Advenger and ST Quick Start Service Manual

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INTRODUCTION

Quick Start Service Manual Purpose

This manual is a technical resource that Nilfisk-Advance expects to be utilized while an Advenger or ST is being serviced. It contains information deemed necessary to provide basic troubleshooting, maintenance, and repairs within a timeframe of 2-3 hours maximum. If your repair involves multiple visits to repair the same problem or the repair cannot be completed within 3 hours, a call to Nilfisk-Advance Technical Support is needed, whether to alert the factory to potential issues or to provide the customer with an acceptable level of service. Refer to the website www.advance-us.com for additional information not contained here-in, as well as updates or expanded instructions to procedures noted here.

Note: Bold numbers in parentheses in the text indicate an illustrated item.

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

General Machine Description

The Advenger and ST machines are commercial automatic floor scrubbers available with multiple deck sizes, multiple corresponding squeegee blade sizes and materials, and variable scrub pressure and solution flow rates. Advengers equipped with AXP™ detergent systems default into the EverGreen™ cleaning mode (1:400 detergent ratio), a patented new Green cleaning technology designed to reduce chemical use, environmental impact, and the cost of cleaning.

Parts and Service

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

Nameplate

The Model Number and Serial Number of the machine are shown on the Nameplate located on the chassis under the left rear corner as shown.

This information is required when ordering repair parts for the machine or contacting Nilfisk-Advance Technical Support.

Caution and Warning Symbols

Nilfisk-Advance uses the symbols below to signal potentially dangerous conditions. Always 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.

General Safety Instructions

The following specific Cautions and Warnings are included to warn you of the potential danger of machine damage or bodily harm.

⚠ WARNING!

- This machine must be serviced only by properly trained and authorized persons.
- **Turn the key switch Off and disconnect the red Anderson battery connector inside the battery compartment before servicing electrical components.**
- Keep sparks, flame and smoking materials away from batteries. Explosive gases are vented during normal operation.
- Charging batteries produces highly explosive hydrogen gas. Charge batteries in well-ventilated areas only, away from open flame. Do not smoke while charging batteries.
- Remove all jewelry when working near electrical components.
- Never work under a machine without safety blocks or stands to support the machine. Refer to "Jacking Points".
- 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.

⚠ CAUTION!

- Before performing any service function, carefully read all instructions pertaining to that function.
- Do not leave machine unattended without first turning the key switch off (O) and removing the key.
- Turn the key switch Off 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.
- Before scrapping machine, remove batteries and dispose of them in accordance with local environmental regulations.
- **Save these Instructions**

Related Reference Sources

Nilfisk-Advance provides Operator Manuals, Sales literature, Parts Lists, Technical Service Bulletins, and Instruction Sheets on our website www.advance-us.com for 24/7 availability of information to order parts, operate, troubleshoot, or repair all current production and most pruned machine models.

For the Advenger and ST, please refer to the following documents for additional information:

- Parts List - Form Number 56042495
- Operation Manuals - Form Number 56041735 (English)
  56041xxx (Language)
  56041xxx (Language)

- Curtis Programmer Manual 56043101
- **TSB US2008-984** Batteries and Chargers
- **TSB US2008-979** QuiQ Delta-Q Battery Charger Reprogramming Kit 56315732 Instructions

Diagnostic and Service Tools

In addition to a full set of metric and standard tools, the following items are required in order to successfully and quickly perform troubleshooting and repair of Nilfisk-Advance commercial floor cleaning equipment.

- Laptop computer loaded with current version of EZParts, Adobe Reader, and (preferably cellular) internet access
- Digital voltmeter (DVM) with DC current clamp
- Hydrometer
- Battery load tester for checking 6V batteries
- Bearing puller
- Static control wrist strap
- Set of torque wrenches
- Hard (printed) copies of service manuals for all regularly serviced machines (available at www.advance-us.com and other Nilfisk-Advance websites)
- 6” section of 1 1/2” PVC pipe with a 1” hole drilled into one side to check vacuum system against 1” lift spec
- 1 1/2” and 2 3/8” drill bit or hole cutter if a Dual Vac Kit is to be installed
- Also these tools available from Nilfisk-Advance, Inc.:

56407502	Actuator Power Cord Adapter
56205281	Water Lift Gauge
56206921	Timer Bypass Kit (used to bypass timing function when troubleshooting shelf chargers)
56409441	Curtis Handheld Programmer
56409823	Curtis Adapter Cable (Quad Plug)
56315732	Delta-Q QuiQ Onboard Charger Interface Module
56422174	Tire Puller Kit for Drive Wheel Assembly

Technical Specifications

GENERAL

Machine Voltage	24 VDC	
Dimensions (without Squeegee and Scrub Deck)	Length (W/squeegee): 60 in (152.4 cm)	
	Width (body): 27.5 in (70 cm)	
	Height (Recovery tank): 51.7 in (131.3cm)	
Scrub Deck and Squeegee Widths	Scrub Deck Width:	Squeegee Width:
	30.3 in (77 cm) 28 disc	32.6 in (82.8 cm)
	36.3 in (92.2 cm) 34 disc	41.4 in (105.2 cm)
	31.6 in (80.3 cm) 28 cyl	32.6 in (82.8 cm)
Tank Capacities	Solution Tank: 28 gal (106 l)	
	Recovery Tank: dynamic: 25 gal (95 l); static: 28 gal (106 l)	
Gross Weight (standard machine w/o options; w/full solution tank, empty recovery tank and heaviest batteries installed)		1451 lbs (658 kg)
Net Weight (standard machine w/o options, batteries or removable brushes; w/ empty solution and recovery tanks)		536 lbs (244 kg)
Static Wheel Loading	Front: 615 lbs (279 kg)	Rear: 836 lbs (379 kg)
Static Wheel Pressure	Front: 174.7 psi (12.3 kg/cm^2)	Rear: 124.7 psi (8.8 kg/cm^2)
Ingress Protection Code	IPX3	
Sound Pressure Level (IEC 60704-1)	63.7 dB(A)	
Vibrations at the Hand Controls (ISO 5349-1)		.26 m/s^2
Vibrations at the Seat (EN 1032)		.05 m/s^2
Gradeability	Transport: 16 % 9 degrees	
	Cleaning: 9 % 5 degrees	

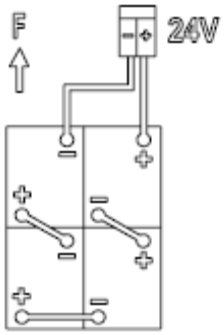
BATTERY COMPARTMENT DIMENSIONS

Maximum Battery Compartment

25" L X 15.5" W X 21" H

Without the Box:

26.25" X 16" X 21"



ELECTRICAL SPECIFICATIONS

Batteries	Number of Batteries 4 Battery Voltage 6V 305 Ah wet
	Number of Batteries 4 Battery Voltage 6V 395 Ah wet
	Number of Batteries 4 Battery Voltage 6V 315 Ah AGM
	Standard Battery Capacity: 305 amp-hours @ 20-hour rate
Onboard Battery Charger	24-volt Manufacturer: Delta Q Model: 912-2400-N1 Output 25A Gel Compatible: Yes

DRIVE SYSTEM

Drive Wheel	Diameter: 9.84 in (25 cm) Width: 3.15 in (80 cm)
	Type/Material: Blue Urethane
Drive Motor	1.05 HP (780 watts)
Max. Transport Speed	Fwd: 3.91 mph (6.30 km/h)
	Rev: 2.61 mph (4.20 km/h)

SOLUTION SYSTEM

Solution Control		Pulse-control Solenoid Valve
Advenger Solution Flow Rates	(1) Regular Scrub	.38 gal/min (1.44 L/min) or 70 minutes per solution tank
	(2) Heavy Scrub	.62 gal/min (2.35 L/min) or 40 minutes per solution tank
	(3) Extreme Scrub	.92 gal/min (3.48 L/min) or 23 minutes per solution tank
ST Solution Flow Rates (Average)	(1) Regular Scrub	.30 gal/min (1.13 L/min) or 60 minutes per solution tank
	(2) Heavy Scrub	.48 gal/min (1.82 L/min) or 45 minutes per solution tank
	(3) Extreme Scrub	.88 gal/min (3.33 L/min) or 30 minutes per solution tank
AXP™ System Available		Advenger only
Detergent Ratios Available		400:1 = .25% 200:1 = .5% 100:1 = 1% 32:1 = 3% 300:1 = .3% 150:1 = .66% 64:1 = 1.5% 256:1 = .4% 128:1 = .8% 50:1 = 2%
Recycle System Available		No

RECOVERY SYSTEM

Vacuum Motor(s)		.75 HP (560-watt) 3-stage
Vacuum Water Lift (measured at recovery hose)	One Motor	Sealed: 63.0 in of Water (15.7 kPa) 1" Open-hole Aperture: 10.3 in of Water (2.6 kPa)
	Two Motors	Sealed: 65.0 in of Water (16.2 kPa) 1" Open-hole Aperture: 18.5 in of Water (4.6 kPa)

SCRUB SYSTEM

Scrub Deck Types	Disc and Cylindrical
Scrub Brush/Pad Sizes and Types	Disc: (2) 14 in (35.6 cm) Scrub Path: 28 in (71.1 cm)
	Disc: (2) 17 in (43.2 cm) Scrub Path: 34 in (86.4 cm)
	Cylindrical: (2) 27 in (68.6 cm) Scrub Path: 28 in (71.1 cm)
Scrub Motors - Disc	Number of Motors 2 Right-hand/Single Motor: .64 HP 480 watts Left-hand Motor: .64 HP 480 watts
Scrub Head Speeds - Disc	Right-hand/Single Motor: 215-260 RPM Left-hand Motor: 215-260 RPM
Scrub Motors – Cylindrical	Right-hand Motor: .5 HP 373 watts Left-hand Motor: .5 HP 373 watts
Scrub Head Speeds – Cylindrical	Right-hand Motor: 900 RPM Left-hand Motor: 900 RPM
Scrub Force 28" ST	(1) Regular Scrub: 75-85 lbs (32.7-37.0 kg)
	(2) Extreme Scrub (factory setting): 170-180 lbs (77.1-81.6 kg)
Scrub Force 34" ST	(1) Regular Scrub: 95-105 lbs (41.4-45.7 kg)
	(2) Extreme Scrub (factory setting): 195-205 lbs (88.5-93.0kg)
Scrub Force Advenger - Disc	(1) Regular Scrub: 70-90 lbs (31.8-39.2kg)
	(2) Heavy Scrub: 120-150 lbs (52.3-65.3kg)
	(3) Extreme Scrub: 180-220 lbs (78.4-95.8 kg)
Scrub Force Advenger - Cylindrical	(1) Regular Scrub: 45-60 lbs (20.4-27.2 kg)
	(2) Heavy Scrub: 70-80 lbs (31.8–36.3 kg)
	(3) Extreme Scrub: 90-100 lbs (40.8-45.4 kg)

MINIMUM AISLE TURN AROUND RADIUS (TURNING LEFT)

28" deck Advenger and ST	63 inches (1.63 m)
34" deck Advenger and ST	67.5 inches (1.71 m)
Cylindrical Advenger	63 inches (1.63 m)

MINIMUM DOOR PASS-THRU WIDTH (SIDE SKIRTS ON, SQUEEGEE OFF)

28" deck Advenger and ST	31 inches (.79 m)
34" deck Advenger and ST	36.5 inches (.93 m)
Cylindrical Advenger	32 inches (.81 m)

Transporting The Machine

⚠ CAUTION!

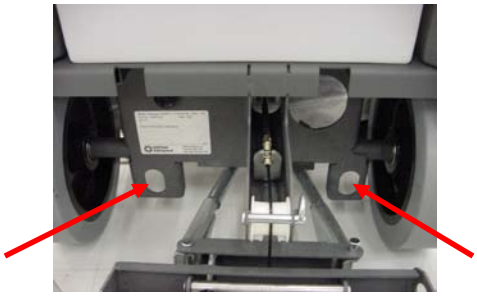
Before transporting the machine on an open truck or trailer:

1. Remove the Squeegee Assembly (**11**) and secure.
2. Tie the machine down securely per the instructions in "Tie-Down Points".
3. Tape and strap all access doors and covers as necessary.
4. **In temperatures below freezing, remove all water from the machine and flush with windshield washer fluid to prevent damage to valves and fittings**.
5. Do not drive machine onto a ramp grade exceeding 16% (9 degrees) or damage to the machine may occur.

Tie-Down Points

Front

Rear



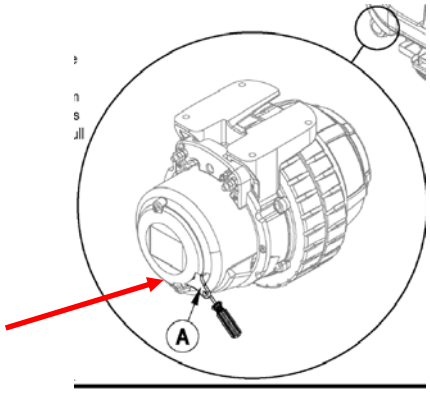
Towing the Machine

⚠ CAUTION!

The Drive Wheel **(4)** has a built in electromagnetic brake that is engaged whenever the Key Switch is Off or the Drive Pedal **(3)** is in the Neutral position, i.e. there is no power to the Speed Control. This brake can be manually over ridden if necessary by inserting a medium to large screwdriver behind the Yoke **(A)** as shown. (A rubber door stop can also be used). This should only be done in the event you need to push or pull the machine.

Tow the machine for short distances only.

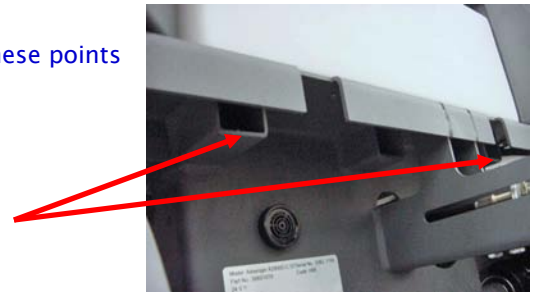
Insert screwdriver here



Jacking Points

Front - When facing the front of the machine and underneath looking up, place the jack to the left of the chain on the frame member as shown.

Rear – remove Squeegee Assembly (**11**) to access here. Use a bottle jack at these points as shown.



Emergency Stop Knob

⚠ WARNING!

The Emergency Stop Knob (**7**) disconnects power from the Speed Control and Drive Wheel.

It does not disconnect the batteries, but will continue to power the control board . Do not use the Emergency Stop Knob as a substitute for disconnecting the red Anderson battery connector inside the battery compartment.

KNOW YOUR MACHINE

As you read this manual, you will occasionally run across a bold number in parentheses – example: (2). A bold number refers to an item shown on the Know Your Machine pages unless otherwise noted (bold letters refer to items on the same page). Refer back to the Know Your Machine pages whenever necessary to pinpoint the location of an item mentioned in the text.

Basic Machine Operation (refer to Operator Manuals such as 56041735 (English) for detailed information regarding how to operate the machine):

1. Turn on the key to turn on the graphical display showing battery condition, hour meter, solution tank level and AXP dilution ratio if so equipped.

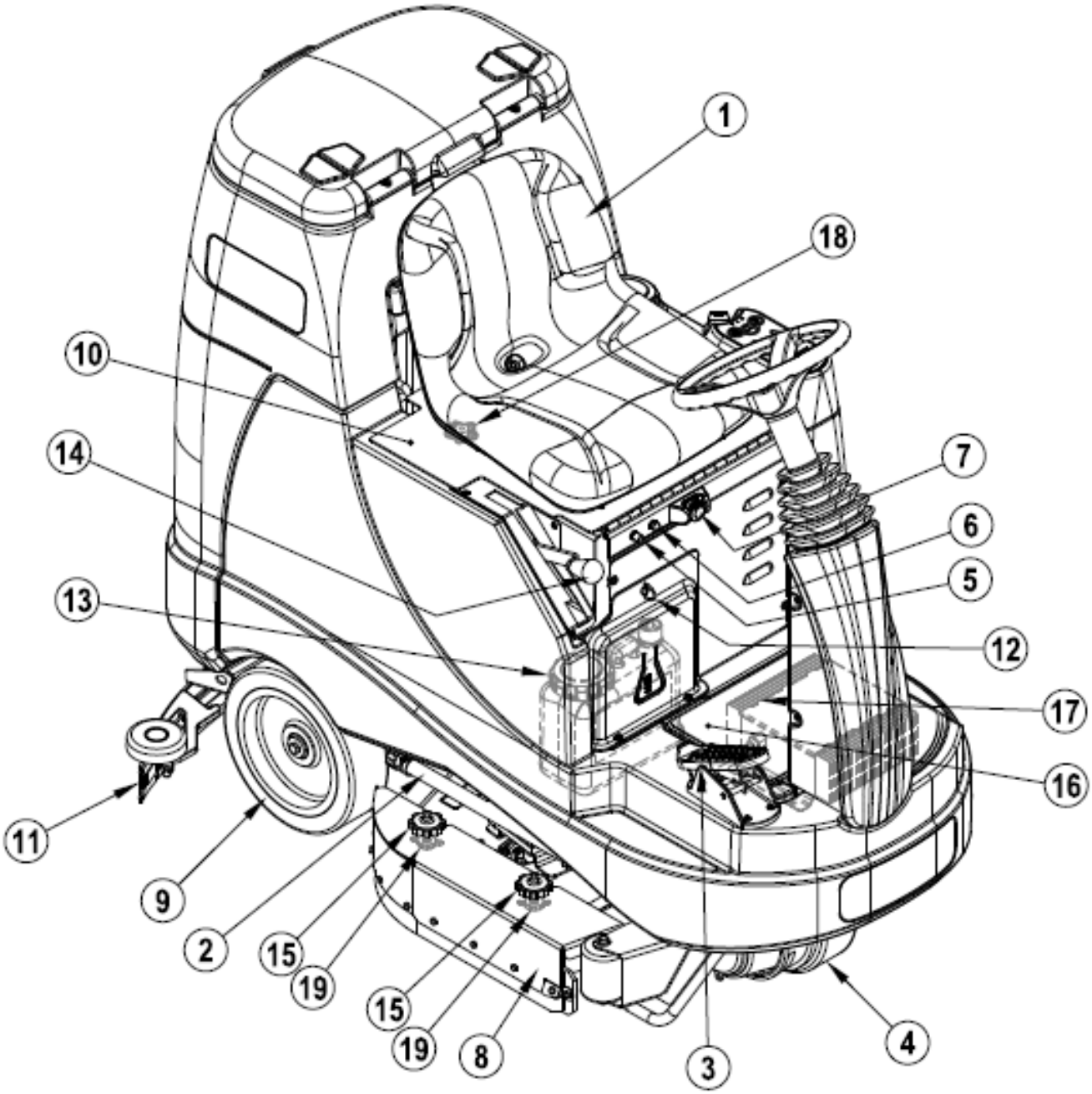
   ADVENGER: Pressing the red SCRUB ON / OFF button once will enable regular scrub mode. The deck and rear squeegee will be lowered to the floor.

   ST: Manually lower the scrub deck and squeegee using levers (14) and (22).

2. Depress the foot pedal forward to begin scrubbing. The brushes, water and vacuum will turn on.
3. When the machine stops the brushes and water will stop. The vacuum will continue to run for 10 seconds and then stop.
4. At any time the scrub mode can be changed to regular, heavy or extreme scrub by using the SCRUB + or SCRUB - button.
5. At any time the solution flow rate can be changed by using the SOLUTION + or SOLUTION - button.
6. If the scrub mode and solution flow rate are at different positions they can be reset or aligned using two methods.
   a. Use the SOLUTION + or SOLUTION - buttons to change the solution flow rate to match the scrub mode setting.
   b. Change the scrub mode using the SCRUB + or SCRUB - buttons. The scrub pressure and solution flow will automatically be aligned for optimized results.
7. To stop all scrubbing functions and transport the machine, (ADVENGER) press the red SCRUB ON / OFF button or [(ST) return the scrub deck and squeegee control levers to the up position]. The solution and brushes will stop, [(ADVENGER) the deck and squeegee will raise], and the vacuum will shut off after a 10 second delay.

