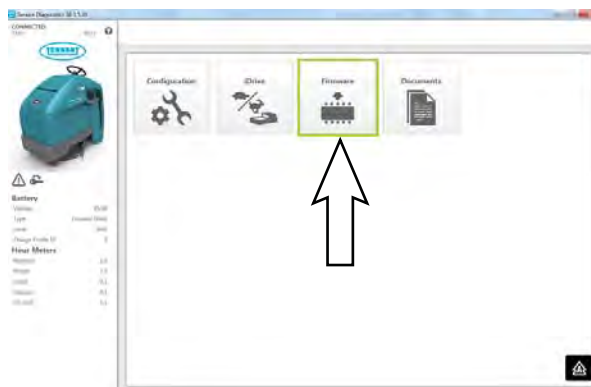
NOTE: Computer may prompt a restart after installing the machine driver. Decline the restart, close Service Diagnostics, and relaunch Service Diagnostics.



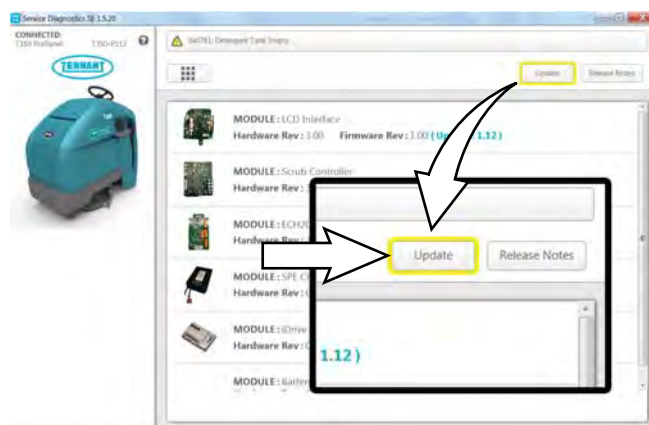
Service
Diagnostics

4. Check for machine software updates. A yellow highlight surrounding the Firmware button indicates that updates are available. Click on the Firmware button to access the Update screen.

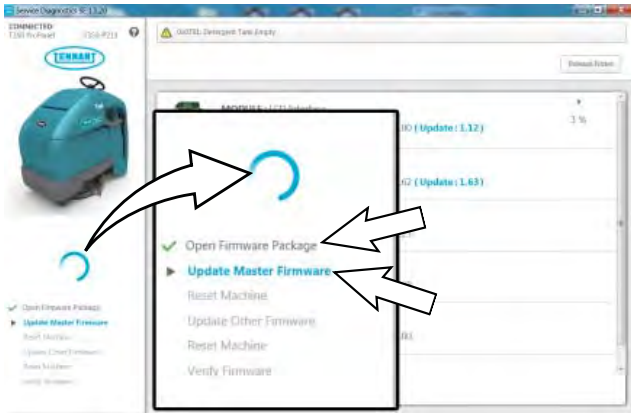
NOTE: Update installation may take several minutes. Do not interrupt process unless prompted.



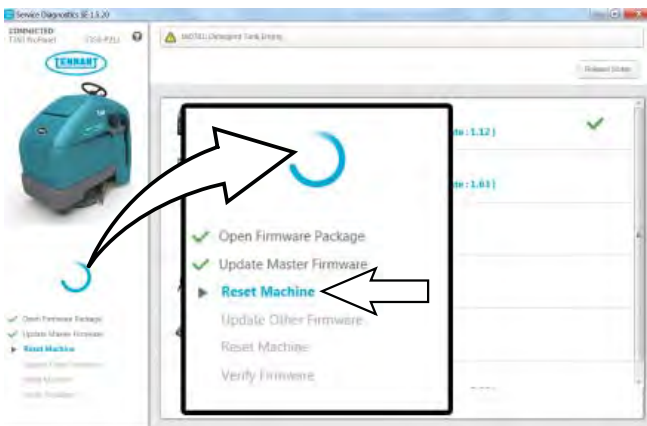
5. Click on the Update button to begin updating the modules.



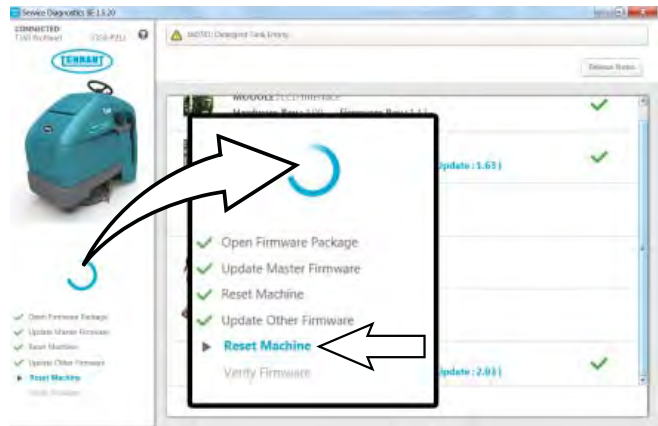
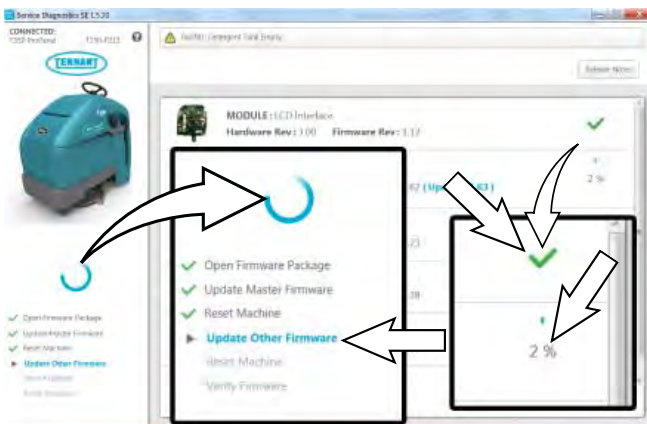
- The firmware package opens and “Update Master Firmware” begins. The process indicator and firmware update status bar appear on the left side of the screen.



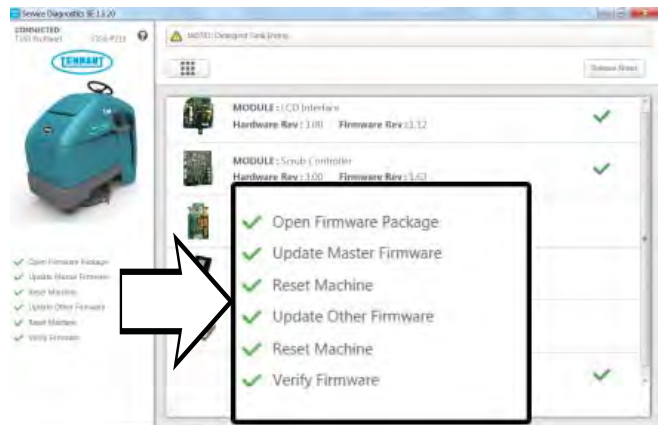
Allow the firmware update package to update the machine operating system. Various update status indicators appear on the screen while the firmware updates are occurring.



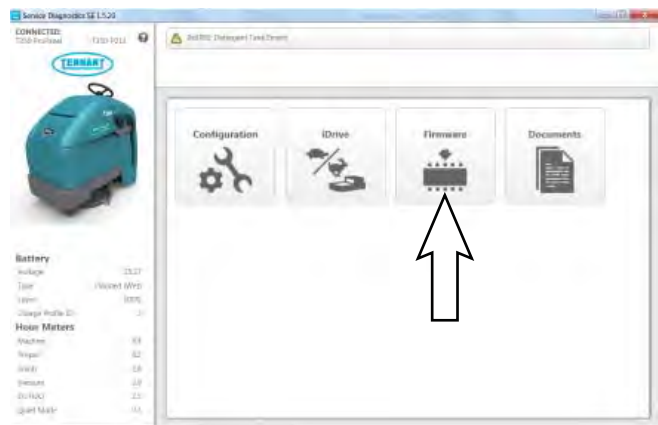
Watch the visual status indicators on the screen for the firmware update status.



The process indicator will disappear from the screen and all items in the firmware update status bar will have check marks to the left to verify the firmware has occurred.

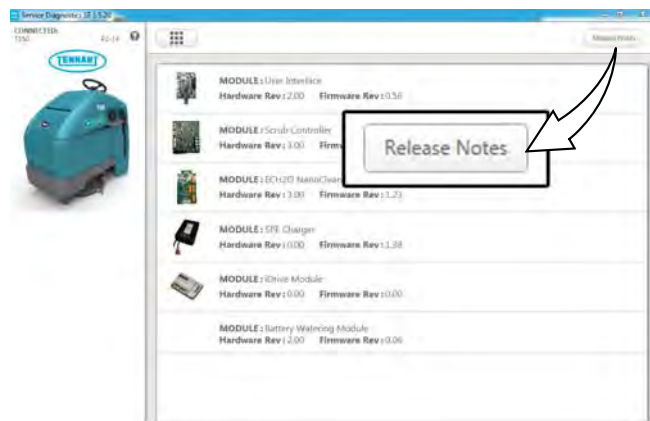


The firmware updates are complete when there is no longer a yellow highlight surrounding the Firmware button.



- Cycle the key switch to save the firmware updates.

8. Click the Release Notes button to access the attached PDF notes for the firmware updates.



9. Refer to the PDF notes to confirm the firmware updates and fixes to the machine.



T350 Firmware Release Notes

<u>Package</u>				
<u>Version</u>	<u>Release Date</u>	<u>Firmware Revision</u>		<u>Changes</u>
1.07	2017.10.31	User Interface: 1.12 Scrub Controller: 1.63 ECH2O NanoClean: 1.23 Battery Watering: 2.03		☒ Prevents constant on SE mode in Lockout Mode 3 ☒ Improve IDrive communication
1.06	2017.09.25	User Interface: 1.10 Scrub Controller: 1.63 ECH2O NanoClean: 1.23 Battery Watering: 2.03		☒ Production Release

PROGRAMMING THE i-DRIVE MODULE

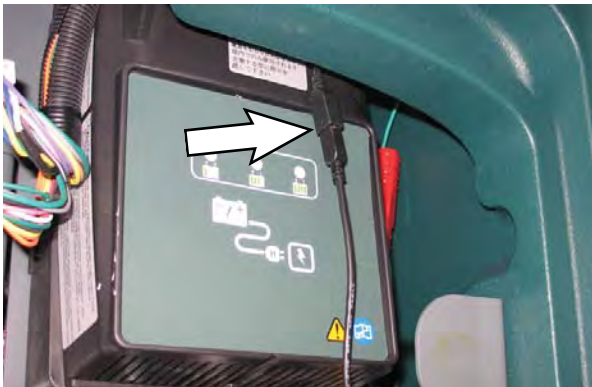
SYSTEM REQUIREMENTS: Windows® 7 Operating System, Microsoft .NET 4.5 or later, USB to Mini-USB cable.

Machine software configuration, which is stored in the interface module, must be programmed if the i-Drive or interface modules are replaced or if optional features are installed in the field.

Authorized service providers can download the Service Diagnostics software. Factory-Direct Tennant Service personnel have this software installed on their ServiceLink devices.

A USB cable connects from the notebook to an external port on the control console (USB to mini USB adapter cable required). The SERVICE DIAGNOSTICS TOOL configures up to seven control modules depending on options. The interface module stores configuration data and communicates via RS232 serial communication with the i-Drive and through a CAN-Bus to all other modules.

1. Connect a USB cable from a notebook computer to the machine.

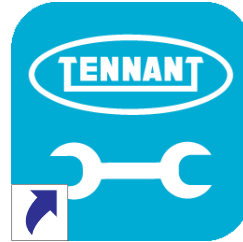


2. Turn the key switch to the ON position.



3. Double click the Service Diagnostics desktop shortcut or find the software in All Programs to launch the software.

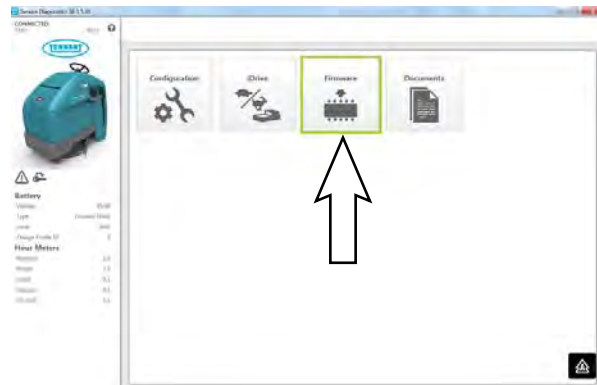
NOTE: Computer may prompt a restart after installing the machine driver. Decline the restart, close Service Diagnostics, and relaunch Service Diagnostics.



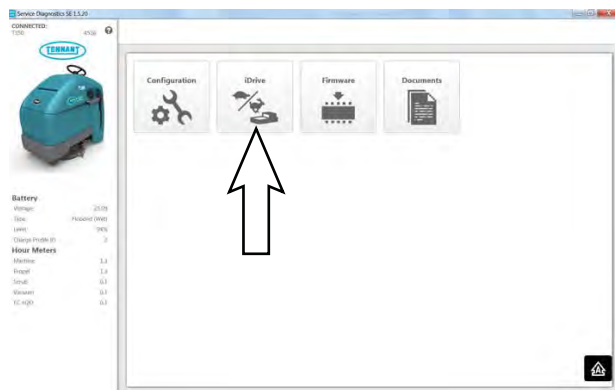
Service
Diagnostics

4. Check for machine software updates. A yellow highlight surrounding the Firmware button indicates that updates are available. Click on the Firmware button to install updates. If there are no Firmware updates, proceed to the next step.

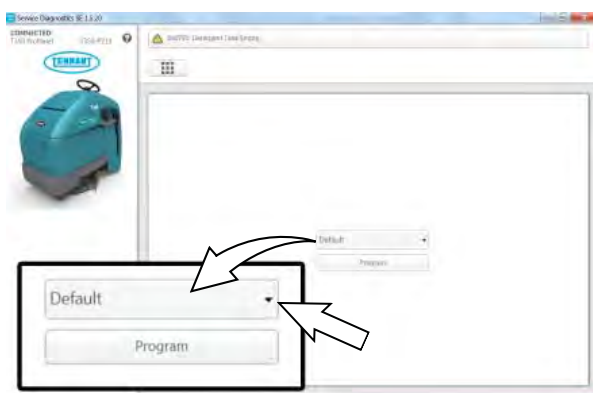
NOTE: Update installation may take several minutes.



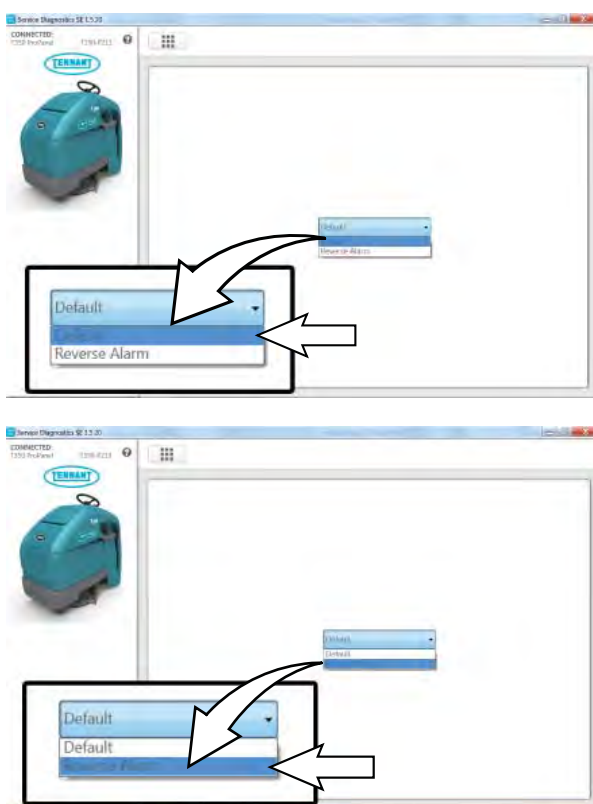
5. Click on the i-Drive button.



6. Click on the Default pull down menu.



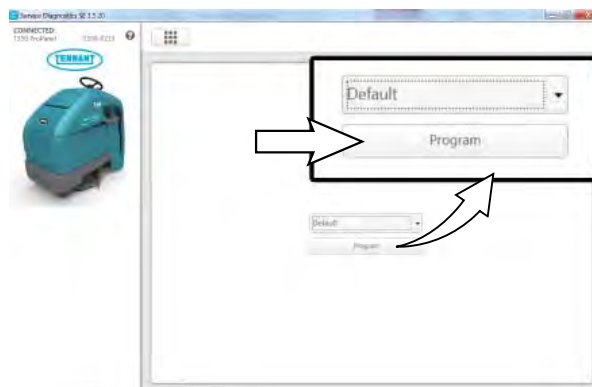
7. Select item(s) from pull down menu to program into the i-Drive.



In the above example the only two options are
 Default = No reverse alarm, and
 Reverse Alarm = Having a reverse alarm.
 User definable hardware is present in all machines.

NOTE: This feature can also be set up in machine Configuration. Use the Warning Lights and Alarms tab. See RECONFIGURING THE MACHINE AFTER NEW HARDWARE / OPTION INSTALLATION.

8. Click on the Program button to program the drive module.



9. Cycle the key switch to save.

RECONFIGURING THE MACHINE AFTER NEW HARDWARE / OPTION INSTALLATION

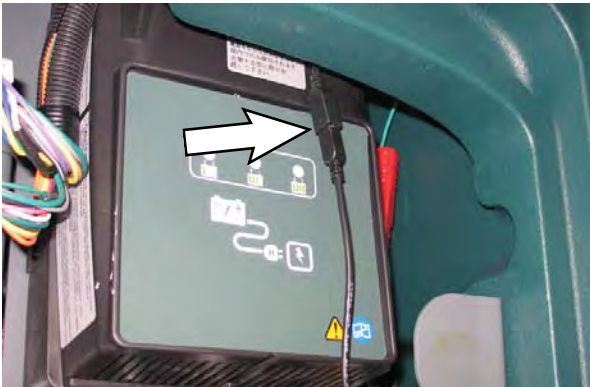
SYSTEM REQUIREMENTS: Windows® 7 Operating System, Microsoft .NET 4.5 or later, USB to Mini-USB cable.

Machine software configuration, which is stored in the interface module, must be programmed if the i-Drive or interface modules are replaced or if optional features are installed in the field.

Authorized service providers can download the Service Diagnostics software Factory-Direct Tennant Service personnel have this software installed on their ServiceLink devices.

A USB cable connects from the notebook to an external port on the control console (USB to mini USB adapter cable required). The SERVICE DIAGNOSTICS TOOL configures up to seven control modules depending on options. The interface module stores configuration data and communicates via RS232 serial communication with the i-Drive and through a CAN-Bus to all other modules.

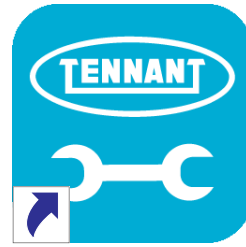
1. Connect a USB cable from the computer to the machine.



2. Turn the key switch to the ON position.

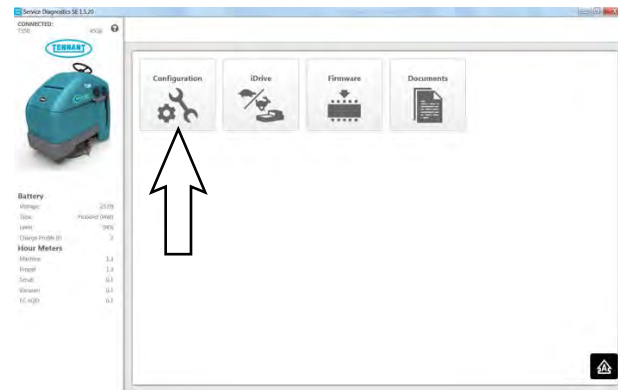


3. Double click the Service Diagnostics desktop shortcut or find the software in All Programs to launch the software.

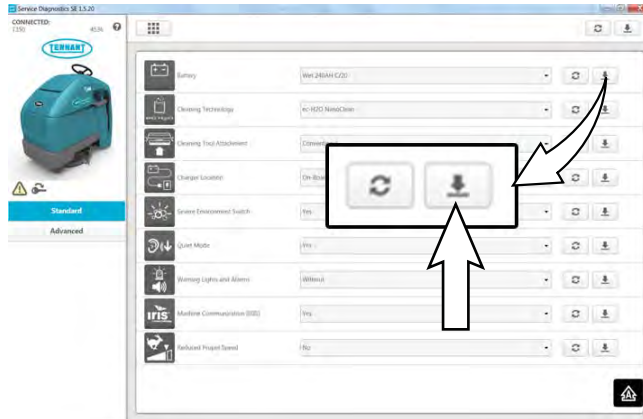


Service
Diagnostics

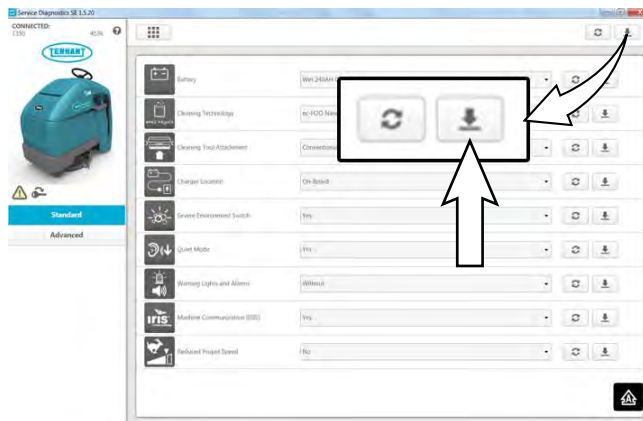
4. Click on the Configuration button to display a list of configurable options.



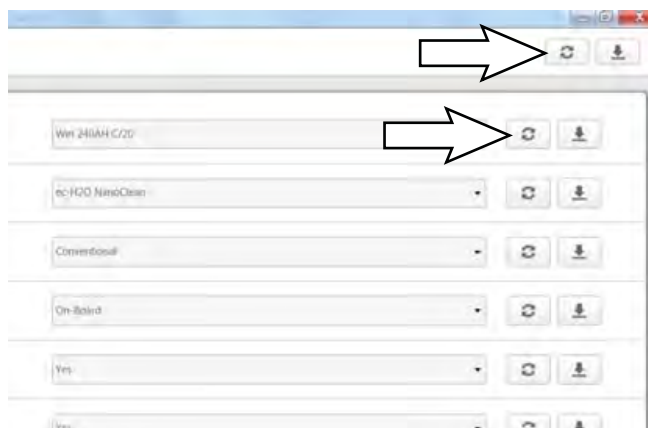
5. Select the configurable options that apply from the drop down menus and then click individual arrow buttons to launch individual module reprogramming (this is faster).



Or click the header arrow button to launch all module reprogramming (this is slower).



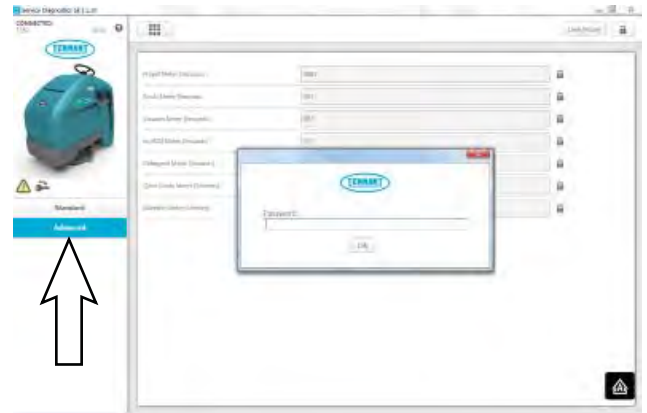
6. Click the refresh button to display the new configuration after reprogramming is completed.



7. Cycle the key switch to save.

It is possible to perform advanced configuration updates, but a password is required to access the Advanced configuration options.

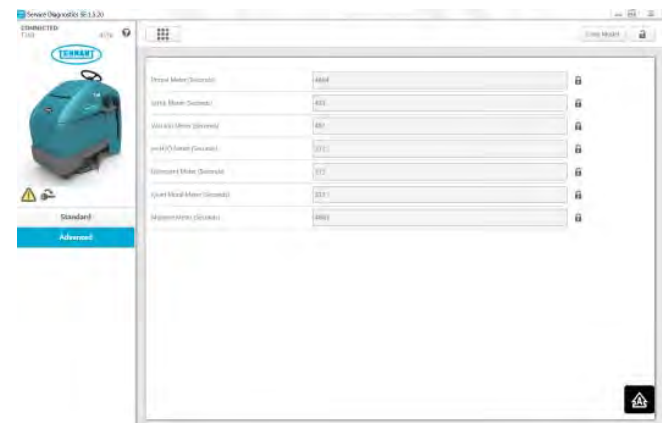
8. Click on the menu located on the left side of the screen. A password box will appear on the screen.



9. Enter the password into the password box and click the OK button. Contact T.A.C. (Tennant Assistance Center) for required password.



10. Access the advanced configuration screen to reset component hours or record old hours on repair order for warranty purposes.



11. Cycle the key switch to save and exit the Advanced Configuration screen.

ACCESSING SUPPORT DOCUMENTATION

SYSTEM REQUIREMENTS: Windows® 7 Operating System, Microsoft .NET 4.5 or later, USB to Mini-USB cable.

Machine software configuration, which is stored in the interface module, must be programmed if the i-Drive or interface modules are replaced or if optional features are installed in the field.

Authorized service providers can download the Service Diagnostics software. Factory-Direct Tennant Service personnel have this software installed on their ServiceLink devices.

A USB cable connects from the notebook to an external port on the control console (USB to mini USB adapter cable required). The SERVICE DIAGNOSTICS TOOL configures up to seven control modules depending on options. The interface module stores configuration data and communicates via RS232 serial communication with the i-Drive and through a CAN-Bus to all other modules.

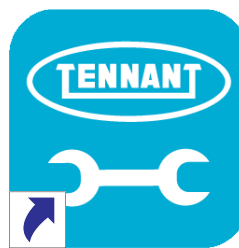
1. Connect a USB cable from the computer to the machine.



2. Turn the key switch to the ON position.

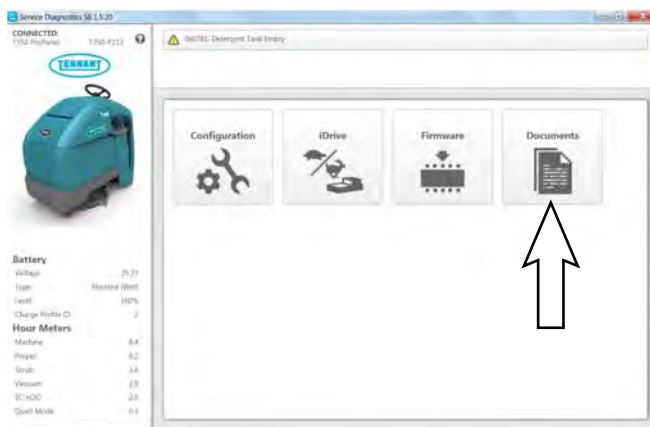


3. Double click the Service Diagnostics desktop shortcut or find the software in All Programs to launch the software.

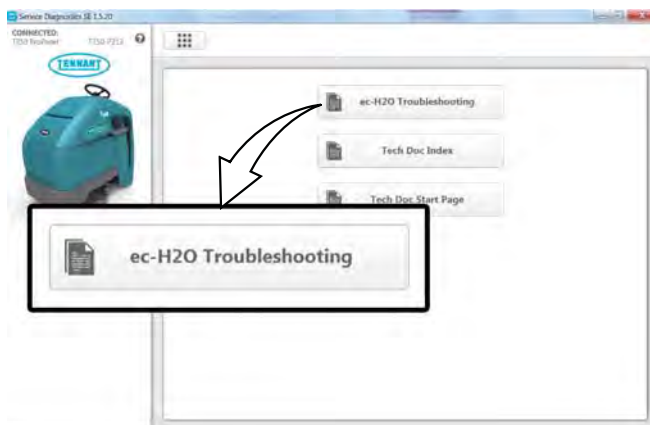


Service
Diagnostics

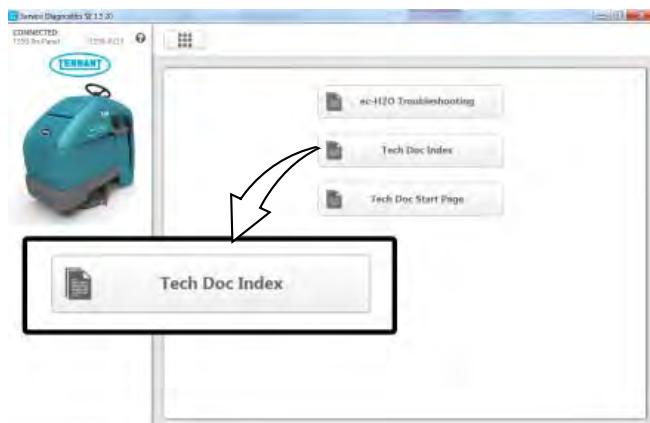
4. Click on the Documentation button to display a list of support documentation.



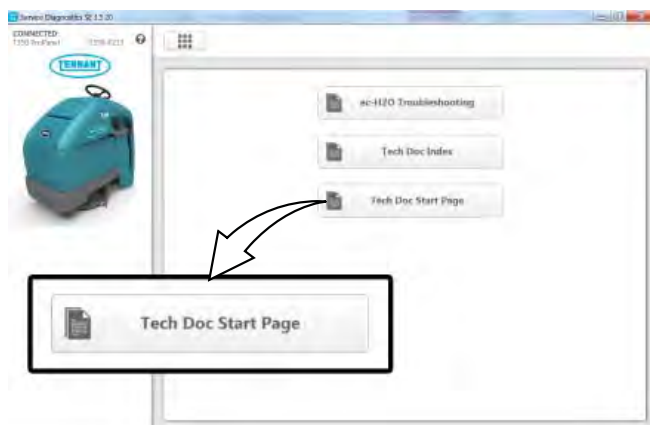
5. Click on the appropriate button to access needed support documentation. Click on the ec-H2O Troubleshooting button to access ec-H2O troubleshooting documentation.



Click on the Tech Doc Index button to access the Technical Documentation Index.



Click on the Tech Doc Start Page button to access the Technical Publications Start Page.



