

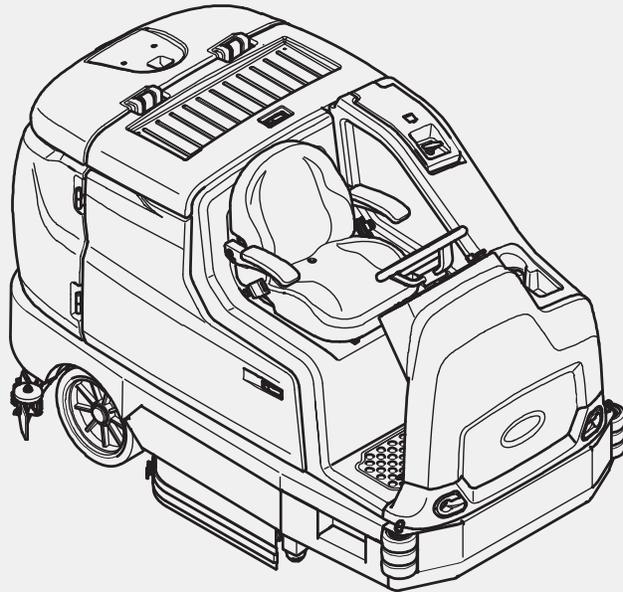


T17

(Battery)

Scrubber

English **EN**
Service Manual



ES® Extended Scrub System
Tennant True® Parts
IRIS® a Tennant Technology
Pro-Panel™ Controls
Insta-Fit™ Adapter



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INTRODUCTION

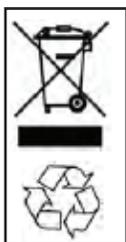
This manual is furnished with each new model. It provides necessary operation and maintenance instructions.



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

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

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



PROTECT THE ENVIRONMENT

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

Always remember to recycle.

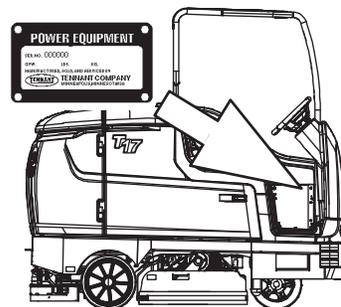
MACHINE DATA

Please fill out at time of installation for future reference.

Model No. - _____

Serial No. - _____

Installation Date - _____



INTENDED USE

The T17 is an industrial/commercial rider machine designed to wet scrub both rough and smooth hard surfaces (concrete, tile, stone, synthetic, etc). Typical applications include schools, hospitals / health care facilities, office buildings, and retail centers. Do not use this machine on soil, grass, artificial turf, or carpeted surfaces. This machine is intended for indoor use only. This machine is not intended for use on public roadways. Do not use this machine other than described in this Operator Manual.

Tennant Company

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DFS (Dual Force Sweeping), PerformanceView, Pro-ID, Pro-Check, Perma-Filter, ShakeMax, Zone Settings, SmartRelease, QA Controls, 1-Step, Dura-Track, Touch-N-Go, Duramer, are trademarks of Tennant Company.

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**IMPORTANT SAFETY INSTRUCTIONS
- SAVE THESE INSTRUCTIONS**

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



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



CAUTION: To warn of unsafe practices that could result in minor or moderate personal injury.

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

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



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



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



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



WARNING: Heavy object. Back injury could result from improper lifting. Use hoist when removing.



WARNING: Do not spray people or animals. Severe personal injury can result. Wear eye protection. Hold sprayer with two hands.



WARNING: Electrical Hazard
– **Disconnect Battery Cables and Charger Plug Before Servicing Machine.**
– **Do Not Charge Batteries with Damaged Power Supply 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.

This machine may be equipped with technology that automatically communicates over the cellular network. If this 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.
 - Under the influence of alcohol or drugs.
 - While using a cell phone or other types of electronic devices.
 - Unless mentally and physically capable of following machine instructions.
 - With brake disabled.
 - Without filters in place or with clogged filters.
 - In dusty environments without the vacuum fan on.
 - If it is 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 unless operating / headlights are turned on.
 - In areas with possible falling objects unless equipped with overhead guard.
 - With the rear bumper door / step in the lowered position.
2. Before Starting Machine:
 - Check machine for fluid leaks.
 - Make sure all safety devices are in place and operate properly.
 - Check brakes and steering for proper operation.
 - Check parking brake pedal for proper operation.
 - Adjust seat and fasten seat belt (if equipped).

3. When using machine:
 - Use only as described in this manual.
 - Use brakes to stop machine.
 - Go slowly on inclines and slippery surfaces.
 - Base machine: Do not scrub on ramp inclines that exceed 8.7% / 5° grade or transport (GVWR) on ramp inclines that exceed 12% / 7° grade.
 - Machine with ramp kit: Do not scrub on ramp inclines that exceed 10.5% / 6° grade or transport (GVWR) on ramp inclines that exceed 14.8% / 8.5° grade.
 - Reduce speed when turning.
 - Keep all parts of body inside operator station while machine is moving.
 - Always be aware of surroundings while operating 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 carry passengers on any part of the machine.
 - Always follow safety and traffic rules.
 - Report machine damage or faulty operation immediately.
 - Follow mixing, handling and disposal instructions on chemical containers.
 - Follow site safety guidelines concerning wet floors.
 - Follow site safety guidelines concerning backup alarms.
 - Do not leave machine unattended when filling solution tank with auto-fill feature.
 - Park machine on level surface when filling solution tank with auto-fill feature.
 4. Before leaving or servicing machine:
 - Stop on level surface.
 - Set parking brake.
 - 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 in the seat controlling the machine.
 - Do not push or tow the machine on inclines with the brake disabled.
 - Do not power spray or hose off machine near electrical components.
 - Disconnect battery connections and charger cord before working on machine.
 - Do not pull on battery charger cord to unplug. Grasp plug at outlet and pull.
 - Do not use incompatible battery chargers as this may damage battery packs and potentially cause a fire.
 - Inspect charger cord regularly for damage.
 - 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.
 - 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 a trained service mechanic.
 - Do not modify the machine from its original design.
 - Use Tennant supplied or approved replacement parts.
 - Wear personal protective equipment as needed and where recommended in this manual.



For Safety: wear hearing protection.



For Safety: wear protective gloves.



For Safety: wear eye protection.



For Safety: wear protective dust mask.

SAFETY

6. When using Lithium-ion Battery Model:
 - Battery service to be performed by Tennant Service only.
 - Battery installation requires a specific service kit which includes a hoisting strap and proper lifting instructions. Contact Tennant Service.\
 - Do not attempt to lift battery by hand or by any other unauthorized method.
 - Battery pack is designed exclusively for specific Tennant machine applications. Do not install battery pack in unapproved machines.
 - Dispose of battery in accordance with local regulations. Contact Tennant Service.
 - Contact Tennant Service or your local regulatory authorities for proper transporting instructions of lithium-ion batteries.
 - Disconnect battery cable connector, battery management system (BMS) connector and charger cord before working on machine.
 - Use only OEM approved battery charger supplied with lithium-ion battery.
 - Do not expose battery to temperatures below -22°F (-30°C), above 140°F (60°C).
 - Do not use machine immediately after long-term extreme temperature storage. Before use, return battery module temperature range to 50°F (10°C)~95°F (35°C).
 - Do not operate or store battery in hazardous environment (electrically charged, humidity, extreme temperatures and magnetic fields).
 - Do not expose battery to flame or plasma.
 - Do not disassemble or mistreat battery. Do not tear seal tape or will void warranty.
 - Do not drop, crush or subject battery to impact, as it may cause battery to heat up or catch fire.
 - Do not put battery in fire or water to avoid battery explosion.
 - Do not touch battery with wet hand, avoid electric shock.
 - Stop using or charging the battery immediately if battery has abnormal temperature, leakage or other abnormal conditions.
7. When loading/unloading machine onto/off truck or trailer:
 - Use ramp, truck or trailer that will support the weight of the machine and operator.
 - Drain tanks before loading machine.
 - Do not drive on a slippery ramp.
 - Use caution when driving on a ramp.
 - Do not load/unload on ramp inclines that exceed 21% / 12° grade.
 - Lower scrub head and squeegee before tying down machine.
 - Stop on a level surface, set parking brake and leave the key in the ON position until all tie-down straps are secure.
 - Block machine tires.
 - Turn off machine and remove key.

The safety labels appear on the machine in the locations indicated. Replace damaged/missing labels

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



Located on bottom of battery compartment cover.

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



Located on solution tank cover and on detergent tank (option).

FOR SAFETY LABEL – Do not operate machine with rear bumper door / step in the lowered position. Do not carry passengers on any part of the machine.



Located on rear bumper door / step.

FOR SAFETY LABEL – Read manual before operating machine.



Located on electrical panel.

FOR SAFETY LABEL – Authorized Service Mechanic Only.



Located on circuit board cover and electrical panel.

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



Located on electrical panel.

SAFETY

WARNING LABEL – Heavy object. Back injury could result from improper lifting. Use hoist when removing.

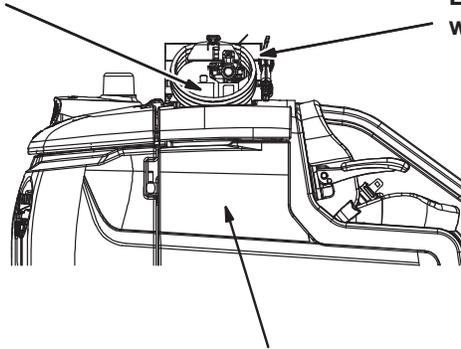


Located under high pressure washer cover.

WARNING LABEL – Do not spray people or animals. Severe personal injury can result. Wear eye protection. Hold sprayer with two hands.



Located on high pressure washer cover.



LITHIUM-ION BATTERY CAUTION LABEL

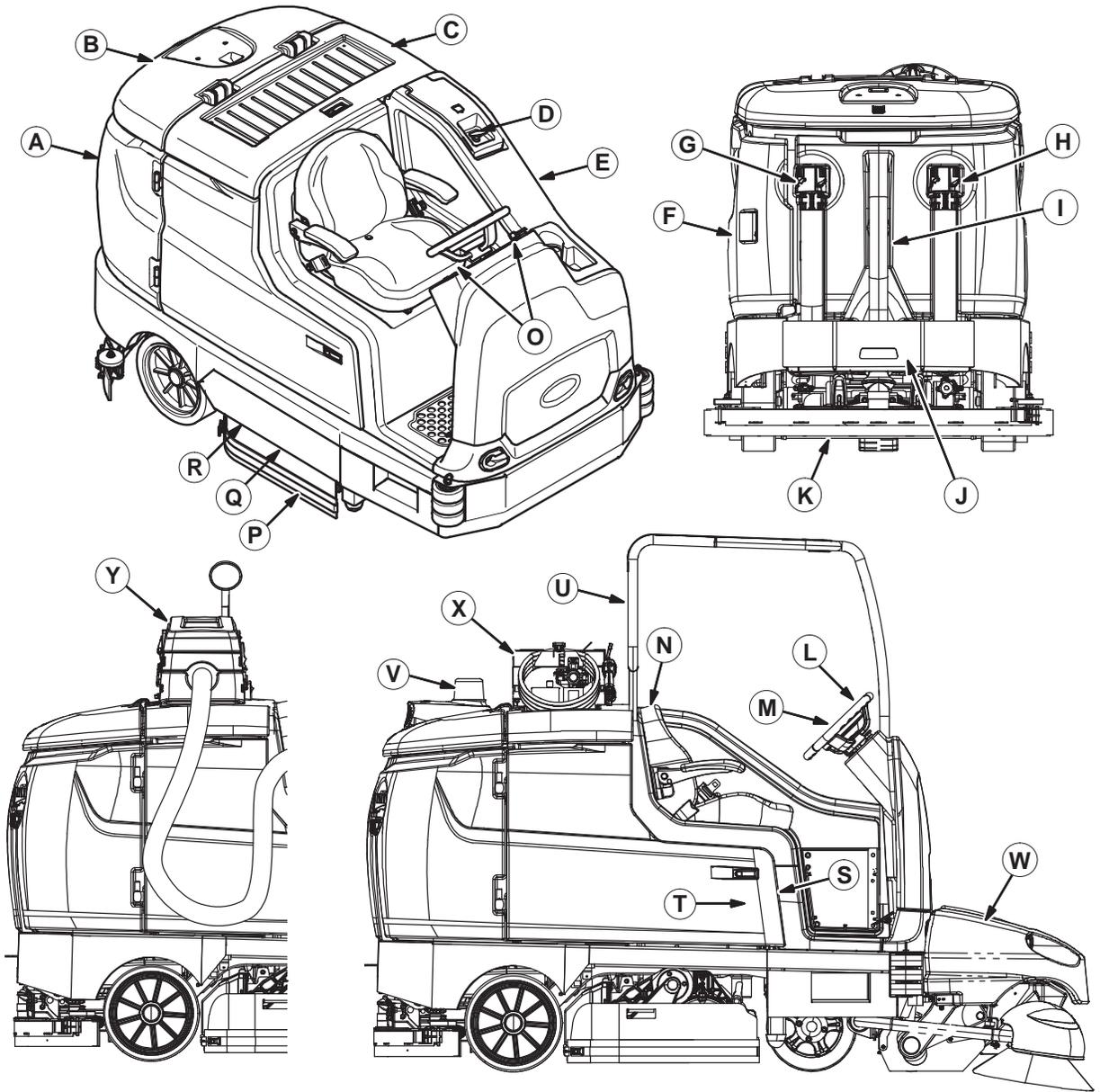
⚠ CAUTION	⚠ ATTENTION	⚠ ATENCIÓN
<ol style="list-style-type: none"> 1. Do not expose battery to temperatures below -30° C (-22°F) above 50°C (140°F). 2. Do not disassemble or mistreat battery. Do not crush. 3. Do not drop or subject it to impact. 4. Use only OEM approved charger. 5. Failure to follow these instructions may present risk of explosion, fire, or high temperatures. 6. See owner's manual for additional safety instructions. 7. Recommended torque for stud assembly is: M8 = 9 Nm (8.112 = 24.5 lbs) 8. Refer to owner's manual for lifting instructions. 9. Service by Tennant Personnel only. 	<ol style="list-style-type: none"> 1. No exponga la batería a temperaturas por debajo de -30° C (-22°F) por encima de 50° C (140° F). 2. No desmonte ni maltrate la batería. No la aplaste. 3. No deje caer ni la someta a impactos. 4. Use sólo el cargador original aprobado. 5. El incumplimiento de estas instrucciones puede presentar riesgo de explosión, fuego o altas temperaturas. 6. Vea el manual del propietario para instrucciones adicionales de seguridad. 7. El par recomendado de apriete para el poste es de: M8 = 9 Nm (8.112 = 24.5 lbs) 8. Consulte el manual del propietario para las instrucciones de elevación. 9. Servicio por técnicos de Tennant exclusivamente. 	<ol style="list-style-type: none"> 1. Ne laissez pas la batterie à des températures inférieures à -30° C (supérieures à 140° F). 2. Ne pas démonter ni maltraiter la batterie. Ne pas écraser. 3. Ne la laissez pas tomber et ne la soumettez pas à un impact. 4. Utilisez uniquement un chargeur approuvé par OEM. 5. Le non-respect de ces instructions peut présenter un risque d'explosion, d'incendie ou de températures élevées. 6. Voir le manuel du propriétaire pour des conseils de sécurité supplémentaires. 7. Le couple recommandé pour le montage des goujons est de: M8 = 9 Nm (8.112 = 24.5 lbs) 8. Reportez-vous au manuel du propriétaire pour les instructions de levage. 9. Service réservé au personnel Tennant.
Tennant Co File Number: MHS465		Battery Disposal contact: Tennant Technical Service 1-800-553-8033 1247721

Located on top of battery pack.

356408

GENERAL INFORMATION

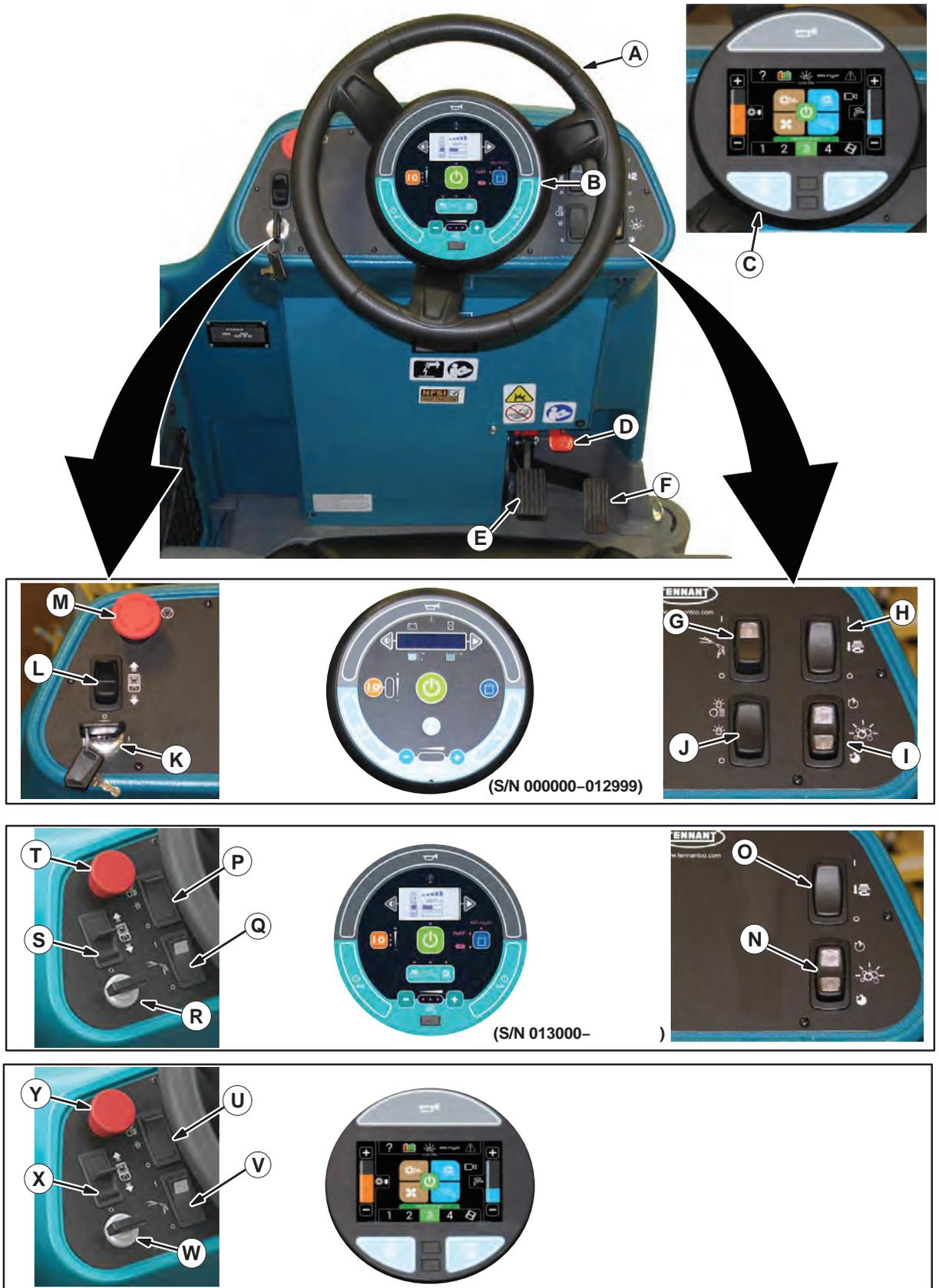
MACHINE COMPONENTS



356408

- A. Recovery tank
- B. Recovery tank cover
- C. Battery compartment cover
- D. Solution tank cover
- E. Solution tank
- F. Left shroud
- G. Solution tank drain hose
- H. Recovery tank drain hose
- I. Vacuum hose
- J. Rear squeegee
- K. Rear bumper door/step
- L. Steering wheel
- M. Standard control panel/Pro-Panel
- N. Operator seat
- O. Control/instrument panels
- P. Side squeegee
- Q. Scrub head
- R. Main brush door
- S. Right shroud
- T. ec-H2O System Module compartment
(Option) – located behind right shroud
- U. Overhead guard (Option)
- V. Backup alarm/flashing light (Option)
- W. Pre-Sweep (Option)
- X. High pressure washer (Option)
- Y. Live wand dry vacuum (Option)

INSTRUMENTS AND CONTROLS



- A. Steering wheel
- B. Standard touch panel
- C. Pro-Panel
- D. Parking brake pedal
- E. Brake pedal
- F. Propel pedal

Standard Control Panel (S/N 000000-012999)

- G. Spray nozzle switch (option)
- H. Scrubbing side brush switch (option)/
Sweeping side brush switch (option)/
Pre-Sweep switch (option)
- I. Severe environment switch
- J. Operating lights/hazard lights switch
(option)
- K. Key switch
- L. Directional switch
- M. Emergency shut-off button

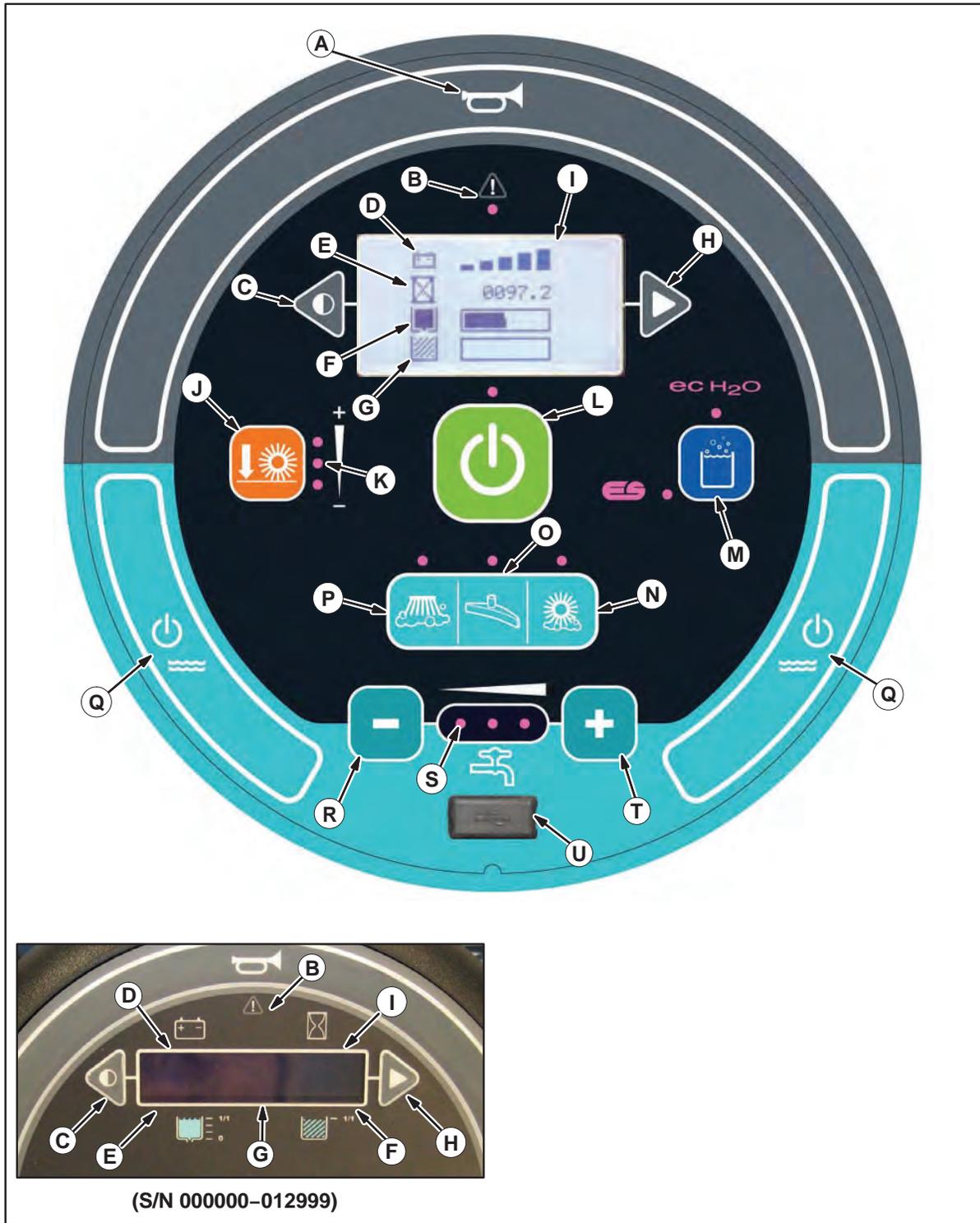
Standard Control Panel (S/N 013000-)

- N. Severe environment switch
- O. Pre-Sweep switch (option)
- P. Operating lights/hazard lights switch
(option)
- Q. Spray nozzle switch (option)/
High pressure washer switch (option)
- R. Key switch
- S. Directional switch
- T. Emergency shut-off button

Pro-Panel

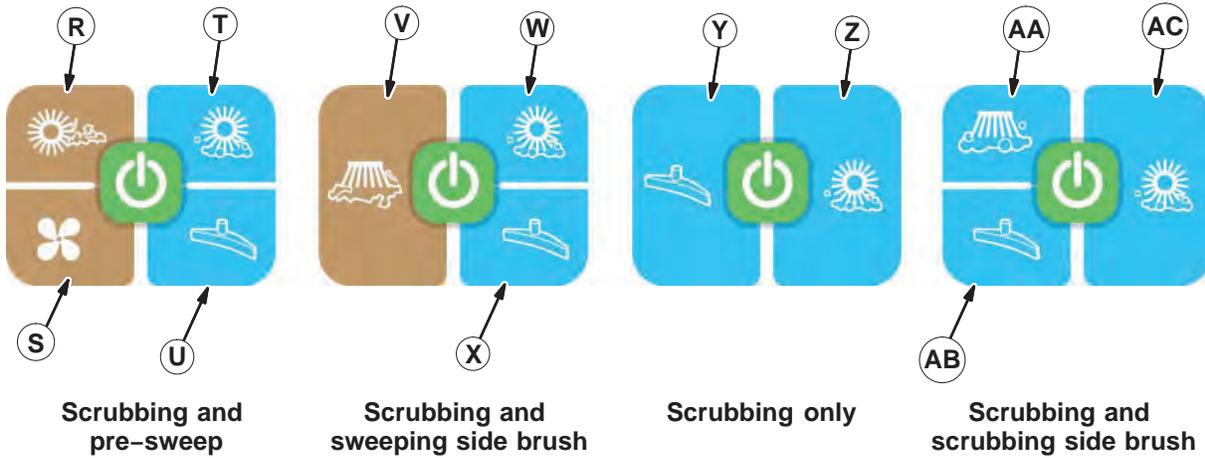
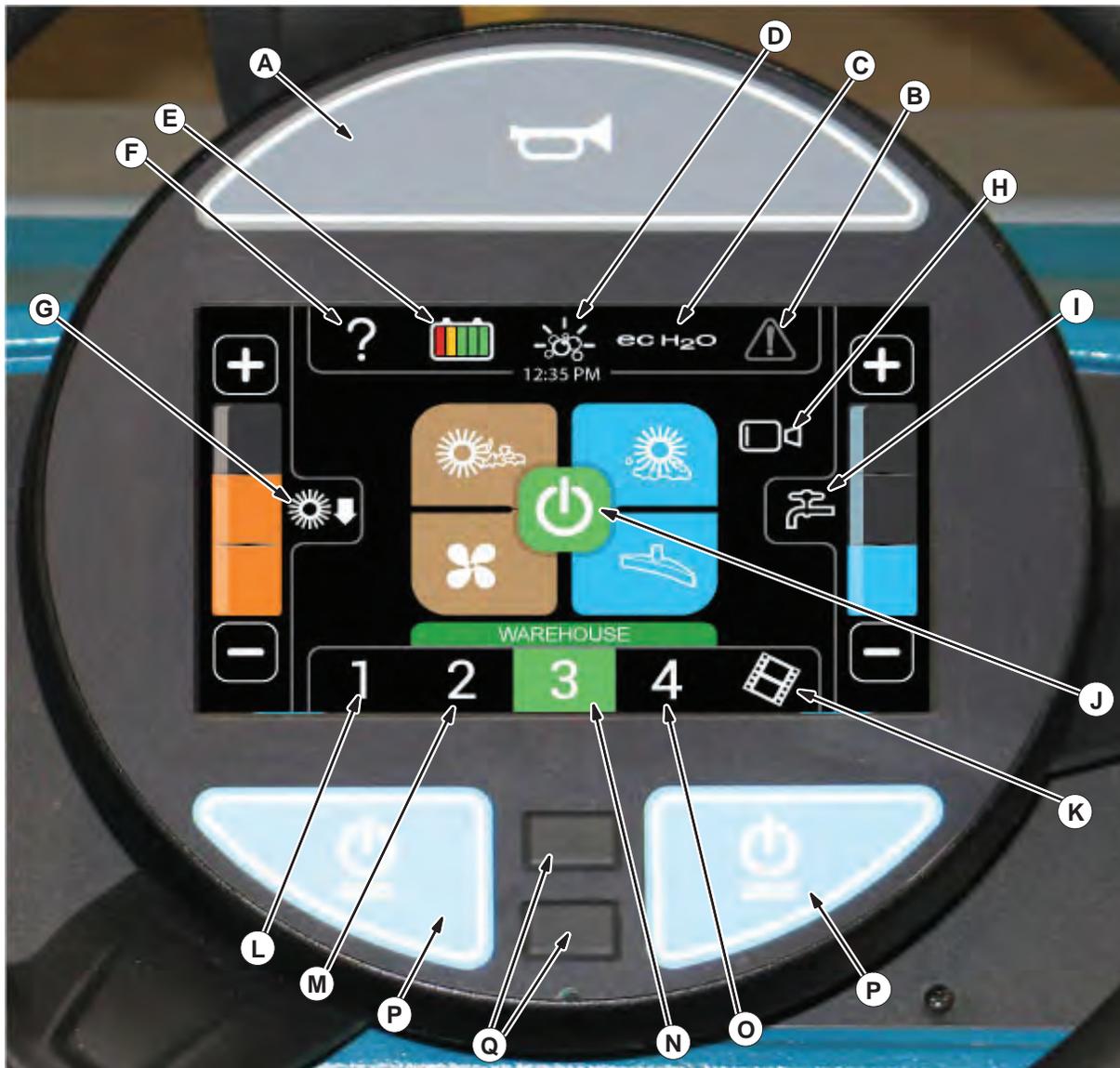
- U. Operating lights/hazard lights switch
(option)
- V. Spray nozzle switch (option)/
High pressure washer switch (option)
- W. Key switch
- X. Directional switch
- Y. Emergency shut-off button

STANDARD TOUCH PANEL



- A. Horn
- B. Fault/Alert indicator light
- C. Contrast control button
- D. Battery discharge indicator
- E. Hour meter
- F. Solution tank indicator
- G. Recovery tank full indicator
- H. Configuration mode button
- I. LCD display
- J. Brush pressure button
- K. Brush pressure indicator lights
- L. 1-Step button
- M. ec-H₂O / ES (Extended Scrub) button
(Option)
- N. Scrubbing main brush button
- O. Scrubbing vacuum fan/squeegee button
- P. Scrubbing side brush (Option)
- Q. Solution on/off buttons
- R. Solution flow decrease button (-)
- S. Solution flow indicator lights
- T. Solution flow increase button (+)
- U. USB port (Service only)

PRO-PANEL CONTROLS



- A. Horn
- B. Fault/alert indicator button
- C. ec-H₂O / ES (Extended Scrub) button
- D. Severe environment button (Option)
- E. Machine status button
- F. Help button
- G. Main brush pressure access button
- H. Rearview camera button
- I. Solution control access button
- J. 1-Step button
- K. Video help
- L. Zone control 1 button
- M. Zone control 2 button
- N. Zone control 3 button
- O. Zone control 4 button
- P. Solution on/off buttons
- Q. USB ports (Service only)

Scrubbing and Pre-Sweep (Option)

- R. Pre-Sweep main brush button
- S. Pre-Sweep vacuum fan button
- T. Scrubbing main brush button
- U. Scrubbing vacuum fan/squeegee button

Scrubbing and sweeping side brush (Option)

- V. Sweeping side brush button
- W. Scrubbing main brush button
- X. Scrubbing vacuum fan/squeegee button

Scrubbing only

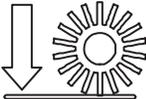
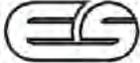
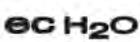
- Y. Scrubbing vacuum fan/squeegee button
- Z. Scrubbing main brush button

Scrubbing and scrubbing side brush (Option)

- AA. Scrubbing side brush button
- AB. Scrubbing vacuum fan/squeegee button
- AC. Scrubbing main brush button

SYMBOL DEFINITIONS

These symbols are used on the machine to identify controls, displays, and features.

	Horn		Solution decrease (-)
	Fault / Alert indicator		Solution increase (+)
	Forward / Reverse		Solution flow
	Circuit breaker		Solution On / Off
	Main brush pressure		On
	1-STEP		Off
	ES (Extended Scrub) (Option)		Emergency shut-off
	ec-H ₂ O (Option)		Severe environment (Option)
	Scrub mode		Spray nozzle (Option) / High pressure washer (Option)
	Operating lights / Hazard light		Hour meter
	Headlights		Scrubbing main brush
	Scrubbing side brush		Scrubbing vacuum fan / squeegee
	Battery charge		Emergency shut-off



Contrast control



Jack point



Configuration mode

Standard Panel Symbols



1/1

Recovery tank



Contrast control



1/1

Solution tank



Configuration mode



Brush pressure (minimum / maximum)

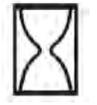


Solution flow (minimum / maximum)



Side brush (option)

Pro-Panel Symbols

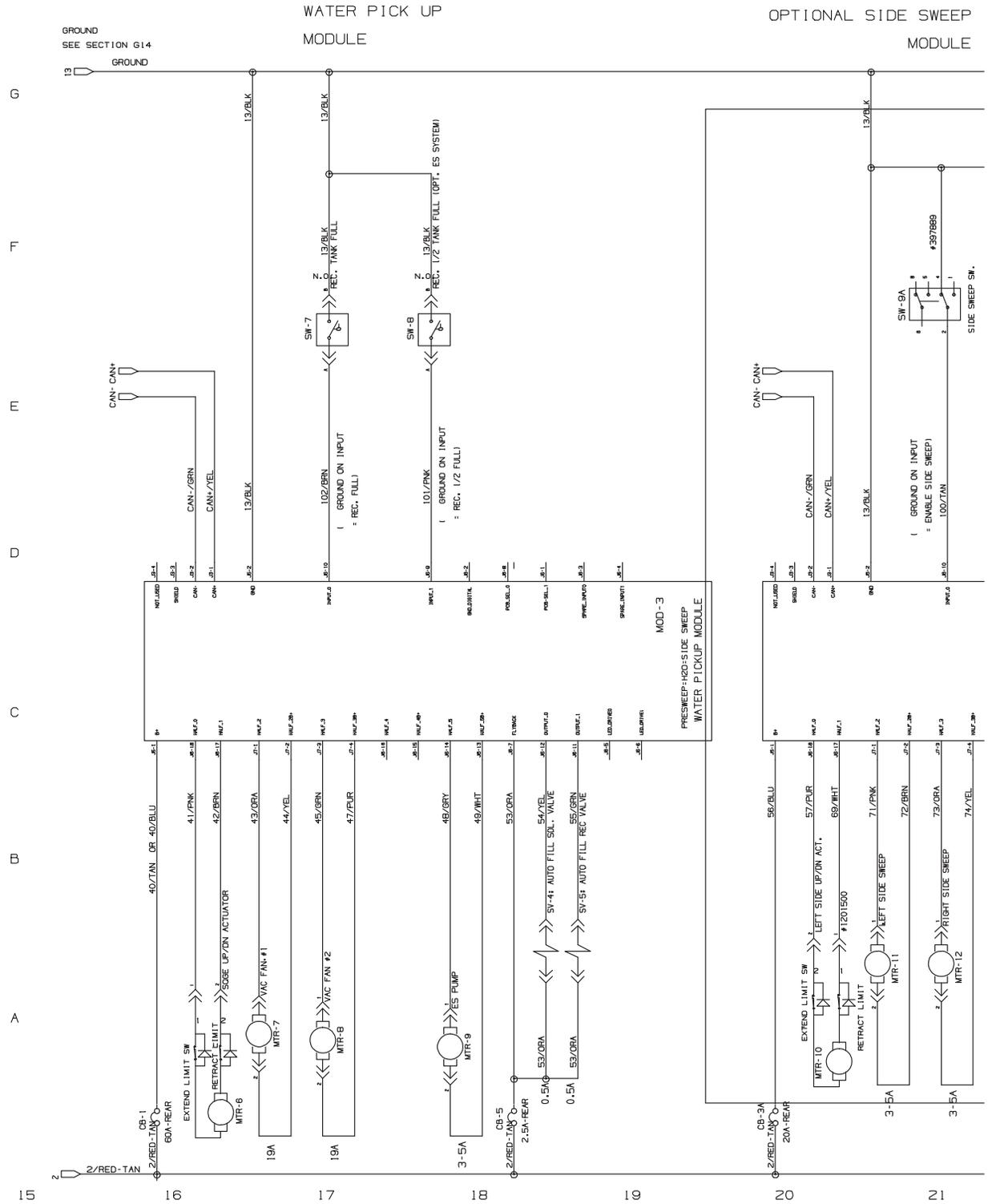
	Zone setting 1		Help
	Zone setting 2		Alert / Fault
	Zone setting 3		Enter
	Zone setting 4		Checklist item unconfirmed
	Hour meter		Checklist item confirmed
	Login		Logout
	Select		Supervisor settings
	Rotate machine view		Supervisor menu
	Camera settings		Start-up video
	Control help		Video help
	About		Video button
	Backspace		Video list button
	Rearview camera		Home (main operating screen)

Pro-Panel Symbols

	Up arrow		Down arrow
	Disable login		Back arrow
	Add / Edit profiles		Enable login
	Operator		Calibrate touch
	Supervisor		Checklist setup
	Edit profile		Export all
	Add profile		Export new
	Delete profile		Export checklists
	Copy profile		Screen lock
	Date / Time set		

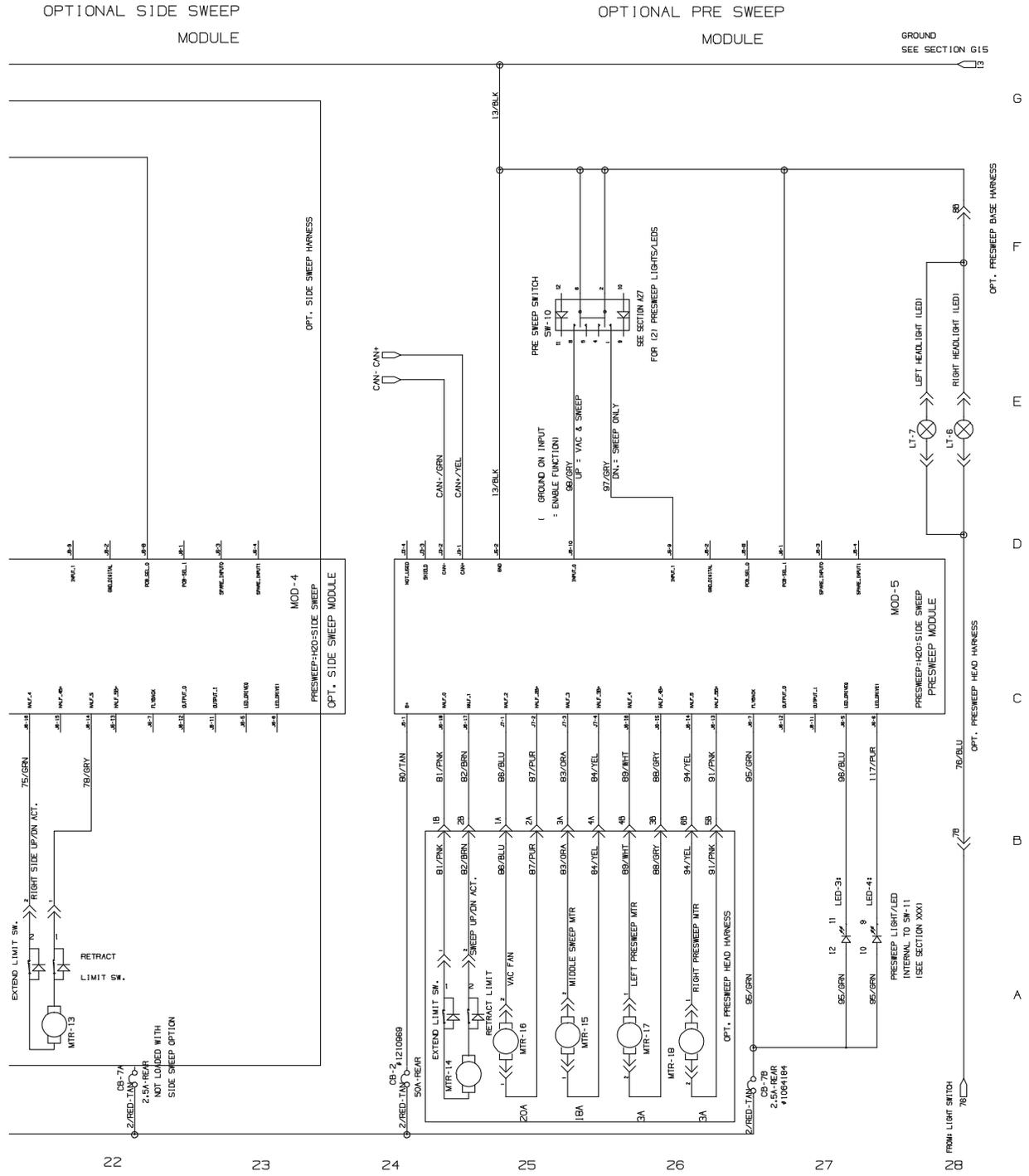
GENERAL INFORMATION

ELECTRICAL SCHEMATIC (000000-010999) - Page 3



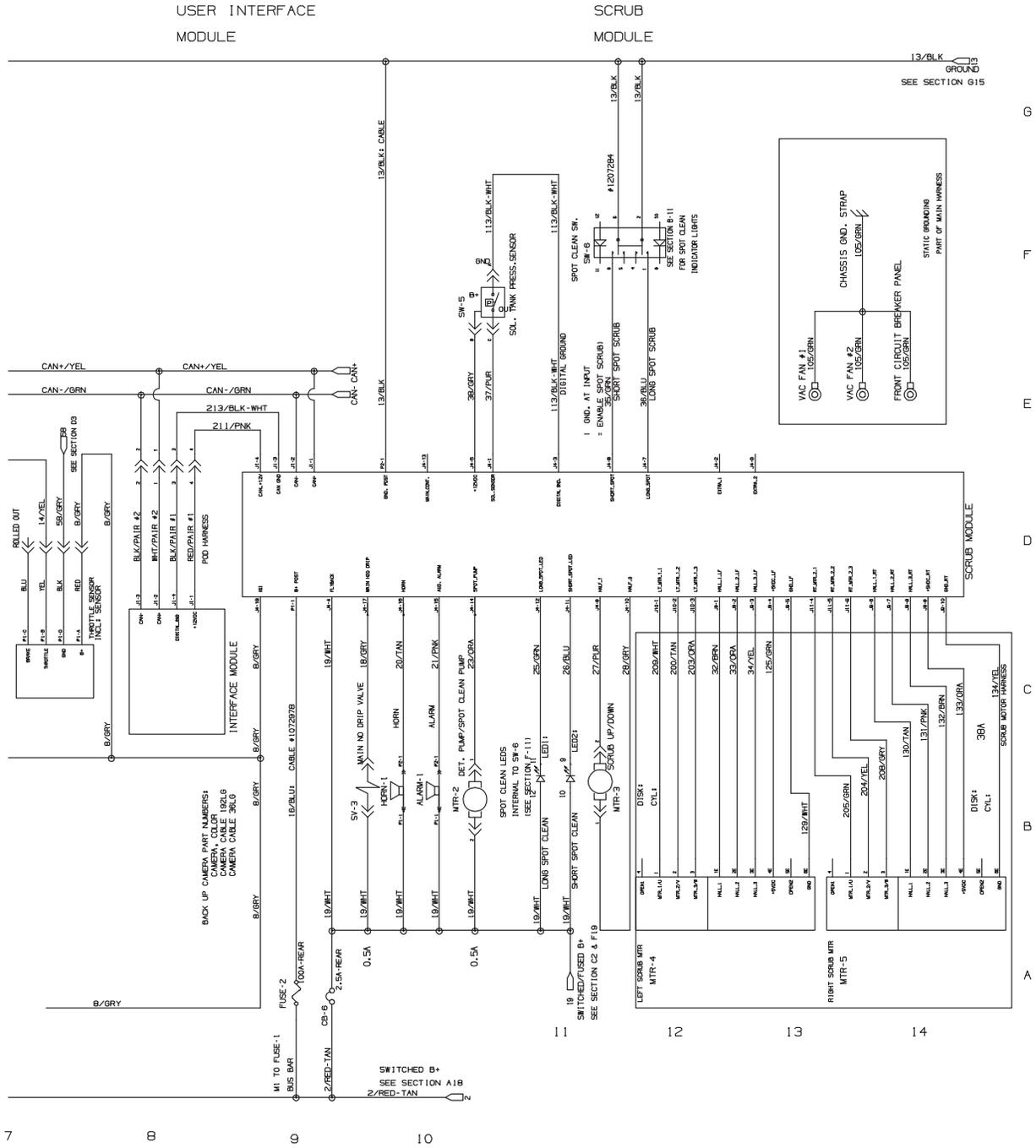
356516 - 1074089

ELECTRICAL SCHEMATIC (00000-010999) - Page 4



356516 - 1074089

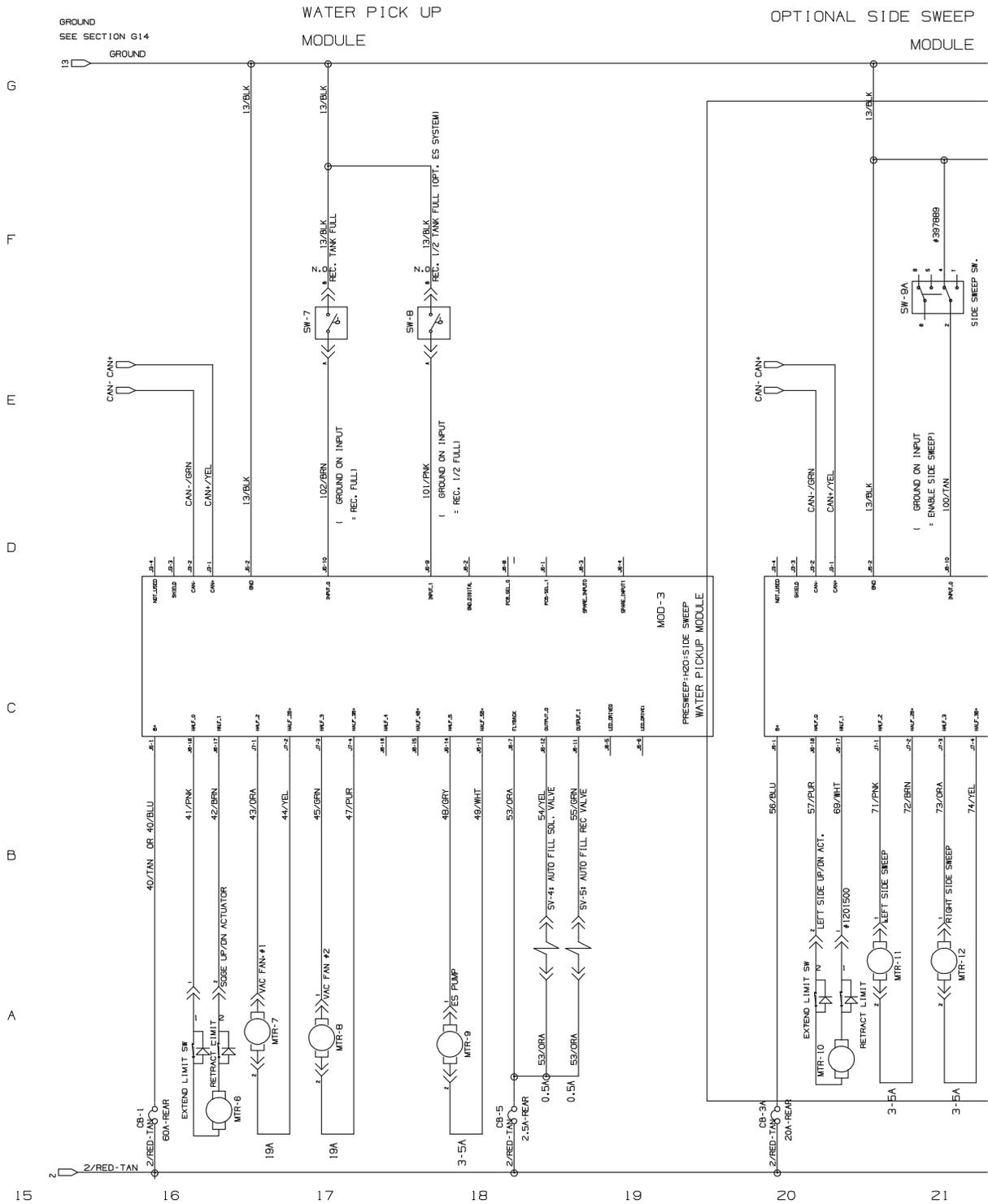
ELECTRICAL SCHEMATIC (011000-012999) -
Page 2



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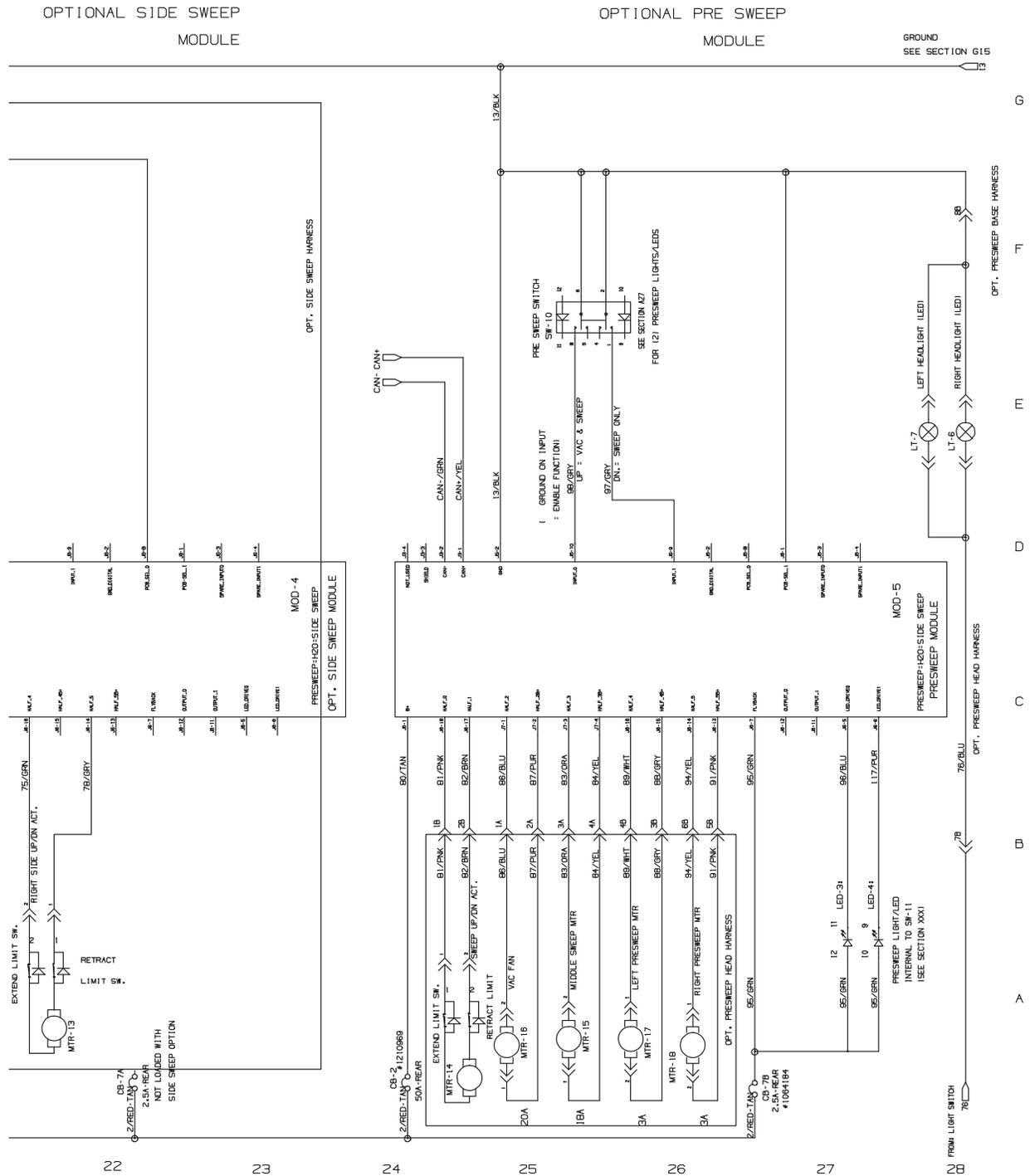
GENERAL INFORMATION

ELECTRICAL SCHEMATIC (012000-011999) - Page 3



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ELECTRICAL SCHEMATIC (011000-012999) -

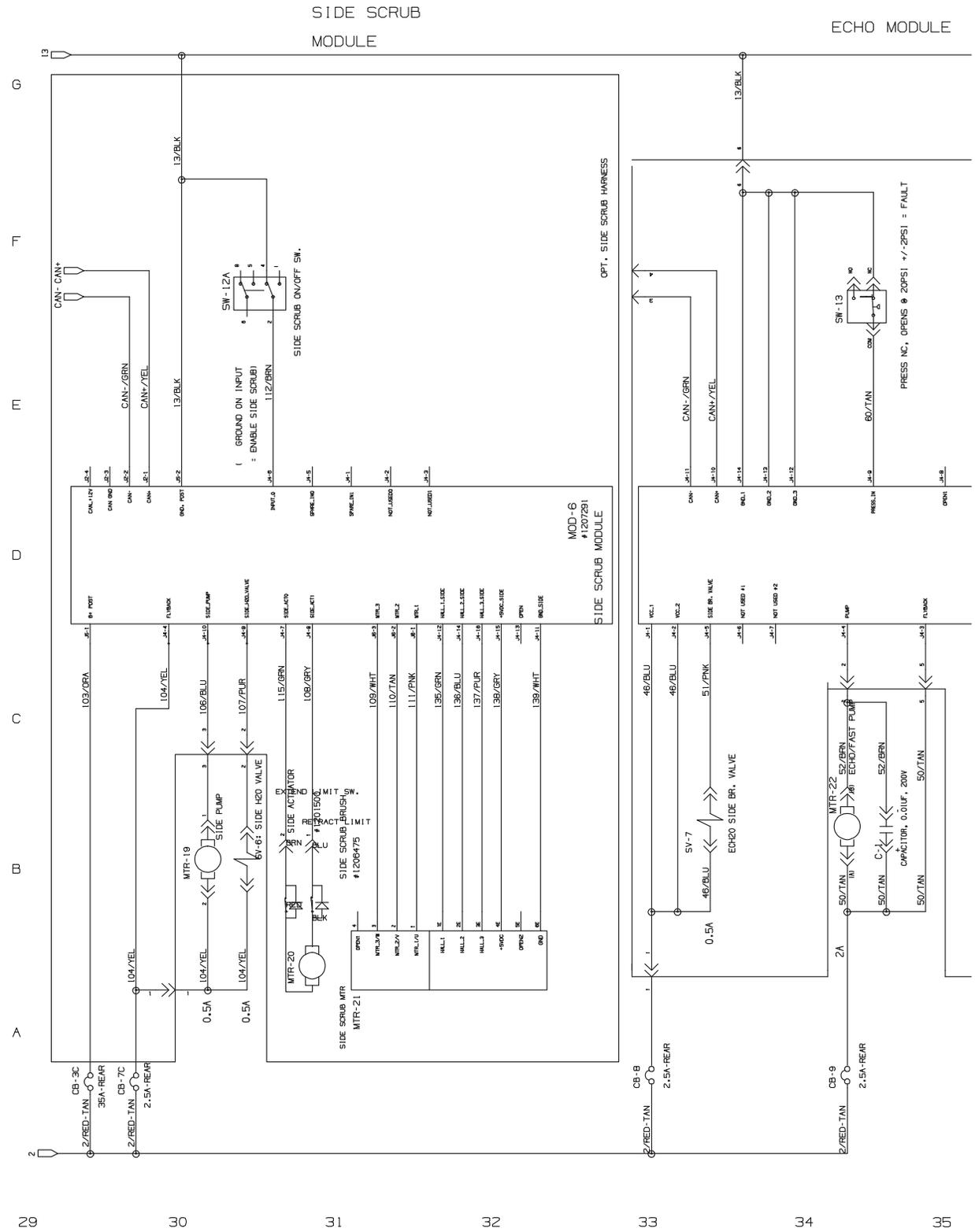


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GENERAL INFORMATION

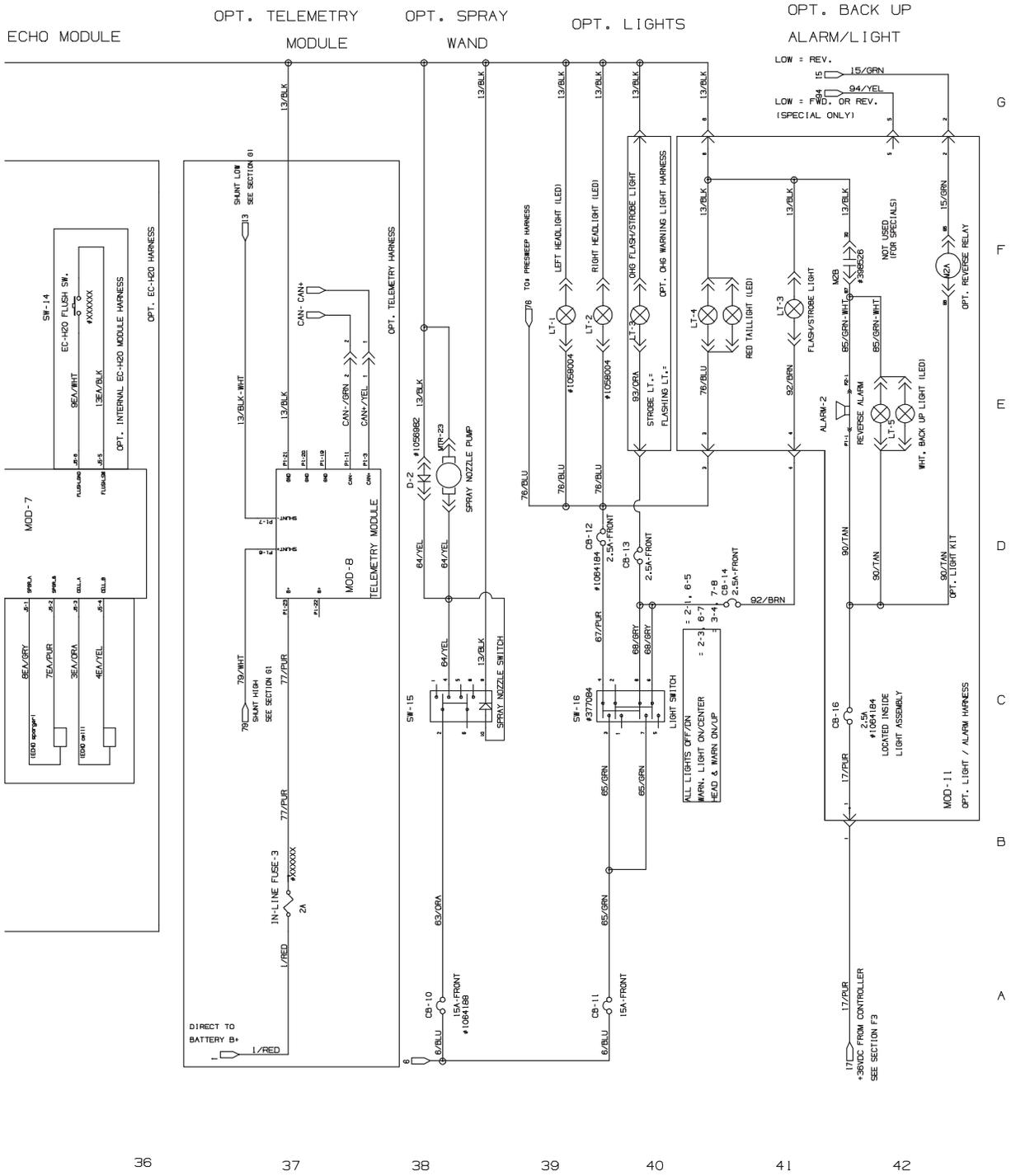
ELECTRICAL SCHEMATIC (011000-012999) -

Page 5



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ELECTRICAL SCHEMATIC (011000-012999) -
Page 6



36

37

38

39

40

41

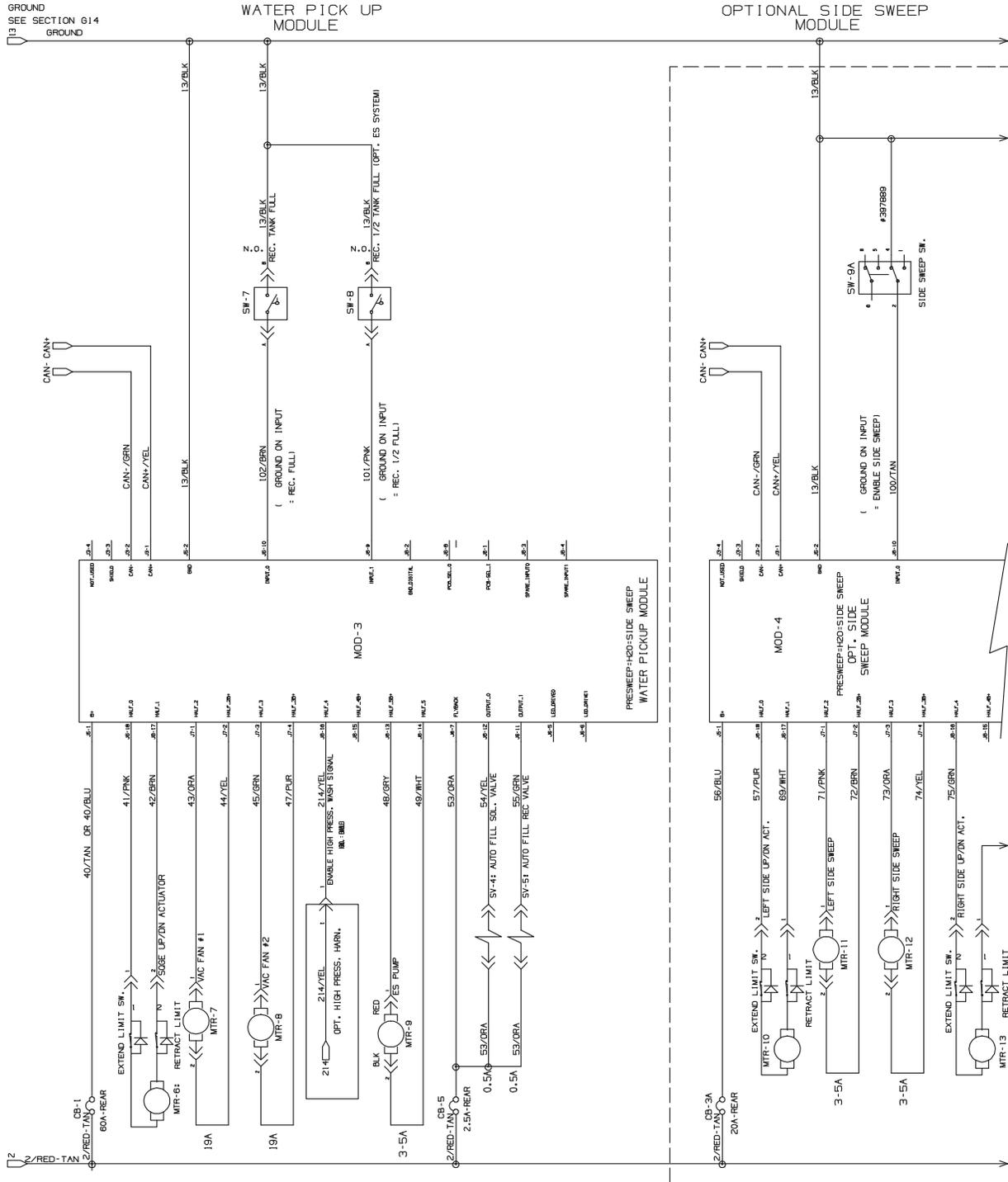
42

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GENERAL INFORMATION

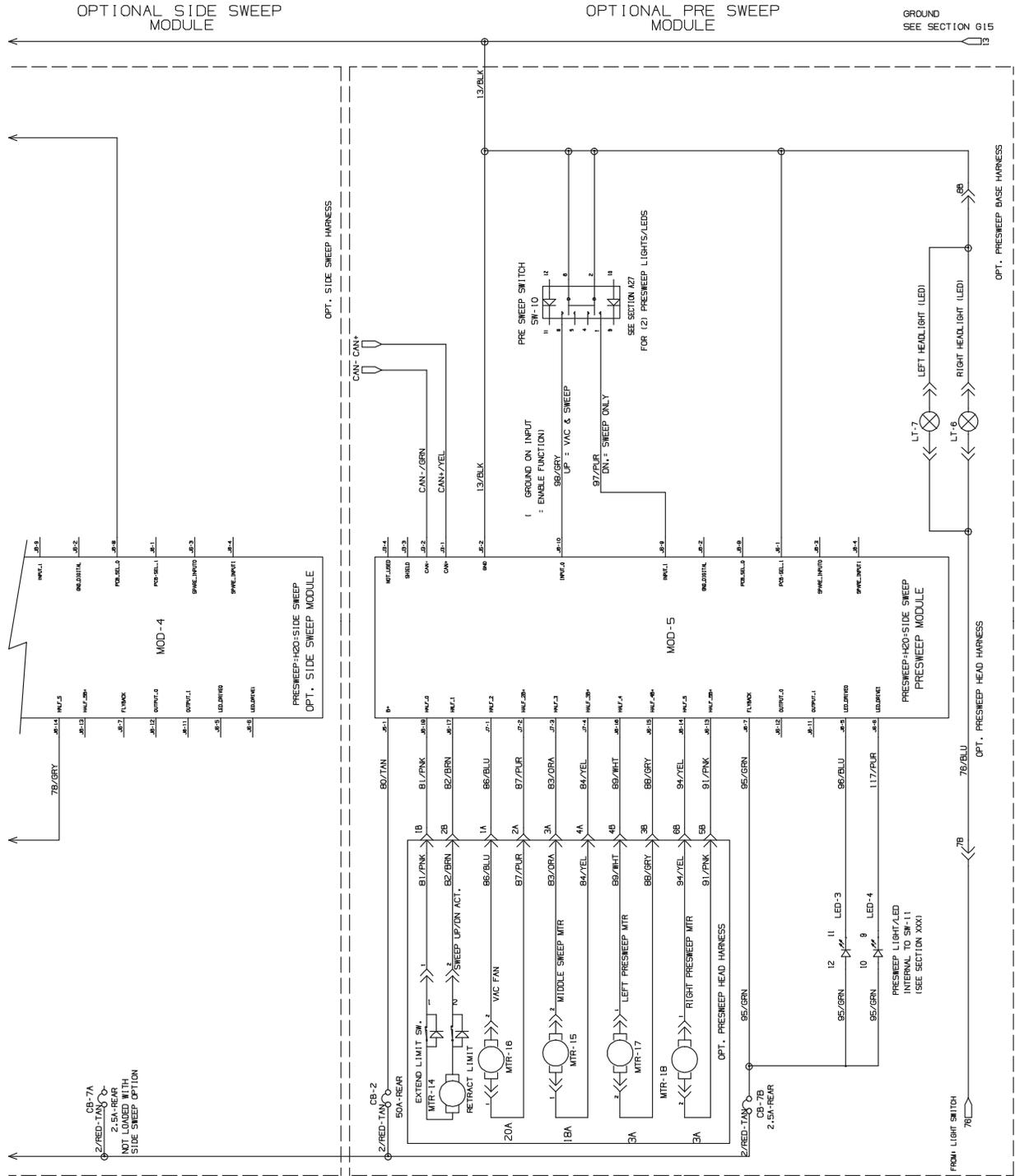
ELECTRICAL SCHEMATIC (013000-013999) -

Page 3



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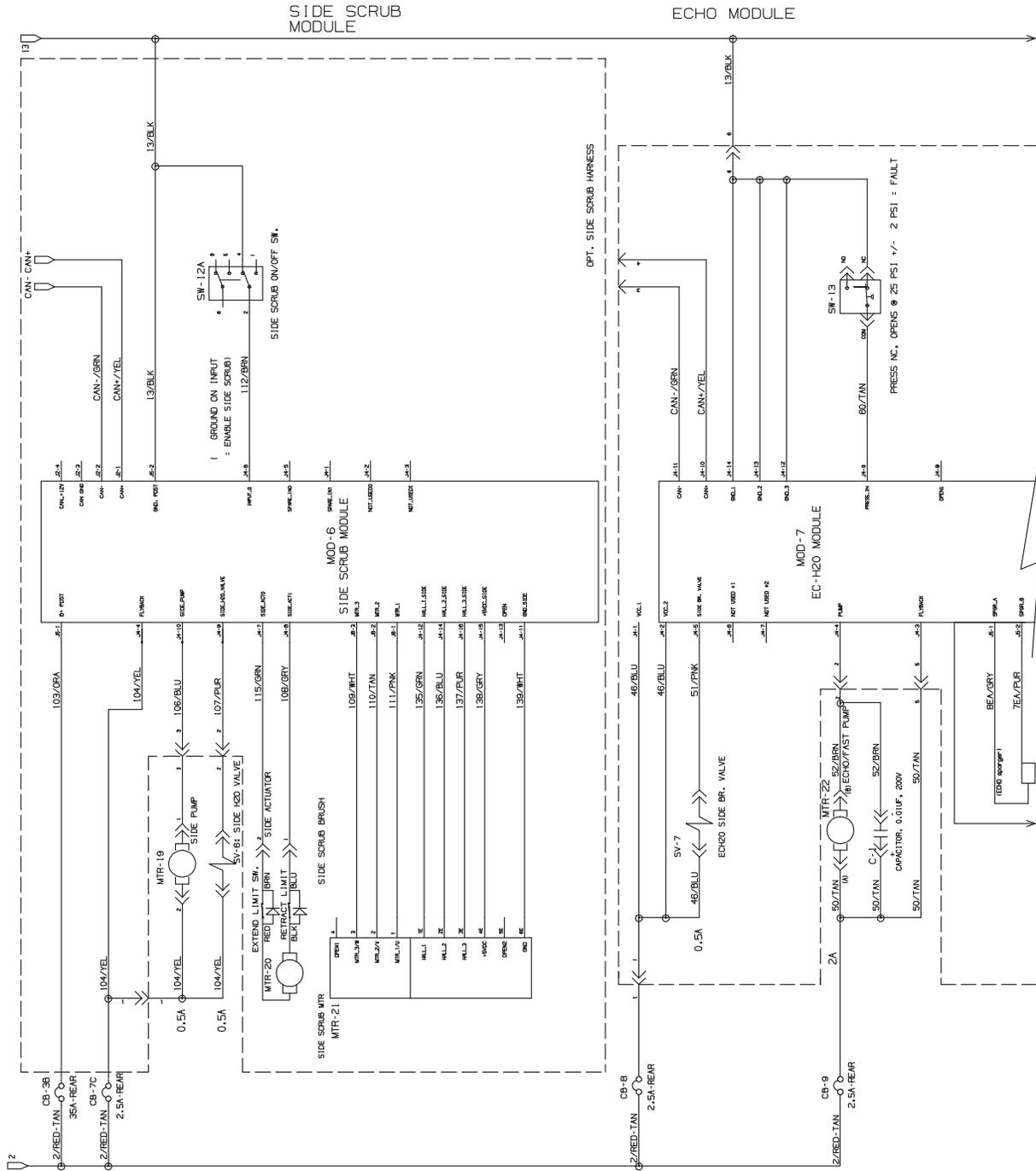
ELECTRICAL SCHEMATIC (013000-013999) -
Page 4



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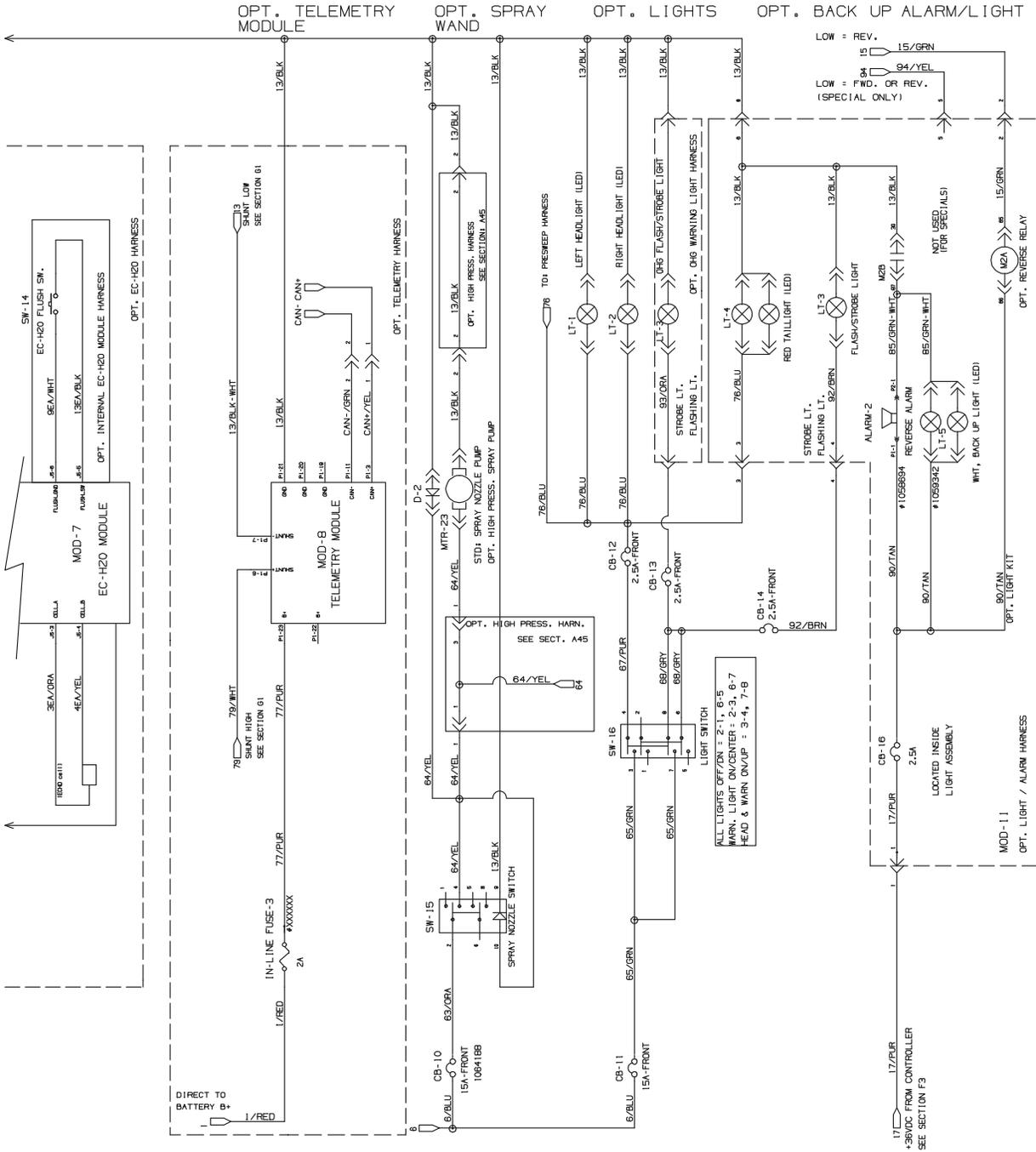
GENERAL INFORMATION

ELECTRICAL SCHEMATIC (013000-013999) - Page 5



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ELECTRICAL SCHEMATIC (013000-013999) -
Page 6

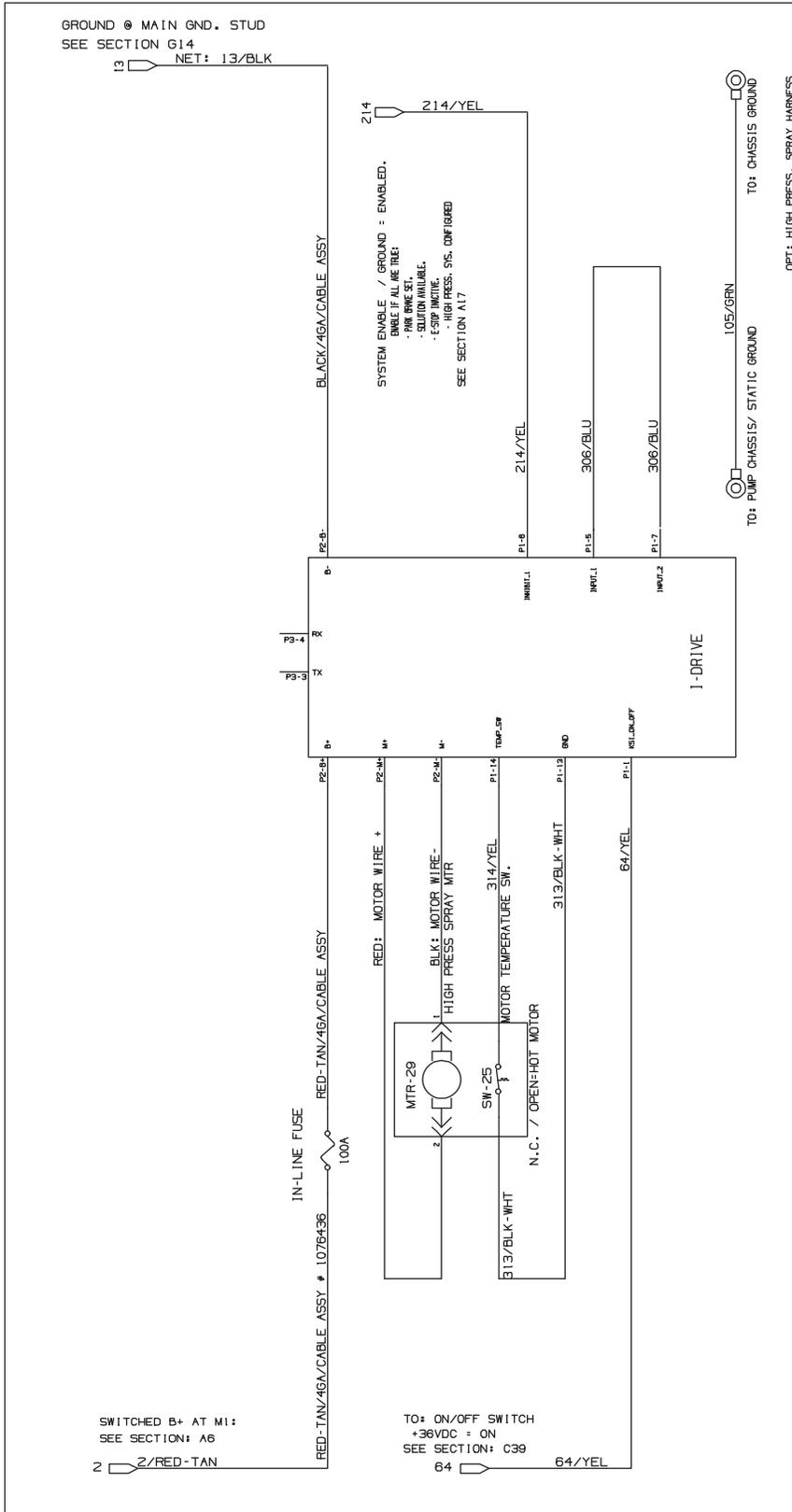


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GENERAL INFORMATION

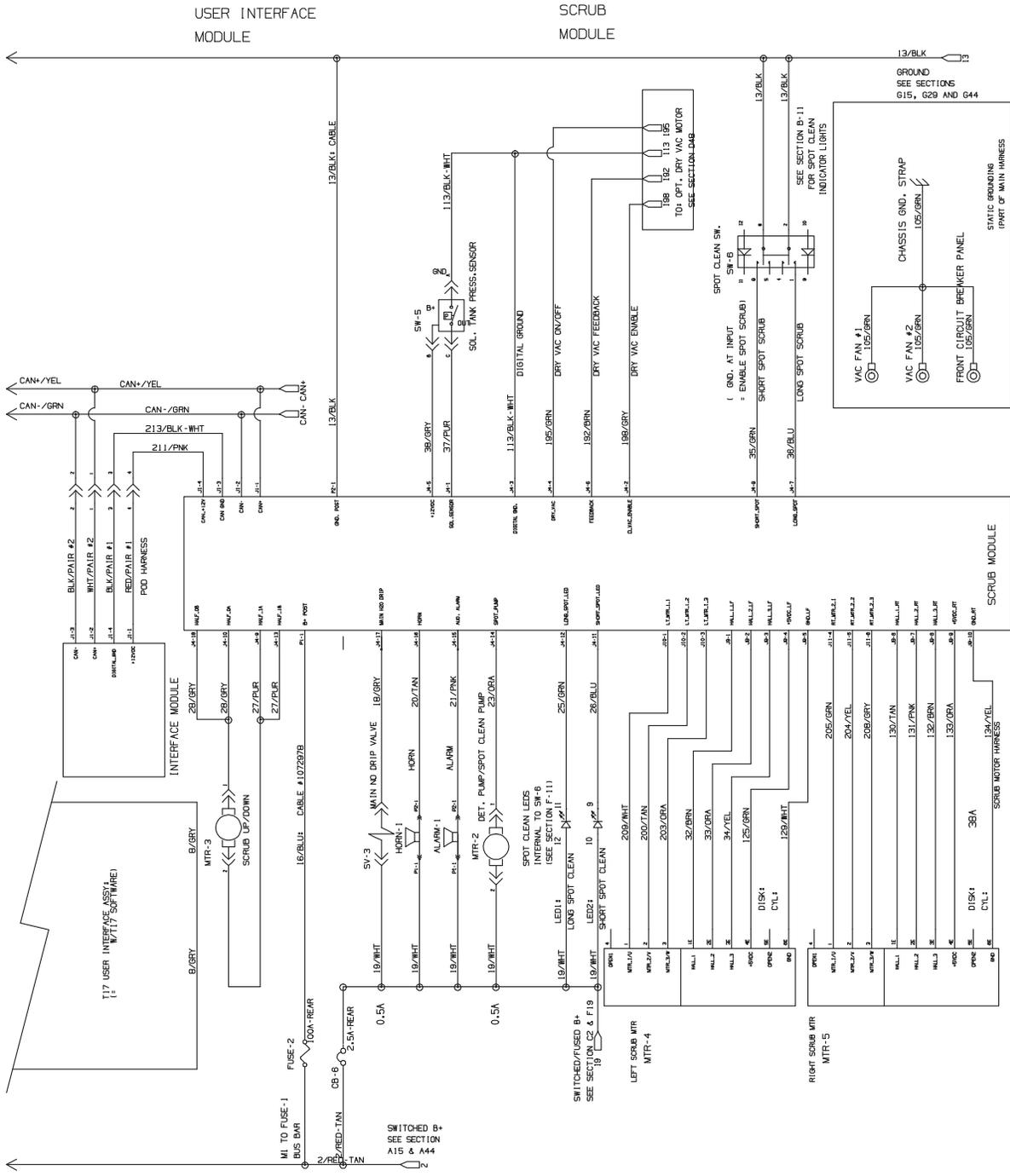
ELECTRICAL SCHEMATIC (013000-013999) - Page 7

OPT. HIGH PRESS. SPRAY



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ELECTRICAL SCHEMATIC (014000-) -
Page 2

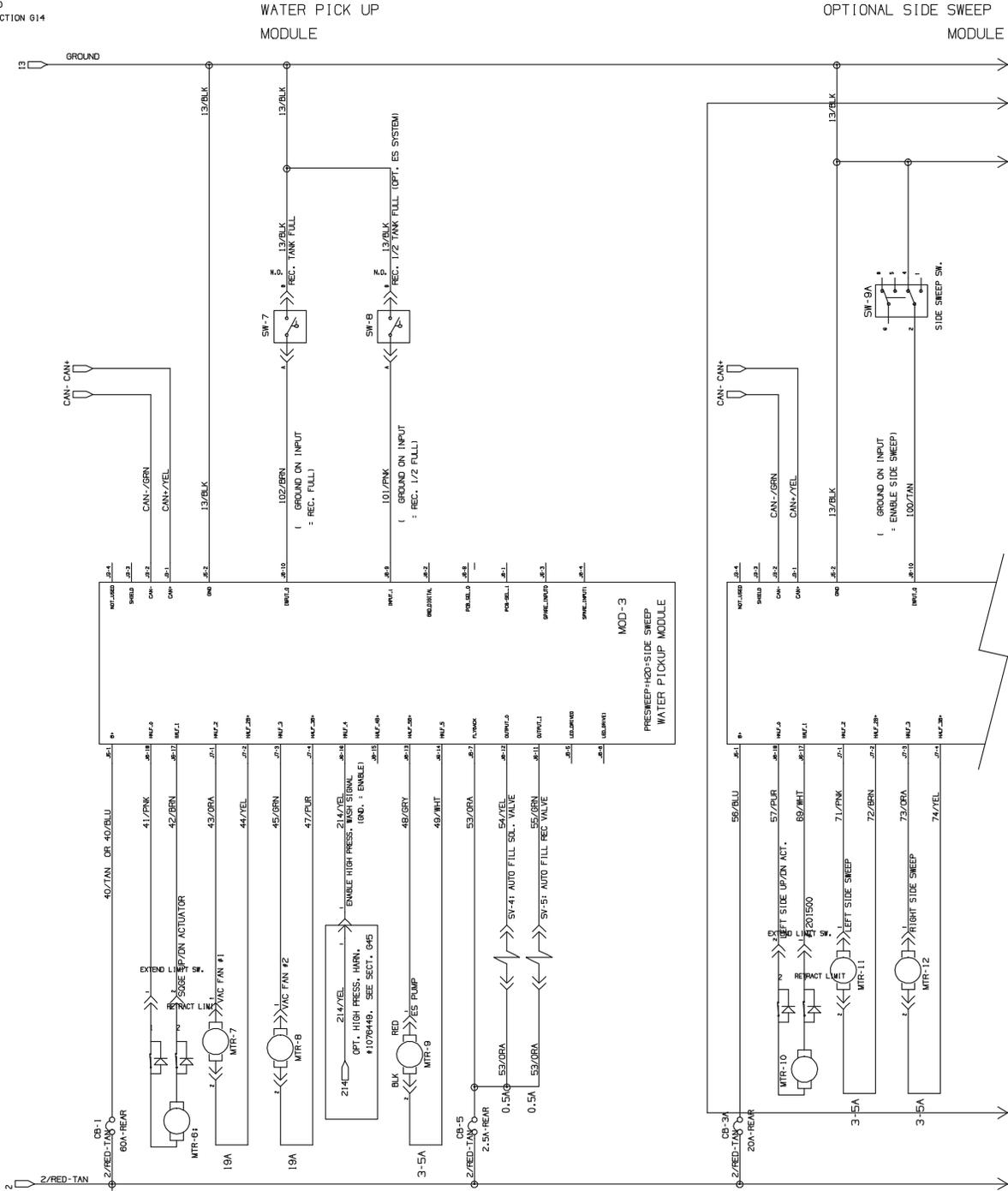


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GENERAL INFORMATION

ELECTRICAL SCHEMATIC (014000-) - Page 3

GROUND
SEE SECTION 614



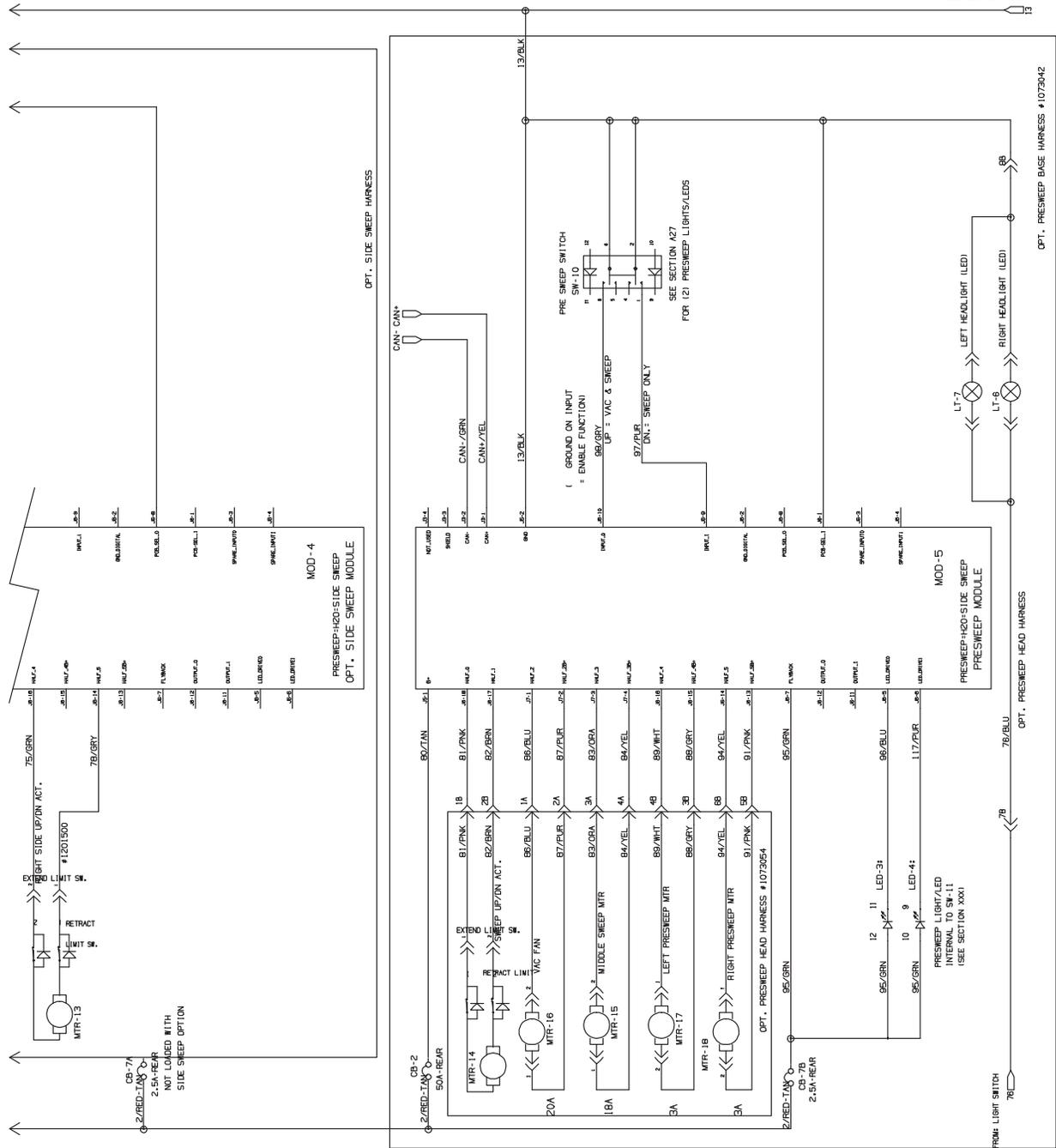
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ELECTRICAL SCHEMATIC (014000-) -
Page 4

OPTIONAL SIDE SWEEP
MODULE

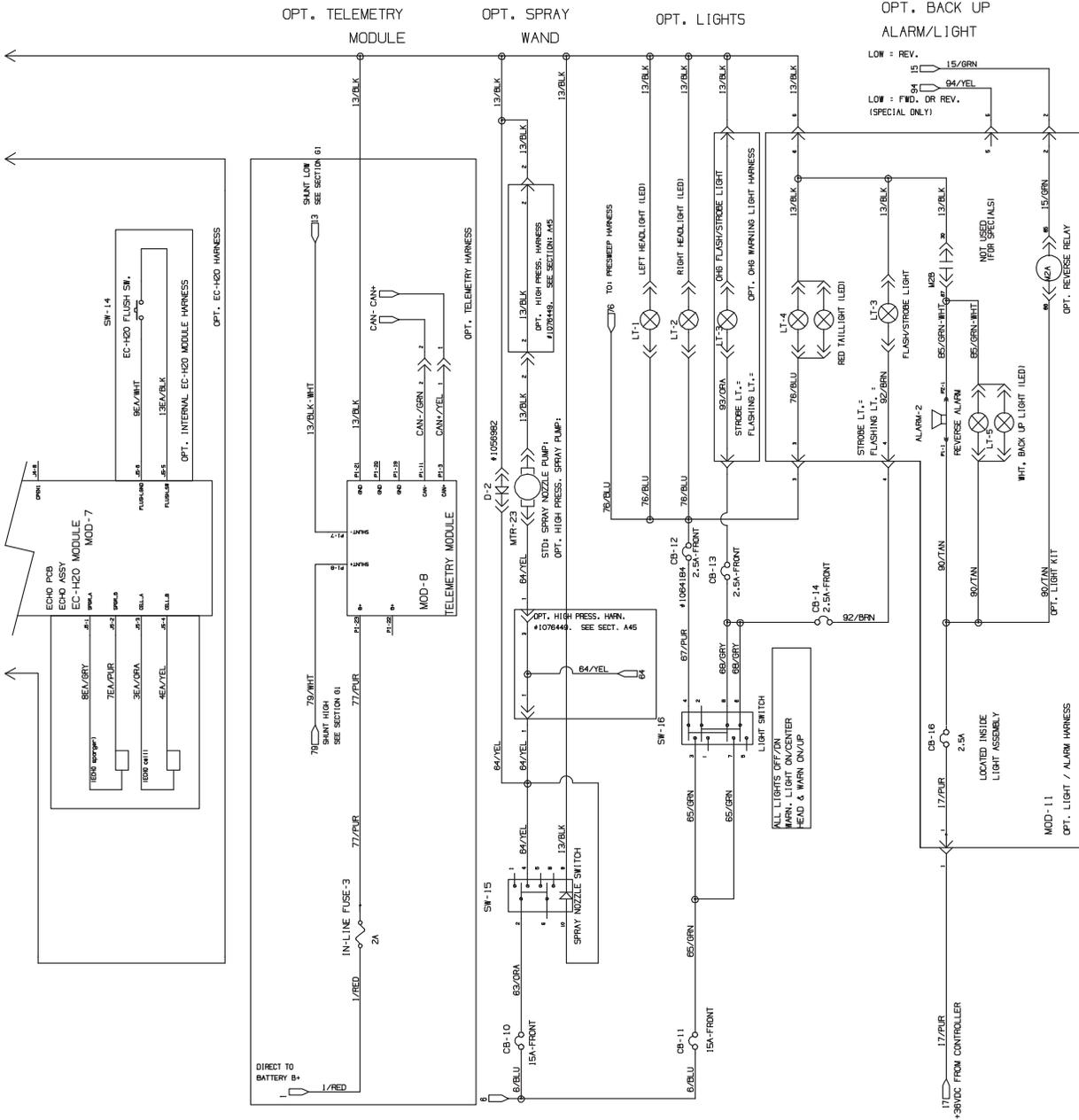
OPTIONAL PRE SWEEP
MODULE

GROUND
SEE SECTION 615



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ELECTRICAL SCHEMATIC (014000-) -
Page 6

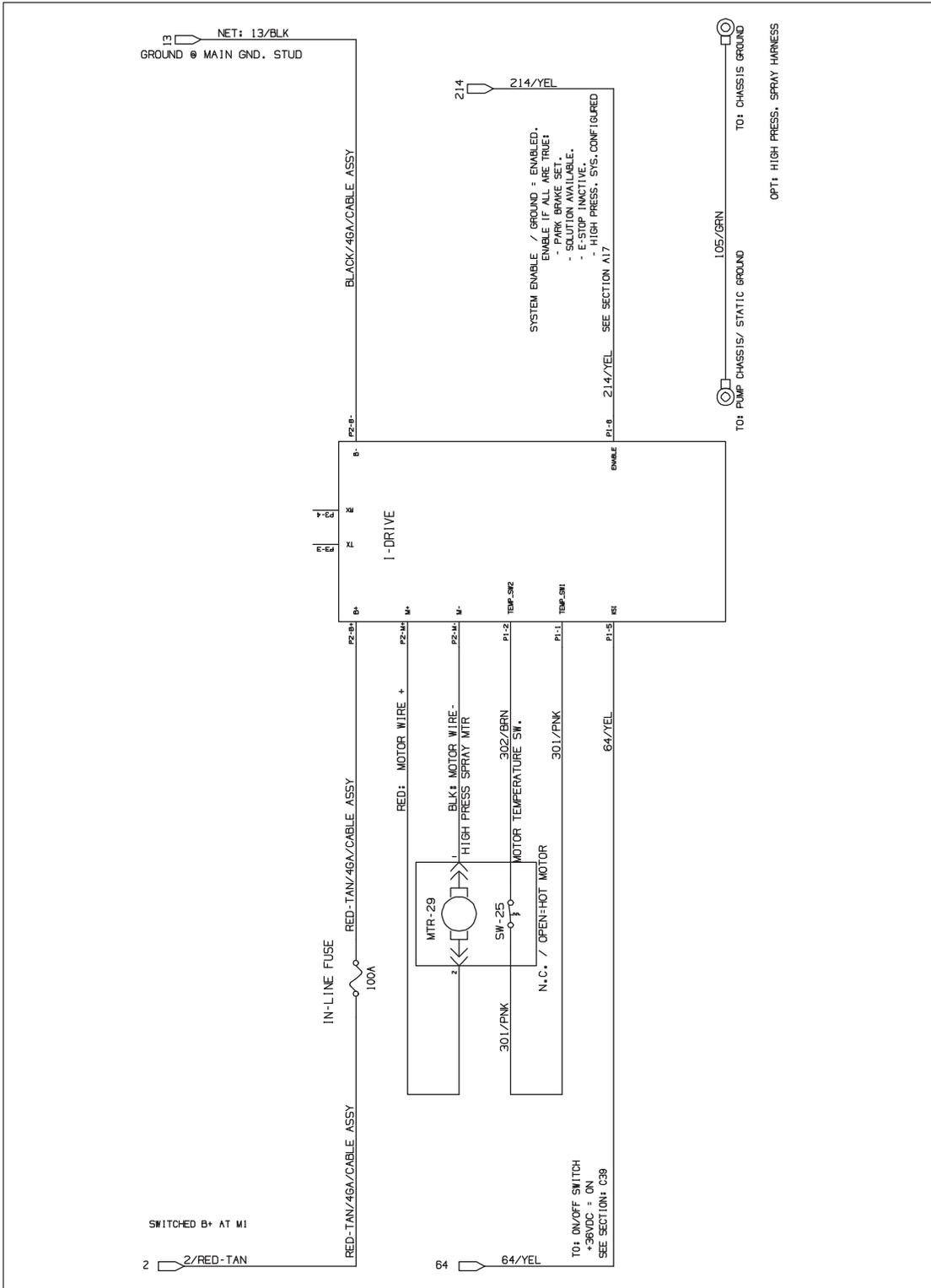


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GENERAL INFORMATION

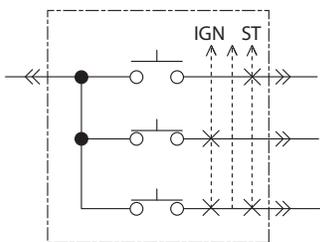
ELECTRICAL SCHEMATIC (014000-) -
Page 7

OPT. HIGH PRESS. SPRAY



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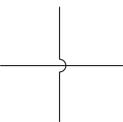
ELECTRICAL SCHEMATIC SYMBOLS



Key Switch



Connected



Not Connected



Connector



Energized



Adaptor Harness



Notes



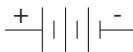
Assembly



AC Plug



Capacitor



Battery



Circuit Breaker



Fuse



Diode



Single Continuation Tab



Double Continuation Tab



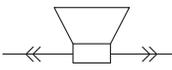
Relay Coil



N.C. Relay Contacts



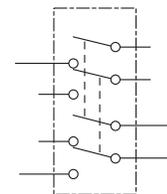
N.O. Relay Contacts



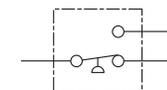
Horn or Alarm



Light



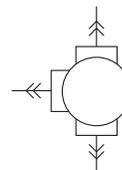
DPDT Switch



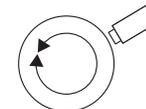
Pressure Switch



Motor



3 Phase AC Induction Motor



Motor Encoder



Sensor (Variable Resistor)



Momenary Switch N.O.



Contact Switch N.C.



Solenoid Valve

GENERAL INFORMATION

FASTENER TORQUES

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	

SPECIFICATIONS

GENERAL MACHINE DIMENSIONS/ CAPABILITIES

Item	Dimension/capacity
Length (S/N 013000–)	2245 mm (88.4 in)
Length (S/N 000000–012999)	2230 mm (87.9 in)
Length (with Pre-Sweep) (S/N 013000–)	2880 mm (113.4 in)
Length (with Pre-Sweep) (S/N 000000–012999)	2870 mm (113 in)
Width (less squeegee)	1168 mm (46 in)
Width (with squeegee)	1245 mm (49 in)
Width (with side brush)	1346 mm (53 in)
Wheel base	1163 mm (45.8 in)
Height (top of steering wheel)	1480 mm (58.25 in)
Height (with high pressure washer option)	1680 mm (66.2 in)
Height (with live wand option – Pro-Panel)	1766 mm (69.5 in)
Height (with live wand option w/ rear view mirror)	1979 mm (77.9 in)
Height (with overhead guard)	2096 mm (82.5 in)
Track	1041 mm (41 in)
Disk brush diameter	510 mm (20 in)
Cylindrical brush diameter	230 mm (9 in)
Cylindrical brush length	1015 mm (40 in)
Disk brush diameter for scrubbing side brush (option)	411 mm (16.18 in)
Disk brush diameter for sweeping side brush (option)	482.60 mm (19 in)
Disk brush diameter for Pre-Sweep (option)	482.60 mm (19 in)
Cylindrical sweep brush diameter for Pre-Sweep (option)	203.20 mm (8 in)
Cylindrical sweep brush length for Pre-Sweep (option)	709.68 mm (27.94 in)
Scrubbing path width	1015 mm (40 in)
Scrubbing path width (with scrubbing side brush)	1320 mm (52 in)
Scrubbing path width (with right sweeping side brush)	1165 mm (46 in)
Scrubbing path width (with dual sweeping side brushes)	1320 mm (52 in)
Solution tank capacity	285 L (75 gallons)
Recovery tank capacity	346 L (91.1 gallons)
Detergent tank capacity (option)	17.6 L (4.6 gallons)
Demisting chamber	61 L (16.1 gallons)
Weight (Empty)	875 Kg (1925 lbs)
Weight (with standard 510 AH batteries)	1525 Kg (3365 lbs)
GVWR	2790 Kg (6150 lbs)
Protection Grade	IPX3

GENERAL INFORMATION

Values determined as per IEC 60335-2-72	Measure – Cylindrical scrub head	Measure – Disk scrub head
Sound pressure level L_{pA}	68 dB(A)	65 dB(A)
Sound pressure uncertainty K_{pA}	2.8 dB(A)	3.0 dB(A)
Sound power level L_{WA} + Uncertainty K_{WA}	88.2 dB(A)	85.8 dB(A)
Vibration – Hand–arm	<2.5 m/s ²	<2.5 m/s ²
Vibration – Whole body	<0.5 m/s ²	<0.5 m/s ²

GENERAL MACHINE PERFORMANCE

Item	Measure
Aisle turnaround width (less side brush)	2370 mm (93.25 in)
Aisle turnaround width (with Pre–Sweep)	2941 mm (115.75 in)
Travel Speed (Forward)	9 Km/h (5.5 mph)
Travel Speed while scrubbing (Forward)	6.5 Km/h (4 mph)
Travel Speed (Reverse)	5 Km/h (3 mph)
Maximum ramp incline for loading – Empty	21%
Maximum ramp incline for scrubbing	8.7%
Maximum ramp incline for scrubbing (With optional ramp kit)	10.5%
Maximum ramp incline for transporting (GVWR)	12%
Maximum ramp incline for transporting (GVWR)(With optional ramp kit)	14.8%
Maximum ambient temperature for machine operation	43° C (110° F)
Minimum temperature for operating machine scrubbing functions	0° C (32° F)

POWER TYPE

Type	Quantity	Volts	Ah Rating	Weight
Lead–acid Batteries (Max. battery dimensions: 406 mm (15.98 in) W x 963 mm (37.91 in) L x 775 mm (30.51 in) H	1	36	510 @ 6 hr rate	661 kg (1458 lb)
	1	36	750 @ 6 hr rate	963 kg (2124 lb)
	1	36	930 @ 6 hr rate	988 kg (2178 lb)
Lithium–ion Battery	1	36	497	209 kg (462 lb)
	1	36	1049	414 kg (914 lb)

Type	Use	VDC	kW (hp)
Electric Motors	Scrub brush (disk)	36	1.125 (1.50)
	Scrub brush (cylindrical)	36	1.125 (1.50)
	Vacuum fan	36	0.6 (0.8)
	Propelling	36	2.25 (3.0)
	High pressure washer	36	2.25 (3.0)
	Live wand vacuum	36	1.125 (1.5)

POWER TYPE

Type	VDC	amp	Hz	Phase	VAC
Chargers (Smart)	36	21	45-65	1	85-265
Charger, Lithium-Ion Battery	36	80	50-60	1	200-240
Charger, Lithium-Ion Battery	36	80	50-60	3	200-240
Charger, Lithium-Ion Battery	36	100	50-60	3	480
Charger, Lithium-Ion Battery	36	215	50-60	3	480

TIRES

Location	Type	Size
Front (1)	Solid	150 mm wide x 350 mm OD (5.8 in wide x 13.8 in OD)
Rear (2)	Solid	125 mm wide x 380 mm OD (5 in wide x 15 in OD)

SCRUBBING SIDE BRUSH SOLUTION FLOW RATE (OPTION)

Item	Measure
Solution pump	36 Volt DC up to 1.51 LPM (0.40 GPM)

ec-H2O SYSTEM (OPTION)

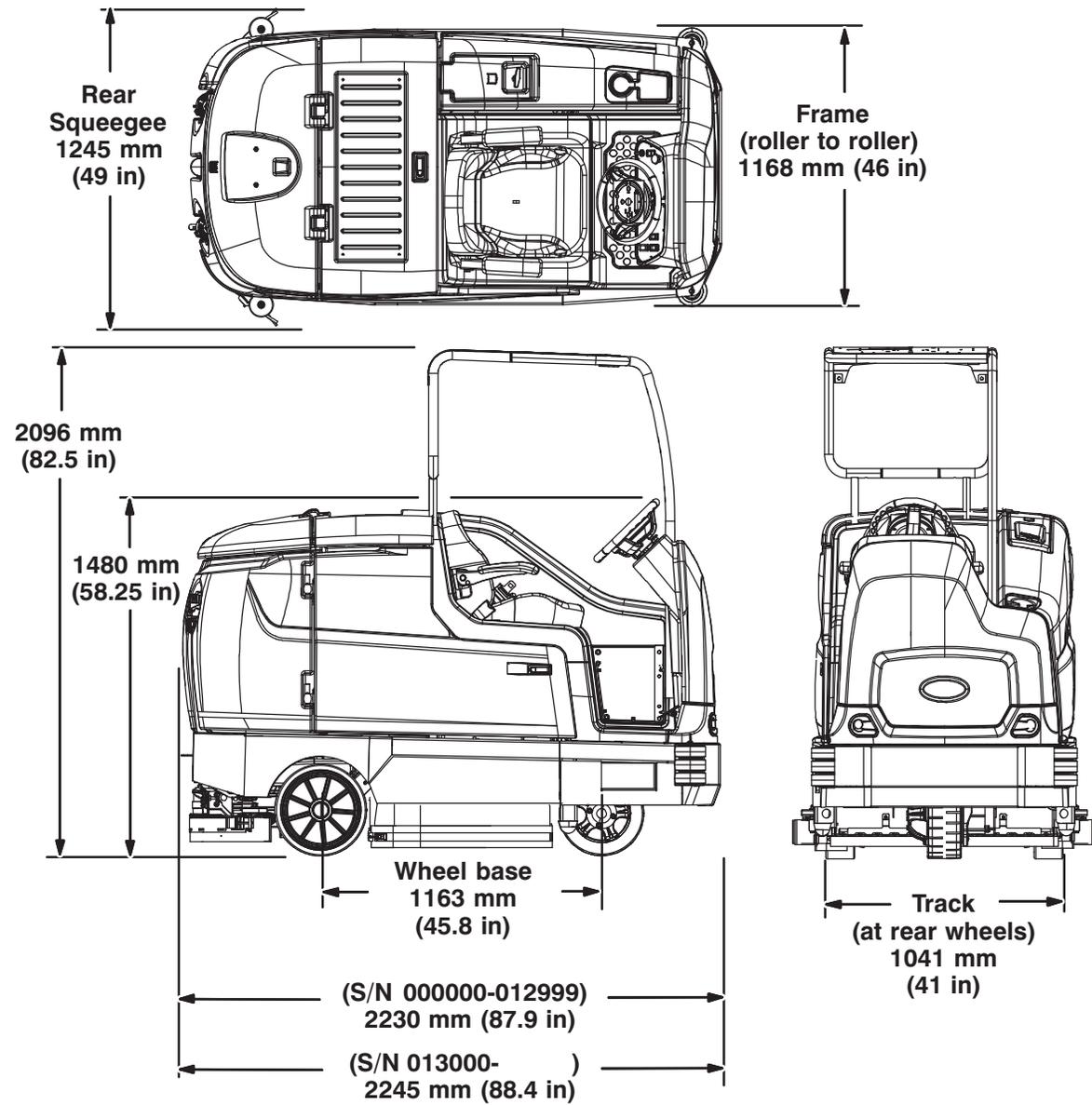
Item	Measure
Solution pump	36 Volt DC, 5A, 6.8 LPM (1.8 GPM) open flow
Solution flow rate (machines without optional scrubbing side brush)	Up to 3.79 LPM (1.0 GPM)
Solution flow rate (machines with optional scrubbing side brush)	Up to 2.65 LPM (0.70 GPM) – To main scrub head
	Up to 1.14 LPM (0.30 GPM) – To scrubbing side brush

HIGH PRESSURE WASHER (OPTION)

Item	Measure
Pump pressure (max)	Up to 17236 kpa (2500 psi)
Solution flow rate (max @ 2500psi)	Up to 7.57 LPM (2.0 GPM)

GENERAL INFORMATION

MACHINE DIMENSIONS



356389

SUPERVISOR CONTROLS

PRO-PANEL SUPERVISOR CONTROLS

The supervisor controls feature allows a supervisor to program the machine scrubbing settings for operator use. The lockout functionality will prevent the operator from changing or saving the settings.

The supervisor controls feature will lower machine variability for consistent, repeatable cleaning results, machine quality assurance regardless of user experience, and reduce user training requirements.

There are two types of user modes that will interface with the operator home screen:

Operator Mode - Capable of machine operation with permissions and restrictions controlled by the supervisor.

Supervisor Mode - Capable of machine operation with full use of all controls, along with configuring permissions and restrictions for the operator mode.

A new machine from the factory will automatically start in the supervisor mode with a preassigned default supervisor profile. The factory-assigned supervisor login number is "1234". This login number is not required until it is enabled. The default supervisor profile name and login number can be changed as described in this section. If the new assigned supervisor mode login number is forgotten, please contact Tennant service.

ENTERING THE SUPERVISOR MODE - FIRST TIME USE ONLY

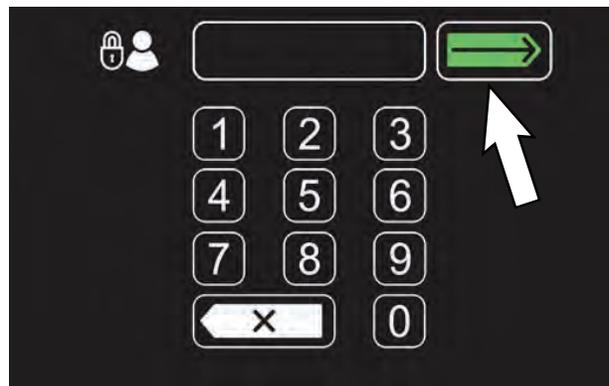
1. Turn on the machine. The main operating screen will appear in the display..
2. Press the help button to access the help screen.



3. Press the login button.



4. Use the keypad to enter the factory assigned supervisor login number 1234 into the display above the keypad. Press the enter button when finished entering the supervisor login number.



 Press the backspace button if necessary to delete and reenter a number.

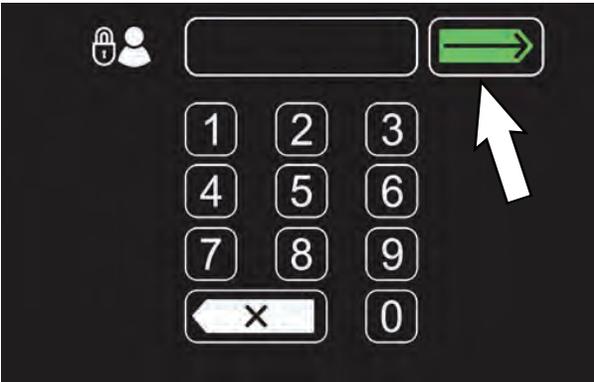
5. The supervisor machine operation screen should appear in the display. Press the settings button to access the supervisor settings screen.



6. Proceed to *ADDING / EDITING PROFILES*.

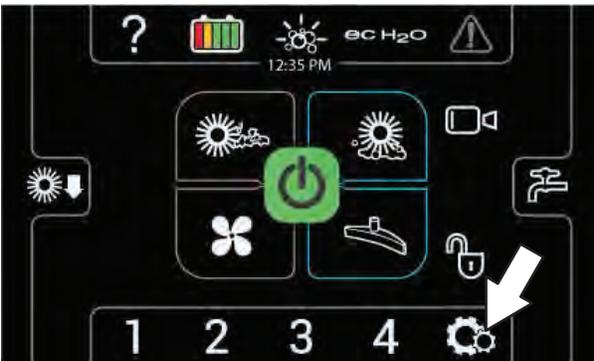
ENTERING THE SUPERVISOR MODE

1. Turn on the machine. The login screen will appear on the display.
2. Use the keypad to enter the supervisor login number into the display above the keypad. Press the enter button when finished entering the supervisor login number.



Press the backspace button if necessary to delete and reenter a number.

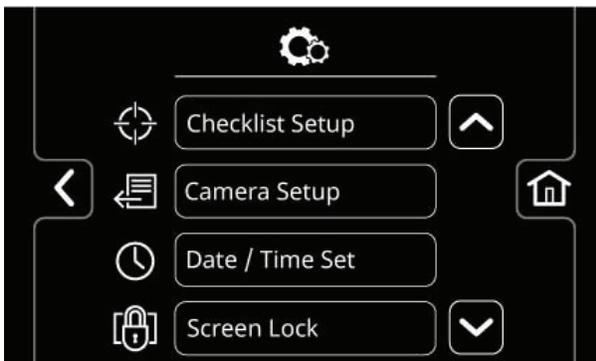
3. The supervisor machine operation screen should appear in the display. Press the settings button to access the supervisor settings screen.



SUPERVISOR CONTROLS

SUPERVISOR SETTING SCREEN/SCREEN ICONS

Use the supervisor maintenance screen to setup / change user passwords, user machine settings, and other machine setup items.



 Press the up arrow button to navigate up through the menu items.

 Press the down arrow button to navigate down through the menu items.

 Press the home button to navigate back to the main operating screen.

 Press the back button to navigate back to the previous screen.

Use the below menu buttons to access the various supervisor setup menus / screens.

 Press the video help button to access the various machine help videos.

 Press the Add / Edit Profiles button to add, delete, and / or change machine user and supervisor profiles. See *ADDING / EDITING PROFILES*.

 Press the Battery Type button to change the type battery being used in the machine. See *CHANGING BATTERY TYPE*.

 Press the Enable Login button to activate a required login number at machine start up for all user profiles to operate machine.

 Press the Disable Login button to deactivate a login number at machine start up for all user profiles to operate machine. See *DISABLING LOGIN*

 Press the Calibrate Touch button to calibrate the touch screen if the touch points become misaligned.

 Press the Export Checklists button to access the Export Checklists menu. See *EXPORTING CHECKLISTS*.

 Press the Checklists Setup button to access the Checklist Setup menu. See *DISABLING / ENABLING THE PRE-OPERATION CHECKLIST*.

 Press the Camera Settings button to access the Camera Settings screen. See *CHANGING REARVIEW CAMERA SETTINGS*.

 Press the SYSTEM TIME button to access the date / time screen. See *SETTING / CHANGING THE TIME AND DATE*

 Press the Screen Lock button to access the Screen Lock setting Screen. See *SETTING THE SCREEN LOCK*.

ADDING/EDITING PROFILES

1. Turn on the machine, log into the supervisor screen, and press the settings button to access the supervisor settings screen. See *ENTERING THE SUPERVISOR MODE*.
2. Press the Add/Edit Profiles button to access the Add/Edit Profiles screen.

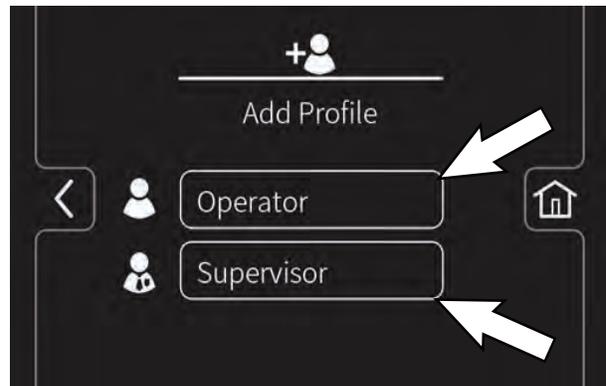


3. Press the Add Profile button to access the Add Profile screen.



-  Press the Add Profile button to access the screens and menus to add a new profile.
-  Press the Edit Profile button to edit an existing profile.
-  Press the Copy Profile button to copy an existing profile.
-  Press the Delete Profile button to delete an existing profile.
-  Press the home button to navigate back to the main operating screen.
-  Press the back button to navigate back to the previous screen.

4. Press the Operator button to add a new operator, or Supervisor button to add a new supervisor.



NOTE: The default supervisor cannot be deleted from the profile list.

-  Press the Operator button to add / edit / copy / delete an operator profile .
-  Press the Supervisor button to add / edit / copy / delete a supervisor profile.

5. Use the keypad to enter the new user / supervisor name. Press the enter button.



SUPERVISOR CONTROLS

- Use the keypad to assign the new user / supervisor a login number. The new login number can be any combination of numbers ranging from 3 to 8 digits in length. Press the enter button. The “maximum speed” screen will appear.



 Press the backspace button if necessary to delete and reenter a number.

- Select the controls the new user should have access to use. Green represents unlocked controls and gray represents locked controls. Press the flashing save button to save the new profile.

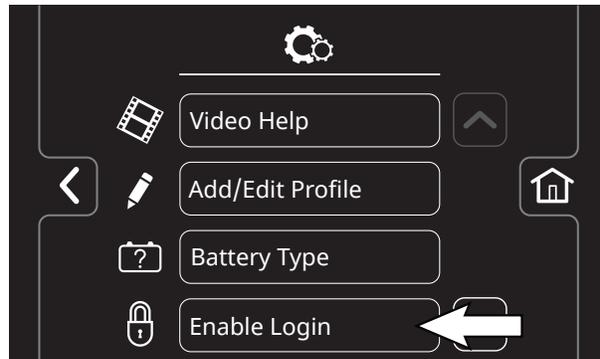


 Press the help button to access the help screen.

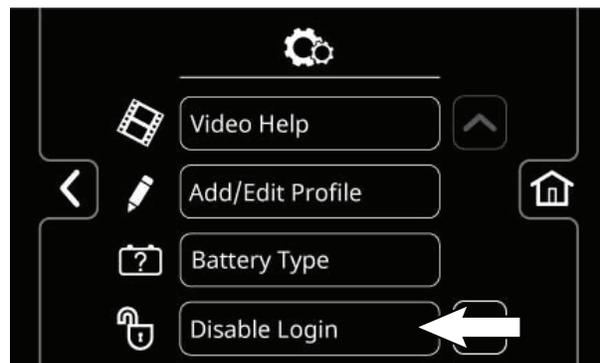


 Press the back button to return to the user access page.

- The new user profile is now saved to the operator profile list. Multiple operator and supervisor user profiles can be added. Press the back arrow button to return to the previous screen to add more user profiles or to enable login.
- To enable the login number at start up, press the Enable Login button.



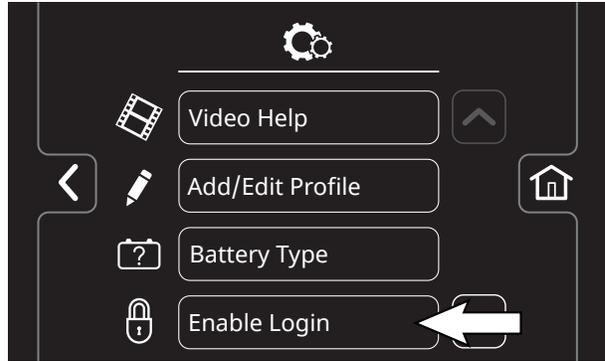
The Enable Login button will change from Enable Login to Disable Login. See *DISABLING LOGIN* for instructions how to disable login.



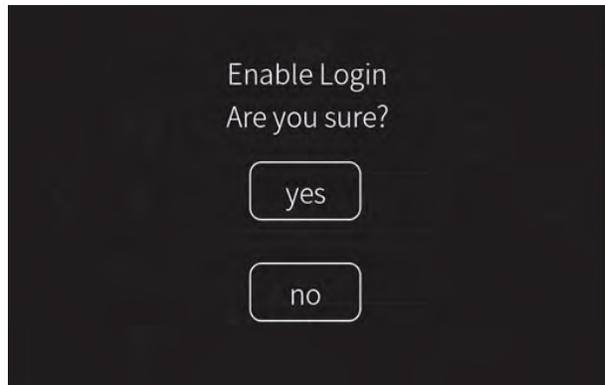
10. Now at machine start up, a login screen will display. The new user will need to enter their assigned login number to operate machine.
11. When the user is done operating the machine, it is recommended the user log out by pressing the help button, and then pressing the logout button. Turning the key to the off position is another way to also logout.
12. Use the Edit Profile button, Copy Profile button, and Delete Profile button to manage the current user profiles.

ENABLING THE LOGIN

1. Turn on the machine, log into the supervisor screen, and press the settings button to access the supervisor settings screen. See *ENTERING THE SUPERVISOR MODE*.
2. Press the Enable Login button.



3. Press the yes button to enter the Default User screen.



4. Press either the Operator button or Supervisor button to select the desired default user.



DISABLING THE LOGIN

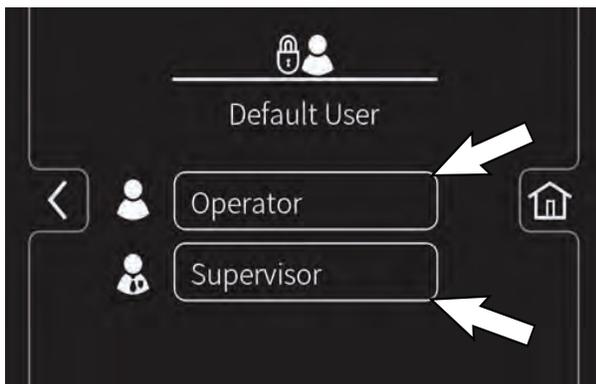
1. Turn on the machine, log into the supervisor screen, and press the settings button to access the supervisor settings screen. See *ENTERING THE SUPERVISOR MODE*.
2. Press the Disable Login button.



