



Electronic Service Manuals

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Warrior ST, Warrior AXP, Warrior EcoFlex



Service Manual

Nilfisk-Advance Warrior™ ST, Warrior™ AXP, Warrior™ EcoFlex™ model number:
56315040 (X28D-C), 56315041(X32D-C), 56315541(X28C-C), 56315542(X32C-C),
56307250(X28D-C), 56315786 (32D-C), 56315036 (28D), 56307250(X28D-C), 56315037(32D),
56315038(28C) 56315538(28D-C), 56315539(32D-C), 56315540(28C-C) 56315039(32C-C),
56381014(X28D-C), 56381015 (X32D-C), 56381023(X32D-C), 56381024(X28C-C),
56381028(X32C-C), 56381017 WARRIOR X32D-C W/STRAINER, 56315584 WARRIOR 32D-C
WAL-MART, 56381023 (X32D-C W/STRAINER)



English

Contents

General Information	.6
Service Manual Purpose and Application	.6
Revision History	.6
Other Reference Manuals	.6
Conventions	.7
Transporting the Machine	.7
Cautions and Warnings	.7
<i>Symbols</i>	.7
<i>General Safety Instructions</i>	.8
Nameplate	.9
Know Your Machine — Major components:	.9
Specifications	10
Maintenance Schedule	12
<i>Lubricating the Machine</i>	12
Chassis System	14
Functional Description	14
Front Nose Removal	14
Control System	15
Functional Description	15
<i>Control Panel</i>	15
<i>Control Panel Indicators</i>	16
<i>Scrub Mode Indicators</i>	18
<i>Battery Indicator</i>	18
<i>Warrior Controller</i>	18
Main Control Board Programming	19
<i>Displaying the Control Board Revision Level</i>	20
<i>Recall of Stored Error Codes</i>	20
<i>Selecting Machine Type (EcoFlex version only)</i>	21
<i>Turning Fault Detection On or Off:</i>	21
<i>Low-voltage Cutout Threshold</i>	22
<i>Scrub Deck Type</i>	22
<i>Chemical Option</i>	23
<i>Extended Scrub Option</i>	23
<i>Scrub Deck Down Time Period Adjustment</i>	24
<i>Scrub Deck Pressure, Solution Flow Rate, and Chemical Flow Rate Adjustments</i>	24
<i>Restoring the Scrub Pressures to Factory Default Settings</i>	25
<i>Regular Scrub Setting Adjustment</i>	26
<i>Heavy Scrub Setting Adjustment:</i>	27
<i>Extreme Scrub Setting Adjustment</i>	28
<i>Recovery Tank-Full Switch Orientation</i>	29
<i>LCD Style Selection (Warrior AXP)</i>	29
<i>Monitor Mode (Warrior AXP/EcoFlex)</i>	30
<i>Chemical User Ratio Selection (Warrior AXP/EcoFlex)</i>	30
Troubleshooting Guide	31
<i>Main Controller Error Codes</i>	31
<i>Service Test Mode</i>	33

<i>Test Mode Input Indicators</i>	33
<i>Battery Voltage (AXP/Ecoflex Models)</i>	33
<i>Speed Controller Status</i>	33
<i>Forward/Reverse Status</i>	33
<i>Reverse Status.</i>	33
<i>Test Mode Output Controls</i>	34
<i>Description of Output Controls</i>	34
<i>Sample Voltage Measurements</i>	37
Electrical System	39
Functional Description	39
<i>Description Of The Low-Voltage Cutout Feature</i>	39
<i>Description Of The Battery Condition Indicators</i>	39
Maintenance and Adjustments	40
<i>Charging Batteries.</i>	40
<i>Extending Battery Life.</i>	40
Troubleshooting	41
<i>Battery Testing.</i>	41
Removal and Installation.	41
<i>Batteries</i>	41
Specifications	42
<i>Wet Cell Battery specifications:</i>	42
<i>Wet Cell Battery Charger Specifications</i>	42
Wiring Diagram	43
Options and Accessories	44
Recovery System	45
Functional Description	45
<i>Vacuum Motor and Recovery Tank.</i>	45
<i>Float Switches</i>	46
<i>Vacuum Motor Control Circuit Overview</i>	47
<i>Troubleshooting</i>	48
.	48
Removal and Installation.	49
<i>Vacuum Motor.</i>	49
<i>Float Switches</i>	50
Specifications	50
.	50
Scrub System, Cylindrical	51
Functional Description	51
<i>Brush Motors</i>	51
<i>Brush Lift Actuator</i>	52
<i>Circuit Overview</i>	52
Maintenance and Adjustment.	53
<i>Lift Actuator Limit Adjustment</i>	53
Removal and Installation.	55
<i>Scrub Deck</i>	55
<i>Lift Actuator</i>	56

<i>Brush Motor Contactor</i>	57
<i>Scrub Brush Motor</i>	58
Special Tools	58
Scrub System, Disc	59
Functional Description	59
<i>Brush Motors</i>	59
<i>Brush Lift Actuator</i>	60
<i>Circuit Overview</i>	60
Maintenance and Adjustment.	61
<i>Lift Actuator Limit Adjustment</i>	61
Removal and Installation.	63
<i>Scrub Deck</i>	63
<i>Lift Actuator</i>	64
<i>Brush Motor Contactor</i>	65
<i>Scrub Brush Motor</i>	66
Special Tools	66
Solution System.	67
Functional Description	67
<i>Non-detergent Models</i>	67
<i>Detergent Models</i>	67
<i>Extended Scrub Models</i>	68
<i>Circuit Overview</i>	69
<i>Solenoid Valve Circuit.</i>	69
<i>Solution Pump Circuit.</i>	69
<i>Detergent (Chemical) Pump</i>	69
<i>Solution System Schematic.</i>	70
Troubleshooting	71
Removal and Installation.	72
<i>Solution Pump</i>	72
Squeegee System	73
Functional Description	73
<i>Squeegee.</i>	73
<i>Squeegee Lift/Pivot</i>	73
Maintenance and Adjustment.	74
<i>Squeegee Blade Cleaning and Inspection</i>	74
<i>Squeegee Trim Adjustment</i>	74
<i>Squeegee Lift Adjustment.</i>	75
Removal and Installation.	75
<i>Rear Squeegee Blade Reversal or Replacement</i>	75
<i>Front Squeegee Blade Reversal or Replacement</i>	76
Wheel System, Non-Traction	77
Functional Description	77
Removal and Installation.	77
Wheel System, Traction	78
Functional Description	78
<i>Throttle Position Potentiometer</i>	78
<i>Speed Limiting Potentiometer</i>	78

Drive Motor System Function	79
Speed Control Potentiometer Function	80
Speed Controller J10 Pinout Functions	80
Troubleshooting	81
.	81
Drive Controller (Curtis 1228).	81
Throttle Potentiometer Testing and Adjustment	83
Removal and Installation.	84
Throttle Potentiometer	84
Drive Controller	86
Follow-up Testing	87
Wheels	88
Drive Motor and Transaxle	89
Special Tools	91
Curtis 1311 Programmer	91

General Information

Service Manual Purpose and Application

This Service Manual is a resource for professional service technicians. It provides information for understanding how the machine operates, where components are located, basic troubleshooting, maintenance and mechanical service operations.

This manual covers the Nilfisk-Advance models Warrior™ ST, Warrior™ AXP, and Warrior™ EcoFlex™. The cover page of this manual lists each machine part number that the manual applies to. Compare the model number of the machine you are working on to the model numbers listed on the cover page to be sure you are using the correct manual.

The Warrior machine has three primary machine feature levels. The easiest way to identify a machine for feature level is the decal on the side of the recovery tank. These decals are shown to the right. The basic machine is the Warrior ST. The two advanced feature machines are the AXP and EcoFlex models.



Revision History

- 6/2012
 - Correct extreme scrub amperage specification value for 28" Disc.
- 12/2013
 - Control System, Main Control Board Programming - Added information for selecting machine type.

Other Reference Manuals

The following documents contain parts information and instructions for machine operation:

- Instructions for Use Form # 56041972 applies to the following models: 56315036, 56307250(28D), 56315037(32D), 56315038(28C), 56315538(28D-C), 56315539(32D-C), 56315540(28C-C), 56315039(32C-C), 56381014(X28D-C), 56381015, 56381023(X32D-C), 56381024(X28C-C), 56381028(X32C-C).
- Parts List Form # 56042463 applies to the following models:
 - Standard Models: 56315036(28D), 56315037(32D), 56315038(28C), 56315039(32C-C), 56307250(28D-C), 56315538(28D-C), 56315539, 56315786(32D-C), 56315540(28C-C)
 - Obsolete AXP Models: 56315040(X28D-C), 56315041(X32D-C), 56315541(X28C-C), 56315542(X32C-C)
 - EcoFlex Models: 56381014(X28D-C), 56381015, 56381023(X32D-C), 56381024(X28C-C), 56381028(X32C-C)

SAVE THESE INSTRUCTIONS

Conventions

Forward, backward, front, rear, left or right are intended with reference to the operator's position, that is to say in operating position with the hands on the handlebar.

Transporting the Machine



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

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



Caution! If the machine must be towed or pushed, make sure the Master On/Off Key Switch (A) is in the OFF position and do not move the machine faster than a normal walking pace (2-3 mph, 3-5kph) and for short distances only. Note: Disconnecting the wheel drive motor wiring connector will make a disabled machine easier to push.

Cautions and Warnings

Symbols

It is important for you to read and understand this manual. The information it contains relates to protecting your safety and preventing problems. The symbols below are used to help you recognize this information.



Danger! Indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury.



Warning! Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



Caution! Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.

Caution! When used without the Safety Alert Symbol, indicates a potential situation which, if not avoided, could result in property or machine damage.

General Safety Instructions



Warning!

- This machine should be used only by properly trained and authorized persons.
- Never work under a machine without safety blocks or stands to support the machine.
- Keep sparks, flame and smoking materials away from batteries. Explosive gases are vented during normal operation.
- Charging the batteries produces highly explosive hydrogen gas. Charge batteries only in well-ventilated areas away from open flame. Do not smoke while charging the batteries.
- Remove all jewelry when working near electrical components.
- Do not dispense flammable cleaning agents, operate the machine on or near these agents, or operate in areas where flammable liquids exist.



Caution!:

- When operating this machine, ensure that third parties, particularly children, are not endangered.
- Turn the key switch off (O) and disconnect the batteries before servicing electrical components.
- Turn the key switch off (O) and remove the key, before changing the brushes, and before opening any access panels.
- This machine is not suitable for picking up hazardous dust.
- Do not use on surfaces having a gradient exceeding that marked on the machine.
- While on ramps or inclines, avoid sudden stops when loaded. Avoid abrupt sharp turns. Use low speed down hills. Clean only while ascending (driving up) the ramp.
- Before performing any service function, carefully read all instructions pertaining to that function.
- Do not leave the machine unattended without first turning the key switch off (O), removing the key and securing the machine.
- Take precautions to prevent hair, jewelry, or loose clothing from becoming caught in moving parts.
- Only use the brushes provided with the appliance or those specified in the instruction manual. The use of other brushes may impair safety.
- Refer to the battery charger OEM product manual for additional specific battery charger warnings.

Caution!:

- This machine is not approved for use on public paths or roads.
- Use care when using abrasive brushes, scarifier discs, or grinding stones. Advance will not be held responsible for any damage to floor surfaces.
- Turn the key switch off (O) and remove the key, before changing the brushes, and before opening any access panels.
- Use caution when moving this machine in below freezing temperature conditions. Any water in the solution, recovery or detergent tanks or in the hose lines could freeze, causing damage to valves and fittings. Flush with windshield washer fluid.
- The batteries must be removed from the machine before the machine is scrapped. The disposal of the batteries should be safely done in accordance with your local environmental regulations.
- Do not clean this machine with a pressure washer.
- All doors and covers are to be positioned as indicated in the instruction manual before using the machine.

General Machine Description

The Warrior machine is a battery-powered, walk-behind, self-propelled floor scrubber with either a disc or cylindrical scrub system. The Warrior ST is a configuration with a gravity-fed, pre-mix solution system. The Warrior AXP and EcoFlex machines utilize on-board chemical (detergent) injection of the solution. The Extended Scrub option (available only on AXP models) reduces the frequency of refilling the solution tank, by reusing a portion of the recovered solution from the floor surface.

Nameplate

The nameplate contains important identification information which will be needed when ordering parts: Model (Name), Part No. (Part number of the machine which is often referred to as the “Model Number”), and Serial Number.



Know Your Machine — Major components:

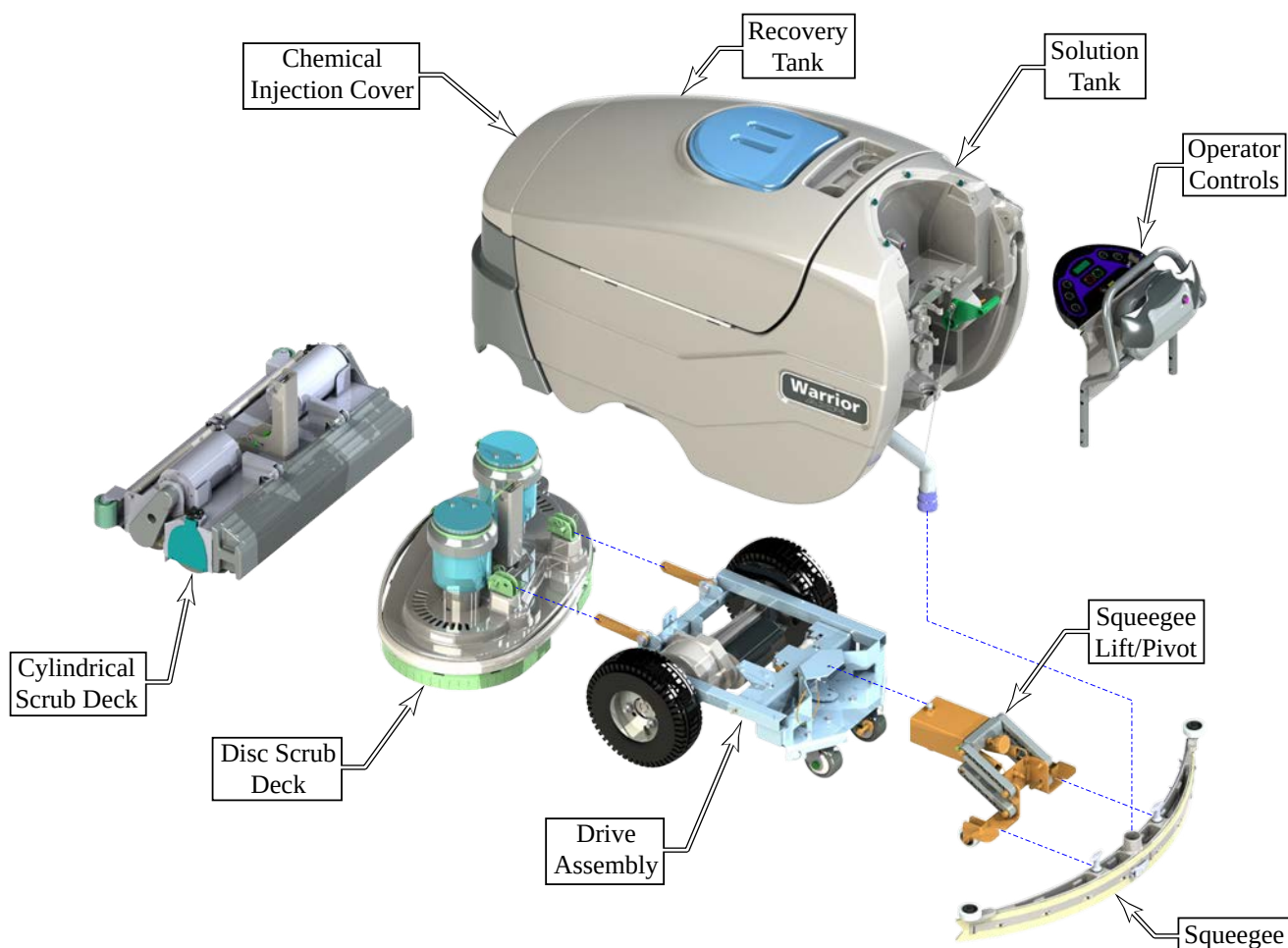


Warrior Disc model



Warrior Cylindrical Model

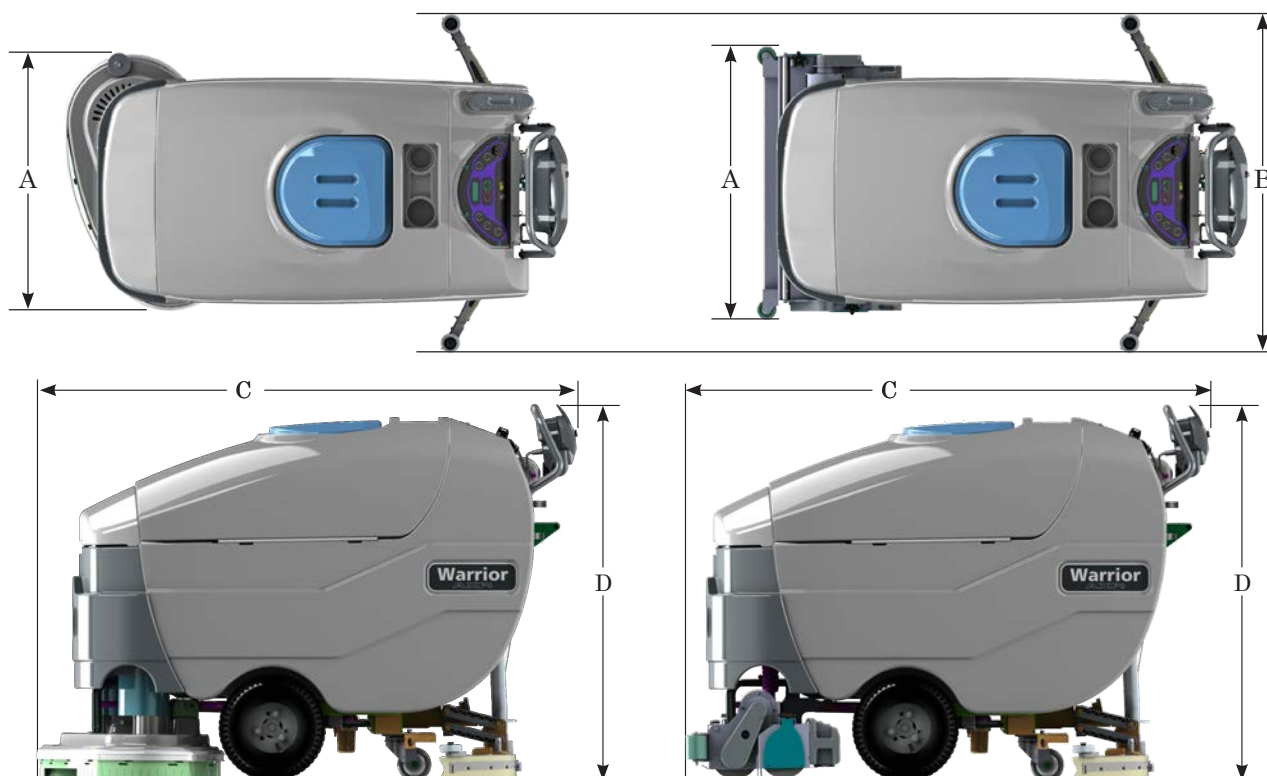
Know Your Machine — Major components:



Specifications

Specifications	
Voltage	36 Volt
Power Source	(6) 6 volt batteries (wet acid and gel cell available)
Optional Onboard Battery Charger	36 volt, 25 amp Wet/Gel Compatible
Solution Control	Precision-flow electric pump - EcoFlex system (Pulse-control gravity feed -Warrior ST)
Solution Tank	30 gal. (114 L)
Recovery Tank	30 gal. (114 L)
Scrub Motors	(2) .75 hp (560 watt)
Vacuum Motor	0.75 hp (560 watt) 3-stage
Sound Level	69 dB(A) with sound suppression kit or 71dB(A) standard
Drive System	0.5 hp (375 watt) variable forward and reverse, max speed = 3 mph (4.83 km/hr)
Drive Wheels	(2) 13 in. (33 cm) dia. foam-filled, black non-marking
Gradeability	16% transport, 5% scrubbing

Specifications (continued)				
	Warrior 28D	Warrior 32D	Warrior 28C	Warrior 32C
Scrub Head Type	Disc	Disc	Cylindrical	Cylindrical
Scrub Path	28 in (71cm)	32 in (81cm)	28 in (71cm)	32 in (81cm)
Max Productivity @ 3 mph	36,960 ft ² /hr (3,434 m ² /hr)	42,240 ft ² /hr (3,924 m ² /hr)	36,960 ft ² /hr (3,434 m ² /hr)	42,240 ft ² /hr (3,924 m ² /hr)
Max Productivity @ 1.5mph	18,480 ft ² /hr (1,717 m ² /hr)	21,120 ft ² /hr (1,962 m ² /hr)	18,480 ft ² /hr (1,717 m ² /hr)	21,120 ft ² /hr (1,962 m ² /hr)
Scrub Head Size & Type	(2) 14 in (36 cm) brushes/pad holders	(2) 16 in (41 cm) brushes/pad holders	(2) 27 in (69 cm) brushes	(2) 31 in (79 cm) brushes
Scrub Pressure				
Regular Scrub	max 90 lbs (41 kg)	max 90 lbs (41 kg)	max 80 lbs (36 kg)	max 80 lbs (36 kg)
Heavy Scrub	max 175 lbs (79 kg)	max 175 lbs (79 kg)	max 100 lbs (45 kg)	max 100 lbs (45 kg)
Extreme Scrub	max 250 lbs (113 kg)	max 250 lbs (113 kg)	max 120 lbs (54 kg)	max 120 lbs (54 kg)
Scrub Head Speed	220 rpm	220 rpm	900 rpm	900 rpm
Solution Flow Rate				
Regular Scrub	.30 gal/min (1.1 L/min) or 100 minutes per solution tank			
Heavy Scrub	.60 gal/min (2.3 L/min) or 50 minutes per solution tank			
Extreme Scrub	.90 gal/min (3.4 L/min) or 33 minutes per solution tank			
Dimensions (See images below)	A=30.5 in (77cm) B= 41.9 in (106 cm) C=61.5 in (156 cm) D=45 in (114 cm)	A=31 in (79 cm) B= 41.9 in (106 cm) C=62.5 in (159 cm) D=45 in (114 cm)	A=33.5 in (85cm) B= 41.9 in (106 cm) C=61.75 in (157 cm) D=45 in (114 cm)	A=35 in (89cm) B= 41.9 in (106 cm) C=61.75 in (157 cm) D=45 in (114 cm)
Weight w/ Std Batteries	914 lb (415 kg)	914 lb (415 kg)	946 lb (430 kg)	946 lb (430 kg)
Chemical Dispensing (AXP and EcoFlex models)				
Cartridge Capacity	1.25 gal (4.75 L)			
Dilution Rates	32:1, 50:1, 64:1, 100:1, 128:1, 150:1, 200:1, 256:1, & 300:1			



Maintenance Schedule

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

Maintenance Item	Interval			
	Daily	Weekly	Monthly	Yearly
Charge Batteries	•			
Check/Clean Tanks & Hoses (clean recovery tank switches & vacuum inlet screen)	•			
Check/Clean/Rotate the Brushes/Pads	•			
Check/Clean the Squeegee	•			
Clean Hopper on Cylindrical System	•			
Purge Extended Scrub System (if installed)	•			
Check Battery Cell Water Level (does not apply to gel cell batteries)		•		
Inspect Scrub Housing Skirts		•		
Inspect and clean Solution Filter		•		
Clean Solution Manifolds on Cylindrical System		•		
Purge Detergent System (AXP and EcoFlex)		•		
Lubricate the Machine			•	
Check Vacuum Motor Carbon Brushes				300 hours
Check Brush Motor Carbon Brushes				500 hours
Check Drive Motor Carbon Brushes				500 hours

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

Carbon Brush Notes:

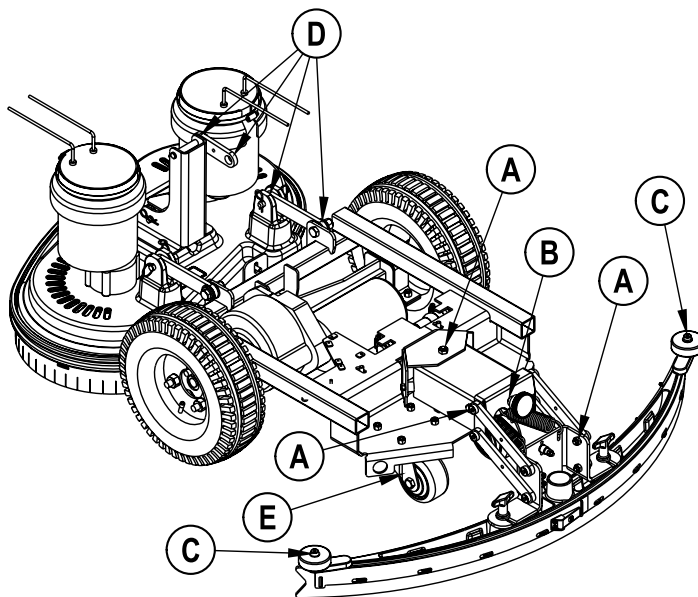
- The original (new) length of each carbon brush is 1" (25.4mm) on brush and wheel drive motors.
- All motors: Replace carbon brushes when shorter than 3/8" (9.5mm) to obtain the same motor efficiency as new brushes.
- **Important:** Motor damage resulting from failure to service the carbon brushes is not covered under warranty. See the Limited Warranty Statement.

Lubricating the Machine

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

- General Pivot Points For the Squeegee Linkage (A).
- Squeegee mount angle adjustment knob threads (B).
- Squeegee Tool end wheels (C).
- General Pivot Points For the Brush Linkage (D).
- Scrub Deck Bumper Wheels.

Once per quarter Grease the Rear Caster Wheel Swivels (E).



Warrior ST, Warrior AXP, Warrior EcoFlex

Cylindrical and Disc

PM Checklist

Customer _____

Address _____

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

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

Defect Codes

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

Ref	OPERATIONAL INSPECTION ITEMS	OK	Defect Codes (circle)	Does Not Work
1	Drive Paddle operation (check for forward/reverse drive and any neutral creep)		A B D	
2	Drive System performance (speed changes Min/Max)		noisy sluggish	
3	Scrub System (raise/lower, Brush Motor on/off and optional Brush remove feature)		A B D	
4	Scrub Brush pressure settings (1-3)		A B	
5	Squeegee System (raise/lower and Squeegee Tool pickup performance)		A B D	
6	Vacuum Performance (sealed water lift and 1" open-hole adapter, 36V: 70/12)		C L W	
7	Solution Control (on/off manual/auto and flow Volume settings 1,2 and 3)		A B L	
8	Battery Charger (auto turn on and off)		D	
9	Main Controller Special Program Options (see Service Manual 56043103). Check all applicable machine settings. Examples: Scrub mode pressure settings, SVR test mode, low voltage cutout, etc.		A	

Ref	VISUAL INSPECTION ITEMS	Comments	OK	Defect Codes (circle)	Does Not Work
10	Scrub Brushes, check for wear and rotate			D M W	
11	Scrub Brush Motor(s), check for carbon brush wear	500 Hours		B C W	
12	Scrub Brush Motor(s), check gearboxes	(disc deck)		B D L	
13	Brush Drive Plate Retainer Clips and Flex Couplers	(disc deck)		C D M	
14	Scrub Brush Motor Drive Belts	(cylindrical deck)		D W	
15	Scrub Deck Lift Motor, Skirt and Side Wheel			D M W	
16	Solution Solenoid Valve			C L W	
17	Solution Pump and Hoses			C L W	
18	Solution Tank, Delivery Hoses and Filter	clean filter screen		C L	
19	Vacuum Motor Carbon Brushes (wear limit 3/8")	300 Hours		B C W	
20	Vacuum Motor Inlet Filter (located in recovery tank)	clean screen		C D M	
21	Recovery Tank Cover Gasket			L M W	
22	Recovery Tank Drain Hose and Cap			C D L	
23	Squeegee Pickup Hose	back flush		C D L	
24	Squeegee Tool and Blades (clean, rotate and adjust)			A D W	
25	Squeegee Tool mount bottom wheels, Squeegee Tool end wheels (lubricate)	two side and two floor		A D W	
26	Battery Condition (load test, clean and water)			C W	
27	Drive Wheel Transaxle Motor - check Carbon Brushes	500 Hours		B C D W	
28	Transaxle Drive Tires	tread wear		W	
29	Rear Chassis Caster Wheel (lubricate)	tread wear		W	

Note: For additional service information see service manual, form number 56043103, and operator manual, form number 56041619 (English).

