



T5e

Automatic Scrubber

Service Information Manual

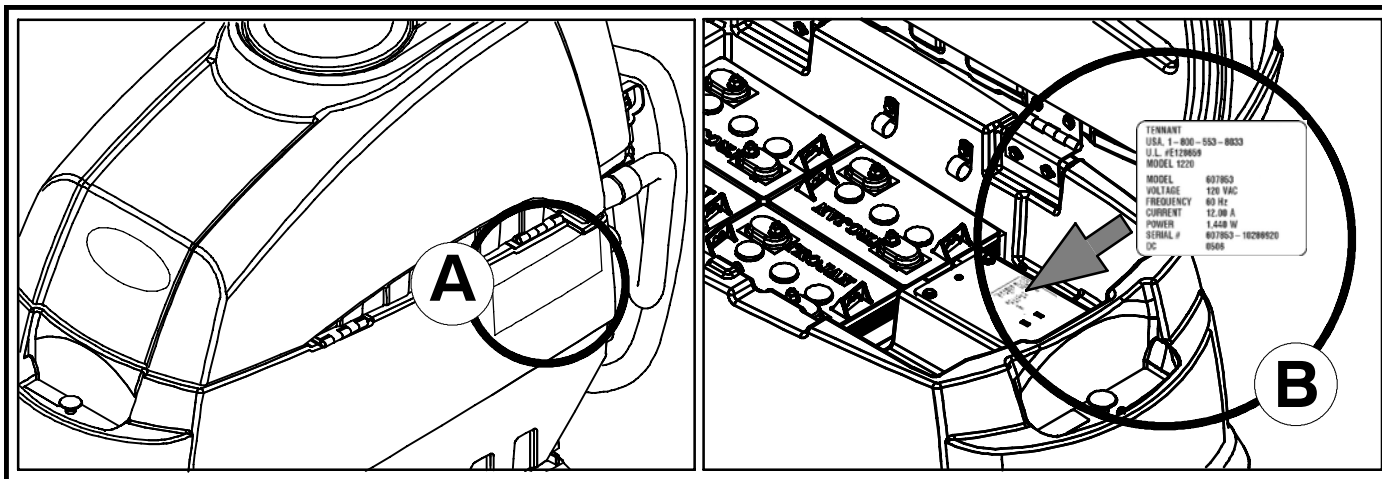


International

www.tennantco.com

9002342
Rev. 00 (10-2006)





FOR REPLACEMENT PARTS

Identify machine model and serial number.

1. **(A)** Identify the machine model.
2. **(B)** Identify the machine serial number from the data plate.

Refer to the TENNANT Parts Manual.

NOTE: Only use TENNANT Company supplied or equivalent parts. Parts and supplies may be ordered online, by phone, by fax or by mail.

Tennant Company

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www.tennantco.com

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Specifications and parts are subject to change without notice.

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T5e Service Information Manual

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BEFORE CONDUCTING TESTS:



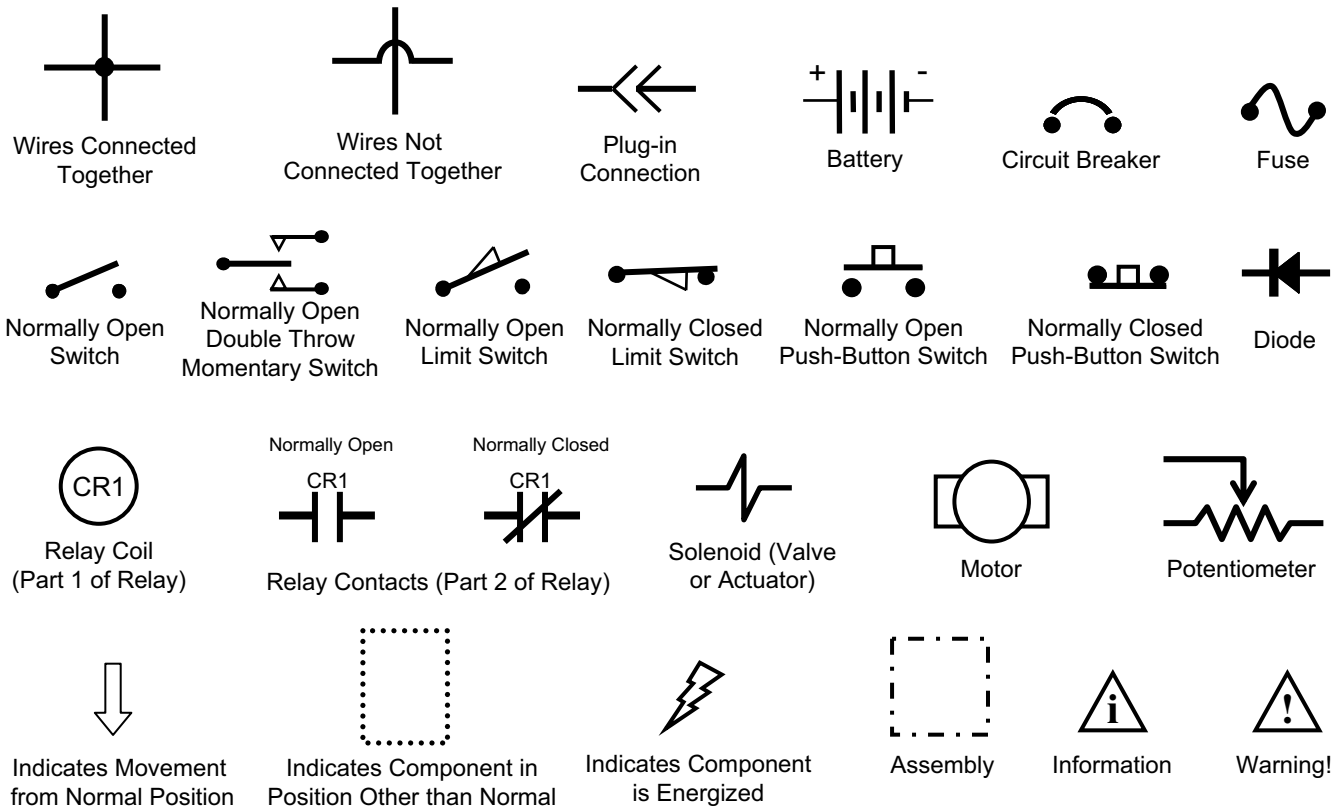
- Read and Follow ALL Safety Warnings and Precautions in Operator's Manual
- Always use an ESD (Electrostatic Discharge) strap when working near the Control Board
- Be cautious when working near Control Board – Battery voltage is always present, even with Key OFF
- Always Disconnect Batteries when removing or replacing components

DURING TESTS:

- Call Technical Services if Diagnostic Time Exceeds One Hour with Unknown Cause or Course of Action

Commonly Used Electrical Symbols & Terms

NOTE: The term “NORMALLY” refers to the components’ “at rest” or “de-energized” position



Terms & Abbreviations

AC – Alternating Current

BDI – Battery Discharge Indicator

CB – Circuit Breaker

CR – Relay (Contact Type)

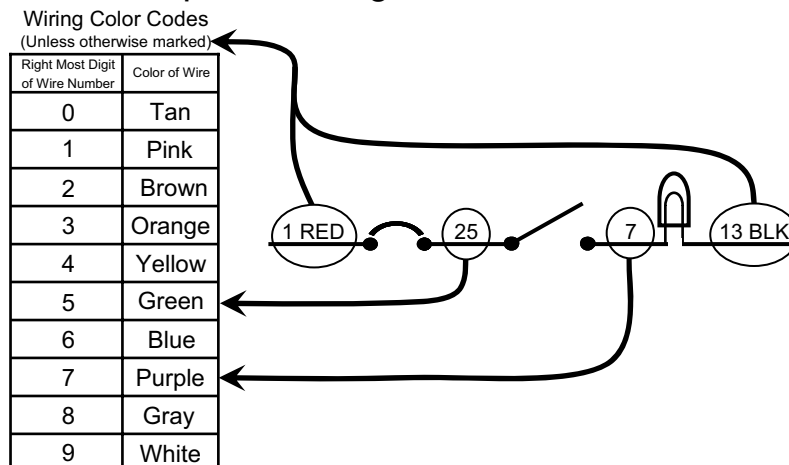
LED – Light Emitting Diode

M – Motor

PWM (Pulse Width Modulation) – A method of using controlled on/off times to regulate voltage and current to an electrical device

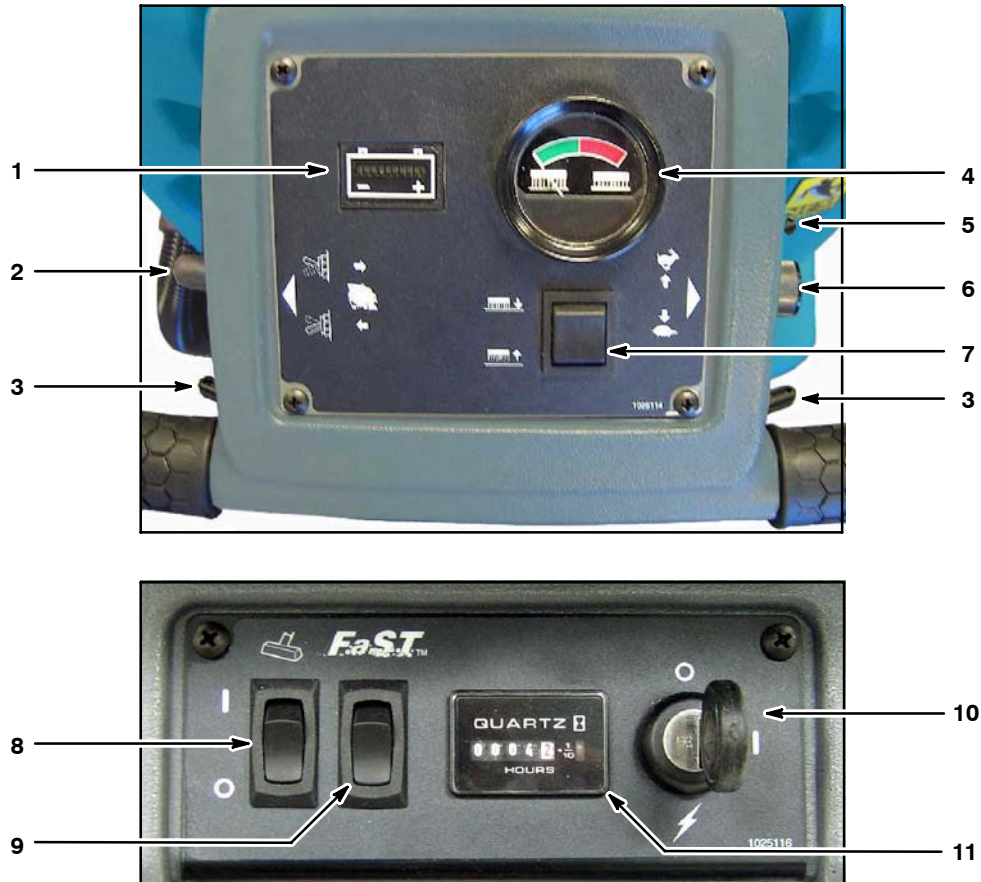
Standoff – A common connecting point for multiple wires

Example of Wiring Numbers & Colors:



T5e Component Locator

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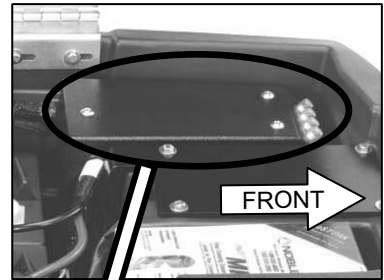
1. Battery Meter
2. Reverse Trigger
3. Start Triggers
4. Brush Pressure Meter
5. Control Console Height Adjustment Lever
6. Speed Control Knob

7. Brush Pressure Switch
8. Off-Aisle Wand on/off Switch (option)
9. FaST System on/off Switch (option)
10. Main Power on/off Key Switch
11. Hour Meter

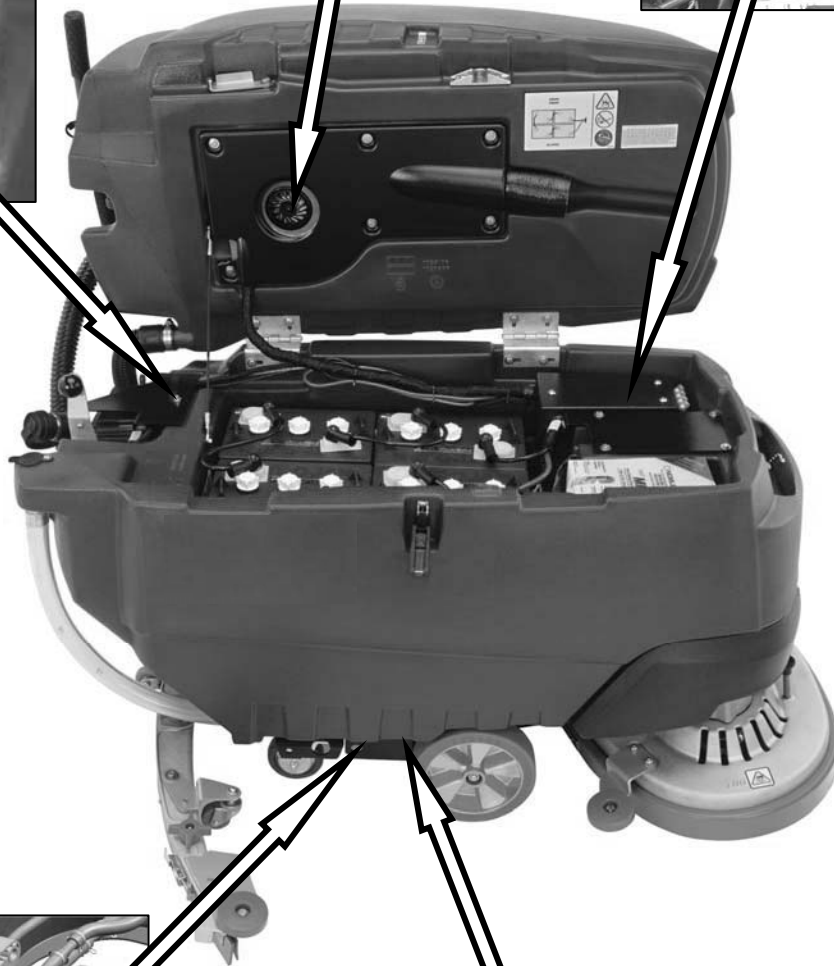
T5e Component Locator

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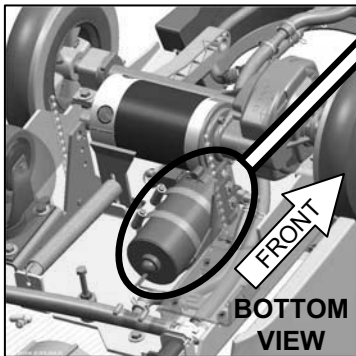
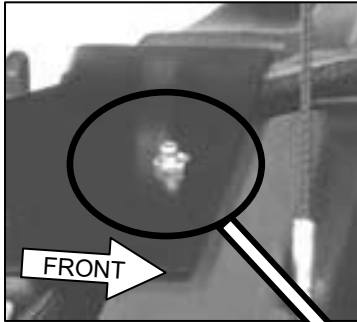
CONTROL BOARD AND
CIRCUIT BREAKERS



