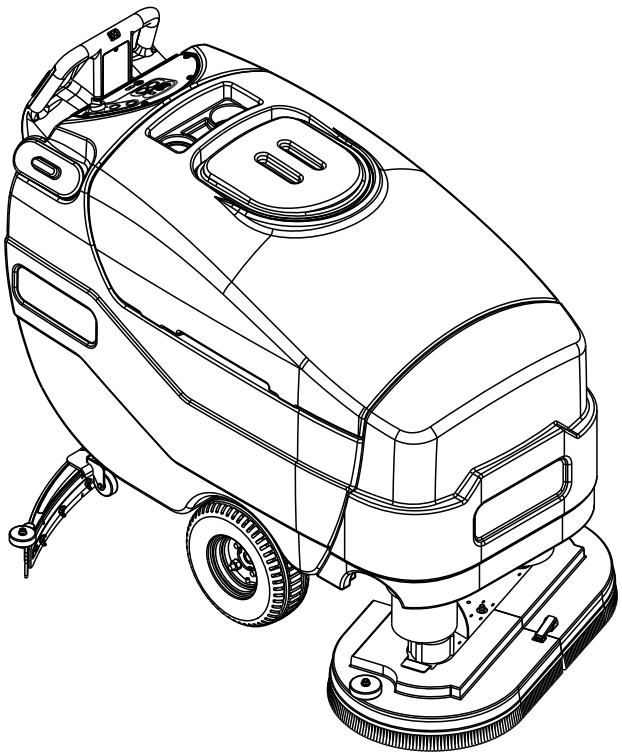
34 RST



Service Manual

Advance Models: 56315900(34RST D), 56315901(34RST D-C)
56315902(34RST D-C / W/Strainer)
56315903(34RST D-C / W/Battery Watering)

Advance
by Nilfisk-Advance

4/08 revised 7/08 FORM NO. 56043115

TABLE OF 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 **Advance 34 RST D and 34 RST D-C models, 34 RST D-C models with Strainer, and 34 RST D-C models with a Battery Watering Kit.** Read it thoroughly before servicing the machine.
Note: Bold numbers and letters in parentheses indicate illustrated items.

PARTS AND SERVICE

Repairs should be performed by your Authorized Nilfisk-Advance Service Center, who employs factory trained service personnel, and maintains an inventory of Nilfisk-Advance original replacement parts and accessories.

Call the NILFISK-ADVANCE DEALER named below for repair parts or service. Please specify the Model and Serial Number when discussing your machine.

(Dealer, affix service sticker here.)

NAMEPLATE

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

MODEL 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 AVAILABLE FOR YOUR MACHINE

The manuals listed below can be found via Nilfisk-Advance's two electronic supported databases. They are:

- Nilfisk-Advance Dealer Customer Zone
- EzParts service / parts CD-Rom
- Instructions for Use (English/Español) – Form Number 56041706
- Parts List – Form Number 56042485
- Curtis Programmer Manual – Form Number 56043101

CAUTIONS AND WARNINGS

SYMBOLS

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

⚠ DANGER!

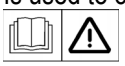
Is used to warn of immediate hazards that will cause severe personal injury or death.

⚠ 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.

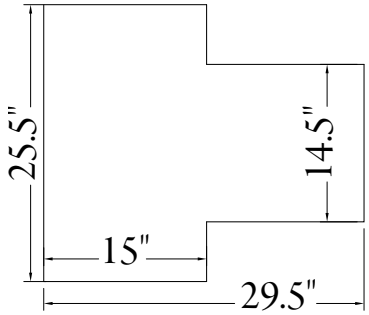
⚠ CAUTION!

- 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. Nilfisk-Advance 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 appropriate paragraph in the *Electrical System / Batteries* section at the back of this manual for additional specific battery charger warnings.

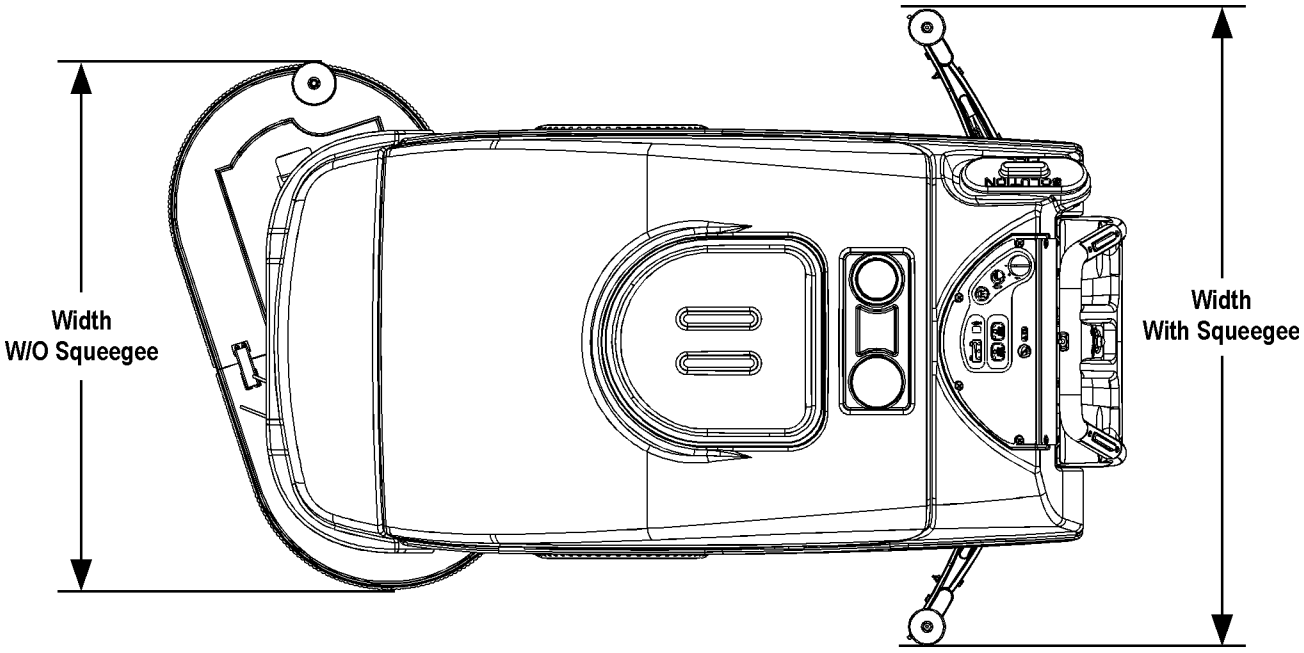
SAVE THESE INSTRUCTIONS

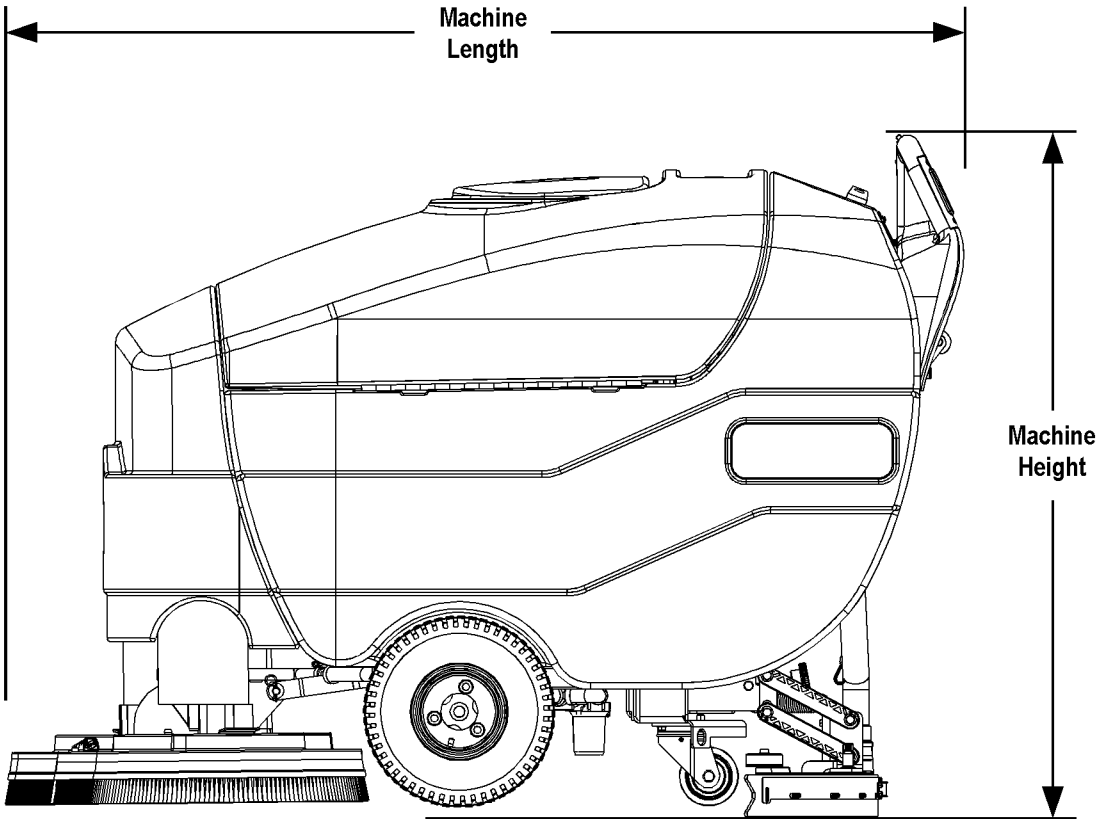
TECHNICAL SPECIFICATIONS

Voltage		36-Volt
Power Source		(6) 6-volt Batteries (wet acid and gel cell available)
Battery Capacity		305 amp-hrs.
Protection Grade		IPX3
Onboard Battery Charger		36-volt, 25-amp Wet/Gel Compatible
Solution Control		Pulse-control gravity feed
Solution Tank		30 gal. (114 L)
Recovery Tank		30 gal. (114 L)
Scrub Motors		(2) 0.75 HP (560-watt)
Vacuum Motor		0.75 HP (560-watt) three-stage
Sound Pressure Level (IEC 60704-1)		74.5 dB(A)/20µPa
Drive System		0.5 HP (375-watt) variable forward and reverse; max. speed = 3 mph (4.83 km/hr)
Drive Wheels		(2) 13-inch (33 cm) diameter; foam-filled; black non-marking
Scrub Head Type		Disc
Scrub Path		34 inches (86 cm)
Gradeability	Transport	2% (1.15º)
	Cleaning	2% (1.15º)
Max. Productivity @ 3.0 mph		44,880 ft^2/hr (4,169 m^2/hr)
Max. Productivity @ 1.5 mph		22,440 ft^2/hr (2,085 m^2/hr)
Scrub Head Size and Type		(2) 17 in,(43 cm) Brushes or Pad Holders
Scrub Pressure	(1) Regular Scrub	Max. 90 lbs (40.8 kg)
	(2) Heavy Scrub	Max. 175 lbs (79.4 kg)
	(3) Extreme Scrub	Max. 250 lbs (113.4 kg)
Scrub Head Speed		220 RPM
Solution Flow Rate	(1) Regular Scrub	0.30 gal/min (1.1 L/min) or 100 minutes per solution tank
	(2) Heavy Scrub	0.60 gal/min (2.3 L/min) or 50 minutes per solution tank
	(3) Extreme Scrub	0.90 gal/min (3.4 L/min) or 33 minutes per solution tank
Squeegee Width		41.9 in (106 cm)
Dimensions (w/o Squeegee)		W = 35.5 in (90 cm); L = 62.5 in (159 cm); H = 45 in (114 cm)
Gross Weight w/Standard Batteries		1,245 lbs (565 kg)
Battery Compartment Size		See Illustration below; W = 25.5 in (65 cm), L = 29.5 in (75 cm), H = 15 in (38 cm)



TECHNICAL SPECIFICATIONS (CONTINUED)





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 the Batteries	X			
Check/Clean Tanks and Hoses (clean recovery tank switch and vacuum inlet screen)	X			
Check/Clean/Rotate the Brushes/Pads	X			
Check/Clean the Squeegee	X			
Check the Water Level in each Battery Cell (does not apply to gel cell batteries)		X		
Inspect the Brush Housings		X		
Inspect and Clean the Solution Filter		X		
Lubricate the Machine			X	
* Check the Carbon Brushes				X

Note: See the individual machine system sections in this manual for maintenance information.

⚠ WARNING!

Turn the key switch off and disconnect the batteries before servicing the machine.

* Carbon brush inspection intervals and replacement recommendations:

- Check the vacuum motor carbon brushes (two per motor) once a year or after 300 operating hours.
- Check the carbon brushes on the brush and wheel drive motors (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 36-volt machine models brush and wheel drive motors.
- All motors: Replace carbon brushes when 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

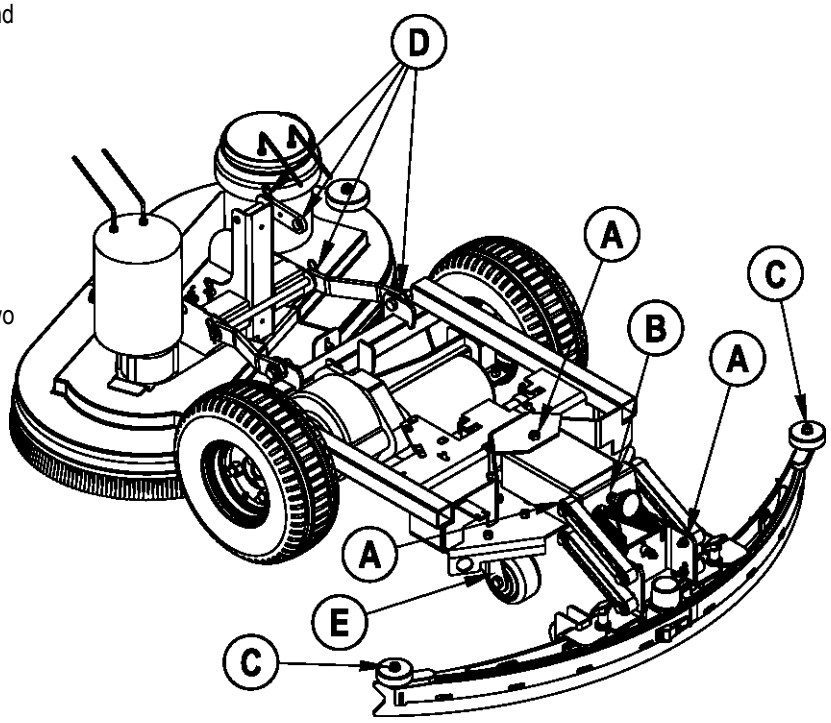
Attention: See the *Electrical System/Batteries* section in this manual for battery installation, battery maintenance and charger system requirements.

LUBRICATING THE MACHINE

Once a month, apply light machine oil to lubricate the:

- General pivot points for the squeegee linkage **(A)**.
- Threads on the squeegee angle adjustment knob **(B)**.
- Squeegee tool end wheels **(C)**.
- General pivot points for the brush linkage **(D)**.

Once per quarter, grease the zerk fitting on each of the two caster swivels **(E)**.



ADVANCE 34 RST MODELS
PM CHECKLIST

Customer_____

Address_____

City_____ St_____ Zip_____

Model_____ Serial No._____ 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	Palm Drive Button and Reverse Button Operation (check for Fwd/Rev Drive)		B D W	
2	Drive System Performance (Speed Changes Min/Max)		noisy sluggish	
3	Scrub System (Raise/Lower, Brush Motor On/Off)		A B D	
4	Scrub Brush Pressure settings (1-3)		A B	
5	Squeegee System (Raise/Lower and Squeegee Tool pick-up Performance)		A B D	
6	Vacuum Performance (Sealed water lift and 1" open hole adapter, 36v-68/12)		C L W	
7	Solution Control (Auto On/Off and Flow Volume settings 1, 2 and 3		A B L	
8	Battery Charger (Auto turn ON and OFF)		D	
9	Main Controller Special Program Options (see *Electrical System/Main Control Programming Options*). Check all applicable machine settings. Examples: Scrub mode pressure settings, service test mode, low voltage cut-out, etc.		A	

Ref	VISUAL INSPECTION ITEMS	Comments	OK	Defect Codes (circle)	Does Not Work
10	Scrub Brushes, check for wear and rotate			D M W	
11	Scrub Brush Motor(s), check for carbon brush wear	500 Hours		B C W	
12	Scrub Brush Motor(s), check gearboxes			B D L	
13	Brush Drive Motor Gimbals			C D M	
14	Scrub Deck Lift Motor, Brush Housings and Side Wheel			D M W	
15	Solution Solenoid Valve			C L W	
16	Solution Tank, Delivery Hoses and Filter	clean filter screen		C L	
17	Vacuum Motor Carbon Brushes (wear limit 3/8" [9.5 mm])	300 Hours		B C W	
18	Vacuum Motor Inlet Filter (located in recovery tank)	clean screen		C D M	
19	Recovery Tank Cover Gasket			L M W	
20	Recovery Tank Drain Hose and Cap			C D L	
21	Squeegee Pick-up Hose	back flush		C D L	
22	Squeegee Tool and Blades (clean, rotate and adjust)			A D W	
23	Squeegee Tool End Wheels and Squeegee Mount Wheels (lubricate)	2 mount wheels and 2 end wheels		A D W	
24	Battery Condition (load test, clean and water)			C W	
25	Drive Wheel Transaxle Motor Check Carbon Brushes	500 Hours		B C D W	
26	Transaxle Drive Tires	tread wear		W	
27	Rear chassis Caster Wheel (grease the zerks)	tread wear		W	

Note: For additional service information, see the individual machine system sections and the Instructions for Use, form #56041706.

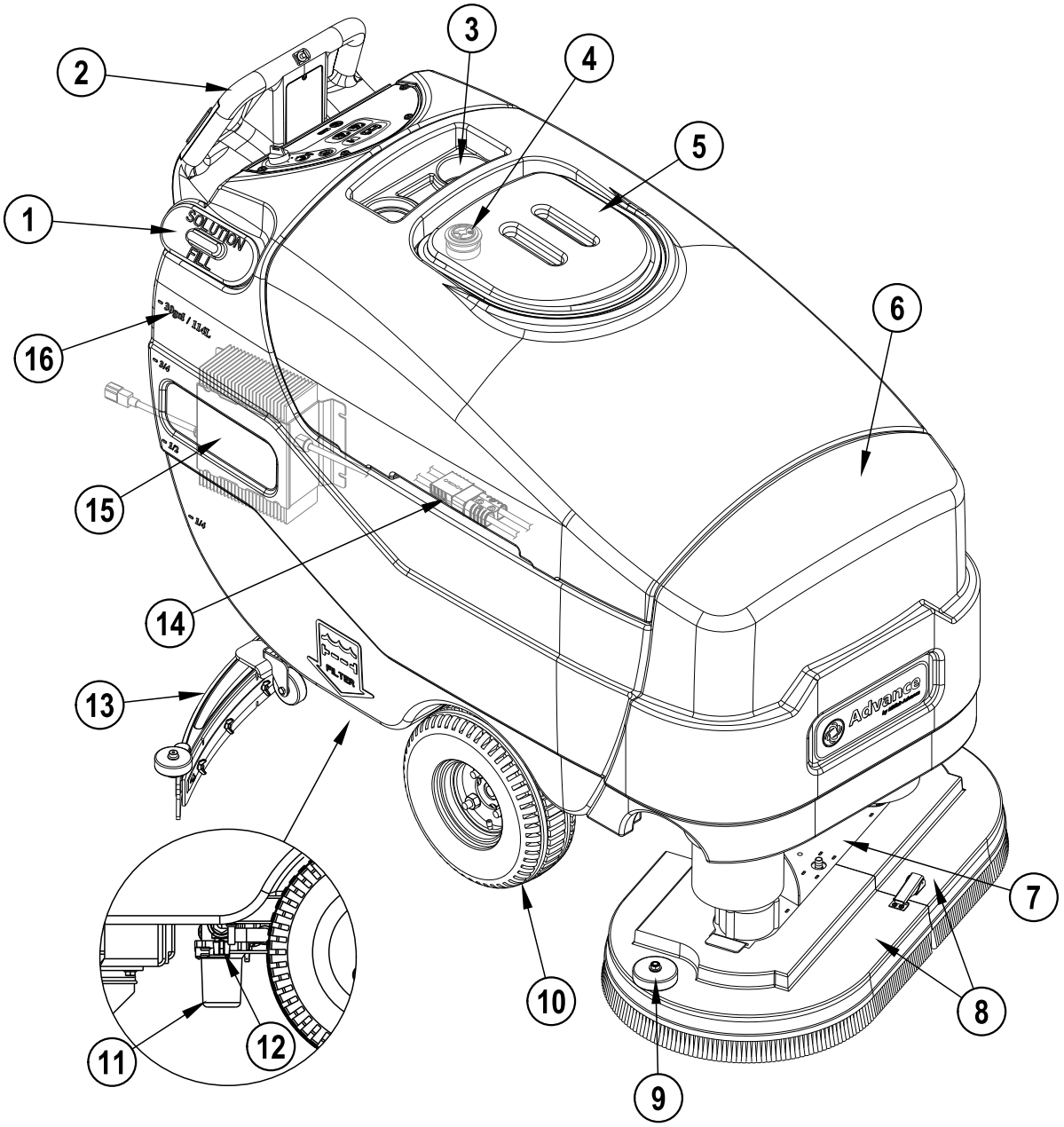
WORK COMPLETED BY: **ACKNOWLEDGED BY:**

Service Technician Signature _____ Date _____ Customer Signature _____ Date _____

KNOW YOUR MACHINE

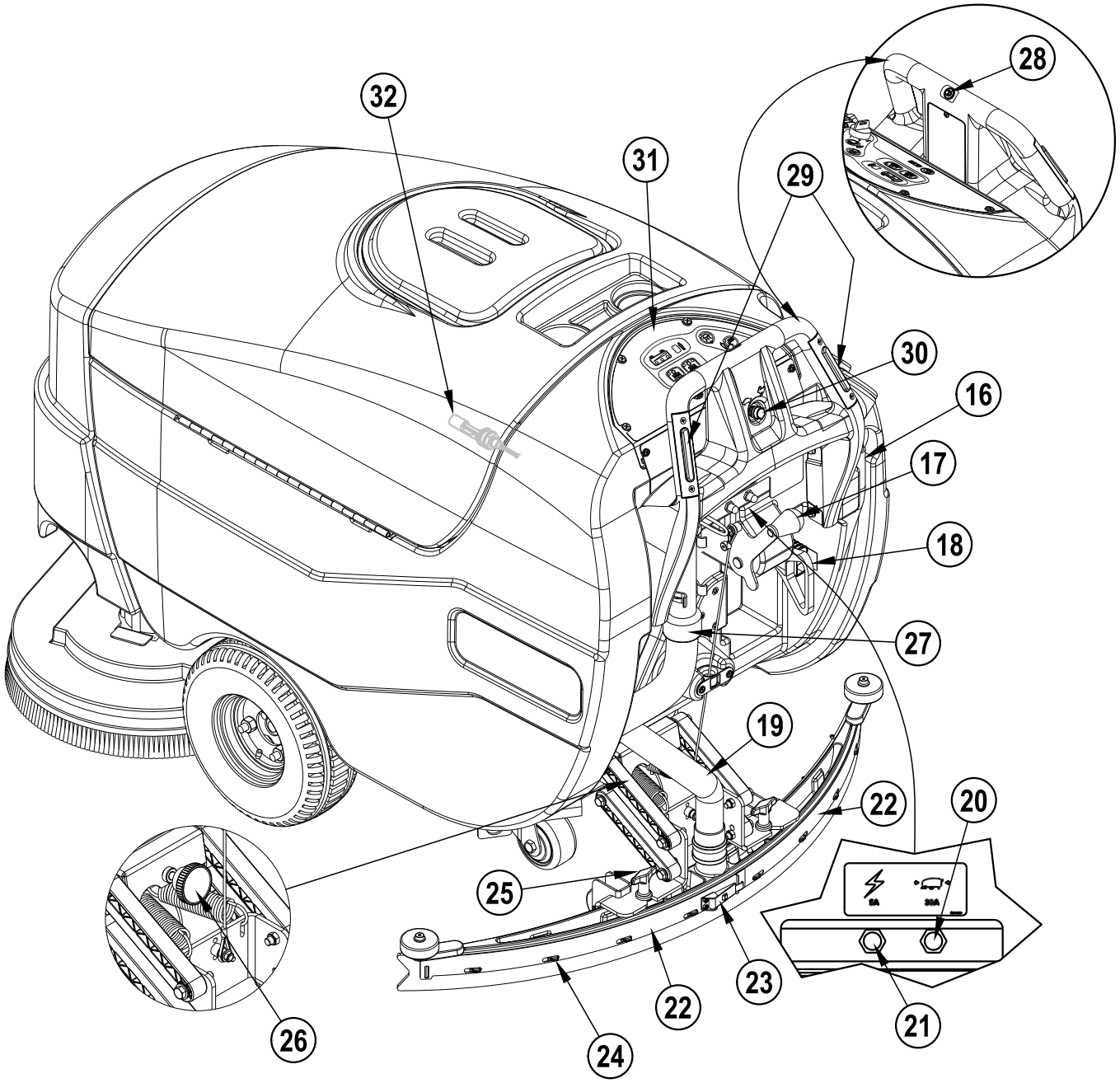
As you read this manual you will occasionally run across a bold number or letter in parentheses - example: **(2).** These numbers refer to items shown on the following pages unless otherwise noted. Refer to these pages for the location of items highlighted in bold in the text.

1 Solution Tank Fill
2 Operator Control Handle
3 Bottle Holders
4 Vacuum Motor Inlet Screen
5 Recovery Tank Cover
6 Nose Cone
7 Scrub Deck
8 Brush Housings (includes Bristle Skirt)
9 Scrub Deck Bumper Wheel
10 Drive Wheel
11 Solution Filter
12 Solution Shutoff Valve
13 Squeegee Assembly
14 Battery Pack Connector (onboard charger models only)
15 Onboard Battery Charger (not found on all models)
16 Solution Drain Hose/Level Indicator



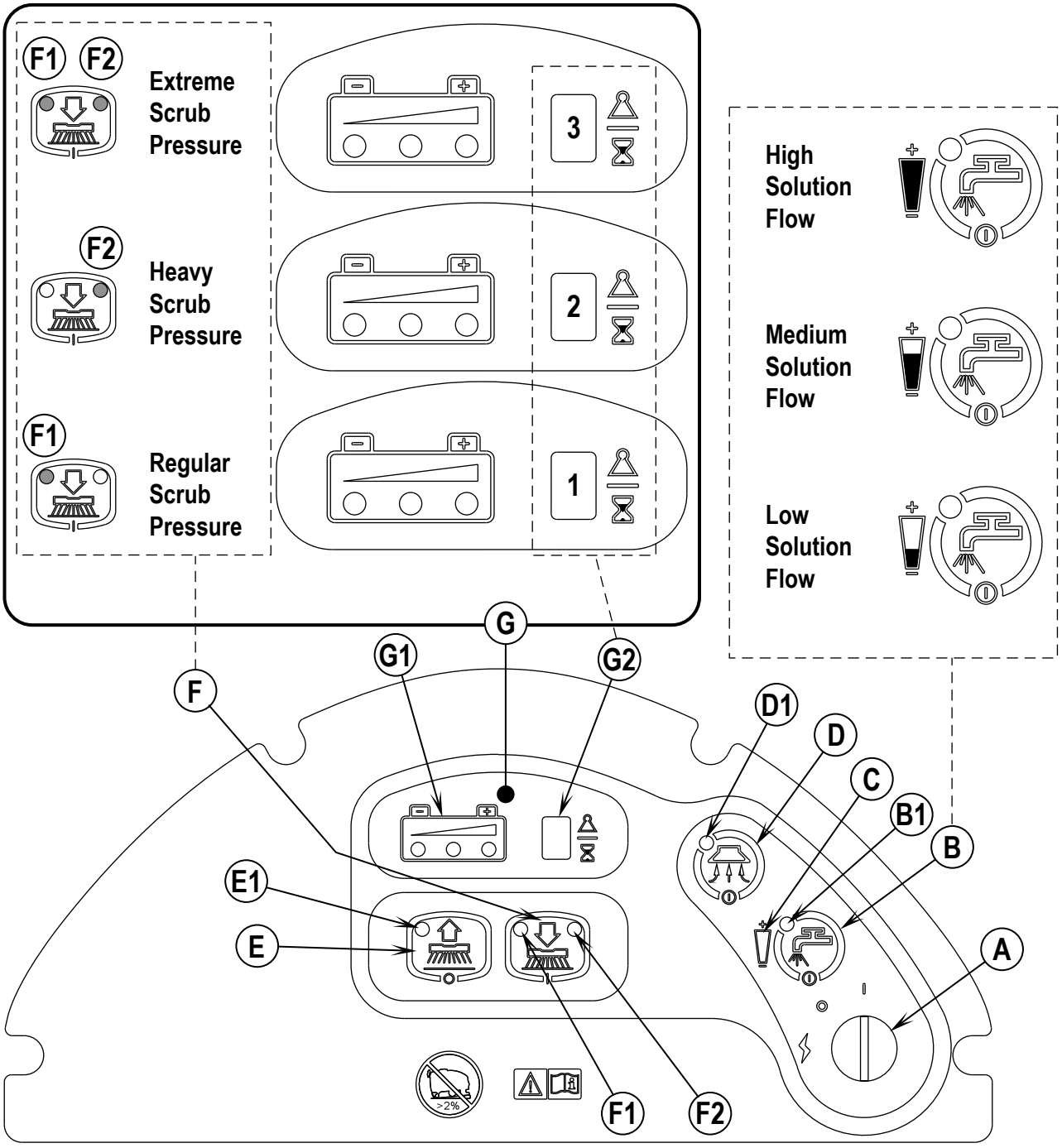
KNOW YOUR MACHINE

16 Solution Drain Hose/Level Indicator
17 Squeegee Raise/Lower Lever
18 Battery Pack Connector (non onboard charger models only)
19 Recovery Hose
20 Wheel Drive Circuit Breaker
21 Circuit Breaker for the Control Circuit
22 Squeegee Blade Tension Strap
23 Squeegee Blade Latch
24 Squeegee Blade Alignment Pins
25 Squeegee Mount Thumb Nut
26 Squeegee Adjustment Knob
27 Recovery Tank Drain Hose
28 Reverse Button
29 Palm Drive Buttons
30 Speed Limit Control Knob
31 Control Panel
32 Vacuum Shutoff Switch



KNOW YOUR MACHINE
CONTROL PANEL

A Key Switch (Main Power)
B Solution Switch
B1 Solution System Indicator
C Solution Flow Indicator
D Vacuum Switch
D1 Vacuum System Indicator
E Scrub OFF Switch
E1 Scrub OFF Indicator
F- Scrub ON Switch
F1 – Regular Scrub ON Indicator
F2 – Heavy Scrub ON Indicator
F1 and F2 – Extreme Scrub ON Indicators
G Display
G1 Battery Indicator
G2 Hour Meter / Scrub Pressure Indicator / Fault Code Display / Recovery Tank FULL Indicator



KNOW YOUR MACHINE

FUNCTIONAL DESCRIPTION OF CONTROL PANEL:

The controls on the 34 RST were designed with *one touch operation* in mind. For single-pass scrubbing the user can simply depress one switch and all systems on the machine will be ready to go. For most single-pass scrubbing operations, the operator should only need to use the middle switches on the control panel. These are the Scrub System OFF and Scrub System ON switches.

Key Switch (A) – Main power switch.

Solution Switch (B) - This switch is used to turn the solution system on or off and select the solution flow rate. Pressing this switch when the scrub system has been activated will increment the solution flow rate as displayed on the Solution Flow Indicator **(C)**. The solution flow will turn on when a **Palm Drive Button (29)** is pressed with the Reverse Button released (the forward drive position). The solution flow will turn off if both **Palm Drive Buttons (29)** are released. Pressing the **Solution Switch (B)** when the scrub system is off will momentarily turn the solution flow on (at the high flow rate) to allow pre-wetting of the scrub brushes. Pressing and holding in the **Solution Switch (B)** when the scrub system is off will allow continuous solution flow for as long as the switch is depressed.

Scrub OFF Switch (E) - Pressing this switch when the unit is in a scrub mode will cause the following to occur:

- The scrub brushes will turn off and the scrub deck will be raised to the up position.
- The solution flow will be stopped.
- The first time that this switch is pressed, the vacuum system will NOT be turned off. This is so that any remaining water may be picked up without having to turn the vacuum back on. If this switch is pressed a second time or if the machine is stopped (after the scrub system has been turned off), the vacuum will shut off after a 10-second delay.