Work Completed by: _____

Acknowledged by: _____

Service Technician Signature _____

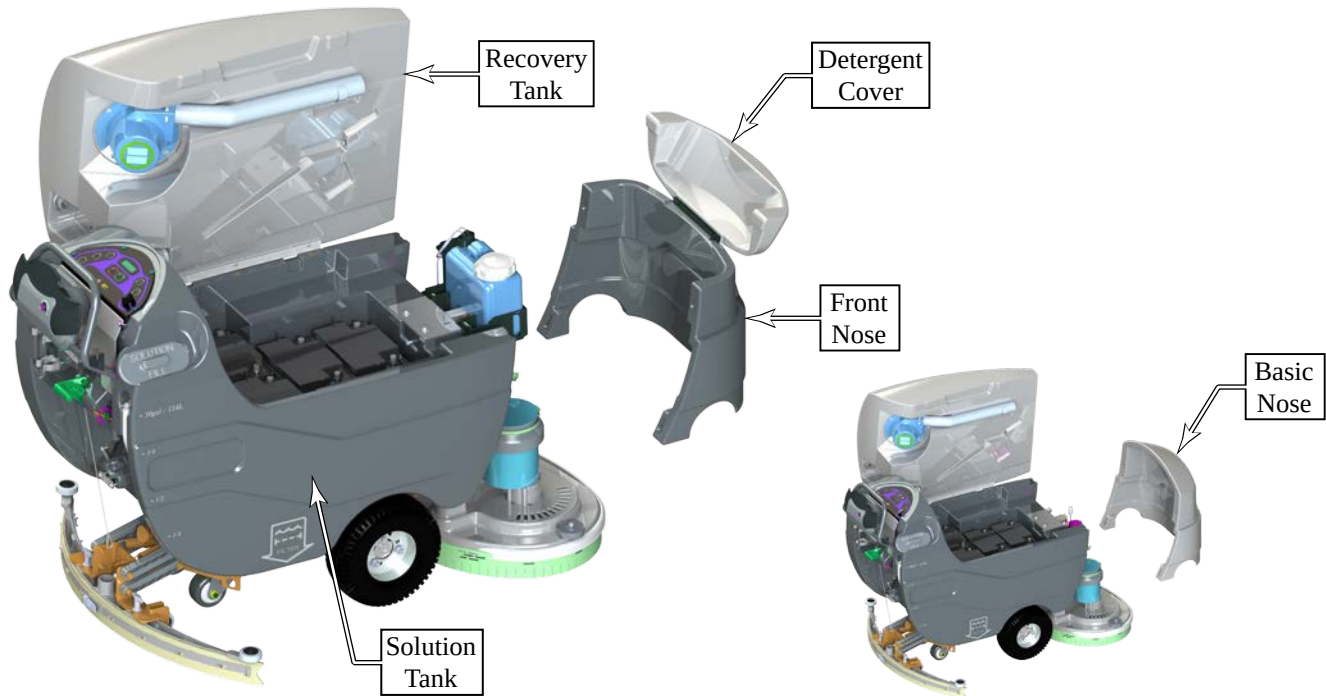
Date _____

Customer Signature _____

Date _____

Chassis System

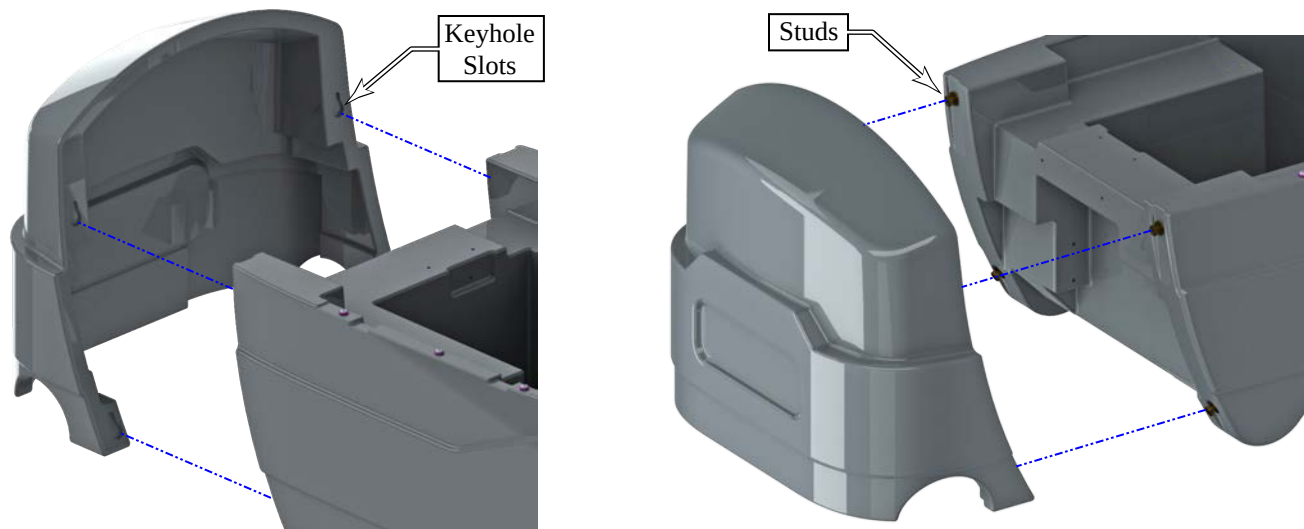
Functional Description



The main component of the chassis system is the solution tank, to which the rest of the machine components attach. The recovery tank is connected to the solution tank with a hinge so that it may be opened to access the battery compartment of the machine. The front nose is attached to the solution tank with 4 lift-off studs for access to the scrub deck components. The front nose on a basic machine (Warrior ST) is a one-piece component. For machines with detergent systems (Warrior AXP and EcoFlex), the front nose contains a hinged detergent cover for accessing the detergent bottle.

Front Nose Removal

To remove the front nose, lift it up until the studs are clear of the keyhole slots, and pull it away from the machine. To replace the front nose, insert all 4 studs through the keyhole slots and press the nose down until locked in place.



Control System

Functional Description

Within the Warrior system there are two primary controllers: the Warrior Controller (A1) and the Curtis Drive controller (A2). The Warrior controller controls the primary machine functions, and the Curtis controller controls the drive functions. The Curtis controller communicates with the Warrior controller to inform the Warrior controller of machine movement status.

Control Panel

There are three versions of the main control panel depending on the machine type: ST, AXP, and EcoFlex. The functions of the control panel are similar for each model, and are shown to the right and summarized below. (Also see the *Control Panel Indicators* section for descriptions of the various indicator lights and displays.) The control panel is an integral component with the Warrior controller (A1) circuit board.

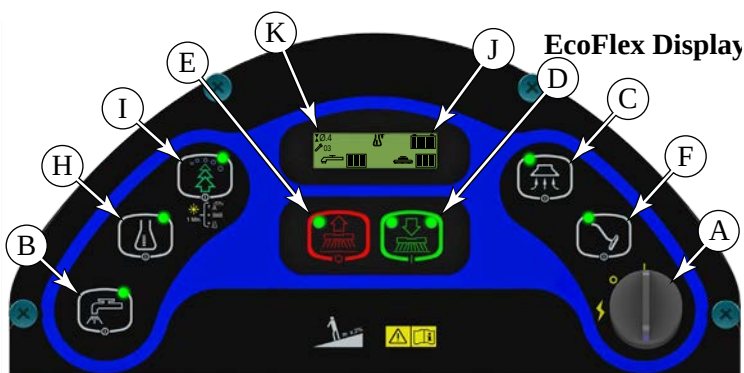
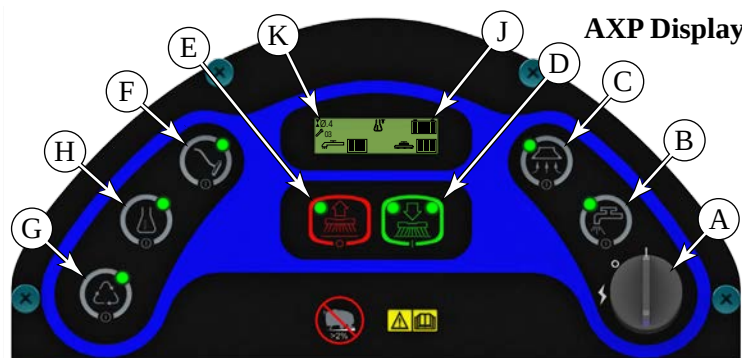
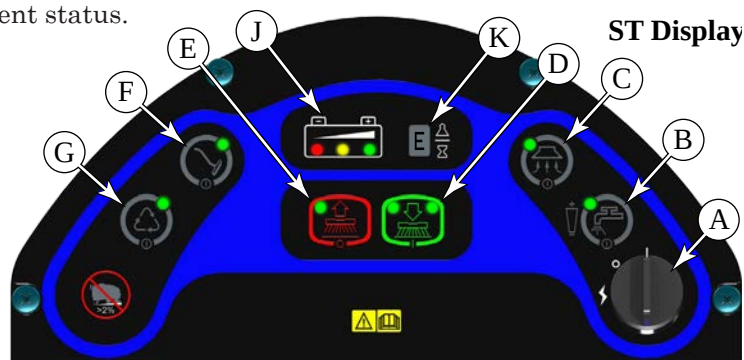
Key Switch (A): The keyswitch serves as a main control switch to enable or disable operation of the machine. The key is removable to prevent unwanted operation when not in use. The keyswitch doesn't disconnect any power circuits, but instead, sends a signal to both the Warrior controller and Curtis Drive controller to indicate the On/Off function.

Solution Switch (B): This switch turns the solution system on, off, or change the solution rate (regular, heavy, extreme). The solution flow will turn on only when the throttle is moved from the neutral position in the forward direction. The solution flow will turn off if the throttle returns to neutral or is moved to reverse. Pressing this switch when the scrub system is off will momentarily turn the solution flow on to allow pre-wetting of the scrub brushes.

Vacuum Switch (C): This switch is used to turn the vacuum system on or off. Pressing this switch will alternate between on and off. The vacuum will only turn on when the throttle is moved from the neutral position. It will remain on for 10 seconds after the throttle returns to neutral. The vacuum also has an automatic shutoff feature that will turn the vacuum and scrub systems off if the recovery tank becomes full.

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

- The scrub system will be enabled with the scrub pressure set to the regular setting and the scrub deck will be lowered. Note: press twice for the heavy scrub pressure mode and hold this switch for 5 seconds to enter the extreme scrub mode.
- The vacuum system and solution system will be enabled.
- As soon as the throttle (operator drive paddle) is moved from the neutral position the scrub brushes will start turning and the vacuum will turn on. If the direction is forward the solution flow will start. If the direction is reverse, the solution flow will be stopped. If the scrub system is already enabled when this switch is pressed, the scrub pressure will increase to the heavy scrub mode. If the switch is held for 5



seconds the pressure will change to the extreme scrub mode. At the same time the panel display will show the correct changed scrub pressure setting.

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

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

Wand Switch (F): This switch is used when an external vacuum/scrub wand is used. Pressing this switch will turn the vacuum on continuously without regard to the throttle position. If the scrub system was on it will be turned off. This includes turning off the scrub brushes and turning the solution flow off (to the scrub deck). **Note: automatic shutoff of the vacuum motor when the recovery tank is full is disabled when the wand is enabled.**

Extended Scrub (Recycle) Switch (G): Extended Scrub is available only on Warrior ST and AXP models. Pressing this switch will turn on or off the extended scrub option. When extended scrub is active, a portion of the solution to the scrub deck will come from the recovery tank. By recycling some of the used solution with some new solution, the overall scrubbing time of the machine can be extended before refilling the solution tank or emptying the recovery tank. See the main programming options in this manual to select (activate) the recycle option. **Purge Function:** To prevent buildup of debris in the recycling lines and pump, the system should be purged after use. Drain the recovery tank and fill with clean water, and then push and hold the extended scrub switch for 3 seconds to initiate the purge function. The purge will run for 20 seconds to flush the lines. **Note: Failure to purge the recycle system after use may cause the extended scrub pump and/or solenoid valve to become fouled.**

Chemical Switch (H): The chemical (detergent mixing) option is available only on Warrior AXP and EcoFlex models. Pressing this switch will turn on or off the chemical option. When active, a small pump will inject chemical (detergent) into the solution line upstream from the scrub deck. The chemical pump is disabled any time the solution system is inactive. See the main programming options in this manual to select (activate) the onboard chemical distribution system.

EcoFlex Switch (I): This option is available only on EcoFlex models. By default, the EcoFlex cleaning mode is active during normal operation to conserve solution and detergent. Press this switch for 2 seconds to override the EcoFlex cleaning mode and temporarily increase scrub pressure, solution flow, and the detergent ratio. See the main programming options in this manual to select (activate) the EcoFlex option.

Control Panel Indicators

Each of the switches on the control panel have an indicator LED adjacent to the switch. Most LEDs are dual channel and provide two colors within the same LED. In general, the following guidelines apply to the control panel indicators, and various exceptions to this rule are listed separately:

A **steady green** indicator means that the particular system or function is on.

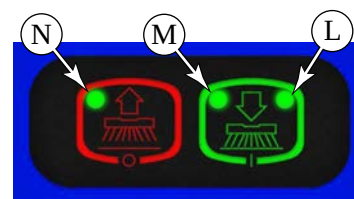
A **flashing green** indicator means that the particular system is in a delayed-off condition. An example of this is when a scrub mode is selected and the throttle goes from forward or reverse to neutral. When this happens the vacuum indicator will flash green indicating that the vacuum is still on but that it will be turning off after the delay period.

A **steady yellow** indicator means that the particular function has been enabled and in a ready state, but is not currently on. For example, if a scrub mode is selected and the throttle is in neutral, the scrub system, vacuum, and solution indicators will all be yellow indicating that the systems are enabled and ready to turn on when the throttle is moved to forward and/or reverse.

A **flashing yellow** indicator means that a fault has occurred in the particular system. An example of this would be an over-current fault on one of the motors.

Scrub ON Indicators (L & M):

- For Regular scrub mode, the **(L)** LED will be active.
- For Heavy scrub mode, the **(M)** LED will be active.
- For Extreme scrub mode, both **(L&M)** LED's will be active.
- When a scrub mode (regular, heavy, or extreme) is active and the drive paddle is in the neutral position, the LED's **(L and/or M)** will be solid yellow.
- When a scrub mode (regular, heavy, or extreme) is active and the drive paddle is in the drive position, the LED's **(L and/or M)** will be solid green.
- Both indicators will be off if the scrub system has been turned off.

**Scrub OFF Indicator (N):**

- This indicator has green and red colors.
- The indicator will be green if the scrub system is off and ready to be activated.
- The indicator will be red if the scrub system has been turned off and the scrub deck is not up yet.
- The indicator will flash red if there is a fault in the scrub system.
- The indicator will be off if the scrub system has been activated.