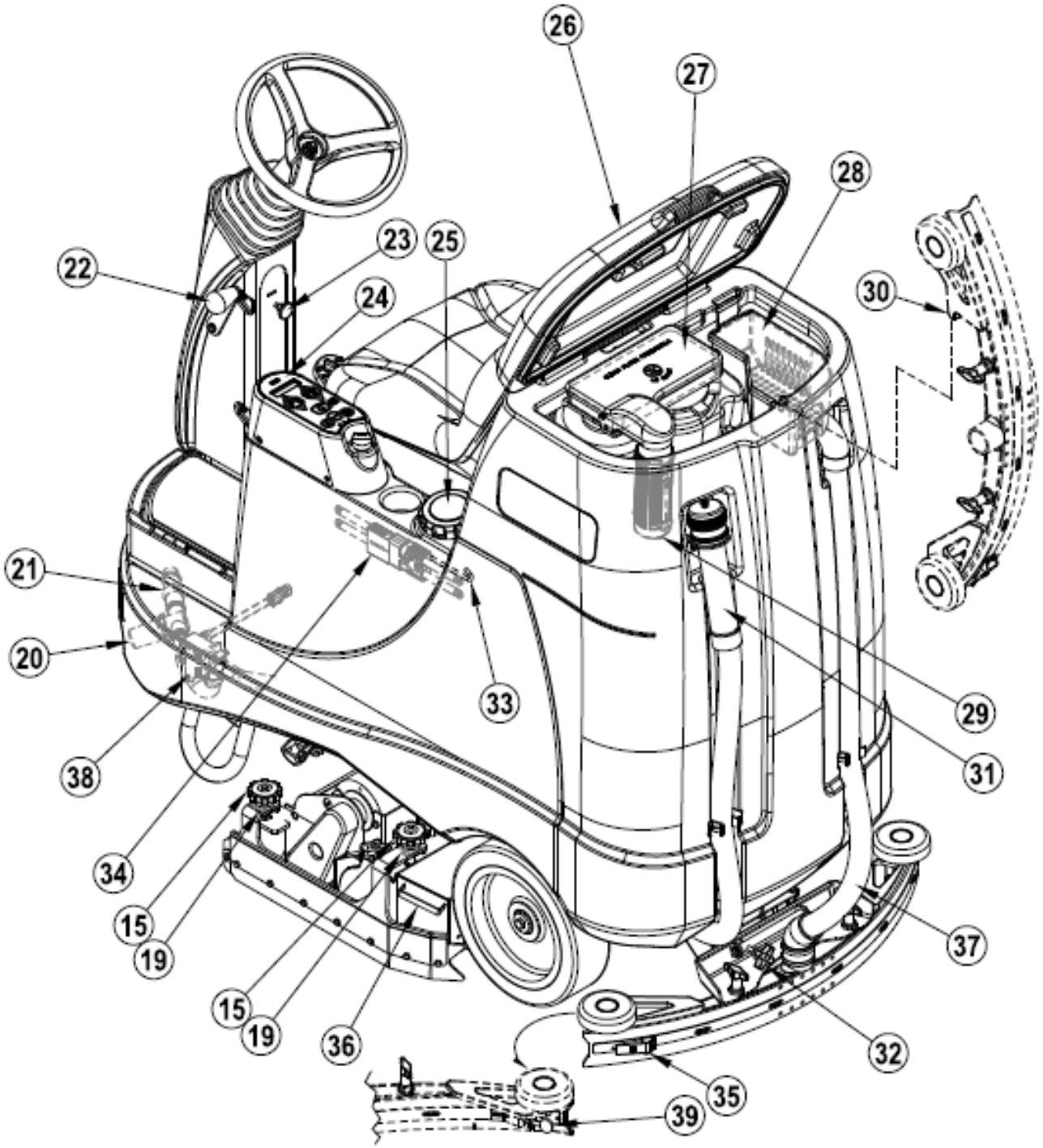
Machine Front RH View

1 Operator's Seat
2 Solution Tank Drain Hose
3 Drive Pedal, Directional/Speed
4 Drive Wheel
5 Drive Wheel Circuit Breaker (70 Amp)
6 Control Circuit Circuit Breaker (10 Amp)
7 Emergency Stop
8 Scrub Deck
9 Rear Wheel
10 Battery Compartment (under seat)
11 Squeegee Assembly
12 Detergent Cartridge Access Cover (AXP models only)
13 Detergent Cartridge (AXP models only)
14 Scrub Deck Raise/Lower Lever (ST models only)
15 Deck Skirt Removal Knobs
16 Battery Charger Access Door
17 Battery Charger (optional)
18 Seat Adjustment Knob (optional)
19 Deck Skirt Height Adjustment Knob



Machine Rear LH View

20 Solution Filter
21 Solution Shutoff Valve
22 Squeegee Raise/Lower Lever (ST models only)
23 Steering Wheel Tilt Adjust Knob
24 Control Panel
25 Solution Tank Fill Cover
26 Recovery Tank Cover
27 Vacuum Motor Filter Housing
28 Strainer Basket (optional)
29 Recovery Tank Shutoff Float
30 Squeegee Storage Hook
31 Recovery Tank Drain Hose
32 Squeegee Tilt Adjustment Knob
33 Seat Prop-Rod
34 Machine Battery Connector
35 Rear Squeegee Blade Removal Latch
36 Hopper (Cylindrical models only)
37 Recovery Hose
38 Solution Solenoid Valve
39 Front Squeegee Blade Removal Knob

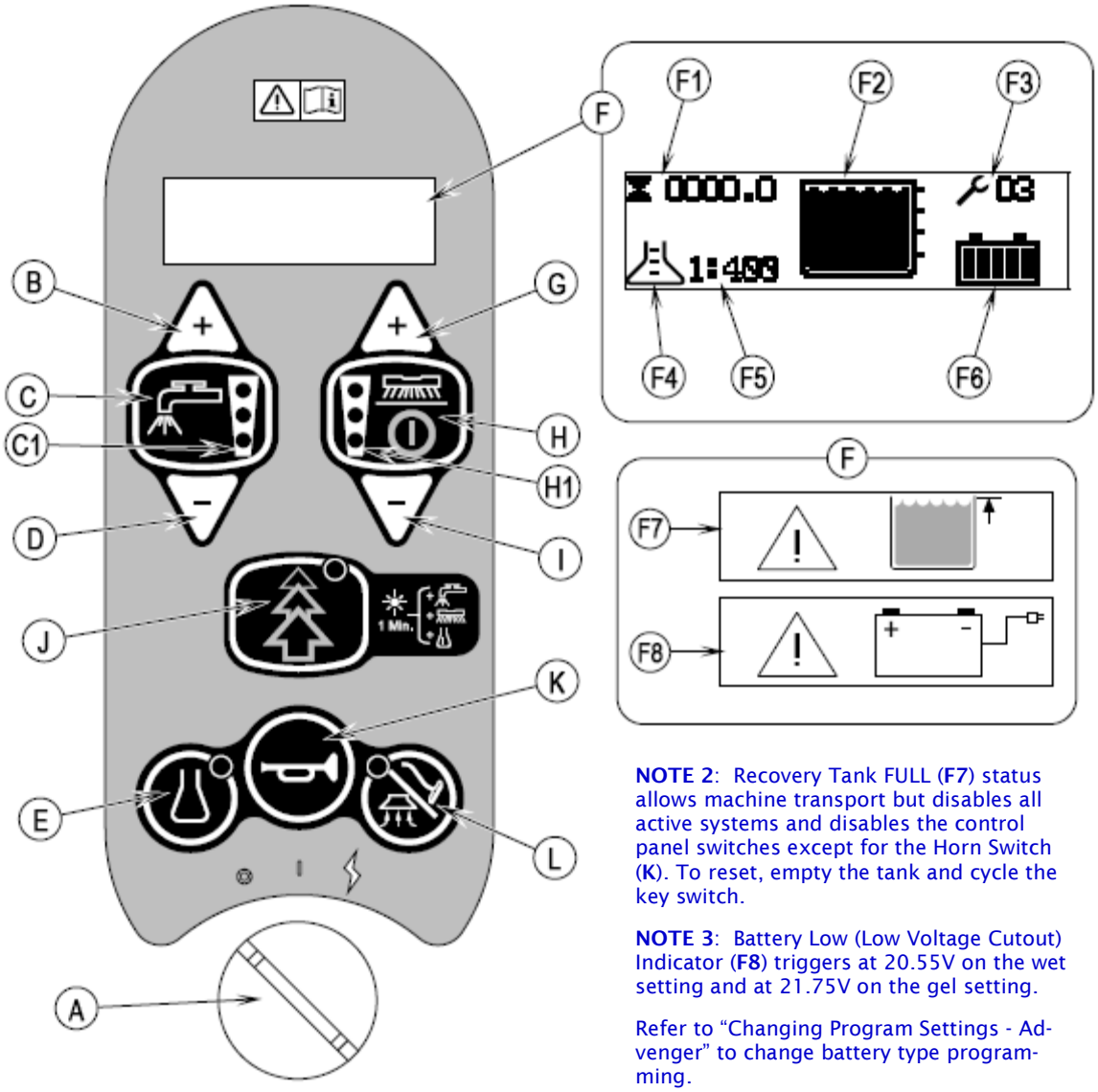


CONTROL PANEL (ADVENGER MODELS)

A Key Switch
B Solution Increase Switch
C Solution ON/OFF Switch
C1 Solution Flow Indicators (Normal, Heavy & Extreme)
D Solution Decrease Switch
E AXP ON/OFF Switch
F Display
F1 Hour Meter
F2 Solution Tank Level Indicator
F3 Fault Codes
F4 AXP Indicator
F5 Detergent Ratio Indicator
F6 Battery Indicator
F7 Recovery Tank FULL Indicator
F8 Battery Low Indicator

G Scrub Pressure Increase Switch
H Scrub ON/OFF Switch
H1 Scrub Pressure Indicators (Normal, Heavy and Extreme)
I Scrub Pressure Decrease Switch
J EverGreen Switch
K Horn Switch
L Vacuum/Wand Switch

NOTE 1: The display will go into Sleep Mode to save power if the machine is turned on, in Neutral pedal, and idle for more than 10 minutes. Closing the seat switch, moving the drive pedal, or pressing a control panel button will refresh the LCD display and LEDs.



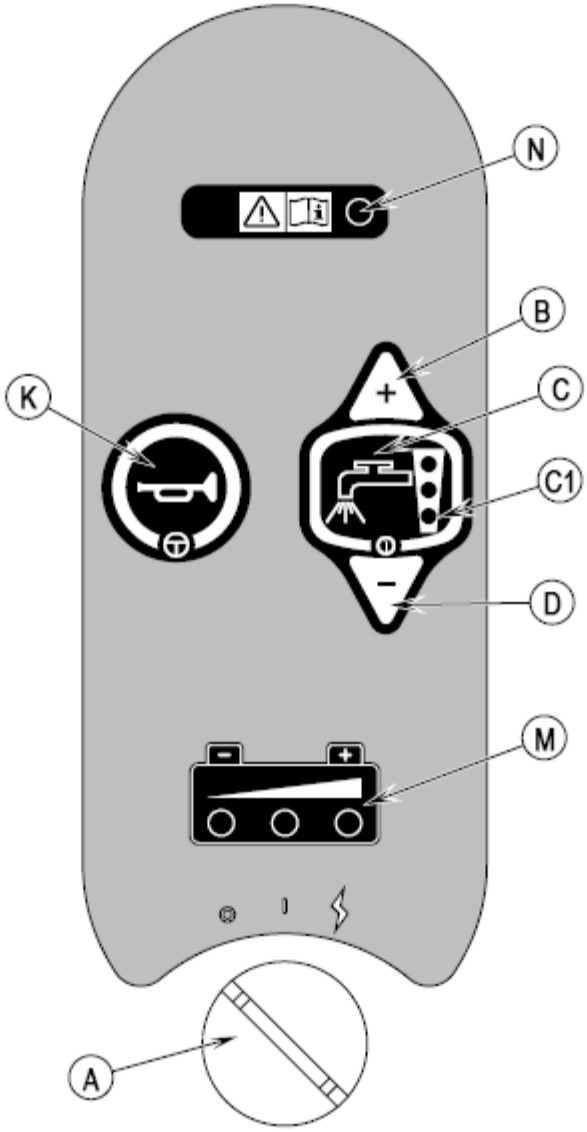
NOTE 2: Recovery Tank FULL (**F7**) status allows machine transport but disables all active systems and disables the control panel switches except for the Horn Switch (**K**). To reset, empty the tank and cycle the key switch.

NOTE 3: Battery Low (Low Voltage Cutout) Indicator (**F8**) triggers at 20.55V on the wet setting and at 21.75V on the gel setting.

Refer to "Changing Program Settings - Advenger" to change battery type programming.

CONTROL PANEL (ST MODELS)

A Key Switch
B Solution Increase Switch
C Solution ON/OFF Switch
C1 Solution Flow Indicators (Normal, Heavy & Extreme)
D Solution Decrease Switch
K Horn
M Battery Indicator
N Fault Indicator



NOTE 1: Recovery Tank FULL status is indicated by the Solution Flow Indicator LED (**C1**) turning Off. This status allows machine transport but disables all active systems and disables the control panel switches except for the Horn Switch (**K**). To reset, empty the tank and cycle the key switch.

NOTE 2: Battery Low (Low Voltage Cutout) status is indicated by the red battery LED (**M**) flashing. It triggers at 20.55V on the wet setting and 21.75V on the gel setting. Refer to "Changing Program Settings - ST" to change battery type programming.

Main Controller Error Codes – Advenger and ST

Advenger Display Error Code	ST Service LED Blink Code *	Fault Description	System Affected	Refer to page:
3	1,1	Speed control fault	Wheel Drive	
4	NA	Scrub deck lift actuator overload	Scrub	
5	1, 2	Brush motor overload	Scrub	
6	NA	Squeegee lift actuator overload	Squeegee	
7	1, 3	Vacuum motor overload	Recovery	
8	1, 4	Solution solenoid overload	Solution	
9	2, 1	Vacuum contactor coil overload	Recovery	
10	2, 2	Brush motor contactor coil overload	Scrub	
11	NA	Chemical pump overload	AXP	
30	2, 3*	Solution solenoid open	Solution	
31	2, 4	Brush motor circuit open	Scrub	
32	NA	Scrub deck lift actuator open	Scrub	
33	3, 1	Vacuum motor circuit open	Recovery	
34	NA	Squeegee lift actuator open	Squeegee	
35	3, 2	Brush motor contactor coil open	Scrub	
36	3, 3	Vacuum motor contactor coil open	Recovery	
37	NA	Chemical pump open	AXP	
60	3, 4	Brush motor circuit contacts stuck closed	Scrub	
61	4, 1	Vacuum motor circuit contacts stuck closed	Recovery	
62	4, 2	Solution solenoid control fault	Probable board failure	
63	4, 3	Brush contactor coil control fault	Probable board failure	
64	4, 4	Vacuum contactor coil control fault	Probable board failure	

* ST open circuit errors are only visible in Fault Recall Mode, accessible via the Hidden Menu. Refer to “Changing Program Settings - ST” section. Then verify fault by entering Service Test Mode.

Speed Control Error Flash Codes

STATUS LED FAULT CODES (TABLE 1)			
LED CODE	STATUS LIGHT DISPLAY	EXPLANATION	POSSIBLE CAUSE
1,1	O O	over-/under-temperature cutback	1. Temperature >97°C (206°F) or < -25°C (-13°F). 2. Excessive load on vehicle. 3. Operation in extreme environments. 4. Electromagnetic, foot or parking brake not releasing properly.
1,2	O OO	throttle fault	1. Throttle input wire open or shorted. 2. Throttle pot defective. 3. Wrong throttle type selected.
1,3	O OOO	speed limit pot fault	1. Speed limit pot wire(s) broken or shorted. 2. Broken speed limit pot.
1,4	O OOOO	battery voltage too low	1. Battery voltage <17 volts. 2. Bad connection at battery or controller.
1,5	O OOOOO	battery voltage too high	1. Battery voltage >36 volts. 2. Vehicle operating with charger attached. 3. Intermittent battery connection.
2,1	OO O	main contactor driver Off fault	1. Main contactor driver failed open.
2,3	OO OOO	main contactor fault	1. Main contactor welded or stuck open. 2. Main contactor driver fault. 3. Brake coil resistance too high.
2,4	OO OOOO	main contactor driver On fault	1. Main contactor driver failed closed.
3,1	OOO O	HPD fault present for >10 sec.	1. Misadjusted throttle. 2. Broken throttle pot or throttle mechanism.
3,2	OOO OO	brake On fault	1. Electromagnetic brake driver shorted. 2. Electromagnetic brake coil open.
3,3	OOO OOO	precharge fault	1. Controller failure. 2. Low battery voltage.
3,4	OOO OOOO	brake Off fault	1. Electromagnetic brake driver open. 2. Electromagnetic brake coil shorted.
3,5	OOO OOOOO	HPD (High Pedal Disable) fault	1. Improper sequence of throttle and KSI*, push, or inhibit inputs. 2. Misadjusted throttle pot
4,1	OOOO O	current sense fault	1. Short in motor or in motor wiring. 2. Controller failure.
4,2	OOOO OO	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	OOOO OOO	EEPROM fault	1. EEPROM failure or fault.
4,4	OOOO OOOO	power section fault	1. EEPROM failure or fault. 2. Short in motor or in motor wiring. 3. Controller failure.

*NOTE: A KSI (key switch input) system problem is a specific HPD (high pedal disable) type operational fault, caused by the operator activating the Fwd/Rev drive pedal before turning on the main key switch or activating the throttle before sitting on the seat. This can be cleared by returning the operator's drive pedal to neutral and cycling the key switch OFF and ON.

Error Code System Diagnostics – Advenger and ST

The following table describes the systems that are disabled for each error code to assist you in understanding machine response to error code status.

		Disable System					Flash Indicator			
Display Code	Fault Description	Disable Chemical	Disable Solution	Disable Brush Motors	Disable Recovery	Brush Deck Lift Disable	Chemical Indicator	Solution Indicator	Brush Motor Indicator	Vacuum Indicator
3	Speed control fault	x	x	x						
4	Brush deck lift actuator overload					x				
5	Brush motor overload	x	x	x		X			x	
6	Squeegee lift actuator overload	x	x							
7	Vacuum motor overload	x	x		x					x
8	Solution solenoid overload	x	x					x		
9	Vacuum contactor coil overload	x	x		x					x
10	Brush contactor coil overload	x	x	x		X			x	
11	Chemical Pump overload	x					x			
30	Solution solenoid open	x	x					x		
31	Brush motor open	x	x	x					x	
32	Brush deck lift actuator open					x				
33	Vacuum motor open	x	x		x					x
34	Squeegee lift actuator open	x	x							
35	Brush contactor coil open	x	x	x					x	
36	Vacuum contactor coil open	x	x		x					x
37	Chemical pump open	x					x			
60	Brush motor circuit contacts stuck closed									
61	Vacuum motor circuit contacts stuck closed									
62	Solution solenoid coil control fault									
63	Brush contactor coil control fault									
64	Vacuum contactor coil control fault									

Understanding Control of Squeegee, Scrub, and Recovery Systems via Modes

Due to the unique One-Touch functions of the new Advenger and ST, multiple systems are engaged via one action defined by the Mode that is chosen - Scrub Mode, Vacuum Mode, or Wand Mode. The following tables outline the various components of the systems that are controlled in tandem by pressing a particular button or engaging the Drive Pedal in Forward, Neutral, or Reverse under normal machine operation. **To bypass these systems, refer to the "Service Test Mode" section.**

