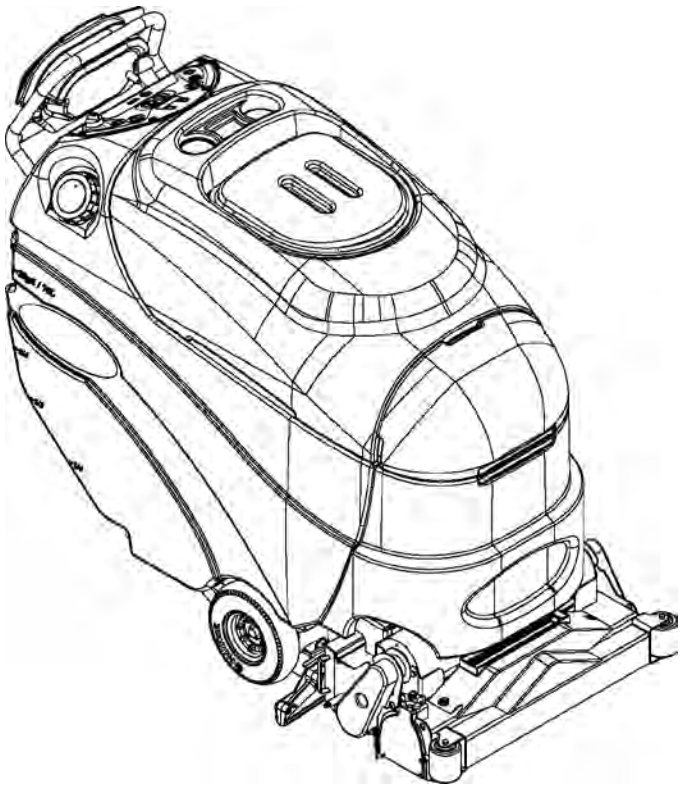
Clean Track® L24



Service Manual

Clarke Clean Track® L24, Model 56317170

Clarke®

5/12 Form No. 56043161

Contents

Note: *All references to right, left, front, or rear in this manual are as seen from the operator's standpoint.*

Introduction

This manual will help you get the most from your Clarke machine. Read it thoroughly before servicing the machine.

Note: *Bold numbers and letters in parentheses indicate items illustrated in the* ***Know Your Machine*** *section.*

Parts and Service

Repairs should be performed by your Authorized Clarke Center, that employs factory trained service personnel and maintains an inventory of original replacement parts and accessories.

Call the Clarke Dealer named below for repair parts or service. Please specify the Model Number (same as the Part Number) and Serial Number when discussing your machine.

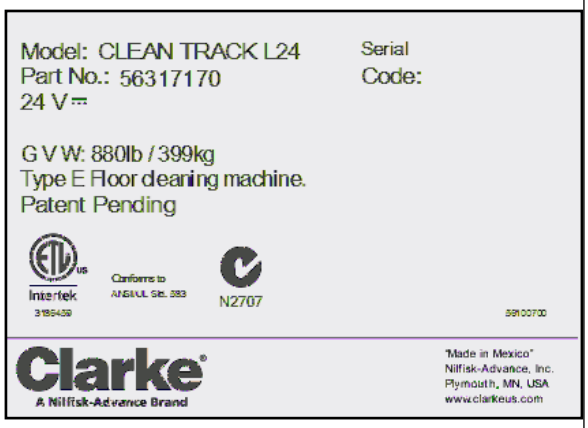
(Dealer, affix service sticker here.)

Nameplate

The Part (Model) Number and Serial Number of your machine are shown on the Nameplate located in the battery compartment. This information is needed when ordering repair parts for the machine. Use the space below to note the Part (Model) Number and Serial Number of your machine for future reference.

Part Number _____

Serial Number _____



Transporting the Machine

Caution!

Before transporting the machine on an open truck or trailer, make sure that:

- The machine is tied down securely.
- All access doors and covers are secured (tape and strap as needed).

Towing

Caution!

If the machine must be towed or pushed, make sure the Master On/Off Key Switch (**A**) is in the Off position and do not move the machine faster than a normal walking pace (2-3 mph, 3-5 kph) and for short distances only.

Note: Disconnecting the wheel drive motor wiring connector will make a disabled machine easier to push.

Other Manuals and Information Sources for Your Machine

- Instructions for Use (English, Spanish and French) – Form Number 56091061
- Parts List – Form Number 56042598

These manuals can be found on the following Clarke electronic supported databases:

- Clarke website: www.clarkeus.com
- Clarke CustomerZone™
- EzParts service / parts CD-ROM

Cautions and Warning Symbols

Clarke uses the symbols below to signal potentially dangerous conditions. Read this information carefully and take the necessary steps to protect personnel and property.

Danger!

Is used to warn of immediate hazards that will cause severe personal injury or death.

Warning!

Is used to call attention to a situation that could cause severe personal injury.

Caution!

Is used to call attention to a situation that could cause minor personal injury or damage to the machine or other property.

Read all instructions before using.

General Safety Instructions

Specific Cautions and Warnings are included to warn you of potential danger of machine damage or bodily harm.

Warning!

- This machine should only be used by properly trained and authorized persons.
- While on ramps or inclines, avoid sudden stops when loaded. Avoid abrupt sharp turns. Use low speed down hills. Clean only while ascending (driving up) the ramp.
- Keep sparks, flame and smoking materials away from batteries. Explosive gases are vented during normal operation.
- Charging the batteries produces highly explosive hydrogen gas. Charge batteries only in well-ventilated areas away from open flame. Do not smoke while charging the batteries.
- Remove all jewelry when working near electrical components.
- Turn the Key Switch off (O) and disconnect the batteries before servicing electrical components.
- Never work under a machine without safety blocks or stands to support the machine.

- Do not dispense flammable cleaning agents, operate the machine on or near these agents, or operate in areas where flammable liquids exist.
- Do not clean this machine with a pressure washer.
- Do not operate this machine on ramps or inclines of more than a two-percent gradient.
- Only use the brushes provided with the appliance or those specified in the instruction manual. The use of other brushes may impair safety.

Caution!

- This machine is not approved for use on public paths or roads.
- This machine is not suitable for picking up hazardous dust.
- Use care when using scarifier discs and grinding stones. Clarke will not be held responsible for any damage to floor surfaces caused by scarifiers or grinding stones.
- When operating this machine, ensure that third parties, particularly children, are not endangered.
- Before performing any service function, carefully read all instructions pertaining to that function.
- Do not leave the machine unattended without first turning the Key Switch off (O), removing the key and securing the machine.
- Turn the Key Switch off (O) and remove the key before changing the brushes, and before opening any access panels.
- Take precautions to prevent hair, jewelry or loose clothing from becoming caught in moving parts.
- Use caution when moving this machine in below freezing temperature conditions. Any water in the solution or recovery tanks, or in the hose lines could freeze, causing damage to valves and fittings. Flush with windshield washer fluid.
- The batteries must be removed from the machine before the machine is scrapped. The disposal of the batteries should be safely done in accordance with your local environmental regulations.
- Do not use on surfaces having a gradient exceeding that marked on the machine.
- All doors and covers are to be positioned as indicated in the instruction manual before using the machine.
- Refer to the ***Electrical System*** section at back of this manual for additional specific battery charger warnings.

Save These Instructions

Technical Specifications

Voltage		24 Volt			
Power Source		(4) 6 volt batteries (wet acid and gel cell available)			
Onboard Battery Charger		24 volt, 25 amp Wet/Gel Compatible			
Solution Control		Precision-flow electric pump/solenoid valves			
Solution Tank		20 gal. [76 L]			
Recovery Tank		20 gal. [76 L]			
Solution System	Solution Capacity	20 gal [76 L]			
	Solution Pump	100 psi diaphragm demand			
	Flow Rates	Restoration Mode	Maintenance Mode	Pre-spray Mode	
		0.81 gpm [3,1 L/min]	0.26 gpm [1 L/min]	0.93 gpm [3,5 L/min]	
Scrub System	Type	Cylindrical, 24” [61 cm] scrub path			
	Brush Motors	(2) ½ hp (375 watt), permanent magnet, 960 RPM			
	Brushes	Dual 24” [61 cm] dual counter-rotating cylindrical, with debris hopper			
	Brush Speed	960 RPM			
Vacuum System	Vacuum Motor	(2) 24 VDC, three-stage bypass			
	Airflow	93 cfm [44 L/sec]			
	Water Lift	70 in H_2O [17,4 km/hr]			
	Vacuum Shoes	Dual 13.5” [34 cm] dual pivoting laminar flow, 45 lb down-pressure			
Drive System	Drive Motor	0.4 hp (300 watt) variable forward and reverse, max speed - 3 mph [4.83 km/hr]			
	Drive Wheels	(2) 7 in. [18 cm] dia. foam-filled, gray non-marking			
	Gradeability	Transport – 15.4% (8.3°)	Cleaning – 12.5% (7.1°)		
Machine Speed		Transport	Maintenance Mode	Restoration Mode	Fast Pre-spray Mode	Heavy Pre-spray Mode
		220 ft/min [4 km/hr]	90 ft/min [1,6 km/hr]	50 ft/min [0,9 km/hr]	150 ft/min [2,7 km/hr]	100 ft/min [1,8 km/hr]
Coverage Rate		Maintenance Mode - 10,800 ft^2/hr		Restoration Mode - 6,000 ft^2/hr		
Sound Pressure Level		IEC 60335-2-72: 2002 Amend. 1:2005, ISO 11201 – 69 dB (A)		IEC 60335-2-72: 2002 Amend. 1:2005, ISO 3744 – 86.9 Lwa		
Machine Dimensions		Length – 56” [142 cm]	Width – 27” [69 cm]	Height – 43.5” [110 cm]		
Gross Weight		810 lbs [367 kg]				

On-board Chemical Mixing System	
Refillable Cartridge Capacity	1.25 gal [4,75 L]
Available Dilution Rates	32:1, 50:1, 64:1, 100:1, 128:1, 150:1, 200:1, 256:1, 300:1
Low Detergent Warning	Standard

General Maintenance

Maintenance Schedule

Maintenance intervals given are for average operating conditions. Machines used in severe operational environments may require service more often.

Maintenance Item	Daily	Weekly	Monthly	Yearly
Charge Batteries	X			
Check/Clean Tanks and Hoses	X			
Check/Clean the Brushes	X			
Clean Vacuum Inlet Screens	X			
Empty and Clean Debris Hopper	X			
Clean Vacuum Shoes	X			
Check the Water Level on each Battery Cell (does not apply to gel cell batteries)		X		
Inspect and Clean Solution Filter		X		
Clean Solution Spray Nozzles		X		
Purge Chemical Mixing System		X		
Lubricate the Machine			X	
* Check the Carbon Brushes				X

Note: *See the individual machine system sections for maintenance information.*

* Have Clarke check the vacuum motor carbon brushes once a year or after 300 operating hours. Check the brush motor and drive motor carbon brushes every 500 hours or once a year.

Warning!

Turn the Key Switch off and disconnect the batteries before servicing the machine.

- Check the vacuum motor carbon brushes once a year or after 300 operating hours.
- Check brush and wheel drive motor(s) carbon brushes (four per motor) once a year or after 500 operating hours.
- The original (new) length of each carbon brush is 1” (25,4mm) on all 24-volt machine models brush and wheel drive motors.
- Replace the carbon brushes on all motors when the brushes are shorter than 3/8” (9.5mm) to obtain the same motor efficiency as new brushes.

Important!

Motor damage resulting from failure to service the carbon brushes is not covered under warranty. See the ***Limited Warranty Statement***.

Batteries and Chargers

Attention: *See the **Electrical System** section for battery installation, battery maintenance and charger system requirements.*

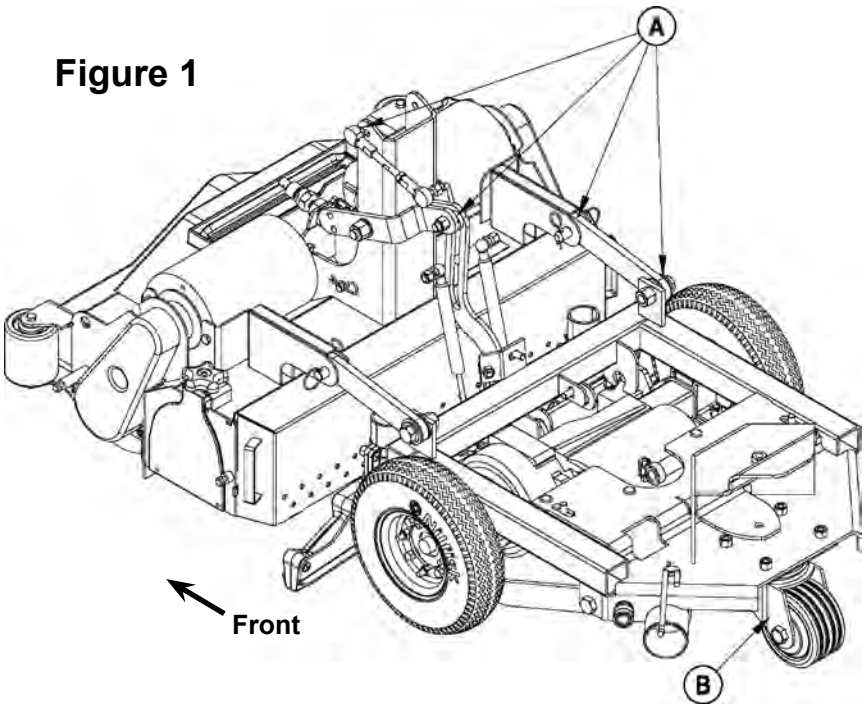
Lubricating the Machine

Lubricate the following components:

Refer to Figure 1.

- Once a month lubricate the General Pivot Points for the Brush Linkage (A). For best results, use a silicone spray.
- Once per quarter, grease the Rear Caster Wheel Swivel (B). Wipe off any excess grease to avoid staining carpet.

Figure 1



Clarke® Clean Track® L24

PM Checklist

Customer _____

Address _____

City _____ **St** _____ **Zip** _____

Model _____ **Serial** _____ **Hours** _____

Defect Codes

- **A** needs adjustment
- **B** binding
- **C** dirty or contaminated
- **D** damaged, bent or torn
- **L** leaks
- **M** missing
- **W** worn out

Ref	Operational Inspection Items	OK	Defect Codes (circle)	Does Not Work
1	Drive Paddle Operation (check for fwd/rev drive and any neutral creep)		A B D	
2	Drive System Performance (speed changes min/max)		noisy sluggish	
3	Scrub System (raise/lower, brush motor on/off)		A B D	
4	Vacuum Performance (sealed water lift and 1" open-hole adapter)		C L W	
5	Solution control (on/off and flow volume settings; three flow settings)		A B L	
6	Battery Charger (auto turn on and off)		D	
7	Main Controller Special Program Options (see the ***Electrical System/ Main Control Programming Options*** section in this manual)		A	

Ref	Visual Inspection Items	Comments	OK	Defect Codes (circle)	Does Not Work
8	Scrub Brushes, check for wear and tear			D M W	
9	Scrub Brush Motor(s), check carbon brushes for wear	500 hours		B C W	
10	Scrub Brush Motor(s), check gearboxes			B D L	
11	Brush Drive Plate Retainer Clips & flex couplers			C D M	
12	Scrub Deck Lift Motor, Skirt & Side Wheel			D M W	
13	Solution Solenoid Valve			C L W	
14	Solution Pump and Hoses			C L W	
15	Solution Tank, Delivery Hoses and Filter	clean filter screen		C L	
16	Vacuum Motor Carbon Brushes (wear limit 3/8")	300 hours		B C W	
17	Vacuum motor inlet filter (located in recovery tank	clean screen		C D M	
18	Recovery Tank Cover Gasket			L M W	
19	Recovery Tank Drain Hose & Cap			C D L	
20	Battery Condition (load test, clean & water)			C W	
21	Drive Wheel Transaxle Motor - Check Carbon Brushes	500 Hours		B C D W	
22	Transaxle Drive Tires	tread wear		W	
23	Rear Chassis Caster Wheel (lubricate)	tread wear		W	

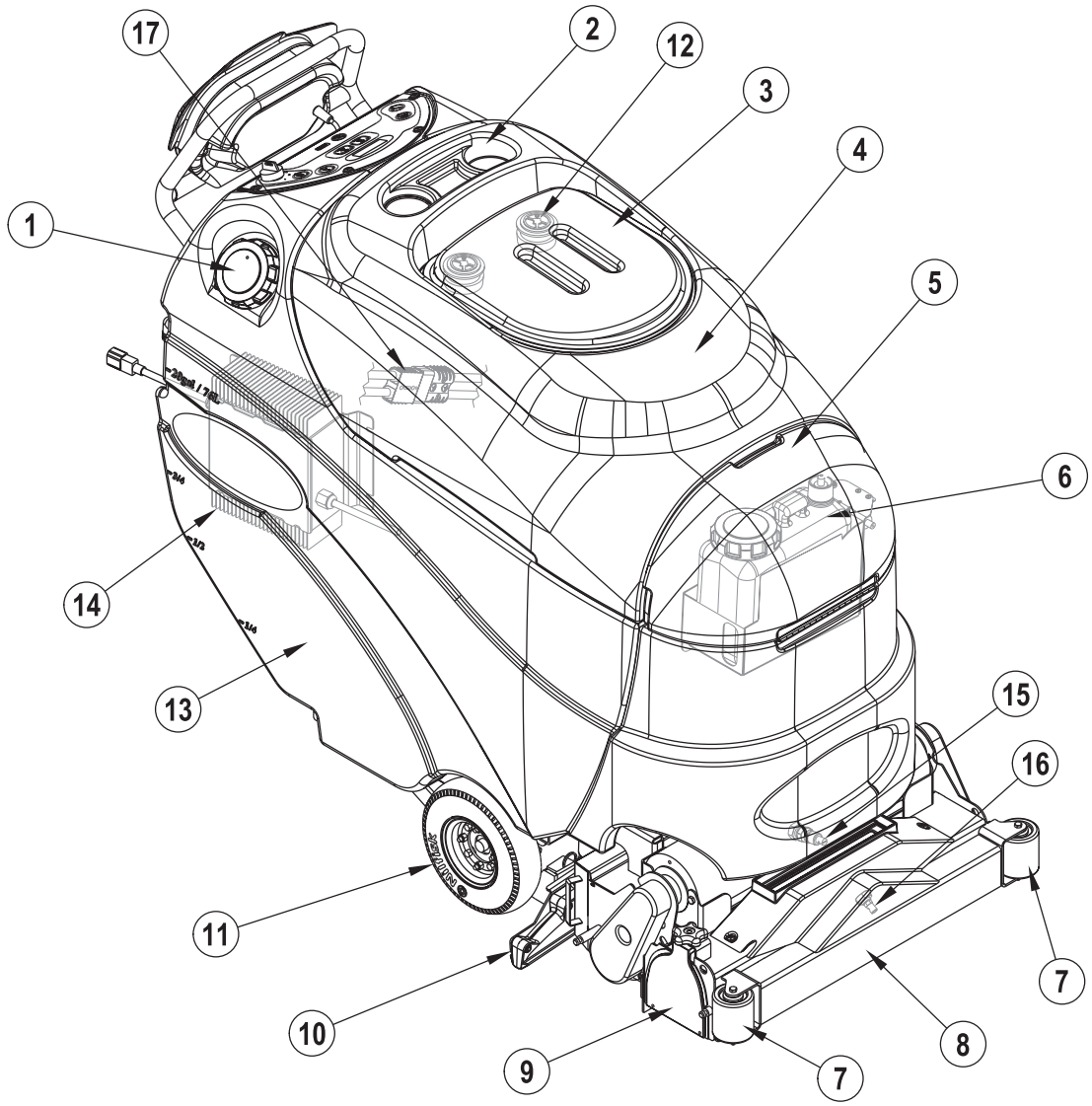
Know Your Machine

Major Components

As you read this manual, you will occasionally run across a bold number or letter in parentheses - example: (**2**). These numbers refer to an item shown on this page unless otherwise noted. Refer back to this page whenever necessary to pinpoint the location of an item mentioned in the text. **Note:** Detailed explanations of each item illustrated on the next three pages are provided later in this section.

1 Solution Fill Cap
2 Bottle Holders
3 Recovery Tank Dome Lid
4 Recovery Tank
5 Detergent Cartridge Access Cover
6 Detergent Cartridge (Chemical Mixing System)
7 Scrub Deck Rollers
8 Scrub Deck
9 Idler Assembly
10 Extraction/Vacuum Shoes
11 Drive Wheel
12 Vacuum Motor Inlet Screens
13 Solution Tank
14 Onboard Battery Charger
15 Maintenance Spray Nozzle
16 Restoration Spray Nozzle
17 Battery Pack Connector

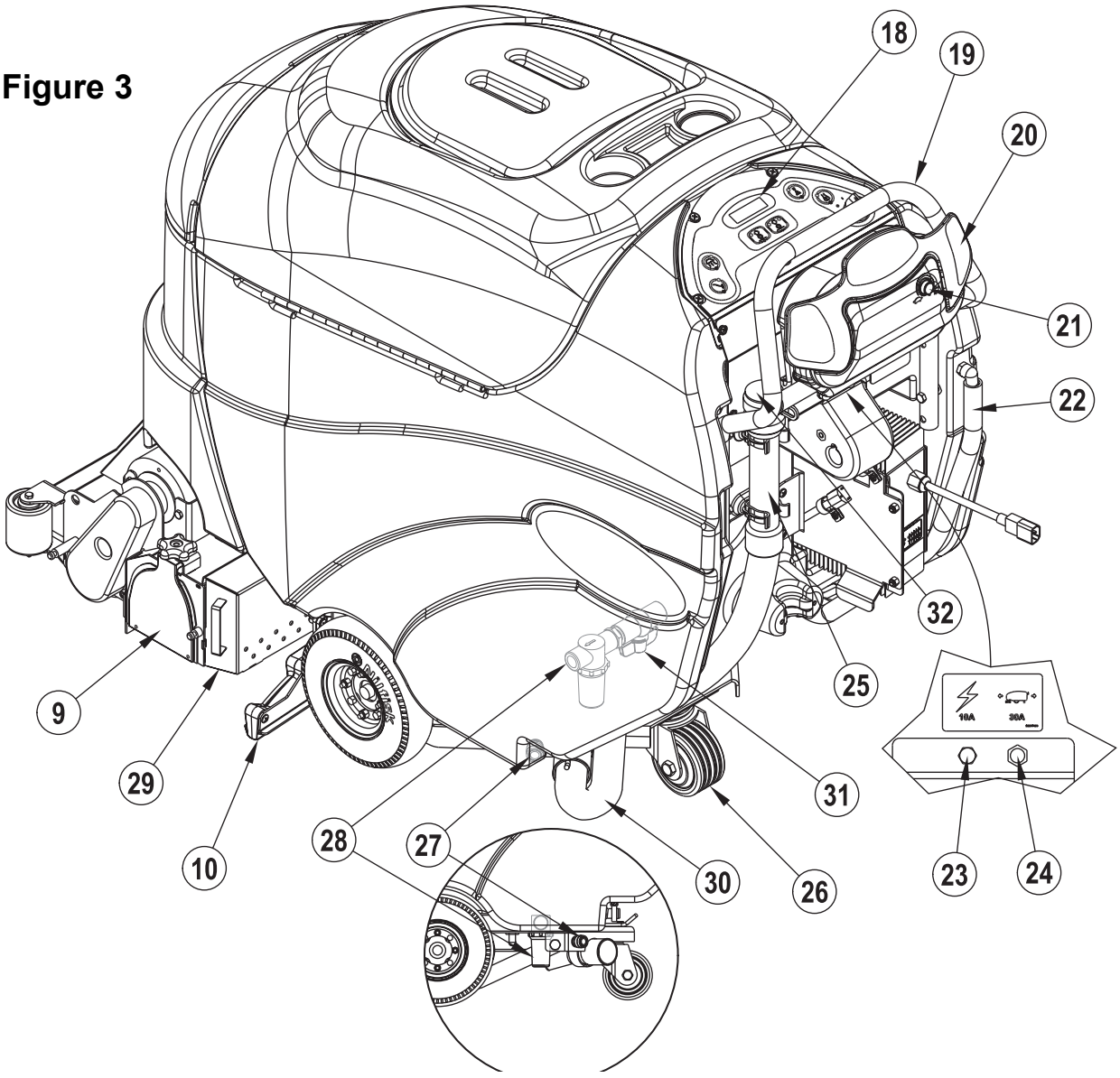
Figure 2



Major Components (continued)

18 Control Panel
19 Operator Control Handle
20 Drive Paddle
21 Speed Control Knob
22 Solution Drain Hose / Level Indicator
23 10-amp Control Circuit Circuit Breaker
24 30-amp Drive Motor Circuit Breaker
25 Recovery Tank Drain Hose
26 Rear Caster
27 Accessory Port
28 Solution Filter
29 Debris Hopper
30 Vacuum Recovery Hose
31 Solution Shutoff Valve
32 Recovery Drain Hose Cap

Figure 3



Control Panel

A Key Switch (Main Power)

B Detergent System Switch

C Solution/Pre-spray Switch

D Display Panel

- **D1** Detergent (Chemical Mixing) System Indicator
- **D2** Hour Meter/Battery Indicator
- **D3** Fault Indicator
- **D4** Chemical Mixing System Ratio Indicator
- **D5** Maintenance Extract Mode Indicator
- **D6** Restoration Extract Mode Indicator
- **D7** Fast Pre-spray Mode
- **D8** Heavy Pre-spray Mode
- **D9** Battery Low Indicator

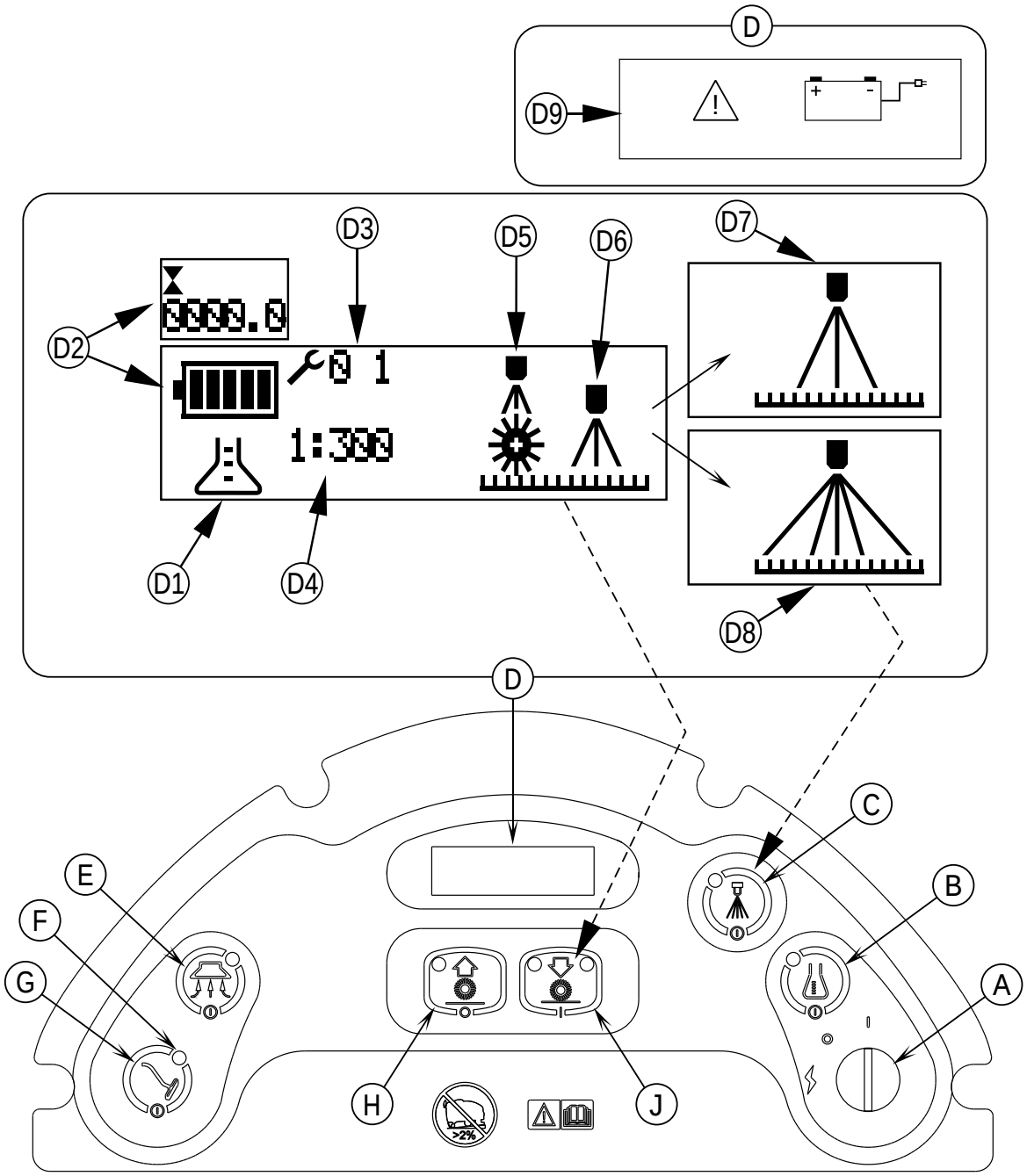
E Vacuum Switch

F Speed Control Fault Code Indicator

G Wand Switch

H Scrub OFF Switch (red)

J Scrub ON Switch (green)



Control Panel Switch Functions

Key Switch (A)

Main power switch

Detergent System Switch (B)

This switch controls the on-board chemical mixing (detergent) system.