CHANGING THE OFF-BOARD BATTERY CHARGER SETTINGS

1. Disconnect the charger power cable from the wall outlet or the charger. Wait 30 seconds for the input relay to open.



2. While reconnecting AC input, press and hold the Select Charge Profile Button for approximately 10 seconds, through the light check function, until the Error Indicator is illuminated (amber) and Battery Charging Indicator starts flashing (green).



3. Press and release the Select Charge Profile Button to advance through the charge profiles. The selected charging profile will be displayed up to three times.

NOTE: Process will time out and profile will remain unchanged if there is 15 seconds of inactivity. A profile number is allowed to display three times.



4. When the new charging profile is displayed, press and hold the Select Charge Profile button for 10 seconds to confirm selection and exit Profile Selection Mode. When the charge profile is confirmed, the Error Indicator and Battery Charging Indicator lights will turn off and the blue AC Power Indicator will remain illuminated. Release the Select Charge Profile button.
5. Press the Select Charge Profile Button to ensure the new profile is selected.

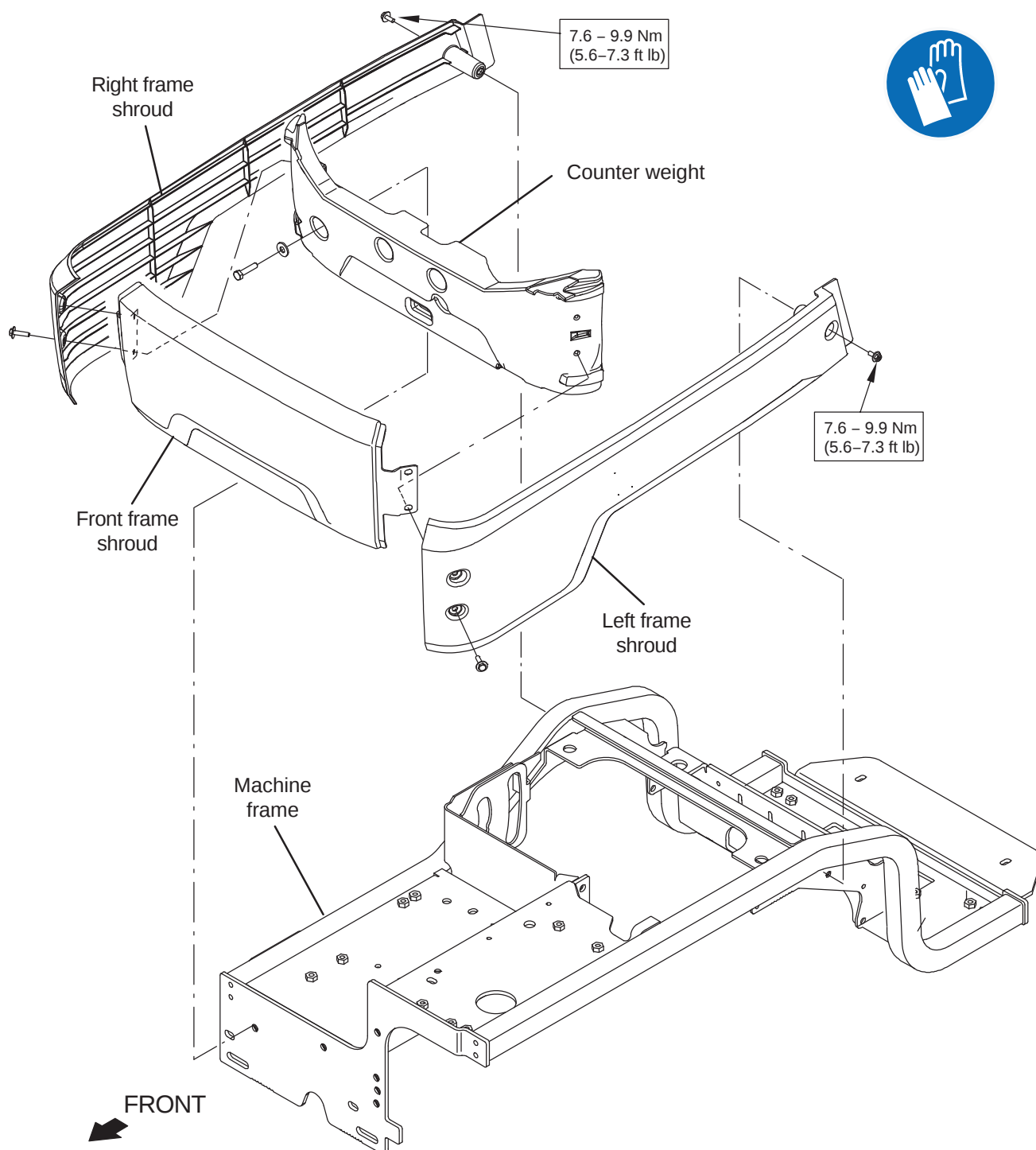
Changing the Off-Board Battery Charger Settings instructions and photos taken from the Delta-Q IC650 Charger Manual.

© Delta-Q Technologies Corp. (PN: 710-0138 Rev 3
Date: 14/07/2014)

CLEANING SYSTEMS

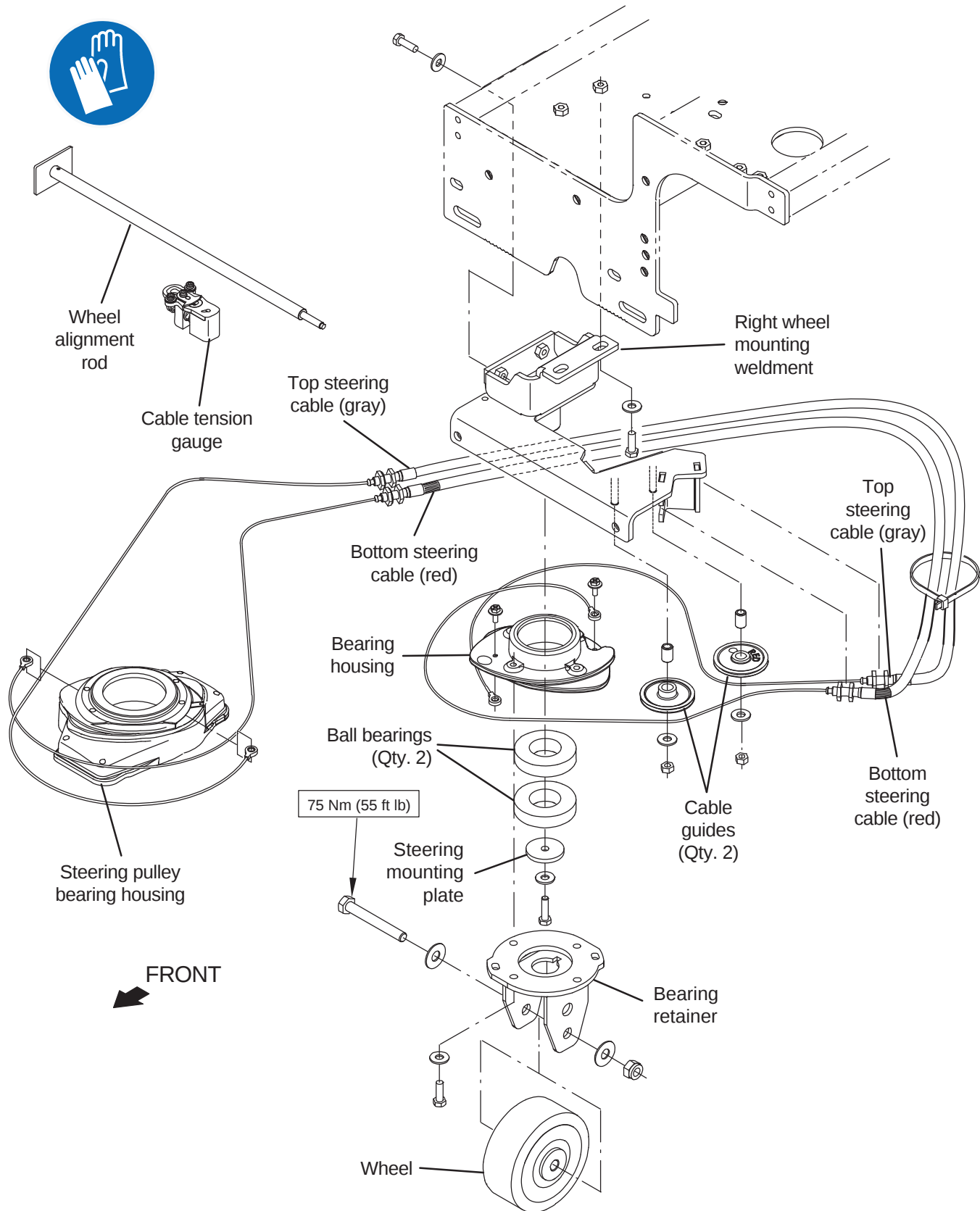
REMOVING / INSTALLING THE SHROUDS

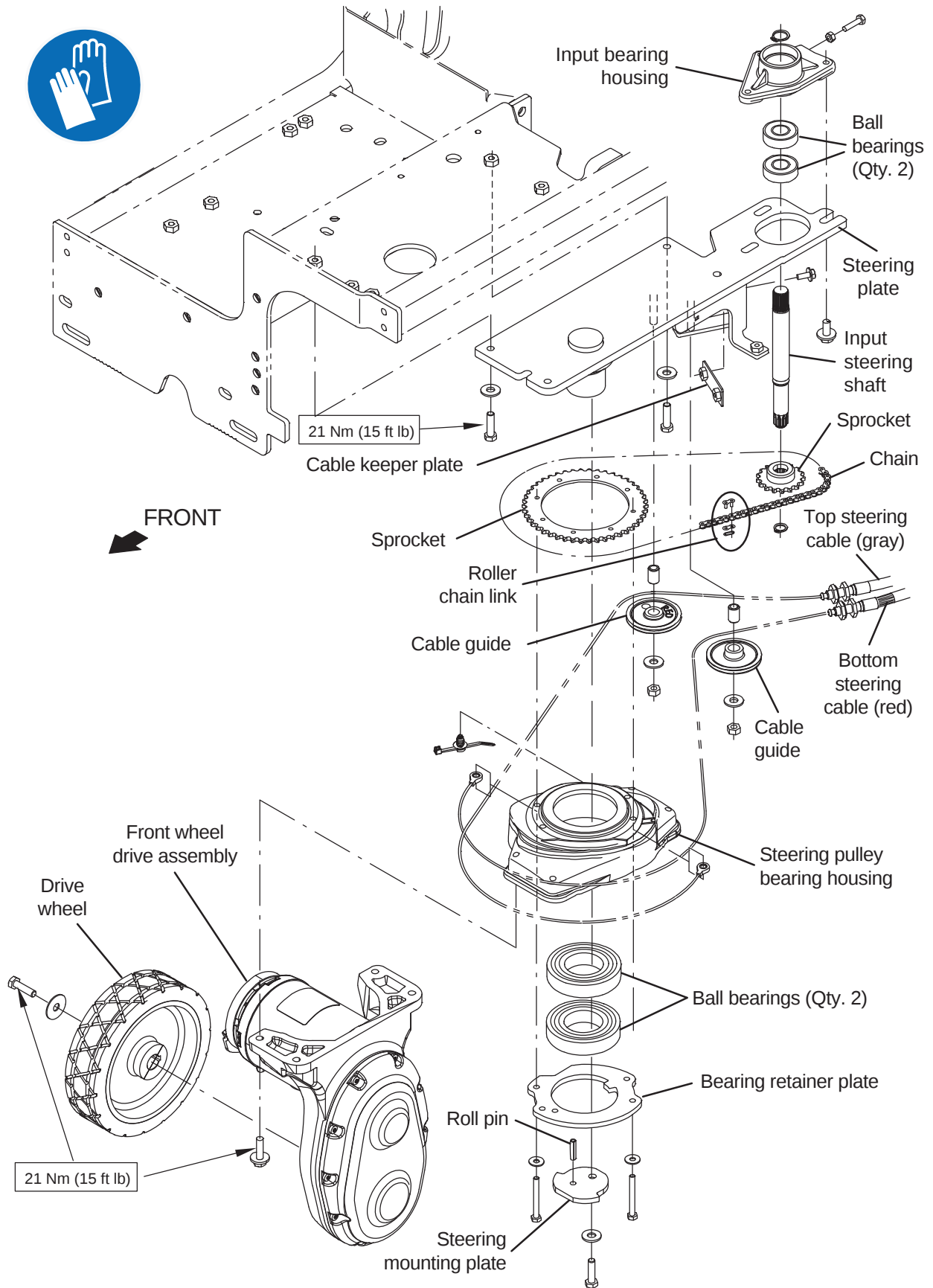
NOTE: Always tighten the hardware to the correct torque specifications to avoid damaging the front frame shroud, left frame shroud, and right frame shroud when reinstalling / replacing the shrouds.



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

REMOVING / INSTALLING / ADJUSTING THE STEERING CABLES





1. Completely empty both the solution tank and the recovery tank.
2. Turn on the machine and completely lower the scrub head.
3. Turn the key to the OFF position.

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

FOR SAFETY: When servicing machine, disconnect battery connection and charger cord before working on machine.

4. Remove the right frame shroud, the left frame shroud, and the center frame shroud from the machine. See REMOVING / INSTALLING THE SHROUDS.
5. Disconnect the battery cable from the machine.
6. Remove the batteries from the machine.
7. Remove the scrub head from the machine. Move the scrub head out of the way. See REMOVING / INSTALLING / REPLACING THE SCRUB HEAD ASSEMBLY.

FOR SAFETY: When servicing machine, avoid contact with battery acid, keep all metal objects off batteries, and use a hoist or adequate assistance when lifting batteries.

8. Position a protective blanket next to the left side of the machine that will be tipped onto the floor.

NOTE: Do Not allow the machine to drop when tipping it onto the protective blanket. Components could be damaged if machine is allowed to drop.

9. Carefully tip the machine onto the protective blanket.

10. Remove the right front wheel from the machine. Remove only the wheel, not the entire wheel assembly.



11. Remove the front wheel drive assembly from the machine. It is not necessary to unplug main wire harness from the front wheel drive assembly when removing the front drive wheel assembly from the machine. Place the front drive wheel assembly out of the way near the machine.



12. Loosen both steering cable jam nuts located near the right wheel mounting weldment end of the bottom steering cable (red).



13. Disconnect the bottom steering cable (red) from the right front wheel bracket.



14. Remove the bottom steering cable (red) from the right front wheel mounting weldment.

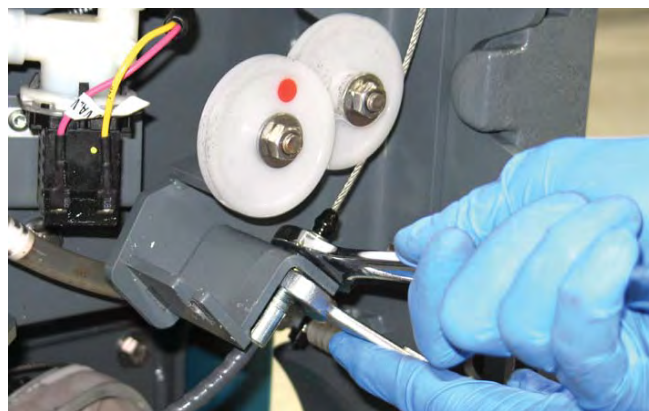


15. Cut all cable ties securing the steering cables to the machine. Note locations of wire ties before cutting them from the machine. New wire ties will need to be installed in the same locations to secure the steering cables to the machine.

16. Pull the bottom steering cable (red) out through the frame of the machine.



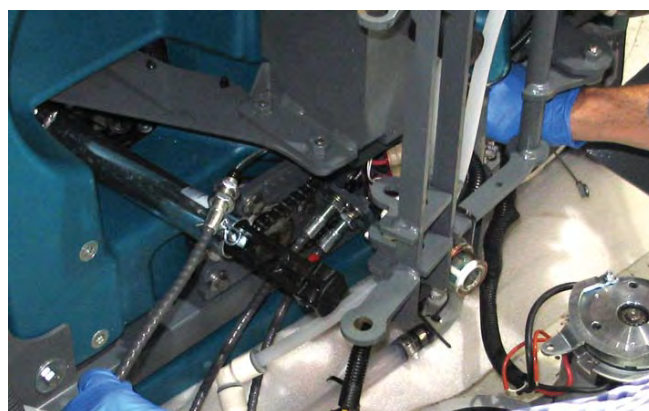
17. Loosen the jam nuts located near the right front wheel mounting weldment end of the top steering cable (gray).



18. Disconnect the top steering cable (gray) from the right front wheel bracket.

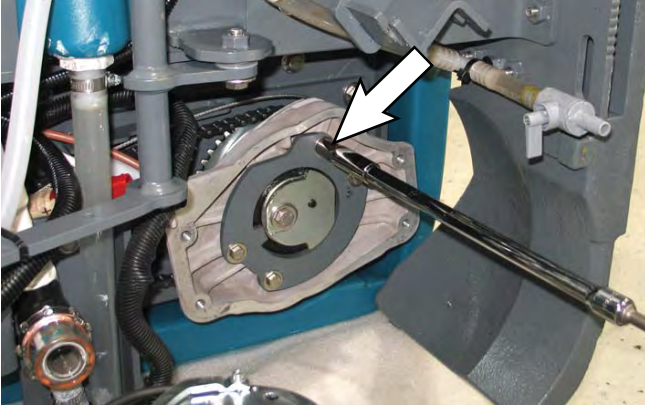


19. Remove the top steering cable (gray) from the frame bracket and pull the cable through the frame.

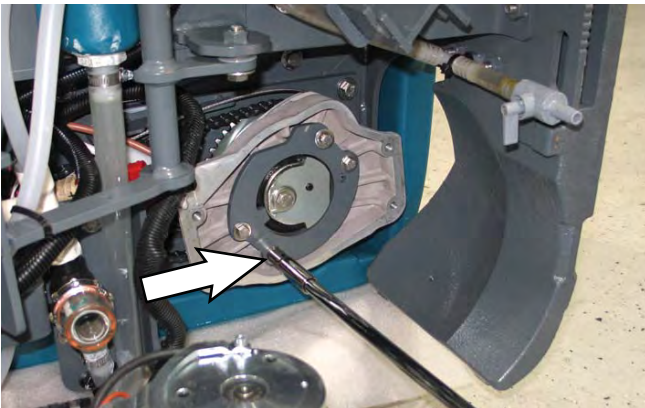


*NOTE: Only loosen / remove hardware noted in the following two steps. **Do Not** loosen / remove any of the other hardware securing the bearing retainer plate to the steering pulley bearing housing / sprocket.*

20. Loosen the hardware securing the bottom steering cable (red) to the drive wheel bearing retainer plate.

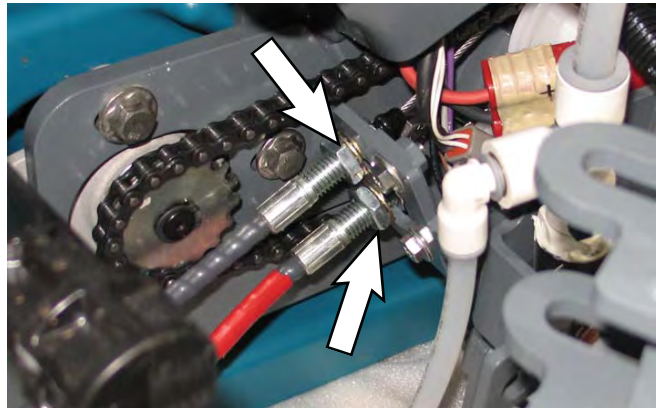


21. Loosen the hardware securing the top steering cable (gray) to the drive wheel bearing retainer plate.



22. Remove the cable keeper plate from the steering transmission.

23. Loosen jam nuts securing both steering cable to bracket of machine frame near the drive wheel bearing retainer plate.



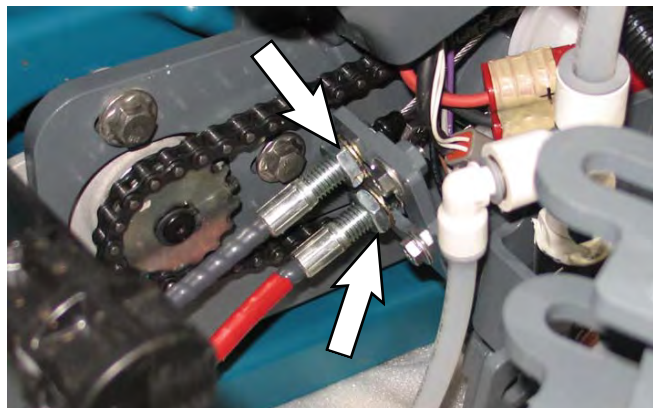
24. Cut the cable ties securing the steering cables to the machine and remove both steering cables from the machine. Note locations of wire ties before cutting them from the machine. New wire ties will need to be installed in the same locations to secure the steering cables to the machine.

25. Center all the jam nuts on both ends of both new steering cables.



26. Install both cables onto the bracket of the machine frame located near the steering plate.

NOTE: Cables must be installed onto bracket on machine frame exactly as shown. Since cables are different lengths, machine will not steer correctly if cables are not installed in the correct locations as shown.

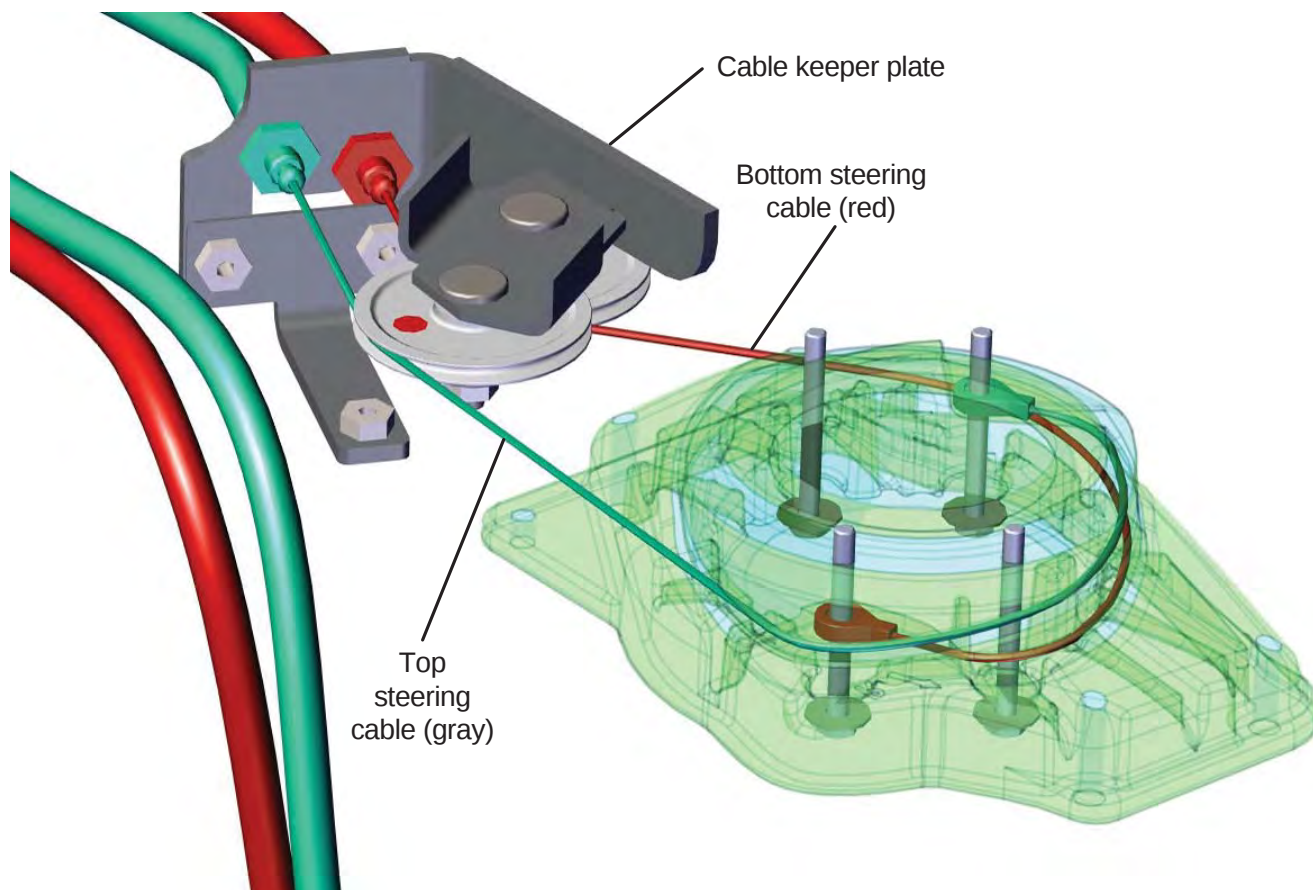


27. Route the bottom steering cable (red) into groove in the steering pulley bearing housing and connect the cable to the steering pulley bearing housing / bearing retainer plate / sprocket.

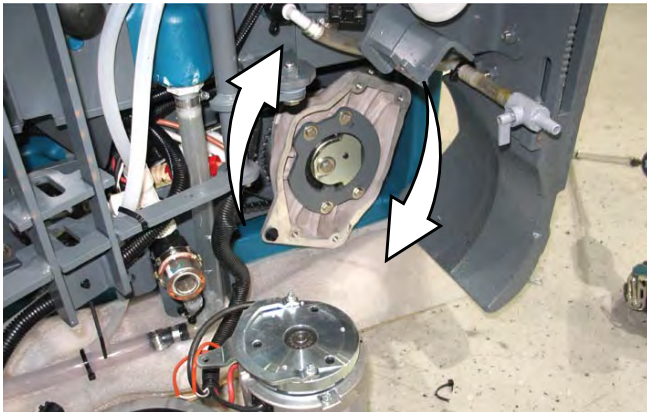
28. Route the top steering cable (gray) into groove in the steering pulley bearing housing and connect the cable to the steering pulley bearing housing / bearing retainer plate / sprocket.



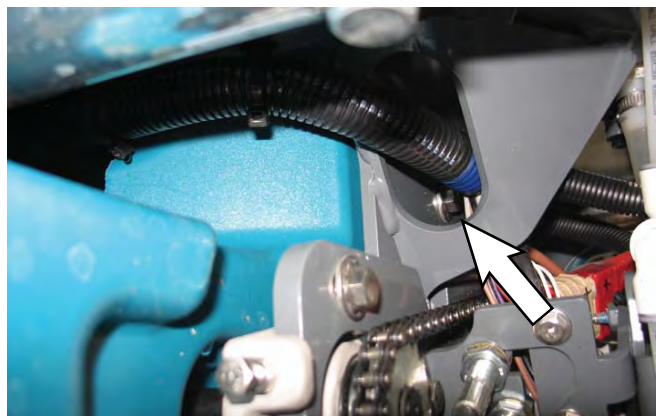
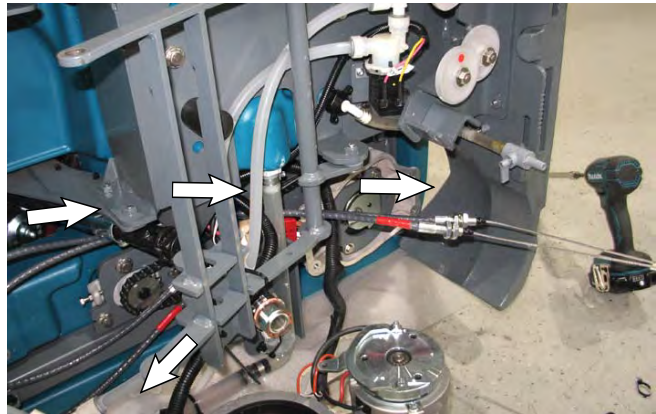
*NOTE: **Do Not** tighten the jam nuts at this time. Jam nuts should be snug, but completely tightened.*



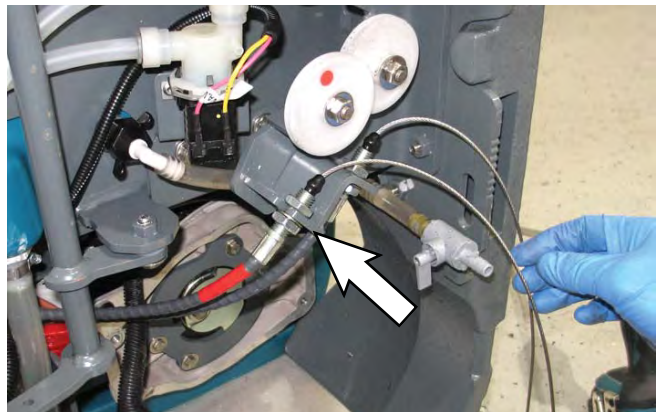
30. Place the ends of both steering cables on the floor, step on the cables, pull each cable, and observe the steering pulley bearing housing. The steering pulley bearing housing should move freely in both directions as the applicable steering cable is being pulled. Be sure to keep tension on both cables for the entire time this test is being conducted.



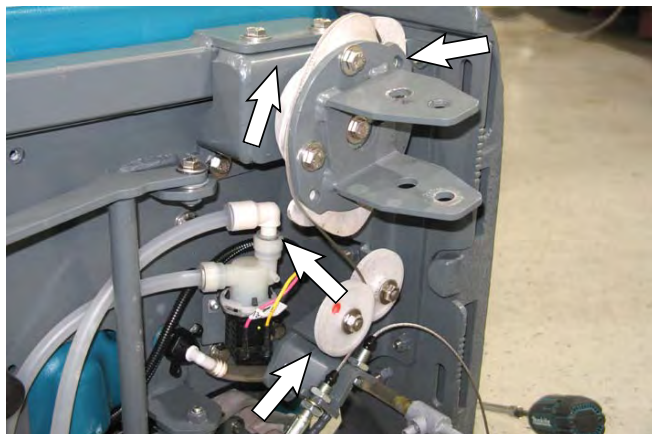
31. Route both steering cables along the main wire harness, through the hole in the frame of the machine, and to the front of the machine



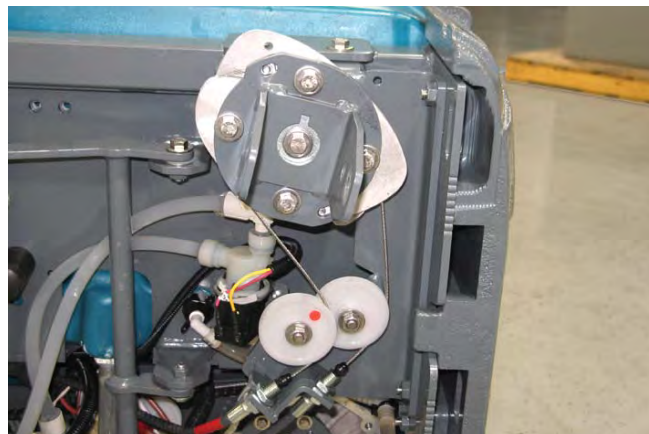
32. Connect both steering cables to the right wheel mounting weldment. Do not completely tighten the jam nuts. Jam nuts are tightened during later adjustment for each cable. Note locations of both steering cables. Steering cables must be installed exactly as shown below.