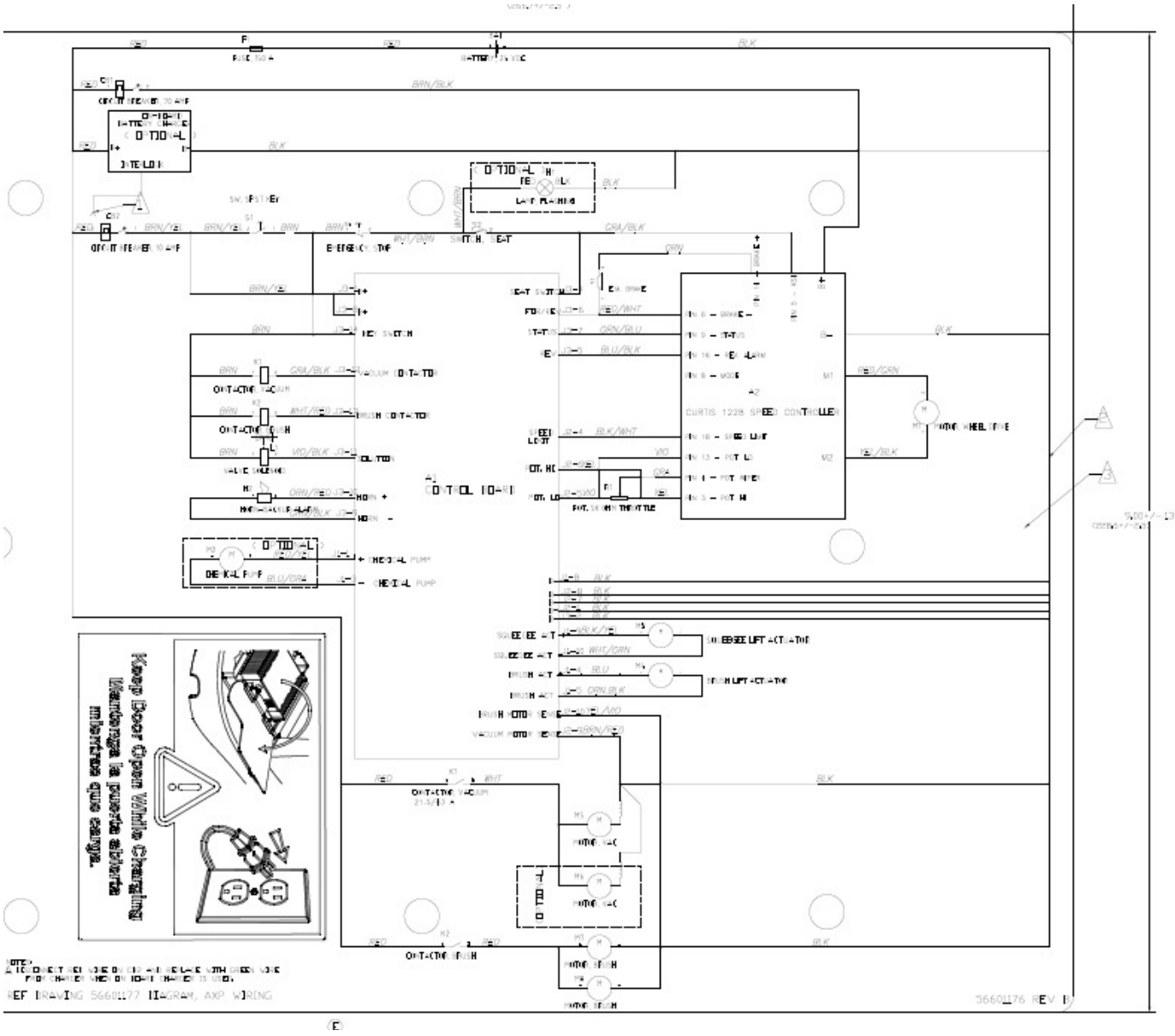
Advenger

Mode	Operator Position	Seat Switch Status	Action	Result
Scrub Mode	**Seated**	**Closed**	Press Scrub On	Squeegee lowers (24V to M3 for 4 seconds - adjustable.) Scrub deck lowers (24V to M4 for 3 sec., then pulsed signal)
			Press Foot Pedal Forward	Vacuum motor circuit On Scrub motor circuit On Solution Solenoid On Chemical Pump On if equipped
			Press Foot Pedal Reverse	Solution Solenoid Off Chemical Pump Off if equipped Squeegee raises (reverse 24V to M3 for 4 seconds) Pulsed voltage to M4 deck actuator maintaining down position Brush motor circuit On Vacuum motor circuit off after 10 seconds continuous in reverse
			Foot Pedal in Neutral	Brush motor circuit Off but Enabled Vacuum motor circuit Off after 10 sec. but Enabled Pulsed voltage to M4 deck actuator maintaining down position Squeegee in down position
			Press Scrub Off	Brush motor circuit Off Scrub deck raises (reverse 24V to M4 for 3 sec.) Squeegee raises after 10 sec. (reverse 24V to M3 for 4 seconds) Vacuum motor circuit On for 20 seconds total Solution Solenoid Off Chemical Pump Off if equipped
			Press Scrub Off Foot Pedal in Neutral >10 sec.	Brush motor circuit Off Scrub deck raises (reverse 24V to M4 for 3 sec.) Squeegee raises (reverse 24V to M3 for 4 seconds) Vacuum motor circuit Off Solution Solenoid Off Chemical Pump Off if equipped
Vac Mode	**Seated**	**Closed**	Press Vac/Wand On	Squeegee lowers (24V to M3 for 4 seconds)
			Press Foot Pedal Forward	Vacuum motor circuit On
			Press Foot Pedal Reverse	Squeegee raises until Foot Pedal in Neutral or Forward again (reverse 24V to M3 for 4 sec.) Vacuum motor circuit On for 10 seconds
			Press Vac/Wand Off	Squeegee raises after 10 sec (reverse 24V to M3 for 4 seconds) * Vacuum motor circuit On for 20 seconds total * * If drive pedal in Neutral >10 sec, squeegee will raise and vac motor circuit will be Off immediately with no delay.
			Press Vac/Wand Off Twice	Squeegee raises immediately (reverse 24V to M3 for 4 seconds) Vacuum motor circuit Off immediately
Wand Mode*	**Standing**	**Open**	Press Vac/Wand On	Squeegee lowers (24V to M3 for 4 seconds) Vacuum motor circuit On
* Recovery Tank Full is disabled in Wand Mode			Press Vac/Wand Off	Squeegee raises (reverse 24V to M3 for 4 sec.) Vacuum motor circuit Off

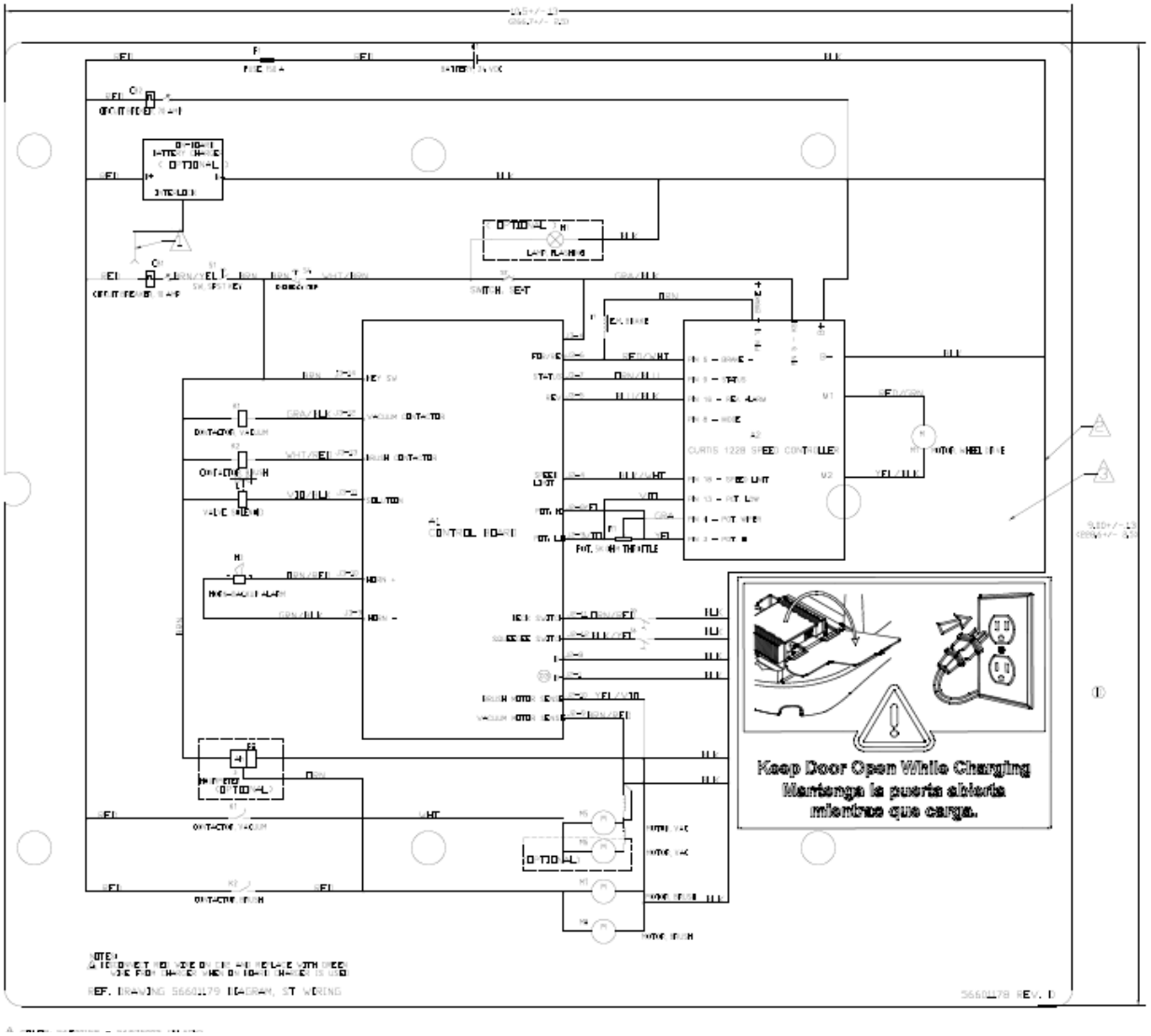
ST

Mode	Operator Position	Seat Switch Status	Action	Result
Scrub Mode	**Seated**	**Closed**	Lower Scrub Deck	Brush motor circuit enabled
			Lower Squeegee	Vacuum motor circuit enabled
			Press Foot Pedal Forward	Vacuum motor circuit On Brush motor circuit On Solution Solenoid On
			Press Foot Pedal Reverse (Lift Squeegee to prevent damage)	Solution Solenoid Off Brush motor circuit On Vacuum motor circuit On for 10 seconds
			Foot Pedal Neutral	Brush motor circuit Off but enabled Vacuum motor circuit On for 10 seconds, then enabled Solution Solenoid Off but enabled
			Lift Scrub Deck	Solution Solenoid Off Brush motor circuits Off
			Lift Squeegee	Vacuum motor circuit Off after 10 seconds
Vac Mode	**Seated**	**Closed**	Lower Squeegee	Vacuum motor circuit enabled
			Press Foot Pedal Forward	Vacuum motor circuit On
			Press Foot Pedal Reverse (Lift Squeegee to prevent damage)	Vacuum motor circuit Off after 10 seconds
			Foot Pedal Neutral	Vacuum motor circuit On for 10 seconds, then enabled
Wand Mode	**Standing**	**Open**	Lower Squeegee	Vacuum motor circuit On
			Raise Squeegee	Vacuum motor circuit Off after 10 seconds

Electrical Schematic – Advenger



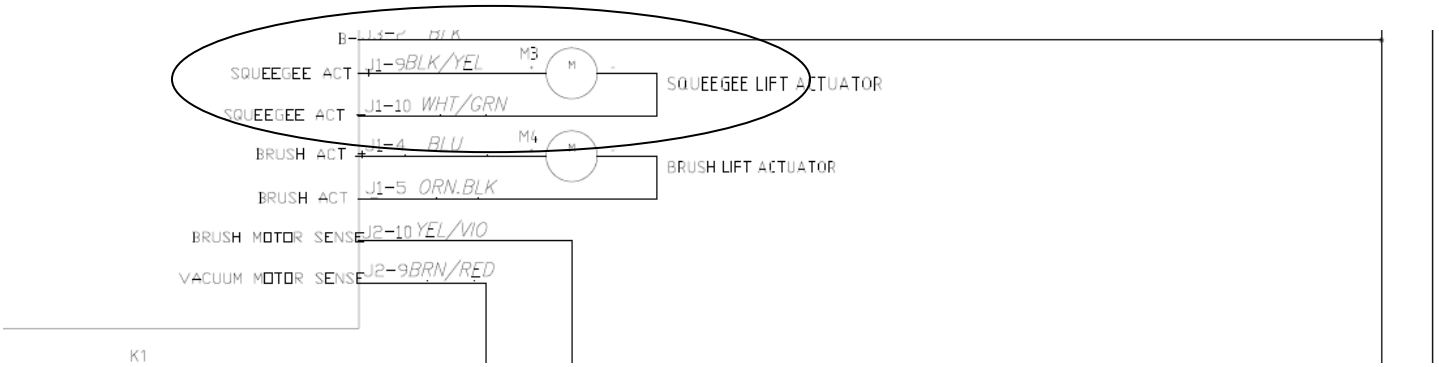
Electrical Schematic – ST



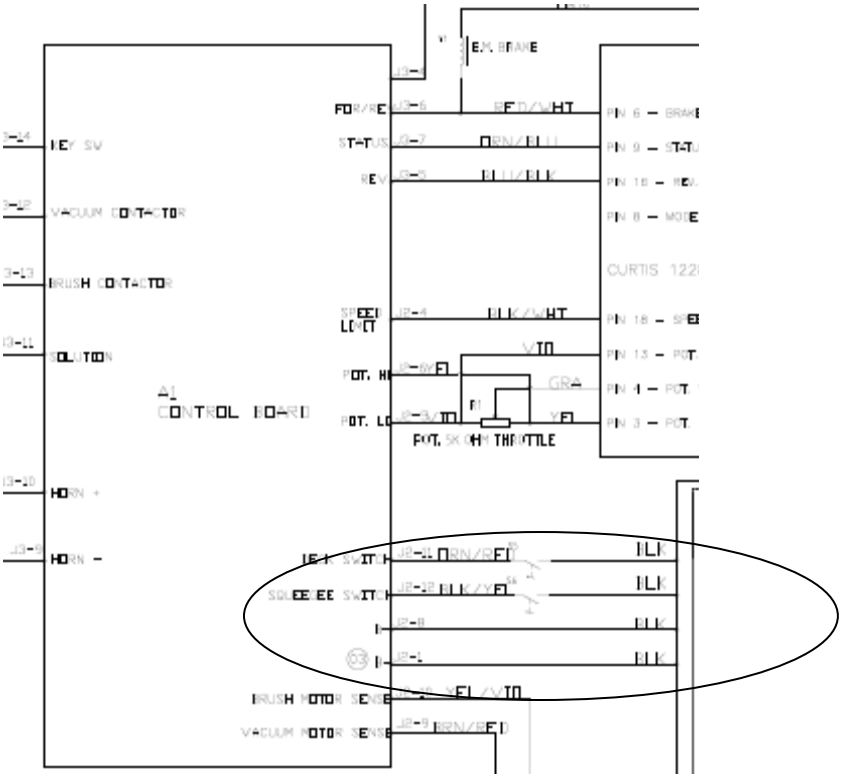
SQUEEGEE SYSTEM

Refer to the section “Understanding Control of Squeegee, Scrub, and Recovery Systems via Modes” for explanation of control due to functionality of multiple systems in tandem.

Advenger



ST



Squeegee Lift Actuator Circuit Error Codes and Measurements - Advenger

Advenger Display Error Code	ST Service LED Blink Code	Fault Description	Troubleshooting Action
6	NA	Squeegee lift actuator overload	1. Check for binding or frozen squeegee lift linkage and excessive weight on squeegee. 2. Check for short circuit in wiring or actuator motor. Repair or replace.
34	NA	Squeegee lift actuator open	1. Check for disconnected actuator wiring, open in wiring or defective actuator motor. Repair or replace. 2. Check controller output voltage at BLK/YEL wire.

Actuator	Nominal Current (A)	Overload Current	Wire Colors
M3	2.5 - 3.5	5A for > 4 seconds	BLK/YEL & WHT/GRN

Troubleshooting Squeegee Issues

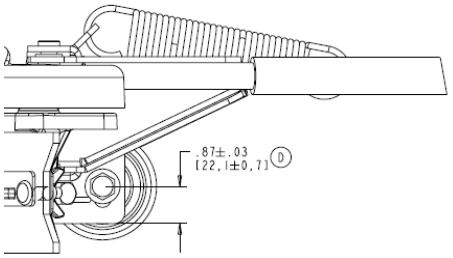
Problem	Possible Cause
Not enough adjustment of squeegee tool by turning adjustment knob	Squeegee Mount Weldment Bracket is bent. Replace
Squeegee is “hopping”	Wheel isn’t making contact with the floor - reposition wheel in slot on squeegee tool. Refer to “Squeegee Adjustments” section.
Squeegee tips are being driven into the floor	Adjust squeegee using Adjustment Knob turning CW to raise tips.
Advenger	
Lift motor runs in both directions but does not raise or lower the squeegee tool assembly	1. Threads in the moveable lift motor assembly drive tube are damaged (stripped). 2. Lift cable damaged (stretched or broken).
Lift motor does not run and the display shows an error fault code	Lift motor electrical system failure - refer to chart in “Main Controller Error Codes” for service actions.
ST	
Squeegee lift Linkage Arm at steering column keeps bending or breaking	Squeegee Lift Cable is too tight - follow instruction in “Squeegee Lift Cable Adjustment - ST” section.
Squeegee lift Linkage Arm / Knob doesn’t raise or lower squeegee	Cable Bushing under Eyelet of Squeegee Cable in Steering Column is worn or Weldment Linkage is bent/sheared because Squeegee Lift Cable is too tight. Follow instruction in “Squeegee Lift Cable Adjustment - ST” section.

Squeegee Adjustments

Correct squeegee alignment is critical to water pickup performance and life of squeegee blades. If the squeegee is not angled correctly or hops, use the following settings as nominal and adjust as necessary to achieve the required performance.

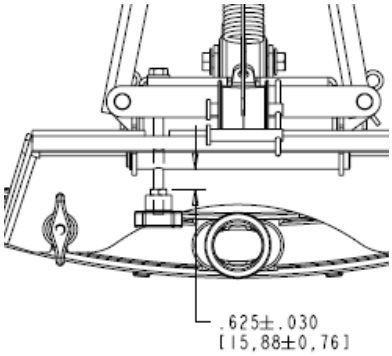
Tilt

Factory setting is 0.625” nominal



Wheel Height

Factory setting is 0.87” nominal



Squeegee Lift Actuator Replacement - Advenger

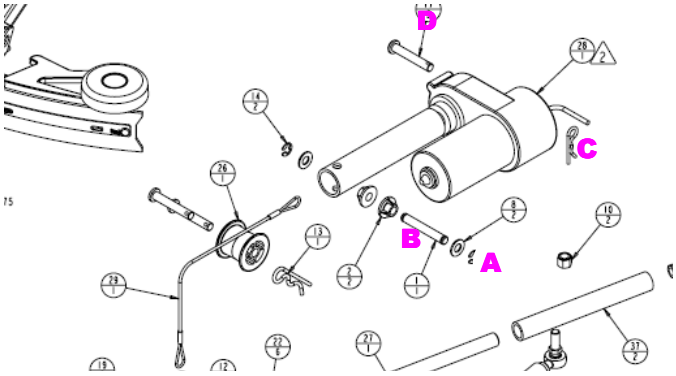
⚠ CAUTION!

The Recovery Tank is heavy and care should be taken in removing it. Two people recommended, or battery roll-out unit.

1. Lower the squeegee tool to the floor and then disconnect the battery pack at the red Anderson connector in the battery compartment.
2. Drain the recovery tank using the Recovery Tank Drain Hose (**31**).
3. Disconnect the squeegee hose from the squeegee tool and remove the tool from its mount.
4. Lift up the seat and unplug vacuum motor (and warning beacon if equipped) connectors located in battery compartment.
5. Open the hinged recovery tank cover and grip the top inside edge of the tank, then pull straight up to free it from the solution tank platform. Guide the tank off the rear of the machine to the floor.
6. From the back of the machine, remove the Retainer Ring (A) securing the lift cable Pin (B) and separate the pin and cable from the motor drive tube housing and chassis mounts. Note: Don't lose the two plastic cable spacers positioned in motor drive tube.
7. Locate the wire tie that attaches the motor wiring to the chassis and then disconnect the motor harness
8. From underneath the machine remove the Hairpin (C) securing the lift motor Pin (D) and disassemble the motor from the chassis mount. Then pull the motor towards the machine front to remove it completely.

   NOTE: New replacement lift actuator motors do not come with the lift nut pre-adjusted.

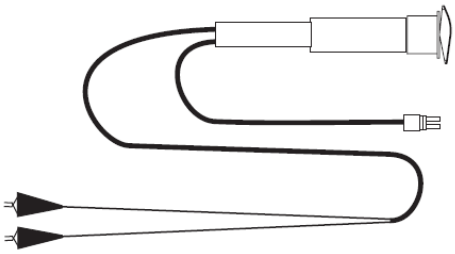
   Follow the "Squeegee Lift Actuator Drive Nut Adjustment" procedure using 56407502 Actuator Power Cord Adapter to set the new lift actuator to the correct settings:
9. When finished, reassemble in reverse order.
10. When lifting the recovery tank back onto the machine, pay attention to the location of the foam tubes. Route them into the battery tray, otherwise they will crush. - 5/20 delete



Squeegee Lift Actuator Drive Nut Adjustment - Advenger

⚠ WARNING!

1. Open the battery compartment and disengage the red Anderson battery connectors.
2. Connect the Scrub Deck Lift Actuator (completely assembled) to the Actuator Power Cord Adapter 56407502 (see “Diagnostic and Service Tools”).
3. Connect the red alligator clip to the positive battery terminal.
4. Connect the black alligator clip to the negative battery terminal.