- Pressing and releasing this switch while the solution system is active will toggle the detergent system on and off.
- The Chemical Mixing System Indicator (**D1**) informs the operator when the detergent bottle is low. Pressing and holding the Detergent System Switch (**B**) for two seconds after the detergent bottle has been refilled will reset the Chemical Mixing System Indicator (**D1**) on the display to show full.
- Holding the Detergent System Switch (**B**) and the Solution/Pre-spray Switch (**C**) at the same time for two seconds will switch the machine into the purge mode.

Solution/Pre-spray Switch (C)

If the scrub system is off, pressing this switch will cause the machine to enter fast pre-spray mode. The following will occur:

- The scrub system will be enabled with the system configured for fast pre-spray mode, and the scrub deck will be lowered while the extraction/vacuum shoes stay up in the locked position.
- The solution system will be enabled for fast pre-spray mode.
- The detergent system will be enabled for pre-spray mode.
- The travel speed will be limited to a fast pre-spray mode speed setting.
- As soon as the throttle is moved from the neutral position the scrub brushes will start turning. If the direction is forward, the solution and detergent flow will start. If the direction is reverse, the solution and detergent flow will be stopped.
- The Fast Pre-spray Mode indicator (**D7**) will indicate the scrub system is activated in fast pre-spray mode.
- The Scrub ON Switch (**J**), Solution Pre-spray Switch (**C**) and Detergent System Switch (**B**) will be green if the scrub system is on and the fast pre-spray mode has been selected. The indicators will be off if the scrub system is off. The indicators will be yellow if the pre-spray mode has been selected but the throttle is in neutral.
- Pressing the Scrub ON Switch (**J**) in the fast pre-spray mode switches the machine to the heavy pre-spray mode. In this mode the machine moves slower and more solution is sprayed on the carpet. The Heavy Pre-spray Mode indicator (**D8**) will indicate that the scrub system is in heavy pre-spray mode.

If the pre-spray mode is active, pressing this switch will cause the following to occur:

- The scrub brushes will turn off and the scrub deck will rise to the up position.
- The solution flow will be stopped.
- The detergent flow will be stopped.
- The travel speed limit will return to the transport speed setting.
- The display will indicate the nozzles are turned off and the deck is in the raised position.
- The scrub off indicator will be green if the scrub system is off and ready to be activated. The indicator will be off if the scrub system has been activated. If the scrub system has been turned off and the scrub deck is not up yet, the indicator will be red. If there is a fault in the scrub system, this indicator will flash red.

If the scrub system is activated in the maintenance or restoration extraction mode, pressing this switch will cause the following to occur:

- The solution system will toggle between disabled and enabled. The solution flow will only turn on when the throttle is moved from the neutral position in the forward direction. The solution flow will turn off if the throttle returns to neutral or is moved to reverse.
- The solution indicator will be green if the solution is on. If the solution is off, this indicator will be off. The indicator will be yellow if the solution has been enabled but the throttle is in neutral. If there is a solution system fault, the indicator will flash yellow.

Display Panel (D)

Refer to the ***Control Panel Indicators*** subsection for a description of the display functions.

Vacuum Switch (E)

This switch toggles the vacuum system on or off.

- The vacuum will only turn on when the throttle is moved from the neutral position. It will remain on for 10 seconds after the throttle returns to neutral.
- The vacuum indicator will be green if the vacuum is on. It will flash green if the vacuum is in the 10-second delayed-off condition. If the vacuum is off, this indicator will be off. The indicator will be yellow if the vacuum has been enabled but the throttle is in neutral. If there is a vacuum system fault, the indicator will flash yellow.

Speed Control Fault Code Indicator (F)

If a speed control fault occurs (error code 3), the Speed Control Fault Code Indicator in the Wand Switch (**G**) will flash the fault code produced by the Curtis speed control. Refer to the ***Electrical/Curtis Controller Diagnostics*** section for details.

Wand Switch (G)

This switch is used when an external scrub wand is used. Pressing this switch will turn the vacuum on continuously without regard to the throttle position. It will also enable the solution pump. If the scrub system was on, it will be turned off. This includes turning off the scrub brushes, raising the scrub deck and turning the solution flow to the scrub deck off. The indicator in the Wand Switch will be green when the wand function is on. Otherwise it will be off.

Scrub OFF Switch (H)

Pressing this switch when the scrub system is active will cause the following to occur:

- The scrub brushes will turn off and the scrub deck will rise to the up position.
- The solution flow will be stopped.
- The vacuum will shut off after a 10-second delay
- The travel speed limit will return to the transport speed setting.
- The display will indicate the nozzles are turned off and the deck is in the raised position.
- The scrub off indicator will be green if the scrub system is off and ready to be activated. The indicator will be off if the scrub system has been activated. If the scrub system has been turned off and the scrub deck is not up yet, the indicator will be red. If there is a fault in the scrub system, this indicator will flash red.

Scrub ON Switch (J)

If the scrub system is off or in the restoration extract mode, pressing this switch will cause the machine to enter maintenance extract mode. The following will occur:

- The scrub system will be enabled with the system configured for the maintenance mode, and the scrub deck will be lowered.
- The vacuum system will be enabled.
- The solution system will be enabled for the maintenance extract mode.
- The travel speed will be limited to the maintenance extract mode speed setting.
- As soon as the throttle is moved from the neutral position, the scrub brushes will start turning and the vacuum will turn on. If the direction is forward, the solution flow will start. If the direction is reverse, the solution flow will be stopped.
- The Maintenance Extract Mode Indicator (**D5**) will indicate that the scrub system is activated in the maintenance extract mode.

If the scrub system is in the maintenance extract mode, pressing this switch will cause the machine to enter the restoration extract mode. The following will occur:

- The scrub system will be enabled with the system configured for the restoration extract mode.
- The vacuum system will be enabled.
- The solution system will be enabled for restoration extract mode.
- The travel speed will be limited to the restoration extract mode speed setting.
- As soon as the throttle is moved from the neutral position, the scrub brushes will start turning and the vacuum will turn on. If the direction is forward, the solution flow will start. If the direction is reverse, the solution flow will be stopped.
- The Restoration Extract Mode Indicator (**D6**) will indicate that the scrub system is activated in the restoration extract mode.

Control Panel Indicators

Chemical Mixing System Indicator (D1)

The machine has a Chemical Mixing System Indicator in the lower left corner of the display. When the detergent (chemical) system is enabled, the indicator will show a detergent bottle icon. When the detergent system is disabled, the detergent bottle icon will have a cross through it. If the operator chooses a specific mix ratio on the detergent bottle, it will be displayed in the Chemical Mixing System Ratio Indicator (**D4**) to the right of the Chemical Mixing System Indicator.

Hour Meter (D2)

The Hour Meter is shown in the upper left corner of the display for five seconds after the machine is turned on. The Hour Meter displays the total time spent scrubbing for the life of the machine.

Battery Indicator (D2)

After five seconds of operation, the battery condition indicator replaces the hour meter in the upper left corner of the display. It gives a relative indication of the state of charge of the battery pack. A fully-charged battery pack will measure above 25.1 volts with no load applied (2.09 volts per cell). The Clean Track® L24 is equipped with a low-voltage cutout feature that will turn the scrub system off when the batteries are discharged to their minimum level. There are two different cutout levels to accommodate different battery types. See the ***Electrical/Main Control Programming Options*** section for details. The voltage levels for the various indications are as follows (the voltages shown represent the voltage under load):

Indicator Voltage Levels For Standard Cutout Level:

- 5 Bars = full charge down to 23.8 volts
- 4 Bars = 23.7 volts down to 23.6 volts
- 3 Bars = 23.5 volts down to 23.2 volts
- 2 Bars = 23.1 volts down to 22.5 volts
- 1 Bar = 22.4 volts down to 21.7 volts
- 0 Bars = 21.6 volts down to 20.6 volts
- Low Voltage Warning Screen = less than 20.5 volts. The scrub system will shut down.

Indicator voltage levels for alternate cutout level:

- 5 Bars = full charge down to 23.8 volts
- 4 Bars = 23.7 volts down to 23.6 volts
- 3 Bars = 23.5 volts down to 23.3 volts
- 2 Bars = 23.2 volts down to 22.9 volts
- 1 Bar = 22.8 volts down to 22.3 volts
- 0 Bars = 22.2 volts down to 21.8 volts
- Low Voltage Warning Screen = less than 21.7 volts. The scrub system will shut down.

Note: *Once the low-voltage cutout level has been reached and the Battery Low Indicator (**D9**) is displayed) the batteries must be FULLY recharged to reset the battery condition indicator. The scrub system will not function until the indicator has been reset.*

Fault Indicator (D3)

If an electrical fault occurs, the Fault Indicator will display the associated error code immediately. The error code number will be displayed with a wrench icon right of the battery condition indicator. Refer to the ***Error Code*** section for descriptions.

Note: *If a speed control fault occurs (error code 3), the wand indicator will flash the fault code produced by the Curtis speed control. Refer to the* ***Electrical/Curtis Controller Diagnostics*** *section for details.*

Chemical Mixing System Ratio Indicator (D4)

Displays the specific mix ratio on the detergent bottle as selected by the operator.

Maintenance Extract Mode Indicator (D5)

Indicates that the machine is in the maintenance extraction mode.

Restoration Extract Mode Indicator (**D6)**

Indicates that the machine is in the restoration extraction mode.

Fast Pre-spray Mode indicator (**D7)**

Indicates that the machine is in the fast pre-spray mode.

Heavy Pre-spray Mode indicator (**D8)**

Indicates that the machine is in the heavy pre-spray mode.

Battery Low Indicator (**D9)**

Displays the “attention” symbol when the batteries require recharging. Note that the vacuum motors will shut off 30 seconds after the Battery Low indicator is displayed.

General Guidelines for Control Panel Indicators

In general, the following guidelines apply to the control panel indicators:

- A flashing green or yellow indicator means that a fault has occurred in the particular system. An example of this would be an over-current fault.
- A yellow indicator means that the particular function has been enabled but is not currently on. For example, if a scrub mode is selected and the throttle is in neutral, the scrub system, vacuum and solution indicators will all be yellow. This indicated that the systems are enabled and ready to turn on when the throttle is moved to forward or reverse.
- A green indicator means that the particular system is on.
- A flashing green indicator means that the particular system is in a delayed-off condition. An example of this is when a scrub mode is selected and the throttle goes from forward or reverse to neutral. When this happens, the vacuum indicator will flash green indicating that the vacuum is still on, but that it will be turning off after the delay period.

Solution System

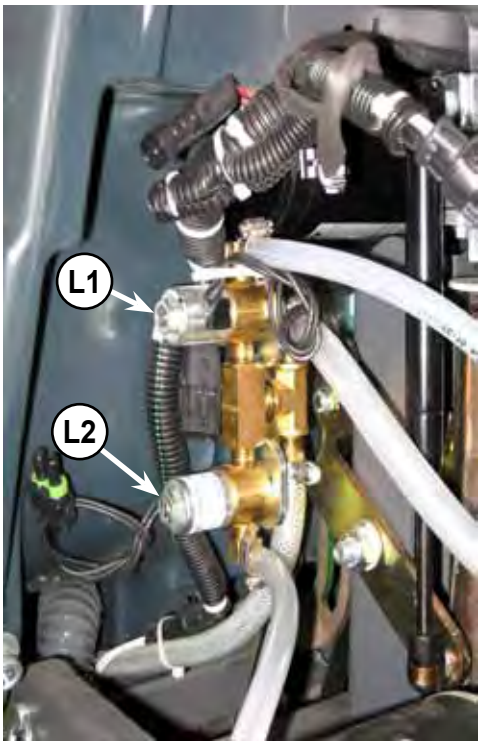
Functional Overview

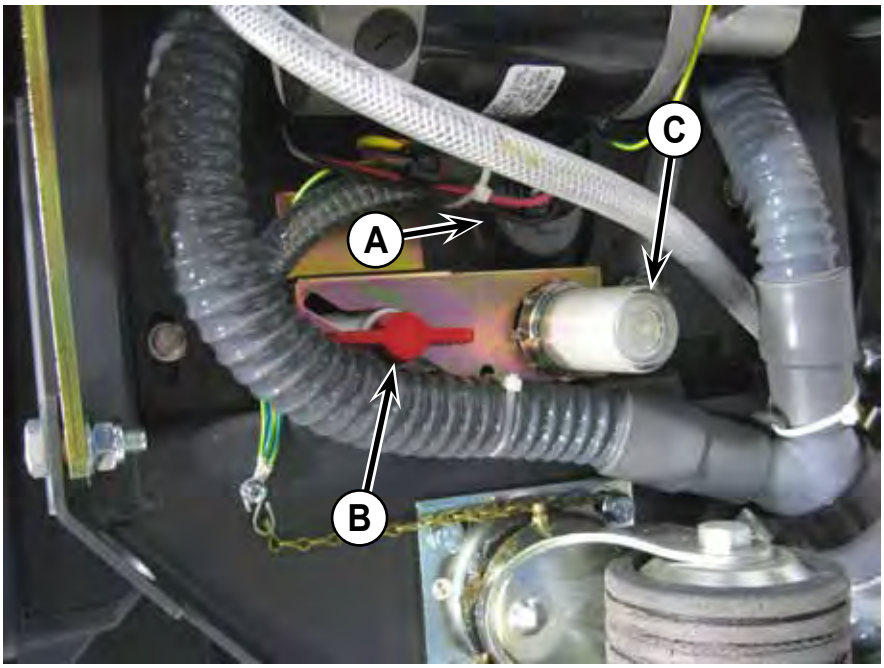
The Clean Track L24 has a solution tank capacity of 20 gallons (76 liters) with a right rear tank fill opening. A flexible clear hose on the side of the solution tank indicates the solution level, and is used to drain the tank for system maintenance.

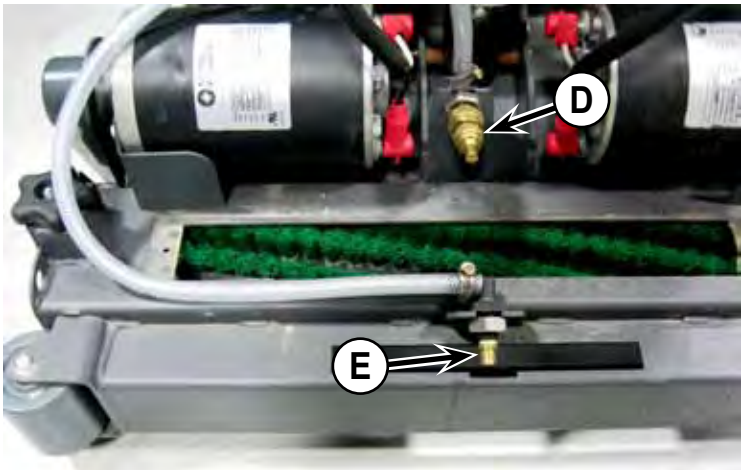
See Figure 4. A serviceable Solution Filter (C) is plumbed into the manual Solution Shutoff Valve (B) outlet to keep debris from entering the solenoid valves.

Electrical Solenoid Valves (L1 and L2) switch the solution flow to the Maintenance (D) and Restoration (E) spray nozzles on and off. The M1 solution pump (A) on the machine chassis controls the needed flow volume demand to the nozzles. (See the electrical diagram in Figure 5.) The electrical circuit that turns on (energizes) the solenoid coils and solution pump is activated through the (A1) control panel's solution switch button input and the FOR / Reverse. (A2) Speed Controller voltage output signals.

Figure 4







Note: *See the **Control Panel Switch Functions** sections in this manual for a complete explanation of the solution operation modes.*

During normal machine scrubbing the solution system's Auto Mode is selected and works in conjunction with the wheel drive speed controller and the (A1) main controller's scrub system outputs to turn solenoid valves L1 and L2 and solution pump M1 on and off. The solution will flow to the nozzle(s) when the scrub deck is lowered and the handle drive paddle is pushed forward. Note that when the detergent system switch is off, no flow can occur while the machine scrub deck is down and the drive paddle activated.

See the detailed drawings shown in the ***Control Panels*** section for the specific description of the individual icon symbols.

Note: *If a speed control fault occurs (error code 3) the wand indicator will flash the fault code produced by the Curtis speed control. Refer to the **Electrical/Curtis Controller Diagnostics** section for details.*

Circuit Overview - Solution Auto Mode (Solenoid Valve Circuit)

See Figure 5.

In order for the solution to flow to the nozzles, the

+ (Positive) circuit input starts with:

A closed S1 Key Switch that will direct the needed positive voltage (BRN wires) to the L1 and L2 solenoid coils, pin #5 - KSI on the A2 Speed Controller and pin #J2-8 on the A1 Control Board.

- (Negative) circuit input starts with:

- Battery negative ground inputs at the A1 Control Board and A2 Speed Control Ground terminals.
- The A1 control board solution button enabled.
- A negative voltage output from the A2 speed controller's (pin #6) RED/BLK wire to the A1 control board RED/BLK wire (terminal J1-5). Note that the A2 speed control Brake output (pin #6) occurs whenever the R1 direction throttle pot is moved off its neutral setting.
- Negative voltage outputs from the A1 board terminals J1-2 RED/GRN wire and J1-4 YEL/GRN wire to the L1 and L2 solenoid coils respectively, actuating the solenoids to allow flow through the valve bodies.

Circuit Overview - Solution Auto Mode (Solution Pump Circuit)

See Figure 5.

+ (Positive) circuit input starts with:

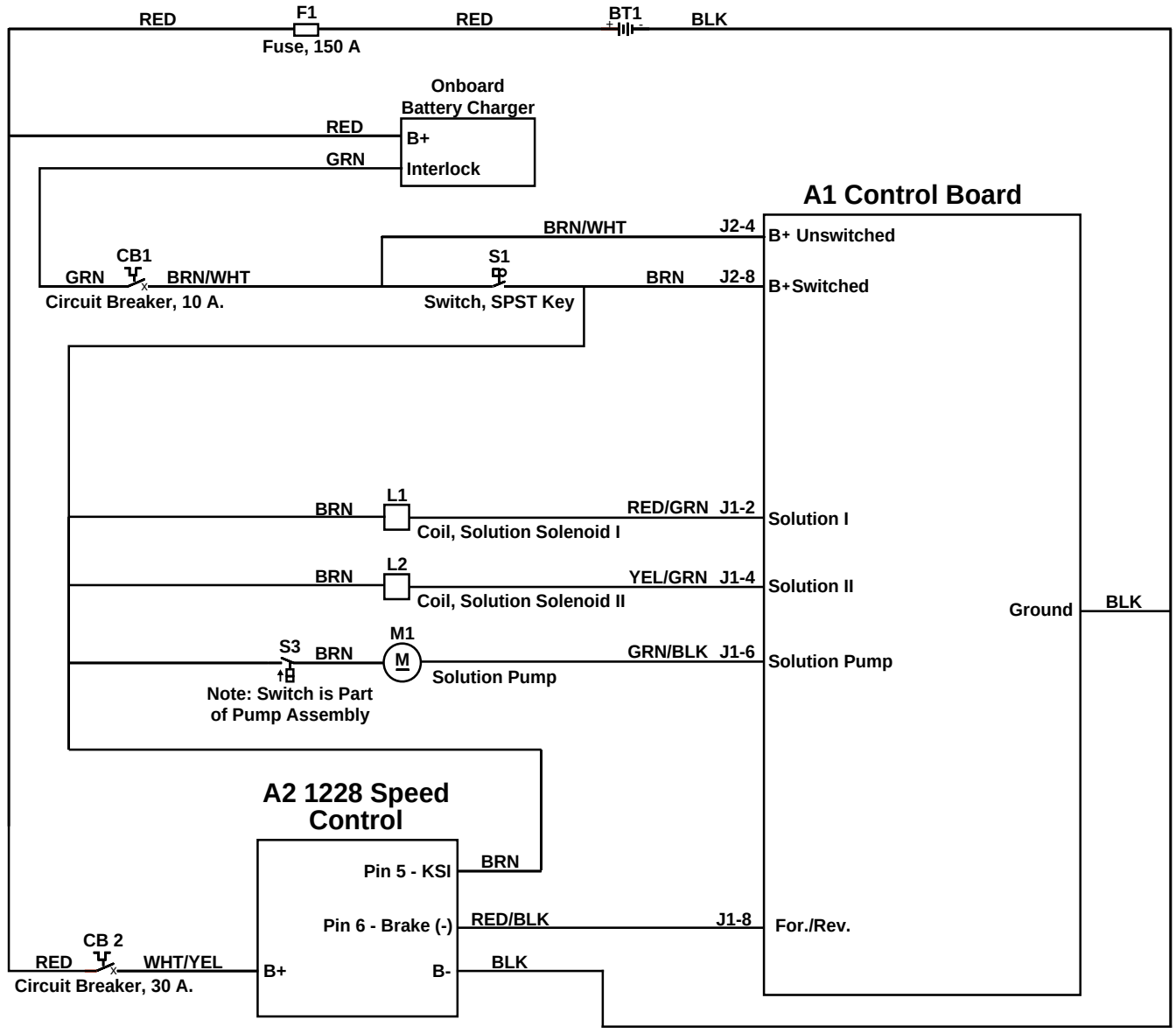
A closed S1 Key Switch will direct the needed positive voltage (BRN wires) to the M1 Solution Pump, pin #5 - KSI on the A2 Speed Controller and pin J2-8 on the A1 Control Board.

- (Negative) circuit input starts with:

- Battery negative ground inputs at the A1 Control Board and A2 Speed Control Ground terminals.
- The A1 control board solution button enabled.
- A negative voltage output from the A2 speed controller's (pin #6) RED/BLK wire to the A1 control board RED/BLK wire (terminal J1-5). Note that the A2 speed control Brake output (pin #6) occurs whenever the R1 direction throttle pot is moved off its neutral setting.

A negative voltage output from terminal J1-6 GRN/BLK wire is direct to the M1 Solution Pump turning it on to allow flow to the L1 and L2 Solenoids. Note that the voltage should be the same when one or two nozzles are actuated. The voltage is a PWM signal at 10KHz.

Figure 5



Solution System Maintenance

Solution Tank

1. Empty the solution tank weekly.
2. Remove the solution Drain Hose from its storage area (located on the right rear control handle compartment). Direct the hose to a designated “Disposal Site” and flush the tank with clean water.

Solution Filter

See Figure 4. Remove and clean the in-line Solution Filter (C). To access the filter housing for removal, work underneath the middle left side chassis panel. No tools are needed to remove the filter (hand-tighten only).

Service Tip: *The solution shutoff valve (B) must be placed in the OFF (Closed) position. This prevents loss of solution when servicing the filter strainer with a partial or full tank.*

Troubleshooting Guide

Problem	Possible Cause
Inadequate Solution Flow	No solution in the tank
	Solution tank filter ball valve in the off position
	Clogged solution filter, valves and/or hoses

*Reference the Solution System Troubleshooting Guide flowchart in this manual section for further component diagnostics.

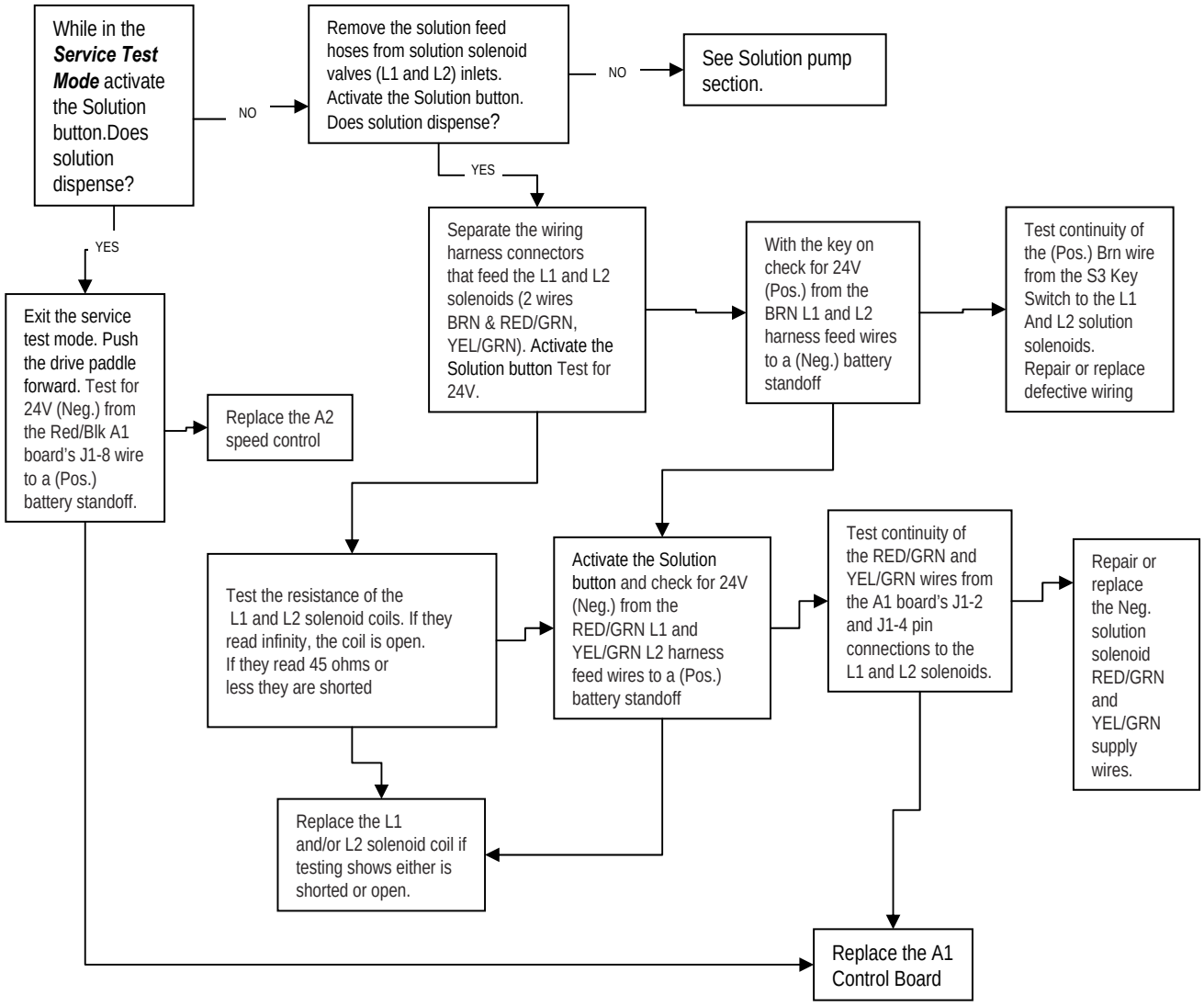
Solution System - Electrical Troubleshooting Guide

Possible Symptoms

1. No solution flow while in the scrub auto solution mode.
2. Solution Pump will not operate:

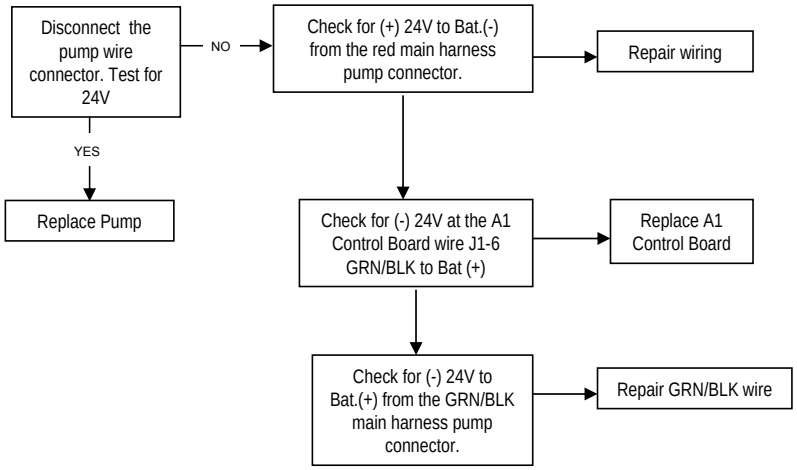
Symptom One - No Solution Flow While in the Scrub Auto Solution Mode

Note: *Activate the Service Test Mode Program. See the optional program section for instructions. All testing will be performed in the Service Test Mode Program.*



Symptom Two - Solution Pump Will Not Operate

Note: *Activate the Service Test Mode Program. See the optional program section for instructions. All testing will be performed in the Service Test Mode Program.*



Solenoid Valve Removal

1. Drain the solution tank or turn the solution filter ball valve to the off position to prevent solution loss.
2. Lower the deck and disconnect the battery supply to the machine.
3. Remove the front nose cone from the machine by firmly grasping the lower part and lifting straight up.
4. See Figure 4. Unplug the L1/L2 solenoid valve wire assembly connection from the machine harness.
5. Unscrew the inlet hose clamps that secure the hoses to the valve body.
6. Separate (pry) the solution outlet hose off from its valve body barbed fitting.
7. Remove the (2) screws that secure the valve to the mount bracket, then pull the valve body to the front separating it from the solution inlet hose, completing the part removal.

