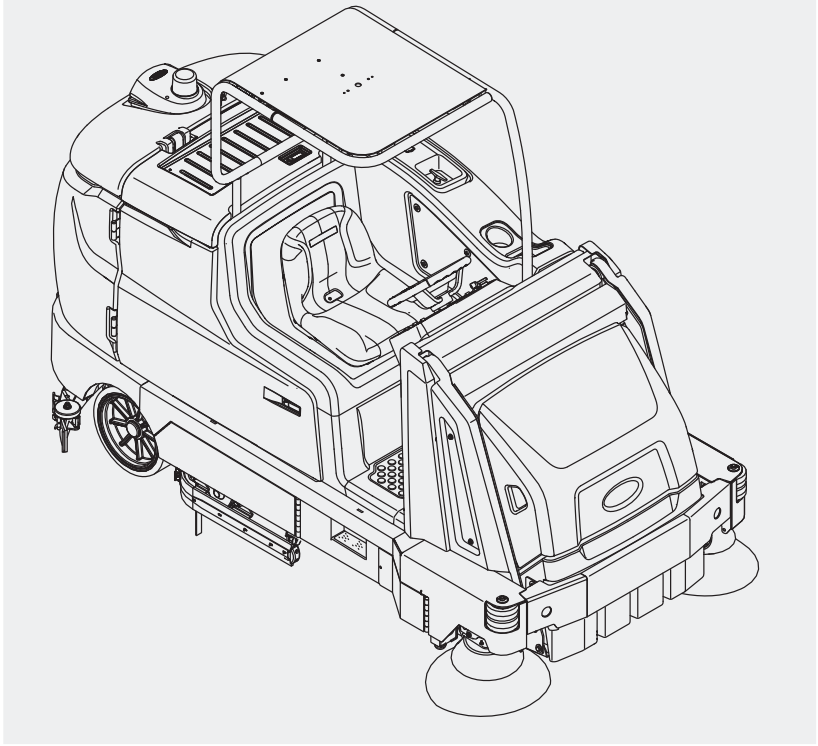
M17
(Battery)



Sweeper - Scrubber
Service Information Manual

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

ec H2O
An ORBIO™ Technology

North America / International

For the latest Parts Manuals and other language Operator Manuals, visit:

www.tennantco.com/manuals

9017358
Rev. 00 (08-2016)

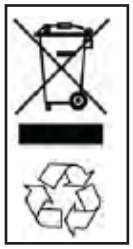
INTRODUCTION

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 f uids in an environmentally safe way according to local waste disposal regulations.

Always remember to recycle.

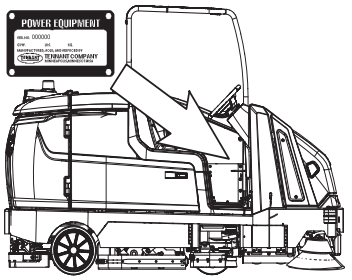
MACHINE DATA

Please f ll out at time of installation for future reference.

Model No. - _____

Serial No. - _____

Installation Date - _____



INTENDED USE

The M17 is an industrial rider machine designed to wet scrub and sweep both rough and smooth hard surfaces (concrete, tile, stone, synthetic, etc). Typical applications include schools, hospitals / health care facilities, off ce buildings, and retail centers. Do not use this machine on soil, grass, artif cial 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 Operators Manual.

Tennant Company
PO Box 1452
Minneapolis, MN 55440
Phone: (800) 553-8033 or (763) 513-2850
www.tennantco.com

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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: 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: Raised hopper may fall. Engage hopper support bar.

WARNING: Lift arm pinch point. Stay clear of hopper lift arms.

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.

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

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.
   - Do not pick up burning or smoking debris, such as cigarettes, matches or hot ashes.
   - Go slowly on inclines and slippery surfaces.
   - Do not scrub on ramp inclines that exceed 11% grade or transport (GVWR) on ramp inclines that exceed 13% 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.
   - Move machine with care when hopper is raised.
   - Make sure adequate clearance is available before raising hopper.
   - Do not raise hopper when machine is on an incline.
   - 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.

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.
   - Empty both solution and recovery tanks.
   - 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.
   - Use cardboard to locate leaking hydraulic fluid under pressure.
   - Do not power spray or hose off machine near electrical components.
   - Disconnect battery connections and charger cord before working on machine.
   - Do not use incompatible battery chargers as this may damage battery packs and potentially cause a fire.
   - Inspect charger cord regularly for damage.
   - Do not 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.

6. When loading/unloading machine onto/off truck or trailer:
   - Drain tanks before loading machine.
   - Lower scrub head and squeegee before tying down machine.
   - Empty debris hopper before loading 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.
   - Tie machine down to truck or trailer.
   - Use ramp, truck or trailer that will support the weight of the machine and operator.
   - Do not load/unload on ramp inclines that exceed 20% grade.
   - Use winch. Do not push the machine onto/off the truck or trailer unless the load height is 380 mm (15 in) or less from the ground.

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

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

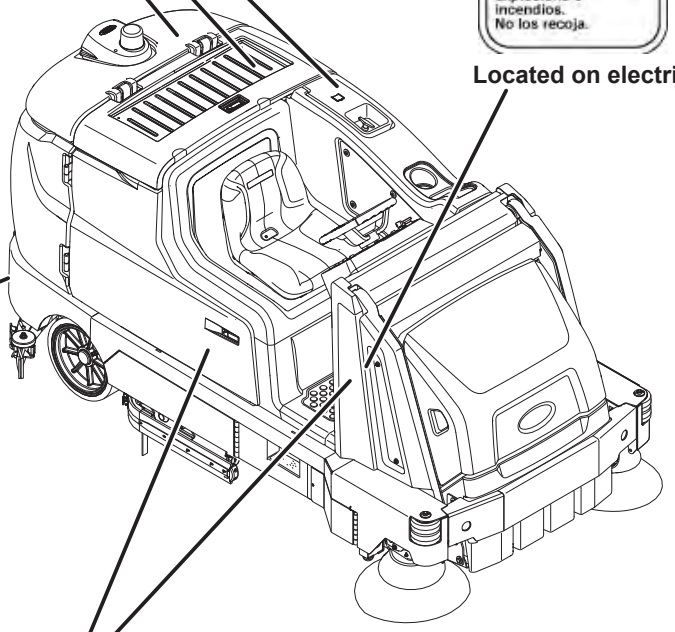
Located on solution tank cover, recovery tank cover and detergent tank (option).

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

Located on electrical panel.

FOR SAFETY LABEL - Do not operate machine with the 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 - Authorized Service Mechanic Only.

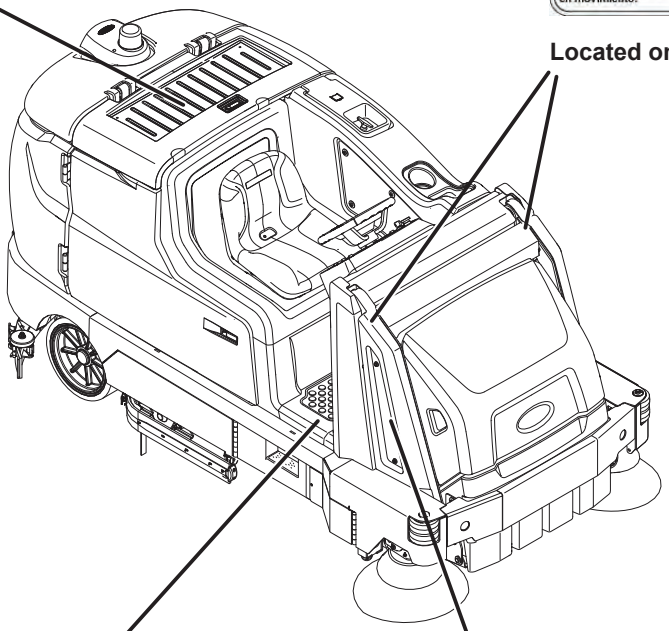
Located on circuit board cover and electrical panel.

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 - Lift arm pinch point. Stay clear of lift arms.

Located on both lift arms.



FOR SAFETY LABEL - Read manual before operating machine.

Located on electrical panel.

WARNING LABEL - Raised hopper may fall. Engage hopper support bar.

Located on hopper support bar.

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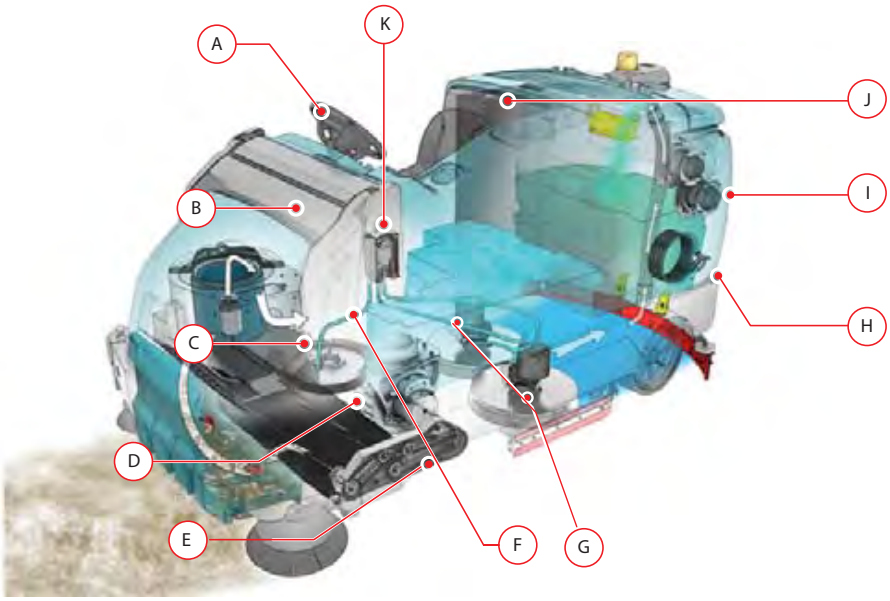
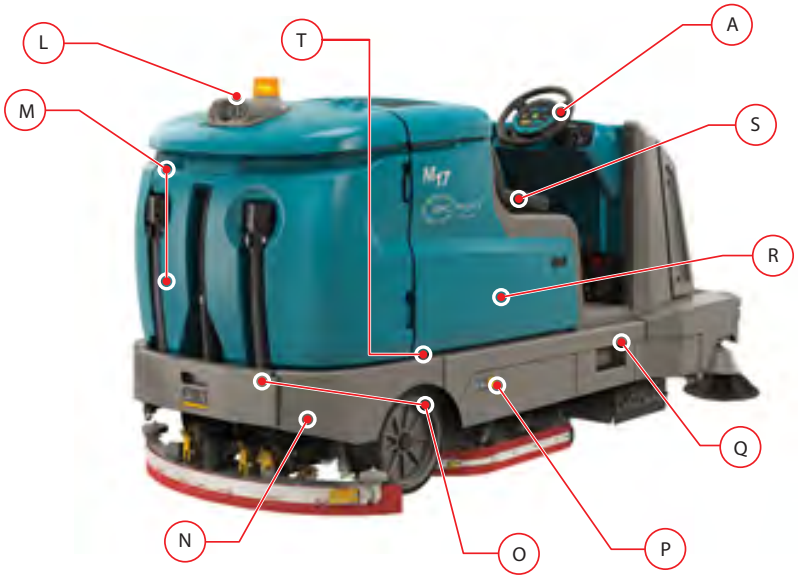
COMPONENT LOCATOR

Components	
A	Interface Module and Touch Panel
B	Curtis® AC Propel Controller
C	Power Steering Assembly*
D	AC Drive Assembly
E	Main Sweep Motors
F	ec-H2O Pump*
G	BLDC (Brushless DC) Brush Motors
H	Spray Wand*
I	Dual Vacuum Fans
J	IRIS™ Shunt Assembly*
K	ec-H2O Module*
L	Backup Alarm/Flashing Light*, Circuit Breaker #16, M2 Relay
M	Recovery Tank Full Switch, ES Half-Full Switches*
N	Rear Squeegee Lift Actuator
O	Brake Adjustment Rods
P	Scrub Head Lift Actuator
Q	Brake Pedal Interlock Switch
R	Control Modules, M1 Contactor Circuit Breakers (1-9)
S	Seat Switch
T	Battery Rollout Switch

*** optional equipment**

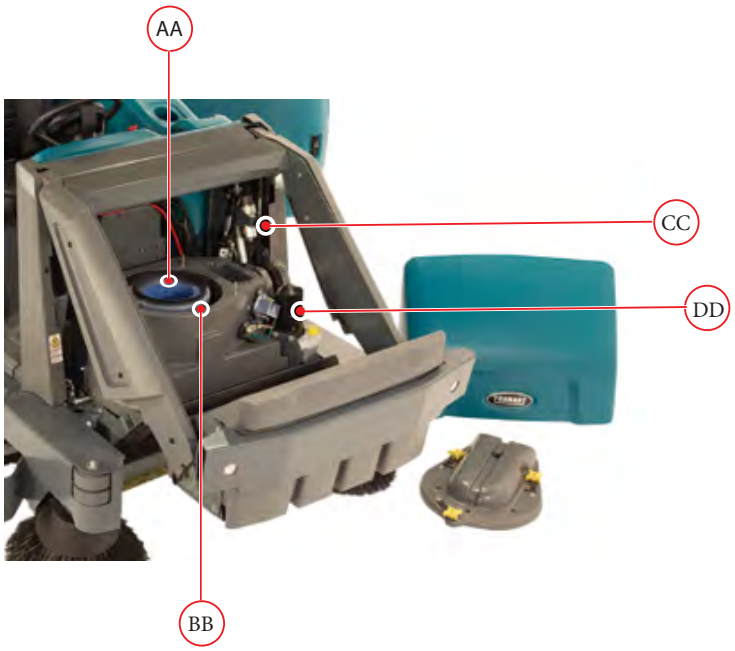




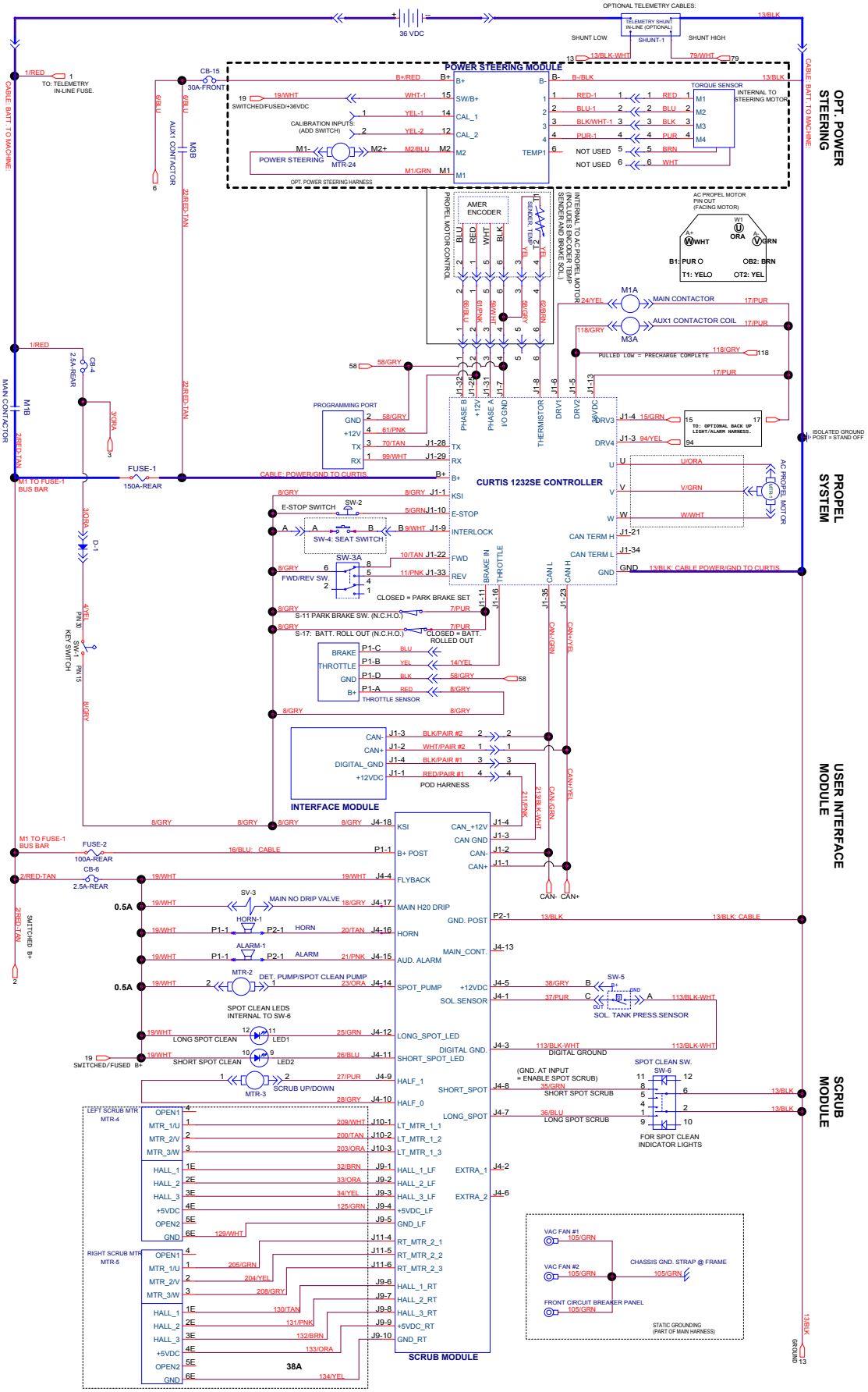
COMPONENT LOCATOR

Components	
U	Battery
V	Detergent Metering Pump*
W	BLDC (Brushless DC) Side Scrub Brush Motor
X	Side Scrub Brush Lift Actuator
Y	Electrical Sweeping Motor Control Box
Z	Throttle Sensor
AA	Shaker Sweep System
BB	Sweeping, Filter
CC	Hopper Lift Cylinder and Roll-Out Actuator
DD	Hopper Lift Pump & Reservoir
EE	Sweeper, Hopper
FF	Side Sweep Brush Motors

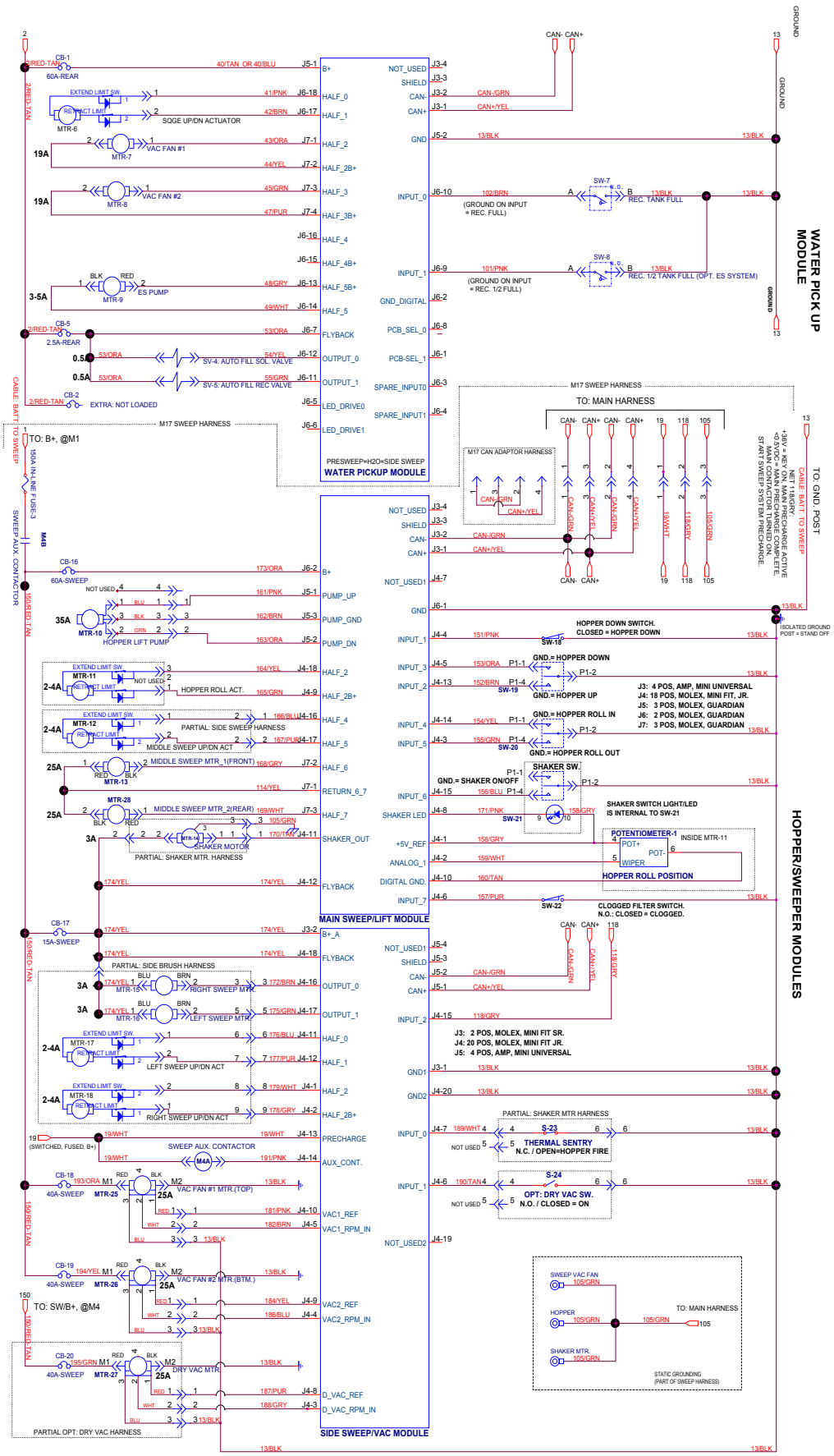
*** optional equipment**



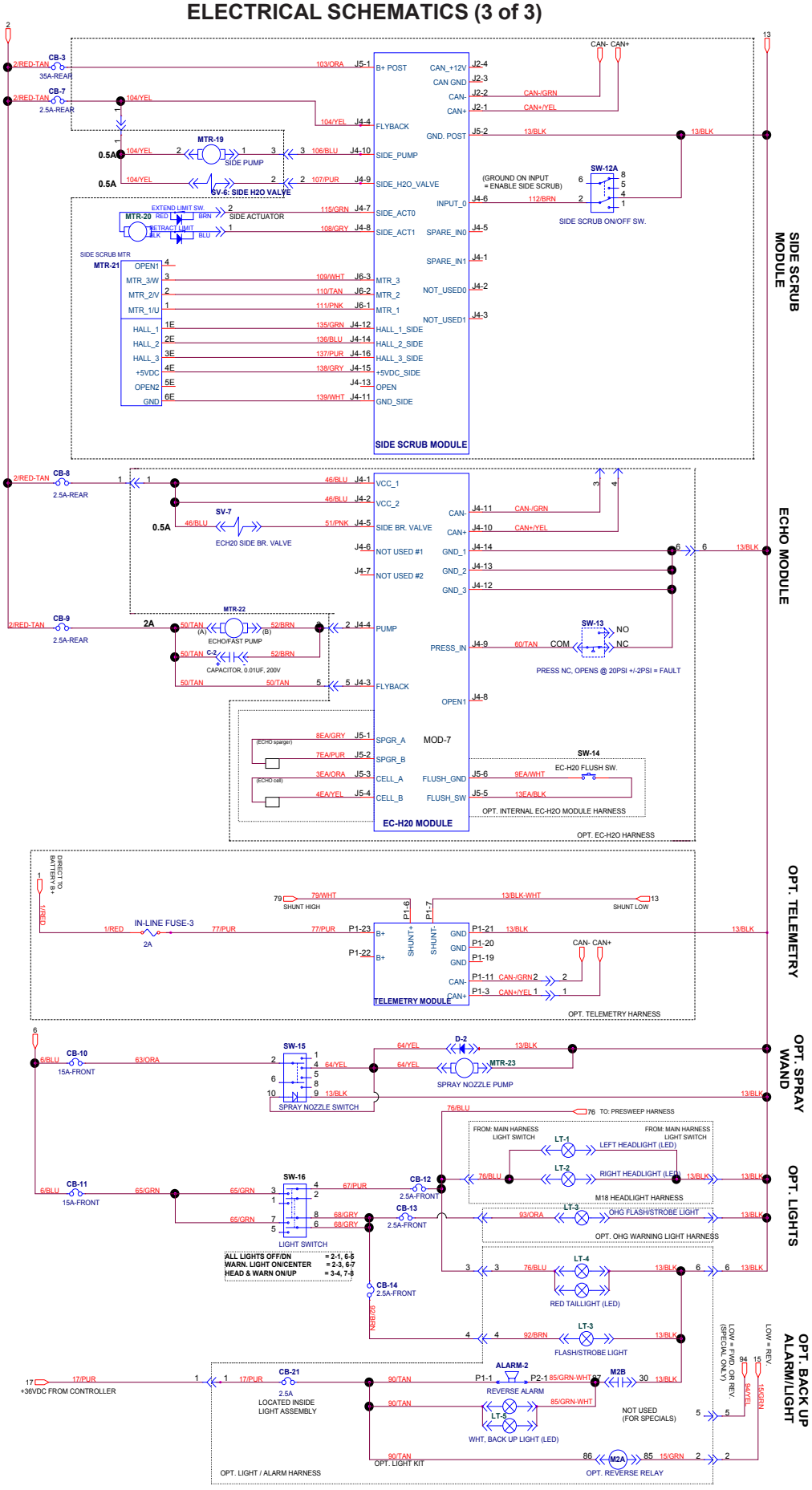
ELECTRICAL SCHEMATICS (1 of 3)



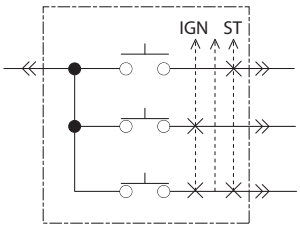
ELECTRICAL SCHEMATICS (2 of 3)



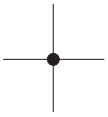
ELECTRICAL SCHEMATICS (3 of 3)

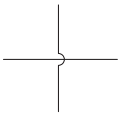


ELECTRICAL SCHEMATIC SYMBOLS



Key Switch


Connected


Not Connected


Connector


Energized


Adaptor Harness


Notes


Assembly


AC Plug

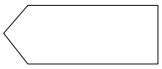
Capacitor

Battery

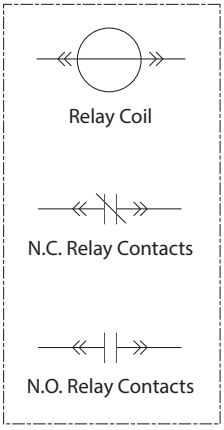

Circuit Breaker

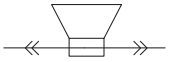

Fuse

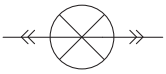

Diode

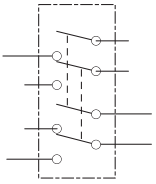

Single Continuation Tab

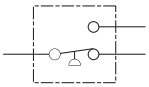

Double Continuation Tab

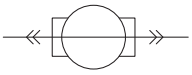


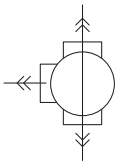

Horn or Alarm

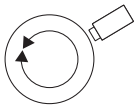

Light


DPDT Switch


Pressure Switch


Motor


3 Phase AC
Induction Motor


Motor Encoder


Sensor
(Variable Resistor)


Momentary Switch N.O.


Contact Switch N.C.


Solenoid Valve

OPERATIONAL MATRIX

Output	Pin(s)	Enable	Input	Disable	Input
Vacuum Fan, Scrubbing	Water PU Module: Fan #1 *J7-1, J7-2* Fan #2 *J7-3, J7-4*	1-STEP On	Interface Module	1-STEP Off	Interface Module
		Squeegee Selected	Interface Module	Squeegee Off	Interface Module
				Recovery Tank Full	Water PU Module, *J6-10 Low*
				Low Battery Voltage	Curtis PMC Module, *J1-1 ≈ < 32 Vdc*
				Circuit Fault	CAN-Bus to Interface Module
Rear Squeegee Down	Water PU Module: *J6-17, J6-18*	1-STEP On	Interface Module	1-STEP Off	Interface Module
		Squeegee Selected	Interface Module	Squeegee Off	Interface Module
				Reverse Propel	Curtis PMC, *J1-33 High*
				Recovery Tank Full	Water PU Module, *J6-10 Low*
				Low Battery Voltage	Curtis PMC Module, *J1-1 ≈ < 32 Vdc*
				Circuit Fault	CAN-Bus to Interface Module
Main Scrub Brushes	Scrub Module: Left Motor *J10-1, J10-2, J10-3, J9-1, J9-2, J9-3, J9-4, J9-5* Right Motor *J11-4, J11-5, J11-6, J9-6, J9-7, J9-8, J9-9, J9-10*	1-STEP On	Interface Module	1-STEP Off	Interface Module
		Main Scrub Selected	Interface Module	Main Scrub Deselected	Interface Module
		Fwd/Rev Throttle Command	Curtis PMC, *J1-6 ≈ 0.2-5 vDC*	Neutral - Ready State	Curtis PMC, *J1-6 ≈ 0 Vdc*
				Recovery Tank Full	Water PU Module, *J6-10 Low*
				Solution Tank Empty	Scrub Module, *J4-1 ≈ < 0.73 Vdc*
				Low Battery Voltage	Curtis PMC Module, *J1-1 ≈ < 32 Vdc*
				Circuit Fault	CAN-Bus to Interface Module

OPERATIONAL MATRIX (cont'd)

Output	Pin(s)	Enable	Input	Disable	Input
Scrub Head Down	Scrub Module: *J4-9, J4-10*	1-STEP On	Interface Module	1-STEP Off	Interface Module
		Scrub Selected	Curtis PMC, *J1-6 ≈ 0.2-5 vDC*	Scrub Deselected	Interface Module
				Recovery Tank Full	Water PU Module, *J6-10 Low*
				Solution Tank Empty	Scrub Module, *J4-1 ≈ < 0.73 Vdc*
				Low Battery Voltage	Curtis PMC Module, *J1-1 ≈ < 32 Vdc*
				Circuit Fault	CAN-Bus to Interface Module
Side Brush Extend/ Down (Option)	Side Scrub Module: *J4-7, J4-8*	1-STEP On	Interface Module	1-STEP Off	Interface Module
		Side Brush Selected	Side Scrub Module, *J4-6 Ground*	Side Brush Deselected	Side Scrub Module, *J4-6 Not Grounded*
				Recovery Tank Full	Water PU Module, *J6-10 Low*
				Solution Tank Empty	Scrub Module, *J4-1 ≈ < 0.73 Vdc*
				Low Battery Voltage	Curtis PMC Module, *J1-1 ≈ < 32 Vdc*
				Circuit Fault	CAN-Bus to Interface Module
Side Sweep Brushes	Scrub Module: Left Motor *J3-2 CB-17, J4-17* Right Motor *J3-2 CB-17, J4-16*	1-STEP On	Interface Module	1-STEP Off	Interface Module
		Side Sweep Selected	Interface Module	Side Sweep Deselected	Interface Module
		Fwd/Rev Throttle Command	Curtis PMC, *J1-6 ≈ 0.2-5 vDC*	Neutral - Ready State	Curtis PMC, *J1-6 ≈ 0 Vdc*
				Low Battery Voltage	Curtis PMC Module, *J1-1 ≈ < 32 Vdc*
				Circuit Fault	CAN-Bus to Interface Module

OPERATIONAL MATRIX (cont'd)

Output	Pin(s)	Enable	Input	Disable	Input
Side Scrub Brush Motor (Option)	Side Scrub Module: Motor *J6-1, J6-2, J6-3, J4-11, J4-12, J4-14, J4-15, J4-16*	1-STEP On	Interface Module	1-STEP Off	Interface Module
		Side Brush Selected	Side Scrub Module, *J4-6 Ground*	Side Brush Deselected	Side Scrub Module, *J4-6 Not Grounded*
		Fwd/Rev Throttle Command	Curtis PMC, *J1-6 ≈ 0.2-5 vDC*	Neutral - Ready State	Curtis PMC, *J1-6 ≈ 0 Vdc*
				Recovery Tank Full	Water PU Module, *J6-10 Low*
				Solution Tank Empty	Scrub Module, *J4-1 ≈ < 0.73 Vdc*
				Low Battery Voltage	Curtis PMC Module, *J1-1 ≈ < 32 Vdc*
				Circuit Fault	CAN-Bus to Interface Module
Solution Control (Conventional)	Scrub Module: Main Valve *J4-17, CB-6* Side Scrub Module (Option): Side Pump *J4-10, CB-7* Side Valve *J4-9, CB-7*	1-STEP On	Interface Module	1-STEP Off	Interface Module
		Main Scrub Selected	Interface Module	Main Scrub Deselected	Interface Module
		Fwd/Rev Throttle Command	Curtis PMC, *J1-6 ≈ 0.2-5 vDC*	Neutral - Ready State	Curtis PMC, *J1-6 ≈ 0 Vdc*
		Side Scrub Selected (Option)	Side Scrub Module, *J4-6 ≈ Grounded*	Side Scrub Deselected (Option)	Side Scrub Module, *J6-10 ≈ Not Grounded*
				Recovery Tank Full	Water PU Module, *J6-10 Low*
				Solution Tank Empty	Scrub Module, *J4-1 ≈ < 0.73 Vdc*
				Low Battery Voltage	Curtis PMC Module, *J1-1 ≈ < 32 Vdc*
				Circuit Fault	CAN-Bus to Interface Module

OPERATIONAL MATRIX (cont'd)

Output	Pin(s)	Enable	Input	Disable	Input
Side Sweep Brushes Down	Side Sweep Module: LH Side Actuator J4-11, J4-12 RH Side Actuator J4-1, J4-2	1-STEP On	Interface Module, CAN-Bus	1-STEP Off	Interface Module, CAN-Bus
		Side Sweep Selected	Interface Module, CAN-Bus	Side Sweep Deselected	Interface Module, CAN-Bus
Solution Control ec-H2O (Option)	ec-H2O Module: Side Br. Valve *J4-5, CB-8* Pump *J4-4, CB-9* Sparger *J5-1, J5-2* e-Cell *J5-3, J5-4*	1-STEP On	Interface Module, CAN-Bus	1-STEP Off	Interface Module, CAN-Bus
		ec-H2O Enabled	Interface Module, CAN-Bus	ec-H2O Disabled	Interface Module, CAN-Bus
		Main Scrub Selected	Interface Module, CAN-Bus	Main Scrub Deselected	Interface Module, CAN-Bus
		Fwd/Rev Throttle Command	Curtis PMC, *J1-6 ≈ 0.2-5 vDC*	Neutral - Ready State	Curtis PMC, *J1-6 ≈ 0 Vdc*
				Recovery Tank Full	Water PU Module, *J6-10 Low*
				Solution Tank Empty	Scrub Module, *J4-1 ≈ < 0.73 Vdc*
				Low Battery Voltage	Curtis PMC Module, *J1-1 ≈ < 32 Vdc*
				ec-H2O System Fault (see ec-H2O system troubleshooting)	ec-H2O Module to CAN-Bus
				Circuit Fault	CAN-Bus to Interface Module
				Flush Mode	ec-H2O Module, *J5-5 and J5-6 = Closed*
				System Over Pressure (≈ > 20 psi)	ec-H2O Module, *J4-9 = Not Grounded*
				Severe Environment Mode	Scrub Module, *J4-8 Low or J4-7 Low*

OPERATIONAL MATRIX (cont'd)

Output	Pin(s)	Enable	Input	Disable	Input
ES (Extended Scrub) Pump (Option) *NOTE: 45 seconds/10 seconds Off until recovery tank is less than 1/2 full and solution tank is not full.*	Water PU Module: Water Pump *J6-13, J6-14*	1-STEP On	Interface Module, CAN-Bus	1-STEP Off	Interface Module, CAN-Bus
		Main Scrub Selected	Interface Module, CAN-Bus	Main Scrub Deselected	Interface Module, CAN-Bus
		ES Enabled	Interface Module, CAN-Bus	ES Disabled	Interface Module, CAN-Bus
		Recovery Tank 1/2 Full	Water PU Module, *J6-9 = Ground*	Recovery Tank Full	Water PU Module, *J6-10 = Ground*
		Solution Tank Not Full	Scrub Module, *J4-1 ≈ < 1.34 Vdc*	Solution Tank Full	Scrub Module, *J4-1 ≈ > 1.34 Vdc*
				Low Battery Voltage	Curtis PMC Module, *J1-1 ≈ < 32 Vdc*
				Circuit Fault	CAN-Bus to Interface Module
ES Detergent Pump: (Option) *NOTE: Does not operate on 1 solution level LED.*	Scrub Module: Detergent Pump *J4-14, CB-6*	1-STEP On	Interface Module, CAN-Bus	1-STEP Off	Interface Module, CAN-Bus
		Main Scrub Selected	Interface Module, CAN-Bus	Main Scrub Deselected	Interface Module, CAN-Bus
		ES Enabled	Interface Module, CAN-Bus	ES Disabled	Interface Module, CAN-Bus
		Fwd/Rev Throttle Command	Curtis PMC, *J1-6 ≈ 0.2-5 vDC*	Neutral - Ready State	Curtis PMC, *J1-6 ≈ 0 Vdc*
				Recovery Tank Full	Water PU Module, *J6-10 = Ground*
				Solution Tank Empty	Scrub Module, *J4-1 ≈ < 0.73 Vdc*
				Low Battery Voltage	Curtis PMC Module, *J1-1 ≈ < 32 Vdc*
				Circuit Fault	CAN-Bus to Interface Module

OPERATIONAL MATRIX (cont'd)

Output	Pin(s)	Enable	Input	Disable	Input
Severe Environment Pump: (Option) *NOTE: Short and Long cycle duration times can be adjusted in configuration mode.*	Scrub Module: Detergent Pump *J4-1, CB-6*	1-STEP On	Interface Module, CAN-Bus	1-STEP Off	Interface Module, CAN-Bus
		Severe Environment Enabled	Scrub Module, *J4-8 Low or J4-7 Low*	Severe Environment Disabled	Scrub Module, *J4-8 Not Low and J4-7 Not Low*
		Fwd/Rev Throttle Command	Curtis PMC, *J1-6 ≈ 0.2-5 vDC*	Neutral - Ready State	Curtis PMC, *J1-6 ≈ 0 Vdc*
		Configured for 1%, 2%, or 3% Mix Ratio	Interface Module, CAN-Bus	Configured for 0% Mix Ratio	Interface Module, CAN-Bus
				Recovery Tank Full	Water PU Module, *J6-10 = Ground*
				Solution Tank Empty	Scrub Module, *J4-1 ≈ < 0.73 Vdc*
				Low Battery Voltage	Curtis PMC Module, *J1-1 ≈ < 32 Vdc*
				Circuit Fault	CAN-Bus to Interface Module
Main Sweep Brushes	Main Sweeper Module: Front *J7-1, J7-2* Rear *J7-1, J7-3*	1-STEP On	Interface Module, CAN-Bus	1-STEP Off	Sweeper Module: *J4-4 and J4-6 = Not Grounded*
		Main Sweep Selected	Interface Module, CAN-Bus	Main Sweep Deselected	CAN-Bus to Interface Module
		Fwd/Rev Throttle Command	Curtis PMC, *J1-6 ≈ 0.2-5 vDC*	Neutral - Ready State	Curtis PMC, *J1-6 ≈ 0 Vdc*
				Low Battery Voltage	Curtis PMC Module, *J1-1 ≈ < 32 Vdc*
				Circuit Fault	CAN-Bus to Interface Module
Main Sweep Actuator	Main Sweep/ Lift Module: Actuator *J4-16, J4-17*	1-STEP On	Interface Module, CAN-Bus	1-STEP Off	Sweeper Module: *J6-1 = Not Grounded*
		Main Sweep Selected	Interface Module, CAN-Bus	Main Sweep Deselected	CAN-Bus to Interface Module

OPERATIONAL MATRIX (cont'd)

Output	Pin(s)	Enable	Input	Disable	Input
Dust Vacuum Fan	Sweep/Vac Module: Vacuum *J4-3, J4-8, CB-20*	1-STEP On Dust Vacuum Selected	Sweep/Vac Module: *J4-7, J4-15 = Grounded*	1-STEP Off Dust Vacuum Deselected	Sweep Module: *J4-7, J4-15 = Not Grounded*
		Fwd/Rev Throttle Command	Curtis PMC, *J1-6 ≈ 0.2-5 vDC*	Neutral - Ready State	Curtis PMC, *J1-6 ≈ 0 Vdc*
				Low Battery Voltage	Curtis PMC Module, *J1-1 ≈ < 32 Vdc*
				Circuit Fault	CAN-Bus to Interface Module
Propel	Curtis PMC	Parking Brake Off		Parking Brake On	
		Fwd/Rev Throttle Command	Curtis PMC, *J1-6 ≈ 0.2-5 vDC*	Neutral - Ready State	Curtis PMC, *J1-6 ≈ 0 Vdc*
		Fwd/Rev Switch Input	Curtis PMC, J1-22 or J1-33 ≈ Battery Voltage	Brake Switch Input	Curtis PMC, *J1-11 ≈ Battery Voltage*
				Rollout Battery Switch Input	Curtis PMC, *J1-11 ≈ Battery Voltage*
				Curtis® Propel Control Fault	See Curtis PMC Diagnostics.
Back-Up Alarm/ Lights (Option)	*Curtis PMC J1-4, CB-21*	Reverse Switch Input	Curtis PMC, J1-33 ≈ Battery Voltage	Forward Switch Input	Curtis PMC, J1-22 ≈ Battery Voltage
		Reverse Throttle Command	Curtis PMC, *J1-6 ≈ 0.2-5 vDC*	Neutral - Ready State	Curtis PMC, *J1-6 ≈ 0 Vdc*
				Curtis® Propel Control Fault	See Curtis PMC Diagnostics.
Filter Shaker	*Main Sweep/ Lift Module J4-15, J4-11, CB-17*	Filter Shaker Button On		Filter Shaker Button Off	
		Main Sweep Deselected		1-Step On	
		Dust Vacuum Deselected		Sweep Function Enabled	
		1-Step Off			

FASTENER TORQUE

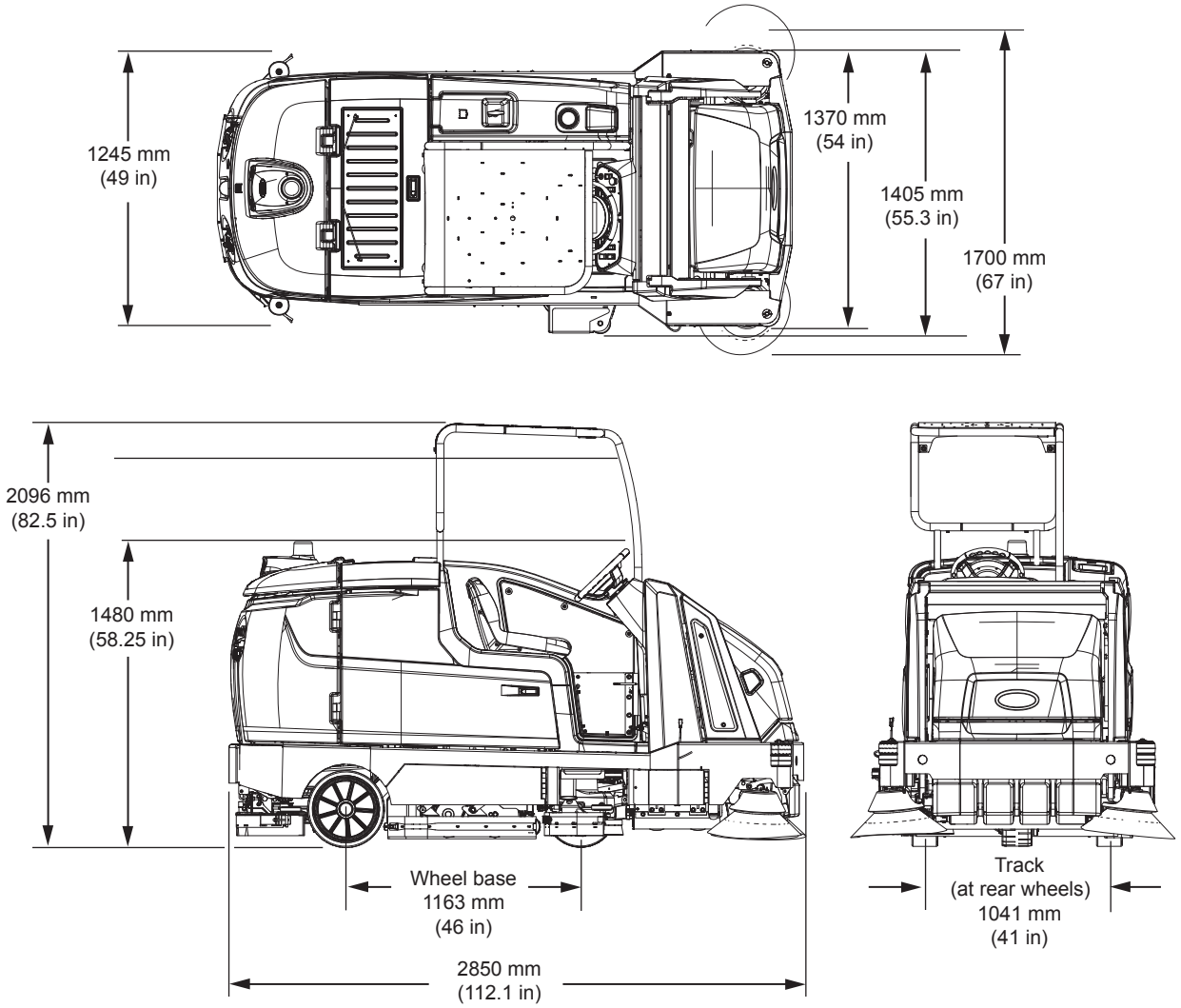
SAE (STANDARD)

Thread Size	SAE Grade 1	SAE Grade 2 Carriage Bolts	Thread Cutting Thread Rolling	SAE Grade 5 Socket & Stainless Steel	SAE Grade 8	Headless Socket Set Screws	Square Head Set Screws	
4 (.112)	(5) - .5)					(4) -		**Inch Pounds**
5 (.125)	(6) -					(9) - (		
6 (.138)	(7) -		(20) -			(9) - (		
8 (.164)	(12) -		(40) -			(17) -		
10 (.190)	(20) -		(50) -			(31) -		
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	

MACHINE DIMENSIONS



SPECIFICATIONS

GENERAL MACHINE DIMENSIONS/CAPACITIES

Item	Dimension / Capacity
Length	2850 mm (112.1 in)
Width (Body)	1370 mm (54 in)
Width (Body with side scrub brush)	1405 mm (55.3 in)
Wheel base	1163 mm (46 in)
Height (top of steering wheel)	1480 mm (58.25 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 (scrubbing)	230 mm (9 in)
Cylindrical brush length (scrubbing)	1015 mm (40 in)
Cylindrical brush diameter (sweeping)	203 mm (8 in)
Cylindrical brush length (sweeping)	915 mm (36 in)
Disk brush diameter for scrubbing side brush (option)	330 mm (13 in)
Disk brush diameter for sweeping side brush	480 mm (19 in)
Scrubbing path width	1015 mm (40 in)
Scrubbing path width (with scrubbing side brush)	1220 mm (48 in)
Squeegee width (rear squeegee)	1245 mm (49 in)
Sweeping path width - main sweep	915 mm (36 in)
Sweeping path width (with dual sweeping side brushes)	1700 mm (67 in)
Solution tank capacity	285 L (75 gallons)
Recovery tank capacity	346 L (91 gallons)
Solution capacity (ES)	435 L (115 gallons)
Detergent tank capacity (option)	17.6 L (4.6 gallons)
Demisting chamber	61 L (16.1 gallons)
Hopper capacity (light litter)	85 L (3.0 ft^3)
Hopper weight capacity	136 Kg (300 lbs)
Hopper minimum ceiling dump height	2134 mm (84 in)
Hopper maximum dump height	1525 mm (60 in)
Dust filter area	5.1 m^2 (54.9 ft^2)
Weight (Empty)	1515 Kg (3335 lbs)
Weight (with standard 510 AH batteries)	2165 Kg (4770 lbs)
GVWR	3245 Kg (7150 lbs)
Protection Grade	IPX3

Values determined as per IEC 60335-2-72	Measure - Cylindrical scrub head	Measure - Disk scrub head
Sound pressure level LpA	75 dB	75 dB
Sound pressure uncertainty KpA	3 dB	3 dB
Sound power level LWA + Uncertainty KWA	94.63 dB + 2.98 dB	94.63 dB + 2.98 dB
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

SPECIFICATIONS

GENERAL MACHINE PERFORMANCE

Item	Measure
Aisle turnaround width (less side brush)	3003 mm (118.25 in)
Travel Speed (Forward)	9 Km/h (5.5 mph)
Travel Speed while scrubbing (Forward)	6.5 Km/h (4 mph)
Travel Speed while sweeping (Forward)	6.5 Km/h (4 mph)
Travel Speed lifted hopper (Forward)	3.25 Km/h (2 mph)
Travel Speed dry vacuum (Forward)	3.25 Km/h (2 mph)
Travel Speed (Reverse)	5 Km/h (3 mph)
Maximum ramp incline for loading - Empty	20%
Maximum ramp incline for scrubbing	11%
Maximum ramp incline for sweeping	11%
Maximum ramp incline for transporting (GVWR)	13%
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
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)

Type	Use	VDC	k W (hp)
Electric Motors	Scrub brush (disk)	36	1.125 (1.50)
	Scrub brush (cylindrical)	36	1.125 (1.50)
	Side scrub brush	36	0.90 (1.25)
	Main sweep brush	36	0.75 (1.00)
	Side sweep brush	36	0.06 (0.08)
	Vacuum fan (sweep)	36	0.85 (1.10)
	Vacuum fan (scrub)	36	0.6 (0.80)
	Propelling	36	2.25 (3.00)

Type	VDC	amp	Hz	Phase	VAC
Charger (Smart)	36	80	50-60	1	200-240
Charger (Smart)	36	120	50-60	1	380-415
Charger (Smart)	36	150	50-60	1	480-600
Charger (Opportunity)	36	240	50-60	1	480

SPECIFICATIONS

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 GMP) - To main scrub head
	Up to 1.14 LPM (0.30 GPM) - To scrubbing side brush

SPECIFICATIONS

ELECTRICAL COMPONENTS *(For Reference Only)*

Component	Measure
Contactor Coil, M1	102 Ω +/- 10%
Relay Coil, M2	0.822 kΩ +/- 5%
Contactor Coil, M3	160 Ω +/- 10%
Actuator, Scrub head lift	1 - 3 Amps continuous
Actuator, Side brush/sweep lift	1 - 3 Amps continuous, Internal limit switches
Actuator, Rear squeegee lift	2 - 4 Amps continuous, Internal limit switches
Actuator, Main sweeper lift	2 - 4 Amps continuous, Internal limit switches
Actuator, Hopper roll out	2 - 4 Amps continuous, Internal limit switches
Hopper, Lift pump	35 Amps
Motor, Vacuum Fan(s)	14 - 20 Amps continuous (15 - 16 Amps average)
Motor, Propelling (5.4 mph transport speed)	38 - 64 Amps continuous
Motors, Main cylindrical brush	
Down pressure #1	12 - 18 Amps/Motor (default 13 Amps)
Down pressure #2	18 - 28 Amps/Motor (default 26 Amps)
Down pressure #3	28 - 35 Amps/Motor (default 35 Amps)
Down pressure #1	12 - 18 Amps/Motor (default 14 Amps)
Down pressure #2	18 - 28 Amps/Motor (default 25 Amps)
Down pressure #3	28 - 35 Amps/Motor (default 35 Amps)
Motor, Side Sweep Brush	5 - 8 Amps
Motor, Side Scrub Brush	12-40 Amps
Pump, *ec-H2O*	4 - 6 Amps
Pump, Spray Nozzle	2 - 3 Amps
Pump, Side Brush	0.5 - 2 Amps
Pump, Detergent Metering/ Severe Environment	0.5 - 1.5 Amps
Valve, ec-H2O Side Brush	129 Ω +/- 5%
Valve, Conventional Side Brush	108 Ω +/- 10%
Valve, Conventional Main Brush	108 Ω +/- 10%
Valve, Autofill	218 Ω +/- 10%

SECTION 3

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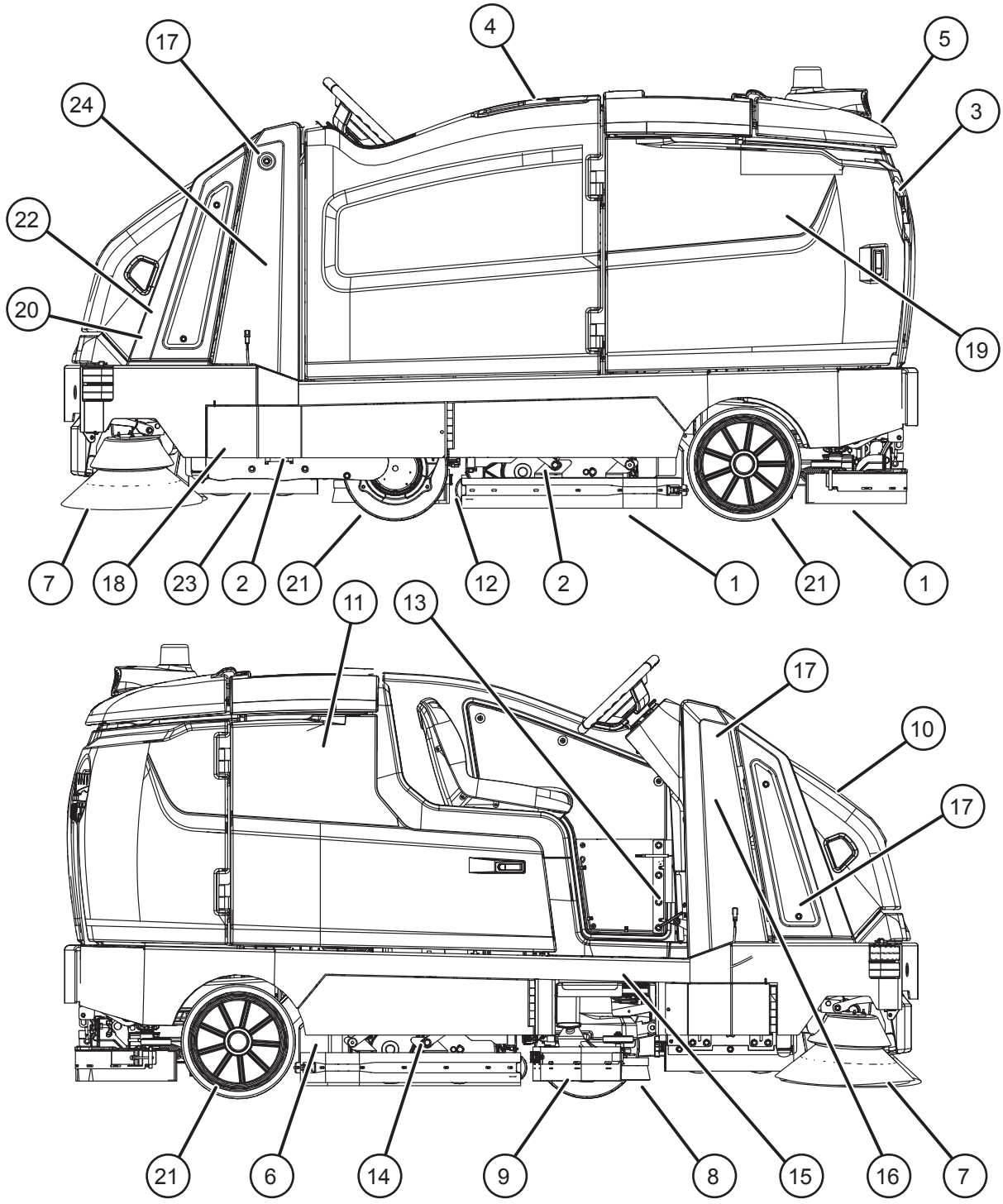
MAINTENANCE



MAINTENANCE CHART

The table below indicates the Person Responsible for each procedure.

O = Operator.
T = Trained Personnel.

NOTE:Check procedures indicated (■) after the first 50 hours of operation.

Interval	Person Resp.	Key	Description	Procedure	Lubricant/ Fluid	No. of Service Points
Daily	O	22	Hydraulic reservoir	Check hydraulic fluid level	HYDO	1
	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	7	Sweeping side brush(es)	Check for damage, wear, debris	-	1 (2)
	O	8	Scrubbing side brush	Check for damage, wear, debris	-	1
	O	9	Scrubbing side brush squeegee	Check for damage and wear	-	1
	O	10	Hopper dust filter	Shake to clean	-	1
Weekly	T	11	Battery cells	Check electrolyte level	DW	Multiple
50 Hours	T	1	Side and rear squeegees	Check leveling	-	4
	O	1	Main brushes (cylindrical)	Rotate brushes from front to rear	-	2
	O	12	Scrub head skirts (disk)	Check for damage and wear	-	2
	O	23	Sweeping skirts	Check for damage and wear	-	4
	O	7	Sweeping side brush(es)	Check brush pattern		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.

NOTE:Check procedures indicated (■) after the first 50 hours of operation.

Interval	Person Resp	Key	Description	Procedure	Lubricant/ Fluid	No. of Service Points
100 Hours	T	11	Battery watering system (option)	Check hoses and connections for damage and wear	-	Multiple
	T	10	Hopper seals	Check for damage and wear	-	2
	T	10	Hopper	Clean hopper, dust filter and Perma-Filter		1
200 Hours	T	13	Brakes	Check adjustments	-	1
	T	11	Battery terminals and cables	Check and clean	-	Multiple
	T	14	Cylindrical brush drive belts	Check for damage and wear	-	2
	T	18	Sweeping brush drive belts	Check for damage and wear	-	2
	T	15	Drive wheel pivot	Lubricate	SPL	1
	T	15	Steering chain	Lubricate and check for damage and wear.	GL	1
		16	Steering gear chain	Lubricate and check for damage and wear	GL	1
	T	24	Hopper chains	Lubricate and check for damage and wear.	GL	2
	T	17	Hopper lift arm pivots	Lubricate	SPL	3
500 Hours	T	19	Scrub vacuum fan motor(s)	Check motor brushes	-	1 (2)
	O	21	Tires	Check for damage and wear	-	3
	T	24	Hopper chains	■ Check tension.	-	2
800 Hours	T	22	Hydraulic hoses	Check for wear and damage	-	Multiple
1000 Hours	T	7	Sweeping side brush motors	Check motor brushes **(Check every 100 hours after initial 1000 hour check)**	-	2
	T	8	Sweeping main brush motors	Check motor brushes **(Check every 100 hours after initial 1000 hour check)**	-	1
2400 Hours	T	22	Hydraulic reservoir	Change hydraulic fluid	HYDO	1

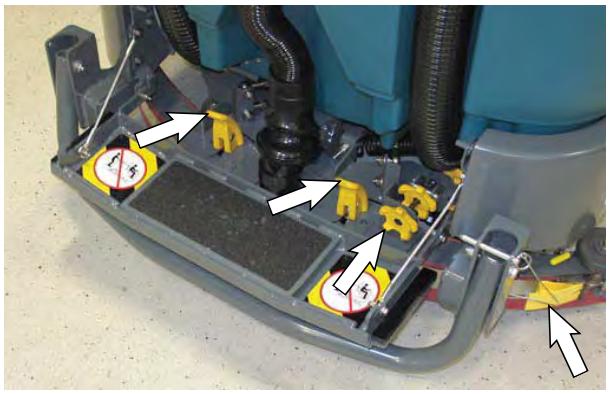
LUBRICANT/FLUID

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.

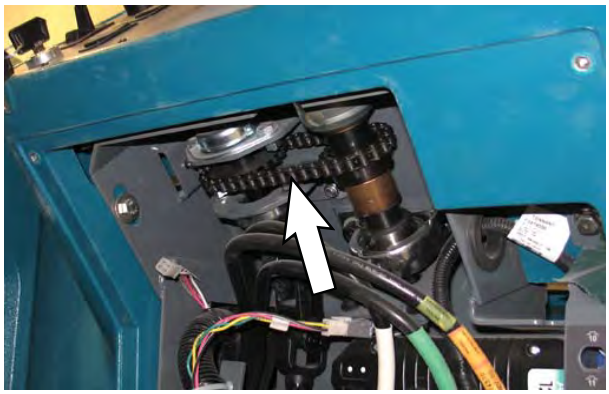


LUBRICATION

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

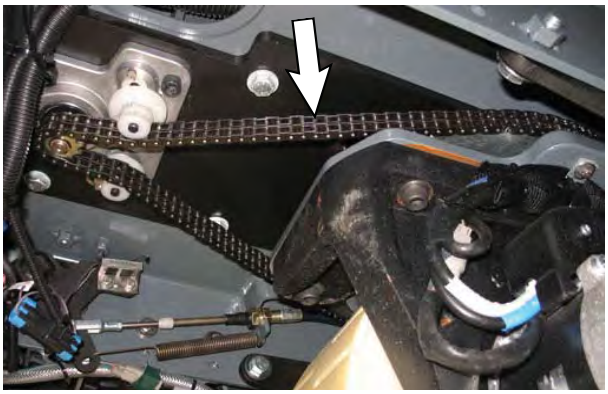
STEERING CHAIN

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.



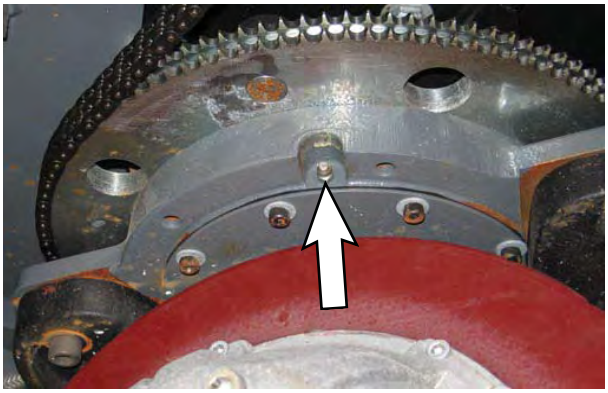
STEERING GEAR CHAIN

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.



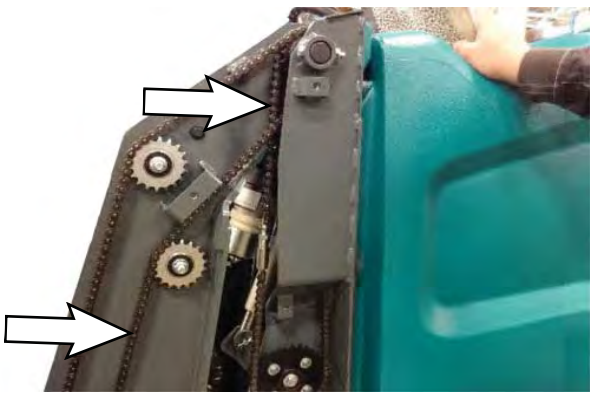
DRIVE WHEEL PIVOT

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



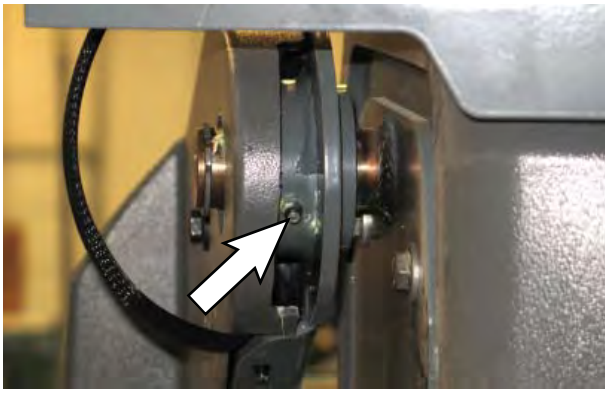
HOPPER CHAINS

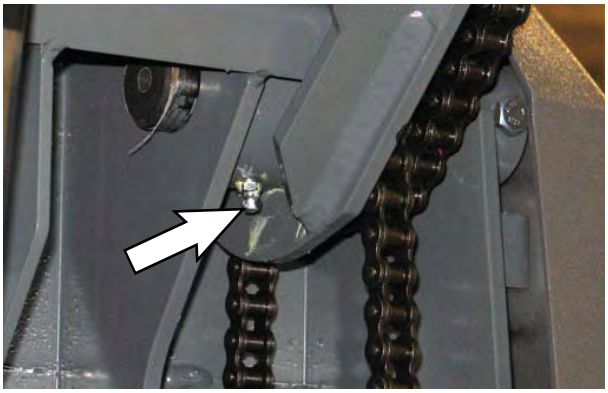
The hopper chains are located on the left hand side of the machine. Check for damage or wear and lubricate the hopper chains after every 200 hours..



HOPPER LIFT ARM PIVOTS

Lubricate the hopper lift arm pivots after every 200 hours of operation.

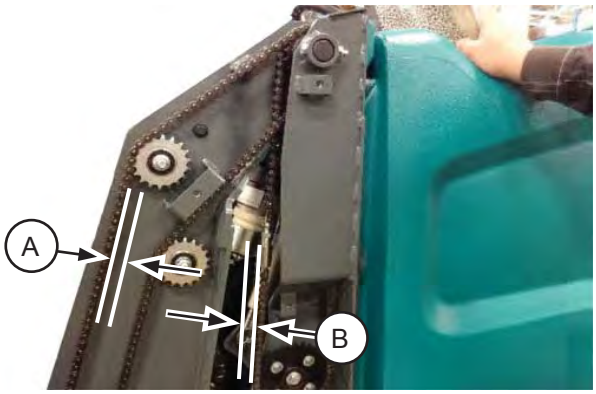




HOPPER CHAINS

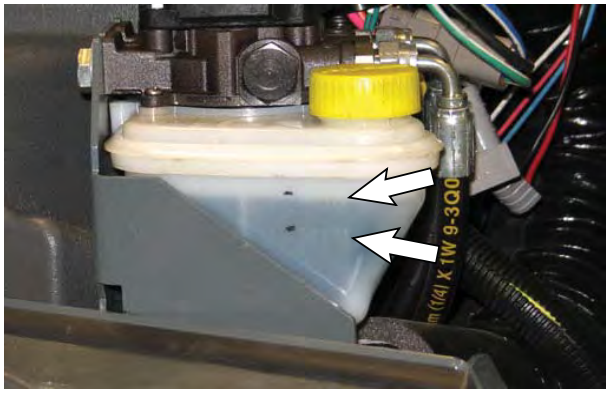
The hopper chains are located on the left hand side of the machine. Check the tension of the hopper chains after the first 50 hours of operation then every 500 hours after that.

With the hopper in the lowered position; the longer arm chain (A) should not move more than 25 mm (1 in) and the shorter lintel chain (B) should not move more than 12 mm (0.5 in).



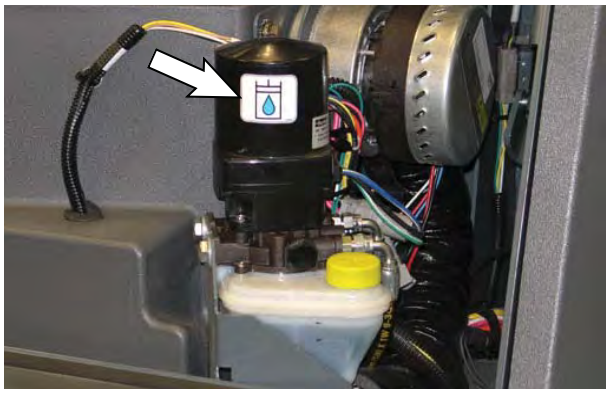
HYDRAULICS

Check the hydraulic fluid level at operating temperature daily. The hydraulic fluid level should be between the MIN and MAX markings on the hydraulic reservoir. The hopper must be down when checking hydraulic fluid level.



ATTENTION! Do not overfill the hydraulic fluid reservoir or operate the machine with a low level of hydraulic fluid in the reservoir. Damage to the machine hydraulic system may result.

Drain and refill the hydraulic fluid reservoir with new **Tennant*True*** premium hydraulic fluid after every 2400 hours of operation.



HYDRAULIC FLUID

Tennant*True* premium hydraulic fluid (Extended Life)		
Part Number	**Capacity**	**ISO Grade Viscosity Index (VI)**
1057707	3.8 L (1 gal)	ISO 32 VI 163 or higher
1057708	19 L (5 gal)	

If using a locally-available hydraulic fluid, be sure the specifications match Tennant hydraulic fluid specifications. Substitute fluids can cause premature failure of hydraulic components.

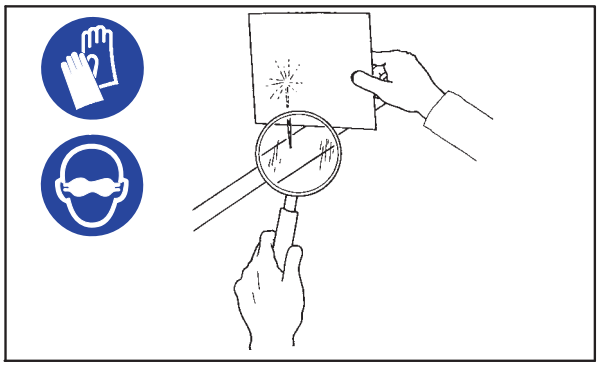
ATTENTION! Hydraulic components depend on system hydraulic fluid for internal lubrication. Malfunctions, accelerated wear, and damage will result if dirt or other contaminants enter the hydraulic system.

HYDRAULIC HOSES

Check the hydraulic hoses after every 800 hours of operation for wear or damage.

FOR SAFETY: When servicing machine, use cardboard to locate leaking hydraulic fluid under pressure.

High pressure fluid escaping from a very small hole can almost be invisible, and can cause serious injuries.



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Consult a physician immediately if injury results from escaping hydraulic fluid. Serious infection or reaction can occur if proper medical treatment is not given immediately.

Contact a mechanic or supervisor if a leak is discovered.

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.

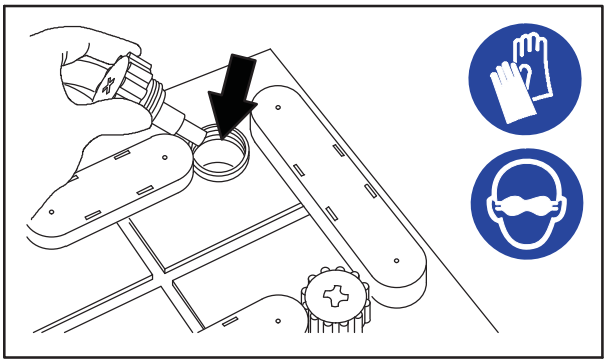
– Do not charge the battery more than once a day and only after running the machine for a minimum of 15 minutes.

– 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).



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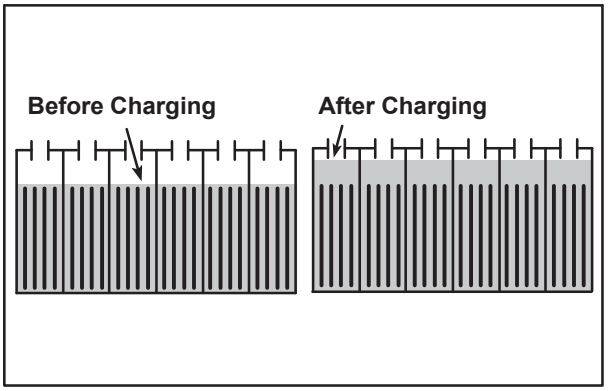
FOR SAFETY: When servicing machine, keep all metal objects off batteries. Avoid contact with battery acid.

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.



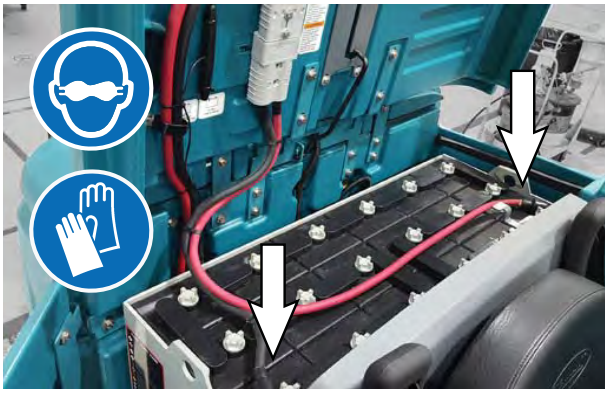
NOTE: Make sure the battery caps are in place while charging. There may be a sulfur smell after charging batteries. This is normal.