Wand Switch (F) Indicator:

- This indicator uses green color only.
- This indicator will be green if the Wand Switch has been turned ON.
- This indicator will be off if the Wand Switch has been turned OFF.
- This indicator is also the Status LED indicator, and will flash green with an error code from the Curtis Drive controller (See the *Wheel System, Traction* chapter for details).

Vacuum Switch (C) Indicator:

- This indicator will be off if the vacuum is disabled and turned off.
- This indicator will be green if the vacuum is on.
- This indicator will flash green if the vacuum is in the 10 second delayed-off condition.
- This indicator will be yellow if the vacuum is enabled but the drive pedal is in neutral.
- This indicator will flash yellow if there is a vacuum system fault.

Solution Switch (B) Indicator:

- This indicator will be off if the solution is disabled and turned off.
- This indicator will be green if the solution is on.
- This indicator will be yellow if the solution is enabled but the drive paddle is in neutral.
- This indicator will flash yellow if there is a solution system fault.

Chemical Switch (H) Indicator:

- This Indicator will be green if the chemical system is on.
- This indicator will be yellow if the chemical system is enabled but the drive paddle is in neutral.
- This indicator will be off if the chemical system is disabled and turned off.

Extended Scrub Switch (G) Indicator:

- This indicator will be green if the Extended Scrub system is on or if the “Purge” function has been started.
- This indicator will be yellow if the Extended Scrub system is enabled but the recovery tank switches haven't been activated.
- This indicator will be off if the Extended Scrub system is disabled and turned off.

EcoFlex Switch (I) Indicator:

- This indicator will be green if the EcoFlex system is on.
- This indicator will flash green if the EcoFlex system is in a temporary override state.
- This indicator will be off if the EcoFlex system is disabled and turned off.

Scrub Mode Indicators

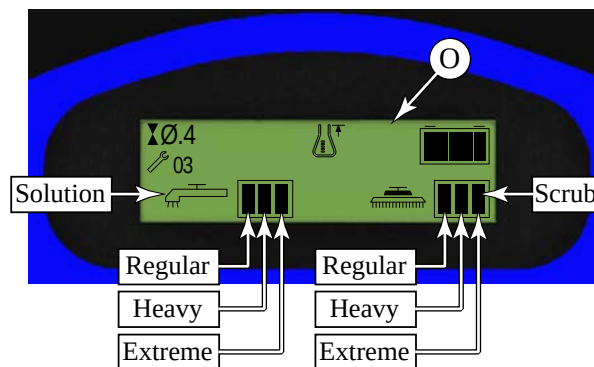
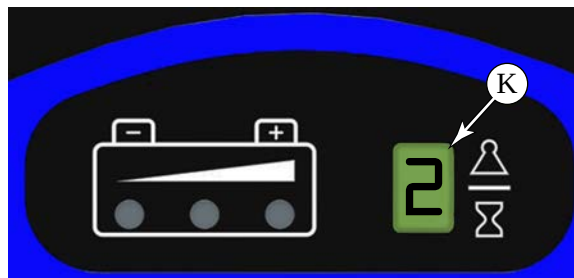
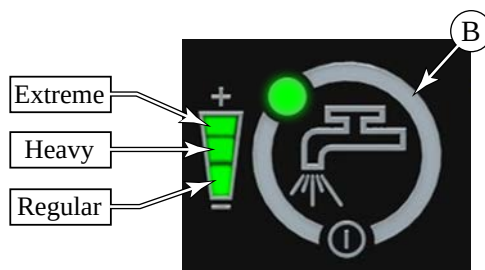
The Solution system and Scrub system have three scrub modes (regular, heavy, and extreme). These scrub modes are jointly controlled when the Scrub On Switch **(D)** is pressed, but the Solution system can be controlled separately by pressing the Solution Switch **(B)**.

- Pressing the Scrub On Switch **(D)** once will set both the scrub mode and solution mode to regular (and clear any solution system overrides).
- Pressing the Scrub On Switch **(D)** twice will set both the scrub mode and solution mode to heavy (and clear any solution system overrides).
- Pressing the Scrub On Switch **(D)** for 5 seconds will set both the scrub mode and solution mode to extreme (and clear any solution system overrides).
- Pressing the Solution Switch **(B)** once, twice, or for 5 seconds; will change the solution mode accordingly, but without changing the scrub mode.

Warrior ST Display: The solution mode is displayed in a bar graph adjacent to the solution switch **(B)**, and the scrub mode is indicated in the display **(K)** with a number representing the mode.

(1 = regular, 2 = heavy, 3 = extreme).

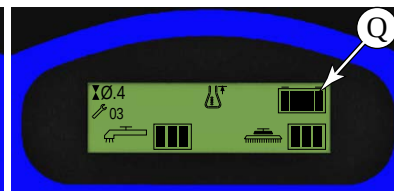
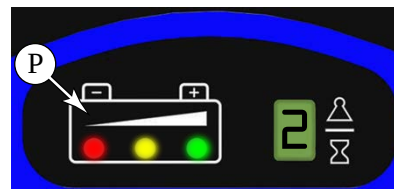
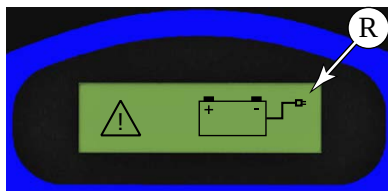
Warrior AXP and EcoFlex Display: The solution mode and scrub mode are both shown in bar graphs on the main display **(O)**.



Battery Indicator

The charge state of the battery is shown in the main display area of the control panel. For Warrior ST models, this is indicated by three colored LED's **(P)**. For Warrior AXP and EcoFlex models, this is shown with a bar graph **(Q)** in the main display. For AXP and EcoFlex models, when the battery is depleted and needs to be charged, the charge indicator **(R)** will be displayed.

Also note that for AXP and EcoFlex models, when in Service Mode, the actual battery voltage will be displayed numerically in the lower left corner of the main display.



Warrior Controller

The Warrior controller **(A1)**, which includes the control board and the display, is the primary electronic control for the Warrior machine and its functions (except drive control). The control board is the basic input/output device and contains a micro-controller chip to regulate function. The controller receives and interprets user inputs, sensor inputs, and even some motor amperage readings, and controls device output for the user display, solenoid operation, and motor control. Most low and medium power outputs are controlled with power MOSFET



transistors, with some moderately high power devices controlled with micro-relays, and very high power devices (vacuum and brush motors) controlled with external motor contactors.

Another function of the main controller is to detect any system failures and display an error code on the display panel or store it in the main control board's memory. The error code(s) are used to help the service person determine the fault and to quickly guide in repairing a specific system malfunction. Note: See the Troubleshooting Guide for further information. An additional special feature of the main control board is to change program settings for a set of specific machine functions. See the *Main Control Board Programming* section in this chapter for further information.

Main Control Board Programming

The Warrior controller is programmable for machine specific functions and parameters. This is a required task when replacing the controller with a new controller. The table below and following sections describe the parameters to be programmed.

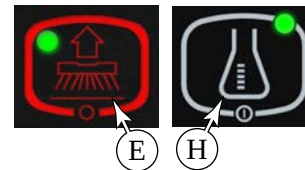
Programming Option	Button(s) to Hold While Turning Key Switch to On		
	Warrior EcoFlex	Warrior AXP	Warrior ST
Enter Service Test Mode	Wand Switch (F)	Wand Switch (F)	Wand Switch (F)
Machine Type	Vacuum Switch (C) Wand Switch (F)	N/A	N/A
Low-voltage Cut-out Threshold	Scrub OFF Switch (E)	Scrub OFF Switch (E)	Scrub OFF Switch (E)
Enable/Disable Fault Detection	Scrub OFF Switch (E) Solution Switch (B)	Scrub OFF Switch (E) Solution Switch (B)	Scrub OFF Switch (E) Solution Switch (B)
Recall/Clear Stored Error Codes	Solution Switch (B)	Solution Switch (B)	Solution Switch (B)
Controller Software Revision Level	Scrub OFF Switch (E) Chemical Switch (H)	Scrub OFF Switch (E) Chemical Switch (H)	Scrub OFF Switch (E) Wand Switch (F)
Scrub Deck Down Time	Scrub ON Switch (D) Solution Switch (B)	Scrub ON Switch (D) Solution Switch (B)	Scrub ON Switch (D) Solution Switch (B)
Regular Scrub Setting	Scrub ON Switch (D) Wand Switch (F)	Scrub ON Switch (D) Wand Switch (F)	Scrub ON Switch (D) Wand Switch (F)
Heavy Scrub Setting	Scrub ON Switch (D) Chemical Switch (H)	Scrub ON Switch (D) Chemical Switch (H)	Scrub ON Switch (D) Vacuum Switch (C)
Extreme Scrub Setting	Scrub ON Switch (D) EcoFlex Switch (I)	Scrub ON Switch (D) Recycle Switch (G)	Scrub ON Switch (D) Recycle Switch (G)
Restore Factory Default Scrub Settings	Scrub ON Switch (D)	Scrub ON Switch (D)	Scrub ON Switch (D)
Scrub Deck Type/Size	Scrub OFF Switch (E) Scrub ON Switch (D)	Scrub OFF Switch (E) Scrub ON Switch (D)	Scrub OFF Switch (E) Scrub ON Switch (D)
Chemical Option	Scrub OFF Switch (E) Scrub ON Switch (D)	Scrub OFF Switch (E) Scrub ON Switch (D)	Scrub OFF Switch (E) Scrub ON Switch (D)
Recycle Option	N/A	Scrub OFF Switch (E) Scrub ON Switch (D)	Scrub OFF Switch (E) Scrub ON Switch (D)
Recovery Tank-full Switch Orientation	Scrub OFF Switch (E) Vacuum Switch (C)	Scrub OFF Switch (E) Vacuum Switch (C)	Scrub OFF Switch (E) Vacuum Switch (C)
LCD Style Selection	N/A	Scrub ON Switch (D) Vacuum Switch (C)	N/A
Machine Setting Monitor Mode	Vacuum Switch (C)	Recycle Switch (G)	N/A
Chemical Ratio Selection	Chemical Switch (F)	Chemical Switch (F)	N/A

Displaying the Control Board Revision Level

During machine service, it may be helpful to know the control board revision level to determine machine configuration. To view the control board revision level:

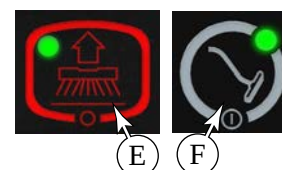
AXP & EcoFlex Models:

1. Turn the key switch to the off position.
2. While holding the Scrub Off (**E**) and Chemical (**H**) switches depressed, turn on the key switch.
3. Hold both switches until Scrub Off and Chemical indicators turn green.
4. The display will show the revision level (letter) of the control unit. Chemical indicator will blink in revision display mode.
5. To exit this mode, turn the main power key switch to the off position.



ST models:

1. Turn the key switch to the off position.
2. While holding the Scrub Off (**E**) and Wand (**F**) switches depressed, turn on the key switch.
3. Hold both switches until Scrub Off and Wand indicators turn green.
4. The LED display will show the revision level (letter) of the controller software.
5. To exit the revision level recall mode, turn the key switch to the off position.



Recall of Stored Error Codes

To assist with service troubleshooting, the Warrior controller maintains a list of past error codes. To recall and/or clear the stored error codes perform the following steps:

1. Turn the key switch to the off position.
2. While holding the Solution Switch (**B**) depressed, turn the key switch to the on position.
3. Continue to hold the solution switch until the solution indicator turns green.
 - On AXP/EcoFlex models:
 - If there are no error codes stored, the display will show the key switch icon.
 - If any error codes are stored, the display will show the wrench icon and error number right next to the wrench. If more than one error code is stored, it will cycle through all the error codes stored.
 - On ST models:
 - If there are no error codes stored, the display will show “—”.
 - If any error codes are stored, the scrub off indicator will be red and the display will show the error code number(s). If more than one error code is stored, the display will scroll through the error codes in sequence.
4. To clear the stored codes, press the scrub off switch. (It is recommended that error codes are cleared after servicing so that future error codes represent only errors that occur between service intervals.)
 - On AXP/EcoFlex models, the display will now show the key switch icon.
 - On ST models, the display will now show “—”.
- 7 To exit the error code recall mode, turn the key switch to the off position.

Selecting Machine Type (EcoFlex version only)

Selecting the machine type must be done before selecting the scrub deck type in order for the correct scrub deck values to be available. This menu is only available on EcoFlex version machines and not the AXP or ST versions.

1. Turn the key switch to the off position.
2. While holding the Vacuum Switch **(C)** and the Wand Switch **(F)** depressed, turn on the key switch.
3. Hold both switches until the scrub on (M) and scrub off (N) indicators both turn green.
4. Release both switches.
 - The display will show either “Warrior” or “34-RST”
5. Press the Scrub On (D) switch to toggle between the values.
 - Select “Warrior”
6. Once the proper machine type has been selected, press the Scrub Off switch **(E)** to save this setting.
 - The display will show the key switch icon.
7. Turn the key switch to the off position to commit the setting.

Turning Fault Detection On or Off:

If a fault occurs in a particular system, that system (and possibly others) will be shut down. This can make troubleshooting the system difficult. This option will allow service personnel to disable some of the fault detection checks to facilitate troubleshooting. This will not disable the over-current protection on any of the systems. **Important:** Make sure to turn Fault Detection back on before returning the machine to normal operation. To turn the fault checking on or off:

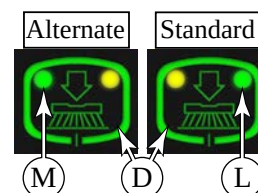
1. Turn the key switch to the off position.
2. While holding the Scrub System Off **(E)** and the Solution **(B)** switches depressed, turn on the key switch.
3. Continue to hold both switches until the solution indicator turns yellow.
4. Release both switches. The scrub off indicator will turn red.
5. Pressing the solution switch will toggle between fault detection enabled and disabled.
 - On AXP/EcoFlex models, the display will show the normal wrench icon for Fault Detection enabled or a wrench with a cross for Fault Detection disabled.
 - On ST models, the LED display will toggle between “E” (enabled) and “d” (disabled).
6. To save the setting, press the scrub off switch.
 - AXP/EcoFlex models will display the key switch icon asking user to reset the machine.
 - On ST models, the scrub off indicator will turn green.
7. Turn the key switch to the off position. The new setting will be saved and will remain in effect until it is changed again.