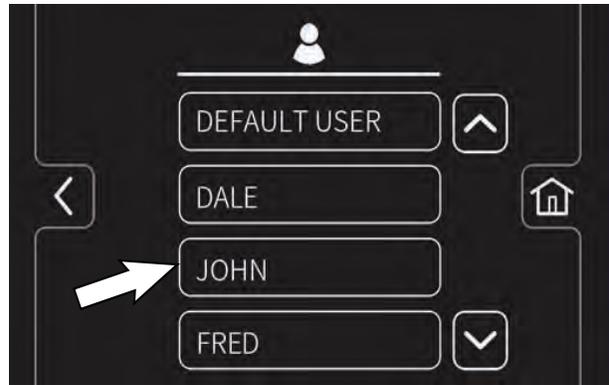
3. Press the yes button to enter the Default User screen.



4. Press either the Operator button or Supervisor button to select the desired default user.



5. Select a pre-assigned user profile. Turn off the machine to apply the setting.



6. At start up, the home screen is now set without a login requirement for the operator profile as the default.

CHANGING BATTERY TYPE

Changing the battery type allows the machine to be programmed for the correct battery type if the battery has been changed.

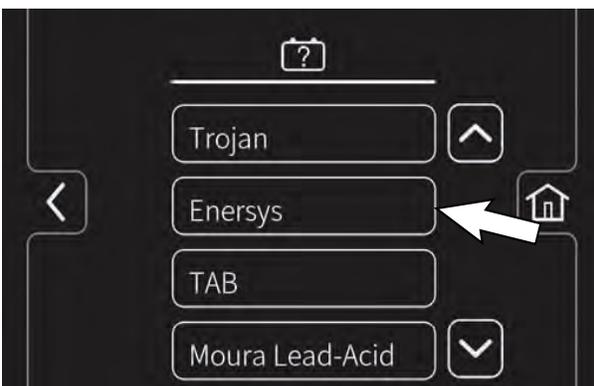
IMPORTANT: Before charging, make sure that the charger setting is properly set for the battery type.

NOTE: Use a charger with the proper rating for the battery to prevent damage to the battery or reduce the battery life.

1. Turn on the machine, login to the main operation screen, and press the setting button to access the supervisor settings screen. See *ENTERING THE SUPERVISOR MODE*.
2. Press the Battery Type button to access the battery selection screen.



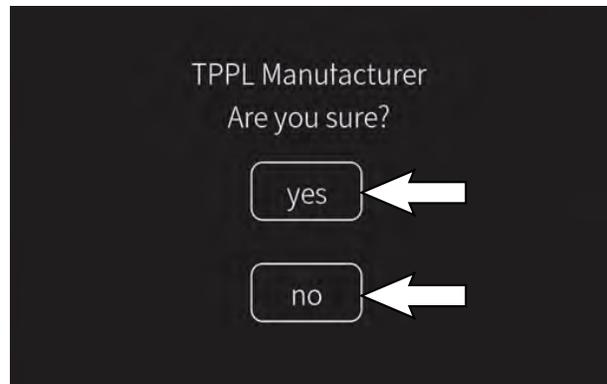
3. Press the button for the applicable battery from the list. If necessary, use the up arrow button and the down arrow button to navigate through the list of batteries.



4. If a battery sub list appears on the screen, press the button for the applicable battery from the list.



5. If Are You Sure appears on the screen, press either the yes button or the no button.



NOTE: If yes button is pushed the supervisor settings screen will reappear in the display. If the no button is pushed the applicable battery sub list will reappear in the display.

CALIBRATING THE TOUCH

1. Turn on the machine, login to the main operation screen, and press the setting button to access the supervisor settings screen. See *ENTERING THE SUPERVISOR MODE*.
2. Press the Calibrate Touch button to recalibrate touch. If the touch points become misaligned.

SUPERVISOR CONTROLS

EXPORTING CHECKLISTS

Exporting the checklists allows the checklists to be exported from the machine and to a flash drive.

1. Turn on the machine, login to the main operation screen, and press the setting button to access the supervisor settings screen. See *ENTERING THE SUPERVISOR MODE*.
2. Plug the flash drive into the USB port.



3. Press the Export Checklists button to access the export screen.



4. Export the Pre-Operation Checklists from the machine to the memory stick.



 Press the Export New button to export the newly completed Pre-Operation Checklists from the machine.

 Press the Export All button to export all completed Pre-Operation Checklists from the machine.

 Press the home button to navigate back to the main operating screen.

 Press the back button to navigate back to the previous screen.

5. Remove the flash drive from USB port and turn off the machine.

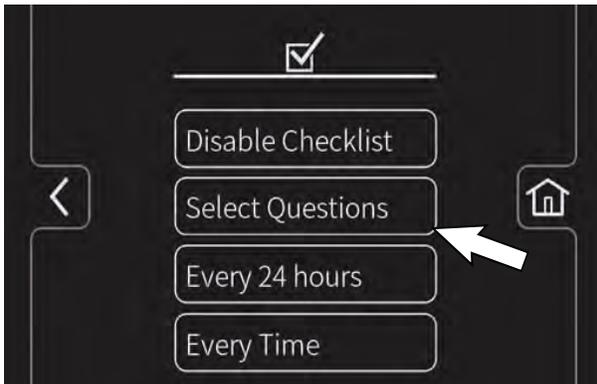
CHECKLIST SETUP

Checklist setup allows the checklist to be setup / changed to meet machine usage demands.

1. Turn on the machine, login to the main operation screen, and press the setting button to access the supervisor settings screen. See *ENTERING THE SUPERVISOR MODE*.
2. Press the Checklist Setup button to access the Pre-Operation checklist setup screen.

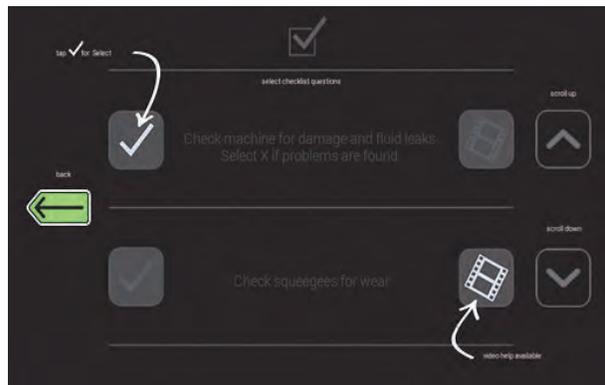


3. Press the Select Questions button to access the Pre-Operation Checklist master list screen.



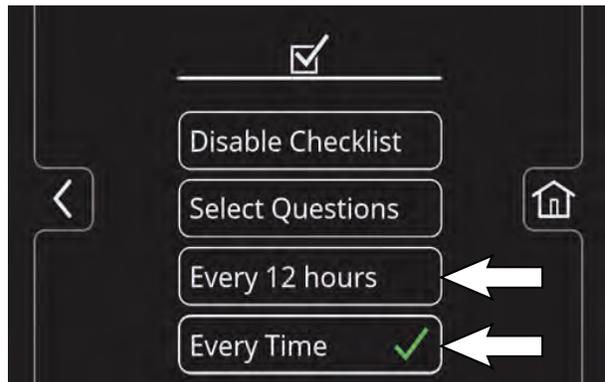
-  Press the down arrow button to scroll down through Pre-Operation Checklist items.

-  Press the up arrow button to scroll up through Pre-Operation Checklist items.
-  Press the check box button to select a new checklist item to add to the checklist.
-  Press either the video help button to view the video related to a particular Pre-Operation Checklist item.
-  Press the Enter button to add the selected Pre-Operation Checklist item(s) to the Pre-Operation Checklist.
-  Press the help button to access the Pre-Operation Checklist help screen.



-  Press the back button to return to the Pre-Operation Checklist Master List screen.

4. Press the Every 12 hours button or the Every Time button to set the interval the operator must complete the Pre-Operation Checklist. A check mark appears in the chosen interval.



-  Press the home button to navigate back to the main operating screen.
-  Press the back button to navigate back to the previous screen.

SUPERVISOR CONTROLS

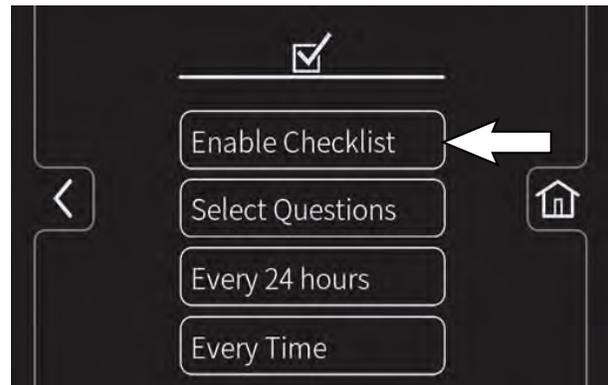
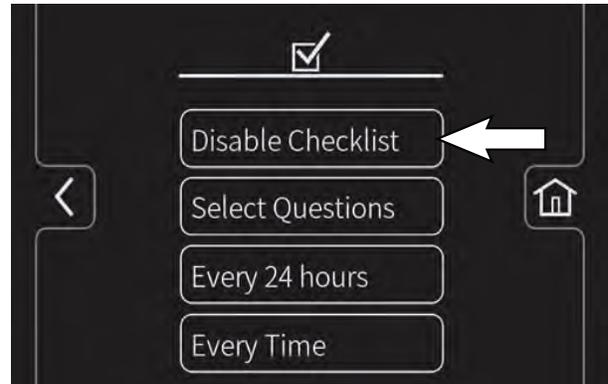
DISABLING/ENABLING THE PRE-OPERATION CHECKLIST

Disabling / enabling the Pre-Operation checklist allows the Pre-Operation checklist to be disabled if it is not necessary for the operator to complete the checklist prior to operating the machine and enabled if it is necessary for the operator to complete the checklist prior to operating the machine.

1. Turn on the machine, login to the main operation screen, and press the setting button to access the supervisor settings screen. See *ENTERING THE SUPERVISOR MODE*.
2. Press the Checklist Setup button to access the Pre-Operation Checklist setup screen.



3. Press the Disable Checklist button / Enable Checklist button to disable / enable the Pre-Operation Checklist.



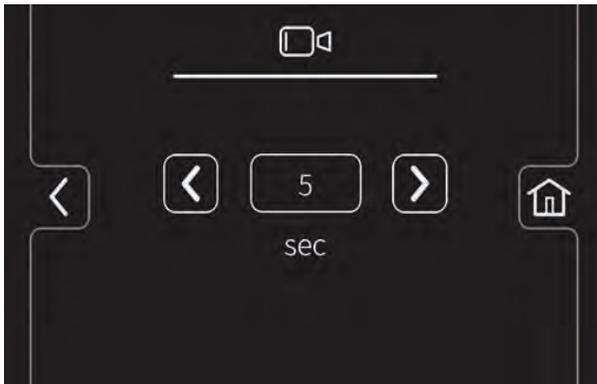
 Press the home button to navigate back to the main operating screen.

 Press the back button to navigate back to the previous screen.

CHANGING THE REAR VIEW CAMERA SETTINGS

Changing the rear view camera settings allows the time the rearview camera remains on when the *rearview camera button* is pushed to be changed. The rearview camera can be set to any time between 5 seconds and 2 minutes.

1. Turn on the machine, login to the main operation screen, and press the setting button to access the supervisor settings screen. See *ENTERING THE SUPERVISOR MODE*.
2. Press the *Camera Settings button* to access the rear view camera settings screen.



 Press the *increase button* to increase the time the rear view camera remains on when the operator presses the *rearview camera button*.

 Press the *decrease button* to decrease the time the rear view camera remains on when the operator presses the *rearview camera button*.

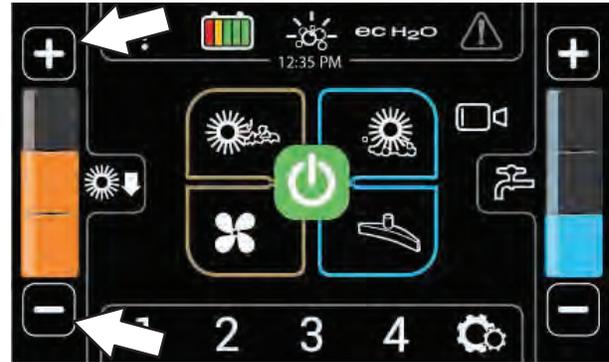
 Press the *home button* to navigate back to the main operating screen.

 Press the *back button* to navigate back to the previous screen.

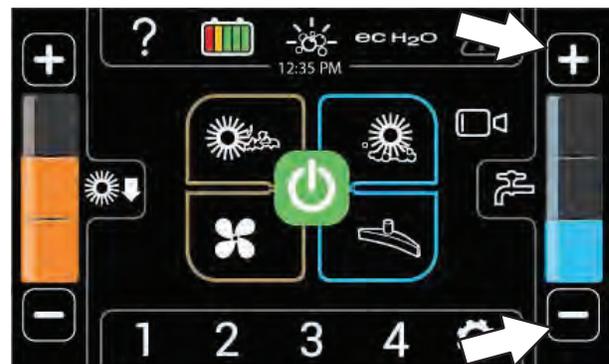
PROGRAMMING THE ZONE CONTROL BUTTONS

Programming the zone control buttons allows the parameters for the zone control buttons to be changed / updated to meet scrubbing / sweeping demands.

1. Turn on the machine, login to the main operation screen, and press the setting button to access the supervisor settings screen. See *ENTERING THE SUPERVISOR MODE*.
2. Use the *brush pressure increase (+) button* and the *brush pressure decrease (-) button* to set the zone brush pressure.

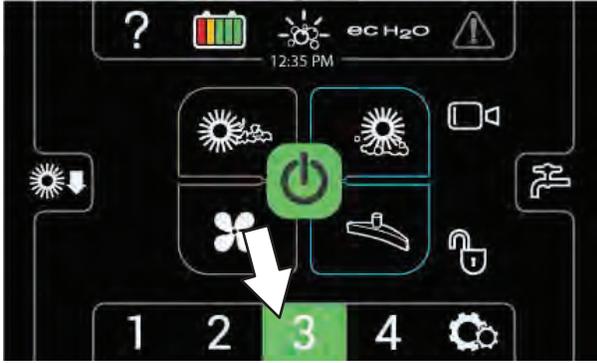


3. Use the *solution increase (+) button* and the *solution decrease (-) button* to set the zone solution flow level.



SUPERVISOR CONTROLS

4. Press and hold the zone control button until the "name preset" screen appears.



6. Use the key pad to enter the name for the zone control button.



5. Press the yes button to set the zone settings. Press the no button to return to the main operating screen.



 Press the home button to navigate back to the main operating screen.

 Press the back button to navigate back to the previous screen.

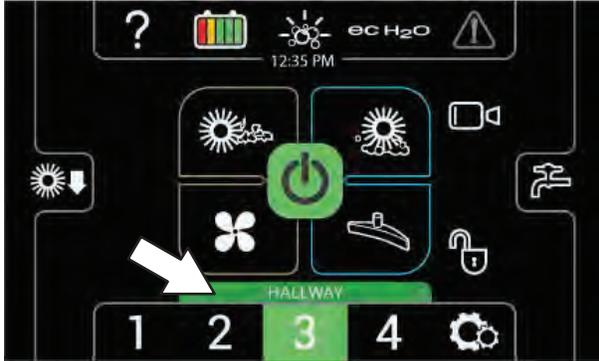
 Press the enter button to set the zone button name.

 Press the backspace button if necessary to delete and reenter a number.

 Press the space button to place space between letters / numbers.

 Press the pound button to toggle between the number keypad and the letter keypad.

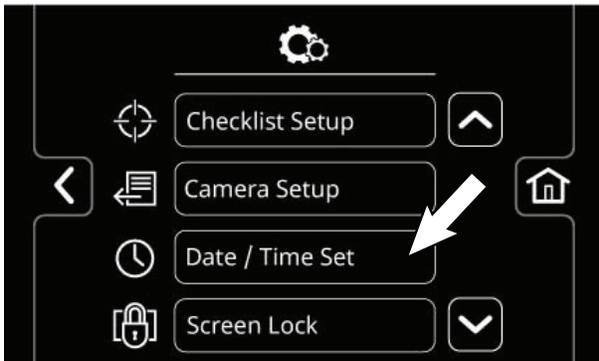
- Press the enter button to set the zone button settings. The main operating screen returns to the display with the zone button named. The brush pressure and solution flow setting also briefly appear in the display.



SETTING/CHANGING THE DATE AND TIME

Setting / changing the date and time allow the system date and time to be set / changed.

- Turn on the machine, login to the main operation screen, and press the setting button to access the supervisor settings screen. See *ENTERING THE SUPERVISOR MODE*.
- Press the *System Time button* to access the date / time screen.

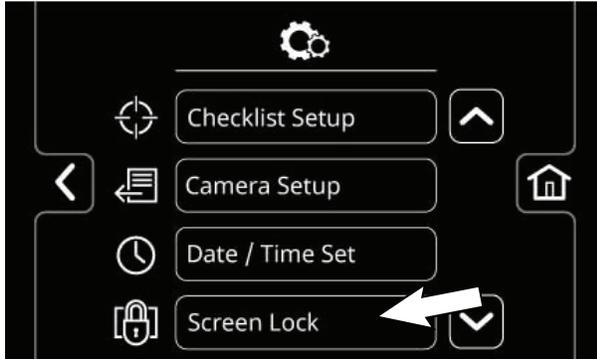


-  Press the *date button* to change the system date.
 -  Press the *time button* to change the system time.
 -  Press the *toggle button* to toggle between hours, minutes, and AM / PM on the time screen and the month, day, and year on the date screen.
 -  Press the *increase button* advance the time / date parameters.
 -  Press the *decrease button* to reverse the time / date parameters.
 -  Press the *home button* to navigate back to the main operating screen.
 -  Press the *back button* to navigate back to the previous screen.
- Press the *home button* when finished setting / changing the system date and time to return to the main operating screen.

SETTING/CHANGING THE SCREEN LOCK

The screen lock setting adjusts the amount of time the screen remains unlocked before going into the screen lock mode during operation.

1. Turn on the machine, login to the main operation screen, and press the setting button to access the supervisor settings screen. See ENTERING THE SUPERVISOR MODE
2. Scroll down and press the Screen Lock button to access the screen lock screen.



The screen lock delay can be set to never, 30 seconds, or one minute intervals up to 5 minutes.



 Press the *home button* to navigate back to the main operating screen.

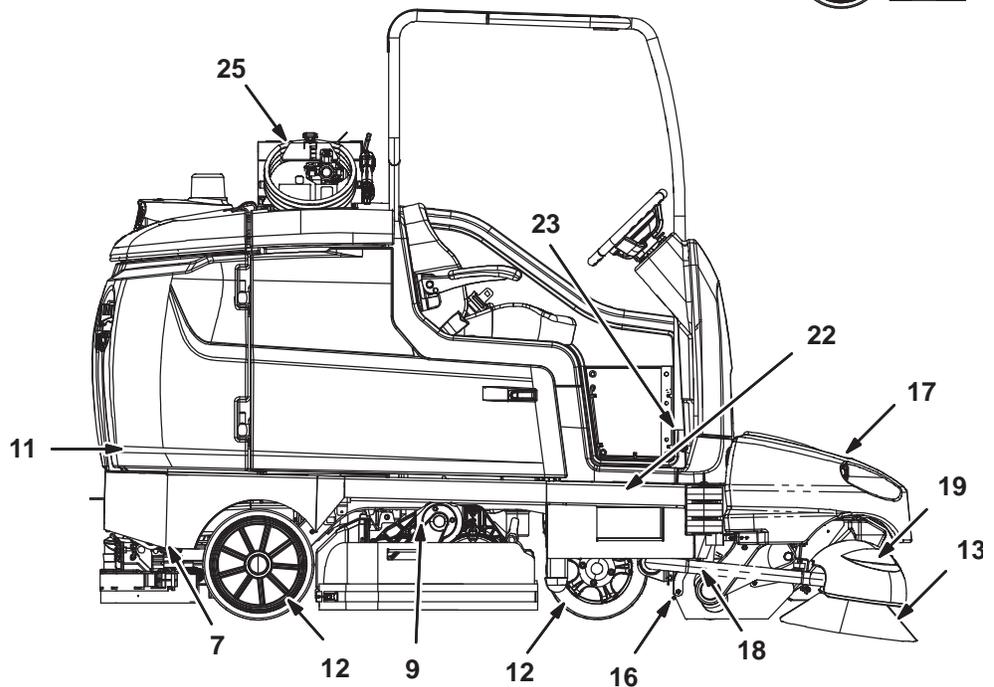
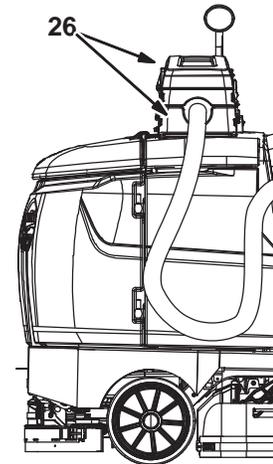
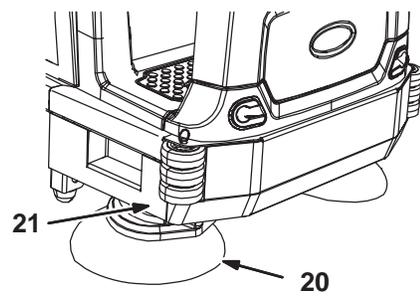
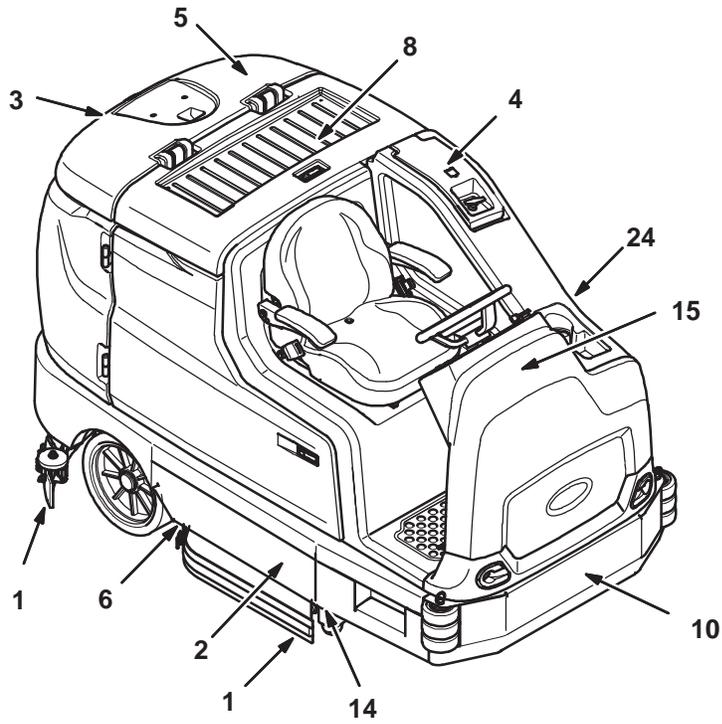
 Press the *back button* to navigate back to the previous screen.

 Press the down arrow button to scroll down through screen lock times.

 Press the up arrow button to scroll up through screen lock times.

3. Press the home button when finished setting / changing the screen lock time to return to the main operating screen.

MAINTENANCE



356408

MAINTENANCE

MAINTENANCE CHART

The table below indicates the Person Responsible for each procedure.

O = Operator.

T = Trained Personnel.

Interval	Person Resp.	Key	Description	Procedure	Lubricant/ Fluid	No. of Service Points
Daily	O	1	Side and rear squeegees	Check for damage and wear. Check deflection.	-	4
	O	2	Main brushes and pads	Check for damage, wear, and debris	-	2
	O	3	Recovery tank	Clean tank, top sensor, and check cover seal	-	1
	O	4	Solution tank	Check cover seal	-	1
	O	3	ES machines only: Recovery tank	Clean tank and level sensor	-	2
	O	4	ES machines only: Solution tank	Clean tank and level sensor	-	1
	O	5	Vacuum fan inlet filter, screen, and debris tray	Clean	-	1
	O	6	Cylindrical brushes only: Debris trough	Clean	-	1
	O	20	Sweeping or scrubbing side brush (Option)	Check for damage, wear, debris	-	1 (2)
	O	20	Scrubbing side brush squeegee (Option)	Check for damage, wear, debris	-	1
	O	13	Pre-Sweep side brushes (Option)	Check for damage, wear, debris	-	2
	O	16	Pre-Sweep main bush (Option)	Check for damage, wear, debris	-	1
	O	17	Pre-Sweep debris hopper (Option)	Clean	-	1
	O	26	Live wand vacuum debris tray	Clean	-	1
Weekly	T	11	Battery cells	Check electrolyte level	DW	Multiple
50 Hours	T	1	Side and rear squeegees	Check leveling	-	4
	O	16/17	Pre-Sweep skirts and seals (Option)	Check for damage and wear	-	2
	O	2	Main sweeping brushes (cylindrical)	Main brushes (cylindrical)	-	2

LUBRICANT/FLUID

DW Distilled water.

SPL Special lubricant, Lubriplate EMB grease (Tennant part number 01433-1)

GL SAE 90 weight gear lubricant

HYDO Tennant True premium hydraulic fluid or equivalent

NOTE: More frequent maintenance intervals may be required in extremely dusty conditions.

The table below indicates the Person Responsible for each procedure.

O = Operator.

T = Trained Personnel.

Interval	Person Resp	Key	Description	Procedure	Lubricant/ Fluid	No. of Service Points
50 Hours	O	14	Scrub head skirts (disk)	Check for damage and wear	-	2
	O	24	Solution supply filter	Check screen and clean	-	1
	O	25	Live wand vacuum seals (Option)	Check for damage and wear	-	3
	T	25	High pressure washer (Option)	Change oil (Only after initial 50 hours)	HYDO	1
100 Hours	T	8	Battery watering system (option)	Check hoses and connections for damage and wear	-	Multiple
200 Hours	T	13	Brakes	Check adjustments	-	1
	T	8	Battery terminals and cables	Check and clean	-	Multiple
	T	9	Cylindrical brush drive belts	Check for damage and wear	-	2
	T	18	Pre-Sweep brush drive belt	Check for damage and wear	-	1
	T	22	Drive wheel pivot	Lubricate	SPL	1
	T	15	Steering chain	Lubricate and check for damage and wear.	GL	1
	T	10	Steering gear chain	Lubricate and check for damage and wear	GL	1
500 Hours	T	11	Scrub vacuum fan motor(s)	Check motor brushes	-	2
	O	12	Tires	Check for damage and wear	-	3
800 Hours	T	12	Drive wheel motor	Change oil	HYDO	1
1000 Hours	T	21	Sweeping side brush motors	Check motor brushes (Check every 100 hours after initial 1000 hour check)	-	1 (2)
	T	18	Pre-Sweep main brush motor (Option)	Check motor brushes (Check every 100 hours after initial 1000 hour check)	-	1
	T	19	Pre-Sweep side brush motors (Option)	Check motor brushes (Check every 100 hours after initial 1000 hour check)	-	2

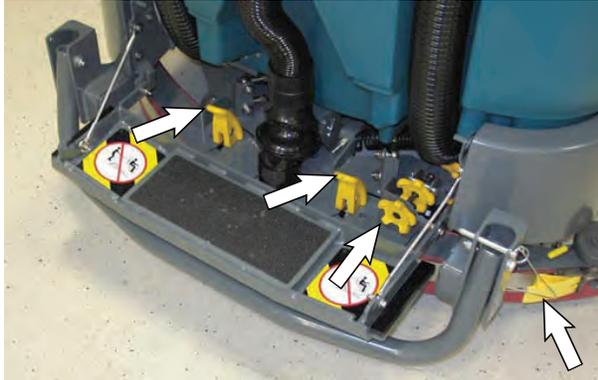
LUBRICANT/FLUID

- DW Distilled water.
- SPL Special lubricant, Lubriplate EMB grease (Tennant part number 01433-1)
- GL SAE 90 weight gear lubricant
- HYDO Tennant True premium hydraulic fluid or equivalent

NOTE: More frequent maintenance intervals may be required in extremely dusty conditions.

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.



LUBRICATION

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

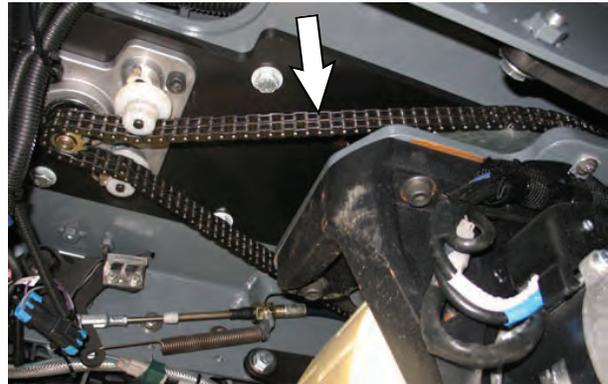
STEERING CHAIN

The steering chain is located on the steering column directly under the control panel. Check for damage or wear and lubricate the steering chain after every 200 hours.



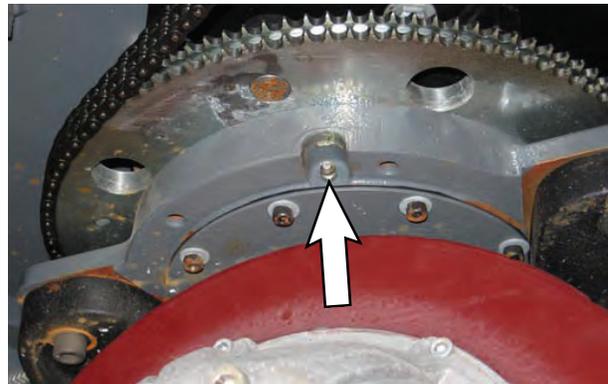
STEERING GEAR CHAIN

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



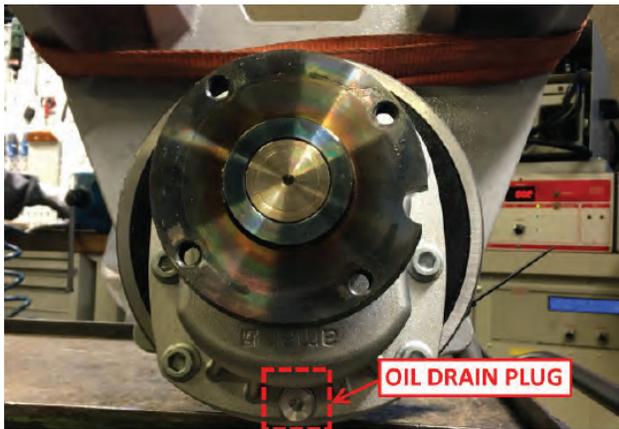
DRIVE WHEEL PIVOT

The drive wheel pivot is located directly above the drive wheel. Lubricate the drive wheel pivot after every 200 hours.



DRIVE WHEEL OIL

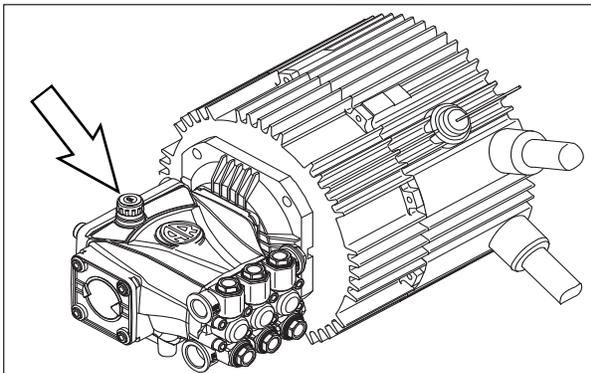
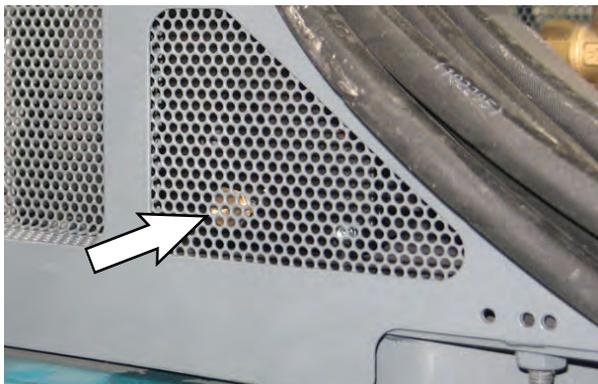
The drive wheel oil plug is located near the bottom of the drive wheel assembly. Change the drive wheel oil after every 800 hours.



HIGH PRESSURE WASHER OIL

Change the high pressure washer oil after the initial 50 hours of high pressure washer operation.

NOTE: Remove high pressure washer cover to access both the high pressure washer drain plug and vented fill cap.



BATTERY



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

The lifetime of the battery depends on proper maintenance. To get the most life from the battery:

- Do not leave the battery partially discharged for long period of time.
- Only charge the battery in a well ventilated area to prevent gas build up. Charge batteries in areas with ambient temperatures 27°C (80°F) or less.
- Maintain the proper electrolyte levels of the flooded (wet) battery by checking levels weekly.

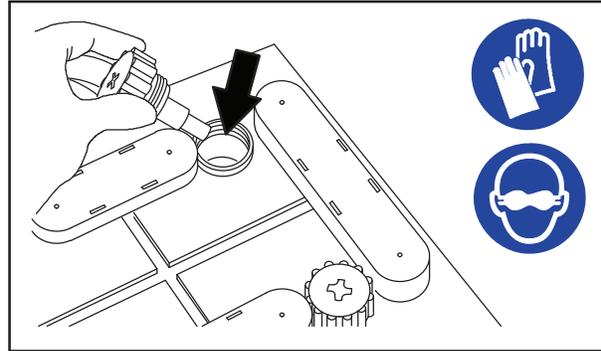
The following steps do not apply if Opportunity charging (See *OPPORTUNITY CHARGING* section).

- Do not charge the battery more than once a day and only after running the machine for a minimum of 15 minutes.
- Allow the charger to completely charge the battery before reusing the machine.

CHECKING THE ELECTROLYTE LEVEL

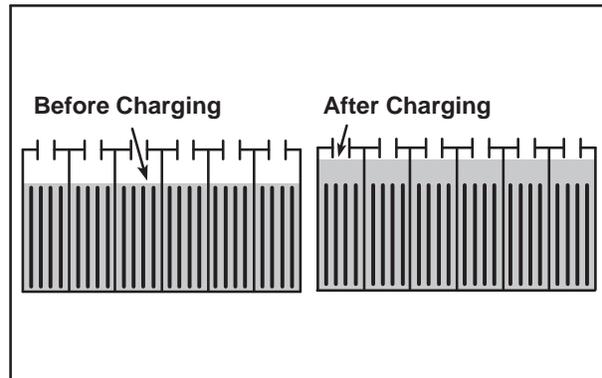
The flooded (wet) lead-acid battery requires routine maintenance as described below. Check the battery electrolyte level weekly.

NOTE: Do Not check the electrolyte level if the machine is equipped with the battery watering system. Proceed to the BATTERY WATERING SYSTEM (OPTION).



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

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



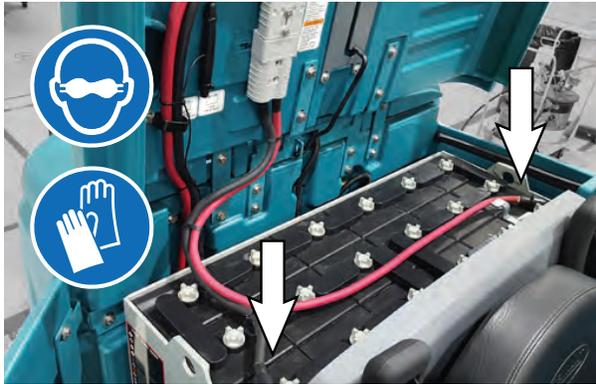
NOTE: Make sure the battery caps are in place while charging. There may be a sulfur smell after charging batteries. This is normal.

MAINTENANCE-FREE BATTERIES

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

CHECKING CONNECTIONS / CLEANING

After every 200 hours of use check for loose battery connections and clean the surface of the batteries, including terminals and cable clamps, with a strong solution of baking soda and water. Replace any worn or damaged wires. Do not remove battery caps when cleaning batteries.



LITHIUM-ION BATTERY PACK

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

- Carefully follow the Important Safety Instructions section in the manual when using the Lithium-ion Battery Model.
- Only use the lithium-ion battery charger supplied with machine.
- Charge battery pack in well-ventilated areas. For best charging performance, charge the battery pack in temperatures below 80°F/27°C and above 32°F/0°C. Battery pack may shut down and not take a charge in elevated or freezing temperatures.
- It is recommended to only recharge battery pack when the discharge level is fully depleted (i.e. when discharge indicator reaches red light). If the red light begins to flash, the scrub function will automatically be disabled. This allows the user to use the remaining power to propel the machine back to charging station. Do not store the machine for a long period at this depleted level, the battery pack may further discharge to a level that is unrecoverable.
- When the machine shuts down due to a depleted battery pack, do not repeatedly cycle the key on and off. This may cause permanent battery pack damage. Recharge battery pack immediately to avoid damage.
- Allow charge cycle to completely charge battery pack.
- Avoid frequent complete charge cycles if battery pack was not fully depleted.
- Opportunity charging (i.e. partial charge cycle of a half hour or more) is only recommended if discharge level is below 80% (i.e. when discharge indicator is at or beyond second green light).
- Do not operate machine in temperatures above 110°F / 43°C or below -4°F / -20°C. Machine may shutdown if exceed these temperatures.
- When removing or replacing the lithium ion battery pack, use non-conductive lifting straps positioned at all four lift points with straps angled at 45° or greater when hoisting battery pack.
- Contact Tennant Service for lithium-ion battery service and replacement.

CHARGING THE BATTERY

IMPORTANT: Before charging, make sure that the machine and charger settings are properly set for the battery type.

NOTE: Use a charger with the proper rating for the batteries to prevent damage to the batteries or reduce the battery life.

NOTE: Do not opportunity charge standard batteries since doing so can shorten battery life.

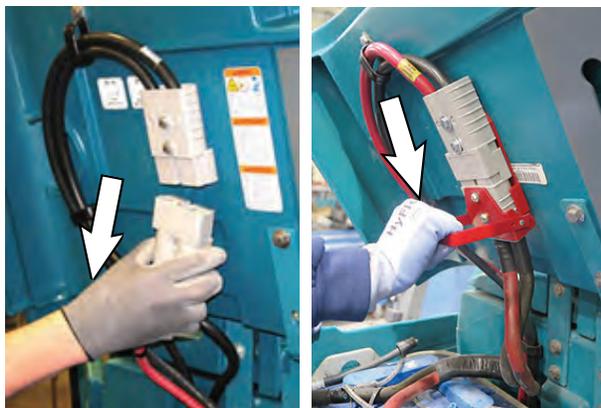
1. Drive the machine to a flat, dry surface in a well-ventilated area.
2. Stop the machine and turn off the machine power.

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

3. Lift the battery compartment top cover open and engage the support.

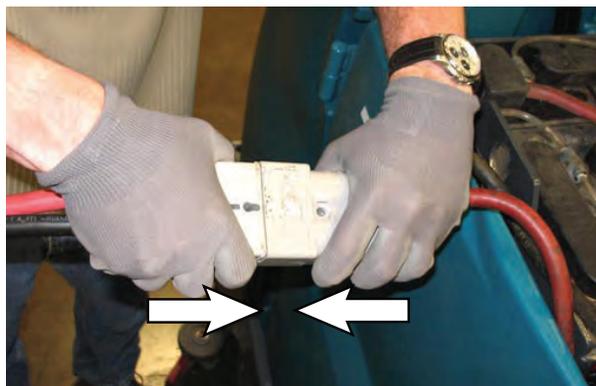
NOTE: Make sure the batteries have the proper electrolyte level before charging. See **CHECKING THE ELECTROLYTE LEVEL.**

4. Plug the charger AC power supply cord into a properly grounded outlet.
5. Disconnect the battery side cable connector from the machine by pulling down on the connector or the battery quick-disconnect lever (option). Do not pull on the cables.



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

6. Connect the charger connector to the battery cable.



TO CHARGE WITH TENNANT BRANDED CHARGER

1. Turn on the battery charger if required.



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

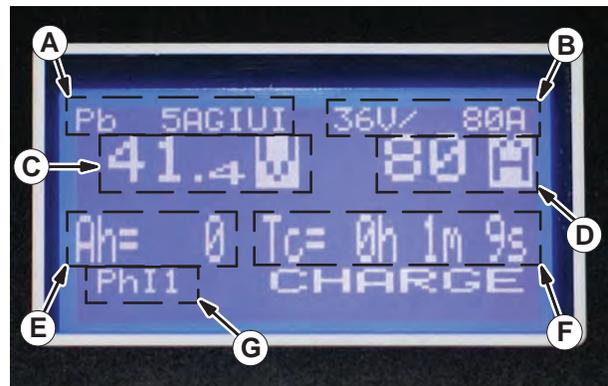
NOTE: If there are charger fault codes when the battery is plugged into the battery charger, the fault codes will appear at the bottom of the charger display. Refer to the battery charger manual for fault code definitions



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



Charger Display:



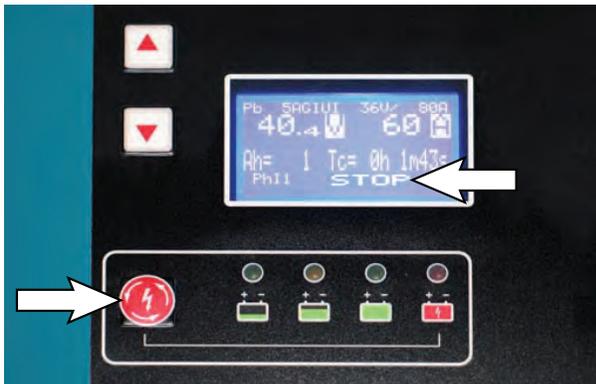
- A. Charge profile number
- B. Charger rating (Volts and Current)
- C. Battery voltage (Volts)
- D. Charger current (Amperes)
- E. Ampere hours charged
- F. Time charged (hours / minutes / seconds)
- G. Charging phase (Phase 1 / Phase 2 / Phase 3 / Maintenance)

MAINTENANCE

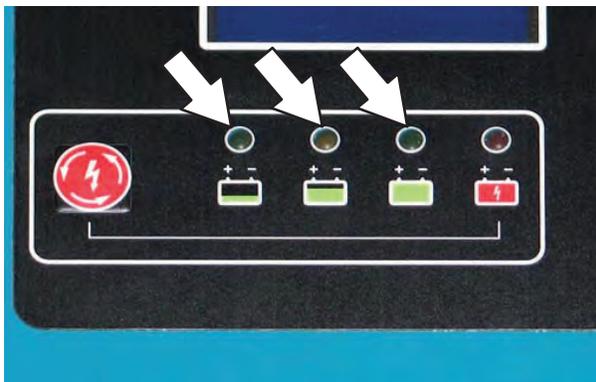
3. If necessary, press the navigation buttons to access additional screens. Press the charger stop / start / enter button to enter selection. The charger will return to the default screen. Refer to manufacturers operator manual for additional information.



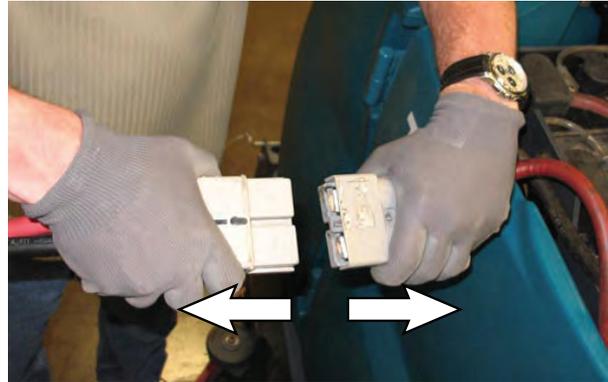
NOTE: If the charger cable must be disconnected from the battery before they are fully charged, press the charger stop / start / enter button to stop charging. Be sure STOP appears on the display and the red stop charge light is illuminated before disconnecting the battery charger cable.



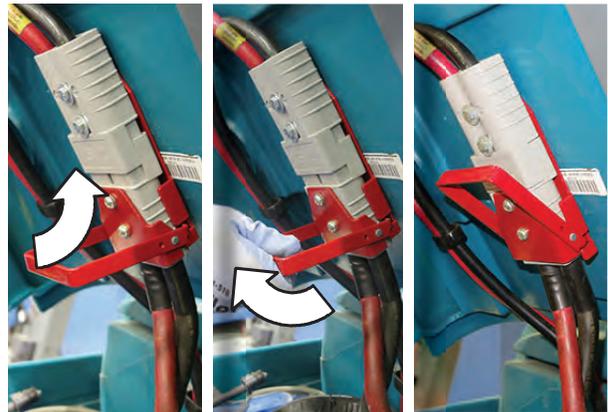
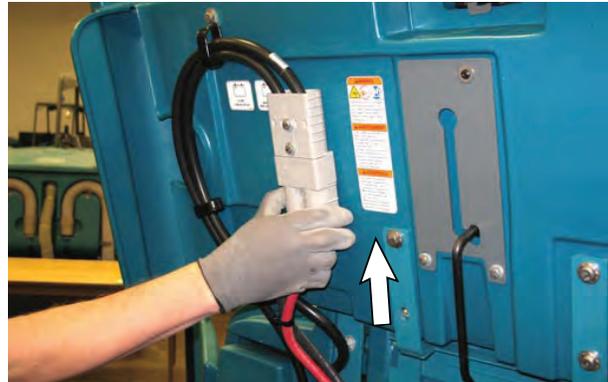
4. The charger status indicators will illuminate from left to the right as the battery is charging. COMPLETE will appear in the display, all the charger status indicators will be illuminated, and the Tennant charger will stop charging when the battery is completely charged.



5. After the batteries have completely charged, disconnect the charger connector from the battery cable connector.



6. Reconnect the battery connector to the machine connector.



FOR SAFETY: When servicing machine 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.

7. Close the battery compartment top cover.

TO CHARGE WITH ENERSYS BATTERY CHARGER

1. Turn on battery charger if required.



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

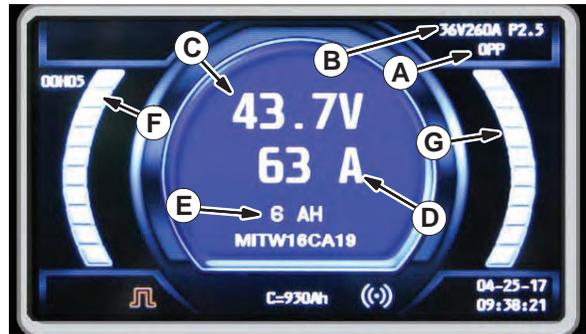
NOTE: If there are charger fault codes when the battery is plugged into the battery charger, the fault codes will appear on the charger display. Refer to the battery charger manual for fault code definitions.



2. Observe the charger display. The charging indicator will illuminate on the display when the battery is charging. This is the charger default screen.



Charger Display:

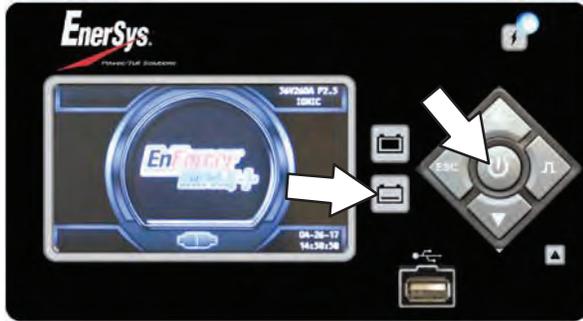


- A. Charge profile number
 - C. Charger rating (Volts and current)
 - D. Battery voltage (Volts)
 - E. Charger current (Amperes)
 - F. Ampere hours charged
 - G. Time charged
 - H. Percent of charge
3. If necessary, press the navigation buttons to access additional screens. Press the charger stop/start/enter button to enter the selection. The charger will return to the default screen. Refer to manufacture's operator manual for additional information.

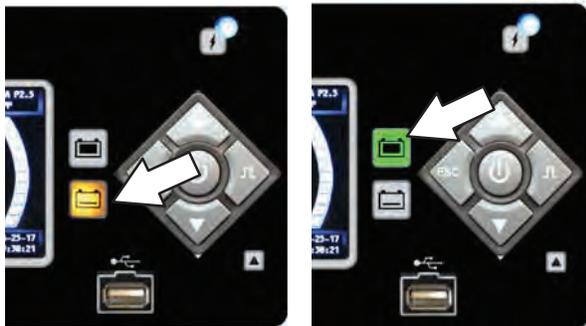


MAINTENANCE

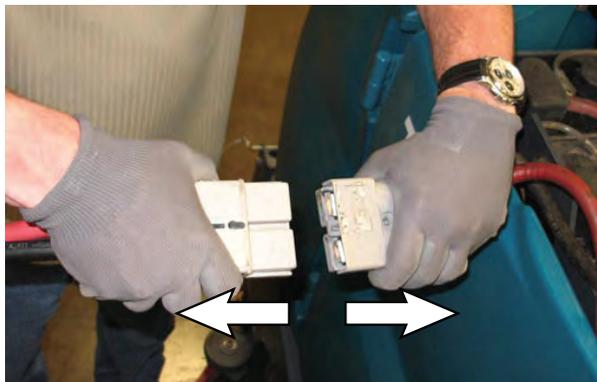
NOTE: If the charger cable must be disconnected from the battery before they are fully charged, press the charger stop / start / enter button to stop charging. Be sure the charging indicator is no longer illuminated before disconnecting the battery charger cable.



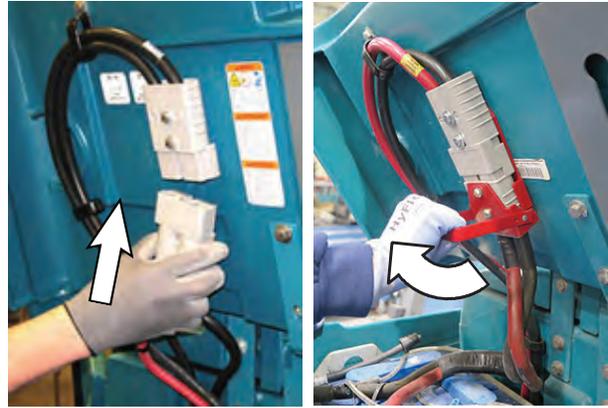
4. The yellow charging indicator will illuminate while the battery is charging. Once the charging is complete the yellow charging indicator light will go out and the green charge complete indicator will be illuminated. The charger will stop charging when the battery is completely charged.



5. After the batteries have completely charged, disconnect the charger connector from the battery cable connector.



6. Reconnect the battery connector to the machine connector.



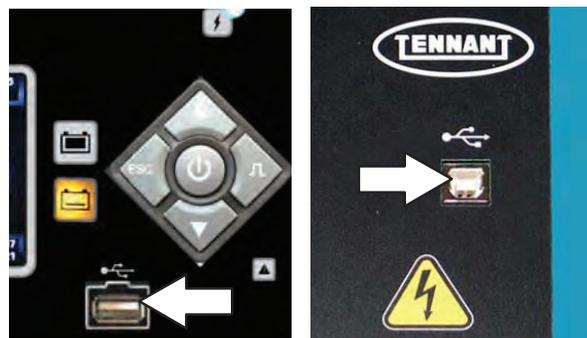
FOR SAFETY: When servicing machine do not disconnect the off-board charger's DC cord from the machine receptacle when the charger is operating. Arcing may result. If the charger must be interrupted during charging, disconnect the AC power supply cord first.

7. Close the battery compartment top cover.

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

BATTERY CHARGER USB PORT

The battery charger USB port is for maintenance computer access to the charger by authorized service personnel only. **Do Not** plug cell phones or other unauthorized electronic devices into the battery charger USB port. **Do Not** plug anything into the USB port while the battery is charging.



OPPORTUNITY CHARGING (OPTION)

Opportunity charging is used to extend machine run time and productivity by allowing batteries to be charged during breaks, lunch, between shifts, or whenever there is an “opportunity” to charge.

Opportunity charging (i.e. partial charge cycle of a half hour or more) is only recommended if discharge level is below 80% (i.e. when discharge indicator is at or beyond second green light).

IMPORTANT: Before charging, make sure that the machine and charger settings are properly set for the battery type.

NOTE: The machine must be equipped with a lithium-ion battery or a battery capable of being opportunity charged. Do not opportunity charge standard batteries since doing so can shorten battery life.

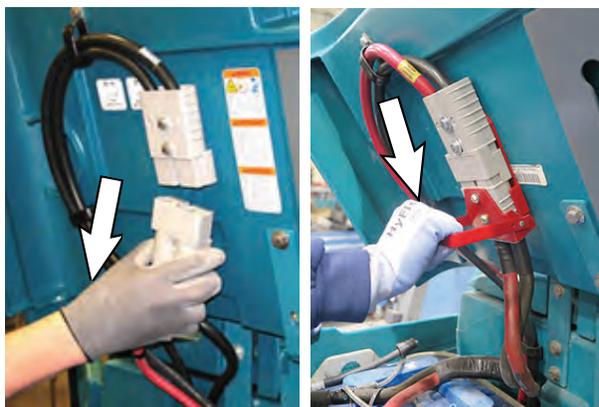
1. Drive the machine to a flat, dry surface in a well-ventilated area.
2. Stop the machine and turn off the machine power.

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

3. Lift the battery compartment top cover open and engage the support.

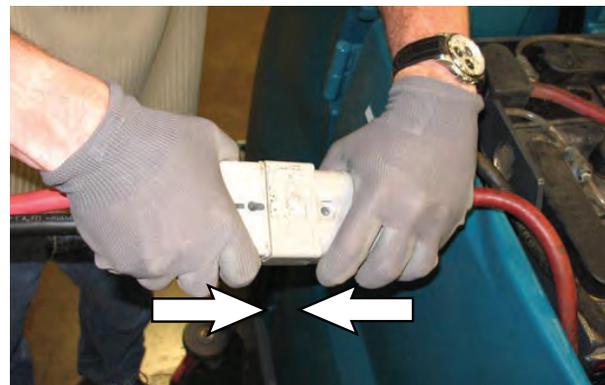
NOTE: Make sure the batteries have the proper electrolyte level before charging. See CHECKING THE ELECTROLYTE LEVEL.

4. Disconnect the battery side cable connector from the machine by pulling down on the connector. Do not pull on the cables.



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

5. Connect the charger connector to the battery cable.



6. The battery will be opportunity charged during the break.

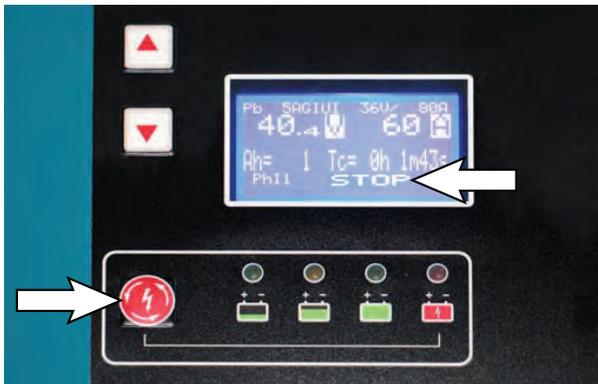
MAINTENANCE

- When ready to start using the machine again press the charger stop / start button to stop the charger.

Lead Acid:

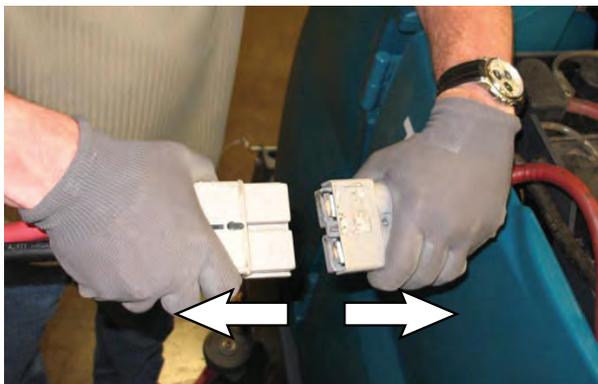


Lithium-Ion:

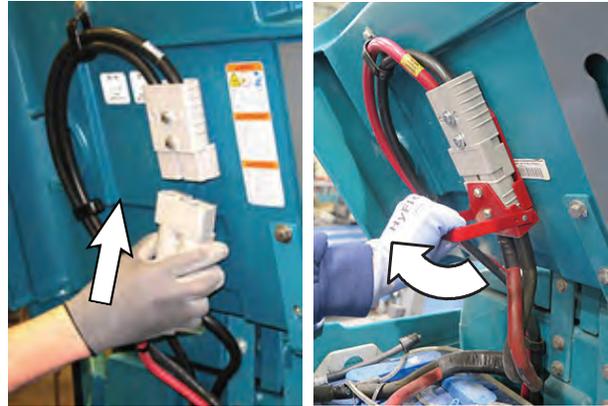


FOR SAFETY: When servicing machine do not disconnect the off-board charger's DC cord from the machine receptacle when the charger is operating. Arcing may result. If the charger must be interrupted during charging, press charger stop / start button to stop charger.

- Disconnect the charger connector from the battery cable connector.



- Reconnect the battery connector to the machine connector.



- Close the battery compartment top cover.

WEEKLY EQUALIZATION CHARGE

The opportunity charger is programmed to automatically provide a full equalization charge at a designated weekly interval.

IMPORTANT: The weekly equalization charge must be completed in its entirety. If it is interrupted during charging, it must be allowed to complete the equalization charge the next time it is started or it could damage the battery or severely shorten the battery life.

NOTE: Sunday is the default day for the charger to conduct a full equalization charge to the battery. The default day can be changed to another day if necessary. Consult a Tennant service representative about changing the default day.

Allow the charger to fully complete the equalization charge. The yellow charging indicator will be illuminated and the charging status will be displayed in the graphic display.



The yellow charging indicator will go out and the green charge complete indicator will be illuminated when the battery equalization charge is complete.



MAINTENANCE

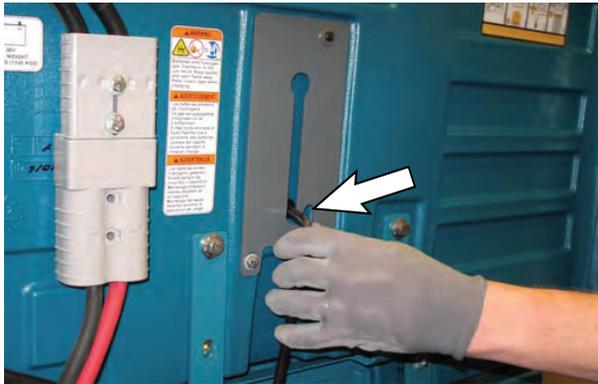
BATTERY WATERING SYSTEM (OPTION)

The optional battery watering system provides a safe and easy way to maintain the proper electrolyte levels in the batteries.

Check the battery watering system hoses and connections for damage or wear after every 100 hours.

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

1. Lift the battery compartment cover open and engage the support.

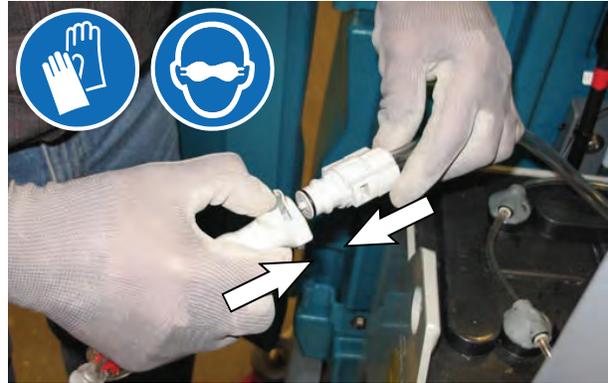


2. Fully charge batteries prior to using the battery watering system. Do not add water to batteries before charging, the electrolyte level will expand and may overflow when charging. See CHARGING THE BATTERIES.
3. Connect the battery watering system hose to the water supply source.

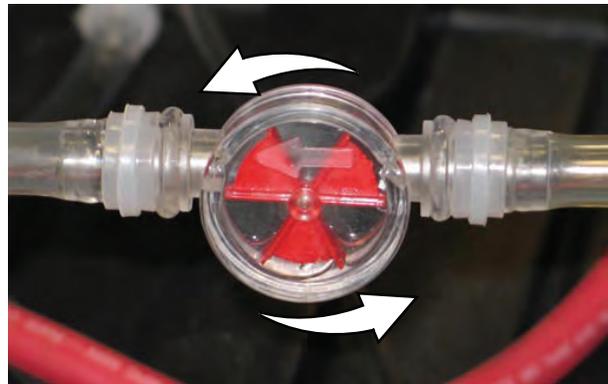
NOTE: Water quality is important to maintain the life of the battery. Always use water that meets battery manufacturer requirements.

NOTE: The water supply to the battery water system must always be 7.57 LPM (2 GPM) or more. Use the purger to confirm the water supply pressure. Refer to manufacturer Operator Manual for additional information.

4. Connect the battery watering system hose to the battery fill hose.



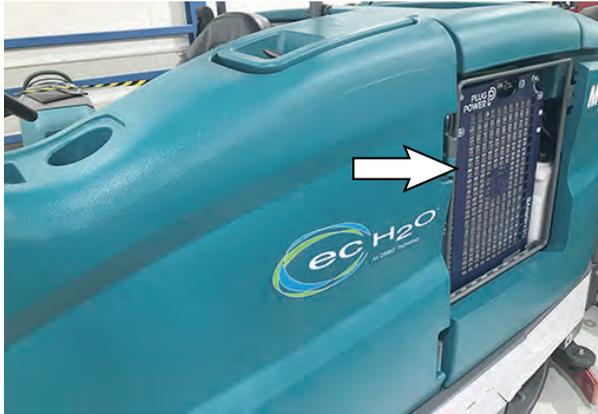
5. Turn on the water supply. The indicator inside the flow indicator will spin. The indicator stops spinning when the batteries are full.



6. Disconnect the battery watering system hose from the water supply hose.
7. Turn off the water supply.
8. After adding water, return the battery watering system hose to the storage location for future use.

FUEL CELL BATTERY (OPTION)

Machines can be equipped for use with fuel cell battery systems. Contact the fuel cell battery provider for all fuel cell battery information.



CIRCUIT BREAKERS, FUSES, AND RELAYS

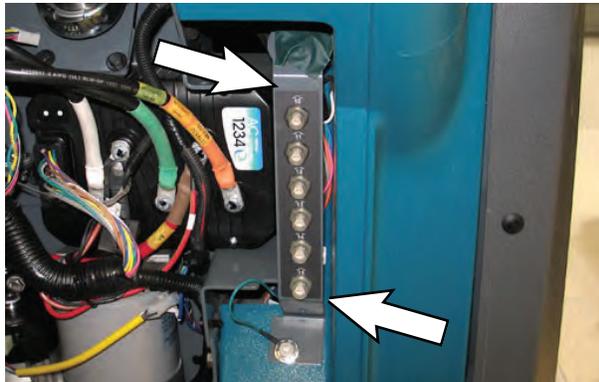
CIRCUIT BREAKERS

Circuit breakers are resettable electrical circuit protection devices designed to stop the flow of current in the event of a circuit overload. Once a circuit breaker is tripped, reset it manually by pressing the reset button after the breaker has cooled down.

Circuit breakers 1 through 9 are located under the operator seat behind the battery compartment side cover.



Circuit breakers 10 through 15 are located behind the steering shroud access panel.



Circuit breaker 16 is located inside the optional light assembly.



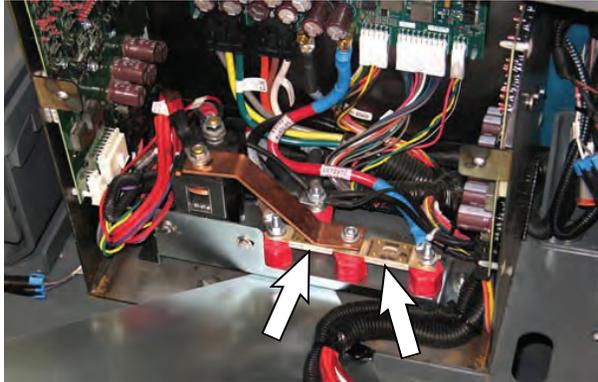
If the overload that caused the circuit breaker to trip is still present, the circuit breaker will continue to stop current flow until the problem is corrected.

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

Circuit Breaker	Rating	Circuit Protected
CB1	60A	Water pickup module
CB2	50A	Pre-Sweep module (Option)
CB3A	20A	Side brush sweep module (Option)
CB3B	35A	Side scrub brush module (Option)
CB4	2.5A	Key switch
CB5	2.5A	Water pick up module
CB6	2.5A	Scrub module
CB7A	-	Not Used
CB7B	2.5A	Pre-Sweep module (Option)
CB7C	2.5A	Side brush scrub module (Option)
CB8	2.5A	ec-H2O power module (Option)
CB9	2.5A	ec-H2O pump module (Option)
CB10	15A	Spray nozzle (Option)/High pressure washer (Option)
CB11	15A	Lights (Option)
CB12	2.5A	Headlights/Taillights
CB13	2.5A	Strobe light/Flashing light on overhead guard (Option)
CB14	2.5A	Strobe light/Flashing light on recovery tank (Option)
CB15	15A	Power steering (Option)
CB16	2.5A	Backup alarm/light (Option)

FUSES

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



The fuses are located in the control box behind the circuit breaker panel or inline on harnesses and cables.

Fuse	Rating	Circuit Protected
Fuse-1	150A	Propelling
Fuse-2	100A	Scrub module power
Fuse-3	2A	Telemetry (inline, Option)
Inline fuse	100A	High pressure washer (Option)
Inline fuse	40A	Live wand (Option)

RELAYS

Relays are electrical switches that open and close under the control of another electrical circuit. Relays are able to control an output circuit of higher power than the input circuit. The relays are located in the control box behind the circuit breaker panel.

Refer to the table below for the relays and circuits controlled.

Relay	Rating	Circuit Controlled
M1	36 VDC, 200 A	Main contactor
M2	36 VDC, 5 A	Backup alarm / light (Option)
M3	36 VDC, 100 A	Auxiliary line contactor

ELECTRIC MOTORS

Inspect the carbon brushes on the scrubbing vacuum fan motors after every 500 hours of operation. Inspect the carbon brushes on the scrubbing side brush motors after the first 1000 hours of operation and every 100 hours after the initial check. Refer to the table below for carbon brush inspection intervals.

Carbon Brush Inspection	Hours
Side brush motors - Sweeping (Option)	1000*
Pre-Sweep motors (Option)	1000*
Vacuum fan motor	500
High pressure washer motor (Option)	1000**

**Inspect carbon brushes every 100 hours after the initial 1000 hour change.*

***Inspect after 1000 high pressure washer hours, not machine hours.*

SOLUTION SUPPLY FILTER

Check the solution supply filter screen after every 50 hours of operation and clean if necessary. Lower the scrub head for easier access.

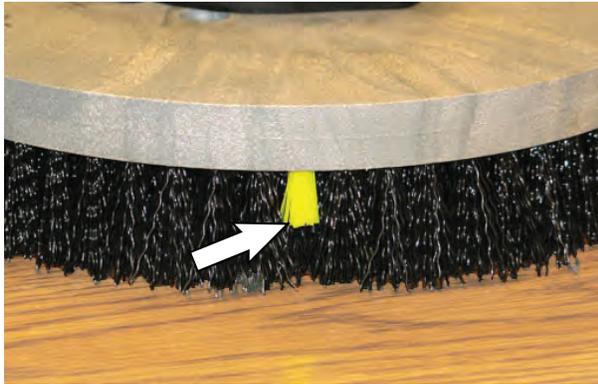


SCRUB BRUSHES

The machine can be equipped with either disk or cylindrical scrub brushes. Check scrub brushes daily for wire or string tangled around the brush or brush drive hub. Also check brushes or pads for damage and wear.

DISK BRUSHES AND PADS

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



Cleaning pads must be placed on pad drivers before they are ready to use. The cleaning pad is held in place 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 DISK SCRUB BRUSHES OR PAD DRIVERS

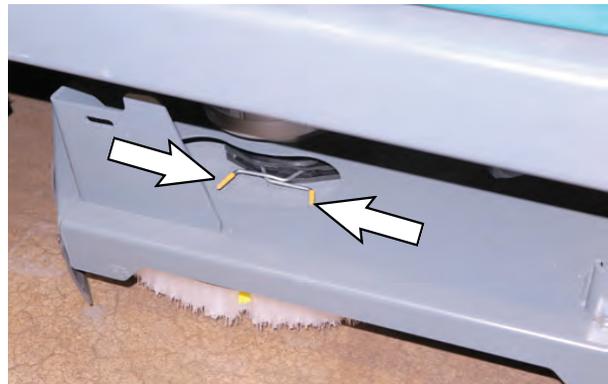
1. Raise the scrub head.
2. Turn off the machine.

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

3. Open the main brush access door and side squeegee support door.



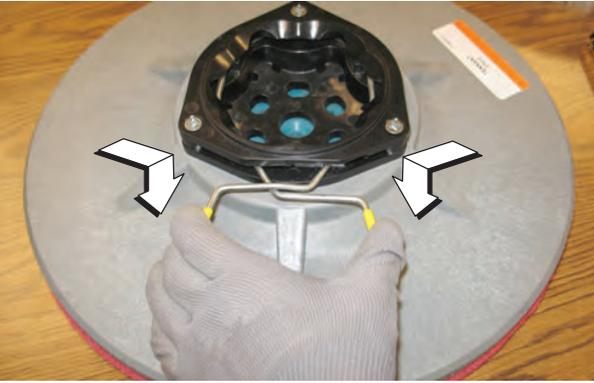
4. Turn the brush until the spring handles are visible.



5. Squeeze the spring handles and let the brush drop to the floor. Remove the brush from under the scrub head.



6. Set the brush spring open on the new brush to make installation easier.



7. Push the new brush under the scrub head, align the brush drive socket with the brush drive hub, and lift the brush up onto the brush drive hub until the brush locks onto the hub.



8. Ensure the brush is securely mounted on the brush drive hub.
9. Close and secure the squeegee support door and close the main brush access door.
10. Repeat procedure for the other brushes.

REPLACING DISK SCRUB PADS

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



3. Remove the scrub pad from the pad driver.



4. Flip or replace the scrub pad. Center the scrub pad on the pad driver and reinstall the center disk to secure the pad in place on the pad driver.
5. Reinstall the pad driver onto the machine.

MAINTENANCE

CYLINDRICAL SCRUB BRUSHES

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

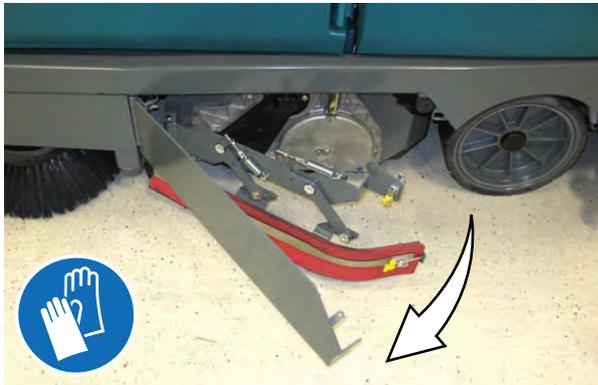
Replace the brushes when they no longer clean effectively.

NOTE: Replace worn brushes in pairs. Scrubbing with brushes of unequal bristle length will result in diminished scrubbing performance.

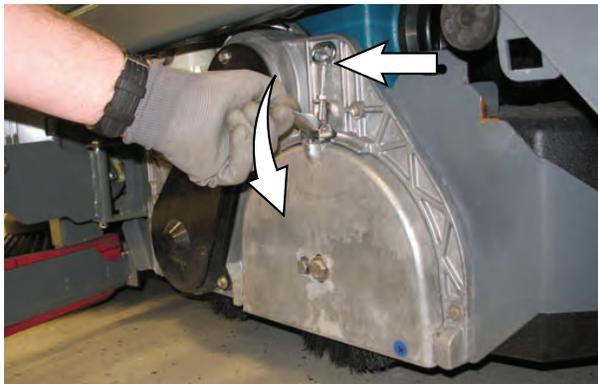
REPLACING CYLINDRICAL SCRUB BRUSHES

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

1. Open the main brush access door and side squeegee support door.



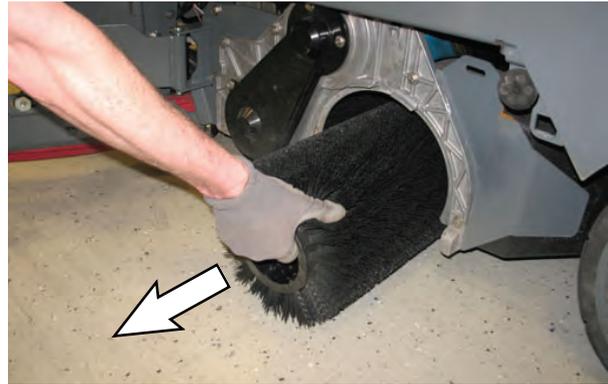
2. Lift the idler plate retainer handle and unhook the retainer ring from the idler plate hook.



3. Remove the idler plate from the scrub head.

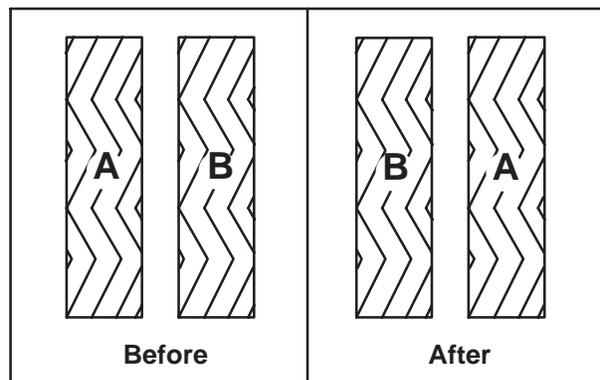


4. Remove the brush from the scrub head.



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

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



- Slide the idler plate up into the scrub head.



- Secure the idler plate into place with the idler plate retainer.



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

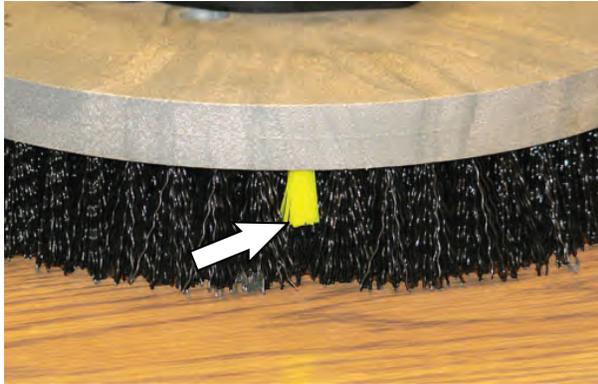
- Close and secure the squeegee support door and close the main brush access door.
- Repeat for the brush on the other side of the scrub head.

SIDE BRUSH(ES) (OPTION)

Check the side brush(es) daily for wear or damage. Remove any tangled string or wire from the side brush(es) or side brush drive hubs.

REPLACING THE SCRUBBING SIDE BRUSH

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



1. Raise the side brush assembly and turn off the machine.

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

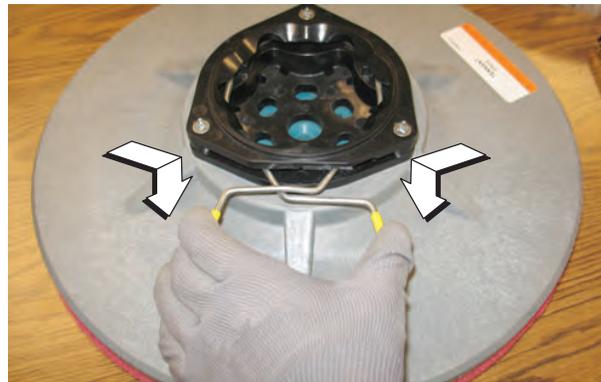
2. Squeeze the spring handles and let the side brush drop to the floor.



3. Remove the side brush from under the side brush assembly.



4. Set the brush spring open on the new brush to make installation easier.



5. Place the new side brush underneath the side brush assembly and lift the side brush up onto the side brush hub until the brush locks onto the hub.

REPLACING THE SWEEPING SIDE BRUSHES

Replace the brushes when they no longer clean effectively.

1. Raise the side brush assembly and turn off the machine.

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

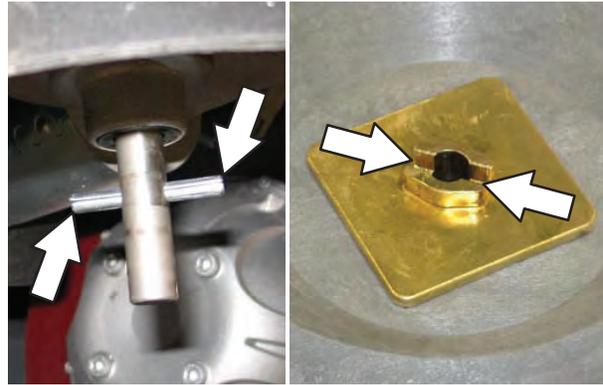
2. Reach into the center of the brush and remove the cotter pin and washer holding the brush and the retainer to the hub.



3. Remove the side brush and retainer from under the side brush assembly.



4. Place the side brush underneath the side brush assembly and align the channel in the retainer with the retainer pin in the side brush hub.



5. Lift the side brush, retainer, and washer up onto the side brush hub and reinstall the cotter pin into the hub.

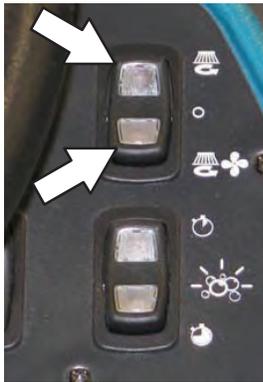
PRE-SWEEP BRUSHES (OPTIONAL)

The Pre-Sweep assembly is equipped with disk side brushes and a cylindrical main brush. Check the brushes daily for wire or string tangled around the brush or brush drive hub. Check the brushes daily for damage and wear.

REPLACING THE PRE-SWEEP SIDE BRUSHES

Replace the brushes when they no longer clean effectively.

1. Turn on the machine.
2. Press the Pre-Sweep switch to raise the Pre-Sweep assembly and stop sweeping.



Standard Panel



Pro-Panel

3. Turn off the machine.

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

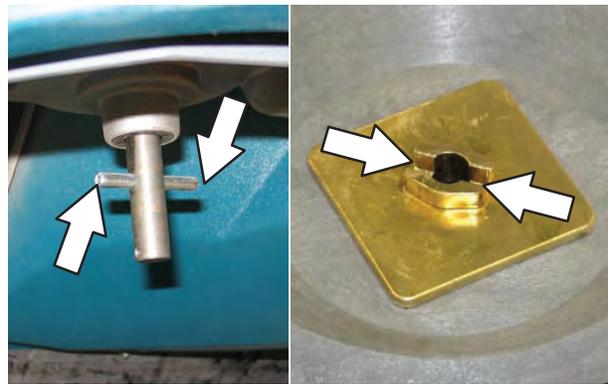
4. Reach into the center of the brush and remove the cotter pin holding the brush and the retaining washer to the hub.



5. Remove the side brush and retaining washer from under the Pre-Sweep assembly.



6. Place the new side brush underneath the side brush and align the channel in the side brush receptacle with the two brush locks on the side brush hub.



7. Lift the side brush up onto the side brush hub, hold the side brush onto the hub, install the retaining washer onto the hub, and reinstall the cotter pin into the hub.

REPLACING THE PRE-SWEEP CYLINDRICAL BRUSH

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

Replace the brush when it no longer cleans effectively.

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

1. Turn off the machine.
2. Loosen both Pre-Sweep cover latches.



3. Lift the Pre-Sweep cover, lock the cover open, and engage the Pre-Sweep cover support.



4. Loosen and remove the left brush arm knob.



5. Remove the left brush arm.



6. Remove the three knobs holding the Pre-Sweep side skirt and side skirt plate to the Pre-Sweep assembly.



MAINTENANCE

7. Remove the side skirt plate and side skirt from the Pre-Sweep assembly.



8. Remove the cylindrical brush and replace with a new brush.



9. Guide the slotted end of the new brush onto the drive hub.
10. Reinstall the side skirt, side skirt plate, and left brush arm.

SQUEEGEE BLADES

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

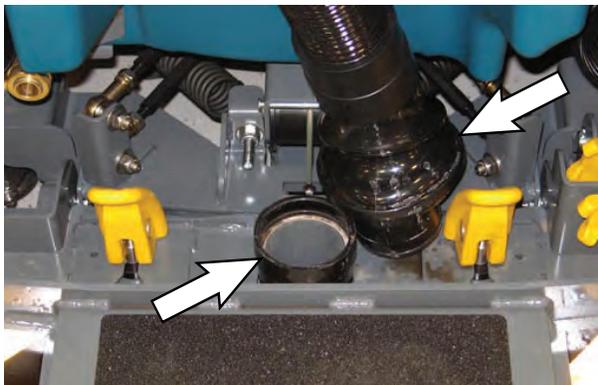
Check the deflection of the squeegee blades daily or when scrubbing a different type of surface. Check the leveling of the rear squeegee every 50 hours of operation.

REPLACING (OR ROTATING) THE REAR SQUEEGEE BLADES

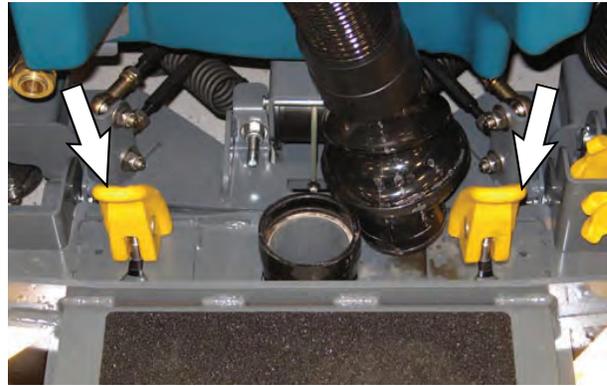
1. If necessary, lower the *rear bumper door / step*.

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

2. Disconnect the vacuum hose from the rear squeegee assembly



3. Loosen both squeegee mounting handles.

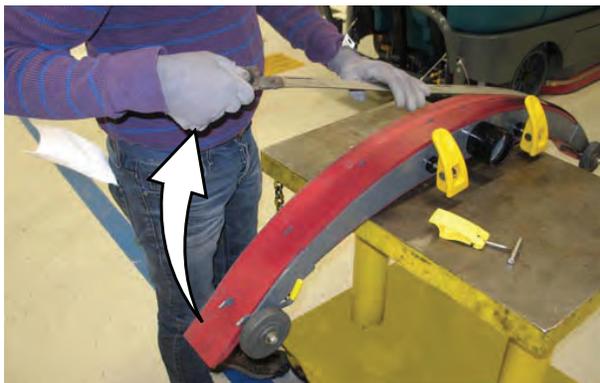


4. Pull the rear squeegee assembly from the machine.



MAINTENANCE

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



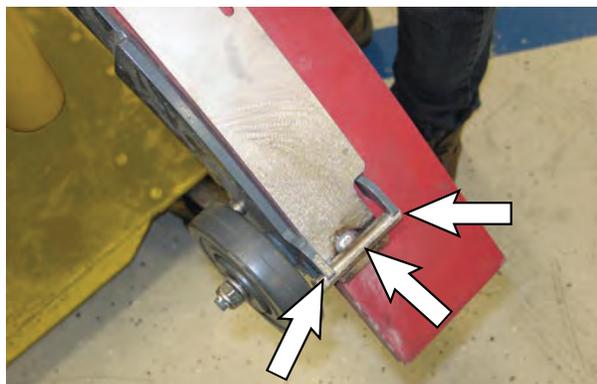
6. Remove the rear squeegee from the squeegee assembly.



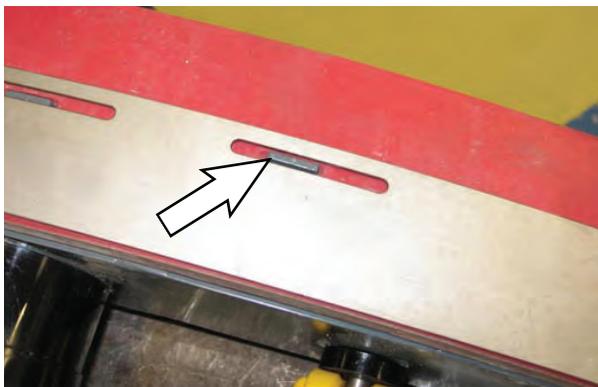
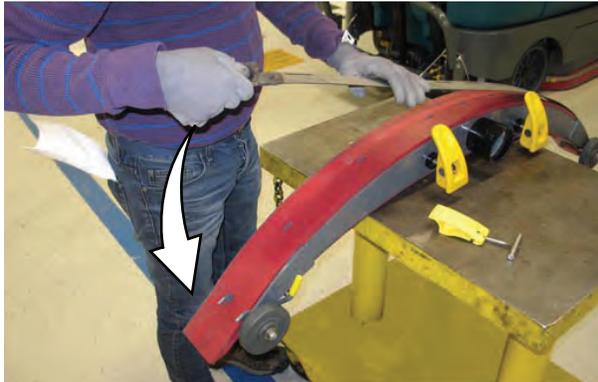
7. Place the rotated or new squeegee blade onto the rear squeegee assembly. Be sure the squeegee is securely attached on each tab on the rear squeegee assembly.



8. Insert the hinge end of the retainer into the hooks in the rear squeegee assembly.

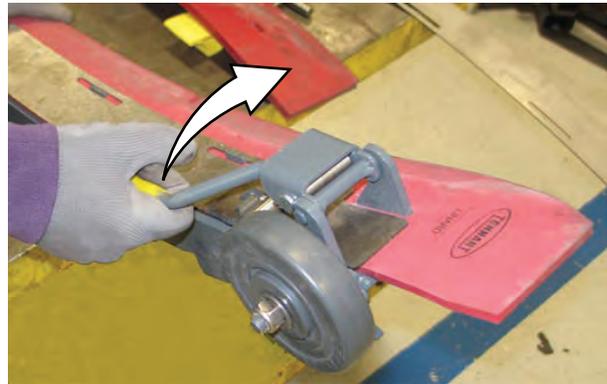


9. Install the retainer along the rest of the squeegee assembly, align the tabs on the squeegee assembly into the slots in the retainer, and tighten the latch onto the other end of the squeegee assembly.



10. Turn the rear squeegee assembly over to access the front of the squeegee assembly.

11. Loosen the front retainer latch and remove the latch and the retainer from the squeegee assembly.



12. Remove the front squeegee from the squeegee assembly.

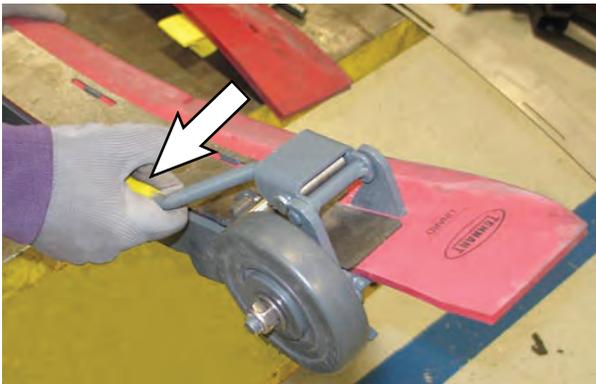
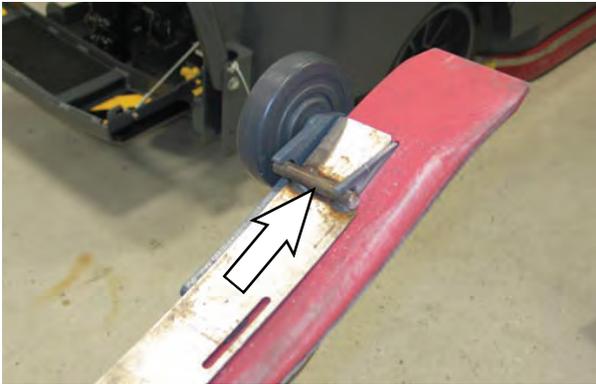


MAINTENANCE

13. Install the rotated or new squeegee blade onto the squeegee assembly. Be sure the holes in the squeegee blade are hooked onto the tabs.



14. Install the front squeegee retainer onto the rear squeegee assembly.



15. Reinstall the rear squeegee assembly onto the machine
16. Raise the *rear bumper door / step* if it was lowered to access the rear squeegee assembly.

LEVELING THE REAR SQUEEGEE

Leveling the squeegee ensures the entire length of the squeegee blade is in even contact with the surface being scrubber.

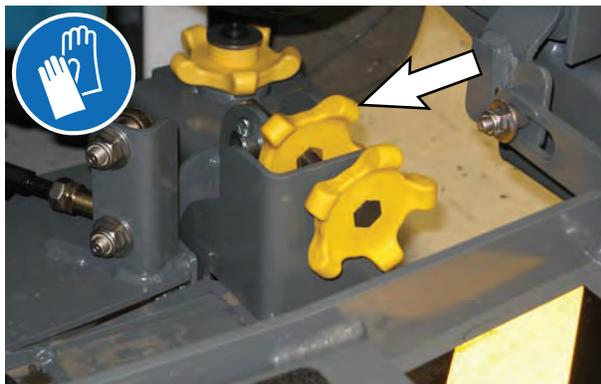
1. Lower the squeegee and drive the machine several meters (feet) forward and slowly bring the machine to a stop.
2. Check the squeegee deflection over the full length of the squeegee blade.

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

3. Lower the *rear bumper door / step*.
4. If the deflection is not the same over the full length of the blade, use the tilt adjust knob to make adjustments.

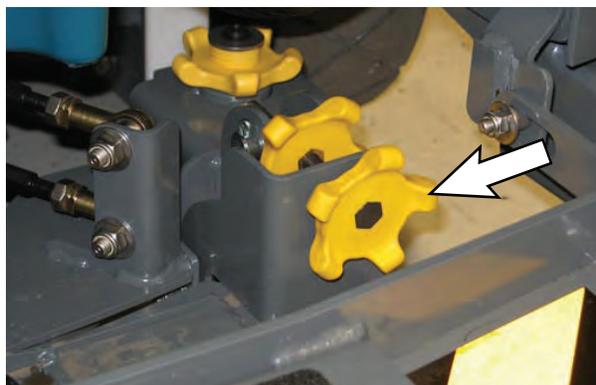
DO NOT disconnect the vacuum hose from the squeegee frame when leveling squeegee.

5. To adjust the squeegee leveling, loosen the tilt lock knob.



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

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



7. Tighten the tilt lock knob.
8. Drive the machine forward with the squeegee down to recheck the squeegee blade deflection if adjustments were made.
9. Readjust the squeegee blade deflection if necessary.
10. Raise the Rear bumper door / step when finished leveling the rear squeegee.

ADJUSTING THE REAR SQUEEGEE BLADE DEFLECTION

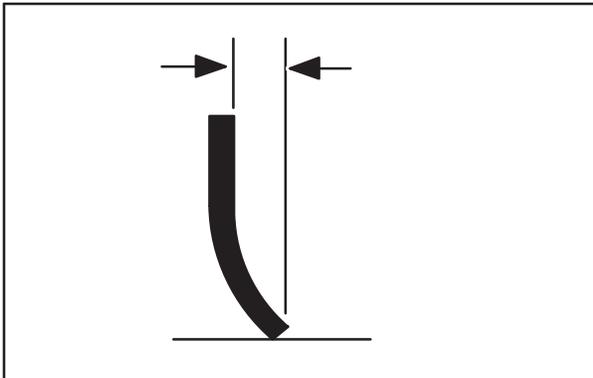
Deflection is the amount of curl the overall squeegee blade has when the machine moves forward. The best deflection is when the squeegee wipes the floor dry with a minimal amount of deflection.

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

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

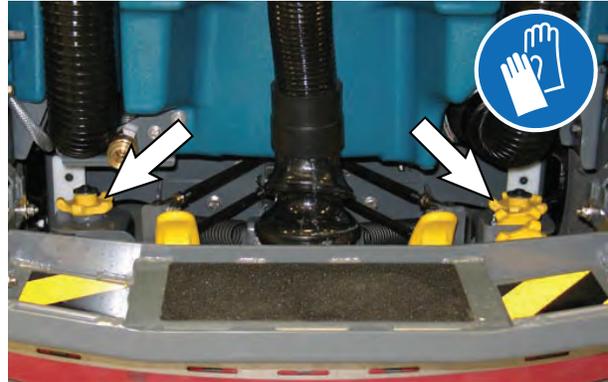
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, set parking brake, and remove key.

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

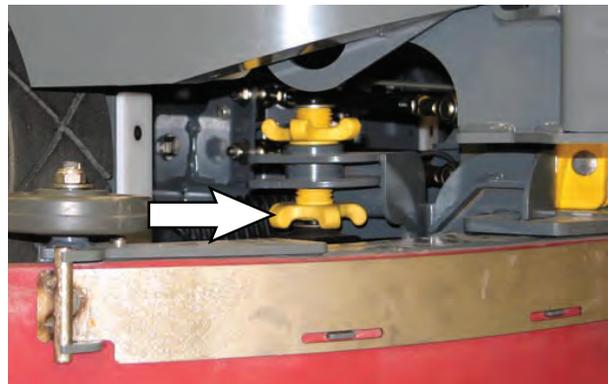


3. Lower the *rear bumper door / step*.

4. To adjust the overall squeegee blade deflection, loosen the lock knobs on both sides of the machine.



5. Turn the adjustment knobs clockwise to increase deflection or counterclockwise to decrease deflection.



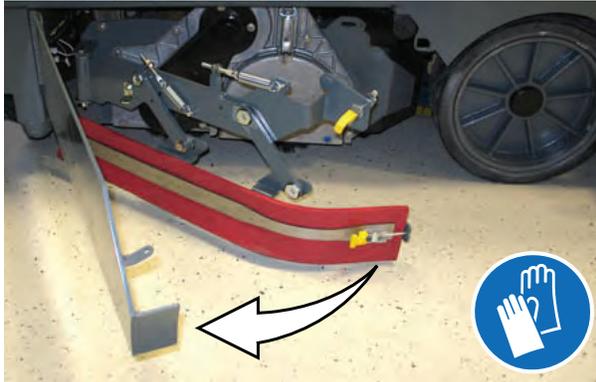
6. Retighten the lock knobs.
7. Drive the machine forward again to recheck the squeegee blade deflection.
8. Readjust the squeegee blade deflection if necessary.
9. Raise the *rear bumper door / step* when finished adjusting the rear squeegee blade deflection.

REPLACING OR ROTATING THE SIDE SQUEEGEE BLADES

1. If necessary, raise the scrub head.

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

2. Open the main brush access door and side squeegee support door.



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



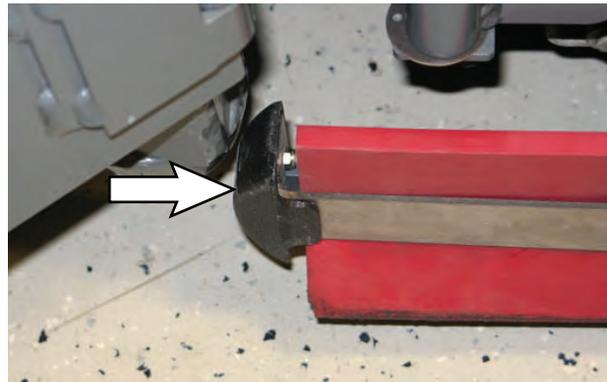
4. Remove the retaining band from the side squeegee assembly.



5. Remove the squeegee blade from the side squeegee assembly.



6. Install the rotated or new rear squeegee blade onto the side squeegee assembly.
7. Hook the retaining band onto the retaining band retainer tab on the side squeegee assembly.



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



9. Close and secure the squeegee support door and close the main brush access door.
10. Repeat for the side squeegee on the other side of the scrub head.

MAINTENANCE

REPLACING OR ROTATING THE SIDE BRUSH SQUEEGEE BLADES (OPTION)

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

Check the side brush squeegee blades for damage and wear daily. Replace or rotate a blade if the leading edge is torn or worn half-way through the thickness of the blade.

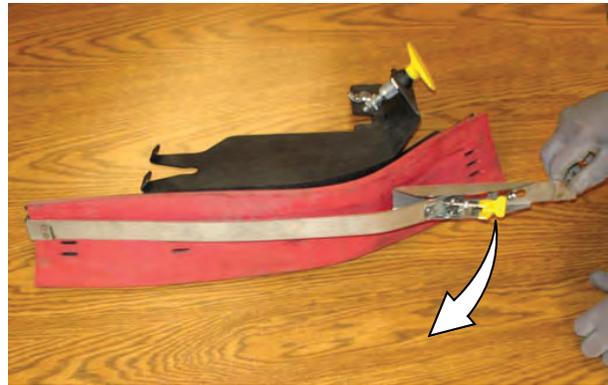
1. Loosen the side brush squeegee assembly handle and remove the squeegee assembly from the machine.



2. Loosen the retaining band latch.



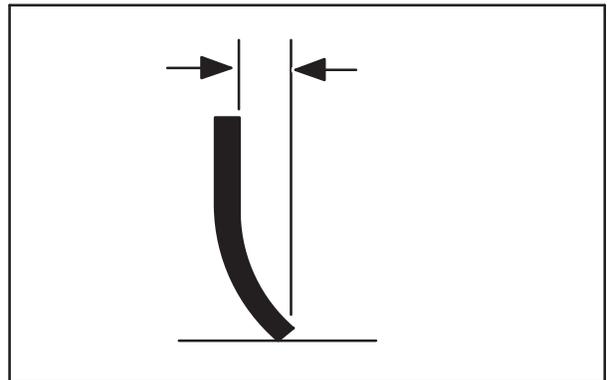
3. Remove the retaining band, squeegee blades, and spacer from the squeegee frame.



NOTE: Observe which squeegee slots were installed on the squeegee frame before removing the squeegee.



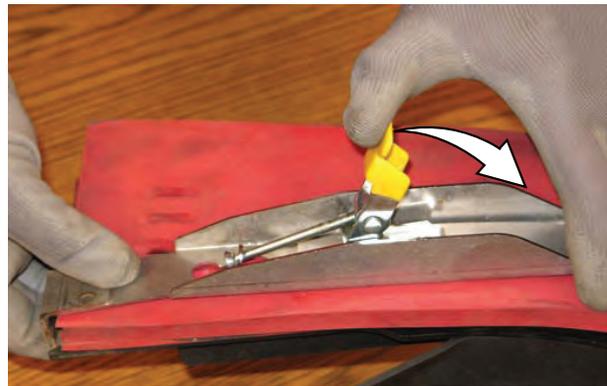
NOTE: The squeegee blade(s) have slots for adjusting the squeegee blade deflection. Install / reinstall squeegees so the deflection is approximately 12 mm (0.50 in) for smooth floors and 15 mm (0.62 in) for rough floors.



4. Install the rotated / new squeegee blades, spacer, and retaining band onto the side brush assembly. Be sure the holes in the squeegee blade are hooked onto the tabs.



5. Fasten the side brush retaining band latch.



6. Reinstall the side brush squeegee assembly onto the side brush assembly.

SKIRTS AND SEALS

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

RECOVERY TANK SEAL

Check the recovery tank cover seal for damage and wear daily.



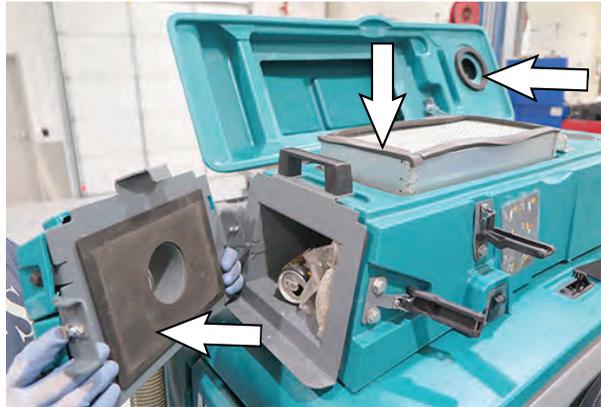
SOLUTION TANK SEAL

Check the solution tank cover seal for damage and wear daily.



LIVE WAND VACUUM SEALS (OPTION)

Check the live wand vacuum seals for damage and wear after every 50 hours of operation.



SCRUB HEAD SKIRTS (DISK SCRUB HEADS ONLY)

Check the scrub head skirts for damage and wear after every 50 hours of operation.



PRE-SWEEP SKIRTS (OPTION)

The Pre-Sweep skirts are located around the Pre-Sweep main brush.



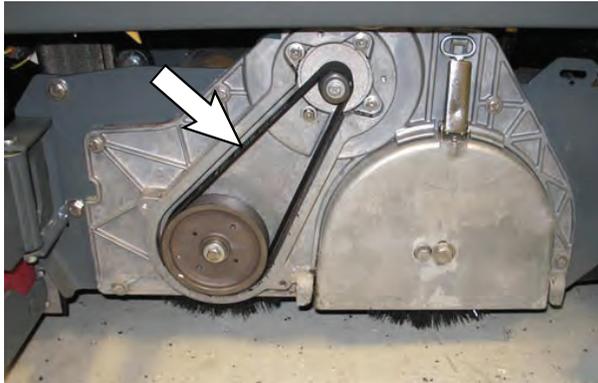
Check the skirts for damage and wear after every 50 hours of operation.

BELTS

CYLINDRICAL BRUSH DRIVE BELTS

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

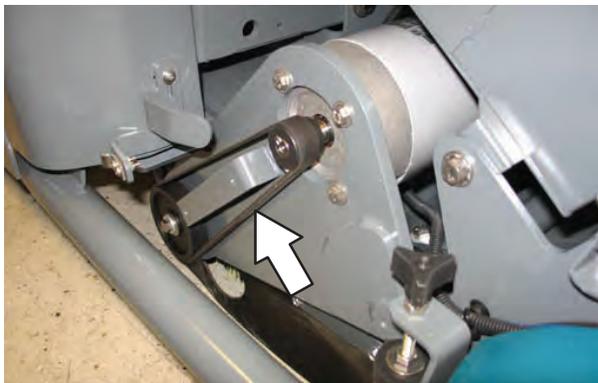
The brush drive belts are located on the cylindrical brush scrub head. Check the belts for damage and wear after every 200 hours of operation.



PRE-SWEEP BRUSH DRIVE BELT (OPTION)

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

The Pre-Sweep brush drive belt is located inside the Pre-Sweep assembly on the right side of the cylindrical brush. Check the belt for damage and wear after every 200 hours of operation.



BRAKES

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

The foot brake and the parking brake operate the linkage that controls the brakes on the rear wheels.

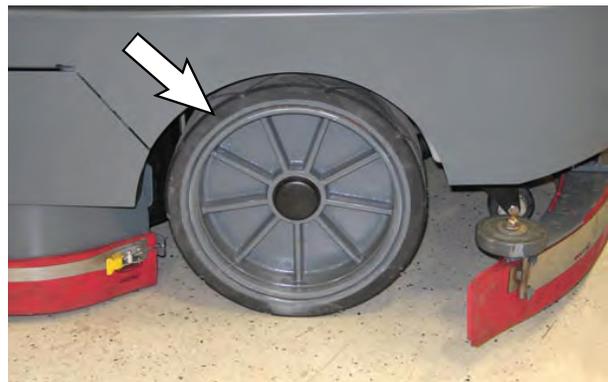
The foot pedal should not travel more than 25 mm (1 in) to engage the brake. Check the brake adjustment after every 200 hours of operation.



TIRES

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

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



PUSHING, TOWING, AND TRANSPORTING THE MACHINE

PUSHING OR TOWING THE MACHINE

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

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

ATTENTION! Do not push or tow machine for a long distance or damage may occur to the propelling system.

TRANSPORTING THE MACHINE

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

1. Raise the squeegee, scrub head, and brushes.

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

2. Park the trailer on a level surface and apply parking brake.
3. Position the machine at the loading edge of the truck or trailer.

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

FOR SAFETY: When loading/unloading machine onto/off truck or trailer, do not load/unload on ramp inclines that exceed 21% / 12° grade.

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

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

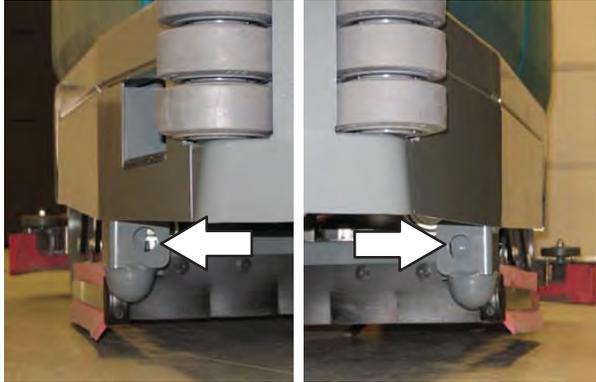
FOR SAFETY: When loading/unloading machine onto/off truck or trailer, stop on a level surface, set parking brake and leave the key in the ON position until all tie-down straps are secure.

NOTE: The drive wheel dynamic brake system is active when the key is in the ON position.

5. Lower the scrub head and rear squeegee.

MAINTENANCE

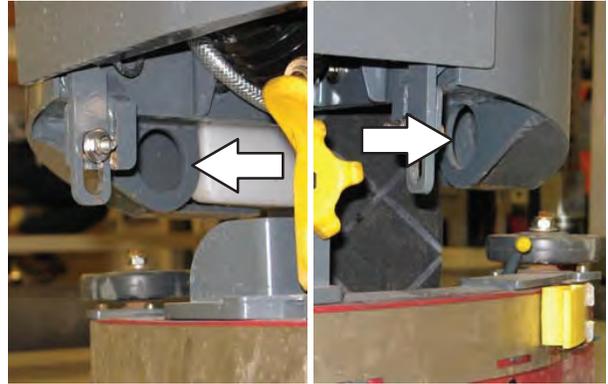
6. Place a block behind each wheel to prevent the machine from rolling.
7. Connect the tie-down straps to the right and left stabilizers in front of the machine.



Machines with optional scrubbing side brush only: Connect one tie down strap to the step located on top the scrubbing side brush assembly and the other to the stabilizer located on the other side of the machine.



8. Connect the tie-down straps to the holes in the rear jacking brackets at the rear of the machine.



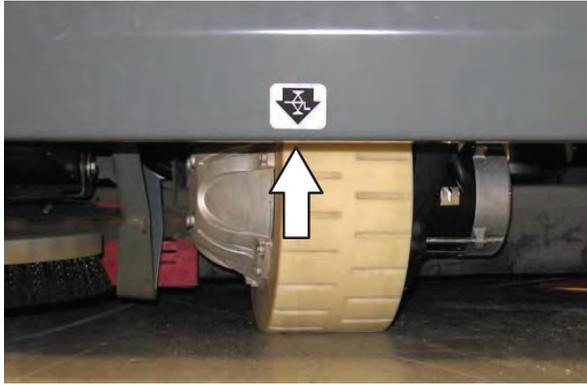
9. Turn off machine and remove the key after the machine is secured.

MACHINE JACKING

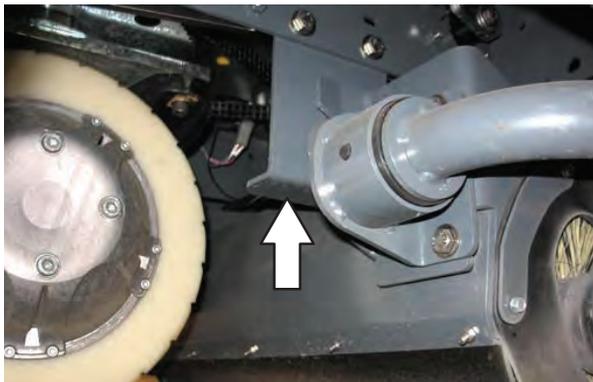
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, set parking brake, and remove key.

Empty the recovery and solution tanks before jacking the machine.

Jacking point locations at the front of all machines.



Jacking point locations at the front of machines equipped with the Pre-Sweep option.



Jacking point location at the rear of all machines.



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

ec-H2O MODULE FLUSH PROCEDURE

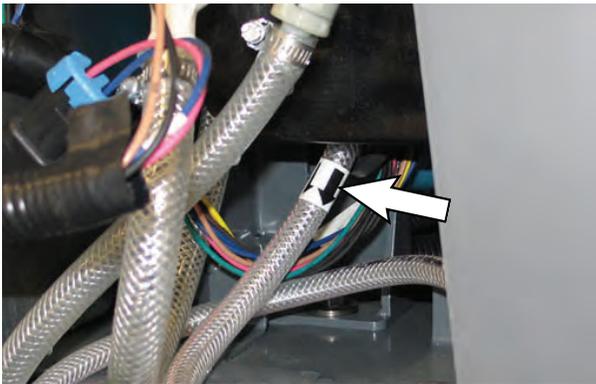
This procedure is only required when the red indicator light begins to flash and there is an audible alarm.

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

1. Open the right shroud to access the ec-H2O assembly.
2. Press the connector button to disconnect the outlet hose from the ec-H2O manifold.



NOTE: Look for arrows on the hose near where the hose is coming from the bottom of the ec-H2O assembly to determine which hose is the outlet hose.



3. Remove the drain hose from the ec-H2O compartment.

4. Connect the drain hose to the ec-H2O outlet hose.



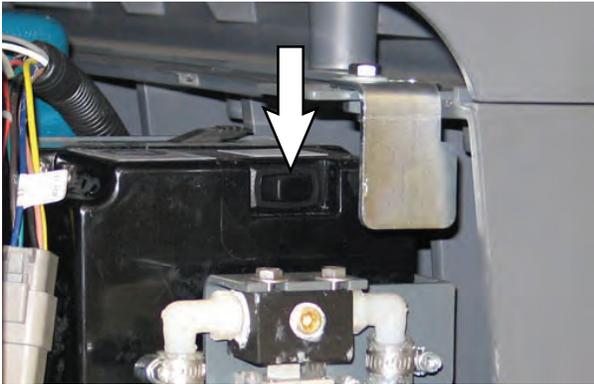
5. Place the drain hose into a empty container.



6. Pour 2 gallons (7.6 liters) of white or rice vinegar into the solution tank.



7. Turn on the machine.
8. Press and release the ec-H2O module flush switch to start the flush cycle.



NOTE: The module will automatically shut off when the flush cycle is complete (approximately 7 minutes). The module must run the full 7-minute cycle in order to reset the system indicator light and alarm.

9. Pour 2 gallons (7.6 liters) of cool clean water into the solution tank.
10. Press and release the flush switch to rinse any remaining vinegar from the module. After 1-2 minutes, press the flush switch to turn off the module.
11. Disconnect the drain hose from the *ec-H2O* manifold hose.
12. Reconnect the outlet hose to the *ec-H2O* manifold hose.
13. Return the drain hose to storage location in the *ec-H2O* compartment.
14. Close the right shroud.

STORAGE INFORMATION

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. Thoroughly drain and rinse the solution and recovery tanks.
4. Store the machine in a dry area with the squeegee and scrub head in the up position.

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

5. Open the recovery tank cover 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

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

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

1. Completely drain the solution tank, recovery tank, and detergent tank.

2. Pour 7.6 L (2 gal) of Propylene Glycol Based/Recreational Vehicle (RV) antifreeze into the solution tank.



3. Machines equipped with optional detergent tank only: Pour 1.9 L (1/2 gal) of Propylene Glycol Based/Recreational Vehicle (RV) antifreeze into the detergent tank.

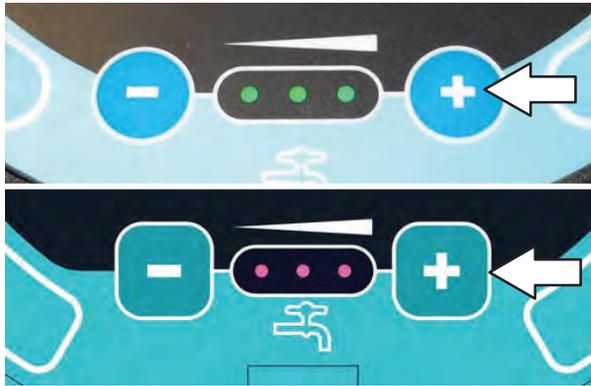


NOTE: Machines equipped with optional ES system will need to fill the pump lines with Propylene Glycol Based/Recreational Vehicle (RV) antifreeze.

4. Turn on the machine.
5. Press the *1-STEP* button.



- Repeatedly press the *solution increase button (+)* until the solution flow is at the highest setting.



Standard Panel



Pro-Panel

- Machines with severe environment switch option only: Press the bottom of the severe environment switch or the severe environment button to activate the severe environment scrubbing system.

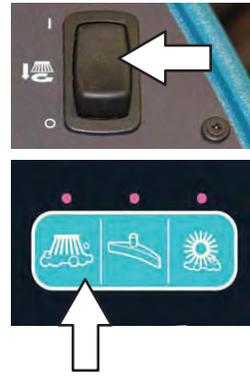


Standard Panel



Pro-Panel

- Machines with scrubbing side brush option only: Press the side brush switch or side brush button to activate the side brush.



Standard Panel



Pro-Panel

- Drive the machine to circulate the antifreeze completely through all the systems and clear out any remaining water.
- Machines with scrubbing side brush option only: Press the side brush switch to turn off the side brush.
- Stop the machine.
- Machines with spray nozzle option only: Operate the wand for a few seconds to protect the pump.
- Machines with high pressure washer option only: Prime the high pressure washer with the antifreeze and operate the high pressure washer for a few seconds to protect the pump. See PRIMING THE HIGH PRESSURE WASHER PUMP.
- Press the 1-STEP button to turn off the system.
- Turn off the machine.
- The remaining antifreeze does not need to be drained from the solution tank, recovery tank, or detergent tank.

MAINTENANCE

PREPARING THE MACHINE FOR OPERATION AFTER STORAGE

All antifreeze must be completely cleaned from the scrubbing system before the machine can be used for scrubbing.

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

1. Completely drain all antifreeze from the solution tank.
2. Rinse out the solution tank. Refer to *DRAINING AND CLEANING THE SOLUTION TANK* in the *OPERATION* section for instructions how to clean the solution tank.
3. Pour 11.4 L (3 gal) of cool clean water into the solution tank.

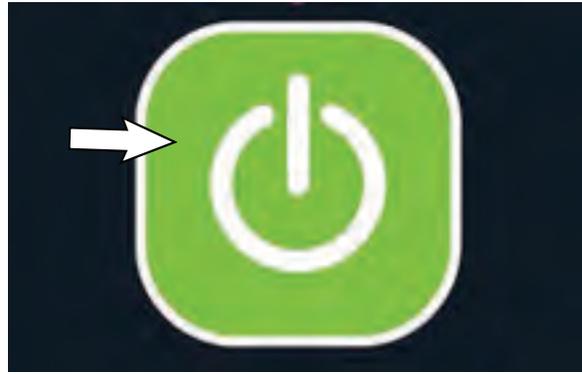


4. Machines equipped with optional detergent tank only: Pour 1.9 L (1/2 gal) of cool clean water into the detergent tank.

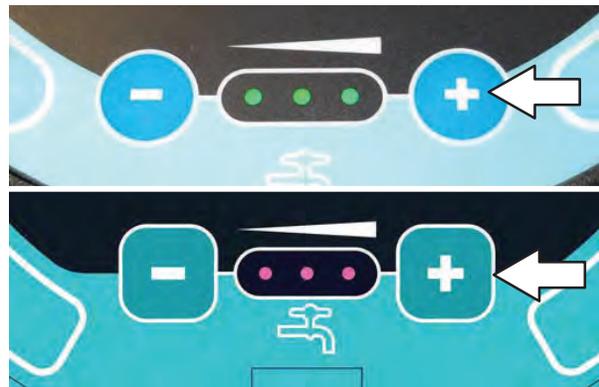


5. Turn on the machine.

6. Press the 1-STEP button.



7. Repeatedly press the solution increase button (+) until the solution flow is at the highest setting.



Standard Panel



Pro-Panel

NOTE: The ec-H2O systems on machines equipped with ec-H2O must be primed before the machine is ready for operation. See PRIMING THE ec-H2O SYSTEM for additional instructions.

8. Machines with severe environment switch option only: Press the bottom of the severe environment switch or the severe environment button to activate the severe environment scrubbing system.

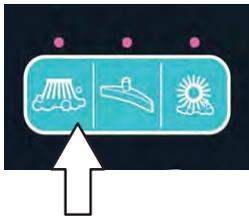


Standard Panel

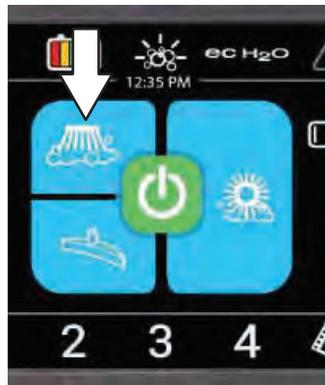


Pro-Panel

9. Machines with scrubbing side brush option only: Press the side brush switch or side brush button to activate the side brush.



Standard Panel



Pro-Panel

10. Drive the machine until all water and antifreeze is emptied from the tanks.

11. **Machines with scrubbing side brush option only:** Press the side brush switch to turn off the side brush.

NOTE: Machines equipped with optional ES system will need to drain the antifreeze from the pump lines.

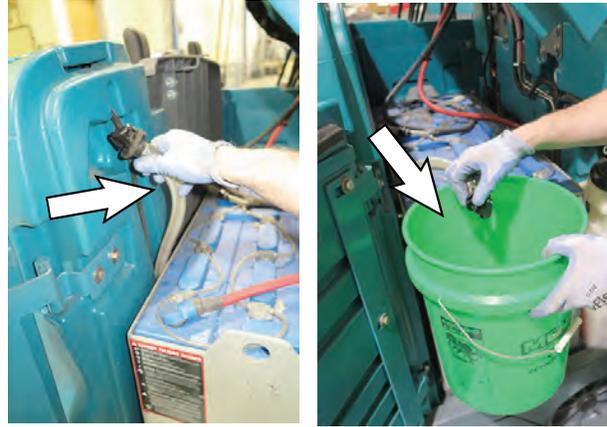
12. Stop the machine.

- 13. Machines with spray nozzle option only:**

Operate the wand for a few seconds to clean the antifreeze from the pump.

14. Press the *1-STEP* button to turn off the system.

- 15. Machines with high pressure washer option only:** Unhook the return line to the solution tank and place into a bucket.



Operate the pressure washer for a few seconds to drain antifreeze from the pump. Release the trigger for a few more seconds which will drain the antifreeze from the return line into the bucket. Turn off the pressure washer switch and reconnect the return line to the solution tank.



WARNING: Do not spray people or animals. Severe personal injury can result. Wear eye protection. Hold sprayer with two hands.



16. Turn off the machine.

PRIMING THE *ec-H2O* SYSTEM

Prime the *ec-H2O* system if the machine has been stored for a long period with no water in the solution tank / *ec-H2O* system.

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

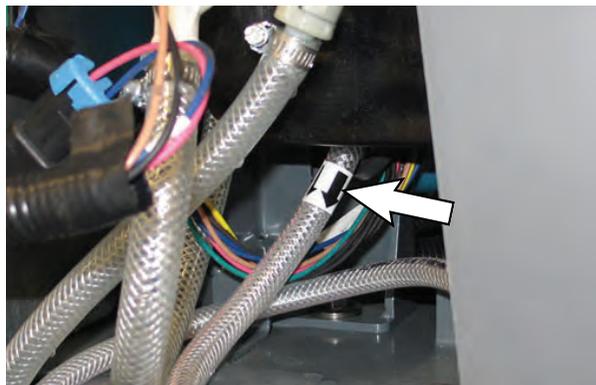
1. Fill the solution tank with clean cool water. See *FILLING THE SOLUTION TANK* section of this manual.



2. Open the right shroud to access the *ec-H2O* assembly.
3. Press the connector button to disconnect the outlet hose from the *ec-H2O* manifold.



NOTE: Look for arrows on the hose near where the hose is coming from the bottom of the *ec-H2O* assembly to determine which hose is the outlet hose.



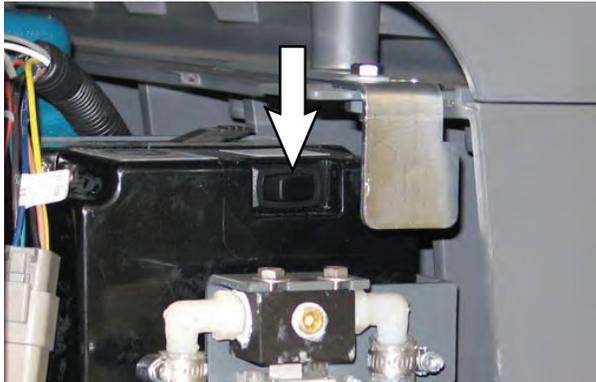
4. Remove the drain hose from the *ec-H2O* compartment.
5. Connect the drain hose to the *ec-H2O* outlet hose.



6. Place the drain hose into a empty container.



7. Turn on the machine.
8. Press and release the *ec-H2O* module flush switch. Allow the system to drain water into the container for 2 minutes.



9. Press the *ec-H2O* module flush switch to shut off the system.
10. Disconnect the drain hose from the *ec-H2O* manifold hose.
11. Reconnect the outlet hose to the *ec-H2O* manifold hose.
12. Place the drain hose back into the *ec-H2O* compartment.
13. Close the right shroud.

TROUBLESHOOTING

INITIAL TROUBLESHOOTING MATRIX

Use the Troubleshooting Matrix to begin preliminary troubleshooting. Some errors may be caused by a blocked vacuum hose or debris preventing the actuator(s) from moving in the complete range of motion. Always check these items before conducting more labor intensive troubleshooting procedures.