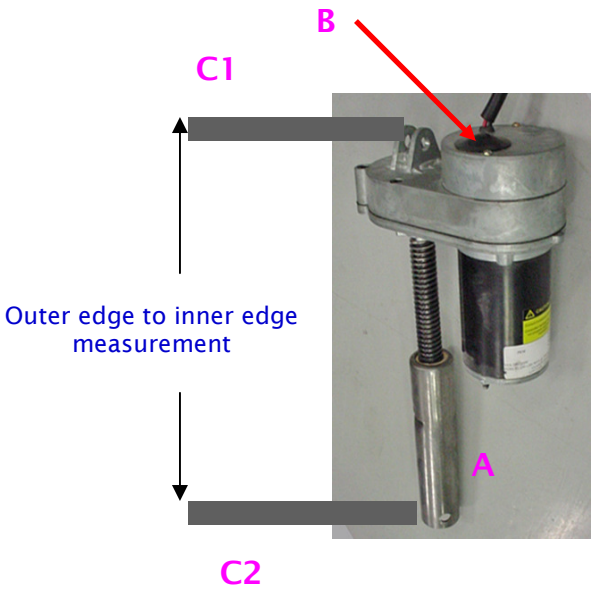
5. Hold onto the metal nut (**A**) and press the rocker switch to run the motor and retract the nut towards the motor housing (the IN or Retract Limit).
6. With the motor laying on a flat surface, place a 3/8” pin or bolt (**C1 and C2)** through the top mounting holes and the bottom (nut) mounting holes because you will be measuring the distance between them..
7. Manually turn the metal nut (**A**) **until the distance between the outer edge of one pin and the inner edge of the other pin*** matches the Retracted setting shown below.
8. Hold the metal nut and press the rocker switch, running the motor until it stops. If the measurement doesn’t match 13.25” (33.65cm) as shown below, pry off the black cover (**B**) to access the Cam Adjuster.
9. Using a 1/2” socket, gently turn the adjuster CW to increase travel, CCW to decrease travel of the Drive Nut. Each click of the adjuster will change the nut travel by 0.09” (2.29mm) or just under 3/32”.
10. After each adjustment, re-check the travel by holding the metal nut and running the actuator IN and OUT, checking against the values below.
11. Repeat until it is set correctly and replace the Cam Adjuster cover (**B**).
12. DO NOT TURN THE NUT before mounting - mark the position on the shaft if helpful.

Actuator Setting – mounting hole center to center:

Retracted: 9.00” +/- .06

Extended: 13.25” +/- .06

* It’s not practical to measure center to center of the holes, so an outer edge to inner edge of the pins measurement is suggested.



Squeegee Lift Cable Replacement – Advenger

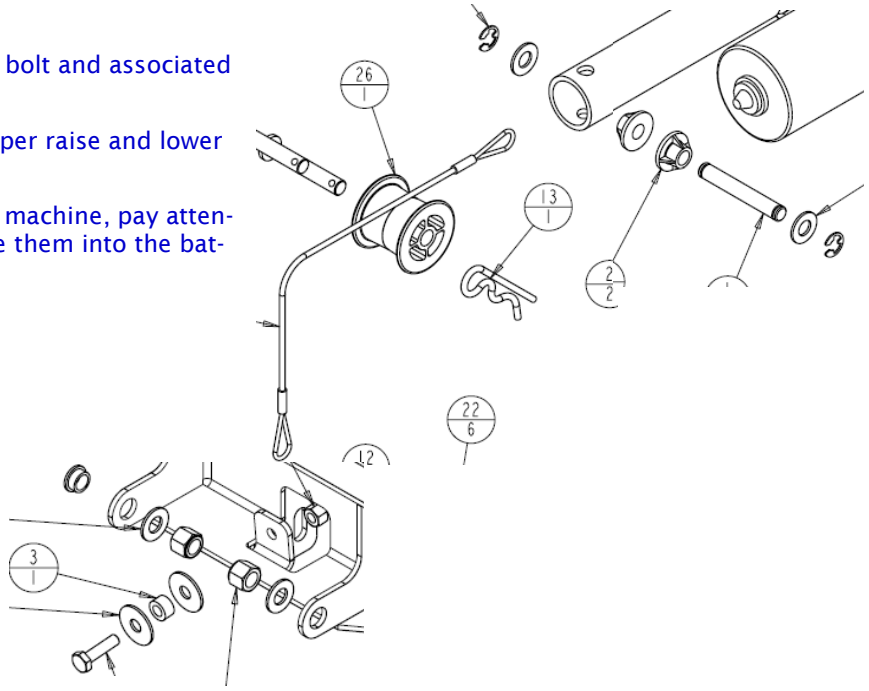
1. Follow steps 1-6 of “Squeegee Lift Actuator Replacement - Advenger” to disengage front end of lift cable under machine.

   NOTE: the motor does not need to be disconnected for this procedure.

2. Using 7/16” wrenches, remove the hex head bolt and associated hardware (**A**) to free other end of lift cable.

3. Reassemble in reverse order and test for proper raise and lower functions.

4. When lifting the recovery tank back onto the machine, pay attention to the location of the foam tubes. Route them into the battery tray, otherwise they will crush.



A

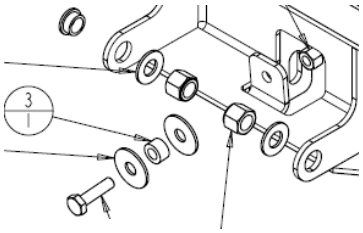
Squeegee Lift Cable Replacement - ST

⚠ CAUTION!

The Recovery Tank is heavy and care should be taken in removing it. Two people recommended, or battery roll-out unit.

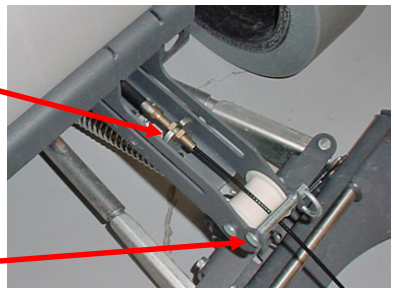
REAR:

1. Lower the Squeegee Tool to the floor and then disconnect the battery pack at the red Anderson connector in the battery compartment.
2. Drain the recovery tank using the Recovery Tank Drain Hose (**31**).
3. Disconnect the Squeegee Hose from the Squeegee Tool and remove the tool from its mount via the two thumbscrews.
4. Lift up the seat and unplug the vacuum motor (and warning beacon if equipped) connectors located in the battery compartment.
5. Open the hinged recovery tank cover and grip the top inside edge of the tank, then pull straight up to free it from the solution tank platform. Guide the tank off the rear of the machine to the floor.
6. Using 7/16" wrenches, remove the hex head bolt and associated hardware (**A**) from the Squeegee Pivot Bracket Weldment to free this end of the lift cable.



A

7. Loosen the Adjustment Nut to free the cable from the slotted Cable Bracket.



8. Remove the Cotter and Clevis pins at the white plastic roller to permit cable eyelet clearance as the cable is later pulled through from the front of the machine.

FRONT:

1. Follow the steps outlined in "Steering Column Assembly Shroud Removal" to allow access to Squeegee Lift Cable in the Steering Column.
2. Use a 1/2" wrench to loosen the cable nuts from the Linkage Arm to free the cable. Note condition of plastic bushing in eyelet and replace if worn.
3. Loosen Adjustment Nut to free cable from slotted Cable Bracket.
4. Using a 3/8" socket, remove charger and charger bracket underneath, exposing cavity though which cable passes.
5. Pull the cable through the machine from the front.

To reinstall the cable, reverse this procedure.

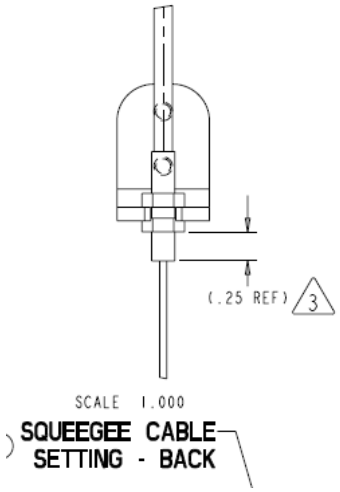
Follow instructions found in "Squeegee Lift Cable Adjustment – ST" to correctly set the Squeegee Lift Cable tightness.

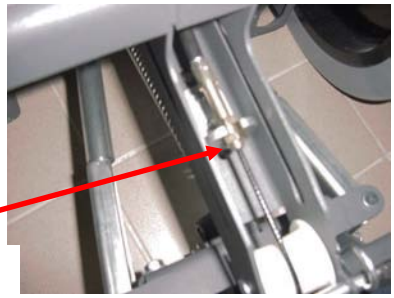
NOTE: When lifting the recovery tank back onto the machine, pay attention to the location of the foam tubes. Route them into the battery tray, otherwise they will crush.

Squeegee Lift Cable Adjustment – ST

REAR

Factory setting is 0.25”





adjustment nut

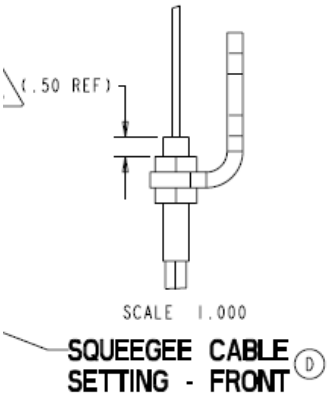
Follow steps 1 – 6 of Squeegee Lift Actuator Replacement - Advenger

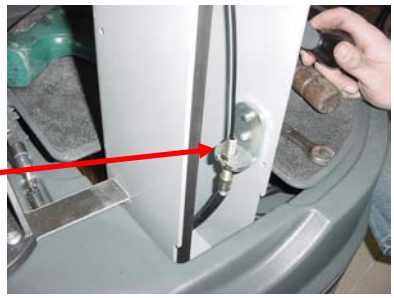
- If the cable is too long and the squeegee doesn’t lift off the ground, move the nut closest to the squeegee away from the machine, decreasing the distance from the nut to the reference end shown above.
- If the cable is too short (squeegee doesn’t reach the ground), back the nut towards the machine, increasing the distance from the nut to the reference end shown above.

To check the adjustment, lift up on the Squeegee Lift Lever. It should not require excessive force. Too much force needed to move the handle means that the cable is too tight (short) and the nut should be adjusted accordingly.

FRONT

Factory setting is 0.50”





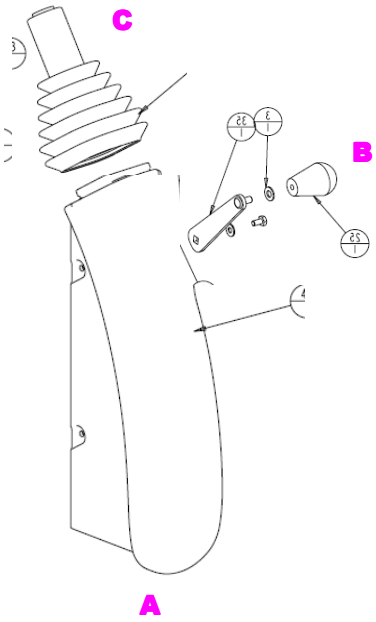
adjustment nut

Follow the steps outlined in “Steering Column Assembly Shroud Removal”

- If the cable is too long and the squeegee doesn’t lift off the ground, move the upper nut away from the machine, decreasing the distance from the nut to the reference end shown above.
- If the cable is too short (squeegee doesn’t reach the ground), back the nut towards the machine, increasing the distance from the nut to the reference end shown above.

Steering Column Assembly Shroud Removal - (to access steering and ST squeegee lift cable components)

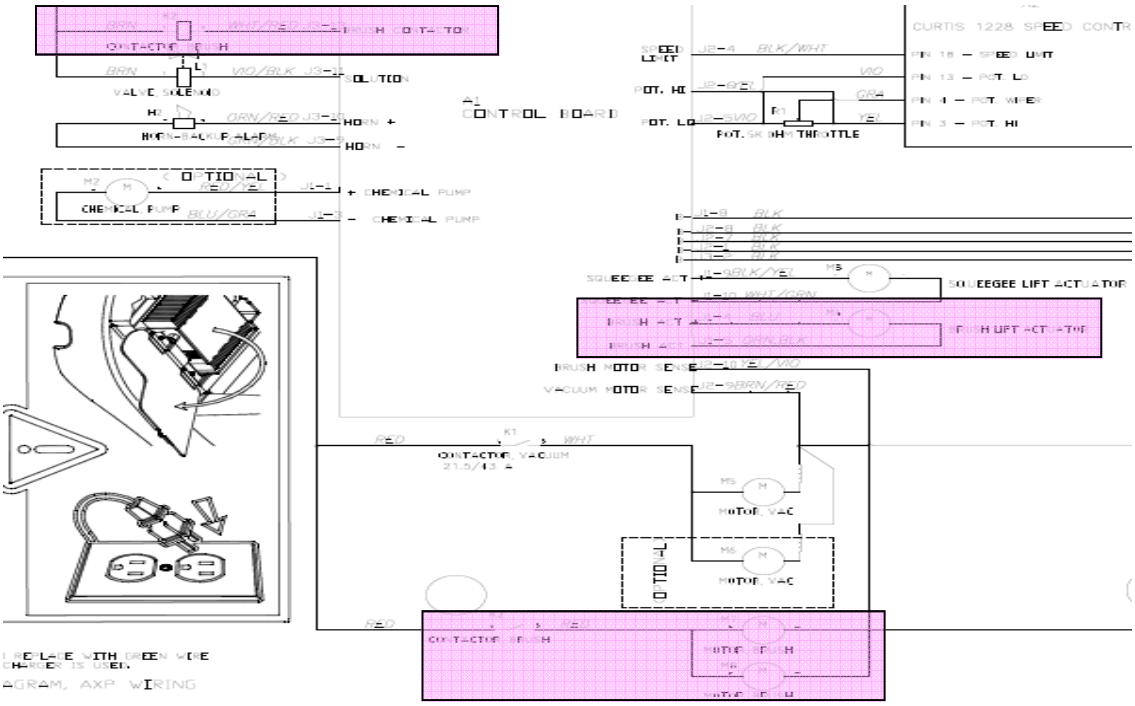
1. Remove the 4 screws fastening the Lower Column Shroud (**A**) to the Lower Column Weldment.
2. (**ST**) Using a 7/16" socket, remove Squeegee Lift Knob and Linkage Arm (**B**)
3. Using a flat bladed screwdriver, pry off the steering wheel plastic center cap.
4. Using a ¾" socket, remove the hex nut from the steering wheel center.
5. Pound the steering wheel off from behind using a mallet, observing Woodruff key as it may fly off in the process.
6. Pull off accordion Steering Boot (**C**) from the upper steering column.
7. Lift the battery charger cover.
8. Pry the plastic Lower Column Shroud off of the weldment by starting on the left side (away from knob) so shroud can clear the Weldment Linkage bump on the right side (ST - you may want to tap the linkage in a bit to permit clearance).



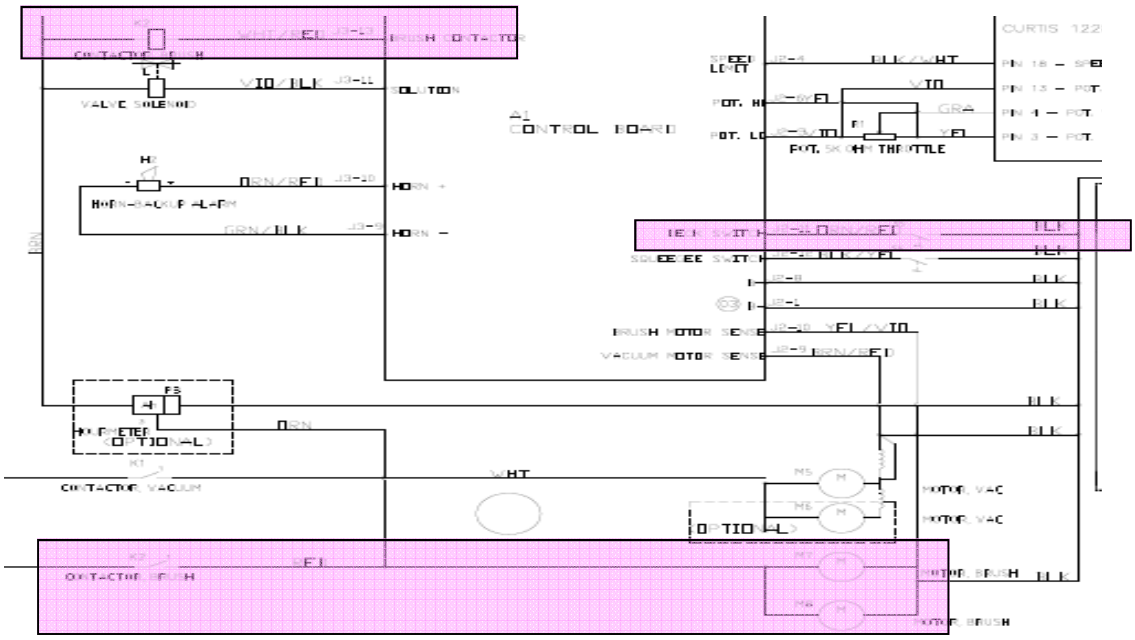
Reassemble in reverse order, applying a light coating of Silicone Spray or water to the inside of the Steering Boot to permit free travel over the shaft.

SCRUB SYSTEM

Advenger - pressing the Scrub On button with the seat switch closed causes the scrub deck and squeegee to drop. The control board provides 24V to the deck lift actuator M4; this signal is DVM measureable for 3 seconds and then becomes a pulsed signal while the deck is down. Pressing the drive pedal forward causes the brush and vacuum contactors K2 and K1 to energize. The 24V brush and vacuum motors M7, M8, M5, (M6) turn on; the pulsed solution solenoid L1 and chemical pump M2 turn on. Combined brush motor current is monitored via the YEL/VIO sense wire. Reversing the drive pedal turns off the solution solenoid and chemical pump, but the deck remains down and the brush motors stay on (for double scrub). Because multiple systems are engaged via on button, a further summary is provided in the section "Understanding Control of Squeegee, Scrub, and Recovery Systems via Modes."



ST - with the seat switch closed, lowering the squeegee and brush deck and pressing the drive pedal forward causes the brush and vacuum contactors to energize. The 24V brush and vacuum motors turn on; the pulsed solution solenoid turns on. Combined brush motor current is monitored via the YEL/VIO sense wire. Reversing the drive pedal turns off the solution solenoid, but the brush motors stay on (for double scrub).



Brush Motor Control and Load Circuit Error Codes and Measurements

Advenger Display Error Code	ST Service LED Blink Code	Fault Description	Troubleshooting Action
5	1, 2	Brush motor circuit overload	1. Check for binding in rotation of brushes or improper brush lift actuator operation. 2. Check for mechanical interference of the brushes with the side skirts. 3. Check the negative supply cable at the brush motor for a wiring problem, improper modifications, or poor connections at the YEL/VIO sense wire. 4. Check that the deck is set correctly in the control board programming.
10	2, 2	Brush motor K2 contactor coil overload	Check for short circuit in wiring or K2 contactor coil. Repair or replace.
31	2, 4 Visible in Fault Recall Mode	Brush motor circuit open	1. Check for motor wiring open or defective motor 2. Check the negative supply cable at the brush motor for a wiring problem or improper modifications (this is a special cable and must be replaced with original OEM due to sense wire). 3. Check K2 contacts – if open circuit while scrub is on*, replace K2. 4. Verify brushes are installed. 5. Verify the brushes are touching the floor and there is no interference between the deck and the floor.
35	3, 2 Visible in Fault Recall Mode	Brush motor K2 contactor coil open	1. Check coil resistance (see chart below) 2. Check for tight connections at contactor and WHT/RED wire to control board. Repair or replace.
60	3, 4	Brush motor circuit contacts stuck closed	With no power to circuit, if contacts measure 0 ohms they're stuck. Replace K2.
63	4, 3	Brush motor K2 contactor coil control fault	1. If J3-13 is 24V referenced to B+ when Scrub switch is Off, replace control board. 2. If J3-13 is 0V referenced to B+ when Scrub switch is Off, disable fault via Hidden Menu. Refer to "Control Board J1, J2, and J3 Pin Outs and Test Points" section.
* with Scrub On, the control board at the contactor coils should measure -24V for 2 seconds, then drop to -18V when referenced to B+. The solution solenoid when On should measure -24V or 0V referenced to B+.			

Brush Motor Type	Scrub Pressure	Nominal Current (A) +/- 3A	Overload Current (A)	Wire Colors
Disc	Low Medium High	27 32 40	60	Red & Black
Cylindrical	Low Medium High	23 30 35	48	Red & Black
Brush Contactor Coil	**Nominal Resistance**	**Nominal Current**	**Overload Current**	**Wire Colors**
K2	120 ohms	200 mA +/- 100 mA	750 mA	Brown & White/Red

Scrub Deck Lift Actuator Error Codes and Measurements - Advenger

Advenger Display Error Code	ST Service LED Blink Code	Fault Description	Troubleshooting Action
4	NA	Scrub deck lift actuator overload	1. Check for improper actuator adjustment – refer to Actuator Drive Nut Adjustment section. 2. Check for binding or frozen brush deck lift linkage and excessive weight on brush deck. 3. Check for short circuit in brush motor and wiring. Repair or replace.
32	NA	Scrub deck lift actuator open	1. Check for disconnected actuator wiring, open in wiring, defective actuator motor, or drift in motor current draw to less than 100mA (call factory for instructions). Repair or replace.