Low-voltage Cutout Threshold

The Warrior is equipped with a low-voltage cutout feature to prevent over-discharging the batteries. This feature will automatically shut down the scrub system when the battery voltage falls to the selected threshold. The cutout threshold has two levels: Standard and Alternate. The Standard setting is 30.96 volts (5.16 volts per battery), and is for standard lead acid batteries. The Alternate setting is 32.58 volts (5.43 volts per battery), and is for typical gelled electrolyte batteries. Select the proper cutout level based on the battery manufacturer's specifications. **Factory Default:** 30.96V (Standard Battery)

To select between the two cutout levels:

1. Turn the key switch **(A)** to the off position.
2. While holding the Scrub Off switch **(E)** turn the key switch **(A)** to the on position.
3. Continue to hold the Scrub Off switch until the Scrub Off indicator **(N)** turns red, and then release the Scrub Off switch.
4. To toggle between Standard and Alternate, press the Scrub On switch **(D)**. The two modes are identified by the following indicators:
 - The Scrub On Regular **(M)** and Heavy **(L)** LED's will toggle green and yellow, as shown to the right.
 - On AXP/EcoFlex models, the status display will now show "30.96V" or "32.58V."
 - On ST models, the status display will show an "S" (standard) or an "A" (alternate).
5. To save the new setting, press the scrub off switch. The scrub off indicator will turn green. On AXP/EcoFlex models, the display will show key switch icon to reset the machine.
6. Turn the key switch to the off position to commit the settings to permanent memory.



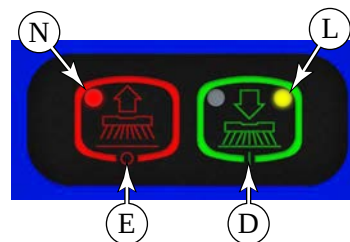
Scrub Deck Type

On EcoFlex machines be sure to select the correct machine type before entering this menu.

Note: This procedure may be completed concurrently with the *Chemical Option* and *Extended Scrub Option* procedures.

Warrior models can be equipped with numerous scrub deck options. This function configures the Warrior controller for each of the scrub deck types. **Important:** Improper setting of the deck type may result in motor damage due to overloading.

1. Turn the key switch to the off position.
2. While holding the Scrub Off **(E)** and Scrub On **(D)** switches depressed, turn the key switch to the on position.
3. Continue to hold both switches until the Regular Scrub indicator **(L)** turns yellow.
4. Release both switches. The Scrub Off indicator **(N)** will turn red.
 - For AXP and EcoFlex models, the display will show the current scrub brush type icon and scrub deck size (28" cylindrical, 32" cylindrical, 28" disc, or 32" disc).
 - For the ST model, the LED display will scroll through the deck types (C_2_8, C_3_2, d_2_8, or d_3_2)
5. Press the Scrub On **(D)** switch to toggle between the four settings.
6. Once the proper scrub deck size is selected, press the Scrub Off switch **(E)** to save this setting.
7. The AXP/EcoFlex display will show the key switch icon asking user to reset the machine.
8. Turn the key switch to the off position to commit the setting.

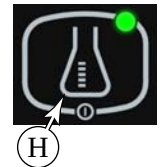
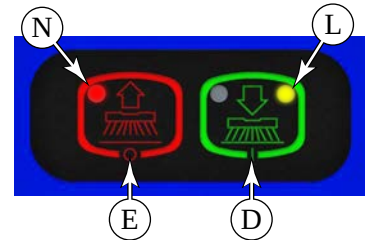


Chemical Option

Note: This procedure may be completed concurrently with the *Scrub Deck Type* and *Extended Scrub Option* procedures.

Warrior AXP and EcoFlex models are equipped with the chemical (detergent) system. To enable or disable this option, do the following:

1. Turn the key switch to the off position.
2. While holding the Scrub Off (**E**) and Scrub On (**D**) switches depressed, turn the key switch to the on position.
3. Continue to hold both switches until the Regular Scrub indicator (**L**) turns yellow.
4. Release both switches. The Scrub Off indicator (**N**) will turn red.
5. Press the Chemical switch (**H**) to toggle the chemical option between enabled and disabled. The Chemical indicator will turn green for enabled and be off for disabled.
6. Press the Scrub Off switch (**E**) to save this setting. The display will show the key switch icon asking user to reset the machine.
7. Turn the key switch to the off position to commit the setting.

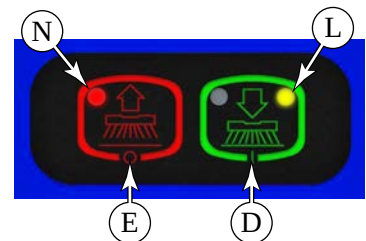


Extended Scrub Option

Note: This procedure may be completed concurrently with the *Scrub Deck Type* and *Chemical Option* procedures.

Warrior ST and AXP models may be equipped with the extended scrub system. To enable or disable this option, do the following:

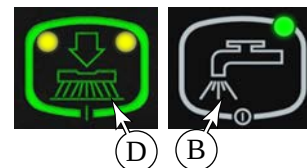
1. Turn the key switch to the off position.
2. While holding the Scrub Off (**E**) and Scrub On (**D**) switches depressed, turn the key switch to the on position.
3. Continue to hold both switches until the Regular Scrub indicator (**L**) turns yellow.
4. Release both switches. The Scrub Off indicator (**N**) will turn red.
5. Press the Recycle switch (**G**) to toggle the extended scrub option between enabled and disabled. The Recycle indicator will turn green for enabled and be off for disabled.
6. Press the Scrub Off switch (**E**) to save this setting. The display will show the key switch icon asking user to reset the machine.
7. Turn the key switch to the off position to commit the setting.



Scrub Deck Down Time Period Adjustment

The initial lowering of the scrub deck is timed, because there will not be any brush motor amperage to monitor for determining when to stop lowering the deck. The time that the deck is lowered is adjustable from 3.5 seconds to 4.4 seconds in 0.1-second increments. To adjust the scrub deck down time, perform the following steps:

1. Turn the key switch to the off position.
2. While holding the Scrub On **(D)** and the Solution **(B)** switches depressed, turn the key switch to the on position.
3. Continue to hold both switches until the regular and heavy scrub on indicators and solution indicator turn green.
4. Release both switches. The Regular and Heavy Scrub On indicators will turn yellow and the Scrub Off indicator will turn red.
 - On AXP/EcoFlex models, the display will show the scrub deck icon on right top corner and clock icon with number.
 - On ST models, the LED display will show the number corresponding to the deck down time as listed in the table shown on the right.
5. Press the Scrub On **(D)** switch to toggle through the deck down time period values. These values represent the times shown in the table to the right.
6. To save the new setting, press scrub off switch.
 - On AXP/EcoFlex models, the key switch icon will appear on the display.
 - On ST models, the scrub off indicator will turn green.
7. Turn the key switch to the off positions.



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

Scrub Deck Pressure, Solution Flow Rate, and Chemical Flow Rate Adjustments

Each of the scrub settings (Regular, Heavy, and Extreme) affects the scrub deck pressure, solution flow rate, and chemical flow rate (if equipped). These settings are adjustable. The default values are shown in the tables below. The scrub pressures are determined by examining the amperage through the brush motors.

Scrub Pressure & Amperage Specifications Chart					
Scrub Mode	Default Pressure Indicator	Deck Type			
		Disc 28"	Cyl. 28"	Disc 32"	Cyl. 32"
Regular Scrub	1 bar(#1)	14 AMPS	22 AMPS	16 AMPS	24 AMPS
Heavy Scrub	2 bars(#2)	22 AMPS	31 AMPS	24 AMPS	33 AMPS
Extreme Scrub	3 bars(#3)	36 AMPS	40 AMPS	38 AMPS	42 AMPS

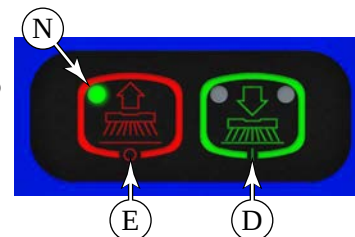
Default Solution Flow Rate Chart	
Solution Flow Indicator	Flow Rate
One bar gauge(#1)	0.3 g/m
Two bar gauge(#2)	0.6 g/m
Three bar gauge(#3)	0.9 g/m

Chemical Chart	
0	Normal chemical setting
-	10% less than normal chemical setting
+	10% more than normal chemical setting

Restoring the Scrub Pressures to Factory Default Settings

Use this procedure to restore all of the scrub deck pressure settings to their factory default values.

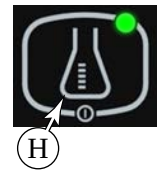
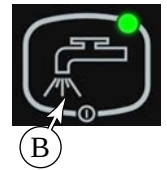
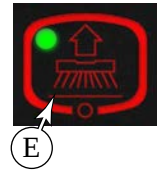
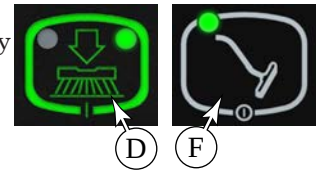
1. Turn the key switch to the off position.
2. While holding the Scrub On switch (**D**) depressed, turn the key switch to the on position.
3. Continue to hold the Scrub On switch until the Scrub Off indicator (**N**) turns green, then release the Scrub On switch.
 - On AXP/EcoFlex models, the display will show pressure icon on the right top corner indicating you are in pressure restoring mode and the factory default pressures have been restored. Now display will show key switch icon asking you to reset the machine.
 - On ST models, the display will show "d" to indicate that the factory default scrub pressures have been restored.
4. Turn the key switch to the off position.



Regular Scrub Setting Adjustment

Use this procedure to adjust the scrub deck pressure, solution rate, and chemical rate that are used for the Regular scrub mode.

1. Turn the key switch to the off position.
2. While holding the Scrub On (D) and Wand (F) switches depressed, turn the key switch to the on position.
3. Continue to hold the both switches until the Wand and Regular Scrub indicators turn green.
4. Release both switches. The scrub off indicator will turn red and the regular scrub indicator will turn yellow. Also:
 - AXP/EcoFlex models: The display will now show the cylinder/disc deck icon with current scrub pressure setting.
 - ST model: The LED display will show the level number of the current scrub pressure setting.
5. Pressing the Scrub On switch (D) will scroll through the 3 scrub pressure settings.
6. Pressing Scrub Off switch (E) will save the pressure setting and move to solution rate setting.
7. **Solution Rate Setting:** The Regular Scrub indicator (L) will turn from yellow to green and the Solution indicator will turn yellow. For AXP/EcoFlex, the display will show the solution icon with gauge.
8. Press the Solution switch (B) to scroll through the 3 solution rate settings.
9. Press the Scrub Off switch (E) to save the new setting and move to the chemical rate setting (or the end of the program mode for Warrior ST).
10. **Chemical Rate Setting:** (Not available on Warrior ST) The display will now show chemical bottle with current chemical setting. Solution indicator will turn green and chemical indicator will turn green.
11. Press the Chemical switch (H) to scroll through the 9 chemical settings.
12. Press the Scrub Off switch (E) to save the new setting and display key switch icon on display.
13. Turn the key switch to the off position. The new settings will be saved and will remain in effect until they are changed again.



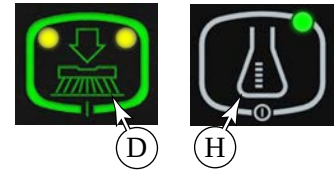
Heavy Scrub Setting Adjustment:

Use this procedure to adjust the scrub deck pressure, solution rate, and chemical rate that are used for the Heavy scrub mode.

1. Turn the key switch to the off position.

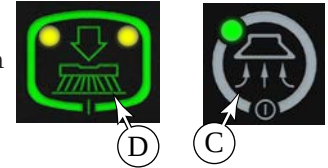
2. For AXP/EcoFlex models:

- a. While holding the Scrub On **(D)** and Chemical **(H)** switches depressed, turn the key switch to the on position.
- b. Continue to hold the both switches until the Wand and Heavy Scrub indicators turn green.



3. For ST models:

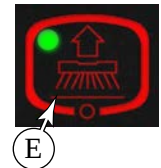
- a. While holding the Scrub On **(D)** and Vacuum **(C)** switches depressed, turn the key switch to the on position.
- b. Continue to hold both switches until the heavy scrub on indicator turns green and the red battery indicator light switches on.



4. Release both switches. The scrub off indicator will turn red and the heavy scrub indicator **(M)** will turn yellow. Also:
 - AXP/EcoFlex models: The display will now show the cylinder/disc deck icon with current scrub pressure setting.
 - ST model: The LED display will show the level number of the current scrub pressure setting.

5. Press the Scrub On switch **(D)** to scroll through the 3 scrub pressure settings.

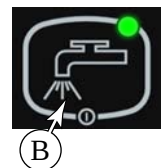
6. Press the Scrub Off switch **(E)** to save the pressure setting and move to solution rate setting.



7. **Solution Rate Setting:** The Heavy Scrub indicator **(L)** will turn from yellow to green and the Solution indicator will turn yellow. For AXP/EcoFlex, the display will show the solution icon with gauge.

8. Press the Solution switch **(B)** to scroll through the 3 solution rate settings.

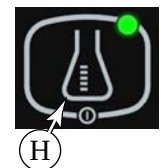
9. Press the Scrub Off switch **(E)** to save the new setting and move to the chemical rate setting (or the end of the program mode for Warrior ST).



10. **Chemical Rate Setting:** (Not available on Warrior ST) The display will now show the chemical bottle with current chemical setting. Solution indicator will turn green and chemical indicator will turn green.

11. Press the Chemical switch **(H)** to scroll through the 9 chemical settings.

12. Press the Scrub Off switch **(E)** to save the new setting and display key switch icon on display.



13. Turn the key switch to the off position. The new settings will be saved and will remain in effect until they are changed again.

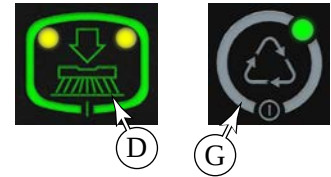
Extreme Scrub Setting Adjustment

Use this procedure to adjust the scrub deck pressure, solution rate, and chemical rate that are used for the Extreme scrub mode.

1. Turn the key switch to the off position.

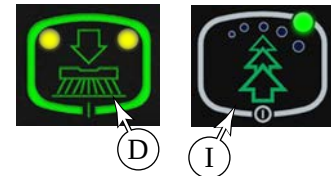
2. For ST/AXP models:

- a. While holding the Scrub On (D) and Recycle (G) switches depressed, turn the key switch to the on position.
- b. Continue to hold the both switches until the Recycle, Regular Scrub, and Heavy Scrub indicators turn green.



3. For EcoFlex models:

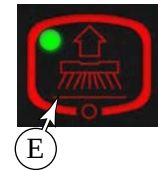
- a. While holding the Scrub On (D) and EcoFlex (I) switches depressed, turn the key switch to the on position.
- b. Continue to hold both switches until the EcoFlex, Regular Scrub, and Heavy Scrub indicator turn green.