Solenoid Valve Disassembly and Cleaning

1. Remove the solenoid valve. (See the Solenoid Valve Removal section above.)
2. Remove the four screws and disassemble the valve. (Be careful not to lose any internal parts.)
3. Thoroughly wash any dirt or debris from block and diaphragm.
4. After reassembling, test the solenoid valve for correct operation.

Solution Filter and Shutoff Valve Removal

1. Drain the solution tank using the solution drain hose.
2. See Figure 4. Loosen the (2) hose clamps and pry off the inlet and outlet solution hoses.
3. Remove the nut holding the filter mount bracket to the chassis and remove the assembly from the machine.

Solution Pump Removal

1. Drain the solution tank or turn the solution shutoff valve to the off position to prevent solution loss.
2. See Figure 4. Loosen the (2) hose clamps and pry off inlet hose and outlet hose from solution pump.
3. Remove the fasteners holding the solution pump to the chassis.
4. Disconnect the solution pump electrical connector. Note that a tie strap may need to be cut to complete the part removal.

Note: *Refer to the **Appendix** at the back of this manual for solution system flow schematics and detergent system information.*

Scrub System

Functional Overview

The Clean Track® L24 uses two cylindrical brushes that counter-rotate to sweep up light debris and scrub at the same time. Each scrub brush is powered on opposing ends by 1/2 HP permanent magnet motors attached to separate poly-V belt/pulley drives. Note that the Recovery Tank Full switch must be tilted down (tank empty, switch open) for the brushes to run.

The scrub deck platform is raised and lowered automatically by a vertically mounted electric lift actuator motor. The operation of the machine's scrub functions are activated when the operator selects (presses) the scrub on (mode) panel button.

See Figure 6. The machine's main scrub system input and output operating functions are regulated (managed) by the display panel and combined main control board A1. The major scrub system functions are:

Circuit Overview - Scrub Brush Motor M4 and M5 Run Function

See Figure 6.

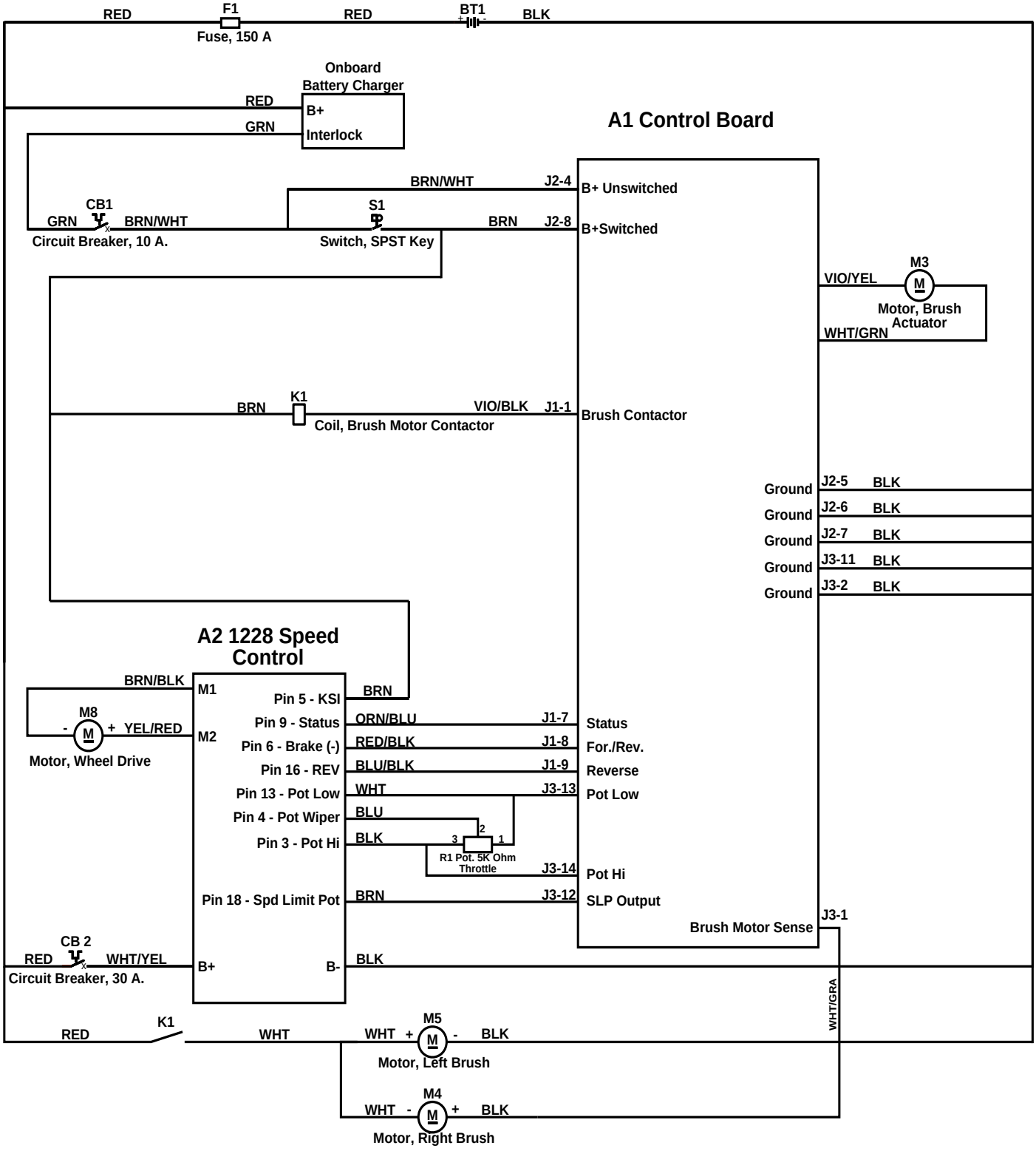
+ (Positive) Circuit input starts with:

- A closed S1 Key Switch that supplies the needed positive voltage to the K1 brush motor contactor, pin #5 - KSI (BRN wire) on the A2 Speed Controller and pin #J2-8 (BRN wire) on the A1 Control Board. Note that the A1 control board scrub-on button must also be depressed (enabled). This operator command lowers the brush deck.
- Once the K1 load is closed, the needed positive voltage is supplied to the motors M4 and M5 from the battery post (WHT wire).

- (Negative) Circuit input starts with:

- Battery negative ground inputs at the A1 Control Board and A2 Speed Control Ground terminals (BLK wires). Note that the A1 control board scrub-on button must also be depressed (enabled).
- A negative voltage output from the A2 speed controller pin #6 - Brake (-) to the A1 control board pin J1-8 For./Rev. (RED/BLK wire) Note that the A2 speed control brake negative output (pin #6) occurs whenever the R1 direction throttle pot is moved off its neutral setting.
- A negative voltage output from the A1 board's terminal J1-1 Brush Contactor (VIO/BLK wire) completes the K1 solenoid coil circuit (positive and negative) and pulls in the load contact making the brush motors run.
- The Negative M4 and M5 load voltage is supplied from the battery negative.

Figure 6


RED
F1
Fuse, 150 A
RED
BT1
BLK
Onboard
Battery Charger
RED
B+
GRN
Interlock
A1 Control Board
BRN/WHT
J2-4
B+ Unswitched
CB1
GRN
BRN/WHT
Circuit Breaker, 10 A.
S1
Switch, SPST Key
BRN
J2-8
B+Switched
M3
VIO/YEL
Motor, Brush
Actuator
WHT/GRN
K1
BRN
VIO/BLK
J1-1
Coil, Brush Motor Contactor
Brush Contactor
Ground
J2-5
BLK
Ground
J2-6
BLK
Ground
J2-7
BLK
Ground
J3-11
BLK
Ground
J3-2
BLK
A2 1228 Speed
Control
BRN/BLK
M1
Pin 5 - KSI
BRN
M8
M
YEL/RED
M2
Pin 9 - Status
ORN/BLU
J1-7
Status
Motor, Wheel Drive
Pin 6 - Brake (-)
RED/BLK
J1-8
For./Rev.
Pin 16 - REV
BLU/BLK
J1-9
Reverse
Pin 13 - Pot Low
WHT
J3-13
Pot Low
Pin 4 - Pot Wiper
BLU
Pin 3 - Pot Hi
BLK
R1 Pot. 5K Ohm
Throttle
J3-14
Pot Hi
Pin 18 - Spd Limit Pot
BRN
J3-12
SLP Output
Brush Motor Sense
J3-1
CB 2
RED
WHT/YEL
Circuit Breaker, 30 A.
B+
B-
BLK
WHT/GRA
K1
RED
WHT
M5
WHT
BLK
Motor, Left Brush
M4
WHT
BLK
Motor, Right Brush

M3 - Scrub Brush Actuator Lift Motor Function

The Scrub Brush Actuator continuously raises and lowers the scrub deck as needed to maintain optimum brush contact with the floor surface. The Scrub Brush Actuator lift motor is controlled by the amount current drawn by the scrub brush motors as follows:

- If the control board senses that the brush motors are drawing too much current, the Scrub Brush Actuator lift motor raises the scrub deck until the brush motor current draw is within the acceptable range.
- If the control board senses that the brush motors are drawing too little current, the Scrub Brush Actuator lift motor lowers the scrub deck until the brush motor current draw is again within the acceptable range.

The A1 control board provides voltage through J2-2 (VIO/YEL wire) and J2-3 (WHT/GRN wire) that changes polarity to raise and lower the scrub-deck. The large BLK negative (-) scrub brush motor wire is specially designed so that it has a known (specified) resistance value. As brush motor current passes through the negative wire that is, in effect, a low-value resistor, a small voltage drop is developed across it which is proportional to the motor current. This voltage change is inputted to the A1 control board at J3-1 Brush Motor Sense (WHT/GRA wire) and J2-5 (BLK ground). Any surrounding temperature change in this large negative motor wire affects its resistance, so the temperature is sensed by a thermistor built into the control board A1. This allows the controller to provide error correction for the temperature resistance changes. When the controller senses a current draw out of the desired range, it automatically turns on the M3 actuator motor to raise or lower the scrub deck. This process is ongoing in maintaining the operator's selected scrub motor current load setting to sustain the desired brush working pressure.

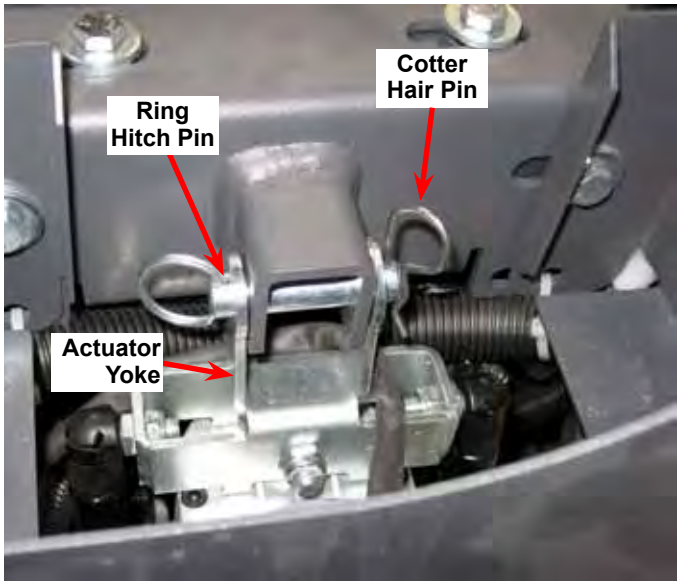
Scrub System Low-voltage Cut-out Function

The purpose of the special low battery voltage cutout function is to help prolong battery life. The scrub deck will be raised and the brush motors and solution solenoid valves will switch off automatically when the batteries discharge to the selected cutout level. The cutout level can be set to the standard setting (wet cell/lead acid) of 1.72 volts per cell, or to the alternate setting (gel/maintenance-free) of 1.81 volts per cell. (See the ***Main Control Programming Options/ Selection of Low Voltage Cutout Threshold*** section for instructions for selecting the cutout threshold.

Scrub Brush Deck Removal

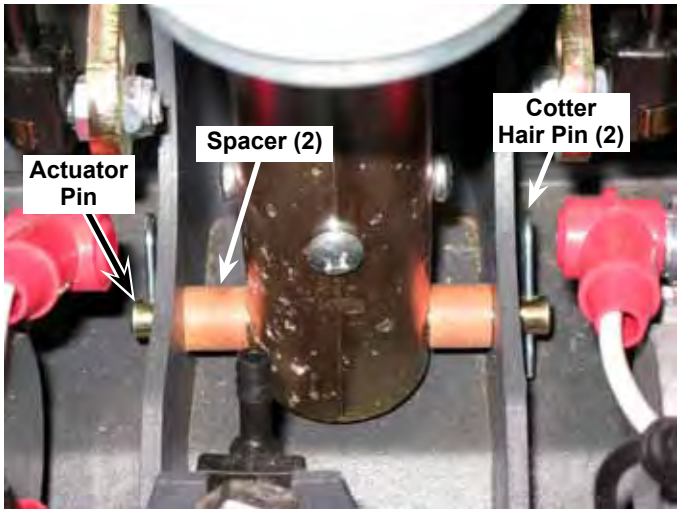
1. Turn the Key Switch on and lower the scrub deck.
2. Lift up and remove the cover and nose cone from the front of the machine.
3. Disconnect the electrical connector from the deck actuator motor to prevent the deck from rising once the Key Switch is turned off.
4. Turn the Key Switch off and disconnect the battery pack.
5. Remove the debris hopper from the scrub deck.
6. Disconnect and remove the detergent cartridge from the machine.
7. Remove the Nozzle Cover.
8. Disconnect the green and yellow ground wire from the left-hand scrub motor.
9. Disconnect the solution system water lines from the nozzle fittings. Use a cup or other receptacle to catch any solution remaining in the lines.
10. Unplug both of the brush motor wiring harnesses. Note that you may need to cut cable ties to do this.
11. Remove the Cotter Hair Pin and Ring Hitch Pin holding the Actuator Yoke to the actuator bracket weldment.

Note: *Carefully lift up on the scrub deck if necessary to take pressure off of the Ring Hitch Pin.*

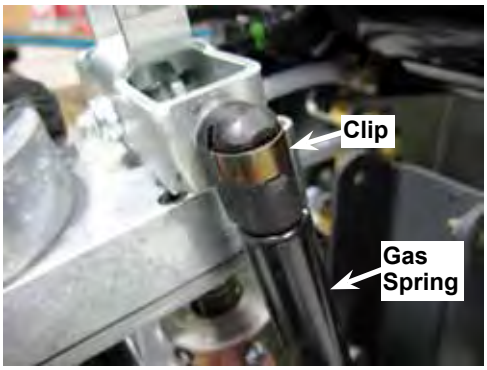


12. Remove the Cotter Hair Pin from one side of the Actuator Pin, then remove the Actuator Pin and the two Spacers from the deck weldment and Actuator Tube.

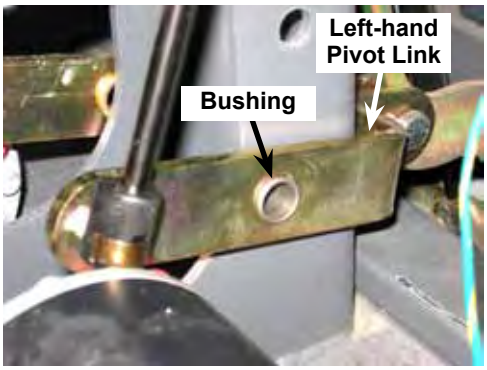
Service Tip: *It is important that the actuator motor is not run or the actuator is not rotated while it is disconnected from the deck or chassis mounts. This precaution will prevent the actuator drive nut from getting out of adjustment (moved out of its set specification).*

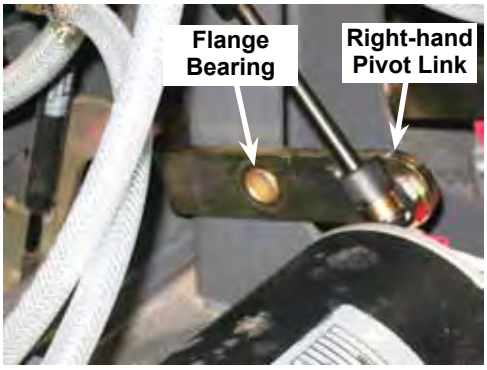


13. Remove the Clips holding the Gas Springs to the Actuator Yoke, then remove the actuator assembly from the machine.



14. Disconnect the two Pivot Links from the deck weldment. Note that there is a Bushing in the Left-hand Pivot Link and a Flange Bearing in the Right-hand Pivot Link (as viewed from the operator position).





15. Disconnect the Turnbuckle from the deck weldment.

16. Remove the cotter hair pins and ring pins that attach the scrub deck to the machine chassis linkage arms, then rotate the arms out of the way.

17. Carefully slide the deck toward the front of the machine. Note that you may need to loosen the fasteners holding the two Pivot Links together to free the deck weldment from the Pivot Links. Pull the deck forward away from the machine to complete the removal.

18. To reinstall the scrub deck, follow the above steps in reverse order.

Scrub Brush Motor Removal

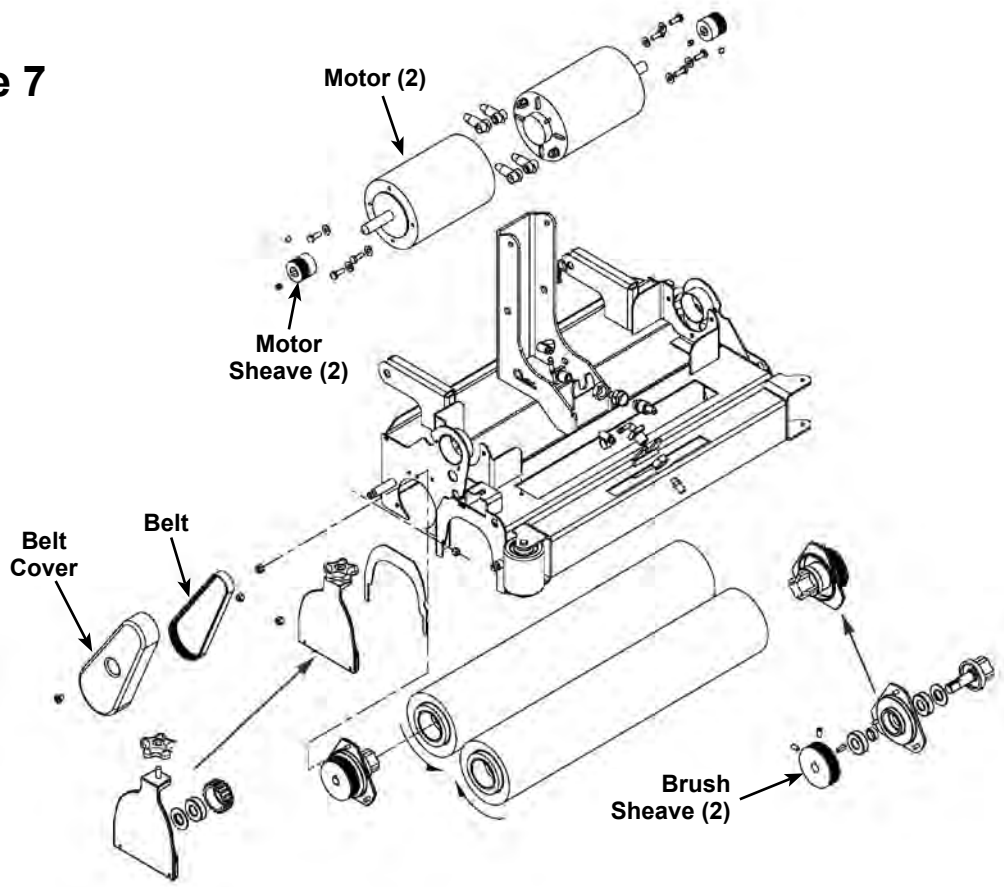
1. See Figure 7. Remove the Belt Cover(s) held in place by one screw.
2. Disconnect the Motor electrical connectors.
3. Remove the three screws and slide the Motor out. Note that the Belt can be removed at this time.
4. Reassemble in reverse order. Note that the belts are self-tensioning and no adjustment is needed.

Scrub Brush Belt Replacement

1. See Figure 7. Remove the Belt Cover(s) held in place by one screw.
2. Carefully roll the Belt off of the top Motor Sheave.
3. Reinstall the belt by placing it on the top Motor Sheave and carefully roll it onto the lower Brush Sheave.

Note: *Make sure the Belt grooves and Sheave grooves match up (are aligned).*

Figure 7



Scrub Brush System Maintenance

The scrubbing system must be serviced at regular intervals to maintain good scrubbing performance. Follow the maintenance steps listed below:

Daily Maintenance	Weekly Maintenance	Monthly Maintenance
Rinse and clean any built-up debris from the debris hopper drain holes.	Clean the drain holes in the solution delivery trough on top of the scrub deck.	Inspect the scrub brush bristles for wear. The brushes should be replaced when the bristle length is 1 inch (26mm) or less.
	Clean built-up dirt from the inside of the scrub brush housing.	
	Remove any string wrapped around the scrub brush, drive hub and idler hub.	
	Remove both the scrub brushes and rotate, turn end for end. See the ***Scrub Brush Removal and Installation*** section.	

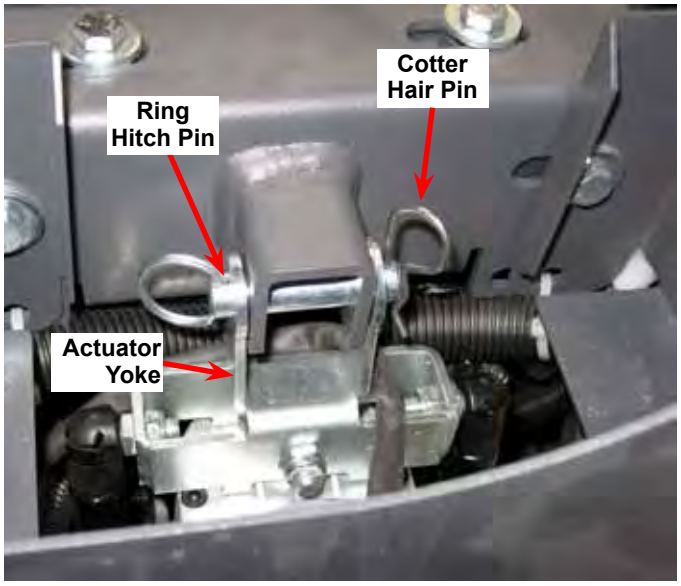
Scrub Brush Lift Actuator Removal

1. Turn the Key Switch on and lower the scrub deck.

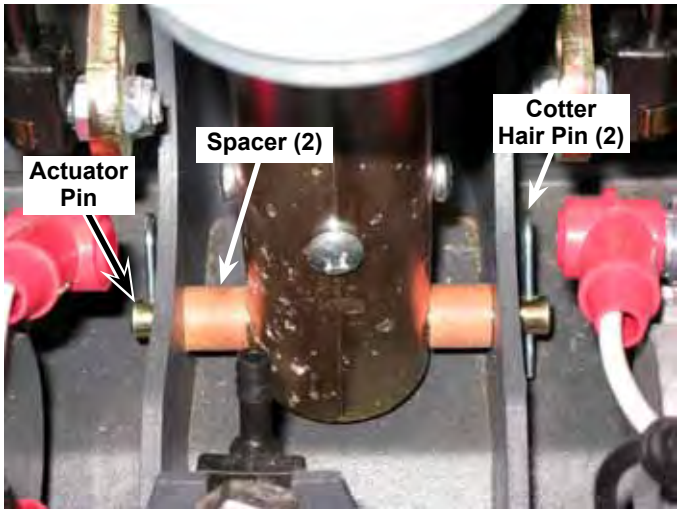
Note: *If the lift actuator motor will not run, go to step 4 and shim up the brush deck to remove the weight on the pins holding the actuator.*

2. Lift up and remove the cover and nose cone from the front of the machine.
3. Disconnect the electrical connector from the deck actuator motor to prevent the deck from rising once the Key Switch is turned off.
4. Turn the Key Switch off and disconnect the battery pack.
5. Remove the debris hopper from the scrub deck.
6. Disconnect and remove the detergent cartridge from the machine.
7. Remove the Cotter Hair Pin and Ring Hitch Pin holding the Actuator Yoke to the actuator bracket weldment.

Note: *Carefully lift up on the scrub deck if necessary to take pressure off of the Ring Hitch Pin.*



8. Remove the Cotter Hair Pin from one side of the Actuator Pin, then remove the Actuator Pin and the two Spacers from the deck weldment and Actuator Tube.

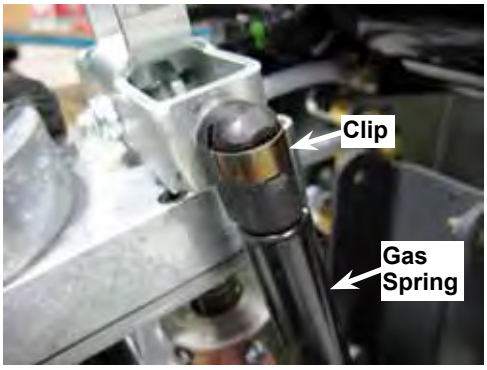


Service Tip: *It is important that the actuator motor is not run or the actuator is not rotated while it is disconnected from the deck or chassis mounts. This precaution will prevent the actuator drive nut from getting out of adjustment (moved out of its set specification).*

9. Remove the Clips holding the Gas Springs to the Actuator Yoke, then remove the actuator assembly from the machine.

**See Important Service Note below.*

10. Reinstall in reverse order.



****Important Service Note:***

After removing any actuator motor and before installing a new motor or drive nut, the IN and OUT limit switches must be set (or checked) to their correct specifications. Refer to the ***Electrical System/Actuator Drive Nut Adjustment*** *section and follow the instructions before replacing the actuator motor.*

After setting the correct actuator nut adjustments for the scrub brush lift motor, follow removal steps in reverse order to reassemble.

Scrub Brush Removal and Installation

1. Make sure the deck is raised, then turn the Key Switch off and disconnect the battery pack.
2. See Figure 8. Loosen the black knobs (one on each side) that secure the removable bearing Idler Support Plate Assembly **(9)** to the brush housing, then pull the plates down and out to remove. Grip the scrub brush and slide it from the housing end.
3. To install the brush, slide it into the housing, lift slightly, push and turn until it seats into the drive end assembly.
4. Reinstall the Idler Support Plate Assembly.

