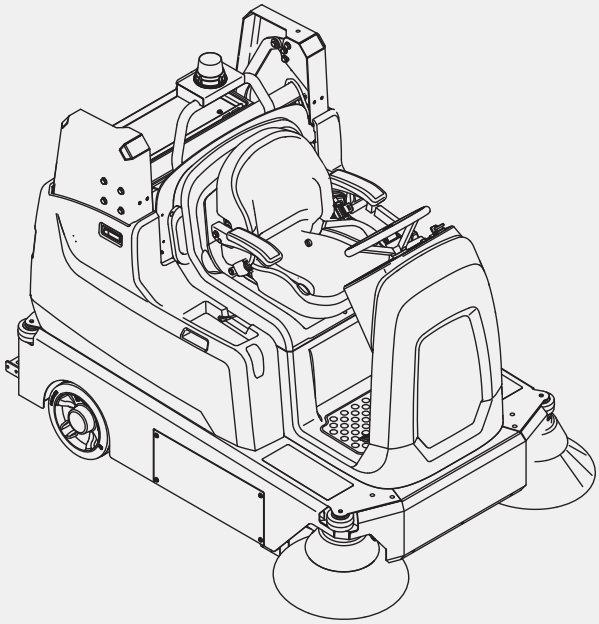
S16

Sweeper

English EN
Service Manual



Tennant True® Parts
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www.tennantco.com/manuals

9045326
Rev. 00 (2-2021)

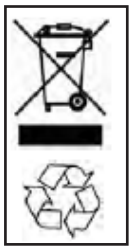
INTRODUCTION

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

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

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

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



PROTECT THE ENVIRONMENT

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

Always remember to recycle.

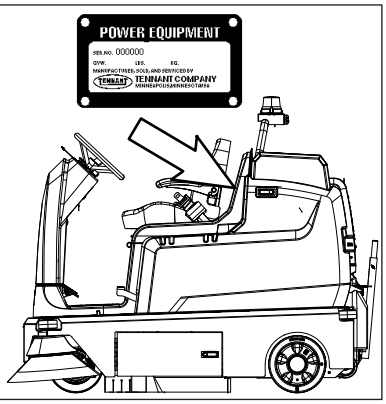
MACHINE DATA

Please fill out at time of installation for future reference.

Model No. - _____

Serial No. - _____

Installation Date - _____



INTENDED USE

The S16 is an industrial rider machine designed to sweep both rough and smooth hard surfaces (concrete, tile, stone, synthetic, etc) and carpeted surfaces (commercial grade nylon, polyester, and / or wool). Typical applications include schools, office buildings, convention centers, airports, warehouses, manufacturing facilities, and retail centers. Do not use this machine on soil, grass, or surfaces with residential type carpeting. This machine is intended for both indoor and outdoor use. This machine is not intended for use on public roadways. Do not use this machine other than described in this Operators Manual.

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CONTENTS

CONTENTS

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

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

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

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

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

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

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

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

WARNING: Electrical Hazard

− Disconnect Battery Cables and Charger Plug Before Servicing Machine.

− Do Not Charge Batteries with Damaged Power Supply Cord. Do Not Modify Plug.

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

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

FOR SAFETY:

1. Do not operate machine:
   - Unless trained and authorized.
   - Unless operator manual is read and understood.
   - Under the influence of alcohol or drugs.
   - While using a cell phone or other types of electronic devices.
   - Unless mentally and physically capable of following machine instructions.
   - With brake disabled.
   - Without filters in place or with clogged filters.
   - In dusty environments without the vacuum fan on.
   - If it is not in proper operating condition.
   - 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.
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.
   - 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 sweep on ramp inclines that exceed 14.1% / 8° grade. Do not transport on ramp inclines that exceed 21.3% / 12° 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.
   - Use care when reversing machine.
   - Move machine with care when hopper is raised (High Dump).
   - Make sure adequate clearance is available before raising hopper (High Dump).
   - Do not raise hopper when machine is on an incline (High Dump).
   - Use care when emptying hopper. Hopper can hold up to 91 kg (200 lbs). Lifting heavy material improperly can result in back strain or other personal injury (Low Dump).
   - 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.

4. Before leaving or servicing machine:
   - Stop on level surface.
   - Turn off machine and remove key.

5. When servicing machine:
   - All work must be done with sufficient lighting and visibility.
   - Keep work area well ventilated.
   - Avoid moving parts. Do not wear loose clothing, jewelry and secure long hair.
   - Block machine tires before jacking machine up.
   - Jack machine up at designated locations only. Support machine with jack stands.
   - Use hoist or jack that will support the weight of the machine.
   - Do not push or tow the machine without an operator 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 pull on battery charger cord to unplug. Grasp plug at outlet and pull.
   - Do not use incompatible battery chargers as this may damage battery packs and potentially cause a fire.
   - Inspect charger cord regularly for damage.
   - Do not disconnect the off−board charger's DC cord from the machine receptacle when the charger is operating. Arcing may result. If the charger must be interrupted during charging, disconnect the AC power supply cord first.
   - Avoid contact with battery acid.
   - Keep all metal objects off batteries.
   - Use a non−conductive battery removal device.
   - Use a hoist and adequate assistance when lifting batteries.
   - Battery installation must be done by trained personnel.
   - Follow site safety guidelines concerning battery removal.
   - All repairs must be performed by a trained service mechanic.
   - Do not modify the machine from its original design.
   - Use Tennant supplied or approved replacement parts.
   - Wear personal protective equipment as needed and where recommended in this manual.

For Safety: wear hearing protection.

For Safety: wear protective gloves.

For Safety: wear eye protection.

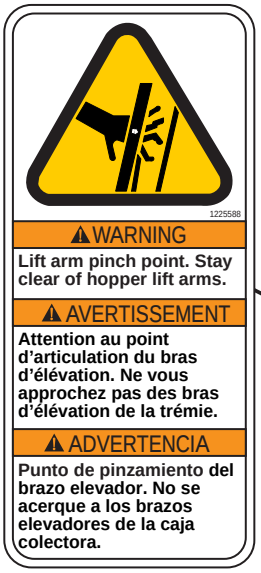
For Safety: wear protective dust mask.

6. When loading/unloading machine onto/off truck or trailer:
   - Use ramp, truck or trailer that will support the weight of the machine and operator.
   - Empty debris hopper before loading machine.
   - Do not drive on slippery ramp.
   - Use caution when driving on a ramp.
   - Do not load/unload machines on ramp inclines that exceed 21.3% / 12°.
   - Turn off machine and remove key.
   - Block machine tires.
   - Tie machine down to truck or trailer.

7. When using Lithium-ion Battery Model:
   - Battery service to be performed by Tennant Service only.
   - Do not attempt to lift battery by hand or by any other unauthorized method.
   - Battery pack is designed exclusively for specific Tennant machine applications. Do not install battery pack in unapproved machines.
   - Dispose of battery in accordance with local regulations. Contact Tennant Service.
   - Contact Tennant Service or your local regulatory authorities for proper transporting instructions of lithium-ion batteries.
   - Disconnect battery cable connector, battery management system (BMS) connector and charger cord before working on machine.
   - Use only OEM approved battery charger supplied with lithium-ion battery.
   - Do not expose battery to temperatures below -22°F (-30°C), above 140°F (60°C).
   - Do not use machine immediately after long-term extreme temperature storage. Before use, return battery module temperature range to 50°F (10°C)~95°F (35°C).
   - Do not operate or store battery in hazardous environment (electrically charged, humidity, extreme temperatures and magnetic fields).
   - Do not expose battery to flame or plasma.
   - Do not disassemble or mistreat battery. Do not tear seal tape or will void warranty.
   - Do not drop, crush or subject battery to impact, as it may cause battery to heat up or catch fire.
   - Do not put battery in fire or water to avoid battery explosion.
   - Do not touch battery with wet hand, avoid electric shock.
   - Stop using or charging the battery immediately if battery has abnormal temperature, leakage or other abnormal conditions.

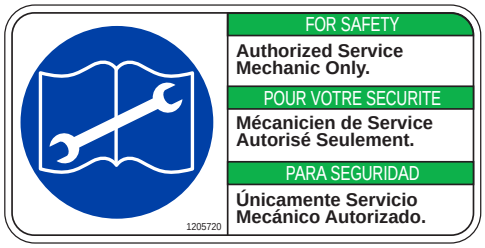
The following safety labels are mounted on the machine in the locations indicated. Replace damaged/missing labels

WARNING LABEL - Lift pinch point. Stay clear of hopper lift arms.

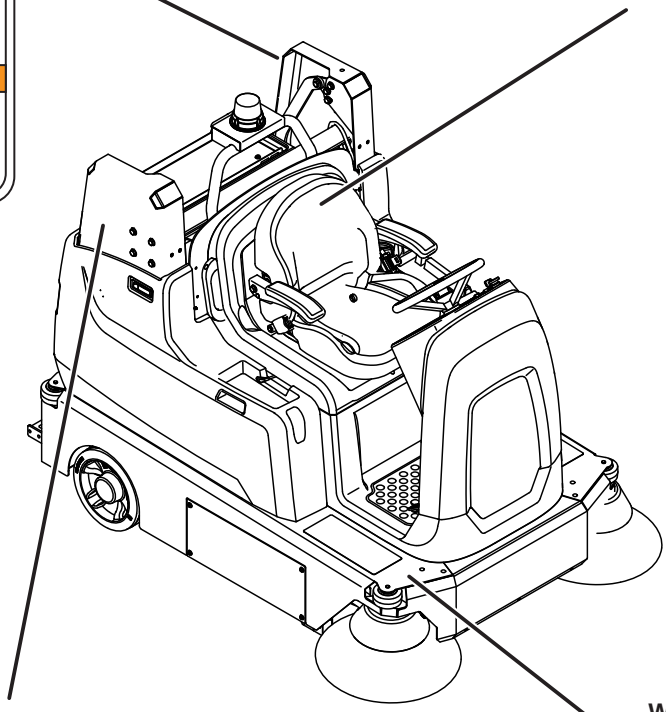


Located on back of both lift arms (high dump machines only).

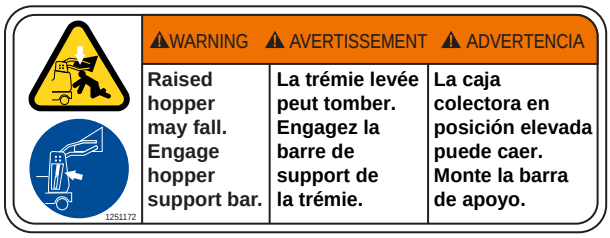
FOR SAFETY LABEL - Authorized Service Mechanic Only.



Located on electronic compartment cover (behind operator seat shroud).



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



Located on side of both lift arms (high dump machines only).

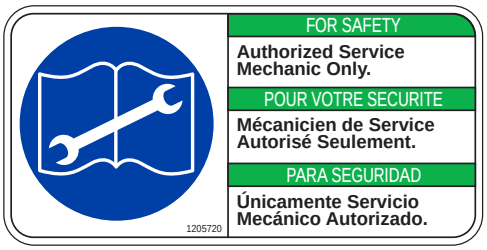
WARNING LABEL - Spinning brush. Keep hands away.

Located on side brush plate(s) (machines equipped with optional side brush(es) only).

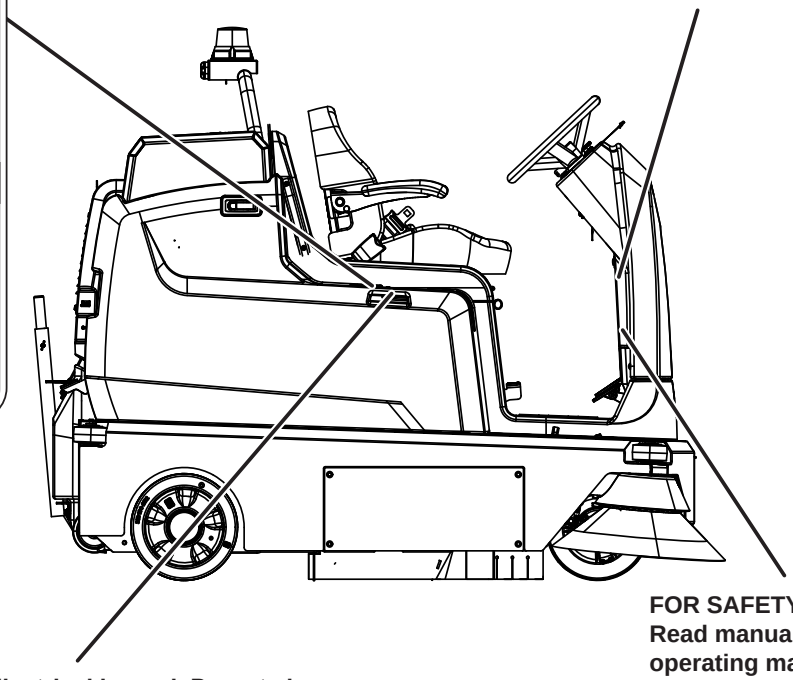
WARNING LABEL - Batteries emit hydrogen gas. Explosion or fire can result. Keep sparks and flames away. Keep covers open when charging.

Located on bottom of seat shroud plate.

FOR SAFETY LABEL - Authorized Service Mechanic Only.

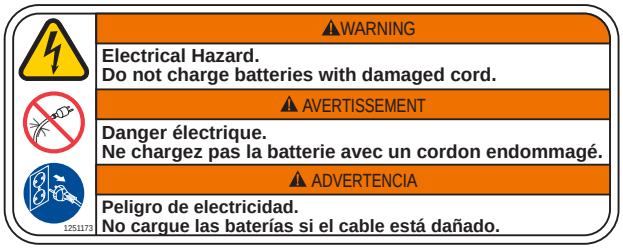


Located on electrical panel.



FOR SAFETY LABEL - Read manual before operating machine.

WARNING LABEL - Electrical hazard. Do not charge batteries with damaged cord.



Located on bottom of seat shroud plate.

Located on electrical panel.

LITHIUM-ION BATTERY CAUTION LABEL

⚠CAUTION	⚠ ATTENTION	⚠ ATENCIÓN
1. Do not expose battery to temperatures below -30° C(-22°F), above 60°C (140°F). 2. Do not disassemble or mistreat battery. Do not crush. 3. Do not drop or subject it to impact. 4. Use only OEM approved charger. 5. Failure to follow these instructions may present risk of explosion, fire, or high temperatures. 6. See owner's manual for additional safety instructions. 7. Recommended torque for stud assembly is; M8 = 9.1Nm / M12 = 24.5Nm. 8. Refer to owner's manual for lifting instructions. 9. Service by Tennant Personnel only.	1. No exponga la batería a temperaturas por debajo de-30 ° C(-22°F), por encima de 60 ° C (140 ° F). 2. No desarmar ni maltratar la batería. No la aplaste. 3. No deje caer ni la someta a impactos. 4. Use sólo el cargador Original aprobado. 5. El incumplimiento de estas instrucciones puede presentar riesgo de explosión, fuego o altas temperaturas. 6. Véase el manual del propietario para instrucciones adicionales de seguridad. 7. El par recomendado de apriete para el poste es de; M8 - 9.1Nm / M12 = 24.5Nm. 8. Consulte el manual del propietario para las instrucciones de elevación. 9. Servicio por técnicos de Tennant exclusivamente.	1. N'exposez pas la batterie à des températures inférieures à -30 ° C (supérieures à 60 ° C). 2. Ne pas démonter ni maltraiter la batterie. Ne pas écraser. 3. Ne la laissez pas tomber et ne la soumettez pas à un impact. 4. Utilisez uniquement un chargeur approuvé par l'OEM. 5. Le non-respect de ces instructions peut présenter un risque d'explosion, d'incendie ou de températures élevées. 6. Voir le manuel du propriétaire pour les consignes de sécurité supplémentaires. 7. Le couple recommandé pour le montage des goujons est de; M8 - 9.1Nm / M12 = 24,5 Nm. 8. Reportez-vous au manuel du propriétaire pour les instructions de levage. 9. Service réservé au personnel Tennant.

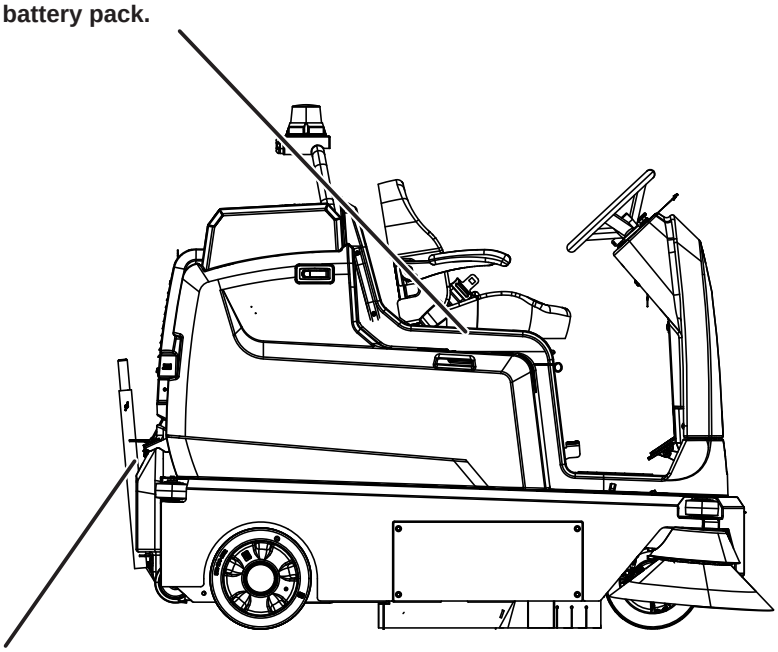
c UL us LISTED

Tennant Co
File Number: MH63465

Battery Disposal contact Tennant
Technical Service 1-800-553-8033

1247721

Located on top of battery pack.



WARNING LABEL - Brush throws debris. Stop motor before lifting hopper.

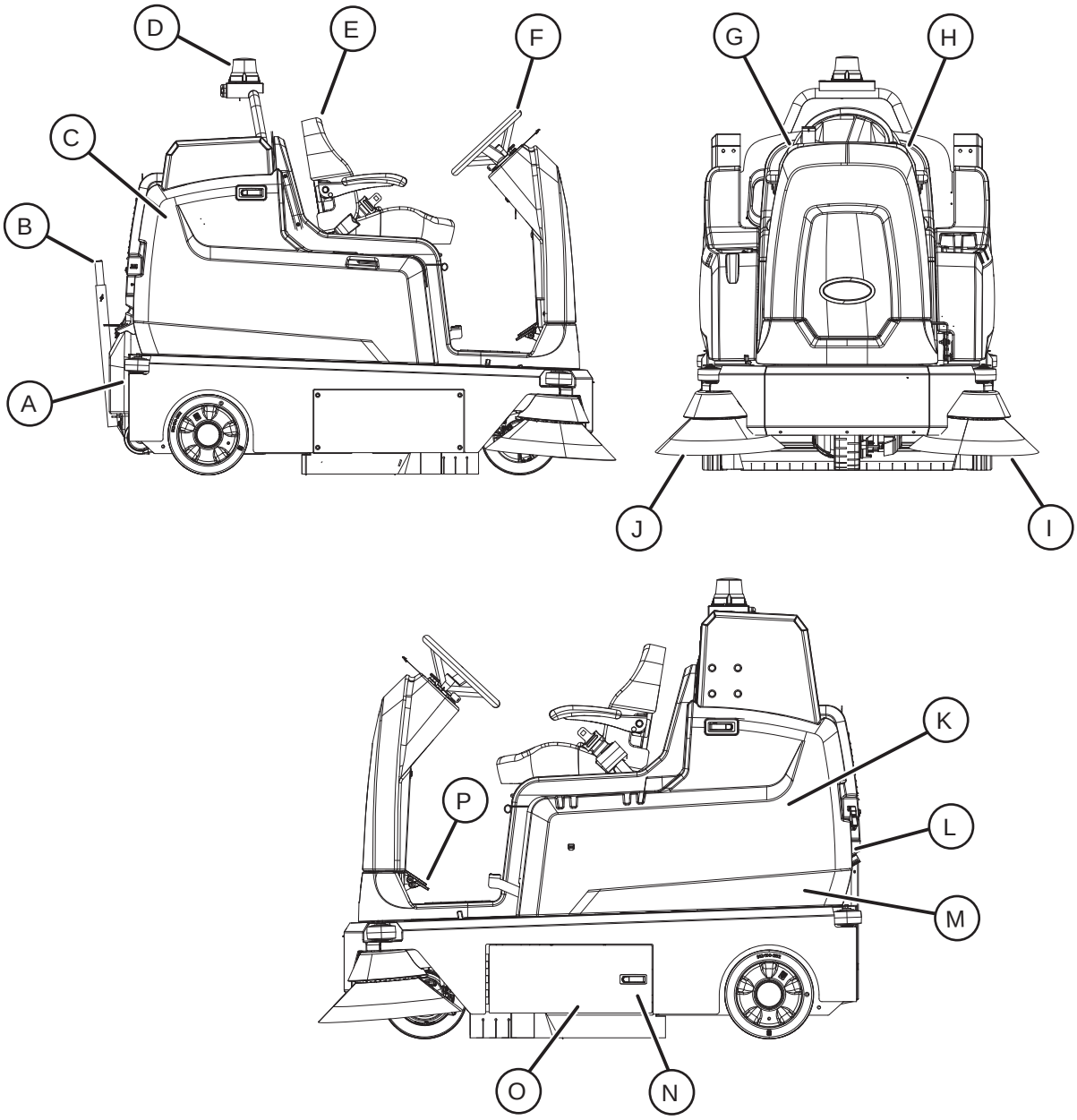
⚠WARNING	⚠ AVERTISSEMENT	⚠ ADVERTENCIA
Brush throws debris. Stop motor before lifting hopper.	**La brosse projette des détritus. Coupes le moteur avant de relever la trémie.**	**Depósito de desperdicios del cepillo. Detenga el motor antes de elevar la caja colectora.**

25972

Located on back of hopper (low dump machines only)

GENERAL INFORMATION

MACHINE COMPONENTS

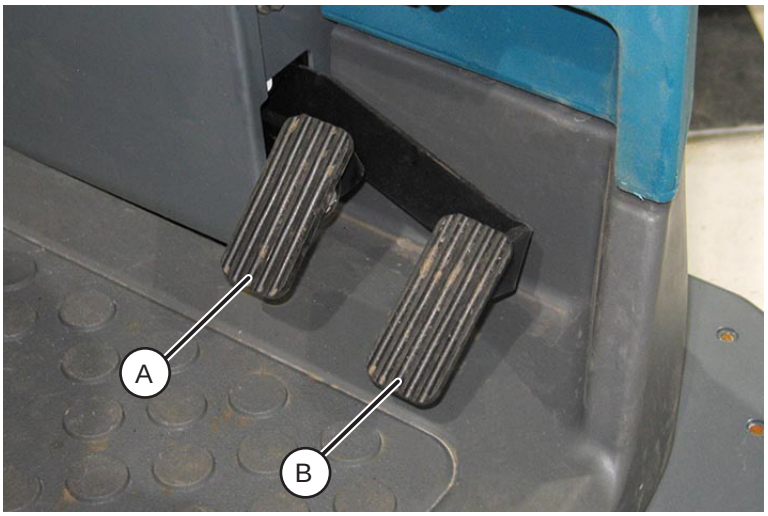


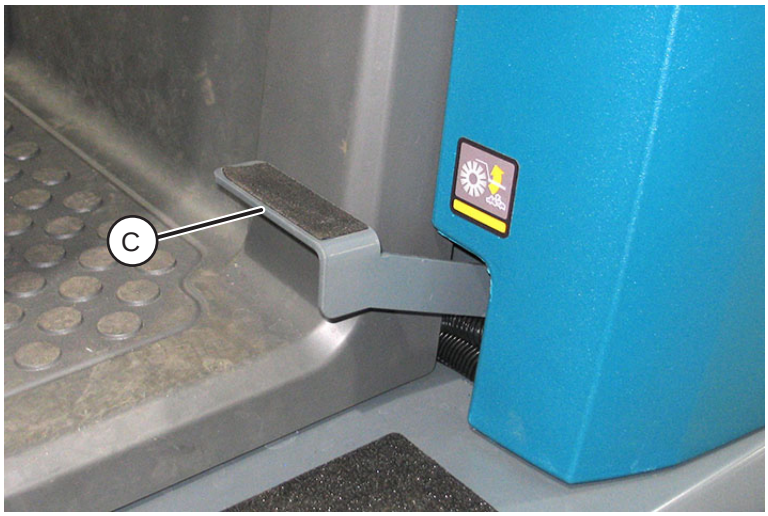
A. Hopper
B. Hopper handle (Low Dump Only)
C. Right shroud
D. Backup alarm / flashing light (Option)
E. Operator seat
F. Steering wheel
G. Right control panel
H. Left control panel
I. Left side brush (Option)
J. Right side brush
K. Hopper support (High Dump Only)
L. Hopper filter
M. Left shroud
N. Main sweep brush access door
O. Main sweep brush
P. Control pedals

CONTROLS AND INSTRUMENTS

A. Key switch
B. Directional switch
C. Emergency shut-off button
D. Vacuum wand switch (Option)
E. Hopper raise/lower switch (High Dump Only)
F. Hopper rollout switch (High Dump Only)
G. Operating lights/hazard lights switch (Option)
H. Hour meter
I. Battery indicator lights
J. Main brush pressure indicator rights
K. Main brush pressure button
L. Vacuum fan button
M. Vacuum fan indicator lights (behind steering wheel)
N. 1-Step button
O. Eco (Economy) button
P. Horn button
Q. Filter shaker button
R. Right side sweep brush button
S. Left side sweep brush button (Option)
T. Hopper safety button (High Dump Only)
U. Indicators lights (Worn brush, Smart-Fill ABW (Automatic Battery Watering) tank low (Option), HEPA filter clogged (Option), and Fault indicators)

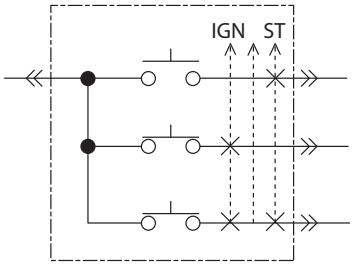
CONTROL PEDALS



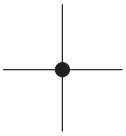


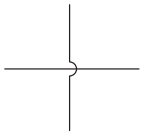
A. Brake pedal
B. Propel pedal
C. Large debris trap pedal

ELECTRICAL SCHEMATIC SYMBOLS



Key Switch


Connected


Not Connected

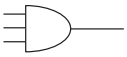
Connector


Energized


Adaptor Harness


Notes


Assembly


AC Plug

Battery

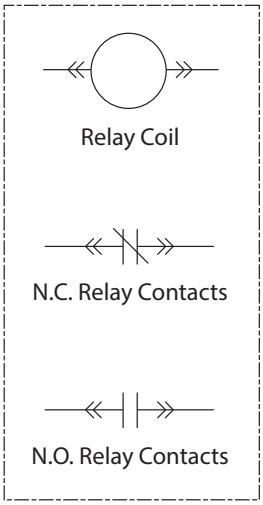

Circuit Breaker

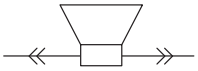

Fuse

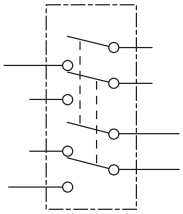

Diode

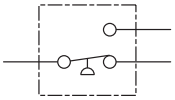

Single Continuation Tab

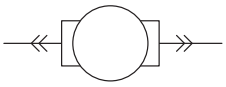

Double Continuation Tab

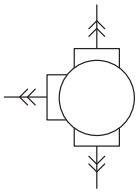


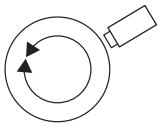

Horn or Alarm


DPDT Switch

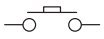

Pressure Switch

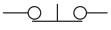

Motor


3 Phase AC
Induction Motor

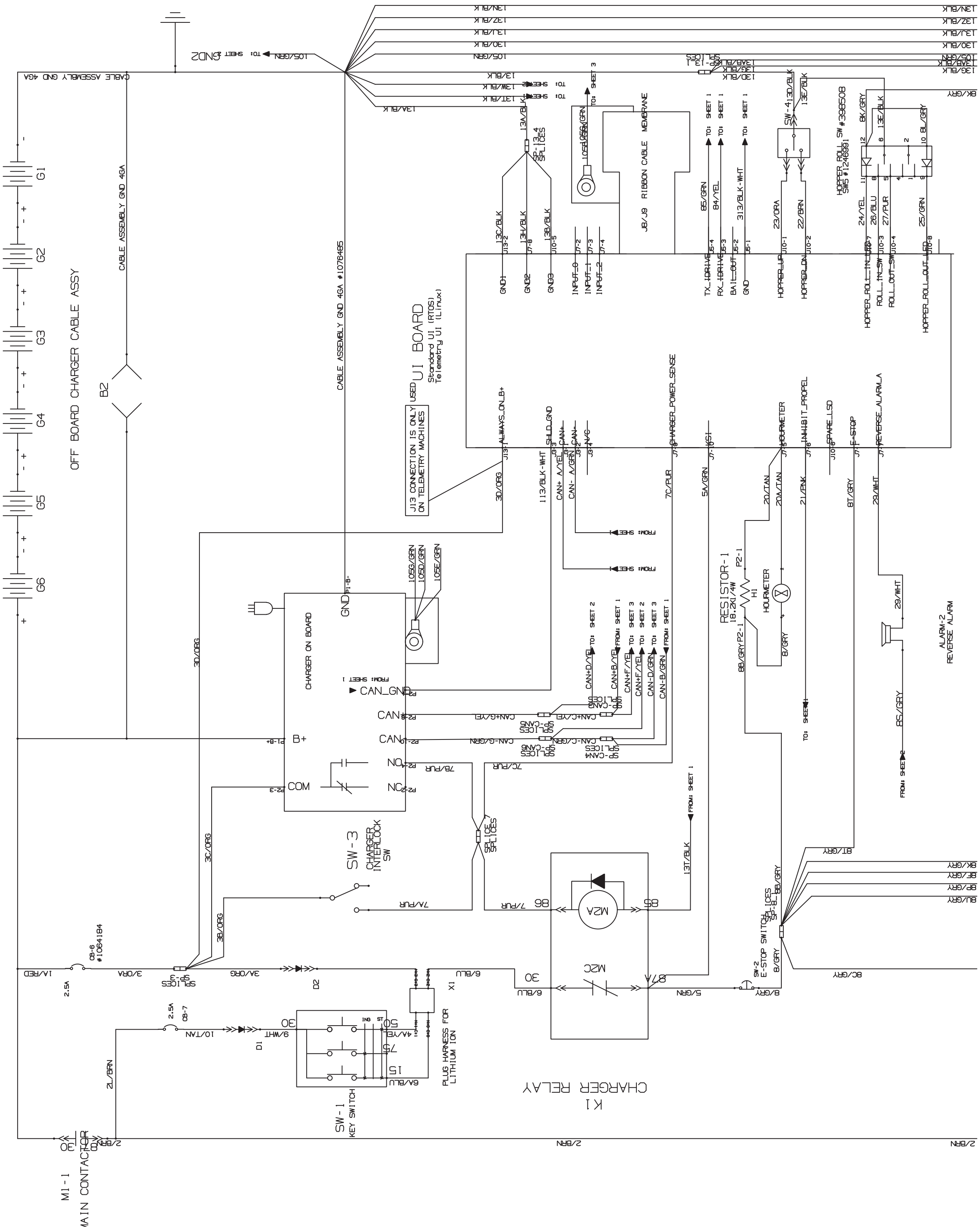

Motor Encoder

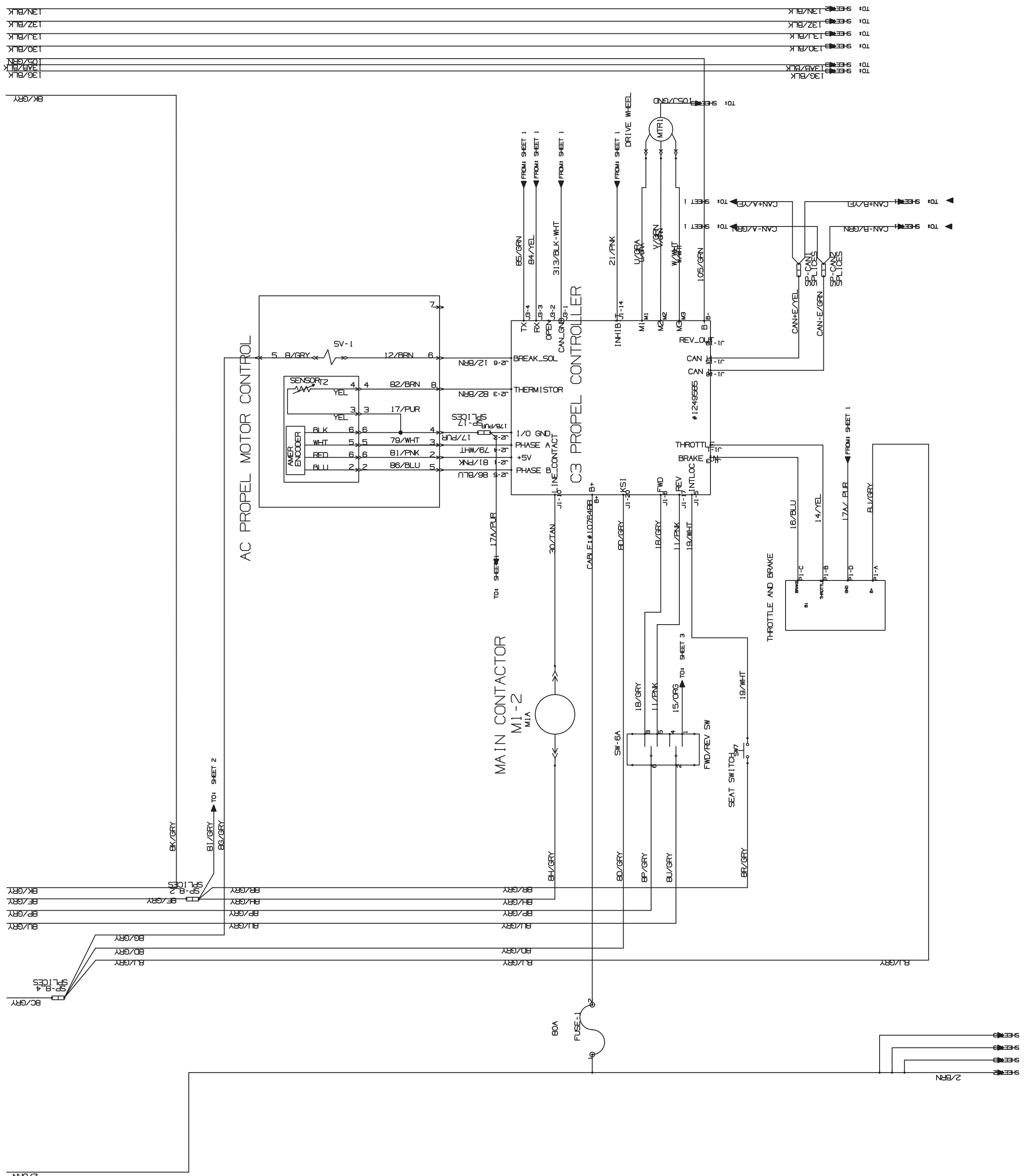

Sensor
(Variable Resistor)

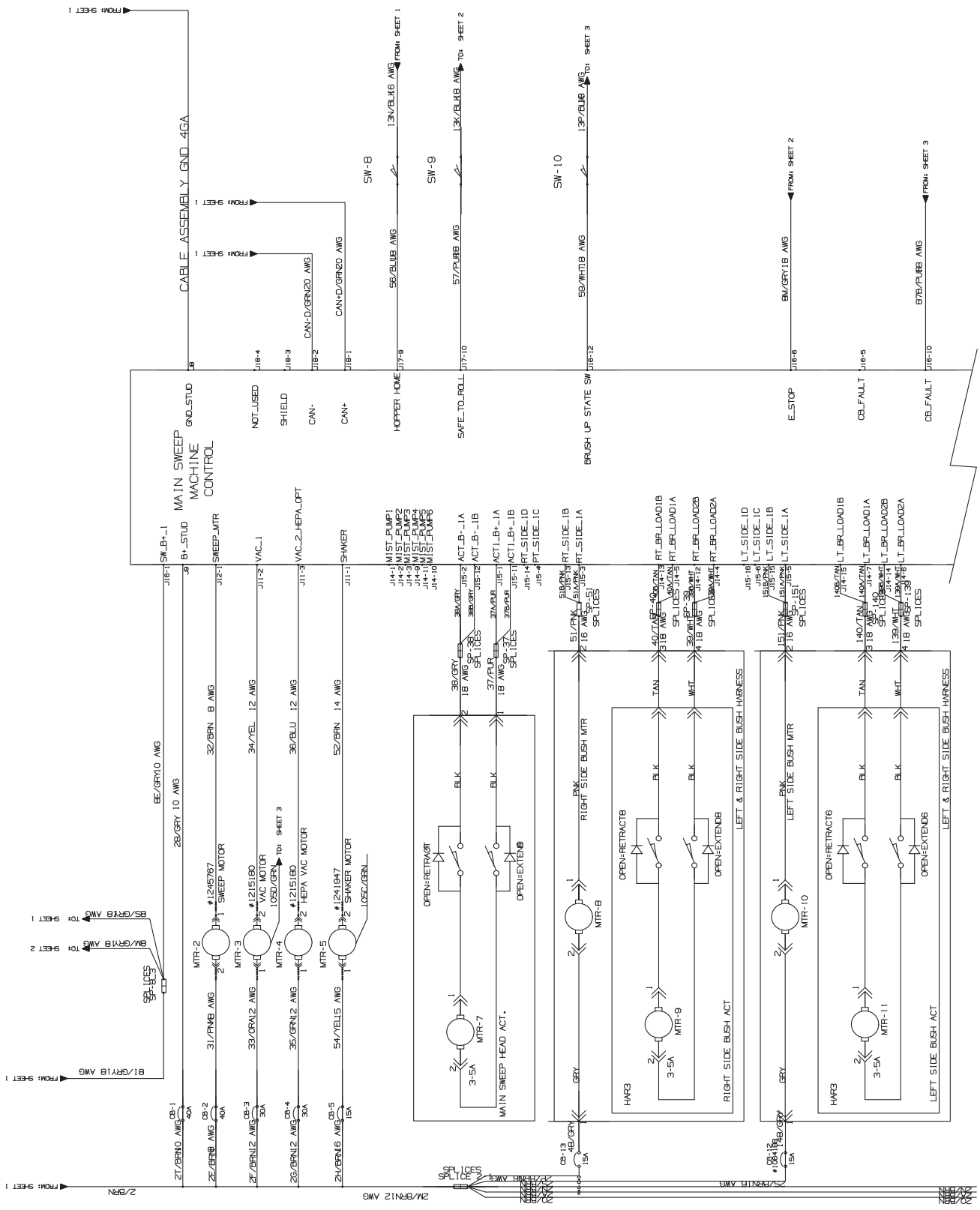

Momenary Switch N.O.

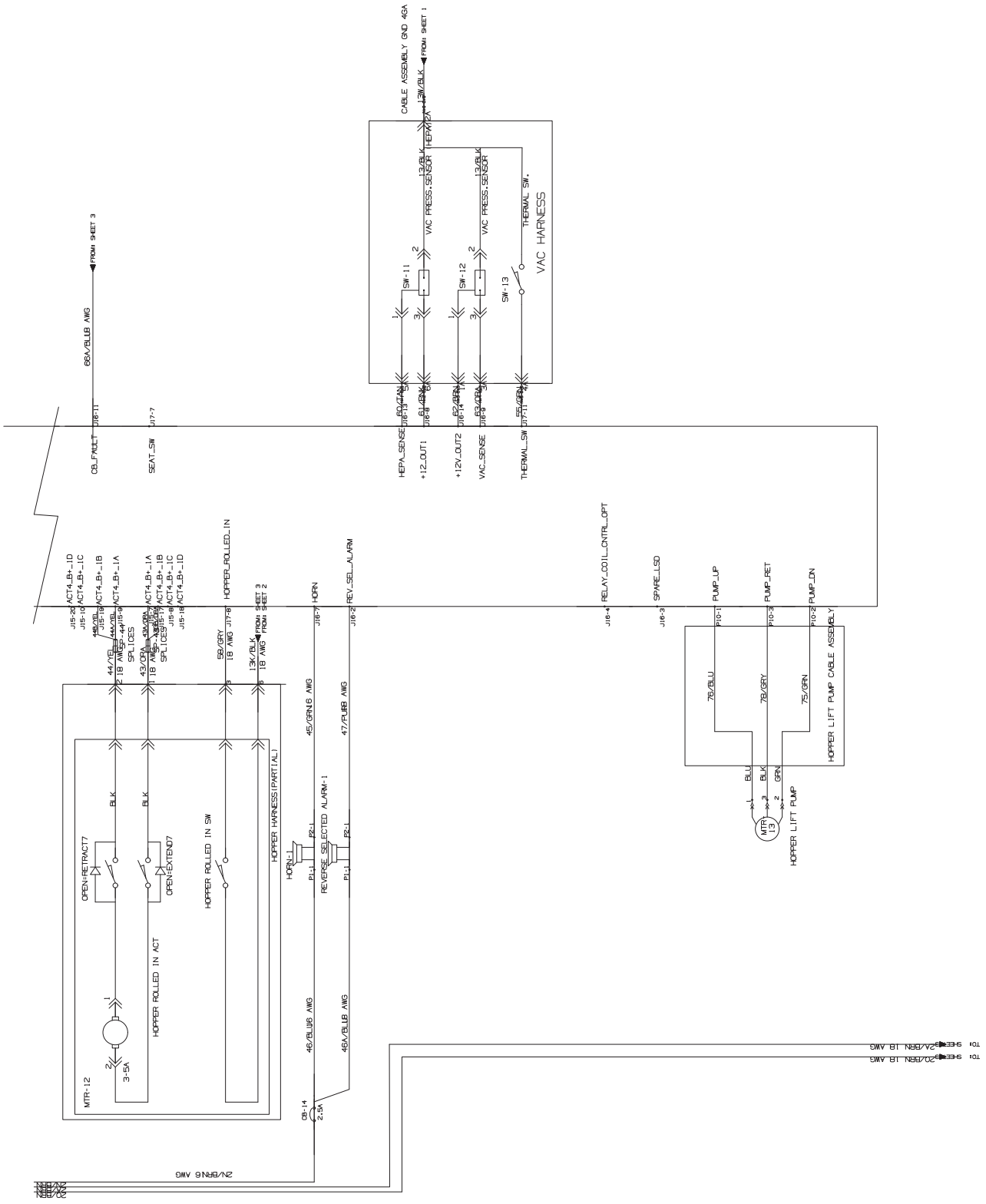

Contact Switch N.C.

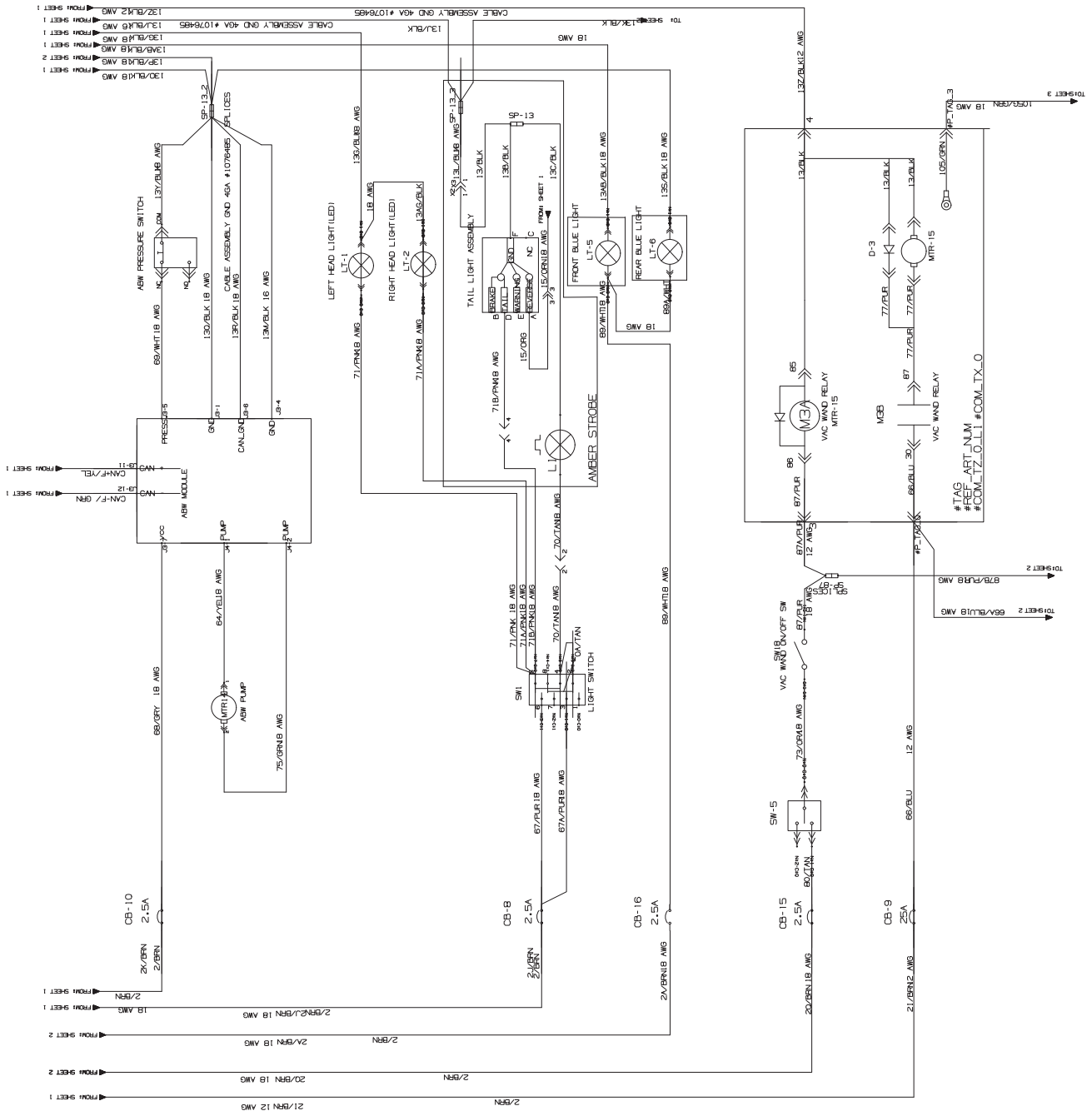
SCHEMATICS

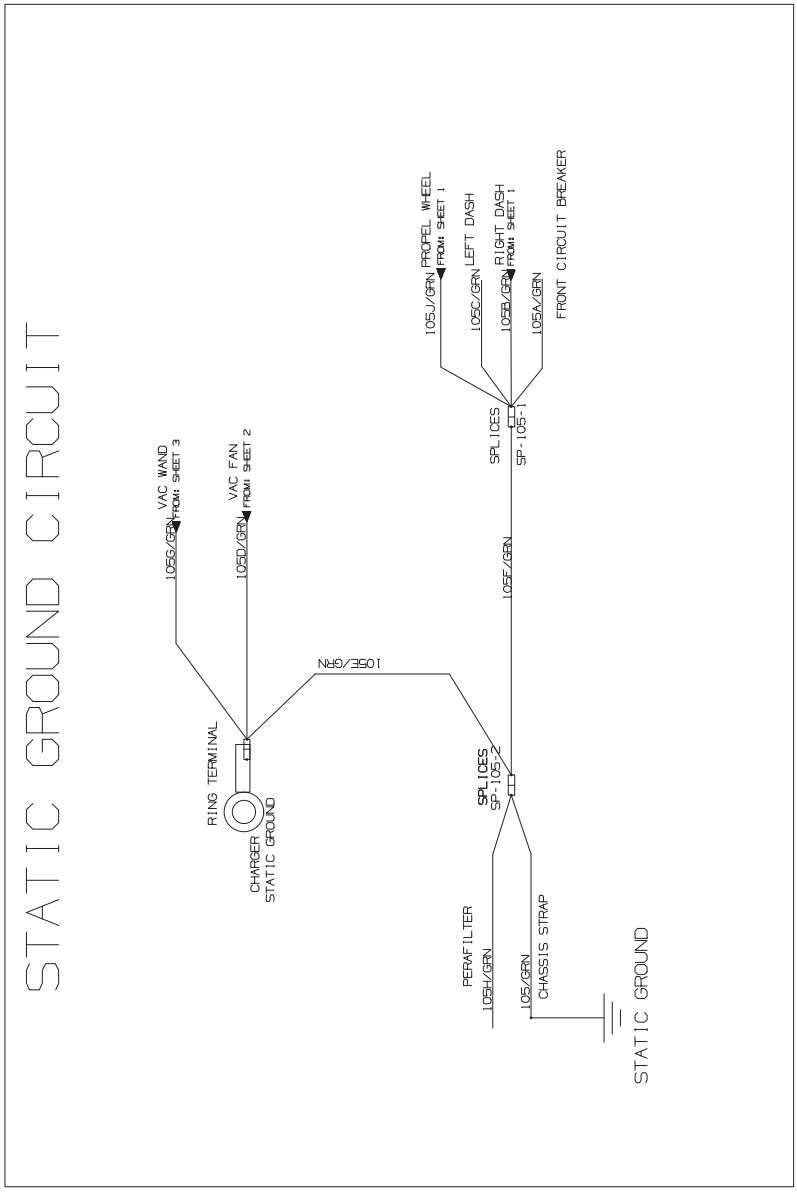

UI BOARD
Standard UI (RTOS)
Telemetry UI (Linux)
J13 CONNECTION IS ONLY USED ON TELEMETRY MACHINES
OFF BOARD CHARGER CABLE ASSY
CABLE ASSEMBLY GND 4GA
CABLE ASSEMBLY GND 4GA #1076485
B2
G1
G2
G3
G4
G5
G6
CHARGER ON BOARD
SW-3
CHARGER INTERLOCK SW
SW-1
KEY SWITCH
PLUG HARNESS FOR LITHIUM ION
K1
CHARGER RELAY
M1-1
MAIN CONTACTOR
RESISTOR-1
HOURMETER
ALARM-2
REVERSE ALARM
SW-2
E-STOP SWITCH
SW-4
J8/J9 RIBBON CABLE MEMBRANE
HOPPER ROLL SW #398508
SW5 #1249991

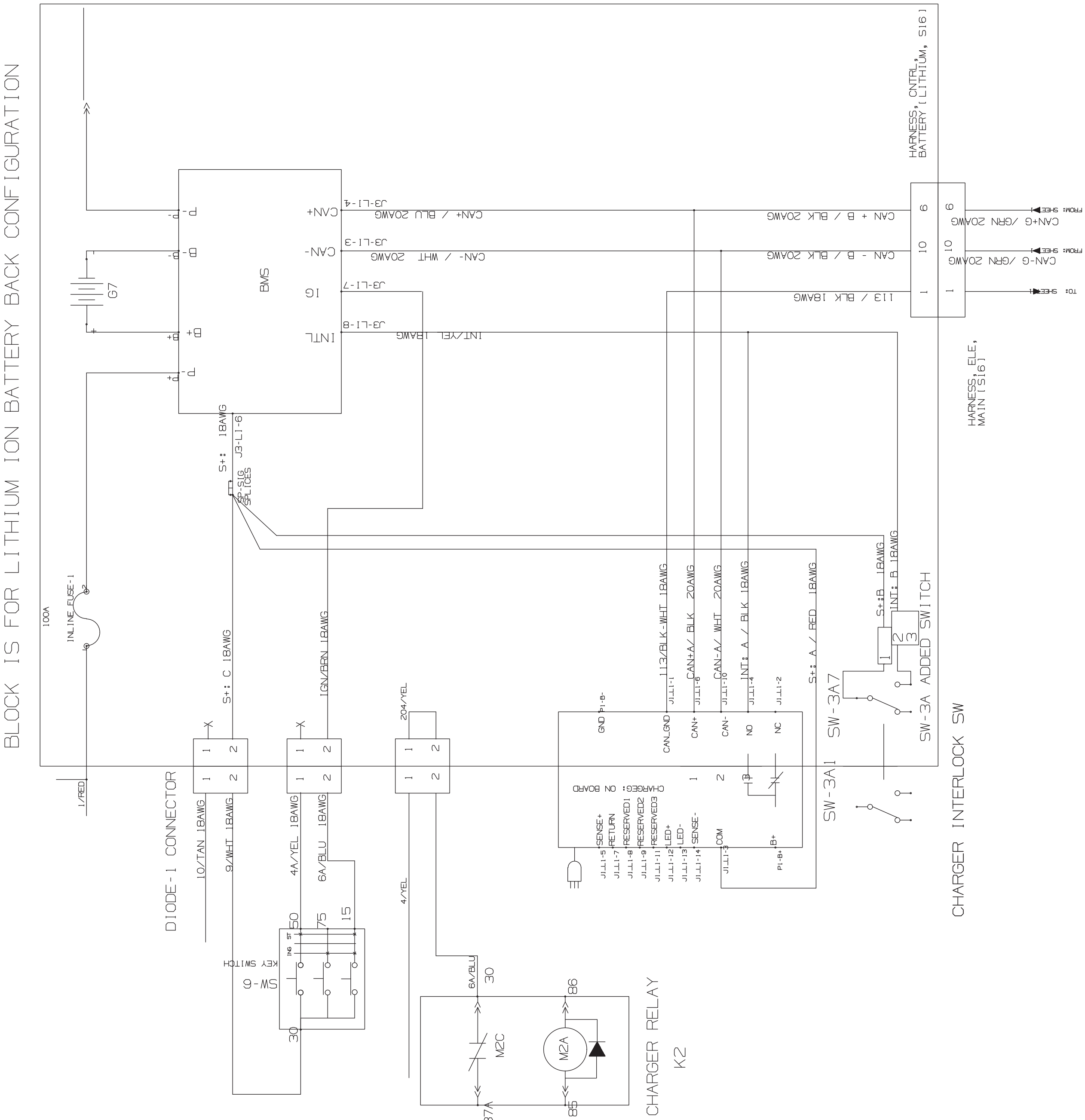

C3 PROPEL CONTROLLER
AC PROPEL MOTOR CONTROL
MAIN CONTACTOR
M1-2
DRIVE WHEEL
THROTTLE AND BRAKE
FWD/REV SW
SEAT SWITCH


MAIN SWEEP MACHINE CONTROL
CABLE ASSEMBLY GND 4GA
SW-8
SW-9
SW-10
GND_STUD
NOT_USED
SHIELD
CAN-
CAN+
HOPPER HOME
SAFE_TO_ROLL
BRUSH UP STATE SW
E_STOP
CB_FAULT
CB_FAULT
SW_B+_1
B+_STUD
SWEEP_MTR
VAC_1
VAC_2_HEPA_OPT
SHAKER
MIST_PUMP1
MIST_PUMP2
MIST_PUMP3
MIST_PUMP4
MIST_PUMP5
MIST_PUMP6
ACT_B-_1A
ACT_B-_1B
ACT1_B+_1A
ACT1_B+_1B
RT_SIDE_1D
RT_SIDE_1C
RT_SIDE_1B
RT_SIDE_1A
RT_BR_LOAD1B
RT_BR_LOAD1A
RT_BR_LOAD2B
RT_BR_LOAD2A
LT_SIDE_1D
LT_SIDE_1C
LT_SIDE_1B
LT_SIDE_1A
LT_BR_LOAD1B
LT_BR_LOAD1A
LT_BR_LOAD2B
LT_BR_LOAD2A
#1245767 SWEEP MOTOR
#1215180 VAC MOTOR
#1215180 HEPA VAC MOTOR
#1241947 SHAKER MOTOR
MTR-2
MTR-3
MTR-4
MTR-5
MTR-7
MTR-8
MTR-9
MTR-10
MTR-11
MAIN SWEEP HEAD ACT.
RIGHT SIDE BUSH MTR
LEFT SIDE BUSH MTR
RIGHT SIDE BUSH ACT
LEFT SIDE BUSH ACT
OPEN=RETRACT
OPEN=EXTEND
LEFT & RIGHT SIDE BUSH HARNESS
SPLICES
FROM: SHEET 1
FROM: SHEET 2
FROM: SHEET 3
TO: SHEET 1
TO: SHEET 2
TO: SHEET 3


CABLE ASSEMBLY GND 45A
FROM SHEET 1
VAC HARNESS
VAC PRESS. SENSOR (HEPA)
VAC PRESS. SENSOR
THERMAL SW.
SW-11
SW-12
SW-13
HEPA_SENSE
+12_OUT1
+12V_OUT2
VAC_SENSE
THERMAL_SW
CB_FAULT
SEAT_SW
FROM SHEET 3
HOPPER_ROLLED_IN
HORN
REV_SEL_ALARM
RELAY_COIL_CNTRL_OPT
SPARE_LSD
PUMP_UP
PUMP_RET
PUMP_DN
HOPPER LIFT PUMP CABLE ASSEMBLY
HOPPER LIFT PUMP
MTR-12
HOPPER ROLLED IN ACT
HOPPER ROLLED IN SW
OPEN-RETRACT7
OPEN-EXTEND7
HOPPER HARNESS (PARTIAL)
REVERSE SELECTED ALARM-1
HORN-1
CB-14
2.5A
3-5A
TO: SHEET 3 20/GRN 18 AWG
TO: SHEET 3 24/GRN 18 AWG




STATIC GROUND CIRCUIT
VAC WAND
FROM: SHEET 3
105G/GRN
VAC FAN
FROM: SHEET 2
105D/GRN
105E/GRN
RING TERMINAL
CHARGER
STATIC GROUND
SPLICES
SP-105-2
105F/GRN
SPLICES
SP-105-1
105J/GRN
PROPEL WHEEL
FROM: SHEET 1
105C/GRN
LEFT DASH
105B/GRN
RIGHT DASH
FROM: SHEET 1
105A/GRN
FRONT CIRCUIT BREAKER
PERAFILTER
105H/GRN
105/GRN
CHASSIS STRAP
STATIC GROUND


BLOCK IS FOR LITHIUM ION BATTERY BACK CONFIGURATION
BMS
G7
HARNESS, CNTRL, BATTERY [LITHIUM, S16]
HARNESS, ELE, MAIN [S16]
INLINE FUSE-1
100A
DIODE-1 CONNECTOR
KEY SWITCH
SW-6
CHARGER RELAY
K2
SW-3A7
SW-3A1
SW-3A ADDED SWITCH
CHARGER INTERLOCK SW

FASTENER TORQUES

SAE (STANDARD)

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

METRIC

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

SPECIFICATIONS

GENERAL MACHINE DIMENSIONS/CAPACITIES

Item	Dimension / Capacity
Length	1815 mm (71 in)
Width (Body)	1168 mm (46 in)
Width (Body with optional left side brush)	1168 mm (46 in)
Wheel base	1206 mm (47.5 in)
Height (Without overhead guard)	1500 mm (59 in)
Height (With overhead guard)	2095 mm (82.5 in)
Height (With high dump)	1570 mm (61.8 in)
Track	1030 mm (40.5 in)
Main brush length (Cylindrical)	810 mm (32 in)
Side brush diameter (Disk)	510 mm (20 in)
Sweeping path width (Single side brush)	1170 mm (46 in)
Sweeping path width (Dual side brushes)	1520 mm (60 in)
Hopper volume capacity	150 L (5.3 ft^3)
Hopper weight capacity (High Dump)	159 Kg (350 lbs)
Hopper weight capacity (Low Dump)	91 Kg (200 lbs)
Hopper maximum dump height (High Dump)	1572 mm (61.9 in)
Hopper minimum ceiling dump height (High Dump)	2220 mm (87.4 in)
Dust filter area (Standard)	9 m^2 (97 ft^2)
Dust filter area (HEPA)	4.6 m^2 (50 ft^2)
Weight no batteries (High Dump)	793 Kg (1748 lbs)
Weight no batteries (Low Dump)	698 Kg (1538 lbs)
Weight high dump (with standard batteries)	975 Kg (2150 lbs)
Weight low dump (with standard batteries)	880 Kg (1940 lbs)
GVWR (High Dump)	1406 Kg (3100 lbs)
GVWR (Low Dump)	1243 Kg (2740 lbs)
Protection Grade	IPX5

Values determined as per IEC 60335-2-72	Measure
Sound pressure level LpA	67 dB
Sound pressure uncertainty KpA	3 dB
Sound power level LWA + Uncertainty KWA	91 dB + 2.98 dB
Vibration - Hand-arm	<2.5 m/s^2
Vibration - Whole body	<0.5 m/s^2

GENERAL MACHINE PERFORMANCE

Item	Measure
Aisle turnaround width (less side brush)	2140 mm (84 in)
Travel Speed (Forward)	8.8 Km/h (5.5 mph)
Travel Speed while sweeping (Forward)	8.8 Km/h (5.5 mph)
Travel Speed lifted hopper (Forward)	2.4 Km/h (1.5 mph)
Travel Speed (Reverse)	4.8 Km/h (3 mph)
Maximum ramp incline for loading - Empty	21.3% / 12°
Maximum ramp incline for sweeping	14.1% / 8°
Maximum ramp incline for transporting (GVWR)	21.3% / 12°
Maximum ambient temperature for machine operation	43° C (110° F)
Minimum temperature for operating machine sweeping functions	0° C (32° F)

POWER TYPE

Type	Quantity	Volts	Ah Rating	Weight
Lead-acid Batteries (Max. battery dimensions): 28.8 in / 731 mm W x 19.9 in / 506 mm L x 15.6 in / 395 mm H	6	36	240 @ 20 hr rate	30 kg (67 lb)
	6	36	360 @ 20 hr rate	44 kg (98 lb)
Lithium-ion Battery	2 pack	36	110 / 4.1 kWh	51 Kg (112 lb)
	4 pack	36	221 / 8.2 kWh	83 Kg (183 lb)
	6 pack	36	331 / 12.2 kWh	114.5 Kg (252.5 lb)

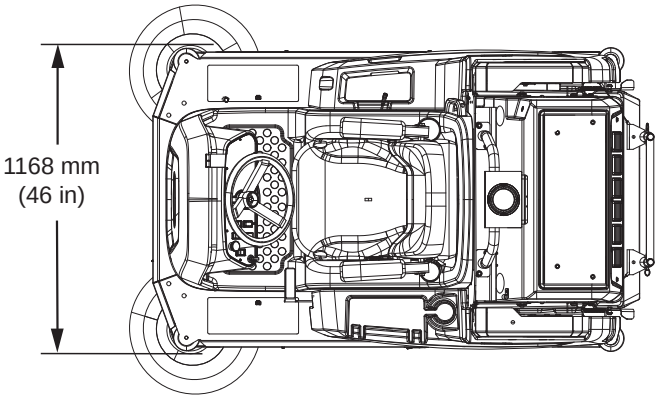
Type	Use	VDC	k W (hp)
Electric Motors	Main sweep brush	36	0.75 (1.00)
	Side sweep brush	36	0.12 (0.16)
	Vacuum fan	36	0.60 (8.00)
	Propelling	36	1.20 (1.60)
	Vacuum wand (Option)	36	0.71 (0.95)

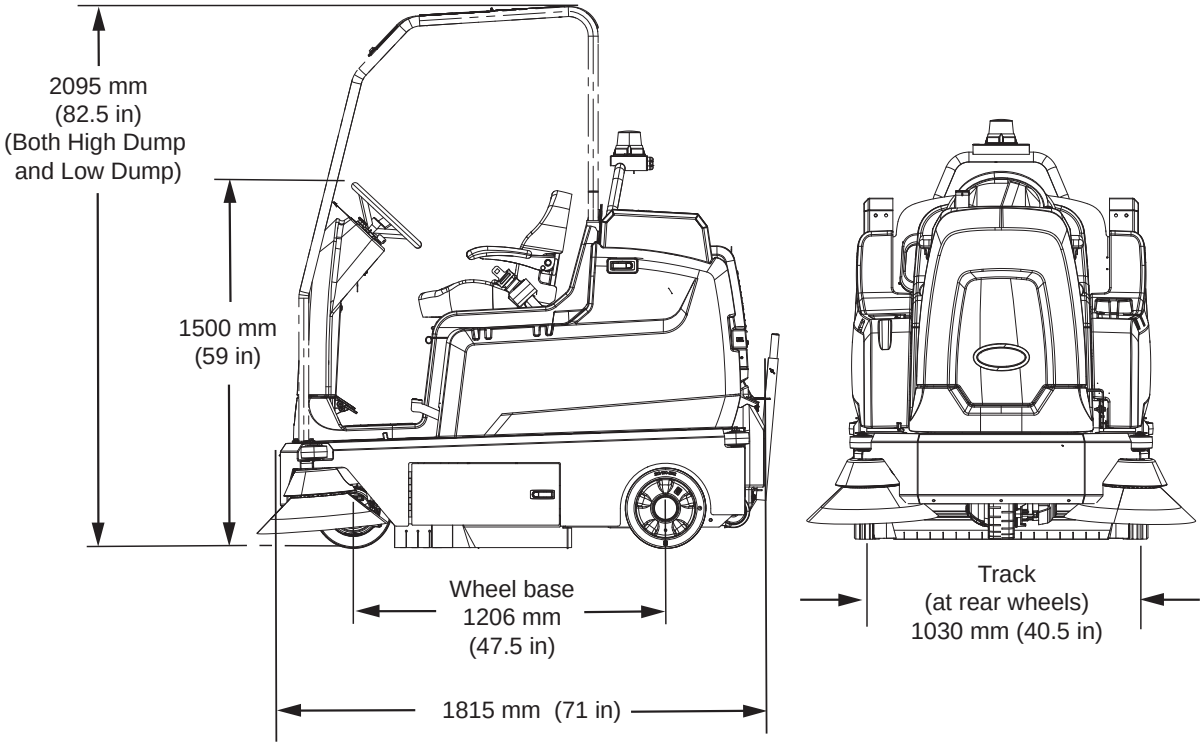
Type	VDC	amp	Hz	Phase	VAC
Charger (On-Board)	36	25	50-60	1	100-240
Charger (On-Board)	36	33	50-60	1	100-240
Charger (Off-Board)	36	25	50-60	1	100-240
Charger, Lithium-Ion Battery (Off-Board)	36	33	50-60	1	100-240

TIRES

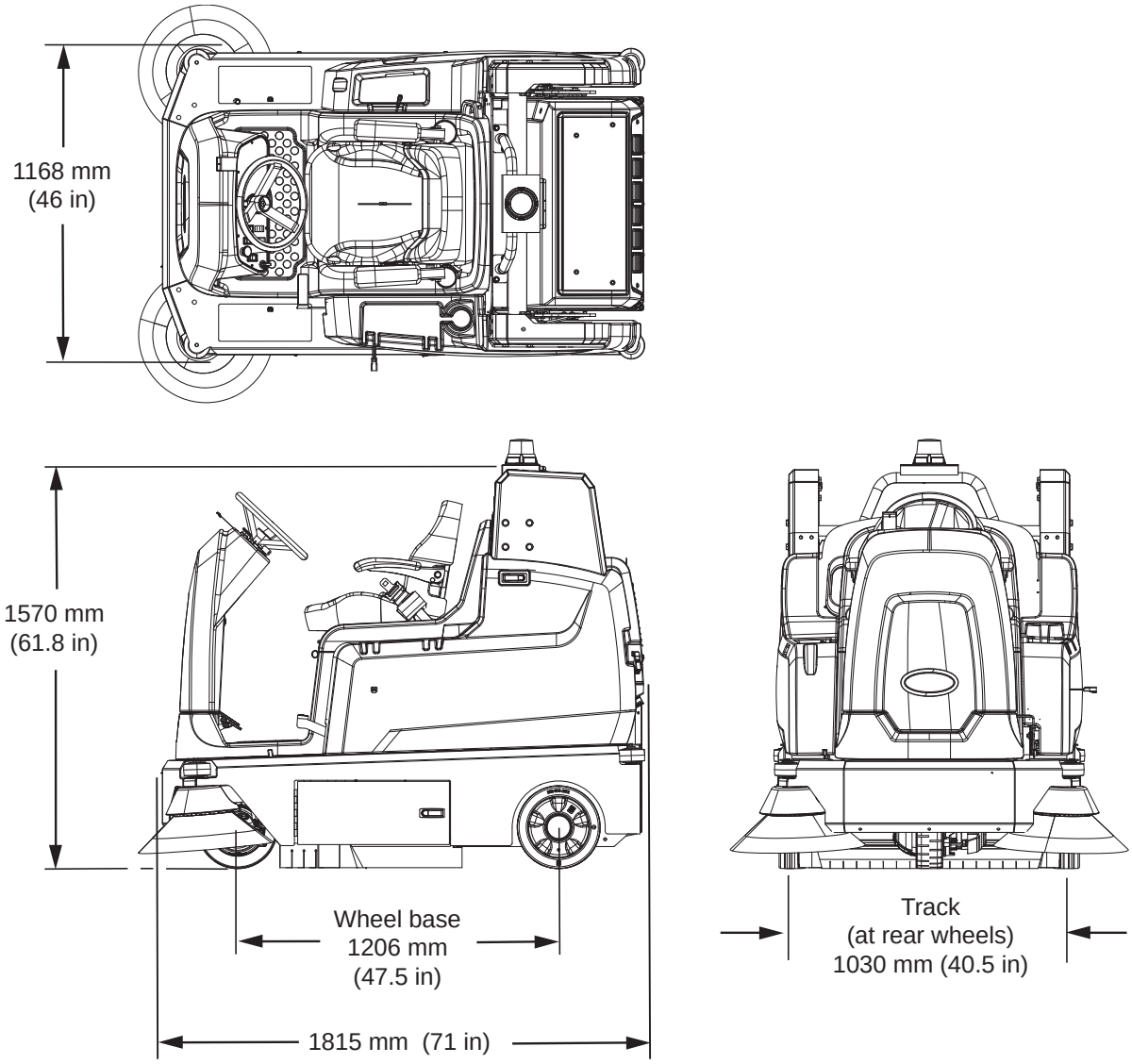
Location	Type	Size
Front (1)	Solid	102 mm wide x 300 mm OD (4 in wide x 12 in OD)
Rear (2)	Solid	102 mm wide x 300 mm OD (4 in wide x 12 in OD)

MACHINE DIMENSIONS - LOW DUMP

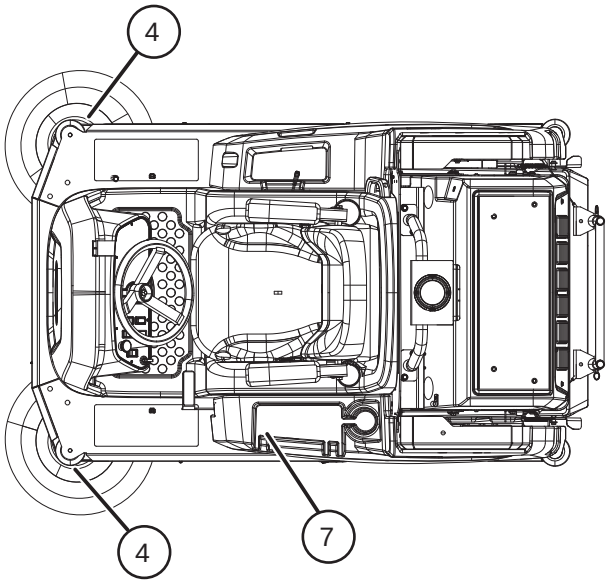


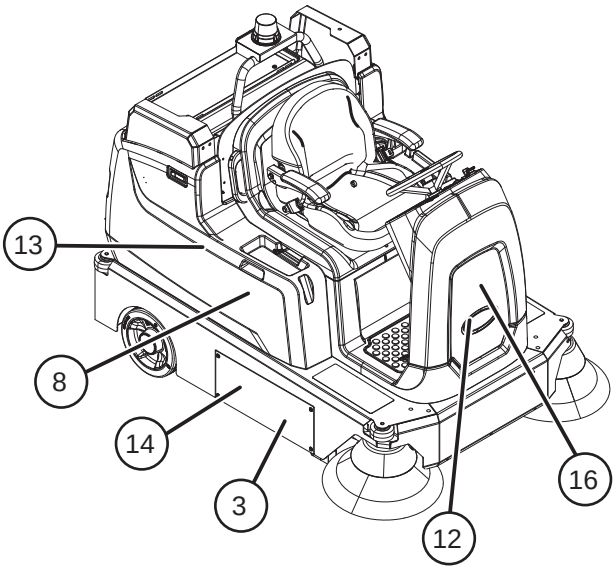


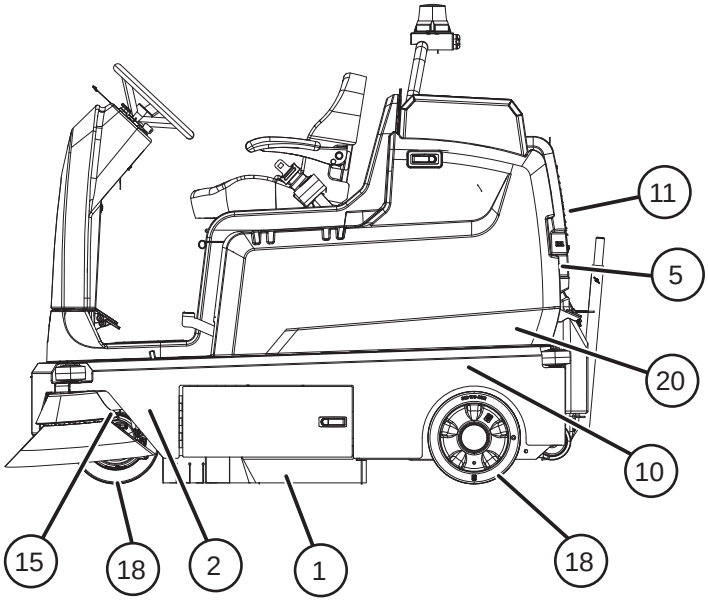
MACHINE DIMENSIONS - HIGH DUMP

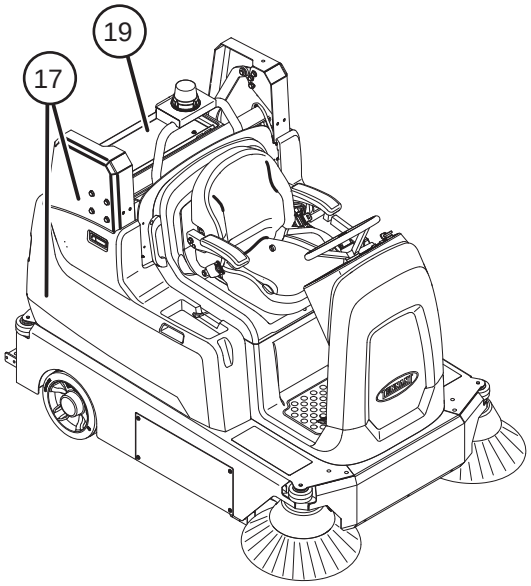


MAINTENANCE









MAINTENANCE CHART

The table below indicates the Person Responsible for each procedure.

O = Operator.
T = Trained Personnel.

▭ = *Indicates unique maintenance schedule for machines equipped with HEPA filtration system.*

Interval	Person Resp.	With HEPA	Without HEPA	Key	Description	Procedure	Lubricant/ Fluid	No. of Service Points
Daily / 8 Hours	O			7	Hydraulic reservoir (High Dump Machines Only)	Check hydraulic fluid level	HYDO	1
	O			1	Brush compartment skirts	Check for damage, wear and adjustment	-	5
	O	*		-	Brush compartment HEPA skirts	Check for damage, wear and adjustment	-	2
	O			1	Side skirts	Check for damage, wear and adjustment	-	2
	O			3	Main brush	Check for damage, wear, and debris. Remove debris from main brush compartment	-	1
	O			4	Right side brush/ Left side brush (Option)	Check for damage, wear, debris	-	1 (2)
	O			-	Side brush dust control skirts (Option)	Check for damage, wear and adjustment	-	All
	O			5	Hopper dust filter	Shake to clean	-	1
	O	*		5	Hopper	Clean and rinse	-	1
	O	*		-	Main brush door HEPA seals	Check for damage and wear	-	1
	O			6	Vacuum wand bag (Option)	Clean	-	1
Weekly	T			8	Battery cells	Check electrolyte level	DW	All
	O			8	Battery compartment	Check for liquid. Drain if necessary	-	
50 Hours	O			3	Main brush	Rotate end for end	-	1
	T			3	Main brush	Check brush pattern and adjust if needed	-	1
	T			4	Side brush(es)	Check pattern		1 (2)
	O			-	Vacuum wand bag (Option)	Check or change vacuum bag	-	1
	O			-	Vacuum wand fan (Option)	Check for damage or wear	-	1

The table below indicates the Person Responsible for each procedure.

O = Operator.
T = Trained Personnel.

▭ = *Indicates unique maintenance schedule for machines equipped with HEPA filtration system.*

Interval	Person Resp	With HEPA	Without HEPA	Key	Description	Procedure	Lubricant/ Fluid	No. of Service Points
100 Hours	T			8	Battery watering system (option)	Check hoses and connections for damage and wear		All
	O			5	Hopper dust filter	Change for damage, clean or replace		1
	O			10	Hopper seals	Check for damage or wear	-	6
	O			5	Hopper filter seals	Check for damage or wear	-	2
	O			20	Perma-Filter	Check for debris, clean as necessary		1
	O			5	Lint screen (option)	Check for debris, clean as necessary		
	O			11	Vacuum seal	Check for damage or wear	-	1
	O			1	Large debris trap skirt	Check for damage or wear	-	1
200 Hours	T			14	Main brush drive belt	Check for wear	-	1
	T			16	Steering chain	Lubricate and check for damage and wear.	GL	1
	O			4	Side brush(es) guard	Check for damage or wear	-	1 (2)
	T			8	Battery terminals and cables	Check and clean	-	All
	T			17	Hopper lift arm pivots (High Dump Machines Only)	Lubricate	SPL	3
	T			2	Main sweep damper (shock absorber)	Check for dirt, debris, and damage. Clean as necessary. Replace if damaged.		1
500 Hours	O			18	Tires	Check for damage and wear	-	3
	T			19	Vacuum wand fan motor(s)	Check motor brushes	-	1
	T	*		11	HEPA vacuum fan motors	Check motor brushes	-	2

The table below indicates the Person Responsible for each procedure.

O = Operator.
T = Trained Personnel.

▭ = *Indicates unique maintenance schedule for machines equipped with HEPA filtration system.*

Interval	Person Resp	With HEPA	Without HEPA	Key	Description	Procedure	Lubricant/ Fluid	No. of Service Points
800 Hours	T			-	Hydraulic hoses (High Dump Machines Only)	Check for wear and damage	-	All
1750 Hours	T			13	Vacuum fan motor	Check motor brushes	-	1
2400 Hours	T			7	Hydraulic reservoir (High Dump Machines Only)	Change hydraulic fluid	HYDO	1

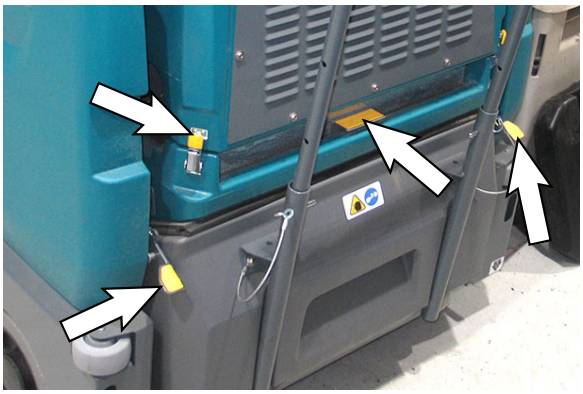
LUBRICANT/FLUID

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 depending on types of floor surfaces and type of and/or amount of debris being swept.

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.

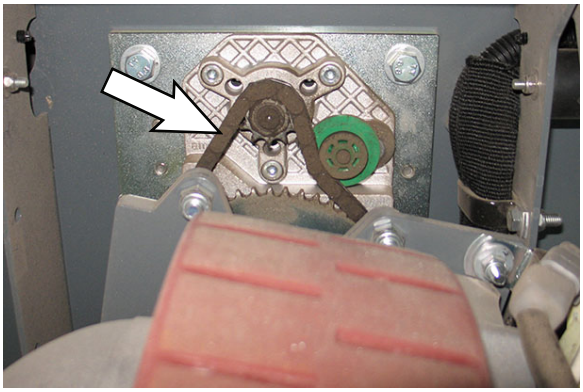


LUBRICATION

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

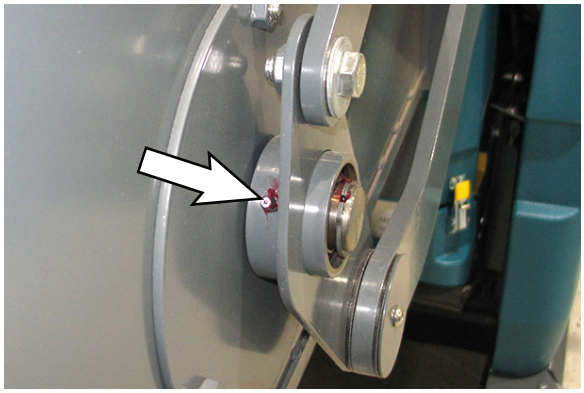
STEERING CHAIN

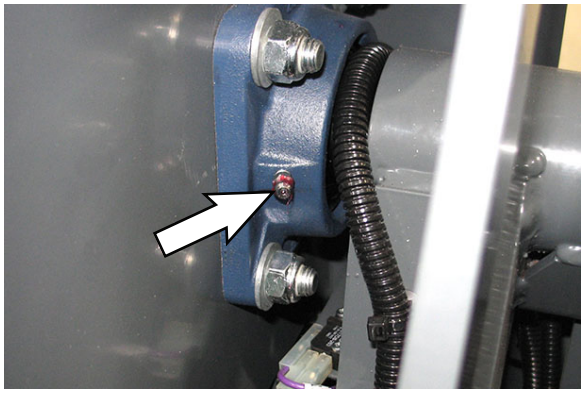
The steering chain is located directly above the drive wheel assembly. Check for damage or wear and lubricate the steering chain after every 200 hours.

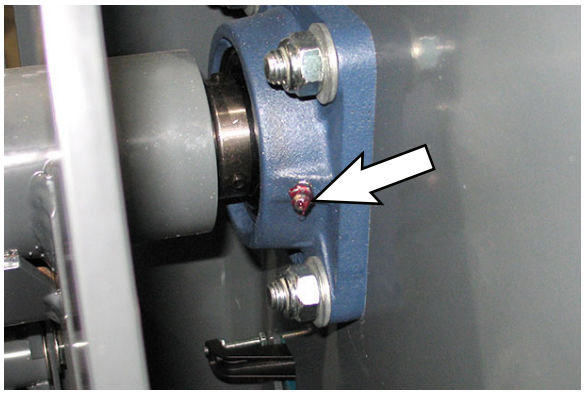


HOPPER LIFT ARM PIVOTS (HIGH DUMP MACHINES ONLY)

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

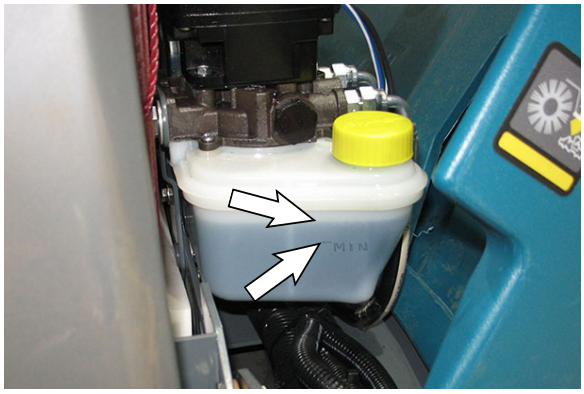






HYDRAULICS (HIGH DUMP MACHINES ONLY)

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.

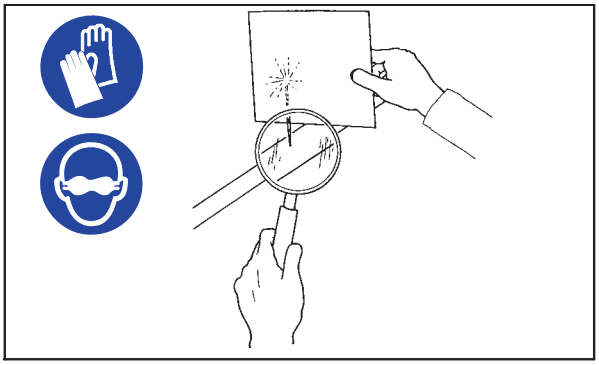
ATTENTION! Hydraulic components depend on system hydraulic fluid for internal lubrication. Malfunctions, accelerated wear, and damage will result if dirt or other contaminants enter the hydraulic system.

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.

BATTERIES

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

FLOODED (WET) AND MAINTENANCE-FREE SEALED LEAD-ACID BATTERIES

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

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

– Do not leave the battery partially discharged for long period of time.

– Only charge the battery in a well ventilated area to prevent gas build up. Charge the battery pack in temperatures below 80°F/27°C and above 32°F/0°C.

– Allow the charger to completely charge the battery before reusing the machine.

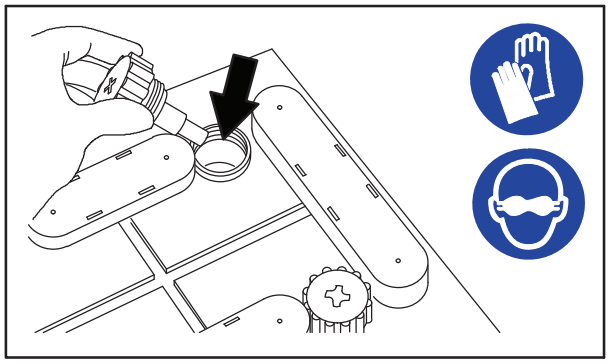
– Maintain the proper electrolyte levels of flooded (wet) batteries by checking battery cell levels weekly.

NOTE: If machine is equipped with the automatic battery watering system, proceed to the SMART-FILL AUTOMATIC BATTERY WATERING SYSTEM.

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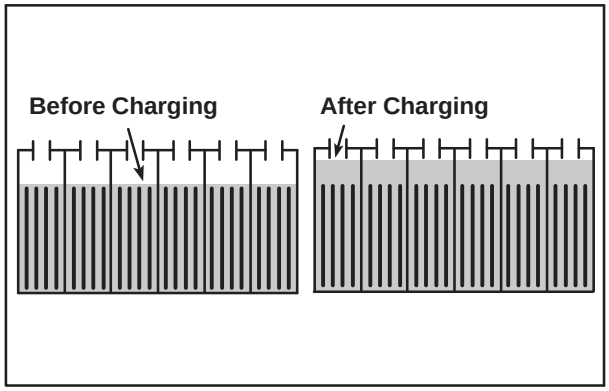
FOR SAFETY: When servicing machine, keep all metal objects off batteries. Avoid contact with battery acid.

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.



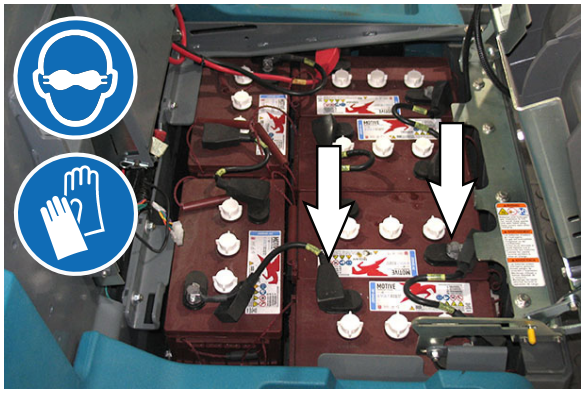
NOTE: Make sure the battery caps are in place while charging. There may be a sulfur smell after charging batteries. This is normal.

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.



LITHIUM-ION BATTERY PACK

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

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

CHARGING THE BATTERIES

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.

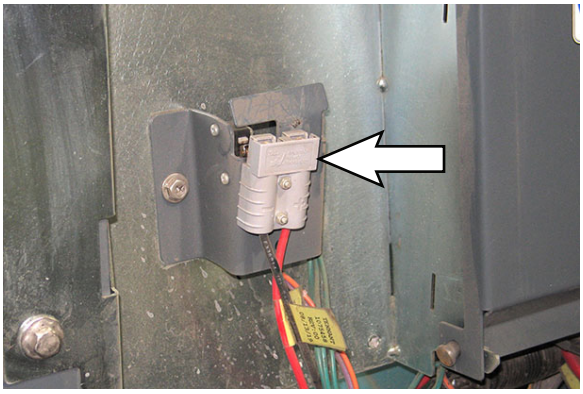
1. Park the machine on a flat, dry surface in a well-ventilated area.
2. Turn *key switch* OFF.

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

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

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

4. Machines with off-board chargers: Connect the charger connector to the machine off-board battery charging connector.



5. Plug the charger AC power supply cord into a properly grounded outlet.
6. The charger will automatically begin charging and shut off when fully charged. The maximum charging cycle may take up to 6-12 hours depending on battery type.

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

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

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

7. Machines with off-board chargers: After the batteries have completely charged, disconnect the AC power supply chord from the outlet and then disconnect the charger cable from the machine off-board battery charging connector.

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

   Machines with on-board chargers: After the batteries have completely charged, disconnect the AC power supply chord from the outlet and wrap the chord onto the storage hooks located on the battery compartment cover.

NOTE: Lithium-ion Battery Model - If the key is in the off position when charging (recommended), the battery discharge indicator will automatically shut off 5 minutes after the charge cycle has completed to conserve energy. To see the charge status, turn the key to the on position.

ON-BOARD AND OFF-BOARD BATTERY CHARGER SETTINGS

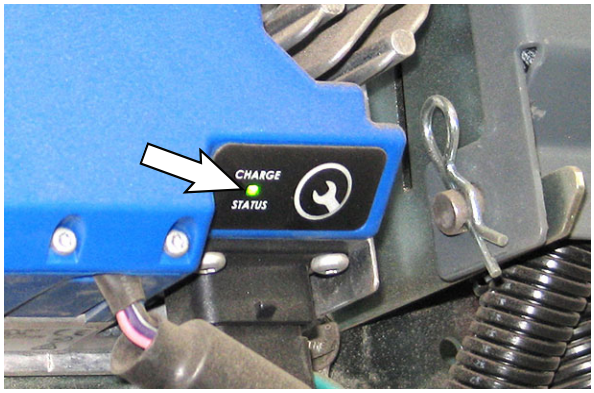
NOTE: The following instructions are intended for the Delta-Q charger model RC-900-U36 supplied by Tennant.

NOTE: The Tennant Service Diagnostic tool must be used to change the on-board charger settings.

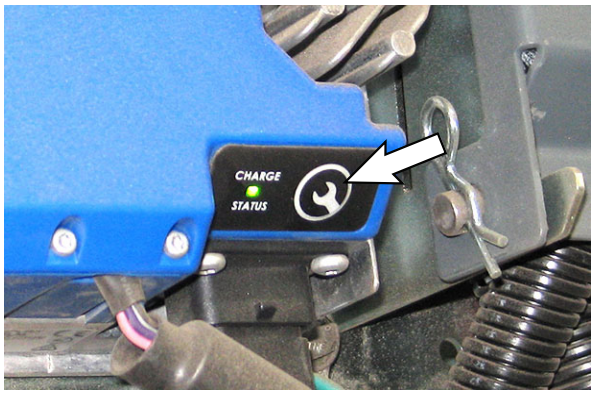
1. To display the current profile setting, press and release the Select Charge Profile Button. The profile setting is indicated by the number of consecutive green flashes after the initial two red flashes. This code is repeated twice.

   ex. Profile Setting 3: ☼ ☼ ☼ ☼ ☼
   (Flashes: Red-Red-Green-Green-Green)

   ex. Profile Setting 4-3: ☼☼☼☼ ‖ ☼☼☼
   (Flashes: Red-Red, Green-Green-Green - Green - pause - Green-Green-Green)



2. To enter the battery select mode to choose a new profile setting, press and hold the Select Charge Profile Button for 5 seconds. Fast red flashes will confirm select mode entry.



3. Indicator will then display current profile setting. This is repeated 4 times.

   ex. Profile Setting 3: ☼ ☼ ☼ ☼ ☼
   (Flashes: Red-Red-Yellow-Yellow-Yellow)

4. To change profile setting, press the Select Charge Profile Button while the current setting is repeating 4 times. Continue to press button until desired profile setting is flashing

Profile Setting	Battery Description
3	Wet, Trojan 180-240 AH
7	Wet, Trojan 270-360 AH
2-1	Wet, TAB/Enersys 180-260 AH
2-8	Gel, Deka 180-200 AH
4-3	AGM, Discover 200-400 AH
5-1	Gel, Sonnenschein 150-250 AH
1-6-8	TPPL, 12XFC48/12XFC58/12XFC60

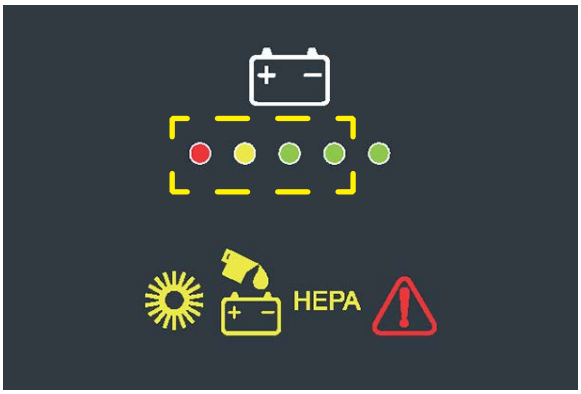
5. To save new setting, press the button for 7 seconds until new setting is displayed by green flashes. The new setting will repeat two times with two red flashed between repeats.

6. Repeat Step 1 to confirm the new battery charger setting.

OPPORTUNITY CHARGING (LITHIUM-ION BATTERIES ONLY)

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

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



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

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

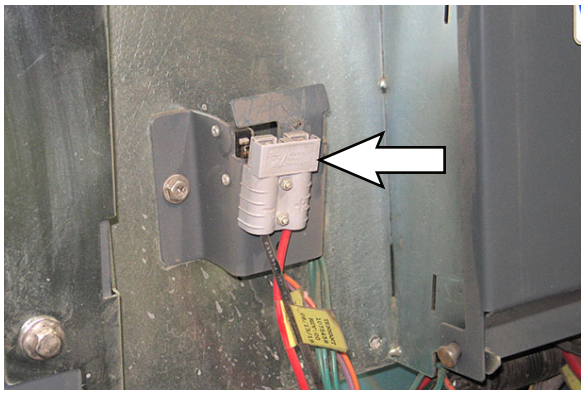
1. Park the machine on a flat, dry surface in a well-ventilated area.
2. Turn *key switch* OFF.

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

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

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

4. Machines with off-board chargers: Connect the charger connector to the machine off-board battery charging connector.



5. Plug the charger AC power supply cord into a properly grounded outlet.
6. The battery will be opportunity charged during the break.

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.

7. Machines with off-board chargers: When finished opportunity charging, disconnect the AC power supply chord from the outlet and then disconnect the charger cable from the machine off-board battery charging connector.

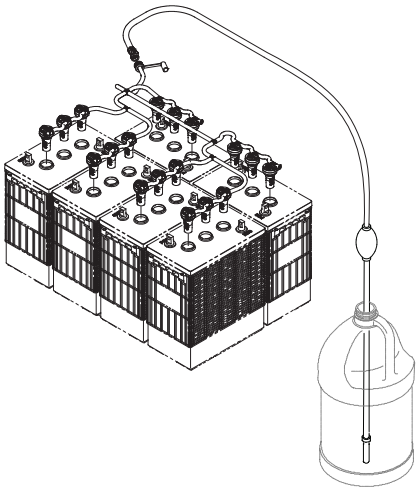
NOTE: For models equipped with an off-board charger, always disconnect the AC power supply cord first before disconnecting charger from machine.

Machines with on-board chargers: When finished opportunity charging, disconnect the AC power supply chord from the outlet and wrap the chord onto the storage hooks located on the seat shroud.

8. Close the battery compartment cover.

MANUAL BATTERY WATERING SYSTEM

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



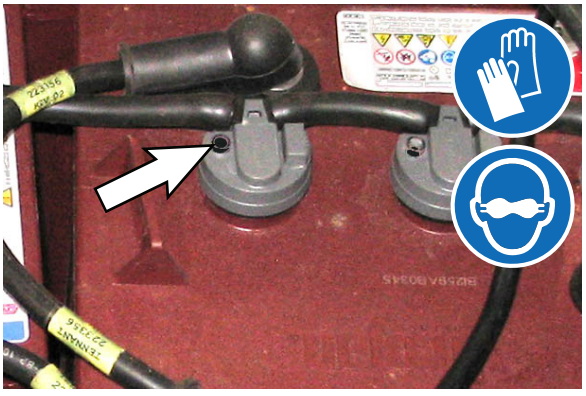
The optional manual battery watering system provides a safe and easy way to maintain the proper electrolyte levels in your batteries. It is designed exclusively for flooded (wet) lead-acid batteries.

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

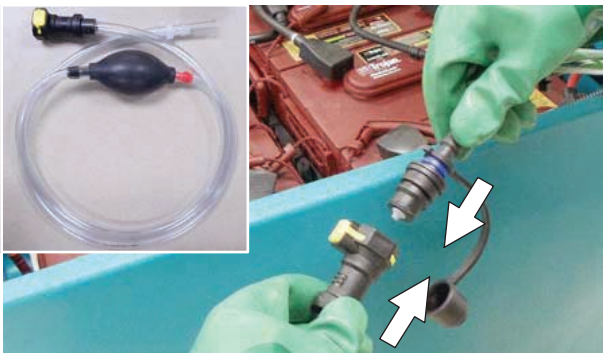
Before using the battery watering system check hoses and connections for damage or wear.

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

2. After charging batteries, check the battery electrolyte level indicators located on the battery covers. If the level indicator is black add water as described in the following instructions. If the level indicators are white the electrolyte is at the correct level, no water is required.

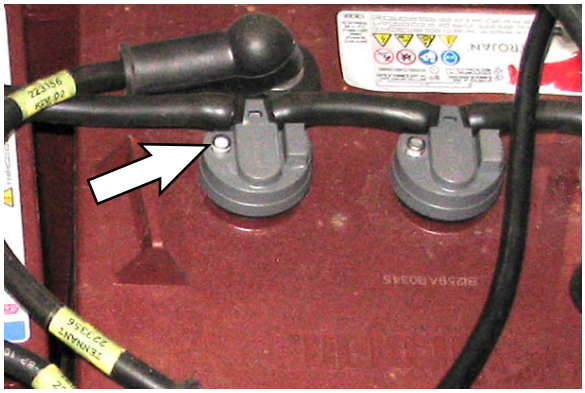


3. Locate the battery fill hose coupler inside the battery compartment. Remove the dust cap and connect the hand pump hose.



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

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



6. After adding water, reinstall the dust cap onto the battery fill hose and store the hand pump hose inside the battery compartment for future use.

SMART-FILL ABW (AUTOMATIC BATTERY WATERING) SYSTEM

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

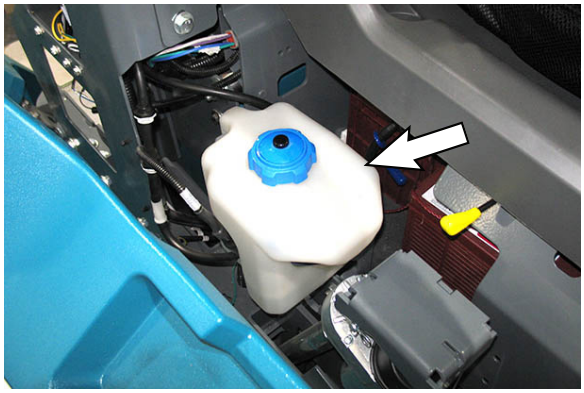
The *Smart-Fill* ABW system is designed to automatically refill the batteries after the machine reaches a limited number of charge cycles. Do not remove battery caps to manually add water to the batteries.

Check the *Smart-Fill* ABW system for leaks, loose hose connections, and for damage or wear after every 100 hours. Replace if damaged.

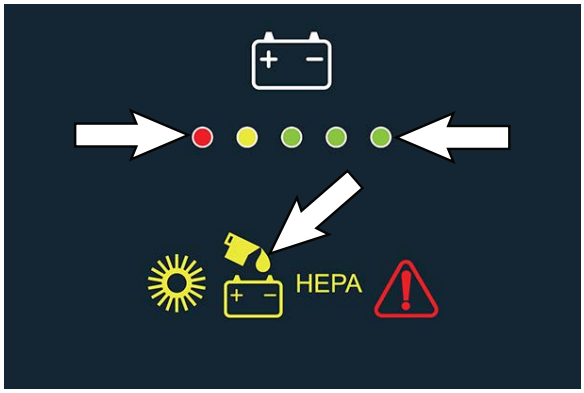
The ABW tank is located behind the shroud on the right side of the machine. Press the release and tilt the shroud, or lift the shroud, from the machine to access the automatic watering tank.

Periodically check the water level in the ABW tank. Add distilled water when low.

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



The automatic battery watering indicator will also alert user to add distilled water when tank is empty. See SMART-FILL ABW (*AUTOMATIC BATTERY WATERING) INDICATOR*.



BATTERY COMPARTMENT DRAIN VALVE

Use the battery compartment drain valve to drain liquid from the battery compartment. Check the battery compartment for liquid weekly and drain if there is liquid in the battery compartment.

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

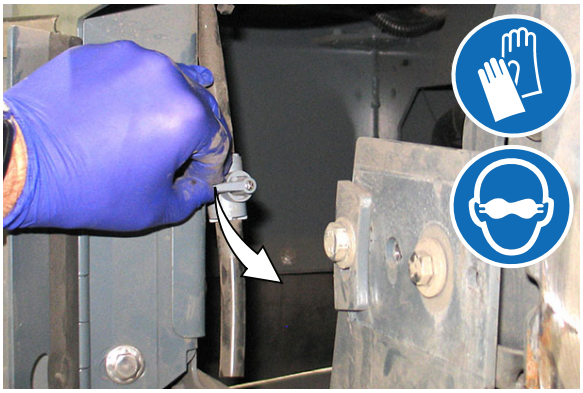
1. Position the machine over an area where the battery compartment can be safely drained, turn off the machine, and remove the key.