4. Release both switches. The scrub off indicator will turn red and the Regular and Heavy scrub indicators will turn yellow. Also:
 - AXP/EcoFlex models: The display will now show the cylinder/disc deck icon with current scrub pressure setting.
 - ST model: The LED display will show the level number of the current scrub pressure setting.

5. Press the Scrub On switch (D) to scroll through the 3 scrub pressure settings.

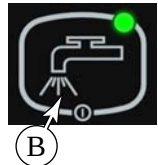
6. Press the Scrub Off switch (E) to save the pressure setting and move to solution rate setting.



7. **Solution Rate Setting:** The Heavy Scrub indicator (L) will turn from yellow to green and the Solution indicator will turn yellow. For AXP/EcoFlex, the display will show the solution icon with gauge.

8. Press the Solution switch (B) to scroll through the 3 solution rate settings.

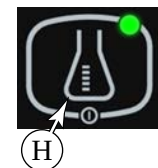
9. Press the Scrub Off switch (E) to save the new setting and move to the chemical rate setting (or the end of the program mode for Warrior ST).



10. **Chemical Rate Setting:** (Not available on Warrior ST) The display will now show the chemical bottle with current chemical setting. Solution indicator will turn green and chemical indicator will turn green.

11. Press the Chemical switch (H) to scroll through the 9 chemical settings.

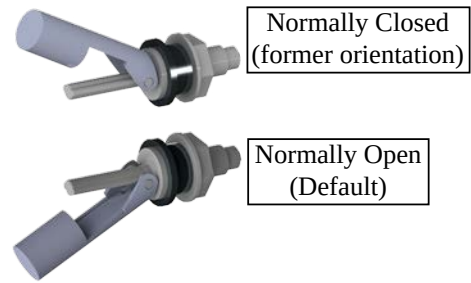
12. Press the Scrub Off switch (E) to save the new setting and display key switch icon on display.



13. Turn the key switch to the off position. The new settings will be saved and will remain in effect until they are changed again.

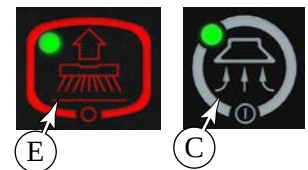
Recovery Tank-Full Switch Orientation

Use this procedure if installing a new control board on an older Warrior machine that uses the recovery tank full switch in the normally closed orientation. All current Warrior machines use the normally open orientation, which is also the default option for the control board setting. You may also use this option when changing the orientation of an existing sensor to the normally open direction during a sensor replacement procedure.



Note: *This feature may not be available on older ST/AXP control board versions. If the main controller on your machine does not have the switch orientation programming option available (below Revision level I for AXP machines, and below Revision level E for ST machines), you must run the machine with the switch in the normally-closed configuration. Refer to the Displaying the Control Unit Revision Level section for instructions on how to view the software revision level of your controller.*

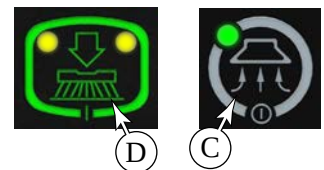
1. Turn the key switch to the off position.
2. While holding the Scrub System Off (E) and Vacuum (C) switches depressed, turn the key switch to the on position.
3. Continue to hold both switches until only the vacuum indicator is lit (approximately 2 seconds).
4. Release both switches. The status or LED display will now indicate “0” or “1” and the scrub off indicator will be red.
5. Press the Vacuum switch (C) to toggle between “1” for the normally closed configuration or “0” for the normally open configuration.
6. To save the new setting, press the scrub off button. The scrub off indicator will change from red to green.
7. Turn the main power key switch to the off position. The new setting will be saved and will remain in effect until it is changed again.



LCD Style Selection (Warrior AXP)

Factory Default: Rectangular Shape With Three Bars LCD graphic style can be programmed to different style. There are two different styles and to change LCD graphic style, perform the following steps:

1. Turn the key switch to the off position.
2. While holding the Scrub System On (D) and Vacuum (C) switches depressed, turn the key switch to the on position.
3. Continue to hold both switches until the vacuum indicator and scrub on indicator turn yellow.
4. Release both switches. The display will now show current graphic style. The scrub off switch will turn red.
5. Pressing scrub on switch will now select between two different graphic styles and the display will be updated with new graphic style.
6. Press scrub off switch to save the setting. Turn the main power key switch to the off position.
7. The new setting will be saved and will remain in effect until it is changed again.



Monitor Mode (Warrior AXP/EcoFlex)

The Warrior is equipped with a monitor mode where the current deck setting, low-voltage cutout setting, and error checking setting can be quickly checked for the machine's specific set up.

1. Turn the key switch to the off position.
2. For AXP: While holding the Recycle switch (**G**) turn the main key switch to the on position.
3. For EcoFlex: While holding the Vacuum switch (**C**) turn the main key switch to the on position.
4. Continue to hold the switch until the indicator turns yellow (AXP: Recycle, EcoFlex: Vacuum).
5. The display will display current deck setting, low-voltage cutout setting and error checking setting.
6. To exit this mode, turn the main power key switch to the off position.

Chemical User Ratio Selection (Warrior AXP/EcoFlex)

Factory Default: 8

1. Turn the key switch to the off position.
2. Press and hold the chemical switch.
3. While holding the Chemical switch (**H**) turn the key switch to the on position.
4. Continue to hold the chemical switch until the chemical indicator turns yellow. The Chemical indicator will then turn green.
5. The display will show the chemical bottle with the current user ratio.
6. Press the Chemical switch to scroll through the chemical settings (32, 50, 64, 100, 128, 150, 200, 256, 300).
7. Press Scrub Off switch (**E**) to save new setting. The display will show key switch icon.
8. Turn the main power key switch to the off position.
9. The new setting will be saved and will remain in effect until it is changed again.

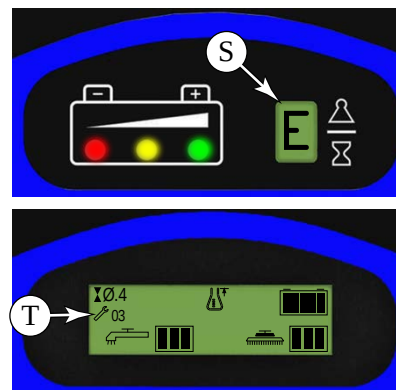
%	oz./gal	RATIO	
.3	-	1:300	← 9
.4	½	1:256	← 8
.5	-	1:200	← 7
.66	-	1:150	← 6
.8	1	1:128	← 5
1	-	1:100	← 4
1.5	2	1:64	← 3
2	2½	1:50	← 2
3	4	1:32	← 1

Note: Program to the desired ratio needed when not using a chemical container (cartridge) that uses the magnetic slider.

Troubleshooting Guide

Any error codes detected by the main control board will be displayed on the display panel as they occur. If more than one error exists the display will sequence through the error codes at one-second intervals. On AXP/EcoFlex models the error **(T)** will display as a mechanical wrench symbol followed by a two-digit code. On standard models the hour meter / error display will flash an “E” and 2 numbers one at a time.

When troubleshooting any “Fault Description” noted with a double asterisk (**) follow the instructions for entering the Service Test Mode in the control boards special programs. See the *Main Control Board Special Program Options* section in this manual.



Main Controller Error Codes

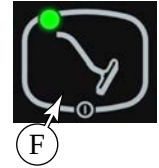
Error	Description	Comments
E03	Drive system fault.	The Wand indicator (F) will flash out a specific Curtis Drive controller error code. See the <i>Wheel System, Traction</i> chapter troubleshooting section for a list of error codes.
E04	Scrub deck lift actuator overload.	- Inspect the scrub deck for obstruction. - Measure the actuator amperage with and without the scrub deck connected. - No-load current = 1.4 amps - Normal current = 1.0-2.5 Amps - Maximum current = 6 Amps - If the no-load current remains high, then the actuator or wiring is faulty.
E05	Solution pump overload.	- Inspect for downstream obstructions in the solution line. - Measure the pump amperage with and without solution flow - Normal current = 0.8-1.8 Amps - Maximum current = 3.2 Amps - If the no-load current remains high, then the pump or wiring is faulty.
E06	Scrub motor overload	- Check the scrub setting adjustments described previously in this chapter. - Check for binding in rotation of brushes or improper deck lift actuator operation. - Inspect the ground wire supplying the brush motors for poor or corroded connections. The voltage drop across this wire is used to measure the amperage to the motors. - Inspect the current sense wire (white/gray) for continuity. - Make sure the correct scrub deck is specified in the control board settings (cylindrical versus disc).
E07	Vacuum motor overload	- Inspect the vacuum motor impeller for obstruction. - Check the vacuum discharge for obstruction (inlet obstruction will reduce the amperage). - Normal current load 17-19 Amps. - Inspect the vacuum motor brushes - Defective motor bearings. - Inspect the current sense wire (orange) for continuity

E08	Solenoid Bank Coil Circuit Overload • Brush Motor Contactor (K1) • Vacuum Motor contactor (K2) • Solution Solenoid (L1) • Recycle Solenoid (L2)	The <u>sum</u> of the currents through these coils is too high • Inspect the “B-3” ground bus (J2-9 wire) at the controller for negative battery voltage. This error will occur is B-3 is disconnected. • If this error occurs when no coils are active (and J2-9 wire is good), the control board is defective • Operate various combinations of coils to identify which coil is causing the problem. • Check for wiring problems on the coil circuit(s) and repair wiring. • Check resistance on all contactor/solenoid coils. If the value is less than 20% of the values below, replace the contactor/solenoid • Brush motor contactor coil (K1): 98 to 120 Ω • Vacuum motor contactor coil (K2): 102 to 120 Ω • Solution solenoid coil (L1): AXP, EcoFlex 128 Ω • Solution solenoid coil (L1): ST 76 Ω • Recycle solenoid coil (L2): ST 128 Ω
E017	Scrub deck lift actuator circuit open (**)	The controller's internal circuitry is not seeing any voltage change. • Inspect the B+2 bus (J2-7) and fuse (F2) for positive battery voltage. • Check for disconnected actuator wiring or defective actuator motor. • Check controller's actuator output voltage. This is a switched ground PWM, so one terminal will be 36 volts (B+2 bus) to Battery-Negative and the other should be non-zero (PWM of B-2) to Battery-Negative. If both remain near 36 volts, it indicates a controller failure.
E018	Scrub deck lift actuator short	The controller's internal circuitry is seeing maximum voltage in the current sensing circuit. • Inspect the B-2 bus (J1-9) for connection to ground • Inspect the actuator wiring for short circuit(s) • Inspect the scrub deck for obstructions to movement • Check the lift actuator limit adjustment
E021	Brush motor circuit open (**)	The controller's internal circuitry is not seeing any voltage change. • Inspect the current sense wire (white/gray) for continuity. • Inspect the brush motor contactor for proper operation. • Inspect the motor power circuit and cable connectors for open circuits
E022)	Scrub motor short	The controller's internal circuitry is seeing maximum voltage in the current sensing circuit. • Same troubleshooting as E06
E023)	Vacuum motor circuit open (**)	The controller's internal circuitry is not seeing any voltage change. • Inspect the current sense wire (orange) for continuity. • Check the vacuum motor contactor for proper operation • Inspect the motor's power wiring for open circuit
E024)	Vacuum motor short	The controller's internal circuitry is seeing maximum voltage in the current sensing circuit. • Same troubleshooting as E07

Service Test Mode

To assist in the troubleshooting and servicing of the electrical system and related components, a special test mode allows independent control of the various outputs and monitoring of the various inputs. To enter the service test mode perform the following step:

1. Turn the key switch to the off position.
2. While holding the Wand (**F**) switch depressed, turn the key switch to the on position.
3. Continue to hold the Wand switch until the Wand indicator turns green.
4. ST model: The Display will show “t” for Test Mode.
5. AXP/EcoFlex models: The Display will show “SVCTEST” (AXP/EcoFlex models) or “t” (ST models)
6. To exit Service Test Mode, turn the key switch to the off position.



Test Mode Input Indicators

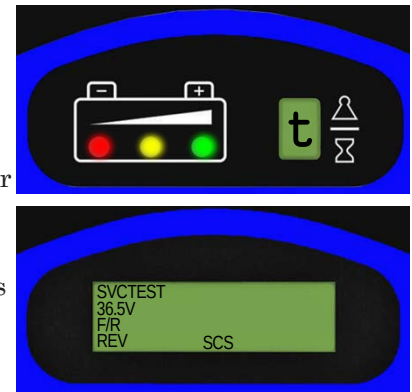
Battery Voltage (AXP/Ecoflex Models)

The battery voltage, as detected by the controller, is displayed below the “SVCTEST” indicator. If this displayed voltage differs significantly from the actual battery voltage, it indicates a poor connection between the batteries and the controller.

Speed Controller Status

This is a Warrior controller input from the Curtis Drive controller. The indicator is passed through the Warrior controller without interpretation, and represents the error code from the Drive controller.

- On ST models, the green light in the battery indicator will light whenever the key is on. If there is a speed control fault, the indicator will flash the fault code produced by the speed controller.
- On AXP / EcoFlex models, the SCS will be displayed whenever the key is on. If there is a speed control fault, this indicator will flash the fault code produced by the speed control.



Refer to the speed control section for details on these codes. If the indicator does not display, disconnect the Orn/Blu wire from the speed controller and main controller and check the continuity of the wire. If the wire tests open repair or replace the wire or plug. If wire tests OK, the fault is likely with the Drive controller.

Forward/Reverse Status

This indicator comes from the Curtis Drive controller, and indicates that the drive paddle is moved out of the neutral position (either forward or reverse). The indicator is active when the signal is low.

- On AXP/EcoFlex models, F/R will be shown in the display.
- On ST models, the indicator is the yellow light in the battery status.

Reverse Status

This indicator comes from the Curtis Drive controller and indicates when the drive paddle is in the reverse direction (pulled low in reverse, high in neutral and forward).

- On AXP/EcoFlex models, REV will be displayed if this signal is active.
- On ST models, the red battery indicator will light when the throttle is in the reverse position.

Test Mode Output Controls

The control panel switches are used to control various output functions of the Warrior controller while in Test Mode. Below is a list of each switch and the function it controls. Following the list is a detailed description of each function.

Scrub off Switch (H): Controls the brush motor.

Scrub on Switch (I): Controls the scrub deck lift actuator.

Vacuum Switch (C): Controls the vacuum motor.

Wand Switch (E): Jogs the scrub deck lift actuator.

Solution Switch (B): Turns on the solution pump (if so equipped) and solenoid valve.

Extended Scrub Switch (G): Turns on the recycle pump (If available).

Detergent System Switch (F): Turns on the chemical pump (If available).

Description of Output Controls

Scrub System Off Switch (H):

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

Off – Brush motor output is off and there is no brush motor current sensed.