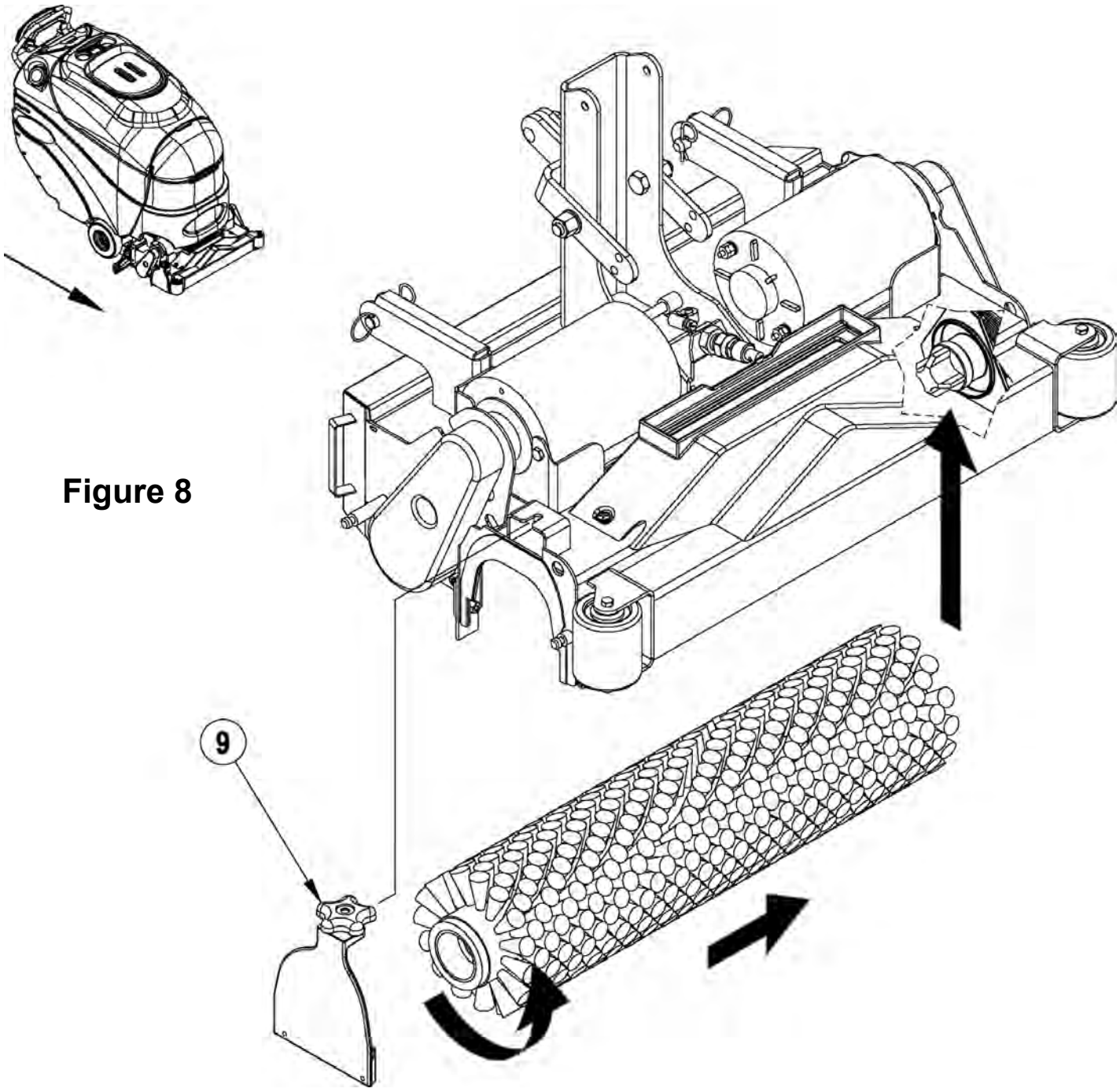


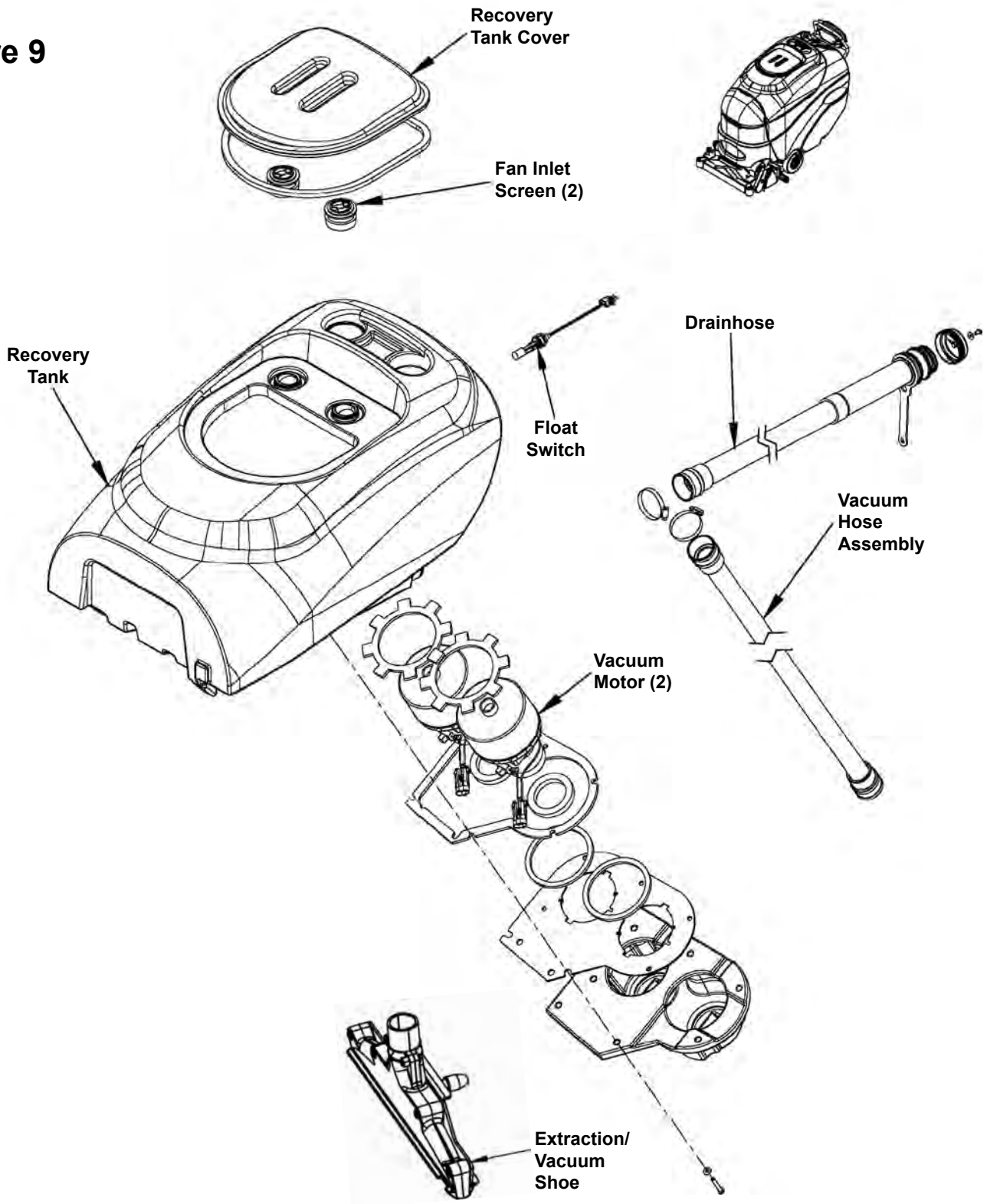
Figure 8

Recovery System

Functional Overview

See Figure 9. Dirt and water are lifted off the floor into the recovery tank by airflow created by two three-stage 24V Vacuum Motors.

Figure 9



The wastewater and air enter the vacuum system through the extraction/vacuum shoe assemblies. The air and wastewater move through the vacuum hoses at high speed until they reach the recovery tank.

Once the air and wastewater reach the recovery tank, the air slows down because of the increased volume (large size) of tank. With the decreased airspeed, the heavier water falls to the bottom of the recovery tank. The airflow then continues through the tank, vacuum fan inlet screens and vacuum motors, then is exhausted out of vacuum exhaust acoustic foam. No wastewater ever actually moves through the vacuum motors, just the working air.

The vacuum system uses a float switch to prevent the tank from being overfilled and stops any water from being sucked into the vacuum motors.

Vacuum Motor Control Circuit Overview (Auto Mode)

See Figure 10.

Contactors K2 and K3 supply positive voltage to Vacuum Motors M6 and M7 respectively. M6 and M7 get their negative ground from negative battery terminal SP2. Float Switch S2 must be open to prevent the Recover Tank Full Sense terminal (J3-5) on A1 from connecting to ground.

+ (Positive) Circuit input starts with:

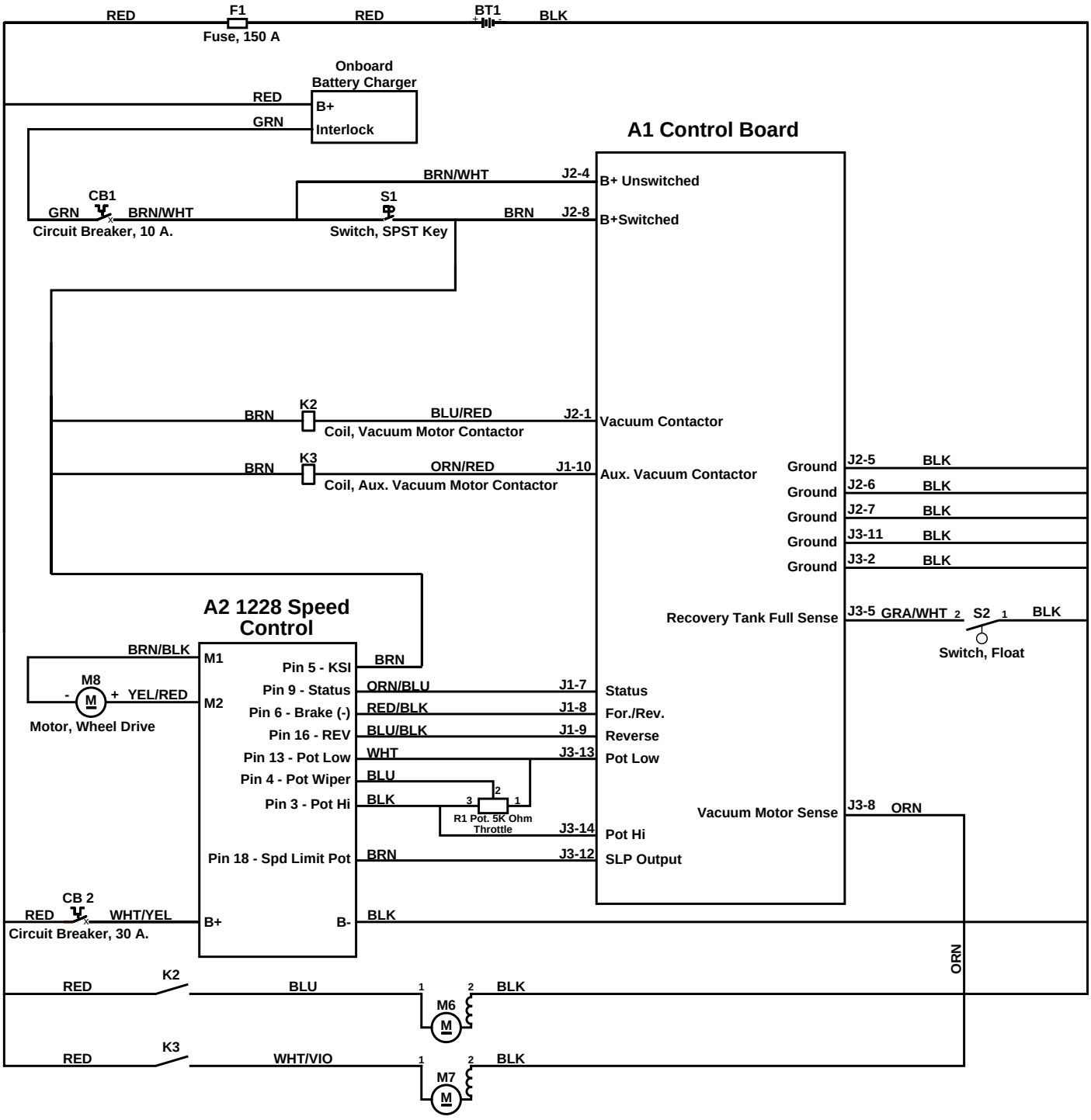
- A closed S1 Key Switch that supplies the needed positive voltage to the K2 vacuum motor contactor (BLU/RED wire), the K3 auxiliary vacuum motor contactor, pin #5 - KSI (BRN wire) on the A2 Speed Controller and pin #J2-8 (BRN wire) on the A1 Control Board. Note that the A1 control board scrub-on button must also be depressed (enabled). This operator command lowers the brush deck.
- Once the K2 and K3 loads are closed, the needed positive voltage is supplied to motors M6 (BLU wire) and M7 (WHT/VIO wire) from the battery post.

- (Negative) circuit input starts with:

- Battery negative ground inputs at the A1 control board and at the A2 speed controller terminal B-.
- A negative voltage output from the A2 speed controller pin #6 - Brake (-) to the A1 control board pin J1-8 For./Rev. (RED/BLK wire) Note that the A2 speed control brake negative output (pin #6) occurs whenever the R1 direction throttle pot is moved off its neutral setting. This operator command happens when the drive paddle is pushed or pulled to run the wheel drive motor in forward or reverse with the vacuum enabled.
- The recovery tank float switch (S2) must be open to prevent negative input to the Recover Tank Full Sense terminal (J3-5) on A1. This allows negative voltage output from the A1 board terminals J2-1 (BLU/RED wire) and J1-10 (ORN/RED wire) to complete the K2 and K3 solenoid coil circuits (positive and negative) and pull in the solenoid load contacts making the vacuum motors run.

Note: *Refer to Figure 11 for an illustration of the float switch configuration.*

Figure 10


RED
F1
Fuse, 150 A
RED
BT1
BLK
Onboard
Battery Charger
RED
B+
GRN
Interlock
A1 Control Board
BRN/WHT
J2-4
B+ Unswitched
CB1
GRN
BRN/WHT
Circuit Breaker, 10 A.
S1
Switch, SPST Key
BRN
J2-8
B+Switched
BRN
K2
BLU/RED
J2-1
Vacuum Contactor
Coil, Vacuum Motor Contactor
BRN
K3
ORN/RED
J1-10
Aux. Vacuum Contactor
Coil, Aux. Vacuum Motor Contactor
Ground
J2-5
BLK
Ground
J2-6
BLK
Ground
J2-7
BLK
Ground
J3-11
BLK
Ground
J3-2
BLK
A2 1228 Speed
Control
Recovery Tank Full Sense
J3-5
GRA/WHT
S2
BLK
Switch, Float
BRN/BLK
M1
Pin 5 - KSI
BRN
M8
YEL/RED
M2
Pin 9 - Status
ORN/BLU
J1-7
Status
Motor, Wheel Drive
Pin 6 - Brake (-)
RED/BLK
J1-8
For./Rev.
Pin 16 - REV
BLU/BLK
J1-9
Reverse
Pin 13 - Pot Low
WHT
J3-13
Pot Low
Pin 4 - Pot Wiper
BLU
Pin 3 - Pot Hi
BLK
R1 Pot. 5K Ohm
Throttle
Vacuum Motor Sense
J3-8
ORN
J3-14
Pot Hi
Pin 18 - Spd Limit Pot
BRN
J3-12
SLP Output
CB 2
RED
WHT/YEL
Circuit Breaker, 30 A.
B+
B-
BLK
ORN
K2
RED
BLU
BLK
M6
K3
RED
WHT/VIO
BLK
M7

Vacuum / Recovery System Service Maintenance Checklist

Whenever there is a vacuum problem, it's best to check over the entire system. Use the checklist below as a guide, to thoroughly check the vacuum system.

- ☐ Inspect and clean the vacuum motor float switch.
- ☐ Inspect the vacuum motor inlet screens and clean any built-up debris from the screens.
- ☐ Clean built-up dirt from the vacuum shoes.
- ☐ Clean built-up dirt from the vacuum hoses to the vacuum shoes.
- ☐ Inspect the hoses between the vacuum shoes and the recovery tank and rinse any built-up dirt from the hose. Replace the hose if it is kinked or damaged.
- ☐ Inspect and make sure the gasket on the recovery tank cover is sealing and not damaged.
- ☐ Make sure that the recovery tank drain hose cap seals airtight.

Troubleshooting Guide

When the vacuum system performs poorly, it is usually because of one of the following problems:

Vacuum Leaks

Vacuum leaks are caused by air flowing into the vacuum system past a bad gasket or leaky hose, damaged tank or a leaky drain valve. A vacuum leak below the waterline will create turbulence in the recovery tank, causing water to enter the vacuum motors.

Restrictions

Restrictions are anything that blocks the flow of air through the system. Restrictions may also be caused by built-up debris in the vacuum shoes, vacuum hoses or vacuum motor inlet screens, or wherever the airflow is forced to make a sharp turn.

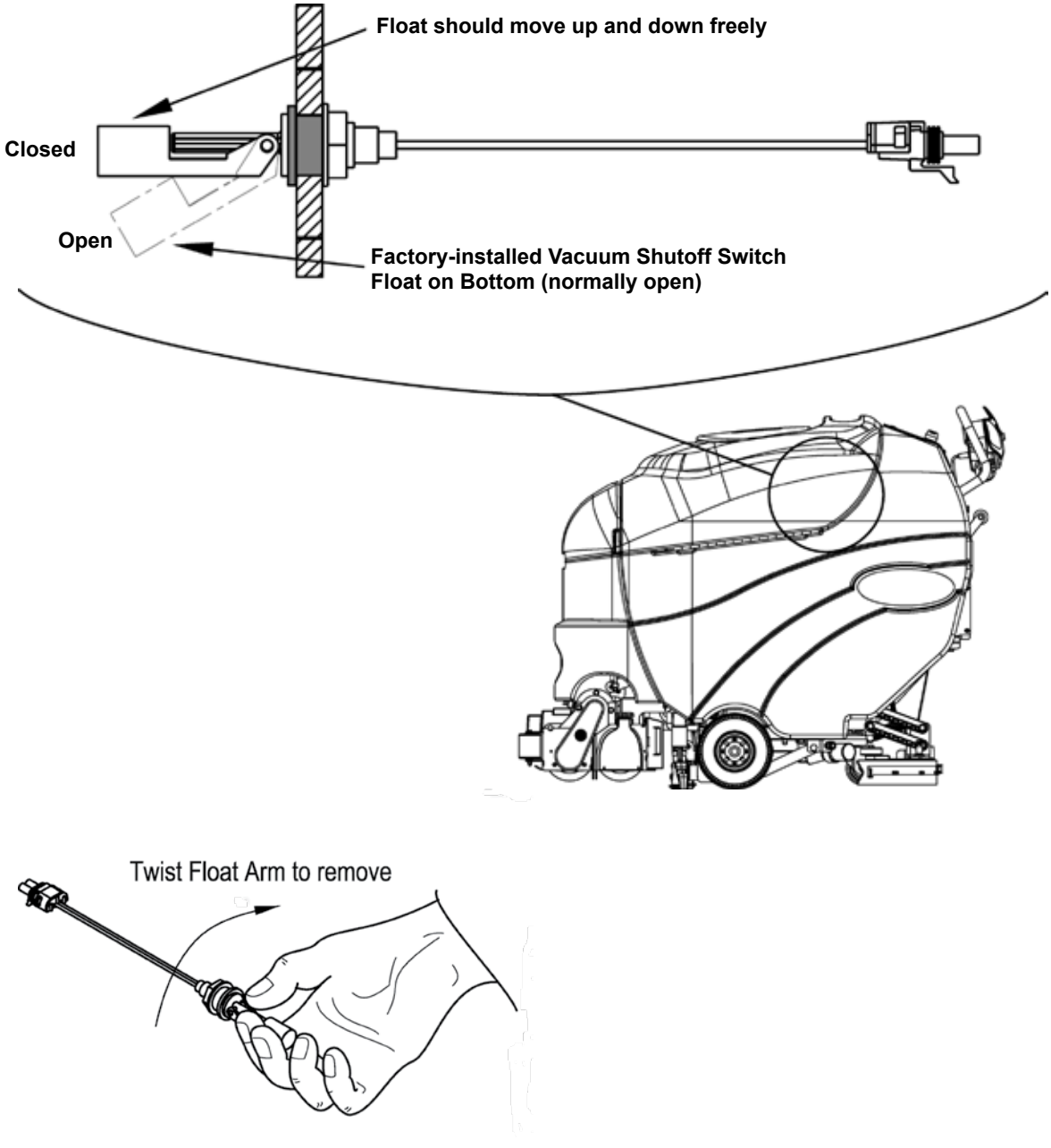
Both leaks and restrictions decrease the quantity of air flowing through the vacuum shoes. The air that does go through the vacuum shoes moves slower, so it has less suction (water lift performance).

Maintenance of Recovery Tank Float Switch

See Figure 11. If the recovery tank float switch becomes dirty it can impair its operation. A dirty vacuum shutoff switch can cause the vacuum motors to not function at all, or not shut off when the tank is full.

If daily rinsing of the recovery tank is not adequate to keep the switch clean, you may need to remove the float arm for cleaning. The float arm can be removed easily by grasping it as shown below and twisting to remove. It is very important that it be reassembled correctly in order to function. See Figure 11 for the correct orientation of the switch float arm.

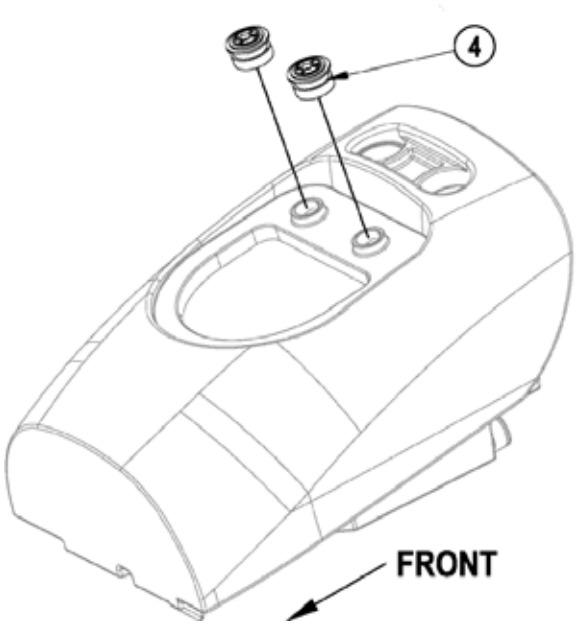
Figure 11



Maintenance of the Vacuum Motor Inlet Screens

The two Vacuum Motor Inlet Screens **(4)** should be cleaned on a daily basis. DO NOT run water down the screens in an attempt to clean them. If you do this you will be running water directly into the vacuum motors. Remove the Screens (4) from the machine to clean them, then reinstall.

Figure 12



Spray Nozzle Maintenance

Remove the spray nozzles once a week. Soak the nozzles overnight in a vinegar and water solution to remove any chemical deposits.

Vacuum Shoe Maintenance

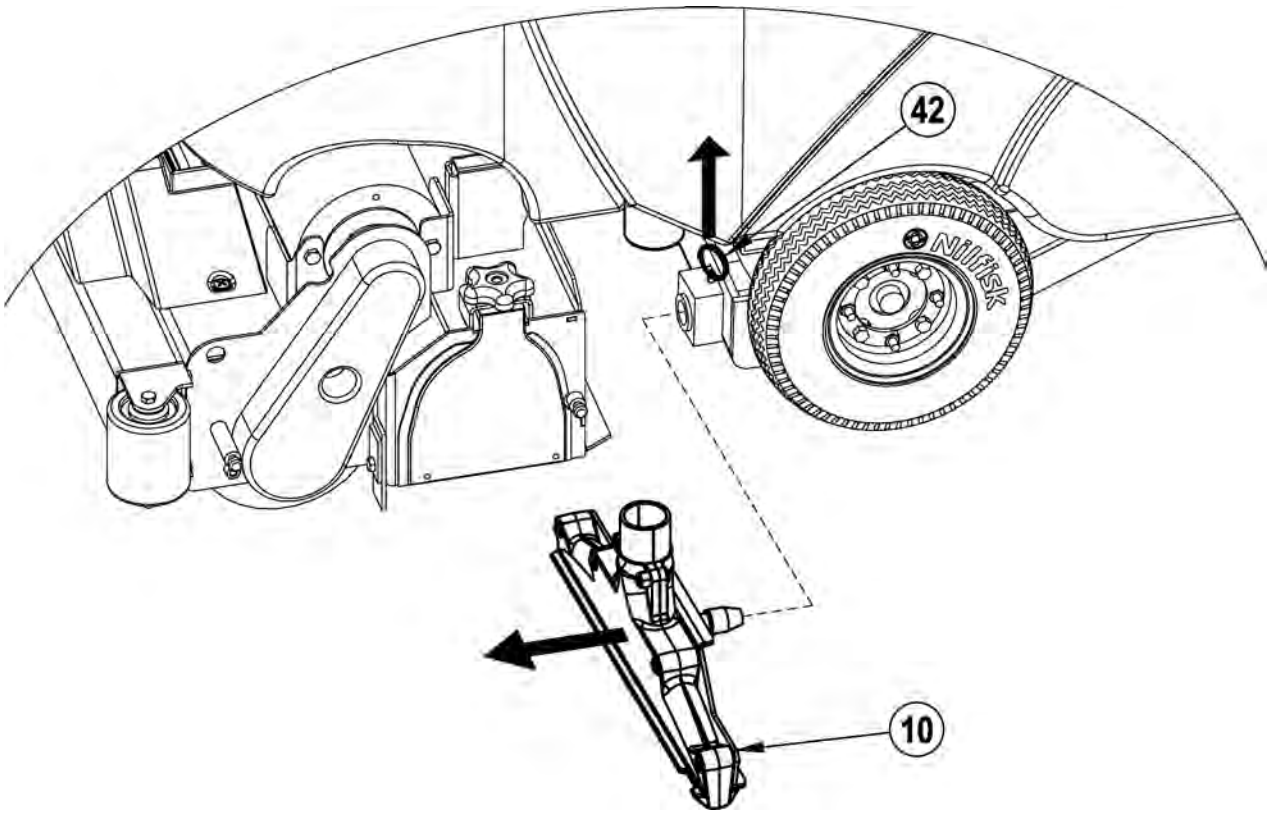
Check the vacuum shoes daily. Remove any built-up string, hair or carpet fibers. To remove:

1. Press the red Scrub OFF Switch **(H)**. Turn the master Key Switch **(A)** off.
2. Remove the Debris Hopper **(29)**.

Note: *Remove the left side shoe first to allow clearance for the right side shoe to slide out.*

3. See Figure 13. Disconnect the Vacuum Hoses from the Vacuum Shoes **(10)**.
4. Pull up on the Ring **(42)** and hold up while pulling the Vacuum Shoe forward, then out of the machine.
5. Repeat steps 3 and 4 for the right side Vacuum Shoe.
6. Follow the above steps in reverse order to reassemble.

Figure 13



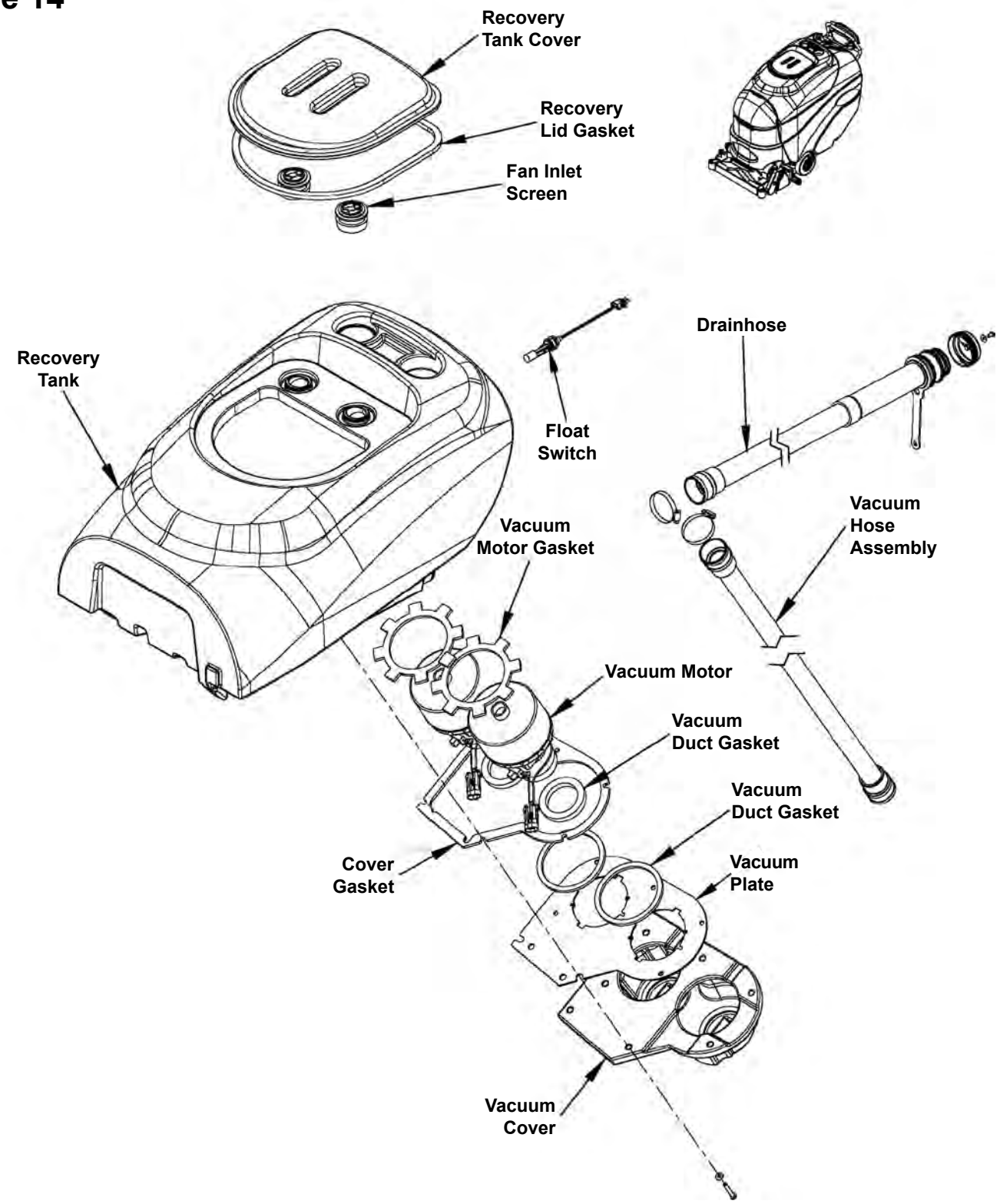
Vacuum Motor Removal

1. Drain the recovery tank using the drain hose.
2. Turn the key off and disconnect the battery pack.
3. See Figure 14. Swing open the Recovery Tank and remove the Vacuum Cover (seven screws and washers).
4. Disconnect the vacuum motor electrical connectors from the harness connectors. Note that you may need to cut wire ties to do this.
5. Carefully remove the Vacuum Plate, then remove the Vacuum Motor(s) from the machine.
6. Inspect the condition of the Vacuum Duct Gaskets, the Vacuum Motor Gaskets on the top of the Vacuum Motors, and the Cover Gasket on the Vacuum Plate. Replace any worn or damaged gaskets as necessary.
7. Make service repairs to the Vacuum Motor(s) as required, then reinstall the Vacuum Motors by following the above steps in reverse order.

Recovery Tank Removal

1. Remove the Vacuum Motors as described in the ***Vacuum Motor Removal*** section above.
2. See Figure 14. Disconnect the Recovery Tank Float Switch.
3. Disconnect the Drain Hose and Vacuum Hose Assembly from the Recovery Tank.
4. Remove the screw and tank cable and allow the Recovery Tank to swing down to the side of the battery compartment box.
5. Support the Recovery Tank and remove the three screws that attach the Tank to the hinge.
6. Carefully lift the Recovery Tank free from the machine.
7. Reinstall the Recovery Tank by following the above steps in reverse order.