Scrub ON Switch (F) – If the scrub system is off, pressing this switch once will cause the following to occur:

- The scrub system will be enabled with the scrub pressure set to the “Regular” (“Normal”) mode (#1) and the scrub deck will be lowered. Note that pressing the Scrub-ON switch twice will set the scrub pressure to the “Heavy” scrub pressure mode (#2). Pressing and holding the Scrub-ON switch in for five seconds will set the scrub pressure to the “Extreme” scrub mode (#3).
- The vacuum system will be enabled.
- The solution system will be enabled.
- As soon as either of the **Palm Drive Buttons (29)** is pressed, the scrub brushes will start turning and the vacuum will turn on. If the direction is set to forward, the solution flow will start. If the **Reverse Button (28)** is pressed, the solution flow will be stopped. If the scrub system is already enabled when the Scrub ON Switch is pressed, the scrub pressure will increase to the “Heavy” scrub mode (#2). If the Scrub ON Switch is pressed and held in for 3 to 5 seconds, the scrub pressure will change to the “Extreme” scrub mode (#3). Note that the **Scrub Pressure Indicator (G2)** on the panel display will show the current scrub pressure setting (1, 2 or 3).

Note: Both the scrub pressure and the solution flow rate will return to their default settings when the key switch is turned on again after the machine has been switched off.

Vacuum Switch (D) – This switch is used to turn the vacuum system on or off. Pressing this switch will alternate between on and off. The vacuum will only turn on when a **Palm Drive Button (29)** is pressed. It will remain on for 10 seconds after the **Palm Drive Buttons (29)** are released.

The vacuum also has an automatic shutoff feature that will turn the vacuum and scrub systems off if the recovery tank becomes full.

KNOW YOUR MACHINE
DESCRIPTION OF INDICATORS ON THE CONTROL PANEL:

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

- A **flashing green** or **flashing 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 but neither of the palm drive buttons has been pressed, the scrub system, vacuum and solution indicators will all be yellow. This indicates that the systems are enabled and ready to turn on when a palm drive button is pressed.
- 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 palm drive buttons are released. 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 Indicator (B1) – indicates the following:

- Green - the solution is on.
- Yellow – the solution is enabled but neither of the palm drive buttons has been pressed.
- Flashing Yellow - there is a solution system fault.
- Off - the solution is disabled and turned off.

Solution Flow Indicator (C) – indicates the following:

- When the bottom one-third of the nozzle icon is green, the solution flow is set to low.
- When the bottom two-thirds of the nozzle icon is green, the solution flow is set to medium.
- When the entire nozzle icon is green, the solution flow is set to high.
- When the entire nozzle icon is black (empty), the solution flow is switched off.

Vacuum System Indicator (D1) – indicates the following:

- Green - the vacuum is on.
- Flashing Green - the vacuum is in the 10-second delayed-off condition.
- Yellow - the vacuum is enabled but neither of the palm drive buttons has been pressed.
- Flashing Yellow - there is a vacuum system fault.
- Off - the vacuum is disabled and turned off.

Scrub OFF Indicator (E1) - indicates the following:

- Green - the scrub system is off and ready to be activated.
- Red - the scrub system has been turned off but the scrub deck is not up yet.
- Flashing Red - there is a fault in the scrub system.
- Off - the scrub system has been activated.

KNOW YOUR MACHINE
DESCRIPTION OF INDICATORS ON THE CONTROL PANEL:

Regular Scrub ON Indicator (F1) - indicates the following:

- Yellow - the scrub system is enabled in the "Regular" scrub mode but neither of the palm drive buttons has been pressed.
- Green - the scrub system has been turned on in the "Regular" scrub mode and the machine is moving in either direction.
- Off - the scrub system has been turned OFF.
- Flashing Yellow - indicates the number of the speed control fault code with a sequence of blinks. Refer to the *Electrical System/Curtis Controller Diagnostics* section for more information on the Curtis speed controller status light and display.

Heavy Scrub ON Indicator (F2) - indicates the following:

- Yellow - the scrub system is enabled in the "Heavy" scrub mode but neither of the palm drive buttons has been pressed.
- Green - the scrub system has been turned on in the "Heavy" scrub mode and the machine is moving in either direction.
- Off - the scrub system has been turned OFF.

Extreme Scrub ON Indicators (F1 and F2) - indicate the following:

- Both Yellow - the scrub system is enabled in the "Extreme" scrub mode but neither of the palm drive buttons has been pressed.
- Both Green - the scrub system has been turned on in the "Extreme" scrub mode and the machine is moving in either direction.

Battery Indicator (G1) - indicates the level of battery discharge as follows:

- Green – 0 (full charge) to 50%
- Green and Yellow – 50% to 75%
- Yellow – 75% to 90%
- Yellow and Red - 90% to 95%
- Red - 95% to 99%
- Flashing Red – 100%

Note: Refer to the *Electrical System/Description of the Battery Condition Indicators* section in this manual for additional information about the battery indicator.

Hour Meter (G2) – the window will display the total number of run hours on the machine. The run hours will be displayed sequentially when key switch is first switched on provided the recovery tank is not full and there is no fault condition to generate a fault code number. For example, a sequential display of "1-3-5-.-6" indicates that there are 135.6 total hours on the machine.

Scrub Pressure Indicator (G2) – the window will display the number corresponding to the scrub pressure selected with the **Scrub ON Switch (F)** as follows:

- **0** – Scrub deck retracted upward
- **1** – "Regular" ("Normal") scrub pressure
- **2** – "Heavy" scrub pressure
- **3** – "Extreme" scrub pressure

Note: After the machine has been stopped and the scrub deck has been raised, the window will again display the hour meter.

Fault Code Display (G2) – if a main controller fault occurs, the window will display the corresponding error code number beginning with an "E" followed by two digits. For example, a sequential display of "E-0-4" indicates a "04" error code which is a scrub deck lift actuator overload fault. Refer to the *Electrical System/Main Controller Error Codes (Table 2)* section for explanations and possible causes of main controller faults and error codes.

Recovery tank FULL Indicator (G2) – when the recovery tank is full, the solution will actuate the **Vacuum Shutoff Switch (32)**. The window will display the letters "FULL" in sequence.

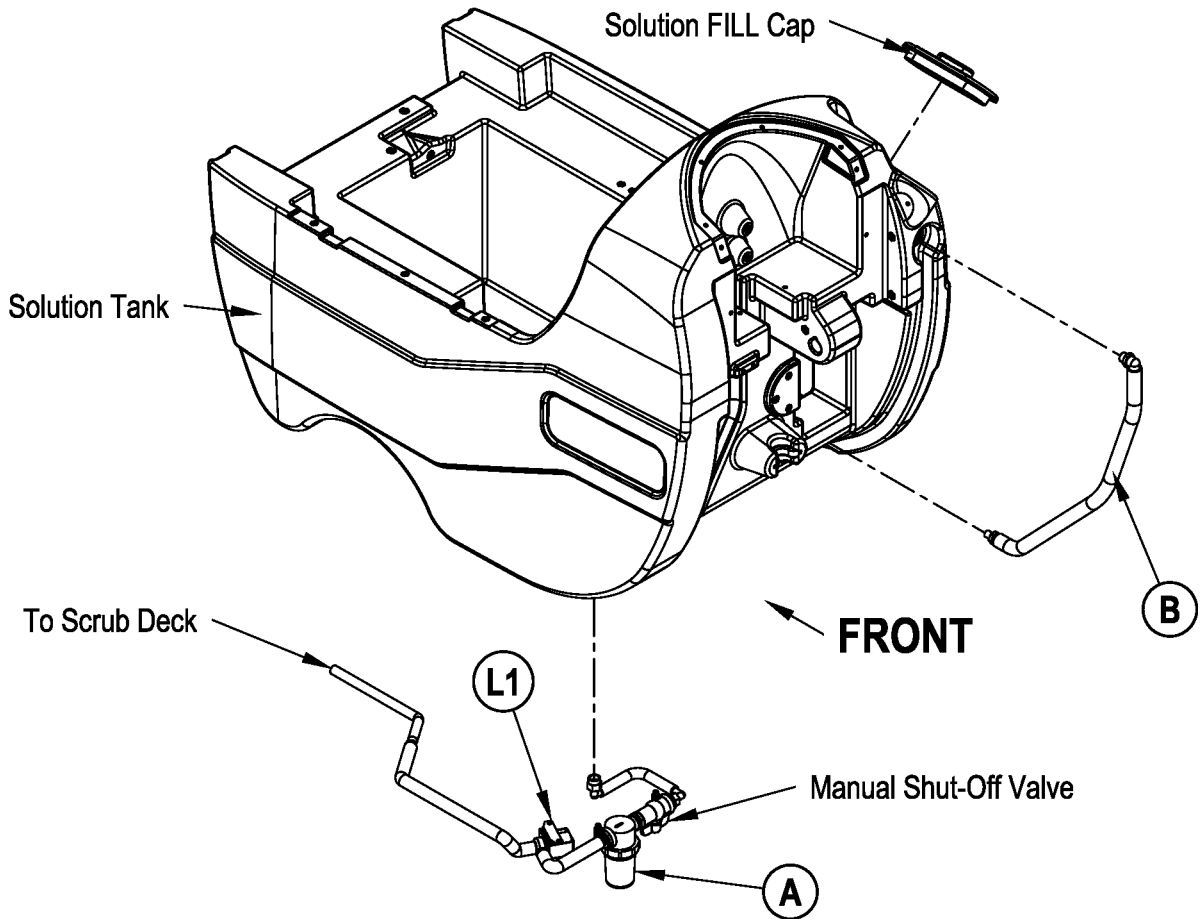
SOLUTION SYSTEM FUNCTIONAL OVERVIEW

See Figure 1. The 34 RST models have a solution tank fill capacity of 30 gallons (114 liters). All models use one right rear tank fill opening for ease of filling. A serviceable Solution Filter **(A)** is plumbed into the manual solution shutoff valve outlet to keep debris from entering the solenoid valve. Also fitted to the tank is a flexible Solution Drain Hose/Level Indicator **(B)** used to indicate the solution level and to drain the tank for system maintenance.

The standard solution system uses an electrical Solenoid Valve **(L1)** which stops and starts the solution flow to the scrub brushes. **See Electrical Diagram Figure 2**. The electrical circuit that turns on (energizes) the solenoid coil is activated through the (A1) control panel's solution switch button input and the FWD / REV (A2) Speed Controller voltage output signals. **Note**: See the *Know Your Machine* section 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 the (L1) solenoid valve on and off. The solution will flow to the scrub brushes when the scrub deck is lowered and a palm drive button is pressed. **Note**: When the solution on/off button is turned off, no flow can occur while the machine scrub deck is down and a palm drive button is pressed.

FIGURE 1



SOLUTION SYSTEM
CIRCUIT OVERVIEW SOLUTION AUTO MODE (SOLENOID VALVE CIRCUIT)

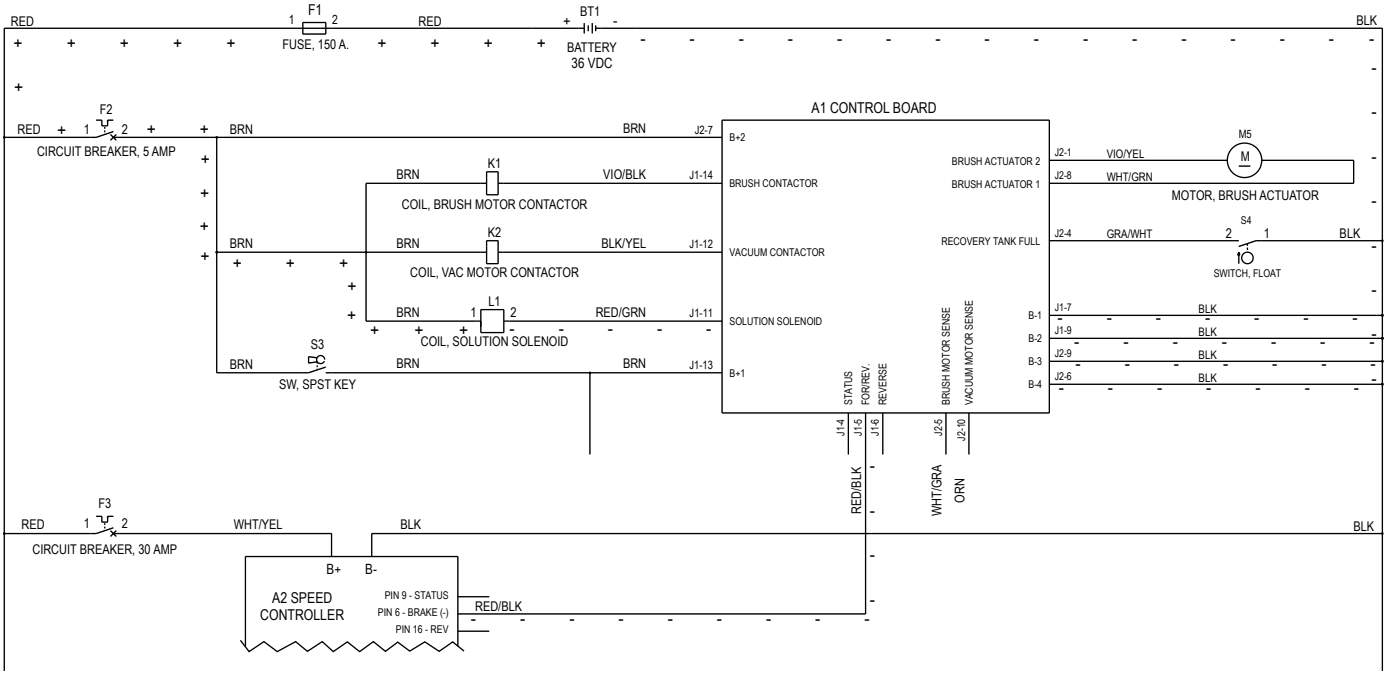
The 34 RST machines do not use a solution pump. The (3) solution flow volumes are managed by the A1 control board's negative voltage output from the terminal J1-11 Red/Grn wire. This input from A1 to the solution solenoid also requires negative voltage from Pin 6 - Brake on the speed controller (A2) to J1-5 – For/Rev. on A1 (Red/Blk wire). The J1-11 Red/Grn L1 solenoid circuit turns on and off to open and close the L1 solenoid which controls the three different solution flow rates by gravity feed only. The total solenoid cycle time is approximately six seconds. The solution flow is proportional to the time the solenoid is on (open) during the total solenoid cycle time. The approximate solenoid on/off times corresponding to the three solution flow rate is shown in the table below.

Solution Indicator	Flow Rate	Solenoid On Time	Solenoid Off Time
One-bar gauge	0.3 g/m	2 sec.	4 sec.
Two-bar gauge	0.6 g/m	4 sec.	2 sec.
Three-bar gauge	0.9 g/m	6 sec.	0 sec.

Electrical Diagram

Note: For a complete description of all callouts see the *Electrical System/Wiring Diagram/Schematic* section in this manual.

FIGURE 2



SOLUTION SYSTEM

SOLUTION SYSTEM MAINTENANCE

- **Solution Tank: See Figure 1**. Empty the solution tank weekly; remove the solution Drain Hose **(B)** 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:** Remove and clean the inline Solution Filter **(A)**. To access the filter housing for removal, work underneath the middle right rear side of the machine's chassis. No tools are needed to remove the filter (hand tighten only). **Service Tip:** The solution manual shutoff valve 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 or no solution flow	No solution in the tank
	Solution tank filter ball valve in the off position
	Clogged solution filter, solenoid valve or hoses

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

SOLUTION SYSTEM
TROUBLESHOOTING GUIDE ELECTRICAL

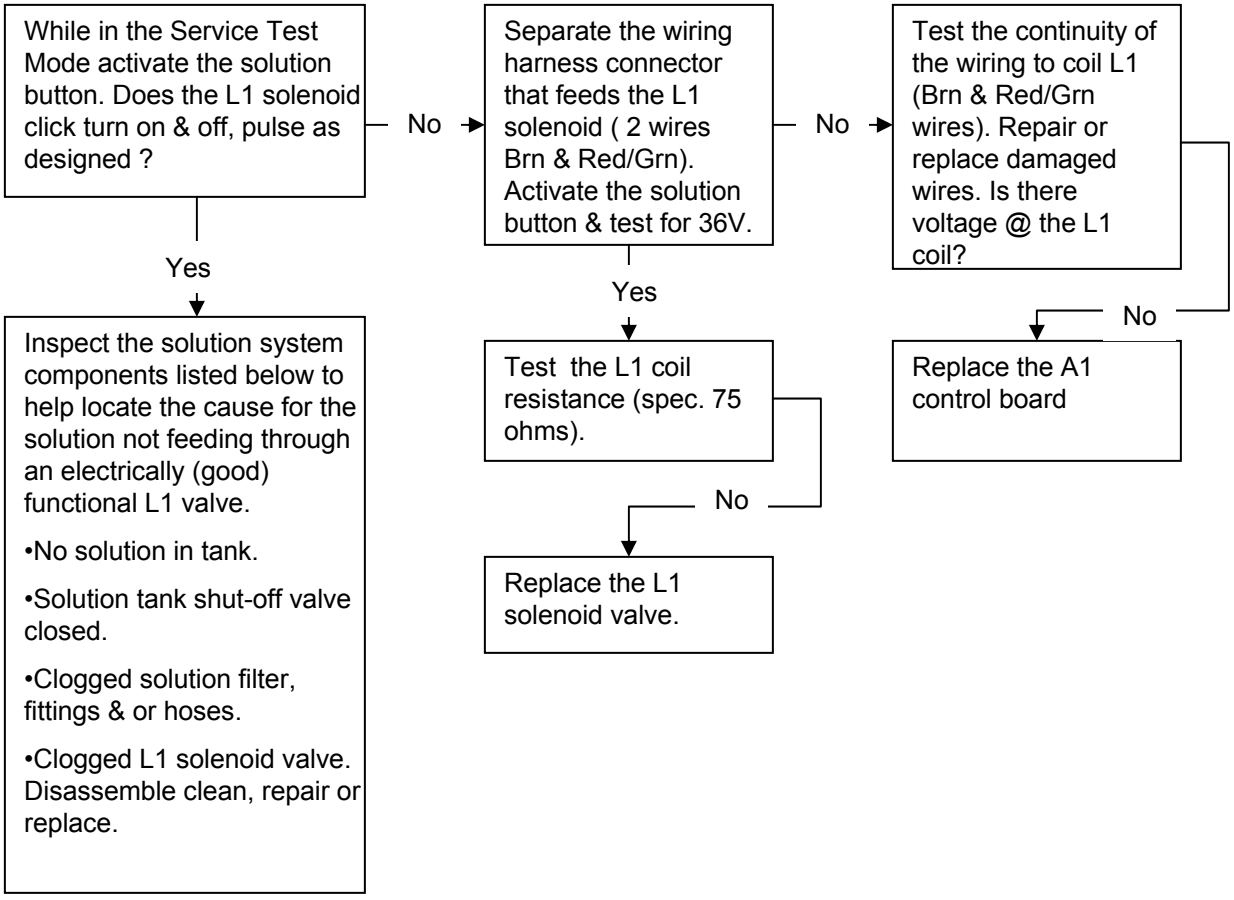
Possible Symptom - No solution flow while in the scrub auto solution mode.

Note: Activate the Service Test Mode Program. See the *Electrical System/Service Test Mode* section in this manual for instructions. All testing will be performed in the **Service Test Mode Program.**

Symptom

No solution flow when scrubbing in the auto solution mode.

Note: Activate the Service Test Mode Program. See optional program section for instructions.



SOLUTION SYSTEM

SOLENOID VALVE REMOVAL

1 Drain the solution tank or turn off the solution ball valve to prevent solution loss.

2 Shut off the key switch and disconnect the battery connector.

⚠ WARNING!

Disconnect the battery pack connector before servicing machine.

Note: You may want to jack up the left side of the machine for better access to the Solenoid Valve **(H)** and associated hardware. If you choose to jack up the machine, make sure you support the machine with safety stands or blocking to prevent the machine from dropping and possibly causing personal injury or machine damage.

⚠ WARNING!

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

3 **See Figure 3.** Unplug the L1 solenoid valve Connector Assembly **(G)** from the machine harness. Note that you may need to cut the wire tie.

Note: You may want to place a pan underneath the Solenoid Valve **(H)** to catch any water remaining in the Inlet and Outlet hoses when you disconnect the hoses.

4 Loosen the Hose Clamps **(K)** holding the Inlet Hose **(N)** and Outlet Hose **(L)** to the Solenoid Valve **(H)**.

5 Carefully remove (pry off) the Outlet Hose **(L)** from barbed fitting on the Solenoid Valve **(H)**.

6 Remove the (2) Phillips Pan Head Screws **(M)** and Washers **(J)** holding the valve to the machine frame.

7 Carefully remove (pry off) the Inlet Hose **(N)** from the barbed fitting on the Solenoid Valve **(H)** and remove the Solenoid Valve **(H)** from the machine.

SOLENOID VALVE DISASSEMBLY AND CLEANING

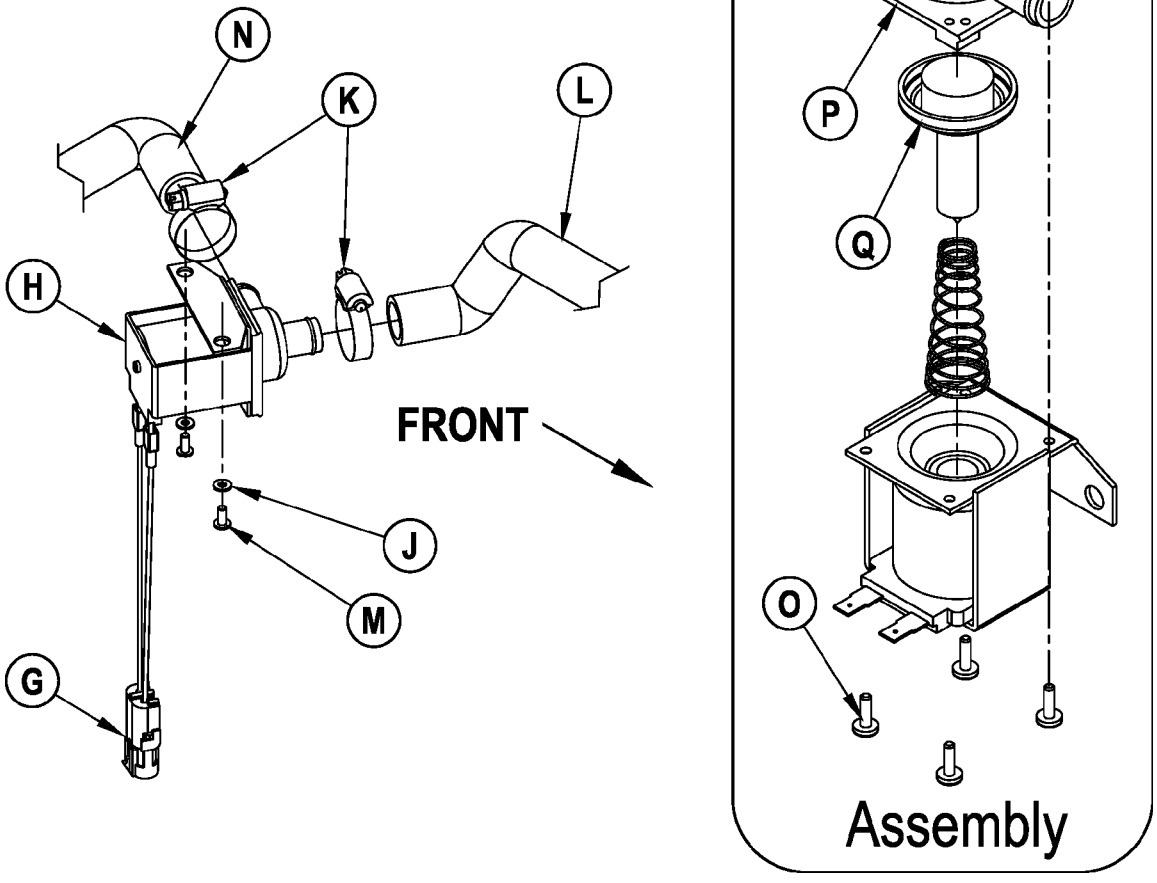
1 Remove the Solenoid Valve **(H)**. See the *Solution System/Solenoid Valve Removal* section above for instructions.

2 **See Figure 3.** Remove the (4) Screws **(O)** and disassemble the Solenoid Valve **(H)**. Be careful not to lose any internal parts.

3 Thoroughly wash any dirt or debris from the Block **(P)** and Diaphragm **(Q)**.

4 After reassembling, test the Solenoid Valve **(H)** for correct operation.

FIGURE 3



SOLUTION SYSTEM
SOLUTION FILTER AND BALL VALVE REMOVAL

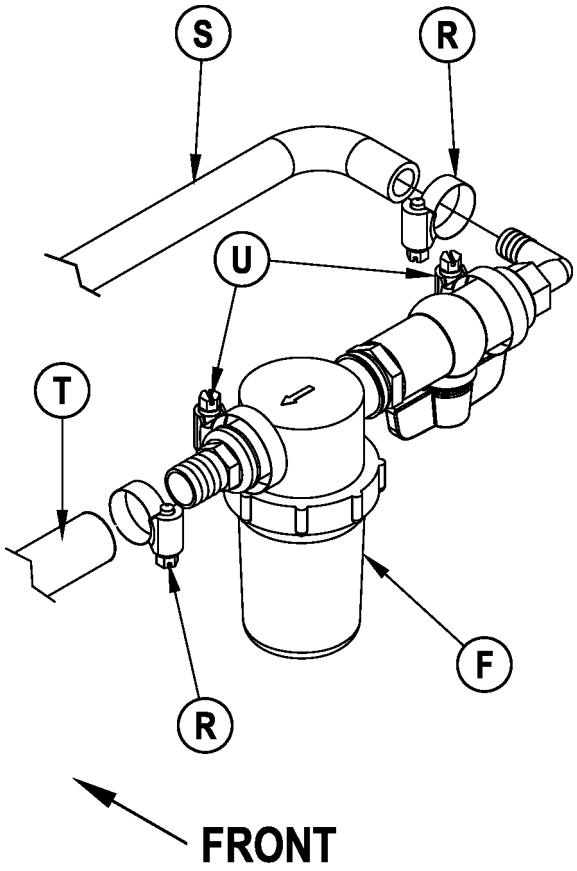
1 **See Figure 1.** Drain the solution tank using the solution drain hose **(B).**

2 **See Figure 4.** Loosen the (2) Hose Clamps **(R)** and carefully remove (pry off) the solution Inlet Hose **(S)** and Outlet Hose **(T)** from the Filter/Valve Assembly **(F)**.

3 Remove the (2) Hose Clamps **(U)** that secure the Filter/Valve Assembly **(F)** to the chassis and remove the Filter/Valve Assembly **(F)** from the machine.

Note: Refer to the *Appendix* at the back of this manual for solution system flow schematic.

FIGURE 4



SCRUB SYSTEM
FUNCTIONAL OVERVIEW

- **Disc Brush System Overview**
  See Figure 2. The 34 RST models use the disc-type scrub system powered by (2) 3/4 HP motor gearbox assemblies.

- **General Brush Overview**
  Note: Recovery Tank Full switch must be open (Tank empty). On all models 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. The scrub pad or brush pressure ranges (1-3) are selectable allowing the operator the choice to vary the scrubbing effort (pressure) while operating the machine. **Note**: See the *Electrical System/Main Control Programming Options* section in this manual for more detailed operation and instructions on how to change the factory default regular scrub pressure settings.

  See Figure 1. 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:

- **M2/M3 - Scrub Brush Motor Run Function**
  Scrub Brush Motor Circuit Overview
  + (Positive) circuit input starts with:
  - A closed S3 key switch supplies the needed positive voltage to the A1 control board #J1-13 (Brn wire).
  - A closed 5-amp circuit breaker (F2) supplies positive battery voltage (Brn wire) to the control side of the brush motor contactor coil (K1).
  - Once the load side of K1 is closed, the needed positive battery voltage is supplied to motors M2 and M3.

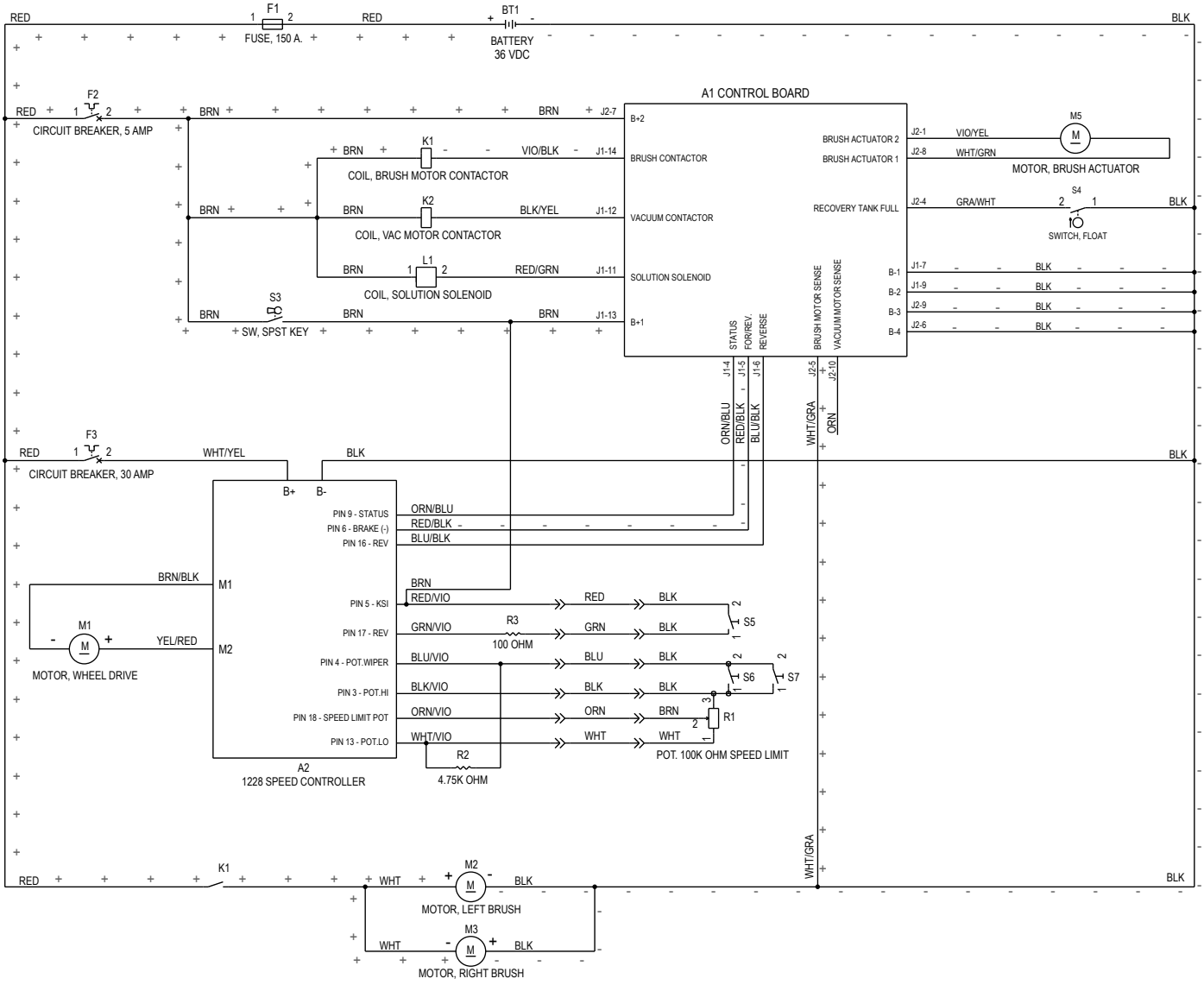
  - (Negative) circuit input starts with:
  - Negative battery voltage is supplied to the A1 control board at terminals B1 (J1-7) Blk, B2 (J1-9) Blk, B3 (J2-9) and B4 (J2-6) Blk.
  - **Note**: The A1 control board scrub-on button must also be depressed (enabled).
  - When a palm drive switch is pressed (S6/S7), Pin 6 – Brake on the speed controller (A2) supplies negative voltage to J1-5 – For/Rev. on A1 (Red/Blk wire).
  - A negative voltage output from J1-14 – Brush Contactor (Vio/Blk wire) is supplied to the K1 solenoid coil control circuit and pulls in the load contacts on K1.
  - The negative load voltage is supplied from the battery negative to motors M2 and M3.