TROUBLESHOOTING MATRIX

Output	Pin(s)	Enable	Input	Disable	Input
Vacuum Fan, Scrubbing	Combo Module (Water Pickup): Fan #1 <i>J7-1, J7-2</i> Fan #2 <i>J7-3, J7-4</i>	1-Step ON	Interface Module	1-Step OFF	Interface Module
		Squeegee/Vacuum ON	Interface Module	Squeegee/Vacuum OFF	Interface Module
				Recovery Tank Full	Combo Module (Water Pickup), <i>J6-10 Low</i>
				Low Battery Voltage	Propel Controller, <i>J1-1 ≈ < 32 VDC</i>
				Circuit Fault	CAN to Interface Module
Rear Squeegee Down	Combo Module (Water Pickup): <i>J6-17, J6-18</i>	1-Step ON	Interface Module	1-Step OFF	Interface Module
		Squeegee/Vacuum ON	Interface Module	Squeegee/Vacuum OFF	Interface Module
				Reverse Propel	Propel Controller, <i>J1-33 High</i>
				Recovery Tank Full	Combo Module (Water Pickup), <i>J6-10 Low</i>
				Low Battery Voltage	Propel Controller, <i>J1-1 ≈ < 32 VDC</i>
				Circuit Fault	CAN to Interface Module
Main Scrub Brushes	Main Scrub/Solution Delivery Module: Left Motor <i>J10-1, J10-2, J10-3, J9-1, J9-2, J9-3, J9-4, J9-5</i> Right Motor <i>J11-4, J11-5, J11-6, J9-6, J9-7, J9-8, J9-9, J9-10</i>	1-Step ON	Interface Module	1-Step OFF	Interface Module
		Main Scrub Selected	Interface Module	Main Scrub Deselected	Interface Module
		Forward/Reverse Command	Propel Controller, <i>J1-16 ≈ 0.2-5 VDC</i>	Neutral - Ready State	Propel Controller, <i>J1-16 ≈ 0 VDC</i>
				Recovery Tank Full	Combo Module (Water Pickup), <i>J6-10 Low</i>
				Solution Tank Empty	Main Scrub/Solution Delivery Module, <i>J4-1 ≈ < 0.73 VDC</i>
				Low Battery Voltage	Propel Controller, <i>J1-1 ≈ < 32 VDC</i>
				Circuit Fault	CAN to Interface Module

TROUBLESHOOTING

Output	Pin(s)	Enable	Input	Disable	Input
Scrub Head Down	Main Scrub/Solution Delivery Module: <i>J4-9, J4-10</i> <i>(J4-9, J4-18, J4-10, J4-14 Module #1243629 only)</i>	1-Step ON	Interface Module	1-Step OFF	Interface Module
		Scrub Selected	Propel Controller, <i>J1-6 ≈ 0.2-5 VDC</i>	Scrub Deselected	Propel Controller, <i>J1-6 ≈ 0 VDC</i>
				Recovery Tank Full	Combo Module (Water Pickup), <i>J6-10 Low</i>
				Solution Tank Empty	Main Scrub/Solution Delivery Module, <i>J4-1 ≈ < 0.73 VDC</i>
				Low Battery Voltage	Propel Controller, <i>J1-1 ≈ < 32 VDC</i>
Circuit Fault	CAN to Interface Module				
Side Scrub Brush Extend/Down (Option)	Side Scrub Module (Option): <i>J4-7, J4-8</i>	1-Step ON	Interface Module	1-Step OFF	Interface Module
		Side Scrub Brush Selected	Side Scrub Module (Option), <i>J4-6 Ground</i>	Side Brush Deselected	Side Scrub Module, <i>J4-6 Not Grounded</i>
				Recovery Tank Full	Combo Module (Water Pickup), <i>J6-10 Low</i>
				Solution Tank Empty	Main Scrub/Solution Delivery Module, <i>J4-1 ≈ < 0.73 VDC</i>
				Low Battery Voltage	Propel Controller, <i>J1-1 ≈ < 32 VDC</i>
Circuit Fault	CAN to Interface Module				
Side Scrub Brush Motor (Option)	Side Scrub Module (Option): Motor <i>J6-1, J6-2, J6-3, J4-11, J4-12, J4-14, J4-15 J4-16</i>	1-Step ON	Interface Module	1-Step OFF	Interface Module
		Side Brush Selected	Side Scrub Module (Option), <i>J4-6 Ground</i>	Side Brush Deselected	Side Scrub Module, <i>J4-6 Not Grounded</i>
				Neutral - Ready State	Propel Controller, <i>J1-16 ≈ 0 VDC</i>
				Recovery Tank Full	Combo Module (Water Pickup), <i>J6-10 Low</i>
				Solution Tank Empty	Main Scrub/Solution Delivery Module, <i>J4-1 ≈ < 0.73 VDC</i>
Low Battery Voltage	Propel Controller, <i>J1-1 ≈ < 32 VDC</i>				
Circuit Fault	CAN to Interface Module				

Output	Pin(s)	Enable	Input	Disable	Input
Solution Control (Conventional)	Main Scrub/ Solution Delivery Module: Main Valve <i>J4-17, CB-6</i> Side Scrub Module (Option): Side Pump <i>J4-10, CB-7</i> Side Valve <i>J4-9, CB-7</i>	1-Step Scrub ON	Interface Module	1-Step OFF	Interface Module
		Main Scrub Selected	Interface Module	Main Scrub Deselected	Interface Module
		Forward/Reverse Command	Propel Controller, <i>J1-16 ≈ 0.2-5 VDC</i>	Neutral - Ready State	Propel Controller, <i>J1-16 ≈ 0 VDC</i>
		Side Scrub Selected	Side Scrub Module (Option), <i>J4-6 ≈ Grounded</i>	Side Scrub Deselected	Side Scrub Module, <i>J4-6 ≈ Not Grounded</i>
				Recovery Tank Full	Combo Module (Water Pickup), <i>J6-10 Low</i>
				Solution Tank Empty	Main Scrub/Solution Delivery Module, <i>J4-1 ≈ < 0.73 VDC</i>
				Low Battery Voltage	Propel Controller, <i>J1-1 ≈ < 32 VDC</i>
		Circuit Fault	CAN to Interface Module		
Solution Control <i>ec-H2O</i> (Option)	<i>ec-H2O</i> Module: Side Brush. Valve <i>J4-5, CB-8</i> Pump <i>J4-4, CB-9</i> Sparger <i>J5-1, J5-2</i> <i>e-Cell</i> <i>J5-3, J5-4</i>	1-Step ON	Interface Module, CAN	1-Step OFF	Interface Module, CAN
		<i>ec-H2O</i> Enabled	Interface Module, CAN	Solution Control OFF	Interface Module, CAN
		Main Scrub Selected	Interface Module, CAN	Main Scrub Deselected	Interface Module, CAN
		Forward/Reverse Command	Propel Controller, <i>J1-16 ≈ 0.2-5 VDC</i>	Neutral - Ready State	Propel Controller, <i>J1-16 ≈ 0 VDC</i>
				Recovery Tank Full	Combo Module (Water Pickup), <i>J6-10 Low</i>
		Solution Tank Empty	Main Scrub/Solution Delivery Module, <i>J4-1 ≈ < 0.73 VDC</i>		
		Low Battery Voltage	Propel Controller, <i>J1-1 ≈ < 32 VDC</i>		
		<i>ec-H2O</i> System Fault (see <i>ec-H2O</i> system troubleshooting)	<i>ec-H2O</i> Module to CAN		
		Circuit Fault	CAN to Interface Module		
		Flush Mode	<i>ec-H2O</i> Module, <i>J5-5 and J5-6 = Closed</i>		
		System Over Pressure ($\approx > 20$ psi)	<i>ec-H2O</i> Module, <i>J4-9 = Not Grounded</i>		
		Severe Environment Mode	Main Scrub/Solution Delivery Module, <i>J4-8 Low or J4-7 Low</i>		

TROUBLESHOOTING

Output	Pin(s)	Enable	Input	Disable	Input
ES (Extended Scrub) Pump (Option) <i>NOTE: 45 seconds/10 seconds Off until recovery tank is less than 1/2 full and solution tank is not full.</i>	Combo Module (Water Pickup):	1-Step ON	Interface Module, CAN	1-Step OFF	Interface Module, CAN
		Main Scrub Selected	Interface Module, CAN	Main Scrub Deselected	Interface Module, CAN
	Water Pump J6-13, J6-14	ES Enabled	Interface Module, CAN	ES Disabled	Interface Module, CAN
		Recovery Tank 1/2 Full	Combo Module (Water Pickup), J6-9 = Ground	Recovery Tank Full	Combo Module (Water Pickup), J6-10 = Ground
		Solution Tank Not Full	Main Scrub/Solution Delivery Module, J4-1 ≈ < 1.34 VDC	Solution Tank Full	Main Scrub/Solution Delivery Module, J4-1 ≈ > 1.34 VDC
Low Battery Voltage	Propel Controller, J1-1 ≈ < 32 VDC				
			Circuit Fault	CAN to Interface Module	
	ES Detergent Pump: (Option) <i>NOTE: Does not operate on one solution level LED.</i>	Main Scrub/Solution Delivery Module:	1-Step ON	Interface Module, CAN	1-Step OFF
Main Scrub Selected			Interface Module, CAN	Main Scrub Deselected	Interface Module, CAN
Detergent Pump J4-14, CB-6		ES Enabled	Interface Module, CAN	ES Disabled	Interface Module, CAN
		Forward/Reverse Command	Propel Controller, J1-16 ≈ 0.2-5 VDC	Neutral - Ready State	Propel Controller, J1-16 ≈ 0 VDC
				Recovery Tank Full	Combo Module (Water Pickup), J6-10 = Ground
				Solution Tank Empty	Main Scrub/Solution Delivery Module, J4-1 ≈ < 0.73 VDC
				Low Battery Voltage	Propel Controller, J1-1 ≈ < 32 VDC
		Circuit Fault	CAN to Interface Module		

Output	Pin(s)	Enable	Input	Disable	Input
Severe Environment Pump: (Option) <i>NOTE: Short and Long cycle duration times can be adjusted in configuration mode.</i>	Main Scrub/Solution Delivery Module: Detergent Pump J4-14, CB-6	1-Step ON	Interface Module, CAN	1-Step OFF	Interface Module, CAN
		Severe Environment Enabled	Main Scrub/Solution Delivery Module, J4-8 Low or J4-7 Low	Severe Environment Disabled	Main Scrub/Solution Delivery Module, J4-8 Not Low and J4-7 Not Low
		Forward/Reverse Command	Propel Controller, J1-16 \approx 0.2-5 VDC	Neutral - Ready State	Propel Controller, J1-16 \approx 0 VDC
		Configured for 1%, 2%, or 3% Mix Ratio	Interface Module, CAN	Configured for 0% Mix Ratio	Interface Module, CAN
				Recovery Tank Full	Combo Module (Water Pickup), J6-10 = Ground
				Solution Tank Empty	Main Scrub/Solution Delivery Module, J4-1 \approx < 0.73 VDC
				Low Battery Voltage	Propel Controller, J1-1 \approx < 32 VDC
Circuit Fault	CAN to Interface Module				
Pre-Sweep Brushes (Option)	Pre-Sweep Module: Main J7-3, J7-4 Right J6-13, J6-14 Left J6-15, J6-16	Pre-Sweep Switch On	Pre-Sweep Module: J6-9 or J6-10 = Grounded	Pre-Sweep Switch Off	Pre-Sweep Module: J6-9 and J6-10 = Not Grounded
		Fwd/Rev Throttle Command	Curtis PMC, J1-6 \approx 0.2-5 VDC	Neutral - Ready State	Curtis PMC, J1-6 \approx 0 VDC
				Low Battery Voltage	Curtis PM C Module, J1-1 \approx < 32 VDC
				Circuit Fault	CAN to Interface Module
Pre-Sweep Brushes Down (Option)	Pre-Sweep Module: Actuator J6-17, J6-18	Pre-Sweep Switch On	Pre-Sweep Module: J6-9 or J6-10 = Grounded	Pre-Sweep Switch Off	Pre-Sweep Module: J6-9 and J6-10 = Not Grounded
Pre-Sweep Vacuum Fan (Option)	Pre-Sweep Module: Vacuum Fan J7-1, J7-2	Pre-Sweep Vacuum Fan Switch On	Pre-Sweep Module: J6-10 = Grounded	Pre-Sweep Vacuum Fan Switch Off	Pre-Sweep Module: J6-10 = Not Grounded
		Forward/Reverse Throttle Command	Curtis PMC, J1-6 \approx 0.2-5 VDC	Neutral - Ready State	Curtis PMC, J1-6 \approx 0 VDC
				Low Battery Voltage	Curtis PMC Module, J1-1 \approx < 32 VDC
				Circuit Fault	CAN to Interface Module

TROUBLESHOOTING

Output	Pin(s)	Enable	Input	Disable	Input
Propel	Propel Controller	Parking Brake Disengaged		Parking Brake Engaged	
		Forward/Reverse Command	Propel Controller, J1-6 ≈ 0.2-5 VDC	Neutral - Ready State	Propel Controller, J1-6 ≈ 0 VDC
		Forward/Reverse Switch Input	Propel Controller, J1-22 or J1-33 ≈ Battery Voltage	Brake Switch Input	Propel Controller, J1-11 ≈ Battery Voltage
				Rollout Battery Switch Input	Propel Controller, J1-11 ≈ Battery Voltage
				Propel Controller Fault	See Propel Controller Diagnostics.
Back-Up Alarm/Lights (Option)		Reverse Switch Input	Propel Controller, J1-33 ≈ Battery Voltage	Forward Switch Input	Propel Controller, J1-22 ≈ Battery Voltage
		Reverse Command	Propel Controller, J1-16 ≈ 0.2-5 VDC	Neutral - Ready State	Propel Controller, J1-16 ≈ 0 VDC
				Propel Controller Fault	See Propel Controller Diagnostics.
High Pressure Spray (Option)	Combo Module (Water Pickup) High Pressure Wire Harness J6-16, CB-10	High Pressure Washer Switch ON		High Pressure Washer Switch OFF	
Dry Vacuum System (Option)	Main Scrub/Solution Delivery Module: Dry Vacuum Wire Harness J4-1, J4-2, J4-3, J4-4, J4-5, J4-6	Dry Vacuum Switch ON		Dry Vacuum Switch OFF	

FAULTS AND WARNINGS

When the machine detects a fault, the service indicator will flash. A fault code is provided to determine the problem. See *FAULT CODES TABLE* for fault codes, conditions, reasons, and corrective action(s) for the fault codes.

FAULT/ALERT INDICATORS – STANDARD PANEL

This machine is equipped with two visual indicators, a red indicator light and an LCD (liquid crystal display).

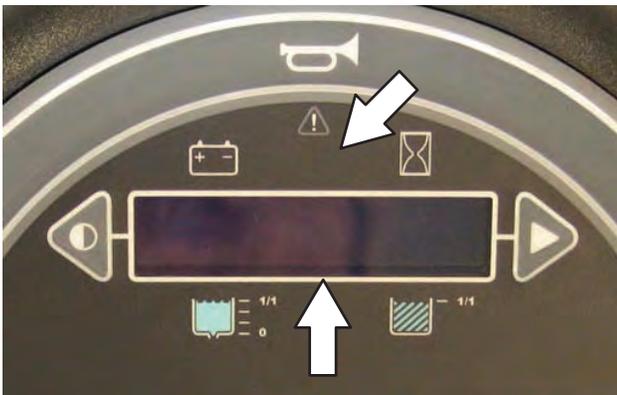
The red indicator light will blink continuously indicating that a fault has occurred.



The LCD will display a fault code. If there is more than one fault, each fault code will alternately display.

FAULT/WARNING INDICATORS - STANDARD PANEL (S/N 000000–012999)

NOTE: See WARNING CODES TABLE (PREVIOUS MODEL STANDARD PANEL) and FAULT CODES TABLE (PREVIOUS MODEL STANDARD PANEL) for all warning/fault codes displayed on this previous model pod LCD screen.



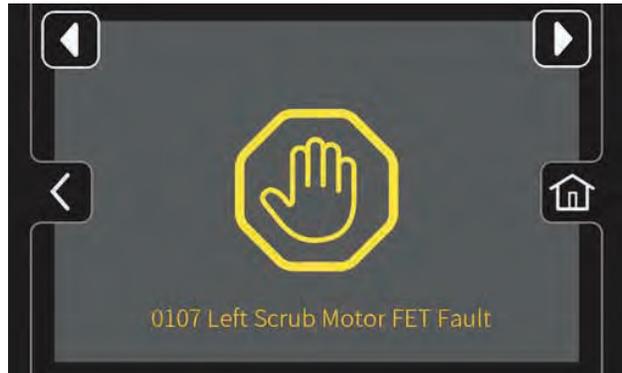
FAULT/ALERT INDICATORS – PRO-PANEL

The fault / alert indicator button will flash continuously indicating a fault / alert has occurred. The multicolored background will change to a black background.



Press the flashing red fault indicator button to view the faults. A fault / alert screen will appear in the display. Press the flashing yellow alert indicator button to view the alerts. A fault / alert screen will appear in the display.

Fault/alert text will appear under the icon in the center of the screen.



FAULT CODES TABLE (PRO-PANEL AND CURRENT STANDARD PANEL)

Fault Code Number	Fault Code - Standard Panel	Fault Code - Pro-Panel	Cause(s)	Remedy
0xFF0	E Stop	Emergency Stop Fault	<ol style="list-style-type: none"> 1. E-Stop pressed. 2. E-Stop wiring problem. 	<ol style="list-style-type: none"> 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 Propel Controller. 5. Replace or repair harness. 6. Replace E-Stop.
0xFF11	Low Battery	Low Battery Warning	<ol style="list-style-type: none"> 1. Battery voltage too low. 	<ol style="list-style-type: none"> 1. Charge battery.
0xFF12	Low Battery	Very Low Battery Warning	<ol style="list-style-type: none"> 1. Battery voltage too low. 	<ol style="list-style-type: none"> 1. Charge battery.
0xFF20	M Scrub CAN	Main Scrub CAN Communication Fault	<ol style="list-style-type: none"> 1. Main Scrub/Solution Delivery Module is not communicating properly. 2. Main Scrub/Solution Delivery Module lost power (wiring issue). 3. Circuit breaker supplying power to Main Scrub/Solution Delivery Module tripped. 4. Main Scrub/Solution Delivery Module may be damaged. 	<ol style="list-style-type: none"> 1. Power cycle machine. 2. Check circuit breaker supplying power to Main Scrub/Solution Delivery Module. 3. No communication with Main Scrub/Solution Delivery Module - Check CAN Line reference (2.2v each line) and 5VDC voltage regulator and to Motor Encoders.
0xFF21	WPickup CAN	Water Pickup CAN Communication Fault	<ol style="list-style-type: none"> 1. Combo Module (Water Pickup) is not communicating properly. 2. Combo Module (Water Pickup) lost power (wiring issue). 3. Circuit breaker supplying power to Combo Module (Water Pickup) tripped. 4. Combo Module (Water Pickup) may be damaged. 	<ol style="list-style-type: none"> 1. Power cycle machine. 2. Check circuit breaker supplying power to Combo Module (Water Pickup). 3. No communication with Combo Module (Water Pickup).
0xFF22	S Scrub CAN	Side Scrub CAN Communication Fault	<ol style="list-style-type: none"> 1. Side Scrub Module is not communicating properly. 2. Side Scrub Module lost power (wiring issue). 3. Circuit breaker supplying power to Side Scrub Module tripped. 4. Side Scrub Module may be damaged. 	<ol style="list-style-type: none"> 1. Power cycle machine. 2. Check circuit breaker supplying power to Side Scrub Module. 3. No communication with Side Scrub Module - Check CAN Line reference (2.2v ea. line) and 5VDC voltage regulator and to Motor Encoders.
0xFF23	EcH2O CAN	EcH2O CAN Communication Fault	<ol style="list-style-type: none"> 1. <i>ec-H2O</i> Module is not communicating properly. 2. <i>ec-H2O</i> Module lost power (wiring issue). 3. Circuit breaker supplying power to <i>ec-H2O</i> Module tripped. 4. <i>ec-H2O</i> Module may be damaged. 	<ol style="list-style-type: none"> 1. Power cycle machine. 2. Check circuit breaker supplying power to <i>ec-H2O</i> Module. 3. No communication with <i>ec-H2O</i> Module.

TROUBLESHOOTING

Fault Code Number	Fault Code - Standard Panel	Fault Code - Pro-Panel	Cause(s)	Remedy
0xFF26	Propel Comm	Propel CAN Communication Fault	<ol style="list-style-type: none"> 1. Propel Controller is not communicating properly. 2. Propel Controller lost power (wiring issue). 3. Circuit breaker supplying power to Propel Controller tripped. 4. Propel Controller may be damaged. 	<ol style="list-style-type: none"> 1. Power cycle machine. 2. Check circuit breaker supplying power to Propel Controller. 3. No communication with Propel Controller.
0x0010	Parking Brk	Parking Brake	<ol style="list-style-type: none"> 1. Flashing indicator indicates manual parking brake is engaged, locking brake pedal. 	<ol style="list-style-type: none"> 1. Release parking brake.
0x0101	L Scrub Opn	Left Scrub Motor Open Warning	<ol style="list-style-type: none"> 1. Wiring, connector, or Main Scrub/Solution Delivery Module issue with circuit to motor. 	<ol style="list-style-type: none"> 1. Check connections, Main Scrub/Solution Delivery Module gets power from key switch and battery. If connections are good, replace Main Scrub/Solution Delivery Module.
0x0106	L Scrub Srt	Left Scrub Motor Short Fault	<ol style="list-style-type: none"> 1. Shorted load condition. 2. Higher current draw than hardware design limit. 	<ol style="list-style-type: none"> 1. Check wire harness. Repair as needed.
0x0107	L Scrub FET	Left Scrub Motor FET Fault	<ol style="list-style-type: none"> 1. Main Scrub/Solution Delivery Module problem. 2. Power/battery issue on startup. 	<ol style="list-style-type: none"> 1. Check voltage references. 2. Replace Main Scrub/Solution Delivery Module.
0x0111	R Scrub Opn	Right Scrub Motor Open Warning	<ol style="list-style-type: none"> 1. Wiring, connector or Main Scrub/Solution Delivery Module issue with circuit to motor. 	<ol style="list-style-type: none"> 1. Check connections, Main Scrub/Solution Delivery Module gets power from key switch and battery. If connections are good, replace Main Scrub/Solution Delivery Module.
0x0116	R Scrub Srt	Right Scrub Motor Short Fault	<ol style="list-style-type: none"> 1. Shorted load condition. 2. Higher current draw than hardware design limit. 	<ol style="list-style-type: none"> 1. Check wire harness. Repair as needed.
0x0117	R Scrub FET	Right Scrub Motor FET Fault	<ol style="list-style-type: none"> 1. Main Scrub/Solution Delivery Module problem. 2. Power/battery issue on startup. 	<ol style="list-style-type: none"> 1. Check voltage references. 2. Replace Main Scrub/Solution Delivery Module.
0x0120	S Scrub Flt	Side Scrub Motor Generic	<ol style="list-style-type: none"> 1. Side scrub brush motor issue. 	<ol style="list-style-type: none"> 1. Replace side scrub brush motor.
0x0121	S Scrub Opn	Side Scrub Motor Open Warning	<ol style="list-style-type: none"> 1. Wiring, connector or Side Scrub Module issue with circuit to motor. 	<ol style="list-style-type: none"> 1. Check connections, Side Scrub Module gets power from key switch and battery. If connections are good, replace Side Scrub Module.
0x0122	S Scrub Vlt	Side Scrub Motor Voltage Loss	<ol style="list-style-type: none"> 1. Shorted load condition. 2. Higher current draw than hardware design limit. 	<ol style="list-style-type: none"> 1. Check wire harness and repair as needed.
0x0127	S Scrub FET	Side Scrub Motor FET Fault	<ol style="list-style-type: none"> 1. Side Scrub Module problem. 2. Power/battery issue on startup. 	<ol style="list-style-type: none"> 1. Check voltage references. 2. Replace Side Scrub Module.
0x0129	S Scrub Tmp	Side Scrub Motor Overheat	<ol style="list-style-type: none"> 1. Motor temperature too high (over 104F). 	<ol style="list-style-type: none"> 1. Check motor temp. 2. Repair or replace.
0x0130 (Pre-Sweep)		FAULT_MOTOR4_GENERIC	<ol style="list-style-type: none"> 1. Pre-Sweep left side brush motor generic fault. 	<ol style="list-style-type: none"> 1. Check voltage references. 2. Replace Pre-Sweep left side brush motor.
0x0131 (Pre-Sweep)		FAULT_MOTOR4_OPEN	<ol style="list-style-type: none"> 1. Wiring, connector, or Pre-Sweep Module issue with circuit to motor. 	<ol style="list-style-type: none"> 1. Check connections, Pre-Sweep Module gets power from key switch and battery. If connections are good, replace Pre-Sweep Module.

Fault Code Number	Fault Code - Standard Panel	Fault Code - Pro-Panel	Cause(s)	Remedy
0x0132 (Pre-Sweep)		FAULT_MOTOR4_VOLTAGE_LOSS	1. Shorted load condition. 2. Higher current draw than hardware design limit.	1. Check wire harness and repair as needed.
0x0133 (Pre-Sweep)		FAULT_MOTOR4_OVERCURRENT	1. Pre-Sweep left side brush motor has hit hardware current limit.	1. Check Pre-Sweep left side brush motor. 2. Check Pre-Sweep Module.
0x0134 (Pre-Sweep)		FAULT_MOTOR4_FAULT_1		
0x0135 (Pre-Sweep)		FAULT_MOTOR4_FAULT_2		
0x0136 (Pre-Sweep)		FAULT_MOTOR4_SHORT	1. Shorted load condition. 2. Higher current draw than hardware design limit.	1. Check wire harness. Repair as needed.
0x0137 (Pre-Sweep)		FAULT_MOTOR4_FET_SHORT	1. Pre-Sweep Module problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Pre-Sweep Module.
0x0139 (Pre-Sweep)		FAULT_MOTOR4_OVERHEAT	1. Pre-Sweep left side brush motor temperature too high (over 104F).	1. Check Pre-Sweep left side brush motor temp. 2. Repair or replace.
0x0140 (Pre-Sweep)		FAULT_MOTOR5_GENERIC	1. Pre-Sweep main brush motor generic fault.	1. Check voltage references. 2. Replace Pre-Sweep side brush motor.
0x0141 (Pre-Sweep)		FAULT_MOTOR5_OPEN	1. Wiring, connector, or Pre-Sweep Module issue with circuit to motor.	1. Check connections, Pre-Sweep Module gets power from key switch and battery. If connections are good, replace Pre-Sweep Module.
0x0142 (Pre-Sweep)		FAULT_MOTOR5_VOLTAGE_LOSS	1. Shorted load condition. 2. Higher current draw than hardware design limit.	1. Check wire harness and repair as needed.
0x0143 (Pre-Sweep)		FAULT_MOTOR5_OVERCURRENT	1. Pre-Sweep main brush motor has hit hardware current limit.	1. Check Pre-Sweep main brush motor. 2. Check Pre-Sweep Module.
0x0144 (Pre-Sweep)		FAULT_MOTOR5_FAULT_1		
0x0145 (Pre-Sweep)		FAULT_MOTOR5_FAULT_2		
0x0146 (Pre-Sweep)		FAULT_MOTOR5_SHORT	1. Shorted load condition. 2. Higher current draw than hardware design limit.	1. Check wire harness. Repair as needed.
0x0147 (Pre-Sweep)		FAULT_MOTOR5_FET_SHORT	1. Pre-Sweep Module problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Pre-Sweep Module.
0x0149 (Pre-Sweep)		FAULT_MOTOR5_OVERHEAT	1. Pre-Sweep main brush motor temperature too high (over 104F).	1. Check Pre-Sweep main brush motor temp. 2. Repair or replace.

TROUBLESHOOTING

Fault Code Number	Fault Code - Standard Panel	Fault Code - Pro-Panel	Cause(s)	Remedy
0x0170 (Pre-Sweep)		FAULT_MOTOR8_GENERIC	1. Pre-Sweep right side brush motor generic fault.	1. Check voltage references. 2. Replace Pre-Sweep right side brush motor.
0x0171 (Pre-Sweep)		FAULT_MOTOR8_OPEN	1. Wiring, connector, or Pre-Sweep Module issue with circuit to motor.	1. Check connections, Pre-Sweep Module gets power from key switch and battery. If connections are good, replace Pre-Sweep Module.
0x0172 (Pre-Sweep)		FAULT_MOTOR8_VOLTAGE_LOSS	1. Shorted load condition. 2. Higher current draw than hardware design limit.	1. Check wire harness and repair as needed.
0x0173 (Pre-Sweep)		FAULT_MOTOR8_OVERCURRENT	1. Pre-Sweep right side brush motor has hit hardware current limit.	1. Check Pre-Sweep right side brush motor. 2. Check Pre-Sweep Module.
0x0174 (Pre-Sweep)		FAULT_MOTOR8_FAULT_1		
0x0175 (Pre-Sweep)		FAULT_MOTOR8_FAULT_2		
0x0176 (Pre-Sweep)		FAULT_MOTOR8_SHORT	1. Shorted load condition. 2. Higher current draw than hardware design limit.	1. Check wire harness. Repair as needed.
0x0177 (Pre-Sweep)		FAULT_MOTOR8_FET_SHORT	1. Pre-Sweep Module problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Pre-Sweep Module.
0x0179 (Pre-Sweep)		FAULT_MOTOR8_OVERHEAT	1. Pre-Sweep right side brush motor temperature too high (over 104F).	1. Check Pre-Sweep right side brush motor temp. 2. Repair or replace.
0x0301	M Water Opn	Main Water Valve Open Warning	1. Wiring, connector, or Main Scrub/Solution Delivery Module issue with circuit to motor.	1. Check connections, Main Scrub/Solution Delivery Module gets power from key switch and battery. If connections are good, replace Main Scrub/Solution Delivery Module.
0x0306	M Water Srt	Main Water Valve Short Fault	1. Shorted load condition. 2. Higher current draw than hardware design limit.	1. Check wire harness and repair as needed.
0x0307	M Water FET	Main Water Valve FET Fault	1. Main Scrub/Solution Delivery Module problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Main Scrub/Solution Delivery Module.
0x0311	Horn Opn	Horn Open Warning	1. Wiring, connector, or Main Scrub/Solution Delivery Module issue with circuit to motor.	1. Check connections, Main Scrub/Solution Delivery Module gets power from key switch and battery. If connections are good, replace Main Scrub/Solution Delivery Module.
0x0316	Horn Srt	Horn Short Fault	1. Shorted load condition. 2. Higher current draw than hardware design limit.	1. Check wire harness. Repair as needed.
0x0317	Horn FET	Horn FET Fault	1. Main Scrub/Solution Delivery Module problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Main Scrub/Solution Delivery Module.

Fault Code Number	Fault Code - Standard Panel	Fault Code - Pro-Panel	Cause(s)	Remedy
0x0321	Alarm Opn	Alarm Open Warning	1. Wiring, connector, or Propel Controller issue with circuit to motor.	1. Check connections, Propel Controller gets power from key switch and battery. If connections are good, replace Propel Controller.
0x0326	Alarm Srt	Alarm Short Fault	1. Shorted load condition. 2. Higher current draw than hardware design limit.	1. Check wire harness. Repair as needed.
0x0327	Alarm FET	Alarm FET Fault	1. Propel Controller problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Propel Controller.
0x0331	S Scrub Opn	Side Scrub Valve Open Warning	1. Wiring, connector, or Side Scrub Module issue with circuit to motor.	1. Check connections, Side Scrub Module gets power from key switch and battery. If connections are good, replace Side Scrub Module.
0x0336	S Scrub Srt	Side Scrub Valve Short Fault	1. Shorted load condition. 2. Higher current draw than hardware design limit.	1. Check wire harness. Repair as needed.
0x0337	S Scrub FET	Side Scrub Valve FET Fault	1. Side Scrub Module problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Side Scrub Module.
0x0341	SAF Vlv Opn	Solution AutoFill Valve Open Warning	1. Wiring, connector, or Combo Module (Water Pickup) issue with circuit to motor.	1. Check connections, Combo Module (Water Pickup) gets power from key switch and battery. If connections are good, replace Combo Module (Water Pickup).
0x0346	SAF Vlv Srt	Solution AutoFill Valve Short Fault	1. Shorted load condition. 2. Higher current draw than hardware design limit.	1. Check wire harness. Repair as needed.
0x0347	SAF Vlv FET	Solution AutoFill Valve FET Fault	1. Combo Module (Water Pickup) problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Combo Module (Water Pickup).
0x0351	RAF Vlv Opn	Recovery AutoFill Valve Open Warning	1. Wiring, connector, or Combo Module (Water Pickup) issue with circuit to motor.	1. Check connections, Combo Module (Water Pickup) gets power from key switch and battery. If connections are good, replace Combo Module (Water Pickup).
0x0356	RAF Vlv Srt	Recovery AutoFill Valve Short Fault	1. Shorted load condition. 2. Higher current draw than hardware design limit.	1. Check wire harness. Repair as needed.
0x0357	RAF Vlv FET	Recovery AutoFill Valve FET Fault	1. Combo Module (Water Pickup) problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Combo Module (Water Pickup).
0x0501	Vac 1 Opn	Pickup Vac 1 Electrical Open Alert	1. Wiring, connector, or Combo Module (Water Pickup) issue with circuit to motor.	1. Check connections, Combo Module (Water Pickup) gets power from key switch and battery. If connections are good, replace Combo Module (Water Pickup).
0x0503		FAULT_VACUUM1_OVERCURRENT	1. Pickup Vacuum 1 has hit hardware current limit.	1. Check vacuum fan 1 2. Check Combo Module (Water Pickup).
0x0504	Vac 1 OC1	Pickup Vac 1 Over Current 1 Fault	1. Current draw higher than expected.	1. Verify vacuum load, damage and/or usage conditions.
0x0505	Vac 1 OC2	Pickup Vac 1 Over Current 2 Fault	1. Current draw higher than expected.	1. Verify vacuum load, damage and/or usage conditions.
0x0507	Vac 1 FET	Pickup Vac 1 FET Fault	1. Combo Module (Water Pickup) problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Combo Module (Water Pickup).

TROUBLESHOOTING

Fault Code Number	Fault Code - Standard Panel	Fault Code - Pro-Panel	Cause(s)	Remedy
0x0511	Vac 2 Opn	Pickup Vac 2 Electrical Open Alert	1. Wiring, connector, or Combo Module (Water Pickup) issue with circuit to motor.	1. Check connections, Combo Module (Water Pickup) gets power from key switch and battery. If connections are good, replace Combo Module (Water Pickup).
0x0513		FAULT_VACUUM2_OVERCURRENT	1. Pickup Vacuum 2 has hit hardware current limit.	1. Check vacuum fan 1 2. Check Combo Module (Water Pickup).
0x0514	Vac 2 OC1	Pickup Vac 2 Over Current 1 Fault	1. Current draw higher than expected.	1. Verify vacuum load, damage and/or usage conditions.
0x0515	Vac 2 OC2	Pickup Vac 2 Over Current 2 Fault	1. Current draw higher than expected.	1. Verify vacuum load, damage and/or usage conditions.
0x0517	Vac 2 FET	Pickup Vac 2 FET Fault	1. Combo Module (Water Pickup) problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Combo Module (Water Pickup).
0x0521 (Pre-Sweep)		FAULT_VACUUM3_OPEN	1. Wiring, connector, or Pre-Sweep Module issue with circuit to motor.	1. Check connections, Pre-Sweep Module gets power from key switch and battery. If connections are good, replace Pre-Sweep Module.
0x0601	SdePump Opn	Side Scrub Pump Open Warning	1. Wiring, connector, or Side Scrub Module issue with circuit to motor.	1. Check connections, Side Scrub Module gets power from key switch and battery. If connections are good, replace Side Scrub Module.
0x0606	SdePump Srt	Side Scrub Pump Short Fault	1. Shorted load condition. 2. Higher current draw than hardware design limit.	1. Check wire harness. Repair as needed.
0x0607	SdePump FET	Side Scrub Pump FET Fault	1. Side Scrub Module problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Side Scrub Module.
0x0611	DetPump Opn	Detergent Pump Open Warning	1. Wiring, connector, or Main Scrub/Solution Delivery Module issue with circuit to motor.	1. Check connections, Main Scrub/Solution Delivery Module gets power from key switch and battery. If connections are good, replace Main Scrub/Solution Delivery Module.
0x0616	DetPump Srt	Detergent Pump Short Fault	1. Shorted load condition. 2. Higher current draw than hardware design limit.	1. Check wire harness and repair as needed.
0x0617	DetPump FET	Detergent Pump FET Fault	1. Main Scrub/Solution Delivery Module problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Main Scrub/Solution Delivery Module.
0x0621	ES Pump Opn	Extended Scrub Pump Open Warning	1. Wiring, connector, or Combo Module (Water Pickup) issue with circuit to motor.	1. Check connections, Combo Module (Water Pickup) gets power from key switch and battery. If connections are good, replace Combo Module (Water Pickup).
0x0626	ES Pump Srt	Extended Scrub Pump Short Fault	1. Shorted load condition. 2. Higher current draw than hardware design limit.	1. Check wire harness. Repair as needed.
0x0627	ES Pump FET	Extended Scrub Pump FET Fault	1. Combo Module (Water Pickup) problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Combo Module (Water Pickup).
0x0701	Ec Flsh Flt	EC-H2O System Flush Needed	1. <i>ec-H2O</i> module needs a manually triggered flush.	1. Press switch on <i>ec-H2O</i> module.
0x0702	Ec Press Sw	EC-H2O Pressure Switch Active	1. System pressure switch is detecting a trip or is unconnected.	1. System pressure too high, check connections. 2. Verify functionality of scrub head switch and parking brake switch; connectors possibly connected to incorrect switches.

Fault Code Number	Fault Code - Standard Panel	Fault Code - Pro-Panel	Cause(s)	Remedy
0x0704	Ec CAN	EC-H2O CAN Communication Fault	<ol style="list-style-type: none"> 1. <i>ec-H2O</i> Module is not communicating properly. 2. <i>ec-H2O</i> Module lost power (wiring issue). 3. Circuit breaker supplying power to <i>ec-H2O</i> Module. 4. <i>ec-H2O</i> Module may be damaged. 	<ol style="list-style-type: none"> 1. Power cycle machine. 2. Check circuit breaker supplying power to <i>ec-H2O</i> Module. 3. No communication with a network module.
0x0711	Ec Pump Opn	EC-H2O Pump Open Fault	<ol style="list-style-type: none"> 1. Wiring, connector, or <i>ec-H2O</i> Module issue with circuit to motor. 	<ol style="list-style-type: none"> 1. <i>ec-H2O</i> Module is not detecting pump current. Check connections for voltage and verify pump is operating.
0x0716	Ec Pump Srt	EC-H2O Pump Short Fault	<ol style="list-style-type: none"> 1. Shorted load condition. 2. Higher current draw than hardware design limit. 	<ol style="list-style-type: none"> 1. Check wiring for shorted condition. 2. Replace pump.
0x0717	Ec Pump FET	EC-H2O Pump FET Fault	<ol style="list-style-type: none"> 1. <i>ec-H2O</i> Module problem. 2. Power/battery issue on startup. 	<ol style="list-style-type: none"> 1. Check voltage references. 2. Replace <i>ec-H2O</i> Module.
0x0720	Ec Cell Flt	EC-H2O Cell Generic Fault	<ol style="list-style-type: none"> 1. <i>ec-H2O</i> generic fault. 	<ol style="list-style-type: none"> 1. Check voltage references. 2. Replace <i>ec-H2O</i> Module.
0x0727	Ec Cell FET	EC-H2O Cell FET Faults	<ol style="list-style-type: none"> 1. <i>ec-H2O</i> Module problem. 2. Power/battery issue on startup. 	<ol style="list-style-type: none"> 1. FET detection includes motor, actuator, detergent pump, vacuum and battery watering pump. 2. Replace <i>ec-H2O</i> Module.
0x0730	Ec Spgr Flt	EC-H2O Sparger Generic Fault	<ol style="list-style-type: none"> 1. <i>ec-H2O</i> sparger generic fault. 	<ol style="list-style-type: none"> 1. Use trouble-shooting tree to diagnosis.
0x0737	Ec Spgr FET	EC-H2O Sparger FET Fault	<ol style="list-style-type: none"> 1. <i>ec-H2O</i> Module problem. 2. Power/battery issue on startup. 	<ol style="list-style-type: none"> 1. Check voltage references. 2. Replace <i>ec-H2O</i> Module.
0x0751	Ec Vlv Opn	EC-H2O Valve Open Fault	<ol style="list-style-type: none"> 1. Wiring, connector, or <i>ec-H2O</i> Module issue on <i>ec-H2O</i> valve. 	<ol style="list-style-type: none"> 1. <i>ec-H2O</i> Module is not detecting pump current. Check connections for voltage and verify pump is operating.
0x0756	Ec Vlv Srt	EC-H2O Valve Short Fault	<ol style="list-style-type: none"> 1. Shorted load condition. 2. Higher current draw than hardware design limit. 	<ol style="list-style-type: none"> 1. Check valve and wiring. 2. Replace if out of specifications.
0x0757	Ec Vlv FET	EC-H2O Valve FET Fault	<ol style="list-style-type: none"> 1. <i>ec-H2O</i> Module problem. 2. Power/battery issue on startup. 	<ol style="list-style-type: none"> 1. Check voltage references. 2. Replace <i>ec-H2O</i> Module.
0x0761		FAULT_ECH2O_SIDE_VALVE_OPEN	<ol style="list-style-type: none"> 1. <i>ec-H2O</i> valve. 2. Wire/cable connection broken. 	<ol style="list-style-type: none"> 1. Check <i>ec-H2O</i> valve. 2. Check <i>ec-H2O</i> valve wiring connections. 3. Check <i>ec-H2O</i> Module.
0x0766		FAULT_ECH2O_SIDE_VALVE_SHORT	<ol style="list-style-type: none"> 1. <i>ec-H2O</i> valve shorted. 2. Connection shorted. 	<ol style="list-style-type: none"> 1. Check <i>ec-H2O</i> valve. 2. Check <i>ec-H2O</i> valve wiring connections. 3. Check <i>ec-H2O</i> Module.
0x0767		FAULT_ECH2O_SIDE_VALVE_FET_SHORT	<ol style="list-style-type: none"> 1. <i>ec-H2O</i> valve shorted. 2. <i>ec-H2O</i> Module damaged. 	<ol style="list-style-type: none"> 1. Check <i>ec-H2O</i> valve. 2. Check <i>ec-H2O</i> Module.
0x0790	SolTnkEmpty	Solution Tank Empty	<ol style="list-style-type: none"> 1. Solution tank empty. 2. Wiring, connector, or solution tank switch issue. 	<ol style="list-style-type: none"> 1. If tank is not empty, check tank switch and wiring.
0x0791	RcvTnk Full	Recovery Tank Full	<ol style="list-style-type: none"> 1. Recovery tank full. 2. Wiring, connector, or recovery tank switch issue. 	<ol style="list-style-type: none"> 1. If tank is not full, check tank switch and wiring.
0x07A0		Clogged Filter Warning	<ol style="list-style-type: none"> 1. Filter clogged with dust and debris. 	<ol style="list-style-type: none"> 1. Engage filter shaker. 2. Clean filter.
0x07A1	Hopper Fire	Hopper on Fire	<ol style="list-style-type: none"> 1. Hopper on fire. 	<ol style="list-style-type: none"> 1. Extinguish hopper fire.
0x07A2		Hopper not in Home position	<ol style="list-style-type: none"> 1. Hopper not completely lowered. 	<ol style="list-style-type: none"> 1. Completely lower hopper. 2. Check actuator for binding.

TROUBLESHOOTING

Fault Code Number	Fault Code - Standard Panel	Fault Code - Pro-Panel	Cause(s)	Remedy
0x1003	Dwn Pressure	Down Pressure Unattainable	1. Unable to achieve target brush motor current following down shift(s) to lowest down pressure level.	1. SET: Main Scrub/Solution Delivery Module unable to achieve target brush motor current in desired down pressure setting. Main Scrub/Solution Delivery Module attempts to “down shift” to lower setting(s) until it is unable to achieve target current in lowest down pressure setting. CLEAR: Power cycle machine.
0x1004		FAULT_SWEEP_DOWN_PRESSURE_UNATTAINABLE	1. Unable to achieve target brush motor current following down shift(s) to lowest down pressure level.	1. SET: Main Sweep/Hopper Lift Module unable to achieve target brush motor current in desired down pressure setting. Main Sweep/Hopper Lift Module attempts to “down shift” to lower setting(s) until it is unable to achieve target current in lowest down pressure setting. CLEAR: Power cycle machine.
0x2000	Pascal Flt	Touchscreen Error	1. Touchscreen control board problem.	1. Replace pod.

A Service Diagnostics tool is available to provide additional fault detail. See *SERVICE DIAGNOSTICS TOOL* in *SERVICE* section.

**WARNING CODES TABLE (PREVIOUS MODEL
STANDARD PANEL)**

LCD Code	Error Message	Description	Set/Clear
W1	W1:Batt Low	Low Battery	<i>SET:</i> Battery discharge threshold of 30-32 Volts at KSI terminal or 32-33 Volts at batteries <i>CLEAR:</i> Charge batteries to BDI reset threshold of 37 Volts at KSI terminal or 38 Volts at batteries
W2	W2:Unavailable	No optional solution enabled	<i>SET:</i> Operator selects a solution technology that is not configured on the machine <i>CLEAR:</i> Release button
W3	W3:No [Side/Sweep] Config	No side sweep option enabled	<i>SET:</i> Operator selects the side brush when the side brush is not enabled in configuration mode. <i>CLEAR:</i> Release button
W4	W4:Not Active	Inactive feature	<i>SET:</i> Operator selects a button and the related function is inactive <i>CLEAR:</i> Correct warning condition
W5	W5:Solution Off	Solution water is off	<i>SET:</i> Solution is OFF during scrub mode for 15 seconds <i>CLEAR:</i> Correct warning condition
W6	W6:Brake On	Parking brake on	<i>SET:</i> Parking brake engaged (switch closed) <i>CLEAR:</i> Release parking brake (switch open)
W7	W7:Side Br. Wrn [##]	BLDC Side Scrub Motor Circuit Warning: <i>VF, OT, HW, Com, or MF</i>	<i>SET - VF:</i> Voltage Fault - Complete SUN-I/O testing on side scrub module <i>SET - OT:</i> Over Temperature - Side scrub module overheat <i>SET - HW:</i> Hardware Fault - System over current <i>SET - Com:</i> Communications Fault - Interface module has lost communications with side scrub module Complete SUN-I/O testing on the side scrub module <i>SET - MF:</i> Motor Fault - Locked rotor or mechanical problem with the motor or brush drive mechanism <i>CLEAR:</i> Correct warning condition and cycle key switch.
W8	W8:LSide Br Short	Left side sweep motor shorted	<i>SET:</i> Left side sweep brush motor circuit shorted <i>CLEAR:</i> Correct warning condition
W9	W9:RSide Br Short	Right side sweep motor shorted	<i>SET:</i> Right side sweep brush motor circuit shorted <i>CLEAR:</i> Correct warning condition
W10	W10:LSweepBrShrt	Left Pre-Sweep motor shorted	<i>SET:</i> Left side pre-sweep brush motor circuit shorted <i>CLEAR:</i> Correct warning condition
W11	W11:MSweepBrShrt	Middle Pre-Sweep motor shorted	<i>SET:</i> Main pre-sweep brush motor circuit shorted <i>CLEAR:</i> Correct warning condition
W12	W12:RSweepBrShrt	Right Pre-Sweep motor shorted	<i>SET:</i> Right side pre-sweep brush motor circuit shorted <i>CLEAR:</i> Correct warning condition
W13	W13:Open [Frnt/Left] Br	Open front/left motor	<i>SET:</i> [Front/Left] main brush motor circuit open <i>CLEAR:</i> Correct warning condition
W14	W14:Open [Rear/Rght] Br	Open right/rear motor	<i>SET:</i> [Rear/Right] main brush motor circuit open <i>CLEAR:</i> Correct warning condition
W15	W15:OpenSideBrush	Open side scrub brush motor	<i>SET:</i> Side scrub brush motor circuit open <i>CLEAR:</i> Correct warning condition
W16	W16:Open LSideBr	Open left side sweep brush motor	<i>SET:</i> Left side sweep brush motor circuit open <i>CLEAR:</i> Correct warning condition

TROUBLESHOOTING

LCD Code	Error Message	Description	Set/Clear
W17	W17:Open RSideBr	Open right side sweep brush motor	SET: Right side sweep brush motor circuit open CLEAR: Correct warning condition
W18	W18:OpenLSweepBr	Open left Pre-Sweep brush motor	SET: Left side pre-sweep brush motor circuit open CLEAR: Correct warning condition
W19	W19:OpenMSweepBr	Open middle Pre-Sweep brush motor	SET: Main pre-sweep brush motor circuit open CLEAR: Correct warning condition
W20	W20:OpenRSweepBr	Open right Pre-Sweep brush motor	SET: Right side pre-sweep brush motor circuit open CLEAR: Correct warning condition
W21	W21:SweepVacShrt	Shorted Pre-Sweep vacuum motor	SET: Pre-sweep vacuum motor circuit shorted CLEAR: Correct warning condition
W22	W22:Open Vac 1	Vacuum fan motor 1 no current	SET: Scrub vacuum motor circuit #1 open CLEAR: Correct warning condition
W23	W23:Open Vac 2	Vacuum fan motor 2 no current	SET: Scrub vacuum motor circuit #2 open CLEAR: Correct warning condition
W24	W24:OpenSweepVac	Open Pre-Sweep vacuum motor	SET: Pre-sweep vacuum motor circuit open CLEAR: Correct warning condition
W25	W25:SqueegeeStall	Rear squeegee actuator stalled	SET: Rear squeegee actuator stall condition CLEAR: Correct warning condition.
W26	W26:SideActStall	Side scrub brush actuator stalled	SET: Side scrub brush actuator stall condition CLEAR: Correct warning condition
W27	W27:L Side Stall	Left side sweep actuator stalled	SET: Left side sweep brush actuator stall condition. CLEAR: Correct warning conditio
W28	W28:R Side Stall	Right side sweep actuator stalled	SET: Right side sweep brush actuator stall condition CLEAR: Correct warning condition
W29	W29:Sweep Stall	Pre-Sweep actuator stalled	SET: Pre-sweep actuator stall condition CLEAR: Correct warning condition
W30	W30:DetPumpShort	Shorted detergent pump	SET: Detergent pump motor circuit shorted CLEAR: Correct warning condition
W31	W31:ES PumpShort	Shorted ES pump	SET: ES pump motor circuit shorted CLEAR: Correct warning condition
W32	W32:SidePumpShrt	Shorted side scrub pump	SET: Side scrub pump motor circuit shorted CLEAR: Correct warning condition
W33	W33:Ec Pump Shrt	Shorted ec-H2O pump	SET: ec-H2O pump motor circuit shorted CLEAR: Correct warning condition
W34	W34:DetPumpOpen	Open detergent pump	SET: Detergent pump motor circuit open CLEAR: Correct warning condition
W35	W35:ES PumpOpen	Open ES pump	SET: ES pump motor circuit open CLEAR: Correct warning condition
W36	W36:SidePumpOpen	Open side scrub pump	SET: Side scrub pump motor circuit open CLEAR: Correct warning condition
W37	W37:Ec Pump Open	Open ec-H2O pump	SET: ec-H2O pump motor circuit open CLEAR: Correct warning condition
W38	W38: [Side/Sweep] Offline	Side module offline	SET: Side module CAN connectivity, power supply, or faulty side module CLEAR: Correct warning condition
W39	W39:EcH2OOffline	ec-H2O module offline	SET: ec-H2O module CAN connectivity, power supply, or faulty ec-H2O module CLEAR: Correct warning condition

**FAULT CODES TABLE (PREVIOUS MODEL
STANDARD PANEL)**

LCD Code	Error Message	Description	Set/Clear
F1	F1:Rcv Tank Full	Recovery Tank Full	<i>Set:</i> Recovery tank full for 5 seconds <i>Clear:</i> Recovery tank not full for 5 seconds
F2	F2:SolTank Empty	Solution Tank Empty	<i>Set:</i> Solution tank empty for 60 seconds <i>Clear:</i> Cycle key switch
F3	F3:Batt Very Low	Very Low Battery Voltage	<i>SET:</i> Battery discharge threshold of 30.2 Volts at KSI terminal of PMC or 31.6 Volts at battery. <i>CLEAR:</i> Charge batteries to BDI reset threshold of 37 Volts at KSI terminal of PMC or 38.3 Volts at batteries and cycle key switch
F4	F4:F/L Br Flt #	BLDC Front/Left Main Scrub Motor Circuit Fault: <i>VF, OT, HW, Com, or MF</i>	<i>SET - VF:</i> Voltage Fault - Complete SUN-I/O testing on scrub module <i>SET - OT:</i> Over Temperature - Scrub module overheat <i>SET - HW:</i> Hardware Fault - System over current <i>SET - Com:</i> Communications Fault - Interface module has lost communications with scrub module. Complete SUN-I/O testing on the scrub module <i>SET - MF:</i> Motor Fault - Locked rotor or mechanical problem with the motor or brush drive mechanism <i>CLEAR:</i> Correct warning condition and cycle key switch
F5	F5:R/R Br Flt #	BLDC Right/Rear Main Scrub Motor Circuit Fault: <i>VF, OT, HW, Com, or MF</i>	<i>SET - VF:</i> Voltage Fault - Complete SUN-I/O testing on scrub module <i>SET - OT:</i> Over Temperature - Scrub module overheat <i>SET - HW:</i> Hardware Fault - System over current <i>SET - Com:</i> Communications Fault - Interface module has lost communications with scrub module. Complete SUN-I/O testing on the scrub module <i>SET - MF:</i> Motor Fault - Locked rotor or mechanical problem with the motor or brush drive mechanism <i>CLEAR:</i> Correct warning condition and cycle key switch
F6	F6:Vac 1 Short	Vacuum fan motor #1 circuit is shorted	<i>SET:</i> Vacuum fan motor #1 circuit shorted <i>CLEAR:</i> Correct fault condition and cycle key switch
F7	F7:Vac 2 Short	Vacuum fan motor #2 circuit is shorted	<i>SET:</i> Vacuum fan motor #2 circuit shorted <i>CLEAR:</i> Correct fault condition and cycle key switch
F8	F8:Check Brushes	Unable to achieve target brush motor current following down shift(s) to lowest down pressure level	<i>SET:</i> Scrub module unable to achieve target brush motor current in desired down pressure setting. Scrub module attempts to "down shift" to lower setting(s) until it is unable to achieve target current in lowest down pressure setting <i>CLEAR:</i> Correct fault condition and cycle key switch
F9	F9:Propel Error	Propel Controller CAN Connectivity Error	<i>SET:</i> Curtis PMC to T17 interface module CAN connectivity problem or Curtis PMC power supply problem <i>CLEAR:</i> See "Curtis PMC Diagnostics" and cycle key switch
F10	F10:Pickup Error	Pickup module CAN Fault	<i>SET:</i> CAN connectivity to pickup module failed <i>CLEAR:</i> Correct fault condition and cycle key switch
F11	F11:Scrub Error	Scrub module CAN Fault	<i>SET:</i> CAN connectivity to scrub module failed <i>CLEAR:</i> Correct fault condition and cycle key switch

LITHIUM ION BATTERY INDICATOR CODES

Fault Code Number	Fault Code	Fault Condition	Cause	Solution
0x0D00	FAULT_LPBMS_GENERIC	General (undefined) fault occurrence in BMS.	BMS General Fault	Recycle power to BMS. If fault repeats, replace BMS.
0x0D0A	FAULT_LPBMS_CHGP_CROSSCOND	Occurs when charger interlock is active and a reversed current is detected for more than 5 seconds.	BMS Charger Protection (Cross Conduction)	Verify charger cables are not swapped + for -, Restart charge cycle. If fault repeats, replace BMS.
0x0D17	FAULT_LPBMS_CURR_SENSOR_SHORT	Current sensor in BMS is shorted and not presenting a current measurement.	BMS Current Sensor Short	Recycle power to BMS. If fault repeats, replace BMS.
0x0D18	FAULT_LPBMS_CURR_SENSOR_OPEN	Current sensor is an open circuit and not presenting a current measurement.	BMS Current Sensor Open	Recycle power to BMS. If fault repeats, replace BMS.
0x0D19	FAULT_LPBMS_RELAY_ON_ERROR	BMS internal contactor is closed (shorted) when it is supposed to be open.	BMS Relay On Error	Recycle power to BMS. If fault repeats, replace BMS.
0x0D1A	FAULT_LPBMS_RELAY_OFF_ERROR	BMS internal contactor is open when it is supposed to be closed.	Relay Off Error	Recycle power to BMS. If fault repeats, replace BMS.
0x0D1B	FAULT_LPBMS_BPLUS_SENSOR_ERROR	Failure to measure cell module voltage at the B+ input to BMS.	BMS B+ Sensor Error	Verify wiring to BMS from Cell Modules. Measure raw battery voltage between B+ and B-. If voltage is greater than 30V, replace BMS. If voltage is less than 30V, replace battery Pack.
0x0D1F	FAULT_LPBMS_MOD_NUM_ERROR	Wrong number of cell modules is connected to the BMS. Generally means that one or more cell modules are disconnected from COM cable.	BMS Module Number Error	Verify M/S cable is connected to BMS and fully tightened, and other connectors are all connected to Cell Modules and fully tightened. If problem persists, measure raw battery voltage between B+ and B-. If voltage is greater than 30V, replace BMS. If voltage is less than 30V, replace Battery Pack.
0x0D20	FAULT_LPBMS_CELL_ID_ERROR	Incompatible Cell Module type.	BMS Cell ID Error	
0x0D21	FAULT_LPBMS_CELL_SERIES_ERROR	Incompatible Cell Module type.	BMS Cell Series Error	
0x0D22	FAULT_LPBMS_CELL_PARALLEL_ERROR	Incompatible Cell Module type.	BMS Cell Parallel Error	
0x0D23	FAULT_LPBMS_MASTER_BD_ERROR	BMS hardware failure.	BMS Master Board Type Error	
0x0D25	FAULT_LPBMS_SWTF_COMM_SLAVE	Communication between BMS and Cell Modules has failed.	BMS Master-Slave Communication Error	Verify M/S cable is connected to BMS and fully tightened, and other connectors are all connected to Cell Modules and fully tightened. If problem persists, measure raw battery voltage between B+ and B-. If voltage is greater than 30V, replace BMS. If voltage is less than 30V, replace Battery Pack.

Fault Code Number	Fault Code	Fault Condition	Cause	Solution
0x0D26	FAULT_LPBMS_HWTF_THERMISTOR	A thermistor in BMS has failed.	BMS Thermistor Error	Recycle power to BMS. If fault repeats, replace BMS.
0x0D27	FAULT_LPBMS_HWTV_CVSENS	Error occurred in cell voltage sensing internal to one or more Cell Modules.	BMS Cell Voltage Sensing Error	Recycle power to BMS. If fault repeats, replace BMS.
0x0D28	FAULT_LPBMS_SWTV_NVM	BMS hardware failure.	BMS NVM Read/Write/Erase Error	Recycle power to BMS. If fault repeats, replace BMS.
0x0D29	FAULT_LPBMS_SWTF_INITDATA	BMS hardware failure.	BMS Initial Data Error	Recycle power to BMS. If fault repeats, replace BMS.
0x0D2A	FAULT_LPBMS_SWTF_CHKSUM_ROM	BMS hardware failure.	BMS ROM Checksum Error	Recycle power to BMS. If fault repeats, replace BMS.
0x0D2B	FAULT_LPBMS_CHARGE	BMS hardware failure.	BMS Abnormal Charge Protection	Recycle power to BMS. If fault repeats, replace BMS.
0x0D35		Incompatible Cell Module type.	BMS Incorrect Battery Type	
0x0D03	FAULT_LPBMS_OVERCURRENT_CHARGE_PROTECTION	An over-current error is determined during charging. Will shut down charging operation.	BMS Over Current Charge Protection	Unplug charger from power. Wait 2 minutes. Re-plug charger into power. If fault repeats, may indicate a charger failure, or use of wrong charger.
0x0D04	FAULT_LPBMS_OVERCURRENT_DC_PROTECTION_1	Machine is drawing too much current from battery pack. Will cause BMS to shut down.	BMS Over Current Discharge Protection 1	Look for obstruction and restart machine. If fault repeats look for machine component drawing too much current.
0x0D05	FAULT_LPBMS_OVERCURRENT_DC_PROTECTION_2	Machine is drawing too much current from battery pack. Will cause BMS to shut down.	BMS Over Current Discharge Protection 2	Look for obstruction and restart machine. If fault repeats look for machine component drawing too much current.
0x0D15	FAULT_LPBMS_OVERCURR_DC_WARN_1	Machine is drawing too much current from battery pack. Will cause machine to stop operation.	BMS Over Current Discharge Warning 1	Look for obstruction and restart machine. If fault repeats look for machine component drawing too much current.
0x0D16	FAULT_LPBMS_OVERCURR_CHARGE_WARN	Machine is drawing too much current from battery pack. Will cause machine to stop operation.	BMS Over Current Charge Warning	Look for obstruction and restart machine. If fault repeats look for machine component drawing too much current.
0x0D24	FAULT_LPBMS_OVERCURR_DC_WARN_2	Machine is drawing too much current from battery pack. Will cause machine to stop operation.	BMS Over Current Discharge Warning 2	Look for obstruction and restart machine. If fault repeats look for machine component drawing too much current.
0x0D01	FAULT_LPBMS_CELL_OVERVOLT_PROTECTION_1	A cell in one or more cell modules has too high a voltage (above 4.05 volts per cell). Will cause BMS to turn off.	BMS Cell Over Voltage Protection 1	Stop charging. Restart machine in scrubbing mode. If fault repeats, contact service.
0x0D02	FAULT_LPBMS_CELL_UNDERVOLT_PROTECTION_1	A cell in one or more cell modules has too high a voltage (above 3.0 volts per cell). Will cause BMS to turn off.	BMS Cell Under Voltage Protection 1	Stop use of machine and recharge battery. If fault repeats, contact service.

TROUBLESHOOTING

Fault Code Number	Fault Code	Fault Condition	Cause	Solution
0x0D0B	FAULT_LPBMS_CELL_OVERVOLT_PROT_2	A cell in one or more cell modules has too high a voltage (above 4.05 volts per cell). Will cause BMS to turn off.	BMS Cell Over Voltage Protection 2	Stop charging. Restart machine in scrubbing mode. If fault repeats, contact service.
0x0D0C	FAULT_LPBMS_CELL_UNDERVOLT_PROT_2	A cell in one or more cell modules has too low a voltage (below 3.0 volts per cell). Will cause BMS to turn off.	BMS Cell Under Voltage Protection 2	Stop use of machine and recharge battery. If fault repeats, contact service.
0x0D0D	FAULT_LPBMS_CELL_OVERVOLT_WARN_1	A cell in one or more cell modules has too high a voltage (above 4.05 volts per cell). Will cause machine to stop operation	BMS Cell Over Voltage Warning 1	Stop charging. Restart machine in scrubbing mode. If fault repeats, contact service.
0x0D0E	FAULT_LPBMS_CELL_OVERVOLT_WARN_2	A cell in one or more cell modules has too high a voltage (above 4.05 volts per cell). Will cause machine to stop operation	BMS Cell Over Voltage Warning 2	Stop charging. Restart machine in scrubbing mode. If fault repeats, contact service.
0x0D0F	FAULT_LPBMS_CELL_UNDERVOLT_WARN_1	A cell in one or more cell modules has too low a voltage (below 3.0 volts per cell). Will cause machine to stop operation	BMS Cell Under Voltage Warning 1	Stop use of machine and recharge battery. If fault repeats, contact service.
0x0D10	FAULT_LPBMS_CELL_UNDERVOLT_WARN_2	A cell in one or more cell modules has too low a voltage (below 3.0 volts per cell). Will cause machine to stop operation.	BMS Cell Under Voltage Warning 2	Stop use of machine and recharge battery. If fault repeats, contact service.
0x0D1C	FAULT_LPBMS_CELL_DEEP_DC_FAILURE	Permanent failure of one or more cell modules that has been discharged beyond recovery.	BMS Cell Deep Discharge Failure	Restart machine in scrubbing mode. If fault repeats, this is a permanent failure that requires replacement of Battery Pack.
0x0D1D	FAULT_LPBMS_CELL_IMBALANCE_FAILURE	Failure of automatic cell balancing circuit to keep cell voltages in balance within specification.	BMS Cell Imbalance Failure	Restart machine in scrubbing mode. If fault repeats, this is a permanent failure that requires replacement of Battery Pack.
0x0D1E	FAULT_LPBMS_MOD_VOLT_DELTA_ERROR	Too great a difference between lowest and highest cell voltages.	BMS Module Voltage Delta Error	Restart machine in scrubbing mode. If fault repeats, this is a permanent failure that requires replacement of Battery Pack.
0x0D36		A cell in one or more cell modules has too high a voltage. (above 4.05 volts per cell) Will cause machine to stop operation.	BMS Over Charge Cell Voltage Threshold Warning	Restart machine in scrubbing mode. If fault repeats, this is a permanent failure that requires replacement of Battery Pack.
0x0D34	FAULT_LPBMS_CAN_LOST	CAN communication between User Interface (UI) and BMS has been interrupted.	BMS CAN Communication Lost	Verify Tap Harness (COM) connector is properly connected to BMS. Verify no other connectors of Tap Harness have been disconnected. If problem persists, contact service for possible replacement of BMS or other components on CAN bus.

Fault Code Number	Fault Code	Fault Condition	Cause	Solution
0x0D06	FAULT_LPBMS_OVERTEMP_CHARGE_PROTECTION	Over temperature condition detected during a charge operation. Battery pack will shut down.	BMS Over Temp Charge Protection	Stop charging. Move machine to cooler location. Allow battery to cool down, before restarting charging. If fault repeats, contact service.
0x0D07	FAULT_LPBMS_UNDERTEMP_CHARGE_PROTECTION	Under temperature condition detected during a charge operation. Battery pack will shut down.	BMS Under Temp Charge Protection	Stop charging. Move machine to warmer location. Allow battery to warm up above 0°C (-32°F), before restarting charging. If fault repeats, contact service.
0x0D08	FAULT_LPBMS_OVERTEMP_DC_PROTECTION	Over temperature condition detected during a cleaning operation. Battery pack will shut down.	BMS Over Temp Discharge Protection	Stop operating machine. Move machine to cooler location. Allow battery to cool down, before restarting operation. If fault repeats, contact service.
0x0D09	FAULT_LPBMS_UNDERTEMP_DC_PROTECTION	Under temperature condition detected during a cleaning operation. Battery pack will shut down.	BMS Under Temp Discharge Protection	Stop operating machine. Move machine to warmer location. Allow battery to warm up above 0°C (-32°F), before restarting operation.
0x0D11	FAULT_LPBMS_OVERTEMP_CHARGE_WARN	Over temperature condition detected during a charge operation. Machine will stop operation.	BMS Over Temp Charge Warning	Stop charging. Move machine to cooler location. Allow battery to cool down, before restarting charging. If fault repeats, contact service.
0x0D12	FAULT_LPBMS_UNDERTEMP_CHARGE_WARN	Under temperature condition detected during a charge operation. Machine will stop operation.	BMS Under Temp Charge Warning	Stop charging. Move machine to warmer location. Allow battery to warm up above 0°C (-32°F), before restarting charging. If fault repeats, contact service.
0x0D13	FAULT_LPBMS_OVERTEMP_DISCHARGE_WARN	Over temperature condition detected during a cleaning operation. Machine will stop operation.	BMS Over Temp Discharge Warning	Stop operating machine. Move machine to cooler location. Allow battery to cool down, before restarting operation. If fault repeats, contact service.
0x0D14	FAULT_LPBMS_UNDERTEMP_DISCHARGE_WARN	Under temperature condition detected during a cleaning operation. Machine will stop operation.	BMS Under Temp Discharge Warning	Stop operating machine. Move machine to warmer location. Allow battery to warm up above 0°C (-32°F), before restarting operation.
0x0D31	FAULT_LPBMS_BUS_BAR_TEMP_ERR	BMS temperature has exceeded specification. Battery pack will shut down.	BMS Bus-Bar Temp Error	Stop using or charging machine. Allow battery to cool down, before restarting operation. If fault repeats, contact service.
0x0D32	FAULT_LPBMS_BUS_BAR_TEMP_PROT	BMS temperature has exceeded specification. Battery pack will shut down.	BMS Bus-Bar Temp Protection	Stop using or charging machine. Allow battery to cool down, before restarting operation. If fault repeats, contact service.
0x0D33	FAULT_LPBMS_BUS_BAR_TEMP_WARN	BMS temperature has exceeded specification. Machine will stop operation.	BMS Bus-Bar Temp Warning	Stop using or charging machine. Allow battery to cool down, before restarting operation. If fault repeats, contact service.

TROUBLESHOOTING

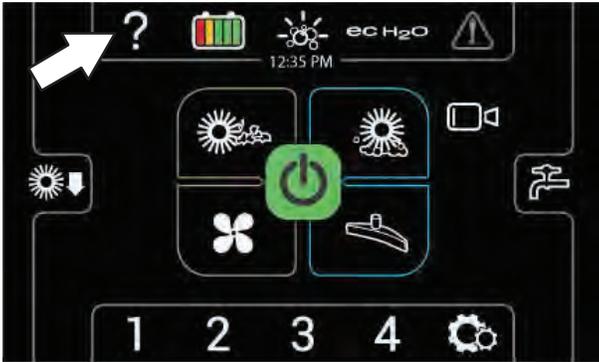
Fault Code Number	Fault Code	Fault Condition	Cause	Solution
0x0D37		Under temperature condition detected during a charging operation. Machine will stop operation.	BMS Under Temp Charge Threshold Warning	Stop charging machine. Move machine to warmer location. Allow battery to warm up above 0°C (-32°F), before restarting charging. If fault repeats, contact service.
0x0D38		Over temperature condition detected during a charging operation. Machine will stop operation.	BMS Over Temp Charge Threshold Warning	Stop charging machine. Move machine to cooler location. Allow battery to cool down, before restarting charging. If fault repeats, contact service.
0x0D39	FAULT_LPBMS_THRESH_UNDERTEMP_DISCHARGE_WARN	Under temperature condition detected during a cleaning operation. Machine will stop operation.	BMS Under Temp Discharge Threshold Warning	Stop operating machine. Move machine to warmer location. Allow battery to warm up above 0°C (-32°F), before restarting operation. If fault repeats, contact service.
0x0D3A	FAULT_LPBMS_THRESH_OVERTEMP_DISCHARGE_WARN	Over temperature condition detected during a cleaning operation. Machine will stop operation.	BMS Over Temp Discharge Threshold Warning	Stop operating machine. Allow battery to cool down, before restarting operation. If fault repeats, contact service.

SERVICE MODES

SELF-TEST MODE - PRO-PANEL

Use the Self-Test Mode diagnostic utility to test for open or shorted output circuits. Once completed, open and/or shorted output pins are displayed on the LCD (Liquid Crystal Display).

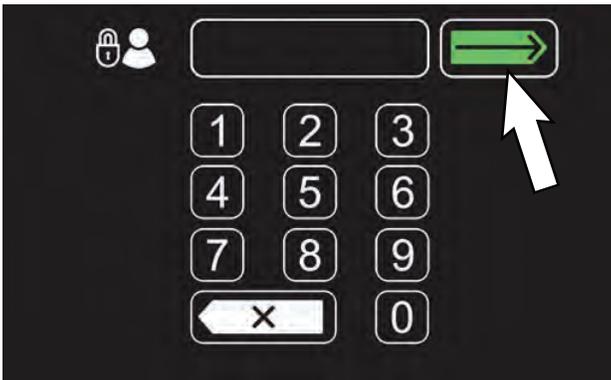
1. Turn key switch ON.
2. Touch the Help button to access the Help screen.



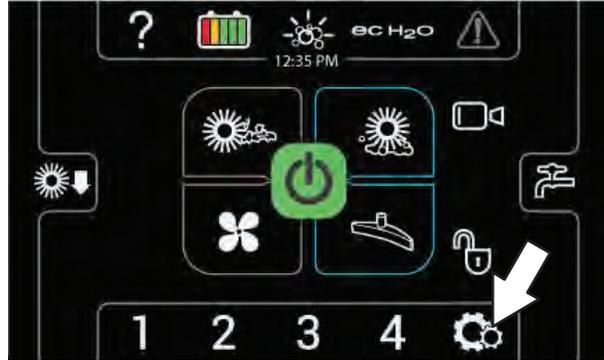
3. Touch the Login button to go to the Login screen.



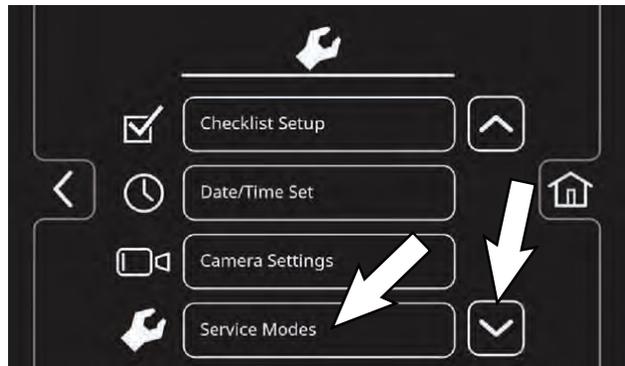
4. Use the keypad to enter the Service login number into the display above the keypad. Press the enter button when finished entering the supervisor login number.



5. Touch the settings button to access the service settings screen.



6. Scroll down to and touch the SERVICE MODES button to access the main Service Modes menu.



7. The first service setting to appear will be the Config Mode setting. Touch and release the left arrow button or right arrow button until SELF TEST appears.



8. Press the Check button to start the self-test mode. All self-test mode settings will appear on the screen as the particular system is being tested. See the table on the following page for a list of self-tests.

NOTE: Machines functions are briefly automatically activated while each function is being tested.

9. The controller sequentially tests each output circuit listed below. The self-test only tests systems that have been configured on the machine. If an option has not been configured, it will not be tested.

Testing Main Scrub Brushes...
Testing Side Scrub Brush...
Testing Vacuum Fan Motors...
Testing Main Scrub Actuator...
Testing Squeegee Actuator...
Testing Side Brush Actuator...
Testing Side Scrub Actuator...
Testing Main Valve...
Testing Det Pump...
Testing Side Pump...
Testing ES Pump...
Testing Solution Autofill Valve...
Testing Recovery Autofill Valve...
Testing Horn Output
Testing Alarm Output...
Testing Curtis CAN Communication...

10. The self-test results are displayed in "JX-X,X" format. JX = Connector, "-X,X" = Control board output pins as shown on the electrical schematic.

MESSAGE	MESSAGE
S1:Self Test "Done" or "<Results>"	S36:LSideSweepBr J7-1,2 Open
S2:Front/Left Br J10-1,2,3 Open	S37:LSideSweepBr J7-1,2 Short
S3:Front/Left Br J10-1,2,3 Short	S38:RSideSweepBr J7-3,4 Open
S4:Rear/Right Br J11-4,5,6 Open	S39:RSideSweepBr J7-3,4 Short8
S5:Rear/Right Br J11-4,5,6 Short	S40:LSideSweepAct J6-17,18 Open
S6:Main Act J4-9,10 Open	S41:LSideSweepAct J6-17,18 Short
S7:Main Act J4-9,10 Short	S42:RSideSweepAct J6-14,16 Open
S8:Main Sol Vlv J4-17 Open	S43:RSideSweepAct J6-14,16 Short
S9:Main Sol Vlv J4-17 Short	S44:L PreSweepBr J6-15,16 Open
S10:Horn J4-16 Open	S45:L PreSweepBr J6-15,16 Short
S11:Horn J4-16 Short	S46:M PreSweepBr J7-3,4 Open4
S12:Alarm J4-15 Open	S47:M PreSweepBr J7-3,4 Short
S13:Alarm J4-15 Short	S48:R PreSweepBr J6-13,14 Open
S14:Vac Fan 1 J7-1,2 Open	S49:R PreSweepBr J6-13,14 Sh
S15:Vac Fan 1 J7-1,2 Short	S50:PreSweep Vac J7-1,2 Open
S16:Vac Fan 2 J7-3,4 Open	S51:PreSweep Vac J7-1,2 Short
S17:Vac Fan 2 J7-3,4 Short	S52:PreSweep Act J6-17,18 Open
S18:Det Pump J4-14 Open	S53:PreSweep Act J6-17,18 Short
S19:Det Pump J4-14 Short	S58:Ec Pump J4-4 Open
S20:Squeegee Act J6-17,18 Open	S59:Ec Pump J4-4 Short
S21:Squeegee Act J6-17,18 Short	S60:Ec Side Vlv J4-5 Open
S22:ES Pump J6-13,14 Open	S61:Ec Side Vlv J4-5 Short
S23:ES Pump J6-13, 14 Short	S62:Curtis CAN Offline
S24:Sol AF Valve J6-12 Open	S64:Scrub Module Offline
S25:Sol AF Valve J6-12 Short	S65:PickupModule Offline
S26:Rcvr AF Vlv J6-11 Open	S66:ECH2O Module Offline
S27:Rcvr AF Vlv J6-11 Short	S67:SScrubModule Offline
S28:Side ScrubBr J6-1,2,3 Open	S68:SSweepModule Offline
S29:Side ScrubBr J6-1,2,3 Short	S69:PSweepModule Offline
S30:SideScrubAct J4-7,8 Ope	
S31:SideScrubAct J4-7,8 Short	
S32:Side Pump J4-10 Open	
S33:Side Pump J4-10 Short	
S34:Side Valve J4-9 Open	
S35:Side Valve J4-9 Short	

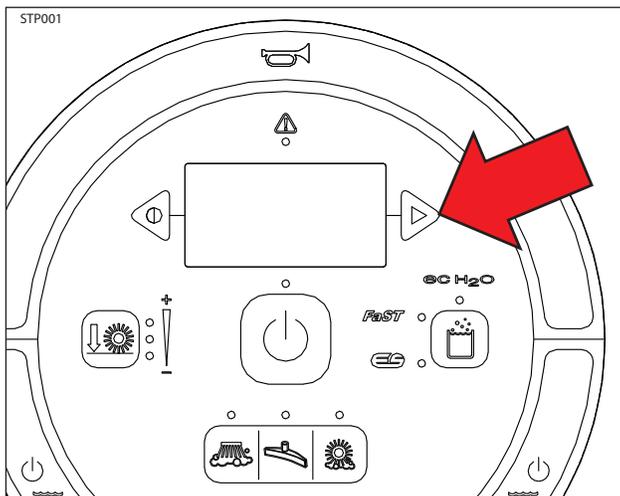
NOTE: LCD messages above can be seen as an open or a short.

11. Turn key switch OFF after self-test is completed.

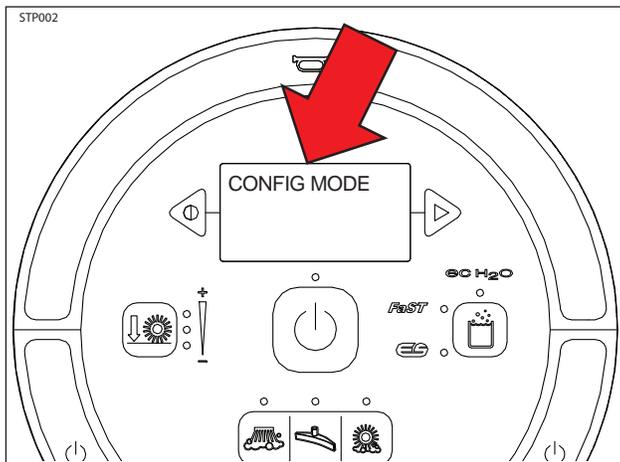
SELF-TEST MODE - STANDARD CONTROL PANEL

Use the Self-Test Mode diagnostic utility to test for open or shorted output circuits. Once completed, open and/or shorted output pins are displayed on the LCD (Liquid Crystal Display).

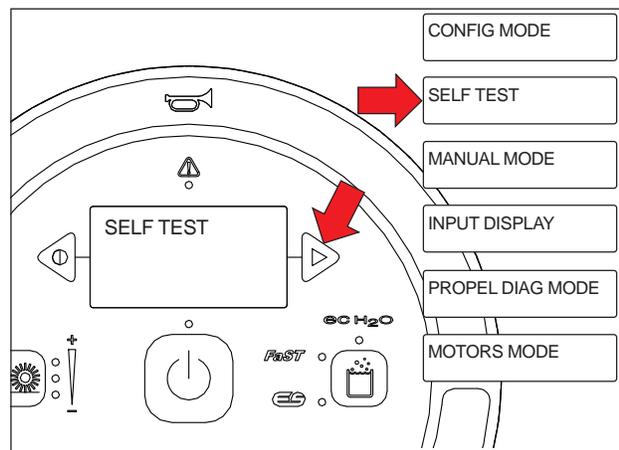
1. Turn key switch OFF.
2. Press and hold the configuration mode button and turn key switch ON while continuing to hold the configuration mode button.



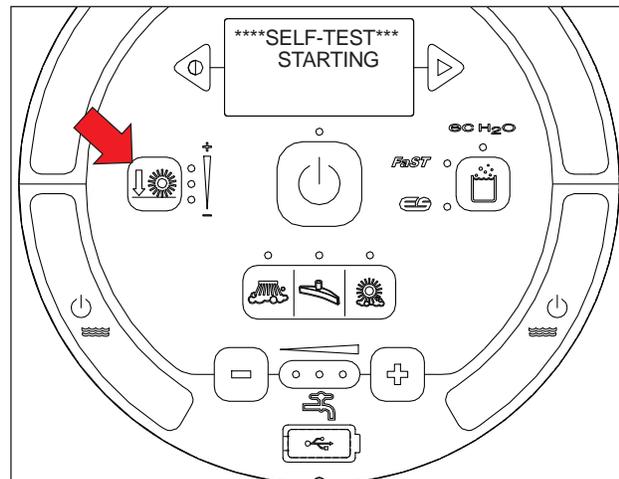
3. Release the configuration mode button when CONFIG MODE appears on the LCD.



4. Press and release the configuration mode button to scroll through a list of utilities until SELF TEST appears on the LCD.



5. Press and release the brush pressure button to activate the self-test. SELF-TEST STARTING will appear on the LCD.



6. The controller sequentially tests each output circuit listed below. The self-test only tests systems that have been configured on the machine. If an option has not been configured, it will not be tested.

Testing Main Scrub Brushes...
Testing Side Scrub Brush...
Testing Vacuum Fan Motors...
Testing Main Scrub Actuator...
Testing Squeegee Actuator...
Testing Side Brush Actuator...
Testing Side Scrub Actuator...
Testing Main Valve...
Testing Det Pump...
Testing Side Pump...
Testing ES Pump...
Testing Solution Autofill Valve...
Testing Recovery Autofill Valve...
Testing Horn Output
Testing Alarm Output...
Testing Curtis CAN Communication...

7. The self-test results are displayed in "JX-X,X" format. JX = Connector, "-X,X" = Control board output pins as shown on the electrical schematic.

LCD MESSAGE	LCD MESSAGE
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S3:Front/Left Br J10-1,2,3 Short	S38:RSideSweepBr J7-3,4 Open
S4:Rear/Right Br J11-4,5,6 Open	S39:RSideSweepBr J7-3,4 Short8
S5:Rear/Right Br J11-4,5,6 Short	S40:LSideSweepAct J6-17,18 Open
S6:Main Act J4-9,10 Open	S41:LSideSweepAct J6-17,18 Short
S7:Main Act J4-9,10 Short	S42:RSideSweepAct J6-14,16 Open
S8:Main Sol Vlv J4-17 Open	S43:RSideSweepAct J6-14,16 Short
S9:Main Sol Vlv J4-17 Short	S44:L PreSweepBr J6-15,16 Open
S10:Horn J4-16 Open	S45:L PreSweepBr J6-15,16 Short
S11:Horn J4-16 Short	S46:M PreSweepBr J7-3,4 Open4
S12:Alarm J4-15 Open	S47:M PreSweepBr J7-3,4 Short
S13:Alarm J4-15 Short	S48:R PreSweepBr J6-13,14 Open
S14:Vac Fan 1 J7-1,2 Open	S49:R PreSweepBr J6-13,14 Sh
S15:Vac Fan 1 J7-1,2 Short	S50:PreSweep Vac J7-1,2 Open
S16:Vac Fan 2 J7-3,4 Open	S51:PreSweep Vac J7-1,2 Short
S17:Vac Fan 2 J7-3,4 Short	S52:PreSweep Act J6-17,18 Open
S18:Det Pump J4-14 Open	S53:PreSweep Act J6-17,18 Short
S19:Det Pump J4-14 Short	S58:Ec Pump J4-4 Open
S20:Squeegee Act J6-17,18 Open	S59:Ec Pump J4-4 Short
S21:Squeegee Act J6-17,18 Short	S60:Ec Side Vlv J4-5 Open
S22:ES Pump J6-13,14 Open	S61:Ec Side Vlv J4-5 Short
S23:ES Pump J6-13, 14 Short	S62:Curtis CAN Offline
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S25:Sol AF Valve J6-12 Short	S65:PickupModule Offline
S26:Rcvr AF Vlv J6-11 Open	S66:ECH2O Module Offline
S27:Rcvr AF Vlv J6-11 Short	S67:SScrubModule Offline
S28:Side ScrubBr J6-1,2,3 Open	S68:SSweepModule Offline
S29:Side ScrubBr J6-1,2,3 Short	S69:PSweepModule Offline
S30:SideScrubAct J4-7,8 Ope	
S31:SideScrubAct J4-7,8 Short	
S32:Side Pump J4-10 Open	
S33:Side Pump J4-10 Short	
S34:Side Valve J4-9 Open	
S35:Side Valve J4-9 Short	

NOTE: LCD messages above can be seen as an open or a short.

CONFIGURATION MODE - PRO-PANEL

Use the Configuration Mode diagnostic utility to configure controller software to operate optional equipment and to electronically adjust certain output functions.

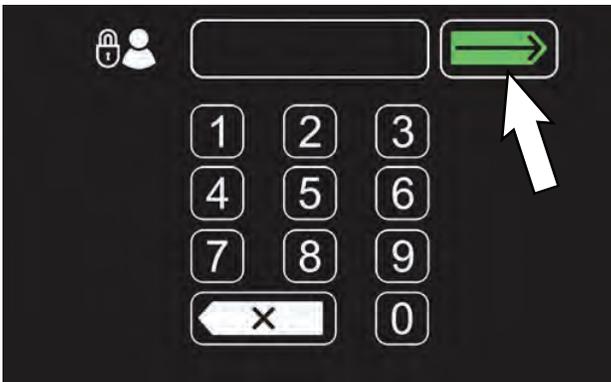
1. Turn key switch ON.
2. Touch the Help button to access the Help screen.



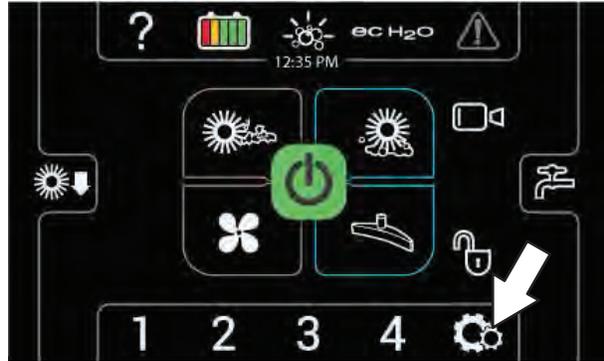
3. Touch the Login button to go to the Login screen.



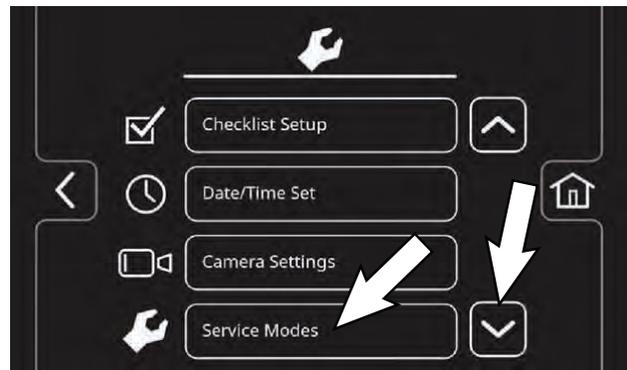
4. Use the keypad to enter the Service login number (083957530) into the display above the keypad. Touch the enter button when finished entering the Service login number.



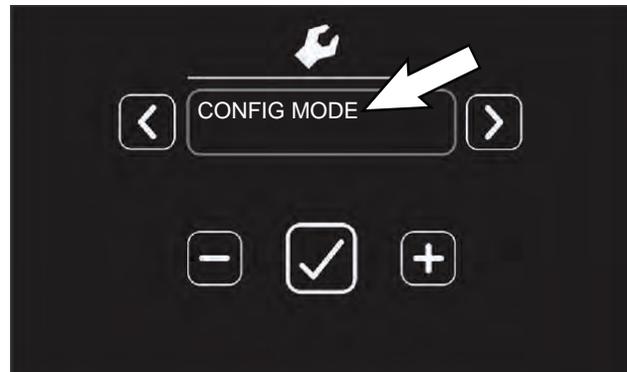
5. Touch the settings button to access the service settings screen.



6. Scroll down to and touch the SERVICE MODES button to access the main Service Modes menu.



7. The first service menu to appear will be the Config Mode setting. Touch the Check button to select CONFIG MODE. The first configuration mode item will appear.



8. Touch and release the left arrow to scroll forward chronologically through the list and the right arrow to scroll back chronologically through the list. Press the Check button to select the configuration mode to be changed/updated. See the table below for a list of Configuration Mode utilities and a description of each Configuration Mode utility.



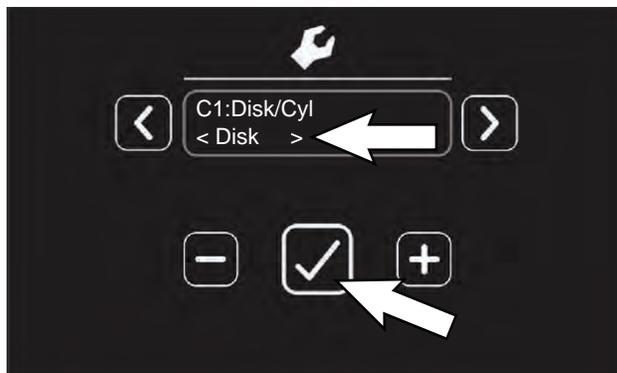
TEXT	DESCRIPTION
C1:Disk/Cyl	Configure scrub head type
C2:Ec/ES/None	Configure <i>ec-H2O</i> , ES or none
C3:Set Det Level	Set ratio of detergent for ES option to 1%, 2%, or 3%
C4:Autofill/None	Enable Autofill feature (w/ ES option)
C5:SE/None	Enable Severe Environment feature for machines equipped with <i>ec-H2O</i>
C6:SE Short Time	Set Severe Environment Short On-Time. Default 30 seconds
C7:SE Long Time	Set Severe Environment Long On-Time. Default 3600 seconds
C8:Option	Configure unit for side scrub brush, side sweep brush, dual side sweep brush, or Pre-Sweep side brushes
C9:Reset Press.?	Reset down pressures to factory default settings
C10:Main Press #1**	Set max down pressure #1 (12-18 Amps, Default 14D, 13C)
C11:Main Press #2**	Set max down pressure #2 (18-28 Amps, Default 25D, 26C)
C12:Main Press #3**	Set max down pressure #3 (28-35 Amps, Default 35 Amps)
C13:Transport Spd	Adjust maximum forward transport speed
C14:Scrub Spd	Adjust maximum scrubbing speed
C15:Main Water	Set conventional solution flow range; Low, Med, or High
C16:Propel H.M.	View propel hourmeter
C17:Scrub H.M.	View scrub hourmeter

TEXT	DESCRIPTION
C18:Reset	Resets scrub head type, solution configuration, down pressure targets, flow range, side option, travel speeds, autofill option, SE option to default settings.
C19:Diag Mode Disabled/Enabled	Enable technical data during normal machine operation. Scroll through LCD data by pressing contrast or configuration mode buttons during normal operation. Cycle key 1x to enable, 2x to disable.
Exit Config Mode	Exit Configuration Mode menu

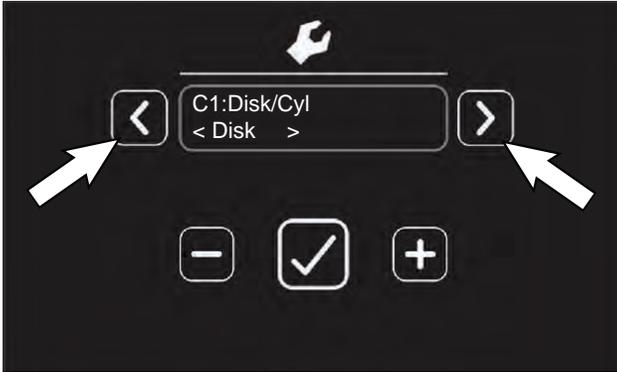
*C9:Reset Press.? mode. Press the brush pressure button after “No” changes to “Yes” following Step 7. This completes the reset process.

** C10, C11, and C12 Main Press (Main Brush Pressure) adjustments set the maximum brush motor amp draw for each down pressure setting; 1 LED, 2 LEDs, or 3 LEDs.

9. Touch and release the Check button to enable the change. A “<” and “>” symbol will appear around the setting to be changed/updating the configuration utility is now enabled.



10. Touch and release the left arrow and the right arrow to buttons to change settings.



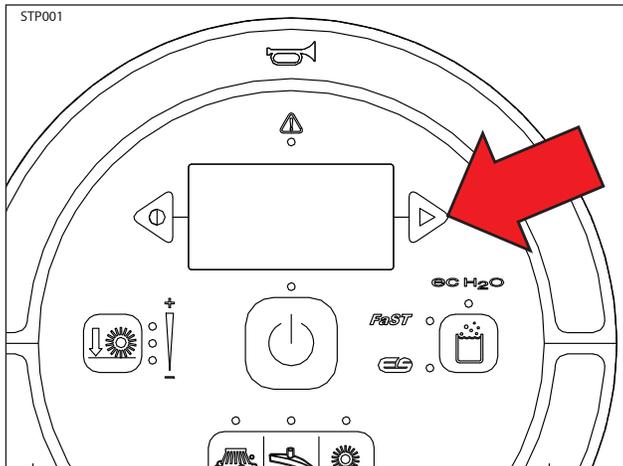
11. Touch and release the Check button to save the change.
12. To exit Configuration Mode, either turn key switch OFF, or exit Configuration Mode and return to the SERVICE MODE menu.

NOTE: If making multiple changes, do not turn key switch OFF. Return to the Configuration Mode menu to make additional changes. If machine is turned off it will be necessary to log back into the main service menu and return to the Configuration Mode to make additional changes.

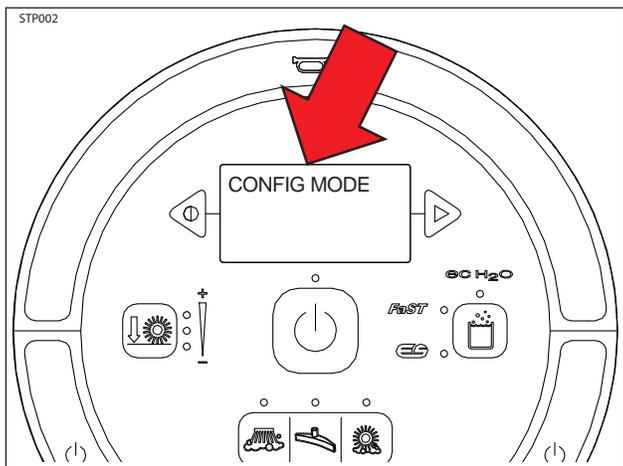
CONFIGURATION MODE - STANDARD CONTROL PANEL

Use the Configuration Mode diagnostic utility to configure controller software to operate optional equipment and to electronically adjust certain output functions.

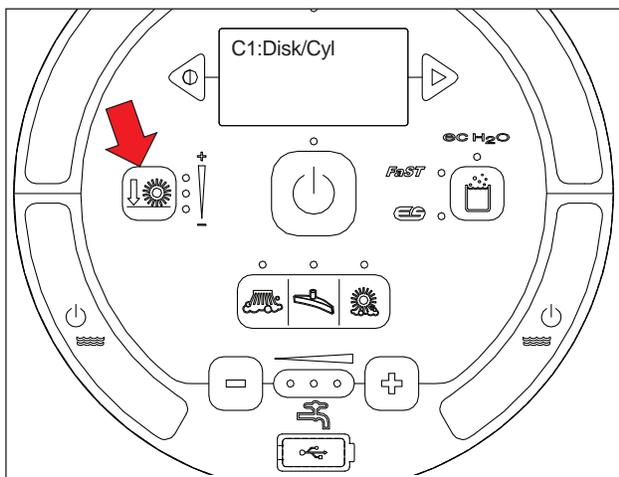
1. Turn key switch OFF.
2. Press and hold the configuration mode button and turn key switch ON while continuing to hold the configuration mode button.



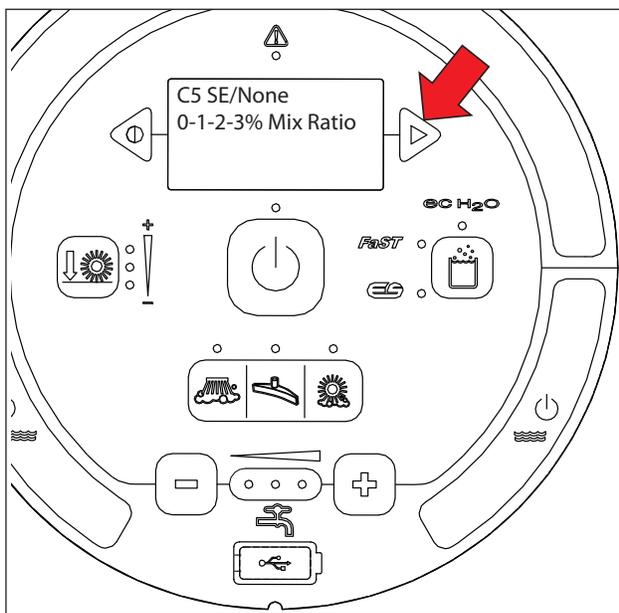
3. Release the configuration mode button when CONFIG MODE appears on the LCD.



4. Press and release the brush pressure button to enter Configuration Mode. C1:Disk/Cyl will appear on the LCD.



5. Press and release the configuration mode button to scroll through the list of utilities. See the table on the next page for a list of utilities.



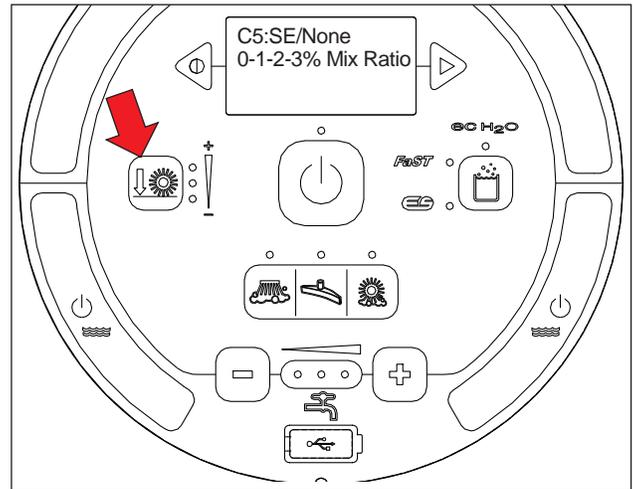
6. Use the table below for further description of each Configuration Mode utility.

TEXT	DESCRIPTION
C1:Disk/Cyl	Configure scrub head type
C2:Ec/ES/None	Configure <i>ec-H2O</i> , ES or none
C3:Set Det Level	Set ratio of detergent for ES option to 1%, 2%, or 3%
C4:Autofill/None	Enable Autofill feature (w/ ES option)
C5:SE/None	Enable Severe Environment feature for machines equipped with <i>ec-H2O</i>
C6:SE Short Time	Set Severe Environment Short On-Time. Default 30 seconds
C7:SE Long Time	Set Severe Environment Long On-Time. Default 3600 seconds
C8:Option	Configure unit for side scrub brush, side sweep brush, dual side sweep brush, or Pre-Sweep side brushes
C9:Reset Press.?	Reset down pressures to factory default settings
C10:Main Press #1**	Set max down pressure #1 (12-18 Amps, Default 14D, 13C)
C11:Main Press #2**	Set max down pressure #2 (18-28 Amps, Default 25D, 26C)
C12:Main Press #3**	Set max down pressure #3 (28-35 Amps, Default 35 Amps)
C13:Transport Spd	Adjust maximum forward transport speed
C14:Scrub Spd	Adjust maximum scrubbing speed
C15:Main Water	Set conventional solution flow range; Low, Med, or High
C16:Propel H.M.	View propel hourmeter
C17:Scrub H.M.	View scrub hourmeter
C18:Reset	Resets scrub head type, solution configuration, down pressure targets, flow range, side option, travel speeds, autofill option, SE option to default settings.
C19:Diag Mode Disabled/Enabled	Enable technical data during normal machine operation. Scroll through LCD data by pressing contrast or configuration mode buttons during normal operation. Cycle key 1x to enable, 2x to disable.
Exit Config Mode	Exit Configuration Mode menu

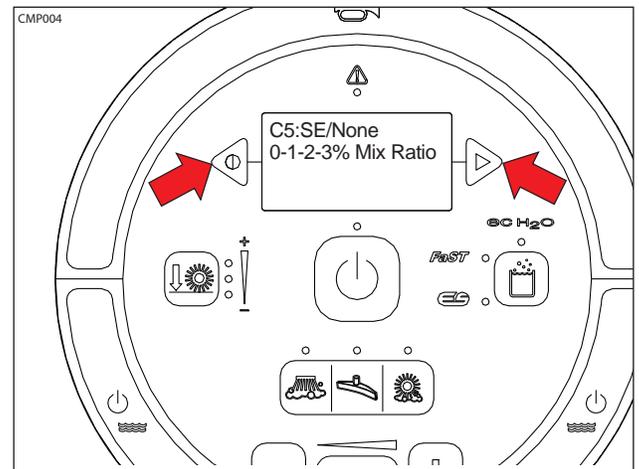
**C9:Reset Press.? mode. Press the brush pressure button after “No” changes to “Yes” following Step 7. This completes the reset process.*

*** C10, C11, and C12 Main Press (Main Brush Pressure) adjustments set the maximum brush motor amp draw for each down pressure setting; 1 LED, 2 LEDs, or 3 LEDs.*

7. Press and release the brush pressure button to enable the change. A “<” symbol will appear on the bottom line of the LCD indicating the configuration utility is now enabled.



8. Press and release the contrast or configuration mode buttons to change settings. Turn key Off to save selection.



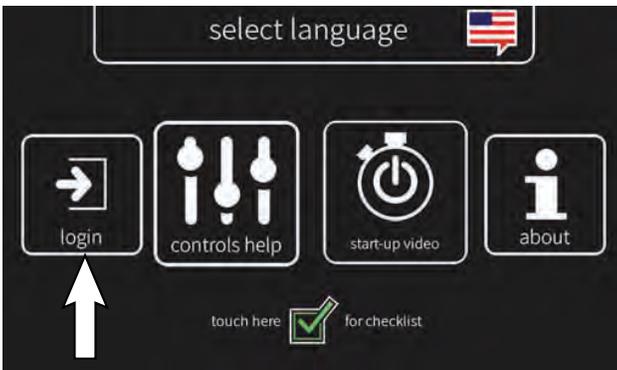
PROPEL DIAGNOSTIC MODE - PRO-PANEL

Use the Propel Diagnostic Mode (Propel Input Mode) diagnostic utility to display Curtis 1234 controller inputs on the instrument panel LCD (Liquid Crystal Display). The input data is transmitted to the controller through a CAN -bus (Controller Area Network).

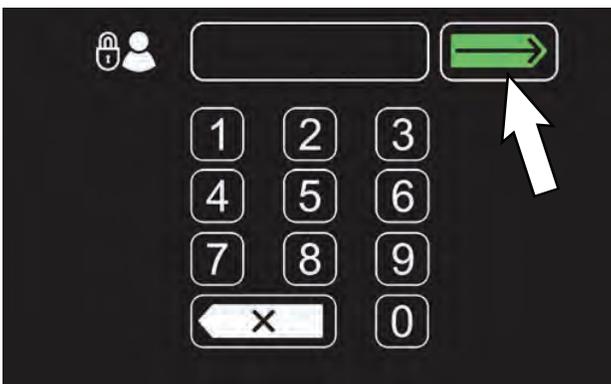
1. Turn key switch ON.
2. Touch the Help button to access the Help screen.



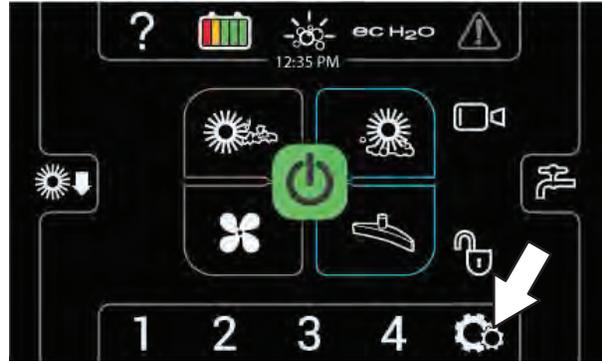
3. Touch the Login button to go to the Login screen.



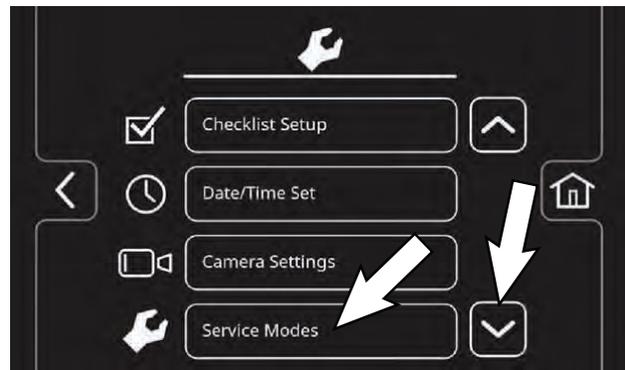
4. Use the keypad to enter the Service login number (083957530) into the display above the keypad. Touch the enter button when finished entering the Service login number.



5. Touch the settings button to access the service settings screen.



6. Scroll down to and touch the SERVICE MODES button to access the main Service Modes menu.



7. The first service setting to appear will be the Config Mode setting. Touch and release the left arrow button or right arrow button until PROPEL DIAG MODE appears.



8. Touch and release the left arrow button or right arrow button until the desired T17 Propel Diagnostic Mode appears. See table below for how each input operates.



T17 Propel Diagnostic Mode		
CODE	LCD MESSAGE	DESCRIPTION
P1	P1:Curtis Online/ Error	Curtis/T17 controllers CAN-bus connection status
P2	P2:Throttle XXXX.X v	Displays foot throttle commanded voltage (0-5V).
P3	P3:Brake Pedal On/Off	Displays brake pedal command (On/Off).
P4	P4:Direction Fwd/ Rev	Displays directional switch input (Fwd/Rev).
P5	P5:Speed XXXX.X Mph	Displays propel speed from motor encoder located in drive assembly.
P6	P6:Curtis Temp XXXX.XC XXXX.XF	Displays Curtis 1234 controller temperature
P7	P7:Motor Temp XXXX.XC XXXX.XF	Displays drive motor temperature. Thermistor located in drive assembly.
P8	P8:PropelCurrent XXXX.X A	Displays propel motor current.

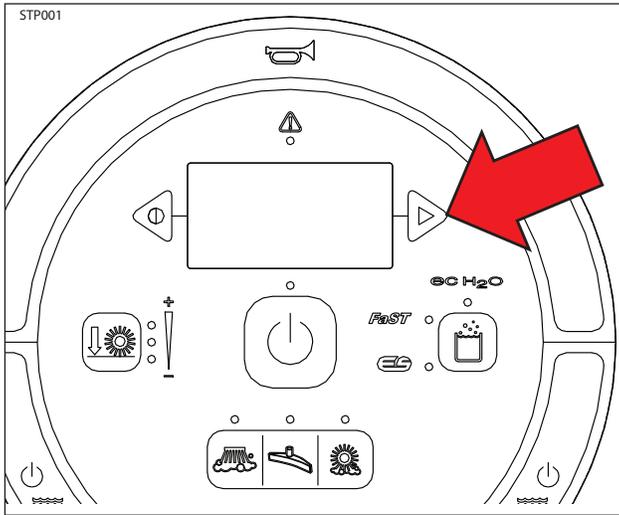
PDM004

9. To exit PROPEL DIAG MODE, either turn key switch OFF, or exit PROPEL DIAG MODE and return to the Service Modes menu.

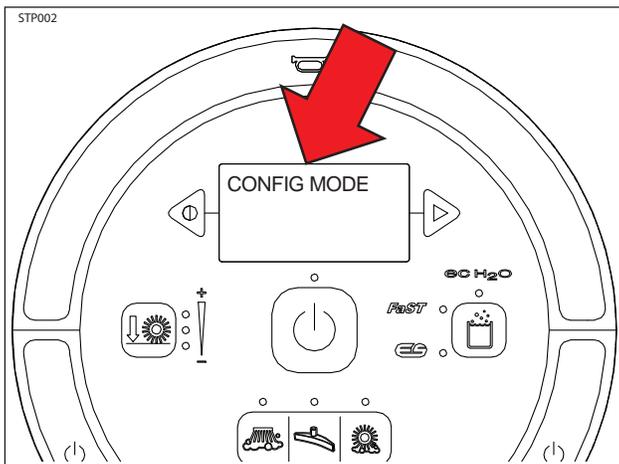
PROPEL DIAGNOSTIC MODE - STANDARD CONTROL PANEL

Use the Propel Diagnostic Mode (Propel Input Mode) diagnostic utility to display Curtis 1234 controller inputs on the instrument panel LCD (Liquid Crystal Display). The input data is transmitted to the controller through a CAN -bus (Controller Area Network).

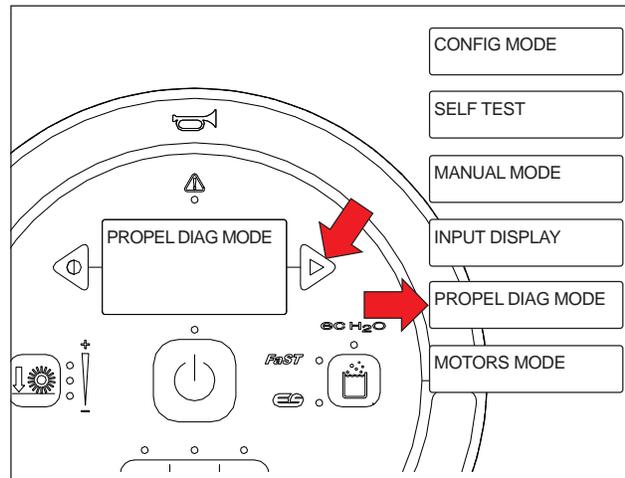
1. Turn key switch OFF.
2. Press and hold the configuration mode button and turn key switch ON while continuing to hold the configuration mode button.



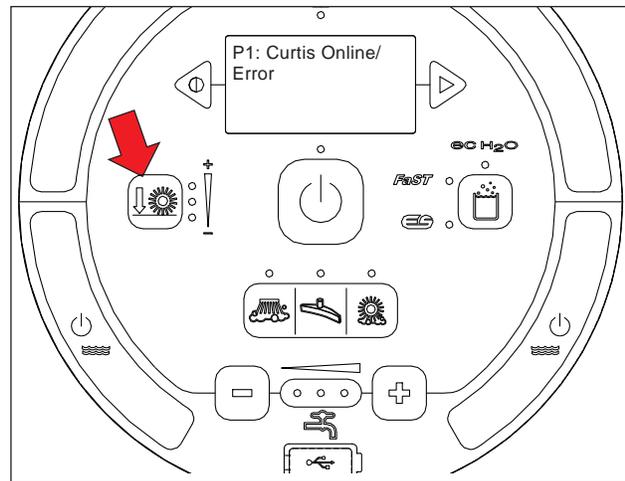
3. Release the configuration mode button when CONFIG MODE appears on the LCD.



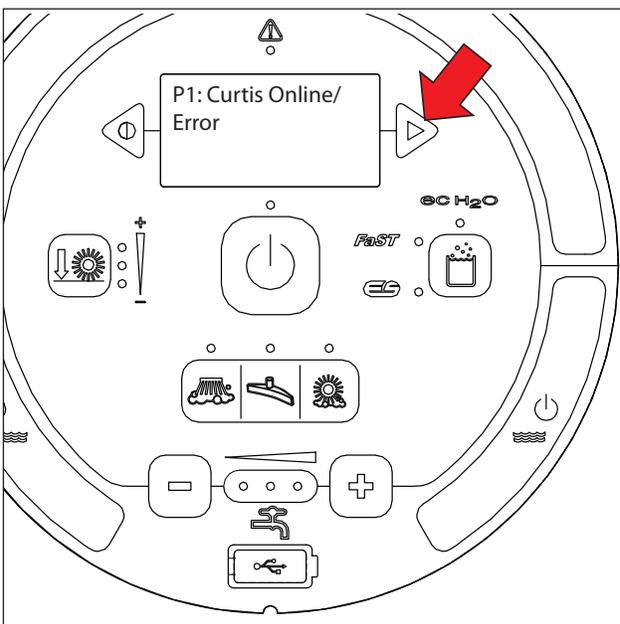
4. Press and release the configuration mode button to scroll through a list of utilities until PROPEL DIAG MODE appears on the LCD.



5. Press and release the brush pressure button to enter Propel Diagnostic Mode. P1:Curtis Online... will appear on the LCD.



- Press and release the configuration mode button to scroll through a list of Curtis 1234 controller inputs. See the table below for a list of utilities

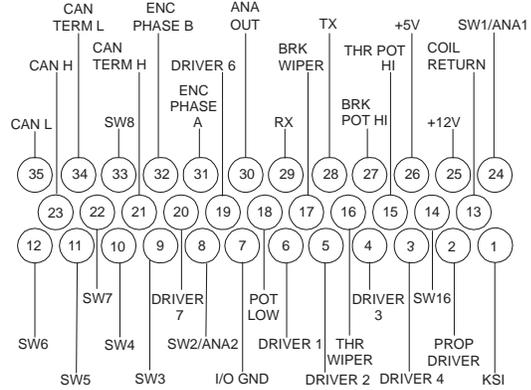
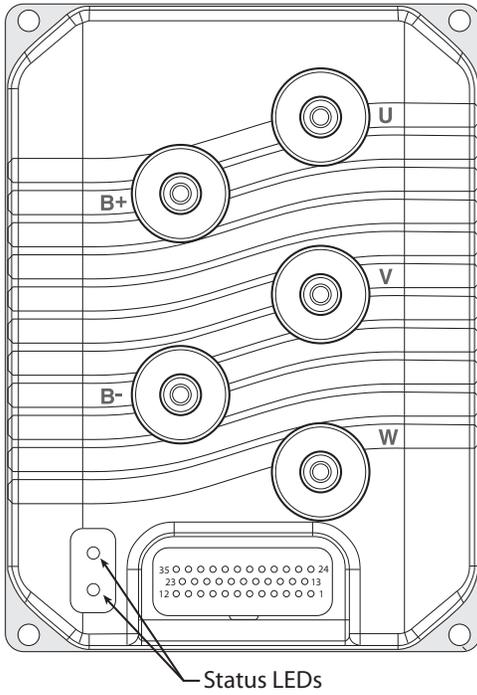


T17 Propel Diagnostic Mode		
CODE	LCD MESSAGE	DESCRIPTION
P1	P1:Curtis Online/ Error	Curtis/T17 controllers CAN-bus connection status
P2	P2:Throttle XXXX.X v	Displays foot throttle commanded voltage (0-5V).
P3	P3:Brake Pedal On/Off	Displays brake pedal command (On/Off).
P4	P4:Direction Fwd/ Rev	Displays directional switch input (Fwd/Rev).
P5	P5:Speed XXXX.X Mph	Displays propel speed from motor encoder located in drive assembly.
P6	P6:Curtis Temp XXXX.XC XXXX.XF	Displays Curtis 1234 controller temperature
P7	P7:Motor Temp XXXX.XC XXXX.XF	Displays drive motor temperature. Thermistor located in drive assembly.
P8	P8:PropelCurrent XXXX.X A	Displays propel motor current.

PDM004

PROPEL CONTROLLER DIAGNOSTIC LED OPERATION

PMC002



Types of LED Display													
Display	Status												
Neither LED illuminated	Controller is not powered on, has a dead battery, or is severely damaged.												
Yellow LED flashing	Controller is operating normally.												
Yellow and red LEDs both on solid	Controller is in Flash program mode.												
Red LED on solid	Watchdog failure. Cycle KSI to restart.												
Red LED and yellow LED flashing alternately	Controller has detected a fault. 2-digit code* flashed by yellow LED identifies the specific fault; one or two flashes by red LED indicate whether first or second code digit will follow.												
*The red LED flashes once to indicate that the first digit of the code will follow; the yellow LED then flashes the appropriate number of times for the first digit. The red LED flashes twice to indicate that the second digit of the code will follow; the yellow LED flashes the appropriate number of times for the second digit.													
<p>Example: Battery Undervoltage (Code 23)</p> <table style="width: 100%; text-align: center;"> <tr> <td>RED</td> <td>YELLOW</td> <td>RED</td> <td>YELLOW</td> </tr> <tr> <td>*</td> <td>⚙️ ⚙️</td> <td>* *</td> <td>⚙️ ⚙️ ⚙️</td> </tr> <tr> <td>(first digit)</td> <td>(2)</td> <td>(second digit)</td> <td>(3)</td> </tr> </table>		RED	YELLOW	RED	YELLOW	*	⚙️ ⚙️	* *	⚙️ ⚙️ ⚙️	(first digit)	(2)	(second digit)	(3)
RED	YELLOW	RED	YELLOW										
*	⚙️ ⚙️	* *	⚙️ ⚙️ ⚙️										
(first digit)	(2)	(second digit)	(3)										

Curtis Controller Diagnostics LED Operation and Curtis Diagnostic Codes taken from the Curtis 1234/36/38 Manual.

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PROPEL CONTROLLER DIAGNOSTIC CODES

TROUBLESHOOTING CHART			
CODE	PROGRAMMER LCD DISPLAY EFFECT OF FAULT	POSSIBLE CAUSE	SET/CLEAR CONDITIONS
12	Controller Overcurrent <i>ShutdownMotor;</i> <i>ShutdownMainContactor;</i> <i>ShutdownEMBrake;</i> <i>ShutdownThrottle;</i> <i>FullBrake;</i> <i>ShutdownPump.</i>	<ol style="list-style-type: none"> External short of phase U,V, or W motor connections. Motor parameters are mis-tuned. Controller defective. Speed encoder noise problems. 	<p><i>Set:</i> Phase current exceeded the current measurement limit.</p> <p><i>Clear:</i> Cycle KSI.</p>
13	Current Sensor Fault <i>ShutdownMotor;</i> <i>ShutdownMainContactor;</i> <i>ShutdownEMBrake;</i> <i>ShutdownThrottle;</i> <i>FullBrake;</i> <i>ShutdownPump.</i>	<ol style="list-style-type: none"> Leakage to vehicle frame from phase U, V, or W (short in motor stator). Controller defective. 	<p><i>Set:</i> Controller current sensors have invalid offset reading.</p> <p><i>Clear:</i> Cycle KSI.</p>
14	Precharge Failed <i>ShutdownMotor;</i> <i>ShutdownMainContactor;</i> <i>ShutdownEMBrake;</i> <i>ShutdownThrottle;</i> <i>FullBrake;</i> <i>ShutdownPump.</i>	<ol style="list-style-type: none"> External load on capacitor bank (B+ connection terminal) that prevents the capacitor bank from charging. See Monitor menu » Battery: Capacitor Voltage. 	<p><i>Set:</i> Precharge failed to charge the capacitor bank to the KSI voltage.</p> <p><i>Clear:</i> Cycle Interlock input or use VCL function Precharge().</p>
15	Controller Severe Undertemp <i>ShutdownMotor;</i> <i>ShutdownMainContactor;</i> <i>ShutdownEMBrake;</i> <i>ShutdownThrottle;</i> <i>FullBrake;</i> <i>ShutdownPump.</i>	<ol style="list-style-type: none"> See Monitor menu » Controller: Temperature. Controller is operating in an extreme environment. 	<p><i>Set:</i> Heatsink temperature below -40°C.</p> <p><i>Clear:</i> Bring heatsink temperature above -40°C, and cycle interlock or KSI.</p>
16	Controller Severe Overtemp <i>ShutdownMotor;</i> <i>ShutdownMainContactor;</i> <i>ShutdownEMBrake;</i> <i>ShutdownThrottle;</i> <i>FullBrake;</i> <i>ShutdownPump.</i>	<ol style="list-style-type: none"> See Monitor menu » Controller: Temperature. Controller is operating in an extreme environment. Excessive load on vehicle. Improper mounting of controller. 	<p><i>Set:</i> Heatsink temperature above +95°C.</p> <p><i>Clear:</i> Bring heatsink temperature below +95°C, and cycle interlock or KSI.</p>
17	Severe Undervoltage <i>Reduced drive torque.</i>	<ol style="list-style-type: none"> Battery Menu parameters are misadjusted. Non-controller system drain on battery. Battery resistance too high. Battery disconnected while driving. See Monitor menu » Battery Capacitor Voltage. Blown B+ fuse or main contactor did not close. 	<p><i>Set:</i> Capacitor bank voltage dropped below the Severe Undervoltage limit (see page 55) with FET bridge enabled.</p> <p><i>Clear:</i> Bring capacitor voltage above Severe Undervoltage limit.</p>

Terms:

KSI = Key Switch Interlock

FET = Field Effect Translator

PROPEL CONTROLLER DIAGNOSTIC CODES (CONTINUED)

TROUBLESHOOTING CHART			
CODE	PROGRAMMER LCD DISPLAY EFFECT OF FAULT	POSSIBLE CAUSE	SET/CLEAR CONDITIONS
18	Severe Overvoltage <i>ShutdownMotor;</i> <i>ShutdownMainContactor;</i> <i>ShutdownEMBrake;</i> <i>ShutdownThrottle;</i> <i>FullBrake;</i> <i>ShutdownPump.</i>	<ol style="list-style-type: none"> 1. See Monitor menu » Battery: Capacitor Voltage. 2. Battery menu parameters are misadjusted. 3. Battery resistance too high for given regen current. 4. Battery disconnected while regen braking. 	<p><i>Set:</i> Capacitor bank voltage exceeded the Severe Overvoltage limit (see page 55) with FET bridge enabled.</p> <p><i>Clear:</i> Bring capacitor voltage below Severe Overvoltage limit, and then cycle KSI.</p>
22	Controller Overtemp Cutback <i>Reduced drive and brake torque.</i>	<ol style="list-style-type: none"> 1. See Monitor menu » Controller: Temperature. 2. Controller is performance-limited at this temperature. 3. Controller is operating in an extreme environment. 4. Excessive load on vehicle. 5. Improper mounting of controller. 	<p><i>Set:</i> Heatsink temperature exceeded 85°C.</p> <p><i>Clear:</i> Bring heatsink temperature below 85°C.</p>
23	Undervoltage Cutback <i>Reduced drive torque.</i>	<ol style="list-style-type: none"> 1. Normal operation. Fault shows that the batteries need recharging. Controller is performance limited at this voltage. 2. Battery parameters are misadjusted. 3. Non-controller system drain on battery. 4. Battery resistance too high. 5. Battery disconnected while driving. 6. See Monitor menu » Battery: Capacitor Voltage. 7. Blown B+ fuse or main contactor did not close. 	<p><i>Set:</i> Capacitor bank voltage dropped below the Undervoltage limit (see page 55) with the FET bridge enabled.</p> <p><i>Clear:</i> Bring capacitor voltage above the Undervoltage limit.</p>
24	Overvoltage Cutback <i>Reduced brake torque.</i>	<ol style="list-style-type: none"> 1. Normal operation. Fault shows that regen braking currents elevated the battery voltage during regen braking. Controller is performance limited at this voltage. 2. Battery parameters are misadjusted. 3. Battery resistance too high for given regen current. 4. Battery disconnected while regen braking. 5. See Monitor menu » Battery: Capacitor Voltage. 	<p><i>Set:</i> Capacitor bank voltage exceeded the Overvoltage limit (see page 55) with the FET bridge enabled.</p> <p><i>Clear:</i> Bring capacitor voltage below the Overvoltage limit.</p>
25	+5V Supply Failure <i>None, unless a fault action is programmed in VCL.</i>	<ol style="list-style-type: none"> 1. External load impedance on the +5V supply (pin 26) is too low. 2. See Monitor menu » outputs: 5 Volts and Ext Supply Current. 	<p><i>Set:</i> +5V supply (pin 26) outside the +5V±10% range.</p> <p><i>Clear:</i> Bring voltage within range.</p>
26	Digital Out 6 Overcurrent <i>Digital Output 6 driver will not turn on.</i>	<ol style="list-style-type: none"> 1. External load impedance on Digital Output 6 driver (pin 19) is too low. 	<p><i>Set:</i> Digital Output 6 (pin 19) current exceeded 15 mA.</p> <p><i>Clear:</i> BRemedy the overcurrent cause and use the VCL function <i>Set_DigOut()</i> to turn the driver on again.</p>

Terms:

KSI = Key Switch Interlock

FET = Field Effect Translator

**PROPEL CONTROLLER DIAGNOSTIC CODES
(CONTINUED)**

TROUBLESHOOTING CHART			
CODE	PROGRAMMER LCD DISPLAY <i>EFFECT OF FAULT</i>	POSSIBLE CAUSE	SET/CLEAR CONDITIONS
27	Digital Out 7 Overcurrent <i>Digital Output 7 driver will not turn on.</i>	1. External load impedance on Digital Output 7 driver (pin 20) is too low.	<i>Set:</i> Digital Output 7 (pin 20) current exceeded 15 mA. <i>Clear:</i> Remedy the overcurrent cause and use the VCL function <i>Set_DigOut()</i> to turn the driver on again.
28	Motor Temp Hot Cutback <i>Reduced drive torque.</i>	1. Motor temperature is at or above the programmed Temperature Hot setting, and the requested current is being cut back. 2. Motor Temperature Control Menu parameters are mis-tuned. 3. See Monitor menu » Motor: Temperature and » Inputs: Analog2. 4. If the application doesn't use a motor thermistor, Temp Compensation and Temp Cutback should be programmed Off.	<i>Set:</i> Motor temperature is at or above the Temperature Hot parameter setting. <i>Clear:</i> Bring the motor temperature within range.
29	Motor Temp Sensor Fault <i>MaxSpeed reduced (LOS, Limited Operating Strategy), and motor temperature cutback disabled.</i>	1. Motor thermistor is not connected properly. 2. If the application doesn't use a motor thermistor, Motor Temp Sensor Enable should be programmed Off. 3. See Monitor menu » Motor: Temperature and » Inputs: Analog2.	<i>Set:</i> Motor thermistor input (pin 8) is at the voltage rail (0 or 10V). <i>Clear:</i> Bring the motor thermistor input voltage within range.
31	Coil1 Driver Open/Short <i>ShutdownDriver1.</i>	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	<i>Set:</i> Driver 1 (pin 6) is either open or shorted. This fault can be set only when Main Enable = Off. <i>Clear:</i> Correct open or short, and cycle driver.
31	Main Open/Short <i>ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; FullBrake; ShutdownPump.</i>	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	<i>Set:</i> Main contactor driver (pin 6) is either open or shorted. This fault can be set only when Main Enable = On. <i>Clear:</i> Correct open or short, and cycle driver.
32	Coil2 Driver Open/Short <i>ShutdownDriver2.</i>	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	<i>Set:</i> Driver 2 (pin 5) is either open or shorted. This fault can be set only when EM Brake Type = 0. <i>Clear:</i> Correct open or short, and cycle driver.
32	EMBrake Open/Short <i>ShutdownEMBrake; ShutdownThrottle; FullBrake.</i>	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	<i>Set:</i> Electromagnetic brake driver (pin 5) is either open or shorted. This fault can be set only when EM Brake Type > 0. <i>Clear:</i> Correct open or short, and cycle driver.
33	Coil3 Driver Open/Short <i>ShutdownDriver3.</i>	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	<i>Set:</i> Driver 3 (pin 4) is either open or shorted. <i>Clear:</i> Correct open or short, and cycle driver.
34	Coil4 Driver Open/Short <i>ShutdownDriver4.</i>	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	<i>Set:</i> Driver 4 (pin 3) is either open or shorted. <i>Clear:</i> Correct open or short, and cycle driver.