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

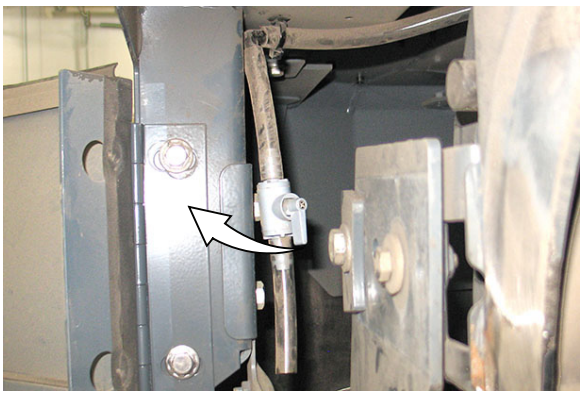
1. Release the main sweeping brush compartment access door and open the door to access the battery compartment drain valve located in the main sweep brush compartment

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

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



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



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 11 are located in the electrical compartment behind the operator seat. Remove the electrical compartment cover to access the circuit breakers.

Circuit breakers 12 through 19 are located behind the steering shroud access panel.

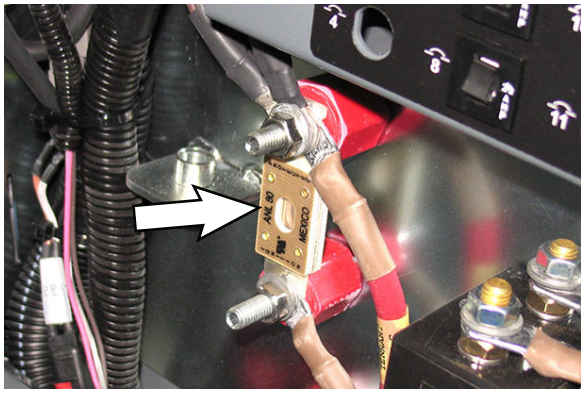
If the overload that caused the circuit breaker to trip is still present, the circuit breaker will continue to stop current flow until the problem is corrected.

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

Circuit Breaker	Rating	Circuit Protected
CB1	40A	Main control board
CB2	40A	Main sweep motor
CB3	30A	Vacuum fan motor
CB4	30A	HEPA vacuum fan motor
CB5	15A	Filter shaker
CB6	2.5A	User interface/ignition
CB7	2.5A	Key switch
CB8	2.5A	Headlight/taillight/strobe light switch (option)
CB9	25A	Vacuum wand fan motor
CB10	2.5A	Smart-Fill ABW (Automatic Battery Watering) (option)
CB11	-	Not Used
CB12	15A	Left side brush motor
CB13	15A	Right side brush motor
CB14	2.5A	Front horn and reverse selected
CB15	2.5A	Vacuum wand switch (option)
CB16	2.5A	Blue lights (option)
CB17	-	Not Used
CB18	-	Not Used
CB19	-	Not Used

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 in-line on harnesses and cables.

Fuse	Rating	Circuit Protected
Fuse-1	80A	Propel system

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 main contactor relay (M1) is located in the electrical compartment behind the operator seat. The charger bypass relay (M2) is located behind the circuit breaker panel in the electrical compartment behind the operator seat. The vacuum wand relay (M3) is located in the vacuum wand compartment.

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, 25 A	Charger Bypass
M3	36 VDC, 25 A	Vacuum Wand (option)

ELECTRIC MOTORS

Inspect the carbon brushes on the various electric motors. Refer to the table below for carbon brush inspection intervals.

Carbon Brush Inspection	Hours
Vacuum fan motor	1750
HEPA vacuum fan motor (Option)	500
Vacuum wand fan motor (Option)	500

HEPA (HIGH EFFICIENCY PARTICULATE ARRESTANCE) FILTRATION SYSTEM (OPTION)

The HEPA (High Efficiency Particulate Arrestance) filtration system is a dry sweeping system consisting of dry dust control and a HEPA filter. The filters, skirts and seals in each of these areas are critical in the performance of the HEPA system.

The optional HEPA filtration system helps clean in fine dust environments.

NOTE: While cleaning or performing any type of maintenance on HEPA filter systems, refer to company or local regulations regarding safety requirements.

HOPPER

Inspect and clean the hopper daily.

CLEANING THE LOW DUMP HOPPER

1. Turn the *key switch* OFF.

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

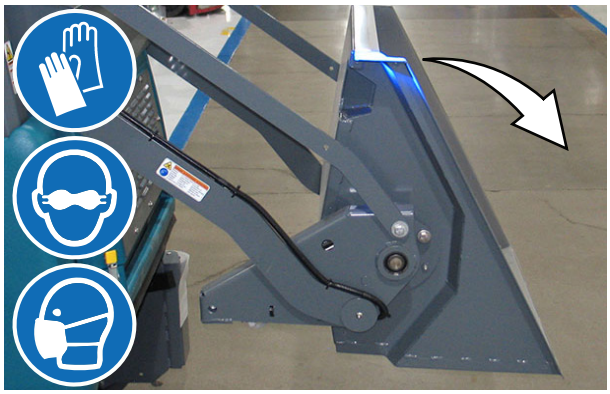
2. Remove the hopper from the machine. See *EMPTYING THE HOPPER (LOW DUMP MACHINES)* for instructions for removing the hopper from the machine.

3. Clean any debris from hopper.
4. HEPA Machines: Use a garden hose to clean the hopper.
5. Machines equipped with optional removable hopper bins only: Lift the bins from the hopper and empty and rinse the bins. Reinstall the bins into the hopper.

6. Reinstall the hopper into the machine.
7. Allow hopper to dry before using the machine.

CLEANING THE HIGH DUMP HOPPER

1. Turn on the machine, raise the hopper until the *hopper roll out switch* lights are illuminated, completely roll out the hopper, and turn off the machine.



2. Clean any debris from hopper.
3. HEPA Machines: Use a garden hose to clean the hopper.
4. Turn on the machine, roll in the hopper, lower the hopper, and turn off the machine.
5. Allow hopper to dry before using the machine.

HOPPER DUST FILTER

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

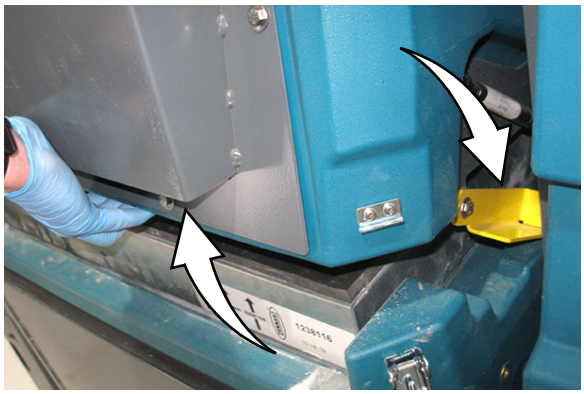
REMOVING / REPLACING THE HOPPER DUST FILTER

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.

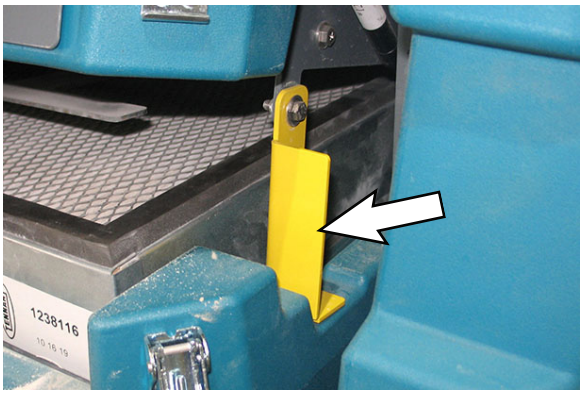
NOTE: Clean the filter more often if used in extremely dusty conditions.

1. Loosen each hopper filter compartment retainer located on both sides of the filter compartment.

2. Lift the hopper filter compartment until the hopper filter compartment prop arms secure the hopper filter compartment open.



NOTE: Ensure the hopper filter compartment prop arm is fully engaged before removing the filter from the machine.



3. Remove the filter from the hopper filter compartment

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

5. Machines with the *FiberShield* lint screen option only: Remove the lint screen from the hopper filter compartment and clean dust and debris from the lint screen. Reinstall the lint screen.

6. Reinstall the dust filter.

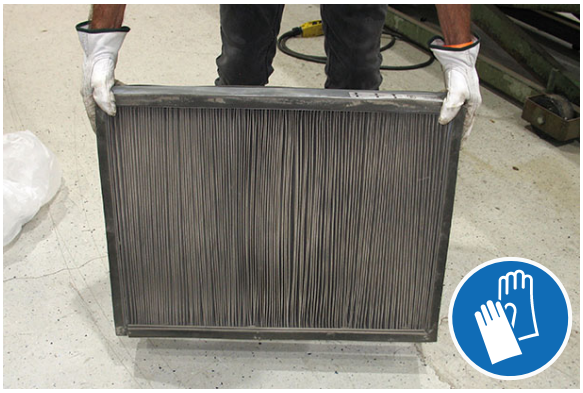
7. Disengage the hopper filter compartment prop arms, lower the hopper filter compartment, and secure the hopper filter compartment closed.

CLEANING THE HOPPER DUST FILTER (MACHINES EQUIPPED WITH STANDARD FILTRATION SYSTEM)

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

SHAKING-Press the *filter shaker switch*.

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.

CLEANING THE HOPPER DUST FILTER (MACHINES EQUIPPED WITH HEPA FILTRATION SYSTEM ONLY)

NOTE: Do Not clean the HEPA filter when it becomes clogged with debris. The HEPA cannot be cleaned and must be replaced when damaged or clogged. The following cleaning methods can only be used to clean the hopper dust filter.

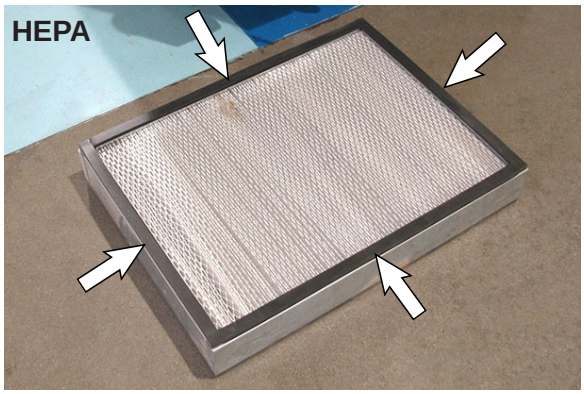
Use one of the following methods to clean the dust filter:

SHAKING-Press the *filter shaker switch*.

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.

Do Not use air to clean the dust filter.

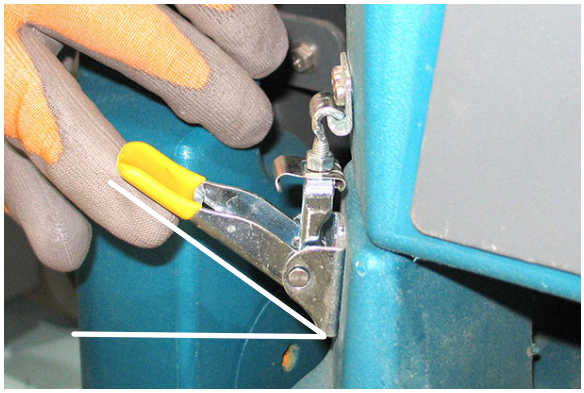
Inspect the dust filter seals for proper seal and damage after every 100 hours of operation. Dust build up on the seal surfaces means dust is getting past the dust filter, significantly reducing the filter life.



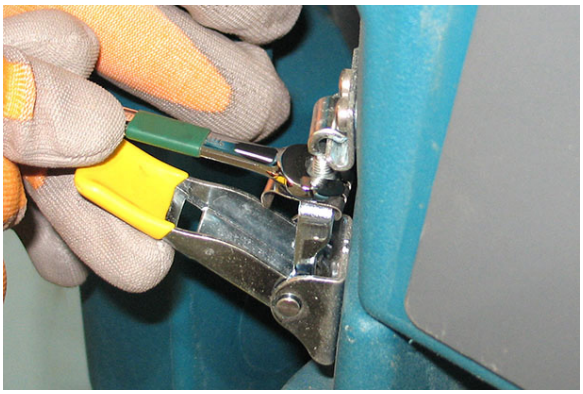
ADJUSTING THE HOPPER FILTER COVER LATCHES

Adjust the filter cover latch lengths if there is poor vacuum performance.

1. Remove the hopper dust filter from the machine.
2. Check the latch length. The latch should begin to pull the latch keeper at approximately 0 and 45 degrees from horizontal.

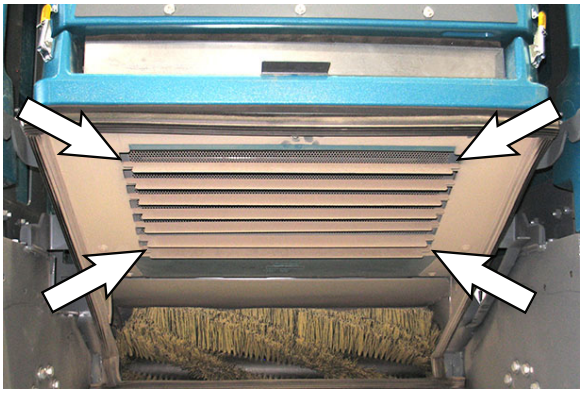


3. Leave the latch hook still attached to the latch keeper, and turn the jam nut to shorten the latch length.



INSPECTING / CLEANING THE PERMA-FILTER

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

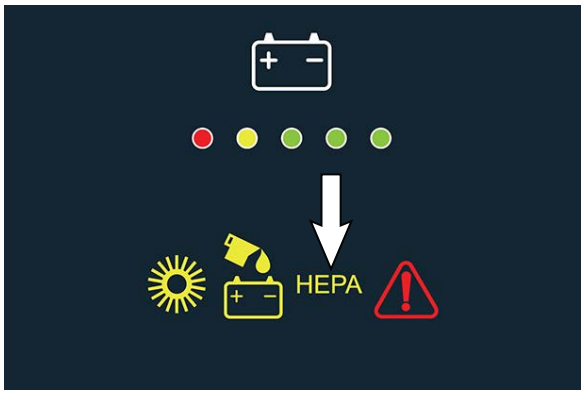


THERMO-SENTRY

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 horn will also sound as an alarm when the Thermo-Sentry is activated. Press the horn button to quiet the horn/Thermo-Sentry alarm. The Thermo-Sentry automatically resets after cooling down.

REPLACING THE HEPA FILTER

Replace the HEPA filter when the HEPA light is illuminated. When the light is illuminated, check the system for blockages that may be restricting the flow to the HEPA filter.

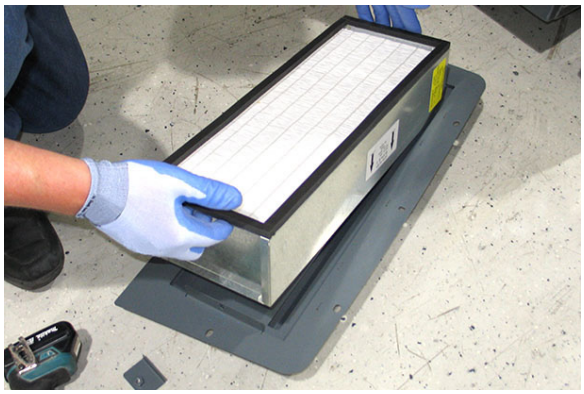


FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and remove key.

1. Remove the hardware securing the HEPA tray assembly to the hopper.

2. Remove the HEPA tray assembly from the hopper.

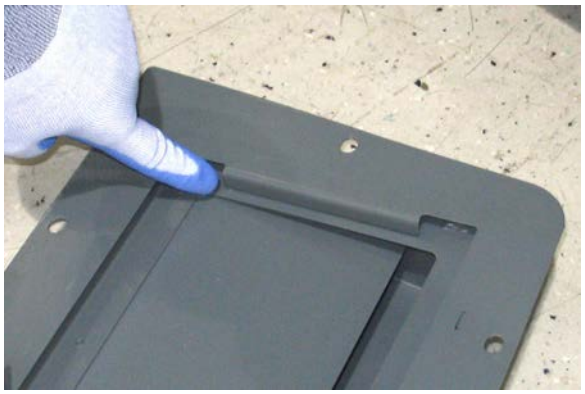
3. Remove the hardware securing the HEPA filter to the HEPA tray and remove the HEPA filter from the tray.

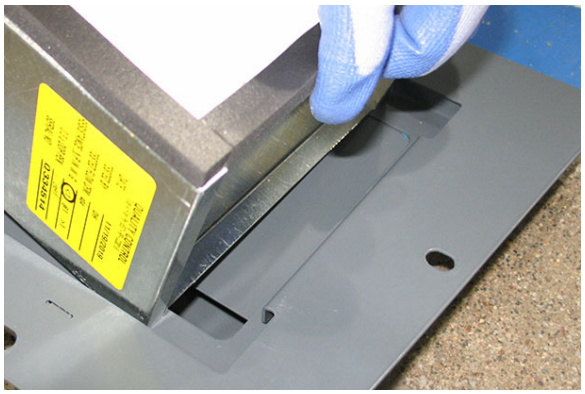


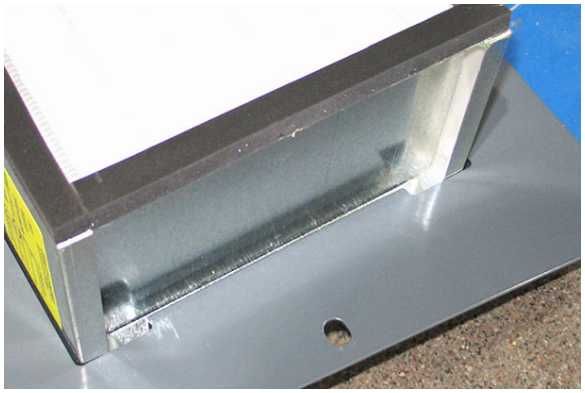
NOTE: Do Not touch or damage the new HEPA filter media when installing the HEPA filter onto the HEPA tray.

4. Orient the new HEPA filter so the label is located at the top of the HEPA tray and the arrows on the label point out the direction of the airflow.

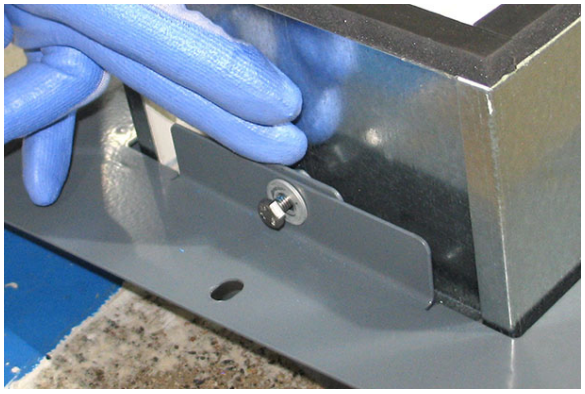
5. Slide the HEPA filter into the HEPA filter tray. Be sure the edge of the HEPA filter is secure under the tray retainer.

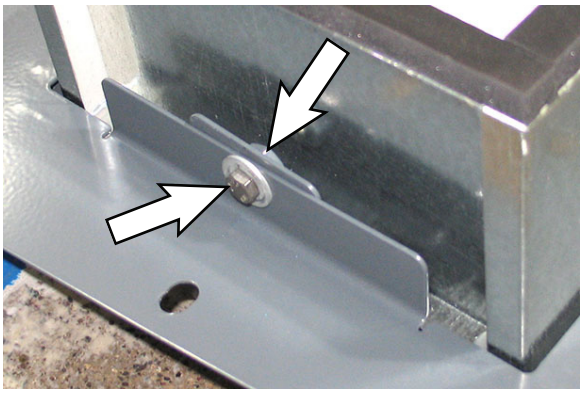




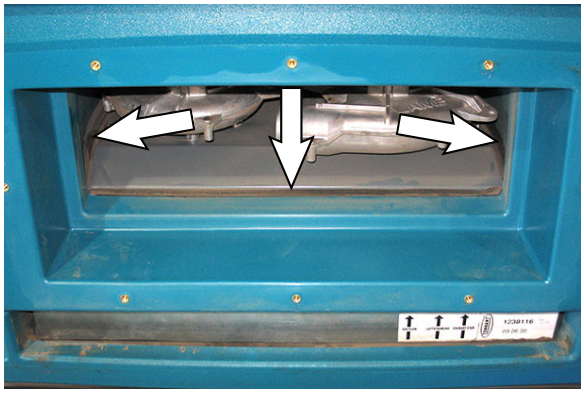


6. Reinstall and tighten the hardware to secure the other end of the HEPA filter into the HEPA filter tray.





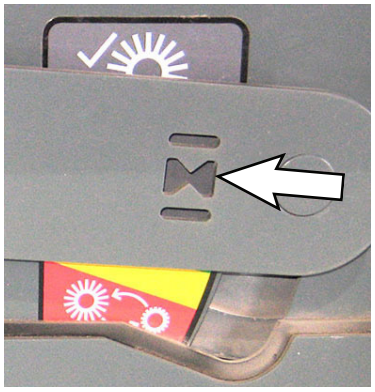
7. Inspect the HEPA fan vacuum fan tray seal for damage and evidence of leaks (excessive dust deposited on seal surfaces). Replace the seal if it is damaged or there are leaks.



8. Reinstall the HEPA filter tray assembly into the machine.

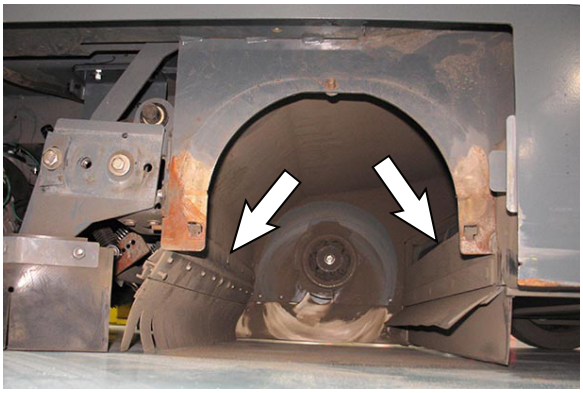
MAIN SWEEP BRUSH

Check the brush daily for wear. Lower the brush and observe the *brush wear site* on the main sweep brush idler arm. If the site is at the bottom of the brush wear label (red portion of label is visible in the site), replace the main sweep brush.



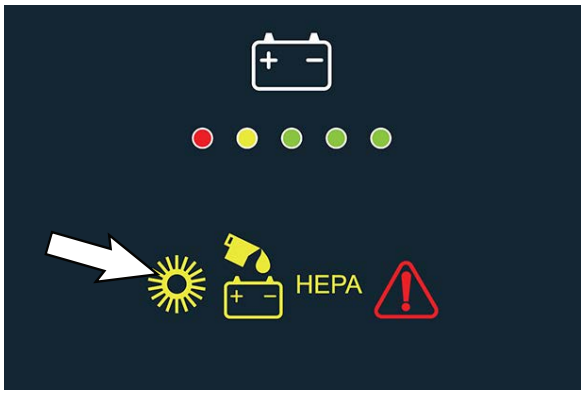
Observe the brush for damage. Remove any string or wire tangled on the main brush, main brush drive hub, or main brush idler hub.

Observe daily for large debris loose in the main brush compartment and debris that may be caught in the main brush compartment brush wrap. Remove all loose or caught debris.



Check the brush pattern and 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 or when brush worn icon is illuminated to alert that the brush needs to be changed.



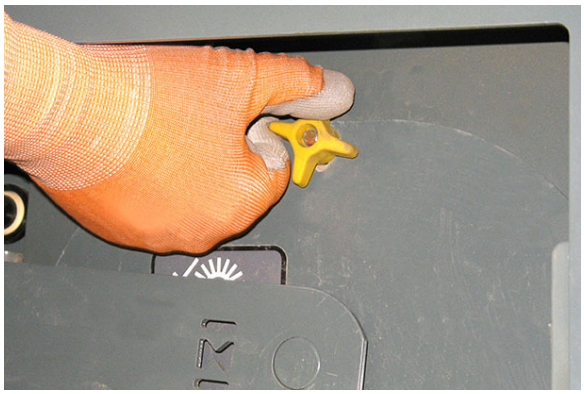
REPLACING THE MAIN SWEEPING BRUSH

1. Raise the sweeping main brush and turn off the machine.

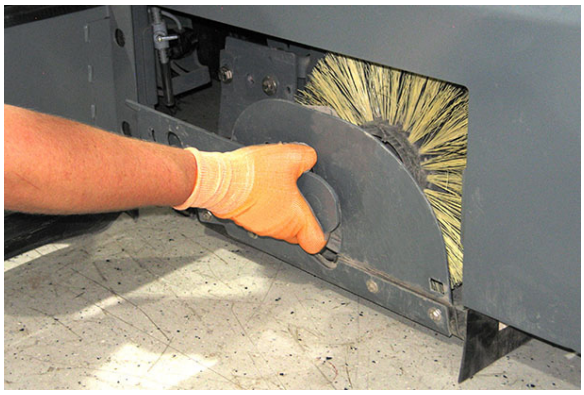
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and remove key.

2. Release the main sweeping brush compartment access door and open the access door.

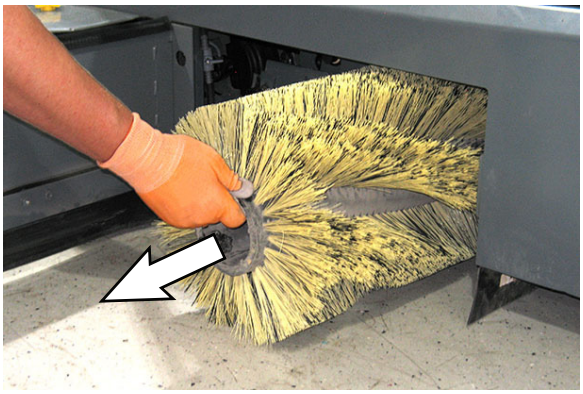
3. Remove the knobs securing the idler arm assembly to the main sweep assembly.



4. Remove the idler arm assembly from the main brush assembly.



5. Pull the brush from the main sweep compartment.



6. Put the new or rotated end-for-end main brush on the floor next to the main sweep compartment.

7. Slide the main brush onto the drive plug. Rotate the brush until it engages the drive plug, and push it completely onto the plug.

8. Reinstall the idler arm assembly onto the main sweep assembly. Be sure to keep the idler arm above the brush compartment skirt when installing the idler arm assembly onto the main sweep assembly.

9. Reinstall the hardware to secure the idler arm to the main sweep assembly. Hand tighten the hardware.

10. Close and secure the main sweep brush compartment access door.

CHECKING THE MAIN SWEEP BRUSH PATTERN

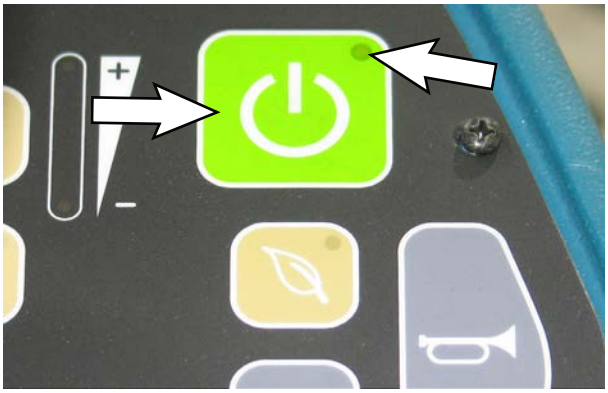
1. Apply chalk, or a similar marking material, to a smooth and level section of the floor.

NOTE: If chalk or other material is not available, allow the brush to spin on the floor for two minutes. A polish mark will remain on the floor.

2. Turn the key switch ON.

3. Position the main brush over the chalked area.

4. Press and hold the *1-Step button* for 5 seconds. The machine will go into the brush pattern check mode. The LED indicator will continue flashing while the brush pattern check is in progress.



NOTE: The pattern check sequence will be canceled if the 1-Step button is pressed at any time during the brush pattern check sequence.

5. The main brush motor will turn on and the actuator will partially lower to check the motor operating currents. The main brush will then continue to lower until the motor reaches the selected down force target current or until the actuator is fully extended.

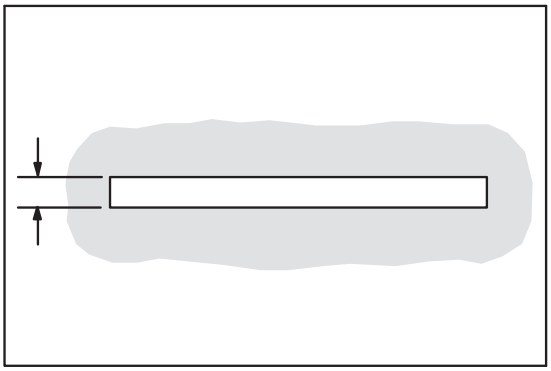
NOTE: If the monitored current of the main brush/ selected side brush(es) is outside the correct range, the brush pattern check sequence will be canceled and a main sweep system fault will be displayed.

6. The pattern check will run for approximately 10 seconds at which point the main brush will raise and the brush motor will turn off. The *1-Step button* LED indicator will stop flashing when the brush pattern check is completed.

7. Drive the machine off the test area.

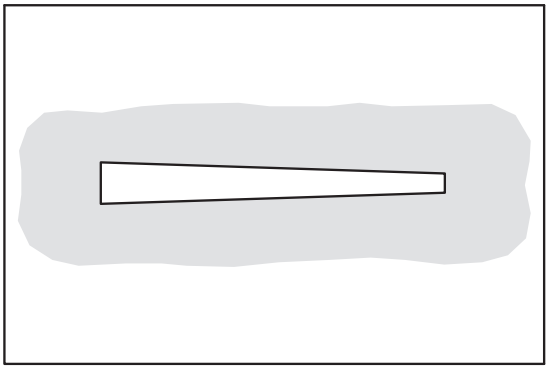
8. Observe the width of the brush pattern. The proper brush pattern width is 25 mm (1 in) or larger.

   The brush taper is factory set and should not need adjustment unless parts of the brush system have been replaced.



00582

If the main brush pattern is tapered, more than 15 mm (0.5 in) on one end than the other, adjust the taper. Refer to ADJUSTING THE MAIN SWEEP BRUSH PATTERN:



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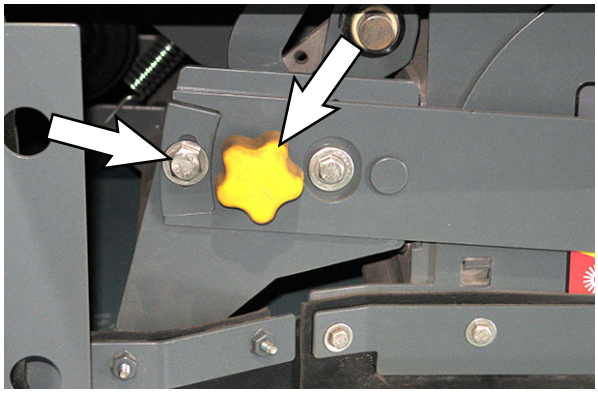
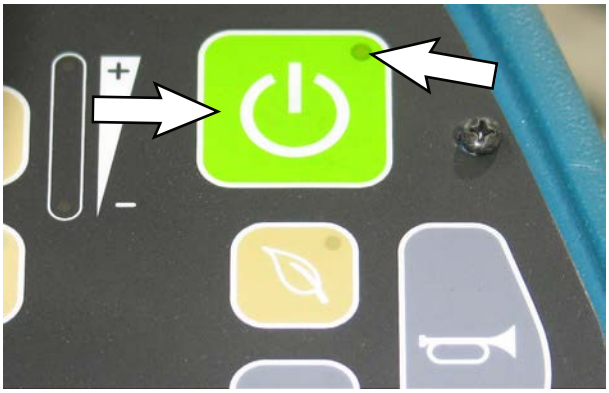
ADJUSTING THE MAIN SWEEP BRUSH PATTERN

1. Loosen the brush shaft bearing bracket mounting hardware and the idler arm knob.



2. Turn the key switch ON.
3. Position the main brush over the chalked area.
4. Press and hold the *1-Step button* for 5 seconds. The machine will go into the brush pattern check mode. The LED indicator will continue flashing while the brush pattern check is in progress.



NOTE: The pattern check sequence will be canceled if the 1-Step button is pressed at any time during the brush pattern check sequence.

5. The main brush motor will turn on and the actuator will partially lower to check the motor operating currents. The main brush will then continue to lower until the motor reaches the selected down force target current or until the actuator is fully extended.
6. The pattern check will run for approximately 10 seconds at which point the main brush will raise and the brush motor will turn off. Turn the key switch OFF before the brush raises.
7. Tighten the brush shaft bearing bracket mounting hardware and the idler arm knob.
8. Recheck the main brush pattern. See CHECKING THE MAIN SWEEP BRUSH PATTERN. Adjust the main brush taper as necessary.

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 SIDE BRUSH(ES)

Replace the brushes when they no longer clean effectively.

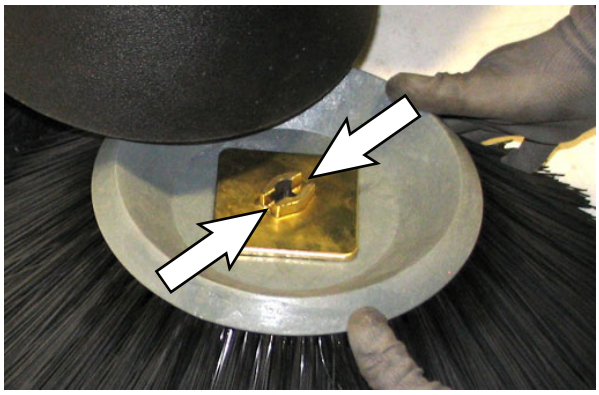
1. Raise the side brush(es) and turn off the machine.

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

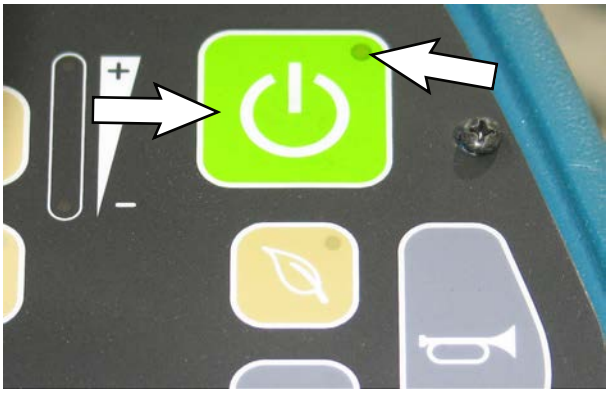


5. Lift the side brush, retainer, and washer up onto the side brush hub and reinstall the cotter pin into the hub.

CHECKING THE SIDE BRUSH PATTERN(S)

Check the side brush pattern after every 50 hours of operation or whenever the brush(es) is/are replaced.

1. Turn the key switch ON.
2. Press the side brush button(s) to activate the side brush(es).
3. Press and hold the *1-Step button* for 5 seconds. The LED indicator will begin flashing and continue flashing until the brush pattern check is complete.

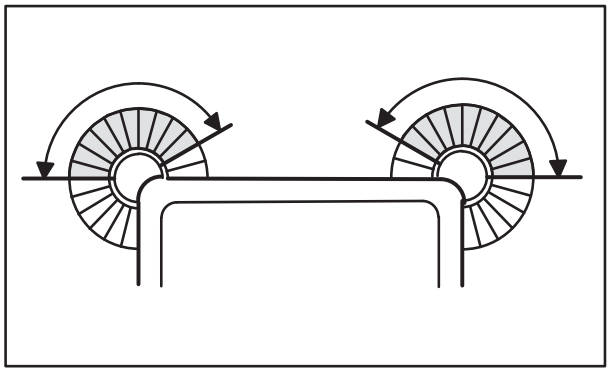


NOTE: The pattern check sequence will be canceled if the 1-Step button is pressed at any time during the brush pattern check sequence.

4. The side brush motor(s) will turn on and the actuators will partially lower to check the motor operating currents.

NOTE: If the monitored current of the side brush motor(s) is outside the correct range, the brush pattern check sequence will be canceled and a side sweep system fault will be displayed.

5. The side brush(es) will continue to lower until the actuator(s) is/are fully extended.
6. Observe the side brush pattern(s). The side brush bristles should touch the floor in the patterns shown in the illustration.



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7. Adjust the side brush pattern(s) as necessary. See ADJUSTING THE SIDE BRUSH PATTERN(S).

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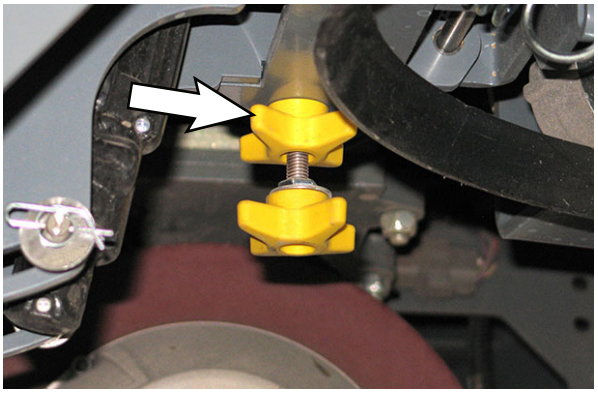
ADJUSTING THE SIDE BRUSH PATTERN(S)

The side brush pattern(s) should be adjusted whenever the side brush(es) is/are replaced or when it is determined that the brush patterns need adjustment following the patterns being checked.

1. Raise the side brush(es) and turn off the machine.

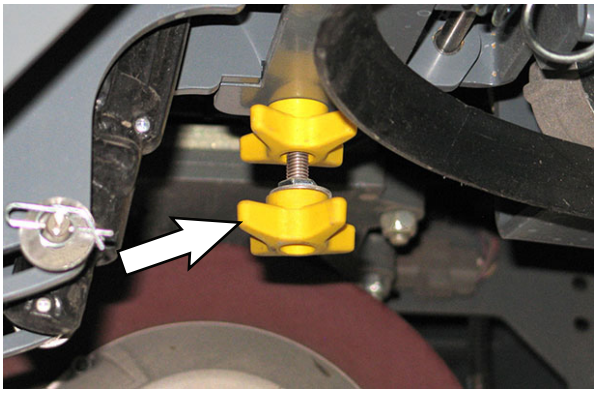
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and remove key.

2. Loosen the top star knob approximately a 1/2 turn.



3. Turn the bottom star knob counterclockwise to increase the brush pattern.

   Turn the bottom star knob clockwise to decrease the brush pattern.



4. Tighten the upper star knob to secure the side brush pattern adjustment.

5. Recheck the side brush pattern(s). See CHECKING THE SIDE BRUSH PATTERN(S). Adjust the side brush patterns as necessary.

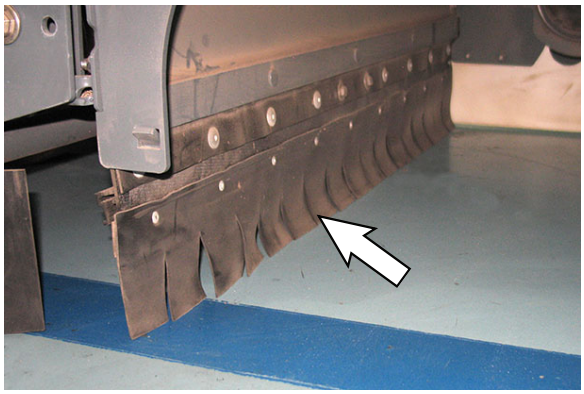
SKIRTS AND SEALS

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

LARGE DEBRIS TRAP SKIRT

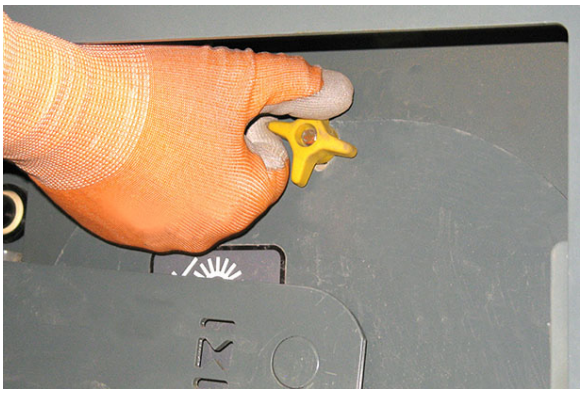
The large debris trap skirt is raised and lowered by the large debris trap pedal, allowing larger debris to be trapped and swept up into the hopper.

Check the skirt for damage and wear after every 100 hours of operation. Check the skirt length after every 100 hours of operation. The skirt should be long enough to barely touch floor, but not so long that it becomes caught in the main brush.

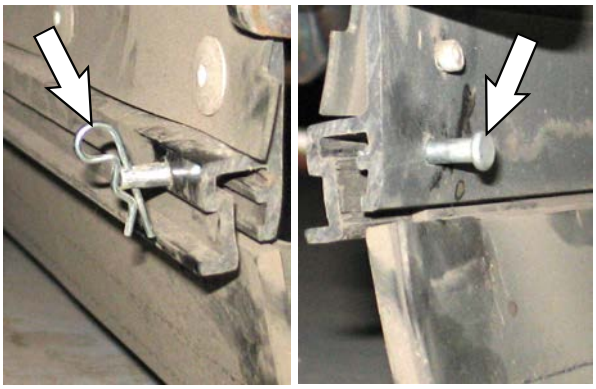


To change the large debris trap skirt:

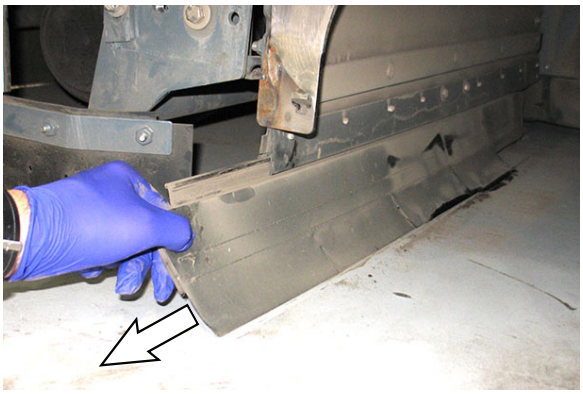
1. Release the main sweeping brush compartment access door and open the door to access the main sweep brush compartment.
2. Remove the knobs securing the idler arm assembly to the main sweep assembly.



3. Remove the cotter pin/clevis pin securing the large debris trap skirt to the sweep head.



4. Pull the large debris trap skirt from the sweep head.

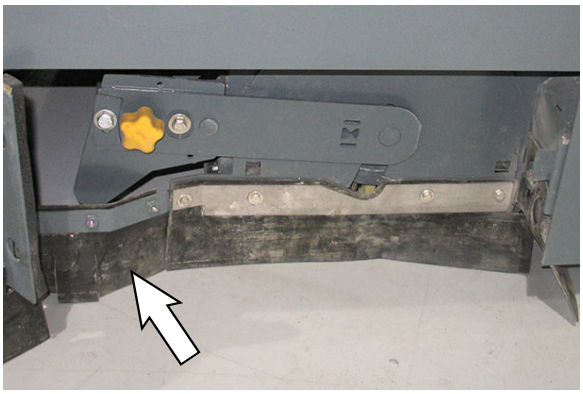


5. Install the new large debris trap skirt onto the sweep head.
6. Reinstall the cotter pin/clevis pin to secure the large debris trap skirt to the sweep head.

SIDE SKIRTS

The side skirts are located on both sides of the machine in front of the main brush compartment. The side skirts should slightly touch a flat floor surface.

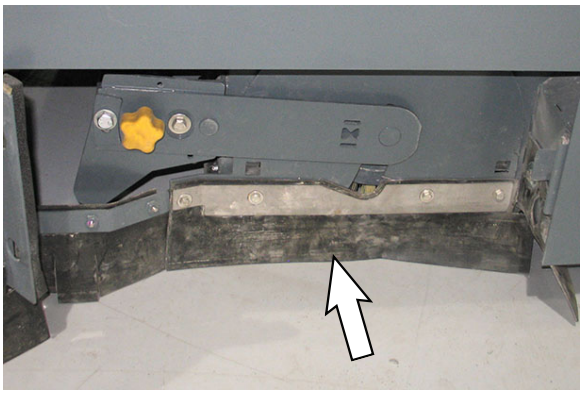
Check the skirts for damage, wear and adjustment daily.



SIDE RECIRCULATION SKIRTS

The side recirculation skirts are located on both sides of the main brush compartment. The side recirculation skirts should slightly touch a flat floor surface.

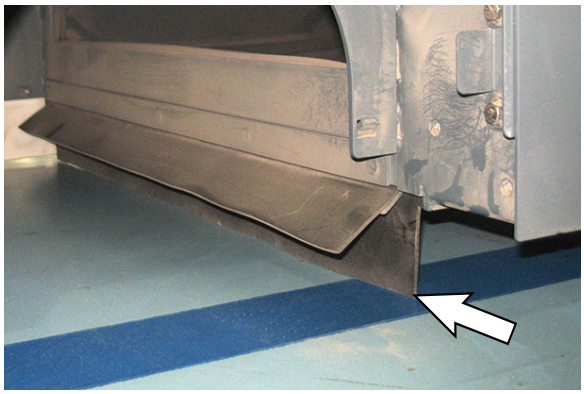
Check the skirts for damage, wear and adjustment daily.



REAR SKIRT

The rear skirt is located on the bottom rear of the main brush compartment. The vertical skirt should slightly touch a flat floor surface.

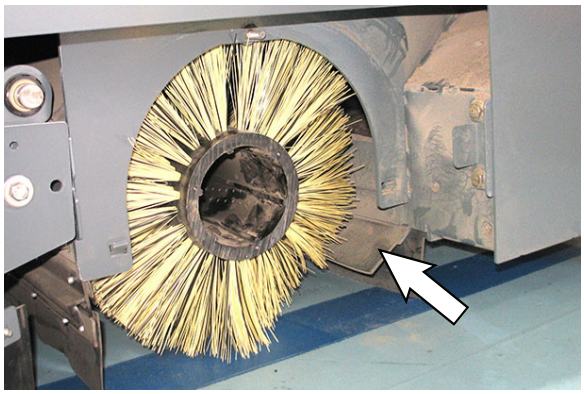
Check the skirt for damage, wear and adjustment daily.



REAR RECIRCULATION SKIRT

The rear recirculation skirt is located on the bottom rear of the main brush compartment, directly behind the main sweep brush. The recirculation skirt should not touch the main sweep brush when the brush is sweeping.

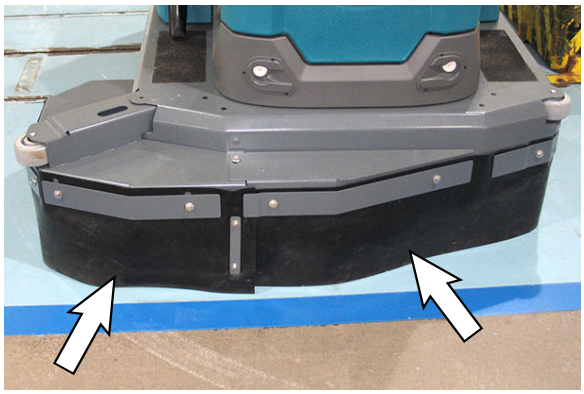
Check the skirt for damage, wear and adjustment daily.



SIDE BRUSH DUST CONTROL SKIRTS (OPTION)

The single side brush dust control skirts and dual side brush dust control skirts wrap around the entire side brush assembly for machines equipped with the single side brush and around both side brush assemblies for machines equipped with dual side brushes. The side skirts should slightly touch a flat floor surface.

Check the skirts for wear and damage daily.



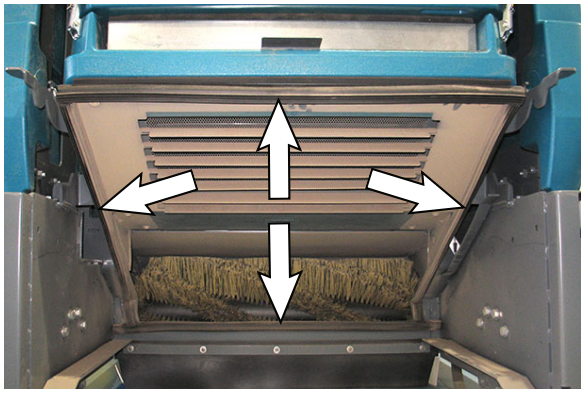
HOPPER SEALS

The hopper seals are located around the edge of the opening between the main brush and the hopper. The hopper rests against the seals when the hopper is in the closed position.

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

Machines equipped with high dump:

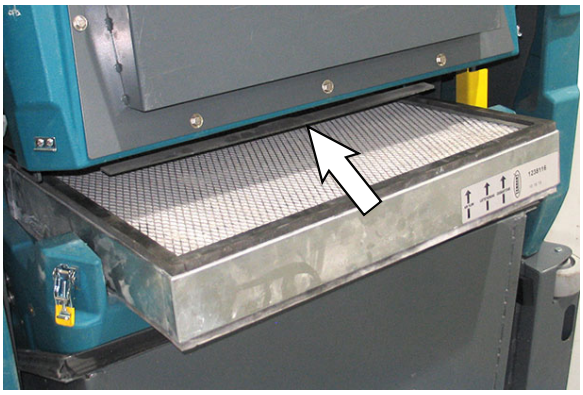
WARNING: Raised hopper may fall. Engage hopper support bar.



VACUUM SEAL

The vacuum seal is located on top the debris hopper and seals with the hopper filter when the hopper is in the closed position.

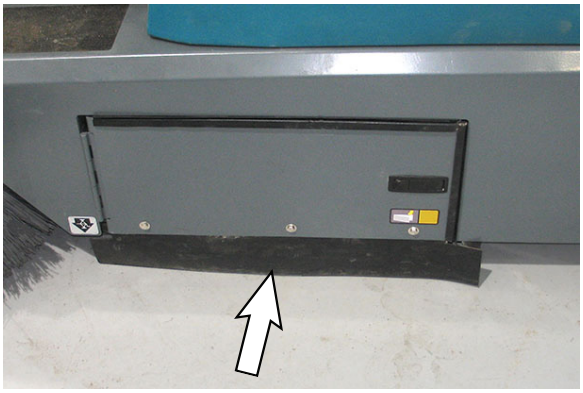
Check the seal for wear or damage after every 100 hours of operation.



SWEEP COMPARTMENT HEPA SIDE SKIRTS (MACHINES EQUIPPED WITH HEPA FILTRATION SYSTEM OPTION ONLY)

The sweep compartment HEPA side skirts with machines equipped with HEPA filtration are located on both sides of the main brush compartment. The sweep compartment HEPA side skirts should slightly touch a flat floor surface.

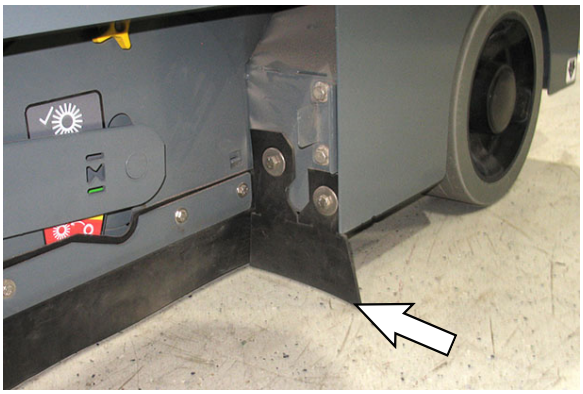
Check the skirts for damage, wear and adjustment daily.



BRUSH COMPARTMENT SKIRTS (MACHINES EQUIPPED WITH HEPA FILTRATION SYSTEM OPTION ONLY)

The brush compartment skirts with machines equipped with HEPA are located on both sides of the machine at the rear of the main brush compartment.

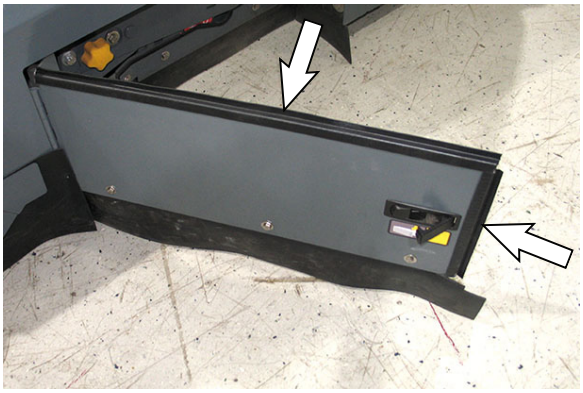
Check the skirts for wear and damage daily.



MAIN BRUSH DOOR SEALS (MACHINES EQUIPPED WITH HEPA FILTRATION SYSTEM OPTION ONLY)

Main brush door seals for machines equipped with HEPA filtration are located on the top and rear of both main brush doors.

Check the seals for wear or damage daily.

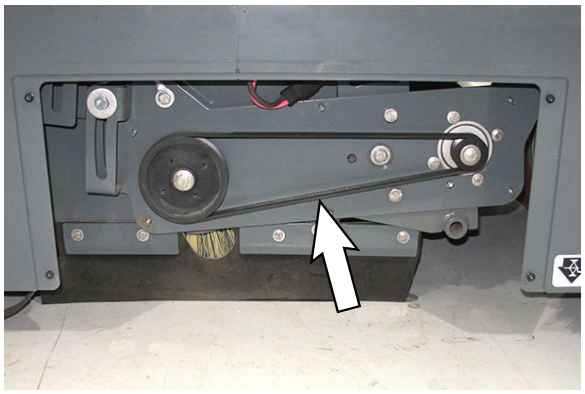


BELTS

MAIN BRUSH DRIVE BELT

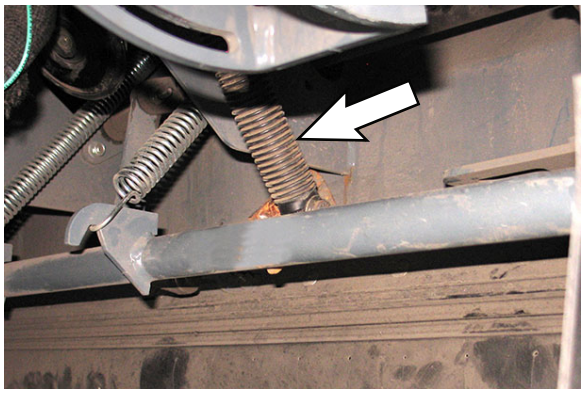
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and remove key.

The main brush drive belt is located on the main sweep brush head. Check the belt for damage and wear after every 200 hours of operation.



MAIN SWEEP DAMPER (SHOCK ABSORBER)

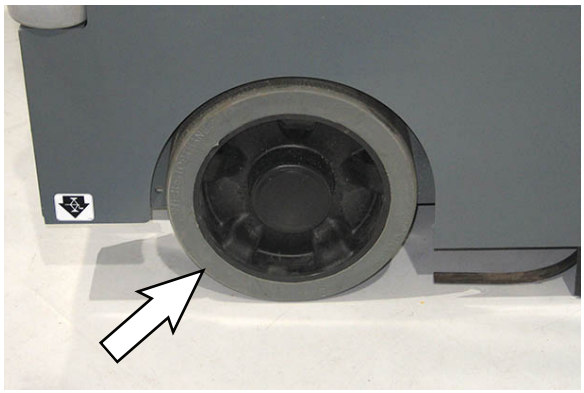
The main sweep damper (shock absorber) is connected to the damper bracket and the sweep lift arm. Inspect the main sweep damper (shock absorber) for dirt, debris, and damage after every 200 hours of operation.



TIRES

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

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

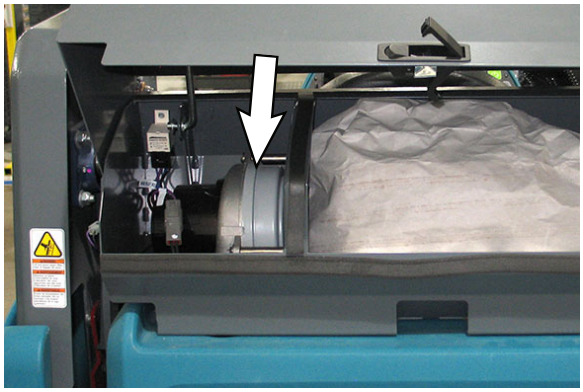


VACUUM WAND MAINTENANCE (OPTION)

VACUUM WAND FAN

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

Check the vacuum wand fan for damage after every 50 hours of operation.



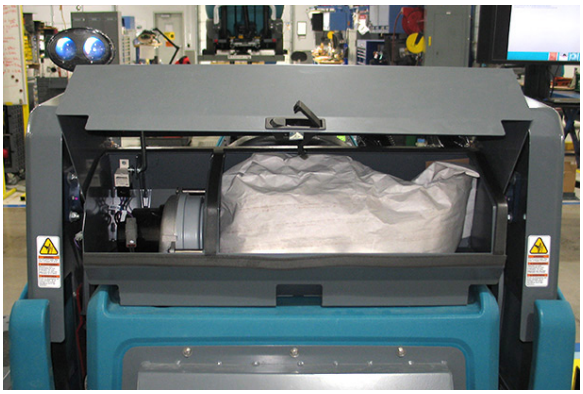
REPLACING THE VACUUM WAND BAG

Check the vacuum wand bag after every 50 hours of operation. Replace the vacuum wand bag when the wand begins to lose power, the bag is full, or if the bag is torn or damaged.

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

1. Press the latch release to allow the vacuum wand housing cover to be opened.

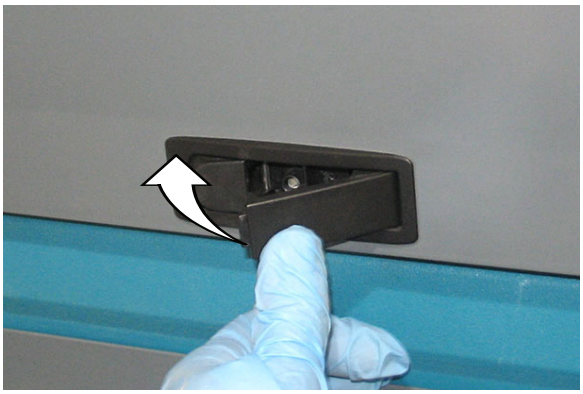
2. Lift the vacuum wand housing cover open and use the prop rod to secure the cover open.



3. Remove the vacuum wand bag from the vacuum wand compartment.

4. Install the new vacuum wand bag into the vacuum wand compartment. Be sure the bag is completely installed onto the vacuum tube.

5. Release the vacuum wand housing cover support and close and secure the vacuum wand compartment cover.



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.

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

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.

Immediately after pushing the machine, remove the screw driver from between the electronic brake lever and the hub. NEVER operate the machine with the parking brake disabled.

FOR SAFETY: Do not operate machine with brake disabled.

TRANSPORTING THE MACHINE

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

1. Raise the sweep head.
2. Remove the hopper (Low Dump) or raise the hopper enough (High Dump) to clear the ground before loading. The machine can be loaded onto a ramp up to 21.3%.
3. Park the truck or trailer on a level surface.
4. Position the back end of the machine at the loading edge of the truck or trailer.

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

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

6. Turn the key switch OFF.
7. Place a block behind each wheel to prevent the machine from rolling.

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

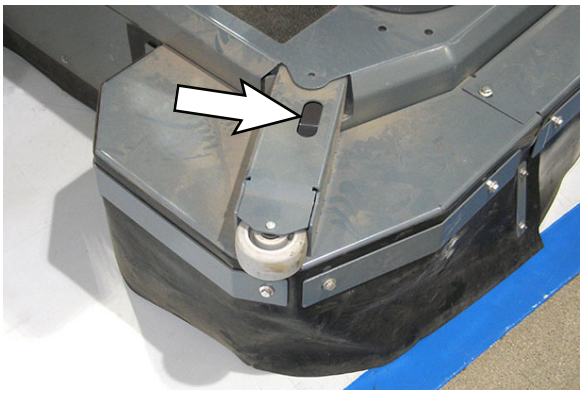
FOR SAFETY: When loading/unloading machine onto/off truck or trailer, use tie-down straps to secure machine.

8. Connect the tie-down straps to the holes in the rear of the frame, directly below the bumper wheels located on both sides of the machine and secure the tie-downs to the trailer or truck to prevent the machine from moving.

9. Connect the tie-down straps to the front of the frame of the machine, in the recessed area located on both sides of the machine directly behind each front bumper wheel and secure the tie-downs to the trailer or truck to prevent the machine from moving.

If machine is equipped with the optional dust control skirts, connect the tie down straps to the holes in the bumper wheel brackets located on each side of the machine to secure the machine to the truck or trailer.

NOTE: Ensure the straps are not placing pressure on the rear of the skirt mount when the tie down straps are tightened,



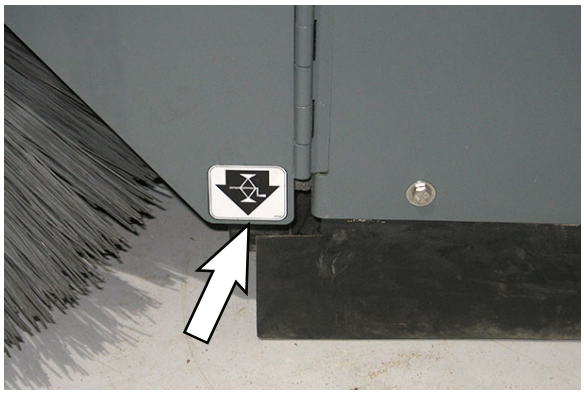
10. Ensure all tie-down straps are fully tightened and machine is completely secure on the trailer or truck.

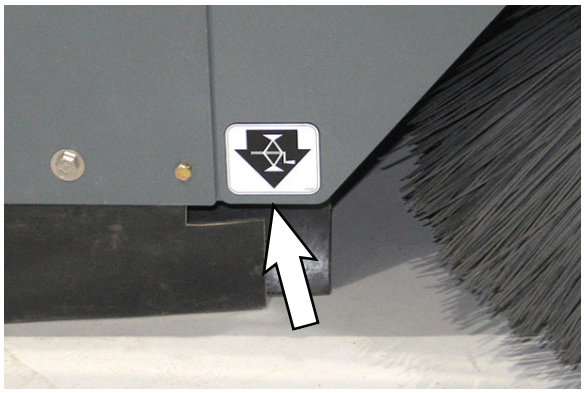
MACHINE JACKING

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

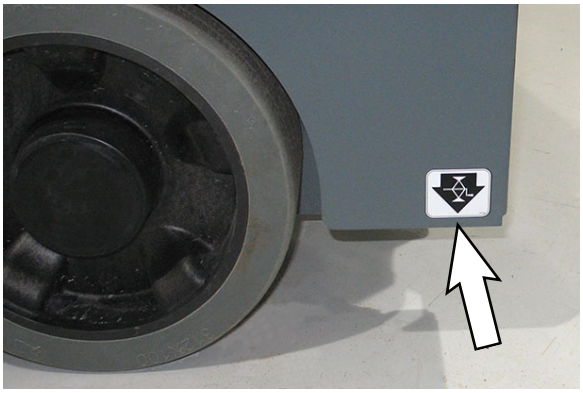
Empty the hopper before jacking the machine.

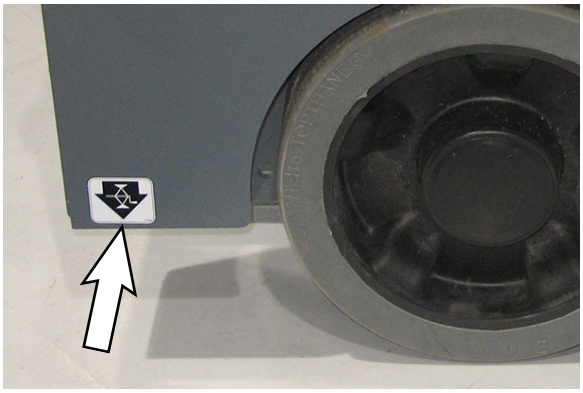
Jacking point locations at the front of all machines.





Jacking point locations 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.

STORAGE INFORMATION

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

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

1. Park the machine in a cool, dry area. Do not expose the machine to rain or snow. Store indoors.
2. Charge the batteries before storing machine to prolong the life of the batteries. Recharge lead-acid batteries once a month. Recharge lithium-ion battery pack once a year.
3. Disconnect batteries before storing.
4. Store the machine in a dry area with the sweep head in the raised position.

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

TROUBLESHOOTING

INITIAL TROUBLESHOOTING MATRIX

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

NOTE: A faulty hopper home switch or faulty seat switch can prevent the 1-Step button and all machine cleaning functions from operating.

Output	Pin(s)	Enable	Input	Disable	Input
Sweep Vacuum Fan	Sweep Module: *J11-2, CB3*	1-Step ON	Interface Module	1-Step OFF	Interface Module
		Vacuum ON	Interface Module	Vacuum OFF	Interface Module
				Low Battery Voltage	Propel Controller, *B+, J1-20 ≈ < 32 VDC*
				Circuit Fault	CAN to Interface Module
Main Sweep Brush Motor	Sweep Module: *J12-1, CB2*	1-Step ON	Interface Module	1-Step OFF	Interface Module
		Sweep Selected	Interface Module	Main Sweep Deselected	Interface Module
		Forward/Reverse Command	Propel Controller, *J1-1 ≈ 0.2-5 VDC*	Neutral - Ready State	Propel Controller, *J1-1 ≈ 0 VDC*
				Low Battery Voltage	Propel Controller, *B+, J1-20 ≈ < 32 VDC*
				Circuit Fault	CAN to Interface Module
Main Sweep Brush Down	Sweep Module: *J15-1, J15-11* *J15-2, J15-12*	1-Step ON	Interface Module	1-Step OFF	Interface Module
		Sweep Selected	Propel Controller, *J1-1 ≈ 0.2-5 VDC*	Sweep Deselected	Propel Controller, *J1-1 ≈ 0 VDC*
				Low Battery Voltage	Propel Controller, *B+, J1-20 ≈ < 32 VDC*
				Circuit Fault	CAN to Interface Module
		Forward/Reverse Command	Propel Controller, *J1-1 ≈ 0.2-5 VDC*	Neutral - Ready State	Propel Controller, *J1-1 ≈ 0 VDC*
				Low Battery Voltage	Propel Controller, *B+, J1-20 ≈ < 32 VDC*
				Circuit Fault	CAN to Interface Module

Output	Pin(s)	Enable	Input	Disable	Input
Right Side Sweep Brush Motor	Sweep Module: Right Motor *CB13, J15-3, J15-13*	1-Step ON	Interface Module	1-Step OFF	Interface Module
		Side Sweep Selected	Interface Module	Side Sweep Deselected	Interface Module
		Forward/Reverse Command	Propel Controller, *J1-1 ≈ 0.2-5 VDC*	Neutral - Ready State	Propel Controller, *J1-1 ≈ 0 VDC*
				Low Battery Voltage	Propel Controller, *B+, J1-20 ≈ < 32 VDC*
				Circuit Fault	CAN to Interface Module
Left Side Sweep Brush Motor (Option)	Sweep Module: Left Motor CB12, *J15-5, J15-15*	1-Step ON	Interface Module	1-Step OFF	Interface Module
		Side Sweep Selected	Interface Module	Side Sweep Deselected	Interface Module
		Forward/Reverse Command	Propel Controller, *J1-1 ≈ 0.2-5 VDC*	Neutral - Ready State	Propel Controller, *J1-1 ≈ 0 VDC*
				Low Battery Voltage	Propel Controller, *B+, J1-20 ≈ < 32 VDC*
				Circuit Fault	CAN to Interface Module
Side Sweep Brushes Down	Sweep Module: Right Side Actuator *J14-4, J14-12* *J14-5, J14-13* Left Side Actuator *(Option)* *J14-6, J14-14* *J14-7, J14-15*	1-Step ON	Interface Module, CAN	1-Step OFF	Interface Module, CAN
		Side Sweep Selected	Interface Module, CAN	Side Sweep Deselected	Interface Module, CAN
		Forward/Reverse Command	Propel Controller, *J1-1 ≈ 0.2-5 VDC*	Neutral - Ready State	Propel Controller, *J1-1 ≈ 0 VDC*
				Low Battery Voltage	Propel Controller, *B+, J1-20 ≈ < 32 VDC*
				Circuit Fault	CAN to Interface Module
Propel	Propel Controller	Parking Brake Disengaged	*J2-6 Goes High*	Parking Brake Engaged	J2-6 Goes Low
		Forward/Reverse Command	Propel Controller, *J1-1 ≈ 0.2-5 VDC*	Neutral - Ready State	Propel Controller, *B+, J1-20 ≈ 0 VDC*
		Forward/Reverse Switch Input	Propel Controller Forward *J1-6 ≈ B+* Reverse *J1-17 ≈ B+*	Brake Switch Input	Propel Controller, *J2-6 ≈ Battery Voltage*
				Seat Switch Input	Propel Controller, *J1- 5 Not B+*
				Propel Controller Fault	See Propel Controller Diagnostics.
Back-Up Alarm/ Lights (Option)		Reverse Switch Input	Propel Controller, *J1-17 ≈ B+*	Forward Switch Input	Propel Controller, *J1-6 ≈ B+*
		Reverse Command	Propel Controller, *J1-1 ≈ 0.2-5 VDC*	Neutral - Ready State	Propel Controller, *J1-1 ≈ 0 VDC*
				Propel Controller Fault	See Propel Controller Diagnostics.

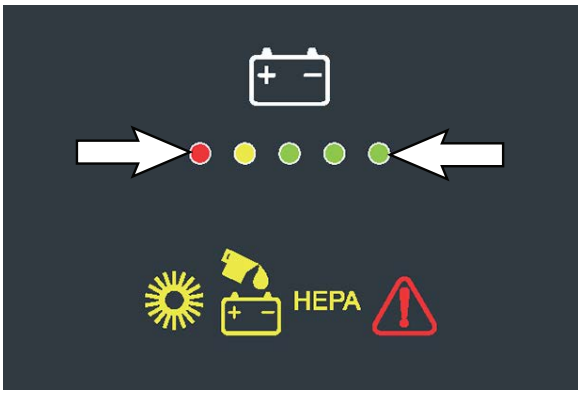
Output	Pin(s)	Enable	Input	Disable	Input
Filter Shaker	Sweep Module *CB5, J11-1*	Filter Shaker Button ON	Interface Module	Filter Shaker Button OFF	Interface Module
		Main Sweep Deselected	Interface Module	1-Step ON	Interface Module
		Dust Vacuum Deselected	Interface Module	Sweep Function Enabled	Interface Module
		1-Step OFF	Hopper Home Switch J17-9 ≈ *GND*	Hopper Not Home *J17-9 = Not GND*	Main Sweep/Hopper Lift Module: *J17-9 = Not GND*
HEPA Vacuum System (Option)	Sweep Module: *CB4, J11-3*	1-Step ON	Interface Module	1-Step OFF	Interface Module
		Vacuum ON	Interface Module	Vacuum OFF	Interface Module
				Low Battery Voltage	Propel Controller, *B+, J1-20 ≈ < 32 VDC*
				Circuit Fault	CAN to Interface Module
Smart-Fill ABW (Automatic Battery Watering) System	ABW Module ABW Pump *CB10, J4-1, J4-2* ABW Pressure Switch *J3-5, GND*	Key Switch ON	ABW Pressure Switch *J3-5 ≈ GND*	Key Switch OFF	ABW Pressure Switch *J3-5 ≈ Not GND*
Vacuum Wand (Option)	Sweep Module *CB9, CB15, J16-10, J16-11*	Vacuum Wand Switch ON	Control Panel	Vacuum Wand Switch OFF	Control Panel

FAULTS AND WARNINGS

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

BATTERY DISCHARGE INDICATOR

The *battery discharge indicator* displays the charge level of the batteries while the machine is operating.



When the batteries are fully charged, all five indicators are illuminated. Recharge the batteries when there is only one indicator illuminated. Do not allow the batteries to discharge below 20% (last indicator).

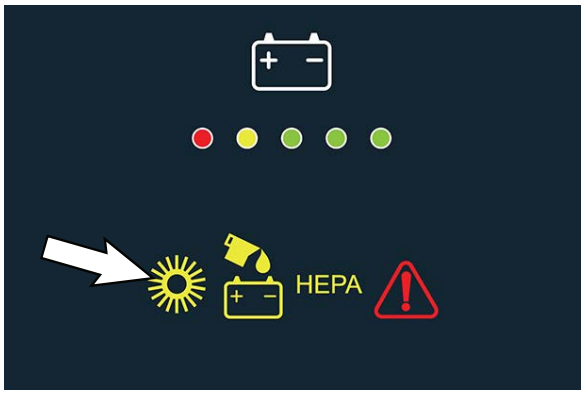
NOTE: The reading on the battery discharge indicator is not accurate when the machine is first powered on. Operate the machine a few minutes before reading the charge level of the batteries.

NOTE: If battery discharge level falls below 20%, the Red LED will start to flash and the machine will automatically turn off sweeping functions while still allowing machine to propel, shake the filter, dump the hopper, and sound the horn. Charge the battery as soon as possible.

NOTE: Lithium-ion Battery Model - Do not store the machine for an extended period if battery is discharged to the last bar, the battery may further discharge to a level that is unrecoverable.

WORN BRUSH INDICATOR

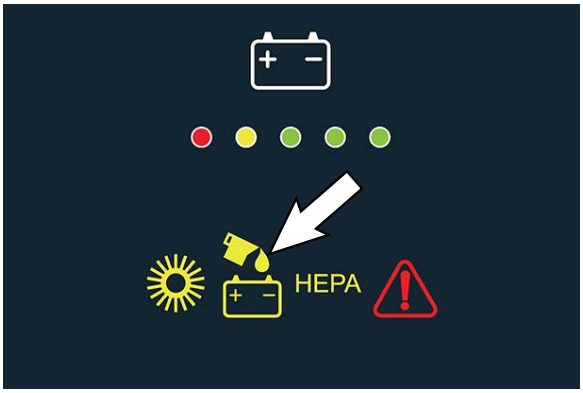
The *worn brush indicator* flashes when the main brush motor detects the main brush is worn. For best sweeping performance it is recommended that the main sweeping brush always be replaced as soon as possible when the *worn brush indicator* is flashing. The *worn brush indicator* will eventually illuminate solid if the main sweeping brush is not changed when the indicator is flashing, and sweeping performance will continue to deteriorate. See *REPLACING THE MAIN SWEEPING BRUSH* in the *MAINTENANCE* section for instructions how to change the main sweeping brush.



NOTE: Types of brush condition, floor surfaces, debris being swept, brush pressure, and any combination of the four can affect whether the worn brush indicator illuminates. The indicator could illuminate while machine is sweeping lighter debris or a smoother surface, and then go off when the machine is sweeping heavy debris or on a rough surface. Adjusting the brush pressure can also affect when the indicator illuminates, or goes off if already illuminated.

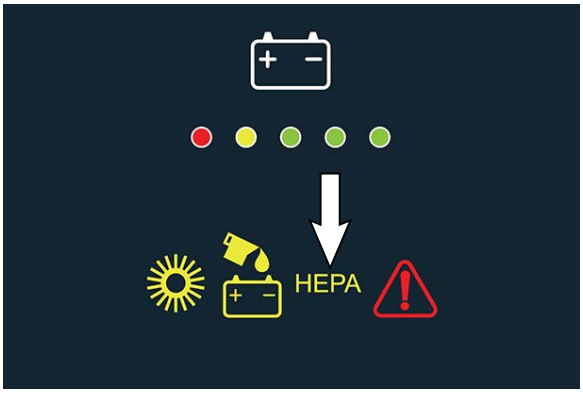
SMART-FILL ABW (AUTOMATIC BATTERY WATERING) INDICATOR (OPTION)

The *Smart-Fill ABW indicator* illuminates when there is not adequate water in the tank to fill the batteries. All sweep functions will cease operating and will remain inoperable if the machine is operated for 10 hours past when the indicator light is initially illuminated. See SMART-FILL ABW (*AUTOMATIC BATTERY WATERING) SYSTEM* in the *MAINTENANCE* section for instructions how to fill the tank.



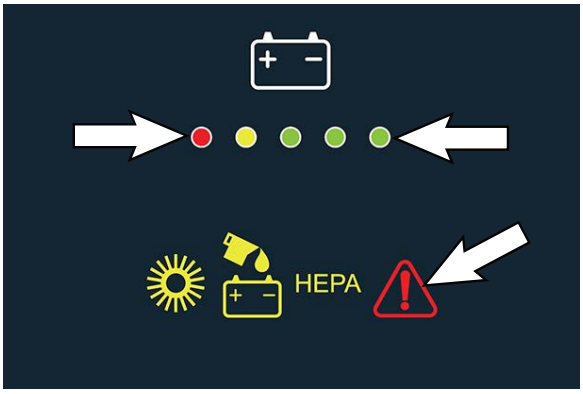
HEPA (HIGH EFFICIENCY PARTICULATE ARRESTANCE) INDICATOR (MACHINES EQUIPPED WITH HEPA FILTRATION SYSTEM OPTION ONLY)

The *HEPA indicator* illuminates when the HEPA filter needs to be replaced due to excessive blockage preventing air from moving through the filter. For best sweeping performance, always replace the HEPA filter as soon as possible when the *HEPA indicator* is illuminated. See *REMOVING/REPLACING THE HOPPER DUST FILTER* in the *MAINTENANCE* section for instructions how to replace the HEPA filter.



FAULT/ALERT INDICATORS

When the machine or battery charger detects a fault, the service indicator and a series of LED lights will flash.



To reset the fault/alert indicators, turn off the machine and eliminate the cause of the fault/alert. The fault/alert and will reset when the machine is again turned on.

NOTE: Lithium-ion Battery Model - To clear fault code, turn the key switch off and wait up to 3 seconds for machine power to completely shut off. Then turn key switch back on again.

Refer to the fault/alert indicators table to determine the cause and remedy for the fault/alerts.

FAULT CODES TABLE

LED Fault Code ☼ = Flashing	Fault Code	Cause(s)	Remedy
☼ ☼ ☼ ☼ ☼	0xFFF0	Emergency stop button engaged	1. Key off machine. 2. Press and reset Emergency stop button. 3. Key on machine. 4. If fault persists, check harness connections between Emergency stop button and Propel Controller. 5. Replace or repair harness. 6. Replace Emergency stop button.
● ☼ ● ☼ ☼	0xFF00	Software Load Fault	1. Retry software download
☼ ☼ ☼ ● ●	0xF100	Charger Generic Fault	1. Replace charger
	0xFF13	Invalid KSI Voltage	1. Check wiring for voltage on KSI when on charger.
☼ ☼ ● ☼ ●	0x0B06	Battery water tank empty warning	1. Fill automatic battery watering tank.
● ● ● ● ☼	0x0010	Parking Brake	1. Release parking brake.
	0xXXXX	Unknown Fault	1. Contact T.A.C. for further assistance.
	0x07A1	Hopper fire	1. Shut off machine. Extinguish fire. If necessary, call emergency personnel. *Note: Horn sounds when this fault occurs. Press horn button to silence horn.*
● ☼ ☼ ● ●	0x0F101	Charger no load warning	1. Verify charger is connected to batteries. 2. Check all battery connections. Repair as necessary.
● ● ● ☼ ☼	0x0131	Main Sweep Motor Open Warning	1. Check corresponding circuit breaker. Reset circuit breaker if tripped. 2. Check harness connections to motor. Repair as necessary. 3. Measure resistance across component. Resistance should be single digit ohms (Ω). If resistance is double digits, test is inconclusive. If resistance is triple digits, replace component. 4. Replace main sweep circuit board.
	0x0151	Right Side Sweep Motor Open Warning	
	0x0161	Left Side Sweep Motor Open Warning	
	0x0171	Filter/Shaker Motor Open Warning	
☼ ● ● ☼ ☼	0x0133	Main sweep motor over current fault	1. Check main sweep brush for obstructions. 2. Check Main Sweep Lifted position switch alignment for main brush in air fault and main brush springs. 3. Ensure correct size brush is being used. Brush diameter should be between 10.5 in. (267 mm) and 13.1 in. (333 mm). 4. Ensure there is tension on main brush lift cable.
	0x0134	Main sweep motor DP over current fault	Main Brush Motor: 1. Check for debris obstructing brush/brush motor. Remove debris. 2. Ensure flap skirt is not caught in brush. Inspect flap skirt of wear and if it is bent toward brush.
	0x0135	Main sweep motor SW over current fault	

LED Fault Code ☼ = Flashing	Fault Code	Cause(s)	Remedy
☼ ● ● ☼ ☼ (Continued)	0x0153	Right sweep motor over current fault	Side Brush(es) 1. Check side brush pattern. Decrease side brush pressure if pattern is too heavy. 2. Inspect side brush motor mount weldment for damage. Replace/repair as necessary. 3. While operating the machine, reduce side brush contact with wall/curb.
	0x0154	Right sweep motor DP over current fault	
	0x0155	Right sweep motor SW over current fault	
	0x0163	Left sweep motor over current fault	
	0x0164	Left sweep motor DP over current fault	
	0x0165	Left sweep motor SW over current fault	
	0x0173	Filter/shaker motor over current fault	1. Verify shaker motor rotates freely. Remove obstructions preventing shaker motor from rotating.
	0x0174	Filter/shaker motor over current 1 fault	
	0x0175	Filter/shaker motor over current 2 fault	
☼ ☼ ☼ ● ☼	0x0136	Main Sweep Motor Shorted Fault	1. Ensure flap skirt is not caught in brush. Inspect flap skirt of wear and if it is bent toward brush. 2. Check harness connections to motor for shorts. Repair as necessary.
	0x0156	Right Sweep Motor Shorted Fault	Side Brush(es) 1. Check side brush pattern. Decrease side brush pressure if pattern is too heavy. 2. Inspect side brush motor mount weldment for damage. Replace/repair as necessary. 3. While operating the machine, reduce side brush contact with wall/curb.
	0x0166	Left Sweep Motor Shorted Fault	
	0x0176	Filter/Shaker Motor Shorted Fault	1. Check harness connections to motor for shorts. Repair as necessary.
☼ ● ☼ ☼ ● ☼	0x0137	Main Sweep Motor FET Fault	1. Confirm component is not damaged. Replace/repair as necessary. 2. Check harness connections to component for shorts. Repair as necessary. 3. Replace main sweep circuit board.
	0x0157	Right Side Sweep Motor FET Fault	
	0x0167	Left Side Sweep Motor FET Fault	
	0x0177	Filter/Shaker Motor FET Fault	
	0x0237	Main Sweep Actuator FET Fault	
	0x0247	Right Side Sweep Actuator FET Fault	
	0x0257	Left Side Sweep Actuator FET Fault	
	0x0267	Hopper Lift Actuator FET Fault	
	0x0277	Hopper Roll Actuator FET Fault	
	0x0317	Horn FET Fault	
	0x0527	Standard Vacuum FET Fault	
	0x0537	HEPA Vacuum FET Fault	
	0x0B17	ABW FET Fault	

LED Fault Code ☼ = Flashing	Fault Code	Cause(s)	Remedy
● ● ● ☼ ●	0x0231	Main Sweep Actuator Open Warning	1. Check harness connection to main sweep actuator. Repair as necessary. 2. Check main sweep actuator home switch connections. Repair as necessary.
	0x0241	Right Side Sweep Actuator Open Warning	1. Check harness connection to actuator. Repair as necessary. 2. Measure resistance across component. Resistance should be single digit ohms (Ω). If resistance is double digits, test is inconclusive. If resistance is triple digits, replace component. 3. Replace main sweep circuit board.
	0x0251	Left Side Sweep Actuator Open Warning	
	0x0261	Hopper Lift Actuator Open Warning	
	0x0271	Hopper Roll Actuator Open Warning	
● ☼ ☼ ● ☼	0x0238	Main sweep actuator stalled	1. Check for debris obstructing actuator. Remove debris. 2. Check harness connections to actuators for shorts. Repair as necessary.
	0x0248	Right side sweep actuator stalled	
	0x0258	Left side sweep actuator stalled	
	0x0268	Hopper lift actuator stalled	
	0x0278	Hopper roll actuator stalled	
	0x0235	Main Sweep Actuator Current Limit	
	0x0245	Right Sweep Actuator Current Limit	
	0x0255	Left Sweep Actuator Current Limit	
	0x0265	Hopper Lift Actuator Current Limit	
	0x0275	Hopper Roll Actuator Current Limit	
	0xF104	Charger Timer Phase I Warning	1. Replace charger.
● ☼ ● ● ☼	0x0311	Horn Open Warning	1. Check circuit breaker 14 (CB14). Reset circuit breaker if tripped. 2. Replace main sweep circuit board.
	0x0321	Reverse Selected Beeper Open Warning	
● ☼ ● ☼ ●	0x0315	Horn Current Limit	1. Check harness connection to horn/alarm. 2. Replace main sweep circuit board.
	0x0325	Reverse Selected Beeper Current Limit	
	0x0328	Reverse Selected Beeper Overheat	
☼ ● ● ● ●	0x0316	Horn Shorted Fault	1. Check harness connections to horn/alarm for shorts. Repair as necessary
	0x0326	Reverse Selected Beeper Shorted Fault	
☼ ☼ ● ● ●	0x0520	Standard Vacuum Generic Fault	1. Check harness connection to vacuum fan for shorts. Repair as necessary. 2. Check motor for appropriate vacuum.
	0x0526	Standard Vacuum Shorted Fault	
	0x0530	HEPA Vacuum Generic Fault	
	0x0536	HEPA Vacuum Shorted Fault	
● ● ☼ ● ●	0x0521	Standard Vacuum Motor Open Warning	1. Check circuit breaker 4 (CB4). Reset circuit breaker if tripped. 2. Check harness connections to motor. Repair as necessary. 3. Replace main sweep circuit board.
	0x0531	HEPA Vacuum Motor Open Warning	

LED Fault Code ☼ = Flashing	Fault Code	Cause(s)	Remedy
☼ ● ☼ ☼ ☼	0x0523	Standard Vacuum Over Current Fault	1. Verify vacuum load. 2. Check usage conditions. 3. Check vacuum fan for damage. Repair/ replace if damaged. 4. Ensure vacuum fan rotates freely. Replace vacuum fan if it does not rotate freely. 5. Check harness connections to vacuum fan for shorts. Repair as necessary. 6. Replace main sweep circuit board.
	0x0524	Standard Vacuum Over Current 1 Fault	
	0x0525	Standard Vacuum Current Limit Fault	
	0x0533	HEPA Vacuum Over Current Fault	
	0x0534	HEPA Vacuum Over Current 1 Fault	
	0x0535	HEPA Vacuum Current Limit Fault	
☼ ● ● ● ☼	0x0980	Propel generic	1. Key cycle machine. 2. Check circuit breaker 1 (CB1). Reset circuit breaker if tripped.
	0x0981	Propel Throttle High Ref Err	
	0x0982	Propel Throttle Wiper Open Circuit	
	0x0983	Propel Throttle Wiper Error	
	0x0984	Propel Throttle Input High	
	0x0985	Propel Throttle Input Low	
	0x0986	Propel Throttle Input Out of Range	
	0x0987	Propel Throttle Pot Res High	
	0x0988	Propel Throttle Pot Res Low	
	0x0989	Propel Throttle High Ref Iso Err	
	0x098A	Propel Throttle Low Ref Iso Err	
	0x098B	Propel High Motor Current	
	0x098C	Propel Traction Motor Stalled	
	0x098D	Propel Very High Motor Current	
	0x098E	Propel Solenoid Brake Short Circuit	
	0x098F	Propel Solenoid Brake Open Circuit	
	0x0990	Propel High Battery Voltage	
	0x0991	Propel Line Contactor Open Circuit	
	0x0992	Propel Line Contactor Short Circuit	
	0x0993	Propel Line Contactor Coil Short	
	0x0994	Propel Line Contactor Coil Open	
	0x0995	Propel Cycle Power	
	0x0996	Propel Both Direction Switch Active	
	0x0997	Propel Inhibit 1 Active	
	0x0998	Propel Inhibit 2 Active	
	0x0999	Propel Inhibit 3 Active	
	0x099A	Propel High Motor Voltage	
	0x099B	Propel Low Battery Voltage	
	0x099C	Propel Watchdog Error	

LED Fault Code ☼ = Flashing	Fault Code	Cause(s)	Remedy
☼ ● ● ● ☼ (Continued)	0x099D	Propel Low Voltage Cut Out	1. Key cycle machine. 2. Check circuit breaker 1 (CB1). Reset circuit breaker if tripped.
	0x099E	Propel High Battery Foldback	
	0x099F	Propel Drive Cmd Active Startup	
	0x09A0	Propel Liftlower Cmd Active Startup	
	0x09A1	Propel Low Bridge Voltage	
	0x09A2	Propel High Bridge Voltage	
	0x09A3	Propel Very High Bridge Voltage	
	0x09A4	Propel Bad Settings	
	0x09A5	Propel Invalid Settings	
	0x09A6	Propel Bad Nameplate Settings	
	0x09A8	Propel Motor Shorted High	
	0x09AA	Propel Record of Controller Error	
	0x09AB	Propel Motor Temperature Foldback	
	0x09AC	Propel Timed Current Foldback	
	0x09AD	Propel Cont Traction Foldback	
	0x09AE	Propel Cont Traction Cut Off	
	0x09AF	Propel Motor Temperature Cut Off	
	0x09B0	Propel Controller Temp Foldback	
	0x09B1	Propel Controller Temp Cut Off	
	0x09B2	Propel Belly Button Active Startup	
	0x09B3	Propel Belly Button Input Invalid	
	0x09B4	Propel Belly Button Input Mismatch	
	0x09B5	Propel Belly Button Input Cfg Error	
	0x09B6	Propel Motor Thermistor Open	
	0x09B7	Propel Belly Button Input Data TO	
	0x09B8	Propel Throttle Input Data Timeout	
	0x09B9	Propel Liftlower Input Data Invalid	
	0x09BA	Propel Throttle Input Data Invalid	
	0x09BB	Propel Horn Short Circuit	
	0x09BC	Propel Horn Open Circuit	
	0x09BD	Propel Lift Contactor Coil Open	
	0x09BE	Propel Lift Contactor Coil Short	
	0x09BF	Propel Overload Current Cut Out	
	0x09C0	Propel High Pump Current	
	0x09C1	Propel Very High Pump Current	

LED Fault Code ☼ = Flashing	Fault Code	Cause(s)	Remedy
☼ ● ● ☼ (Continued)	0x09C2	Propel Ctrl Pump Circuit Cut Off	1. Key cycle machine. 2. Check circuit breaker 1 (CB1). Reset circuit breaker if tripped.
	0x09C3	Propel High Pump Motor Voltage	
	0x09C4	Propel Proportional Valve Open	
	0x09C5	Propel Proportional Valve Over Current	
	0x09C6	Propel Lower Valve Open Circuit	
	0x09C7	Propel Lower Valve Short Circuit	
	0x09C8	Propel Hold Valve Short Circuit	
	0x09C9	Propel Hold Valve Open Circuit	
	0x09CA	Propel Pump Motor Open Circuit	
	0x09CB	Propel Pump Motor Wiring Error	
	0x09CC	Propel High Bridge Current	
	0x09CD	Propel Keyswitch Speed Limit Active	
	0x09CE	Propel Active Speed Limit Active	
	0x09CF	Propel Lift Lower Wiper Error	
	0x09D0	Propel Lift Lower High Ref Error	
	0x09D1	Propel Lift Lower Input Invalid	
	0x09D2	Propel Lift Lower Input High	
	0x09D3	Propel Lift Lower Input Low	
	0x09D4	Propel Lift Lower Pot Resist High	
	0x09D5	Propel Lift Lower Pot Resist Low	
	0x09D6	Propel Lift Lower Wiper Open	
	0x09D7	Propel Lift Lower High Ref Iso Err	
	0x09D8	Propel Lift Lower Low Ref Iso Err	
	0x09D9	Propel Brake Wiper Error	
	0x09DA	Propel Brake High Ref Error	
	0x09DB	Propel Brake Input Invalid	
	0x09DC	Propel Brake Input High	
	0x09DD	Propel Brake Input Low	
	0x09DE	Propel Brake Pot Resistance High	
	0x09DF	Propel Brake Pot Resistance Low	
	0x09E0	Propel Brake Open Circuit	
	0x09E1	Propel Brake High Ref Iso Error	
	0x09E2	Propel Brake Low Ref Iso Error	
	0x09E3	Propel controller error	

LED Fault Code ☼ = Flashing	Fault Code	Cause(s)	Remedy
● ☼ ☼ ☼ ●	0x0B04	Battery watering system CAN fault	1. Key cycle machine. 2. Check harness connections to control board(s).
	0x0D34	Lithium-ion battery pack BMS CAN fault	
	0x0F103	Battery charger CAN communication fault	
	0xFF20	Main sweep board CAN fault	
	0x09F0	Propel communication lost warning	
☼ ☼ ● ☼ ●	0x0B01	Battery Watering System Timed Out	1. Check battery watering tank. Fill as necessary. 2. Check circuit breaker 10 (CB10). Reset circuit breaker if tripped. 3. Check ABW plumbing/hoses for leaks and blockages. Repair as necessary. 4. Check harness connection to ABW pump. Repair as necessary. 5. Check harness connection to ABW controller. Repair as necessary.
	0x0B02	Battery Watering System No Feedback	
	0x0B06	Battery Watering Tank Empty	
	0x0B13	Battery Watering Pump HW Over Current Fault	
	0x0B14	Battery Watering Pump SW Over Current 1 Fault	
	0x0B15	Battery Watering Pump SW Over Current 2 Fault	
	0x0B16	Battery Watering Pump Shorted Load	
☼ ● ● ☼ ●	0x09A9	Propel Motor Shorted Low	1. Check harness connections to propel motor. Repair as necessary. 2. Check harness connections to C3 controller. Repair as necessary. 3. Replace C3 controller.
	0x0B09	Battery Watering Pump Pressure Switch Open	1. Check harness connection to ABW pump. Repair as necessary. 2. Ensure ABW pump is operable. Replace ABW pump if it is inoperable.
	0x0B11	Battery Watering Pump Open Warning	
● ● ☼ ☼ ☼	0x09A7	Propel Motor Open Fault	1. Check harness connection to propel motor. Repair as necessary. 2. Check harness connections to C3 controller. Repair as necessary.