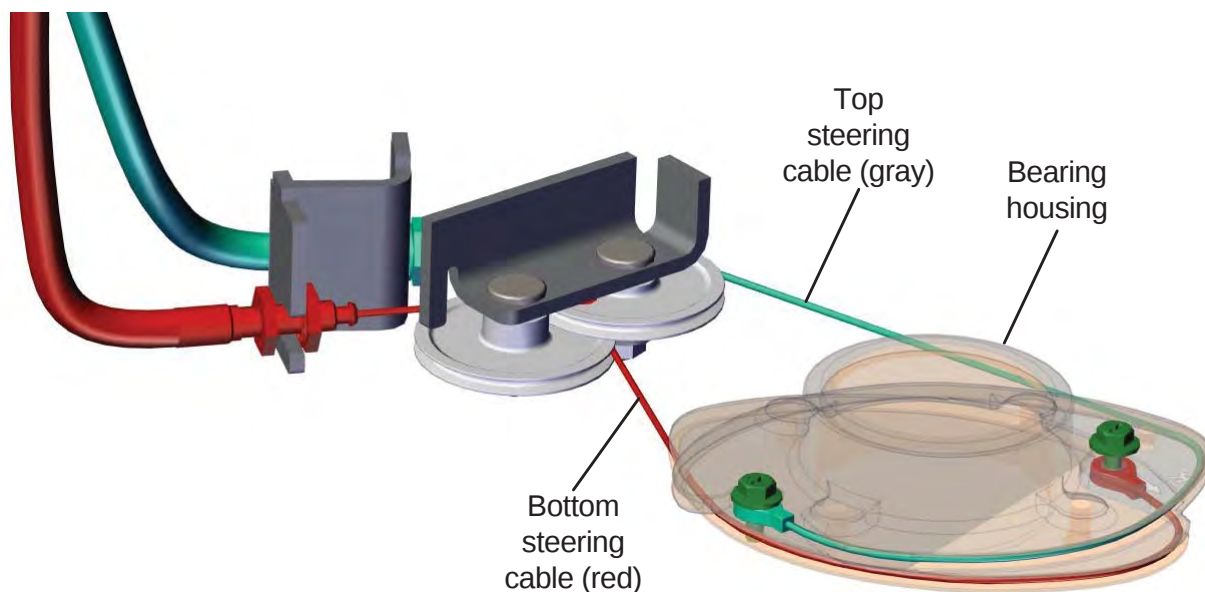
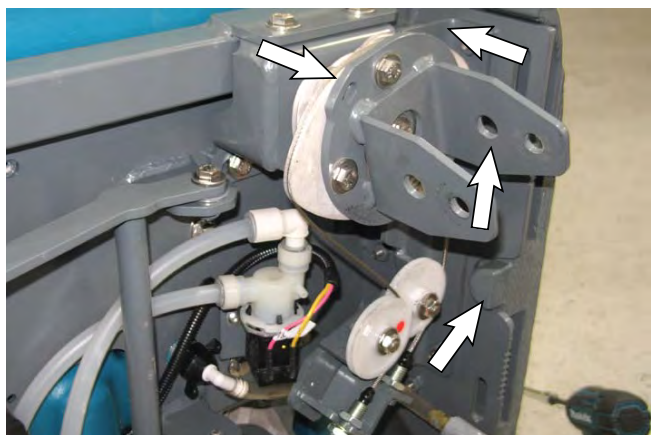
33. Route the bottom steering cable (red) around the pulley with the red dot, around the groove located on the bottom of the bearing housing, and connect the cable to the bearing housing.



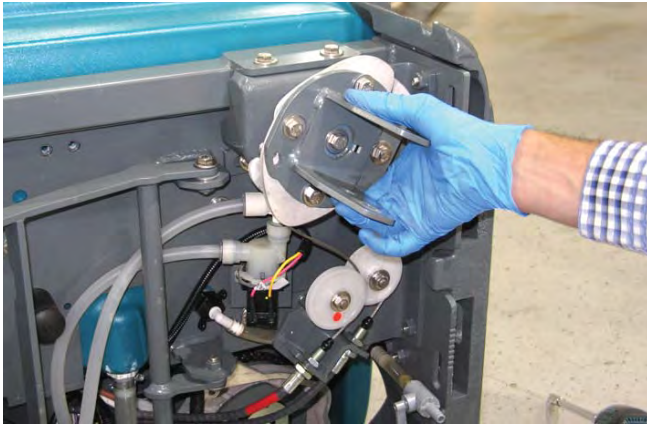
The bottom steering cable (red) and top steering cable (gray) should appear as shown below after both cables have been routed and connected to the bearing housing.



34. Route the top steering cable (gray) around the other pulley, around the other groove located on the bearing housing, and connect the cable to the bearing housing.



35. Turn the bearing housing through the full range of motion in both directions. Observe the movement of the steering pulley bearing housing. Both the bearing housing and the steering pulley bearing housing should move freely.



36. Remove the hardware securing the drive wheel to the drive wheel assembly. Set the hardware aside.



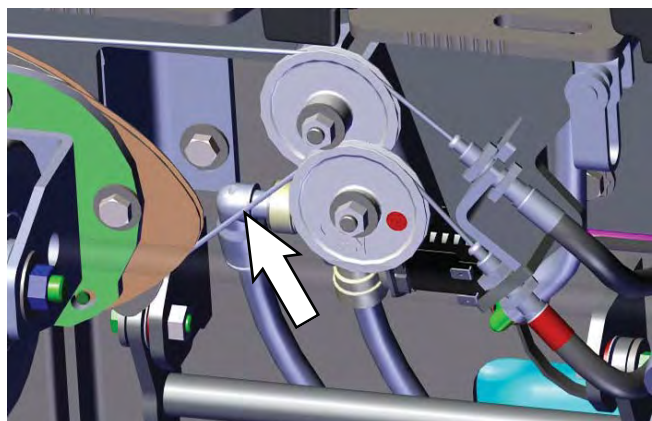
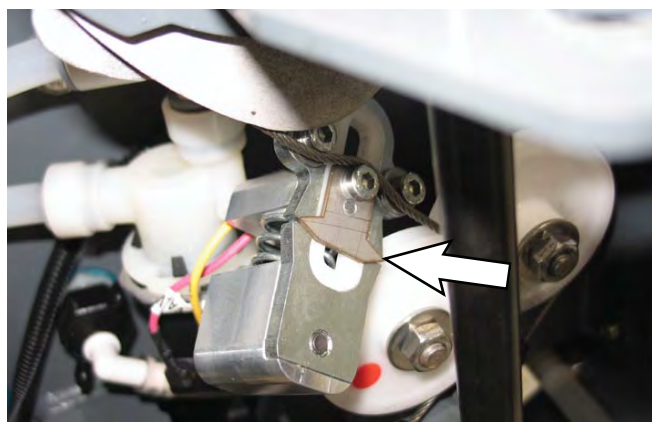
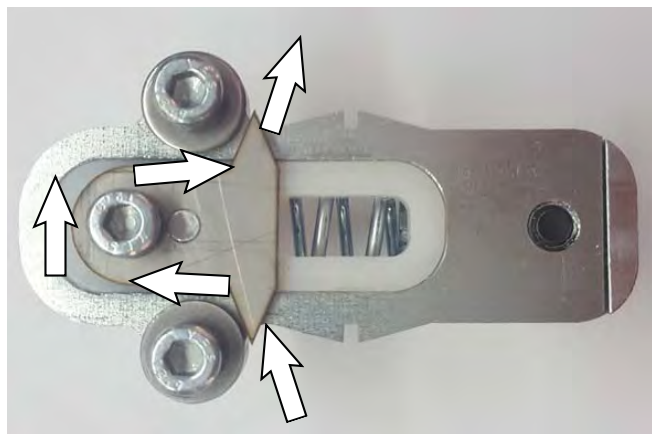
37. Install the drive wheel assembly onto the machine.



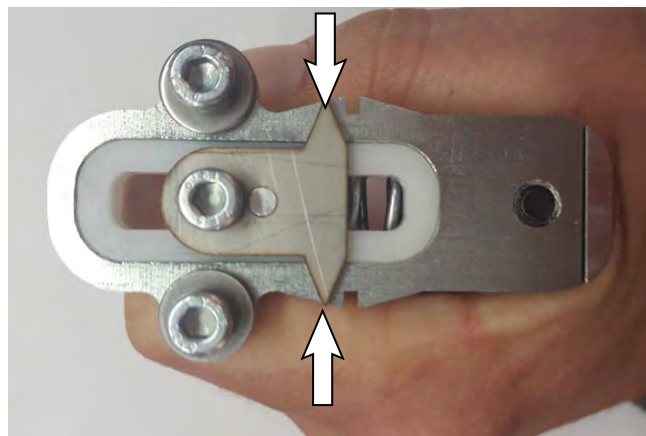
38. Insert the wheel alignment rod through the bearing retainer and thread the wheel alignment rod into the drive wheel / drive wheels assembly. **Do Not** over tighten the wheel alignment rod.



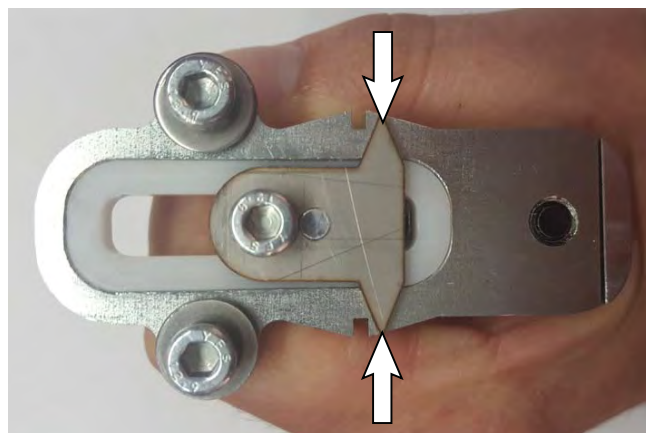
39. Install the tension gauge onto the bottom steering cable (red). Follow arrow when routing cable in the tension gauge.



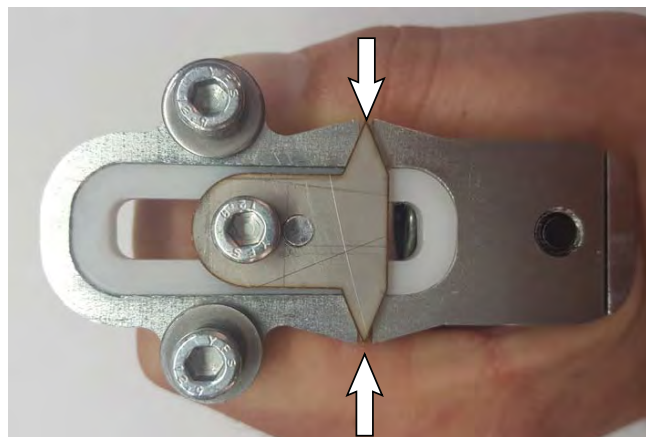
If tension gauge indicator is positioned as below the steering cable is loose and must be tightened.



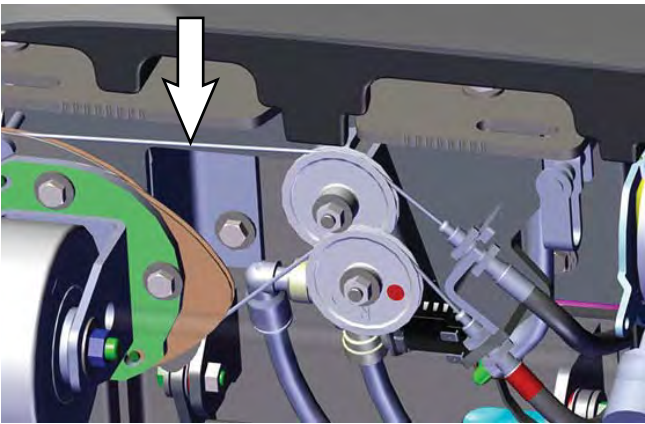
If the tension gauge indicator is positioned as below the steering cable is too tight and must be loosened.



If the tension gauge indicator is in the notch as below the cable tension is correct and needs no further adjustment.



40. Loosen jam nuts and loosen / tighten bottom steering cable (red) until the tension gauge indicator is centered in the notches. Retighten the jam nuts on both ends of the bottom steering cable (red). Recheck the tension.
41. Remove the tension gauge from the bottom steering cable (red).
42. Install the tensioner onto the top steering cable (gray). Repeat procedure (Step 39 and Step 40) used to check / adjust the steering cable tension on the bottom steering cable (red) to check / adjust the tension on the top steering cable (gray).



43. Remove the tensioner from the top steering cable (gray).
44. Remove the wheel alignment tool from the machine.

45. Reinstall the hardware to secure the drive wheel to the drive wheel assembly.



46. Use a cable tie to secure both steering cables to the frame of the machine. Match location noted during disassembly.



47. Turn the front drive wheel assembly. The entire steering system should turn freely with no binding or catching. Confirm the main wire harness is not getting caught in the front drive wheel assembly when the front drive wheel assembly is being turned.

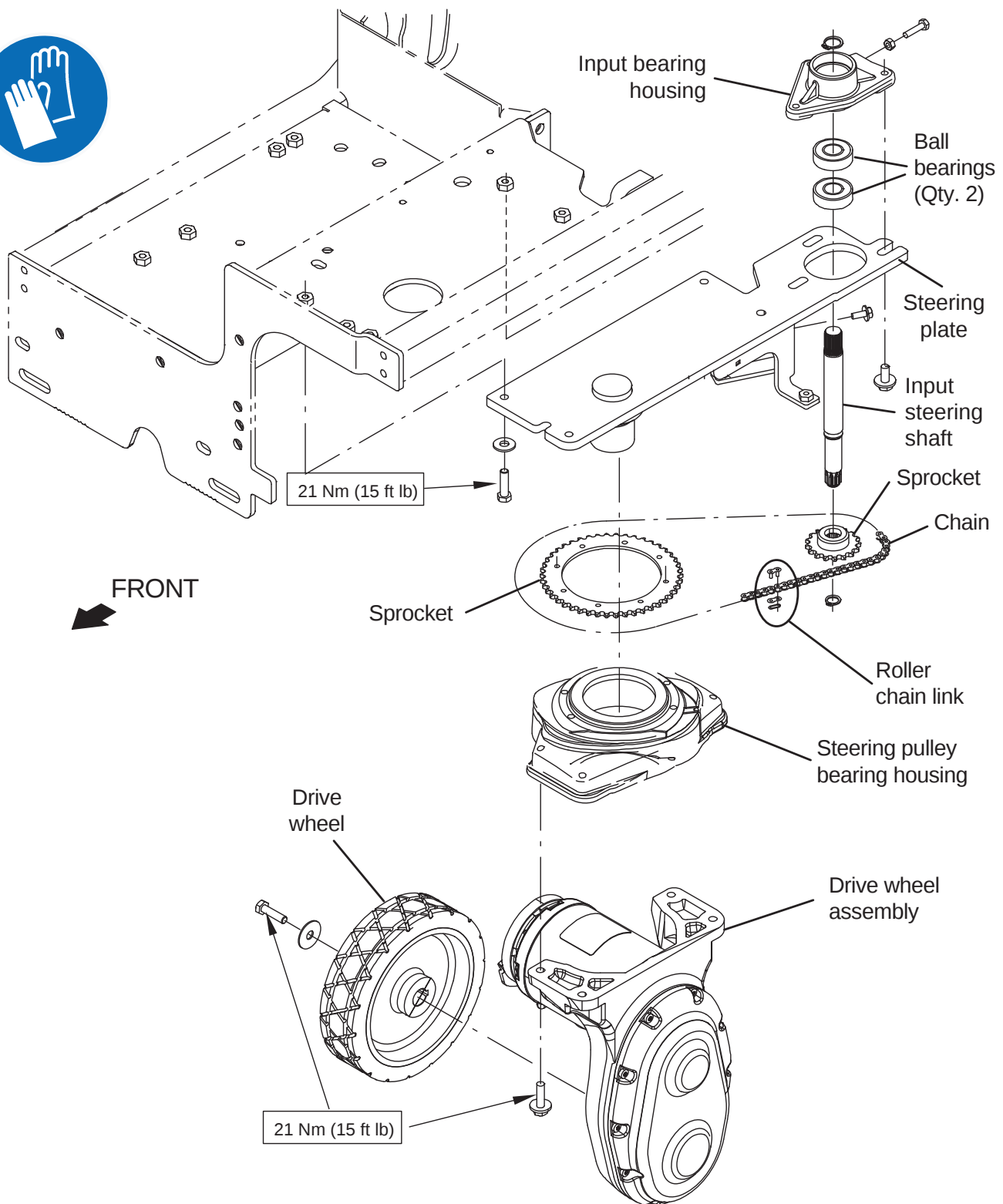


48. Use a cable tie to secure both steering cables to the frame of the machine. Match location noted during disassembly.



49. Install additional cable ties to secure the steering cable to the machine and away from any moving parts. Match locations noted during disassembly.
50. Lift the machine back onto its wheels. Seek assistance as required.
51. Reinstall the scrub head onto the machine.
52. Reinstall the frame shrouds onto the machine.
53. Reinstall the batteries into the machine.
54. Start and test the machine. Turn the steering wheel through the full range of motion in both direction while driving the machine forward.

REMOVING / INSTALLING THE FRONT DRIVE WHEEL ASSEMBLY



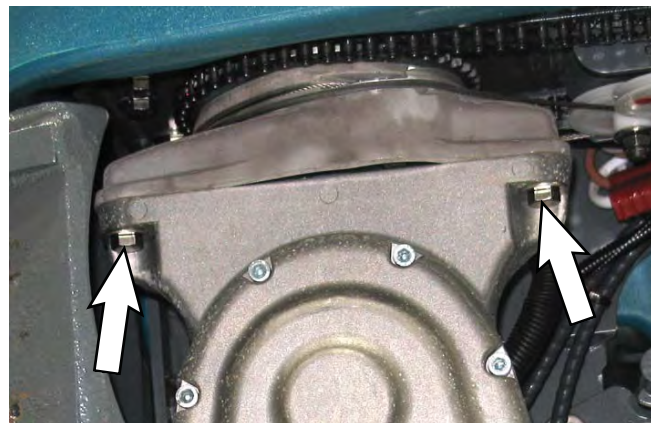
1. Completely empty both the solution tank and the recovery tank.
2. Turn the key to the OFF position.

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

FOR SAFETY: When servicing machine, Disconnect battery connection and charger cord before working on machine.

3. Disconnect the battery cable from the machine.
4. Remove the right frame shroud, the left frame shroud, and the center frame shroud from the machine. See REMOVING / INSTALLING THE SHROUDS.
5. Jack up the front end of the machine enough to access the hardware securing the front drive wheel assembly to the machine and remove the drive wheel assembly from under the machine. Refer to JACKING UP THE FRONT OF THE MACHINE in the MAINTENANCE section for additional instructions and safety information.
6. Note / photograph the locations of cable ties and how the main wire harness is routed near the front drive wheel assembly. The main wire harness must be routed exactly the same and the cable ties must be reinstalled in same locations when the front drive wheel assembly is reinstalled onto the machine.
7. Cut all cable ties securing the front drive wheel assembly cable / portion of main wire harness connected to the front drive wheel assembly cable to the machine and disconnect the main wire harness from the front drive wheel assembly.

8. Remove the hardware (Qty. 4) securing the front drive wheel assembly to the machine and carefully pull the front drive wheel assembly from under the machine.

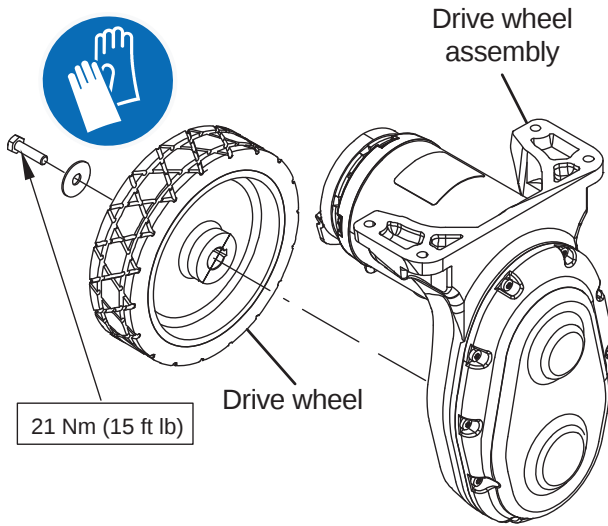


9. Reinstall the removed front drive wheel assembly / install the new front drive wheel assembly in the reverse order of removal.
10. Route the main wire harness as it was previously routed and reconnect the main wire harness to the front drive wheel assembly. Use cable ties to secure the main wire harness to the same locations on the machine where the cut cable ties had previously been installed.
11. Reinstall the right frame shroud, the left frame shroud, and the center frame shroud onto the machine. See REMOVING / INSTALLING THE SHROUDS.

REMOVING / INSTALLING THE DRIVE MOTOR CARBON BRUSHES

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

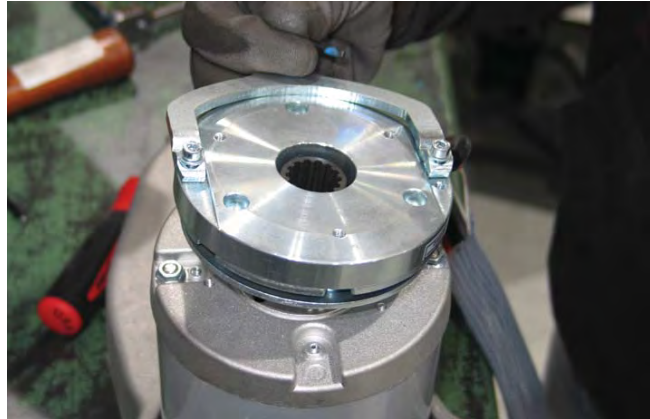
1. Remove the front drive wheel assembly from the machine. See REMOVING / INSTALLING THE FRONT DRIVE WHEEL ASSEMBLY.
2. Remove the wheel from the front drive wheel assembly



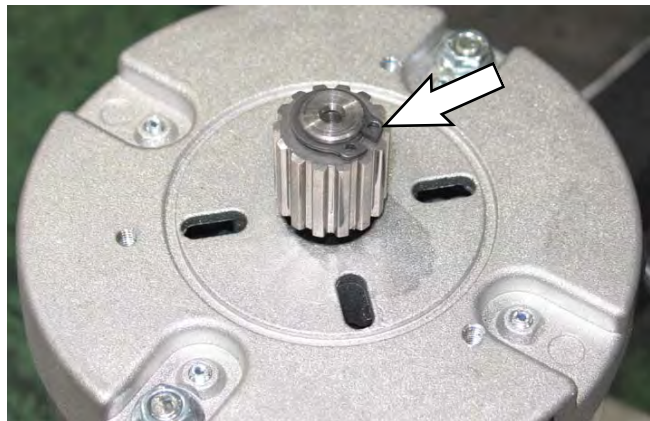
3. Remove the hardware securing the brake assembly to the front drive wheel assembly.



4. Carefully remove the brake assembly from the front drive wheel assembly.



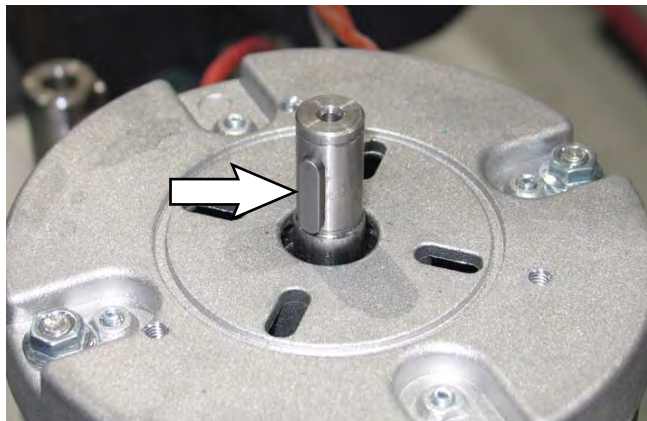
5. Remove the retaining ring from the front drive wheel assembly shaft.



6. Remove the collar from the front drive wheel assembly shaft.



7. Remove the key from the front drive wheel assembly shaft.



8. Remove the hardware securing the brush plate to the front drive wheel assembly.



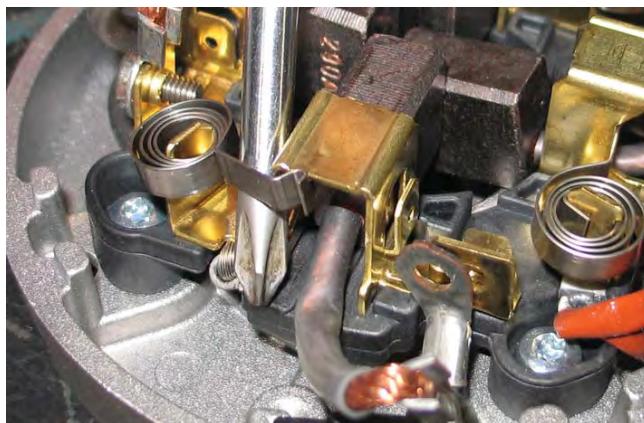
9. Press down on the front drive wheel assembly shaft and carefully remove the brush plate from the front drive wheel assembly. The front drive wheel assembly shaft must remain in place in the front drive wheel assembly when removing the brush plate.



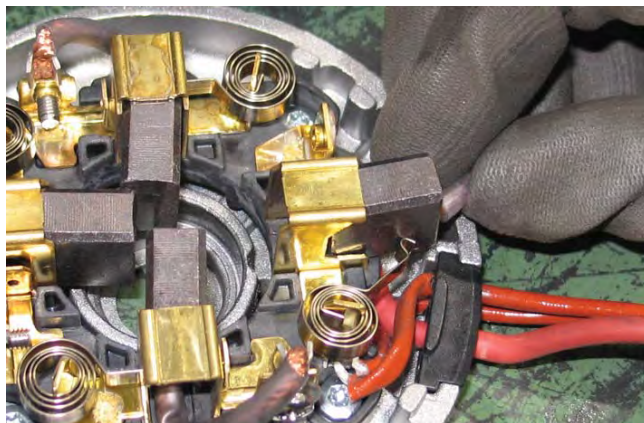
10. Remove the hardware securing the carbon brush cable to the brush motor plate



11. Move the retainer spring securing the motor brush in the brush motor plate.



12. Remove the carbon brush from the brush motor plate.

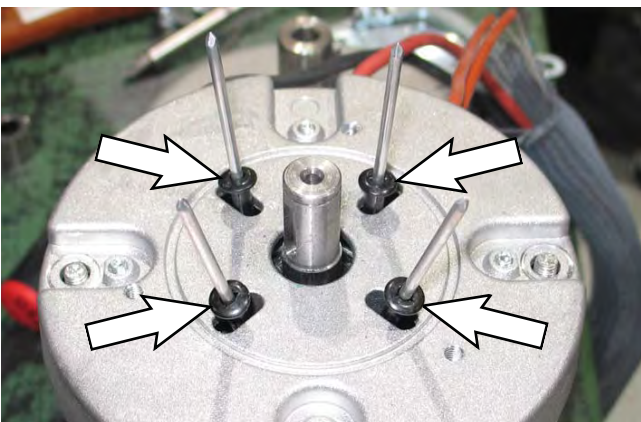


13. Repeat previous steps to remove the remaining three carbon brushes from the drive motor.
14. Use compressed air to clean any dust from inside the drive motor.



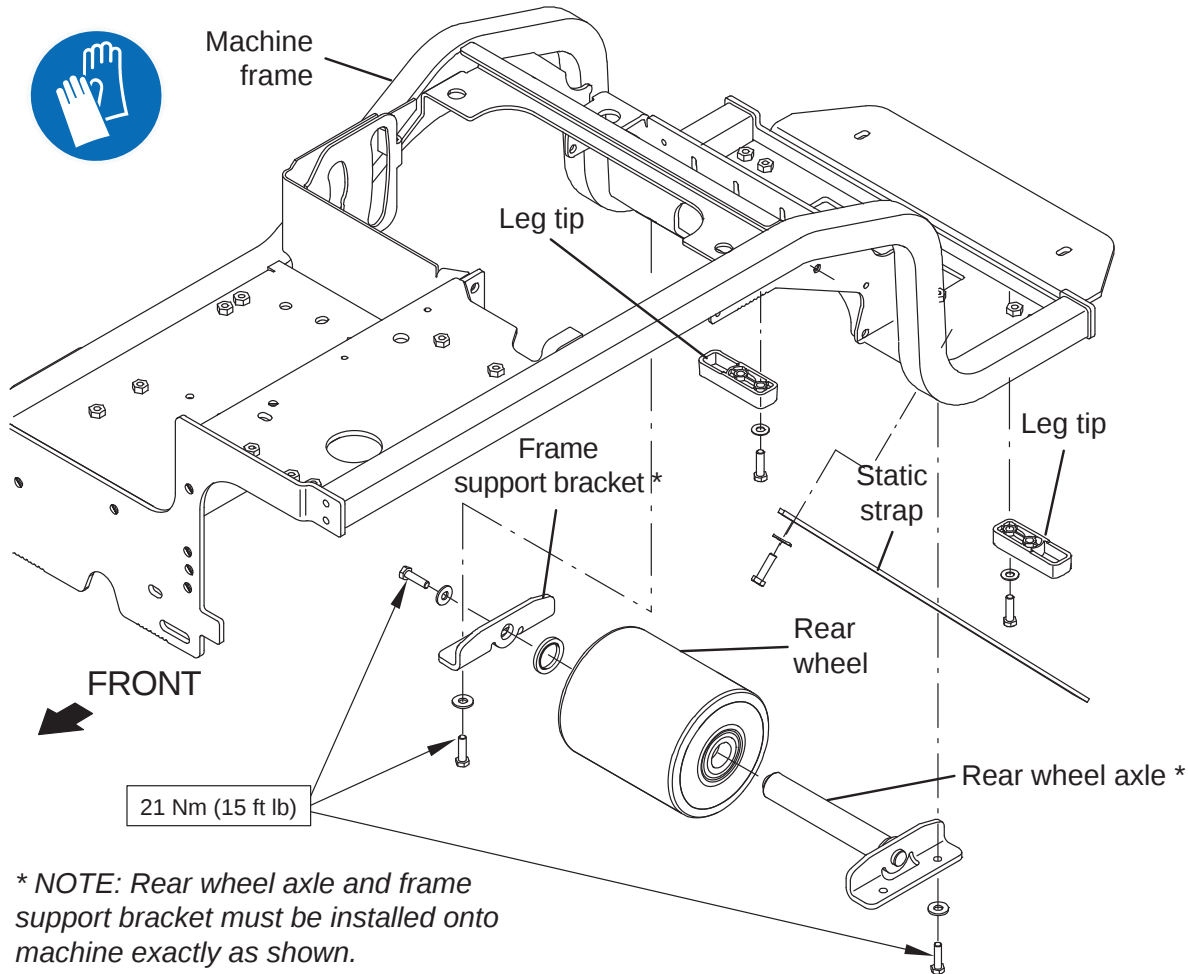
NOTE: Carbon brushes should be replaced as sets.