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VCL = Vehicle Control Language

PROPEL CONTROLLER DIAGNOSTIC CODES (CONTINUED)

TROUBLESHOOTING CHART			
CODE	PROGRAMMER LCD DISPLAY EFFECT OF FAULT	POSSIBLE CAUSE	SET/CLEAR CONDITIONS
35	PD Open/Short <i>ShutdownPD.</i>	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	<i>Set:</i> Proportional driver (pin 2) is either open or shorted. <i>Clear:</i> Correct open or short, and cycle driver.
36	Encoder Fault <i>ShutdownEMBrake;</i> <i>ShutdownThrottle.</i>	1. Motor encoder failure. 2. Dirty connector pins. 3. See Monitor menu » Motor: Motor RPM.	<i>Set:</i> Motor encoder phase failure detected. <i>Clear:</i> Cycle KSI.
37	Motor Open <i>ShutdownMotor;</i> <i>ShutdownMainContactor;</i> <i>ShutdownEMBrake;</i> <i>ShutdownThrottle;</i> <i>FullBrake;</i> <i>ShutdownPump.</i>	1. Motor phase is open. 2. Bad crimps or faulty wiring.	<i>Set:</i> Motor phase U, V, or W detected open. <i>Clear:</i> Cycle KSI.
38	Main Contactor Welded <i>ShutdownMotor;</i> <i>ShutdownMainContactor;</i> <i>ShutdownEMBrake;</i> <i>ShutdownThrottle;</i> <i>FullBrake;</i> <i>ShutdownPump.</i>	1. Main contactor tips are welded closed. 2. Motor phase U or V is disconnected or open. 3. An alternate voltage path (such as an external precharge resistor) is providing a current to the capacitor bank (B+ connection terminal).	<i>Set:</i> Just prior to the main contactor closing, the capacitor bank voltage (B+ connection terminal) was loaded for a short time and the voltage did not discharge. <i>Clear:</i> Cycle KSI.
39	Main Contactor Did Not Close <i>ShutdownMotor;</i> <i>ShutdownMainContactor;</i> <i>ShutdownEMBrake;</i> <i>ShutdownThrottle;</i> <i>FullBrake;</i> <i>ShutdownPump.</i>	1. Main contactor did not close. 2. Main contactor tips are oxidized, burned, or not making good contact. 3. External load on capacitor bank(B+ connection terminal) that prevents capacitor bank from charging. 4. Blown B+ fuse.	<i>Set:</i> With the main contactor commanded closed, the capacitor bank voltage (B+ connection terminal) was loaded for a connection terminal) did not charge to B+. <i>Clear:</i> Cycle KSI.
41	Throttle Wiper High <i>ShutdownThrottle.</i>	1. See Monitor menu » Inputs: Throttle Pot. 2. Throttle pot wiper voltage too high.	<i>Set:</i> Throttle pot wiper (pin 16) voltage is higher than the high fault threshold (can be changed with the VCL function <i>Setup_Pot_Faults()</i>). <i>Clear:</i> Bring throttle pot wiper voltage below the fault threshold.
42	Throttle Wiper Low <i>ShutdownThrottle.</i>	1. See Monitor menu » Inputs: Throttle Pot. 2. Throttle pot wiper voltage too low.	<i>Set:</i> Throttle pot wiper (pin 16) voltage is lower than the low fault threshold (can be changed with the VCL function <i>Setup_Pot_Faults()</i>). <i>Clear:</i> Bring throttle pot wiper voltage above the fault threshold.
43	Pot2 Wiper High <i>FullBrake.</i>	1. See Monitor menu » Inputs: Pot2 Raw. 2. Pot2 wiper voltage too high.	<i>Set:</i> Pot2 wiper (pin 17) voltage is higher than the high fault threshold (can be changed with the VCL function <i>Setup_Pot_Faults()</i>). <i>Clear:</i> Bring Pot2 wiper voltage below the fault threshold.

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**PROPEL CONTROLLER DIAGNOSTIC CODES
(CONTINUED)**

TROUBLESHOOTING CHART			
CODE	PROGRAMMER LCD DISPLAY <i>EFFECT OF FAULT</i>	POSSIBLE CAUSE	SET/CLEAR CONDITIONS
44	Pot2 Wiper Low <i>FullBrake.</i>	<ol style="list-style-type: none"> See Monitor menu » Inputs: Pot2 Raw. Pot2 wiper voltage too low. 	<i>Set:</i> Pot2 wiper (pin 17) voltage is lower than the low fault threshold (can be changed with the VCL function <i>Setup_Pot_Faults()</i>). <i>Clear:</i> Bring Pot2 wiper voltage above the fault threshold.
45	Pot Low Overcurrent <i>ShutdownThrottle;</i> <i>FullBrake.</i>	<ol style="list-style-type: none"> See Monitor menu » Outputs: Pot Low. Combined pot resistance connected to pot low is too low. 	<i>Set:</i> Pot low (pin 18) current exceeds 10mA. <i>Clear:</i> Clear pot low overcurrent condition and cycle KSI.
46	EEPROM Failure <i>ShutdownMotor;</i> <i>ShutdownMainContactor;</i> <i>ShutdownEMBrake;</i> <i>ShutdownThrottle;</i> <i>ShutdownInterlock;</i> <i>ShutdownDriver1;</i> <i>ShutdownDriver2;</i> <i>ShutdownDriver3;</i> <i>ShutdownDriver4;</i> <i>ShutdownPD;</i> <i>FullBrake;</i> <i>ShutdownPump.</i>	<ol style="list-style-type: none"> Failure to write to EEPROM memory. This can be caused by EEPROM memory writes initiated by VCL, by the CAN bus, by adjusting parameters with the programmer, or by loading new software into the controller. 	<i>Set:</i> Controller operating system tried to write to EEPROM memory and failed. <i>Clear:</i> Download the correct software (OS) and matching parameter default settings into the controller and cycle KSI.
47	HPD/Sequencing Fault <i>ShutdownThrottle.</i>	<ol style="list-style-type: none"> KSI, interlock, direction, and throttle inputs applied in incorrect sequence. Faulty wiring, crimps, or switches at KSI, interlock, direction, or throttle inputs. See Monitor menu » Inputs. 	<i>Set:</i> HPD (High Pedal Disable) or sequencing fault caused by incorrect sequence of KSI, interlock, direction, and throttle inputs. <i>Clear:</i> Reapply inputs in correct sequence.
47	Emer Rev HPD <i>ShutdownThrottle;</i> <i>ShutdownEMBrake.</i>	<ol style="list-style-type: none"> Emergency Reverse operation has concluded, but the throttle, forward and reverse inputs, and interlock have not been returned to neutral. 	<i>Set:</i> At the conclusion of Emergency Reverse, the fault was set because various inputs were not returned to neutral. <i>Clear:</i> If EMR_Interlock = On, clear the interlock, throttle, and direction inputs. If EMR_Interlock = Off, clear the throttle and direction inputs.
49	Parameter Change Fault <i>ShutdownMotor;</i> <i>ShutdownMainContactor;</i> <i>ShutdownEMBrake;</i> <i>ShutdownThrottle;</i> <i>FullBrake;</i> <i>ShutdownPump.</i>	<ol style="list-style-type: none"> This is a safety fault caused by a change in certain parameter settings so that the vehicle will not operate until KSI is cycled. For example, if a user changes the Throttle Type this fault will appear and require cycling KSI before the vehicle can operate. 	<i>Set:</i> Adjustment of a parameter setting that requires cycling of KSI. <i>Clear:</i> Cycle KSI.
51-67	OEM Faults (See OEM documentation.)	<ol style="list-style-type: none"> These faults can be defined by the OEM and are implemented in the application-specific VCL code. See OEM documentation. 	<i>Set:</i> See OEM documentation. <i>Clear:</i> See OEM documentation.

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PROPEL CONTROLLER DIAGNOSTIC CODES (CONTINUED)

TROUBLESHOOTING CHART,			
CODE	PROGRAMMER LCD DISPLAY EFFECT OF FAULT	POSSIBLE CAUSE	SET/CLEAR CONDITIONS
68	VCL Run Time Error <i>ShutdownMotor;</i> <i>ShutdownMainContactor;</i> <i>ShutdownEMBrake;</i> <i>ShutdownThrottle;</i> <i>ShutdownInterlock;</i> <i>ShutdownDriver1;</i> <i>ShutdownDriver2;</i> <i>ShutdownDriver3;</i> <i>ShutdownDriver4;</i> <i>ShutdownPD;</i> <i>FullBrake;</i> <i>ShutdownPump.</i>	1. VCL code encountered a runtime VCL error. 2. See Monitor menu » Controller: VCL Error Module and VCL Error. This error can then be compared to the runtime VCL module ID and error code definitions found in the specific OS system information file.	<i>Set:</i> Runtime VCL code error condition. <i>Clear:</i> Edit VCL application software to fix this error condition; flash the new compiled software and matching parameter defaults; cycle KSI.
69	External Supply Out of Range <i>None, unless a fault action is programmed in VCL.</i>	1. External load on the 5V and 12V supplies draws either too much or too little current. 2. Fault Checking Menu parameters Ext Supply Max and Ext Supply Min are mis-tuned. 3. See Monitor menu » Outputs: Ext Supply Current.	<i>Set:</i> The external supply current (combined current used by the 5V supply [pin 26] and 12V supply [pin 25]) is either greater than the upper current threshold or lower than the lower current threshold. The two thresholds are defined by the External Supply Max and External Supply Min parameter settings (page 52). <i>Clear:</i> Bring the external supply current within range.
71	OS General <i>ShutdownMotor;</i> <i>ShutdownMainContactor;</i> <i>ShutdownEMBrake;</i> <i>ShutdownThrottle;</i> <i>ShutdownInterlock;</i> <i>ShutdownDriver1;</i> <i>ShutdownDriver2;</i> <i>ShutdownDriver3;</i> <i>ShutdownDriver4;</i> <i>ShutdownPD;</i> <i>FullBrake;</i> <i>ShutdownPump.</i>	1. Internal controller fault.	<i>Set:</i> Internal controller fault detected. <i>Clear:</i> Cycle KSI.
72	PDO Timeout <i>ShutdownInterlock;</i> <i>CAN NMT State set to Pre-operational.</i>	1. Time between CAN PDO messages received exceeded the PDO Timeout Period.	<i>Set:</i> Time between CAN PDO messages received exceeded the PDO Timeout Period. <i>Clear:</i> Cycle KSI or receive CAN NMT message.
73	Stall Detected <i>ShutdownEMBrake;</i> <i>ShutdownThrottle;</i> <i>Control Mode changed to LOS (Limited Operating Strategy).</i>	1. Stalled motor. 2. Motor encoder failure. 3. Bad crimps or faulty wiring. 4. Problems with power supply for the motor encoder. 5. See Monitor menu » Motor: Motor RPM.	<i>Set:</i> No motor encoder movement detected. <i>Clear:</i> Either cycle KSI, or detect valid motor encoder signals while operating in LOS mode and return Throttle Command = 0 and Motor RPM = 0.
74	Fault On Other Traction Controller	Dual Drive fault: see Dual Drive manual.	
75	Dual Severe Fault	Dual Drive fault: see Dual Drive manual.	

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 FET = Field Effect Translator
 VCL = Vehicle Control Language
 CAN = Controller Area Network

PROPEL CONTROLLER DIAGNOSTIC CODES (CONTINUED)

TROUBLESHOOTING CHART			
CODE	PROGRAMMER LCD DISPLAY EFFECT OF FAULT	POSSIBLE CAUSE	SET/CLEAR CONDITIONS
87	Motor Characterization Fault <i>ShutdownMotor;</i> <i>ShutdownMainContactor;</i> <i>ShutdownEMBrake;</i> <i>ShutdownThrottle;</i> <i>FullBrake;</i> <i>ShutdownPump.</i>	1. Motor characterization failed during characterization process. See Monitor menu » Controller: Motor Characterization Error for cause: 0=none 1=encoder signal seen, but step size not determined; set Encoder Step Size manu 2=motor temp sensor fault 3=motor temp hot cutback fault 4= controller overtemp cutback fault 5=controller undertemp cutback fault 6=undervoltage cutback fault 7=severe overvoltage fault 8=encoder signal not seen, or one or both channels missing 9=motor parameters out of characterization range.	<i>Set:</i> Motor characterization failed during the motor characterization process. <i>Clear:</i> Correct fault; cycle KSI.
89	Motor Type Fault <i>ShutdownMotor;</i> <i>ShutdownMainContactor;</i> <i>ShutdownEMBrake;</i> <i>ShutdownThrottle;</i> <i>FullBrake;</i> <i>ShutdownPump.</i>	1. The Motor_Type parameter value is out of range.	<i>Set:</i> Motor_Type parameter is set to an illegal value. <i>Clear:</i> Set Motor_Type to correct value and cycle KSI.
91	VCL/OS Mismatch <i>ShutdownMotor;</i> <i>ShutdownMainContactor;</i> <i>ShutdownEMBrake;</i> <i>ShutdownThrottle;</i> <i>ShutdownInterlock;</i> <i>ShutdownDriver1;</i> <i>ShutdownDriver2;</i> <i>ShutdownDriver3;</i> <i>ShutdownDriver4;</i> <i>ShutdownPD;</i> <i>FullBrake;</i> <i>ShutdownPump.</i>	1. The VCL software in the controller does not match the OS software in the controller.	<i>Set:</i> VCL and OS software do not match; when KSI cycles, a check is made to verify that they match and a fault is issued when they do not. <i>Clear:</i> Download the correct VCL and OS software into the controller.
92	EM Brake Failed to Set <i>ShutdownEMBrake;</i> <i>ShutdownThrottle.</i>	1. Vehicle movement sensed after the EM Brake has been commanded to set. 2. EM Brake will not hold the motor from rotating.	<i>Set:</i> After the EM Brake was commanded to set and time has elapsed to allow the brake to fully engage, vehicle movement has been sensed. <i>Clear:</i> Activate the throttle.
93	Encoder LOS (Limited Operating Strategy) <i>Enter LOS control mode.</i>	1. Limited Operating Strategy (LOS) control mode has been activated, as a result of either an Encoder Fault (Code 36) or a Stall Detect Fault (Code 73). 2. Motor encoder failure. 3. Bad crimps or faulty wiring. 4. Vehicle is stalled.	<i>Set:</i> Encoder Fault (Code 36) or Stall Detect Fault (Code 73) was activated, and Brake or Interlock has been applied to activate LOS control mode, allowing limited motor control. <i>Clear:</i> Cycle KSI or, if LOS mode was activated by the Stall Fault, clear by ensuring encoder senses proper operation, Motor RPM = 0, and Throttle Command = 0.

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PROPEL CONTROLLER DIAGNOSTIC CODES (CONTINUED)

TROUBLESHOOTING CHART			
CODE	PROGRAMMER LCD DISPLAY <i>EFFECT OF FAULT</i>	POSSIBLE CAUSE	SET/CLEAR CONDITIONS
94	Emer Rev Timeout <i>ShutdownEMBrake;</i> <i>ShutdownThrottle.</i>	<ol style="list-style-type: none"> Emergency Reverse was activated and concluded because the EMR Timeout timer has expired. The emergency reverse input is stuck On. 	<p><i>Set:</i> Emergency Reverse was activated and ran until the EMR Timeout timer expired.</p> <p><i>Clear:</i> Turn the emergency reverse input Off.</p>
98	Illegal Model Number <i>ShutdownMotor;</i> <i>ShutdownMainContactor;</i> <i>ShutdownEMBrake;</i> <i>ShutdownThrottle;</i> <i>FullBrake;</i> <i>ShutdownPump.</i>	<ol style="list-style-type: none"> Model_Number variable contains illegal value. For 1234/36/38 models, a value other than 1234, 1236, 1238, or 1298 is illegal. For 1232 models, a value other than 1232 is illegal. Software and hardware do not match. Controller defective. 	<p><i>Set:</i> Illegal Model_Number variable; when KSI cycles, a check is made to confirm a legal Model_Number, and a fault is issued if one is not found.</p> <p><i>Clear:</i> Download appropriate software for your controller model.</p>
99	Dualmotor Parameter Mismatch	Dual Drive fault: see Dual Drive manual.	

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 EMR = Emergency Reverse

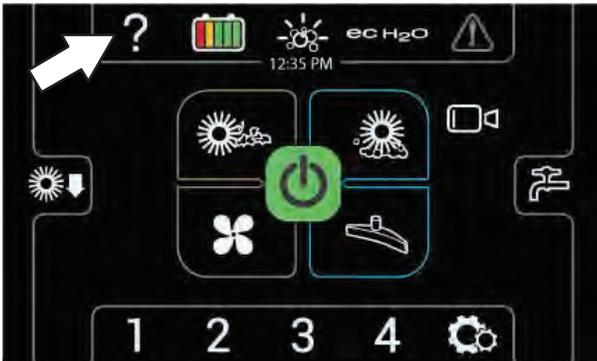
T17 CONTROLLER CUSTOM FAULTS

Code	Condition	Cause of Condition	Clear Condition	Action
51	Throttle SRO Fault	Throttle is active at same time service brake is pressed.	Release throttle to neutral	Shutdown Throttle
52	HPD Fault	1. Throttle is active immediately after timer set by "Throttle PowerUp Check Delay" parameter (500ms) has expired or 2. Throttle is active after operator has lifted from seat for longer than "Seat Switch Debounce Delay" parameter (2.0 sec).	Release throttle to neutral	Shutdown Throttle
53	Emergency Stop (E-Stop) Fault	1. E-Stop button is Open (Pushed In) and 2. Key switch voltage is greater than "Low Voltage Switch Check Threshold" parameter (22 V) and 3. Timer set to "E-Stop Switch Powerup Check Delay" parameter (3.0 sec) has expired and 4. "E-Stop Reporting" parameter = On Note: When E-Stop button is Open, throttle is shutdown immediately but fault is not reported unless above conditions are met.	E-Stop button is closed (pulled out) and Key switch is cycled	Shutdown Throttle
54	CAN Startup Fault	An initial heartbeat is not received over CAN bus upon power up from Tennant Master Controller within "Master Heartbeat Startup Period" parameter (15.0 sec)	Restore CAN communication and cycle key switch	Speed Limit is set to "Fault Max Speed" parameter (311 rpm)
55	CAN Operational Fault	After initial heartbeat, subsequent heartbeats are not received over CAN bus from Tennant Master Controller within "Master Heartbeat Time out Period" parameter (2.5 sec)	Restore CAN communication and cycle key switch	Speed Limit is set to "Fault Max Speed" parameter (311 rpm)
56	CAN Transmission Stopped	CAN engine has been set to a "non-operational" state by Tennant Master Controller. Following NMT messages will set fault: "Enter Pre-Operational State" (Command Specifier = 0x80), "Stop Remote Node" (Command Specifier = 0x02), "Reset Communication" (Command Specifier = 0x82)	Master Tennant controller resets Curtis controller via NMT message "Reset Node" (Command Specifier = 0x81) or cycle key switch	Shutdown CAN PDO transmission Speed Limit is set to "Fault Max Speed" parameter (311 rpm)

INPUT DISPLAY MODE - PRO-PANEL

Use the Input Display Mode diagnostic utility to display controller input conditions. Input Display Mode displays text messages for hard-wired switch, sensor, and touch panel button inputs.

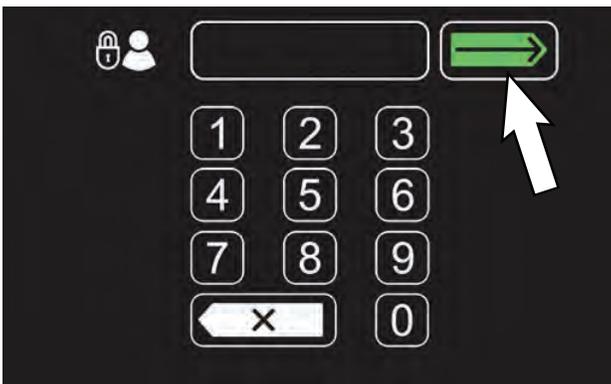
1. Turn key switch ON.
2. Touch the Help button to access the Help screen.



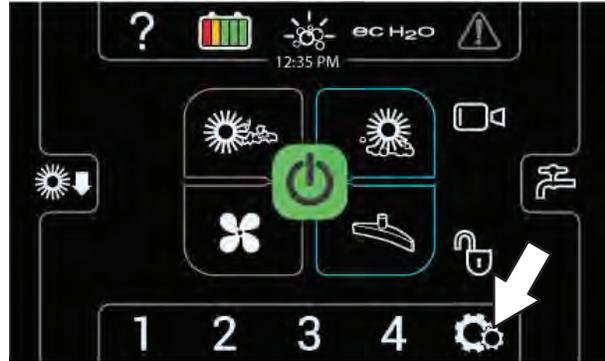
3. Touch the Login button to go to the Login screen.



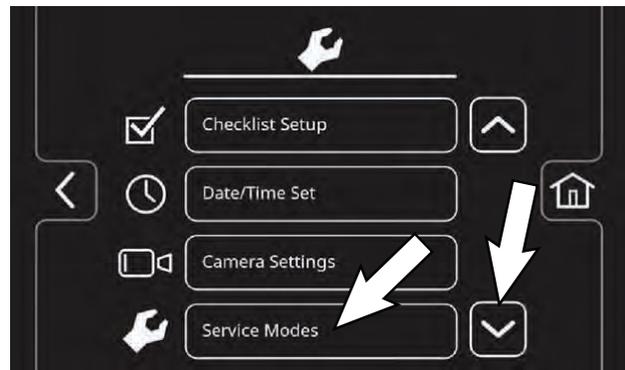
4. Use the keypad to enter the Service login number (083957530) into the display above the keypad. Touch the enter button when finished entering the Service login number.



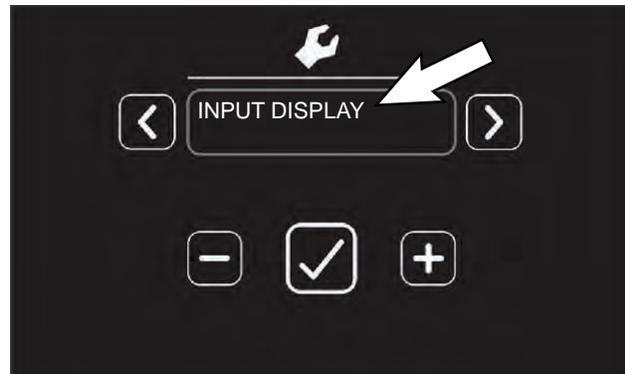
5. Touch the settings button to access the service settings screen.



6. Scroll down to and touch the SERVICE MODES button to access the main Service Modes menu.



7. The first service setting to appear will be the Config Mode setting. Touch and release the left arrow button or right arrow button until INPUT DISPLAY appears.



8. Touch and release the left arrow button or right arrow button until the desired Input Display Mode appears. See the table below for a list of Input Display Mode conditions.



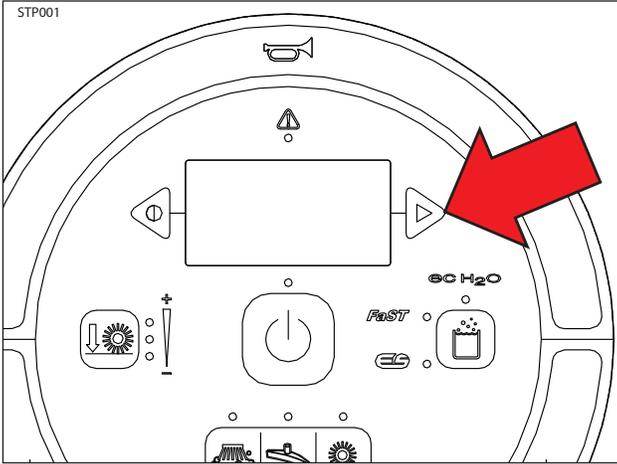
MESSAGE	MESSAGE
I1:Solution Tank Level: X XV	I6:Side Sweep Off / On
I2:Recovery Tank Not Full / Full	I7:Pre-Sweep Off / On
I3:Hlf Rcvr Tank	I8:Pressure Switch Open / Closed
I4:Seat Switch Seated	I9:Flush Button
I5:Side Scrub Off / On	I10:Seat Switch Off / On

9. Touch any other button to display a corresponding text message. The message confirms the control module received the input.
10. To exit Input Display Mode, either turn key switch OFF, or exit Input Display Mode and return to the main Service Modes menu.

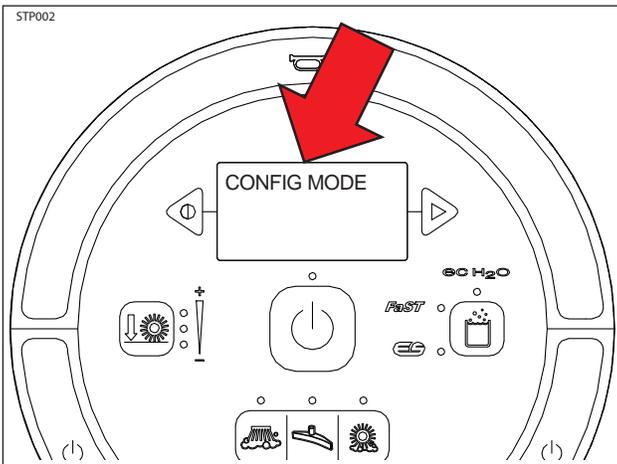
INPUT DISPLAY MODE - STANDARD CONTROL PANEL

Use the Input Display Mode diagnostic utility to display controller input conditions. Input Display Mode displays LCD text messages for hard-wired switch, sensor, and touch panel button inputs.

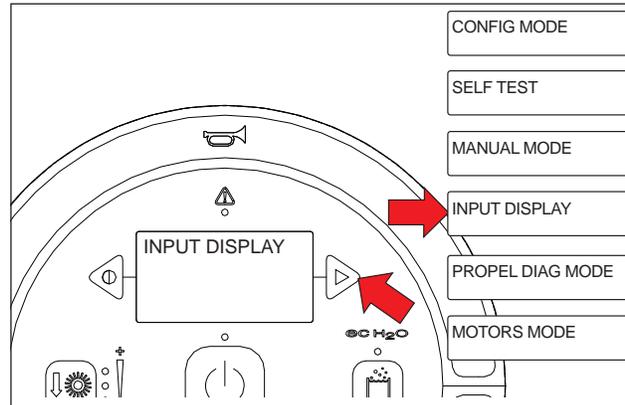
1. Turn key switch OFF.
2. Press and hold the configuration mode button and turn key switch ON while continuing to hold the configuration mode button.



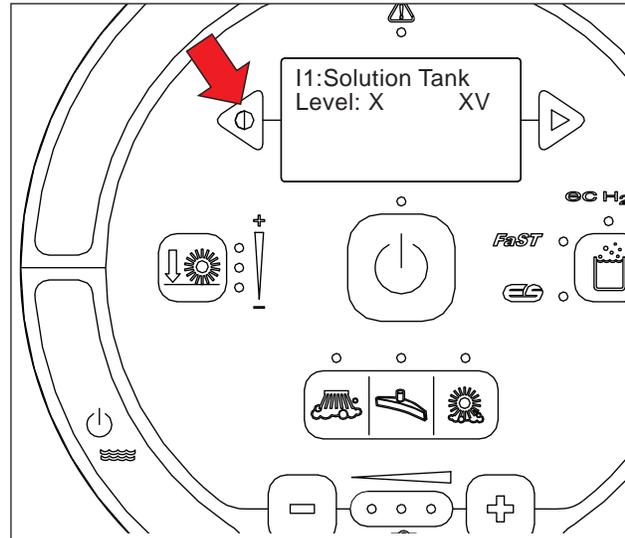
3. Release the configuration mode button when CONFIG MODE appears on the LCD.



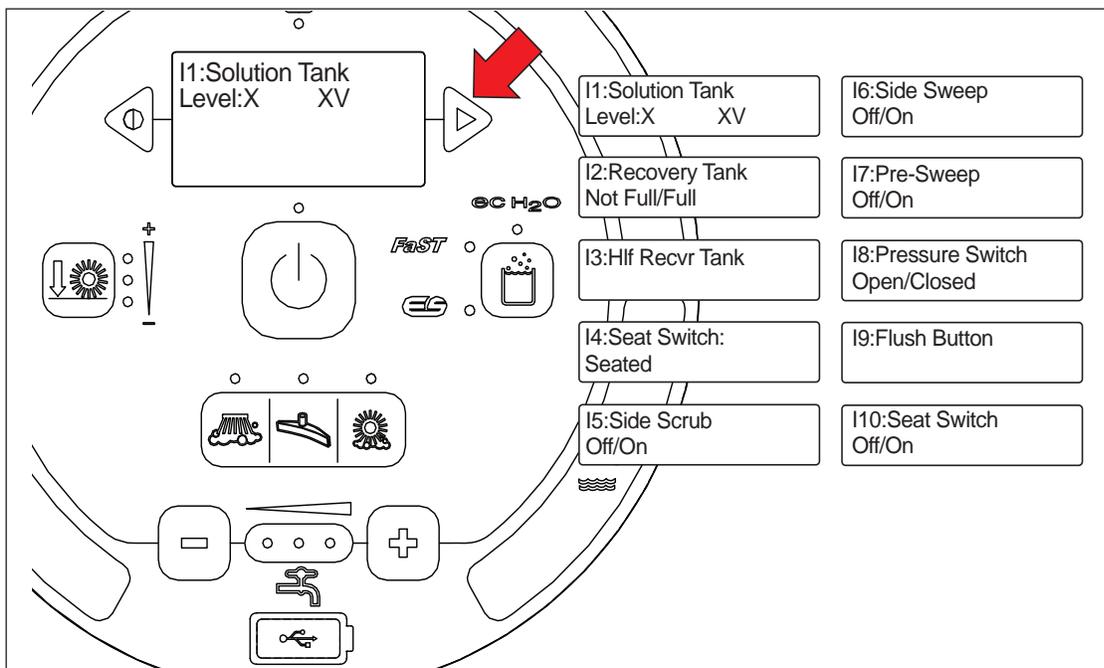
4. Press and release the configuration mode button to scroll through a list of utilities until INPUT DISPLAY appears on the LCD.



5. Press and release the brush pressure button to enter Input Display Mode. I1:Solution Tank Level:X XV will appear on the LCD.



- Press and release the configuration mode button to scroll through the list of hard-wired switch and sensor inputs.



- Press any other touch panel button to display a corresponding LCD text message. The message confirms that the control board received the input

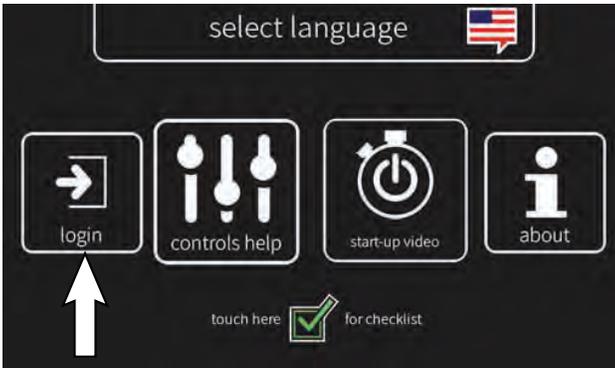
MANUAL MODE - PRO-PANEL

Use the Manual Mode diagnostic utility to manually activate machine functions and display output current in "XX.X Amps" format. This mode bypasses interlocking inputs and should be used for diagnostic purposes only.

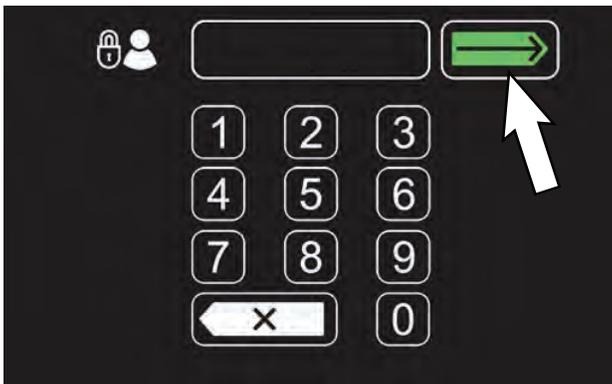
1. Turn key switch ON.
2. Touch the Help button to access the Help screen.



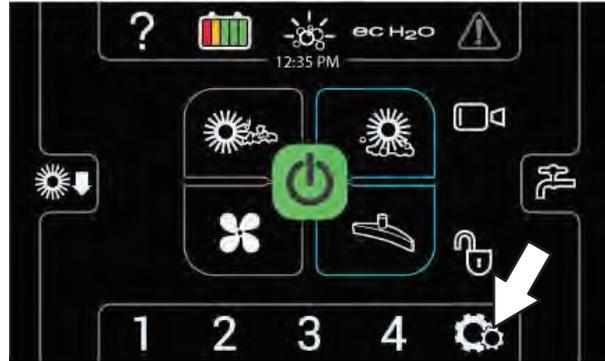
3. Touch the Login button to go to the Login screen.



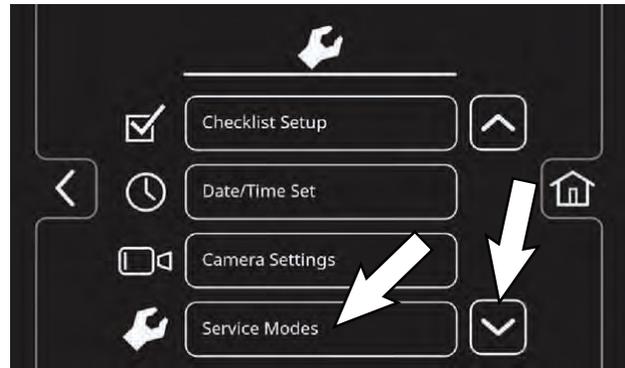
4. Use the keypad to enter the Service login number (083957530) into the display above the keypad. Touch the enter button when finished entering the Service login number.



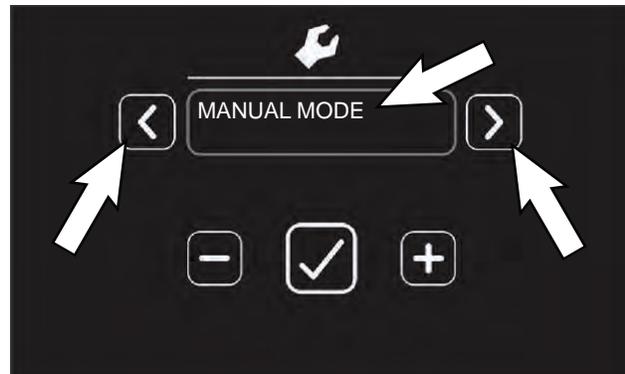
5. Touch the settings button to access the service settings screen.



6. Scroll down to and touch the SERVICE MODES button to access the main Service Modes menu.

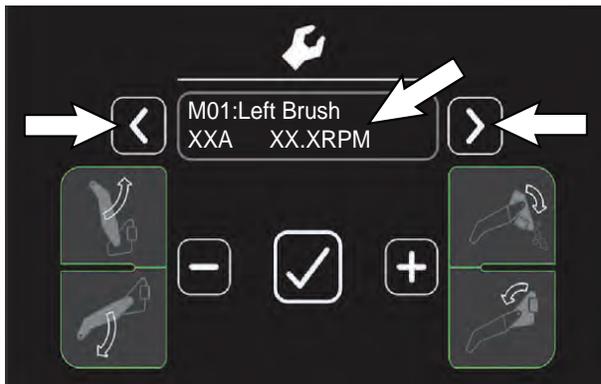


7. The first service setting to appear will be the Config Mode setting. Touch and release the left arrow button or right arrow button until MANUAL MODE appears.

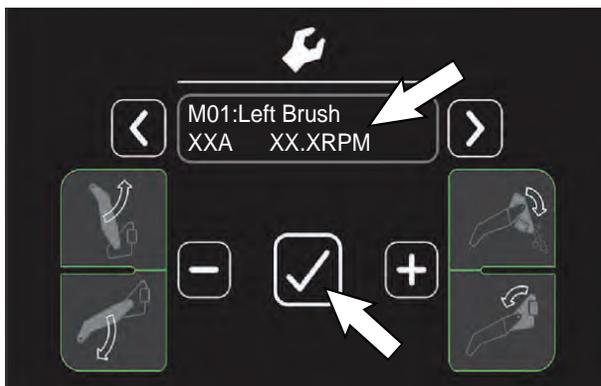


8. Touch the Check button to access the various manual mode output functions. The Manual Mode screen will appear.

9. Touch the and release the left arrow button or right arrow button until the desired Manual Mode output function appears. See the table in the next column for a list of manual mode functions.



10. Touch the Check button to manually activate the function.



11. Touch the Check button again to stop the function.
12. To exit MANUAL MODE, either turn key switch OFF, or exit Manual Mode and return to the Service Modes menu.

MESSAGE	MESSAGE
M01:Left Brush XX.XA XX.XRPM	M16: Water Valve Closed OK XA
M02:Right Brush XX.XA XX.XRPM	M17: Side Valve Closed OK XA
M03:Side Brush XX.XA XX.XRPM	M18: Ec Valve Closed OK XA
M04:LH Sweep Br	M19: Soltn Valve Closed OK XA
M05:RH Sweep Br	M20: Recvr Valve Closed OK XA
M06: Left Pre Br	M21: Ec Sparger
M07:Mid Pre Br	M22: Ec Cell
M08:Right Pre Br	M23: Scrub Act R/E X% XA
M09:Vac 1 X% XA	M24:Side Scrub Act R/E X% XA
M10:Vac 2 X% XA	M25: Sweep Act R/E X% XA
M11:PreSweep Vac	M26: R Sweep Act R/E X% XA
M12:Side Pump XV X% XA	M27:PreSweep Act XV X% XA
M13: Ec Pump XV X% XA	M28:Squeegee Act R/E X% XA
M14: ES Pump XV X% XA	Exit Manual Mode Yes / No
M15:Det Pump XV X% XA	

NOTE: "XX.X A" format indicates that the actual amperage value will vary. See the SPECIFICATIONS section of this manual for approximate amp draw values.

NOTE: "R" or "E" in the lower left corner of the LCD indicates Retracted or Extended actuator position.

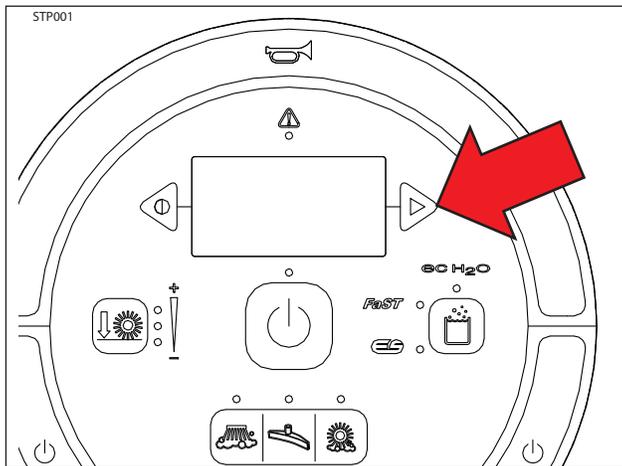
NOTE: "XX%" refers to the duty cycle of the circuit load when activated.

NOTE: "OK" indicates that the displayed function is not open or shorted.

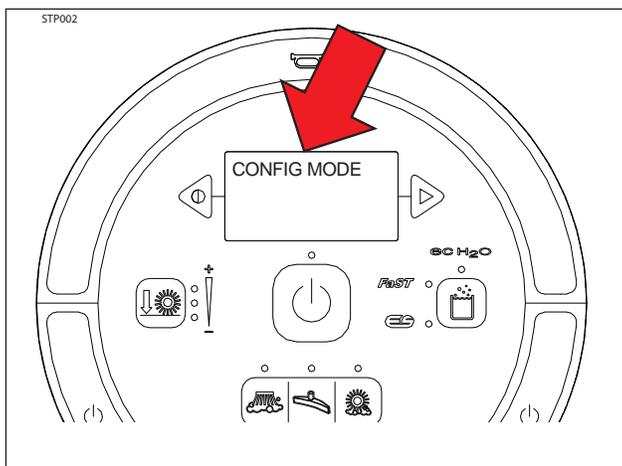
MANUAL MODE - STANDARD CONTROL PANEL

Use the Manual Mode diagnostic utility to manually activate machine functions and display output current in "XX.X Amps" format. This mode bypasses interlocking inputs and should be used for diagnostic purposes only.

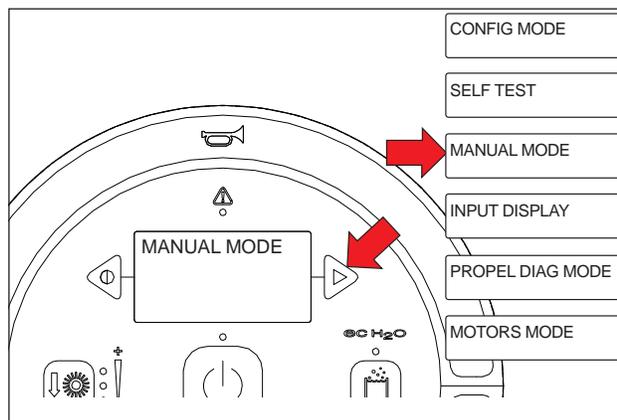
1. Turn key switch OFF.
2. Press and hold the configuration mode button and turn key switch ON while continuing to hold the configuration mode button.



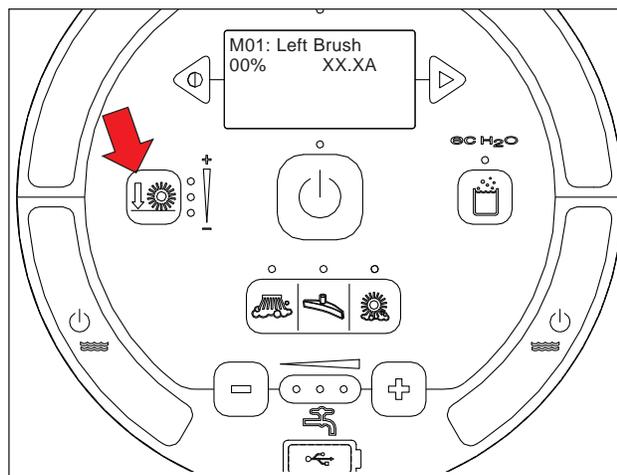
3. Release the configuration mode button when CONFIG MODE appears on the LCD.



4. Press and release the configuration mode button to scroll through a list of utilities until MANUAL MODE appears on the LCD.



5. Press and release the brush pressure button to enter Manual Mode. M01: Left Brush, 00% XX.XA will appear on the LCD.



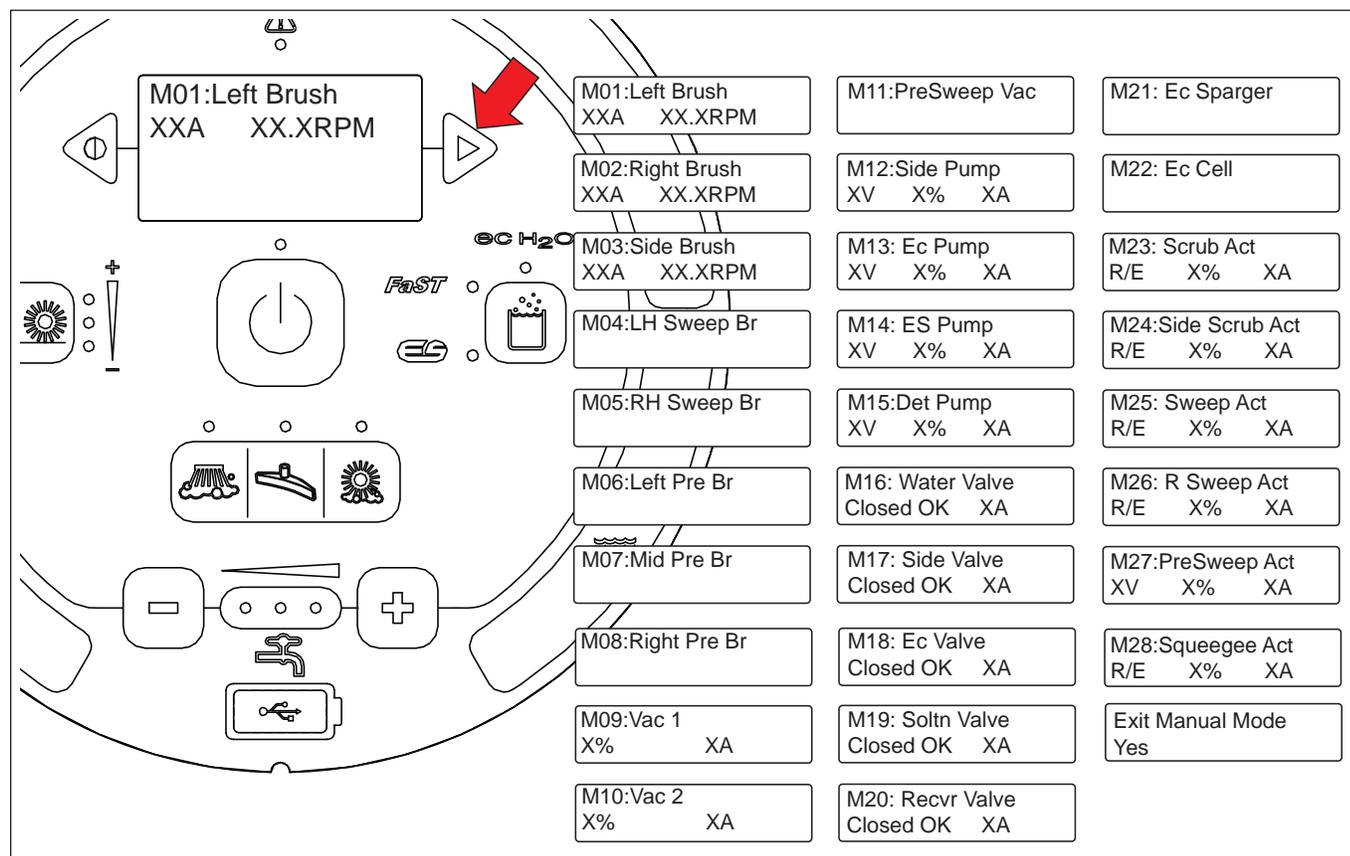
- Press and release the configuration mode button to scroll through a list of output functions. **Press the brush down pressure button to activate the function displayed on the LCD.**

NOTE: "XX.XA" format indicates that the actual amperage value will vary. See the SPECIFICATIONS section of this manual for approximate amp draw values.

NOTE: "R" or "E" in the lower left corner of the LCD indicates Retracted or Extended actuator position.

NOTE: "XX%" refers to the duty cycle of the circuit load when activated.

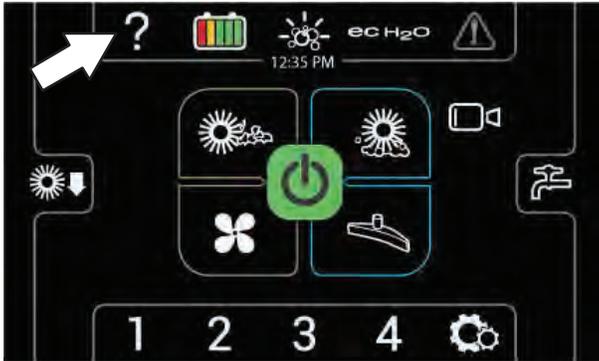
NOTE: "OK" indicates the displayed function is not open or shorted.



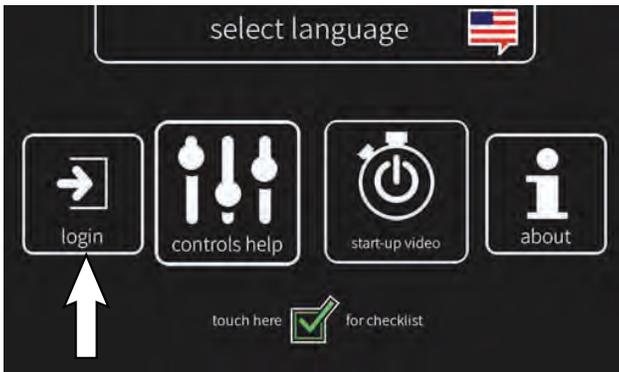
MOTORS MODE - PRO-PANEL

Use the Motors Mode diagnostic utility to operate various motors independently for service testing purposes only.

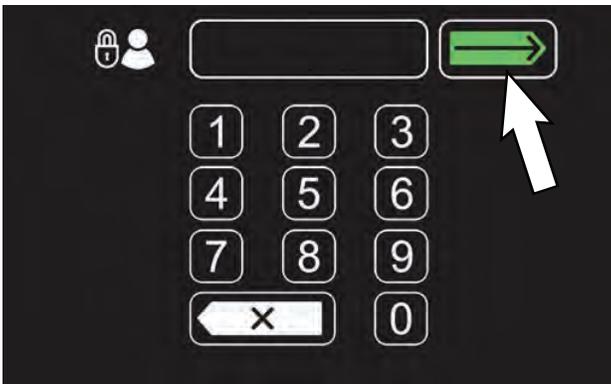
1. Turn key switch ON.
2. Touch the Help button to access the Help screen.



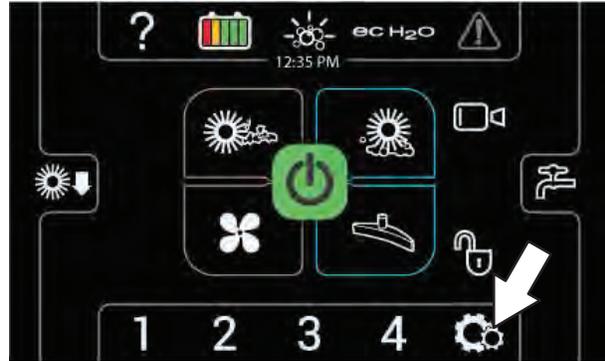
3. Touch the Login button to go to the Login screen.



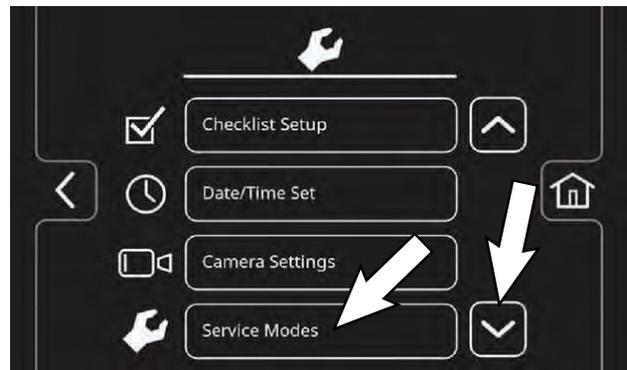
4. Use the keypad to enter the Service login number (083957530) into the display above the keypad. Touch the enter button when finished entering the Service login number.



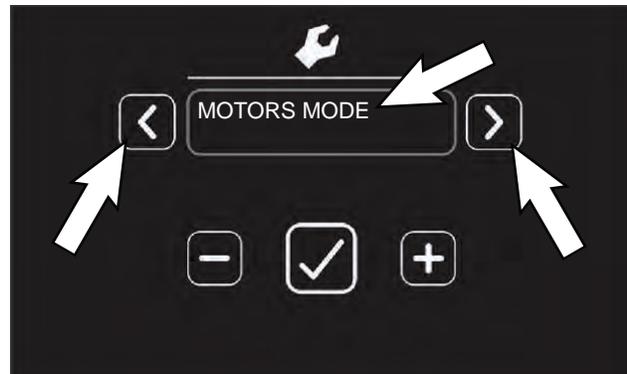
5. Touch the settings button to access the service settings screen.



6. Scroll down to and touch the SERVICE MODES button to access the main Service Modes menu.

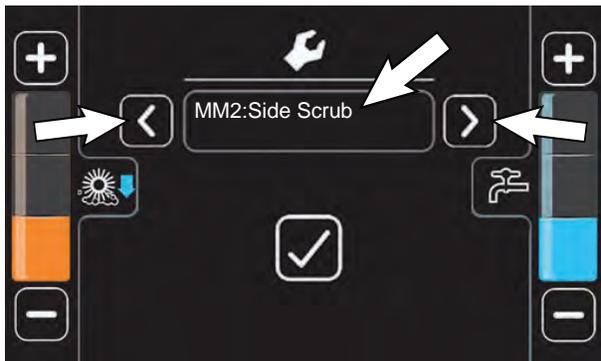


7. The first service setting to appear will be the Config Mode setting. Touch and release the left arrow button or right arrow button until MOTORS MODE appears.

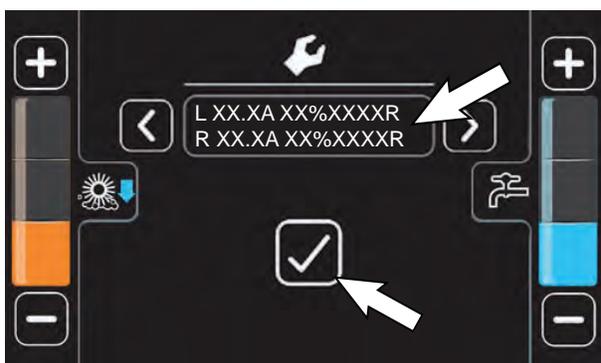


8. Touch the Check button to access the various motors mode output functions. The Motors Mode screen will appear.

9. Touch and release the left arrow button or right arrow button until the desired Motor Mode appears. See the table below for a list of the various motor modes.



10. Touch the Check button to open/test/activate the selected motor. Motor operational parameters will appear on the screen while the test is occurring. Touch the Check button again to stop the test and return to previous motor mode screen.



MESSAGE	MESSAGE
MM1:Run Main Scrub Brushes	MM4:Run Side Sweep Brushes
MM2: Run Side Scrub Brush	MM5:Run ec-H2O
MM3:Run PreSweep	Exit Motors Mode (Yes/No)

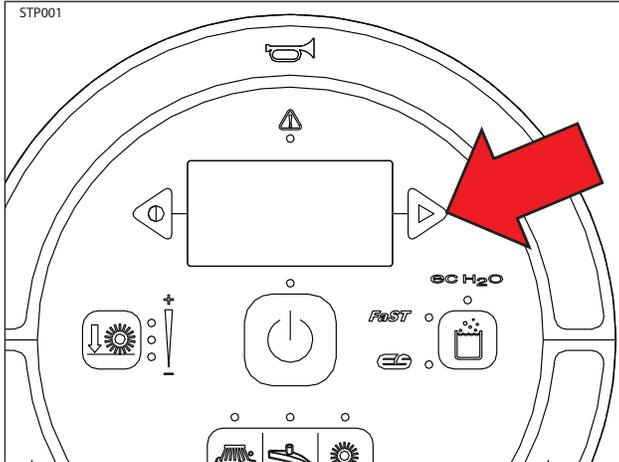
11. To exit MOTORS MODE, either turn key switch OFF, or exit Motors Mode and return to the Service Modes menu.

NOTE: Once MM1 or MM2 is activated, the down pressure button can be used to adjust the down pressure setting. Use the Check button to turn the motor(s) off

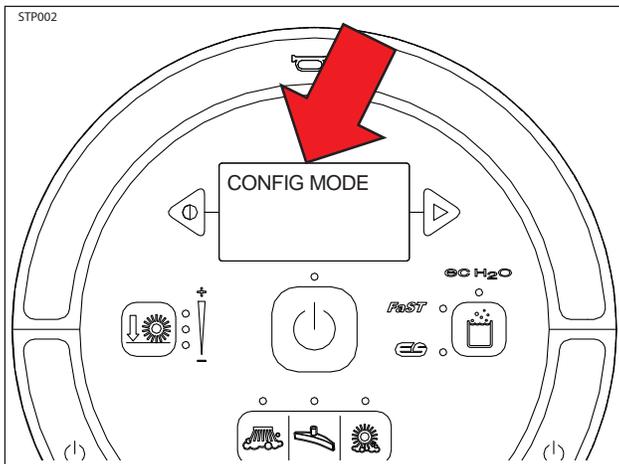
MOTORS MODE - STANDARD CONTROL PANEL

Use the Motors Mode diagnostic utility to operate various motors independently for service testing purposes only.

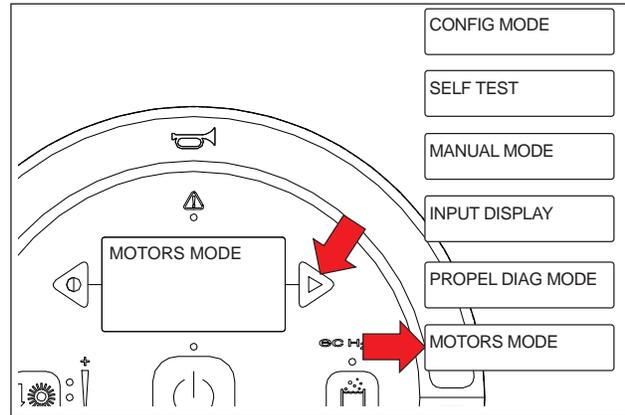
1. Turn key switch OFF.
2. Press and hold the configuration mode button and turn key switch ON while continuing to hold the configuration mode button.



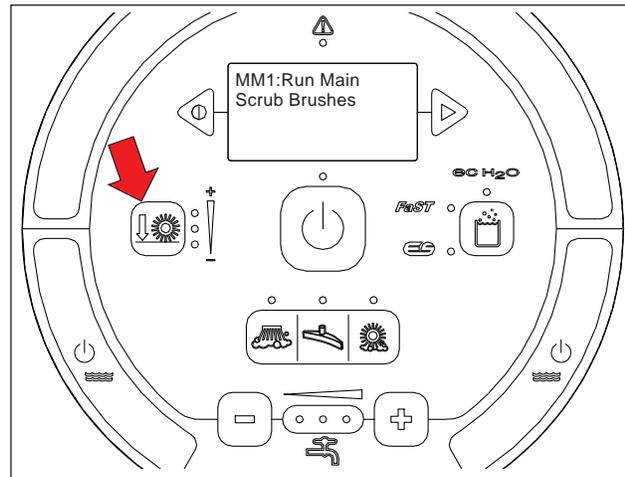
3. Release the configuration mode button when CONFIG MODE appears on the LCD.



4. Press and release the configuration mode button to scroll through a list of utilities until MOTORS MODE appears on the LCD.

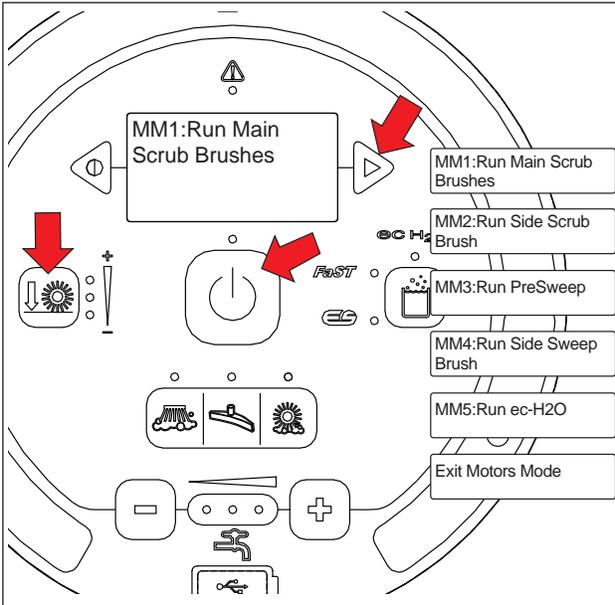


5. Press and release the brush pressure button to enter Motors Mode. MM1: Run Main Scrub Brushes will appear on the LCD.



- Press and release the configuration mode button to scroll through the list of motors. Press the brush down pressure button to activate the selected motor(s) and the 1-STEP button to deactivate the selected motor(s).

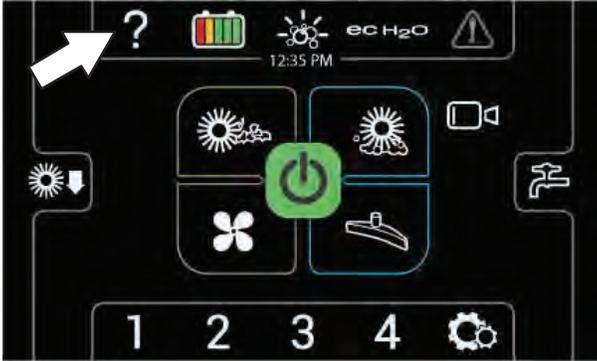
NOTE: Once MM1 or MM2 is activated, the down pressure button can be used to adjust the down pressure setting. Use the 1-Step button to turn the motor(s) off.



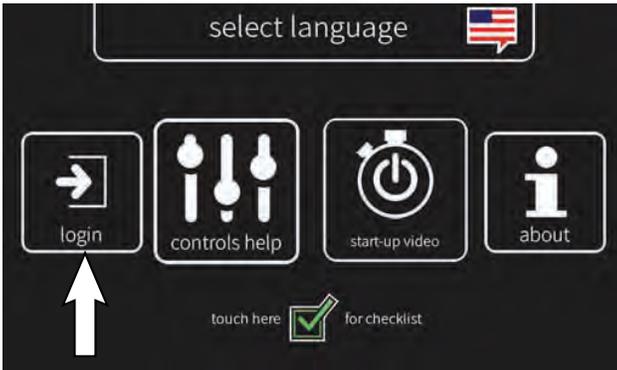
MEMBRANE TEST - PRO-PANEL

Use the Membrane Test to test the membrane buttons on machines equipped with Pro-Panel controls.

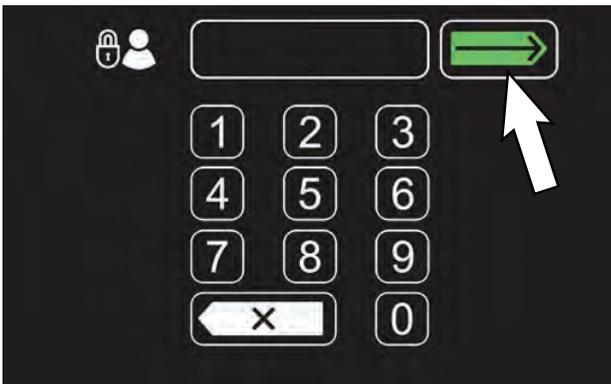
1. Turn key switch ON.
2. Touch the Help button to access the Help screen.



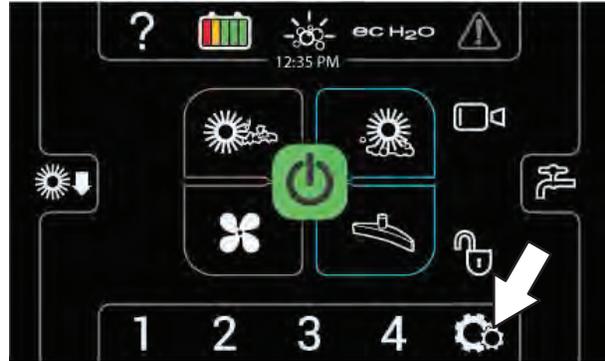
3. Touch the Login button to go to the Login screen.



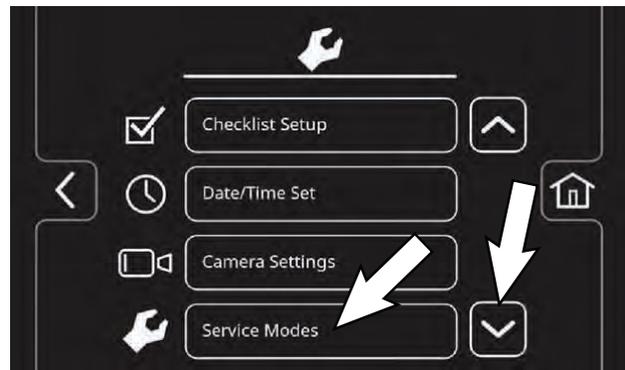
4. Use the keypad to enter the Service login number (083957530) into the display above the keypad. Touch the enter button when finished entering the Service login number.



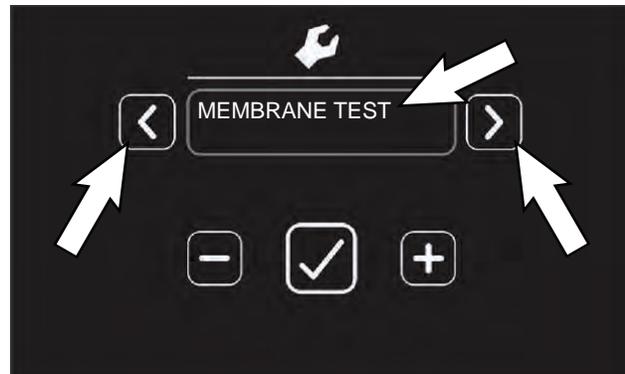
5. Touch the settings button to access the service settings screen.



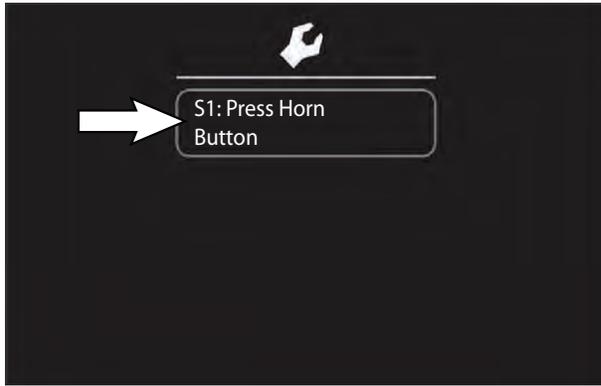
6. Scroll down to and touch the SERVICE MODES button to access the main Service Modes menu.



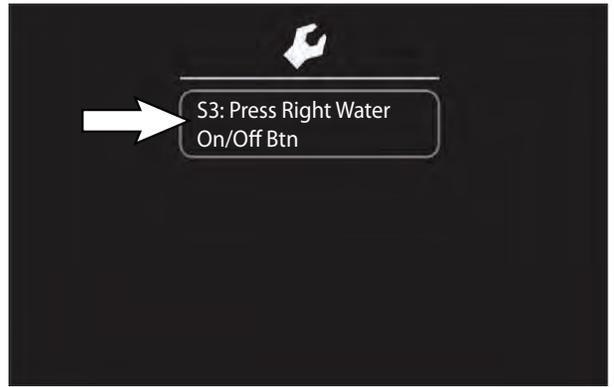
7. The first service setting to appear will be the Config Mode setting. Touch and release the left arrow button or right arrow button until MEMBRANE TEST appears.



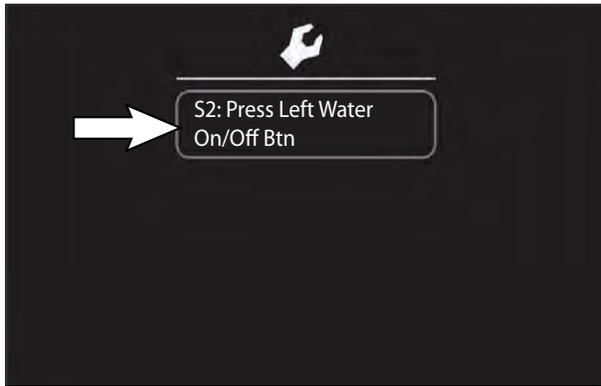
8. Touch the Check button to access the membrane tests. The horn membrane test will appear on the screen.



10. Press the left water on/off button. S3: Press Right Water On/Off Btn should appear on the screen if the left water on/off button passed the membrane test.



9. Press the horn button. S2: Press Left Water On/Off Btn should appear on the screen if the horn button passed the membrane test.



11. Press the right water on/off button. S20: PASSED will appear on the screen if all membrane buttons passed the membrane test.



NOTE: If there was an issue with the horn button where it did not pass the membrane test an error message (S19: Failed) will appear on the screen.

NOTE: An error message (S19: Failed) will also appear on the screen if the button being tested is not pressed within approximately 10 seconds of the test appearing on the screen. Press the button for the test appearing on the screen as soon as possible.

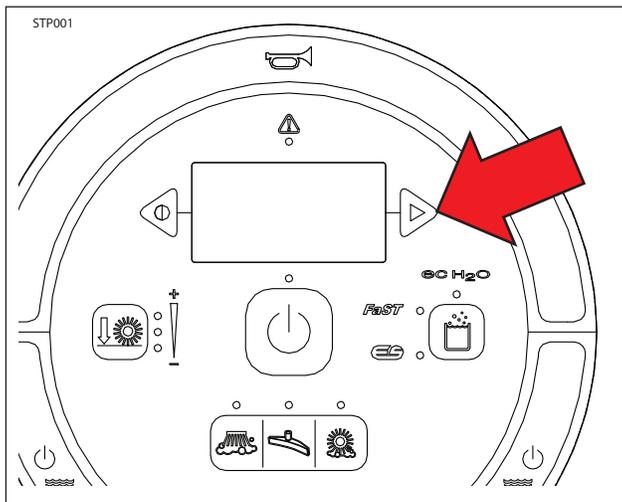


12. Turn key switch OFF to exit the Membrane Test.

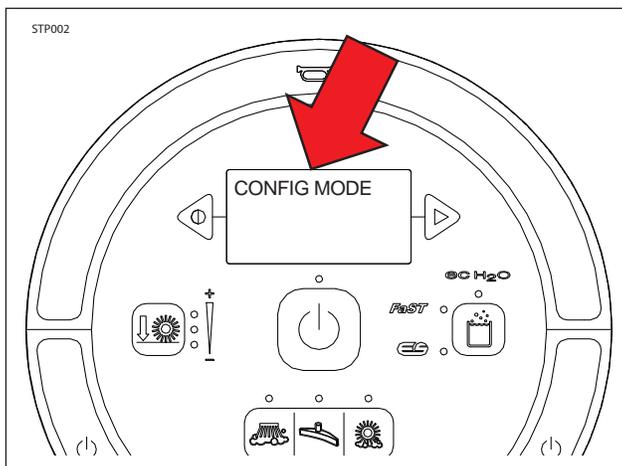
MEMBRANE TEST - STANDARD PANEL

Use the Membrane Test to test the membrane buttons on machines equipped with standard panel controls.

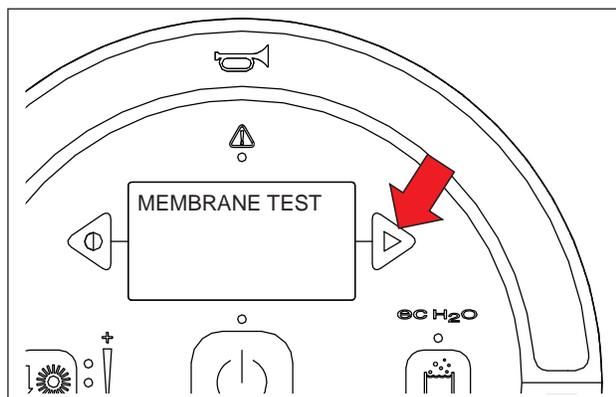
1. Turn key switch OFF.
2. Press and hold the configuration mode button and turn key switch ON while continuing to hold the configuration mode button.



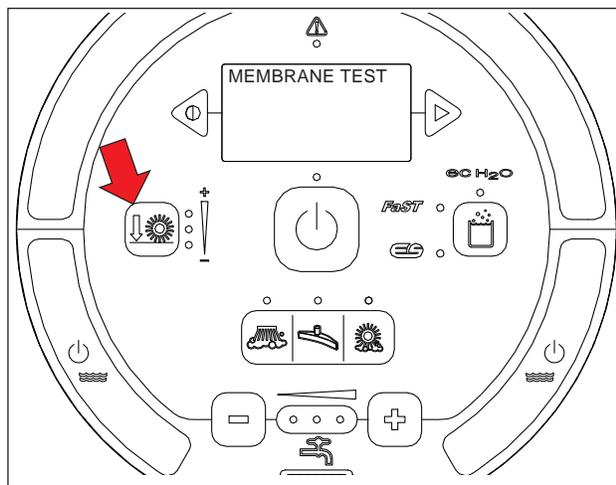
3. Release the configuration mode button when CONFIG MODE appears on the LCD.



4. Press and release the configuration mode button to scroll through a list of utilities until MEMBRANE TEST appears on the LCD.



5. Press and release the brush pressure button to select and begin the membrane test.



6. Follow the prompts on the LCD screen to test all membrane buttons on the panel. Immediately press each button when prompted to do so.

NOTE: The membrane test will end if no button is pressed within 10 seconds of the prompt appearing on the LCD screen.

7. Message PASSED appears on the LCD screen if all buttons and LEDs successfully pass the membrane test. Key cycle the machine to resume normal operation.

If a button or LED do not pass the membrane test a FAILED message appears on the LCD screen. Replace the pod if it does not pass the membrane test. See *REMOVING/REPLACING THE PRO-PANEL/STANDARD PANEL POD*.

NOTE: The membrane test immediately ends after the first button or LED fails the test. The membrane test does not continue after the first button or LED fails.

POWER STEERING STATUS LED (OPTION)

1. Remove the front panel below the steering wheel to access the power steering components.
2. Observe the status LED and use the table below to determine derate level.

LED	Description
Off	Normal Operation, up to 100% of Maximum Torque Output No LED may also indicate a power supply failure to power steering control module. Turn steering wheel completely to one side and hold pressure for 30 seconds to see if LED flashes for derate as listed below:
Purple Flashing	Derate Level 1, up to 75% of Maximum Torque Output
Yellow Flashing	Derate Level 2, up to 50% of Maximum Torque Output
Red Flashing	Derate Level 3, up to 20% of Maximum Torque Output

BACKUP ALARM/LIGHT FAILED TO TURN ON

Step	Action	Value(s)	Yes	No
1	<ul style="list-style-type: none"> • Key ON • Enable back-up alarm/lights • Is there a fault code/message displayed? 		See <i>FAULT CODES</i> section of this manual	Proceed to STEP 2
2	<ul style="list-style-type: none"> • Key ON • Enable back-up alarm/lights • See <i>PROPEL CONTROLLER DIAGNOSTIC CODES</i> • Is there a Propel Controller fault displayed? 		Correct fault condition	Proceed to STEP 3
3	<ul style="list-style-type: none"> • Key OFF • See <i>PROPEL DIAGNOSTIC MODE</i> section of this manual • Check P4:Direction Fwd/Rev input from the directional switch • Check P2:Throttle (0-5 VDC) input from the directional pedal • Are the P2 and P4 inputs operating properly? 		Proceed to STEP 4	Correct fault condition
4	<ul style="list-style-type: none"> • Key OFF • Remove M2 relay from connector (see component locator) • Connect ohmmeter between relay terminals 30 and 87 (should test open or "O.L.") • Use fuse-protected jumper leads to apply battery voltage to relay terminals 86 (+) and 85 (-) • Does relay "click" and do N.O. (normally open) terminals 30 and 87 close? 		Proceed to STEP 5	Replace relay
5	<ul style="list-style-type: none"> • Key OFF • Disconnect back-up alarm/light from main harness • Use fuse-protected jumper leads to apply battery voltage to back-up alarm/light • Does the back-up alarm/light turn On? 		Proceed to STEP 6	Replace Backup Alarm/Light
6	<ul style="list-style-type: none"> • Key ON • Reconnect back-up alarm/light to main harness • Enable back-up alarm/light • Use voltmeter to back probe between 15/GRN and 17/PUR at the Propel Controller connection • Is there battery voltage applied? 		Repair or replace wire harness	Replace Curtis 1234 Controller

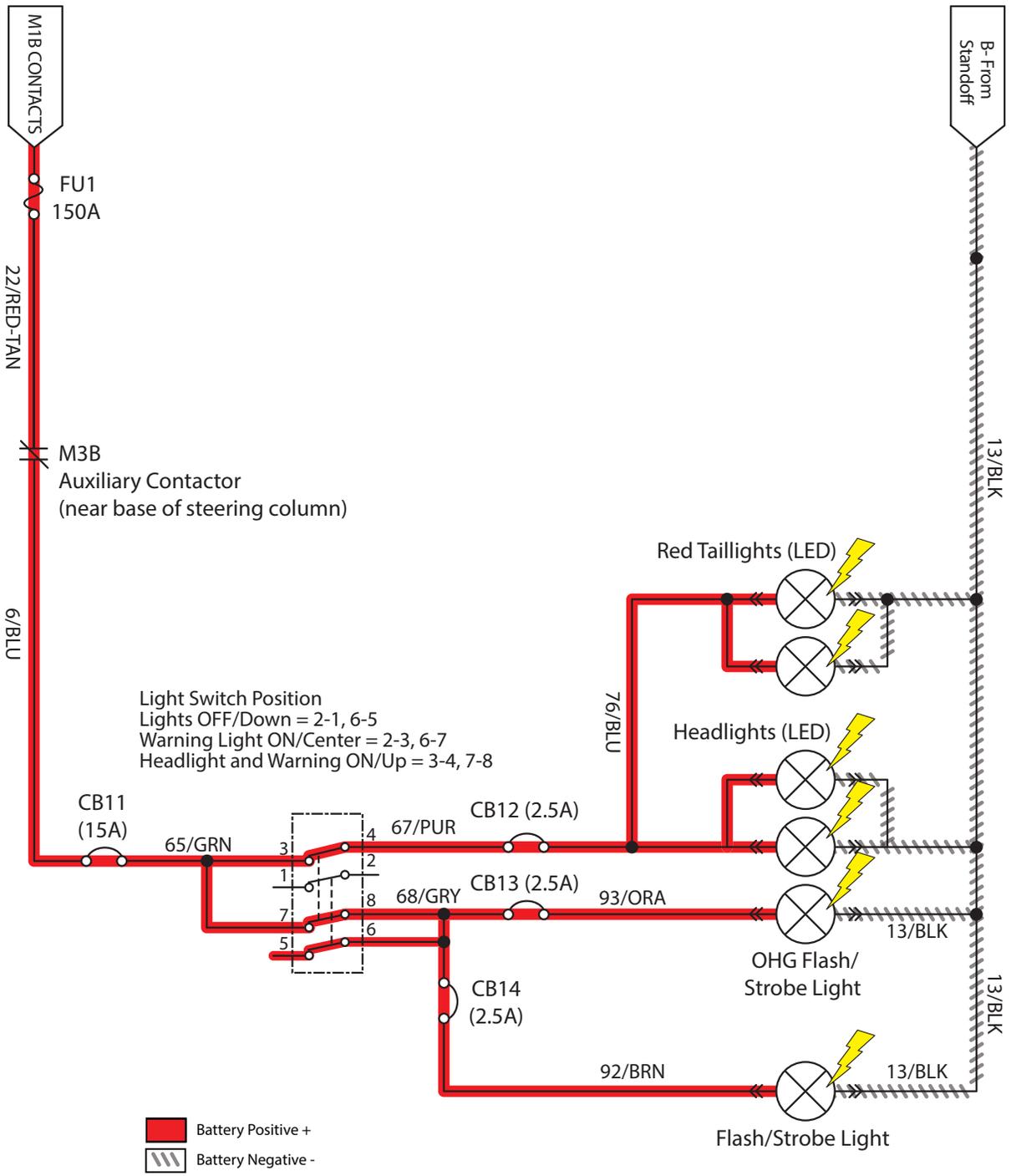
Terms:

Back probe = To insert voltmeter probe(s) into back of a connector to contact a terminal(s) while circuit operates or should be operating.

VDC = DC Voltage

LIGHTS ON

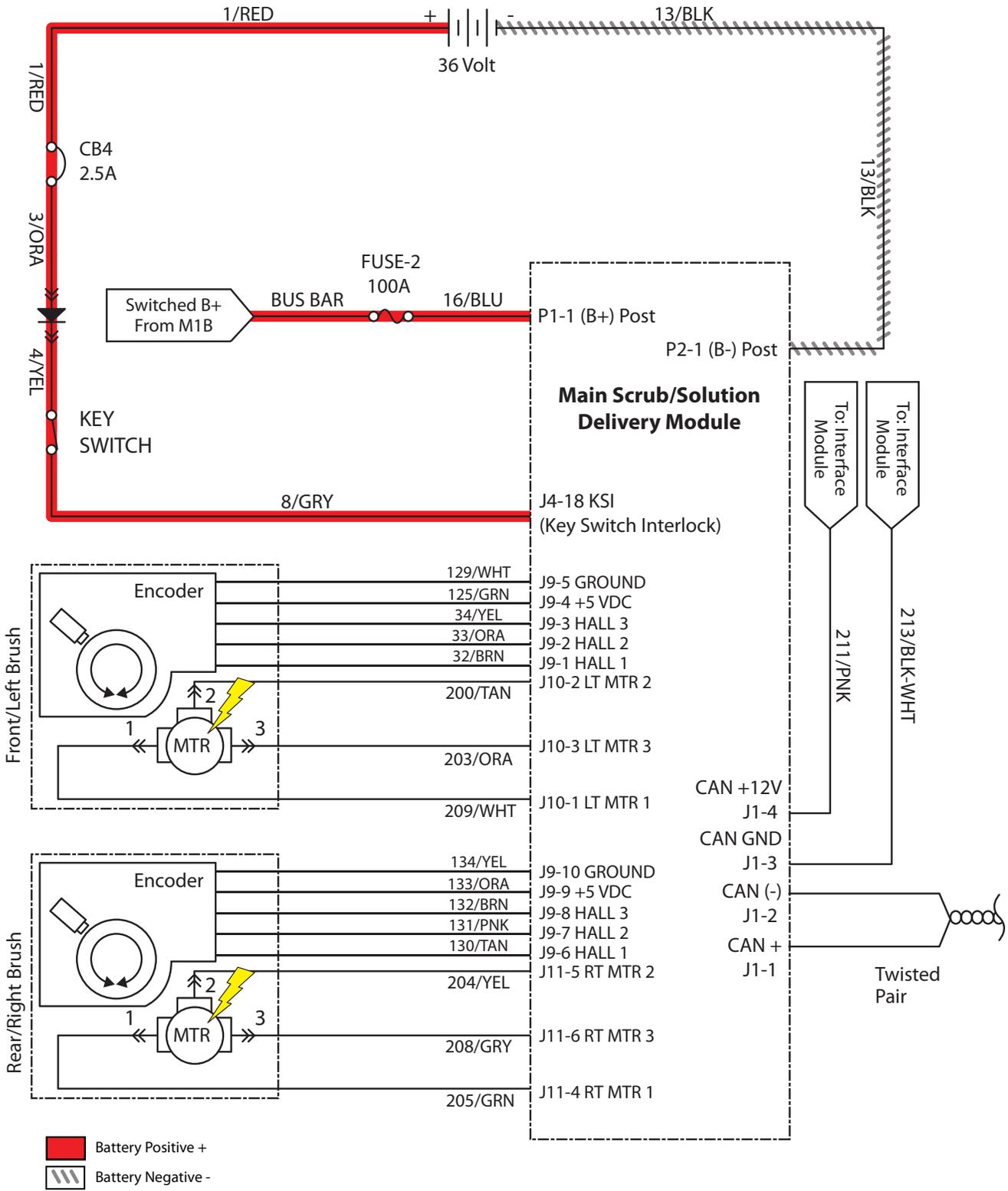
Note: Key Switch ON



LIGHTS FAIL TO TURN ON

Step	Action	Value(s)	Yes	No
1	<ul style="list-style-type: none"> • Key ON • Light switch ON • Firmly press circuit breaker #11 to reset • Is circuit breaker #11 tripped? 		Reset and Test Lighting Operation	Proceed to STEP 2
2	<ul style="list-style-type: none"> • Key ON • Light switch ON • Firmly press circuit breaker #12 (Option) to reset • Is circuit breaker #12 tripped? 		Reset and Test Lighting Operation	Proceed to STEP 3
3	<ul style="list-style-type: none"> • Key ON • Light switch ON • Firmly press circuit breaker #13 (Option) to reset • Is circuit breaker #13 tripped? 		Reset and Test Lighting Operation	Proceed to STEP 4
4	<ul style="list-style-type: none"> • Key ON • Light switch ON • Firmly press circuit breaker #14 (Option) to reset • Is circuit breaker #14 tripped? 		Reset and Test Lighting Operation	Proceed to STEP 5
5	<ul style="list-style-type: none"> • Key ON • Light switch ON • Test voltage applied to light subsystem • Are electrical circuits operating? 		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

MAIN SCRUB BRUSHES ON (S/N 000000-010999)



MAIN SCRUB BRUSHES FAIL TO TURN ON

Step	Action	Value(s)	Yes	No
1	<ul style="list-style-type: none"> • Key ON • Enable main scrub brushes subsystem • Is there a fault/code message displayed? 		See <i>FAULT CODES</i> section of this manual	Proceed to STEP 2
2	<ul style="list-style-type: none"> • Key OFF • See <i>MOTORS MODE</i> section of this manual • Activate main scrub brushes in Motors Mode • Do the scrub brushes turn On? 		Proceed to STEP 6	Proceed to STEP 3
3	<ul style="list-style-type: none"> • Key OFF • See <i>SELF-TEST MODE</i> section of this manual • Does Self-Test display output circuits J10-1, 2, 3 or J11-4, 5, 6 as open or shorted? 		Correct open or short circuit condition	Proceed to STEP 4
4	<ul style="list-style-type: none"> • Proceed to Step #5 for disk scrub head models • Key OFF • Remove cylindrical brushes from scrub head • Check for worn out brushes (see <i>MAINTENANCE</i> section of this manual) • Check brushes for entangled debris • Check brush idler plugs and bearings for excessive wear, damage, seizure, etc... • Check main brush drive belts for excessive wear, damage, etc... • Do any of above conditions exist? 		Repair or replace necessary cylindrical scrub head components	Proceed to STEP 5
5	<ul style="list-style-type: none"> • Proceed to STEP #6 if both brush motors fail to turn ON • Lower main scrub head • Key OFF • Swap motor leads between left and right motors • Does the same motor fail to turn on? 		Repair or replace main scrub brush motors	Proceed to STEP 5
6	<ul style="list-style-type: none"> • Key OFF • Reconnect main scrub brush motors to correct main harness connectors • Key ON • Enable main scrub brush motors • Test voltage applied to main scrub brush motor subsystem • Are electrical circuits operating? 		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:

J5-5 = Main Scrub/Solution Delivery Module

Connector #5, Pin #5

J5-4 = Main Scrub/Solution Delivery Module

Connector #5, Pin #4

J5-2 = Main Scrub/Solution Delivery Module

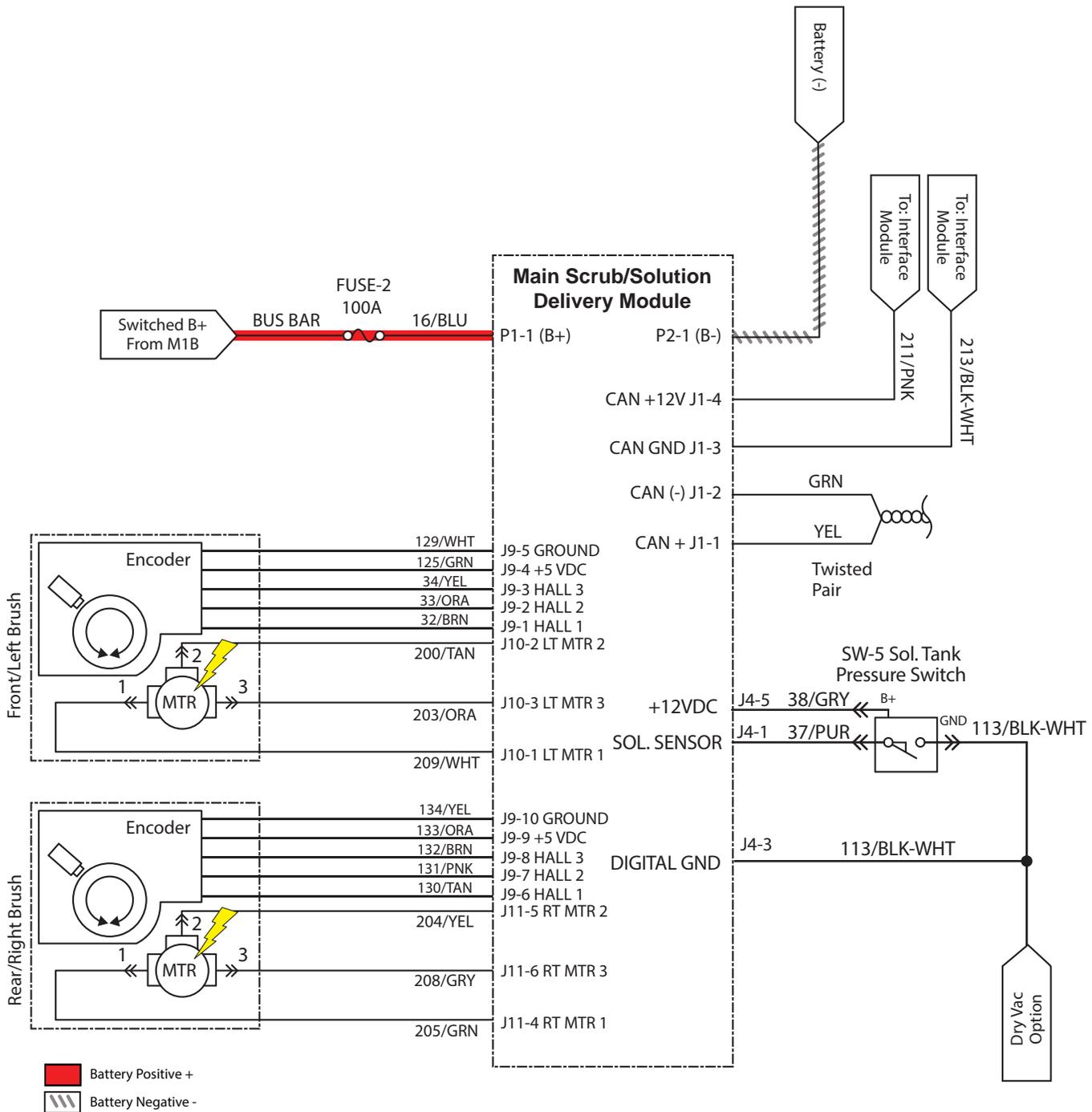
Connector #5, Pin #2

J5-1 = Main Scrub/Solution Delivery Module

Connector #5, Pin #1

TROUBLESHOOTING

MAIN SCRUB BRUSHES ON (S/N 014000-)



MAIN SCRUB BRUSHES FAIL TO TURN ON

Step	Action	Value(s)	Yes	No
1	<ul style="list-style-type: none"> • Key ON • Enable main scrub brushes subsystem • Is there a fault/code message displayed? 		See <i>FAULT CODES</i> section of this manual	Proceed to STEP 2
2	<ul style="list-style-type: none"> • Key OFF • See <i>MOTORS MODE</i> section of this manual • Activate main scrub brushes in Motors Mode • Do the scrub brushes turn On? 		Proceed to STEP 6	Proceed to STEP 3
3	<ul style="list-style-type: none"> • Key OFF • See <i>SELF-TEST MODE</i> section of this manual • Does Self-Test display output circuits J10-1, 2, 3 or J11-4, 5, 6 as open or shorted? 		Correct open or short circuit condition	Proceed to STEP 4
4	<ul style="list-style-type: none"> • Proceed to Step #5 for disk scrub head models • Key OFF • Remove cylindrical brushes from scrub head • Check for worn out brushes (see <i>MAINTENANCE</i> section of this manual) • Check brushes for entangled debris • Check brush idler plugs and bearings for excessive wear, damage, seizure, etc... • Check main brush drive belts for excessive wear, damage, etc... • Do any of above conditions exist? 		Repair or replace necessary cylindrical scrub head components	Proceed to STEP 5
5	<ul style="list-style-type: none"> • Proceed to STEP #6 if both brush motors fail to turn ON • Lower main scrub head • Key OFF • Swap motor leads between left and right motors • Does the same motor fail to turn on? 		Repair or replace main scrub brush motors	Proceed to STEP 5
6	<ul style="list-style-type: none"> • Key OFF • Reconnect main scrub brush motors to correct main harness connectors • Key ON • Enable main scrub brush motors • Test voltage applied to main scrub brush motor subsystem • Are electrical circuits operating? 		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:

J5-5 = Main Scrub/Solution Delivery Module

Connector #5, Pin #5

J5-4 = Main Scrub/Solution Delivery Module

Connector #5, Pin #4

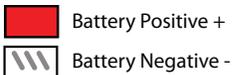
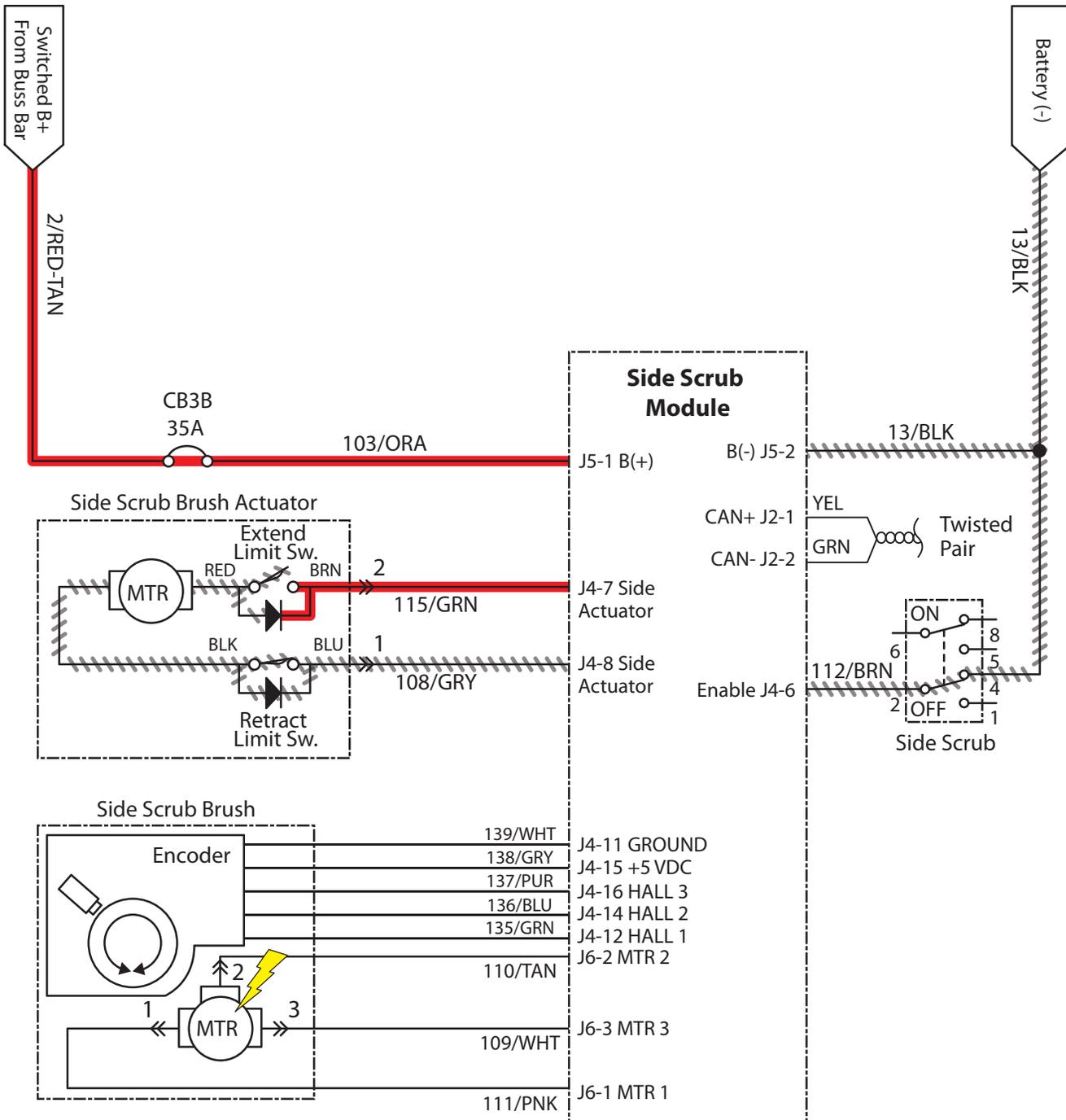
J5-2 = Main Scrub/Solution Delivery Module

Connector #5, Pin #2

J5-1 = Main Scrub/Solution Delivery Module

Connector #5, Pin #1

SIDE SCRUB BRUSH ON/DOWN



Operational Matrix:

	Enabled	Disabled
Side Scrub Brush On/Down	<ul style="list-style-type: none"> • 1-STEP Scrub ON • Side Brush Switch ON 	<ul style="list-style-type: none"> • 1-STEP Scrub OFF • Side Brush Switch OFF • Recovery Tank Full • Solution Tank Empty • Very Low Batt Voltage • Circuit Fault • Neutral (Ready State)

SBC004

SIDE SCRUB BRUSH FAILS TO TURN ON/LOWER

Step	Action	Value(s)	Yes	No
1	<ul style="list-style-type: none"> • Key ON • Enable side scrub brush subsystem • Is there a fault code/message displayed? 		See <i>FAULT CODES</i> section of this manual	Proceed to STEP 2
2	<ul style="list-style-type: none"> • Key OFF • See <i>MOTORS MODE</i> section of this manual • Activate side scrub brush in Motors Mode • Do side scrub brushes turn on? 		Proceed to STEP 6	Proceed to STEP 3
3	<ul style="list-style-type: none"> • Key OFF • See <i>SELF-TEST MODE</i> • Does Self-Test display output circuits J4-7,8 or J6-1,2,3 as open or shorted? 		Correct open or short circuit condition	Proceed to STEP 4
4	<ul style="list-style-type: none"> • Key OFF • Check brush for entangled debris or damage • Do any of the above conditions exist? 		Repair or replace necessary components	Proceed to STEP 5
5	<ul style="list-style-type: none"> • Key ON • Enable side scrub brush motor • Test voltage applied to side scrub brush motor and lift actuator subsystems as shown on electrical schematic • Are electrical circuits operating as shown on electrical schematic? <p><i>NOTE: Side scrub motor can be tested using main brush motor connections of wire harness. Side scrub motor must be removed to reach main brush motor connections.</i></p>		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

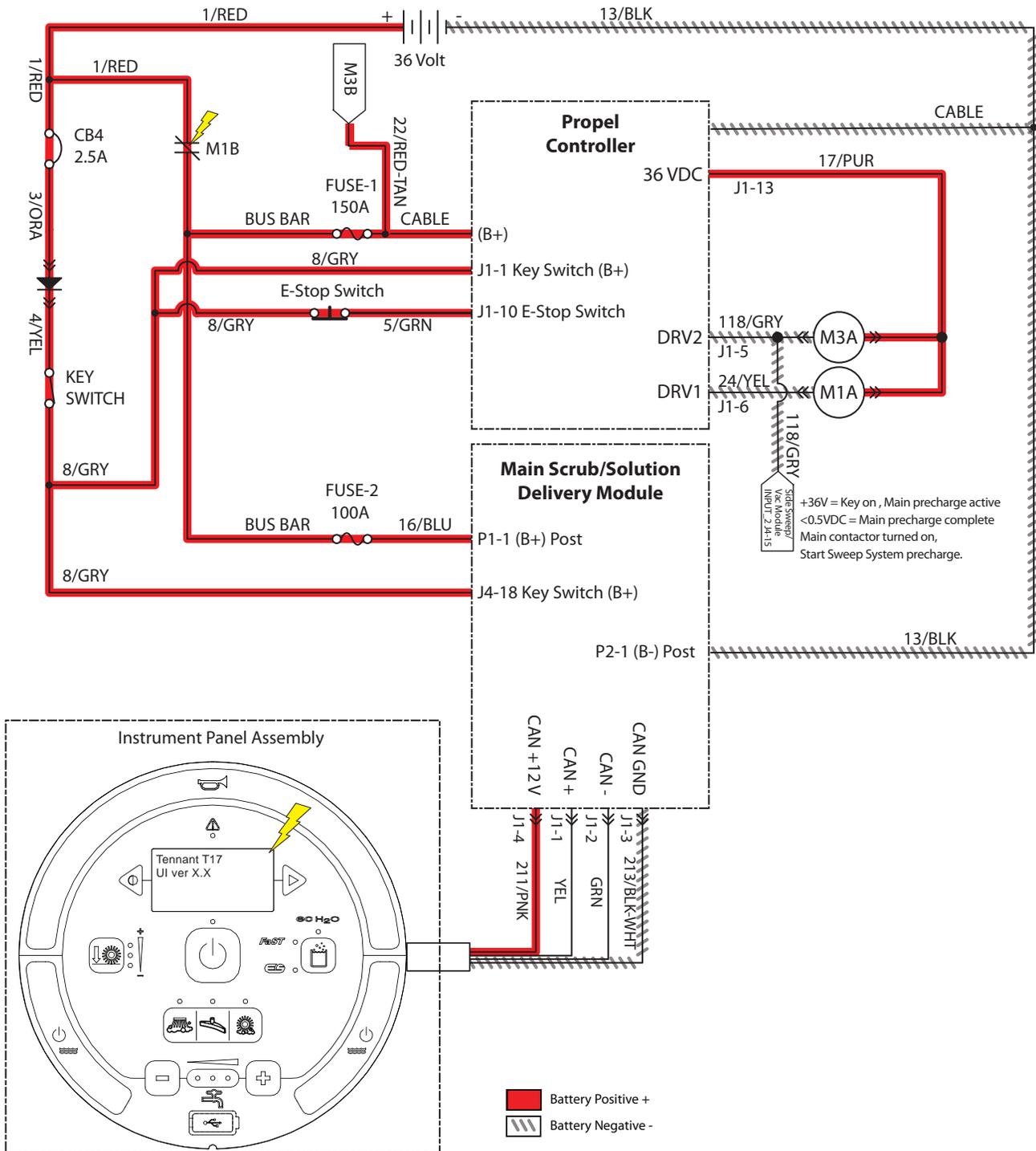
Terms:

J4-7,8 = Side Scrub Module Connector #4, Pin #7 or 8

J6-1,2,3 = Side Scrub Module Connector #6, Pin #1, 2, or 3

POWER UP ON (S/N 000000-010999)

(B-) 



MACHINE FAILS TO POWER UP

Step	Action	Value(s)	Yes	No
1	<ul style="list-style-type: none"> • Key ON • Test total battery voltage using a voltmeter • Is the total battery voltage greater than 30 VDC? 		Proceed to STEP 2	Recharge batteries and test power-up circuit operation
2	<ul style="list-style-type: none"> • Key OFF • Firmly press circuit breaker 4 to reset • Is circuit breaker #4 tripped? 		Reset and test power up circuit operation	Proceed to STEP 3
3	<ul style="list-style-type: none"> • Key ON • Test voltage applied to power up subsystem • Are electrical circuits operating? 		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:

VDC = DC Voltage

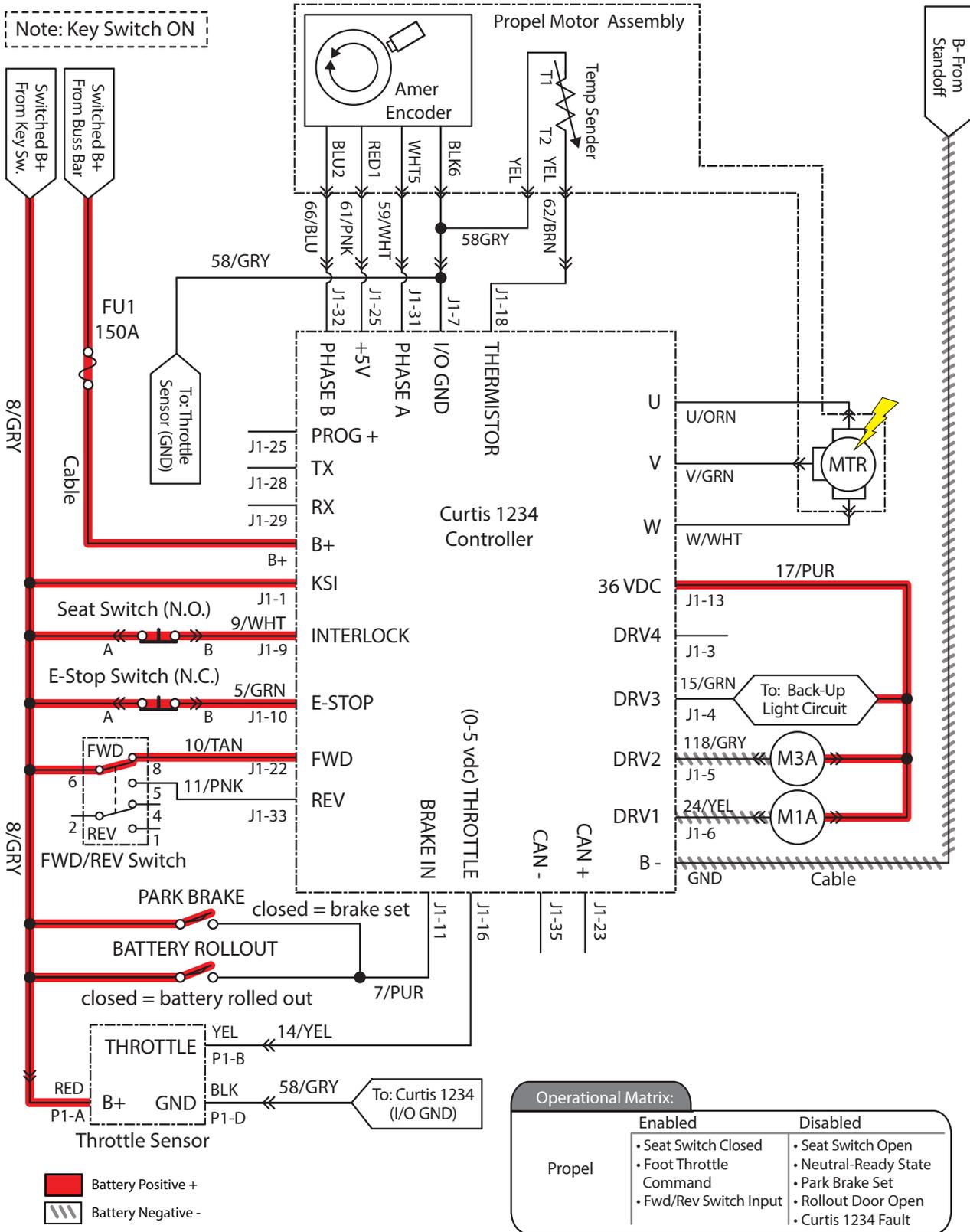
MACHINE FAILS TO POWER UP

Step	Action	Value(s)	Yes	No
1	<ul style="list-style-type: none"> • Key ON • Test total battery voltage using a voltmeter • Is the total battery voltage greater than 30 VDC? 		Proceed to STEP 2	Recharge batteries and test power-up circuit operation
2	<ul style="list-style-type: none"> • Key OFF • Firmly press circuit breaker 4 to reset • Is circuit breaker #4 tripped? 		Reset and test power up circuit operation	Proceed to STEP 3
3	<ul style="list-style-type: none"> • Key ON • Test voltage applied to power up subsystem • Are electrical circuits operating? 		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:

VDC = DC Voltage

PROPEL SUBSYSTEM, FORWARD



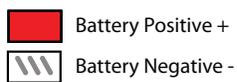
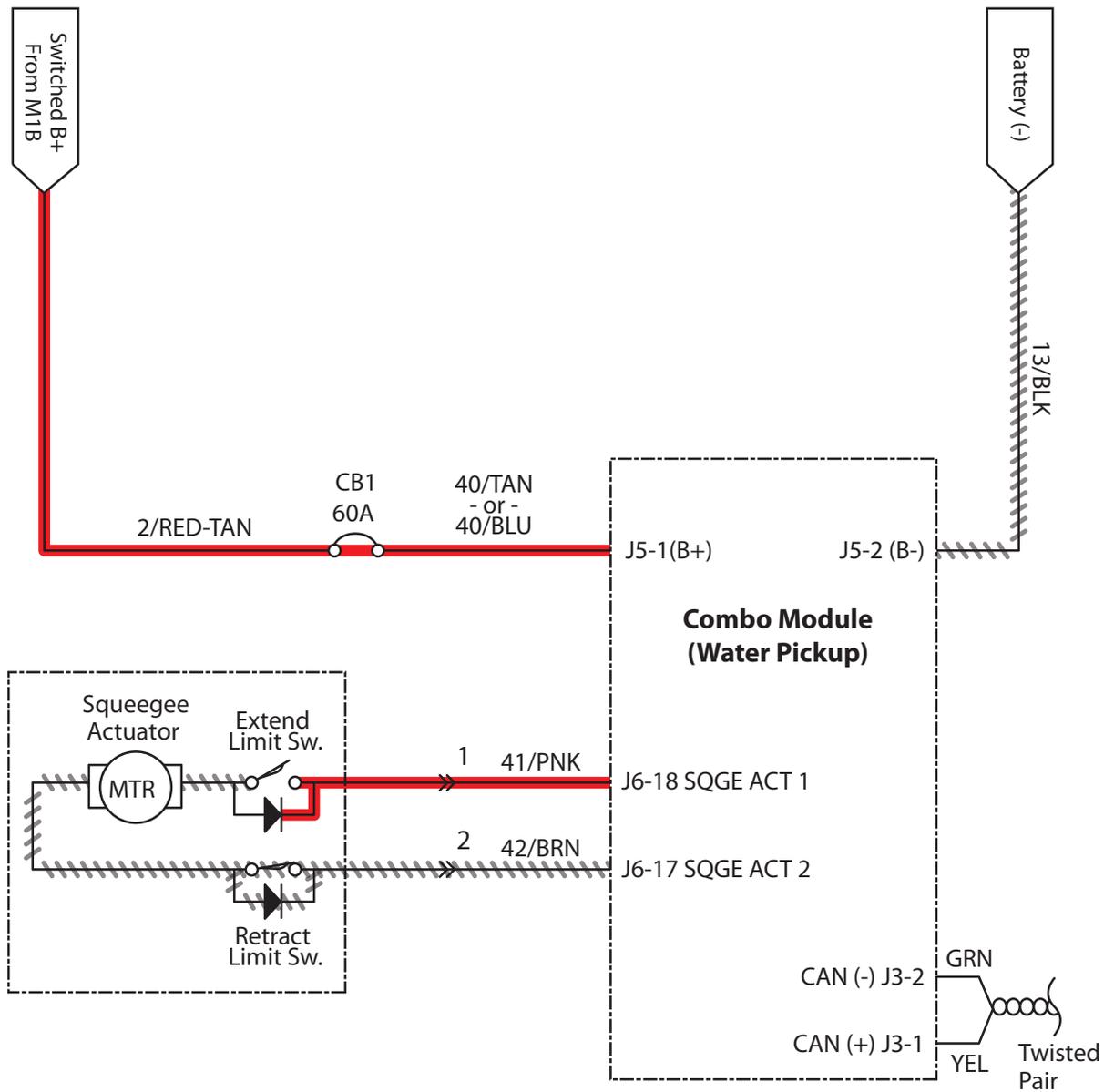
MACHINE FAILS TO PROPEL

Step	Action	Value(s)	Yes	No
1	<ul style="list-style-type: none"> • Key ON • See <i>PROPEL CONTROLLER DIAGNOSTIC CODES</i> section of this manual • Does a Propel Controller fault condition exist? 		Correct fault condition	Proceed to STEP 2
2	<ul style="list-style-type: none"> • Key ON • See <i>PROPEL DIAGNOSTIC MODE</i> section of this manual • Is P1: Curtis Online? • Does P2: Throttle input voltage (0-5 VDC) change proportionally with throttle pedal movement? • Does P3: Brake pedal input turn On/Off with brake pedal activation? • Does P4: Direction input correspond with Fwd/Rev rocker switch position? • Does P5: Speed input from drive assembly encoder (speed, direction, position sensor) read 0000.0 MPH? • Does P8: Propel motor current read 0000.0 Amps? • Is answer "Yes" to all of above? 		Proceed to STEP 3	Correct faulty input condition
3	<ul style="list-style-type: none"> • Key OFF • Place machine on jack stands so drive wheel is lifted off the floor • Enable forward propel • Test voltage applied to propel subsystem • Are electrical circuits operating? 		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:

VDC = Direct Current Voltage

REAR SQUEEGEE DOWN, OFF



Operational Matrix:

	Enabled	Disabled
Squeegee Down	<ul style="list-style-type: none"> • 1-STEP Scrub ON • Squeegee/Vac ON 	<ul style="list-style-type: none"> • 1-STEP Scrub OFF • Squeegee/Vac OFF • Reverse Propel • Recovery Tank Full • Very Low Batt Voltage • Circuit Fault

SQUEEGEE FAILS TO RAISE/LOWER

Step	Action	Value(s)	Yes	No
1	<ul style="list-style-type: none"> • Key ON • Enable rear squeegee down • Is there a fault code/message displayed? 		See <i>FAULT CODES</i> section of this manual	Proceed to STEP 2
2	<ul style="list-style-type: none"> • Key OFF • See <i>MANUAL MODE</i> section of this manual • Activate the rear squeegee in Manual Mode • Does the rear squeegee raise/lower? 		Proceed to STEP 5	Proceed to STEP 3
3	<ul style="list-style-type: none"> • Key OFF • See <i>SELF-TEST MODE</i> section of this manual • Does the Self-Test display output circuits J5-3 and J5-2 as open or shorted? 		Correct open or short circuit condition	Proceed to STEP 4
4	<ul style="list-style-type: none"> • Key OFF • See <i>TESTING REAR SQUEEGEE LIFT ACTUATOR</i> section of this manual • Does the rear squeegee lift actuator pass the testing? 	See <i>TESTING REAR SQUEEGEE LIFT ACTUATOR</i> section of this manual.	Proceed to STEP 5	Replace rear squeegee lift actuator
5	<ul style="list-style-type: none"> • Key OFF • Reconnect rear squeegee lift actuator to main wire harness • Test voltage applied to rear squeegee lift subsystem • Are electrical circuits operating? 		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:

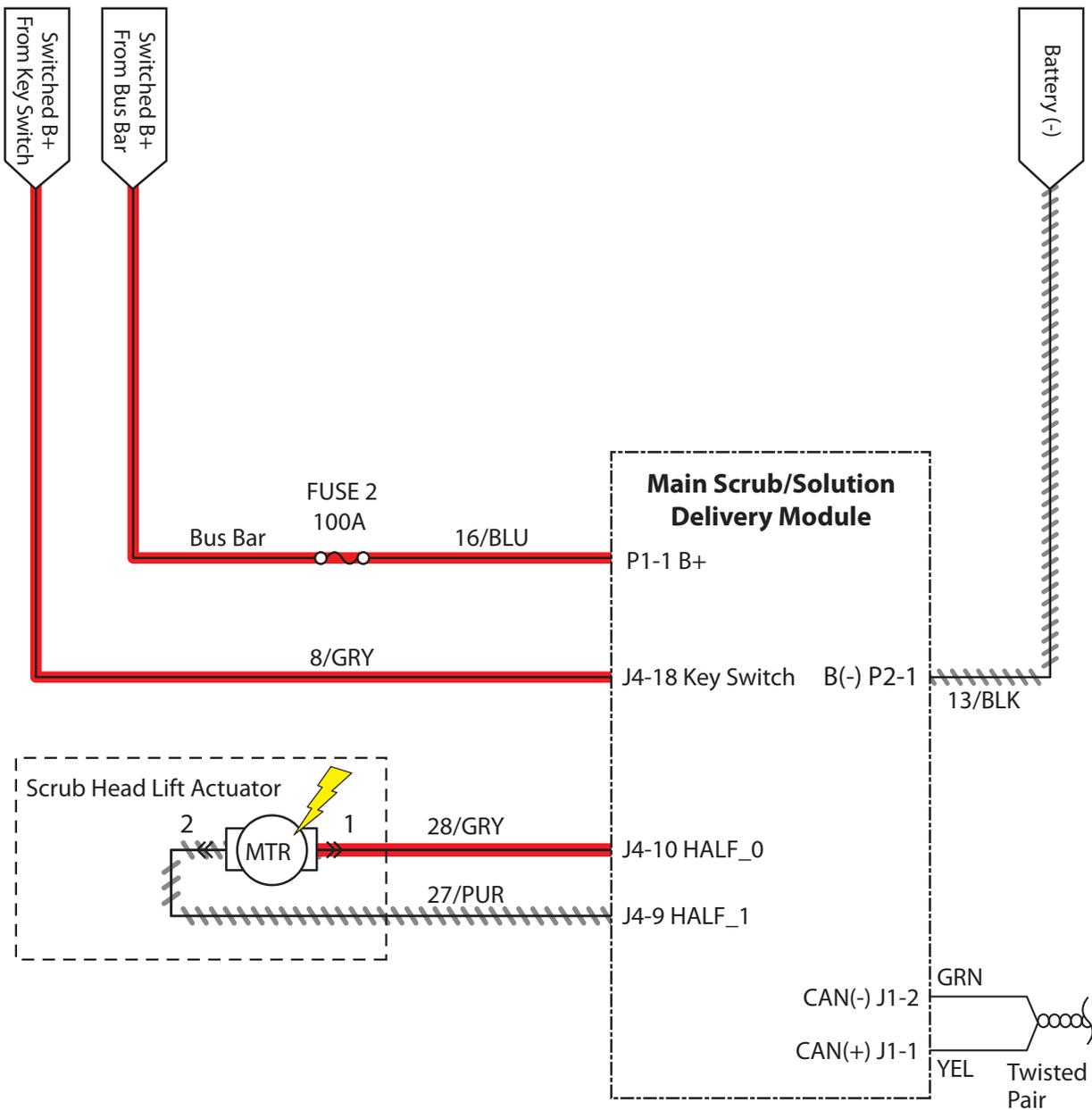
J6-18 = Combo Module (Water Pickup)

Connector #6, Pin #18

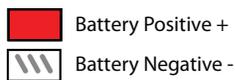
J6-17 = Combo Module (Water Pickup)

Connector #6, Pin #17

SCRUB HEAD LIFT (S/N 000000-010999)



Operational Matrix:



	Enabled	Disabled
Scrub Head Down	<ul style="list-style-type: none"> • 1-STEP Scrub ON • Fwd/Rev Propel 	<ul style="list-style-type: none"> • 1-STEP Scrub OFF • Neutral-Ready State • Recovery Tank Full • Solution Tank Empty • Very Low Batt Voltage • Circuit Fault

SCRUB HEAD FAILS TO RAISE/LOWER

Step	Action	Value(s)	Yes	No
1	<ul style="list-style-type: none"> • Key ON • Enable scrub head down • Is there a fault code/message displayed? 		See <i>FAULT CODES</i> section of this manual	Proceed to STEP 2
2	<ul style="list-style-type: none"> • Key OFF • See <i>MANUAL MODE</i> section of this manual • Activate scrub head in Manual Mode • Does the scrub head raise/lower? 		Proceed to STEP 5	Proceed to STEP 3
3	<ul style="list-style-type: none"> • Key OFF • See <i>SELF-TEST MODE</i> section of this manual • Does Self-Test display output circuits J4-9 and J4-10 as open or shorted? 		Correct open or short circuit condition	Proceed to STEP 4
4	<ul style="list-style-type: none"> • Key OFF • See <i>TESTING MAIN BRUSH LIFT ACTUATOR in SERVICE</i> section of this manual • Does the scrub head lift actuator pass the testing? 	See <i>TESTING MAIN BRUSH LIFT ACTUATOR</i> section of this manual	Proceed to STEP 5	Replace scrub head lift actuator
5	<ul style="list-style-type: none"> • Key OFF • Reconnect scrub head lift actuator to main wire harness • Test voltage applied to scrub head lift subsystem • Are electrical circuits operating? 		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:

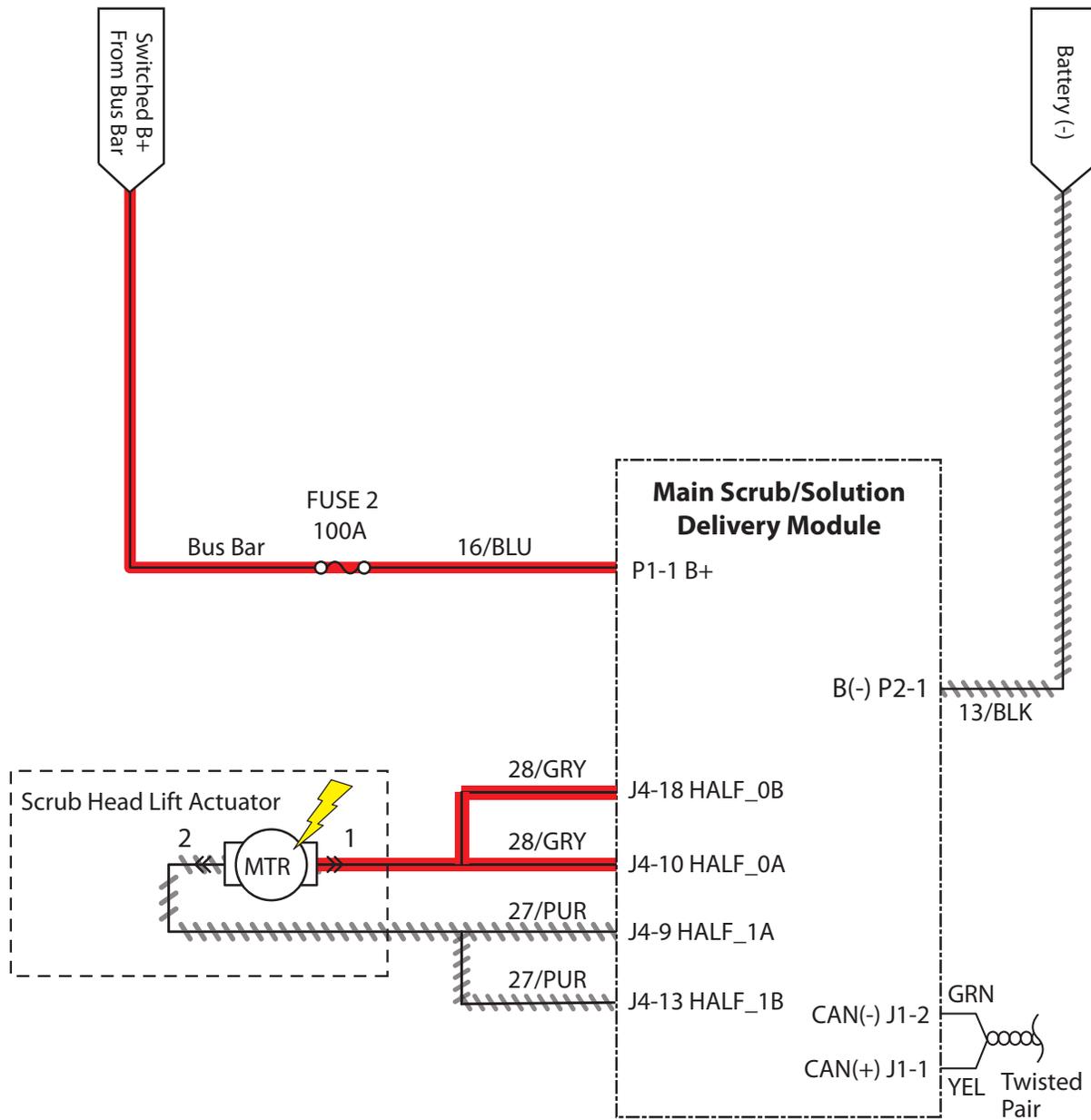
J4-9 = Main Scrub/Solution Delivery Module