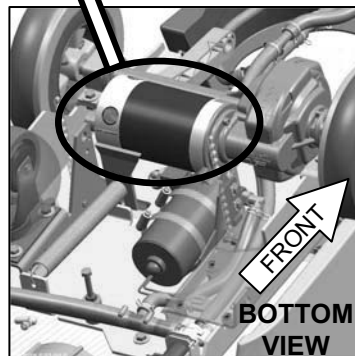
VACUUM FAN
MOTOR M3



RECOVERY TANK
INTERLOCK SWITCH



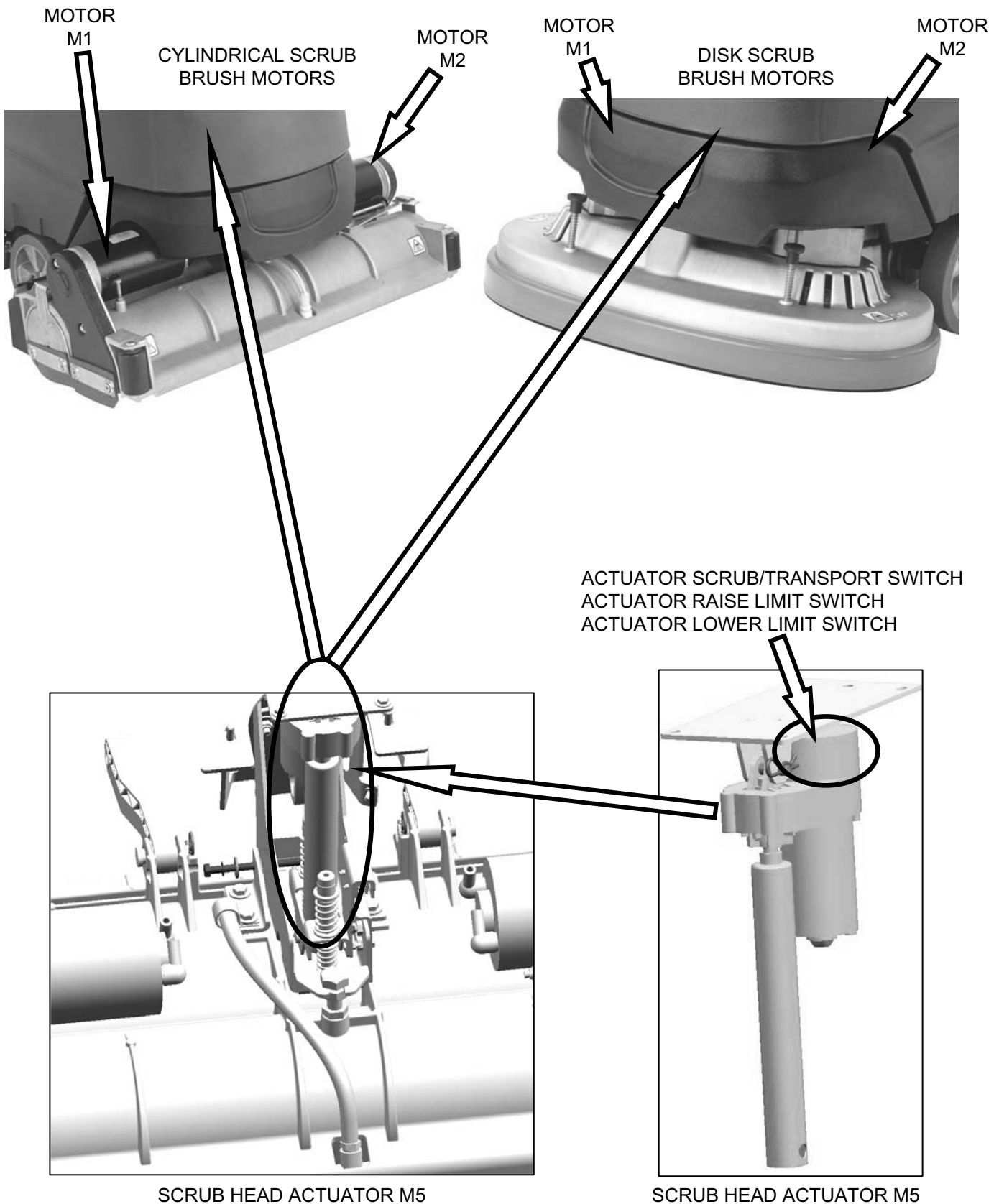
FaST PUMP MOTOR M6



PROPEL MOTOR M4

T5e Component Locator

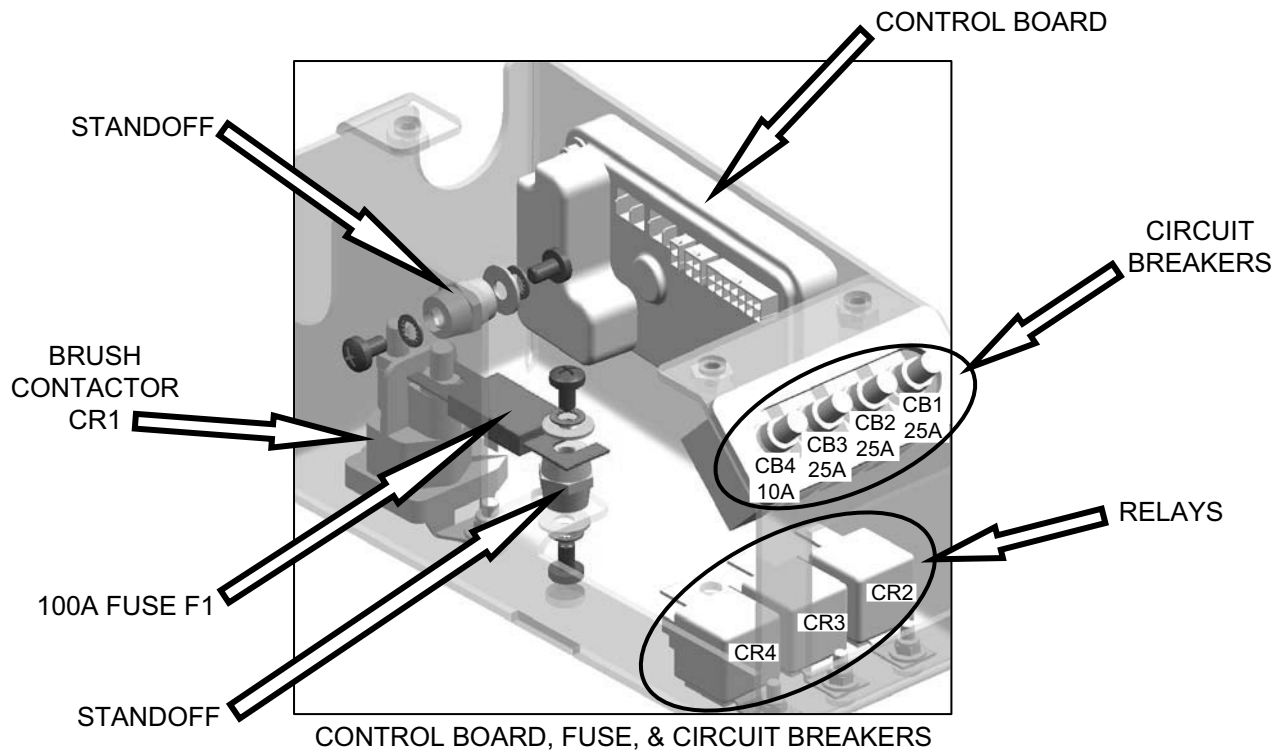
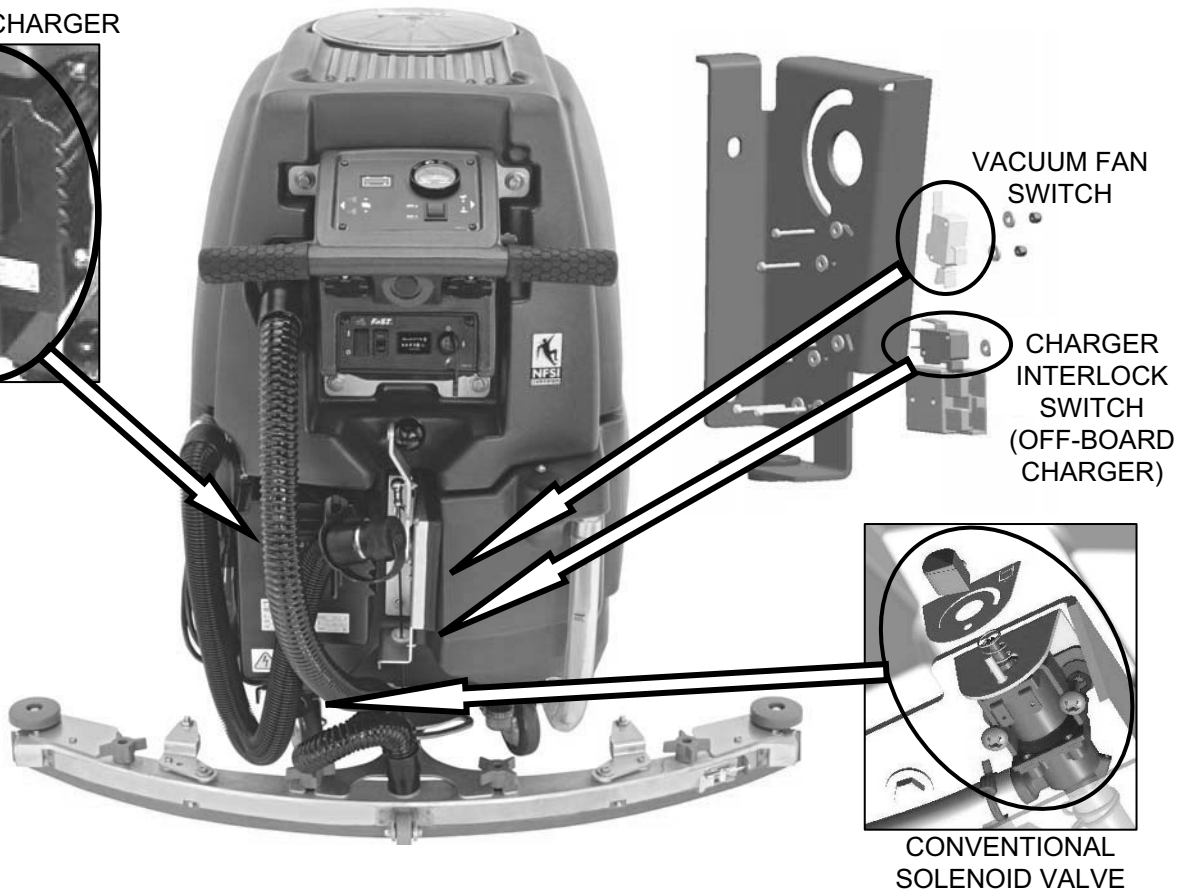
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T5e Component Locator

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ON-BOARD CHARGER



T5e Machine Specifications

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MODEL	Disk, 600mm	Disk, 700mm	Disk, 800mm	Cylindrical, 650mm	Cylindrical, 800mm
LENGTH	1,357 mm	1,408 mm	1,471 mm	1,399 mm	1,399 mm
WIDTH	645 mm	737 mm	838 mm	711 mm	864 mm
HEIGHT	1,120 mm				
MINIMUM AISLE TURN	1,346 mm	1,499 mm	1,626 mm	1,575 mm	1,638 mm
WEIGHT	133 kg	145 kg	151 kg	151 kg	155 kg
WEIGHT WITH BATTERIES	258 kg	269 kg	275 kg	275 kg	279 kg
RECOVERY TANK CAPACITY	105 L				
SOLUTION TANK CAPACITY	85 L				
DRIVE SYSTEM	Transaxle, 24 V, .19 kW				
TRAVEL SPEED, MAXIMUM	Cleaning: 67 m/min Transporting: 72 m/min				
PRODUCTIVITY RATE Theoretical	2,450 m ² /hr	2,860 m ² /hr	3,270 m ² /hr	2,660 m ² /hr	3,270 m ² /hr
PRODUCTIVITY RATE Estimated Actual	1,660 m ² /hr	1,930 m ² /hr	2,230 m ² /hr	1,785 m ² /hr	2,230 m ² /hr
CLEANING PATH WIDTH	600 mm	700 mm	800 mm	650 mm	800 mm
BRUSH DIAMETER	302 mm	353 mm	404 mm	151 mm	151 mm
BRUSH PRESSURE	Up to 54 kg				
SOLUTION FLOW RATE	1.89 L /min	1.89 L/min		2.27 L/min	2.27 L/min
SQUEEGEE WIDTH	908 mm standard	1,051 mm standard	1,185 mm standard	1,051 mm standard	1,185 mm standard
	800 mm narrow aisle	908 mm narrow aisle	1,051 mm narrow aisle	908 mm narrow aisle	1,051 mm narrow aisle
BRUSH MOTOR	Qty 2, .55 kW, 220rpm, 24 V, 29 A			Qty 2, .47 kW, 1500 rpm, 24 V, 23 A	
VACUUM MOTOR	640 W, 3-stage 5.7, 24 V, 26 A				
WATER LIFT/AIR FLOW	55 mm H ² O/ 32.4 L ³ /m				
BATTERIES	Qty 4, 6 V				
BATTERY CAPACITY	WET (lead Acid) = 235Ah @ 20 h rate Sealed (Gel)= 200Ah @ 20 h rate				
RUN TIME PER CHARGE*	WET = Up to 5.0 hours Gel = Up to 4.0 hours				
ON-BOARD CHARGER	120VAC, 10A, 50/60Hz, 24VDC, 20A output / 230VAC, 5A, 50/60Hz, 24VDC, 20A output				
TOTAL POWER CONSUMPTION	50 A nominal				
VOLTAGE DC	24 VDC				
PROTECTION GRADE	IPX3				
DECIBEL RATING AT OPERA-TOR'S EAR, INDOORS.**	67dBA			68dBA	
VIBRATION AT CONTROLS	<.1188 m/s ²			<.103 m/s ²	
ACCELERATION RATE ON OPERATOR - MAX.	.179 m /s ²				
GRADE LEVEL, MAX.	Scrubbing 5% (3°), Transporting 8% (5°)				

* Run times are based on Continuous Scrubbing Run Times.

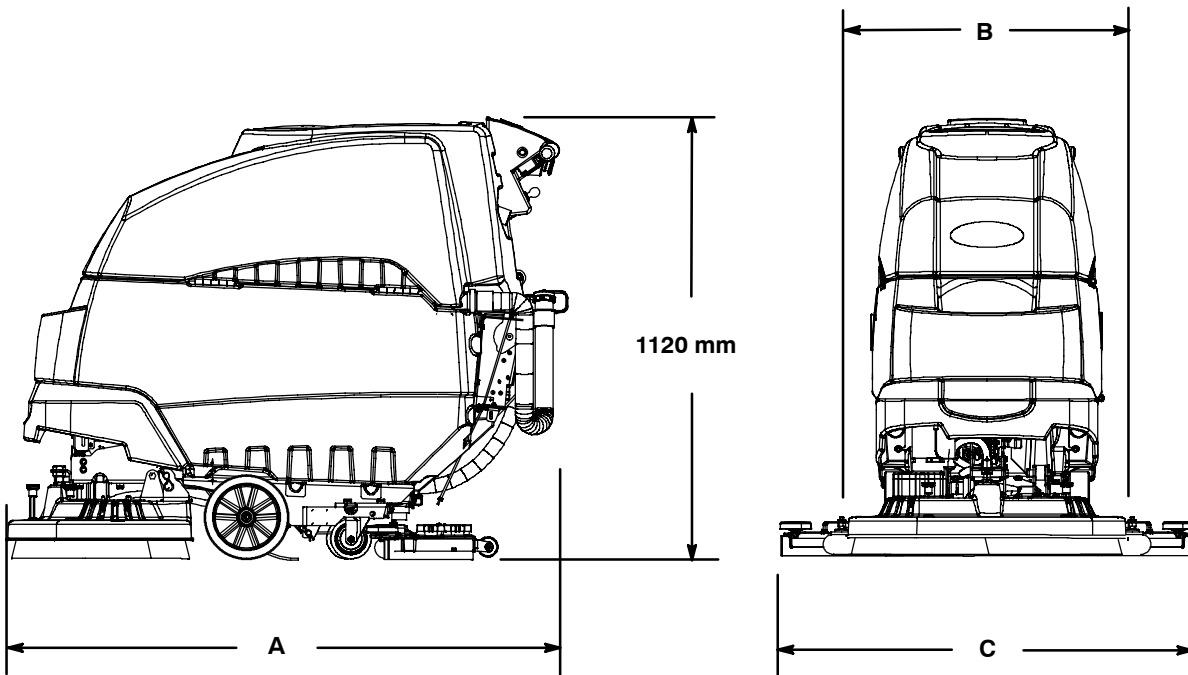
** Sound levels (ISO 11201) as recommended by the American Association of Cleaning Equipment Manufacturers (AACEM) and OSHA.

T5e Machine Specifications

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FaST SYSTEM	Disk, 600mm	Disk, 700mm	Disk, 800mm	Cylindrical, 650mm	Cylindrical, 800mm
PRODUCTIVITY RATE Estimated Actual	1865 m ² /hr	2115 m ² /hr	2440 m ² /hr	1950 m ² /hr	2440 m ² /hr
SOLUTION PUMP	24 Volt DC, 3.5 A, 5.6 L/min open flow, 4.13 Bar bypass setting				
SOLUTION FLOW RATE	0.57 L/min.	0.83 L/min.		0.57 L/min.	0.83 L/min.
CONCENTRATE FLOW RATE	0.57 CC/min.	0.83 CC/min.		0.57 CC/min.	0.83 CC/min.
CONCENTRATE TO WATER DILUTION RATIO	1:1000				

MACHINE DIMENSIONS



Models:	600 mm Disk	700 mm Disk	800 mm Disk	650 mm Cylindrical	800 mm Cylindrical
A =	1,357 mm	1,408 mm	1,471 mm	1,399 mm	1,399 mm
B =	645 mm	737 mm	838 mm	711 mm	864 mm
C =	908 mm	1,051 mm	1,185 mm	1,051 mm	1,185 mm

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SAFETY LABELS

The safety labels appear on the machine in the locations indicated. Replace labels if they are missing or become damaged or illegible.

WARNING LABEL -

Located on recovery tank cover.



BATTERY CHARGE LABEL -

Located on bottom side of recovery tank.

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



SPINNING BRUSH LABEL -

Located on scrub head

⚠ WARNING: Spinning Brush. Keep Hands Away. Turn Off Power Before Working On Machine.

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BATTERY INSTALLATION

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

FOR SAFETY: When installing batteries, wear protective gloves and eye protection. Avoid contact with battery acid.

Battery Specifications:

Four 6 volt, 235A/20h deep cycle batteries. Maximum battery dimensions:
7.5 in / 190 mm W x 10.8 in / 275 mm L x 11.2 in / 284 mm H.

1. Park the machine on a level surface, remove the key and set the parking brake, if equipped.
2. Carefully install the batteries into the battery compartment tray (Figure 1). Arrange the battery posts as shown (Figure 2).

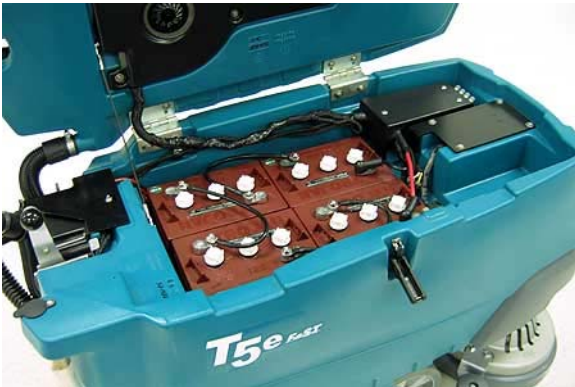


FIG. 1

3. Connect the battery cables to the battery posts as shown (Figure 2), RED TO POSITIVE (+) and BLACK TO NEGATIVE (-).

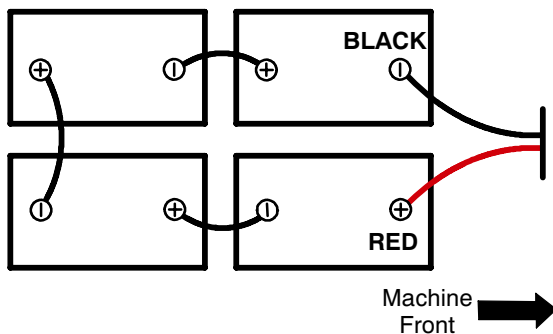


FIG. 2

SQUEEGEE REMOVAL & INSTALLATION

REMOVING SQUEEGEE ASSEMBLY

1. Park the machine on a level surface, remove the key and set the parking brake if equipped.
2. Lift the squeegee lift lever to the upward position (Figure 3).



FIG. 3

3. Remove the vacuum hose from the squeegee assembly. Note loop and clip on hose (Figure 4).

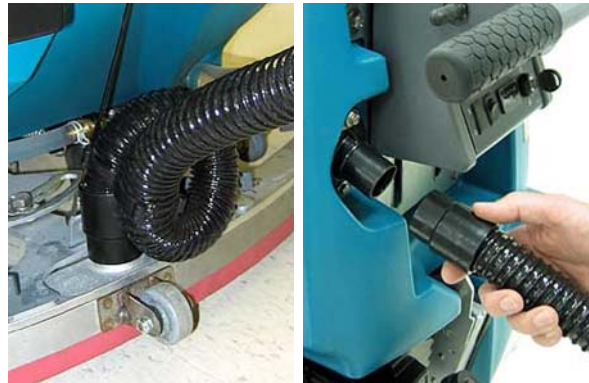


FIG. 4

4. Loosen the knobs and slide squeegee assembly away from pivot bracket (Figure 5).

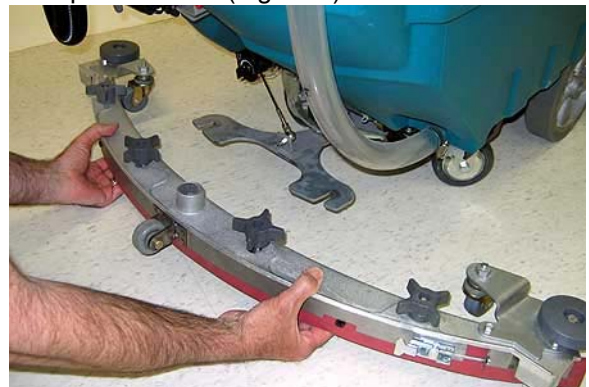


FIG. 5

5. Installation is in reverse order of removal.

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6. Check the squeegee blades for proper deflection. The blades should deflect as shown (Figure 6).

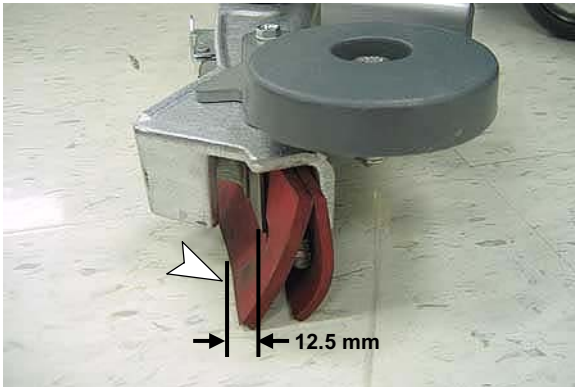


FIG. 6

7. To adjust the blade deflection, place the squeegee assembly on a level surface and adjust the casters as shown (Figure 7).

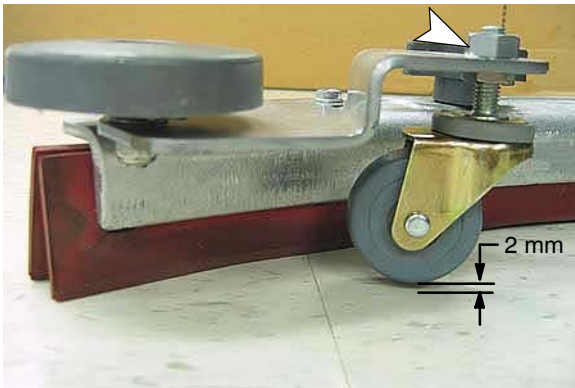


FIG. 7

CIRCUIT BREAKERS AND FUSES

The machine is equipped with four resettable circuit breakers and four fuses to protect the machine from damage. If a breaker should trip, determine the cause, allow the motor to cool then manually reset the circuit breaker button. The circuit breaker panel is located near the battery compartment (Figure 29). The fuses are located inside the circuit breaker box. When replacing a fuse never substitute a higher Amp rated fuse than specified.

CIRCUIT BREAKERS:

- 10 A – Main (A)
- 25 A – Vacuum motor (B)
- 25 A – Left brush motor (C)
- 25 A – Right brush motor (D)

FUSES:

- 100 A – Main
- 30 A – Propel motor
- 7.5 A – FaST system
- 7.5 A – Off-aisle wand pump (located in control console)

CHARGING BATTERIES

ATTENTION: To prolong the life of the batteries only recharge the batteries if the machine was used for a total of 30 minutes or more. Do not leave batteries discharged for lengthy periods.

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

FOR SAFETY: When servicing batteries, wear protective gloves and eye protection when handling batteries and battery cables. Avoid contact with battery acid.