15. Reinstall brushes / install new brushes into the drive motor in reverse order of disassembly.
16. Reinstall the brush motor plate onto the front drive wheel assembly. Use a screw driver or similar item(s) (rivets shown below) to push the brushes away from the front drive wheel shaft when installing the brush motor plate. The brush motor plate will not seat correctly on the front drive wheel assembly if brushes are not pushed away from the front drive wheel shaft as the brush cover is being installed.



17. Reassemble parts removed from the front drive wheel assembly in reverse order of disassembly.
18. Reinstall the wheel onto the front drive wheel assembly.
19. Reinstall the front drive wheel assembly onto the machine. See REMOVING / INSTALLING THE FRONT DRIVE WHEEL ASSEMBLY.

REMOVING / INSTALLING THE REAR WHEEL ASSEMBLY



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

FOR SAFETY: When servicing machine, Disconnect battery connection and charger cord before working on machine.

1. Completely drain both the solution tank and the recovery tank.
2. Turn the key to the OFF position.

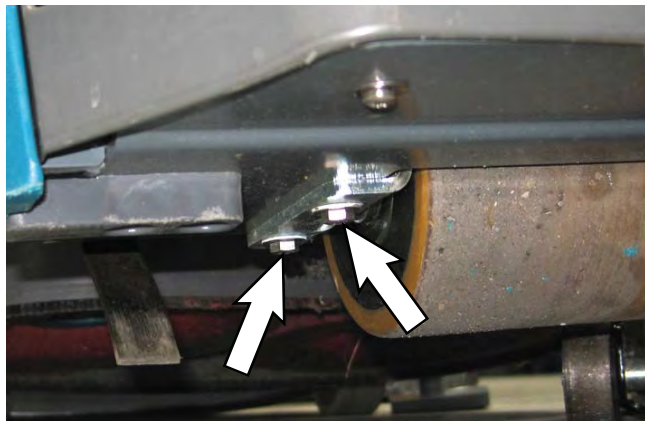
NOTE: The rear wheel assembly can be removed from either the front of the operator compartment or the rear of the machine.

3. If removing the rear wheel assembly from the front of operator compartment, remove the squeegee assembly from the machine. Proceed to the following step if removing the rear wheel assembly from the rear of the machine.

4. Jack up the back end of the machine high enough to access and remove the rear wheel from under the machine. Place blocks under the rear of the machine to support it in the raised position. Refer to JACKING UP THE REAR OF THE MACHINE in the MAINTENANCE section for additional instructions and safety information.



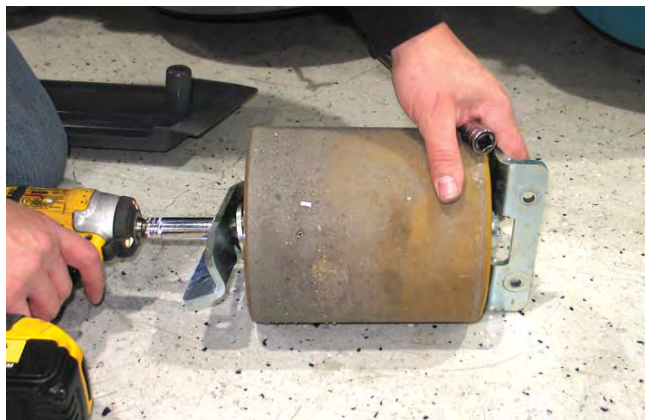
5. Remove the hardware securing the frame support bracket and rear wheel axle from the machine.



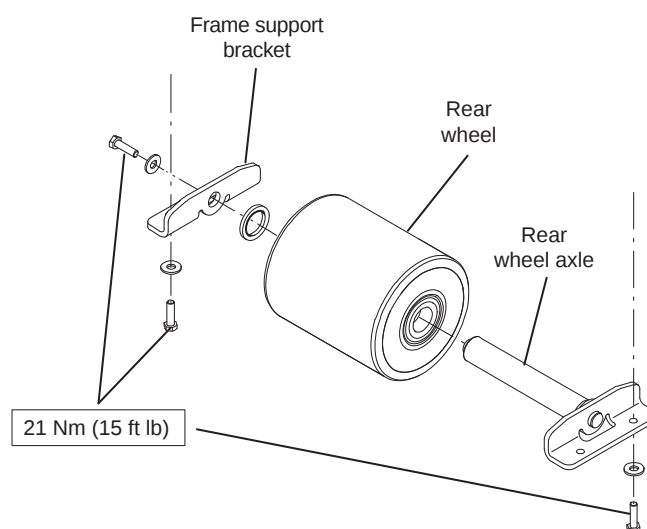
6. Roll the rear wheel assembly out from under the machine.



7. Remove the frame support bracket and rear wheel axle from the rear wheel.



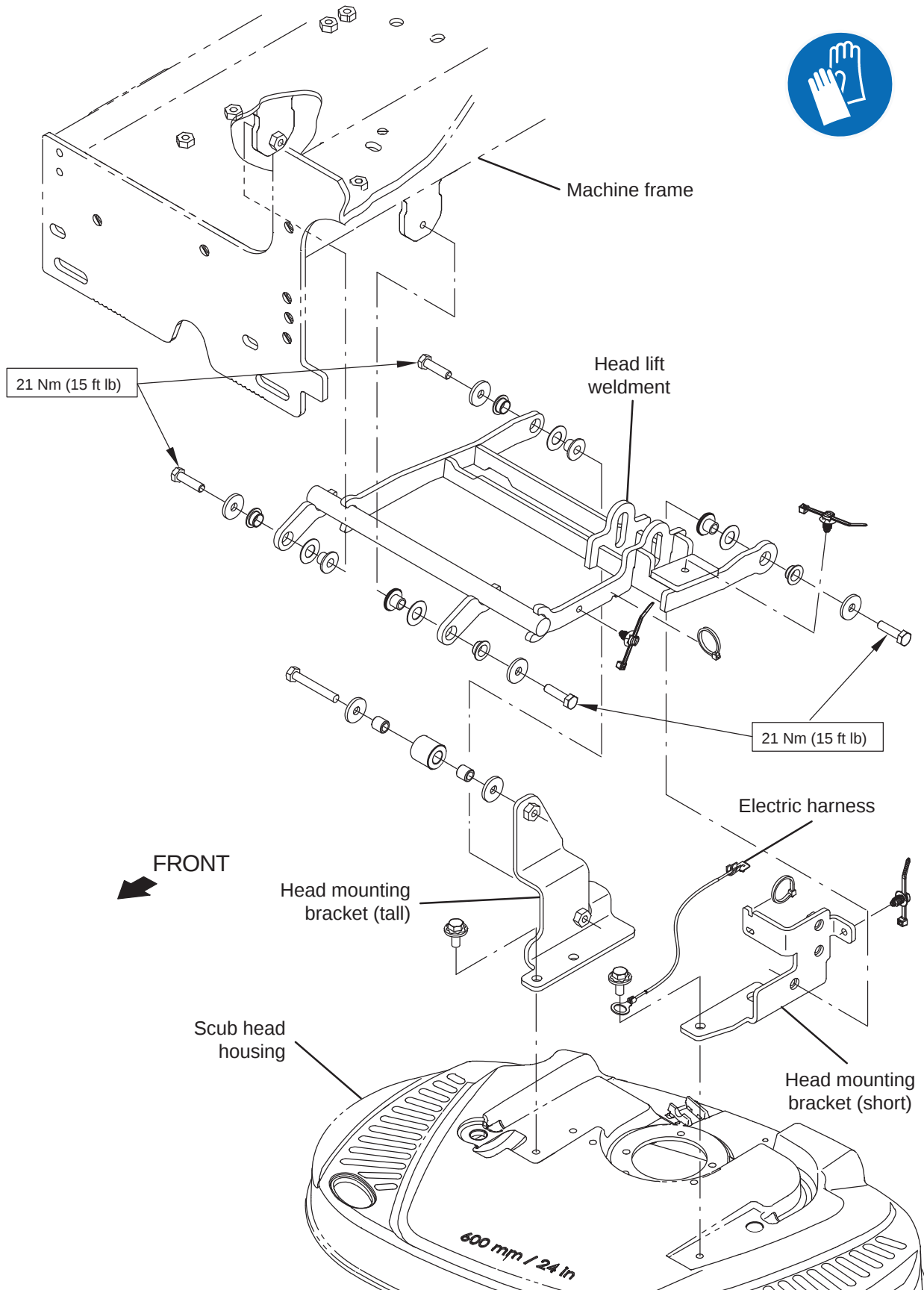
8. Reinstall the frame support bracket and rear wheel axle onto the rear wheel.

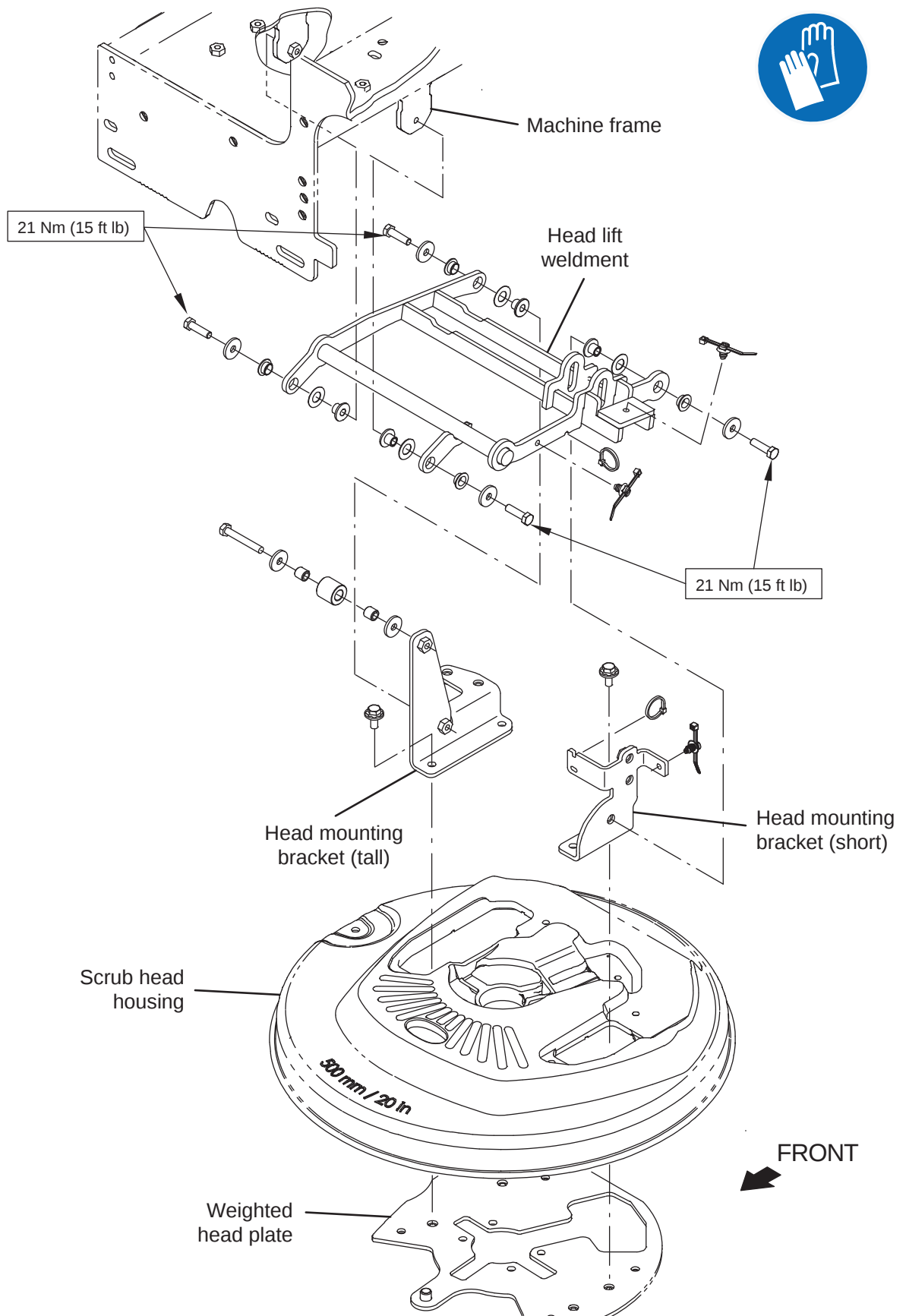


9. Reinstall the rear wheel assembly onto the machine in the reverse order of removal.

** NOTE The frame support bracket and rear wheel axle must be oriented / installed onto the machine as shown. Machine will not clean properly if parts are not installed as shown.*

REMOVING / INSTALLING / REPLACING THE
SCRUB HEAD ASSEMBLY

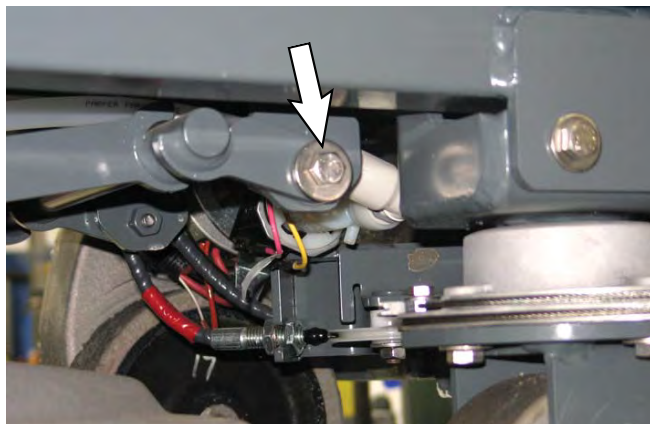
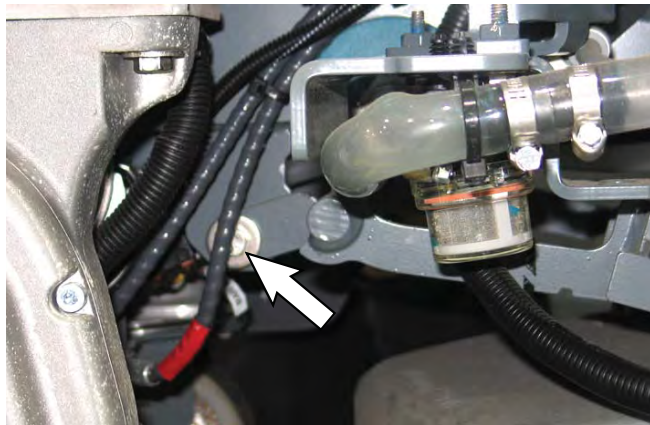




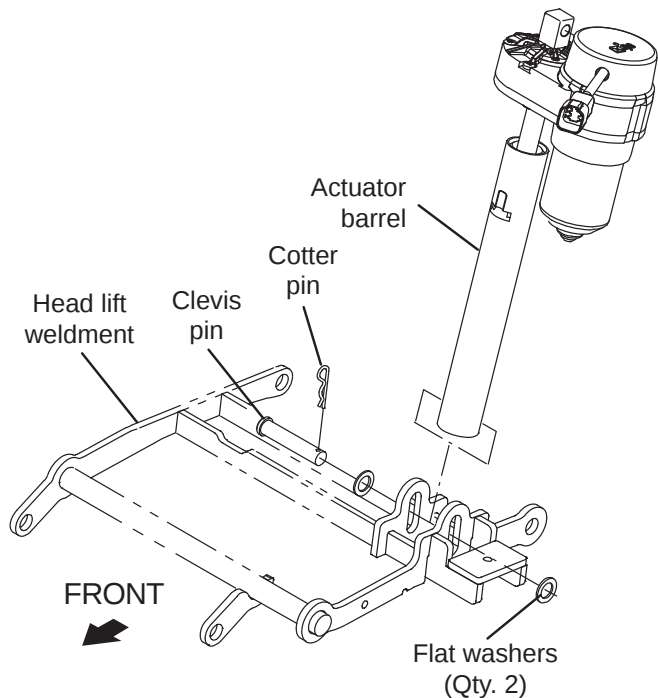
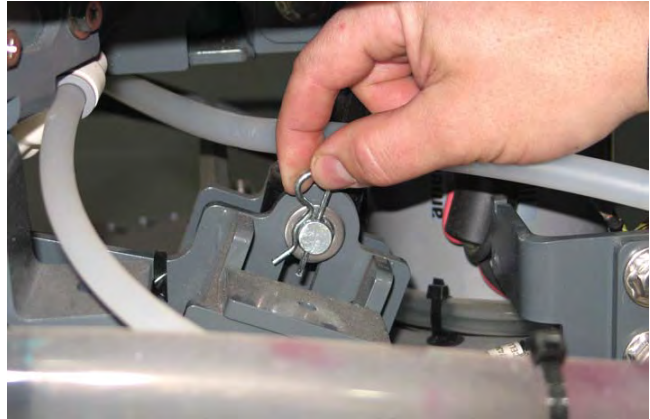
1. Drain all solution from the solution tank.
2. Turn on the machine and completely lower the scrub head

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

3. Turn the key to the OFF position and remove the key.
4. Remove the right frame shroud from the machine. Refer to REMOVING / INSTALLING THE SHROUDS.
5. Disconnect the vacuum hose from the squeegee.
6. Remove the squeegee assembly from the scrub head.
7. Disconnect the main wire harness from brush motor(s).
8. Disconnect the solution supply hoses from the scrub head.
9. Remove the squeegee rail assembly from the scrub head.
10. Remove the hardware securing the head lift weldment to the machine.



11. Remove the cotter pin / clevis pin securing the actuator to the scrub head lift weldment.



NOTE: Do Not turn the actuator barrel when removing the clevis pin / cotter pin securing the actuator to the scrub head or when reinstalling the actuator barrel onto the head lift weldment. The actuator barrel length / position is set at the factory and must remain at the same length / position. The machine will not function properly and damage could result if the barrel length / position is changed. If actuator barrel is turned out of adjustment, see REMOVING / REPLACING THE ACTUATOR for actuator adjustments.

12. If replacing the scrub head, remove the squeegee rail assembly from the scrub head.
13. Slide the scrub head out from underneath the machine.
14. Reinstall the removed scrub head / install the new scrub head and all parts previously removed from the machine onto the machine in the reverse order of removal.
15. Confirm the actuator and scrub head are functioning properly.

REMOVING / INSTALLING THE SCRUB HEAD MOTOR CARBON BRUSHES

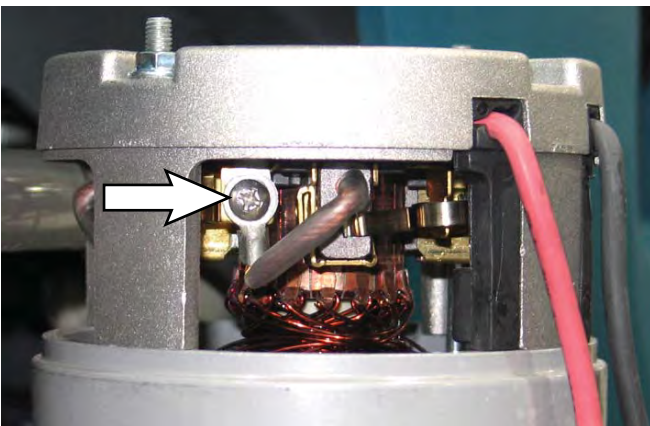
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, remove key, and set parking brake if equipped.

FOR SAFETY: When servicing machine, Disconnect battery connection and charger cord before working on machine.

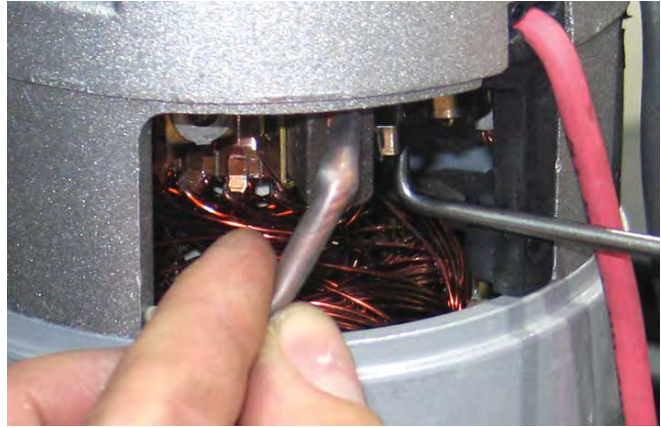
1. Turn the key to the OFF position.
2. Disconnect the battery cable from the machine.
3. Remove the right frame shroud from the machine. Refer to REMOVING / INSTALLING THE SHROUDS.
4. Remove the scrub head from the machine. Refer to REMOVE / INSTALL / REPLACE THE SCRUB HEAD ASSEMBLY.
5. Remove the cap from the brush motor.



6. Remove the hardware securing the carbon brush cable to the brush motor.



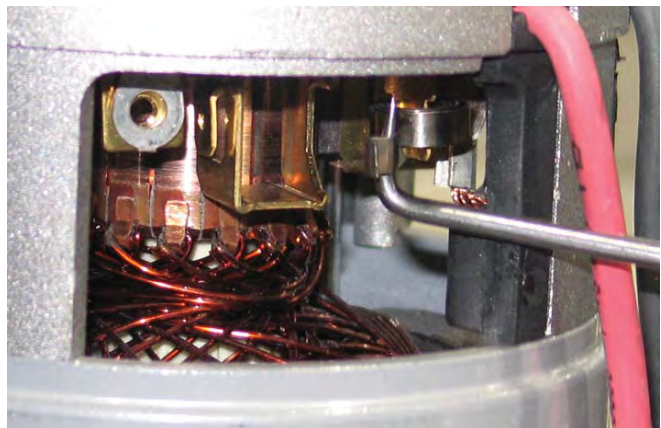
7. Pull the retainer to release the carbon brush and pull the carbon brush from the brush motor.



8. Use compressed air to clean any dust from inside the motor.



9. Pull the retainer and insert the new carbon brush into the brush motor.

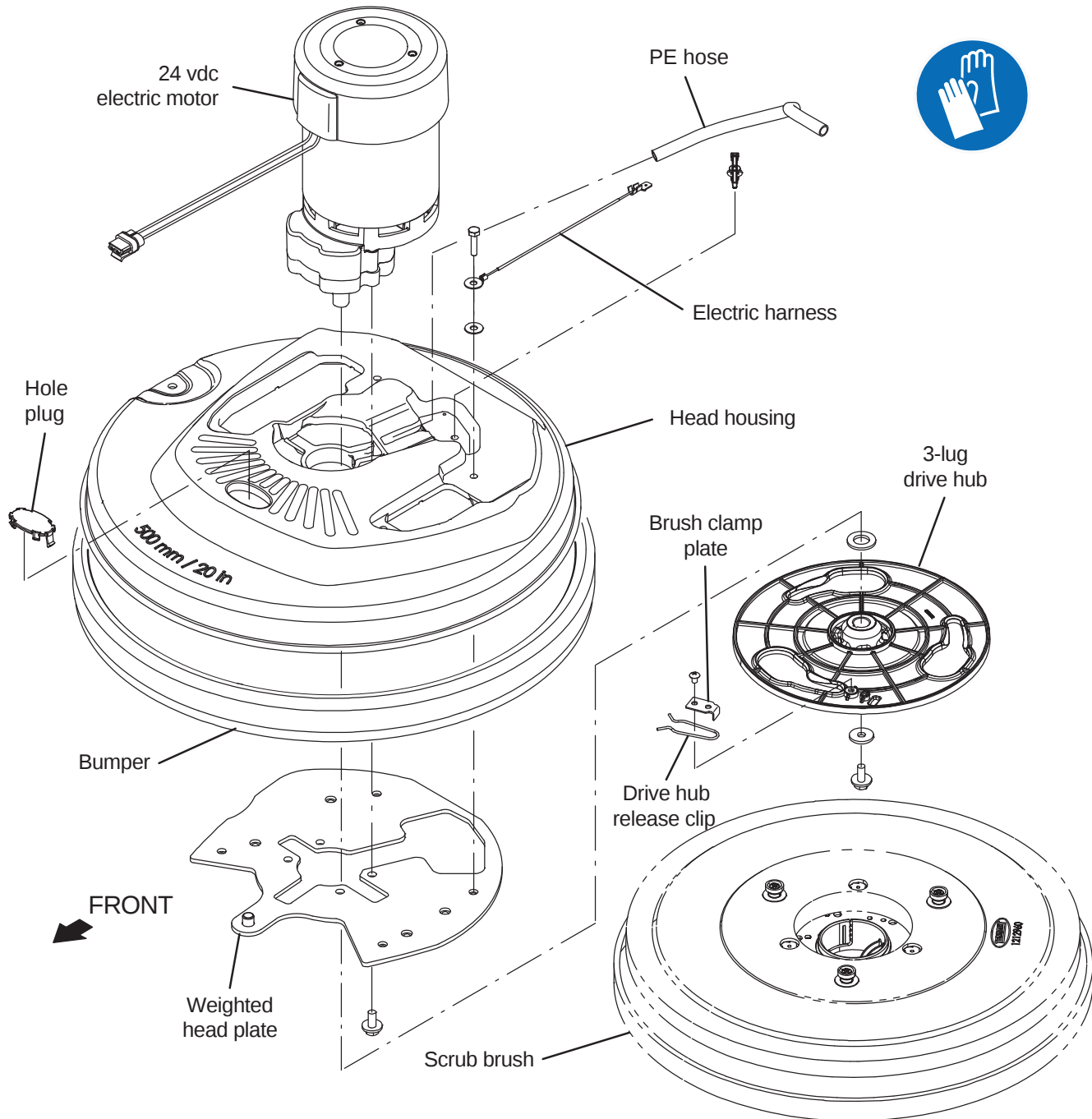


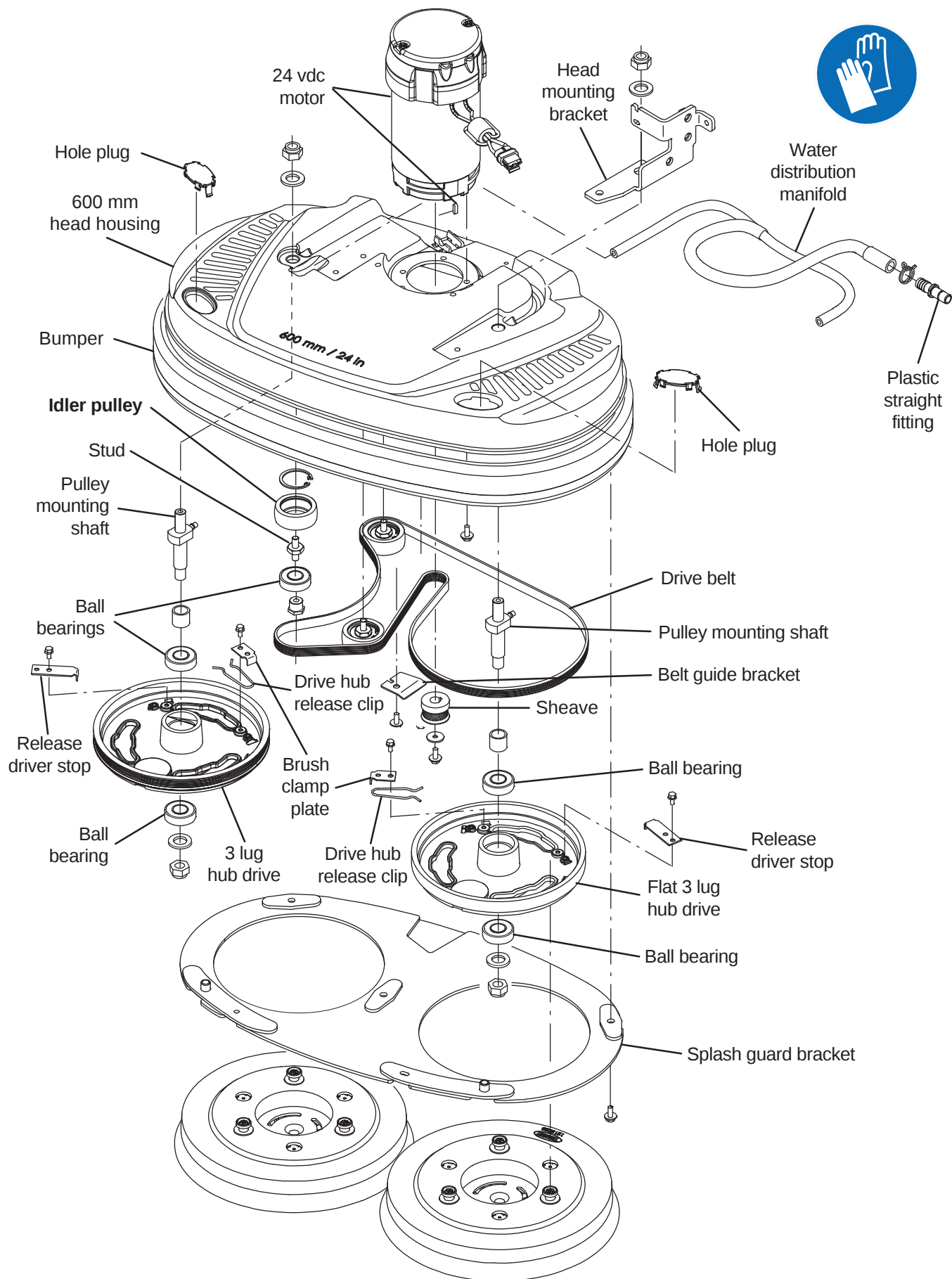
10. Repeat previous steps to remove the carbon brush located on the other side of the disk brush motor.