Connector #4, Pin #9

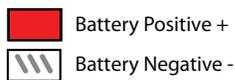
J4-10 = Main Scrub/Solution Delivery Module

Connector #4, Pin #10

SCRUB HEAD LIFT (S/N 014000-)



Operational Matrix:



	Enabled	Disabled
Scrub Head Down	<ul style="list-style-type: none"> • 1-STEP Scrub ON • Fwd/Rev Propel 	<ul style="list-style-type: none"> • 1-STEP Scrub OFF • Neutral-Ready State • Recovery Tank Full • Solution Tank Empty • Very Low Batt Voltage • Circuit Fault

SCRUB HEAD FAILS TO RAISE/LOWER

Step	Action	Value(s)	Yes	No
1	<ul style="list-style-type: none"> • Key ON • Enable scrub head down • Is there a fault code/message displayed? 		See <i>FAULT CODES</i> section of this manual	Proceed to STEP 2
2	<ul style="list-style-type: none"> • Key OFF • See <i>MANUAL MODE</i> section of this manual • Activate scrub head in Manual Mode • Does the scrub head raise/lower? 		Proceed to STEP 5	Proceed to STEP 3
3	<ul style="list-style-type: none"> • Key OFF • See <i>SELF-TEST MODE</i> section of this manual • Does Self-Test display output circuits J4-9, J4-10, J4-13, J4-18 as open or shorted? 		Correct open or short circuit condition	Proceed to STEP 4
4	<ul style="list-style-type: none"> • Key OFF • See <i>TESTING MAIN BRUSH LIFT ACTUATOR</i> section of this manual • Does the scrub head lift actuator pass the testing? 	See <i>TESTING MAIN BRUSH LIFT ACTUATOR</i> section of this manual	Proceed to STEP 5	Replace scrub head lift actuator
5	<ul style="list-style-type: none"> • Key OFF • Reconnect scrub head lift actuator to main wire harness • Test voltage applied to scrub head lift subsystem • Are electrical circuits operating? 		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:

J4-9 = Combo Module (Water Pickup)

Connector #4, Pin #9

J4-10 = Combo Module (Water Pickup)

Connector #4, Pin #10

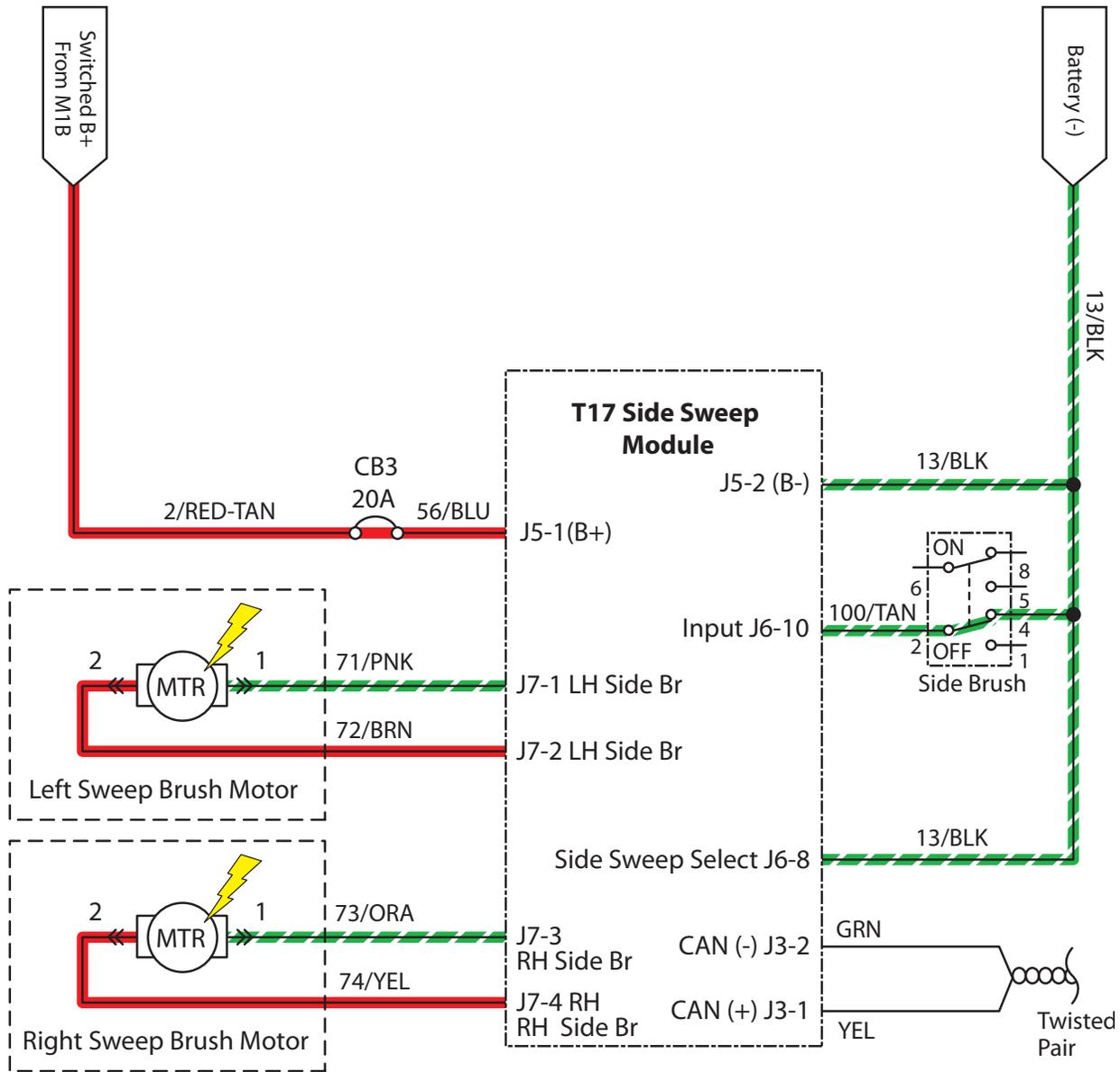
J4-13 = Combo Module (Water Pickup)

Connector #4, Pin #13

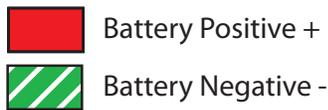
J4-18 = Combo Module (Water Pickup)

Connector #4, Pin #18

SIDE SWEEP BRUSHES ON (OPTION)



Operational Matrix:



Side Sweep Brush(es)

Enabled

- 1-STEP Scrub ON
- Side Brush Switch ON
- Fwd/Rev Propel

Disabled

- 1-STEP Scrub OFF
- Side Brush Switch OFF
- Recovery Tank Full
- Solution Tank Empty
- Very Low Batt Voltage
- Circuit Fault
- Neutral (Ready State)

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SIDE SWEEP BRUSHES FAIL TO TURN ON

Step	Action	Value(s)	Yes	No
1	<ul style="list-style-type: none"> Key ON Enable side brush Is there a fault code/message displayed? 		See <i>FAULT CODES</i> section of this manual	Proceed to STEP 2
2	<ul style="list-style-type: none"> Key OFF See <i>MANUAL MODE</i> section of this manual Activate the side brush in Manual Mode Does/do side brush(es) turn On? 		Proceed to STEP 6	Proceed to STEP 3
3	<ul style="list-style-type: none"> Key OFF See <i>SELF-TEST MODE</i> section of this manual Does Self-Test display output circuits J7-1,2, J7-3,4 as open or shorted? 		Correct open or short circuit condition	Proceed to STEP 4
4	<ul style="list-style-type: none"> Key OFF See <i>INPUT DISPLAY MODE</i> section of this manual Does I6: Side Sweep On/Off input correspond with side brush rocker switch position? 		Proceed to STEP 5	Correct faulty input condition
5	<ul style="list-style-type: none"> Key OFF See <i>TESTING SIDE SWEEP BRUSH MOTOR</i> section of this manual Does the side brush motor pass the testing? 	See <i>TESTING SIDE SWEEP BRUSH MOTOR</i> section of this manual	Proceed to STEP 5	Replace side brush motor
6	<ul style="list-style-type: none"> Key OFF Reconnect side brush motor to main wire harness Test voltage applied to side brush subsystem Are electrical circuits operating? 		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:

CB17 = High Side

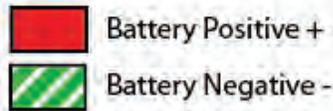
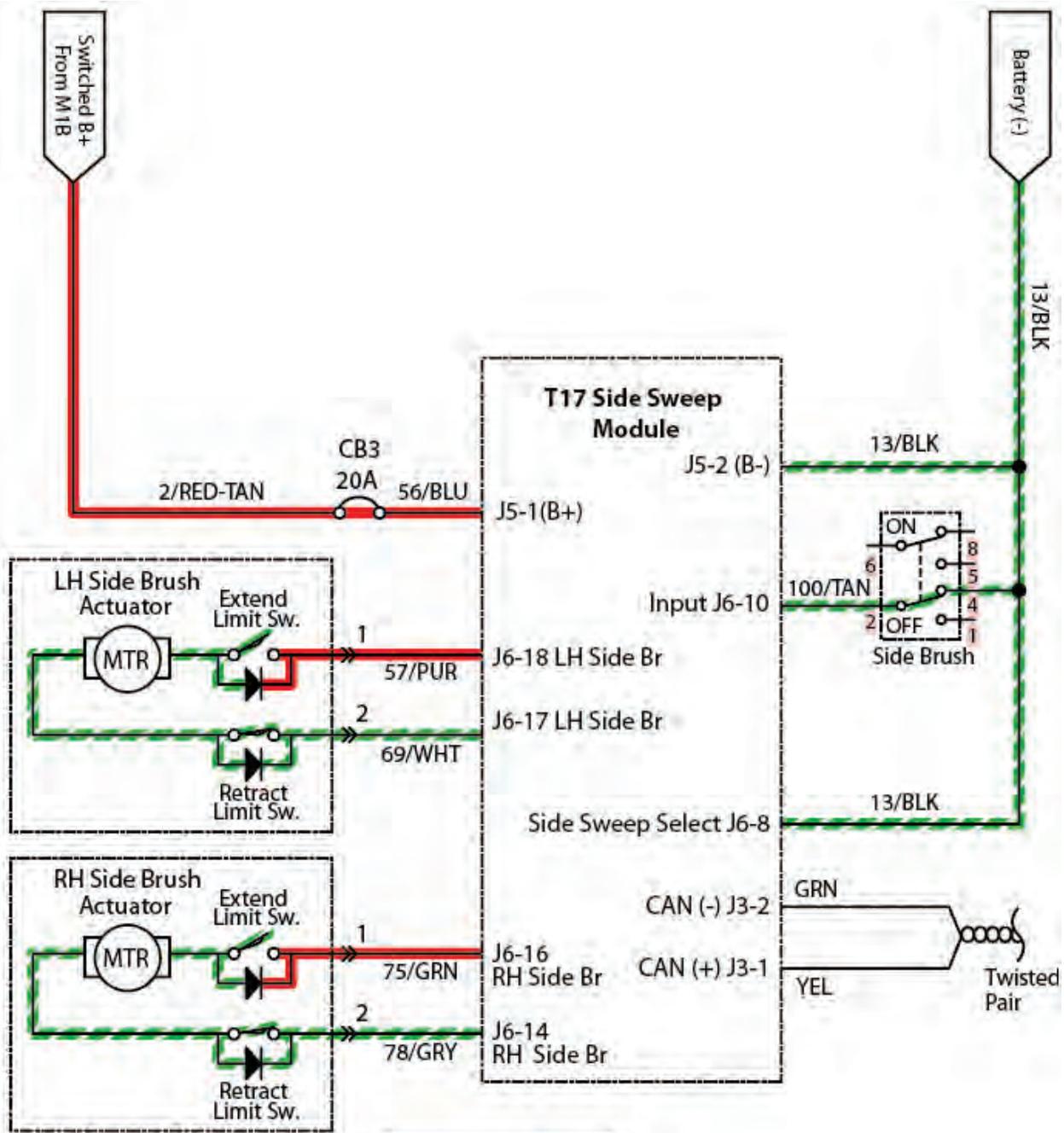
J7-1,2 = Side Sweep/Vacuum Module

Connector #7, Pin #1,2

J7-3,4 = Side Sweep/Vacuum Module

Connector #7, Pin #3,4

SIDE SWEEP BRUSH(ES) EXTEND/DOWN, OFF (OPTION)



Operational Matrix:		
	Enabled	Disabled
Side Sweep Brush(es)	<ul style="list-style-type: none"> • 1-STEP Scrub ON • Side Brush Switch ON 	<ul style="list-style-type: none"> • 1-STEP Scrub OFF • Side Brush Switch OFF • Recovery Tank Full • Solution Tank Empty • Very Low Batt Voltage • Circuit Fault • Neutral (Ready State)

**SIDE SWEEP BRUSH(ES) FAIL(S) TO EXTEND/
LOWER**

Step	Action	Value(s)	Yes	No
1	<ul style="list-style-type: none"> • Key ON • Enable side brush extend/down • Is there a fault code/message displayed? 		See <i>FAULT CODES</i> section of this manual	Proceed to STEP 2
2	<ul style="list-style-type: none"> • Key OFF • See <i>MANUAL MODE</i> section of this manual • Extend/Lower the side brush in Manual Mode • Does the side brush extend/lower? 		Proceed to STEP 6	Proceed to STEP 3
3	<ul style="list-style-type: none"> • Key OFF • See <i>SELF-TEST MODE</i> section of this manual • Does Self-Test display output circuits J6-17,18 or J6-14, 16 as open or shorted? 		Correct open or short circuit condition	Proceed to STEP 4
4	<ul style="list-style-type: none"> • Key OFF • See <i>INPUT DISPLAY MODE</i> section of this manual • Does I6: Side Sweep On/Off input correspond with side brush rocker switch position? 		Proceed to STEP 5	Correct faulty input condition
5	<ul style="list-style-type: none"> • Key OFF • See <i>TESTING SIDE SWEEP BRUSH LIFT ACTUATOR</i> section of this manual • Does side brush lift actuator pass testing? 	See <i>TESTING SIDE SWEEP BRUSH LIFT ACTUATOR</i> section of this manual	Proceed to STEP 6	Replace side brush lift actuator
6	<ul style="list-style-type: none"> • Key OFF • Reconnect side brush lift actuator to main wire harness • Key ON • Side brush extend/down enabled • Test voltage applied to side brush lift subsystem • Are electrical circuits operating? 		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:

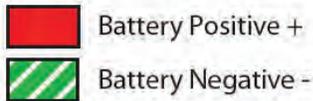
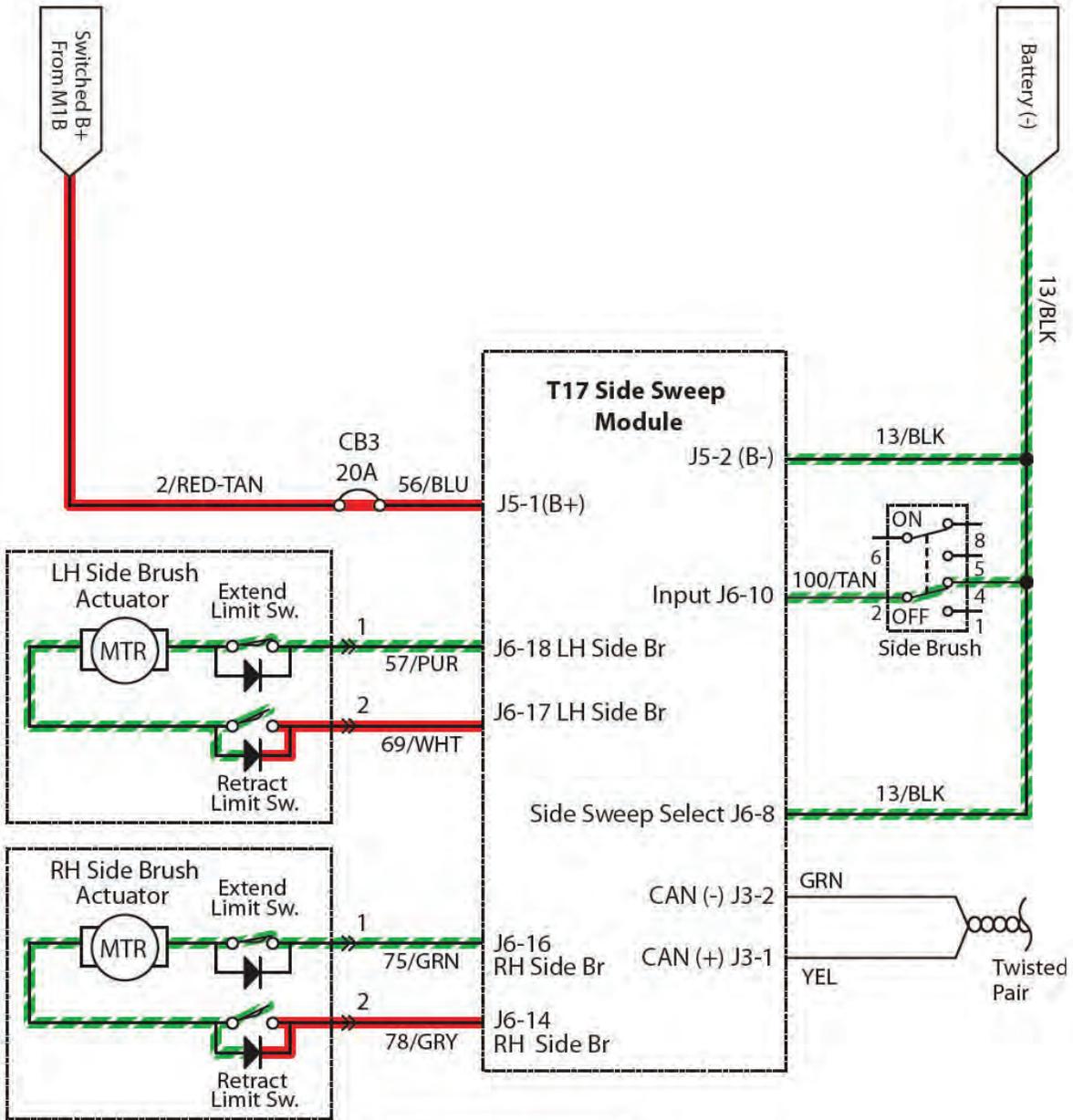
J6-17,18 = Side Sweep/Vacuum Module

Connector #6, Pin #17 or 18

J6-14,16 = Side Sweep/Vacuum Module

Connector #6, Pin #14 or 16

SIDE SWEEP BRUSH(ES) RETRACT/UP, OFF



Operational Matrix:

	Enabled	Disabled
Side Sweep Brush(es) Retract/Up	<ul style="list-style-type: none"> • 1-STEP Scrub OFF • Side Brush Switch OFF • Recovery Tank Full • Solution Tank Empty • Very Low Batt Voltage • Circuit Fault 	<ul style="list-style-type: none"> • 1-STEP Scrub ON • Side Brush Switch ON

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**SIDE SWEEP BRUSH(ES) FAIL(S) TO RETRACT/
RAISE**

Step	Action	Value(s)	Yes	No
1	<ul style="list-style-type: none"> • Key ON • Enable side brush retract/up • Is there a fault code/message displayed? 		See <i>FAULT CODES</i> section of this manual	Proceed to STEP 2
2	<ul style="list-style-type: none"> • Key OFF • See <i>SELF-TEST MODE</i> section of this manual • Does Self-Test display output circuits J6-17,18 or J6-14,16 as open or shorted? 		Proceed to STEP 3	Correct faulty input condition
3	<ul style="list-style-type: none"> • Key OFF • See <i>INPUT DISPLAY MODE</i> section of this manual • Does I6: Side Sweep On/Off input correspond with side brush rocker switch position? 		Proceed to STEP 4	Correct faulty input condition
4	<ul style="list-style-type: none"> • Key OFF • See <i>TESTING SIDE SWEEP BRUSH LIFT ACTUATOR</i> section of this manual • Does the side brush lift actuator pass the testing? 	See <i>TESTING SIDE SWEEP BRUSH LIFT ACTUATOR</i> section of this manual	Proceed to STEP 5	Replace side brush lift actuator
5	<ul style="list-style-type: none"> • Key ON • Side brush switch OFF • Test voltage applied to side brush lift subsystem • Are electrical circuits operating? 		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:

J6-17,18 = Side Sweep/Vacuum Module

Connector #6, Pin #17 or 18

J6-14,16 = Side Sweep/Vacuum Module

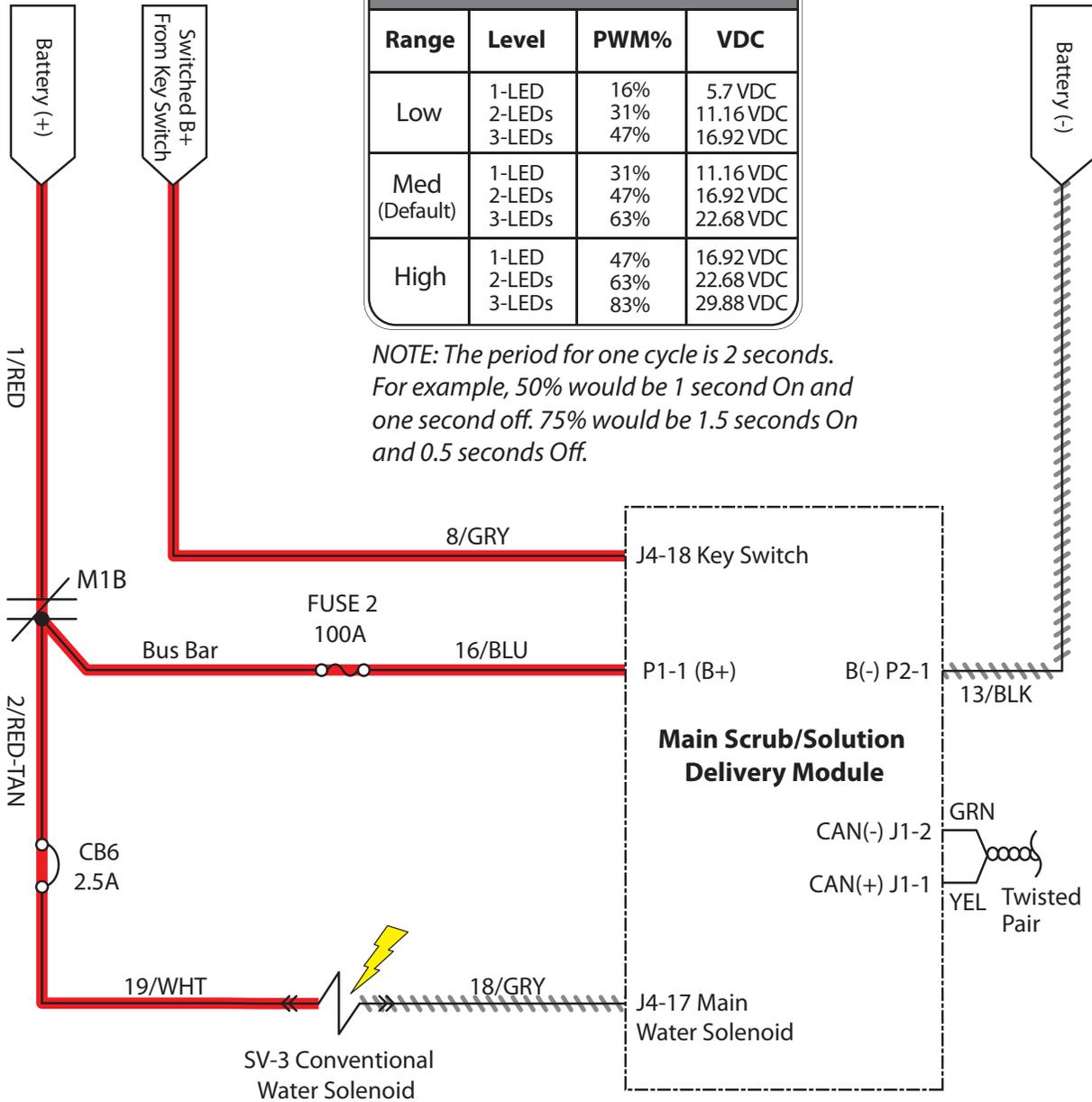
Connector #6, Pin #14 or 16

**SOLUTION CONTROL ON - MAIN BRUSH
(CONVENTIONAL) (S/N 000000-010999)**

*** SV3 (J4-17) H2O Valve Voltages**

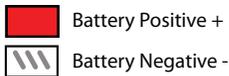
Range	Level	PWM%	VDC
Low	1-LED	16%	5.7 VDC
	2-LEDs	31%	11.16 VDC
	3-LEDs	47%	16.92 VDC
Med (Default)	1-LED	31%	11.16 VDC
	2-LEDs	47%	16.92 VDC
	3-LEDs	63%	22.68 VDC
High	1-LED	47%	16.92 VDC
	2-LEDs	63%	22.68 VDC
	3-LEDs	83%	29.88 VDC

*NOTE: The period for one cycle is 2 seconds.
For example, 50% would be 1 second On and one second off. 75% would be 1.5 seconds On and 0.5 seconds Off.*



Operational Matrix:

	Enabled	Disabled
Solution Control - Main (Conventional)	<ul style="list-style-type: none"> • 1-STEP Scrub ON • Solution Control ON • Fwd/Rev Propel 	<ul style="list-style-type: none"> • 1-STEP Scrub OFF • Solution Control OFF • Neutral-Ready State • Recovery Tank Full • Solution Tank Empty • Very Low Batt Voltage • Circuit Fault



**SOLUTION CONTROL FAILS TO TURN ON -
MAIN BRUSH (CONVENTIONAL)**

Step	Action	Value(s)	Yes	No
1	<ul style="list-style-type: none"> • Key ON • Enable solution control (conventional) • Is there a fault code/message displayed? 		See <i>FAULT CODES</i> section of this manual	Proceed to STEP 2
2	<ul style="list-style-type: none"> • Key OFF • See <i>MANUAL MODE</i> section of this manual • Activate solution control in manual mode • Does the machine dispense water to the floor? 		Proceed to STEP 7	Proceed to STEP 3
3	<ul style="list-style-type: none"> • Key OFF • See <i>SELF-TEST MODE</i> section of this manual • Does Self-Test display output circuit J4-17 as open or shorted? 		Correct open or short circuit condition	Proceed to STEP 4
4	<ul style="list-style-type: none"> • Key OFF • Firmly press circuit breaker #6 to reset • Is circuit breaker #6 tripped? 		Reset and test solution control operation	Proceed to STEP 5
5	<ul style="list-style-type: none"> • Key OFF • Disconnect SV3 from main wire harness • Apply battery voltage to SV3 using fuse-protected jumper leads • Does main brush dispense solution? 		Proceed to STEP 6	Repair or replace SV3
6	<ul style="list-style-type: none"> • Key OFF • Reconnect SV3 to main wire harness • Key ON • Enable solution control (conventional) • Test voltage applied to solution control subsystem • Are electrical circuits operating? 		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:

J4-17 = Main Scrub/Solution Delivery Module

Connector #4, Pin #17

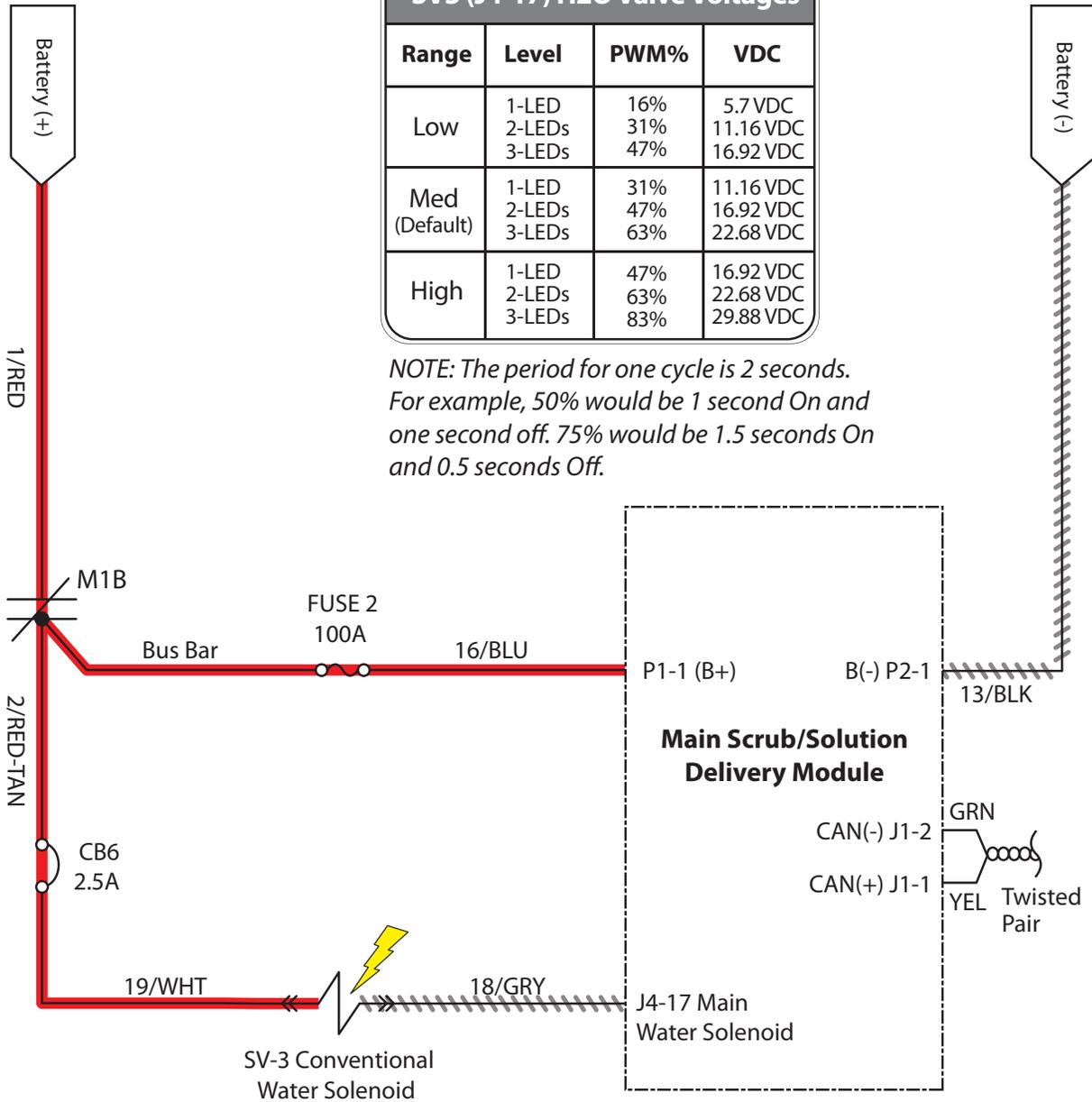
SV3 = Solenoid Valve #3 (Main Brush)

**SOLUTION CONTROL ON - MAIN BRUSH
(CONVENTIONAL) (S/N 014000-)**

*** SV3 (J4-17) H2O Valve Voltages**

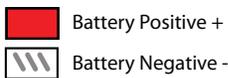
Range	Level	PWM%	VDC
Low	1-LEDs	16%	5.7 VDC
	2-LEDs	31%	11.16 VDC
	3-LEDs	47%	16.92 VDC
Med (Default)	1-LEDs	31%	11.16 VDC
	2-LEDs	47%	16.92 VDC
	3-LEDs	63%	22.68 VDC
High	1-LEDs	47%	16.92 VDC
	2-LEDs	63%	22.68 VDC
	3-LEDs	83%	29.88 VDC

*NOTE: The period for one cycle is 2 seconds.
For example, 50% would be 1 second On and one second off. 75% would be 1.5 seconds On and 0.5 seconds Off.*



Operational Matrix:

	Enabled	Disabled
Solution Control - Main (Conventional)	<ul style="list-style-type: none"> • 1-STEP Scrub ON • Solution Control ON • Fwd/Rev Propel 	<ul style="list-style-type: none"> • 1-STEP Scrub OFF • Solution Control OFF • Neutral-Ready State • Recovery Tank Full • Solution Tank Empty • Very Low Batt Voltage • Circuit Fault



**SOLUTION CONTROL FAILS TO TURN ON -
MAIN BRUSH (CONVENTIONAL)**

Step	Action	Value(s)	Yes	No
1	<ul style="list-style-type: none"> • Key ON • Enable solution control (conventional) • Is there a fault code/message displayed? 		See <i>FAULT CODES</i> section of this manual	Proceed to STEP 2
2	<ul style="list-style-type: none"> • Key OFF • See <i>MANUAL MODE</i> section of this manual • Activate solution control in manual mode • Does the machine dispense water to the floor? 		Proceed to STEP 7	Proceed to STEP 3
3	<ul style="list-style-type: none"> • Key OFF • See <i>SELF-TEST MODE</i> section of this manual • Does Self-Test display output circuit J4-17 as open or shorted? 		Correct open or short circuit condition	Proceed to STEP 4
4	<ul style="list-style-type: none"> • Key OFF • Firmly press circuit breaker #6 to reset • Is circuit breaker #6 tripped? 		Reset and test solution control operation	Proceed to STEP 5
5	<ul style="list-style-type: none"> • Key OFF • Disconnect SV3 from main wire harness • Apply battery voltage to SV3 using fuse-protected jumper leads • Does main brush dispense solution? 		Proceed to STEP 6	Repair or replace SV3
6	<ul style="list-style-type: none"> • Key OFF • Reconnect SV3 to main wire harness • Key ON • Enable solution control (conventional) • Test voltage applied to solution control 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:

J4-17 = Main Scrub/Solution Delivery Module

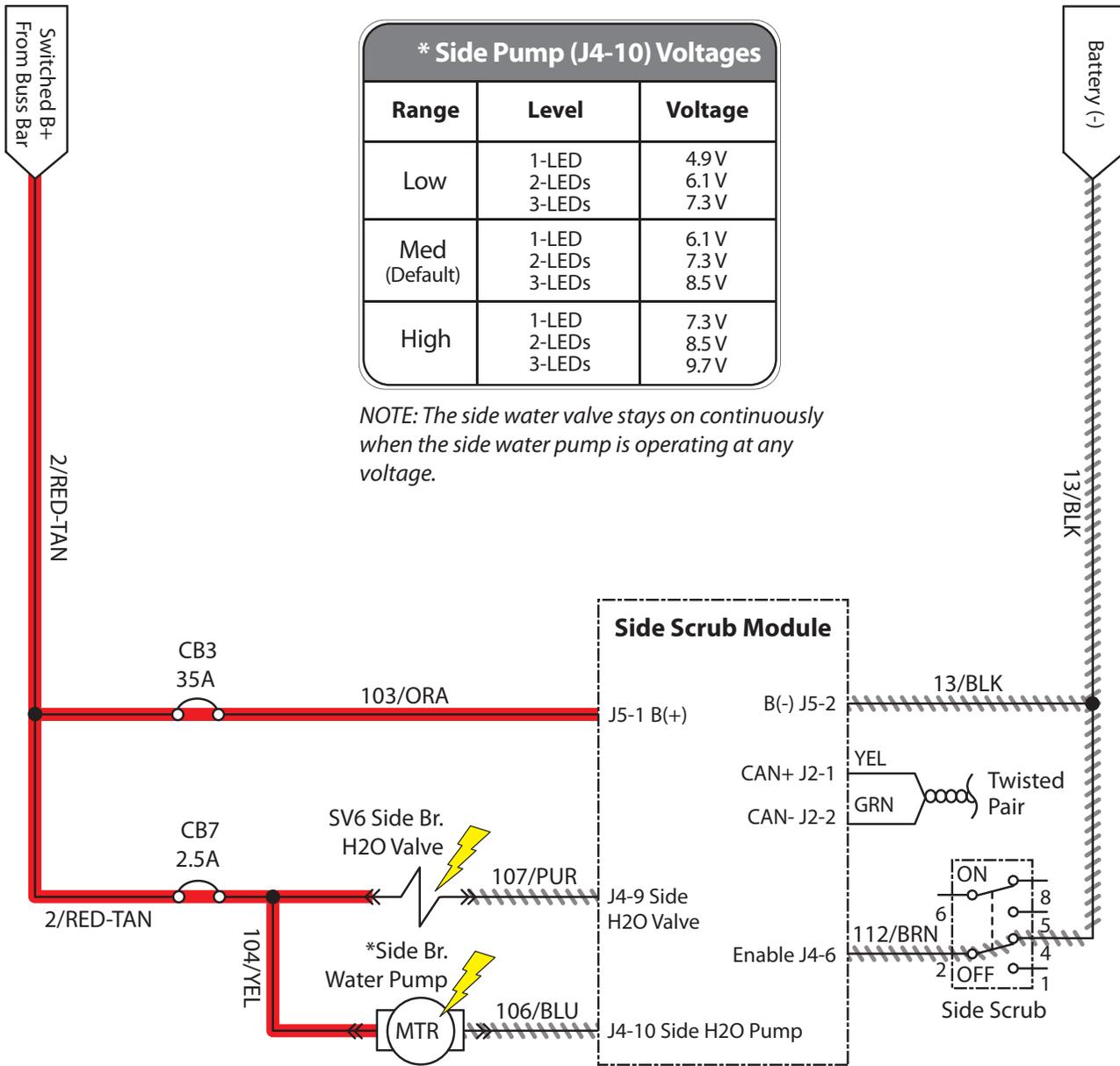
Connector #4, Pin #17

SV3 = Solenoid Valve #3 (Main Brush)

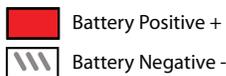
**SOLUTION CONTROL ON - SIDE BRUSH
(CONVENTIONAL) (S/N 000000-010999)**

* Side Pump (J4-10) Voltages		
Range	Level	Voltage
Low	1-LED	4.9V
	2-LEDs	6.1V
	3-LEDs	7.3V
Med (Default)	1-LED	6.1V
	2-LEDs	7.3V
	3-LEDs	8.5V
High	1-LED	7.3V
	2-LEDs	8.5V
	3-LEDs	9.7V

NOTE: The side water valve stays on continuously when the side water pump is operating at any voltage.



Operational Matrix:



Solution Control-Side (Conventional)

Enabled

- 1-STEP Scrub ON
- Side Brush Switch ON
- Fwd/Rev Propel

Disabled

- 1-STEP Scrub OFF
- Side Brush Switch OFF
- Recovery Tank Full
- Solution Tank Empty
- Very Low Batt Voltage
- Circuit Fault
- Neutral (Ready State)

**SOLUTION CONTROL FAILS TO TURN ON -
SIDE BRUSH (CONVENTIONAL)**

Step	Action	Value(s)	Yes	No
1	<ul style="list-style-type: none"> • Key ON • Enable side brush solution control (conventional) • Is there a fault code/message displayed? 		See <i>FAULT CODES</i> section of this manual	Proceed to STEP 2
2	<ul style="list-style-type: none"> • Key OFF • See <i>MANUAL MODE</i> section of this manual • Activate solution control in Manual Mode • Does the machine dispense water to the side brush? 		Proceed to STEP 7	Proceed to STEP 3
3	<ul style="list-style-type: none"> • Key OFF • See <i>SELF-TEST MODE</i> section of this manual • Does Self-Test display output circuits J4-10 or J4-9 as open or shorted? 		Correct open or short circuit condition	Proceed to STEP 4
4	<ul style="list-style-type: none"> • Key OFF • Firmly press circuit breaker #3 to reset • Is circuit breaker #3 tripped? 		Reset and test solution control operation	Proceed to STEP 5
5	<ul style="list-style-type: none"> • Key OFF • Firmly press circuit breaker #7 to reset • Is circuit breaker #7 tripped? 		Reset and test solution control operation	Proceed to STEP 6
6	<ul style="list-style-type: none"> • Key OFF • Disconnect SV6 and side brush water pump from main wire harness • Apply battery voltage to SV6 and side brush water pump using fuse-protected jumper leads • Does the side brush dispense solution? 		Proceed to STEP 7	Repair or replace SV6 or side brush water pump
7	<ul style="list-style-type: none"> • Key OFF • Reconnect SV6 and side brush water pump to main wire harness • Key ON • Enable side brush solution control (conventional) • Test voltage applied to side brush solution control subsystem • Are electrical circuits operating? 		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:

J4-9 = Side Scrub Module Connector #4, Pin #9

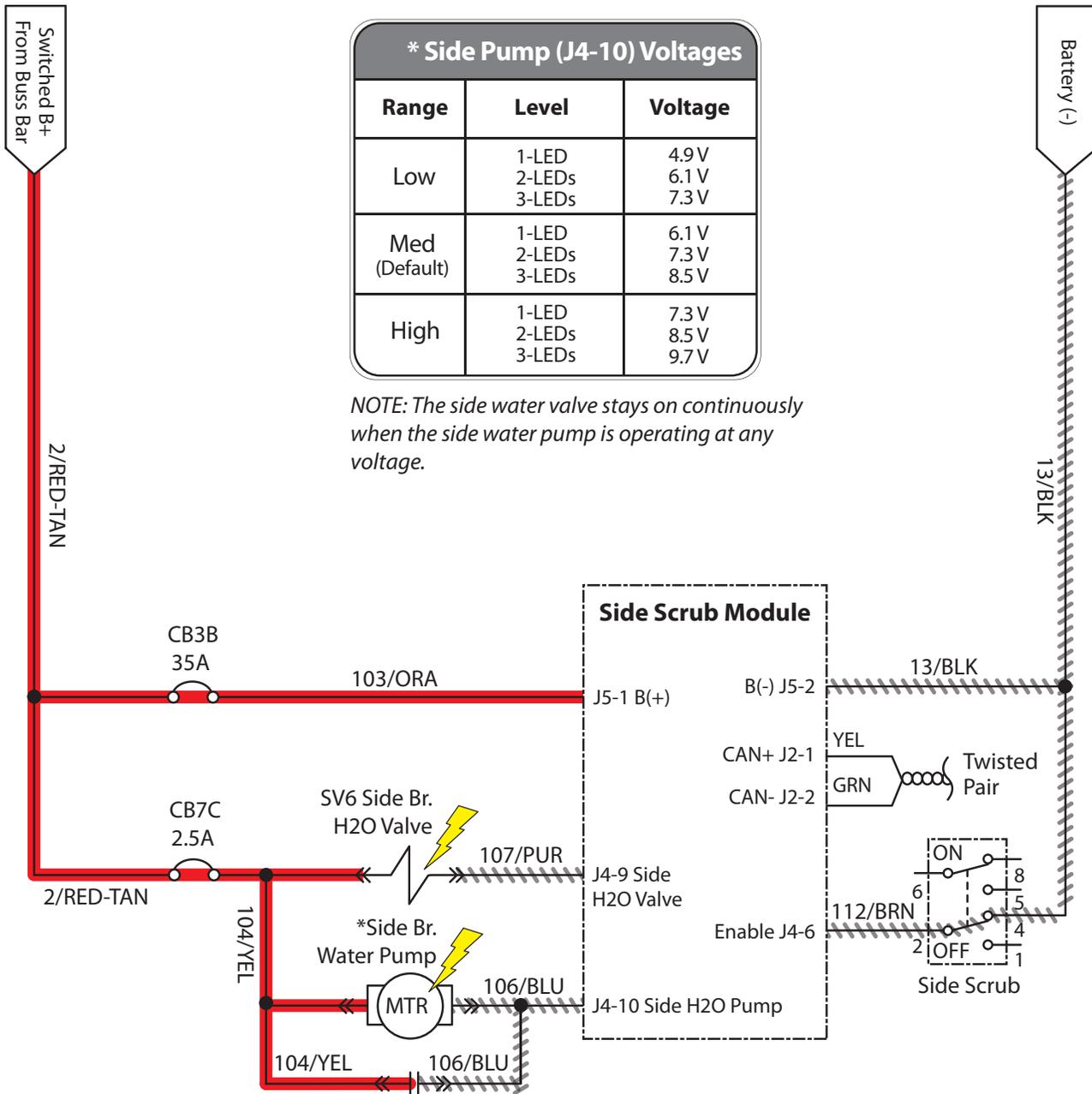
J4-10 = Side Scrub Module Connector #4, Pin #10

SV6 = Solenoid Valve #6 (Side Brush)

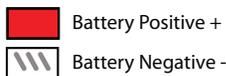
**SOLUTION CONTROL ON - SIDE BRUSH
(CONVENTIONAL) (S/N 014000-)**

* Side Pump (J4-10) Voltages		
Range	Level	Voltage
Low	1-LED	4.9V
	2-LEDs	6.1V
	3-LEDs	7.3V
Med (Default)	1-LED	6.1V
	2-LEDs	7.3V
	3-LEDs	8.5V
High	1-LED	7.3V
	2-LEDs	8.5V
	3-LEDs	9.7V

NOTE: The side water valve stays on continuously when the side water pump is operating at any voltage.



Operational Matrix:



	Enabled	Disabled
Solution Control-Side (Conventional)	<ul style="list-style-type: none"> • 1-STEP Scrub ON • Side Brush Switch ON • Fwd/Rev Propel 	<ul style="list-style-type: none"> • 1-STEP Scrub OFF • Side Brush Switch OFF • Recovery Tank Full • Solution Tank Empty • Very Low Batt Voltage • Circuit Fault • Neutral (Ready State)

**SOLUTION CONTROL FAILS TO TURN ON -
SIDE BRUSH (CONVENTIONAL)**

Step	Action	Value(s)	Yes	No
1	<ul style="list-style-type: none"> • Key ON • Enable side brush solution control (conventional) • Is there a fault code/message displayed? 		See <i>FAULT CODES</i> section of this manual	Proceed to STEP 2
2	<ul style="list-style-type: none"> • Key OFF • Firmly press circuit breaker #3 to reset • Is circuit breaker #3 tripped? 		Reset and test solution control operation	Proceed to STEP 3
3	<ul style="list-style-type: none"> • Key OFF • Firmly press circuit breaker #7 to reset • Is circuit breaker #7 tripped? 		Reset and test solution control operation	Proceed to STEP 4
4	<ul style="list-style-type: none"> • Key OFF • See <i>MANUAL MODE</i> section of this manual • Activate solution control in Manual Mode • Does the machine dispense water to the side brush? 		Proceed to STEP 7	Proceed to STEP 5
5	<ul style="list-style-type: none"> • Key OFF • See <i>SELF-TEST MODE</i> section of this manual • Does Self-Test display output circuits J4-10 or J4-9 as open or shorted? 		Correct open or short circuit condition	Proceed to STEP 6
6	<ul style="list-style-type: none"> • Key OFF • Disconnect SV6 and side brush water pump from main wire harness • Apply battery voltage to SV6 and side brush water pump using fuse-protected jumper leads • Does the side brush dispense solution? 		Proceed to STEP 7	Repair or replace SV6 or side brush water pump
7	<ul style="list-style-type: none"> • Key OFF • Reconnect SV6 and side brush water pump to main wire harness • Key ON • Enable side brush solution control (conventional) • Test voltage applied to side brush solution control subsystem • Are electrical circuits operating? 		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

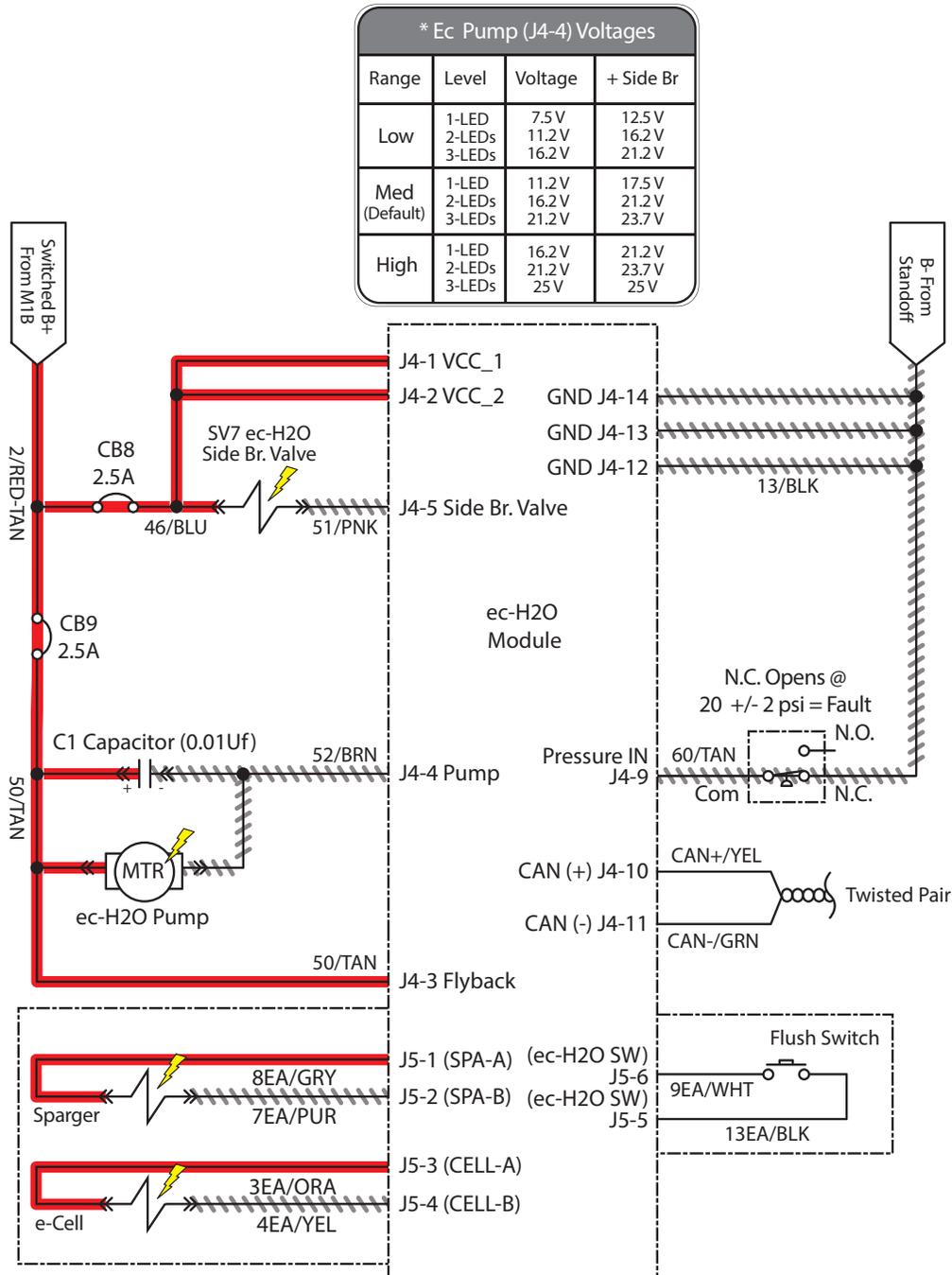
Terms:

J4-9 = Side Scrub Module Connector #4, Pin #9

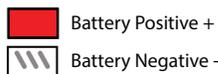
J4-10 = Side Scrub Module Connector #4, Pin #10

SV6 = Solenoid Valve #6 (Side Brush)

SOLUTION CONTROL ON (ec-H2O)



Operational Matrix:



	Enabled	Disabled
Solution Control (ec-H2O)	<ul style="list-style-type: none"> • 1-STEP Scrub ON • Solution Control ON • ec-H2O Button ON • Fwd/Rev Propel 	<ul style="list-style-type: none"> • 1-STEP Scrub OFF • Solution Control OFF • ec-H2O Button OFF/SE ON • Neutral-Ready State • Recovery Tank Full • Solution Tank Empty • Very Low Batt Voltage • ec-H2O System Fault • Circuit Fault

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

Step	Action	Value(s)	Yes	No
1	<ul style="list-style-type: none"> Key ON Enable solution control (<i>ec-H2O</i>) Is there a fault code/message displayed? 		See <i>FAULT CODES</i> section of this manual	Proceed to STEP 2
2	<ul style="list-style-type: none"> Key OFF Firmly press circuit breakers #8 and #9 to reset Is a circuit breaker tripped? 		Reset and test <i>ec-H2O</i> solution control operation	Proceed to STEP 3
3	<ul style="list-style-type: none"> Key OFF Enable solution control (<i>ec-H2O</i>) Is <i>ec-H2O</i> LED flashing RED, indicating a system restriction or low water conductivity? 		See <i>ec-H2O MODULE FLUSH PROCEDURE</i> section in this manual. Proceed to STEP 4	Proceed to STEP 5
4	<ul style="list-style-type: none"> Key OFF See <i>ec-H2O MODULE FLUSH PROCEDURE</i> section of this manual Did the flush procedure fix the problem? 		System OK	See TESTING <i>ec-H2O</i> PRESSURE SWITCH
5	<ul style="list-style-type: none"> Key OFF See <i>MANUAL MODE</i> section of this manual Activate solution control (<i>ec-H2O</i>) in Manual Mode Does solution control (<i>ec-H2O</i>) turn On? 		Proceed to STEP 8	Proceed to STEP 6
6	<ul style="list-style-type: none"> Key OFF See <i>SELF-TEST MODE</i> section of this manual Does Self-Test display output circuits J4-4,5 or J5-1,2 or J5-3,4 as open or shorted? 	See <i>SELF-TEST MODE</i> section of this manual	Correct open or short circuit condition	Proceed to STEP 7
7	<ul style="list-style-type: none"> Key OFF Disconnect <i>ec-H2O</i> water pump from wire harness Apply battery voltage to <i>ec-H2O</i> water pump using fuse-protected jumper leads Does the <i>ec-H2O</i> water pump dispense water? 		Proceed to STEP 8	Repair or replace <i>ec-H2O</i> water pump
8	<ul style="list-style-type: none"> Key OFF Reconnect <i>ec-H2O</i> water pump to wire harness Key ON Enable solution control (<i>ec-H2O</i>) Test voltage applied to solution control (<i>ec-H2O</i>) system Are electrical circuits operating? 		Proceed to STEP 9	Identify voltage drop location and repair or replace necessary components
9	<ul style="list-style-type: none"> Key ON Enable solution control (<i>ec-H2O</i>) Is <i>ec-H2O</i> LED solid RED, indicating an over current condition on a system component? 		Replace <i>ec-H2O</i> module	Repeat STEP 1

**NOTE: Add 1/2 tablespoon of salt for every 10 gallons of water in solution tank to increase water conductivity.*

Terms:

LED = Light Emitting Diode

J4-4 = *ec-H2O* Module Connector #4, Pin #4

J4-5 = *ec-H2O* Module Connector #4, Pin #5

J5-1 = *ec-H2O* Module Connector #5, Pin #1

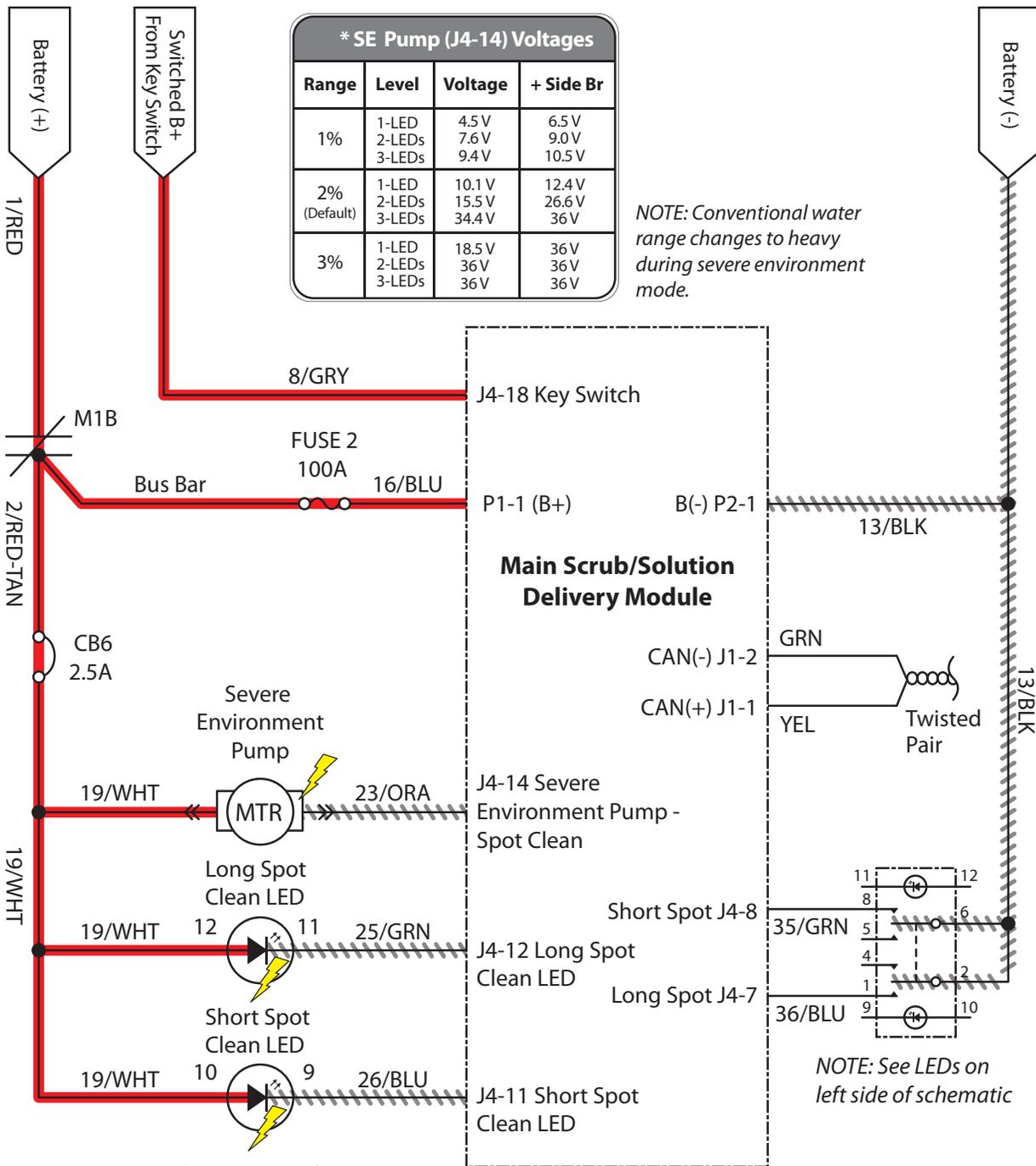
J5-2 = *ec-H2O* Module Connector #5, Pin #2

J5-3 = *ec-H2O* Module Connector #5, Pin #3

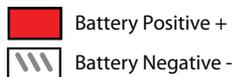
J5-4 = *ec-H2O* Module Connector #5, Pin #4

TROUBLESHOOTING

SEVERE ENVIRONMENT - SPOT CLEANING (S/N 000000-010999)



NOTE: Pump and LED operate for duration set in configuration mode. Default duration is 30 seconds (short) and 36 minutes (long).



Operational Matrix:		
	Enabled	Disabled
Severe Environment Spot Clean	<ul style="list-style-type: none"> 1-STEP Scrub ON Solution Control ON Fwd/Rev Propel SE Switch On 	<ul style="list-style-type: none"> 1-STEP Scrub OFF Solution Control OFF Neutral-Ready State Recovery Tank Full Solution Tank Empty Very Low Batt Voltage Circuit Fault

SEVERE ENVIRONMENT - SPOT CLEANING FAILS TO TURN ON

Step	Action	Value(s)	Yes	No
1	<ul style="list-style-type: none"> Key ON Enable severe environment - spot clean Is there a fault code/message displayed? 		See <i>FAULT CODES</i> section of this manual	Proceed to STEP 2
2	<ul style="list-style-type: none"> Key OFF Firmly press circuit breaker #6 to reset Is circuit breaker #6 tripped? 		Reset and test solution control operation	Proceed to STEP 3
3	<ul style="list-style-type: none"> Key OFF See <i>MANUAL MODE</i> section of this manual Activate detergent pump in Manual Mode Does pump dispense detergent? 		Proceed to STEP 6	Proceed to STEP 4
4	<ul style="list-style-type: none"> Key OFF See <i>SELF-TEST MODE</i> section of this manual Does Self-Test display output circuits J4-14, J4-12, or J4-11 as open or shorted? 		Correct open or short circuit condition	Proceed to STEP 5
5	<ul style="list-style-type: none"> Key OFF Check to be sure there is detergent in concentrate tank Disconnect detergent pump from main wire harness Apply battery voltage to detergent pump using fuse protected jumper leads Does pump dispense detergent? 		Proceed to STEP 6	Repair or replace detergent pump
6	<ul style="list-style-type: none"> Key OFF Reconnect detergent pump to main wire harness Key ON Enable severe environment subsystem Test voltage applied to severe environment subsystem Are electrical circuits operating? 		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:

J4-14 = Main Scrub/Solution Delivery Module

Connector #4, Pin #14

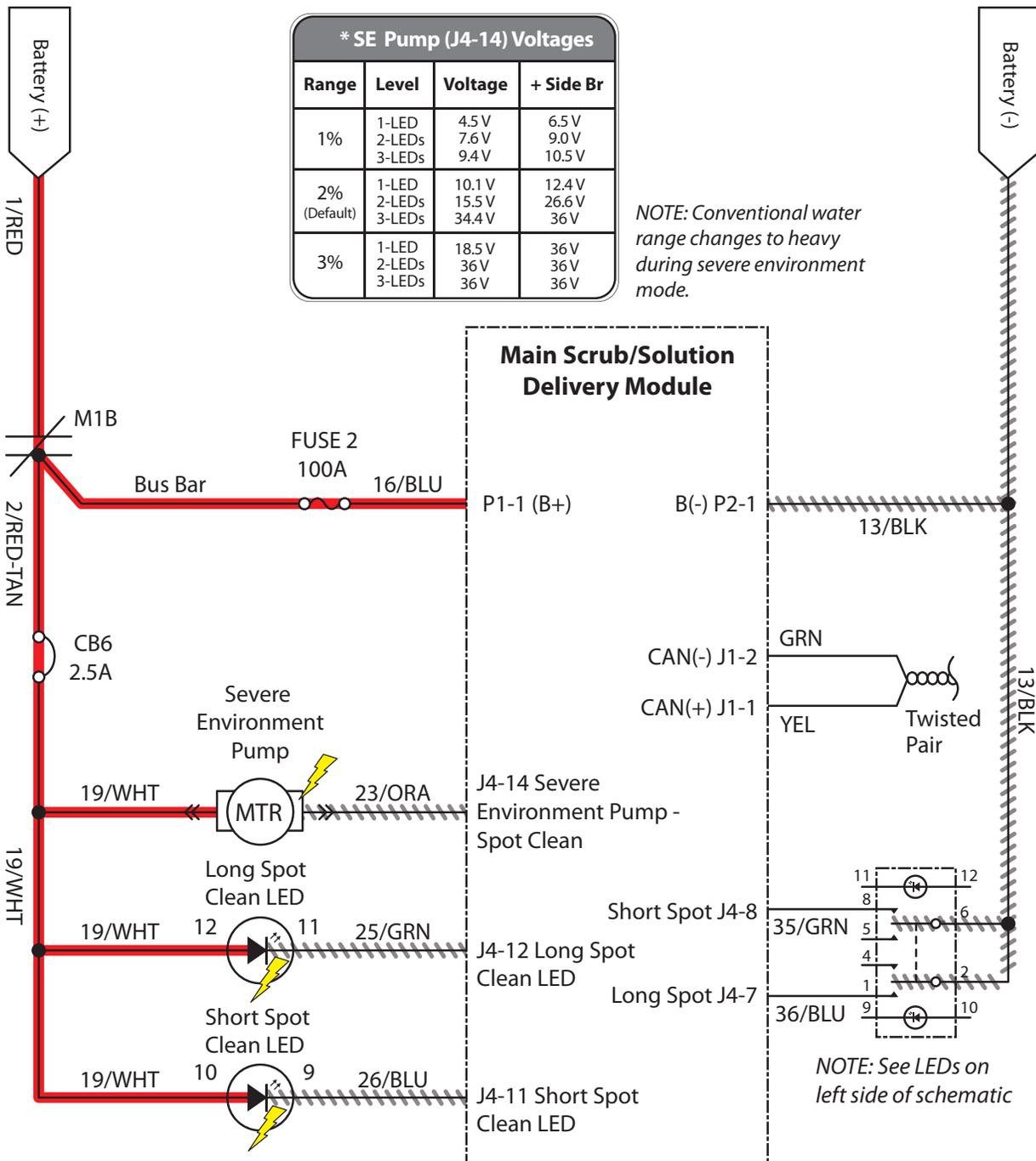
J4-12 = Main Scrub/Solution Delivery Module

Connector #4, Pin #12

J4-11 = Main Scrub/Solution Delivery Module

Connector #4, Pin #11

SEVERE ENVIRONMENT - SPOT CLEANING
(S/N 014000-)



* SE Pump (J4-14) Voltages			
Range	Level	Voltage	+ Side Br
1%	1-LED	4.5V	6.5V
	2-LEDs	7.6V	9.0V
	3-LEDs	9.4V	10.5V
2% (Default)	1-LED	10.1V	12.4V
	2-LEDs	15.5V	26.6V
	3-LEDs	34.4V	36V
3%	1-LED	18.5V	36V
	2-LEDs	36V	36V
	3-LEDs	36V	36V

NOTE: Conventional water range changes to heavy during severe environment mode.

NOTE: Pump and LED operate for duration set in configuration mode. Default duration is 30 seconds (short) and 36 minutes (long).



Operational Matrix:		
	Enabled	Disabled
Severe Environment Spot Clean	<ul style="list-style-type: none"> • 1-STEP Scrub ON • Solution Control ON • Fwd/Rev Propel • SE Switch On 	<ul style="list-style-type: none"> • 1-STEP Scrub OFF • Solution Control OFF • Neutral-Ready State • Recovery Tank Full • Solution Tank Empty • Very Low Batt Voltage • Circuit Fault

SEVERE ENVIRONMENT - SPOT CLEANING FAILS TO TURN ON

Step	Action	Value(s)	Yes	No
1	<ul style="list-style-type: none"> Key ON Enable severe environment - spot clean Is there a fault code/message displayed? 		See <i>FAULT CODES</i> section of this manual	Proceed to STEP 2
2	<ul style="list-style-type: none"> Key OFF Firmly press circuit breaker #6 to reset Is circuit breaker #6 tripped? 		Reset and test solution control operation	Proceed to STEP 3
3	<ul style="list-style-type: none"> Key OFF See <i>MANUAL MODE</i> section of this manual Activate detergent pump in Manual Mode Does pump dispense detergent? 		Proceed to STEP 6	Proceed to STEP 4
4	<ul style="list-style-type: none"> Key OFF See <i>SELF-TEST MODE</i> section of this manual Does Self-Test display output circuits J4-14, J4-12, or J4-11 as open or shorted? 		Correct open or short circuit condition	Proceed to STEP 5
5	<ul style="list-style-type: none"> Key OFF Check to be sure there is detergent in concentrate tank Disconnect detergent pump from main wire harness Apply battery voltage to detergent pump using fuse protected jumper leads Does pump dispense detergent? 		Proceed to STEP 6	Repair or replace detergent pump
6	<ul style="list-style-type: none"> Key OFF Reconnect detergent pump to main wire harness Key ON Enable severe environment subsystem Test voltage applied to severe environment subsystem Are electrical circuits operating? 		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:

J4-14 = Main Scrub/Solution Delivery Module

Connector #4, Pin #14

J4-12 = Main Scrub/Solution Delivery Module

Connector #4, Pin #12

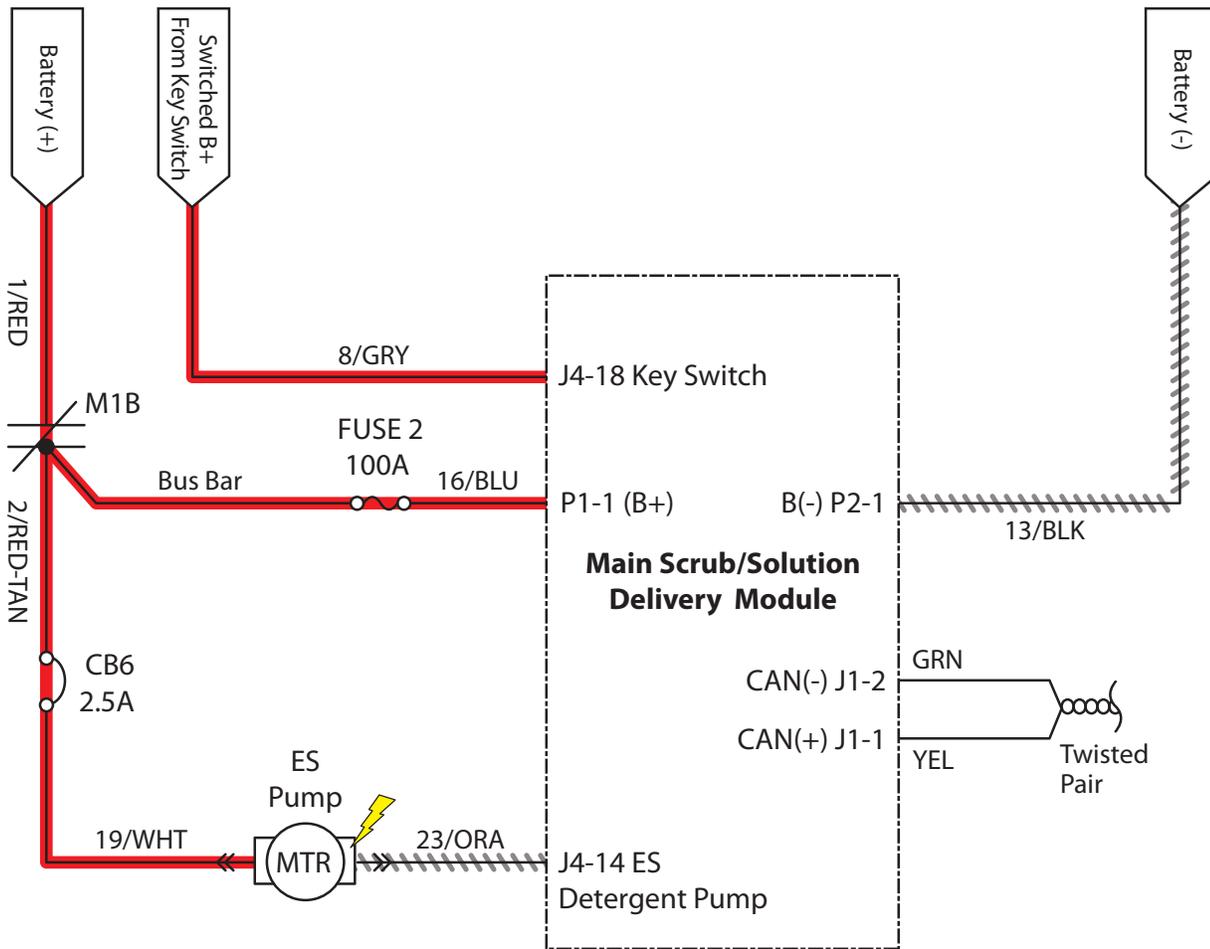
J4-11 = Main Scrub/Solution Delivery Module

Connector #4, Pin #11

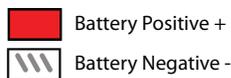
TROUBLESHOOTING

ES DETERGENT PUMP (S/N 000000-010999)

ES Detergent Pump Voltages									
ES w/o Side Brush	Economy 1 LED	Economy 2 LEDs	Economy 3 LEDs	Normal 1 LED	Normal 2 LEDs	Normal 3 LEDs	Heavy 1 LED	Heavy 2 LEDs	Heavy 3 LEDs
1% Dilution	0V	2.0V	4.5V	0V	6.8V	10.1V	0V	9.8V	18.5V
2% Dilution	0V	4.5V	7.6V	0V	10.1V	15.5V	0V	18.5V	36V
3% Dilution	0V	7.6V	9.4V	0V	15.5V	34.4V	0V	36V	36V
ES w/Side Brush	Economy 1 LED	Economy 2 LEDs	Economy 3 LEDs	Normal 1 LED	Normal 2 LEDs	Normal 3 LEDs	Heavy 1 LED	Heavy 2 LEDs	Heavy 3 LEDs
1% Dilution	0V	3.0V	6.5V	0V	9.0V	12.4V	0V	12.7V	36V
2% Dilution	0V	6.5V	9.0V	0V	12.4V	26.6V	0V	36V	36V
3% Dilution	0V	9.0V	10.5V	0V	26.6V	36V	0V	36V	36V



Operational Matrix:



	Enabled	Disabled
ES Detergent Pump	<ul style="list-style-type: none"> • 1-STEP Scrub ON • Solution Control ON • 2 or 3 LEDs • Fwd/Rev Propel • ES On 	<ul style="list-style-type: none"> • 1-STEP Scrub OFF • Solution Control/ES OFF • Neutral-Ready State • Recovery Tank Full • Solution Tank Empty • Very Low Batt Voltage • Circuit Fault

ES DETERGENT PUMP FAILS TO TURN ON

Step	Action	Value(s)	Yes	No
1	<ul style="list-style-type: none"> Key ON Enable ES scrubbing technology Is there a fault code/message displayed? 		See <i>FAULT CODES</i> section of this manual	Proceed to STEP 2
2	<ul style="list-style-type: none"> Key OFF Firmly press circuit breaker #6 to reset Is circuit breaker #6 tripped? 		Reset and test ES detergent pump operation	Proceed to STEP 3
3	<ul style="list-style-type: none"> Key OFF See <i>MANUAL MODE</i> section of this manual Activate solution control in manual mode Does the pump dispense detergent? 		Proceed to STEP 6	Proceed to STEP 4
4	<ul style="list-style-type: none"> Key OFF See <i>SELF-TEST MODE</i> section of this manual Does the Self-Test display output circuits J4-14 as open or shorted? 		Correct open or short circuit condition	Proceed to STEP 5
5	<ul style="list-style-type: none"> Key OFF Ensure there is detergent in concentrate tank Disconnect detergent pump from main wire harness Apply battery voltage to detergent pump using fuse protected jumper leads Does the pump dispense detergent? 		Proceed to STEP 6	Repair or replace detergent pump
6	<ul style="list-style-type: none"> Key OFF Reconnect detergent pump to main wire harness Key ON Enable ES detergent pump Test voltage applied to ES detergent pump Are electrical circuits operating? 		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:

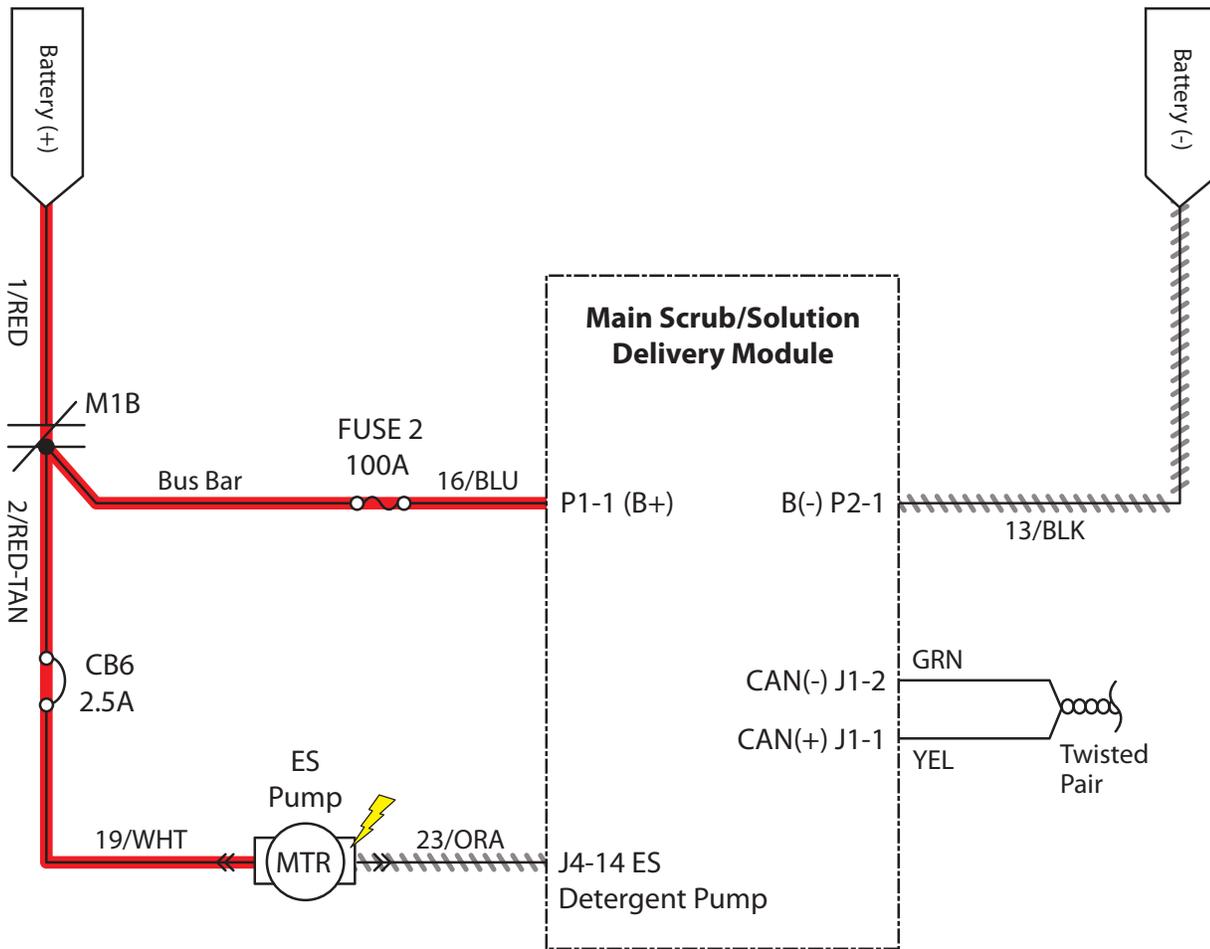
J4-14 = Main Scrub/Solution Delivery Module

Connector #4, Pin #14

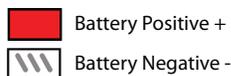
TROUBLESHOOTING

ES DETERGENT PUMP (S/N 014000-)

ES Detergent Pump Voltages									
ES w/o Side Brush	Economy 1 LED	Economy 2 LEDs	Economy 3 LEDs	Normal 1 LED	Normal 2 LEDs	Normal 3 LEDs	Heavy 1 LED	Heavy 2 LEDs	Heavy 3 LEDs
1% Dilution	0V	2.0V	4.5V	0V	6.8V	10.1V	0V	9.8V	18.5V
2% Dilution	0V	4.5V	7.6V	0V	10.1V	15.5V	0V	18.5V	36V
3% Dilution	0V	7.6V	9.4V	0V	15.5V	34.4V	0V	36V	36V
ES w/Side Brush	Economy 1 LED	Economy 2 LEDs	Economy 3 LEDs	Normal 1 LED	Normal 2 LEDs	Normal 3 LEDs	Heavy 1 LED	Heavy 2 LEDs	Heavy 3 LEDs
1% Dilution	0V	3.0V	6.5V	0V	9.0V	12.4V	0V	12.7V	36V
2% Dilution	0V	6.5V	9.0V	0V	12.4V	26.6V	0V	36V	36V
3% Dilution	0V	9.0V	10.5V	0V	26.6V	36V	0V	36V	36V



Operational Matrix:



	Enabled	Disabled
ES Detergent Pump	<ul style="list-style-type: none"> • 1-STEP Scrub ON • Solution Control ON • 2 or 3 LEDs • Fwd/Rev Propel • ES On 	<ul style="list-style-type: none"> • 1-STEP Scrub OFF • Solution Control/ES OFF • Neutral-Ready State • Recovery Tank Full • Solution Tank Empty • Very Low Batt Voltage • Circuit Fault

ES DETERGENT PUMP FAILS TO TURN ON

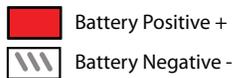
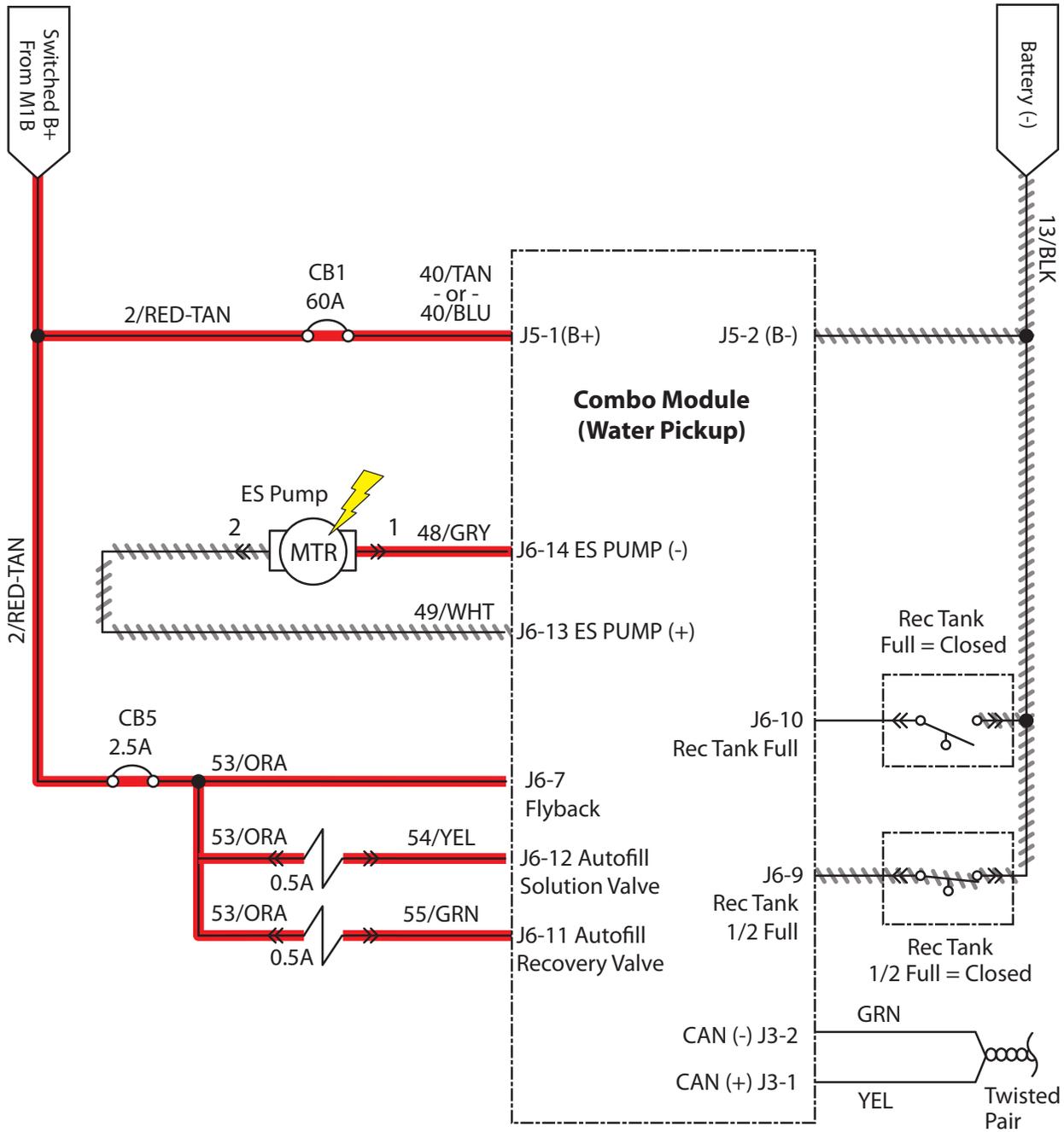
Step	Action	Value(s)	Yes	No
1	<ul style="list-style-type: none"> Key ON Enable ES scrubbing technology Is there a fault code/message displayed? 		See <i>FAULT CODES</i> section of this manual	Proceed to STEP 2
2	<ul style="list-style-type: none"> Key OFF Firmly press circuit breaker #6 to reset Is circuit breaker #6 tripped? 		Reset and test ES detergent pump operation	Proceed to STEP 6
3	<ul style="list-style-type: none"> Key OFF See <i>MANUAL MODE</i> section of this manual Activate solution control in manual mode Does the pump dispense detergent? 		Proceed to STEP 6	Proceed to STEP 4
4	<ul style="list-style-type: none"> Key OFF See <i>SELF-TEST MODE</i> section of this manual Does the Self-Test display output circuits J4-14 as open or shorted? 		Correct open or short circuit condition	Proceed to STEP 5
5	<ul style="list-style-type: none"> Key OFF Ensure there is detergent in concentrate tank Disconnect detergent pump from main wire harness Apply battery voltage to detergent pump using fuse protected jumper leads Does the pump dispense detergent? 		Proceed to STEP 6	Repair or replace detergent pump
6	<ul style="list-style-type: none"> Key OFF Reconnect detergent pump to main wire harness Key ON Enable ES detergent pump Test voltage applied to ES detergent pump Are electrical circuits operating? 		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:

J4-14 = Main Scrub/Solution Delivery Module

Connector #4, Pin #14

ES WATER PUMP



Operational Matrix:

	Enabled	Disabled
ES Water Pump	<ul style="list-style-type: none"> • 1-STEP Scrub ON • Squeegee/Vac ON • ES On • Rec Tank 1/2 Full • Sol Tank Not Full 	<ul style="list-style-type: none"> • 1-STEP Scrub OFF • Squeegee/Vac OFF • Sol/Rec Tank Full • ES Off • Very Low Batt Voltage • Circuit Fault

ES WATER PUMP FAILS TO TURN ON

Step	Action	Value(s)	Yes	No
1	<ul style="list-style-type: none"> • Key ON • Enable ES scrubbing technology • Is there a fault code/message displayed? 		See <i>FAULT CODES</i> section of this manual	Proceed to STEP 2
2	<ul style="list-style-type: none"> • Key OFF • Firmly press circuit breaker #1 to reset • Is circuit breaker #1 tripped? 		Reset and test ES pump operation	Proceed to STEP 5
3	<ul style="list-style-type: none"> • Key OFF • See <i>MANUAL MODE</i> section of this manual • Activate ES pump in manual mode • Does the ES pump turn On? 		Proceed to STEP 6	Proceed to STEP 4
4	<ul style="list-style-type: none"> • Key OFF • See <i>SELF-TEST MODE</i> section of this manual • Does Self-Test display output circuits J6-13,14 as open or shorted? 		Correct open or short circuit condition	Proceed to STEP 5
5	<ul style="list-style-type: none"> • Key OFF • Ensure there is water in the recovery tank and solution tank is not full • Disconnect ES pump from main wire harness • Apply battery voltage to ES pump using fuse-protected jumper leads • Does ES pump transfer water from recovery tank to solution tank? 		Proceed to STEP 6	Repair or replace ES pump
6	<ul style="list-style-type: none"> • Key OFF • Reconnect ES pump to main wire harness • Key ON • Enable ES pump • Test voltage applied to ES pump • Are electrical circuits operating? 		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

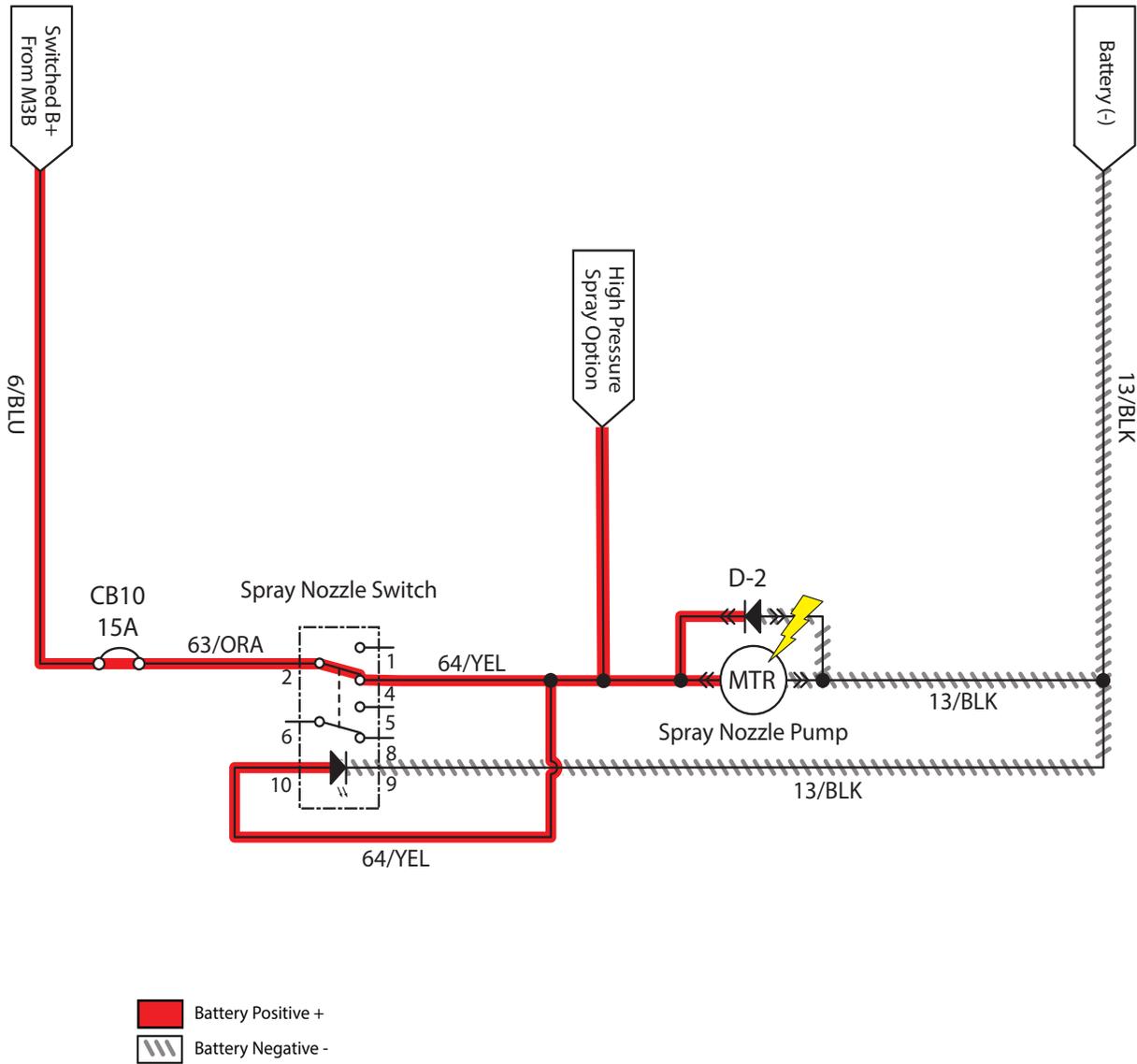
Terms:

J6-14,13 = Combo Module (Water Pickup)

Connector #6, Pin #14,13

SPRAY NOZZLE ON (OPTION)

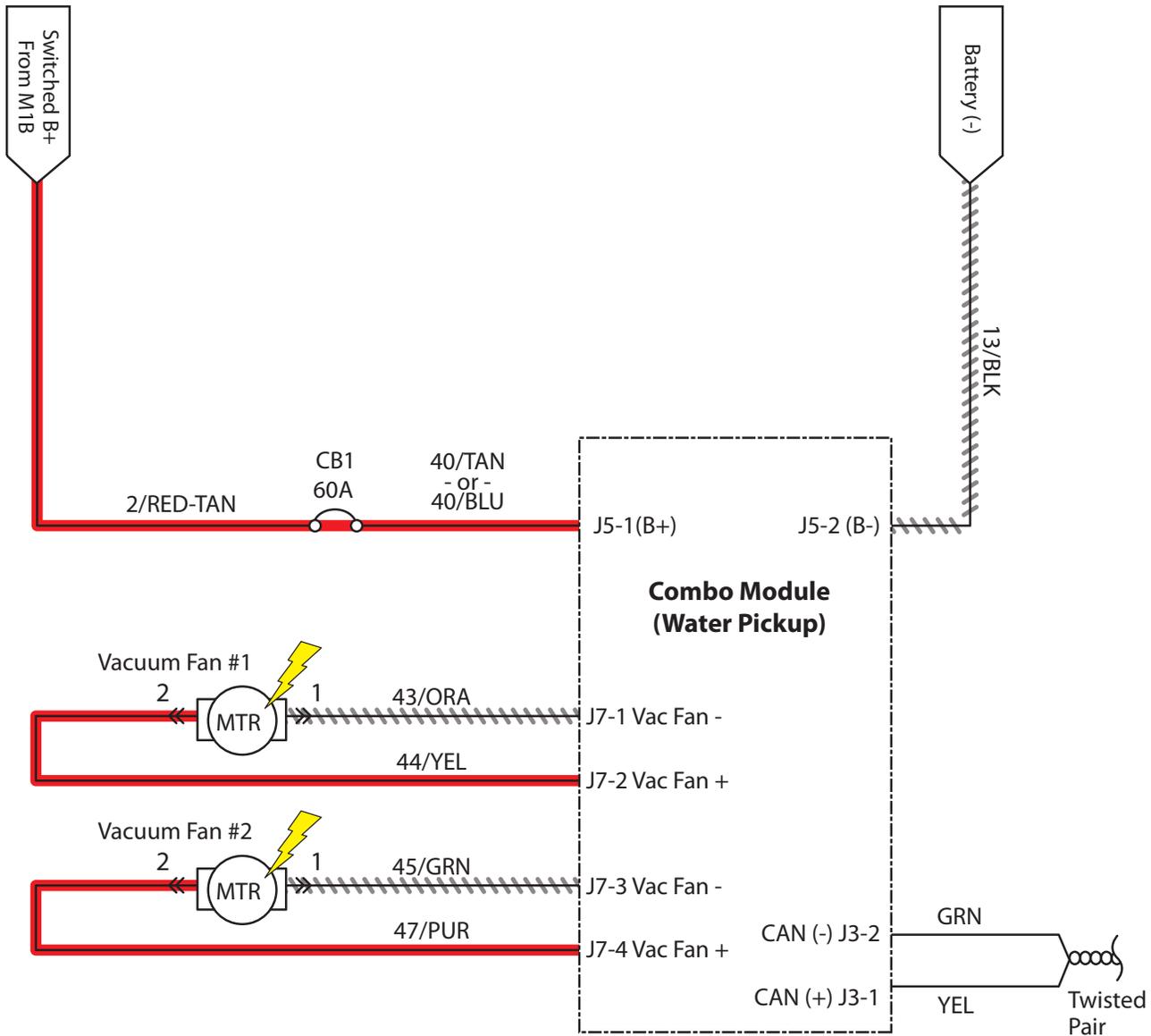
Note: Key Switch ON



SPRAY NOZZLE FAILS TO TURN ON (OPTION)

Step	Action	Value(s)	Yes	No
1	<ul style="list-style-type: none"> • Key ON • Enable spray nozzle subsystem • Is there a fault code/message displayed? 		See <i>FAULT CODES</i> section of this manual	Proceed to STEP 2
2	<ul style="list-style-type: none"> • Key OFF • Firmly press circuit breaker #10 to reset • Is circuit breaker #10 tripped? 		Reset and test spray nozzle operation	Proceed to STEP 3
3	<ul style="list-style-type: none"> • Key OFF • Disconnect spray nozzle water pump from wire harness • Apply battery voltage to spray nozzle water pump using fuse-protected jumper leads • Does spray nozzle water pump dispense water? 		Proceed to STEP 4	Repair or replace spray nozzle water pump
4	<ul style="list-style-type: none"> • Key OFF • Reconnect spray nozzle water pump to wire harness • Key ON • Turn spray nozzle switch ON • Test voltage applied to spray nozzle subsystem • Are electrical circuits operating? 		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

SCRUB VACUUM FANS ON



The Vacuum Fan Motors (M7)/(M8) are controlled by PWM (pulse width modulation control): The setting will reduce the duty cycle to conserve battery energy and reduce noise when the scrub system is activated.

Operational Matrix:

- Battery Positive +
- Battery Negative -

	Enabled	Disabled
Vacuum Fans	<ul style="list-style-type: none"> • 1-STEP Scrub ON • Squeegee/Vac ON 	<ul style="list-style-type: none"> • 1-STEP Scrub OFF • Squeegee/Vac OFF • Recovery Tank Full • Very Low Batt Voltage • Circuit Fault

SCRUB VACUUM FAN(S) FAIL(S) TO TURN ON

Step	Action	Value(s)	Yes	No
1	<ul style="list-style-type: none"> • Key ON • Enable scrubbing vacuum fans • Is there a fault code/message displayed? 		See <i>FAULT CODE</i> section of this manual	Proceed to STEP 2
2	<ul style="list-style-type: none"> • Key OFF • See <i>MANUAL MODE</i> section of this manual • Activate vacuum fans in Manual Mode • Do vacuum fans turn ON? 		Proceed to STEP 5	Proceed to STEP 3
3	<ul style="list-style-type: none"> • Key OFF • See <i>SELF-TEST MODE</i> section of this manual • Does Self-Test display output circuits J7-1,2 or J7-3,4 as open or shorted? 		Correct open or short circuit condition	Proceed to STEP 4
4	<ul style="list-style-type: none"> • Key OFF • See <i>TESTING VACUUM FAN (SCRUBBING)</i> section of this manual • Do vacuum fan motors pass testing? 	See <i>TESTING VACUUM FAN (SCRUBBING)</i> section of this manual	Proceed to STEP 5	Repair or replace vacuum fan motor
5	<ul style="list-style-type: none"> • Key OFF • Reconnect vacuum fan motor to main wire harness • Key ON • Enable scrubbing vacuum fan subsystem • Test voltage applied to scrubbing vacuum fan subsystem • Are electrical circuits operating? 		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:

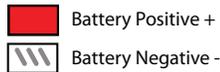
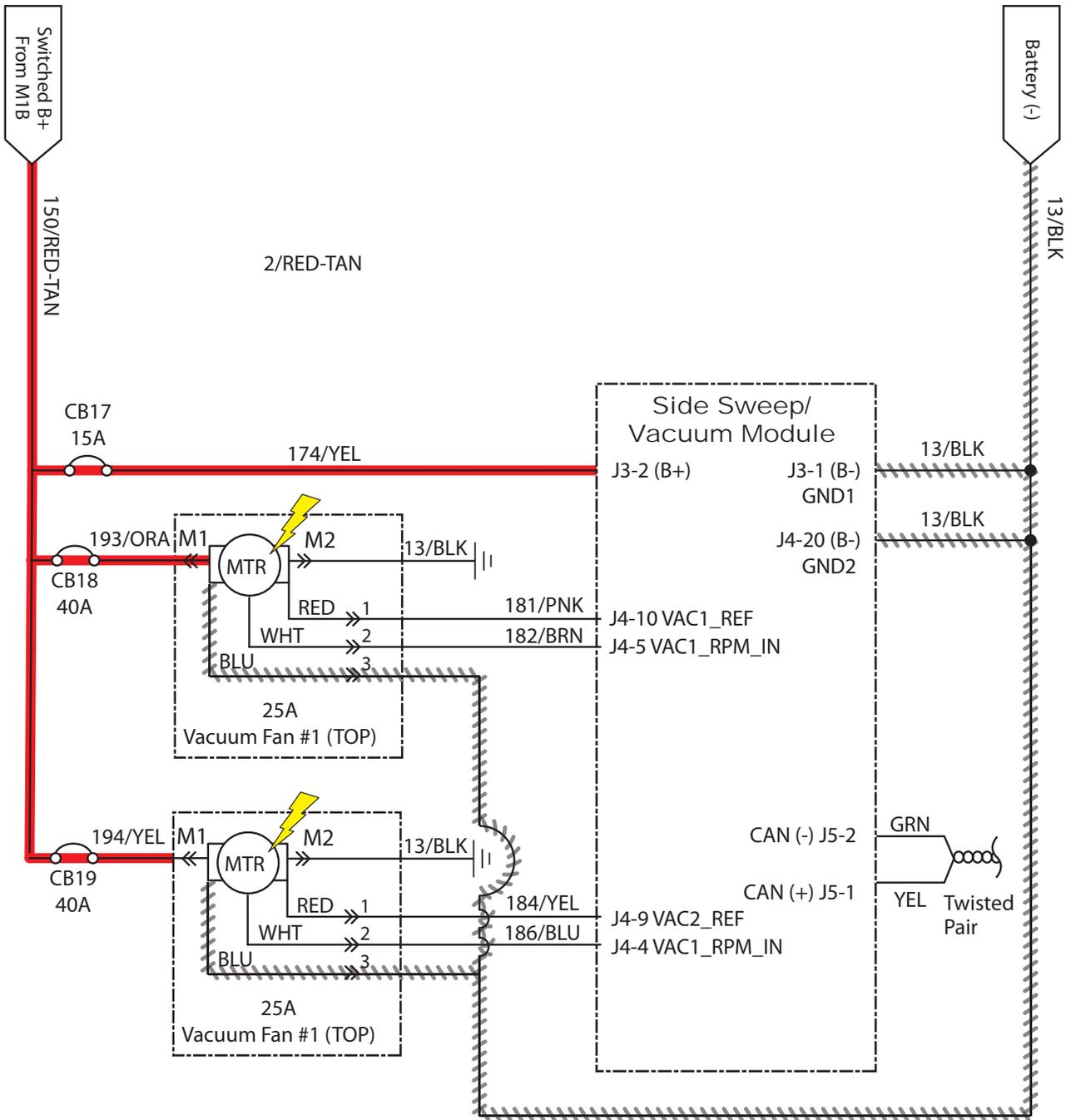
J7-1,2 = Combo Module (Water Pickup)

Connector #7, Pin #1 or 2

J7-3,4 = Combo Module (Water Pickup)

Connector #7, Pin #3 or 4

SWEEP VACUUM FANS ON



Operational Matrix:

	Enabled	Disabled
Vacuum Fans	<ul style="list-style-type: none"> • 1-STEP Scrub ON • Sweep Brush Switch ON • FWD/Rev Propel 	<ul style="list-style-type: none"> • 1-STEP Scrub OFF • Sweep Brush Switch OFF • Recovery Tank Full • Very Low Batt Voltage • Circuit Fault • Neutral (Ready State)

SWEEP VACUUM FAN(S) FAIL(S) TO TURN ON

Step	Action	Value(s)	Yes	No
1	<ul style="list-style-type: none"> Key ON Enable sweep vacuum fans Is there a fault code/message displayed? 		See <i>FAULT CODE</i> section of this manual	Proceed to STEP 2
2	<ul style="list-style-type: none"> Key OFF Firmly press circuit breaker #18 and/or #19 to reset Is circuit breaker #18 and/or #19 tripped? 		Reset and test vacuum fan(s) operation	Proceed to STEP 3
3	<ul style="list-style-type: none"> Key OFF See <i>MANUAL MODE</i> section of this manual Activate sweep vacuum fans in Manual Mode Do sweep vacuum fans turn ON? 		Proceed to STEP 6	Proceed to STEP 4
4	<ul style="list-style-type: none"> Key OFF See <i>SELF-TEST MODE</i> section of this manual Does Self-Test display output circuits J4-5,10 or J4-4,9 as open or shorted? 		Correct open or short circuit condition	Proceed to STEP 5
5	<ul style="list-style-type: none"> Key OFF See <i>TESTING VACUUM FAN (SCRUBBING)</i> section of this manual Do vacuum fan motors pass testing? 	See <i>TESTING VACUUM FAN (SCRUBBING)</i> section of this manual	Proceed to STEP 6	Repair or replace vacuum fan motor
6	<ul style="list-style-type: none"> Key OFF Reconnect sweep vacuum fan motor to main wire harness Key ON Enable sweep vacuum fan subsystem Test voltage applied to sweep vacuum fan subsystem Are electrical circuits operating? 		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:

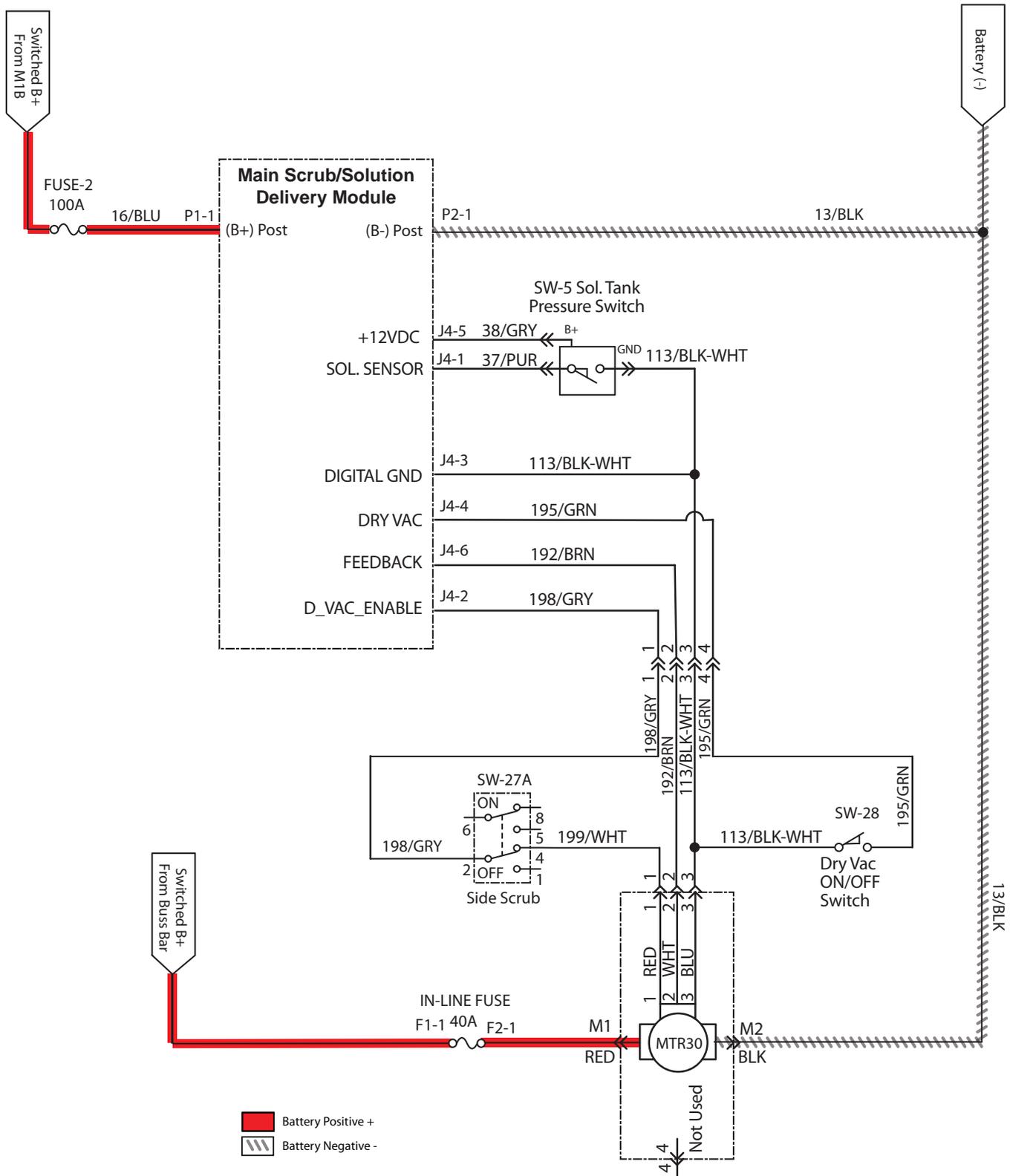
J4-5,10 = Side Sweep/Vacuum Module

Connector #4, Pin #5 or 10

J4-4,9 = Side Sweep/Vacuum Module

Connector #4, Pin #4 or 9

DRY VACUUM WAND (OPTION)



DRY VACUUM WAND FAILS TO TURN ON

Step	Action	Value(s)	Yes	No
1	<ul style="list-style-type: none"> • Key ON • Enable dry vacuum wand switch • Is there a fault code/message displayed? 		See <i>FAULT CODE</i> section of this manual	Proceed to STEP 2
2	<ul style="list-style-type: none"> • Key OFF • See <i>MANUAL MODE</i> section of this manual • Activate dry vacuum wand in Manual Mode • Does dry vacuum wand fan turn ON? 		Proceed to STEP 5	Proceed to STEP 3
3	<ul style="list-style-type: none"> • Key OFF • See <i>SELF-TEST MODE</i> section of this manual • Does Self-Test display output circuits J4-1,2,3,4,5,6 as open or shorted? 		Correct open or short circuit condition	Proceed to STEP 4
4	<ul style="list-style-type: none"> • Key OFF • See <i>TESTING THE DRY VACUUM WAND FAN</i> section of this manual • Do dry vacuum wand fan motor pass testing? 	See <i>TESTING THE DRY VACUUM FAN</i> section of this manual	Proceed to STEP 5	Repair or replace dry vacuum wand fan motor
5	<ul style="list-style-type: none"> • Key OFF • Reconnect dry vacuum wand fan motor to main wire harness • Key ON • Enable dry vacuum wand subsystem • Test voltage applied to dry vacuum wand fan subsystem • Are electrical circuits operating? 		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

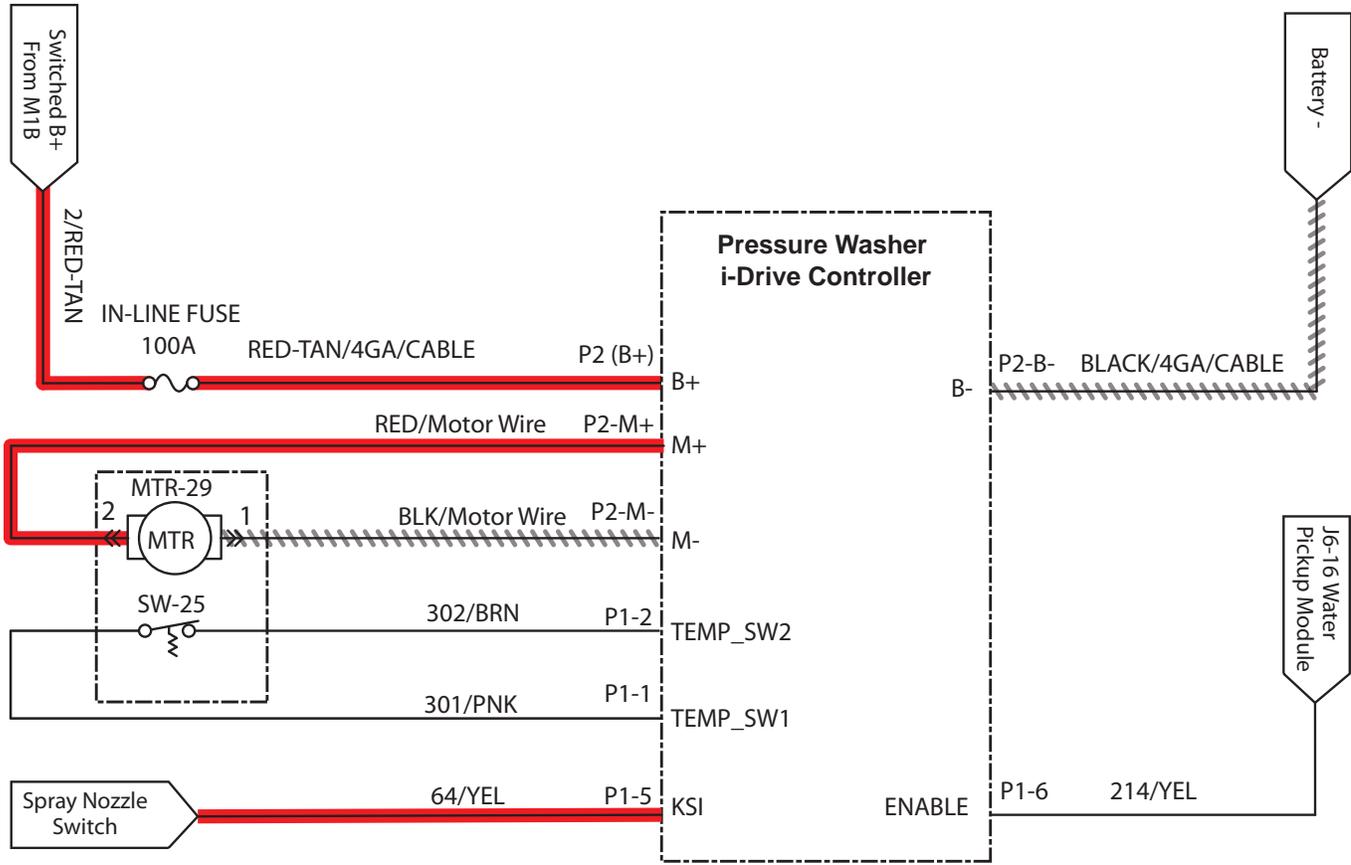
Terms:

J4-1,2,3,4,5,6 = Main Scrub/Solution Delivery Module

Connector #4, Pin #1, #2, #3, #4, #5, #6

TROUBLESHOOTING

HIGH PRESSURE WASHER ON (OPTION)



- Battery Positive +
- Battery Negative -

HIGH PRESSURE WASHER FAILS TO TURN ON (OPTION)

Step	Action	Value(s)	Yes	No
1	<ul style="list-style-type: none"> • Key ON • Enable pressure washer switch • Is there a fault code/message displayed? 		See <i>FAULT CODE</i> section of this manual	Proceed to STEP 2
2	<ul style="list-style-type: none"> • Key OFF • Firmly press circuit breaker #10 to reset • Is circuit breaker #10 tripped? 		Reset and test filter shaker operation	Proceed to STEP 3
3	<ul style="list-style-type: none"> • Key OFF • Disconnect high pressure sprayer water pump from wire harness • Apply battery voltage to high pressure sprayer water pump using fuse-protected jumper leads • Does high pressure sprayer water pump dispense water? 		Proceed to STEP 4	Repair or replace high pressure sprayer water pump
4	<ul style="list-style-type: none"> • Key OFF • Reconnect high pressure sprayer water pump to wire harness • Key ON • Turn high pressure sprayer switch ON • Test voltage applied to high pressure sprayer 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:

TROUBLESHOOTING CAN (CONTROLLER AREA NETWORK) ISSUES

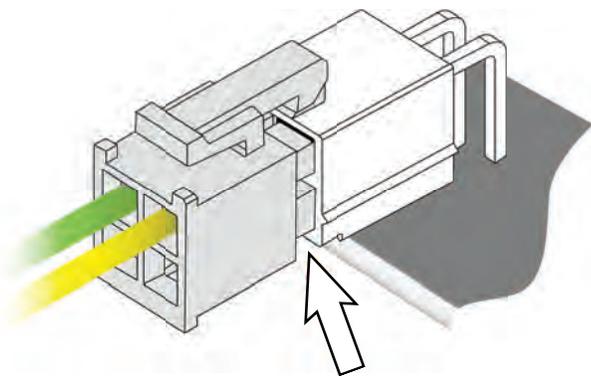
Procedures to investigate a fault related to a CAN open network.

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

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

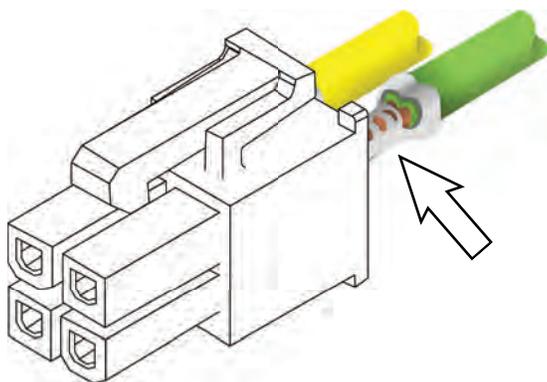
CONNECTOR FULLY SEATED

Each node on the network has a connector for the CAN communication wires. A loose connection could cause a fault. Check each board to ensure all 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

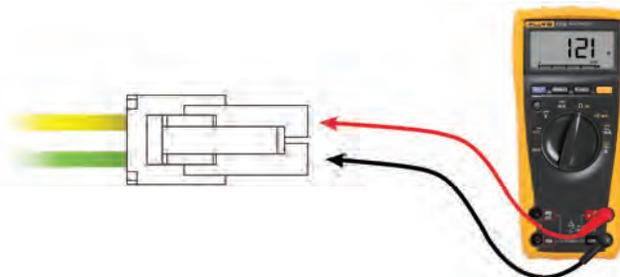
A pin within the harness side of the connector may not be fully seated or may come loose over time causing a fault. If the pin is not fully seated, push it back in and power cycle the machine to see if the fault clears.



NETWORK RESISTANCE

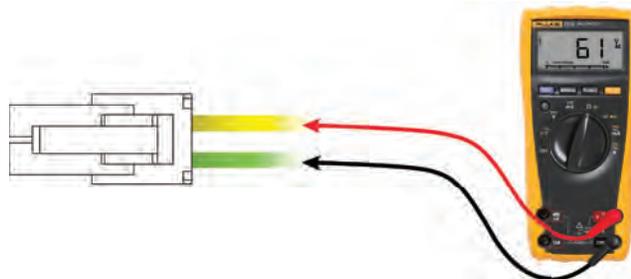
The network resistance must be correct for the network to operate correctly. Depending on which node the measurement is taken at and the method of measurement, the resistance may be one of two approximate values: 121Ω or 61Ω. Any value other than 121Ω or 61Ω means there is a network issue.

Method 1



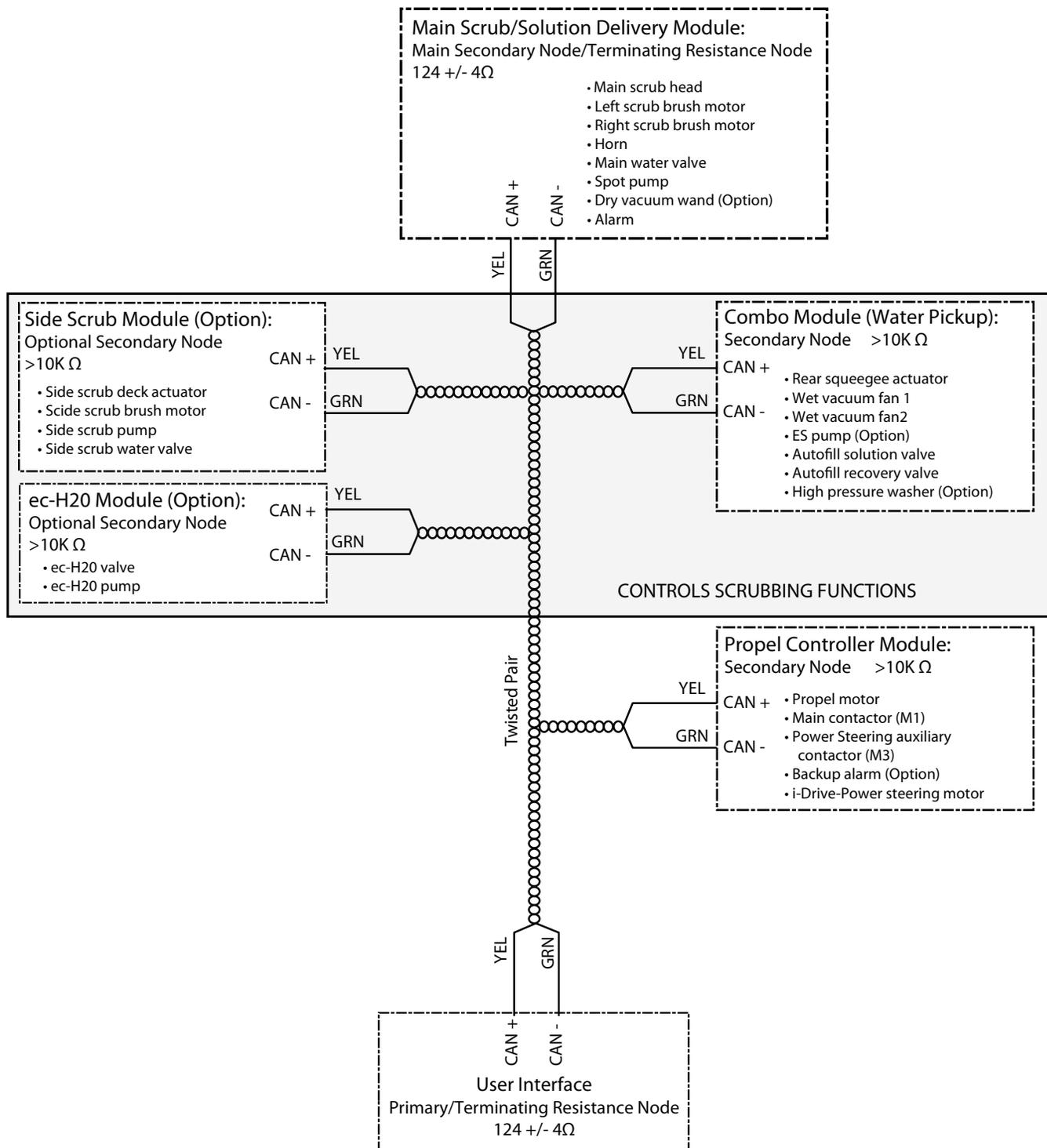
1. Turn key switch OFF.
2. Locate a CAN node location on the machine.
3. Disconnect the connector containing the CAN wires.
4. Measure the resistance between the green and yellow wires. Depending which nodes are still connected, resistance should be either 61Ω or 121Ω.

Method 2



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

CAN SYSTEM OVERVIEW



INITIAL CAN TROUBLESHOOTING

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

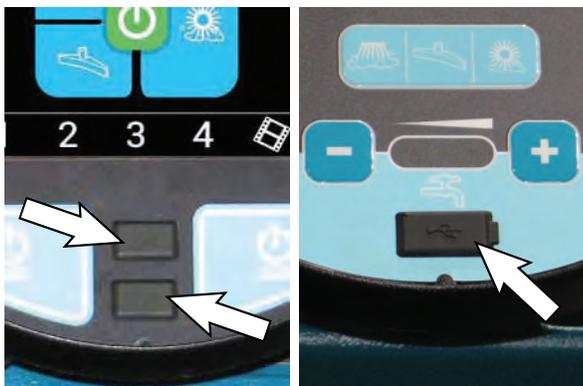
1. Turn key switch ON. Wait for machine to completely power up.

NOTE: When turning on the machine while troubleshooting, always wait for the machine to completely power up before continuing troubleshooting.

2. Check battery voltage. The machine must have adequate power from the battery in order to continue troubleshooting procedures.
3. Ensure the emergency shut-off button is not engaged. Release the emergency shut-off button if it is engaged.
4. If pod is operable, observe the pod for fault codes. See **FAULT CODES** in the **FAULTS AND WARNINGS** sections for fault codes/causes of the fault codes.

If pod is inoperable, proceed to **TROUBLESHOOTING THE STANDARD POD** to troubleshoot machines equipped with the standard pod or **TROUBLESHOOTING THE PRO-PANEL POD** to troubleshoot machines equipped with the Pro-Panel pod.

5. Turn key switch OFF.
6. Connect the service device to the machine.



7. Turn key switch ON.
8. Observe the service device for fault codes and ensure the machine has the latest firmware installed. If necessary, update the machine to the latest firmware revision.
9. If firmware was updated, turn key switch OFF.
10. Wait at least eight seconds for the pre-charge (capacitors) to discharge.

11. After the eight-second wait, turn key switch ON.
12. Observe service device and pod for fault codes. Proceed to the following step to continue troubleshooting procedure if problem persists.
13. Turn key switch OFF.
14. Ensure the circuit breaker(s) to the system(s) in question are not tripped. Reset tripped circuit breaker(s).

Open the right side access door to access scrub system and ec-H₂O system circuit breakers.