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

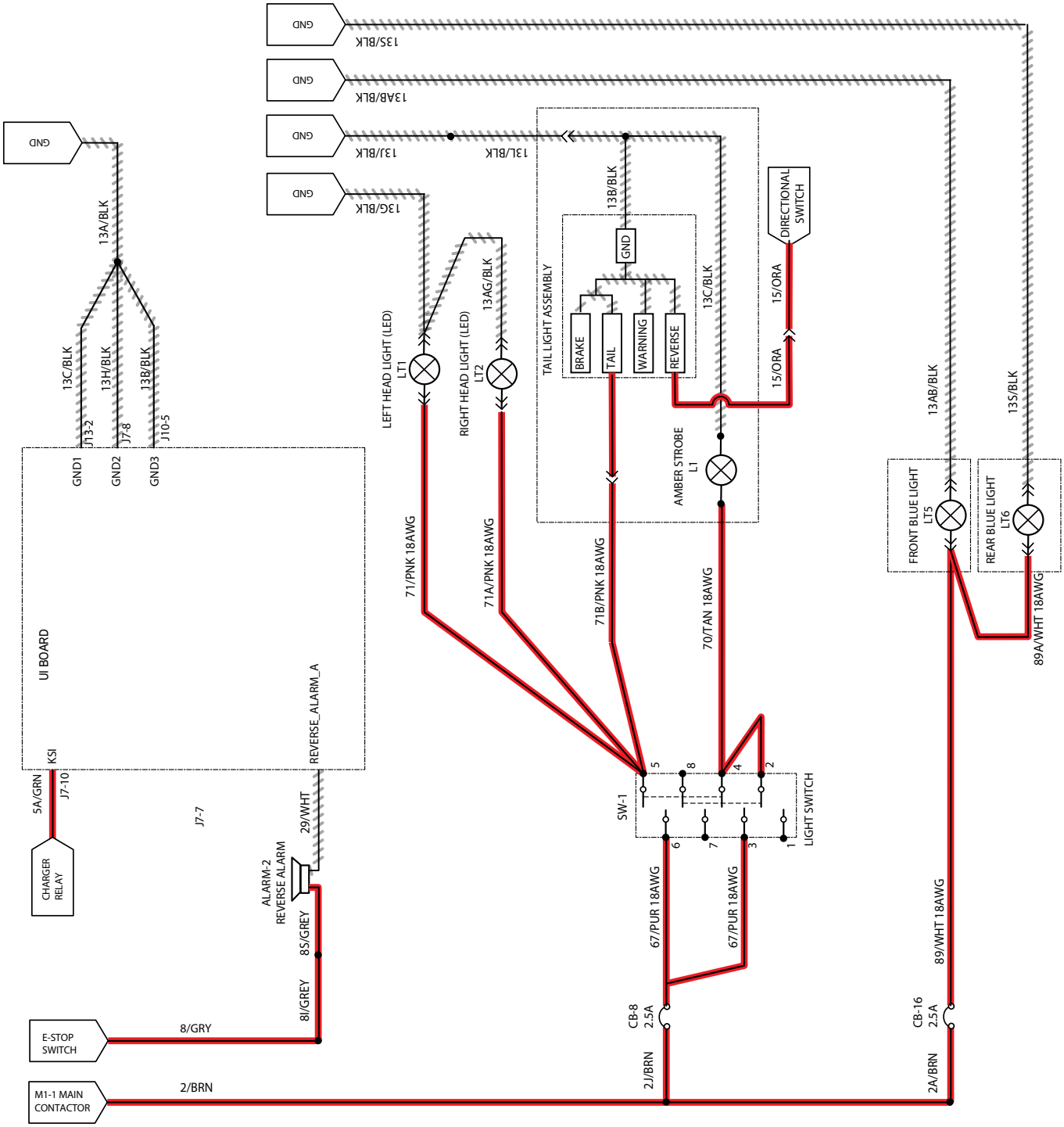
LITHIUM ION BATTERY INDICATOR CODES

LED Fault Code ☼ = Flashing	Fault Code	Fault Condition	Remedy
☼ ● ☼ ☼ ☼	0x0D34	CAN Communication Lost	Check Battery BMS CAN connections.
☼ ● ● ● ☼	0x0D06	Over Temp Charge Protection	1. Check Battery BMS and cell connections. 2. Check harness connections.
	0x0D07	Under Temp Charge Protection	
	0x0D08	Over Temp Discharge Protection	
	0x0D09	Under Temp Discharge Protection	
	0x0D10	Over Temp Charge Warning	
	0x0D11	Under Temp Charge Warning	
	0x0D12	Over Temp Discharge Warning	
	0x0D13	Under Temp Discharge Warning	
	0x0D14	Over Current Discharge Warning 1	
	0x0D31	Bus-Bar Temp Protection	
	0x0D32	Bus-Bar Temp Warning	
	0x0D33	Under Temp Charge Threshold Warning	
	0x0D37	Over Temp Charge Threshold Warning	
	0x0D38	Under Temp Discharge Threshold Warning	
	0x0D39	Over Temp Discharge Threshold Warning	
	0x0D3A	Over Current Pre-Charge Protection	
☼ ☼ ☼ ● ☼	0x0D01	Cell Over Voltage Protection 1	1. Check Battery BMS and cell connections. 2. Check harness connections.
	0x0D02	Cell Under Voltage Protection 1	
	0x0D0B	Cell Over Voltage Protection 2	
	0x0D0C	Cell Under Voltage Protection 2	
	0x0D0D	Cell Over Voltage Warning 1	
	0x0D0E	Cell Over Voltage Warning 2	
	0x0D0F	Cell Under Voltage Warning 1	
	0x0D10	Cell Under Voltage Warning 2	
	0x0D1C	Cell Deep Discharge Failure	
	0x0D1D	Cell Imbalance Failure	
	0x0D1E	Module Voltage Delta Error	
	0x0D36	Over Charge Cell Voltage Threshold Warn	
☼ ☼ ☼ ☼ ●	0x0D03	Over Current Charge Protection	1. Check Battery BMS and cell connections. 2. Check harness connections.
	0x0D04	Over Current Discharge Protection 1	
	0x0D05	Over Current Discharge Protection 2	
	0x0D15	Over Current Discharge Warning 1	
	0x0D16	Over Current Charge Warning	
	0x0D3B	Over Current Pre-Charge Warning	
	0x0D3C	Over Current Pre-Charge Protection	

LED Fault Code ☼ = Flashing	Fault Code	Fault Condition	Remedy
☼ ☼ ☼ ☼ ☼	0x0D00	General Fault	1. Check Battery BMS and cell connections. 2. Check harness connections.
	0x0D0A	Charger Protection (Cross Conduction)	
	0x0D17	Current Sensor Short	
	0x0D18	Current Sensor Open	
	0x0D19	Relay On Error	
	0x0D1A	Relay Off Error	
	0x0D1B	B+ Sensor Error	
	0x0D1F	Module Number Error	
	0x0D20	Cell ID Error	
	0x0D21	Cell Series Error	
	0x0D22	Cell Parallel Error	
	0x0D23	Master Board Type Error	
	0x0D25	Master-Slave Communication Error	
	0x0D26	Thermistor Error	
	0x0D27	Cell Voltage Sensing Error	
	0x0D28	NVM Read/Write/Erase Error	
	0x0D29	Initial Data Error	
	0x0D2A	ROM Checksum Error	
	0x0D2B	Abnormal Charge Protection	
	0x0D2C	Loose Connection 1	
	0x0D2D	Loose Connection 2	
	0x0D2E	Loose Connection 3	
	0x0D2F	Loose Connection 4	
	0x0D30	Loose Connection 5	
	0x0D35	Incorrect Battery Type	

SYSTEM TROUBLESHOOTING

BACKUP ALARM/LIGHT ON (OPTION)

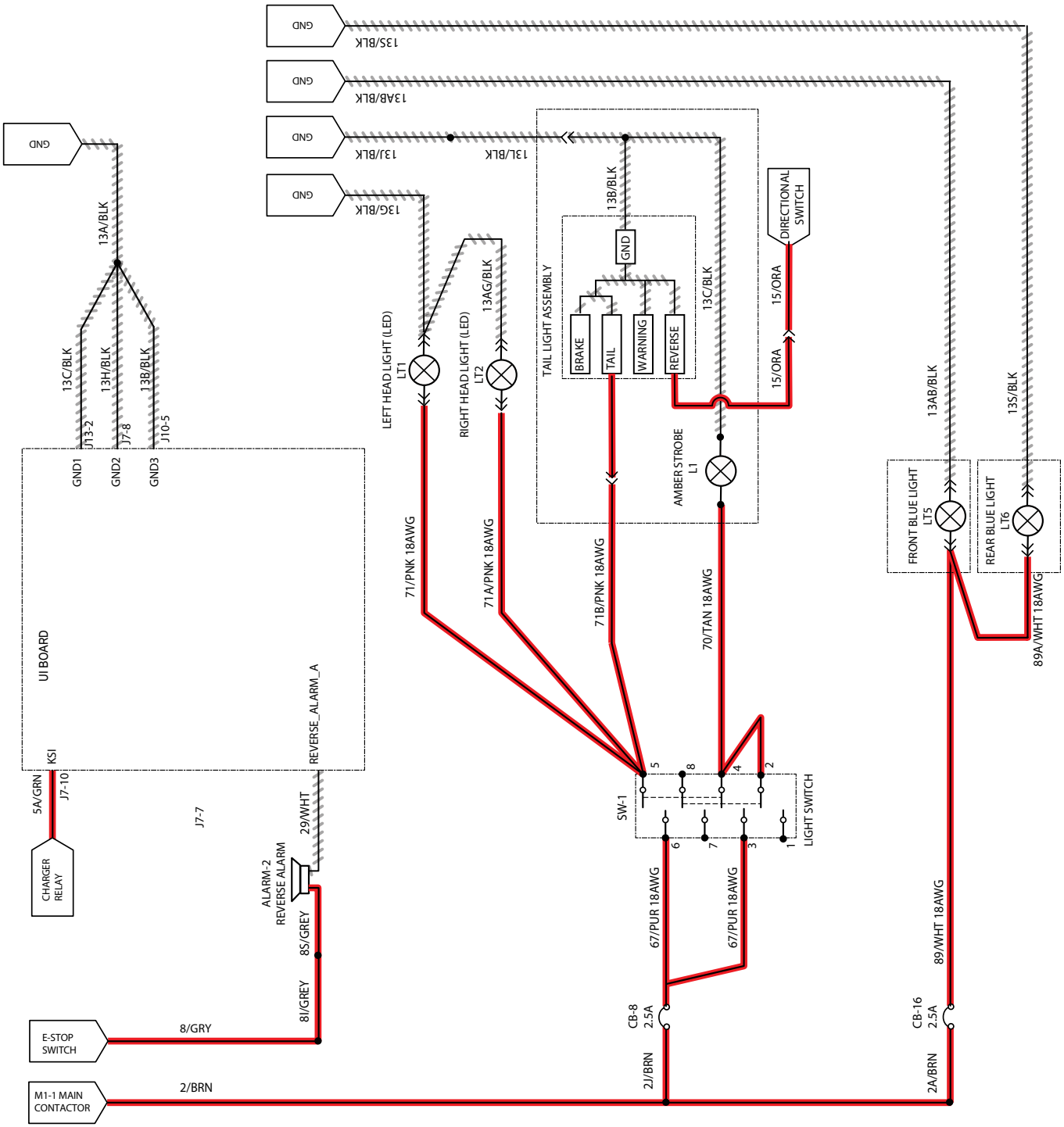


BACKUP ALARM/LIGHT FAILED TO TURN ON

Step	Action	Value(s)	Yes	No
1	• Key ON • Ensure Emergency Stop is not engaged • Enable back-up alarm/lights • Is there a fault code/message displayed?		See *FAULT CODES* section of this manual	Proceed to STEP 2
2	• Key ON • Enable back-up alarm/lights • See *PROPEL CONTROLLER DIAGNOSTIC CODES* • Is there a Propel Controller fault displayed?		Correct fault condition	Proceed to STEP 3
3	• Key ON • See *PROPEL DIAGNOSTIC MODE* section of this manual • Check P4:Direction Fwd/Rev input from the directional switch • Check P2:Throttle (0-5 VDC) input from the directional pedal • Are the P2 and P4 inputs operating properly?		Proceed to STEP 4	Correct fault condition
4	• Key OFF • Remove M2 relay from connector (see component locator) • Connect ohmmeter between relay terminals 30 and 87A (should test closed) • Use fuse-protected jumper leads to apply battery voltage to relay terminals 86 (+) and 85 (-) • Does relay “click” and do N.C. (normally closed) terminals 30 and 87A open?		Proceed to STEP 5	Replace relay
5	• Key OFF • Disconnect back-up alarm/light from main harness • Use fuse-protected jumper leads to apply battery voltage to back-up alarm/light • Does the back-up alarm/light turn On?		Proceed to STEP 6	Replace Backup Alarm/ Light
6	• Key ON • Reconnect back-up alarm/light to main harness • Enable back-up alarm/light • Use voltmeter to back probe between 15/GRN and 17/PUR at the Propel Controller connection • Is there battery voltage applied?		Repair or replace wire harness	Replace Drive Controller (C3)

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

HEADLIGHT/TAILLIGHTS ON (OPTION)/ BLUE LIGHTS ON (OPTION)



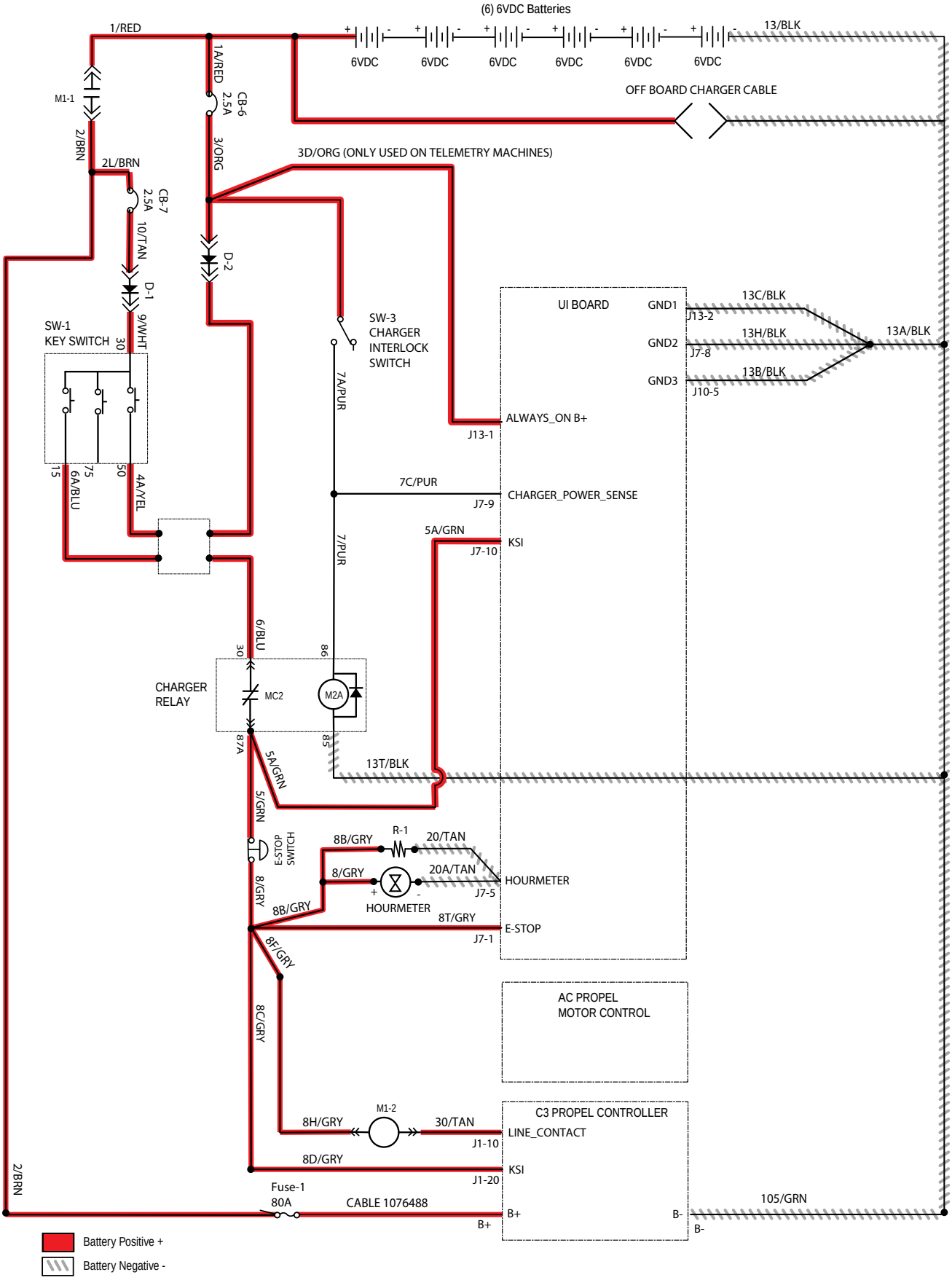
HEADLIGHTS/TAILLIGHTS FAIL TO TURN ON

Step	Action	Value(s)	Yes	No
1	• Key OFF • Firmly press circuit breaker CB8 to reset • Is circuit breaker CB8 tripped?		Reset and test headlight/taillight operation	Proceed to STEP 2
2	• Key ON • Light switch ON • Test voltage applied to headlight/taillight light subsystem • Are electrical circuits operating?		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

BLUE LIGHTS FAIL TO TURN ON

Step	Action	Value(s)	Yes	No
1	• Key OFF • Firmly press circuit breaker CB16 to reset • Is circuit breaker CB16 tripped?		Reset and test blue light operation	Proceed to STEP 2
2	• Key ON • Test voltage applied to blue light subsystem • Are electrical circuits operating?		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

POWER UP ON


(6) 6VDC Batteries
6VDC
6VDC
6VDC
6VDC
6VDC
6VDC
1/RED
13/BLK
1A/RED
CB-6
2.5A
3/ORG
M1-1
2/BRN
2L/BRN
CB-7
2.5A
10/TAN
D-1
D-2
9/WHT
SW-1
KEY SWITCH
30
15
75
50
6A/BLU
4A/YEL
OFF BOARD CHARGER CABLE
3D/ORG (ONLY USED ON TELEMETRY MACHINES)
SW-3
CHARGER
INTERLOCK
SWITCH
7A/PUR
UI BOARD
GND1
GND2
GND3
J13-2
J7-8
J10-5
13C/BLK
13H/BLK
13B/BLK
13A/BLK
ALWAYS_ON B+
J13-1
7C/PUR
CHARGER_POWER_SENSE
J7-9
5A/GRN
KSI
J7-10
7/PUR
6/BLU
30
86
CHARGER
RELAY
MC2
M2A
87A
85
13T/BLK
5A/GRN
5/GRN
E-STOP
SWITCH
8B/GRY
R-1
20/TAN
8/GRY
20A/TAN
HOURMETER
J7-5
HOURMETER
8T/GRY
E-STOP
J7-1
8F/GRY
AC PROPEL
MOTOR CONTROL
8C/GRY
M1-2
C3 PROPEL CONTROLLER
8H/GRY
30/TAN
LINE_CONTACT
J1-10
8D/GRY
KSI
J1-20
Fuse-1
80A
CABLE 1076488
B+
B+
B-
B-
105/GRN
2/BRN
Battery Positive +
Battery Negative -

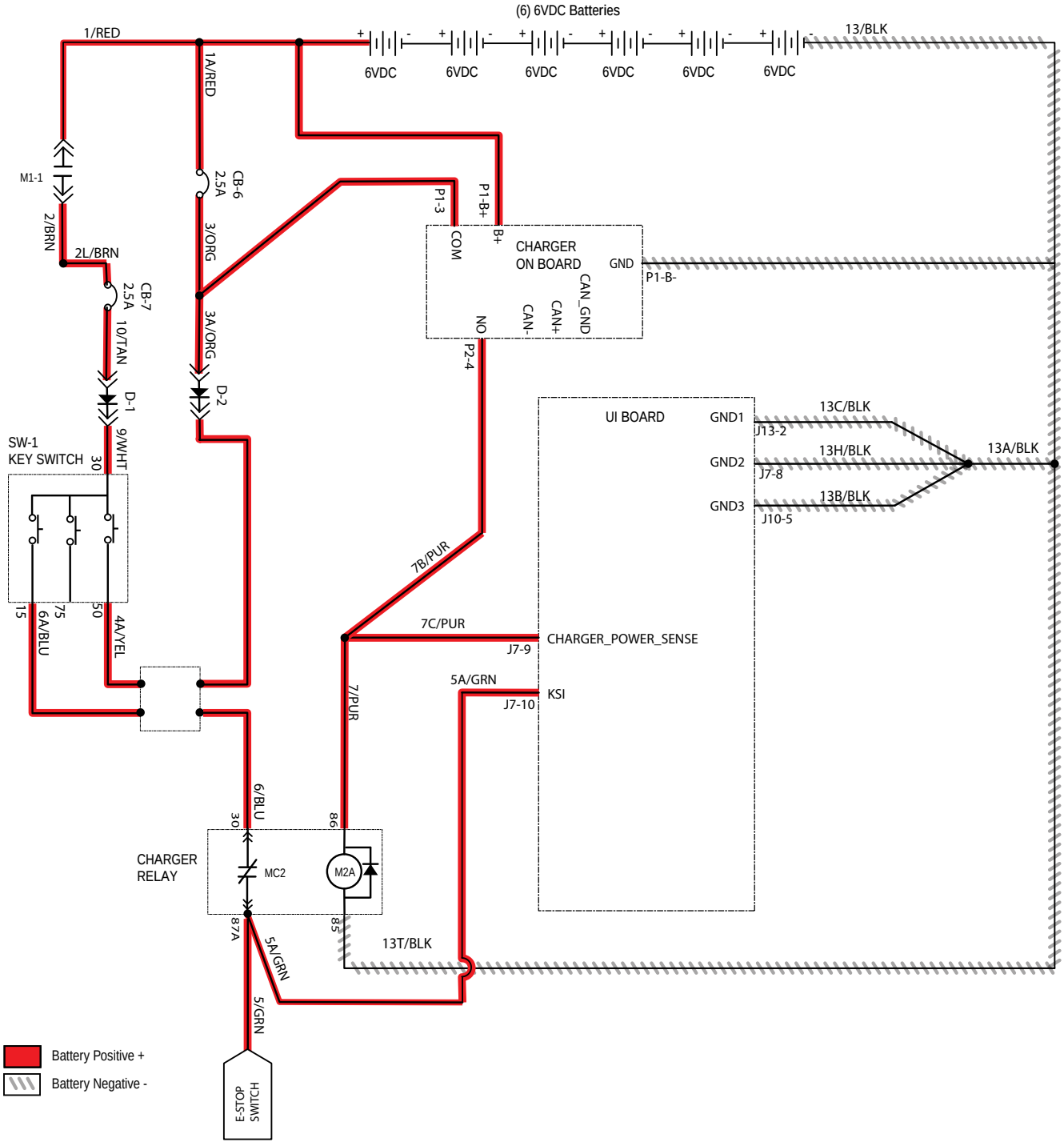
MACHINE FAILS TO POWER UP

Step	Action	Value(s)	Yes	No
1	• Key ON • Ensure Emergency Stop is not engaged • Ensure batteries are charged.		Proceed to STEP 2	Recharge batteries and test power-up circuit operation
2	• Key OFF • Firmly press circuit breaker CB6 and CB7 to reset • Are circuit breaker CB6 and CB7 tripped?		Reset and test power up circuit operation	Proceed to STEP 3
3	• Test total battery voltage using a voltmeter • Is the total battery voltage greater than 30 VDC?			
4	• Key ON • Test voltage applied to power up subsystem • Are electrical circuits operating?		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:
CB6/CB7 = High Side
VDC = DC Voltage

C Voltage

ON-BOARD BATTERY CHARGER



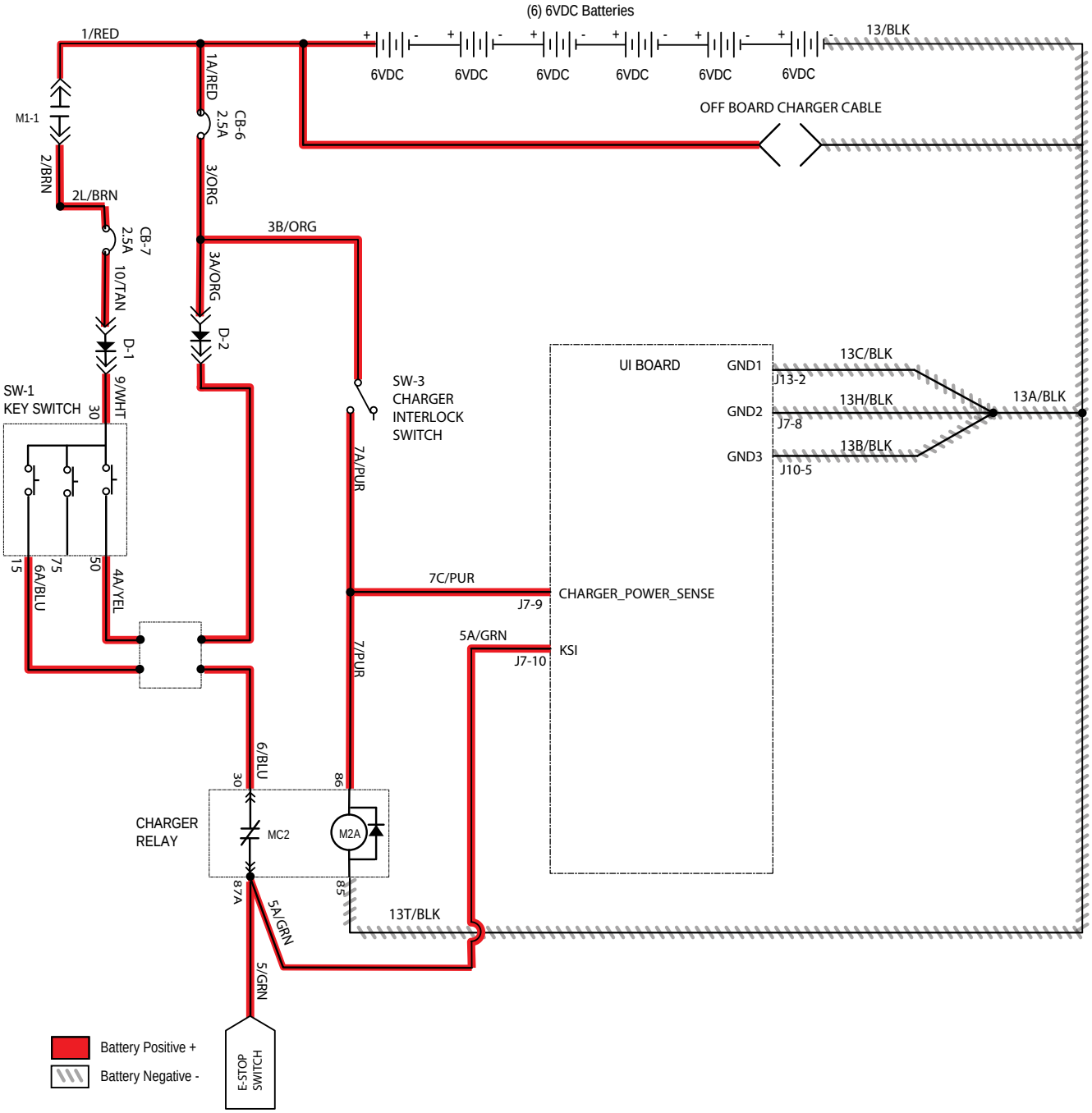
ON-BOARD BATTERY CHARGER FAILS TO POWER UP

Step	Action	Value(s)	Yes	No
1	• Key OFF • Observe charger light sequence for errors/faults • Test total battery voltage using a voltmeter • Is the total battery voltage greater than 30 VDC?		Proceed to STEP 2	Recharge batteries and test power-up circuit operation
2	• Key OFF • Firmly press circuit breaker CB6 to reset • Is circuit breaker CB6 tripped?		Reset and test power up circuit operation	Proceed to STEP 3
3	• Key OFF • Remove M2 relay from connector (see component locator) • Connect ohmmeter between relay terminals 30 and 87A (should test closed) • Use fuse-protected jumper leads to apply battery voltage to relay terminals 86 (+) and 85 (-) • Does relay “click” and do N.C. (normally closed) terminals 30 and 87A open?		Proceed to STEP 4	Replace relay
4	• Key ON • Test voltage applied to power up subsystem • Are electrical circuits operating?		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:
CB6 = High Side
VDC = DC Voltage

C Voltage

OFF-BOARD BATTERY CHARGER



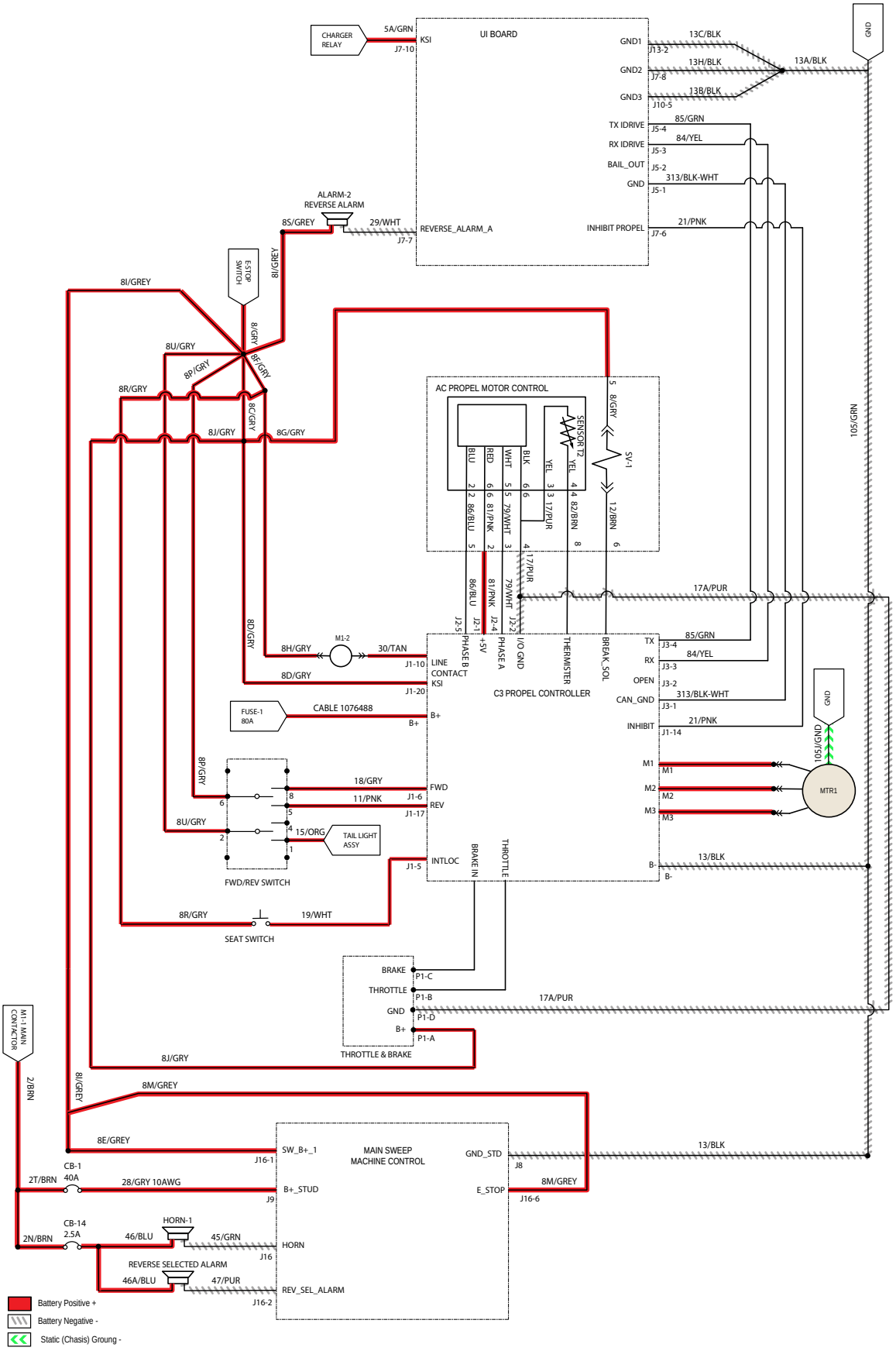
OFF-BOARD BATTERY CHARGER FAILS TO POWER UP

Step	Action	Value(s)	Yes	No
1	• Key ON • Test total battery voltage using a voltmeter • Is the total battery voltage greater than 30 VDC?		Proceed to STEP 2	Recharge batteries and test power-up circuit operation
2	• Key OFF • Firmly press circuit breaker CB6 to reset • Is circuit breaker CB6 tripped?		Reset and test power up circuit operation	Proceed to STEP 3
3	• Key OFF • Remove M2 relay from connector (see component locator) • Connect ohmmeter between relay terminals 30 and 87A (should test closed) • Use fuse-protected jumper leads to apply battery voltage to relay terminals 86 (+) and 85 (-) • Does relay “click” and do N.C. (normally closed) terminals 30 and 87A open?		Proceed to STEP 4	Replace relay
4	• Key ON • Test voltage applied to power up subsystem • Are electrical circuits operating?		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:
CB6 = High Side
VDC = DC Voltage

C Voltage

PROPEL SUBSYSTEM

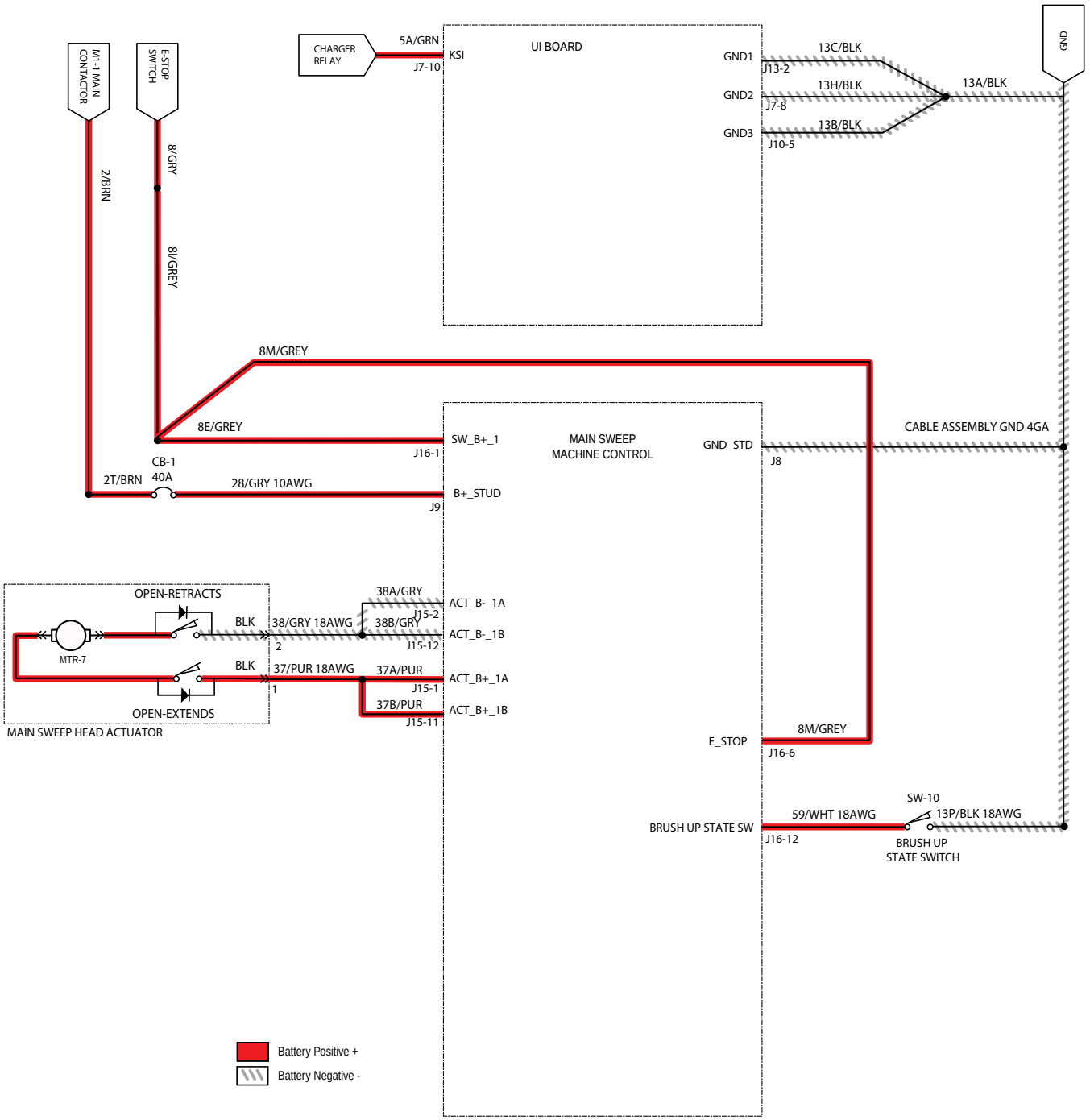


MACHINE FAILS TO PROPEL

Step	Action	Value(s)	Yes	No
1	• Key ON • Ensure Emergency Stop is not engaged • Is Fuse 1 open? • Does a Propel Controller fault condition exist?		Correct fault condition	Proceed to STEP 2
2	• Key ON • Does a Propel Controller fault condition exist? • Is P1: Curtis Online? • Does P2: Throttle input voltage (0-5 VDC) change proportionally with throttle pedal movement? • Does P3: Brake pedal input turn On/Off with brake pedal activation? • Does P4: Direction input correspond with Fwd/Rev rocker switch position? • Does P5: Speed input from drive assembly encoder (speed, direction, position sensor) read 0000.0 MPH? • Does P8: Propel motor current read 0000.0 Amps? • Is answer “Yes” to all of above?		Proceed to STEP 3	Correct faulty input condition
3	• Key OFF • Place machine on jack stands so drive wheel is lifted off the floor • Enable forward propel • Test voltage applied to propel subsystem • Are electrical circuits operating?		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:
VDC = Direct Current Voltage

MAIN SWEEP BRUSH ACTUATOR RETRACT/RAISE AND EXTEND/LOWER



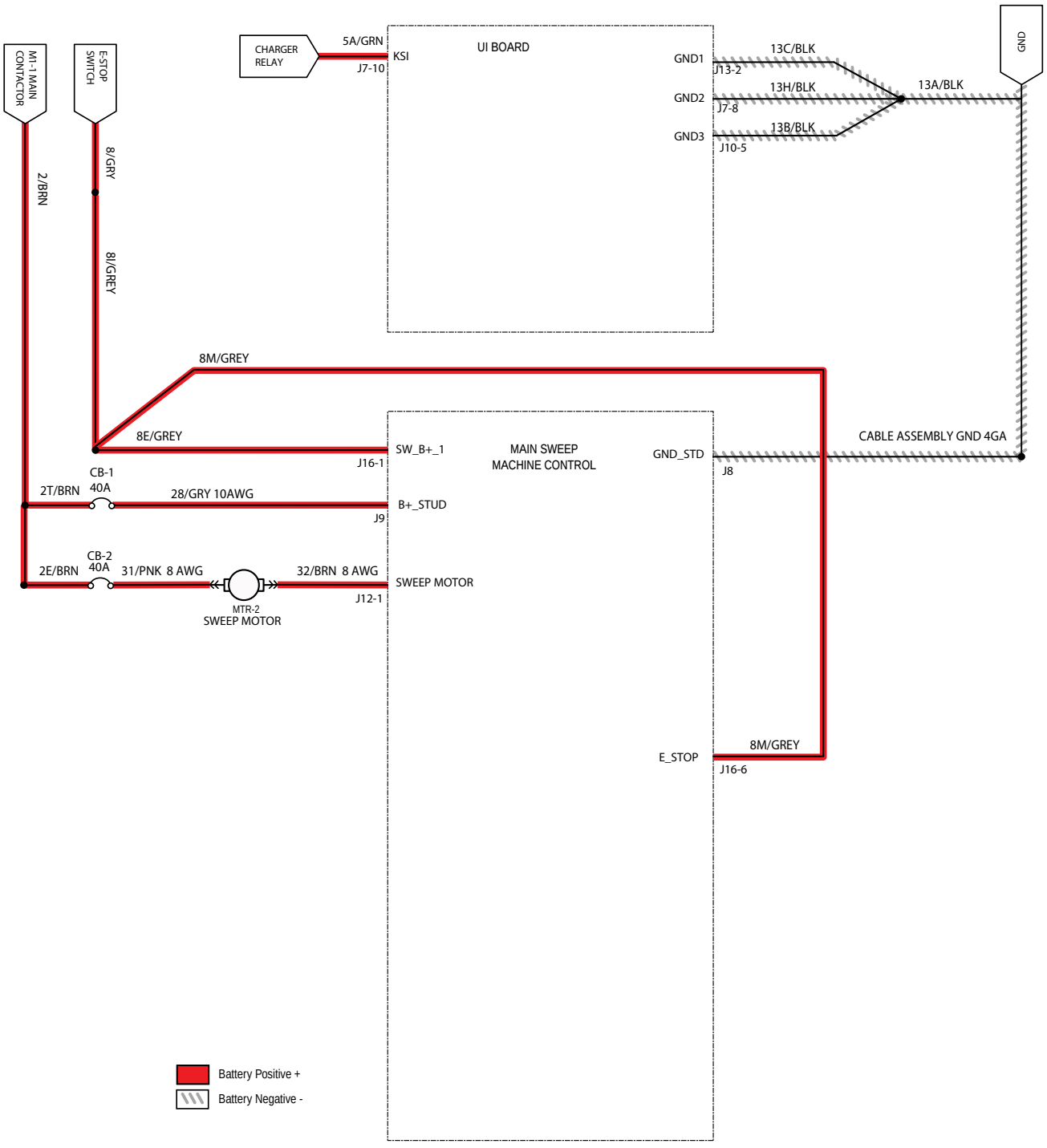
MAIN SWEEP BRUSH FAILS TO RAISE/LOWER

Step	Action	Value(s)	Yes	No
1	• Key ON • Enable sweeping • Is there a fault code/message displayed?		See *FAULT CODES* section of this manual	Proceed to STEP 2
2	• Key OFF • See *MANUAL MODE* section of this manual • Activate sweep actuator in Manual Mode • Does the main sweep brush raise/lower?		Proceed to STEP 5	Proceed to STEP 3
3	• Key OFF • Ensure SW-10 changes state when lever is pushed and released. • Does SW-10 change state?		Proceed to STEP 4	Replace SW-10
4	• Key OFF • See *TESTING THE MAIN SWEEP ACTUATOR* section of this manual • Does the main sweep actuator pass testing?	See *TESTING THE MAIN SWEEP ACTUATOR* in this manual	Proceed to STEP 5	Replace main sweep actuator
5	• Key OFF • Reconnect main sweep actuator to main wire harness • Test voltage applied to main sweep actuator subsystem • Are electrical circuits operating?		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:
Extend/Lower
J15-2/J15-12 = Main Sweep Board
Connector #15, Pin #2. Pin 12

Retract/Raise
J15-1/J15- 11 = Main Sweep Board
Connector #15, Pin #1, Pin 11

MAIN SWEEP MOTOR ON

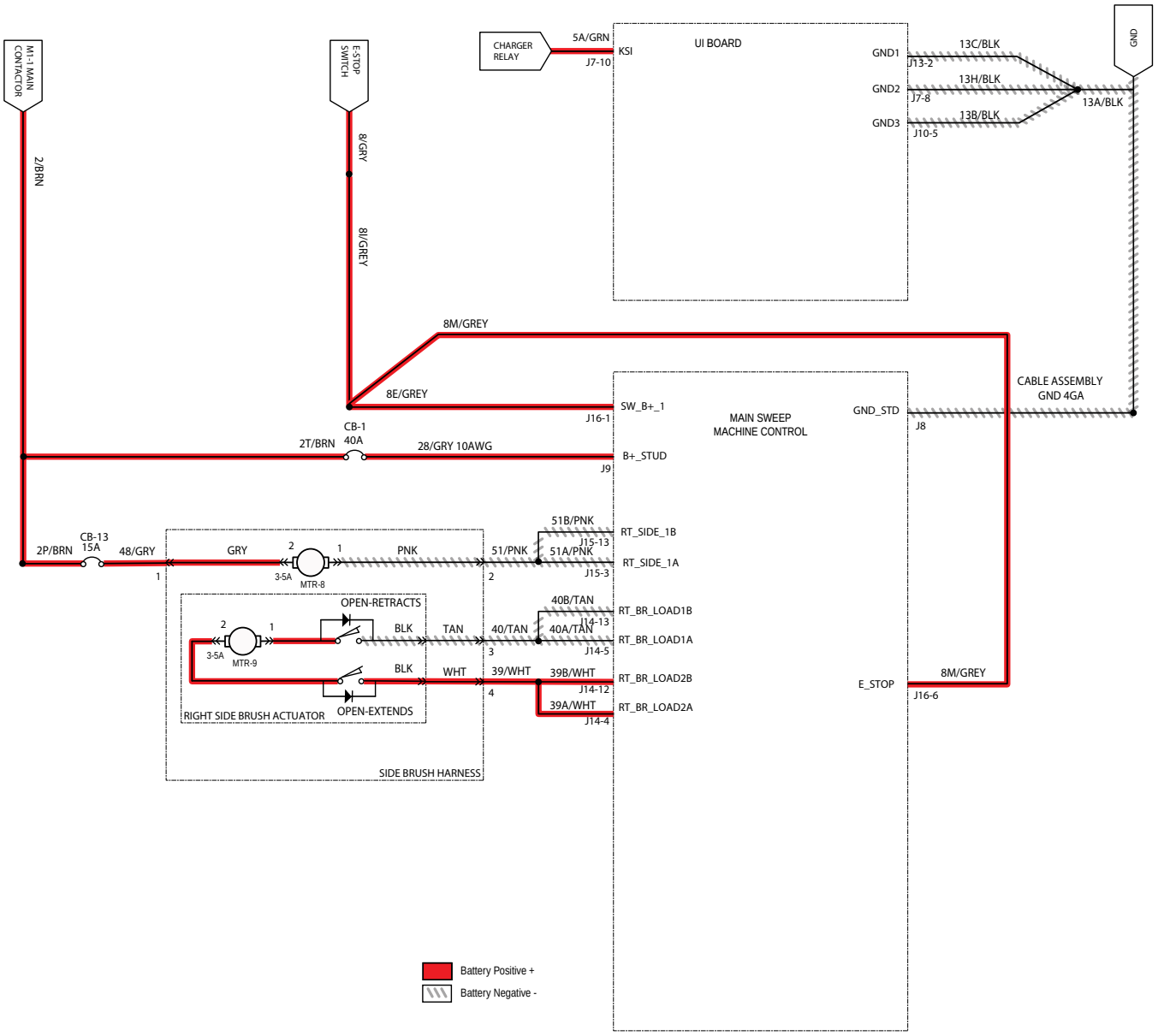


MAIN SWEEP MOTOR FAILS TO ACTIVATE

Step	Action	Value(s)	Yes	No
1	• Key ON • Enable 1-Step • Is there a fault code/message displayed?		See *FAULT CODE* section of this manual	Proceed to STEP 2
2	• Key OFF • Firmly press circuit breaker CB1 and CB2 to reset • Are circuit breaker CB1 and CB2 tripped?		Reset and test main brush motor operation	Proceed to STEP 3
3	• Key OFF • See *MANUAL MODE* section of this manual • Activate main sweep motor in Manual Mode • Does main sweep motor activate?		Proceed to STEP 6	Proceed to STEP 4
4	• Key OFF • Test voltage applied to brush motors • Are the electrical circuits operating?		Proceed to STEP 5	Correct faulty input condition
5	• Key OFF • See *TESTING THE MAIN SWEEP MOTORS* section of this manual • Does main sweep motor pass testing?	See *TESTING THE MAIN SWEEP MOTORS* in this manual	Proceed to STEP 6	Repair or replace main sweep motor
6	• Key OFF • Reconnect main sweep motor to main wire harness • Key ON • Enable main sweep subsystem • Test voltage applied to main sweep subsystem • Are electrical circuits operating?		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:
CB1/CB2 = High Side
J12-1 = Main Sweep Board
Connector #12, Pin #1

RIGHT SIDE SWEEP BRUSH ON

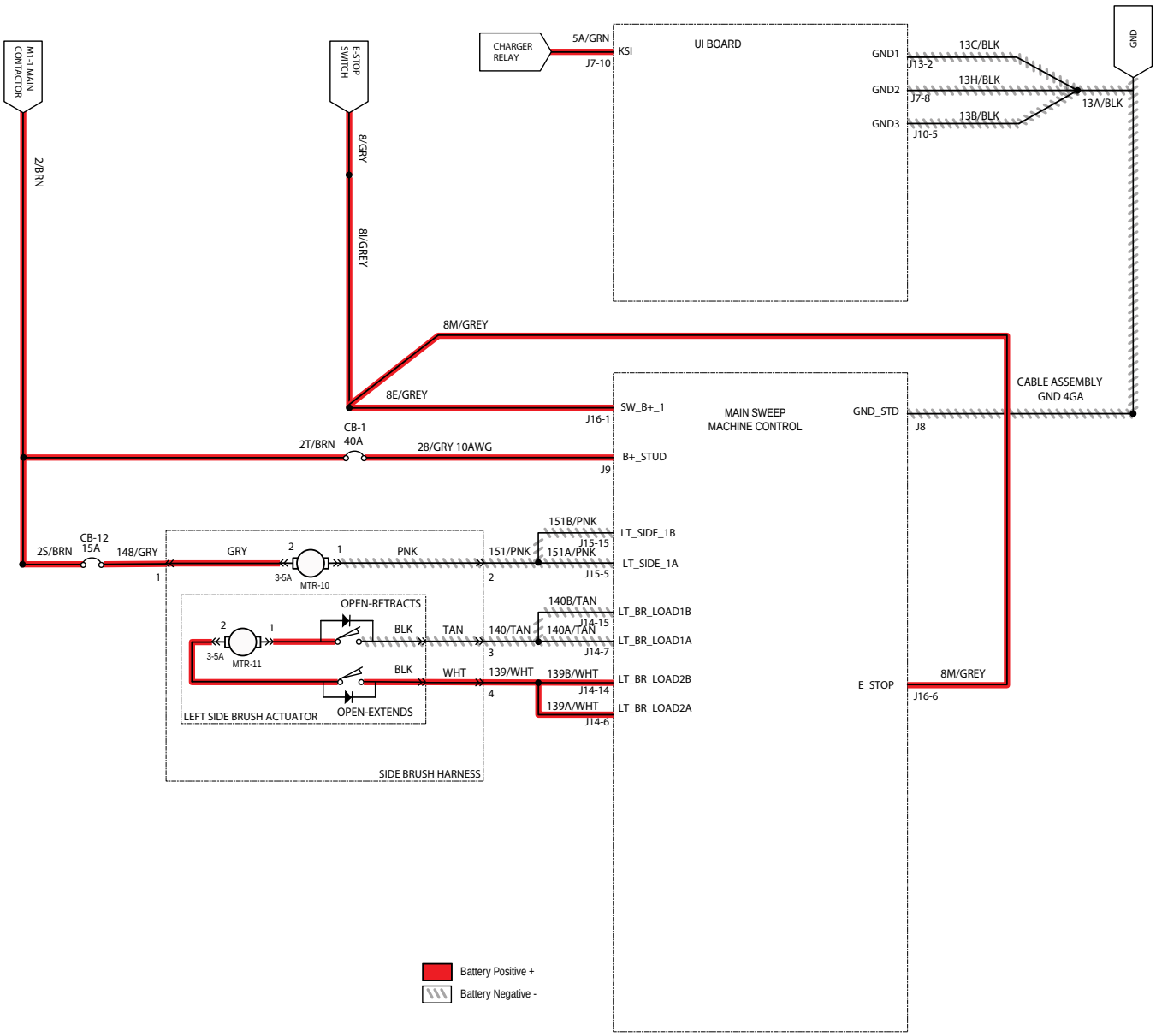


RIGHT SIDE SWEEP BRUSH FAILS TO TURN ON

Step	Action	Value(s)	Yes	No
1	• Key ON • Enable side brush • Enable 1-Step • Is there a fault code/message displayed?		See *FAULT CODES* section of this manual	Proceed to STEP 2
2	• Key OFF • Firmly press circuit breaker CB13 and CB1 to reset • Are circuit breaker CB13 and CB1 tripped?		Reset and test right side sweep brush motor operation	Proceed to STEP 3
3	• Key OFF • See *MANUAL MODE* section of this manual • Activate the side brush in Manual Mode • Does the right side brush turn On?		Proceed to STEP 5	Proceed to STEP 4
4	• Key OFF • See *TESTING SIDE SWEEP BRUSH MOTOR* section of this manual • Does the side brush motor pass the testing?	See *TESTING THE SIDE SWEEP BRUSH MOTOR* in this manual	Proceed to STEP 5	Replace side brush motor
5	• Key OFF • Reconnect side brush motor to main wire harness • Test voltage applied to side brush subsystem • Are electrical circuits operating?		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:
CB13/CB1 = High Side
J15-13/J15-3 = Main Sweep Board
Connector #15, Pin #13, Pin #3

LEFT SIDE SWEEP BRUSH ON (OPTION)

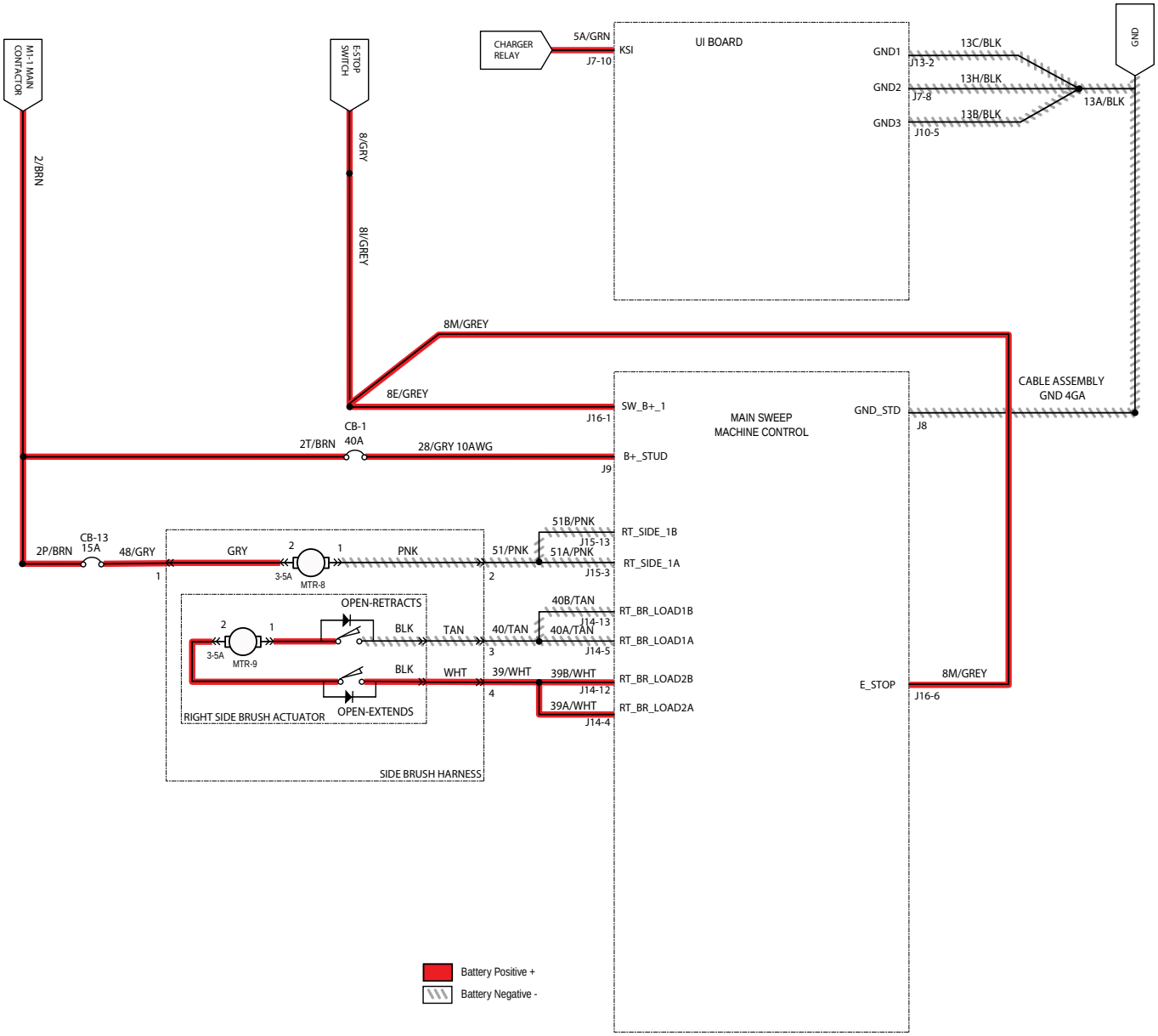


LEFT SIDE SWEEP BRUSH FAILS TO TURN ON

Step	Action	Value(s)	Yes	No
1	• Key ON • Enable side brush • Enable 1-Step • Is there a fault code/message displayed?		See *FAULT CODES* section of this manual	Proceed to STEP 2
2	• Key OFF • Firmly press circuit breaker CB12 and CB1 to reset • Are circuit breaker CB12 and CB1 tripped?		Reset and test left side sweep brush motor operation	Proceed to STEP 3
3	• Key OFF • See *MANUAL MODE* section of this manual • Activate the side brush in Manual Mode • Does side brush turn On?		Proceed to STEP 5	Proceed to STEP 4
4	• Key OFF • See *TESTING THE SIDE SWEEP BRUSH MOTOR* section of this manual • Does the side brush motor pass the testing?	See *TESTING THE SIDE SWEEP BRUSH MOTOR* in this manual	Proceed to STEP 5	Replace side brush motor
5	• Key OFF • Reconnect side brush motor to main wire harness • Test voltage applied to side brush subsystem • Are electrical circuits operating?		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:
CB12/CB1 = High Side
J15-15/J15-5 = Main Sweep Board
Connector #15, Pin #15, Pin #5

RIGHT SIDE SWEEP BRUSH EXTEND/LOWER, OFF AND RETRACT/RAISE, OFF



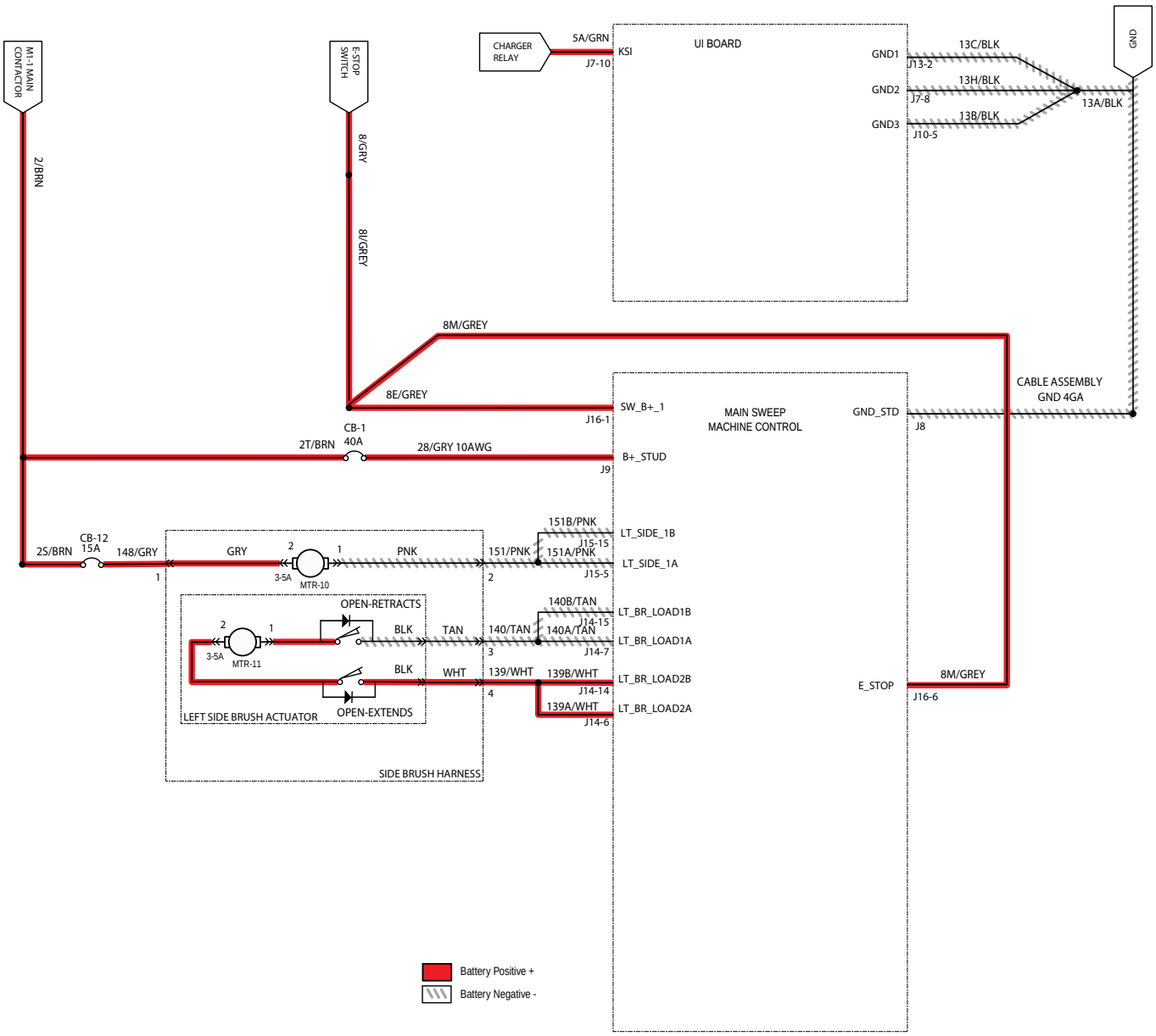
RIGHT SIDE SWEEP BRUSH FAILS TO RAISE/ LOWER

Step	Action	Value(s)	Yes	No
1	• Key ON • Enable side brush extend/down and/or retract/ lower • Is there a fault code/message displayed?		See *FAULT CODES* section of this manual	Proceed to STEP 2
2	• Key OFF • See *MANUAL MODE* section of this manual • Extend/Lower and /or retract/raise the side brush in Manual Mode • Does side brush lower/raise while in manual mode?		Proceed to STEP 4	Proceed to STEP 3
3	• Key OFF • See *TESTING THE SIDE SWEEP ACTUATOR(S)* section of this manual • Does side brush actuator pass testing?	See *TESTING THE SIDE SWEEP ACTUATOR(S)* in this manual	Proceed to STEP 4	Replace side brush lift actuator
4	• Key OFF • Reconnect side brush actuator to main wire harness • Key ON • Side brush extend/down and/or retract/raise enabled • Test voltage applied to side brush lift subsystem • Are electrical circuits operating?		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:
Extend/Lower
J14-12/J14-4 = Main Sweep Board
Connector #14, Pin #12, Pin 4

Retract/Raise
J14-13/J14-5 = Main Sweep Board
Connector #14, Pin #13, Pin 5

LEFT SIDE SWEEP BRUSH EXTEND/LOWER, OFF AND RETRACT/RAISE, OFF (OPTION)



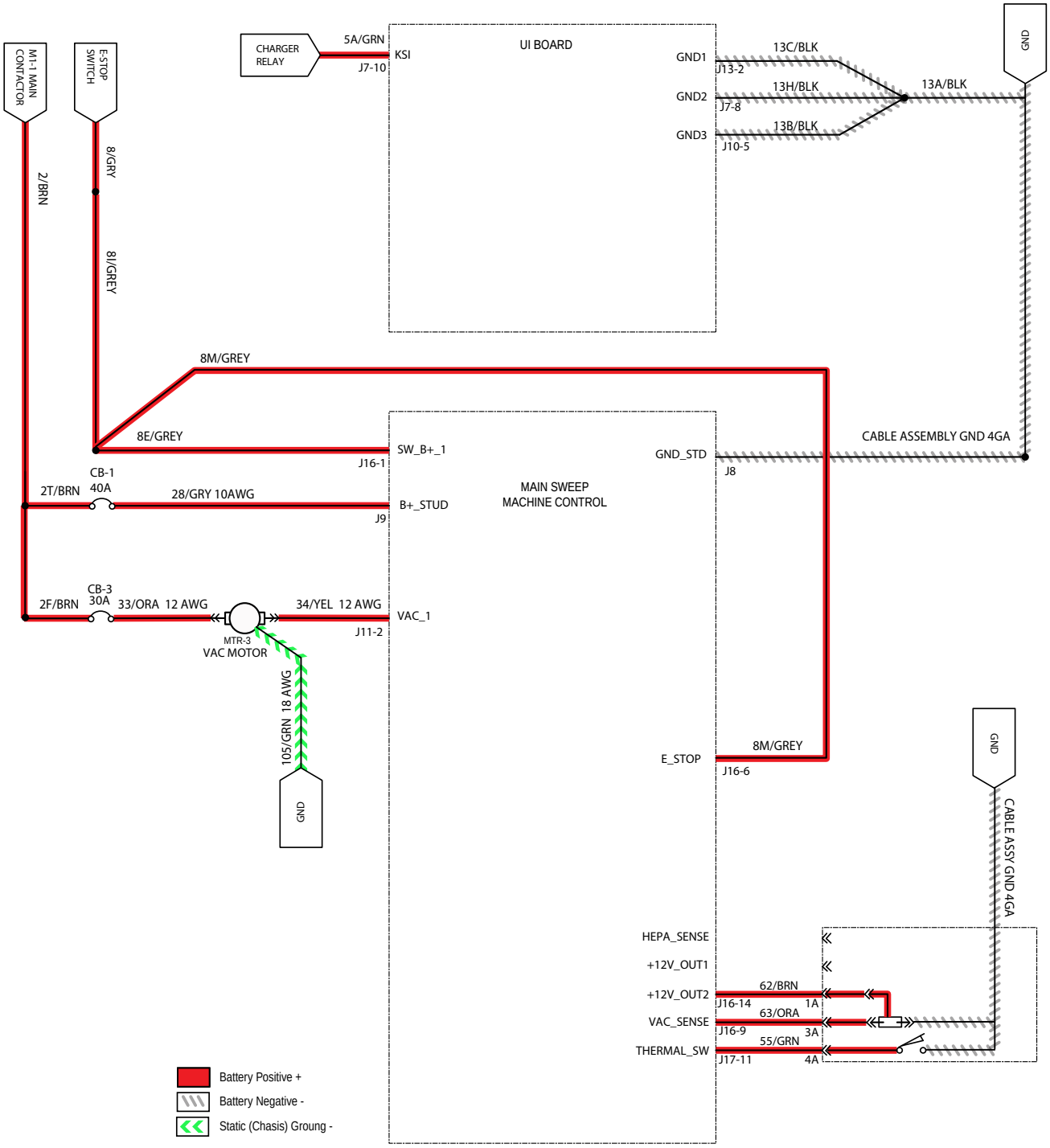
LEFT SIDE SWEEP BRUSH FAILS TO RAISE/ LOWER

Step	Action	Value(s)	Yes	No
1	• Key ON • Enable side brush extend/down and/or retract/ raise • Is there a fault code/message displayed?		See *FAULT CODES* section of this manual	Proceed to STEP 2
2	• Key OFF • See *MANUAL MODE* section of this manual • Extend/lower and/or retract/raise the side brush in Manual Mode • Does side brush lower/raise while in manual mode?		Proceed to STEP 4	Proceed to STEP 3
3	• Key OFF • See *TESTING THE SIDE SWEEP ACTUATOR(S)* section of this manual • Does side brush actuator pass testing?	See *TESTING THE SIDE SWEEP ACTUATOR(S)* in this manual	Proceed to STEP 4	Replace side brush lift actuator
4	• Key OFF • Reconnect side brush actuator to main wire harness • Key ON • Side brush extend/down and/or retract/raise enabled • Test voltage applied to side brush actuator subsystem • Are electrical circuits operating?		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:
Extend/Lower
J14-14/J14-6 = Main Sweep Board
Connector #14, Pin #14, Pin #6

Retract/Raise
J14-15/J14-7 = Main Sweep Board
Connector #14, Pin #15, Pin #7

SWEEP VACUUM FAN ON

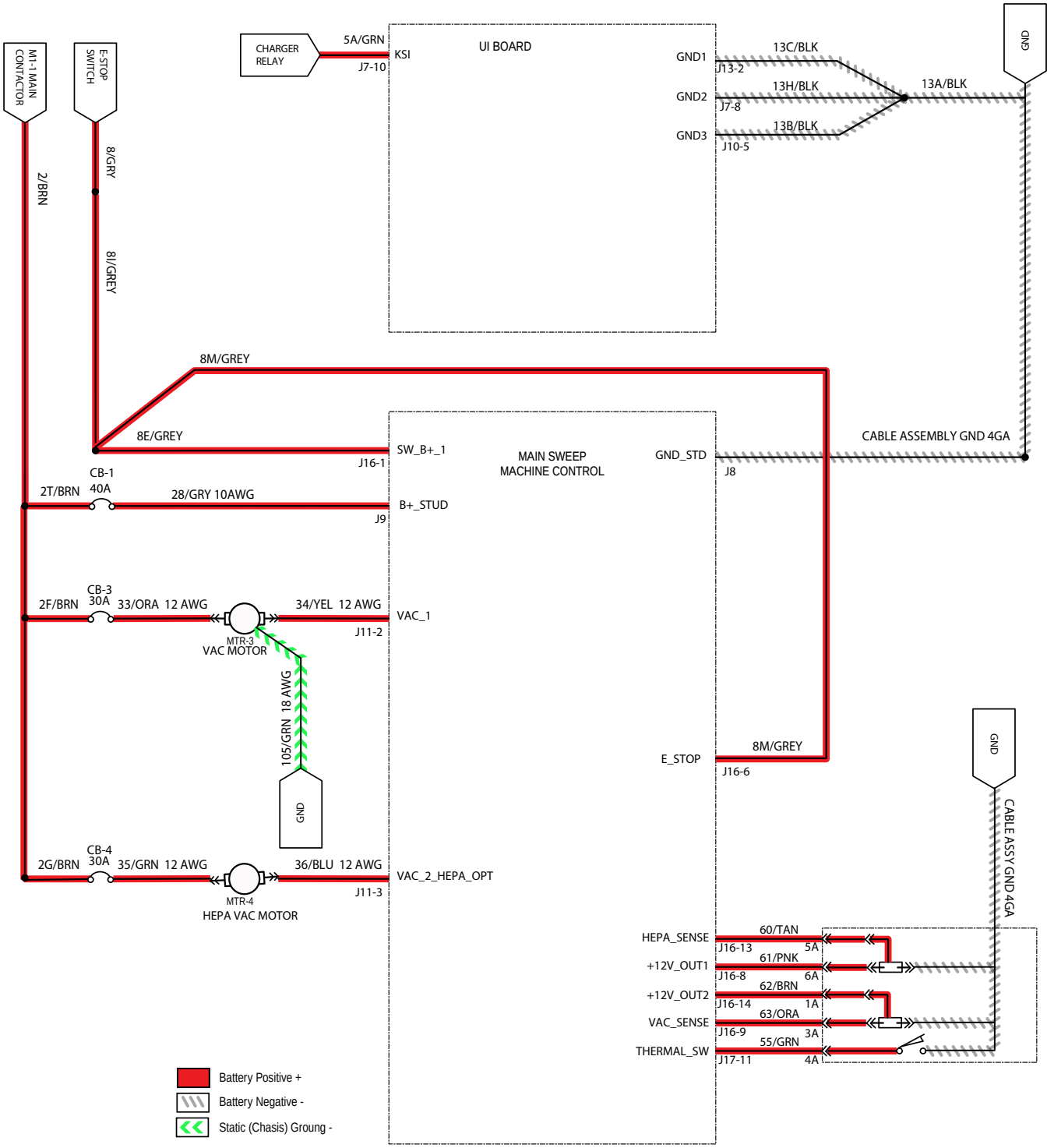


SWEEP VACUUM FAN FAILS TO TURN ON

Step	Action	Value(s)	Yes	No
1	• Key ON • Enable sweep vacuum fan • Enable 1-Step • Is there a fault code/message displayed?		See *FAULT CODE* section of this manual	Proceed to STEP 2
2	• Key OFF • Firmly press circuit breaker CB3 and CB1 to reset • Are circuit breaker CB3 and CB1 tripped?		Reset and test vacuum fan operation	Proceed to STEP 3
3	• Key OFF • See *MANUAL MODE* section of this manual • Activate sweep vacuum fan in Manual Mode • Does sweep vacuum fan turn ON?		Proceed to STEP 5	Proceed to STEP 4
4	• Key OFF • See *TESTING THE SWEEP/HEPA VACUUM FAN* section of this manual • Does vacuum fan motor pass testing?	See *TESTING THE SWEEP/ HEPA VACUUM FAN* in this manual	Proceed to STEP 5	Repair or replace vacuum fan motor
5	• Key OFF • Reconnect sweep vacuum fan motor to main wire harness • Key ON • Enable sweep vacuum fan subsystem • Test voltage applied to sweep vacuum fan subsystem • Are electrical circuits operating?		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:
CB3/CB1 = High Side
J11-2 = Main Sweep Board
Connector #11, Pin #2

HEPA VACUUM FAN ON (OPTION)

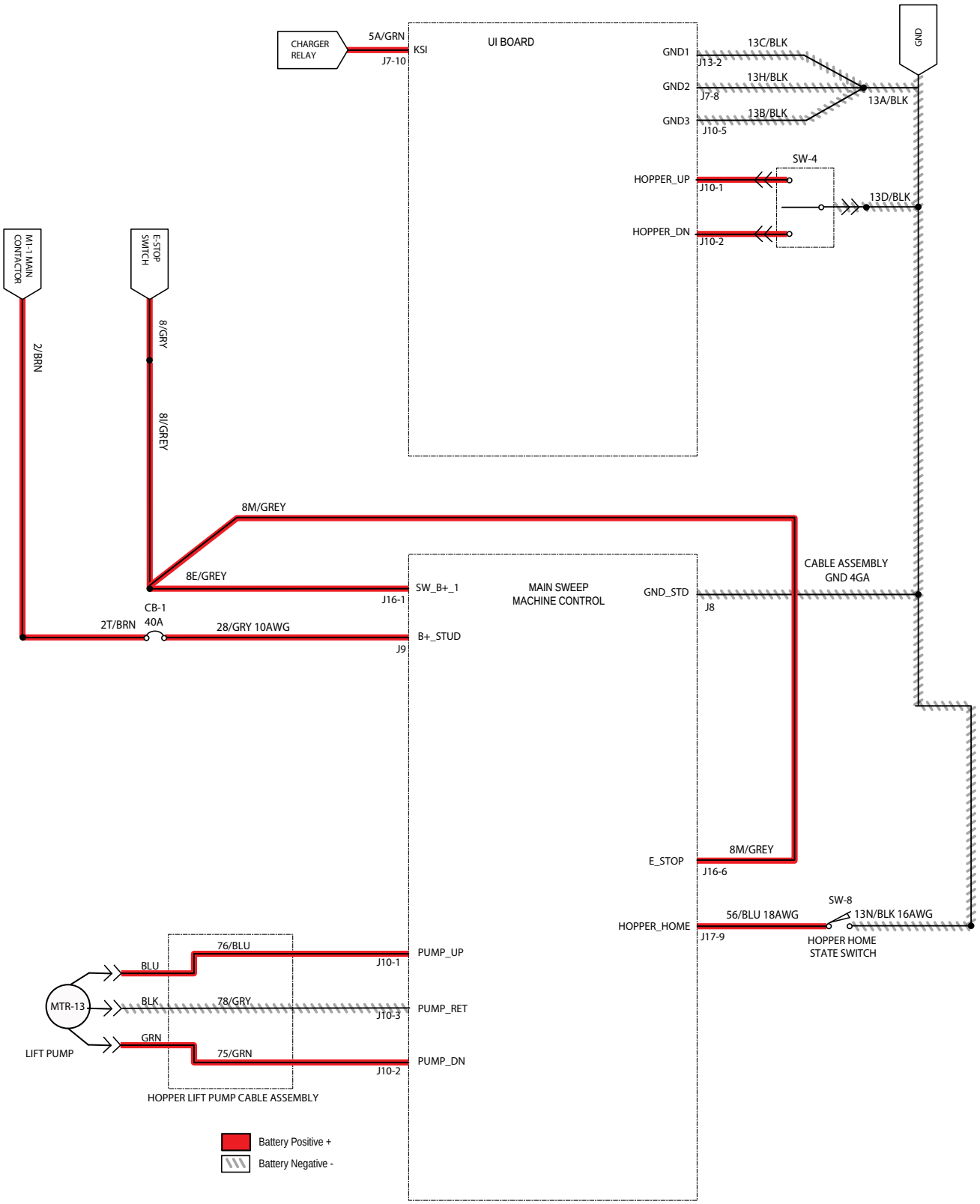


HEPA VACUUM FAN FAILS TO TURN ON

Step	Action	Value(s)	Yes	No
1	• Key ON • Enable HEPA vacuum fan • Is there a fault code/message displayed?		See *FAULT CODE* section of this manual	Proceed to STEP 2
2	• Key OFF • Firmly press circuit breaker CB4 and CB1 to reset • Are circuit breaker CB4 and CB1 tripped?		Reset and test HEPA fan operation	Proceed to STEP 3
3	• Key OFF • See *MANUAL MODE* section of this manual • Activate HEPA vacuum fan in Manual Mode • Does HEPA vacuum fan turn ON?		Proceed to STEP 5	Proceed to STEP 4
4	• Key OFF • See *TESTING THE SWEEP/HEPA VACUUM FAN* section of this manual • Does HEPA fan motor pass testing?	See *TESTING THE SWEEP/ HEPA VACUUM FAN* in this manual	Proceed to STEP 5	Repair or replace HEPA fan motor
5	• Key OFF • Reconnect HEPA fan motor to main wire harness • Key ON • Enable HEPA fan subsystem • Test voltage applied to HEPA fan subsystem • Are electrical circuits operating?		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:
CB4/CB1 = High Side
J11-3 = Main Sweep Board
Connector #11, Pin #3

HOPPER LIFT PUMP, UP (HIGH DUMP ONLY)

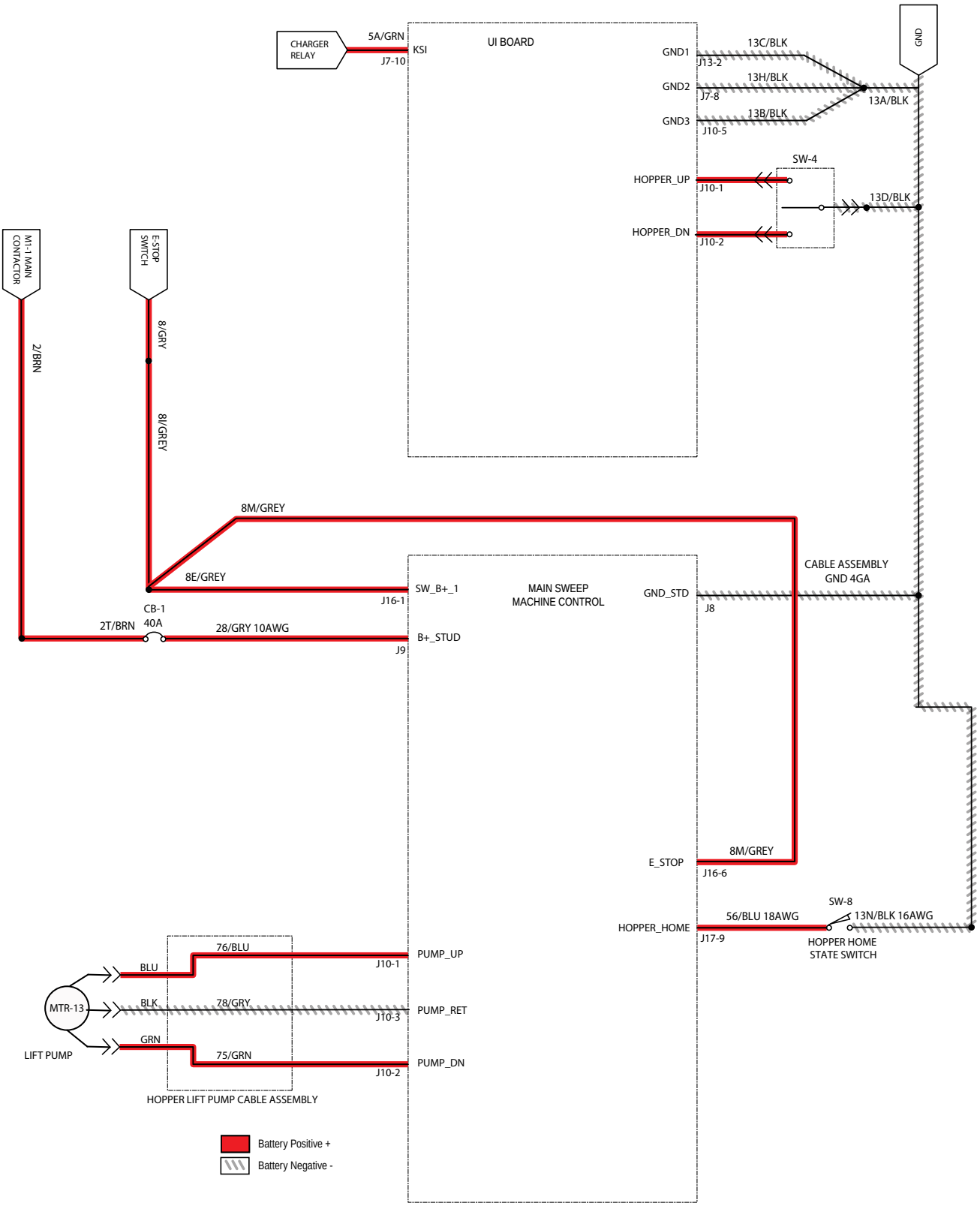


HOPPER FAILS TO RAISE (HIGH DUMP ONLY)

Step	Action	Value(s)	Yes	No
1	• Key ON • Enable hopper lift (hopper raise lower switch and hopper safety button) • Is there a fault code/message displayed?		See *FAULT CODE* section of this manual	Proceed to STEP 2
2	• Key OFF • See *TESTING THE HOPPER PUMP MOTOR* section of this manual • Does hopper pump pass testing?	See *TESTING THE HOPPER PUMP MOTOR* in this manual	Proceed to STEP 3	Repair or replace hydraulic pump
3	• Key OFF • Reconnect hopper pump to main wire harness • Key ON • Enable hopper subsystem • Test voltage applied to hopper subsystem • Are electrical circuits operating?		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:
J10-1/J10-2/J10-3 = Main Sweep Board
Connector #10, Pin #1, Pin #2, Pin #3

HOPPER LIFT PUMP, DOWN (HIGH DUMP ONLY)

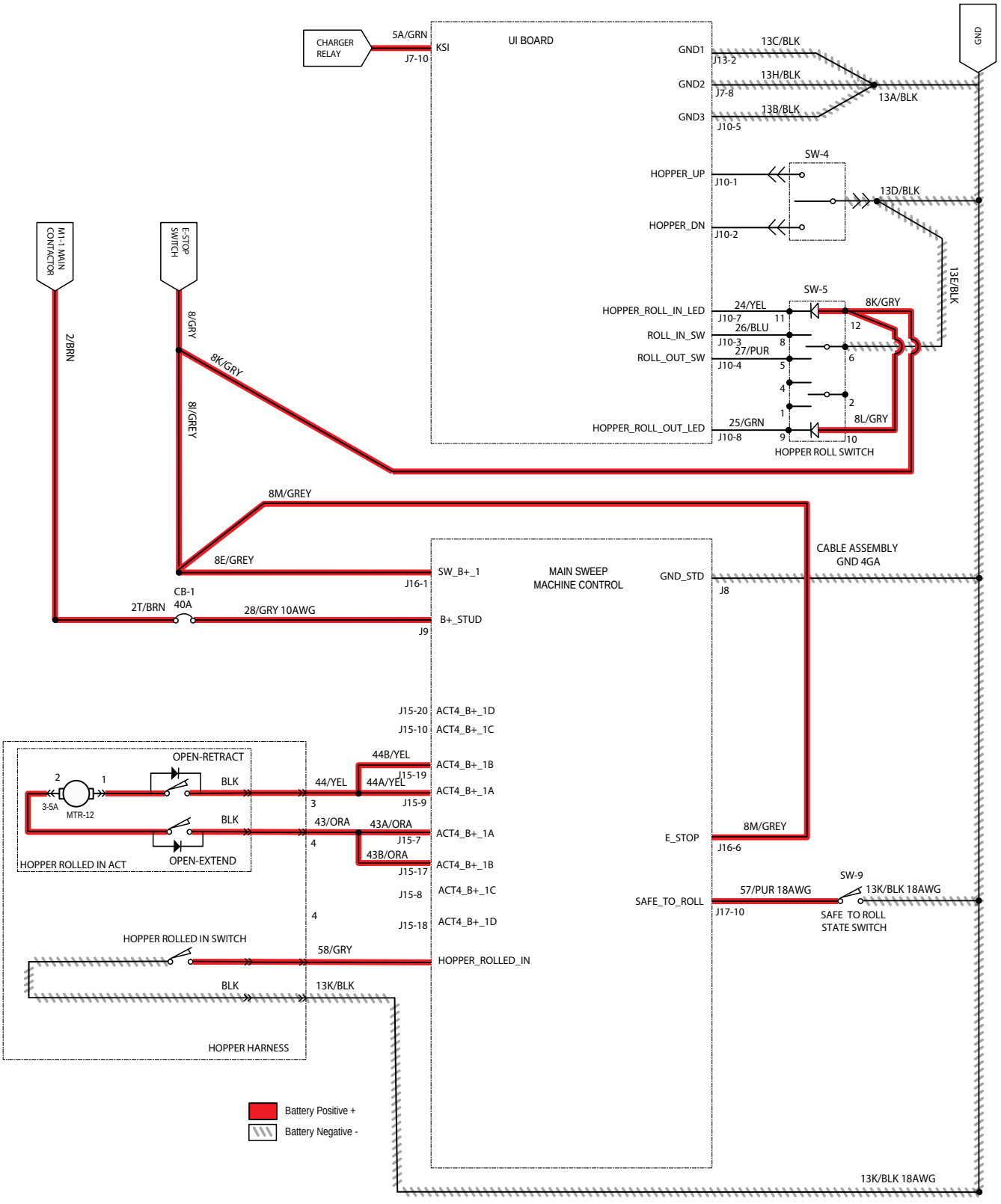


HOPPER FAILS TO LOWER (HIGH DUMP ONLY)

Step	Action	Value(s)	Yes	No
1	• Key ON • Enable hopper lower (hopper raise lower switch and hopper safety button) • Is there a fault code/message displayed?		See *FAULT CODE* section of this manual	Proceed to STEP 2
2	• Key OFF • See *TESTING THE HOPPER LIFT PUMP MOTOR* section of this manual • Does hopper pump pass testing?	See *TESTING THE HOPPER PUMP MOTOR* in this manual	Proceed to STEP 3	Repair or replace hydraulic pump
3	• Key OFF • Reconnect hopper pump to main wire harness • Key ON • Enable hopper subsystem • Test voltage applied to hopper subsystem • Are electrical circuits operating?		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:
P10-2/P10-3 = Main Sweep Board
Connector #10, Pin #2, Pin #3

HOPPER ROLL ACTUATOR, EXTEND/OUT, OFF (HIGH DUMP ONLY)

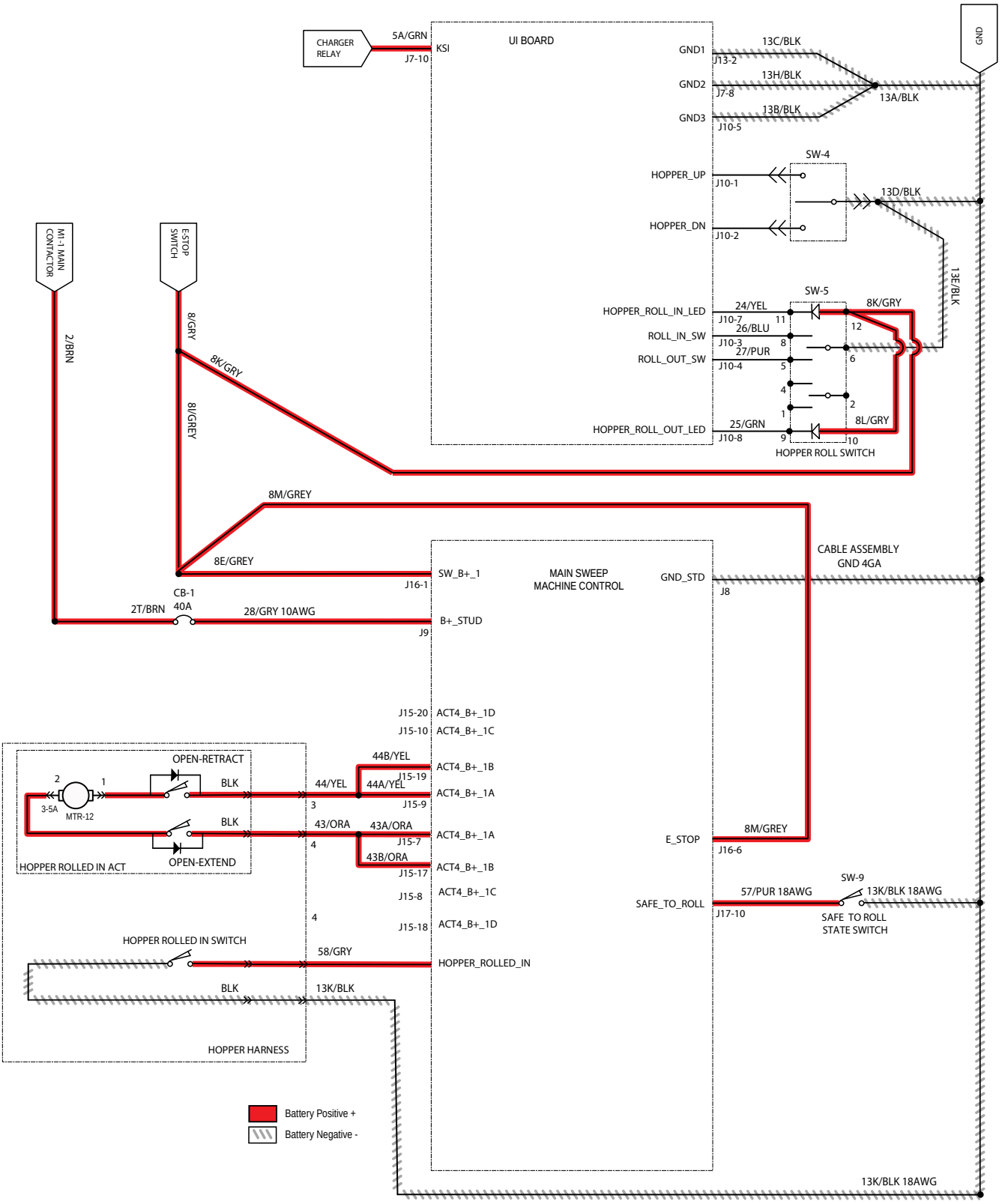


HOPPER FAILS TO EXTEND OUT (HIGH DUMP ONLY)

Step	Action	Value(s)	Yes	No
1	• Key ON • Raise hopper high enough above safe to roll switch to allow hopper to roll out • Enable hopper roll out • Is there a fault code/message displayed?		See *FAULT CODE* section of this manual	Proceed to STEP 2
2	• Key OFF • See *TESTING THE HOPPER ROLL OUT/ ROLL IN ACTUATOR* section of this manual • Does actuator pass testing?	See *TESTING THE HOPPER ROLL OUT/ ROLL IN ACTUATOR* in this manual	Proceed to STEP 3	Repair or replace hopper roll out/roll in actuator
3	• Key OFF • Reconnect hopper roll actuator to main wire harness • Key ON • Enable hopper roll in/out subsystem • Test voltage applied to hopper roll in/out subsystem • Are electrical circuits operating?		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:
J15-7/J15-17 = Main Sweep Board
Connector #15, Pin #7, Pin #17

HOPPER ROLL ACTUATOR, RETRACT/IN, OFF (HIGH DUMP ONLY)

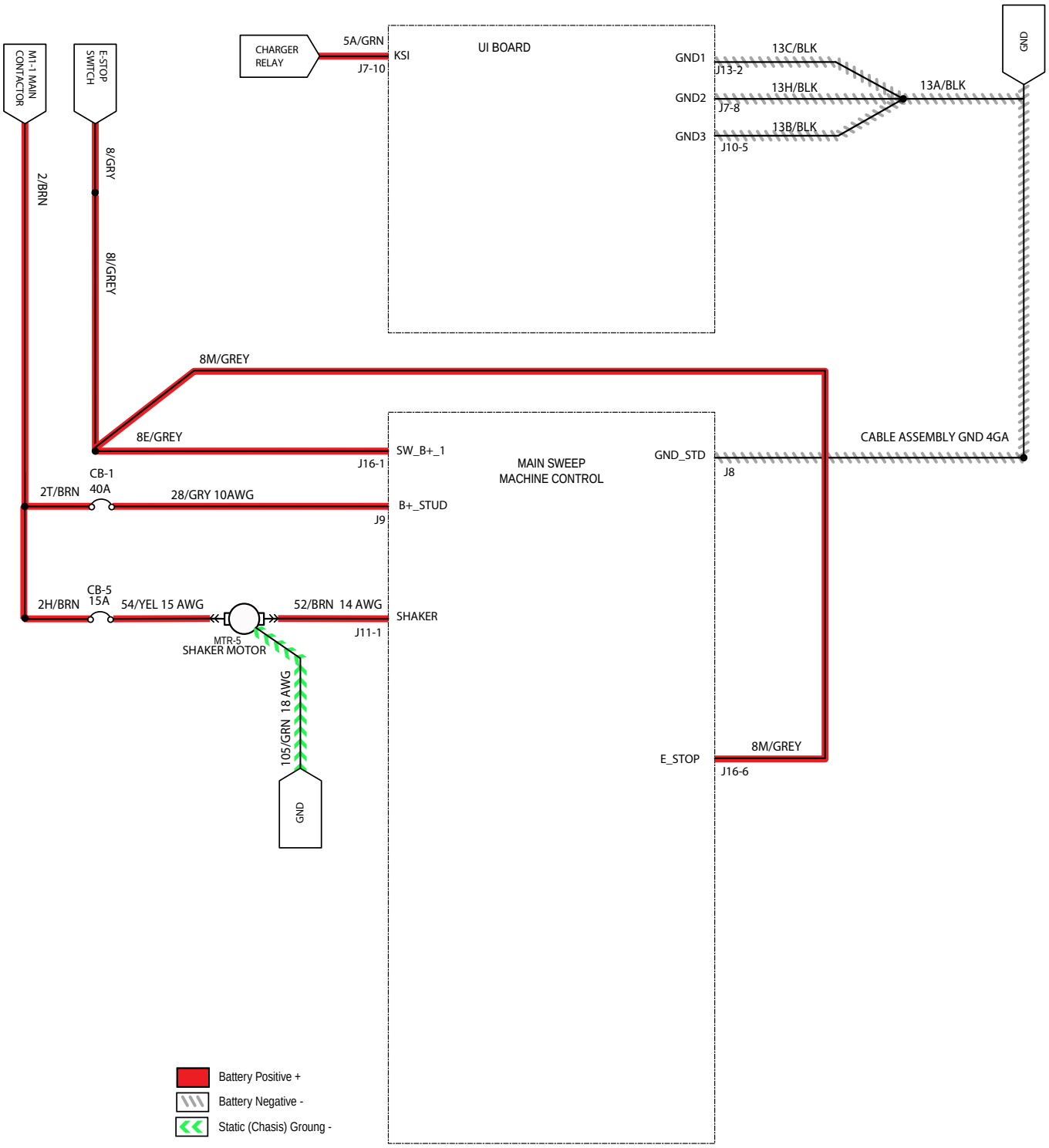


HOPPER FAILS TO RETRACT IN (HIGH DUMP ONLY)

Step	Action	Value(s)	Yes	No
1	• Key ON • Enable hopper roll in • Is there a fault code/message displayed?		See *FAULT CODE* section of this manual	Proceed to STEP 2
2	• Key OFF • See *TESTING THE HOPPER ROLL OUT/ ROLL IN ACTUATOR* section of this manual • Does hopper roll actuator pass testing?	See *TESTING THE HOPPER ROLL OUT/ ROLL IN ACTUATOR* in this manual	Proceed to STEP 3	Repair or replace hopper roll out/roll in actuator
3	• Key OFF • Reconnect hopper roll actuator to main wire harness • Key ON • Enable hopper roll in/out subsystem • Test voltage applied to hopper roll in/out subsystem • Are electrical circuits operating?		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:
J15-19/J15-9 = Main Sweep Board
Connector #15, Pin #19, Pin #9

FILTER SHAKER MOTOR

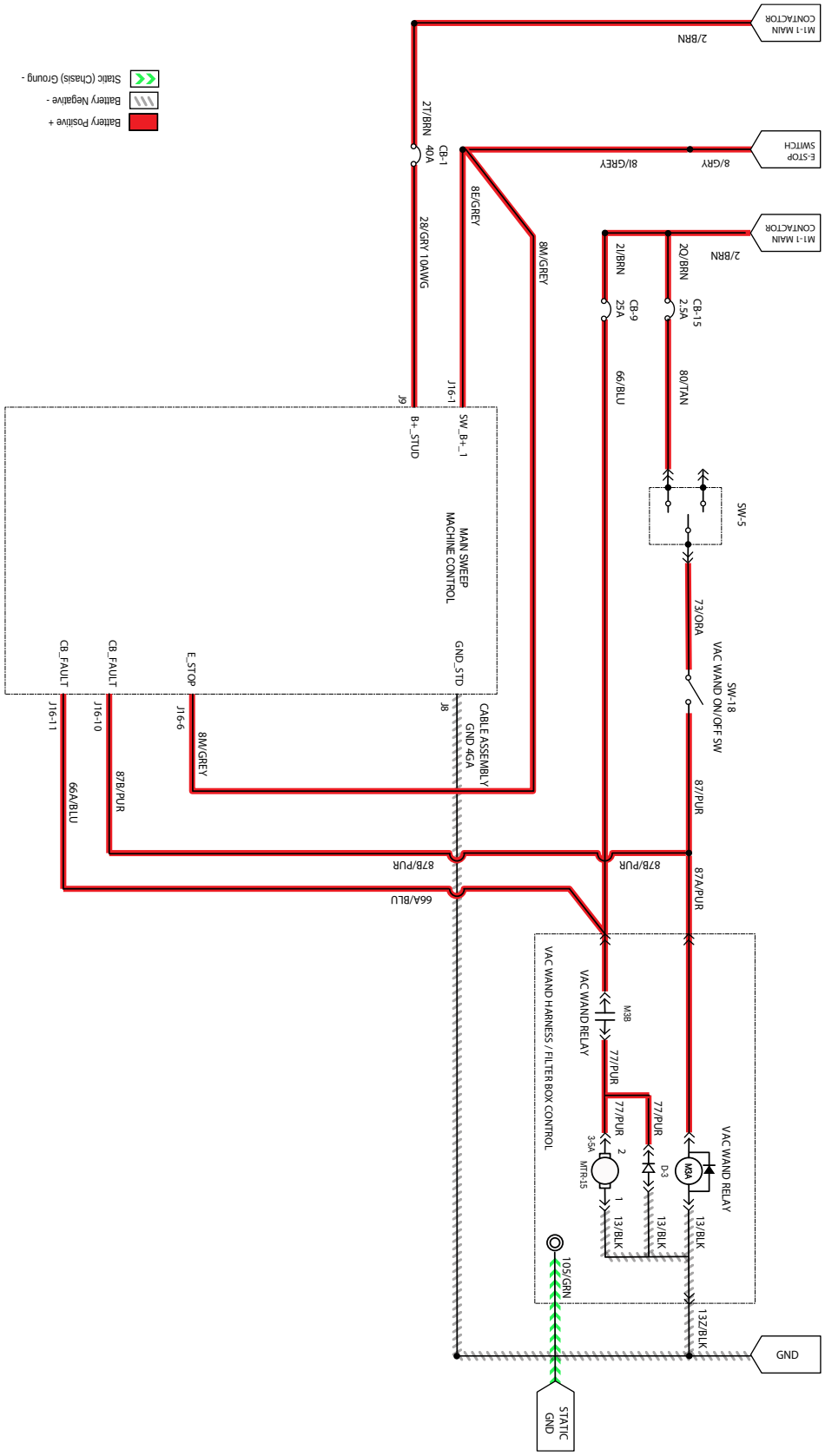


SHAKER MOTOR NOT FUNCTIONING

Step	Action	Value(s)	Yes	No
1	• Key ON • Enable filter shaker • Is there a fault code/message displayed?		See *FAULT CODE* section of this manual	Proceed to STEP 2
2	• Key OFF • Firmly press circuit breaker CB5 and CB1 to reset • Is circuit breaker CB5 and CB1 tripped?		Reset and test filter shaker operation	Proceed to STEP 3
3	• Key OFF • See *MANUAL MODE* section of this manual • Activate filter shaker in Manual Mode • Does filter shaker motor turn ON?		Proceed to STEP 5	Proceed to STEP 4
4	• Key OFF • See *TESTING THE FILTER SHAKER MOTOR* section of this manual • Does filter shaker motor pass testing?	See *TESTING THE FILTER SHAKER MOTOR* in this manual	Proceed to STEP 5	Repair or replace filter shaker motor
5	• Key OFF • Reconnect filter shaker motor to main wire harness • Key ON • Enable filter shaker subsystem • Test voltage applied to filter shaker subsystem • Are electrical circuits operating?		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:
CB5/CB1= High Side
J11-1 = Main Sweep Board
Connector #11, Pin #1

VACUUM WAND (OPTION)

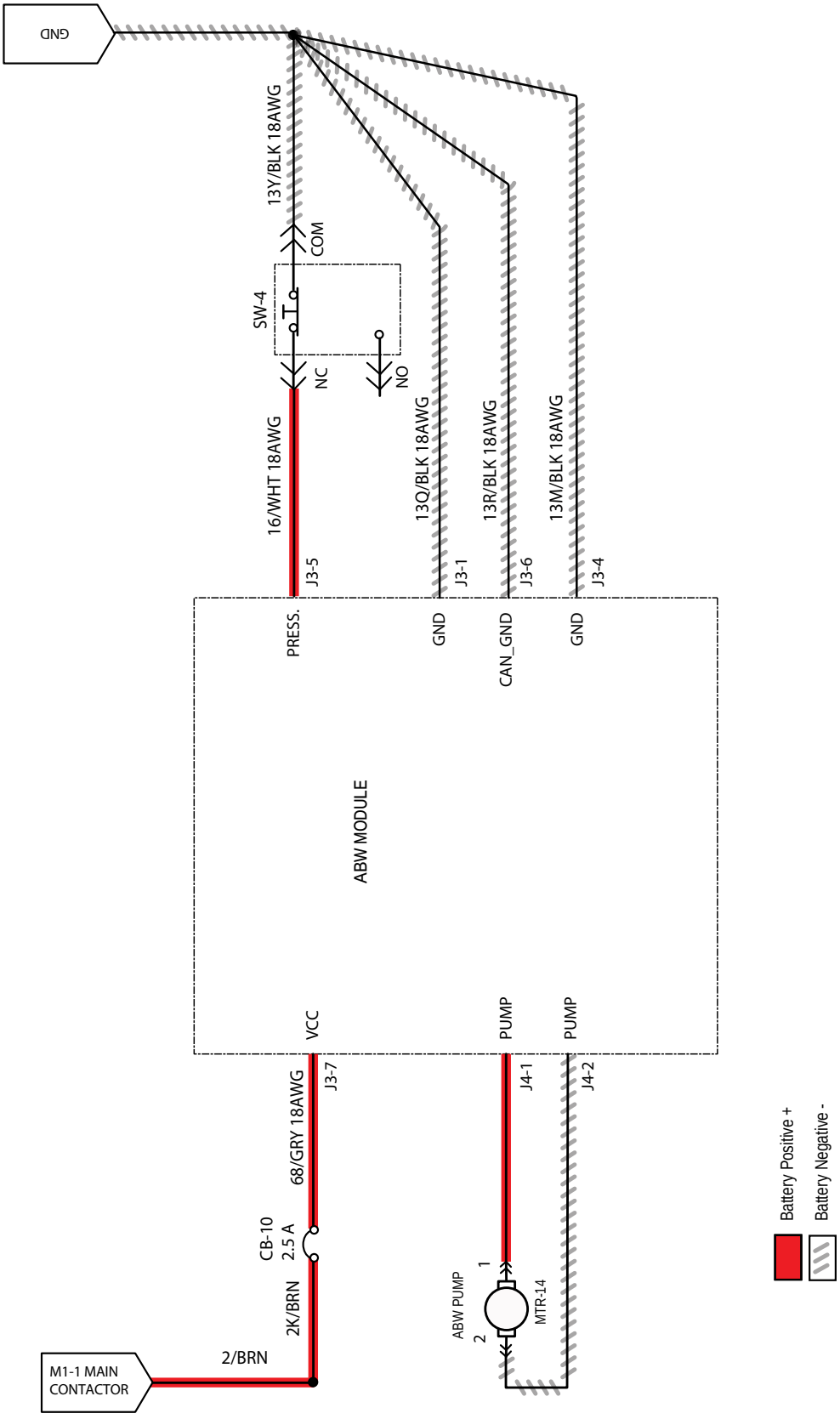


VACUUM WAND FAILS TO TURN ON

Step	Action	Value(s)	Yes	No
1	• Key ON • Enable vacuum wand switch to turn on vacuum wand system • Lift wand from carrier to activate vacuum wand fan motor		See *FAULT CODE* section of this manual	Proceed to STEP 2
2	• Key OFF • Firmly press circuit breaker CB9 and CB15 to reset • Are circuit breaker CB9 and CB15 tripped?		Reset and test vacuum wand fan motor operation	Proceed to STEP 3
3	• Key OFF • See *TESTING THE VACUUM WAND FAN* section of this manual • Does vacuum wand fan motor pass testing?	See *TESTING THE VACUUM FAN* in this manual	Proceed to STEP 4	Repair or replace vacuum wand fan motor
4	• Key OFF • Reconnect vacuum wand fan motor to main wire harness • Key ON • Enable vacuum wand subsystem • Test voltage applied to vacuum wand fan subsystem • Are electrical circuits operating?		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:
CB9 = High Side
CB15 = Switch
J16-10/J16-11 = Main Sweep Board
Connector #16, Pin #10, Pin #11

ABW (AUTOMATIC BATTERY WATERING) (OPTION)



ABW (AUTOMATIC BATTERY WATERING) FAILS TO TURN ON

Step	Action	Value(s)	Yes	No
1	• Key ON (ABW automatically enabled upon key ON) • Is there a fault code/message displayed?		See *FAULT CODE* section of this manual	Proceed to STEP 2
2	• Key OFF • Firmly press circuit breaker CB10 to reset • Is circuit breaker CB10 tripped?		Reset and test ABW operation	Proceed to STEP 3
3	• Key OFF • See *MANUAL MODE* section of this manual • Activate ABW • Does ABW turn ON?		Proceed to STEP 4	Replace ABW module.
4	• Key OFF • Reconnect ABW to main wire harness • Key ON • Enable ABW subsystem • Test voltage applied to ABW subsystem • Are electrical circuits operating?		Repeat STEP 1	Identify voltage drop location and repair or replace necessary components

Terms:
CB10 = High Side
J4-1,2 = ABW Module
Connector #2, Pin #1,2
J3-1,5,6,7 = ABW Module
Connector #3, Pin #1,5,6,7

TROUBLESHOOTING CAN (CONTROLLER AREA NETWORK) ISSUES

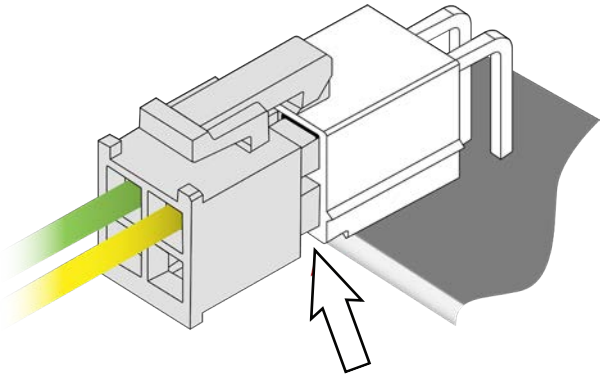
Procedures to investigate a fault related to a CAN open network.

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

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

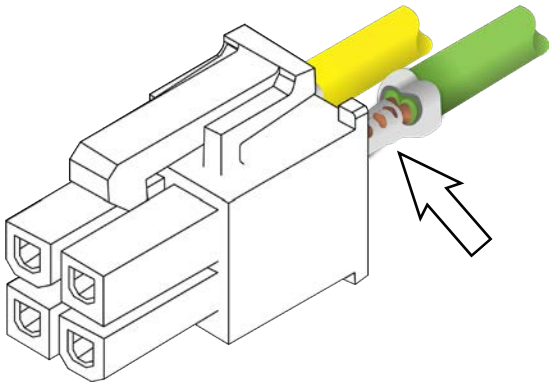
CONNECTOR FULLY SEATED

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



PIN FULLY SEATED

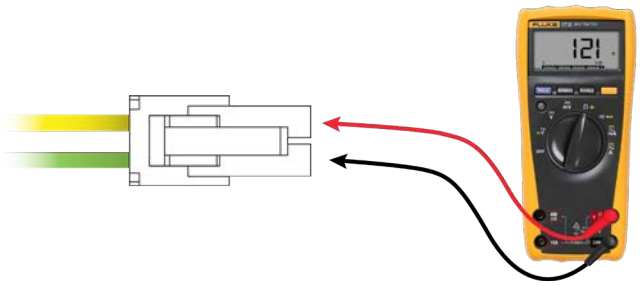
A pin within the harness side of the connector may not be fully seated or may come loose over time causing a fault. If the pin is not fully seated, push it back in and power cycle the machine to see if the fault clears.