NOTE: Carbon brushes should be replaced as sets.

11. Reinstall the cap onto the disk brush motor and reinstall the scrub head onto the machine in the reverse order of removal.
12. Reinstall the scrub head onto the machine. REMOVE / INSTALL / REPLACE THE SCRUB HEAD ASSEMBLY.
13. Reinstall the right frame shroud onto the machine. Refer to REMOVING / INSTALLING THE SHROUDS.

REPLACING THE 500MM / 600MM 3-LUG SCRUB HEAD COMPONENTS



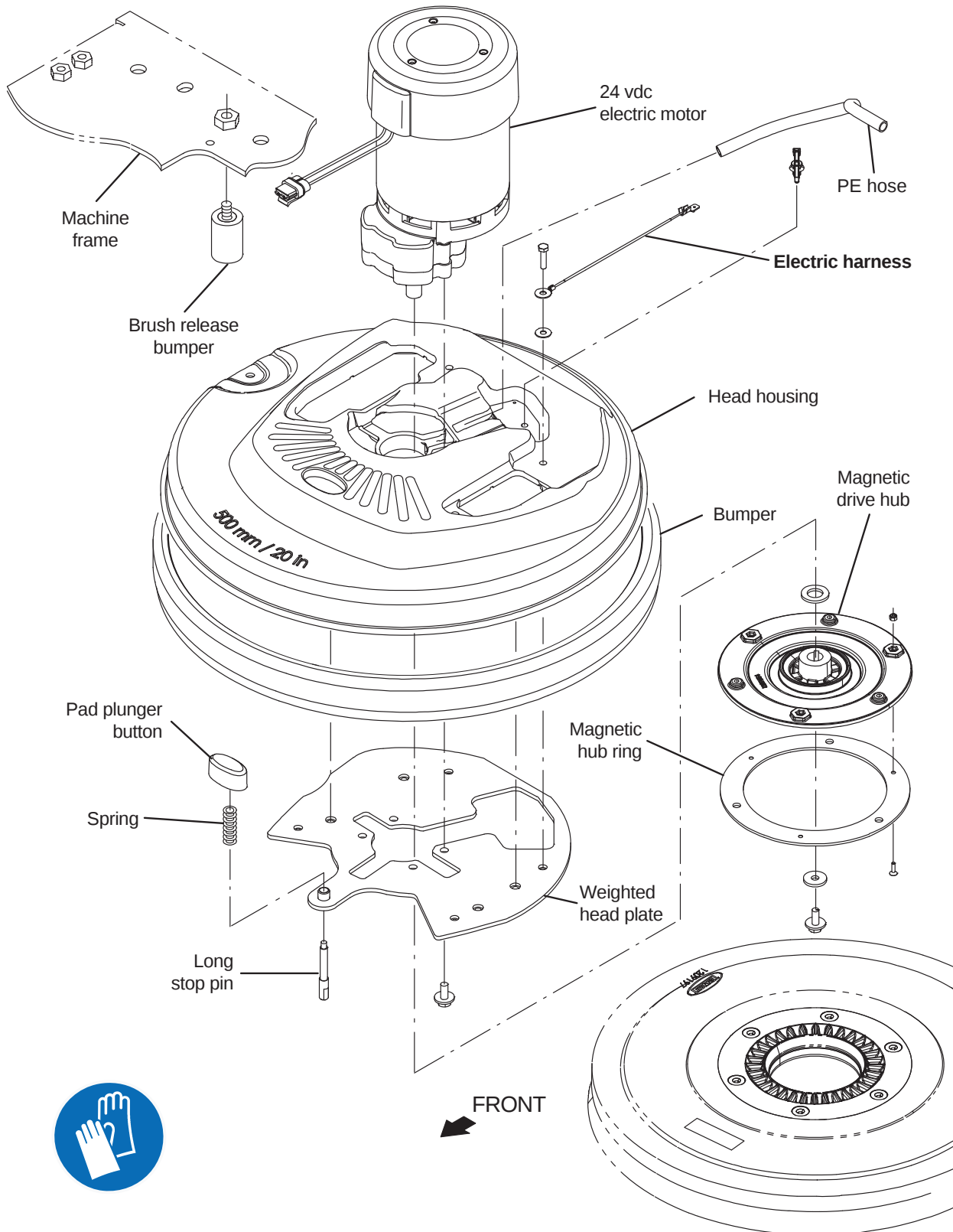


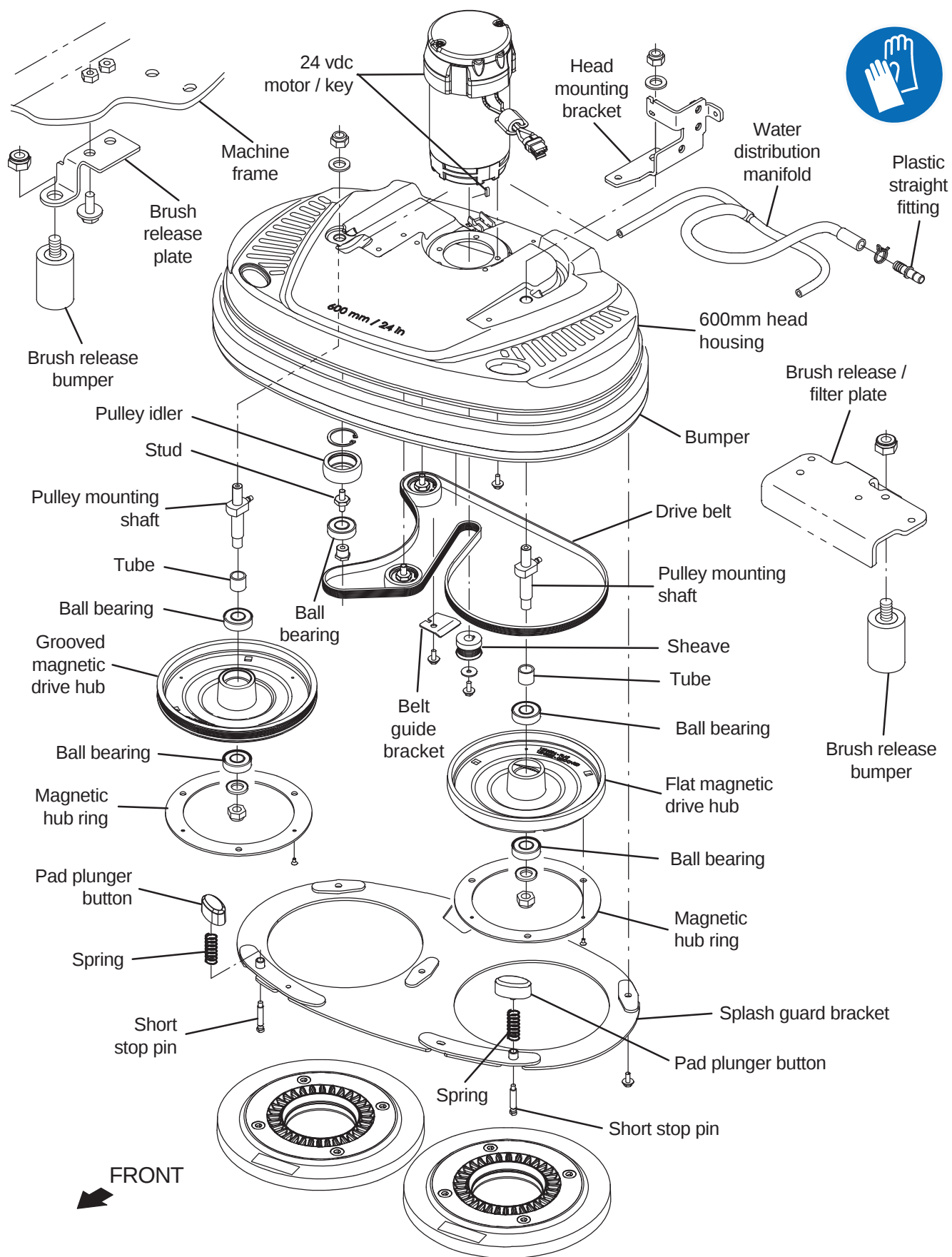
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, remove key, and set parking brake if equipped.

FOR SAFETY: When servicing machine, Disconnect battery connection and charger cord before working on machine.

1. Remove the right frame shroud from the machine.
Refer to REMOVING / INSTALLING THE SHROUDS.
2. Remove the scrub head from the machine. Refer to REMOVE / INSTALL / REPLACE THE SCRUB HEAD ASSEMBLY.
3. Remove components necessary to complete maintenance from the scrub head.
4. Replace parts as needed.
5. Reassemble the scrub head in reverse order of disassembly.
6. Reinstall the scrub head onto the machine.
REMOVE / INSTALL / REPLACE THE SCRUB HEAD ASSEMBLY.
7. Reinstall the right frame shroud onto the machine.
Refer to REMOVING / INSTALLING THE SHROUDS.

REPLACING THE 500MM / 600MM MAGNETIC SCRUB HEAD COMPONENTS



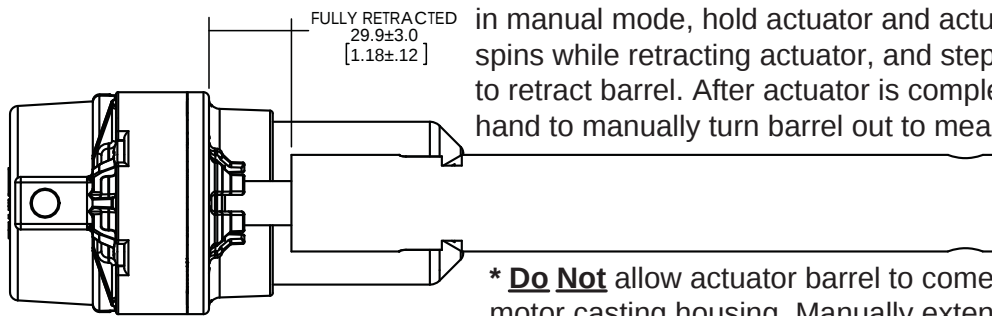
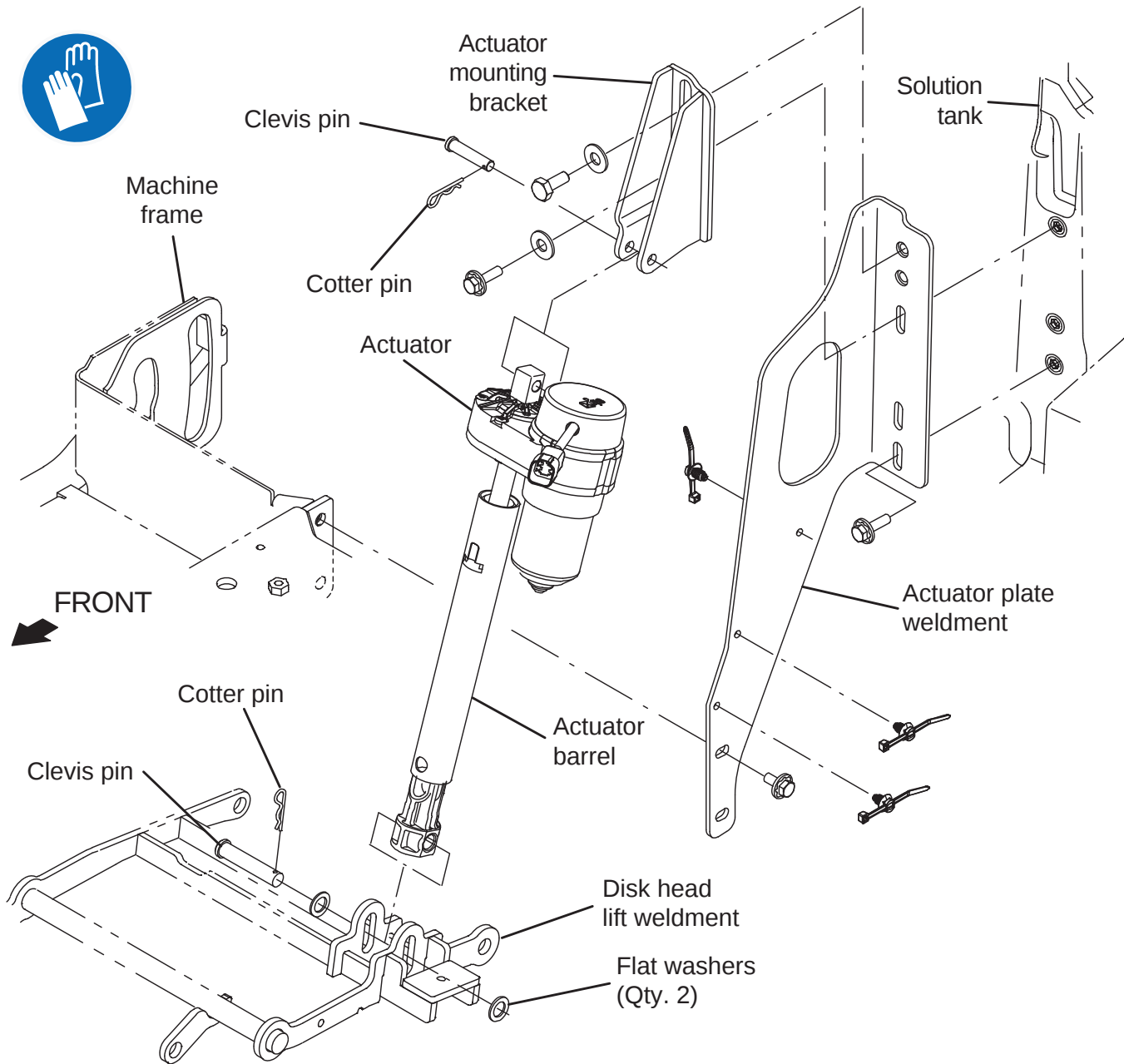


FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, remove key, and set parking brake if equipped.

FOR SAFETY: When servicing machine, Disconnect battery connection and charger cord before working on machine.

1. Remove the right frame shroud from the machine.
Refer to REMOVING / INSTALLING THE SHROUDS.
2. Remove the scrub head from the machine. Refer to REMOVE / INSTALL / REPLACE THE SCRUB HEAD ASSEMBLY.
3. Remove components necessary to complete maintenance from the scrub head.
4. Replace parts as needed.
5. Reassemble the scrub head in reverse order of disassembly.
6. Reinstall the scrub head onto the machine.
REMOVE / INSTALL / REPLACE THE SCRUB HEAD ASSEMBLY.
7. Reinstall the right frame shroud onto the machine.
Refer to REMOVING / INSTALLING THE SHROUDS.

REMOVING / REPLACING THE ACTUATOR



If actuator should become out of adjustment, place machine in manual mode, hold actuator and actuator barrel so neither spins while retracting actuator, and step on Green Go pedal to retract barrel. After actuator is completely retracted, use hand to manually turn barrel out to measurement shown to left.

* **Do Not** allow actuator barrel to come in contact with actuator motor casting housing. Manually extend actuator barrel as necessary to prevent barrel from coming in contact with housing and then when barrel is fully retracted, use procedure above to set adjustment.

1. Completely empty the recovery tank.
2. Ensure there is a pad / pad driver / brush installed on the scrub head.
3. Turn on the machine, select brush pressure setting #1, press the direction switch, and press the Go Pedal for a couple seconds to completely lower the scrub head to the floor.

NOTE: If it is not possible to lower the scrub head due to the actuator being inoperable, pry the scrub head enough to relieve pressure on the clevis pin / cotter pin securing the actuator barrel to the disk head lift weldment and place a block of wood under the scrub head to keep the pressure from the clevis pin / cotter pin.

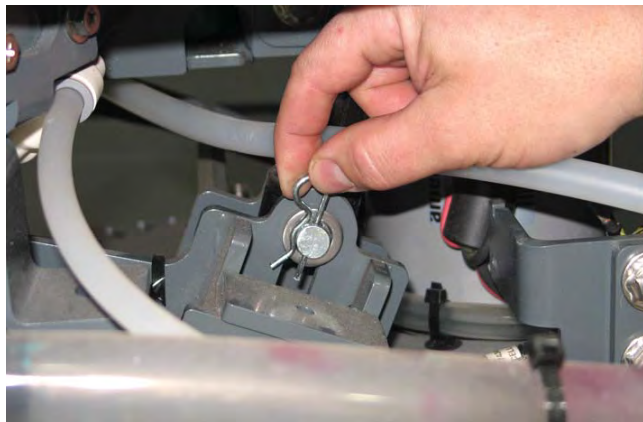
4. Turn the key to the OFF position and remove the key.

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

5. Open the recovery tank to access the actuator.
6. Disconnect the battery cable from the machine.

FOR SAFETY: When servicing machine, disconnect battery connection and charger cord before working on machine.

7. Remove the cotter pin / clevis pin securing the actuator to the scrub head lift weldment.



8. Move / disconnect or remove any items necessary to make it easier to access / remove the actuator.

9. Disconnect the main wire harness from the actuator.



10. Remove the cotter pin / clevis pin securing the actuator to the actuator mounting plate.

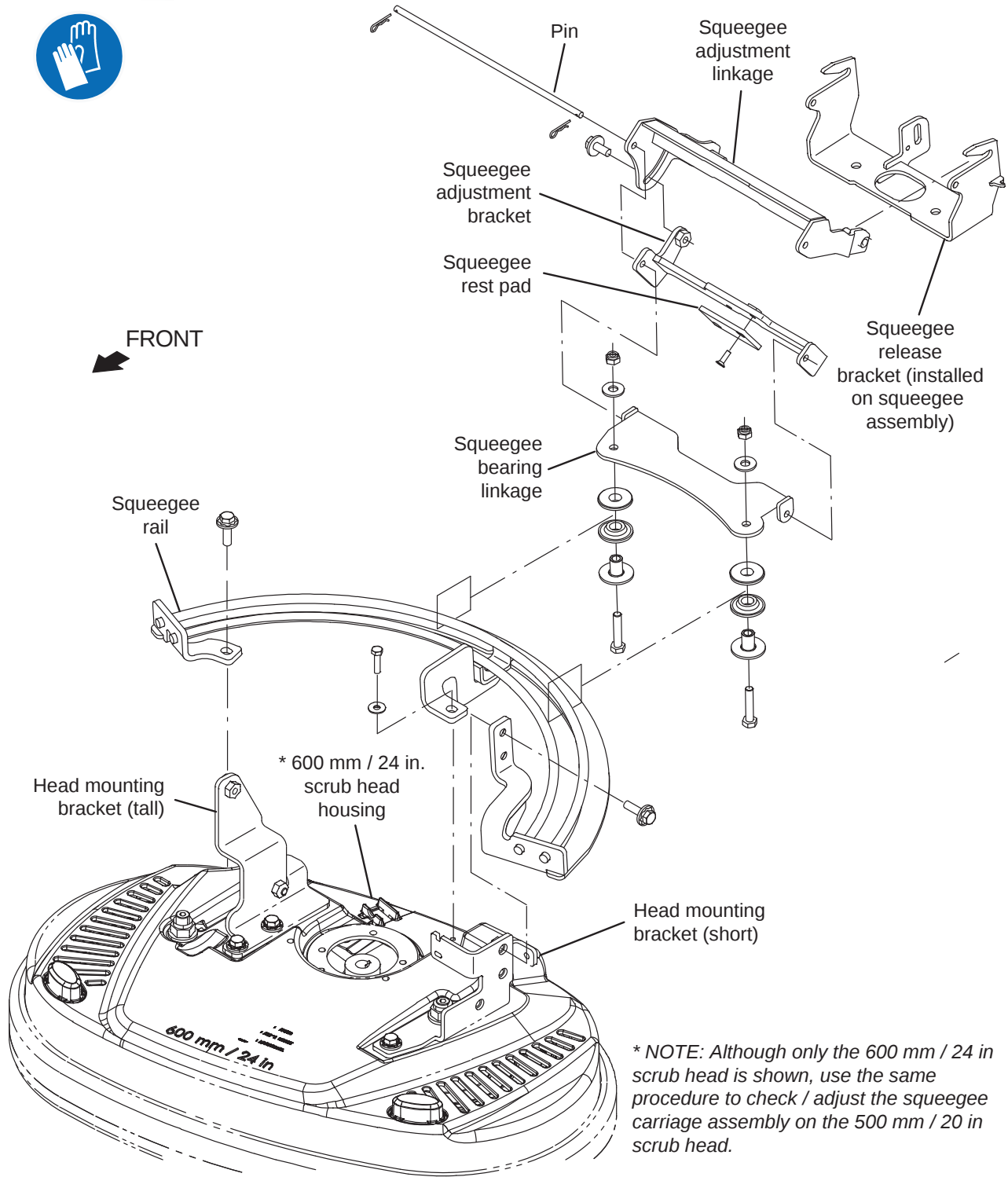
*NOTE: **Do Not** remove the actuator mounting bracket or loosen hardware securing the actuator bracket to the machine. The actuator mounting bracket will need to be returned to the factory install marked position if bracket is removed / hardware is loosened.*



11. Remove the actuator from the machine.
12. If a block of wood was used to hold the scrub head raised, remove the block of wood from under the scrub head and lower the scrub head to the floor.
13. Connect the main wire harness to the new actuator.
14. Reconnect the battery cable to the machine.
15. Turn the key to the ON position and press the 1-Step button.

16. Hold the actuator and actuator barrel so neither spins while extending the actuator and step on the Green Go pedal to extend the barrel until the hole in barrel is aligned with slot in the disk head lift weldment.
17. Use the clevis pin / cotter pin to reinstall the actuator onto the actuator mounting bracket.
18. Use the clevis pin / cotter pin to secure the barrel of the actuator to the disk head lift weldment.
19. Verify the following machine operations function properly:
 - The brush is released when the brush release button is pushed and the machine goes through the brush release sequence.
 - Squeegee wheels are on the floor and rotating when the machine is moving and in the vacuum only mode.
 - Scrub head is level on the floor.
 - Actuator motor turns off before the barrel of the actuator touches the actuator motor housing.

ADJUSTING THE SQUEEGEE ASSEMBLY



1. Confirm scrub head actuator is properly installed and adjusted.

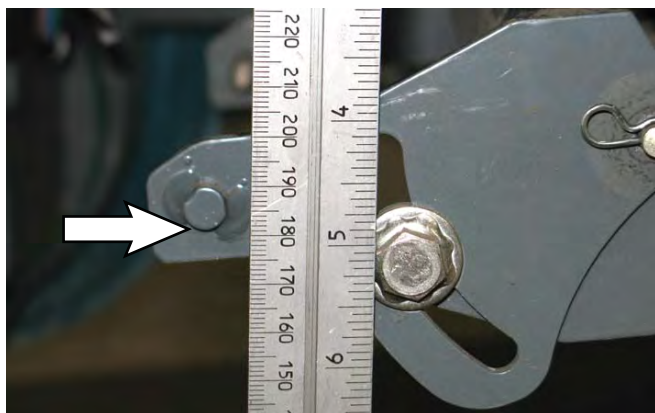
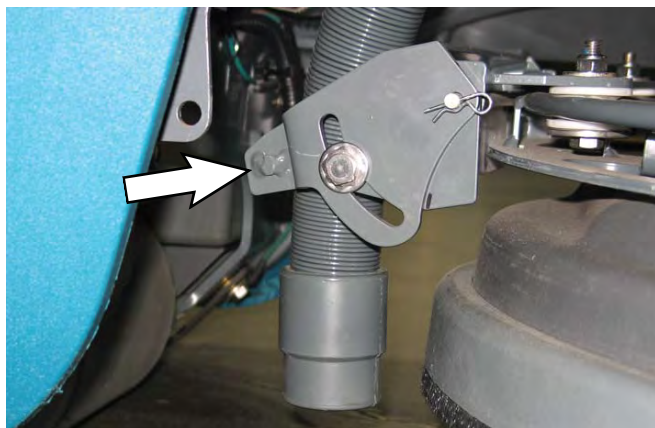
NOTE: The adjustment for the squeegee assembly must be checked whenever the scrub head is changed and whenever any parts or components of the squeegee rail group (squeegee adjustment linkage / squeegee adjustment bracket / squeegee bearing linkage / squeegee rail) are removed or replaced.

2. Raise the scrub head to the completely raised (transport) position.
3. Turn the key to the OFF position and remove the key.

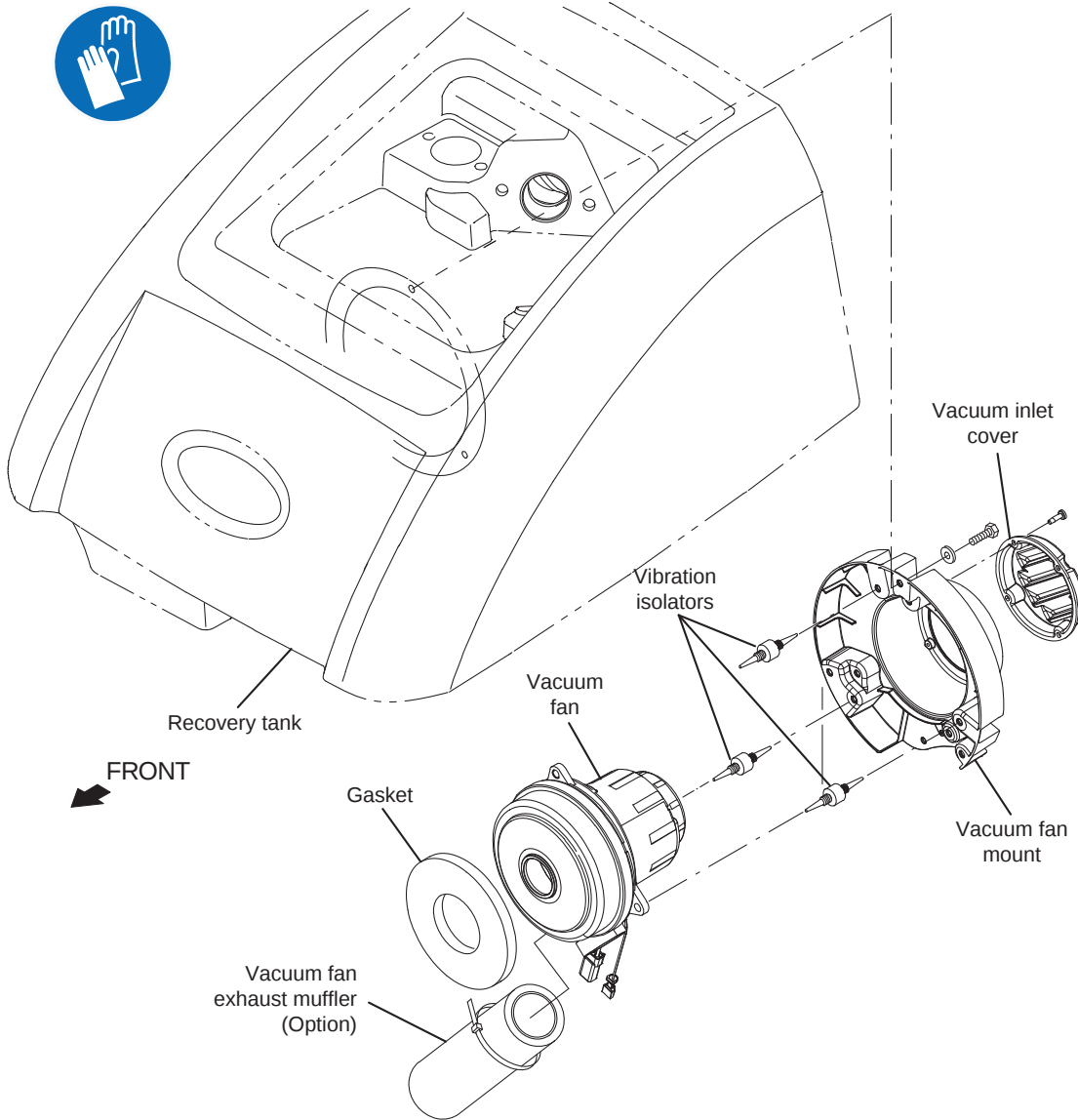
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, remove key, and set parking brake if equipped.

4. Remove the squeegee assembly from the squeegee carriage assembly.
5. Center the squeegee carriage assembly back underneath the machine.
6. Measure from the bottom of the pin located on the right side of the squeegee adjustment bracket. The center of the pin should be 181 mm +/- 4 mm (7.13 in. +/- 0.16 in.) from the floor.

7. If the bottom of the pin is not at the correct measurement, loosen the hex screw and adjust the location of the squeegee adjustment bracket in the squeegee adjustment linkage and retighten the hex screw.
8. Recheck the measurement of the pin located on the right side of the squeegee adjustment bracket. Adjust as necessary.
9. Reinstall the squeegee assembly onto the squeegee carriage assembly.



REMOVING / INSTALLING THE VACUUM FAN

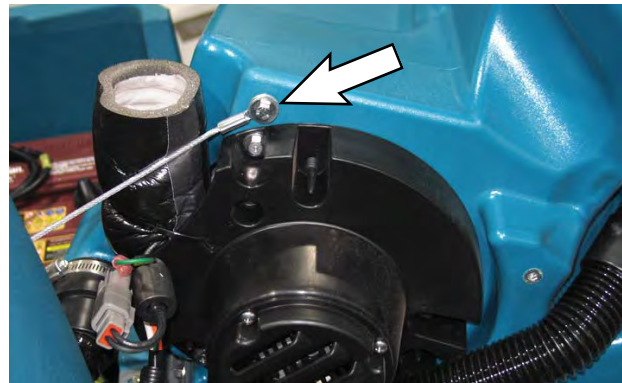


FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, remove key, and set parking brake if equipped.

FOR SAFETY: When servicing machine, Disconnect battery connection and charger cord before working on machine.

1. Completely drain the recovery tank.
2. Turn the key to the OFF position.
3. Disconnect the battery cable from the machine.
4. Lift the recovery tank open.

5. To allow easier access to the vacuum fan, hold recovery tank in place, remove the hardware securing the lanyard to the standard position on the recovery tank, and attach the lanyard to the alternate location on the recovery tank.



6. Lower recovery tank into the completely open position.
7. Cut the cable tie securing the main wire harness connections to the vacuum fan assembly and disconnect the main wire harness from the vacuum fan.



8. Disconnect the main wire harness from the vacuum fan.



9. Remove hardware (Qty. 3) securing the vacuum fan to the recovery tank.



10. Remove the vacuum fan assembly from the machine.



11. Machines with optional exhaust muffler: Cut the cable tie securing the vacuum fan / exhaust muffler to the vacuum fan mount.