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.



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.

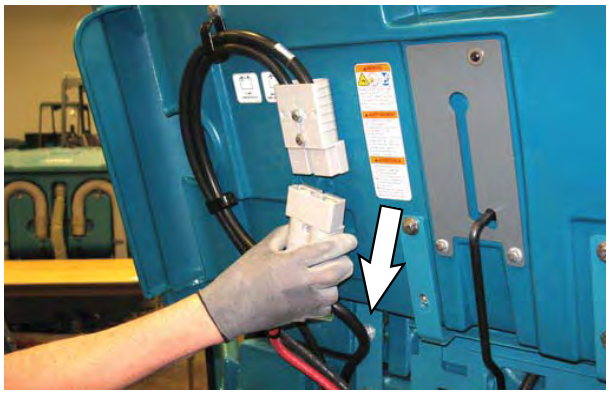
1. Drive the machine to a flat, dry surface in a well-ventilated area.
2. Stop the machine and turn off the machine power.

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

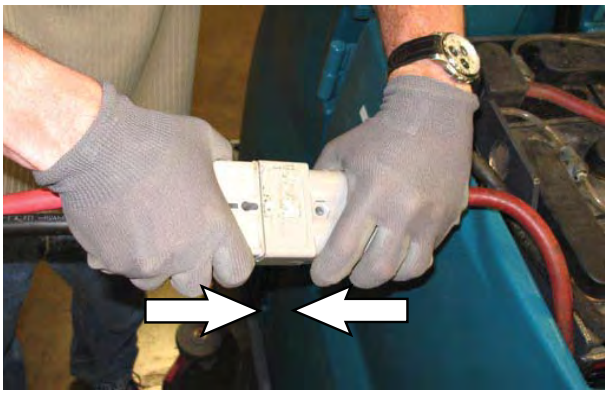
3. Lift the battery compartment top cover open and engage the support.

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

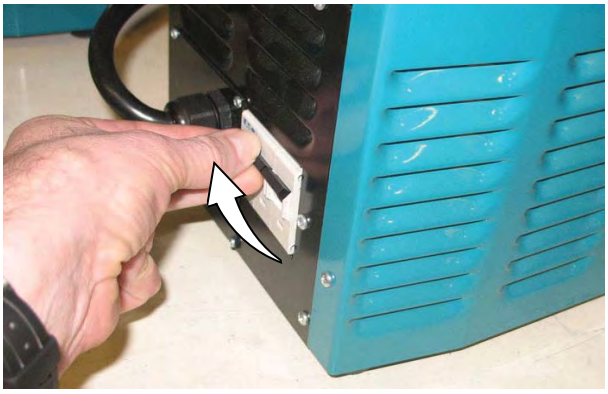
4. Plug the charger AC power supply cord into a properly grounded outlet.
5. Disconnect the battery cable from the machine connector.



6. Connect the charger connector to the battery cable.



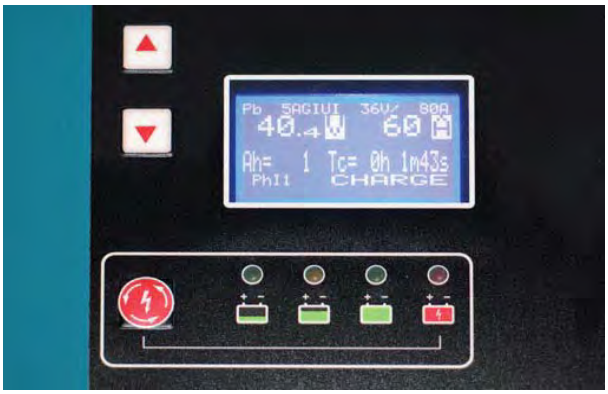
7. Turn on the battery charger if required.



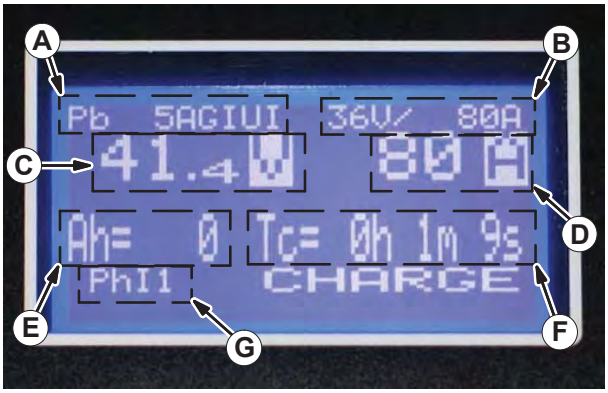
WARNING: Batteries emit hydrogen gas. Explosion or fire can result. Keep sparks and open flame away. Keep covers open when charging.

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 def nitions

8. 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)

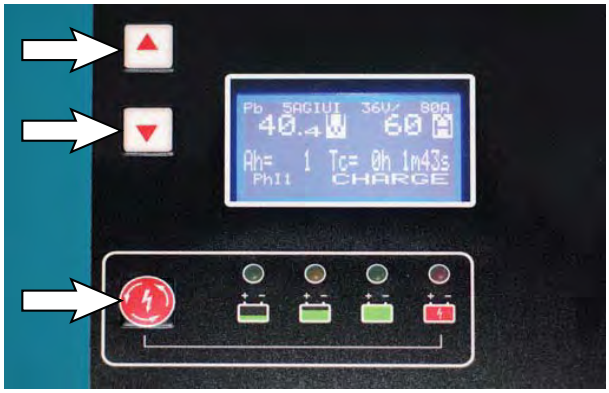
D. Charger current (Amperes)

E. Ampere hours charged

F. Time charged (hours / minutes / seconds)

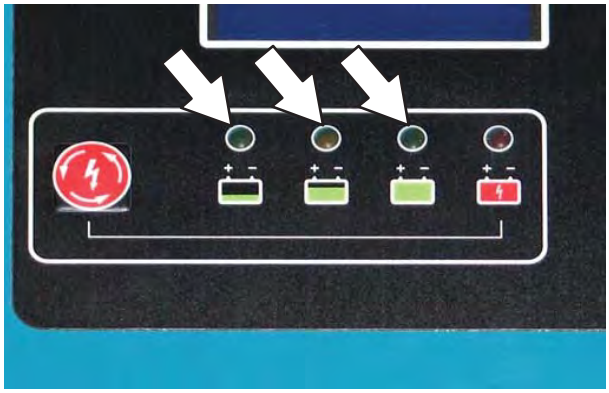
G. Charging phase (Phase 1 / Phase 2 / Phase 3 / Maintenance)

9. 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.

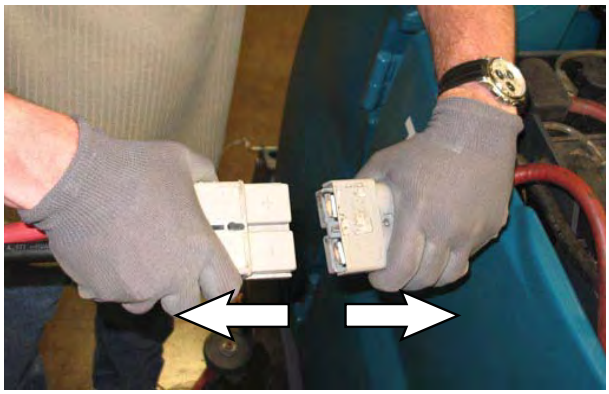


NOTE: If the charger cable must be disconnected from the battery before they are fully charged, press the charger stop / start / enter button to stop charging. Be sure STOP appears on the display and the red stop charge light is illuminated before disconnecting the battery charger cable.

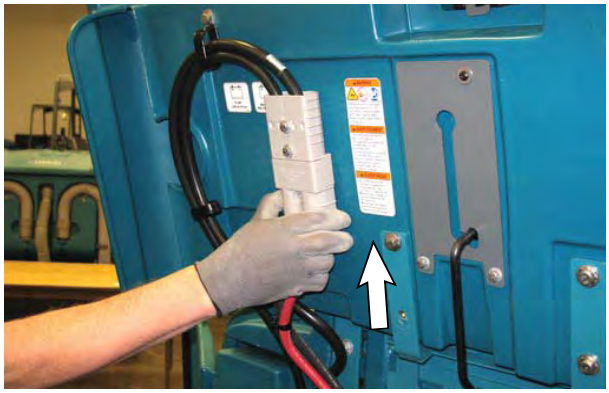
10. The charger status indicators will illuminate from left to the right as the battery is charging. COMPLETE will appear in the display, all the charger status indicators will be illuminated, and the Tennant charger will stop charging when the battery is completely charged.



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



12. Reconnect the battery connector to the machine connector.

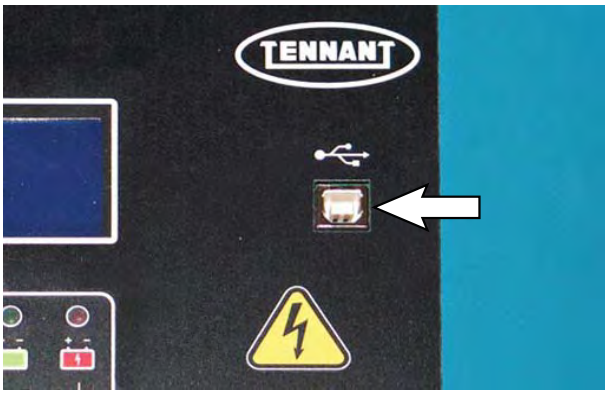


FOR SAFETY: When servicing machine do not disconnect the off-board charger's DC cord from the machine receptacle when the charger is operating. Arcing may result. If the charger must be interrupted during charging, disconnect the AC power supply cord first.

13. Close the battery compartment top cover.

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.

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 battery capable of being opportunity charged. Do not opportunity charge standard batteries since doing so can shorten battery life.

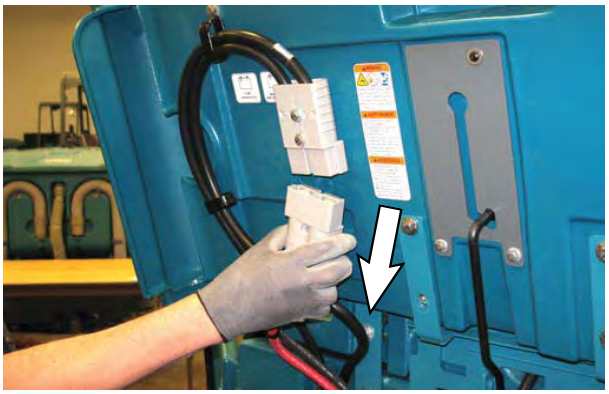
1. Drive the machine to a flat, dry surface in a well-ventilated area.
2. Stop the machine and turn off the machine power.

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

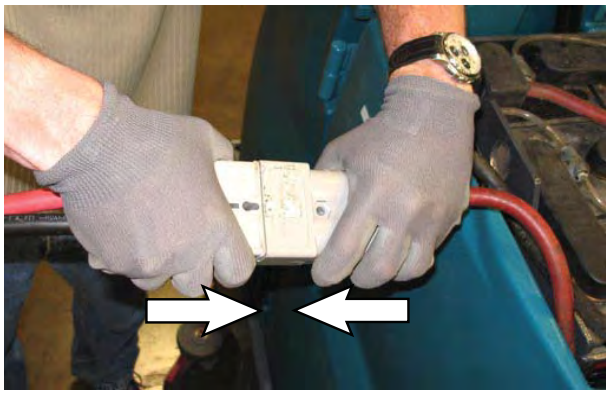
3. Lift the battery compartment top cover open and engage the support.

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

4. Disconnect the battery cable from the machine connector.



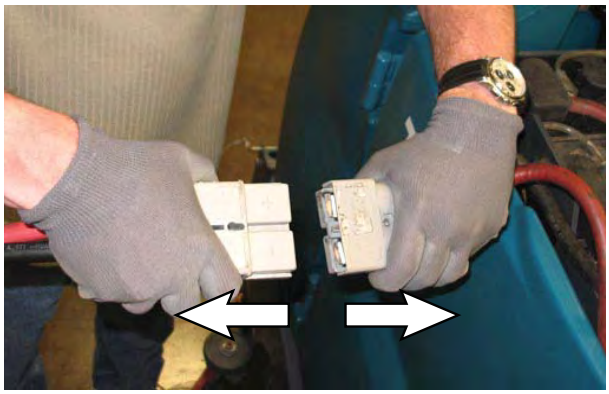
5. Connect the charger connector to the battery cable.



6. The battery will be opportunity charged during the break.
7. When ready to start using the machine again press the charger stop / start button to stop the charger.

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.

8. Disconnect the charger connector from the battery cable connector.



9. Reconnect the battery connector to the machine connector.

10. 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.

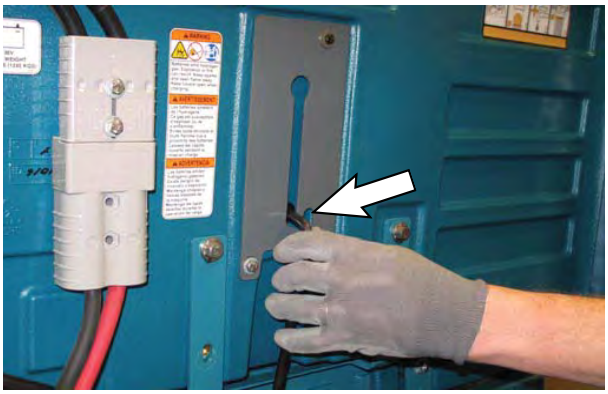
BATTERY WATERING SYSTEM (OPTION)

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.



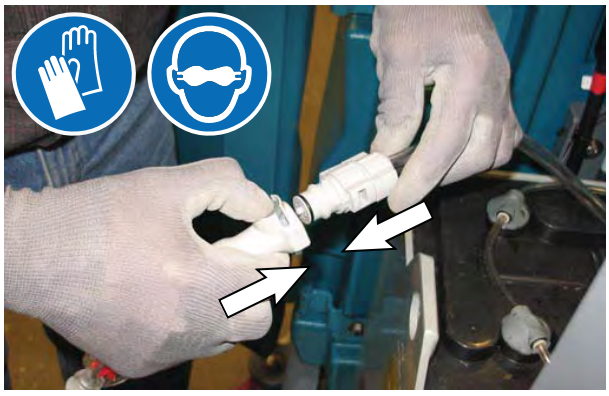
2. Fully charge batteries prior to using the battery watering system. Do not add water to batteries before charging, the electrolyte level will expand and may overflow when charging. See CHARGING THE BATTERIES.

3. Connect the battery watering system hose to the water supply source.

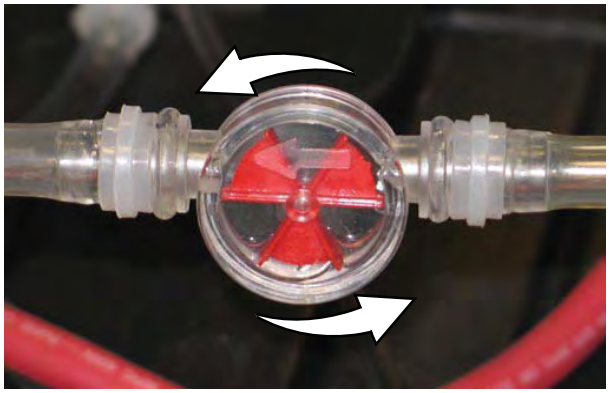
NOTE: Water quality is important to maintain the life of the battery. Always use water that meets battery manufacturer requirements.

NOTE: The water supply to the battery water system must always be 7.57 LPM (2 GPM) or more. Use the purger to conf rm 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.

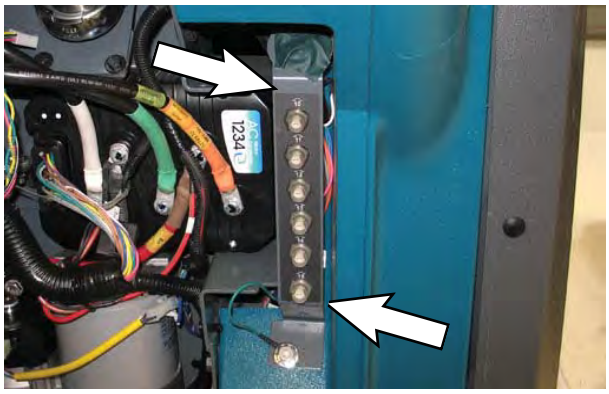
CIRCUIT BREAKERS, FUSES, AND RELAYS

CIRCUIT BREAKERS

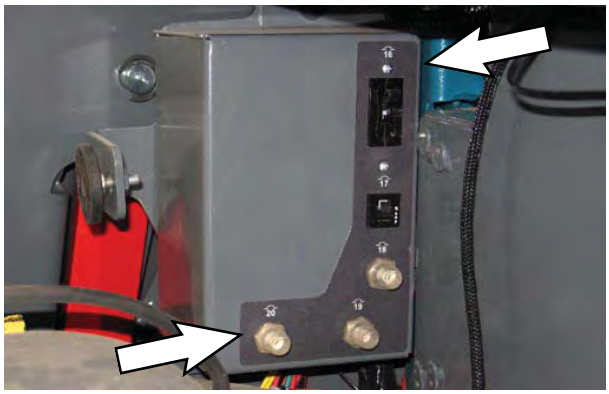
Circuit breakers are resettable electrical circuit protection devices designed to stop the flow of current in the event of a circuit overload. Once a circuit breaker is tripped, reset it manually by pressing the reset button after the breaker has cooled down.

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 breakers 16 through 20 are located in the hopper compartment.



Circuit breaker 21 is located inside the optional light assembly mounted on top of the recovery tank.

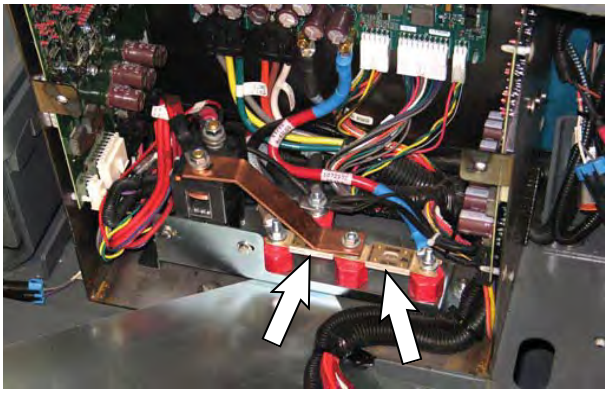
If the overload that caused the circuit breaker to trip is still present, the circuit breaker will continue to stop current flow until the problem is corrected.

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

Circuit Breaker	Rating	Circuit Protected
CB1	60A	Water pickup module
CB2	-	Not used
CB3	35A	Side brush scrub 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)
CB8	2.5A	*ec-H2O* power module (Option)
CB9	2.5A	*ec-H2O* pump module (Option)
CB10	15A	Spray nozzle (Option)
CB11	15A	Lights (Option)
CB12	2.5A	Lights (Option)
CB13	2.5A	Strobe light / Flashing light on overhead guard (Option)
CB14	2.5A	Strobe light / Flashing light on overhead recovery tank (Option)
CB15	30A	Power steering (Option)
CB16	60A	Lift module
CB17	15A	Sweep module
CB18	40A	Sweep vacuum 1
CB19	40A	Sweep vacuum 2
CB20	40A	Dry vacuum (Option)
CB21	2.5A	Alarm / Flashing 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)
Fuse-4	150A	Sweep (inline)

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
M4	36 VDC, 200A	Sweep 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 sweeping and 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*
Side brush motor - Scrubbing (Option)	1000*
Scrubbing vacuum fan motor	500

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

HOPPER DUST FILTER / PERMA-FILTER

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

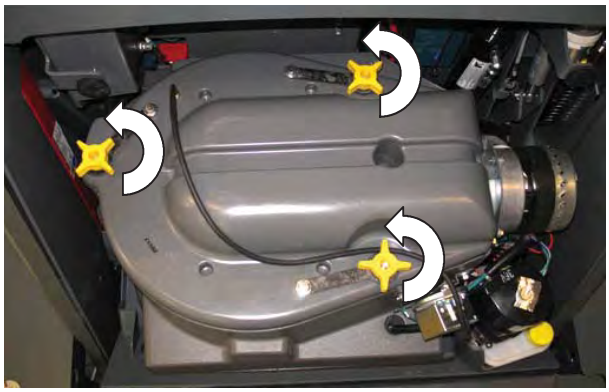
REMOVING / REPLACING THE HOPPER DUST FILTER

Shake the dust filter at the end of every shift and before removing the filter from the machine. Inspect and clean the filter after every 100 hours of operation. Replace damaged dust filters.

NOTE: Clean the f lter more often if used in extremely dusty conditions.

1. Remove the hopper cover from the hopper.

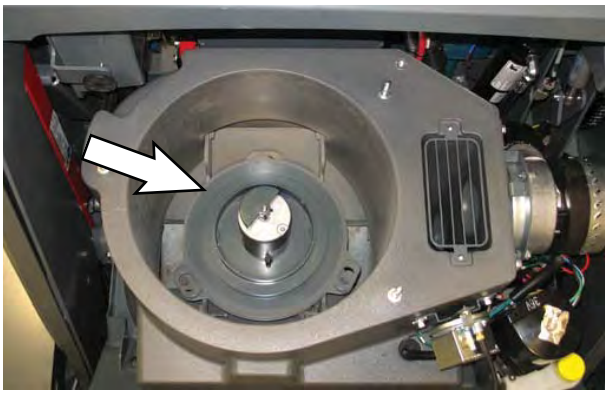
2. Remove the dust filter cover.



3. Remove the dust filter from the hopper.

4. Clean or discard the dust filter element. Refer to *CLEANING THE DUST FILTER*.

5. Clean dust and debris from the dust filter tray. See *CLEANING THE HOPPER DUST FILTER*.



6. Reinstall the dust filter.

7. Reinstall the dust filter cover.

8. Reinstall the hopper cover.

CLEANING THE HOPPER DUST FILTER

Use one of the following methods to clean the dust filter:

SHAKING-Press the *f ltershakerswitch* .

TAPPING-Tap the filter gently on a flat surface. **Do not damage the edges of the filter.** The filter will not seal properly if the edges of the filter are damaged.

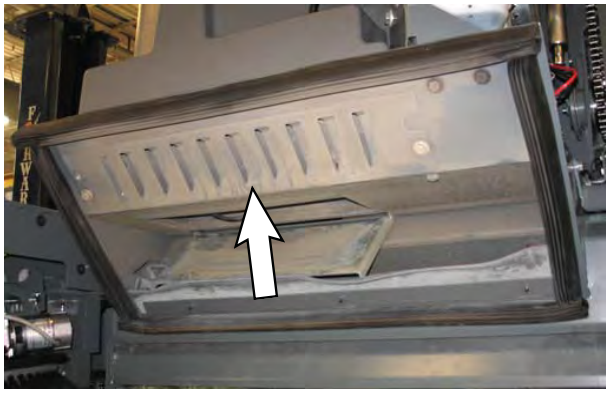
AIR-Always wear eye protection when using compressed air. Blow air through the center of the filter and out toward the exterior. Never use more than 550 kPa (80 psi) of air pressure with a nozzle no smaller than 3 mm (0.13 in) and never hold the nozzle closer than 50 mm (2 in) to the filter.

THERMO-SENTRY

The Thermo-Sentry, located inside the hopper, senses the temperature of the air pulled up from the hopper. If there is a fire in the hopper, the Thermo-Sentry stops the vacuum fan and cuts off the air flow. The Thermo-Sentry automatically resets after cooling down.

INSPECTING / CLEANING THE PERMA-FILTER

Inspect and clean the Perma-Filter after every 100 hours of operation.

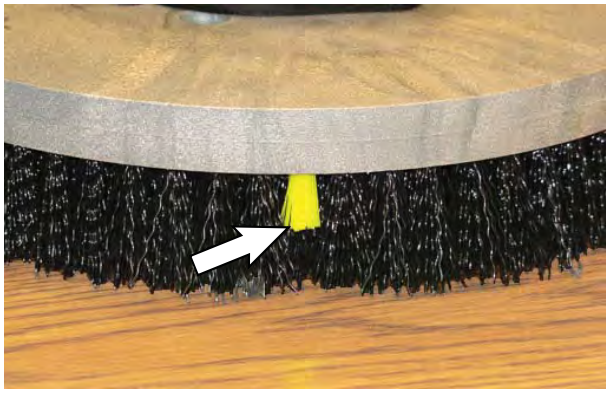


MAIN SCRUB BRUSHES

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.

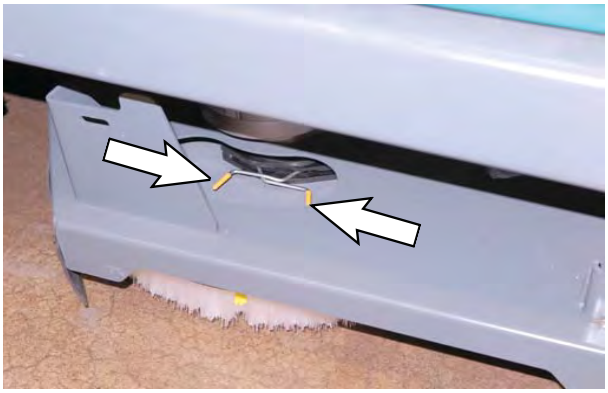
REPLACING DISK SCRUB BRUSHES OR PAD DRIVERS

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.

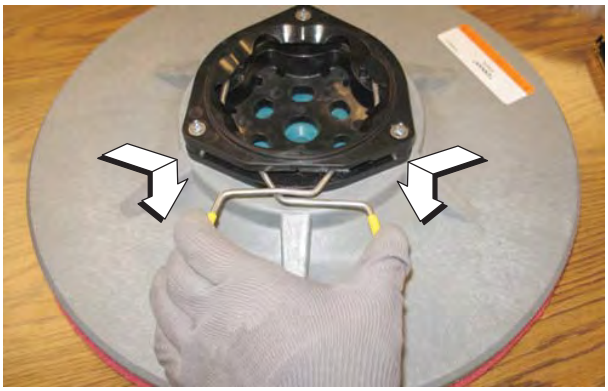
3. Open the main brush access door and side squeegee support door.

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.

CYLINDRICAL SCRUB BRUSHES

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

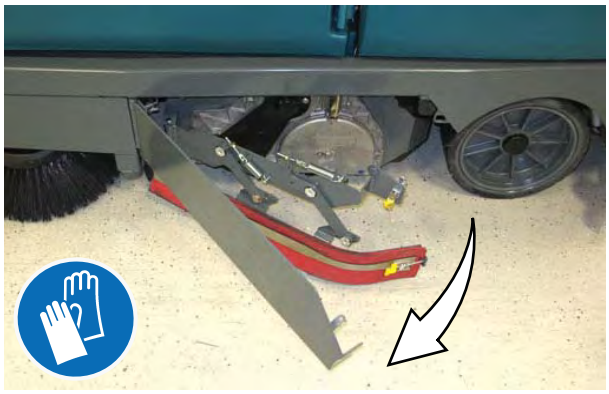
Replace the brushes when they no longer clean effectively.

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

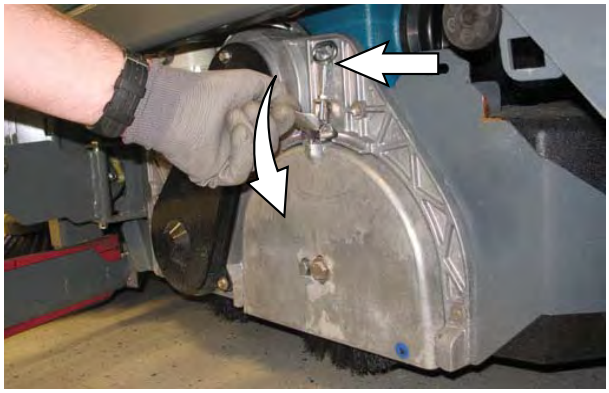
REPLACING CYLINDRICAL SCRUB BRUSHES

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.

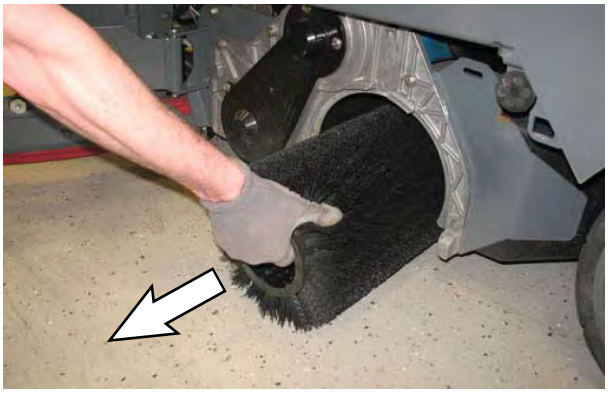


2. Lift the idler plate retainer handle and unhook the retainer ring from the idler plate hook.



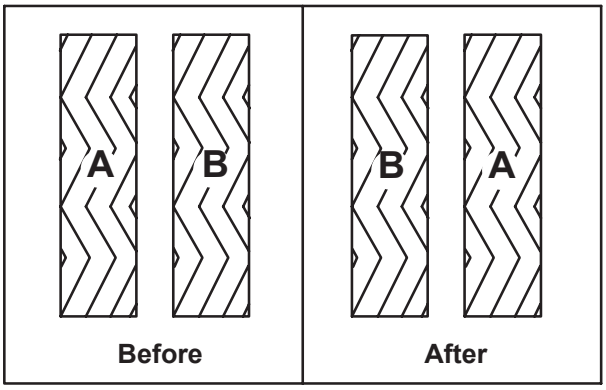
3. Remove the idler plate from the scrub head.

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.



7. Slide the idler plate up into the scrub head.

8. 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.

9. Close and secure the squeegee support door and close the main brush access door.

10. Repeat for the brush on the other side of the scrub head.

MAIN SWEEP BRUSHES

Check the brush daily for wear or damage. Remove any string or wire tangled on the main brush, main brush drive hub, or main brush idler hub.

Rotate the brush end-for-end after every 50 hours of operation, for maximum brush life and best sweeping performance. Refer to REPLACING OR ROTATING THE MAIN BRUSH.

Replace the brushes when they no longer clean effectively.

REPLACING THE MAIN SWEEPING BRUSH

1. Raise the sweeping main brush 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. Open the main sweeping brush compartment access door.

3. Remove the knob and the main sweep brushes idler plate.

4. Pull the brushes from the main sweep compartment.

5. Replace or rotate the main brushes end-for-end.
6. Slide the brushes into the main sweep brush compartment and all the way onto the drive hubs.
7. Reinstall the main sweep brushes idler plate.
8. Close the main sweeping brush compartment access door.

SIDE BRUSH(ES)

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.

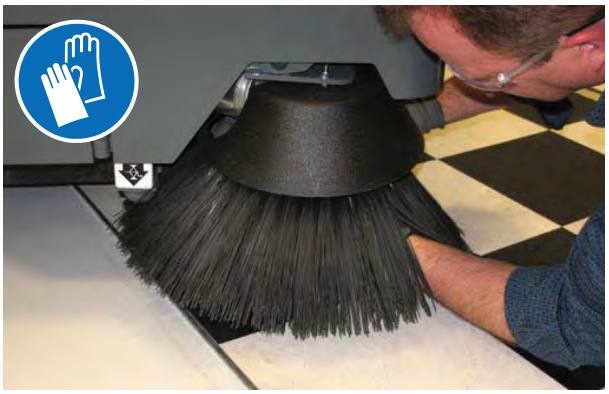
REPLACING THE SWEEPING SIDE BRUSHES

Replace the brushes when they no longer clean effectively.

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

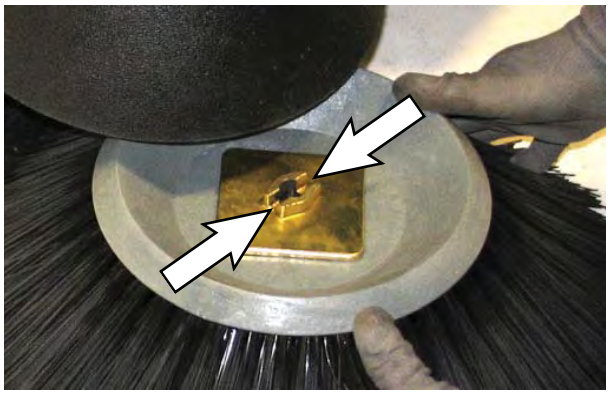
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, set parking brake, and remove key.

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.

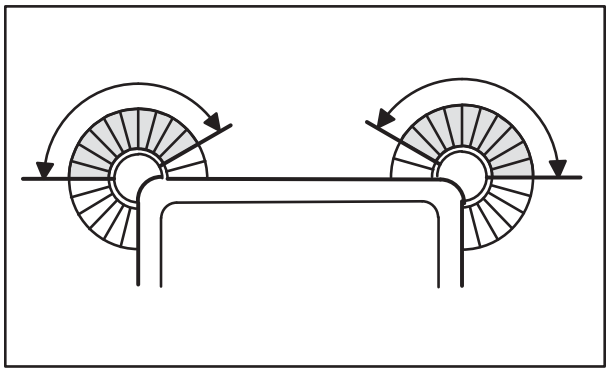
4. Place the side brush underneath the side brush assembly and align the channel in the retainer with the retainer pin in the side brush hub.



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

ADJUSTING THE SWEEPING SIDE BRUSHES

Check the side brush pattern after every 50 hours of operation. The right side brush bristles should touch the floor between 10 o'clock and 3 o'clock and the left side brush bristles should touch the floor between 9 o'clock and 2 o'clock when the brushes are in motion.



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TO ADJUST SWEEPING SIDE BRUSH - STANDARD PANEL

1. Turn on the machine.
2. Press and hold the *sweeping side brush button* until the side brush height adjustment screen appears in the LCD display.

NOTE: The Contrast Control and Conf guration Mode buttons are used for selecting and adjusting the side brush height.

3. Press the desired sweeping side brush button to select it. The selected side brush will lower and spin.

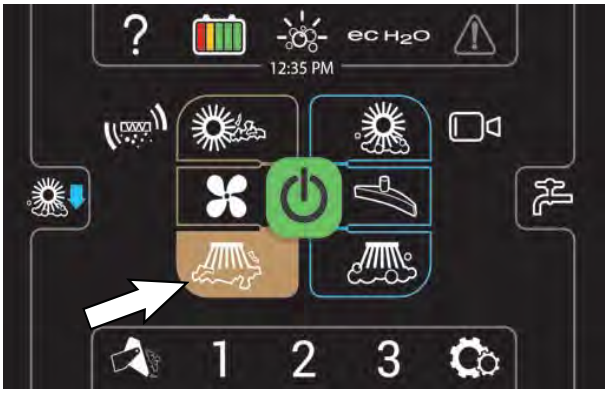
4. Observe the brush pattern
5. Press the left (-) button to raise the brush or the right (+) button to lower it to obtain the correct brush pattern. The indicator bars increase as the brush gets lower.

6. Press the *sweeping side brush button* to save the setting and return to the side brush adjustment text prompt.
7. Repeat previous instructions to adjust the other sweeping side brush.
8. Recheck the brush patterns. Adjust brush height as necessary.

NOTE: Contact a Tennant service representative if there is a f at pattern (full circle) after the sweeping side brushes have been adjusted.

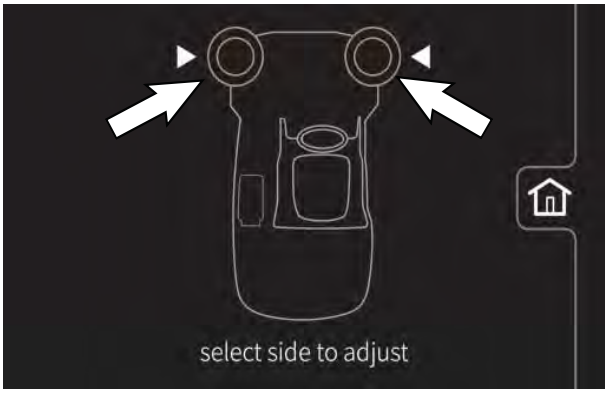
TO ADJUST SWEEPING SIDE BRUSH - PRO-PANEL

1. Turn on the machine.
2. Press and hold the *sweeping side brush button* until the side brush height adjustment screen appears in the display.

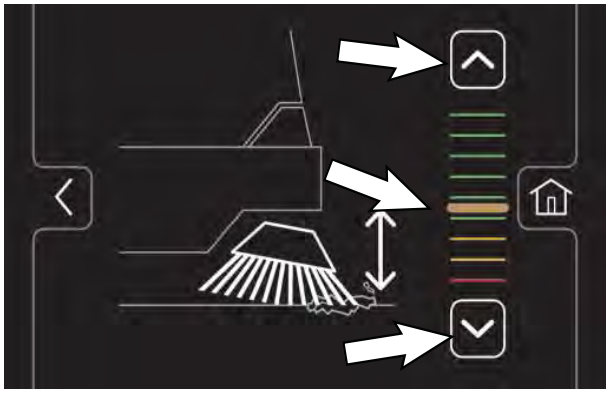


3. Press the yes button.

4. Press the desired sweeping side brush button to adjust it. The selected brush will lower and spin.



5. Observe the brush pattern.
6. Press the up button to raise the brush or the down button to lower it to obtain the correct brush pattern. The indicator moves up / down to show the change in brush height.



Press the home button to save the setting and navigate back to the main operating screen.

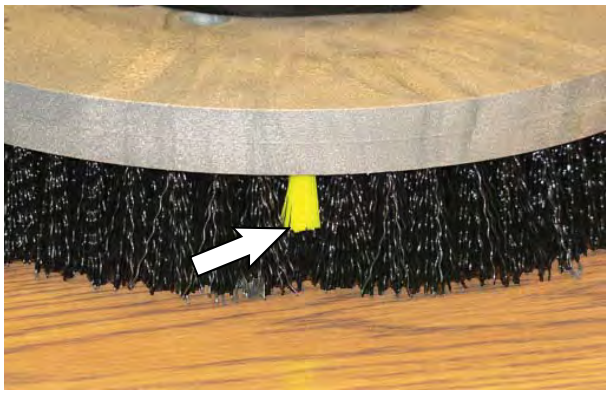
Press the back button to navigate back to the previous screen.

7. Press the *back button* to return to the “select side to adjust” screen.
8. Repeat previous instructions to adjust the other sweeping side brush.
9. Recheck the brush patterns. Adjust brush pressure as necessary.

NOTE: Contact a Tennant service representative if there is a f at pattern (full circle) after the sweeping side brushes have been adjusted.

REPLACING THE SCRUBBING SIDE BRUSH (OPTION)

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.

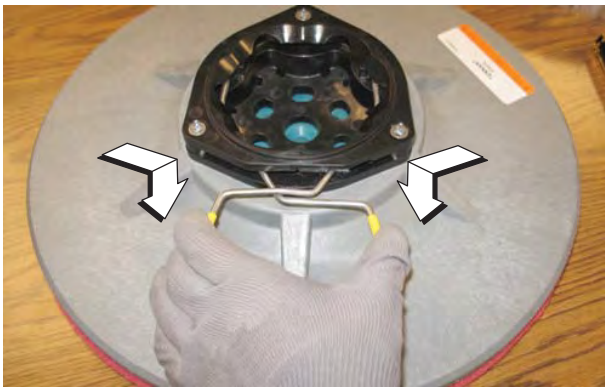
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, set parking brake, and remove key.

2. If necessary, remove the scrubbing side brush squeegee assembly to make access to the scrubbing side brush easier.

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

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

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



6. 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.

7. Reinstall the scrubbing side brush squeegee assembly.

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.

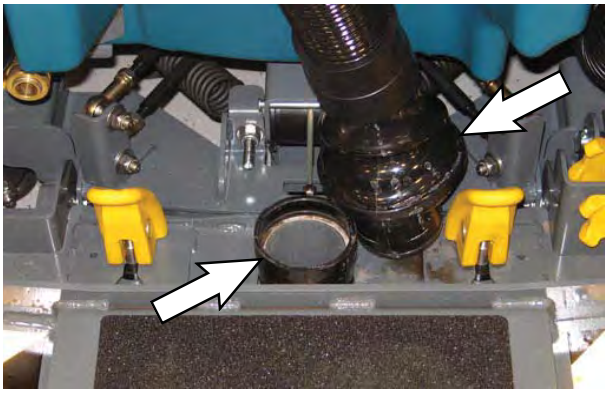
Check the deflection of the squeegee blades daily or when scrubbing a different type of surface. Check the leveling of the rear squeegee every 50 hours of operation.

REPLACING (OR ROTATING) THE REAR SQUEEGEE BLADES

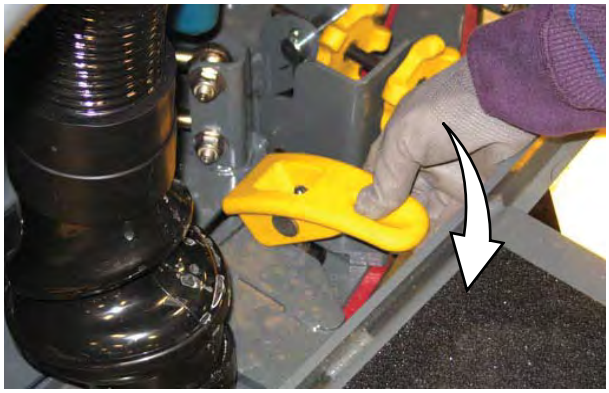
1. If necessary, lower the *rear bumper door / step*.

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

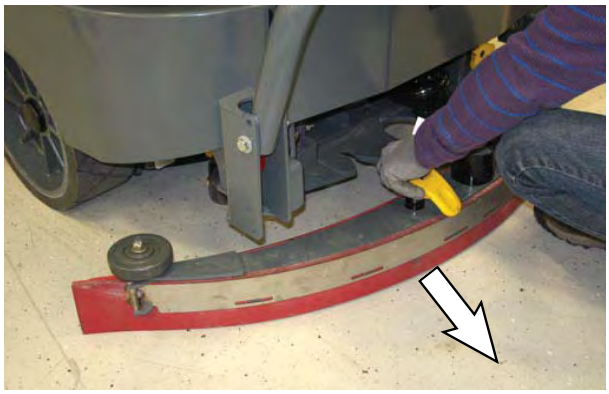
2. Disconnect the vacuum hose from the rear squeegee assembly



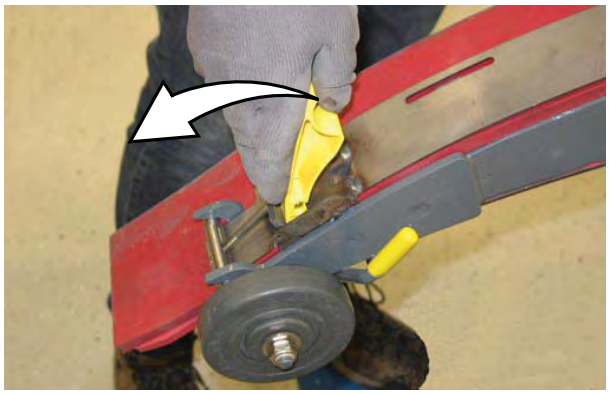
3. Loosen both squeegee mounting handles.

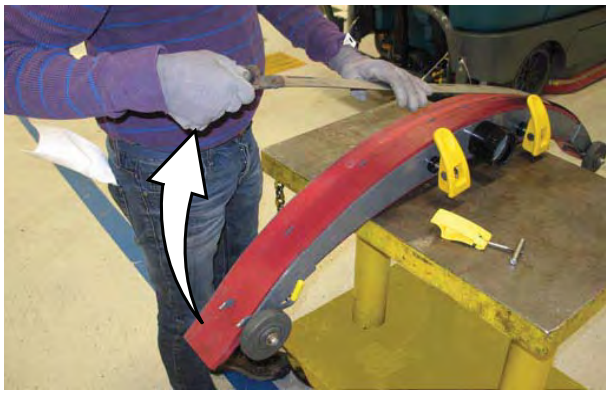


4. Pull the rear squeegee assembly from the machine.

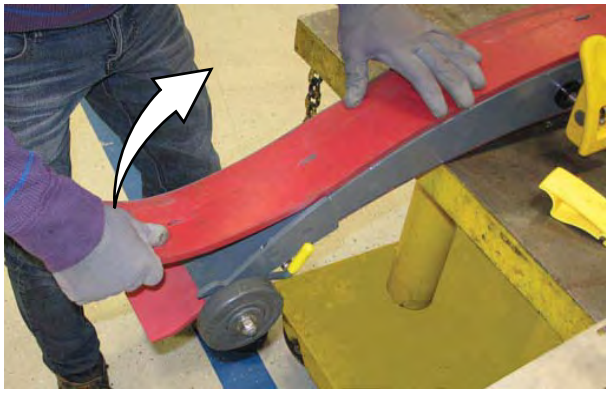


5. Loosen the rear retainer latch and remove the latch and the retainer from the squeegee assembly.



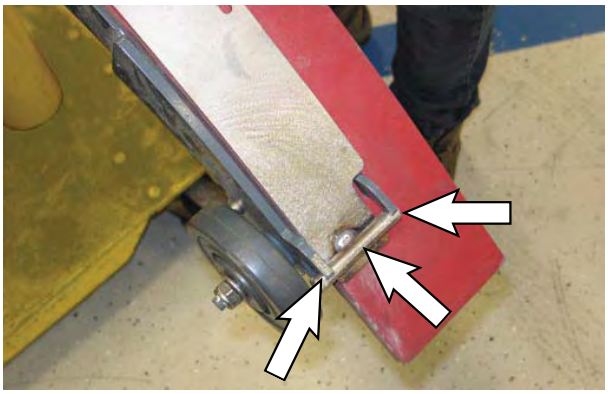


6. Remove the rear squeegee from the squeegee assembly.

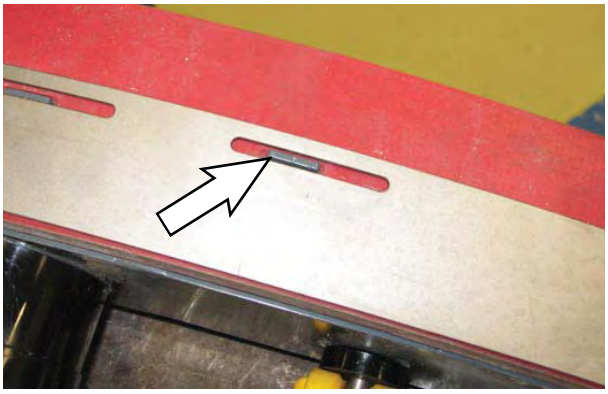


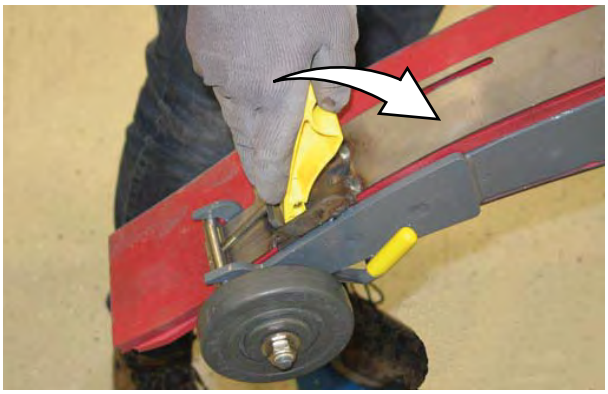
7. Place the rotated or new squeegee blade onto the rear squeegee assembly. Be sure the squeegee is securely attached on each tab on the rear squeegee assembly.

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



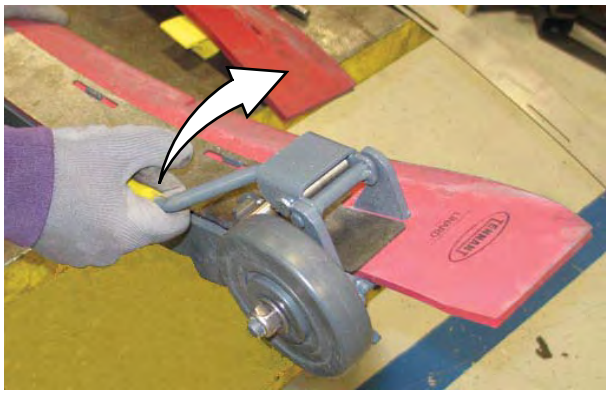
9. Install the retainer along the rest of the squeegee assembly, align the tabs on the squeegee assembly into the slots in the retainer, and tighten the latch onto the other end of the squeegee assembly.





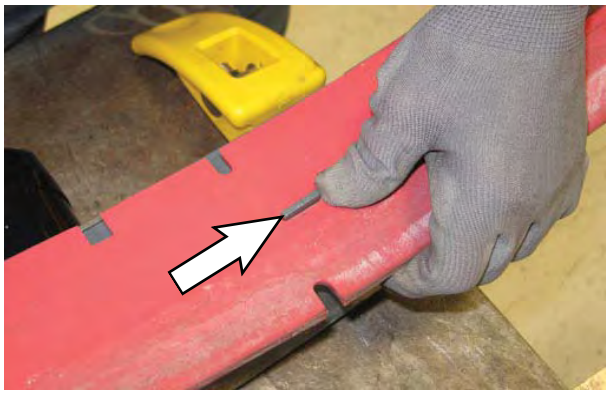
10. Turn the rear squeegee assembly over to access the front of the squeegee assembly.

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

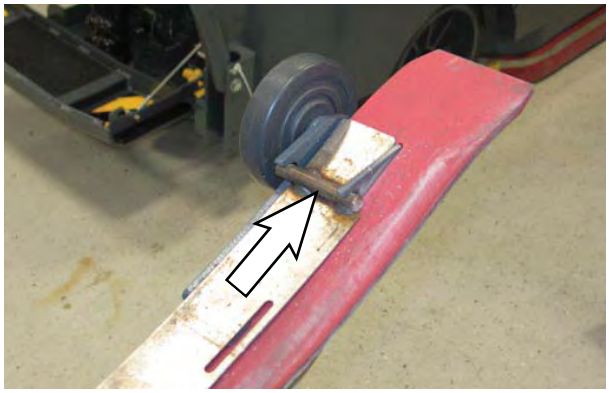


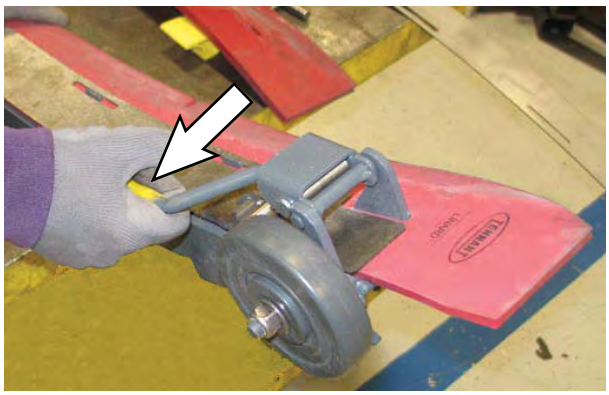
12. Remove the front squeegee from the squeegee assembly.

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.

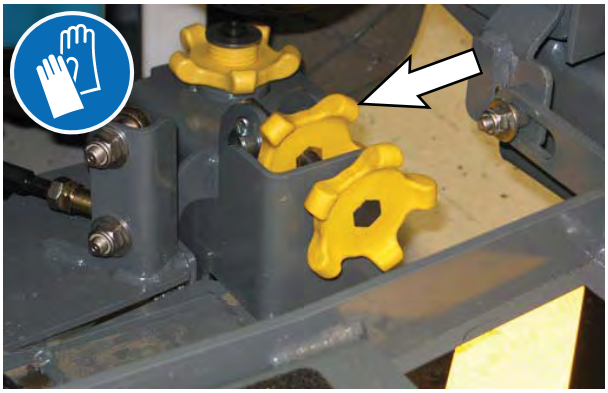
1. Lower the squeegee and drive the machine several meters (feet) forward and slowly bring the machine to a stop.
2. Check the squeegee deflection over the full length of the squeegee blade.

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

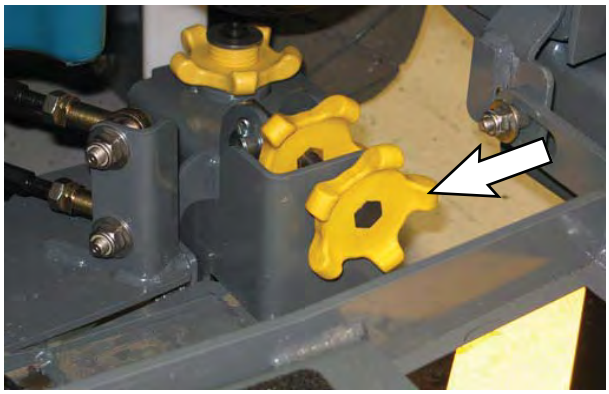
3. Lower the *rear bumper door / step*.
4. If the deflection is not the same over the full length of the blade, use the tilt adjust knob to make adjustments.

   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

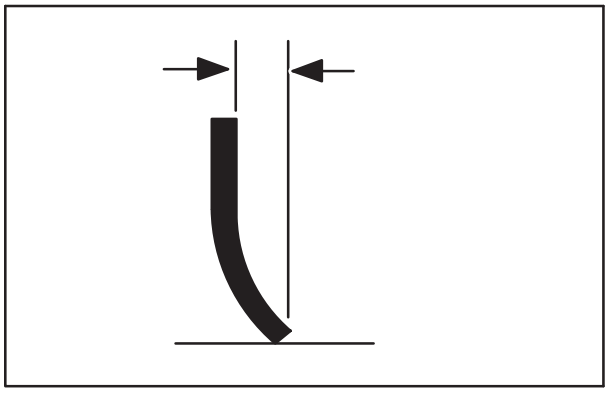
Deflection is the amount of curl the overall squeegee blade has when the machine moves forward. The best deflection is when the squeegee wipes the floor dry with a minimal amount of deflection.

NOTE: Make sure the squeegee is level before adjusting the def ection.SeeLEVELINGTHE REAR SQUEEGEE.

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

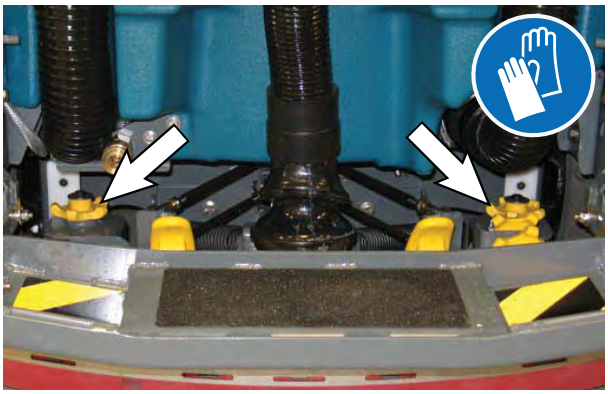
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, set parking brake, and remove key.

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.

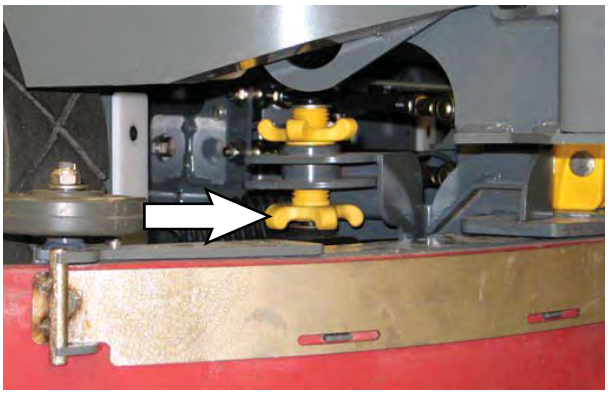


3. Lower the *rear bumper door / step*.

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.

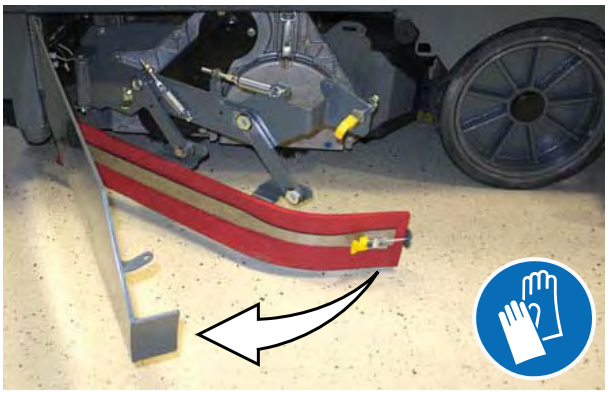
9. Raise the *rear bumper door / step* when finished adjusting the rear squeegee blade deflection.

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.



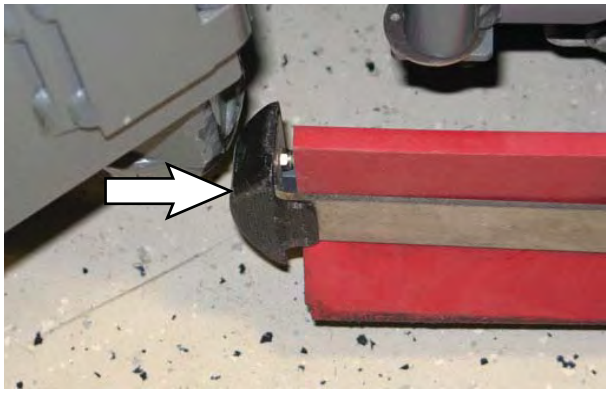
3. Unhook the retaining band latch from the side squeegee assembly.

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.

REPLACING OR ROTATING THE SCRUBBING SIDE BRUSH SQUEEGEE BLADES (OPTION)

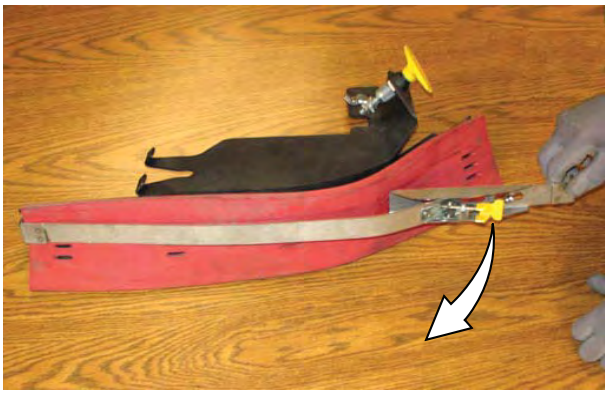
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, set parking brake, and remove key.

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.

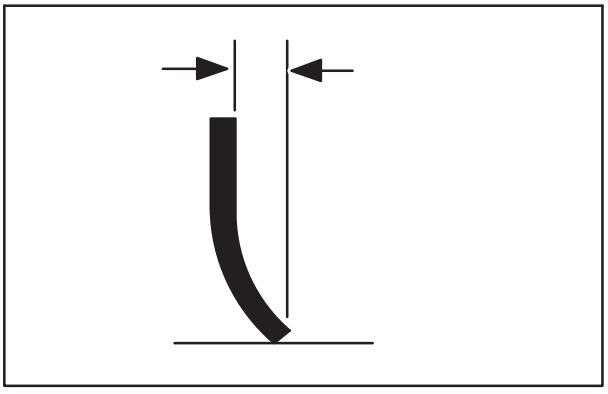
2. Loosen the retaining band latch.

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

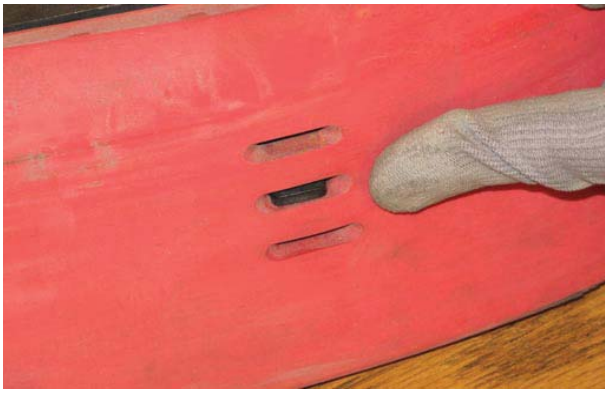


NOTE: Observe which squeegee slots were installed on the squeegee frame before removing the squeegee.

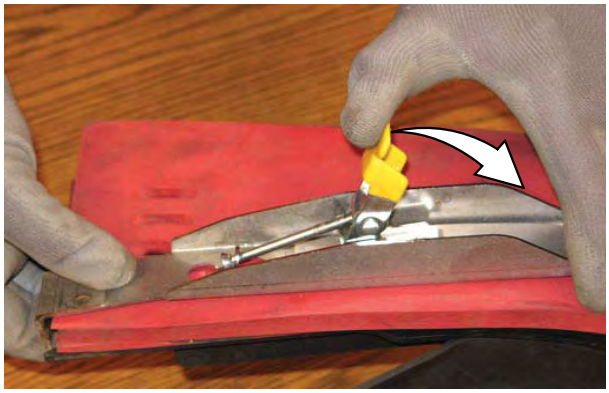
NOTE: The squeegee blade(s) have slots for adjusting the squeegee blade def ection. Install / reinstall squeegees so the def ection is approximately 12 mm (0.50 in) for smooth f oors and 15 mm (0.62 in) for rough f oors.



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

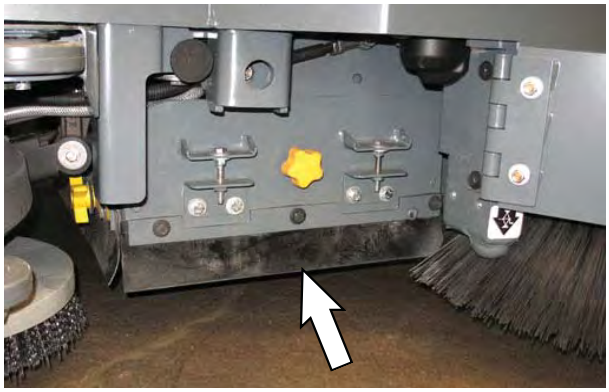
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, set parking brake, and remove key.

SWEEPING RECIRCULATION SKIRTS

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

SWEEPING SIDE SKIRTS

The side skirts are located on both sides of the main sweeping brushes. The side skirts should be just touching the floor. Check the skirts after every 50 hours of operation for damage and wear.



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.

SCRUB HEAD SKIRTS (DISK SCRUB HEADS ONLY)

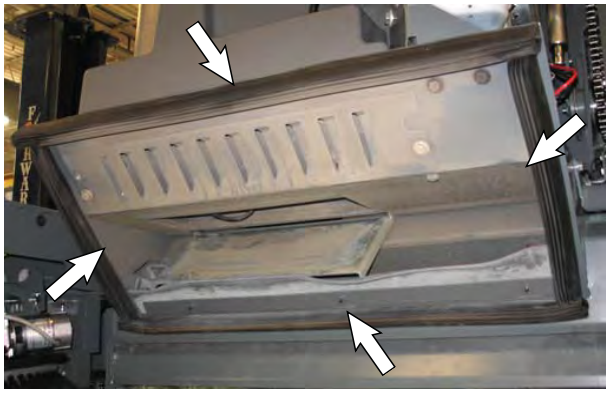
Check the scrub head skirts for damage and wear after every 50 hours of operation.

HOPPER DUST FILTER SEAL

Check the hopper dust filter cover seal for wear or damage every 100 hours of operation. Clean dust and debris from the seal as necessary.

HOPPER SEALS

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

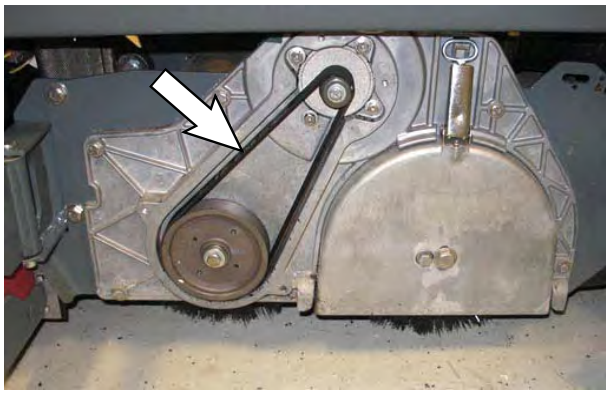


BELTS

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.



SWEEPING BRUSH DRIVE BELTS

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

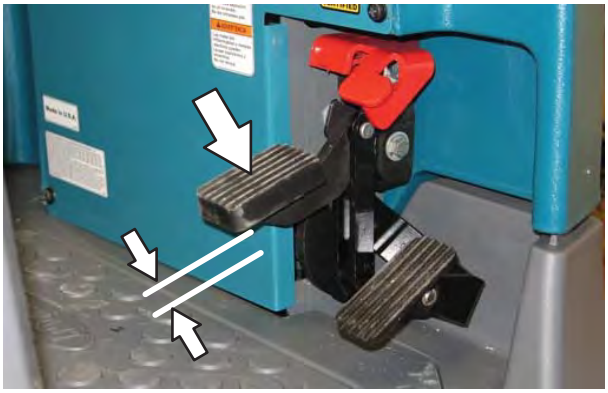
The sweeping brush drive belts are located on the left side of the main sweep head. Check the belts for damage and wear after every 200 hours of operation.

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.

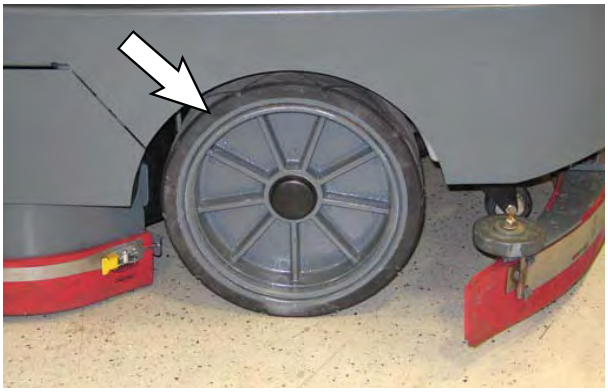
The foot pedal should not travel more than 25 mm (1 in) to engage the brake. Check the brake adjustment after every 200 hours of operation.



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.

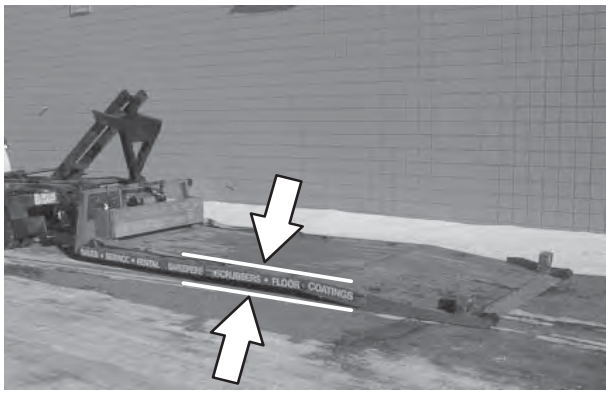
TRANSPORTING THE MACHINE

1. Raise the squeegee, scrub head, and brushes.
2. Raise the hopper enough to clear ground and remove the rear squeegee if backing up onto a ramp grade of 14% or greater.

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

3. Position the back end of the machine at the loading edge of the truck or trailer.
4. If the loading surface is not horizontal or is higher than 380 mm (15 in) from the ground, use a winch to load machine.

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



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

5. Back the machine onto the trailer or truck.

6. To winch the machine onto the truck or trailer, attach the winching chains to the holes in the front jacking brackets located on both sides of the machine, between the hopper and the main scrub head.

7. Position the machine as close to the front of the trailer or truck as possible. If the machine starts to veer off the center line of the truck or trailer, stop and turn the steering wheel to center the machine.

*NOTE: **Do** **not** position the front of machine against the trailer. The hopper / sweeping assemblies could be damaged due to contact of the front of the machine with the trailer during transport.*

FOR SAFETY: When loading/unloading machine onto/off truck of 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.

8. Place a block behind each wheel to prevent the machine from rolling.

9. Lower the hopper, scrub head, and rear squeegee.

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

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

UNLOADING THE MACHINE

1. Set parking brake and turn key to the ON position.

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

2. Unstrap machine and remove the blocks.

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

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

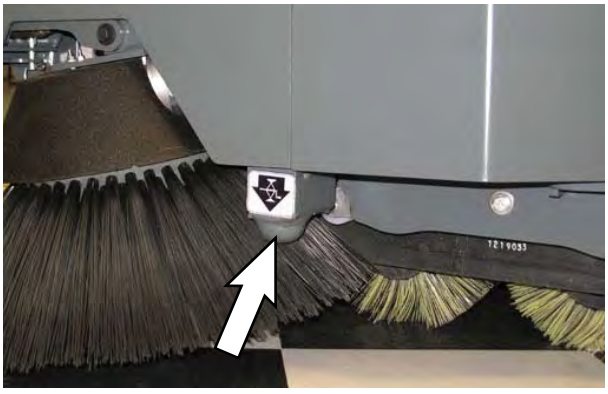
FOR SAFETY: When unloading machine off truck or trailer, use winch. Do not drive the machine off the truck or trailer unless the loading surface is horizontal AND 380 mm (15 in) or less from the ground.

MACHINE JACKING

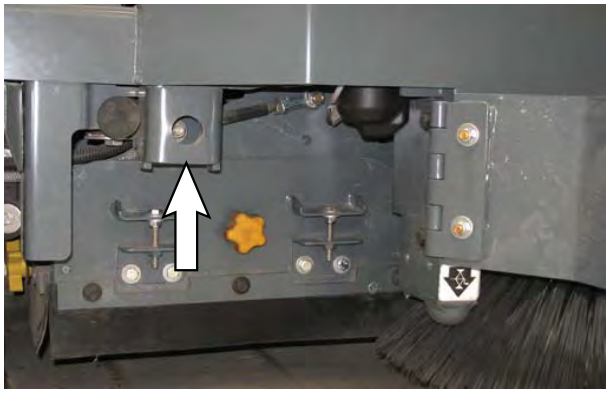
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, set parking brake, and remove key.

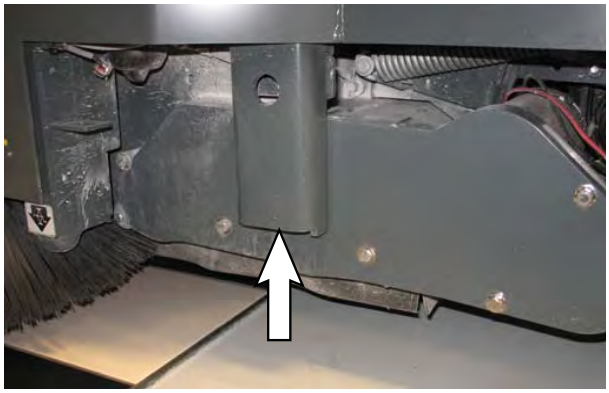
Empty the hopper, recovery and solution tanks before jacking the machine.

Jacking point locations at the front of all machines.

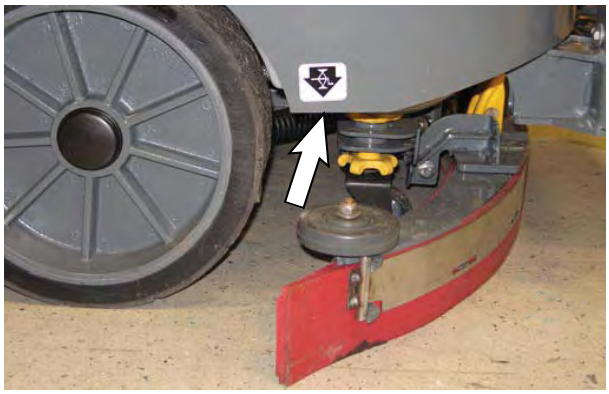


Jack stand locations at the front of the machine.





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.