BATTERY CHARGER SPECIFICATIONS

- CHARGER TYPE:
 - FOR SEALED (Gel) BATTERIES
 - FOR WET (Lead acid) BATTERIES
- OUTPUT VOLTAGE - 24 VOLTS
- OUTPUT CURRENT - 20 AMPS
- AUTOMATIC SHUTOFF CIRCUIT
- FOR DEEP CYCLE BATTERY CHARGING

ON-BOARD BATTERY CHARGER SETTINGS

If your machine is equipped with the on-board charger, the charger settings must be set for your battery type before charging. Failure to properly set will result in battery damage.

To determine your battery type, see battery label. Contact your battery supplier if not specified.

To verify the setting of the charger, connect the charger cord into an electrical receptacle. The charger will display a sequence of codes. One of the codes will either read “GEL” or “Acid” (Figure 41).

GEL = Set for sealed/maintenance free batteries
Acid = Set for wet/lead acid batteries



FIG. 41

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To change the setting, unplug the charger, peel up the corner of the display label and set the switches accordingly (Fig. 42). The charger cord must be unplugged when resetting.



FIG. 42

USING THE ON-BOARD BATTERY CHARGER

IMPORTANT: Before charging, make sure that the charger setting is properly set for your battery type (See ON-BOARD CHARGER SETTINGS).

1. Transport the machine to a well-ventilated area.
2. Park the machine on a flat, dry surface. Turn the key off and set the parking brake, if equipped.
3. If charging wet (lead acid) batteries check the fluid level before charging (See BATTERY MAINTENANCE).
4. Prop up the recovery tank for ventilation (Figure 43).



5. Connect the charger's AC power supply cord into a properly grounded receptacle (Figure 44).

NOTE: The machine will not operate when charging.



6. The charger will display a sequence of codes once the cord is connected (Figure 45).

Three-digits + the following code:

A = Charging current

U = Battery voltage

h = Charging time

C = Charging ampere-hours [Ah]

E = Energy used [Kwh]

"GEL" or "Acd" = Battery type the charger is currently set for. Before charging make sure your battery type matches the display:

GEL=Sealed, Acd=Wet (lead acid). To change setting, see ON-BOARD CHARGER SETTINGS.

Press the arrow button to review the codes.



7. Once the charging cycle begins, the indicator lights will progress from red, yellow to green. When the green indicator light comes on, the charging cycle is done. Unplug the charger cord.

If the charger detects a problem, the charger will display an error code (See ON-BOARD BATTERY CHARGER ERROR CODES).

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ON-BOARD BATTERY CHARGER ERROR CODES

DISPLAY CODE	FAULT	SOLUTION
bat	Loose or damaged battery cable	Check battery cable connections.
	Battery exceeded maximum voltage level.	No action necessary.
E01	Exceeded maximum battery voltage allowed.	No action necessary.
E02	Safety thermostat exceeded maximum internal temperature.	Check if the charger vents are obstructed.
E03	Exceeded maximum time for charging phase leaving the batteries undercharged due to a sulfated or faulty battery.	Repeat the charging cycle and if the error code E03 reappears check battery or replace it.
SCt	Safety timer exceeded maximum charging time. Interrupts charging cycle.	Replace battery.
Srt	Possible internal short circuit.	Contact Tennant Service 1-800-553-8033

USING AN OFF-BOARD BATTERY CHARGER

1. Transport the machine to a well-ventilated area.
2. Park the machine on a flat, dry surface. Turn the key off and set the parking brake, if equipped.
3. If charging wet (lead acid) batteries, check the fluid level before charging (See BATTERY MAINTENANCE).
4. Prop up the recovery tank for ventilation (Figure 46).



FIG. 46



FIG. 47

7. The supplied charger will automatically begin charging and shut off when fully charged.

NOTE: The machine will not operate when charging.

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

5. Connect the charger's AC power supply cord into a properly grounded receptacle.
6. Connect the charger's DC cord into the machine's battery receptacle (Figure 47).

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ADJUSTING SCRUB HEAD BRUSHES

To ensure optimum scrubbing performance periodically check the scrub head for proper adjustment.

FOR SAFETY: Before adjusting scrub head, stop machine on level surface, remove key and set parking brake if equipped.

DISK MODEL

Tools required: Measuring device, 1-1/16 in / 27 mm wrench and 15/16 in / 24mm wrench

1. With brushes installed, lower the scrub head and apply medium brush pressure.
2. Turn machine off and remove key.
3. From the center front and back of scrub head, measure the distance from the top edge of scrub head to the floor (Figure 48).

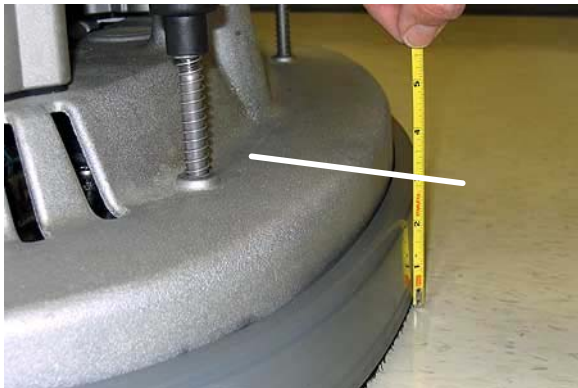


FIG. 48

4. If scrub head is not level, loosen the lock nut and turn the scrub head leveling screw to level. Tighten down the lock nut once head is level (Figure 49).



FIG. 49

CYLINDRICAL BRUSH MODEL

After installing a new set of cylindrical brushes check the brush pattern to ensure proper brush adjustment. Brushes that are not properly adjusted will result in premature wear and poor scrubbing performance (Figure 50).

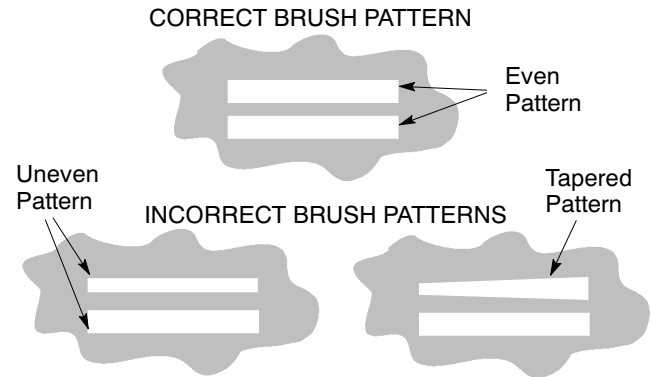


FIG. 50

To Inspect the Brush Pattern:

1. Position the machine on a dry dusty floor or apply a powdered substance, such as chalk.
2. Disconnect the drive motor wire connector to keep machine from moving forward (Figure 51).

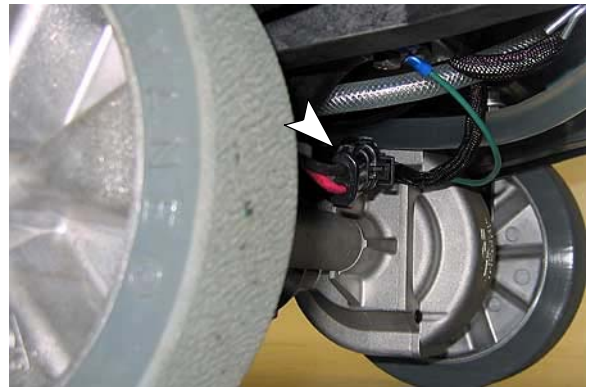


FIG. 51

3. Lower the scrub head to the floor and apply maximum brush pressure.
4. Shut off the solution flow.
5. Pull the triggers to create a brush pattern on the floor.
6. Raise the scrub head and pull the machine away.
7. Observe the brush pattern on floor. If the brush pattern is uneven or tapered, adjustment is required.
8. Reconnect drive motor wire.

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To Adjust an Uneven Brush Pattern:

Tools required: Measuring device, 1-1/16 in / 27 mm wrench and 15/16 in / 24mm wrench

1. Measure the distance from the front edge of the scrub head to the floor and from the back edge of the scrub head to the floor (Figure 52). The measurements should be the same.



FIG. 52

2. To level the scrub head, loosen the lock nut and turn the leveling screw clockwise to lower the rear of the scrub head or counter-clockwise to lower the front (Figure 53).

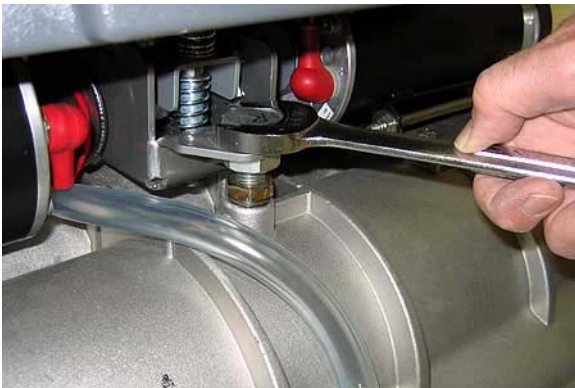


FIG. 53

3. Recheck brush pattern.

NOTE: Replace brush when bristles are worn to 5/8 in / 15 mm.

To Adjust a Tapered Brush Pattern:

Tools required: 3/8 in / 10mm wrench and 6mm hex wrench

1. Raise the scrub head off floor and remove key.
2. Remove the idler plate from the brush (Figure 54).



FIG. 54

3. Hold the brush plug shaft with a wrench and loosen the 6mm hex screw (Figure 55).

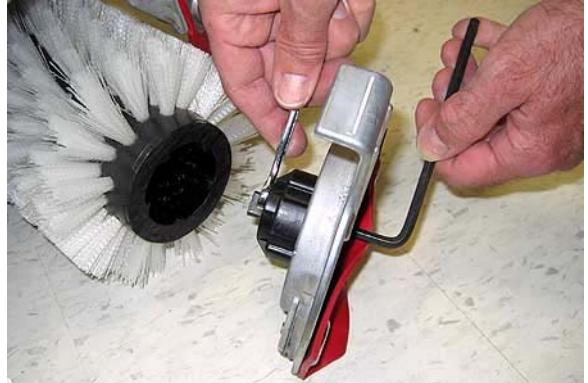


FIG. 55

4. To lower the brush end, turn the shaft clockwise for the front brush and counter-clockwise for the rear brush. Retighten hex screw (Figure 56).

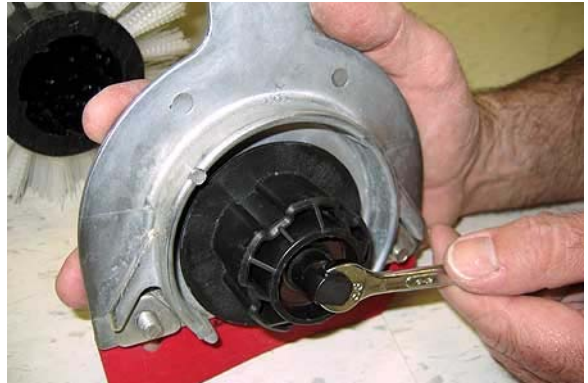


FIG. 56

5. Recheck brush pattern.

NOTE: Replace brushes when bristles are worn to 5/8 in / 15 mm.

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MACHINE MAINTENANCE

To keep the machine in good working condition, it's important that the following maintenance procedures are performed on a routine basis.

⚠ WARNING: Electrical Hazard. Disconnect Battery Cables Before Servicing Machine.

DAILY MAINTENANCE (After Every Use)

1. Drain the recovery tank (Figure 57).



FIG. 57

2. Rinse out the recovery tank (Figure 58).



FIG. 58

3. Remove the recovery tank float shut-off screen and clean (Figure 59).



FIG. 59

4. Drain the solution tank (Figure 60).

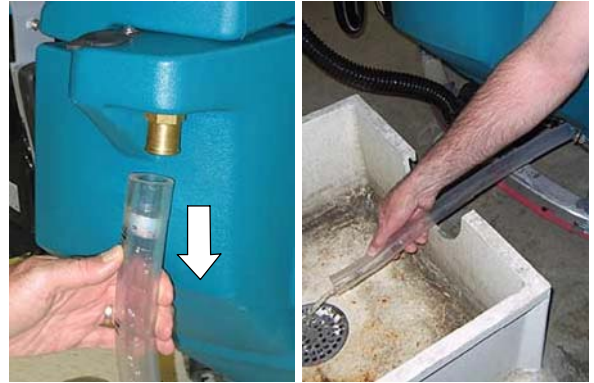


FIG. 60

5. Rotate pad or replace when worn (Figure 61).

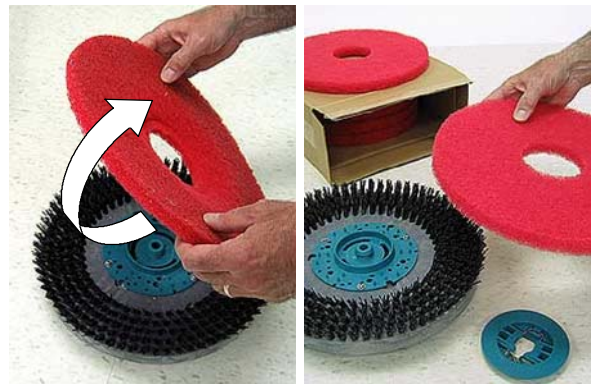


FIG. 61

6. Empty and rinse out the debris trough (Figure 62).

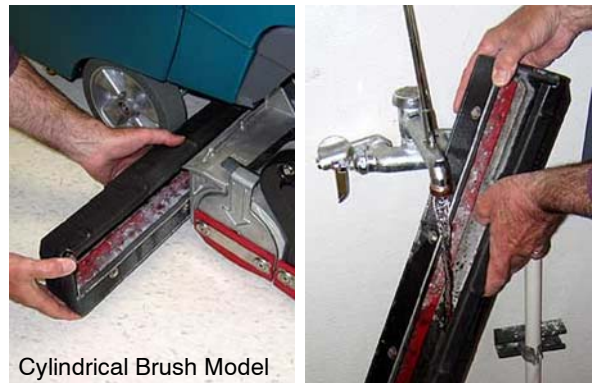


FIG. 62

7. Inspect the cylindrical brushes for wear. Rotate brushes from front-to-rear every 50 hours (Figure 63). Replace when worn to a length of 5/8 in / 15 mm.

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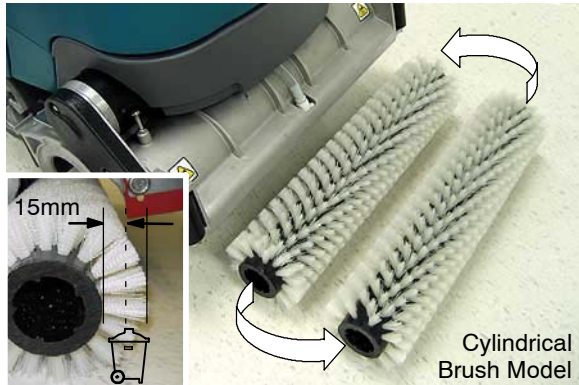


FIG. 63

8. Remove debris buildup from the underside of the cylindrical brush scrub head, including the idler plates and drive hubs (Figure 64).

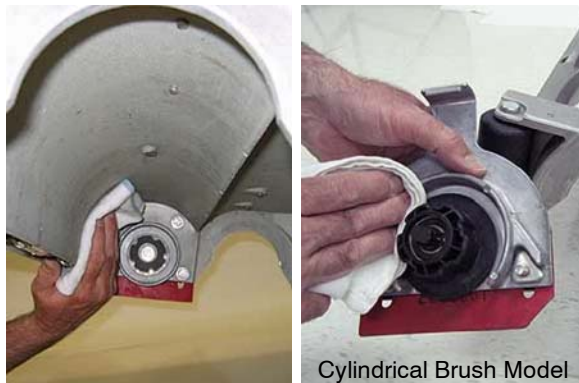


FIG. 64

9. Wipe the squeegee blades clean (Figure 65). Store the squeegee assembly in the raised position to prevent blade damage.



FIG. 65

10. Check the condition of the squeegee blade wiping edge (Figure 66). Rotate blade if worn (See SQUEEGEE BLADES).



FIG. 66

11. Clean the machine with an all purpose cleaner and damp cloth (Figure 67).

FOR SAFETY: When cleaning machine, do not power spray or hose off machine. Electrical malfunction may occur.



FIG. 67

12. Inspect the condition of the scrub head skirt, replace if worn or damaged (Figure 68).

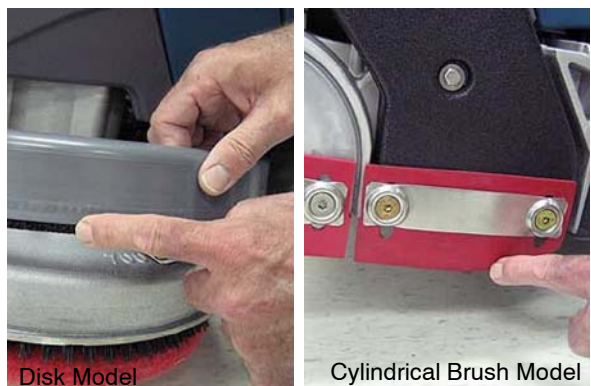


FIG. 68

T5e – Maintenance

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13. FaST Model: Connect the FaST-PAK supply hose to the storage plug when not in use (Figure 69). Remove any dried concentrate from the hose connector by soaking it in warm water.

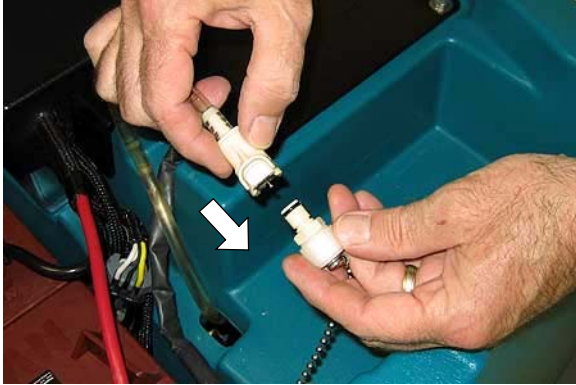


FIG. 69

14. Clean wet/lead acid batteries to prevent corrosion and check for loose battery cable connections (See BATTERY MAINTENANCE).
15. Recharge the batteries (Figure 70) after a total of 30 minutes of use or more.

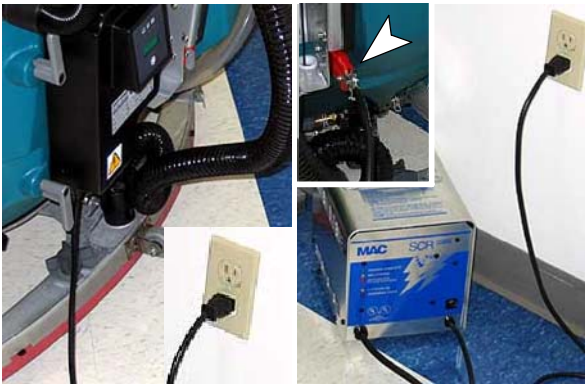


FIG. 70

MONTHLY MAINTENANCE

1. Remove the solution tank filter from underneath the machine and rinse out the screen (Figure 71). Make sure the solution tank is empty before removing filter.

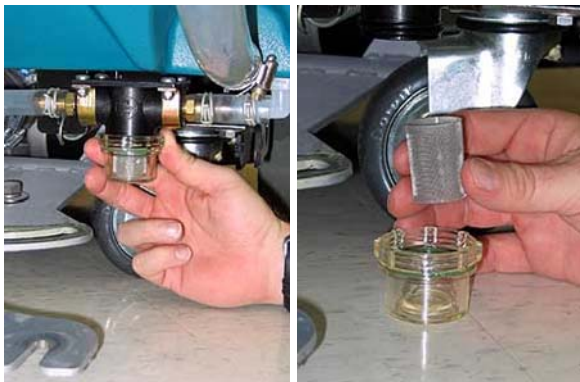


FIG. 71

2. Check the cylindrical brush belt tension every 100 hours (Figure 72). Belt tension should flex 0.1 in / 3mm at midpoint, with 2.5-2.7 lb / 1.13-1.22 kg force.

⚠ WARNING: Electrical Hazard. Disconnect Battery Cables Before Servicing Machine.