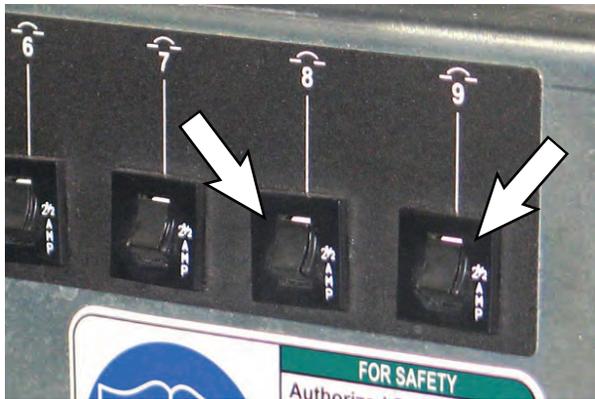


Main Scrub/Solution Delivery Module, Combo Module (Water Pickup), and/or Side Scrub Module (Option) circuit breakers:



Circuit Breaker	Rating	Circuit Protected
CB1	60A	Water pickup module
CB2	-	Not used
CB3	35A	Side scrub brush module (Option)
CB4	2.5A	Key switch
CB5	2.5A	Water pick up module
CB6	2.5A	Scrub module
CB7	2.5A	Side brush scrub module (Option)

ec-H2O Module circuit breakers:



Circuit Breaker	Rating	Circuit Protected
CB8	2.5A	<i>ec-H2O</i> power module (Option)
CB9	2.5A	<i>ec-H2O</i> pump module (Option)

15. Turn key switch ON.
16. Observe service device and pod for fault codes.
Proceed to the following step to continue troubleshooting procedure if problem persists.

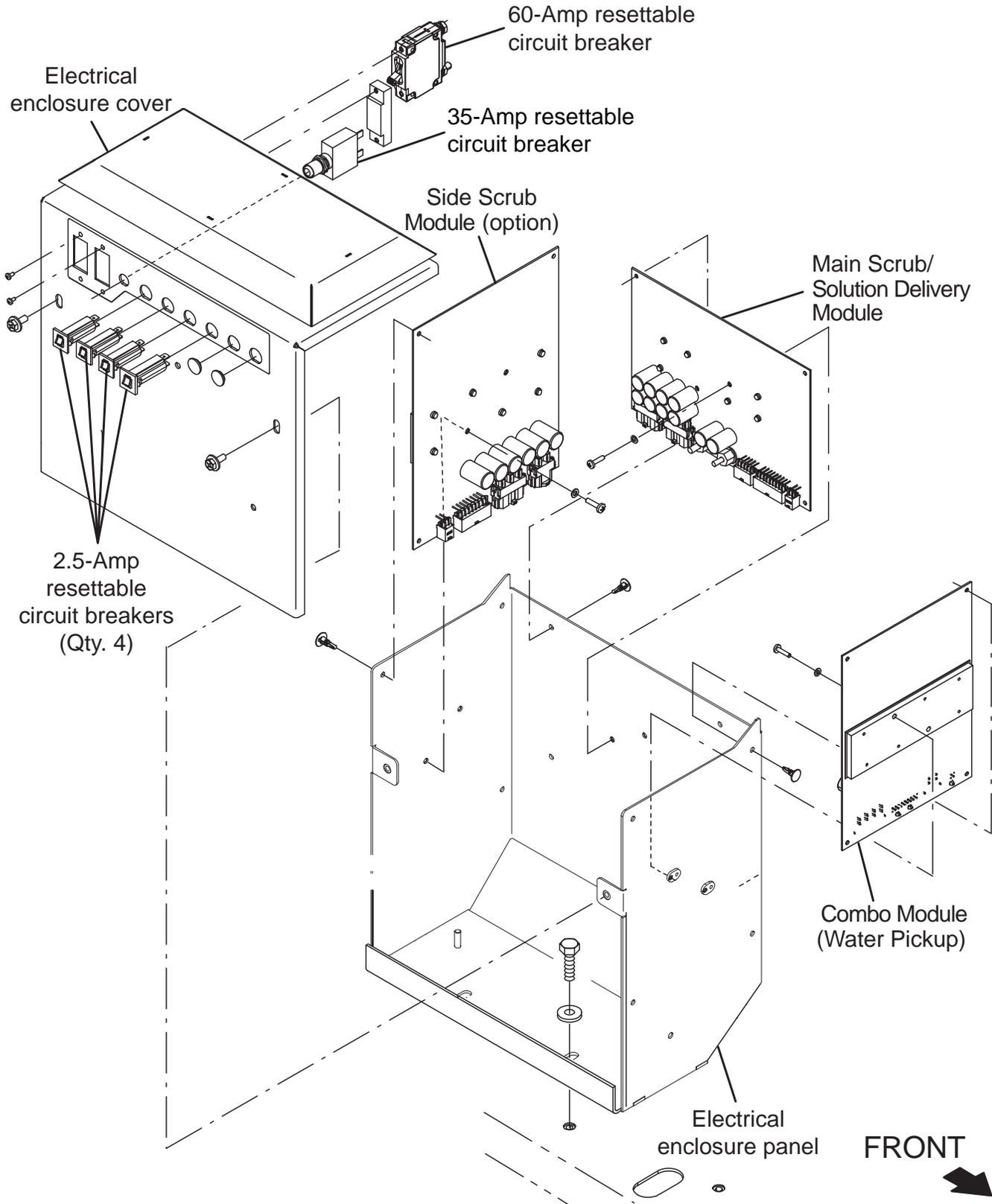
If no fault codes appear, reinstall items removed to access circuit breakers and prepare machine to be put back into service.
17. If fault code(s) still persist, open the area of the machine where the module in question is located to access the module and begin CAN troubleshooting procedures.

To troubleshoot the scrub modules see *TROUBLESHOOTING THE MAIN SCRUB/ SOLUTION DELIVERY MODULE, COMBO MODULE (WATER PICK UP)*, and/or *SIDE SCRUB MODULE (OPTION)*.

To troubleshoot the *ec-H2O* Module, see *TROUBLESHOOTING THE ec-H2O MODULE*.

To troubleshoot the Propel Controller, see *TROUBLESHOOTING THE PROPEL CONTROLLER*.

**TROUBLESHOOTING THE MAIN SCRUB/
SOLUTION DELIVERY MODULE**

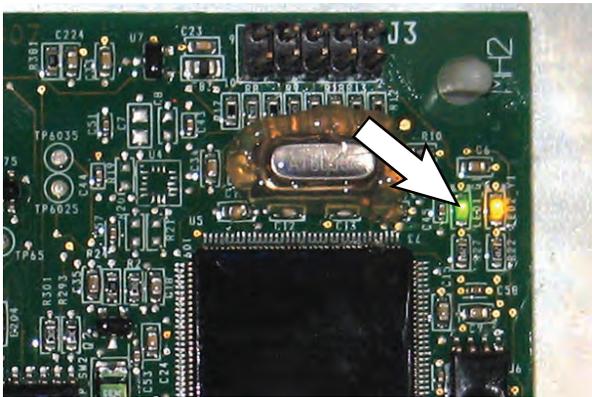


FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and set parking brake.

1. Turn key switch OFF.
2. Remove the hardware securing the electrical enclosure cover to the electrical enclosure panel and carefully lower the electrical enclosure cover. **Do Not** break any cable/wire connections.



3. Turn key switch ON.
4. Confirm there is power to the Main Scrub/Solution Delivery Module (Green LED (LED1_G1) illuminates and pod is powered ON).



If the green LED (LED1_G1) is not illuminated there is no power to the module. Proceed to Step 6.

5. Confirm there is CAN communication to the Main Scrub/Solution Delivery Module (Yellow LED (LED2_Y1) on module illuminates/pod responds).



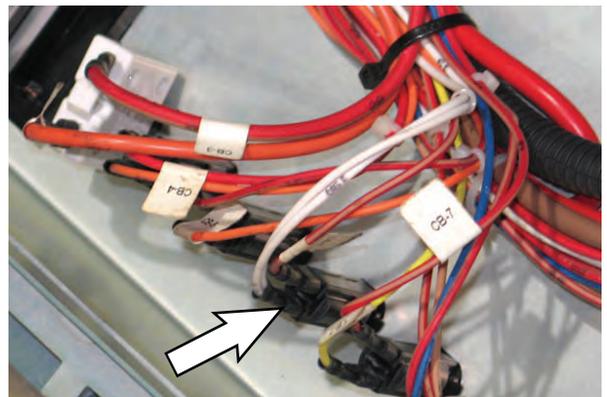
If the yellow LED (LED2_Y1) is not illuminated there is no CAN communication to the module. Proceed to Step 10.

6. Turn key switch OFF.
7. Disconnect the battery cable from the machine.

NOTE: Always disconnect the battery cable from the machine before disconnecting/repairing electrical connections.

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

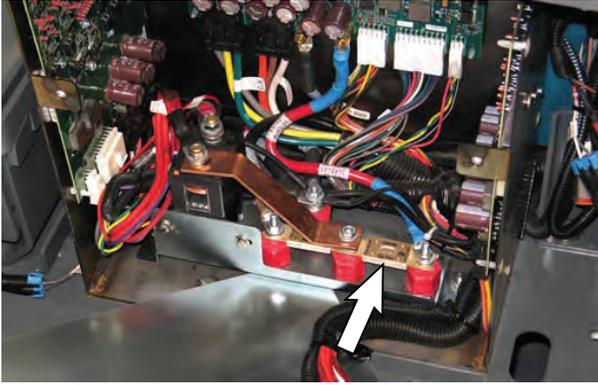
8. Ensure wire connections at the 2.5-Amp circuit breaker (CB6) are secure and undamaged. Secure/repair connections as necessary. Continue testing/troubleshooting procedure if problem persists.



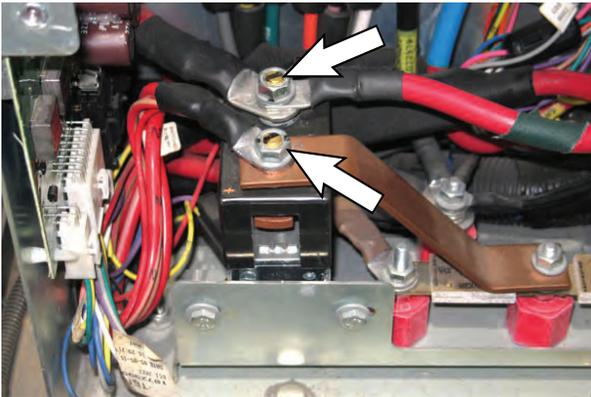
9. Reconnect the battery cable to the machine.

TROUBLESHOOTING

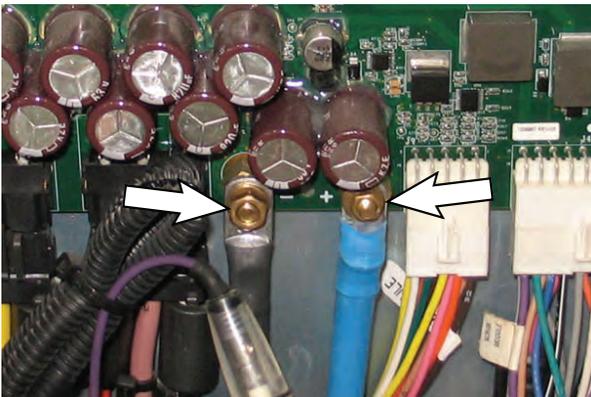
10. Check in-line 100-Amp fuse (Fuse-2/main electrical enclosure). Secure/repair connections. Continue testing/troubleshooting if still no power at the module.



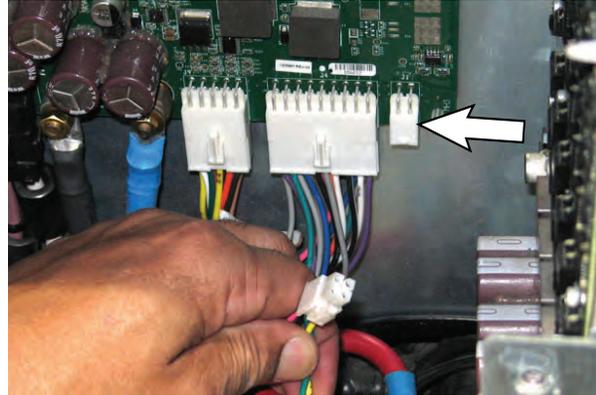
11. Inspect connections at Main Contactor (M1). Secure/repair connections. Continue testing/troubleshooting if still no power at the module.



12. Confirm connections at Main Scrub/Solution Delivery Module. Secure/repair connections. Call T.A.C. for further assistance if there is still no power at the module.

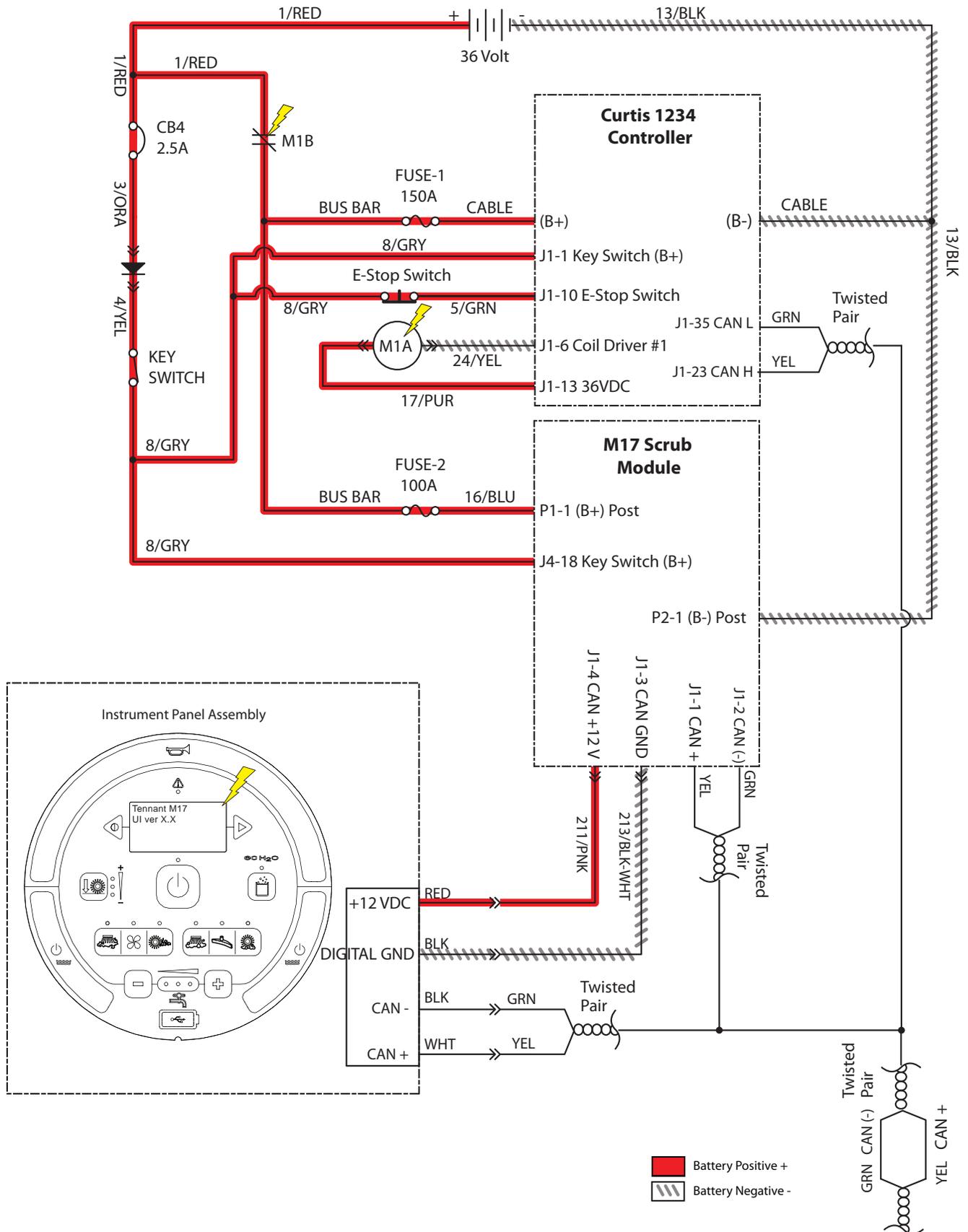


13. Disconnect the main wire harness CAN connector from J1 on the Main Scrub/Solution Delivery Module and verify connectors and connector pins are fully seated and connector pins are not damaged.

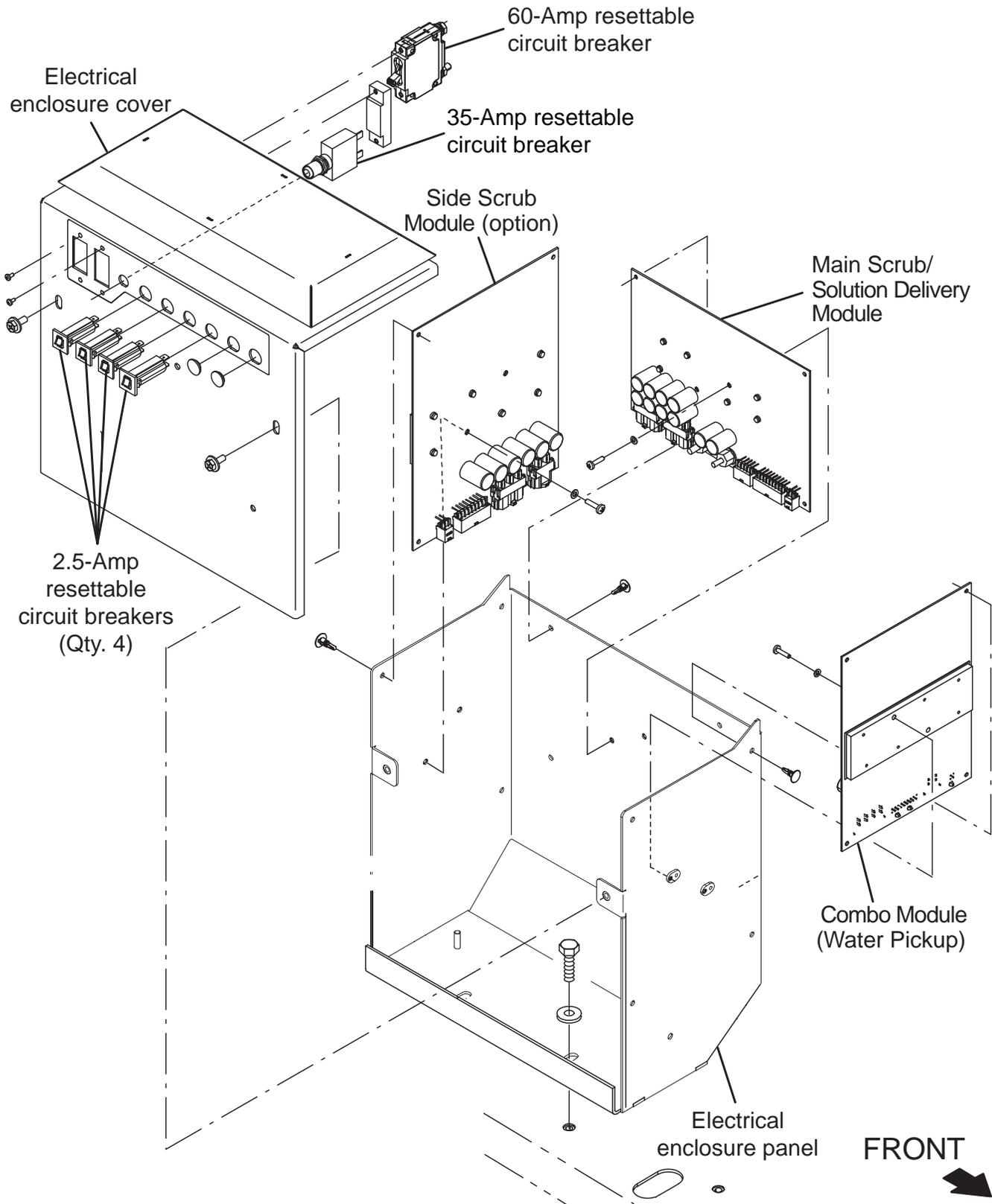


14. Reconnect the main wire harness CAN connector to J1 on the Main Scrub/Solution Delivery Module. Call T.A.C. for further assistance if there is still no CAN communication to the module.

CAN POWER CONTROLLER / USER INTERFACE / MAIN SCRUB (S/N 000000-010999)



**TROUBLESHOOTING THE COMBO MODULE
(WATER PICKUP)**

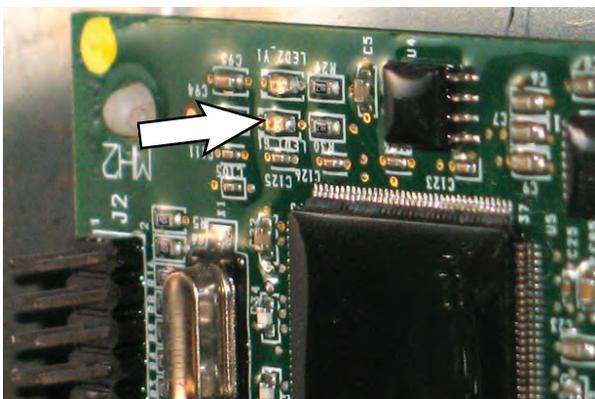


FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and set parking brake.

1. Turn key switch OFF.
2. Remove the hardware securing the electrical enclosure cover to the electrical enclosure panel and carefully lower the electrical enclosure cover. **Do Not** break any cable/wire connections.

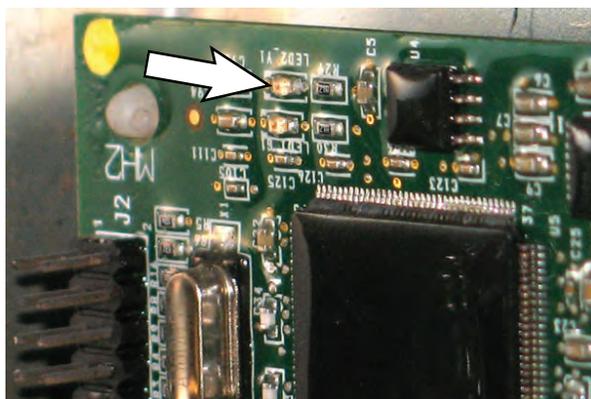


3. Turn key switch ON.
4. Confirm there is power to the Combo Module (Water Pickup) (Green LED (LED1_G1) illuminates and pod is powered ON).



If the green LED (LED1_G1) is not illuminated there is no power to the module. Proceed to Step 6.

5. Confirm there is CAN communication to the Combo Module (Water Pickup) (Yellow LED (LED2_Y1) on module illuminates/pod responds).



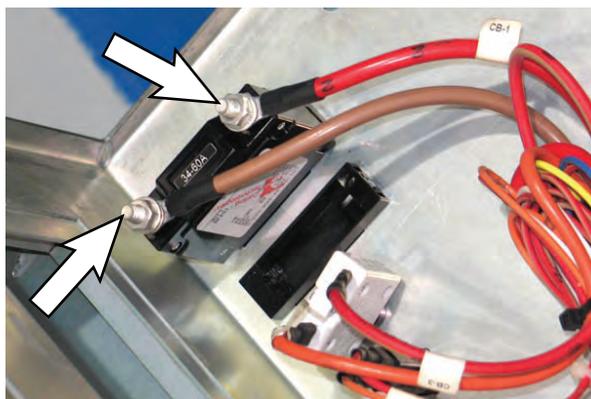
If the yellow LED (LED2_Y1) is not illuminated there is no CAN communication to the module. Proceed to Step 13.

6. Turn key switch OFF.
7. Disconnect the battery cable from the machine.

NOTE: Always disconnect the battery cable from the machine before disconnecting/repairing electrical connections.

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

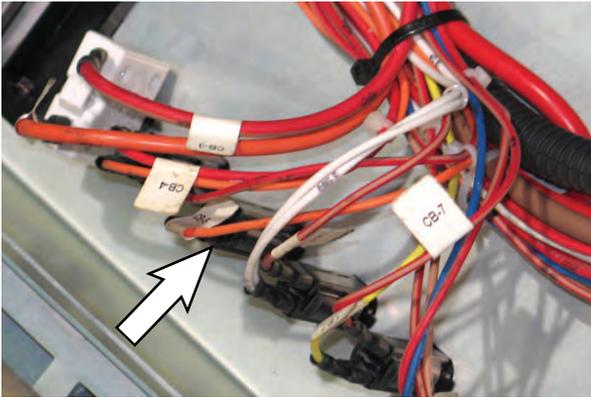
8. Ensure wire connections at the 60-Amp circuit breaker circuit breaker (CB1) are secure and undamaged. Secure/repair connections. Continue testing/troubleshooting if problem persists.



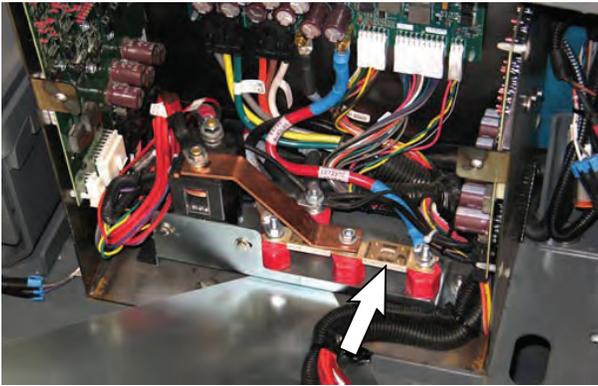
9. Reconnect the battery cable to the machine.

TROUBLESHOOTING

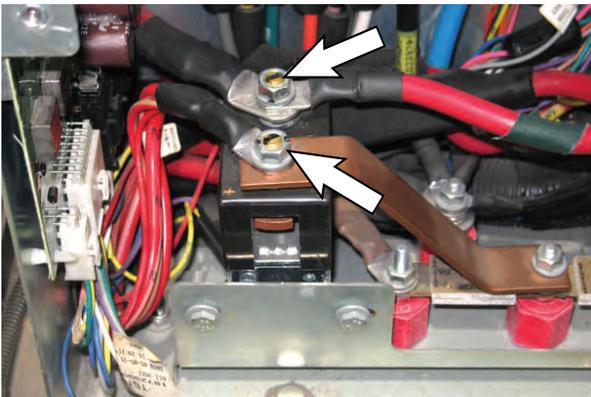
10. Ensure wire connections at the 2.5-Amp circuit breaker (CB5) are secure and undamaged. Secure/repair connections as necessary. Continue testing/troubleshooting procedure if problem persists.



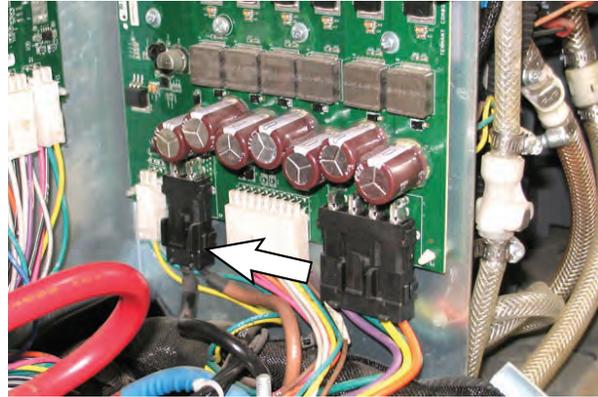
11. Check in-line 100-Amp fuse (Fuse-2/main electrical enclosure). Secure/repair connections. Continue testing/troubleshooting if still no power at the module.



12. Confirm connections at Main Contactor (M1). Secure/repair connections. Continue testing/troubleshooting if still no power at the module.



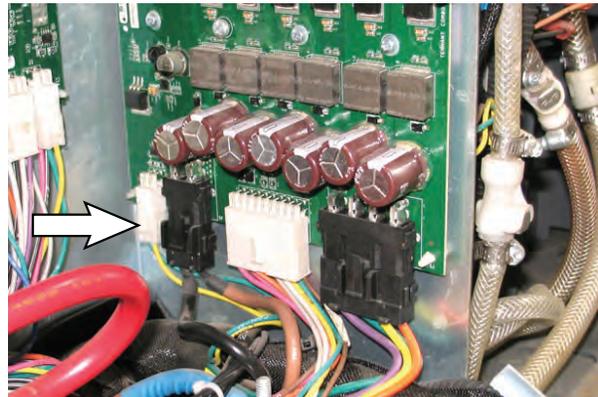
13. Disconnect the main wire harness connector from J5 on the Combo Module (Water Pickup).



14. Verify connectors and connector pins are fully seated and connector pins are not damaged and back probe the connector at J5-1 and J5-2 to verify power to the Combo Module (Water Pickup).

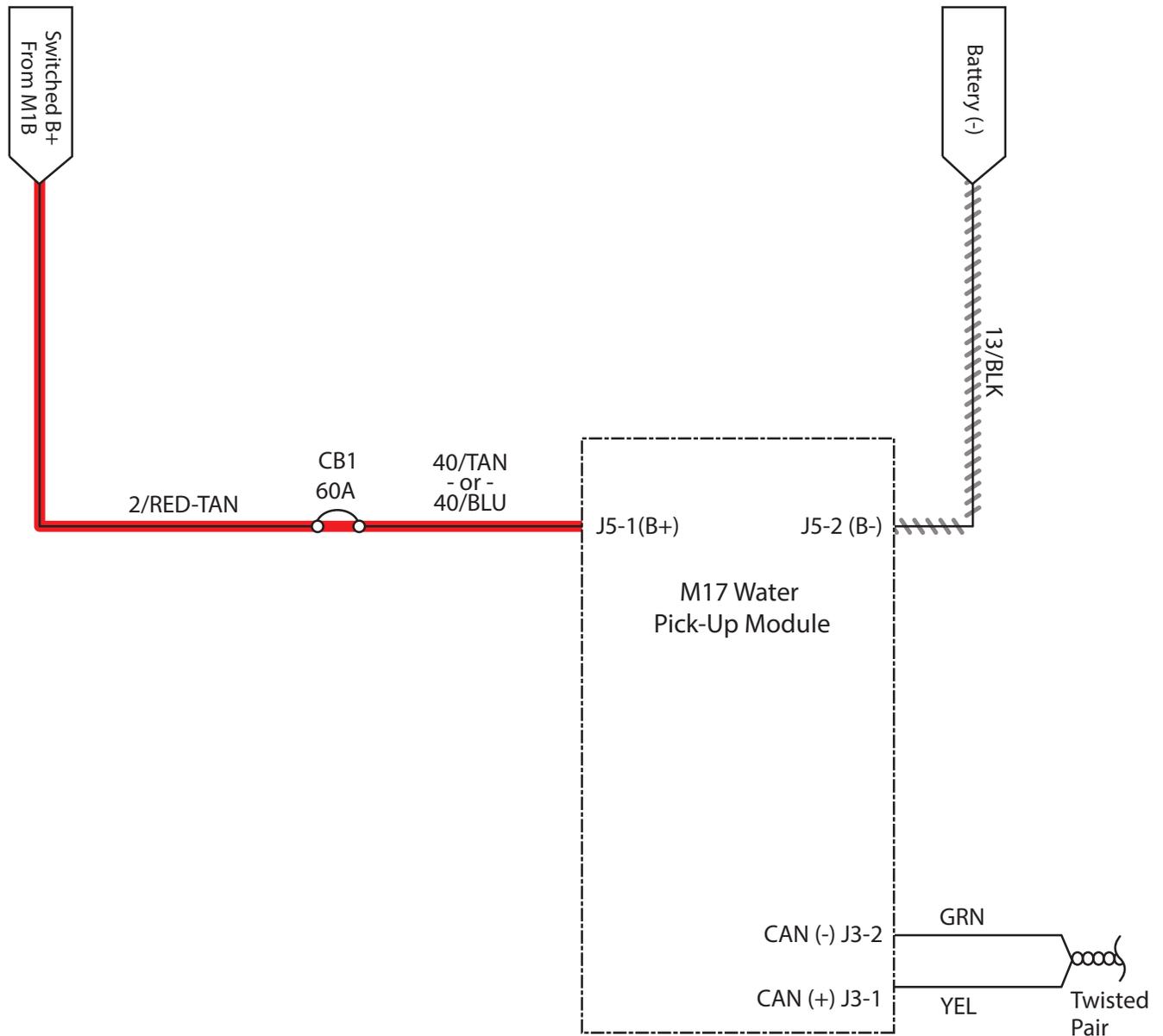
15. Reconnect the main wire harness connector to J5 on the Combo Module (Water Pickup). Call T.A.C. for further assistance if there is still no power at the module.

16. Disconnect the main wire harness CAN connector from Combo Module (Water Pickup) J1.



17. Verify connectors and connector pins are fully seated and connector pins are not damaged.

18. Reconnect the main wire harness CAN connector to J1 on the Combo Module (Water Pickup). Call T.A.C. for further assistance if there is still no CAN communication to the module.

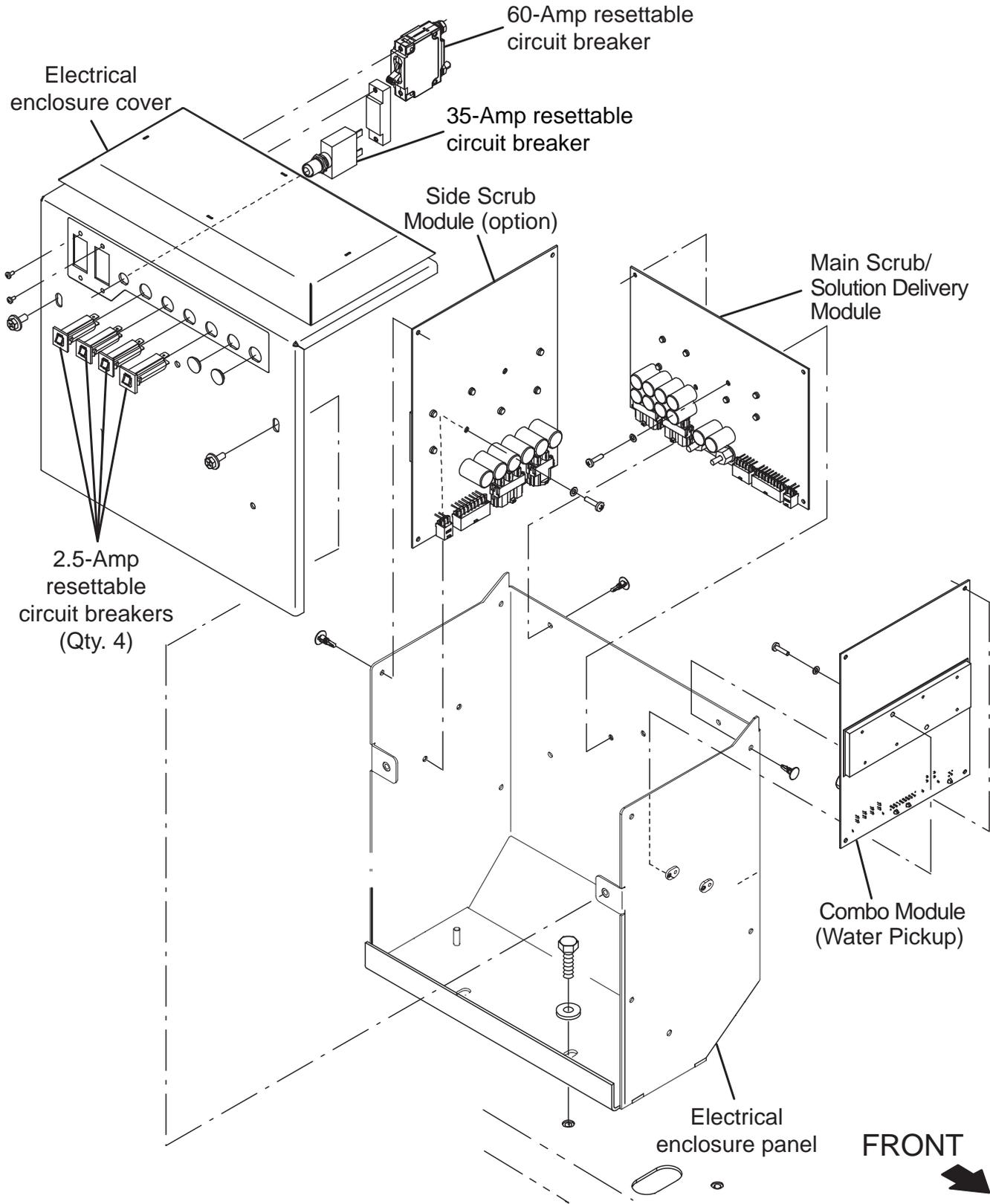


Operational Matrix:

 Battery Positive +
 Battery Negative -

	Enabled	Disabled
Vacuum Fans	<ul style="list-style-type: none"> • 1-STEP Scrub ON • Squeegee/Vac ON 	<ul style="list-style-type: none"> • 1-STEP Scrub OFF • Squeegee/Vac OFF • Recovery Tank Full • Very Low Batt Voltage • Circuit Fault

**TROUBLESHOOTING THE SIDE SCRUB MODULE
(OPTION)**

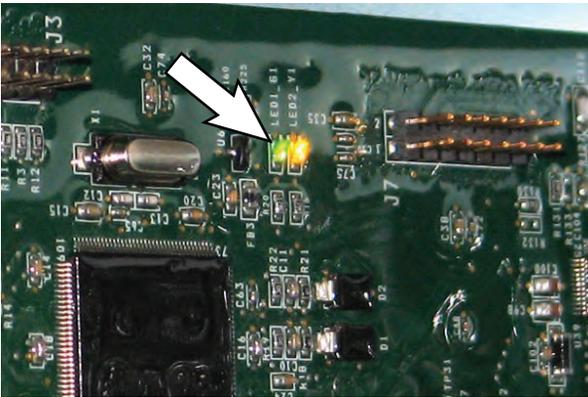


FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and set parking brake.

1. Turn key switch OFF.
2. Remove the hardware securing the electrical enclosure cover to the electrical enclosure panel and carefully lower the electrical enclosure cover. **Do Not** break any cable/wire connections.

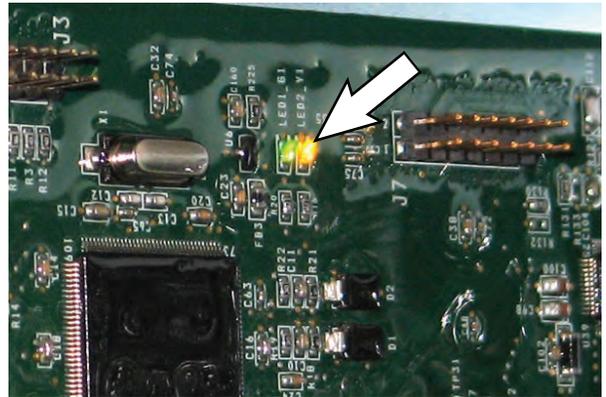


3. Turn key switch ON.
4. Confirm there is power to the Side Scrub Module (Option) (Green LED (LED1_G1) illuminates and pod is powered ON).



If the green LED (LED1_G1) is not illuminated there is no power to the module. Proceed to Step 6.

5. Confirm there is CAN communication to the Side Scrub Module (Option) (Yellow LED (LED2_Y1) on module illuminates/pod responds).



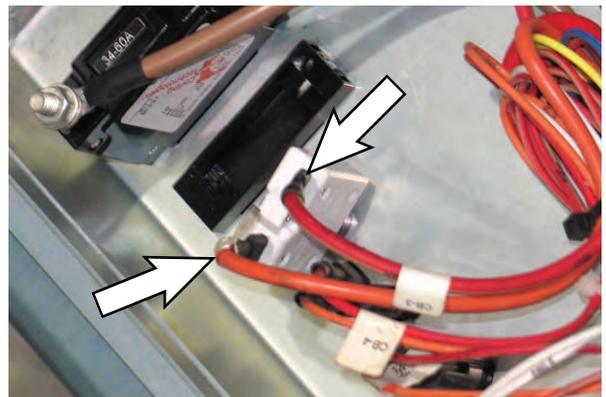
If the yellow LED (LED2_Y1) is not illuminated there is no CAN communication to the module. Proceed to Step 13.

6. Turn key switch OFF.
7. Disconnect the battery cable from the machine.

NOTE: Always disconnect the battery cable from the machine before disconnecting/repairing electrical connections.

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

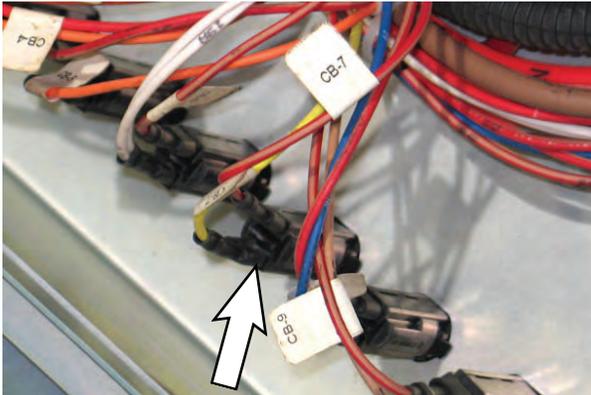
8. Ensure wire connections at the 35-Amp circuit breaker (CB3) are secure and undamaged. Secure/repair connections as necessary. Continue testing/troubleshooting procedure if problem persists.



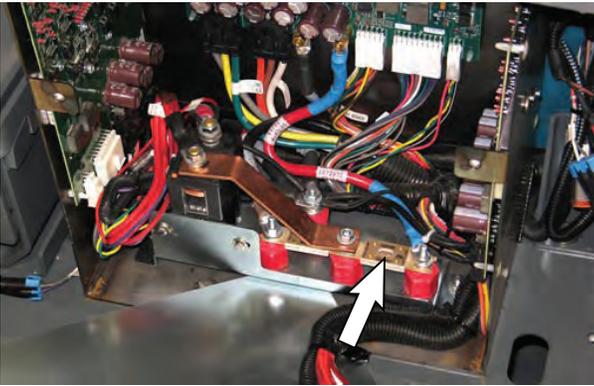
9. Reconnect the battery cable to the machine.

TROUBLESHOOTING

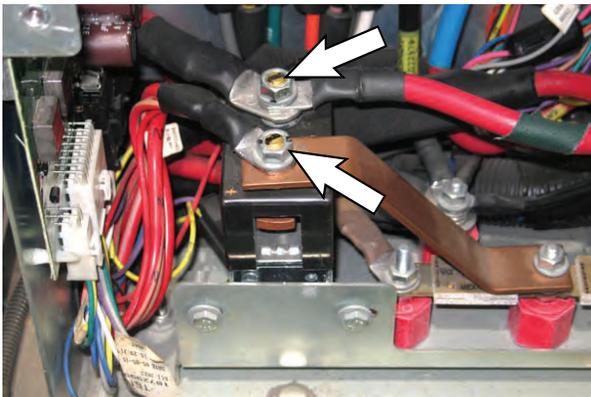
10. Ensure wire connections at the 2.5-Amp circuit breaker (CB7) are secure and undamaged. Secure/repair connections as necessary. Continue testing/troubleshooting procedure if problem persists.



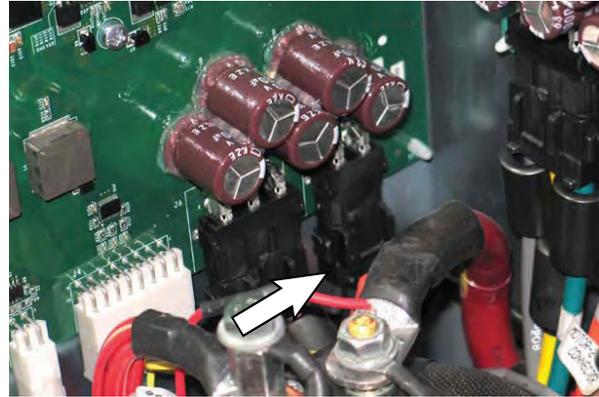
11. Check in-line 100-Amp fuse (Fuse-2/main electrical enclosure). Secure/repair connections. Continue testing/troubleshooting if still no power at the module.



12. Confirm connections at Main Contactor (M1). Secure/repair connections. Continue testing/troubleshooting if still no power at the module.



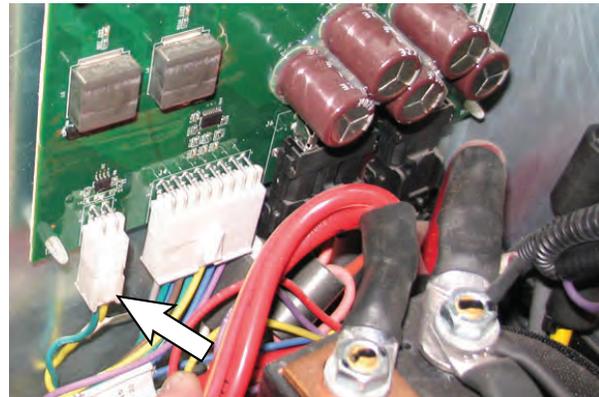
13. Disconnect the main wire harness connector from J5 on the Side Scrub Module (Option).



14. Verify connectors and connector pins are fully seated and connector pins are not damaged and back probe the connector at J5-1 and J5-2 to verify power to the Side Scrub Module (Option).

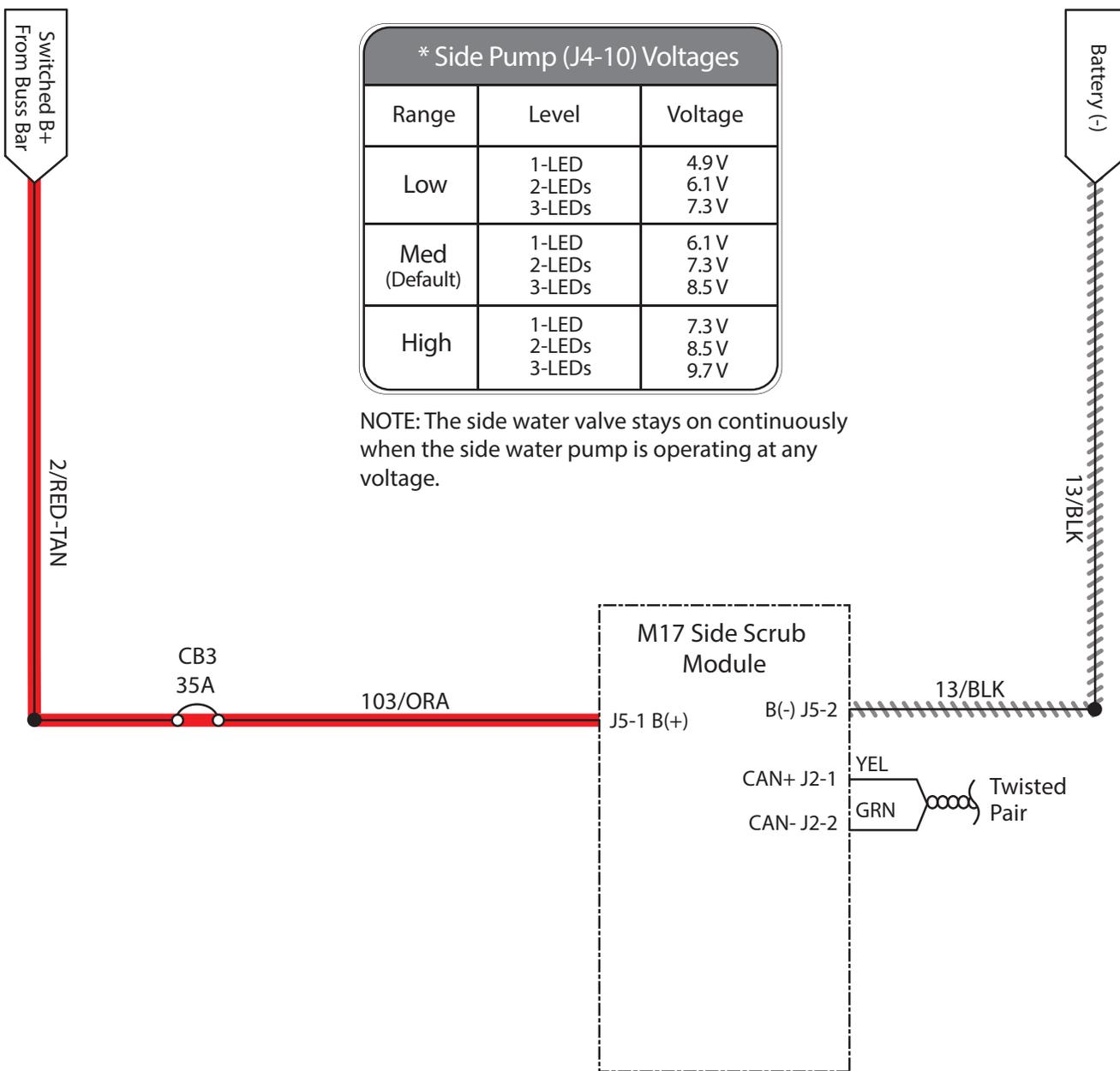
15. Reconnect the main wire harness connector to J5 on the Side Scrub Module (Option). Call T.A.C. for further assistance if there is still no power at the module.

16. Disconnect the main wire harness CAN connector from J1 on the Side Scrub Module (Option).



17. Verify connectors and connector pins are fully seated and connector pins are not damaged.

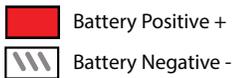
18. Reconnect the main wire harness connector to J1 on the Side Scrub Module (Option). Call T.A.C. for further assistance if there is still no CAN communication to the module.



*** Side Pump (J4-10) Voltages**

Range	Level	Voltage
Low	1-LED	4.9V
	2-LEDs	6.1V
	3-LEDs	7.3V
Med (Default)	1-LED	6.1V
	2-LEDs	7.3V
	3-LEDs	8.5V
High	1-LED	7.3V
	2-LEDs	8.5V
	3-LEDs	9.7V

NOTE: The side water valve stays on continuously when the side water pump is operating at any voltage.



Operational Matrix:

	Enabled	Disabled
Solution Control-Side (Conventional)	<ul style="list-style-type: none"> • 1-STEP Scrub ON • Side Brush Switch ON • Fwd/Rev Propel 	<ul style="list-style-type: none"> • 1-STEP Scrub OFF • Side Brush Switch OFF • Recovery Tank Full • Solution Tank Empty • Very Low Batt Voltage • Circuit Fault • Neutral (Ready State)

TROUBLESHOOTING THE *ec-H2O* MODULE

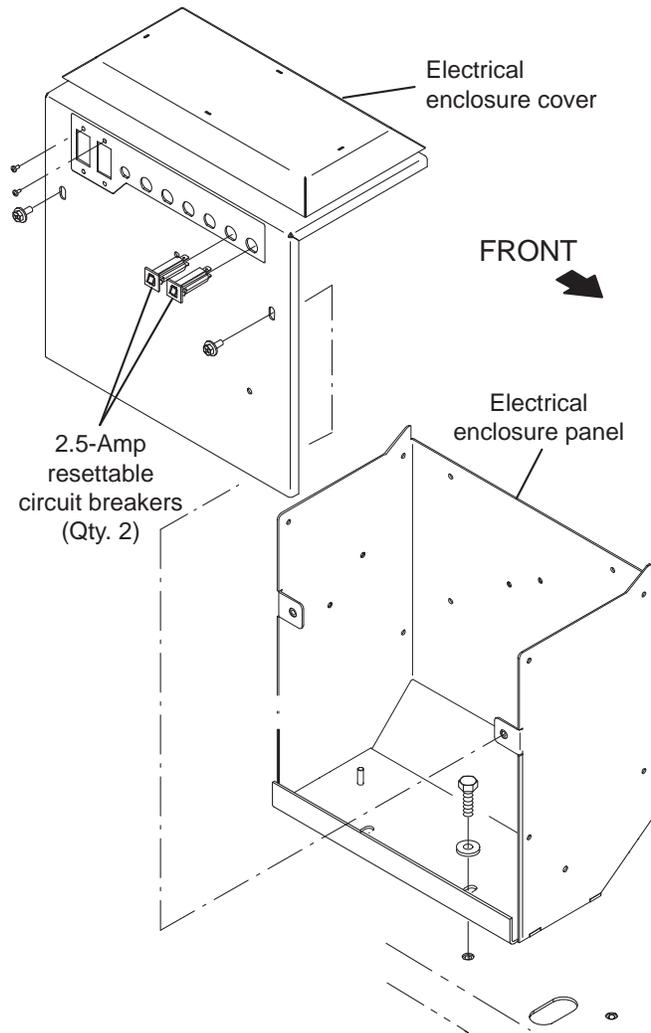
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, remove key, and set parking brake.

1. Turn key switch OFF.
2. Disconnect the battery cable from the machine.
3. Open the right side access door.



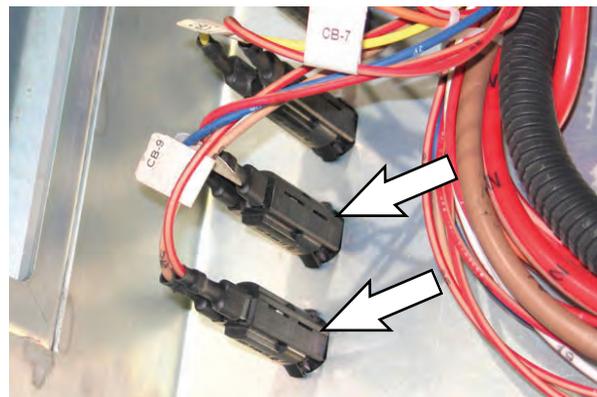
NOTE: Always disconnect the battery cable from the machine before disconnecting/testing/repairing electrical connections.

4. Remove the hardware securing the electrical enclosure cover to the electrical enclosure panel and carefully lower the electrical enclosure cover. **Do Not** break any cable/wire connections.

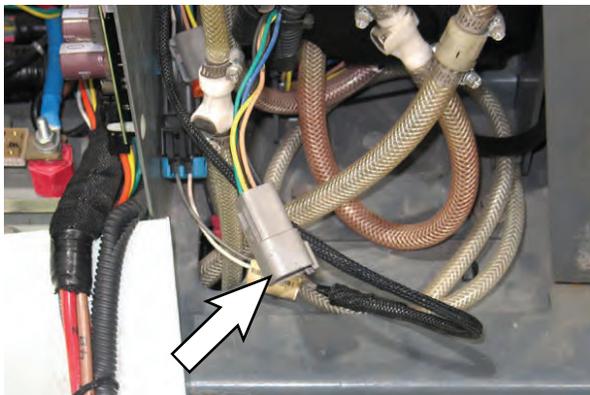


NOTE: To avoid damaging electronic components, a static ground strap must be worn at all times while handling/testing electrical components. Attach the other end of the static ground strap to the machine chassis.

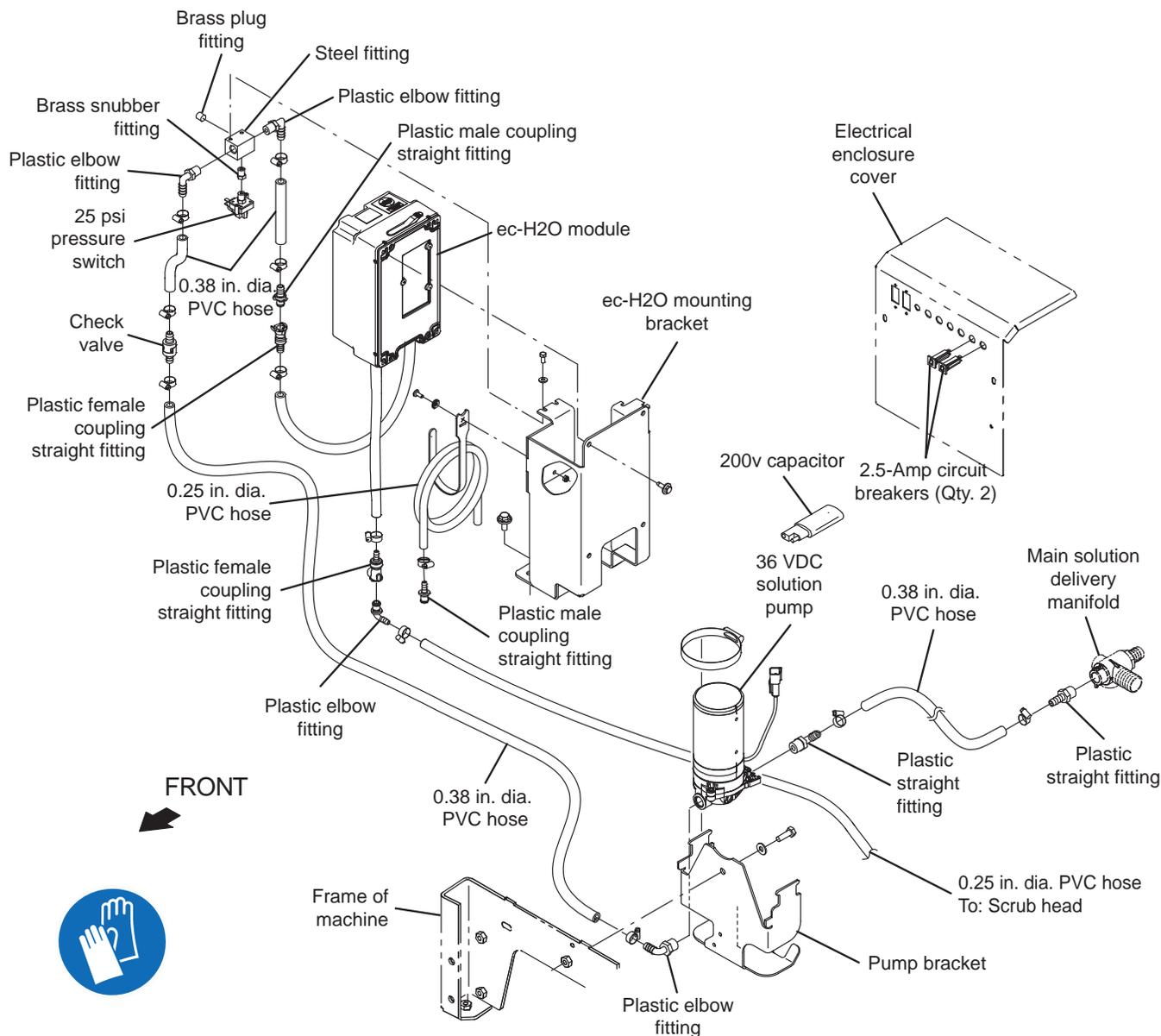
5. Ensure wire connections at the 2.5-Amp circuit breakers (CB8/CB9) are secure and undamaged. Secure/repair connections as necessary. Continue testing/troubleshooting procedure if problem persists.

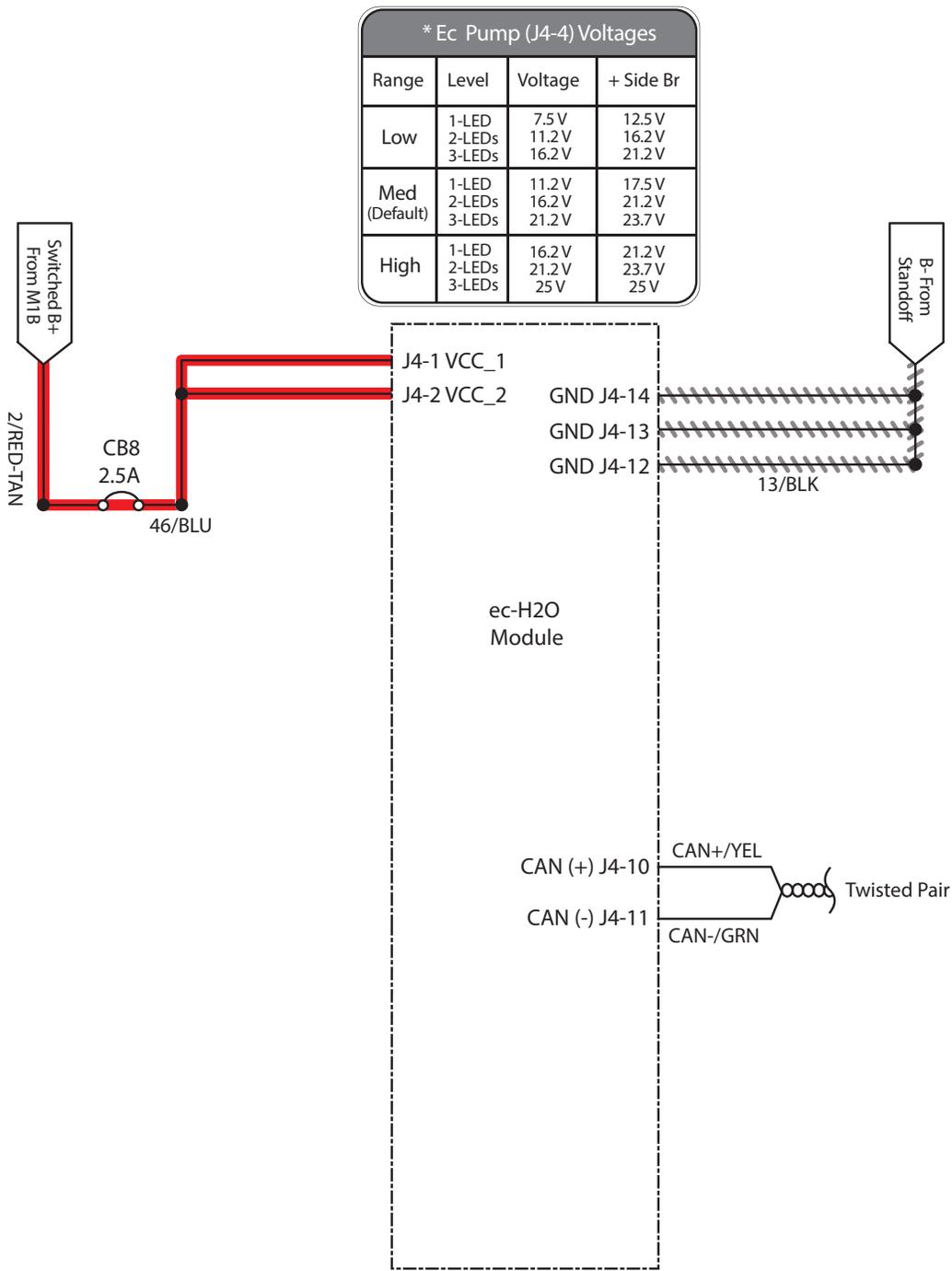


- Disconnect the 6-pin *ec-H2O* cable from the main wire harness.



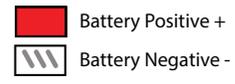
- Inspect the 6-pin *ec-H2O* connector pins for damage. Replace connector if damaged.
- Reconnect the 6-pin *ec-H2O* connector to the main wire harness.
- Reconnect the battery cable to the machine.
- Turn key switch ON.
- Observe for an *ec-H2O* fault code. If problem persists, troubleshoot the *ec-H2O* module per instructions in the *ec-H2O* Troubleshooting Guide and perform necessary repairs/maintenance. If problem persists, replace the *ec-H2O* assembly and/or inoperable *ec-H2O* components.





*** Ec Pump (J4-4) Voltages**

Range	Level	Voltage	+ Side Br
Low	1-LEDs	7.5V	12.5V
	2-LEDs	11.2V	16.2V
	3-LEDs	16.2V	21.2V
Med (Default)	1-LEDs	11.2V	17.5V
	2-LEDs	16.2V	21.2V
	3-LEDs	21.2V	23.7V
High	1-LEDs	16.2V	21.2V
	2-LEDs	21.2V	23.7V
	3-LEDs	25V	25V

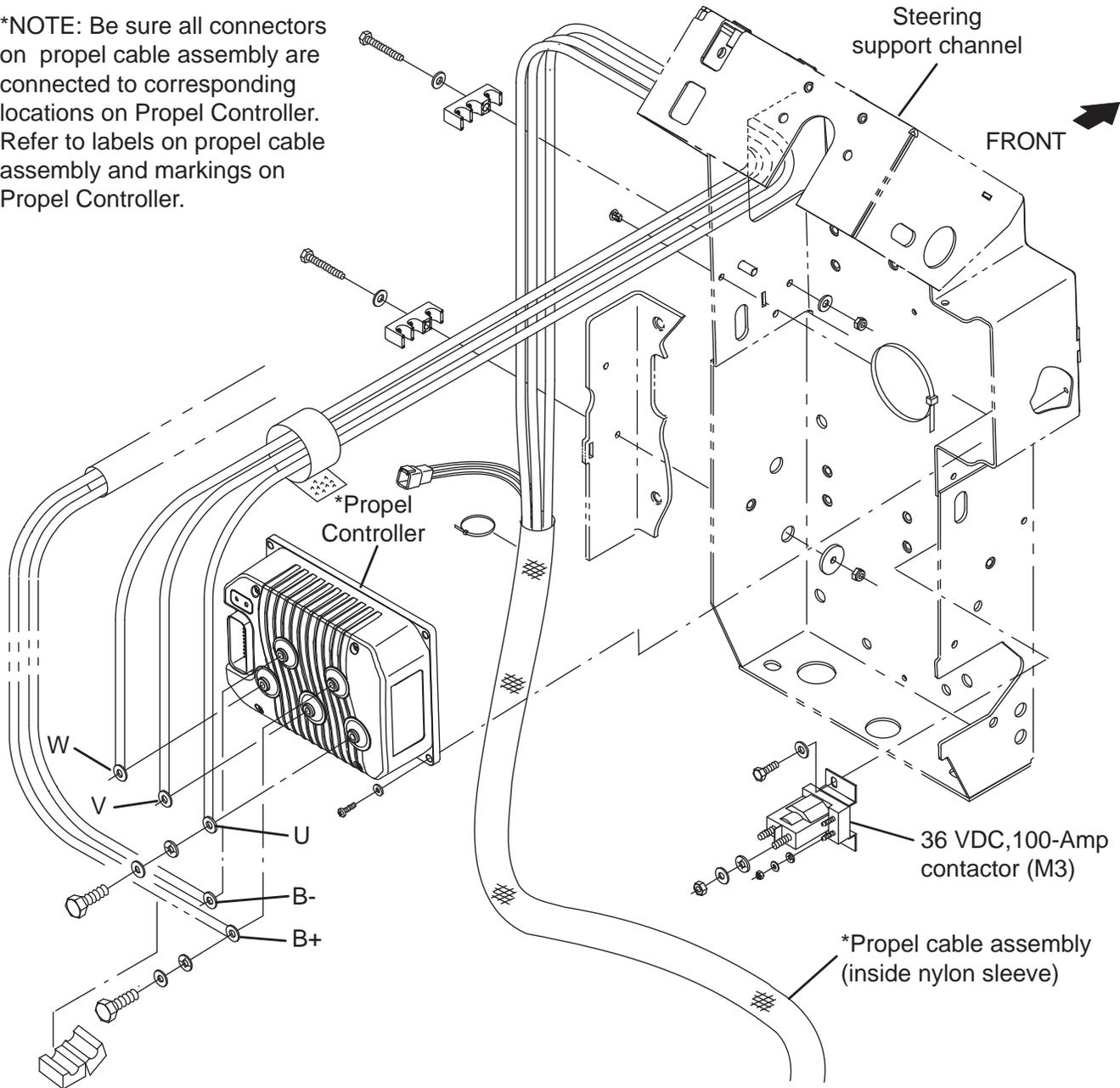


Operational Matrix:

	Enabled	Disabled
Solution Control (ec-H2O)	<ul style="list-style-type: none"> • 1-STEP Scrub ON • Solution Control ON • ec-H2O Button ON • Fwd/Rev Propel 	<ul style="list-style-type: none"> • 1-STEP Scrub OFF • Solution Control OFF • ec-H2O Button OFF/SE ON • Neutral-Ready State • Recovery Tank Full • Solution Tank Empty • Very Low Batt Voltage • ec-H2O System Fault • Circuit Fault

TROUBLESHOOTING THE PROPEL CONTROLLER

*NOTE: Be sure all connectors on propel cable assembly are connected to corresponding locations on Propel Controller. Refer to labels on propel cable assembly and markings on Propel Controller.



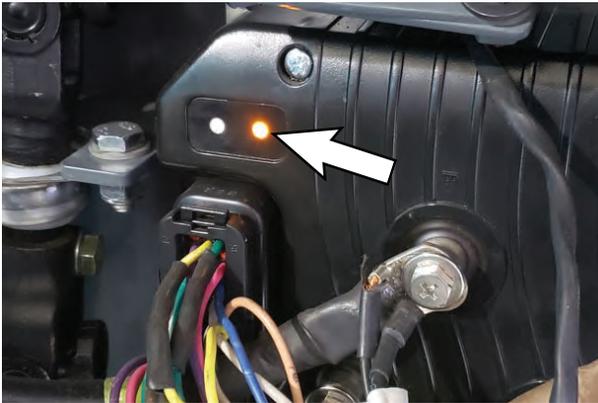
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and set parking brake.

1. Turn key switch OFF.
2. Remove the access panel from the machine.

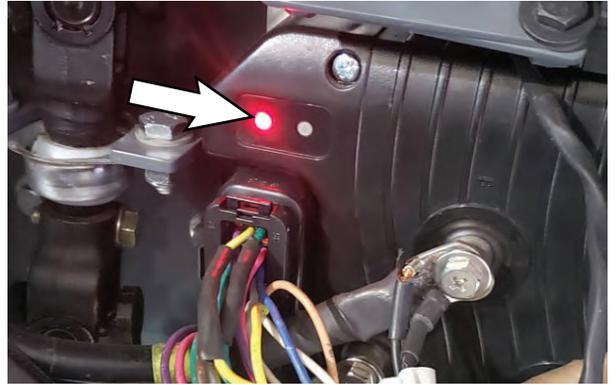


3. Turn key switch ON.
4. Observe the lights on the Propel Controller.

Flashing yellow light: Continually flashes approximately one flash per second when Propel Controller is functioning properly.



Flashing red fault code light: Flashes when there is a fault/issue with the Propel Controller.



If there is a flashing red fault code see *PROPEL CONTROLLER DIAGNOSTIC LED OPERATION* and *PROPEL CONTROLLER DIAGNOSTIC CODES* sections of this manual.

TROUBLESHOOTING THE STANDARD POD

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

1. Turn key switch ON.
2. Observe the pod. Does the pod power on? Is the pod functioning properly?
 - Blank/dark screen
 - Tennant logo then a blank screen
 - Pod is not retaining the configuration
 - Pod is not retaining the machine serial number
 - Lines, poor image quality, illegible text, etc...
 - Buttons not responsive
 - USB port(s) not functioning
3. If pod powers on, record the version number or date that appears on the screen during the start up sequence.



4. Observe pod for fault codes and record all active displayed fault codes. See *FAULT CODES* in *FAULTS AND WARNINGS*.

NOTE: Although machine configuration is set at the pod, the pod functions only as a pass through for the other modules. The pod displays only information it receives from the modules. Fault codes from the other modules signify an issue with the module, not the pod.

5. Confirm all control modules have the latest versions of the firmware.
6. Key cycle the machine.
7. Note any fault code changes or changes in how the machine operates/functions. May be necessary to briefly operate the machine for fault codes to appear.

If it is determined that there is an issue with the pod

8. Determine cause of failure(s). Is it a component issue/failure? Or a pod issue/failure?
9. Continue observing the screen. Does the screen go blank shortly after initial start up? Does the screen freeze?
10. Check configuration. Is the configuration retained?
11. Initiate a membrane test. See *MEMBRANE TEST - STANDARD PANEL*.
12. If it is determined there is an issue with a component/module, did it function when the self-test was conducted?

Example: Did horn function when self-test was conducted, but does not function when the horn button is pressed.

If horn functions during self-test, there may be damaged pod buttons.
13. Determine which module/component is affected.
14. Confirm machine is properly configured.
15. What type of failure? Was there a fault code? Did issue occur while machine was in use? Why did component/module fail? Was cause of failure due to machine abuse/misuse?
16. Confirm harnesses, connectors, fuses, circuit breakers for the suspected module(s) are not damaged and are functioning properly.

TROUBLESHOOTING THE PRO-PANEL POD

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

1. Turn key switch ON.
2. Observe the pod. Does the pod power on? Is the pod functioning properly?
 - Blank/dark screen
 - Tennant logo then a blank screen
 - Pod is not retaining the configuration
 - Pod is not retaining the machine serial number
 - Lines, poor image quality, illegible text, etc...
 - Touch screen not responsive
 - USB port(s) not functioning

Replace the pod if there are screen artifacts, a USB port is not functioning, or it there is a memory card failure.

If pod powers on and is functioning properly continue troubleshooting.

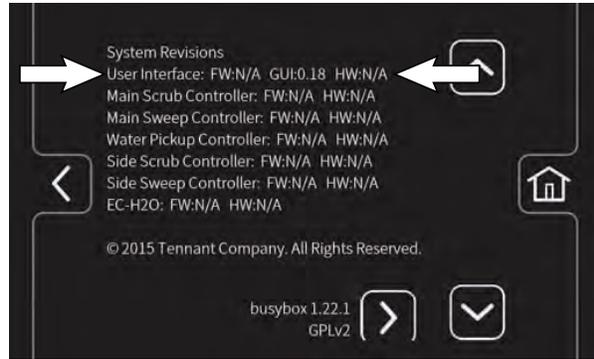
3. Press the *help* button to access the help screen.



4. Press the *about* button for the firmware information screen.



5. Record the firmware/GUI version on the information screen.



6. Exit the information screen and return to the main operation screen
7. Observe pod for fault codes. See *FAULT CODES* in *FAULTS AND WARNINGS*.

NOTE: Although the machine configuration is set at the pod, the pod functions only as a pass through for the other modules. The pod displays only information it receives from the modules. Fault codes from the other modules signify an issue with that particular module, not the pod.

If it is determined that there is an issue with the pod

8. Determine cause of failure(s). Is it a component issue/failure? Or a pod issue/failure.
9. Continue observing the screen. Does the screen go blank shortly after initial start up? Does the screen freeze?
10. Check configuration. Is the configuration retained?
11. Operate various machine functions and observe if pod buttons are functioning/functioning properly. Do all pod button and lights function?
12. If a component is not functioning, did it function when the self-test was conducted?

Example: Did horn function when self-test was conducted, but does not function when the horn button is pressed.

If horn functions during self-test, there may be damaged buttons on the pod.

If it is determined there is an issue with a component/module

13. Determine which module/component is affected.
14. Confirm machine is properly configured.
15. What type of failure? Was there a fault code? Did issue occur while machine was in use? Why did component/module fail? Was cause of failure due to machine abuse/misuse?
16. Confirm harnesses, connectors, fuses, circuit breakers for the suspected module(s) are functioning properly.

TROUBLESHOOTING THE HORN

When the horn button is pressed the pod/UI (User Interface) reads the signal and then sends a signal to the main scrub module to turn the horn on. When the horn button is released, the pod/UI sends a signal to the main scrub module to turn the horn off.

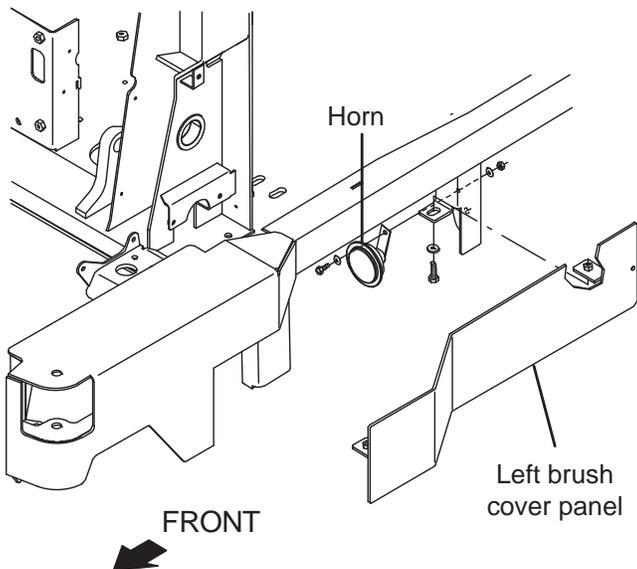
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and set parking brake.

HORN SOUNDS BUT NOT CORRECT

1. Turn key switch OFF.

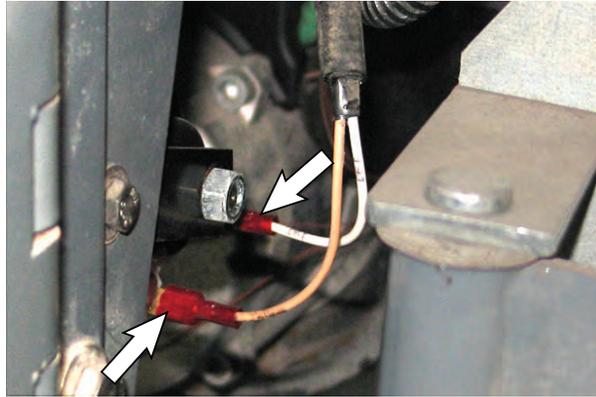
FOR SAFETY: When servicing machine, disconnect battery connections and charger cord before working on machine.

2. Disconnect the battery cable from the machine.
3. Check horn bracket position on the frame of the machine and ensure all hardware is completely tightened.

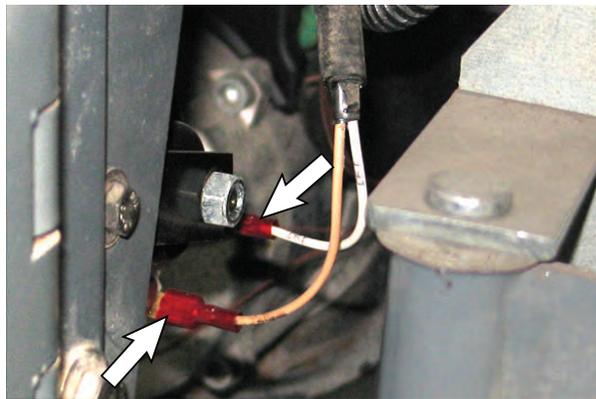


4. Check horn for physical damage.

5. Ensure the main harness connections to the horn are secure and the terminals are not corroded.



6. Ensure main harness wires to the horn are not damaged (pinched, discolored, etc...).
7. If there are no signs of external damage and all harness connections are secure, but horn sound remains noticeably different, remove the horn from the machine and install a new horn.
8. Reconnect the battery cable to the machine.
9. Read voltage across pins while new horn is active. If voltage is not ~19V to 23V (when battery is between 31.5V and 38V), replace the Main Scrub/Solution Delivery Module and reconfigure all modules.

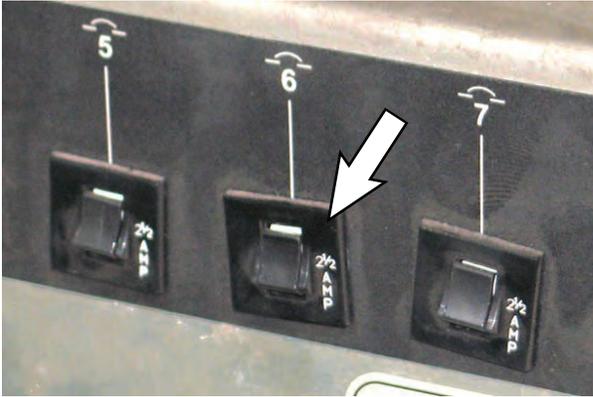


10. Main scrub/solution delivery module issue (Silver Horns Only): Replace horn if horn sound is quieter or pod displays Horn Open fault (0311).
11. Replace the Main Scrub/Solution Delivery Module if new black horn shows Horn Short fault (0316). If this fault is seen on machines outside of serial numbers 011000 and above, call T.A.C. for assistance.

HORN DOES NOT SOUND

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

1. Turn key switch OFF.
2. Ensure the 2.5-Amp circuit breaker (CB6) is not tripped.

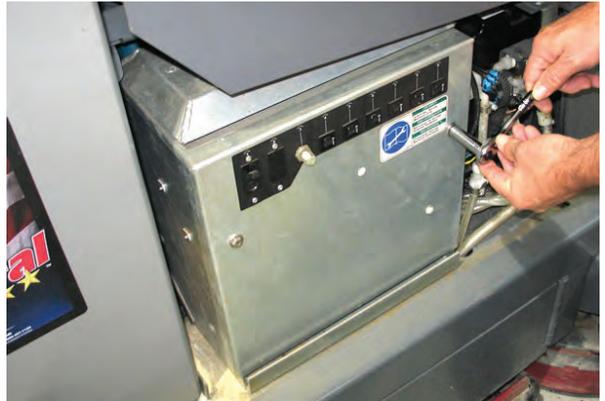


FOR SAFETY: When servicing machine, disconnect battery connections and charger cord before working on machine.

3. Open the right side access door.

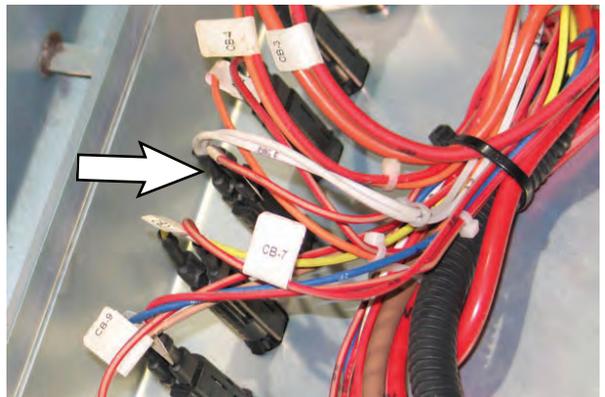


4. Remove the hardware securing the electrical enclosure cover to the electrical enclosure panel and carefully lower the electrical enclosure cover. **Do Not** break any cable/wire connections.

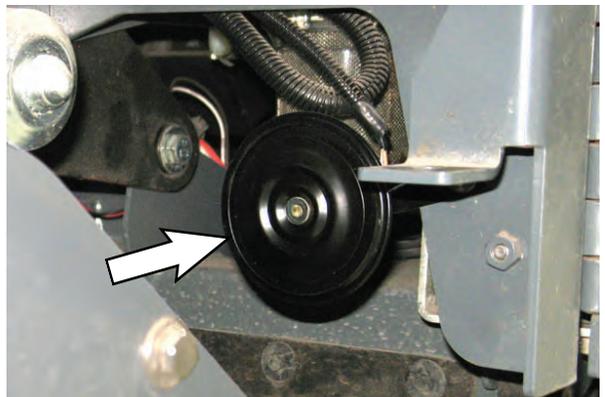


NOTE: To avoid damaging electronic components, a static ground strap must be worn at all times while handling/testing electrical components. Attach the other end of the static ground strap to the machine chassis.

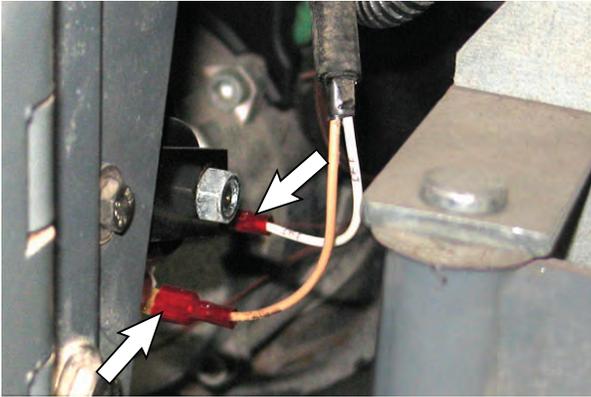
5. Inspect the wire connections at circuit breaker (CB6).



6. Check horn for physical damage.



7. Inspect connections at pins/terminals for signs of corrosion/damage.



8. Check the pins for shorts (possibly due to moisture/debris between pins).
9. Run ~31V to 38V across pins to directly test horn. If horn sounds incorrect or does not sound, the horn is damaged. Replace the horn.
10. If cause is not yet determined troubleshoot pod issues.

POD ISSUE

1. Turn key switch ON.
2. Perform Horn Self-Test through UI.
3. Replace pod and reprogram all modules If horn functions when tested through self-test but not when the horn button is pressed on the pod, and no faults appear on the display.
4. If faults are shown or the horn does not function, troubleshoot for a CAN and Main Scrub/Solution Delivery Module issue.
5. Replace the Main Scrub/Solution Delivery Module if new black horn shows horn short fault (0316). If this fault is seen on machines outside of serial number 011000 and higher call T.A.C. for further assistance.

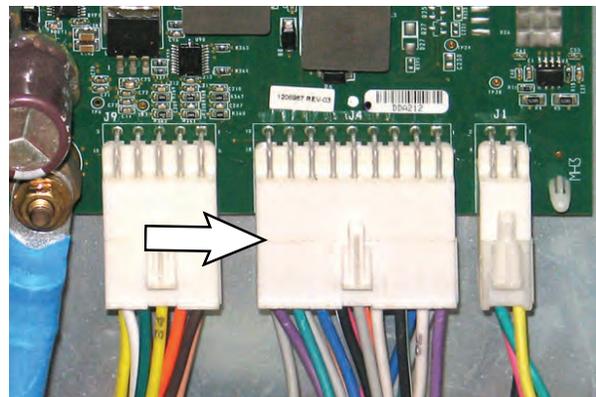
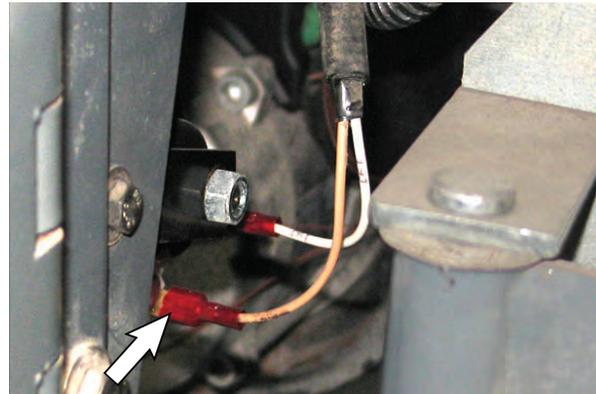
CAN ISSUE

1. Turn key switch ON.
2. Press any button for another machine function to verify another feature functions via CAN by pod activation.
3. If the feature from the previous step is not functioning, continue troubleshooting. See *TROUBLESHOOTING THE MAIN SCRUB/SOLUTION DELIVERY MODULE*. If problem persists, call T.A.C. for assistance.

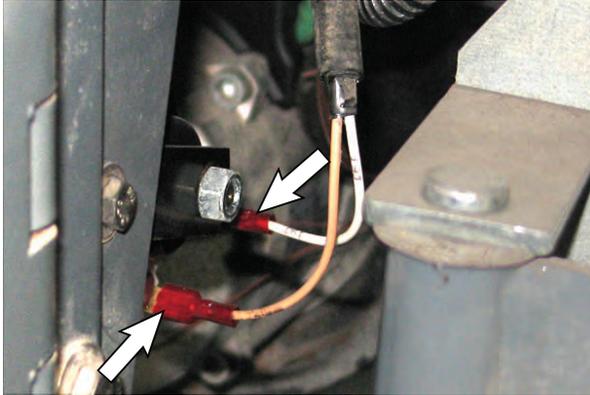
SCRUB MODULE ISSUE

1. Check harness, confirm continuity in 20/tan wire (Horn P2-1 to Main Scrub/Solution Delivery Module J4-16).

NOTE: A jumper/extension lead may be required to connect the voltmeter to P2-1 on the horn and J4-16 on the Main Scrub/Solution Delivery Module.



2. Read voltage across horn while horn button is pressed. If voltage is not ~19V to 23V (when battery is between 31.5V and 38V), check wires and connections for damage.



3. If issue persists, replace the Main Scrub/Solution Delivery Module (horn driver has failed). See *REMOVING/REPLACING THE MAIN SCRUB/SOLUTION DELIVERY MODULE*.

HORN DOES NOT STOP/UNINTENTIONALLY SOUNDS (ACTIVATES WITHOUT PRESSING HORN BUTTON) POD ISSUE

1. Turn key switch ON.
2. Press any button on the pod except the horn button. If horn sounds when another button is pushed, the membrane has a short. Replace the pod.
3. If horn sounds when key switch is turned ON there may be a short in the membrane.

Troubleshoot the Main Scrub/Solution Delivery Module. See *TROUBLESHOOTING THE MAIN SCRUB/SOLUTION DELIVERY MODULE/COMBO MODULE (WATER PICK UP)/SIDE SCRUB MODULE (OPTION)*. If problem persists, call T.A.C. for further assistance.

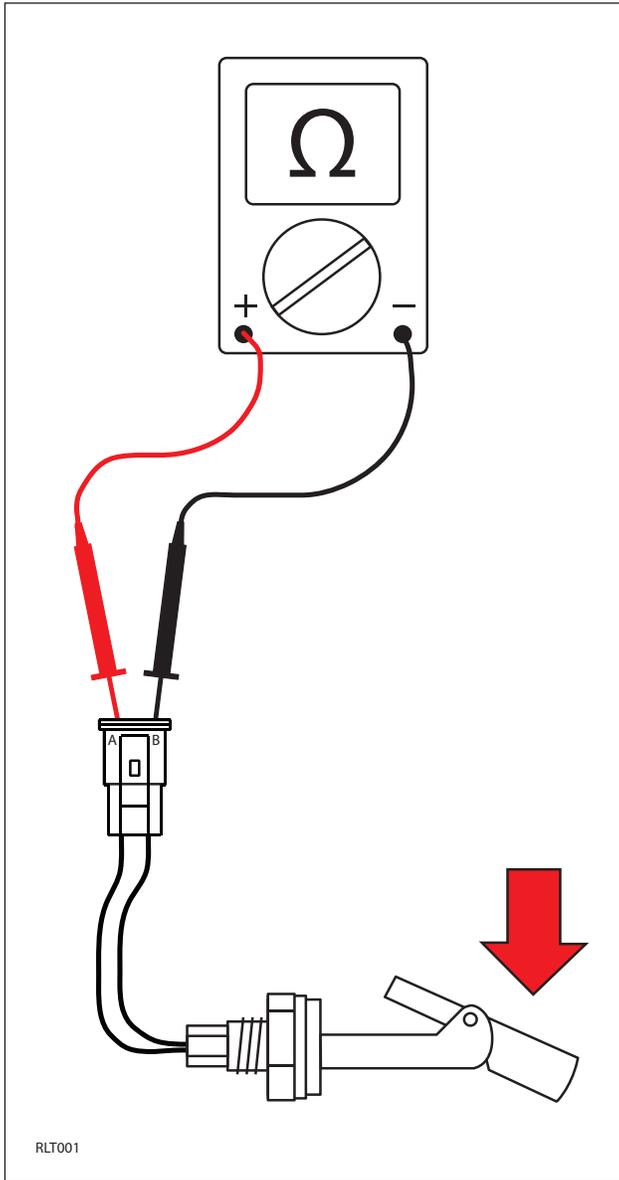
4. Turn key switch OFF.

COMPONENT TESTING

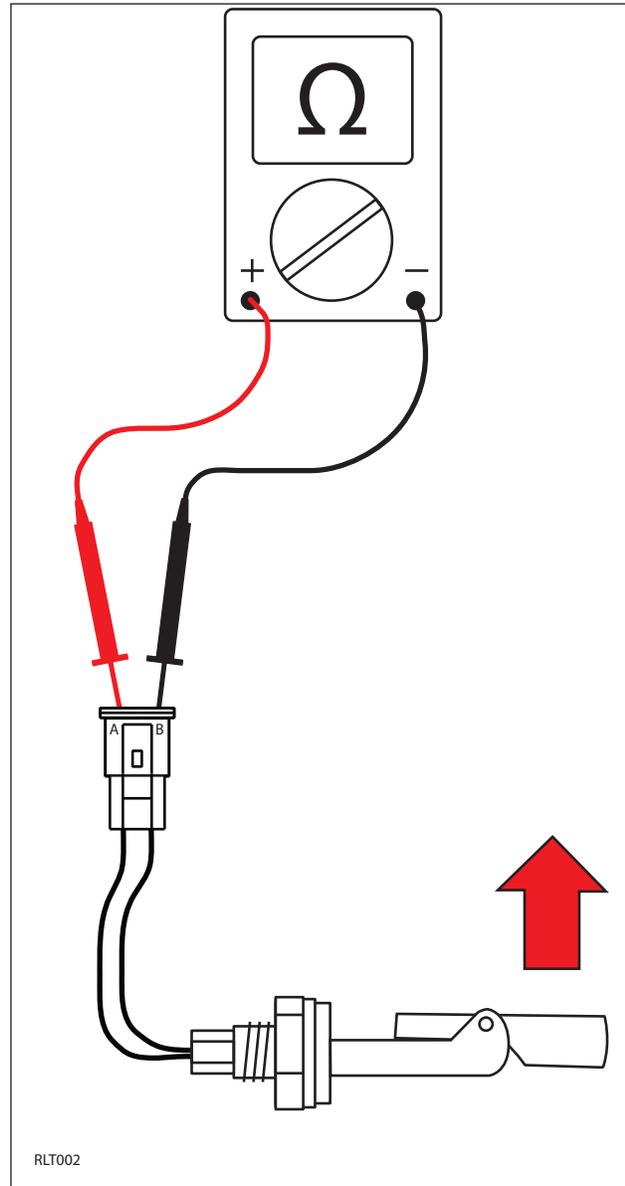
TESTING THE RECOVERY TANK LEVEL SENSOR

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

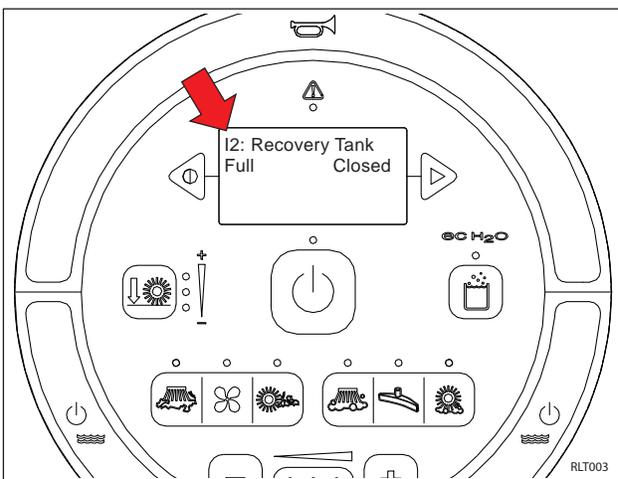
1. Use an ohmmeter to test the resistance of the recovery tank level sensor. The tank level switch should test as "O. L." or open.



2. Use an ohmmeter to test the resistance of the recovery tank level sensor. The tank level switch should test at 0-1 Ω or closed.



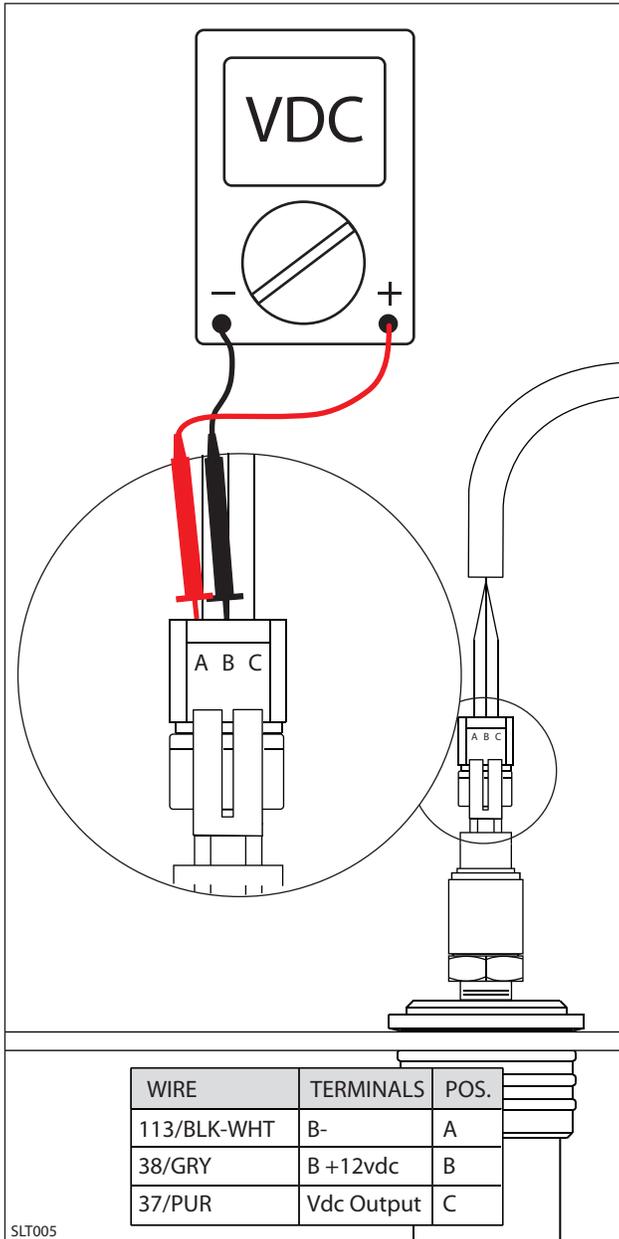
- The recovery tank full and half-full sensor conditions are also viewable in Input Display Mode. See *INPUT DISPLAY MODE*.



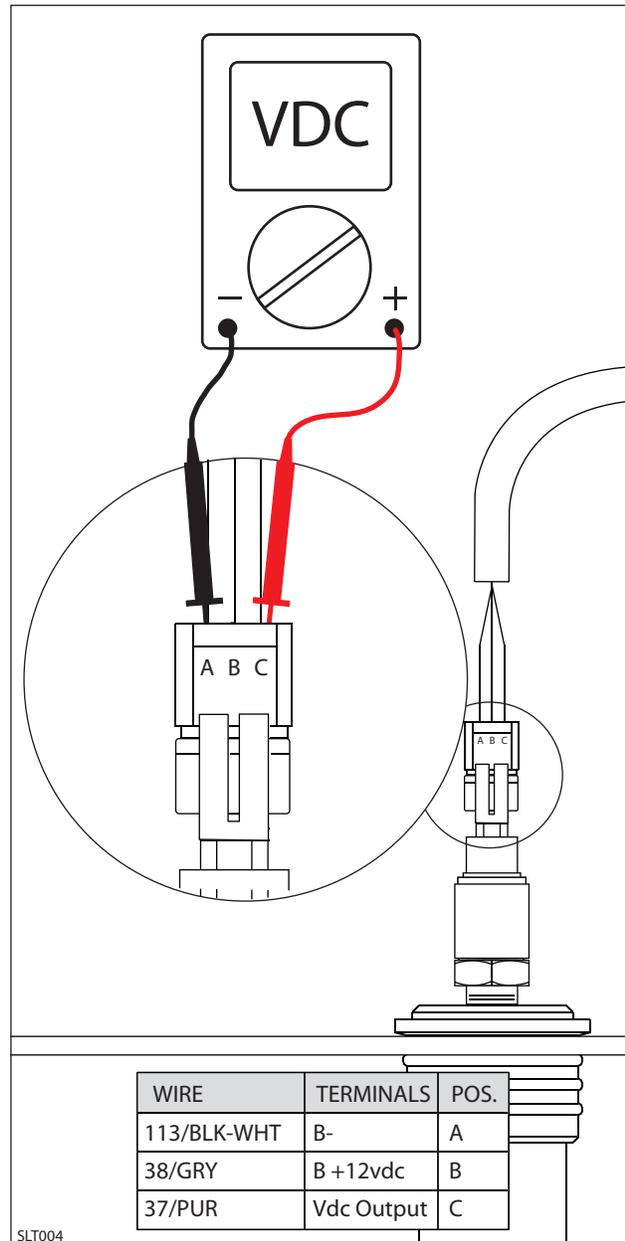
TESTING THE SOLUTION TANK LEVEL SENSOR

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

1. Turn key switch ON.
2. Use a voltmeter to back probe solution tank level sensor connector terminals A and B. The voltmeter should display 10-12 volts.



3. Turn key switch ON.
4. Use a voltmeter to back probe solution tank level sensor connector terminals A and C. The voltmeter should display 1-5 volts depending on solution tank water level.



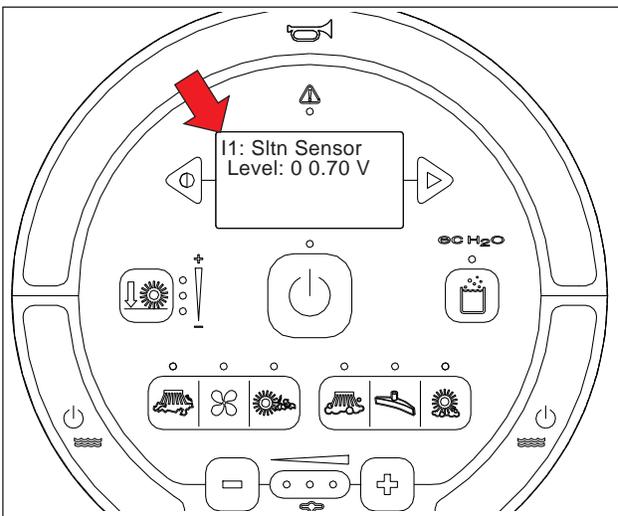
5. Drain the solution tank.

- Slowly fill the solution tank with water and compare the actual voltmeter readings to the chart below. Replace the sensor if the values are not within specification.

Solution Tank Sensor Output	
Tank Level	Output Voltage
0 BARS - EMPTY	0.0 - 0.72 Volts
1 BAR - 20%	0.73 - 0.87 Volts
2 BARS - 40%	0.88 - 0.98 Volts
3 BARS - 60%	0.99 - 1.11 Volts
4 BARS - 80%	1.12 - 1.33 Volts
5 BARS - FULL	1.34 + Volts

SI.T002

- The solution tank level sensor output voltage is also viewable in Input Display Mode. See *INPUT DISPLAY MODE*.



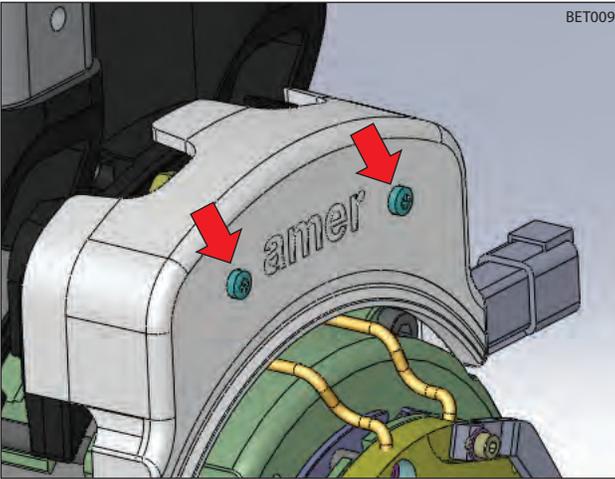
TROUBLESHOOTING

TESTING THE PROPEL MOTOR

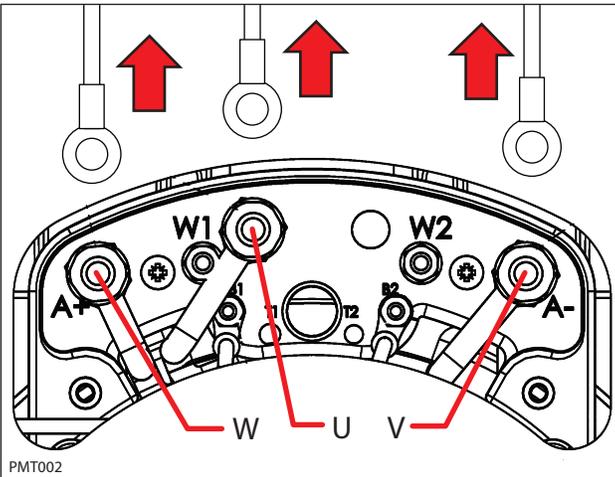
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, remove key, and set parking brake.

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

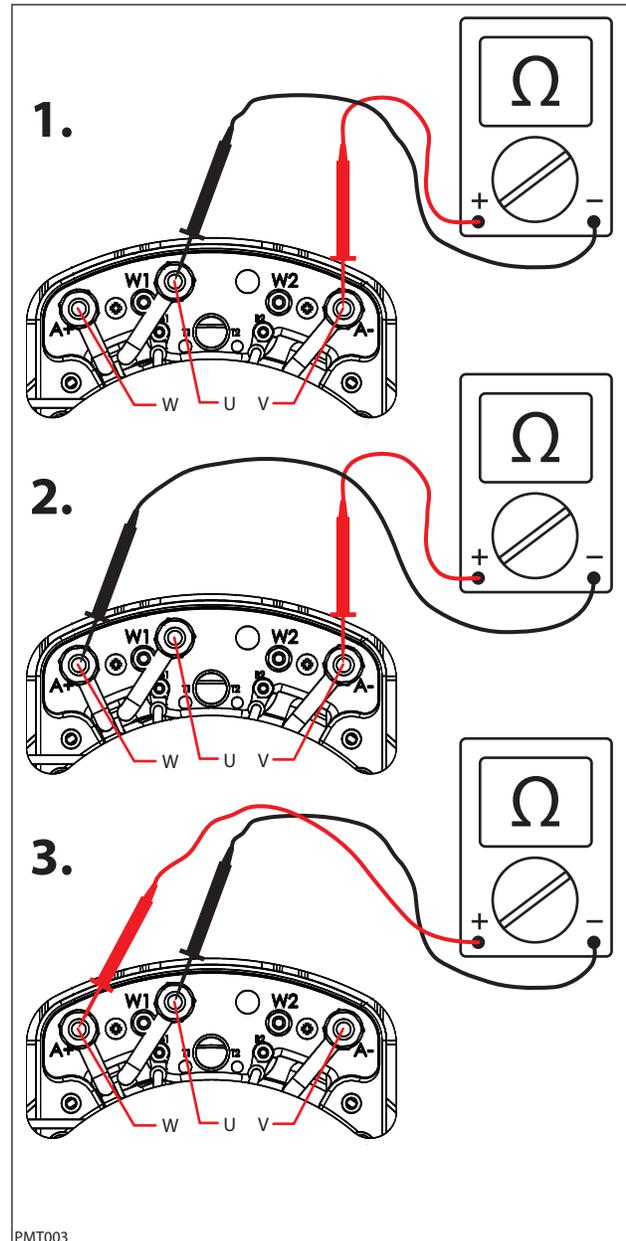
1. Turn key switch OFF.
2. Remove terminal box cover.



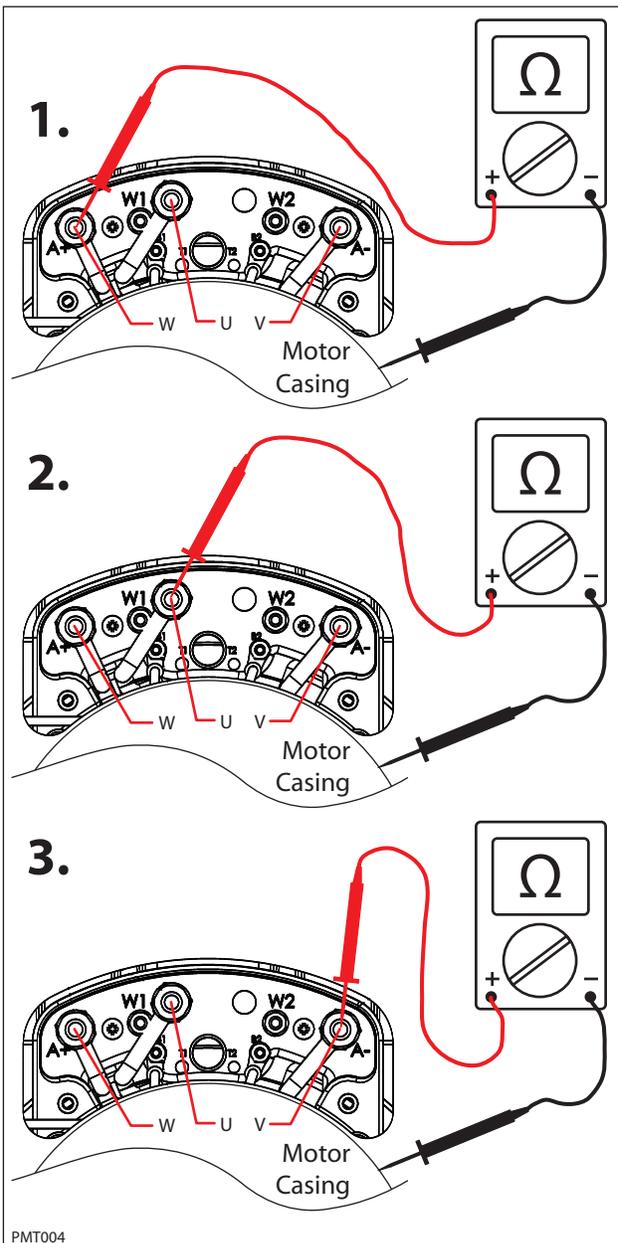
3. Disconnect U, V, and W cables from W1, A-, and A+ terminals (respectively).



4. Use an ohmmeter to test the resistance of all three motor windings. The resistances of each winding should not be open (O. L.). An open winding indicates a faulty motor.

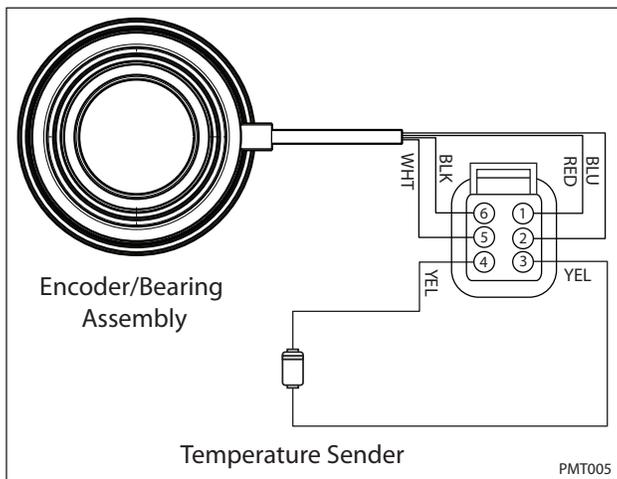


- Test the resistance between all three motor terminals and the motor case. The ohmmeter should read "O. L." or open. A shorted winding indicates a faulty motor.



- The drive motor temperature sender and motor encoder are non-serviceable components. The motor encoder senses rotor position, speed, and direction. The encoder is integrated into an internal roller bearing assembly. See *PROPEL CONTROLLER DIAGNOSTIC CODES* for encoder related faults.

The temperature sender senses the propel motor temperature. Use an ohmmeter to test the resistance of the temperature sender and then compare the values to the chart below. Replace the motor assembly if the resistance values are outside the specified range.



Temperature		Resistance (Ω)		
($^{\circ}\text{C}$)	($^{\circ}\text{F}$)	MIN.	TYP.	MAX.
-30	-22	362	381	368
0	32	464	486	507
25	77	565	588	611
30	86	587	610	633
50	122	679	704	728
70	158	781	806	831
80	176	835	860	885
100	212	950	975	1000
110	230	1007	1036	1064

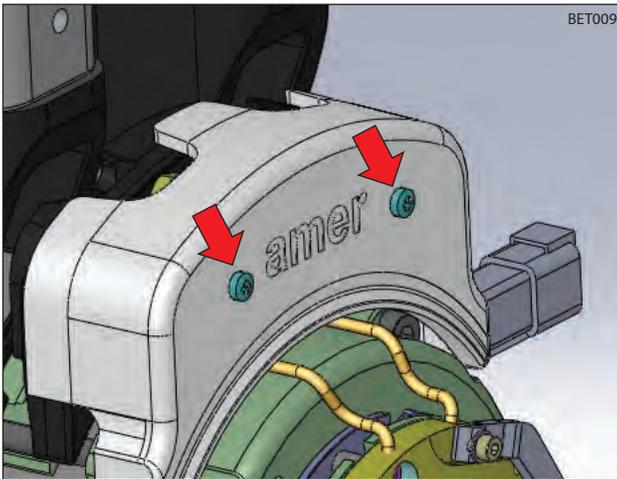
TROUBLESHOOTING

TESTING THE PROPEL MOTOR CABLES

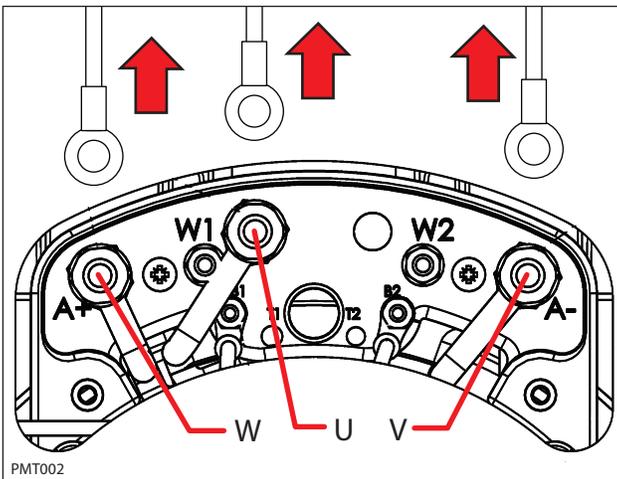
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, remove key, and set parking brake.

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

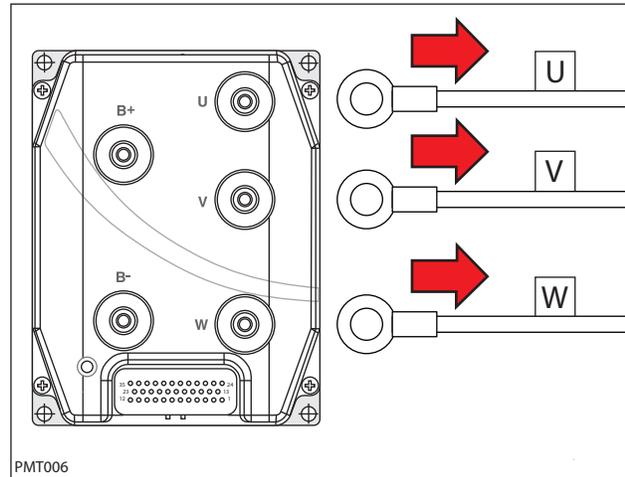
1. Turn key switch OFF.
2. Remove terminal box cover.



3. Disconnect U, V, and W cables from W1, A-, and A+ terminals (respectively).

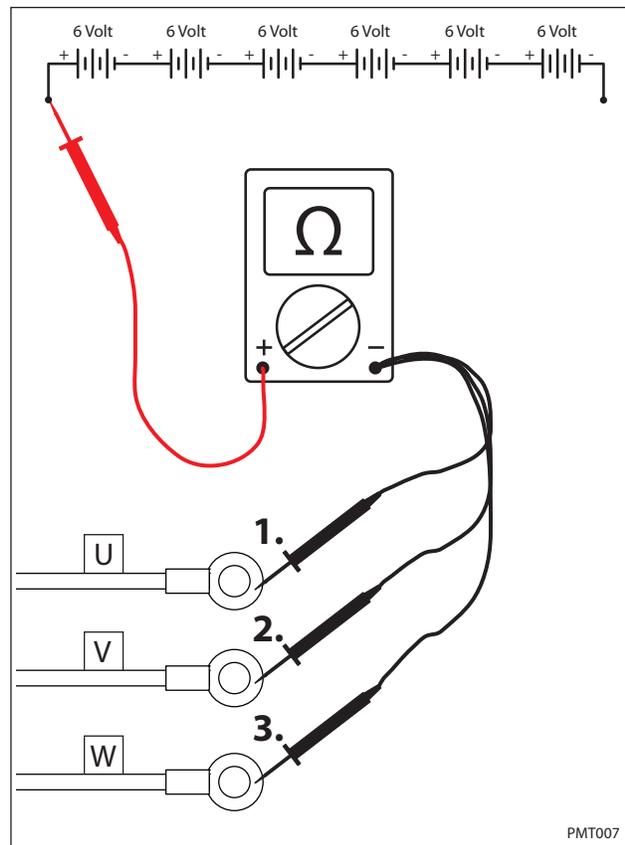


4. Disconnect U, V, and W cables from the Propel Controller.



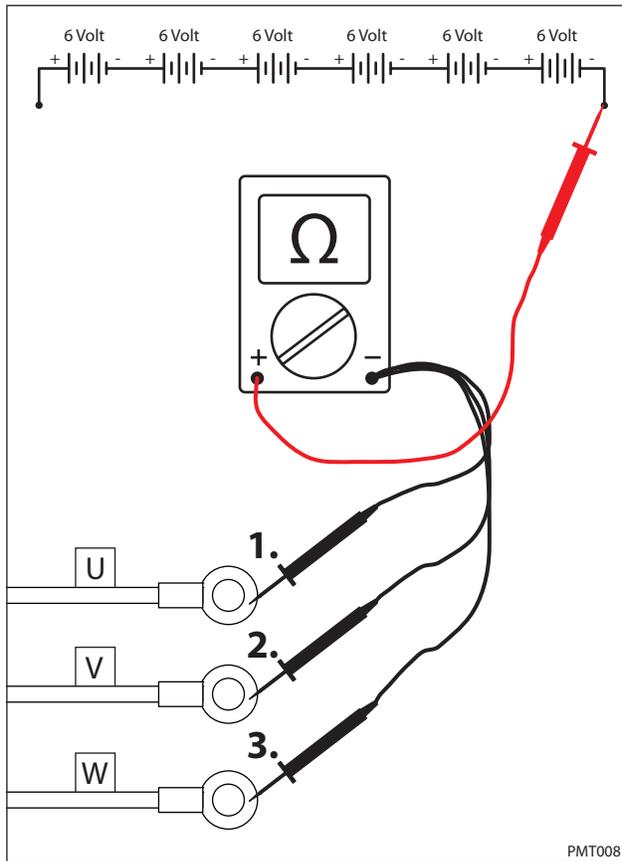
5. Reconnect battery connection and test each cable using an ohmmeter for a short to battery +. Each cable should test as "O. L." or open to battery +.

Replace shorted cable(s).



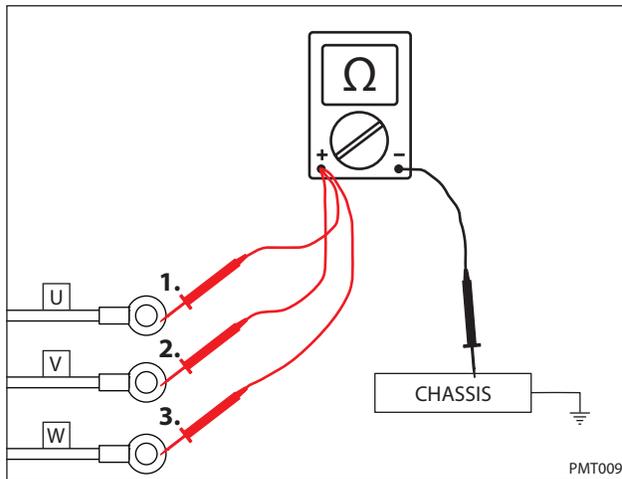
- Use an ohmmeter to test each cable for a short to battery -. Each cable should test as "O. L." or open to battery -.

Replace shorted cable(s).



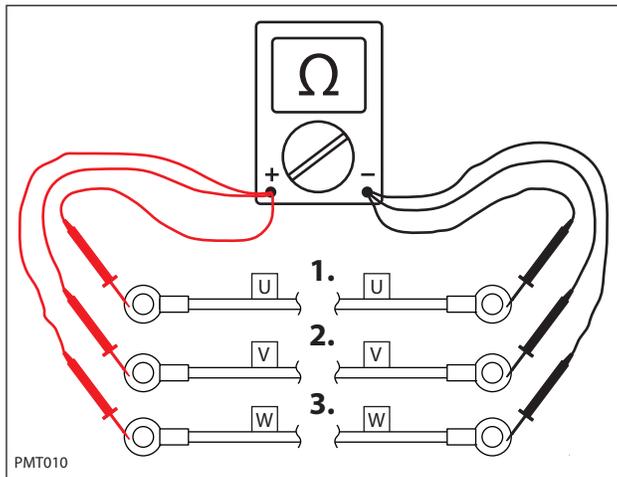
- Test each cable using an ohmmeter for a short to chassis as shown below. Each cable should test as "O. L." or open to chassis.

Replace shorted cable(s).



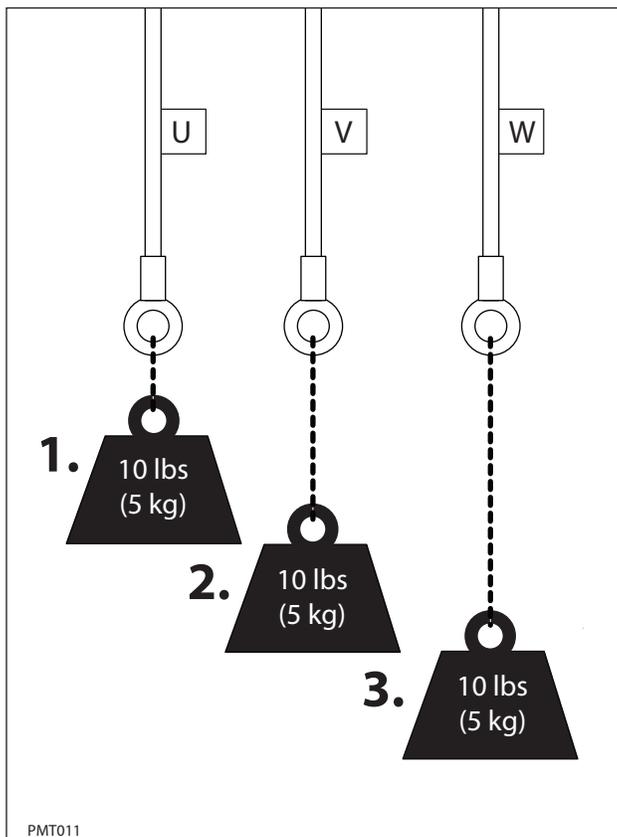
- Use an ohmmeter to test each cable for end-to-end continuity. Each cable should test between 0-1Ω resistance.

Replace open cable(s).



- "Tug test" each cable (motor end) to determine if a cable is broken inside the insulation. Do not exceed 10 lbs (45 N) of force as cable damage may occur.

Replace broken cables.



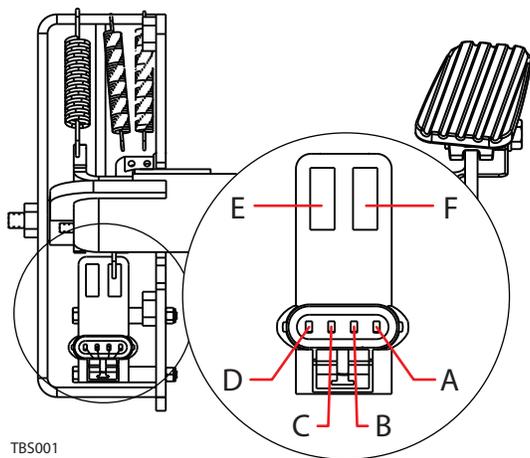
TESTING THE THROTTLE SENSOR

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

FOR SAFETY: When servicing machine, jack machine up at designated locations only. Block machine up with jack stands.

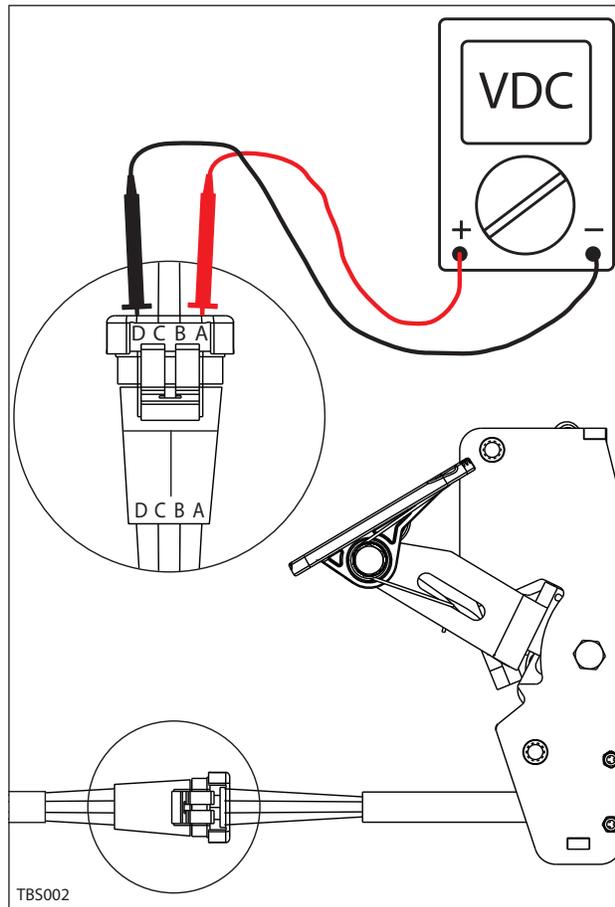
FOR SAFETY: When servicing machine, avoid moving parts. Do not wear loose jackets, shirts, or sleeves when working on machine.