- **M5 - Scrub Brush Actuator Lift Motor Function**
  The A1 control board outputs a controlled motor voltage polarity change (wires J2-1 and J2-8) that raises and lowers the scrub deck for installing, removing and controlling the scrub brushes' selected current load. 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 J2-5 and J1-7 (sense wires Wht/Gra and Blk). Any surrounding temperature change in this large Neg. 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 M5 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 cut-out function is to help prolong battery life. The scrub deck will be raised and the brush motors and solution solenoid valve will turn OFF automatically and cease to function when the batteries discharge to the selected cut-out level. The cut-out level is adjustable between two settings. The standard (S) setting (wet cell/lead-acid) is 31.34 volts or 1.74 volts per cell. The alternate (A) setting (gel/maintenance free) is 32.63 volts or 1.81 volts per cell. **Note**: See the *Electrical System/Main Control Programming Options* section in this manual for instructions on how to select the appropriate voltage cut-out threshold.

Special Service Note: There is a minimum battery charge level that the must be reached before the low-voltage cut-out function will reset and allow the machine to function again. On the 34 RST, the batteries must be charged to a minimum of 37.6 volts (2.09 volts per cell) in order to reset the low-voltage cut-out function.

FIGURE 1


RED
F1
FUSE, 150 A.
BT1
BATTERY
36 VDC
BLK
F2
CIRCUIT BREAKER, 5 AMP
A1 CONTROL BOARD
J2-7
B+2
BRUSH CONTACTOR
VACUUM CONTACTOR
SOLUTION SOLENOID
B+1
BRUSH ACTUATOR 2
BRUSH ACTUATOR 1
RECOVERY TANK FULL
BRUSH MOTOR SENSE
VACUUM MOTOR SENSE
STATUS
FOR/REV.
REVERSE
K1
COIL, BRUSH MOTOR CONTACTOR
VIO/BLK
J1-14
K2
COIL, VAC MOTOR CONTACTOR
BLK/YEL
J1-12
L1
COIL, SOLUTION SOLENOID
RED/GRN
J1-11
S3
SW, SPST KEY
J1-13
M5
MOTOR, BRUSH ACTUATOR
J2-1
VIO/YEL
J2-8
WHT/GRN
S4
SWITCH, FLOAT
J2-4
GRA/WHT
B-1
B-2
B-3
B-4
J1-7
J1-9
J2-9
J2-6
J1-4
J1-5
J1-6
J2-5
J2-10
ORN/BLU
RED/BLK
BLU/BLK
WHT/GRA
ORN
F3
CIRCUIT BREAKER, 30 AMP
WHT/YEL
A2
1228 SPEED CONTROLLER
B+
B-
PIN 9 - STATUS
PIN 6 - BRAKE (-)
PIN 16 - REV
PIN 5 - KSI
PIN 17 - REV
PIN 4 - POT.WIPER
PIN 3 - POT.HI
PIN 18 - SPEED LIMIT POT
PIN 13 - POT.LO
BRN/BLK
M1
YEL/RED
M2
MOTOR, WHEEL DRIVE
R3
100 OHM
R2
4.75K OHM
S5
S6
S7
R1
POT. 100K OHM SPEED LIMIT
K1
M2
MOTOR, LEFT BRUSH
M3
MOTOR, RIGHT BRUSH

SCRUB SYSTEM

MOTOR GIMBAL REMOVAL

1 Make sure the scrub brush deck is in its raised position, then turn the key switch off and disconnect the battery pack.

⚠ WARNING!

Disconnect the battery pack connector before servicing machine.

2 See Figure 2. Unlatch and remove the left- and right-hand Brush Housings **(A** and **B)**.

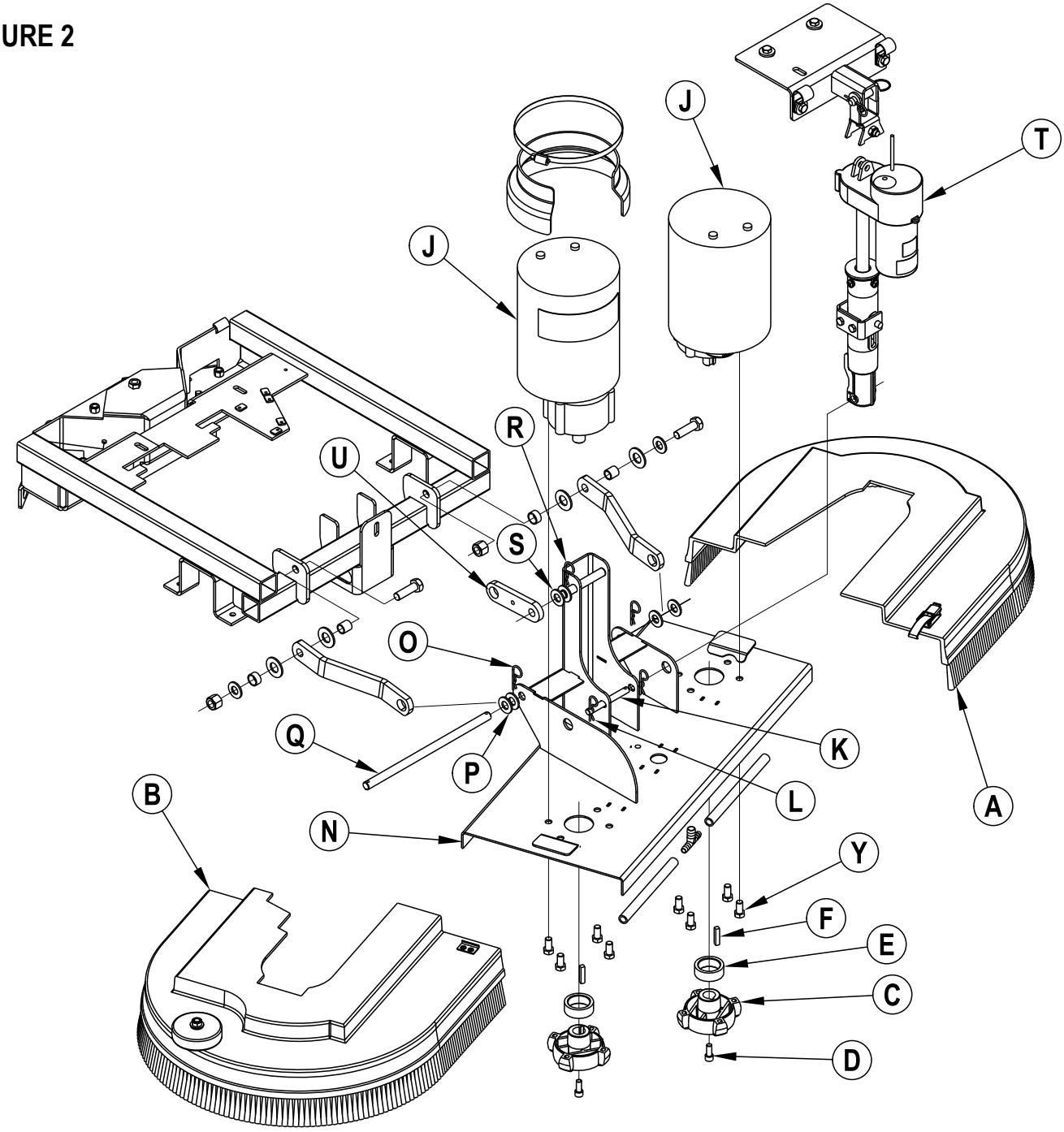
3 Push the brushes/pads straight down to remove them from the Motor Gimbals **(C)**.

4 Remove the 5/16"-18 Socket Head Screw **(D)** using a ¼" hex wrench, then remove the Motor Gimbal **(C)**, Brush Driver Collar **(E)** and Key **(F)** from the scrub motor shaft.

Special Service Note: If the 5/16"-18 Socket Head Screw **(D)** is frozen in the scrub motor shaft, it may be easier to remove the scrub deck from the machine before you remove the screw. (Refer to the *Scrub Brush Deck Removal* section in this manual.)

5 To reinstall the Motor Gimbal **(C)**, follow the above steps in reverse order. **Note**: Apply a small amount of grease or a product called "Never-Seez®" to the scrub motor shaft when reinstalling the Motor Gimbal **(C)**, Brush Drive Collar **(E)** and Key **(F)**.

FIGURE 2



SCRUB SYSTEM

SCRUB BRUSH DECK REMOVAL

1 With scrub brushes installed, lower the scrub brush deck, turn the key switch off and disconnect the battery pack.

⚠ WARNING!

Disconnect the battery pack connector before servicing machine.

Note: If the battery pack is connected and the key switch is switched on when the scrub brush deck is lowered, the deck will automatically rise to its upper limit. This could cause personal injury or machine damage.

2 Remove the front nose cone by firmly grasping the lower part and lifting straight up.

3 **See Figure 2.** Unlatch and remove the left- and right-hand Brush Housings **(A and B)**.

4 **See Figure 3.** Disconnect the Solution Hose **(G)** from the Coupler Barb **(H)**.

5 **See Figure 2.** Unplug both Motor/Gear Unit Assemblies (M2 and M3) **(J)**. **Note**: Cable ties may need to be cut.

Service Note: If you have an optional Actuator Power Cord Adapter (Advance Part #56407502), you can use the Adapter to run the lift actuator up or down to relieve the pressure on the connecting hardware and ease removal of the Pin **(K)**.

6 Remove either of the Cotter Hair Pins **(L)** and remove the Pin **(K)** to detach the Lift Actuator Assembly **(T)** from the lower mount on the Deck Weldment **(N)**. **Note:** Lift up on the scrub brush deck to take pressure off the Pin **(K)**.

Service Note: It is important not to run the actuator motor or the rotate the spring housing assembly on the lead screw while the Lift Actuator Assembly **(T)** is disconnected from the scrub brush deck or chassis mounts. This precaution will prevent the actuator drive nut from getting out of adjustment (moved out of its set specification) and will maintain the correct actuator “IN” / “OUT” travel limits.

7 Remove the Cotter Hair Pin **(O)** and Washers **(P)** on either side of the Linkage Pivot Pin **(Q)** and remove the Linkage Pivot Pin **(Q)**.

8 Remove the Cotter Hair Pin **(R)** and Washer **(S)** from the mounting boss on the Deck Weldment **(N)**.

9 Make sure the Lift Actuator Assembly **(T)** is clear of the scrub brush deck, then carefully slide the scrub brush deck toward the right (operator’s left) to disengage the mounting boss from the Linkage Arm **(U)**.

10 Slide the deck toward the front to remove it from the machine.

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

Service Note: If you want to run the transaxle motor to move the machine with the Lift Actuator Assembly **(T)** disconnected from the scrub brush deck, first disconnect the lift actuator motor wiring harness pigtail connector. This will prevent the lift actuator motor from running automatically when you turn on the key switch, and will keep drive nut and the actuator “IN” / “OUT” travel limits from getting out of adjustment.

SCRUB SYSTEM

SCRUB BRUSH LIFT ACTUATOR REMOVAL

1 **See Figure 3.** With scrub brushes installed, lower the scrub brush deck, turn the key switch off and disconnect the battery pack.

⚠ WARNING!

Disconnect the battery pack connector before servicing machine.

Note: If the lift actuator motor will not run, go to step 2, then shim up the brush deck to relieve the pressure on the connecting hardware to ease removal of the Lift Actuator Assembly **(T)**.

2 Remove the front nose cone by firmly grasping the lower part and lifting straight up.

3 Disconnect the actuator motor wiring harness pigtail connector.

Service Note: If you have an optional Actuator Power Cord Adapter (Advance Part #56407502), you can use the Adapter to run the lift actuator up or down to relieve the pressure on the connecting hardware and ease removal of the Lift Actuator Assembly **T)**.

4 **See Figures 2 and 3.** Remove either of the Cotter Hair Pins **(L)** and remove the Pin **(K)** to detach the Lift Actuator Assembly **(T)** from the lower mount on the Deck Weldment **(N)**. **Note:** Lift up on the scrub brush deck to take pressure off the Pin **(K)**.

5 **See Figure 3.** Remove the Cotter Hair Pin **(V)** from the Ring Pin **(W)**.

6 Hold the Lift Actuator Assembly **(T)** securely, remove the Ring Pin **(W)** from the Actuator Mount Weldment **(X)**, then remove the Lift Actuator Assembly **(T)** from the machine.

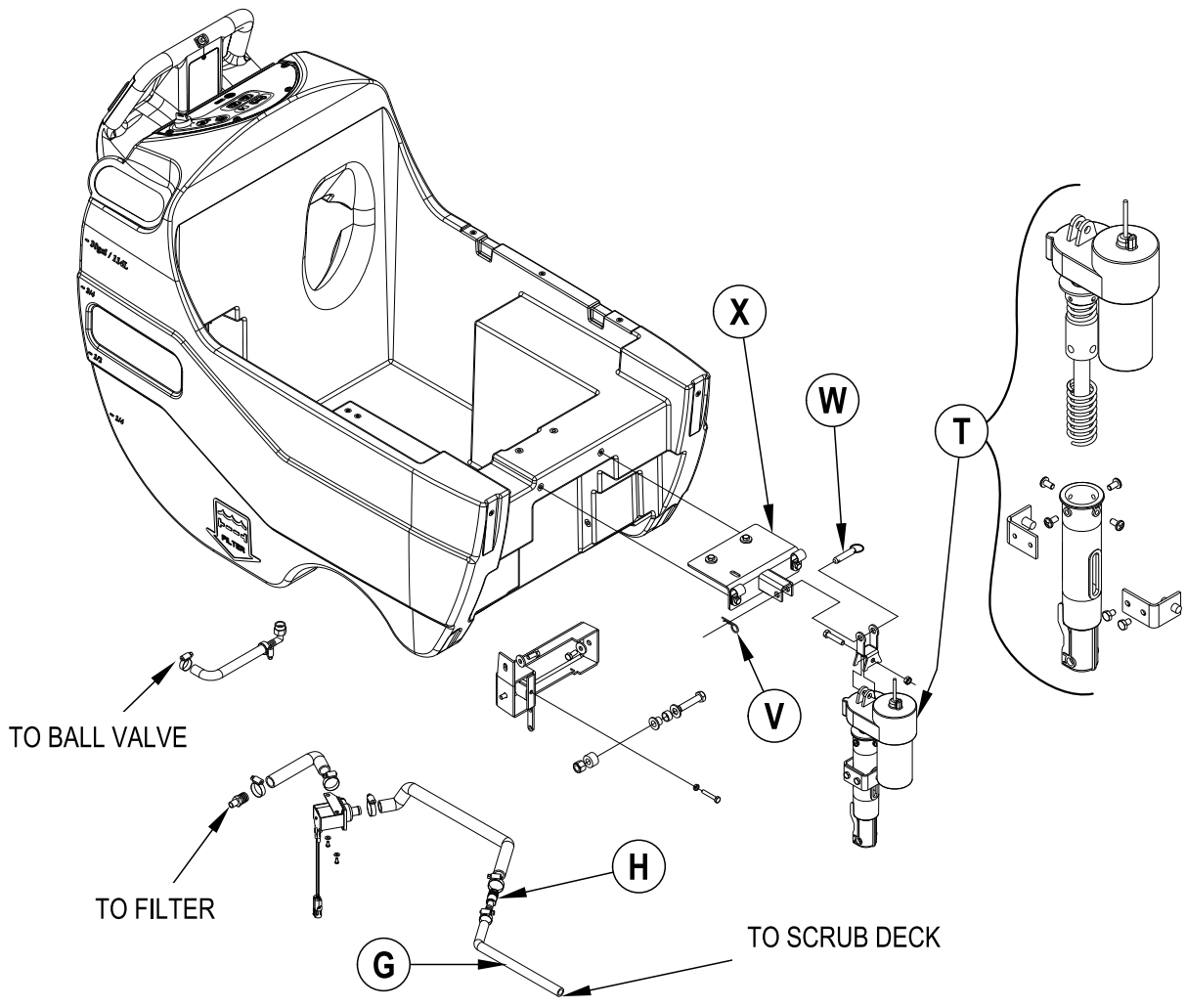
7 See *Important Service Note below.

8 Reinstall in reverse order.

***Important Service Note:** If you've installed a new motor or drive nut in an actuator lift assembly, or if the actuator has gotten out of adjustment, you will need to check the actuator "IN" and "OUT" travel limits and set them to the correct specifications if necessary. Refer to the *Electrical System / Lift Actuator Assembly and Travel Limit Adjustment* section and follow these instructions before installing the actuator motor assembly in the machine.

After setting the correct actuator "IN" and "OUT" travel limits, follow the above removal steps in reverse order to reassemble.

FIGURE 3



SCRUB SYSTEM

SCRUB BRUSH MOTOR/GEARBOX REMOVAL

1 Remove the scrub deck from the machine following the steps in the *Scrub Brush Deck Removal* section.

2 Turn the brush deck on its back.

3 **See Figure 2.** Remove the brushes/pads from the Motor Gimbals **(C)**. If removing both Motor / Gear Unit Assemblies **(J)**, mark the location of the Assemblies on the Deck Weldment **(N)** for correct reassembly.

4 Remove the 5/16”-18 Socket Head Screw **(D)** holding the Motor Gimbal **(C)** to the motor output shaft, then remove the Motor Gimbal **(C)**, Brush Driver Collar **(E)** and Key **(F)**. Make sure to save the Key **(F)**.

5 Remove the (4) 3/8”-16 Hex Head Locking Screws **(Y)** holding the Motor / Gear Unit Assembly **(J)** to the Deck Weldment **(N)** and remove the Motor / Gear Unit Assembly **(J)**.

6 Reinstall the Motor / Gear Unit Assembly **(J)** by following the above steps in reverse order, then test for correct operation. **Note**: Apply a small amount of grease or a product called “Never-Seez®” to the output shaft on the Motor / Gear Unit Assembly **(J)** when reinstalling the Motor Gimbals **(C)**, Brush Drive Collars **(E)** and Keys **(F)**.

7 Reinstall the scrub deck by following the steps in the *Scrub Brush Deck Removal* section.

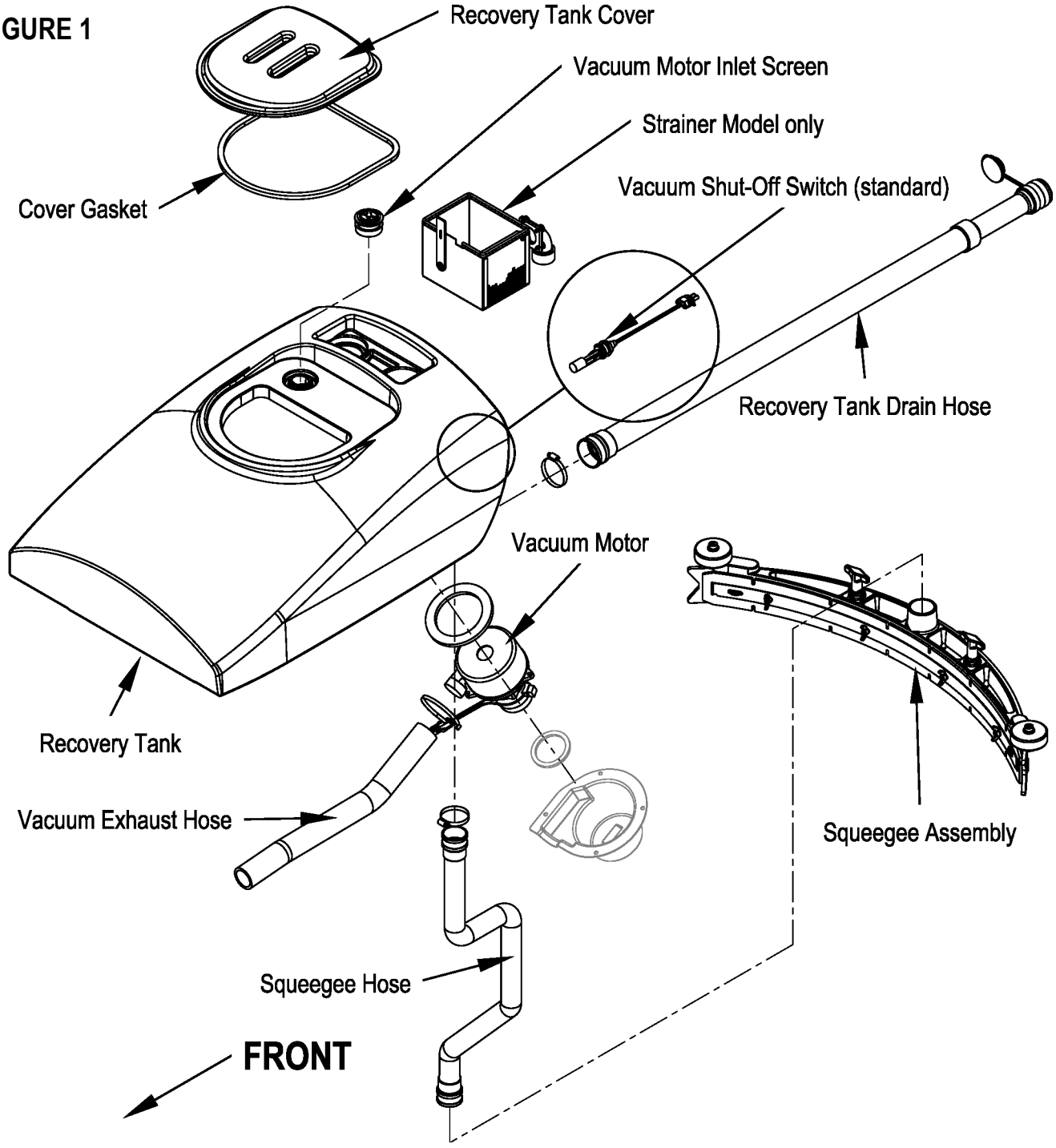
RECOVERY SYSTEM FUNCTIONAL OVERVIEW

Vacuum / Recovery System General

See Figure 1. Dirt and water are lifted off the floor into the recovery tank by airflow created by a three-stage 36V vacuum motor. The wastewater and air enter the vacuum system at the squeegee tool through small openings (notches) in the front squeegee blade. The small openings are the entrance points for the water and air and help speed up the airflow, producing the suction to lift the wastewater off of the floor. The air and wastewater move through the squeegee hose at high speed until the wastewater reaches the recovery tank. There the air slows down because of the increased volume (large size) of the tank. With the decreased air speed, the heavier water falls to the bottom of the recovery tank. The airflow continues through the tank, vacuum fan inlet screen and vacuum motor, and is exhausted out of the vacuum exhaust hose. No wastewater ever actually moves through the vacuum motor, 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 motor.

FIGURE 1



RECOVERY SYSTEM
VACUUM MOTOR CONTROL CIRCUIT OVERVIEW (AUTO MODE)

See Figure 2.

+ (Positive) Circuit input starts with:

- A closed S3 key switch supplies the needed positive voltage to the A1 control board J1-13 (Brn wire). **Note:** The A1 control board scrub-on button must also be depressed (enabled). This operator command lowers the brush deck.
- A closed 5-amp circuit breaker (F2) supplies positive battery voltage (Brn wire) to the control side of the vacuum motor contactor coil (K2).
- Once the load side of K2 is closed, the needed positive battery voltage is supplied to motor M4.

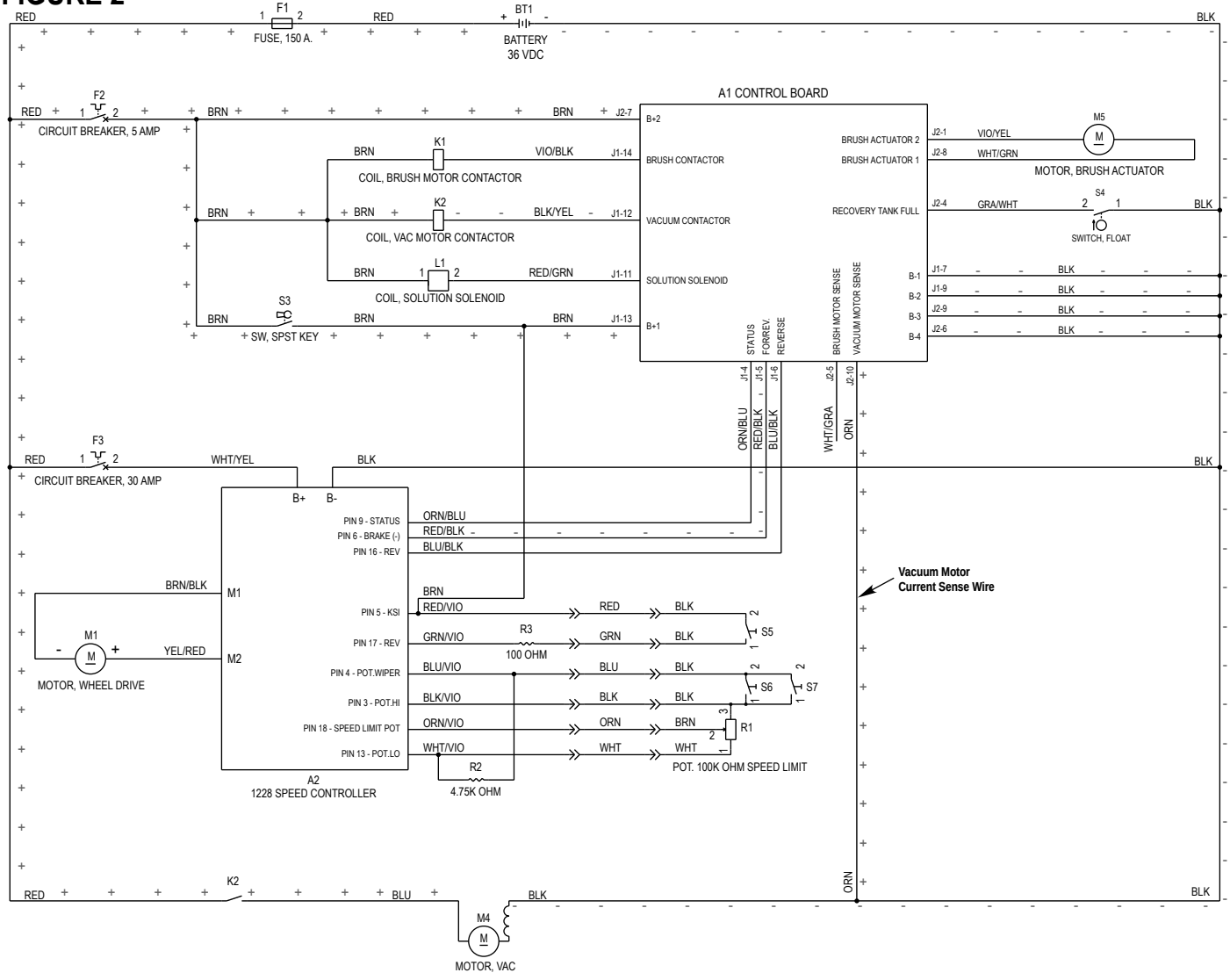
- (Negative) circuit input starts with:

- Battery negative ground inputs at the A1 control board terminals B-1 (J1-7), B-2 (J1-9), B-3 (J2-9) and B-4 (J2-6) at the A2 speed controller terminal B-.
- A negative voltage output from the A2 speed controller's (pin #6) Brake Neg. to the A1 control boards Red/Blk wire (J1-5) For/Rev. **Note**: The A2 speed control brake output (pin #6) occurs whenever a palm drive switch (S6/S7) is pressed. This operator command happens when a palm drive button is pressed to run the wheel drive motor. The recovery tank full float switch (S4) must be open (in its lowered position) in order for a negative voltage output from the A1 board's terminal J1-12 Blk/Yel wire to complete the K2 solenoid coil circuit (Pos. and Neg.) and pulls in the solenoid load contact K2 making the vacuum motor run.
- The Neg. M4 load voltage is supplied from the battery Neg.

Electrical Diagram

Note: For a complete description of all callouts see the *Electrical System/Wiring Diagram/Schematic* section in this manual.

FIGURE 2



RECOVERY SYSTEM

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. (If the switch is closed [tipped up] the vacuum motor will not operate)
- ☐ Clean built-up dirt from the inside of the squeegee tool.
- ☐ Replace the squeegee blades if they are nicked or torn.
- ☐ Inspect the hose between the squeegee tool 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.
- ☐ Inspect and clean the vacuum motor inlet filter screen.

TROUBLESHOOTING GUIDE

If water flows around the ends of the squeegee tool instead of being pulled into the tool, the vacuum system is not working correctly. When a vacuum system performs poorly it is usually because of one of the following problems:

Vacuum Leak(s) – 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 water line will create turbulence in the recovery tank, causing water to enter the vacuum motor.

Restriction(s) – Anything that blocks the flow of air through the system. Restrictions may also be caused by built-up debris in the squeegee tool, vacuum hoses or vacuum motor inlet screen, or wherever the airflow is forced to make a sharp turn.

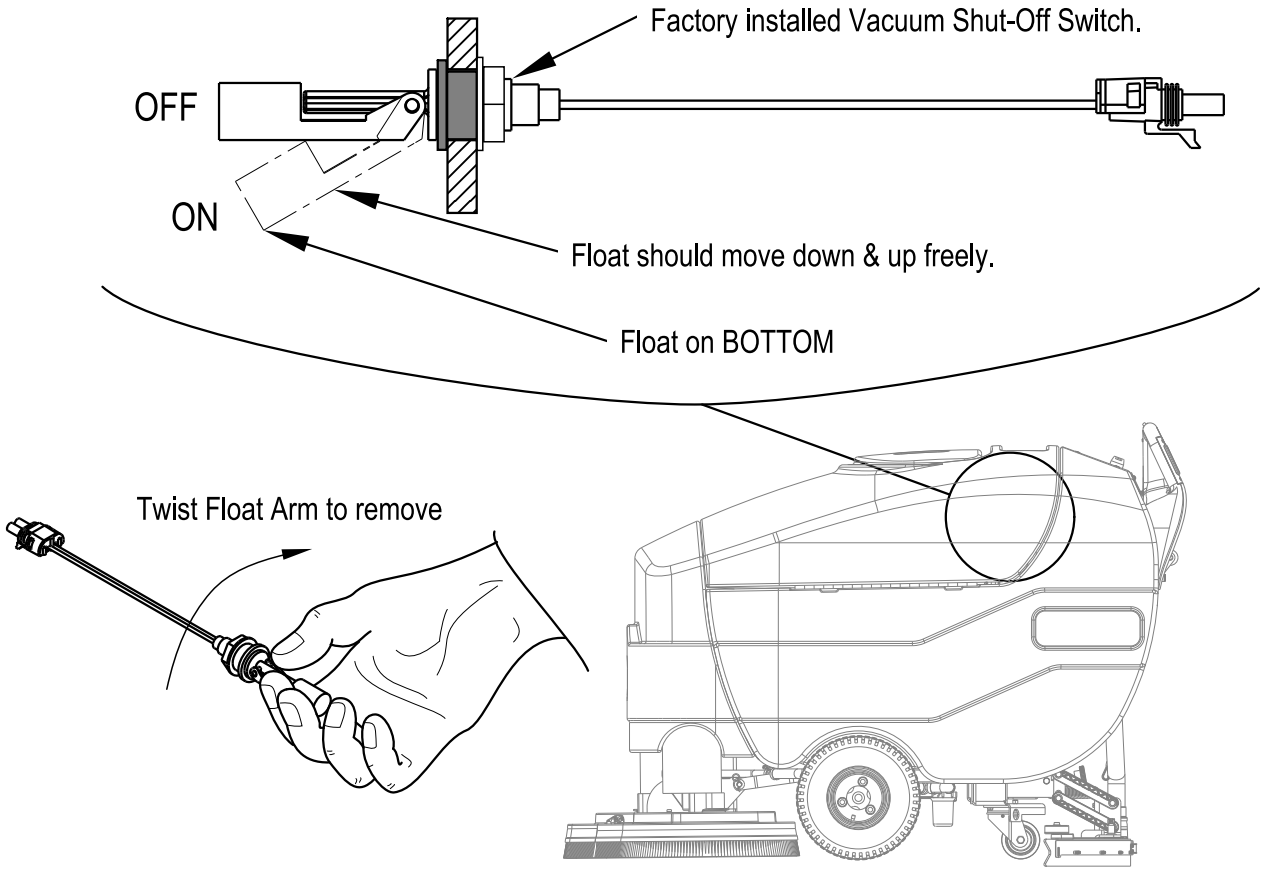
Both leaks and restrictions decrease the quantity of air flowing through the squeegee tool. The air that does go through the squeegee tool moves slower, so it has less suction (water lift performance).

RECOVERY SYSTEM
MAINTENANCE OF THE RECOVERY TANK FLOAT SWITCH

If the recovery tank float switch becomes dirty it can impair the operation of the recovery system. A dirty vacuum shutoff switch can cause the vacuum motor to not function at all, or fail to shut off when the tank is full.

If daily rinsing of the recovery tank is not sufficient 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 the float switch be reassembled correctly in order to function. See **Figure 3** for the correct orientation of the switch float arm.