12. Separate the vacuum fan from the vacuum fan mount bracket.

13. Install the new vacuum fan onto the mount bracket. Be sure the vibration isolators are completely inserted into the vacuum fan.



14. Install new vacuum fan assembly / reinstall the removed vacuum fan assembly in the reverse order of removal.

15. Install new cable tie to secure main wire harness connection to vacuum fan into place.

16. Reinstall the lanyard into the standard position on the recovery tank.

REMOVING / REPLACING THE VACUUM FAN CARBON BRUSHES

1. Remove the vacuum fan from the machine. See REMOVING / INSTALLING THE VACUUM FAN in this section manual.
2. Remove hardware securing the vacuum fan cover assembly to the motor.



3. Loosen the carbon brush mounting hardware.



4. Lift up to release and remove carbon brushes.



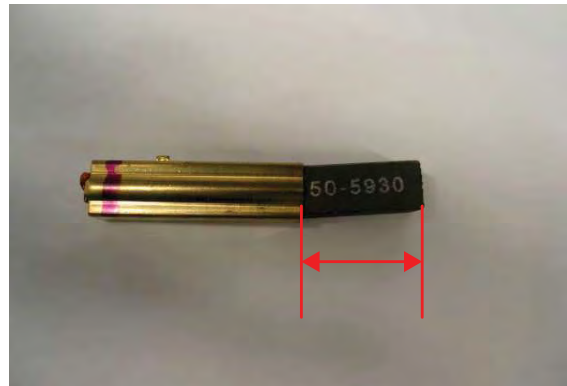
NOTE: Carbon brushes should be replaced as sets.

INSTALLING THE VACUUM FAN CARBON BRUSHES

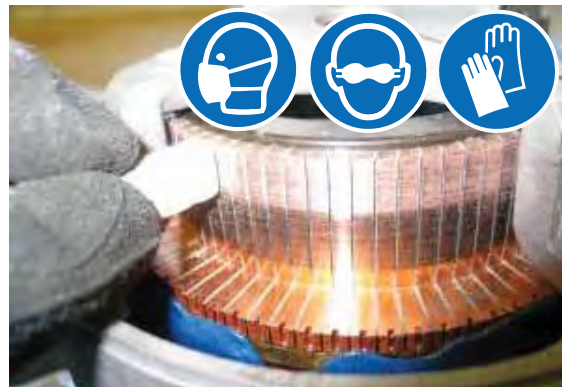
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, set parking brake, and remove key.

1. Inspect carbon brushes. Replace carbon brushes if they are stuck or are less than 10 mm (0.375 in) in length.

NOTE: Carbon brushes should be replaced as sets.

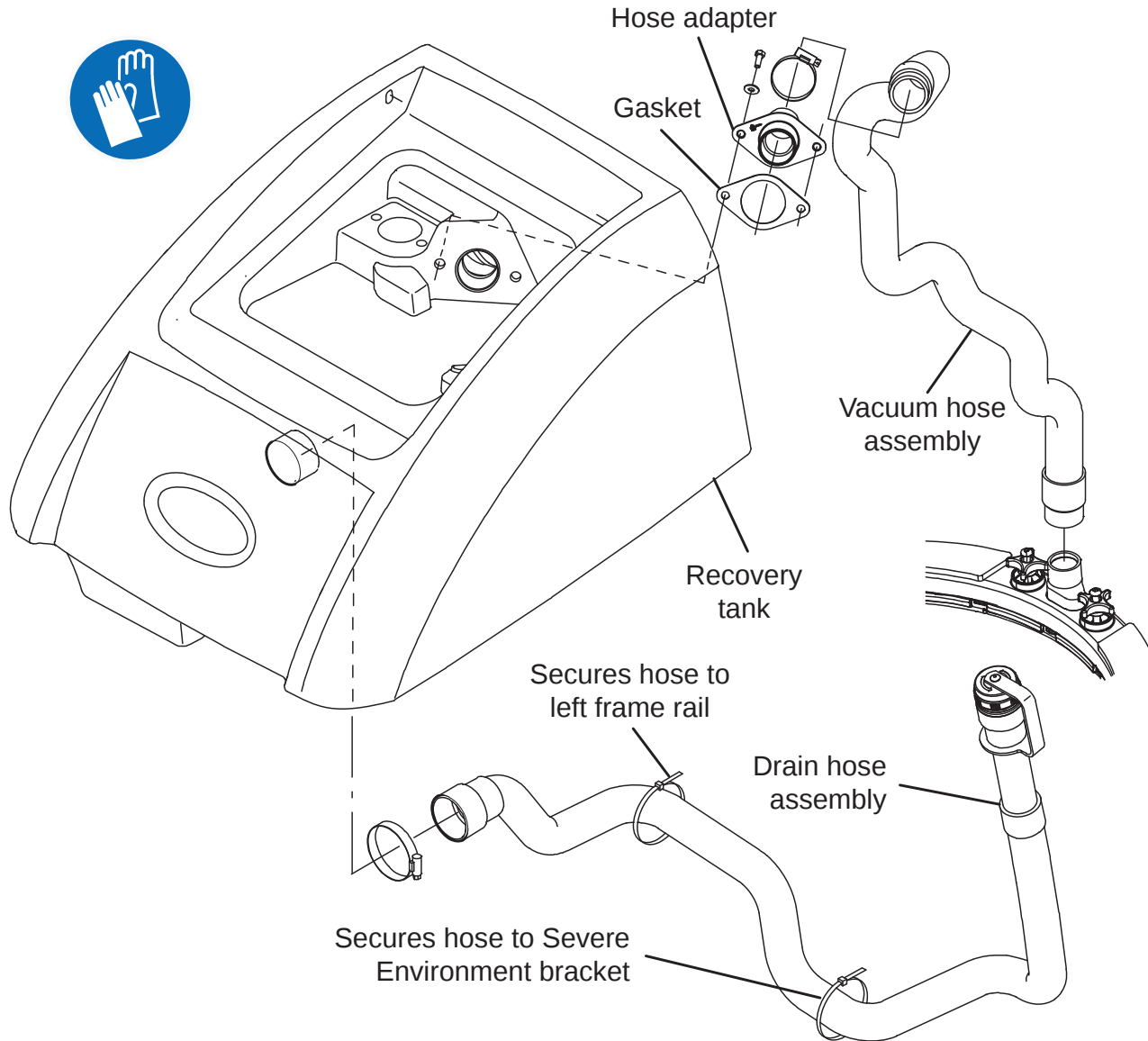


2. Use a stone to clean the commutator and then use compressed air to clean any dust from inside the motor.



3. Reinstall the vacuum fan onto the machine. See REMOVING / INSTALLING THE VACUUM FAN in this section of manual.

INSTALLING / ROUTING THE RECOVERY TANK DRAIN HOSE AND THE VACUUM HOSE

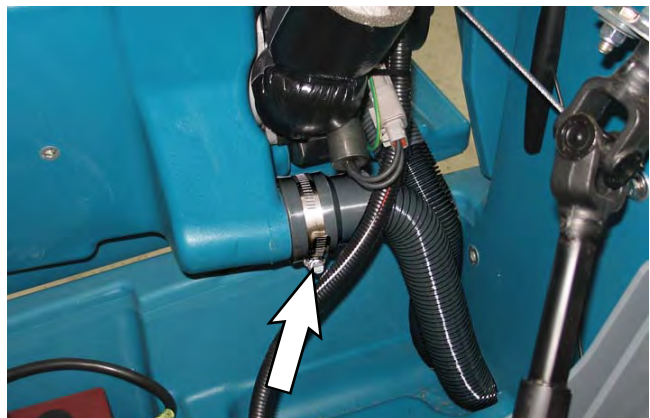


FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, remove key, and set parking brake if equipped.

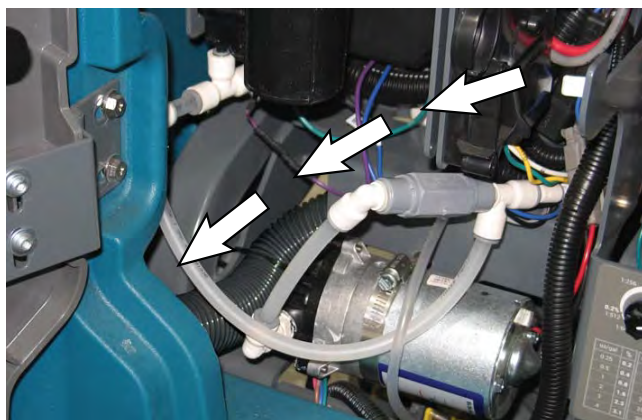
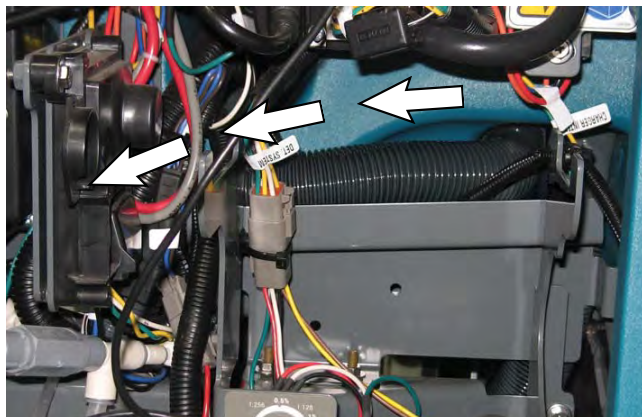
FOR SAFETY: When servicing machine, Disconnect battery connection and charger cord before working on machine.

1. Completely drain the recovery tank.
2. Turn the key to the OFF position.
3. Lift the recovery tank open.
4. Remove the existing drain hose assembly from the machine. Note location of existing drain hose on machine before

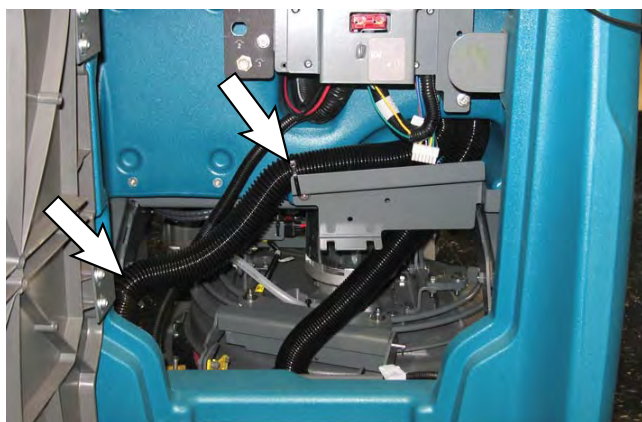
5. Connect the new drain hose assembly to the recovery tank.



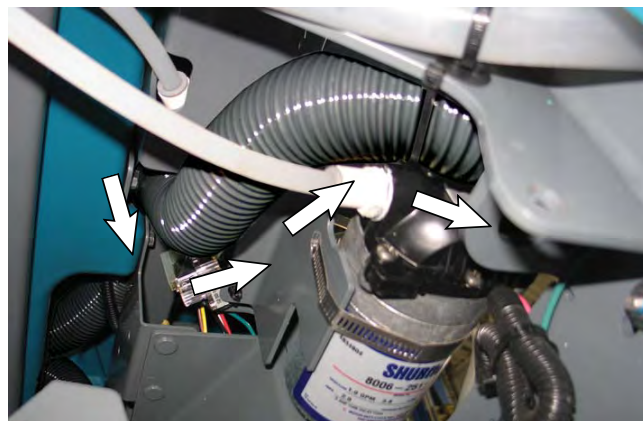
6. Route the drain hose assembly down through the hole in the solution tank, down behind the automatic battery water bracket, and down to the ec-H2O solution pump as the removed hose was previously routed.



NOTE: Hose routing for the drain hose on machines without ec-H2O and Severe Environment options. The drain hose is routed exactly the same on machines equipped with these options. Do not leave excess slack in the drain hose between the two cable ties. The drain hose should not sag in this area of the machine.



7. Continue routing the drain hose past the ec-H2O solution pump and out the side of the machine.

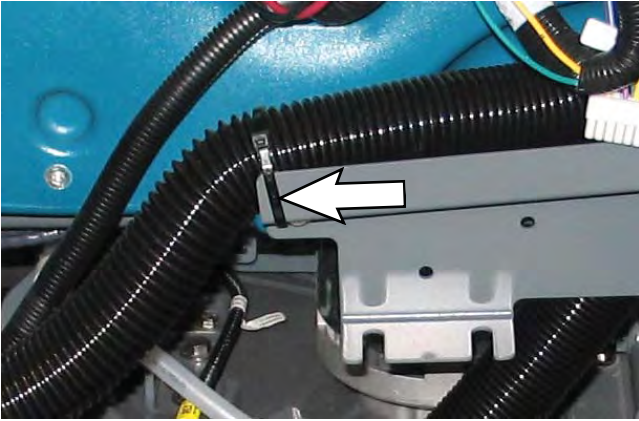


8. Adjust slack of drain hose so the drain hose can easily be installed into accessory rail.

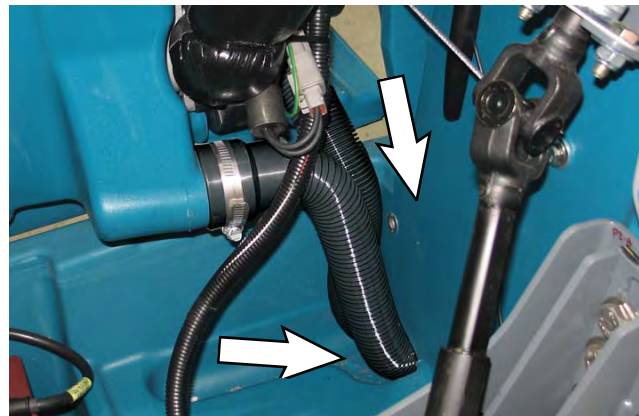
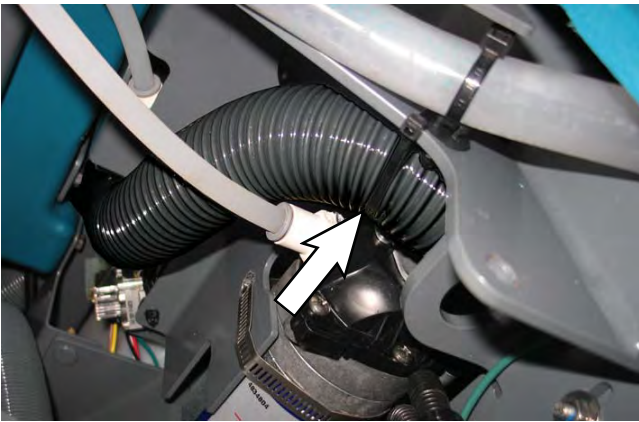


9. Confirm there is enough slack in the drain hose where it is attached to the recovery tank. There should be enough slack in the drain hose to easily open the recovery tank.

10. Use cable ties to secure the drain hose to the left frame rail and the Severe Environment support bracket.



6. Route the drain hose assembly down through the hole in the solution tank, down behind the automatic battery water bracket, and down to the squeegee assembly.



INSTALLING / ROUTING THE RECOVERY TANK DRAIN HOSE AND THE VACUUM HOSE

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

FOR SAFETY: When servicing machine, Disconnect battery connection and charger cord before working on machine.

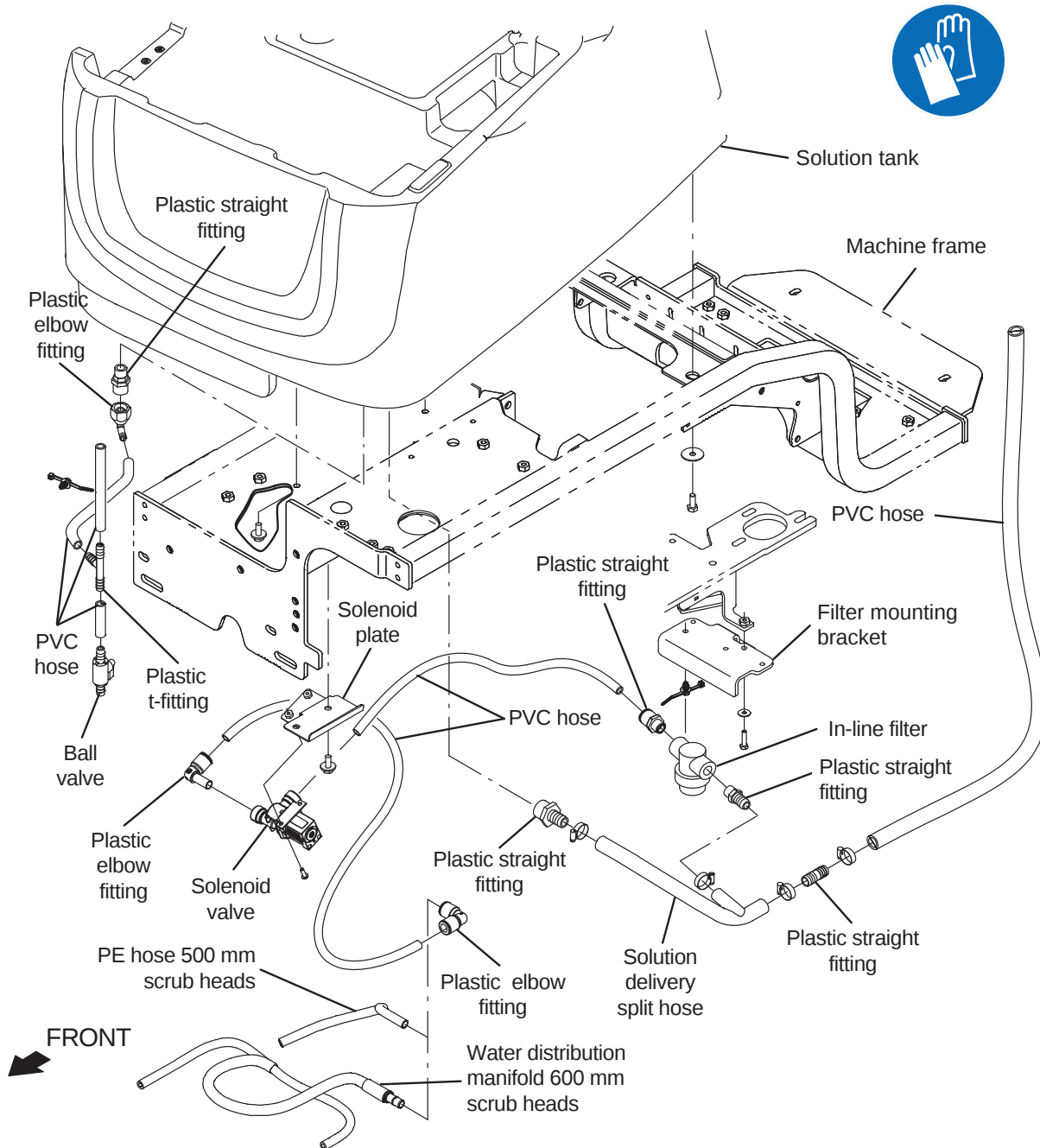
1. Completely drain the recovery tank.
2. Turn the key to the OFF position.
3. Lift the recovery tank open.
4. Remove the existing vacuum hose assembly from the machine.
5. Connect the vacuum hose to the hose adapter on the recovery tank.

NOTE: Hose routing for the vacuum hose on machines without ec-H2O and Severe Environment options. The vacuum hose is routed exactly the same on machines equipped with these options.



7. Connect the vacuum hose to the squeegee assembly.
8. Confirm there is enough slack in the vacuum hose where it is attached to the recovery tank. There should be enough slack in the vacuum hose to easily open the recovery tank.

REMOVING / INSTALLING THE WATER SOLENOID VALVE



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

FOR SAFETY: When servicing machine, Disconnect battery connection and charger cord before working on machine.

1. Completely drain both the recovery tank and the solution tank.
2. Turn the key to the OFF position.

CONNECTING HOSES TO PTC (PUSH-TO-CONNECT) FITTINGS



1. Cut the tube square. The outer diameter of the tubing must be free of score marks, burrs, or sharp edges.



2. Insert tube into the fitting. The fitting will grip the hose before it seals.



3. Push into the tube stop. The stainless steel teeth inside the collet firmly hold the tube in position and the o-ring provides a permanent leak-proof seal.



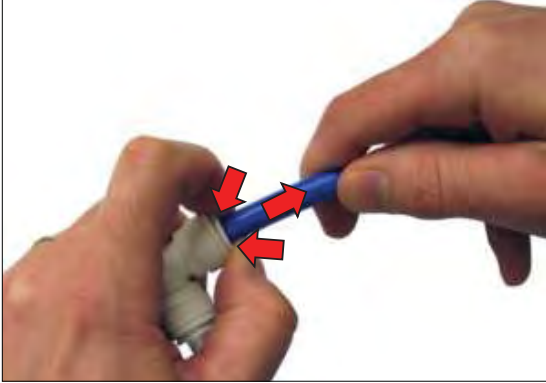
4. Pull on the fitting to ensure the hose connection is secure.



5. Test the fitting / hose connections for leaks prior to leaving the site.

DISCONNECT HOSES FROM PTC (PUSH-TO-CONNECT) FITTINGS

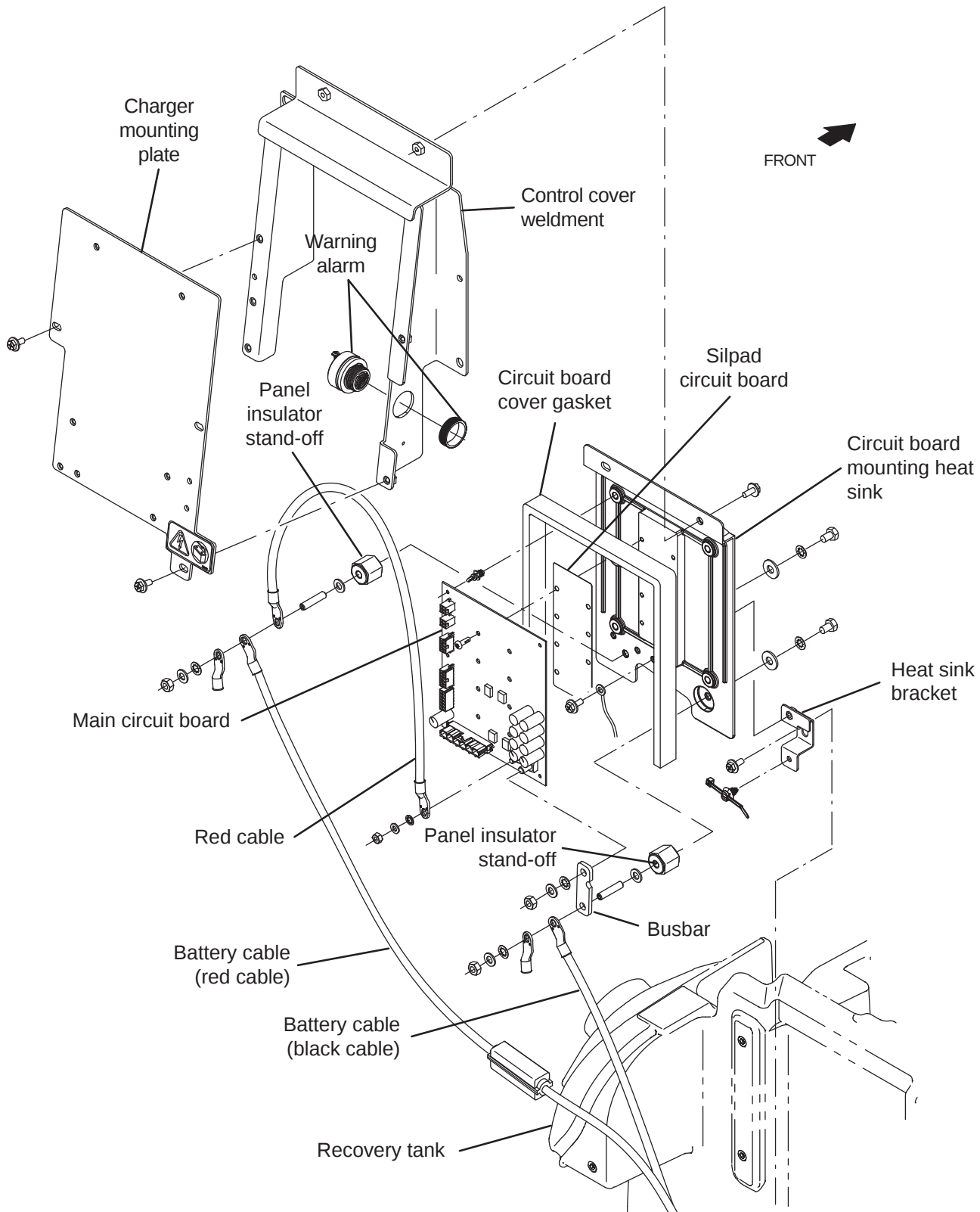
1. Push the hose into the fitting and push the collet squarely in against face of fitting to release the hose from the fitting. Continue to hold the collet held in against the fitting and pull the hose from the fitting.



NOTE: Be sure there is no pressure in the system and the system is emptied of all solution before disconnecting hose(s) from the fitting.

CONTROL MODULES / CONTROLS

REMOVING / INSTALLING THE CONTROL MODULE



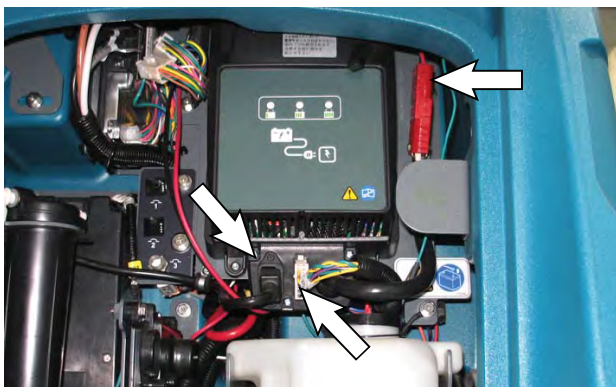
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, remove key, and set parking brake if equipped.

FOR SAFETY: When servicing machine, Disconnect battery connection and charger cord before working on machine.

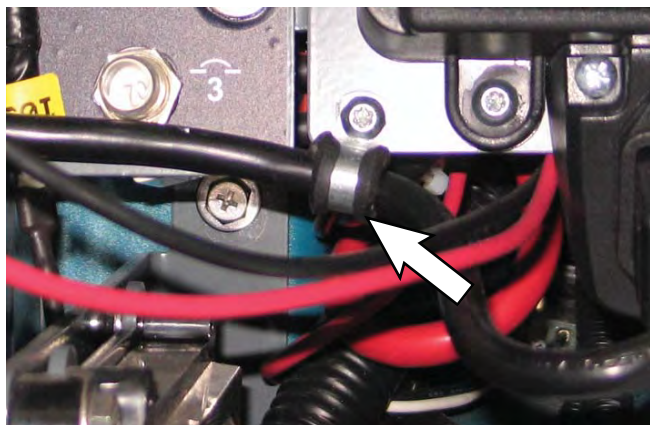
1. Completely drain the recovery tank.
2. Turn the key to the OFF position.
3. Disconnect the battery cable from the machine.

FOR SAFETY: When servicing machine, avoid contact with battery acid, keep all metal objects off batteries, and use a hoist or adequate assistance when lifting batteries.

- 4.
5. Disconnect all cable / main wire connections from the on-board battery charger.



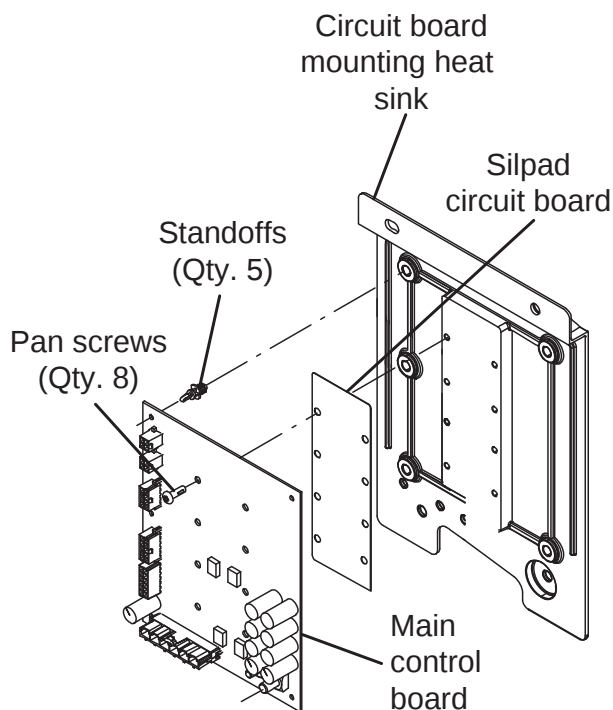
6. Remove the p-clamp securing the charger cable to the charger mounting plate.