1. Jack machine up so front drive wheel is not touching the floor. Block machine up with jack stands.
2. The throttle hall effect sensor is a component of the pedal subassembly.



TBS001

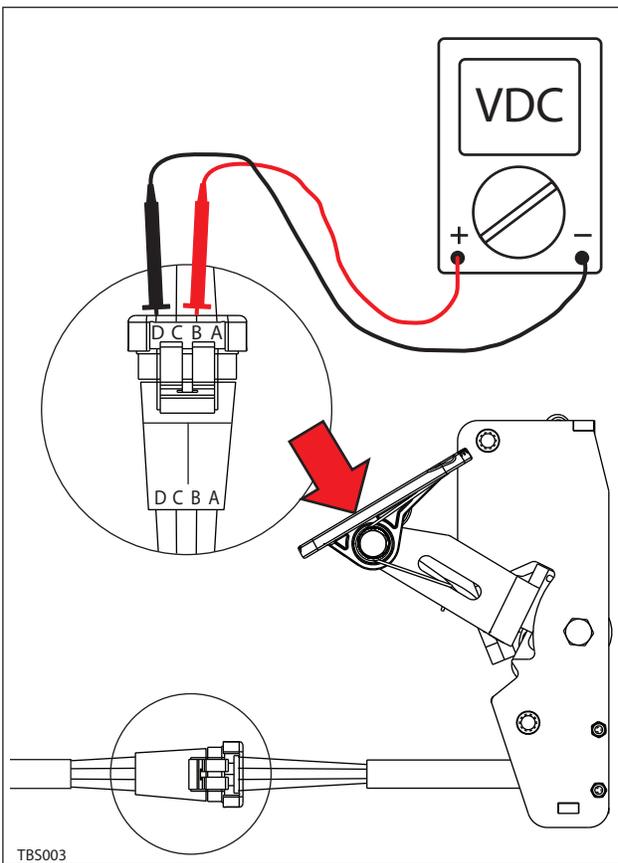
3. Turn key switch ON.
4. Use a voltmeter to back probe the power supply to the throttle sensor terminals A and D. The voltmeter should display battery voltage.



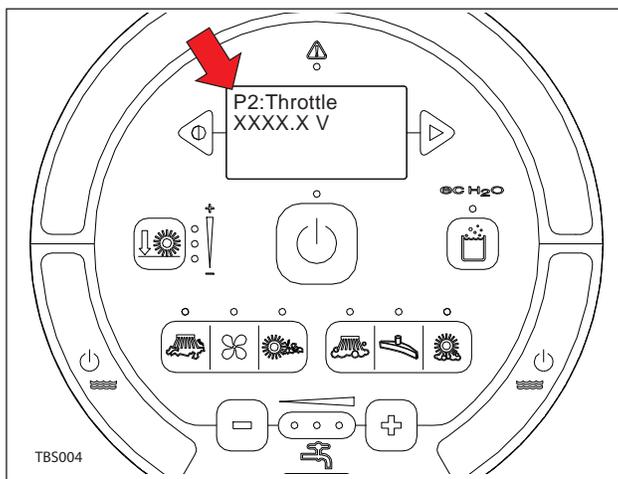
TBS002

Pin/Cavity	Notes	Color
A	Power (Battery +)	Red.
B	Pro Pel Output (0-5 VDC)	Yellow
C	Not Used	Blue
D	Ground (Battery -)	Black
E	Not Used	N/A
F	Gate B	N/A

5. Turn key switch ON.
6. Use a voltmeter to back probe the throttle sensor output terminals B and D. The voltmeter should display 0-5 volts proportional to 0-100% propel pedal movement.



7. See *PROPEL DIAGNOSTIC MODE*. The voltage in Step 3 should match the LCD displayed voltage in Propel Diagnostic Mode.



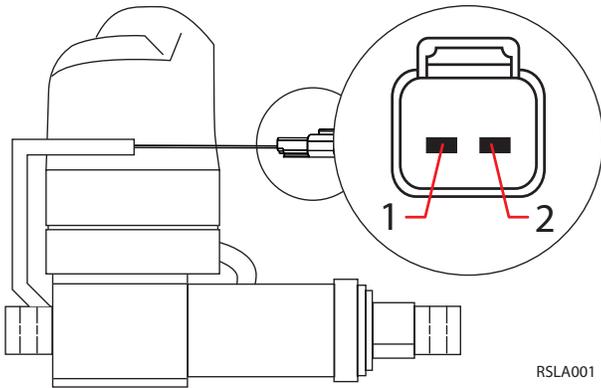
TESTING THE SIDE SCRUB BRUSH LIFT ACTUATOR

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

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

FOR SAFETY: When servicing machine, avoid moving parts. Do not wear loose jackets, shirts, or sleeves when working on machine.

1. Turn key switch OFF.
2. Disconnect the side brush lift actuator from the wire harness.

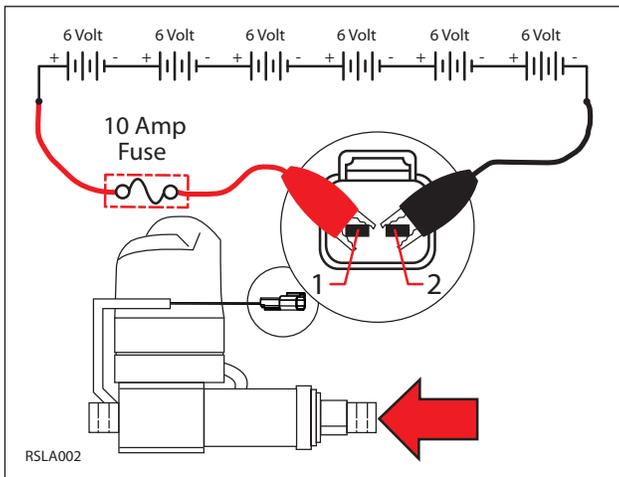


RSLA001

Pin Assignment	
2	Black
1	Black

3. Use fuse-protected jumper leads to apply battery voltage to the lift actuator. Connect battery positive (+) to terminal 1 and battery negative (-) to terminal 2. The actuator should retract completely.

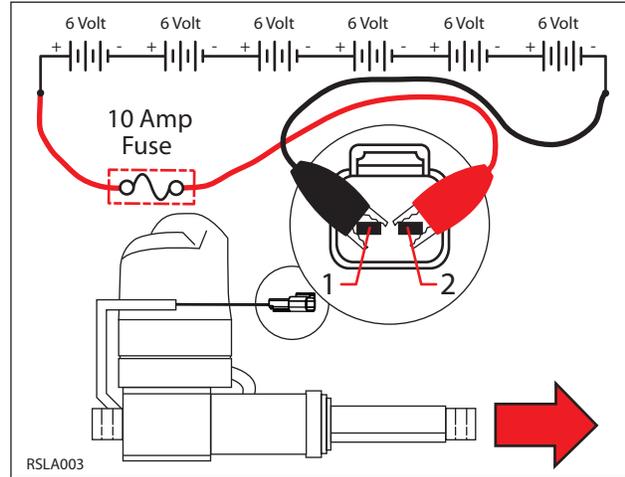
Replace the actuator if it fails to retract.



RSLA002

4. Reverse polarity and apply battery voltage to the lift actuator using fuse-protected jumper leads. Connect battery negative (-) to terminal 1 and battery positive (+) to terminal 2. The actuator should extend completely.

Replace the actuator if it fails to extend.



RSLA003

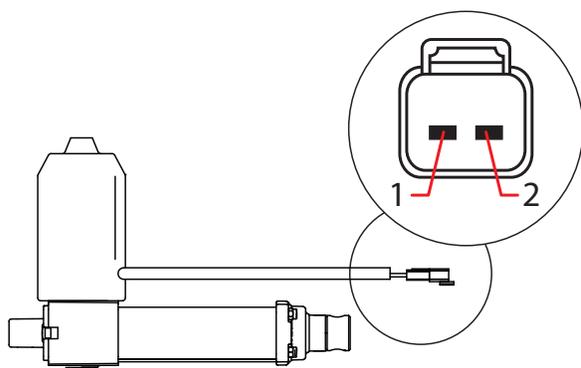
TESTING THE MAIN SCRUB BRUSH LIFT ACTUATOR

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

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

FOR SAFETY: When servicing machine, avoid moving parts. Do not wear loose jackets, shirts, or sleeves when working on machine.

1. Turn key switch OFF.
2. Disconnect the main brush lift actuator from the wire harness.

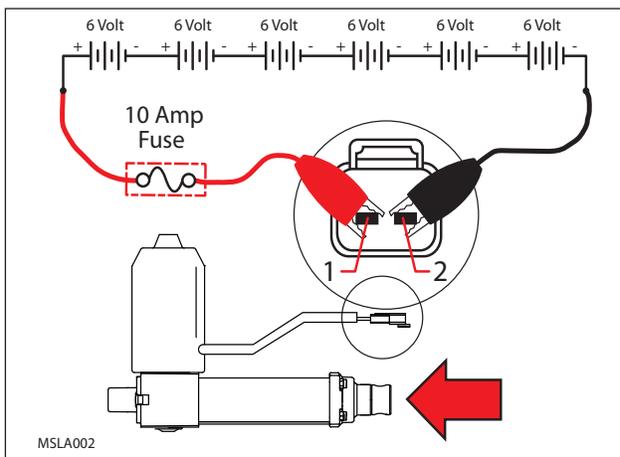


MSLA001

Pin Assignment	
2	Red
1	Black

3. Use fuse-protected jumper leads to apply battery voltage to the lift actuator. Connect battery positive (+) to terminal 1 and battery negative (-) to terminal 2. The actuator should retract completely.

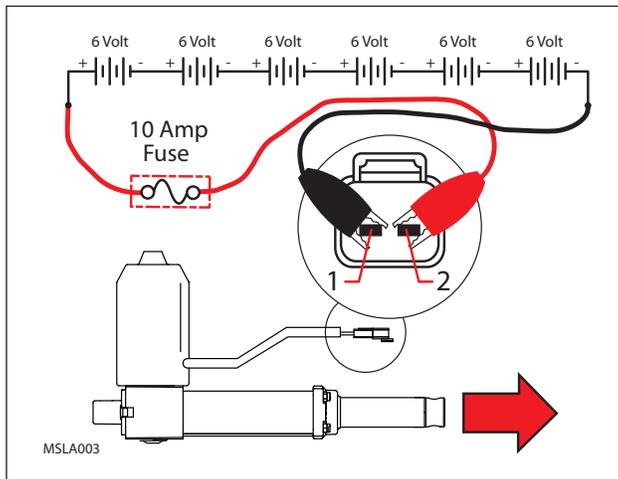
Replace the actuator if it fails to retract.



MSLA002

4. Use fuse-protected jumper leads to reverse polarity and apply battery voltage to the lift actuator. Connect battery negative (-) to terminal 1 and battery positive (+) to terminal 2. The actuator should extend completely.

Replace the actuator if it fails to extend.



MSLA003

TROUBLESHOOTING

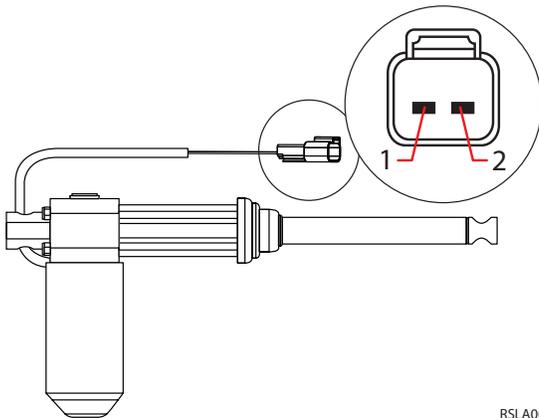
TESTING THE REAR SQUEEGEE LIFT ACTUATOR

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

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

FOR SAFETY: When servicing machine, avoid moving parts. Do not wear loose jackets, shirts, or sleeves when working on machine.

1. Turn key switch OFF.
2. Disconnect the rear squeegee lift actuator from the wire harness.

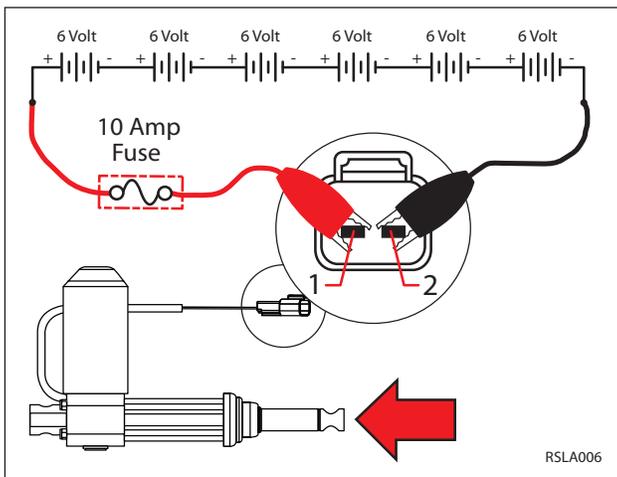


RSLA005

Pin Assignment	
2	Red
1	Black

3. Use fuse-protected jumper leads to apply battery voltage to the lift actuator. Connect battery positive (+) to terminal 1 and battery negative (-) to terminal 2. The actuator should retract completely.

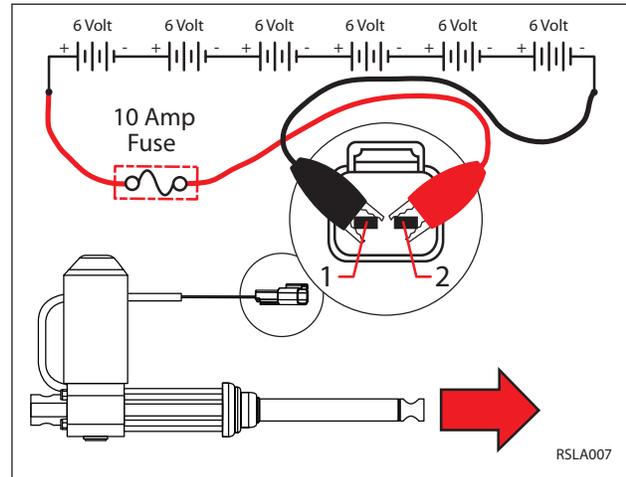
Replace the actuator if it fails to retract.



RSLA006

4. Use fuse-protected jumper leads to reverse polarity and apply battery voltage to the lift actuator. Connect battery negative (-) to terminal 1 and battery positive (+) to terminal 2. The actuator should extend completely.

Replace the actuator if it fails to extend.



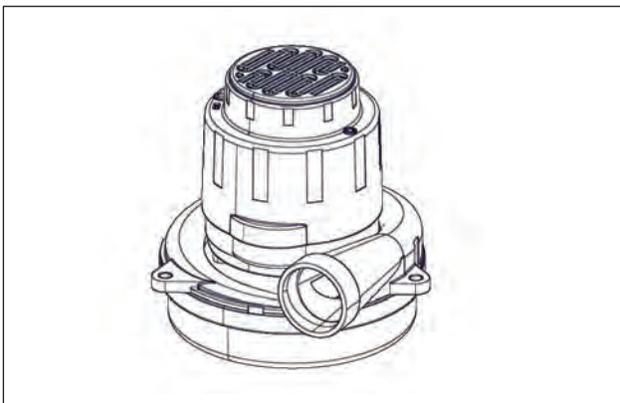
RSLA007

TESTING THE VACUUM FAN

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

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

1. Turn key switch OFF.
2. Disconnect the wire harness from the vacuum fan.

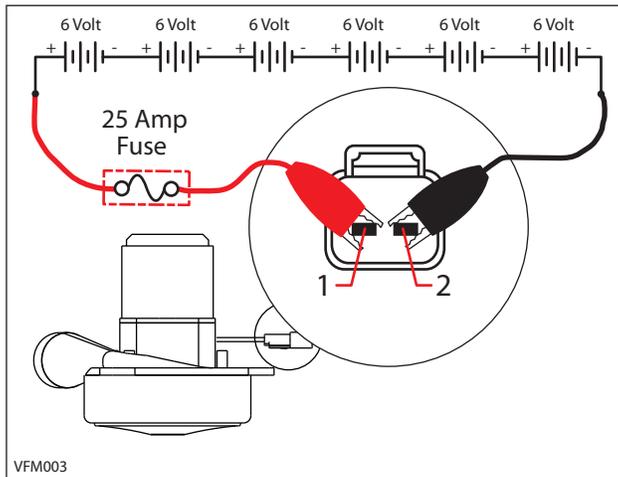


3. Inspect carbon brushes. Replace carbon brushes if they are shorter than 10mm (0.375 in).

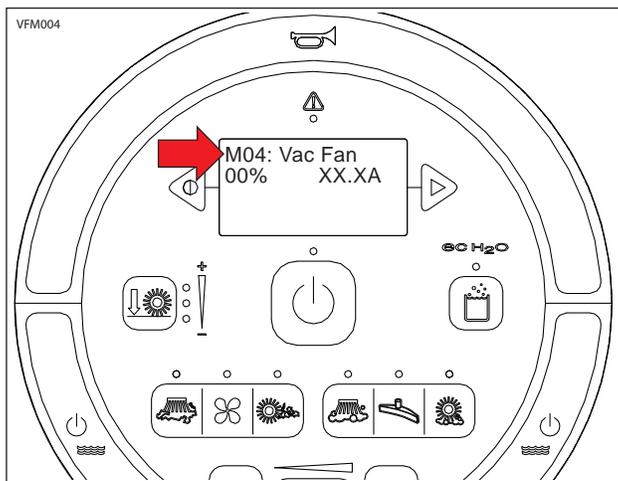


4. Use fuse-protected jumper leads to apply battery voltage to the vacuum fan(s). The fan should turn On.

Replace the vacuum fan if it fails to turn on.



5. Reconnect vacuum fan(s) to wire harness. See *MANUAL MODE*. Activate the vacuum fan in Manual Mode. The amperage displayed should be approximately 14-20 Amps (average 16 Amps)

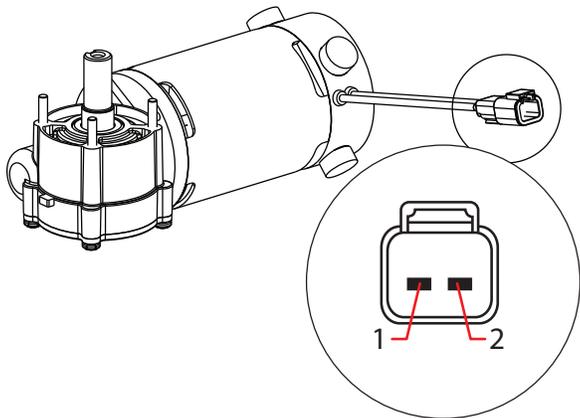


TESTING THE SIDE SWEEP BRUSH MOTOR

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

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

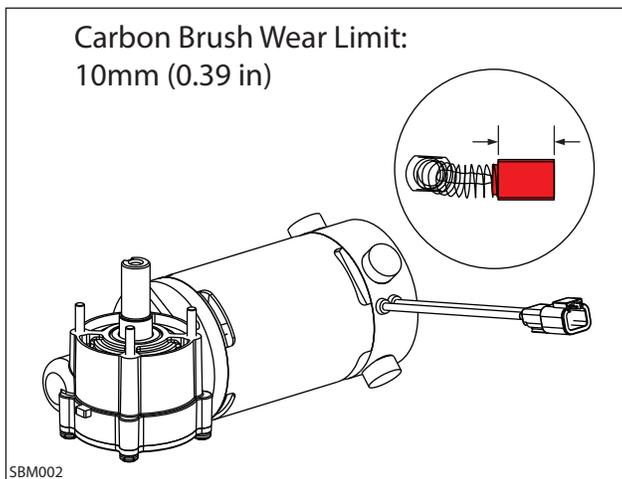
1. Turn key switch OFF.
2. Disconnect the side brush motor from the wire harness.



SBM001

Pin Assignment	
2	Black
1	Red

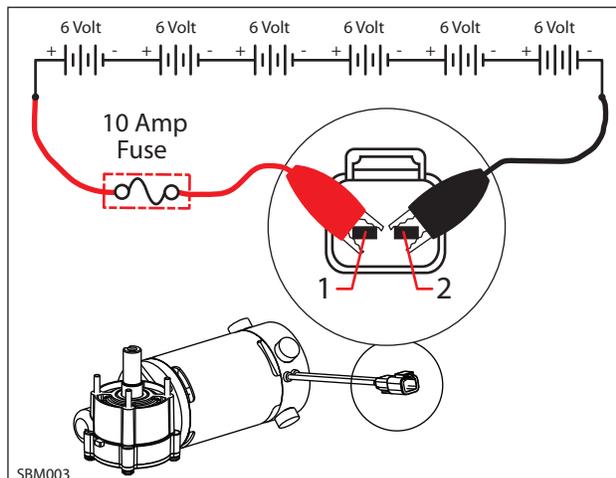
3. Inspect carbon brushes. Replace carbon brushes if they are shorter than 10mm (0.375 in).



SBM002

4. Use fuse-protected jumper leads to apply battery voltage to the side brush motor. The side brush motor should turn On.

Replace the side brush stop motor if it fails to turn on.

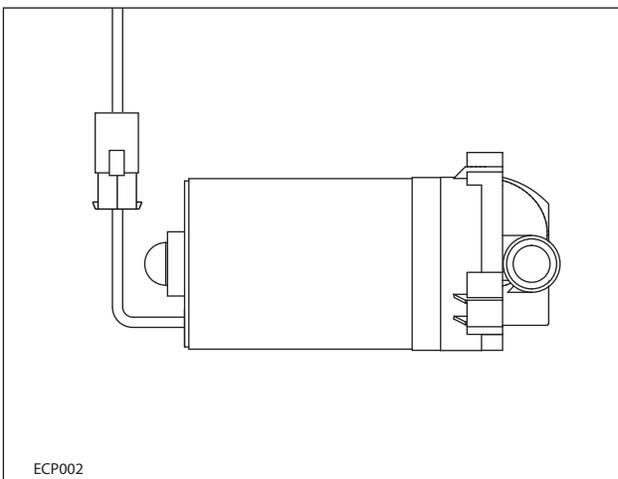


SBM003

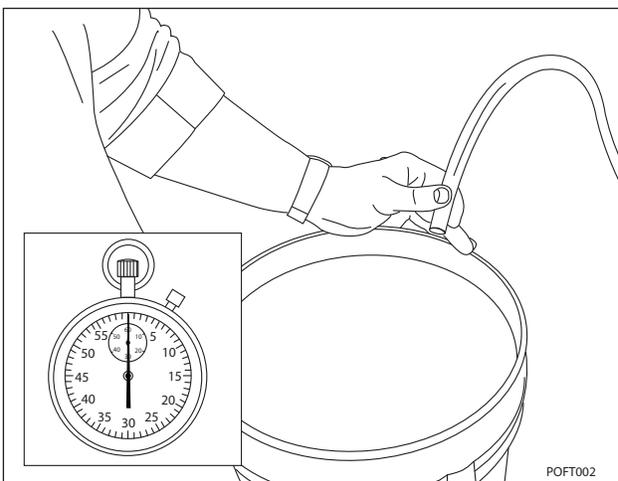
TESTING THE *ec-H2O* PUMP

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

1. Turn key switch OFF.
2. Disconnect *ec-H2O* pump outlet hose.



3. Fill the solution tank.
4. Connect a temporary outlet hose to the pump. The hose must be long enough to reach a 5-gallon bucket.

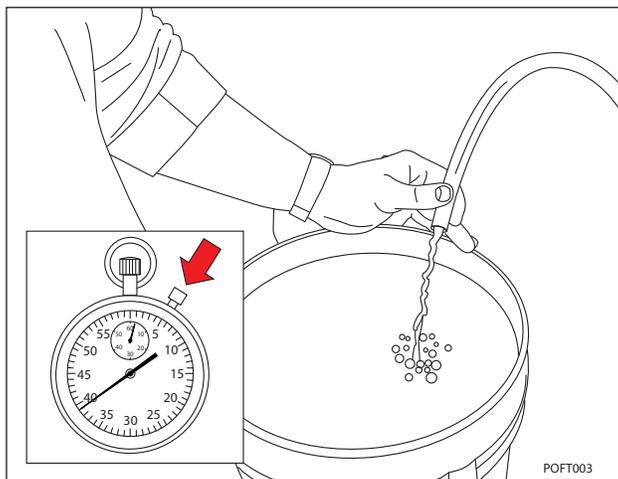


5. Enter Manual Mode and enable the *ec-H2O* system. See *MANUAL MODE* section of this manual.

6. Use a stop watch to time how long it takes to fill a 5-gallon bucket. The open flow specification for the *ec-H2O* pump is 1.8 GPM. The pump should fill the 5-gallon bucket in approximately 2.7 - 3.0 minutes.

Replace the pump if it takes longer than 3.5 minutes to fill the bucket.

NOTE: Open flow is different than system flow and should not be used for scrubbing mode water consumption calculations.



ADJUSTING *ec-H2O* FLOW RATE

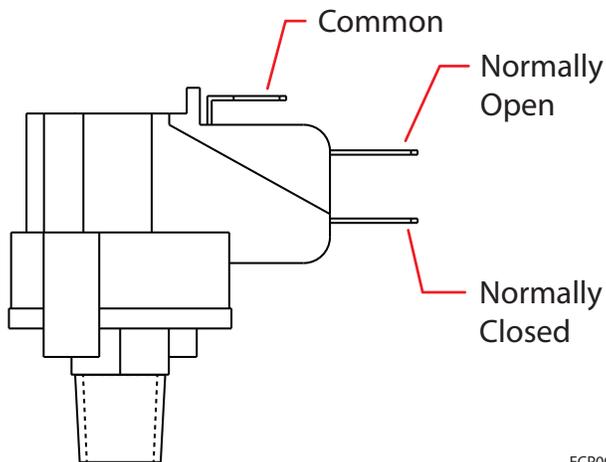
See *CONFIGURATION MODE* in this section of this manual.

TESTING THE *ec-H2O* PRESSURE SWITCH

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

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

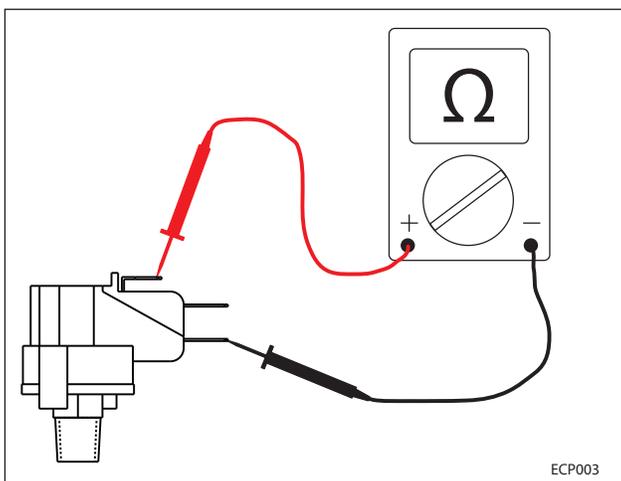
1. Turn key switch OFF.
2. Disconnect the pressure switch from the wire harness and remove the switch from the machine.



ECP001

3. Use an ohmmeter to test the resistance of the switch between the common and normally closed terminals. There should be 0-1 Ω resistance.

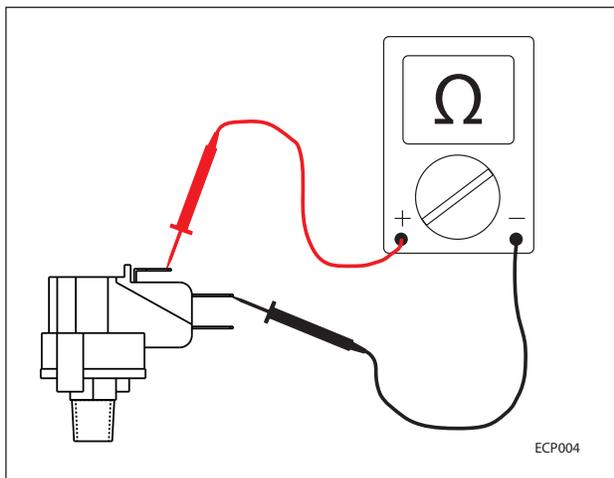
Replace the switch if the N.C. contacts are open.



ECP003

4. Use an ohmmeter to test the resistance of the switch between the common and normally open terminals. The switch should test as "O. L." or open.

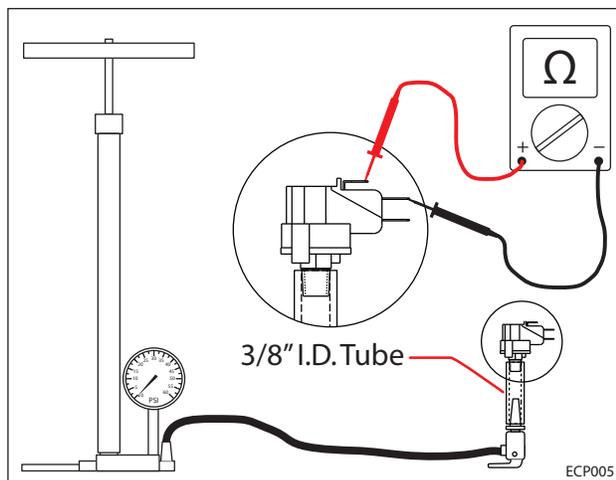
Replace the switch if the N.O. contacts are shorted.



ECP004

5. Use a bicycle pump with pressure gauge to apply pressure to the switch. The normally open contacts should close at 20 +/- 2 psi (1.4 Bar), increasing pressure.

Replace the switch if it does not open correctly.



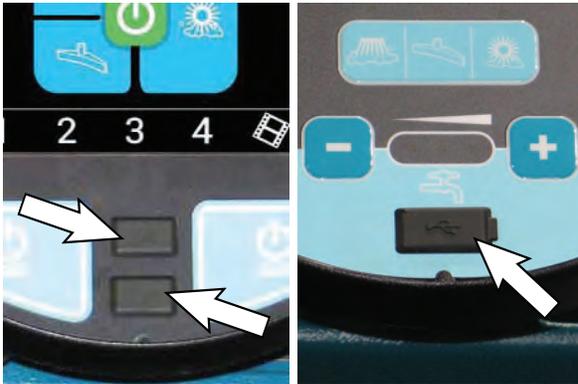
ECP005

DISPLAYING FAULT CODES ON SERVICE DEVICE

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

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

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



2. Turn key switch ON.



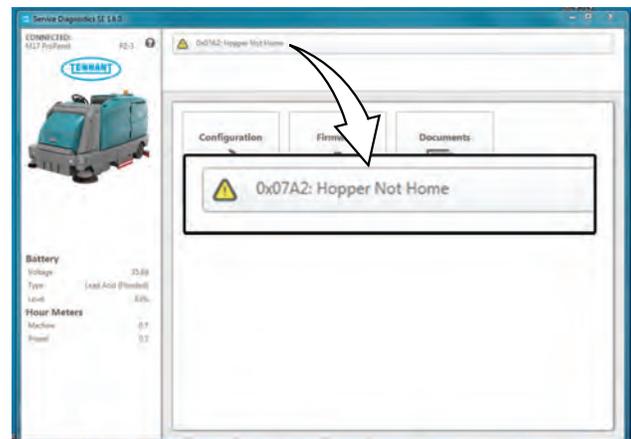
3. Double click the Service Diagnostics desktop shortcut or find the software in All Programs to launch the software.

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.

SERVICE

SERVICE DIAGNOSTICS TOOL

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

Factory-Direct Tennant Service personnel have this software installed on their ServiceLink devices. Authorized service providers can download the Service Diagnostics software. Authorized service providers must uninstall and reinstall the service diagnostic program to get firmware updates. The authorized service provider version does not self update.

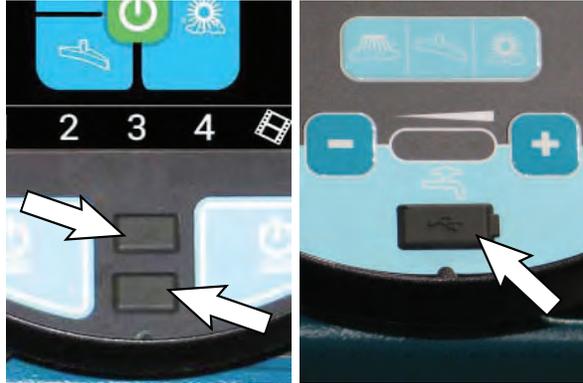
A USB cable connects from the service device to the control console (USB to mini USB adapter cable required). The SERVICE DIAGNOSTICS TOOL can configure multiple control modules. The interface module stores configuration data and communicates via RS232 serial communication with the main control module and through a CAN (controller area network) to all other modules.

- **Interface Module:** Located inside the pod.
- **Main Scrub/Solution Delivery Module:** Located inside the electrical box beneath the operator compartment.
- **Combo Module (Water Pickup):** Located inside the electrical box beneath the operator compartment.
- **Side Scrub Module (option):** Located inside the electrical box beneath the operator compartment.
- **Side Sweep/Vacuum Module:** Located inside the sweep electrical box on the left lintel of the machine frame.
- **Propel Controller:** Located on the steering support channel.
- **Power Steering Module (option):** Located on the steering support channel.
- **IRIS Module (option):** Mounted to the lower front left side of the machine frame.
- **ec-H2O NanoClean Module (option):** Located next to the electrical box beneath the operator compartment.

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 key switch ON.

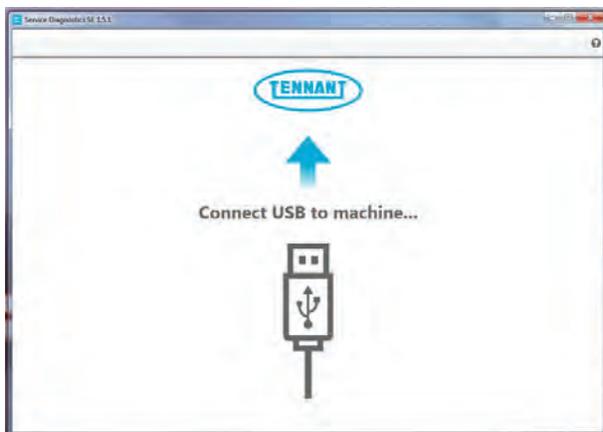


- Double click the Service Diagnostics desktop shortcut or find the software in All Programs to launch the software.

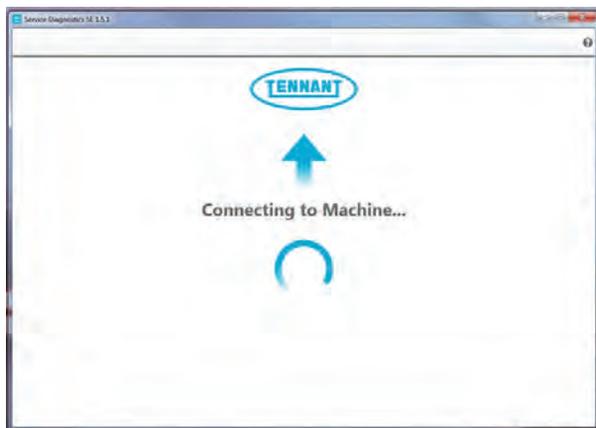
NOTE: Computer may prompt a restart after installing the machine driver. Decline the restart, close Service Diagnostics, and relaunch Service Diagnostics.



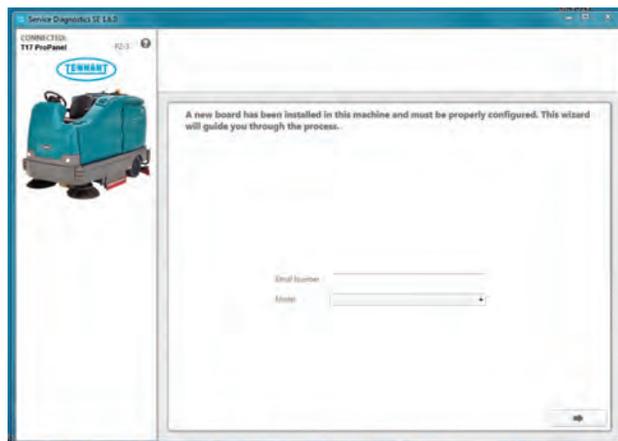
NOTE: Confirm key switch is ON and check USB cable connection to the machine if the screen below appears on the computer screen.



- 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.



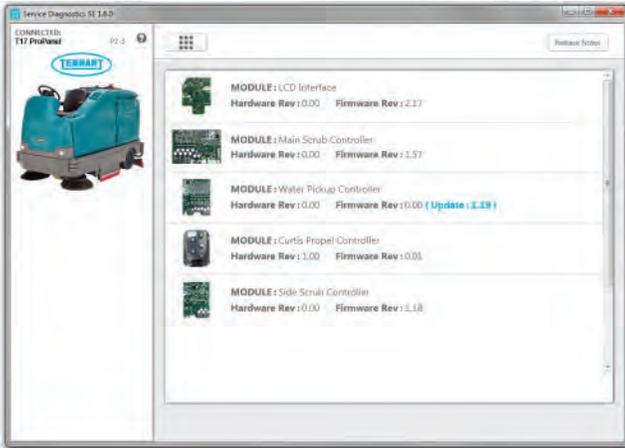
- Inspect the actual machine configuration and match applicable configurations from the drop-down menus and then click on the arrow button.

NOTE: Reconfiguring may take several minutes.

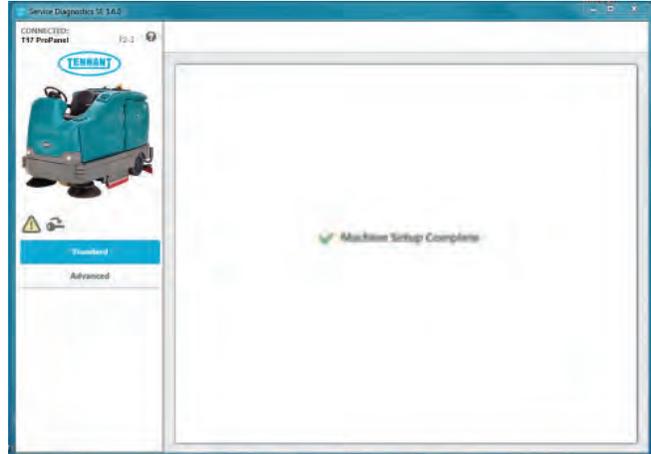
NOTE: Configurations may differ from what is shown, depending on the options/features equipped on the machine. If no interface module was installed, this screen will appear first. First confirm there is no Firmware update available. If a Firmware update is available, the Firmware update should be done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



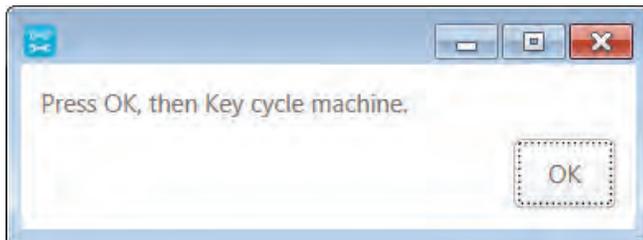
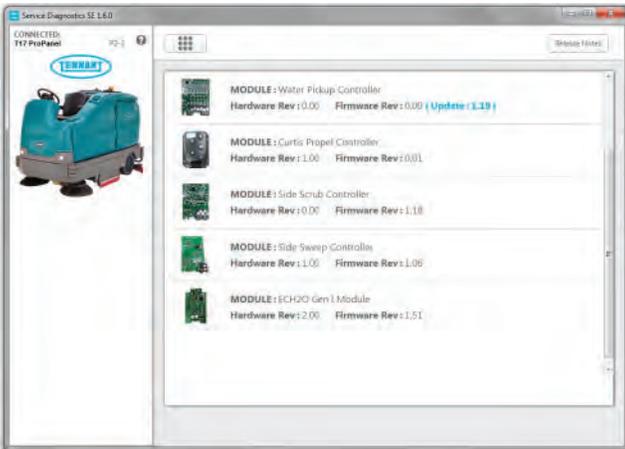
- The programming process begins and all control modules are updated (if applicable).



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



- 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.



UPDATING THE MACHINE FIRMWARE

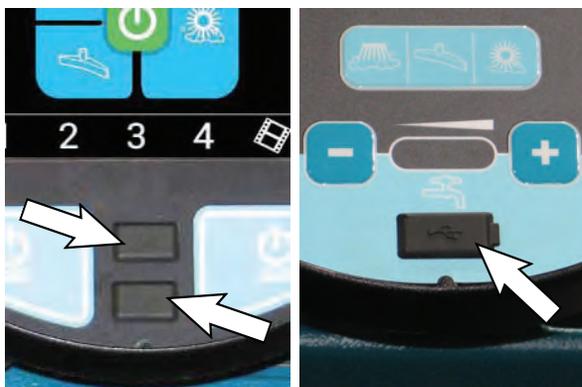
SYSTEM REQUIREMENTS: Windows® 7 Operating System, Microsoft .NET 4.5 or later, USB to Mini-USB cable.

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

Factory-Direct Tennant Service personnel have this software installed on their ServiceLink devices. Authorized service providers can download the Service Diagnostics software. Authorized service providers must uninstall and reinstall the service diagnostic program to get firmware updates. The authorized service provider version does not self update.

A USB cable connects from the service device to the control console (USB to mini USB adapter cable required). The SERVICE DIAGNOSTICS TOOL can configure multiple control modules. The interface module stores configuration data and communicates via RS232 serial communication with the main control module and through a CAN (controller area network) to all other modules.

1. Connect a USB cable from the service device to the machine.



2. Turn key switch ON.



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

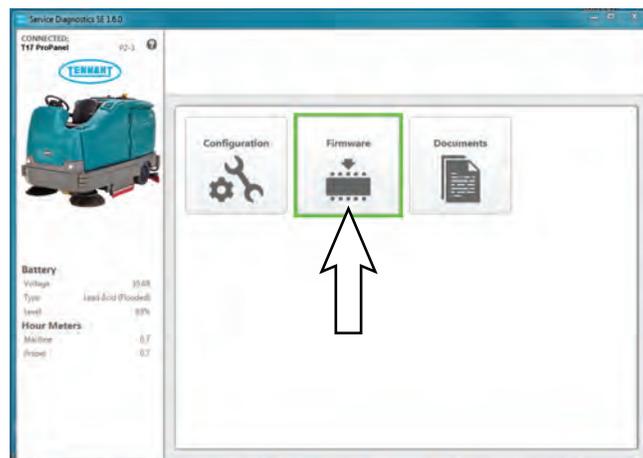
NOTE: Computer may prompt a restart after installing the machine driver. Decline the restart, close Service Diagnostics, and relaunch Service Diagnostics.



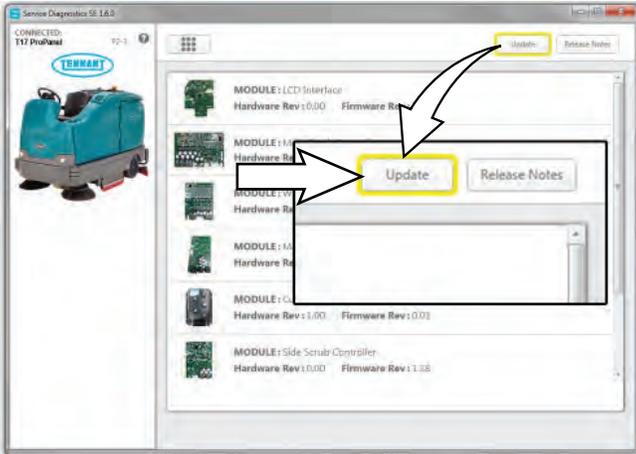
Service Diagnostics

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.

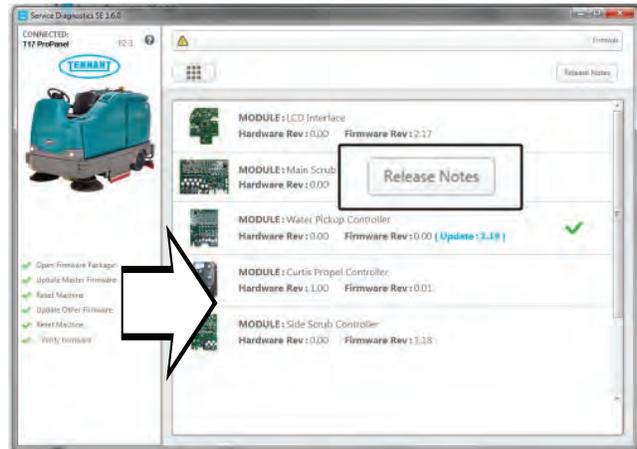
NOTE: Update installation may take several minutes. Do not interrupt process unless prompted.



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

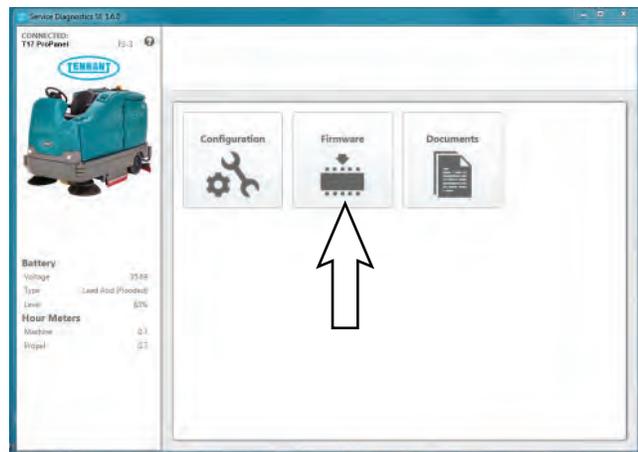
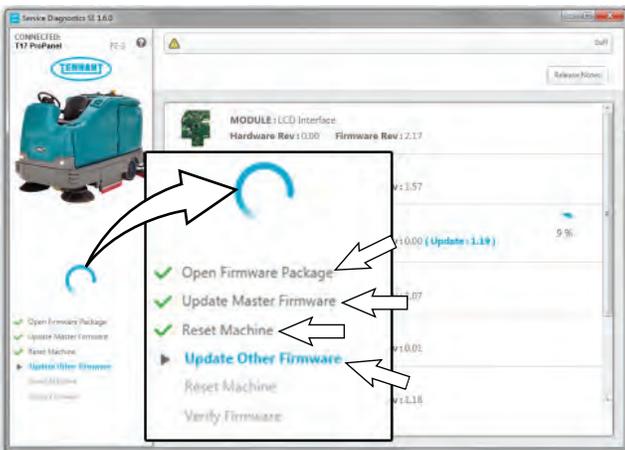


The process indicator will disappear from the screen and all items in the firmware update status bar will have check marks to the left to verify the firmware has occurred.



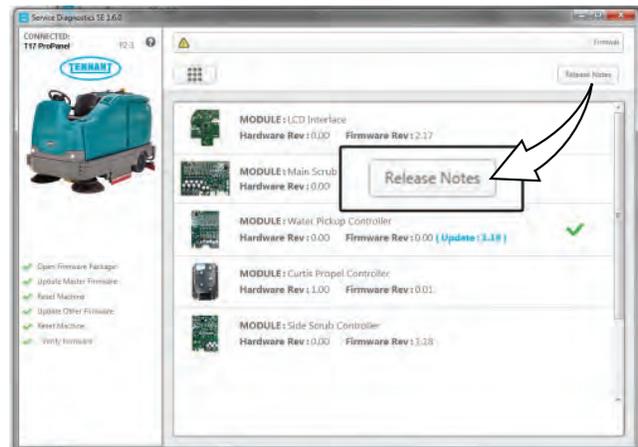
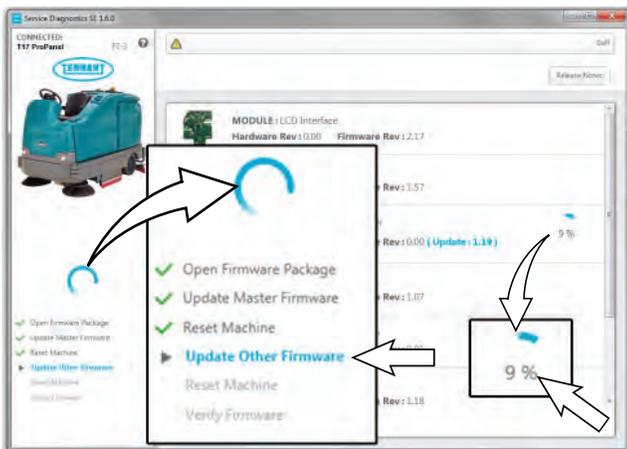
- The firmware package opens and "Update Master Firmware" begins. The process indicator and firmware update status bar appear on the left side of the screen.

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



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 update status.

- Cycle the key switch to save the firmware updates.
- Click the Release Notes button to access the attached PDF notes for the firmware updates.



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

T17 ProPanel Firmware Release Notes



<u>Package</u>				
<u>Version</u>	<u>Release Date</u>	<u>Firmware Revision</u>		<u>Changes</u>
1.26/1.27	2018.03.26	User Interface:	1.29	<ul style="list-style-type: none"> ▪ Fixed Main sweep actuator over extension issue ▪ Fixed the fault code text display for Vac Fan Fault ▪ Sweeping system will shut down if contactor relay opens ▪ Battery selection indicated by green checkmark in Battery menu ▪ Progress bar added to checklist export screen ▪ Fixed Boost Icon bug on Home Screen
		Side Sweep:	1.06	
		Main Scrub:	1.57	
		Water Pickup:	1.17	
		Side Scrub:	1.13	
		EC-h2o:	1.51	

RECONFIGURING THE MACHINE AFTER NEW HARDWARE/OPTION INSTALLATION

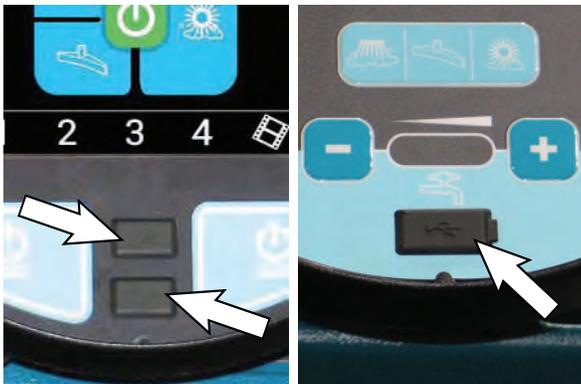
SYSTEM REQUIREMENTS: Windows® 7 Operating System, Microsoft .NET 4.5 or later, USB to Mini-USB cable.

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

Factory-Direct Tennant Service personnel have this software installed on their ServiceLink devices. Authorized service providers can download the Service Diagnostics software. Authorized service providers must uninstall and reinstall the service diagnostic program to get firmware updates. The authorized service provider version does not self update.

A USB cable connects from the service device to the control console (USB to mini USB adapter cable required). The SERVICE DIAGNOSTICS TOOL can configure multiple control modules. The interface module stores configuration data and communicates via RS232 serial communication with the main control module and through a CAN (controller area network) to all other modules.

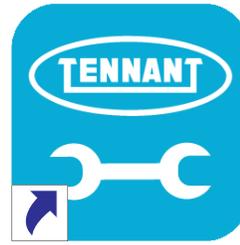
1. Connect a USB cable from the service device to the machine.



2. Turn key switch ON.

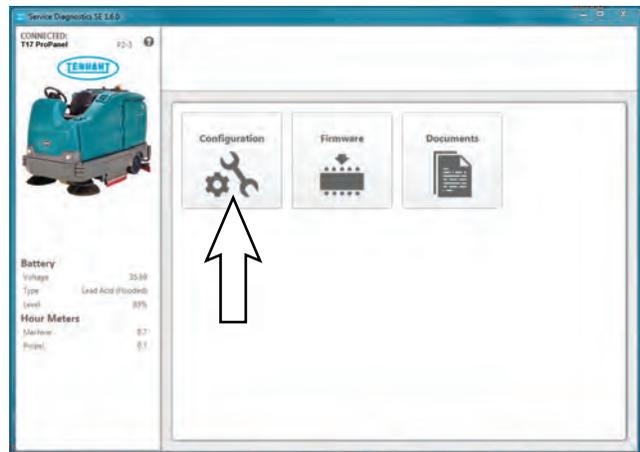


3. Double click the Service Diagnostics desktop shortcut or find the software in All Programs to launch the software.

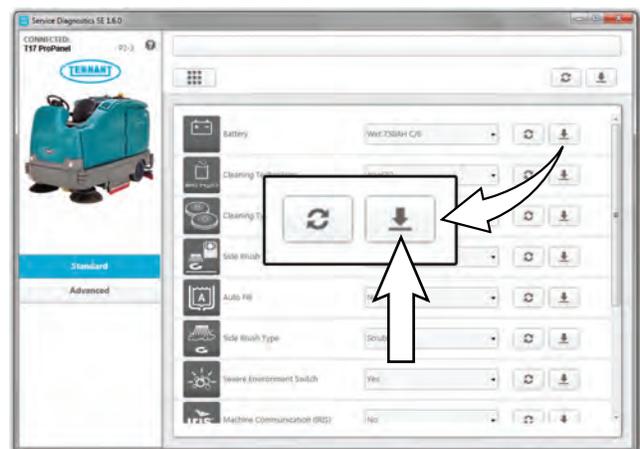


Service Diagnostics

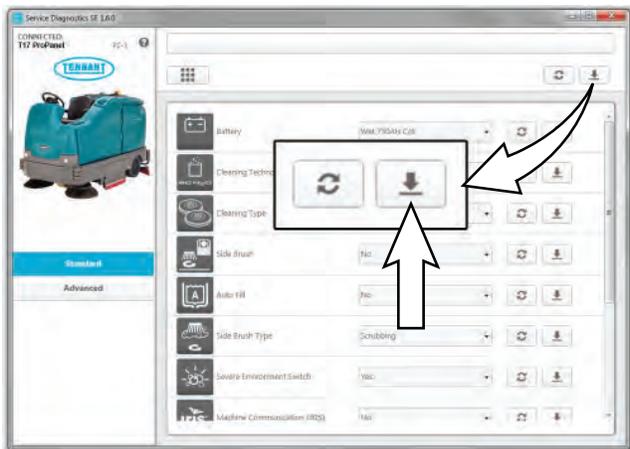
4. Click on the Configuration button to display a list of configurable options.



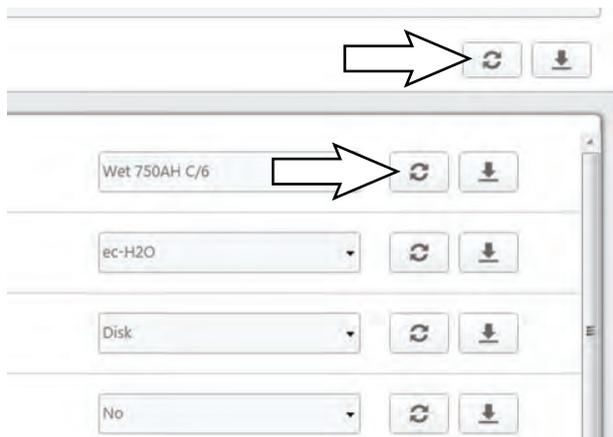
5. Select the configurable options that apply from the drop down menus and then click individual arrow buttons to launch individual module reprogramming (this is faster).



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



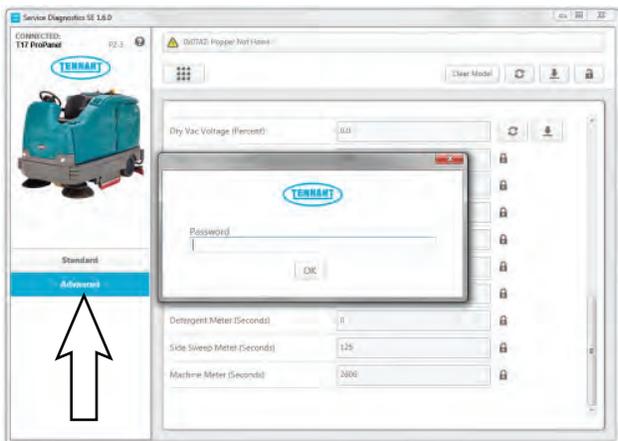
- Click the refresh button to display the new configuration after reprogramming is completed.



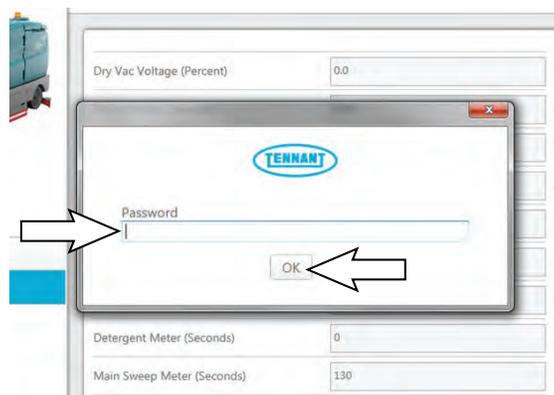
- Cycle the key switch to save the new configuration setting(s).

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

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

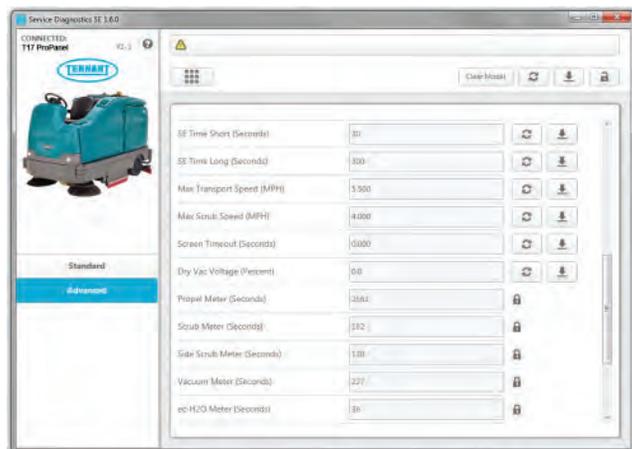
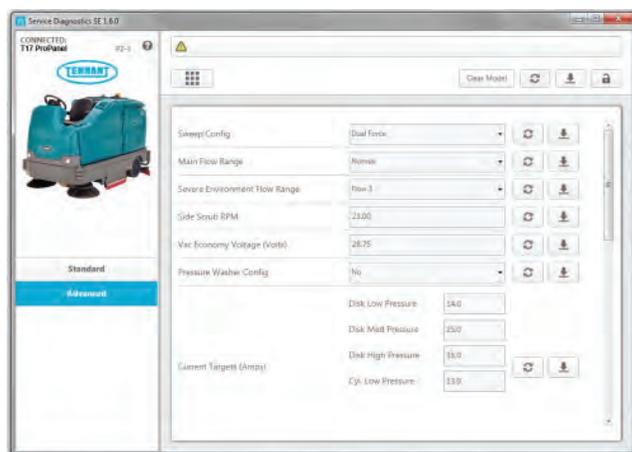


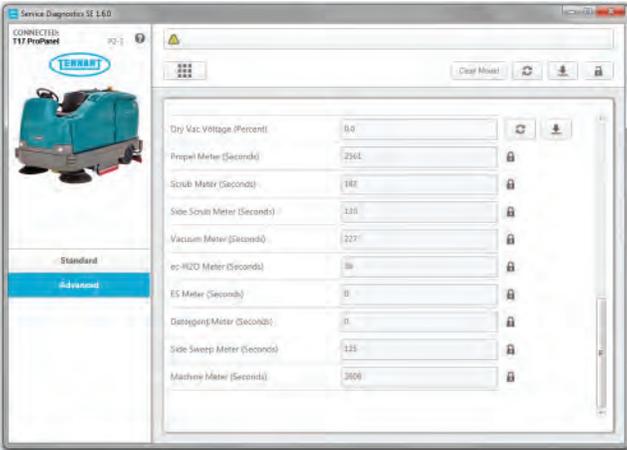
- Enter the password into the password box and click the OK button. Contact T.A.C. (Tennant Assistance Center) for required password.



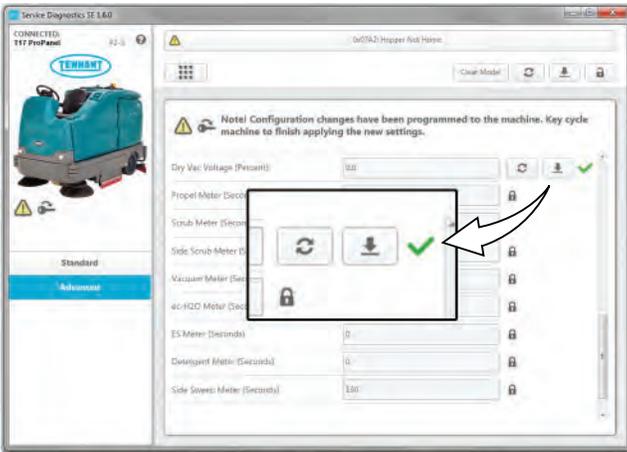
- Access the advanced configuration screen to reset component hours or record old hours on repair order for warranty purposes.

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

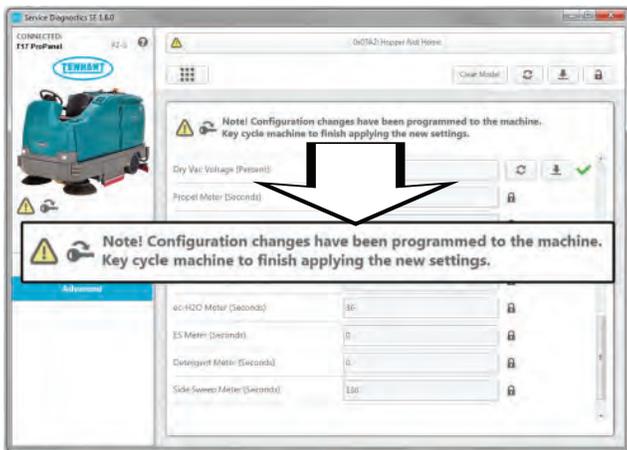




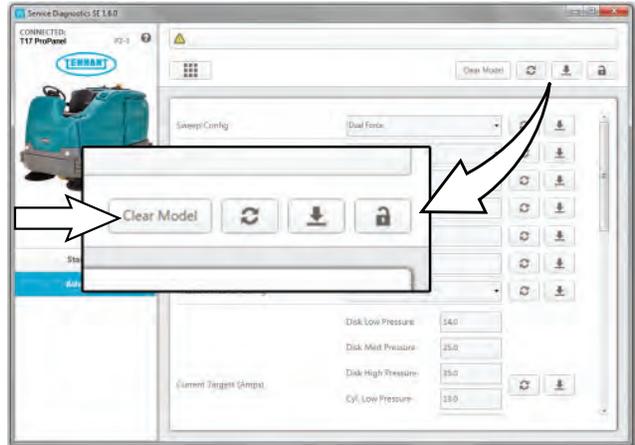
12. A check appears next to the item reconfigured after reconfiguring is complete.



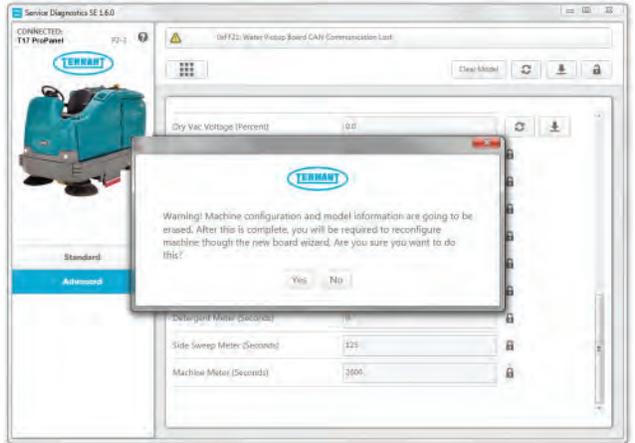
Cycle the key switch to save the new advanced configuration setting(s). That setting(s) will not be saved until the machine is key cycled.



13. If the machine must be completely reconfigured, select the Clear Model button to completely clear all previous machine configuration parameters and completely reconfigure the machine.



14. A warning box appears stating "Warning! Machine configuration and model information are going to be erased. After this is complete, you will be required to reconfigure machine through the new board wizard. Are you sure you want to do this?" Select the Yes button to continue complete reconfiguring the machine.



Select the No button to cancel complete machine configuration and return to Advanced configuration screen.

**ACCESSING SUPPORT DOCUMENTATION
(AVAILABLE TO FACTORY-DIRECT SERVICE
PERSONNEL ONLY)**

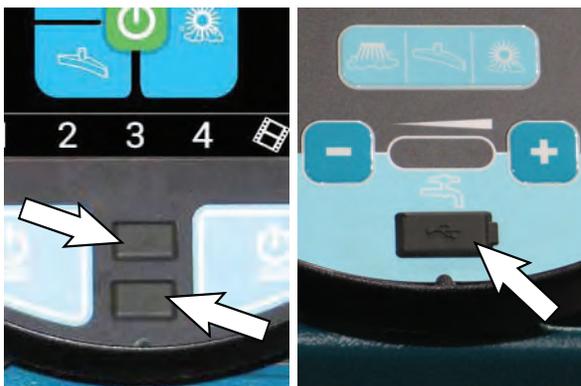
SYSTEM REQUIREMENTS: Windows® 7 Operating System, Microsoft .NET 4.5 or later, USB to Mini-USB cable.

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Factory-Direct Tennant Service personnel have this software installed on their ServiceLink devices.

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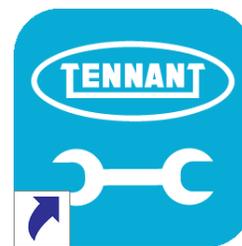
1. Connect a USB cable from the service device to the machine.



2. Turn key switch ON.

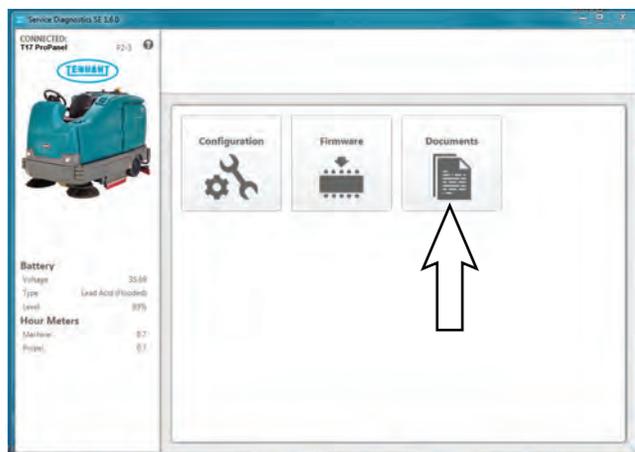


3. Double click the Service Diagnostics desktop shortcut or find the software in All Programs to launch the software.

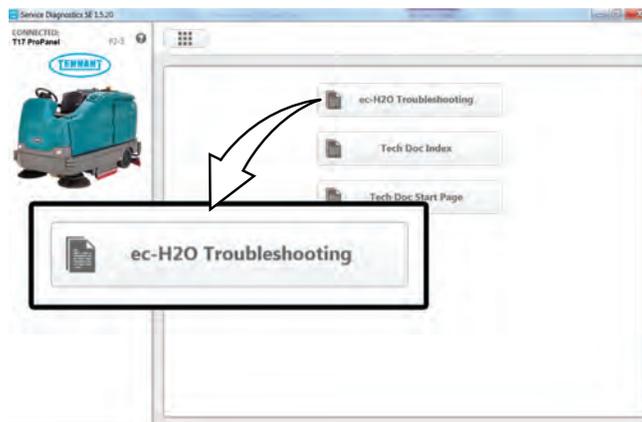


Service
Diagnostics

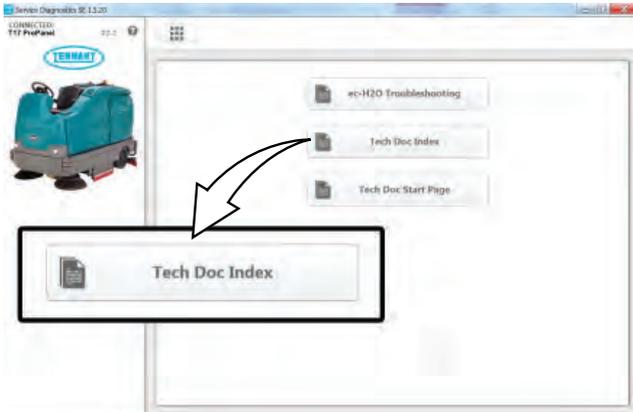
4. Click on the Documentation button to display a list of support documentation.



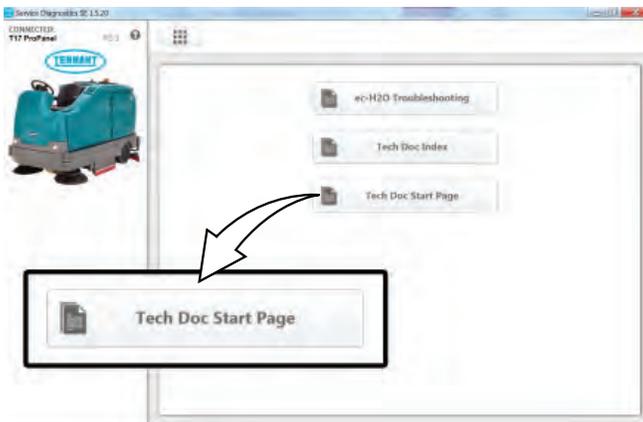
5. Click on the appropriate button to access needed support documentation. Click on the ec-H2O Troubleshooting button to access ec-H2O troubleshooting documentation.



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

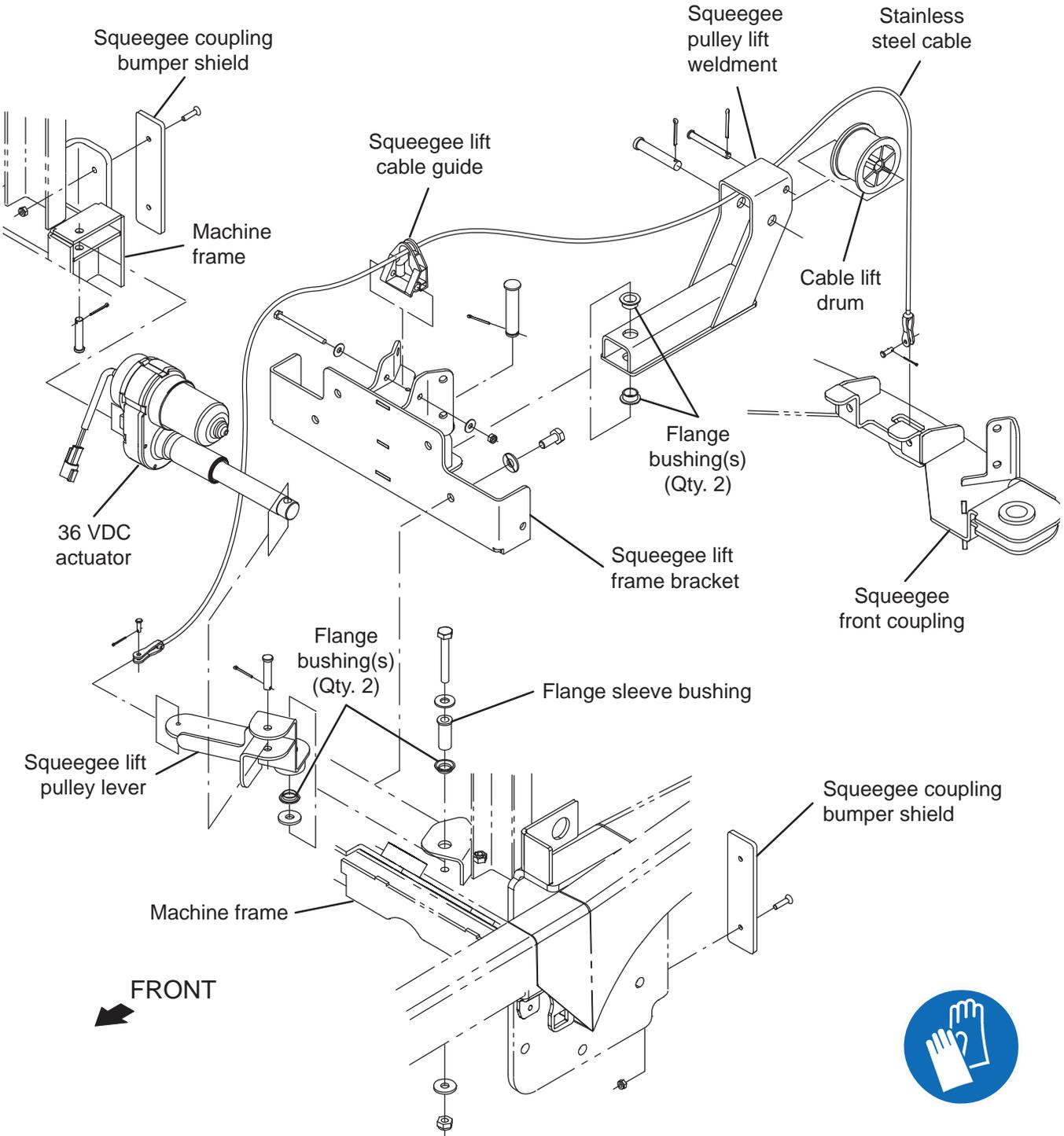


Click on the Tech Doc Start Page button to access the Technical Publications Start Page.



CLEANING SYSTEMS

REMOVING THE REAR SQUEEGEE LIFT ACTUATOR



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

1. Remove the rear squeegee.



2. Jack up the back end of the machine. See *MACHINE JACKING* in the *MAINTENANCE* section for additional machine jacking and safety information.

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

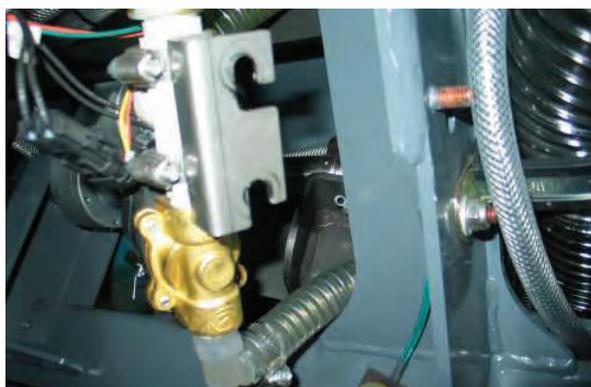
3. Proceed to the following step if actuator failed in lowered position. Use a spacer block to support rear squeegee mounting bracket and remove spring tension from the lift cable.



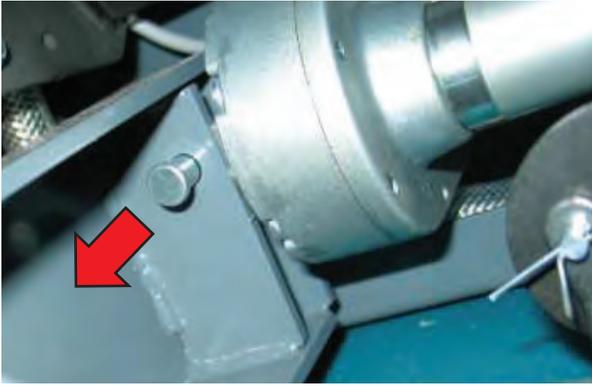
4. Turn key switch ON. Enter Manual Mode and completely lower the scrub head (See *MANUAL MODE* in the *TROUBLESHOOTING* section of this manual). Turn key switch OFF immediately when the head touches the floor.

NOTE: Cylindrical Scrub Head Only: Remove debris tray from rear of scrub head to allow for additional clearance.

5. Loosen auto-fill valve mounting bracket (option) and carefully move the valve assembly aside to allow access to the lift actuator clevis pin.



6. Remove lift actuator cotter and clevis pins and set hardware aside. Cut zip tie and disconnect lift actuator from wire harness.



7. Remove the rear squeegee lift actuator.



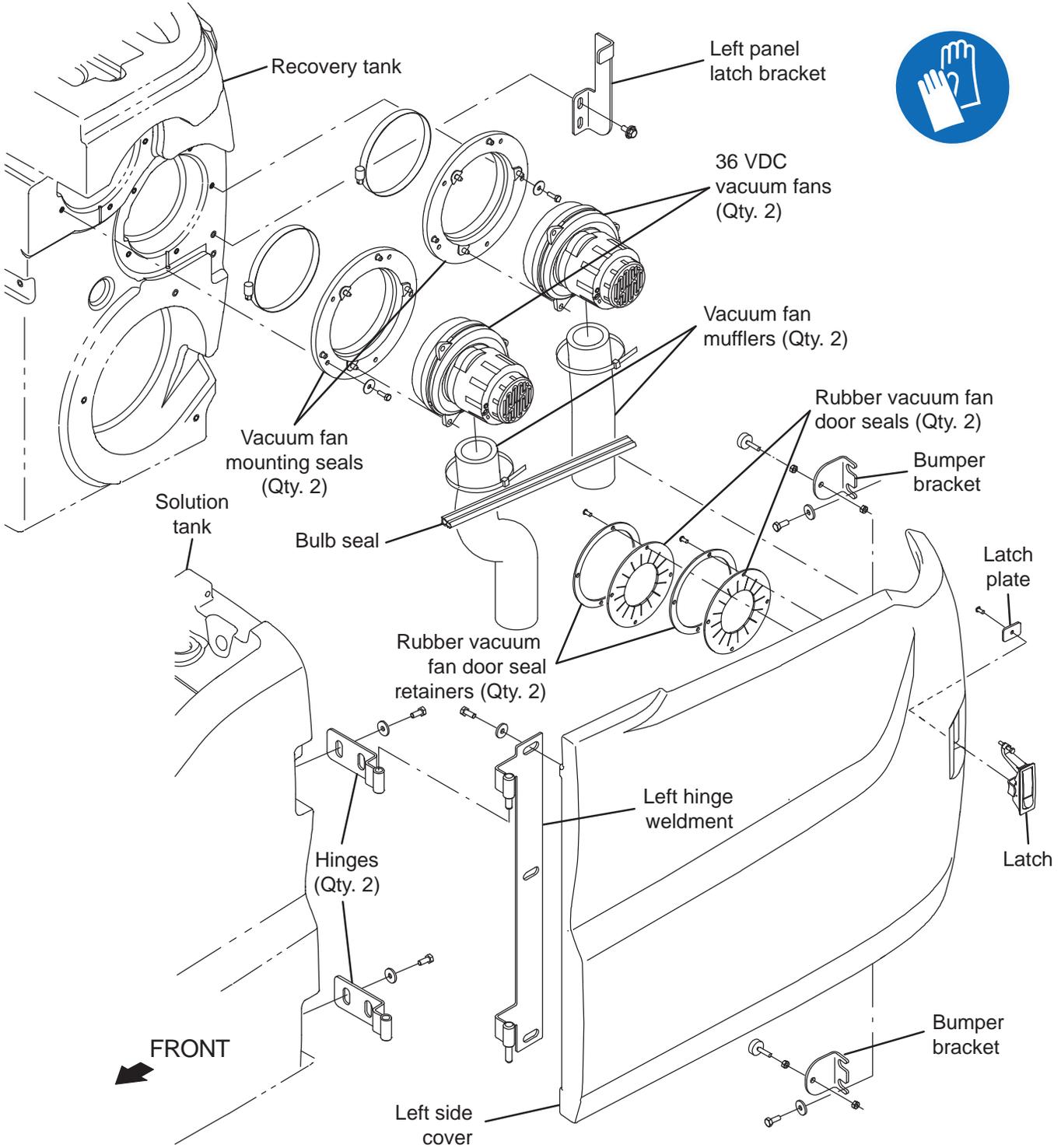
1. Reinstall the rear squeegee lift actuator in reverse of disassembly.

REAR SQUEEGEE LINKAGE ROD ADJUSTMENT

1. The initial squeegee linkage rod adjustment is 11.5 in (29.2 cm) center-to-center.



REMOVING/REPLACING/INSTALLING THE RECOVERY TANK VACUUM FAN(S)



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

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

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

4. Disconnect vacuum fan from wire harness connections.



5. Remove vacuum fan mounting hardware (5).



6. Remove the vacuum fan assembly.



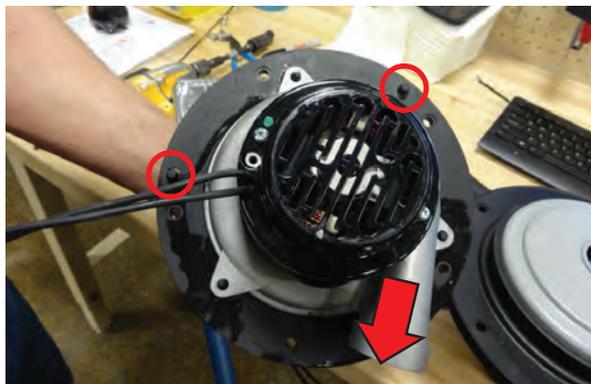
7. Draw a line across the vacuum fan assembly and the mounting flange as an orientation indicator for reassembly.



8. Loosen the clamp and remove mounting flange from vacuum fan assembly.



9. Disconnect muffler from vacuum fan assembly.
10. Proceed to *REMOVING/INSPECTING/REPLACING THE RECOVERY TANK VACUUM FAN CARBON BRUSHES* if replacing the brushes.
11. Reassemble the vacuum fan is reverse order of disassembly. Note the orientation of the vacuum fan exhaust port to the rubber indicators.



12. Reassemble the vacuum fan onto the recovery tank in reverse order of disassembly.

REMOVING/INSPECTING/REPLACING THE RECOVERY TANK VACUUM FAN CARBON BRUSHES

NOTE: Carbon brushes should be replaced as sets.

1. Remove the vacuum fan from the machine. See *REMOVING/INSTALLING THE RECOVERY TANK VACUUM FAN(S)* in this section manual.
2. Remove hardware securing the vacuum fan cover assembly to the vacuum fan motor and remove the vacuum fan cover assembly from the motor.



3. Loosen the carbon brush mounting hardware.



4. Lift up to release and remove carbon brushes from the vacuum fan motor.

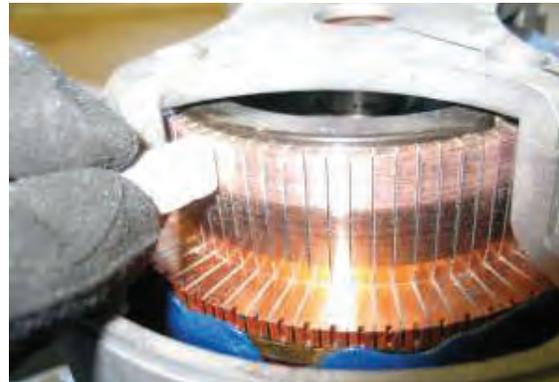


5. Inspect carbon brushes. Replace carbon brushes if they are stuck or are less than 10 mm (0.375 in) in length.

NOTE: Carbon brushes should be replaced as sets.

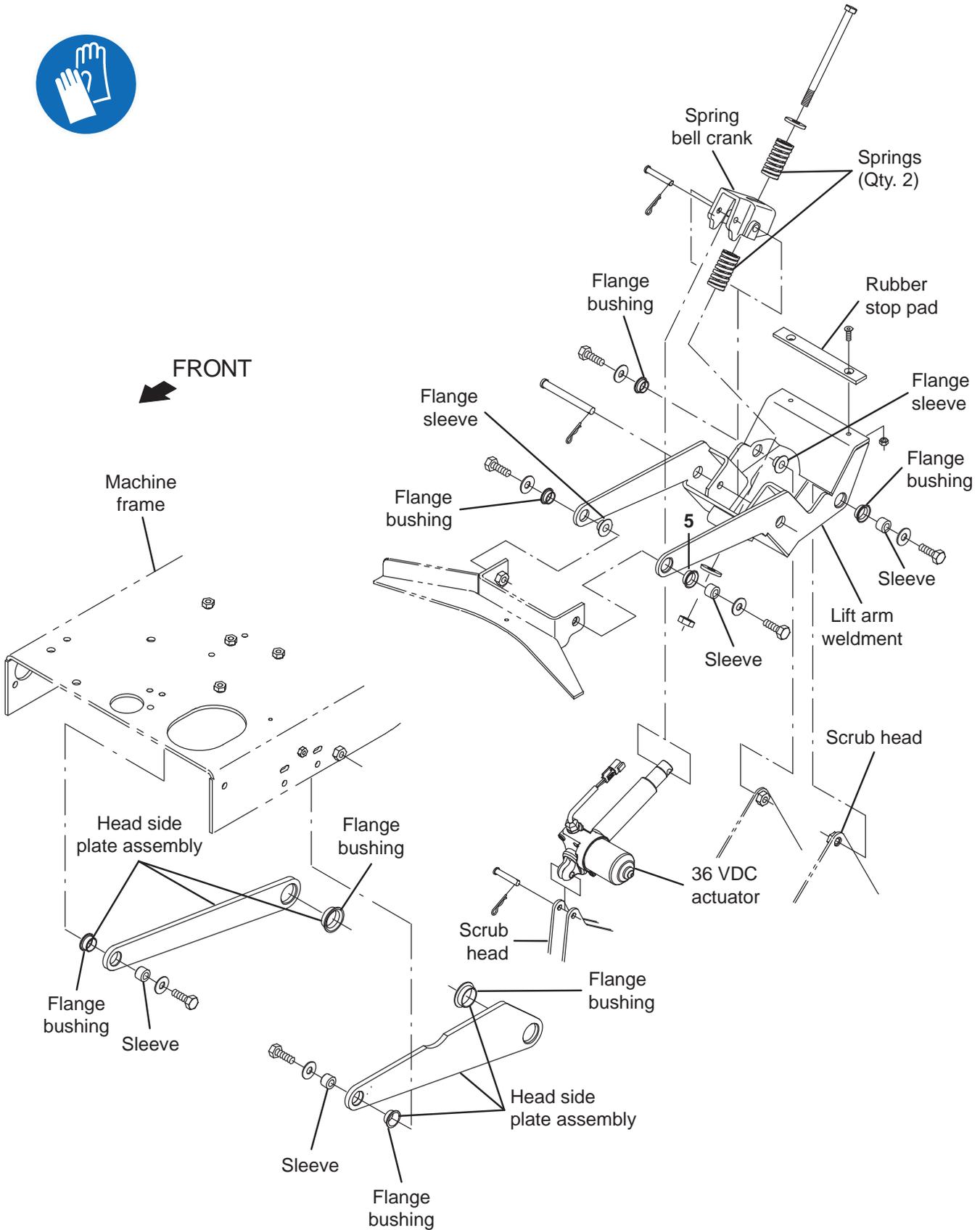


6. Use a stone to clean the commutator,



7. Use compressed air to clean dust from inside the vacuum fan motor.
8. Reinstall the removed vacuum fan brushes/install the new vacuum fan brushes in reverse order of disassembly.
9. Reinstall the vacuum fan onto the machine. See *REMOVING/INSTALLING THE RECOVERY TANK VACUUM FAN(S)* in this section of manual.

REMOVING/REINSTALLING THE SCRUB HEAD
LIFT ACTUATOR



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

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

1. Turn key switch OFF.
2. Disconnect the battery cable from the machine.
3. Remove the scrub brushes.
4. Carefully remove front linkage pivot bolts (Qty. 2).

NOTE: The front of the scrub head will drop to the floor once the mounting hardware is removed.



5. Carefully remove rear linkage pivot bolts (Qty. 2).

NOTE: The rear of the scrub head will drop to the floor once the mounting hardware is removed.



6. Jack up the front of machine. See *MACHINE JACKING* in the *MAINTENANCE* section for additional machine jacking and safety information.

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

7. Disconnect the wire harness from the lift actuator.
8. Remove lift actuator mounting pins (Qty. 2).



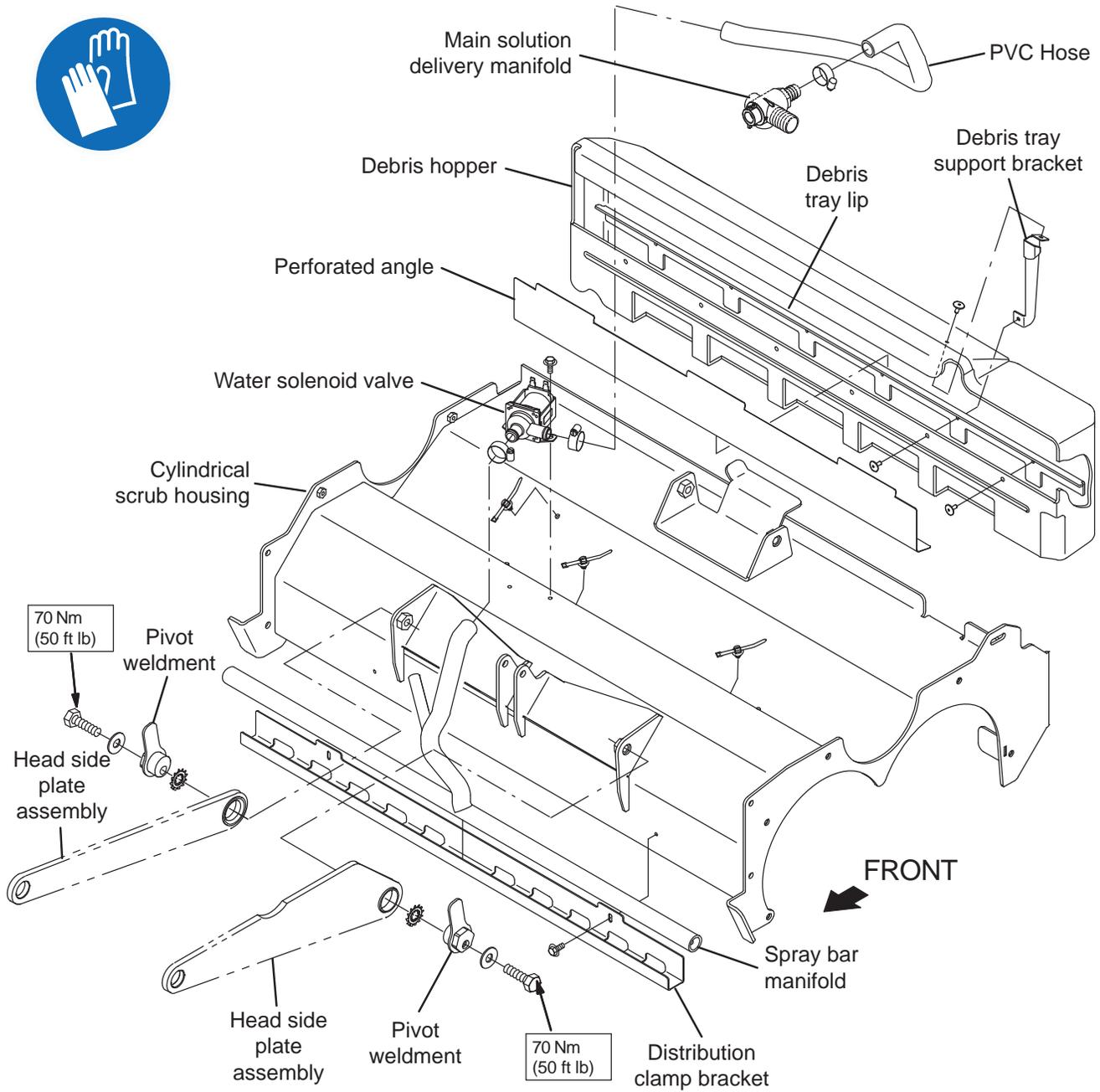
9. Remove the scrub head lift actuator.

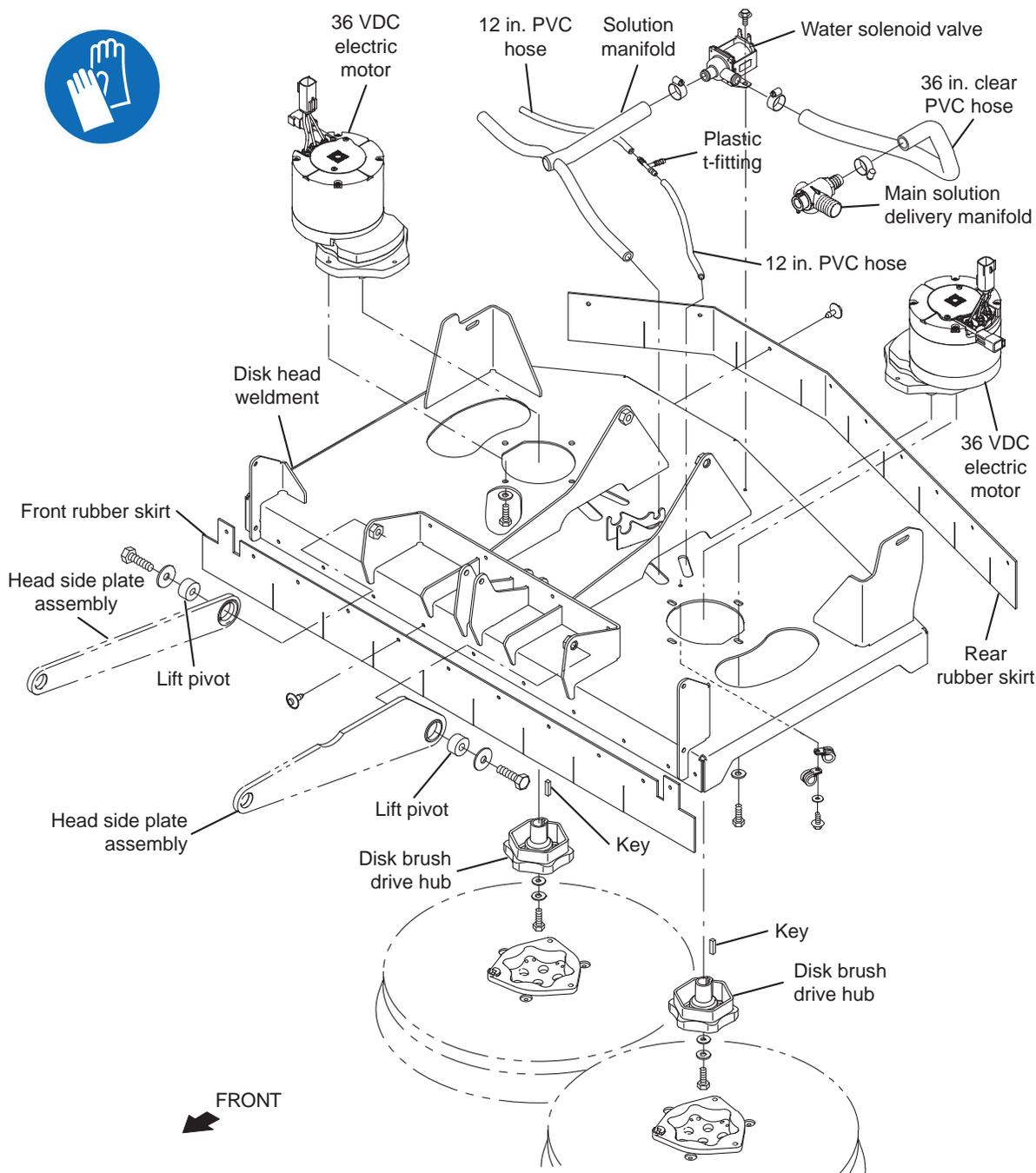


10. Reinstall the scrub head lift actuator in reverse order of disassembly.

NOTE: The scrub head actuator does not require an installation adjustment. This actuator is controlled via current, not limits or switches. Turn the actuator tube manually to align the mounting holes and insert clevis and cotter pins.

REMOVING/REINSTALLING THE SCRUB HEAD
(CYLINDRICAL AND DISK)





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

1. Drain solution tank.
2. Turn key switch OFF.
3. Disconnect the battery cable from the machine.
4. Remove scrub brushes.
5. Remove the debris tray (machines with cylindrical scrub heads only).

6. Jack up the front of machine. See *MACHINE JACKING* in the *MAINTENANCE* section for additional machine jacking and safety information.

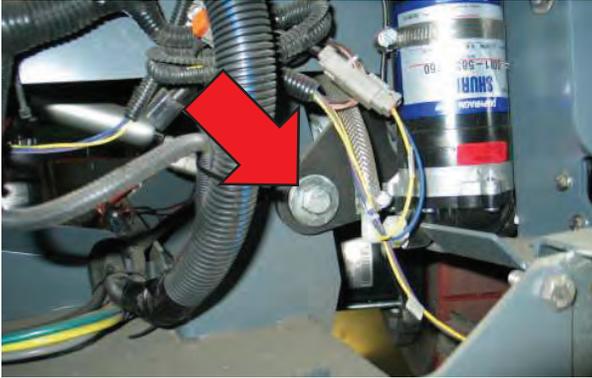
FOR SAFETY: When servicing machine, block machine tires before jacking machine up. Use a hoist or jack that will support the weight of the machine. Jack machine up at designated locations only. Support machine with jack stands.

SERVICE

- Turn key switch ON. Enter Manual Mode and completely lower the scrub head (See *MANUAL MODE* in the *TROUBLESHOOTING* section of this manual). Turn key switch OFF immediately when head touches the floor.

- Carefully remove front linkage pivot bolts (Qty. 2).

NOTE: The front of the scrub head will drop to the floor when the mounting hardware is removed.



- Carefully remove rear linkage pivot bolts (Qty. 2).

NOTE: The rear of the scrub head will drop to the floor when the mounting hardware is removed.

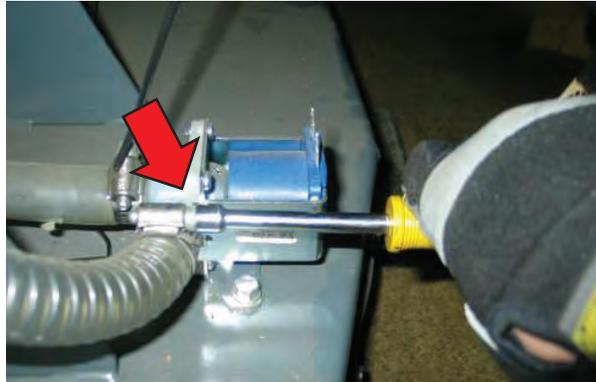


- Disconnect the main wire harness from the lift actuator.

- Remove lift actuator mounting pins (Qty. 2).



- Disconnect the main wire harness from the main solution delivery manifold.



- Disconnect the solution hose from the main solution delivery manifold.

- Use a ratchet strap to support the lift mechanism to avoid interference during scrub head removal.



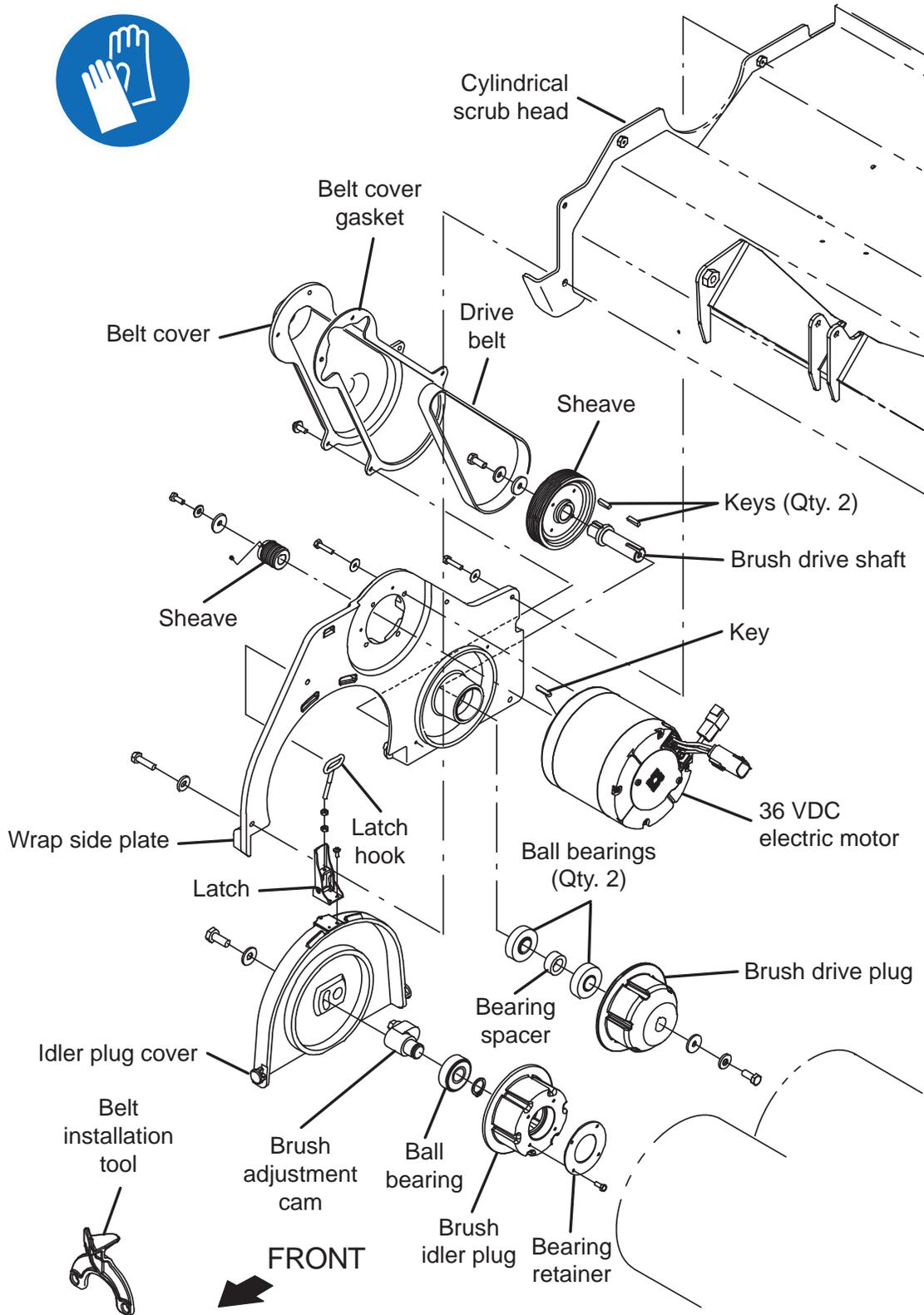
- Remove the scrub head.

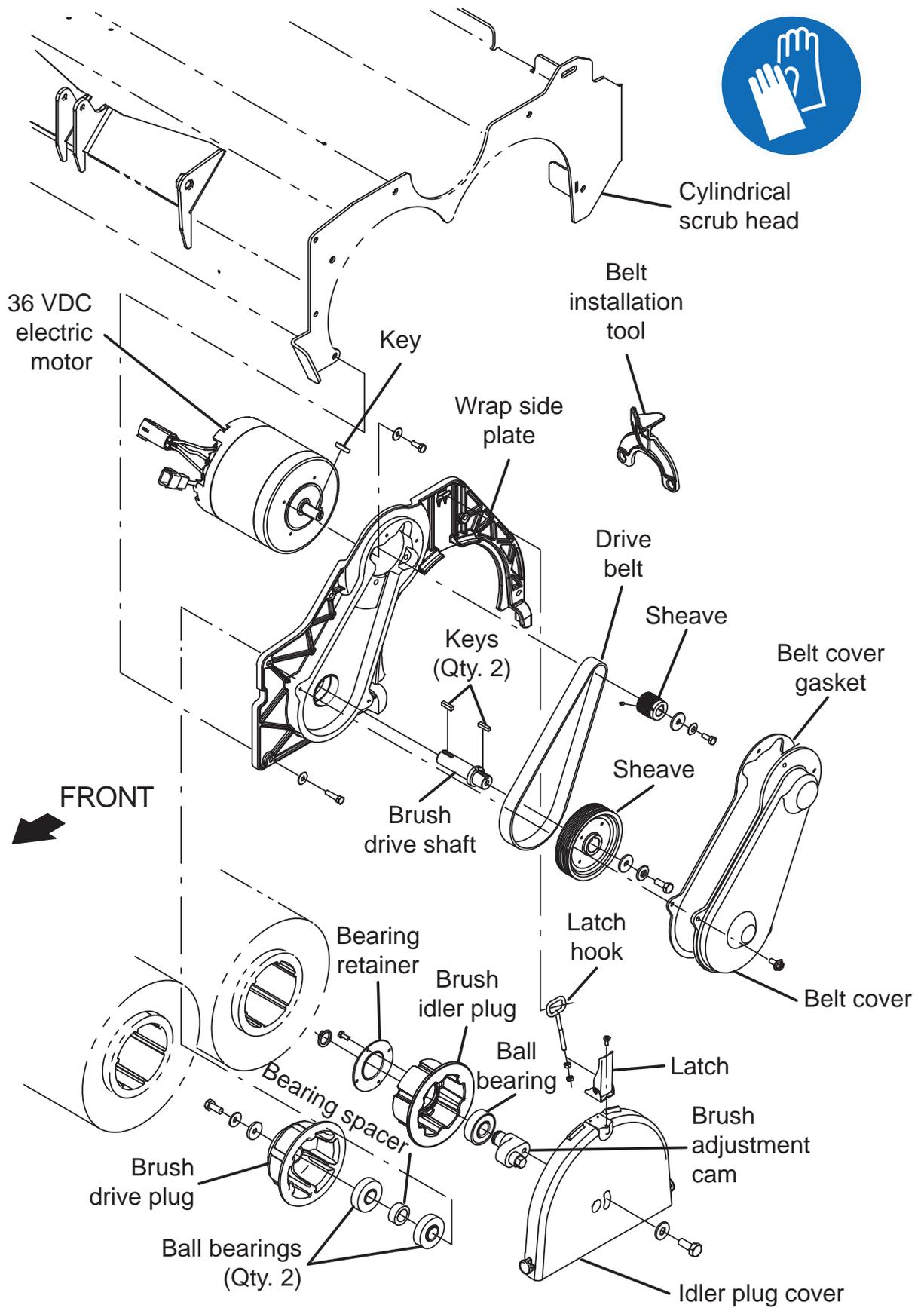
- Reinstall the scrub head back onto the machine in reverse order of disassembly.

NOTE: This actuator does not require an installation adjustment. Turn the actuator tube manually to align the mounting holes and insert clevis and cotter pins.

- Cylindrical scrub head only: Check and adjust the scrub brush pattern. See *CHECKING/ADJUSTING THE CYLINDRICAL SCRUB BRUSH PATTERN* section of this manual.

MAIN SCRUB CYLINDRICAL BRUSH ASSEMBLY





REMOVING/REPLACING THE SCRUB DRIVE BELT

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

1. Turn key switch ON, completely lower the scrub head, turn key switch OFF, and remove the key.
2. Open the main brush access door and side squeegee support door.

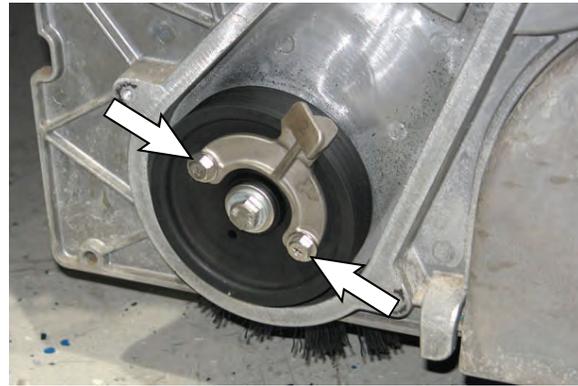


3. Remove the scrubbing drive belt cover from the scrub head.

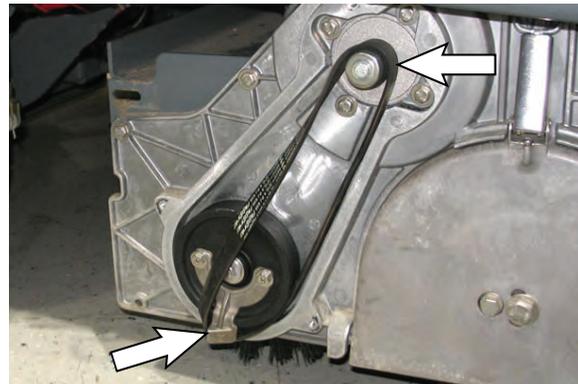


4. If removing/replacing the motor, proceed to *REMOVE SCRUB CYLINDRICAL BRUSH MOTORS*. If replacing the drive belt, proceed to the following step

5. Use two of hex screws/washers removed when the scrubbing belt cover was removed to install the belt installation tool onto the sheave.



6. Position the new cylindrical brush drive belt onto the smaller sheave installed on the electric motor and belt installation tool.



7. Turn the sheave clockwise and coax the belt over the belt installation tool and onto both sheaves. Be sure the belt is completely seated into the grooves in both sheaves.



8. Reassemble items removed to install the new belt in reverse order of disassembly.

REMOVING THE SCRUB CYLINDRICAL BRUSH MOTOR(S)

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

1. Jack up the front of machine. See *MACHINE JACKING* in the *MAINTENANCE* section for additional machine jacking and safety information.

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

2. Remove scrub brushes.
3. Turn key switch ON. Enter Manual Mode and lower scrub head completely (See *MANUAL MODE* in the *TROUBLESHOOTING* section of this manual). Turn key switch OFF immediately when scrub head is completely lowered to the floor.
4. Disconnect the battery cable from the machine.

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

5. Remove belt cover bolts (Qty. 2) and set cover and hardware aside.



6. Remove belt by turning pulleys and applying outward pressure on the belt



7. Remove motor mounting hardware (Qty. 4).



8. Disconnect the main wire harness from the scrub brush motor.

NOTE: Slide white locking tab inward and then press the release button.



9. Reinstall the cylindrical brush motor(s) in reverse order of disassembly. See *REMOVING/REPLACING THE SCRUB DRIVE BELT* for instructions how to reinstall the scrub brush drive belt.

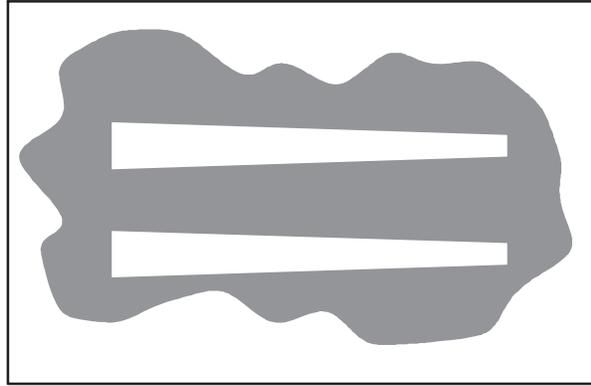
CHECKING/ADJUSTING THE CYLINDRICAL SCRUB BRUSH PATTERN

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

NOTE: Machine must be on level/flat surface before testing motor currents. Variations in current may occur if machine is not parked on a level/flat surface.

1. Turn key switch ON.
2. Place the machine into the Manual Mode. See *MANUAL MODE* in the *TROUBLESHOOTING* section for information how to place machine into the Manual Mode.
 1. Verify the motor current for each brush. The current for each brush motor should be as close as possible and be between 12-15 amps.
 2. Turn key switch OFF. Leave the sweep head in the lowered position. It is easier to access adjustment hardware with sweep head lowered.
 3. If current is low, loosen the eye bolt attached to the extension spring.
If current is high, tighten the eye bolt attached to the extension spring.
 4. Recheck current measurements. Adjust as necessary.
 5. Reassemble all parts removed from the machine.
 6. Turn key switch ON, place machine in Manual Mode, and run the sweep brushes on a smooth level surface for approximately 15-20 seconds. Raise the sweep head and back the machine away from where the brushes were tested.

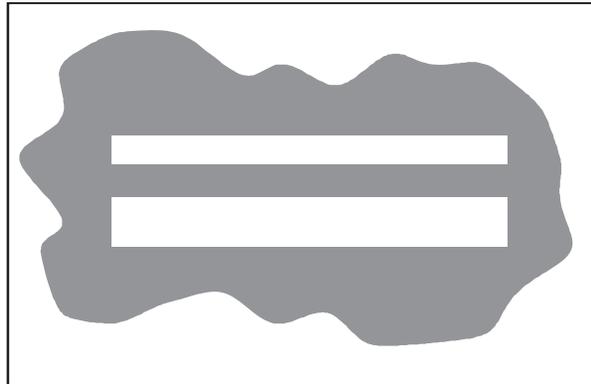
7. Observe the brush pattern.



8. Loosen the bolt on the handle.
9. Tighten the adjustment screw to raise the right side of the brush if pattern is too heavy to the right side of the machine

Loosen the adjustment screw to lower the right side of the brush if pattern is too heavy to the left side of the machine

10. Adjust the front to rear sweep brush pattern. The patterns should be approximately 1.5 in. across each pattern and vary no more than 0.25 in.

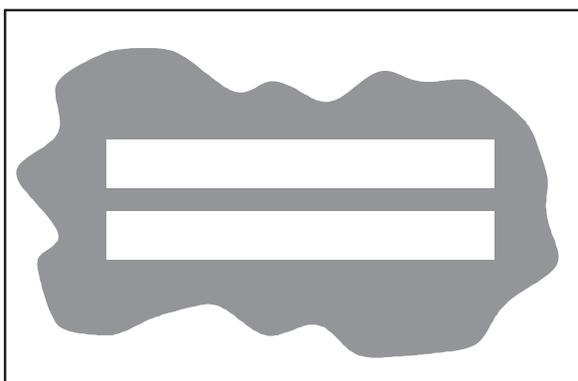


11. Adjust the rod ends to adjust the front to rear brush pattern. When adjusting with rod-ends always use the same number of turns per side. Turn clockwise to tilt the sweep head to the rear, making the pattern lighter in the front and heavier to the rear of the machine.

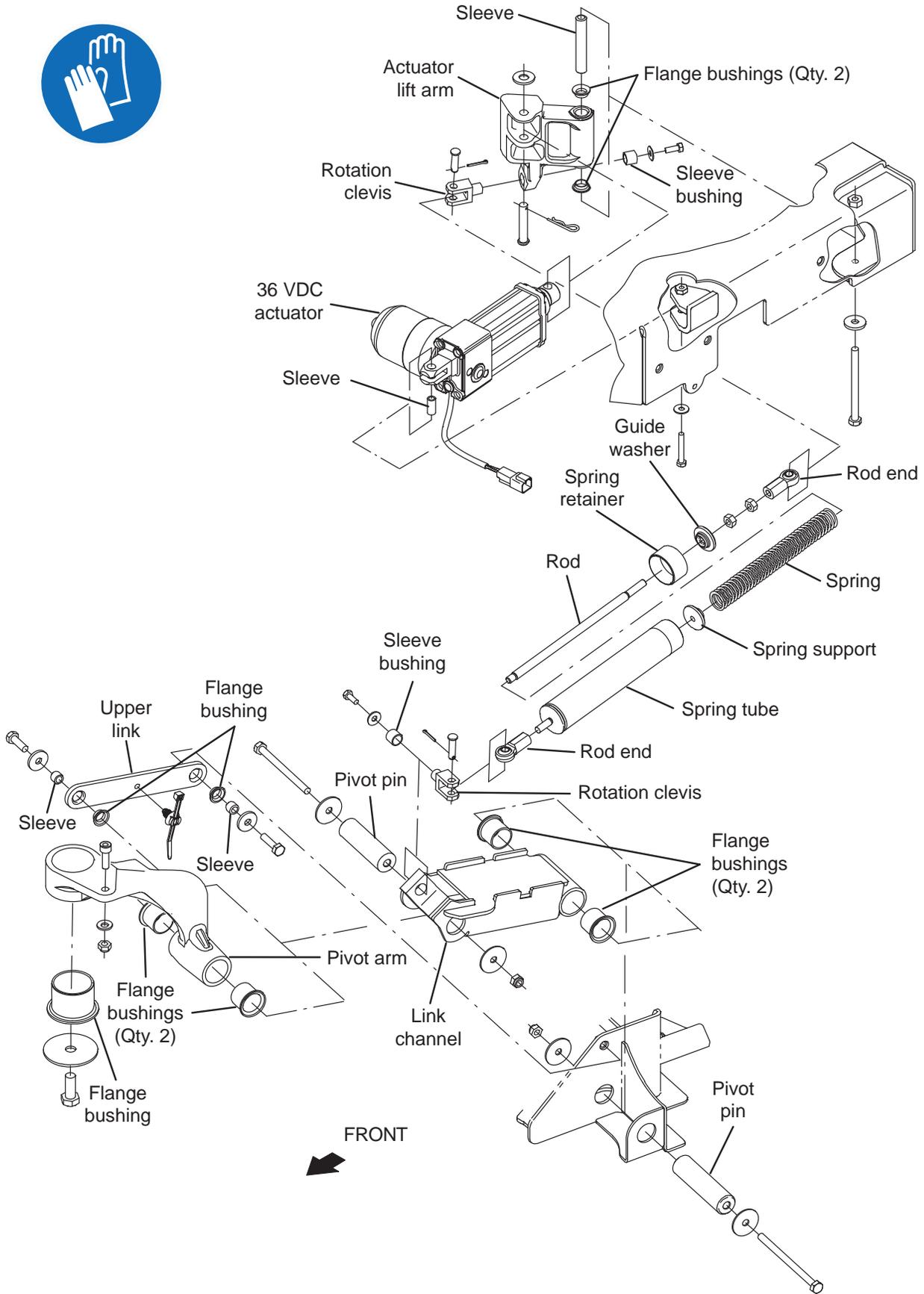
Turn counterclockwise to tilt the sweep head to the front, making the pattern heavier in the front and lighter to the rear of the machine



12. If pattern is even between the front and back sweep brushes and the tape is still under 1.25 in. at the smallest width, adjust the lift spring. Loosen the eye bolt a thread to make the pattern heavier.



REMOVING/REINSTALLING THE SIDE BRUSH LIFT ACTUATOR



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

1. Turn key switch OFF.
2. Disconnect the battery cable from the machine.
3. Jack up the front of machine. Be sure to use wheel chocks and jack stands. See *MACHINE JACKING* in the *MAINTENANCE* section of this manual.

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

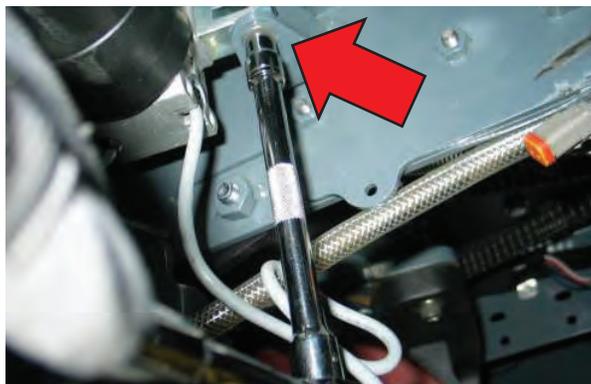
4. Remove side brush side squeegee assembly and side brush and set aside



5. Remove side brush assembly mounting bolt and carefully lower the side brush mechanism to the floor.



6. Cut zip tie securing actuator connector to wire harness and disconnect actuator from wire harness.
7. Remove actuator mounting clevis (2) and cotter (2) pins.



8. Remove cotter and clevis pin from actuator.



9. Remove lift actuator from machine.



10. Reinstall the side brush lift actuator in reverse order of disassembly.

ADJUSTING THE SIDE BRUSH SPRING TUBE ASSEMBLY

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

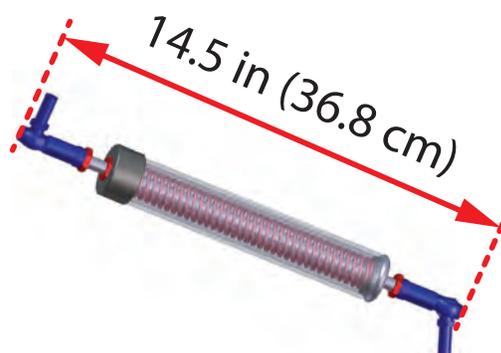
1. Jack up the front of machine. Be sure to use wheel chocks and jack stands. See *MACHINE JACKING* in the *MAINTENANCE* section of this manual.

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

2. Turn key switch ON. Activate and lower the side brush to provide access to the spring-tube assembly. Turn key switch OFF after brush has lowered.



3. Loosen the jam nut on the spring-tube assembly and turn the body of the spring tube until the initial end-to-end dimension is 14.5 in (36.8 cm).



4. Inspect the side scrub brush in the raised/retracted position. The bottom of the brush hub should be 3.75-4.00 in (9.5-10.2 cm) from the floor to allow for brush replacement clearance. Tighten the jam nut when the desired height has been reached.
5. Turn key switch ON, 1-Step ON, side brush switch ON. Allow the side brush to completely lower and turn key switch OFF.



6. Loosen forward jam nut on side brush spring tube assembly.

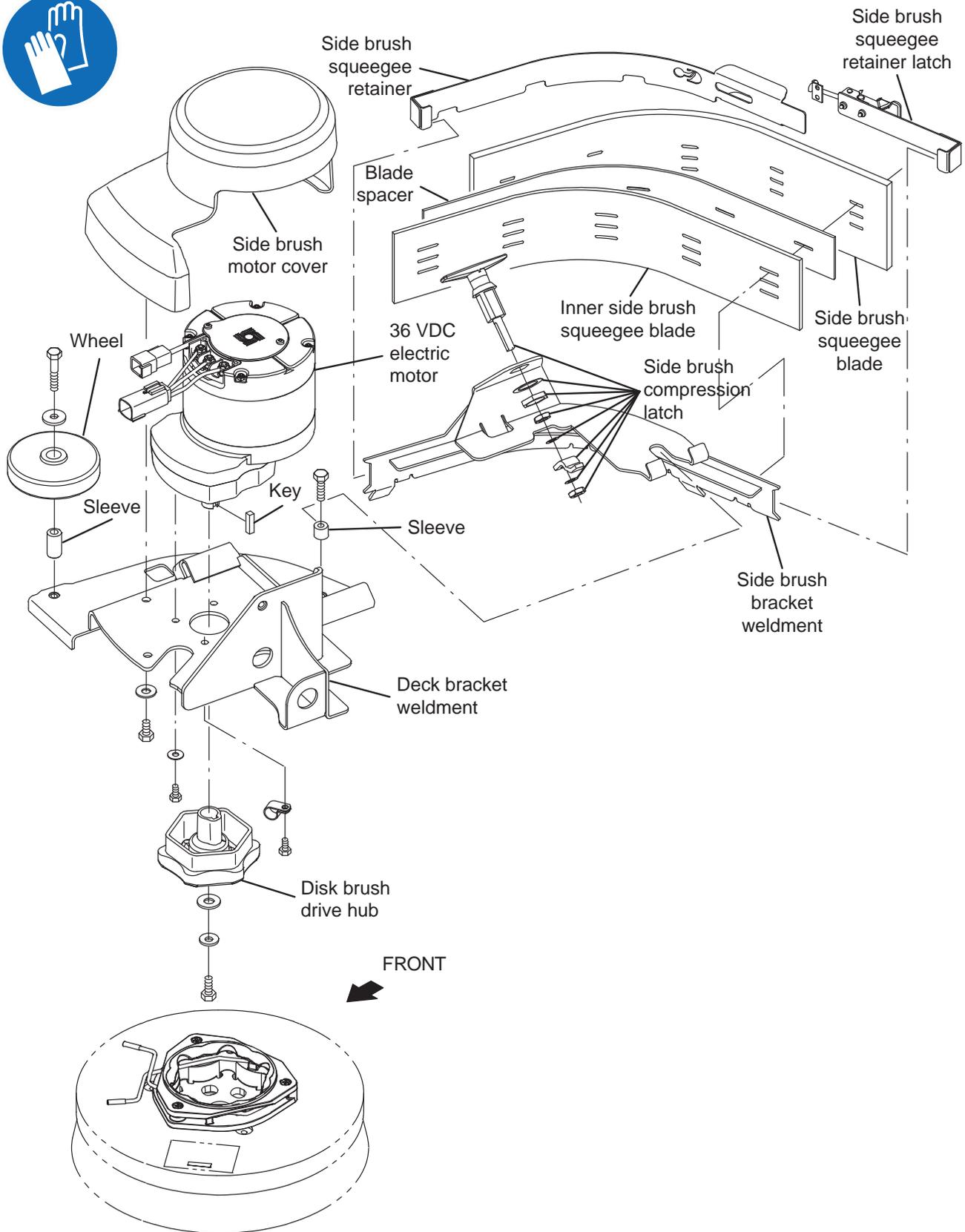


7. Turn the spring tube assembly clockwise to shorten the tube (opening the adjustment gap). Turn the spring tube assembly counterclockwise to lengthen the tube (closing the adjustment gap). Cycle the side brush up down to check the gap.