Lift Actuator	Nominal Current (A)	Overload Current	Wire Colors
M4	2.5 – 3.5	5A for > 4 seconds	Blue & Orange/Black

Troubleshooting Scrub System Issues

It is unlikely that the scrub system will malfunction without generating an error code, so most issues will be found on the preceding tables. A few more machine-specific items are listed here:

Problem	Possible Cause
Advenger	
Scrub deck lift actuator overload	Mechanical interference between the deck and the ground. Badly worn internal components of actuator.
ST	
Brush motor overload	Pin/spring location is too aggressive on the deck linkage for the floor/brush combination.

Scrub Deck Lift Actuator Replacement - Advenger

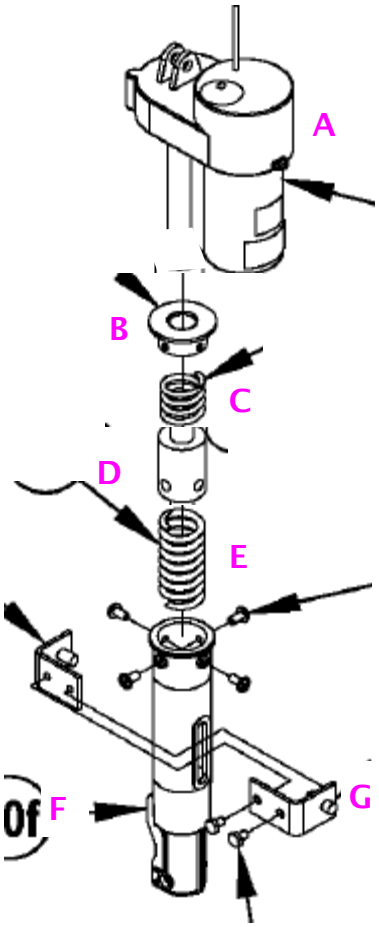
1. Lower the scrub deck per the instructions found in “Service Test Mode.”
2. Quickly disconnect the batteries at the red Anderson battery connector inside the battery compartment. This is done not only for safety but to keep the deck from rising.
3. Unplug the Deck Lift Actuator connector.
4. Remove the Cotter Hairpins from the weldment arm and U-bracket to free the actuator.
5. Remove the Deck Actuator.
6. Using the Actuator Power Cord Adapter 56407502 from your Nilfisk-Advance service tool kit, set the Extend and Retract limit switch positions as shown in the “Scrub Deck Lift Actuator Drive Nut Adjustment” section.

⚠ CAUTION!

Failure to set the lower stop correctly may result in damage to the Spring Housing (F).

7. Then reassemble in reverse order after drive nut position has been set.

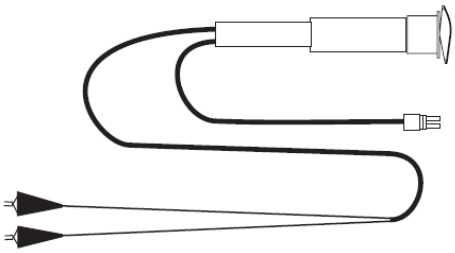
NOTE: to replace a portion of this assembly (items **A - G**), follow these instructions as they apply, noting component position in the diagram at right, and set limit switch end stops in accordance with the instructions found in “Scrub Deck Lift Actuator Drive Nut Adjustment” section.



Scrub Deck Lift Actuator Drive Nut Adjustment - Advenger

⚠ WARNING!

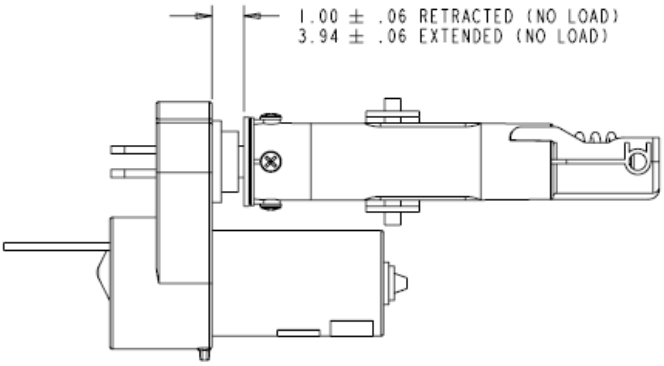
1. Open the battery compartment and disengage the red Anderson battery connectors.
2. Connect the Scrub Deck Lift Actuator (completely assembled) to the Actuator Power Cord Adapter 56407502 (see “Diagnostic and Service Tools”).
3. Connect the red alligator clip to the positive battery terminal.
4. Connect the black alligator clip to the negative battery terminal.

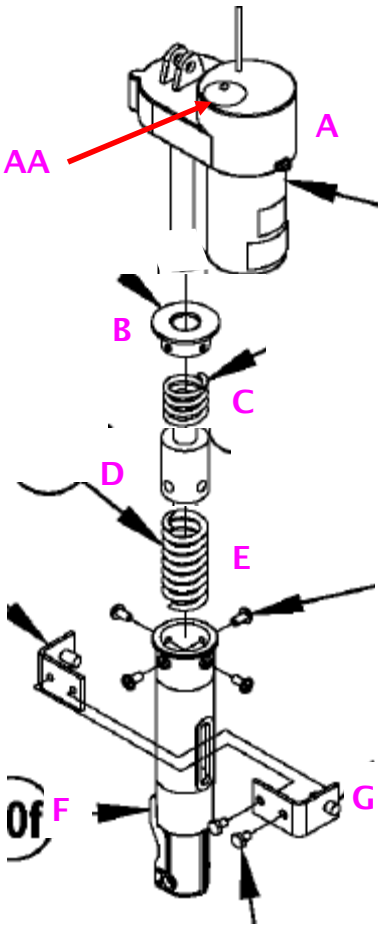


5. Hold onto the plastic Spring Housing (**F**) /Drive Nut assembly and press the rocker switch to run the motor and retract the nut towards the motor housing (the IN or Retract Limit).
6. Measure the position of the Spring Housing Guide (B) in reference to the shoulder as shown in the figure below.
7. Manually turn the plastic Spring Housing (**F**) assembly until the position measure matches the figure below.
8. Hold the Spring Housing and press the rocker switch, running the motor until it stops **but no further than 4” from the shoulder as shown in the figure below or damage to the Housing may occur.**
9. If the measurement doesn’t match 3.94” (100.08mm) as shown below, pry off the black cover (**AA**) to access the Cam Adjuster.

Using a 1/2” socket, gently turn the adjuster CW to increase travel, CCW to decrease travel of the Drive Nut. Each click of the adjuster will change the nut travel by 0.09” (2.29mm) or just under 3/32”.

5. After each adjustment, re-check the travel by holding the Spring Housing/Drive Nut assembly and running the actuator IN and OUT, checking against the values below.
6. Repeat until it is set correctly and replace the Cam Adjuster cover (AA).





Scrub Brush System – Disc

Deck Removal

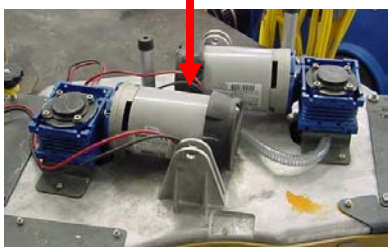
1. Turn the key switch Off.
2. Remove both side skirt assemblies by loosening the black Deck Skirt Removal Knobs (15), and sliding the skirt assemblies slightly forward and then off of the scrub deck.
3. Remove the left brush or pad holder by grasping it firmly and giving it a hard turn CCW to free the lugs from the Brush Plate Assembly.
4. Remove the right brush or pad holder by grasping it firmly and giving it a hard turn CW
5. **Advenger** - follow the instructions found in "Service Test Mode" to lower the Scrub Deck (8).
6. **ST** - manually lower the scrub deck.

⚠ WARNING!

7. Disconnect the batteries at the red Anderson connectors inside the battery compartment.

8. **Advenger** - Mark the current position of the drive nut on the worm gear.
9. **Advenger** - Remove the Cotter Hairpins from the weldment arm and U-bracket.
10. **Advenger** - Remove the Deck Actuator.

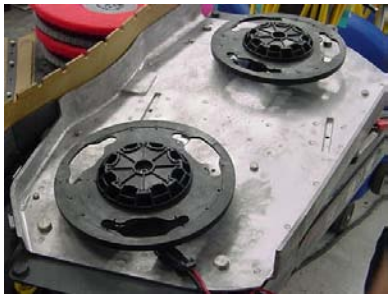
    NOTE: DO NOT TURN the actuator drive nut or you will need to verify the actuator extend and retract positions per the "Scrub Deck Lift Actuator Replacement" instructions.



11. Unhook the clear water manifold hose from the deck.
12. Unplug the red and black wire connectors from the brush motors.
13. Pull the deck out from under the machine.

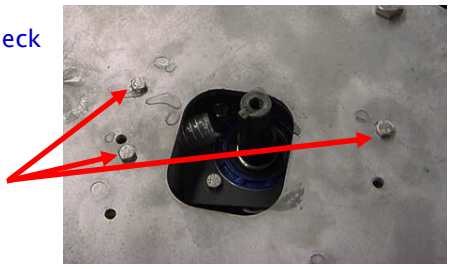
Scrub Brush Motor Removal

(also needed for Carbon Brush check)



1. After removing the deck per instructions above, turn it over so the Brush Plates are on top.
2. Remove the hex socket screw from the Motor Gimbal located at the Brush Plate center.
3. Remove the C clamp to release the Motor Gimbal and Brush Plate.
4. Pry off the Brush Plate, which is press fit onto the shaft, using a flat screw driver against the aluminum gimbal shoulder underneath the Brush Plate.

5. Mark the bolt locations before removing them because one deck is used for all deck sizes and there are multiple configurations.
6. Remove the bolts to free the gray bracket and motor.
7. Extract the hose from the gray bracket.
8. Disassemble the existing scrub brush motor from the bracket.



9. Apply Loctite #242 to the motor bolts before fastening the new motor to the bracket.

10. Feed the hose back into the bracket making sure that the hose is pointed towards the shaft.

⚠ CAUTION!

If the hose is not positioned correctly, the scrub brush will be damaged (melted) due to lack of water.

Hose pointed towards shaft

11. Reattach the motor/bracket assembly to the deck making sure to use the correct holes. (If position is not correct, brushes will either interfere with each other or with the deck sides.)
12. Lubricate the Motor Gimbal and apply anti-seize to the socket head bolt before reassembly.
13. Press the Brush Plate firmly onto the motor shaft. If it is not pressed in completely, the deck will not be level, causing one motor to prematurely burn out. (see Caution).

⚠ CAUTION!

ST - the control board monitors total current drawn by both motors combined. It cannot differentiate if one is bound and pulling high current, or if one is forced into the floor while the other is barely making contact. To verify proper operation of each motor, monitor them individually with a current clamp while the machine is scrubbing.

14. Firmly tighten the socket head screw without over-torquing as damage to Motor Gimbal may occur.

Scrub Brush System – Cylindrical - Advenger

Deck Removal

1. Turn the key switch Off.
2. Follow the instructions found in “Service Test Mode” to lower the Scrub Deck (**8**).

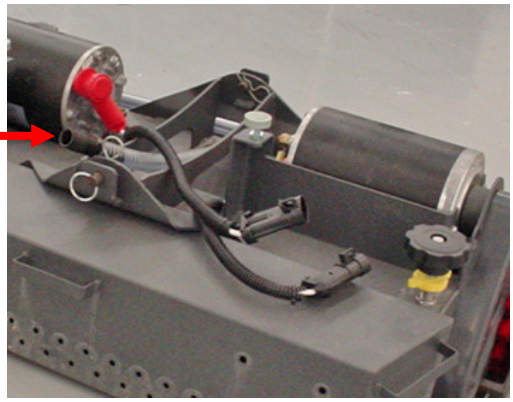
⚠ WARNING!

3. Quickly disconnect the batteries at the red Anderson connectors inside battery compartment before the deck rises.
4. Remove the Cotter Hairpins from the weldment arm and U-bracket
5. Remove the Deck Actuator.

Cotter Hairpins

NOTE: Removing the side skirts is optional

Unhook hose here



6. Unhook the clear water manifold hose from the barb fitting as shown.
7. Unplug the white and black wire connectors from the brush motors.
8. Pull the deck out from under the machine

To reassemble, perform in reverse order.

Scrub Brush System – Cylindrical - Advenger

Scrub Brush Motor Removal

1. Remove the side skirts.
2. Remove the Belt Cover on each side. With an operator in the driver's seat with the key switch On and the increase scrub function selected press the drive pedal to start the scrub brushes and observe which brush motor needs to be replaced.

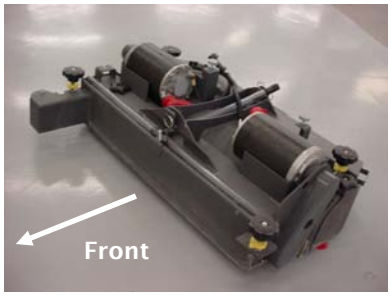
⚠ WARNING!

3. Disconnect the battery pack at the red Anderson connectors in the battery compartment.
4. Using a 5/8" wrench, loosen the scrub brush belt tension Hex screw in the center of the Belt Idler (AO).
5. Remove the wiring at both the Pos. & Neg. brush motor terminal studs and note the correct wiring connections (for reinstallation). Then remove the (3) Screws (AP) and lift the motor out from the scrub deck.
6. Reassemble in reverse order, installing motors with wires pointing to the rear towards the hopper.
7. Apply anti-seize to the motor shafts.

* Rotation from shaft end.

NOTE: the belts are self-tensioning.

Left hand view

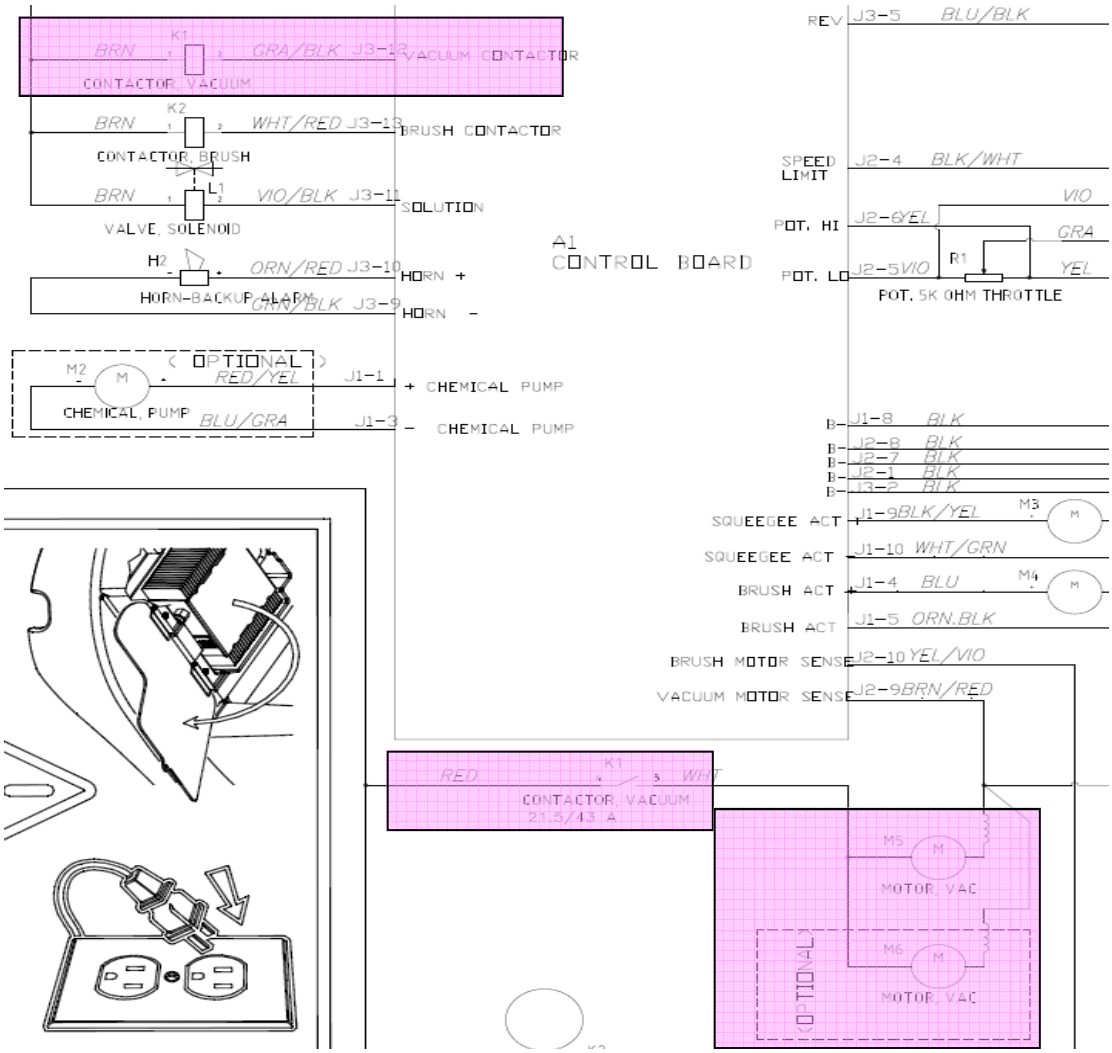


RECOVERY SYSTEM

The recovery system is controlled via the control board output to contactor K1 coil, turning on one or both (if equipped) vac motors M5 (M6), with control board feedback provided via the BRN/RED vac motor current-monitoring sense wire.

Refer to the section “Understanding Control of Squeegee, Scrub, and Recovery Systems via Modes” for details about functionality of the Recovery System due to multiple systems operating in tandem under various seat switch and button configurations.

For the Recovery System to function properly, the systems mentioned above in addition to the Wheel Drive System must be operating properly in order for the vac motors to turn on unless by-passed by entering Service Test Mode for troubleshooting purposes.



Can we combine diagrams for both?

Recovery System Error Codes and Measurements

Advenger Display Error Code	ST Service LED Blink Code	Fault Description	Troubleshooting Action
7	1, 3	Vacuum motor circuit overload	1. Check for debris in vac motor 2. Check for worn carbon brushes 3. Check for defective/corroded motor bearings 4. Check for short circuit in vac motor or wiring. 5. Check the negative supply cable at the vac motor for a wiring problem, improper modifications, or poor connections at the BRN/RED sense wire. Repair or replace.
9	2, 1	Vacuum K1 contactor coil overload	Check for short circuit in wiring or K1 contactor coil. Repair or replace
33	3, 1 Visible in Fault Recall Mode	Vacuum motor circuit open	1. Check for motor wiring open or defective motor, 2. Check the negative supply cable at the vac motor for a wiring problem or improper modifications (this is a special cable and must be replaced with original OEM due to sense wire). 3. Check K1 contacts - if open circuit while vac is turned on (0V at J3-12), replace K1.
36	3, 3 Visible in Fault Recall Mode	Vacuum K1 contactor coil open	1. Check coil resistance (see chart below). 2. Check for tight connections at contactor and GRA/BLK wire to control board. Repair or replace.
61	4, 1	Vacuum K1 contactor contacts stuck closed	With no power to circuit, if contacts measure 0 ohms they're stuck. Replace K1.
64	4, 4	Vacuum contactor coil control fault	1. If J3-12 is 24V referenced to B+ when Vacuum switch is Off, replace control board. 2. If J3-12 is 0V referenced to B+ when Vacuum switch is Off, disable fault via Hidden Menu. Refer to "Control Board J1, J2, and J3 Pin Outs and Test Points" section.