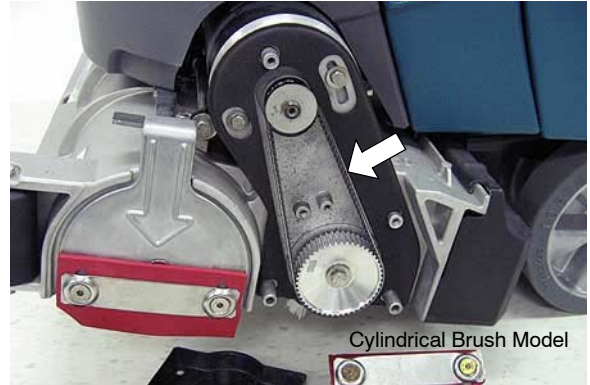


FIG. 72

3. Inspect and clean the recovery tank cover seal (Figure 73). Replace if damaged.



FIG. 73

4. Lubricate all pivot points and rollers with a water resistant grease.
5. Lubricate the casters with a water resistant grease (Figure 74).



FIG. 74

6. Clean the parking brake clamp with a cleaning solvent.
7. Check the machine for loose nuts and bolts.

T5e – Maintenance

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8. Check the machine for leaks.

BATTERY MAINTENANCE (Wet/lead acid batteries)

1. Check battery fluid level frequently to prevent battery damage. The fluid should be at the level shown (Figure 75). Add distilled water if low. DO NOT OVERFILL, the fluid may expand and overflow when charging.



CORRECT BATTERY FLUID LEVEL:

Before Charging

After Charging

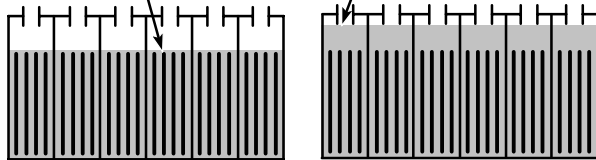


FIG. 75

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

2. Clean the batteries to prevent battery corrosion. Use a scrub brush with a mixture of baking soda and water (Figure 76).

FOR SAFETY: When cleaning batteries, wear protective gloves and eye protection. Avoid contact with battery acid.



FIG. 76

SQUEEGEE BLADES

When the blades become worn, simply rotate the blades end-for-end or top-to-bottom to a new wiping edge. Replace blades when all edges are worn.

The front blades on the 28 in / 700 mm and 32 in / 800mm squeegee assemblies have 12/14 slots on one edge and 6 slots on the opposite edge (Figure 77). If making sharp turns with the cylindrical brush models use the 12/14 slotted edge for maximum water pickup.

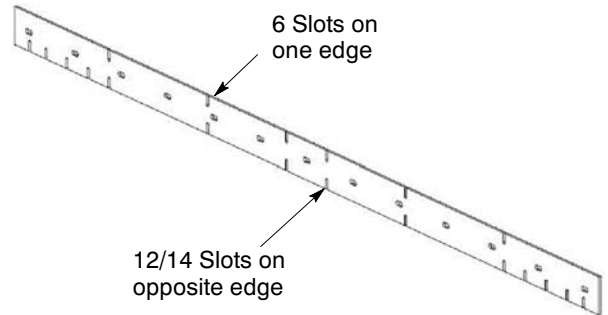


FIG. 77

Replacing Squeegee Blades:

1. Loosen the band clamp and remove the band from the squeegee assembly (Figure 78).

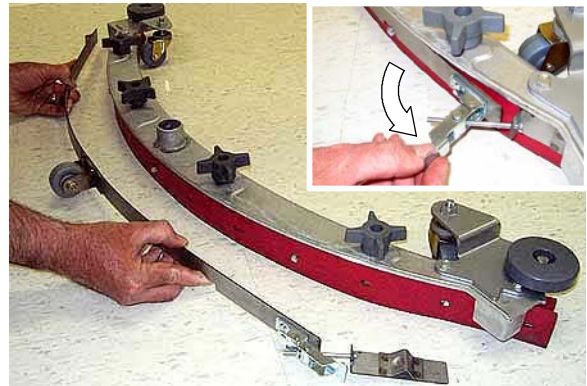


FIG. 78

T5e – Maintenance

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2. Replace or rotate the rear blade to a new wiping edge and replace band (Figure 79).

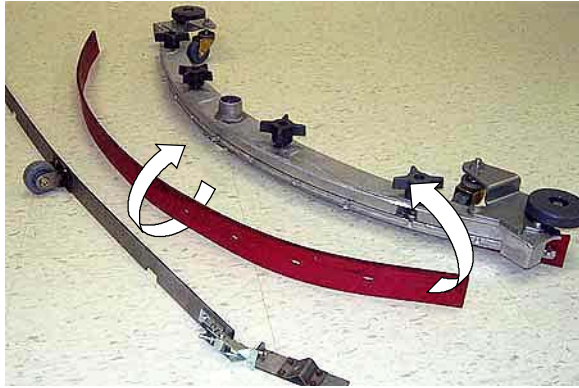


FIG. 79

3. To change the front blade, remove the band and loosen the four knobs. Replace or rotate the front blade to a new wiping edge (Figure 80)

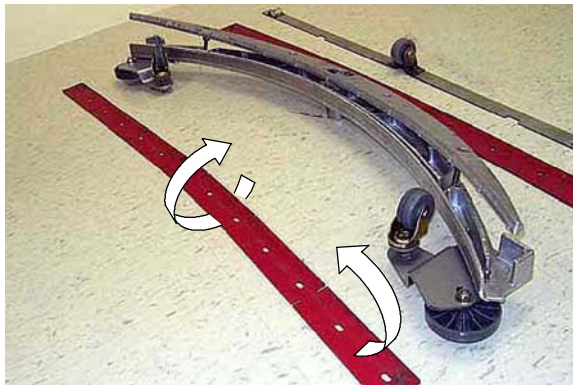


FIG. 80

MOTOR MAINTENANCE

Contact an Authorized Tennant Service Center for carbon brush replacement.

Carbon Brush Replacement	Hours
Drive Transaxle Motor	750
Vacuum Motor	
Disk Brush Motors	
Cylindrical Brush Motors	1000

⚠ WARNING: Electrical Hazard. Disconnect Battery Cables Before Servicing Machine.

FaST SYSTEM MAINTENANCE

Every 1000 hours replace the orifice plate and filter screen located inside the detergent injector assembly.

1. To access the detergent injector assembly, lower the scrub head and remove the front shroud (Figure 81)

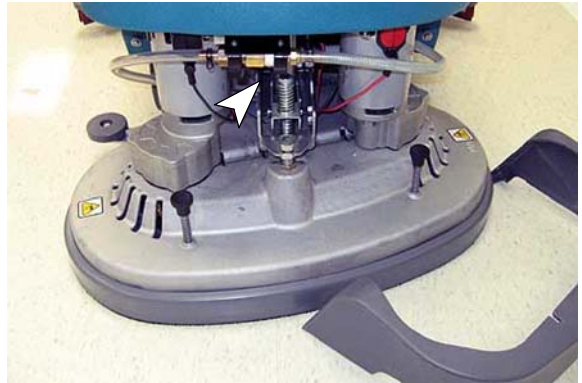


FIG. 81

2. Remove the injector assembly from clamps (Figure 82).



FIG. 82

3. Unthread the black plastic filter housing and replace the orifice plate and filter (Figure 83).

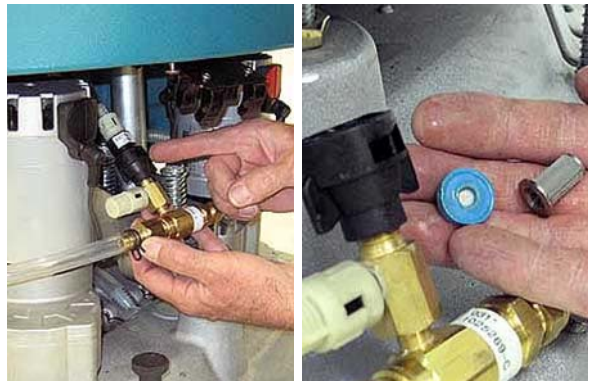


FIG. 83

JACKING UP MACHINE

Use the designated locations to jack up the machine for service (Figure 84). Empty the recovery and solution tanks and position the machine on a level before jacking.

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

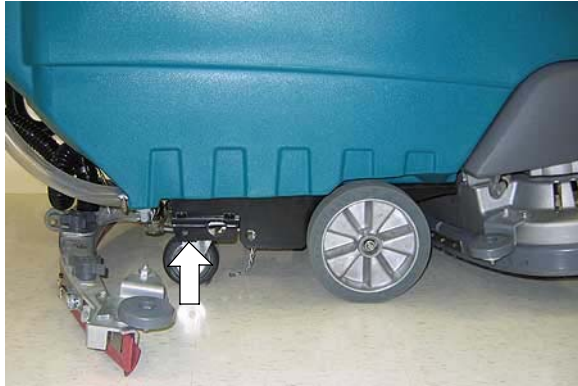


FIG. 84

TRANSPORTING MACHINE

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

1. Drain machine tanks.
2. Load the machine using a ramp that can support the machine weight and person loading it. The maximum ramp incline should not exceed 11° at a ramp length of 3.7m (12 ft).
3. Position the front of machine up against the front of the trailer or truck. Lower the scrub head and squeegee.
4. Set the parking brake, if equipped, and place a block behind each wheel to prevent the machine from rolling.
5. Secure with tie-down straps as shown (Figure 85). It may be necessary to install tie-down brackets to trailer or truck.

FOR SAFETY: When loading/unloading machine onto/off truck or trailer, use a ramp that can support the machine weight and person loading it, do not exceed a 11° ramp incline at a ramp length of 3.7m (12 ft), use tie-down straps to secure machine and block machine wheels.

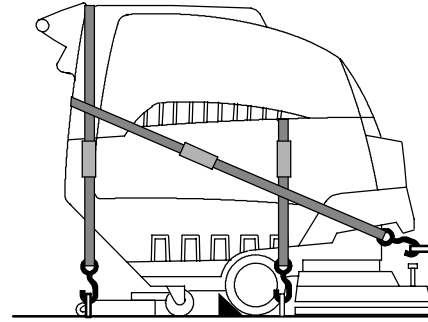


FIG. 85

STORING MACHINE

1. Charge the batteries before storing machine to prolong the life of the batteries.
2. Drain and rinse the tanks thoroughly.
3. Store the machine in a dry area with the squeegee and scrub head in the up position.
4. Open the recovery tank cover to promote air circulation.

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

5. If storing machine in freezing temperatures, make sure to drain machine of all water.

For models equipped with the FaST System, follow the FaST SYSTEM FREEZE PROTECTION procedure below.

FaST SYSTEM FREEZE PROTECTION

Valve Coupling #1002856 and 15 cm Hose #63182 are required (Purchased separately).

1. Remove the FaST-PAK carton and connect the valve coupling and 15cm hose (purchased parts) to the supply hose (Figure 86).

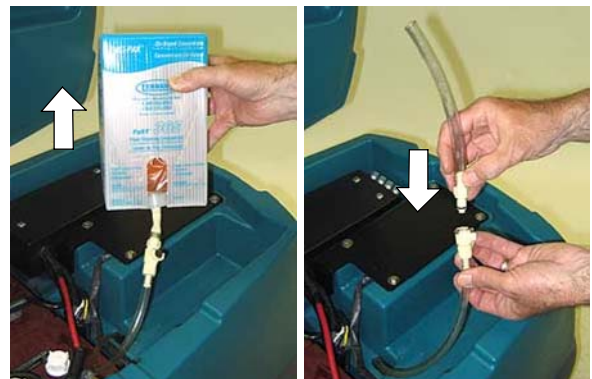


FIG. 86

T5e – Maintenance

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2. Disconnect the opposite end of the supply hose from the injector assembly and drain the supply hose (Figure 87). To access the injector assembly remove the front shroud.

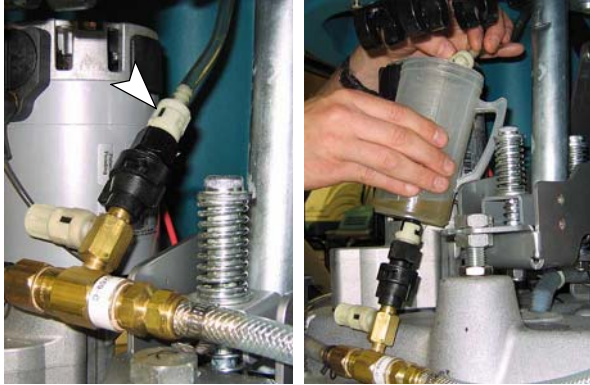


FIG. 87

3. Reconnect the supply hose to injector assembly and pour a recreational vehicle (RV) anti-freeze into the supply hose until full (Figure 88).



FIG. 88

4. Operate the FaST system as normal until the foaming stops. This step could take anywhere from 5-10 minutes.
5. Remove the valve coupling and connect the storage plug (Figure 89).

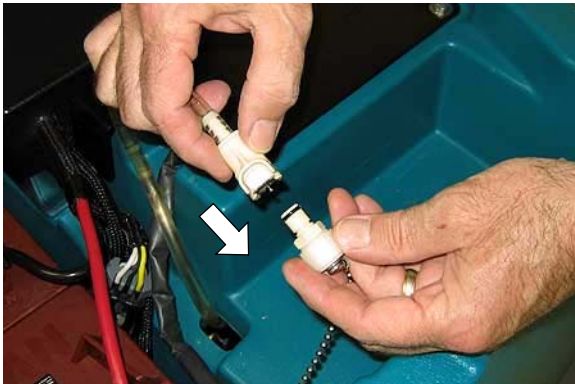


FIG. 89

6. Drain the recovery and solution tanks and store machine.

7. To drain the anti-freeze, repeat the draining process above and reconnect the supply hose to the FaST-PAK carton.

RECOMMENDED STOCK ITEMS

Refer to the Parts List Manual for recommended stock items. Stock Items are clearly identified with a bullet preceding the parts description. See example below:

26	1017380	(00000000-) • Hose, Drain, Assy, 1.5d X 29.5l, Blk, Fix
27	1008639	(00000000-) • Drain Assy
28	1019563	(00000000-) • Strap, Drain Cap
29	1008637	(00000000-) • O Ring, 1.48" Id, 1.76" Od

T5e – Maintenance

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TROUBLESHOOTING

PROBLEM	CAUSE	SOLUTION
Machine will not operate	Discharged batteries	Charge batteries
	Emergency-stop button activated	Turn button clockwise to reset
	Faulty battery(s)	Replace battery(s)
	Loose battery cable	Tighten loose cable
	Tripped main circuit breaker	Reset 10A main circuit breaker
	Main fuse blown	Replace 100A main fuse
	Faulty key switch	Contact Service Center
	Machine fault detected.	See Battery Meter LED Fault Codes
On-board battery charger will not operate	Plug not connected to power supply	Check plug connection
	Faulty charger fuse	Replace charger fuse
	Faulty power supply cord	Replace cord
	Error detected.	See On-board Battery Charger Error Codes
Brush motor(s) will not operate	Scrub head is raised off floor	Lower scrub head
	Battery meter lockout activated	Recharge batteries
	Discharged batteries	Charge batteries
	Tripped brush motor circuit breaker	Reset 25A circuit breaker button
	Faulty scrub head (up/down) switch	Contact Service Center
	Faulty trigger switch(es)	Contact Service Center
	Faulty brush motor or wiring	Contact Service Center
	Worn carbon brushes	Contact Service Center
	Broken or loose belt (cylindrical brush model)	Replace or tighten belt
	Faulty relay switch	Contact Service Center
Machine will not propel	Parking brake is set	Release parking brake lever
	Machine fault detected	See Battery Meter LED Fault Codes
	Propel motor fuse blown	Replace 30A fuse
	Faulty transaxle motor or wiring	Contact Service Center
	Worn carbon brushes	Contact Service Center
	Exceeded maximum incline	Avoid steep inclines and reset key
Vacuum motor will not operate	Squeegee is raised off floor	Lower squeegee
	Discharged batteries	Charge batteries
	Tripped vacuum motor circuit breaker	Reset 25A circuit breaker button
	Faulty vacuum motor or wiring	Contact Service Center
	Worn carbon brushes	Contact Service Center
Little or no solution flow	Solution tank is empty	Fill solution tank
	Clogged solution tank filter	Clean solution tank filter
	Discharged batteries	Charge batteries
	Clogged solution valve	Remove valve and clean
	Solution flow control knob set too low	Adjust solution control flow knob
	Loose screw on control knob	Calibrate knob and retighten screw.

T5e – Maintenance

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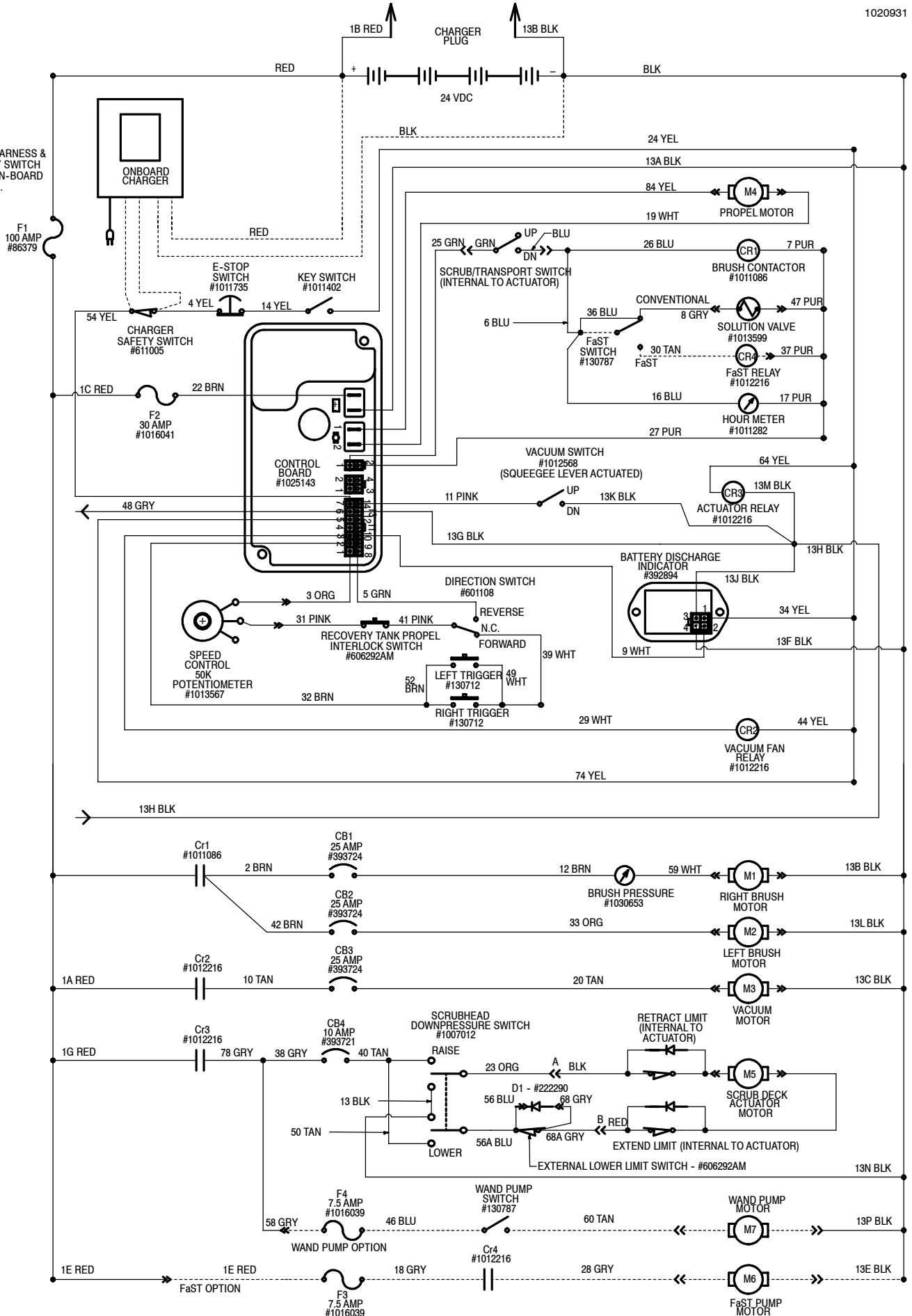
TROUBLESHOOTING - Continued