Figure 14


Recovery Tank Cover
Recovery Lid Gasket
Fan Inlet Screen
Recovery Tank
Float Switch
Drainhose
Vacuum Hose Assembly
Vacuum Motor Gasket
Vacuum Motor
Vacuum Duct Gasket
Vacuum Duct Gasket
Cover Gasket
Vacuum Plate
Vacuum Cover

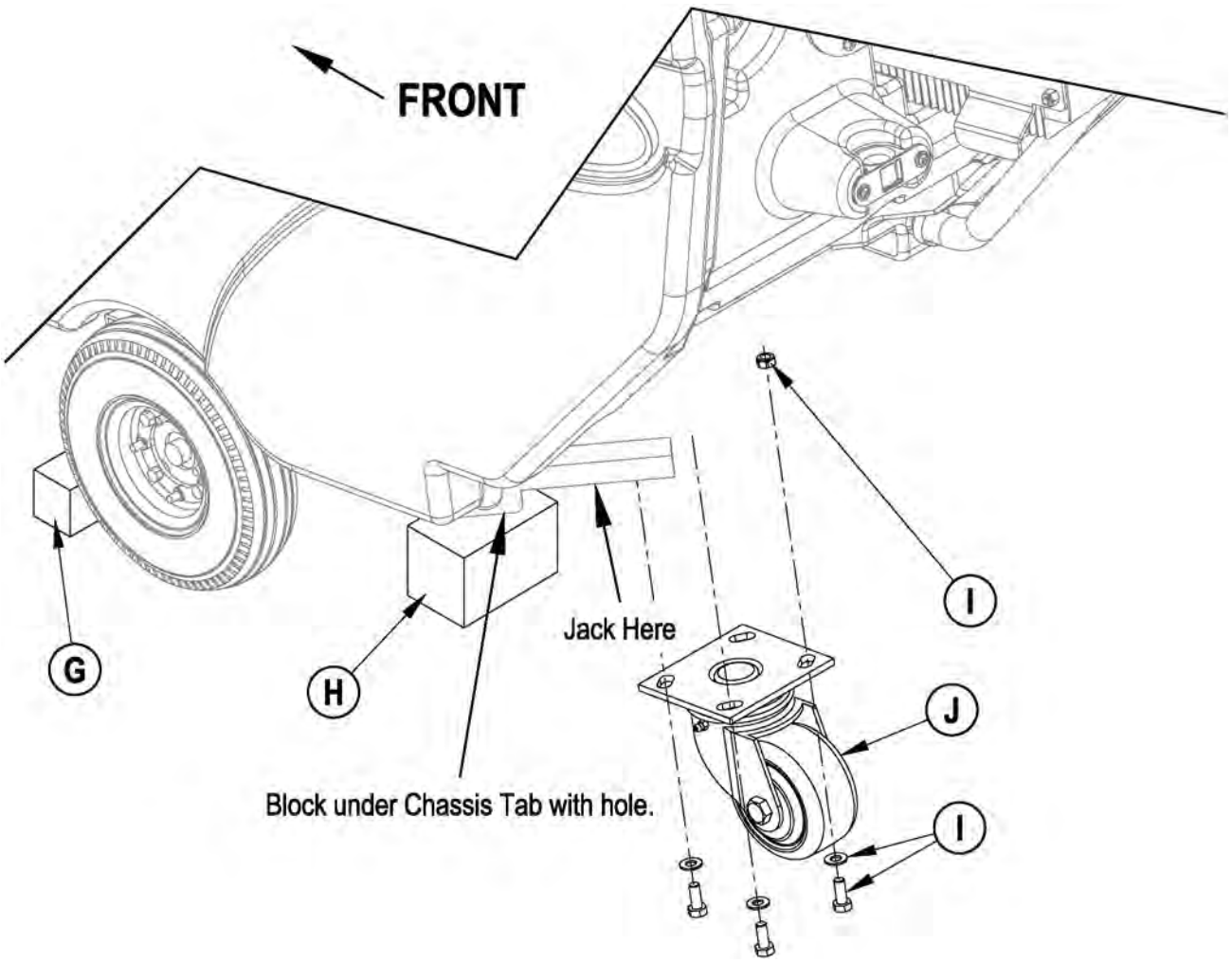
Caster Wheel Removal

Warning! Disconnect the battery pack connector before servicing machine.

Warning! Never work under machine without safety stands or blocking to support the machine.

1. Drain both the solution and recovery tanks.
2. Have the scrub deck in the up (stored) position with the scrub brushes installed.
3. See Figure 15. Place Wood Blocking **(G)** in front of the drive wheels to prevent the machine from rolling.
4. Jack the machine in the location shown until the caster wheel is approximately 1" off the ground.
5. Place Blocking **(H)** under the chassis tab as shown.
6. Remove the four Screws, Nuts and Washers **(I)** then remove the Caster Assembly **(J)**.
7. Reinstall in reverse order.

Figure 15

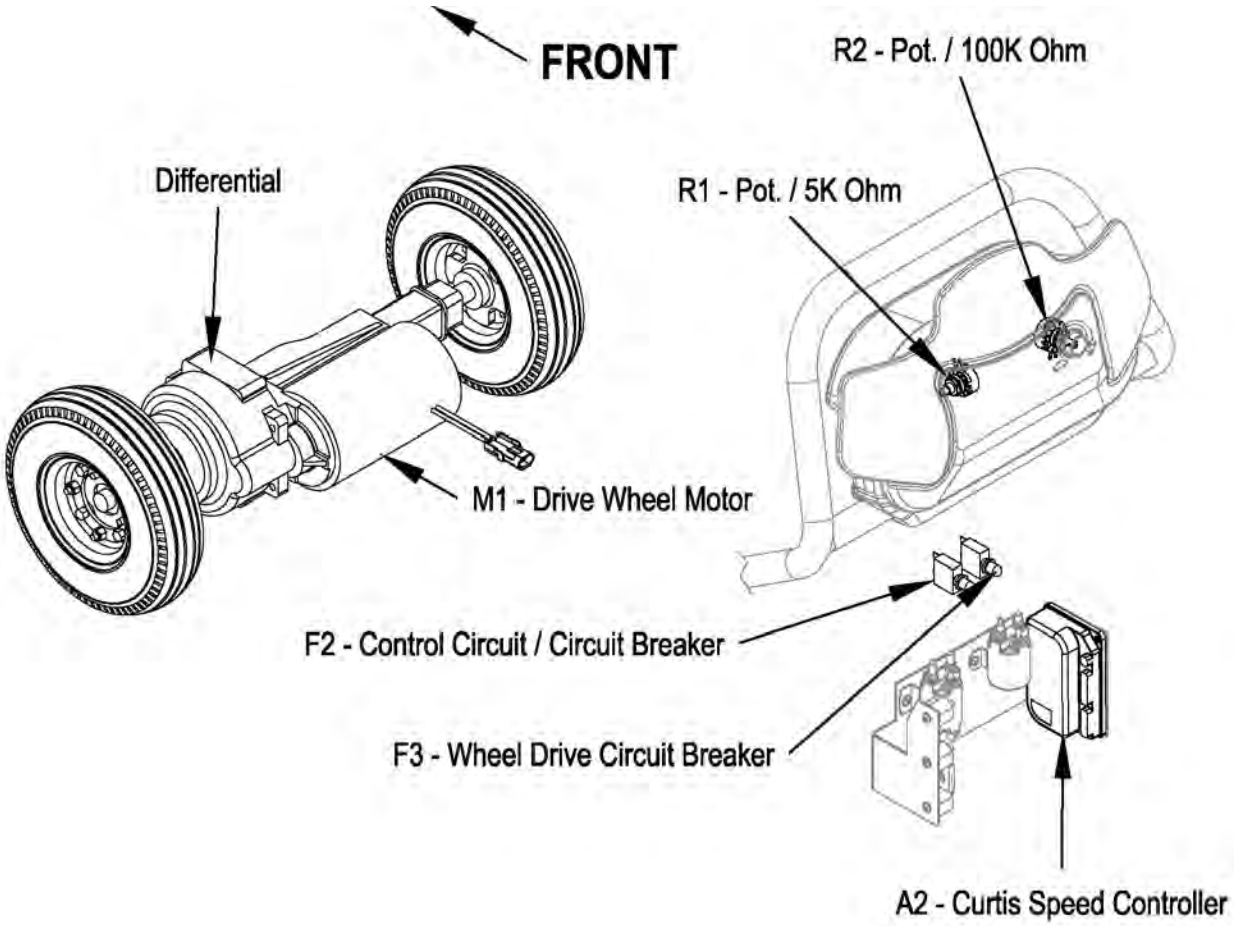


Wheel Drive System

General Functional Overview

See Figures 16 and 17. A 300-watt (.4 HP) permanent magnet (24V) motor transaxle (M8) is used for the wheel drive on all machines. A Curtis PMC solid-state speed controller (A2) regulates the variable speed and Forward/Reverse wheel drive motor functions. Location of the controller is in the rear handle housing electrical compartment (accessible by removing the four screws securing the rear electrical panel). The potentiometer R1 mounted inside the drive paddle inputs to the A2 controller the machine operator's throttle (variable speed) and direction demands. A second pot R2 (knob adjusted) is located on the outside of the paddle cover and controls the machine's maximum transport and scrub speeds.

Figure 16



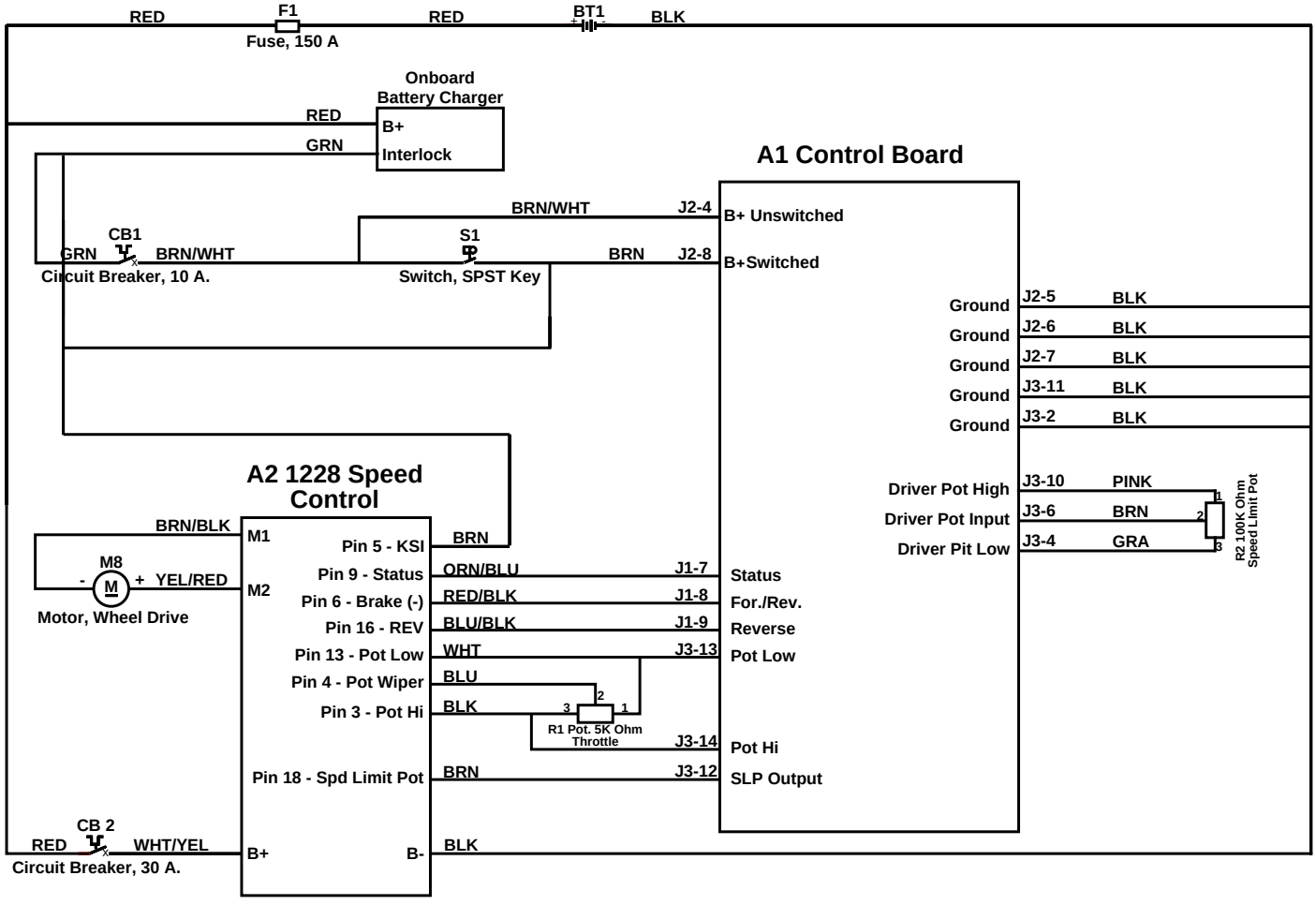
Drive Motor System Function

See Figures 17 and 18. With the Key Switch S1 closed, the BRN wire inputs 24V to the A2 speed controller (pin 5-KSI) to make its internal control circuits operational (powering it up). The CB2 circuit breaker (30-Amp) supplies the positive load circuit voltage input to the B+ controller terminal (WHT/YEL wire). The black wire from the battery negative standoff supplies the negative input to the B- controller terminal.

Moving the 5K Ohm R1 pot off its centered balanced neutral setting of approximately 2500 Ohms, activates the operator input to the speed control. Forward or Reverse movement of the drive paddle rotates the pot shaft, and the pot's variable resistance values are changed which generates the internal voltage signals (0-5 Volts) needed for the controller's output operation. These control board voltage input signals are what energizes the Forward and Reverse directional relays, which then select the motor polarity and final voltage level outputs at the M1 and M2 terminals.

When the operator turns the R2 speed limit Pot from min. to max. (CW) this causes an input resistance relationship change between the pot high (+) and wiper terminals (high to low Ohms), thus increasing the maximum wheel motor operating speed range. Turning the knob (CCW) increases the resistance and the motor speed range is reduced.

Figure 17



Electrical Diagram

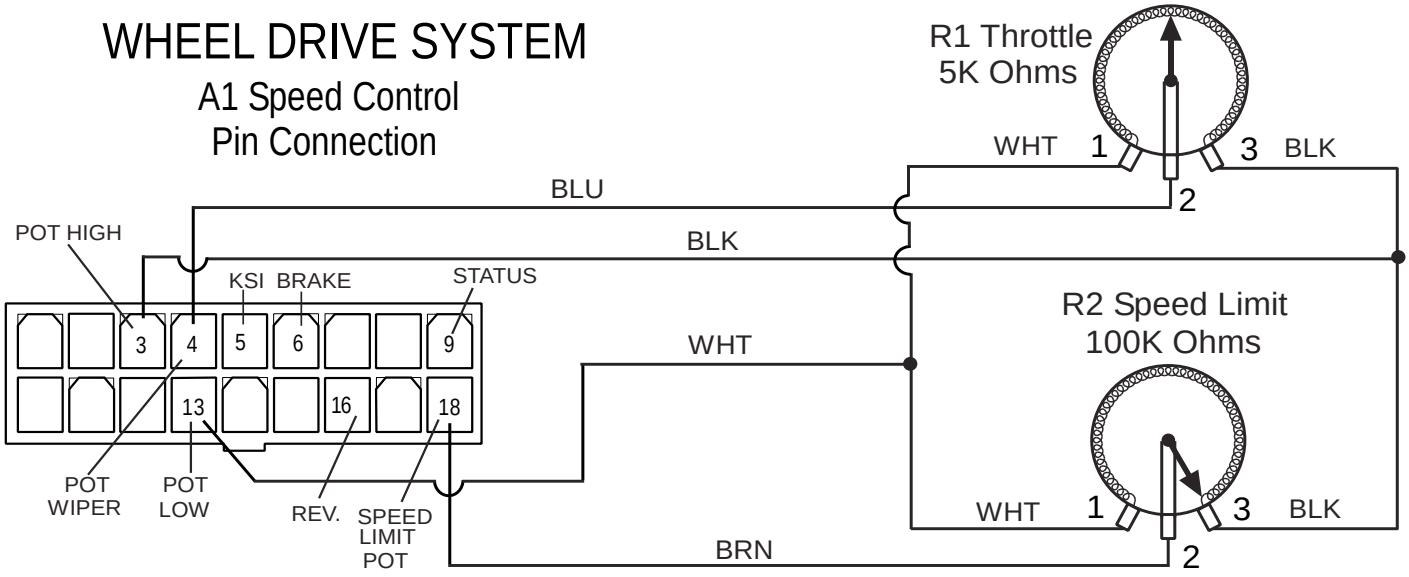
*For a complete description of all callouts see the ***Electrical Wiring Diagram/Schematic***.

A1 Speed Control Pin Connections

R2 Voltage Values
0V -= Minimum Speed
5V = Maximum Speed

R1 Voltage Values
2.5V - 5V Forward
0 - 2.5V Reverse

Figure 18



This drawing shows additional controller input circuit detail. The R2 pot is shown at the Max speed setting and the R1 pot in neutral.

Low Current A1 Speed Control Pin Key Detail

Pin #	Wire Color	Controller Description and Function
1	-	Open - not used
2	-	Open - not used
3	Black	Throttle Pot R1 pot high input
4	Blue	Throttle Pot R1 pot wiper input
5	Brown	KSI (key switch input): Battery (+) powers up controller logic circuits
6	Red/Black	Auxiliary Driver: Battery (-) output to main controller (E1) to turn on (activate) all auto scrub functions
7	-	Open - not used
8	-	Open - not used
9	Orange/ Blue	Status Fault: Speed controller fault output to main control panel fault indicator light (accessory wand)
10	-	Open - not used
11	-	Open - not used
12	-	Open - not used
13	White	Throttle Pot R1 pot low input
14	-	Open - not used
15	-	Open - not used
16	Blue/Black	Rev/Alarm Driver output Battery (-) command turns off solution valve(s)
17	-	Open - not used
18	Brown	Speed limit pot input connection

Wheel Drive Troubleshooting Guide

Problem	Possible Cause
Wheel drive motor will not run in forward and reverse.	• Wheel Drive Motor Circuit Breaker (CB2) tripped - reset 30A circuit breaker • Control Circuit Circuit Breaker (CB1) tripped - reset circuit breaker • Defective Wheel Drive Motor - replace motor • Defective Throttle Potentiometer (R1) - replace *
Wheel drive in one direction only, loss of either forward or reverse.	• Test the Forward and Reverse (R1) wiring outputs (pins 3, 4 and 13) at the speed control for an open. • Repair wiring or replace the R1 pot. • Controller can't change electrical polarity to wheel motor - replace the (A1) speed control.
Display LED panel shows an error 03 fault code.	• Speed controller has sensed an operation error code fault. (See the ***Status LED Fault Codes -Table 1*** in the ***Electrical*** *section*.)

* = See the ***Curtis Controller Diagnostics*** section.

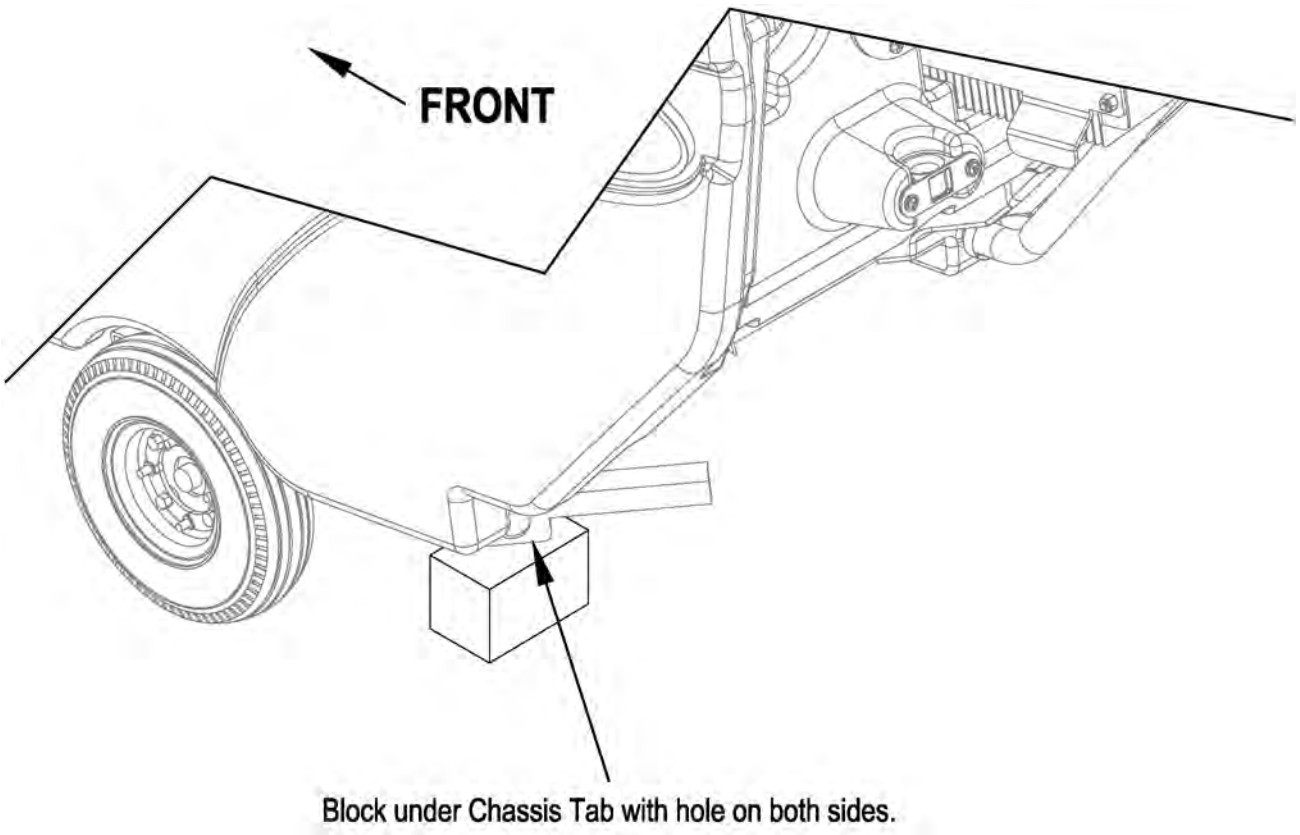
Drive Motor Transaxle Removal

Warning! Disconnect the battery pack before servicing machine.

Warning! Never work under machine without safety stands or blocking to support the machine.

1. Drain both the solution and recovery tanks.
2. Remove the Scrub deck by following the ***Scrub Brush Deck Removal*** instructions in this manual.
3. Block the rear of the machine. See Figure 19 for correct placement of the wood blocking.

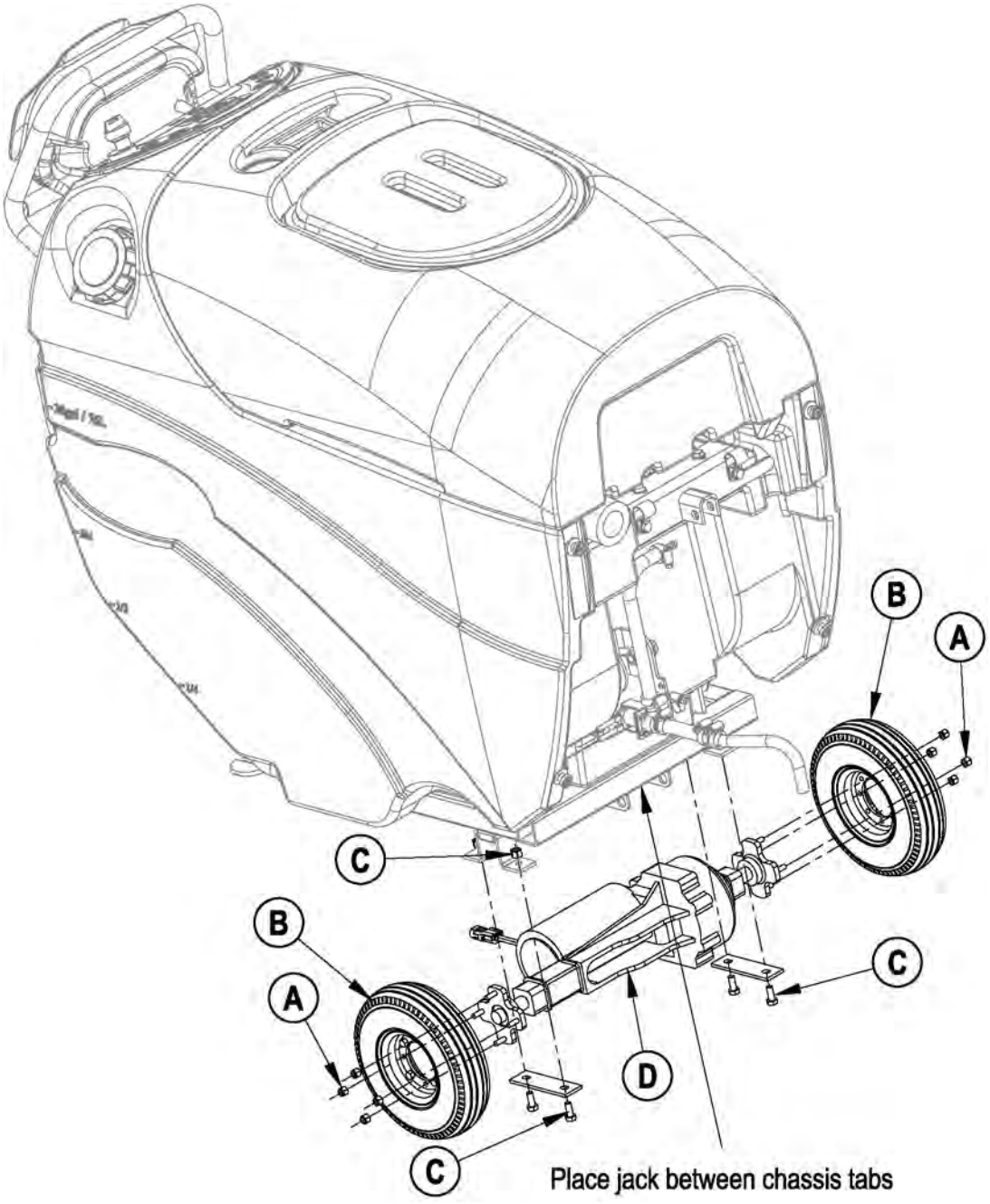
Figure 19



Drive Motor Transaxle Removal (continued)

1. See Figure 20. Jack the front of the machine from this location until the drive wheels are approximately 1” off the ground.
2. Remove the eight Locknuts **(A)** and then remove the two Drive Wheels **(B)** from the transaxle.
3. Disconnect the drive motor wiring connector.
4. Remove the four Motor Mount Bolts and Nuts **(C)** and carefully slide the Motor Transaxle **(D)** away from the machine.
5. Reinstall the transaxle by following the above steps in reverse order.

Figure 20



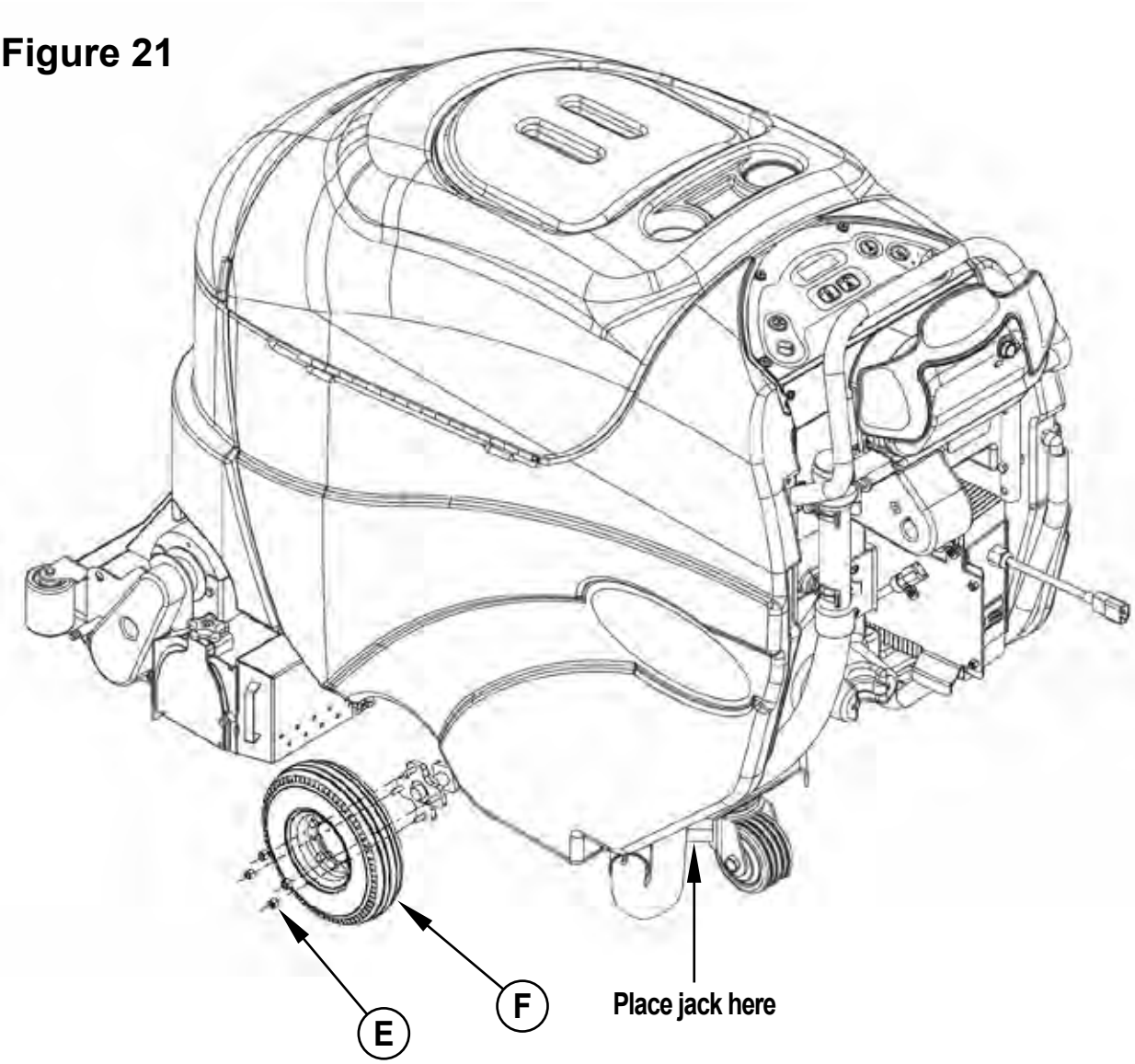
Drive Wheel Removal

Warning! Disconnect the battery pack before servicing machine.