NETWORK RESISTANCE

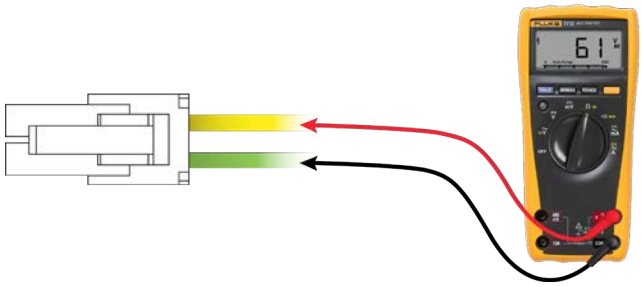
The network resistance must be correct for the network to operate correctly. Depending on which node the measurement is taken at and the method of measurement, the resistance may be one of two approximate values: 121Ω or 61Ω or 40Ω. Any value other than 121Ω or 61Ω or 40Ω means there is a network issue.

Method 1



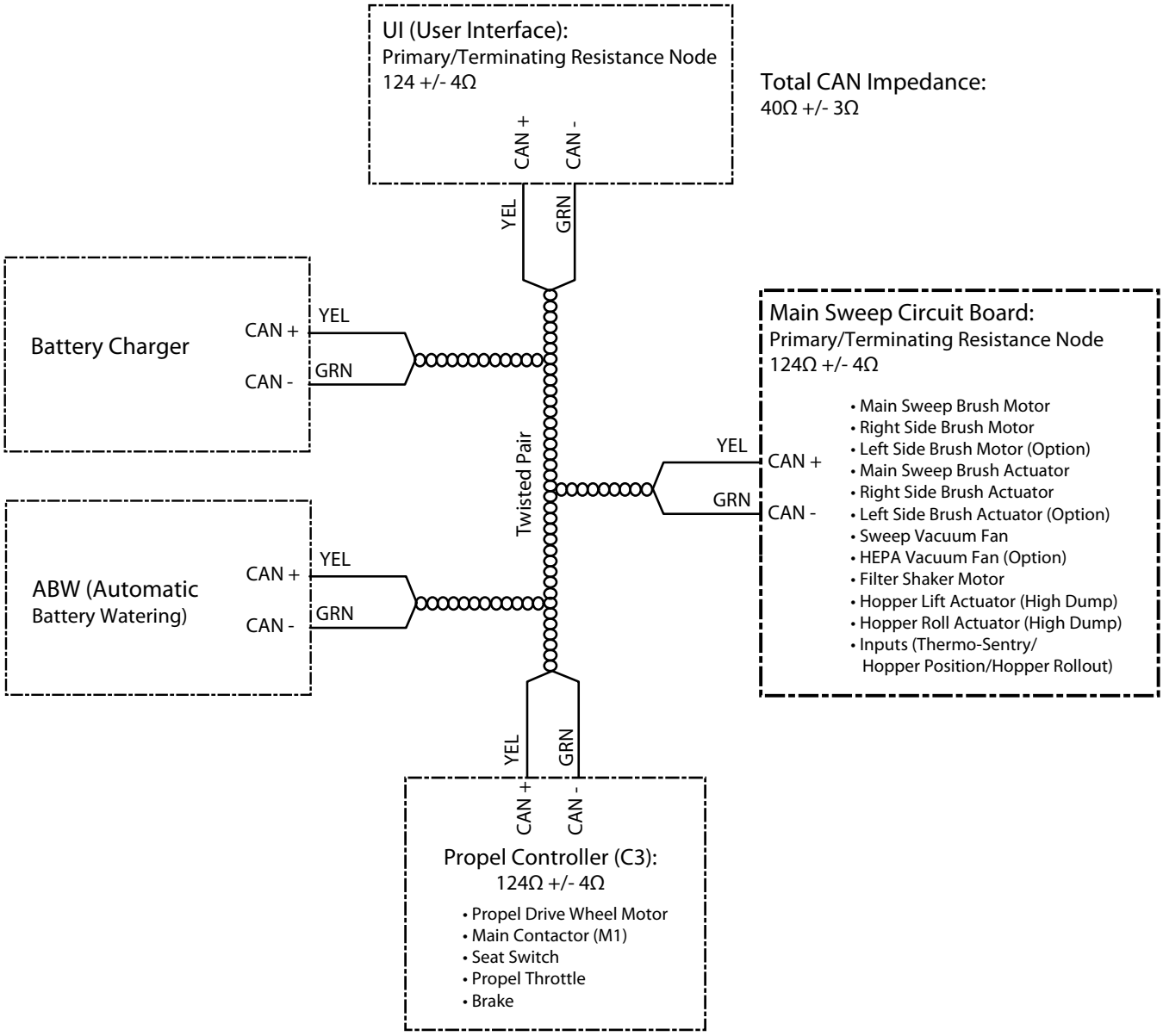
1. Turn key switch OFF.
2. Locate a CAN node location on the machine.
3. Disconnect the connector containing the CAN wires.
4. Measure the resistance between the green and yellow wires. Depending which nodes are still connected, resistance should be either 61Ω or 121Ω.

Method 2



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

CAN (CONTROLLER AREA NETWORK) SYSTEM OVERVIEW



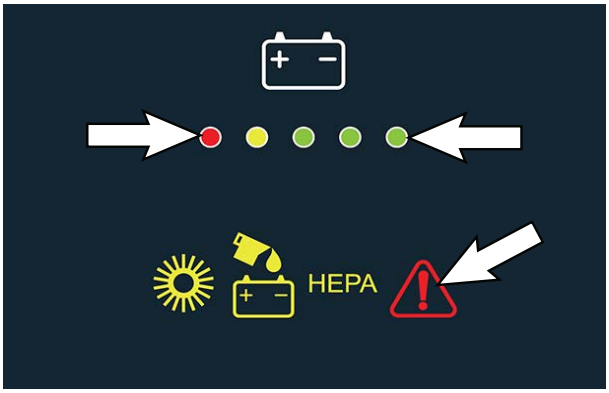
INITIAL CAN (CONTROLLER AREA NETWORK) TROUBLESHOOTING

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

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

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

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

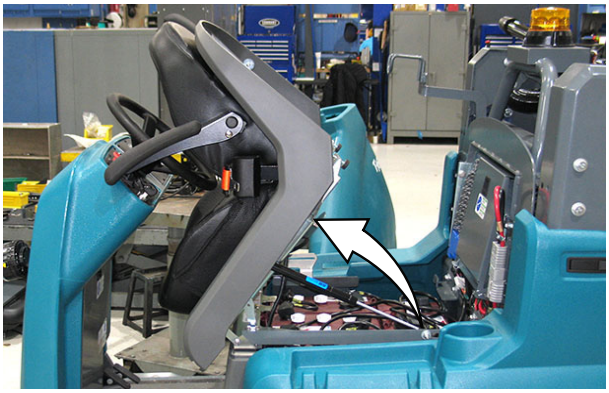


   If membrane panel is inoperable, proceed to *TROUBLE-SHOOTING THE MEMBRANE PANEL*.

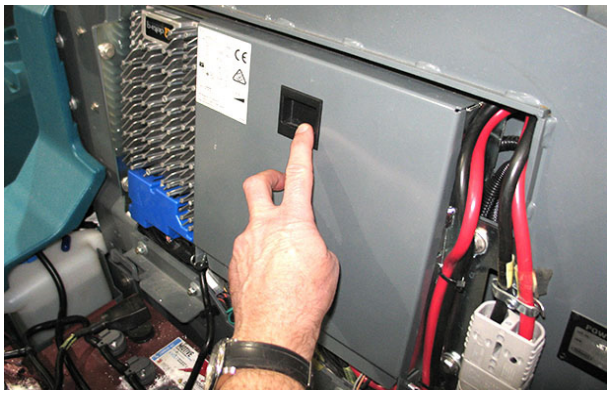
5. Turn key switch OFF.
6. Connect the service device to the machine.

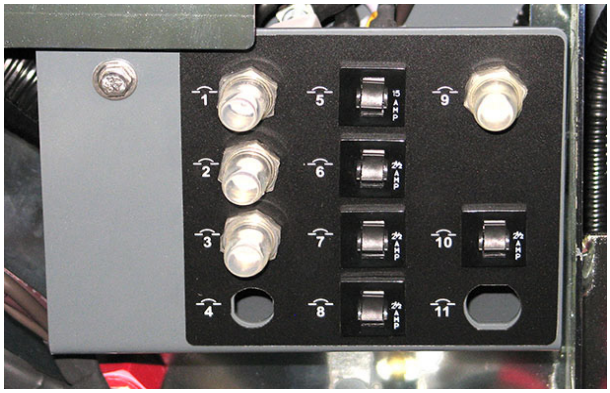
7. Turn key switch ON.
8. Observe the service device for fault codes. Ensure the machine has the latest firmware installed. If necessary, update the machine to the latest firmware revision.
9. If firmware was updated, turn key switch OFF.
10. Wait at least eight seconds for the pre-charge (capacitors) to discharge.
11. After the eight-second wait, turn key switch ON.
12. Observe service device and membrane panel for fault codes. Proceed to the following step to continue troubleshooting procedure if problem persists.
13. Turn key switch OFF.
14. Ensure the circuit breaker(s) to the system(s) in question are not tripped. Reset tripped circuit breaker(s).

    Lift the seat open to access the electrical compartment.



Open the electrical compartment cover to access circuit breakers 1 through 11.





Circuit Breaker	Rating	Circuit Protected
CB1	40A	Main control board
CB2	40A	Main sweep motor
CB3	30A	Vacuum fan motor
CB4	30A	HEPA vacuum fan motor
CB5	15A	Filter shaker
CB6	2.5A	User interface
CB7	2.5A	Key switch
CB8	2.5A	Headlight/taillight/strobe light switch (option)
CB9	25A	Vacuum wand fan motor
CB10	2.5A	Smart-Fill ABW (Automatic Battery Watering) (option)
CB11	-	Not Used

15. Remove the front access panel from the steering channel to access circuit breakers 12 through 19.

Circuit Breaker	Rating	Circuit Protected
CB12	15A	Left side brush motor
CB13	15A	Right side brush motor
CB14	2.5A	Front horn and reverse selected
CB15	2.5A	Vacuum wand switch (option)
CB16	2.5A	Blue lights (option)
CB17	-	Not Used
CB18	-	Not Used
CB19	-	Not Used

16. Turn key switch ON.

17. Observe service device and membrane panel for fault codes. Proceed to the following step to continue troubleshooting procedure if problem persists.

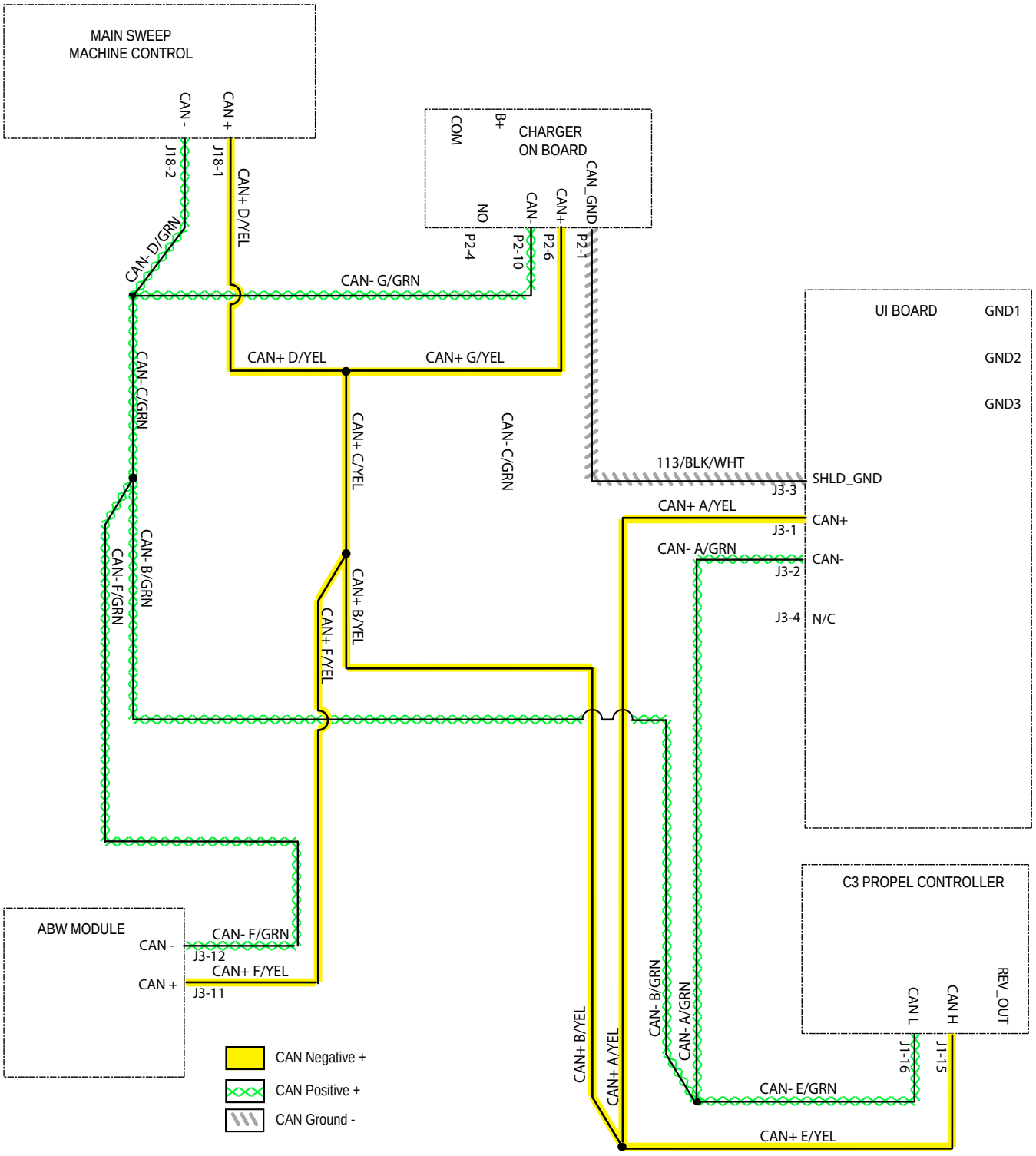
    If no fault codes appear, reinstall items removed to access circuit breakers and prepare machine for sweeping.

18. If fault code(s) still persist, open the area of the machine where the main sweep circuit board/ component is located to access the circuit board/ component and begin troubleshooting procedures.

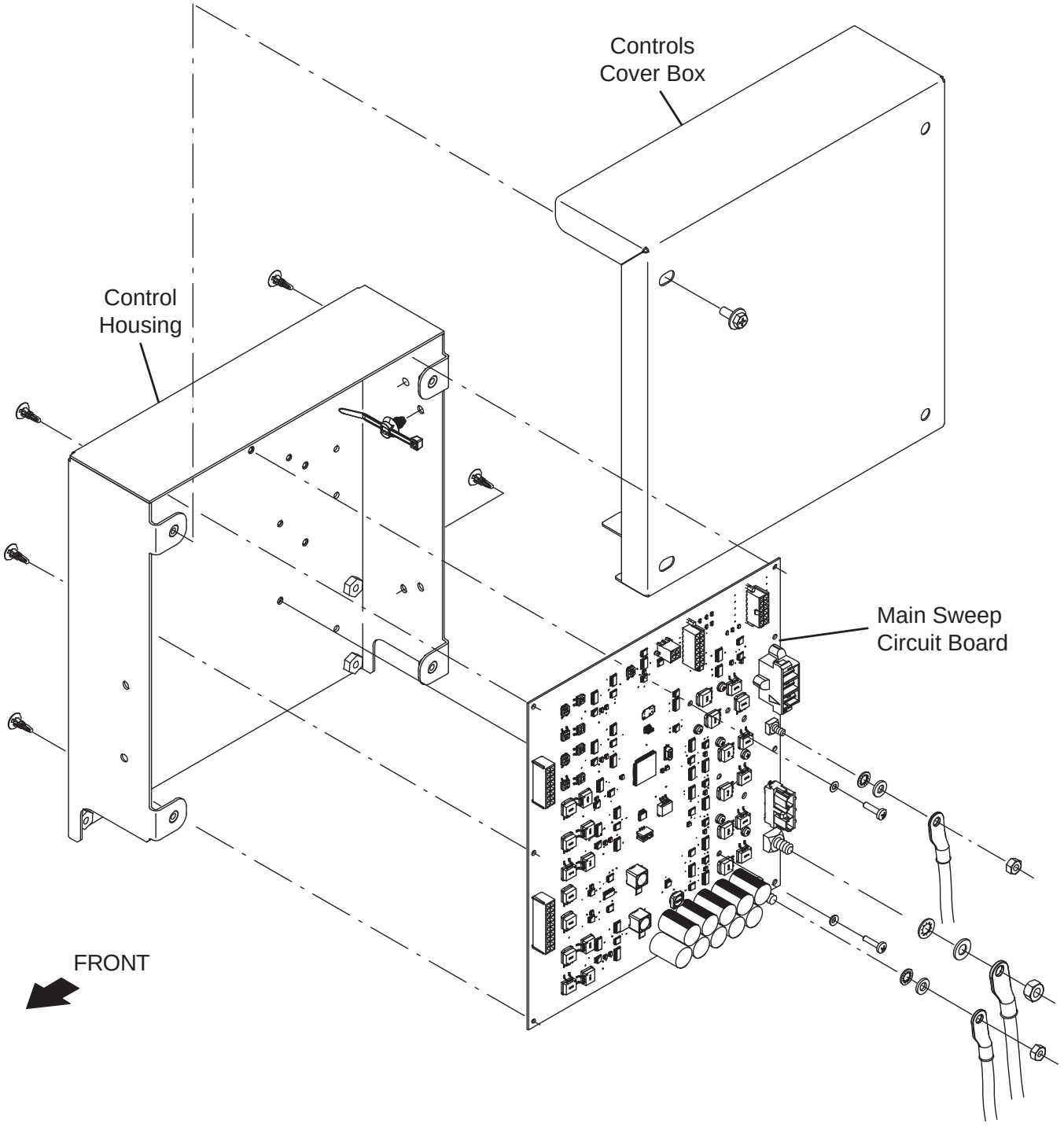
    To troubleshoot the UI (User Interface) membrane panel see *TROUBLESHOOTING THE UI (USER INTERFACE) MEMBRANE PANEL.*

    To troubleshoot the propel functions and power delivery, see *TROUBLESHOOTING THE DRIVE CONTROLLER (C3)* and *TROUBLESHOOTING THE MAIN CONTACTOR (M1)*.

    To troubleshoot the sweep functions see *TROUBLESHOOTING THE MAIN SWEEP CIRCUIT BOARD*.

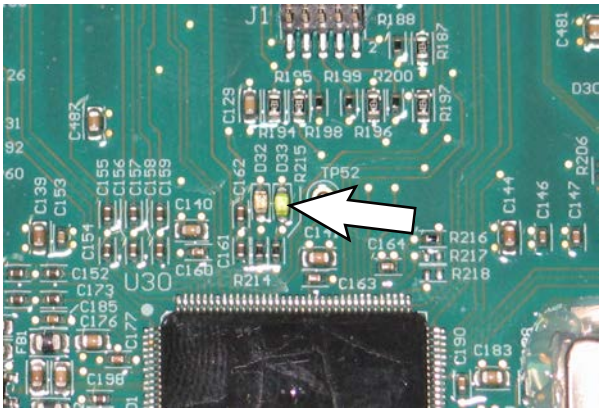

MAIN SWEEP
MACHINE CONTROL
CAN -
CAN +
J18-2
J18-1
CAN+ D/YEL
CAN- D/GRN
CHARGER
ON BOARD
COM
B+
NO
CAN-
CAN+
CAN_GND
P2-4
P2-10
P2-6
P2-1
CAN- G/GRN
UI BOARD
GND1
GND2
GND3
CAN+ D/YEL
CAN+ G/YEL
CAN- C/GRN
CAN+ C/YEL
CAN- C/GRN
113/BLK/WHT
SHLD_GND
J3-3
CAN+ A/YEL
CAN+
J3-1
CAN- A/GRN
CAN-
J3-2
J3-4
N/C
CAN- B/GRN
CAN- F/GRN
CAN+ B/YEL
CAN+ F/YEL
C3 PROPEL CONTROLLER
REV_OUT
CAN L
CAN H
J1-16
J1-15
ABW MODULE
CAN -
CAN +
CAN- F/GRN
J3-12
CAN+ F/YEL
J3-11
CAN+ B/YEL
CAN+ A/YEL
CAN- B/GRN
CAN- A/GRN
CAN- E/GRN
CAN+ E/YEL
CAN Negative +
CAN Positive +
CAN Ground -

TROUBLESHOOTING THE MAIN SWEEP CIRCUIT BOARD



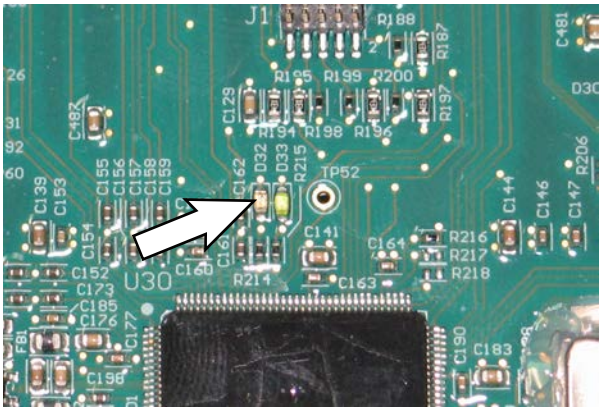
FOR SAFETY: Before leaving or servicing machine, stop on level surface and turn off machine.

1. Turn key switch OFF.
2. Remove the controls cover box from the control housing.
3. Turn key switch ON.
4. Confirm there is power to the main sweep circuit board. (Green LED (D33) illuminates and control panels are powered ON)



If the green LED (D33) is not illuminated there is no power to the circuit board. Proceed to Step 6.

5. Confirm there is CAN communication to the main sweep circuit board (Yellow LED (D32) on module illuminates).



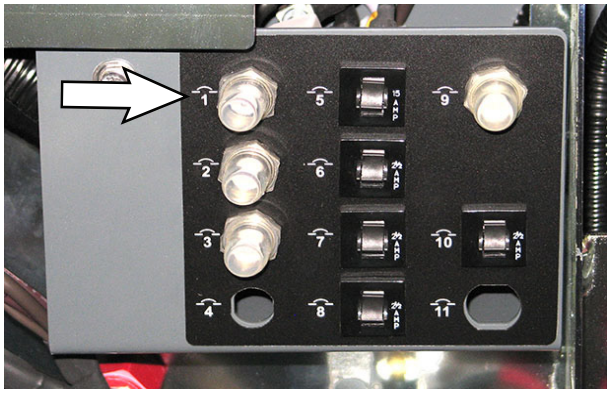
If the yellow LED (D32) is not illuminated there is no CAN communication to the circuit board. Proceed to Step 10.

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

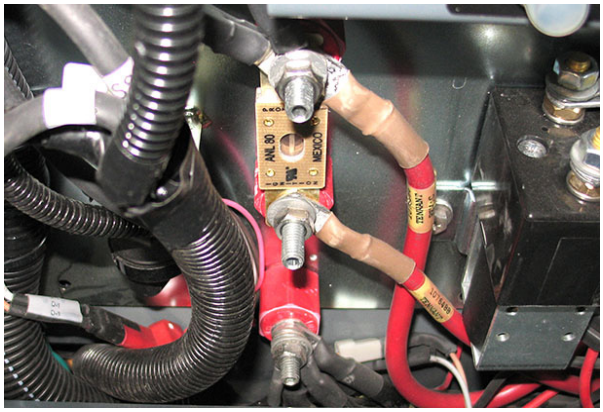
NOTE: Always disconnect the battery cable from the machine before disconnecting/repairing electrical connections

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

8. Ensure wire connections at the 40-Amp circuit breaker (CB1) are secure and undamaged. Secure/repair connections as necessary. Continue testing/troubleshooting procedure if problem persists.

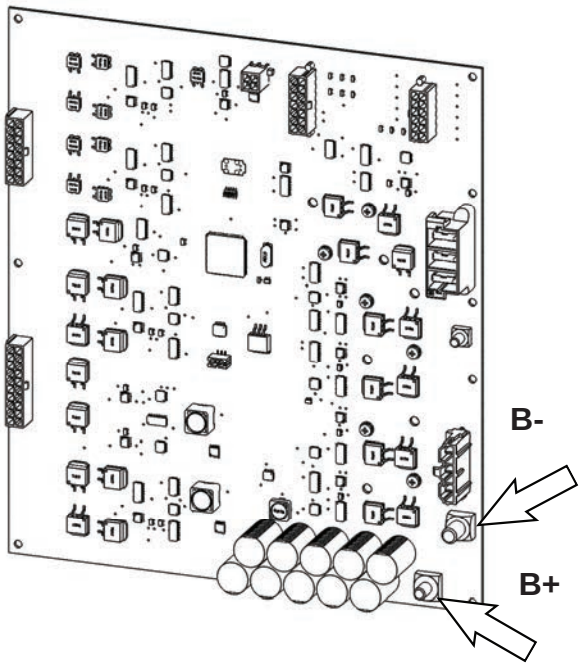


9. Check in-line 100-Amp fuse. Secure/repair connections to in-line 100-Amp fuse as necessary.



10. Inspect connections at Main Contactor (M1). Secure/repair connections to Main Contactor (M1) as necessary.

11. Confirm connections at B- and B+ main sweep circuit board. Secure/repair connections to main sweep circuit board as necessary.



12. Reconnect the battery cable to the machine.

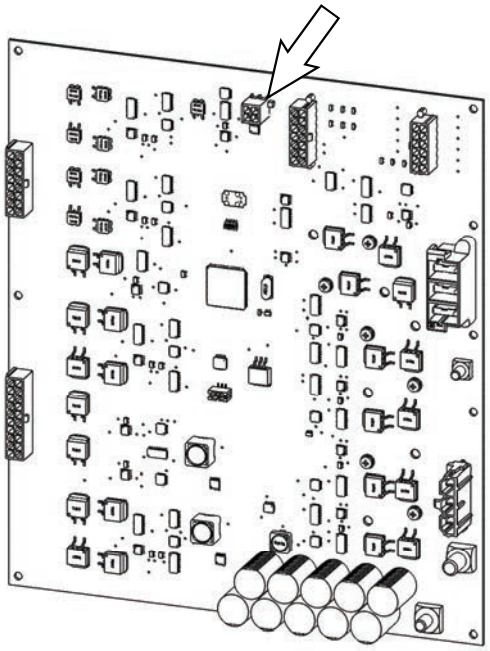
13. Continue testing/troubleshooting if still no power at the module.

14. If the Main Contactor (M1) is not closing, see *TESTING THE MAIN CONTACTOR* for further troubleshooting procedures.

15. Turn key switch OFF.

16. Disconnect the battery cable from the machine.

17. Disconnect the main wire harness CAN connector from J18 on the main sweep circuit board and verify connectors and connector pins are fully seated and connector pins are not damaged.



Measure between yellow and green on harness and should be 61Ω +/- 2Ω.

Measure pins on board and should be 124Ω +/- 5Ω.

Check harness CAN + (yellow) against B-, B+, and chassis. Resistance must be 5KΩ or greater.

Check harness CAN - (green) against B-, B+, and chassis. Resistance must be 5KΩ or greater.

Check board pin CAN + against B-, B+, and chassis. Resistance must be 5KΩ or greater.

Check board pin CAN - against B- B+ and chassis. Resistance must be 5KΩ or greater.

18. Reconnect the main wire harness CAN connector to J18 on the main sweep circuit board.

19. If CAN has further issues continue troubleshooting CAN at user interface section.

20. Reconnect the battery cable to the machine.

21. Turn key switch ON.

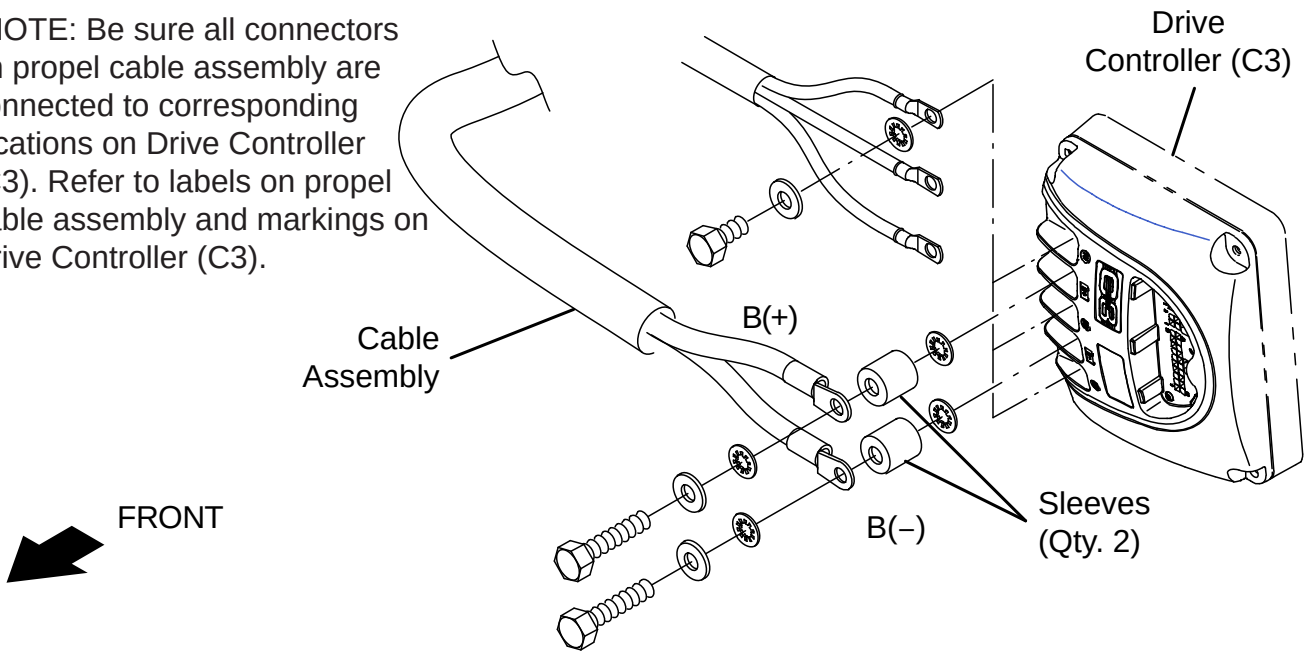
22. Observe for heartbeat at user interface (green and yellow). See *TROUBLESHOOTING THE UI (USER INTERFACE) PANEL*. If no green (and/or yellow), proceed with *TROUBLESHOOTING THE UI (USER INTERFACE) PANEL*. Continue to next step if no yellow heartbeat.

23. Press the horn button. If the horn functions, the CAN is good. If horn does not function either the horn is inoperable or there are CAN issues. See *TROUBLESHOOTING THE HORN* to determine if there is an issue with the horn. If there are no issues with the horn, there are likely CAN issues.

24. If no CAN or power related issues are found on the main sweep circuit board and the interface board, turn key switch OFF and proceed to *TROUBLESHOOTING THE PROPEL CONTROLLER (C3)*.

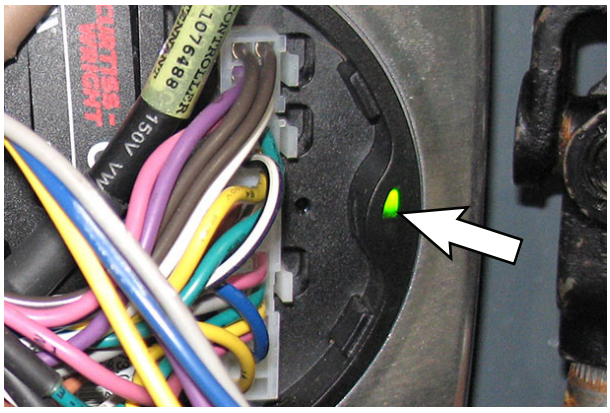
TROUBLESHOOTING THE DRIVE CONTROLLER (C3) ASSEMBLY

*NOTE: Be sure all connectors on propel cable assembly are connected to corresponding locations on Drive Controller (C3). Refer to labels on propel cable assembly and markings on Drive Controller (C3).



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

1. Turn key switch ON.
2. Observe the lights on the drive controller. If light is not illuminated proceed to TROUBLESHOOTING THE DRIVE CONTROLLER (C3) CAN.



TROUBLESHOOTING THE DRIVE CONTROLLER (C3) CAN

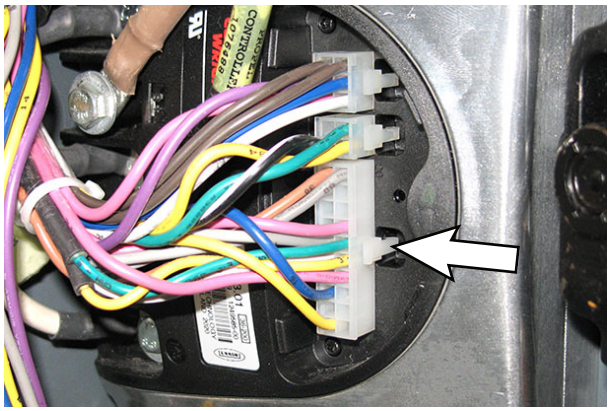
FOR SAFETY: Before leaving or servicing machine, stop on level surface, and turn off machine.

1. Turn key switch OFF.
2. Disconnect the battery cable from the machine.

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

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

3. Remove the J1 20-pin connector from the Drive Controller (C3).



4. Check J1-15 and J1-16. 62Ω +/-3Ω at harness and 120 ohm +/-5 on the pins on Drive Controller (C3).

   Check harness CAN+ yellow against B-, B+, and chassis. Resistance must be 5KΩ or greater.

   Check harness CAN- green against B-, B+, and chassis. Resistance must be 5KΩ or greater.

   Check Drive Controller (C3) CAN+ pin against B-, B+, and chassis. Resistance must be 5KΩ or greater.

   Check Drive Controller (C3) CAN- pin against B-, B+, and chassis. Resistance must be 5KΩ or greater.

5. If values at the Drive Controller (C3) are wrong, it is likely damaged. Replace the Drive Controller (C3). See *REPLACE THE DRIVE CONTROLLER (C3)* in *SERVICE.*

TROUBLESHOOTING THE MAIN CONTACTOR (M1)

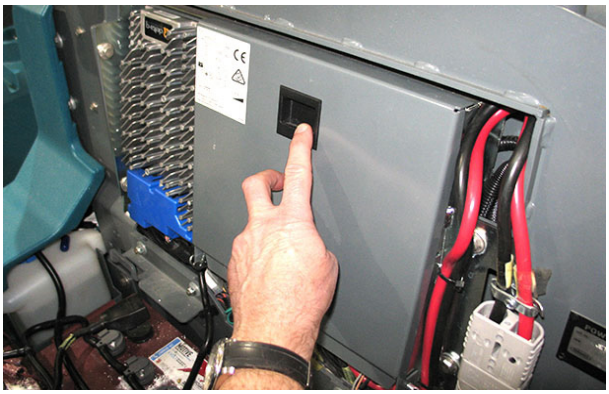
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and remove key.

1. Turn key switch OFF.
2. Lift the seat open to access the electrical compartment.
3. Disconnect the battery cable from the machine

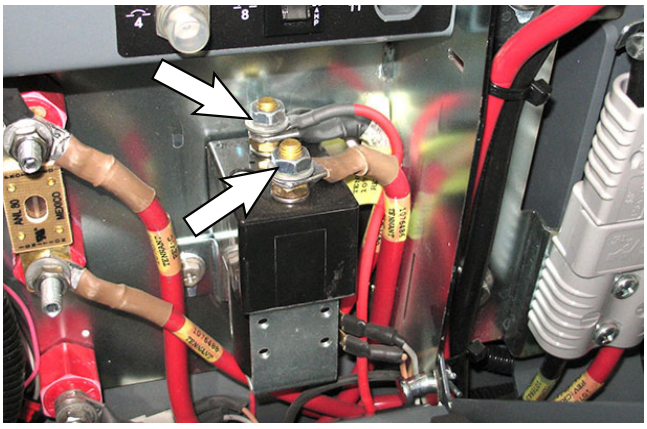
NOTE: Always disconnect the battery cable from the machine before disconnecting/repairing electrical connections

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

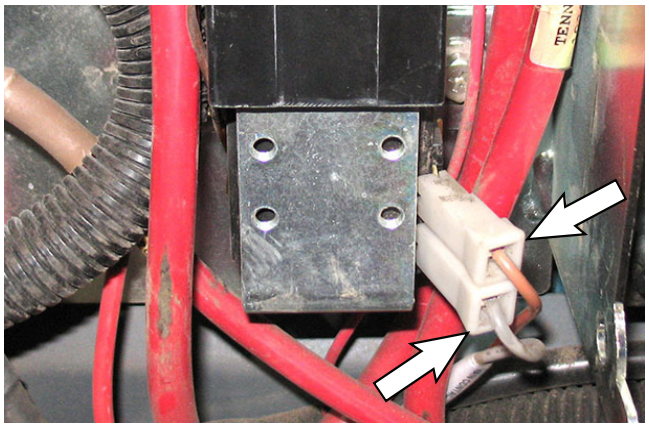
4. Open and/or remove the electrical compartment cover to access components inside the electrical compartment.

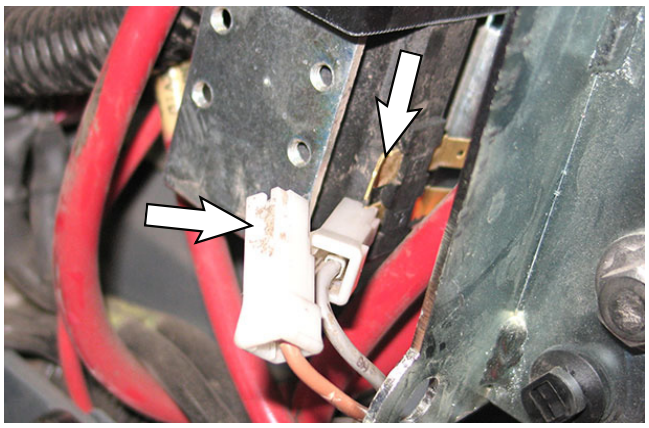


5. Ensure hardware securing connections to the terminals on top the main contactor (M1) are tight.



6. Disconnect the connector from one of the coil terminals located on the lower side of the main contactor (M1).





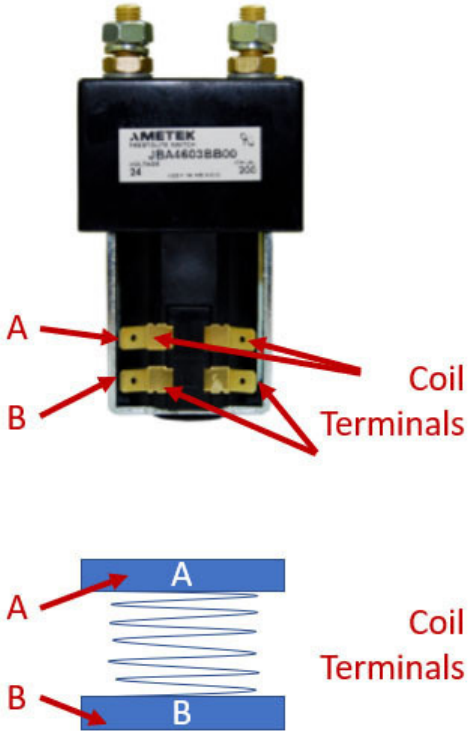
7. Test/confirm resistance across main contactor coil terminals (approximately 92-112Ω).

   If main contactor (M1) reads more than 5Ω above or below 92-112Ω, discontinue testing and replace the main contactor. See *REMOVE/REPLACE THE CONTACTOR* in the *SERVICE* section.

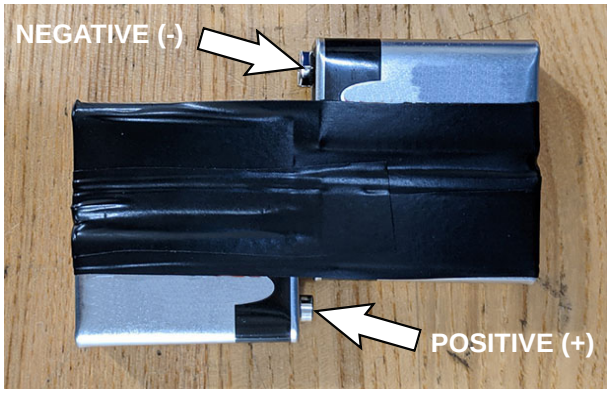
   If main contactor closes, proceed to the following steps to continue troubleshooting.

8. Assemble the 36V battery pack needed to move the actuator from the limit switch location. See *ASSEMBLE A 4X9V OR 36V BATTERY PACK* to assemble the battery pack needed to move actuator from limit switch.

9. Connect one side of each set of alligator clips to an upper and lower coil terminal. Polarity does not matter for this connection.



10. Connect one set of alligator clips to the POSITIVE (+) battery pack terminal.



NOTE: This battery pack is only meant for brief 1-2 second testing. The battery pack cannot sustain large currents.

11. Touch (do not connect) the second alligator clip to the NEGATIVE (-) battery pack terminal and listen for the contactor to close (wait at least two seconds).

    If contactor closed, the contactor is operating as expected.

12. Remove the alligator clip touching the NEGATIVE (-) battery pack terminal and listen for the contactor to instantly open.

13. Disconnect the alligator clip from the POSITIVE (+) battery pack terminal.

14. If main contactor closed and opened as expected, cover open terminal ends with electrical tape to prevent accidental shorts and remove the alligator clips from the cell terminals.

15. Reinstall the spade connector previously disconnected from the main contactor.

16. Continue troubleshooting the main contactor electrical connections.

17. If the main contactor did not close confirm voltage on battery pack 34-36V.

18. Retest/confirm resistance across coil terminals (approximately 92-112Ω).

19. Inspect main contactor for debris that may be preventing it from operating correctly.

20. Remove the main contactor from the inside the electrical compartment. See *REMOVE/REPLACE THE MAIN CONTACTOR* in *SERVICE.*

21. Inspect the main contactor internal contacts for damage.

22. If battery is confirmed to be good and no there appears to be no obvious damage to the contactor, call T.A.C. for further assistance.

OTHER MAIN CONTACTOR ISSUES

1. If the main contactor (M1) latches then disconnects (at start up) check all signals and connections to the contactor.

   Inspect applicable circuit breaker and fuses for damage. A damaged, but not blown, circuit breaker and/or fuse could cause main contactor issues.

   If problem persists, call T.A.C. for further assistance.

2. If main contactor (M1) latches then disconnects randomly under load check for voltage drop across contactor at key switch ON. Contactor terminals should read B+.

   Check for voltage drift across contactor at full load, if drift from B+ is more than 2 volts contact T.A.C.

   If problem persists, call T.A.C. for further assistance.

TROUBLESHOOTING THE MAIN SWEEP BRUSH MOTOR

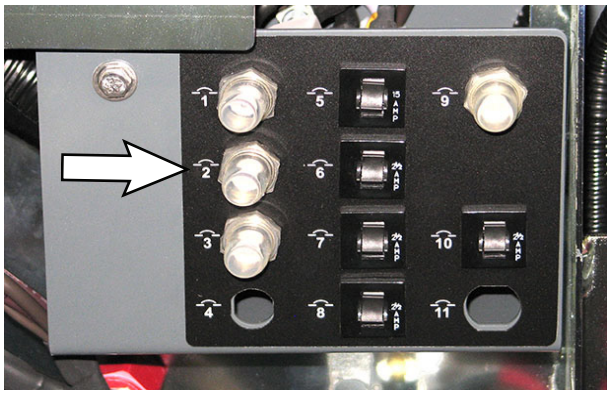
FOR SAFETY: Before leaving or servicing machine, stop on level surface, and turn off machine.

1. Turn the key switch ON and press the horn button. If the horn sounds proceed to the following step to begin troubleshooting the main sweep system. If the horn does not sound, the CAN system must be tested first. See TROUBLESHOOTING THE MAIN SWEEP CIRCUIT BOARD (CAN).
2. Turn key switch OFF.
3. Disconnect the battery cable from the machine

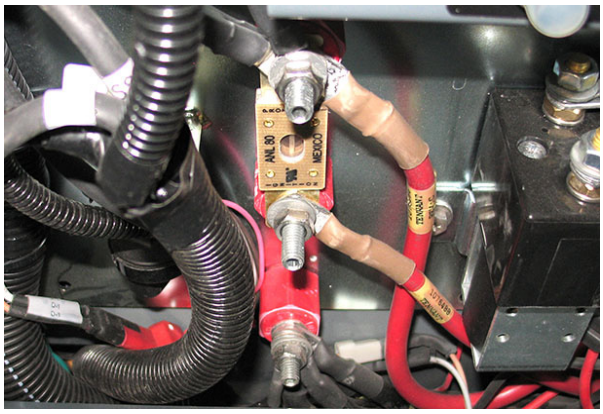
NOTE: Always disconnect the battery cable from the machine before disconnecting/repairing electrical connections.

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

4. Ensure wire connections at the 40-Amp circuit breaker (CB2) are secure and undamaged. Secure/repair connections as necessary. Continue testing/troubleshooting procedure if problem persists.

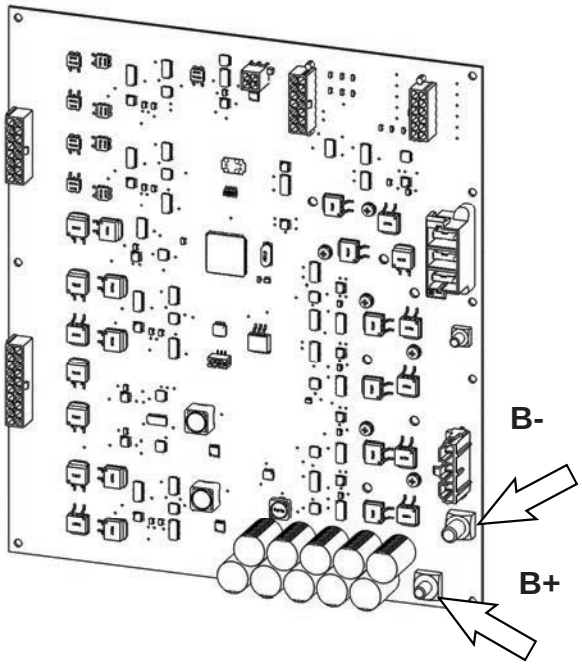


5. Check in-line 100-Amp fuse. Secure/repair connections. Continue testing/troubleshooting procedure if problem persists.

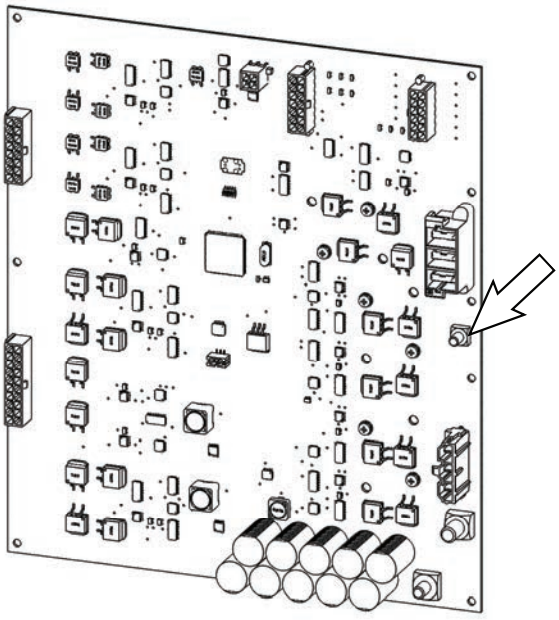


6. Inspect connections at Main Contactor (M1). Secure/repair connections. Continue testing/troubleshooting procedure if problem persists.

7. Confirm connections at B- and B+ main sweep circuit board. Secure/repair connections.



8. Disconnect the main wire harness connector from J12 on the main sweep circuit board and verify connector is not damaged. Secure/repair connection.



9. Troubleshoot harness connections to motor.

   Check J12 against B- and chassis. Resistance must be 5KΩ or greater.

   Check J12 against B+. Resistance must less than 1Ω.

10. If resistance is greater than 1Ω, check resistance at motor. If problem persists, replace the motor. See *REMOVE/REINSTALL/REPLACE THE MAIN SWEEP MOTOR* in *SERVICE.*

TROUBLESHOOTING THE MAIN SWEEP ACTUATOR

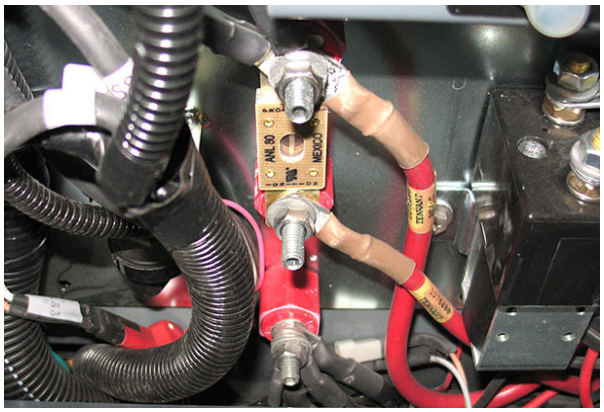
FOR SAFETY: Before leaving or servicing machine, stop on level surface, and turn off machine.

1. Turn the key switch ON and press the horn button. If the horn sounds proceed to the following step to begin troubleshooting the main sweep system. If the horn does not sound, the CAN system must be tested first. See TROUBLESHOOTING THE MAIN SWEEP CIRCUIT BOARD (CAN).
2. Turn key switch OFF.
3. Disconnect the battery cable from the machine

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

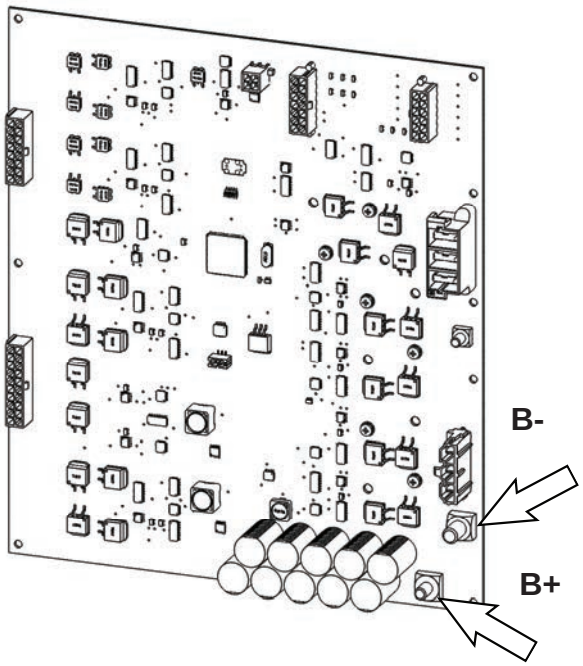
NOTE: To avoid damaging electronic components, a static ground strap must be worn at all times while handling/testing electrical components. Attach the other end of the static ground strap to the machine chassis.

4. Check in-line 100-Amp fuse. Secure/repair connections. Continue testing/troubleshooting procedure if problem persists.

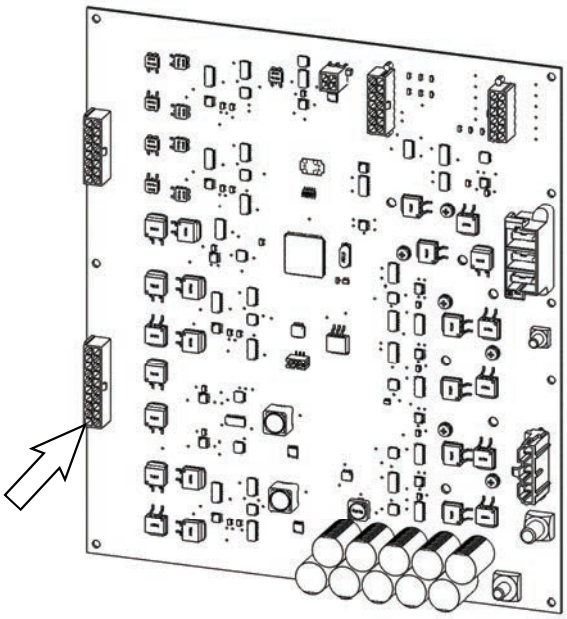


5. Inspect connections at Main Contactor (M1). Secure/repair connections. Continue testing/troubleshooting procedure if problem persists.

6. Confirm connections at B- and B+ main sweep circuit board. Secure/repair connections.



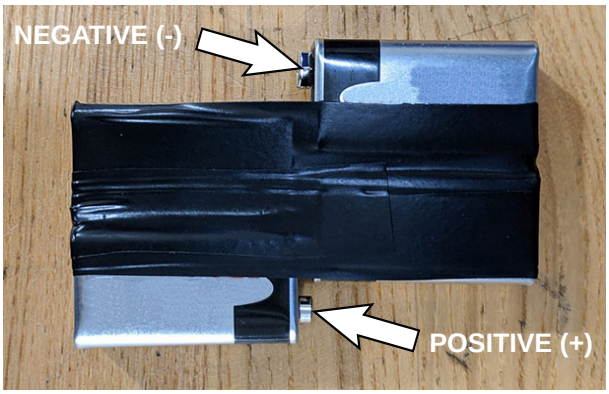
7. Disconnect the main wire harness connector from J15 on the main sweep circuit board and verify connectors and connector pins are fully seated and connector pins are not damaged. Secure/repair connections.



8. Remove parts/components necessary to access the actuator.
9. Check harness connections at the actuator.
10. Disconnect the main wire harness from the actuator.
11. Confirm there is no short on the harness end of the actuator cable.
12. Inspect the harness cable connector and connector terminals for damage.
13. Confirm resistance across the actuator connector terminals. The resistance should be 6Ω +/- 2Ω.

NOTE: The actuator may be at the limit switch location making resistance measurement impossible. If actuator is at limit switch location proceed to following steps to move actuator from limit switch location. Repeat previous step to confirm resistance after actuator is moved from limit switch location.

14. Assemble the 36V battery pack needed to move the actuator from the limit switch location. See *ASSEMBLE A 4X9V OR 36V BATTERY PACK* to assemble the battery pack needed to move actuator from limit switch.
15. Connect one side of each set of alligator clips to each connector terminal. Polarity does not matter for this connection. Take care to prevent the terminals from shorting.
16. Connect one set of alligator clips to the POSITIVE (+) battery pack terminal.



17. Touch (do not connect) the second alligator clip to the NEGATIVE (-) battery pack terminal and watch for the actuator to move.

NOTE: Actuator may be at an end stop if there is no movement.

NOTE: This battery pack is only meant for brief 1-2 second testing. The battery pack cannot sustain large currents.

18. Remove the alligator clip touching the NEGATIVE (-) battery pack terminal.
19. Disconnect the alligator clip from the POSITIVE (+) battery pack terminal.
20. Connect the alligator clip previously used to touch the NEGATIVE (-) battery pack terminal to the POSITIVE (+) battery pack terminal.

NOTE: This battery pack is only meant for brief 1-2 second testing. It cannot sustain large currents.

21. Touch (do not connect) the second alligator clip previously connected the POSITIVE (+) battery pack terminal to the NEGATIVE (-) battery pack terminal and watch for the actuator to move in the opposite direction.

22. If the actuator moved it is responding to the voltage that was briefly applied in the previous steps. The actuator could still have operational problems, but if the actuator moved when voltage was applied, it is likely there is an issue elsewhere in the system.

23. Continue troubleshooting the electrical connections and signals to the actuator.

24. If the actuator did not move when the voltage was briefly applied confirm the battery pack voltage (~34-36V).

    Confirm leads were reversed to check operation in both directions.

    Repeat the test.

    Confirm test validity by repeating test on another actuator on the machine.

    If no movement, replace the actuator.

TROUBLESHOOTING THE RIGHT SWEEP BRUSH MOTOR

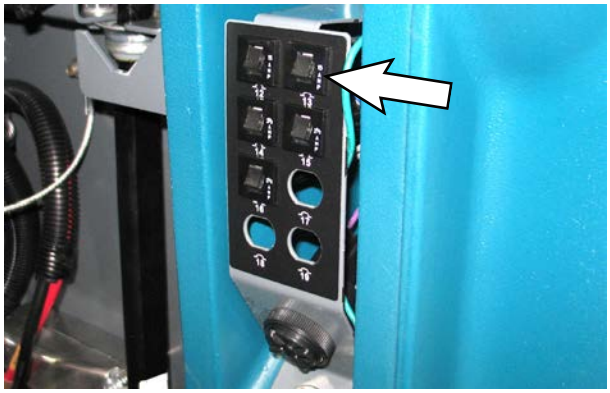
FOR SAFETY: Before leaving or servicing machine, stop on level surface, and turn off machine.

1. Turn the key switch ON and press the horn button. If the horn sounds proceed to the following step to begin troubleshooting the main sweep system. If the horn does not sound, the CAN system must be tested first. See TROUBLESHOOTING THE MAIN SWEEP CIRCUIT BOARD (CAN).
2. Turn key switch OFF.
3. Disconnect the battery cable from the machine

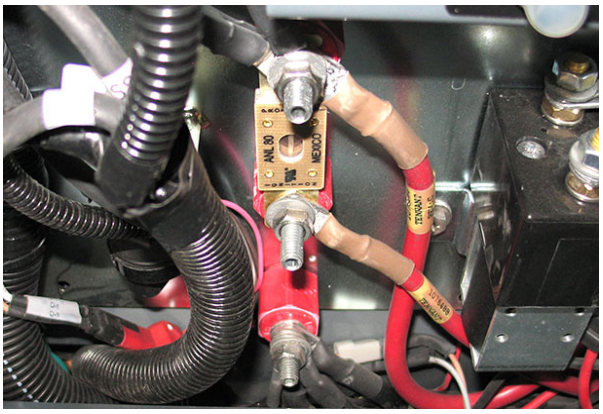
NOTE: Always disconnect the battery cable from the machine before disconnecting/repairing electrical connections

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

4. Ensure wire connections at the 15-Amp circuit breaker (CB13) are secure and undamaged. Secure/ repair connections as necessary. Continue testing/troubleshooting procedure if problem persists.

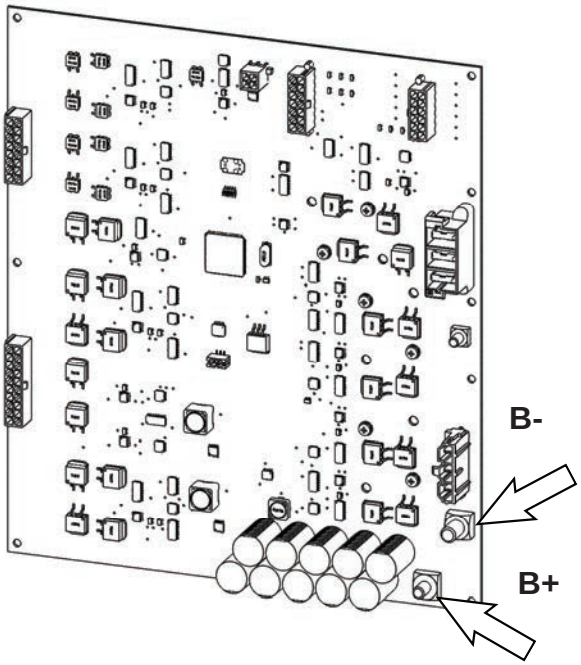


5. Check in-line 100-Amp fuse. Secure/repair connections. Continue testing/troubleshooting procedure if problem persists.

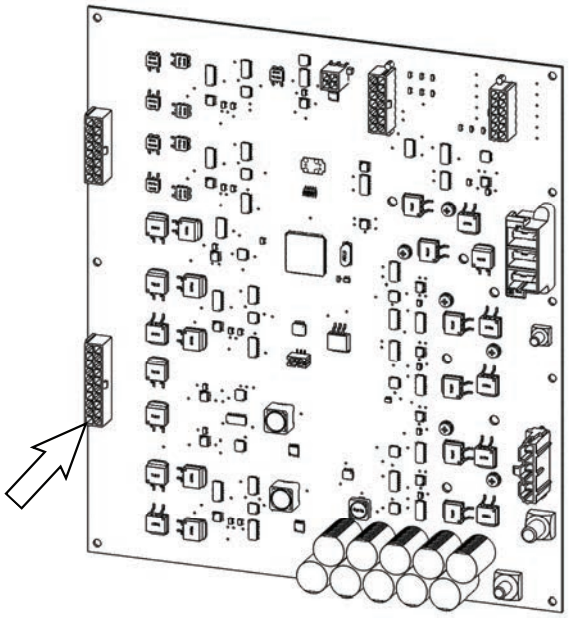


6. Inspect connections at Main Contactor (M1). Secure/repair connections. Continue testing/ troubleshooting procedure if problem persists.

7. Confirm connections at B- and B+ main sweep circuit board. Secure/repair connections.



8. Disconnect the main wire harness connector from J15 on the main sweep circuit board and verify connectors and connector pins are fully seated and connector pins are not damaged. Secure/repair connections.



9. Troubleshoot harness connections to motor.

   Check J15-3 and J15-13 against B- and chassis. Resistance must be 10KΩ or greater

   Check J15-3 and J15-13 against B+. Resistance must less than 10Ω, but great than 2Ω.

10. If resistance is greater than 10Ω, or less than 2Ω, check resistance at motor. If problem persists, replace the motor. See *REMOVING/REPLACING THE RIGHT SIDE SWEEP ACTUATOR OR OPTIONAL LEFT SIDE SWEEP ACTUATOR* in *SERVICE.*

TROUBLESHOOTING THE RIGHT SWEEP ACTUATOR

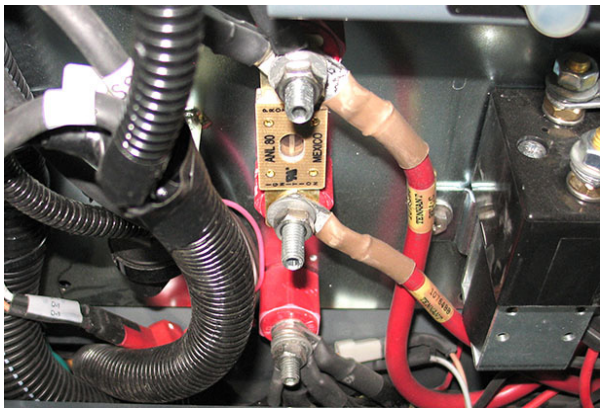
FOR SAFETY: Before leaving or servicing machine, stop on level surface, and turn off machine.

1. Turn the key switch ON and press the horn button. If the horn sounds proceed to the following step to begin troubleshooting the main sweep system. If the horn does not sound, the CAN system must be tested first. See TROUBLESHOOTING THE MAIN SWEEP CIRCUIT BOARD (CAN).
2. Turn key switch OFF.
3. Disconnect the battery cable from the machine

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

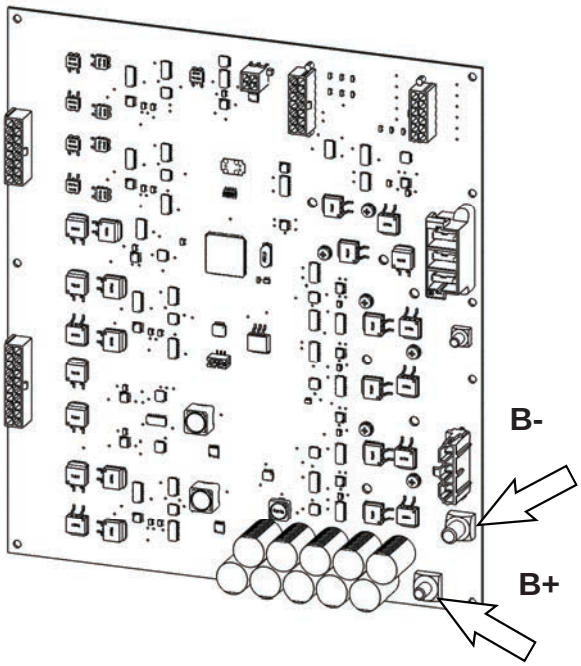
NOTE: To avoid damaging electronic components, a static ground strap must be worn at all times while handling/testing electrical components. Attach the other end of the static ground strap to the machine chassis.

4. Check in-line 100-Amp fuse. Secure/repair connections. Continue testing/troubleshooting if still no power at the module.

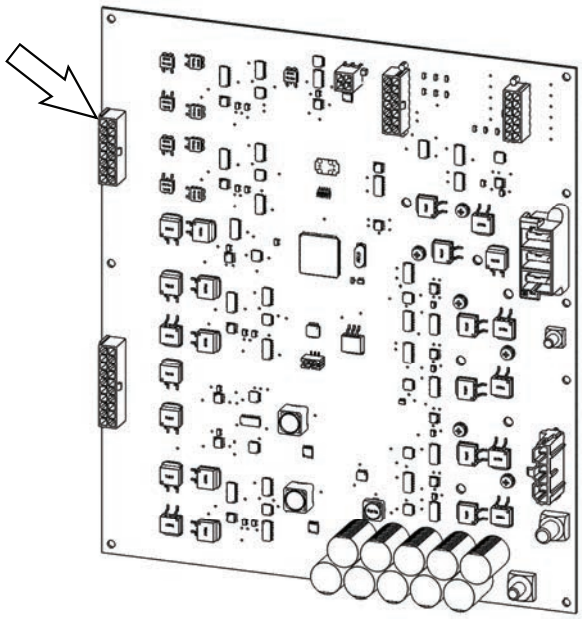


5. Inspect connections at Main Contactor (M1). Secure/repair connections. Continue testing/ troubleshooting procedure if problem persists.

6. Confirm connections at B- and B+ main sweep circuit board. Secure/repair connections.



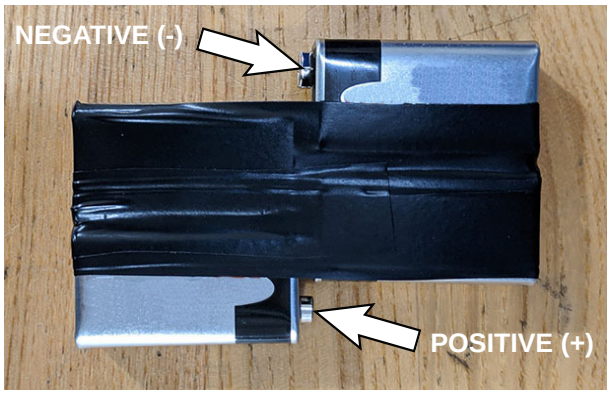
7. Disconnect the main wire harness connector from J14 on the main sweep circuit board and verify connectors and connector pins are fully seated and connector pins are not damaged. Secure/repair connections.



8. Remove parts/components necessary to access the actuator.
9. Check harness connections at the actuator.
10. Disconnect the main wire harness from the actuator.
11. Confirm there is no short on the harness end of the actuator cable.
12. Inspect the harness cable connector and connector terminals for damage.
13. Confirm resistance across the actuator connector terminals. The resistance should be 7Ω +/- 2Ω.

NOTE: The actuator may be at the limit switch location making resistance measurement impossible. If actuator is at limit switch location proceed to following steps to move actuator from limit switch location. Repeat previous step to confirm resistance after actuator is moved from limit switch location.

14. Assemble the 36V battery pack needed to move the actuator from the limit switch location. See *ASSEMBLE A 4X9V OR 36V BATTERY PACK* to assemble the battery pack needed to move actuator from limit switch.
15. Connect one side of each set of alligator clips to each connector terminal. Polarity does not matter for this connection. Take care to prevent the terminals from shorting.
16. Connect one set of alligator clips to the POSITIVE (+) battery pack terminal.



17. Touch (do not connect) the second alligator clip to the NEGATIVE (-) battery pack terminal and watch for the actuator to move.

NOTE: Actuator may be at an end stop if there is no movement.

NOTE: This battery pack is only meant for brief 1-2 second testing. The battery pack cannot sustain large currents.

18. Remove the alligator clip touching the NEGATIVE (-) battery pack terminal.
19. Disconnect the alligator clip from the POSITIVE (+) battery pack terminal.
20. Connect the alligator clip previously used to touch the NEGATIVE (-) battery pack terminal to the POSITIVE (+) battery pack terminal.

NOTE: This battery pack is only meant for brief 1-2 second testing. It cannot sustain large currents.

21. Touch (do not connect) the second alligator clip previously connected the POSITIVE (+) battery pack terminal to the NEGATIVE (-) battery pack terminal and watch for the actuator to move in the opposite direction.

22. If the actuator moved it is responding to the voltage that was briefly applied in the previous steps. The actuator could still have operational problems, but if the actuator moved when voltage was applied, it is likely there is an issue elsewhere in the system.

23. Continue troubleshooting the electrical connections and signals to the actuator.

24. If the actuator did not move when the voltage was briefly applied confirm the battery pack voltage (~34-36V).

    Confirm leads were reversed to check operation in both directions.

    Repeat the test.

    Confirm test validity by repeating test on another actuator on the machine.

    If no movement, replace the actuator.

TROUBLESHOOTING THE LEFT SWEEP BRUSH MOTOR (OPTION)

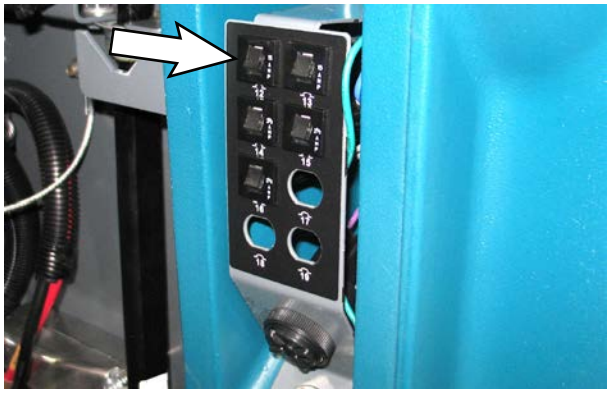
FOR SAFETY: Before leaving or servicing machine, stop on level surface, and turn off machine.

1. Turn the key switch ON and press the horn button. If the horn sounds proceed to the following step to begin troubleshooting the main sweep system. If the horn does not sound, the CAN system must be tested first. See TROUBLESHOOTING THE MAIN SWEEP CIRCUIT BOARD (CAN).
2. Turn key switch OFF.
3. Disconnect the battery cable from the machine

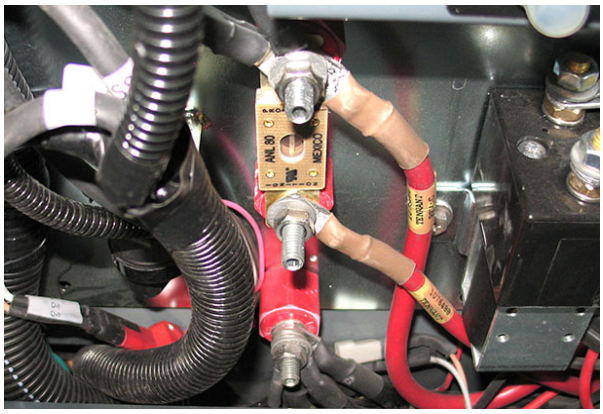
NOTE: Always disconnect the battery cable from the machine before disconnecting/repairing electrical connections

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

4. Ensure wire connections at the 15-Amp circuit breaker (CB12) are secure and undamaged. Secure/ repair connections as necessary. Continue testing/troubleshooting procedure if problem persists.

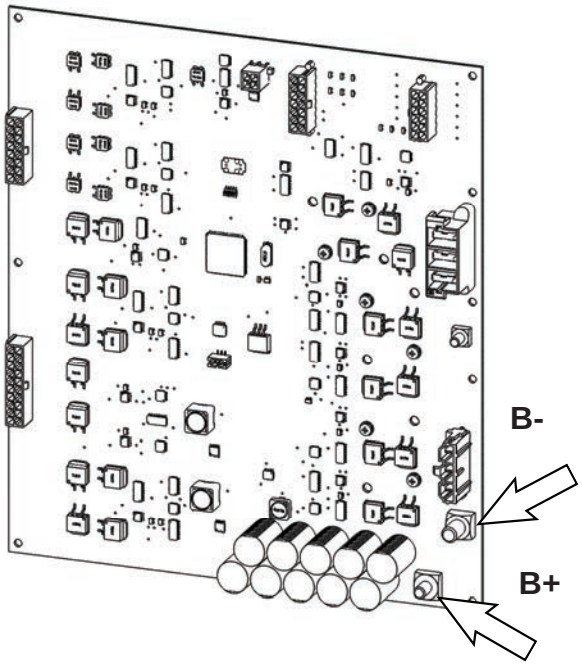


5. Check in-line 100-Amp fuse. Secure/repair connections. Continue testing/troubleshooting procedure if problem persists.

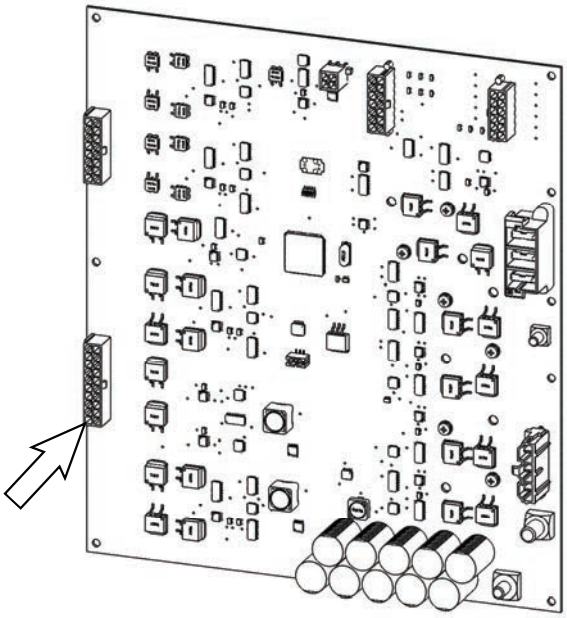


6. Inspect connections at Main Contactor (M1). Secure/repair connections. Continue testing/ troubleshooting procedure if problem persists.

7. Confirm connections at B- and B+ main sweep circuit board. Secure/repair connections.



8. Disconnect the main wire harness connector from J15 on the main sweep circuit board and verify connectors and connector pins are fully seated and connector pins are not damaged. Secure/repair connections.



9. Troubleshoot harness connections to motor.

   Check J15-5 and J15-15 against B- and chassis. Resistance must be 10KΩ or greater

   Check J15-5 and J15-15 against B+. Resistance must less than 10 ohms, but greater than 2Ω.

10. If resistance is greater than 10Ω, or less than 2Ω, check resistance at motor. If problem persists, replace the motor. See *REMOVING/REPLACING THE RIGHT SIDE SWEEP ACTUATOR OR OPTIONAL LEFT SIDE SWEEP ACTUATOR* in *SERVICE.*

TROUBLESHOOTING THE LEFT SWEEP ACTUATOR (OPTION)

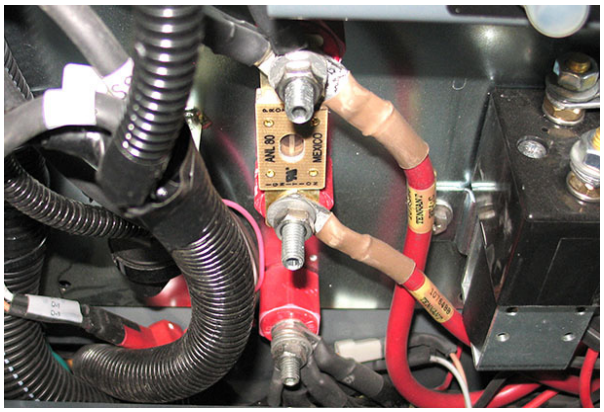
FOR SAFETY: Before leaving or servicing machine, stop on level surface, and turn off machine.

1. Turn the key switch ON and press the horn button. If the horn sounds proceed to the following step to begin troubleshooting the main sweep system. If the horn does not sound, the CAN system must be tested first. See TROUBLESHOOTING THE MAIN SWEEP CIRCUIT BOARD (CAN).
2. Turn key switch OFF.
3. Disconnect the battery cable from the machine

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

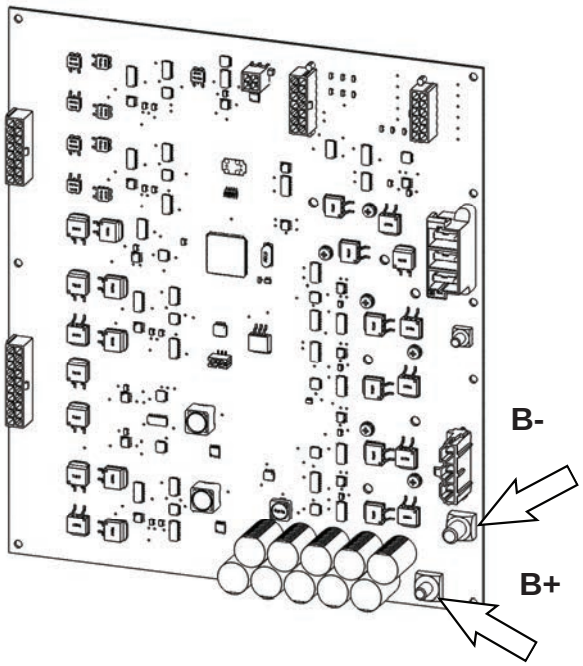
NOTE: To avoid damaging electronic components, a static ground strap must be worn at all times while handling/testing electrical components. Attach the other end of the static ground strap to the machine chassis.

4. Check in-line 100-Amp fuse. Secure/repair connections. Continue testing/troubleshooting procedure if problem persists.

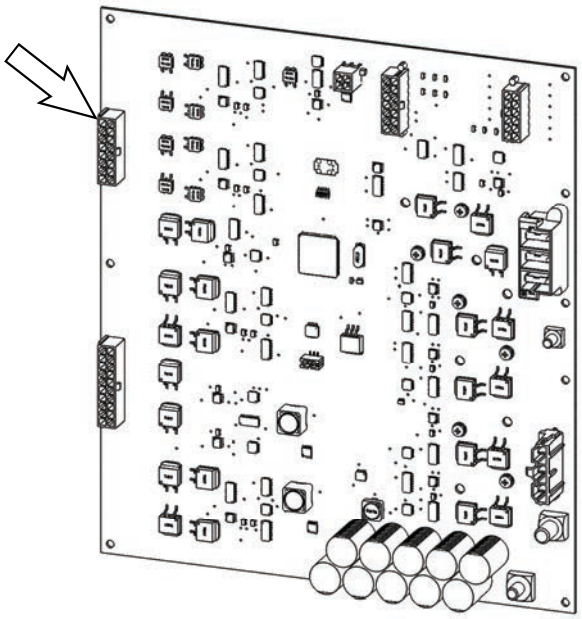


5. Inspect connections at Main Contactor (M1). Secure/repair connections. Continue testing/troubleshooting procedure if problem persists.

6. Confirm connections at B- and B+ main sweep circuit board. Secure/repair connections.



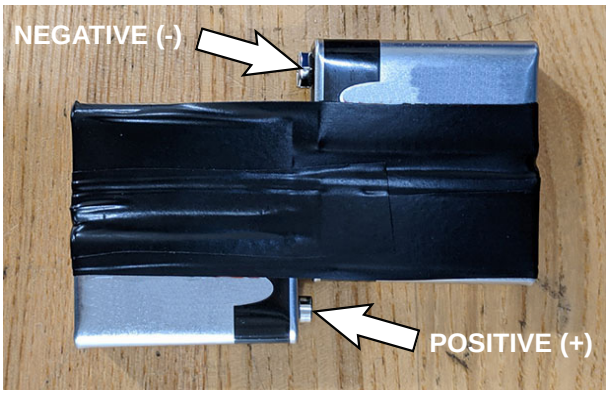
7. Disconnect the main wire harness connector from J14 on the main sweep circuit board and verify connectors and connector pins are fully seated and connector pins are not damaged. Secure/repair connections.



8. Remove parts/components necessary to access the actuator.
9. Check harness connections at the actuator.
10. Disconnect the main wire harness from the actuator.
11. Confirm there is no short on the harness end of the actuator cable.
12. Inspect the harness cable connector and connector terminals for damage.
13. Confirm resistance across the actuator connector terminals. The resistance should be 7Ω +/- 2Ω.

NOTE: The actuator may be at the limit switch location making resistance measurement impossible. If actuator is at limit switch location proceed to following steps to move actuator from limit switch location. Repeat previous step to confirm resistance after actuator is moved from limit switch location.

14. Assemble the 36V battery pack needed to move the actuator from the limit switch location. See *ASSEMBLE A 4X9V OR 36V BATTERY PACK* to assemble the battery pack needed to move actuator from limit switch.
15. Connect one side of each set of alligator clips to each connector terminal. Polarity does not matter for this connection. Take care to prevent the terminals from shorting.
16. Connect one set of alligator clips to the POSITIVE (+) battery pack terminal.



17. Touch (do not connect) the second alligator clip to the NEGATIVE (-) battery pack terminal and watch for the actuator to move.

NOTE: Actuator may be at an end stop if there is no movement.

NOTE: This battery pack is only meant for brief 1-2 second testing. The battery pack cannot sustain large currents.

18. Remove the alligator clip touching the NEGATIVE (-) battery pack terminal.
19. Disconnect the alligator clip from the POSITIVE (+) battery pack terminal.
20. Connect the alligator clip previously used to touch the NEGATIVE (-) battery pack terminal to the POSITIVE (+) battery pack terminal.

NOTE: This battery pack is only meant for brief 1-2 second testing. It cannot sustain large currents.

21. Touch (do not connect) the second alligator clip previously connected the POSITIVE (+) battery pack terminal to the NEGATIVE (-) battery pack terminal and watch for the actuator to move in the opposite direction.

22. If the actuator moved it is responding to the voltage that was briefly applied in the previous steps. The actuator could still have operational problems, but if the actuator moved when voltage was applied, it is likely there is an issue elsewhere in the system.

23. Continue troubleshooting the electrical connections and signals to the actuator.

24. If the actuator did not move when the voltage was briefly applied confirm the battery pack voltage (~34-36V).

    Confirm leads were reversed to check operation in both directions.

    Repeat the test.

    Confirm test validity by repeating test on another actuator on the machine.

    If no movement, replace the actuator.

TROUBLESHOOTING THE HOPPER ROLLOUT ACTUATOR - HIGH DUMP MACHINES

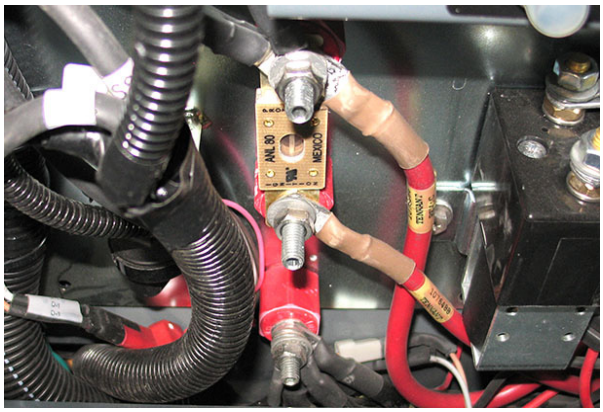
FOR SAFETY: Before leaving or servicing machine, stop on level surface, and turn off machine.

1. Turn the key switch ON and press the horn button. If the horn sounds proceed to the following step to begin troubleshooting the main sweep system. If the horn does not sound, the CAN system must be tested first. See TROUBLESHOOTING THE MAIN SWEEP CIRCUIT BOARD (CAN).
2. Turn key switch OFF.
3. Disconnect the battery cable from the machine

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

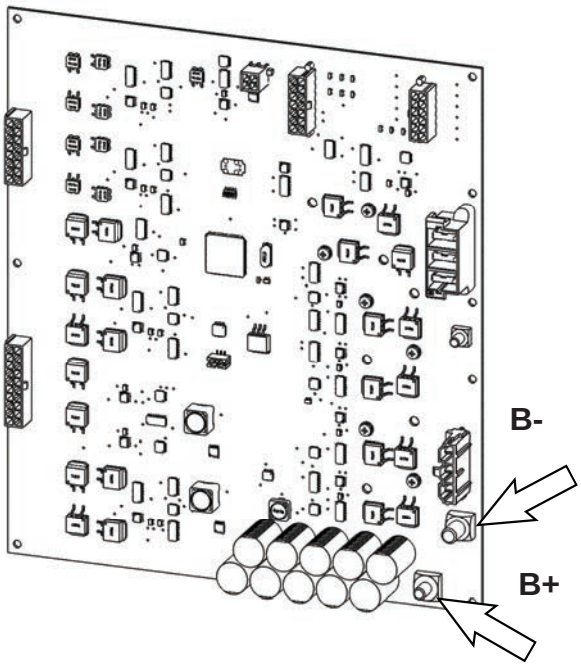
NOTE: To avoid damaging electronic components, a static ground strap must be worn at all times while handling/testing electrical components. Attach the other end of the static ground strap to the machine chassis.

4. Check in-line 100-Amp fuse. Secure/repair connections. Continue testing/troubleshooting procedure if problem persists.

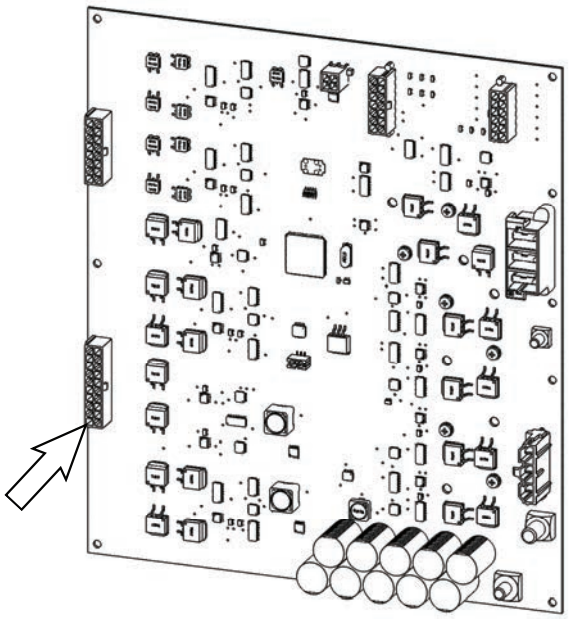


5. Inspect connections at Main Contactor (M1). Secure/repair connections. Continue testing/ troubleshooting procedure if problem persists.

6. Confirm connections at B- and B+ main sweep circuit board. Secure/repair connections.



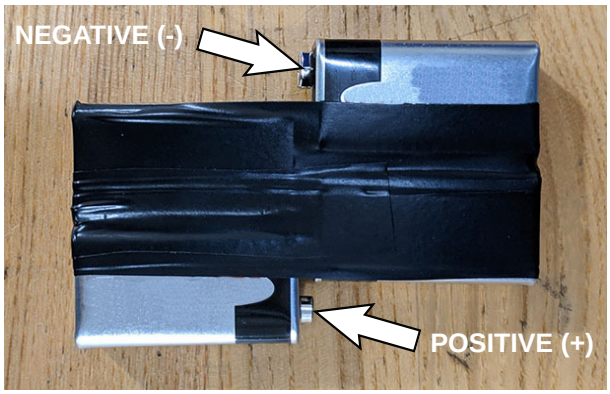
7. Disconnect the main wire harness connector from J15 on the main sweep circuit board and verify connectors and connector pins are fully seated and connector pins are not damaged. Secure/repair connections.



8. Remove parts/components necessary to access the actuator.
9. Check harness connections at the actuator.
10. Disconnect the main wire harness from the actuator.
11. Confirm there is no short on the harness end of the actuator cable.
12. Inspect the harness cable connector and connector terminals for damage.
13. Confirm resistance across the actuator connector terminals. The resistance should be no less than 0.7Ω and no great than 3.0Ω.

NOTE: The actuator may be at the limit switch location making resistance measurement impossible. If actuator is at limit switch location proceed to following steps to move actuator from limit switch location. Repeat previous step to confirm resistance after actuator is moved from limit switch location.

14. Assemble the 36V battery pack needed to move the actuator from the limit switch location. See *ASSEMBLE A 4X9V OR 36V BATTERY PACK* to assemble the battery pack needed to move actuator from limit switch.
15. Connect one side of each set of alligator clips to each connector terminal. Polarity does not matter for this connection. Take care to prevent the terminals from shorting.
16. Connect one set of alligator clips to the POSITIVE (+) battery pack terminal.



17. Touch (do not connect) the second alligator clip to the NEGATIVE (-) battery pack terminal and watch for the actuator to move.

NOTE: Actuator may be at an end stop if there is no movement.

NOTE: This battery pack is only meant for brief 1-2 second testing. The battery pack cannot sustain large currents.

18. Remove the alligator clip touching the NEGATIVE (-) battery pack terminal.
19. Disconnect the alligator clip from the POSITIVE (+) battery pack terminal.
20. Connect the alligator clip previously used to touch the NEGATIVE (-) battery pack terminal to the POSITIVE (+) battery pack terminal.

NOTE: This battery pack is only meant for brief 1-2 second testing. It cannot sustain large currents.

21. Touch (do not connect) the second alligator clip previously connected the POSITIVE (+) battery pack terminal to the NEGATIVE (-) battery pack terminal and watch for the actuator to move in the opposite direction.

22. If the actuator moved it is responding to the voltage that was briefly applied in the previous steps. The actuator could still have operational problems, but if the actuator moved when voltage was applied, it is likely there is an issue elsewhere in the system.

23. Continue troubleshooting the electrical connections and signals to the actuator.

24. If the actuator did not move when the voltage was briefly applied confirm the battery pack voltage (~34-36V).

    Confirm leads were reversed to check operation in both directions.

    Repeat the test.

    Confirm test validity by repeating test on another actuator on the machine.

    If no movement, replace the actuator.

TROUBLESHOOTING THE HOPPER LIFT SYSTEM (HYDRAULIC PUMP) - HIGH DUMP MACHINES

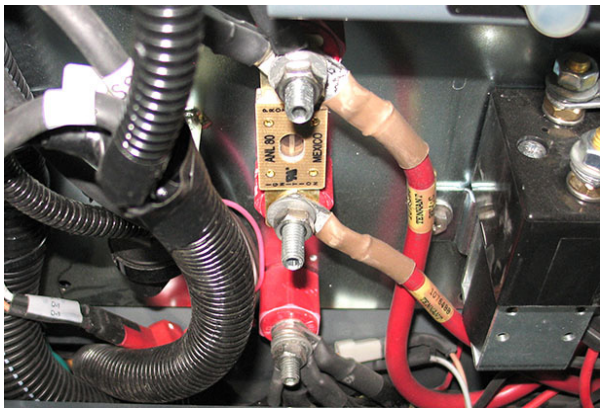
FOR SAFETY: Before leaving or servicing machine, stop on level surface, and turn off machine.

1. Turn the key switch ON and press the horn button. If the horn sounds proceed to the following step to begin troubleshooting the main sweep system. If the horn does not sound, the CAN system must be tested first. See TROUBLESHOOTING THE MAIN SWEEP CIRCUIT BOARD (CAN).
2. Turn key switch OFF.
3. Disconnect the battery cable from the machine

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

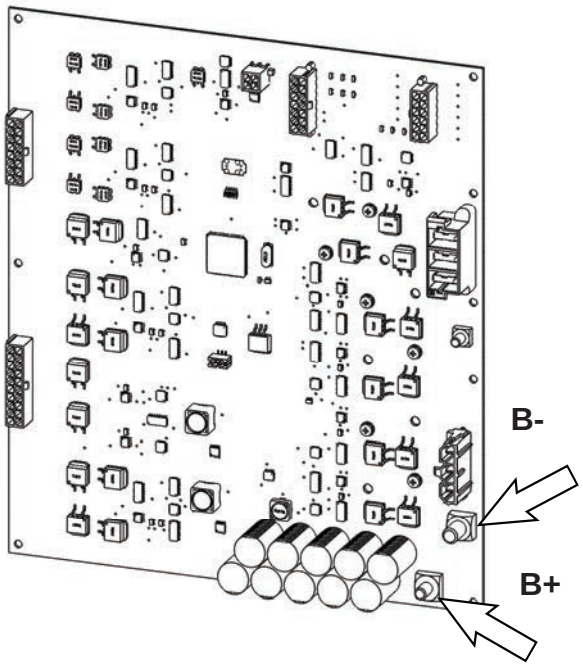
NOTE: To avoid damaging electronic components, a static ground strap must be worn at all times while handling/testing electrical components. Attach the other end of the static ground strap to the machine chassis.

4. Check in-line 100-Amp fuse. Secure/repair connections. Continue testing/troubleshooting procedure if problem persists.

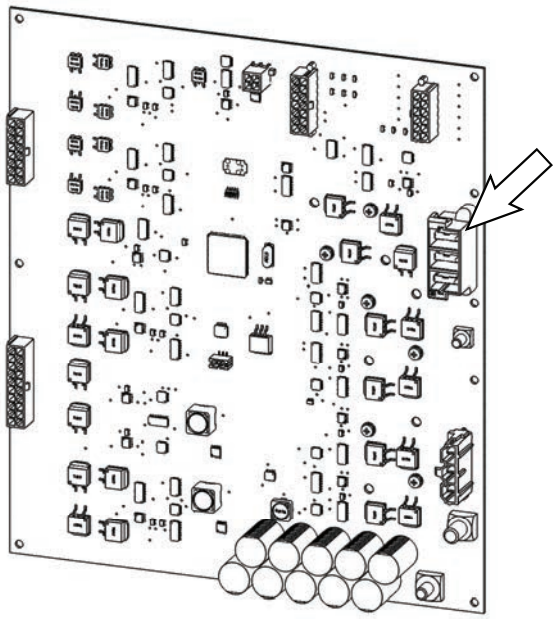


5. Inspect connections at Main Contactor (M1). Secure/repair connections. Continue testing/troubleshooting procedure if problem persists.

6. Confirm connections at B- and B+ main sweep circuit board. Secure/repair connections.



7. Disconnect the main wire harness connector from J10 on the main sweep circuit board and verify connectors and connector pins are fully seated and connector pins are not damaged. Secure/repair connections.



8. Check harness connections at the hydraulic pump. The coil resistance is typically less than 0.5Ω for both sides. J10-1 to J10-3 should measure less than 0.5Ω and J10-2 to J10-3 should measure less than 0.5Ω.

NOTE: This may be tested while on for over current. If measuring with a DC current clamp, a current in excess of 30-Amps RMS may indicate a faulty hydraulic pump. Contact T.A.C. for further assistance.

TROUBLESHOOTING THE VACUUM FAN MOTOR

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

1. Turn the key switch ON and press the horn button. If the horn sounds proceed to the following step to begin troubleshooting the main sweep system. If the horn does not sound, the CAN system must be tested first. See TROUBLESHOOTING THE MAIN SWEEP CIRCUIT BOARD (CAN).

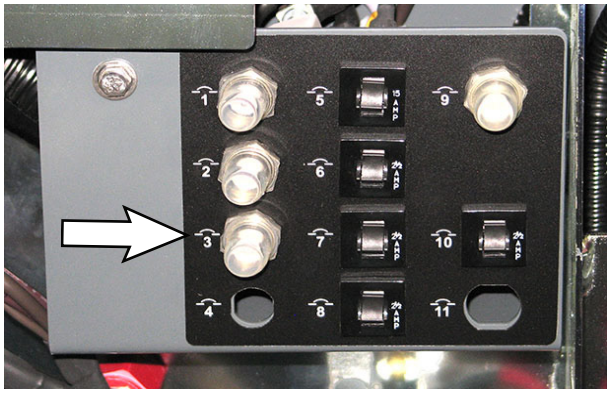
2. Turn key switch OFF.

3. Disconnect the battery cable from the machine.

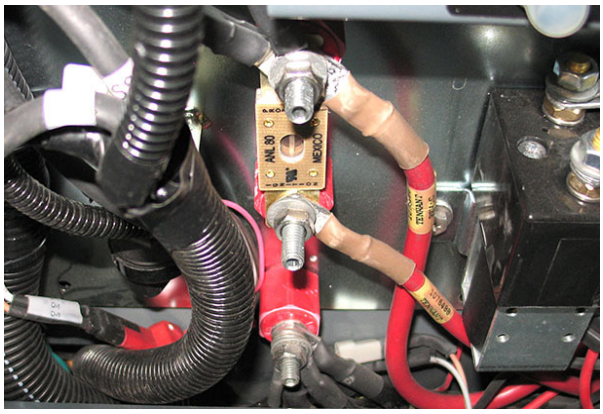
NOTE: Always disconnect the battery cable from the machine before disconnecting/repairing electrical connections.

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

4. Ensure wire connections at the 30-Amp circuit breaker (CB3) are secure and undamaged. Secure/repair connections as necessary. Continue testing/troubleshooting procedure if problem persists.

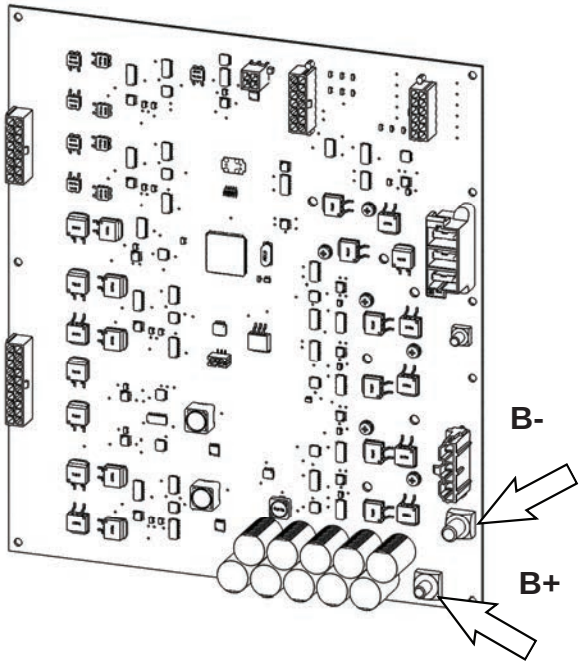


5. Check in-line 100-Amp fuse. Secure/repair connections. Continue testing/troubleshooting procedure if problem persists.

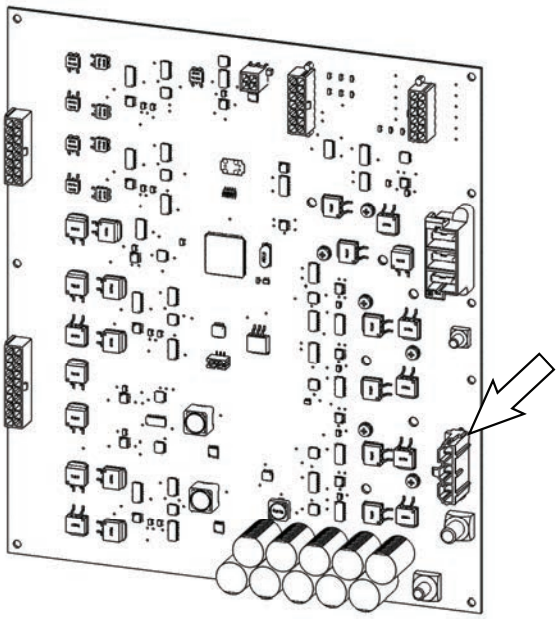


6. Inspect connections at Main Contactor (M1). Secure/repair connections. Continue testing/troubleshooting procedure if problem persists.

7. Confirm connections at B- and B+ main sweep circuit board. Secure/repair connections.



8. Disconnect the main wire harness connector from J11 on the main sweep circuit board and verify connectors and connector pins are fully seated and connector pins are not damaged. Secure/repair connections.



9. Troubleshoot harness connections to motor.

   Check J11-2 against B- and chassis. Resistance must be 10KΩ or greater.

   Check J11-2 against B+. Resistance must less than 2Ω.

10. If resistance is greater than 2Ω, check resistance at motor. If problem persists, replace the motor. See *REMOVE/REINSTALL/REPLACE THE VACUUM FAN* in *SERVICE.*

TROUBLESHOOTING THE FILTER SHAKER MOTOR

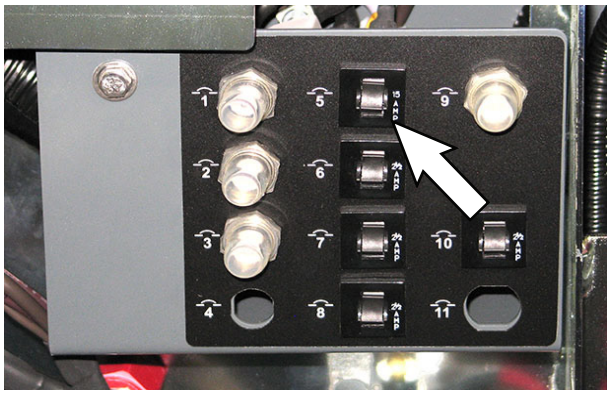
FOR SAFETY: Before leaving or servicing machine, stop on level surface, and turn off machine.

1. Turn the key switch ON and press the horn button. If the horn sounds proceed to the following step to begin troubleshooting the main sweep system. If the horn does not sound, the CAN system must be tested first. See TROUBLESHOOTING THE MAIN SWEEP CIRCUIT BOARD (CAN).
2. Turn key switch OFF.
3. Disconnect the battery cable from the machine.