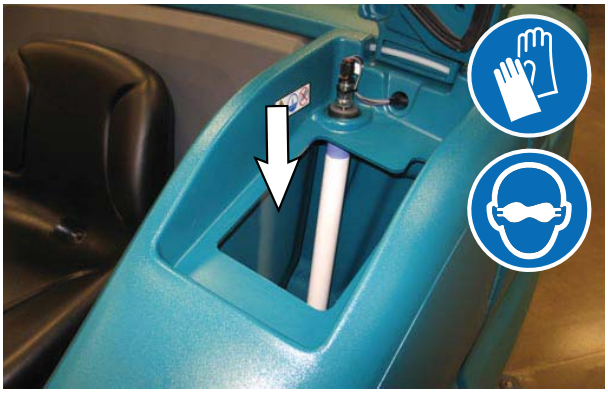
1. Open the right shroud to access the *ec-H2O* assembly.
2. Press the connector button to disconnect the outlet hose from the *ec-H2O* manifold.

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.

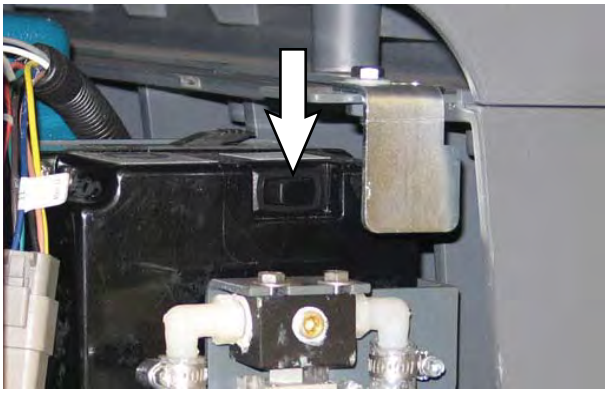
3. Remove the drain hose from the *ec-H2O* compartment.
4. Connect the drain hose to the *ec-H2O* outlet hose.

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 f ush 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.

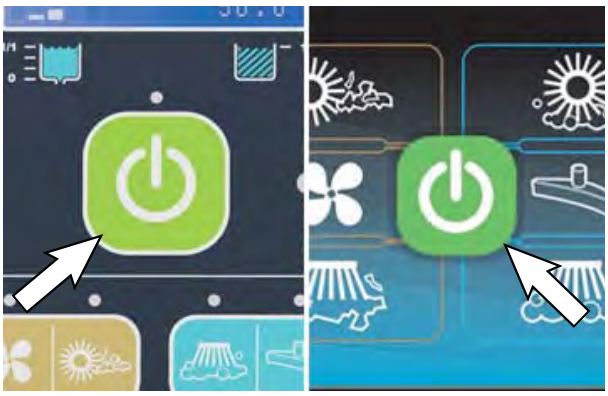
FREEZE PROTECTION

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

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.

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



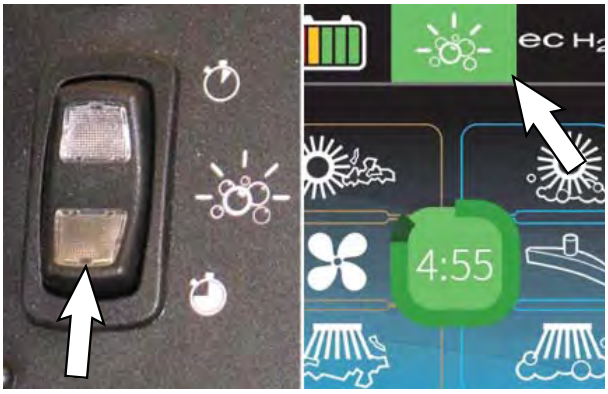
Standard Panel **Pro-Panel**

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

Standard Panel **Pro-Panel**

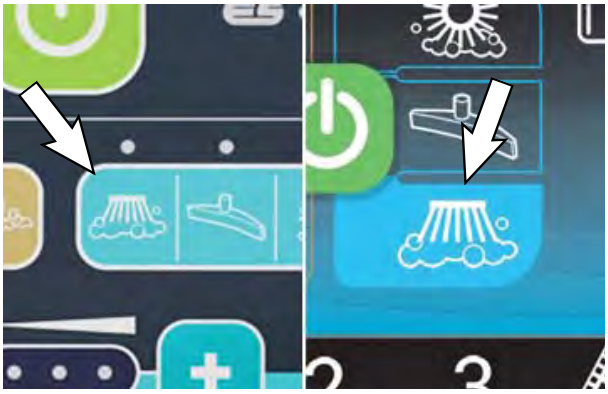
7. **Standard control panel machines with severe environment switch option only:** Press the bottom of the s*evere environment switch* to activate the severe environment scrubbing system.

   Prop-Panel machines with severe environment button option only: Press and hold the s*evere environment button* to activate the severe environment scrubbing



Standard Panel **Pro-Panel**

8. **Machines with scrubbing side brush option only:** Press the *scrubbing side brush button* to activate the side brush.



Standard Panel **Pro-Panel**

9. Drive the machine to circulate the antifreeze completely through all the systems and clear out any remaining water.

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

11. Stop the machine.

12. **Machines with spray nozzle option only:** Operate the wand for a few seconds to protect the pump.

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

14. Turn off the machine.

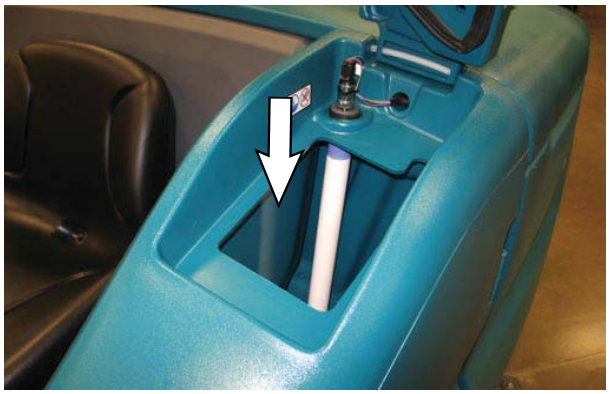
15. The remaining antifreeze does not need to be drained from the solution tank, recovery tank, or detergent tank.

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.

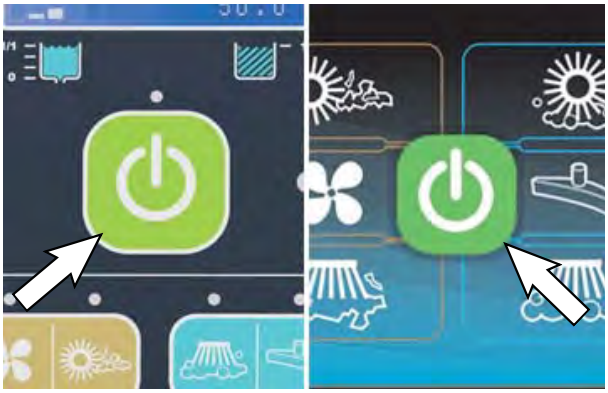
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and set parking brake.

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*.



Standard Panel **Pro-Panel**

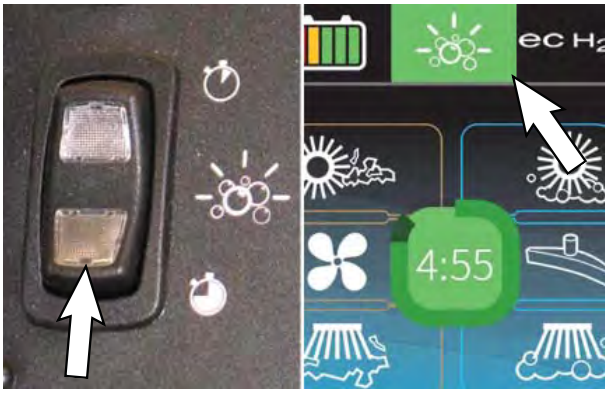
7. Repeatedly press the *solution increase button (+)* until the solution flow is at the highest setting.

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.

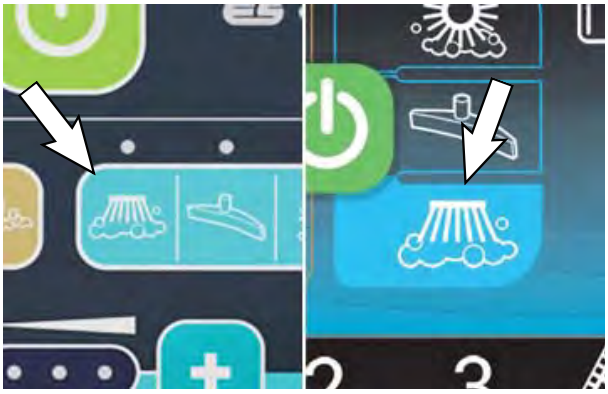
8. **Standard control panel machines with severe environment switch option only:** Press the bottom of the severe environment switch to activate the severe environment scrubbing system.

   Prop-Panel machines with severe environment button option only: Press and hold the s*evere environment button* to activate the severe environment scrubbing



Standard Panel **Pro-Panel**

9. **Machines with scrubbing side brush option only:** Press the side brush switch 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.

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.

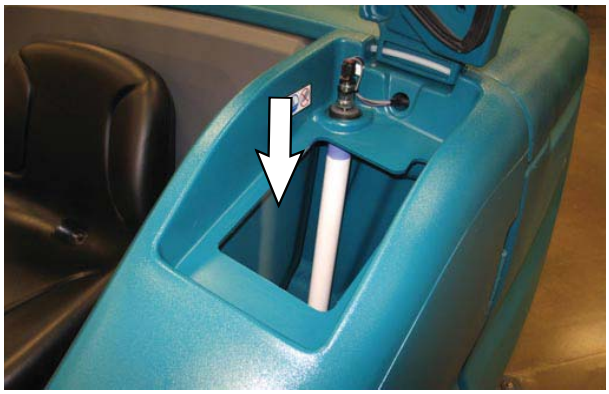
15. Turn off the machine.

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.

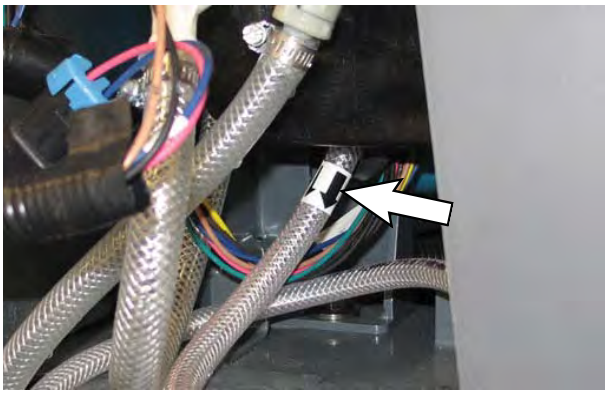
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and set parking brake.

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.

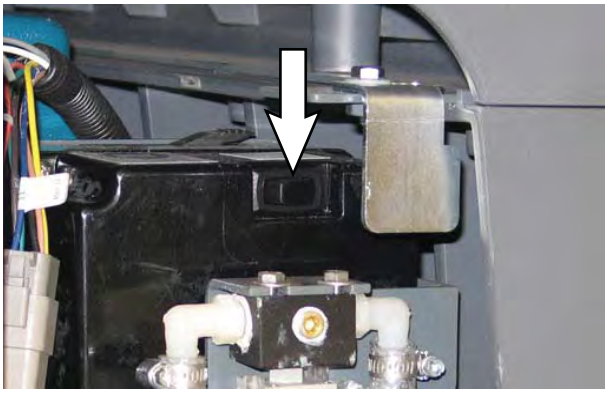
NOTE: Look for arrows on the hose near where the hose is coming from the bottom of the ec-H2O assembly to determine which hose is the outlet hose.



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.

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:

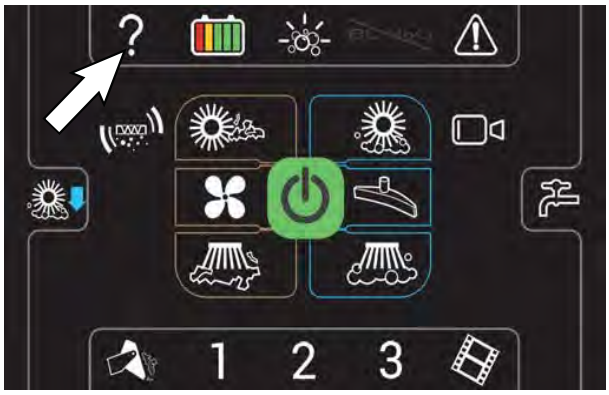
Operator Mode - Capable of machine operation with permissions and restrictions controlled by the supervisor.

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, use the recovery login code 836626826.

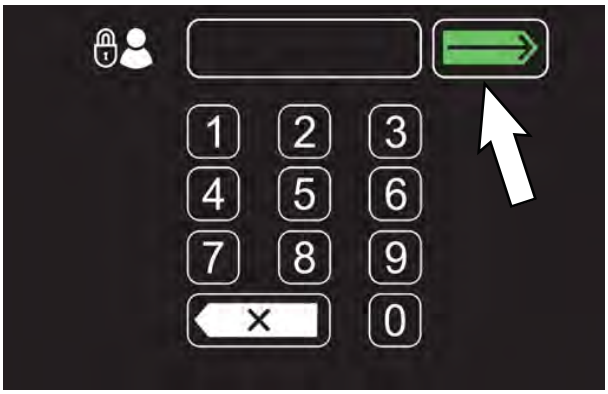
ENTERING THE SUPERVISOR MODE - FIRST TIME USE ONLY

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



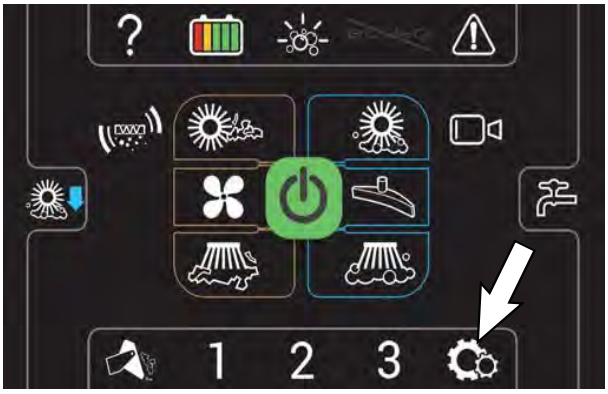
3. Press the login button.

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.

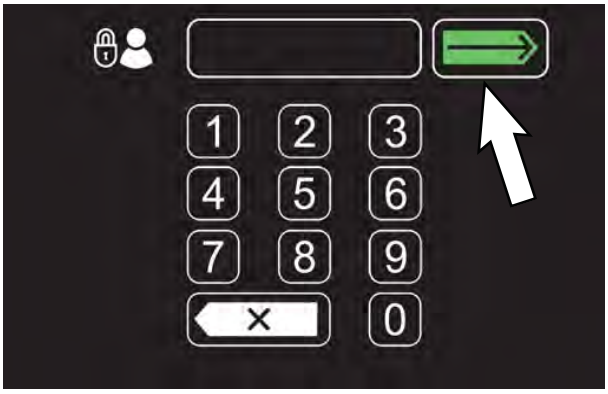
5. The supervisor machine operation screen should appear in the display. Press the settings button to access the supervisor settings screen.



6. Proceed to *ADDING / EDITING PROFILES*.

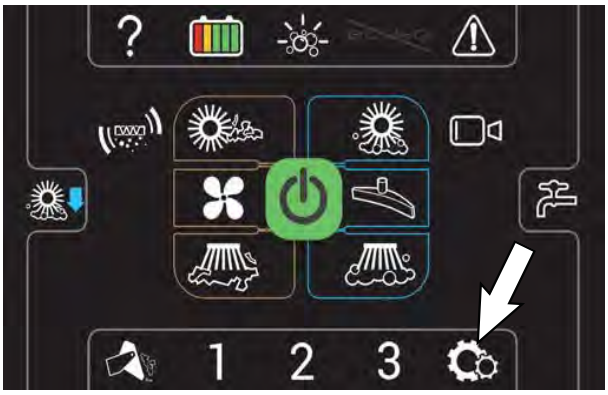
ENTERING THE SUPERVISOR MODE

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.



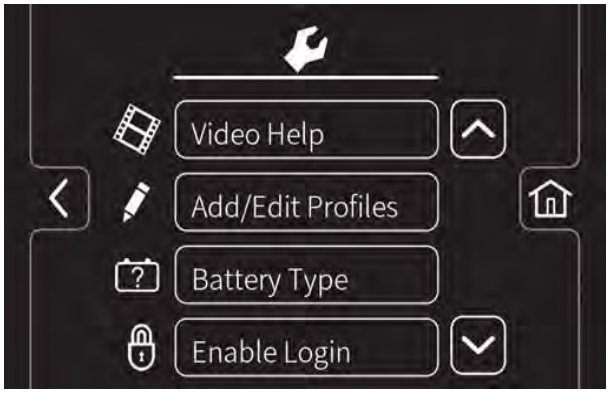
Press the backspace button if necessary to delete and reenter a number.

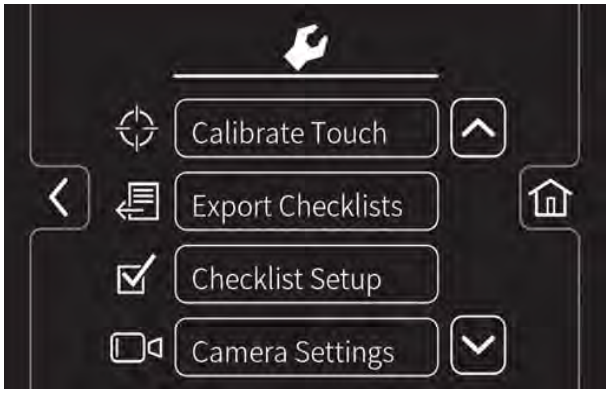
3. The supervisor machine operation screen should appear in the display. Press the settings button to access the supervisor settings screen.



SUPERVISOR 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*.

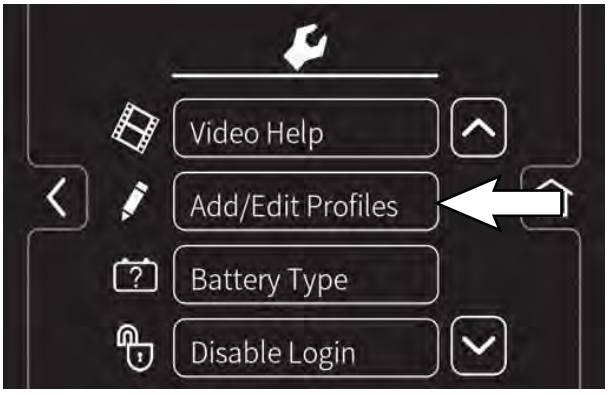
Press the Checklists Setup button to access the Checklist Setup menu. See *DISABLING / ENABLING THE PRE-OPERATION CHECKLIST*.

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

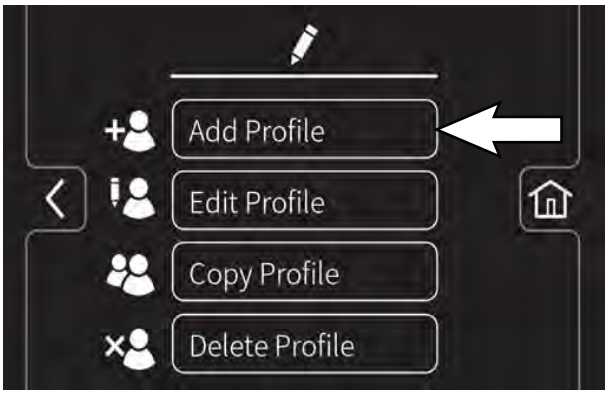
Press the SYSTEM TIME button to access the date / time screen. See SETTING / *CHANGING THE TIME AND DATE*.

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.

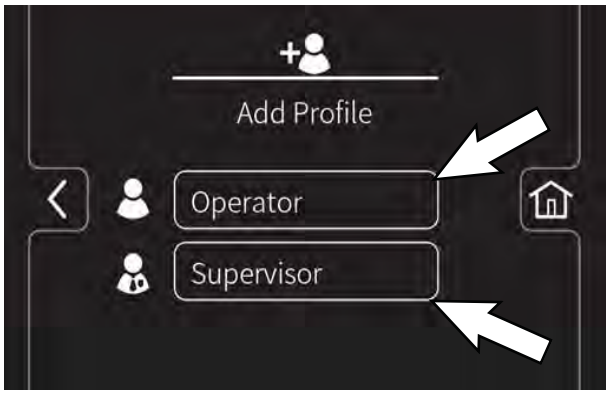

Press the Copy Profile button to copy an existing profile.


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.

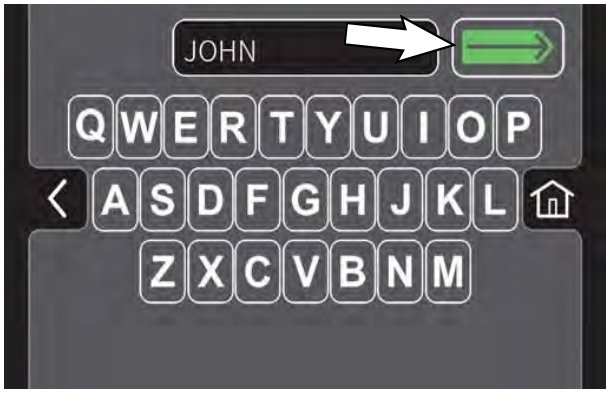


NOTE: The default supervisor cannot be deleted from the prof le list.


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.



6. 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.

7. Set the maximum speed for the machine.

Press the increase arrow button to increase the maximum speed.

Press the decrease arrow button to decrease the maximum speed.

Press the mph button to set the machine speed to miles per hour.

Press the km/h button to set the machine speed to kilometers per hour.

Press the enter button to set the maximum speed for the machine.

8. 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.

9. 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.

10. 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.

11. Now at machine start up, a login screen will display. The new user will need to enter their assigned login number to operate machine.

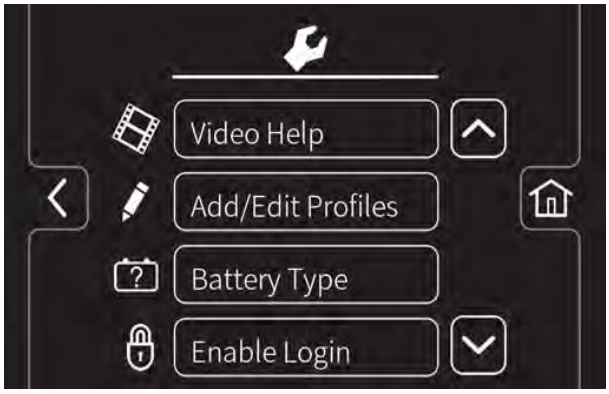
12. When the user is done operating the machine, it is recommended the user log out by pressing the help button, and then pressing the logout button. Turning the key to the off position is another way to also logout.

13. Use the Edit Profile button, Copy Profile button, and Delete Profile button to manage the current user profiles.

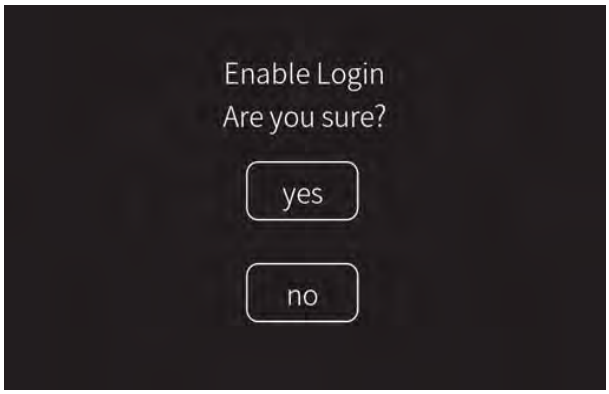
ENABLING THE LOGIN

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.

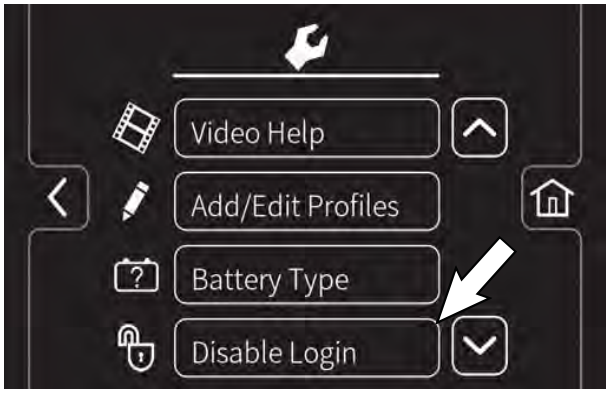


4. Press either the Operator button or Supervisor button to select the desired default user.

DISABLING THE LOGIN

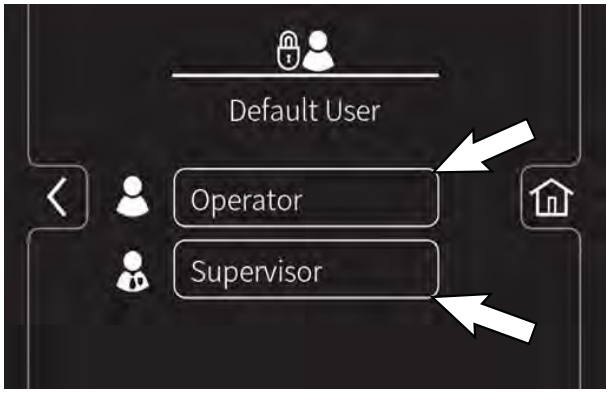
1. Turn on the machine, log into the supervisor screen, and press the settings button to access the supervisor settings screen. See *ENTERING THE SUPERVISOR MODE*.

2. Press the Disable Login button.

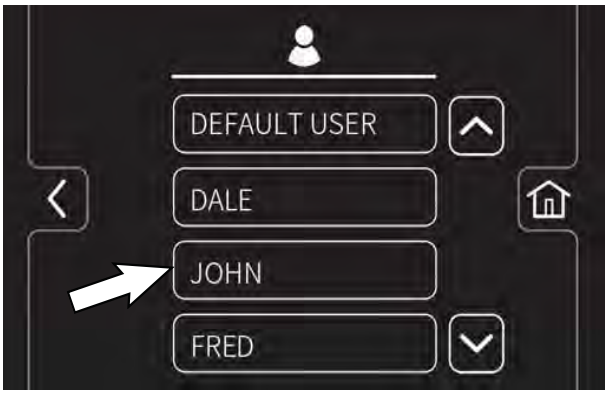


3. Press the yes button to enter the Default User screen.

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.

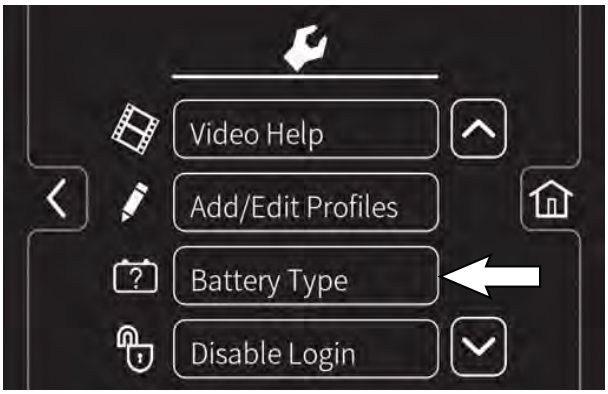
CHANGING BATTERY TYPE

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

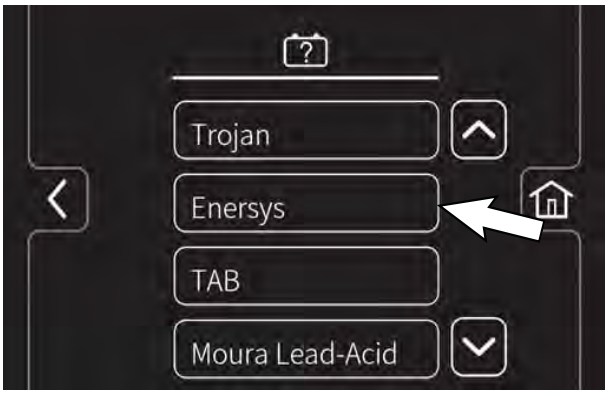
IMPORTANT: Before charging, make sure that the charger setting is properly set for the battery type.

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

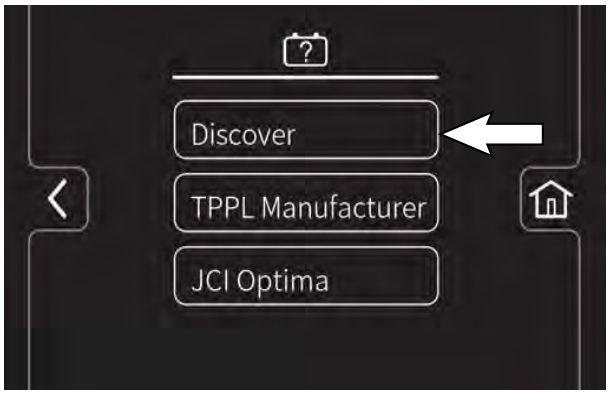
1. Turn on the machine, login to the main operation screen, and press the setting button to access the supervisor settings screen. See *ENTERING THE SUPERVISOR MODE*.
2. Press the Battery Type button to access the battery selection screen.



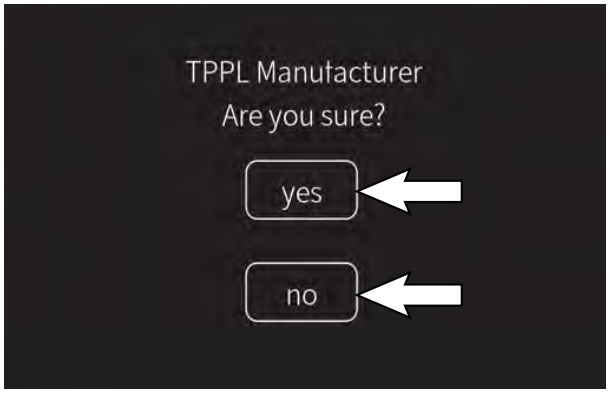
3. Press the button for the applicable battery from the list. If necessary, use the up arrow button and the down arrow button to navigate through the list of batteries.



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.

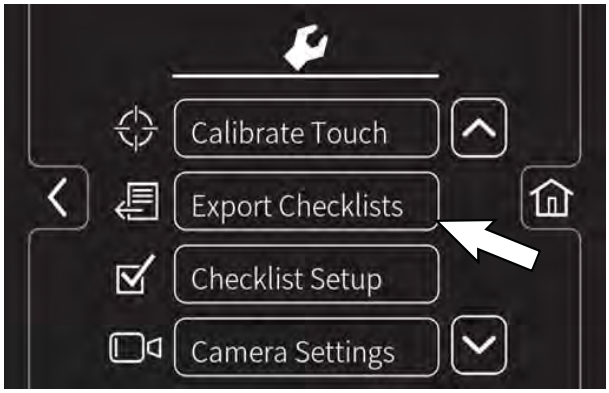
EXPORTING CHECKLISTS

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

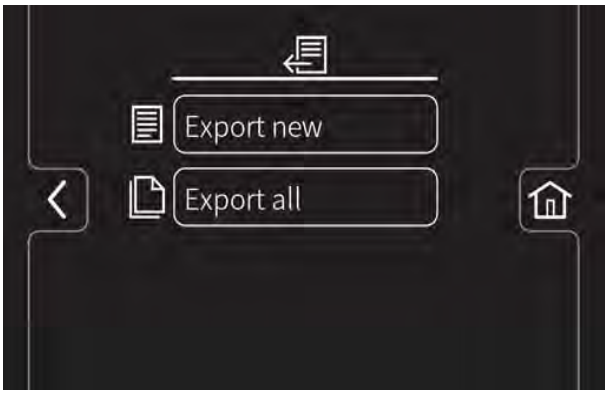
1. Turn on the machine, login to the main operation screen, and press the setting button to access the supervisor settings screen. See *ENTERING THE SUPERVISOR MODE*.

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.

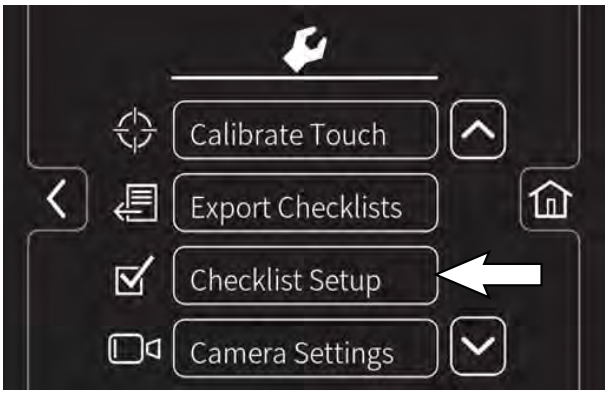
Press the back button to navigate back to the previous screen.

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 items(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 24 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.

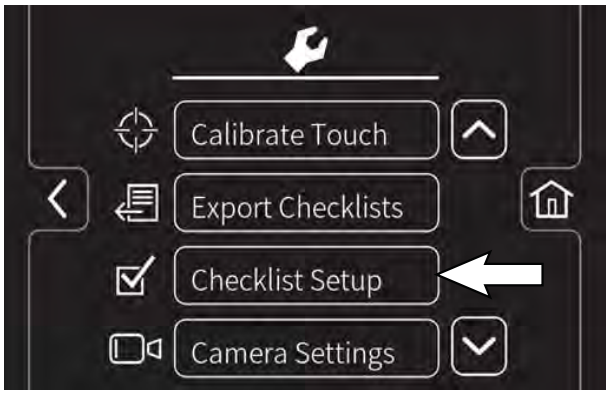
Press the back button to navigate back to the previous screen.

DISABLING / ENABLING THE PRE-OPERATION CHECKLIST

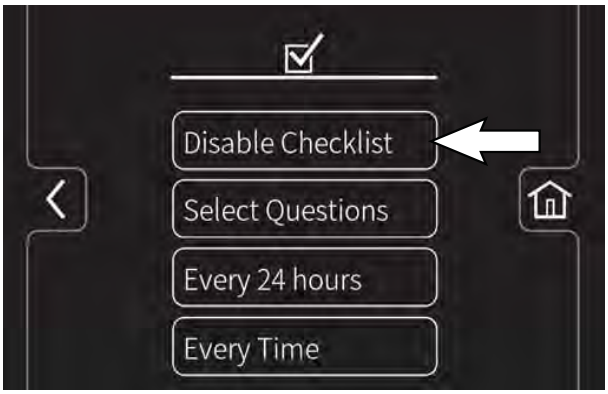
Disabling / enabling the Pre-Operation checklist allows the Pre-Operation checklist to be disabled if it is not necessary for the operator to complete the checklist prior to operating the machine and enabled if it is necessary for the operator to complete the checklist prior to operating the machine.

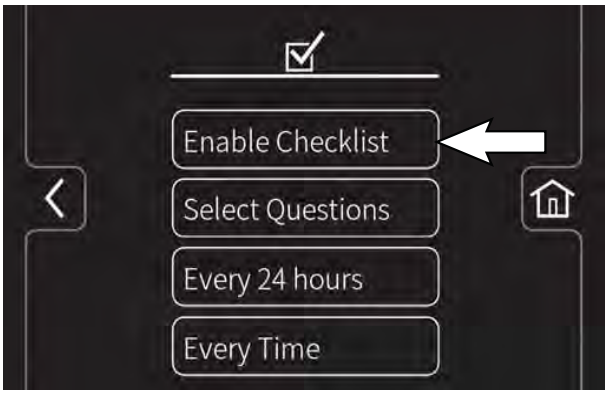
1. Turn on the machine, login to the main operation screen, and press the setting button to access the supervisor settings screen. See *ENTERING THE SUPERVISOR MODE*.

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.





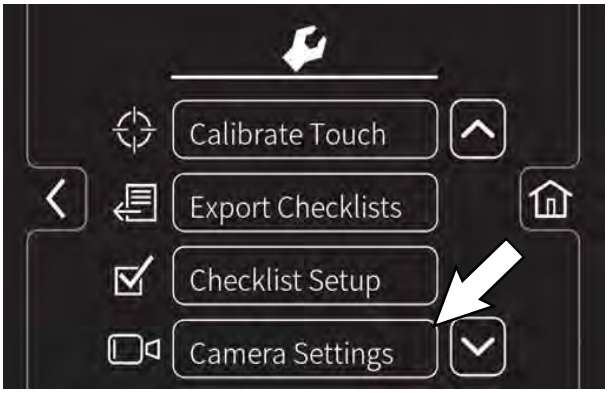
Press the home button to navigate back to the main operating screen.

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.

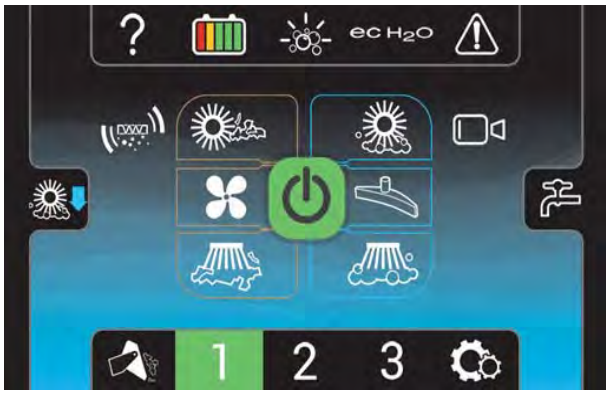
PROGRAMMING THE ZONE CONTROL BUTTONS

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.

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



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

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

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

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

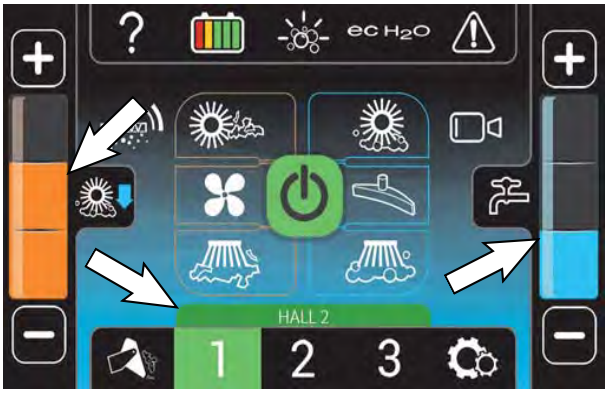
Press the enter button to set the zone button name.

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.

7. 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.

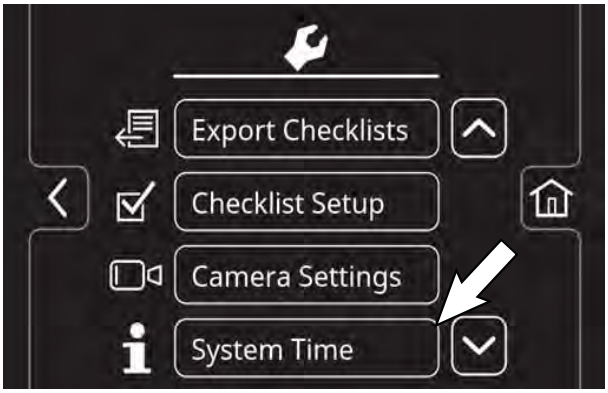


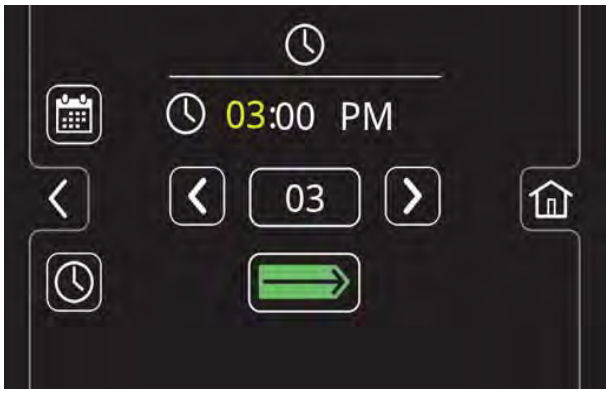
SETTING / CHANGING THE DATE AND TIME

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

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 *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.

3. Press the *home button* when finished setting / changing the system date and time to return to the main operating screen.

SECTION 4

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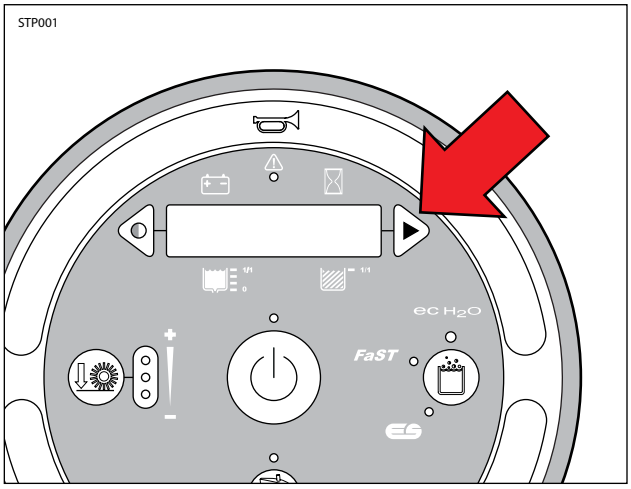
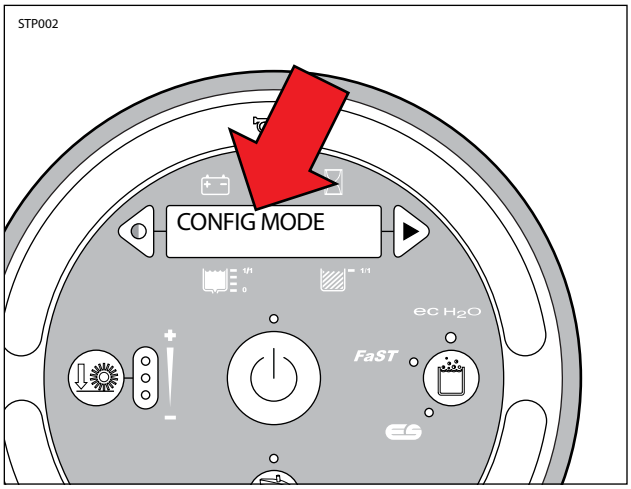
SELF TEST MODE

Self Test Mode is an onboard diagnostic utility that tests for open or shorted output circuits. Once completed, open and/or shorted output pins are displayed on the LCD (liquid crystal display).

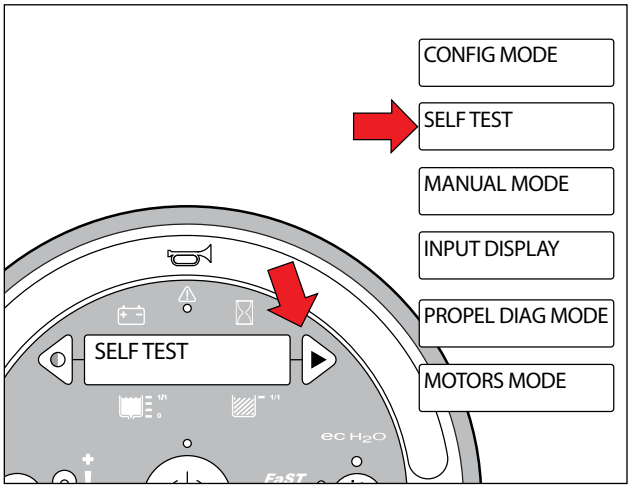
1. Key switch Off. Press and hold the configuration mode button.



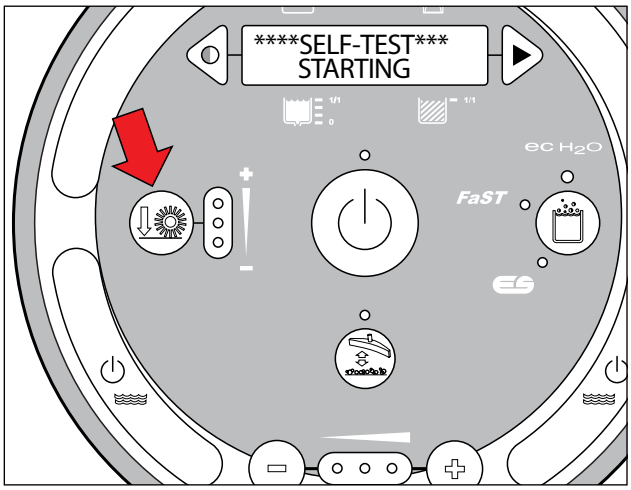
2. Key switch On. Release the configuration mode button when "CONFIG MODE" appears on the LCD.



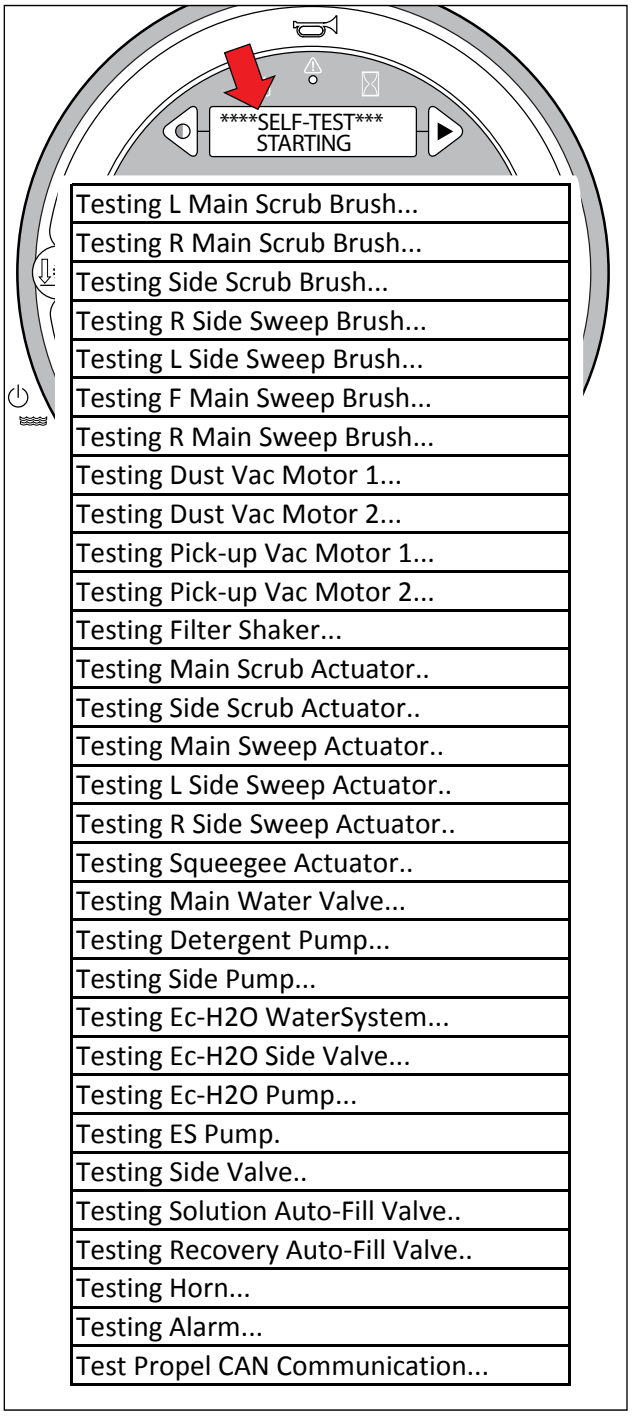
3. Press and release the configuration mode button to scroll through a list of utilities until "SELF TEST" appears on the LCD.



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



5. The controller sequentially tests each output circuit as shown below.



6. 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.

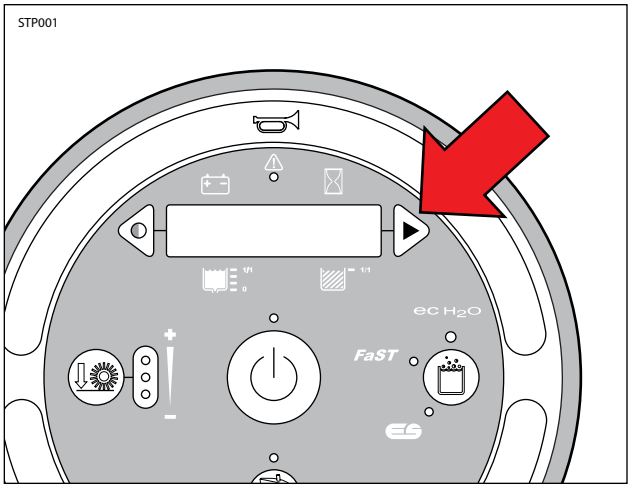
LCD MESSAGE	LCD MESSAGE
S1: SELF-TEST "Done or <Results>"	S38:R Side Swp Act J4-1,2
S2:L Main F/L Scrub Br J10-1,2,3	S39:Squeegee Act J6-17,18
S3:L Main F/L Scrub Br J10-1,2,3	S40:Squeegee Act J6-17,18
S4:R Main R/R Scrub Br J11-4,5,6	S41:Squeegee Act J6-17,18
S5:R Main R/R Scrub Br J11-4,5,6	S42:Main Water Vlv J4-17
S6:Side Scrub Br J6-1,2,3	S43:Main Water Vlv J4-17
S7:Side Scrub Br J6-1,2,3	S44:Detergent Pmp J4-14
S8:L Side Swp Br J4-17	S45:Detergent Pmp J4-14
S9:L Side Swp Br J4-17	S46:Side Scrub Pmp J4-4,10
S10:R Side Swp Br J4-16	S47:Side Scrub Pmp J4-4,10
S11:R Side Swp Br J4-16	S48:EcH2O Cell J5-3,4
S12:L Main Swp Br J7-1,2	S49:EcH2O Cell J5-3,4
S13:L Main Swp Br J7-1,2	S50:EcH2O Spargr J5-1,2
S14:R Main Swp Br J7-1,3	S51:EcH2O Spargr J5-1,2
S15:R Main Swp Br J7-1,3	S52:EcH2O Sde Vlv J4-1,2,5
S16:Dust Vac 1 J4-5,10	S53:EcH2O Sde Vlv J4-1,2,5
S17:Dust Vac 1 J4-5,10	S54:EcH2O Pump J4-4
S18:Dust Vac 2 J4-4,9	S55:EcH2O Pump J4-4
S19:Dust Vac 2 J4-4,9	S56:ES Pump J6-13,14
S20:Pickup Vac 1 J7-1,2	S57:ES Pump J6-13,14
S21:Pickup Vac 1 J7-1,2	S58:Side Valve J4-9
S22:Pickup Vac 2 J7-3,4	S59:Side Valve J4-9
S23:Pickup Vac 2 J7-3,4	S60:Sol AF Vlv J6-7,12
S24:Filter Shkr J4-11,12	S61:Sol AF Vlv J6-7,12
S25:Filter Shkr J4-11,12	S62:Rcvr AF Vlv J6-7,11
S26:Main Scrub Act J4-9,10	S63:Rcvr AF Vlv J6-7,11
S27:Main Scrub Act J4-9,10	S64:Horn J4-16
S28:Main Scrub Act J4-9,10	S65:Horn J4-16
S29:Side Scrub Act J4-7,8	S66:Alarm J4-15
S30:Side Scrub Act J4-7,8	S67:Alarm J4-15
S31:Side Scrub Act J4-7,8	S68:Main Scrub
S32:Main Swp Act J4-16,17	S69:Side Scrub
S33:Main Swp Act J4-16,17	S70:Water Pickup
S34:Main Swp Act J4-16,17	S71:EcH2O Module
S35:L Side Swp Act J4-11,12	S72:Main Sweep
S36:L Side Swp Act J4-11,12	S73:Side Sweep
S37:R Side Swp Act J4-1,2	S74:Propel Ctrl

Note: LCD Message's above can be seen as an open or a short.

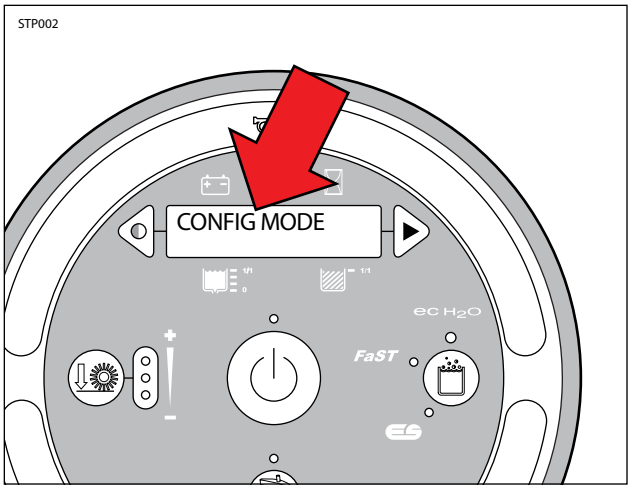
CONFIGURATION MODE

Configuration Mode is an on-board diagnostic utility that configures controller software to operate optional equipment and to electronically adjust certain output functions.

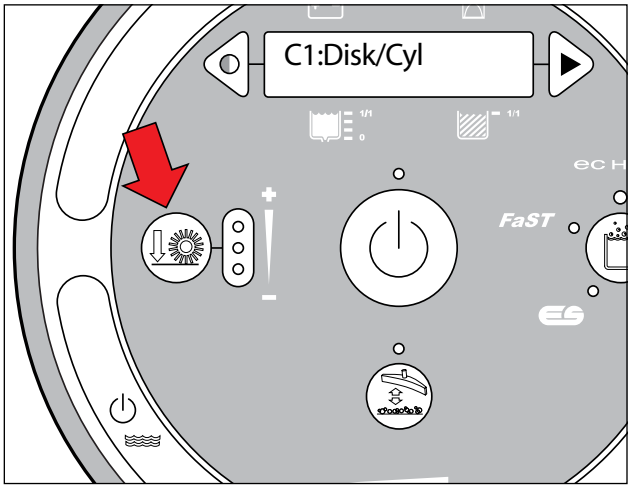
1. Key switch Off. Press and hold the configuration mode button.



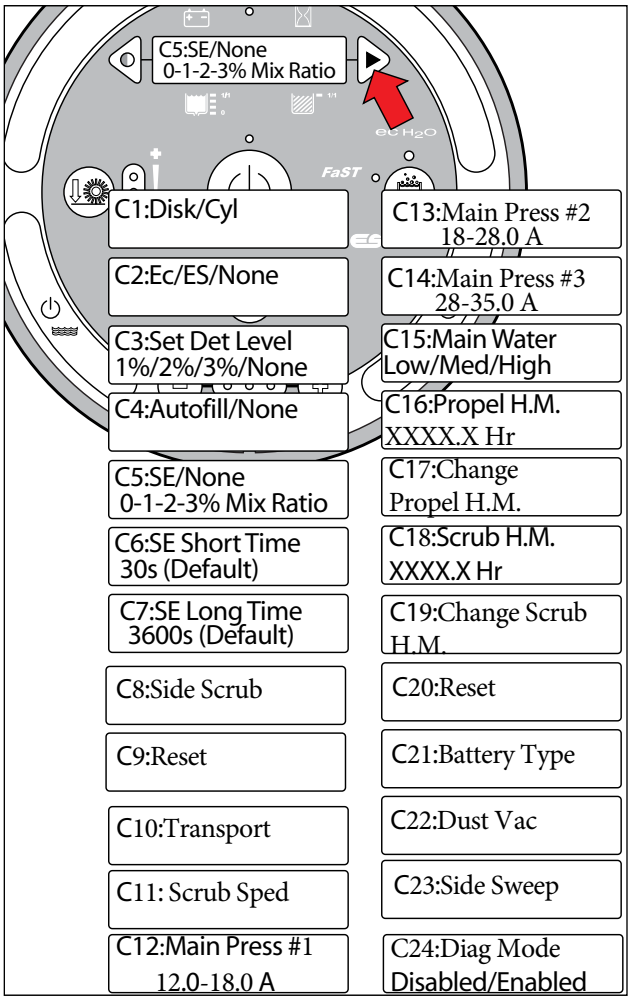
2. Key switch On. Release the configuration mode button when "CONFIG MODE" appears on the LCD.



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



4. Press and release the configuration mode button to scroll through a list of utilities as shown below.



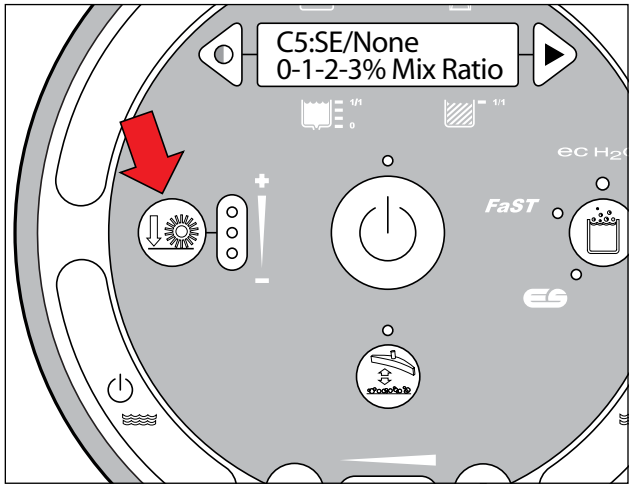
5. Use the table below for further description of each Configuration Mode utility.

LCD TEXT	DESCRIPTION
C1:Disk/Cyl	Configure scrub head type
C2:Ec/ES/None	Configure ec-H2O, ES or none
C3:Set Det Level	Set ratio of detergent for ES option to 1%, 2%, or 3%
C4:Autofill/Non	Enable Autofill eature (w/ ES option)
C5:SE/None	Enable Severe Environment feature for machines equipped with ec-H2O
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:Side Scrub	Configure unit for side scrub brush.
C9:Reset Press.?	Reset down pressures to factory default settings.
C10:Transprt Spd	Adjust maximum forward transport speed.
C11:Scrub Spd	Adjust maximum scrubbing speed.
C12:Main Press #1**	Set max down pressure #1 (12-18 Amps, Default 14D, 13C)
C13:Main Press #2**	Set max down pressure #2 (18-28 Amps, Default 25D, 26C)
C14:Main Press #3**	Set max down pressure #3 (28-35 Amps, Default 35 Amps)
C15:Main Water	Set conventional solution flow range; Low, Med, or High
C16:Propel H.M.	View propel hourmeter.
C17:Chge Propel HM	Change Propel hourmeter.
C18:Scrub H.M.	View scrub hourmeter.
C19: Chge Scrub HM	Change hourmeter.
C20:Reset	Resets scrub head type, solution configuration, down pressure targets, flow range, side option, travel speeds, autofill option, SE option to default settings.
C21:Battery Type	Configure battery type.
C22:Dust Vac	Configure dust vacuums
C23:Side Sweep	Configure side sweep motors
C24:Diag Mode Disabled/Enabled	Enable technical data during normal machine operation. Scroll through LCD data by pressing the contrast or configuration mode buttons during normal operation. Cycle key 1x to enable, 2x to disable.
Exit Config Mode	

** 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.*

6. 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.



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

M17 FAULT CODES

Fault Code Number	Fault Code (Displayed in LCD)	Fault Code (Displayed on Pro-Panel Screen)	Cause(s)	Action(s)
0xFFF0	E Stop	Emergency Stop Fault	1. E-Stop Pressed. 2. E-Stop wiring problem.	1. Release E-Stop button and power cycle machine. 2. If that does not clear the fault, check connections.
0xFF11	Low Battery	Low Battery Warning	1. Battery pack voltage too low.	1. Charge battery pack.
0xFF12	Low Battery	Very Low Battery Warning	1. Battery pack voltage too low.	1. Charge battery pack.
0xFF20	M Scrub CAN	Main Scrub CAN Communication Fault	1. Control boards are not communicating properly. 2. Board lost power (wiring issue) 3. Breaker supplying power to board tripped. 4. Control board may be damaged.	1. Power cycle machine. 2. Check breaker supplying power to board. 3. No communication with a network module - Check CAN Line reference (2.2v ea line) and 5VDC voltage regulator and to Motor Encoders.
0xFF21	WPickup CAN	Water Pickup CAN Communication Fault	1. Control boards are not communicating properly. 2. Board lost power (wiring issue) 3. Breaker supplying power to board tripped. 4. Control board may be damaged.	1. Power cycle machine. 2. Check breaker supplying power to board. 3. No communication with a network module.
0xFF22	S Scrub CAN	Side Scrub CAN Communication Fault	1. Control boards are not communicating properly. 2. Board lost power (wiring issue) 3. Breaker supplying power to board tripped. 4. Control board may be damaged.	1. Power cycle machine. 2. Check breaker supplying power to board. 3. No communication with a network module - Check CAN Line reference (2.2v ea line) and 5VDC voltage regulator and to Motor Encoders.
0xFF23	EcH2O CAN	EcH2O CAN Communication Fault	1. Control boards are not communicating properly. 2. Board lost power (wiring issue) 3. Breaker supplying power to board tripped. 4. Control board may be damaged.	1. Power cycle machine. 2. Check breaker supplying power to board. 3. No communication with a network module.
0xFF24	S Sweep CAN	Side Sweep CAN Communication Fault	1. Control boards are not communicating properly. 2. Board lost power (wiring issue) 3. Breaker supplying power to board tripped. 4. Control board may be damaged.	1. Power cycle machine. 2. Check breaker supplying power to board. 3. No communication with a network module.
0xFF25	M Sweep CAN	Main Sweep CAN Communication Fault	1. Control boards are not communicating properly. 2. Board lost power (wiring issue) 3. Breaker supplying power to board tripped. 4. Control board may be damaged.	1. Power cycle machine. 2. Check breaker supplying power to board. 3. No communication with a network module.
0xFF26	Propel Comm	Propel CAN Communication Fault	1. Control boards are not communicating properly. 2. Board lost power (wiring issue) 3. Breaker supplying power to board tripped. 4. Control board may be damaged.	1. Power cycle machine. 2. Check breaker supplying power to board. 3. No communication with a network module.
0x0010	Parking Brk	Parking Brake	1. This flashing indicator alerts the manual parking brake is engaged locking the brake pedal. The parking brake should be released before machine operation.	1. Release parking brake.
0x0101	L Scrub Opn	Left Scrub Motor Open Warning	1. Wiring, connector or control board issue with circuit to motor.	1. Check connections, board gets power from key switch and battery. If connections check out, replace control board.
0x0106	L Scrub Srt	Left Scrub Motor Short Fault	1. Shorted load condition 2. Some higher current draw than hardware design limit.	1. Check wire harness and repair as needed.
0x0107	L Scrub FET	Left Scrub Motor FET Fault	1. Control board problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Control Board.
0x0111	R Scrub Opn	Right Scrub Motor Open Warning	1. Wiring, connector or control board issue with circuit to motor.	1. Check connections, board gets power from key switch and battery. If connections check out, replace control board.
0x0116	R Scrub Srt	Right Scrub Motor Short Fault	1. Shorted load condition 2. Some higher current draw than hardware design limit.	1. Check wire harness and repair as needed.
0x0117	R Scrub FET	Right Scrub Motor FET Fault	1. Control board problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Control Board.
0x0120	S Scrub Flt	Side Scrub Motor Generic		
0x0121	S Scrub Opn	Side Scrub Motor Open Warning	1. Wiring, connector or control board issue with circuit to motor.	1. Check connections, board gets power from key switch and battery. If connections check out, replace control board.
0x0122	S Scrub Vlt	Side Scrub Motor Voltage Loss	1. Shorted load condition 2. Some higher current draw than hardware design limit.	1. Check wire harness and repair as needed.

M17 FAULT CODES

Fault Code Number	Fault Code (Displayed in LCD)	Fault Code (Displayed on Pro-Panel Screen)	Cause(s)	Action(s)
0x0127	S Scrub FET	Side Scrub Motor FET Fault	1. Control board problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Control Board.
0x0129	S Scrub Tmp	Side Scrub Motor Overheat	1. Motor temperature too high (over 104F).	1. Check motor temp repair or replaced.
0x0131	M Swp 1 Opn	Main Sweep Brush Motor 1 Open Warning	1. Wiring, connector or control board issue with circuit to motor.	1. Check connections, board gets power from key switch and battery. If connections check out, replace control board.
0x0136	M Swp 1 Srt	Main Sweep Brush Motor 1 Short Fault	1. Shorted load condition 2. Some higher current draw than hardware design limit.	1. Check wire harness and repair as needed.
0x0137	M Swp 1 FET	Main Sweep Brush Motor 1 FET Fault	1. Control board problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Control Board.
0x0141	M Swp 2 Opn	Main Sweep Brush Motor 2 Open Warning	1. Wiring, connector or control board issue with circuit to motor.	1. Check connections, board gets power from key switch and battery. If connections check out, replace control board.
0x0146	M Swp 2 Srt	Main Sweep Brush Motor 2 Short Fault	1. Shorted load condition 2. Some higher current draw than hardware design limit.	1. Check wire harness and repair as needed.
0x0147	M Swp 2 FET	Main Sweep Brush Motor 2 FET Fault	1. Control board problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Control Board.
0x0151	R Sweep Opn	Right Sweep Brush Motor Open Warning	1. Wiring, connector or control board issue with circuit to motor.	1. Check connections, board gets power from key switch and battery. If connections check out, replace control board.
0x0156	R Sweep Srt	Right Sweep Brush Motor Short Fault	1. Shorted load condition 2. Some higher current draw than hardware design limit.	1. Check wire harness and repair as needed.
0x0157	R Sweep FET	Right Sweep Brush Motor FET Fault	1. Control board problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Control Board.
0x0161	L Sweep Opn	Left Sweep Brush Motor Open Warning	1. Wiring, connector or control board issue with circuit to motor.	1. Check connections, board gets power from key switch and battery. If connections check out, replace control board.
0x0166	L Sweep Srt	Left Sweep Brush Motor Short Fault	1. Shorted load condition 2. Some higher current draw than hardware design limit.	1. Check wire harness and repair as needed.
0x0167	L Sweep FET	Left Sweep Brush Motor FET Fault	1. Control board problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Control Board.
0x0171	FltShkr Opn	Filter Shaker Motor Open Warning	1. Wiring, connector or control board issue with circuit to motor.	1. Check connections, board gets power from key switch and battery. If connections check out, replace control board.
0x0176	FltShkr Srt	Filter Shaker Motor Short Fault	1. Shorted load condition 2. Some higher current draw than hardware design limit.	1. Check wire harness and repair as needed.
0x0177	FltShkr FET	Filter Shaker Motor FET Fault	1. Control board problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Control Board.
0x0230	MSwpAct Flt	Main Sweep Actuator Generic		
0x0231	MSwpAct Opn	Main Sweep Actuator Open Warning	1. Wiring, connector or control board issue with circuit to motor.	1. Check connections, board gets power from key switch and battery. If connections check out, replace control board.
0x0237	MSwpAct FET	Main Sweep Actuator FET Fault	1. Control board problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Control Board.
0x0240	RSwpAct Flt	Right Sweep Actuator Generic		
0x0247	RSwpAct FET	Right Sweep Actuator FET Fault	1. Control board problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Control Board.

M17 FAULT CODES

Fault Code Number	Fault Code (Displayed in LCD)	Fault Code (Displayed on Pro-Panel Screen)	Cause(s)	Action(s)
0x0250	LSwpAct Flt	Left Sweep Actuator Generic		
0x0257	LSwpAct FET	Left Sweep Actuator FET Fault	1. Control board problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Control Board.
0x0260	LiftAct Flt	Hopper Lift Actuator Generic		
0x0261	LiftAct Opn	Hopper Lift Actuator Open Warning	1. Wiring, connector or control board issue with circuit to motor.	1. Check connections, board gets power from key switch and battery. If connections check out, replace control board.
0x0267	LiftAct FET	Hopper Lift Actuator FET Fault	1. Control board problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Control Board.
0x0270	RollAct Flt	Hopper Roll Actuator Generic		
0x0271	RollAct Opn	Hopper Roll Actuator Open Warning	1. Wiring, connector or control board issue with circuit to motor.	1. Check connections, board gets power from key switch and battery. If connections check out, replace control board.
0x0277	RollAct FET	Hopper Roll Actuator FET Fault	1. Control board problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Control Board.
0x0278	RollAct Stl	Hopper Roll Actuator Stall	1. Over current. 2. Binding issue.	1. Check amp references. 2. Check system for binding.
0x0301	M Water Opn	Main Water Valve Open Warning	1. Wiring, connector or control board issue with circuit to motor.	1. Check connections, board gets power from key switch and battery. If connections check out, replace control board.
0x0306	M Water Srt	Main Water Valve Short Fault	1. Shorted load condition 2. Some 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. Control board problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Control Board.
0x0311	Horn Opn	Horn Open Warning	1. Wiring, connector or control board issue with circuit to motor.	1. Check connections, board gets power from key switch and battery. If connections check out, replace control board.
0x0316	Horn Srt	Horn Short Fault	1. Shorted load condition 2. Some higher current draw than hardware design limit.	1. Check wire harness and repair as needed.
0x0317	Horn FET	Horn FET Fault	1. Control board problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Control Board.
0x0321	Alarm Opn	Alarm Open Warning	1. Wiring, connector or control board issue with circuit to motor.	1. Check connections, board gets power from key switch and battery. If connections check out, replace control board.
0x0326	Alarm Srt	Alarm Short Fault	1. Shorted load condition 2. Some higher current draw than hardware design limit.	1. Check wire harness and repair as needed.
0x0327	Alarm FET	Alarm FET Fault	1. Control board problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Control Board.
0x0331	S Scrub Opn	Side Scrub Valve Open Warning	1. Wiring, connector or control board issue with circuit to motor.	1. Check connections, board gets power from key switch and battery. If connections check out, replace control board.
0x0336	S Scrub Srt	Side Scrub Valve Short Fault	1. Shorted load condition 2. Some higher current draw than hardware design limit.	1. Check wire harness and repair as needed.
0x0337	S Scrub FET	Side Scrub Valve FET Fault	1. Control board problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Control Board.
0x0341	SAF Vlv Opn	Solution AutoFill Valve Open Warning	1. Wiring, connector or control board issue with circuit to motor.	1. Check connections, board gets power from key switch and battery. If connections check out, replace control board.

M17 FAULT CODES

Fault Code Number	Fault Code (Displayed in LCD)	Fault Code (Displayed on Pro-Panel Screen)	Cause(s)	Action(s)
0x0346	SAF Vlv Srt	Solution AutoFill Valve Short Fault	1. Shorted load condition 2. Some higher current draw than hardware design limit.	1. Check wire harness and repair as needed.
0x0347	SAF Vlv FET	Solution AutoFill Valve FET Fault	1. Control board problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Control Board.
0x0351	RAF Vlv Opn	Recovery AutoFill Valve Open Warning	1. Wiring, connector or control board issue with circuit to motor.	1. Check connections, board gets power from key switch and battery. If connections check out, replace control board.
0x0356	RAF Vlv Srt	Recovery AutoFill Valve Short Fault	1. Shorted load condition 2. Some higher current draw than hardware design limit.	1. Check wire harness and repair as needed.
0x0357	RAF Vlv FET	Recovery AutoFill Valve FET Fault	1. Control board problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Control Board.
0x0501	Vac 1 Opn	Pickup Vac 1 Electrical Open Alert	1. Wiring, connector or control board issue with circuit to motor.	1. Check connections, board gets power from key switch and battery. If connections check out, replace control board.
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. Control board problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Control Board.
0x0511	Vac 2 Opn	Pickup Vac 2 Electrical Open Alert	1. Wiring, connector or control board issue with circuit to motor.	1. Check connections, board gets power from key switch and battery. If connections check out, replace control board.
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. Control board problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Control Board.
0x0520	DstVac1 Flt	Dust Vac 1 Underspeed Fault	1. Motor running too slow.	1. Verify vacuum load, damage and/or usage conditions.
0x0530	DstVac2 Flt	Dust Vac 2 Underspeed Fault	1. Motor running too slow.	1. Verify vacuum load, damage and/or usage conditions.
0x0601	SdePump Opn	Side Scrub Pump Open Warning	1. Wiring, connector or control board issue with circuit to motor.	1. Check connections, board gets power from key switch and battery. If connections check out, replace control board.
0x0606	SdePump Srt	Side Scrub Pump Short Fault	1. Shorted load condition 2. Some higher current draw than hardware design limit.	1. Check wire harness and repair as needed.
0x0607	SdePump FET	Side Scrub Pump FET Fault	1. Control board problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Control Board.
0x0611	DetPump Opn	Detergent Pump Open Warning	1. Wiring, connector or control board issue with circuit to motor.	1. Check connections, board gets power from key switch and battery. If connections check out, replace control board.
0x0616	DetPump Srt	Detergent Pump Short Fault	1. Shorted load condition 2. Some higher current draw than hardware design limit.	1. Check wire harness and repair as needed.
0x0617	DetPump FET	Detergent Pump FET Fault	1. Control board problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Control Board.
0x0621	ES Pump Opn	Extended Scrub Pump Open Warning	1. Wiring, connector or control board issue with circuit to motor.	1. Check connections, board gets power from key switch and battery. If connections check out, replace control board.