PROBLEM	CAUSE	SOLUTION
Poor water pickup	Recovery tank is full or excessive foam buildup	Drain recovery tank
	Loose drain hose cap	Tighten cap
	Clogged float shut-off screen located in recovery tank	Clean screen
	Clogged squeegee assembly	Clean squeegee assembly
	Worn squeegee blades	Replace or rotate squeegee blades
	Incorrect Squeegee blade deflection	Adjust Squeegee blade height
	Loose vacuum hose connections	Secure hose connections
	Clogged vacuum hose	Remove clogged debris
	Damaged vacuum hose	Replace vacuum hose
	Recovery tank cover not in place	Properly position cover
	Damaged recovery tank cover seal	Replace seal
	Faulty vacuum motor	Contact Service Center
	Low battery charge	Recharge batteries
Poor scrubbing performance	Debris caught in brush	Remove debris
	Worn brushes/pads	Replace brushes/pads
	Incorrect brush pressure setting	Adjust pressure setting
	Wrong brush/pad type.	Use correct brush/pad
Reduced run time	Batteries not fully charged	Fully recharge batteries
	Defective batteries	Replace battery
	Batteries need maintenance	See BATTERY MAINTENANCE
	Faulty battery charger	Repair or replace battery charger
FaST Model: FaST System does not operate or operate correctly	FaST system switch is not turned on	Turn on FaST system switch
	FaST-PAK supply hose not connected	Connect supply hose
	Clogged FaST-PAK supply hose or connectors	Soak in warm water to unclog
	Empty FaST-PAK carton	Replace FaST-PAK carton
	Kink in FaST-PAK supply hose	Undo hose kink
	Clogged FaST solution system	Contact Service Center
	Faulty FaST system on/off switch	Contact Service Center
	Faulty pump	Contact Service Center
	Clogged solution tank filter	Drain solution tank. Remove solution tank filter, clean and reinstall
	Clogged detergent orifice/filter screen	Replace orifice/filter screen (See FaST SYSTEM MAINTENANCE)
	Clogged FaST solution inlet filter	Contact Service Center
	FaST Pump fuse blown	Replace 7.5A fuse

T5e –Electrical Schematic

1020931

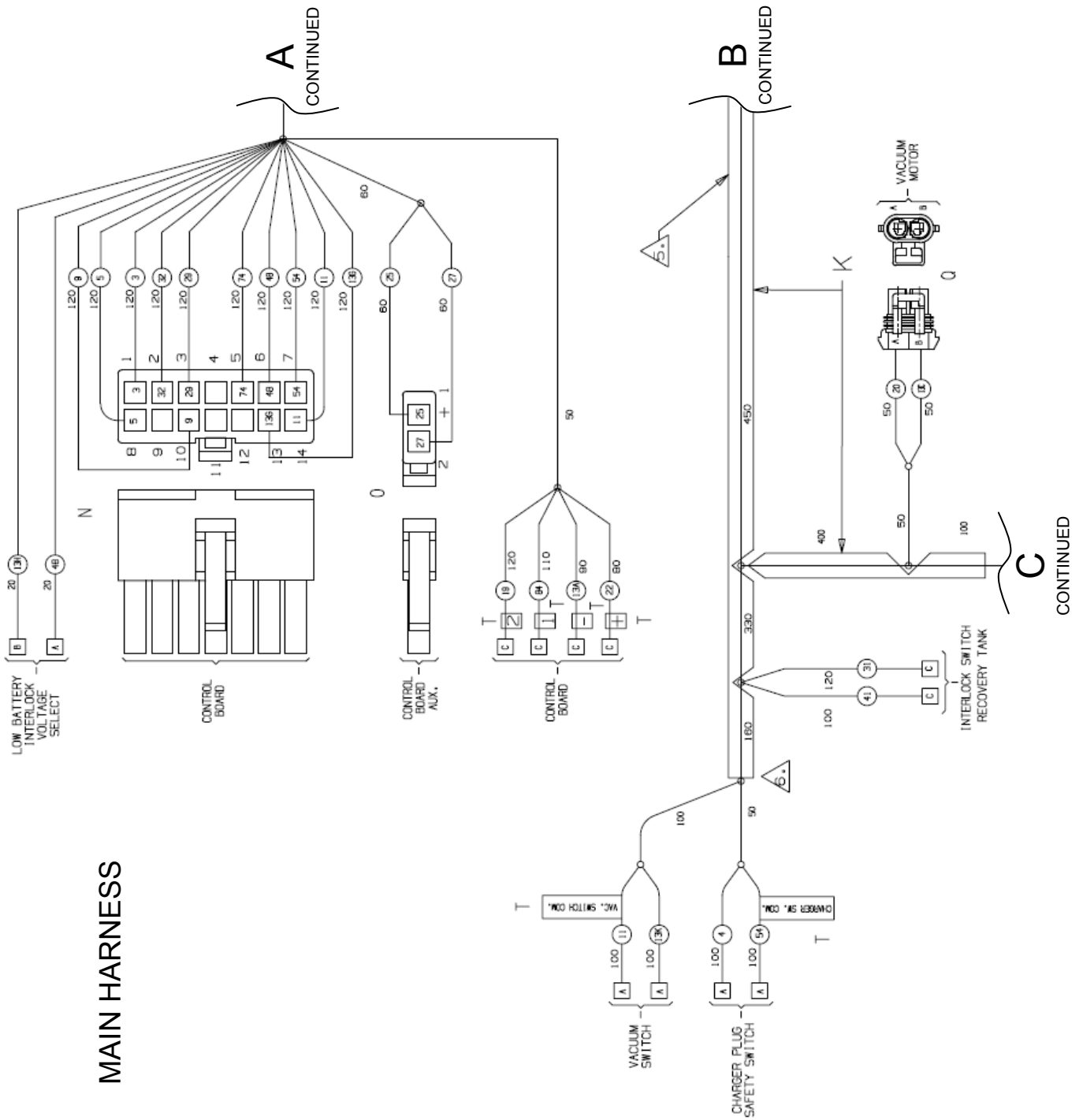
NOTES:
CHARGER PLUG HARNESS &
CHARGER SAFETY SWITCH
REMOVED WITH ON-BOARD
CHARGER OPTION.



T5e –Wiring Harness Detail

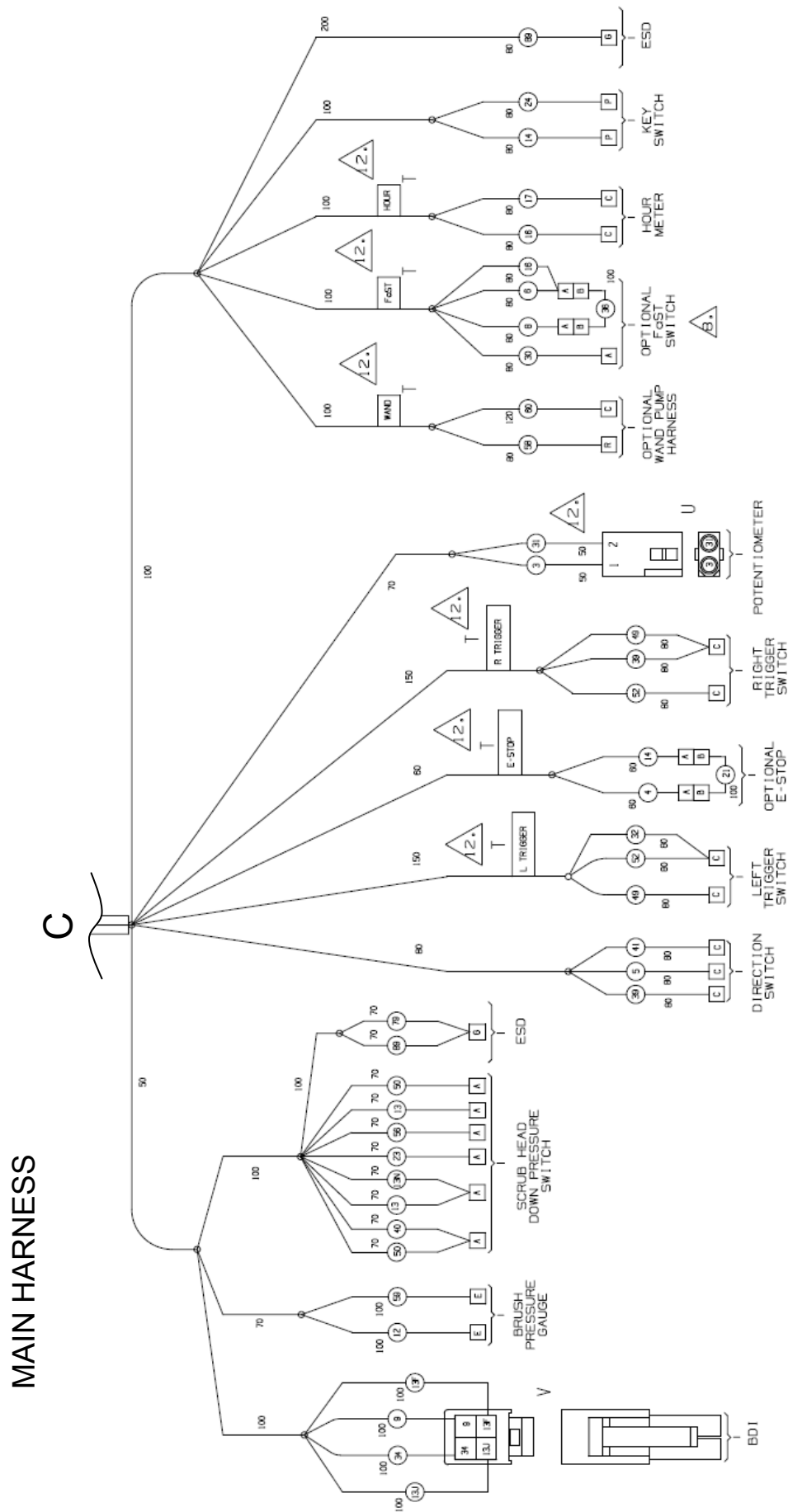
(Page 1 of 6)

MAIN HARNESS



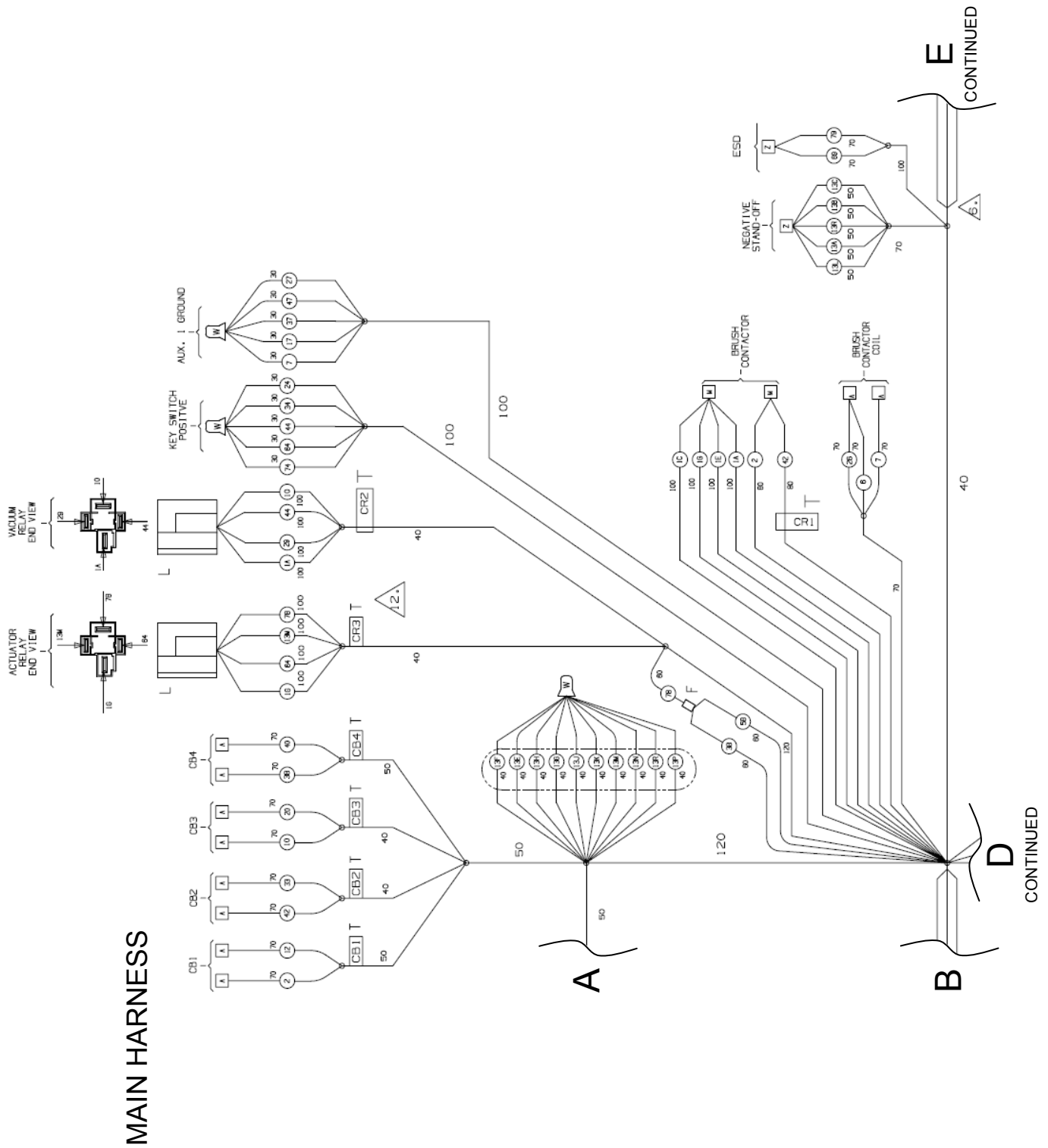
T5e –Wiring Harness Detail

(Page 2 of 6)



T5e –Wiring Harness Detail

(Page 3 of 6)



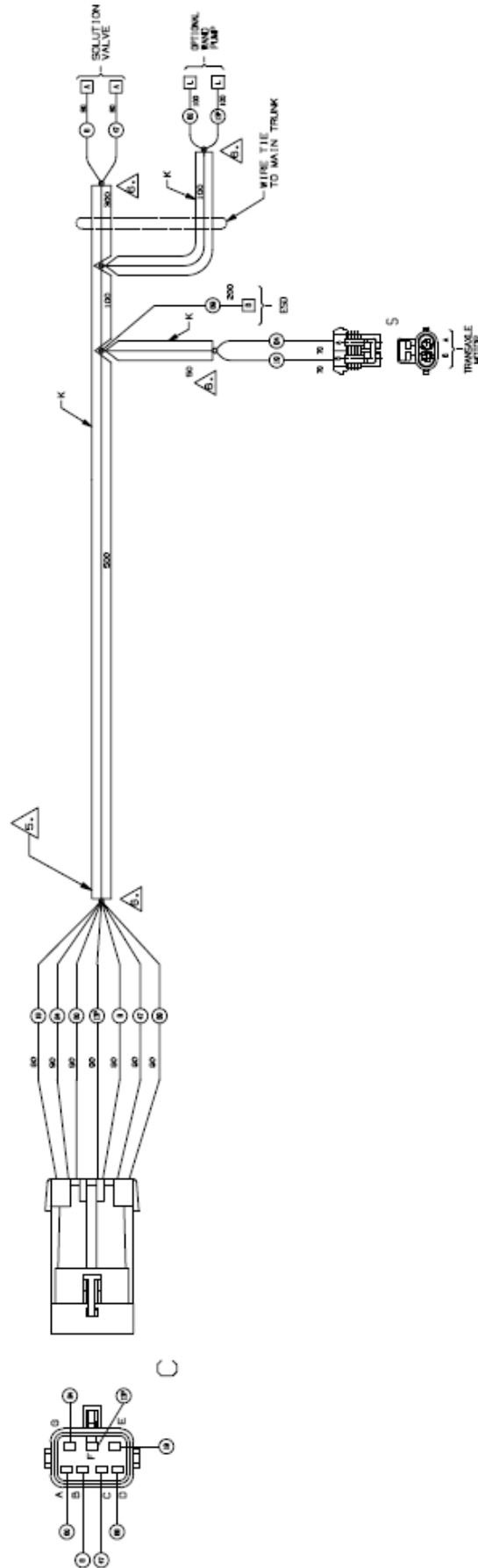
(Page 4 of 6)



T5e –Wiring Harness Detail

(Page 5 of 6)

CHASSIS HARNESS



(Page 6 of 6)

Technical drawing of a mechanical assembly, likely a wire harness, showing a side view and an end view.

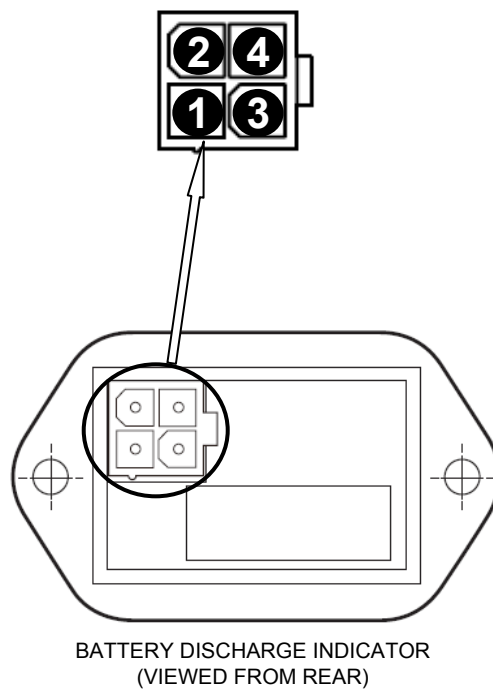
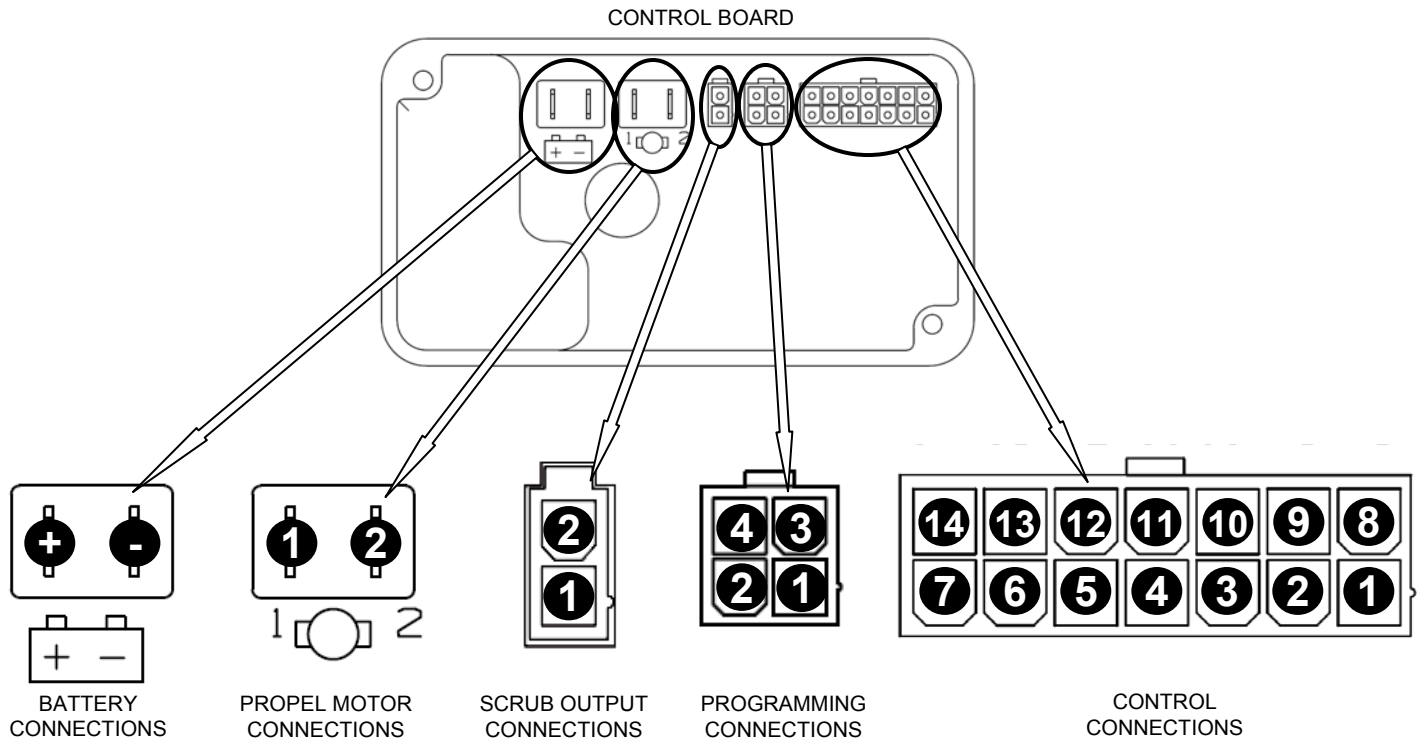
Side View:

- Central cable with diameter 40.0 and length 760.0.
- Left section with diameter 40.0 and length 40.0.
- Right section with diameter 40.0 and length 40.0.
- Dimensions: 4X 40.0, 2X 40.0, 40.0.
- Labels: A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z.
- Note: PRINT TEXT ON LABEL AS SHOWN BOTH SIDES.