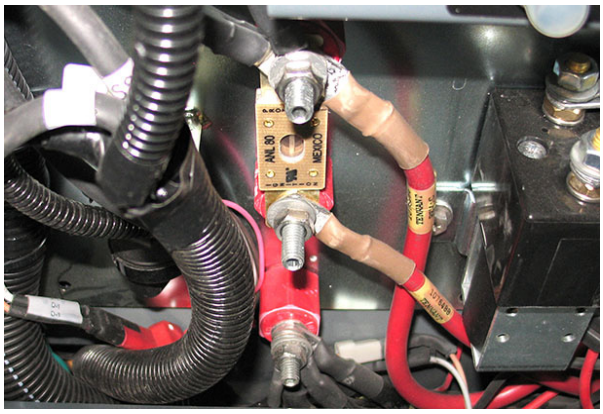
NOTE: Always disconnect the battery cable from the machine before disconnecting/repairing electrical connections.

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

4. Ensure wire connections at the 15-Amp circuit breaker (CB5) are secure and undamaged. Secure/repair connections as necessary. Continue testing/troubleshooting procedure if problem persists.

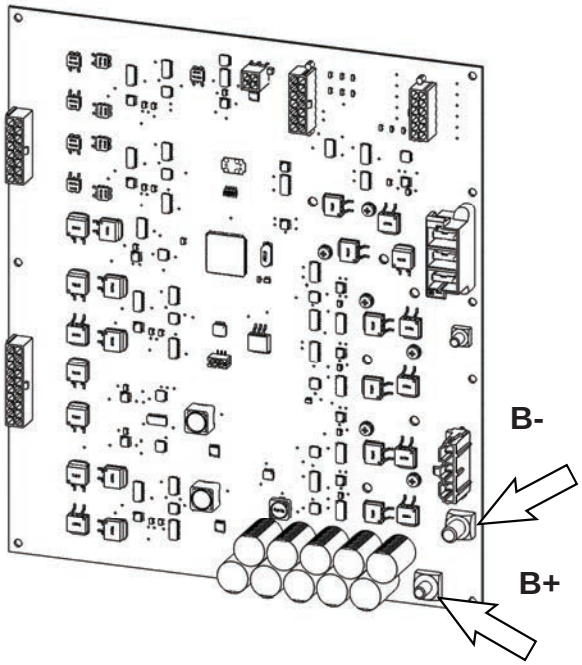


5. Check in-line 100-Amp fuse. Secure/repair connections. Continue testing/troubleshooting procedure if problem persists.

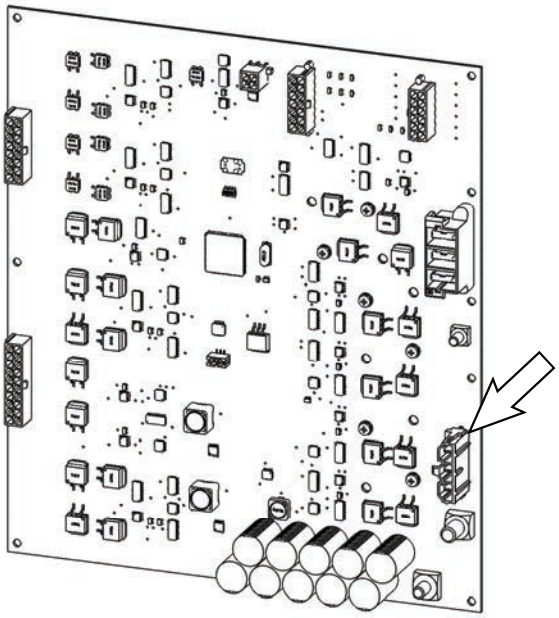


6. Inspect connections at Main Contactor (M1). Secure/repair connections. Continue testing/troubleshooting procedure if problem persists.

7. Confirm connections at B- and B+ main sweep circuit board. Secure/repair connections.



8. Disconnect the main wire harness connector from J11 on the main sweep circuit board and verify connectors and connector pins are fully seated and connector pins are not damaged. Secure/repair connections.



9. Troubleshoot harness connections to motor.

   Check J11-1 against B- and chassis. Resistance must be 10KΩ or greater.

   Check J11-1 against B+. Resistance must less than 3Ω.

10. If resistance is greater than 3Ω, check resistance at motor. If problem persists, replace the motor. See *REMOVE/REPLACE THE FILTER SHAKER MOTOR* in *SERVICE.*

TROUBLESHOOTING THE HEPA VACUUM FAN MOTOR (OPTION)

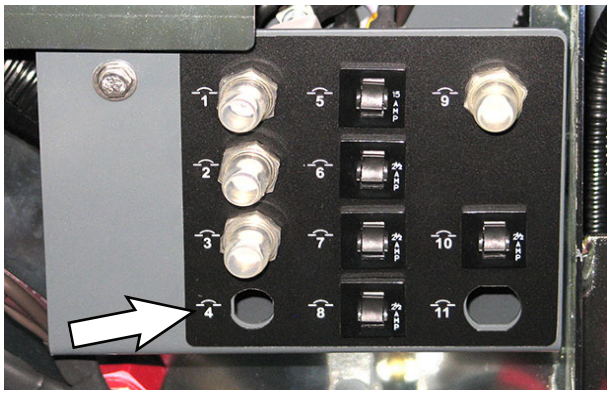
FOR SAFETY: Before leaving or servicing machine, stop on level surface, and turn off machine.

1. Turn the key switch ON and press the horn button. If the horn sounds proceed to the following step to begin troubleshooting the main sweep system. If the horn does not sound, the CAN system must be tested first. See TROUBLESHOOTING THE MAIN SWEEP CIRCUIT BOARD (CAN).
2. Turn key switch OFF.
3. Disconnect the battery cable from the machine

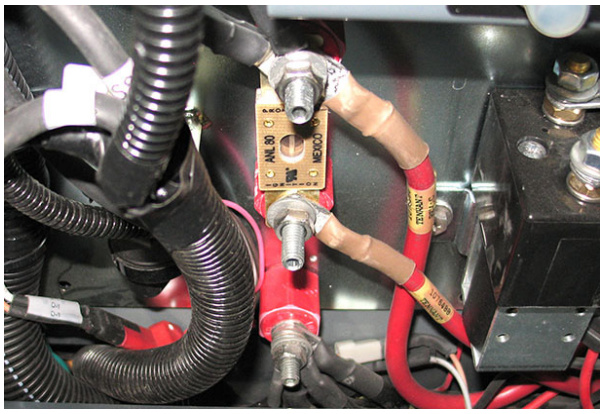
NOTE: Always disconnect the battery cable from the machine before disconnecting/repairing electrical connections.

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

4. Ensure wire connections at the 30-Amp circuit breaker (CB4) are secure and undamaged. Secure/repair connections as necessary. Continue testing/troubleshooting procedure if problem persists.

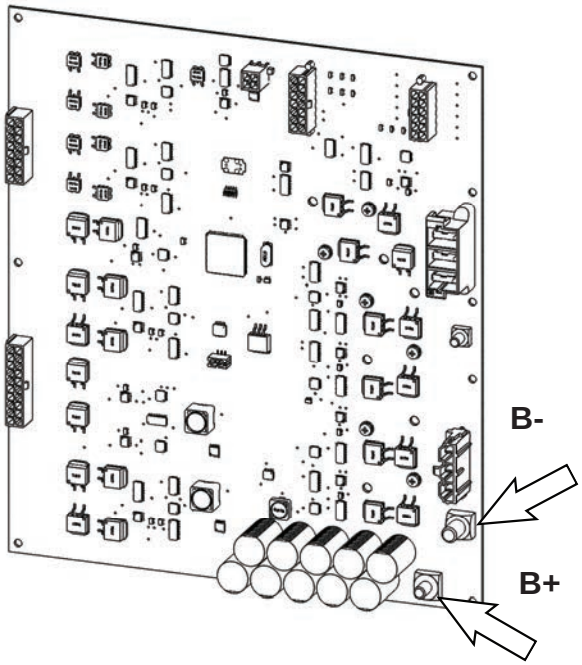


5. Check in-line 100-Amp fuse. Secure/repair connections. Continue testing/troubleshooting procedure if problem persists.

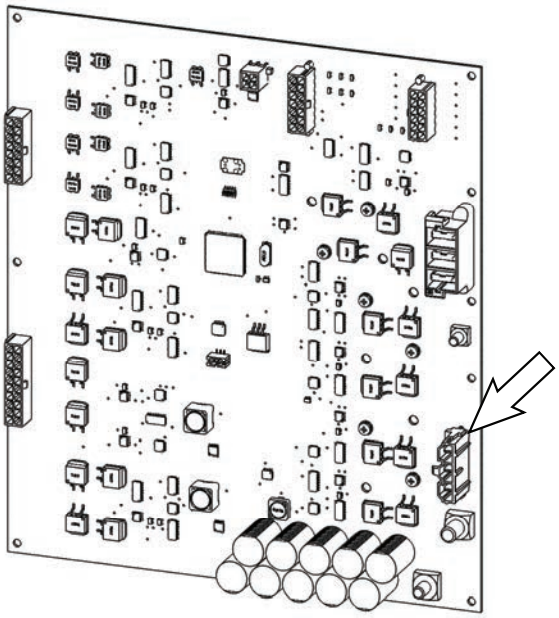


6. Inspect connections at Main Contactor (M1). Secure/repair connections. Continue testing/troubleshooting procedure if problem persists.

7. Confirm connections B- and B+ at main sweep circuit board. Secure/repair connections.



8. Disconnect the main wire harness connector from J11 on the main sweep circuit board and verify connectors and connector pins are fully seated and connector pins are not damaged. Secure/repair connections.



9. Troubleshoot harness connections to motor.

   Check J11-3 against B- and chassis. Resistance must be 10KΩ or greater.

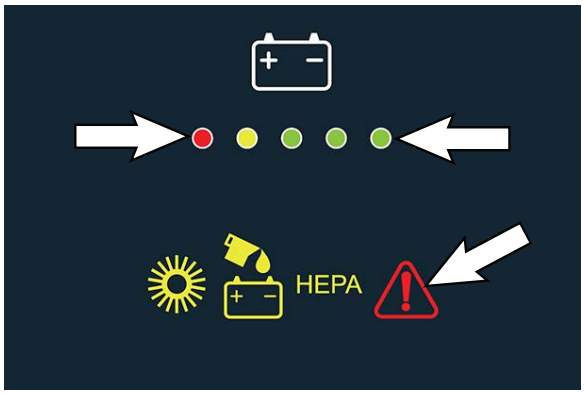
   Check J11-3 against B+. Resistance must less than 2Ω.

10. If resistance is greater than 2Ω, check resistance at motor. If problem persists, replace the motor. See *REMOVE/REPLACE THE HEPA VACUUM FAN* in *SERVICE.*

TROUBLESHOOTING THE UI (USER INTERFACE) MEMBRANE PANEL

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

1. Turn key switch ON.
2. Observe the membrane panel. Does the panel power on? Is the panel functioning properly?
   - Buttons/lights not illuminated
   - Buttons not responsive



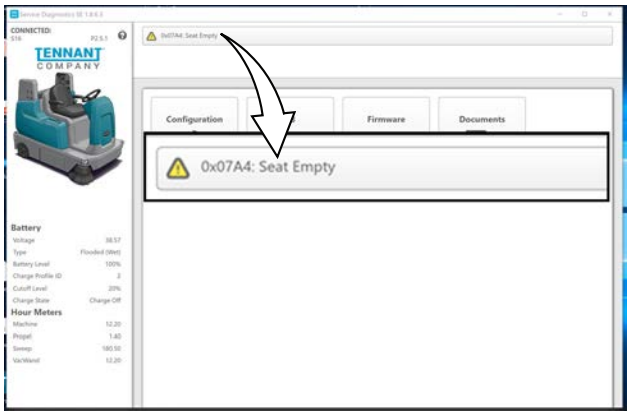
3. Remove the front access panel from the steering channel and connect the USB cable to the service device and the machine.

4. Turn key switch ON.

*NOTE: Although machine configuration is set at the membrane panel, the membrane panel functions only as a pass through for the other modules. The membrane panel displays only information it receives from the modules. Fault codes from the other modules signify an issue with the module, **not** the membrane panel.*

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

6. Observe for fault codes and record all active displayed fault codes. See *FAULT CODES* in *FAULTS AND WARNINGS*.



7. Confirm the main sweep circuit board and user interface have the latest version of firmware. Update firmware if necessary.

8. Key cycle the machine.

9. Note any fault code changes or changes in how the machine operates/functions. May be necessary to briefly operate the machine for fault codes to appear.

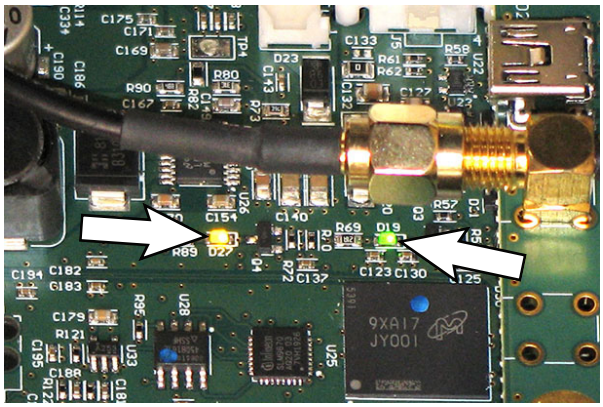
If it is determined that there is an issue with the membrane panel:

10. Determine cause of failure(s). Is it a component issue/failure? Or membrane panel issue/failure?

11. Continue observing the membrane screen. Do lights go off shortly after initial start up?

12. Check configuration. Is the configuration retained?

13. Inspect user interface for green micro-processor heartbeat LED indicator (D19) and yellow CAN communication LED indicator (D27).



If no green micro-processor heartbeat LED indicator (D19), check for power at J7-10 on the main sweep circuit board.

If no yellow CAN communication LED indicator (D27), check for CAN issues at J3-1 and J3-2 on the main sweep circuit board. See *TROUBLESHOOTING THE MAIN SWEEP CIRCUIT BOARD.* If no CAN issues proceed to following step.

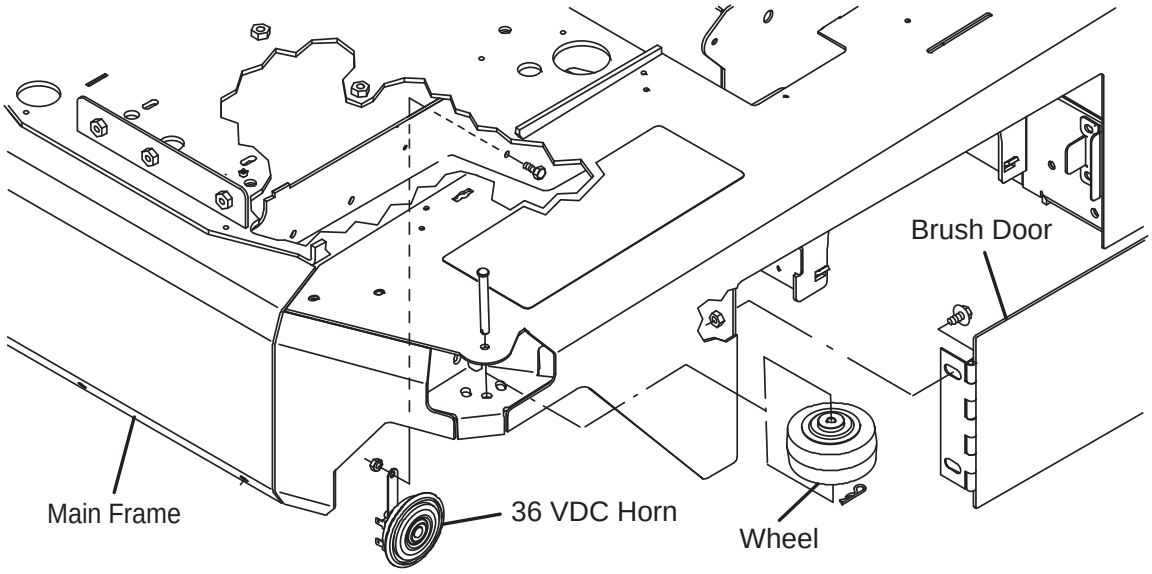
14. Determine which component is affected.

15. Confirm machine is properly configured.

16. What type of failure? Was there a fault code? Did issue occur while machine was in use? Why did component/module fail? Was cause of failure due to machine abuse/misuse?

17. Confirm harnesses, connectors, fuses, circuit breakers for the suspected module(s) are not damaged and are functioning properly.

TROUBLESHOOTING THE HORN



When the horn button is pressed the membrane panel/UI (User Interface) sends a CAN message to the main sweep circuit board to turn the horn on. When the horn button is released, the membrane panel/UI sends a CAN message to the main sweep circuit board to turn the horn off.

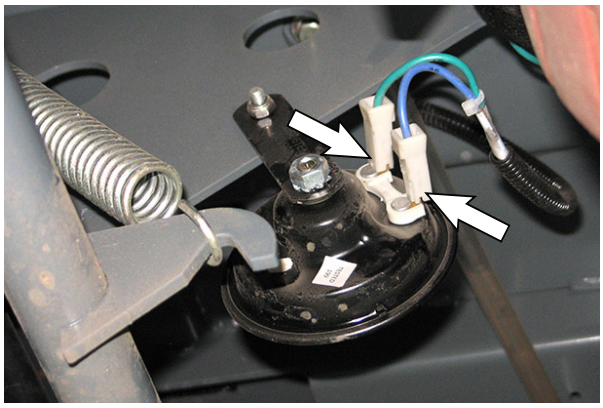
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, set parking brake, and remove key.

HORN SOUNDS BUT NOT CORRECT

1. Turn key switch OFF.
2. Disconnect the battery cable from the machine.

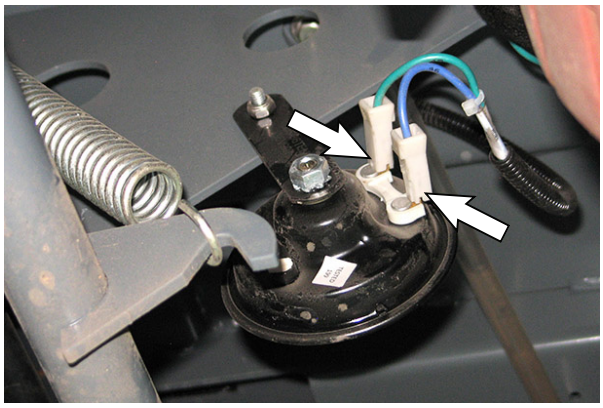
FOR SAFETY: When servicing machine, disconnect battery connections and charger cord before working on machine.

3. Check horn bracket position on the frame of the machine and ensure all hardware is completely tightened.
4. Check horn for physical damage or evidence of moister inside horn unit.
5. Ensure the main harness connections to the horn are secure and the terminals are not corroded.



6. Ensure main harness wires to the horn are not damaged (pinched, discolored, etc...).
7. If there are no signs of external damage and all harness connections are secure, but horn sound remains noticeably different, remove the horn from the machine and install a new horn.
8. Reconnect the battery cable to the machine.

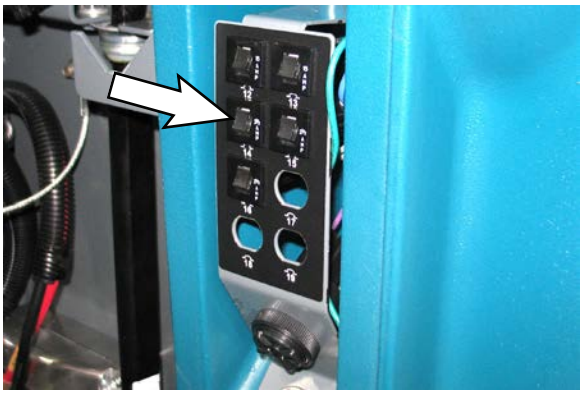
9. Read voltage across pins while new horn is active. If voltage is not ~19V to 23V (when battery is between 31.5V and 38V), replace the main sweep circuit board and reconfigure all modules. See *REMOVE/REINSTALL/REPLACE THE MAIN SWEEP CONTROL BOARD* and *RECONFIGURING THE MACHINE AFTER NEW HARDWARE/OPTION INSTALLATION* in *SERVICE.*



HORN DOES NOT SOUND

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

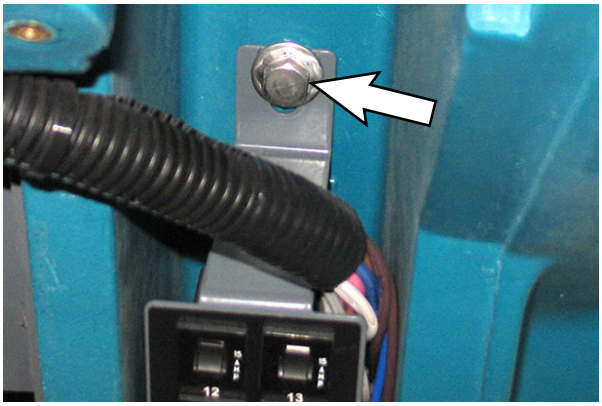
1. Turn key switch OFF.
2. Ensure the 2.5-Amp circuit breaker (CB14) is not tripped.

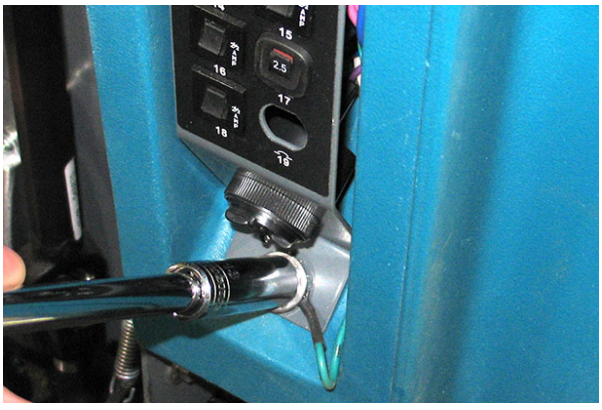


3. Disconnect the battery cable from the machine.

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

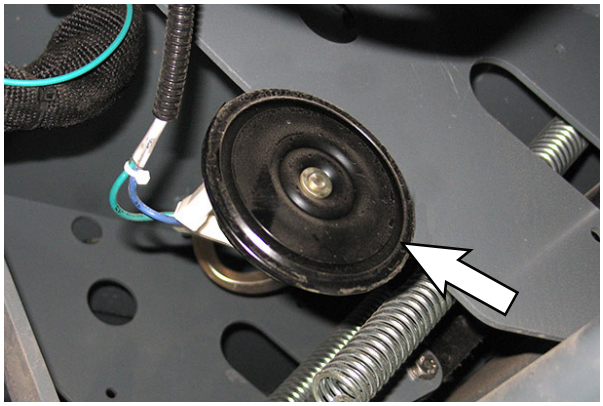
4. Remove the top M8 screw and remove the bottom M8 screw securing the circuit breaker panel to the front shroud.



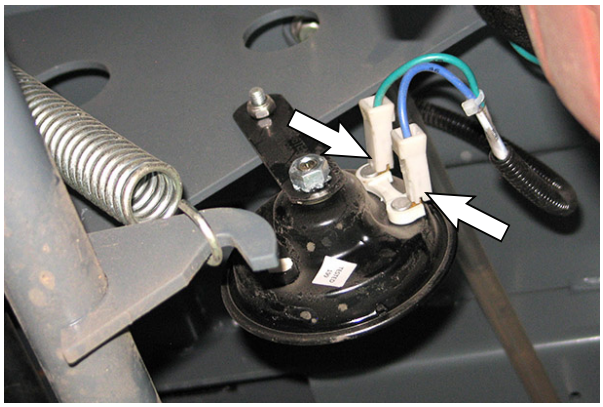


NOTE: To avoid damaging electronic components, a static ground strap must be worn at all times while handling/testing electrical components. Attach the other end of the static ground strap to the machine chassis.

5. Inspect the wire connections at circuit breaker (CB14).
6. Check horn for physical damage.



7. Inspect connections at pins/terminals for signs of corrosion/damage.



8. Check the pins for shorts (possibly due to moisture/debris between pins).
9. Run ~31V to 38V across pins to directly test horn. If horn sounds incorrect or does not sound, the horn is damaged. Replace the horn.
10. If cause is not yet determined troubleshoot for UI (user interface) issues.
11. Reconnect the battery cable to the machine.

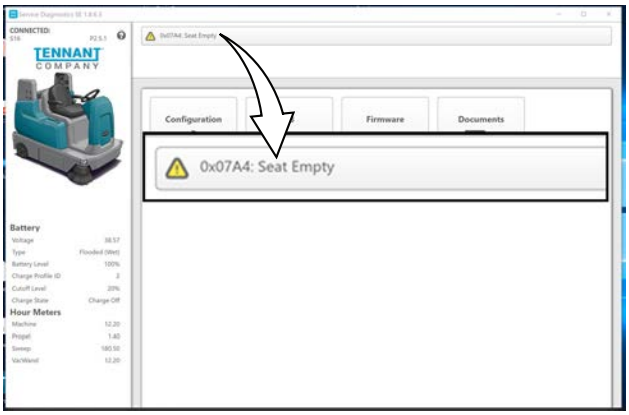
MEMBRANE PANEL ISSUE

1. Remove the front access panel from the steering channel and connect the USB cable to the service device and the machine.

2. Turn key switch ON.

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

4. Observe for fault codes. See *FAULT CODES* in *FAULTS AND WARNINGS*.



5. If faults are shown or the horn does not function, troubleshoot for a CAN and Main Sweep Module issue.

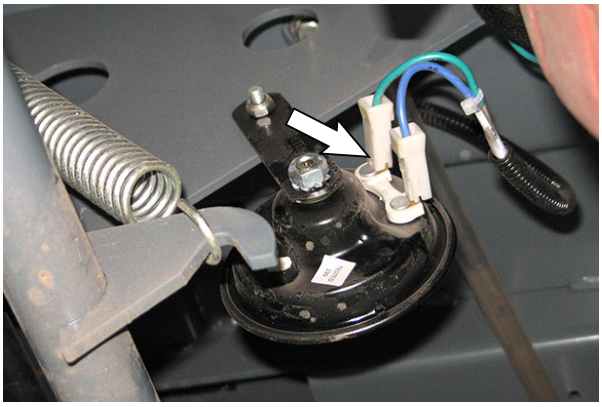
6. If no UI (user interface)/CAN/main sweep circuit board issues, replace the membrane panel.

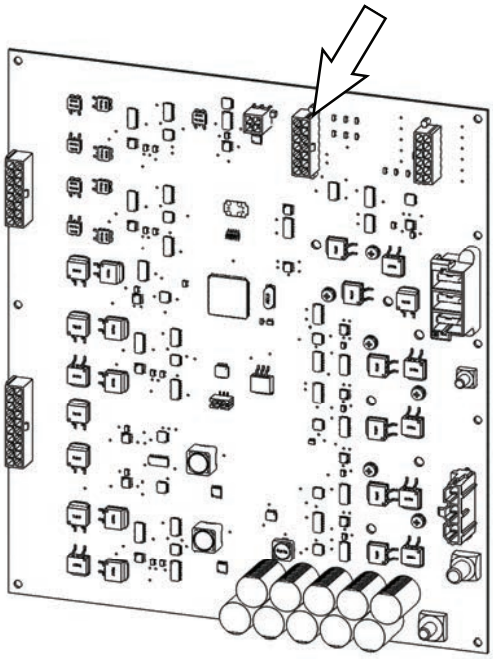
   If CAN/main sweep circuit board issues, continue troubleshooting procedures.

SWEEP CIRCUIT BOARD ISSUE

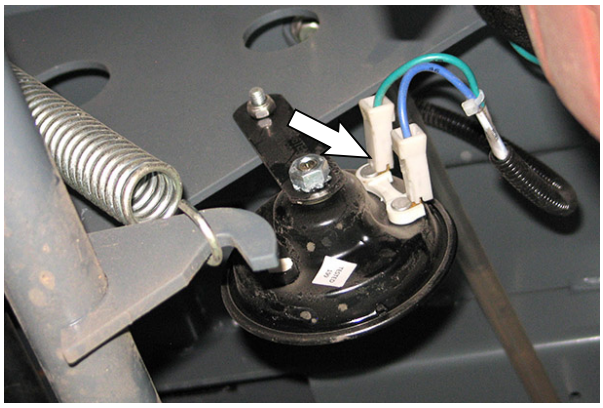
1. Check harness, confirm continuity in 45/green wire (Horn P2-1 to main sweep circuit board J16-7).

NOTE: A jumper/extension lead may be required to connect the voltmeter to P2-1 on the horn and J16-7 on the main sweep circuit board.





2. Read voltage across horn while horn button is pressed. If voltage is not ~19V to 23V (when battery is between 31.5V and 38V), check wires and connections for damage.



3. If issue persists, replace the Main sweep Module (horn driver has failed). See *REMOVING/ REPLACING THE MAIN SWEEP CIRCUIT BOARD.*

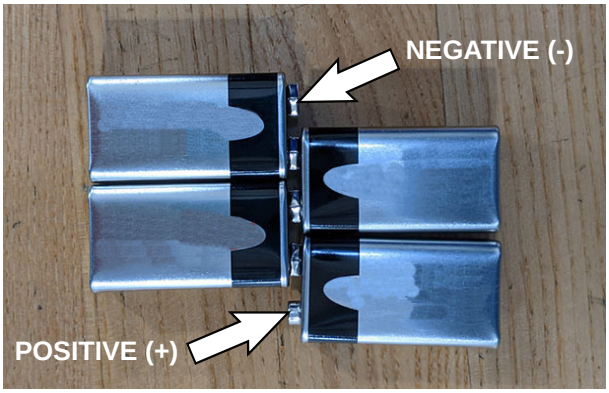
HORN DOES NOT STOP/UNINTENTIONALLY SOUNDS (ACTIVATES WITHOUT PRESSING HORN BUTTON) MEMBRANE PANEL ISSUE

1. Turn key switch ON.
2. Press any button on the membrane panel except the horn button. If horn sounds when another button is pushed, the membrane has a short. Replace the membrane panel.
3. If horn sounds when key switch is turned ON there may be a short in the membrane panel.

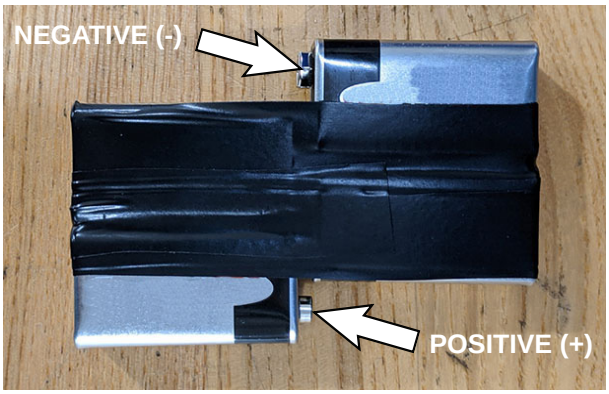
   Troubleshoot the main sweep circuit board. See *TROUBLESHOOTING THE MAIN SWEEP CIRCUIT BOARD.* If problem persists, call T.A.C. for further assistance.
4. Turn key switch OFF.

ASSEMBLE A 4X9V OR 36V BATTERY PACK

1. Assemble the batteries in a + to – daisy chain to create a series path of 36 volts.

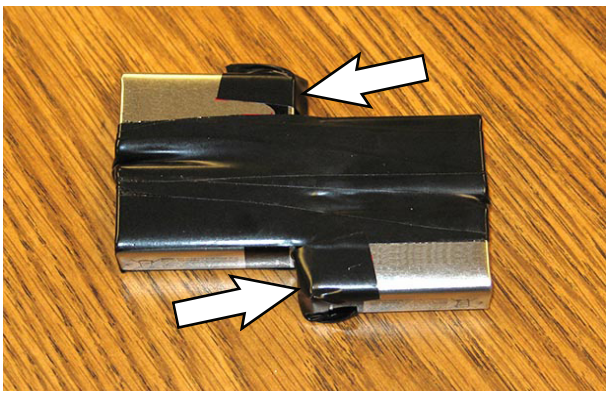


2. Wrap tape around batteries to stabilize the battery pack, leaving the unconnected positive and negative terminals exposed.



NOTE: This battery pack is only meant for brief 1-2 second testing. The battery pack cannot sustain large currents.

3. When storing/not using the battery pack, place tape over terminal ends to prevent accidental shorts.



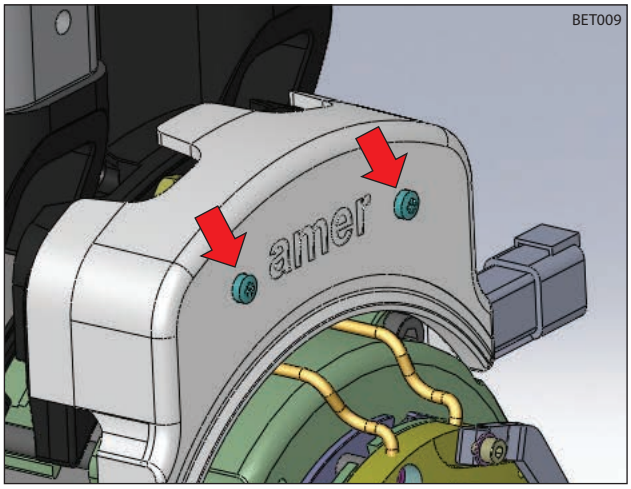
COMPONENT TESTING

TESTING THE PROPEL MOTOR

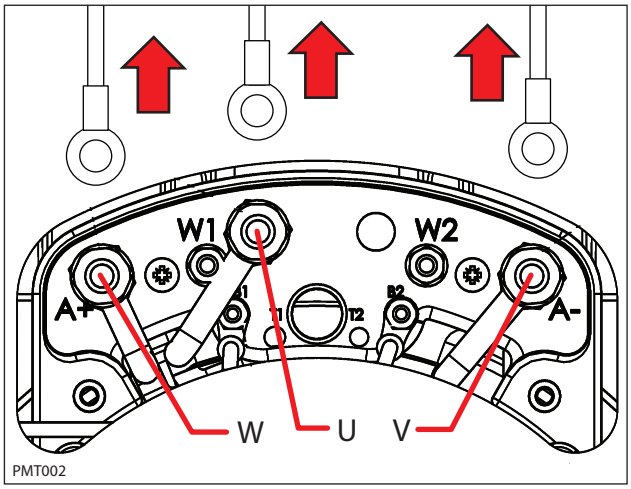
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, remove key, and set parking brake.

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

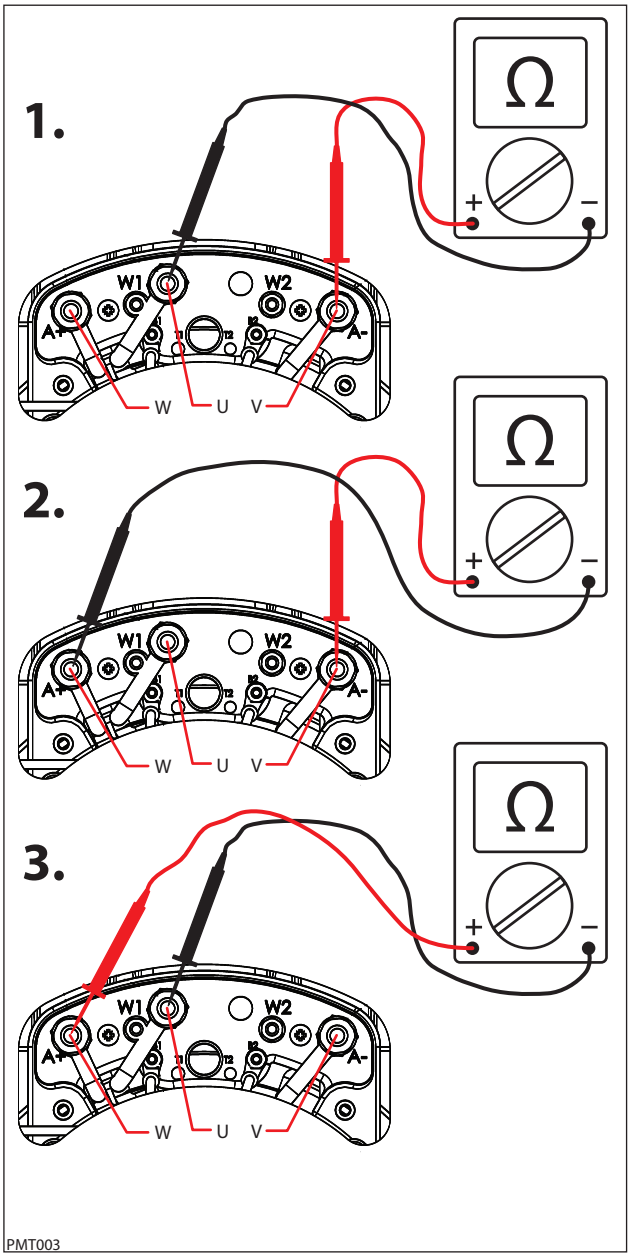
1. Turn key switch OFF.
2. Remove terminal box cover.



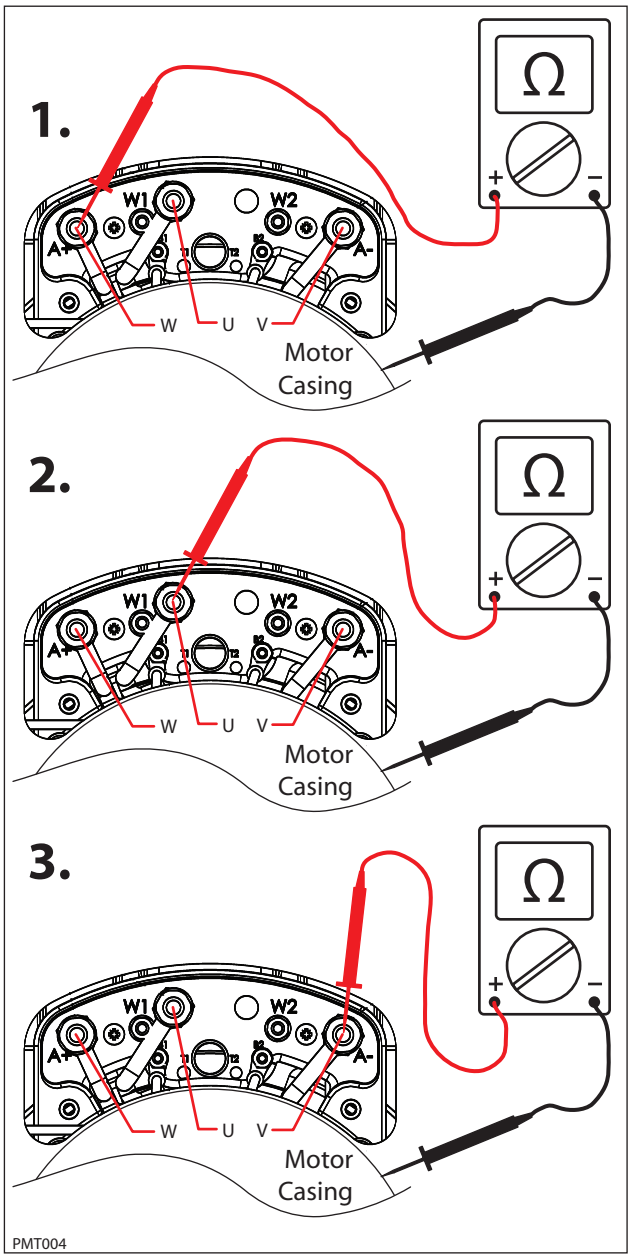
3. Disconnect U, V, and W cables from W1, A-, and A+ terminals (respectively).



4. Use an ohmmeter to test the resistance of all three motor windings. The resistances of each winding should not be open (O. L). An open winding indicates a faulty motor.

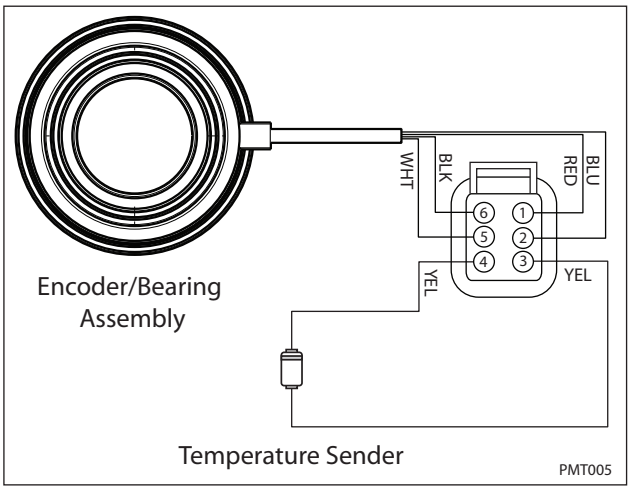


5. Test the resistance between all three motor terminals and the motor case. The ohmmeter should read “O. L.” or open. A shorted winding indicates a faulty motor.



6. The drive motor temperature sender and motor encoder are non-serviceable components. The motor encoder senses rotor position, speed, and direction. The encoder is integrated into an internal roller bearing assembly. See *PROPEL CONTROLLER DIAGNOSTIC CODES* for encoder related faults.

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



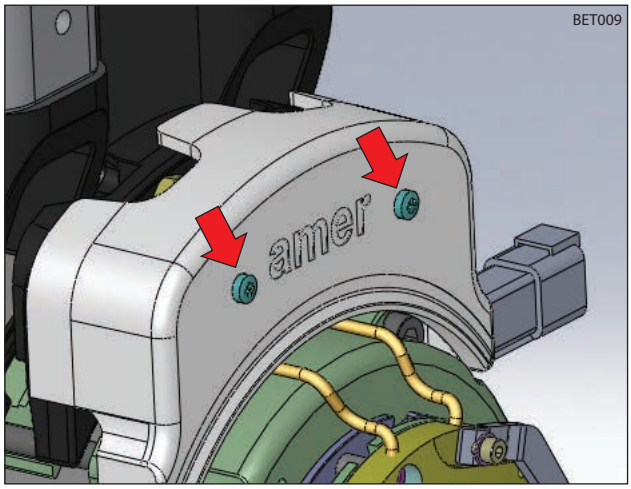
Temperature		Resistance (Ω)		
(°C)	(°F)	MIN.	TYP.	MAX.
-30	-22	362	381	368
0	32	464	486	507
25	77	565	588	611
30	86	587	610	633
50	122	679	704	728
70	158	781	806	831
80	176	835	860	885
100	212	950	975	1000
110	230	1007	1036	1064

TESTING THE PROPEL MOTOR CABLES

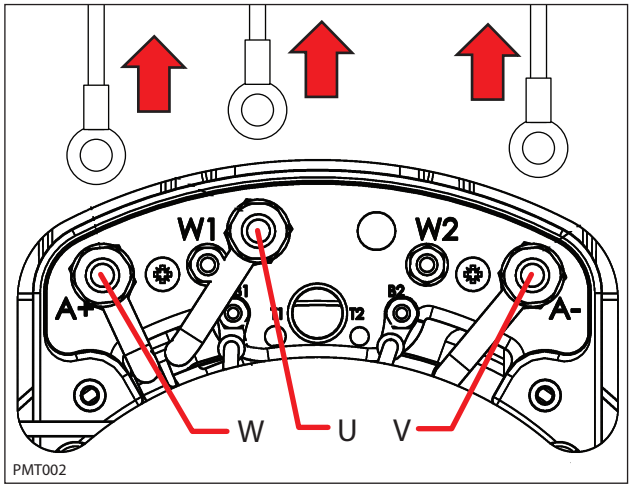
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, remove key, and set parking brake.

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

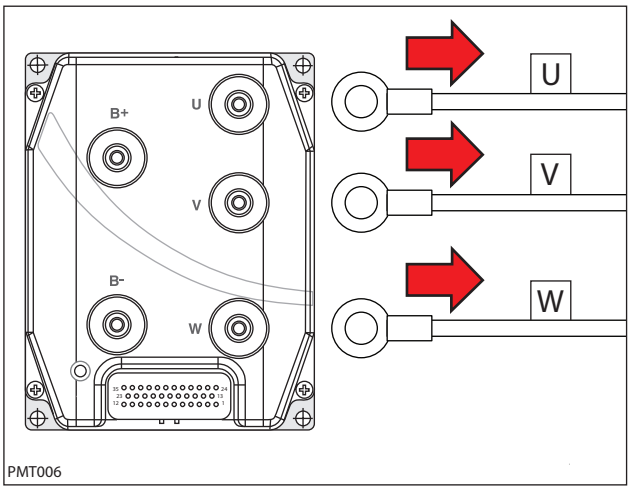
1. Turn key switch OFF.
2. Remove terminal box cover.



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

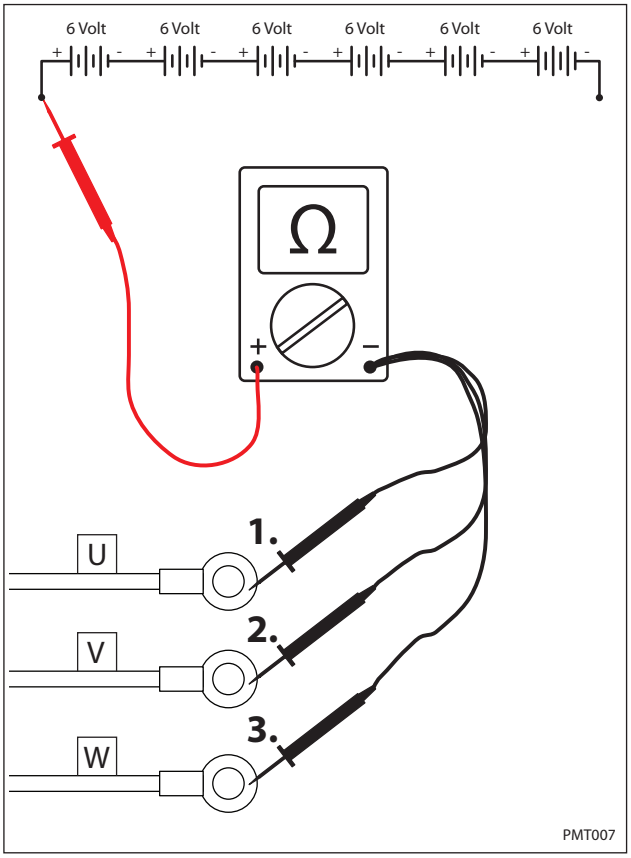


4. Disconnect U, V, and W cables from the Propel Controller.



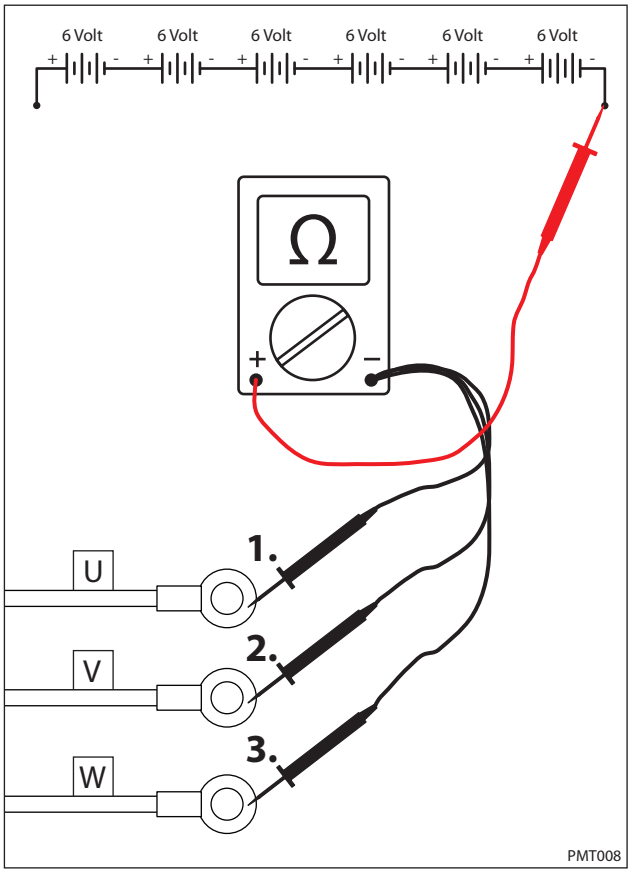
5. Reconnect battery connection and test each cable using an ohmmeter for a short to battery +. Each cable should test as “O. L.” or open to battery +.

   Replace shorted cable(s).



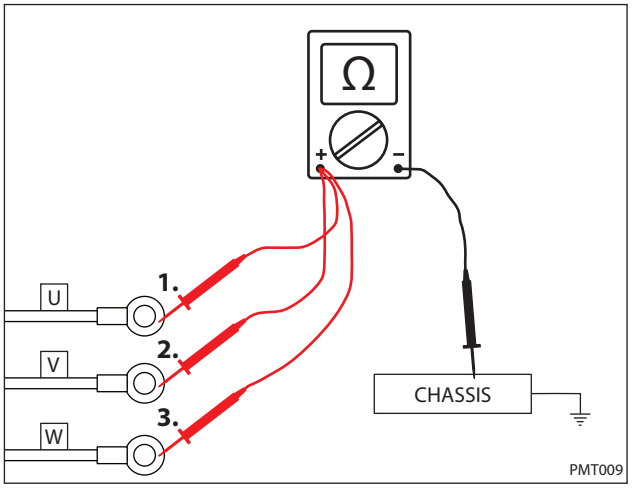
6. Use an ohmmeter to test each cable for a short to battery -. Each cable should test as “O. L.” or open to battery -.

   Replace shorted cable(s).



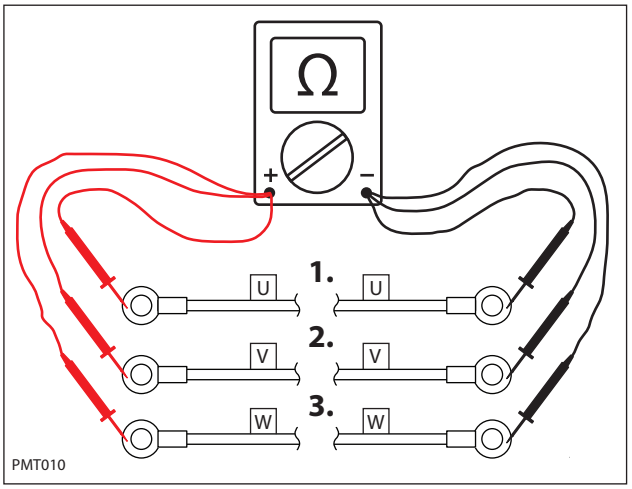
7. Test each cable using an ohmmeter for a short to chassis as shown below. Each cable should test as “O. L.” or open to chassis.

   Replace shorted cable(s).



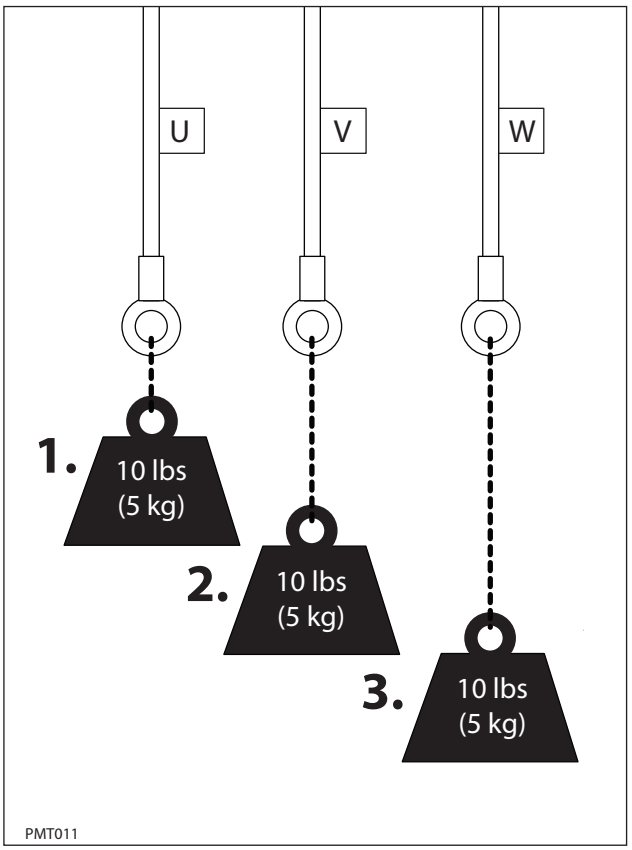
8. Use an ohmmeter to test each cable for end-to-end continuity. Each cable should test between 0-1Ω resistance.

   Replace open cable(s).



9. “Tug test” each cable (motor end) to determine if a cable is broken inside the insulation. Do not exceed 10 lbs (45 N) of force as cable damage may occur.

   Replace broken cables.



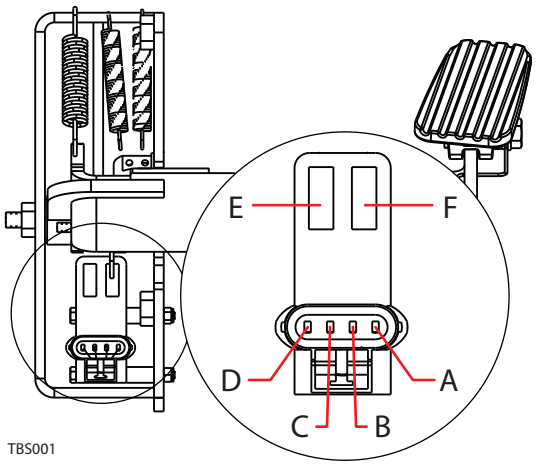
TESTING THE THROTTLE SENSOR

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

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

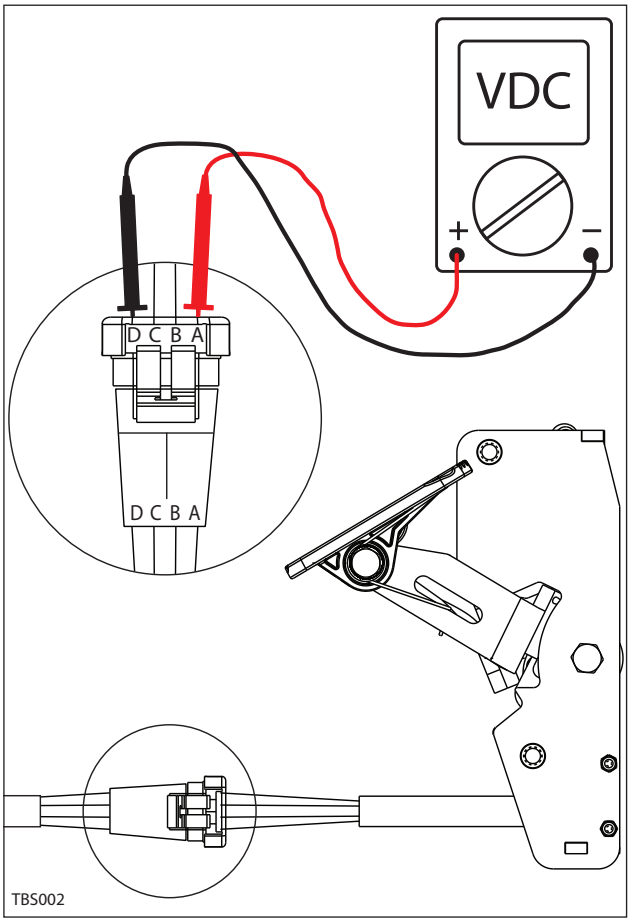
FOR SAFETY: When servicing machine, avoid moving parts. Do not wear loose jackets, shirts, or sleeves when working on machine.

1. Jack machine up so front drive wheel is not touching the floor. Block machine up with jack stands.
2. The throttle hall effect sensor is a component of the pedal subassembly.



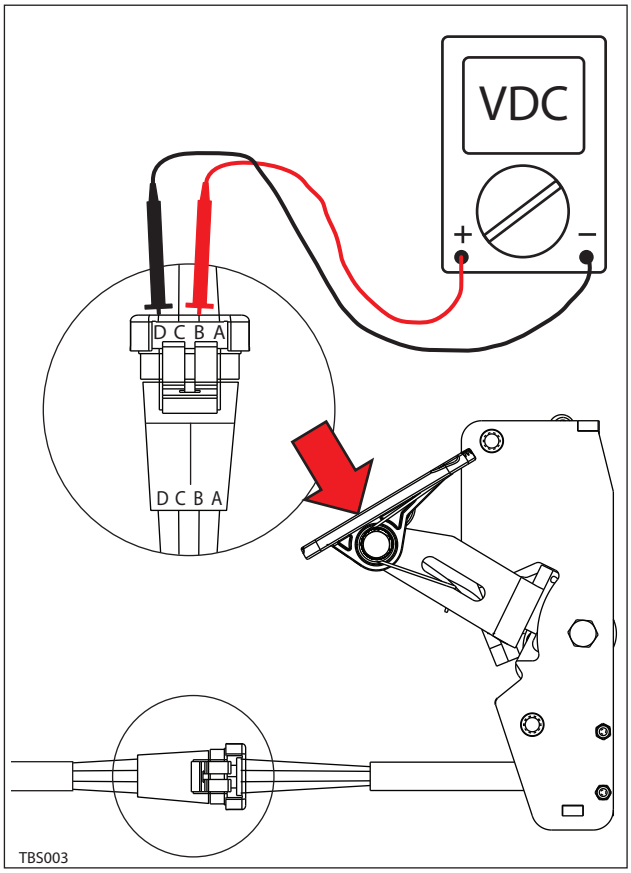
Pin/Cavity	Notes	Color
A	Power (Battery +)	Red.
B	Pro Pel Output (0-5 VDC)	Yellow
C	Brake	Blue
D	Ground (Battery -)	Black
E	Not Used	N/A
F	Gate B	N/A

3. Turn key switch ON.
4. Use a voltmeter to back probe the power supply to the throttle sensor terminals A and D. The voltmeter should display battery voltage.



5. Turn key switch ON.

6. Use a voltmeter to back probe the throttle sensor output terminals B and D. The voltmeter should display 0-5 volts proportional to 0-100% propel pedal movement.



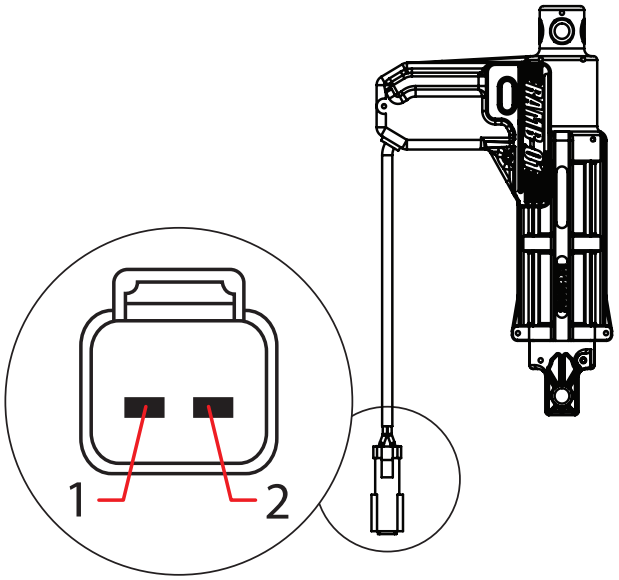
TESTING THE SIDE SWEEP ACTUATOR(S)

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

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

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

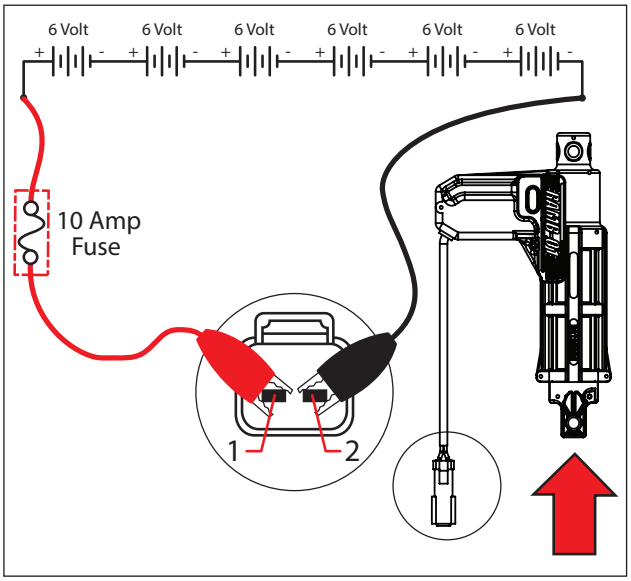
1. Turn key switch OFF.
2. Disconnect the side brush lift actuator from the wire harness.



Pin Assignment	
2	Black
1	Black

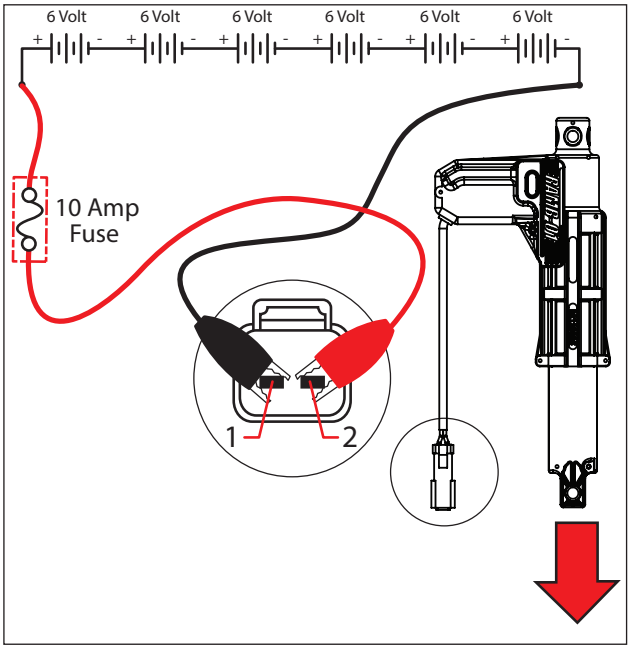
3. Use fuse-protected jumper leads to apply battery voltage to the lift actuator. Connect battery positive (+) to terminal 1 and battery negative (-) to terminal 2. The actuator should retract completely.

   Replace the actuator if it fails to retract.



4. Reverse polarity and apply battery voltage to the lift actuator using fuse-protected jumper leads. Connect battery negative (-) to terminal 1 and battery positive (+) to terminal 2. The actuator should extend completely.

   Replace the actuator if it fails to extend.



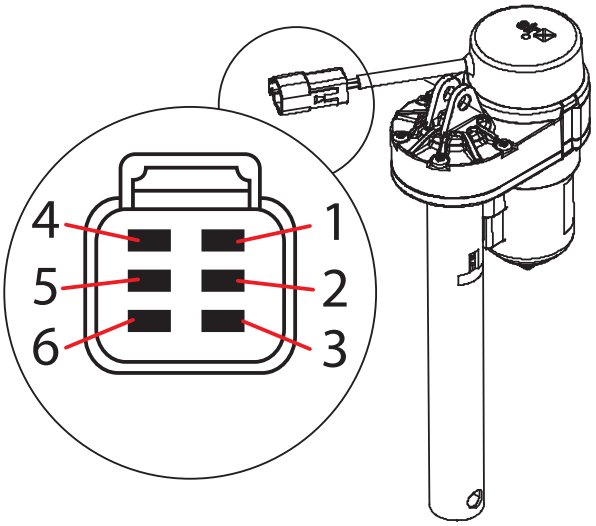
TESTING THE MAIN SWEEP ACTUATOR

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

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

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

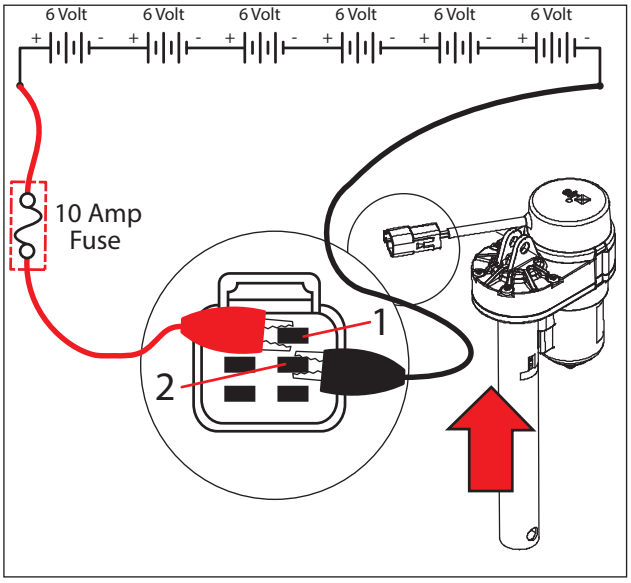
1. Turn key switch OFF.
2. Disconnect the main brush lift actuator from the wire harness.



Pin Assignment	
1	Red
2	Black
3	Black
4	Yellow/Green
5	Open
6	Open

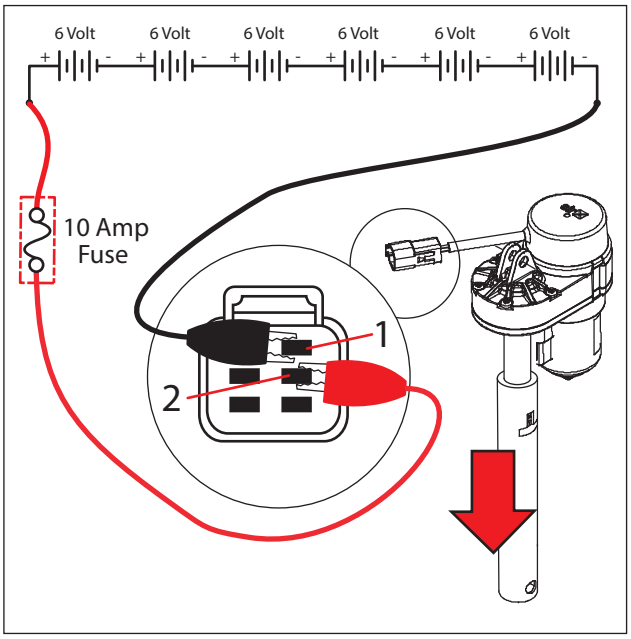
3. Use fuse-protected jumper leads to apply battery voltage to the lift actuator. Connect battery positive (+) to terminal 1 and battery negative (-) to terminal 2. The actuator should retract completely.

   Replace the actuator if it fails to retract.



4. Use fuse-protected jumper leads to reverse polarity and apply battery voltage to the lift actuator. Connect battery negative (-) to terminal 1 and battery positive (+) to terminal 2. The actuator should extend completely.

   Replace the actuator if it fails to extend.

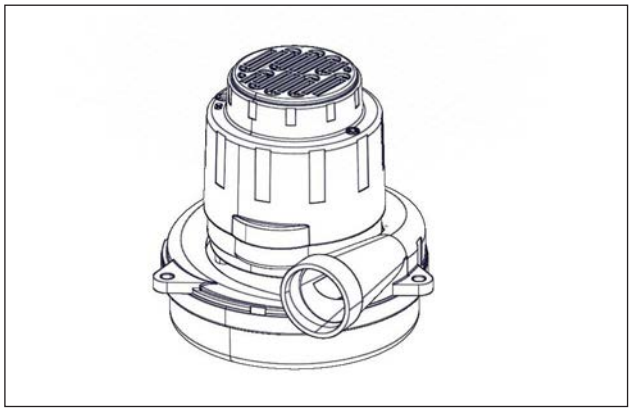


TESTING THE SWEEP/HEPA VACUUM FAN

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

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

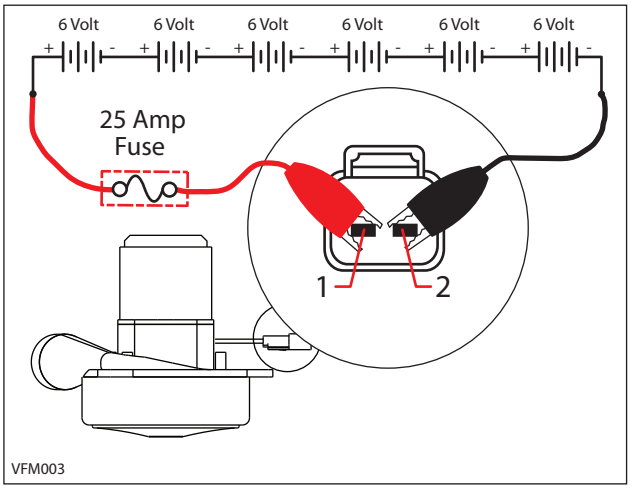
1. Turn key switch OFF.
2. Disconnect the wire harness from the vacuum fan.



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

4. Use fuse-protected jumper leads to apply battery voltage to the vacuum fan(s). The fan should turn On.

   Replace the vacuum fan if it fails to turn on.



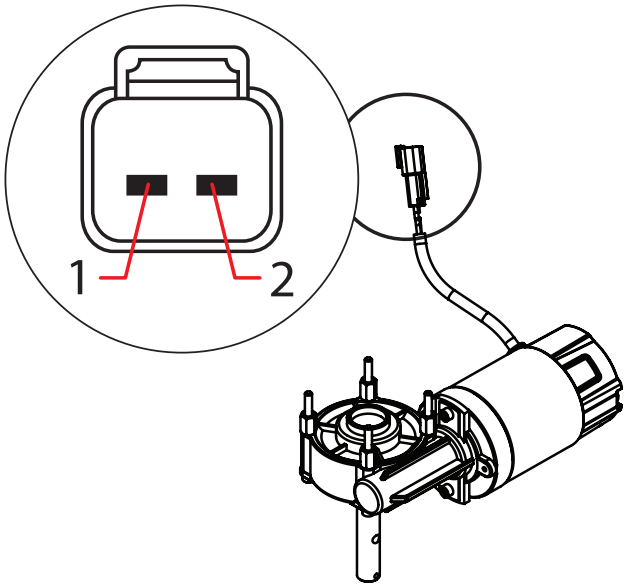
5. Reconnect vacuum fan(s) to wire harness. See *MANUAL MODE*. Activate the vacuum fan in Manual Mode. The amperage displayed should be approximately 14-20 Amps (average 16 Amps).

TESTING THE SIDE SWEEP BRUSH MOTOR(S)

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

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

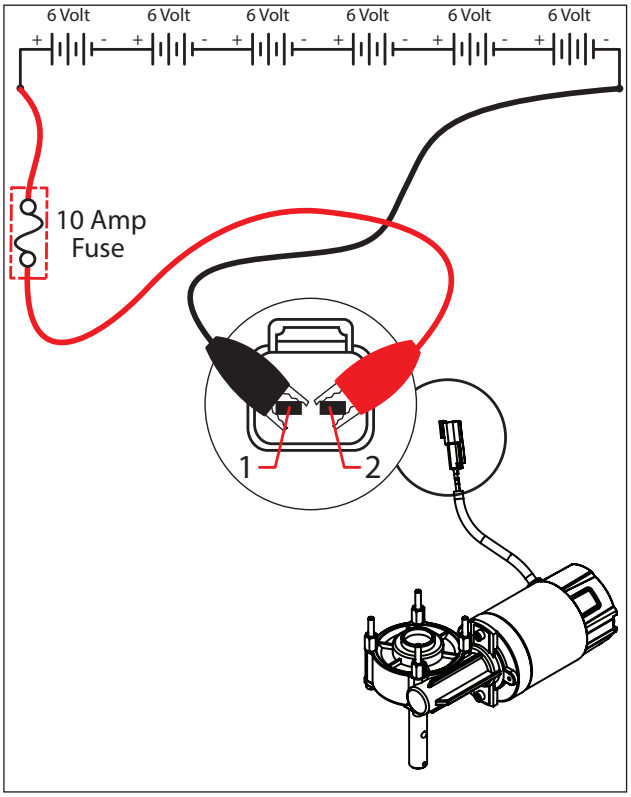
1. Turn key switch OFF.
2. Disconnect the side brush motor from the wire harness.



Pin Assignment	
2	Brown
1	Blue

3. Use fuse-protected jumper leads to apply battery voltage to the side brush motor. The side brush motor should turn On.

   Replace the side brush stop motor if it fails to turn on.



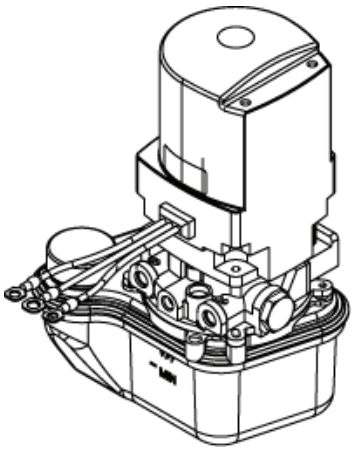
TESTING THE HOPPER PUMP MOTOR

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

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

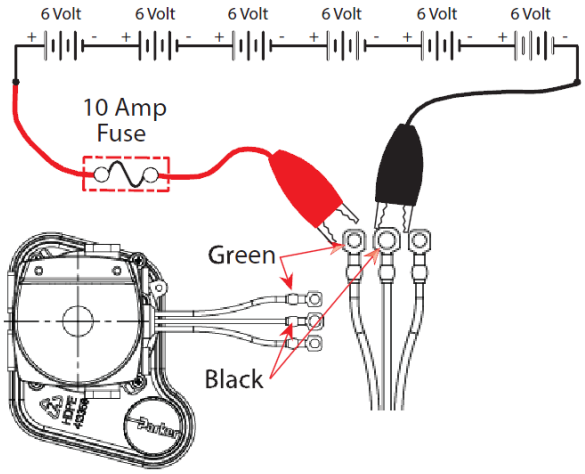
FOR SAFETY: When servicing machine, avoid moving parts. Do not wear loose jackets, shirts, or sleeves when working on machine.

1. Turn key switch OFF.
2. Disconnect the wire harness from the hopper lift pump.



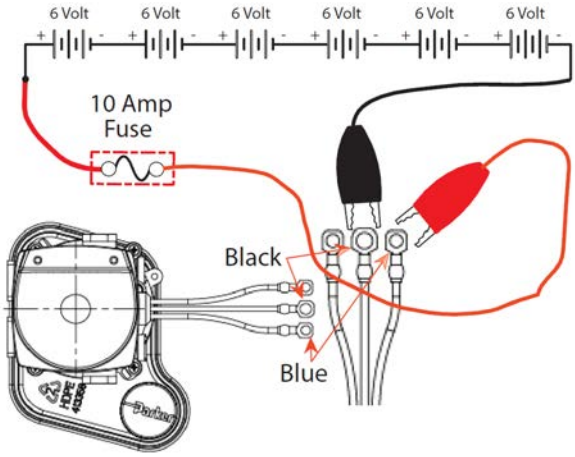
3. Use fuse-protected jumper leads to apply battery voltage to the pump motor. Connect battery positive (+) to green wire and battery negative (-) black wire. The motor should engage hydraulic cylinder to lower.

   Replace the pump if it fails to function properly in either direction.



4. Use fuse-protected jumper leads to apply battery voltage to the pump motor. Connect battery positive (+) to blue wire and battery negative (-) to black wire. The motor should engage hydraulic cylinder to raise.

   Replace the pump if it fails to function properly in either direction.



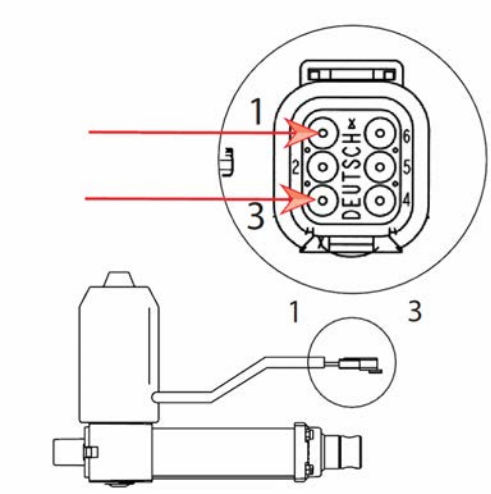
TESTING THE HOPPER ROLL IN/ROLL OUT ACTUATOR

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

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

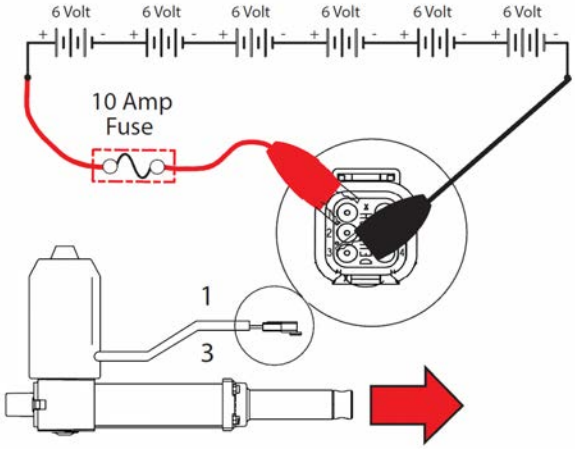
FOR SAFETY: When servicing machine, avoid moving parts. Do not wear loose jackets, shirts, or sleeves when working on machine.

1. Turn key switch OFF.
2. Disconnect the wire harness from the roll out actuator.



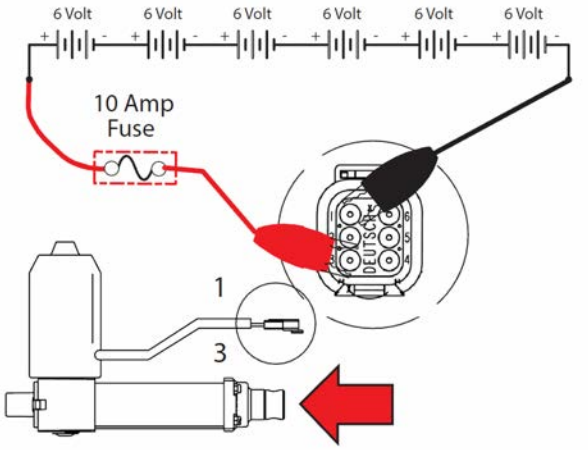
3. Use fuse-protected jumper leads to apply battery voltage to the actuator. Connect battery positive (+) to terminal 1 and battery negative (-) to terminal 3. The actuator should extend completely.

   Replace the actuator if it fails to extend.



4. Use fuse-protected jumper leads to apply battery voltage to the roll out actuator. Connect battery positive (+) to terminal 3 and battery negative (-) 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

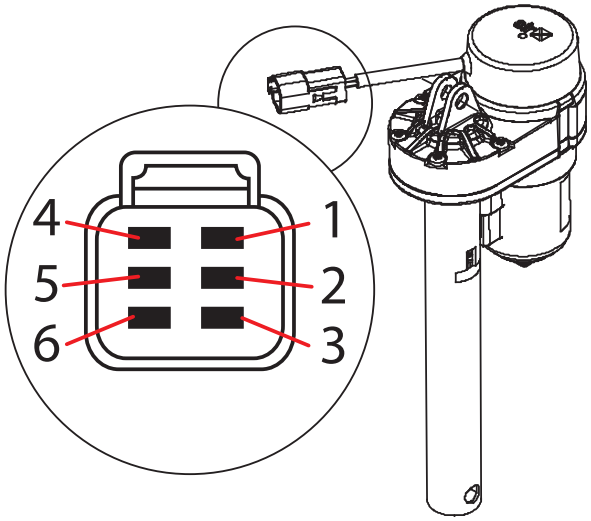
TESTING THE MAIN SWEEP ACTUATOR

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

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

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

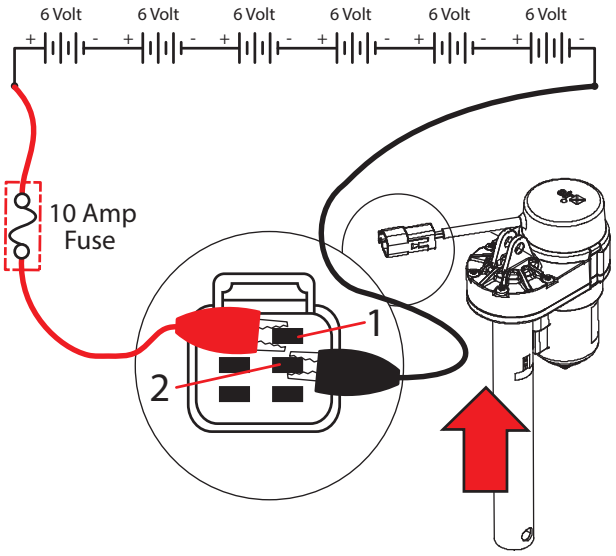
1. Turn key switch OFF
2. Disconnect the wire harness from the main sweep lift actuator.



Pin Assignment	
1	Red
2	Black
3	Black
4	Yellow/Green
5	Open
6	Open

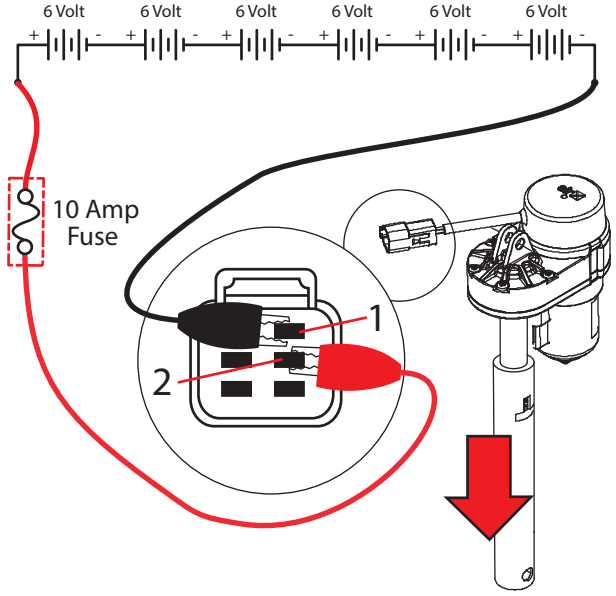
3. Use fuse-protected jumper leads to apply battery voltage to the lift actuator. Connect battery positive (+) to terminal 1 and battery negative (-) to terminal 2. The actuator should retract completely.

   Replace the actuator if it fails to retract.



4. Use fuse-protected jumper leads to reverse polarity and apply battery voltage to the lift actuator. Connect battery negative (-) to terminal 1 and battery positive (+) to terminal 2. The actuator should extend completely.

   Replace the actuator if it fails to extend.



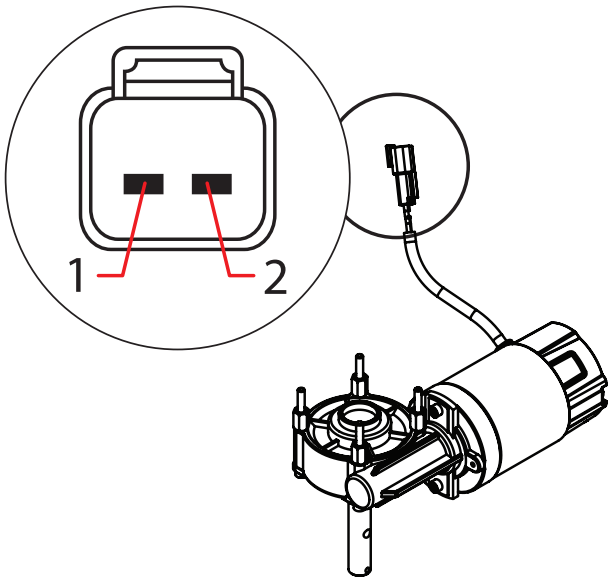
TESTING THE MAIN SWEEP BRUSH MOTOR

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

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

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

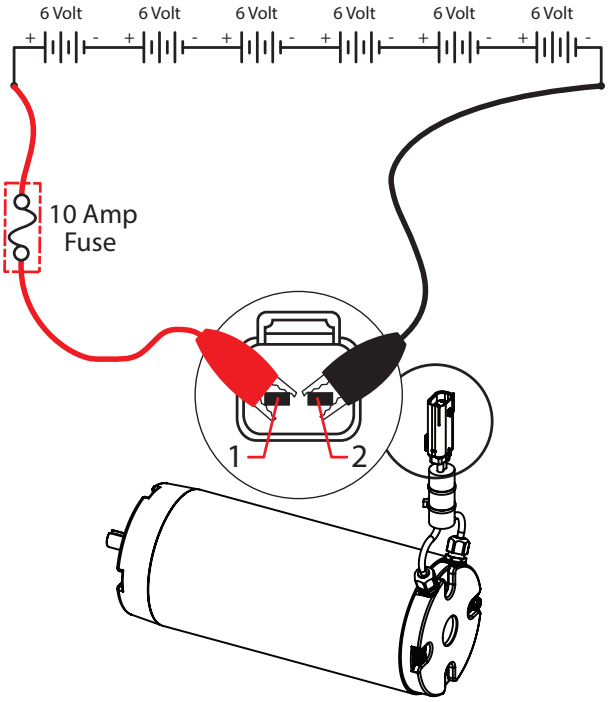
1. Turn key switch OFF.
2. Disconnect the wire harness from the brush motor(s).



Pin Assignment	
1	Red
2	Black

3. Use fuse-protected jumper leads to apply battery voltage to the brush motor. 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	
Counter Clockwise	Clockwise
Red (+)	Black (+)
Black (-)	Red (-)

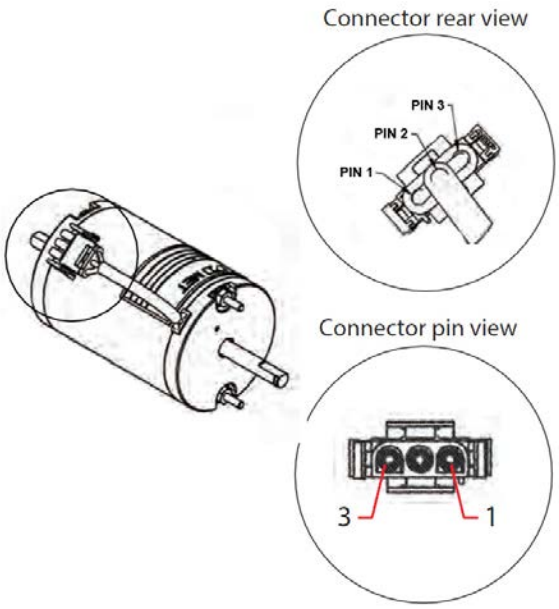
TESTING THE FILTER SHAKER MOTOR

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

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

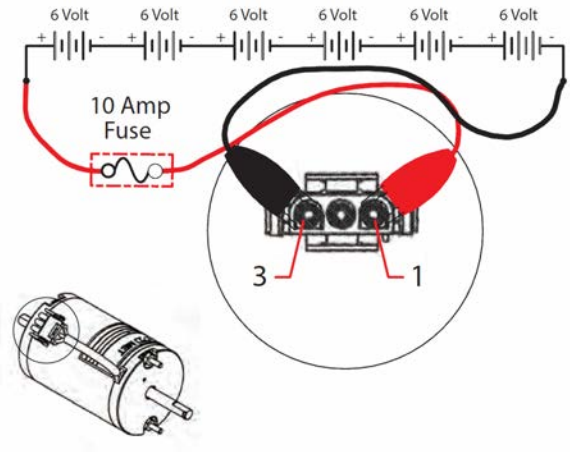
FOR SAFETY: When servicing machine, avoid moving parts. Do not wear loose jackets, shirts, or sleeves when working on machine.

1. Turn key switch OFF.
2. Disconnect the wire harness from the shaker motor.



3. Use fuse-protected jumper leads to apply battery voltage to the shaker motor. The shaker motor should turn ON.

   Replace the shaker motor if it fails to turn on.



Motor Rotation	
Pin 1	Red (+)
Pin 2	Green (grd)
Pin 3	Black (-)

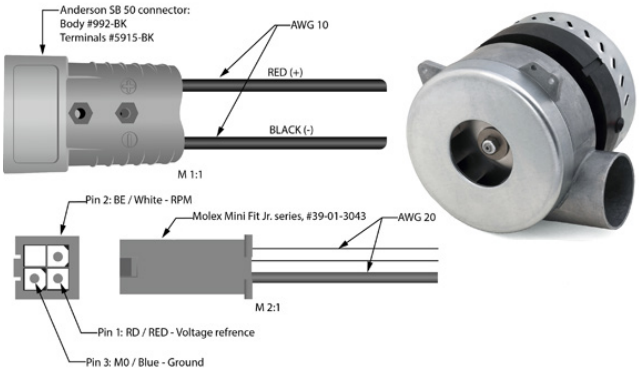
TESTING THE VACUUM WAND FAN

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

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

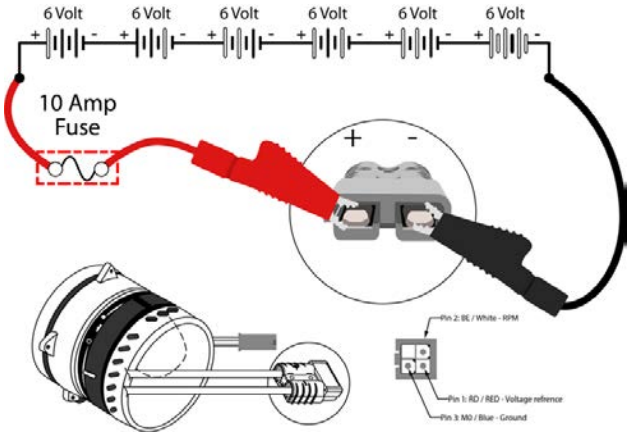
FOR SAFETY: When servicing machine, avoid moving parts. Do not wear loose jackets, shirts, or sleeves when working on machine.

1. Turn key switch OFF.
2. Disconnect the wire harness from the dry vacuum fan.



3. Use fuse-protected jumper leads to apply battery voltage to the vacuum fan. Connect battery positive (+) to terminal 1 and battery negative (-) to terminal 2. The vacuum fan should come on.

   Replace the vacuum fan if it fails to come on.



DISPLAYING FAULT CODES ON SERVICE DEVICE

SYSTEM REQUIREMENTS: Windows® 10 Operating System and USB to Mini-USB cable.

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

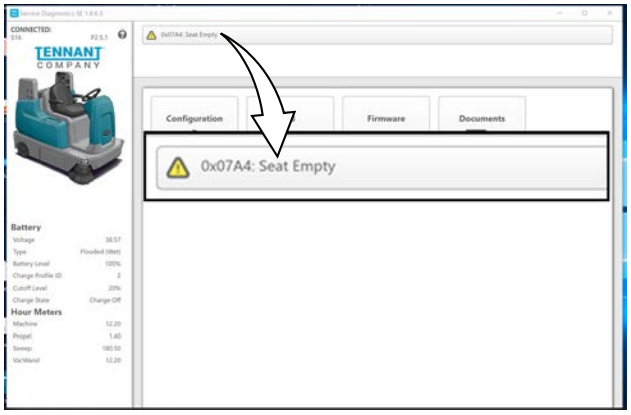
1. Remove the front access panel from the steering channel and connect the USB cable to the service device and the machine.

2. Turn key switch ON.

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

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

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



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

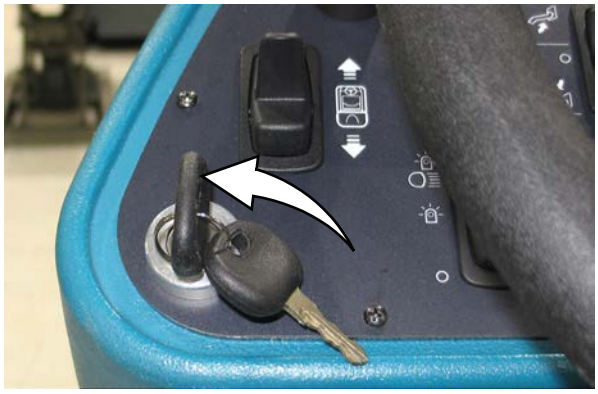
ENTERING THE MANUAL MODE

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

NOTE: Neither hopper lift nor hopper rollout functions are operable while machine is in manual mode.

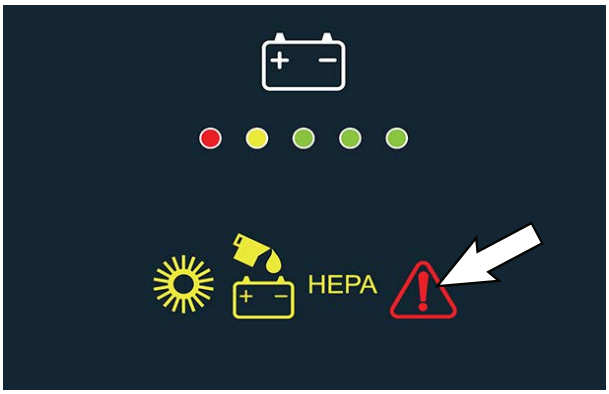
NOTE: An operator must be seated in the operator seat to place the machine into the manual mode and to change manual mode functions. Operator can leave the operator seat once the machine is set to a particular manual mode function.

1. Turn the key switch OFF.



2. Press and hold the center of the *1-Step button* and turn the key switch ON.

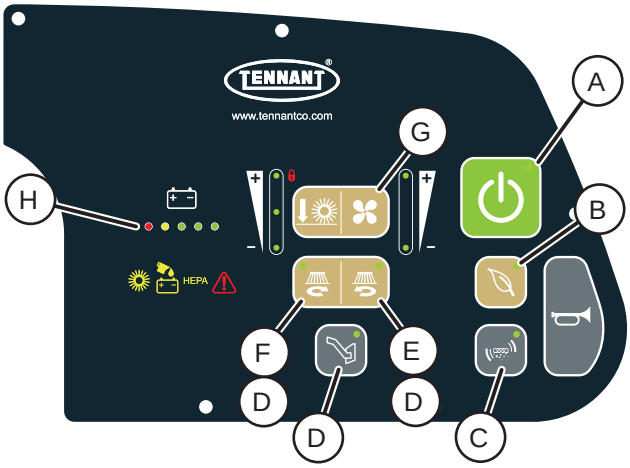
3. Continue holding the *1-Step button* until the service indicator begins to flash slowly, indicating the machine is in the manual mode.\



4. Release the *1-Step button*.

NOTE: The key switch can be turned OFF at anytime to exit the manual mode.

5. Press the applicable button to access the corresponding function. The applicable function LED lights will be illuminated while the selected function is in the manual mode.



A. Press to toggle the main sweep motor on and off.

B. Machines with optional ABW (Automatic Battery Watering) system only: Press to toggle the ABW system on and off.

C. Press to toggle the filter shaker motor on and off.

D. Press to toggle between brush motor control, actuator extend, and actuator retract.

   The machine defaults to brush motor control manual mode when initially placed in manual mode. The LED will not be illuminated.

   Press the button once to place machine in actuator extend manual mode. The LED will be illuminated solid.

   Press the button a second time to place machine in actuator retract manual mode. The LED will be slowly flashing.

   Press the button a third time to return to brush motor control manual mode.

E. While in actuator extend press right side sweep button to extend the right side sweep brush.

   While in actuator retract press right side sweep button to retract the right side sweep brush.

F. While in actuator extend press left side sweep button to extend the left side sweep brush.

   While in actuator retract press left side sweep button to retract the left side sweep brush.

G. Press to toggle the main/HEPA vacuum fan on and off.

H. Indicates battery discharge level.

SERVICE

SERVICE DIAGNOSTICS TOOL

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

Factory-Direct Tennant Service personnel have the Service Diagnostics software installed on their ServiceLink devices. Authorized service providers can download the Service Diagnostics software. Authorized service providers must uninstall and reinstall the service diagnostic program to get firmware updates. The authorized service provider version does not self update.

A USB cable connects from the service device to the control console (USB to mini USB adapter cable required). The SERVICE DIAGNOSTICS TOOL can configure multiple control modules.

- **Interface Circuit Board:** Located inside the front shroud behind the membrane panel assembly.
- **Main Sweep Circuit Board:** Located inside the control housing behind the left shroud.
- **Propel Controller (C3):** Located on the steering support channel.
- **ABW (Automatic Battery Watering) Controller:** Located on the right lift arm.

PROGRAMMING A NEW INTERFACE MODULE

SYSTEM REQUIREMENTS: Windows® 10 Operating System and USB to Mini-USB cable.

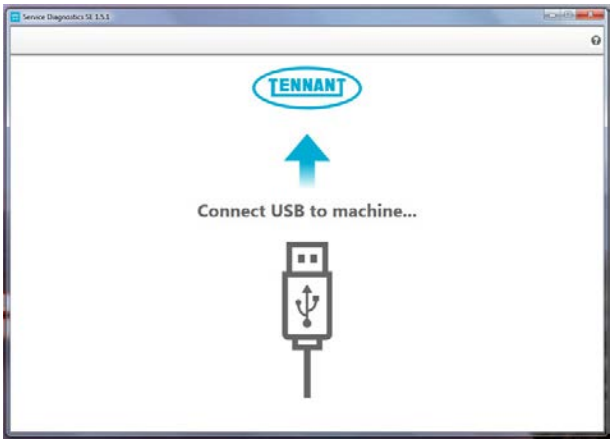
1. Remove the front access panel from the steering channel and connect a USB cable to the service device and the machine.

2. Turn key switch ON.

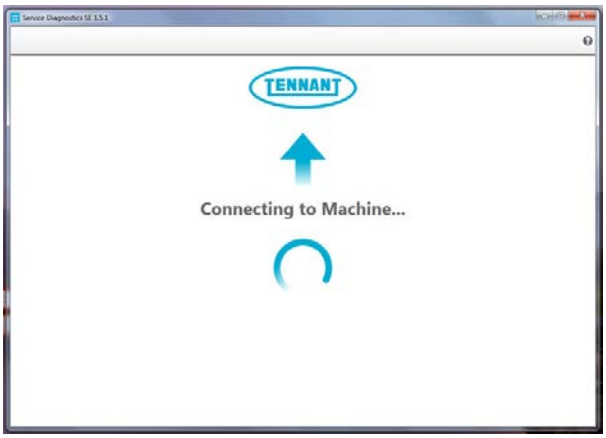
3. Double click the Service Diagnostics desktop shortcut or find the software in All Programs to launch the software.

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

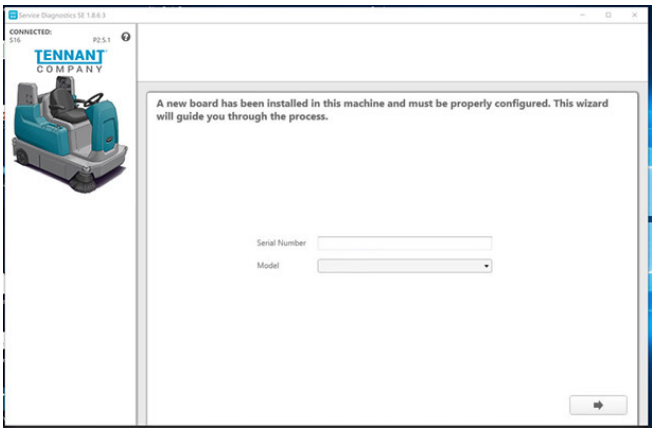
NOTE: Confirm key switch is ON and check USB cable connection to the machine if the screen below appears on the computer screen.



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



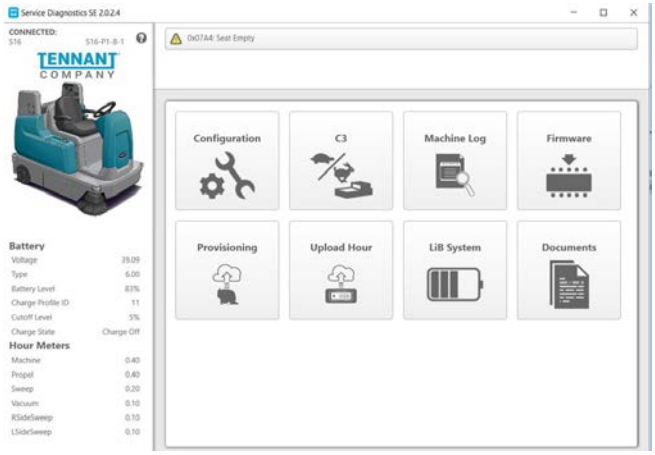
5. The Service Diagnostics tool automatically detects a new interface module installation if a new interface module was installed. Enter the model and serial number and then click the arrow button.



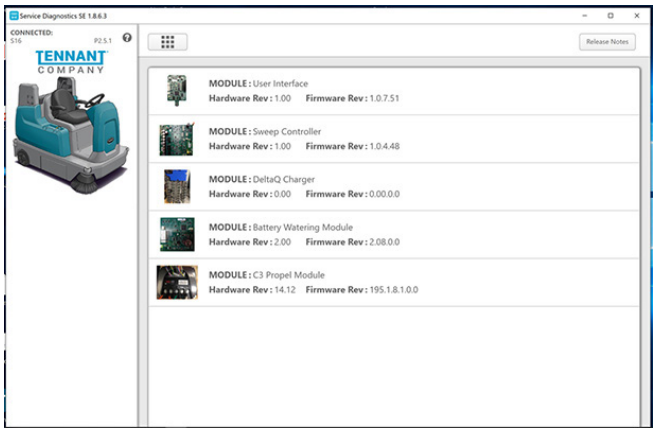
6. Inspect the actual machine configuration and match applicable configurations from the drop-down menus and then click on the arrow button.

NOTE: Reconfiguring may take several minutes.

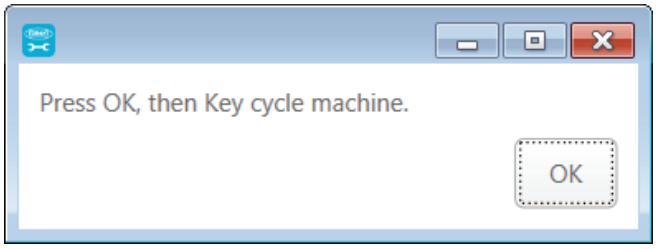
NOTE: Configurations may differ from what is shown, depending on the options/features equipped on the machine. If no interface module was installed, this screen will appear first. First confirm there is no Firmware update available. If a Firmware update is available, the Firmware update should be done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



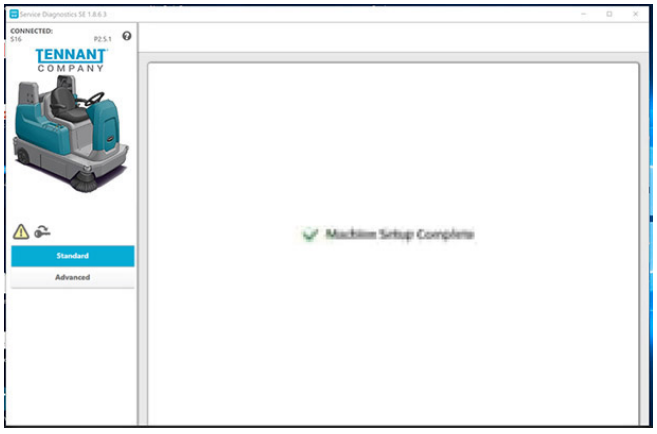
7. The programming process begins and all control modules are updated (if applicable).