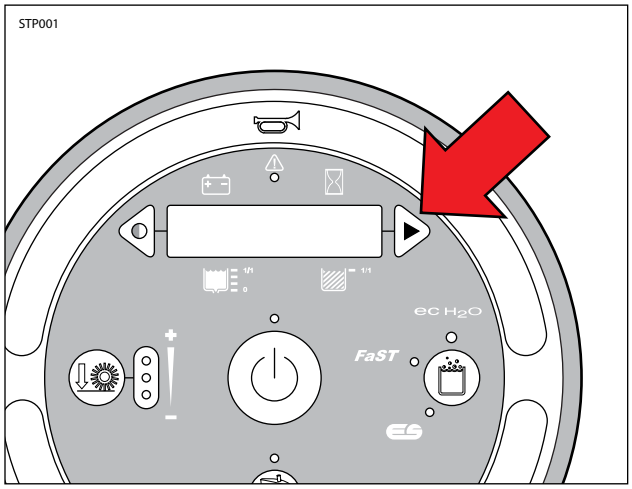
M17 FAULT CODES

Fault Code Number	Fault Code (Displayed in LCD)	Fault Code (Displayed on Pro-Panel Screen)	Cause(s)	Action(s)
0x0626	ES Pump Srt	Extended Scrub Pump Short Fault	1. Shorted load condition 2. Some higher current draw than hardware design limit.	1. Check wire harness and repair as needed.
0x0627	ES Pump FET	Extended Scrub Pump FET Fault	1. Control board problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Control Board.
0x0701	Ec Flsh Flt	EC-H2O System Flush Needed	1. The ecH2O module needs a manually triggered flush.	1. Press switch on ecH2O module..
0x0702	Ec Press Sw	EC-H2O Pressure Switch Active	1. The system pressure switch is detecting a trip or unconnected.	1. System pressure too high, check connections. 2. Verify functionality of scrub head switch and parking brake switch; maybe connectors were accidentally wired to incorrect switches.
0x0704	Ec CAN	EC-H2O CAN Communication Fault	1. Control boards are not communicating properly. 2. Board lost power (wiring issue) 3. Breaker supplying power to board tripped. 4. Control board may be damaged.	1. Power cycle machine. 2. Check breaker supplying power to board. 3. No communication with a network module.
0x0711	Ec Pump Opn	EC-H2O Pump Open Fault	1. Wiring, connector or control board issue on the ecH2O pump.	1. Control board is not detecting pump current. Check connections for voltage and verify pump is operating or not.
0x0716	Ec Pump Srt	EC-H2O Pump Short Fault	1. Shorted load condition 2. Some higher current draw than hardware design limit.	1. Check wiring for shorted condition. 2. Replace pump.
0x0717	Ec Pump FET	EC-H2O Pump FET Fault	1. Control board problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Control Board.
0x0720	Ec Cell Flt	EC-H2O Cell Generic Fault	1. Generic fault with the EC-H2O cell.	1. Check voltage references. 2. Replace Control Board.
0x0727	Ec Cell FET	EC-H2O Cell FET Faults	1. Control board problem. 2. Power/battery issue on startup.	1. FET detection includes motor, actuator, detergent pump, vacuum and battery watering pump. 2. Replace board.
0x0730	Ec Spgr Flt	EC-H2O Sparger Generic Fault	1. Generic fault with the EC-H2O sparger.	1. Use trouble-shooting tree to diagnosis.
0x0737	Ec Spgr FET	EC-H2O Sparger FET Fault	1. Control board problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Control Board.
0x0751	Ec Vlv Opn	EC-H2O Valve Open Fault	1. Wiring, connector or control board issue on the ecH2O valve.	1. Control board is not detecting pump current. Check connections for voltage and verify pump is operating or not.
0x0756	Ec Vlv Srt	EC-H2O Valve Short Fault	1. Shorted load condition 2. Some higher current draw than hardware design limit.	1. Check valve and wiring. 2. Replace if out of specifications.
0x0757	Ec Vlv FET	EC-H2O Valve FET Fault	1. Control board problem. 2. Power/battery issue on startup.	1. Check voltage references. 2. Replace Control Board.
0x0790	SolTnkEmpty	Solution Tank Empty	1. Solution Tank Empty. 2. Wiring, connector, or solution tank switch issue.	1. If tank is not empty, check the tank switch and wiring.
0x0791	RcvTnk Full	Recovery Tank Full	1. Recovery Tank Full. 2. Wiring, connector, or recovery tank switch issue.	1. If tank is not full, check the tank switch and wiring.
0x07A0		Clogged Filter Warning	1. Filter clogged with dust and debris.	1. Engage filter shaker. 2. Clean filter.
0x07A1	Hopper Fire	Hopper on Fire	1. Hopper on fire.	1. Put hopper fire out.
0x07A2		Hopper not in Home position	1. Hopper not completely lowered.	1. Completely lower hopper. 2. Check system for binding.
0x1003		Down Pressure Unattainable		
0x2000	Pascal Flt	Touchscreen Error	1. Touchscreen control board problem.	1. Replace Touchscreen board.

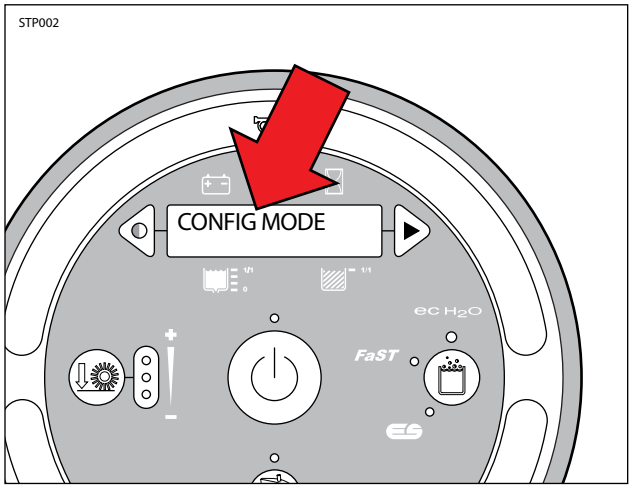
PROPEL DIAGNOSTIC MODE

Propel Diagnostic Mode (Propel Input Mode) is an on-board diagnostic utility that displays Curtis 1232SE controller inputs on the instrument panel LCD (Liquid Crystal Display). The input data is transmitted to the M12 controller through a CAN-bus (Controller Area Network).

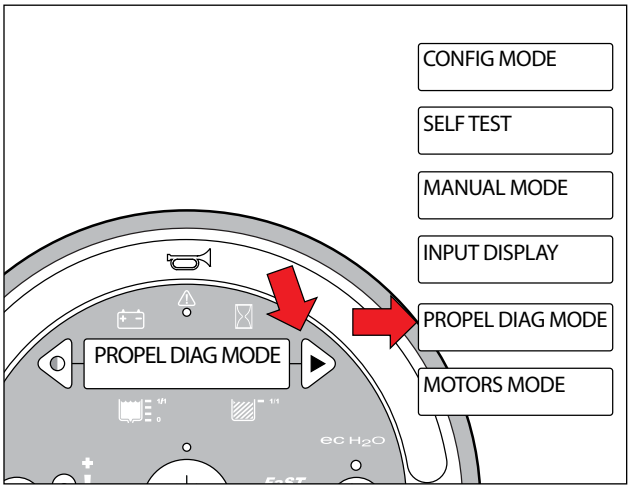
1. Key switch Off. Press and hold the configuration mode button.



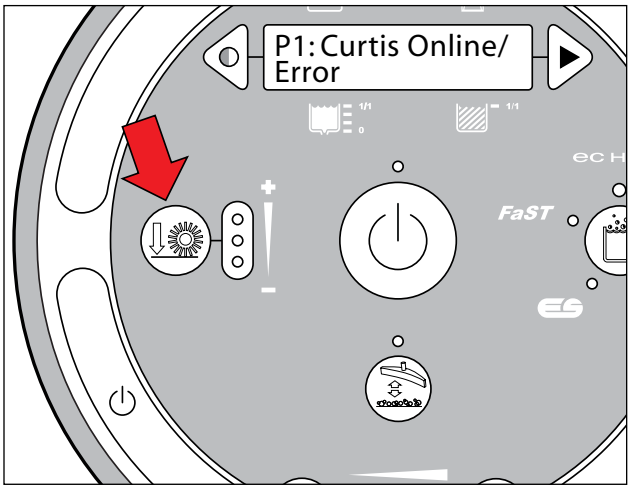
2. Key switch On. Release the configuration mode button when "CONFIG MODE" appears on the LCD.



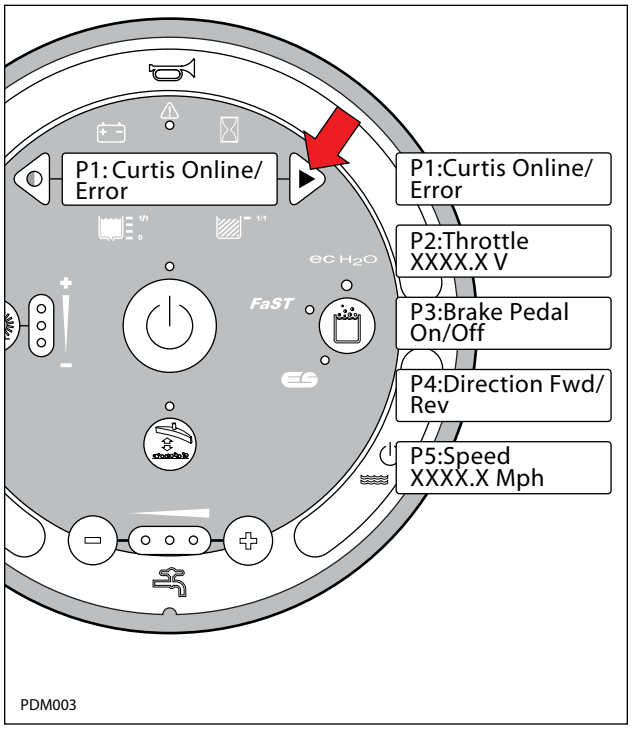
3. Press and release the configuration mode button to scroll through a list of utilities until "PROPEL DIAG MODE" appears on the LCD.



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



5. Press and release the configuration mode button to scroll through a list of Curtis 1232SE controller inputs.



6. The table below describes how each input operates.

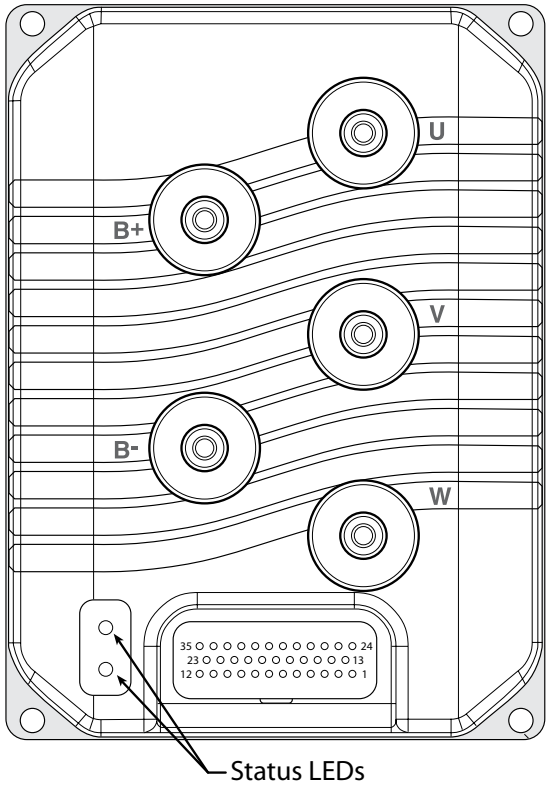
M17 Propel Diagnostic Mode

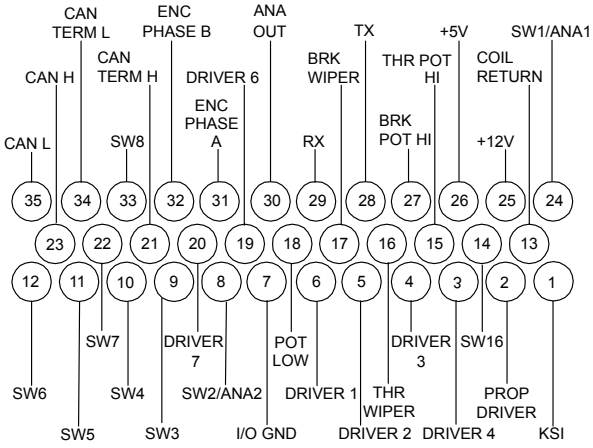
CODE	LCD MESSAGE	DESCRIPTION
P1	P1:Curtis Online/ Error	Curtis/ M17 controllers CAN-bus connection status
P2	P2:Throttle XXXX.X v	Displays foot throttle commanded voltage (0-5V).
P3	P3:Brake Pedal On/O˜	Displays brake pedal command (On/O˜).
P4	P4:Direction Fwd/ Rev	Displays directional switch input (Fwd/Rev).
P5	P5:Speed XXXX.X Mph	Displays propel speed from motor encoder located in drive assembly.

PDM004

Curtis 1232SE 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.

Example: Battery Undervoltage (Code 23)

RED	YELLOW	RED	YELLOW
✱	✲ ✲	✱ ✱	✲ ✲ ✲
(first digit)	(2)	(second digit)	(3)

Curtis 1232SE Controller Diagnostic Codes, continued

TROUBLESHOOTING CHART

CODE	FAULT CONDITION / *EFFECT OF FAULT*	POSSIBLE CAUSE	SET/CLEAR CONDITIONS
12	Controller Overcurrent *ShutdownMotor;* *ShutdownMainContactor;* *ShutdownEMBrake;* *ShutdownThrottle;* *FullBrake;* *ShutdownPump.*	1. External short of phase U, V, or W motor connections. 2. Motor parameters are mis-tuned. 3. Controller defective.	*Set:* Phase current exceeded the current measurement limit. *Clear:* Cycle KSI.
13	Current Sensor Fault *ShutdownMotor;* *ShutdownMainContactor;* *ShutdownEMBrake;* *ShutdownThrottle;* *FullBrake;* *ShutdownPump.*	1. Leakage to vehicle frame from phase U, V, or W (short in motor stator). 2. Controller defective.	*Set:* Controller current sensors have invalid o˜ set reading. *Clear:* Cycle KSI.
14	Precharge Failed *ShutdownMotor;* *ShutdownMainContactor;* *ShutdownEMBrake;* *ShutdownThrottle;* *FullBrake;* *ShutdownPump.*	1. External load on capacitor bank (B+ connection terminal) that prevents the capacitor bank from charging. 2. See Monitor menu » Battery: Capacitor Voltage.	*Set:* Precharge failed to charge the capacitor bank to the KSI voltage. *Clear:* Cycle interlock input or use VCL function.
15	Controller Severe Undertemp *ShutdownMotor;* *ShutdownMainContactor;* *ShutdownEMBrake;* *ShutdownThrottle;* *FullBrake;* *ShutdownPump.*	1. See Monitor menu » Controller: Temperature. 2. Controller is operating in an extreme environment.	*Set:* Heatsink temperature below -40°C. *Clear:* Bring heatsink temperature above -40°C, and cycle interlock or KSI.
16	Controller Severe Overtemp *ShutdownMotor;* *ShutdownMainContactor;* *ShutdownEMBrake;* *ShutdownThrottle;* *FullBrake;* *ShutdownPump.*	1. See Monitor menu » Controller: Temperature. 2. Controller is operating in an extreme environment. 3. Excessive load on vehicle. 4. Improper mounting of controller.	*Set:* Heatsink temperature above +95°C. *Clear:* Bring heatsink temperature below +95°C, and cycle interlock or KSI.
17	Severe Undervoltage *Reduced drive torque.*	1. Battery Menu parameters are misadjusted. 2. Non-controller system drain on battery. 3. Battery resistance too high. 4. Battery disconnected while driving. 5. See Monitor menu » Battery: Capacitor Voltage. 6. Blown B+ fuse or main contactor did not close.	*Set:* Capacitor bank voltage dropped below the severe undervoltage limit with FET bridge enabled. *Clear:* Bring capacitor voltage above severe undervoltage limit.

PMC003

Terms:
KSI = Key Switch Interlock
FET = Field-Effect Transistor

Curtis 1232SE Controller Diagnostic Codes, continued

TROUBLESHOOTING CHART, continued

CODE	FAULT CONDITION / *EFFECT OF FAULT*	POSSIBLE CAUSE	SET/CLEAR CONDITIONS
18	Severe Overvoltage *ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; FullBrake; ShutdownPump.*	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.	*Set:* Capacitor bank voltage exceeded the Severe Overvoltage limit with FET bridge enabled. *Clear:* Bring capacitor voltage below Severe Overvoltage limit, and then cycle KSI.
22	Controller Overtemp Cutback *Reduced drive and brake torque.*	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.	*Set:* Heatsink temperature exceeded 85°C. *Clear:* Bring heatsink temperature below 85°C.
23	Undervoltage Cutback *Reduced drive torque.*	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.	*Set:* Capacitor bank voltage dropped below the Undervoltage limit with the FET bridge enabled. *Clear:* Bring capacitor voltage above the Undervoltage limit.
24	Overvoltage Cutback *Reduced brake torque.*	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.	*Set:* Capacitor bank voltage exceeded the Overvoltage limit with the FET bridge enabled. *Clear:* Bring capacitor voltage below the Overvoltage limit.
25	+5V Supply Failure *None, unless a fault action is programmed in VCL.*	1. External load impedance on the +5V supply (pin 26) is too low. 2. See Monitor menu » outputs: 5 Volts and Ext Supply Current.	*Set:* +5V supply (pin 26) outside the +5V +/-10% range. *Clear:* Bring voltage within range.
26	Digital Out 6 Overcurrent *Digital Output 6 driver will not turn on.*	1. External load impedance on Digital Output 6 driver (pin 19) is too low.	*Set:* Digital Output 6 (pin 19) current exceeded 15 mA. *Clear:* Remedy the overcurrent cause and use the VCL function *Set_DigOut()* to turn the driver on again.

VIC004

Terms:
KSI = Key Switch Interlock
FET = Field-Effect Transistor

Curtis 1232SE Controller Diagnostic Codes, continued

TROUBLESHOOTING CHART, continued

CODE	FAULT CONDITION / *EFFECT OF FAULT*	POSSIBLE CAUSE	SET/CLEAR CONDITIONS
27	Digital Out 7 Overcurrent *Digital Output 7 driver will not turn on.*	1. External load impedance on Digital Output 7 driver (pin 20) is too low.	*Set:* Digital Output 7 (pin 20) current exceeded 15 mA. *Clear:* Remedy the overcurrent cause and use the VCL function Set_DigOut() to turn the driver on again.
28	Motor Temp Hot Cutback *Reduced drive torque.*	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 O˜.	*Set:* Motor temperature is at or above the Temperature Hot parameter setting. *Clear:* Bring the motor temperature within range.
29	Motor Temp Sensor Fault *MaxSpeed reduced (LOS, Limited Operating Strategy), and motor temperature cutback disabled.*	1. Motor thermistor is not connected properly. 2. If the application does not use a thermistor, Temp Compensation and Temp Cutback should be programmed O˜. 3. See Monitor menu»Motor: Temperature and »Inputs: Analog2.	*Set:* Motor thermistor input (pin 8) is at the voltage rail (0 or 10V). *Clear:* Bring the motor thermistor input voltage within range.
31	Coil1 Driver Open/Short *ShutdownDriver1.*	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	*Set:* Driver 1 (pin 6) is either open or shorted. *Clear:* Correct open or short, and cycle driver.
32	EMBrake Open/Short *ShutdownEMBrake; ShutdownThrottle; FullBrake.*	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	*Set:* Electromagnetic brake driver (pin 5) is either open or shorted. *Clear:* Correct open or short, and cycle driver.
33	Coil3 Driver Open/Short *ShutdownDriver3.*	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	*Set:* Driver 3 (pin 4) is either open or shorted. *Clear:* Correct open or short, and cycle driver.
34	Coil4 Driver Open/Short *ShutdownDriver4.*	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	*Set:* Driver 4 (pin3) is either open or shorted. *Clear:* Correct open or short, and cycle driver.

Terms:
KSI = Key Switch Interlock
FET = Field-Effect Transistor
VCL = Vehicle Control Language

PMC005

Curtis 1232SE Controller Diagnostic Codes, continued

TROUBLESHOOTING CHART, continued

CODE	FAULT CONDITION / *EFFECT OF FAULT*	POSSIBLE CAUSE	SET/CLEAR CONDITIONS
35	PD Open/Short *ShutdownPD.*	1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.	*Set:* Proportional driver (pin 2) is either open or shorted. *Clear:* Correct open or short, and cycle driver.
36	Encoder Fault *ShutdownEMBrake.*	1. Motor encoder failure. 2. Bad crimps or faulty wiring. 3. See Monitor menu » Motor: Motor RPM.	*Set:* Motor encoder phase failure detected. *Clear:* Cycle KSI.
37	Motor Open *ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; FullBrake; ShutdownPump.*	1. Motor phase is open. 2. Bad crimps or faulty wiring.	*Set:* Motor phase U, V, or W detected open. *Clear:* Cycle KSI.
38	Main Contactor Welded *ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; FullBrake; ShutdownPump.*	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).	*Set:* 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. *Clear:* Cycle KSI
39	Main Contactor Did Not Close *ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; FullBrake; ShutdownPump.*	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.	*Set:* With the main contactor commanded closed, the capacitor bank voltage (B+ connection terminal) did not charge to B+. *Clear:* Cycle KSI.
41	Throttle Wiper High *ShutdownThrottle.*	1. See Monitor menu » Inputs: Throttle Pot. 2. Throttle pot wiper voltage too high.	*Set:* Throttle pot wiper (pin 16) voltage is higher than the high fault threshold (can be changed with the VCL function Setup_Pot_Faults()) *Clear:* Bring throttle pot wiper voltage below the fault threshold.
42	Throttle Wiper Low *ShutdownThrottle.*	1. See Monitor menu » Inputs: Throttle Pot. 2. Throttle pot wiper voltage too low.	*Set:* Throttle pot wiper (pin 16) voltage is lower than the low fault threshold (can be changed with the VCL function Setup_Pot_Faults()). *Clear:* Bring throttle pot wiper voltage above the fault threshold.
43	Pot2 Wiper High *FullBrake.*	1. See Monitor menu » Inputs: Pot2 Raw. 2. Pot2 wiper voltage too high.	*Set:* Pot2 wiper (pin 17) voltage is higher than the high fault threshold (can be changed with the VCL function Setup_Pot_Faults()). *Clear:* Bring Pot2 wiper voltage below the fault threshold.

PMC006

Terms:
KSI = Key Switch Interlock
FET = Field-Effect Transistor
VCL = Vehicle Control Language

Curtis 1232SE Controller Diagnostic Codes, continued

TROUBLESHOOTING CHART, continued

CODE	FAULT CONDITION / *EFFECT OF FAULT*	POSSIBLE CAUSE	SET/CLEAR CONDITIONS
44	Pot2 Wiper Low *FullBrake.*	1. See Monitor menu » Inputs: Pot2 Raw. 2. Pot2 wiper voltage too low.	*Set:* Pot2 wiper (pin 17) voltage is lower than the low fault threshold (can be changed with the VCL function Setup_Pot_Faults()). *Clear:* Bring Pot2 wiper voltage above the fault threshold.
45	Pot Low Overcurrent *ShutdownThrottle;* *FullBrake.*	1. See Monitor menu » Outputs: Pot Low. 2. Combined pot resistance connected to pot low is too low.	*Set:* Pot low (pin 18) current exceeds 10 mA. *Clear:* Clear pot low overcurrent condition and cycle KSI.
46	EEPROM Failure *ShutdownMotor;* *ShutdownMainContactor;* *ShutdownEMBrake;* *ShutdownThrottle;* *ShutdownInterlock;* *ShutdownDriver1;* *ShutdownDriver2;* *ShutdownDriver3;* *ShutdownDriver4;* *ShutdownPD;* *FullBrake;* *ShutdownPump.*	1. 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.	*Set:* Controller operating system tried to write to EEPROM memory and failed. *Clear:* Download the correct software (OS) and matching parameter default settings into the controller and cycle KSI.
47	HPD/Sequencing Fault *ShutdownThrottle.*	1. KSI, interlock, direction, and throttle inputs applied in incorrect sequence. 2. Faulty wiring, crimps, or switches at KSI, interlock, direction, or throttle inputs. 3. See Monitor menu » Inputs.	*Set:* HPD (High Pedal Disable) or sequencing fault caused by incorrect sequence of KSI, interlock, direction and throttle inputs. *Clear:* Reapply inputs in correct sequence.
49	Parameter Change Fault *ShutdownMotor;* *ShutdownMainContactor;* *ShutdownEMBrake;* *ShutdownThrottle;* *FullBrake;* *ShutdownPump.*	1. 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.	*Set:* Adjustment of a parameter setting that requires cycling of KSI. *Clear:* Cycle KSI
51	Throttle SRO Fault *ShutdownThrottle/brake.* *Shutdown Motor.*	1. Both throttle and brake inputs are active at the same time. 2. Faulty throttle and/or brake inputs.	*Set:* Throttle and brake inputs applied at the same time. *Clear:* Release throttle and brake pedals. *Action:* Throttle Shutdown.
52	HPD Fault *ShutdownThrottle/brake.* *Shutdown Motor.*	1. Throttle is pressed before key switch is turned on. 2. Throttle is pressed before operator presses the seat switch.	*Set:* Throttle is pressed before key switch is turned on or throttle is pressed before operator sits on the seat switch. *Clear:* Release throttle and properly sequence key switch, seat switch and then throttle. Action: Throttle Shutdown.

PMC007

Terms:
KSI = Key Switch Interlock
FET = Field-Effect Transistor
VCL = Vehicle Control Language

Curtis 1232SE Controller Diagnostic Codes, continued

TROUBLESHOOTING CHART, continued

CODE	FAULT CONDITION / *EFFECT OF FAULT*	POSSIBLE CAUSE	SET/CLEAR CONDITIONS
53	Emergency Stop Fault	1. E-Stop Switch is Open (Pushed-In) and 2. The Keyswitch voltage is greater than the "Low Voltage Switch Check Threshold" parameter (22 V) and 3. The timer set to the "E-Stop Switch Powerup Check Delay" parameter (3.0 sec) has expired and 4. The "E-Stop Reporting" parameter = On Note: When the E-Stop Switch is Open, the throttle is shutdown immediately but the fault is not reported unless the above conditions are met.	*Set:* E-Stop is open or low voltage. *Clear:* E-Stop Switch is closed (Pulled-Out) and cycle key-switch off/on. *Action:* Shutdown Throttle
54	CAN Startup Fault	An initial heartbeat is not received over the CAN Bus upon power up from the Tennant Master Controller within the "Master Heartbeat Startup Period" parameter (15.0 sec)	*Set:* No signal thru CAN BUS. *Clear:* Restore CAN communication and cycle Keyswitch. *Action:* Speed Limit is set to "Fault Max Speed" parameter (311 rpm)
55	CAN Operational Fault	After the initial heartbeat, subsequent heartbeats are not received over the CAN bus from the Tennant Master Controller within the "Master Heartbeat Timeout Period" parameter (2.5 sec).	*Set:* No signal thru CAN BUS. *Clear:* Restore CAN communication and cycle Keyswitch. *Action:* Speed Limit is set to "Fault Max Speed" parameter (311 rpm)
56	CAN Transmission Stopped	The CAN engine has been set to a "non-operational" state by the Tennant Master Controller. An NMT message of the following types will set this fault: "Enter Pre-Operational State" (Command Specifier = 0x80), "Stop Remote Node" (Command Specifier = 0x02), "Reset Communication" (Command Specifier = 0x82).	*Set:* Tennant Master Controller set to non-operation. *Clear:* Master Tennant controller resets Curtis controller via the NMT message "Reset Node" (Command Specifier = 0x81) or cycle Keyswitch *Action: Shutdown CAN PDO transmission Speed Limit is set to "Fault Max Speed" parameter (311 rpm)*
68	VCL Run Time Error *ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; ShutdownInterlock; ShutdownDriver1; ShutdownDriver2; ShutdownDriver3; ShutdownDriver4; ShutdownPD; FullBrake; ShutdownPump.*	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 deÿnitions found in the speciÿc OS system information ÿle.	*Set:* Runtime VCL code error condition. *Clear:* Edit VCL application software to ÿx this error condition; ˝ash the new compiled software and matching parameter defaults; cycle KSI.

PMC008

Terms:
KSI = Key Switch Interlock
FET = Field-Effect Transistor
VCL = Vehicle Control Language
CAN = Controller Area Network

Curtis 1232SE Controller Diagnostic Codes, continued

TROUBLESHOOTING CHART, continued

CODE	FAULT CONDITION / *EFFECT OF FAULT*	POSSIBLE CAUSE	SET/CLEAR CONDITIONS
69	External Supply Out of Range *None, unless a fault action is programmed in VCL.*	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.	*Set:* The external supply current (combined current used by the 5V supply [pin 26] and 12V supply [pin 25]) is either greater than the lower current threshold. The two thresholds are deÿned by the External Supply Max and External Supply Min parameter settings. *Clear:* Bring the external supply current within range.
71	OS General *ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; ShutdownInterlock; ShutdownDriver1; ShutdownDriver2; ShutdownDriver3; ShutdownDriver4; ShutdownPD; FullBrake; ShutdownPump.*	1. Internal controller fault.	*Set:* Internal controller fault detected. *Clear:* Cycle KSI
72	PDO Timeout *ShutdownInterlock; CAN NMT State set to Pre-operational.*	1. Time between CAN PDO messages received exceeded the PDO Timeout Period.	*Set:* Time between CAN PDO messages received exceeded the PDO Timeout Period. *Clear:* Cycle KSI.
73	Stall Detected *ShutdownEMBrake.*	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.	*Set:* No motor encoder movement detected. *Clear:* Either cycle KSI, or detect valid motor encoder signals while operating in LOS mode and return Throttle Command = 0 and Motor RPM= 0
87	Motor Characterization Fault *ShutdownMotor; ShutdownMainContactor; ShutdownEMBrake; ShutdownThrottle; FullBrake; ShutdownPump.*	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 manually 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 character-ization range.	*Set:* Motor characterization failed during the motor characterization process. *Clear:* Correct fault; cycle KSI.

PMC009

Terms:
KSI = Key Switch Interlock
FET = Field-Effect Transistor VCL = Vehicle Control Language

Curtis 1232SE Controller Diagnostic Codes, continued

TROUBLESHOOTING CHART, continued

CODE	FAULT CONDITION / *EFFECT OF FAULT*	POSSIBLE CAUSE	SET/CLEAR CONDITIONS
88	Motor Phase Fault	1. The motor encoder output signal does not match the commanded direction.	Set: Motor phase cables U, V, and W possibly installed incorrectly. Clear: Correct faulty cable installation and cycle KSI.
89	Motor Type Fault *ShutdownMotor;* *ShutdownMainContactor;* *ShutdownEMBrake;* *ShutdownThrottle;* *FullBrake;* *ShutdownPump.*	1. The Motor_Type parameter value is out of range.	Set: Motor_Type parameter is set to an illegal value. Clear: Set Motor_Type to correct value and cycle KSI.
91	VCL/OS Mismatch *ShutdownMotor;* *ShutdownMainContactor;*	1. The VCL software in the controller does not match the OS software in the controller.	*Set:* 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. *Clear:* Download the correct VCL and OS software into the controller.
92	EM Brake Failed to Set *ShutdownEMBrake;* *ShutdownThrottle.*	1. Vehicle movement sensed after the EM Brake has been commanded to set. 2. EM Brake will not hold the motor from rotating.	*Set:* After the EM Brake was commanded to set and time has elapsed to allow the brake to fully engage, vehicle movement has been sensed. *Clear:* Activate the throttle.
93	Encoder LOS (Limited *Operating Strategy)* *Enter LOS control mode.*	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.	*Set:* 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. *Clear:* 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.
94	Emer Rev Timeout *ShutdownEMBrake;* *ShutdownThrottle.*	1. Emergency Reverse was activated and concluded because the EMR Timeout timer has expired. 2. The emergency reverse input is stuck On.	*Set:* Emergency Reverse was activated and ran until the EMR Timeout timer expired. *Clear:* Turn the emergency reverse input O˘.
98	Illegal Model Number *ShutdownMotor;* *ShutdownMainContactor;* *ShutdownEMBrake;* *ShutdownThrottle;* *FullBrake;* *ShutdownPump.*	1. Model_Number variable contains illegal value (not 1234, 1236, 1238, or 1298). 2. Software and hardware do not match. 3. Controller defective.	*Set:* Illegal Model_Number variable; when KSI cycles a check is made to conÿrm a legal Model_Number, and a fault is issued if one is not found. *Clear:* Download appropriate software for your controller model.

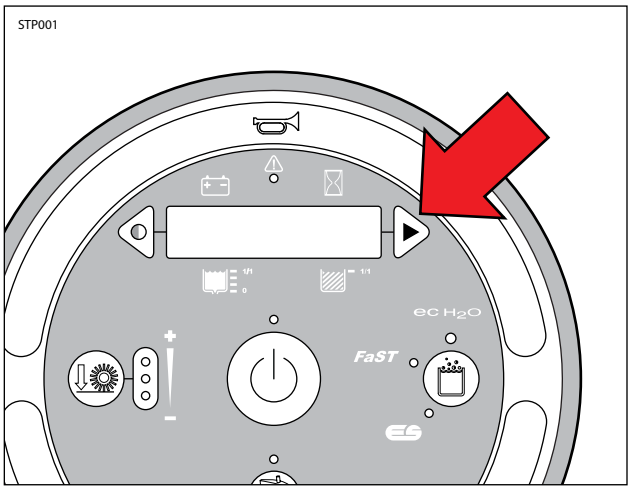
PMC010

Terms:
KSI = Key Switch Interlock
FET = Field-Effect Transistor
EMR = Emergency Reverse

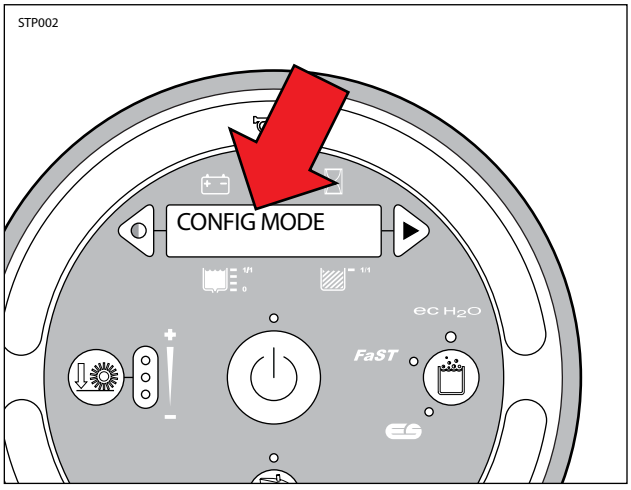
INPUT DISPLAY MODE

Input Display Mode is an onboard diagnostic utility that displays controller input conditions. Input Display Mode displays LCD text messages for hard-wired switch, sensor, and touch panel button inputs.

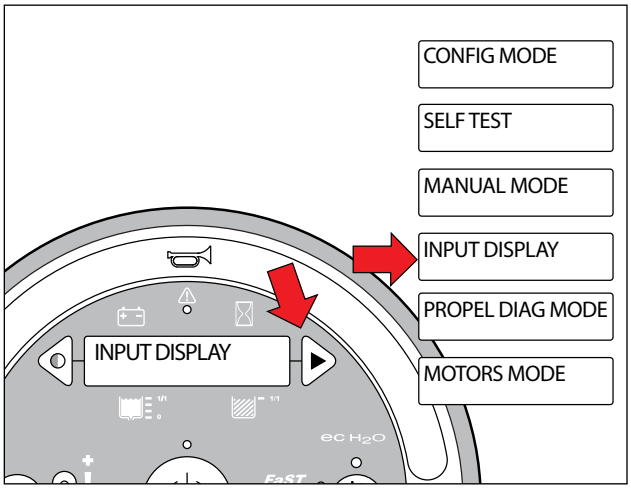
1. Key switch Off. Press and hold the configuration mode button.



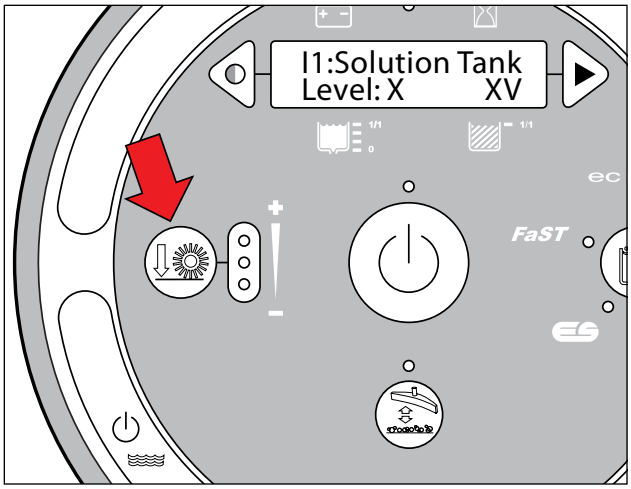
2. Key switch On. Release the configuration mode button when "CONFIG MODE" appears on the LCD.



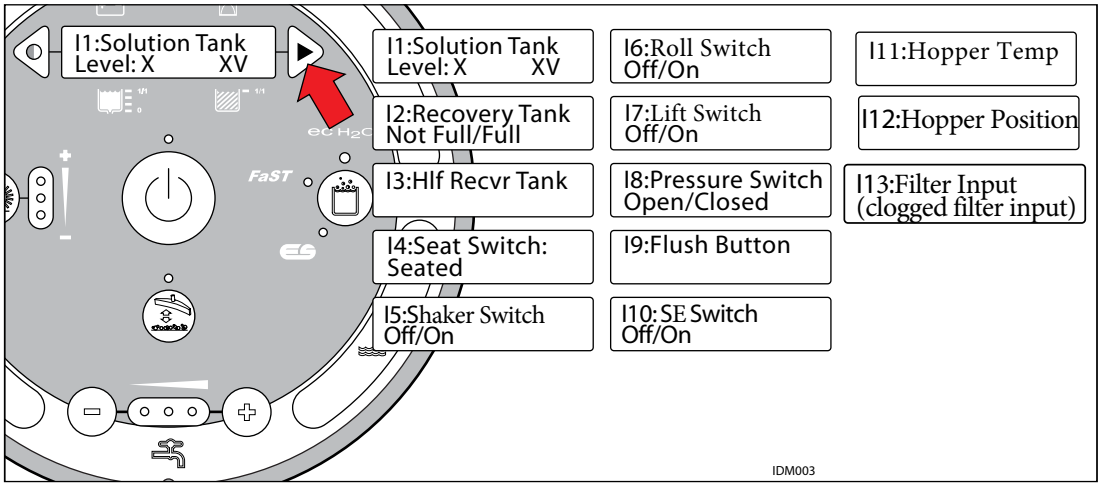
3. Press and release the configuration mode button to scroll through a list of utilities until "INPUT DISPLAY" appears on the LCD.



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



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

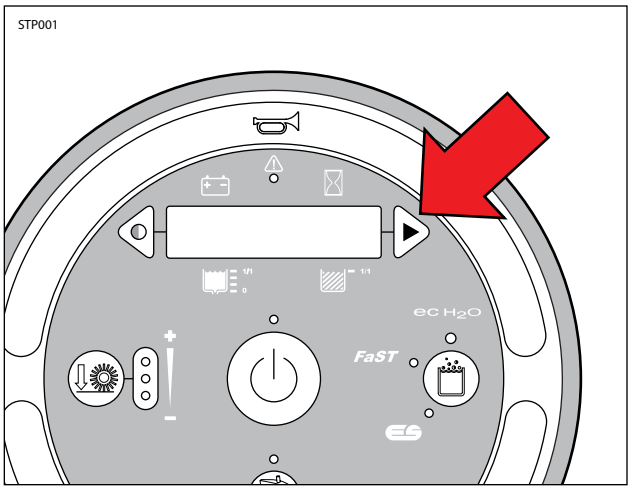


6. Press any other touch panel button to display a corresponding LCD text message. The message confirms that the control board received the input.

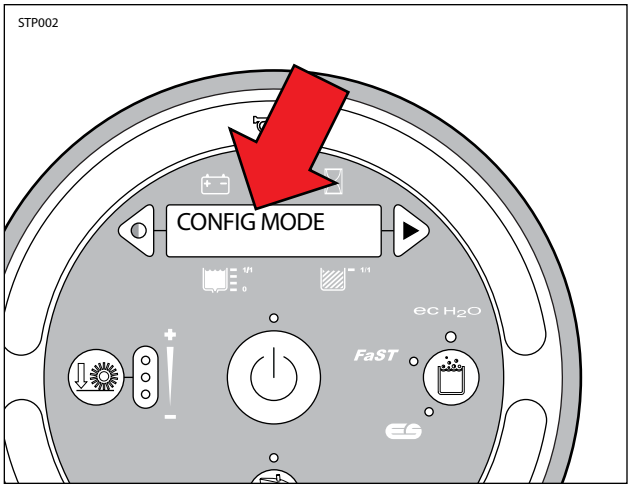
MANUAL MODE

Manual Mode is an onboard diagnostic utility that manually activates machine functions and displays output current in "XX.X Amps" format. This mode bypasses interlocking inputs and should be used for diagnostic purposes only.

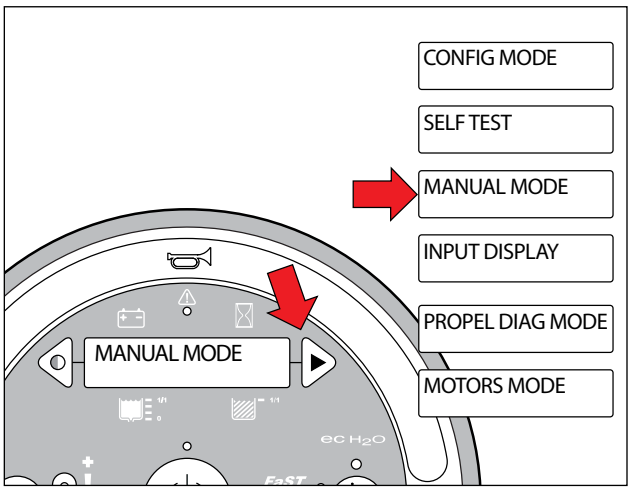
1. Key switch Off. Press and hold the configuration mode button.



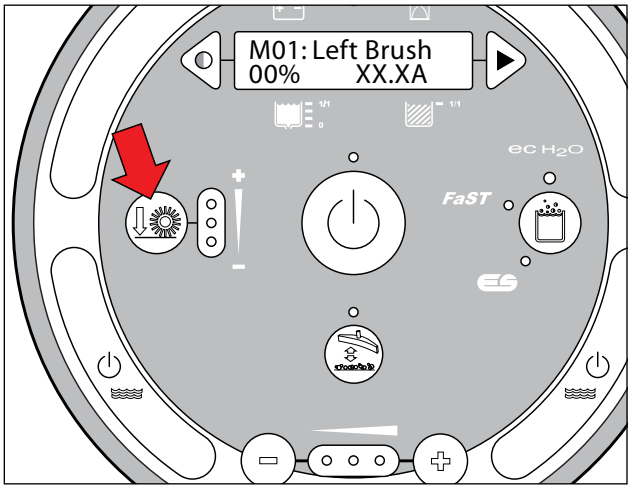
2. Key switch On. Release the configuration mode button when "CONFIG MODE" appears on the LCD.



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



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



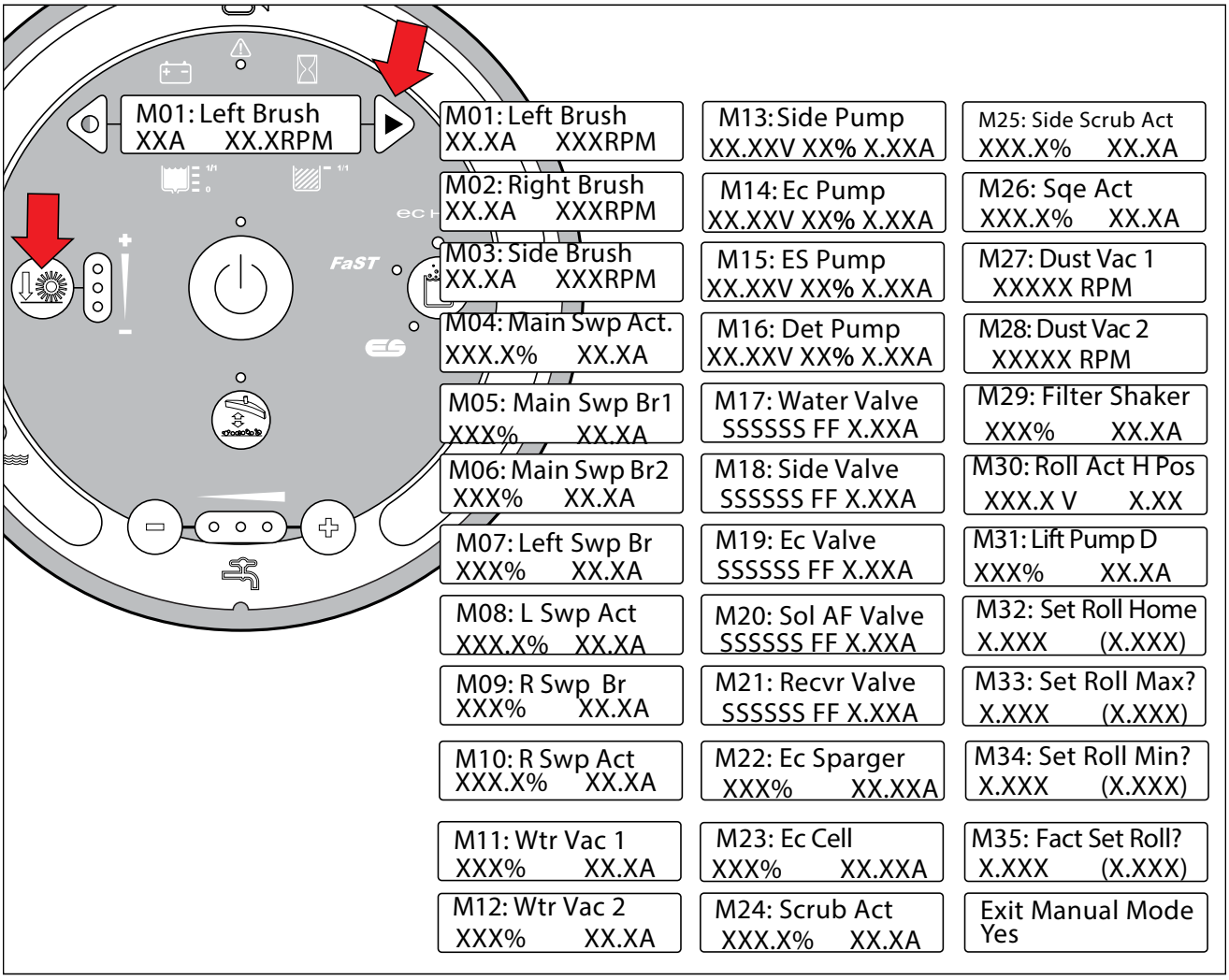
5. Press and release the configuration mode button to scroll through a list of output functions. ***Press the brush down pressure button to activate the function displayed on the LCD.***

NOTE: "XX.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.

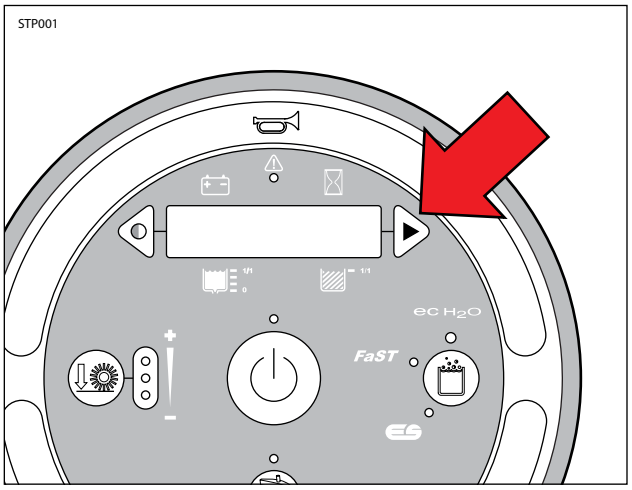
NOTE: "OK" indicates that the displayed function is not open or shorted.



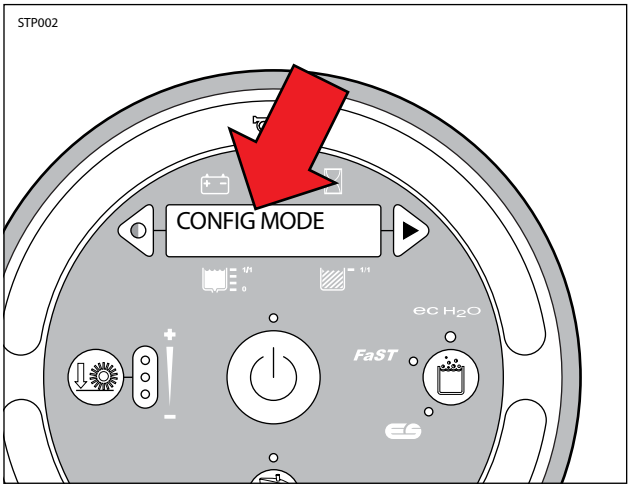
MOTORS MODE

Motors Mode is an onboard diagnostic utility that allows trained service personnel to operate various motors independently for service testing purposes only.

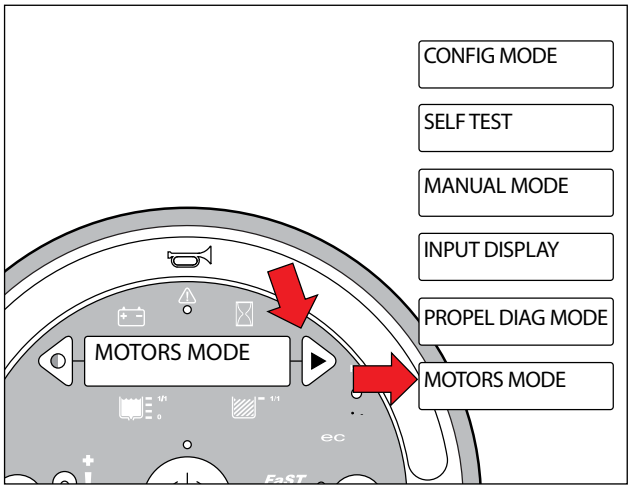
1. Key switch Off. Press and hold the configuration mode button.



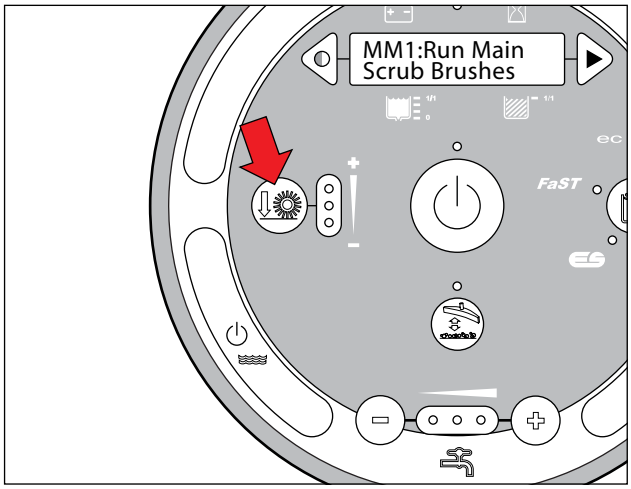
2. Key switch On. Release the configuration mode button when "CONFIG MODE" appears on the LCD.



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

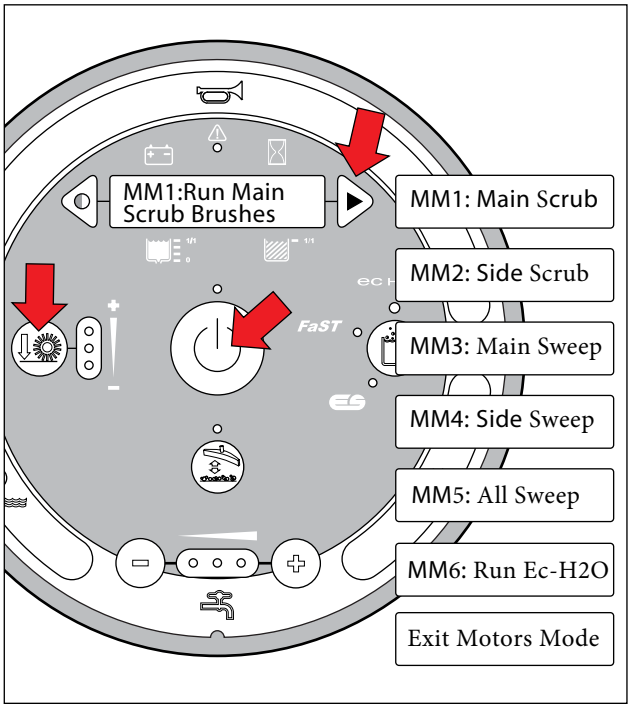


4. Press and release the brush pressure button to enter Motors Mode. "MM1: Run Main Scrub Brushes" will appear on the LCD.



5. Press and release the configuration mode button to scroll through a 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 and the 1-STEP button must be used to turn the motor(s) off.



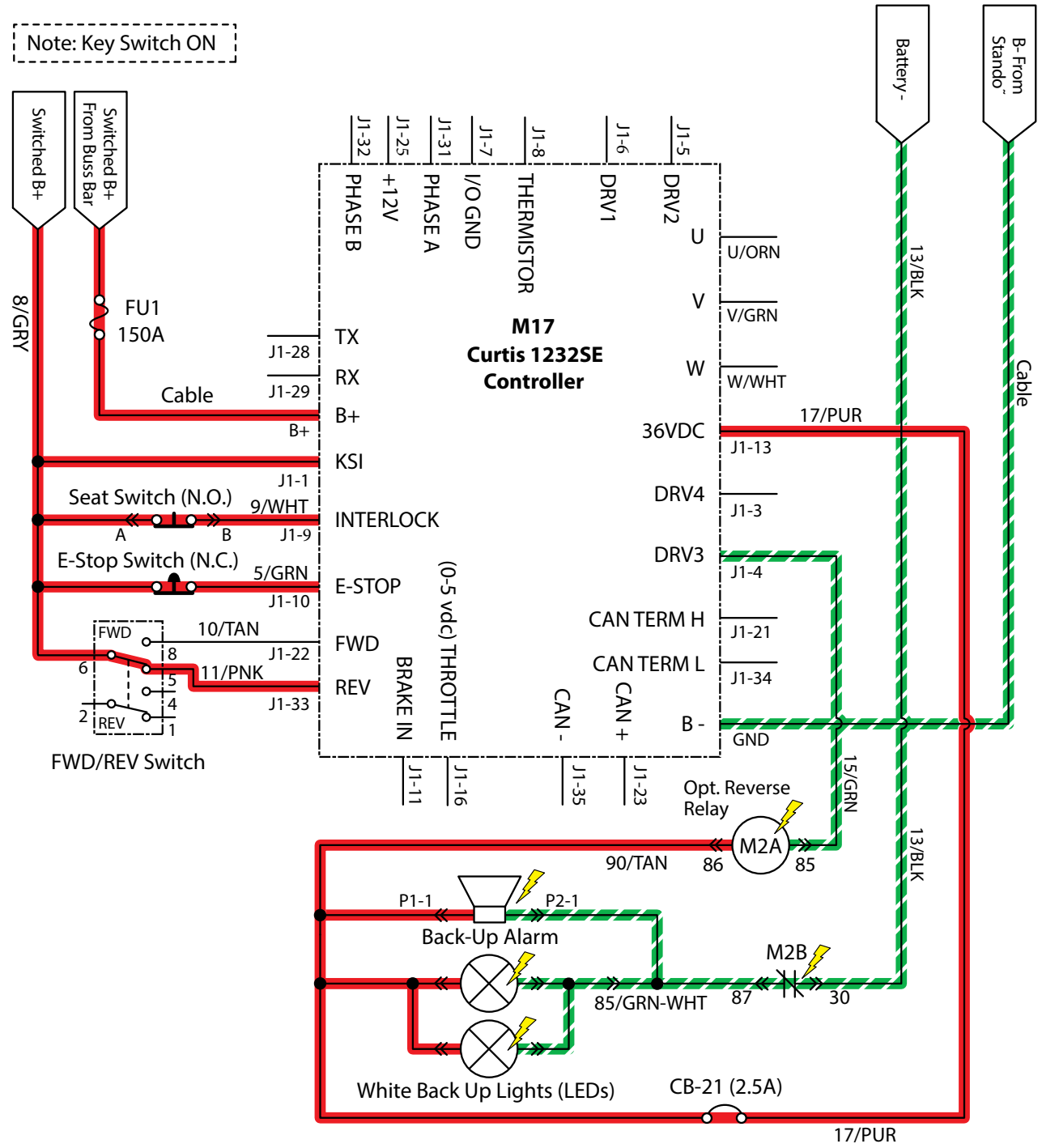
POWER STEERING STATUS LED (OPTION)

1. Remove the front panel below the steering wheel to gain access to the power steering components.

2. Observe 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 the power steering control module. Turn steering wheel completely to one side and hold pressure for 30 seconds to see if the LED flashes for derate as listed below:
Purple, Blinking	Derate Level 1, Up to 75% of Maximum Torque Output
Yellow, Blinking	Derate Level 2, Up to 50% of Maximum Torque Output
Red, Blinking	Derate Level 3, Up to 20% of Maximum Torque Output

Back-Up Alarm/Light ON



Battery Positive +

Battery Negative -

Operational Matrix:

	Enabled	Disabled
Back-Up Alarm/Lights	• Rev Switch Input • Rev Throttle Command	• Fwd Switch Input • Neutral - Ready State • Curtis 1232SE Fault

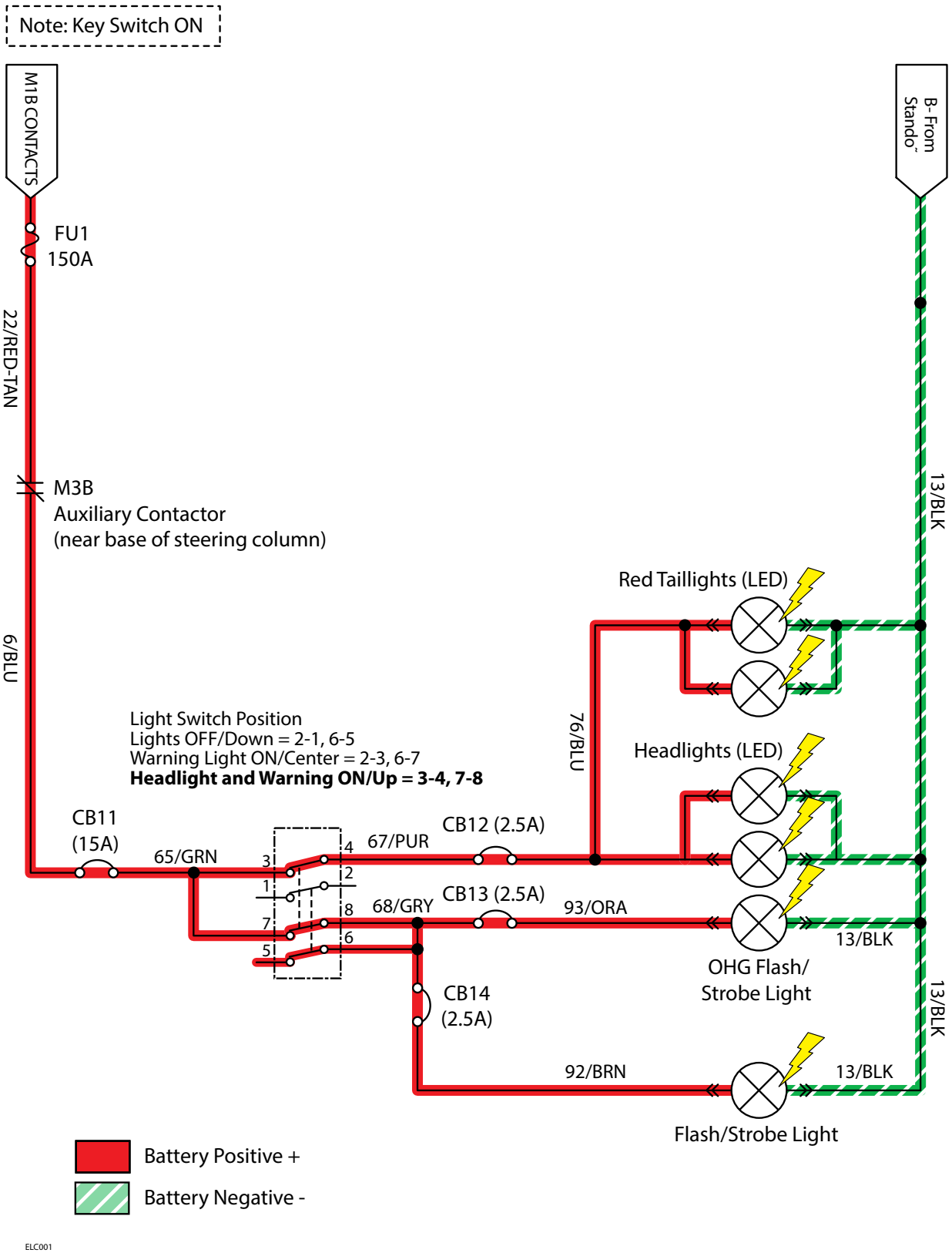
PMC011

Back-Up Alarm/Light Failed to Turn ON

STEP	ACTION	VALUE(S)	YES	NO
1	• Key On • Enable back-up alarm/lights • Is there a pertinent fault message displayed?		See "Fault Section"	Go to Step #2
2	• Key On • Enable back-up alarm/lights • See "Curtis 1232SE Controller Diagnostics" • Is there a pertinent Curtis 1232SE fault displayed?		Correct Fault Condition	Go to Step #3
3	• Key Off • See "Propel Diagnostic Mode" section of this manual • Check the "P4:Direction Fwd/Rev" input from the directional switch • Check the "P2:Throttle" (0-5 vdc) input from the directional pedal • Are the P2 and P4 inputs operating properly?		Go to Step # 4	Correct Faulty Input Condition
4	• Key Off • Remove M2 relay from connector (see component locator) • Connect an Ohmmeter between relay terminals 30 and 87 (should test open or "O.L.") • Apply battery voltage to relay terminals 86 (+) and 85 (-) using fuse-protected jumper leads • Does the relay "click" and do the N.O. (normally open) terminals 30 and 87 close?		Go to Step #5	Replace Relay
5	• Key Off • Disconnect back-up alarm/light from main harness • Apply battery voltage to back-up alarm/light using fuse-protected jumper leads • Does the back-up alarm/light turn On?		Go to Step #6	Replace Back-Up Alarm/ Light
6	• Key On • Reconnect back-up alarm/light to main harness • Enable back-up alarm/light • Backprobe using a voltmeter between 15/GRN and 17/PUR at the Curtis 1232SE controller connection • Is there battery voltage applied?		Repair or Replace Wire Harness	Replace Curtis 1232SE Controller

Terms:
Backprobe = To insert voltmeter probe(s) into the back of a connector to contact a terminal(s) while the circuit operates or should be operating.
VDC = DC Voltage

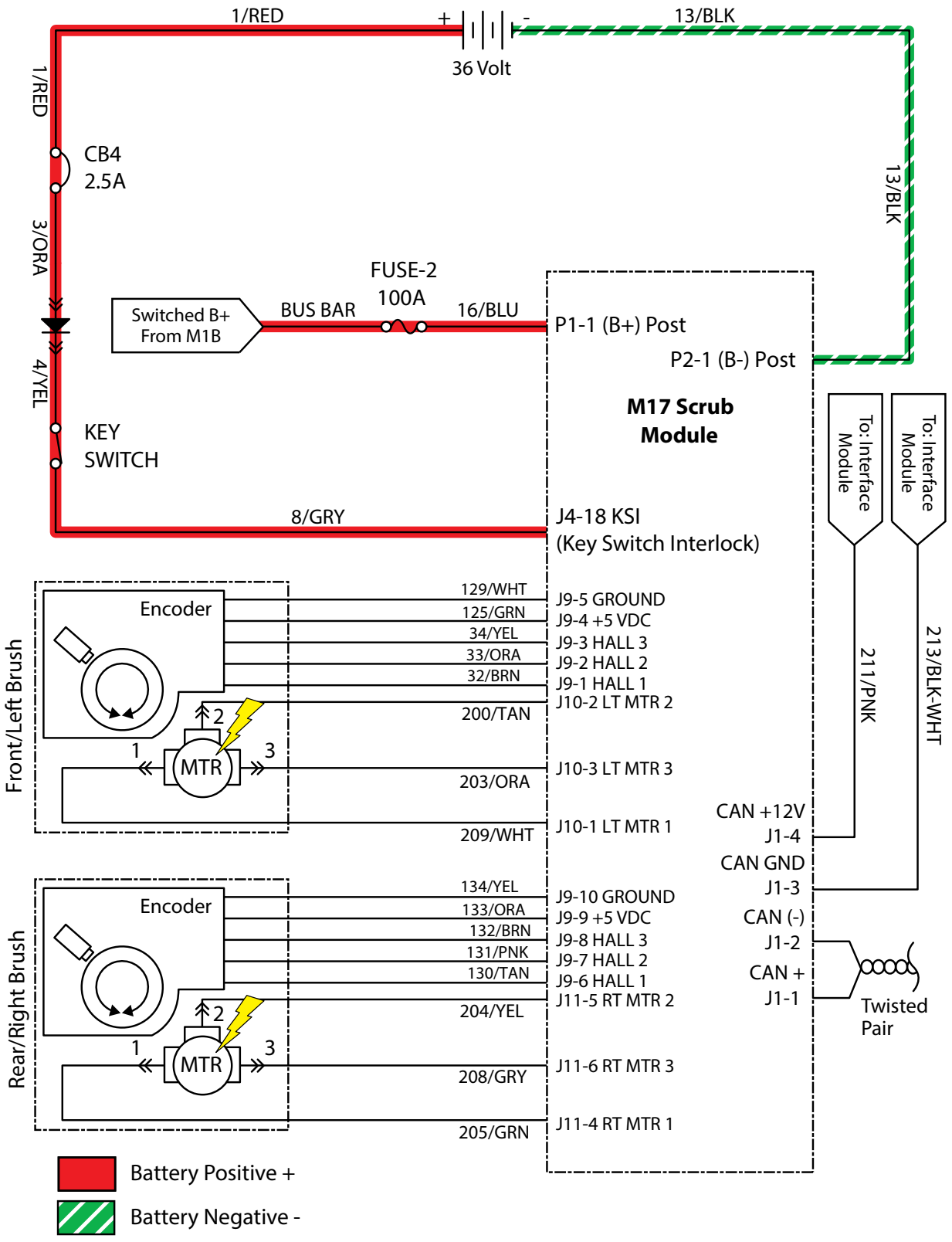
Lighting ON


Note: Key Switch ON
M1B CONTACTS
B- From Stando
FU1
150A
22/RED-TAN
M3B
Auxiliary Contactor
(near base of steering column)
6/BLU
13/BLK
Red Taillights (LED)
76/BLU
Light Switch Position
Lights OFF/Down = 2-1, 6-5
Warning Light ON/Center = 2-3, 6-7
Headlight and Warning ON/Up = 3-4, 7-8
Headlights (LED)
CB11
(15A)
65/GRN
67/PUR
CB12 (2.5A)
68/GRY
CB13 (2.5A)
93/ORA
13/BLK
OHG Flash/
Strobe Light
CB14
(2.5A)
92/BRN
13/BLK
Flash/Strobe Light
Battery Positive +
Battery Negative -
ELC001

Lighting Failed to Turn ON

STEP	ACTION	VALUE(S)	YES	NO
1	• Key On • Light switch On • Firmly press circuit breaker #11 to reset • Is circuit breaker #11 tripped?		Reset and Test Lighting Operation	Go to Step #2
2	• Key On • Light switch On • Firmly press circuit breaker #12 (Option) to reset • Is circuit breaker #12 tripped?		Reset and Test Lighting Operation	Go to Step #3
3	• Key On • Light switch On • Firmly press circuit breaker #13 (Option) to reset • Is circuit breaker #13 tripped?		Reset and Test Lighting Operation	Go to Step #4
4	• Key On • Light switch On • Firmly press circuit breaker #14 (Option) to reset • Is circuit breaker #14 tripped?		Reset and Test Lighting Operation	Go to Step #5
5	• Key On • Light switch On • Test voltage applied to the lighting subsystem as shown on the electrical schematic • Are the electrical circuits operating as shown on the electrical schematic?		Go Back to Step #1	Identify Voltage Drop Location and Repair or Replace Necessary Components

Main Scrub Brushes ON



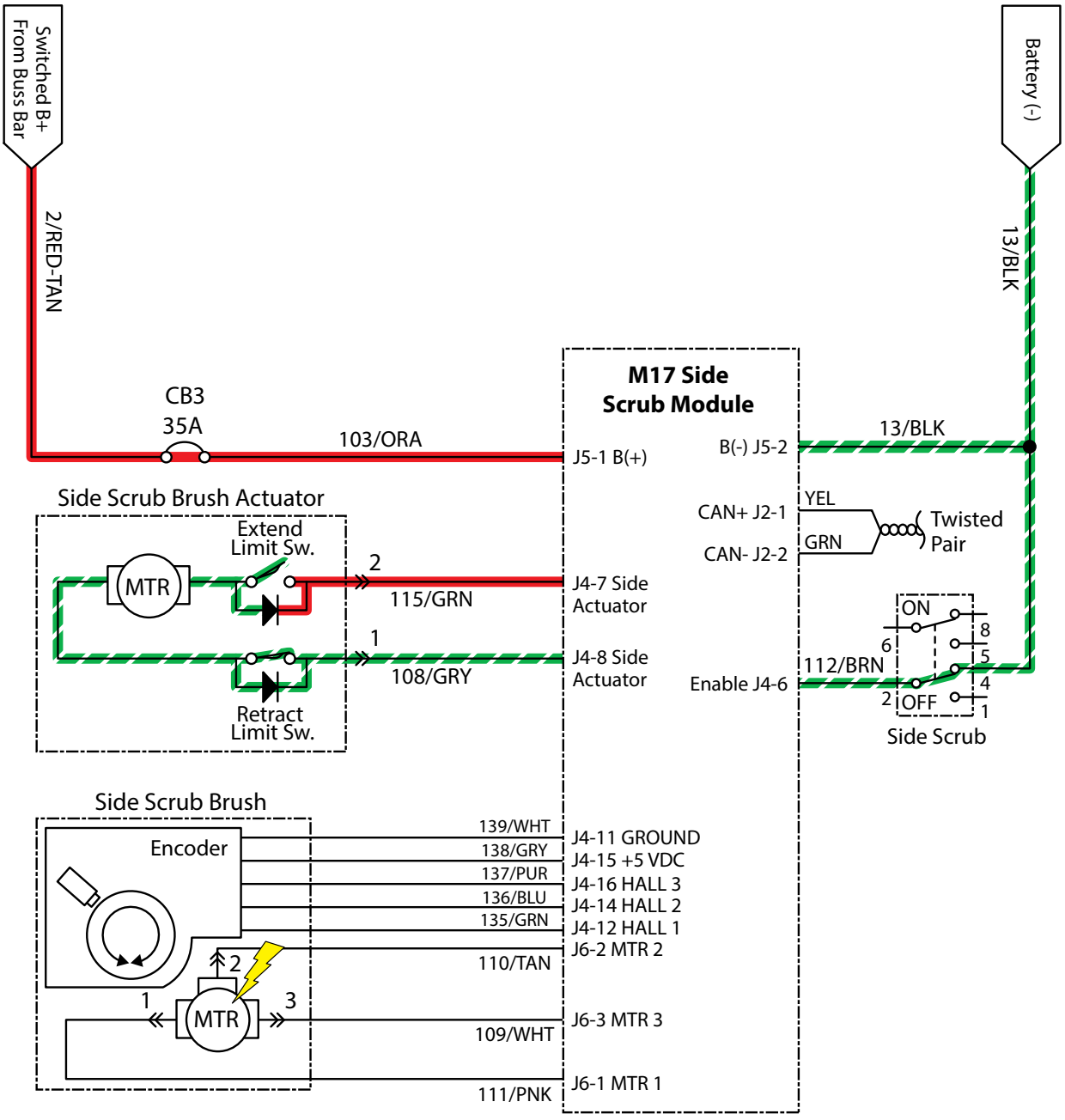
Main Scrub Brushes Failed to Turn ON

STEP	ACTION	VALUE(S)	YES	NO
1	• Key On • Enable main scrub brushes subsystem • Is there a pertinent fault message displayed?		See "Fault Section"	Go to Step #2
2	• Key Off • See "Motors Mode" section of this manual • Activate the main scrub brushes in Motors mode • Do the scrub brushes turn On?		Go to Step #6	Go to Step #3
3	• Key Off • See "Self-Test Mode" • Does the Self-Test display output circuits J10-1, 2, 3 or J11-4, 5, 6 as open or shorted?		Correct Open or Short Circuit Condition	Go to Step #4
4	• Proceed to Step #5 for disk scrub head models • Key Off • Remove cylindrical brushes from scrub head • Check for worn out brushes (see maintenance section) • 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 the above conditions exist?		Repair or Replace Necessary Cylindrical Scrub Head Components	Go to Step #5
5	• Proceed to Step #6 if ***both*** brush motors fail to turn On • Lower main scrub head • Turn 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	Go to Step #6
6	• Key Off • Reconnect main scrub brush motors to correct main harness connectors • Key On • Enable main scrub brush motors • Test voltage applied to the main scrub brush motor subsystem as shown on the electrical schematic • Are the electrical circuits operating as shown on the electrical schematic?		Go Back to Step #1	Identify Voltage Drop Location and Repair or Replace Necessary Components