Vacuum Motor	Single/Dual	Nominal Current (A) +/- 3A	Overload Current (A)	Wire Colors
M5	Single	20	30	White & Black
M5 + M6	Dual	40	60	White & Black
Vacuum Contactor Coil	**Nominal Resistance**	**Nominal Current**	**Overload Current**	**Wire Colors**
K1	100 ohms	240 mA +/- 50 mA	750 mA	Brown & Gray/Black

Troubleshooting Recovery System Issues

Problem	Possible Cause
Advenger and ST	
Poor water pickup from squeegee tool	1. Misadjusted squeegee tool - refer to "Squeegee Alignments" section 2. Worn or damaged blades - refer to Operating Manual for instructions 3. Leak in vacuum system - check for bad gasket, leaky hose, damaged tank, leaky drain valve. 4. Restriction in vacuum system - check for debris in squeegee tool, vacuum hoses, float cage, or wherever air is forced to make a sharp turn.
Vacuum motor keeps corroding and failing.	Liquid is being pulled into vac motor due to excessive foam in recovery tank. Recommend defoamer and don't fill until shuts off automatically.
Vacuum motor is normally dry, now it's wet and failing.	Vacuum leak below the water line creating turbulence in the recovery tank, causing water to enter the vacuum motor.
The control board doesn't indicate the recovery tank is full before the ball valve shuts off the vac motor.	1. Check the vacuum motor sense wire (BRN/RED) for break or poor connection (mV signal). 2. Check that cage for ball float is clean.
Display shows the recovery tank is full but it's not.	Disable Recovery Tank Full automatic shut-off via Hidden Menu.
ST	
Vacuum motor doesn't turn on	1. Go into Fault Recall mode and check for error code 3,1 for vac motor circuit problem. 2. Check limit switch S6 in steering column. Moving the handle to the down position should move squeegee cable down and close switch S6 turning on the vac motor circuit if operating properly.
Vacuum motor contactor doesn't energize	Go into Fault Recall mode and check for error 3,3

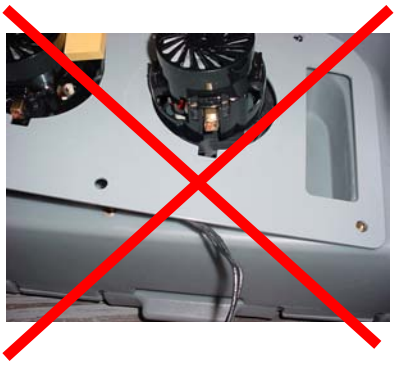
Replacing a Vacuum Motor

1. Lower the Squeegee Tool to the floor.

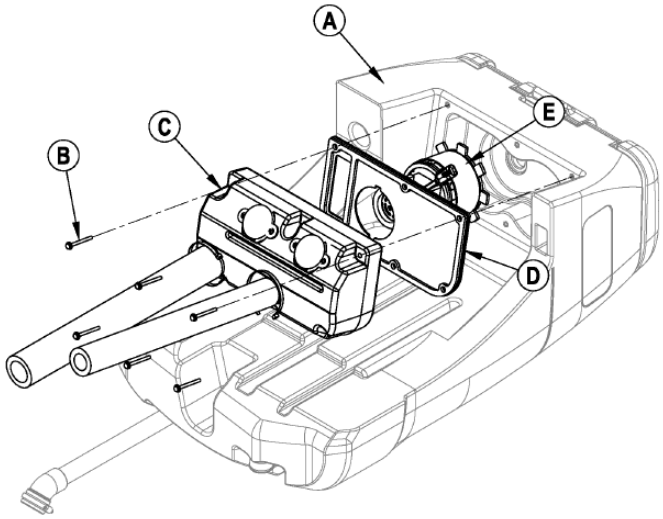
⚠ WARNING!

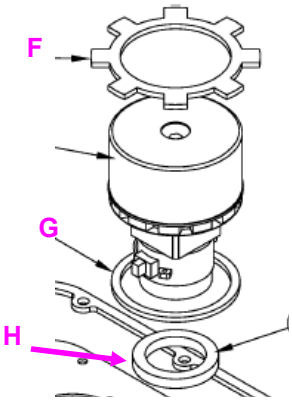
2. Disconnect the battery pack at the red Anderson connectors in the battery compartment.
3. Drain the recovery tank using the Recovery Tank Drain Hose.
4. Disconnect the Squeegee Hose from the Squeegee Tool and remove the tool from its mount via the two thumbscrews.
5. Lift up the seat and unplug the vacuum motor (and warning beacon if equipped) connectors located in the battery compartment.
6. Open the hinged recovery tank cover. **Advenger** - remove the Strainer Basket (**28**).
7. Grip the top inside edge of the tank, then pull straight up to free it from the solution tank platform. Guide the tank off the rear of the machine to the floor.
8. Place the tank upside down with the lid towards the floor or lay on its back.
9. Using a 7/16" socket, remove the (6) fasteners (**B**) from the Vac Motor Cover (**C**) and lift cover off of vac motor(s) (**E**).
10. Carefully lift the metal Standard Vac Plate (**D**) off of the motor(s).

NOTE: the wires should be protruding up through the hole and not from around the edge of the plate. If they are coming from under the plate, examine for damage and repair if cut.



11. Attach gaskets (F) and (G) to the new vac motor; attach gasket (H) to the Vac Motor Cover, and insert motor into base.
12. Reassemble in reverse order, paying attention to route wires up through hole and out towards the back in the groove of Vac Motor Cover (**C**).
13. When lifting tank back onto machine, pay attention to the location of the foam tubes. Route them into the battery tray, otherwise they will crush.

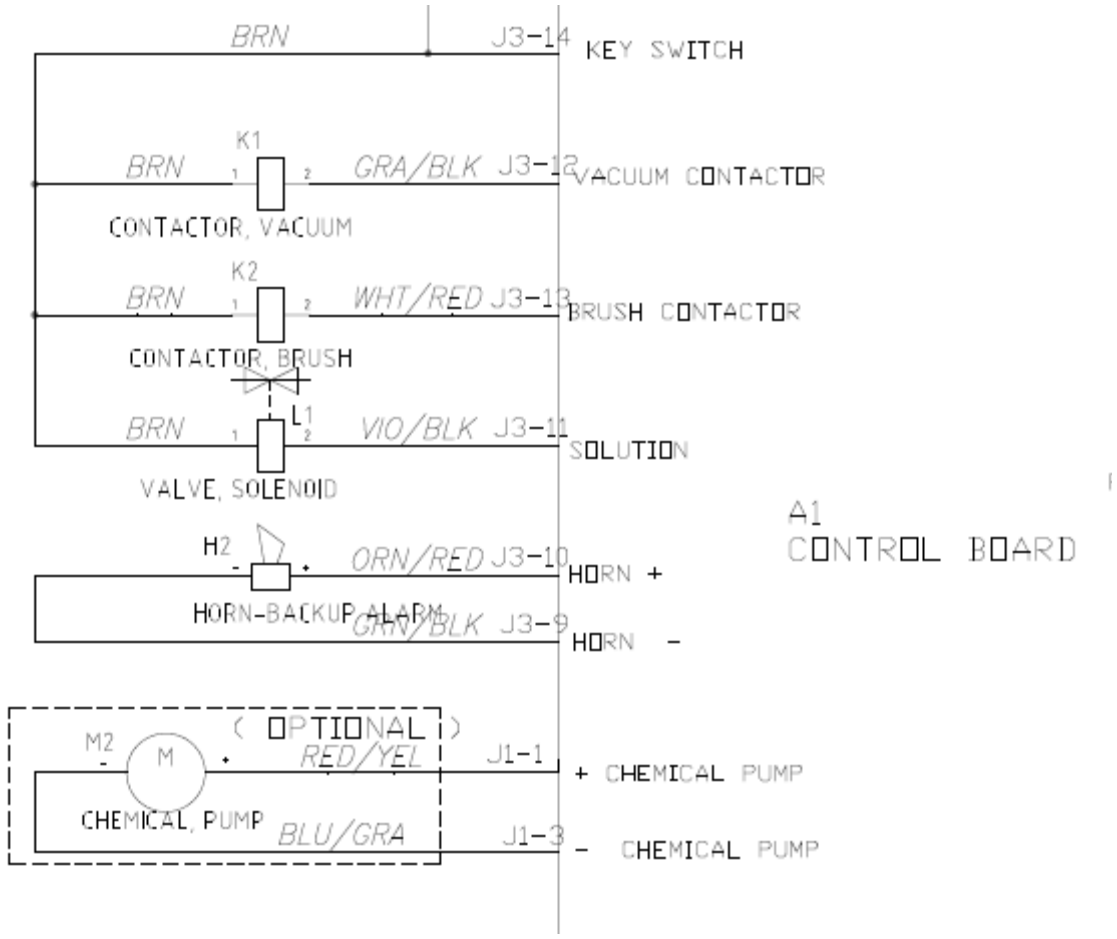




SOLUTION SYSTEM

The Solution System is controlled via a pulsed 24V signal from the control board at J3-11 to the Solution Solenoid valve. On Advenger machines, the solution flow rate is also controlled via feedback provided by a pressure sensor on the control board. For more details, refer to the "Solution System Control" section in this chapter.

To avoid clogging and malfunction of solution system components, it is recommended to avoid using chemicals that are known in the industry to cause performance degradation in commercial auto scrubbers. These chemicals include d-limonene (frequently found in "orange" type cleaners and not listed on the MSDS), and in hard-water areas, carbonates, silicates, and phosphates, which are listed on the MSDS.



Solution & AXP System Error Codes and Measurements - Advenger and ST

Advenger Display Error Code	ST Service LED Blink Code	Fault Description	Troubleshooting Action
8	1, 4	Solution solenoid overload	1. Check for a wiring problem. 2. Check coil resistance (see below). 3. Replace solenoid if coil is shorted.
11	NA	Chemical pump overload	1. Check for a wiring problem. 2. Replace pump.
30	2, 3 Visible in Fault Recall Mode	Solution solenoid open	1. Check for disconnected solenoid wiring plug, open in wiring, or open in solenoid (see below). 2. Repair or replace. Voltage at control board should be -24V referenced to B+.
37	NA	Chemical pump open	1. Check for disconnected plug or open in wiring. 2. Repair or replace When the pump is On, it makes a clicking noise. If the board output is correct it should appear as a pulsed signal to a DVM.
62	4, 2	Solution solenoid control fault	1. If J3-11 is 24V referenced to B+ when Solution switch is Off, replace control board. 2. If J3-11 is 0V referenced to B+ when Solution switch is Off, disable fault via Hidden Menu. Refer to "Control Board J1, J2, and J3 Pin Outs and Test Points" section.

Solution Solenoid	Nominal Resistance	Nominal Current	Overload Current	Wire Colors
L1	35 ohms	650 mA	750 mA	BRN & VIO/BLK
Chemical Pump		**Nominal Current**	**Overload Current**	**Wire Colors**
M2		PWM	870 mA PWM	n/a

Troubleshooting Solution & AXP System Issues

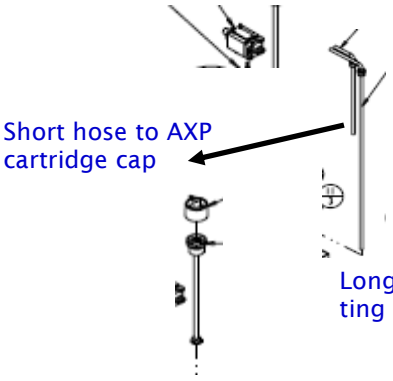
Problem	Possible Cause
Inadequate or no solution flow	No solution in the tank. Red Solution Shutoff Valve (21) is in the Off position . Clogged Solution Filter (20), valve L1, or hoses. L1 Solution Solenoid Valve defect. Main controller fault.
Advenger	
Solution tank level indicator shows empty even though the tank is full	Small clear hose at pressure sensor on control board is kinked - refer to "Replacing the Operator Control Panel" for instructions.
Solution flow and/or chemical rate don't appear to follow programming	1. Air leak at hose connection to pressure sensor. 2. Air leak at Pressure Sensing Tube fitting. 3. Small clear hose at pressure sensor on Interface Control Panel is kinked.
Solution level indicator doesn't work after new control board installed	1. Solution tank wasn't completely drained before installation of new Interface Control Panel. Completely drain the solution tank and the pressure differential should work properly again. 2. Check for air leaks at re-connected hose fittings.
Chemical rate doesn't match manufacturer specifications	Check that pump is wired correctly and that the polarity isn't reversed.

Solution System Diagram

Advenger

Top section plus ST section below:

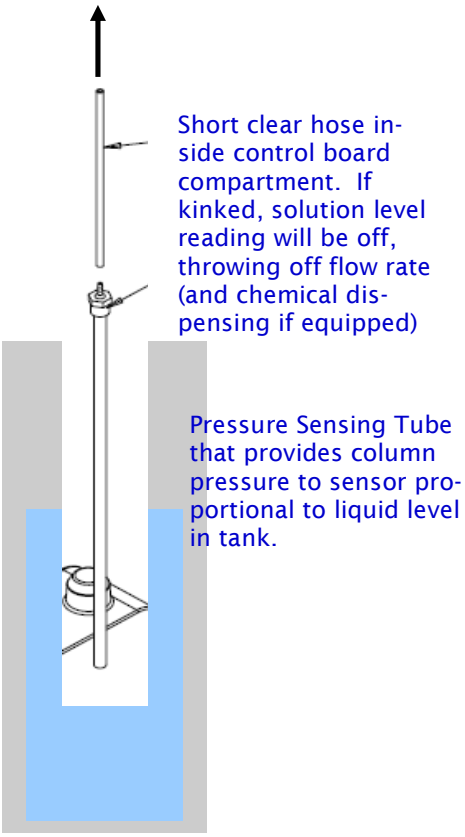
Chemical Pump



Short hose to AXP cartridge cap

Long hose to T fitting at Solution Filter

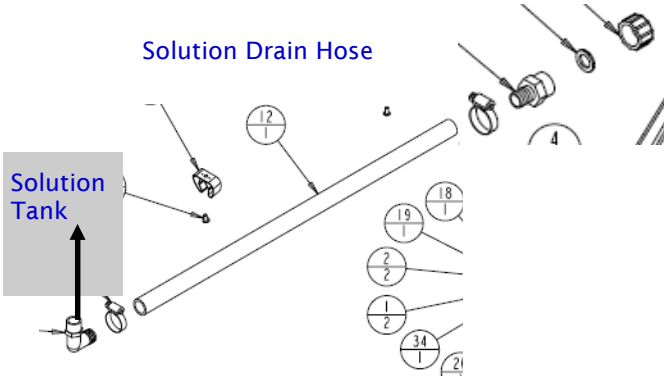
Pressure Sensor on the control board



Short clear hose inside control board compartment. If kinked, solution level reading will be off, throwing off flow rate (and chemical dispensing if equipped)

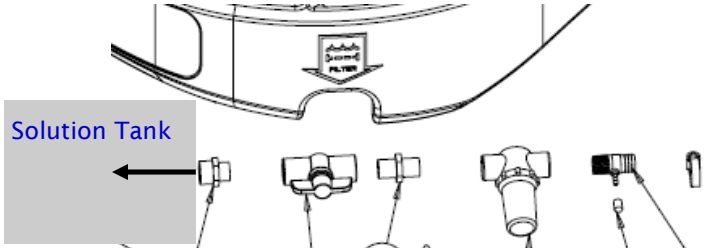
Pressure Sensing Tube that provides column pressure to sensor proportional to liquid level in tank.

Solution Drain Hose



Solution Tank

ST

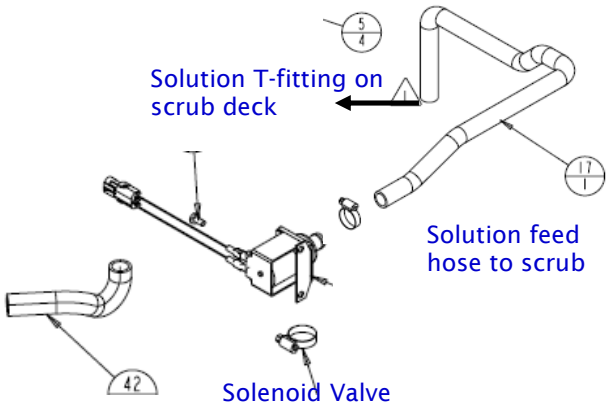


Solution Tank

manual Ball Valve

Solution Filter

T fitting for hose from chemical



Solution T-fitting on scrub deck

Solution feed hose to scrub

Solenoid Valve

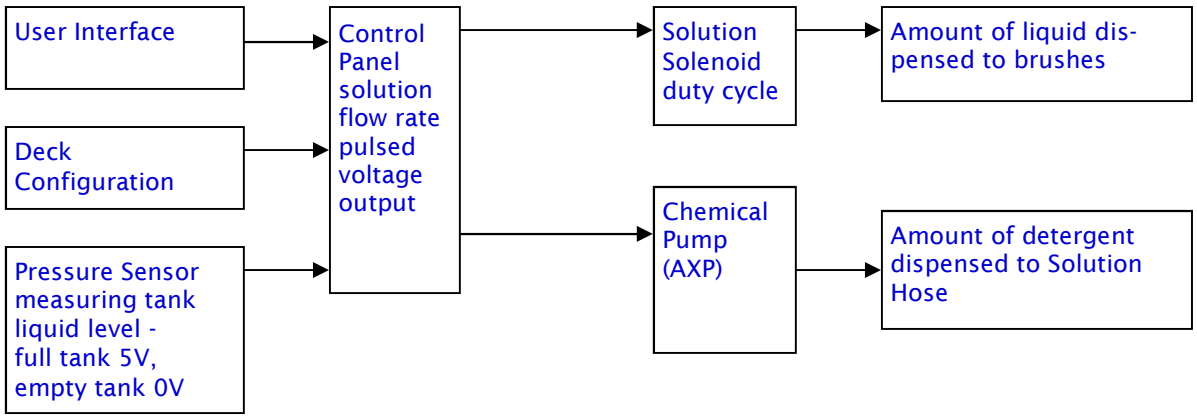
Solution System Control

Advenger

The control board output of pulsed voltage signals driving the Solution System is controlled by the following three parameters:

1. The deck size and type (factory set but selectable via Hidden Menu).
2. The Solution Flow Rate chosen by the operator through the user interface.
3. The Liquid Level Sensor.

The liquid level in the Solution Tank is measured by the Pressure Sensor through the Pressure Sensing Tube. As the liquid level decreases, the pulsed feedback of the Pressure Sensor drives the control board to compensate for this drop in maximum output by adjusting the duty cycle of the solution solenoid, thereby keeping the flow rate constant.



A malfunction of either the Pressure Sensor, the Control Panel, or an air leak in the pressure sensing system may affect the performance of either the Chemical Pump or the Solution Solenoid, or both.

ST

The pulsed 24V output of the control board that controls duty cycle of the Solution Solenoid is driven by:

1. Control board programming of deck size and type (factory set but selectable via the Hidden Menu).
2. The Solution Flow Rate chosen by the operator through the user interface.

ST machines don't have a Pressure Sensor that monitors liquid level in the Solution Tank. Since the maximum output of the Solution Solenoid varies with liquid level, as the level drops in the tank, the output of the Solution Solenoid will also drop. As the tank empties, this results in a decrease in solution output to the brushes from the "full" rate.

Replacing the Solution Solenoid Valve

1. **Advenger** - follow instructions found in “Service Test Mode” to lower the scrub deck.
2. **ST** - manually lower the scrub deck.

⚠ WARNING!

3. Quickly disconnect the batteries at the red Anderson connectors in the battery compartment (done for safety and to keep the deck from rising back up).
4. Reach under the front left side of the machine and manually close the red Solution Shutoff Valve (**21**) adjacent to the Solution Filter (**20**).

Solution Shutoff Valve

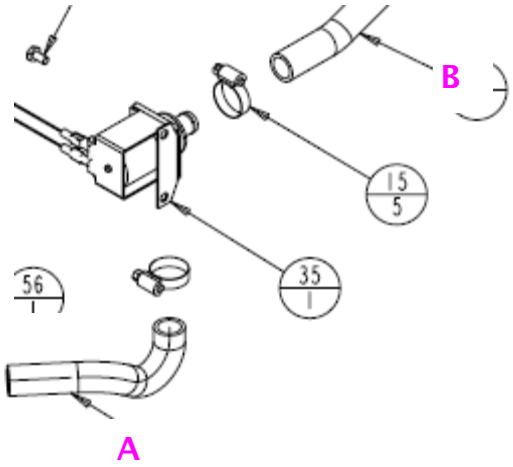
5. Using a flat blade screwdriver or 5/16” socket, loosen the two hose clamps on the valve and remove the black Solution Hose (**A**) from the inlet side and the clear hose (**B**) coming from the deck manifold.

Solution Hose

6. Using a 7/16” socket, remove the bolt fastening the Solution Solenoid to the machine.
7. Unplug the valve body at the connector.