Steady Green – Brush motor output is on and there is normal brush motor current sensed.

Brief On Green Flash – Brush motor output is off and brush motor current is being sensed (abnormal condition).

- Check for voltage at the Wht wire on K1 contactor to battery ground.
- If any voltage is present, replace K1 contactor.
- NO voltage, replace the Main control board.

Brief Off Green Flash – Brush motor output is on and brush motor current is not being sensed (abnormal condition).

- Check brush motor wiring plugs.
- Check one of the Blk wires of the main harness connector at the brush motor to battery Positive. If no voltage repair or replace wire.
- Check one of the Wht wires of the main harness connector at the brush motor to battery Neg. If no voltage repair or replace wire.
- Check for voltage at the Red wire on K1 contactor to battery ground. If no voltage is present repair the Red wire.
- Check for voltage at the Wht wire on K1 contactor to battery ground. If no voltage is present replace the K1 contactor.

Flashing Red – Brush motor overload has occurred.

- Check to see that the proper brush programming type is selected (disc or cyl).
- Check for binding in rotation of brushes or improper scrub brush type installed. (Amp. Test) See Pressure Chart in this Manual.
- Check the negative supply cable at the brush motor for a wiring problem or improper modifications.
- Check for open in the small WHT/GRA current sense wire.

- Check for short circuit* in brush motor or wiring.
- Inspect gearbox for failure (disc). Repair or replace.
- Inspect scrub brush drive bearings for excessive wear (cyl.).

Scrub On Switch (I)

This switch is used to control the output to the scrub deck lift actuator. Pressing and releasing this switch will cycle the actuator output through 4 states. These are:

- 1 – Output off, direction = up
- 2 – Output on, direction = down
 - AXP / EcoFlex models - display will show down arrow.
 - ST models – the normal scrub on indicator will be green.
- 3 – Output off, direction = down
- 4 – Output on, direction = up
 - AXP / EcoFlex models - display will show up arrow.
 - ST models – the normal scrub on indicator will be yellow.

When the output is in state 1, the actuator output is turned off. The scrub pressure decrease indicator should be off. If the indicator is flashing green, this indicates that the control is sensing current flow through the actuator (shorted output driver, control error). If the scrub pressure decrease switch was the last switch pressed, it is possible to momentarily activate the actuator output using the wand switch. This can be used to jog the actuator to allow precise positioning of the actuator. Note: the actuator can only move in this situation if it is not at its up limit.

When the output is in state 2, the actuator output is turned on. The scrub pressure decrease indicator should be green or flashing green. The indicator will be a steady green if the control senses current flow through the actuator. It will flash green if no actuator current flow is sensed (actuator at limit, open circuit, open output driver). The wand switch has no effect in this state.

When the output is in state 3, the actuator output is turned off. The scrub pressure decrease indicator should be off. If the indicator is flashing green, this indicates that the control is sensing current flow through the actuator (shorted output driver, control error). If the scrub pressure decrease switch was the last switch pressed, it is possible to momentarily activate the actuator output using the wand switch. This can be used to jog the actuator to allow precise positioning of the actuator. Note: the actuator can only move in this situation if it is not at its down limit.

When the output is in state 4, the actuator output is turned on. The scrub pressure decrease indicator should be green or flashing green. The indicator will be a steady green if the control senses current flow through the actuator. It will flash green if no actuator current flow is sensed (actuator at limit, open circuit, open output driver). The wand switch has no effect in this state.

Vacuum Switch (C)

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

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

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

Brief On Green Flash – Vacuum motor output is off and vacuum motor current is being sensed (abnormal condition).

- Check for voltage at the Blu wire on K2 contactor to battery ground.
- If any voltage is present, replace K2 contactor.

- NO voltage, replace the Main control board.

Brief Off Green Flash – Vacuum motor output is on and vacuum motor current is not being sensed (abnormal condition).

- Check Vacuum Motor wiring plug, disconnection.
- Check for voltage at the Red wire on K2 contactor to battery ground. If no voltage is present repair the Red wire.
- Check for voltage at the Blu wire on K2 contactor to battery ground. If no voltage is present replace the K2 contactor.
- Check the Blu wire of the main harness connector at the vacuum motor to battery Negative. If no voltage repair or replace wire.
- Check the Blk wire of the main harness connector at the vacuum motor to battery Positive. If no voltage repair or replace wire.

Flashing Yellow – Vacuum motor overload has occurred.

- Check for an open in the small ORG current sense wire.
- To confirm an overload, disconnect the motor plug from the main harness, run a 30 amp fused test leads from the batteries to the motor and perform an Amp draw test. Normal current load 36V 16-19 Amps.
- Check for debris in the vacuum motor.
- Worn carbon brushes.
- Defective motor bearings.
- Check for short circuit* in vacuum motor or wiring. Repair or replace.

Solution Switch (B)

This switch is used to toggle the state of the solution pump and/or solution solenoid. Pressing and releasing this switch will alternately turn the solution solenoid (L1) on and off (ST models), or turn the solution pump (M7) and solution solenoid (L1) on and off (AXP/EcoFlex models). The indicator provides the following status information:

Off - Solution output is off.

Steady Green - Solution output is on (solution pump is on and/or solenoid valve is open).

Flashing Yellow – Solution solenoid/contactor coil overload has occurred.

Extended Scrub Switch (G)

This switch is used to toggle the state of the recycle pump and recycle valve (if the machine is so equipped). Pressing and releasing this switch will alternately turn the recycle pump and recycle valve on and off. The indicator provides the following status information:

Off – Recycle pump and valve off.

Steady Green – Recycle output is on and valve is open.

Detergent Switch (F)

This switch is used to toggle the state of the chemical pump (if the machine is so equipped). Pressing and releasing this switch will alternately turn the chemical pump on and off. The indicator provides the following status information:

Off – Chemical pump and valve off.

Steady Green – Chemical output is on.

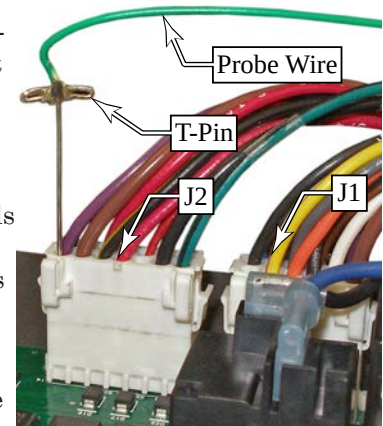
Sample Voltage Measurements

Examining signals sent and received at the control board can be very effective in determining if external components are functioning as expected or if the control board is processing them as expected. The tables below show sample voltage measurements taken from a Warrior machine. Actual voltages will vary from machine to machine, and with battery charge level.

The majority of voltage measurements will be dependant on the battery voltage of the machine at the time. The nominal battery voltage is 36 volts, but depending on the charge state of the battery, the actual voltage may be higher or lower. With regard to digital logic signals, the terms “High (voltage)” and “Low (voltage)” mean a voltage value equal (or close to) Battery-Positive and Battery-Negative, respectively. V_{cc} is a special voltage value that is independent of the battery voltage, and is regulated to be close to 5.0 volts by the Warrior controller’s circuit board.

Some signals are Pulse-Width Modulated (PWM) (See the *Wheel System, Traction* chapter for more information on PWM). This means that these signals are being turned On and Off at a high rate. Even though their instantaneous voltage jumps from 36V to 0V, your voltmeter will average these On/Off jumps into an equivalent voltage somewhere in between 36 and 0 volts.

To aid in taking voltage measurements from the cable connectors without removing the connector, a T-shaped push pin connected to the voltmeter probe wire works well (see image to the right).



Warrior Controller Sample Voltage Measurements at the J1 Connector				
Pin #	Name	Voltage	Ref.	Comments
J1-1	Rec-start	4.99	B-	Sensor input from recycle start sensor. Should be slightly less than V_{cc}
J1-2	Rec-stop	4.99	B-	Sensor input from recycle stop sensor. Should be slightly less than V_{cc}
J1-3	V_{cc}	5.00	B-	Output from internal 5-volt power supply for logic circuitry and semiconductors. This measurement should always be very close to 5.0 volts.
J1-4	SC-Status	A 36.5	B-	Input of status indicator from Drive controller. The actual voltage seen for the Inactive state will be non-zero due to internal circuitry in the Drive controller.
		I 3.20		
J1-5	F/R	A 0.01	B-	Input of F/R from Drive controller. Results should be close to B+ and B-, but will be slightly less due to internal circuitry in the Drive controller.
		I 31.9		
J1-6	Rev	A 1.80	B-	Input of Reverse from Drive controller. Results should be close to B+ and B-, but will be slightly less due to internal circuitry in the Drive controller.
		I 36.3		
J1-7	Bat-	NL 0.004	B-	Measured with Load (Vacuum motor) and No-Load . Any non-zero result represents the voltage drop in the wiring between battery and control board.
		L 0.040		
J1-8	Solution Pump	A 25.0	B-	PWM output to Solution Pump. The Active voltage will vary depending on the duty cycle of the PWM signal.
		I 36.8		
J1-9	B-3 Bus	0.00	B-	Negative bus for solenoids and contactors (brush, vacuum, solution, recycle)
J1-10	Recycle	N/A	B-	Obsolete, not recorded. Output to Recycle solenoid (should be similar to J11)
J1-11	Solution Solenoid	A 0.177	B-	Active voltage may be higher on ST models due to PWM control of the solenoid. AXP/EcoFlex solenoids are On/Off w/o PWM control.
		I 36.9		
J1-12	Vacuum Contactor	A 7.5	B-	A PWM output to the coil. The PWM is to reduce the effective voltage and reduce the load in the solenoid coil.
		I 36.9		
J1-13	Key Switch	A 36.9	B-	Switched battery power that drives the internal V_{cc} power supply. When this is off, so is V_{cc} .
		I 0.00		
J1-14	Brush Contactor	A 7.60	B-	A PWM output to the coil. The PWM is to reduce the effective voltage and reduce the load in the solenoid coil.
		I 36.9		

A = Active I = Inactive NL = No Load

Warrior Controller Sample Voltage Measurements at the J2 Connector							
Pin #	Name	Voltage		Ref.	Comments		
J2-1	Lift Actuator	U	0.20	B-	A DPDT relay inside the control board reverses polarity for Up and Down . J2-1 and J2-8 should have mirrored voltages. High voltage should be close to bat+ (voltage drop in wire). Inactive voltage should be equal to Bat- (mirror J2-8). Active low voltage represents voltage drop across internal switching MOSFET.		
		D	36.9				
		I	0.00				
J2-2	B- (Output)	NL	0.004	B-	Electrically connected to J1-7 as battery negative output. Measured with Load (Vacuum motor) and No-Load (see J1-7).		
		L	0.040				
J2-3	Chemical Ratio Sensor	U	5.00	B-	Input from chemical ratio sensor. When Unplugged , the voltage is V_{cc} due to pull-up resistor in controller. Analog hall effect sensor with voltage range dependant on Top to Bottom position of magnet on chemical bottle.		
		B	4.78				
		T	1.83				
J2-4	Recovery Tank Full	C	0.01	B-	Hall effect sensor. The voltage should be close to V_{cc} when Open (down position), and close to Bat- when Closed (up position).		
		O	4.997				
J2-5	Brush Current	A	table	B-	Represents the voltage drop across the Battery negative wire to the brush motors with a wire resistance of approximately 0.006 Ω . From Ohm's Law, $V = I * R$. The values to the right follow closely with the calculated results.	Motor Amps	Input Voltage
		I	0.0			4	0.025
						8	0.046
						10	0.060
						27	0.187
						30	0.199
J2-6	B-4 bus	NL	0.004	B-	Negative battery bus for the pump motors (Recycle, Solution, Chemical). Measured with Load (Vacuum motor) and No-Load (see J1-7).		
		L	0.040				
J2-7	B+2 bus		36.9	B-	Positive battery bus for Lift Actuator motor. Also a reference voltage (no-load pull-up) for most other switching MOSFET's that are active-low.		
J2-8	Lift Actuator	U	36.9	B-	A DPDT relay inside the control board reverses polarity for Up and Down . J2-1 and J2-8 should have mirrored voltages. High voltage should be close to bat+ (voltage drop in wire). Inactive voltage should be equal to Bat+ (mirror J2-1). Active low voltage represents voltage drop across internal switching MOSFET.		
		D	0.30				
		I	36.9				
J2-9	B-2 bus	NL	0.004	B-	Negative battery bus for Lift Actuator motor. Measured with Load (Vacuum motor) and No-Load (see J1-7).		
		L	0.040				
J2-10	Vacuum Current		Varies	B-	Represents the voltage drop across the Battery negative wire to the vacuum motor. At Idle: 14A = 0.085V; Blocked Exhaust: 17A = 0.105V		
J2-11	Chemical Pump	A	PWM	B-	Active-low PWM signal to chemical pump. The voltage will vary with PWM duty cycle. The lower the voltage, the more active (faster) the pump.		
		I	36.9				
J2-12	Recycle Pump	A	PWM	B-	Active-low PWM signal to chemical pump. The voltage will vary with PWM duty cycle. The lower the voltage, the more active (faster) the pump.		
		I	36.9				

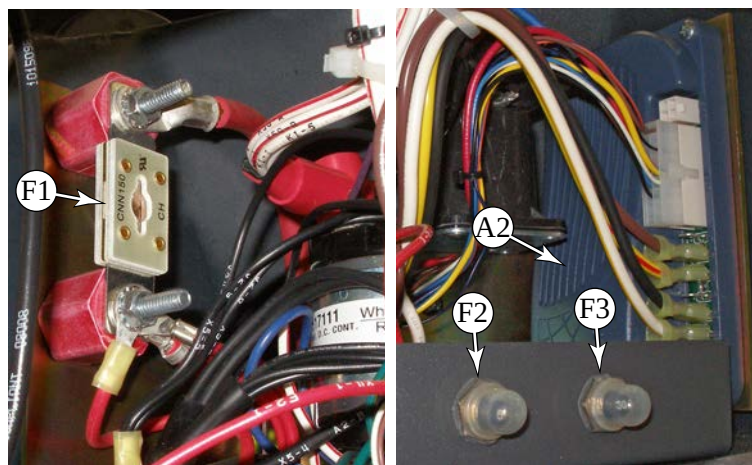
A = Active I = Inactive NL = No Load U/D = Up/Down O/C = Open/Closed

Electrical System

Functional Description

The Warrior machine is powered using six, 6-volt batteries connected in series, for a total system nominal voltage of 36 volts. To protect the batteries from over discharge, the system is protected with a 150 amp fuse (**F1**). With the exception of the optional on-board battery charger, all other connections are downstream from this main fuse.