Terms

J5-5 = T12 Scrub Module Connector #5, Pin #5
J5-4 = T12 Scrub Module Connector #5, Pin #4
J5-2 = T12 Scrub Module Connector #5, Pin #2
J5-1 = T12 Scrub Module Connector #5, Pin #1

Side Scrub Brush ON /Down



Operational Matrix:

	Enabled	Disabled
Side Scrub Brush On/ Down	• 1-STEP Scrub ON • Side Brush Switch ON	• 1-STEP Scrub OFF • Side Brush Switch OFF • Recovery Tank Full • Solution Tank Empty • Very Low Batt Voltage • Circuit Fault • Neutral (Ready State)

Battery Positive +

Battery Negative -

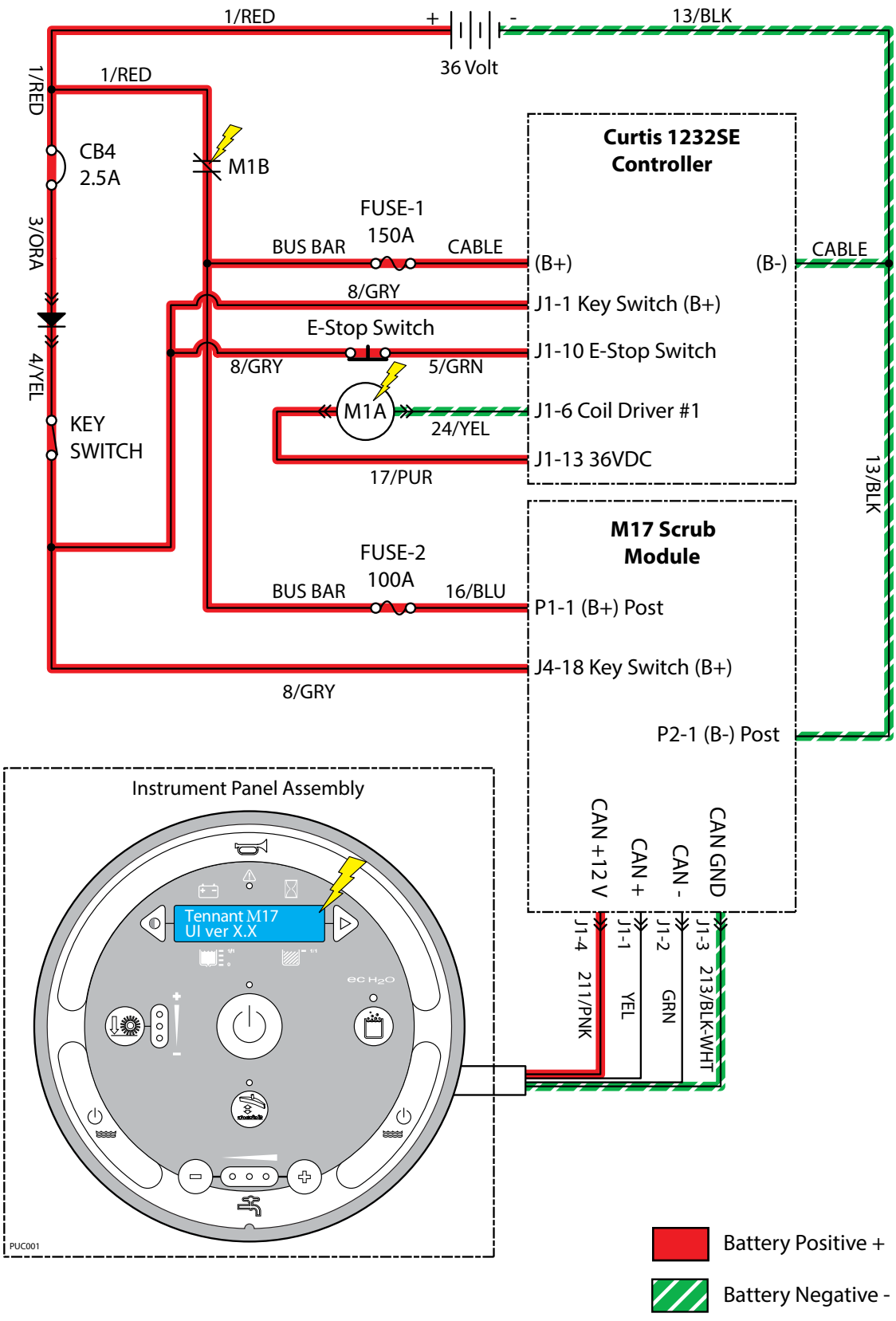
SBC004

Side Scrub Brush Failed to Turn ON/Lower

STEP	ACTION	VALUE(S)	YES	NO
1	• Key On • Enable side scrub brush subsystem • Is there a pertinent fault message displayed?		See "Fault Section"	Go to Step #2
2	• Key Off • See "Motors Mode" section of this manual • Activate the side scrub brush in Motors mode • Do the scrub brushes turn On?		Go to Step #5	Go to Step #3
3	• Key Off • See "Self-Test Mode" • Does the Self-Test display output circuits J4-7, 8 or J6-1, 2, 3 as open or shorted?		Correct Open or Short Circuit Condition	Go to Step #4
4	• Key Off • Check brush for entangled debris or damage • Do any of the above conditions exist?		Repair or Replace Necessary Components	Go to Step #5
5	• Key On • Enable side scrub brush motor • Test voltage applied to the side scrub brush motor and lift actuator subsystems as shown on the electrical schematic • Are the electrical circuits operating as shown on the electrical schematic? • *NOTE: The side scrub motor can be tested using the main brush motor connections of the wire harness. The side scrub motor must be removed to reach the main brush motor connections.*		Go Back to 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

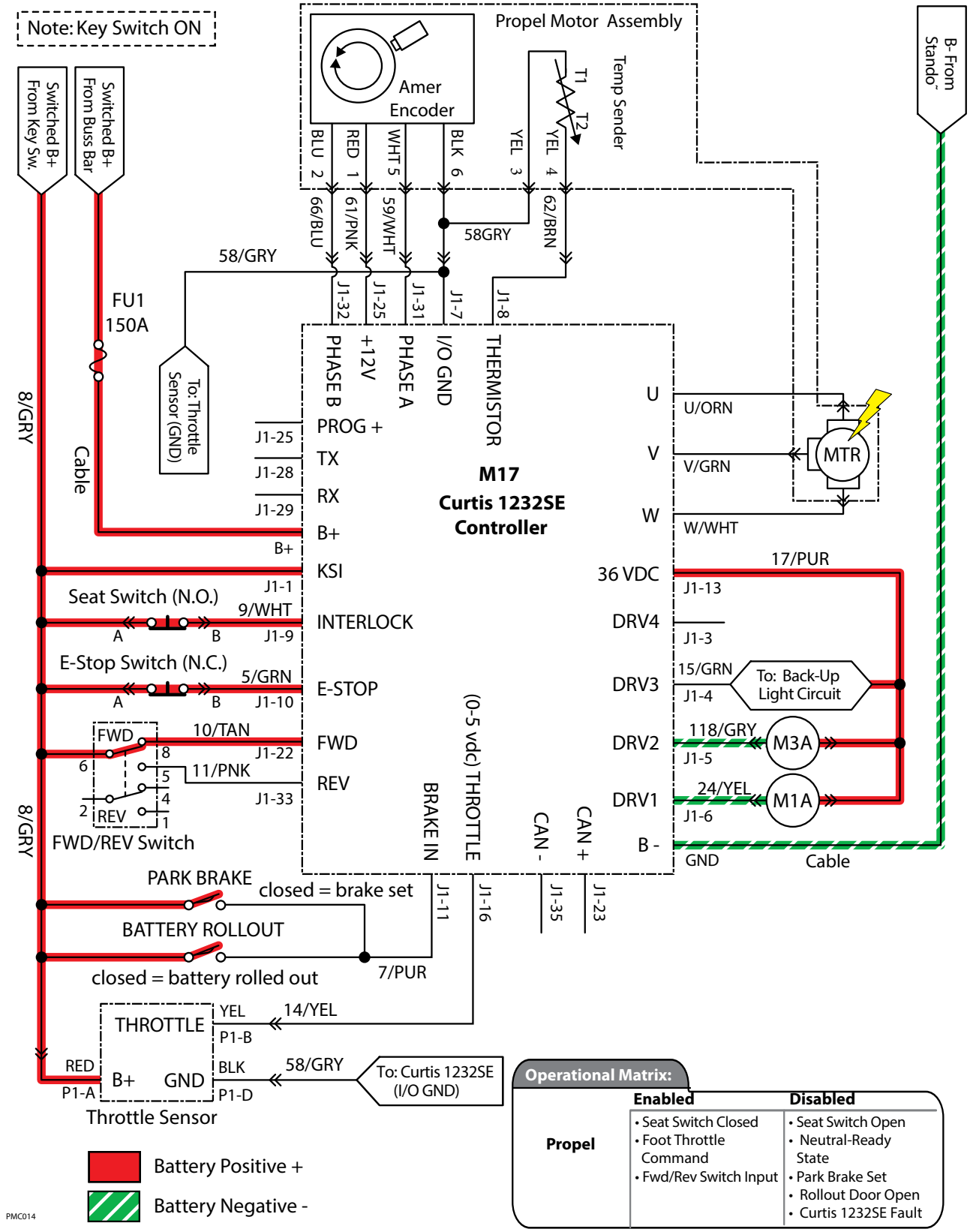

1/RED
+
-
13/BLK
36 Volt
1/RED
1/RED
CB4
2.5A
M1B
3/ORA
FUSE-1
150A
BUS BAR
CABLE
Curtis 1232SE
Controller
(B+)
(B-)
CABLE
8/GRY
J1-1 Key Switch (B+)
E-Stop Switch
J1-10 E-Stop Switch
8/GRY
5/GRN
4/YEL
M1A
J1-6 Coil Driver #1
24/YEL
KEY
SWITCH
J1-13 36VDC
17/PUR
13/BLK
M17 Scrub
Module
FUSE-2
100A
BUS BAR
16/BLU
P1-1 (B+) Post
J4-18 Key Switch (B+)
8/GRY
P2-1 (B-) Post
Instrument Panel Assembly
Tennant M17
UI ver X.X
CAN +12 V
CAN +
CAN -
CAN GND
J1-4
J1-1
J1-2
J1-3
211/PNK
YEL
GRN
213/BLK-WHT
PUC001
Battery Positive +
Battery Negative -

Machine Failed to Power Up

STEP	ACTION	VALUE(S)	YES	NO
1	• Key in On Position • Test the total battery voltage using a voltmeter • Is the total battery voltage greater than 30 VDC?		Go to Step #2	Recharge Batteries and Test Power-Up Circuit Operation
2	• Key Off • Firmly press circuit breaker 4 to reset • Is circuit breaker #4 tripped?		Reset and Test Power-Up Circuit Operation	Go to Step #3
3	• Key On • Test voltage applied to the power-up subsystem as shown on the electrical schematic • Are the electrical circuits operating as shown on the electrical schematic?		Go Back to Step #1	Identify Voltage Drop Location and Repair or Replace Necessary Components

Terms:
VDC = DC Voltage

Propel Subsystem, Forward

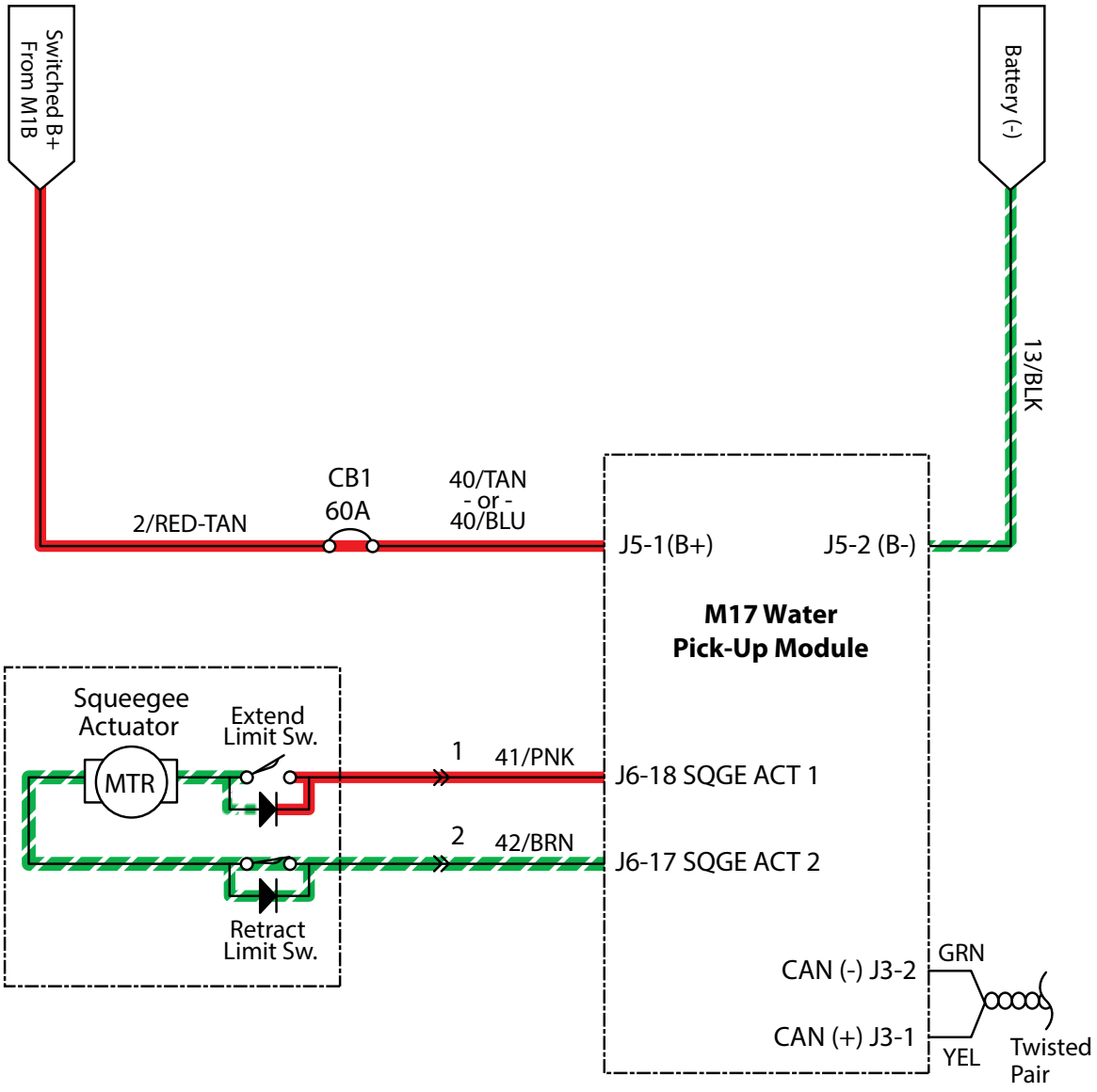


Machine Failed to Propel

STEP	ACTION	VALUE(S)	YES	NO
1	• Key On • See "Curtis 1232SE Controller Diagnostics" section of this manual • Does a Curtis 1232SE controller fault condition exist?		Correct Fault Condition	Go to Step #2
2	• Key Off • See "Propel Diagnostic Mode" • 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 the answer "Yes" to all of the above?		Go to Step #3	Correct Faulty Input Condition
3	• Key Off • Place machine on jackstands so drive wheel is lifted off the floor • Enable forward propel • Test voltage applied to the propel subsystem as shown on the electrical schematic • Are the electrical circuits operating as shown on the electrical schematic?		Go Back to Step #1	Identify Voltage Drop Location and Repair or Replace Necessary Components

Terms:
VDC = Direct Current Voltage

Rear Squeegee Down, OFF



Battery Positive +

Battery Negative -

Operational Matrix:

	Enabled	Disabled
Squeegee Down	• 1-STEP Scrub ON • Squeegee/Vac ON	• 1-STEP Scrub OFF • Squeegee/Vac OFF • Reverse Propel • Recovery Tank Full • Very Low Batt Voltage • Circuit Fault

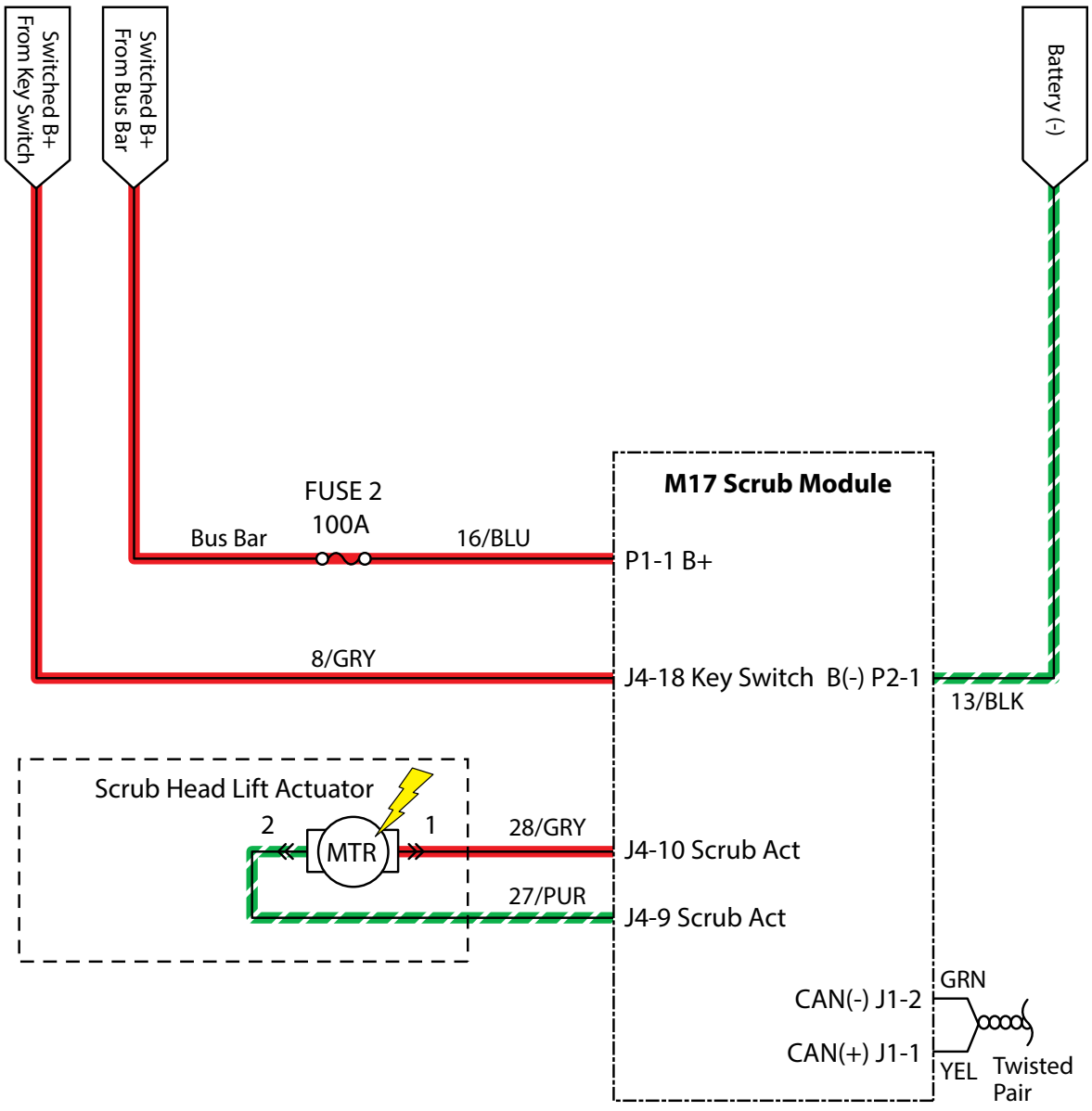
RSL001

Rear Squeegee Failed to Raise/Lower

STEP	ACTION	VALUE(S)	YES	NO
1	• Key On • Enable rear squeegee down • Is there a pertinent fault message displayed?		See "Fault Section"	Go to Step #2
2	• Key Off • See "Manual Mode" section of this manual • Activate the rear squeegee in manual mode • Does the rear squeegee raise/lower?		Go to Step #5	Go to Step #3
3	• Key Off • See "Self-Test Mode" • Does the Self-Test display output circuits J5-3 and J5-2 as open or shorted?		Correct Open or Short Circuit Condition	Go to Step #4
4	• Key Off • See TESTING REAR SQUEEGEE LIFT ACTUATOR in the SERVICE section of this manual • Does the rear squeegee lift actuator pass the testing?	See TESTING REAR SQUEEGEE LIFT ACTUATOR in the SERVICE section of this manual.	Go to Step #5	Replace Rear Squeegee Lift Actuator
5	• Key Off • Reconnect rear squeegee lift actuator to main wire harness • Test voltage applied to rear squeegee lift subsystem as shown on the electrical schematic • Are the electrical circuits operating as shown on the electrical schematic?		Go Back to Step #1	Identify Voltage Drop Location and Repair or Replace Necessary Components

Terms:
J5-3 = Water PU Module Connector #5, Pin #3
J5-2 = Water PU Module Connector #5, Pin #2

Scrub Head Lift



Battery Positive +

Battery Negative -

MSL001

Operational Matrix:

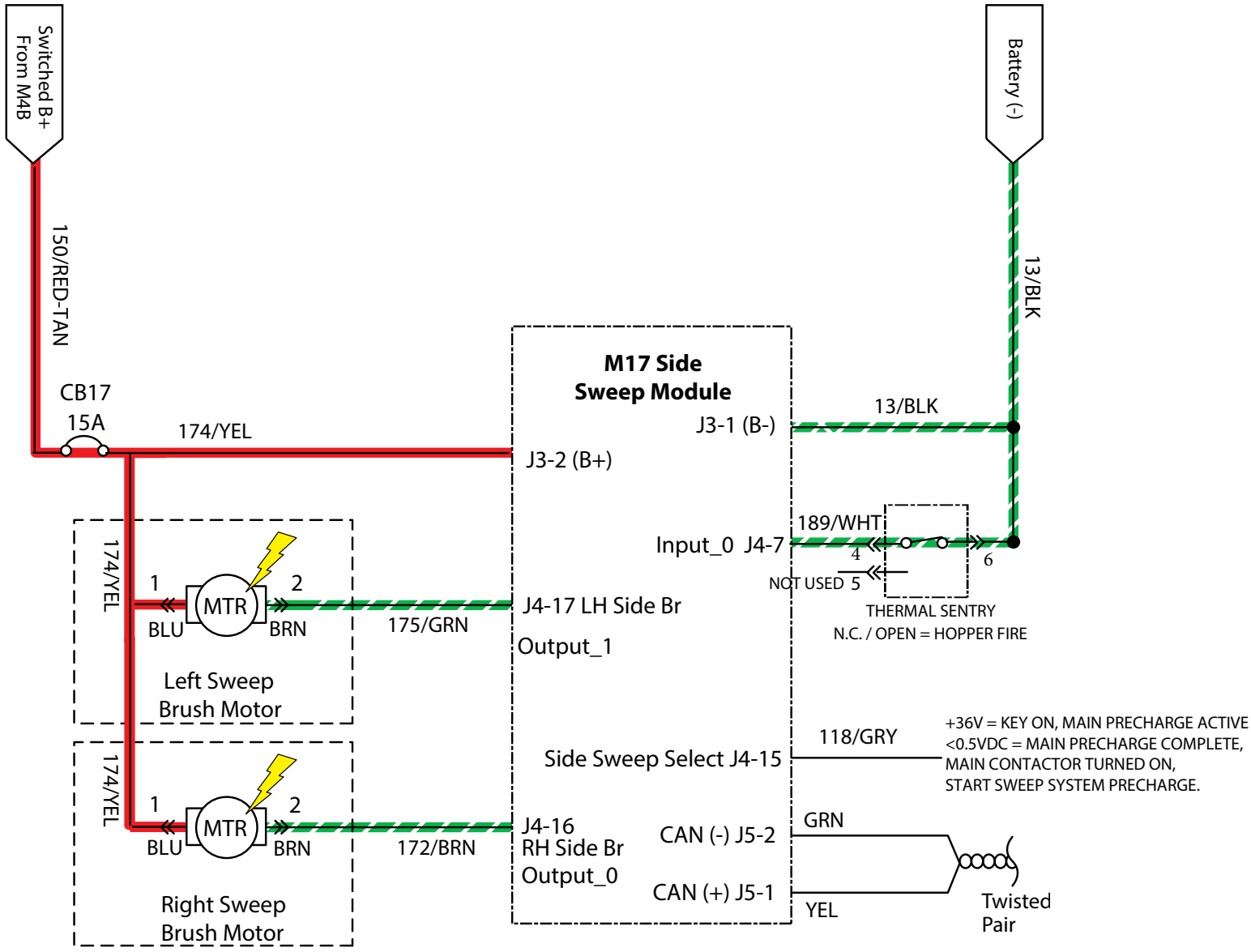
	Enabled	Disabled
Scrub Head Down	• 1-STEP Scrub ON • Fwd/Rev Propel	• 1-STEP Scrub OFF • Neutral-Ready State • Recovery Tank Full • Solution Tank Empty • Very Low Batt Voltage • Circuit Fault

Scrub Head Failed to Raise/Lower

STEP	ACTION	VALUE(S)	YES	NO
1	• Key On • Enable scrub head down • Is there a pertinent fault message displayed?		See "Fault Section"	Go to Step #2
2	• Key Off • See "Manual Mode" section of this manual • Activate the scrub head in manual mode • Does the scrub head raise/lower?		Go to Step #5	Go to Step #3
3	• Key Off • See "Self-Test Mode" • Does the Self-Test display output circuits J4-9 and J4-10 as open or shorted?		Correct Open or Short Circuit Condition	Go to Step #4
4	• Key Off • See TESTING MAIN BRUSH LIFT ACTUATOR in the SERVICE section of this manual • Does the scrub head lift actuator pass the testing?	See TESTING MAIN BRUSH LIFT ACTUATOR	Go to Step #5	Replace Scrub Head Lift Actuator
5	• Key Off • Reconnect scrub head lift actuator to main wire harness • Test voltage applied to scrub head lift subsystem as shown on the electrical schematic • Are the electrical circuits operating as shown on the electrical schematic?		Go Back to Step #1	Identify Voltage Drop Location and Repair or Replace Necessary Components

Terms:
J4-9 = Scrub Module Connector #4, Pin #9
J4-10 = Scrub Module Connector #4, Pin #10

Side Sweep Brush(es) ON



Operational Matrix:

	Enabled	Disabled
Side Sweep Brush(es)	• 1-STEP Scrub ON • Side Brush Switch ON • Fwd/Rev Propel	• 1-STEP Scrub OFF • Side Brush Switch OFF • Recovery Tank Full • Solution Tank Empty • Very Low Batt Voltage • Circuit Fault • Neutral (Ready State)

Battery Positive +

Battery Negative -

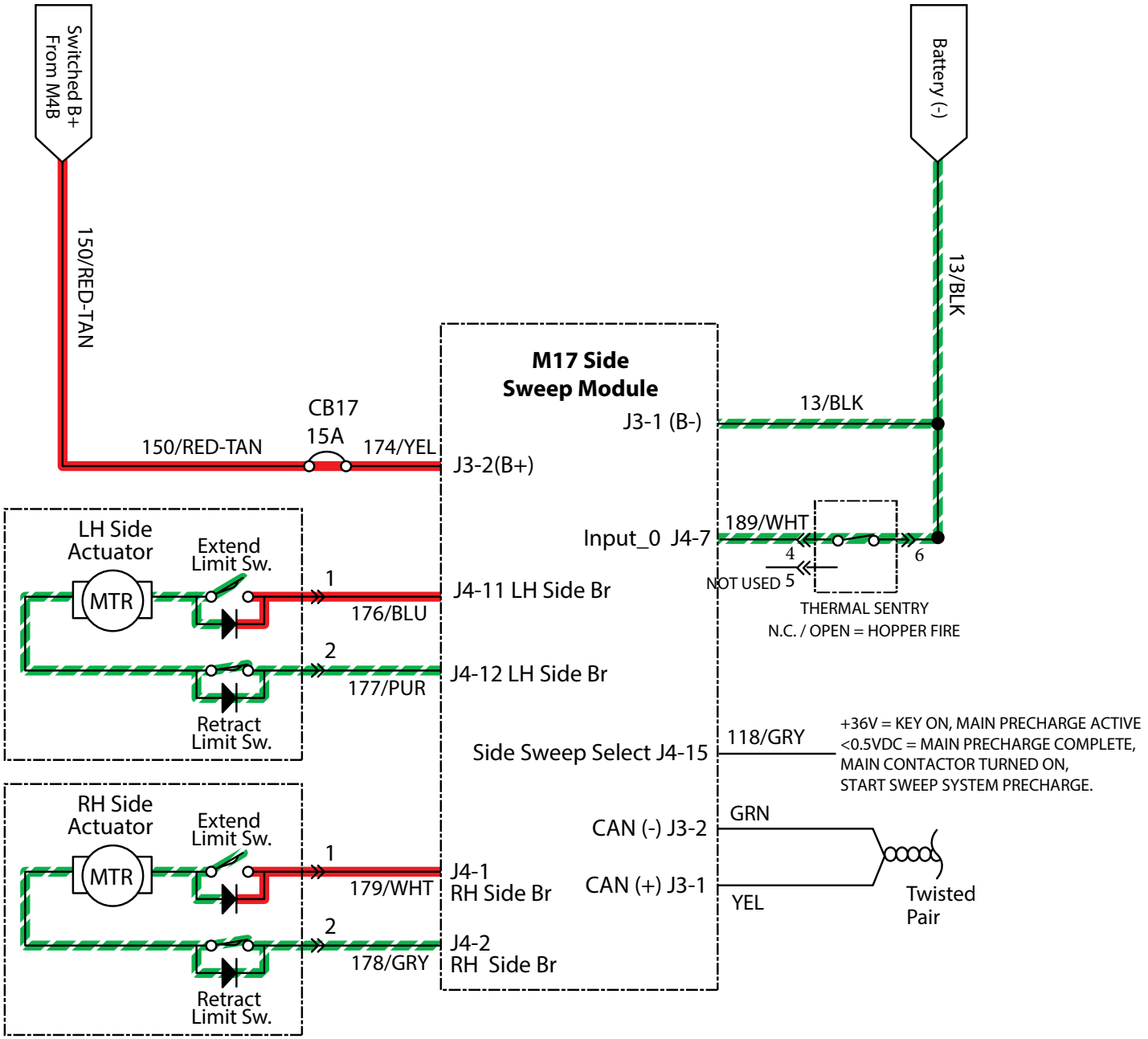
RSL001

Side Sweep Brush(es) Failed to Turn ON

STEP	ACTION	VALUE(S)	YES	NO
1	• Key On • Enable side brush • Is there a pertinent fault message displayed?		See "Fault Section"	Go to Step #2
2	• Key Off • See "Manual Mode" section of this manual • Activate the side brush in manual mode • Do the side brush turn On?		Go to Step #6	Go to Step #3
3	• Key Off • See "Self-Test Mode" • Does the Self-Test display output circuits CB17 or J4-16, J4-17 as open or shorted?		Correct Open or Short Circuit Condition	Go to Step #4
4	• Key Off • See "Input Display Mode" • Does I6: Side Sweep On/Off input correspond with side brush rocker switch position?		Go to Step #5	Correct Faulty Input Condition
5	• Key Off • See TESTING SIDE SWEEP BRUSH MOTOR in the SERVICE section of this manual • Does the side brush motor pass the testing?	See TESTING SIDE SWEEP BRUSH MOTOR	Go to Step #6	Replace Side Brush Motor
6	• Key Off • Reconnect side brush motor to main wire harness • Test voltage applied to side brush subsystem as shown on the electrical schematic • Are the electrical circuits operating as shown on the electrical schematic?		Go Back to Step #1	Identify Voltage Drop Location and Repair or Replace Necessary Components

Terms:
CB17 = High Side
J4-16 = Right Side Sweep Module
J4-17 = Left Side Sweep Module

Side Sweep Brush(es) Extend/Down, OFF



Operational Matrix:

	Enabled	Disabled
Side Sweep Brush(es)	• 1-STEP Scrub ON • Side Brush Switch ON • Fwd/Rev Propel	• 1-STEP Scrub OFF • Side Brush Switch OFF • Recovery Tank Full • Solution Tank Empty • Very Low Batt Voltage • Circuit Fault • Neutral (Ready State)

Battery Positive +

Battery Negative -

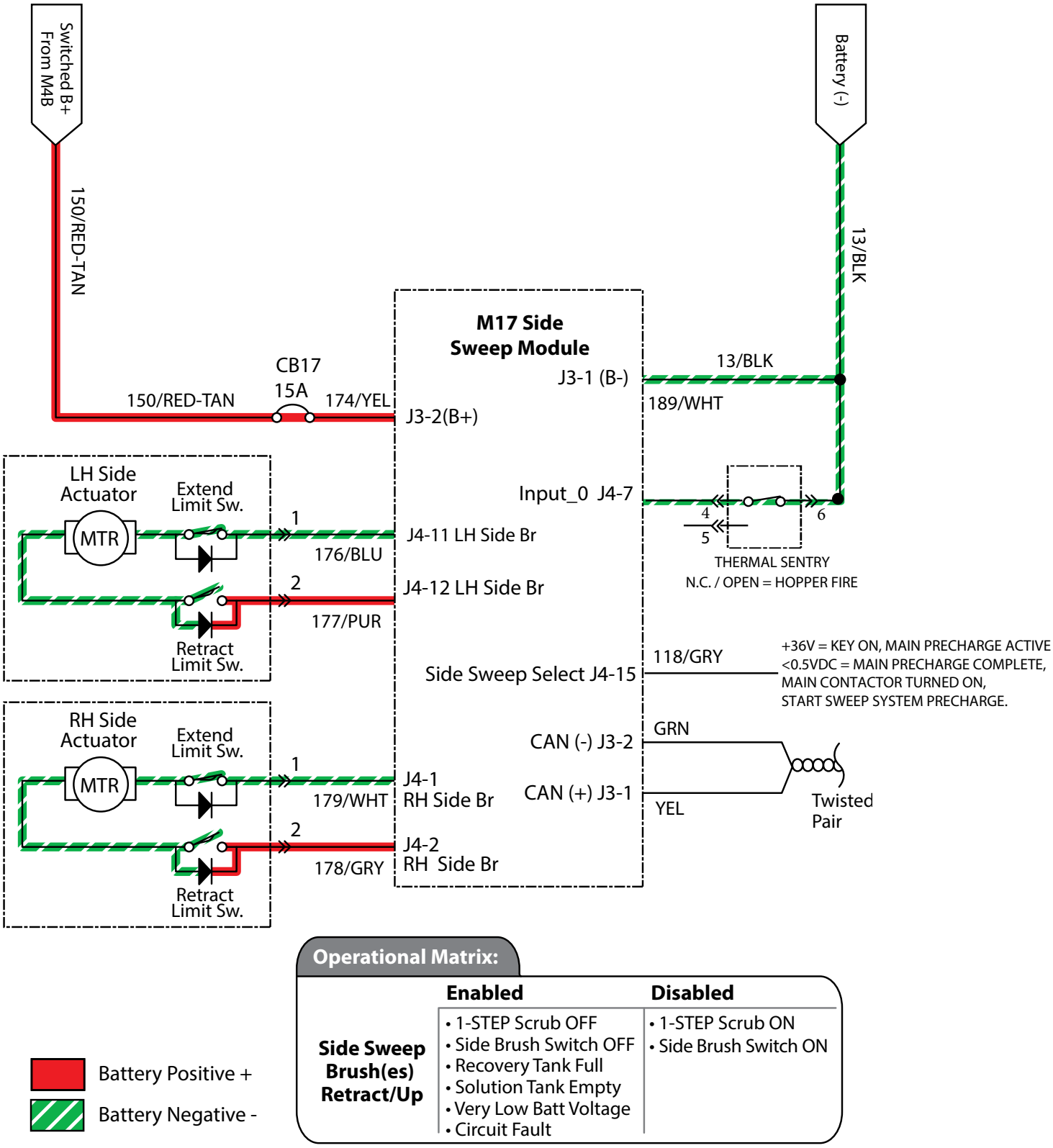
RSL001

Side Sweep Brush(es) Failed to Extend/Lower

STEP	ACTION	VALUE(S)	YES	NO
1	• Key On • Enable side sweep brush extend/down • Is there a pertinent fault message displayed?		See "Fault Section"	Go to Step #2
2	• Key Off • See "Manual Mode" section of this manual • Extend/Lower the side brush in manual mode • Does the side brush extend/lower?		Go to Step #6	Go to Step #3
3	• Key Off • See "Self-Test Mode" • Does the Self-Test display output circuits J4-1, 2 or J4-11, 12 as open or shorted?		Correct Open or Short Circuit Condition	Go to Step #4
4	• Key Off • See "Input Display Mode" • Does I6: Side Sweep On/Off input correspond with side brush rocker switch position?		Go to Step #5	Correct Faulty Input Condition
5	• Key Off • See TESTING SIDE SWEEP BRUSH LIFT ACTUATOR in the SERVICE section of this manual • Does the side brush lift actuator pass the testing?	See TESTING SIDE SWEEP BRUSH LIFT ACTUATOR	Go to Step #6	Replace Side Brush Lift Actuator
6	• 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 as shown on the electrical schematic • Are the electrical circuits operating as shown on the electrical schematic?		Go Back to Step #1	Identify Voltage Drop Location and Repair or Replace Necessary Components

Terms:
J4-1, 2 = Side Sweep Module
J4-11, 12 = Side Scrub Module

Side Sweep Brush(es) Retract/Up, OFF



Operational Matrix:

	Enabled	Disabled
Side Sweep Brush(es) Retract/Up	• 1-STEP Scrub OFF • Side Brush Switch OFF • Recovery Tank Full • Solution Tank Empty • Very Low Batt Voltage • Circuit Fault	• 1-STEP Scrub ON • Side Brush Switch ON

RSL001

Side Sweep Brush(es) Failed to Retract/Raise

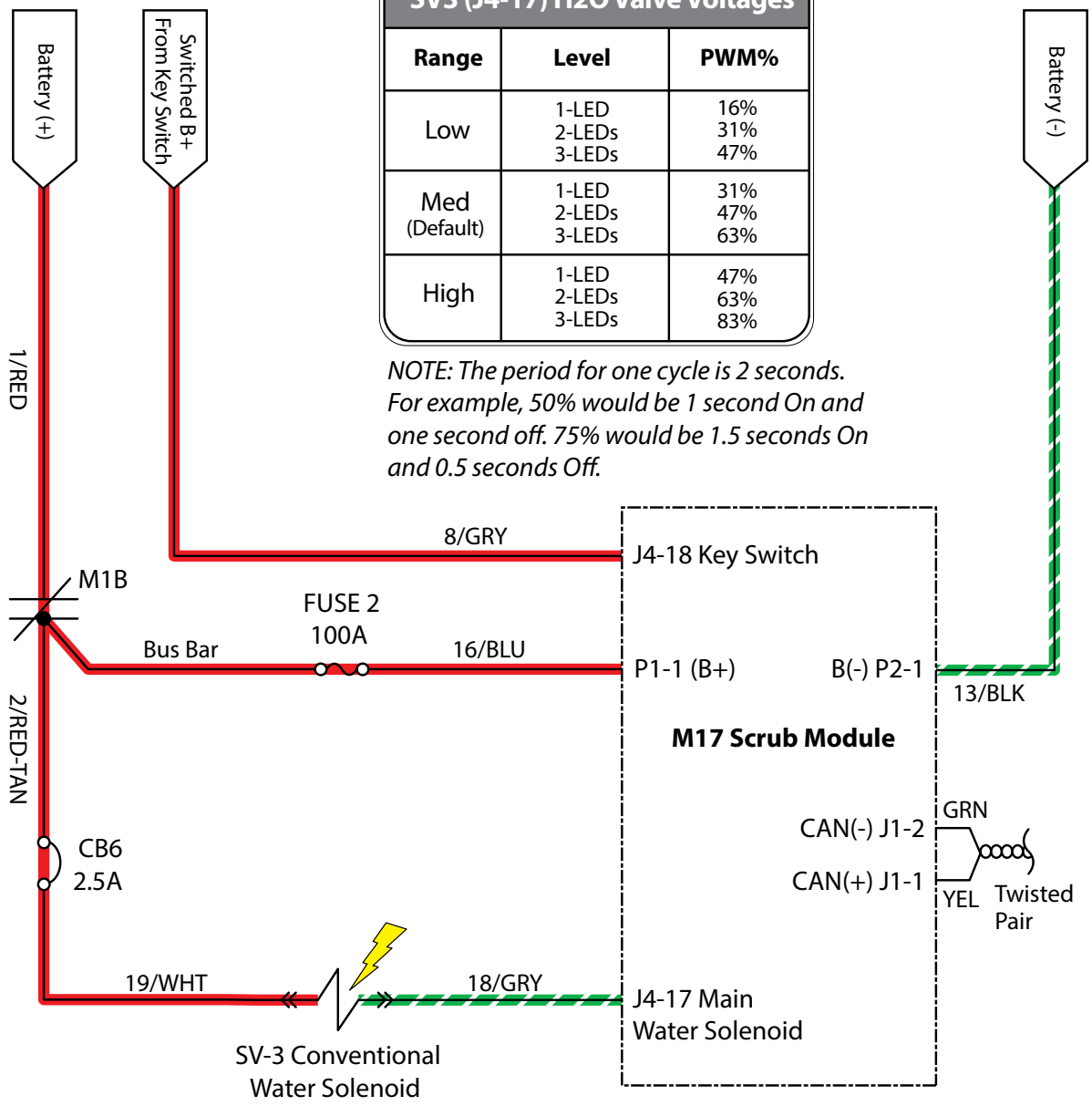
STEP	ACTION	VALUE(S)	YES	NO
1	• Key On • Enable side brush retract/up • Is there a pertinent fault message displayed?		See "Fault Section"	Go to Step #2
2	• Key Off • See "Self-Test Mode" • Does the Self-Test display output circuits J4-1, 2 or J4-11, 12 as open or shorted?		Go to Step #3	Correct Faulty Input Condition
3	• Key Off • See "Input Display Mode" • Does I6: Side Sweep On/Off input correspond with side brush rocker switch position?		Go to Step #4	Correct Faulty Input Condition
4	• Key Off • See TESTING SIDE SWEEP BRUSH LIFT ACTUATOR in the SERVICE section of this manual • Does the side brush lift actuator pass the testing?	See TESTING SIDE SWEEP BRUSH LIFT ACTUATOR	Go to Step #5	Replace Side Brush Lift Actuator
5	• Key On • Side brush switch Off • Test voltage applied to side brush lift subsystem as shown on the electrical schematic • Are the electrical circuits operating as shown on the electrical schematic?		Go Back to Step #1	Identify Voltage Drop Location and Repair or Replace Necessary Components

Terms:
J4-1, 2 = Side Sweep Module Connector #6, Pin #17 or 18
J4-11, 12 = Side Scrub Module Connector #6, Pin #14 or 16

Solution Control ON - Main Brush (Conventional)

* SV3 (J4-17) H2O Valve Voltages		
Range	**Level**	**PWM%**
Low	1-LED 2-LEDs 3-LEDs	16% 31% 47%
Med (Default)	1-LED 2-LEDs 3-LEDs	31% 47% 63%
High	1-LED 2-LEDs 3-LEDs	47% 63% 83%

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)	• 1-STEP Scrub ON • Solution Control ON • Fwd/Rev Propel	• 1-STEP Scrub OFF • Solution Control OFF • Neutral-Ready State • Recovery Tank Full • Solution Tank Empty • Very Low Batt Voltage • Circuit Fault

Battery Positive +

Battery Negative -

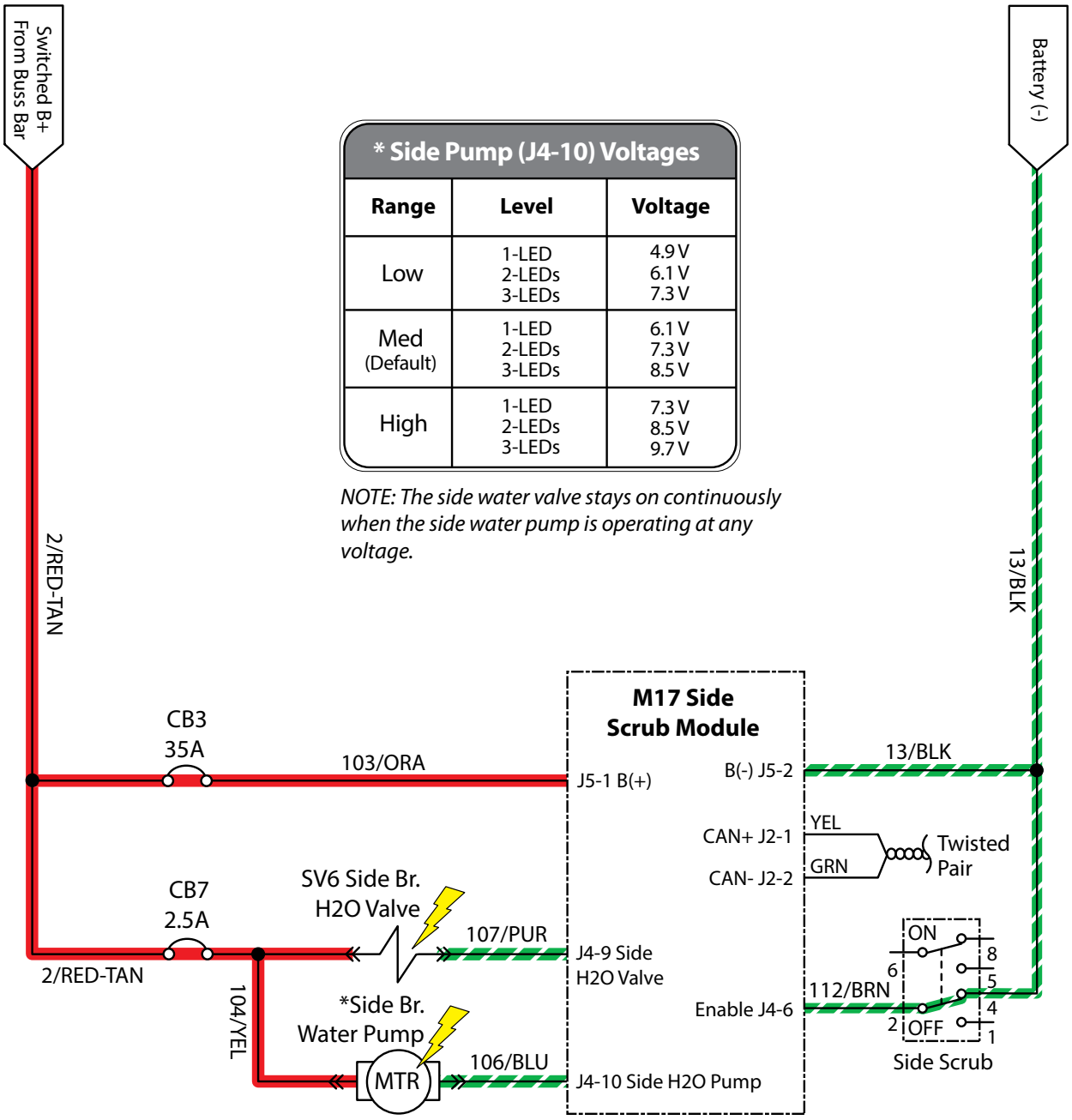
CSC002

Solution Control Failed to Turn ON - Main Brush (Conventional)

STEP	ACTION	VALUE(S)	YES	NO
1	• Key On • Enable solution control (conventional) • Is there a pertinent fault message displayed?		See "Fault Section"	Go to Step #2
2	• Key Off • See "Manual Mode" section of this manual • Activate solution control in manual mode • Does the machine dispense water to the floor		Go to Step #6	Go to Step #3
3	• Key Off • See "Self-Test Mode" • Does the Self-Test display output circuit J4-17 as open or shorted?		Correct Open or Short Circuit Condition	Go to Step #4
4	• Key Off • Firmly press circuit breaker #6 to reset • Is circuit breaker #6 tripped?		Reset and Test Solution Control Operation	Go to Step #5
5	• Key Off • Disconnect SV3 from main wire harness • Apply battery voltage to SV3 using fuse-protected jumper leads • Does the main brush dispense solution?		Go to Step #6	Repair or Replace S3
6	• Key Off • Reconnect SV3 to main wire harness • Key On • Enable solution control (conventional) • Test voltage applied to solution control subsystem as shown on the electrical schematic • Are the electrical circuits operating as shown on the electrical schematic?		Go Back to Step #1	Identify Voltage Drop Location and Repair or Replace Necessary Components

Terms:
J4-17 = Scrub Module Connector #4, Pin #17
SV3 = Solenoid Valve #3 (Main Brush)

Solution Control ON - Side Brush (Conventional)



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

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

Battery Positive +

Battery Negative -

SBC004

Operational Matrix:

	Enabled	**Disabled**
Solution Control-Side (Conventional)	• 1-STEP Scrub ON • Side Brush Switch ON • Fwd/Rev Propel	• 1-STEP Scrub OFF • Side Brush Switch OFF • Recovery Tank Full • Solution Tank Empty • Very Low Batt Voltage • Circuit Fault • Neutral (Ready State)

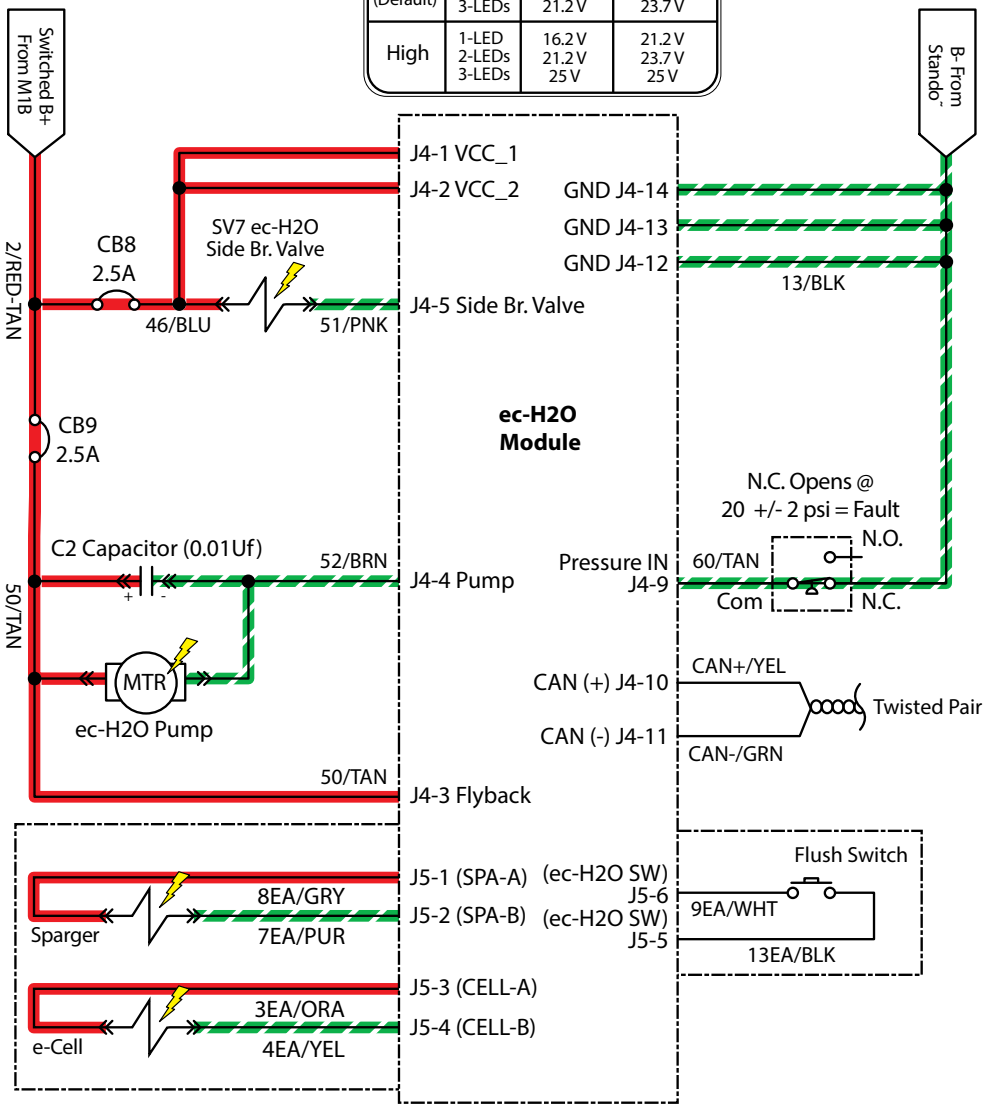
Solution Control Failed to Turn ON - Side Brush (Conventional)

STEP	ACTION	VALUE(S)	YES	NO
1	• Key On • Enable side brush solution control (conventional) • Is there a pertinent fault message displayed?		See "Fault Section"	Go to Step #2
2	• Key Off • See "Manual Mode" section of this manual • Activate solution control in manual mode • Does the machine dispense water to the side brush?		Go to Step #7	Go to Step #3
3	• Key Off • See "Self-Test Mode" • Does the Self-Test display output circuits J4-10 or J4-9 as open or shorted?		Correct Open or Short Circuit Condition	Go to Step #4
4	• Key Off • Firmly press circuit breaker #3 to reset • Is circuit breaker #3 tripped?		Reset and Test Solution Control Operation	Go to Step #5
5	• Key Off • Firmly press circuit breaker #7 to reset • Is circuit breaker #7 tripped?		Reset and Test Solution Control Operation	Go to Step #6
6	• 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?		Go to Step #7	Repair or Replace SV6 or Side Brush Water Pump
7	• 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 the side brush solution control subsystem as shown on the electrical schematic • Are the electrical circuits operating as shown on the electrical schematic?		Go Back to 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)*

* Ec Pump (J4-4) Voltages			
Range	**Level**	**Voltage**	**+ Side Br**
Low	1-LED 2-LEDs 3-LEDs	7.5 V 11.2 V 16.2 V	12.5 V 16.2 V 21.2 V
Med (Default)	1-LED 2-LEDs 3-LEDs	11.2 V 16.2 V 21.2 V	17.5 V 21.2 V 23.7 V
High	1-LED 2-LEDs 3-LEDs	16.2 V 21.2 V 25 V	21.2 V 23.7 V 25 V



Battery Positive +

Battery Negative -

ECC001

Operational Matrix:

	Enabled	Disabled
Solution Control (ec-H2O)	• 1-STEP Scrub ON • Solution Control ON • ec-H2O Button ON • Fwd/Rev Propel	• 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

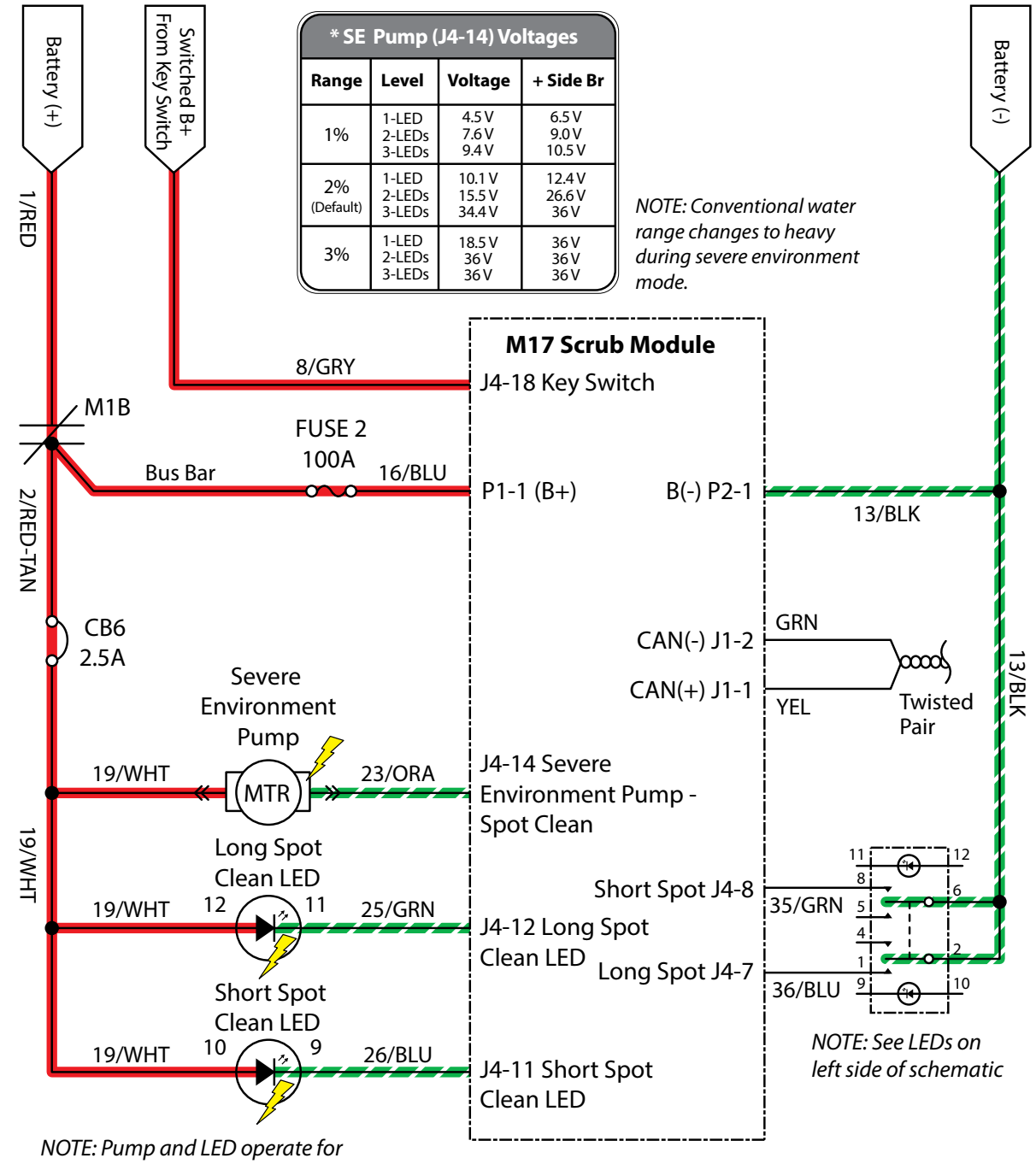
Solution Control Failed to Turn ON *(ec-H2O)*

STEP	ACTION	VALUE(S)	YES	NO
1	• Key On • Enable solution control (*ec-H2O*) • Is there a pertinent fault message displayed?		See "Fault Section"	Go to Step #2
2	• Key Off • Firmly press circuit breakers #8 and #9 to reset • Is a circuit breaker tripped?		Reset and Test *ec-H2O* Solution Control Operation	Go to Step #3
3	• Key Off • Enable solution control (*ec-H2O*) • Is the *ec-H2O* LED flashing RE, indicating a system restriction or low water conductivity*?		See "*ec-H2O* Module Flush Procedure" Section. Then Proceed to Step #4	Go to Step #5
4	• Key Off • See "ec-H2O Module Flush Procedure" section of this manual • Did the flush procedure fix the problem?		System OK	See "Testing *ec-H2O* Pressure Switch"
5	• Key Off • See "Manual Mode" section of this manual • Activate solution control (ec-H2O) in manual mode • Does solution control (ec-H2O) turn On?		Go to Step #8	Go to Step #6
6	• Key Off • See "Self-Test Mode" • Does the Self-Test display output circuits J4-4, 5 or J5-1, 2 or J5-3, 4 as open or shorted?	See "Self-Test Mode"	Correct Open or Short Circuit Condition	Go to Step #7
7	• Key Off • Disconnect *ec-H2O* water pump from wire harness • Apply battery voltage to *ec-H2O* water pump using fuse-protected jumper leads • Does the *ec-H2O* water pump dispense water?		Go to Step #8	Repair or Replace *ec-H2O* Water Pump
8	• Key Off • Reconnect *ec-H2O* water pump to wire harness • Key On • Enable solution control (*ec-H2O*) • Test voltage applied to solution control (*ec-H2O*) system as shown on the electrical schematic • Are the electrical circuits operating as shown on the electrical schematic?		Go to Step #9	Identify Voltage Drop Location and Repair or Replace Necessary Components
9	• Key On • Enable solution control (*ec-H2O*) • Is the *ec-H2O* LED solid RED, indicating an overcurrent condition on a system component?		Replace *ec-H2O* Module	Go Back to Step #1

**NOTE: Add 1/2 tablespoon of salt for every 10 gallons of water in the 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

Severe Environment - Spot Cleaning



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

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

NOTE: See LEDs on left side of schematic

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

Battery Positive +

Battery Negative -

CSC003

Operational Matrix:

	Enabled	Disabled
Severe Environment Spot Clean	• 1-STEP Scrub ON • Solution Control ON • Fwd/Rev Propel • SE Switch On	• 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 Failed to Turn On

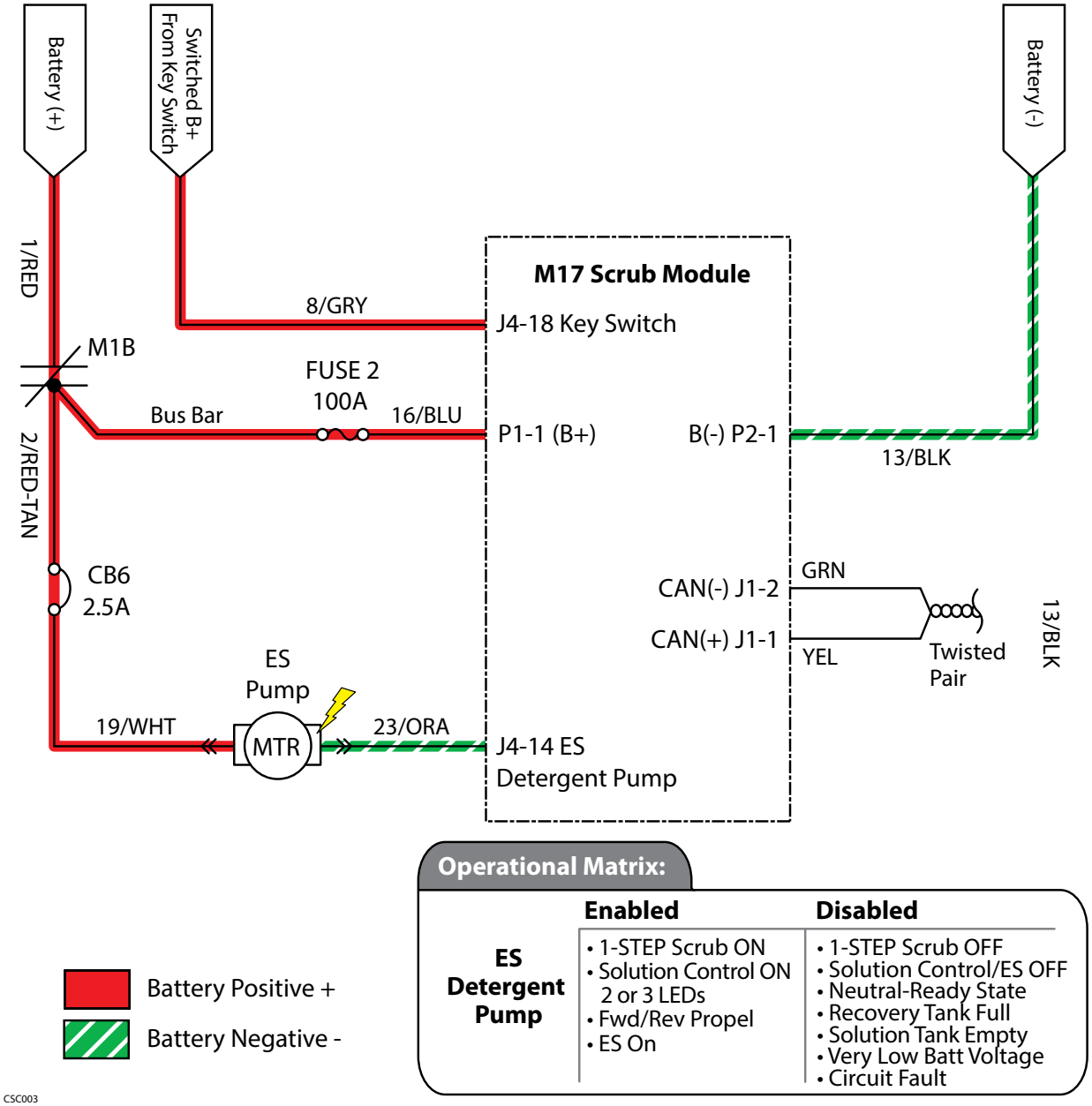
STEP	ACTION	VALUE(S)	YES	NO
1	• Key On • Enable severe environment - spot clean • Is there a pertinent fault message displayed?		See "Fault Section"	Go to Step #2
2	• Key Off • See "Manual Mode" section of this manual • Activate detergent pump in manual mode • Does the pump dispense detergent?		Go to Step #6	Go to Step #3
3	• Key Off • See "Self-Test Mode" • Does the Self-Test display output circuits J4-14, J4-12, or J4-11 as open or shorted?		Correct Open or Short Circuit Condition	Go to Step #4
4	• Key Off • Firmly press circuit breaker #6 to reset • Is circuit breaker #6 tripped?		Reset and Test SE-Spot Clean Operation	Go to Step #5
5	• Key Off • Check to be sure there is detergent in the 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?		Go to Step #6	Repair or Replace detergent pump
6	• Key Off • Reconnect detergent pump to main wire harness • Key On • Enable severe environment subsystem • Test voltage applied to the severe environment subsystem as shown on the electrical schematic • Are the electrical circuits operating as shown on the electrical schematic?		Go Back to Step #1	Identify Voltage Drop Location and Repair or Replace Necessary Components

Terms:
J4-14 = Scrub Module Connector #4, Pin #14
J4-12 = Scrub Module Connector #4, Pin #12
J4-11 = Scrub Module Connector #4, Pin #11

ES Detergent Pump

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

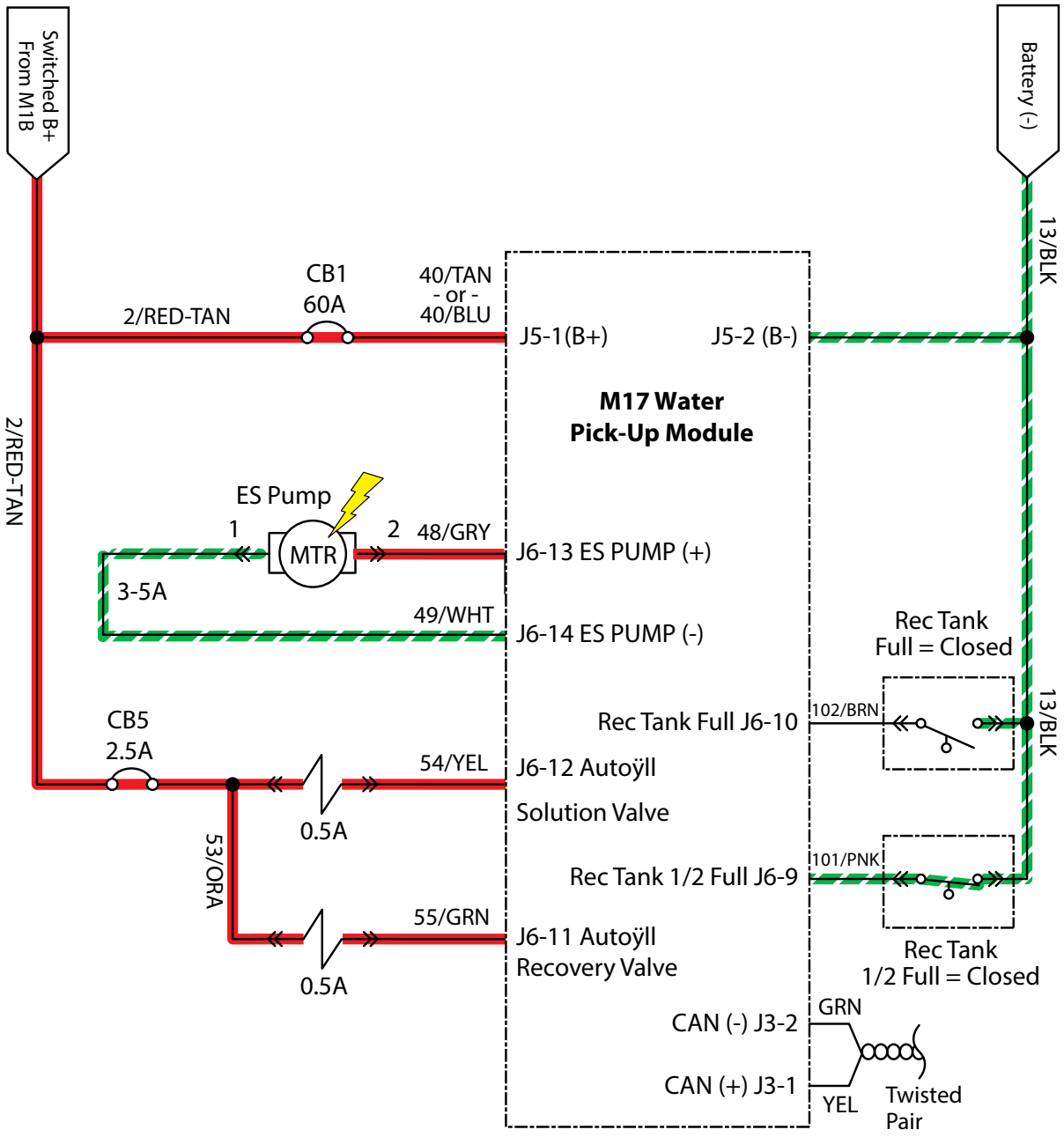


ES Detergent Pump Failed to Turn On

STEP	ACTION	VALUE(S)	YES	NO
1	• Key On • Enable ES scrubbing technology • Is there a pertinent fault message displayed?		See "Fault Section"	Go to Step #2
2	• Key Off • See "Manual Mode" section of this manual • Activate detergent pump in manual mode • Does the pump dispense detergent?		Go to Step #6	Go to Step #3
3	• Key Off • See "Self-Test Mode" • Does the Self-Test display output circuits J4-14 as open or shorted?		Correct Open or Short Circuit Condition	Go to Step #4
4	• Key Off • Firmly press circuit breaker #6 to reset • Is circuit breaker #6 tripped?		Reset and Test ES Detergent Pump Operation	Go to Step #5
5	• Key Off • Check to be sure there is detergent in the 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?		Go to Step #6	Repair or Replace detergent pump
6	• Key Off • Reconnect detergent pump to main wire harness • Key On • Enable ES detergent pump • Test voltage applied to the ES detergent pump as shown on the electrical schematic • Are the electrical circuits operating as shown on the electrical schematic?		Go Back to Step #1	Identify Voltage Drop Location and Repair or Replace Necessary Components