Warning! Never work under machine without safety stands or blocking to support the machine.

1. Place wood blocking in front and rear of the opposite drive wheel that you are removing to prevent the machine from rolling.
2. Using a scissors jack, raise the machine until the wheel is off the ground. See Figure 21 for jack placement.
3. Remove the four Locknuts **(E)** and the Drive Wheel **(F)**.
4. Reinstall the Drive Wheel by following the above steps in reverse order.

Figure 21



5K Directional/Throttle Potentiometer (R1)

Warning! Disconnect the battery pack before servicing machine.

Testing the 5K Directional/Throttle Potentiometer R1

Note: *The potentiometer (pot) doesn't have to be removed from its housing mount to test.*

1. See Figure 22. Remove the front Drive Paddle Cover **(G)** from the Rear Housing **(H)** held together with four Screws (I) . Note the cover will have the speed limiting Pot **(R2)** mounted to it, observe the three wires and separate them to complete the removal of the cover.
2. See Figure 23. Observe the three wires connected to the **R1** pot and disconnect. Note the wire numbers and/or colors and their terminal connections for reassembly.
3. Test the Pot **(R1)** using an ohmmeter. The potentiometer specification is 5K Ohms. Connect the meter leads to each of the outside connections (**3 High** and **1 Low**, shown in Figure 23) on the pot. It should read approximately 5,000 ohms (range 4,500-5,500 ohms).
4. Take the **3 High** pot connection test lead and connect to the middle connection (**2 Wiper**), then push and pull the rear cover to turn the shaft in both directions. The readings should be approximately half the total resistance (2,500 ohms) toward 5,000 ohms and 2,500 ohms toward 0 ohms. Example "A": total resistance of pot 4,840 ohms (**3 High**/**1 Low**) test connections. Example "B": test middle connection (**2 Wiper**) and outside rear (**1 Low**) Forward reading 2,420 ohms to 4,700 ohms, Reverse 2,420 ohms to 230 ohms.
5. **Testing Summary:** The above tests are to show the increase and decrease of the pot through its working range. If you do not get similar readings, replace the Potentiometer **(R1)**.

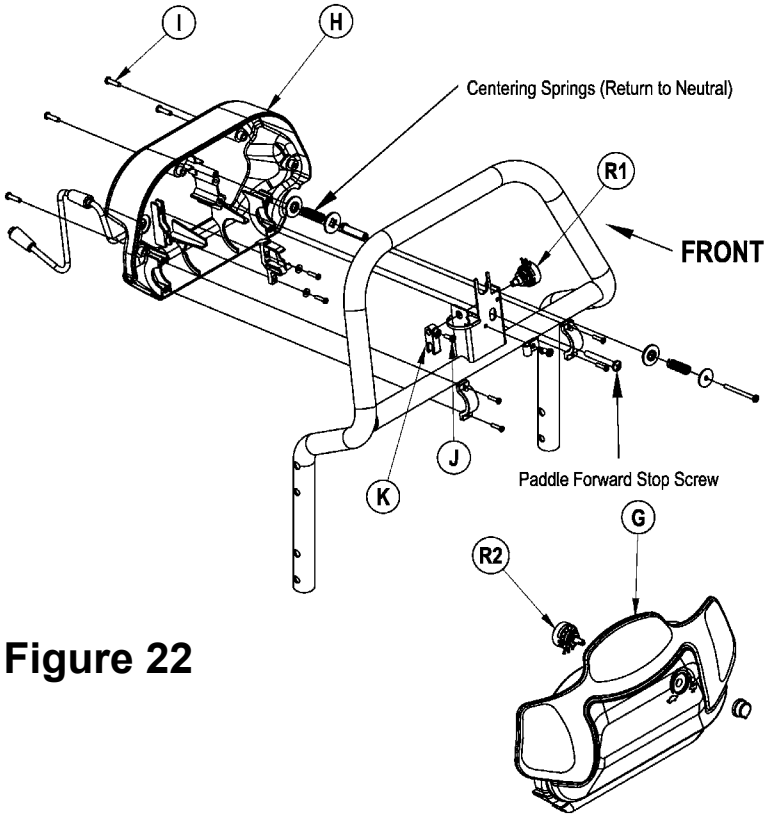
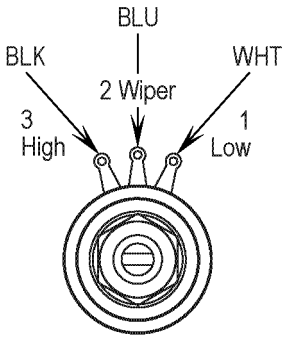


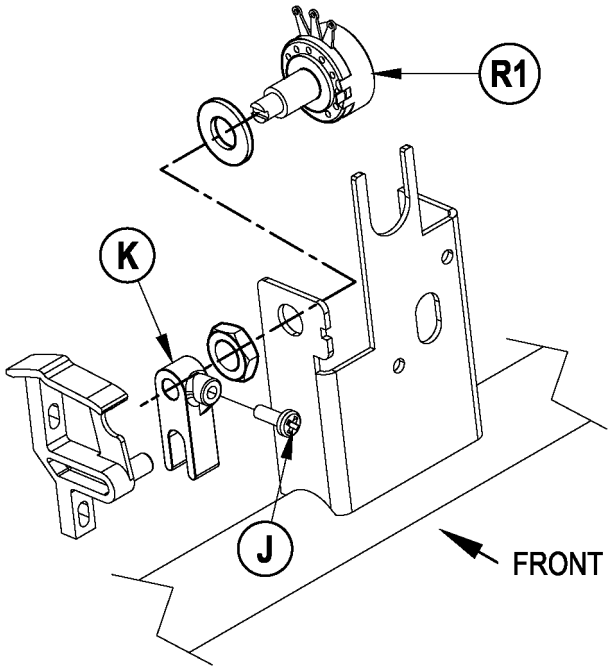
Figure 22

Figure 23



Removing the R1 5K Potentiometer

Figure 24



1. See Figure 24. Loosen the pot shaft anchor nut and spin it to the end of the shaft.
2. Back out the Screw **(J)** from the pot Fork **(K)**.
3. Maneuver the pot **(R1)** out from its mounting bracket hole and separate the Fork **(K)** from the shaft end.
4. Finish removing the anchor nut from the end of the pot, then remove the pot completely from the handle mount.
5. To reinstall a potentiometer, see the following ***Installing and Adjusting the R1 5K Potentiometer*** section below.

Installing and Adjusting the R1 5K Potentiometer

Warning!

The potentiometer adjustment sets the drive paddle for neutral drive motor operation. If the potentiometer is not adjusted correctly, the machine will not move either forward or reverse with normal operator input, and the LED display panel will indicate a speed control system fault 03.

1. See Figure 24. Install the lock washer (on pot side), pot and anchor nut to the handle mount bracket as shown.

Note: *Do not completely tighten the anchor nut at this time.*

2. Connect ohmmeter leads to the middle terminal (**2 Wiper**) and the (**1 Low**) outside terminal (see Figure 23). Then preset, turn the shaft to approximately 2,500 ohms.
3. Install the Fork **(K)** onto the pot shaft and tighten the Screw **(J)**.
4. Without turning the pot shaft, thread the anchor nut just enough to seat the pot to its mounting bracket.
5. Reconnect the ohmmeter test leads to the pot wiper and low terminal connections, then adjust (turn the pot) to obtain half of pot's total resistance. This will accurately set the true neutral drive paddle operator position.
6. Tighten the anchor nut securely.

Note: *Do not turn the potentiometer shaft when tightening.*

7. Reattach all the wiring to both the pots and reinstall the cover.
8. Reconnect the battery connector, turn the key switch on and test the drive system for correct Forward and Reverse operations.

Note: *The covers outside mounted speed limit knob should be turned to the full speed position for testing. If the display panel shows the 03 fault code, the Potentiometers are either not wired correctly or the R1 pot is not set to its neutral setting.*

100K Potentiometer (R2)

Warning! Disconnect the battery pack before servicing machine.

Note: *The potentiometer (pot) doesn't have to be removed from the drive paddle cover to test.*

Test Procedure

1. See Figure 22. Remove the front drive paddle Cover **(G)** from the Rear Housing **(H)** held together with four Screws **(I)**. Note that the cover will have the speed limiting pot **(R2)** mounted to it.
2. Note the location of the three wires for reassembly, then disconnect the wires from the pot and remove the cover.
3. Test the **(R2)** potentiometer's resistance values using an ohmmeter as follows. Its specification is 100,000 ohms (plus or minus 10%).
   a. Connect the meter leads to each of the outside connections on the potentiometer. The meter should read approximately 100,000 ohms.
   b. Take one of the test leads and connect to the middle terminal, then turn the stem both directions. The resistance value will change (vary), increasing and decreasing through its full range of 0-100,000 ohms and 100,000-0 ohms approximately.

If you do not get similar readings, replace the potentiometer.

R2 Potentiometer Removal

1. See Figure 25. Remove the Setscrew **(L)** (1/16" wrench) and pull the Adjustment Knob **(M)** off of the pot stem.
2. Remove the pot's anchor nut (1/2 inch wrench), then remove the Pot **(R2)** from the drive paddle cover.

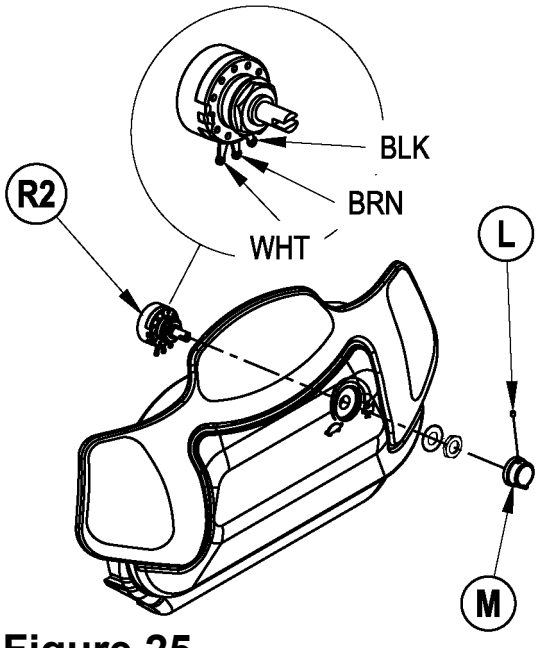


Figure 25

Electrical System

Batteries

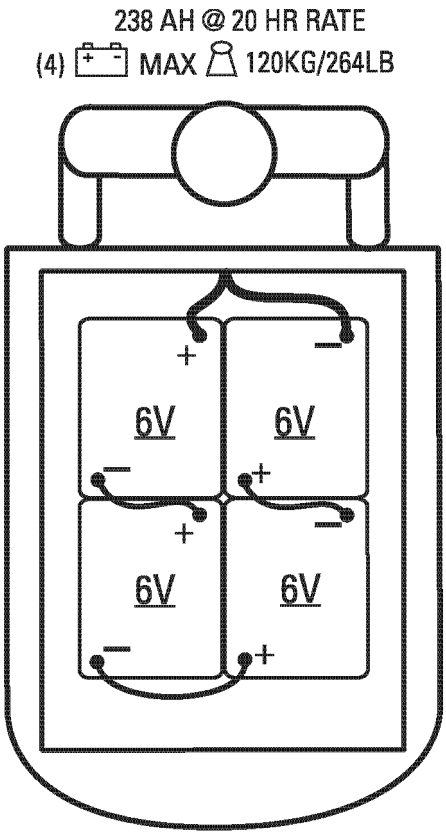


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Figure 26

If your machine shipped with batteries installed, do the following:

- Check that the batteries are connected to the machine (**17**).
- Turn on the Key Switch (**A**) and check the Battery Indicator (**D2**). If the gauge is completely filled, the batteries are ready for use. If the gauge is less than full, the batteries should be charged before use. See the ***Charging The Batteries*** section.

Important!

Important!: If your machine has an onboard battery charger, refer to the OEM product manual and confirm that the charger is set correctly for your battery type.

If your machine shipped without batteries installed do the following:

- Consult your Authorized Clarke dealer for recommended batteries.
- Install the batteries by following the instructions below.
- DO NOT install two 12-volt batteries in your machine. This affects the stability of the machine.

Note: *Refer to TSBUS2007-979 for the latest battery charger algorithms.*

Warning!

Use extreme caution when working with wet cell flooded batteries. Sulfuric acid in batteries can cause severe injury if allowed to contact the skin or eyes. Explosive hydrogen gas is vented from the batteries through openings in the battery caps. This gas can be ignited by any electrical arc, spark or flame. Do not install any lead-acid battery in a sealed container or enclosure. Hydrogen gas from overcharging must be allowed to escape.

When Servicing Batteries

- Remove all jewelry.
- Do not smoke.
- Wear safety glasses, rubber gloves and a rubber apron.
- Work in a well-ventilated area.
- Do not allow tools to touch more than one battery terminal at a time.
- ALWAYS disconnect the negative (ground) cable first when replacing batteries to prevent sparks.
- ALWAYS connect the negative cable last when installing batteries.

Caution!

Electrical components in this machine can be severely damaged if the batteries are not installed and connected correctly. A Clarke technician, a qualified electrician or the battery manufacturer should install batteries.

1. Remove the batteries from their shipping crate and carefully inspect them for cracks or other damage. If damage is evident, contact the carrier that delivered them or the battery manufacturer to file a damage claim.
2. Turn the Key Switch (**A**) off and remove the key.
3. Tip the recovery tank to the side, locked position. Remove the battery cables from inside the battery compartment.
4. Your machine comes from the factory with enough battery cables to install four 6-volt batteries. Carefully lift the batteries into the battery compartment and arrange them exactly as shown in Figure 26. Secure the batteries as close to the back of the machine as possible.
5. Install the battery cables as shown. Position the cables so the battery caps can be removed easily for battery service.
6. Carefully tighten the nut in each battery terminal until the terminal will not turn. Do not overtighten the terminals or they will be very difficult to remove for future service.
7. Coat the terminals with spray-on battery terminal coating (available at most auto parts stores).
8. Put one of the black rubber boots over each of the terminals and connect the Battery Pack Connector (**17**).

Specific Wet Cell Battery Information

Wet Cell Battery Specifications

- Use a combination of multiple 2-volt cell units to construct a 24-volt DC battery pack system.
- The battery pack capacity recommended by Clarke is a 238 AH @ 20 Hour Rate deep cycle battery system.

Note: *The battery pack must fit the battery compartment as listed in the* ***Technical Specifications****.*

Wet Cell Battery Charger Specifications

- Use a 24-volt DC output charger matching the DC battery pack voltage and the input AC line voltage supply being used.
- When selecting a battery charger always follow the recommendation of the battery supplier to match the correct charger DC output amperage to the amp/hour rating batteries being installed. This will prevent the battery pack from being over or under charged.
- The recommended 238 AH battery should be matched to a 24V, 25 Amp output charger on machines using (4) 6V batteries.

Description of the Low-voltage Cutout Feature

The Clean Track® L24 is equipped with a low-voltage cutout feature to prevent over-discharging of the batteries. When a machine's battery pack voltage falls below a specifically defined threshold (voltage setting), the scrub system is automatically shut down. This cutout level is adjustable. The standard lead acid battery (wet cell) setting is 1.72V per cell. The alternate maintenance-free battery (gel cell) setting is 1.81V per cell. The standard setting is factory selected and should be used unless the battery manufacturer specifies the higher cutout voltage.

Service Note: *On all the 24V machines, a minimum recharge voltage of 2.13 volts per cell must be reached to allow the scrub brush and solution system to (reset) function again. A 24V battery pack must increase to a 25.6-volt minimum.*

Description of the Battery Condition Indicators

The Battery Indicator (**D2**) will give an indication of the state of charge of the batteries. Five vertical bars indicate a fully-charged battery after a complete charging cycle. The Battery Indicator will retain the state-of-charge even if the key has been turned off. The state-of-charge indication is reset to full charge when the batteries have been recharged. It is also possible to choose between two different low-voltage thresholds depending on whether maintenance-free or standard batteries are being used. (Have a qualified service engineer perform this selection*.)

Note: *The following percentages are based on usable battery capacity, not total battery capacity. Therefore, 100% discharge = 80% of total battery capacity for standard wet cell batteries, or 70% of total battery capacity for maintenance free batteries.*

Explanation of Battery Indicator Lights and Voltage Ranges

Battery Indicator	Percent of Discharge	24-Volt Machines	
		Standard	Alternate
5 vertical indicator bars	Full to 50%	Full charge down to 23.8 volts	Full charge down to 23.8 volts
4 vertical indicator bars	50% to 75%	23.7 volts down to 23.6 volts	23.7 volts down to 23.6 volts
3 vertical indicator bars	75% to 90%	23.5 volts down to 23.2 volts	23.5 volts down to 23.3 volts
2 vertical indicator bars	90% to 95%	23.1 volts down to 22.5 volts	23.2 volts down to 22.9 volts
1 vertical indicator bars	95% to 99%	22.4 volts down to 21.7 volts	22.8 volts down to 22.3 volts
0 vertical indicator bars	100%	21.6 volts down to 20.6 volts	22.2 volts down to 21.8 volts

****Important Note:*** *See the **Main Control Programming Options** section and follow the instructions for changing the low-voltage cutout threshold.*

Charging Wet Batteries

Charge the batteries each time the machine is used, or when the Battery Indicator (**D2**) is reading less than full.

Warning!

- Do not fill the batteries before charging.
- Charge batteries in a well-ventilated area.
- Do not smoke while charging the batteries.

When Servicing Wet Batteries

- Remove all jewelry.
- Do not smoke.
- Wear safety glasses, rubber gloves and a rubber apron.
- Work in a well-ventilated area.
- Do not allow tools to touch more than one battery terminal at a time.
- ALWAYS disconnect the negative (ground) cable first when replacing batteries to prevent sparks.
- ALWAYS connect the negative cable last when installing batteries.

If your machine shipped with an onboard battery charger, do the following:

1. Turn the Key Switch (**A**) OFF.
2. Unwind the electrical cord from the side of the onboard charger and plug it into a properly grounded outlet. Refer to the OEM product manual for more detailed operating instructions.

If your machine shipped without an onboard battery charger, do the following:

1. Disconnect the batteries from the machine and push the connector from the charger into the Battery Pack Connector (**17**).
2. Follow the instructions on the battery charger.

Service Note: *Make sure you plug the battery charger into the connector with the handle attached to it.*

Caution!

To avoid damage to floor surfaces, wipe water and acid from the top of the batteries after charging.

Checking the Battery Water Level

1. Check the water level in the batteries at least once a week.
2. After charging the batteries, remove the vent caps and check the water level in each battery cell. Use distilled or demineralized water in a battery filling dispenser (available at most auto parts stores) to fill each cell to the level indicator (or to 10 mm over the top of the separators). DO NOT overfill the batteries!

Caution!

Acid can spill onto the floor if the batteries are overfilled.

3. Tighten the vent caps.
4. Wash the tops of the batteries with a solution of baking soda and water (2 tablespoons of baking soda to 1 liter of water).

Charging Gel (VRLA) Batteries

Charge the batteries each time the machine is used, or when the Battery Indicator (**D2**) is reading less than full.

Warning!

- Charge batteries in a well-ventilated area.
- Do not smoke while servicing the batteries.

When Servicing Gel (VRLA) Batteries

- Remove all jewelry.
- Do not smoke.
- Wear safety glasses, rubber gloves and a rubber apron.
- Work in a well-ventilated area.
- Do not allow tools to touch more than one battery terminal at a time.
- ALWAYS disconnect the negative (ground) cable first when replacing batteries to prevent sparks.
- ALWAYS connect the negative cable last when installing batteries.

Caution!

Your voltage regulated lead acid (VRLA) battery will deliver superior performance and life **only if it recharged correctly**! Under or overcharging will shorten battery life and limit performance. Be sure to **follow correct charging instructions! Do not attempt to open this battery!** If a VRLA battery is opened, it loses its pressure and the plates become oxygen contaminated. **The warranty will be voided if the battery is opened.**

If your machine shipped with an onboard battery charger, do the following:

1. Turn the Key Switch (**A**) off.
2. Unwind the electrical cord from the side of the onboard charger and plug it into a properly grounded outlet. Refer to the OEM product manual for more detailed operating instructions.

If your machine shipped without an onboard battery charger, do the following:

1. Disconnect the batteries from the machine and push the connector from the charger into the Battery Pack Connector (**17**).

2. Follow the instructions on the battery charger.

Service Note: *Make sure you plug the battery charger into the connector with the handle attached to it.*

Important:

Make sure you have an appropriate charger for use on Gel cell batteries. Use only “voltage-regulated” or “voltage-limited” chargers. Standard constant current or taper current chargers **must not** be used. A temperature-sensing charger is recommended, as manual adjustments are never accurate and will damage any VRLA battery.

Wet Cell Battery Maintenance

Correct maintenance of electric vehicle batteries can greatly extend their life. Well-maintained batteries may last up to three years, but failure after one year is common if maintenance has been poor.

There are three simple rules for good battery maintenance:

- **Maintain Correct Electrolyte Level (Weekly)** - Use distilled water in batteries whenever possible. If batteries are discharged, add just enough water to cover the plates in each cell. If batteries are fully-charged, fill each cell to the bottom of the filler tube. Do not overfill the batteries! Do not add acid to batteries!
- **Keep the Batteries Charged (Weekly)** - Batteries should be charged each time that a machine is used for more than one hour. Machine operators should open the battery compartment cover for charging to avoid a concentrated buildup of hydrogen gas. Operators should follow the instructions provided with their specific battery charger to determine how long the batteries should be charged. Even when a machine is stored, the batteries should be charged once a month to prevent the batteries from “sulfating”. Almost all battery caps are vented, so there’s no need to loosen or remove them for charging.
- **Keep the Batteries Clean (Monthly)** - Use a damp cloth to wipe dirt from the top of the batteries. Battery terminals must be clean and tight. If the tops of the batteries are wet after charging, the batteries have probably been overfilled or overcharged.

Note: *If there is acid on the batteries, wash the tops of the batteries with a solution of baking soda and water (2) tablespoons of baking soda to 1 quart of water.*

Battery Testing

A battery problem is usually recognized by the machine operator as a decrease in the machine’s running time. This condition is usually caused by one or more “dead cells” in the battery system - that is, one or more cells that are putting out less voltage than the other cells.

Note: *Always charge batteries before testing.*

There are two ways to find a dead cell:

1. Use a hydrometer to check the specific gravity (or “state of charge”) of the fluid in each cell. A dead cell is one that reads 50 points (or more) lower than the other cells. The chart below shows the approximate “percent of charge” of an electric vehicle battery at various electrolyte specific gravity values, corrected to 80°F (26.7°C).

Percent of Charge	Specific Gravity
100% (full charge)	1.265
75%	1.225
50%	1.190
25%	1.155
0% (discharged)	1.120

2. Use a voltmeter to check the voltage of each battery with the scrub and drive motors running. The battery with the dead cell will read 1 or 2 volts lower than the other batteries in the system.

If the batteries in the machine are more than one year old, it's usually best to replace the whole set, rather than replacing just one battery.

Actuator Drive Nut Adjustment

This manual section explains the steps for adjusting the drive nut (spring housing) setting for the scrub brush lift actuator motor. Reference the chart below to find the IN and OUT dimensional specification for an actuator motor needing adjustment.

Part #	Actuator Motor	Spring Housing IN Position	Spring Housing OUT Position	Models
56393303	Scrub Brush Lift (all)	.0"	3.62" (9,19cm) - 3.88" (9,86cm)	All

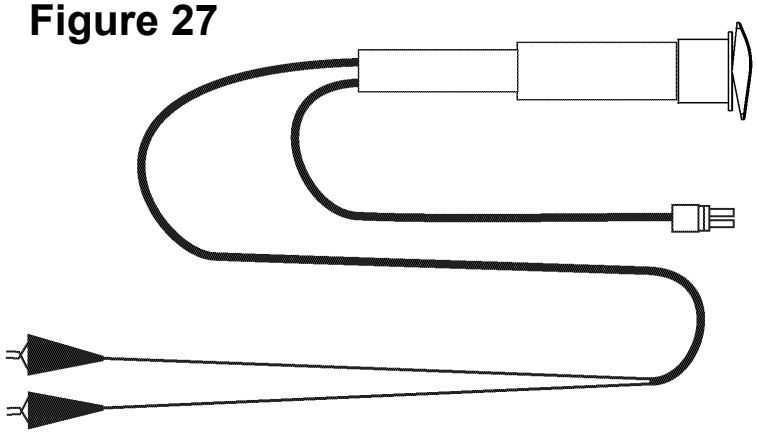
Note: *The "Spring Housing IN/OUT Position" dimensions are measured when completely assembled. Reference points are the gear box step to the edge of the plastic Spring Housing Guide* ***(A)*** *as shown in Figures 28 and 29.*

General Instructions

See Figure 27. This shows the special actuator power cord adapter (p/n 56407502) that is needed to connect the machine's battery pack and actuator motor for setting the drive nut limit settings.

1. Open the machine battery compartment and disconnect the battery connector. The battery pack is needed to power the lift actuator motor to correctly set the IN and OUT limit switches.
2. Connect the actuator motor to be tested to the power cord adapter end.
3. Connect the alligator clips from the cord adapter (red clip to the positive and black to negative) to the battery connector or battery posts. Use the rocker switch to change the motor rotation in setting the correct drive nut dimension.

Figure 27

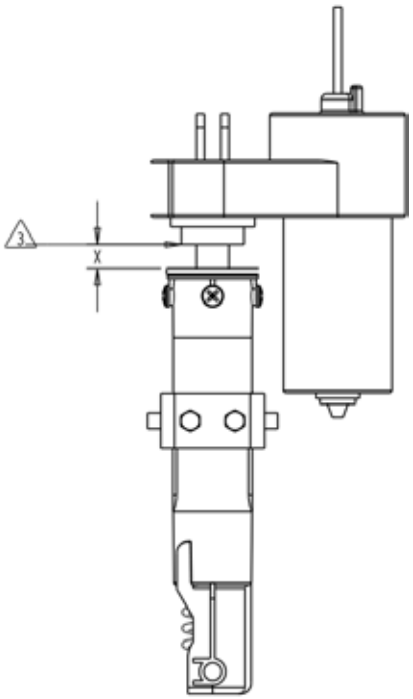


Adjusting the Drive Nut on the Scrub Brush Lift Actuator

1. See Figures 28 and 29. On a new scrub lift actuator motor, remove (spin-off) the Drive Nut (**B**) and slide on the Spring Housing Guide (**A**).
2. Install the short compression Spring (**C**) onto the actuator (lead screw) shaft.
3. Reinstall the plastic Drive Nut (**B**) as shown (with the nut pin pocket away from the motor).
4. Assemble the remaining parts (long compression spring, Spring Housing (**D**) and mounting hardware).
5. Hold onto the spring housing assembly and press the rocker switch to run the drive motor and retract the spring housing toward the motor housing (the IN limit).
6. Measure the position of the spring housing assembly on the actuator shaft. Manually turn the Spring Housing Assembly to the appropriate IN position as shown in the chart on the preceding page.

Figure 28

CONDITION	X
RETRACTED, NO LOAD	.000
EXTENDED, NO LOAD	3.75±.13



ACTUATOR SETTING

7. Hold the spring housing assembly, then press the adapter cord rocker switch to run the drive motor to the OUT position (wait until the motor stops).
8. Measure the position of the spring housing assembly on the shaft and compare the measurement with the OUT position shown in the chart.
9. If the measurement doesn't match the dimension shown in the chart, remove the Adjuster Cover and adjust the OUT position.
10. To increase the travel of the spring housing assembly, turn the adjuster clockwise. To decrease the travel of the assembly, turn the adjuster counterclockwise.