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



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



RECONFIGURING THE MACHINE AFTER NEW HARDWARE/OPTION INSTALLATION

SYSTEM REQUIREMENTS: Windows® 10 Operating System and USB to Mini-USB cable.

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

Factory-Direct Tennant Service personnel have the Service Diagnostics software installed on their ServiceLink devices. Authorized service providers can download the Service Diagnostics software. Authorized service providers must uninstall and reinstall the service diagnostic program to get firmware updates. The authorized service provider version does not self update.

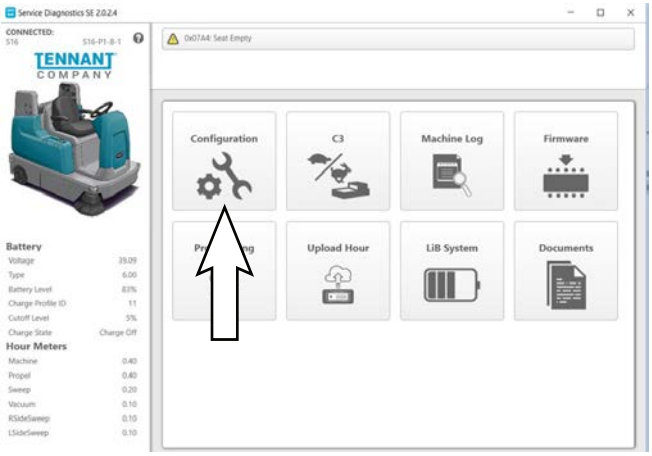
A USB cable connects from the service device to the control console (USB to mini USB adapter cable required). The SERVICE DIAGNOSTICS TOOL can configure multiple control modules.

1. Remove the front access panel from the steering channel and connect a USB cable to the service device and the machine.

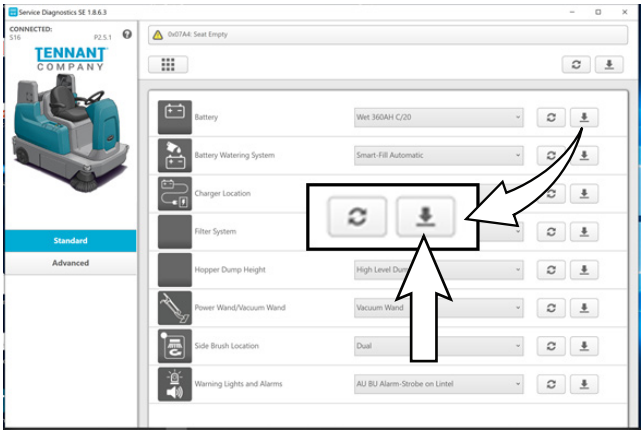
2. Turn key switch ON.

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

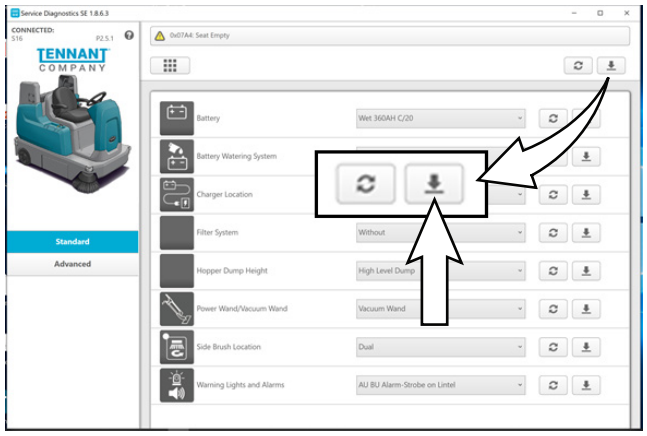
4. Click on the Configuration button to display a list of configurable options.



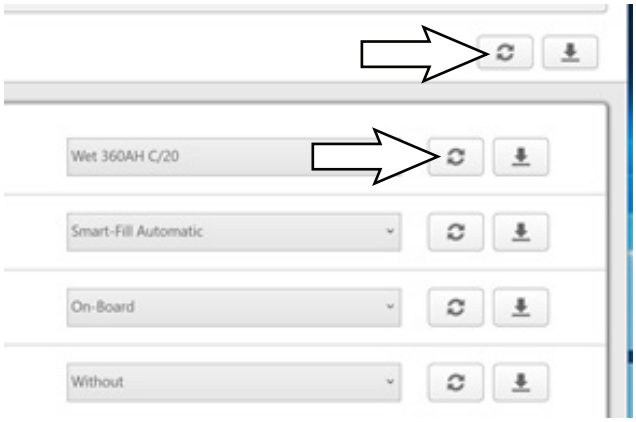
5. Select the configurable options that apply from the drop down menus and then click individual arrow buttons to launch individual module reprogramming (this is quicker).



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



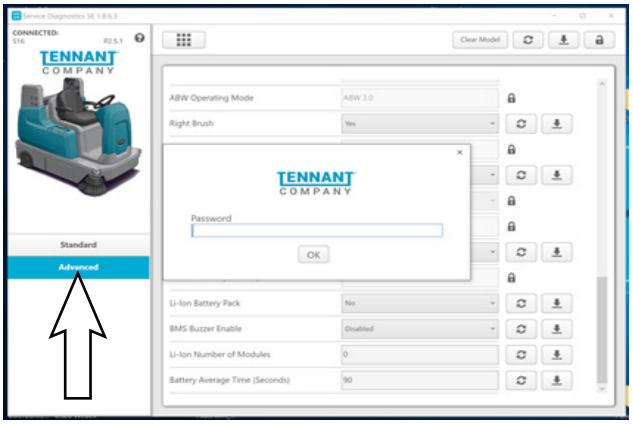
6. Click the refresh button to display the new configuration after reprogramming is completed.



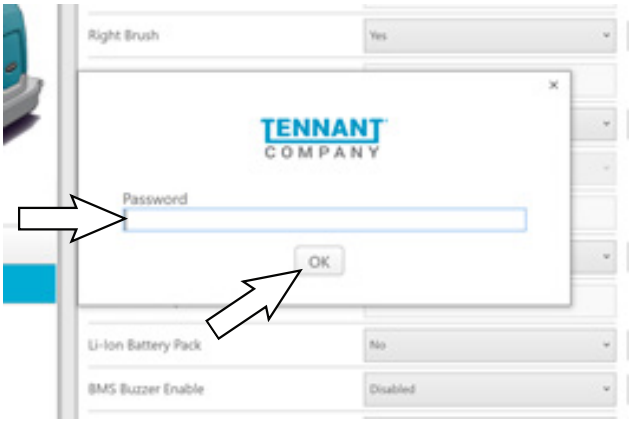
7. Cycle the key switch to save the new configuration setting(s).

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

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

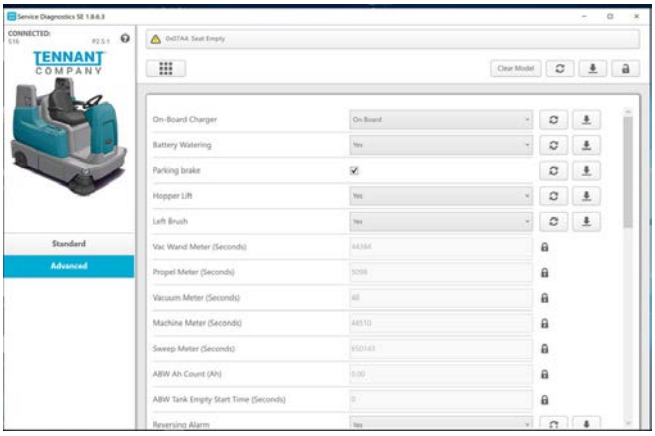


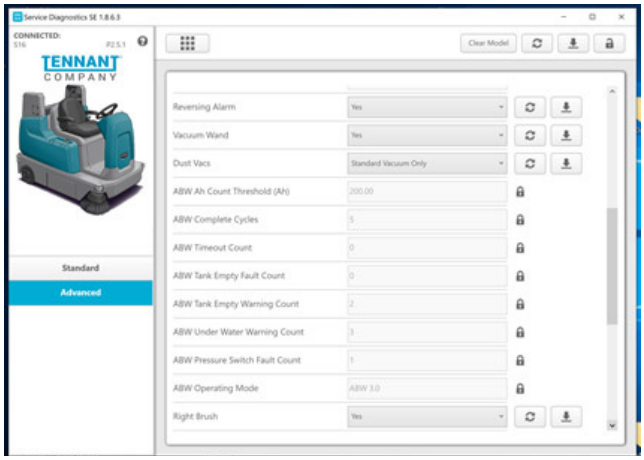
9. Enter the password into the password box and click the OK button. Contact T.A.C. (Tennant Assistance Center) for required password.

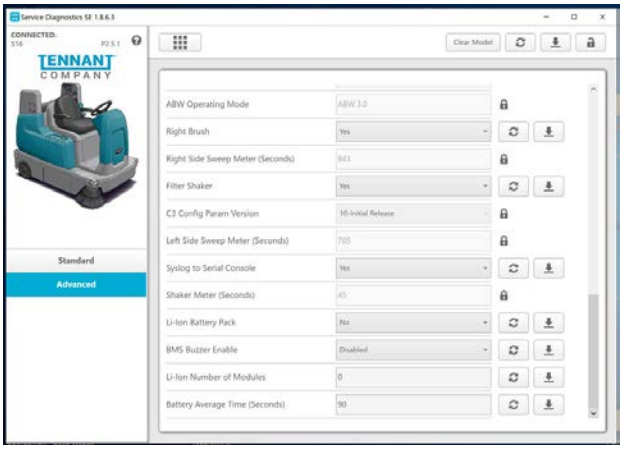


10. Access the advanced configuration screen to reset component hours or record old hours on repair order for warranty purposes.

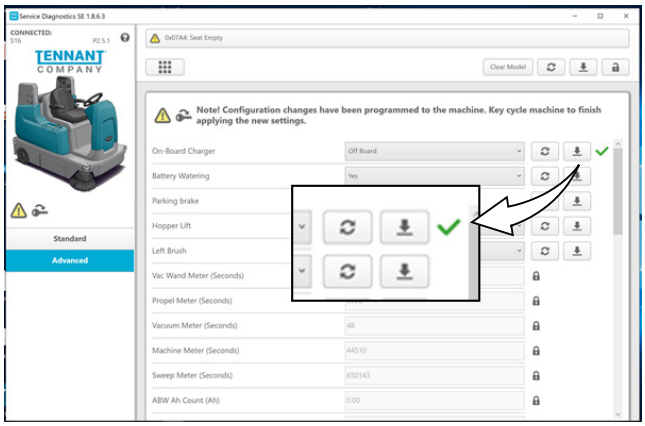
11. Cycle the key switch to save and exit the Advanced Configuration screen.



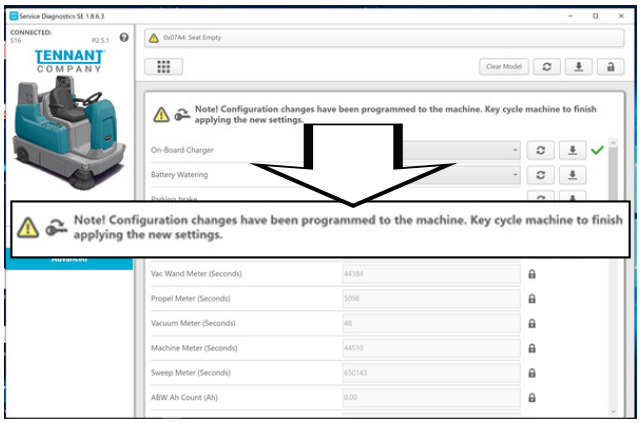




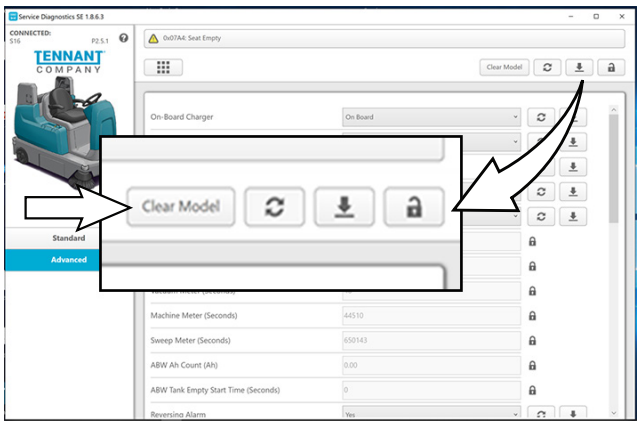
12. A check appears next to the item reconfigured after reconfiguring is complete.



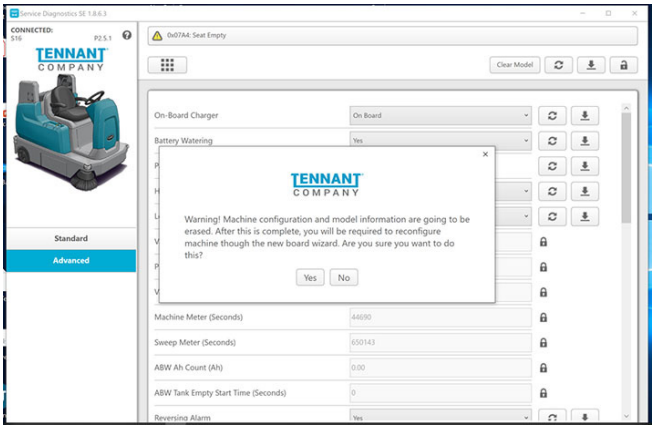
Cycle the key switch to save the new advanced configuration setting(s). That setting(s) will not be saved until the machine is key cycled.

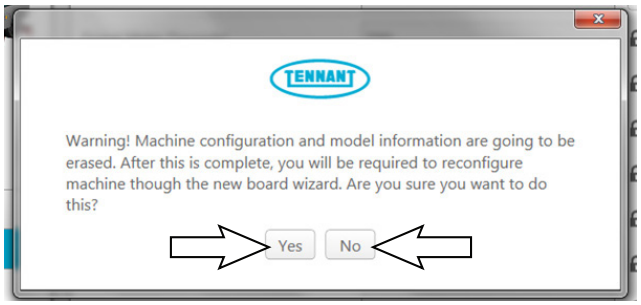


13. If the machine must be completely reconfigured, select the Clear Model button to completely clear all previous machine configuration parameters and completely reconfigure the machine.



14. A warning box appears stating “Warning! Machine configuration and model information are going to be erased. After this is complete, you will be required to reconfigure machine through the new board wizard. Are you sure you want to do this?” Select the Yes button to continue complete reconfiguring the machine.





Select the No button to cancel complete machine configuration and return to Advanced configuration screen.

UPDATING THE C3 DRIVE CONTROLLER

SYSTEM REQUIREMENTS: Windows® 10 Operating System and USB to Mini-USB cable.

The C3 Propel Controller controls the drive wheel and allows the machine to move. If a C3 Propel Controller is replaced, the parameters must be updated to ensure proper machine operation.

Factory-Direct Tennant Service personnel have the Service Diagnostics software installed on their ServiceLink devices. Authorized service providers can download the Service Diagnostics software. Authorized service providers must uninstall and reinstall the service diagnostic program to get firmware updates. The authorized service provider version does not self update.

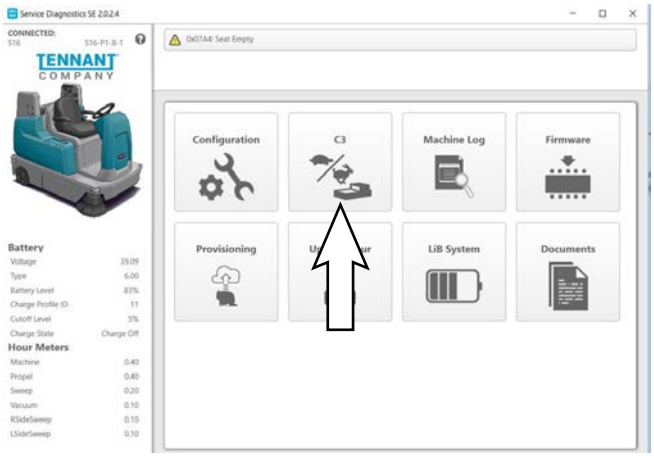
A USB cable connects from the service device to the control console (USB to mini USB adapter cable required). The SERVICE DIAGNOSTICS TOOL can configure multiple control modules.

1. Remove the front access panel from the steering channel and connect a USB cable to the service device and the machine.

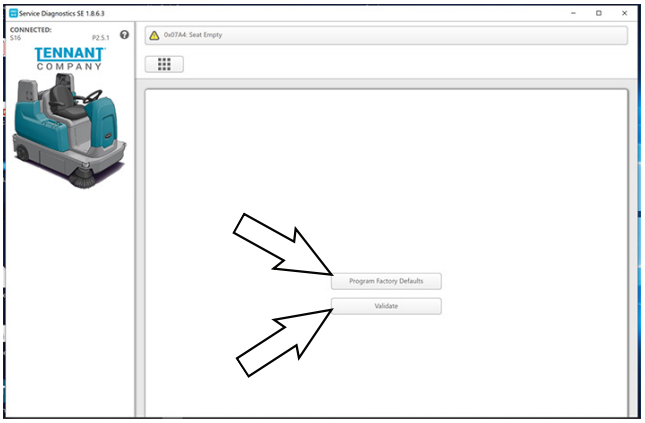
2. Turn key switch ON.

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

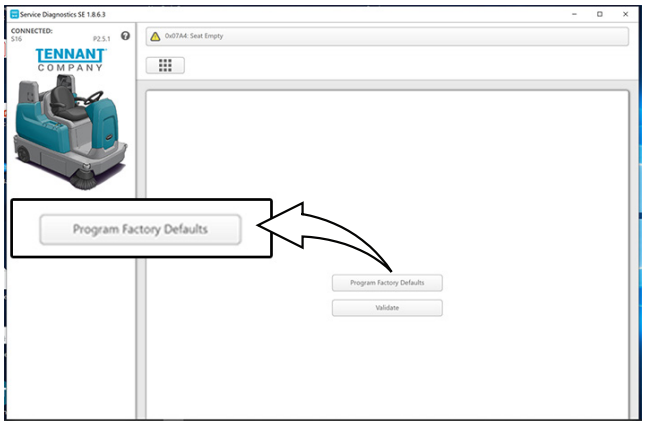
4. Click on the C3 button to access .



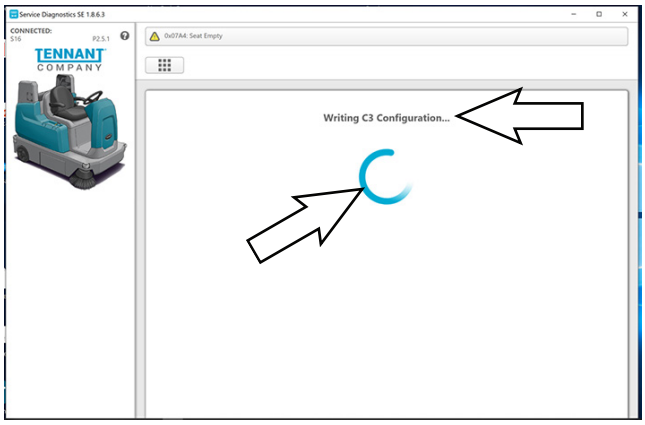
5. Click the Program Factory Defaults button to set the machine to the default factory settings.



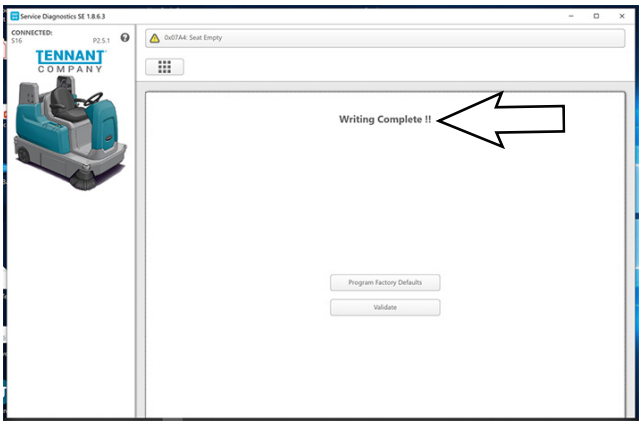
6. Click the Program Factory Defaults button to reset the machine to the factory default settings.



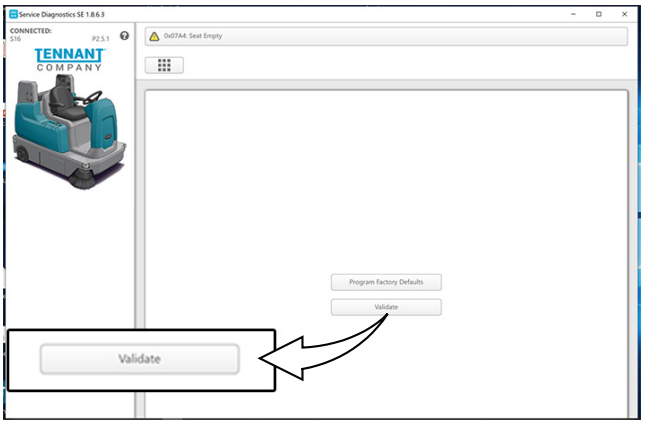
7. A process indicator will appear on the screen. Wait for Writing C3 Configuration...to complete.



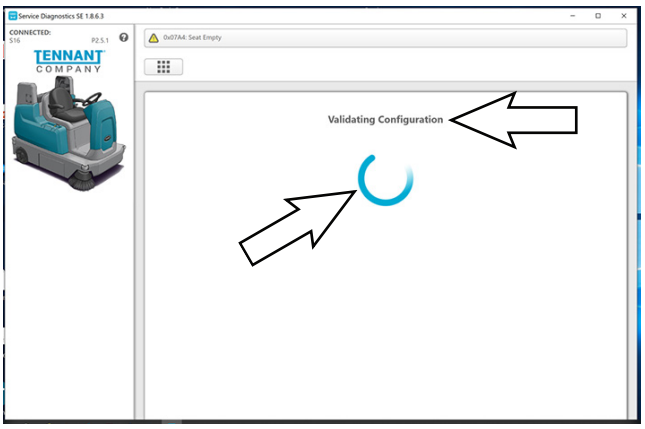
8. Writing Complete!! appears on the screen when programming factory defaults is complete.



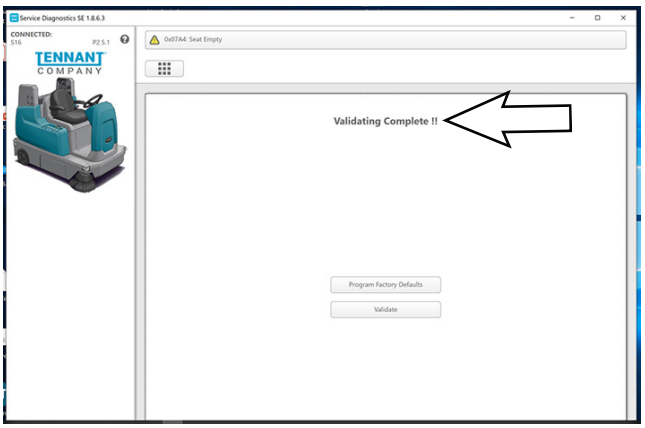
9. Click the Validate button to validate the factory default settings.



10. A process indicator will appear on the screen. Wait for Validating Configuration to complete.



11. Validating Complete!! appears on the screen when validation is complete.



ACCESSING/DOWNLOADING THE MACHINE LOG

SYSTEM REQUIREMENTS: Windows® 10 Operating System and USB to Mini-USB cable.

Access the Machine Log to download all machine error codes onto the service device.

Factory-Direct Tennant Service personnel have the Service Diagnostics software installed on their ServiceLink devices. Authorized service providers can download the Service Diagnostics software. Authorized service providers must uninstall and reinstall the service diagnostic program to get firmware updates. The authorized service provider version does not self update.

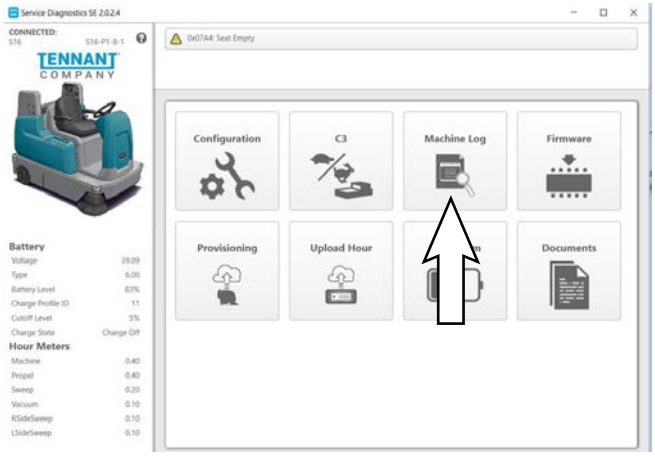
A USB cable connects from the service device to the control console (USB to mini USB adapter cable required). The SERVICE DIAGNOSTICS TOOL can configure multiple control modules.

1. Remove the front access panel from the steering channel and connect a USB cable to the service device and the machine.

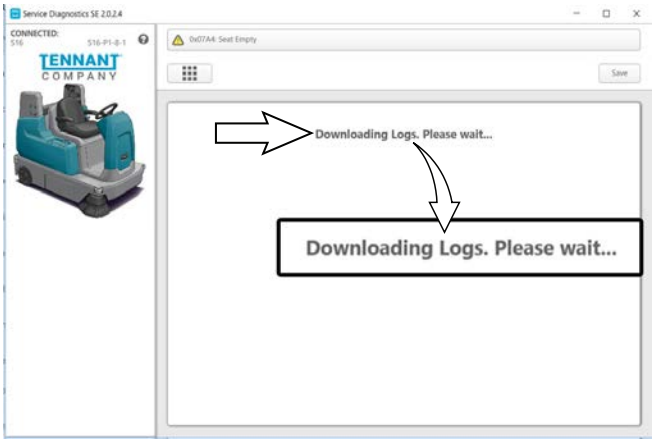
2. Turn key switch ON.

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

4. Click on the Machine Log button to access .

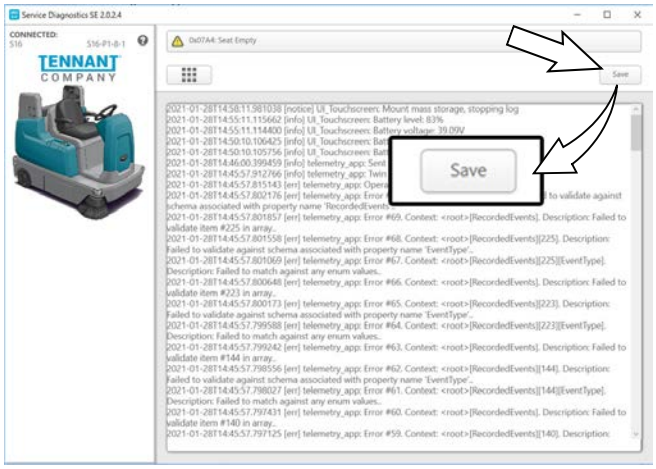


5. Wait for machine to finish downloading the machine logs onto the service device. The Downloading Logs. Please wait....screen appears while the logs are downloading.



6. Click the Save button to save the downloaded logs to the service device.

NOTE: The downloaded logs must be saved to the service device before exiting Machine Log, since downloading the machine logs also removes them from the machine. The machine logs will be lost if they are not saved to service device prior to exiting the Machine Log application.



UPDATING THE MACHINE FIRMWARE

SYSTEM REQUIREMENTS: Windows® 10 Operating System and USB to Mini-USB cable.

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

Factory-Direct Tennant Service personnel have the Service Diagnostics software installed on their ServiceLink devices. Authorized service providers can download the Service Diagnostics software. Authorized service providers must uninstall and reinstall the service diagnostic program to get firmware updates. The authorized service provider version does not self update.

A USB cable connects from the service device to the control console (USB to mini USB adapter cable required). The SERVICE DIAGNOSTICS TOOL can configure multiple control modules.

1. Remove the front access panel from the steering channel and connect a USB cable to the service device and the machine.

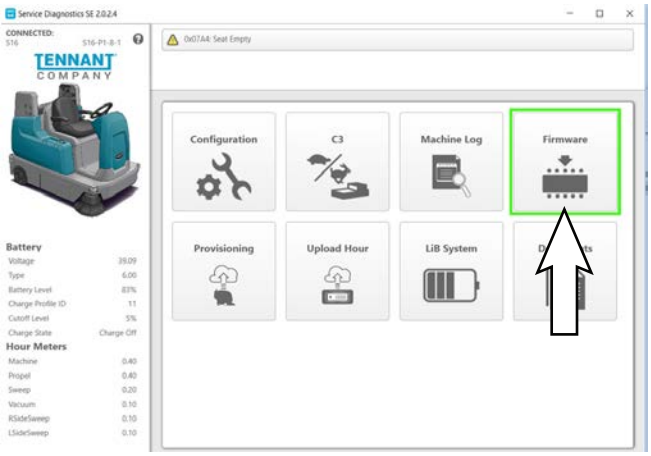
2. Turn key switch ON.

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

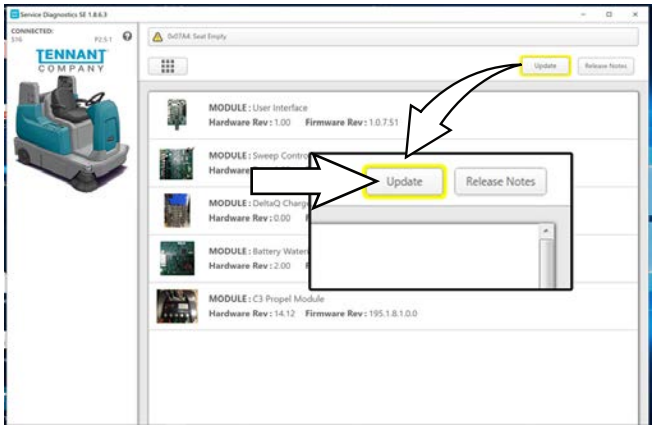
NOTE: Computer may prompt a restart after installing the machine driver. Decline the restart, close Service Diagnostics, and relaunch Service Diagnostics.

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

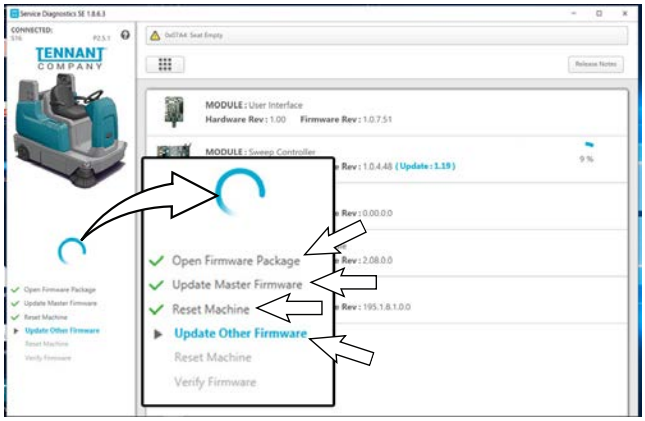
NOTE: Update installation may take several minutes. Do not interrupt process unless prompted.



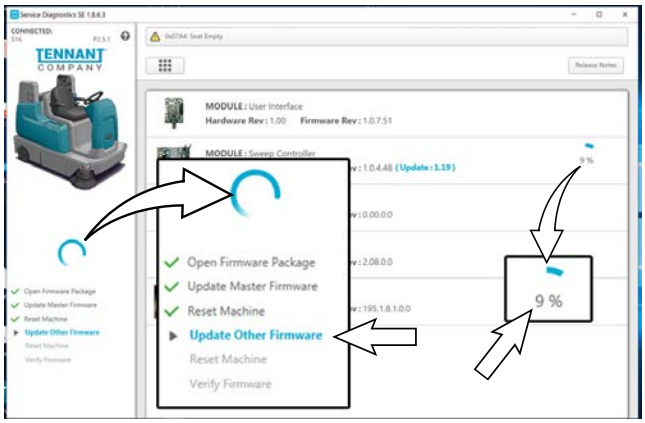
5. Click on the Update button to begin updating the modules.



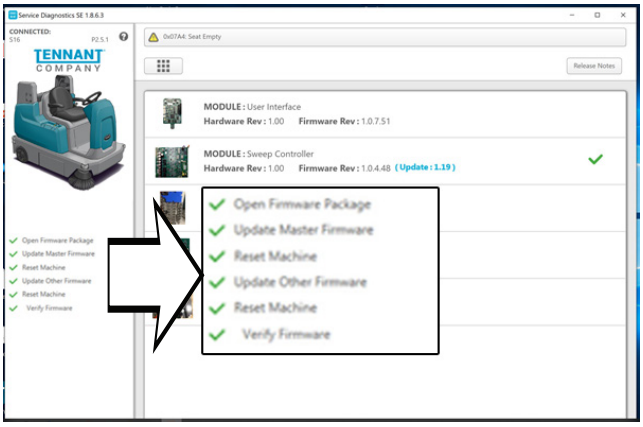
6. The firmware package opens and “Update Master Firmware” begins. The process indicator and firmware update status bar appear on the left side of the screen.



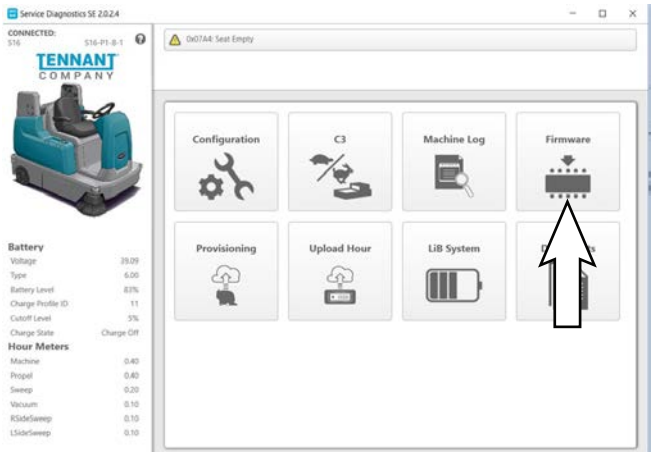
Allow the firmware update package to update the machine operating system. Various update status indicators appear on the screen while the firmware updates are occurring. Watch the visual status indicators on the screen for the update status.



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

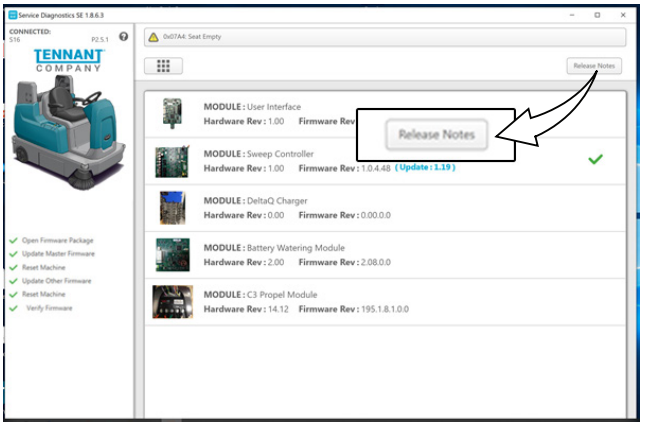


The firmware updates are complete when there is no longer a yellow highlight surrounding the Firmware button.



7. Cycle the key switch to save the firmware updates.

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



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

S16 Firmware Release Notes

Package Version	Release Date	Firmware Revision		Changes
1.00	2020.10.28	User Interface: Main Sweep: Battery Watering:	1.0.7.51 1.0.4.48 2.08	▪ Hot Fix 6 ▪ Fix hopper not lifting issues.
1.00	2020.10.23	User Interface: Main Sweep: Battery Watering:	1.0.6.50 1.0.4.48 2.08	▪ Hot Fix 5 ▪ Change BPCM to use DF1 instead of DF2 ▪ Fix hopper lift buttons ▪ Fox CAN SDO lockup ▪ Saved C3 fault code and monitor display
1.00	2020.10.13	User Interface: Main Sweep: Battery Watering:	1.0.5.49 1.0.4.48 2.08	▪ Hot Fix 4 ▪ Fix RTOS UI for missing 1.2V diode adjust
1.00	2020.10.05	User Interface: Main Sweep: Battery Watering:	1.0.4.48 1.0.4.48 2.08	▪ Hot Fix 3 ▪ Hopper safety button interferes with hopper roll in ▪ One Step LED confused from brush pattern test. ▪ BDI low charge point not holding. ▪ Fix threshold value causing false horn open faults.
1.00	2020.09.24	User Interface: Main Sweep: Battery Watering:	1.0.3.46 1.0.3.46 2.08	▪ Hot Fix 2 ▪ Worn brush fault reset by entering one step. ▪ Inhibit hopper lift until after sweeping for one step LED issue.
1.00	2020.09.21	User Interface: Main Sweep: Battery Watering:	1.0.2.45 1.0.2.45 2.08	▪ Hot Fix 1 ▪ ABW LED not illuminated in manual mode. ▪ EEPROM fix corrupting/setting parameters to default. ▪ ECO mode from DF1 doesn't reduce main sweep voltage. ▪ Change main sweep threshold values ▪ Horn/alarm open/short fault fixes. ▪ False main sweep open faults with worn brush.
1.00	2020.08.26	User Interface: Main Sweep: Battery Watering:	1.0.1.38 1.0.1.38 2.08	▪ Production Release

PROVISIONING THE MACHINE (MACHINES WITH TELEMETRY COMMUNICATIONS ONLY)

SYSTEM REQUIREMENTS: Windows® 10 Operating System and USB to Mini-USB cable.

Use the Provisioning application to reformat the machine after a user interface board has been replaced.

Factory-Direct Tennant Service personnel have the Service Diagnostics software installed on their ServiceLink devices. Authorized service providers can download the Service Diagnostics software. Authorized service providers must uninstall and reinstall the service diagnostic program to get firmware updates. The authorized service provider version does not self update.

A USB cable connects from the service device to the control console (USB to mini USB adapter cable required). The SERVICE DIAGNOSTICS TOOL can configure multiple control modules.

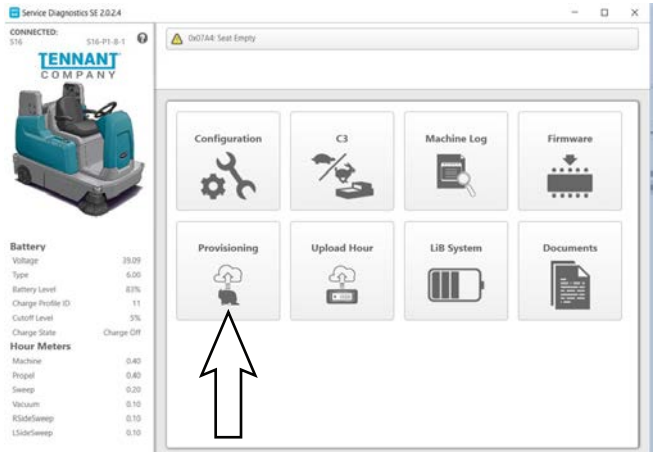
1. Remove the front access panel from the steering channel and connect a USB cable to the service device and the machine.

2. Turn key switch ON.

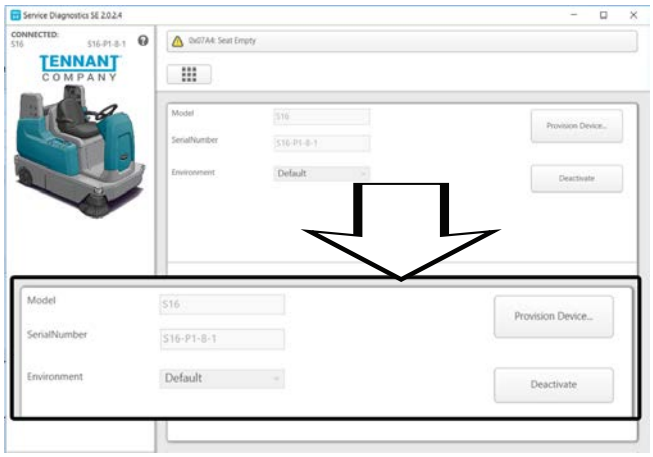
3. Double click the Service Diagnostics desktop shortcut or find the software in All Programs to launch the software.

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

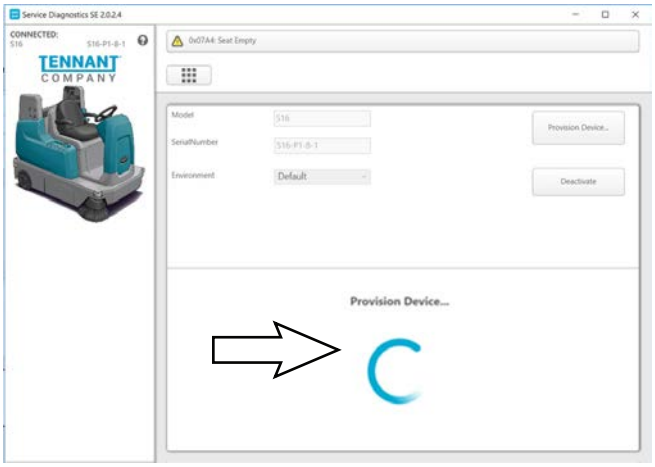
4. Click the Provisioning button to access the provisioning screen.



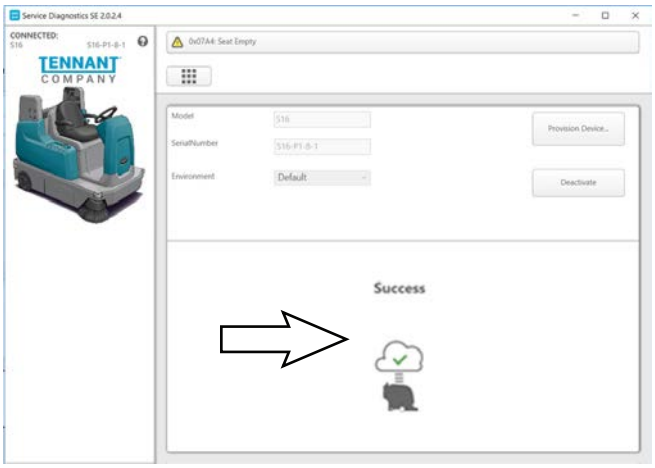
5. Select and/or enter applicable information and click either the Provision Device... button or Deactivate button.



6. Allow provisioning/reformatting to occur.



7. Success will appear on the service device screen when machine has been successfully updated.



UPLOADING THE HOUR COMMUNICATION (MACHINES WITH TELEMETRY COMMUNICATIONS ONLY)

SYSTEM REQUIREMENTS: Windows® 10 Operating System and USB to Mini-USB cable.

Use the Upload Hour application to ensure the machine is communicating after the user interface board has been replaced.

Factory-Direct Tennant Service personnel have the Service Diagnostics software installed on their ServiceLink devices. Authorized service providers can download the Service Diagnostics software. Authorized service providers must uninstall and reinstall the service diagnostic program to get firmware updates. The authorized service provider version does not self update.

A USB cable connects from the service device to the control console (USB to mini USB adapter cable required). The SERVICE DIAGNOSTICS TOOL can configure multiple control modules.

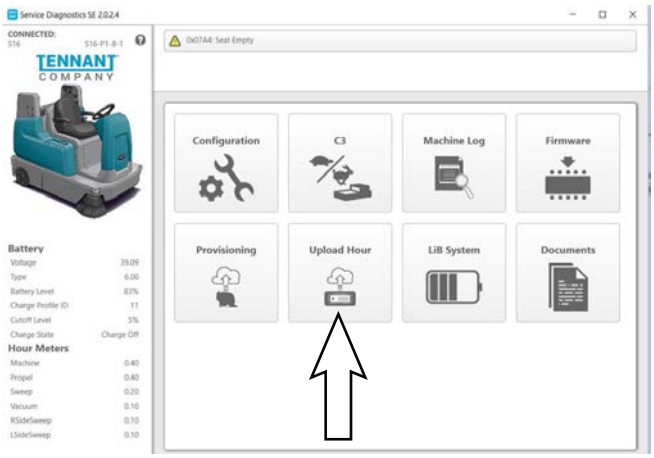
1. Remove the front access panel from the steering channel and connect a USB cable to the service device and the machine.

2. Turn key switch ON.

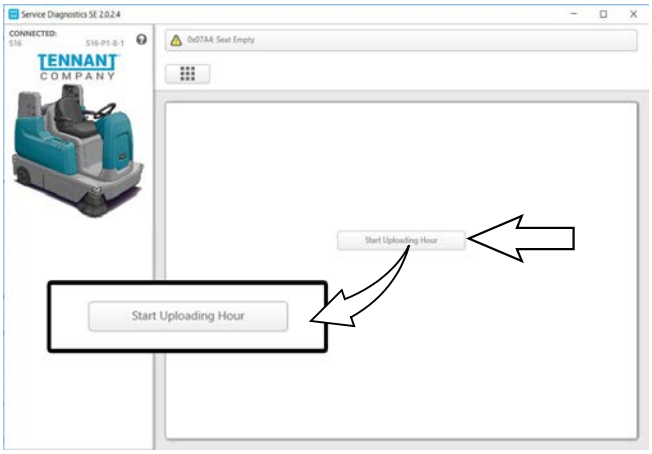
3. Double click the Service Diagnostics desktop shortcut or find the software in All Programs to launch the software.

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

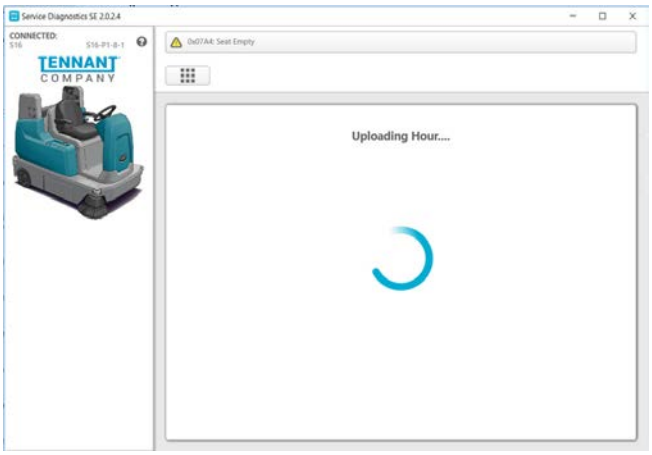
4. Click the Upload Hour button to access the upload hour screen.



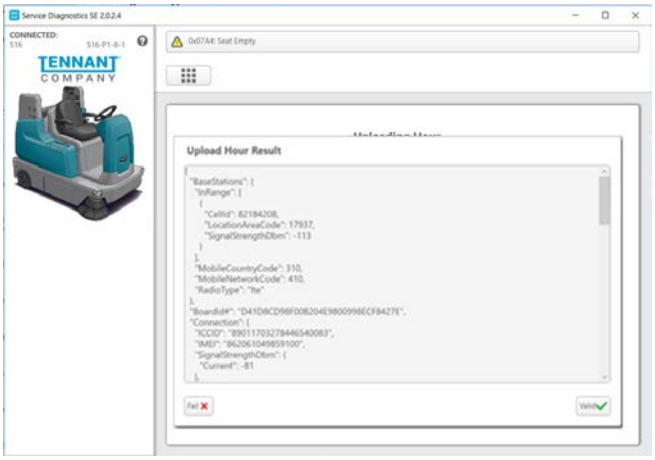
5. Click the Start Uploading Hour button to begin uploading the hour.



6. Wait for the Uploading Hour... indicator to stop and Uploading Hour screen to leave service device screen.

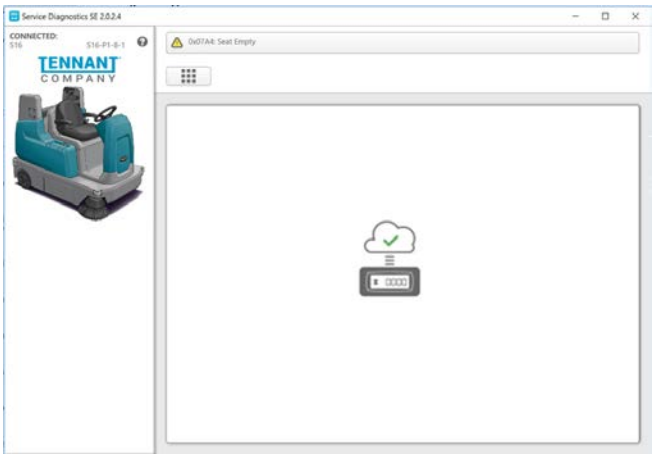


7. An Upload Hour Result screen will display all the information about the board as shown below. Scroll to see all events happening in the machine.



8. Click the Valid button when ready to proceed. Again, wait for the Uploading Hour... indicator to stop and Uploading Hour screen to leave service device screen. An Upload Hour Result screen will display all the information about the board. Verify the information on the screen.

9. Click the Valid button again when finished verifying information. This screen appears to confirm that Upload Hours has been successfully completed.



ACCESSING SUPPORT DOCUMENTATION (AVAILABLE TO FACTORY-DIRECT SERVICE PERSONNEL ONLY)

SYSTEM REQUIREMENTS: Windows® 10 Operating System and USB to Mini-USB cable.

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

Factory-Direct Tennant Service personnel have the Service Diagnostics software installed on their ServiceLink devices. Authorized service providers can download the Service Diagnostics software. Authorized service providers must uninstall and reinstall the service diagnostic program to get firmware updates. The authorized service provider version does not self update.

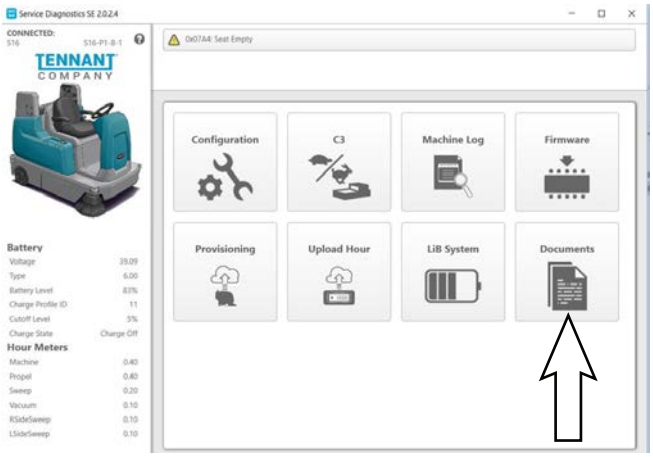
A USB cable connects from the service device to the control console (USB to mini USB adapter cable required). The SERVICE DIAGNOSTICS TOOL can configure multiple control modules.

1. Remove the front access panel from the steering channel and connect a USB cable to the service device and the machine.

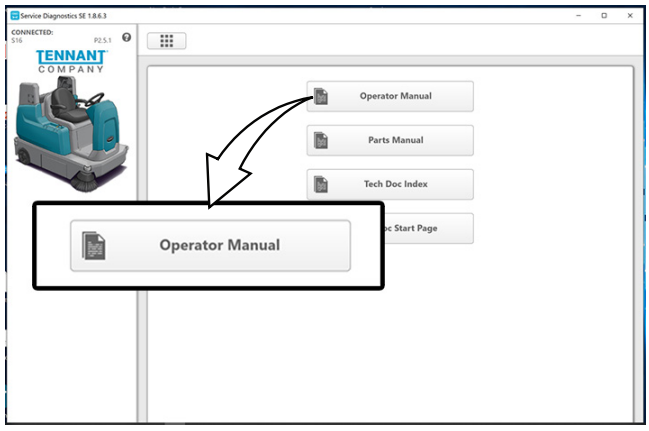
2. Turn key switch ON.

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

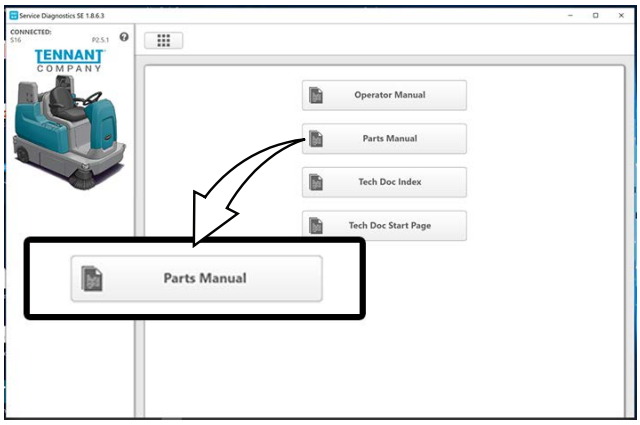
4. Click on the Documentation button to display a list of support documentation.



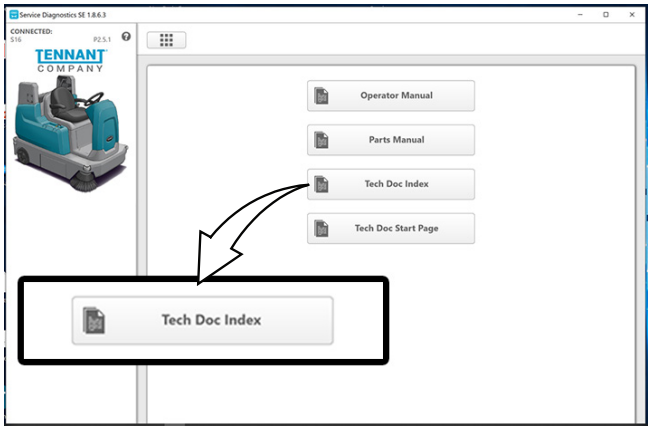
5. Click on the appropriate button to access needed support documentation. Click on the Operator Manual button to access the Operator Manual.



Click on the Parts Manual button to access the Parts Manual.

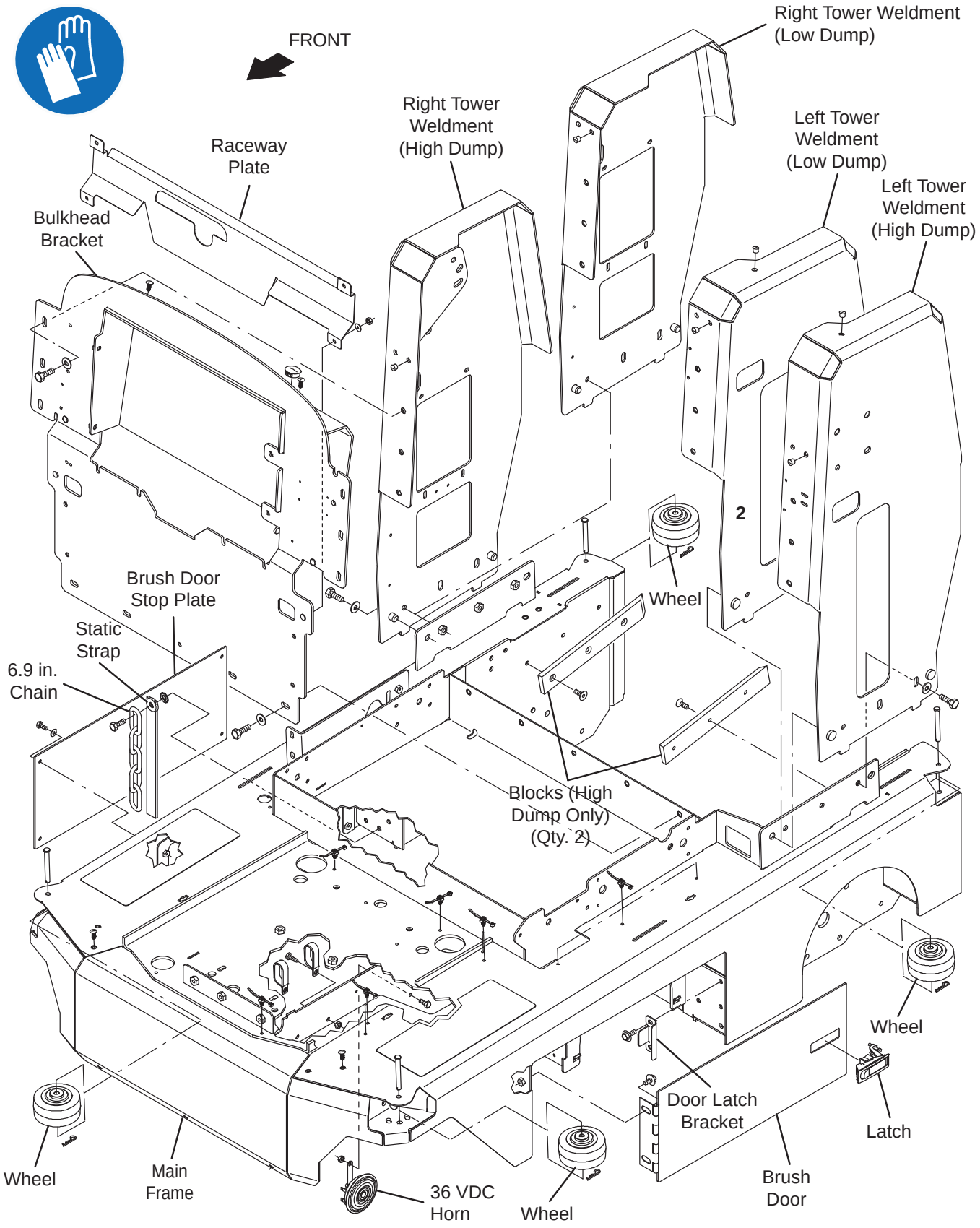


Click on the Tech Doc Index button to access the Technical Publications Index.



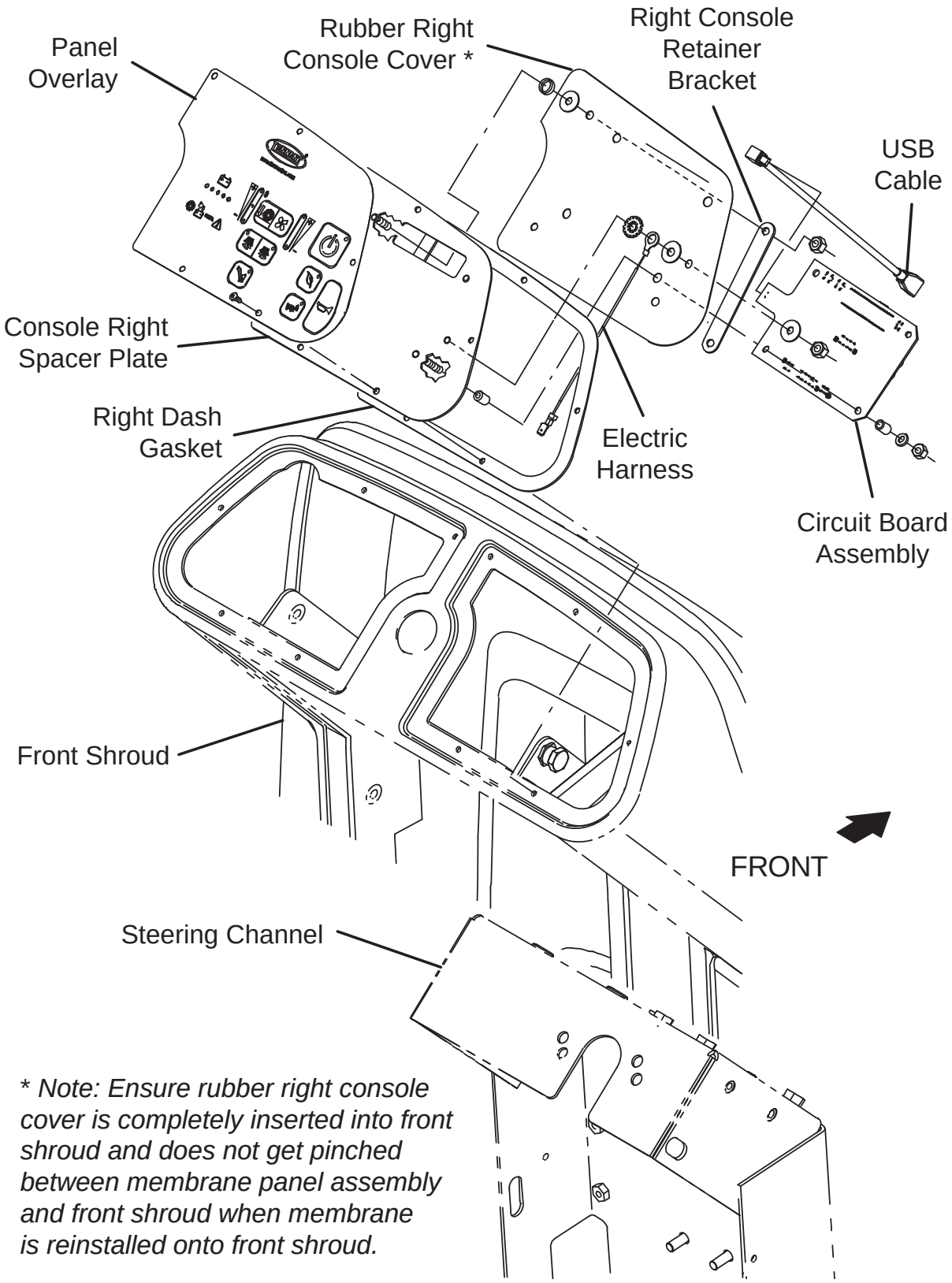
Click on the Tech Doc Start Page button to access the Technical Publications Start Page.

CHASSIS GROUP



CONTROLS GROUP

REMOVE/REINSTALL/REPLACE THE MEMBRANE PANEL



** Note: Ensure rubber right console cover is completely inserted into front shroud and does not get pinched between membrane panel assembly and front shroud when membrane is reinstalled onto front shroud.*

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

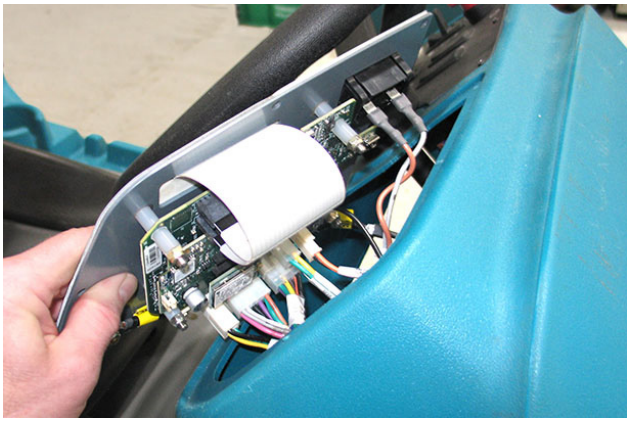
1. Turn the key switch OFF and remove the key.
2. Disconnect the battery cable from the machine.

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

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

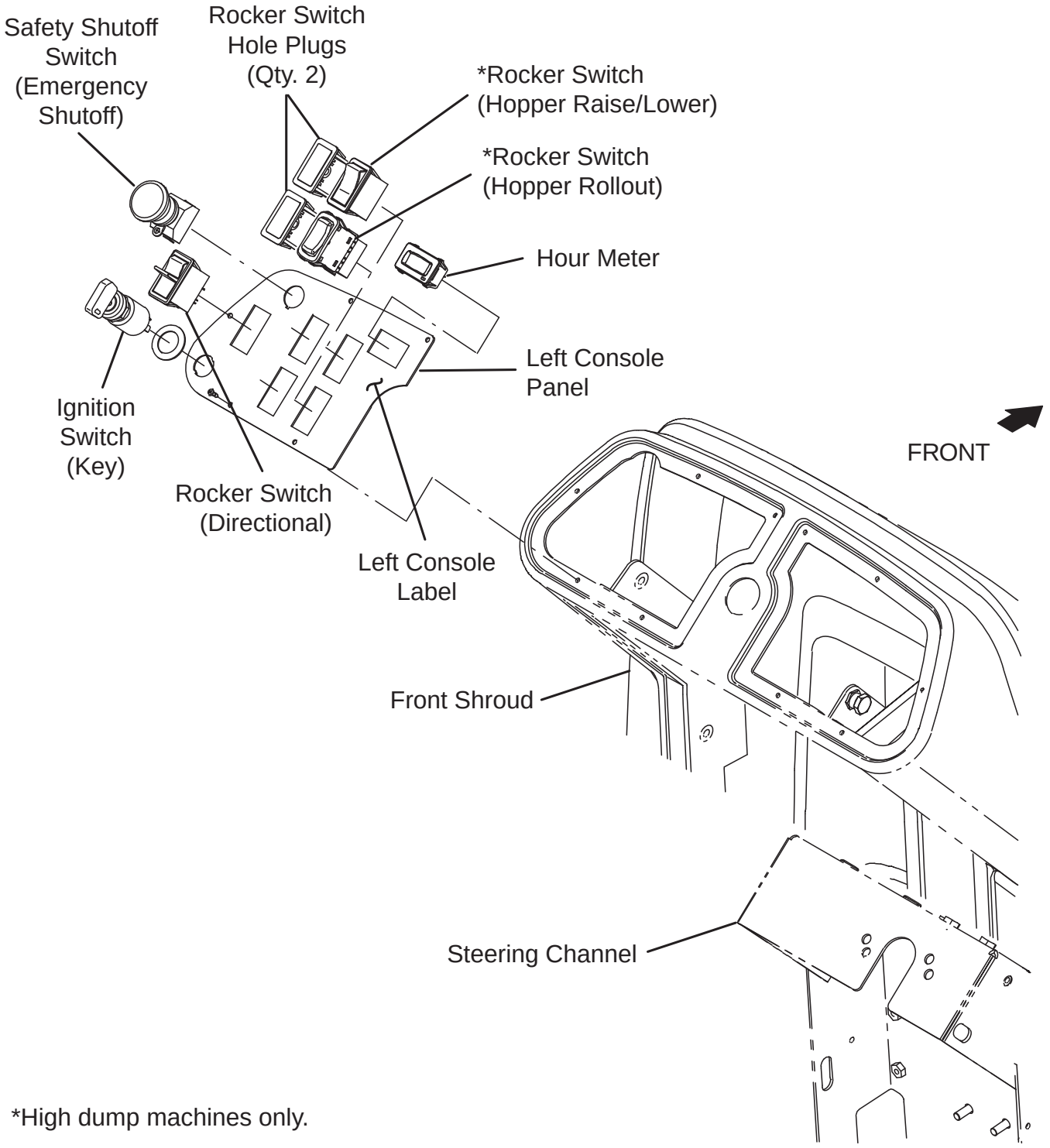
3. Remove the hardware securing the membrane panel to the front shroud.

4. Carefully lift the membrane panel from the front shroud. Do not break any wire or cable connections when lifting the panel from the front shroud.



5. If completely removing the membrane panel/ replacing the membrane panel, disconnect all wire and cable connections from the panel .
6. If the membrane panel was completely removed/ replaced connect the cable connections to the new membrane panel/previously removed membrane panel.
7. Position the membrane panel onto the steering shroud and arrange the rubber right console cover into the steering shroud hole where the membrane panel will be installed so it does not get pinched between the membrane panel and the steering shroud in the following step.
8. Reinstall the hardware to secure the membrane panel onto the steering shroud.
9. Reconnect the battery cable to the machine.
10. Remove the front access panel from the steering channel, connect a USB cable to the service device and the machine, and reconfigure the machine for the new membrane panel/control board assembly. See *RECONFIGURING THE MACHINE AFTER NEW HARDWARE/OPTION INSTALLATION.*

REMOVE/REINSTALL/REPLACE THE CONSOLE PANEL AND/OR CONTROLS ON THE CONSOLE PANEL



*High dump machines only.

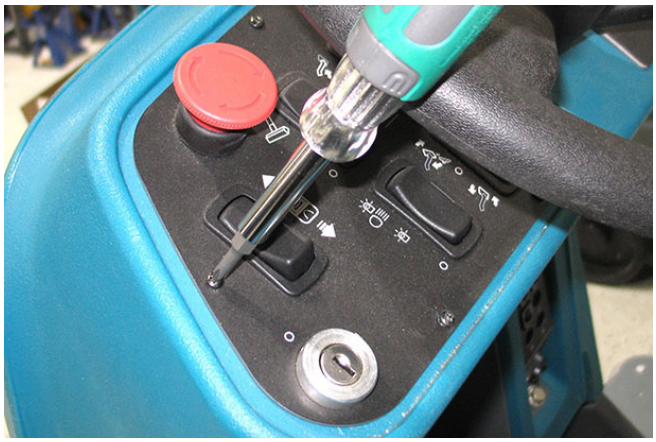
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and remove key.

1. Turn the key switch OFF and remove the key.
2. Disconnect the battery cable from the machine.

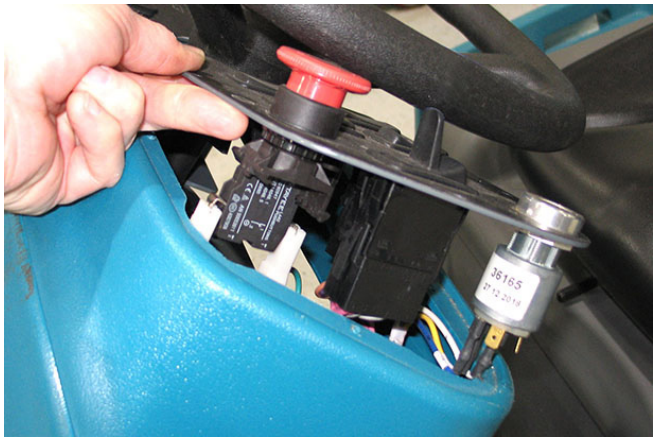
FOR SAFETY: When servicing machine, disconnect battery connection and charger cord before working on machine.

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

3. Remove the hardware securing the control panel to the steering shroud.



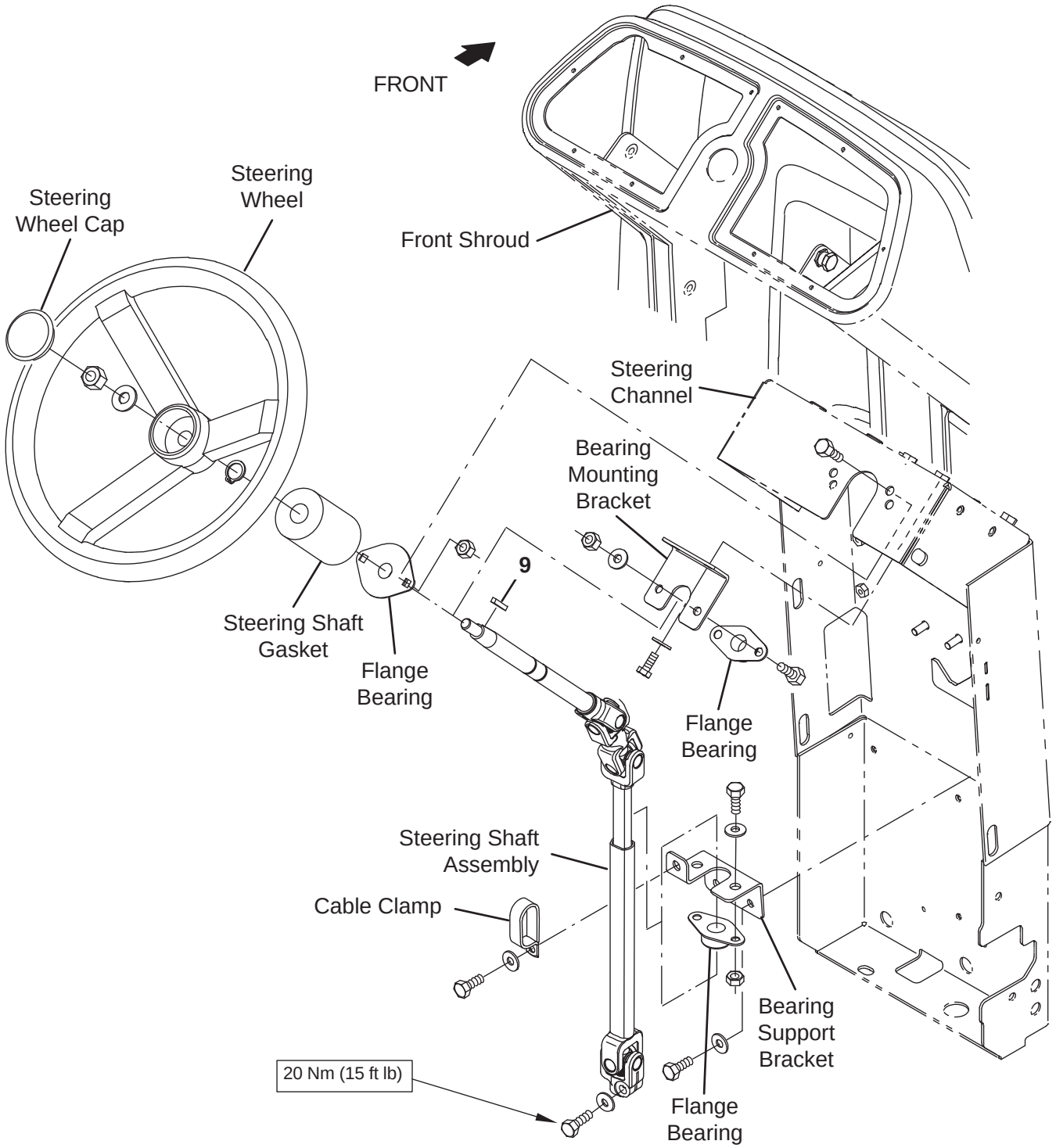
4. Carefully lift the control panel from the shroud. Do not break any wire or cable connections when lifting the panel from the front shroud.



5. If removing the console to conduct other service/ maintenance disconnect all wire harness connections from the controls installed on the panel.
6. If replacing the entire console panel, disconnect the all wire harness connections from the controls installed on the panel and remove the controls from the panel.
7. If replacing a control on the console panel, disconnect the wire harness from the control being replaced, and remove the control from the panel.
8. If the entire console panel was replaced, install previously removed controls into the new console panel.
9. If replacing a control, install the new control into the console panel.
10. Connect the main harness connections to the control(s) previously removed/replaced.
11. Install the console panel onto the steering shroud.
12. Reconnect the battery cable to the machine.

STEERING GROUP/DRIVE WHEEL GROUP

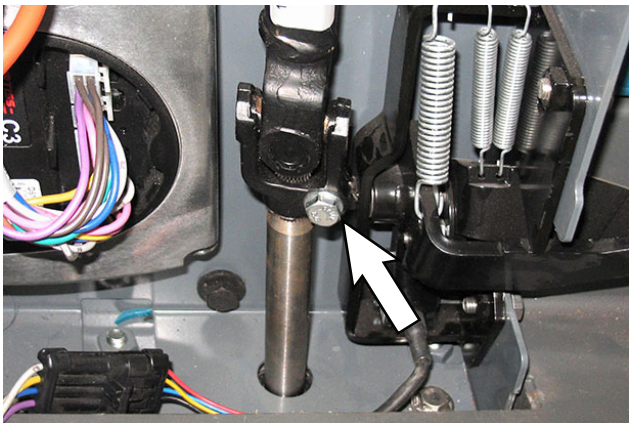
ADJUST THE STEERING WHEEL TIMING



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

1. Turn key switch OFF.
2. Remove the column access panel from the machine. See REMOVE THE COLUMN ACCESS PANEL FROM THE MACHINE.

3. Loosen the hardware securing the u-joint to the steering control assembly shaft.

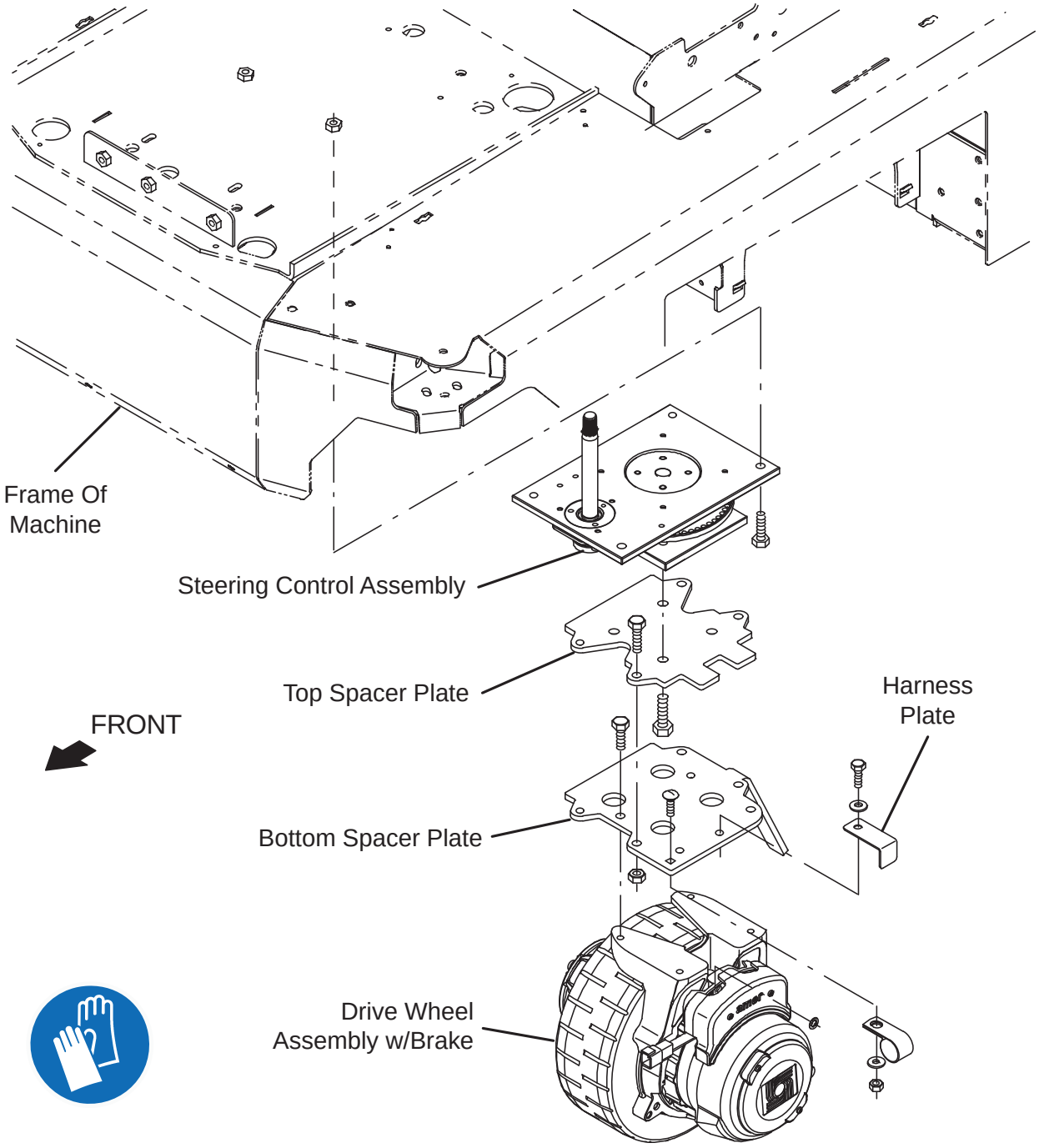


4. Lift the u-joint from the steering control assembly shaft.
5. Align the front drive tire with the center line of the machine so drive wheel is pointing straight out from the front of the machine.
6. Orient the steering wheel as shown below.

7. Carefully, so not disturbing the already adjusted front drive wheel or steering wheel position, reinstall the steering u-joint onto the steering control assembly shaft.

NOTE: Check for interference between the steering shaft u-joint/hardware and other components near the steering shaft u-joint. If necessary, adjust the steering shaft u-joint location enough to clear other components.

REMOVE/REINSTALL/REPLACE THE DRIVE WHEEL ASSEMBLY



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

1. Completely empty the hopper.
2. Turn the key switch OFF and remove the key.
3. Disconnect the battery cable from the machine.

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

4. Chock both rear tires.
5. Jack up the front end of the machine enough to access steering components/remove steering components from under the machine. Place jack stands under the machine and lower the machine onto the jack stands.

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

6. Remove the cover from the drive wheel assembly.

7. Disconnect the speed sensor cable and all main wire harness connections from the drive wheel assembly and encoder.

NOTE: Use care when removing the drive wheel assembly from the machine. The drive wheel weighs approximately 140 lbs (64 kg). If necessary, seek help to remove the drive wheel assembly from the machine.

8. Remove the M10 hex screws (Qty. 4) and M10 hex nuts (Qty. 4) securing the drive wheel assembly to the top spacer plate on the steering control assembly. Turn the drive wheel assembly to the right and left as necessary to access/remove the hardware.
9. Remove the drive wheel assembly from under the machine.
10. Remove the M10 hex screws (Qty. 4) securing the bottom spacer plate to the drive wheel assembly.
11. Install the bottom spacer plate and harness plate removed from the removed drive wheel assembly onto the new drive wheel assembly.
12. Reinstall drive motor/install the new drive motor onto the top spacer plate on the steering control assembly in reverse order of disassembly.
13. Connect the speed sensor cable and main wire harness to the drive wheel assembly and encoder.
14. Install the cover onto the drive wheel assembly.
15. Raise the machine from the jack stands, remove the jack stands from under the machine, and lower the machine to the floor.
16. Reconnect the battery cable to the machine.

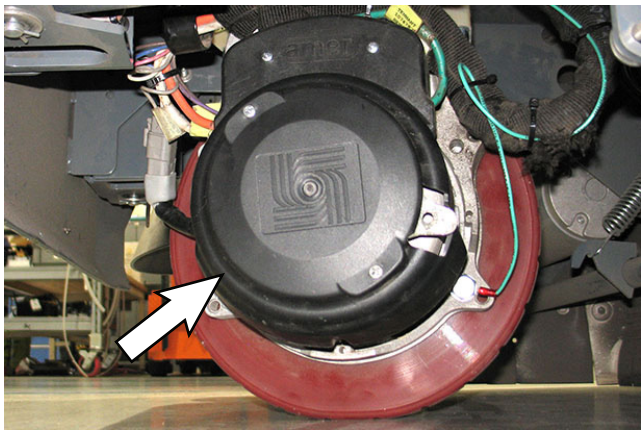
REPLACE THE PARKING BRAKE

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

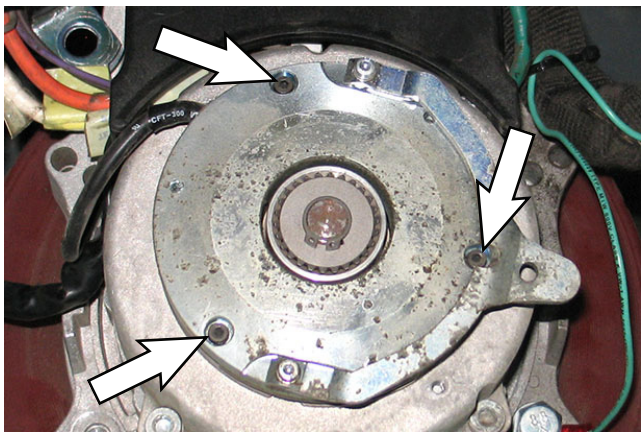
1. Turn the key switch OFF and remove the key.
2. Disconnect the battery cable from the machine.

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

3. Turn steering wheel so the brake assembly on the drive wheel assembly can be easily accessed.
4. Remove the cover protecting the brake assembly from the drive wheel assembly.



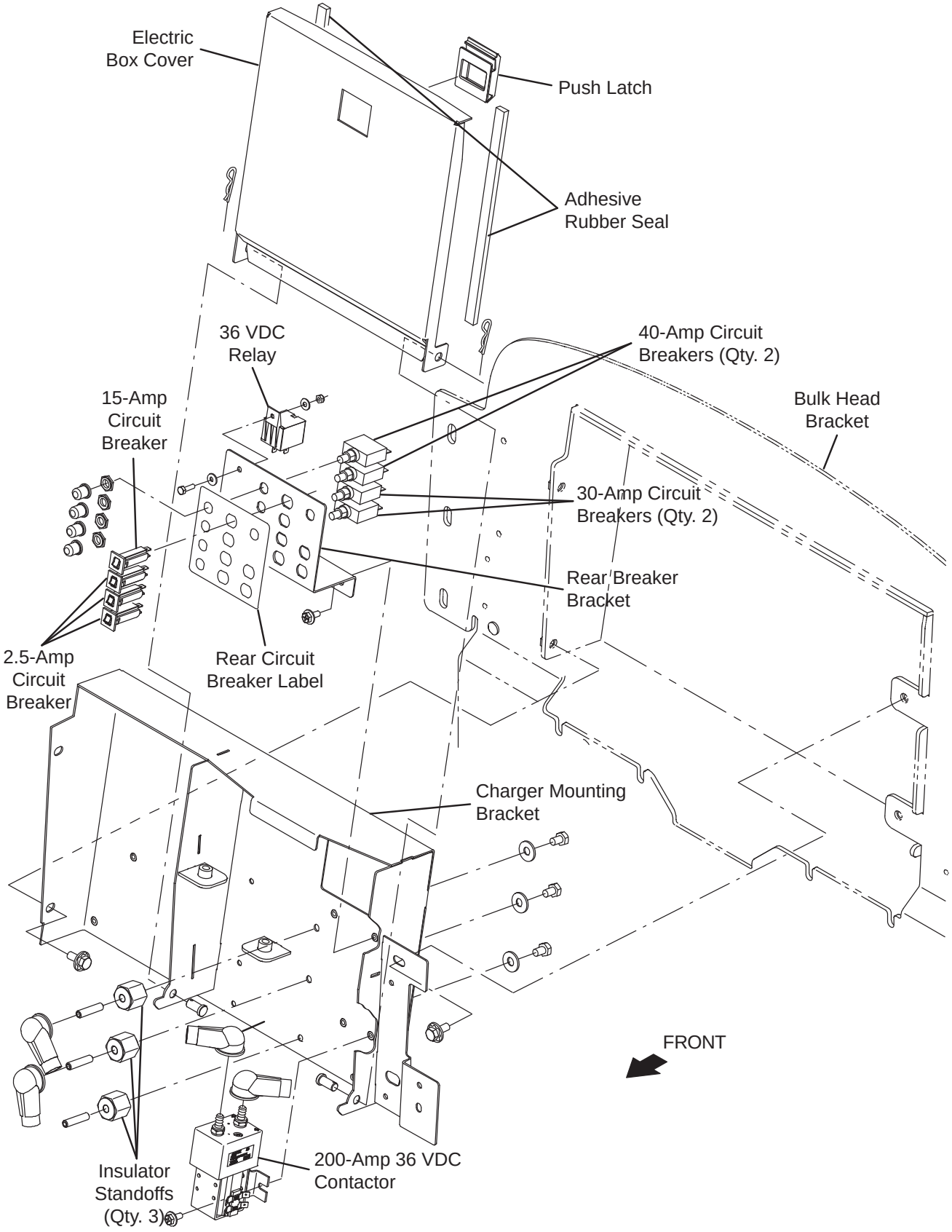
5. Remove the hardware securing the brake assembly to the drive wheel assembly. **Do Not** lose hardware securing the brake assembly. These parts will be needed to reinstall the brake assembly.

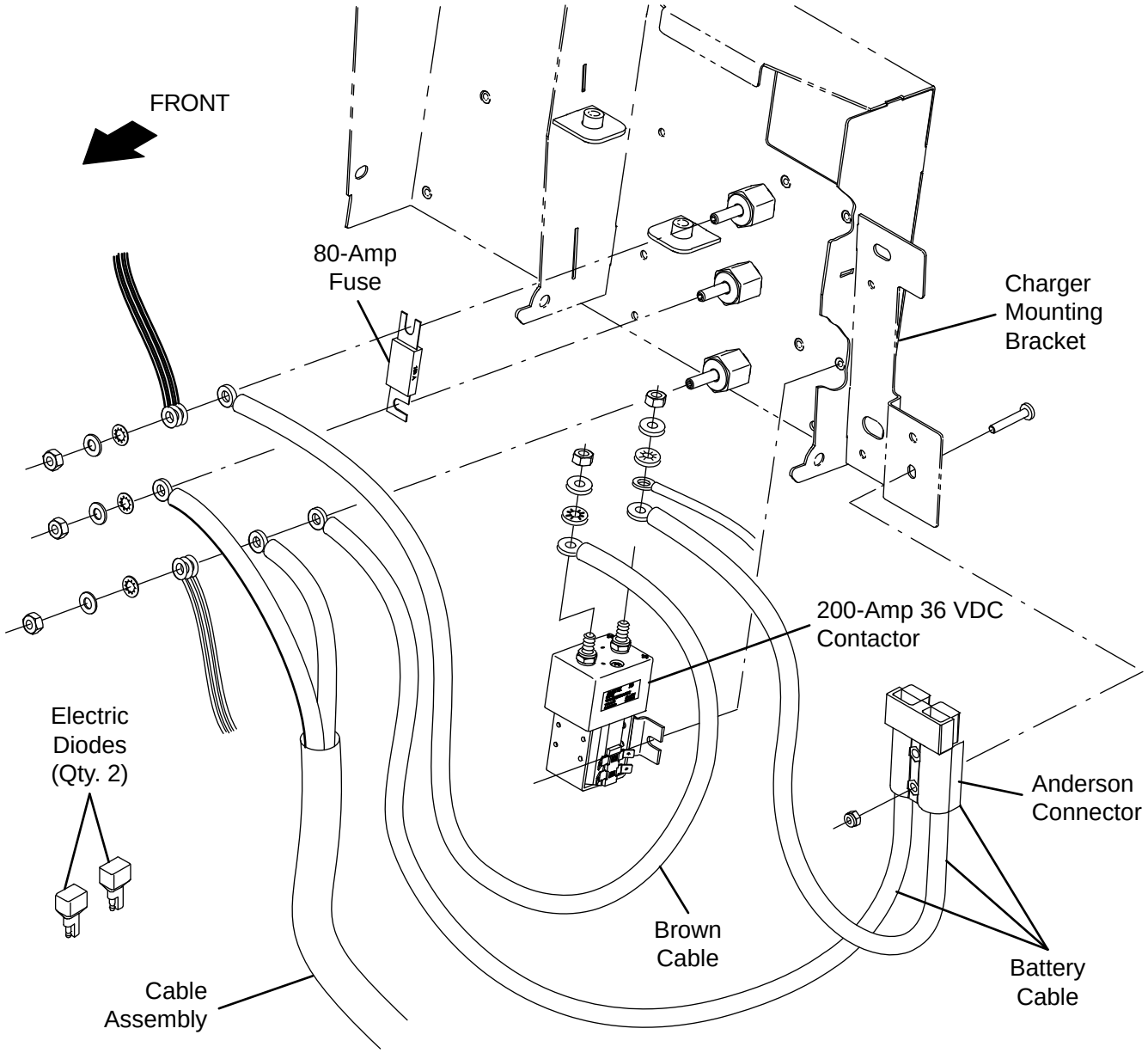


6. Disconnect the harness from the drive wheel brake assembly.
7. Remove the brake assembly from the drive wheel assembly.
8. Install the new brake assembly onto the drive wheel assembly in reverse order of disassembly.
9. Connect the harness to the drive wheel brake assembly.
10. Reinstall the cover onto the drive wheel assembly.
11. Reconnect the battery cable to the machine.

ELECTRICAL

REMOVE/REPLACE THE MAIN CONTACTOR





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

1. Disconnect the battery cable from the machine.

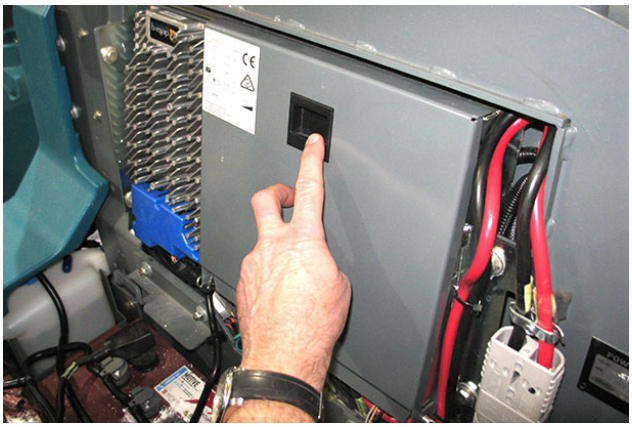
FOR SAFETY: When servicing machine, disconnect battery connection and charger cord before working on machine.

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

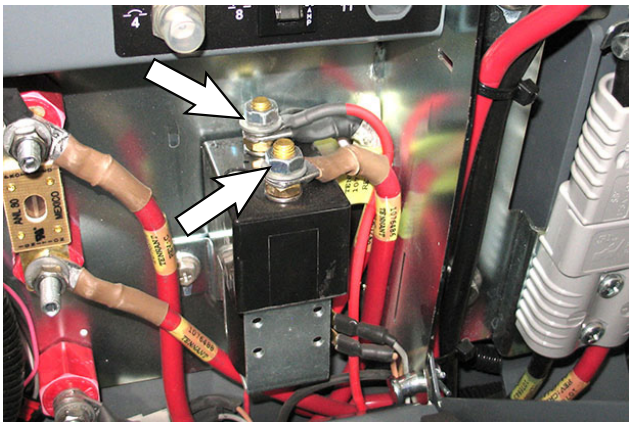
2. Confirm the machine battery cable is disconnected from the batteries.

ATTENTION: Potential electrical hazard if the battery cable is left connected to the batteries. The machine battery cable must be disconnected from the batteries before accessing/performing maintenance on the 100-A 36 VDC contactor.

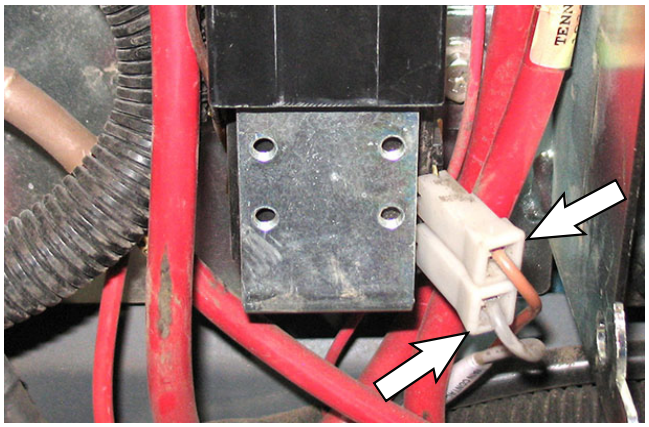
3. Open and/or remove the electrical compartment cover from the circuit breaker compartment.



4. Disconnect wire harness connections from the top terminals of the contactor.

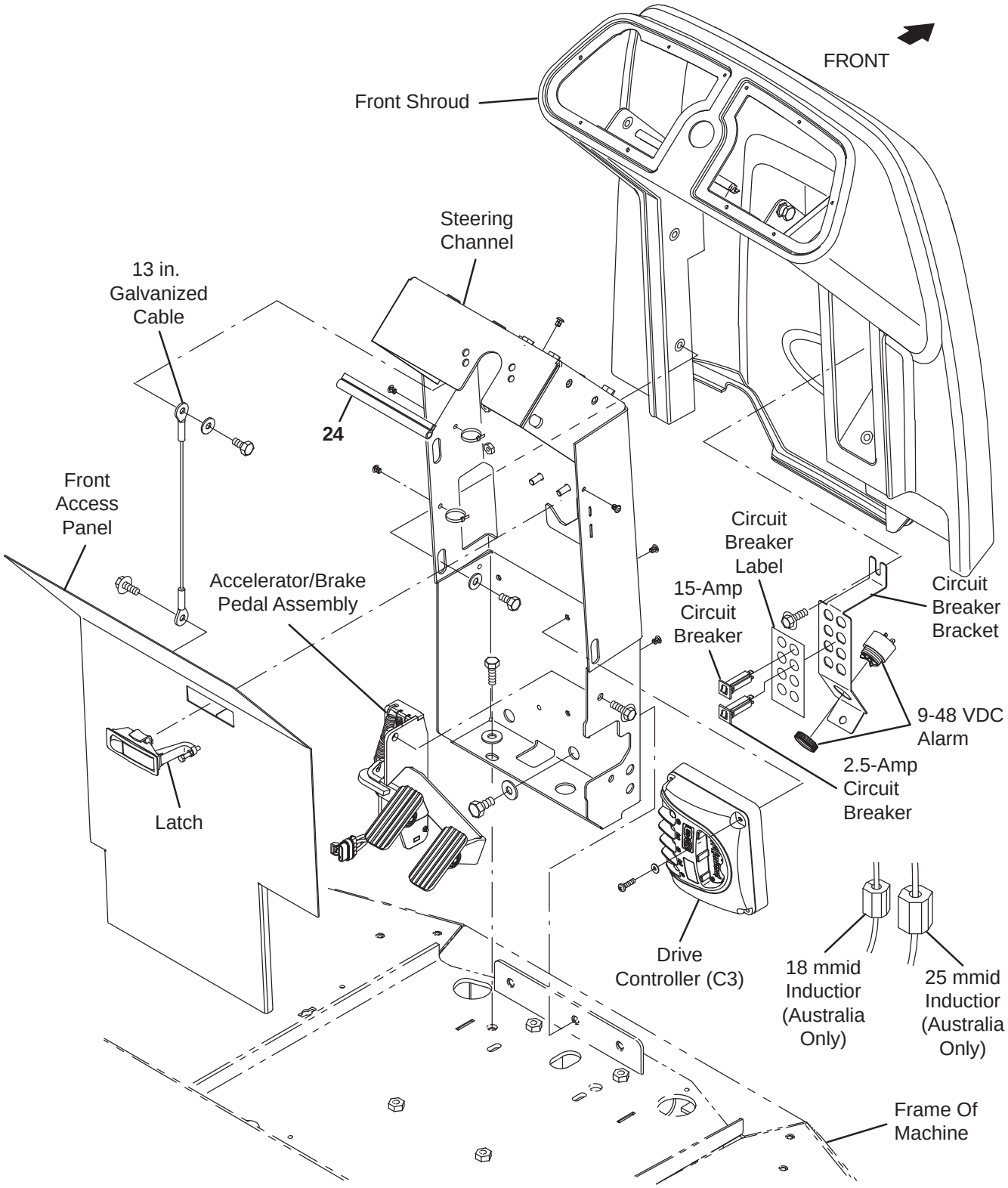


5. Disconnect the wire harness connections from the bottom terminals of the contactor.

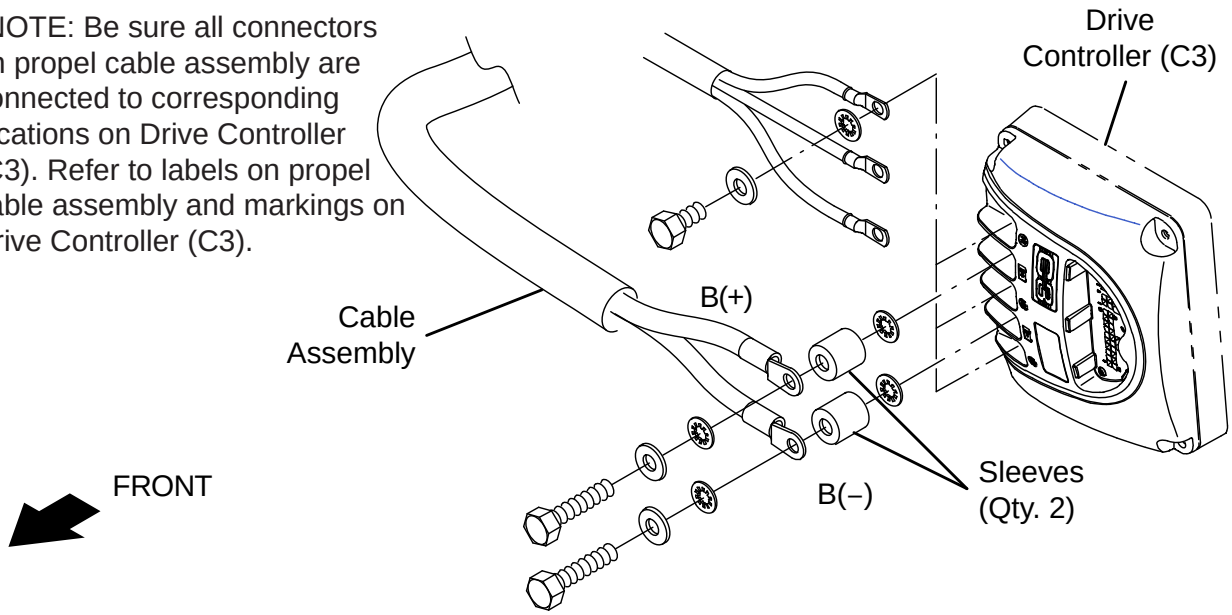


6. Remove the 200-A 36 VDC contactor from the charger mounting bracket.
7. Install the new 200-A 36 VDC contactor onto the charger mounting bracket.
8. Connect the wire harness to the terminals located on the bottom of the new 200-A 36 VDC contactor/ removed 200-A 36 VDC contactor.
9. Connect the wire harness connections to the terminals located on the top of the 200-A 36 VDC contactor.
10. Reinstall/close the electrical compartment cover.
11. Reconnect the battery cable to the batteries.

REPLACE THE DRIVE CONTROLLER (C3)



*NOTE: Be sure all connectors on propel cable assembly are connected to corresponding locations on Drive Controller (C3). Refer to labels on propel cable assembly and markings on Drive Controller (C3).



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

1. Turn key switch OFF.

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

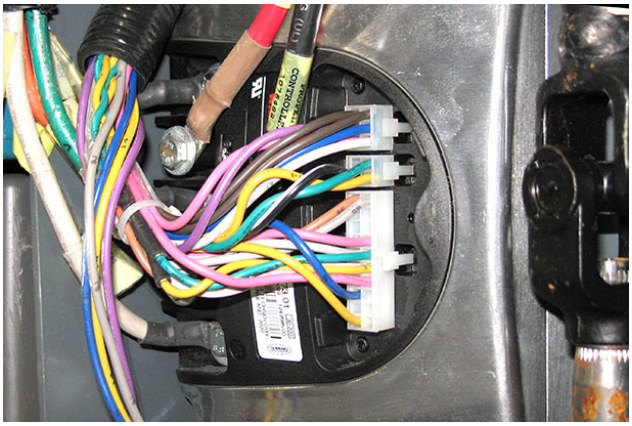
2. Disconnect the battery cable from the machine.