FIGURE 3

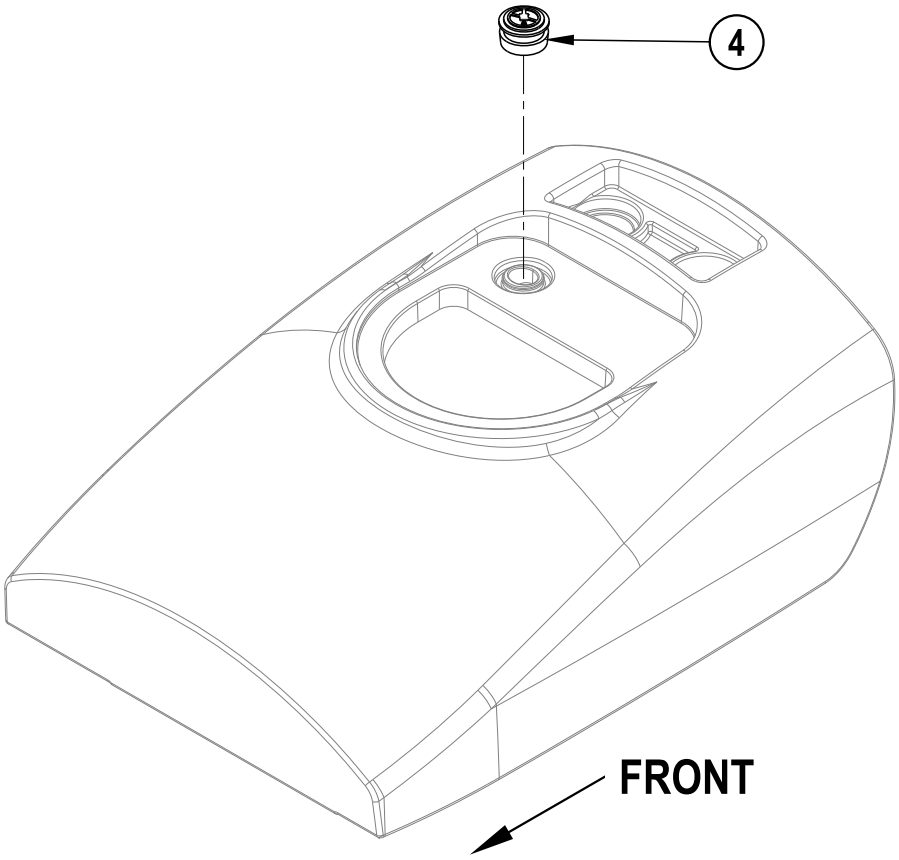


RECOVERY SYSTEM
MAINTENANCE OF VACUUM MOTOR INLET SCREEN

See Figure 4. The Vacuum Motor Inlet Screen **(4)** should be cleaned on a daily basis. DO NOT run water down the screen in an attempt to clean it. If you do this you will be running water directly into the vacuum motor.

To remove the Vacuum Motor Inlet Screen **(4)** from the recovery tank, grip, twist and pull up on the Vacuum Motor Inlet Screen **(4)**.

FIGURE 4



RECOVERY SYSTEM
VACUUM MOTOR REMOVAL

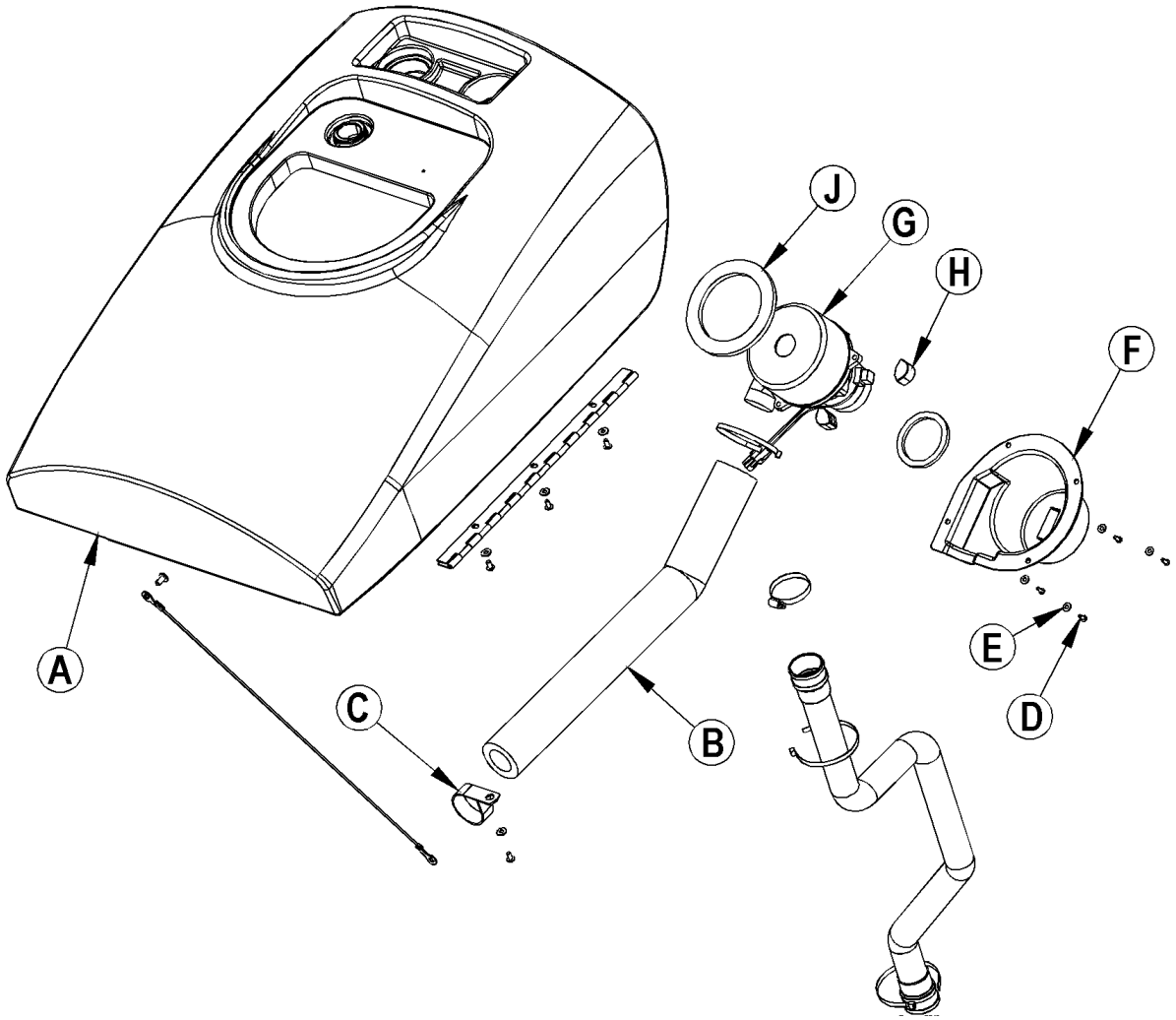
1 Drain the Recovery Tank **(A)** using the drain hose.
2 Turn the key switch off and disconnect the battery pack.

⚠ WARNING!

Disconnect the battery pack connector before servicing machine.

3 Swing open the recovery tank and disconnect the vacuum motor harness connector.
4 **See Figure 5.** Carefully pull the Acoustical Foam vacuum exhaust hose **(B)** out of the P-Clamp **(C)** on the Recovery Tank **(A)**.
5 Remove the (4) Phillips Pan Head Screws **(D)** and Flat Washers **(E)** holding the Vacuum Motor Shroud **(F)** to the bottom of the Recovery Tank **(A)**, then remove the Vacuum Motor Shroud **(F)**.
6 Carefully remove the Vacuum Motor Assembly **(G)** and attached Acoustical Foam vacuum exhaust hose **(B)** from the Recovery Tank **(A)**. **Note:** Take care not to lose the three Vibration Mounts **(H)**.
7 Inspect the condition of the vacuum motor Gasket **(J)**, and the gasket on the inside of the Vacuum Motor Shroud **(F)**.
8 Make service repairs to the vacuum motor and reinstall by following the above steps in reverse order.

FIGURE 5



RECOVERY SYSTEM

RECOVERY TANK REMOVAL

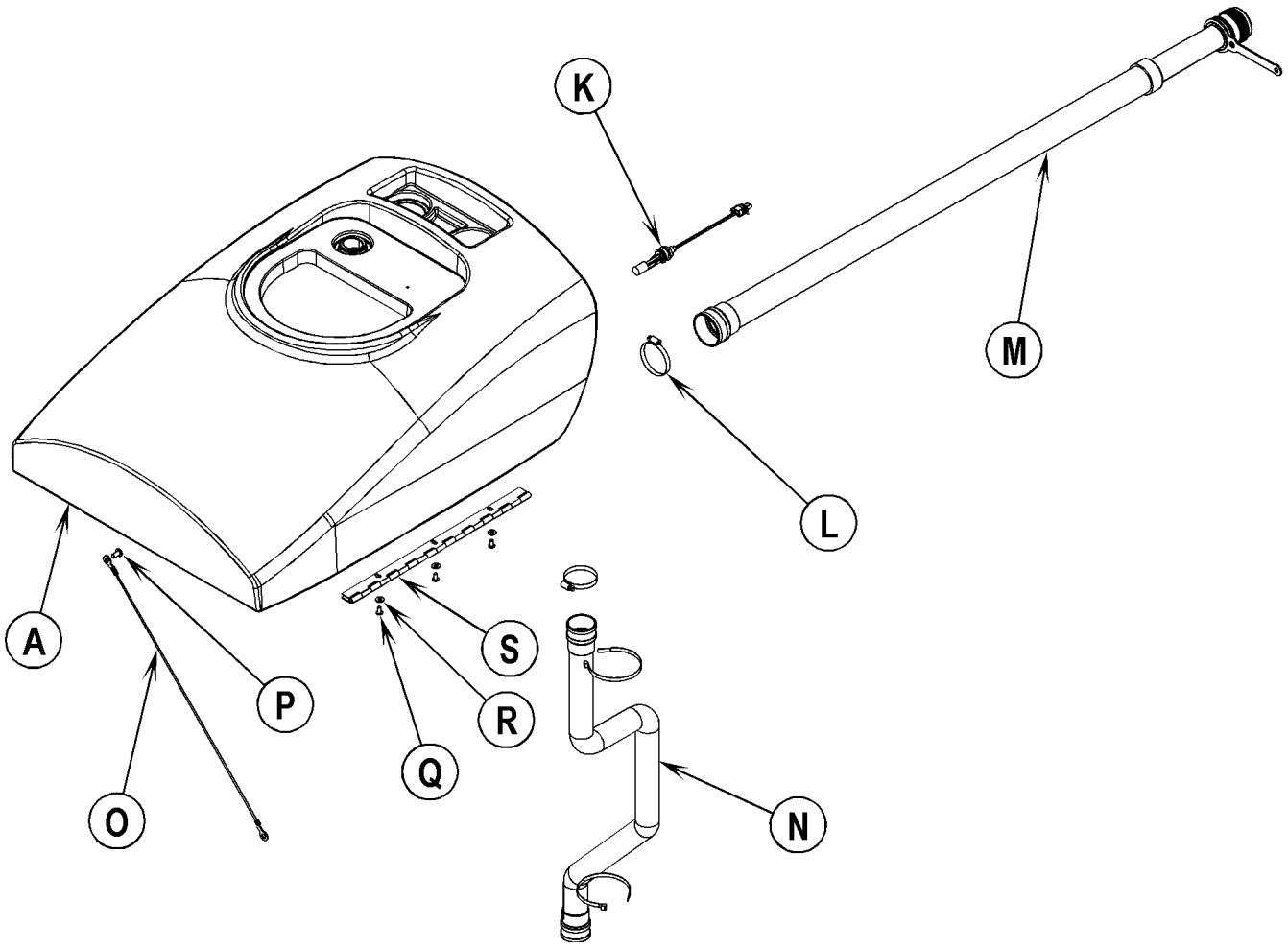
1 If you wish to remove the vacuum motor from the Recovery Tank **(A)**, do so by following steps 1-6 in the *Vacuum Motor Removal* section.
2 Disconnect the electrical connector to the Float Switch **(K)**. Note that you may need to cut a cable tie to access the connector.
3 Loosen the Hose Clamp **(L)** and disconnect the Drain Hose **(M)** from the Recovery Tank **(A)**.
4 Loosen the clamp and disconnect the Vacuum Hose Assembly **(N)** from the Recovery Tank **(A)**.

⚠ CAUTION!

The Recovery Tank **(A)** is relatively heavy. You may choose to get some assistance when swinging the Recovery Tank **(A)** down after disconnecting the Cable Assembly **(O)**, and when removing it from the machine.

5 **See Figure 6.** Remove the Phillips Pan Head Screw **(P)** and tank Cable Assembly **(O)** and allow the Recovery Tank **(A)** to swing down to the side of the battery compartment box.
6 Support the Recovery Tank **(A)** and remove the (3) Phillips Pan Head Screws **(Q)** and flat Washers **(R)** that attach the tank to the Hinge **(S)** and remove the Recovery Tank **(A)** from the machine.
7 Reinstall the Recovery Tank **(A)** by following the above steps in reverse order.

FIGURE 6



SQUEEGEE SYSTEM
SQUEEGEE LIFT LINKAGE ADJUSTMENT

See the *Know Your Machine* section in this manual. The squeegee pick-up tool is raised and lowered manually by a rear control panel mounted Lever **(17)**.

Squeegee Lift Lever Adjustment

The squeegee tool's storage and operating positions are adjustable. To adjust the squeegee position:

1 Lower the squeegee assembly to the floor.

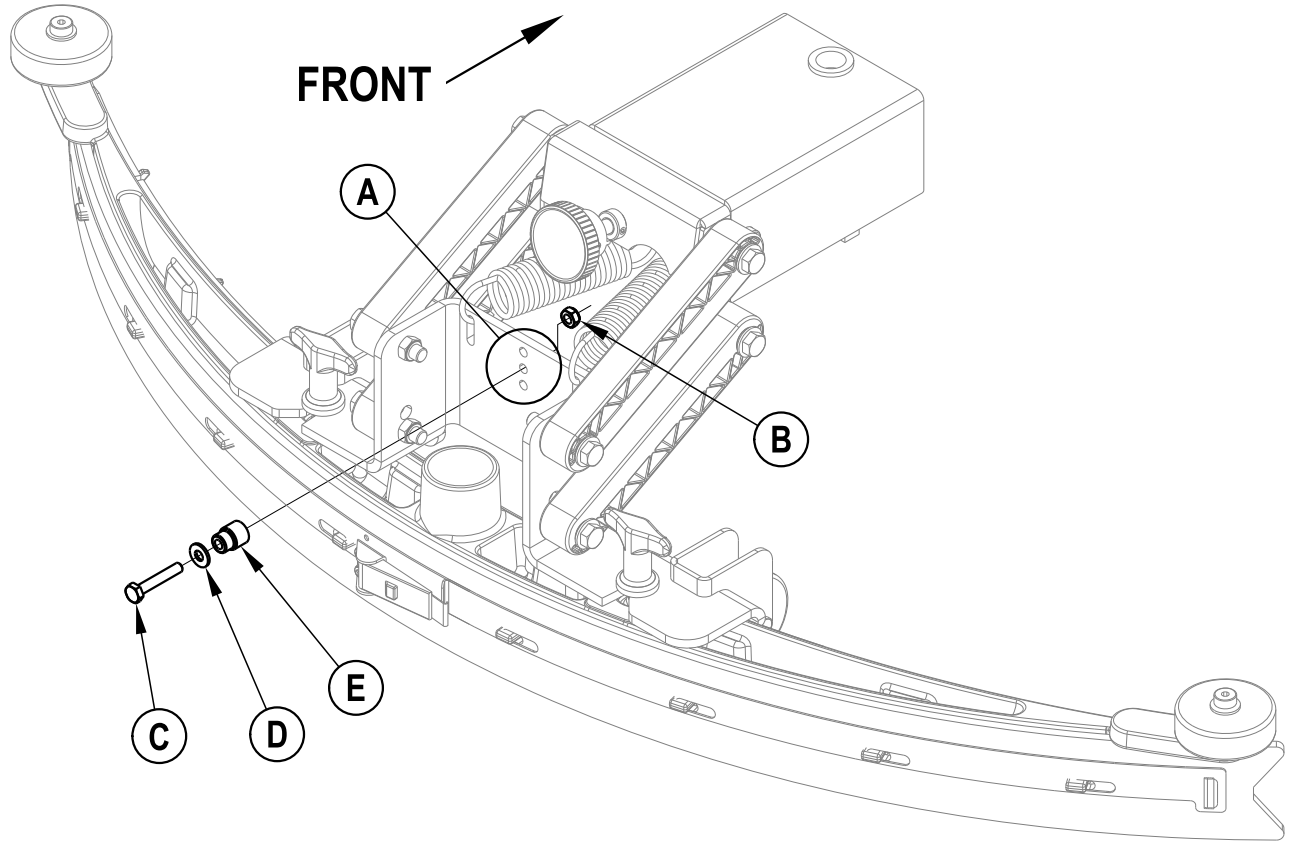
2 See Figure 1. Note that the squeegee mount weldment has three Mounting Holes **(A)** for changing the up / down squeegee positions.

3 Remove the Nyloc Nut **(B)** from the Hex Head Screw **(C)**, then remove the Hex Head Screw **(C)**, flat Washer **(D)**, Cable Bushing **(E)** and attached cable assembly from the squeegee mount weldment.

4 Reinstall in the Hex Head Screw **(C)**, flat Washer **(D)** Cable Bushing **(E)** and attached cable assembly into the appropriate hole to raise or lower the squeegee positions as needed, then reinstall the Nyloc Nut **(B)**.

5 Make sure that the squeegee lift cable has ample free play when the squeegee is lowered. **Note:** This allows the squeegee assembly the correct amount of up and down movement to allow the squeegee to "float" so the rear blade remains on the floor surface through normal adjustments and wear.

FIGURE 1



SQUEEGEE SYSTEM
SERVICING THE SQUEEGEE

If the squeegee leaves narrow streaks or water, the blades may be dirty or damaged. Remove the squeegee, rinse it under warm water and inspect the blades. Reverse or replace the blades if they are cut, torn, wavy or worn.

To Reverse or Replace the Rear Squeegee Wiping Blade:

1 **See Figure 2.** Raise the squeegee tool off the floor, and then unsnap the Center Latch **(23)** on the squeegee tool.
2 Remove the Tension Straps **(22)**.
3 Slip the rear blade off the Alignment Pins **(24)**.
4 The squeegee blade has four working edges. Turn the blade so a clean, undamaged edge points toward the front of the machine. Replace the blade if all four edges are nicked, torn or worn to a large radius.
5 Install the blade, following the steps in reverse order and adjust the squeegee tilt.

To Reverse or Replace the Front Squeegee Blade:

1 Raise the squeegee tool off the floor, loosen the (2) Thumb Nuts **(25)**, disconnect the Recovery Hose **(19)** and remove the Squeegee Assembly **(13)** from the mount.
2 First remove both rear Tension Straps **(22)**.
3 Remove all the wing nuts that hold the front blade in place, and then remove the front tension strap and front blade.
4 The squeegee blade has four working edges. Turn the blade so a clean, undamaged edge points toward the front of the machine. Replace the blade if all four edges are nicked, torn or worn to a large radius.
5 Install the blade, following the steps in reverse order and adjust the squeegee tilt.

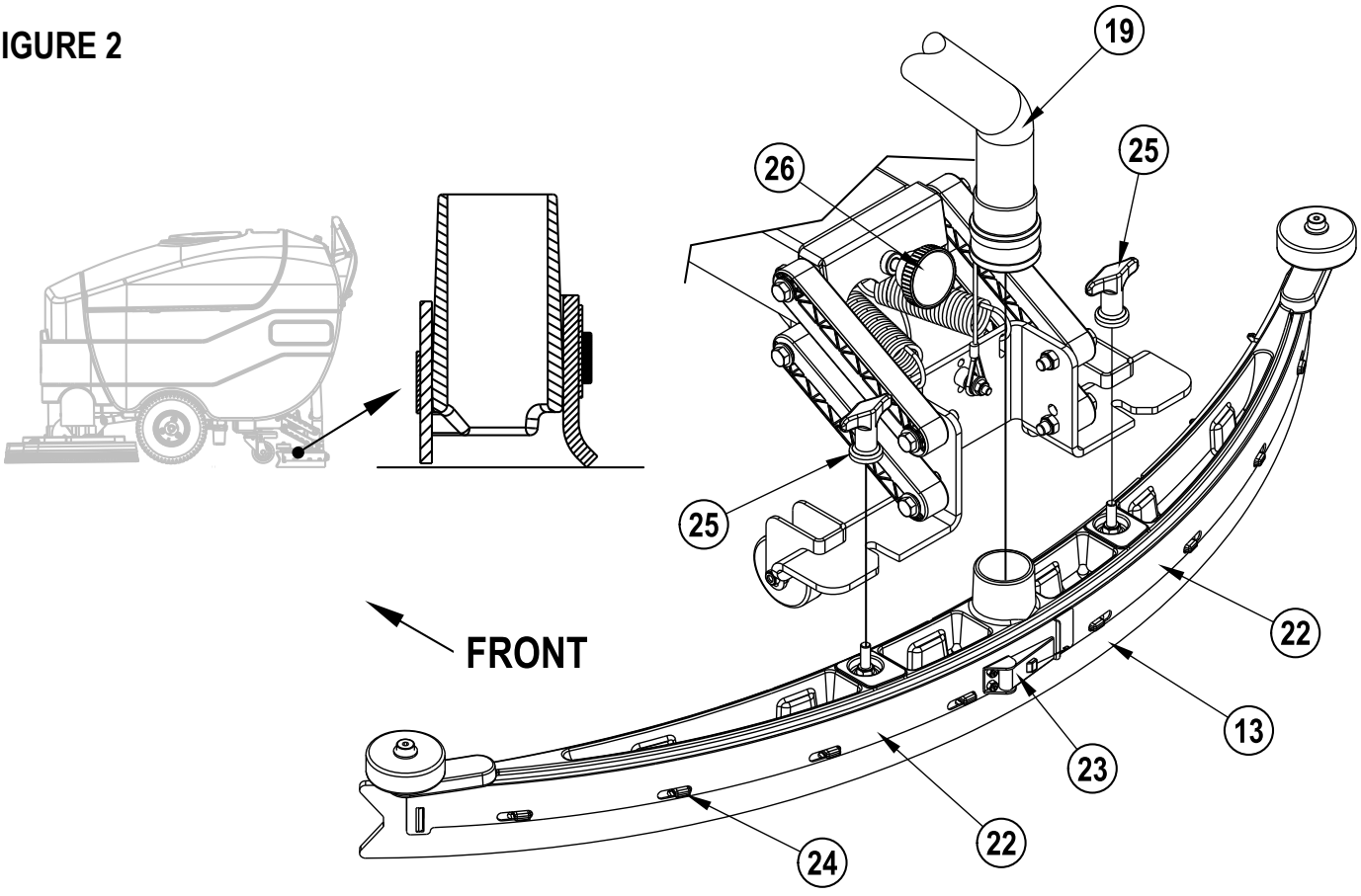
ADJUSTING THE SQUEEGEE

Adjust the squeegee angle whenever a blade is reversed or replaced, or if the squeegee is not wiping the floor dry.

To Adjust the Squeegee Angle:

1 Park the machine on a flat, even surface and lower the squeegee.
2 While moving the machine forward slowly, turn the Squeegee Adjustment Knob **(26)** until the rear squeegee blade folds over evenly across the entire width of the squeegee as shown below.

FIGURE 2



SQUEEGEE SYSTEM

SQUEEGEE MOUNT ASSEMBLY REMOVAL

1. Turn the key switch off and disconnect the battery pack.

⚠ WARNING!

Disconnect the battery pack connector before servicing machine.

2 **See Figure 3.** Disconnect the Squeegee Hose **(19)** and remove the Squeegee Assembly **(13)** from the machine.

3 Lower the Squeegee Lever **(17)** and disconnect the Squeegee Lift Cable **(C)** from the Squeegee Mount Assembly.

Service Note: The downward spring force on the squeegee mount weldment can make it difficult to remove and reinstall the Squeegee Mount Assembly. You may choose to remove the squeegee level Wheels **(F)** from the Squeegee Mount Assembly, or jack up the machine to reduce the effect of the downward spring force.

Note: If you choose to jack up the machine, make sure you support the machine with safety stands or blocking to prevent the machine from dropping and possibly causing personal injury or machine damage.

⚠ WARNING!

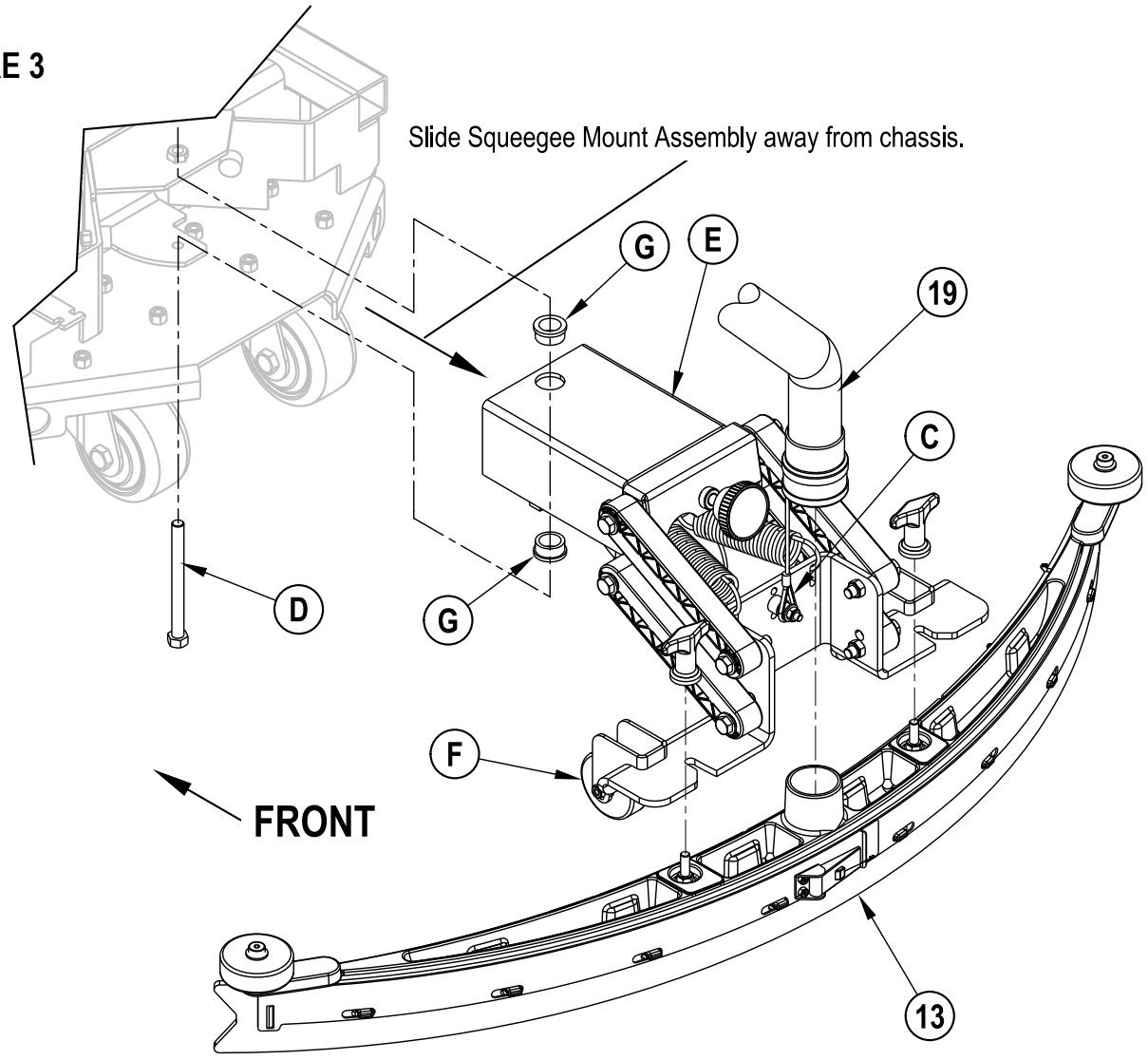
Never work under machine without safety stands or blocking to support the machine.

4 Remove the Screw **(D)** through the access hole in the bottom of the chassis and slide the Squeegee Mount Assembly **(E)** away from the chassis.

5 Reinstall by following the above steps in reverse order. Make sure the spacer bushing is installed on the Screw **(D)**, and the top and bottom Flange Bearings **(G)** are installed correctly in the Squeegee Mount Assembly **(E)** before reinstalling and tightening the Screw **(D)**.

Service Note: If you haven't jacked up the machine, you may need to lift the rear of the squeegee mount weldment to extend the springs slightly in order to correctly align the Squeegee Mount Assembly **(E)** with the chassis when you install the Screw **(D)**.

FIGURE 3



SQUEEGEE SYSTEM
CASTER WHEEL REMOVAL

1. Turn the key switch off and disconnect the battery pack.

⚠ WARNING!

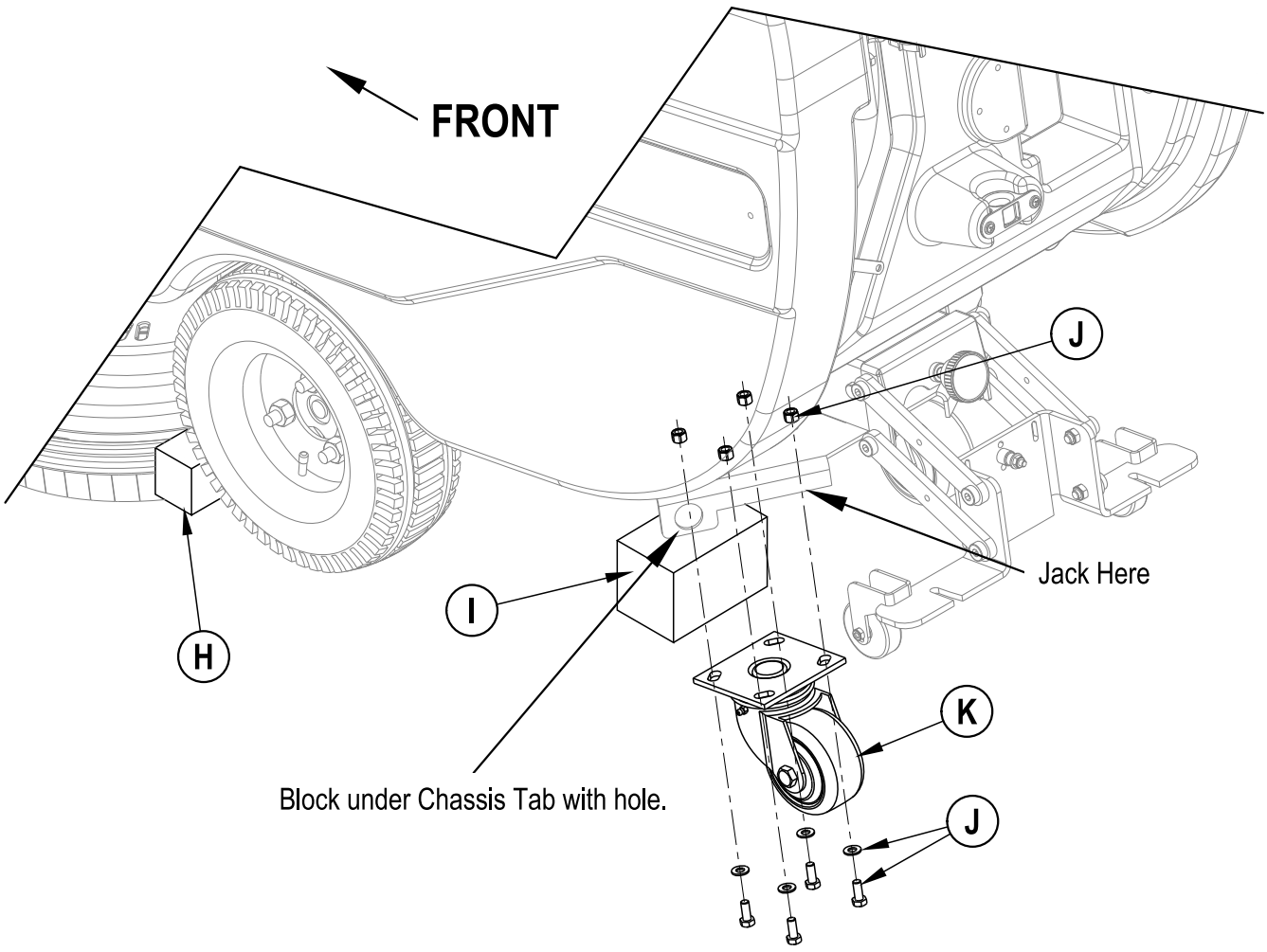
Disconnect the battery pack connector before servicing machine.