Terms:
J4-14 = Scrub Module Connector #4, Pin #14

ES Water Pump



Battery Positive +

Battery Negative -

RSL001

Operational Matrix:

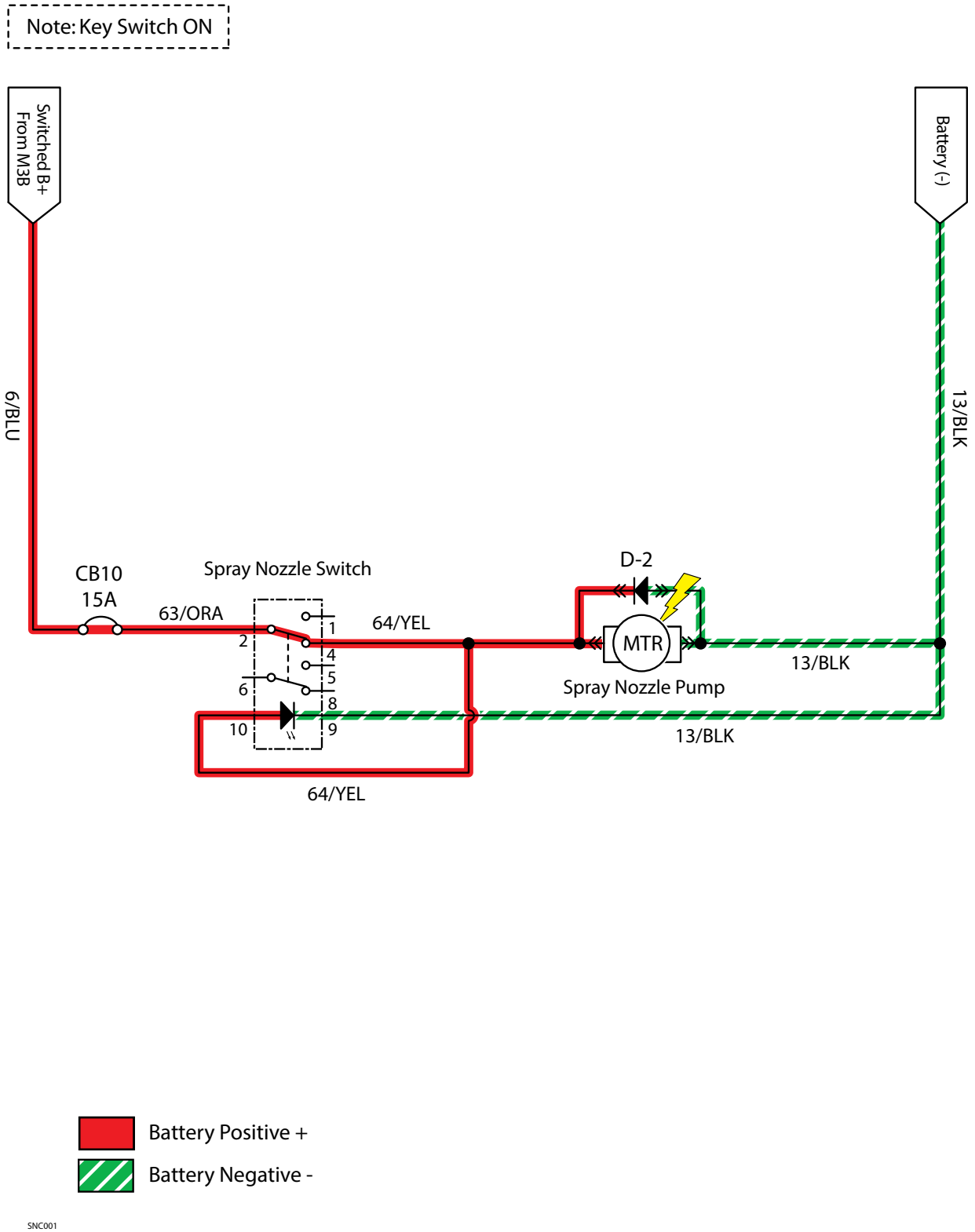
	Enabled	Disabled
ES Water Pump	• 1-STEP Scrub ON • Squeegee/Vac ON • ES On • Rec Tank 1/2 Full • Sol Tank Not Full	• 1-STEP Scrub OFF • Squeegee/Vac OFF • Sol/Rec Tank Full • ES Off • Very Low Batt Voltage • Circuit Fault

ES Water Pump Failed to Turn On

STEP	ACTION	VALUE(S)	YES	NO
1	• Key On • Enable ES scrubbing technology • Is there a pertinent fault message displayed?		See "Fault Section"	Go to Step #2
2	• Key Off • See "Manual Mode" section of this manual • Activate ES pump in manual mode • Does the ES pump turn On?		Go to Step #6	Go to Step #3
3	• Key Off • See "Self-Test Mode" • Does the Self-Test display output circuits J6-13, 14 as open or shorted?		Correct Open or Short Circuit Condition	Go to Step #4
4	• Key Off • Firmly press circuit breaker #1 to reset • Is circuit breaker #1 tripped?		Reset and Test ES Pump Operation	Go to Step #5
5	• Key Off • Check to be sure there is water in the recovery tank and that the solution tank is not full • Disconnect ES pump from main wire harness • Apply battery voltage to ES pump using fuse-protected jumper leads • Does the ES pump transfer water from the recovery tank to the solution tank?		Go to Step #6	Repair or Replace ES pump
6	• Key Off • Reconnect ES pump to main wire harness • Key On • Enable ES pump • Test voltage applied to the ES pump as shown on the electrical schematic • Are the electrical circuits operating as shown on the electrical schematic?		Go Back to Step #1	Identify Voltage Drop Location and Repair or Replace Necessary Components

Terms:
J6-14 = Water/P/U Module Connector #6, Pin #14

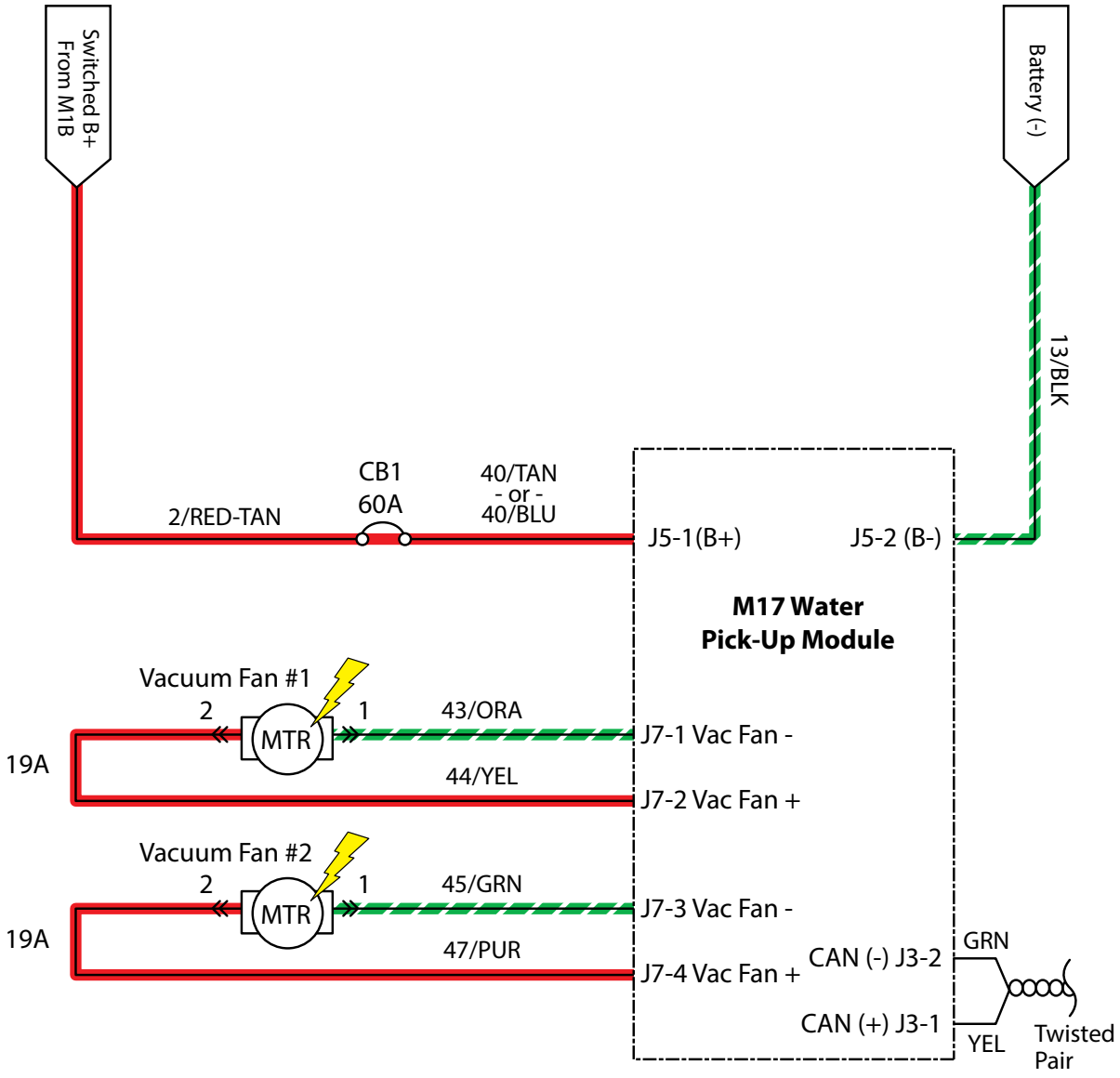
Spray Nozzle ON (Option)



Spray Nozzle Failed to Turn ON (Option)

STEP	ACTION	VALUE(S)	YES	NO
1	• Key On • Enable spray nozzle subsystem • Is there a pertinent fault message displayed?		See "Fault Section"	Go to Step #2
2	• Key Off • Firmly press circuit breaker #10 to reset • Is circuit breaker #10 tripped?		Reset and Test Spray Nozzle Operation	Go to Step #3
3	• Key Off • Disconnect spray nozzle water pump from wire harness • Apply battery voltage to spray nozzle water pump using fuse-protected jumper leads • Does the spray nozzle water pump dispense water?		Go to Step #4	Repair or Replace Spray Nozzle Water Pump
4	• Key Off • Reconnect spray nozzle water pump to wire harness • Key On • Turn spray nozzle switch On • Test voltage applied to spray nozzle subsystem as shown on the electrical schematic • Are the electrical circuits operating as shown on the electrical schematic?		Go Back to Step #1	Identify Voltage Drop Location and Repair or Replace Necessary Components

Scrub Vacuum Fans ON



Battery Positive +

Battery Negative -

Operational Matrix:

	Enabled	Disabled
Vacuum Fans	• 1-STEP Scrub ON • Squeegee/Vac ON	• 1-STEP Scrub OFF • Squeegee/Vac OFF • Recovery Tank Full • Very Low Batt Voltage • Circuit Fault

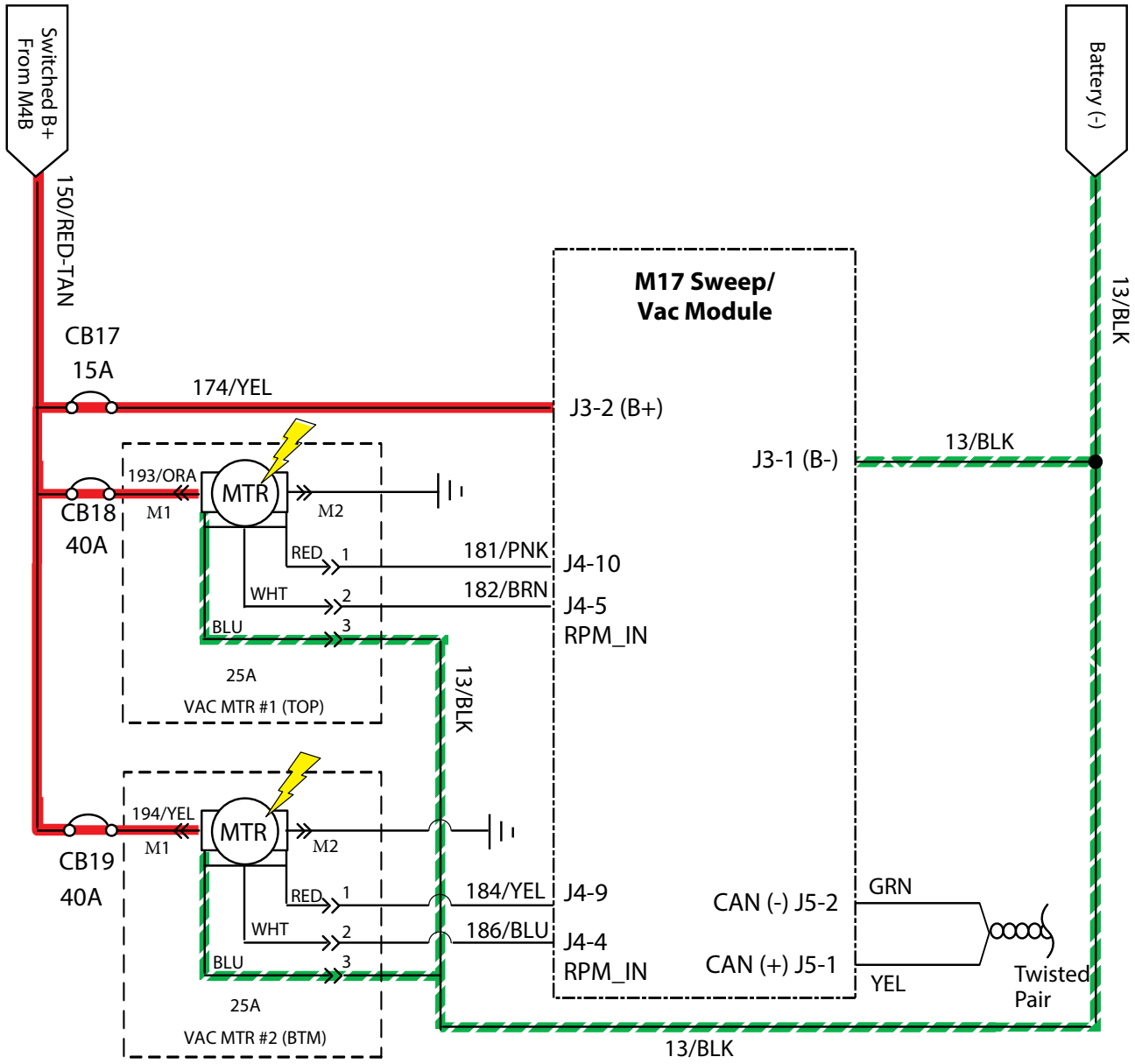
RSL001

Scrub Vacuum Fan(s) Failed to Turn ON

STEP	ACTION	VALUE(S)	YES	NO
1	• Key On • Enable scrubbing vacuum fans • Is there a pertinent fault message displayed?		See "Fault Section"	Go to Step #2
2	• Key Off • See "Manual Mode" section of this manual • Activate vacuum fans in manual mode • Do the vacuum fans turn On?		Go to Step #5	Go to Step #3
3	• Key Off • See "Self-Test Mode" • Does the Self-Test display output circuits J7-1, 2 or J7-3, 4 as open or shorted?		Correct Open or Short Circuit Condition	Go to Step #4
4	• Key Off • See TESTING VACUUM FAN (SCRUBBING) in the SERVICE section of this manual • Do the vacuum fan motors pass the testing?	See TESTING VACUUM FAN (SCRUBBING)	Go to Step #5	Repair or Replace Vacuum Fan Motor
5	• Key Off • Reconnect vacuum fan motor to main wire harness • Key On • Enable scrubbing vacuum fan subsystem • Test voltage applied to the scrubbing vacuum fan subsystem as shown on the electrical schematic • Are the electrical circuits operating as shown on the electrical schematic?		Go Back to Step #1	Identify Voltage Drop Location and Repair or Replace Necessary Components

Terms:
J7-1, 2 = Water PU Module Connector #7, Pin #1 or 2
J7-3, 4 = Water PU Module Connector #7, Pin #3 or 4

Sweep Vacuum Fans ON



Battery Positive +

Battery Negative -

RSL001

Operational Matrix:

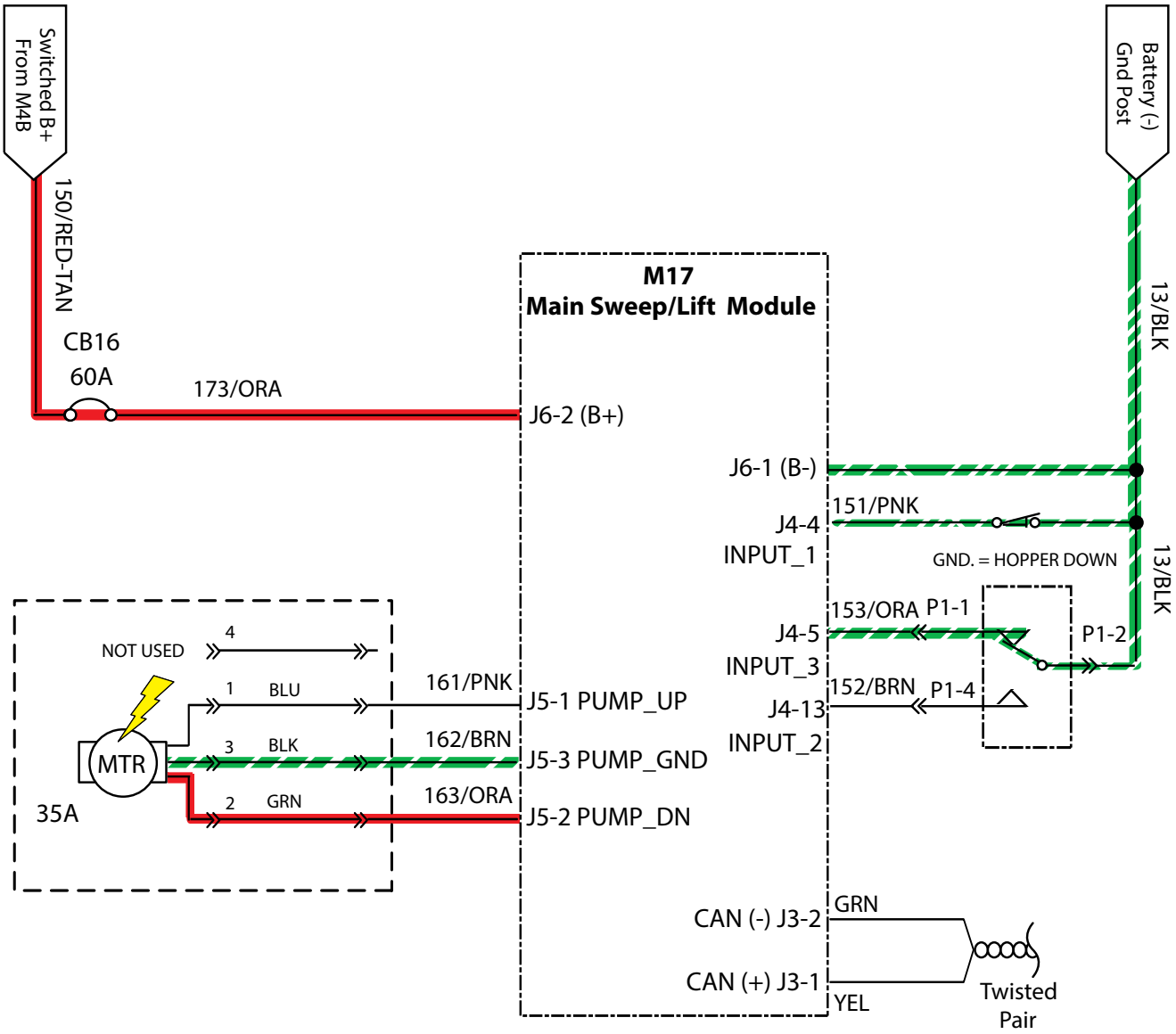
	Enabled	Disabled
Sweep Vac Fans	• 1-STEP Scrub ON • Sweep Brush Switch ON • Fwd/Rev Propel	• 1-STEP Scrub OFF • Siweep Brush Switch OFF • Recovery Tank Full • Solution Tank Empty • Very Low Batt Voltage • Circuit Fault • Neutral (Ready State)

Sweep Vacuum Fans ON

STEP	ACTION	VALUE(S)	YES	NO
1	• Key On • Enable sweep vacuum fans • Is there a pertinent fault message displayed?		See "Fault Section"	Go to Step #2
2	• Key Off • See "Manual Mode" section of this manual • Activate vacuum fans in manual mode • Do the vacuum fans turn On?		Go to Step #5	Go to Step #3
3	• Key Off • See "Self-Test Mode" • Does the Self-Test display output circuits J4-4, 9 J4-5, 10 as open or shorted?		Correct Open or Short Circuit Condition	Go to Step #4
4	• Key Off • See TESTING VACUUM FAN in the SERVICE section of this manual • Do the vacuum fan motors pass the testing?	See TESTING VACUUM FAN	Go to Step #5	Repair or Replace Vacuum Fan Motor
5	• Key Off • Reconnect vacuum fan motor to main wire harness • Key On • Enable sweeping vacuum fan subsystem • Test voltage applied to the scrubbing vacuum fan subsystem as shown on the electrical schematic • Are the electrical circuits operating as shown on the electrical schematic?		Go Back to Step #1	Identify Voltage Drop Location and Repair or Replace Necessary Components

Terms:
J4-4, 9 = Sweep/Vac Module
J4-5, 10 = Sweep/Vac Module

Hopper Lift Pump, Down



Battery Positive +

Battery Negative -

RSL001

Operational Matrix:

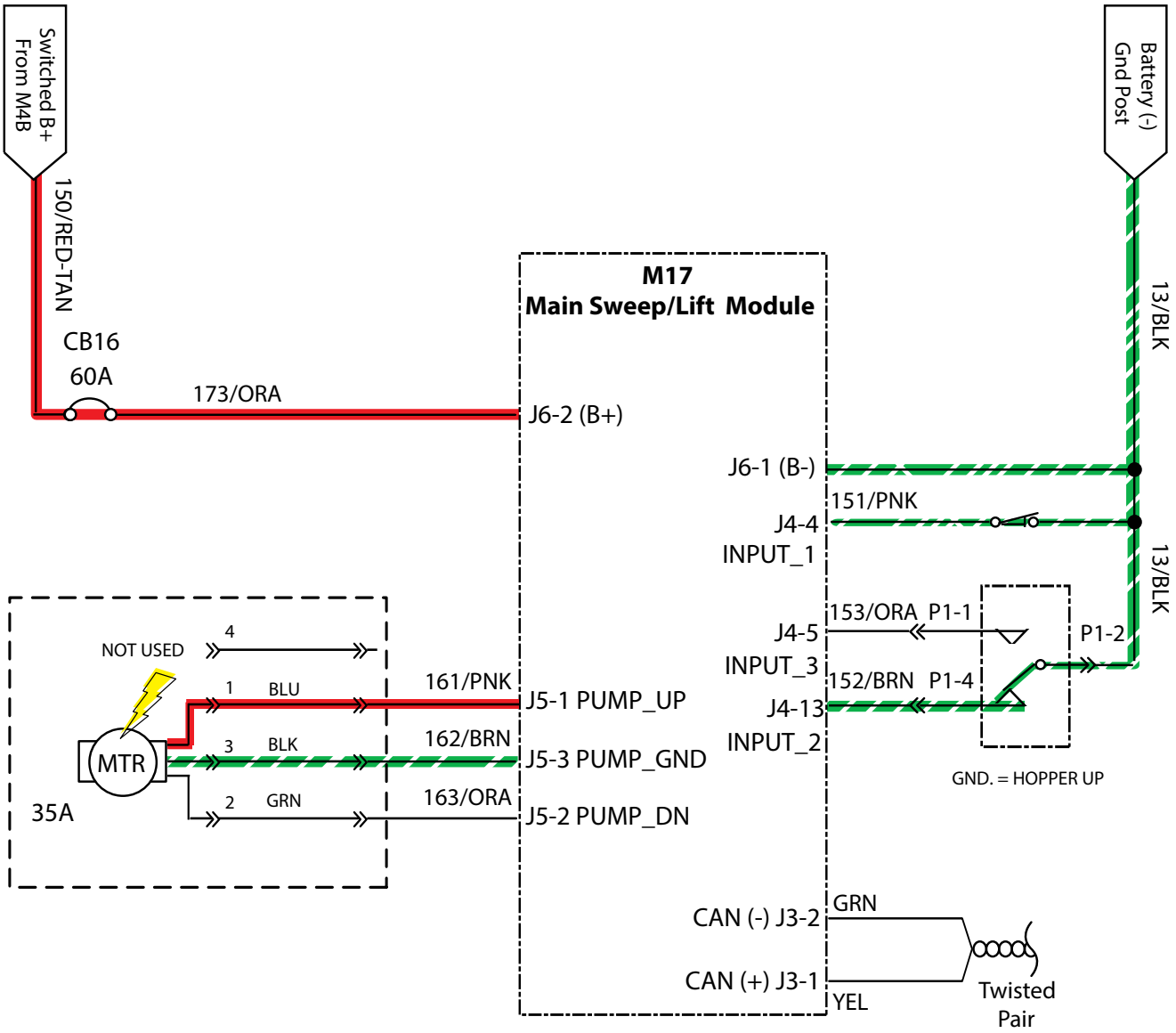
	Enabled	Disabled
Hopper Lift System	• Hopper Switch Activated	• Hopper Switch • Very Low Batt Voltage • Circuit Fault

Hopper Lift Pump, Down

STEP	ACTION	VALUE(S)	YES	NO
1	• Key On • Enable hopper switch to lower. • Is there a pertinent fault message displayed?		See "Fault Section"	Go to Step #2
2	• Key Off • See "Manual Mode" section of this manual • Activate the Hopper Switch • Does the hopper lower?		Go to Step #6	Go to Step #3
3	• Key Off • See "Self-Test Mode" • Does the Self-Test display output circuits J5-2 J5-3 as open or shorted?		Correct Open or Short Circuit Condition	Go to Step #4
4	• Key Off • See "Input Display Mode" • Does I12: Hopper On/Off input correspond with hopper rocker switch position?		Go to Step #5	Correct Faulty Input Condition
5	• Key Off • See TESTING HOPPER LIFT PUMP in the SERVICE section of this manual • Does the hopper lift pump pass the testing?	See TESTING HOPPER LIFT PUMP	Go to Step #6	Replace pump
6	• Key Off • Reconnect hopper lift pump to main wire harness • Test voltage applied to pump system as shown on the electrical schematic • Are the electrical circuits operating as shown on the electrical schematic?		Go Back to Step #1	Identify Voltage Drop Location and Repair or Replace Necessary Components

Terms:
J5-2,3 = Main Sweep/Lift Module

Hopper Lift Pump, UP



Operational Matrix:

	Enabled	Disabled
Hopper Lift System	• Hopper Switch Activated	• Hopper Switch • Very Low Batt Voltage • Circuit Fault

Battery Positive +

Battery Negative -

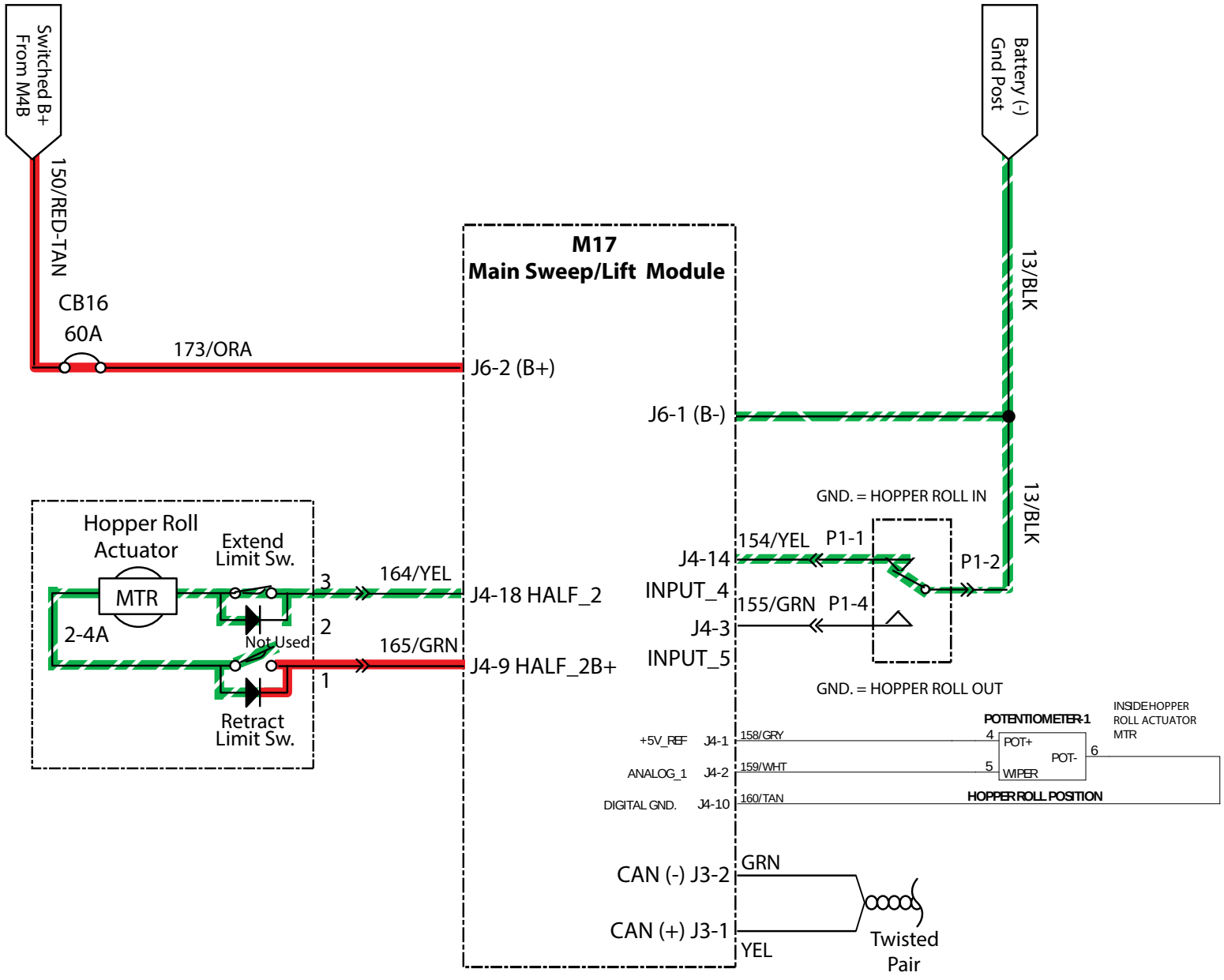
RSL001

Hopper Lift Pump, UP

STEP	ACTION	VALUE(S)	YES	NO
1	• Key On • Enable hopper switch to raise. • Is there a pertinent fault message displayed?		See "Fault Section"	Go to Step #2
2	• Key Off • See "Manual Mode" section of this manual • Activate the Hopper Switch • Does the hopper raise?		Go to Step #6	Go to Step #3
3	• Key Off • See "Self-Test Mode" • Does the Self-Test display output circuits J5-1 J5-3 as open or shorted?		Correct Open or Short Circuit Condition	Go to Step #4
4	• Key Off • See "Input Display Mode" • Does I12: Hopper On/Off input correspond with hopper rocker switch position?		Go to Step #5	Correct Faulty Input Condition
5	• Key Off • See TESTING HOPPER LIFT PUMP in the SERVICE section of this manual • Does the hopper lift pump pass the testing?	See TESTING HOPPER LIFT PUMP	Go to Step #6	Replace pump
6	• Key Off • Reconnect hopper lift pump to main wire harness • Test voltage applied to pump system as shown on the electrical schematic • Are the electrical circuits operating as shown on the electrical schematic?		Go Back to Step #1	Identify Voltage Drop Location and Repair or Replace Necessary Components

Terms:
J5-1,3 = Main Sweep/Lift Module

Hopper Roll Actuator, Retract/In, Off



Battery Positive +

Battery Negative -

RSL001

Operational Matrix:

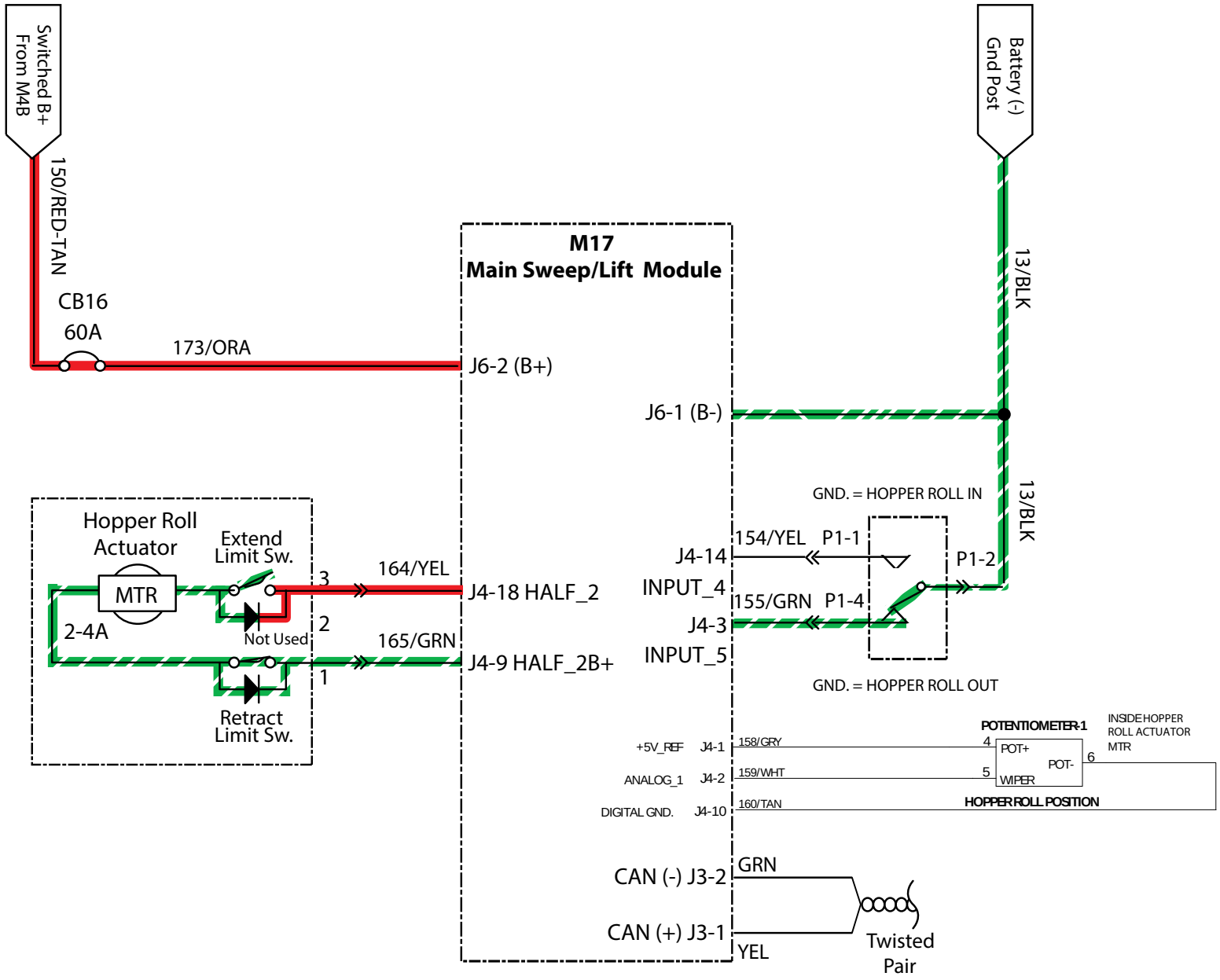
	Enabled	Disabled
Hopper Roll Actuator	• Hopper Roll Actuator Switch IN	• Roll Switch OFF • Very Low Batt Voltage • Circuit Fault

Hopper Roll Actuator, Retract/In, Off

STEP	ACTION	VALUE(S)	YES	NO
1	• Key On • Enable hopper roll switch • Is there a pertinent fault message displayed?		See "Fault Section"	Go to Step #2
2	• Key Off • See "Manual Mode" section of this manual • Activate the hopper roll actuator switch in manual mode • Does the hopper roll IN?		Go to Step #6	Go to Step #3
3	• Key Off • See "Self-Test Mode" • Does the Self-Test display output circuits J4-9, 18 as open or shorted?		Correct Open or Short Circuit Condition	Go to Step #4
4	• Key Off • See "Input Display Mode" • Does I6: Roll Switch in/out correspond with rocker switch position?		Go to Step #5	Correct Faulty Input Condition
5	• Key Off • See TESTING HOPPER ROLL ACTUATOR in the SERVICE section of this manual • Does the roll actuator pass the testing?	See TESTING HOPPER ROLL ACTUATOR	Go to Step #6	Replace Side Brush Motor
6	• Key Off • Reconnect hopper roll actuator to main wire harness • Test voltage applied to hopper roll actuator system as shown on the electrical schematic • Are the electrical circuits operating as shown on the electrical schematic?		Go Back to Step #1	Identify Voltage Drop Location and Repair or Replace Necessary Components

Terms:
J4-9,18 = Main Sweep/Lift Module

Hopper Roll Actuator, Extend/Out, Off



Battery Positive +

Battery Negative -

RSL001

Operational Matrix:

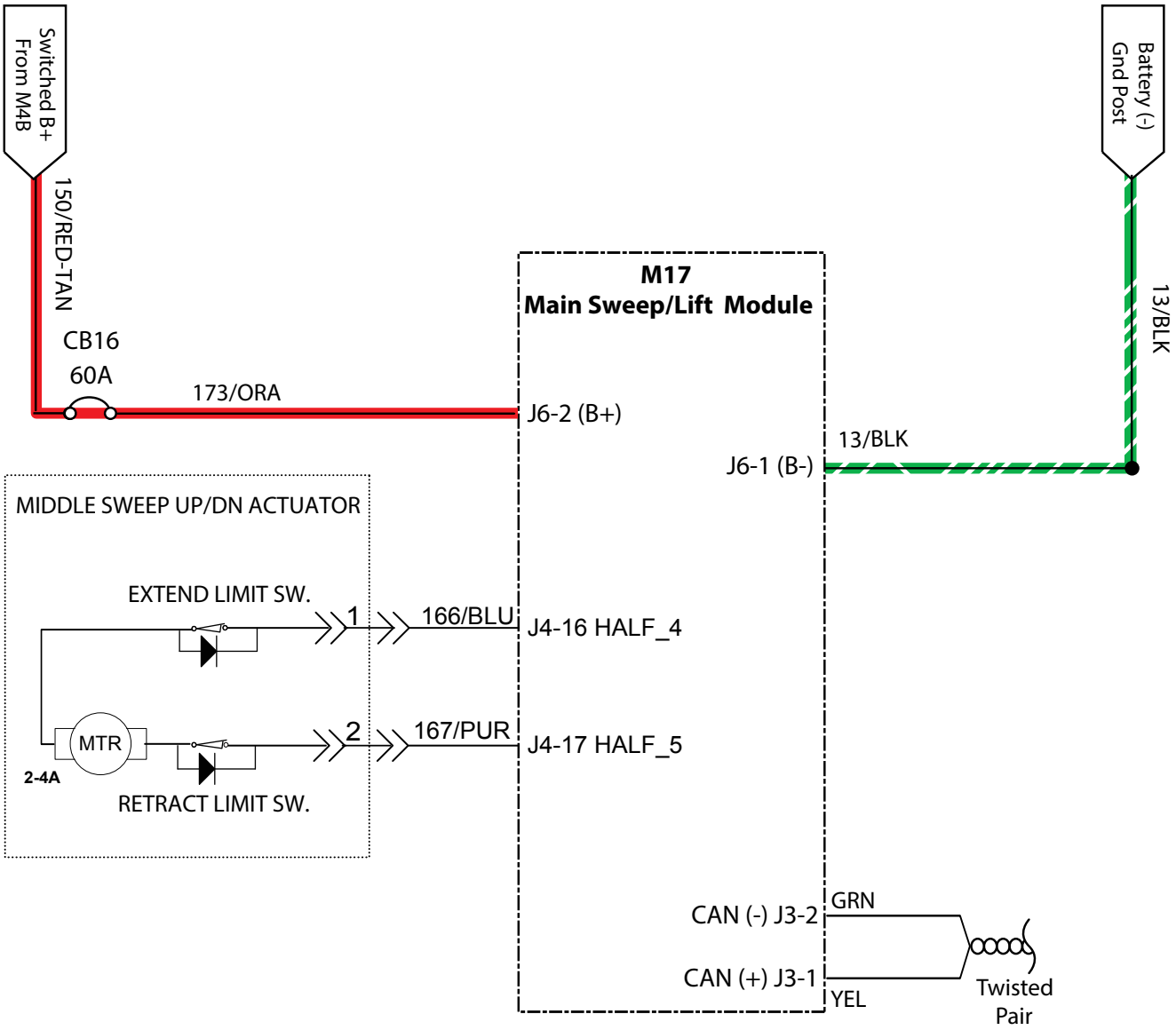
	Enabled	Disabled
Hopper Roll Actuator	• Hopper Roll Actuator Switch OUT	• Roll Switch OFF • Very Low Batt Voltage • Circuit Fault

Hopper Roll Actuator, Extend/Out, Off

STEP	ACTION	VALUE(S)	YES	NO
1	• Key On • Enable sweep brush • Is there a pertinent fault message displayed?		See "Fault Section"	Go to Step #2
2	• Key Off • See "Manual Mode" section of this manual • Activate the hopper roll actuator switch in manual mode • Does the hopper roll OUT?		Go to Step #6	Go to Step #3
3	• Key Off • See "Self-Test Mode" • Does the Self-Test display output circuits J4-9,18 as open or shorted?		Correct Open or Short Circuit Condition	Go to Step #4
4	• Key Off • See "Input Display Mode" • Does I6: Roll switch in/out correspond with rocker switch position?		Go to Step #5	Correct Faulty Input Condition
5	• Key Off • See TESTING HOPPER ROLL ACTUATOR in the SERVICE section of this manual • Does the roll actuator pass the testing?	See TESTING HOPPER ROLL ACTUATOR	Go to Step #6	Replace Side Brush Motor
6	• Key Off • Reconnect hopper roll actuator to main wire harness • Test voltage applied to hopper roll actuator system as shown on the electrical schematic • Are the electrical circuits operating as shown on the electrical schematic?		Go Back to Step #1	Identify Voltage Drop Location and Repair or Replace Necessary Components

Terms:
J4-9,18 = Main Sweep/Lift Module

Middle Sweep Up/Down, Actuator



Battery Positive +

Battery Negative -

RSL001

Operational Matrix:

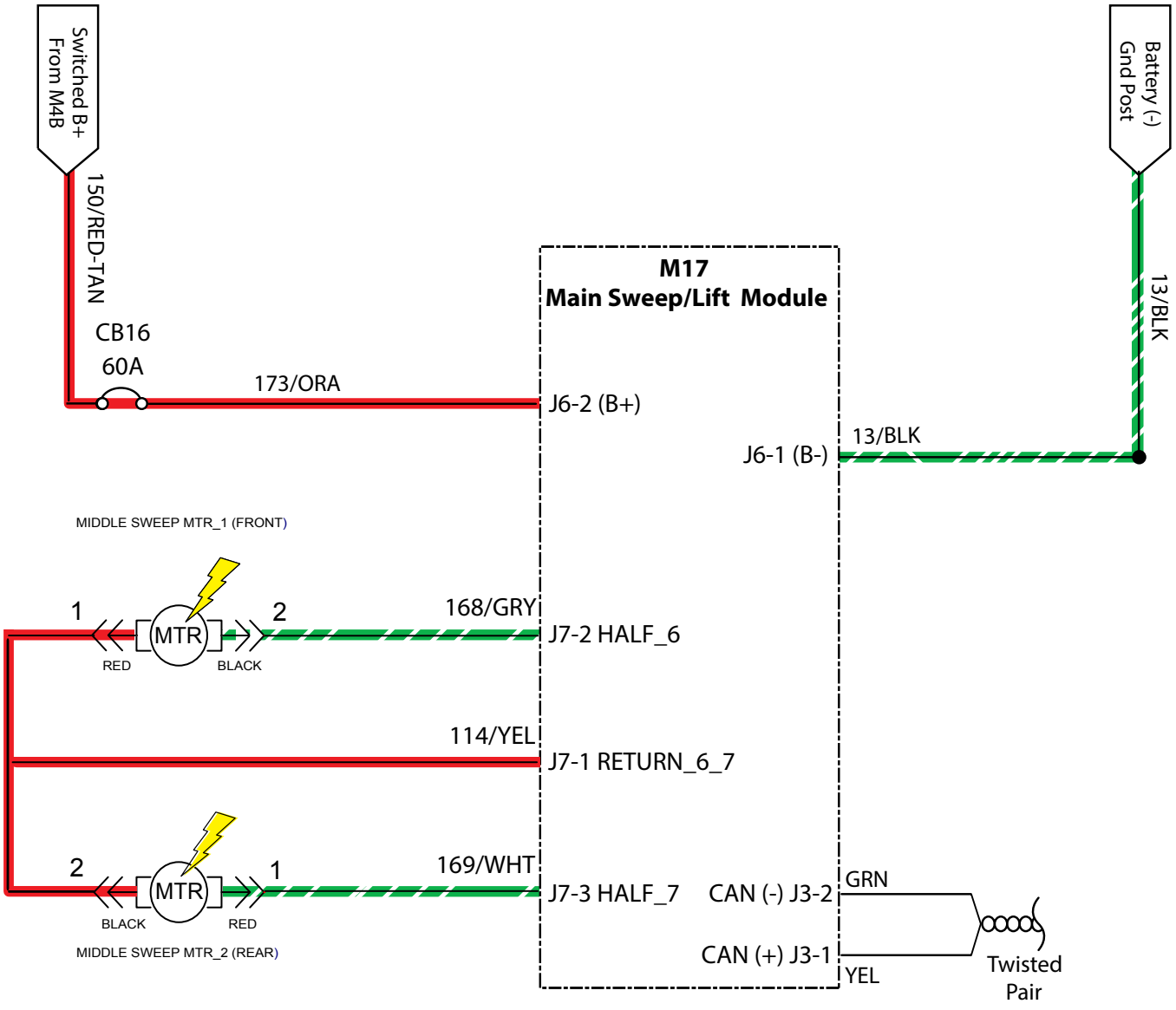
	Enabled	Disabled
Main Brush Actuator	• 1-STEP Scrub ON • Actuator lowered • Brush Switch ON • Fwd/Rev Propel	• 1-STEP Scrub OFF • Sweep Brush Switch OFF • Recovery Tank Full • Solution Tank Empty • Very Low Batt Voltage • Circuit Fault • Neutral (Ready State)

Middle Sweep Up/Down, Actuator

STEP	ACTION	VALUE(S)	YES	NO
1	• Key On • Enable main sweep brushes • Is there a pertinent fault message displayed?		See "Fault Section"	Go to Step #2
2	• Key Off • See "Manual Mode" section of this manual • Activate the sweep brush in manual mode • Does the sweep actuator lower?		Go to Step #6	Go to Step #3
3	• Key Off • See "Self-Test Mode" • Does the Self-Test display output circuits J4-16,17 as open or shorted?		Correct Open or Short Circuit Condition	Go to Step #4
4	• Key Off • Test voltage applied to actuator as shown on the electrical schematic • Are the electrical circuits operating as shown on the electrical schematic?		Go to Step #5	Correct Faulty Input Condition
5	• Key Off • See TESTING MAIN SWEEP ACTUATOR in the SERVICE section of this manual • Does the actuator motor pass the testing?	See TESTING MAIN SWEEP ACTUATOR	Go to Step #6	Replace Actuator
6	• Key Off • Reconnect sweep actuator to main wire harness • Test voltage applied to actuator subsystem as shown on the electrical schematic • Are the electrical circuits operating as shown on the electrical schematic?		Go Back to Step #1	Identify Voltage Drop Location and Repair or Replace Necessary Components

Terms:
J4-16,17= Main Sweep Module

Middle Sweep Motors



Battery Positive +

Battery Negative -

RSL001

Operational Matrix:

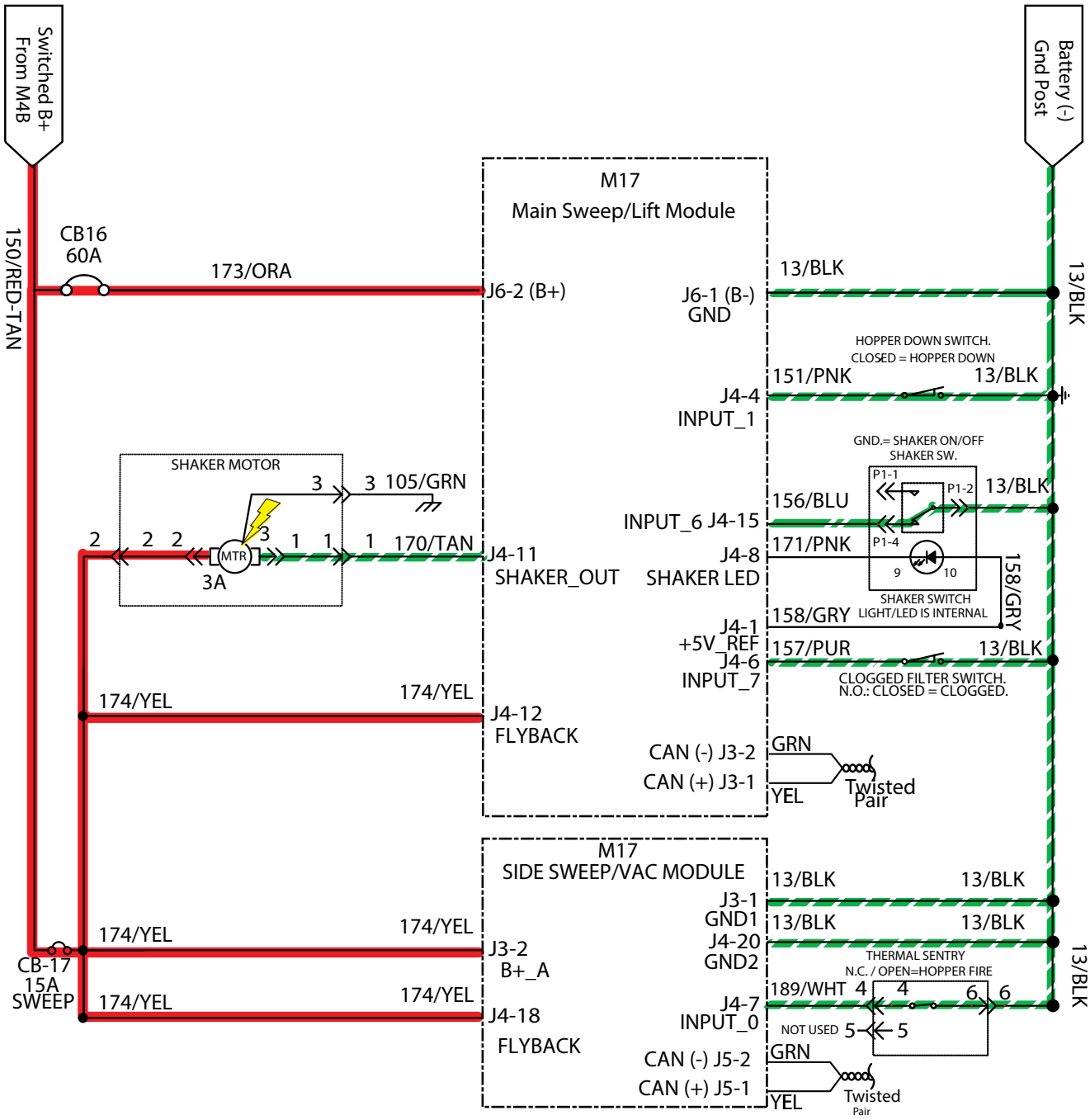
	Enabled	Disabled
Main Sweep Motors	• 1-STEP Scrub ON • Sweep Brush Switch ON • Fwd/Rev Propel	• 1-STEP Scrub OFF • Sweep Brush Switch OFF • Recovery Tank Full • Solution Tank Empty • Very Low Batt Voltage • Circuit Fault • Neutral (Ready State)

Middle Sweep Motors

STEP	ACTION	VALUE(S)	YES	NO
1	• Key On • Enable sweep brush • Is there a pertinent fault message displayed?		See "Fault Section"	Go to Step #2
2	• Key Off • See "Manual Mode" section of this manual • Activate the main sweep brush in manual mode • Do the sweep brushes turn On?		Go to Step #6	Go to Step #3
3	• Key Off • See "Self-Test Mode" • Does the Self-Test display output circuits J7-1, 2 or 3 as open or shorted?		Correct Open or Short Circuit Condition	Go to Step #4
4	• Key Off • Test voltage applied to brush motors as shown on the electrical schematic • Are the electrical circuits operating as shown on the electrical schematic?		Go to Step #5	Correct Faulty Input Condition
5	• Key Off • See TESTING MIDDLE SWEEP MOTORS in the SERVICE section of this manual • Does the motor(s) pass the testing?	See TESTING MIDDLE SWEEP MOTORS	Go to Step #6	Replace Middle Sweep Motor
6	• Key Off • Reconnect side brush motor to main wire harness • Test voltage applied to side brush subsystem as shown on the electrical schematic • Are the electrical circuits operating as shown on the electrical schematic?		Go Back to Step #1	Identify Voltage Drop Location and Repair or Replace Necessary Components

Terms:
J7-1, 2 = Main Sweep Module
J7-1, 3 = Mian Sweep Module

Shaker Motor



Operational Matrix:

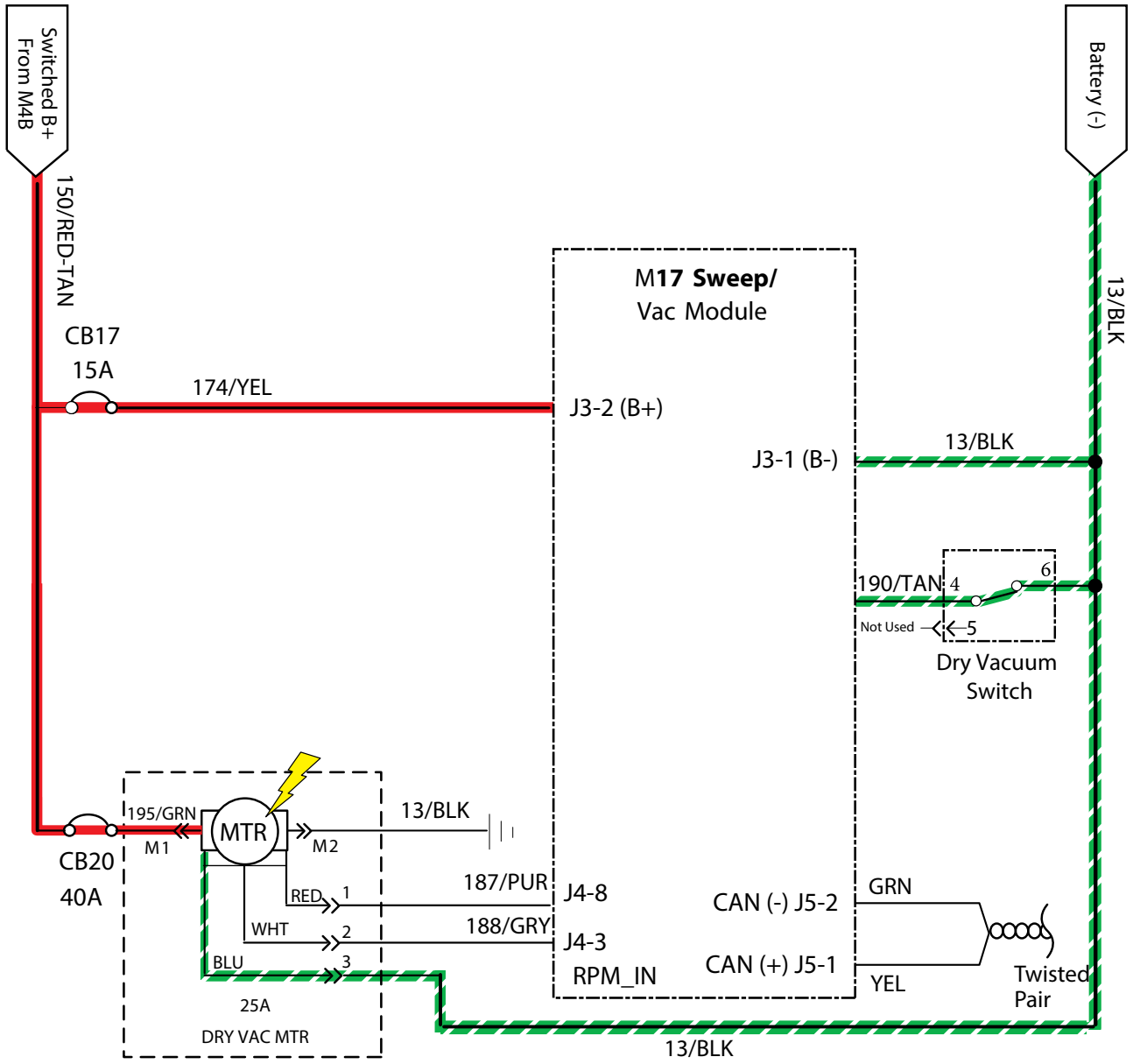
	Enabled	Disabled
Shaker Motor	• Main System ON • Shaker Switch ON	• Main System OFF • Shaker Switch OFF • Very Low Batt Voltage • Circuit Fault • Clogged Filter Switch OPEN • CB-17 OPEN

Shaker Motor

STEP	ACTION	VALUE(S)	YES	NO
1	• Key On • Enable shaker switch • Is there a pertinent fault message displayed? • Check circuit break CB17 reset if tripped		See "Fault Section"	Go to Step #2
2	• Key Off • See "Manual Mode" section of this manual • Activate the shaker switch in manual mode • Does the shaker motor turn On?		Go to Step #6	Go to Step #3
3	• Key Off • See "Self-Test Mode" • Does the Self-Test display output circuits J4-11,12 as open or shorted?		Correct Open or Short Circuit Condition	Go to Step #4
4	• Key Off • See "Input Display Mode" • Does I5: Shaker On/Off input correspond with shaker rocker switch position?		Go to Step #5	Correct Faulty Input Condition
5	• Key Off • See TESTING SHAKER MOTOR in SERVICE section of this manual • Does the shaker motor pass the testing?	See TESTING SHAKER MOTOR	Go to Step #6	Replace Shaker Motor
6	• Key Off • Reconnect shaker motor to main wire harness • Test voltage applied to side brush subsystem as shown on the electrical schematic • Are the electrical circuits operating as shown on the electrical schematic?		Go Back to Step #1	Identify Voltage Drop Location and Repair or Replace Necessary Components

Terms:
J4-11,12 = Main Sweep/Lift Module

Dry Vacuum Fan ON



Operational Matrix:

	Enabled	Disabled
Dry Vacuum Fan	• Dry Vac Switch ON	• Dry Vac Switch OFF • CB-20 OPEN • Very Low Batt Voltage • Circuit Fault

Battery Positive +

Battery Negative -

RSL001

Dry Vacuum Fan ON

STEP	ACTION	VALUE(S)	YES	NO
1	• Key On • Enable dry vac switch • Is there a pertinent fault message displayed?		See "Fault Section"	Go to Step #2
2	• Key Off • See "Manual Mode" section of this manual • Activate the dry vac switch in manual mode • Does the vacuum turn On? • Confirm CB20 not tripped?		Go to Step #6	Go to Step #3
3	• Key Off • See "Self-Test Mode" • Does the Self-Test display output circuits J4-3, 8 as open or shorted?		Correct Open or Short Circuit Condition	Go to Step #4
4	• Key Off • See "Input Display Mode" • Does dry vac switch ON/Off input correspond with rocker switch position?		Go to Step #5	Correct Faulty Input Condition
5	• Key Off • See TESTING DRY VAC FAN in the Service section of this manual • Does the vac fan pass the testing?	See TESTING DRY VAC FAN	Go to Step #6	Replace Dry Vac Fan
6	• Key Off • Reconnect vac fan to main wire harness • Key On • Dry Vac Fan enabled • Test voltage applied to vac fan subsystem as shown on the electrical schematic • Are the electrical circuits operating as shown on the electrical schematic?		Go Back to Step #1	Identify Voltage Drop Location and Repair or Replace Necessary Components

Terms:
J4-3,8 = Sweep Vac Module

SECTION 5

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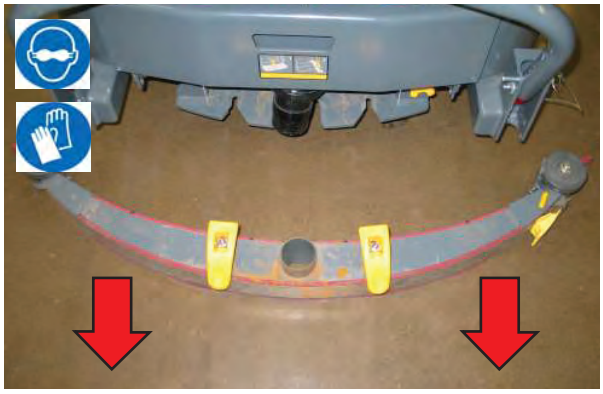
REAR SQUEEGEE LIFT

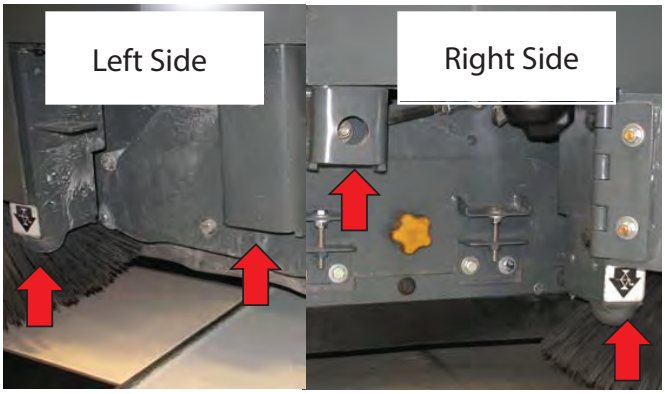
REMOVING REAR SQUEEGEE LIFT ACTUATOR

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

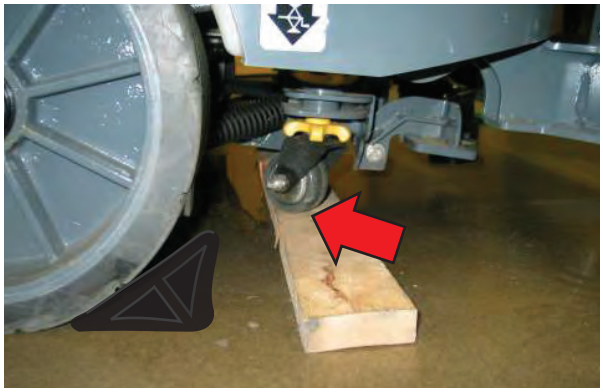
1. Remove rear squeegee and set aside.



2. Jack both sides of machine. Be sure to use wheel chocks and jack stands.

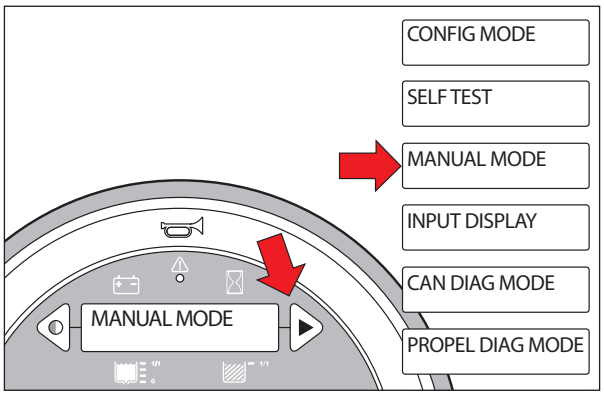


3. *Proceed to next step if actuator failed in lowered position.* Carefully support rear squeegee mounting bracket using a spacer block. This removes any spring tension from the lift cable.



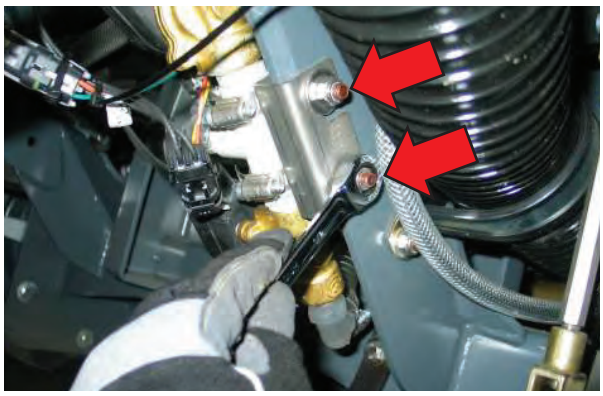
4. Enter Manual Mode and lower scrub head completely

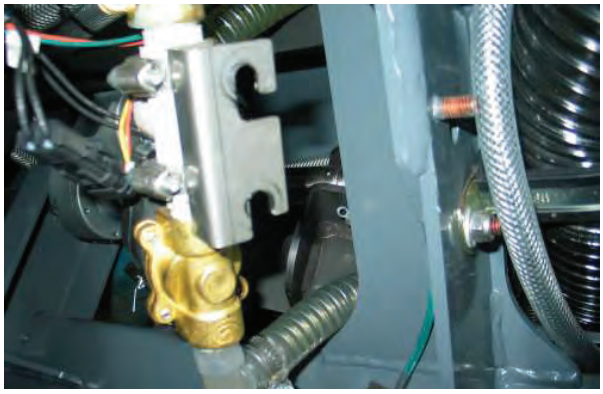
   (See Manual Mode in the Troubleshooting section of this manual). Turn key Off immediately when head touches the floor.



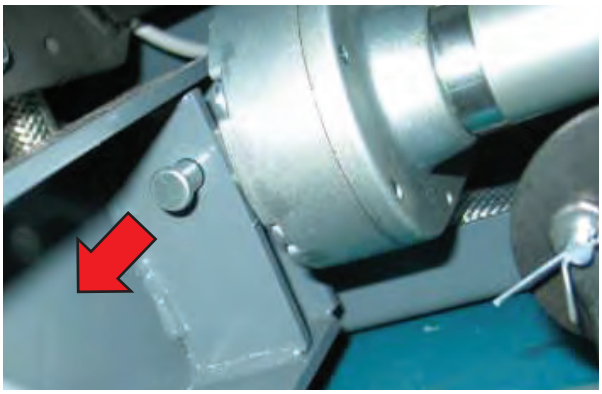
NOTE: Cylindrical Scrub Head Only: Remove debris tray from rear of scrub head to allow for additional clearance.

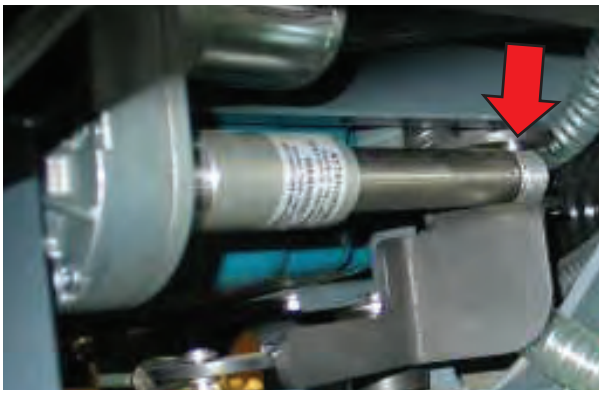
5. Loosen autofill valve mounting bracket (option) and carefully move the valve assembly aside to allow access to the lift actuator clevis pin.



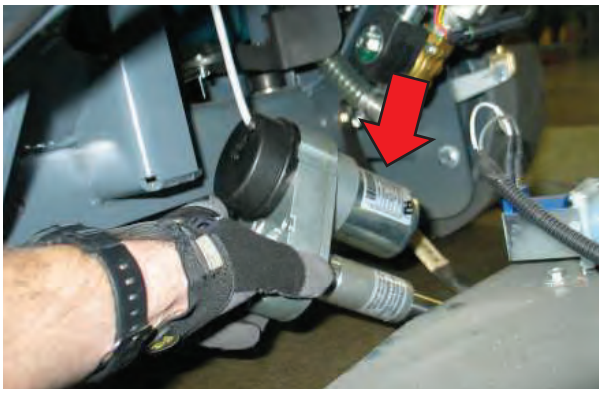


6. Remove lift actuator cotter and clevis pins and set hardware aside. Cut zip tie and disconnect lift actuator from wire harness.





7. Remove lift actuator.

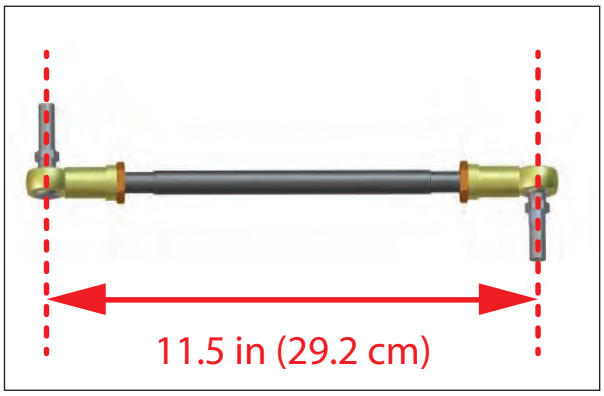


INSTALLING REAR SQUEEGEE LIFT ACTUATOR

1. Installation is reverse of removal.

REAR SQUEEGEE LINKAGE ROD ADJUSTMENT

1. The initial squeegee linkage rod adjustment is 11.5 in (29.2 cm) center-to-center.

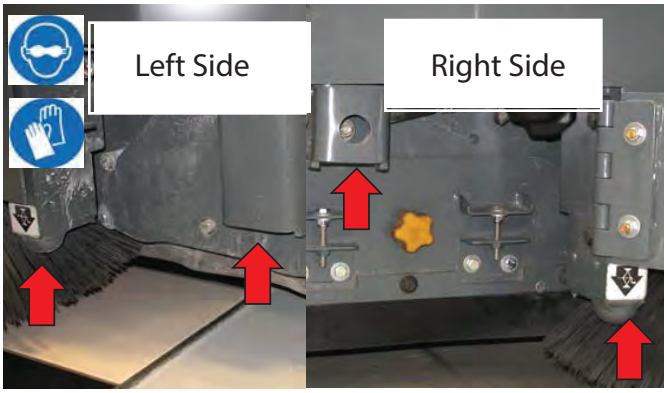


SIDE BRUSH LIFT ACTUATOR

REMOVING SIDE BRUSH LIFT ACTUATOR(S)

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

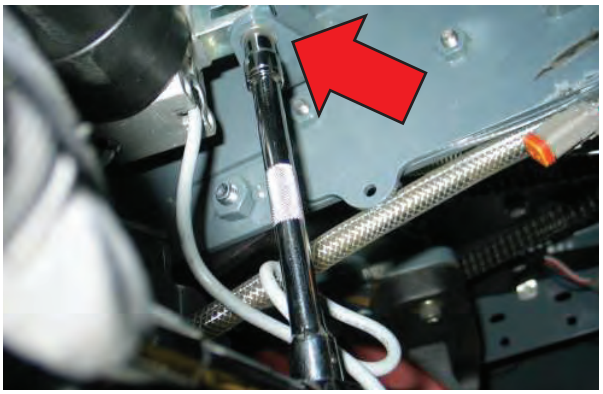
1. Jack both sides of machine. Be sure to use wheel chocks and jack stands.