End View:

- Shows the internal wiring arrangement.
- Labels: A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z.
- Dimensions: 4X 40.0, 2X 40.0, 40.0.

T5e –Control Board & BDI Details



T5e –Control Board & BDI Pin Charts

CONTROL BOARD CONNECTIONS

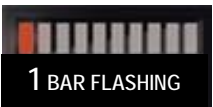
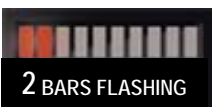
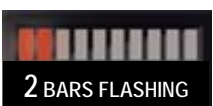
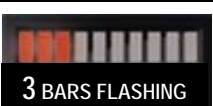







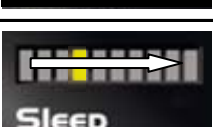
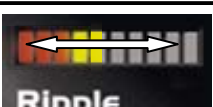
Name	Pin #	Wire #	Color	Active Voltage	Inactive Voltage	Input/ Output	Function/Component Controlled		Notes
Battery Connections	+	22	brown	battery (+)	x	input	x	Battery positive power supply	
	-	13A	black	battery (-)	x	input	x	Battery negative power supply	
Propel Motor Connections	1	84	yellow	0v to 24v	0v	output	M4	Propel motor power supply connections	Forward=4v to 24v, Reverse=0v
	2	19	white	0v to 24v	0v	output			Reverse=1.5v to 12v, Forward=0v
Scrub Output Connections	1	25	green	battery (+)	battery (+)	output	see notes	Scrub functions power supply	Controls CR1 (brush contactor), solution valve, CR4 (FaST relay), & hour meter
	2	27	purple	battery (-)	open	output			
Programming Connections	1	x	x	x	x	x	x	Used only for programming the control board	
	2	x	x	x	x	x	x		
	3	x	x	x	x	x	x		
	4	x	x	x	x	x	x		
Control Connections	1	3	orange	see notes		input	x	Throttle signal input	Reverse=0v to 2.25v; Fwd=2.75v to 5v; Neutral=2.25v to 2.75v
	2	32	brown	5v	x	output	x	Throttle 5v reference signal	
	3	29	white	battery (-)	open	output	CR2	Vacuum fan relay	
	4	x	x	x	x	x	x		
	5	74	yellow	battery (+)	open	input	x	Key switch input	Signal to turn control board ON
	6	48	gray	battery (-)	2.5v	input	x	Low battery voltage lockout level select	Normal mode: wire 48 NOT connected to 13H (22.4v lockout) Special mode: wire 48 connected to 13H (20.7v lockout)
	7	54	yellow	battery (+)	battery (+)	output	x	Battery (+) supply for input switches	Output in series to charger safety, E-stop, & key switches
	8	5	green	0v	x	output	x	Throttle 0v reference signal	
	9	x	x	x	x	x	x		
	10	9	white	see notes		output	BDI	Battery Discharge Indicator	Communicates battery & control board information (up to 10v)
	11	x	x	x	x	x	x		
	12	x	x	x	x	x	x		
	13	13G	black	battery (-)	x	output	see notes	Battery (-) output for various components	Output to vacuum switch, CR3 actuator relay, Battery Discharge Indicator, & low battery voltage lockout select
	14	11	pink	0v	2.5v	input	x	Vacuum switch	

BATTERY DISCHARGE INDICATOR CONNECTIONS

Name	Pin #	Wire #	Color	Active Voltage	Inactive Voltage	Input/ Output	Function
Battery Discharge Indicator	1	34	yellow	battery (+)	x	input	Battery (+) supply voltage
	2	9	white	10v to 24v	x	input	Battery status signal
	3	13J	black	0v	0v	input	Battery (-) supply voltage
	4	13F	black	0v	0v	input	Static drain path

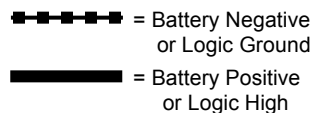
T5e – BDI Diagnostic Fault Indicators

LED Flashing Codes

 1 BAR FLASHING	Very Low Battery Voltage	The batteries need immediate charging or there is a bad connection to the batteries. Charge the batteries, or check the connections to the battery.
 2 BARS FLASHING	Low Battery Voltage (Slowly Flashing @ 40Hz)	The batteries need charging or there is a bad connection to the batteries. Charge the batteries, or check the connections to the battery.
 2 BARS FLASHING	Propel Motor Open (Quickly Flashing @ 200 Hz)	The propel motor has an open connection. Check all the connections and wires between the motor and the control board. Test motor for open circuit.
 3 BARS FLASHING	Propel Motor Shorted	The propel motor has a short circuit. Check all the connections and wires between the motor and the control board. Test motor for short circuit.
 4 BARS FLASHING	Battery Lockout	The voltage level of the batteries has fallen below the Battery Lockout Level and the control board is inhibiting certain machine functions. Charge the batteries.
 5 BARS FLASHING	Not Used	
 6 BARS FLASHING	Not Used	
 7 BARS FLASHING	Not Used	
 8 BARS FLASHING	Possible Control Board Fault	A control board fault is indicated. Make sure that all connections are secure.
 9 BARS FLASHING	Not Used	
 10 BARS FLASHING	High Battery Voltage	An excessive voltage has been applied to the controller. This is usually caused by a poor battery connection. Check all battery connections.
 Sleep	Control Board in Sleep Mode (LED's flash one at a time from left to right)	The controller has entered sleep mode. Switch the control system off and then on again.
 Ripple	Throttle Displaced (LED's ripple back and forth)	A throttle fault is indicated. Make sure that the forward and reverse switches are released before switching on the machine, or check all connections and wires from the switches to the control board.

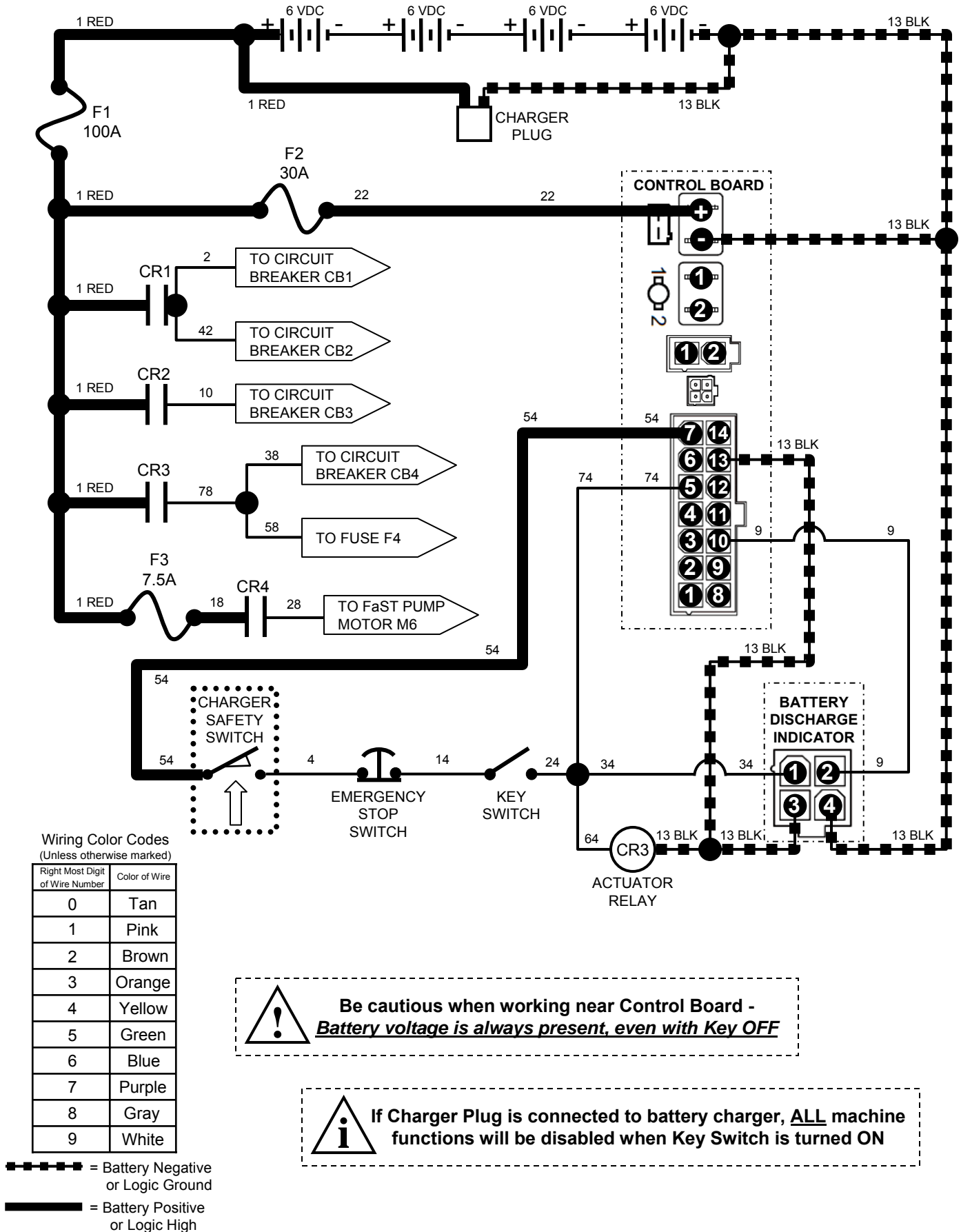
CONDITIONS: Key OFF, off-board battery charger **NOT CONNECTED** to charger plug

CONDITIONS: Key OFF, off-board battery charger **NOT CONNECTED** to charger plug



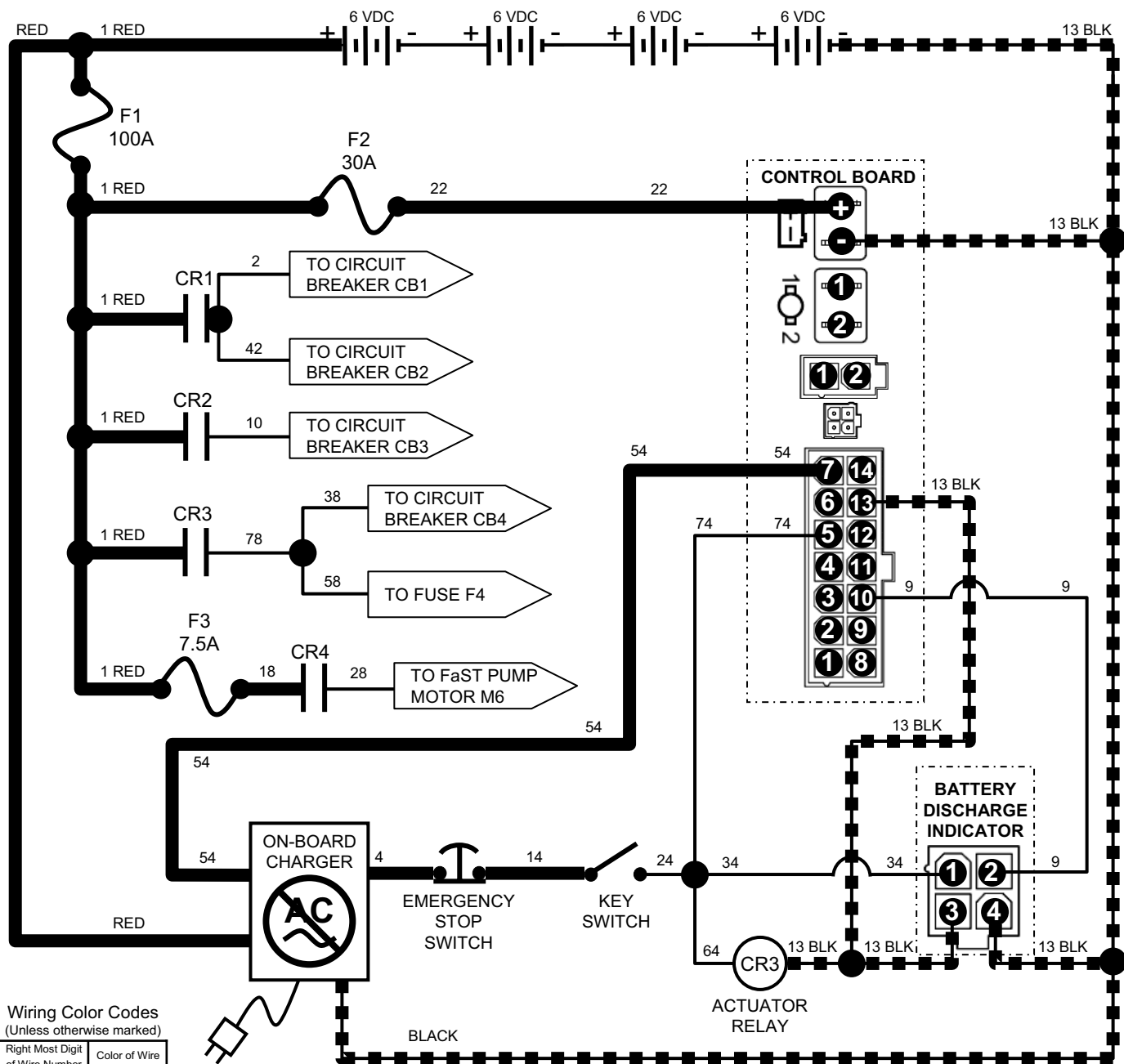
T5e - Key OFF Power Distribution (With Standard Off-Board Battery Charger)

CONDITIONS: Key OFF, off-board battery charger **CONNECTED** to charger plug



T5e - Key OFF Power Distribution (With Optional On-Board Battery Charger)

CONDITIONS: Key OFF, On-Board battery charger **NOT CONNECTED** to AC power



Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

= Battery Negative or Logic Ground
 = Battery Positive or Logic High

NOT CONNECTED TO AC



**Be cautious when working near Control Board -
Battery voltage is always present, even with Key OFF**



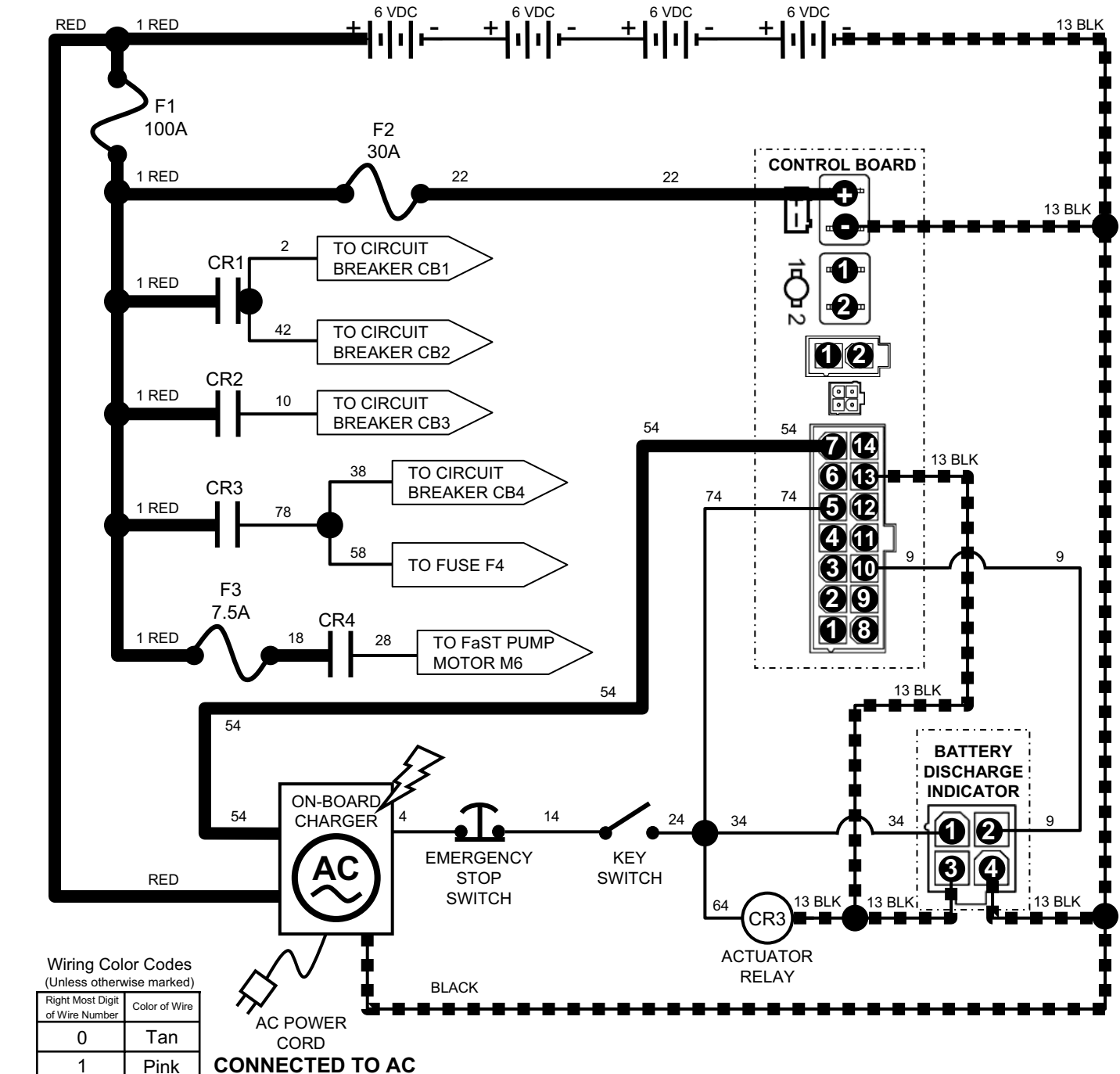
**The battery charger uses a normally closed relay to
send a signal to the control board – the relay opens
when the charger is plugged in to AC power**



**If On-Board Charger is connected to AC
power, ALL machine functions will be
disabled when Key Switch is turned ON**

T5e - Key OFF Power Distribution (With Optional On-Board Battery Charger)

CONDITIONS: Key OFF, On-Board battery charger **CONNECTED** to AC power




Be cautious when working near Control Board -
Battery voltage is always present, even with Key OFF

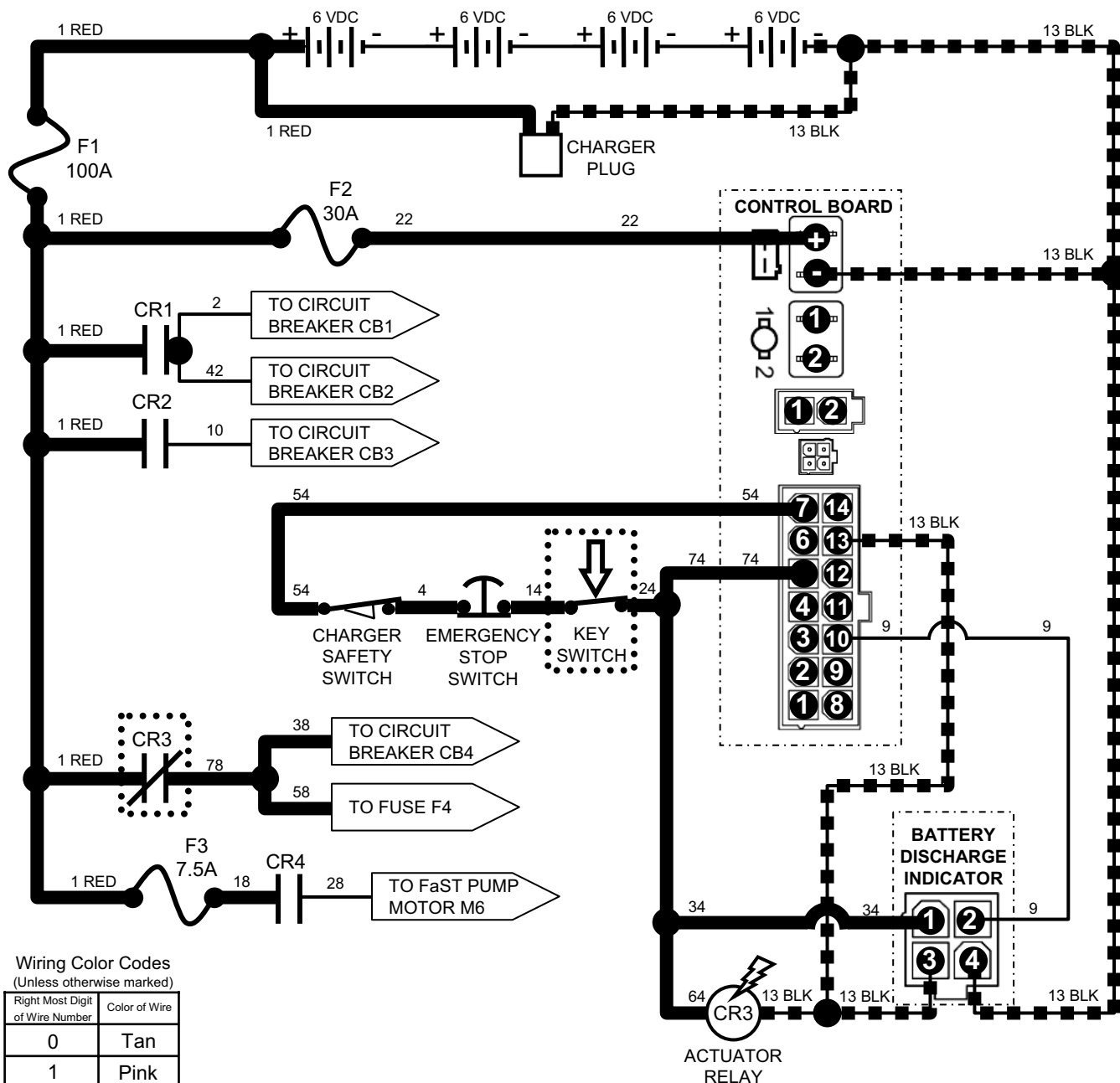
The battery charger uses a normally closed relay to
send a signal to the control board – the relay opens
when the charger is plugged in to AC power