7. Remove the charger mounting plate / on-board charger from the control cover weldment.

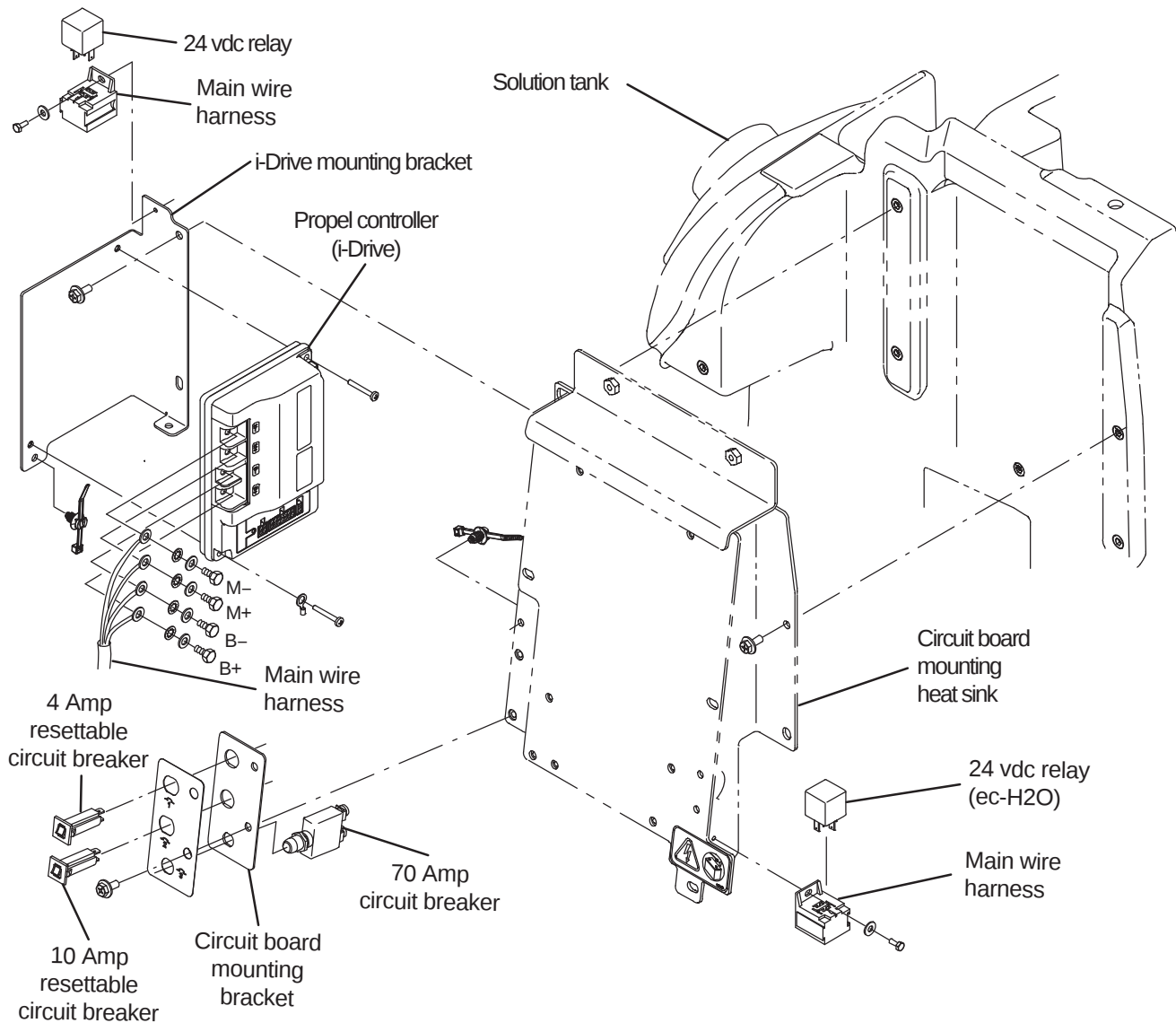
NOTE: To avoid damaging electronic components, a static ground strap must be worn at all times while handling circuit boards / control modules. Attach the other end of the static ground strap to the machine chassis.

8. Disconnect all main wire harness connections from the main circuit board and busbar.
9. Remove the eight screws securing the main circuit board to the circuit board mounting heat sink.



10. Remove the main circuit board from the five standoffs holding the main circuit board off from the circuit board mounting heat sink.
11. Reinstall the main circuit board / install the new main circuit board in reverse order of disassembly.

REMOVING / INSTALLING THE i-DRIVE MODULE



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

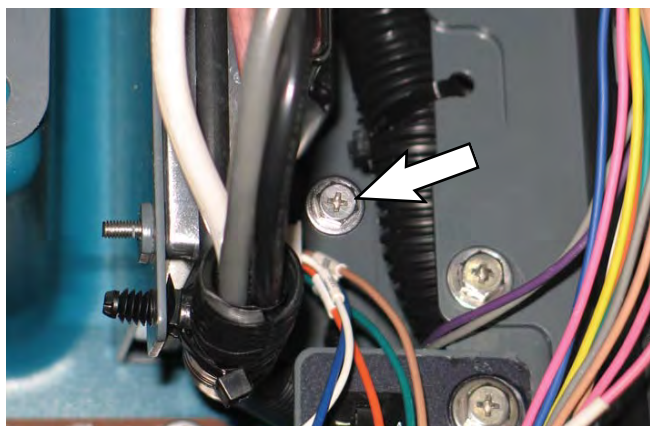
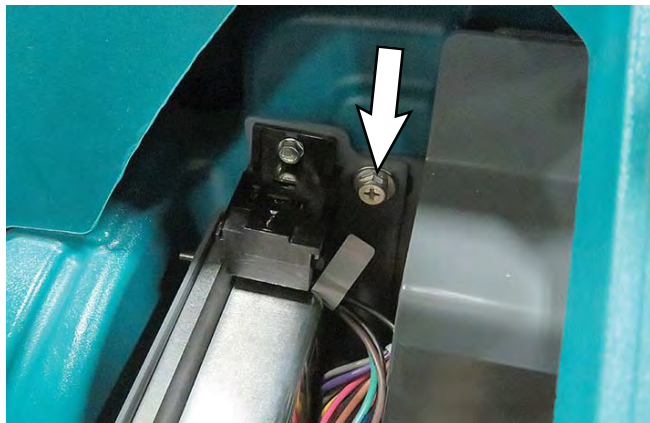
FOR SAFETY: When servicing machine, Disconnect battery connection and charger cord before working on machine.

1. Completely drain the recovery tank.
2. Turn the key to the OFF position.
3. Disconnect the battery cable from the machine.
4. Remove the control panel to access the top area of the i-Drive mounting bracket. See REMOVING / INSTALLING THE CONTROL PANEL for instructions how to remove the control panel.

5. Disconnect the relay from the main wire harness relay terminal connected to the i-Drive mounting bracket.



6. Remove the hardware securing the i-Drive mounting bracket / i-Drive to the solution tank.

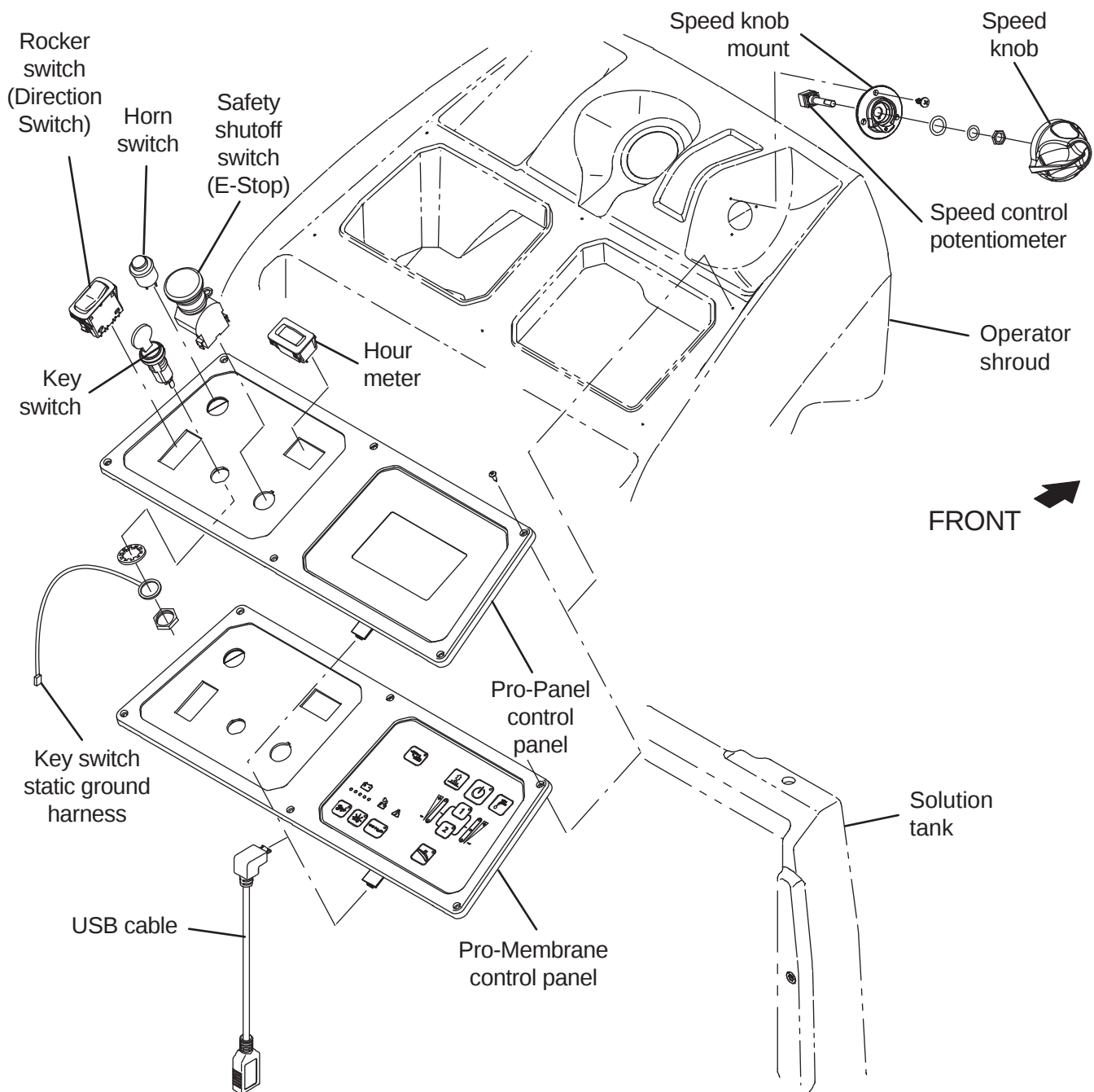


7. Remove the i-Drive from the i-Drive mounting bracket.

NOTE: To avoid damaging electronic components, a static ground strap must be worn at all times while handling circuit boards / control modules. Attach the other end of the static ground strap to the machine chassis.

8. Reinstall the drive module / install the new drive module in reverse order of disassembly.
9. If a new drive module was installed, the new drive module must be programmed for the machine onto which it was installed. See PROGRAMMING THE DRIVE MODULE in this section of the manual.

REMOVING / INSTALLING THE CONTROL PANEL



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

FOR SAFETY: When servicing machine, Disconnect battery connection and charger cord before working on machine.

1. Turn the key to the OFF position.

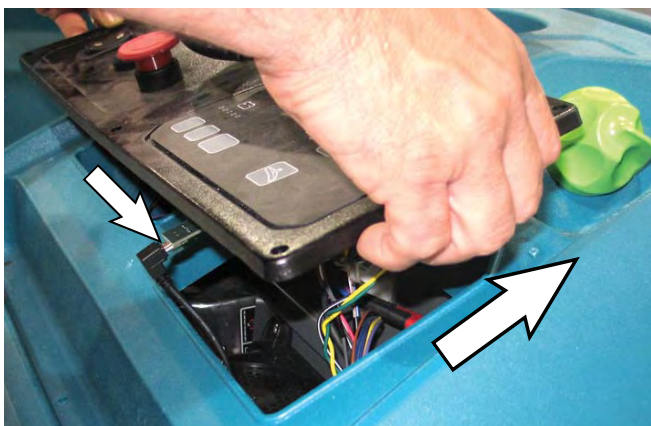
2. Disconnect the battery cable from the machine.

NOTE: To avoid damaging electronic components, a static ground strap must be worn at all times while handling circuit boards / control modules. Attach the other end of the static ground strap to the machine chassis.

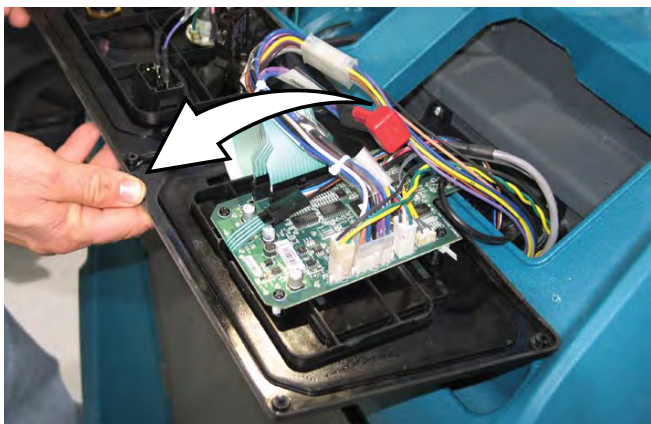
3. Remove the six pan screws securing the control panel to the operator shroud.



4. Carefully lift the control panel toward the steering bellows and rotate the control panel until the USB connect port clears the interior of the operator shroud.



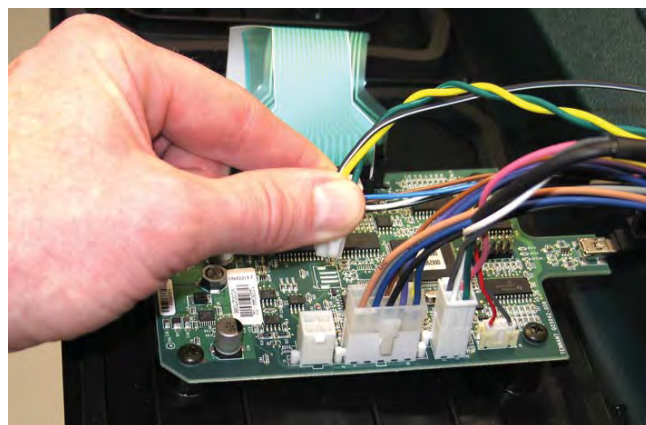
5. Move the control panel towards the rear of the machine while rotating the control panel to allow access to the wire connections located on the back side of the control panel.



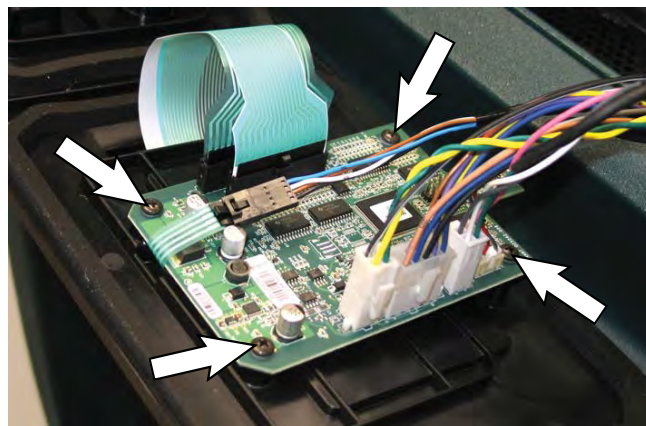
6. Disconnect the cable from the USB connection.
7. If completely removing the control panel from the machine, disconnect the main wire harness connections from the control board and all controls.

REMOVING / REPLACING THE CONTROL PANEL CONTROL BOARD

1. Remove the control panel from the operator shroud. See REMOVING / INSTALLING THE CONTROL PANEL.
2. Disconnect the main wire harness connections from the control board.



3. Remove the hardware securing the control board to the control panel assembly and remove the control board.



4. Reinstall the control board / install the new control board onto the control panel and connect the main wire harness to the control board.

REPLACING THE SPEED KNOB

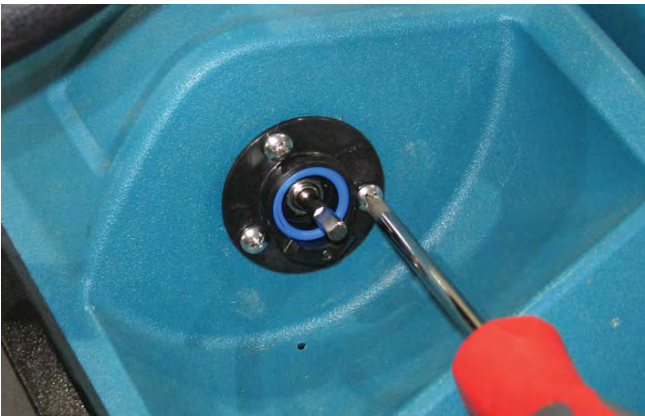
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, remove key, and set parking brake if equipped.

FOR SAFETY: When servicing machine, Disconnect battery connection and charger cord before working on machine.

1. Use two screw drivers to carefully pry the speed control knob from the potentiometer.

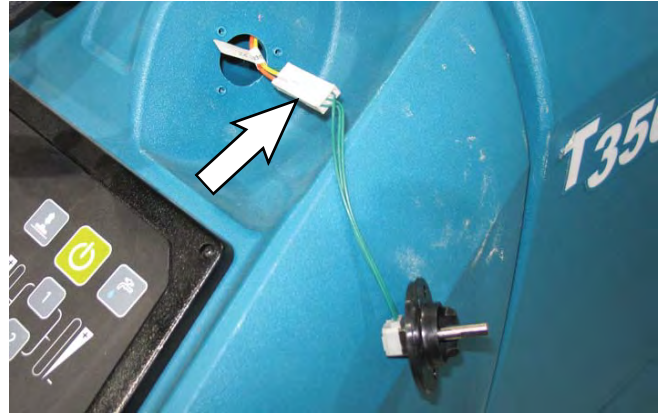


2. Remove the hardware securing the speed knob mount to the operator shroud.



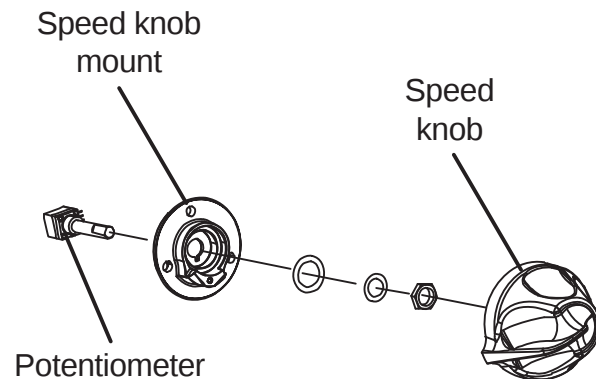
3. Carefully pull the speed knob mount / potentiometer out from the operator shroud.

4. Disconnect the main wire harness from the speed knob potentiometer.



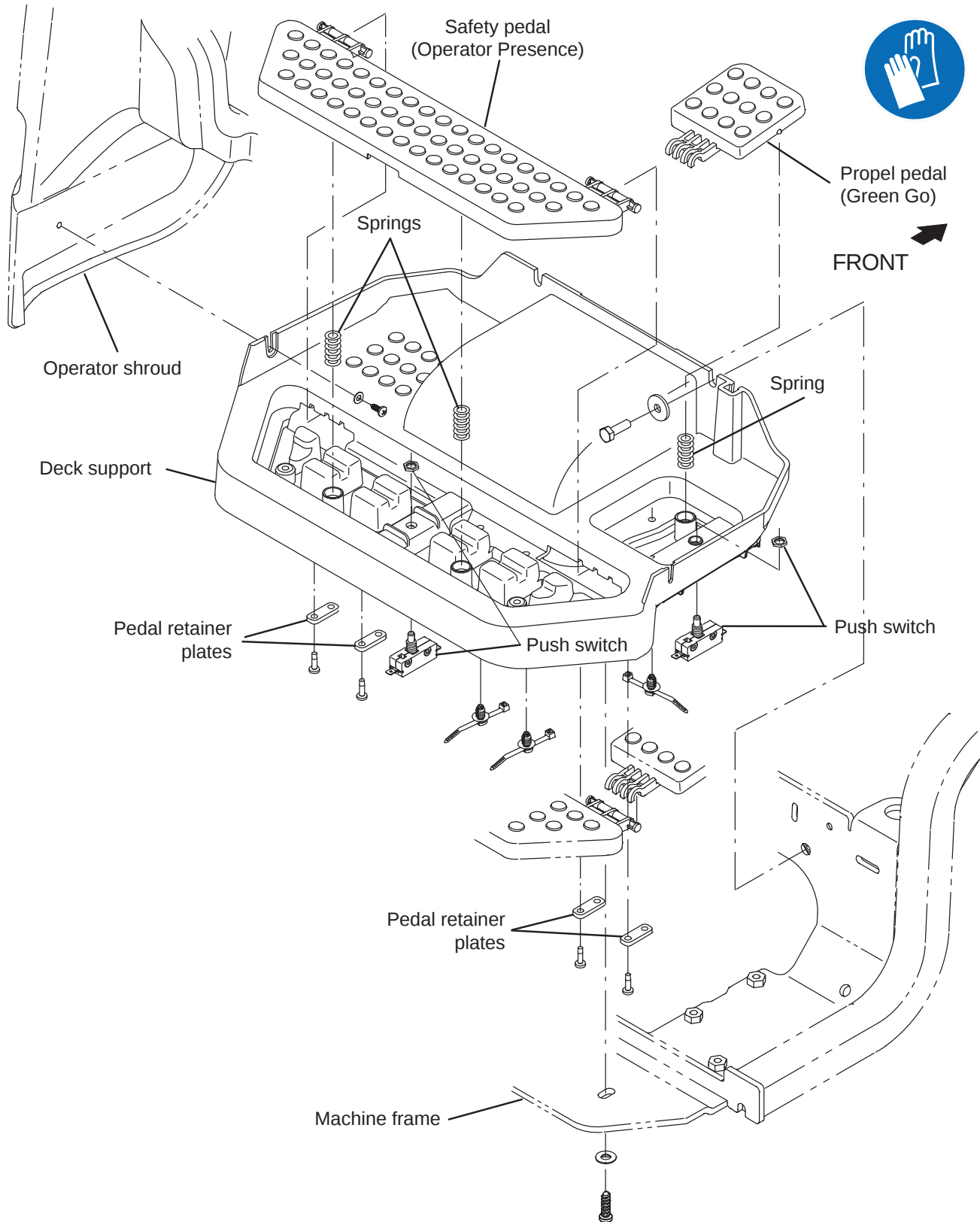
NOTE: If main wire harness should fall into the operator shroud after being disconnected from the potentiometer, open the recovery tank and route the main wire harness speed adjustment lead back through the hole in the operator shroud. Always empty the recovery tank before lifting the tank open.

5. Disassemble the potentiometer from the speed knob mount.



6. Reassemble the potentiometer onto the speed knob mount.
7. Reinstall the speed control assembly onto the machine in the reverse order of disassembly.

REMOVING / INSTALLING THE GREEN GO PEDAL /
OPERATOR PRESENCE PEDAL



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

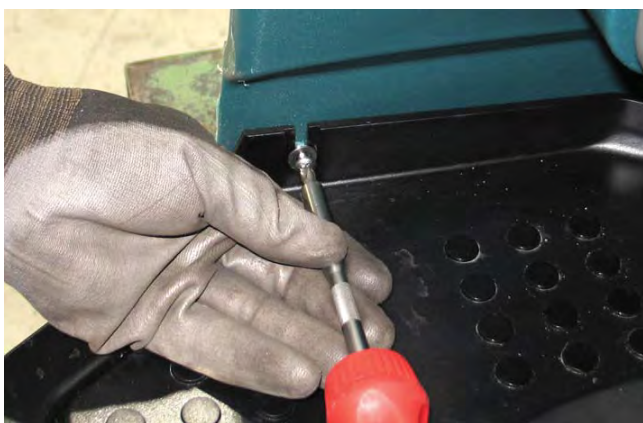
FOR SAFETY: When servicing machine, disconnect battery connection and charger cord before working on machine.

NOTE: Although the following instructions detail the complete disassembly of the Green Go pedal and the operator presence pedal from the support deck, disassemble these items only as far as necessary to make repairs / replace parts.

1. Turn the key to the OFF position.
2. Disconnect the battery cable from the machine.
3. Remove the hardware securing the front of the deck support to the machine frame.



4. Remove the hardware securing both sides of the deck support to the solution tank..



5. Remove the hardware securing the deck support to the frame of the machine.



6. Disconnect the main wire harness from the deck harness.



7. Pull the deck support from the machine.



8. Position the deck support onto the floor or a table so the bottom of the deck support is oriented up.
9. Disconnect the deck harness from the Green Go pedal switch.



12. Turn the deck support over and remove the Green Go pedal, operator presence pedal, and springs from the deck support.



10. Remove both pedal retainer plates securing the Green Go pedal to the deck support

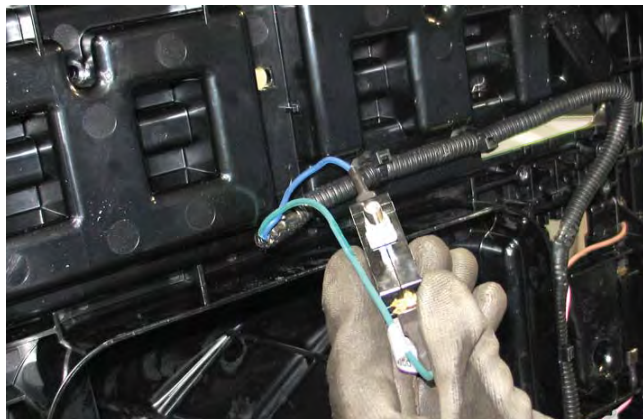


13. Remove the hardware securing the operator presence pedal switch to the deck support.

11. Remove both pedal retainer plates securing the operator presence pedal to the deck support.



14. Remove the operator presence pedal switch from the deck support.



15. Remove the hardware securing the Green Go pedal switch to the deck support.

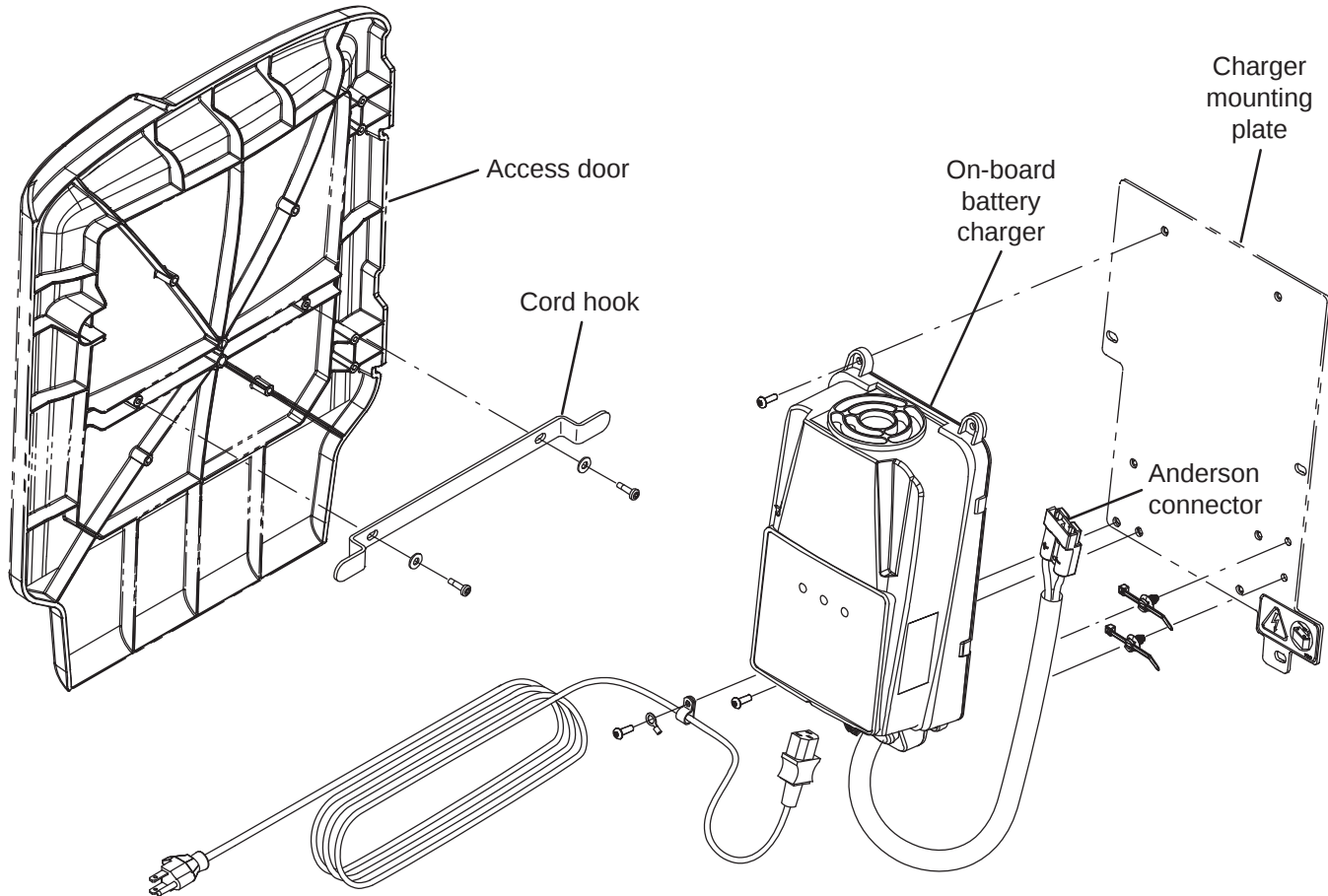


16. Remove the Green Go pedal switch from the deck support.



17. Reassemble the Green Go pedal / operator presence pedal onto the machine in the reverse order of disassembly.

REMOVING / INSTALLING THE ON-BOARD BATTERY CHARGER

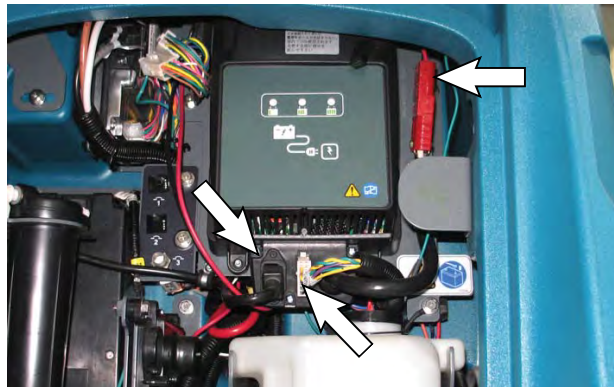


FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, remove key, and set parking brake if equipped.

FOR SAFETY: When servicing machine, Disconnect battery connection and charger cord before working on machine.

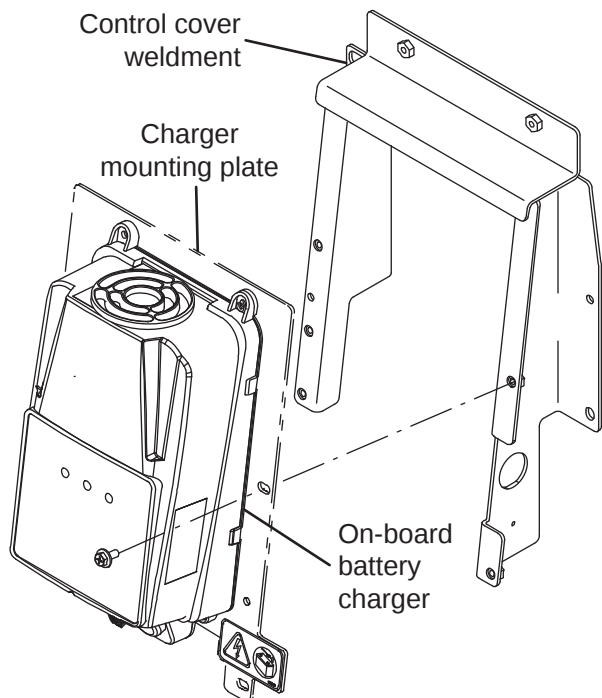
1. Turn the key to the OFF position and disconnect the battery cable from the machine.
2. Disconnect the battery cable from the machine.