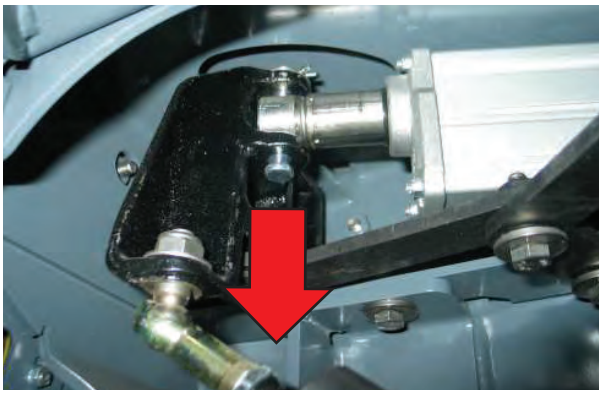
2. Remove side brush side squeegee assembly and side brush and set aside

3. Remove side brush assembly mounting bolt and carefully lower the side brush mechanism to the floor.

4. Cut zip tie securing actuator connector to wire harness and disconnect actuator from wire harness.
5. Remove actuator mounting clevis (2) and cotter (2) pins.



6. Remove cotter and clevis pin from actuaotor.



7. Remove lift actuator from machine.

INSTALLING SIDE BRUSH LIFT ACTUATOR

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

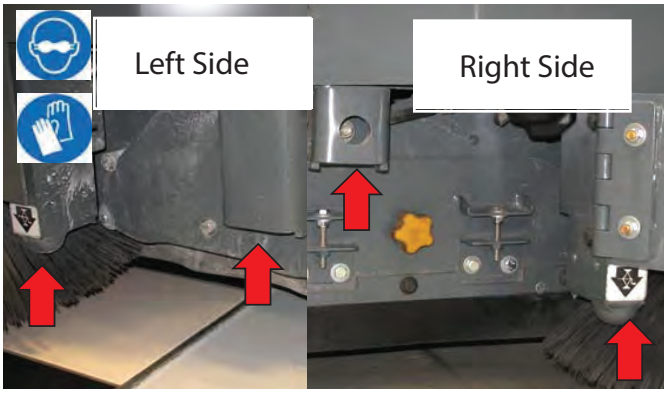
NOTE: The side brush spring tube assembly must be adjusted following the installation of the lift actuator or machine damage will occur.

1. Installation is the reverse of removal.

ADJUSTING SIDE BRUSH SPRING TUBE ASSEMBLY

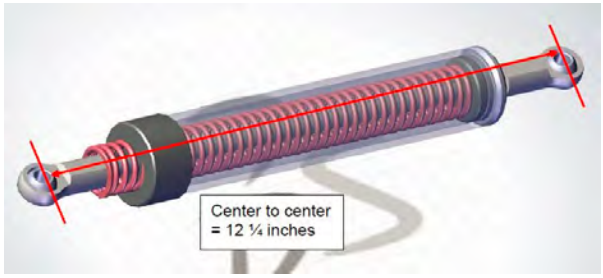
FOR SAFETY: Before leaving or servicing machine, empty solution and recovery tanks, stop on level surface, set parking brake, turn off machine and remove key.

1. Jack both sides of machine. Be sure to use wheel chocks and jack stands.



2. Activate and lower the side brush to provide access to the spring-tube assembly. Turn key 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 12.25 in (31.115 cm).

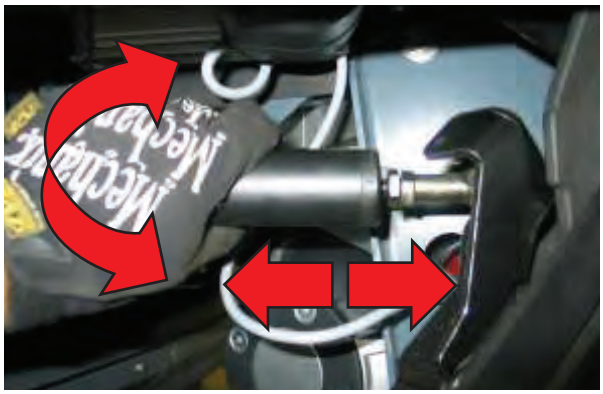


4. The final adjustment should be made following an inspection of the side scrub brush in the raised/retracted position. The bottom of the brush hub should be 3.75-4.00 in (9.5-10.2 cm) from the floor to allow for brush replacement clearance. Tighten the jam nut when the desired height has been reached.

3. Key On, 1-STEP scrub On, side brush switch On. Allow the side brush to lower completely and then turn the key off.

4. Loosen forward jam nut on side brush spring tube assembly.

5. Turn the spring tube assembly CW to shorten the tube, thereby opening the adjustment gap in Step 2. Turn the spring tube assembly CCW to lengthen the tube, therby closing the adjustment gap in Step 2. Cycle the side brush up down to check the gap.



6. Tighten the jam nut.

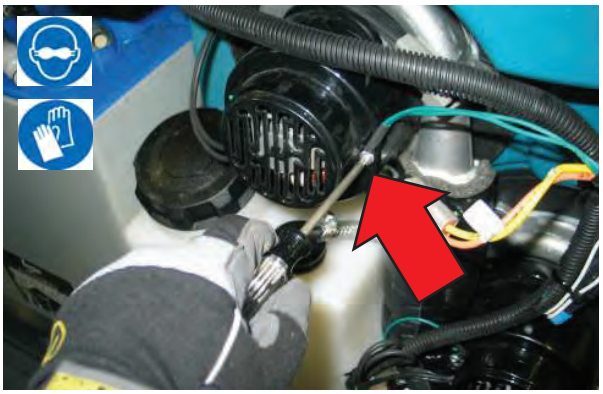
VACUUM FAN ASSEMBLY

REMOVING VACUUM FAN ASSEMBLY

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

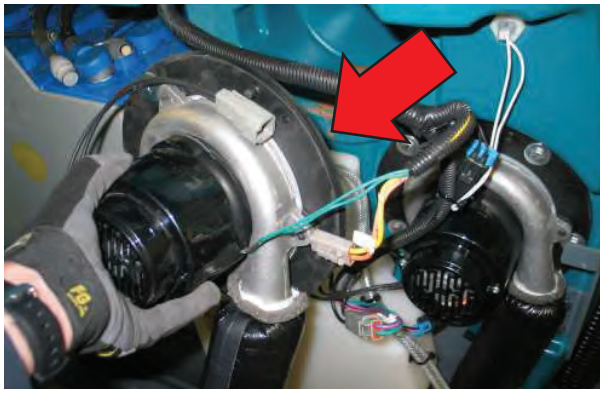
1. Key Off and disconnect battery.

2. Disconnect vacuum fan from wire harness connections.



3. Remove vacuum fan mounting hardware (5).

4. Remove vacuum fan assembly.



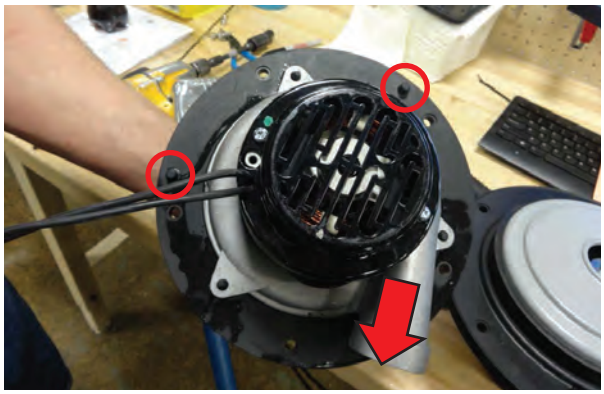
5. Draw a line across the vacuum fan assembly and the mounting flange as an orientation indicator for re-assembly.

6. Loosen the clamp and remove mounting flange from vacuum fan assembly.

7. Disconnect muffler from vacuum fan assembly.

INSTALLING VACUUM FAN ASSEMBLY

1. Note the orientation of the vacuum fan exhaust port to the rubber indicators for proper installation.



2. Remainder of installation is reverse of removal.

SIDE BRUSH MOTOR

REMOVING SIDE BRUSH MOTOR

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

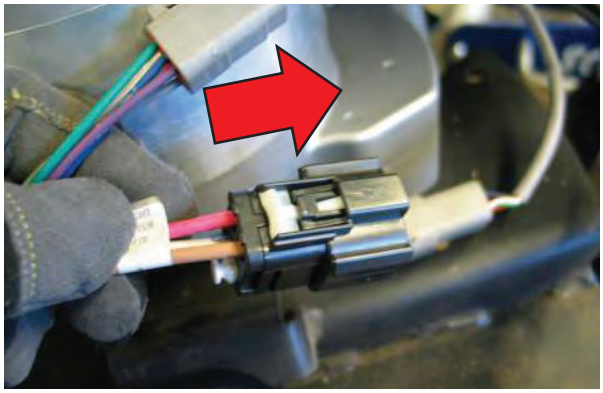
1. Jack front of machine and support using jack stands or support blocks.
2. Remove side brush and side brush squeegee assembly and set aside.
3. Remove side brush hub mounting bolt (1) and hub and set aside.

4. Remove motor mounting hardware (4) and set aside.

5. Key On, 1-STEP Scrub On, side brush On and allow side brush motor to lower completely. Turn Key Off.
6. Remove side brush cover mounting hardware (2) and set aside.

7. Disconnect side brush motor from wire harness and remove side brush motor.

NOTE: Slide white locking tab inward and then press the release button.



8. Remove side brush motor.

INSTALLING SIDE BRUSH MOTOR

1. Installation is the reverse of removal. .

NOTE: Apply anti-seize to side brush motor shaft and motor/hub mounting hardware.

MAIN BRUSH LIFT ACTUATOR

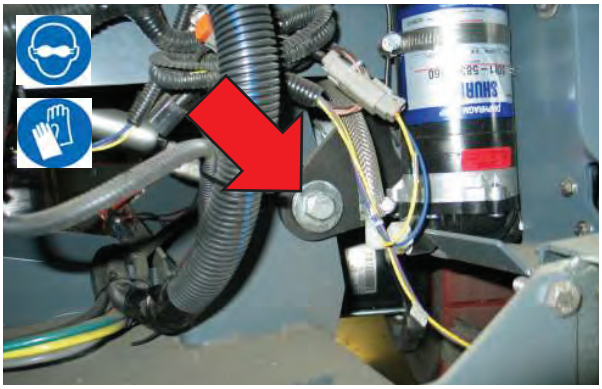
REMOVING MAIN BRUSH LIFT ACTUATOR

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

1. Key Off. Disconnect batteries.
2. Remove Scrub Brushes.
3. Carefully remove front linkage pivot bolts (2).

NOTE: The front of the scrub deck will drop to the floor once the mounting hardware is removed.

WARNING: Pinch point.

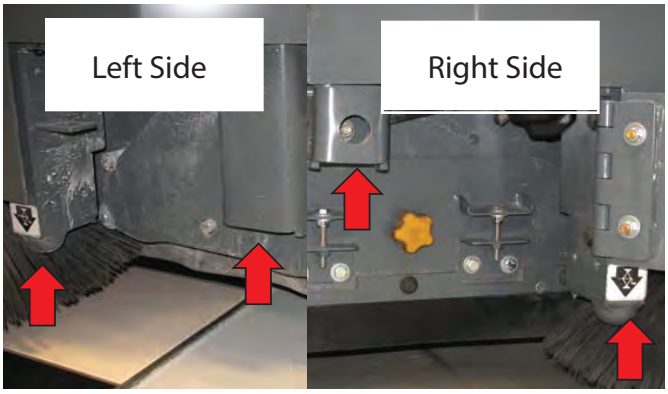


4. Carefully remove rear linkage pivot bolts (2).

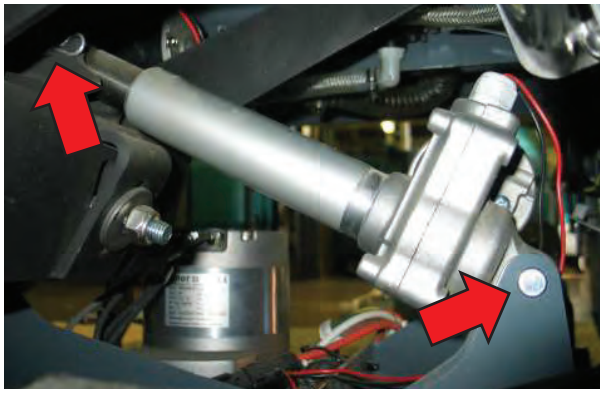
NOTE: The rear of the scrub deck will drop to the floor once the mounting hardware is removed.

WARNING: Pinch point.

5. Jack front of machine and support using jack stands or support blocks.



6. Disconnect lift actuator from wire harness.
7. Remove lift actuator mounting pins (2).



8. Remove lift actuator.

INSTALLING MAIN BRUSH LIFT ACTUATOR

1. Key Off. Disconnect batteries.

2. Installation is the reverse of removal.

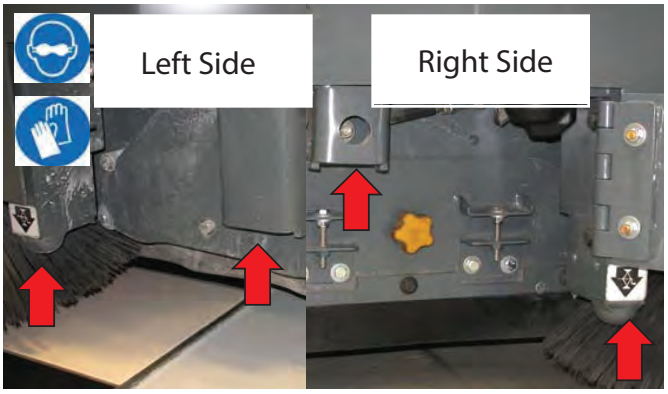
NOTE: This actuator does not require an installation adjustment. Turn the actuator tube manually to align the mounting holes and insert clevis and cotter pins.

MAIN SCRUB HEAD

REMOVING MAIN SCRUB HEAD

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

1. Drain solution tank and turn key Off.
2. Remove scrub brushes and debris tray (cylindrical only).
3. Jack front of machine and support using jack stands or support blocks.

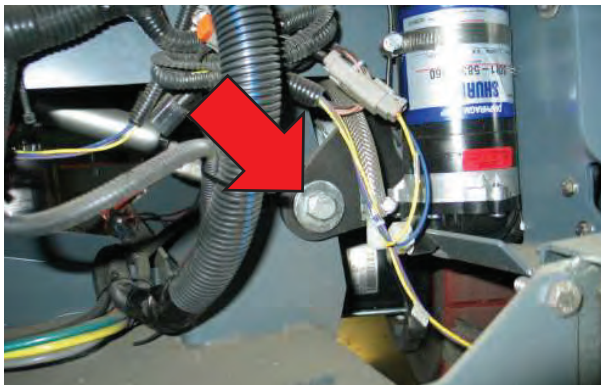


4. Enter Manual Mode and lower scrub head completely (See Manual Mode in the Troubleshooting section of this manual). Turn key Off immediately when head touches the floor.

5. Carefully remove front linkage pivot bolts (2).

NOTE: The front of the scrub deck will drop to the floor once the mounting hardware is removed.

WARNING: Pinch point.

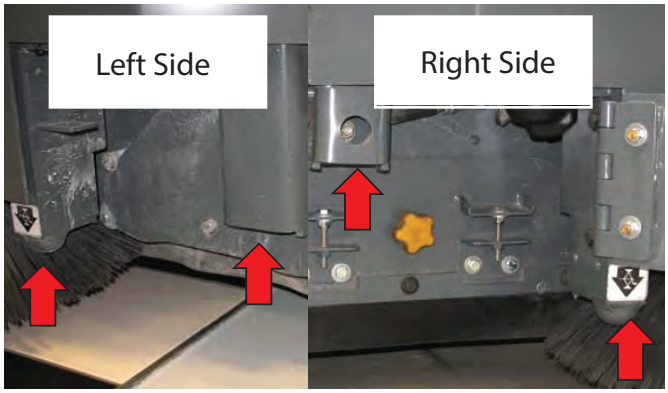


6. Carefully remove rear linkage pivot bolts (2).

NOTE: The rear of the scrub deck will drop to the floor once the mounting hardware is removed.

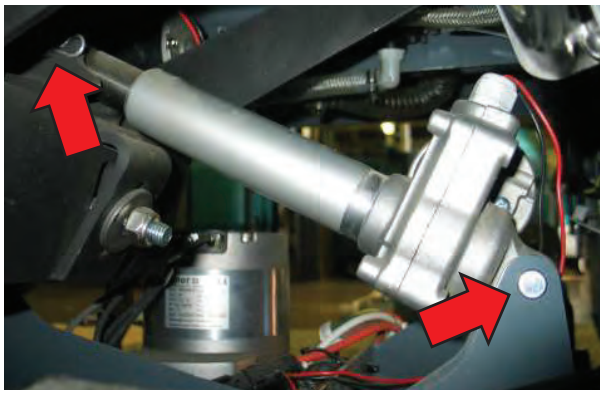
WARNING: Pinch point.

7. Jack front of machine and support using jack stands or support blocks.



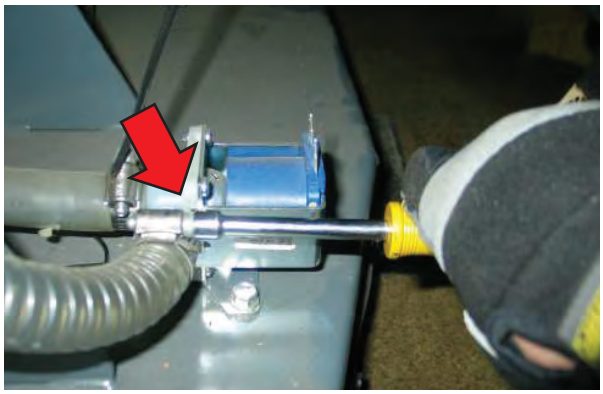
8. Disconnect lift actuator from wire harness.

9. Remove lift actuator mounting pins (2).



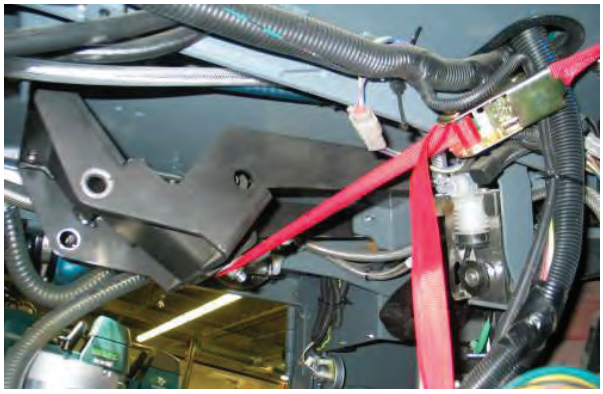
10. Remove lift actuator.

11. Disconnect water valve from wire harness and solution hose.

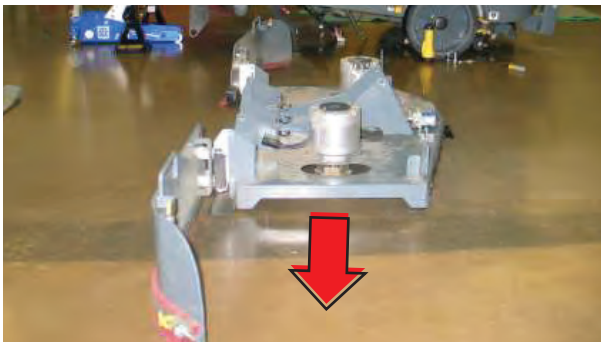


NOTE: The solution tank will drain from this hose. Be sure to drain the solution tank prior to removing the hose. (See Step 1.)

12. Use a ratchet strap to support the lift mechanism to avoid interference during scrub head removal.



13. Remove scrub head.



INSTALLING MAIN SCRUB HEAD

1. Key Off. Disconnect batteries.

2. Installation is the reverse of removal.

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.

3. *Cylindrical Scrub Deck Only: See CYLINDRICAL PATTERN ADJUSTMENT PROCEDURE in the maintenance section of this manual.*

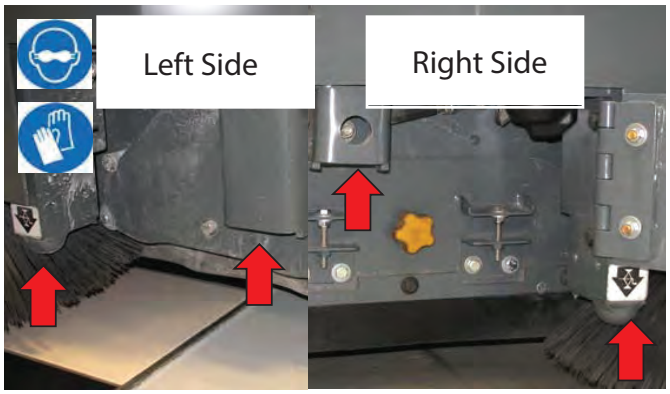
MAIN SCRUB BRUSH MOTOR (CYLINDRICAL)

REMOVING MAIN BRUSH MOTOR

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

FOR SAFETY: When servicing machine, jack machine up at designated locations only. Block machine up with jack stands.

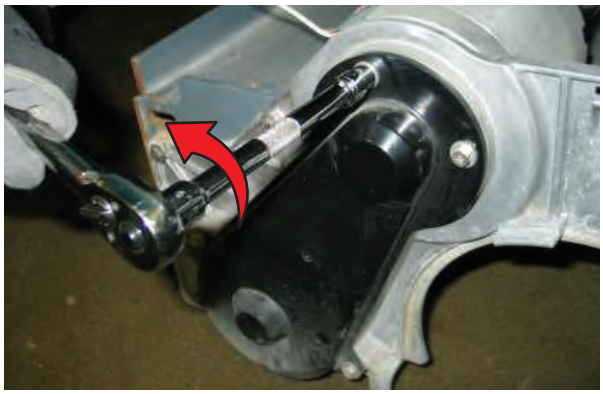
1. Jack front of machine and support using jack stands or support blocks.



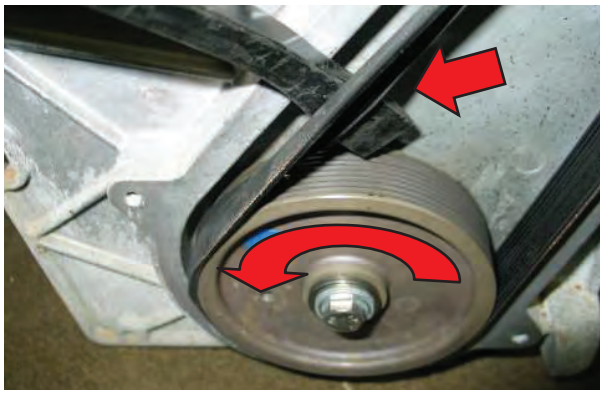
2. Remove scrub brushes.

3. Enter Manual Mode and lower scrub head completely (See Manual Mode in the Troubleshooting section of this manual). Turn key Off immediately when head touches the floor.

4. Remove belt cover bolts (2) and set cover and hardware aside.



5. Remove belt by turning pulleys and applying outward pressure on the belt.

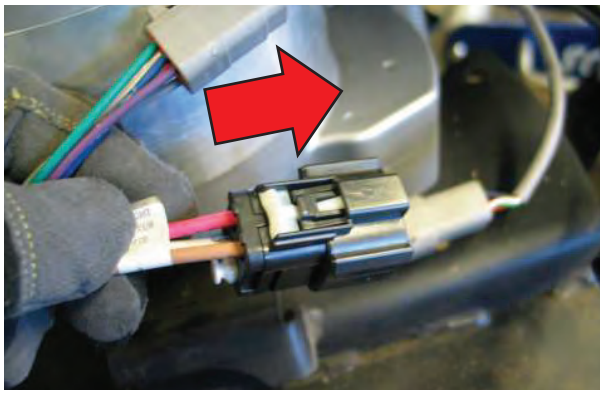


6. Remove motor mounting hardware (4) and set aside.

7. Remove motor mounting hardware (4) and set aside.

8. Disconnect main brush motor from wire harness and remove main brush motor.

NOTE: Slide white locking tab inward and then press the release button.



INSTALLING MAIN BRUSH MOTOR

1. Installation is the reverse of removal.

INSTRUMENT PANEL

REMOVING INSTRUMENT PANEL

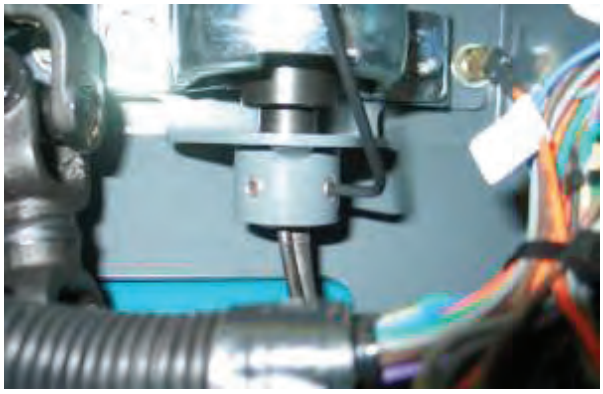
FOR SAFETY: Before leaving or servicing machine, stop on level surface, set parking brake, turn off machine and remove key.

FOR SAFETY: When servicing machine, disconnect bat-tery connections before working on machine.

1. Key Off. Disconnect battery.
2. Remove front access panel.

3. Cut zip tie securing instrument panel wire harness connections.
4. Disconnect instrument panel connector.

5. Loosen set screws (2) securing instrument panel mounting tube.



6. Remove instrument panel assembly.

INSTALLING INSTRUMENT PANEL

1. Installation is the reverse of removal.
2. See CONFIGURATION MODE in the troubleshooting section of this manual to configure the new instru-ment panel.

LOGIC BOARD REPLACEMENT

REMOVING LOGIC BOARD

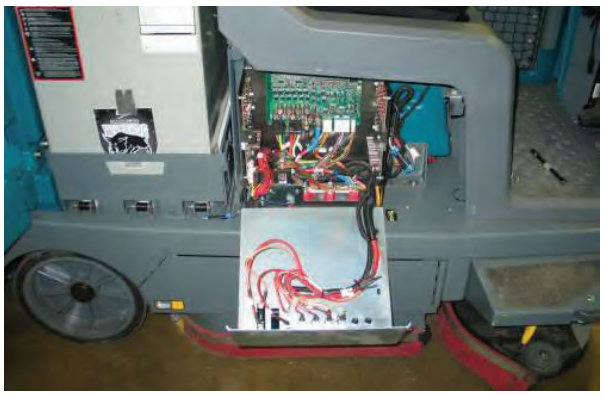
FOR SAFETY: Before leaving or servicing machine, stop on level surface, set parking brake, turn off machine and remove key.

FOR SAFETY: When servicing machine, disconnect bat-tery connections before working on machine.

1. Key Off. Disconnect batteries.

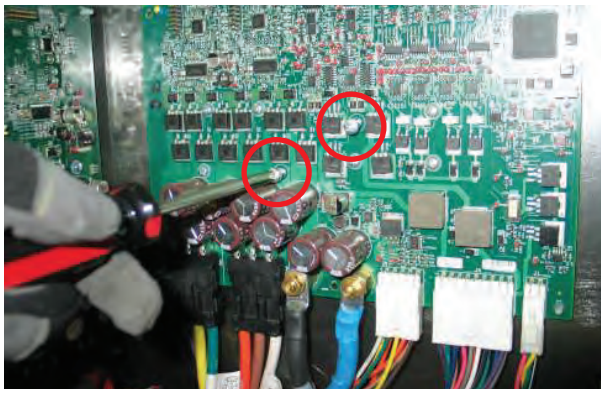
2. Open RH side access door.

3. Remove electrical box cover mounting bolts (2) and carefully lower the cover.



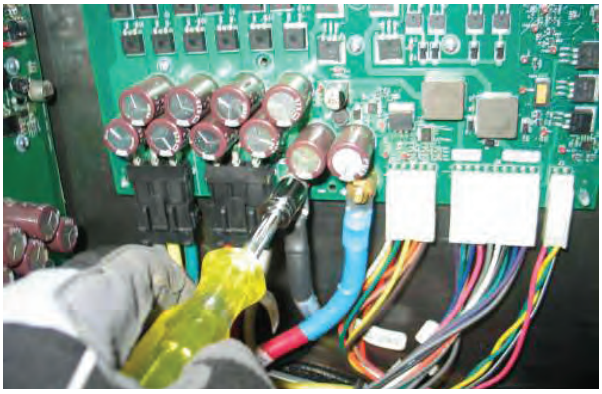
4. Attach a wrist static strap tool to a bare metal surface.

5. Remove logic board mounting screws (2).



6. Carefully squeeze to release the plastic mounting clips securing the logic board to the control box.

7. Disconnect cables and connectors from logic board.



NOTE: Always use two wrenches when securing the power supply terminals or damage to the circuit board will occur. Also, make sure the power supply terminals are secured on the new board before installation. The torque specification is 30-36 in-lbs (339-407 Ncm).

8. Remove logic board.

INSTALLING LOGIC BOARD

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

1. Attach a wrist static strap tool to a metal surface.

2. Remainder of installation is the reverse of removal.

NOTE: Always use two wrenches when securing the power supply terminals or damage to the circuit board will occur. Also, make sure the power supply terminals are secured on the new board before installation. The torque specification is 30-36 in-lbs (339-407 Ncm).

STEERING WHEEL TIMING

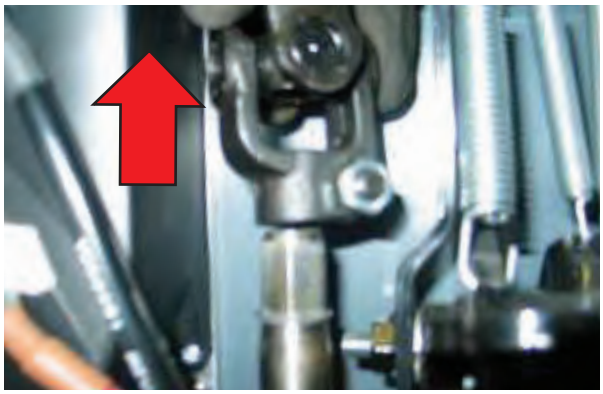
FOR SAFETY: Before leaving or servicing machine, stop on level surface, set parking brake, turn off machine and remove key.

1. Key Off. Disconnect batteries.

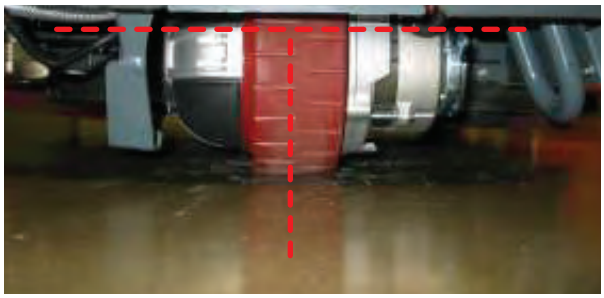
2. Remove front access panel.

3. Loosen steering shaft hardware.

4. Lift steering u-joint off splined shaft.



5. Align the front drive tire with the centerline of the machine.



6. Orientate the steering wheel as shown below.

7. 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.

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REAR BRAKE ADJUSTMENT

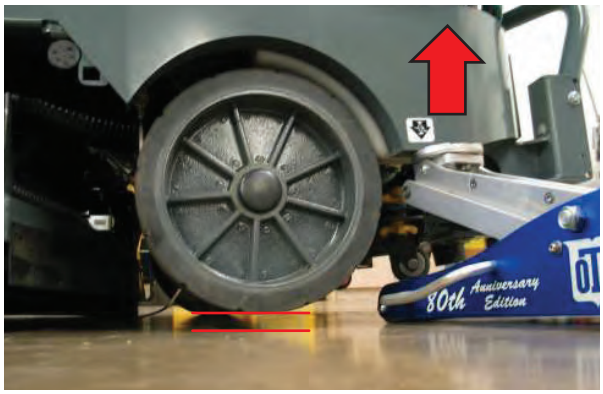
FOR SAFETY: Before leaving or servicing machine, empty solution and recovery tanks, stop on level surface, turn off machine and remove key.

FOR SAFETY: Chock front wheel when jacking rear of machine to prevent machine from rolling.

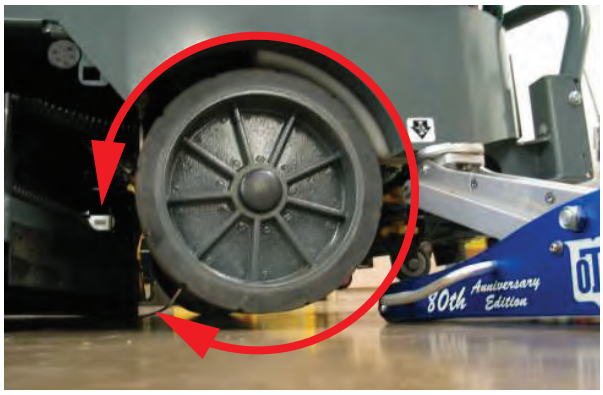
FOR SAFETY: When servicing machine, disconnect battery connection before working on machine.

1. Key off. Open main brush doors.
2. Remove rear squeegee and set aside.

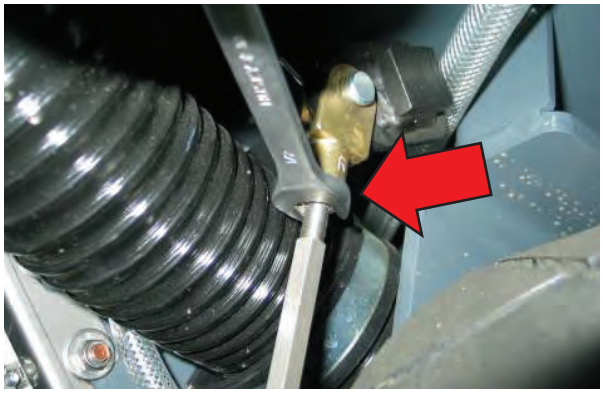
3. Place wheel chocks on both sides of the front wheel.
4. Jack rear of machine until rear wheel is off the floor.



5. Be sure that parking brake is released. Rear wheel should spin freely.



6. Loosen jam nut on rear adjustment rod.



7. Turn the adjuster until the wheel stops spinning freely and then back off two turns.

8. Tighten jam nut and repeat process for other wheel.

MAIN SWEEP BRUSH MOTOR REPLACEMENT

Raise the sweeping main brush and turn off the machine.

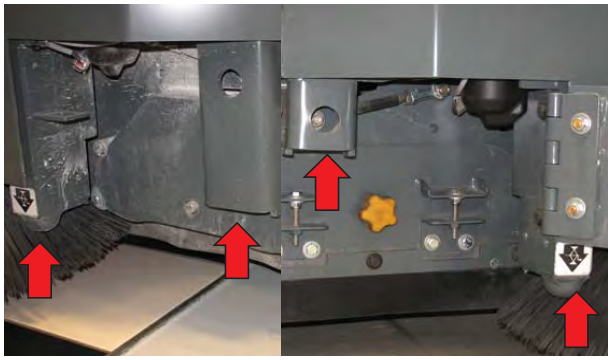
FOR SAFETY: Before leaving or servicing machine, empty solution and recovery tanks, stop on level surface, turn off machine, set parking brake, and remove key.

1. Open the main sweeping brush compartment access door.

2. Remove idler plate.

3. Remove the brushes from the main sweep compartment.

4. Jack both sides of machine. Be sure to use wheel chocks and jack stands.



5. Remove access panel hardware.

6. Disconnect electrical, remove belt and then remove hardware to remove motor(s).

INSTALLING **MAIN SWEEP MOTOR** ASSEMBLY

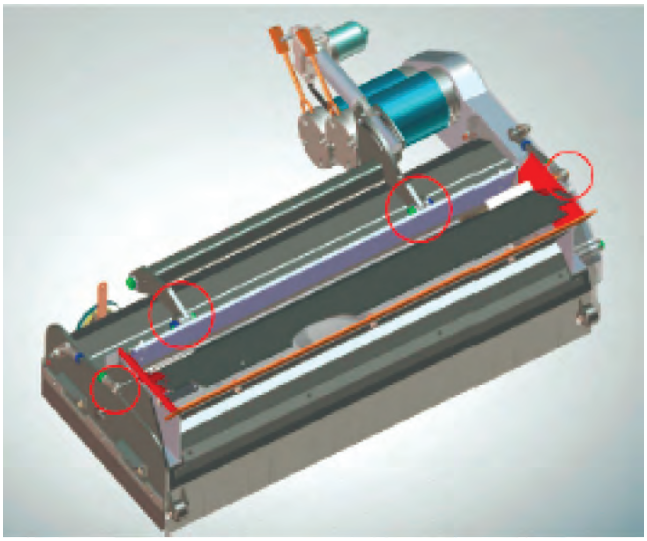
1. Installation is the reverse of removal.

MAIN SWEEP HOUSING REMOVAL PROCEDURE

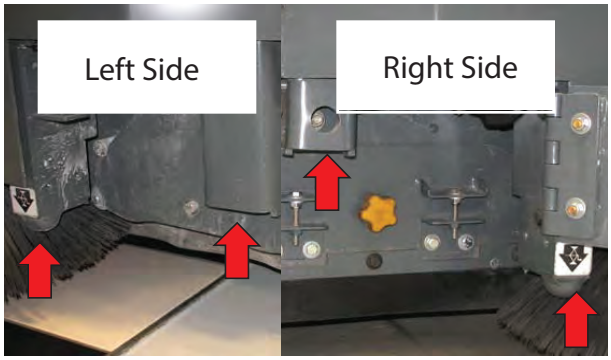
Lower the sweeping main brush and turn off the machine.

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

1. Remove main brushes and motor housing assemble.(See Main Sweep Brush Motor Replacement page 5-24)
2. Lower deck to floor. (Disconnect Electrical)
3. Remove clevis pins and hardware to link-arms.



4. Jack both sides of machine. Be sure to use wheel chocks and jack stands.



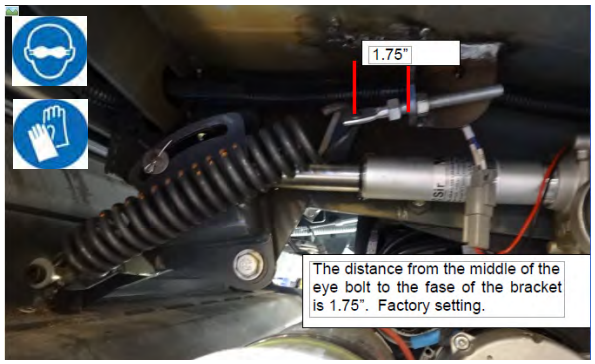
5. Slide assemble out.

INSTALLING MAIN SWEEP HOUSING ASSEMBLY

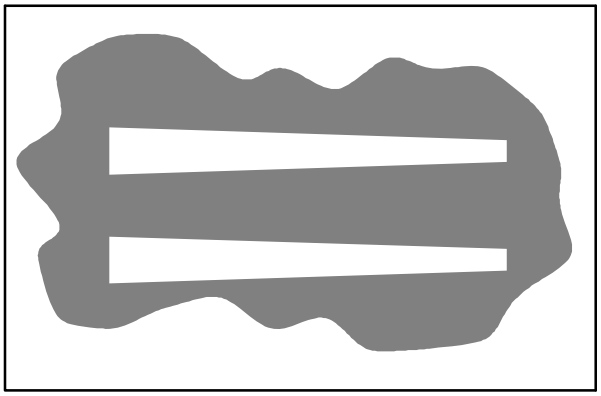
1. Installation is the reverse of removal.

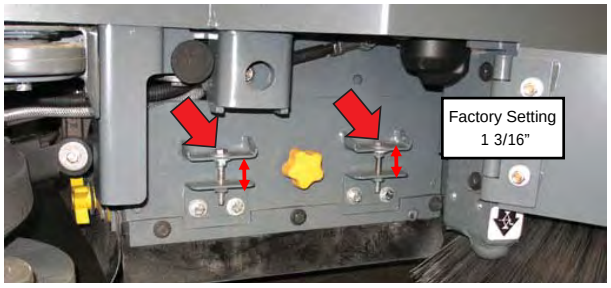
MAIN SWEEP BRUSH PATTERN PROCEDURE

1. Before driving over to pattern area use manual mode to verify motor currents of each brush.
   A. This should be done on a flat surface, variation will be seen if not done on a consistent area.
   B. Currents of each brush motor should be as close to each other as possible.
   C. Currents should fall between 12-15 amps on smooth surface.
   D. If current is low loosen the eye bolt attached to the spring, if high then tighten the eye bolt..

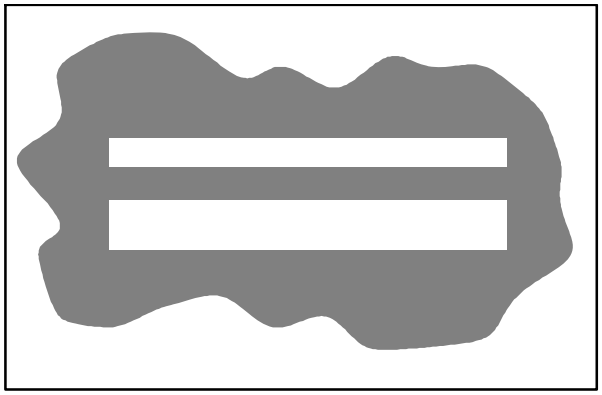


2. Once at the pattern area adjust brush taper first.
   A. Loosen bolts on handle.
   B. Tighten adjustment bolt to raise the right side of the brush (if pattern is heavy to the right of the machine).
   C. Loosen adjustment bolt to lower the right side of the brush (if pattern is light on the right of the machine).

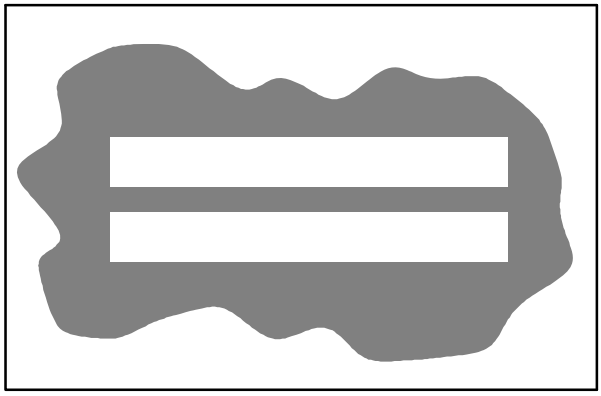




3. With taper set use left and right rod-ends to adjust the evenness between front to back brush pattern.
   A. Pattern should be 1.50" varying across the pattern by no more than .25".
   B. When adjusting with rod-ends always use the same number of turns per side.
   C. Clockwise will tilt the head rearward, lightening the front brush and making the rear brush pattern heavier.
   D. Counter-clockwise will tilt the head frontward, lightening the rear brush and making the front brush pattern heavier.



4. If pattern is even front to back with acceptable taper but still under 1.25" at the smallest width the lift spring may need to be adjusted.
   A. Loosen the spring eye bolt one thread to make the pattern heavier.



ROLL OUT ACTUATOR REPLACEMENT

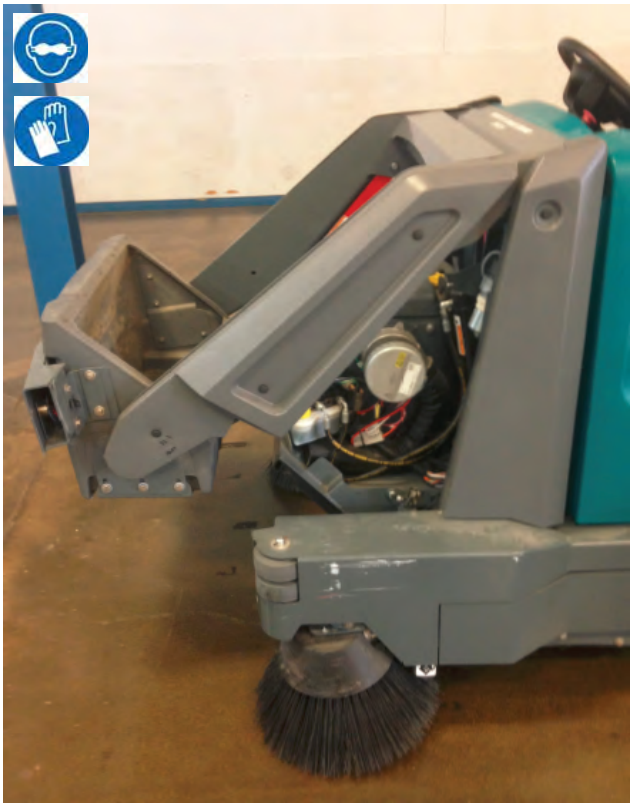
FOR SAFETY: Before leaving or servicing machine, stop on level surface, set parking brake, turn off machine and remove key.

FOR SAFETY: When servicing machine, avoid moving parts. Do not wear loose jackets, shirts, or sleeves when working on machine.

WARNING: Lift arm pinch point. Stay clear of hopper lift arms.

WARNING: Raised hopper may fall. Follow steps to support arms.

1 . Key on, raise hopper arms to allow enough clearance so hopper will rotate and clear machine.



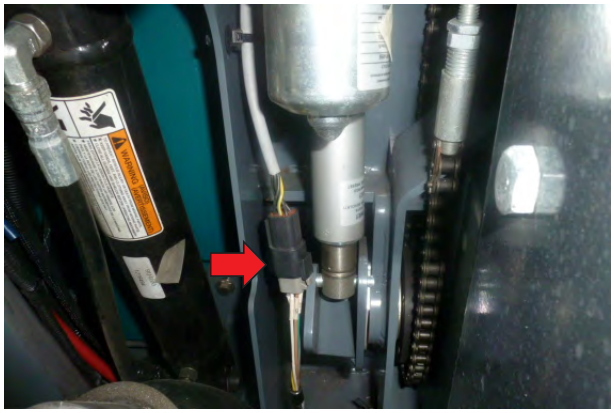
2. Slowly lower the hopper until the hopper arms and hopper rest on the jack stands. Set jack stands for hopper in an off-set position front to rear.

NOTE: Hopper must have clearance to free spin in later steps.

WARNING: The stands under hopper at this step will prevent hopper from being able to free spin causing hopper chain movement.

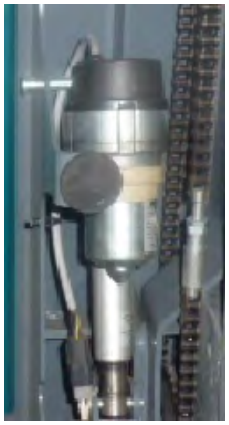
3. Key off.

4. Disconnect roll out actuator from the wire harness.

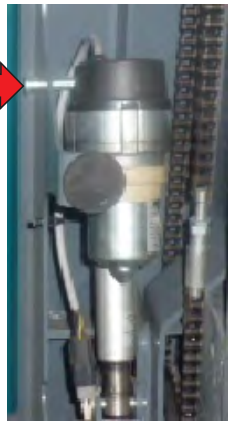


WARNING: The stands under hopper at this step will prevent hopper from being able to free spin causing hopper chain movement.

5. Confirm hopper arm weldment and sprocket do not rotate if they do re-adjust jack stands under hopper.



6. Remove pins from actuator.



ROLL OUT ACTUATOR AND PROGRAMMING INSTRUCTIONS (con't).

1. The actuator should be installed roughly 0.75 inch extended from full retraction when the hopper is in the down stored position.
    a. Note: Any time the actuator is being used near the ends of its stroke, it should only be powered by 12 Volts. Manual Mode limits the actuator to 12 Volts. (See page 4-24 for Manual Mode)

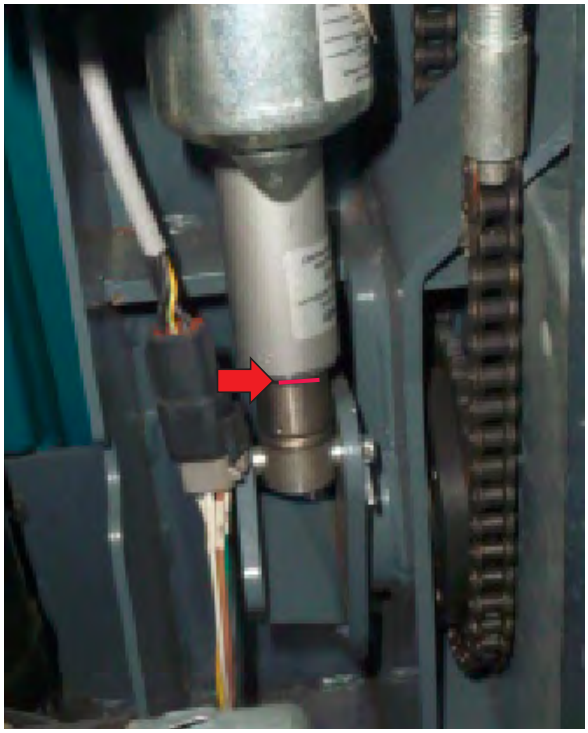
Set to 0.75

2. Remove jack stands and with the actuator installed, actuator retracted to pull the bumper against the frame, and the bumper aligned to the frame, enter Manual Mode (See page 4-24). Navigate and select the 'Set Roll Home' screen and press the down pressure button (Standard POD) or 'checkmark' button (ProPanel POD) to store the hopper home value.

WARNING: Lift arm pinch point. Stay clear of hopper lift arms.

WARNING: Raised hopper may fall.

3. Use Manual Mode to roll hopper out to "Seal Breakaway Position" and raise the hopper until it can safely roll fully without contacting the machine (try not to go beyond horizontal with the arms so enough room is left for the hopper to roll without the bumper contacting the arms).
4. In the position in Item 2, while still in Manual Mode, fully retract the actuator by rolling the hopper all the way in.
5. Using a Sharpie, mark the rod at the end of the cylindrical housing it moves within. This will be used as a reference point for the next step.



6. Using Manual Mode controls, extend the actuator 0.5 inches from the fully retracted position in steps 3 and 4.

7. Navigate to and select the 'Set Roll Min' screen in Manual Mode (See page 4-24) and press the down pressure button (Standard POD) or 'checkmark' button (ProPanel POD) to store the minimum roll value.
8. Using Manual Mode (See page 4-24) controls, extend the actuator until the hopper stops.
9. Using a Sharpie, mark the rod 0.5 inches from the end of the cylindrical housing it moves within. This will be used as a reference point for the next step.

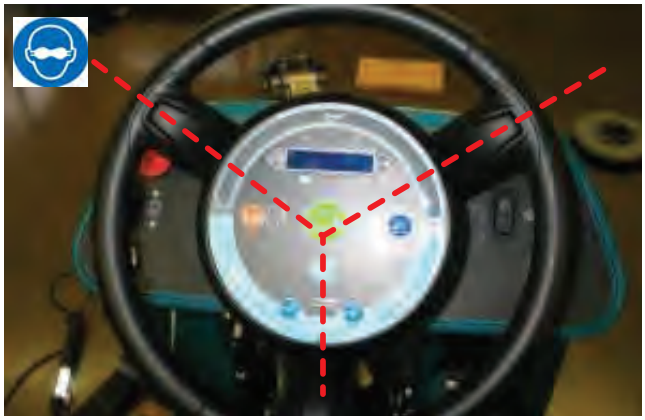
10. Using Manual Mode (See page 4-24) controls, retract the actuator to align the mark in Step 8 with the end of the cylindrical housing.
11. Navigate to and select the 'Set Roll Max' screen in Manual Mode (See page 4-24) and press the down pressure button (Standard POD) or 'checkmark' button (ProPanel POD) to store the maximum roll value.
12. Key-cycle the machine and lower the hopper to seal the bumper against the frame using standard machine controls (This will seal the bumper against the frame using the normal actuator current limits).
13. Enter Manual Mode (See page 4-24) again and navigate to and again select the 'Set Roll Home' screen and press the down pressure button (Standard POD) or 'checkmark' button (ProPanel POD) to store the hopper home value.
    a. The first time this is done is to provide a close position of the hopper for the machine to use in its normal mode to seal the bumper against the frame.
14. Key-cycle the machine to begin using the newly entered values. Then verify that the hopper lift, roll, and lower features function properly using Manual Mode controls, extend the actuator.

CALIBRATION OF POWER STEERING

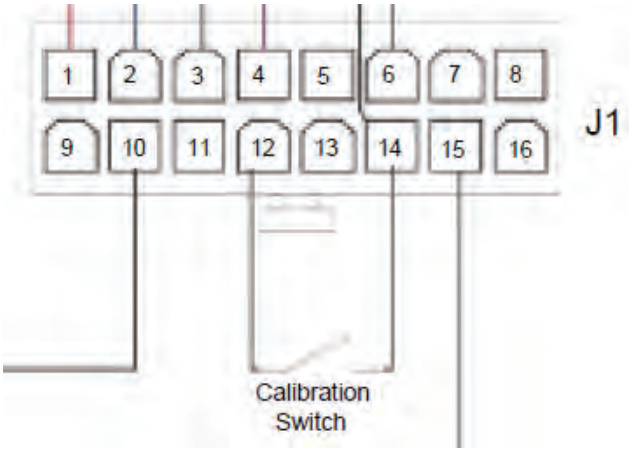
FOR SAFETY: Before leaving or servicing machine, stop on level surface, set parking brake, turn off machine and remove key.

FOR SAFETY: When servicing machine, avoid moving parts. Do not wear loose jackets, shirts, or sleeves when working on machine.

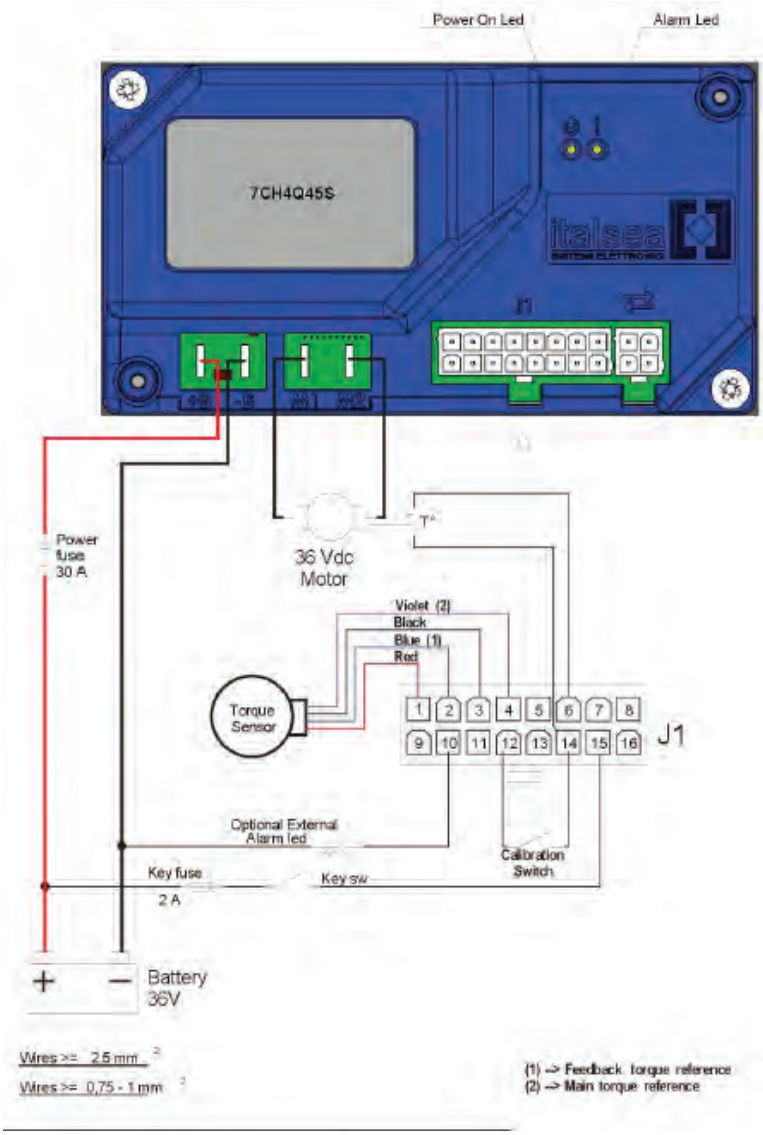
1. Key On. Orientate the steering wheel as shown below.



2. Connect normally-open switch to spade terminals on harness (connect to pins 12 and 14, as shown below). Toggle switch 4 times with-in a 3 second period. Red LED will turn on for 2 seconds, steering is now calibrated.



POWER STEERING - Wiring

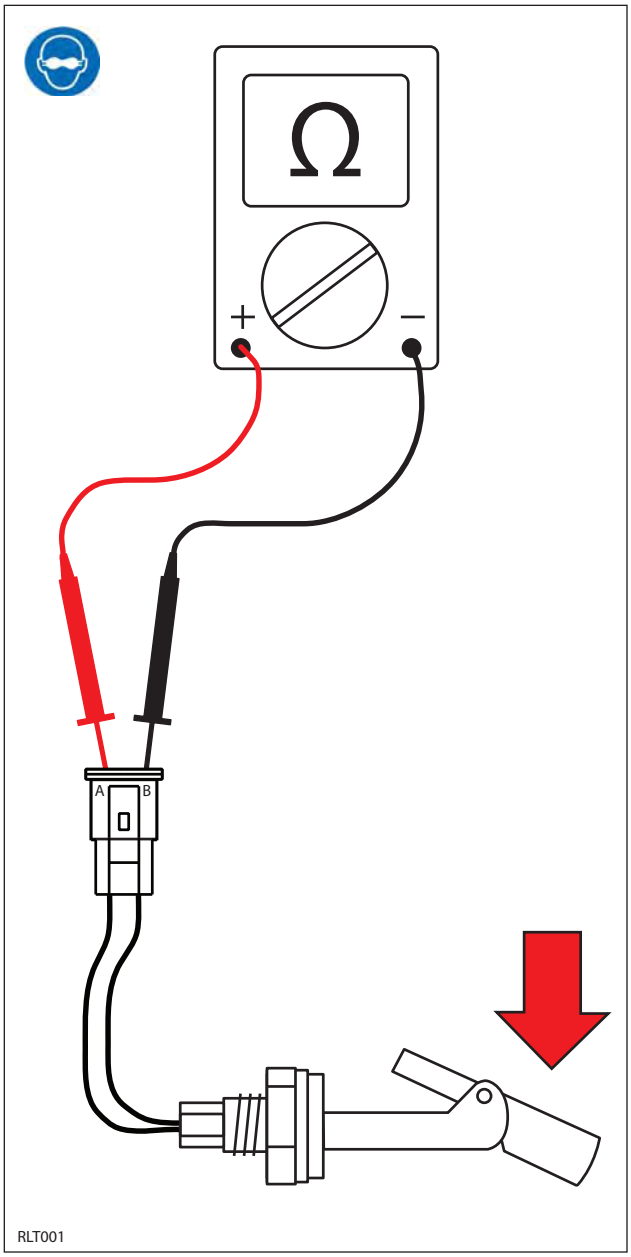


NOTES:
- Use a momentary switch for "calibration switch" appropriately rated.
- After calibration, the steering should be turned left and right to confirm that force is the same - if not, steering should be centered again, and calibration should be run again.

TESTING RECOVERY TANK LEVEL SENSORS

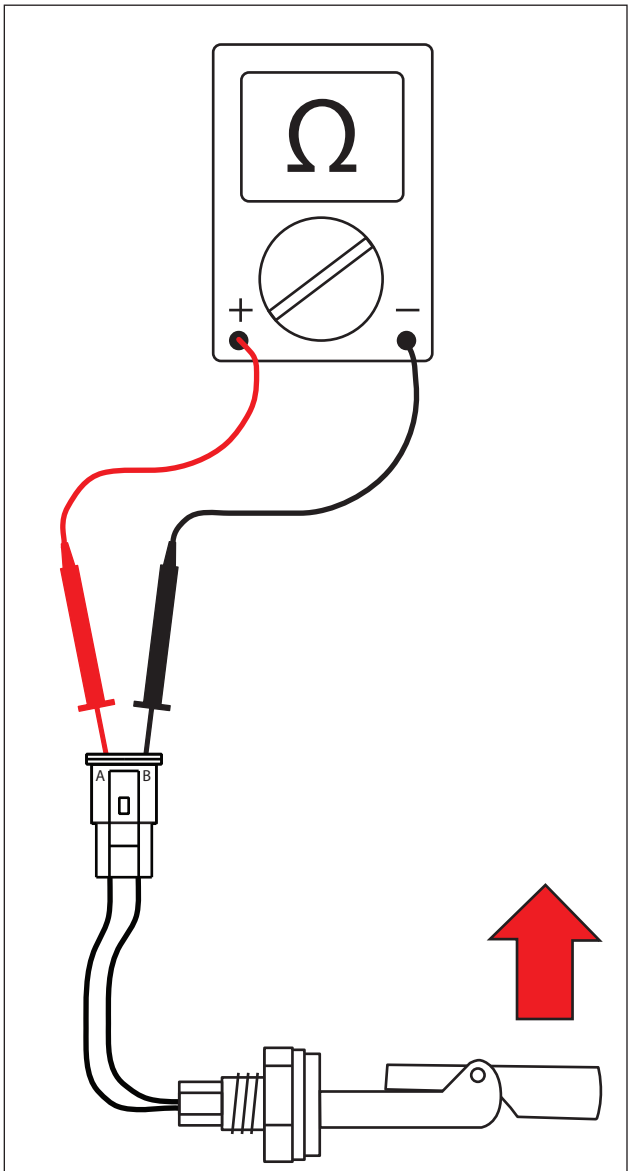
FOR SAFETY: Before leaving or servicing machine, stop on level surface, set parking brake, turn off machine and remove key.

1. Test the resistance of the recovery tank level sensor using an ohmmeter as shown below. The tank level switch should test as "O.L." or open.



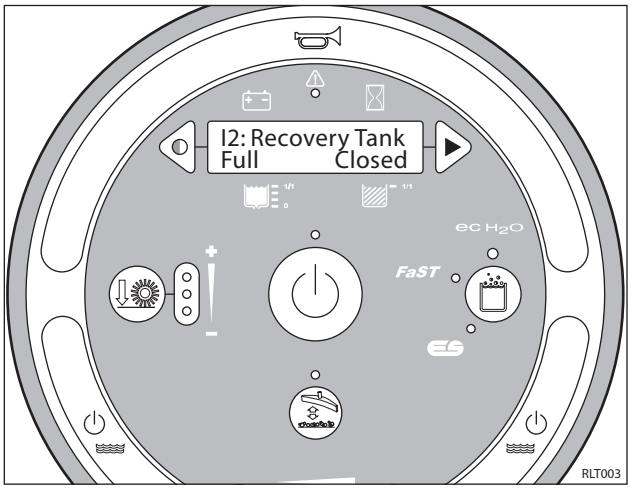
RLT001

2. Test the resistance of the recovery tank level sensor using an ohmmeter as shown below. The tank level switch should test at 0-1 ohms or closed.



RLT002

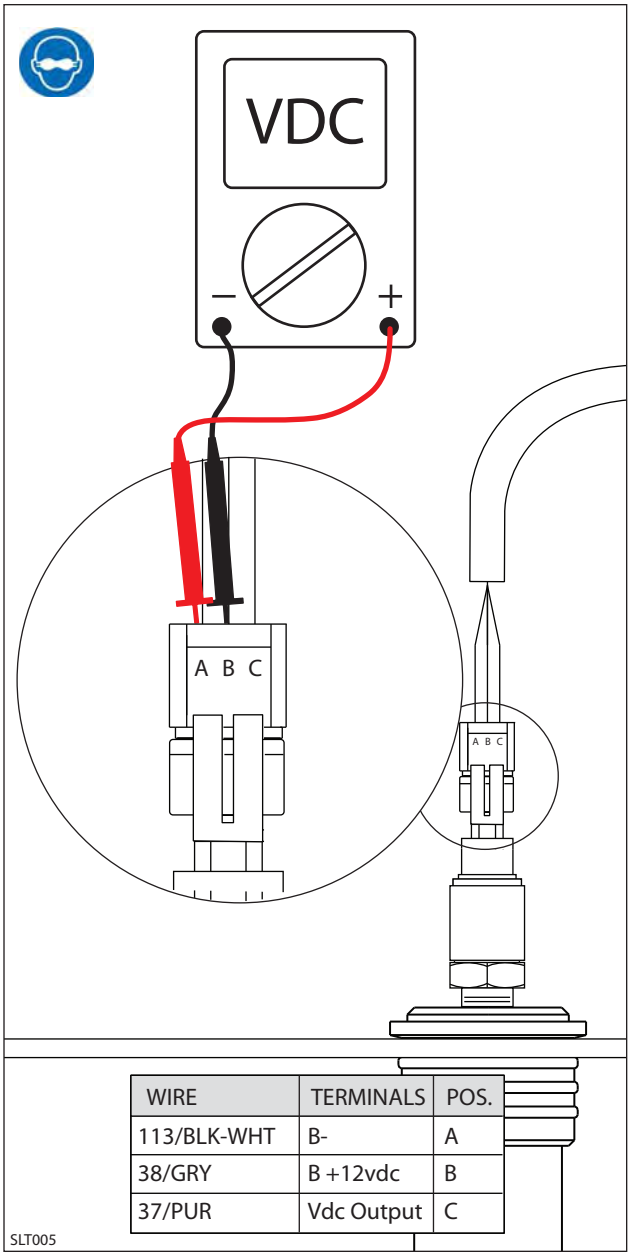
3. The recovery tank full and half-full sensor conditions are also viewable in Input Display Mode. See "Input Display Mode" in the TROUBLESHOOTING section of this manual.



TESTING SOLUTION TANK LEVEL SENSOR

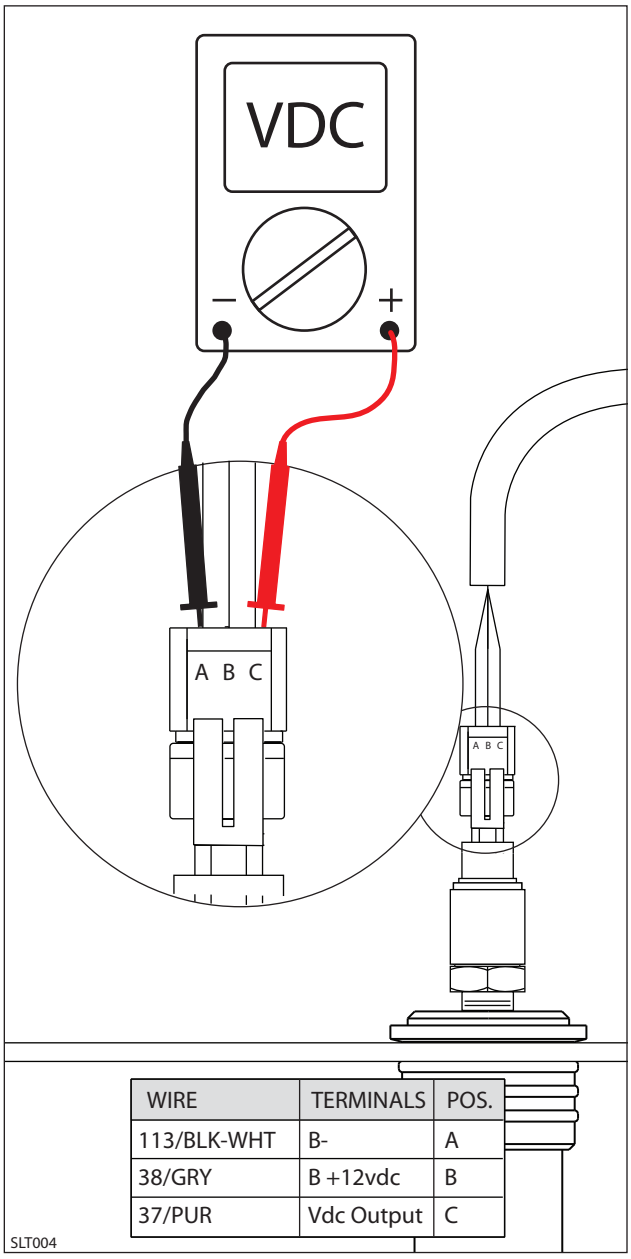
FOR SAFETY: Before leaving or servicing machine, stop on level surface, set parking brake, turn off machine and remove key.

1. Key On. Backprobe solution tank level sensor connector terminals A and B using a voltmeter as shown below. The voltmeter should display 10-12 volts.



WIRE	TERMINALS	POS.
113/BLK-WHT	B-	A
38/GRY	B +12vdc	B
37/PUR	Vdc Output	C

2. Key On. Backprobe solution tank level sensor connector terminals A and C using a voltmeter as shown below. The voltmeter should display 1-5 volts depending on solution tank water level.



WIRE	TERMINALS	POS.
113/BLK-WHT	B-	A
38/GRY	B +12vdc	B
37/PUR	Vdc Output	C

3. Drain the solution tank.

4. 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

SLT002

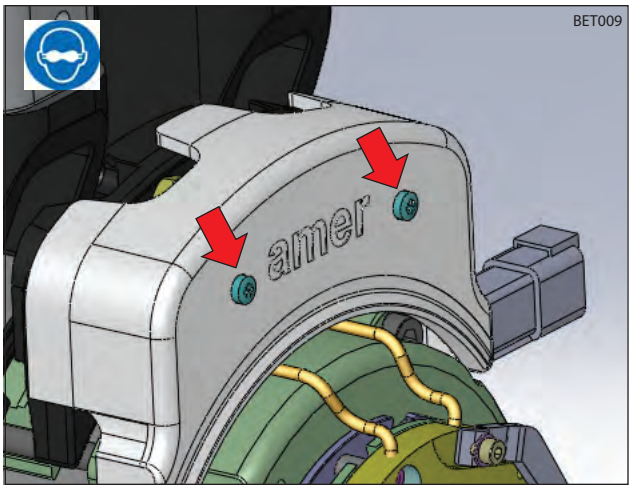
5. The solution tank level sensor output voltage is also viewable in Input Display Mode. See "Input Display Mode" in the TROUBLESHOOTING section.

TESTING PROPEL MOTOR

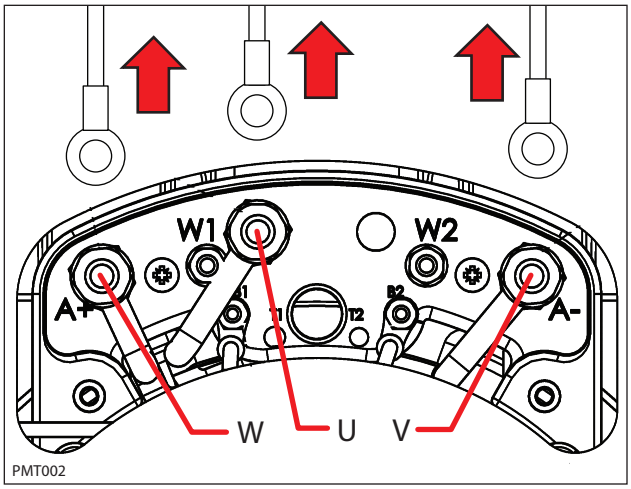
FOR SAFETY: Before leaving or servicing machine, empty solution and recovery tanks, stop on level surface, set parking brake, turn off machine and remove key.