⚠ WARNING!

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

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

FIGURE 4



WHEEL DRIVE SYSTEM
GENERAL FUNCTIONAL OVERVIEW

See Figures 1 and 2. A 375 watt (0.5 HP) permanent magnet (36V) motor transaxle (M1) is used for the wheel drive on all machines. A Curtis PMC solid state speed controller (A2) regulates the variable speed and Fwd/Rev wheel drive motor functions. The controller is located in the rear electrical compartment (accessible by removing the six screws securing the top main control panel). Two palm drive buttons, wired in parallel, actuate the transaxle drive motor. A reverse button controls the machine reverse. A speed limit pot R1 (knob adjusted) mounted in the handle regulates the machine's maximum transport and scrub speeds.

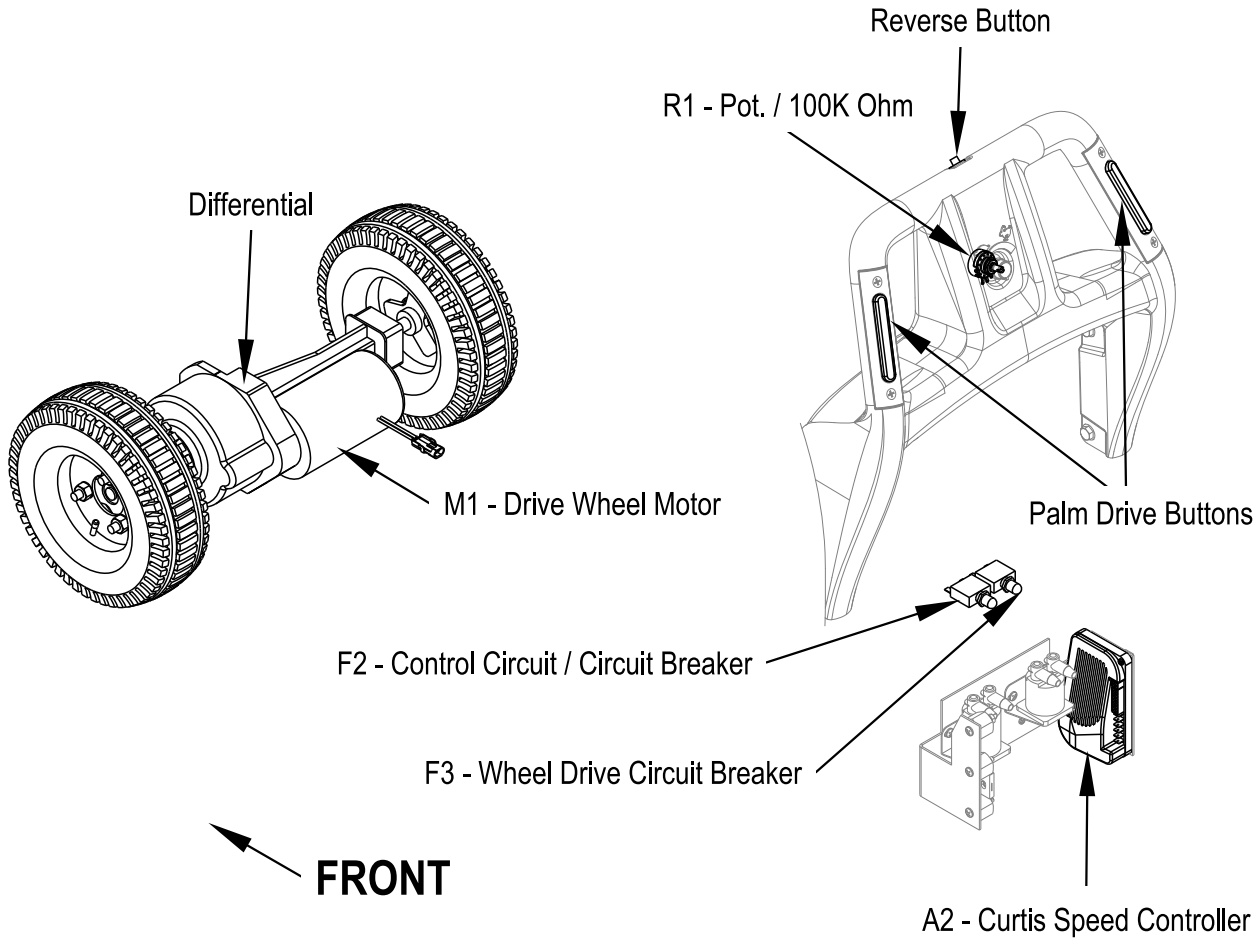
Drive Motor System Function

See Figures 2 and 3. With the key switch S3 closed the Brn wire inputs 36V to the A2 speed controller (Pin 5-KSI) to make its internal control circuits operational (powering it up). The F3 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 (NEG.) input to the B- controller terminal.

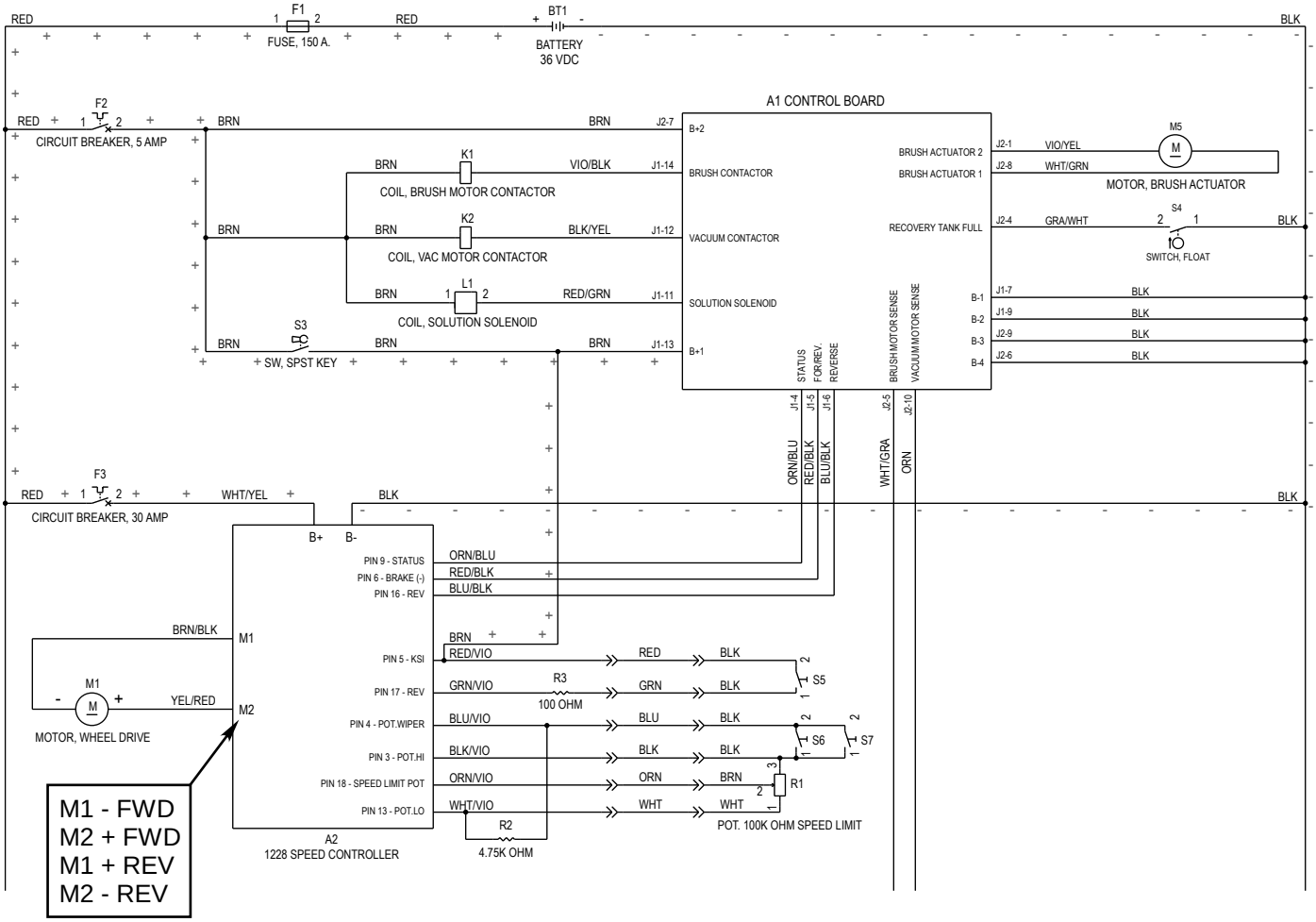
Pressing either palm drive switch (S6 or S7) activates the operator input to the speed control which generates the internal voltage signals (0-5volts) needed for the controller's output operation. These control board voltage input signals are what energizes the Fwd and Rev directional relays, which then selects the motor polarity and final voltage level outputs at the M1 and M2 terminals.

When the operator turns the R1 speed limit Pot from min. to max. (clockwise) 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 (counterclockwise) increases the resistance and the motor speed range is reduced.

FIGURE 1



WHEEL DRIVE SYSTEM



Electrical Diagram

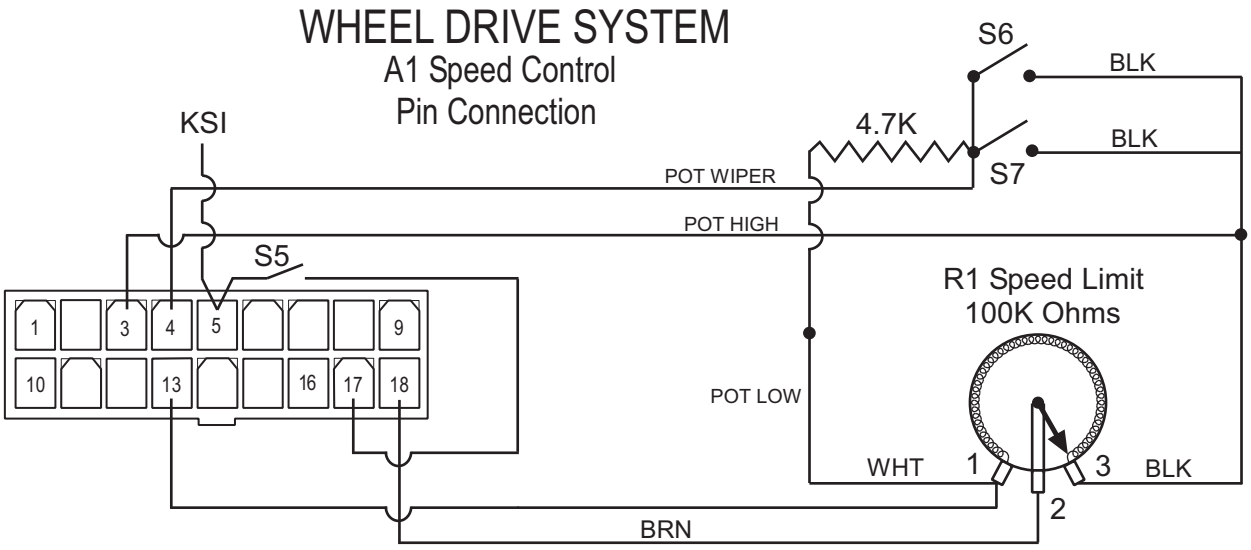
Note: For a complete description of all callouts see the *Electrical System/Wiring Diagram/Schematic* section in this manual.

FIGURE 2

WHEEL DRIVE SYSTEM

FIGURE 3

This drawing shows additional controller input circuit detail. The R1 speed limit pot is shown at its maximum speed setting, with the wiper pin #18 shorted to the pot high pin #3.



A2 SPEED CONTROLLER PIN KEY DETAIL

PIN#	WIRE COLOR	CONTROLLER DESCRIPTION and FUNCTION
1	-	Open - not used
2	-	Open - not used
3	Blk/Vio	Throttle Pot R1 pot high input (+) 5V ref
4	Blu/Vio	Throttle Pot R1 pot wiper input
5	Brn & Red/Vio	KSI (key switch input): Battery (+) powers up controller logic circuits.
6	Red/Blk	Brake Auxiliary Driver: Battery (-) output to main controller (A1), to turn on (activate) all auto scrub functions (its open when in neutral).
7	-	Open - not used
8	-	Open - not used
9	Orn/Blu	Status Fault: Speed controller fault output to main control panel fault indicator light (Regular Scrub On).
10	-	Open - not used
11	-	Open - not used
12	-	Open - not used
13	White/Vio	Throttle Pot R1 pot low input (-)
14	-	Open – not used
15	-	Open - not used
16	Blu/Blk	Reverse/Horn output to A1 controller board to control solution solenoid (L1)
17	Grn/Vio	Reverse Directional Input: Battery (+) signal active with S5 closed
18	Orn/Vio	Speed limit pot input connection.

WHEEL DRIVE SYSTEM
WHEEL DRIVE TROUBLESHOOTING GUIDE

Problem	Possible Cause
No wheel drive in Forward or Reverse	• Wheel drive motor circuit breaker (F3) tripped (reset 30A circuit breaker). • Control circuit breaker (F2) tripped (reset 5A circuit breaker). • Defective S6 & S7 palm drive switches and or circuit wiring (repair or replace). • Defective A2 speed control, replace. • Defective M1 wheel drive motor (repair or replace).
No wheel drive in reverse only	• Defective S5 reverse directional switch or circuit wiring (repair or replace). • Speed control can't change electrical polarity to wheel motor. Replace the A2 speed control.
No variable wheel drive speed (will run @ its slowest speed only).	• Defective R1 speed limit potentiometer, test for an open in both the pot and circuit wiring (repair or replace).
Operator control panel displays error 03 fault code	• Speed controller has sensed an operational error code fault. See Drive Status LED fault codes (table 1) in the Electrical System section.

Additional wheel drive circuit information
Control circuit pin connection test specification data

Circuit Function Test	Correct Circuit Test Values
Test for forward throttle input: • W/key on check pin#13 to pin #4 with palm drive switches open. • W/key on check pin#13 to pin #4 with palm drive switches closed.	• .578 DCV • 4.12 DCV
Test for R1 speed limiting pot input: • W/key on check the R1 Min speed input voltage signal pin#13 to pin#18. Note: Have the R1 pot knob turned fully CCW. • W/key on check the R1 Max speed input voltage signal pin#13 to pin#18. Note: Have the R1 pot knob turned fully CW.	• 0 VDC • 5 VDC

WHEEL DRIVE SYSTEM
DRIVE MOTOR TRANSAXLE REMOVAL

1 Turn the key switch off and disconnect the battery pack.

⚠ WARNING!

Disconnect the battery pack before servicing machine.

⚠ WARNING!

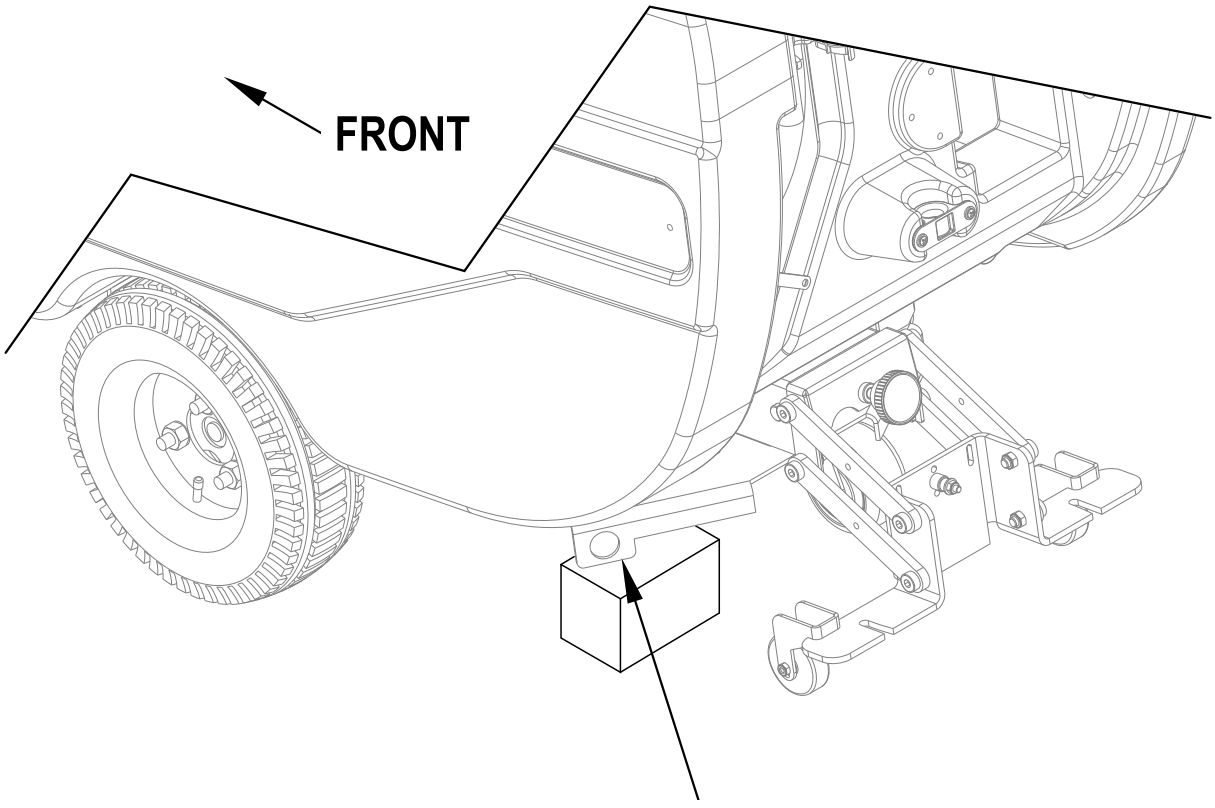
Never work under machine without safety stands or blocking to support the machine.

2 Drain both the solution and recovery tanks and remove the squeegee.

3 Remove the Scrub deck by following the instructions in the *Scrub Brush Deck Removal* section in this manual.

4 Block the rear of the machine. See **Figure 4** for correct placement of the wood blocking.

FIGURE 4



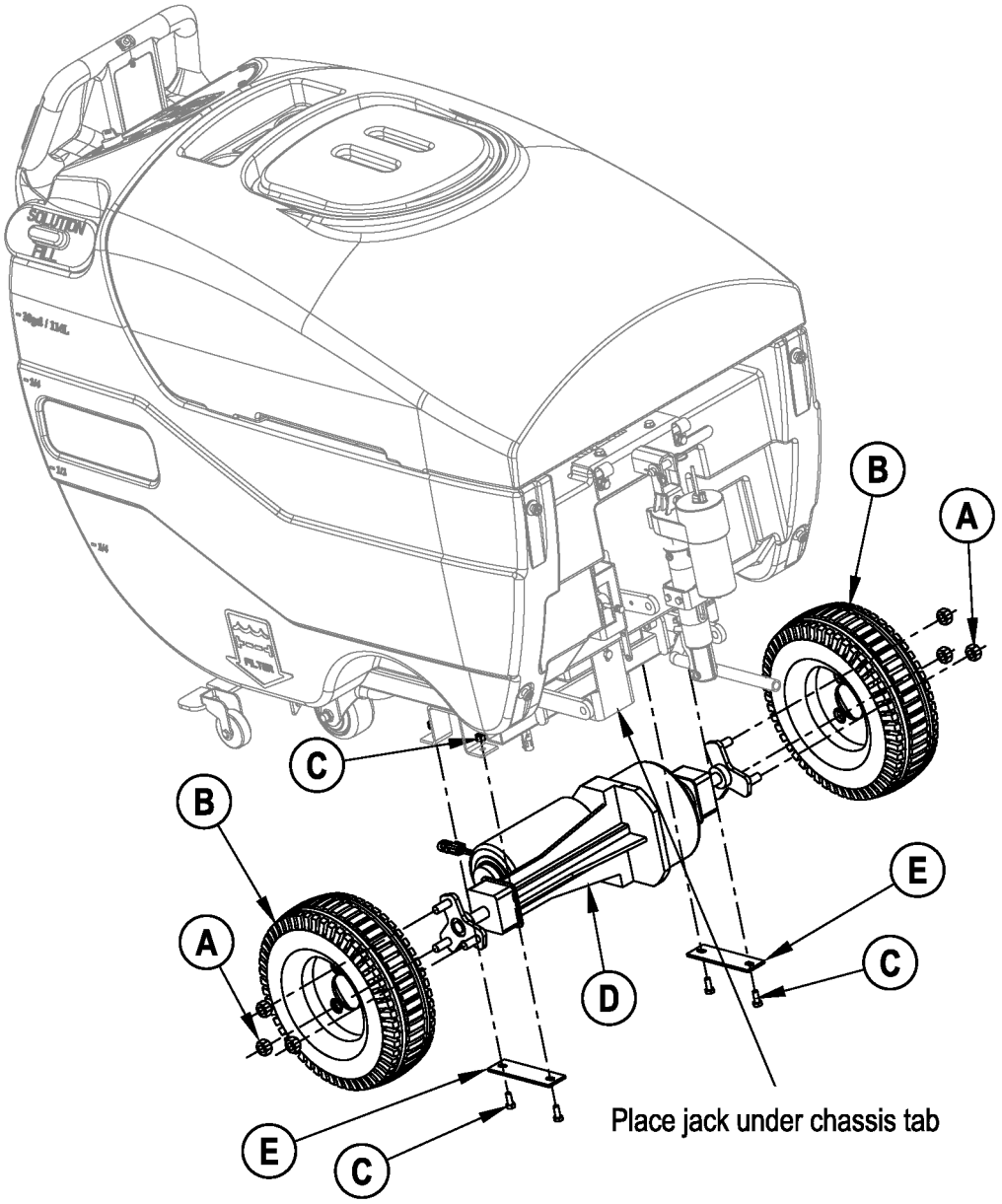
Block under Chassis Tab with hole on both sides.

WHEEL DRIVE SYSTEM
DRIVE MOTOR TRANSAXLE REMOVAL CONTINUED

Service Note: You may find it easier to loosen the wheel Nuts **(A)** slightly when the wheels are still on the ground and before you jack up the machine.

5 **See Figure 5.** Jack the front of the machine from this location until the drive wheels are approximately 1" off the ground.
6 Remove the (6) wheel Nuts **(A)** and remove the (2) Drive Wheels **(B)** from the Motor Transaxle **(D)**.
7 Disconnect the drive motor wiring connector.
8 Remove the (4) Motor Mount Bolts and Nuts **(C)**, and the two Transaxle Mount Plates **(E)** and carefully slide the Motor Transaxle **(D)** away from the machine.
9 Reinstall the Motor Transaxle **(D)** by following the above steps in reverse order. Note that the tapered ends of the wheel Nuts **(A)** go against the Drive Wheels **(B)**.

FIGURE 5



WHEEL DRIVE SYSTEM
DRIVE WHEEL REMOVAL

1 Turn the key switch off and disconnect the battery pack.

⚠ WARNING!

Disconnect the battery pack connector before servicing machine.

⚠ WARNING!

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

2 Remove the squeegee.

3 Place wood blocking in the front and rear of the Drive Wheel **(F)** opposite of the one that you are removing to prevent the machine from rolling.

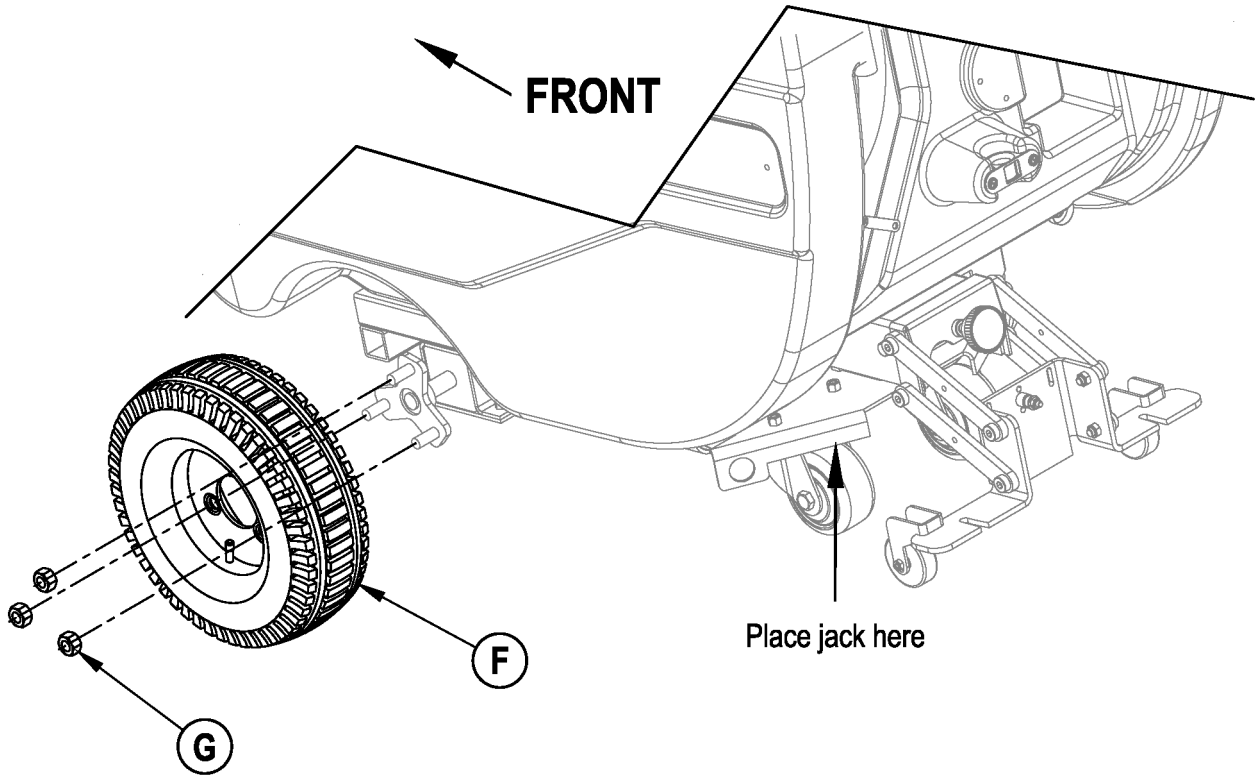
Service Note: You may find it easier to loosen the wheel Nuts **(G)** slightly when the wheel is still on the ground and before you jack up the machine.

4 Using a scissors jack, raise the machine until the Drive Wheel **(F)** is off the ground. **See Figure 6** for jack placement.

5 Remove the (3) wheel Nuts **(G)** and Drive Wheel **(F)**.

6 Reinstall the Drive Wheel **(F)** by following the above steps in reverse order. Note that the tapered ends of the wheel Nuts **(G)** go against the Drive Wheels **(F)**.

FIGURE 6



WHEEL DRIVE SYSTEM
TESTING THE PALM DRIVE BUTTONS

1 **See Figure 7**. Disconnect the Handle Harness **(H)** from the mating connector located to the left of the squeegee raise/lower handle.

2 **See Figure 8.** Use a continuity checker or ohmmeter to check the continuity between pins 4 and 6 on the Handle Harness **(H)**. When the palm drive buttons are working correctly:
- The circuit through pins 4 and 6 should be open when both palm drive buttons are released.
- The circuit through pins 4 and 6 should be closed (approximately zero ohms) when either of the palm drive buttons is pressed.

3 **See Figure 7**. When you're done checking the palm drive buttons, reconnect the Handle Harness **(H)** to the connector on the machine.

FIGURE 7

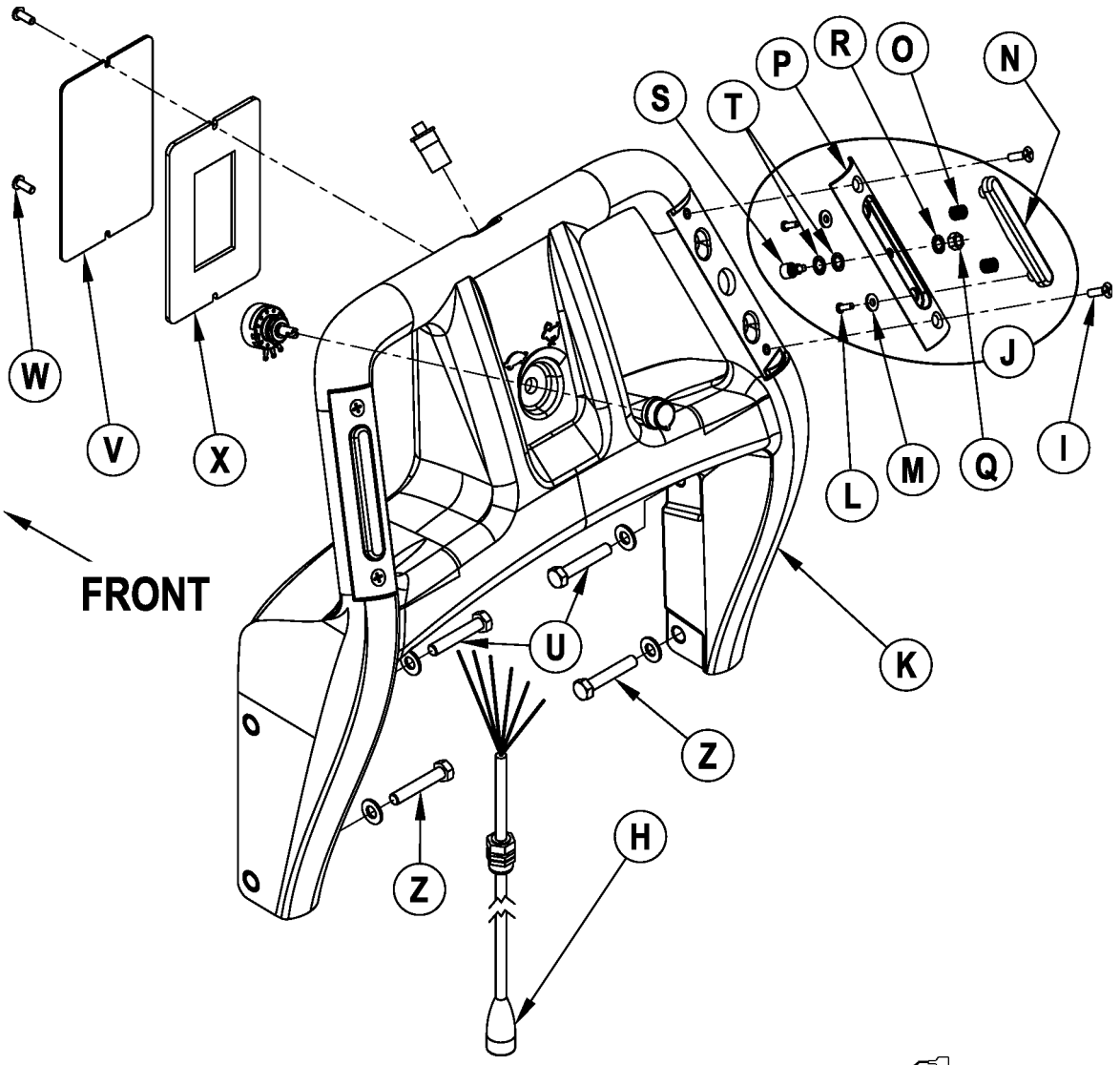
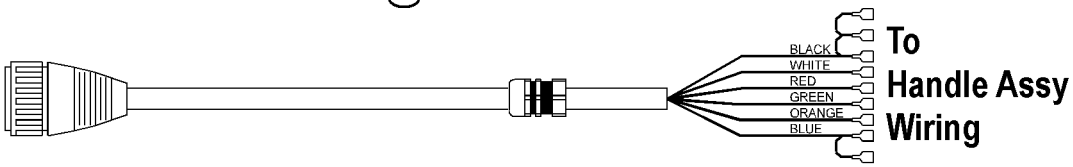
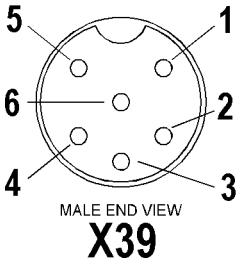


FIGURE 8





Pin 1	Wht	Pot Low
Pin 2	Orn	Pot Wiper
Pin 3	Red	Rev Sw
Pin 4	Blk	Pot High L&R Palm Sw
Pin 5	Grn	Rev Sw
Pin 6	Blu	L&R Palm Sw

WHEEL DRIVE SYSTEM
PALM DRIVE BUTTON REPLACEMENT

⚠ WARNING!

Disconnect the battery pack connector before servicing machine.

Note: It's recommended that you empty the Recovery Tank before replacing a Palm Drive Button.