Connector

8. Replace the valve and reassemble in reverse order.

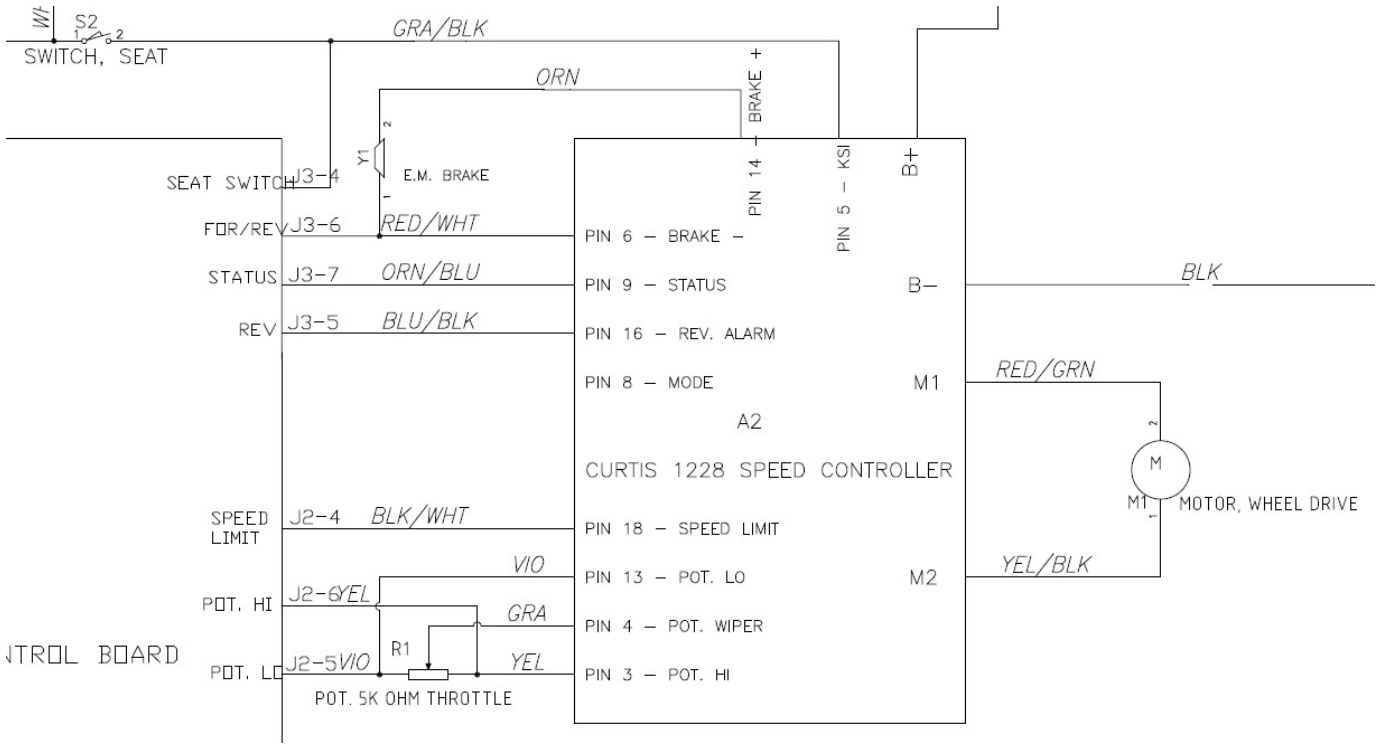


WHEEL DRIVE SYSTEM

The drive wheel assembly is directly connected to the Curtis 1228 speed control, which not only provides an output signal of 24V to the drive wheel for forward and reverse movement, but also monitors current and temperature, and controls the electromagnetic brake. It is the same for both the Advenger and ST models. The speed control is programmable through, and can be monitored via, the Curtis Handheld Programmer 56409441 and Curtis Adapter Cable with Quad Plug 56409823, listed in the recommended "Diagnostic and Service Tools" section of this manual. For information on how to use the Curtis programmer, please refer to the Curtis Programmer Manual 56043101.

The 5k Ohm throttle pot R1 in the foot pedal controls drive speed and forward/reverse movement. The throttle pot input to the main control board also determines whether or not the scrub and vacuum systems will engage, and is therefore critical to machine performance. If the control board senses a Neutral position of the foot pedal, it will not engage these other systems unless placed in Service Test Mode or one of the vacuuming-only modes.

The Electromagnetic Brake is engaged whenever the foot pedal is in Neutral, and released for forward or reverse motion.



Wheel Drive Circuit Error Codes and Measurements

Advenger Display Error Code	ST Service LED Blink Code	Fault Description	Troubleshooting Action
3	1, 1	Speed control fault (will disable all systems unless fault detection is disabled in the Hidden Menu)	1. Verify connector at Drive Pedal is connected 2. Refer to "Speed Control Flash Codes" section 3. Repair 4. Reset machine via key switch.

Wheel Drive Motor	Typical Current (A) Transport, Full Throttle	Typical Current (A) Scrub Mode, Level Floor	Wire Colors
M1	15 - 20	15 - 50	Red/Green and Yellow/Black (2 wires combined - required to prevent overheating if rotor locks)

Troubleshooting Drive Wheel Issues

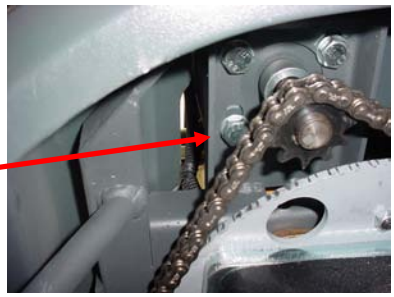
Problem	Possible Cause
Advenger - the LCD indicates E03 and the chemical LED flashes a code	1. Verify connector at Drive Pedal is connected. 2. Refer to "Speed Control Flash Codes" section. 3. Repair 4. Reset machine via key switch.
ST - the Fault Indicator LED is blinking 1, 1 and the Extreme Solution Flow LED flashes a code	1. Verify connector at Drive Pedal is connected. 2. Refer to "Speed Control Flash Codes" section. 3. Repair 4. Reset machine via key switch.
The wheel drive motor will not run in forward or reverse.	1. Batteries need charging (low battery voltage, recharge batteries) 2. Wheel Drive Motor Circuit Breaker **(CB1)** tripped (reset 70A circuit breaker) 3. Control Board Circuit Breaker **(CB2)** tripped (reset circuit breaker) 4. Emergency Stop Knob **(7)** tripped (pull out and twist) 5. Safety Switch **(S2)** in seat not closed (check seat switch) 6. Defective Wheel Drive Motor (replace motor) 7. Defective Throttle Potentiometer **(R1)** (replace)
The wheel drive motor will *only* run in either forward or reverse.	1. Test the Fwd & Rev **(R1)** wiring outputs (pins 3, 4 & 13) at the speed control for an open. Repair wiring or replace the R1 pot. 2. Controller can't change electrical polarity to wheel motor - replace the **(A2)** speed control.

Replacing the Drive Wheel Assembly

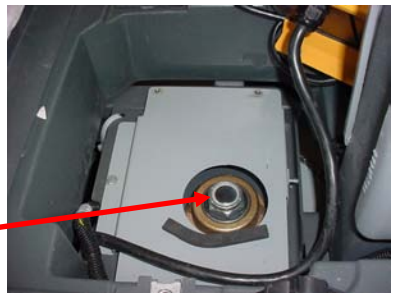
⚠ WARNING!

Park the machine on a dry flat surface, turn the main key switch (J) to the Off position and disconnect the battery pack at the red Anderson connectors inside the battery compartment.

1. Block the rear wheels.
2. Jack up the front of the machine as shown in "Jacking Points" section or use a hoist to lift up the front end of the machine.
3. Using a 17mm socket, loosen but don't remove the four bolts at the steering sprocket to allow the chain to release some.

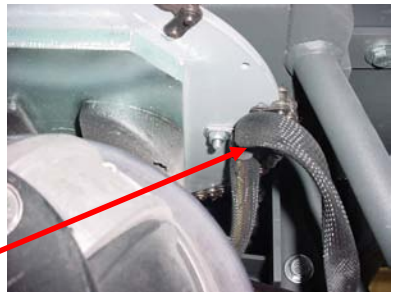


4. Using a 3/8" magnetic socket, remove the four bolts holding the charger in place, and move the charger over to the side.
5. Using a 1 7/16" socket, remove the hex nut at the top of the Spindle Weldment.



6. Turn the Drive Wheel to the right and remove the motor wiring cover.
7. Using a 13mm and a 7mm socket, remove the nuts and wires from the drive motor.

8. Turn the motor towards the left. Using a 7/16" socket and wrench, remove the P-clamp.
9. Jack up the front end of the machine enough to allow the wheel to slip free from the machine.
10. Using a 17mm socket, remove the four bolts at the top to free the motor from the Steering Plate.



Replacing the Drive Wheel Assembly - Cont'd

11. Reassemble the drive wheel in reverse order, attaching the motor wires as shown.

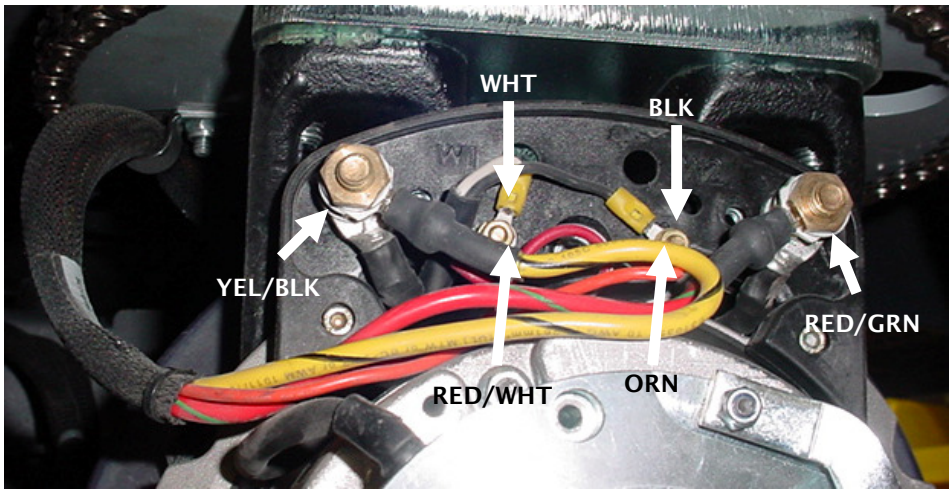
⚠ CAUTION!

Use a Torque Wrench set at 20 ft-lb to retighten the 1 1/2" hex nut at the top of the steering spindle.

NOTE:

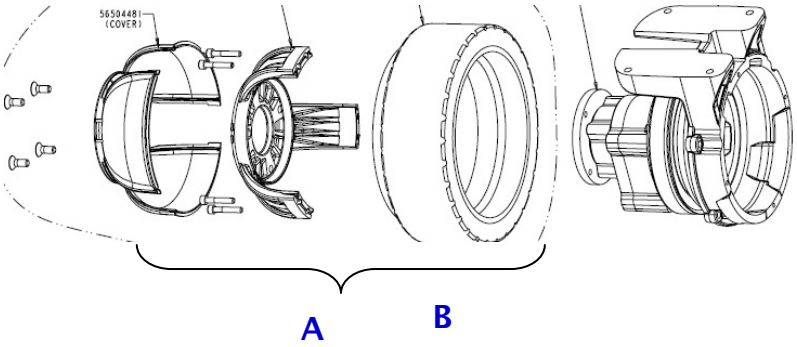
Orient the wires in such a way as to minimize bending at the crimps for optimum motor performance.

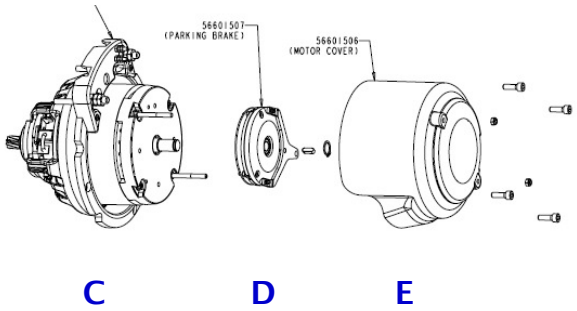
There are (2) each YEL/BLK and RED/GRN going to each post.



Replacing the Drive Tire

The Drive Wheel is assembled as shown:





In addition to carbon brushes, parts available for replacement are:

- tire with hub 56601472 (**A**)
- tire 56601471 (**B**)
- motor 56601473 (**C**)
- parking brake 56601507 (**D**)
- motor cover 56601506 (**E**).

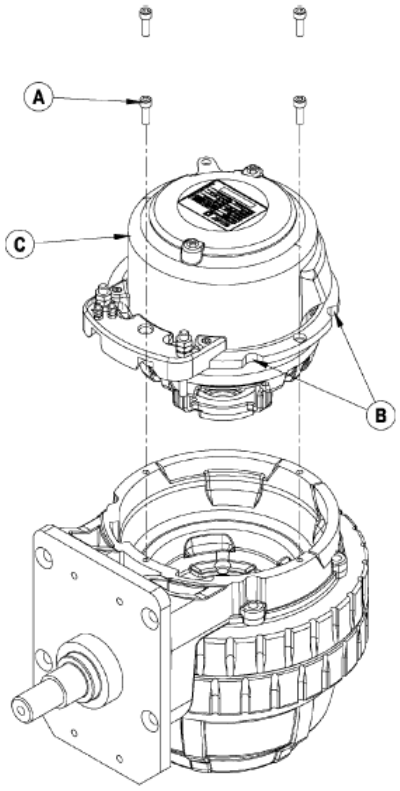
1. To replace the tire, follow steps 1-3 of "Replacing the Drive Wheel Assembly."
2. Remove the six metric socket head screws.
3. Use Tire Puller Kit 56422174 to replace the tire.
4. Reassemble in reverse order.

Inspecting/Replacing the Drive Wheel Assembly Carbon Brushes

IMPORTANT:

To remove/replace/inspect the Carbon Brushes, observe the following:

1. **The motor must come off of the machine.**
2. **The motor assembly must be kept vertical while being disassembled to prevent loss of gear oil.**



⚠ WARNING!

Park the machine on a dry flat surface, turn the main key switch (J) to the Off position and disconnect the battery pack at the red Anderson connectors inside the battery compartment.

1. Follow the instructions in "Replacing the Drive Wheel Assembly".
2. **Place the motor assembly upright, motor side up, as shown**.

⚠ CAUTION!

To prevent gear oil from draining from the gearbox, disassemble the motor with the Drive Wheel assembly in a vertical position. If some oil is lost, drain completely and refill the oil as indicated at the bottom of the page.

3. Remove the four metric socket head cap screws securing the electric motor to the casting.
4. Use a hard piece of wood or a brass drift punch to tap the motor mounting flange (3 notched locations) to loosen.
5. Grip the motor/brake end bell and pull the motor up and out of its housing.
6. Inspect the 4 carbon brushes and springs. A new carbon brush measures 3/4". If less than 1/4", replace.
7. Clean the foam filters, and blow out the motor.
8. If gear oil has been lost, drain and replace with 4.5856 oz (130 g) of **Mobilgear 600 XP 150** or **AGIP BLASIA 150** gear oil.

BRAD - wrong tire but same as Advolution 2710 drive wheel

Replacing the Rear Wheels

⚠ WARNING!

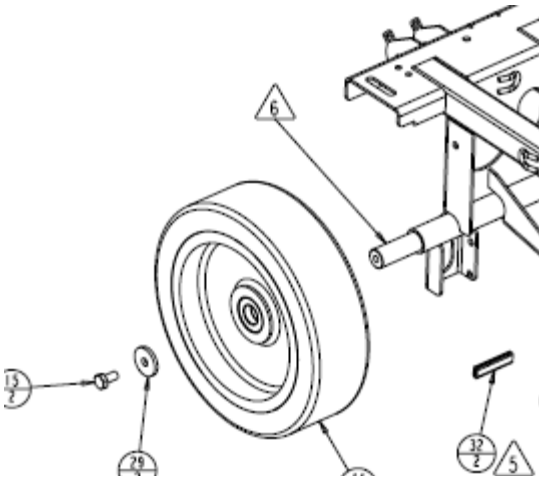
Park the machine on a dry flat surface, turn the main key switch Off and disconnect the battery pack at the red Anderson connectors in the battery compartment.

Block the front Drive Wheel (**4**).

Jack the Rear Wheel (**9**) to be replaced per the instructions at the front of this manual in “Jacking Points” section.

To prevent injury, if the rear wheel bearing has frozen, replace the bottle jack with blocks or a jack stand before pounding the wheel.

1. Use a 17mm socket to remove bolt, washer and wheel.
2. If the bearing has seized, pound off the wheel and use a bearing puller to remove the inner race from the axle.
3. **Apply anti-seize** to the inner bearing surface of the new wheel; then replace wheel on axle.
4. **Apply anti-seize** to the bolt threads before refastening bolt, washer and wheel.



ELECTRICAL SYSTEM

Access to Panel: Chemical Pump, Charger Interlock, Fuses, Contactors, Speed Control

⚠ WARNING!

1. Open the battery compartment and disengage the red Anderson battery connectors.
2. Remove the 3 (AXP - 4) screws fastening the electrical panel to the front of the machine.
3. Inside are found the following:

- Curtis speed control with Drive Wheel motor and logic connections
- K1 and K2 contactors
- Fuses - as shown with onboard charger green interlock wire connected. If no charger, red wire shown would be connected there instead.
- Chemical pump (below fuses)

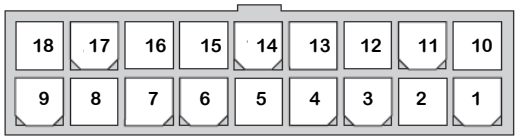
Throttle Potentiometer Wiper Measurement (Neutral Position)

Use a DVM and extended insulated probe tips (shown) to measure the throttle potentiometer Neutral voltage at the wiper (pin 4, the GRA wire) **referenced to the B- standoff (green wires).**

⚠ WARNING!

Open the Electrical Access Panel carefully per step 2 above.

Batteries must be connected to perform this measurement so extreme caution should be observed.



⚠ CAUTION!

Use only insulated test probes designed to backprobe. SPEED CONTROL IS POWERED during these tests.

Referenced to the negative battery standoff, the wiper voltage should read:

Neutral: 2 - 3V

Reverse: < 2V (engage pedal in reverse to measure)

Forward: > 3V (engage pedal forward to measure)

Pin	Function	Wire Color
3	5kOhm Pot High	YEL
4	5kOhm Pot Wiper	GRA
5	Seat Switch	GRA/BLK
6	Brake -	RED/WHT
9	Error Status	ORN/BLU
13	5kOhm Pot Low	VIO
14	Brake +	ORN
16	Reverse Alarm	BLU/BLK
18	Speed Limit	BLK/WHT

CONTROL BOARD J1, J2, AND J3 PIN OUTS AND TEST POINTS

⚠ CAUTION!

Always take measurements at the end connectors for troubleshooting purposes. If readings taken there do not indicate the problem, check the control board as a last resort as damage to the board may occur (see Caution statements in "Replacing Operator Control Panel" section).

Use a DVM and extended insulated probe tips (shown) to take the following measurements.

⚠ CAUTION!

Use only insulated test probes designed to backprobe. CONTROL BOARD IS POWERED during these tests.

Perform steps 2 and 3 of "Replacing Operator Control Panel" section, **observing noted Caution statements.**

J1 - Advenger only - Brush deck lift actuator, squeegee lift actuator, chemical pump

To backprobe J1 for voltages, leave J1 connected to the control board.

Referenced to	Measure	J1				Measure	Referenced to
B+	+24V to M4 for 3 sec. deck downward travel 0V to M4 for 3 sec. deck upward travel	ORN/BLK	5	10	WHT/GRN	0V to M3 for 3 sec. squeegee down travel 24V to M3 for 3 sec. squeegee up travel	B+
B+	0V to M4 for 3 sec. deck downward travel +24V to M4 for 3 sec. deck upward travel	BLU	4	9	BLK/YEL	24V to M3 for 3 sec. squeegee down travel 0V to M3 for 3 sec. squeegee up travel	B+
B+	Not measurable using DVM	BLU/GRY	3	8	BLK	B-	
			2	7			
B-	Not measurable using DVM	RED/YEL	1	6			
Range of 24V measurements is 20 – 26 V							

Backprobe J2 - Speed Control outputs, ST deck and squeegee lever position, and sense wires, J2 connected at control board:

Referenced to	Measure	J2				Measure	Referenced to
B-	n/a	YEL	6	12	BLK/YEL	ST squeegee lever switch S6 Closed sq down 0V Open sq up 5V	B-
B-	n/a	VIO	5	11	ORN/RED	ST deck lever switch S5 Closed deck up 0V Open deck down 5V	B-
B-	n/a	BLK/WHT	4	10	YEL/VIO	M7 & M8 sense monitor brush heights for deck actuator feedback 0-200 mV	B-
			3	9	BRN/RED	M5 & M6 sense monitor vac motors to determine when tank is full 1-200 mV	B-
B+	Advenger B- (ground) input to board +24V	Advenger BLK	2	8	BLK	+24V	B+
B+	B- (ground) Input to board +24V	BLK	1	7	BLK	Advenger +24V	B+

Backprobe J3 - Output to Contactors, Solution Solenoid, Horn; Speed Control error status, EM Brake, reverse status, J3 connected at control board :

Referenced to	Measure	J3				Measure	Referenced to
B-	+24V flashed speed control status error code	ORN/BLU	7	14	BRN	Key switch +24V	B-
B-	Speed control EM brake signal +24V (moving on / neutral off)	RED/WHT	6	13	WHT/RED *	+24V for 2 sec to K2 then 18V pulsed voltage	B+
B-	Speed control reverse direction +24V (reverse off / forward on)	BLU/BLK	5	12	GRA/BLK **	+24V for 2 sec to K1 then 18V pulsed voltage	B+
B-	Seat switch +24V	GRA/BLK	4	11	VIO/BLK ***	Pulsed +24V	B+
			3	10	ORN/RED	-Output to horn +15V	B-
B+	Advenger Ground +24V	BLK	2	9	GRN/BLK	+Output to horn +15V	B-
B-	Advenger Power +24V	BRN/YEL	1	8	BRN/YEL		

* test point for brush motor contactor coil control error 63
** test point for vacuum contactor coil control error 64
*** test point for solution solenoid control error 62

Curtis Speed Control Installation Checkout Procedure

After installing a controller and before operating the vehicle, carefully complete the following checkout procedure. If you find a problem during checkout, refer to the Curtis programmer manual for more information.