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

3. Remove the front access panel from the steering channel.

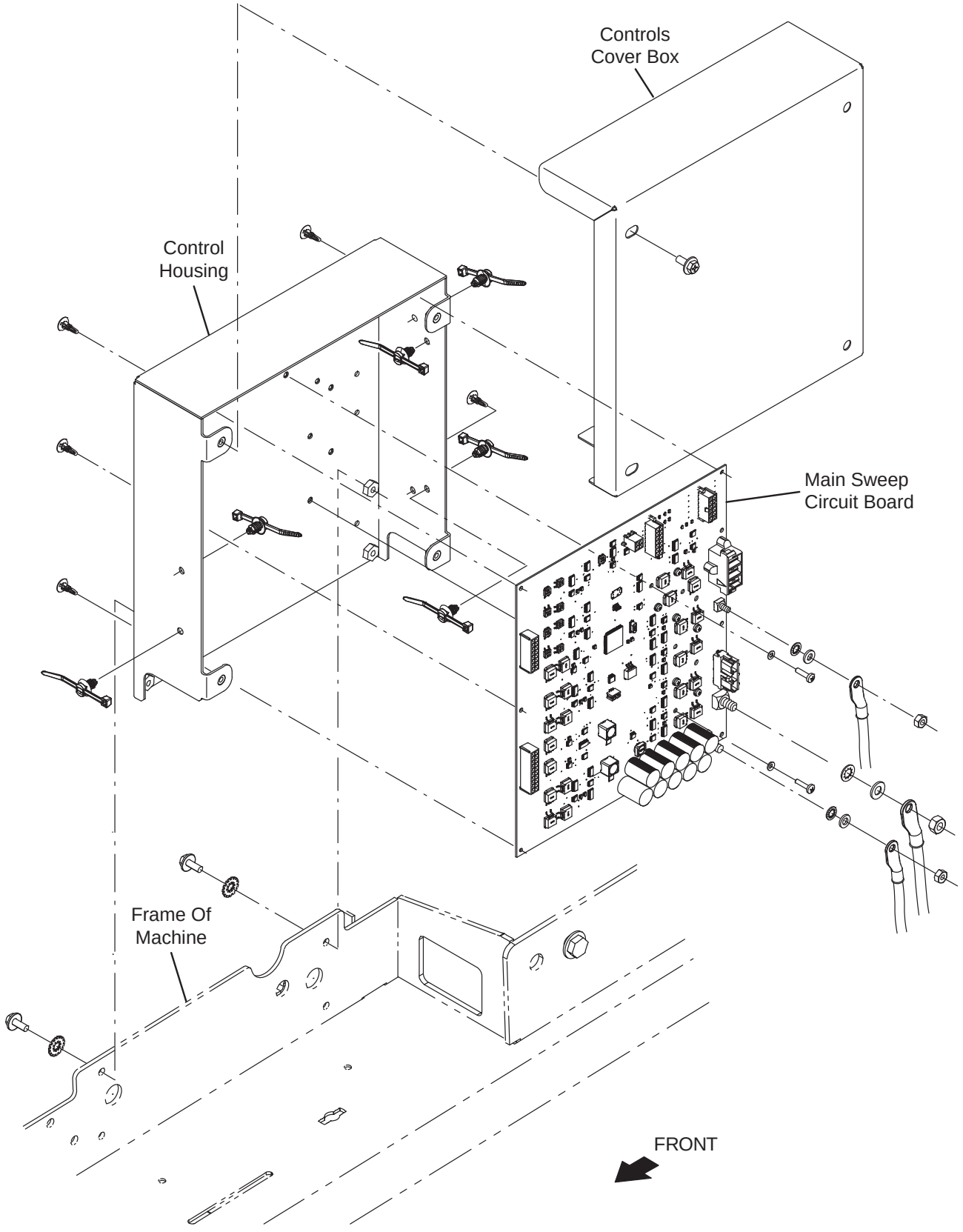
NOTE: To avoid damaging electronic components, a static ground strap must be worn at all times while handling electrical components. Attach the other end of the static ground strap to the machine chassis.

4. Disconnect all main wire harness connections from the drive controller (C3).



5. Remove the hardware securing the drive controller (C3) to the steering channel.
6. Install the new drive controller (3) onto the steering channel.
7. Connect all main wire harness connections to the drive controller (3) onto the steering channel.
8. Reconnect the battery cable to the machine.
9. Reconfigure the machine. See *UPDATING THE C3 DRIVE CONTROLLER*.
10. Reinstall the front access panel onto the steering channel.

REMOVE/REINSTALL/REPLACE THE MAIN SWEEP CONTROL BOARD

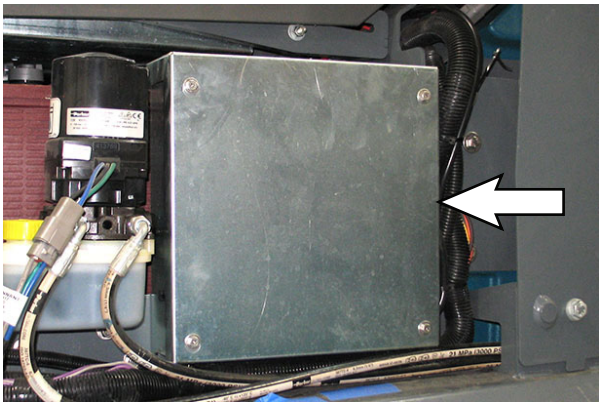


FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and remove key.

1. Disconnect the battery cable from the machine.

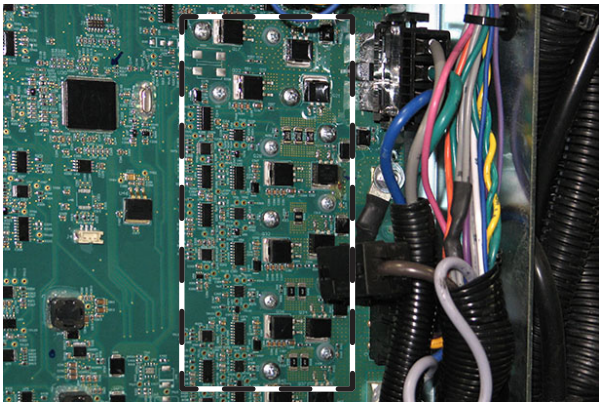
FOR SAFETY: When servicing machine, disconnect battery connection and charger cord before working on machine.

2. Remove the left side cover from the machine.
3. Remove the controls cover box from the control housing.

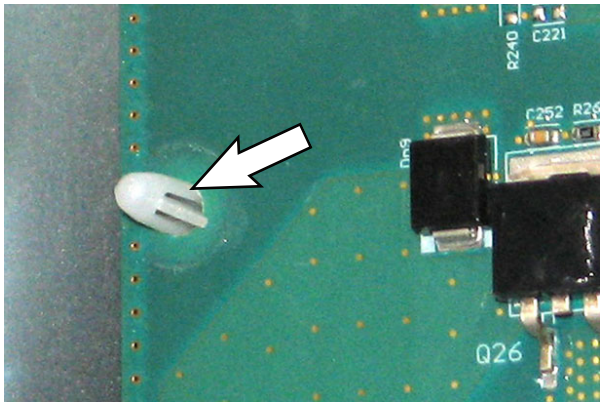


NOTE: To avoid damaging electronic components, a static ground strap must be worn at all times while handling electrical components. Attach the other end of the static ground strap to the machine chassis.

4. Disconnect all main wire harness connectors from the main sweep circuit board.
5. Remove the six pan screws and nylon washers securing the main sweep circuit board to the control housing.



6. Carefully squeeze the plastic standoffs (Qty. 4) located at each corner of the main sweep circuit board to release the circuit board from the electrical enclosure panel and remove the main sweep circuit board from the enclosure.

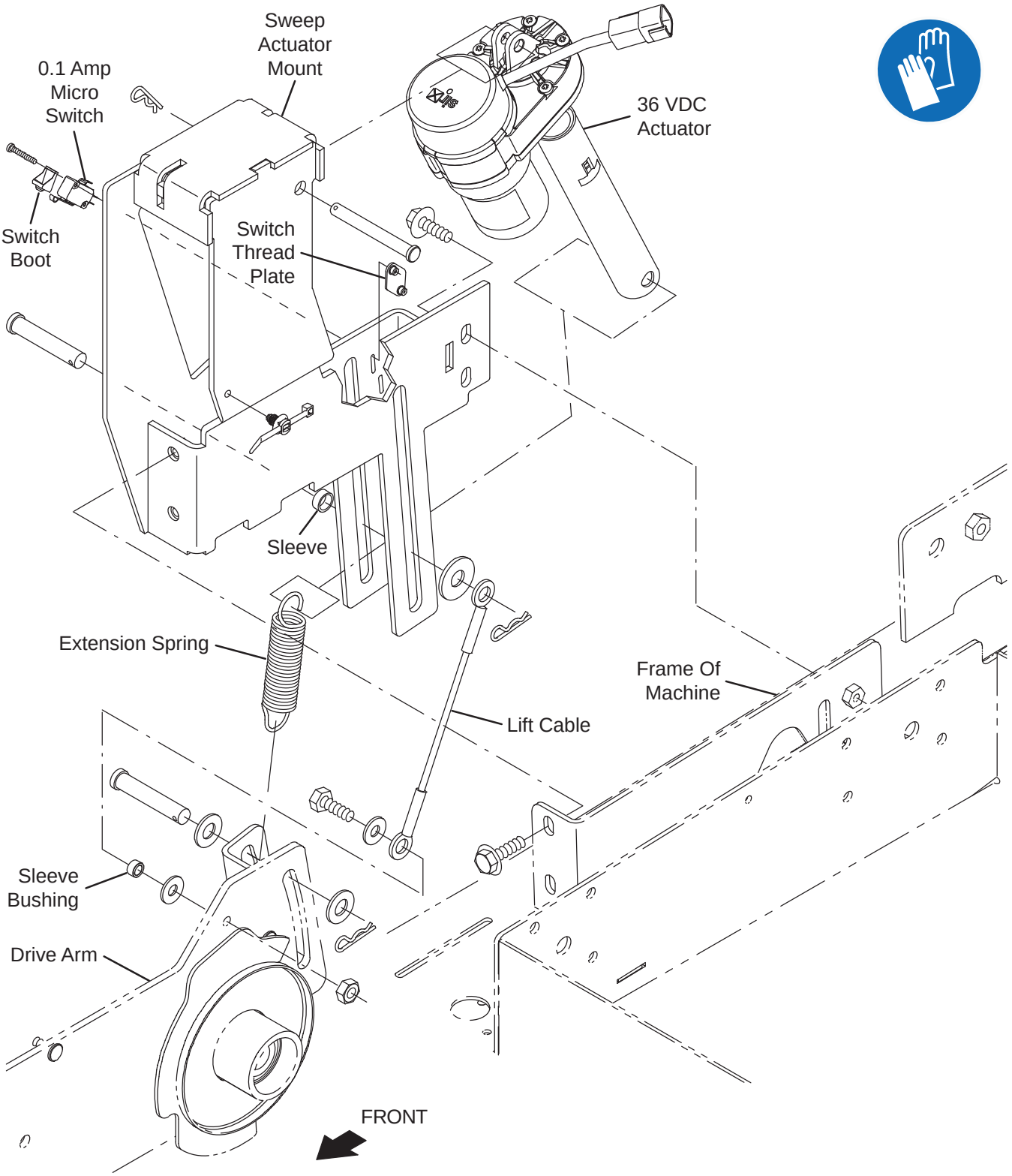


NOTE: Replace damaged plastic standoffs. The standoffs secure the module into place and support the module away from the control housing. The standoffs must be replaced if damaged.

7. Install the new/reinstall the main sweep circuit board into the control housing in reverse order of disassembly. Do Not overtighten the hardware securing the board to the control housing. The board could be damaged if hardware is overtightened.
8. Reinstall remaining parts and components removed from the machine in reverse order of disassembly.
9. Reconfigure the machine. See *PROGRAMMING A NEW INTERFACE MODULE* and *RECONFIGURING THE MACHINE AFTER NEW HARDWARE/OPTION INSTALLATION*.

SWEEP SYSTEMS

REMOVE/REINSTALL/REPLACE THE MAIN SWEEP ACTUATOR



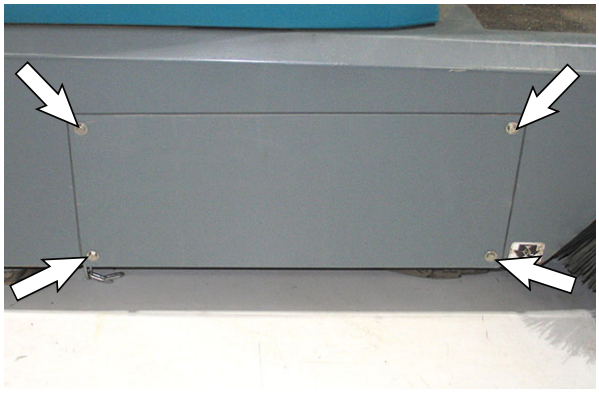
1. Turn the key switch OFF and remove the key.
2. Remove the right side cover from the machine.
3. Turn the key switch ON, press the *1-Step button* to completely lower the sweep head, turn the key switch OFF, and remove the key.

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

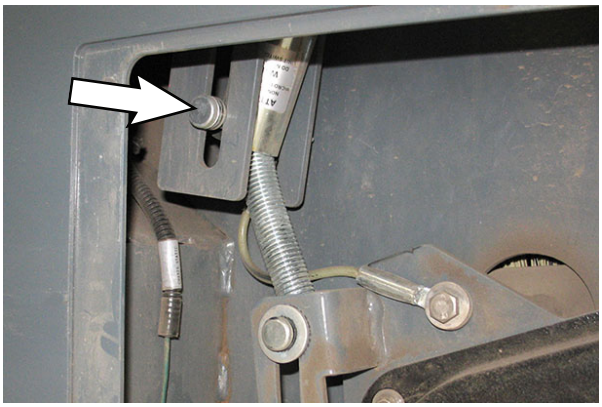
4. Disconnect the battery cable from the machine.

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

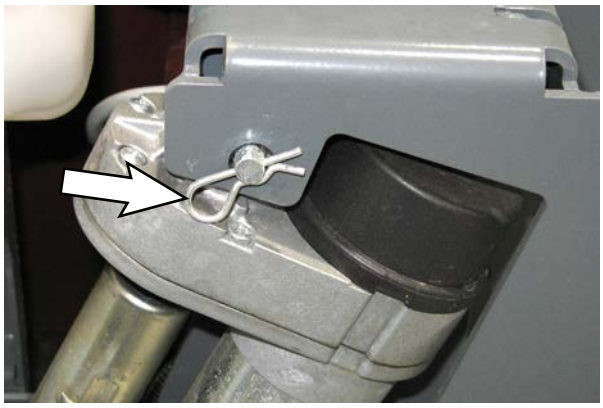
5. Disconnect the main wire harness from the actuator.
6. Remove the brush door stop plate from the machine.



7. Remove the hardware securing the barrel of the actuator, the lift cable, and the extension spring to the sweep actuator mount.



8. Remove the clevis pin/cotter pin securing the actuator to the sweep actuator mount.



9. Install the new main sweep actuator/reinstall the removed actuator in the reverse order of disassembly.
10. Connect the main wire harness to the main brush actuator.
11. Reconnect the battery cable to the machine.
12. Reinstall the right side cover onto the machine.

ADJUST THE MAIN SWEEP POSITION MICRO SWITCH

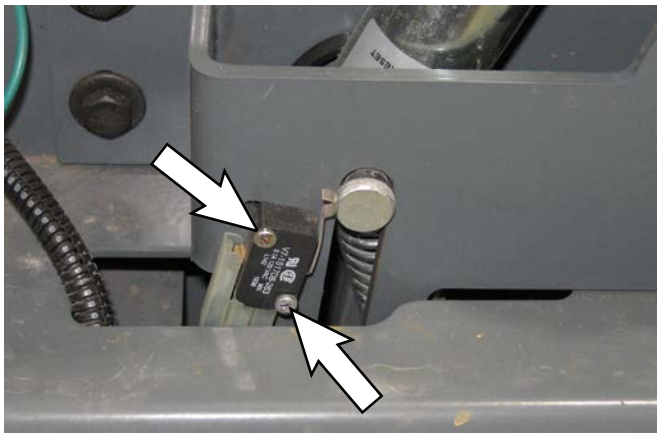
The main sweep brush home position switch must occasionally be adjusted to prevent the main sweep brush from dragging on the ground when in lifted position or lifted into the brush wrap when the brush is raised.

1. Turn key switch ON, raise the main sweep brush to the completed raised position, and turn the key switch OFF.

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

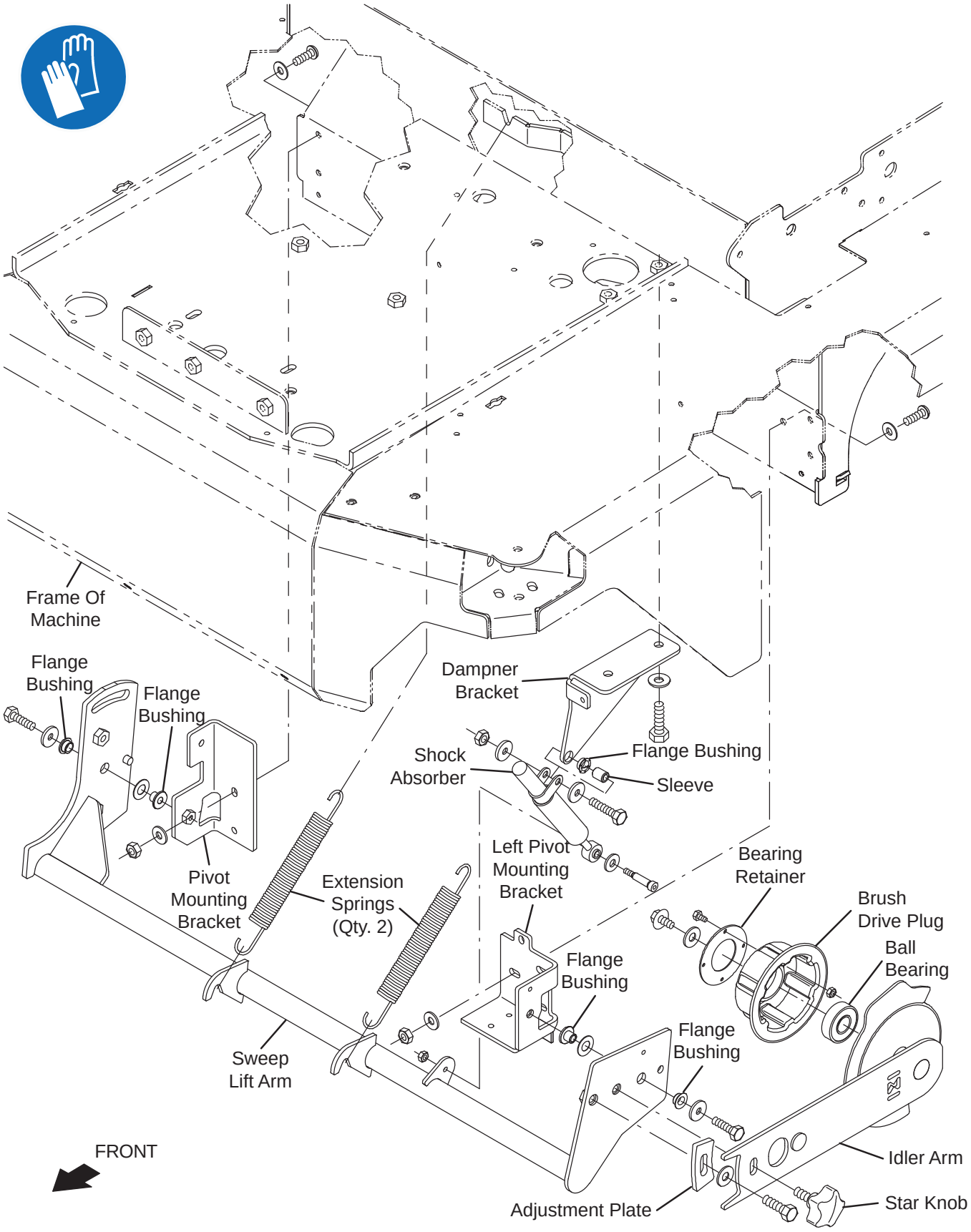
2. Remove the right side cover from the machine.
3. Remove the main sweep brush from the machine and install a new main sweep brush.
4. Measure the distance from the bottom of the main sweep brush to the floor. The distance from the bottom of the main sweep brush to the floor should be between 0.50 in. and 0.875 in. (13 mm and 22 mm).

   If the distance from the bottom of the main sweep brush and the floor is not the between the distances in the previous step the main sweep position micro switch will need to be adjusted.
5. Remove the hardware securing the main sweep position micro switch to the sweep actuator mount.



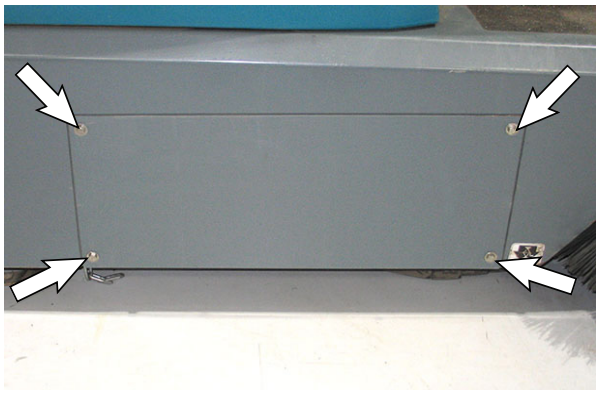
6. Adjust the position of the main sweep position micro switch in the slot. Typically the switch should be positioned near the bottom of the slot.
7. Reinstall the hardware to secure the main sweep position micro switch in the slot in the sweep actuator mount.
8. Turn the key switch ON, lower and raise the main sweep brush, and turn the key switch OFF.
9. Measure the distance from the bottom of the main sweep brush to the floor. If necessary, continue adjusting the micro switch location in the slot until measurement from sweep brush to floor is between 0.50 in. and 0.875 in. (13 mm and 22 mm).
10. Reinstall the right side cover onto the machine.

REPLACE THE MAIN SWEEP LIFT ARM

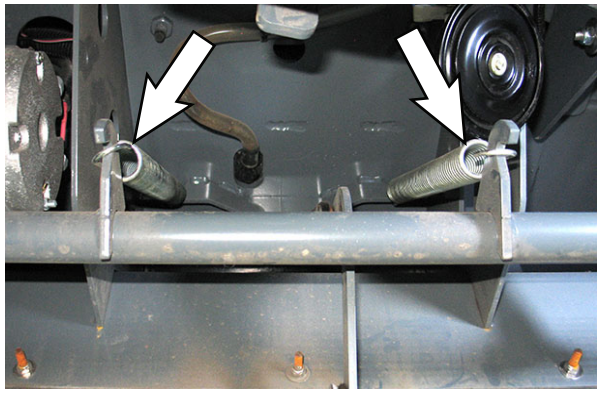


FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and remove key.

1. Turn the key switch OFF and remove the key.
2. Remove the main sweep brush from the machine. See *REPLACING THE MAIN SWEEPING BRUSH* in *MAINTENANCE*.
3. Remove the brush door stop plate from the machine.



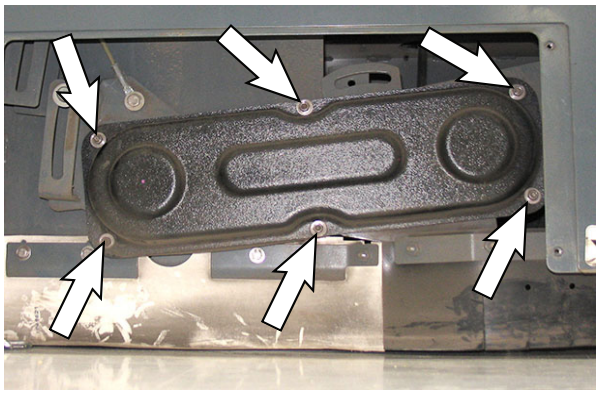
4. Disconnect both extension springs from the main brush lift arm.



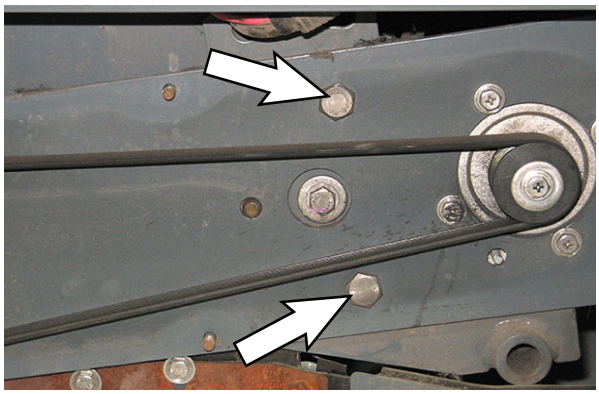
5. Chock both rear wheels.
6. Jack up the front end of the machine enough to access and remove the main sweep brush lift arm from the machine. Place jack stands under the machine and lower the machine onto the jack stands.

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

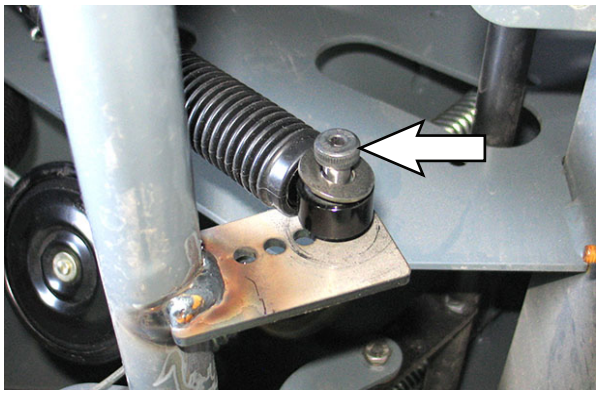
7. Remove the belt cover from the drive arm.



8. Remove M10 hex screws (Qty. 2) securing the drive weldment to the idler arm.



9. Remove the drive weldment from the machine.
10. Remove the M6 shoulder screw securing the shock absorber(damper) to the sweep lift arm.



11. Remove hardware securing the sweep lift arm to the pivot mounting bracket and the left pivot mounting bracket and remove the sweep lift arm from under the machine.

12. Remove the adjustment plate from the sweep lift arm.

13. Install new lift arm onto machine in reverse order of how the old sweep lift arm was disassembled from the machine.

TEST AND REPLACE THE MAIN SWEEP DAMPER (SHOCK ABSORBER)

The main sweep brush damper will degrade over time, cycles, and use, requiring the damper to be replaced. A sign the damper needs to be replaced is main sweep brush “bounce” where the brush does not remain in contact with the sweep surface, adversely affecting sweep performance.

1. Turn key switch ON, raise the main sweep brush to the completed raised position, and turn the key switch OFF.

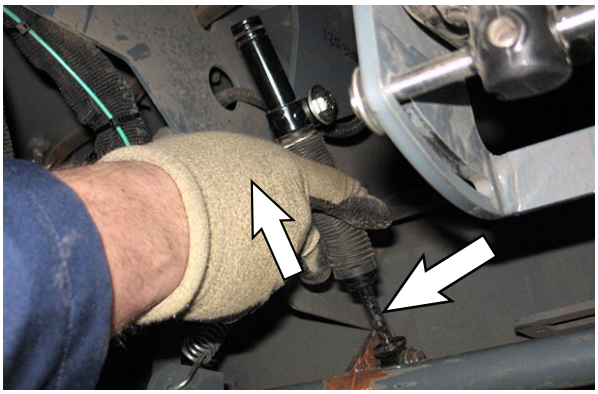
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and remove key.

2. Inspect the main sweep brush. If the main sweep brush is 10.5 in. (267 mm) diameter or less, replace the main sweep brush.

3. Machines with optional left side brush: Remove the left side brush from the machine to allow access to the shock absorber (damper). See *REPLACING THE SIDE BRUSH(ES)* in *MAINTENANCE*.

4. Inspect the main sweep damper boot for damage.

5. Pull shock absorber (damper) boot up from the shaft and inspect the shaft. Clean the shock absorber (damper) shaft as necessary.\



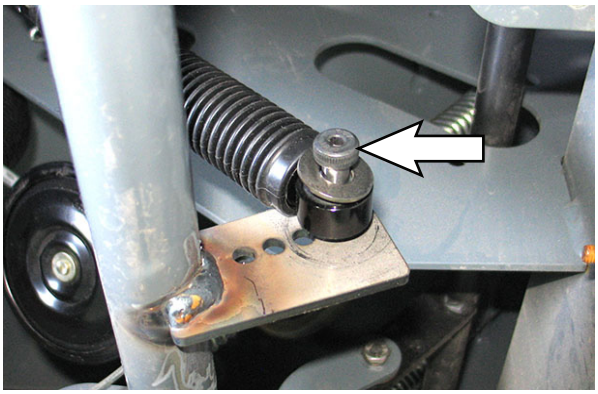
6. Inspect the shock absorber (damper) for damage/ wear. Replace the shock absorber (damper) if damaged/worn.

7. Install a new main sweep brush. See *REPLACING THE MAIN SWEEPING BRUSH* in *MAINTENANCE*.

8. Place the machine into the Manual Mode, lower the main brush, and activate main brush so it spins. Observe the main brush for “bounce”. See *ENTERING THE MANUAL MODE* in *TROUBLE-SHOOTING* section of this manual for instructions how to place machine into Manual Mode.

   If there is brush “bounce” the damper must be replaced.

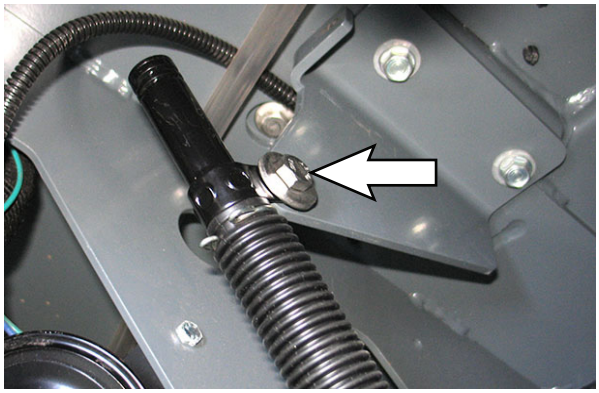
9. Remove the M6 screw securing the shock absorber (damper) to the sweep lift arm.



10. Use hand to extend and retract the shock absorber (damper). The shock absorber (damper) should remain in position when not being moved by hand, and always resist motion. If there is no resistance when retracting/extending the shock absorber (damper), or it does not remain in position when released, replace the shock absorber (damper).

11. If the shock absorber (damper) is not damaged, passes the brush bounce test and the manual test the shock absorber (damper) does not need to be replaced. Reinstall the previously removed M6 shoulder screw to secure the shock absorber (damper) to the sweep lift arm.

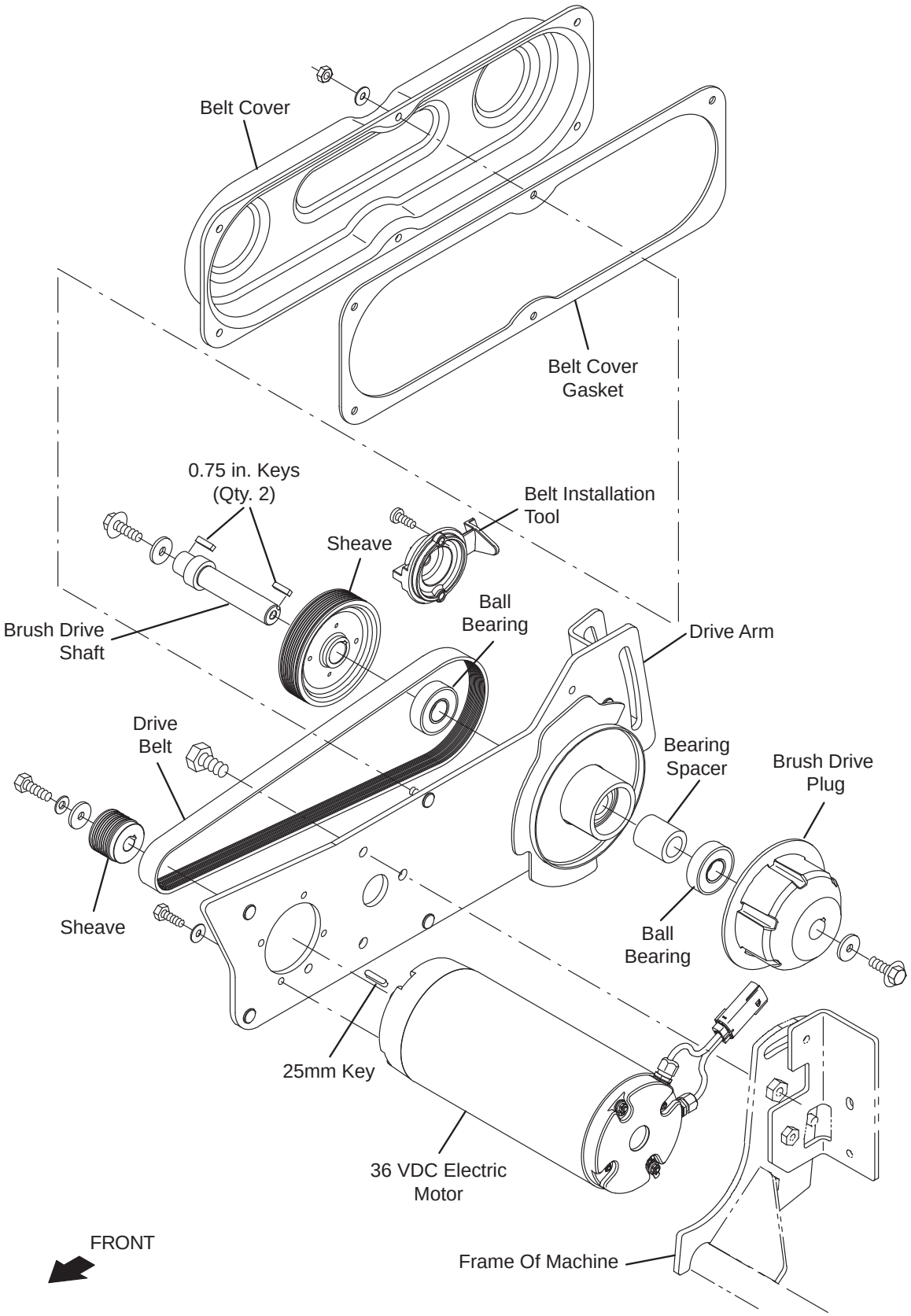
12. If shock absorber (damper) is damaged, remove the M6 screw securing the shock absorber (damper) to the damper bracket and remove the shock absorber (damper) from the machine.



13. Install the new shock absorber (damper) in reverse order of disassembly.

14. Machines with optional left side brush: Reinstall the left side brush onto the machine.

REMOVE/REINSTALL/REPLACE THE MAIN SWEEP MOTOR

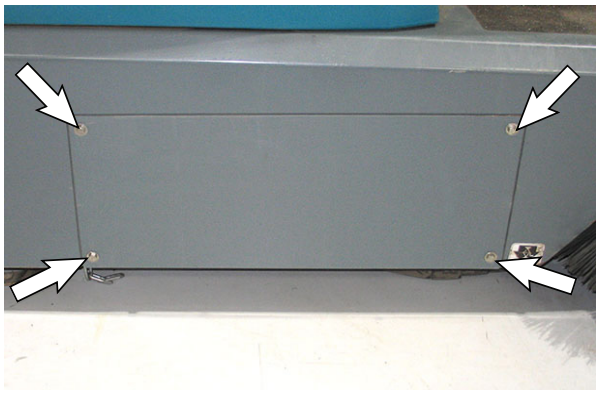


FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and remove key.

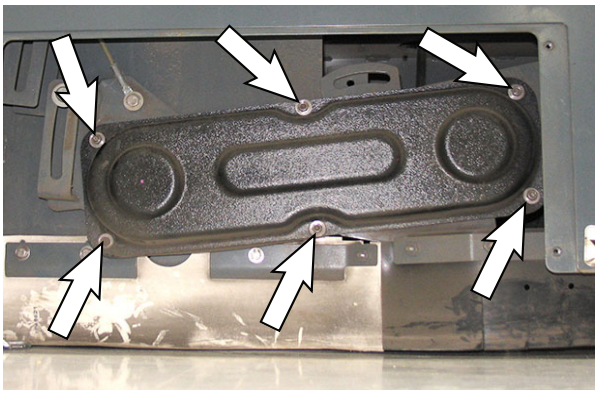
1. Turn the key switch OFF and remove the key.
2. Disconnect the battery cable from the machine.

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

3. Remove the main sweep brush from the machine. See *REPLACING THE MAIN SWEEPING BRUSH* in *MAINTENANCE*.
4. Remove the right side cover from the machine.
5. Remove the brush door stop plate from the machine.



6. Remove the belt cover from the drive arm.



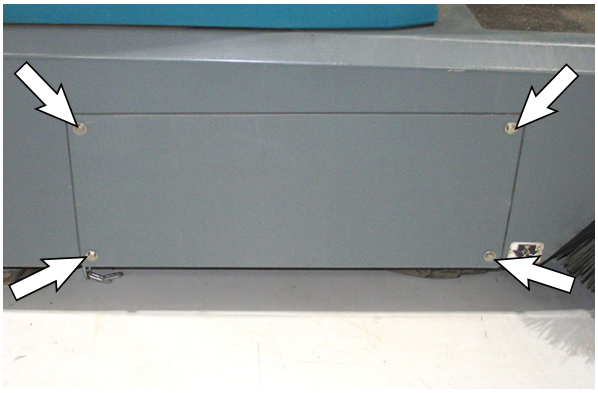
7. Disconnect the main wire harness from the main sweep motor.
8. Carefully remove the belt from the machine.

   If replacing the belt, the belt can be cut from the machine.
9. Remove the hardware securing the main sweep motor to the drive arm and remove the motor from inside the sweep compartment.
10. Remove the M6 hex screw securing the sheave to the main sweep motor.
11. Carefully pry the sheave from the main sweep motor. Take care to not damage sheave when prying it from the main sweep motor.
12. Install the sheave onto the new main sweep motor.
13. Tape a 12 in. (305 mm) piece of wire to the connector/leads of the new main brush motor. Wire will aid routing the main brush motor leads through the frame of the machine.
14. Install the new motor onto the machine in reverse order of disassembly.
15. Connect the main wire harness to the main sweep motor.
16. Reinstall the removed belt/install the new belt onto the main brush drive group. See see *REMOVING/ REPLACING THE MAIN SWEEP DRIVE BELT* for procedure how to install the belt.
17. Reinstall the brush door stop plate onto the machine.
18. Reinstall the main sweep brush into the main sweep brush compartment. See *REPLACING THE MAIN SWEEPING BRUSH* in *MAINTENANCE*.
19. Reinstall the right side cover onto the machine.
20. Reconnect the battery cable to the machine.

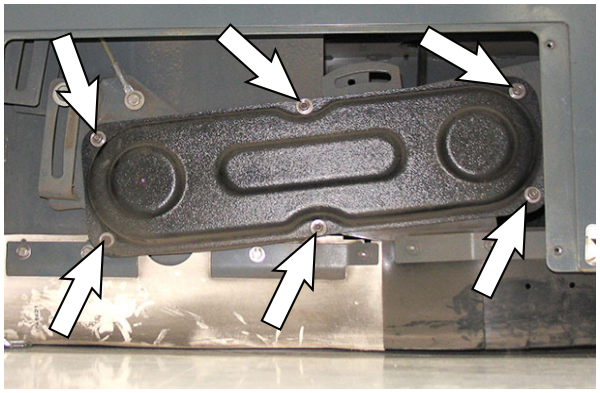
REMOVING/REPLACING THE MAIN SWEEP DRIVE BELT

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

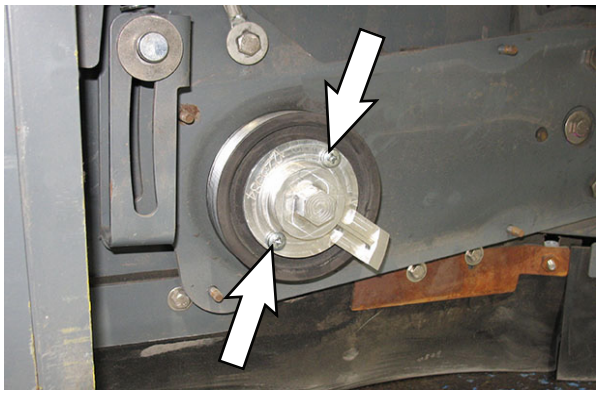
1. Turn the key switch OFF and remove the key.
2. Remove the brush door stop plate from the machine.



3. Remove the belt cover from the drive arm.

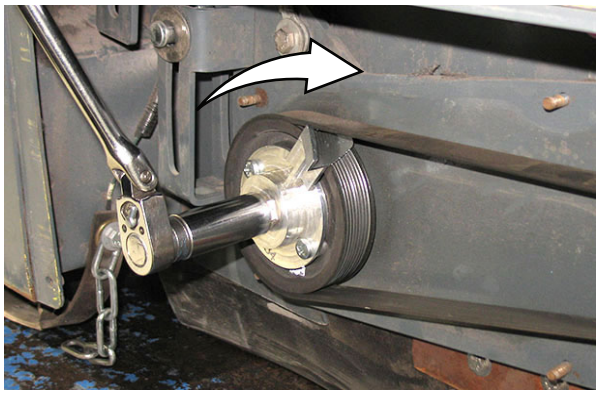


4. Use two M6 pan screws to install the belt installation tool onto one of the large sheaves.



5. Position the belt onto the motor sheave and then position the belt onto the belt installation tool.

6. Turn the belt installation tool/sheave clockwise to install the belt onto both sheaves.

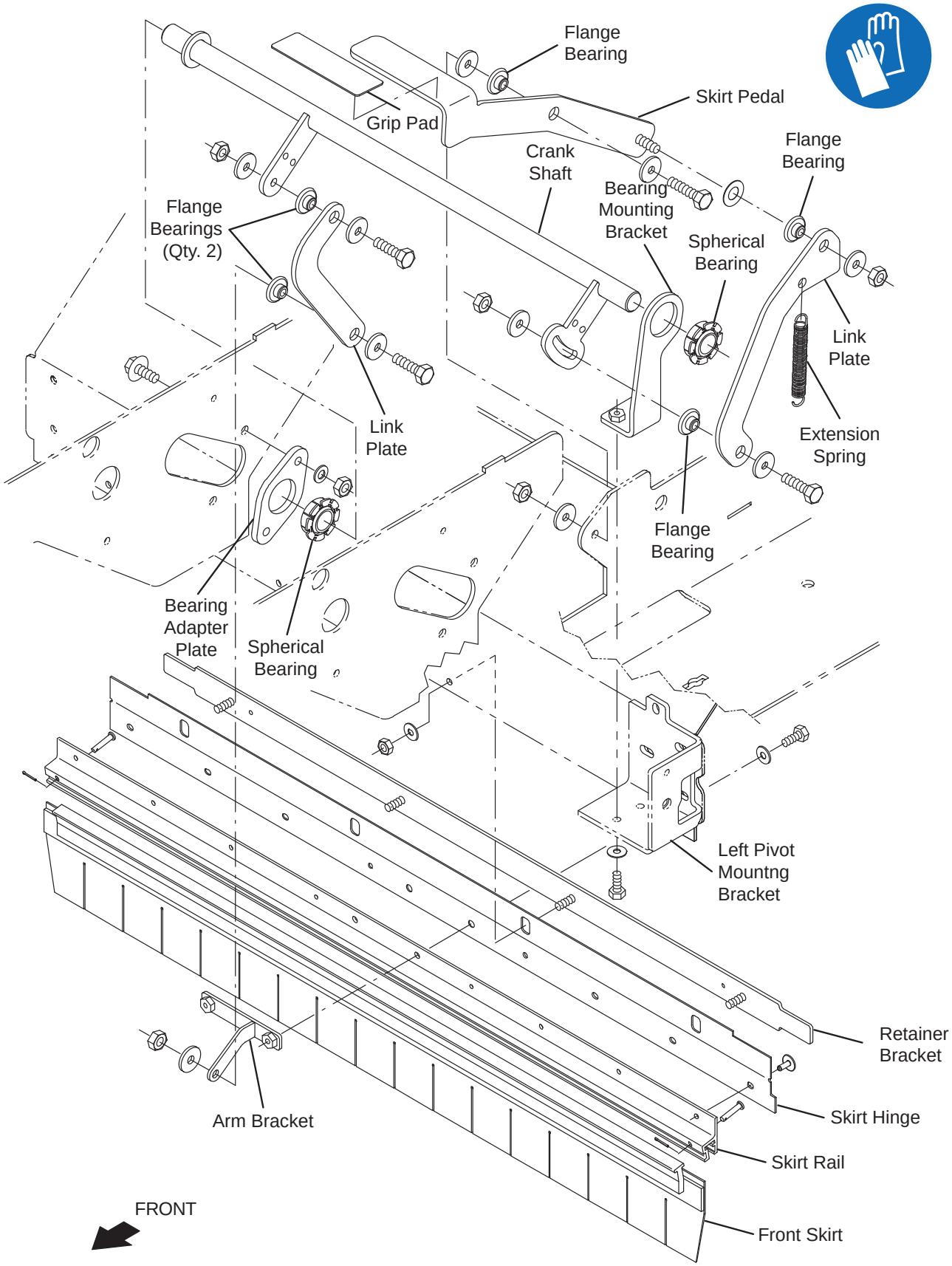


7. Rotate the belt on the sheaves and use fingers to work the belt the rest of the way onto the sheaves

NOTE: Take care to not pinch fingers in the belt(s) and the sheaves while rotating the belt onto the sheaves

8. Remove the belt installation tool from the sheave.
9. Reinstall the drive belt cover onto the machine
10. Reinstall the brush door stop plate onto the machine onto the machine.

REMOVE/REINSTALL/REPLACE THE FLAP HINGE



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

1. Turn the key switch OFF and remove the key.
2. Remove the main sweep brush from the machine. See *REPLACING THE MAIN SWEEPING BRUSH* in *MAINTENANCE* section.
3. Remove the large debris trap skirt from the machine. See *LARGE DEBRIS TRAP SKIRT* in *MAINTENANCE*.
4. Remove the hardware securing the arm bracket to the skirt hinge.
5. Remove the hardware securing the skirt hinge to the retainer bracket and remove the skirt hinge from the retainer bracket.
6. If replacing the skirt hinge, remove the skirt rail from the skirt hinge.
7. If replacing skirt hinge, install the skirt rail onto the new skirt hinge.
8. Install new skirt hinge/reinstall the removed skirt hinge in reverse order of disassembly.
9. Install the large debris trap skirt onto the machine. See *LARGE DEBRIS TRAP SKIRT* in *MAINTENANCE*.
10. Reinstall the main sweep brush. See *REPLACING THE MAIN SWEEPING BRUSH* in *MAINTENANCE*.
11. Test and adjust the large debris trap skirt. See *TEST AND ADJUST THE LARGE DEBRIS TRAP SKIRT*.

TEST AND ADJUST THE LARGE DEBRIS TRAP SKIRT

Adjust the front skirt when the skirt is getting caught in the main sweep brush or if the front skirt hinge has been replaced.

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

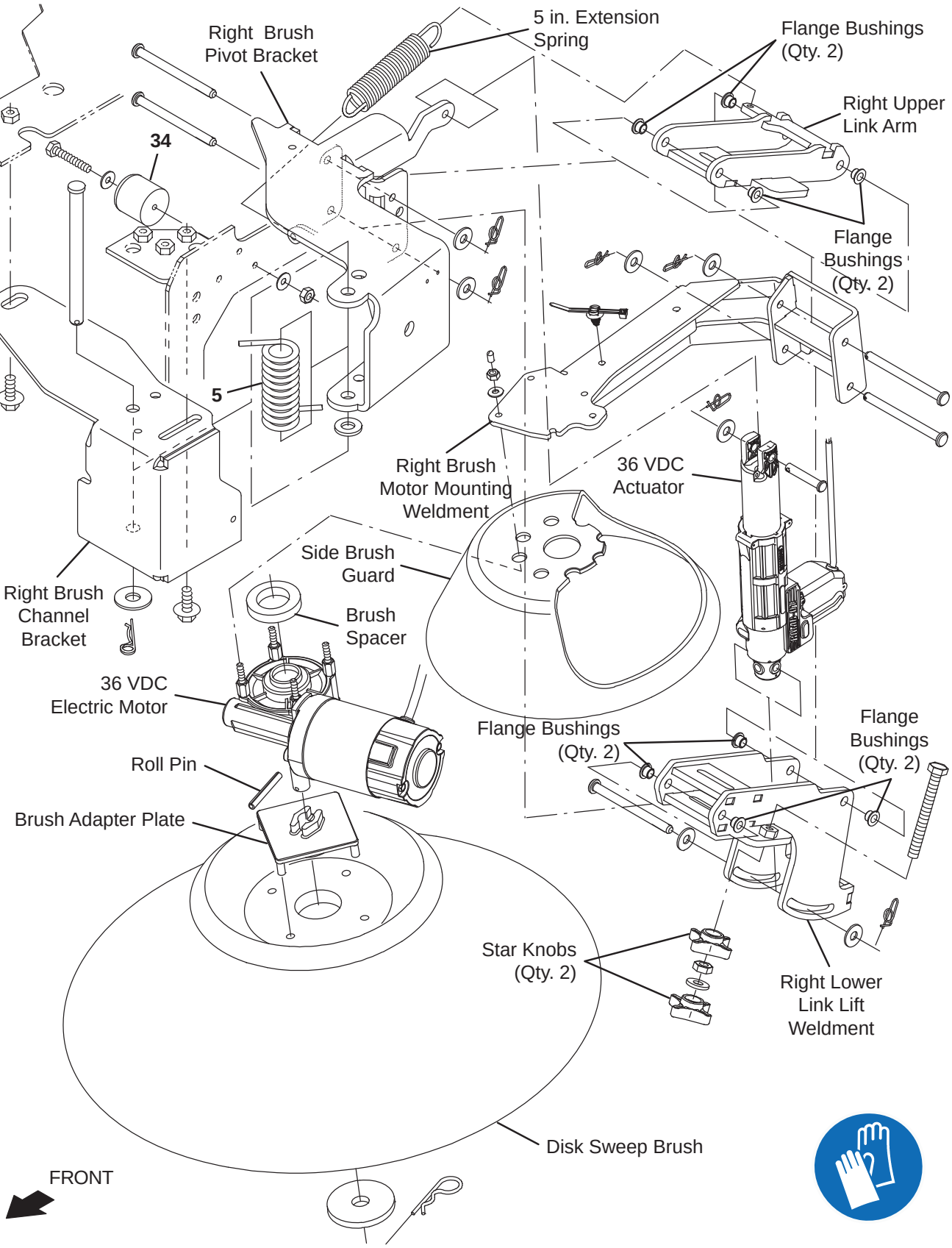
Test the large debris trap skirt:

1. Replace the large debris trap skirt. See **L***ARGE DEBRIS TRAP SKIRT* in *MAINTENANCE* section.
2. Replace the main sweep brush. See *REPLACING THE MAIN SWEEPING BRUSH* in *MAINTENANCE* section.
3. Position the large debris trap skirt so the skirt end is rolled back toward the brush.
4. Turn key switch ON and propel machine forward approximately 24 in. (610 mm). Turn key switch OFF.
5. Observe the large debris trap skirt and main sweep brush. The large debris trap skirt must not be getting caught in the main sweep brush. The large debris trap skirt must be touching the floor or not less than 0.125 in (3 mm) from the floor. Proceed to following step if large debris trap skirt is getting caught in the main sweep brush and/or not touching or within the allowed tolerance of touching the floor. Ensure the large debris trap skirt is not bent/folded.

Adjust the large debris trap skirt:

6. Turn key switch OFF.
7. Remove the main sweep brush from the machine.
8. Loosen the M6 hex nuts (Qty. 4) securing the skirt rail and rubber skirt hinge to the retainer bracket.
9. Separate the rubber skirt hinge from the retainer bracket.
10. Adjust the rubber hinge as necessary so the large debris trap skirt is not getting caught in the main sweep brush.
11. Tighten the previously loosened M6 hex nuts (Qty. 4) to secure the skirt rail and rubber skirt hinge to the retainer bracket.

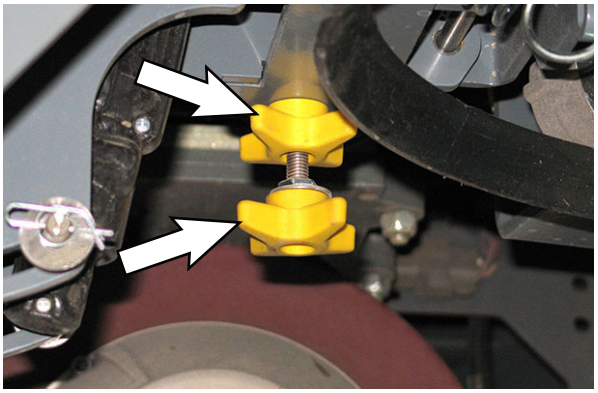
REMOVING/REPLACING THE RIGHT SIDE SWEEP ACTUATOR OR OPTIONAL LEFT SIDE SWEEP ACTUATOR



NOTE: This procedure can be used to remove/replace either the right side brush actuator or the left side brush actuator. Although only the standard right side sweep assembly is shown, the right side sweep illustration can be used for reference since all parts are located in same locations for the right side sweep assembly and the optional left side sweep assembly.

1. Remove the brush from the side brush assembly.

2. Loosen the top star knob and turn the bottom star knob clockwise until it is at the position for a new or moderately worn brush.



3. Turn key switch ON, completely lower the side brush, and turn the key switch OFF.

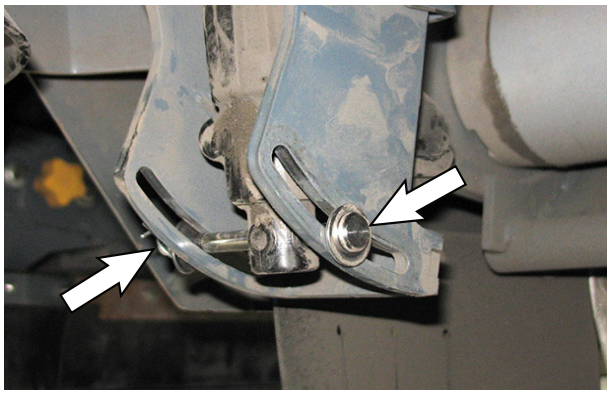
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and remove key.

4. Disconnect the battery cable from the machine.

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

5. Disconnect the main wire harness from the side sweep actuator.

6. Remove the hardware securing the 36 VDC actuator to the lower link lift weldment.



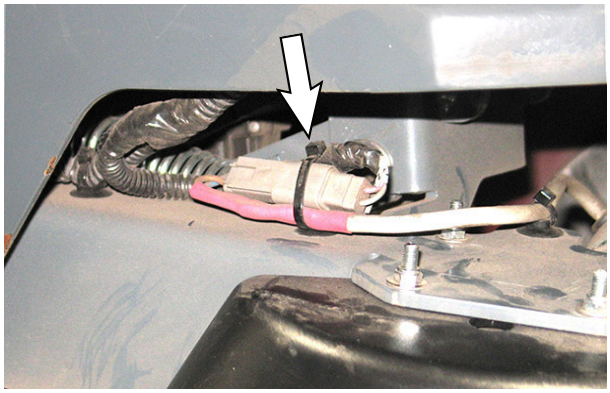
7. Remove the hardware securing the 36 VDC actuator to the brush pivot bracket.

8. Remove the 36 VDC actuator to the side brush assembly.

9. Reinstall the removed 36 VDC actuator/install the new 36 VDC actuator onto the right or left side brush assembly in reverse order of disassembly,

10. If installing a new 36 VDC actuator, fully extend the actuator to make installation easier.

11. Check and adjust the right and/or left side brush pattern(s). See *CHECKING THE SIDE BRUSH PATTERN(S)* and *ADJUSTING THE SIDE BRUSH PATTERN(S)* in the *MAINTENANCE* section of this manual for instructions how to check and adjust the side brush pattern(s).

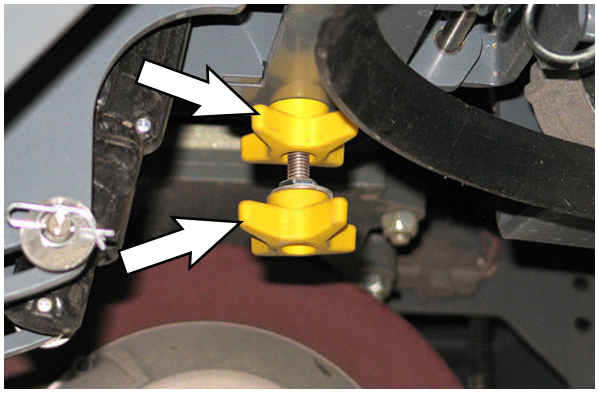


REMOVING/REPLACING THE RIGHT SIDE SWEEP MOTOR OR OPTIONAL LEFT SIDE SWEEP SIDE MOTOR

NOTE: to remove/replace either the right side brush motor the left side brush motor. Although only the standard right side sweep assembly is shown, the right side sweep illustration can be used for reference since all parts are located in same locations for the right side sweep assembly and the optional left side sweep assembly.

1. Remove the brush from the side brush assembly.

2. Loosen the top star knob and turn the bottom star knob counterclockwise until it is at the position for a completely worn brush.



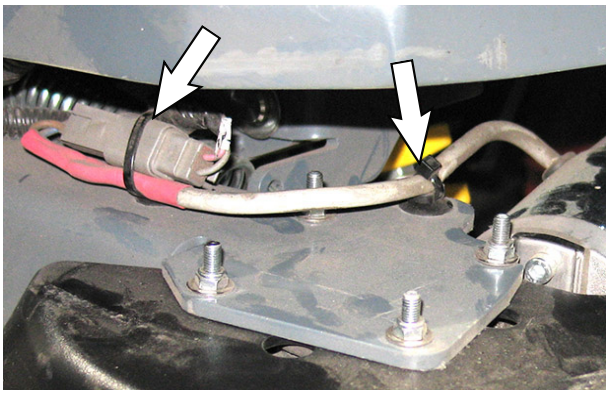
3. Turn key switch ON, completely lower the side brush to allow access to all side brush motor mounting hardware, and turn the key switch OFF.

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

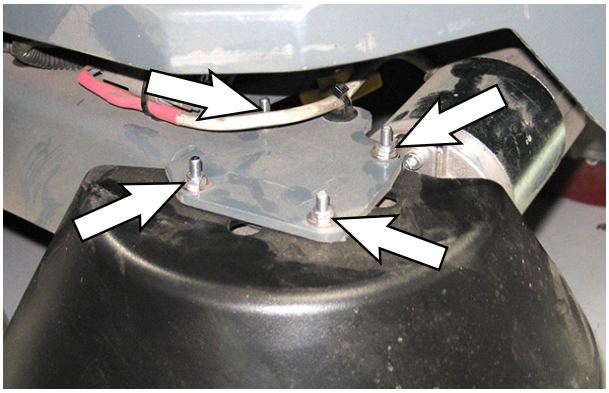
4. Disconnect the battery cable from the machine.

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

5. Cut the cable ties securing the side sweep motor cable to the machine and disconnect the main wire harness from the side sweep motor.



6. Remove the hardware securing the 36 VDC side brush motor and side brush guard to the brush motor mounting weldment.



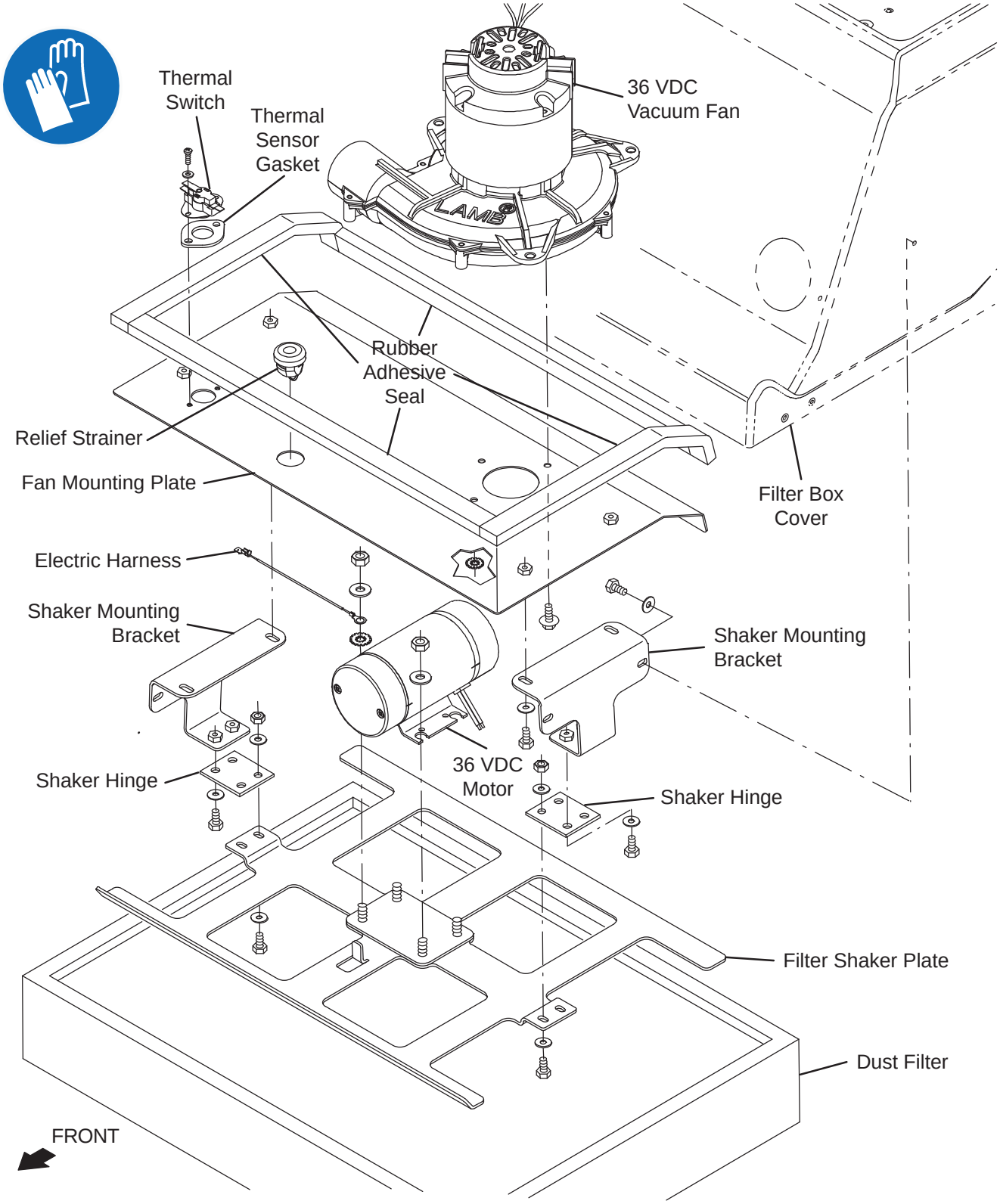
7. Remove the side brush guard from 36 VDC side brush motor.

8. Reinstall the 36 VDC electric motor/install the new 36 VDC electric motor onto the right side brush assembly (left side brush assembly) in reverse order of disassembly.

9. Check and adjust the right and/or left side brush pattern(s). See *CHECKING THE SIDE BRUSH PATTERN(S)* and *ADJUSTING THE SIDE BRUSH PATTERN(S)* in the *MAINTENANCE* section of this manual for instructions how to check and adjust the side brush pattern(s).

HOPPER SYSTEM

REMOVE/REINSTALL/REPLACE THE VACUUM FAN

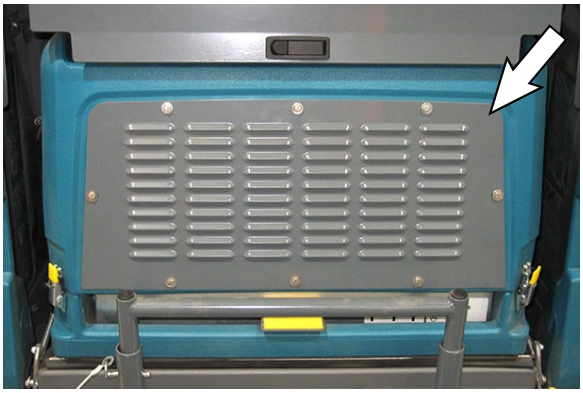


FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and remove key.

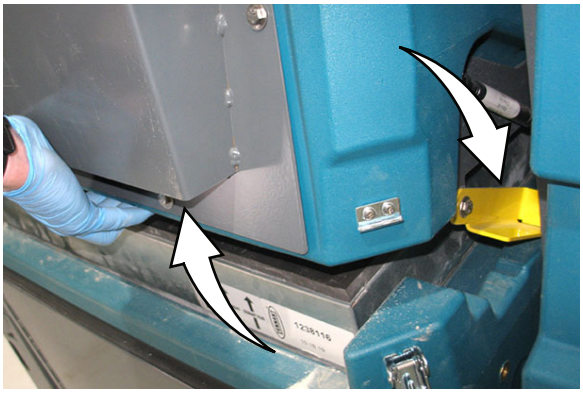
1. Turn the key switch OFF and remove the key.
2. Disconnect the battery cable from the machine.

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

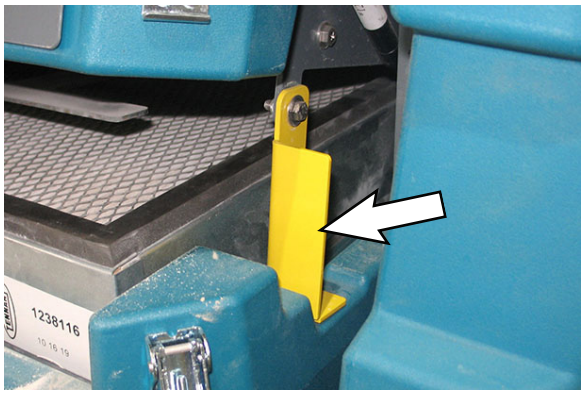
3. Remove the louvered rear cover from the filter box cover.



4. Disconnect the harness from the vacuum fan.
5. Loosen each hopper filter compartment retainer latch located on both sides of the filter compartment.
6. Lift the hopper filter compartment until the hopper filter compartment prop arm secures the hopper filter compartment open.



NOTE: Ensure the hopper filter compartment prop arm is fully engaged before removing the filter from the machine.

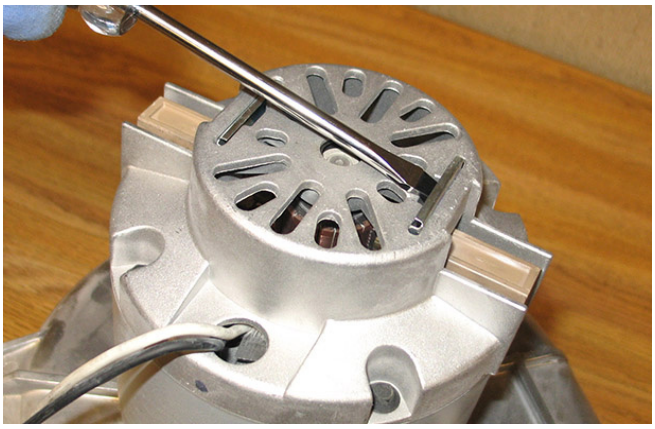


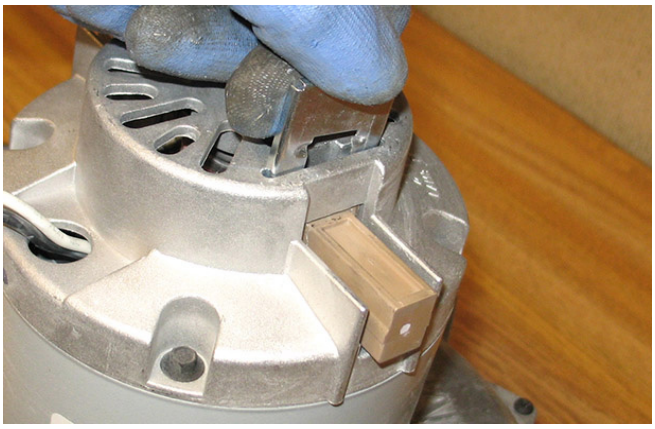
7. Remove the hopper filter from the hopper filter compartment.
8. Remove the hardware securing the filter shaker plates to the shaker mounting brackets and pull the filter shaker plate/filter shaker motor out enough to access the main wire connection to the filter shaker motor.
9. Disconnect the main harness from the filter shaker motor and remove the filter shaker plate/filter shaker motor from the hopper.
10. Remove the hardware securing the vacuum fan to the fan mounting plate.
11. Remove the hardware securing both shaker mounting brackets to the filter box cover.
12. Remove the vacuum fan from the vacuum fan compartment inside the filter box cover.
13. If replacing the vacuum fan carbon brushes, proceed to *REMOVE/INSPECT/REPLACE THE VACUUM FAN CARBON BRUSHES*.
14. Reinstall removed vacuum fan/install new vacuum fan in reverse order of disassembly.
15. Reinstall the filter shaker plate/filter shaker motor into vacuum fan/filter compartment.
16. Reinstall the louvered rear cover onto the filter box cover.
17. Reinstall the hopper filter into the filter compartment.
18. Reconnect the battery cable to the machine.

REMOVE/INSPECT/REPLACE THE VACUUM FAN CARBON BRUSHES

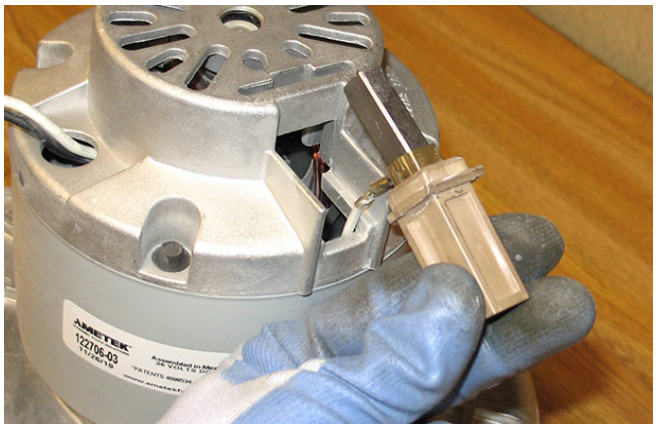
NOTE: Carbon brushes should be replaced as sets.

1. Remove the vacuum fan from the hopper. See *REMOVE/REINSTALL/REPLACE THE VACUUM FAN*.
2. Pry/remove the carbon brush retainer from the vacuum fan motor.

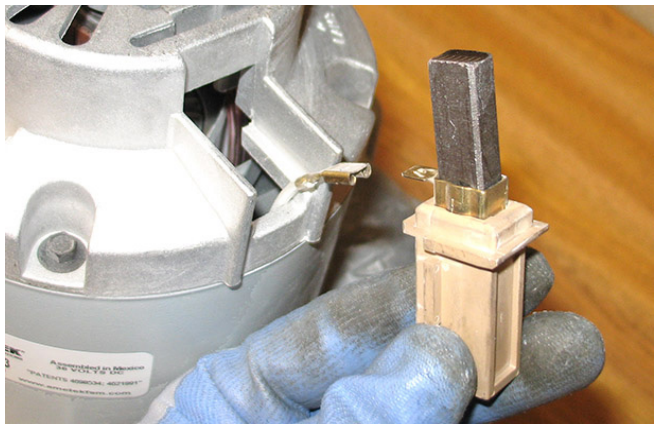




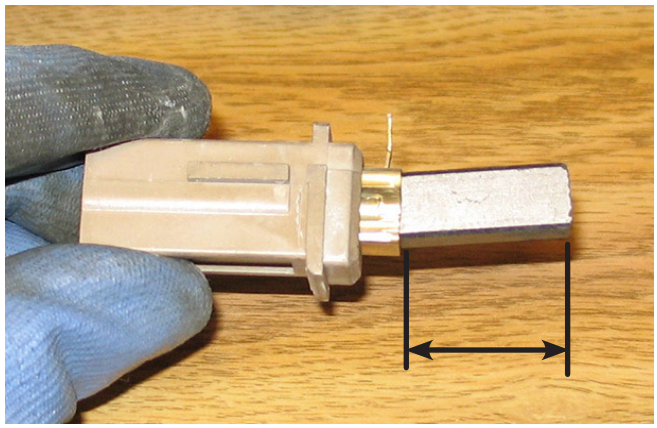
3. Carefully pull the carbon brush from the vacuum fan motor.



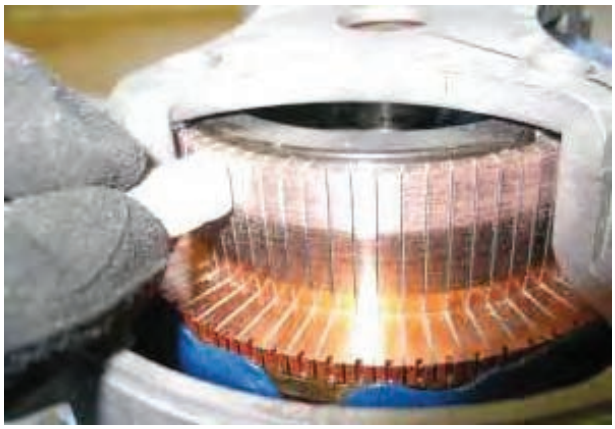
4. Disconnect the wire from the vacuum fan motor carbon brush.



5. Inspect carbon brushes. Replace carbon brushes if they are stuck (brush should freely extend/retract in holder) or are less than 0.375 in. (10 mm) in length.

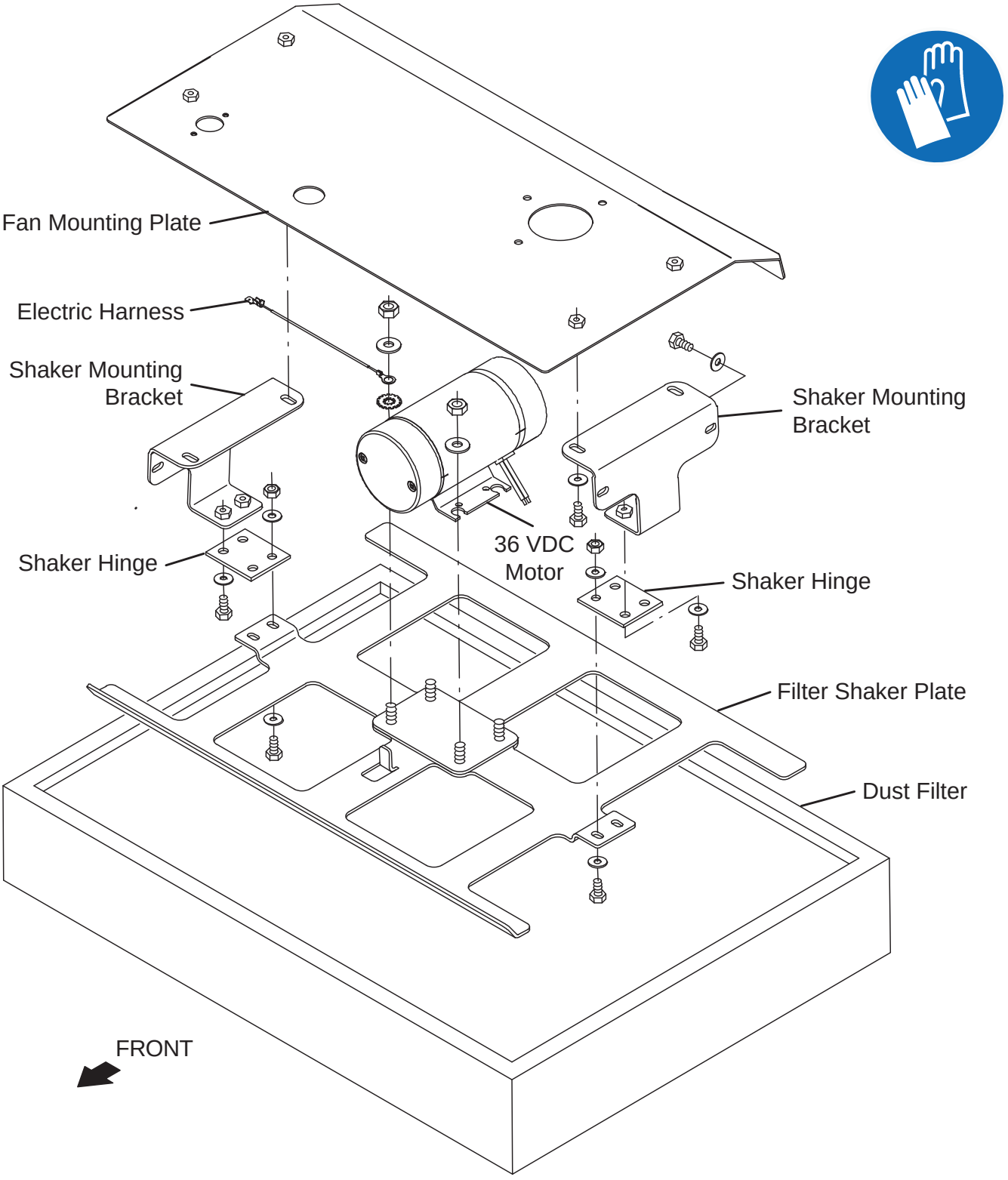


6. Use a stone to clean the commutator.



7. Use compressed air to clean dust from inside the vacuum fan motor.
8. Reinstall the removed vacuum fan brushes/install the new vacuum fan brushes in reverse order of disassembly.
9. Reinstall the vacuum fan into the vacuum fan compartment inside the filter box cover. See *REMOVE/REINSTALL/REPLACE THE VACUUM FAN*

REMOVE/REPLACE THE FILTER SHAKER MOTOR

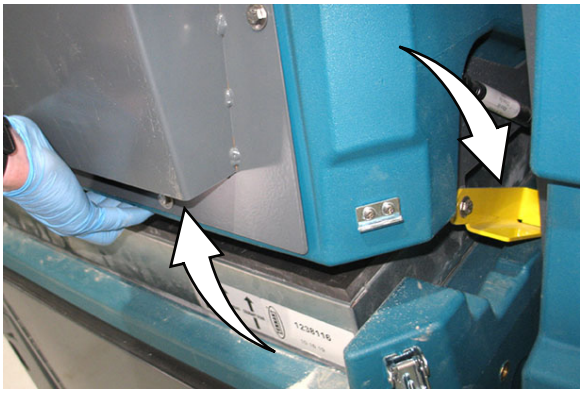


FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and remove key.

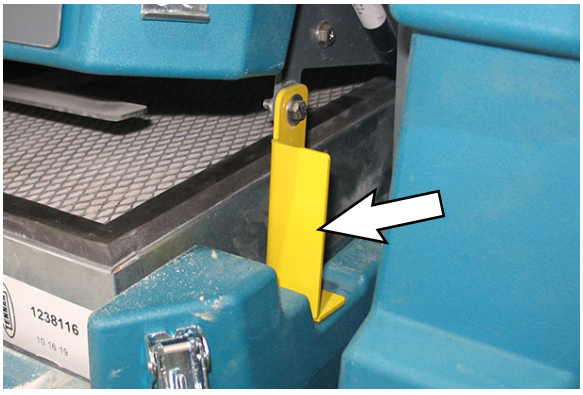
1. Turn the key switch OFF and remove the key.
2. Disconnect the battery cable from the machine.

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

3. Loosen each hopper filter compartment retainer latch located on both sides of the filter compartment.
4. Lift the hopper filter compartment until the hopper filter compartment prop arms secure the hopper filter compartment open.



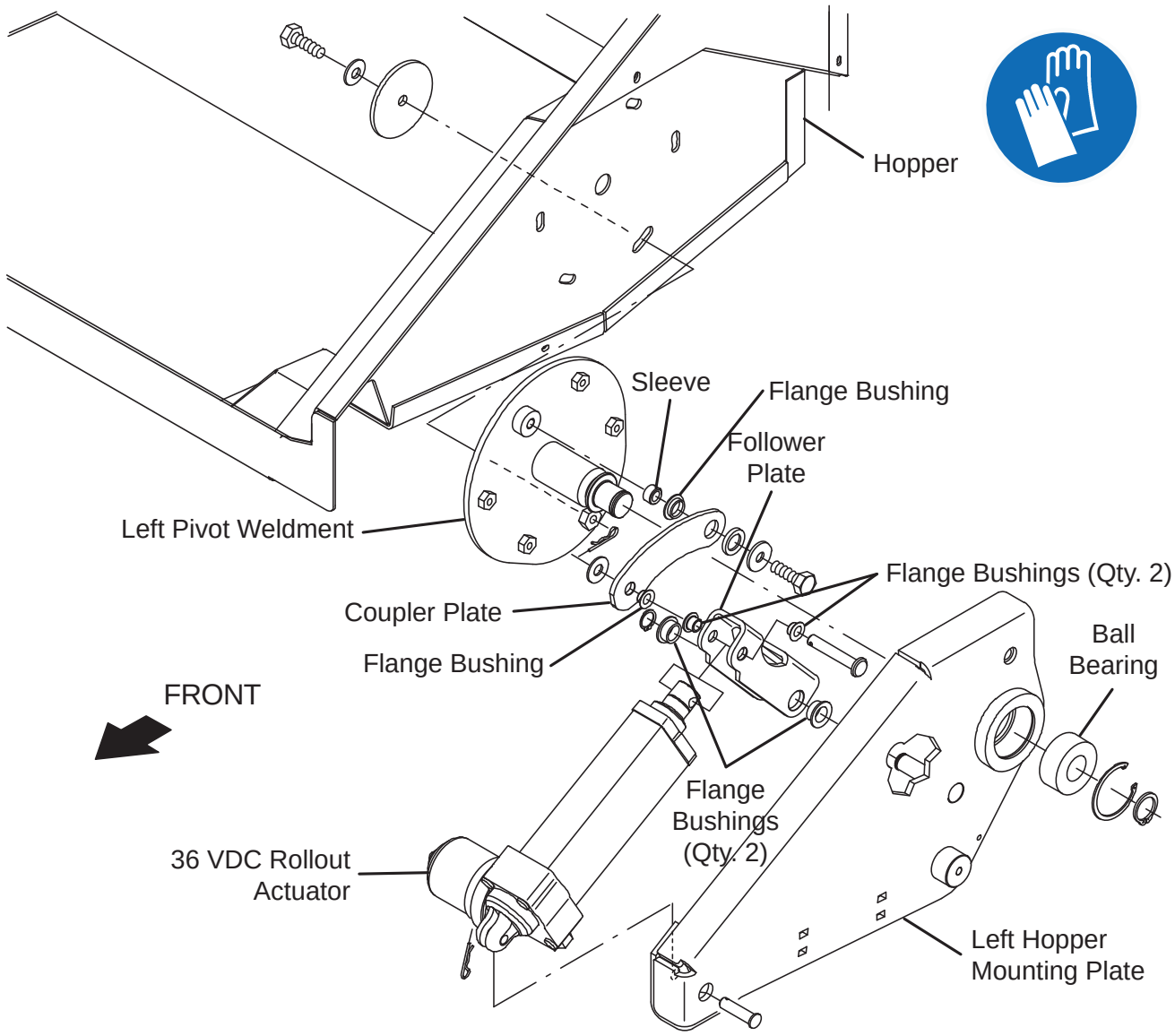
NOTE: Ensure the hopper filter compartment prop arm is fully engaged before removing the filter from the machine.



5. Remove the filter from the hopper filter compartment.
6. Remove the hardware securing the filter shaker plate to the shaker mounting brackets and pull the filter shaker plate/filter shaker motor out enough to access the main wire connection to the filter shaker motor.
7. Disconnect the main harness from the filter shaker motor and remove the filter shaker plate/filter shaker motor from the hopper.
8. Remove the filter shaker motor from the filter shaker plate.
9. Install the new filter shaker motor onto the filter shaker plate.
10. Install the filter shaker plate/filter shaker motor into the hopper in reverse order of disassembly.
11. Reinstall the filter into the hopper and close and secure the filter compartment.

NOTE: Ensure the wire harness is secured away shaker plate and filter so it cannot get pinched between the shaker plate and the filter.

REPLACE THE HOPPER ROLLOUT ACTUATOR



1. Turn the key switch ON, completely raise the hopper, engage the hopper support, turn the key switch OFF, and remove the key.

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

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

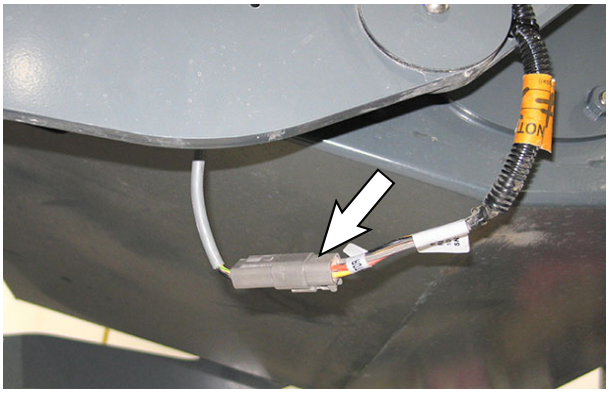
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and remove key.

2. Disconnect the battery cable from the machine.

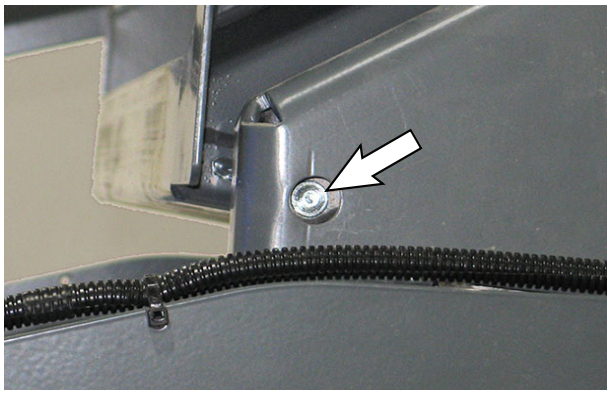
FOR SAFETY: When servicing machine, Disconnect battery connection and charger cord before working on machine.

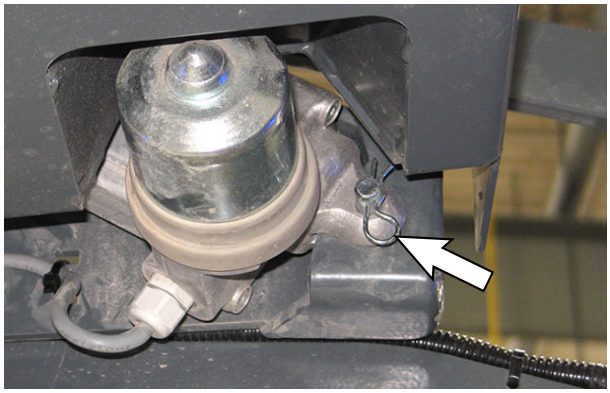
3. Cut cable ties securing the rollout actuator cable to the hopper arm.

4. Disconnect the main wire harness from the rollout actuator.

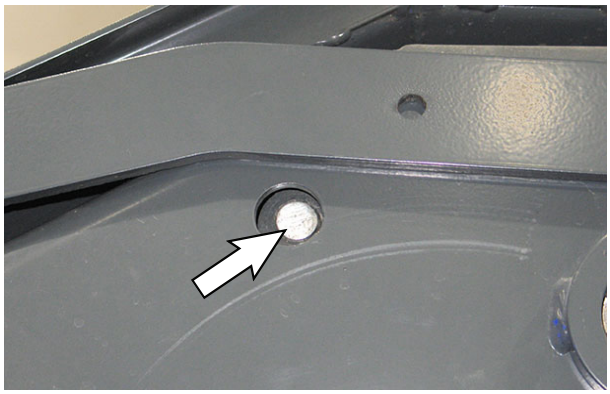


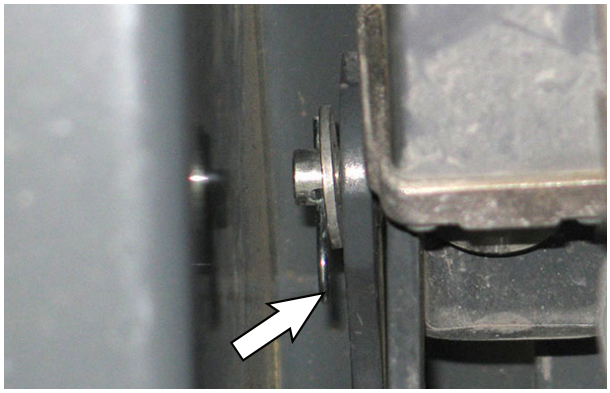
5. Remove the cotter pin securing the clevis pin in the rollout actuator and left hopper mounting plate.





6. Remove the cotter pin securing the clevis pin in the rollout actuator and follower plate





7. Secure the hopper into the rolled in position so hopper does not roll when clevis pins are removed from the rollout actuator and the left hopper mounting plate and follower plate.

8. Remove the clevis pins securing the rollout actuator to the left hopper mounting plate and follower plate and remove the rollout actuator from the machine.

9. Hold the new rollout actuator/removed rollout actuator up into the hopper assembly and install the clevis pin into the rollout actuator and the follower plate.

10. Install the clevis pin into the rollout actuator and the left hopper mounting plate.

11. Unsecure the hopper from the rolled in position.

12. Connect the main wire harness to the rollout actuator.

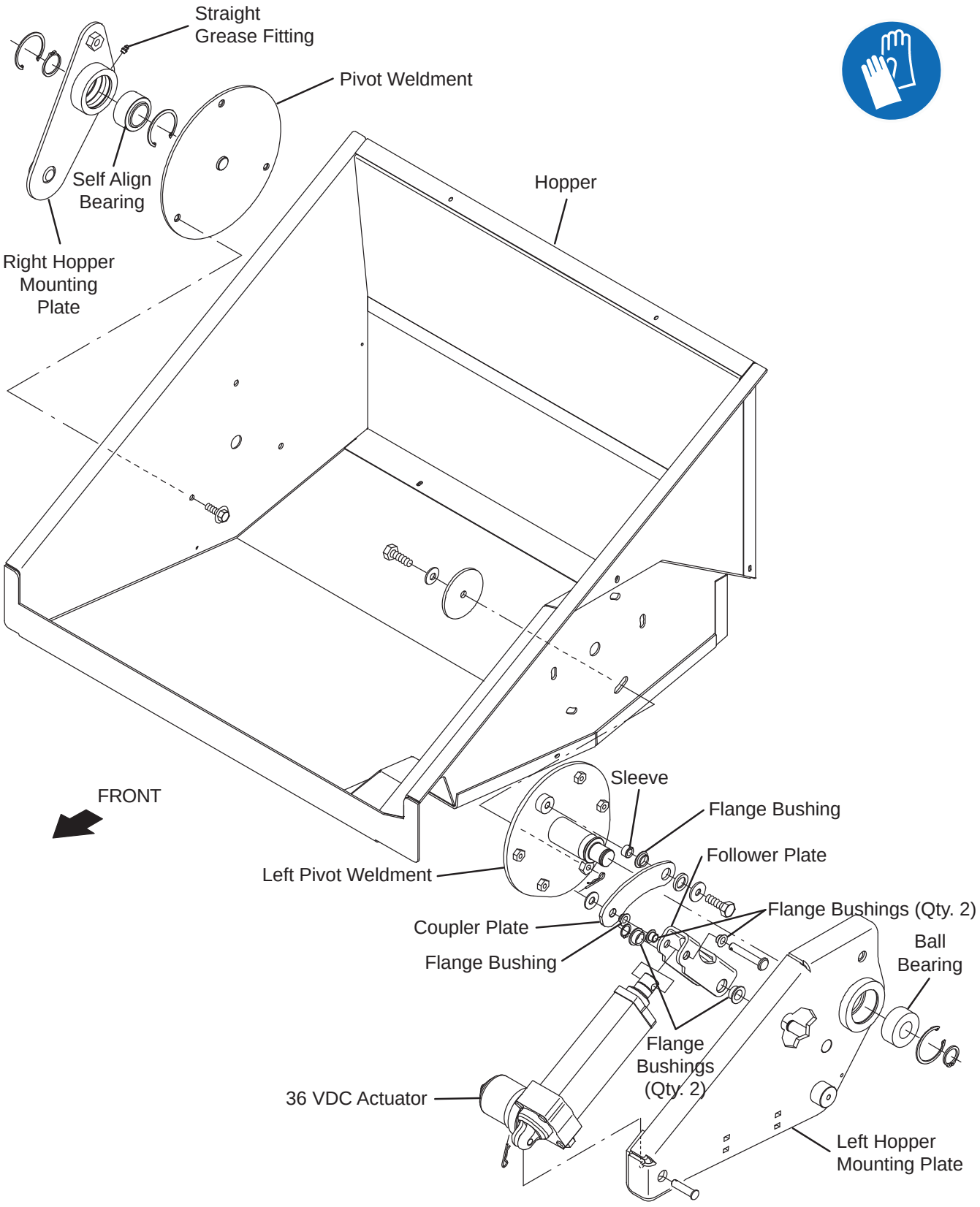
13. Replace previously removed wire ties to secure the main wire harness rollout actuator cable to the hopper left arm.

14. Reconnect the battery cable to the machine.

15. Inspect/Adjust the hopper pitch. See *INSPECTING AND ADJUSTING THE HOPPER PITCH* in the this section of the Service Manual.

16. Inspect/Adjust the hopper seal. See *INSPECTING AND ADJUSTING THE HOPPER SEAL* in this section of the Service Manual.

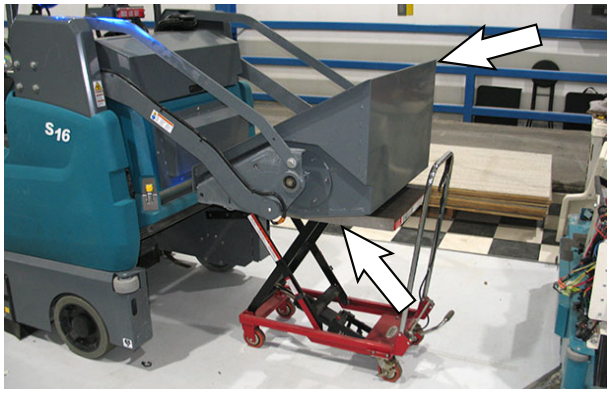
REMOVING/REINSTALLING/REPLACING THE HOPPER



1. Turn the key switch ON, and raise the hopper approximately half way, turn the key switch OFF, and remove the key.

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

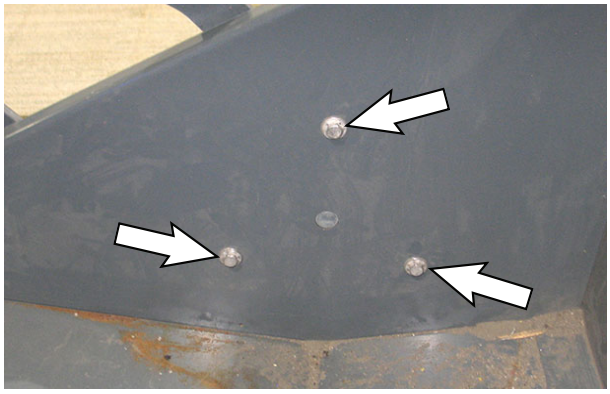
2. Position a sturdy table/platform/elevated flat surface under the hopper.

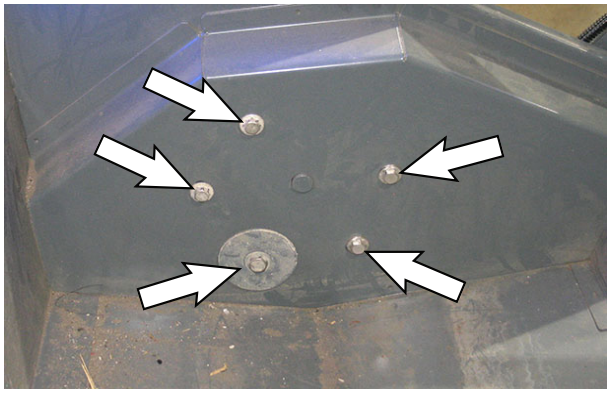


3. Turn the key switch ON, lower the hopper onto item being used to support the hopper, turn the key switch OFF, and remove the key.

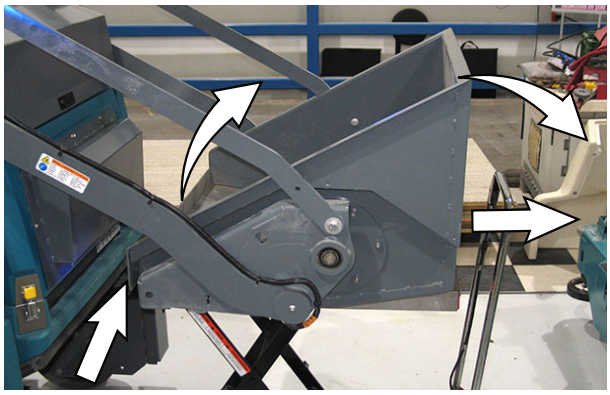
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and remove key.

4. Remove all hardware securing the hopper to the pivot weldment and the left pivot weldment.





5. Tilt hopper back on the table so the front end of the hopper can clear the hopper lift components and pull the hopper out from the machine.



6. Install the new hopper/reinstall the removed hopper onto the machine in reverse order of disassembly.

7. Inspect/Adjust the hopper pitch. See *INSPECTING/ADJUSTING THE HOPPER PITCH* in this section of the Service Manual.

8. Inspect/Adjust the hopper seal. See *INSPECTING/ADJUSTING THE HOPPER SEAL* in this section of the Service Manual.

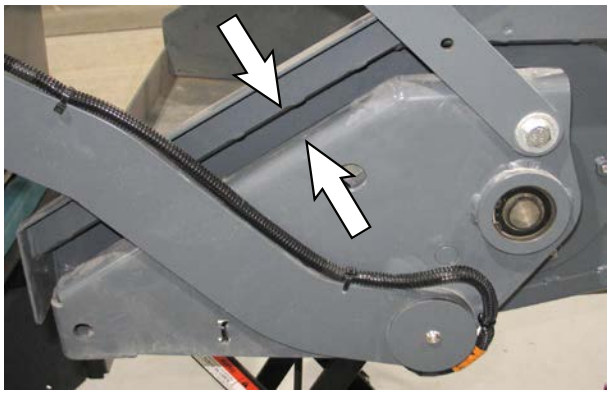
INSPECTING/ADJUSTING THE HOPPER PITCH

1. Turn the key switch ON, raise the hopper approximately half way, turn the key switch OFF, and remove the key.

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

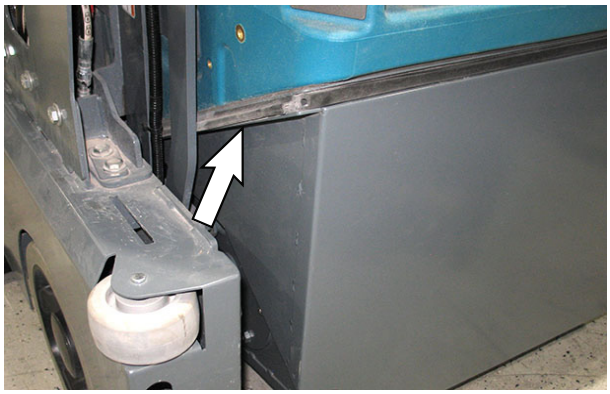
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and remove key.

2. Observe the edge of the hopper with the top edge of the left hopper mounting plate. These two edges should be parallel.



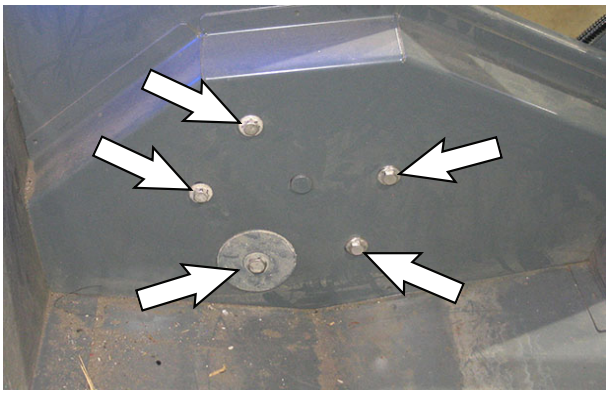
3. Turn the key switch ON, completely lower the hopper, turn the key switch OFF, and remove the key.

4. Observe the angled edge of the hopper. Hopper edge should be parallel with seal plate.



If the hopper edge is not parallel with seal plate, proceed to the following step to adjust pitch.

5. Loosen the hardware securing the hopper to the left pivot weldment.



6. Adjust the hopper so the edge of the hopper is parallel with the top edge of the left hopper mounting plate.

7. Tighten the hardware securing the hopper to the left pivot weldment.

INSPECTING/ADJUSTING THE HOPPER SEAL CONTACT

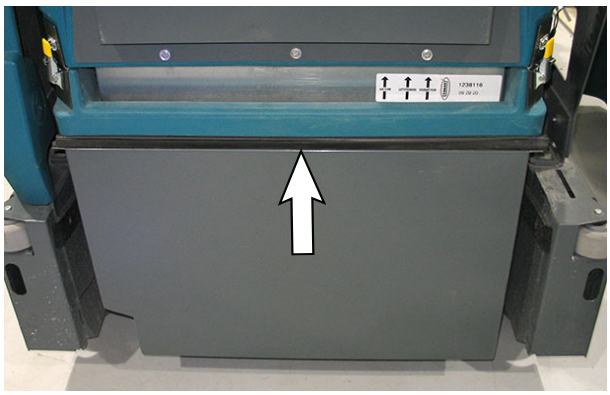
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and remove key.