1 **See Figure 7**. Remove the (2) Phillips Flat Head Screws **(I)** and remove the Palm Switch Assembly **(J)** from the Handle **(K)**.

2 **See the detail in Figure 7**. Remove the (2) Phillips Pan Head Screws **(L)** and Flat Washers **(M)** and remove the Palm Button Switch **(N)** and (2) Switch Springs **(O)** from the Palm Switch Housing **(P)**. Be careful not to lose the Switch Springs **(O)**.

3 Remove the Retaining Nut **(Q)** and Star Washer **(R)** from the SPST Momentary Switch **(S)**, then remove the SPST Momentary Switch **(S)** and the other (2) Star Washers **(T)** from the Palm Switch Housing **(P)**.

4 Pull the Drain Hose out of the brackets to access the 5/16"-18 Hex Head Screws **(U & Z)**.

5 Disconnect the Handle Harness **(H)** from the mating connector located to the left of the squeegee raise/lower handle. (This will prevent excessive pulling or stress on the Handle Harness **(H)** and connector when the Handle **(K)** is swung down to remove the Access Plate **(V)**.)

6 Loosen the bottom left- and right-hand 5/16"-18 Hex Head Screws **(Z)** holding the Handle **(K)** to the machine.

7 Remove the top left- and right-hand 5/16"-18 Hex Head Screws **(U)** holding the Handle **(K)** to the machine, then swing the Handle **(K)** down to allow access to the bottom Phillips Pan Head Screw **(W)** holding the Access Plate **(V)**.

8 Remove the (2) Phillips Pan Head Screws **(W)** and remove the Access Plate **(V)** and attached Access Panel Gasket **(X)** from the Handle **(K)**.

9 Note the wire colors and connector locations, then disconnect the SPST Momentary Switch leads from the connectors in the access area and remove the old SPST Momentary Switch **(S)**. Note that you may need to cut a cable tie to access the wires and connectors.

10 Thread the leads from the replacement SPST Momentary Switch **(S)** into the side of the Handle **(K)** and to the access area, then plug them into the corresponding connectors. Replace the cable tie if necessary.

11 Reinstall the Access Plate **(V)** and attached Access Panel Gasket **(X)** onto the Handle **(K)**, then reinstall and tighten the (2) Phillips Pan Head Screws **(W)**.

12 Swing the Handle **(K)** back up into position, reinstall the top left- and right-hand 5/16"-18 Hex Head Screws **(U)**, then tighten the bottom left- and right-hand 5/16"-18 Hex Head Screws **(Z)**.

13 Install the (2) Star Washers **(T)** onto the SPST Momentary Switch **(S)**, then fasten the SPST Momentary Switch **(S)** to the Palm Switch Housing **(P)** with the remaining Star Washer **(R)** and Retaining Nut **(Q)**.

14 Reassemble the Palm Button Switch **(N)** and (2) Switch Springs **(O)** to the Palm Switch Housing **(P)**, then reinstall the (2) Phillips Pan Head Screws **(L)** and Flat Washers **(M)**. Check the function of the Palm Button Switch **(N)** to make sure the Switch Springs **(O)** are assembled correctly.

15 Reassemble the Palm Switch Assembly **(J)** to the Handle **(K)**, then reinstall and tighten the (2) Phillips Flat Head Screws **(I)**.

16 Reconnect the Handle Harness **(H)** to the connector on the machine.

17 Snap the Drain Hose back into the brackets.

18 Check the machine drive functions (forward, reverse, speed control) to make sure the controls are working correctly.

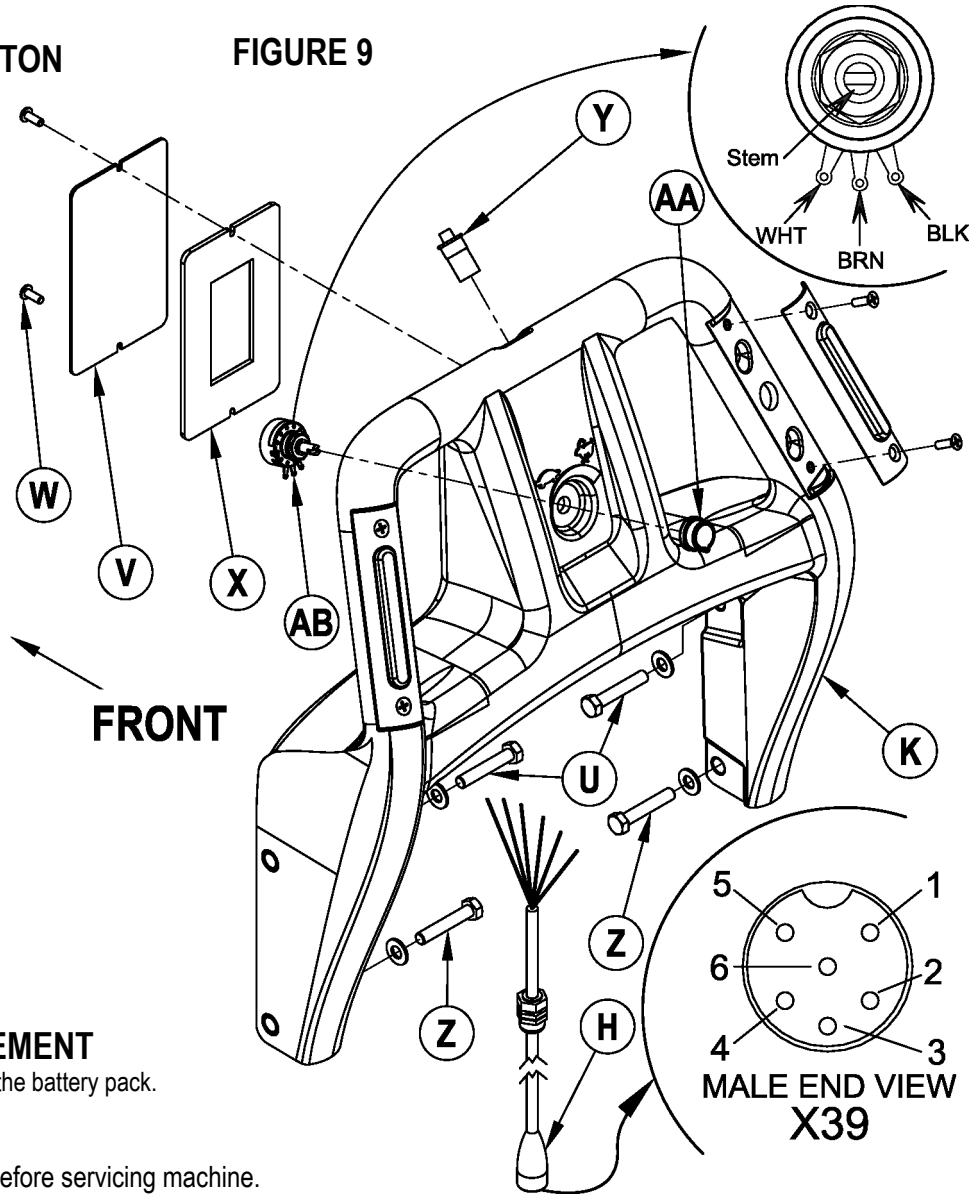
WHEEL DRIVE SYSTEM
TESTING THE REVERSE BUTTON

1 **See Figure 9**. Disconnect the Handle Harness **(H)** from the mating connector located to the left of the squeegee raise/lower handle.

2 **See Figure 8**. Use a continuity checker or ohmmeter to check the continuity between pins 3 and 5 on the Handle Harness **(H)**. When the reverse button is working correctly:
- The circuit through pins 3 and 5 should be open when the reverse button is released.
- The circuit through pins 3 and 5 should be closed (approximately zero ohms) when the reverse button is pressed.

3 **See Figure 9**. When you're done checking the reverse button, reconnect the Handle Harness **(H)** to the connector on the machine.

FIGURE 9



REVERSE BUTTON REPLACEMENT

1 Turn the key switch off and disconnect the battery pack.

⚠ WARNING!

Disconnect the battery pack connector before servicing machine.

Note: It's recommended that you empty the Recovery Tank before replacing the Reverse Button.

2 Pull the Drain Hose out of the brackets to access the 5/16"-18 Hex Head Screws **(U & Z)**.

3 Disconnect the Handle Harness **(H)** from the mating connector located to the left of the squeegee raise/lower handle. (This will prevent excessive pulling or stress on the Handle Harness **(H)** and connector when the Handle **(K)** is swung down to remove the Access Plate **(V)**.)

4 Loosen the bottom left- and right-hand 5/16"-18 Hex Head Screws **(Z)** holding the Handle **(K)** to the machine.

5 Remove the top left- and right-hand 5/16"-18 Hex Head Screws **(U)** holding the Handle **(K)** to the machine, then swing the Handle **(K)** down to allow access to the bottom Phillips Pan Head Screw **(W)** holding the Access Plate **(V)**.

6 Remove the (2) Phillips Pan Head Screws **(W)** and remove the Access Plate **(V)** and attached Access Panel Gasket **(X)** from the Handle **(K)**.

7 Note the wire colors and connector locations, then disconnect the leads on the reverse button SPST Momentary Switch **(Y)** from the connectors in the access area. Note that you may need to cut a cable tie to access the wires and connectors.

8 Remove the old reverse button through the top of the Handle **(K)**.

9 Insert the leads from the replacement reverse button SPST Momentary Switch **(Y)** through the hole in the top of the Handle **(K)** and to the access area, then carefully press the new reverse button into the Handle **(K)**.

10 Plug the leads from the reverse button SPST Momentary Switch **(Y)** into the corresponding connectors. Replace the cable tie if necessary.

11 Reinstall the Access Plate **(V)** and attached Access Panel Gasket **(X)** onto the Handle **(K)**, then reinstall and tighten the (2) Phillips Pan Head Screws **(W)**.

12 Swing the Handle **(K)** back up into position, reinstall the top left- and right-hand 5/16"-18 Hex Head Screws **(U)**, then tighten the bottom left- and right-hand 5/16"-18 Hex Head Screws **(Z)**.

13 Reconnect the Handle Harness **(H)** to the connector on the machine.

14 Snap the Drain Hose back into the brackets.

15 Check the machine drive functions (forward, reverse, speed control) to make sure the controls are working correctly.

WHEEL DRIVE SYSTEM

TESTING THE SPEED LIMIT CONTROL POTENTIOMETER

1 **See Figure 9**. Disconnect the Handle Harness **(H)** from the mating connector located to the left of the squeegee raise/lower handle.

2 **See Figure 8**. Use an ohmmeter on pins 1 and 4 to check the total resistance of the potentiometer. If the potentiometer is working correctly, the resistance across pins 1 and 4 should measure approximately 100K ohms.

3 Use an ohmmeter to measure the resistance across pins 2 and 4. If the potentiometer is working correctly:

- The resistance across pins 2 and 4 should measure 100K ohms with the Speed Limit Control Knob rotated all the way counterclockwise (slow speed).
- The resistance across pins 2 and 4 should measure close to zero ohms with the Speed Limit Control Knob rotated all the way clockwise (fast speed).
- The resistance values across pins 2 and 4 should change proportionately between 100K ohms to zero ohms as the Speed Limit Control Knob is rotated between slow and fast speed. Note that any "dead spots" or spikes in the resistance values could indicate a problem with the potentiometer.

4 **See Figure 9**. When you're done checking the speed limit control potentiometer, reconnect the Handle Harness **(H)** to the connector on the machine.

SPEED LIMIT CONTROL POTENTIOMETER REPLACEMENT

1 Turn the key switch off and disconnect the battery pack.

⚠ WARNING!

Disconnect the battery pack connector before servicing machine.

Note: It's recommended that you empty the Recovery Tank before replacing a Reverse Button.

2 **See Figure 9.** Loosen the setscrew in the Knob **(AA)**, then remove the Knob **(AA)** from the Potentiometer **(AB)** shaft.

3 Pull the Drain Hose out of the brackets to access the 5/16"-18 Hex Head Screws **(U & Z)**.

4 Disconnect the Handle Harness **(H)** from the mating connector located to the left of the squeegee raise/lower handle. (This will prevent excessive pulling or stress on the Handle Harness **(H)** and connector when the Handle **(K)** is swung down to remove the Access Plate **(V)**.)

5 Loosen the bottom left- and right-hand 5/16"-18 Hex Head Screws **(Z)** holding the Handle **(K)** to the machine.

6 Remove the top left- and right-hand 5/16"-18 Hex Head Screws **(U)** holding the Handle **(K)** to the machine, then swing the Handle **(K)** down to allow access to the bottom Phillips Pan Head Screw **(W)** holding the Access Plate **(V)**.

7 Remove the (2) Phillips Pan Head Screws **(W)** and remove the Access Plate **(V)** and attached Access Panel Gasket **(X)** from the Handle **(K)**.

8 Note the wire colors and connector locations, then disconnect the three Potentiometer leads from the connectors in the access area. Note that you may need to cut a cable tie to access the wires and connectors.

9 Note the position of the Potentiometer **(AB)** in the Handle **(K)**, then remove the retaining nut and star washer and remove the old Potentiometer **(AB)** from the Handle **(K)**.

10 Insert the leads from the replacement Potentiometer **(AB)** through the hole in the front of the Handle **(K)** and to the access area, then plug them into the corresponding connectors. Replace the cable tie if necessary.

11 Install the new Potentiometer **(AB)** into the Handle **(K)**, then reinstall the star washer and retaining nut.

12 Reinstall the Access Plate **(V)** and attached Access Panel Gasket **(X)** onto the Handle **(K)**, then reinstall and tighten the (2) Phillips Pan Head Screws **(W)**.

13 Swing the Handle **(K)** back up into position, reinstall the top left- and right-hand 5/16"-18 Hex Head Screws **(U)**, then tighten the bottom left- and right-hand 5/16"-18 Hex Head Screws **(Z)**.

14 Reinstall the Knob **(AA)** onto the Potentiometer **(AB)** shaft, then tighten the setscrew.

15 Check the position of the gray indicator on the Knob **(AA)** with the Potentiometer **(AB)** set to both the full clockwise (fast) and full counterclockwise (slow) positions. Readjust the rotational position of the Knob **(AA)** on the Potentiometer **(AB)** shaft as necessary to center the indicator to the Handle **(K)**.

16 Reconnect the Handle Harness **(H)** to the connector on the machine.

17 Snap the Drain Hose back into the brackets.

18 Check the machine drive functions (forward, reverse, speed control) to make sure the controls are working correctly.

ELECTRICAL SYSTEM
BATTERIES

If your machine shipped with batteries installed do the following:

- Check that the batteries are connected to the machine **(14** or **18)**.
- Turn ON the Key Switch **(A)** and check the Battery Indicator **(G1)**. If the green LED is lighted, the batteries are ready for use. If the yellow and/or red LEDs are lighted, the batteries should be charged before use. See the *Electrical System/Charging Batteries* section in this manual appropriate for your type of battery.
- **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 Nilfisk-Advance dealer for recommended batteries.
- Install the batteries by following the instructions below.
- **DO NOT install three 12-volt batteries in your machine. This affects the stability of the machine.**
- **IMPORTANT!: IF YOUR MACHINE HAS AN ONBOARD BATTERY CHARGER, REFER TO THE OEM PRODUCT MANUAL FOR INSTRUCTIONS REGARDING SETTING THE CHARGER FOR YOUR BATTERY TYPE.**

NOTE! REFERENCE TSBUS2007-979 FOR THE MOST RECENT BATTERY DATA.

⚠ 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...

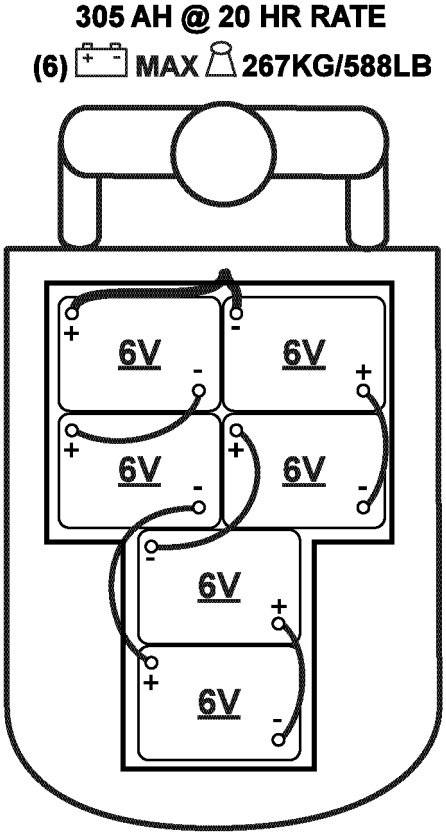
- Remove all jewelry
- Do not smoke
- Wear safety glasses, rubber gloves and a rubber apron
- Work in a well-ventilated area
- Do not allow tools to touch more than one battery terminal at a time
- ALWAYS disconnect the negative (ground) cable first when replacing batteries to prevent sparks.
- ALWAYS 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. Nilfisk-Advance, 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 Master 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 six 6-volt batteries. Carefully lift the batteries into the battery compartment and arrange them exactly as shown in **FIGURE 1**. 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 easily removed 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 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 **(14** or **18)**.

FIGURE 1



ELECTRICAL SYSTEM

SPECIFIC WET CELL BATTERY INFORMATION

Wet Cell Battery Specifications

- Use a combination of multiple two-volt cell units to construct a 36-volt DC battery pack system.
- Nilfisk-Advance recommended battery pack capacity is a 305 AH @ 20 Hour Rate deep cycle battery system. **Note:** The battery pack must fit the battery compartment size listed in *Specifications*.

Wet Cell Battery Charger Specifications

- Use a 36-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 of the batteries being installed. This will prevent the battery pack from being overcharged or undercharged.
- The recommended 305 AH battery should be matched to a 36-volt, 20-25 amp output charger on machines using (six) 6V batteries.

DESCRIPTION OF THE LOW VOLTAGE CUT-OUT FEATURE

All models discussed in this manual are equipped with a low voltage cut-out feature to prevent over-discharging of the batteries. When a machine's battery pack voltage falls below specifically defined thresholds (voltage settings), the scrub system is automatically shut down. The cut-out level is adjustable. The standard lead-acid battery (wet cell) setting is 31.34 volts or 1.74 volts per cell. The alternate maintenance free battery (gel cell) setting is 32.63 volts or 1.81 volts per cell. The standard setting is factory-selected and should be used unless the battery manufacturer specifies the higher cut-out voltage.

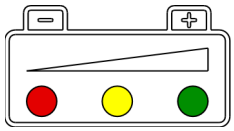
Special Service Note: There is a minimum battery charge level that the must be reached before the low-voltage cut-out function will reset and allow the machine to function again. On the 34 RST, the batteries must be charged to a minimum of 37.6 volts (2.09 volts per cell) in order to reset the low-voltage cut-out function.

DESCRIPTION OF THE BATTERY CONDITION INDICATORS

The Battery Indicator uses a combination of green, yellow and red LEDs to indicate the state of charge of the batteries, A green LED indicates a fully-charged battery after a complete charging cycle. 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 *useable* 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	Standard	Alternate
Green	0 (full charge) to 50%	34.0+	34.5+
Green and Yellow	50% to 75%	33.0 - 34.0	34.0 - 34.5
Yellow	75% to 90%	32.0 - 33.0	33.5 - 34.0
Yellow and Red	90% to 95%	31.5 - 32.0	33.0 - 33.5
Red	95% to 99%	31.0 -31.5	32.5 - 33.0
Flashing Red	100%	<31.52	<32.82



***Important Note:** See the *Electrical System/Main Control Programming Options* section in this manual for instructions on how to change the low-voltage cut-out threshold.

ELECTRICAL SYSTEM

CHARGING WET BATTERIES

Charge the batteries each time the machine is used or when the Battery Indicator **(G1)** LED is other than green.

⚠ WARNING!

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

If your machine shipped <u>with</u> an onboard battery charger do the following:
Turn the Key Switch **(A)** OFF. 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 <u>without</u> an onboard battery charger do the following:
Disconnect the batteries from the machine and push the connector from the charger into the Battery Pack Connector **(18)**. 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

Check the water level of the batteries at least once a week.
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 3/8" (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.
Tighten the vent caps. Wash the tops of the batteries with a solution of baking soda and water (2 tablespoons of baking soda to one liter/quart of water).

CHARGING GEL (VRLA) BATTERIES

Charge the batteries each time the machine is used or when the Battery Indicator **(G1)** LED is other than green.

⚠ WARNING!

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

Your voltage-regulated lead-acid (VRLA) battery will deliver superior performance and life ONLY IF IT IS RECHARGED CORRECTLY! Undercharging 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, the gel electrolyte will dry out (lose its moisture (water)) and the battery will fail prematurely. THE WARRANTY WILL BE VOIDED IF THE BATTERY IS OPENED.

If your machine shipped <u>with</u> an onboard battery charger do the following:
Turn the Key Switch **(A)** OFF. 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 <u>without</u> an onboard battery charger do the following:
Disconnect the batteries from the machine and push the connector from the charger into the Battery Pack Connector **(18)**. 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.

ELECTRICAL SYSTEM
BATTERY MAINTENANCE - WET CELL BATTERIES

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 inadequate.

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 one liter/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:

- Use a hydrometer to check the specific gravity (or "state of charge") of the electrolyte (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

- 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.

Note: 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.

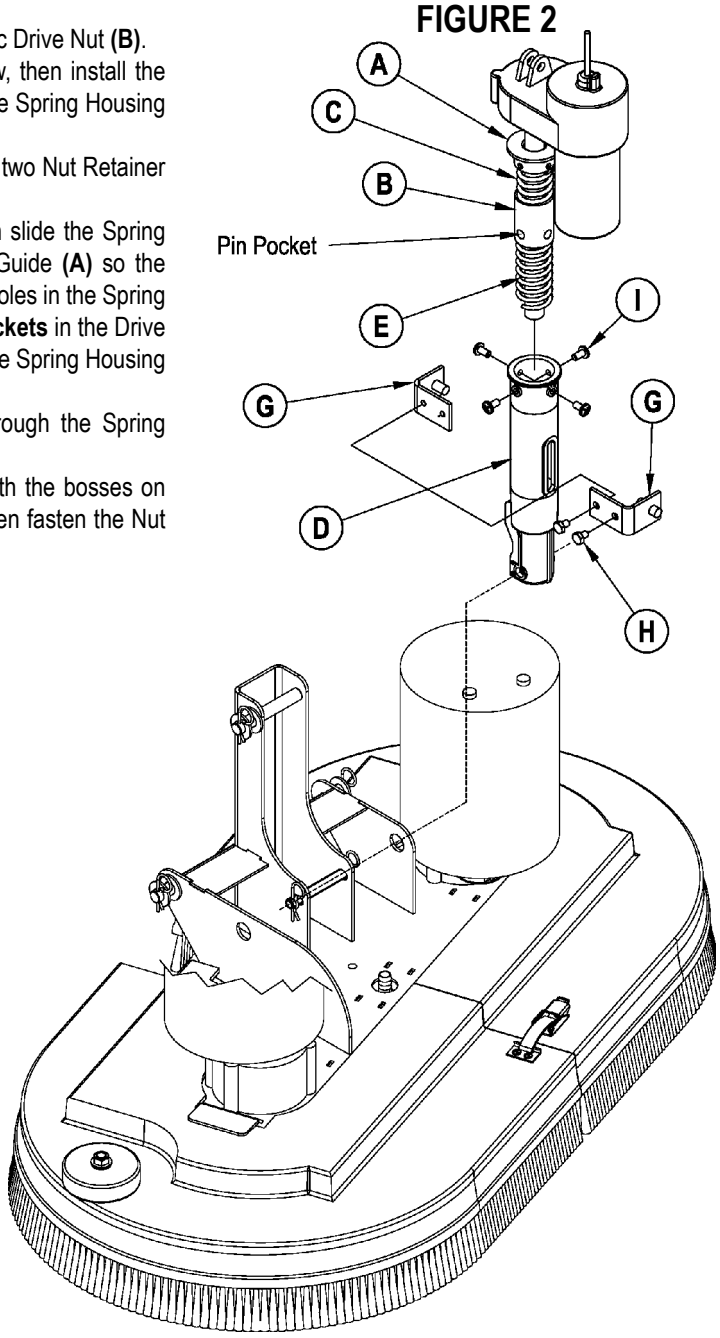
ELECTRICAL SYSTEM
LIFT ACTUATOR ASSEMBLY AND TRAVEL LIMIT ADJUSTMENT

This manual section explains how to assemble a lift actuator assembly and the set the actuator "IN" and "OUT" travel limits.

Instructions for Assembling the Lift Actuator

1 **See Figure 2.** On a new actuator, first remove (spin off) the plastic Drive Nut **(B)**.
2. Slide the Spring Housing Guide **(A)** onto the actuator lead screw, then install the short Compression Spring **(C)** onto the lead screw so it fits into the Spring Housing Guide **(A)**.
3. Reinstall the Drive Nut **(B)** onto the lead screw as shown with the two Nut Retainer **Pin Pockets** away from the motor.
4. Slide the long Compression Spring **(E)** onto the lead screw, then slide the Spring Housing **(D)** onto the lead screw and into the Spring Housing Guide **(A)** so the threaded holes in the Spring Housing **(D)** align with the threaded holes in the Spring Housing Guide **(A)**. Note that it will be helpful to align the **Pin Pockets** in the Drive Nut **(B)** with the slots in the Spring Housing **(D)** when you install the Spring Housing **(D)**.
5. Install the four Phillips Pan Head thread-forming screws **(I)** through the Spring Housing **(D)** and into the Spring Housing Guide **(A)**.
6. Install the two Nut Retainers **(G)** onto the Spring Housing **(D)** with the bosses on the Nut Retainers **(G)** in the **Pin Pockets** in the Drive Nut **(B)**, then fasten the Nut Retainers **(G)** with the two Hex Head thread-forming screws **(H)**.

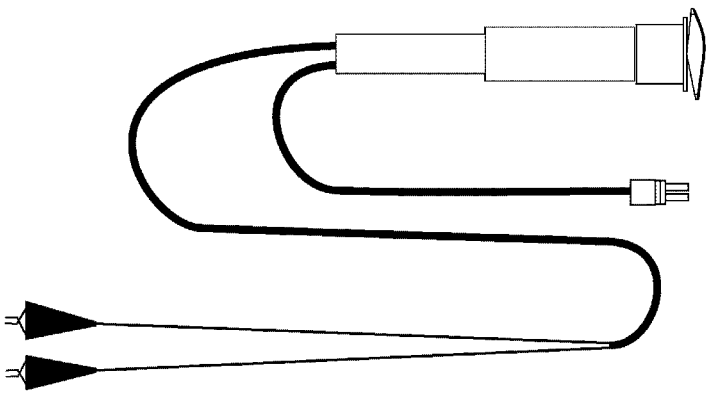
FIGURE 2



General Instructions for Using the Actuator Power Cord Adapter

1 **See Figure 3.** This shows the special actuator power cord adapter (Advance Part # 56407502) that is needed to connect the machine's battery pack to the actuator motor for setting the "IN" and "OUT" travel limit positions.
2 Open the machine battery compartment and disconnect the battery connector. The battery pack is needed to power the lift actuator motor to set the travel limits.
3 Connect the actuator motor to be tested to the power cord adapter end, then connect the alligator clips from the cord adapter (red clip to the positive and black to negative) to the battery connector or battery posts. The rocker switch is used to run the actuator motor to its "IN" and "OUT" travel limits.

FIGURE 3



ELECTRICAL SYSTEM
LIFT ACTUATOR ASSEMBLY AND TRAVEL LIMIT ADJUSTMENT

Reference the chart below for the "IN" and "OUT" dimensional specifications.

Part #	Actuator Motor	Spring Housing IN Position	Spring Housing OUT Position	Models
56393303	Scrub Brush Deck Lift	1/16" to 1/8" (1.59 mm to 3.18 mm)	4-1/8" to 4-1/4" (10.47 cm to 10.8 cm)	All

Note: The spring housing "IN"/"OUT" position dimensions are measured with the actuator completely assembled. Reference points are the gearbox step to the edge of the plastic Spring Housing Guide **(A)** as shown in Figures 2 and 4.

1 Hold onto the spring housing and press the rocker switch in the appropriate direction to run the drive motor and retract the spring housing toward the motor housing. The motor will stop automatically when the spring housing reaches its "IN" limit.

2 **See Figure 4.** Measure the "IN" distance between the gearbox step and the Spring Housing Guide. Manually turn the **Spring Housing Assembly** so the distance between the gearbox step and the Spring Housing Guide is within the specifications shown in the chart above.

3 Hold the **Spring Housing Assembly** to keep it from turning with the lead screw and press the rocker switch on the actuator power cord adapter to run the drive motor and extend the spring housing away from the motor housing. The motor will stop automatically when the spring housing reaches its "OUT" limit.

4 Measure the "OUT" distance between the gearbox step and the **Spring Housing Guide**.

- If the "OUT" dimension is within the specifications shown in the chart above, the travel limits are adjusted correctly.
- If the "OUT" dimension is not within the specifications shown in the chart above, you will need to continue to step 5 below to adjust the cam on the top of the actuator motor.

5. Remove the Adjuster Cover **(J)** from the top of the motor housing to access the "OUT" position cam inside the housing.

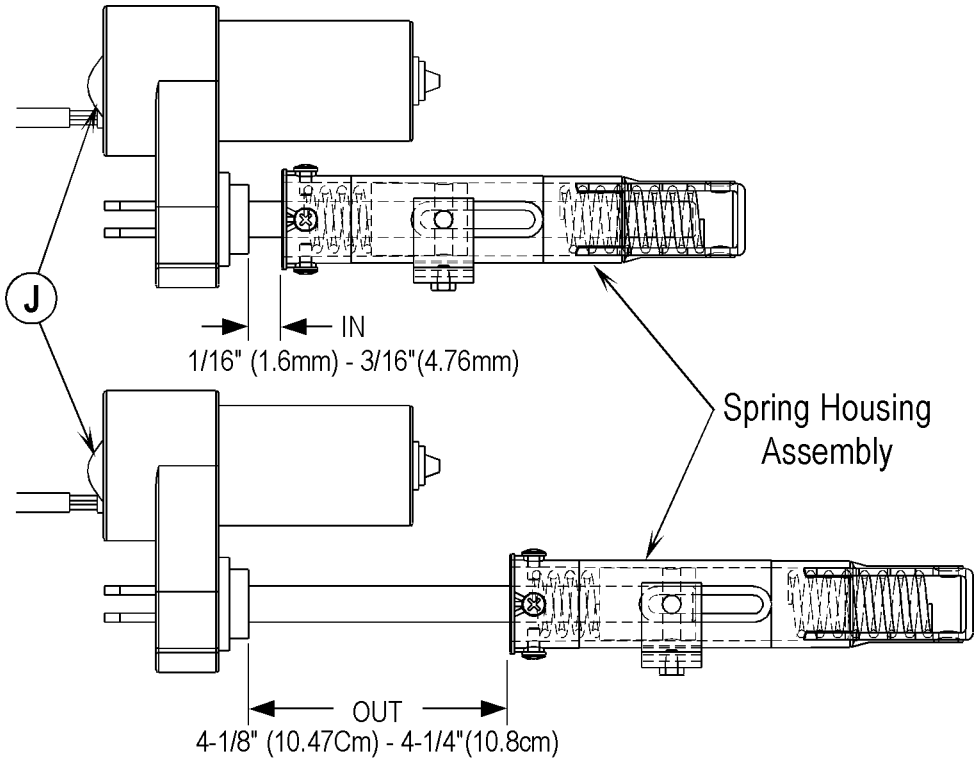
Note: Use a ½" (13 mm) nut driver or socket to turn the cam. One "click" of the cam equals approximately 1/16" (1.6 mm) of **Spring Housing Guide** travel.

6
- Rotate the cam **clockwise** to **increase** the travel of the spring housing assembly and **increase** the "OUT" travel limit dimension.
- Rotate the cam **counterclockwise** to **decrease** the travel of the spring housing assembly and **decrease** the "OUT" travel limit dimension.

Once you've made an adjustment, use the rocker switch on the actuator power cord adapter to run the **Spring Housing Assembly** to its "IN" and "OUT" limits and double-check the dimensions. Readjust the "OUT" travel limit with the cam as necessary.

7. Once the actuator travels limits are set, reinstall the Adjuster Cover **(J)** onto the top of the motor housing.

FIGURE 4



ELECTRICAL SYSTEM

CURTIS CONTROLLER DIAGNOSTICS:

Diagnostics Method A: Uses the machine's LED display and the Regular Scrub ON indicator.