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

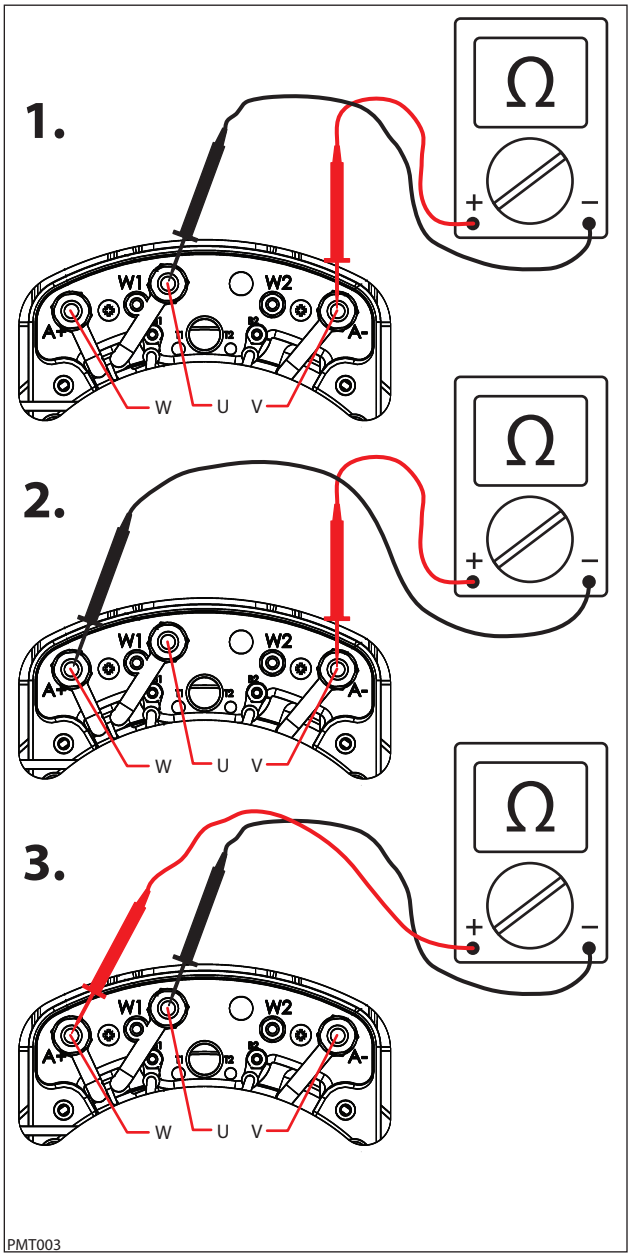
1. Key Off. Remove terminal box cover screws and set cover aside.



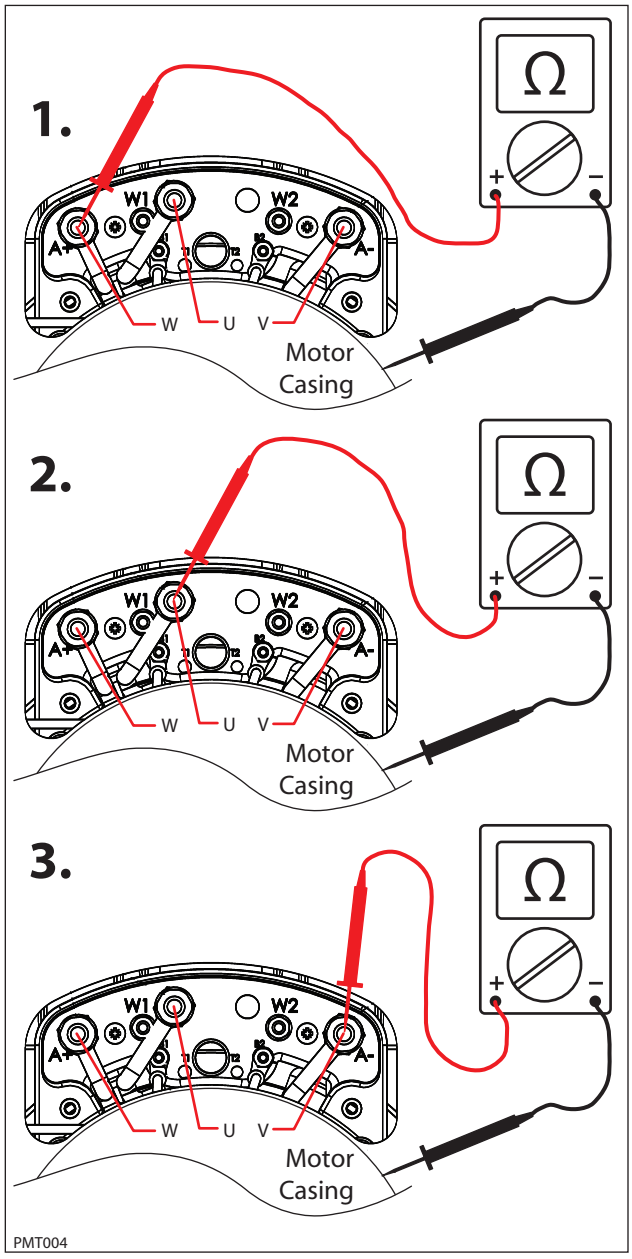
2. Disconnect U, V, and W cables from W1, A-, and A+ terminals (respectively).



3. Test the resistance of all three motor windings using an ohmmeter as shown below. The resistances of each winding should not be open (O.L). An open winding indicates a faulty motor.

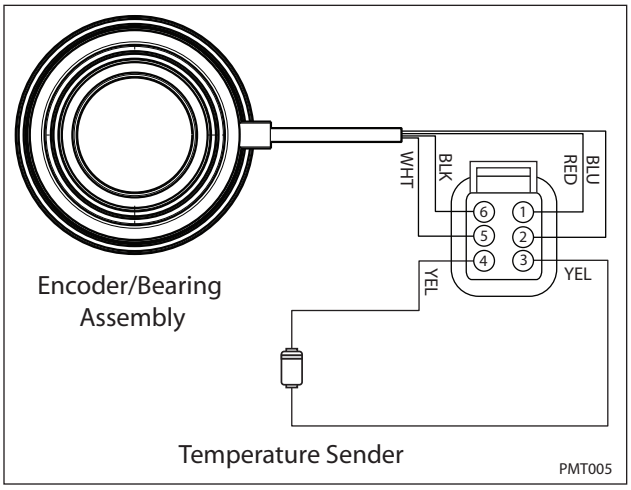


4. Test the resistance between all three motor terminals and the motor case as shown below. The ohmmeter should read "O.L." or open. A shorted winding indi cates a faulty motor.



5. The motor encoder and temperature sender are non-serviceable components of the drive motor. The motor encoder senses rotor position, speed, and direction. The encoder is integrated into an internal roller bearing assembly. See "Curtis 1232 LED Faults" in the TROUBLESHOOTING section for encoder related faults.

   The temperature sender senses the propel motor temperature. Test the resistance of the temperature sender using an ohmmeter and then compare the values to the chart below. Replace the motor assembly if the resistance values are out of the specified range.



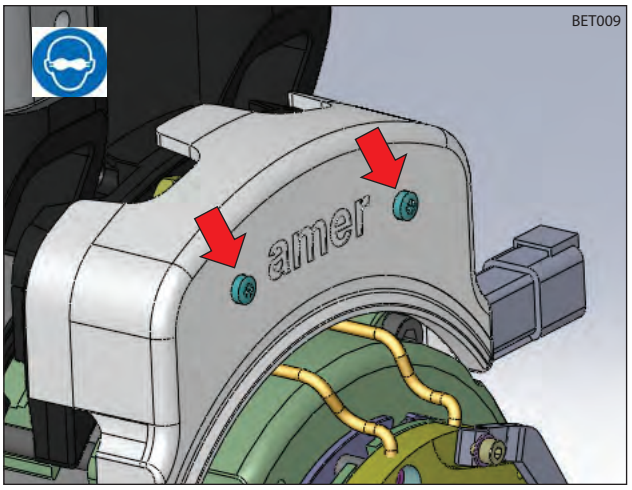
TEMPERATURE		RESISTANCE (Ω)		
(°C)	(°F)	MIN.	TYP.	MAX
-30	-22	362	381	368
0	32	464	486	507
25	77	565	588	611
30	86	587	610	633
50	122	679	704	728
70	158	781	806	831
80	176	835	860	885
100	212	950	975	1000
110	230	1007	1036	1064

TESTING PROPEL MOTOR CABLES

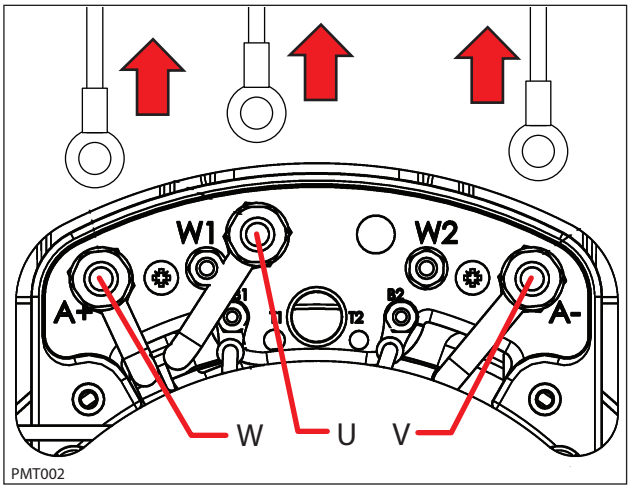
FOR SAFETY: Before leaving or servicing machine, empty solution and recovery tanks, stop on level surface, set parking brake, turn off machine and remove key.

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

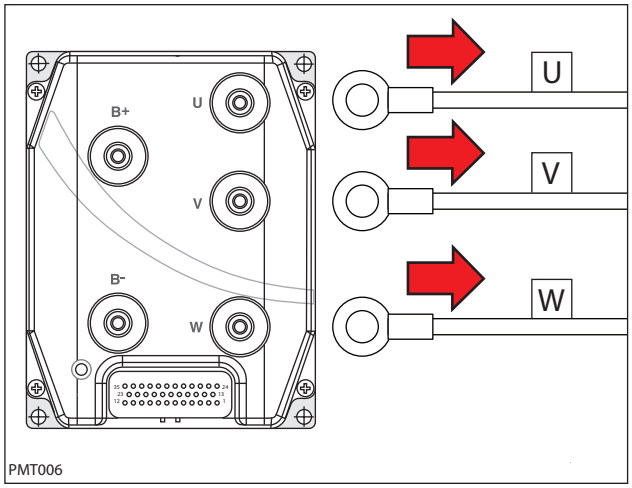
1. Key Off. Disconnect batteries. Remove terminal box cover screws and set cover aside.



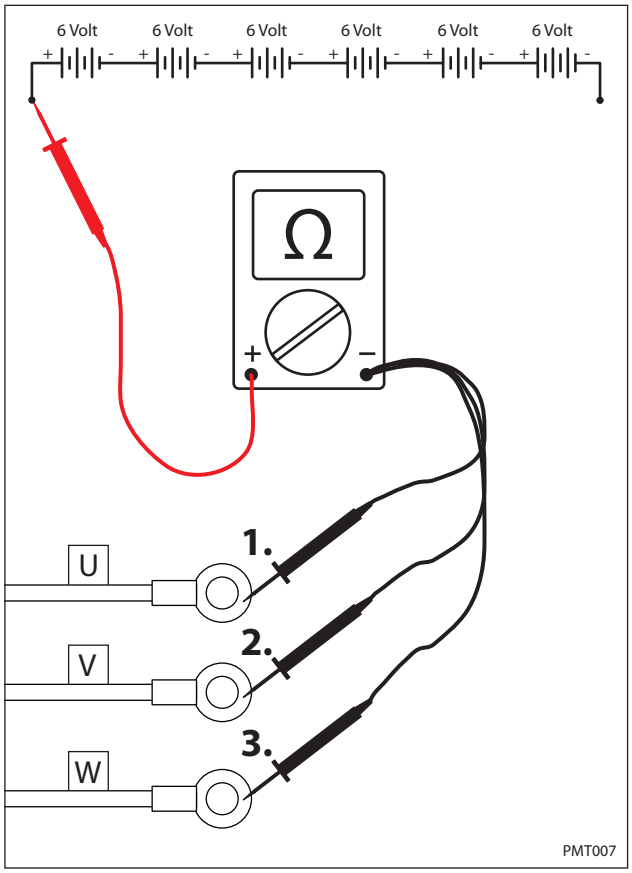
2. Disconnect U, V, and W cables from W1, A-, and A+ terminals (respectively).



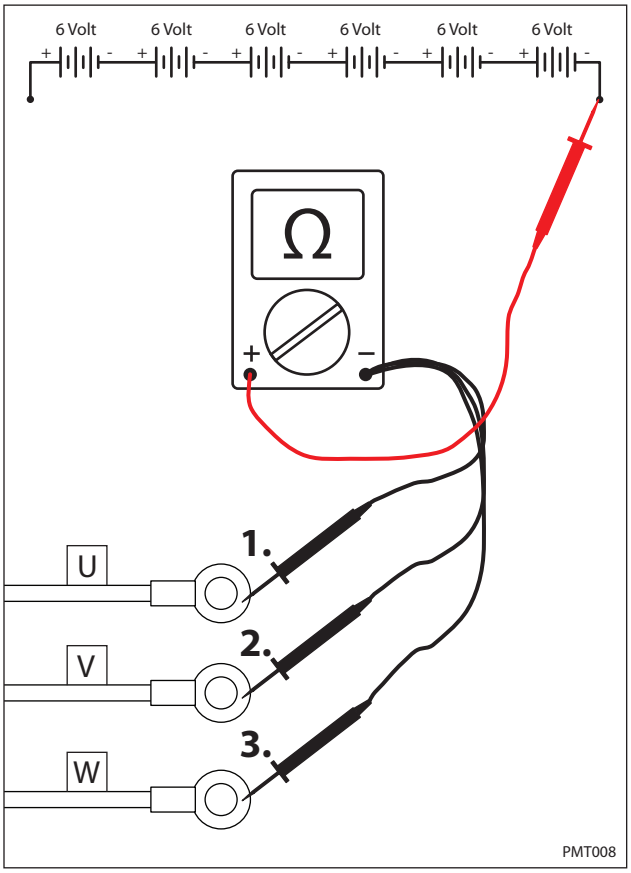
3. Disconnect U, V, and W cables from Curtis 1232 controller as shown below.



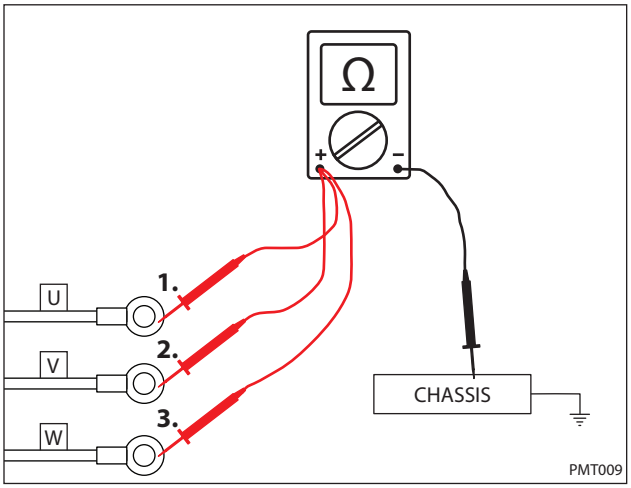
4. Reconnect battery connection and test each cable using an Ohmmeter for a short to battery + as shown below. Each cable should test as "O.L." or open to battery +. Replace shorted cable(s).



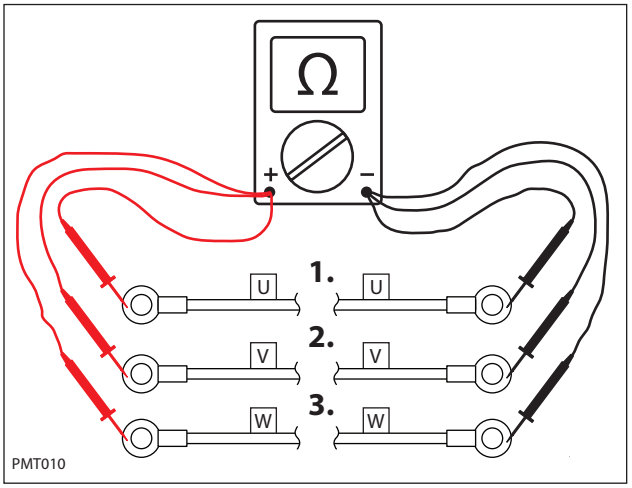
5. Test each cable using an ohmmeter for a short to battery - as shown below. Each cable should test as "O.L." or open to battery -. Replace shorted cable(s).



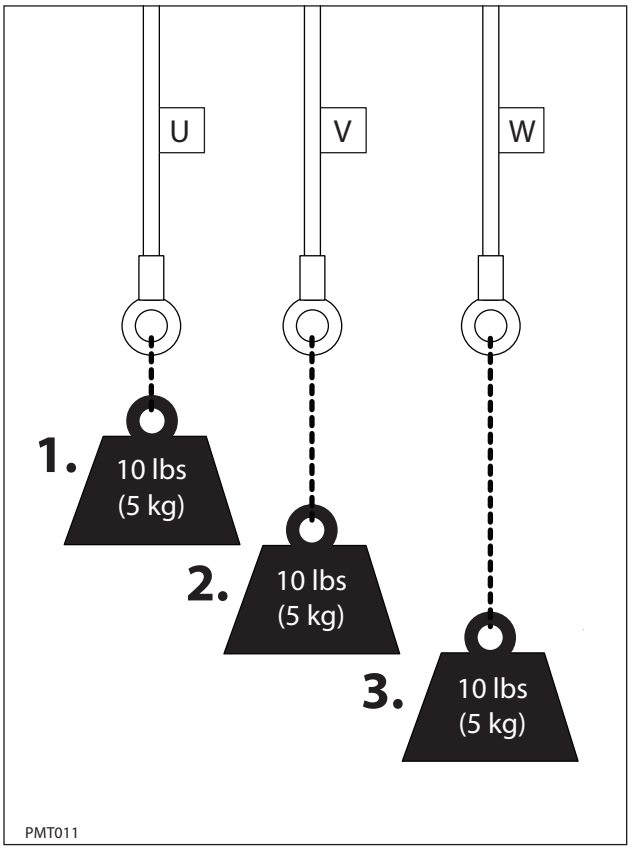
6. Test each cable using an ohmmeter for a short to chassis as shown below. Each cable should test as "O.L." or open to chassis. Replace shorted cable(s).



7. Test each cable using an ohmmeter for end-to-end continuity. Each cable should test between 0-1 ohm resistance. Replace open cable(s).



8. "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 THROTTLE SENSOR

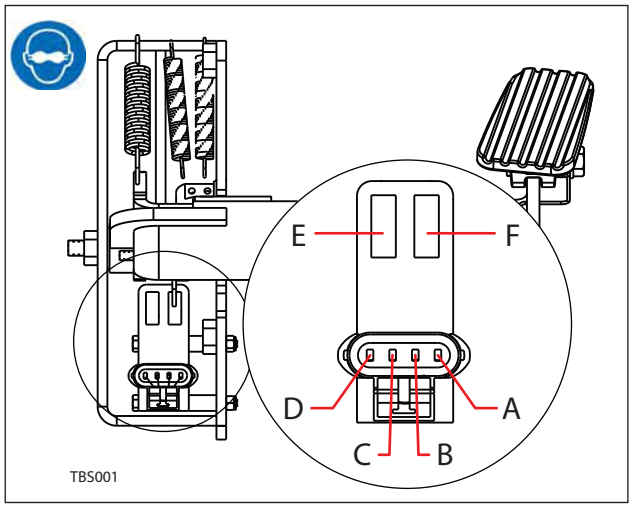
FOR SAFETY: Before leaving or servicing machine, empty solution and recovery tanks, stop on level surface.

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.

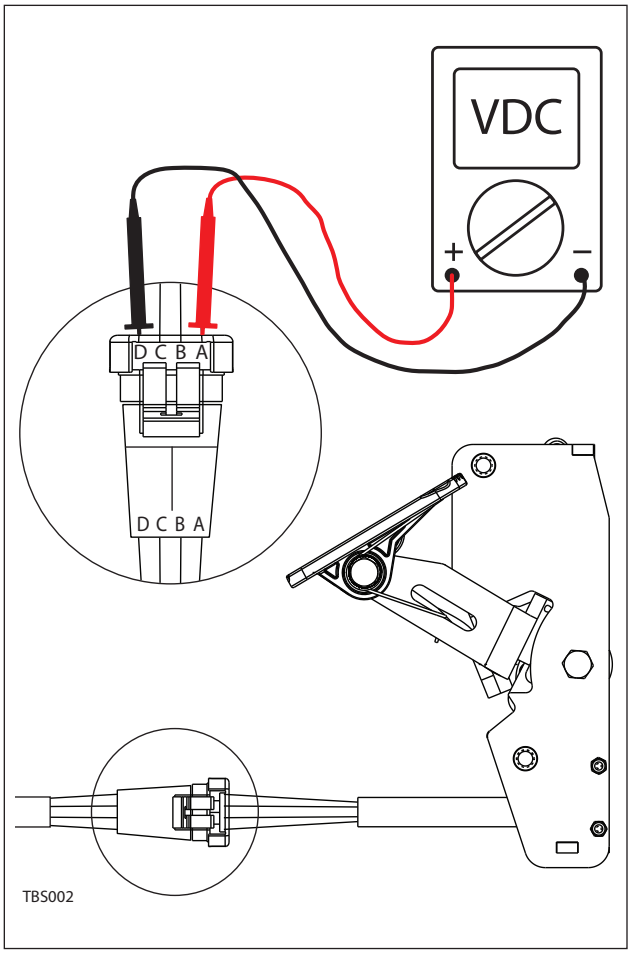
1. Jack machine up so front drive wheel is not touching the floor. Block machine up with jack stands.

2. The throttle hall effect sensor is a component of the pedal subassemble.

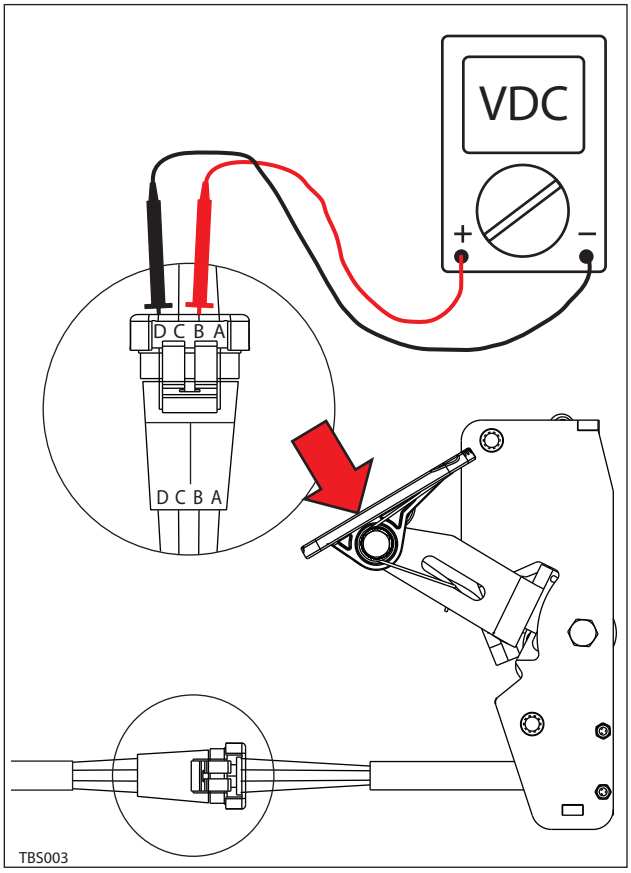


PIN/CAVITY	NOTES	COLOR
A	POWER (BATTERY +)	RED
B	PROPEL OUTPUT (0-5Vdc)	YELLOW
C	NOT USED	BLUE
D	GROUND (BATTERY -)	BLACK
E	NOT USED	N/A
F	GATE B	N/A

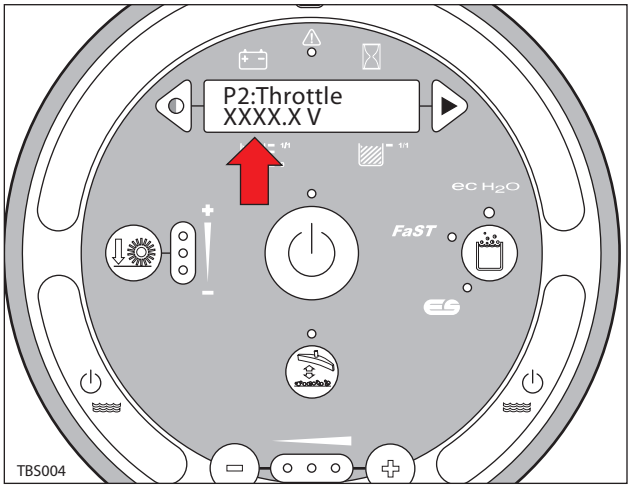
3. Key On. Backprobe the power supply to the throttle sensor terminals A and D using a voltmeter as shown below. The voltmeter should display battery voltage.



4. Key On. Backprobe the throttle sensor output terminals B and D using a voltmeter as shown below. The voltmeter should display 0-5 volts proportional to 0-100% propel pedal movement.



5. See "Propel Diagnostic Mode" in the TROUBLE SHOOTING section. The voltage in step 3 should match the LCD displayed voltage in Propel Diagnostic Mode.



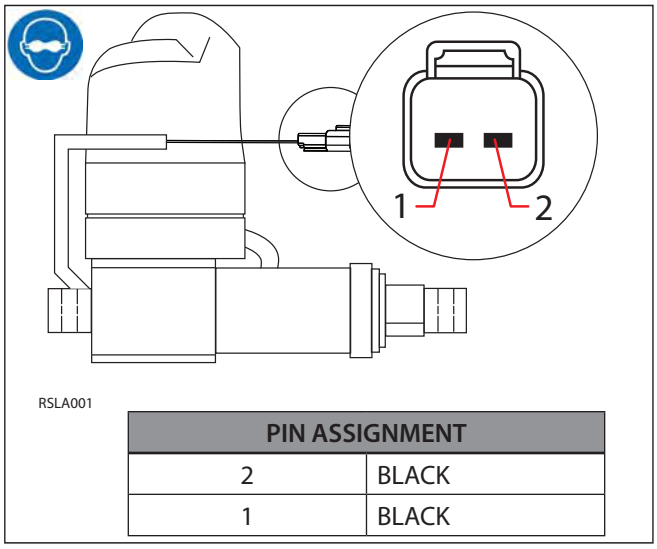
TESTING SIDE BRUSH LIFT ACTUATOR

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

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

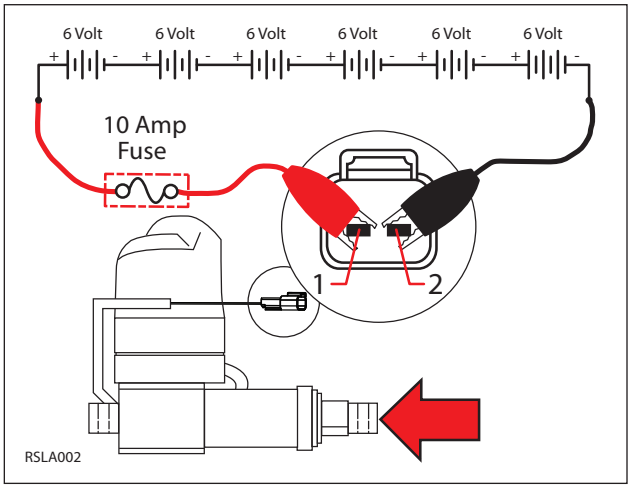
FOR SAFETY: When servicing machine, avoid moving parts. Do not wear loose jackets, shirts, or sleeves when working on machine.

1. Key Off. Disconnect the side brush lift actuator from the wire harness.

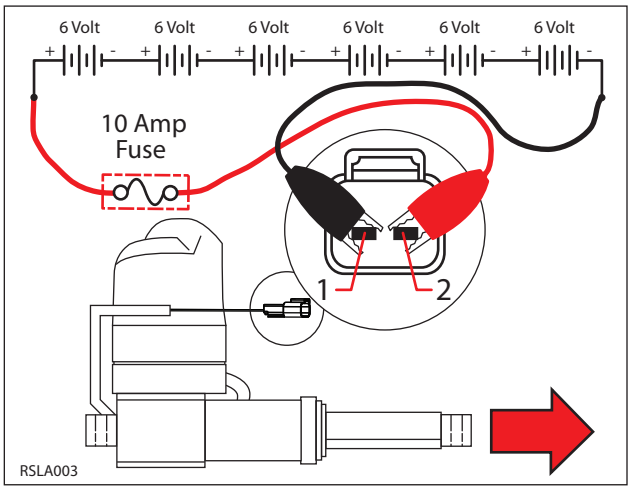


PIN ASSIGNMENT	
2	BLACK
1	BLACK

2. Apply battery voltage to the lift actuator using fuse-protected jumper leads as shown below. Be sure to connect battery + to terminal 1 and battery - to terminal 2. The actuator should retract completely. Replace the actuator if it fails to retract.



3. Reverse polarity and apply battery voltage to the lift actuator using fuse-protected jumper leads as shown below. Connect battery - to terminal 1 and battery + to terminal 2. The actuator should extend completely. Replace the actuator if it fails to extend.



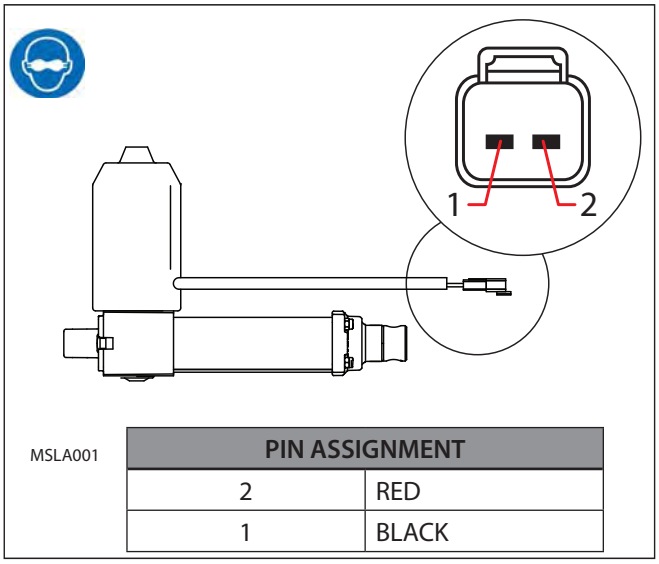
TESTING MAIN BRUSH LIFT ACTUATOR

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

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.

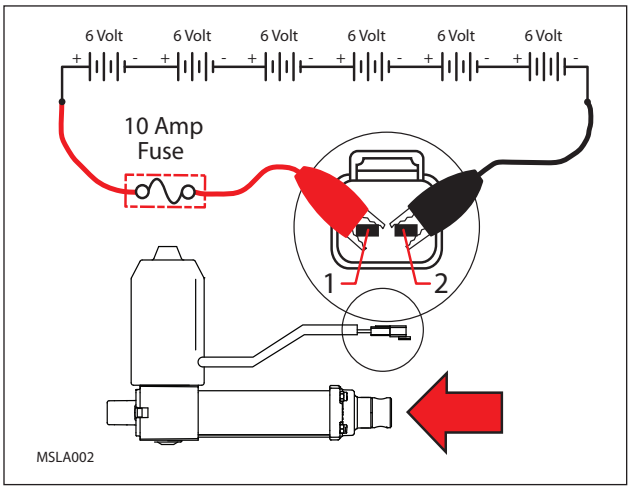
1. Key Off. Disconnect the main brush lift actuator from the wire harness.



MSLA001

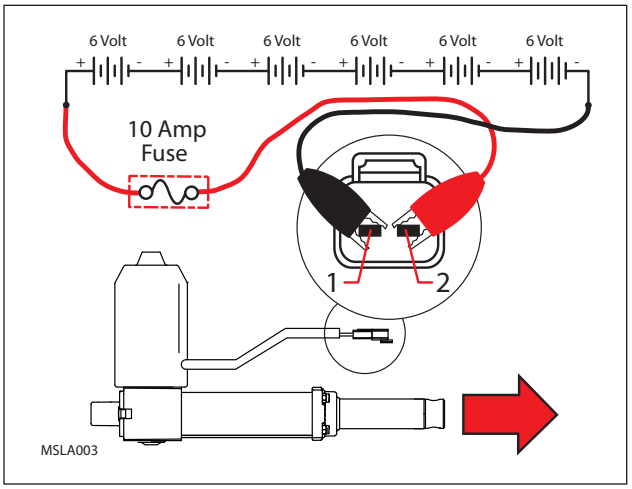
PIN ASSIGNMENT	
2	RED
1	BLACK

2. Apply battery voltage to the lift actuator using fuse-protected jumper leads as shown below. Be sure to connect battery + to terminal 1 and battery - to terminal 2. The actuator should retract completely. Replace the actuator if it fails to retract.



MSLA002

3. Reverse polarity and apply battery voltage to the lift actuator using fuse-protected jumper leads as shown below. Connect battery - to terminal 1 and battery + to terminal 2. The actuator should extend completely. Replace the actuator if it fails to extend.



MSLA003

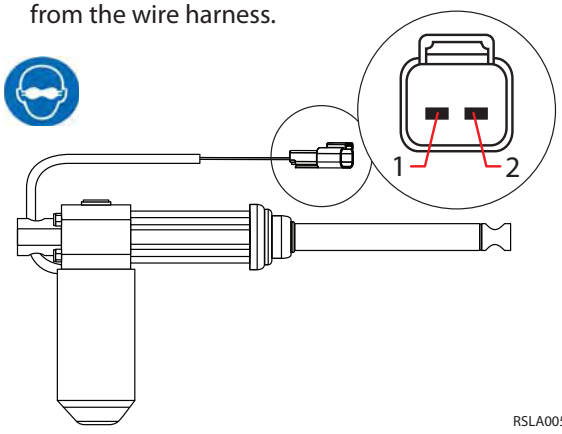
TESTING REAR SQUEEGEE LIFT ACTUATOR

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

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

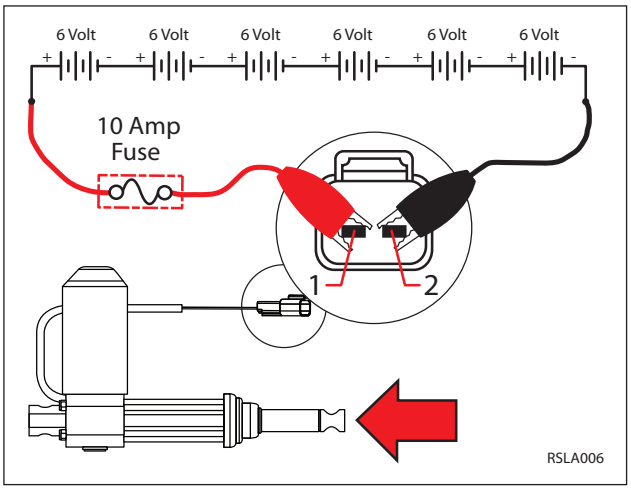
FOR SAFETY: When servicing machine, avoid moving parts. Do not wear loose jackets, shirts, or sleeves when working on machine .

1. Key Off. Disconnect the rear squeegee lift actuator from the wire harness.

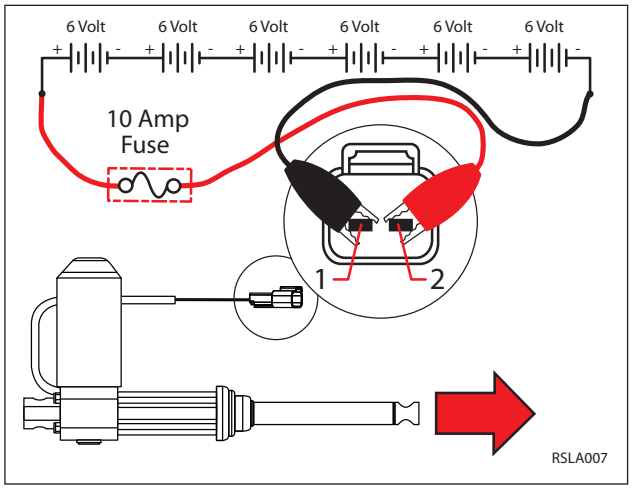


PIN ASSIGNMENT	
2	BLUE
1	BROWN

2. Apply battery voltage to the lift actuator using fuse-protected jumper leads as shown below. Be sure to connect battery + to terminal 1 and battery - to terminal 2. The actuator should retract completely. Replace the actuator if it fails to retract.



3. Reverse polarity and apply battery voltage to the lift actuator using fuse-protected jumper leads as shown below. Connect battery - to terminal 1 and battery + to terminal 2. The actuator should extend completely. Replace the actuator if it fails to extend.

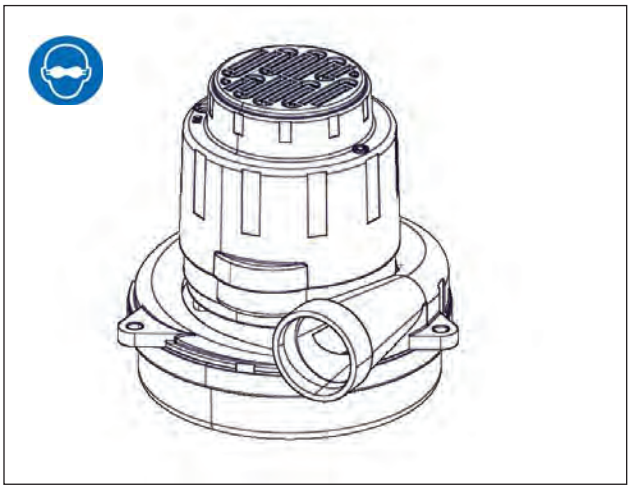


TESTING VACUUM FAN

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

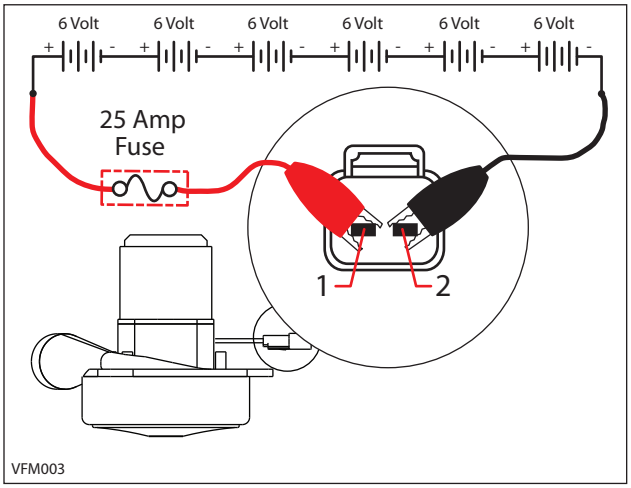
FOR SAFETY: When servicing machine, disconnect battery connection before working on machine.

1. Key Off. Disconnect vacuum fan from wire harness.

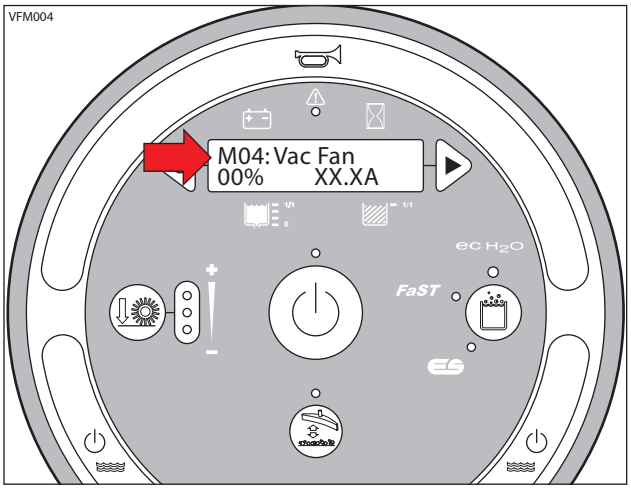


2. Key Off. Inspect carbon brushes. Replace carbon brushes if they are shorter than 10mm (0.375 in).

3. Apply battery voltage to the vacuum fan(s) using fuse-protected jumper leads as shown below. The fan should turn On. Replace the vacuum fan if it fails to turn On.



4. Reconnect vacuum fan(s) to wire harness. See "Manual Mode" in the TROUBLESHOOTING section. Activate the vacuum fan in Manual Mode. The amperage displayed should be approximately 14-20 Amps (avg. 16 Amps)

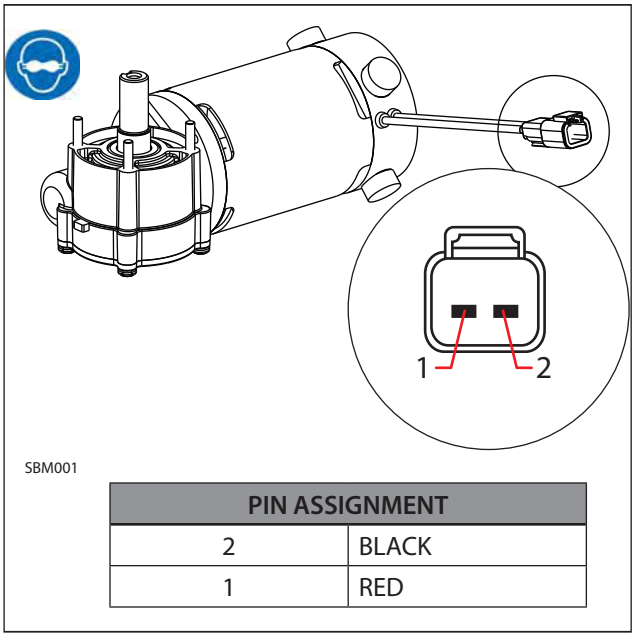


TESTING SIDE SWEEP BRUSH MOTOR

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

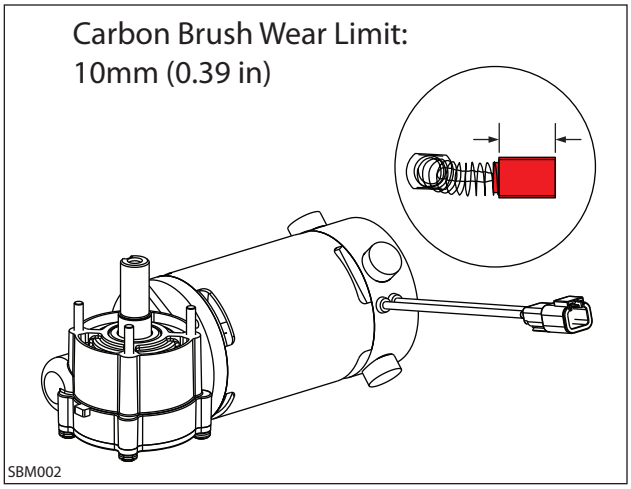
FOR SAFETY: When servicing machine, disconnect battery connection before working on machine.

1. Key Off. Disconnect the side brush motor from the wire harness.

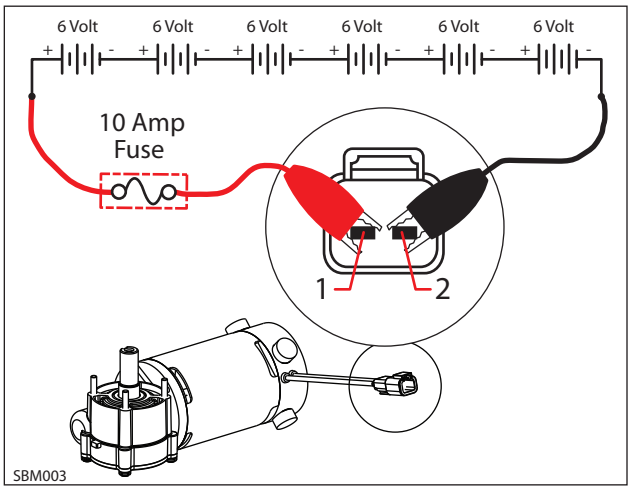


PIN ASSIGNMENT	
2	BLACK
1	RED

2. Key Off. Inspect carbon brushes. Replace carbon brushes if they are shorter than 10mm (0.375 in).



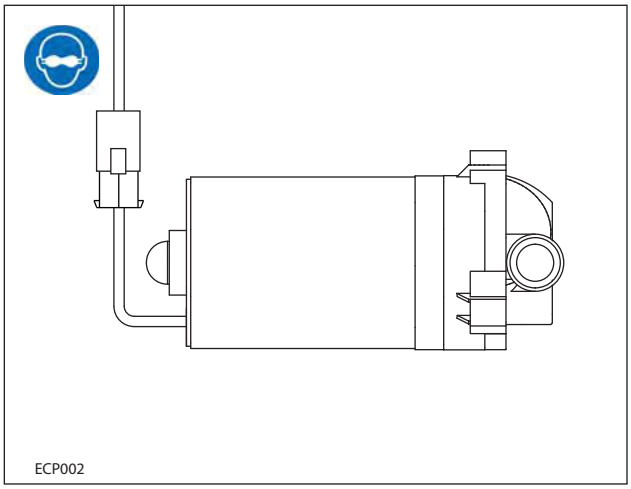
3. Apply battery voltage to the side brush motor using fuse-protected jumper leads as shown below. The side brush motor should turn On. Replace the side brush motor if it fails to turn On.



TESTING ec-H20 PUMP

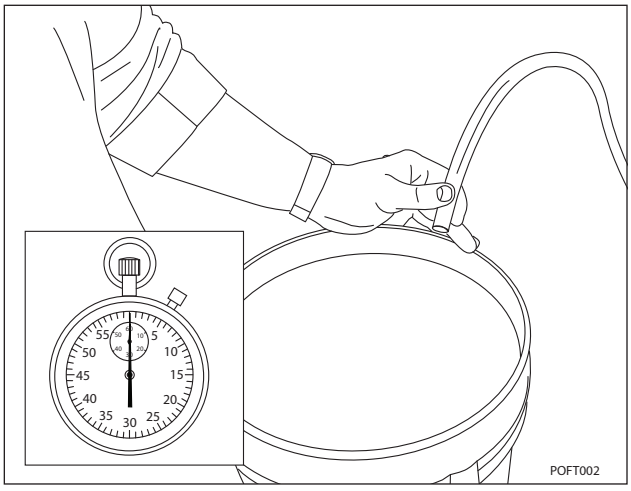
FOR SAFETY: Before leaving or servicing machine, stop on level surface, set parking brake.

1. Key Off. Disconnect ec-H2O pump outlet hose.



2. Fill the solution tank.

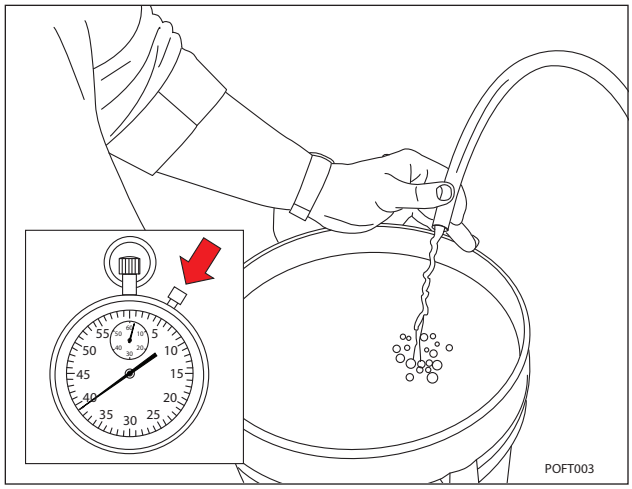
3. Connect a temporary outlet hose to the pump. The hose must be long enough to reach a 5 gallon bucket.



4. Enter Manual Mode and enable the ec-H2O system. See Manual Mode in the Troubleshooting section of this manual.

5. 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 and the pump has an adequate water supply.

NOTE: Open flow is different than system flow and should not be used for scrubbing mode water consumption calculations.



ADJUSTING ec-H2O FLOW RATE

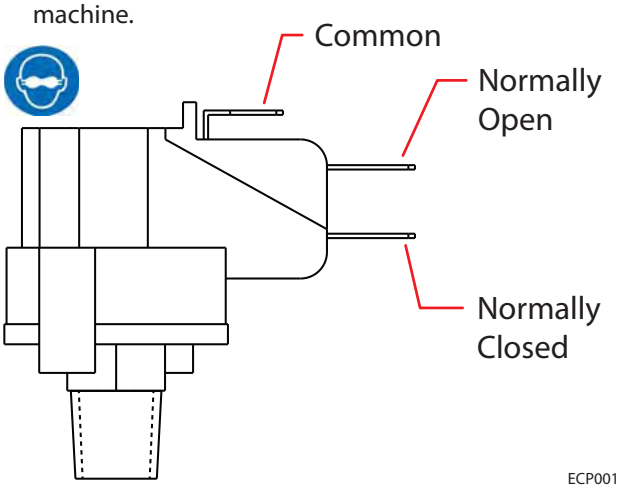
See Configuration mode in the Troubleshooting section of this manual.

TESTING ec-H2O PRESSURE SWITCH

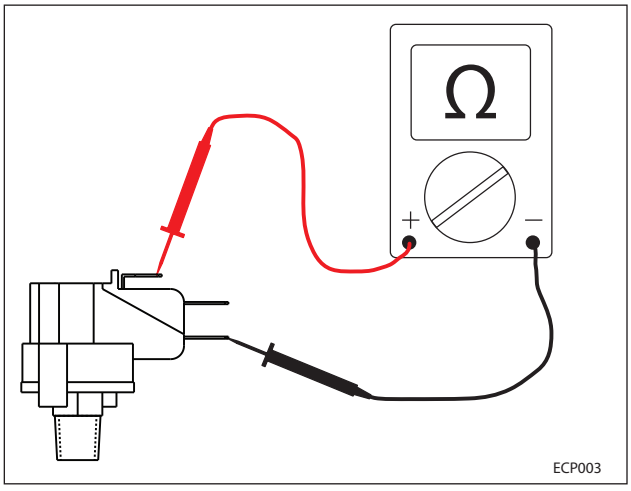
FOR SAFETY: Before leaving or servicing machine, stop on level surface, set parking brake, turn off machine and remove key.

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

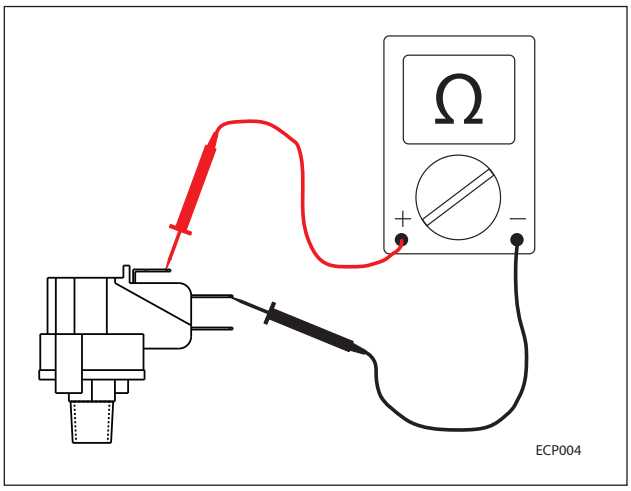
1. Key Off. Disconnect the pressure switch from the wire harness and remove the switch from the machine.



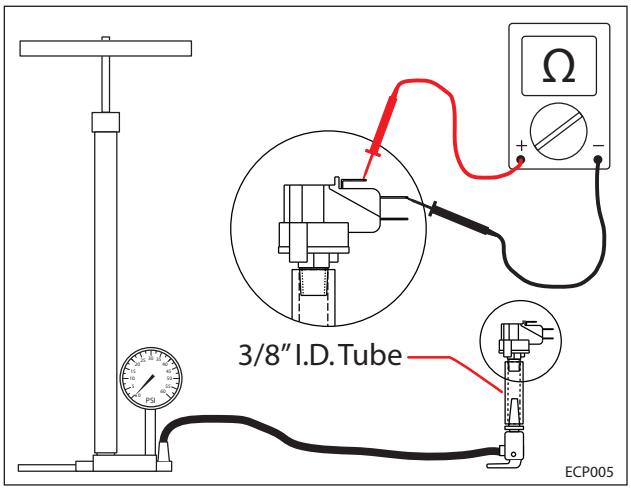
2. Test the resistance of the switch using an ohmmeter between the common and normally closed terminals. There should be 0-1 ohms resistance. Replace the switch if the N.C. contacts are open.



3. Test the resistance of the switch using an ohmmeter 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.



4. Use a bicycle pump with pressure gauge to apply pressure to the switch as shown below. The normally open contacts should close at 20 +/- 2 psi (1.4 Bar), increasing pressure. Replace the switch if it does not open correctly.



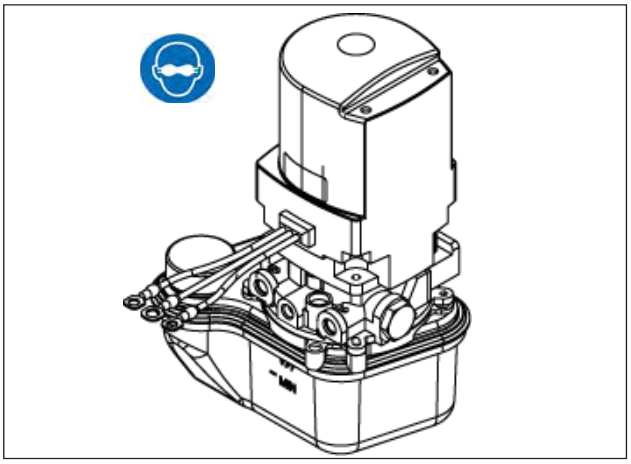
TESTING HOPPER LIFT PUMP MOTOR

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

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

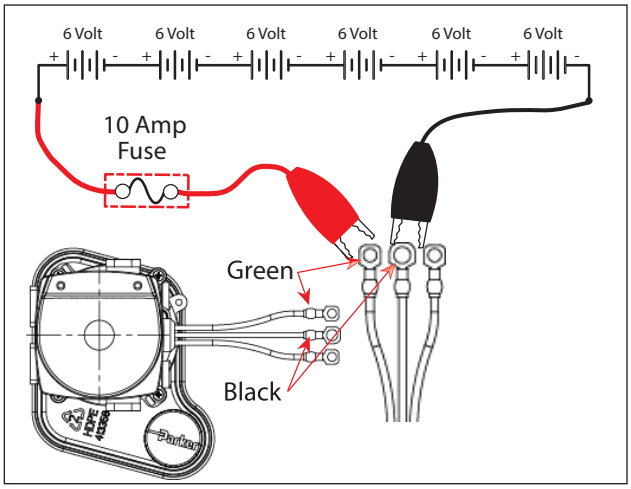
FOR SAFETY: When servicing machine, avoid moving parts. Do not wear loose jackets, shirts, or sleeves when working on machine.

1. Key Off. Disconnect the hopper lift pump from the wire harness.



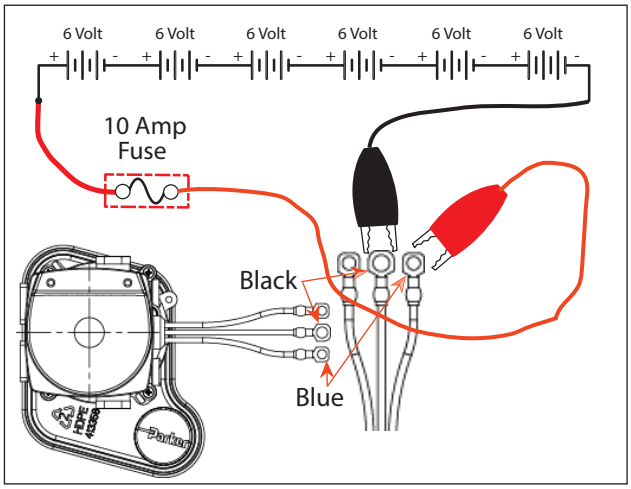
2. Apply battery voltage to the lift pump motor using fuse-protected jumper leads as shown below. Be sure to connect battery + to green wire and battery - to black wire. The motor should engage hydraulic cylinder to lower.

   Replace the pump if it fails to function properly in both directions.



3. Apply battery voltage to the lift pump motor using fuse-protected jumper leads as shown below. Be sure to connect battery + to blue wire and battery - to black wire. The motor should engage hydraulic cylinder to raise.

   Replace the pump if it fails to function properly in both directions.



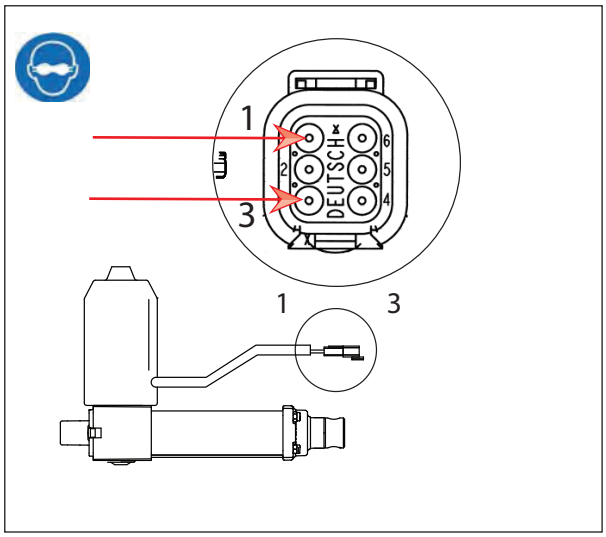
TESTING ROLL OUT ACTUATOR

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

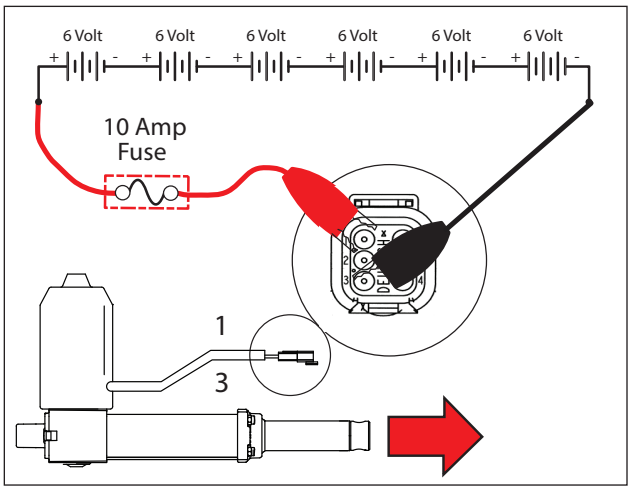
FOR SAFETY: When servicing machine, disconnect battery connection before working on machine.

FOR SAFETY: When servicing machine, avoid moving parts. Do not wear loose jackets, shirts, or sleeves when working on machine .

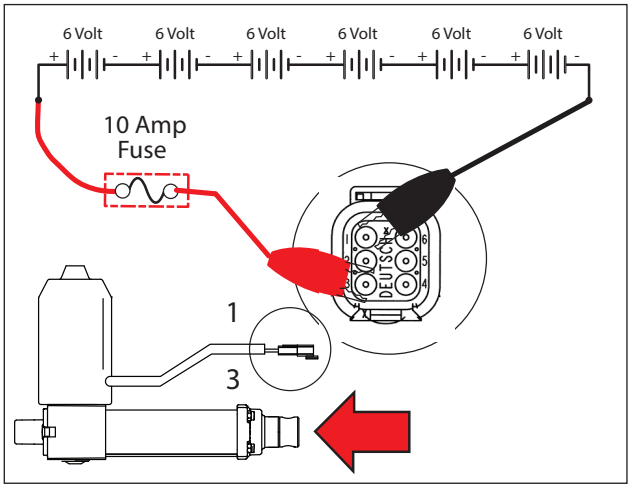
1. Key Off. Disconnect the roll out actuator from the wire harness.



2. Apply battery voltage to the roll out actuator using fuse-protected jumper leads as shown below. Be sure to connect battery + to terminal 1 and battery - to terminal 3. The actuator should extend completely. Replace the actuator if it fails to extend.



3. Apply battery voltage to the roll out actuator using fuse-protected jumper leads as shown below. Be sure to connect battery + to terminal 3 and battery - to terminal 1. The actuator should retract completely. Replace the actuator if it fails to retract.



PIN ASSIGNMENT	
1	Positive (+) Motor Extend
2	Open
3	Negative (-) Motor Extend
4	Positive (+) Potentiometer
5	Potentiometer Signal
6	Negative (-) Potentiometer

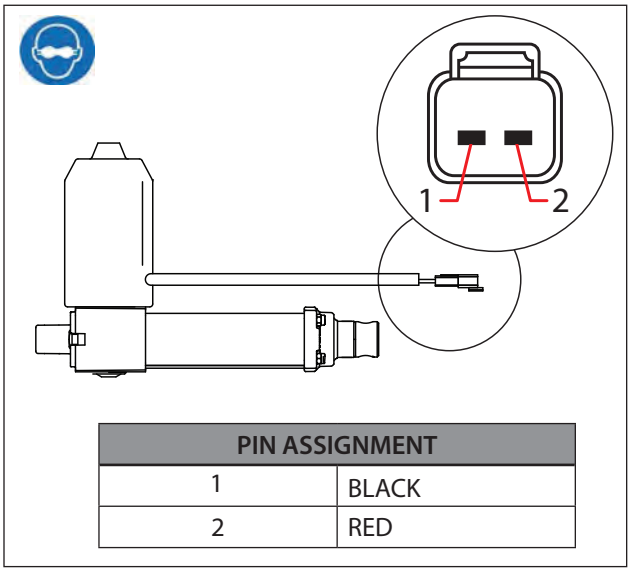
TESTING MAIN SWEEP LIFT ACTUATOR

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

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

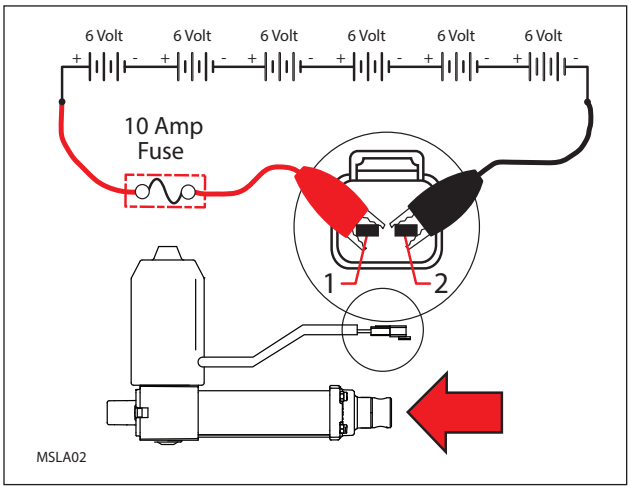
FOR SAFETY: When servicing machine, avoid moving parts. Do not wear loose jackets, shirts, or sleeves when working on machine.

1. Key Off. Disconnect the main sweep lift actuator from the wire harness.

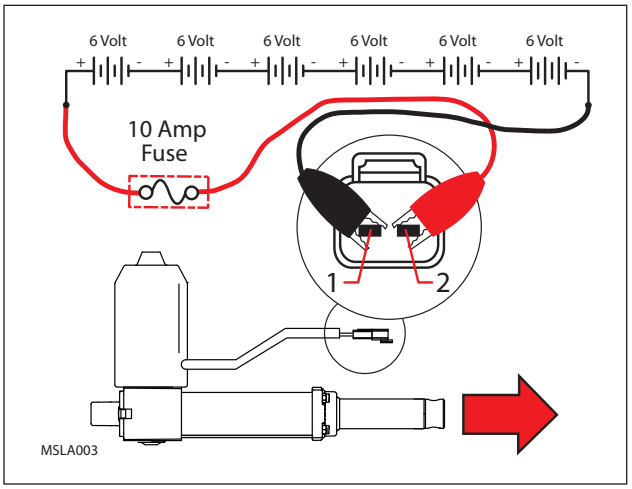


PIN ASSIGNMENT	
1	BLACK
2	RED

2. Apply battery voltage to the lift actuator using fuse-protected jumper leads as shown below. Be sure to connect battery + to terminal 1 and battery - to terminal 2. The actuator should retract completely. Replace the actuator if it fails to retract.



3. Reverse polarity and apply battery voltage to the lift actuator using fuse-protected jumper leads as shown below. Connect battery - to terminal 1 and battery + to terminal 2. The actuator should extend completely. Replace the actuator if it fails to extend.



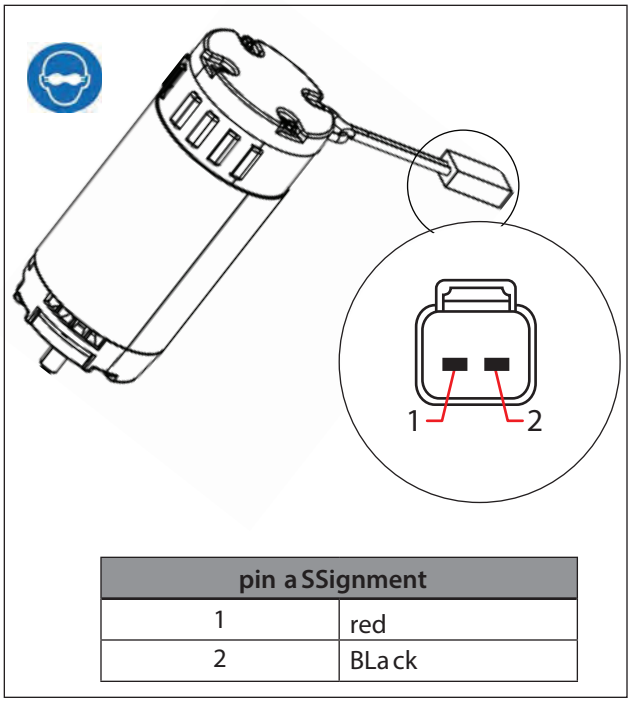
TESTING MAIN SWEEP BRUSH MOTORS

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

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

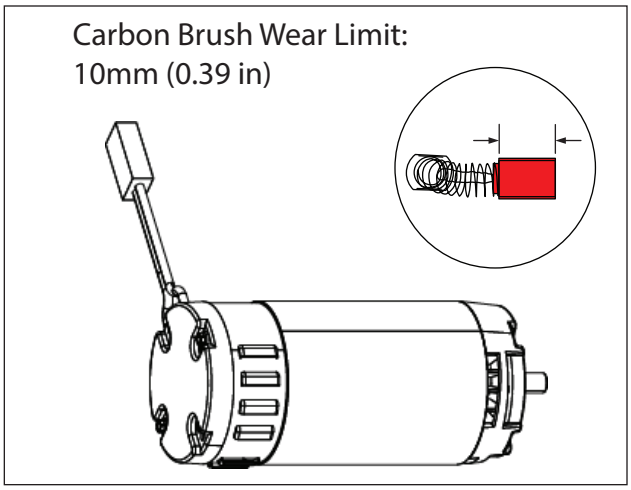
FOR SAFETY: When servicing machine, avoid moving parts. Do not wear loose jackets, shirts, or sleeves when working on machine.

1 . Key off. Disconnect the brush motor from the wire harness.

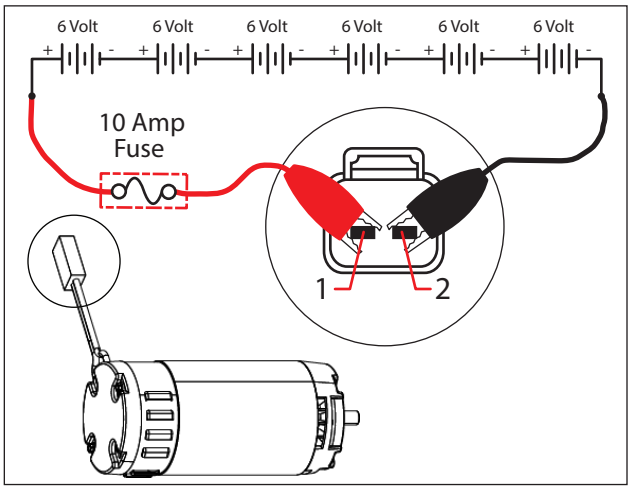


pin a SSignment	
1	red
2	BLa ck

2 . Key off . Inspect carbon brushes. replace carbon brushes if theyare shorter than 10mm (0.375 in).



3 . Apply battery voltag e to the brush motor using fuse-protected jumper leads as shown below. The brush motor should turn On, swap test leads and motor should turn On opposite direction. Replace the brush motor if it fails to turn On.



MOTOR ROTATION	
Left	Right
Red (+)	Black (+)
Black (-)	Red (-)

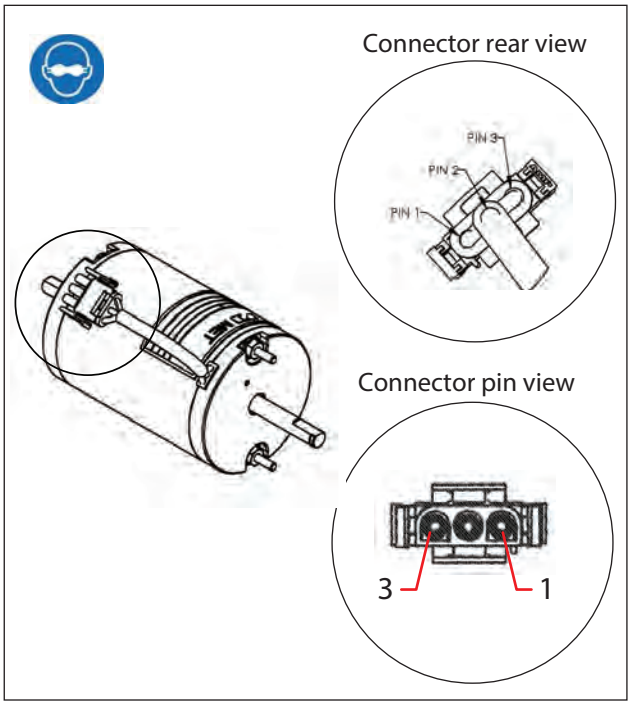
TESTING SHAKER MOTOR

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

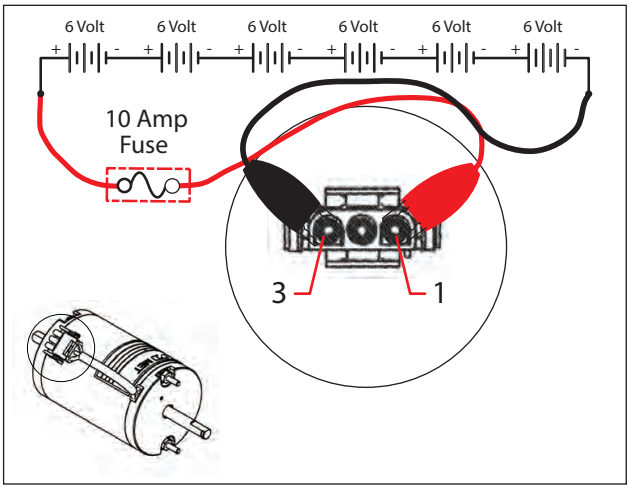
FOR SAFETY: When servicing machine, disconnect battery connection before working on machine.

FOR SAFETY: When servicing machine, avoid moving parts. do not wear loose jackets, shirts, or sleeves when working on machine .

1 . Key off . Disconnect the shaker motor from the wire harness.



2 . Apply battery voltage to the shaker motor using fuse-protected jumper leads as shown below. The shaker motor should turn On. Replace the shaker motor if it fails to turn On.



PIN ASSIGNMENT	
Pin 1	Red (+)
Pin 2	Green (grd)
Pin 3	Black (-)

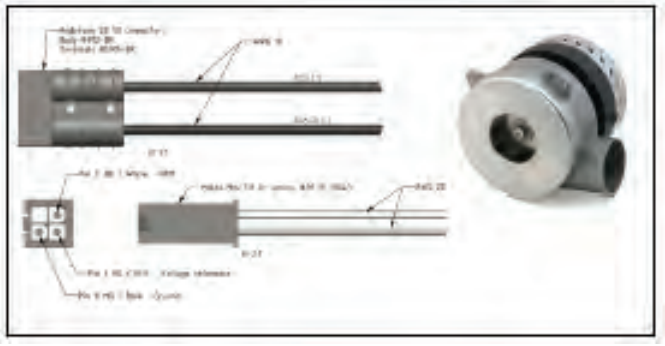
TESTING DRY VAC FAN

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

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. Key Off. Disconnect the vac fan from the wire harness.



2. Apply battery voltage to the vac fan using fuse-protected jumper leads as shown below. Be sure to connect battery + to terminal 1 and battery - to terminal 2. The vac fan should come On. Replace the vac fan if it fails to come On.