8. Tighten the jam nut.

REMOVING/REINSTALLING THE SIDE BRUSH MOTOR (OPTION)



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

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

1. Turn key switch OFF.
2. Disconnect the battery cable from the machine.
3. Jack up the front of machine. See *MACHINE JACKING* in the *MAINTENANCE* section of this manual.

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

4. Remove side brush and side brush squeegee assembly and set aside.
5. Remove side brush hub mounting bolt (Qty. 1) and hub.



6. Remove motor mounting hardware (Qty. 4).



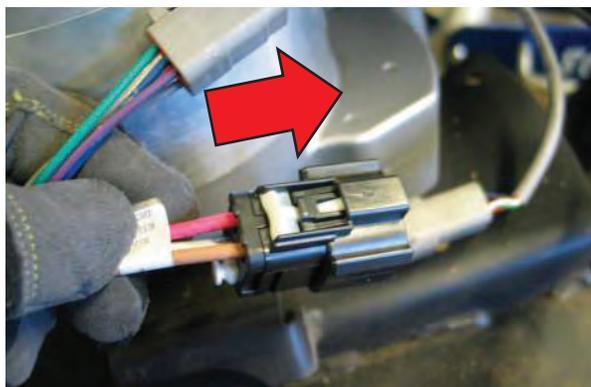
7. Turn key switch ON, 1-Step ON, side brush ON and allow side brush motor to completely lower. Turn key switch OFF.

8. Remove side brush cover mounting hardware (Qty. 2).



9. Disconnect side brush motor from wire harness and remove side brush motor.

NOTE: Slide white locking tab inward and then press the release button.

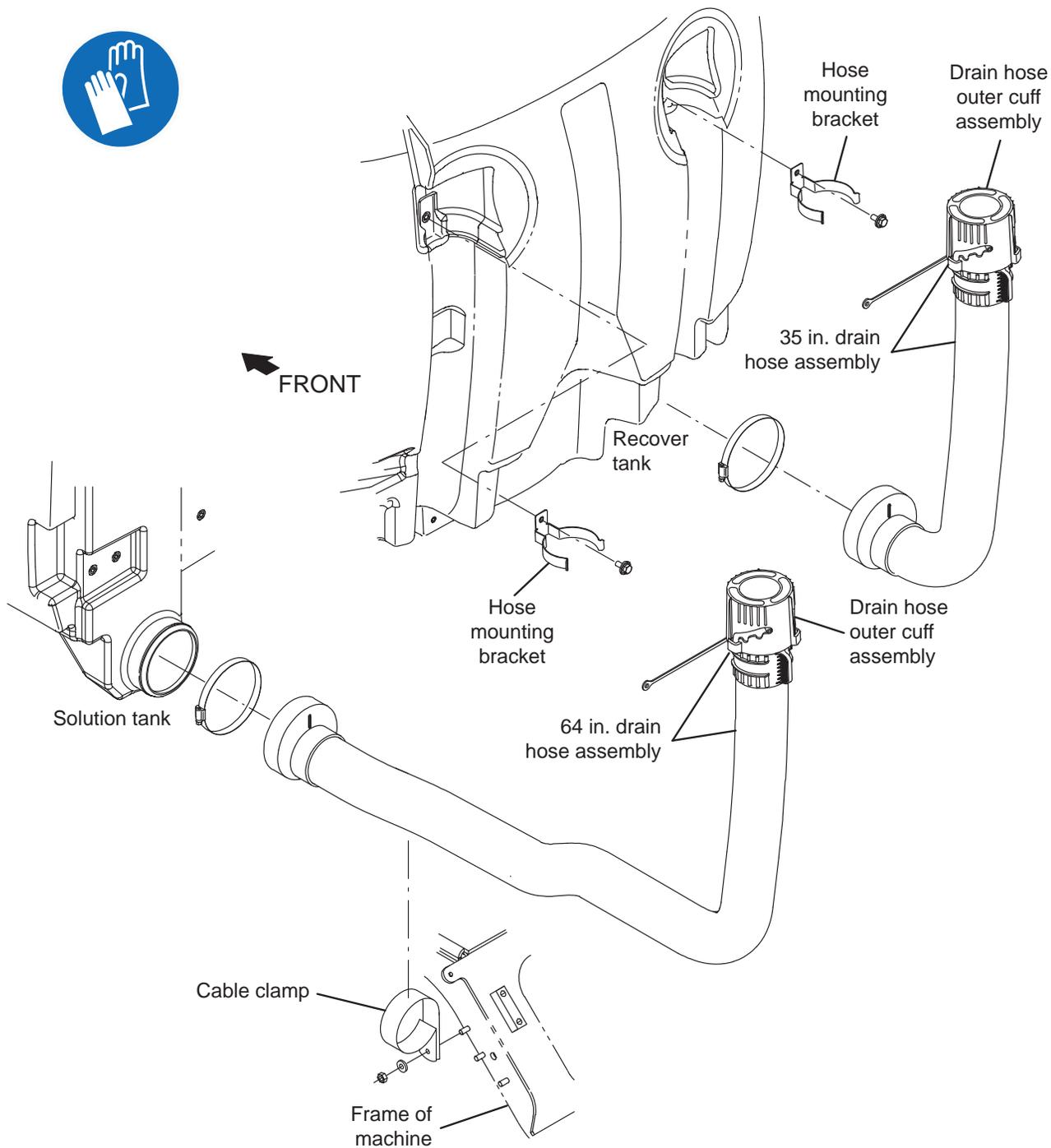


10. Remove the scrubbing side brush motor.



11. Reinstall the scrubbing side brush motor in reverse of disassembly.

REMOVING/INSTALLING THE SOLUTION TANK
DRAIN HOSE



1. Completely empty both the solution tank and the recovery tank.
2. Completely empty the hopper.
3. Remove the main scrub brushes from the machine.
4. Turn key switch ON and completely lower the scrub head.

5. Turn the key switch OFF.

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

6. Chock the right rear wheel.

7. Jack up the left side of the machine enough to access the solution tank drain hose. See *MACHINE JACKING* in the *MAINTENANCE* section of this manual for additional information.

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

NOTE: If necessary, the scrub head can also be removed to gain additional access to the solution drain hose.

8. Remove the cable clamp securing the solution tank drain hose to the frame of the machine.
9. Remove the clamp securing the solution tank drain hose to the solution tank.
10. Remove the solution tank drain hose from the machine.
11. Use the previously removed clamp to secure the new solution tank drain hose to the solution tank.
12. Carefully route the solution tank drain hose along the frame of the machine where the removed solution tank hose was previously located and out the back of the machine.

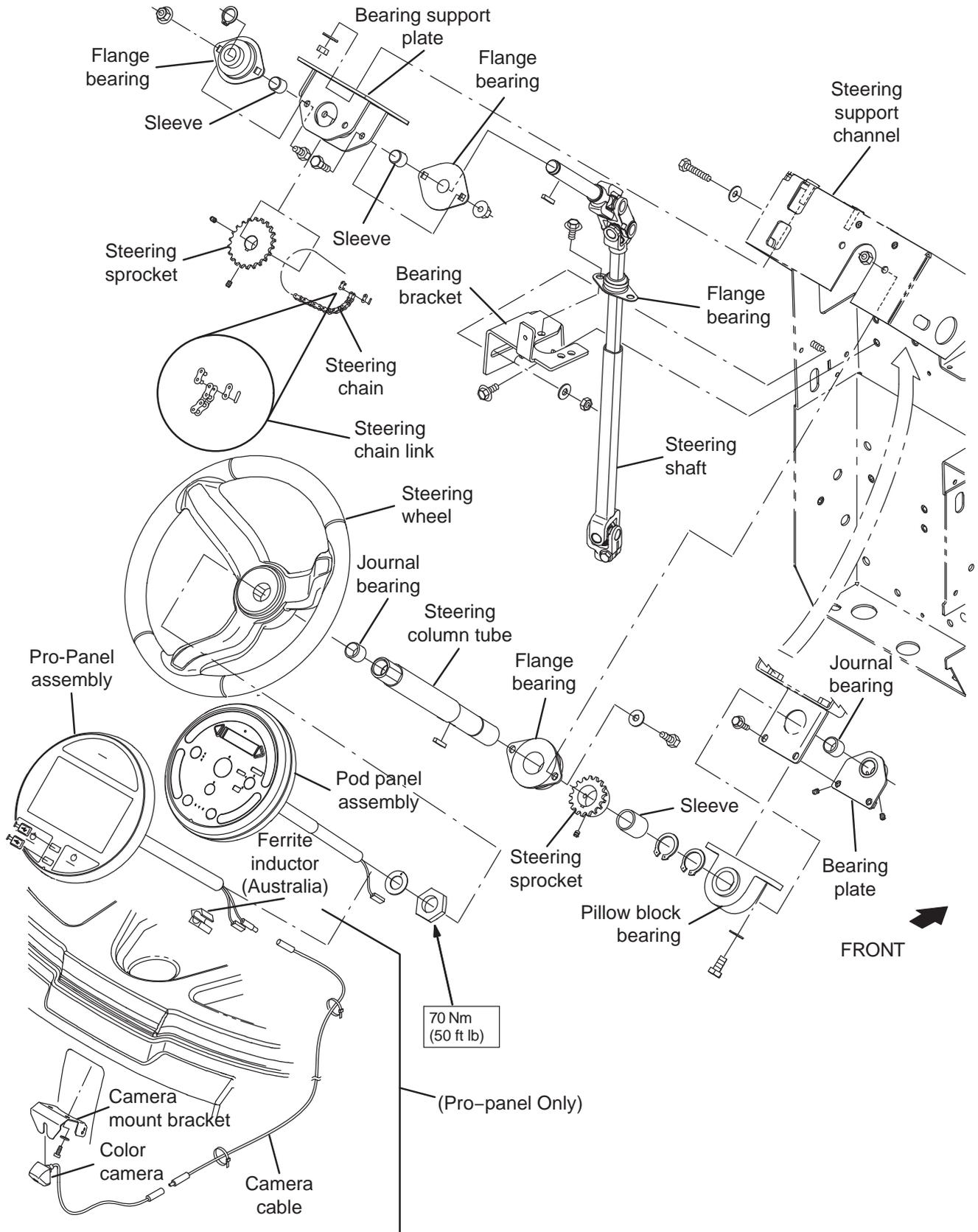
*NOTE: **DO NOT** allow the recovery tank drain hose to be torn or damaged while routing it to the back of the machine. Be sure the hose is not resting on or against any sharp hardware or components that could potentially tear or damage the hose.*

13. Reinstall the cable clamp to secure the recovery tank drain hose to the frame of the machine.

14. Secure the solution tank drain hose to the back of the recovery tank.
15. Raise the machine off the jack stands, remove the jack stands from under the machine, and lower the machine to the floor.
16. Fill the solution tank with several gallons of water.
17. Observe where the solution tank drain hose is connected to the solution tank and along where the solution tank drain hose is routed to the back of the machine for leaks,
18. Reinstall the brushes onto the scrub head.

CONTROL MODULES/CONTROLS

REMOVING/REPLACING THE PRO-PANEL/
STANDARD PANEL POD



REMOVING/REPLACING THE PRO-PANEL/ STANDARD PANEL POD

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

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

1. Turn key switch OFF.
2. Disconnect battery cable from the machine.
3. Remove electrical access panel.



4. Cut zip tie securing instrument panel wire harness connections.
5. Disconnect the main wire harness from the instrument panel.



6. Loosen set screws (Qty. 2) securing instrument panel mounting tube.

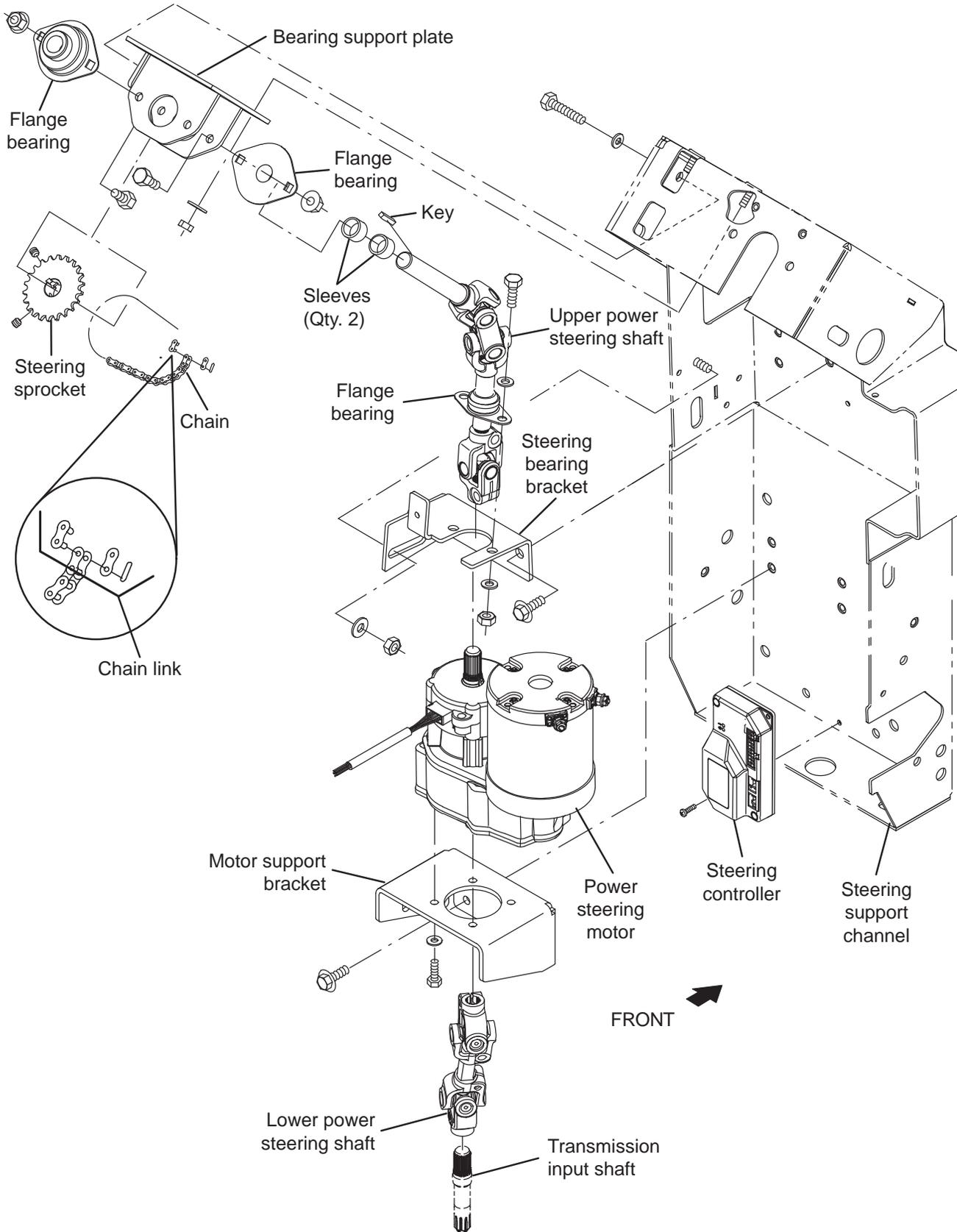


7. Remove instrument panel assembly from the steering assembly.



8. Reinstall the pod in reverse order of disassembly.
9. Reconfigure the new pod assembly. See *CONFIGURATION MODE* in the *TROUBLESHOOTING* section of this manual to configure the new instrument panel.
10. Turn key switch ON. Raise and lower the hopper. If the hopper stops during either the raising or lowering the hopper actuator will need to be reprogrammed. See *ROLL OUT ACTUATOR PROGRAMMING/ADJUSTMENT*.

ADJUSTING THE STEERING WHEEL TIMING



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

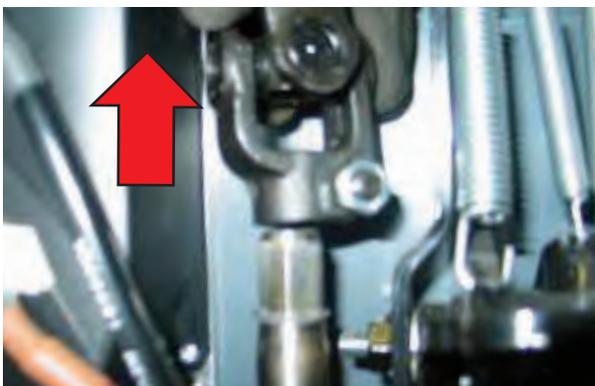
1. Remove electrical access panel.



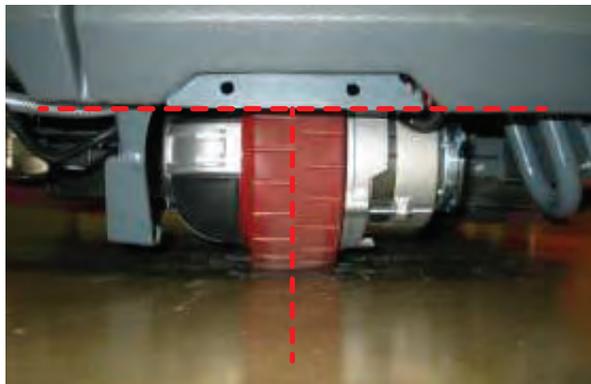
2. Loosen steering shaft hardware.



3. Lift steering u-joint off splined shaft.



4. Align the front drive tire with the center line of the machine.



5. Orientate the steering wheel as shown below.



6. Carefully reinstall the steering u-joint onto the splined steering shaft without changing the orientation of the steering wheel or drive assembly.

NOTE: Check for rotational interference between the hardware and the adjacent pedal assembly. If necessary, raise the steering u-joint enough to clear the pedal assembly.



CALIBRATING THE POWER STEERING (OPTION)

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

FOR SAFETY: When servicing machine, avoid moving parts. Do not wear loose jackets, shirts, or sleeves when working on machine.

1. Turn key switch ON.
2. Drive the machine for a short distance and straighten the steering wheel. The steering wheel must be positioned straight when the power steering motor is calibrated.

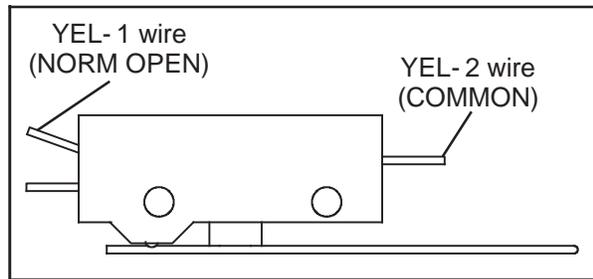
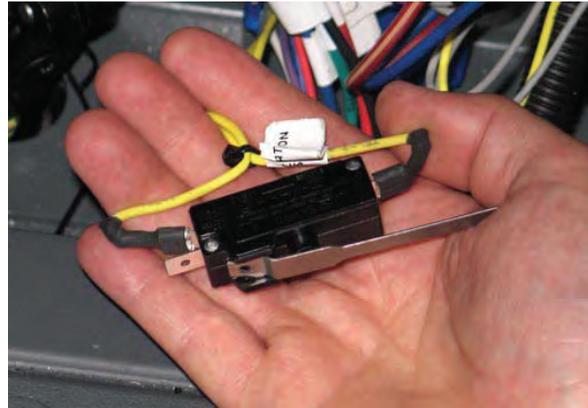


3. Remove the access panel from the machine.



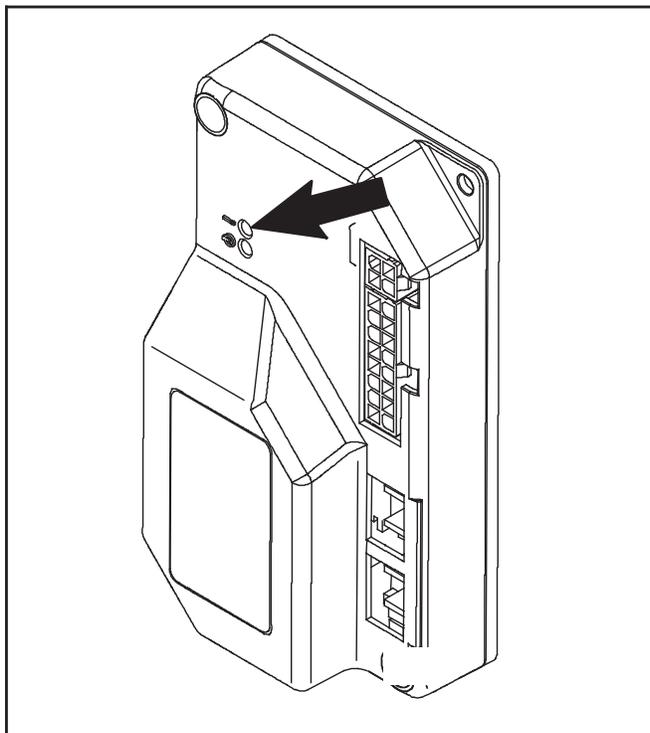
4. Turn key switch OFF.

5. Connect power steering wire harness YEL- 1 wire and YEL- 2 wire located near the power steering controller to the snap switch (Switch, Snap, 25A SPDT - part number 1008142).

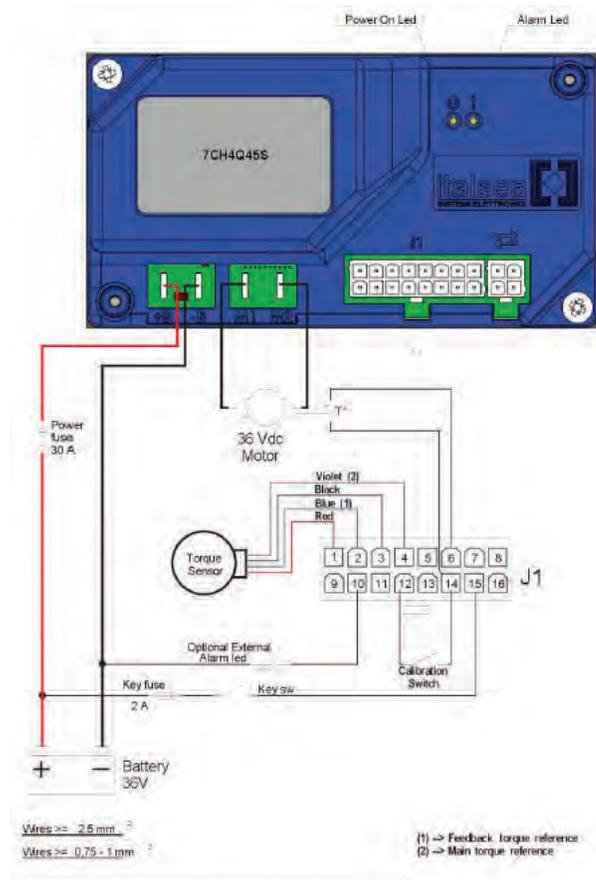


6. If battery cable is disconnected from the machine, reconnect the battery cable to the machine.
7. Turn OFF all machine functions and options. All functions/options (spray nozzle, lights, etc...) must be OFF when the power steering motor is calibrated. The power steering motor will not calibrate if other functions/options are on.

8. Quickly squeeze/activate the switch lever four times within 3 seconds. The power steering controller LED will illuminate each time the snap switch lever is squeezed. The LED will remain illuminated for 2 seconds the fourth time the snap switch lever is squeezed to show the sequence is completed.



POWER STEERING - WIRING

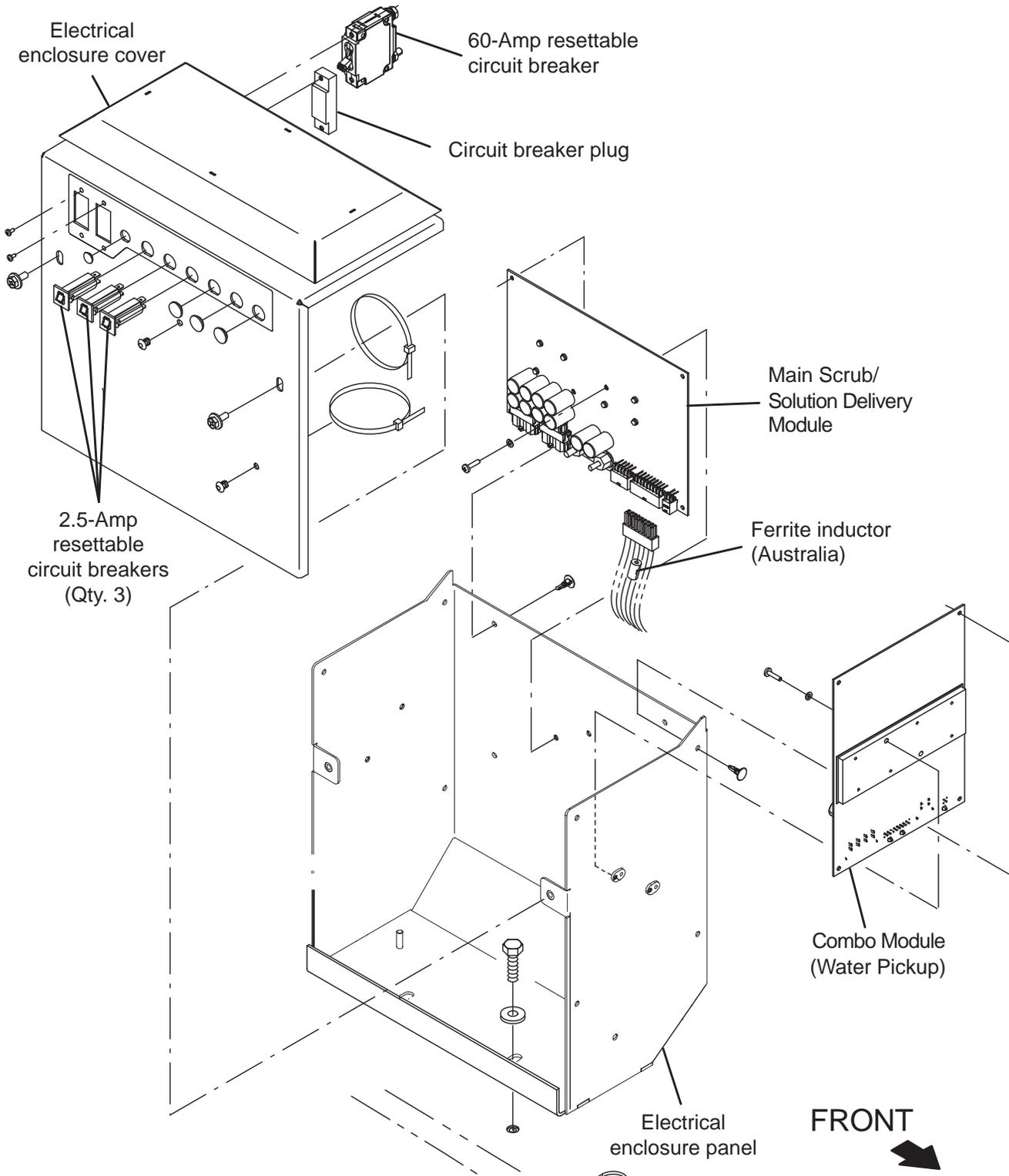


9. Test the machine. Turn the steering wheel in the complete range of motion in both directions. The machine should steer smoothly and with the same amount of resistance in both directions. Center the steering wheel again and repeat this procedure if the steering is not functioning smoothly with the same amount of resistance when turned in either direction. Do Not turn on any machine functions/options when testing the machine.

NOTE: All functions and options must remain OFF until after the key switch is turned to the OFF position to complete calibration.

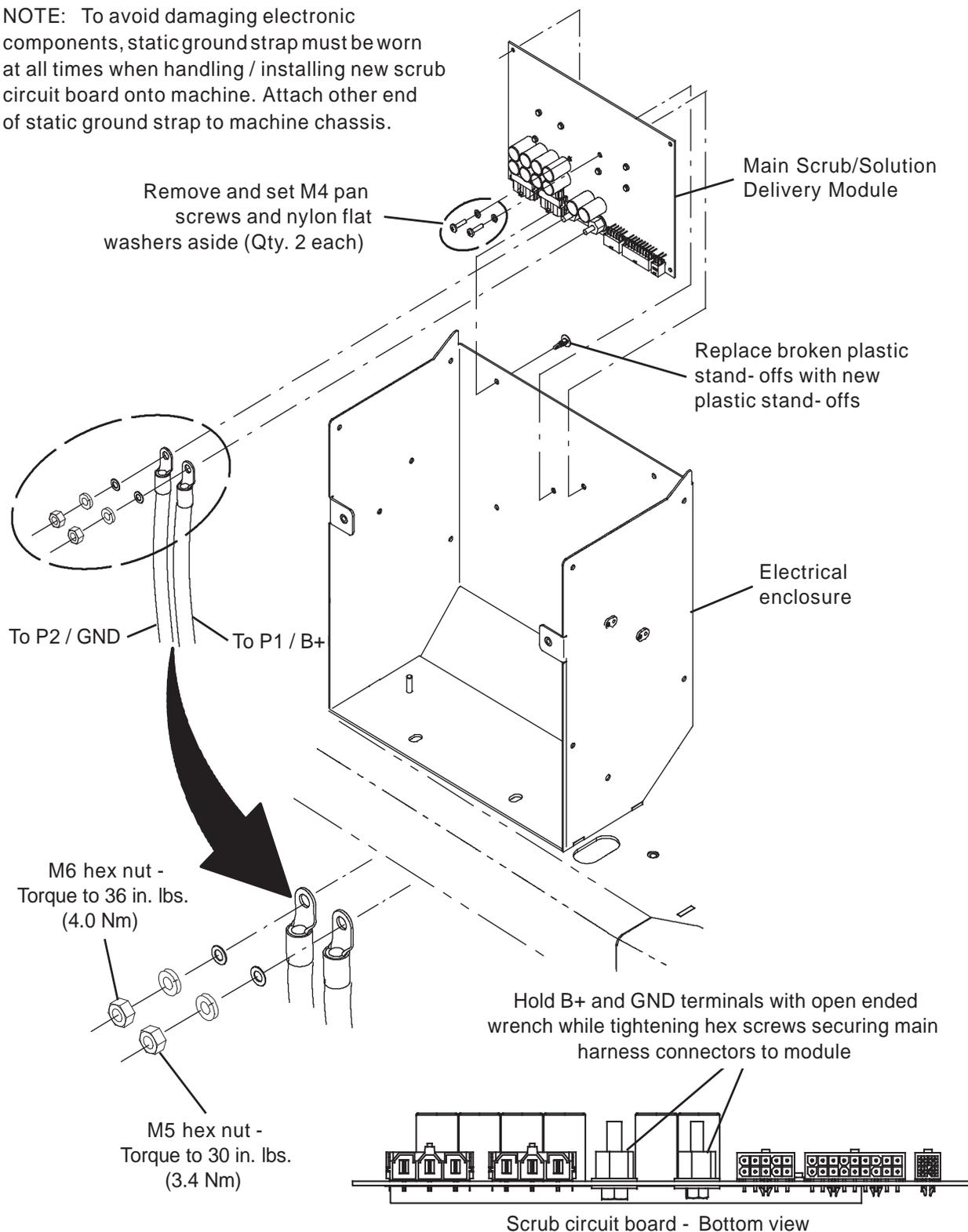
10. Turn key switch OFF.
11. Disconnect the power steering wire harness YEL- 1 wire and YEL- 2 wire from the snap switch.
12. Reinstall the access panel onto the machine.

REPLACING THE MAIN SCRUB/ SOLUTION DELIVERY MODULE



NOTE: DO NOT replace either **Main Scrub/ Solution Delivery Module** or **Combo Module (Water Pickup)** without first consulting **T.A.C. (Technical Assistance Center)**. Troubleshooting procedures must first be completed to determine possible machine issues before modules are replaced.

NOTE: To avoid damaging electronic components, static ground strap must be worn at all times when handling / installing new scrub circuit board onto machine. Attach other end of static ground strap to machine chassis.



SERVICE

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

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

1. Turn key switch OFF.
2. Disconnect the battery cable from the machine.
3. Open right side access door.

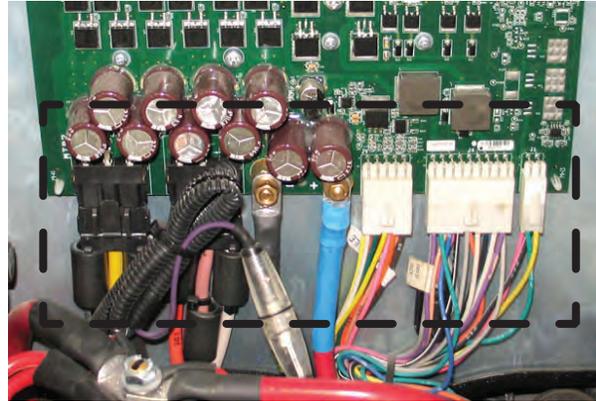


4. Remove the hardware securing the electrical enclosure cover to the electrical enclosure panel and carefully lower the electrical enclosure cover.



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

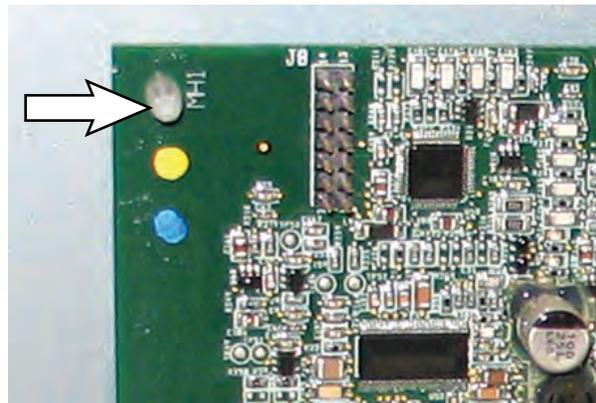
5. Disconnect all main wire harness connections from the module.



6. Remove both pan screws and nylon washers securing the module to the electrical enclosure panel.



7. Carefully squeeze the plastic standoffs (Qty. 4) located at each corner of the module to release the module from the electrical enclosure panel.



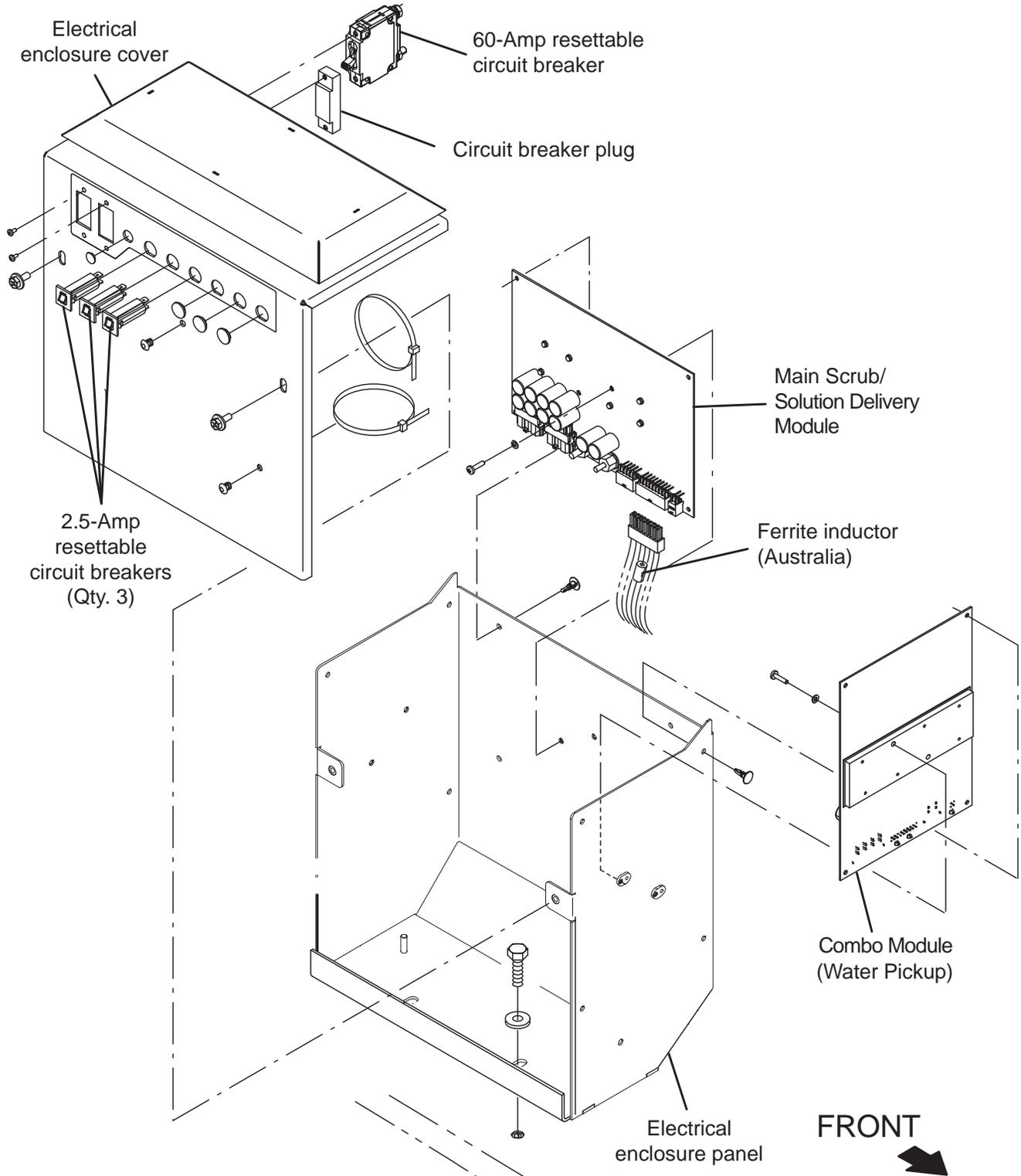
NOTE: Replace damaged plastic standoffs. The standoffs secure the module into place and support the module away from the electrical enclosure panel. The standoffs must be replaced if damaged.

8. Remove the module from the electrical enclosure panel.
9. Install the new/reinstall the module into the electrical enclosure panel in reverse order of disassembly. Do Not overtighten the hardware securing the module to the electrical enclosure. The module could be damaged if hardware is overtightened.

NOTE: Always use two wrenches when securing the power supply terminals or damage to the circuit board will occur. Connect power supply terminals to the new board before installation. Torque to 30-36 in-lbs (339-407 Ncm).

10. Reinstall remaining parts and components removed from the machine in reverse order of disassembly.
11. Reconfigure the machine. See *PROGRAMMING A NEW INTERFACE MODULE* and *RECONFIGURING THE MACHINE AFTER NEW HARDWARE/OPTION INSTALLATION* at the beginning of this section of the manual.

REPLACING THE COMBO MODULE (WATER PICKUP)



NOTE: DO NOT replace either *Main Scrub/ Solution Delivery Module* or *Combo Module (Water Pickup)* without first consulting **T.A.C. (Technical Assistance Center)**. *Troubleshooting procedures must first be completed to determine possible machine issues before modules are replaced.*

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

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

1. Turn key switch OFF.
2. Disconnect the battery cable from the machine.
3. Open right side access door.

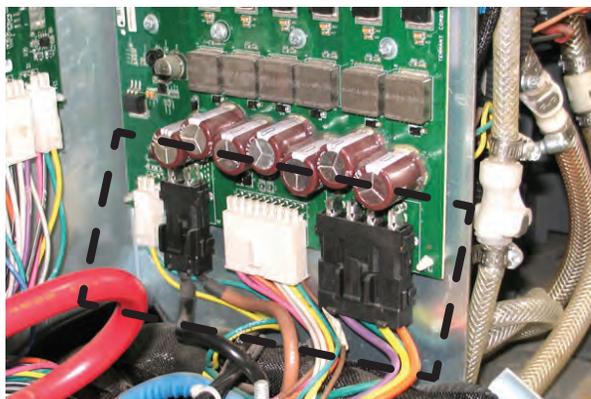


4. Remove the hardware securing the electrical enclosure cover to the electrical enclosure panel and carefully lower the electrical enclosure cover.

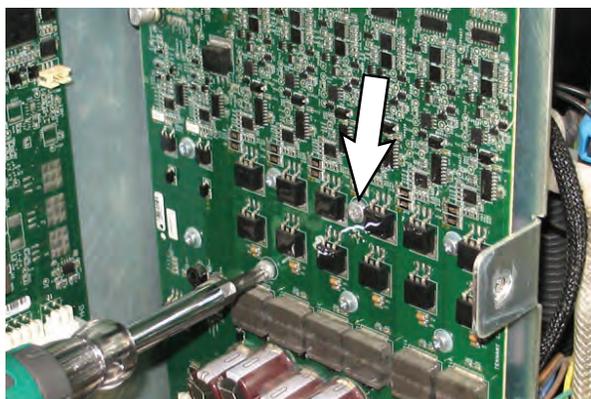


NOTE: To avoid damaging electronic components, a static ground strap must be worn at all times while handling electrical components. Attach the other end of the static ground strap to the machine chassis.

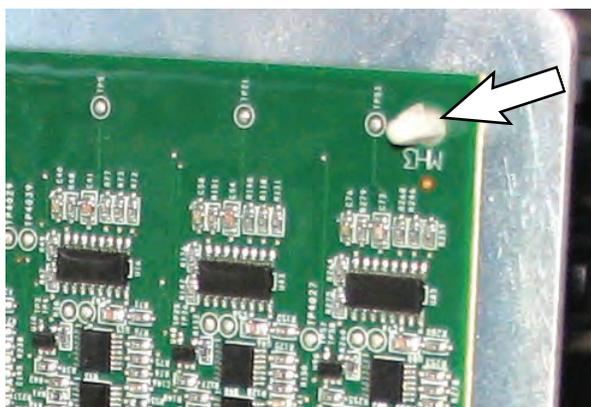
5. Disconnect the main wire harness connectors from the module.



6. Remove both pan screws and nylon washers securing the module to the electrical enclosure panel.



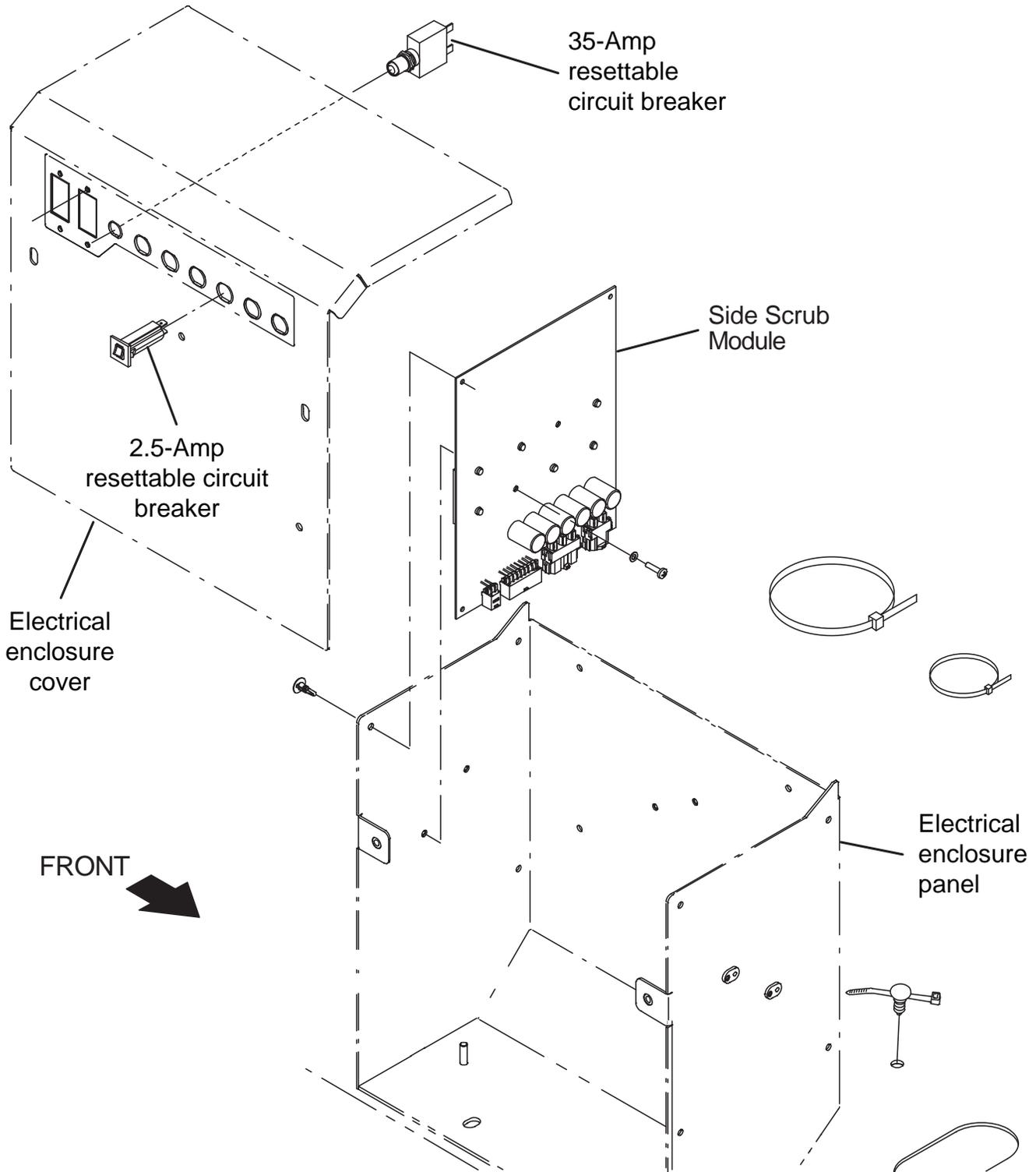
7. Carefully squeeze the plastic standoffs (Qty. 4) located at each corner of the module to release the module from the electrical enclosure panel.



NOTE: Replace damaged plastic standoffs. The standoffs secure the module into place and support the module away from the electrical enclosure panel. The standoffs must be replaced if damaged.

8. Install the new/reinstall the module into the electrical enclosure panel in reverse order of disassembly. Do Not overtighten the hardware securing the module to electrical enclosure. The module could be damaged if hardware is overtightened.
9. Reinstall remaining parts and components removed from the machine in reverse order of disassembly.
10. Reconfigure the machine. See *PROGRAMMING A NEW INTERFACE MODULE* and *RECONFIGURING THE MACHINE AFTER NEW HARDWARE/OPTION INSTALLATION* at the beginning of this section of the manual.

REPLACING THE SIDE SCRUB MODULE/SIDE SWEEP MODULE/PRE-SWEEP MODULE (OPTION)



NOTE: DO NOT replace Side Scrub Module/Side Sweep Module/Pre-Sweep Module without first consulting T.A.C. (Technical Assistance Center). Troubleshooting procedures must first be completed to determine possible machine issues before modules are replaced.

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

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

NOTE: Although only the side scrub control module is referenced in this procedure, use this same procedure to replace the Side Sweep Module or the Pre-Sweep Module.

1. Turn key switch OFF.
2. Disconnect the battery cable from the machine.
3. Open right side access door.



4. Remove the hardware securing the electrical enclosure cover to the electrical enclosure panel and carefully lower the electrical enclosure cover.

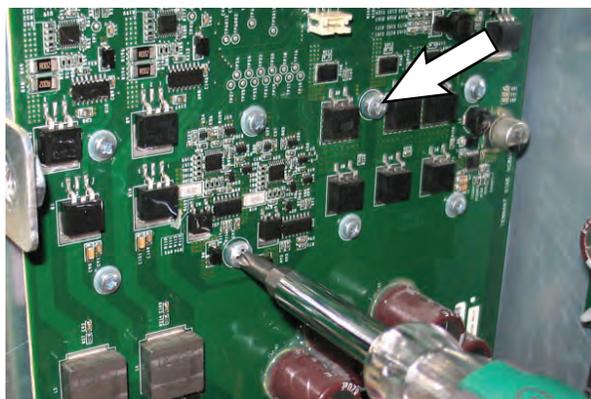


NOTE: To avoid damaging electronic components, a static ground strap must be worn at all times while handling electrical components. Attach the other end of the static ground strap to the machine chassis.

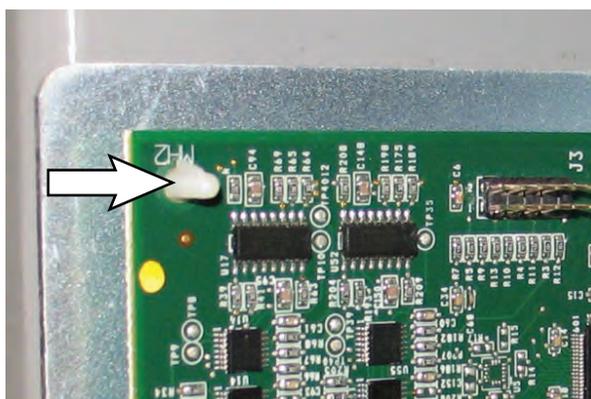
5. Disconnect the main wire harness connectors from the side scrub control module.



6. Remove both pan screws and nylon washers securing the side scrub control module to the electrical enclosure panel.



7. Carefully squeeze the plastic standoffs (Qty. 4) located at each corner of the side scrub control module to release the side scrub control module from the electrical enclosure panel.

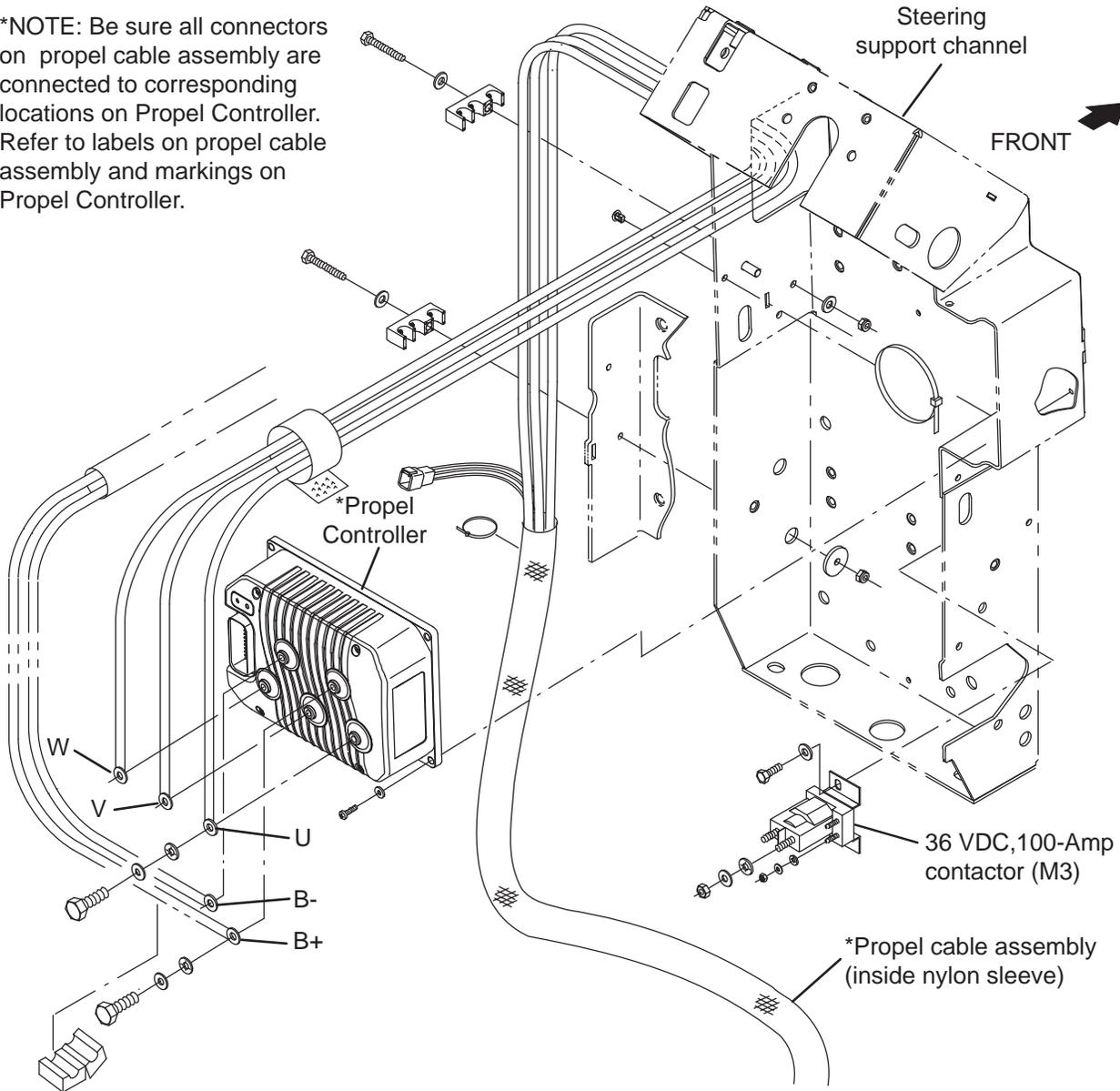


NOTE: Replace damaged plastic standoffs. The standoffs secure the module into place and support the module away from the electrical enclosure panel. The standoffs must be replaced if damaged.

8. Install the new/reinstall the module into the electrical enclosure panel in reverse order of disassembly. Do Not overtighten the hardware securing the module to the electrical enclosure. The module could be damaged if hardware is overtightened.
9. Reinstall remaining parts and components removed from the machine in reverse order of disassembly.
10. Reconfigure the machine. See *PROGRAMMING A NEW INTERFACE MODULE* and *RECONFIGURING THE MACHINE AFTER NEW HARDWARE/OPTION INSTALLATION* at the beginning of this section of the manual.

REPLACING THE PROPEL CONTROLLER

*NOTE: Be sure all connectors on propel cable assembly are connected to corresponding locations on Propel Controller. Refer to labels on propel cable assembly and markings on Propel Controller.



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

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

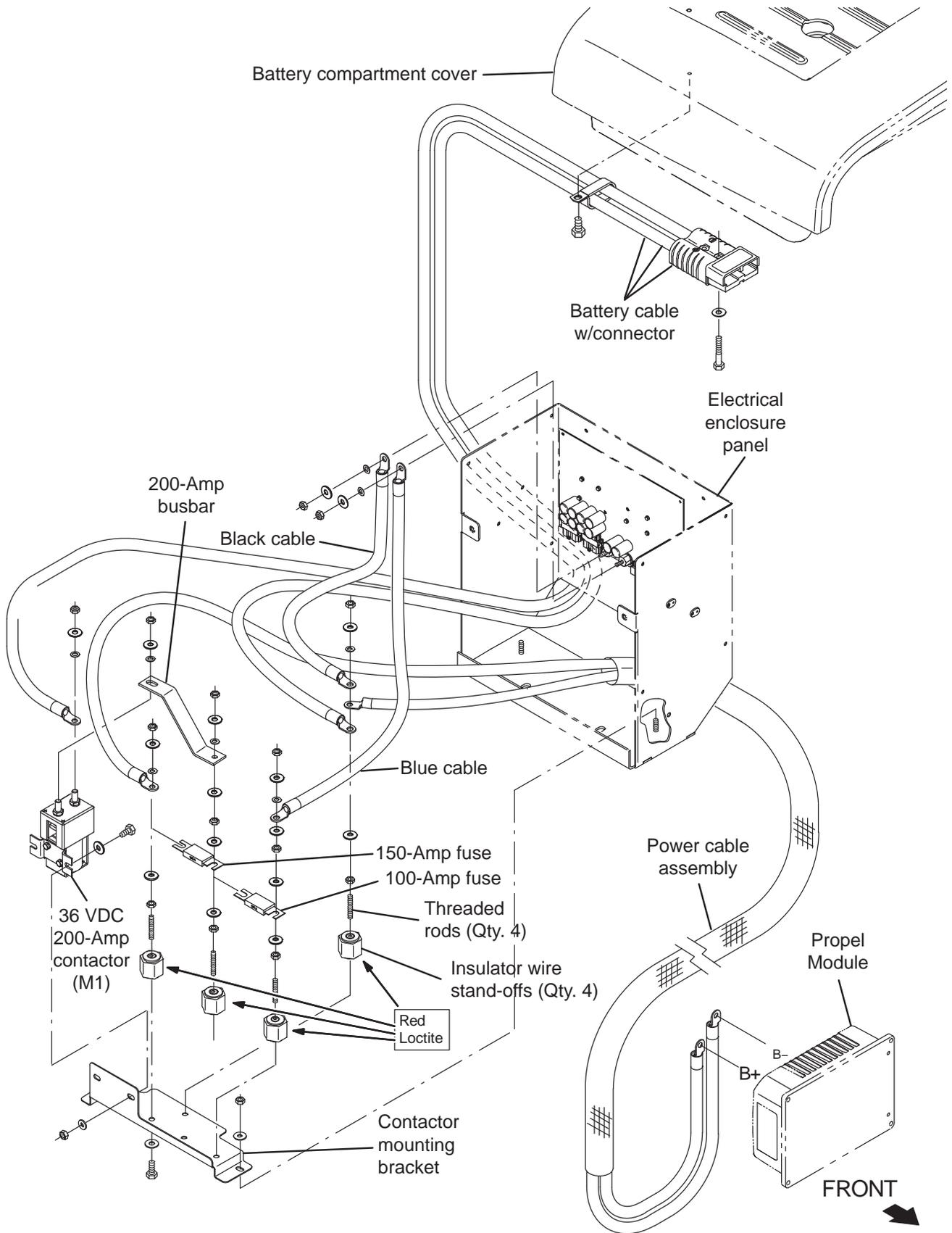
1. Turn key switch OFF.
2. Disconnect the battery cable from the machine.

3. Remove the access panel from the machine.



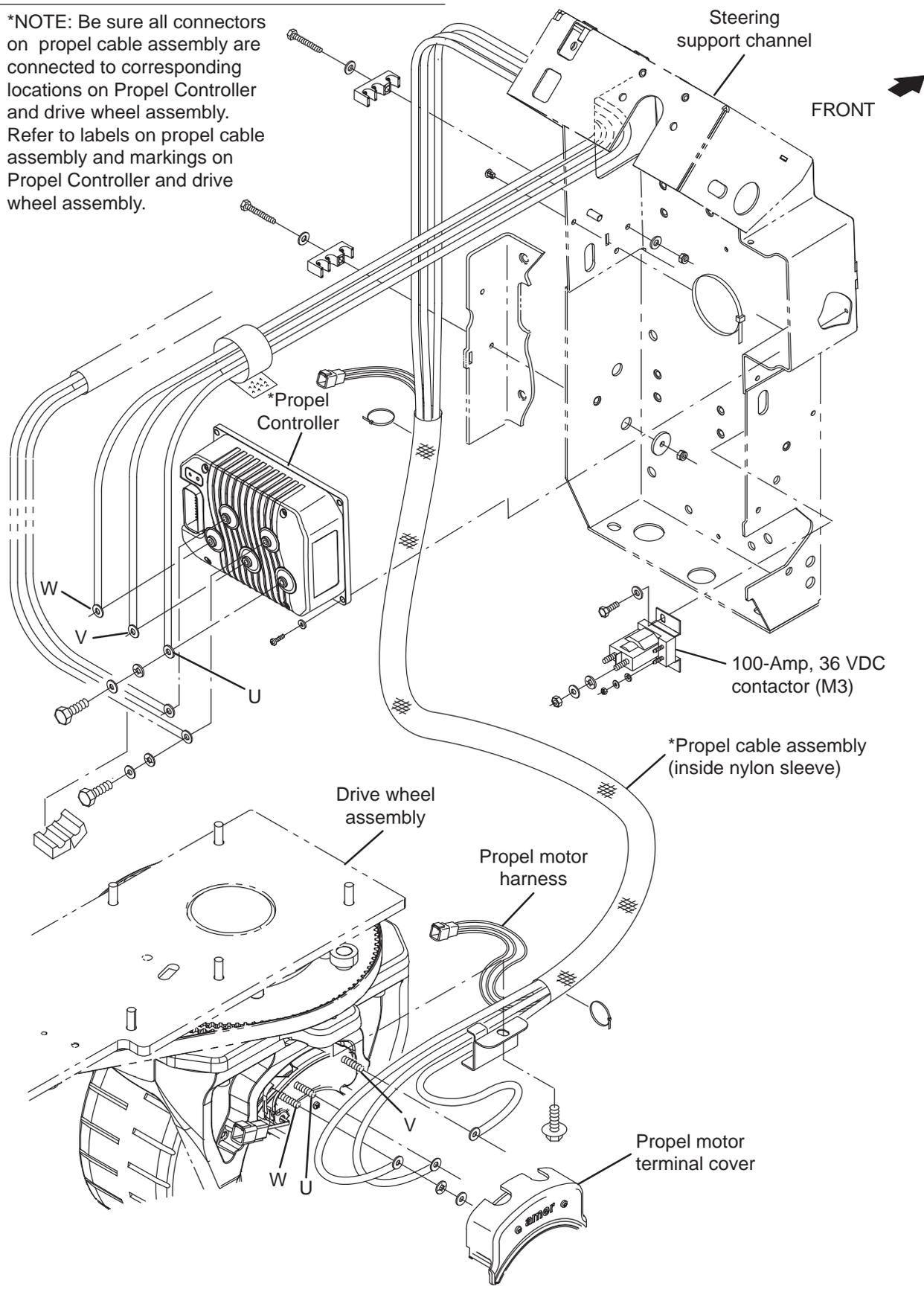
4. Disconnect all harness/cable connections from the Propel Controller.
5. Remove the Propel Controller from the steering support channel.
6. Install the new Propel Controller into the steering support channel.
7. Connect all harness/cable connections to the Propel Controller.
8. Configure the Propel Controller. See *RECONFIGURING THE MACHINE AFTER NEW HARDWARE/OPTION INSTALLATION*.

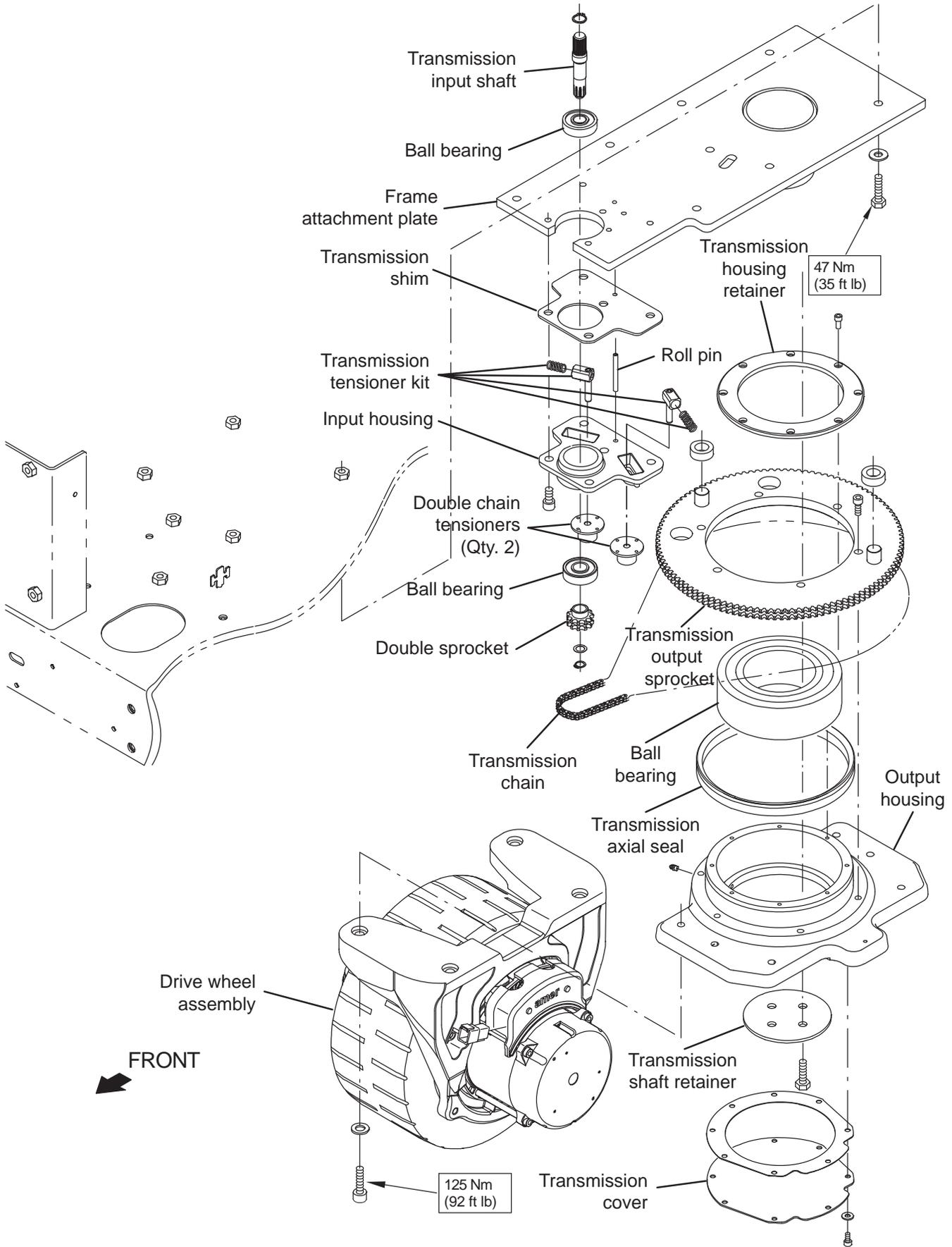
ELECTRICAL BOX WIRES GROUP



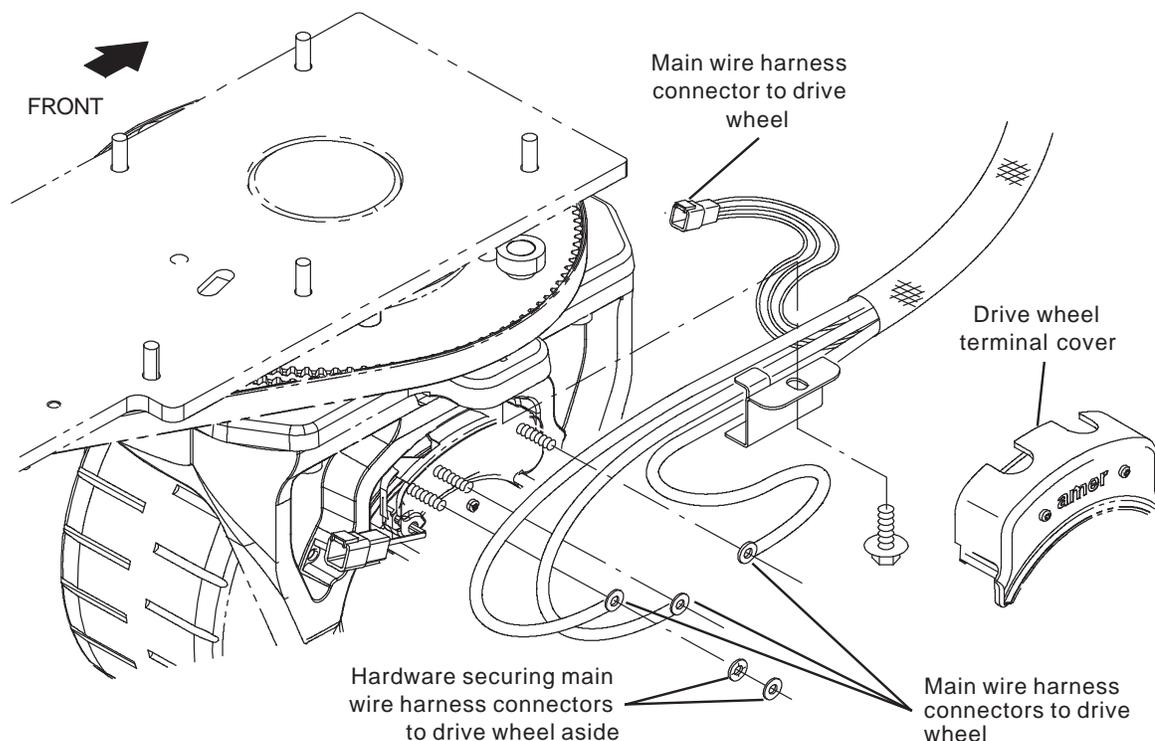
WHEEL DRIVE ASSEMBLY/BRAKES

*NOTE: Be sure all connectors on propel cable assembly are connected to corresponding locations on Propel Controller and drive wheel assembly. Refer to labels on propel cable assembly and markings on Propel Controller and drive wheel assembly.





REMOVING/REPLACING/INSTALLING THE DRIVE WHEEL ASSEMBLY



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

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

1. Turn key switch OFF.
2. Disconnect the battery cable from the machine.
3. Chock both rear wheels.
4. Jack up the front end of the machine enough to access the drive wheel assembly/remove the drive wheel assembly from under the machine. Place jack stands under the machine frame and lower the machine onto the jack stands. See *MACHINE JACKING* in the *MAINTENANCE* section for safety information and additional instructions.

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

5. Remove the terminal cover from the drive wheel assembly.
6. Disconnect all main harness connectors from the drive wheel. Note locations of nuts and washers securing the main wire harness connectors to the drive wheel. Nuts and washers must be arranged the same when connecting the main wire harness to the new drive wheel.
7. Loosen the M12 socket screws (Qty. 4) securing the drive wheel assembly to the output housing. Do not remove the socket screws.



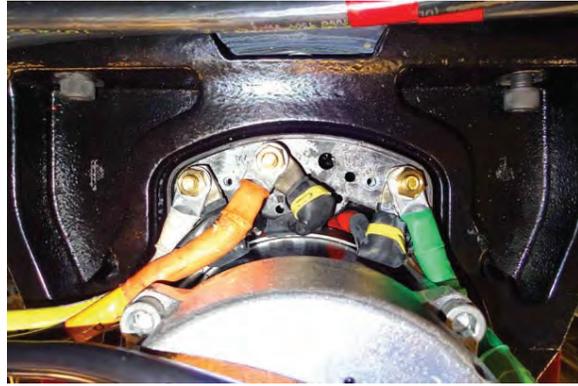
SERVICE

8. Jack the machine up off the jack stands, remove the jack stands from under the machine, and lower the machine to the floor.
9. Raise the jack until it is touching the frame on one side of the machine, but not enough to raise the machine from the floor, and position a jack stand under that side of the machine.
10. Repeat the previous step to slightly raise the other side of the machine.
11. Remove the drive assembly socket head screws (Qty. 4) from the drive wheel assembly/machine.
12. Jack the machine back up off the floor until the drive wheel can be easily removed from under the machine, position the jack stands under the machine, and lower the machine onto the jack stands.

NOTE: Use caution when removing the drive wheel since the brake is not engaged during the removal process. Carefully lower the drive wheel onto the floor.

13. Carefully remove the drive wheel assembly from under the machine.
14. If replacing the drive wheel assembly, remove the terminal cover from the new drive wheel.
15. If replacing the drive wheel assembly, remove hardware necessary to connect main wire harness connectors to the drive wheel assembly.
16. Place the drive wheel assembly onto the jack, position the jack underneath the machine, and raise the drive wheel up to the output housing.
17. Use the M12 socket screws (Qty. 4) to secure the drive wheel (1) to the output housing.
18. Remove the jack from under the machine.
19. Torque the M12 socket screws (Qty. 4) to 125 Nm (92 ft. lbs).

20. Connect all main wire harness connectors to the drive wheel assembly. Position/route cables exactly as shown so the terminal cover can be installed.



21. Install the terminal cover onto the drive wheel assembly.



22. Slightly raise machine from jack stands, remove the jack stands from under the machine, and lower the machine to the floor
23. Reconnect battery cable to the machine.

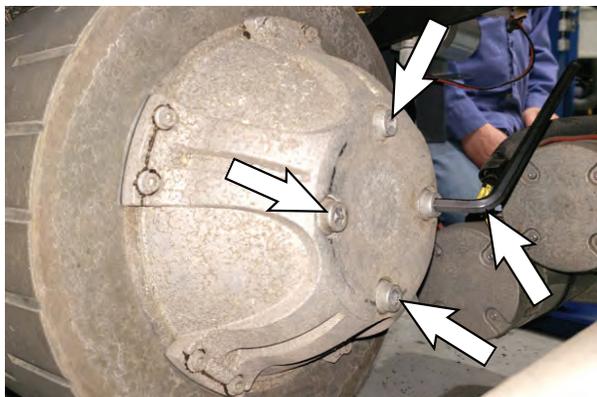
REMOVING THE DRIVE WHEEL

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

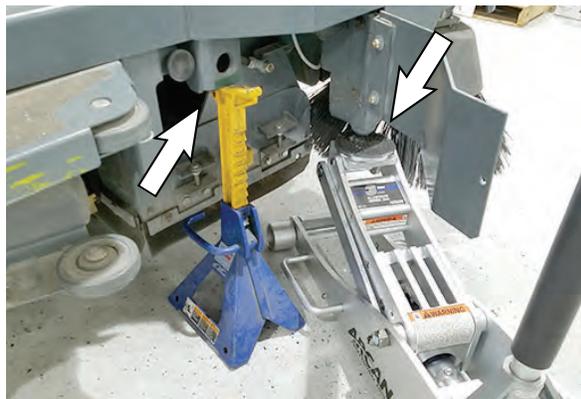
1. Turn key switch ON.
2. If scrub head is not raised, completely raise the scrub head.
3. Turn the steering wheel as far to the left as possible.
4. Turn key switch OFF.
5. Disconnect the battery cable from the machine.

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

6. Place a chock behind both rear tires.
7. Loosen the socket screws (Qty. 4) on the drive wheel.

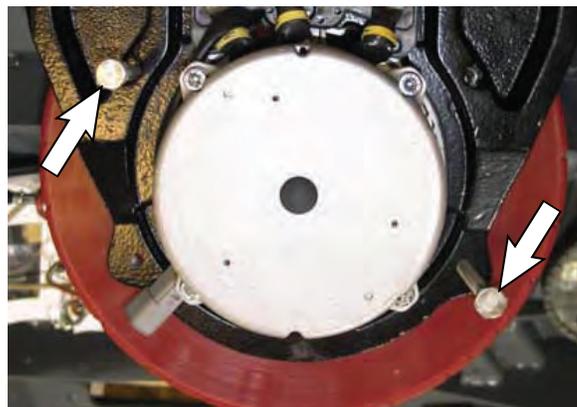


8. Jack up the front end of the machine enough to access the drive wheel assembly. Place jack stands under the machine and lower the machine onto the jack stands. See *MACHINE JACKING* in the *MAINTENANCE* section of this manual.



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

9. Remove the main scrub brush and side scrub brush from the machine.
10. Turn the steering wheel as far to the right as possible to allow easier access to the other side of the drive wheel assembly.
11. Use M10-1.5 x 70 (Class 12.9) hex screws (Qty. 2) to press the wheel from the drive wheel assembly. Tighten the screws evenly until the wheel comes freely from the drive wheel assembly.



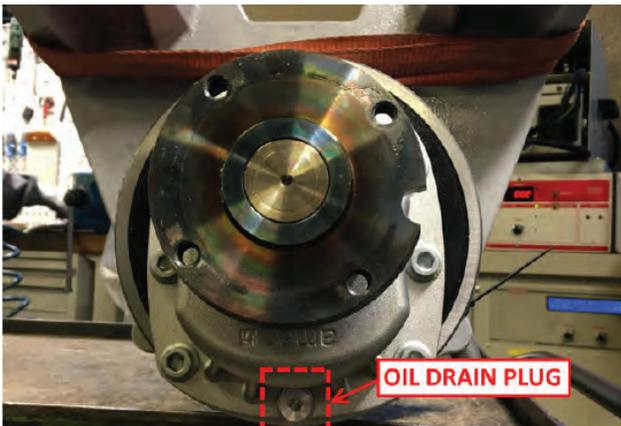
CHANGING THE DRIVE WHEEL ASSEMBLY OIL

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

1. Remove the drive wheel from the machine. See *REMOVING THE DRIVE WHEEL* section of the manual.
2. Turn the steering wheel as far to the left as possible until the drive wheel hub is oriented to the front of the machine to allow easier access to the oil drain and fill plugs.
3. Position a drain pan underneath the drive wheel assembly drain plug.
4. Remove the fill plug from the drive wheel assembly to allow the oil to drain easier.



5. Remove the drain plug from the drive wheel assembly and allow the oil to drain into the drain pan.



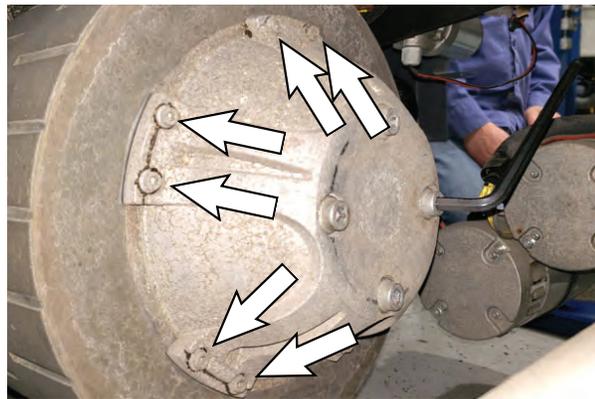
6. Clean the drive wheel assembly drain plug.

7. Tighten the drain plug into the drive wheel assembly.
8. Use a pump to fill the drive wheel assembly with oil.
9. Tighten the fill plug into the drive wheel assembly. Torque the plug to 16-18 Nm.
10. Mark the drain plug/fill plug as correctly torqued with a permanent marker.
11. Replace drive wheel. See *INSTALLING DRIVE WHEEL* section of the manual.

REPLACING THE DRIVE WHEEL TIRE

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

1. Remove the drive wheel from the machine. See *REMOVING THE DRIVE WHEEL* section of the manual.
2. Remove the socket head screws (Qty. 10) securing the tire to the drive wheel assembly hub.

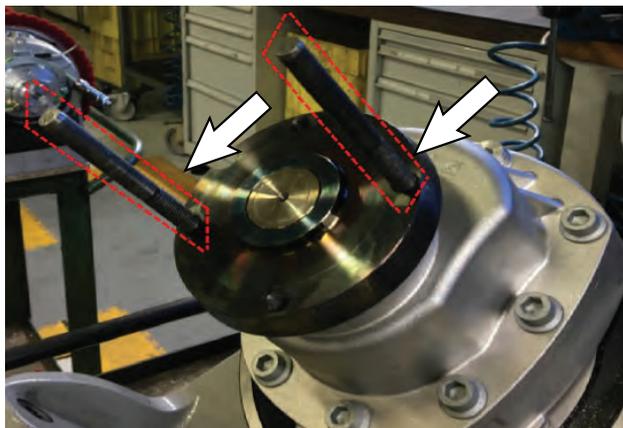


3. Use the socket head screws (Qty. 10) to install the tire onto the new drive wheel assembly hub.
4. Replace drive wheel. See *INSTALLING DRIVE WHEEL* section of the manual.

INSTALLING DRIVE WHEEL

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

1. Place the wheel onto the drive wheel assembly and use two dowels to align the holes in the wheel with the holes in the drive wheel assembly.



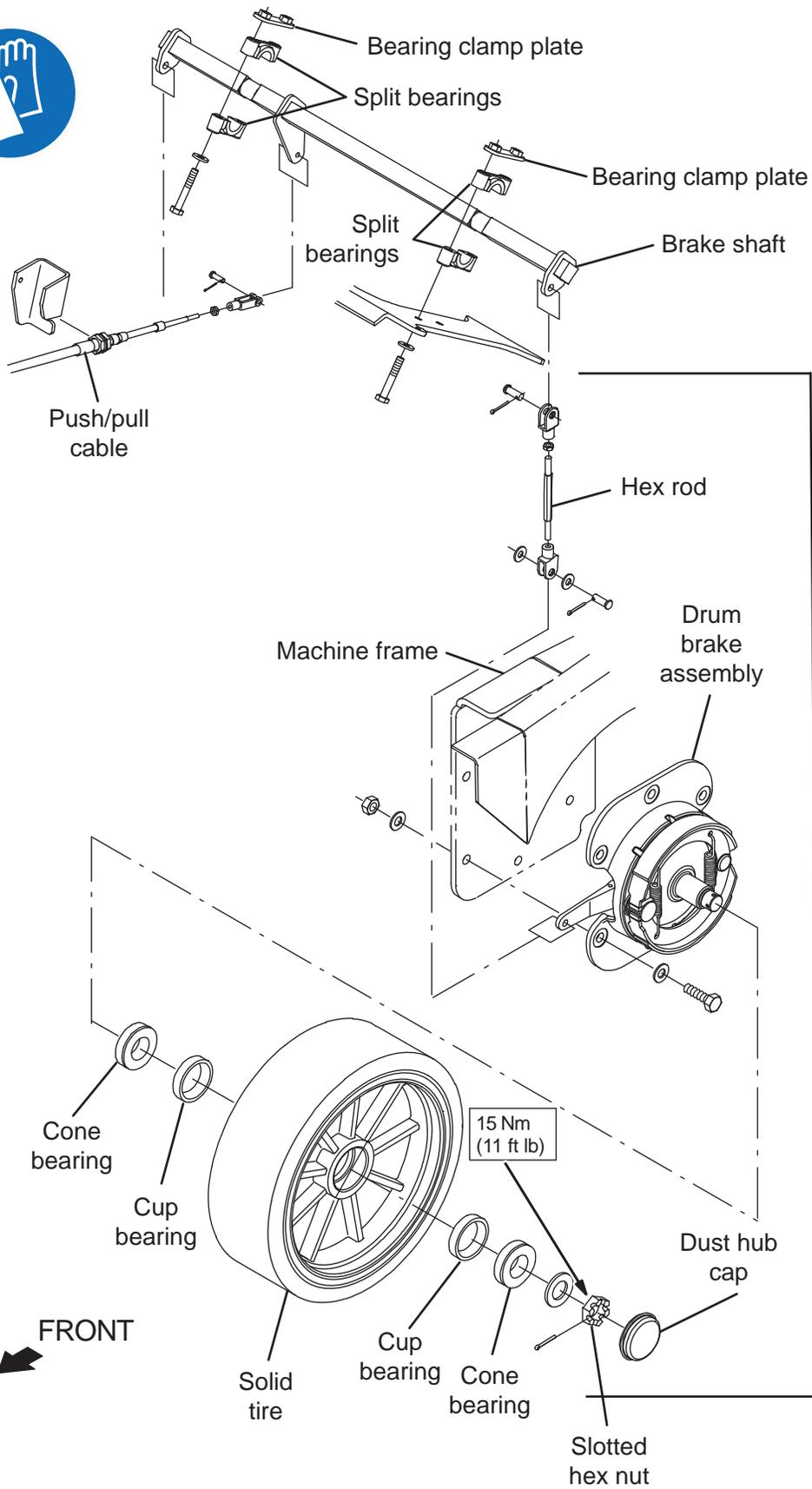
2. Apply red thread sealant onto the threads of two of the hex screws needed to secure the wheel onto the drive wheel assembly.
3. Loosely hand tighten the two hex screws from the previous step into the wheel and the drive wheel assembly until the wheel is loosely secured into place.
4. Remove the alignment dowels from the drive wheel assembly.

5. Apply red thread sealant onto the threads of the two remaining hex screws needed to secure the wheel onto the drive wheel assembly.
6. Loosely hand tighten the two hex screws from the previous step into the wheel and the drive wheel assembly.
7. Tighten the previously installed hex screws (Qty. 4) to 75 Nm (55.3 ft. lbs.). Use a star pattern to evenly tighten the hex screws.

NOTE: It maybe not be possible to achieve final torque with machine jacked up from the floor. It may be necessary to lower machine to the floor to tighten the hex screws to correct torque.

8. Jack the machine up off the jack stands, remove the jack stands from under the machine, and lower the machine to the floor.
9. If necessary, tighten the hex screws (Qty. 4) to the correct torque.
10. Reconnect the battery cable to the machine.

ADJUSTING THE REAR BRAKE



Rear wheel and brake components are identical on other side of machine

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

FOR SAFETY: When servicing machine, disconnect battery connections before working on machine.

1. Turn key switch OFF.
2. Open main brush doors.
3. Remove rear squeegee and set aside.

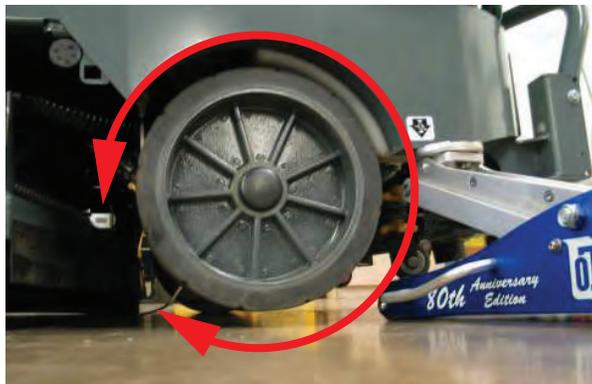


4. Place wheel chocks on both sides of the front wheel.
5. Jack rear of machine until rear wheel is off the floor. See *MACHINE JACKING* in the *MAINTENANCE* section of this manual.

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



6. Be sure the parking brake is released. Rear wheel should spin freely.



7. Loosen jam nut on rear adjustment rod.



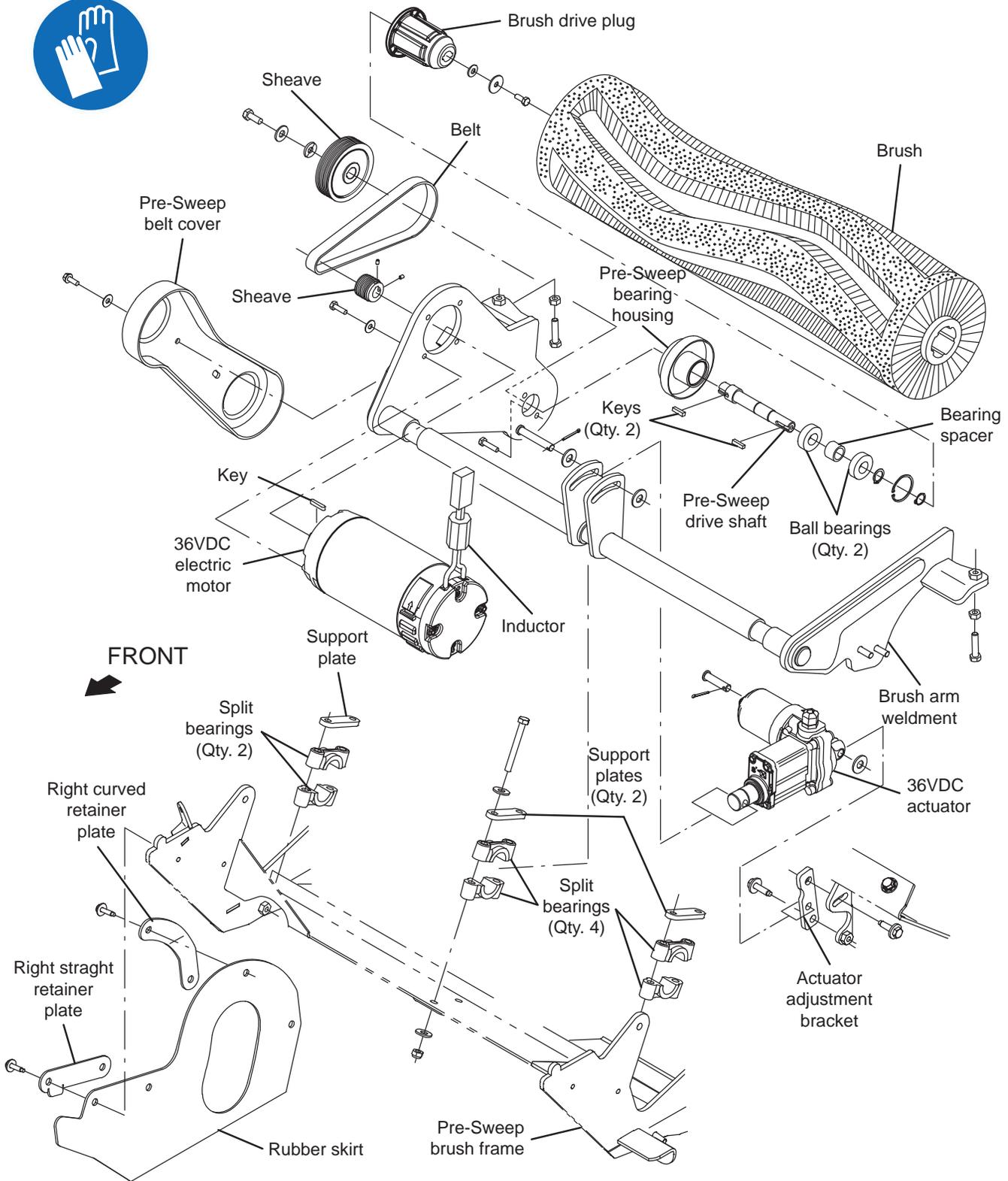
8. Turn the adjuster until the wheel stops spinning freely and then back off two turns.



9. Tighten jam nut and repeat process for other wheel.

OPTIONS

PRE-SWEEP ASSEMBLY



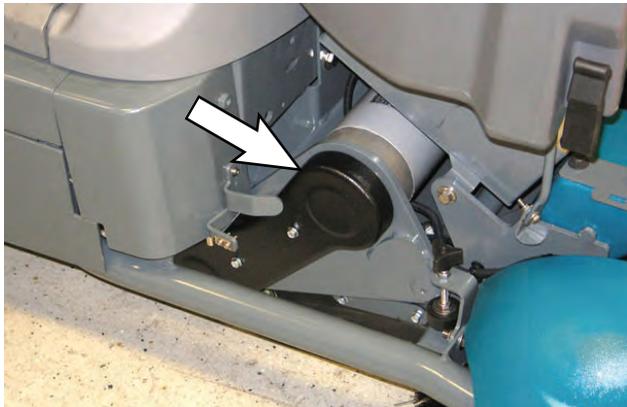
REMOVING/REPLACING THE PRE-SWEEP BRUSH DRIVE BELT

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

1. Turn key switch ON, completely lower the Pre-Sweep assembly, turn key switch OFF, and remove the key.
2. Lift the Pre-Sweep cover open and engage the cover support to support the cover open.



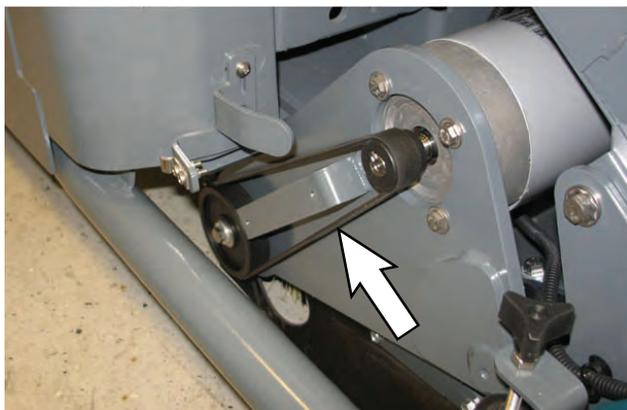
3. Remove the belt cover from the Pre-Sweep assembly.



NOTE: If replacing the Pre-Sweep brush drive belt, or if the belt is no longer installed on the Pre-Sweep assembly, proceed to the following steps to install a new belt/reinstall existing belt, or if removing/replacing the Pre-Sweep brush drive motor, proceed to **REMOVING/REPLACING THE PRE-SWEEP BRUSH DRIVE MOTOR**.

4. Install the belt installation tool onto the larger sheave.

5. If existing brush drive belt is still on Pre-Sweep assembly, use one hand with the wrench to turn the sheave clockwise and the other hand to coax the belt onto the belt installation tool until the belt is loose from the Pre-Sweep assembly. Remove the belt.



6. Situate the new brush drive belt onto the smaller sheave attached to the Pre-Sweep brush drive motor.
7. Use one hand to turn the sheave clockwise with the wrench and the other hand to coax the belt over the belt installation tool and onto both sheaves. Be sure the belt is completely seated into the grooves in both sheaves.
8. Remove the belt installation tool from the larger sheave.
9. Reinstall the belt cover onto the Pre-Sweep assembly.

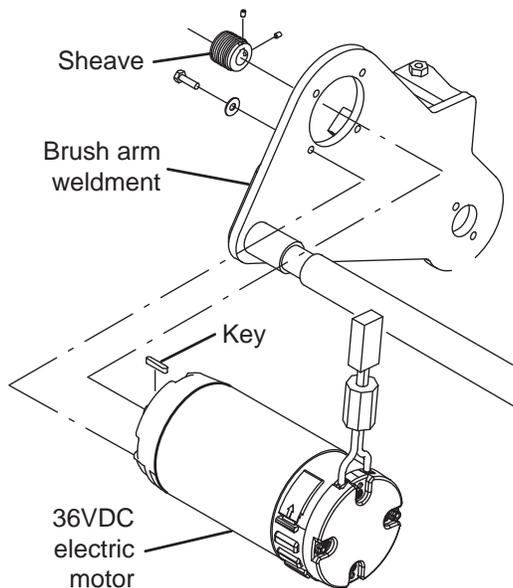
REMOVING/REPLACING THE PRE-SWEEP BRUSH DRIVE MOTOR

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

1. Remove the Pre-Sweep brush drive belt from the Pre-Sweep assembly. See the *REMOVING/REPLACING THE PRE-SWEEP BRUSH DRIVE BELT* section in this manual.
2. Remove the cylindrical brush from the Pre-Sweep assembly. See *REPLACING THE PRE-SWEEP CYLINDRICAL BRUSH* in the *MAINTENANCE* section of this manual.
3. Disconnect the battery cable from the machine.

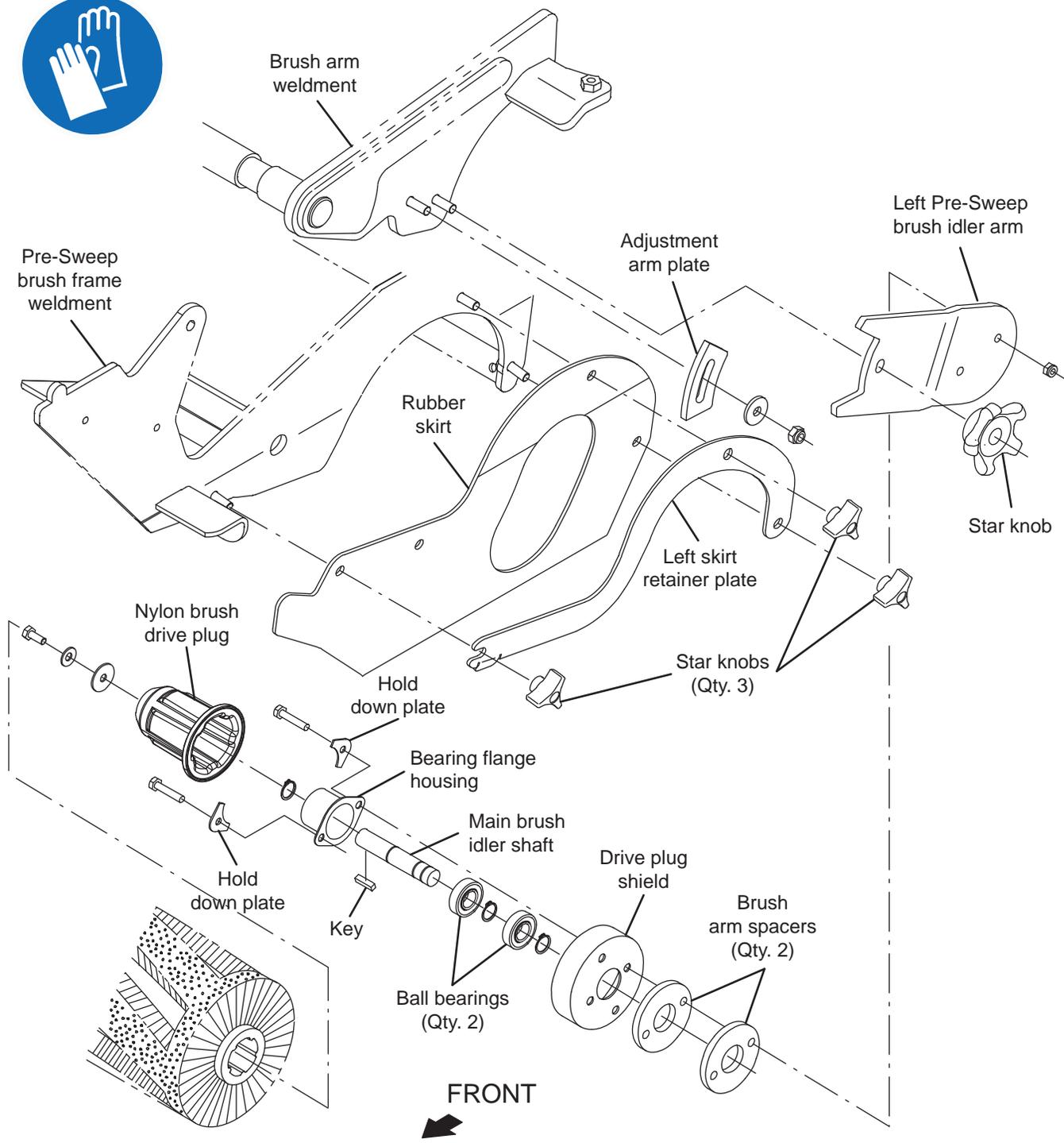
FOR SAFETY: When servicing machine, disconnect battery connections before working on machine.

4. Disconnect the Pre-Sweep harness from the Pre-Sweep cylindrical brush drive motor.
5. Remove the Pre-Sweep cylindrical brush drive motor from the machine.

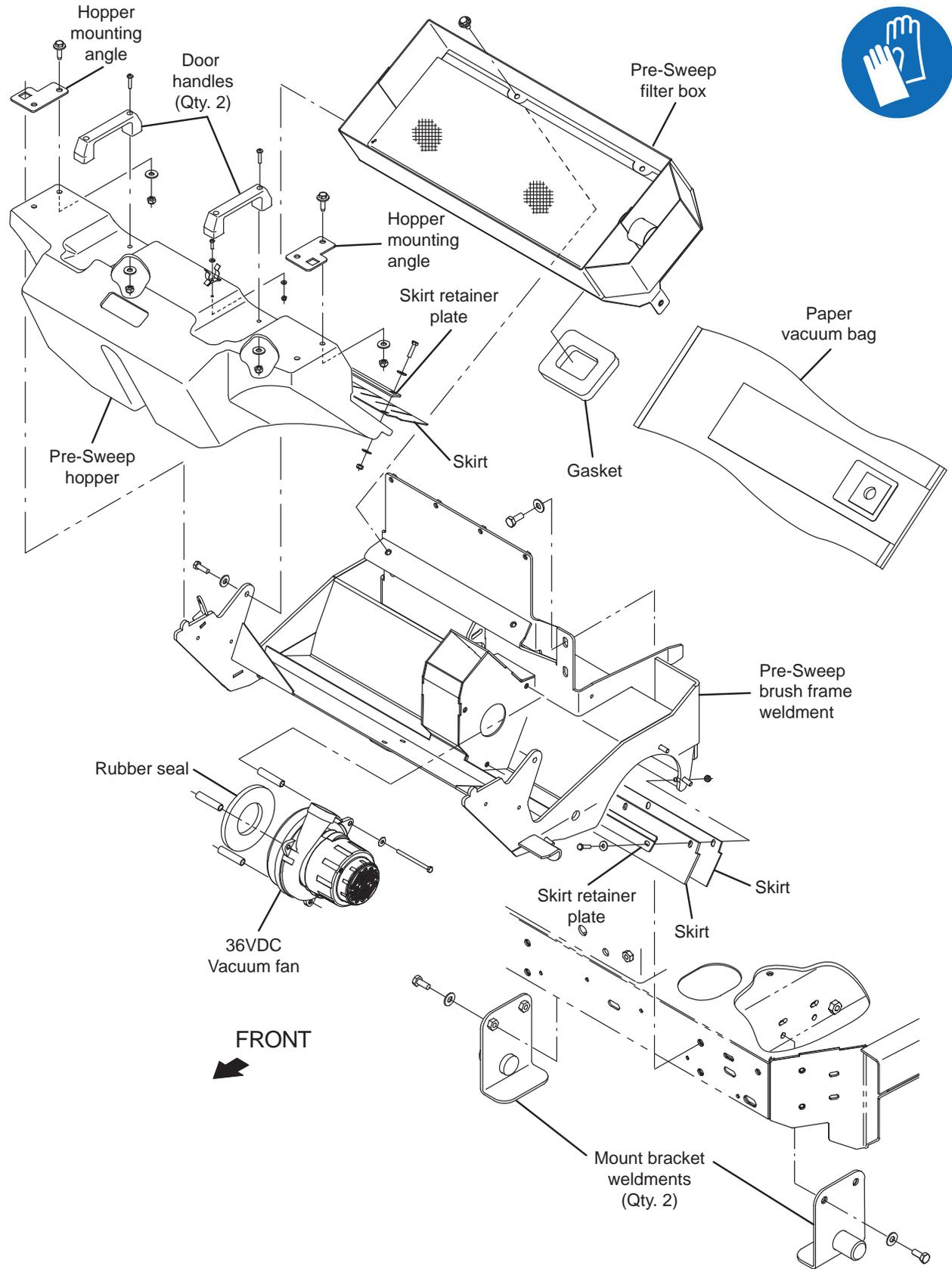


6. If replacing the Pre-Sweep cylindrical brush drive motor, remove the sheave from the motor and install it onto the new motor.

7. Install the new Pre-Sweep cylindrical brush drive motor/reinstall the remove Pre-Sweep cylindrical brush drive motor onto the Pre-Sweep assembly in reverse order of disassembly.
8. Reinstall the Pre-Sweep brush drive belt onto the Pre-Sweep assembly. See the *REMOVING/REPLACING THE PRE-SWEEP BRUSH DRIVE BELT* section in this manual.
9. Reinstall the cylindrical brush into the Pre-Sweep assembly. See *REPLACING THE PRE-SWEEP CYLINDRICAL BRUSH* in the *MAINTENANCE* section of this manual.



REMOVING/REPLACING THE PRE-SWEEP VACUUM FAN



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

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

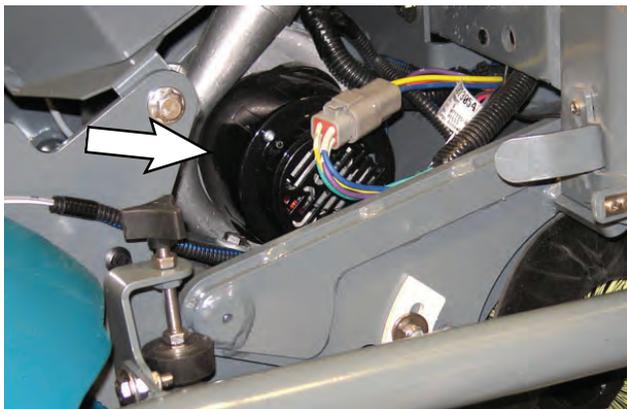
1. Turn key switch OFF.
2. Disconnect the battery cable from the machine.

FOR SAFETY: When servicing machine, disconnect battery connections before working on machine.

3. Lift the Pre-Sweep cover open and engage the cover support to support the cover open.



4. Disconnect main wire harness connection from the vacuum fan.



5. Remove the Pre-Sweep vacuum fan from the Pre-Sweep assembly.
6. If inspecting/replacing the Pre-Sweep vacuum fan carbon brushes, proceed to the *INSPECTING/REPLACING THE PRE-SWEEP VACUUM FAN MOTOR CARBON BRUSHES* section in this manual.
7. If the Pre-Sweep vacuum fan was removed for replacement or to perform other maintenance on the Pre-Sweep assembly, instal the new vacuum fan/reinstall removed vacuum fan in reverse order of removal.

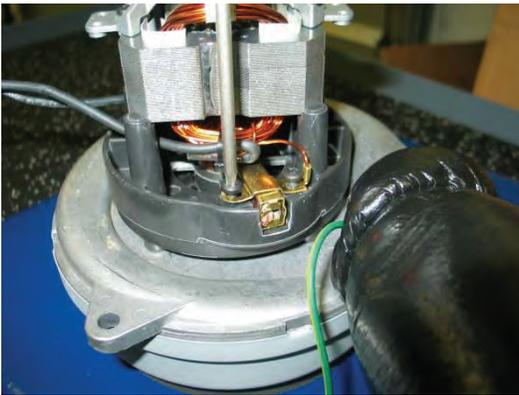
INSPECTING/REPLACING THE PRE-SWEEP VACUUM FAN CARBON BRUSHES

NOTE: Carbon brushes should be replaced as sets.

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



3. Loosen the carbon brush mounting hardware.

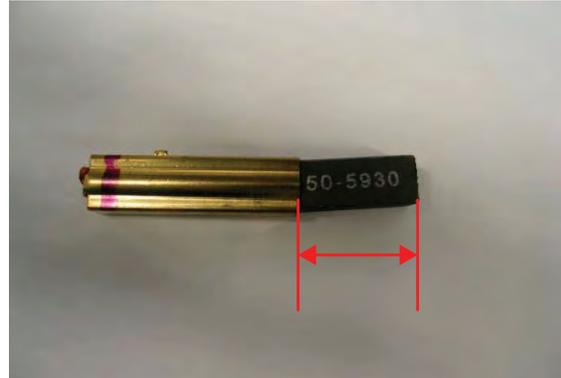


4. Lift up to release and remove carbon brushes from the vacuum fan motor.

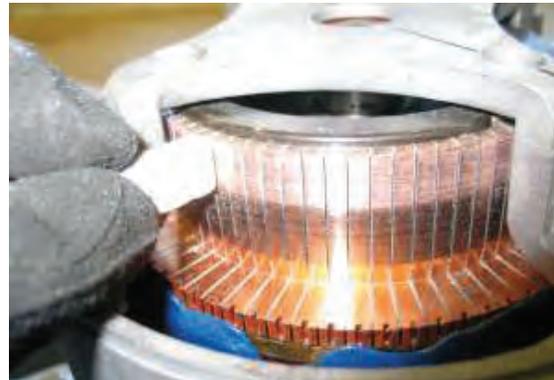


5. Inspect carbon brushes. Replace carbon brushes if they are stuck or are less than 10 mm (0.375 in) in length.

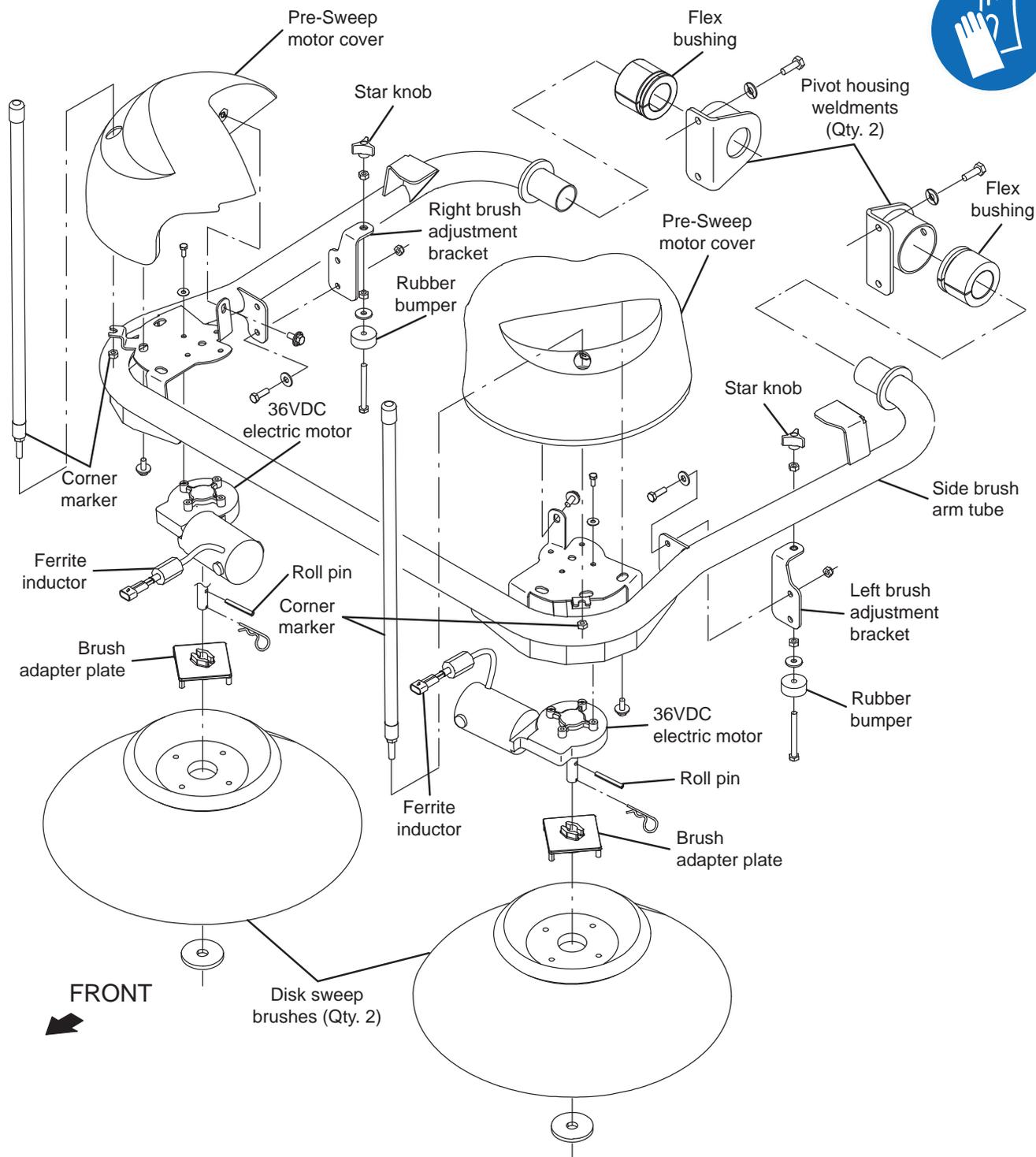
NOTE: Carbon brushes should be replaced as sets.



6. Use a stone to clean the commutator.



7. Use compressed air to clean dust from inside the vacuum fan motor.
8. Reinstall the removed vacuum fan brushes/install the new vacuum fan brushes in reverse order of disassembly.
9. Reinstall the vacuum fan onto the machine. See REMOVING/INSTALLING THE PRE-SWEEP VACUUM FAN in this section of manual.

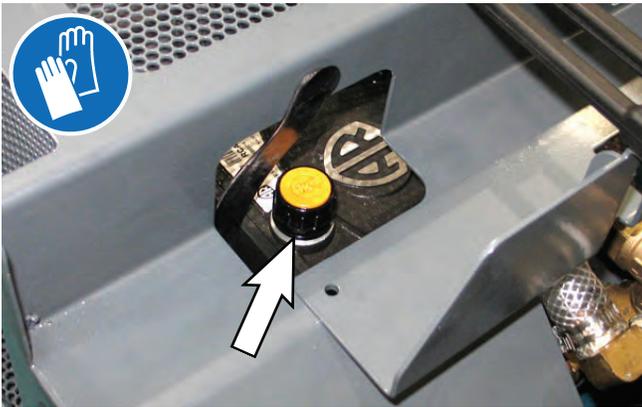


COMPLETELY OPENING BATTERY COMPARTMENT COVER (MACHINES EQUIPPED WITH OPTIONAL PRESSURE WASHER OR LIVE WAND)

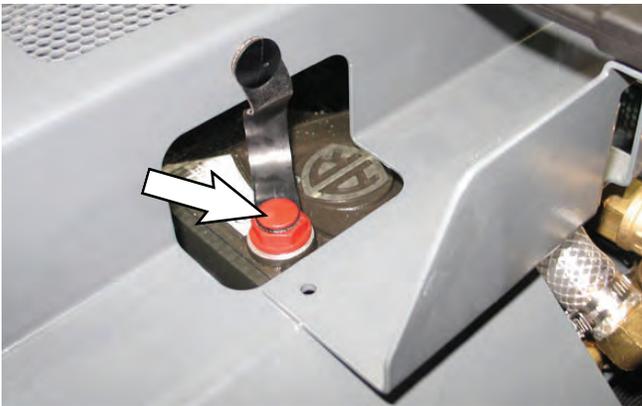
This procedure is used to fully open the battery compartment cover for service when equipped with an optional pressure washer or live wand.

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

1. Machines equipped with optional pressure washer: Remove the breather cap from the pressure washer assembly. Set the breather cap aside. **Do Not** lose or discard the breather cap since it must be reinstalled onto the pressure washer assembly after maintenance/service is complete.



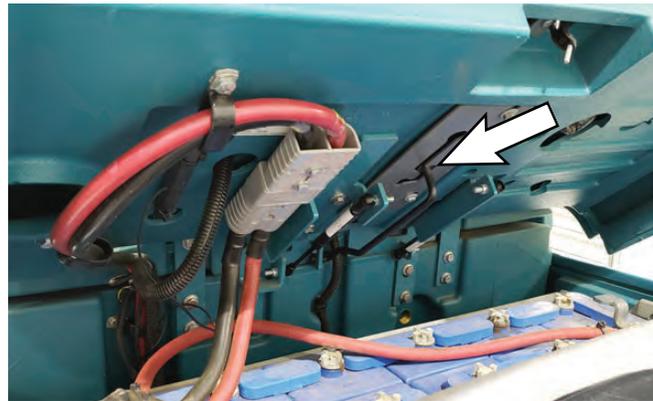
2. Machines equipped with pressure washer: Thread the plug tethered to the pressure washer assembly cover into the port where the breather plug was previously installed.



3. Machines equipped with optional live wand: Remove debris tray from the vacuum chamber and empty the debris tray. Reinstall the debris tray into the vacuum chamber.



4. Lift the battery compartment cover open and engage the support.



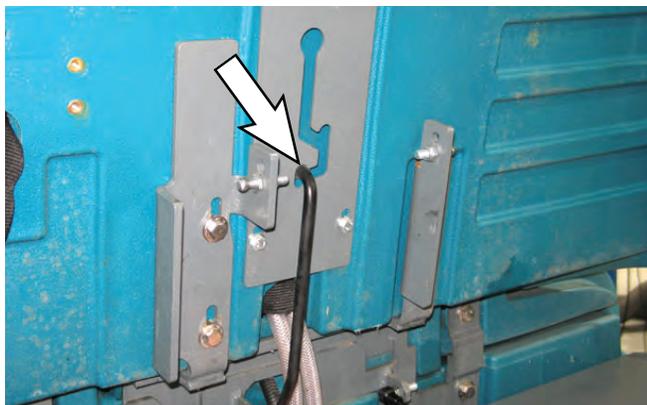
5. Disconnect the battery cable from the machine.

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

6. Carefully pry the retainer from the gas spring enough to disconnect the gas spring from the hinge weldment installed on the battery compartment cover and disconnect the gas spring.

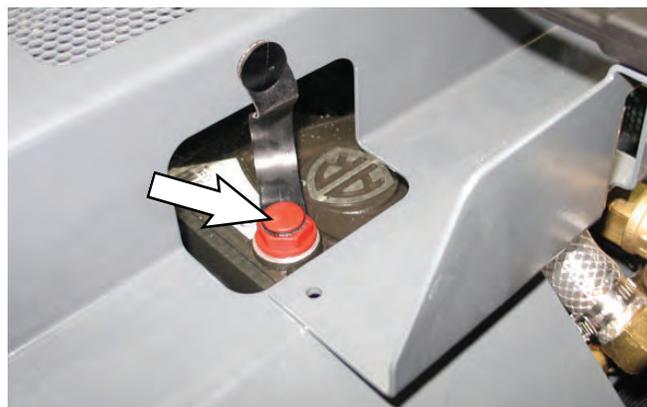


7. Lift the battery compartment cover completely open and engage the support completely open.



8. Remove the battery from the battery compartment or perform required maintenance.

9. Reinstall the battery into the battery compartment if battery was removed.
10. Disengage the support and carefully lower the battery compartment cover onto the lower support position.
11. Reconnect the gas springs to the hinge weldment.
12. Reconnect the battery cable to the machine.
13. Disengage the support and lower the battery compartment cover.
14. Machines equipped with pressure washer: Remove the tethered plug from the pressure washer assembly.



15. Machines equipped with pressure washer: Reinstall the breather cap into the pressure washer assembly/



SERVICING LITHIUM ION BATTERIES

REPLACING THE BATTERY MANAGEMENT SYSTEM (BMS)

NOTE: Service to the Lithium Ion battery must only be performed by Tennant Service.

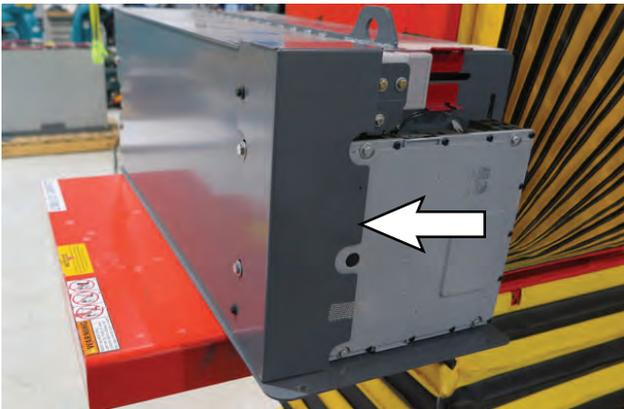
The replacement of the battery management system can be performed with the battery in the machine or removed from the machine.

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

1. Disconnect the battery cable from the machine.
2. Remove the Lithium-Ion battery pack from the machine.

FOR SAFETY: When using Lithium- ion Battery Model: Battery installation requires a specific service kit which includes a hoisting strap and proper lifting instructions. Contact Tennant Service. Do not attempt to lift battery by hand or by any other unauthorized method.

3. Place the Lithium-ion battery pack in an area where there is adequate space to perform maintenance.
4. Remove the corner cover from the Lithium-ion battery pack.



5. Cut the Warranty label from the Lithium-ion battery pack.

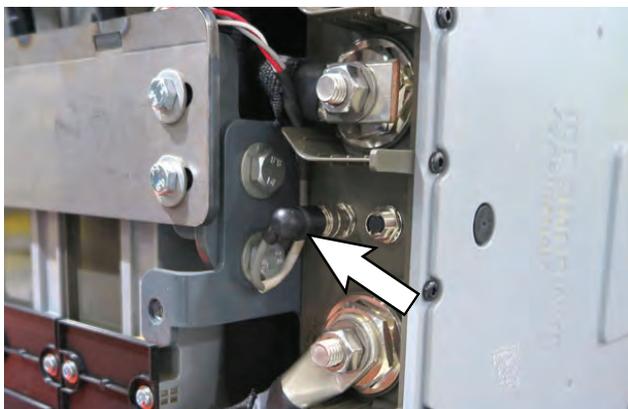


NOTE: Warranty is void if the Warranty label has been removed or tampered with. Contact Customer Service if label has been removed or damaged due to removal.

6. Remove the cover from the Lithium-ion battery pack.



7. Disconnect the Lithium-ion battery pack control cable and COM cable from the battery controller.



NOTE: If Lithium-ion battery pack is equipped with two COM cables, disconnect both COM cables from the battery controller.

8. Disconnect the Lithium-ion battery pack power cables from the battery controller. Disconnect the negative (-) terminal connection first.



Disconnect the positive (+) terminal after the negative (-) has been disconnected.



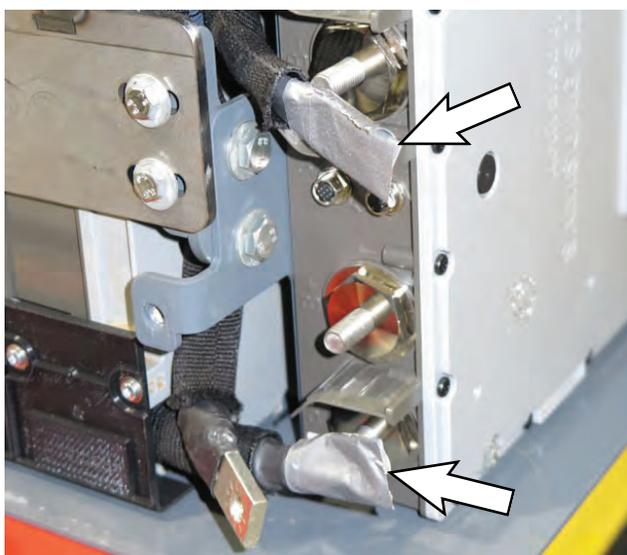
9. Disconnect the Lithium-ion battery pack bus cables from the battery controller. Disconnect the negative (-) terminal connection first.



Disconnect the positive (+) terminal after the negative (-) has been disconnected.



10. Wrap the Lithium-ion battery pack cable connectors with tape to prevent the cables from arcing.



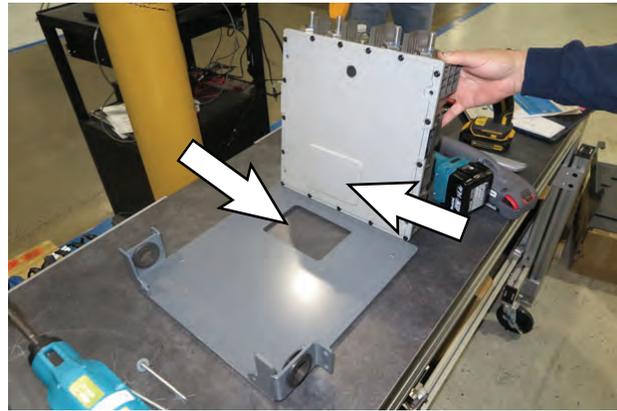
11. Remove the battery controller from the Lithium-ion battery pack



12. Remove the bracket from the battery controller.



13. Reassemble the bracket onto the battery controller. Be sure the protruded area on the battery controller goes back into the cut out section in the bracket.

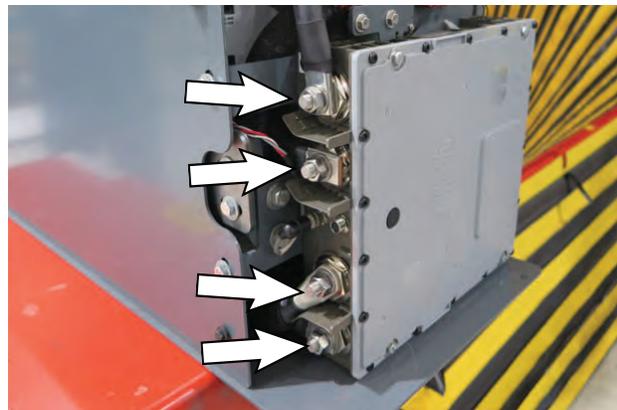


14. Apply blue thread sealant onto screws and reattach battery controller to bracket. Torque screws to 3.8 Nm +/- 0.7 Nm (2.8 ft lbs +/- 0.5 ft lbs).

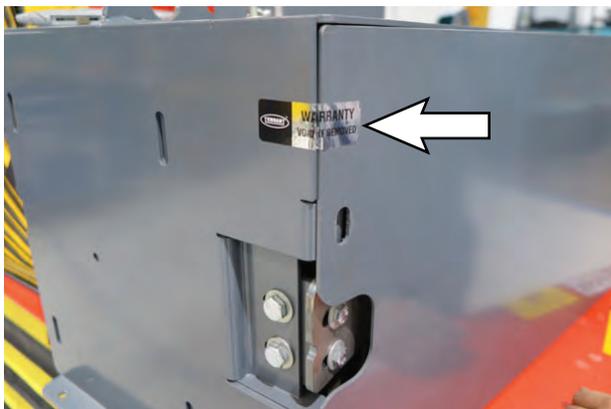


15. Install the battery controller onto the Lithium-ion battery pack in reverse order of disassembly.

16. Torque the nuts on each battery terminal to 24.5 Nm +/- 3.4 Nm (18 ft lbs +/- 2.5 ft lbs).



17. Clean old warranty label and label residue from the Lithium-ion battery pack and cover.
18. Install the new warranty label onto the bracket and Lithium-ion battery pack where the old label was previously located.



19. Reinstall the Lithium-ion battery pack into the battery compartment.
20. Reconnect the battery cable to the machine.