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

⚠ WARNING!

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

Turn the key switch off and make sure that the seat switch is open, and the throttle (pedal) is in neutral.

Do not stand, or allow anyone else to stand, directly in front of or behind the vehicle during the tests.

Remove the electrical panel to access the controller.

1. Observe the error status fault indicator on the operator control panel. If a programmer is available, connect it to the programmer plug-in port
2. Sit on the seat and turn the key switch on. The programmer should "power up" with an initial display. If neither happens, check for continuity in the key switch circuit and controller ground.
3. If you are using a programmer, put it into diagnostic mode by pressing the DIAGNOSTICS key.

- If there is no error detected, the display should indicate "No Faults Found". Note: Before pressing the diagnostics key, wait until model # screen appears, if the throttle is activated prior to this screen appearing the controller will shut down.
- If there is a problem, the control panel will flash a diagnostic code and the programmer will display a diagnostic message. If you are conducting the checkout without a programmer, refer to the Status LED Fault Codes table in "Speed Control Error Flash Codes" to diagnose the cause.

4. When the problem has been corrected, it may be necessary to cycle the key or seat switch to clear the fault code.
5. While sitting on the seat, operate the throttle. The motor should begin to turn in the selected direction. If it does not, verify the wiring to the controller, and the motor. The motor should run proportionally faster with increasing throttle. If not, refer to the Curtis manual.
6. Put the programmer into test mode by pressing the TEST key. Scroll down to observe the status of the forward, reverse and brake switch. Cycle each switch in turn, observing the programmer. Each input should show the correct state on the programmer.
7. Take the vehicle off the blocks and drive it in an open area. It should have smooth acceleration and good top speed.

Replacing the Operator Control Panel

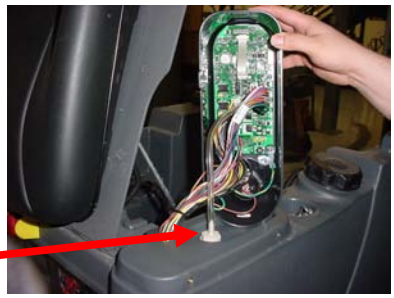
⚠ WARNING!

1. Open the battery compartment and disengage the red Anderson battery connectors.
2. Remove the four screws attaching the control panel assembly to the tank.
3. **IMPORTANT - Advenger - Completely drain the solution tank** to prevent:
   a. water squirting out of the fitting at the control board when the hose is removed
   b. erroneous pressure reading due to a loss of pressure differential in Pressure Sensing Tube after the new control board is installed.

4. **Advenger** - Remove the clear hose from the white barbed fitting.

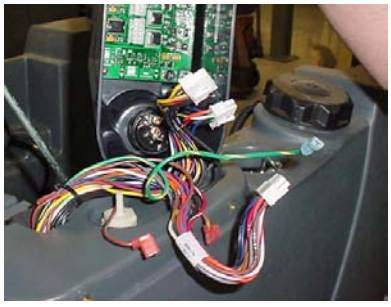
⚠ CAUTION!

Do not remove the hose at the board end as this is connected to the pressure sensor and may damage the sensor and board.



5. Disconnect the seat switch (red wires), connectors J2 and J3 (**on AXP** - also J1 and green ground wire) from the board.
6. When reconnecting a new control panel assembly, follow the instructions supplied with the part.

   NOTE: the clear hose must not be kinked otherwise the Solution System will not function properly.

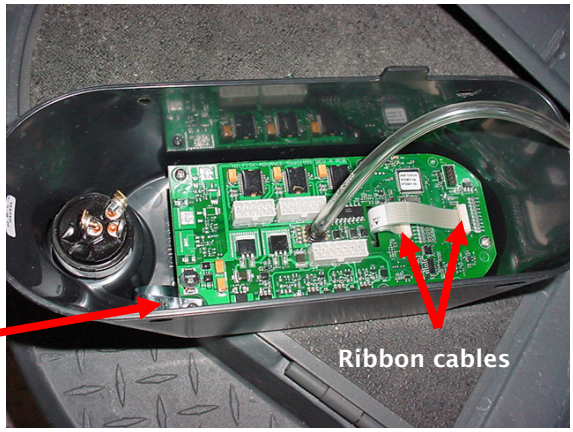


⚠ CAUTION!

To prevent damage to the new control panel assembly due to static electricity (ESD), wear a properly grounded static control wrist strap before removing the new assembly from its protective static shielding bag and throughout the entirety of the installation process until the four screws attaching the assembly to the machine have been re-fastened.

⚠ CAUTION!

The ribbon cable(s) and membrane switch grounding film are fragile - do not scratch or crease during assembly or they may be damaged.

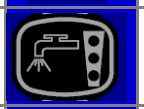


PROGRAMMING FUNCTIONS

Service Test Mode

The purpose of Service Test Mode is to by-pass the lock-out function of the normal control system of components that are in an error state and allow those components to be manually turned on and off for troubleshooting purposes. (Components in an overload error state will still be locked out for safety reasons.)

Advenger - Service Test Mode is accessed via the Hidden Menus. To enter, turn the key switch Off, then press and hold the Scrub and Vacuum switches together. Turn key switch back On and hold the switches for 2 seconds until the Solution and Scrub indicators both turn on. Release both switches - the display will now read "Programming Options." Scroll through the menus using the Solution + or - switches and enter program 16 for Service Test Mode.

Advenger Desired Action	Press Switch	Toggles	LCD Display Indication * ON/OFF
Raise/lower scrub deck lift actuator M4		OFF...DOWN...OFF...UP	DECK
Raise/lower squeegee lift actuator M3		OFF...DOWN...OFF...UP	SQG
Activate solution solenoid L1		ENERGIZED...DE-ENERGIZED	SOL
Activate vacuum motor contactor K1		ENERGIZED...DE-ENERGIZED	VAC
Activate AXP pump M2		ON...OFF	CPUMP
Activate brush motor contactor K2		ENERGIZED...DE-ENERGIZED	BRUSH

* LCD also displays SPD speed control ON/OFF, actual battery voltage measured, and any error codes.

ST - To enter Service Test Mode, turn key switch Off, then press and hold the three buttons shown below simultaneously. Turn key switch back On and hold for 2 seconds until the red, yellow, and green LEDs turn On, then release the switches.

ST Desired Action	Press Switch	Toggles	LED Indication ON/OFF
Activate solution solenoid L1		ENERGIZED...DE-ENERGIZED	Solution Med
Activate brush motor contactor K2		ENERGIZED...DE-ENERGIZED	Solution High
Activate vacuum motor contactor K1		ENERGIZED...DE-ENERGIZED	Solution Low
Other Status Indicators	**Indication**		**LED**
Main control board	ST Service LED Blink Code		Fault Indicator
Speed Control	Speed Control Error Flash Code		Battery RED - Blinking
Drive pedal	Forward Reverse		Battery YELLOW - ON Battery GREEN - ON

Changing Control Board Program Settings

Although the Advenger and ST are delivered with a standard factory preset configuration, there will be times, such as when a control board is replaced, when battery type is changed, or a different size scrub deck is installed, when some parameters in the control system software will need to be changed. Most programmable functions are outlined below. For more details, call the Technical Service Department at Nilfisk-Advance.

IMPORTANT

For field control board replacements, critical settings are highlighted below in bold letters.

Advenger and ST settings that can be changed per the following tables are:

1. **Low Voltage Cutout** (Depth of Discharge) - 20.55V wet battery or 21.75V gel/AGM battery
2. **Scrub Deck size** - 28" or 34"
3. **Number of Vacuum Motors** installed (single or dual configuration - to prevent over current detection malfunction)
4. Maximum speed while scrubbing as a percentage of travel speed (50% - 90%)
5. Recovery Tank Full automatic shut-off disable/enable.
6. Restore factory defaults
7. Fault Recall of previous error codes to aid in troubleshooting.
8. Fault Detection over-ride - disable Fault Detection so systems aren't shut down while in error state (exception is over-load).
9. Solution Flow Rate lock-out

Advenger models allow these additional programming changes to be made via the Hidden Menu:

NOTE: Replacement control boards come with Evergreen OFF and AXP disabled.

10. **Chemical Selection** - Turn AXP Off or On with display indicating US or European (ratio or %) format.

11. **Detergent Mode** - . Turn on Mode 1 (machine factory preset for US market) to enable standard Evergreen mode in which pressing the Evergreen button enables preset ratio for 60 seconds. Turn on Mode 2 (factory preset for the EU market) to run at a preset ratio. In this mode, pressing the Evergreen button increments the ratio (solution concentration) to the next stronger level for 60 seconds.

NOTE: To run the machine in a constant user-defined ratio, turn the Detergent Mode to Off and set the chemical ratio by pressing and holding the AXP On/Off switch (**E**).

12. Brush Pressure lock-out - during normal operation, the pressure settings that are locked out will not be selectable.
13. Chemical rate bias - AXP control set to 10% more or less chemical than the user programmed ratio
14. Deck down time - time for which the control system applies 24V to the deck actuator to raise or lower the scrub deck after the Scrub On switch is pressed (adjustable from 1 to 5 seconds).
15. Backup Alarm volume
16. Horn volume

Changing Program Settings - Advenger

1. To enter this Hidden Menu, turn the key switch Off, then press and hold the Scrub and Vacuum switches together.
2. Turn key switch back On and hold the switches for 2 seconds until the Solution and Scrub indicators both turn on.
3. Release both switches - the display will now read “Programming Options.” Scroll through the menus using the Solution + or - switches and enter the program number corresponding to the needed function.
4. To enter a submenu, press the Solution switch.
5. To save and go back to the main menu, press the Scrub switch.

Prog.	Function	Option 1	Option 2	Option 3	Option 4, etc.
1	DECK TYPE	28” disc / BR 755	28” Cyl / BR 755 C	34” disc / BR 855	--
2	CHEMICAL SELECTION	AXP On US mode: X:XXX	AXP On EU mode: %	AXP Off	
3	DETERGENT MODE	Off no Evergreen (board default)	Mode 1 US Evergreen On	Mode 2 EU or non-Evergreen preset	
4	VACUUM SELECTION	1 (single)	2 (dual)	--	
5	LOW VOLTAGE CUTOUT	Wet battery 80%	Gel/AGM Battery 70%	--	
6	MAXIMUM SCRUB SPEED	100%	90%	80%	...50%
7	LOCK OUT BRUSH PRES (displayed pressure is locked out)	Low	Med	High	Low & Medium, Low & High, High & Medium
8	LOCK OUT SOLUTION (displayed rate is locked out)	Low	Med	High	Low & Medium, Low & High, High & Medium
9	RECOVERY TANK FULL (automatic shutoff turned on)	ENABLED	DISABLED	--	--
10	CHEMICAL RATE BIAS	NONE (equal)	+10% MORE CHEM	-10% LESS CHEM	--
11	DECK DOWN TIME	Incremental from 1 to 5 seconds in 0.1 second intervals			
12	RESTORE FACTORY DEFAULTS	NO	YES	--	--
14	FAULT RECALL	No faults occurred - display is “-”	Error codes	To erase history, press the Solution switch while in this mode.	
15	FAULT DETECTION	ENABLED	DISABLED		
17	BACKUP ALARM VOL	Off	Low	Med	High
18	FWR ALARM VOL	Off	Low	Med	High
19	HORN VOL	Off	Low	Med	High

Changing Program Settings - ST

(1) To enter this Hidden Menu, turn key switch Off, then press and hold the buttons shown in the table below simultaneously.

(2) Turn key switch back On and hold for 2 seconds until the indicated LEDs for the desired function turn On, then release the switches.

(3) Use the Solution + or - switches to change the setting. The fault code LED will blink at the same rate as the fault code display to show what the current setting is.

Press the Solution On/Off switch to save the setting, then turn key switch Off.

(1) SWITCHES PRESSED					(2) INITIAL LED INDICATION						(3) BLINKS	
FUNCTION					LOW Solution	MED Solution	HIGH Solution	RED	YEL	GRN	✹	✹✹
Low Voltage Cutout	●			●			●				Wet	Gel/ AGM
Scrub Deck Size			●	●	●						28”	34”
Single/Dual Vac Motor		●		●		●					S	D
Max Scrub Speed % of Transport Speed		●	●			●	●				50%	60% *
Recovery Tank Full Shutoff	●	●						●			En-abled	Dis-abled
Restore Factory Defaults		●	●	●					●		No	Yes
Fault Recall	●		●	●						●		
Fault Detection	●	●		●				●	●		En-abled	Dis-abled
Solution Flow Rate Lockout	●		●		●	●	●				None	Low **

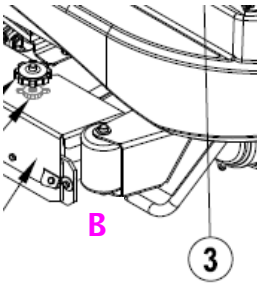
* 70% - 100% are 3 to 6 blinks respectively.

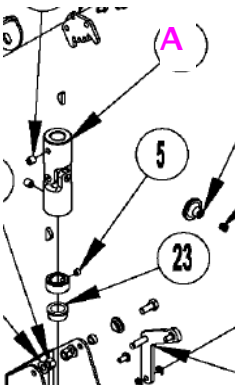
** Medium, High, Low & Medium, Low & High, Medium & High are 3 to 7 blinks respectively.

MAINTENANCE SCHEDULES

OPERATOR PREVENTIVE MAINTENANCE – MACHINE IN USE

MAINTENANCE ITEM	Daily	Weekly	Monthly
Charge Batteries	•		
Check/Clean Tanks & Hoses	•		
Check/Clean/Adjust Squeegee	•		
Check/Clean/Rotate Brushes/Pads	•		
Empty/Clean Strainer Basket in Recovery Tank	•		
Check/Clean Vacuum Shut-Off Float	•		
Check/Clean vacuum motor foam filter(s)	•		
Clean Hopper on Cylindrical System	•		
Charge Batteries – full charge cycle 12-15 hrs		•	
Check Each Battery Cell's Water Level (wet batteries)		•	
Check/Clean/Adjust Scrub Deck Side Skirts		•	
Check/Clean Solution Filter		•	
Clean Solution Trough on Cylindrical System		•	
Purge Detergent System (AXP Only)		•	
Lubricate Steering Chain			•
Lubricate Pivot Points for Squeegee & Scrub Deck Linkage			•
Lubricate Side Skirt Adjustment Knobs **(19)**			•
Lubricate Steering Wheel Shaft Universal Joint **(A)**			•
Lubricate Front Roller Bumper **(B)**			•
Lubricate Squeegee Tilt Adjustment Knob **(32)**			•
(ST) Check for Squeegee Cable Bushing wear inside Steering Column. Wear indicates need for replacement and cable adjustment (too tight)			•





OPERATOR PREVENTIVE MAINTENANCE – MACHINE IN STORAGE

MAINTENANCE ITEM	Daily	Weekly	Monthly	Yearly
Check Each Battery Cell's Water Level (wet)			•	
Charge Batteries – full charge cycle 12-15 hrs			•	

SERVICE TECHNICIAN SUGGESTED MAINTENANCE

MAINTENANCE ITEM	Quarterly	Yearly
Clean battery tops and posts with baking soda solution	•	
Inspect battery connections for tight, corrosion-free fit	•	
Perform hydrometer battery check (wet batteries) to identify bad cells	•	
Perform voltmeter check of individual batteries (gel/AGM) to identify bad cells	•	
Perform battery load test to identify degraded batteries resulting in poor run time	•	
Inspect vacuum motor carbon brushes for wear (Replace if 9.5mm (3/8 inches) or shorter)		300 Op Hrs
Inspect brush motor carbon brushes (Replace if 9.5mm (3/8 inches) or shorter)		500 Op Hrs
While brush motor being checked, also check for wear at Motor Gimbal inside Brush Plate. Remove and replace if worn.		500 Op Hrs
Inspect drive motor carbon brushes (Original carbon brush length is 19.1mm (3/4 inches). Replace when shorter than 6.3 mm (1/4 inches) to obtain the same motor efficiency as a new brush.)		500 Op Hrs

Recommended Maintenance Materials

Typical adhesives and lubricants used on Advenger include Loctite(R) Silver Grade Anti-Seize, Loctite formulas 242, 680, 414, 409, and No More Leaks(TM) 80724 sealant; Uniroyal M6325 Adhesive, CRC White Lithium Grease, Sprayon S00206 All-Purpose Silicone Lube, light machine oil such as 10W-30 motor oil, Mobil SHC 634 lube and Mobilgear 600 XP 150 (EU: AGIP BLASIA 150) gear case oil.

To clean wet batteries, baking soda will also be needed.

Advance Advenger 2805, 2905, 3405
Advance 2800ST, 3400ST
Nilfisk BR 755, 855
Disc and Cylindrical
PM Checklist

PM Checklist

Customer _____

Address _____

City _____ St _____ Zip _____

Model _____ Serial _____ Hours _____

Defect Codes

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

Ref	OPERATIONAL INSPECTION ITEMS	OK or N/A	Defect Codes (circle)	Does Not Work
1	Steering		A B	
2	Drive Pedal Operational (check for Fwd/Rev Drive & any neutral creep)		A B D	
3	Seat Switch		D	
4	Electrical Parking Brake (Brake releases when the key is turned on and the drive pedal is engaged. Brake engages when machine is at rest.)		A B W	
5	Drive System Performance (refer to Curtis Programmer Manual SM56043101 for speed control changes)		Noisy Sluggish	
6	Scrub System (Raise, Lower, auto scrubbing functions)		A B	
7	Scrub Brush (pressure settings Normal/Heavy/Extreme scrub for Adven-ger; Normal/Extreme for ST)		A B	
8	Squeegee System (Raise, Lower, ADVENGER - Auto-raise in reverse)		A B D	
9a	Vacuum Performance Single Motor (sealed water lift 63", 1-inch open hole aperture 10")		C L W	
9b	Vacuum Performance Dual Motor (sealed water lift) (sealed water lift 65", 1-inch open hole aperture 18")		C L W	
10	Solution Control (On/Off, Increase & Decrease for Normal/Heavy/Extreme)		A B L	
11	Emergency Stop Knob		B D	
12	Tilt Steering Mechanism and Seat		A B D	
13	Optional Accessories		D	
14	Main Control Board Special Program Options and Fault Recall Mode– check all applicable program settings per Changing Program Settings section and examine stored fault codes.			
15	Battery Charger Programmed Correctly for Battery		A	
16	Battery Charger Operation		D	

Ref	VISUAL INSPECTION ITEMS	Comments	OK or N/A	Defect Codes (circle)	Does Not Work
17	Scrub Brushes (check for wear and rotate)			A B D W	
18	Scrub Brush Motor Carbon Brushes	Wear Limit 3/8"		B L W	
19	Scrub Brush Motor Gimbals	In Brush Plates		W	
20	Auto Tension Belt – Wear and Tension (cylindrical)			A D W	
21	Spring Retainers	On Brush Plates		D	
22	Scrub Deck Skirt Position	Slight Flare		A B W	
23	Solution Solenoid Valve			C L	
24	Solution Tank, Delivery Hoses & Filter	Clean Filter Screen		C L	
25	Vacuum Motor Carbon Brushes	Wear Limit 3/8"		W	
26	Vacuum Motor Gaskets & Filters			L W	
27	Vacuum Float Ball & Cage Assembly	Clean Float		C M	
28	Recovery Lid Gasket			C D L	
29	Recovery Tank Drain Hose & Cap	Flush		C L	
30	Recovery Tank Strainer Basket	Clean		C D	
31	Squeegee Pick-Up Tool and Hose	Back Flush		C L	
32	Squeegee Blades (clean & rotate)			A C D W	
33	Squeegee Lift Actuator Motor (Advenger) & Cable			A B D	
34	(ST) Squeegee Lift Cable Plastic Bushing in Steering Column	Cable too tight if Worn		W	
35	Battery Condition (clean & water)	Load Test		C W	
36	Front Drive Wheel Motor Carbon Brushes	Wear Limit 1/4"		C W	
37	Drive Pedal Linkage Neutral Return			A C	
38	Steering Chain Lube & Tension	1/4" Deflection		A B C	
39	Steering Column Universal Joint			A D	
40	Rear Wheels			C	
41	Sweep Hopper			C	

WORK COMPLETED BY:

ACKNOWLDEGED BY:

_____ _____

Service Technician Signature Date

_____ _____

Customer Signature Date

INDEX