Note: *Use a 1/2" (13mm) socket to turn the adjuster. Each click of the adjuster will change the spring housing assembly travel 1/16 inch (1.6mm).*

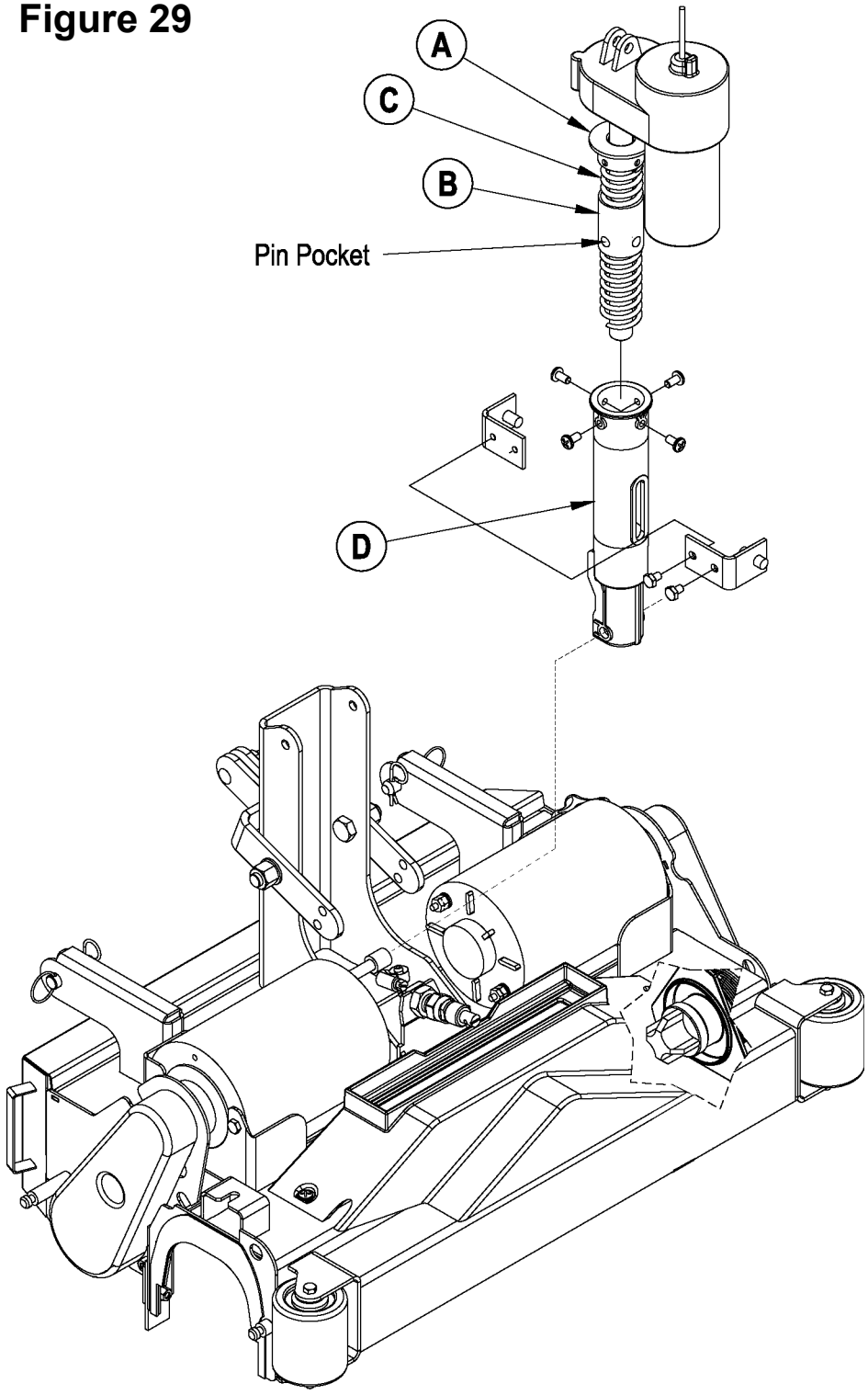
11. After each adjustment, hold the spring housing assembly, run the actuator IN and OUT and check both dimensions. After checking that the spring housing limits are set correctly, replace the Adjuster Cover.

Service Tip: *Use the above power cord adapter to help position the spring housing assembly (in or out) for ease in actuator motor installations.*

12. After adjusting the actuator spring housing dimensions, follow the ***Scrub Brush Lift Actuator Removal*** section to reassemble.

Service Tip: *See Figure 29. Note the correct orientation of the Spring Housing* ***(D)*** *when installing the complete motor assembly. Run the spring housing assembly to the IN (retracted) position for before you install it in the machine.*

Figure 29



Curtis Controller Diagnostics

Diagnostics Method A - LED Panel and Speed Control Fault Code Indicator

Diagnostics Method A uses the machine's control display LED panel and Speed Control Fault Code Indicator (**F**). The Curtis 1210- (24V) speed control will output a fault code if there is a problem associated with the speed control and wheel drive system. See Figure 30. If a speed control fault occurs, the display LED panel (**D**) will indicate **03**. When the **03** is displayed and detects a fault, the Speed Control Fault Indicator (**F**) will flash a special error code sequence until the fault is corrected. See the ***Status LED Fault Codes (Table 1)*** for a description of the fault indications.

Service Note: *This is how to read the error code status light: For example, OO O = two light flashes, a short pause, one flash, then a long pause, then the code will be repeated. This indicates a fault code 2,1.*

Diagnostics Method B - Curtis Programmer

Diagnostics Method B uses the optional hand-held Curtis programmer model 1307, or the new model 1311 MP1101. With a programmer, diagnostics and troubleshooting is more direct than with the LED alone. The programmer presents complete diagnostic information in plain language with no codes to decipher. Faults are displayed in the Diagnostic Menu, and the status of the controller inputs/outputs is displayed in the Test Menu.

The following four-step process is generally used for diagnosing and troubleshooting an inoperative vehicle:

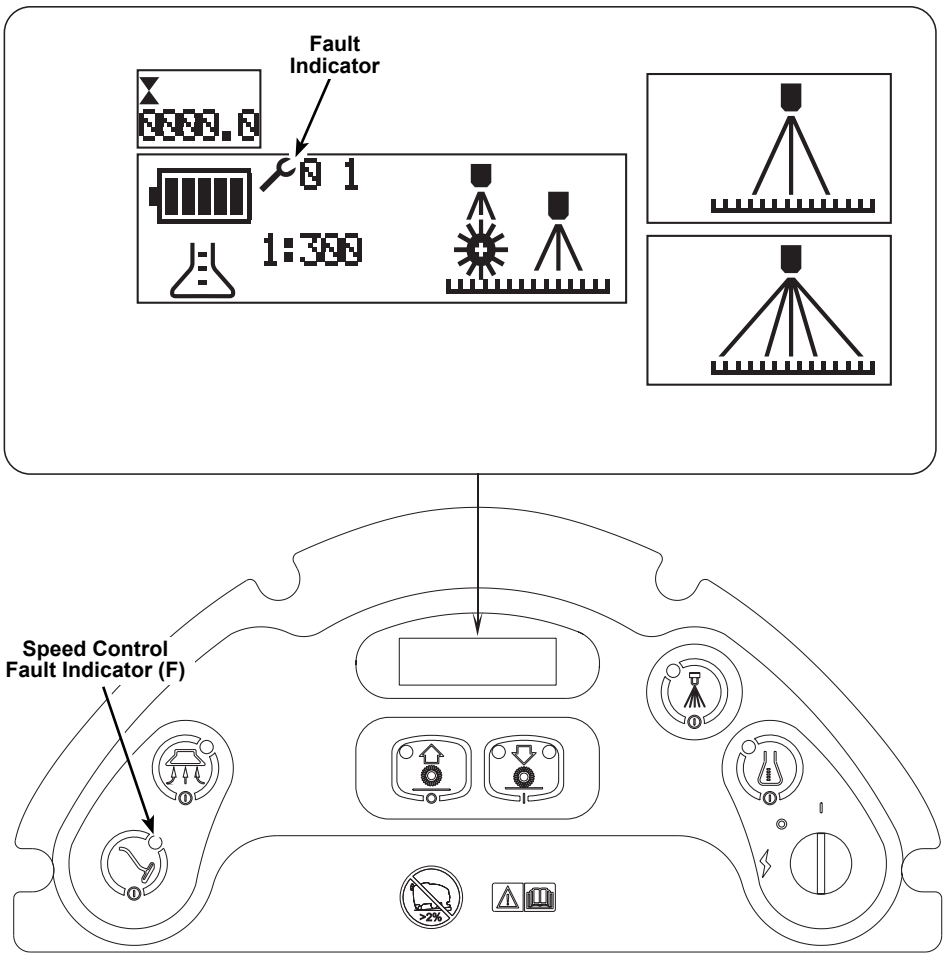
1. Visually inspect the vehicle for obvious problems.
2. Diagnose the problem using the programmer.
3. Test the circuitry with the programmer.
4. Correct the problem.
5. Repeat the last three steps as necessary until the vehicle is operational.

For example, a vehicle is brought in for repair that does not operate in "forward".

1. Examine the vehicle and its wiring for any obvious problems such as broken wires or loose connections.
2. Connect the programmer, put it in diagnostic mode, then read the displayed fault information. In this example, the display shows "No Faults Present", indicating that the controller has not detected anything out of the norm.
3. Put the programmer in test mode and observe the status of inputs and outputs in the forward direction. In this example, the display shows that the forward input did not activate when "forward" was selected, which means the problem is either in the electronic throttle or the throttle wiring.
4. Check or replace the electronic throttle and wiring, then repeat the test. If the programmer shows the forward switch closing and the vehicle now drives normally, the problem has been corrected.

Refer to the ***Status LED Fault Codes (Table 1)*** for suggestions covering a wide range of possible faults.

Figure 30



Diagnostic History

The handheld programmer can be used to access the controller's diagnostic history file. Connect the programmer, press the **MORE INFO** key, then while continuing to hold the **MORE INFO** key, press the **DIAGNOSTICS** key. The programmer will read out all the faults that the controller has experienced since the last time the diagnostic history file was cleared. The faults may be intermittent faults, faults caused by loose wires or faults caused by operator errors. Faults such as HPD or over-temperature may be caused by operator habits or by overloading.

After a problem has been diagnosed and corrected, clearing the diagnostic history file is advisable. This allows the controller to accumulate a new file of faults. By checking the new diagnostic history file at a later date, you can readily determine whether the problem was indeed completely fixed.

To clear the diagnostic history file, go to the Special Program Menu by pressing and holding the **MORE INFO** key, and then pressing the **PROGRAM** key. Scroll through the menu until **Clear Diagnostic History** is the top line in the display, and then press **MORE INFO** again. The programmer will prompt you to acknowledge or cancel.

See the sections of this chapter dealing with the Curtis Speed Controller for more detail on programmer operation.

Status LED Fault Codes (Table 1)			
LED Code	Status Light Display	Explanation	Possible Cause
1,1	0 0	over-/under-temperature cutback	1. Temperature >92°C or < -25°C. 2. Excessive load on vehicle 3. Operation in extreme environments. 4. Electromagnetic brake not releasing.
1,2	0 00	throttle fault	1. Throttle input wire open or shorted 2. Throttle pot defective. 3. Wrong throttle type selected.
1,3	0 000	speed limit pot fault	1. Speed limit pot wire(s) broken or shorted. 2. Broken speed limit pot.
1,4	0 0000	battery voltage too low	1. Battery voltage <17 volts. 2. Bad connection at battery or controller.
1,5	0 00000	battery voltage too high	1. Battery voltage >36 volts. 2. Vehicle operating with charger attached. 3. Intermittent battery connection.
2,1	00 0	main contactor driver Off fault	1. Main contactor driver failed open.
2,3	00 000	main contactor fault	1. Main contactor welded or stuck open. 2. Main contactor driver fault. 3. Brake coil resistance too high.
2,4	00 0000	main contactor driver On fault	1. Main contactor driver failed closed.
3,1	000 0	fault present for >10 sec.	1. Misadjusted throttle. 2. Broken throttle pot or throttle mechanism.
3,2	000 00	brake On fault	1. Electromagnetic brake driver shorted. 2. Electromagnetic brake coil open.
3,3	000 000	pre-charge fault	1. Low battery voltage. 2. KSI and throttle turned on at same time.
3,4	000 0000	brake Off fault	1. Electromagnetic brake driver open. 2. Electromagnetic brake coil shorted.
3,5	000 00000	HPD (High Pedal Disable) fault	1. Incorrect sequence of throttle and KSI,** push, or inhibit inputs. 2. Misadjusted throttle pot.
4,1	0000 O	current sense fault	1. Short in motor or in motor wiring. 2. Controller failure. *
4,2	0000 00	motor voltage fault (hardware fail-safe)	1. Motor voltage does not correspond to throttle request. 2. Short in motor or in motor wiring. 3. Controller failure. *
4,3	0000 000	EEPROM fault	1. EEPROM failure or fault.
4,4	0000 0000	power section fault	1. EEPROM failure or fault. 2. Short in motor or in motor wiring. 3. Controller failure. *

* Jack up vehicle and retest to confirm diagnosis. Clean the connections, inspect system wiring, then retest.

**Note: A KSI (Key Switch Input) system problem is a specific HPD (high pedal disable) type operational fault caused by the operator activating the Forward/Reverse drive paddle before turning on the main Key Switch. This can be cleared by returning the operator's drive paddle to neutral, then cycling the Key Switch OFF and ON.

Speed Control Programming Options

Following is a list of the speed control parameters that can be adjusted using a Curtis hand held programmers:

- M1 MAX SPEED – Transport/Scrub speed maximum limit (% of full throttle)
- M2 MAX SPEED – Not applicable
- M1 MIN SPEED – Transport/Scrub speed maximum limit with the speed limit pot in minimum position (% of full throttle limited by speed limit pot)
- M2 MIN SPEED – Not applicable
- M1 REVERSE MAX SPEED – Reverse Transport/Scrub speed maximum limit (% of full throttle)
- M2 REVERSE MAX SPEED – Not applicable
- REVERSE MIN SPEED – Transport/Scrub speed maximum limit with the speed limit pot in minimum position (% of full throttle limited by speed limit pot)
- THROTTLE AUTOCAL – Used for calibration of the throttle assembly

Installation Checkout for the Curtis Speed Controller

Warning!

The 1210 controller is inherently a high-power device. When working around any battery powered vehicle, appropriate safety precautions should be taken. These include, but are not limited to:

- Proper training,
- Wearing eye protection,
- Avoiding loose clothing and jewelry, and,
- Using insulated wrenches.

After installing a controller and before operating the vehicle, carefully complete the following checkout procedure. If you find a problem during the checkout, refer to the ***Diagnostics*** section of this chapter for further information.

The installation checkout can be conducted with or without the handheld programmer. The checkout procedure is easier with a programmer. Otherwise, observe the Status LED for codes (located on operator panel wand indicator light). The part number of the handheld programmer is 56409441.

Warning!

- Put the vehicle up on blocks to get the drive wheel off the ground before beginning these tests.
- Turn the Key Switch off and make sure the throttle is in neutral.
- Do not stand, or allow anyone else to stand directly in front of or behind the vehicle during the tests.

1. Remove electrical panel to access controller, then observe LED status light on touch pad operator panel wand indicator light. If a programmer is available, connect it to the programmer plug-in port.
2. Turn the Key Switch on. The programmer should “power up” with an initial display. If neither happens, check for continuity in the Key Switch circuit and controller ground.
3. If you are using a programmer, put it into the diagnostic mode by pressing the **DIAGNOSTICS** key. The display should indicate **No Faults Found**.

Note: *Before pressing the diagnostics key, wait until model # screen appears, if the throttle is activated prior to this screen appearing the controller will shut down.*

- If there is a problem, the LED will flash a diagnostic code and the programmer will display a diagnostic message. If you are conducting the checkout without a programmer, look up the LED diagnostic code in the ***Curtis Controller Diagnostics*** section of this chapter and ***Status LED Fault Codes (Table 1)***.
- When the problem has been corrected, it may be necessary to cycle the key or seat switch to clear the fault code.

4. Move the drive paddle to operate the throttle. The motor should begin to turn in the selected direction. If it does not, verify the wiring to the controller, and the motor. The motor should run proportionally faster with increasing throttle. If not, refer to the ***Curtis Controller Diagnostics*** section of this chapter and ***Status LED Fault Codes (Table 1)***.
5. If you are using a programmer, put it into the test mode by pressing the **TEST** key. Scroll down to observe the status of the forward, reverse and brake switch. Cycle each switch in turn, observing the programmer. Each input should show the correct state on the programmer.
6. Take the vehicle off the blocks and drive it in an open area. It should have smooth acceleration and good top speed.

Programming Vehicle Speed Changes

The maximum high-speed M1 (transport) and maximum low speed M2 (scrub) can be changed electronically using the handheld programmer. To change a parameter using the programmer, press the **PROGRAM** key, and scroll down the **Program Menu** until the desired parameter is the top line of the display. Press the appropriate **CHANGE VALUE** key (“up” or “down”) until the desired number is reached. The parameter is now set at the desired value. All programming occurs in real time. In other words, the parameters can be changed while the vehicle is in operation.

The upper and lower limits of parameters are set at the factory. Some parameters have dependencies on other parameters. When the programmer is being used to adjust a parameter and a limit is reached, the display will stop changing. To see why the display has stopped changing, press the **MORE INFO** key. If the limit is related to another parameter, that information will be displayed. Changing the value of the related parameter may allow the original parameter to be adjusted further. Otherwise, the display simply says **Max Limit** or **Min Limit**.

Use of the programmer is described more fully in the ***Speed Control Programming Options*** section of this manual.

Maintenance

There are no user-serviceable parts inside the Curtis PMC 1210 controller. No attempt should be made to open the controller. Opening the controller may damage it and will void the warranty.

However, it is recommended that the controller exterior be cleaned periodically, and if a handheld programmer is available, this periodic cleaning provides a good opportunity to check the controller’s diagnostic history file.

Functional Overview of the Main Control Board

The primary function of the main control board **A1** is to position the scrubbing brushes with respect to the floor surface using a lift actuator motor to maintain the correct brush pressure and current draw of the brush motors. When the Scrub ON switch (**J**) is depressed, this will lower the scrub deck to the operating position and by activating the drive paddle, start the brush motors. The controller is continuously monitoring the current to the brush motors. When it senses a current draw out of the desired range it automatically raises or lowers the brush deck by turning on the brush actuator motor. This process is repeated until the brush motor is shut off. The controller also manages the other supportive systems such as the solution on/off, and vacuum motors.

Note: *See the **Know Your Machine** section for a complete explanation of the machine’s operation.*

The secondary function of the main control board is to detect any system failures and display an error code on the display LED panel, or store it in the main control board's recall memory mode. The error code(s) are used to help the service person determine the fault and to quickly guide in repairing a specific system malfunction.

Note: *See the* ***Troubleshooting Guide*** *below for further information.*

An additional special feature of the main control board is to change program settings for a set of specific machine functions. See the ***Main Control Programming Options*** section in this manual for further information.

Troubleshooting Guide

Any error codes detected by main control board will be displayed on the LED display panel as they occur. If more than one error exists, the display will sequence through the error codes at one-second intervals. The error display will show on the display LED panel as a mechanical wrench symbol followed by a two-digit code. For example: 03 would be a drive system fault. When troubleshooting any "Fault Description" noted with a double asterisk (**) follow the instructions for entering the ***Service Test Mode***. See the ***Service Test Mode*** section in this manual.

Main Controller Error Codes

Display Code	Fault Description	Troubleshooting Action
03	Drive system fault.	1. Check for a tripped drive motor circuit breaker (30 amp). Investigate reason for possible mechanical overload. Examples: Debris wrapped around the drive wheels, defective differential and prolonged ramp climbing. 2. Observe the green flashing wand indicator light (on operator panel), then see ***Curtis Controller Diagnostics*** and ***Status LED Fault Codes (Table 1)*** to further troubleshoot the drive system.
04	Scrub deck lift actuator overload. • Normal current load - 1 to 2.5 Amps. • Max. current load 6 Amps. • Max. current no load - 1.4 Amps.	1. Check for binding or frozen brush lift linkage and excessive weight on brush deck. 2. Check for short circuits in actuator motor and wiring. Repair or replace.* To test, disconnect the motor plug and attach the actuator test cord (56407502) and perform an amp draw test. Compare readings to the current loads listed on the left.
05	Solution pump M1 overload. • Normal current load .8-1.8 Amps. • Max. current load 3.2 Amps. Over will cause 05 pump motor overload.	1. Check for short circuits in the wiring and pump motor. 2. Disconnect the pump motor and run the machine to see if the wiring is shorted. 3. Check the pump motor to see if it is bad.
06	Scrub motor overload Note: See ***Selecting the Scrub Pressure Current Limits*** for detail load current values for the different scrub pressure limit settings.	1. Check for binding in rotation of brushes or incorrect brush Scrub Pressure lift actuator operation. 2. Check the negative supply cable at the brush motor for a wiring problem or incorrect modifications. 3. Check for an open in the small WHT/GRA current sense wire. 4. Check for short circuit* in brush motor or wiring. 5. Inspect scrub brush drive bearings and drive belts for excessive wear.
07	Vacuum motor overload. Normal current load 24V 23-25 Amps for each vacuum motor.	1. Check for debris in the vacuum motors. 2. Worn carbon brushes. 3. Defective motor bearings. 4. Check for short circuit* in vacuum motors or wiring. Repair or replace. 5. Check for an open in the small ORG current sense wire.
08	Solution solenoid coil L1 overload.	1. Check for wiring problems (short) on the coil circuit and repair wiring. 2. Check the coil resistance. The nominal resistance is 53 ohms for White Rogers and 100 ohms for Ametek. If resistance is below 45 Ohms, replace the solenoid.
09	Solution solenoid coil L2 overload.	1. Check for wiring problems (short) on the coil circuit and repair wiring. 2. Check the coil resistance. The nominal resistance is 53 ohms for White Rogers and 100 ohms for Ametek. If resistance is below 45 Ohms, replace the solenoid.

Display Code	Fault Description	Troubleshooting Action
10	Brush motor contactor coil K1 overload.	1. Check for wiring problems (short) on the coil circuit and repair wiring. 2. Check the coil resistance. The nominal resistance is 53 ohms for White Rogers and 100 ohms for Ametek. If resistance is below 45 Ohms, replace the solenoid.
11	Main vacuum contactor coil K2 overload.	1. Check for wiring problems (short) on the coil circuit and repair wiring. 2. Check the coil resistance. The nominal resistance is 53 ohms for White Rogers, and 100 ohms for Ametek. If resistance is below 45 Ohms, replace the solenoid.
12	Auxiliary vacuum contactor coil K3 overload.	1. Check for wiring problems (short) on the coil circuit and repair wiring. 2. Check the coil resistance. The nominal resistance is 53 ohms for White Rogers, and 100 ohms for Ametek. If resistance is below 45 Ohms, replace the solenoid.
13	Chemical pump M2 overload. Max current load is .75 Amps.	1. Check for short circuits in the wiring and pump motor. 2. Disconnect the pump motor and run the machine to see if the wiring is shorted. 3. Check the pump motor to see if it is bad.
15	Solution pump motor circuit open (**).	1. Check for disconnected wiring, open in wiring or defective solution pump. Repair or replace. 2. Check controller output voltage. It should be 24V. If 0V, replace the controller.
16	Brush motor circuit open (**).	1. Check for disconnected brush motors, open in wiring or defective brush motor solenoid load contact failure. 2. Check the negative supply cable at the brush motor for a wiring problem or incorrect modifications.
17	Brush motor stuck closed.	Check the output from the control board. If it is 24 volts referenced to B+ when the switch is off, replace the control board.
18	Vacuum motor circuit open (**).	Check for disconnected vacuum motor wiring, open in wiring, defective vacuum motor and vacuum contactor failure.
19	Vacuum motor stuck closed.	Check the output from the control board. If it is 24 volts referenced to B+ when the switch is off, replace the control board.
20	Solution solenoid 1 open (**).	1. Check for disconnected solenoid wiring or open in wiring. 2 If the wiring is OK, replace the solenoid.
21	Solution solenoid 1 stuck closed.	Check the output from the control board. If it is 24 volts referenced to B+ when the switch is off, replace the control board.
22	Solution solenoid 2 open (**).	1. Check for disconnected solenoid wiring or open in wiring. 2 If the wiring is OK, replace the solenoid.
23	Solution solenoid 2 stuck closed.	Check the output from the control board. If it is 24 volts referenced to B+ when the switch is off, replace the control board.
24	Brush contactor coil open (**).	1. Check for disconnected coil wiring or open in wiring. 2 If the wiring is OK, replace the contactor.
25	Brush contactor coil stuck closed.	Check the output from the control board. If it is 24 volts referenced to B+ when the switch is off, replace the control board.
26	Main vacuum contactor coil open (**).	1. Check for disconnected coil wiring or open in wiring. 2 If the wiring is OK, replace the contactor.
27	Main vacuum contactor coil stuck closed.	Check the output from the control board. If it is 24 volts referenced to B+ when the switch is off, replace the control board.
28	Auxiliary vacuum contactor coil open (**).	1. Check for disconnected coil wiring or open in wiring. 2 If the wiring is OK, replace the contactor.
29	Auxiliary vacuum contactor coil stuck closed.	Check the output from the control board. If it is 24 volts referenced to B+ when the switch is off, replace the control board.
32	Solution pump motor stuck closed.	Check the output from the control board. If it is 24 volts referenced to B+ when the switch is off, replace the control board.

** See ***Service Test Mode*** in this manual for further trouble shooting information.

*** See the ***Main Control Programming Options*** section to activate the brush type selection function.

*Short Circuit definition:

- A short circuit is a parallel path of very low resistance, often caused accidentally.
- With low resistance there is an excessive amount of current.
- The excessive current will either melt the wires or open a fusible link.

Service Test Mode

To assist in the troubleshooting and servicing of the electrical system and related components, a special Service Test Mode has been incorporated that allows independent control of the various outputs and monitoring of the various inputs. The Service Test Mode overrides the normal operational protocols.

To Enter the Service Test Mode

1. Turn the main power Key Switch (**A**) to the off position.
2. Press and hold the Wand Switch (**G**).
3. While holding the Wand Switch, turn the Key Switch to the on position.
4. Continue to hold the Wand Switch until the Speed Control Fault Code Indicator (**F**) turns green.
5. Release the Wand Switch.
6. The Display Panel (**D**) will now display the battery voltage and the machine function indicators. The function of each switch and indicator is described below.
7. To exit the service test mode, turn the main Key Switch to the off position.

Panel Indicators – Service Test Mode

See Figure 31 for panel display.

Figure 31

- Battery Status Display – displays the battery voltage (**24.3** in this example). This display is accurate to within +/- 0.15 volts. Therefore, the voltage displayed may not correlate precisely to a high-accuracy, calibrated voltmeter.

To Run the Wheel Drive Motor

The Drive Paddle (**20**) controls the wheel drive motor in the Service Test Mode.

- With the Drive Paddle in the neutral position, the machine will remain stationary. The display will read **SPD:OFF**.
- Pressing the Drive Paddle forward will move the machine forward. The display will read **SPD:FOR**.
- Pulling the Drive Paddle backward will move the machine in reverse. The display will read **SPD:REV**.

Indicator	Function
SPD:OFF	Machine is stationary
SPD:REV	Machine traveling in reverse
SPD:FWD	Machine traveling in forward

To Switch the Solution System On and Off

The Solution/Pre-spray Switch (**C**) controls the solution pump and solenoids in the Service Test Mode.

- Pressing the Solution/Pre-spray Switch the first time switches on the solution pump and the solenoid controlling the rear nozzle. The display will read **SOL:1**.
- Pressing the Solution/Pre-spray Switch the second time switches off the solution pump and the solenoid controlling the rear nozzle. The display will read **SOL:OFF**.
- Pressing the Solution/Pre-spray Switch the third time switches on the solution pump and the solenoid controlling the front nozzle. The display will read **SOL:2**.
- Pressing the Solution/Pre-spray Switch the fourth time switches off the solution pump and the solenoid controlling the front nozzle. The display will read **SOL:OFF**.

Indicator	Function
SOL:OFF	Solution pump and solenoid valves are off
SOL:1	Solution pump and solenoid valve controlling rear (maintenance) nozzle are active.
SOL:2	Solution pump and solenoid valve controlling front (restoration) nozzle are active

To Lower and Raise the Scrub Deck

The Scrub ON Switch (**J**) controls the deck actuator in the Service Test Mode.

- Pressing the Scrub ON Switch the first time with the deck up will not move the deck. The display will continue to read **ACT:OFF**.
- Pressing the Scrub ON Switch a second time will start the actuator motor and move the deck downward. The display will read **ACT:DN**. When the deck reaches its full-down position, the actuator motor will stop and the display will read **ACT:OFF**.
- Pressing the Scrub ON Switch a third time with the deck down will not move the deck. The display will continue to read **ACT:OFF**.
- Pressing the Scrub ON Switch a fourth time will start the actuator motor and lift the deck upward. The display will read **ACT:UP**. When the deck reaches its full-up position, the actuator motor will stop and the display will read **ACT:OFF**.