3. Disconnect all cable connection from the on-board batter chargers.



4. Remove the p-clamp securing the on-board battery charger charging cable to the charger mounting plate.

5. Remove the hardware securing the charger mounting plate to the control cover weldment.



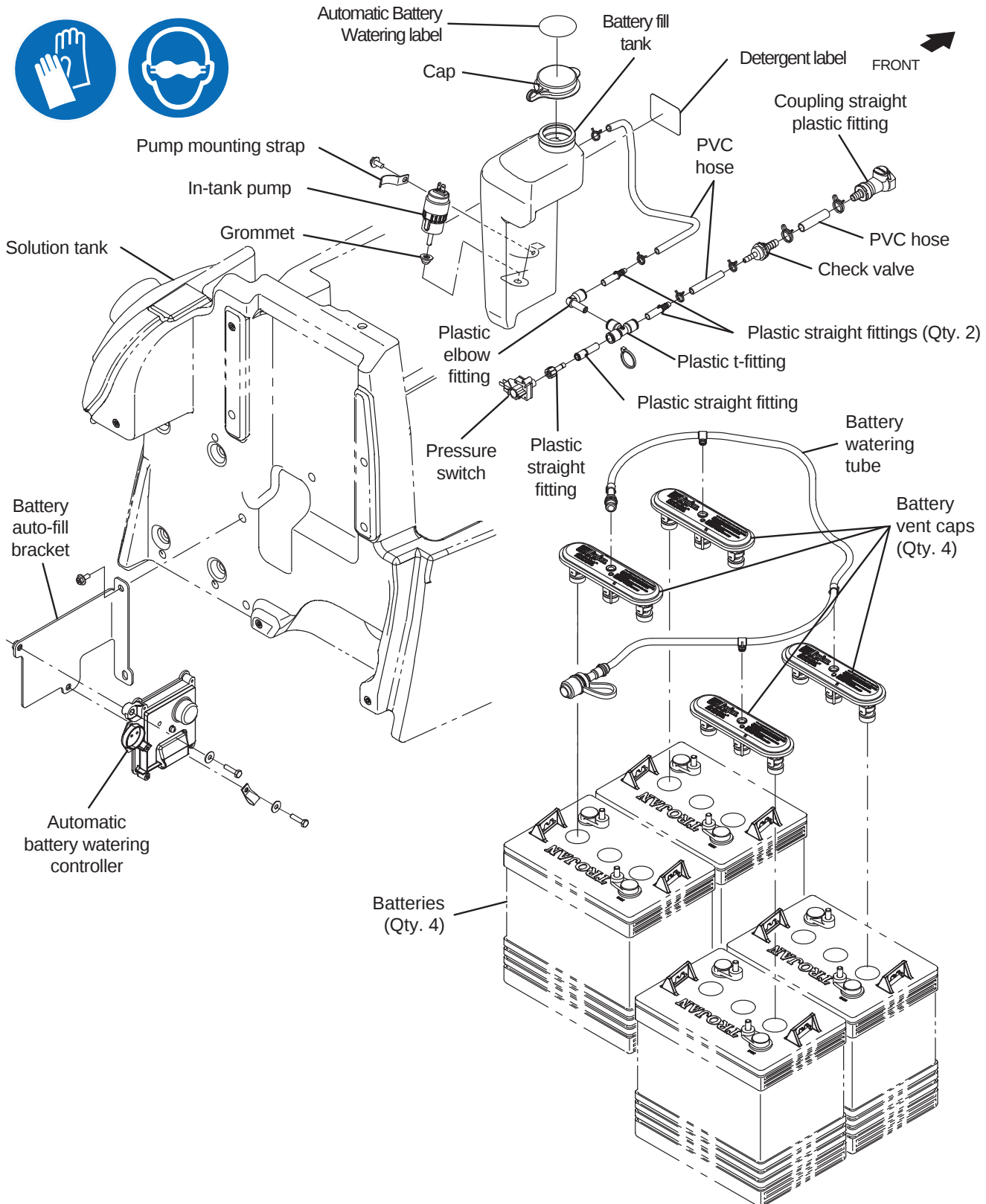
6. Carefully remove the charger mounting plate / on-board battery charger from the control cover weldment.
7. Remove the on-board battery charger from the charger mounting plate.
8. Reinstall the on-board battery / install the new on-board battery in reverse order of disassembly.

NOTE: The on-board charger can be programmed for multiple battery configurations. This configuration data is stored in the interface module and will automatically configure a replacement battery charger once installed and following a power-up cycle. Reprogramming is required if the interface module has been replaced, or if a different type of battery is used (other than factory-installed equipment). (See SERVICE DIAGNOSTICS TOOL section in this manual)

Models equipped with the PRO-Panel LCD Touch Panel can be configured through the touch panel. All other models must be configured through separate configuration software via a mini-USB programming port on the back of the operator console. (See SERVICE DIAGNOSTICS TOOL in this section of the manual)

OPTIONS

SMART-FILL ABW (AUTOMATIC BATTERY WATERING) SYSTEM MAINTENANCE (OPTION)

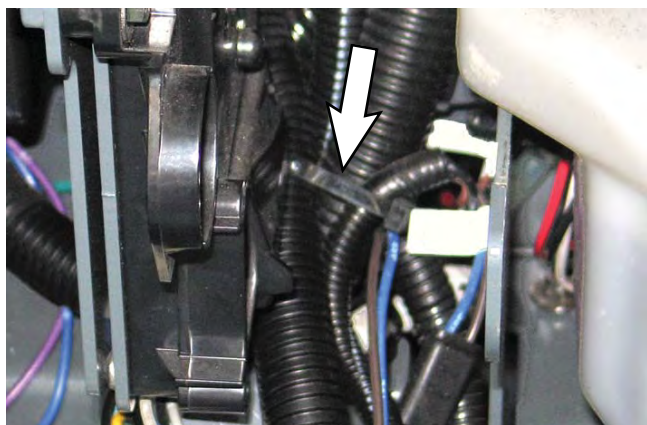


FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, remove key, and set parking brake if equipped.

FOR SAFETY: When servicing machine, Disconnect battery connection and charger cord before working on machine.

REPLACING THE AUTOMATIC BATTERY WATERING CONTROLLER

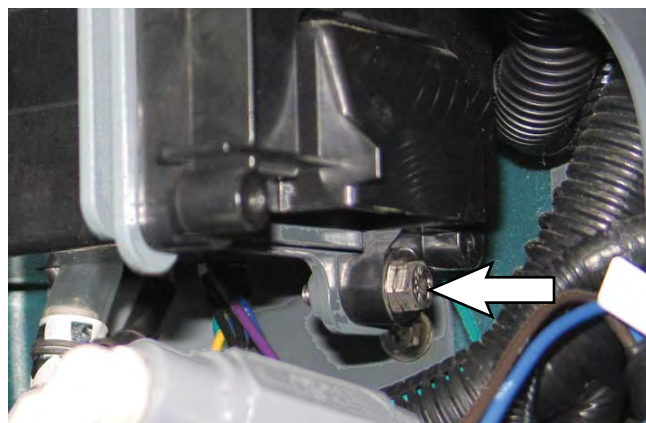
1. Turn the key to the OFF position.
2. Completely empty the recovery tank.
3. Disconnect the battery cable from the machine.
4. If necessary, cut the wire tie securing the main wire harness to the automatic battery watering controller.



5. Disconnect both main wire harness connectors from the automatic battery watering controller.



6. Remove the hardware securing the automatic battery watering controller to the battery auto-fill bracket.



7. Reinstall the automatic battery watering controller / install the new automatic battery watering controller in the reverse order of disassembly.

ABW PUMP IS TIMING OUT (1 MINUTE)

1. Turn the key to the OFF position.
2. Check for water / electrolyte residue on top of batteries and in the battery tray.
3. Identify the source of the leaks. Check all ABW system hoses, connections, fittings, and battery caps for leaks / damage. Ensure battery caps are properly tightened.



4. Replace damaged / worn fittings, hoses, and battery caps as necessary.
5. Clean all water / electrolyte from the tops of the batteries and from inside battery tray.
6. Add distilled water to the battery watering system tank.



7. Turn the key to the ON position.
8. Verify the ABW pump is functioning and the fault is cleared.

ABW OVERFILLS THE BATTERIES

1. Turn the key to the OFF position.
2. Inspect the tops of the batteries and battery tray for water / electrolyte residue.
3. Ensure all battery vent caps are snugly tightened.



4. Replace the vent cap if it still leaks after tightening.
5. Clean all water / electrolyte from the tops of the batteries and from inside battery tray.
6. Add distilled water to the battery watering system tank.



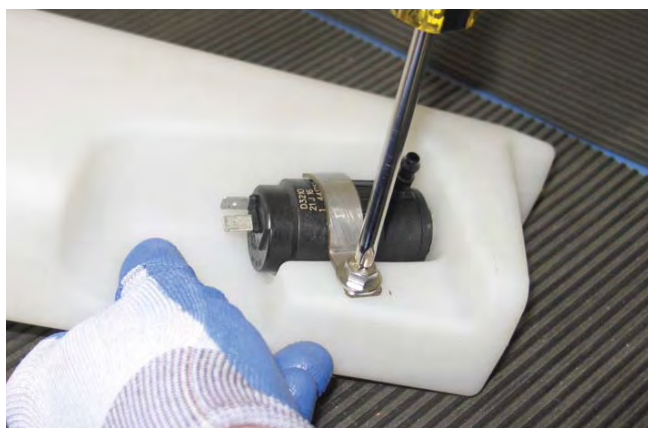
7. Turn the key to the ON position.
8. Verify ABW pump is functioning properly and the fault is cleared.

REPLACING THE ABW IN TANK PUMP

1. Turn the key to the OFF position.
2. Completely empty the ABW tank.
3. Disconnect the clear hose from the ABW tank.
4. Disconnect the main wire harness from the ABW pump.



5. Remove the ABW tank from the bracket.
6. Remove the pump mounting strap securing the ABW pump to the ABW tank from the tank.



7. Carefully pull the ABW pump from the ABW tank.

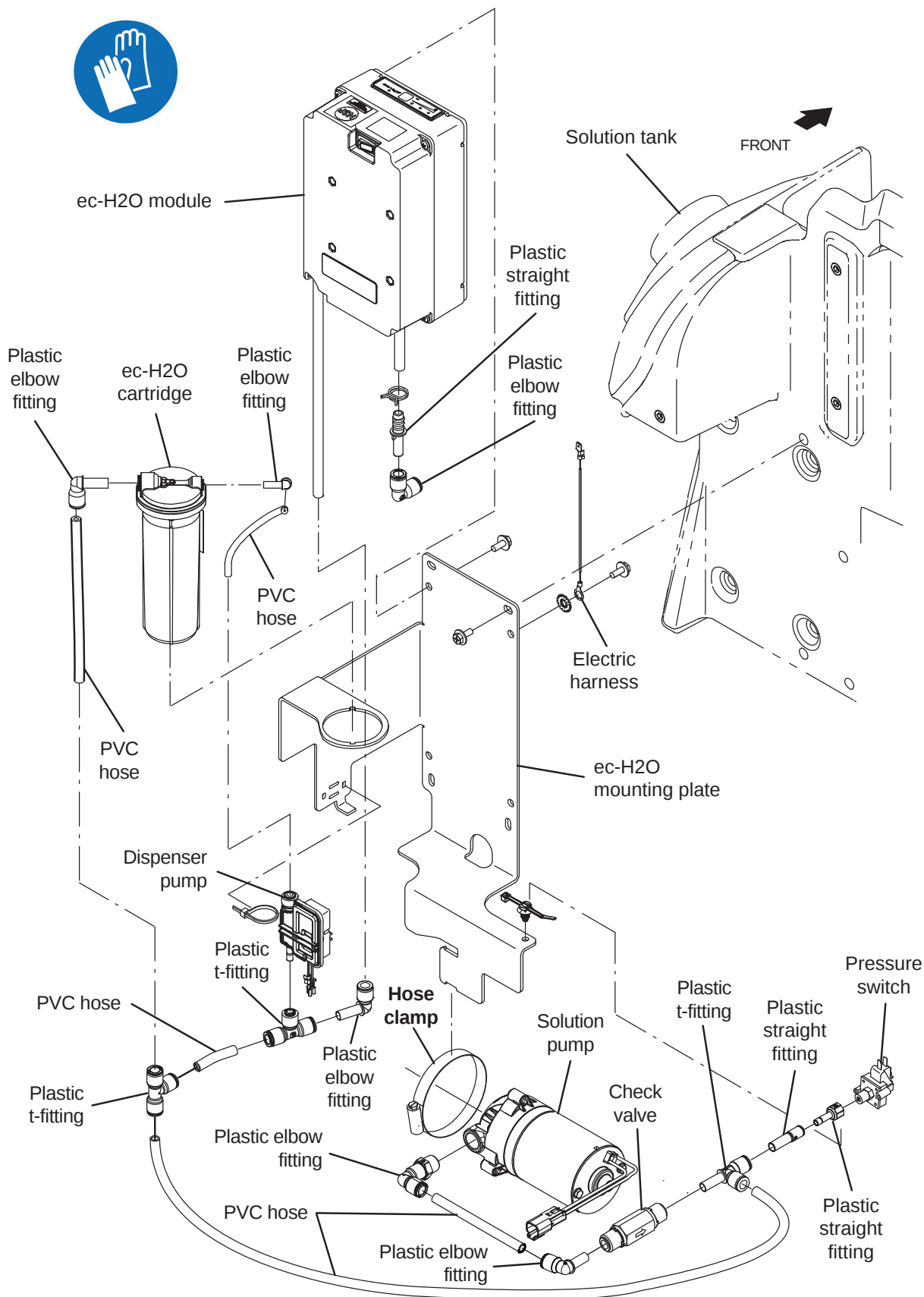


8. Remove the grommet from the ABW tank.



9. Reinstall the ABW pump / install the new ABW pump in reverse order of disassembly

REMOVING / INSTALLING THE ec-H2O SOLUTION PUMP (OPTION)



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

FOR SAFETY: When servicing machine, Disconnect battery connection and charger cord before working on machine.

1. Completely drain the solution tank and the recovery tank.
2. Turn the key to the OFF position.
3. Disconnect the main wire harness from the ec-H2O pump.
4. Disconnect all hoses / connectors from the ec-H2O pump.
5. Loosen the hose clamp securing the ec-H2O pump to the machine.
6. Remove the ec-H2O pump from the machine
7. Reinstall the ec-H2O pump / install the new ec-H2O pump onto the machine in the reverse order of disassembly.

REMOVING / INSTALLING THE ec-H2O MODULE (OPTION)

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

FOR SAFETY: When servicing machine, Disconnect battery connection and charger cord before working on machine.

1. Completely drain the solution tank and the recovery tank.
2. Turn the key to the OFF position.
3. Remove the entire ec-H2O cartridge assembly from the ec-H2O mounting plate.
4. Disconnect the main wire harness from the ec-H2O module.
5. Disconnect all hoses / connectors from the ec-H2O module.
6. Remove any components necessary to allow easier access and removal of the ec-H2O mounting bracket from the machine.
7. Remove the ec-H2O module / ec-H2O mounting bracket from the machine.

8. Remove the ec-H2O module from the ec-H2O mounting bracket.
9. Reinstall the ec-H2O module / install the new ec-H2O module in reverse order of disassembly.
10. Reinstall the ec-H2O cartridge onto the ec-H2O mounting bracket.

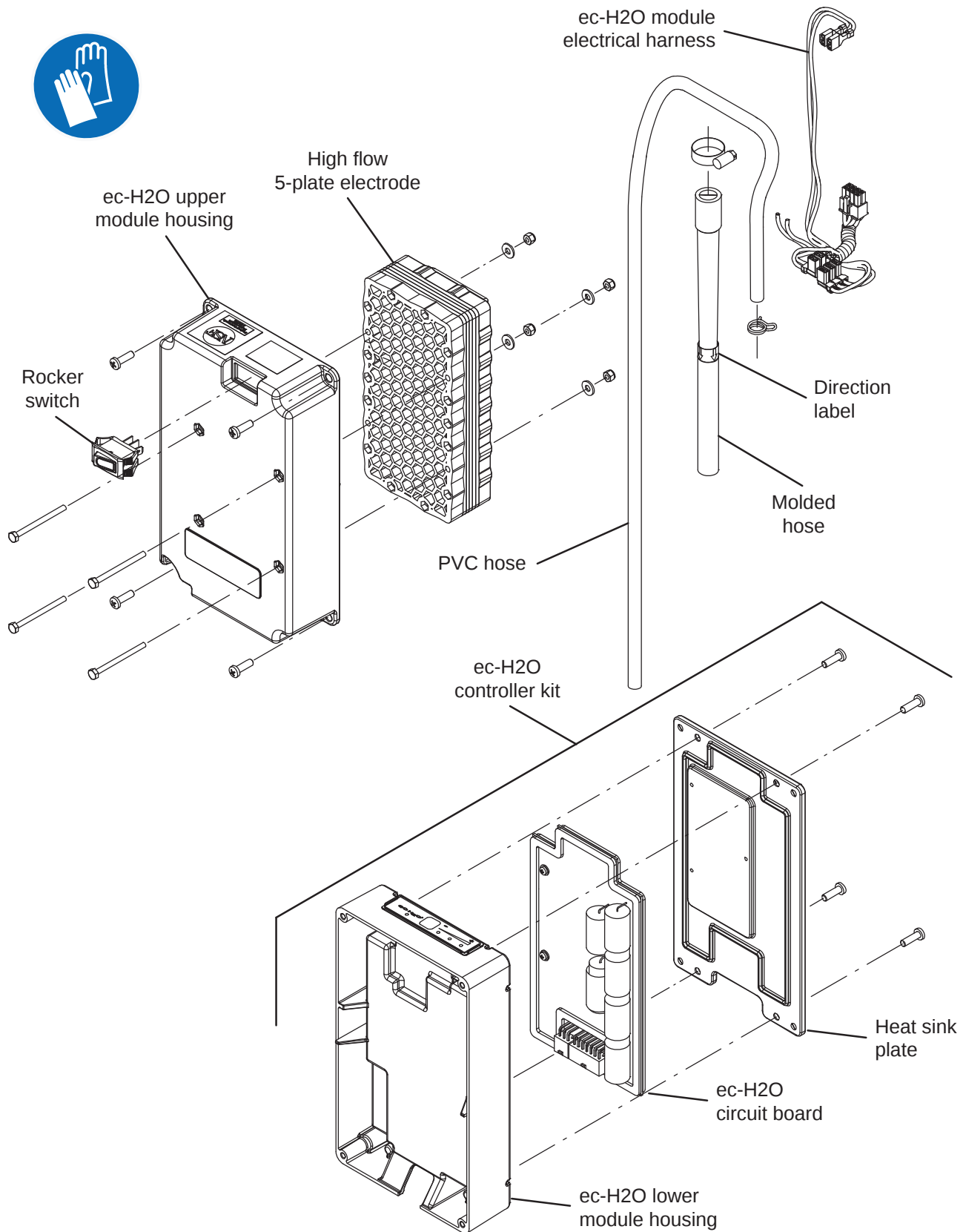
REMOVING / INSTALLING THE ec-H2O DISPENSER PUMP (OPTION)

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

FOR SAFETY: When servicing machine, Disconnect battery connection and charger cord before working on machine.

1. Completely drain the solution tank and the recovery tank.
2. Turn the key to the OFF position.
3. Disconnect the main wire harness from the ec-H2O dispenser pump.
4. Disconnect all hoses / connectors from the ec-H2O dispenser pump.
5. Cut the cable tie securing the ec-H2O dispenser pump to the ec-H2O mounting plate.
6. Remove the ec-H2O dispensing pump from the machine.
7. Reinstall the ec-H2O dispenser pump / install the new ec-H2O dispenser pump in reverse order of disassembly.

SERVICING THE ec-H2O MODULE (OPTION)

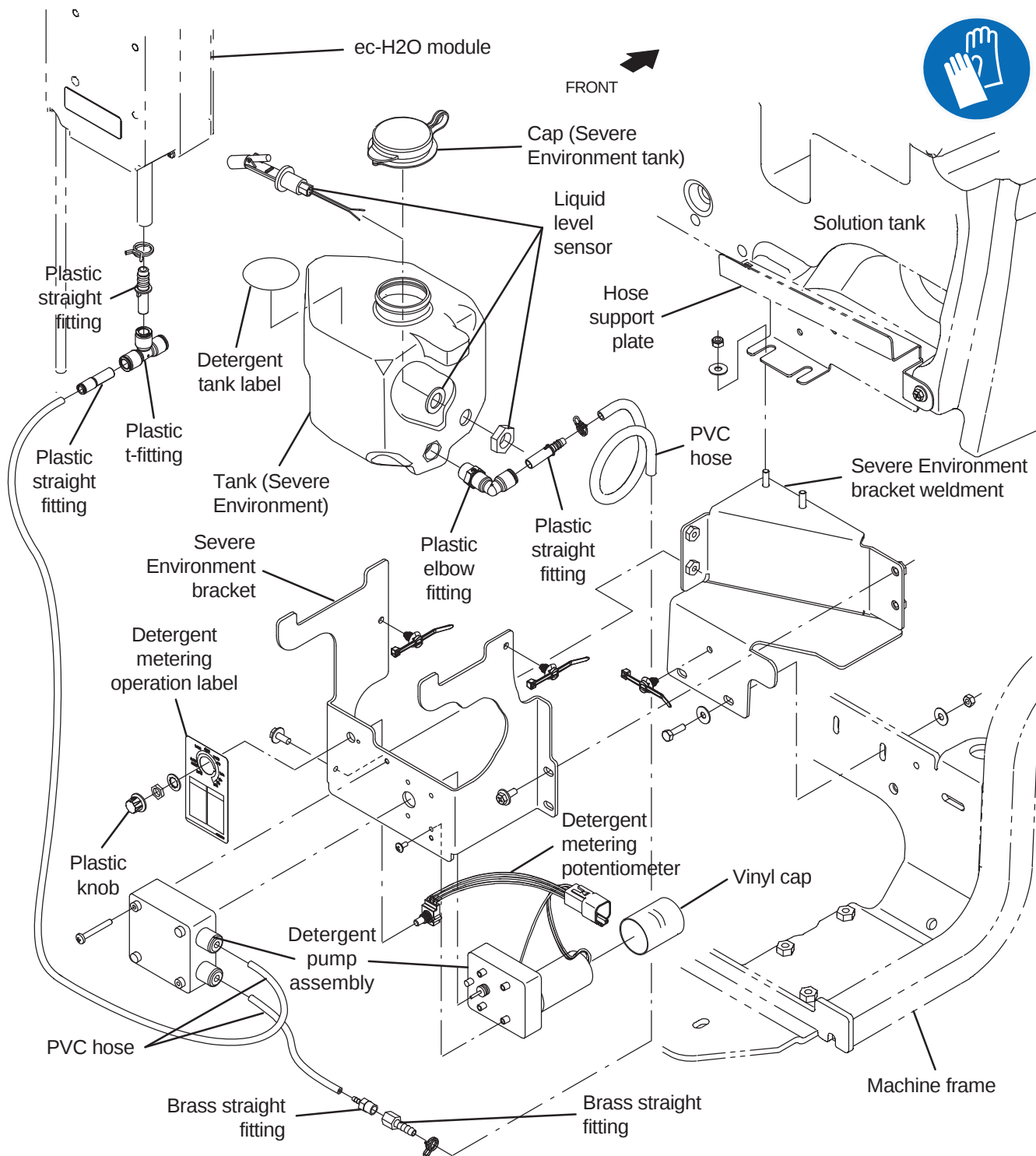


FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, remove key, and set parking brake if equipped.

FOR SAFETY: When servicing machine, Disconnect battery connection and charger cord before working on machine.

1. Turn the key to the OFF position.
2. Remove the ec-H2O module from the machine.
See REMOVING / INSTALLING THE ec-H2O MODULE (OPTION).
3. Remove the ec-H2O upper module housing from the ec-H2O module.
4. Further disassemble the ec-H2O module as necessary to access replace parts.
5. Reassemble the ec-H2O module in the reverse order of disassembly.

SE (SEVERE ENVIRONMENT) GROUP MAINTENANCE (OPTION)

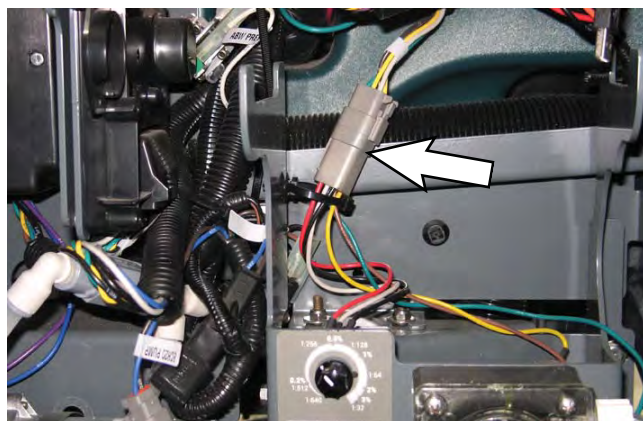


REMOVING / INSTALLING THE DETERGENT PUMP ASSEMBLY / DETERGENT METERING POTENTIOMETER

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

FOR SAFETY: When servicing machine, Disconnect battery connection and charger cord before working on machine.

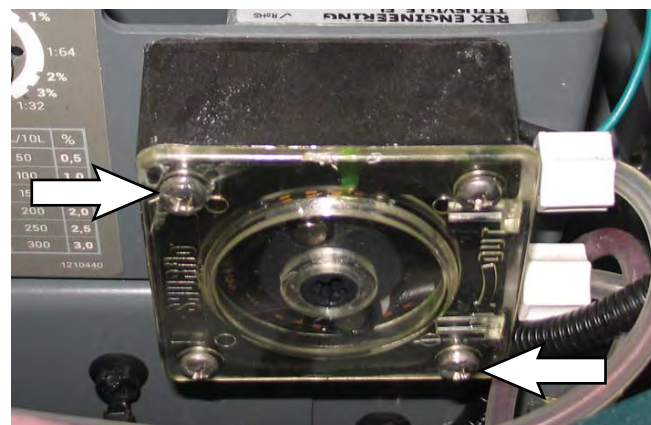
1. Completely empty the solution tank.
2. Turn the key to the OFF position.
3. Disconnect the battery cable from the machine.
4. Completely empty all solution from the Severe Environment tank.
5. Remove the Severe Environment tank from the Severe Environment bracket and set the tank out of the way on the operator deck.
6. Disconnect the main wire harness from the detergent metering potentiometer.



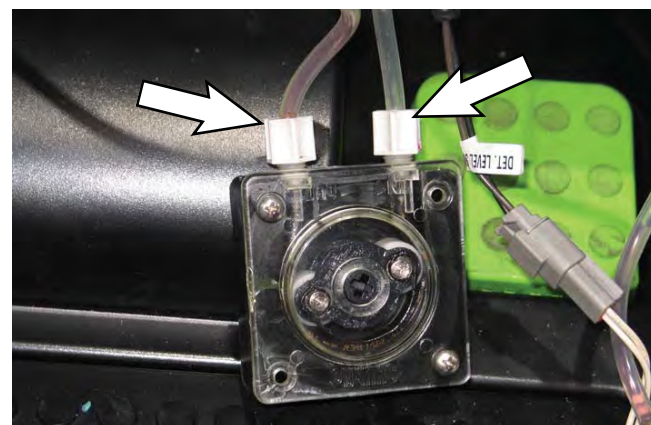
7. Remove knob from the detergent metering potentiometer and remove the potentiometer from the Severe Environment bracket.



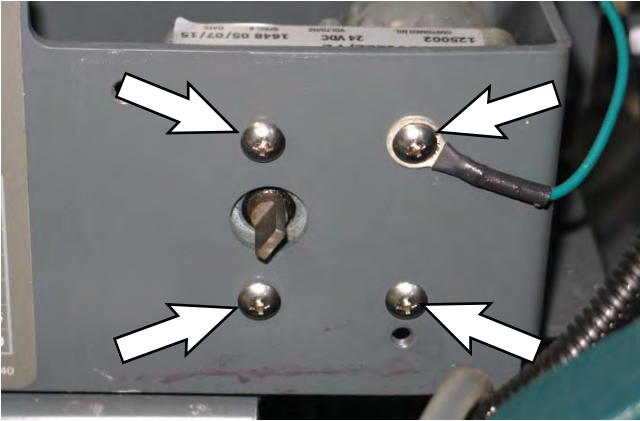
8. Remove the hardware securing the Severe Environment pump head to the Severe Environment bracket.



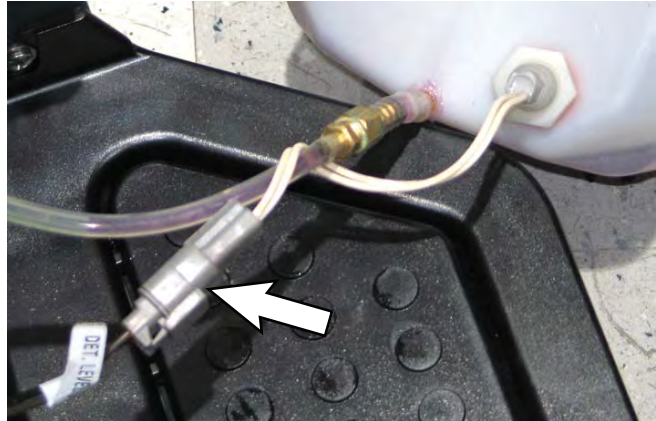
9. Disconnect both solution hoses from the Severe Environment pump head.



10. Remove the Severe Environment gear motor from the Severe Environment bracket.



5. Disconnect the main wire harness from the liquid level sensor.



11. Remove the vinyl cap from the Severe Environment gear motor.
12. Reassemble / reinstall the Severe Environment gear motor, Severe Environment pump head, and detergent metering potentiometer in reverse order of disassembly.

REMOVING / INSTALLING THE DETERGENT METERING LIQUID LEVEL SENSOR

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

FOR SAFETY: When servicing machine, Disconnect battery connection and charger cord before working on machine.

1. Completely empty the solution tank.
2. Turn the key to the OFF position.
3. Disconnect the battery cable from the machine.
4. Completely empty all solution from the Severe Environment tank.



7. Reinstall the liquid level sensor / install the new liquid sensor into the Severe Environment tank in the reverse order of disassembly.