FUNCTION OF THE SPEED CONTROLLER STATUS LIGHT AND DISPLAY

The Curtis 1228 (36V) speed control will output a fault code if there is a problem associated with the speed control and wheel drive system. **See Figure 5.** If a speed control fault occurs, the LED display **(G2)** will flash the three characters **E-0-3** in sequence. When the **03** or **E 0 3** error code is displayed, the yellow Regular Scrub ON Indicator **(F1)** will flash a specific error code sequence until the fault is corrected. See the *Electrical System/ Drive Status LED Fault Codes (Table 1)* section in this manual for a description of these drive fault code indicators.

Service Note: How to read the LED drive fault error code indicators: For example, OO O = two light flashes, a short pause, one flash, then a long pause. The code will then be repeated. This indicates the fault error code 2,1.

Diagnostics Method B: Uses the optional handheld Curtis programmer model 1311 MP1101.

DIAGNOSTICS USING THE CURTIS HANDHELD PROGRAMMER:

Note: Also refer to the Curtis Programmer Manual, Nilfisk-Advance form number 56043101, for more details on programmer operation.

With a Curtis programmer, diagnostics and troubleshooting is more direct than with the LEDs alone. The programmer presents complete diagnostic information in plain language with no codes to decipher. Faults are displayed on the "Faults" screen, and the status of the controller inputs/outputs is displayed on the "Monitor" screen. 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, and (4) correct the problem. Repeat the last three steps as necessary until the vehicle is operational.

Example: A vehicle that does not operate in "forward" is brought in for repair.

1 Examine the vehicle and its wiring for any obvious problems such as broken wires or loose connections.
2 Connect the programmer, navigate to the "Faults" screen, then read the displayed fault information. In this example, the display shows "<Currently no faults>", indicating that the controller has not detected anything out of the norm.
3 Navigate to the "Monitor" screen and observe the status of inputs and outputs in the forward direction. In this example, the display shows that the "THROTTLE" input did not toggle from 0% to 100% when a palm drive switch was pressed, which means there is a problem with the palm drive switches or the palm drive switch wiring.
4 Check and replace/repair the palm drive switches and wiring, then repeat the test. If the programmer shows the palm drive switch circuit closing and the vehicle now drives normally, the problem has been corrected.

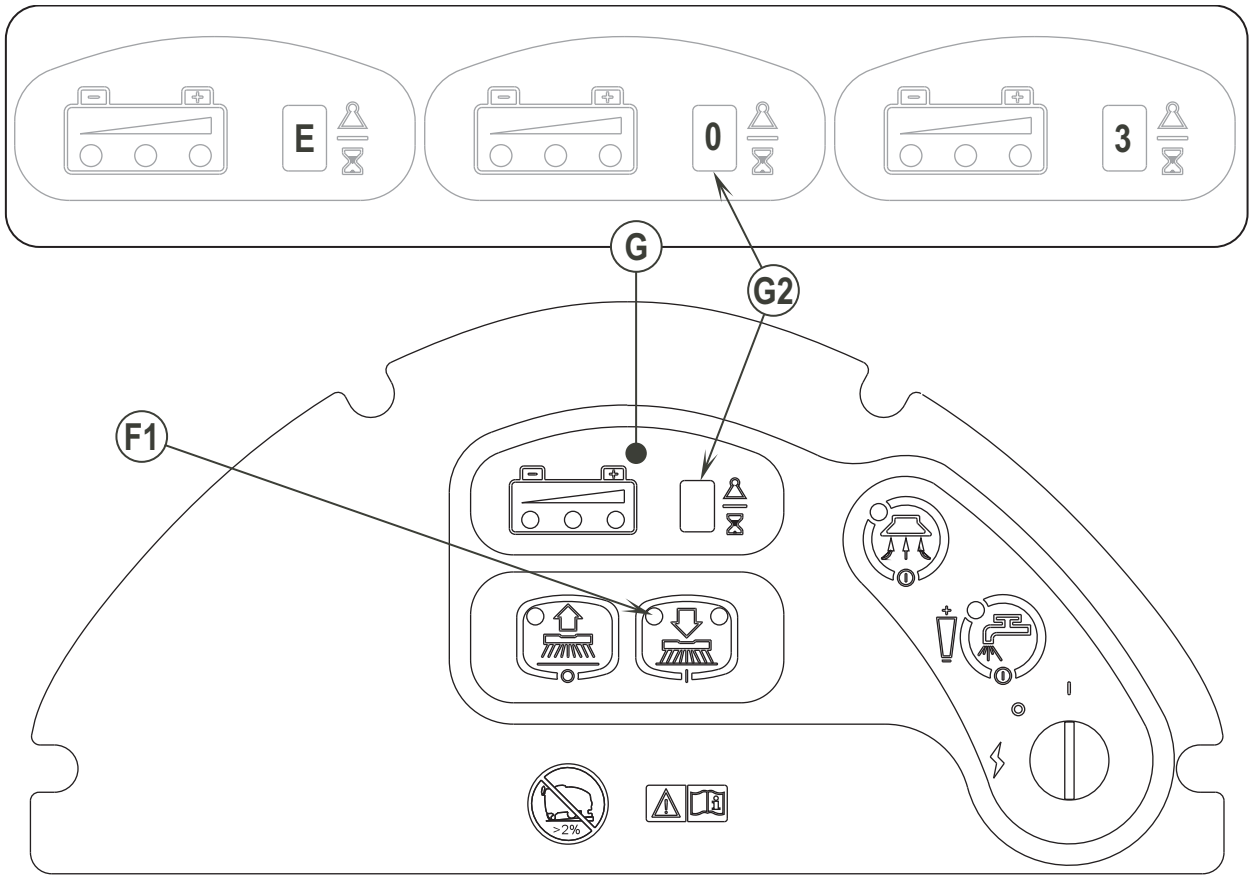
Refer to the *Electrical System/Drive Status LED Fault Codes (Table 1)* section for suggestions covering a wide range of possible faults.

FAULT HISTORY

The handheld programmer can be used to access the controller's fault history file. Connect the programmer, then navigate to the "FAULTS"/"Fault History" screen. The programmer will display all the faults that the controller has experienced since the last time the fault 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, it's advisable to clear the fault history file. This allows the controller to accumulate a new file of faults. By checking the new fault history file at a later date, you can readily determine whether the problem was indeed completely fixed. To clear the fault history file, navigate to the "FAULTS"/"Clear Fault History" screen. The programmer will display the message "You are about to clear Fault History/Continue?

- To clear the fault history, press the "+" (YES) key. The programmer will display the message "Deleted".
- If you decide not to clear the fault history, press the "-" (NO) key. The programmer will return to the expanded "Faults" screen.

FIGURE 5



ELECTRICAL SYSTEM

DRIVE 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.
1,2	0 00	throttle fault	1. Palm drive switch wires open or shorted. 2. Palm switches 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 >48 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.
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. Broken palm drive switch. 2. Broken speed limiting pot.
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 palm drive switch 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 palm drive switch and KSI.** 2. Faulty or shorted palm drive switch.
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 failsafe)	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 connections, inspect system wiring, and retest.

****Note:** A KSI (key switch input) system problem is a specific HPD (high pedal disable) type operational fault caused by the operator activating palm drive switch before turning on the main key switch. This can be cleared by releasing both palm drive switches and cycling the key switch OFF and ON.

ELECTRICAL SYSTEM

SPEED CONTROL PROGRAMMING OPTIONS

Following are the two speed control parameters that can be adjusted using a Curtis handheld programmer:

M1 MAX SPD – Forward Transport/Scrub maximum speed limit (% of full throttle)

M1 REV MAX SPD – Reverse Transport/Scrub maximum speed limit (% of full throttle)

INSTALLATION CHECKOUT FOR THE CURTIS SPEED CONTROLLER

⚠ SAFETY!

The 1228 controller is inherently a high-power device. You must take the necessary safety precautions when working around any battery-powered vehicle. 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 *Electrical System / Curtis Controller Diagnostics* section for further information.

You can perform the installation checkout with or without the handheld programmer. The checkout procedure is easier with a programmer. Otherwise, observe the yellow Regular Scrub ON indicator LED for codes. The Curtis handheld programmer part number is 56409441.

⚠ WARNING!

Put the vehicle up on blocks to get the drive wheels off the ground before beginning these tests.

Turn the key switch off and make sure that both palm drive switches are released.

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 the yellow Regular Scrub ON Indicator LED on the operator panel. If a programmer is available, connect it to the programmer plug-in port.

2 Turn the key switch on. The programmer should “power up” and display “Loading…”. If neither happens, check for continuity in the key switch circuit and controller ground.

3 If you are using a programmer, navigate to the “Faults”/”System Faults” screen. The display should read “<Currently no faults>”.
- 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 fault code in *Table 1* in the *Electrical System* section.
- When the problem has been corrected, it may be necessary to cycle the key switch to clear the fault code.

4 Press one of the palm drive switches. The motor should begin to turn in the selected direction. If it does not, verify the wiring to the controller and to the motor. The motor speed should correspond to the speed limit pot setting. If not, refer to *Table 1* in the *Electrical System* section.

5 If you are using a programmer, navigate to the “Monitor” screen. Scroll down to the “THROTTLE” and “REVERSE INPUT” screens to observe the status of the palm switches and the reverse button. 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

You can change the maximum M1 forward and reverse speeds electronically using the handheld programmer. To change a speed parameter using the programmer, select the “Program” screen.

- To change the maximum forward speed, navigate to the “Program”/ “M1 MAX SPD screen. Press the “+” or (-) keys to increase or decrease the forward speed. Note that the speeds range from 0-100% and the factory setting is 100%.
- To change the maximum reverse speed, navigate to the “Program”/ “M1 REV MAX SPD screen. Press the “+” or (-) keys to increase or decrease the reverse speed. Note that the speeds range from 15-100% and the factory setting is 55%.

MAINTENANCE

There are no user-serviceable parts inside the Curtis PMC 1228 controller. No attempt should be made to open the controller. Opening the controller may damage it and will void the warranty.

It is recommended however that the controller exterior be cleaned periodically. Note that if the handheld programmer is available, this periodic cleaning provides a good opportunity to check the controller’s fault history file.

ELECTRICAL SYSTEM
FUNCTIONAL OVERVIEW OF 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. Pressing the Scrub ON Switch will lower the scrub deck to the operating position. Pressing either palm drive button will 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 continues until the brush motors are shut off. The controller also manages the other supportive systems such as the solution on/off solenoid valve and the vacuum motor. **Note:** See the *Know Your Machine* sections in this manual 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 LED Display **(G2)**, or store it in the main control board's recall memory mode. The error codes are used to help the serviceperson determine the fault and to aid in repairing the specific system malfunction. **Note:** See *Electrical System/Troubleshooting Guide* section in this manual 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 *Electrical System/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 **(G2)** as they occur. If more than one-error exists, the display will sequence through the error codes at one-second intervals. For example, "E03" would be a drive system fault. When troubleshooting any *Fault Description* noted with a double asterisk (**) in Table 2, follow the instructions in the *Electrical System/Service Test Mode* section.

ELECTRICAL SYSTEM

MAIN CONTROLLER ERROR CODES (TABLE 2)		
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, prolonged ramp climbing. 2. Observe the yellow Regular Scrub ON Indicator light (speed control status light) on the control panel, then see the *Electrical System / Drive Status LED Fault Codes (Table 1)* section to further troubleshoot the drive system.
04	Scrub deck lift actuator overload. Normal current load 1-2.5 amps, max. Current load 6 amps, Max. Current no load 1.4 amps.	1. Check for binding or frozen brush deck lift linkage or excessive weight on deck. 2. Check for short circuit in the actuator motor or wiring. Repair or replace.* To test, disconnect the motor plug and attach the actuator power cord adapter (56407502) and perform an amp draw test. Compare readings to the *Fault Description* column on the left.
06	Scrub motor overload **Note:** See the *Scrub Pressure and Current Load (Amps) Specifications Chart* in the *Electrical System* section for load current values for the different scrub pressures.	1. Check for binding in the brush rotation or incorrect function of the scrub brush actuator lift motor. 2. Check the negative supply cable at the brush motor for a wiring problem or incorrect modifications. 3. Check for an open circuit in the small WHT/GRA current sense wire. 4. Check for short circuit* in brush motor or wiring. 5. Inspect gearboxes for failure. Repair or replace. 6. Check the four BLK ground wires to A1 (J1-7/B-1, J1-9/B-2, J2-9/B-3, J2-6/B-4).
07	Vacuum motor overload - normal current load 36V 17-19 amps.	1. Check for debris in the vacuum motor. 2. Worn carbon brushes. 3. Defective motor bearings. 4. Check for short circuit* in vacuum motor or wiring. Repair or replace. 5. Check for an open circuit in the small ORG current sense wire. 6. Check the four BLK ground wires to A1 (J1-7/B-1, J1-9/B-2, J2-9/B-3, J2-6/B-4).
08	Solenoid Coil Bank Overload • Solution Solenoid Coil (L1) • Vacuum Solenoid Coil (K2) • Brush Solenoid Coil (K1)	1. Check for wiring problems (short) on all three coil circuits; repair wiring. 2. Check resistance on all three coils. The resistance specs on the solenoids are: • Solution solenoid coil - 72 ohms. • Vacuum motor solenoid coil - 102 ohms. • Brush motor solenoid coil – 98.5 ohms. If the resistance is less than 20% from spec, replace the solenoid.
17	Scrub deck lift actuator circuit open (**)	1. Check for disconnected actuator wiring, open circuit in wiring or defective actuator motor. Repair or replace. 2. Check controller output voltage - should be 36 volts. If voltage is 0V, there is a controller failure (replace).
18	Scrub deck lift actuator short	1. Check for binding or frozen brush deck lift linkage and excessive weight on deck. 2. Check for short circuit* in brush lift motor or wiring. Repair or replace.
21	Scrub motor circuit open (**)	1. Check for disconnected brush motors, open circuit in wiring, failure in brush motor solenoid load contact. 2. Check the negative supply cable at the brush motor for a wiring problem or incorrect modifications.
22	Scrub motor short	Same as 06.
23	Vacuum motor circuit open (**)	Check for disconnected vacuum motor wiring, open circuit in wiring, defective vacuum motor or vacuum contactor failure.
24	Vacuum motor short	Same as 07

* 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 that will either melt the wires or open a fusible link.

** See the *Electrical System/Service Test Mode* section in this manual for further troubleshooting information.

ELECTRICAL SYSTEM
SERVICE TEST MODE:

To assist in the troubleshooting and servicing of the electrical system and related components on the 34 RST scrubbers, a special test mode has been incorporated that allows independent control of the various outputs and monitoring of the various inputs.

See Figure 6.

To Enter and Exit the Service Test Mode:

1 Turn the main power Key Switch **(A)** to the off position.
2 Press and hold in the Vacuum Switch **(D)**.
3 While holding in the Vacuum Switch **(D)**, turn the Key Switch **(A)** to the on position.
4 Continue to hold the Vacuum Switch **(D)** until the Vacuum System Indicator **(D1)** turns from green to yellow. The Display **(G2)** will show a "t" to indicate that the machine is in the service test mode.
5 Release the Vacuum Switch **(D)**. The Vacuum System Indicator **(D1)** will go out.
6 The Display **(G2)** will show the current battery voltage, and the Battery Indicator **(G1)** will be green to indicate that the machine is in the service test mode. Note that the entire nozzle icon in the Solution Flow Indicator **(C)** will be green.

Note: The function of each switch and indicator in the service test mode is described below.

7 To exit the service test mode, turn the Key Switch **(A)** to the off position.

To Run the Machine Forward or Backward:

1 Press either palm drive switch to move the machine forward. The Battery Indicator **(G1)** will be yellow and green when the machine is moving forward.
2. Press the reverse button and either palm drive switch to move the machine backward. The Battery Indicator **(G1)** will be red, yellow and green when the machine is moving in reverse.

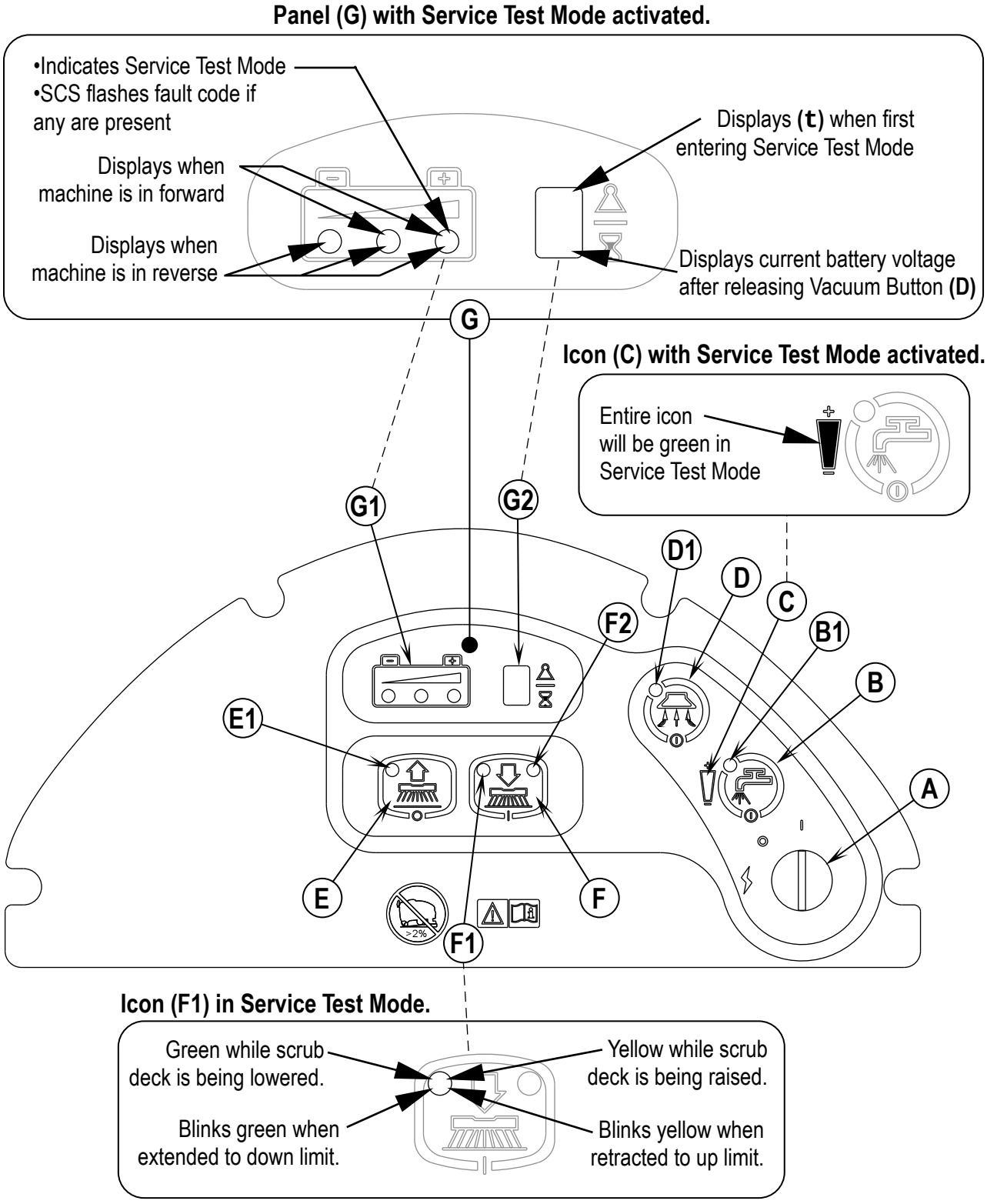
To Raise and Lower the Scrub Brush Deck:

1 Press the Scrub ON Switch **(F)** to lower the scrub brush deck. The Regular Scrub ON Indicator **(F1)** will be green and the deck will extend downward all the way to its "out" travel limit, then stop. When the deck stops, the Regular Scrub ON Indicator **(F1)** will blink green. Pressing the Scrub ON Switch **(F)** with the deck fully-extended will switch off the Regular Scrub ON Indicator **(F1)**.
2. Press the Scrub ON Switch **(F)** to raise the scrub brush deck. The Regular Scrub ON Indicator **(F1)** will be yellow and the deck will retract upward all the way to its "in" travel limit, then stop. When the deck stops in its uppermost position, the Regular Scrub ON Indicator **(F1)** will blink yellow. Pressing the Scrub ON Switch **(F)** with the deck fully-retracted will switch off the Regular Scrub ON Indicator **(F1)**.

Note:
- To stop the deck movement before it reaches its travel limits, press the Scrub ON Switch **(F)**. The deck movement will stop and the Regular Scrub ON Indicator **(F1)** will switch off.
- The Regular Scrub ON Indicator **(F1)** will be green when the deck is moving downward and yellow when the deck is moving upward.

ELECTRICAL SYSTEM
CONTROL PANEL INDICATORS

FIGURE 6



ELECTRICAL SYSTEM
SERVICE TEST MODE CONTROL PANEL INPUT INDICATORS

G2 Status Display:
The Display **(G2)** will show the battery voltage when the machine is in the service test mode. For example, if the display shows "3", "8", "–", then "2" sequentially, this indicates a battery voltage of 38.2 volts. This display is accurate to within ± 0.15 volts. Therefore, the voltage displayed may not correlate precisely to a highly-accurate calibrated voltmeter.

G1 Speed Control Status (SCS) Signal – Green Light:
The green light in the Battery Indicator **(G1)** will light when the machine is in the service test mode to indicate that the Curtis speed controller is communicating with the main control board. If there is a speed control fault, the green light will flash the fault code. Refer to the *Electrical System/ Curtis Controller Diagnostics* section for more information on the Curtis speed controller status light and display.

Note: If the green light in the Battery Indicator **(G1)** does not display in the service test mode, disconnect the Org/Blu wire from the speed controller and main controller and check the continuity of the wire.

- If the wire tests open, repair or replace the wire or plug.
- If wire tests OK, replace the speed controller.

G1 Forward/Reverse (F/R) Signal – Yellow Light:
The yellow light in the Battery Indicator **(G1)** will light when one of the palm drive switches is pressed in the service test mode to indicate an active drive signal from the Curtis speed controller to the main control board.

Note: If the yellow light in the Battery Indicator **(G1)** does not display when a palm drive switch is pressed in the service test mode, disconnect the Red/Blk wire from the speed controller and main controller and check the continuity of the wire.

- If the wire tests open, repair or replace the wire or plug.
- If wire tests OK, replace the speed controller.

G1 Reverse Signal – Red Light:
The red light in the Battery Indicator **(G1)** will light when one of the palm drive switches and the reverse button are pressed in the service test mode to indicate a reverse signal from the Curtis speed controller to the main control board.

Note: If the red light in the Battery Indicator **(G1)** does not display when a palm drive switch and the reverse button are pressed in the service test mode, disconnect the Blu/Blk wire from the speed controller and main controller and check the continuity of the wire.

- If the wire tests open, repair or replace the wire or plug.
- If wire tests OK, replace the speed controller.

ELECTRICAL SYSTEM
SERVICE TEST MODE (CONTINUED):
OUTPUT CONTROLS:

The control panel switches are used to control various output functions of the main control unit when the machine is in the service test mode. Below is a list of each switch and the function it controls. Following the list is a detailed description of each function.

Scrub off Switch (E): Controls brush motor(s).
Scrub on Switch (F): Controls scrub deck lift actuator.
Vacuum Switch (D): Controls vacuum motor.
Solution Switch (B): Controls the solution solenoid valve.

Scrub System Off Switch (E):

This switch is used to toggle the state of the brush motors. Pressing and releasing this switch will alternately turn the brush motors on and off. The indicator provides the following status information:

- Off – Brush motor output is off and there is no brush motor current sensed.
- Steady Green – Brush motor output is on and there is normal brush motor current sensed.
- Brief On Green Flash – Brush motor output is off and brush motor current is being sensed (abnormal condition).
  - Check for voltage at the Wht wire on K1 contactor to battery ground.
  - If any voltage is present, replace the K1 contactor.
  - If no voltage is present, replace the main control board (A1).
- Brief Off Green Flash – Brush motor output is on and brush motor current is not being sensed (abnormal condition).
  - Check the brush motor wiring and plugs.
  - Check for voltage at the brush motor connectors.
  - Check one of the Blk wires of the main harness connector at the brush motor to battery Positive. If no voltage is present, repair or replace wire.
  - Check one of the Wht wires of the main harness connector at the brush motor to battery Neg. If no voltage is present, repair or replace wire.
  - Check for voltage at the Red wire on K1 contactor to battery ground. If no voltage is present, repair the Red wire.
  - Check for voltage at the Wht wire on K1 contactor to battery ground. If no voltage is present, replace the K1 contactor.
- Flashing Red – Brush motor overload has occurred.
  - Check for binding in rotation of brushes or incorrect scrub brush type installed.
  - Perform an amp test to check the motor current draw. (Refer to the *Scrub Pressure and Current Load (Amps) Specifications Chart* in the *Electrical System/Main Control Programming Options* section of this manual.)
  - Check the negative supply cable at the brush motor for a wiring problem or incorrect modifications.
  - Check for open circuit in the small Wht/Gra current sense wire.
  - Check for short circuit* in brush motor or wiring.

ELECTRICAL SYSTEM
OUTPUT CONTROLS (CONTINUED):

Scrub ON Switch (F)

This switch is used to control the output to the scrub deck lift actuator when the machine is in the service test mode. Pressing and releasing this switch will cycle the actuator output through four states. These are:

1 – Output off, direction = up

2 – Output on, direction = down (Scrub indicator green)

3 – Output off, direction = down

4 – Output on, direction = up (Scrub indicator yellow)

- When the output is in state 1, the actuator output is turned off. The Regular Scrub ON Indicator **(F1)** (upper left corner) should be off. If the Regular Scrub ON Indicator **(F1)** is flashing green, this indicates that the control is sensing current flow through the actuator when there should not be power to the actuator. This could indicate a short in the actuator circuit, shorted output driver, control error, etc.
- When the output is in state 2, the actuator output is turned on and is moving the deck downward. The Regular Scrub ON Indicator **(F1)** should be green or flashing green. The Regular Scrub ON Indicator **(F1)** will be a steady green if the control senses current flow through the actuator. It will flash green if no actuator current flow is sensed (actuator at the travel limit, open circuit, open output driver). Note that if the Regular Scrub ON Indicator **(F1)** is flashing between the actuator up and down limits, this indicates a problem. The Regular Scrub ON Indicator **(F1)**, when operating correctly, will always flash at the end of its normal travel limit.
- When the output is in state 3, the actuator output is turned off. The Regular Scrub ON Indicator **(F1)** should be off. If the Regular Scrub ON Indicator **(F1)** is flashing green, this indicates that the control is sensing current flow through the actuator when there should not be power to the actuator. This could indicate a short in the actuator circuit, shorted output driver, control error, etc.
- When the output is in state 4, the actuator output is turned on and is moving the deck upward. The Regular Scrub ON Indicator **(F1)** should be yellow or flashing yellow. The Regular Scrub ON Indicator **(F1)** will be a steady yellow if the control senses current flow through the actuator. It will flash yellow if no actuator current flow is sensed (actuator at the travel limit, open circuit, open output driver). Note that if the Regular Scrub ON Indicator **(F1)** is flashing between the actuator up and down limits, this indicates a problem. The Regular Scrub ON Indicator **(F1)**, when operating correctly, will always flash at the end of its normal travel limits.

  Note: – To stop the deck movement before it reaches its travel limits, press the Scrub ON Switch **(F)**. The deck movement will stop and the Regular Scrub ON Indicator **(F1)** will switch off.

  – The Regular Scrub ON Indicator **(F1)** will be green when the deck is moving downward and yellow when the deck is moving upward.

Vacuum Switch (D):

This switch is used to toggle the state of the vacuum motor when the machine is in the service test mode. Pressing and releasing this switch will alternately turn the vacuum motor on and off. The indicator provides the following status information:

Off - Vacuum motor output is off and there is no vacuum motor current sensed.

Steady Green - Vacuum motor output is on and there is normal vacuum motor current sensed.

- Brief On Green Flash – Vacuum motor output is off and vacuum motor current is being sensed (abnormal condition).
  - Check for voltage at the Blu wire on K2 contactor to battery ground.
  - If any voltage is present, replace the K2 contactor.
  - If no voltage is present, replace the main control board (A1).
- Brief Off Green Flash – Vacuum motor output is on and vacuum motor current is not being sensed (abnormal condition).
  - Check the vacuum motor wiring and plug, check for a disconnection.
  - Check for voltage at the Red wire on K2 contactor to battery ground. If no voltage is present, repair the Red wire.
  - Check for voltage at the Blu wire on K2 contactor to battery ground. If no voltage is present, replace the K2 contactor.
  - Check the Blu wire of the main harness connector at the vacuum motor to battery Negative. If no voltage is present, repair or replace wire.
  - Check the Blk wire of the main harness connector at the vacuum motor to battery Positive. If no voltage is present, repair or replace wire.
- Flashing Yellow – Vacuum motor overload has occurred.
  - Check for an open circuit in the small ORG current sense wire.
  - To confirm an overload, disconnect the motor plug from the main harness, run 30-amp fused test leads from the batteries to the motor and perform an amp draw test. Normal current load at 36V is 23-25 amps.
  - Check for debris in the vacuum motor.
  - Check for worn carbon brushes and replace if necessary.
  - Check for defective motor bearings.
  - Check for short circuit in vacuum motor or wiring. Repair or replace as necessary.

ELECTRICAL SYSTEM
OUTPUT CONTROLS (CONTINUED):

Solution Switch (B):

This switch is used to toggle the state of the solution solenoid when the machine is in the service test mode. Pressing and releasing the Solution Switch **(B)** will alternately turn the solution solenoid on and off.

If you press the Solution Switch **(B)** to open the solenoid valve and don't press it again within a few seconds, the machine will go into the automatic solenoid open/close cycle. In this auto cycle mode the solenoid will switch on (open) for about four seconds, then will switch off (close) for about two seconds. The total on/off cycle time is approximately six seconds. The Solution System Indicator **(B1)** will remain green during the auto cycle mode. Press the Solution Switch **(B)** to stop the auto cycle mode and switch off (close) the solution solenoid.

The Solution System Indicator **(B1)** provides the following status information:

- Off - Solution output is off.
- Steady Green - Solution output is on (solution solenoid valve is open), or the solution system is performing its automatic solenoid open/close cycle.
- Flashing Yellow – Solution solenoid coil overload has occurred.

ELECTRICAL SYSTEM
MAIN CONTROL PROGRAMMING OPTIONS

Note: Refer to the *Switch Sequences for Main Controller Programming Options* table in the *Appendix* at the back of this manual for a list of programming switch sequences.

Selecting the Low-voltage Cut-out Threshold:

Note: The factory default (standard - wet cell) low-voltage cut-out threshold is 31.34 volts.

The 34 RST is equipped with a low-voltage cut-out 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. This cut-out threshold is adjustable. The Standard setting (S) (wet cell) is 31.34 volts (1.74 volts per cell) and the alternate (A) (gel cell) setting is 32.63 volts (1.81 volts per cell). Select the correct cut-out 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 1.74 volts per cell.*

To select between the two cut-out levels:

1 Turn the Key Switch **(A)** to the off position.
2 Press and hold the Scrub OFF Switch **(E)**.
3 While holding in the Scrub OFF Switch **(E)**, turn the Key Switch **(A)** to the on position.
4 Continue to hold the Scrub OFF Switch **(E)** until the Scrub OFF Indicator **(E1)** indicator turns green.
5 Release the Scrub OFF Switch **(E)**. The Scrub OFF Indicator **(E1)** will turn red and the Solution Flow Indicator **(C)** will remain green.
6 The Display **(G2)** will show an "S" (standard) or an "A" (alternate) to indicate which cut-out threshold is currently selected. Note that:
   - If the standard battery cut-out threshold (S) is selected, the Regular Scrub ON Indicator **(F1)** will be green and the Heavy Scrub ON Indicator **(F2)** will be yellow.
   - If the alternate battery cut-out threshold (A) is selected, the Regular Scrub ON Indicator **(F1)** will be yellow and the Heavy Scrub ON Indicator **(F2)** will be green.
7 Press the Scrub ON Switch **(F)** to toggle between the standard and alternate cut-out thresholds.
8 To save the cut-out threshold setting, press the Scrub OFF Switch **(E)**. The Scrub OFF Indicator **(E1)** will turn to green to indicate that the machine has been reset.
9 Turn the Key Switch **(A)** to the off position. The selected cut-out threshold setting will remain in effect until it is changed again.

Enabling and Disabling the Fault Detection:

Note: The factory default setting for fault detection is "E" (enabled).

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. Note that this will not disable the over-current protection on any of the systems.