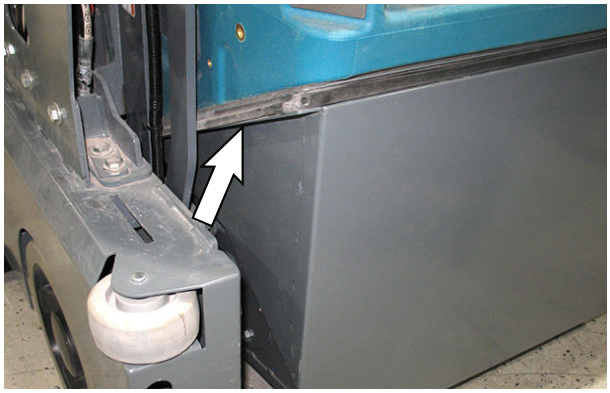
1. Remove the left side cover and the right side cover from the machine.
2. Observe how the edge of the hopper with the bulb seals installed on the hopper filter box housing.

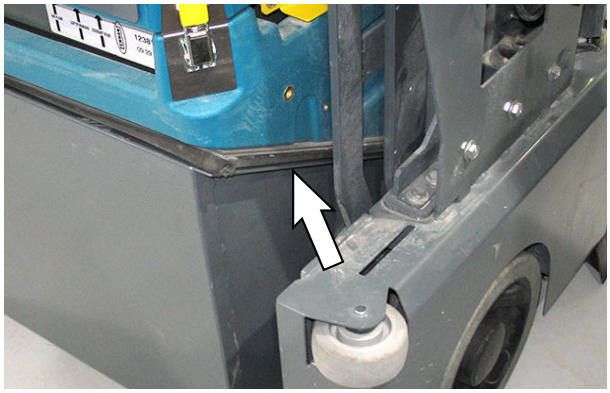
   If the edge of the hopper is pressing evenly on the bulb seals installed on the hopper filter box housing and seal compression is between 0.75 in. and 0.875 in. (19 mm and 22 mm), the seal contact is correct.

   If the seal contact (compression) is not between 0.75 in. and 0.875 in. (19 mm and 22 mm) the hopper will need to be adjusted. Proceed to the following step to adjust the seal contact (compression).

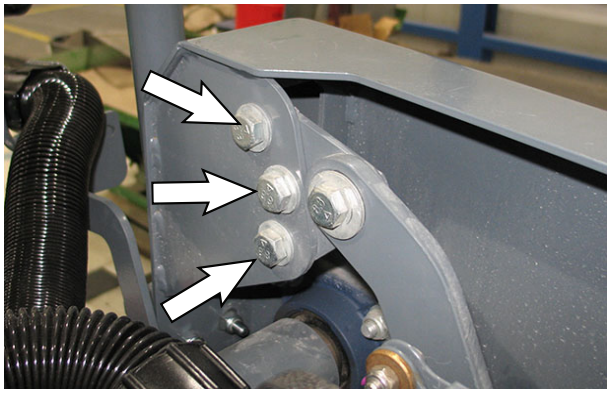
   If the edge of the hopper is not even on bulb seal installed on the hopper filter box housing and there are gaps, the hopper pitch will need to be adjusted. See *INSPECTING/ADJUSTING HOPPER PITCH*.







3. Loosen the hardware securing the adjustment plates to both the right tower and left tower.



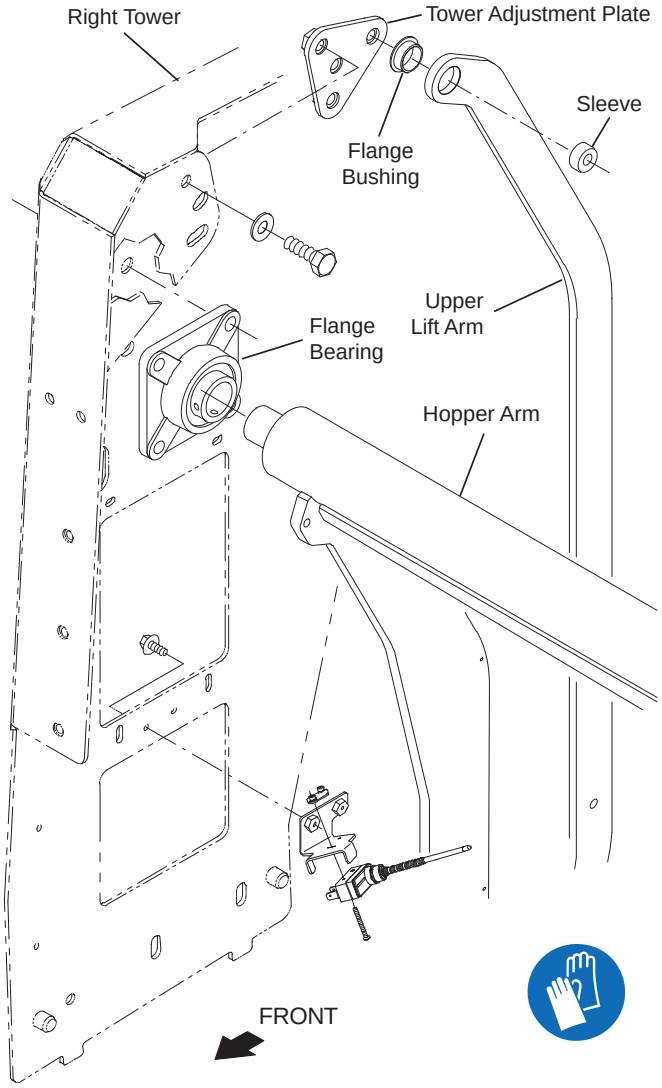
4. Place a floor jack under the back edge of the hopper and raise the jack enough to raise/adjust the hopper position so the hopper is pressed evenly at between 0.75 in. and 0.875 in. (19 mm and 22 mm) on each bulb seal installed on the bottom of the hopper filter box housing.

NOTE: When adjusting the hopper position it may be necessary to adjust position slightly more than required to obtain the correct seal, since the hopper may drop slightly when the floor jack is lowered/removed.

5. Tighten the previously loosened hardware securing the adjustment plates to both the right tower and left tower.
6. Remove the floor jack from under the hopper.

REPLACING THE HOPPER POSITION (WOBBLE) SWITCH

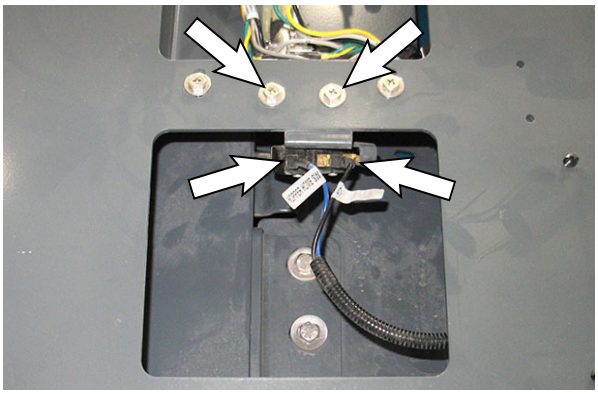
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and remove key.



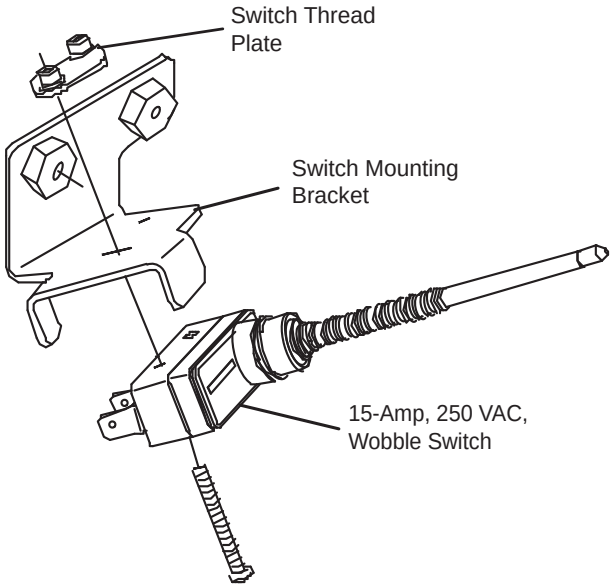
1. Turn the key switch OFF and remove the key.
2. Disconnect the battery cable from the machine.

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

3. Remove the right side cover from the machine.
4. Disconnect the main wire harness from the hopper position switch.

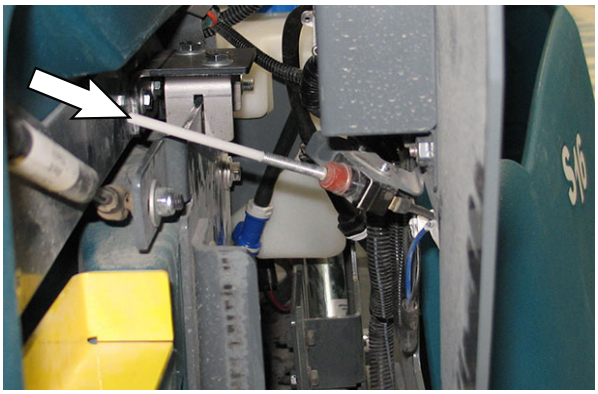


5. Remove the hopper position switch/switch mounting bracket from the right tower.
6. Remove the hopper position switch from the switch mounting bracket.



7. Install the new hopper position switch onto the switch mounting bracket.
8. Install the hopper position switch/switch mounting bracket onto the right tower.
9. Connect the main wire harness to the hopper position switch.
10. Reconnect the battery cable to the machine.

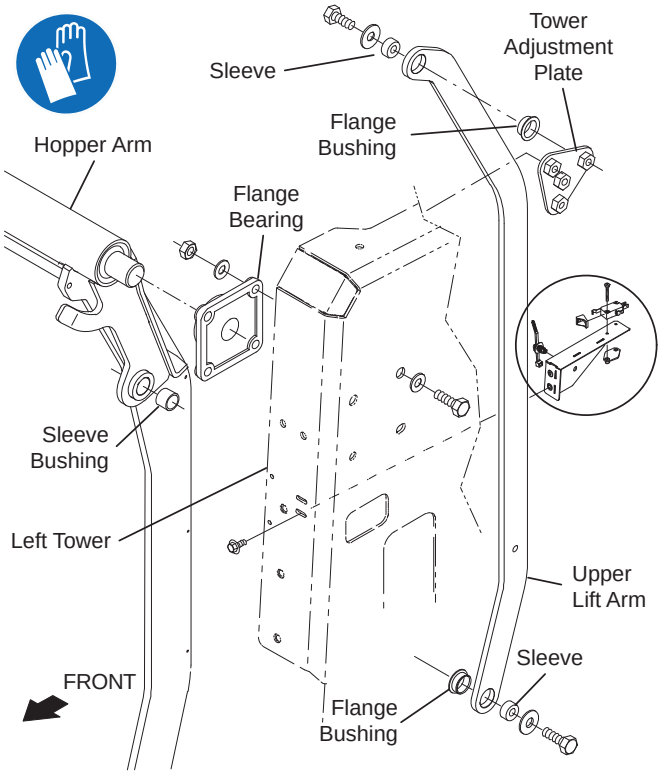
11. Turn the key switch ON.
12. Raise and lower the hopper.
13. The right leg of the hopper arm should touch the hopper position switch when the hopper seats into the completely lowered position.



14. Reinstall the right side cover onto the machine.
15. Reconnect the battery cable to the machine.

REPLACING/ADJUSTING THE HOPPER ROLLOUT SWITCH

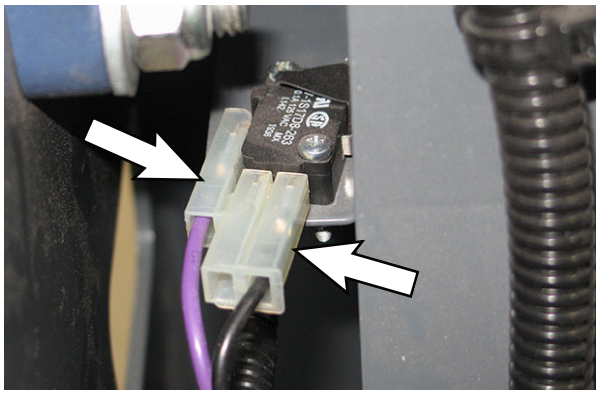
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and remove key.



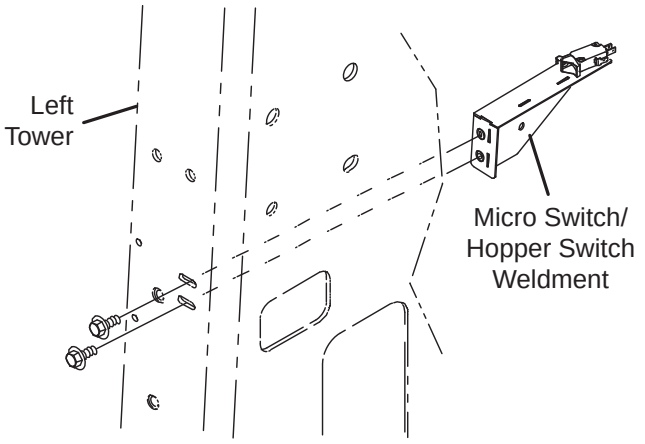
1. Turn the key switch OFF and remove the key.
2. Disconnect the battery cable from the machine.

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

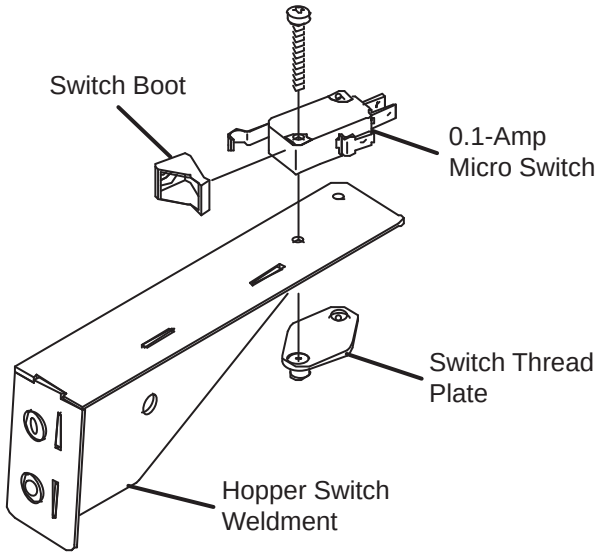
3. Remove the right side cover from the machine.
4. Disconnect the main wire harness from the hopper rollout switch.



5. Remove the micro switch/hopper switch weldment from the left tower.



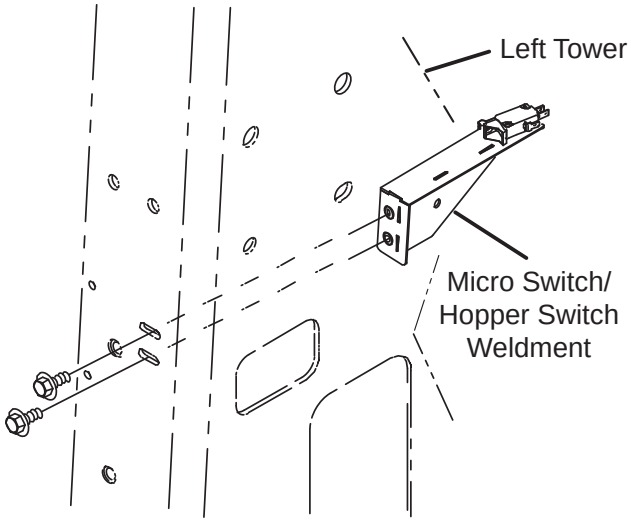
6. Remove the micro switch from the hopper switch weldment.

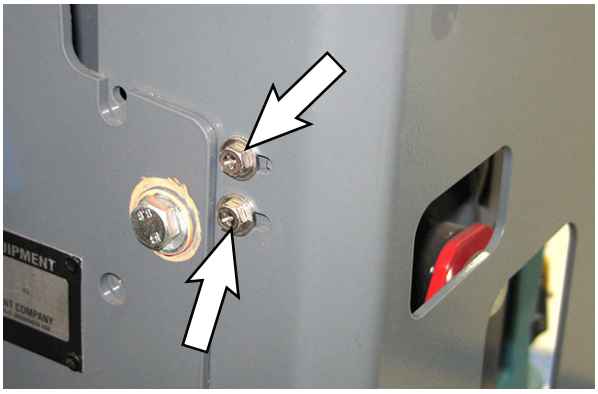


7. Install the new micro switch onto the hopper switch weldment.
8. Install the micro switch/hopper switch weldment onto the left tower. Ensure the micro switch lever is touching the upper lift arm. Adjust position of hopper switch weldment on left tower as necessary.
9. Connect the main wire harness to the micro switch.
10. Reconnect the battery cable to the machine.

11. Observe the hopper rollout switch. The lights in the hopper rollout button will not be illuminated if the micro switch/hopper switch weldment are positioned correctly.

    If the lights in the hopper rollout switch are illuminated, turn key switch OFF, loosen the hardware securing the hopper switch weldment to the machine, and adjust the hopper switch weldment position. Retighten the loosened hardware.





12. Turn the key switch ON.

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

13. Completely raise the hopper.

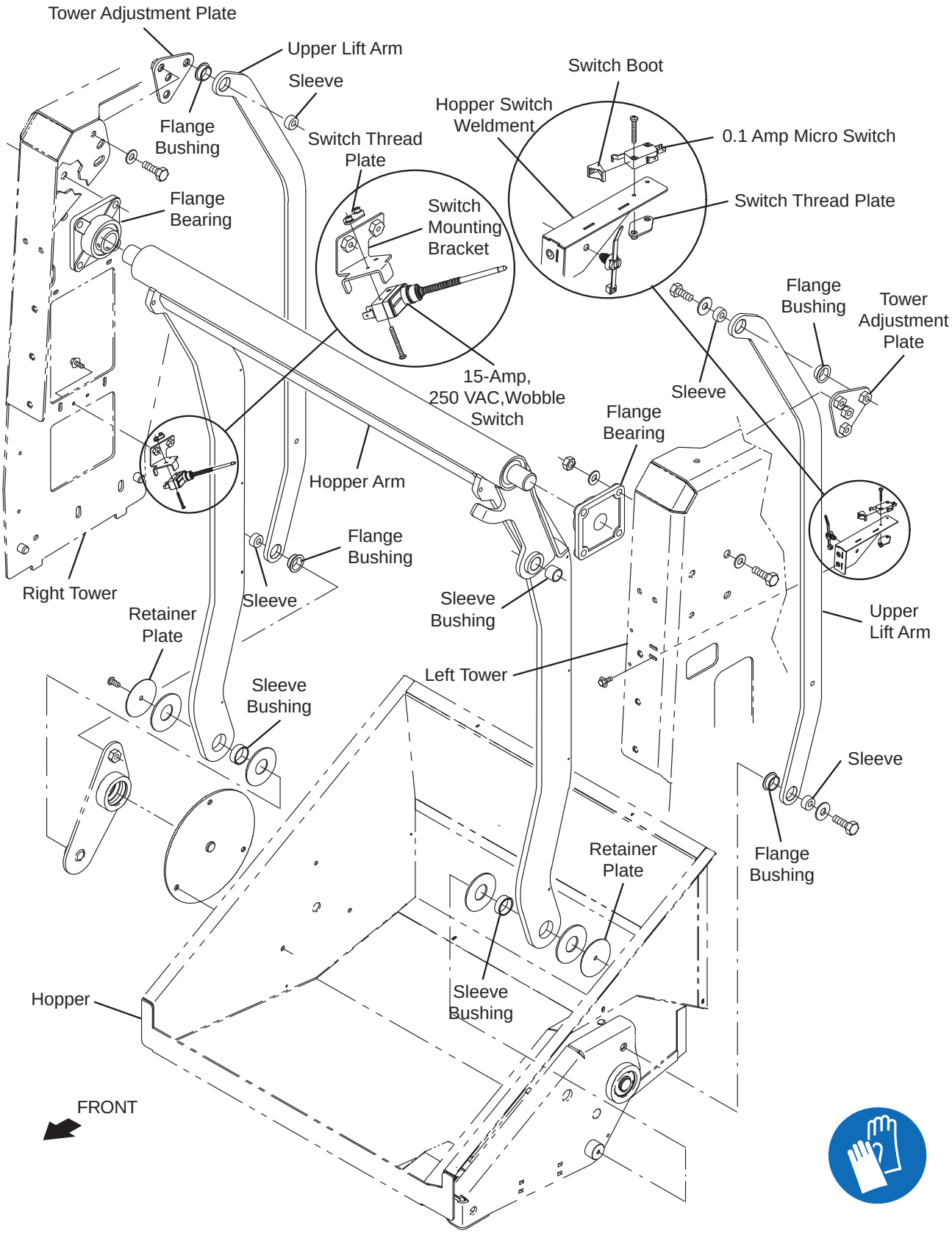
    Observe the lights in the hopper rollout button as the hopper raises. The lights should be flashing when the hopper is risen high enough to safely rollout the hopper.

14. Completely lower the hopper.

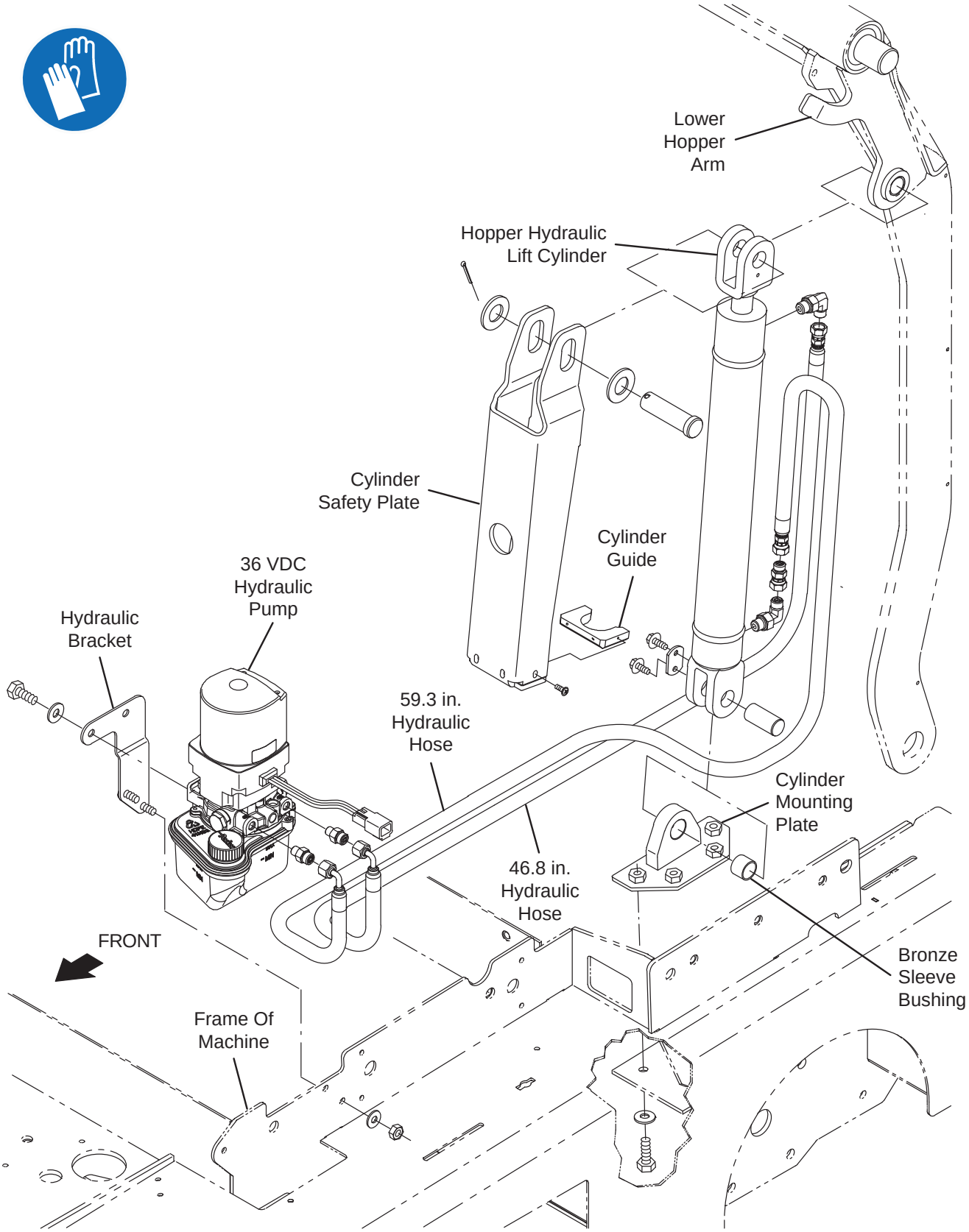
    Observe the lights in the hopper rollout button as the hopper lowers. The lights should be flashing until the hopper lowers to the point where it is not longer safe to rollout the hopper. The lights will stop flashing and the hopper will very briefly stop lowering, and then lower much slower until it reaches the completely lowered position.

15. If the lights in the hopper rollout switch do not flash and/or the hopper does not lower correctly, turn key switch OFF, loosen the hardware securing the hopper switch weldment to the machine, and adjust the hopper switch weldment position. Retighten the loosened hardware.

16. Reinstall the right side cover onto the machine.

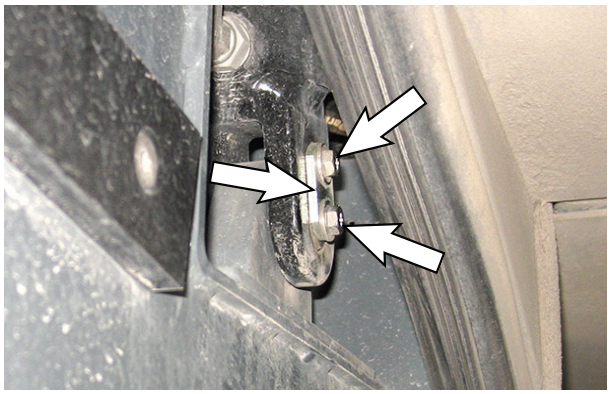

Tower Adjustment Plate
Upper Lift Arm
Sleeve
Flange Bushing
Switch Thread Plate
Switch Boot
Hopper Switch Weldment
0.1 Amp Micro Switch
Switch Thread Plate
Flange Bearing
Switch Mounting Bracket
Flange Bushing
Tower Adjustment Plate
15-Amp, 250 VAC,Wobble Switch
Sleeve
Flange Bearing
Hopper Arm
Flange Bushing
Right Tower
Sleeve
Sleeve Bushing
Upper Lift Arm
Retainer Plate
Left Tower
Sleeve Bushing
Sleeve
Flange Bushing
Retainer Plate
Hopper
Sleeve Bushing
FRONT

REPLACING THE HOPPER LIFT CYLINDER

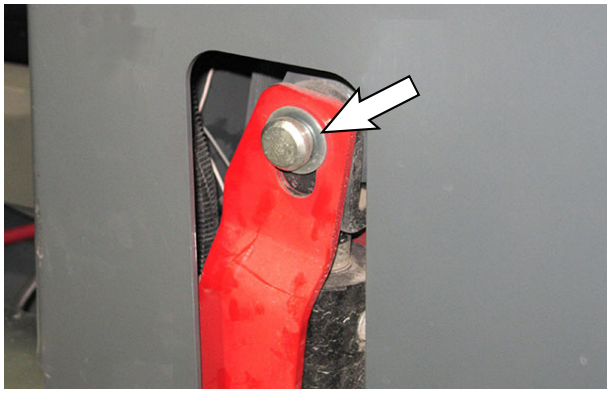


FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and remove key.

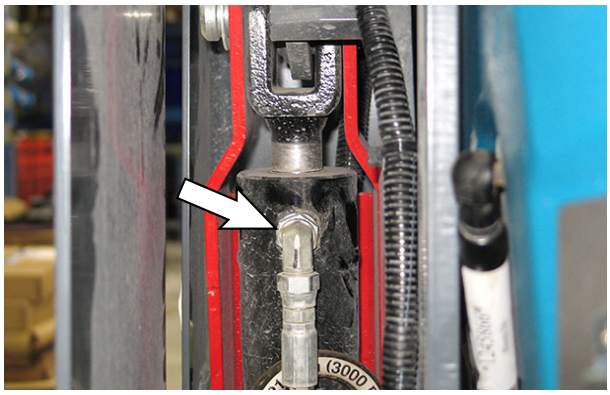
1. Turn the key switch OFF and remove the key.
2. Remove the left side cover from the machine.
3. Remove the hardware and pin securing the bottom of the hopper hydraulic lift cylinder to the cylinder mounting plate.

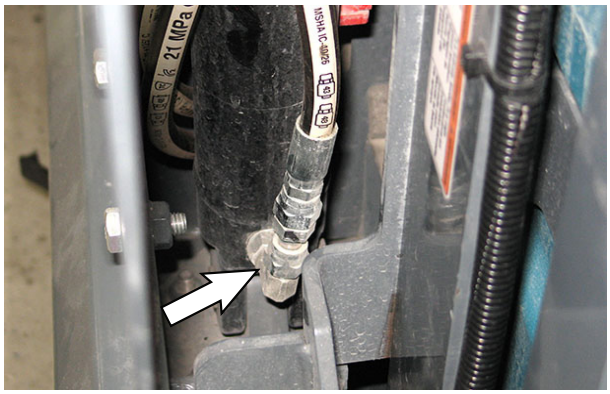


4. Remove the hardware and pin securing the top of the hopper hydraulic lift cylinder to the lower hopper arm and allow the hopper hydraulic lift cylinder to lower.



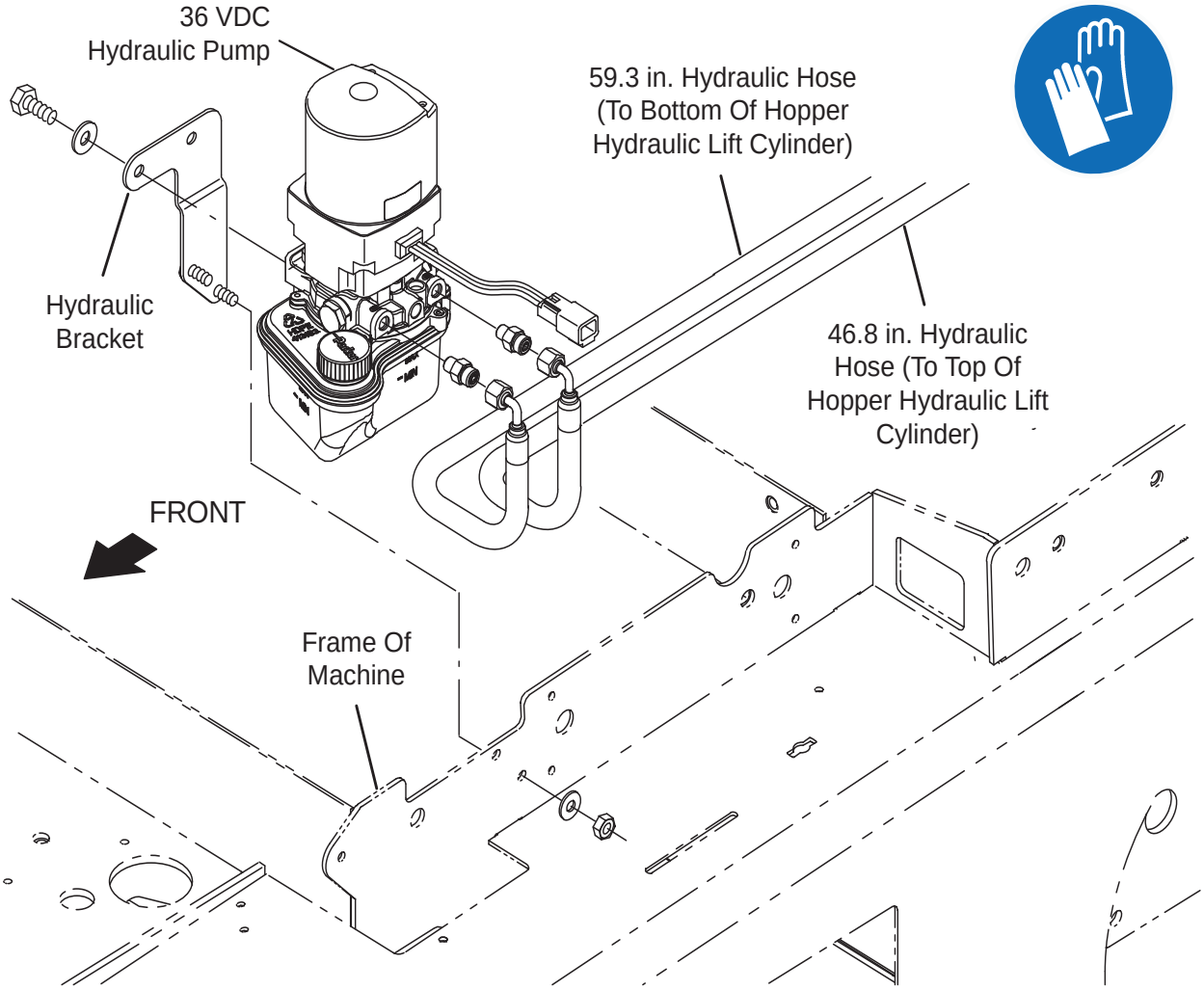
5. Carefully pull the hopper hydraulic lift cylinder out toward the rear of the machine.
6. Disconnect the hydraulic hoses from the hopper hydraulic lift cylinder and cap the ends of the hoses to prevent hydraulic fluid from escaping from the hydraulic system.





7. Mark each hose with location it was removed from the hopper hydraulic lift cylinder.
8. Remove the hopper hydraulic lift cylinder/cylinder safety plate from the machine.
9. Install the new hopper hydraulic lift cylinder and cylinder safety plate onto the machine in reverse order of disassembly.
10. Turn key switch ON and allow the hydraulic fluid to run through the hydraulic system.
11. Turn the keys witch OFF.
12. Observe the hydraulic fluid level in the hydraulic reservoir. Replenish the hydraulic system as necessary. See *HYDRAULICS* in *MAINTENANCE* for additional hydraulic system information.
13. Reinstall the left side cover onto the machine.

REPLACING THE HYDRAULIC PUMP

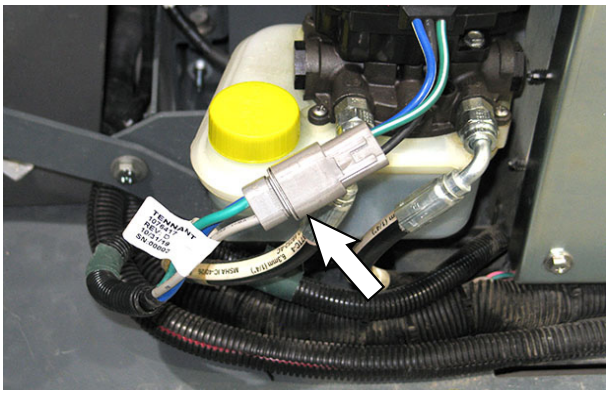


FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and remove key.

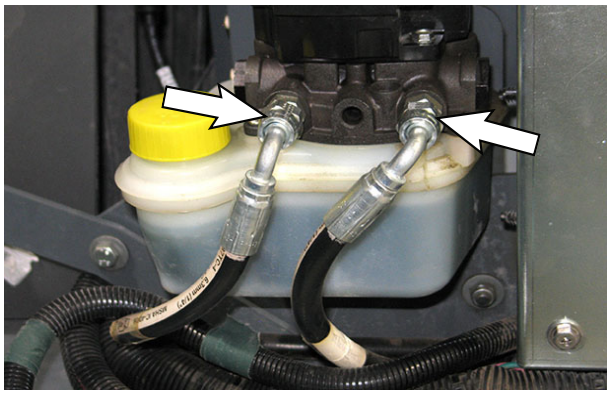
1. Turn the key switch OFF and remove the key.
2. Disconnect the battery cable from the machine.

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

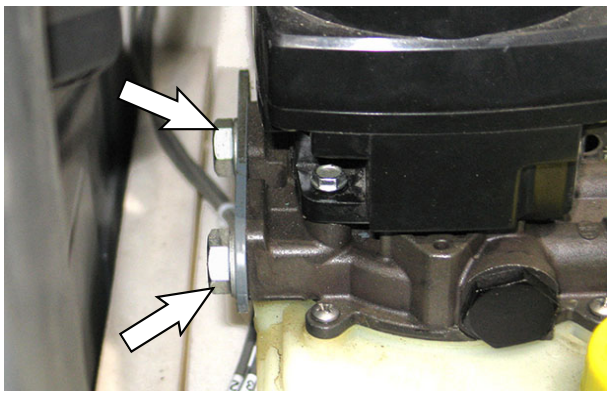
3. Remove the left side cover from the machine.
4. Disconnect the main wire harness from the hydraulic pump.



5. Mark/label the locations for the two hydraulic hoses connected to the hydraulic pump.

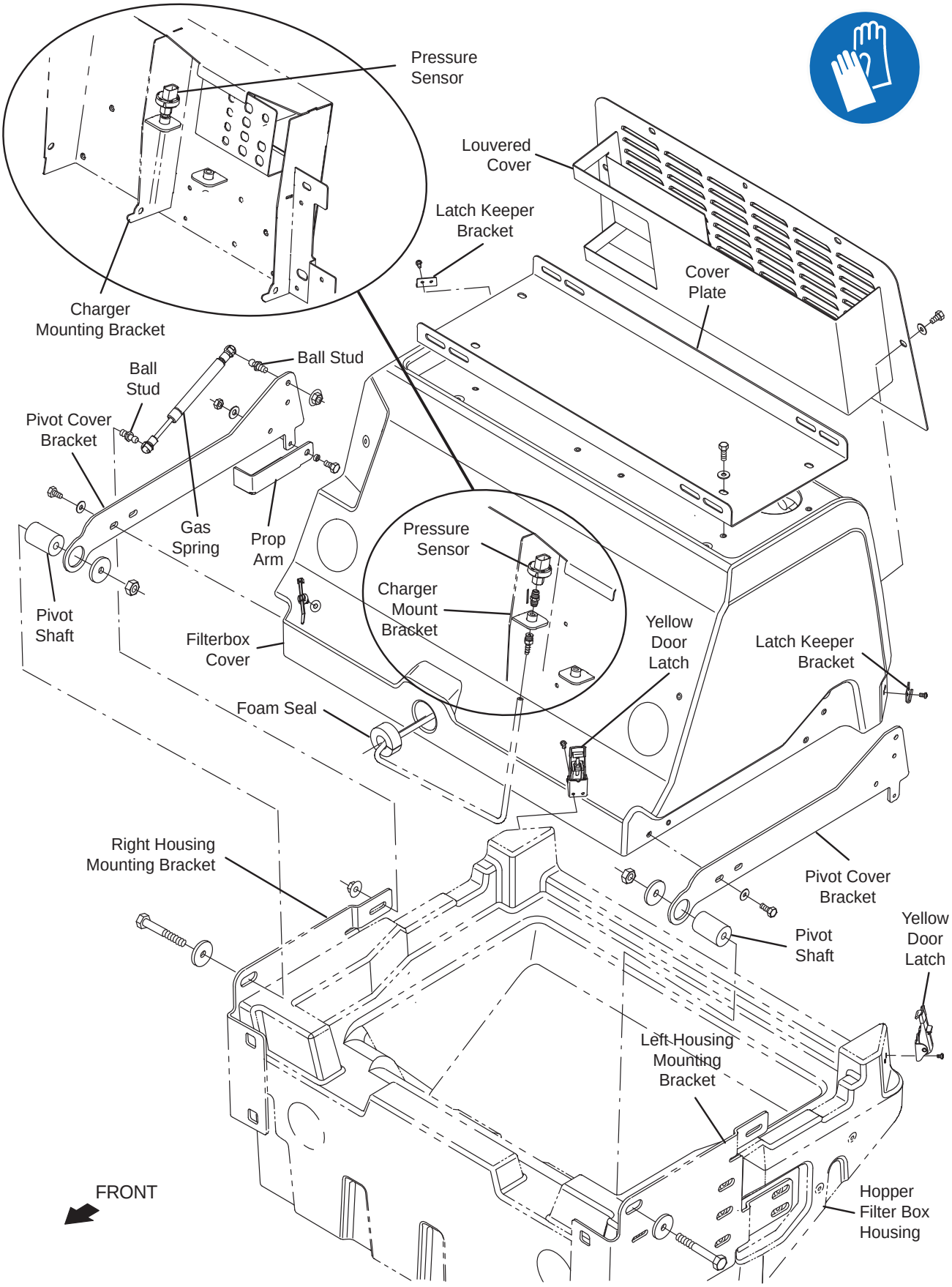


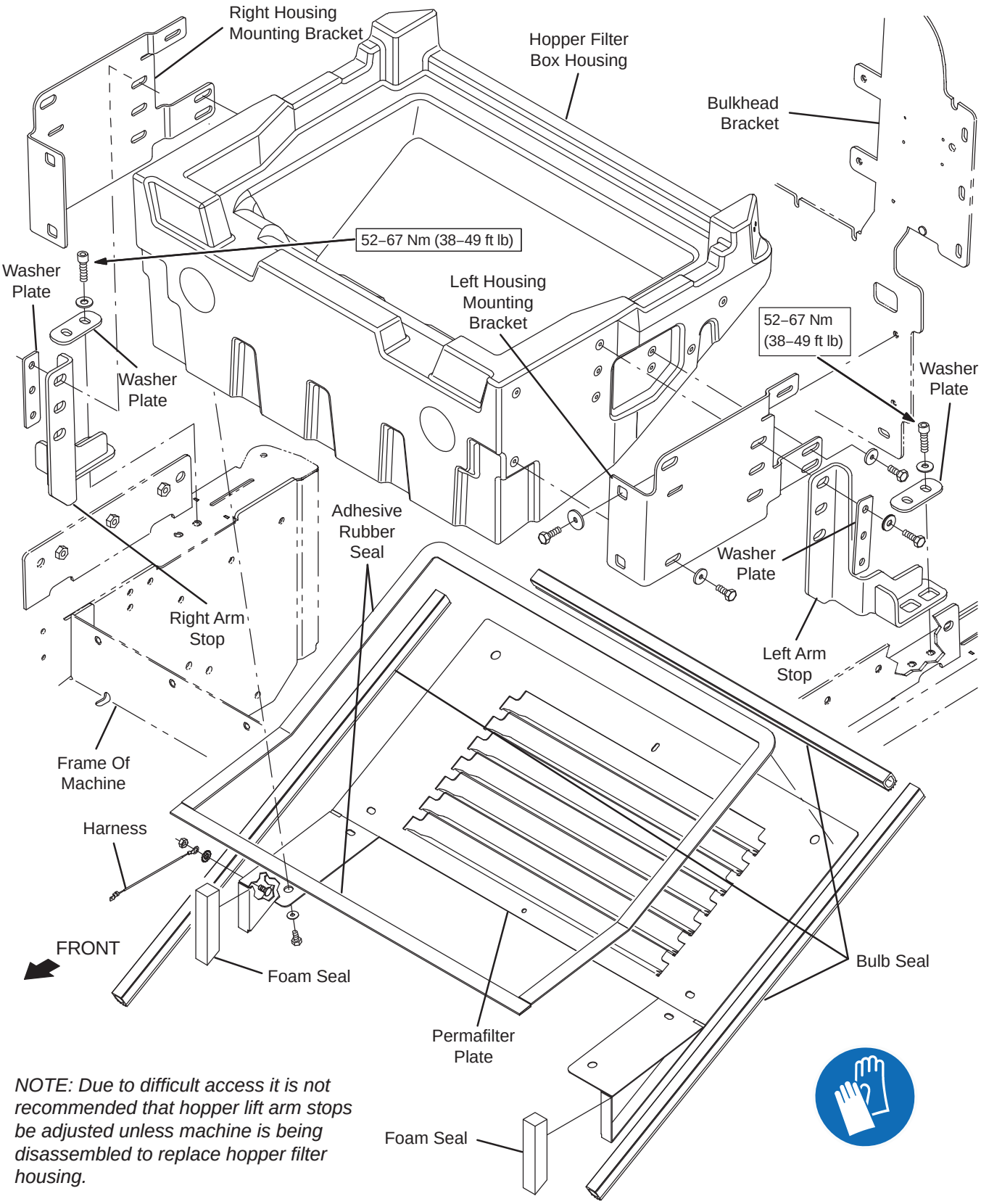
6. Disconnect the hydraulic hoses from the hydraulic pump and cap the ends of the hoses to prevent hydraulic fluid from escaping from the hydraulic system.
7. Remove hardware securing hydraulic pump to machine and remove the hydraulic pump from the machine.



8. Install the new hydraulic pump onto the machine reverse order of disassembly.
9. Reconnect the battery cable to the machine.
10. Turn the key switch ON.
11. Observe the hydraulic fluid level in the hydraulic reservoir. Replenish the hydraulic system as necessary. See *HYDRAULICS* in *MAINTENANCE* for additional hydraulic system information.
12. Reinstall the left side cover onto the machine.

REPLACING THE HOPPER FILTER BOX HOUSING





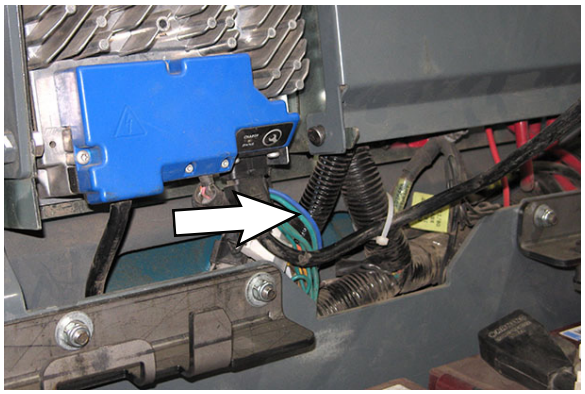
NOTE: Due to difficult access it is not recommended that hopper lift arm stops be adjusted unless machine is being disassembled to replace hopper filter housing.

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

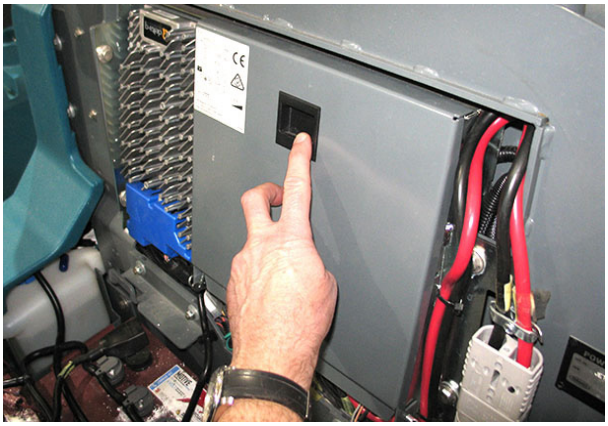
1. Turn the key switch OFF and remove the key.
2. Disconnect the battery cable from the machine.

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

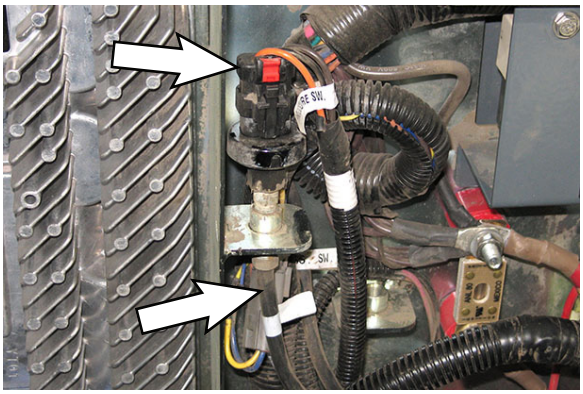
3. Remove the left side cover and the right side cover from the machine.
4. Remove the hopper filter from the hopper filter compartment.
5. Machines equipped with vacuum wand only: Disconnect the vacuum wand harness from the main wire harness, disconnect the vacuum wand hose from the vacuum wand assembly, and remove the vacuum wand assembly from the filter box cover.
6. Disconnect the filter box harness from the main wire harness.



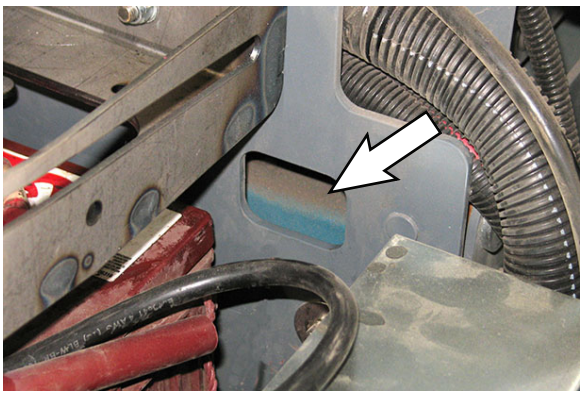
7. Open and/or remove the electrical compartment cover from the circuit breaker compartment.

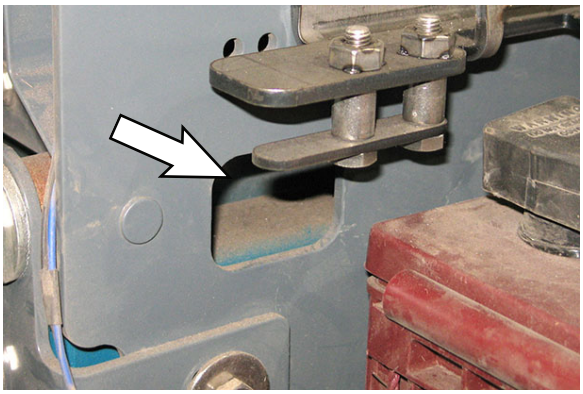


8. Disconnect the vacuum sensor hose and harness connection from the pressure sensor located inside the circuit breaker compartment and pull harness and hose down through the opening in bulkhead bracket.



9. Disconnect the gas spring(s) attached to the pivot cover bracket(s) on the filter box cover and the left housing mounting bracket and the right housing mounting bracket.
10. Remove the hardware securing the filter box cover to the left housing mounting bracket and the right housing mounting bracket installed on the hopper filter box housing. Use access holes in the bulkhead bracket to access the hardware.

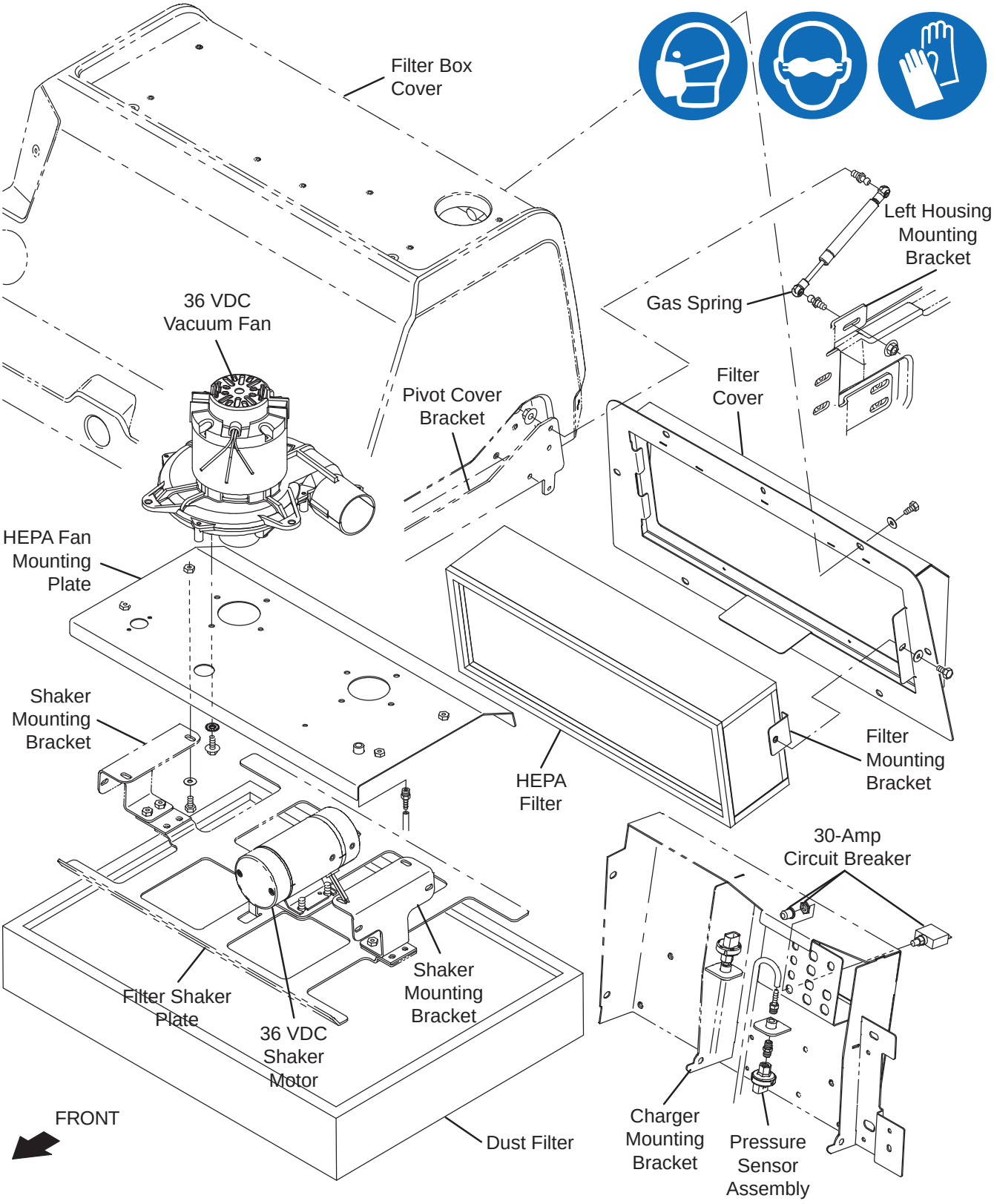




11. Remove the filter box cover assembly from the hopper filter box housing.
12. Ensure the front edge of the hopper is set properly at 0.75 in. (19 mm). See *INSPECTING/ ADJUSTING THE HOPPER SEAL CONTACT.*
13. Use a permanent marker to mark the location of both the left arm stop and the right arm stop onto the frame of the machine.
14. Remove the hardware securing the left arm stop and right arm stop from the frame of the machine and the left housing mounting bracket and the right mounting housing bracket.
15. Remove the hardware securing both the left housing mounting bracket and the right mounting housing bracket from the hopper filter box housing and the bulkhead bracket.
16. Disconnect the perma-filter static ground cable from the main wire harness.
17. Remove the hopper filter box assembly from the machine.
18. Remove the perma-filter components from the hopper filter box housing.
19. Clean all seal residue from the perma-filter.
20. Install new seals onto the perma-filter where the old seals had previously been installed.
21. Install the perma-filter assembly onto the new hopper filter box housing.
22. Set the hopper filter box housing/perma-filter assembly onto the hopper and the frame of the machine.
23. Position the hopper filter box housing so the front of the housing is on top the frame lip and is centered on the hopper. The gap between the rear of the hopper and the perma-filter should still be 0.75 in. (19 mm).
24. Loosely reinstall the hardware to secure both the left housing mounting bracket and the right mounting housing bracket to the hopper filter box housing and the bulkhead bracket.
25. Hold the left housing mounting bracket flush to the bulkhead bracket and tighten the loose hardware installed into the hopper filter box housing. Do not install hardware used for left arm stop. Left arm stop is reinstalled later in procedure.
26. Hold the left housing mounting bracket flush to the bulkhead bracket and tighten the loose hardware installed into the bulkhead bracket.
27. Hold the right housing mounting bracket flush to the bulkhead bracket and tighten the loose hardware installed into the hopper filter box housing. Do not install hardware used for right arm stop. Right arm stop is reinstalled later in procedure.
28. Hold the right housing mounting bracket flush to the bulkhead bracket and tighten the loose hardware installed into the bulkhead bracket.
29. Reinstall the left arm stop and right arm stop onto the frame of the machine. Be sure to align both arm stops with marks previously made onto the frame of the machine.
30. Reinstall the hardware to secure the left arm stop and right arm stop to the left housing mounting bracket and the right mounting housing bracket. Torque the M10 hex screws to 52-67 Nm (38 ft. lb.-49 ft. lb.).
31. Reconnect all previously disconnect harness and hose connections to the various components from where they were disconnected.
32. Reinstall the filter box cover on the hopper filter box housing in reverse order of disassembly.
33. Machines equipped with vacuum wand only: Reinstall the vacuum wand assembly onto the machine in reverse order of disassembly.
34. Replace any hopper seals that may have been damaged during procedure.
35. Reconnect the battery cable to the machine.

OPTIONS

REMOVE/REPLACE THE HEPA VACUUM FAN



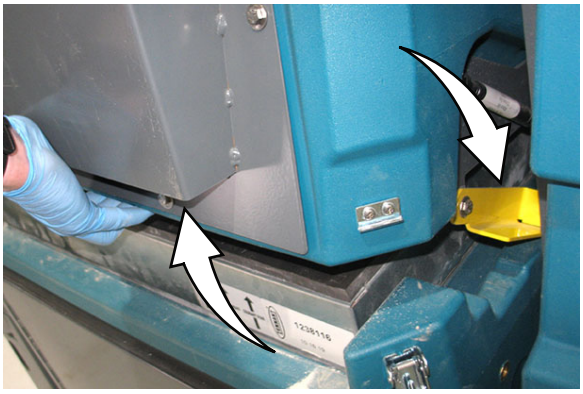
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and remove key.

1. Turn the key switch OFF and remove the key.
2. Disconnect the battery cable from the machine.

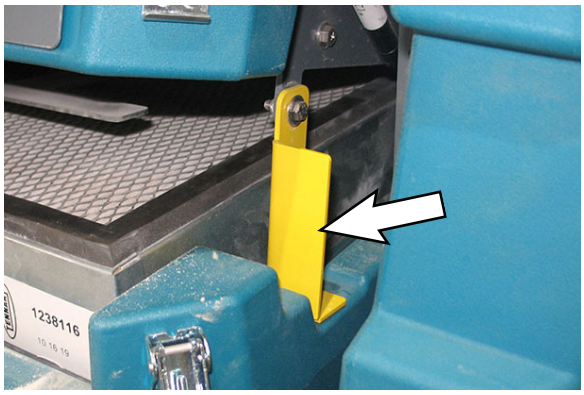
FOR SAFETY: When servicing machine, Disconnect battery connection and charger cord before working on machine.

3. Remove the HEPA filter cover from the filter box cover.

4. Disconnect the harness from both vacuum fans.
5. Loosen each hopper filter compartment retainer latch located on both sides of the filter compartment.
6. Lift the hopper filter compartment until the hopper filter compartment prop arm secures the hopper filter compartment open.



NOTE: Ensure the hopper filter compartment prop arm is fully engaged before removing the filter from the machine.

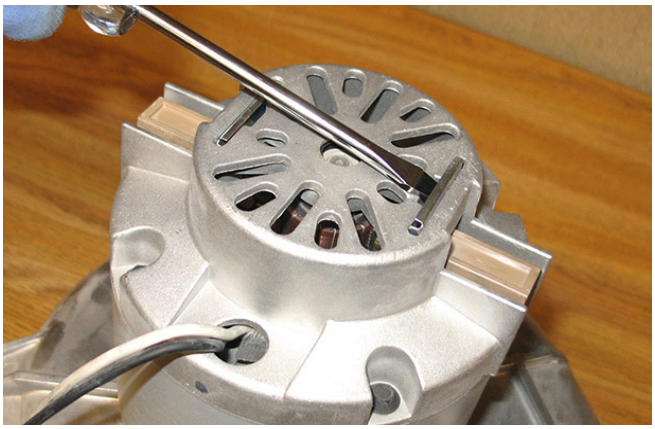


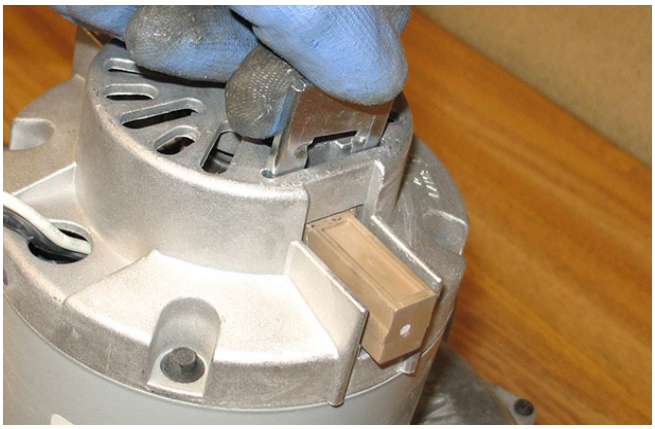
7. Remove the hopper filter from the hopper filter compartment.
8. Remove the hardware securing the filter shaker plates to the shaker mounting brackets and pull the filter shaker plate/filter shaker motor out enough to access the main wire connection to the filter shaker motor.
9. Disconnect the main harness from the filter shaker motor and remove the filter shaker plate/filter shaker motor from the hopper.
10. Remove the hardware securing the vacuum fans to the fan mounting plate.
11. Remove the hardware securing both shaker mounting brackets to the filter box cover.
12. Remove the vacuum fans from the vacuum fan compartment inside the filter box cover.
13. If replacing the vacuum fan carbon brushes, proceed to *REMOVE/INSPECT/REPLACE THE VACUUM FAN CARBON BRUSHES*.
14. Reinstall removed vacuum fans/install new vacuum fans in reverse order of disassembly.
15. Reinstall the filter shaker plate/filter shaker motor into vacuum fan/filter compartment.
16. Reinstall the hopper filter into the filter compartment.
17. Reinstall the HEPA filter cover onto the filter box cover.
18. Reconnect the battery cable to the machine.

REPLACE THE HEPA VACUUM FAN MOTOR CARBON BRUSHES

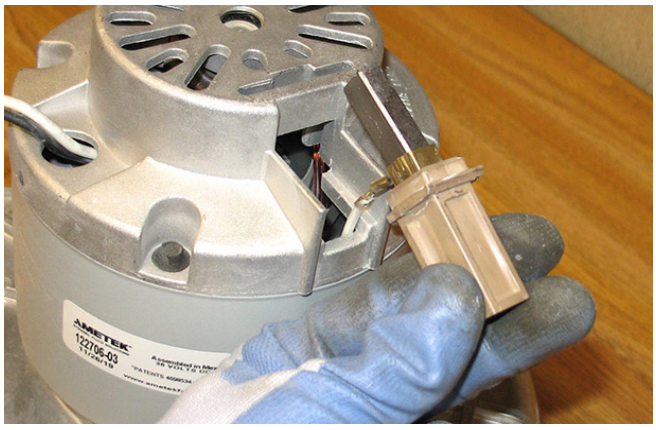
NOTE: Carbon brushes should be replaced as sets.

1. Remove the HEPA vacuum fan from the machine. See REMOVE THE HEPA VACUUM FAN.
2. Pry/remove the carbon brush retainer from the vacuum fan motor.

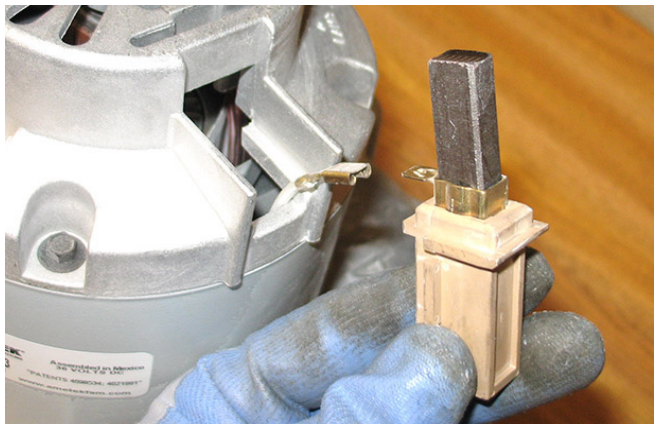




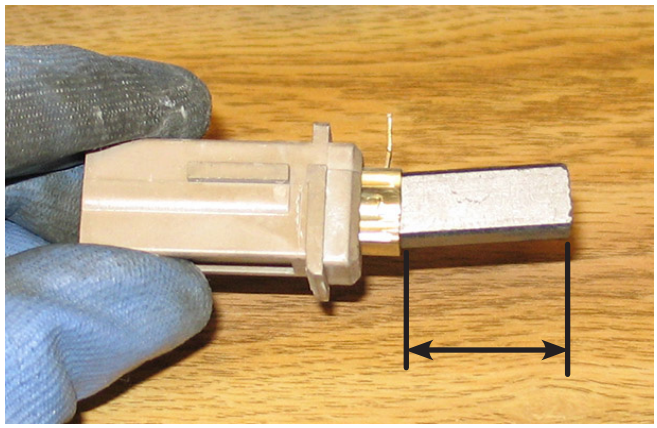
3. Carefully pull the carbon brush from the vacuum fan motor.



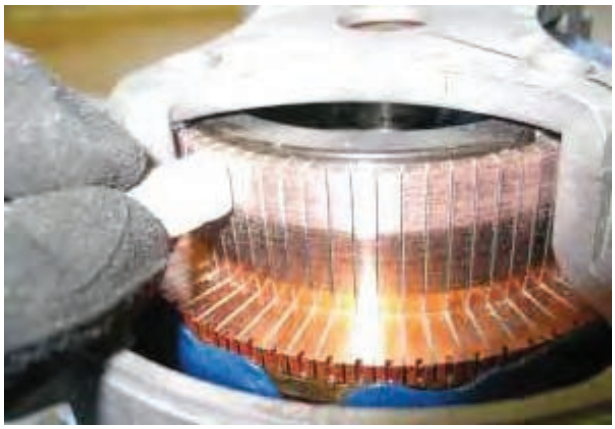
4. Disconnect the wire from the vacuum fan motor carbon brush.



5. Inspect carbon brushes. Replace carbon brushes if they are stuck (brush should freely extend/retract in holder) or are less than 0.375 in. (10 mm) in length.

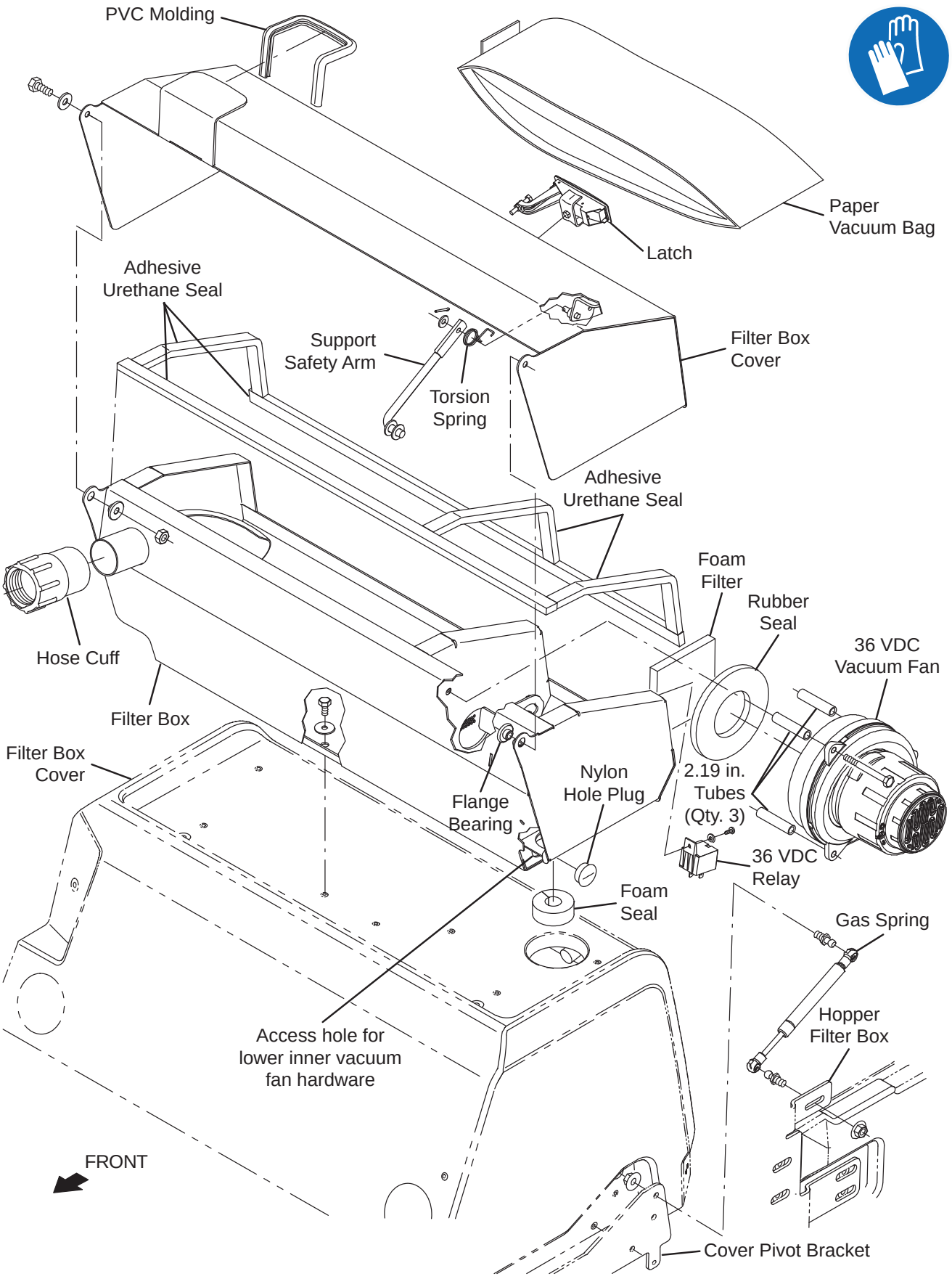


6. Use a stone to clean the commutator.



7. Use compressed air to clean dust from inside the vacuum fan motor.
8. Reinstall the removed vacuum fan brushes/install the new vacuum fan brushes in reverse order of disassembly.
9. Reinstall the HEPA vacuum fan into the vacuum fan compartment inside the filter box cover. See *REMOVE/REINSTALL/REPLACE THE HEPA VACUUM FAN.*

REMOVE/INSTALL THE VACUUM WAND FAN

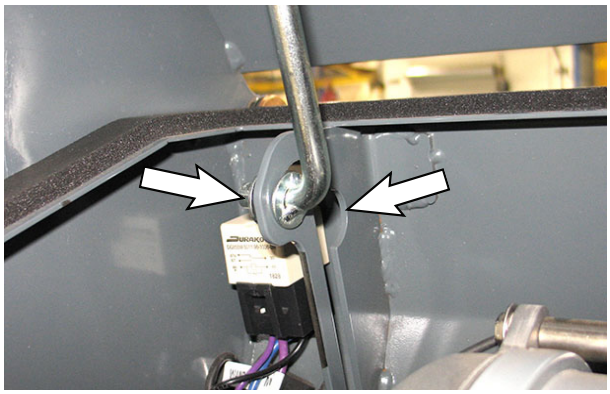


FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and remove key.

1. Turn the key switch OFF and remove the key.
2. Disconnect the battery cable from the machine.

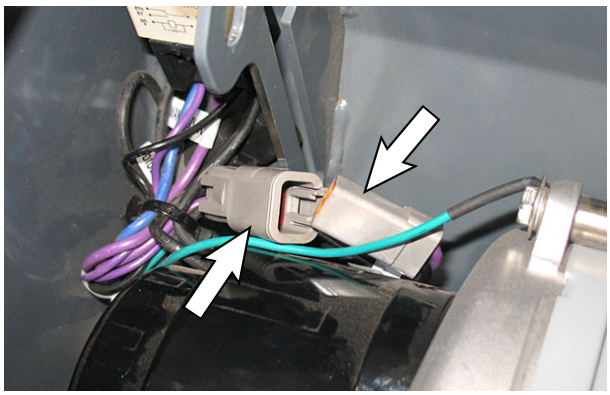
FOR SAFETY: When servicing machine, Disconnect battery connection and charger cord before working on machine.

3. Open the filter box cover and carefully disengage the support safety arm from filter box to get easier access the vacuum wand vacuum fan and mounting hardware.

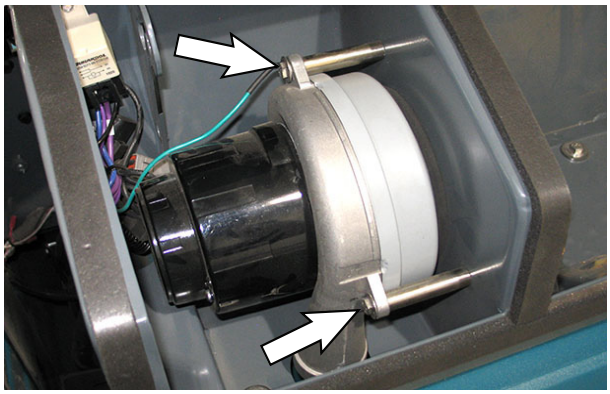


NOTE: The torsion spring installed on the other end of the support safety arm will cause the support safety arm to snap quickly to the filter box cover. Use care when disengaging the support safety arm from the filter box.

4. Disconnect the main wire harness from the vacuum wand fan motor.



5. Remove the hardware securing the filter box (vacuum wand fan assembly) to the filter box cover.
6. Lift the end of the vacuum wand fan assembly with the vacuum fan enough to access the access hole in the filter box.
7. Remove the nylon hole plug from the access hole in the filter box.
8. Remove the lower inner M6 hex screw securing the vacuum wand fan to the filter box.
9. Remove the remaining M6 hex screws (Qty. 2) securing the vacuum wand fan and vacuum electrical harness ground to the filter box.



10. Remove the vacuum wand fan motor from the filter box.
11. If replacing the vacuum fan carbon brushes, proceed to *REMOVING/INSPECTING/ REPLACING THE VACUUM WAND VACUUM FAN CARBON BRUSHES.*
12. Reinstall the vacuum fan/install the new vacuum fan into the filter box in reverse order of disassembly.
13. Reinstall the nylon hole plug into the access hole in the filter box.
14. Reinstall the hardware to secure the filter box (vacuum wand fan assembly) to the filter box cover.
15. Reinstall the disengaged the support safety arm back into filter box.
16. Reconnect the battery cable to the machine.

REMOVING/INSPECTING/REPLACING THE VACUUM WAND VACUUM FAN CARBON BRUSHES

NOTE: Carbon brushes should be replaced as sets

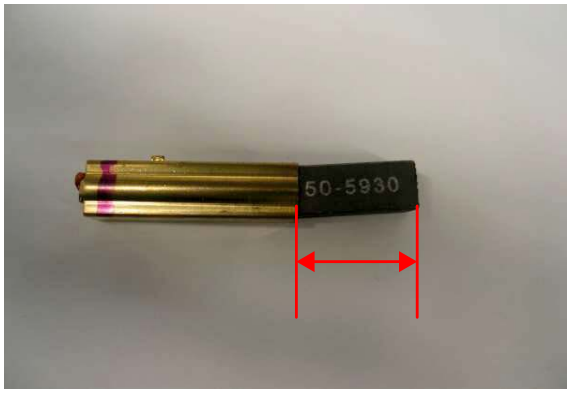
1. Remove the vacuum fan from the machine. See *REMOVING/INSTALLING THE VACUUM WAND FAN*.
2. Remove hardware securing the vacuum fan cover assembly to the vacuum fan motor and remove the vacuum fan cover assembly from the motor.

3. Loosen the carbon brush mounting hardware.

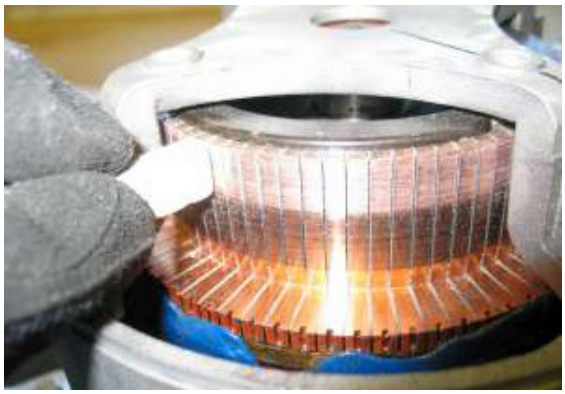
4. Lift up to release and remove carbon brushes from the vacuum fan motor.

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

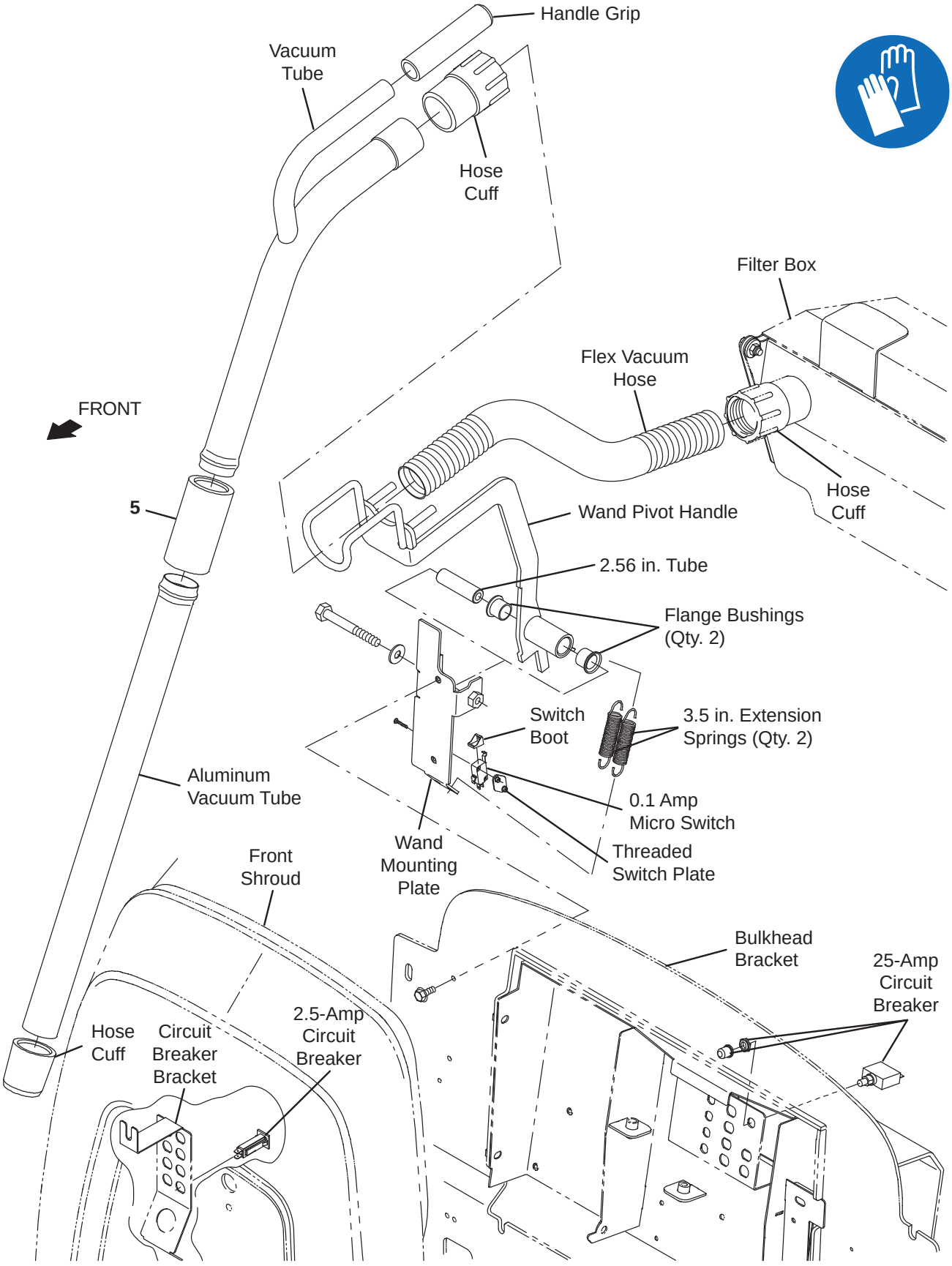
NOTE: Carbon brushes should be replaced as sets.



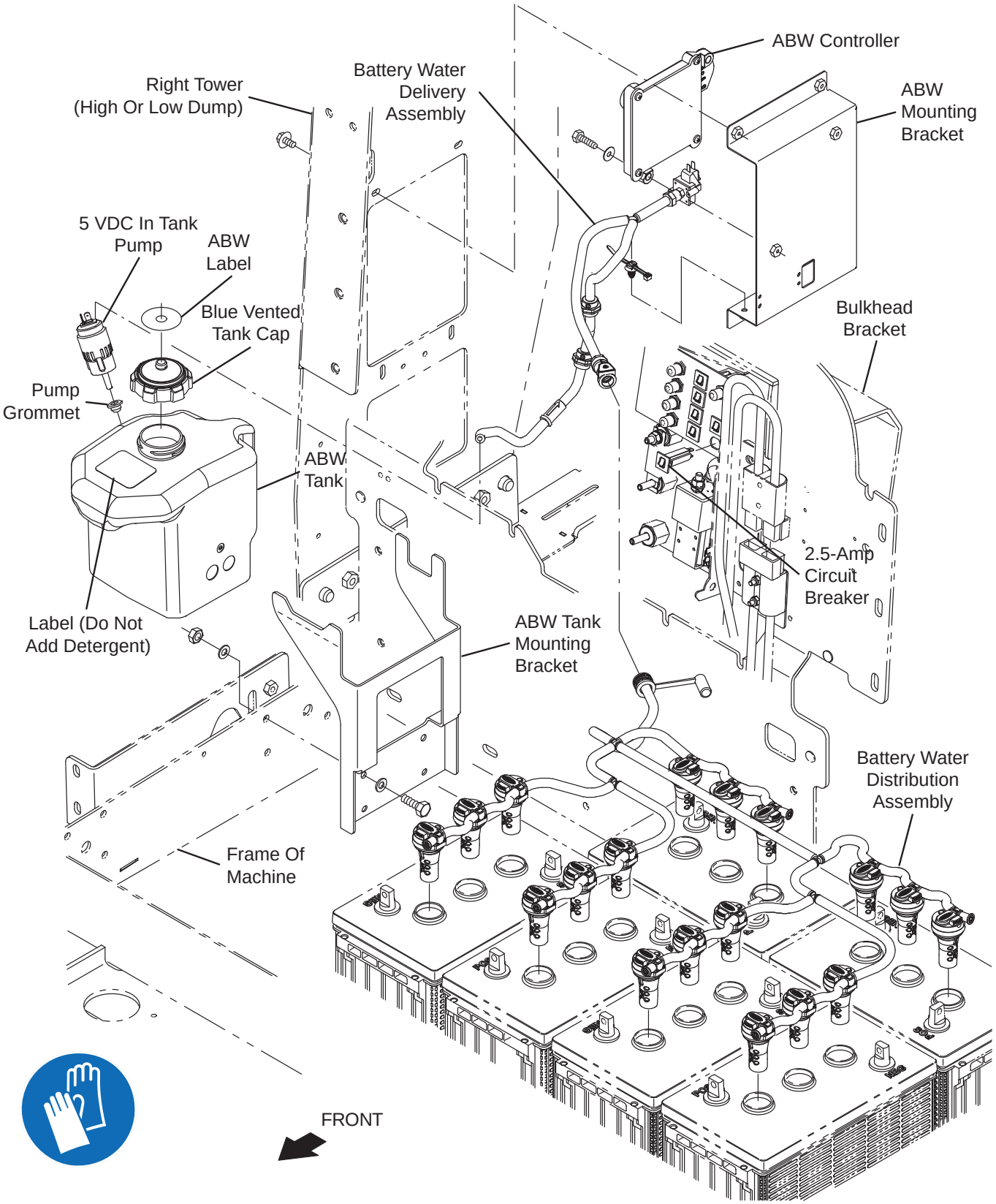
6. Use a stone to clean the commutator,



7. Use compressed air to clean dust from inside the vacuum fan motor.
8. Reinstall the removed vacuum fan brushes/install the new vacuum fan brushes in reverse order of disassembly.
9. Reassemble parts removed from vacuum fan in reverse order of disassembly.
10. Reinstall the vacuum fan onto the machine. See *REMOVING/INSTALLING THE VACUUM WAND FAN*.


Handle Grip
Vacuum Tube
Hose Cuff
Filter Box
Flex Vacuum Hose
FRONT
5
Hose Cuff
Wand Pivot Handle
2.56 in. Tube
Flange Bushings (Qty. 2)
Switch Boot
3.5 in. Extension Springs (Qty. 2)
Aluminum Vacuum Tube
0.1 Amp Micro Switch
Wand Mounting Plate
Threaded Switch Plate
Front Shroud
Bulkhead Bracket
25-Amp Circuit Breaker
Hose Cuff
Circuit Breaker Bracket
2.5-Amp Circuit Breaker

REPLACE THE SMART-FILL ABW (AUTOMATIC BATTERY WATER) CONTROLLER AND/OR THE BATTERY WATER DELIVERY ASSEMBLY



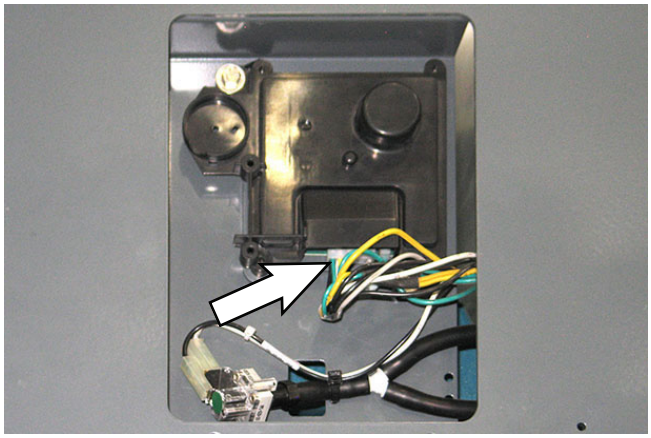
FOR SAFETY: Before leaving or servicing machine, stop on level surface, turn off machine, and remove key.

If replacing the ABW controller

1. Turn the key switch OFF and remove the key.
2. Disconnect the battery cable from the machine.

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

3. Remove the right side cover from the machine.
4. Disconnect the main wire harness from the ABW controller.



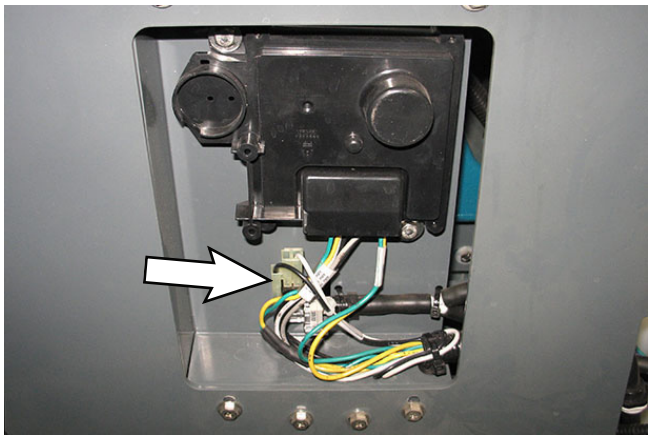
5. Remove the ABW controller from the ABW mounting bracket.
6. Install the new ABW controller onto ABW mounting bracket in reverse order of disassembly.
7. Reinstall the right side cover onto the machine.
8. Reconnect the battery cable to the machine.

If replacing the battery water delivery assembly:

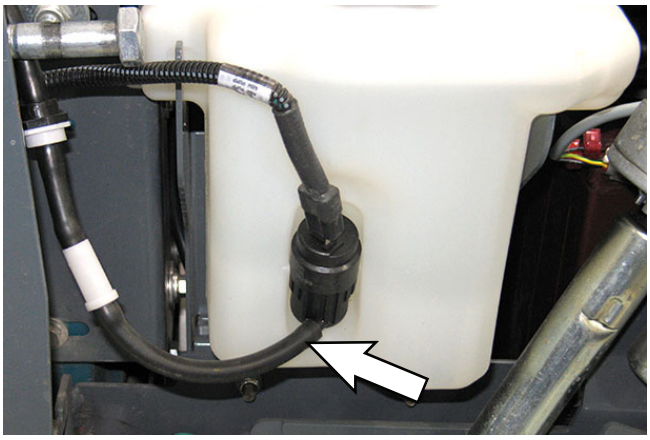
1. Turn the key switch OFF and remove the key.
2. Disconnect the battery cable from the machine.

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

3. Remove the right side cover from the machine.
4. Empty the ABW tank until the water level in the tank is below the 5 VDC in tank pump.
5. Disconnect the main wire harness from the pressure switch on the battery water delivery assembly.



6. Cut the cable ties securing the battery water delivery assembly to the ABW mounting bracket.
7. Disconnect the battery water delivery assembly from the battery water distribution assembly.
8. Disconnect the battery water delivery assembly from the 5 VDC in tank pump.



9. Remove the battery water delivery assembly from the machine.
10. Install the new or replaced battery water delivery assembly in reverse order of disassembly.
11. Connect the main wire harness to the pressure switch on the battery water delivery assembly.
12. Refill the ABW tank.
13. Reconnect the battery cable to the machine.
14. Reinstall the right side cover onto the machine.

SERVICING THE LITHIUM ION BATTERIES

REPLACING THE BATTERY MANAGEMENT SYSTEM (BMS)

NOTE: Service to the Lithium Ion battery must only be performed by Tennant Service.

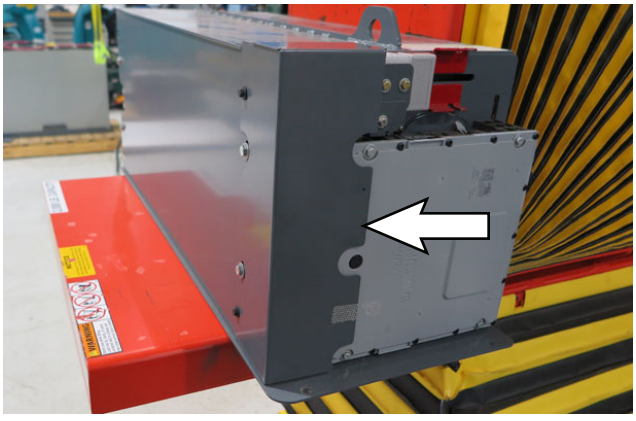
The replacement of the battery management system can be performed with the battery in the machine or removed from the machine.

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

1. Disconnect the battery cable from the machine.
2. Remove the Lithium-Ion battery pack from the machine.

FOR SAFETY: When using Lithium-Ion Battery Model: Battery installation requires a specific service kit which includes a hoisting strap and proper lifting instructions. Contact Tennant Service. Do not attempt to lift battery by hand or by any other unauthorized method.

3. Place the Lithium-Ion battery pack in an area where there is adequate space to perform maintenance.
4. Remove the corner cover from the Lithium-Ion battery pack.

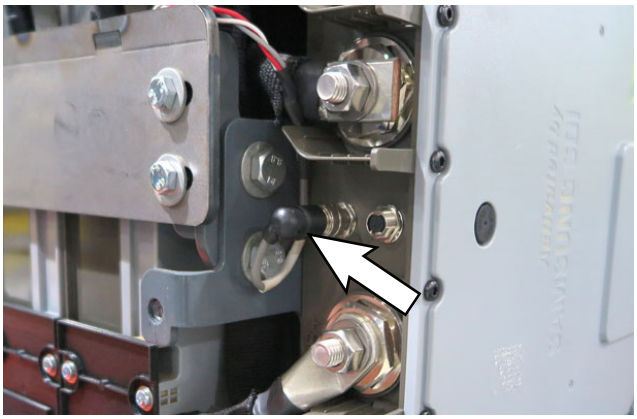


5. Cut the warranty label from the Lithium-Ion battery pack.

NOTE: Warranty is void if the Warranty label has been removed or tampered with. Contact Customer Service if label has been removed or damaged due to removal.

6. Remove the cover from the Lithium-Ion battery pack.

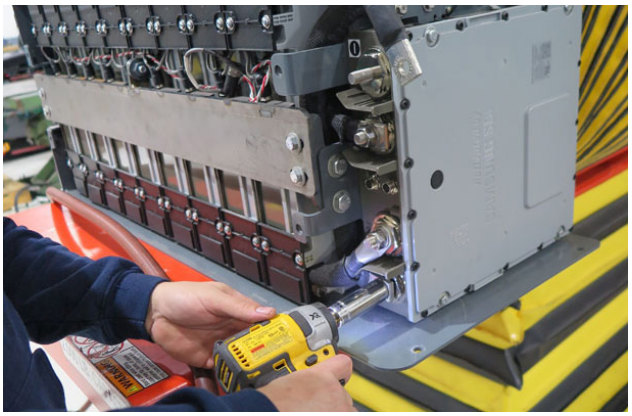
7. Disconnect the Lithium-Ion battery pack control cable and COM cable from the battery controller.



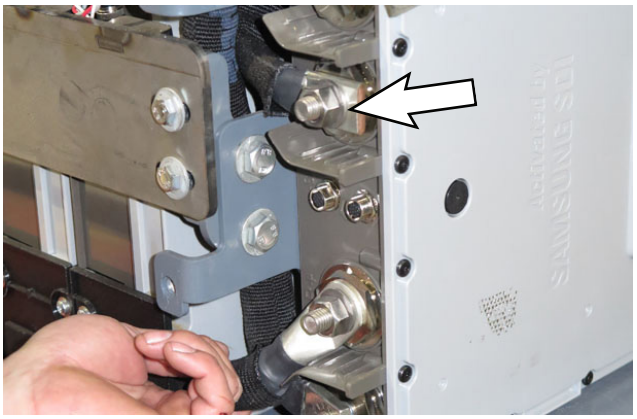
NOTE: If Lithium-Ion battery pack is equipped with two COM cables, disconnect both COM cables from the battery controller.

8. Disconnect the Lithium-Ion battery pack power cables from the battery controller. Disconnect the negative (-) terminal connection first.

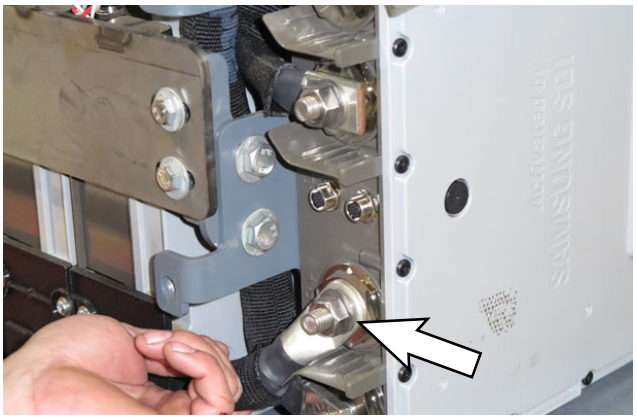
Disconnect the positive (+) terminal after the negative (-) has been disconnected.



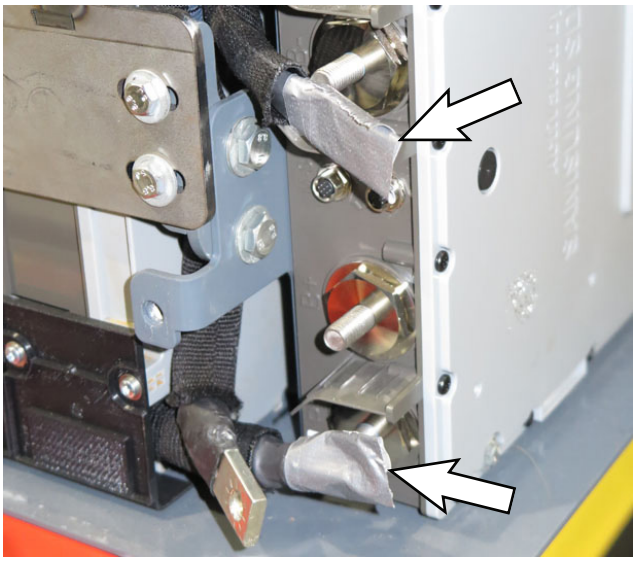
9. Disconnect the Lithium-Ion battery pack bus cables from the battery controller. Disconnect the negative (-) terminal connection first.



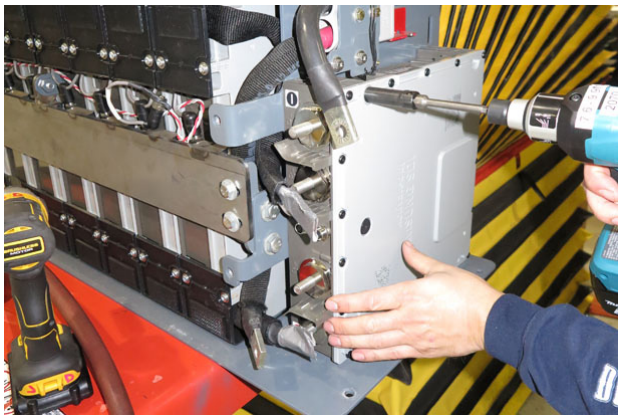
Disconnect the positive (+) terminal after the negative (-) has been disconnected.



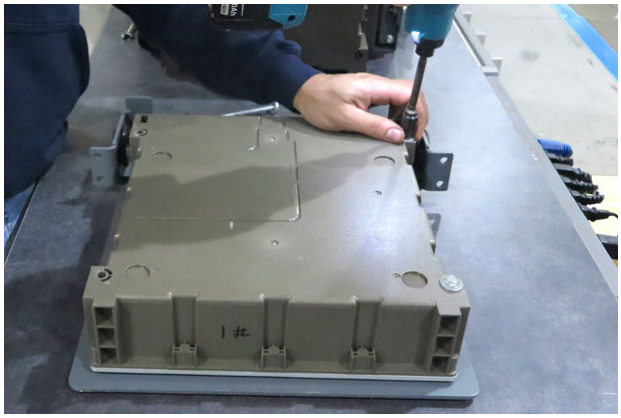
10. Wrap the Lithium-Ion battery pack cable connectors with tape to prevent the cables from arcing.



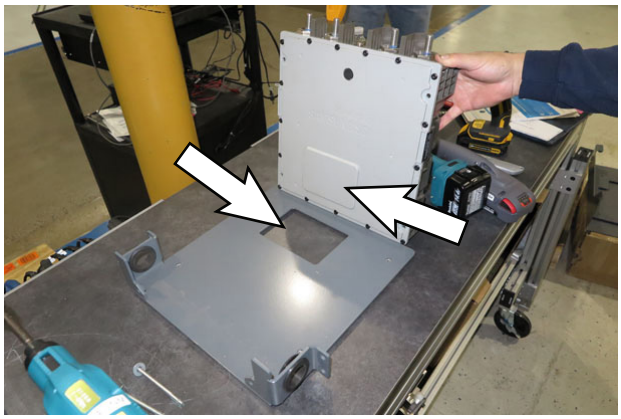
11. Remove the battery controller from the Lithium-Ion battery pack



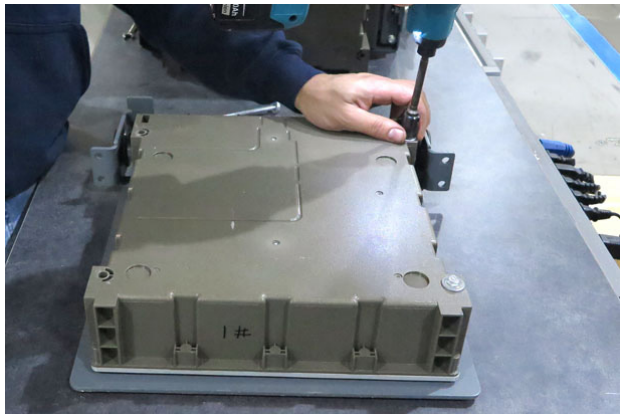
12. Remove the bracket from the battery controller.



13. Reassemble the bracket onto the battery controller Be sure the protruded area on the battery controller goes back into the cut out section in the bracket.

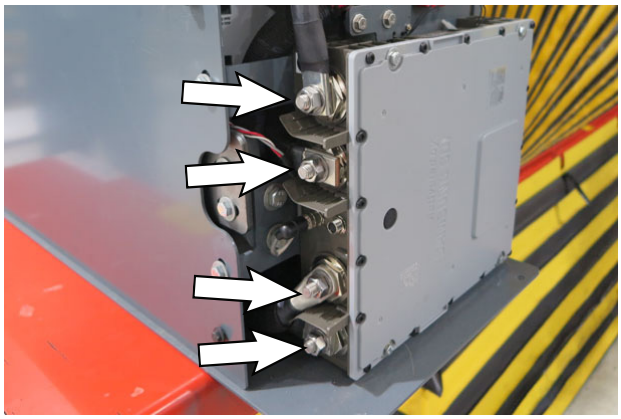


14. Apply blue thread sealant onto screws and reattach battery controller to bracket. Torque screws to 3.8 Nm +/- 0.7 Nm (2.8 ft lbs +/- 0.5 ft lbs).



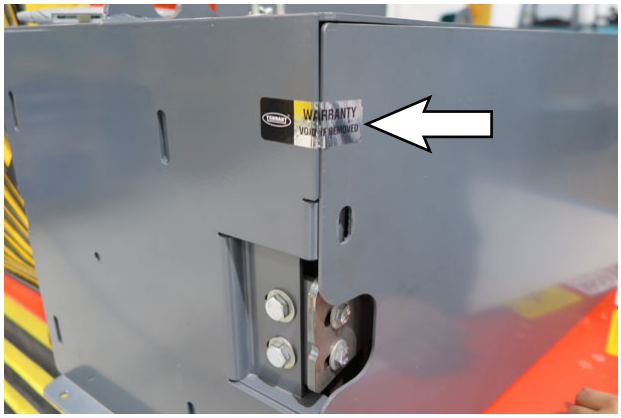
15. Install the battery controller onto the Lithium-Ion battery pack in reverse order of disassembly.

16. Torque the nuts on each battery terminal to 24.5 Nm +/- 3.4 Nm (18 ft lbs +/- 2.5 ft lbs).



17. Clean old warranty label and label residue from the Lithium-Ion battery pack and cover.

18. Install the new warranty label onto the bracket and Lithium-Ion battery pack where the old label was previously located.



19. Reinstall the Lithium-Ion battery pack into the battery compartment.

20. Reconnect the battery cable to the machine.