If On-Board Charger is connected to AC
power, ALL machine functions will be
disabled when Key Switch is turned ON

T5e - Key ON Power Distribution



CONDITIONS: Key ON


 The troubleshooting information from this page forward applies to machines with On-Board or Off-Board Chargers unless otherwise noted




Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

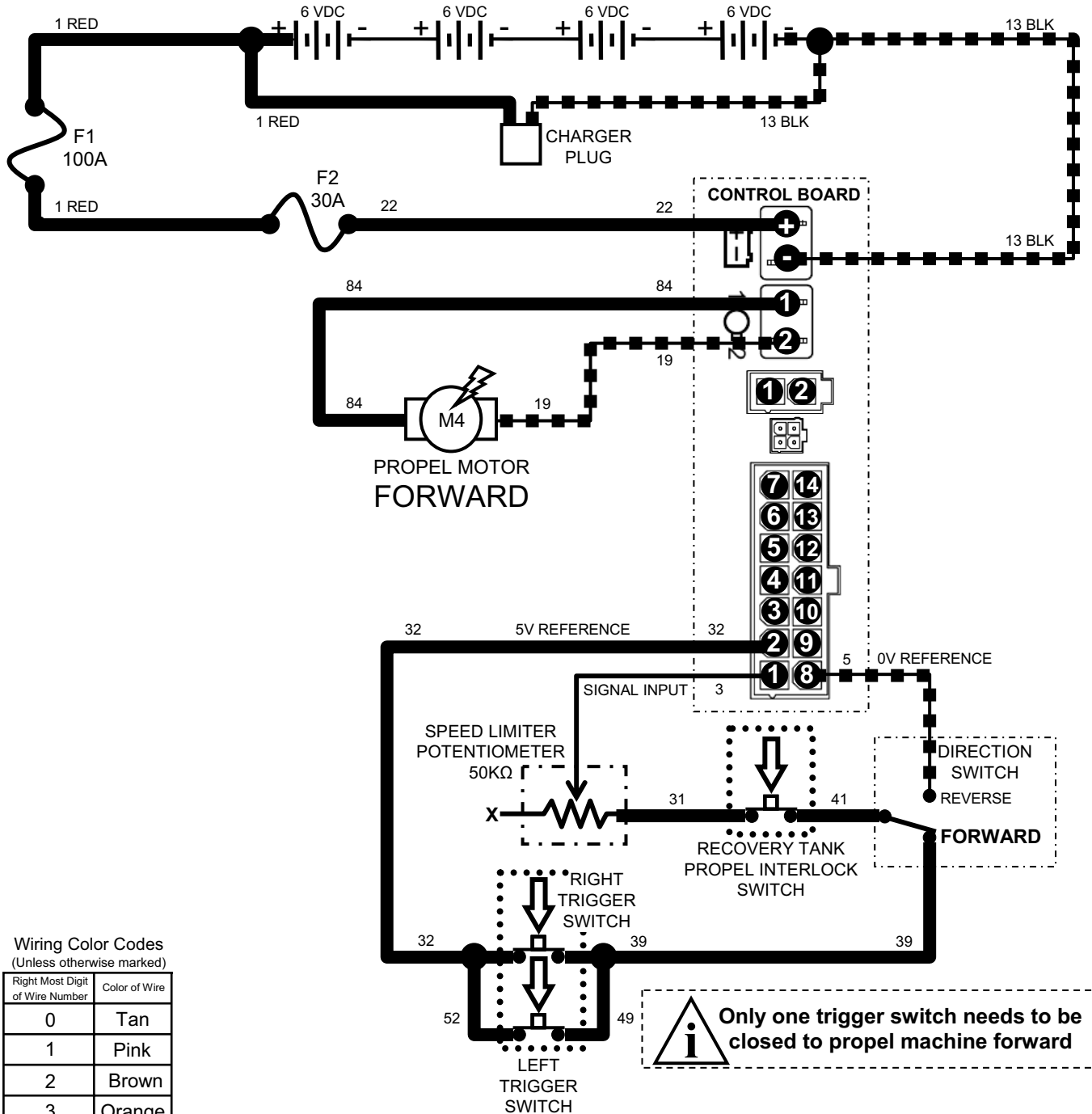
 = Battery Negative or Logic Ground
 = Battery Positive or Logic High

 Be cautious when working near Control Board - **Battery voltage is always present, even with Key OFF**

 If Charger Plug is connected to battery charger, **ALL** machine functions will be disabled when Key Switch is turned ON

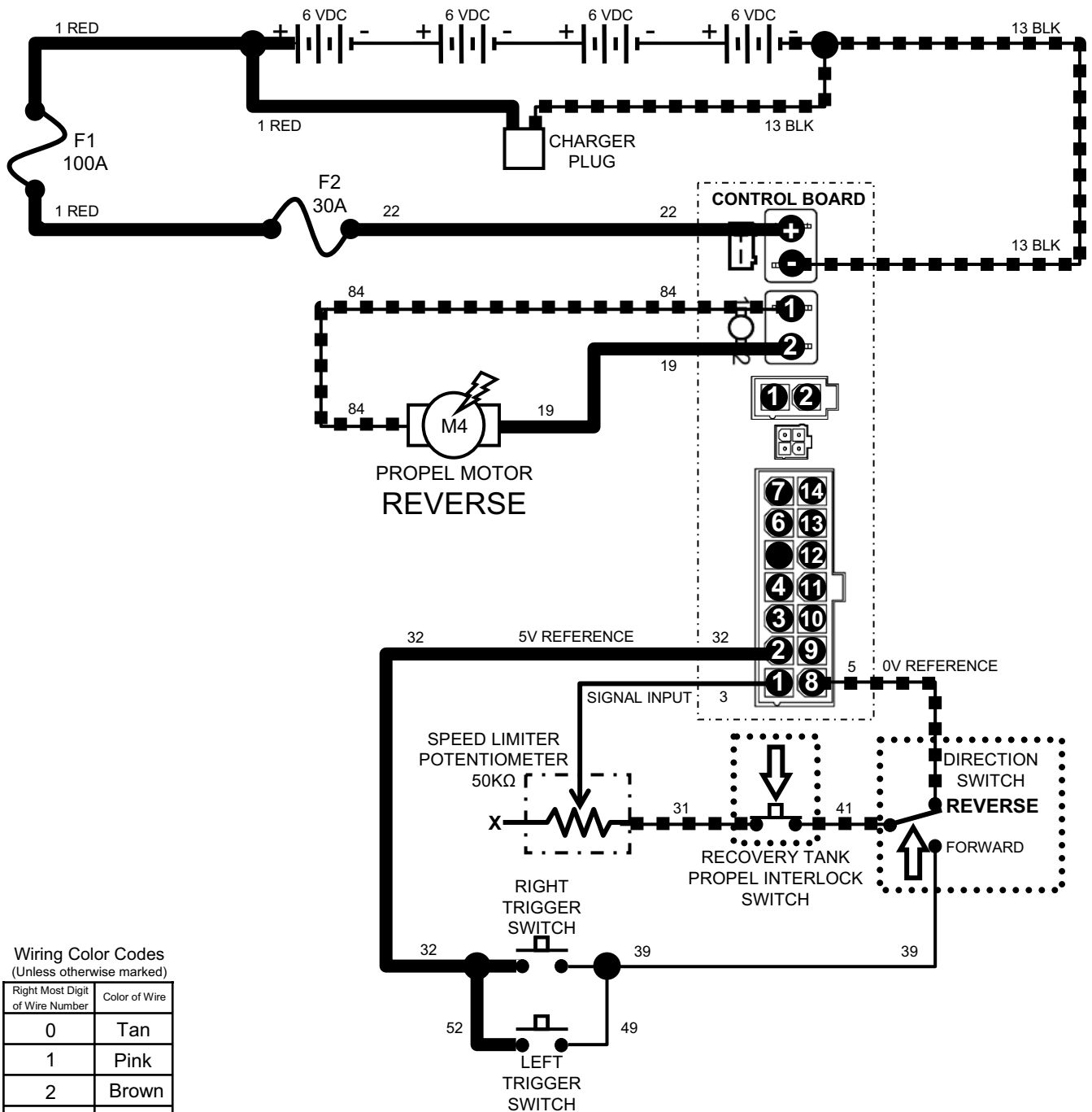
T5e – Propel Forward System

CONDITIONS: Key ON, forward propel engaged



T5e – Propel Reverse System

CONDITIONS: Key ON, reverse propel engaged



**Be cautious when working near Control Board -
Battery voltage is always present, even with Key OFF**



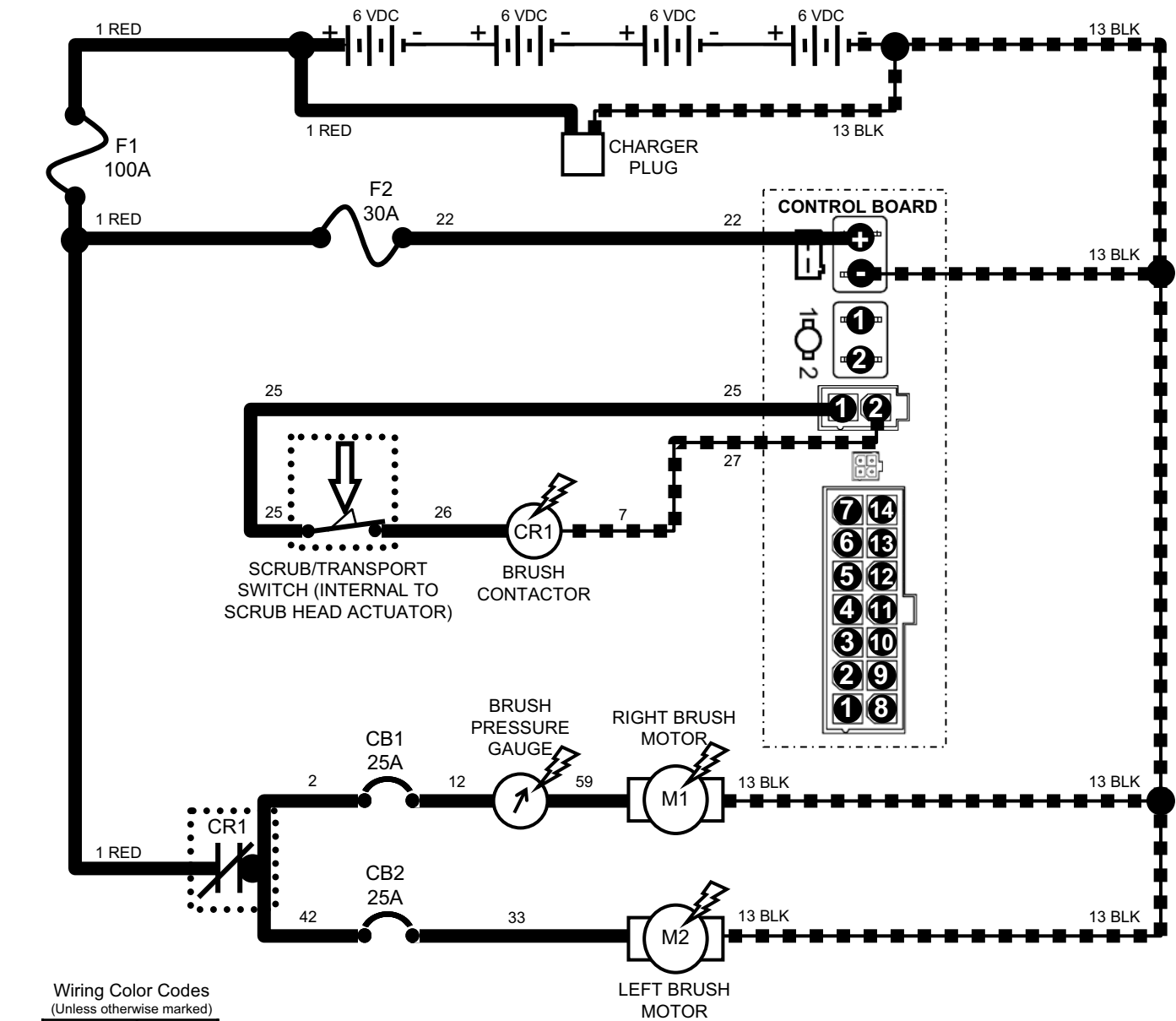
**The Propel Motor (M4) is controlled by PWM; A
higher duty cycle will result in higher travel speed**



**If Charger Plug is connected to battery charger, ALL machine
functions will be disabled when Key Switch is turned ON**

T5e – Scrub Brushes

CONDITIONS: Key ON, Scrub Head lowered for cleaning, propel engaged



Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

= Battery Negative or Logic Ground
 = Battery Positive or Logic High

**Be cautious when working near Control Board -
Battery voltage is always present, even with Key OFF**

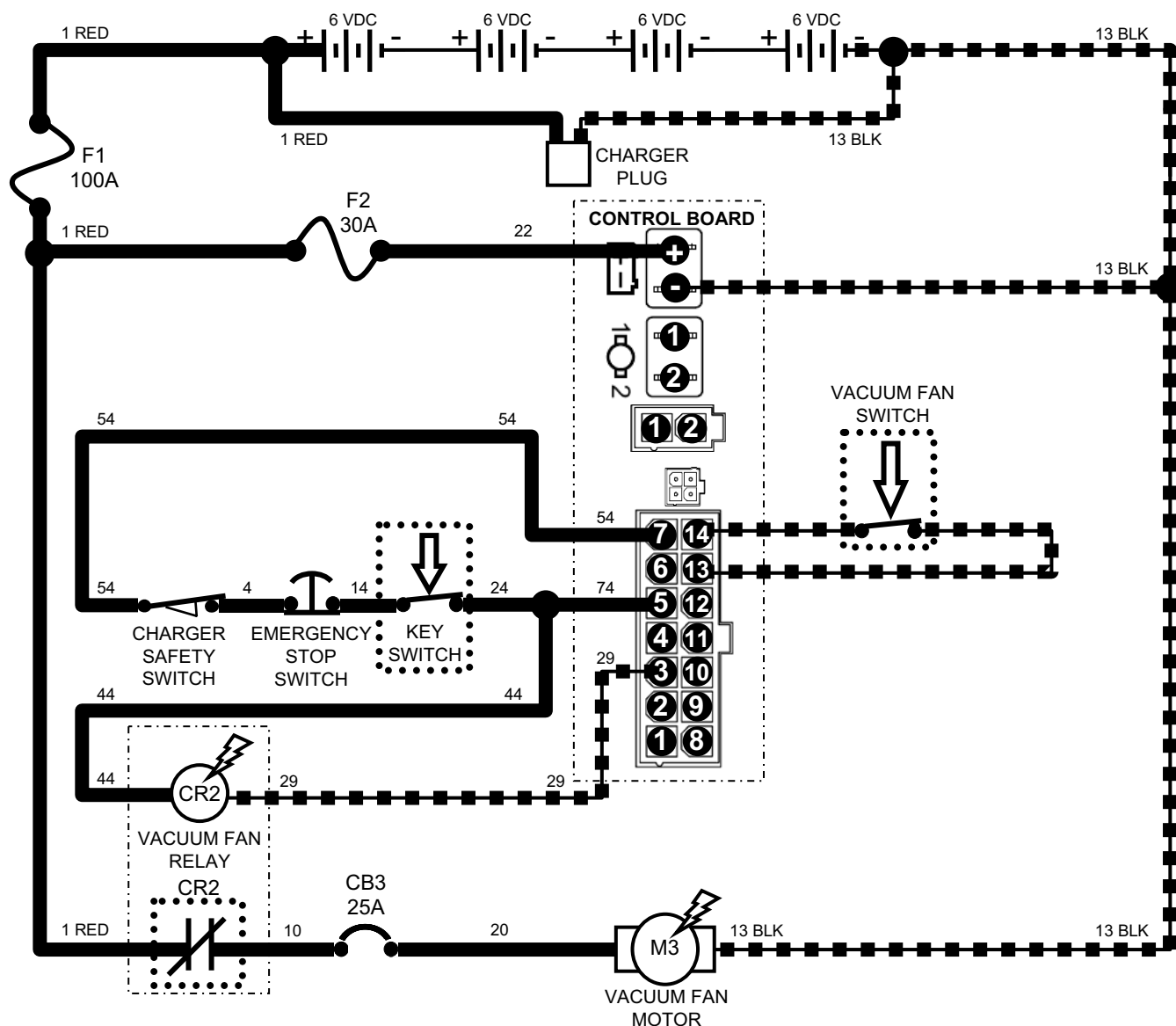
If Charger Plug is connected to battery charger, ALL machine functions will be disabled when Key Switch is turned ON

The Scrub/Transport Switch closes when the Scrub Head Actuator extends (lowers) 2" (50mm) or more