To enable or disable the fault detection:

1 Turn the Key Switch **(A)** to the off position.
2 Press and hold in both the Scrub OFF Switch **(E)** and the Solution Switch **(B)**.
3 While holding both switches, turn the Key Switch **(A)** to the on position.
4 Continue to hold both switches until the Solution Flow Indicator **(C)**, the Solution System Indicator **(B1)** and the Scrub OFF Indicator **(E1)** turn green.
5 Release both the Scrub OFF Switch **(E)** and the Solution Switch **(B)**. The Display **(G2)** will now show "E" for enabled or "d" for disabled. The Scrub OFF Indicator **(E1)** will turn red and the Solution System Indicator **(B1)** will be yellow.
6 Press and release the Solution Switch **(B)** to toggle the fault detection between "E" (enabled) and "d" (disabled). Enabled means that the fault detection is turned on. Disabled means that the fault detection is turned off.
7 To save the fault detection setting, press the Scrub OFF Switch **(E)**. The Scrub OFF Switch **(E)** will turn green.
8 Turn the Key Switch **(A)** to the off position. The new setting will remain in effect until it is changed.

ELECTRICAL SYSTEM
MAIN CONTROL PROGRAMMING OPTIONS (CONTINUED)

Recalling and Clearing Stored Error Codes:

Whenever the main control unit detects an electrical system fault, one or more error codes are displayed and stored by the control unit. You can recall any error code(s) from previous machine operation for troubleshooting purposes.

To recall and clear the stored error codes:

1 Turn the Key Switch **(A)** to the off position.
2 Press and hold in the Solution Switch **(B)**.
3 While holding the Solution Switch **(B)**, turn the Key Switch **(A)** to the on position.
4 Continue to hold the Solution Switch **(B)** until the Solution Flow Indicator **(C)** and the Solution System Indicator **(B1)** turn green.
5 Release the Solution Switch **(B)**.
6
- If there are no error codes stored, the Scrub OFF Indicator **(E1)** will be green and the display will show (-). Skip to step 8.
- If any error codes are stored, the Scrub OFF Indicator **(E1)** will be red and the Display **(G2)** will show the error code number(s). If more than one error code is stored, the Display **(G2)** will scroll through the error codes in sequence.

7 To clear the stored error codes, press the Scrub OFF Switch **(E)**. The Scrub OFF Indicator **(E1)** will be green and the Display **(G2)** will now show (-).
8 To exit the error code recall mode and reset the machine, turn the Key Switch **(A)** to the off position.

Service Note: It is important to clear any stored error codes after performing service on the machine. This will ensure that any observed error codes are current and relevant to the present machine condition.

Displaying the Control Unit Software Revision Level:

To view the revision level of the control unit software:

1 Turn the Key Switch **(A)** to the off position.
2 Press and hold in both the Vacuum Switch **(D)** and the Solution Switch **(B)**.
3 While holding both switches, turn the Key Switch **(A)** to the on position.
4 Continue to hold both switches until the Vacuum System Indicator **(D1)**, Solution System Indicator **(B1)** and Solution Flow Indicator **(C)** turn green.
5 Release both the Vacuum Switch **(D)** and the Solution Switch **(B)**. The Display **(G2)** will now show the revision level (letter) of the main controller software.
6 To exit the revision level recall mode, turn the Key Switch **(A)** to the off position.

Scrub Deck Down Time Period Adjustment:

Note: The factory default setting for the scrub deck down time is four seconds (setting #5).

When the Scrub ON Switch **(F)** is pressed, the control unit will automatically lower the deck for four seconds. The time that the deck is lowered is adjustable from 3.5 seconds to 4.4 seconds in 0.1-second increments.

To adjust the scrub deck down time:

1 Turn the Key Switch **(A)** to the off position.
2 Press and hold in both the Scrub OFF Switch **(E)** and the Vacuum Switch **(D)**.
3 While holding both switches, turn the Key Switch **(A)** to the on position.
4 Continue to hold both switches until both the Scrub OFF Indicator **(E1)** and the Vacuum System Indicator **(D1)** turn green. Note that the Solution Flow Indicator **(C)** will remain green.
5 Release both the Scrub OFF Switch **(E)** and the Vacuum Switch **(D)**. The Display **(G2)** will show a number "0" through "9", the Regular Scrub ON Indicator **(F1)** and the Heavy Scrub ON Indicator **(F2)** will turn yellow, and the Scrub OFF Indicator **(E1)** will turn red.
6 Press the Scrub ON Switch **(E)** to increment the time period numbers shown on the Display **(G2)**. Note that "0" represents the minimum deck down time of 3.5 seconds and "9" represents the maximum deck down time of 4.4 seconds as shown in the chart to the right. Each increase in the number shown in the Display **(G2)** will add 0.1 seconds to the deck down time. For instance, if you increment the number from "5" to "7", you will add 0.2 seconds to the "5" value of 4.0 seconds. This will give you a new deck down time of 4.2 seconds.
7 To save the new setting, press the Scrub OFF Switch **(E)**. The Scrub OFF Indicator **(E1)**, Regular Scrub ON Indicator **(F1)** and Heavy Scrub ON Indicator **(F2)** will turn green.
8 Turn the Key Switch **(A)** to the off position. The new setting will remain in effect until it is changed.

Number in Display (G2)	Scrub Deck Down Time
0	3.5 sec.
1	3.6 sec.
2	3.7 sec.
3	3.8 sec.
4	3.9 sec.
5	4.0 sec.
6	4.1 sec.
7	4.2 sec.
8	4.3 sec.
9	4.4 sec.

ELECTRICAL SYSTEM
MAIN CONTROL PROGRAMMING OPTIONS (CONTINUED)

Scrub Setting Adjustments:

The regular, heavy and extreme scrub settings can be reprogrammed to different scrub pressures to suit a particular application. This is useful if you wish to change the regular scrub setting to a higher scrub pressure, change the extreme scrub setting to a lower scrub pressure, etc.

Note: The factory default scrub settings are: Regular Scrub Pressure – 1; Heavy Scrub Pressure – 2; Extreme Scrub Pressure – 3.

- To Change the Regular Scrub Setting Pressure:
  1. Turn the main power Key Switch **(A)** to the off position.
  2. Press and hold in the Scrub OFF Switch **(E)** and Scrub ON Switch **(F)**.
  3. While holding both switches, turn the Key Switch **(A)** to the on position.
  4. Continue to hold both switches until the Scrub OFF Indicator **(E1)**, Regular Scrub ON Indicator **(F1)** and Heavy Scrub ON Indicator **(F2)** turn green. Note that the Solution Flow Indicator **(C)** will remain green.
  5. Release the Scrub OFF Switch **(E)** and Scrub ON Switch **(F)**. The Display **(G2)** will show the current regular scrub pressure setting (1-3), the Scrub OFF Indicator **(E1)** will turn red and the Regular Scrub ON Indicator **(F1)** will turn yellow.
  6. Press the Scrub ON Switch **(F)** to select new regular scrub pressure.
  7. Press the Scrub OFF Switch **(E)** to save the scrub pressure setting. The Regular Scrub ON Indicator **(F1)** will be green and the Solution System Indicator **(B1)** will be yellow.
  8. Turn the main power key switch to the off position. The new regular pressure setting will remain in effect until it is changed.
- To Change the Heavy Scrub Setting Pressure:
  1. Turn the main power Key Switch **(A)** to the off position.
  2. Press and hold in the Scrub ON Switch **(F)** and Vacuum Switch **(D)**.
  3. While holding both switches, turn the Key Switch **(A)** to the on position.
  4. Continue to hold both switches until the Regular Scrub ON Indicator **(F1)**, Heavy Scrub ON Indicator **(F2)** and Vacuum System Indicator **(D1)** turn green. Note that the Solution Flow Indicator **(C)** will remain green.
  5. Release the Scrub ON Switch **(F)** and Vacuum Switch **(D)**. The Display **(G2)** will show the current heavy scrub pressure setting (1-3), the Scrub OFF Indicator **(E1)** will turn red and the Heavy Scrub ON Indicator **(F2)** will turn yellow.
  6. Press the Scrub ON Switch **(F)** to select new regular scrub pressure.
  7. Press the Scrub OFF Switch **(E)** to save the scrub pressure setting. The Heavy Scrub ON Indicator **(F2)** will be green and the Solution System Indicator **(B1)** will be yellow.
  8. Turn the main power key switch to the off position. The new heavy pressure setting will remain in effect until it is changed.
- To Change the Extreme Scrub Setting Pressure:
  1. Turn the main power Key Switch **(A)** to the off position.
  2. Press and hold in the Scrub ON Switch **(F)** and Solution Switch **(B)**.
  3. While holding both switches, turn the Key Switch **(A)** to the on position.
  4. Continue to hold both switches until the Regular Scrub ON Indicator **(F1)**, Heavy Scrub ON Indicator **(F2)** and Solution System Indicator **(B1)** turn green. Note that the Solution Flow Indicator **(C)** will remain green.
  5. Release the Scrub ON Switch **(F)** and Solution Switch **(B)**. The Display **(G2)** will show the current extreme scrub pressure setting (1-3), the Scrub OFF Indicator **(E1)** will turn red, and the Regular Scrub ON Indicator **(F1)** and Heavy Scrub ON Indicator **(F2)** will turn yellow.
  6. Press the Scrub ON Switch **(F)** to select new regular scrub pressure.
  7. Press the Scrub OFF Switch **(E)** to save the scrub pressure setting. The Regular Scrub ON Indicator **(F1)** and Heavy Scrub ON Indicator **(F2)** will be green, and the Solution System Indicator **(B1)** will be yellow.
  8. Turn the main power key switch to the off position. The new extreme pressure setting will remain in effect until it is changed.

The chart below lists the three scrub modes and their corresponding scrub pressures and current loads for reference.

Scrub Mode	Default Scrub Pressure Indicator	Scrub Pressure	Current Load
Regular Scrub	Number 1	Max. 90 lbs (40.8 kg)	16 amps
Heavy Scrub	Number 2	Max. 175 lbs (79.4 kg)	24 amps
Extreme Scrub	Number 3	Max. 250 lbs (113.4 kg)	38 amps

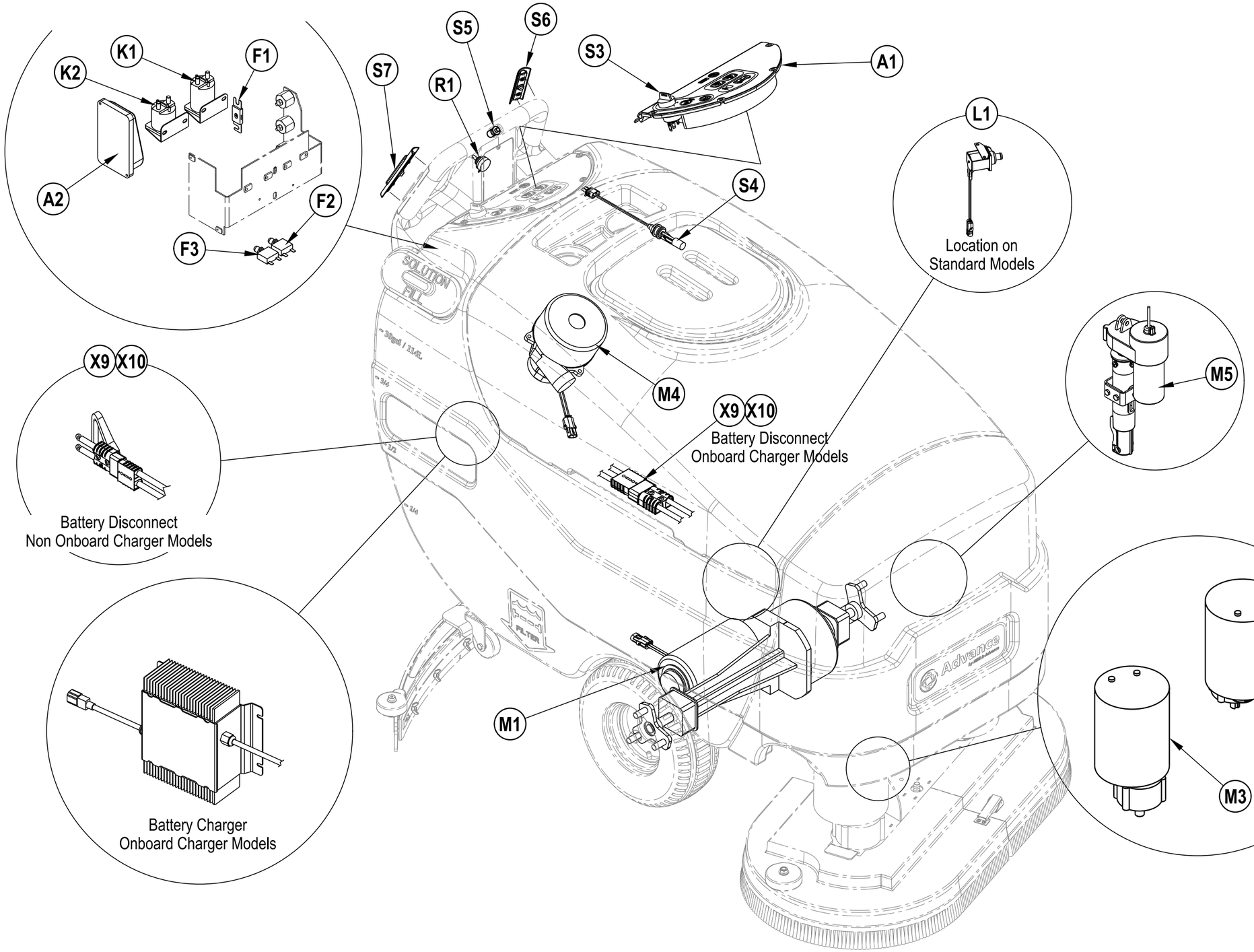
Restoring the Default Scrub Setting Pressures:

1. Turn the main power Key Switch **(A)** to the off position.
2. Press and hold in the Scrub ON Switch **(F)**.
3. While holding the Scrub ON Switch **(F)**, turn the Key Switch **(A)** to the on position.
4. Continue to hold the Scrub ON Switch **(F)** until the Display **(G2)** shows the letter “d” (done) to indicate that the factory default scrub pressures have been restored.
5. Turn the Key Switch **(A)** to the off position. The default scrub setting pressures will remain in effect until changed.

ELECTRICAL SYSTEM

COMPONENT LOCATION

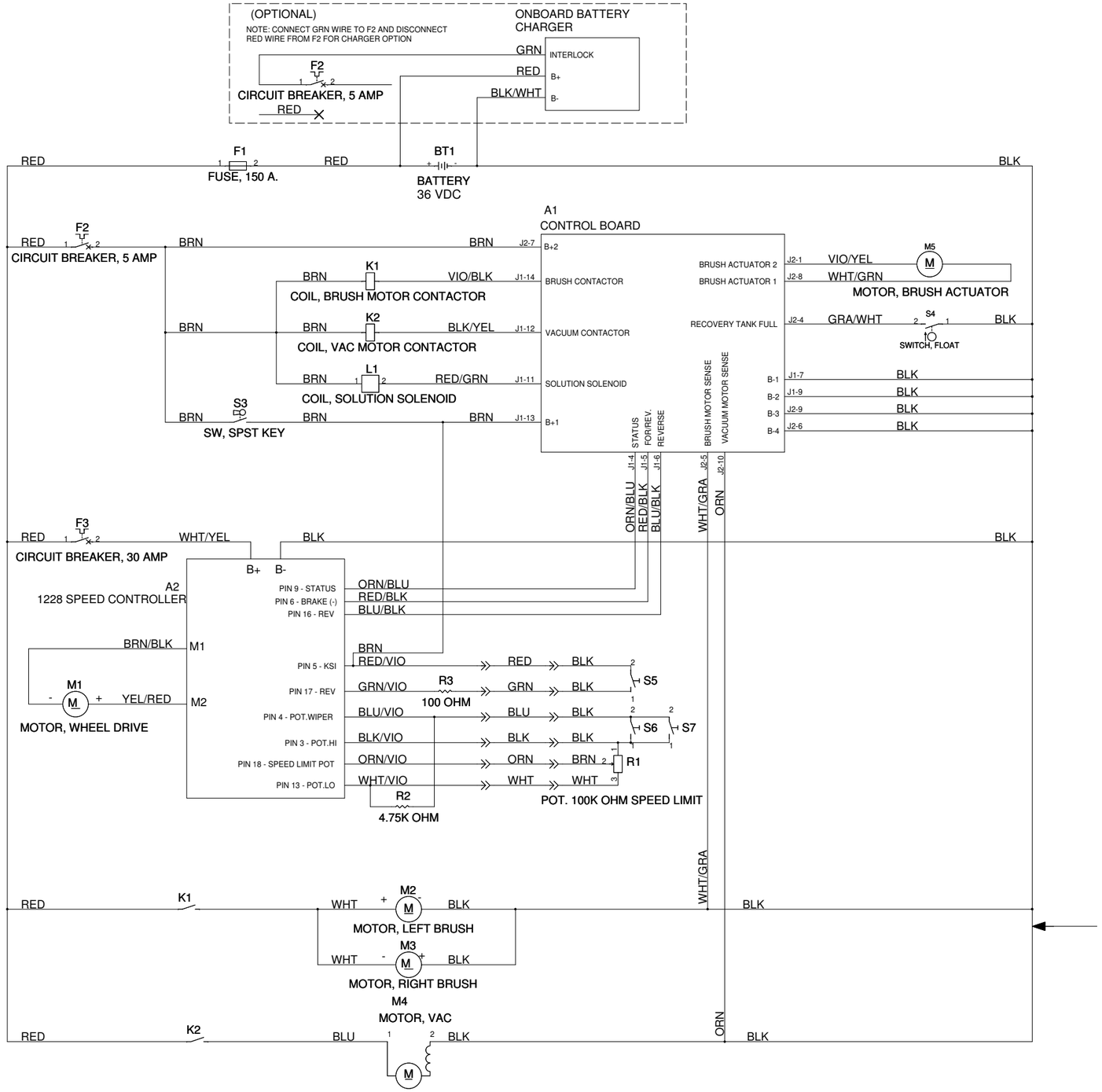
Item	Description
A1	Control Panel Assy
A2	Speed Control
BT1	Battery **(Not Shown)**
F1	Fuse, 150 Amp
F2	Circuit Breaker, 5 Amp
F3	Circuit Breaker, 30 Amp
K1	Contactor, Brush Motor
K2	Contactor, Vac Motor
L1	Solenoid, Solution
M1	Motor, Wheel Drive
M2	Motor, Left Brush
M3	Motor, Right Brush
M4	Motor, Vac
M5	Motor, Brush Actuator
R1	Potentiometer, 100K Ohm, Speed Limit
S3	Switch, Key
S4	Switch, Float **(Recovery Tank Full)**
S5	Switch, Reverse
S6	Switch, Palm Assy
S7	Switch, Palm Assy
X9	Battery Disconnect
X10	Battery Disconnect

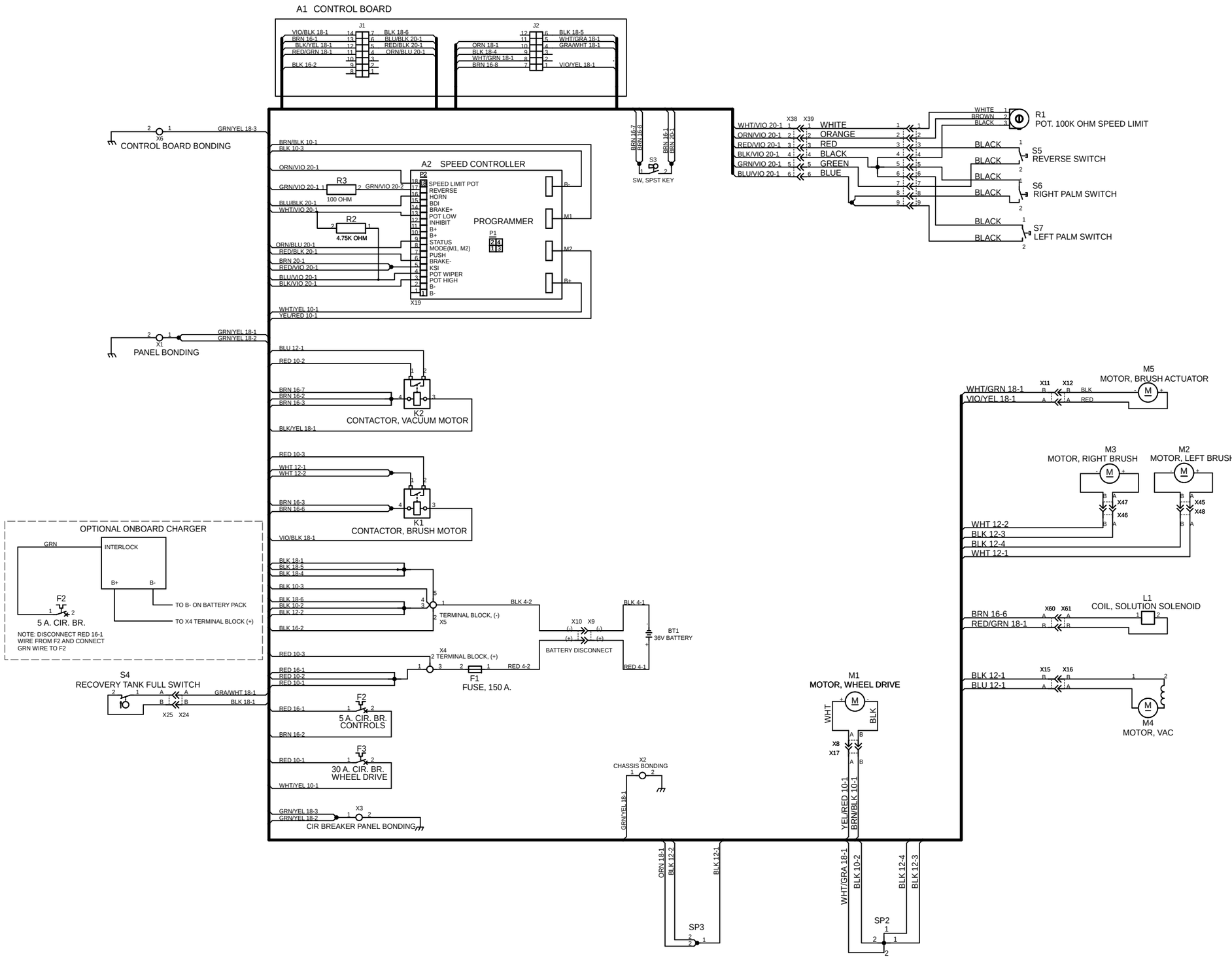


ELECTRICAL SYSTEM

WIRING DIAGRAM / SCHEMATIC

Item	Description
A1	Control Panel Assy
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
M1	Motor, Wheel Drive
M2	Motor, Left Brush
M3	Motor, Right Brush
M4	Motor, Vac
M5	Motor, Brush Actuator
R1	Potentiometer, 100K Ohm, Speed Limit
S3	Switch, Key
S4	Switch, Float **(Recovery Tank Full)**
S5	Switch, Reverse
S6	Switch, Palm Assy
S7	Switch, Palm Assy
X9	Battery Disconnect
X10	Battery Disconnect

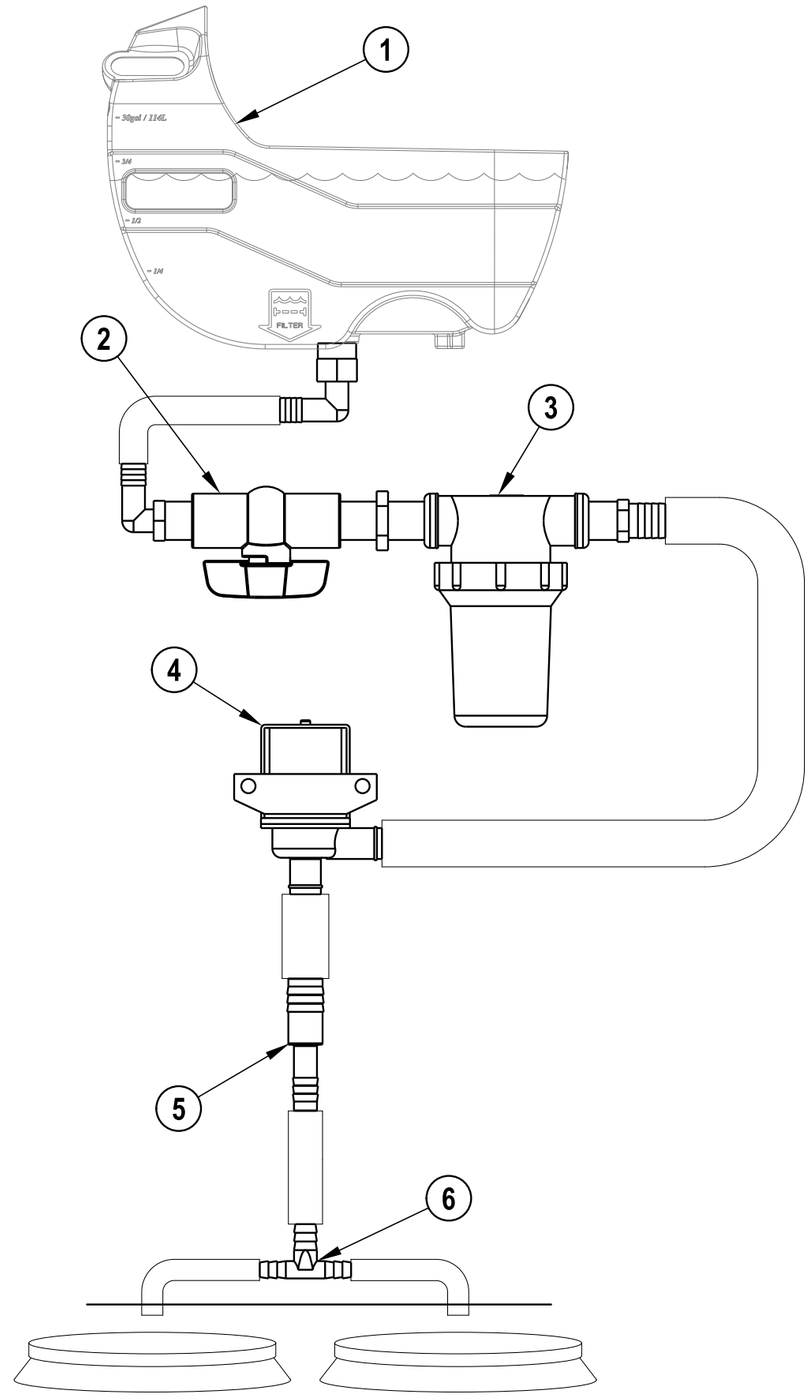



A1 CONTROL BOARD
J1
J2
A2 SPEED CONTROLLER
PROGRAMMER
P1
P2
X19
R1
POT. 100K OHM SPEED LIMIT
S5
REVERSE SWITCH
S6
RIGHT PALM SWITCH
S7
LEFT PALM SWITCH
S3
SW, SPST KEY
X38
X39
CONTROL BOARD BONDING
PANEL BONDING
X1
X6
R2
4.75K OHM
R3
100 OHM
K2
CONTACTOR, VACUUM MOTOR
K1
CONTACTOR, BRUSH MOTOR
TERMINAL BLOCK, (-)
X5
TERMINAL BLOCK, (+)
X4
BATTERY DISCONNECT
X10
X9
BT1
36V BATTERY
F1
FUSE, 150 A.
F2
5 A. CIR. BR.
CONTROLS
F3
30 A. CIR. BR.
WHEEL DRIVE
X2
CHASSIS BONDING
X3
CIR BREAKER PANEL BONDING
OPTIONAL ONBOARD CHARGER
INTERLOCK
TO B- ON BATTERY PACK
TO X4 TERMINAL BLOCK (+)
NOTE: DISCONNECT RED 16-1 WIRE FROM F2 AND CONNECT GRN WIRE TO F2
S4
RECOVERY TANK FULL SWITCH
X25
X24
M1
MOTOR, WHEEL DRIVE
M5
MOTOR, BRUSH ACTUATOR
M3
MOTOR, RIGHT BRUSH
M2
MOTOR, LEFT BRUSH
M4
MOTOR, VAC
L1
COIL, SOLUTION SOLENOID
SP3
SP2
X11
X12
X47
X46
X45
X48
X60
X61
X15
X16
X8
X17

APPENDIX

SCRUB SYSTEM PLUMBING SCHEMATIC

Item	Description
1	Solution Tank
2	Shut Off Valve
3	Inline Solution Filter
4	Solution Solenoid Valve
5	Reducer Coupler
6	Tee



Scrub Deck

APPENDIX
SWITCH SEQUENCES FOR MAIN CONTROLLER PROGRAMMING OPTIONS

Note:
- Refer to the *Know Your Machine/Control Panel* section in this manual for switch locations.
- Refer to the *Electrical System/Main Control Programming Options* section in this manual for complete instructions on how to access and use the main controller programming options.

Programming Option	Switches Pressed to Access Option
Enter Service Test Mode	Vacuum Switch **(D)**
Low-voltage Cut-out Threshold	Scrub OFF Switch **(E)**
Enable/Disable Fault Detection	• Scrub OFF Switch **(E)** • Solution Switch **(B)**
Recall/Clear Stored Error Codes	Solution Switch **(B)**
Display Control Unit Software Revision Level	• Vacuum Switch **(D)** • Solution Switch **(B)**
Scrub Deck Down Time	• Scrub OFF Switch **(E)** • Vacuum Switch **(D)**
Regular Scrub Setting	• Scrub OFF Switch **(E)** • Scrub ON Switch **(F)**
Heavy Scrub Setting	• Scrub ON Switch **(F)** • Vacuum Switch **(D)**
Extreme Scrub Setting	• Scrub ON Switch **(F)** • Solution Switch **(B)**
Restore Factory Default Scrub Settings	Scrub ON Switch **(F)**

APPENDIX
MAIN CONTROLLER I/O TABLES

Ladder Diagram 56315927
B- = Battery - B+ = Battery +

Designation	Pin ID	Wire ID/Color	Description	Signal Characteristic	Nominal Value	Reference To:	Range	Comments
Input	J1-4	ORN/BLU	Speed Control Status	VDC	-36V	B+	37.6 - 30.6V	Pulsed Signal equal to the Fault Code flashed by the Speed Control Built-in Status LED
Input	J1-5	RED/BLK	Forward/Reverse	VDC	-36V	B+	37.6 - 30.6V	Machine is not in Neutral (a palm drive switch is pressed)
Input	J1-6	BLU/BLK	Direction	VDC	-36V	B+	37.6 - 30.6V	Machine is traveling in Reverse
Ground	J1-7	BLK	Power Supply	VDC	-36V	B+	37.6 - 30.6V	
Ground	J1-9	BLK	Power Supply	VDC	-36V	B+	37.6 - 30.6V	
Output	J1-11	RED/GRN	Solution Solenoid Note: Coil resistance spec - 72Ω ±20%	Pulsed Voltage		B+	37.6 - 30.6V	Solenoid voltage is pulsed between 36V and 0V at a rate of about one on/off cycle every five seconds.
Output	J1-12	BLK/YEL	Vacuum Contactor Note: Coil resistance spec - 102Ω ±20%	PWM Voltage		B- (Gnd)	+/- .7V depending on battery voltage	5000 Hz freq, 80% duty cycle Vacuum Motor is Active (~6.9V), 0% duty cycle Vacuum Motor is off (~36V)
Power	J1-13	BRN	Power Supply	VDC	+36V	B- (Gnd)	37.6 - 30.6V	Key is switched On
Output	J1-14	VIO/BLK	Brush Contactor Note: Coil resistance spec - 98.5Ω ±20%	PWM Voltage	+7.2V	B- (Gnd)	+/- .7V depending on battery voltage	5000 Hz freq, 80% duty cycle Brush Motor is Active (~6.9V), 0% duty cycle Brush Motor is off (~36V)
Output	J2-1	VIO/YEL	Actuator	VDC	36V	J2-8	37.6 - 30.6V	+36V while lowering, -36 while raising
Input	J2-4	GRA/WHT	Recovery Tank Float Switch	VDC	-36V	B+	37.6 - 30.6V	Recovery Tank is not Full
					-31V	B+	31.6 - 25.6V	Recovery Tank is Full
Input	J2-5	WHT/GRA	Brush Current Sense	Analog Voltage		B- (Gnd)	0.20 - 0.05V	Brush Motors are Active
Ground	J2-6	BLK	Power Supply	VDC	-36V	B+	37.6 - 30.6V	
Power	J2-7	BRN	Power Supply	VDC	+36V	B- (Gnd)	37.6 - 30.6V	
Output	J2-8	WHT/GRN	Actuator	VDC	36V	J2-1	37.6 - 30.6V	-36V while lowering, +36 while raising
Ground	J2-9	BLK	Power Supply	VDC	-36V	B+	37.6 - 30.6V	
Input	J2-10	ORN	Vacuum Current Sense	Analog Voltage	+0.12V	B- (Gnd)	0.13 - 0.11V	Vacuum Motor is Active

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