Indicator	Function
ACT:OFF	Scrub deck actuator is not moving
ACT:DWN	Scrub deck actuator is lowering
ACT:UP	Scrub deck actuator is rising

To Switch the Vacuum Motors On and Off

The Vacuum Switch (**E**) controls the vacuum motors in the Service Test Mode.

- Pressing the Vacuum Switch when both vacuum motors are off switches on the main vacuum motor. The display will read **VAC:1**.
- Pressing the Vacuum Switch a second time shuts off the main vacuum motor. The display will read **VAC:OFF**.
- Pressing the Vacuum Switch a third time switches on the auxiliary vacuum motor. The display will read **VAC:2**.
- Pressing the Vacuum Switch a fourth time shuts off the auxiliary vacuum motor. The display will read **VAC:OFF**.

Indicator	Function
VAC:OFF	Both vacuum motors are off
VAC:1	The main vacuum motor is on.
VAC:2	The auxiliary vacuum motor is on.

To Extend and Retract the Vacuum Shoe Pin

The Wand Switch (G) controls the solenoid that retracts the vacuum shoe pin.

- Pressing the Wand Switch will extend the shoe pin. The display will read SHOE:ON and the vacuum shoes will extend down with the scrub deck when the deck is lowered.
- Pressing the Wand Switch again will allow the shoe pin to retract. The display will read SHOE:OFF and the vacuum shoes will remain retracted up when the scrub deck is lowered.

Indicator	Function
SHOE:OFF	Shoes will not lower with deck.
SHOE:ON	Shoes will lower when scrub deck is lowered

To Switch the Scrub Brush Motors On and Off

The Scrub OFF Switch (**H**) controls the scrub brush motor contactor (K1) to switch the brush motors on and off in the Service Test Mode.

- Pressing the Scrub OFF Switch with the scrub brush motors off will switch on the motors. The display will read **BRUSH:ON**.
- Pressing the Scrub OFF Switch with the scrub brush motors running will switch off the motors. The display will read **BRUSH:OFF**.

Indicator	Function
BRUSH:OFF	Both scrub brush motors are off
BRUSH:ON	Both scrub brush motors are on

To Switch the On-board Chemical Mixing System On and Off

The Detergent System switch (**B**) controls the chemical (detergent) pump in the Service Test Mode.

- Pressing the Detergent System switch switches on the chemical pump. The display will read **CPUMP:ON**.
- Pressing the Detergent System switch a second time switches off the chemical pump. The display will read **CPUMP:OFF**.

Indicator	Function
CPUMP:OFF	The chemical pump is off.
CPUMP:ON	The chemical pump is on.

Main Control Programming Options

Selecting the Low Voltage Cutout Threshold

Factory Default: 20.6V (1.72 Volts/Cell)

The Clean Track® L24 is equipped with a low-voltage cutout feature to prevent over-discharging the batteries. This feature will automatically shut down the scrub system when the battery voltage falls to the selected threshold. The cutout level is adjustable. The factory default setting is 20.6 volts (1.72 volts per cell) and the alternate setting is 21.8 volts (1.81 volts per cell). Select the correct cutout level based on the battery manufacturer's specifications. It is important to note that some maintenance-free batteries (including some gelled electrolyte cells) are capable of being safely discharged down to 1.72 volts per cell. To select between the two cutout levels:

1. Turn the Key Switch (**A**) to the off position.
2. Press and hold the Scrub OFF Switch (**H**).
3. While holding the Scrub OFF Switch, turn the Key Switch to the on position.
4. Continue to hold the Scrub OFF Switch until the scrub off indicator turns red.
5. Release the Scrub OFF Switch. The display will now show a battery icon and "20.6" or "21.8".
6. Press and release the Scrub ON Switch (**J**) to select between the two options.
    - For the default cutout level, select "20.6".
    - For the alternate cutout level, select "21.8".
7. To save the new setting, press the Scrub OFF Switch. The display will now show a key icon to indicate the procedure is done.
8. Turn the Key Switch to the off position. The new setting will be saved and will remain in effect until it is changed again.

Selecting the Scrub Pressure Current Limits

The Clean Track® L24 uses the combined scrub brush motor current draw to determine if the scrub pressure is correct for the selected extract mode.

- If the current draw goes above the upper limit, the scrub deck lift actuator raises the deck until the scrub motor current draw is within the selected range.
- If the current draw goes below the lower limit, the scrub deck lift actuator lowers the deck until the scrub motor current draw is again within the selected range.

You can select the scrub motor upper and lower current limits to compensate for different brush and/or carpet types. The current limit settings range from 0 to 9, with 0 being the least load/current draw and 9 being the greatest. To select the current limit range for a particular scrub mode:

1. Turn the Key Switch (**A**) to the off position.
2. Press and hold the button combo for the scrub mode you wish to change as listed in the table below.

Scrub Setting	Factory Default	Button Combo for Programming	Programming Indicator
Maintenance Mode	9	Scrub ON & Vacuum Switches	Vacuum = Green (Left) Scrub = Yellow
Restoration Mode	9	Scrub ON & Solution/Pre-spray Switches	Pre-spray = Green (Right) Scrub = Yellow
Pre-spray Mode	9	Scrub ON & Detergent System Switches	Detergent = Green (Right) Scrub = Yellow (Left) Scrub = Yellow

3. While holding the appropriate button combination, turn the Key Switch to the on position.
4. Continue to hold button combination until the programming indicators light.
5. Release the buttons. The display will now show a scrub brush icon and a number from 0 to 9.
6. Press and release the Scrub ON Switch (**J**) to toggle through the numbers. (Refer to the table below for the lower and upper current limits for each setting).
7. Once the desired setting is selected, press the Scrub OFF Switch (**H**) to save this setting. The display will now show a key icon to indicate the procedure is done.
8. Turn the Key Switch to the off position. The new setting will be saved and will remain in effect until it is changed again.

Setting	Lower Current Limit*	Upper Current Limit*
0	15.5	20.6
1	17.7	22.8
2	20.0	25.0
3	22.2	27.3
4	24.4	29.5
5	26.6	31.7
6	28.8	33.9
7	31.1	36.2
8	33.3	38.4
9	35.5	40.6

* Combined current of both scrub motors

Restoring the Scrub Pressure Limits to the Factory Default Settings

Factory Default: Maintenance Mode – 9, Restoration Mode – 9, Pre-spray Mode – 9

To restore the scrub pressure limits to the default setting, perform the following steps:

1. Turn the Key Switch (**A**) to the off position.
2. Press and hold the Scrub ON Switch (**J**).
3. While holding the Scrub ON Switch, turn the Key Switch to the on position.
4. Continue to hold the Scrub ON Switch until the scrub off indicator is green and the display shows a brush icon and a key icon.
5. Release the Scrub ON Switch. The scrub switch operating mode and pressure settings have now been restored.
6. Turn the Key Switch to the off position.

Recall Of Stored Error Codes

Whenever an electrical system fault is detected by the main control unit, one or more error codes are displayed and stored by the control unit. If desired, the error codes (if any) from the previous operation of the machine can be recalled for troubleshooting purposes. To recall the last stored error codes, perform the following steps:

1. Turn the Key Switch (**A**) to the off position.
2. Press and hold the Solution/Pre-spray Switch (**C**).
3. While holding the Solution/Pre-spray Switch, turn the Key Switch to the on position.
4. Continue to hold the Solution/Pre-spray Switch until the pre-spray indicator is green.
5. Release the Solution/Pre-spray Switch.
   - If there were previously no error codes stored, the display will show a wrench icon with a "-" next to it, and the scrub off indicator will be red.
   - If error codes were stored, the display will now show the wrench icon and the stored code(s)
6. To keep the error codes in memory, turn the main Key Switch to the off position.
7. To clear the stored codes, press and release the Scrub OFF Switch (**H**). The display will now show a key icon.
8. Turn the Key Switch to the off position.

Turning Fault Detection On or Off

Factory Default: ON

Normally the main control unit will perform checks of the electrical system during operation. If a fault occurs in a particular system, that system (and possibly others) will be shut down. This can make troubleshooting the system difficult. This option will allow service personnel to disable some of the fault detection checks to facilitate troubleshooting. This will *not* disable the over-current protection on any of the systems. To turn the fault checking on or off:

1. Turn the Key Switch (**A**) to the off position.
2. Press and hold the Scrub OFF Switch (**H**) and the Solution/Pre-spray Switch (**C**).
3. While holding both switches turn the Key Switch to the on position.
4. Continue to hold both switches until the pre-spray indicator is yellow.

5. Release both switches. The display will now show a wrench icon or a wrench icon with a cross through it.
6. Press and release the Scrub ON Switch (**J**) to select between the wrench icon for fault detection enabled, or the wrench icon with a cross through it for fault detection disabled.
7. Once the desired setting is shown, press the Scrub OFF Switch to save it. The display will now show a key icon to indicate the procedure is done.
8. Turn the Key Switch to the off position. The new setting will be saved and will remain in effect until it is changed again.

Note: *When operating with the fault detection disabled, the display will show a wrench icon with a cross through it as a reminder that no faults will be logged.*

Displaying the Control Unit Revision Level

To view the revision level of the control unit, perform the following steps:

1. Turn the Key Switch (**A**) to the off position.
2. Press and hold the Scrub OFF Switch (**H**) and the Detergent System switch (**B**).
3. While holding both switches, turn the Key Switch to the on position.
4. Continue to hold both switches until the detergent and scrub system off indicators are green.
5. Release both switches. The display will now indicate the revision level of the control unit. The displayed value will be a letter from A to Z.
6. To exit this mode, turn the Key Switch to the off position.

Enabling/Disabling the Chemical Mixing System

The Clean Track® L24 comes standard with an on-board chemical mixing system. This chemical system should be enabled at the factory if the machine comes with it. However, this setting can be changed by performing the following steps:

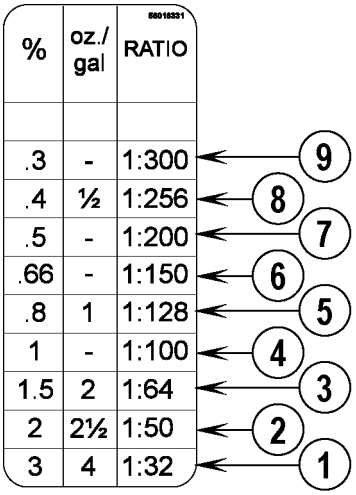
1. Turn the Key Switch (**A**) to the off position.
2. Press and hold the Scrub OFF Switch (**H**) and the Scrub ON Switch (**J**).
3. While holding both switches, turn the Key Switch to the on position.
4. Continue to hold both switches until the left indicator in the Scrub ON Switch (**J**) is on.
5. Release both switches. The display will now show the Chemical Mixing System Indicator (**D1**) or the Chemical Mixing System Indicator with a cross through it. The Chemical Mixing System Indicator represents the chemical system enabled. The Chemical Mixing System Indicator with a cross through it represents the system disabled.
6. Press and release the Detergent System Switch (**B**) to toggle between enabled and disabled.
7. When the correct setting is selected, press the Scrub OFF Switch to save it. The display will now show a key icon to indicate the procedure is done.
8. Turn the Key Switch to the off position. The new setting will be saved and will remain in effect until it is changed again.

Detergent Dilution Ratio Selection

Factory Default: Chemical System Default: Off, Detergent Dilution Ratio: 1:128, Ratio Offset: 0

When the chemical mixing system senses that a ratio is not picked on the detergent bottle, it defaults to a predetermined value. In some cases this value may need to be changed for different detergents. Also, the chemical system defaults to inactive during normal scrubbing operations. Also, it may be determined that the chemical system should pump more or less detergent for a given ratio setting. These the settings can be changed by following this procedure:

1. Turn the Key Switch (**A**) to the off position.
2. Press and hold the Detergent System Switch (**B**).
3. While holding the switch, turn the Key Switch to the on position.
4. Continue to hold the switch until the detergent indicator is yellow.
5. Release the Detergent System Switch. The bottom line of the display will now show the carpet icon, the Chemical Mixing System Indicator (**D1**) enabled or disabled, the default detergent ratio and the offset value.
6. Press the Wand Switch (**G**) to toggle the default setting on or off.
7. Press the Scrub ON Switch (**J**) to toggle between the different ratio offsets.
   - "0" indicates no offset.
   - "-" indicates a -10% offset,
   - "+" indicates a +10% offset in the amount of detergent pumped.
8. Press the Detergent System Switch to change the default ratio when the chemical system does not sense one selected on the detergent bottle. This ratio can be one of nine settings from 1:32 to 1:300.
9. When the correct settings are selected press the Scrub OFF Switch (**H**) to save them. The display will now show a key icon to indicate the procedure is done.
10. Turn the Key Switch to the off position. The new settings will be saved and will remain in effect until they are changed again.



%	oz./ gal	RATIO	
.3	-	1:300	9
.4	½	1:256	8
.5	-	1:200	7
.66	-	1:150	6
.8	1	1:128	5
1	-	1:100	4
1.5	2	1:64	3
2	2½	1:50	2
3	4	1:32	1

Factory Reset

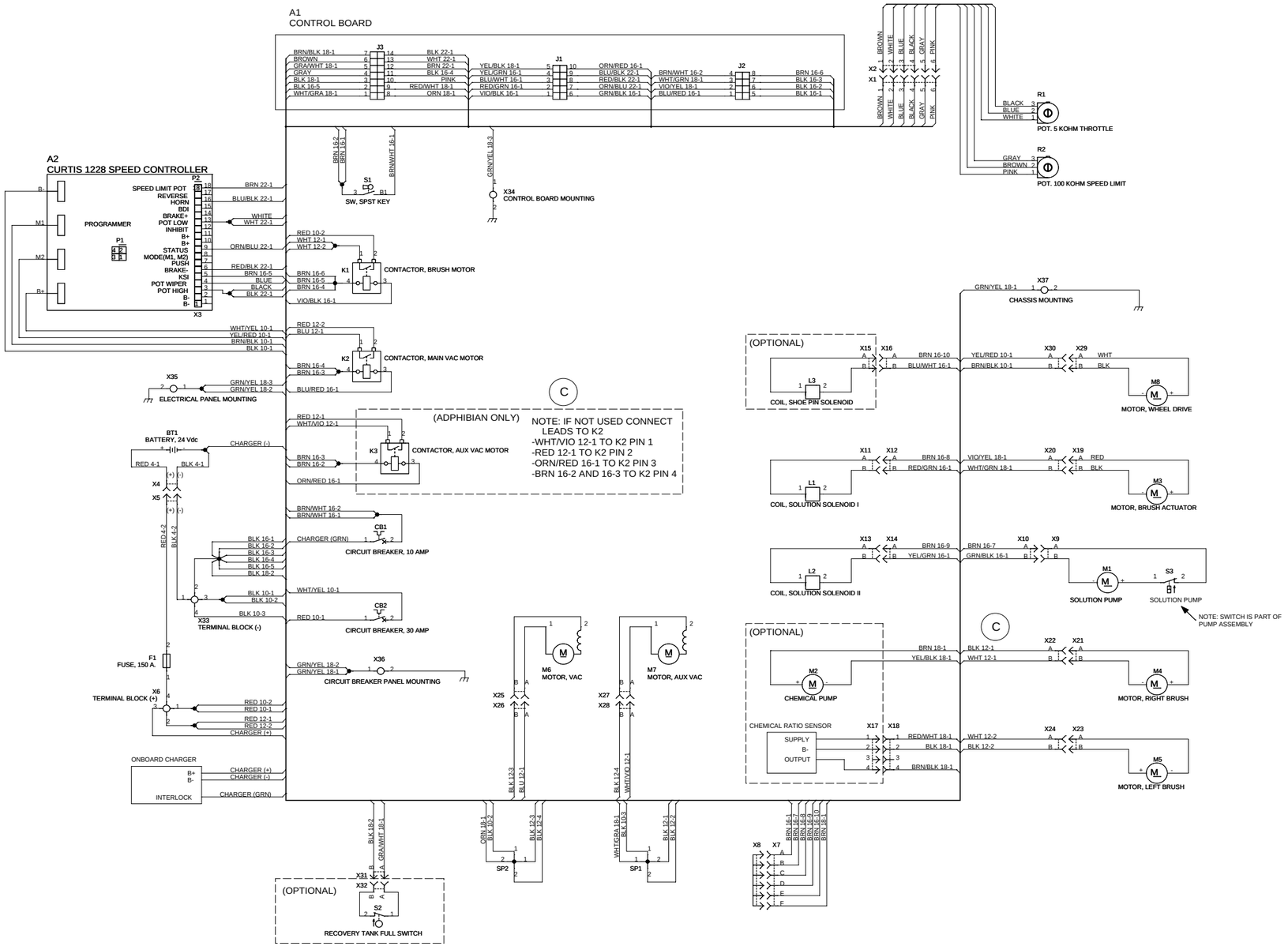
It may be necessary in some circumstances to reset all of the machines parameters back to the default factory settings. This can be accomplished by following this procedure:

1. Turn the Key Switch (**A**) to the off position.
2. Press and hold the Wand Switch (**G**), the Vacuum Switch (**E**) and the Scrub OFF Switch (**H**).
3. While holding these switches, turn the Key Switch to the on position.
4. Continue to hold the switches until the right indicator in the Scrub ON Switch (**J**) is yellow and the key icon is shown on the display.
5. Release the switches.
6. Turn the Key Switch to the off position.
7. Turn the Key Switch to the on position. The display will now show the Chemical Mixing System Indicator (**D1**) with or without a cross through it. The Chemical Mixing System Indicator represents the chemical system enabled, and the Chemical Mixing System Indicator with a cross through it represents the chemical system disabled. Press and release the Detergent System Switch (**B**) to toggle between the two.

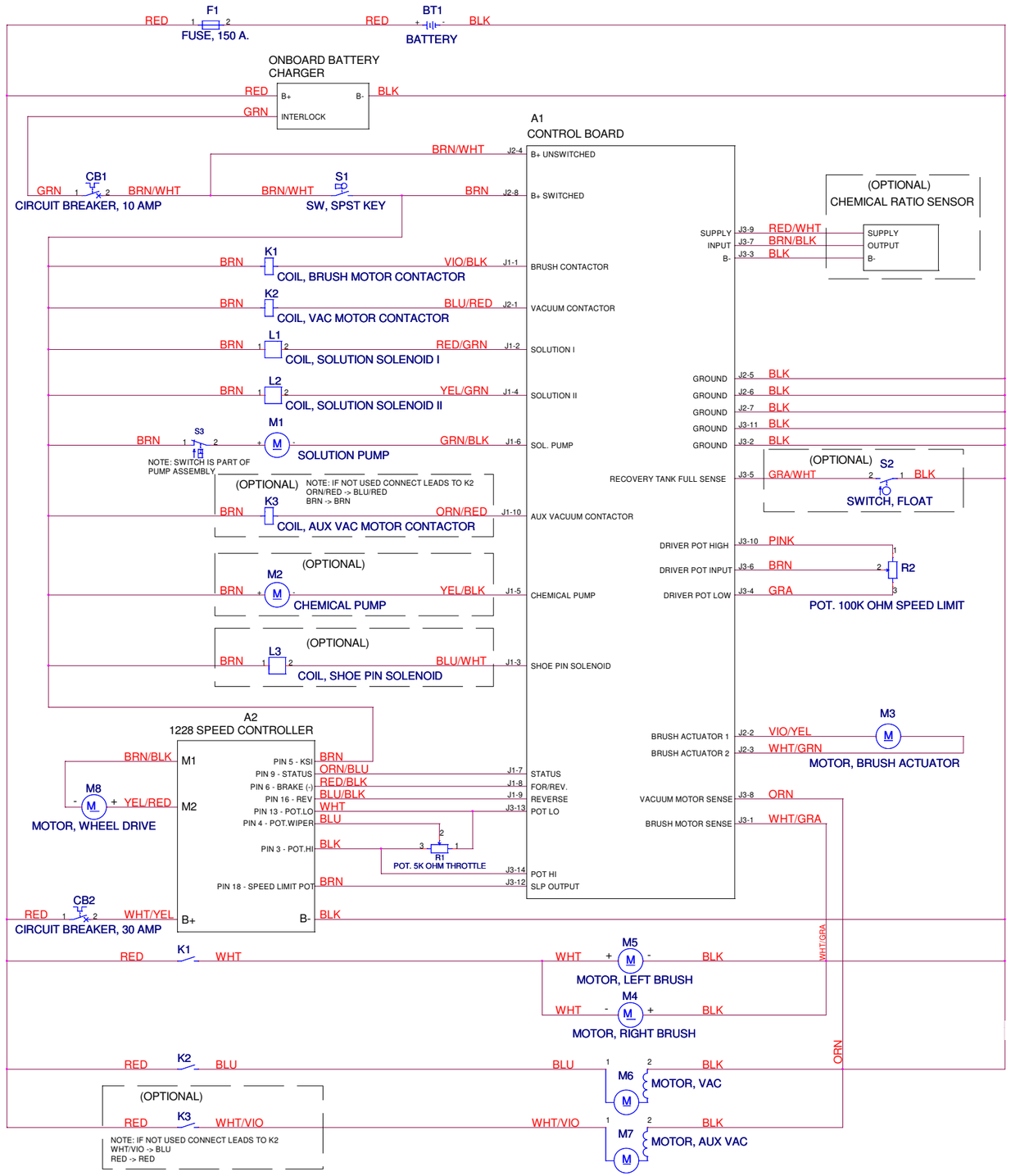
8. When the correct setting is selected, press the Scrub OFF Switch to save it.
9. The display will now show a key icon to indicate the procedure is done. Turn the main power key switch to the off position.
10. The new setting will be saved and will remain in effect until it is changed again.

Electrical Wiring Diagram/Schematic

Item	Description
A1	Control Board
A2	Speed Control
BT1	Battery
F1	Fuse, 150 Amp
F2	Circuit Breaker, 5 Amp
F3	Circuit Breaker, 30 Amp
K1	Contactor, Brush Motor
K2	Contactor, Vac Motor
L1	Solenoid, Solution
L2	Solenoid, Recycle Solution (Optional)
M1	Motor, Wheel Drive
M2	Motor, Left Brush
M3	Motor, Right Brush
M4	Motor, Vac
M5	Motor, Brush Actuator
M8	Pump, Solution
M9	Pump, Recycle (Optional)
M10	Chemical Pump (Optional)
R1	Potentiometer, 5K Ohm, Throttle
R2	Potentiometer, 100K Ohm, Speed Limit
S1	Part of M8
S2	Part of M9
S3	Switch, Key
S4	Switch, Float (Recovery Tank Full)
S5	Switch, Float (Optional / Recycle Start)
S6	Switch, Float (Optional / Recycle Stop)
X9	Battery Disconnect
X10	Battery Disconnect

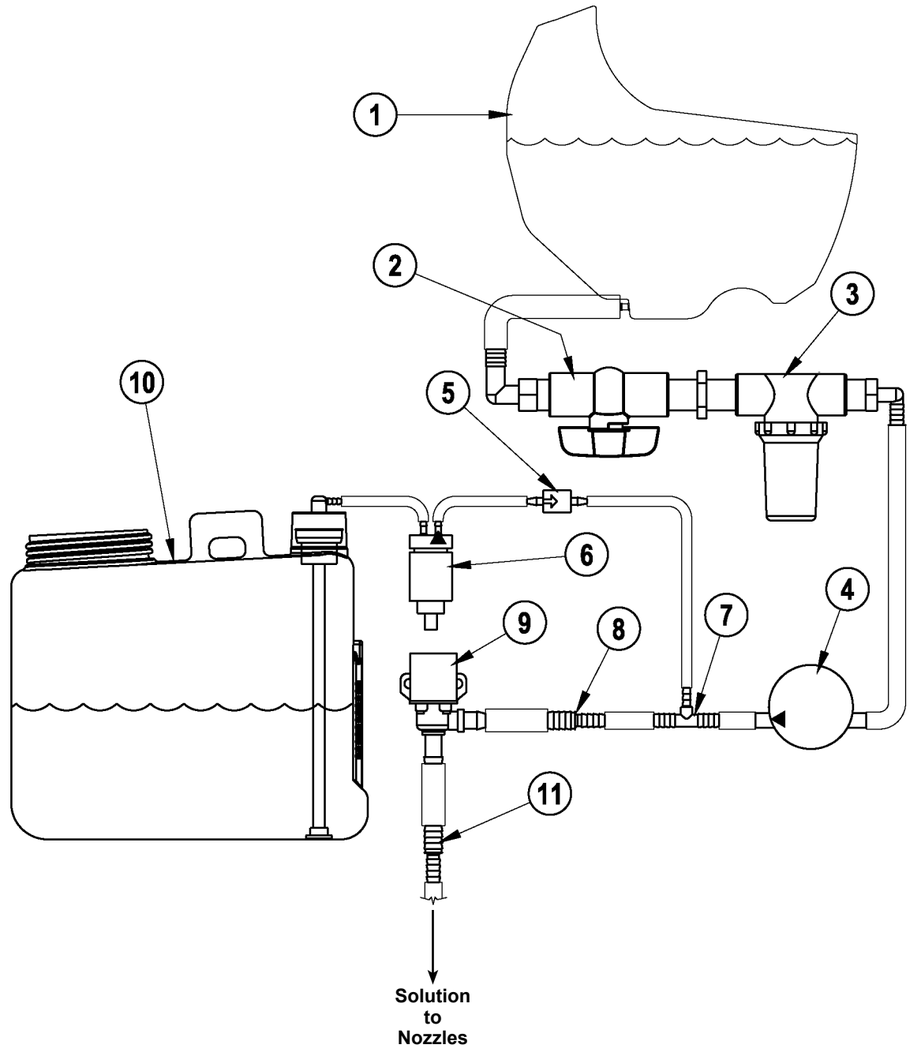


Electrical Ladder Diagram



Detergent (Chemical Mixing) System Plumbing

Item	Description
1	Solution Tank
2	Shutoff Valve
3	Inline Solution Filter
4	Solution Pump
5	Check Valve
6	Detergent Pump
7	Reducer Tee
8	Reducer Coupler
9	Solution Solenoid Valve
10	Detergent Tank
11	Reducer Coupler



Detergent (Chemical Mixing) System Preparation and Use

Common Instructions:

The system should be purged of previous detergent when switching to a different detergent.

Service Note: Move machine over floor drain before purging because a small amount of detergent will be dispensed in the process.

To Purge when Changing Chemicals:

1. Disconnect and remove the detergent cartridge.
2. Turn the Key Switch (**A**) on and press the Detergent System Switch (**B**) and the Solution/Pre-spray Switch (**C**) down for at least 2 seconds. **Note:** Once activated, the purge process takes 30 seconds. See the illustration on the right for Detergent System indicators. Normally one purge cycle is adequate to purge the system.

To Purge Weekly:

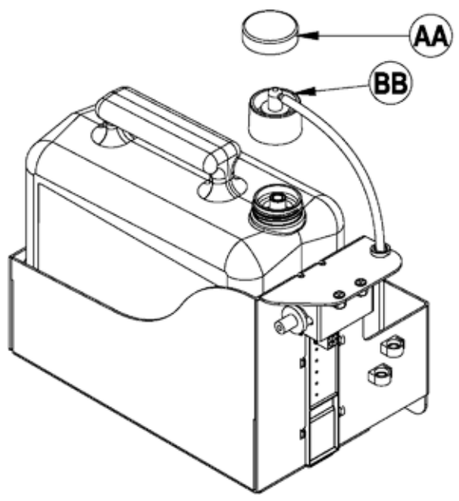
1. Disconnect and remove the detergent cartridge.
2. Install and connect a cartridge filled with clean water.

   Turn the Key Switch (**A**) on and press the Detergent System Switch (**B**) and the Solution/Pre-spray Switch (**C**) down for at least 2 seconds. **Note:** Once activated, the purge process takes 30 seconds. See the illustration on the right for Detergent System indicators. Normally one purge cycle is adequate to purge the system.

   When the Detergent Cartridge is almost empty, the Chemical Mixing System Indicator (**D1**) will come on. This “Detergent Low” indicator will remain on until you reset the system.
3. Once the Chemical Mixing System Indicator indicator comes on, you should be able to simply pour an entire gallon bottle of detergent into the Cartridge to refill without worrying about measuring. **Note:** Only reset the system when the cartridge is full. When switching cartridges, the “Low Detergent” indicator is only accurate if the replacement cartridge is at the same level as the cartridge being replaced.

To Reset:

Turn the Key Switch (**A**) on and hold the Detergent System Switch (**B**) down for 2 seconds. See illustration on the right for Detergent System indicators.



Non-Refillable Cartridge Specific Instructions:

1. Fill the detergent cartridge with a maximum of 1.25 gallons (4.73 Liters) of detergent. **Service Note**: Remove the detergent cartridge from the detergent box prior to filling to avoid spilling detergent on the machine. It is recommended that a separate cartridge be used for each detergent you plan to use. The detergent cartridges have a white decal on them so you can write the detergent name on each cartridge to avoid mixing them up.
2. The detergent cartridge has a Magnetic Slider (CC) on one end that needs to be set to the proper dilution ratio according to the dilution instructions on the manufacturer’s bottle. Slide the Magnet Slider (CC) to the appropriate location on Detergent Dilution Ratio Decal (DD).
3. When installing a new cartridge, remove the Cap (AA) and place the cartridge in the detergent box.
4. Install the Dry Break Cap (BB) as shown.

Service Note: Refer to the ***Electrical/Detergent Dilution Ratio Selection*** section to electronically program the chemical ratio if your cartridge has no magnetic slider.