The Brush Pressure Gauge monitors current on the Right brush motor only

T5e – Vacuum Fan System

CONDITIONS: Key ON, Squeegee lowered



Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

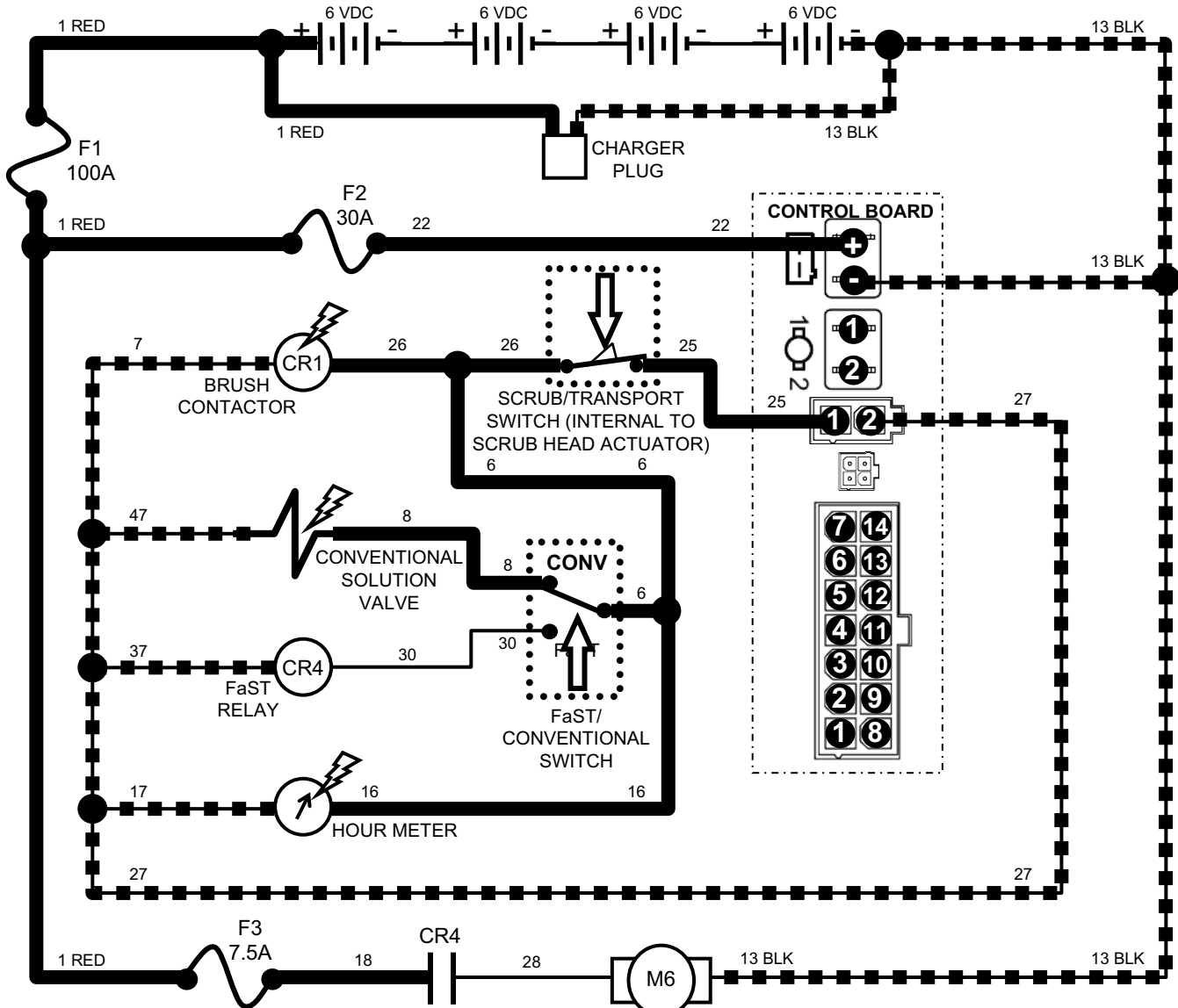
= Battery Negative or Logic Ground
 = Battery Positive or Logic High

Be cautious when working near Control Board -
Battery voltage is always present, even with Key OFF

If Charger Plug is connected to battery charger, ALL machine functions will be disabled when Key Switch is turned ON

T5e – Conventional Solution Valve, Hour Meter


CONDITIONS: Key ON, scrub head lowered for cleaning, propel engaged, conventional scrub selected



Wiring Color Codes
(Unless otherwise marked)


Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

- - - - - = Battery Negative
 or Logic Ground
 ————— = Battery Positive
 or Logic High


Be cautious when working near Control Board -
Battery voltage is always present, even with Key OFF

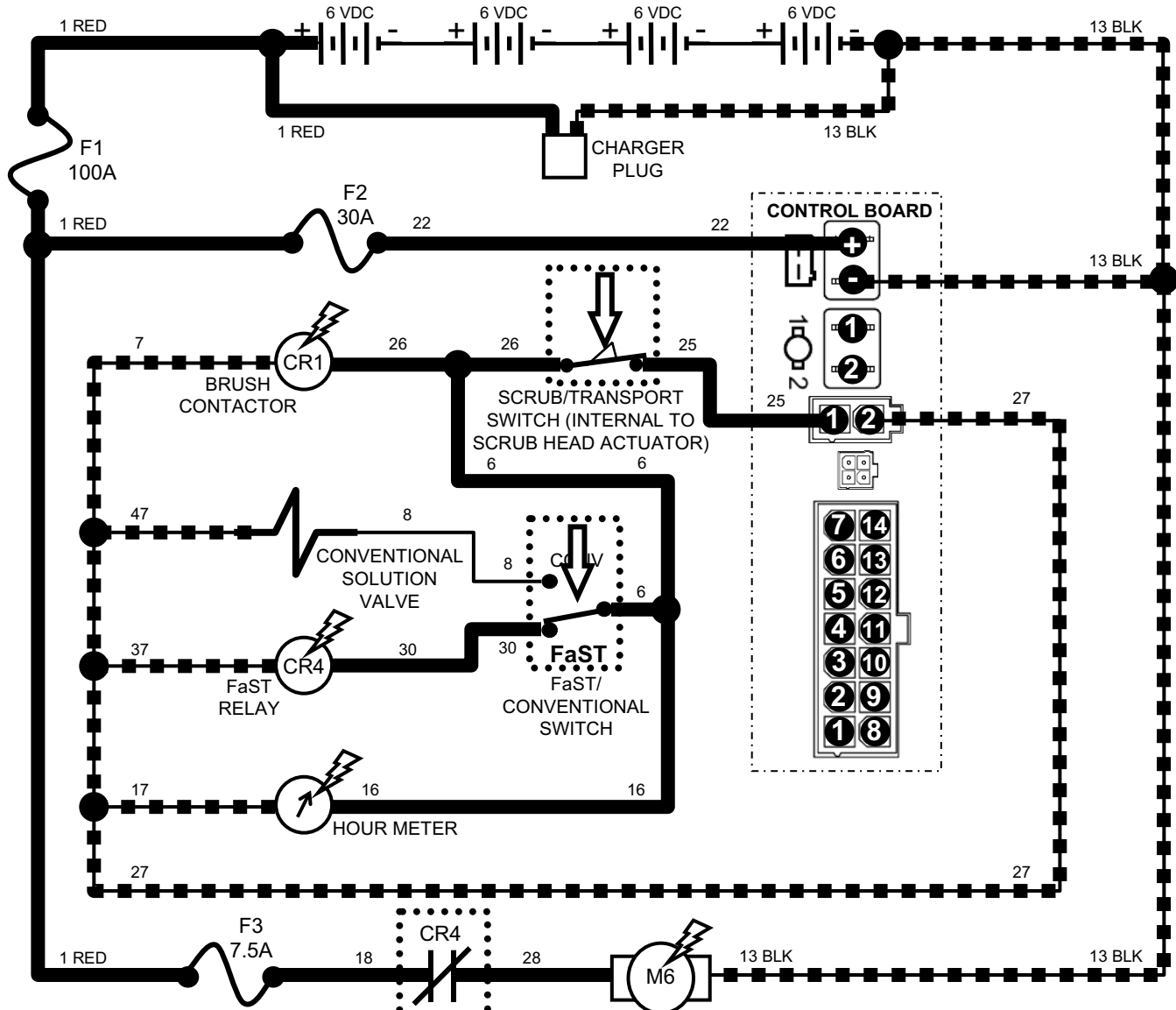

If Charger Plug is connected to battery charger, ALL machine functions will be disabled when Key Switch is turned ON


The Scrub/Transport Switch closes when the Scrub Head Actuator extends (lowers) 2" (50mm) or more


The Hour Meter is activated only when the Scrub Head is lowered, and propel is engaged

T5e – FaST Pump, Hour Meter

CONDITIONS: Key ON, scrub head lowered for cleaning, propel engaged, FaST scrub selected



Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

--- = Battery Negative or Logic Ground
 — = Battery Positive or Logic High

Be cautious when working near Control Board -
Battery voltage is always present, even with Key OFF

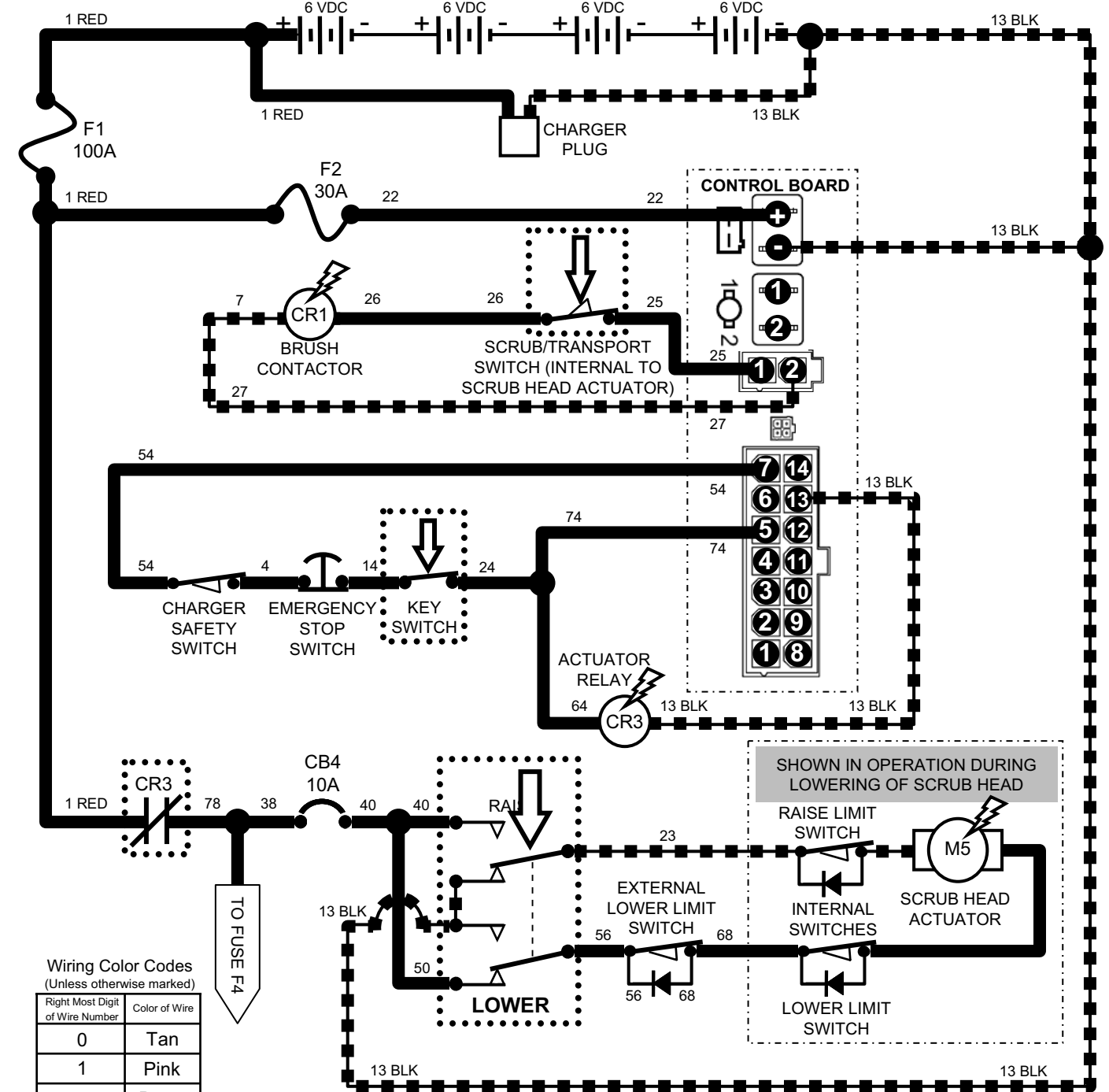
If Charger Plug is connected to battery charger, ALL machine functions will be disabled when Key Switch is turned ON

The Scrub/Transport Switch closes when the Scrub Head Actuator extends (lowers) 2" (50mm) or more

The Hour Meter is activated only when the Scrub Head is lowered, and propel is engaged

T5e – Scrub Head Actuator LOWER (Extend)

CONDITIONS: Key ON, scrub head lower switch activated



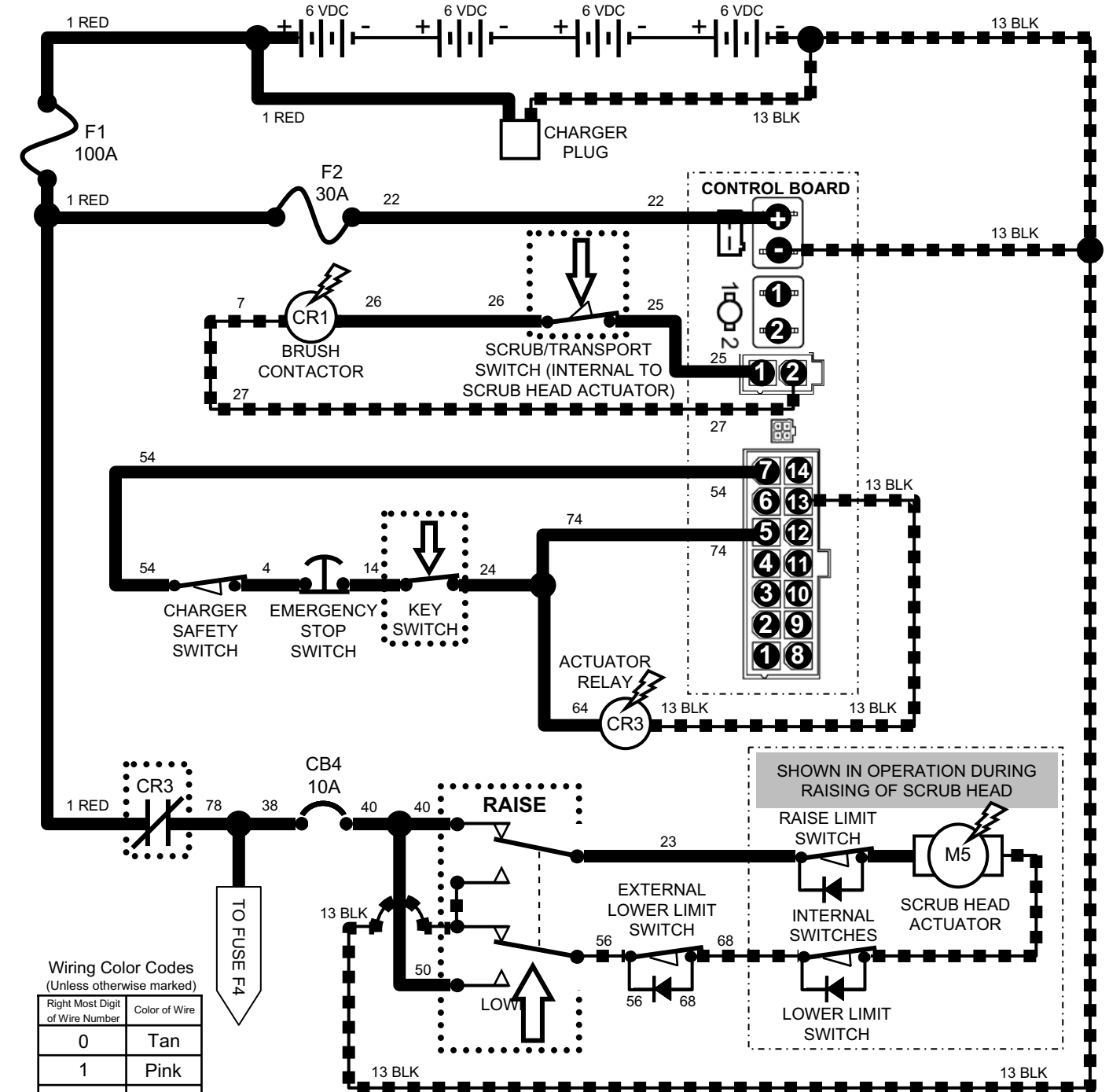
Scrub Head Actuator Logic Chart

switch \ condition	Internal Switches			External Switch
	Scrub/Transport	Raise Limit	Lower Limit	Lower Limit
Fully Retracted (UP)	OPEN	OPEN	CLOSED	CLOSED
Fully Extended (DOWN)	CLOSED	CLOSED	OPEN	OPEN
Retracting (RAISING)	*	CLOSED	CLOSED	CLOSED
Extending (LOWERING)	*	CLOSED	CLOSED	CLOSED

* Scrub/Transport Switch closes when actuator is extended 2" (50mm) or more

T5e – Scrub Head Actuator RAISE (Retract)

CONDITIONS: Key ON, scrub head raise switch activated



Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

- - - - - = Battery Negative or Logic Ground
 ————— = Battery Positive or Logic High

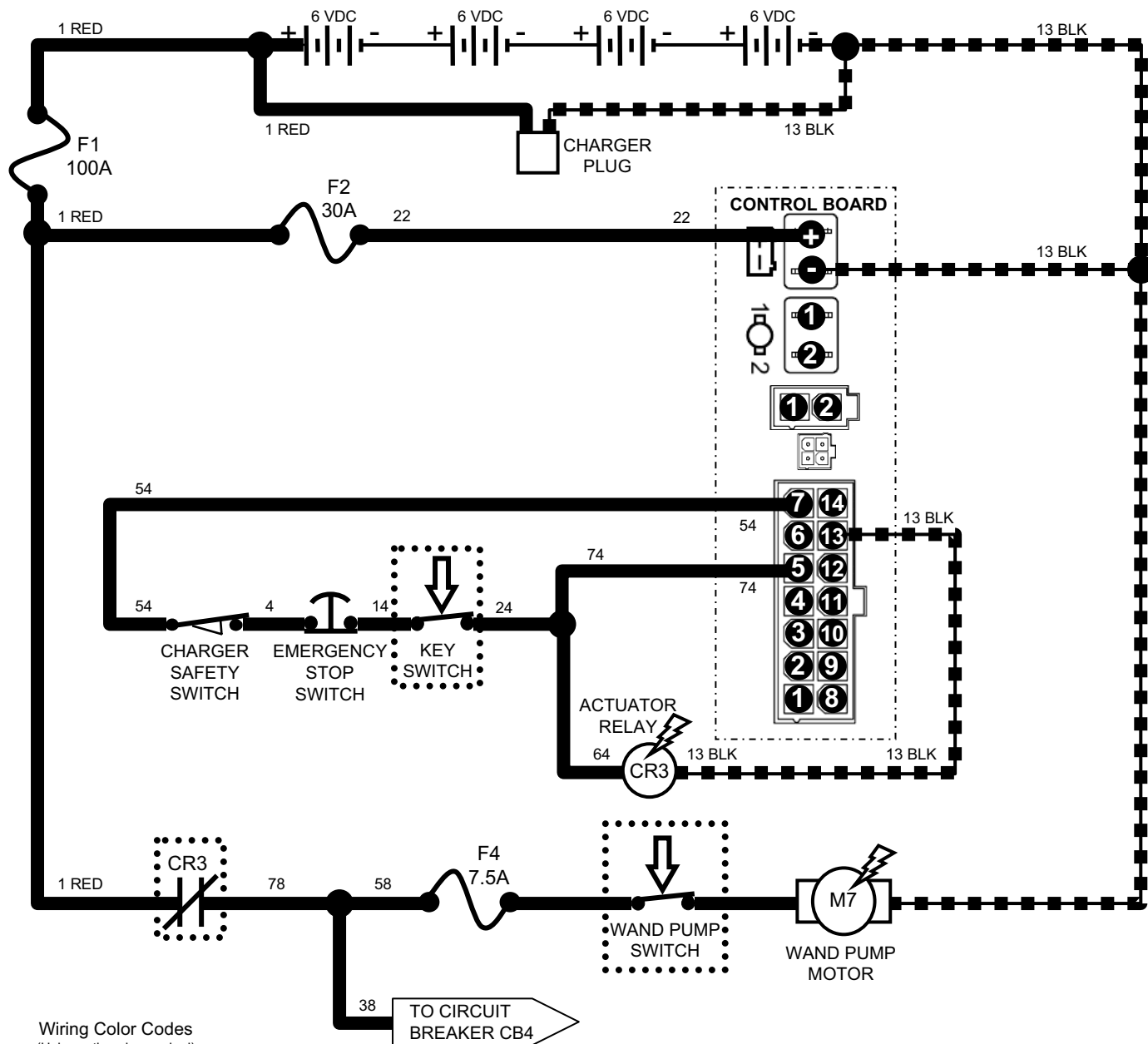
Scrub Head Actuator Logic Chart

switch / condition	Internal Switches			External Switch
	Scrub/Transport	Raise Limit	Lower Limit	Lower Limit
Fully Retracted (UP)	OPEN	OPEN	CLOSED	CLOSED
Fully Extended (DOWN)	CLOSED	CLOSED	OPEN	OPEN
Retracting (RAISING)	*	CLOSED	CLOSED	CLOSED
Extending (LOWERING)	*	CLOSED	CLOSED	CLOSED

* Scrub/Transport Switch closes when actuator is extended 2" (50mm) or more

T5e – Wand Pump

CONDITIONS: Key ON, wand pump switch ON



Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

= Battery Negative or Logic Ground
 = Battery Positive or Logic High

Be cautious when working near Control Board -
Battery voltage is always present, even with Key OFF

If Charger Plug is connected to battery charger, ALL machine functions will be disabled when Key Switch is turned ON