There are 2 circuit breakers that protect the electronics. The keyswitch (**S3**), Warrior controller (**A1**), Brush motor contactor coil (**K1**), Vacuum motor contactor coil (**K2**), Solution solenoid (**L1**), and optional Recycle solenoid (**L2**) are protected with a 5 amp resettable circuit breaker (**F2**). The Curtis Drive controller is protected with a 30 amp resettable circuit breaker (**F3**). If these circuit breakers trip, their respective button will pop up. Pressing the button back in after the overload has cleared will reset the breaker.



When the optional on-board battery charger is present, the battery-side of the (**F2**) fuse is replaced with an interlock circuit from the charger. (Power to the fuse comes through the charger.) This interlock feature allows the charger to disable all control of the machine when the charger is plugged into a wall outlet and the battery is being charged. The charger doesn't disable all power to the machine; just the control power.

Description Of The Low-Voltage Cutout Feature

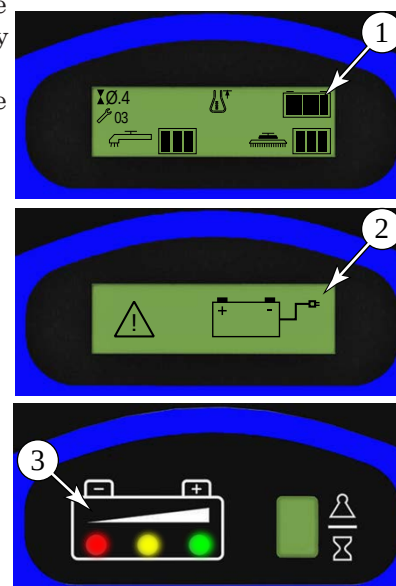
The warrior machine is equipped with a low-voltage cutout feature to prevent over-discharging of the batteries. When the machine's battery voltage falls below the defined threshold, the scrub system is automatically shut down. The voltage cutout level is adjustable for different battery types. The standard lead acid battery (wet cell) setting is 30.96 volts, and the alternate (gel cell) setting is 32.58 volts. The standard setting is factory selected and should be used unless the battery manufacturer specifies the higher cutout voltage. **Note:** A minimum recharge voltage of 38.6 volts must be reached to allow the low-voltage cutout system to reset once activated.

Description Of The Battery Condition Indicators

The Battery Condition Indicator will give an indication of the state of charge of the batteries based on the voltage of the batteries. The Warrior ST display has three colored LED's (**3**) showing 5-levels of voltage. The Warrior AXP/ EcoFlex display has 5 vertical bars (**1**) showing 6-levels of voltage. When the low-voltage cutout is active, the charge symbol (**2**) will be shown, or the red LED will flash. These levels are summarized in the tables below.

AXP/EcoFlex Display		
Display	Standard	Alternate
5 bars	36.1+	36.1+
4 bars	35.5-36.1	35.5-36.1
3 bars	34.4-35.5	34.4-35.5
2 bars	33.9-34.4	33.9-34.4
1 bars	32.2-33.9	33.3-33.9
0 bars	30.9-32.2	32.8-33.3
Cutout	<30.9	<32.8

ST Display		
Display	Standard	Alternate
Grn	34.0+	34.5+
Grn & Yel	33.0-34.0	34.0-34.5
Yel	32.0-33.0	33.5-34.0
Yel & Red	31.5-32.0	33.0-33.5
Red	31.0-31.5	32.5-33.0
Flash Red	<31.0	<32.5



Maintenance and Adjustments

Charging Batteries

Charge the batteries each time the machine is used or when the battery indicator (1 or 3) is reading less than full. *Note: Refer to the algorithm chart in Advance Technical Service Bulletin TSBUS2008-984 for the correct charging algorithm for your battery type and model.*

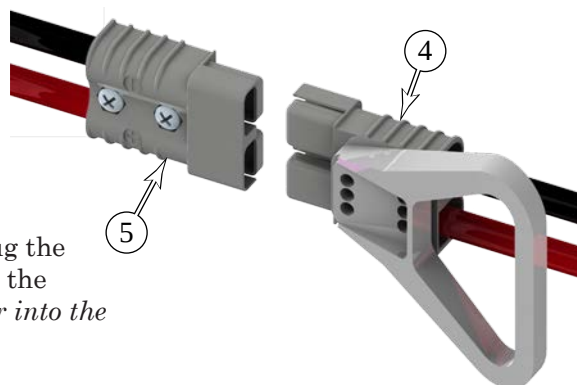


Caution!

- **Charge batteries in a well-ventilated area.**
- **Do not smoke while servicing the batteries.**
- **Remove all jewelry**
- **Wear safety glasses, rubber gloves and a rubber apron**
- **Do not allow tools to touch more than one battery terminal at a time**
- **To avoid damage to floor surfaces, wipe water and acid from the top of the batteries after charging.**

If your machine shipped with an onboard battery charger, turn the Key Switch off. Unwind the electrical cord from the side of the onboard charger and plug it into a properly grounded outlet. Refer to the OEM product manual for more detailed operating instructions.

If your machine uses an external battery charger, unplug the battery connector (4) from the machine connector (5), and plug the battery connector into the charger. Follow the instructions on the battery charger. **Note: Make sure you plug the battery charger into the connector (4) with the handle attached to it.**



Extending Battery Life

Proper maintenance of electric vehicle batteries can greatly extend their life. The following information will help extend the life of your batteries.

- Your battery will deliver superior performance and life if it is recharged properly. Excessive charging or discharging will shorten battery life and limit performance. Be sure to follow proper charging instructions.
- Make sure you have an appropriate charger for the type of battery. Use only “voltage-regulated” or “voltage-limited” chargers. Standard constant-current or taper current chargers must not be used. A temperature-sensing charger is recommended.
- **Important!** Do not attempt to open sealed gel batteries or add water. Doing so will damage the battery and void the warranty.
- For wet batteries, maintain proper electrolyte level and check weekly. Use distilled water in batteries whenever possible. If the batteries are discharged, add just enough water to cover the plates in each cell, and recheck the level after charging (this prevents over-filling the battery). If batteries are fully charged, fill each cell to the bottom of the filler tube. Do not over-fill the batteries! Do not add acid to batteries!
- Keep the Batteries Charged. Batteries should be charged each time that a machine is used for more than 1 hour. Machine operators should open the battery compartment cover for charging, to avoid a concentrated build-up of hydrogen gas. Operators should follow the instructions provided with their specific battery charger, to determine how long the batteries should be charged. Even when a machine is stored, the batteries should be charged once a month to prevent the batteries from “sulfating”. Most battery caps are vented, so there’s no need to loosen or remove them for charging.
- Keep the Batteries Clean. Use a damp cloth to wipe dirt from the top of the batteries. Battery terminals must be clean and tight. If the tops of the batteries are wet after charging, the batteries have probably been overfilled or over-charged. **Note:** If there is acid on the batteries, wash the tops of the batteries with a solution of baking soda and water (2 tablespoons of baking soda to 1 quart of water).

Troubleshooting

Battery Testing

A battery problem is usually recognized by the machine operator as a decrease in the machine's running time. This condition is usually caused by one or more "dead cells" in the battery system.

There are 2 ways to find a dead cell:

- Use a hydrometer to check the specific gravity (or "state of charge") of the fluid in each cell. A dead cell is one that reads 50 points (or more) lower than the other cells.
- Use a volt meter to check the voltage of each battery. Look for a battery with a voltage that is 1 or 2 volts less than the other batteries. Check under the following conditions:
 - With the batteries fully charged,
 - With the scrub and drive motors running,
 - With the batteries discharged, but still above the voltage cutoff threshold.

If the batteries in the machine are more than 1 year old, it's usually best to replace the whole set, rather than replacing just one battery.

Removal and Installation

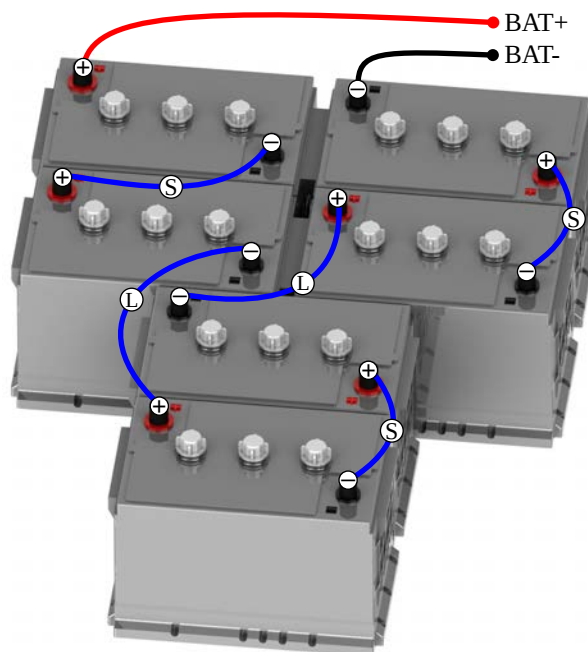
Batteries



Caution!

- Use extreme caution when working with batteries. Sulfuric acid in batteries can cause severe injury if allowed to contact the skin or eyes.
- Explosive hydrogen gas is vented from the batteries through openings in the battery caps. Do not smoke while servicing the batteries.
- Remove all jewelry. Wear safety glasses, rubber gloves and a rubber apron
- Do not allow tools to touch more than one battery terminal at a time
- Electrical components in this machine can be severely damaged if the batteries are not installed and connected properly.

1. Turn the Key Switch to the off position and open the recovery tank.
2. Remove the cables from the batteries, and remove the batteries. Make note of the battery polarity and cable locations.
3. Install the new batteries into the compartment. Note the orientation of the batteries shown to the right. Not all of the batteries are oriented the same way.
4. Put a rubber boot over each end of the battery cables.
5. Connect the battery cables.
 - There are 3 short cables (**S**), 2 long cables (**L**), and the main positive (**Bat+**) and negative (**Bat-**) cables leading to the machine.
 - All cables are connected positive-to-negative for a series connection between all 6 batteries.
 - Position the cables so the battery caps can be easily removed for battery service.
 - Take care to not over torque the cable connector, as this may damage the battery post.
6. Coat the terminals with spray-on battery terminal coating (available at most auto parts stores).



Specifications

Wet Cell Battery specifications:

- Use a combination of multiple 6-volt units to construct a 36 Volt DC battery pack system.
- Advance recommended battery pack capacity is a 305 AH @ 20 Hour Rate deep cycle battery system.
Note: The battery pack must fit the battery compartment size listed in Specifications.

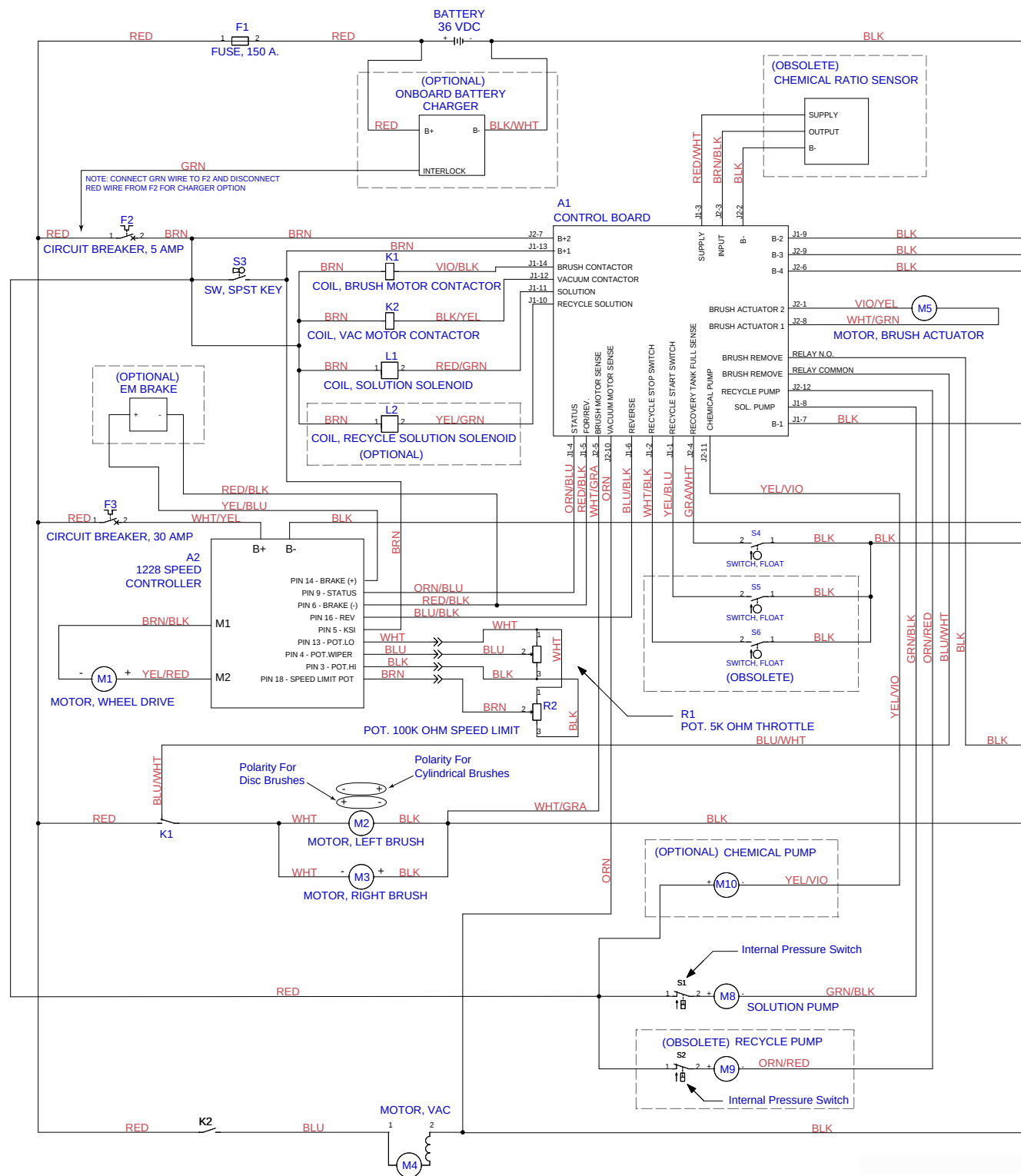
Wet Cell Battery Charger Specifications

- Use a 36 Volt DC output charger matching the DC battery pack voltage and the input AC line voltage supply being used.
- When selecting a battery charger always follow the recommendation of the battery supplier to match the proper charger DC output amperage to the amp/hour rating batteries being installed. This will prevent the battery pack from being over or under charged.
- The recommended 305 AH battery should be matched to a 36V, 20-25 Amp output charger on machines using (6) 6V batteries.

Wiring Diagram

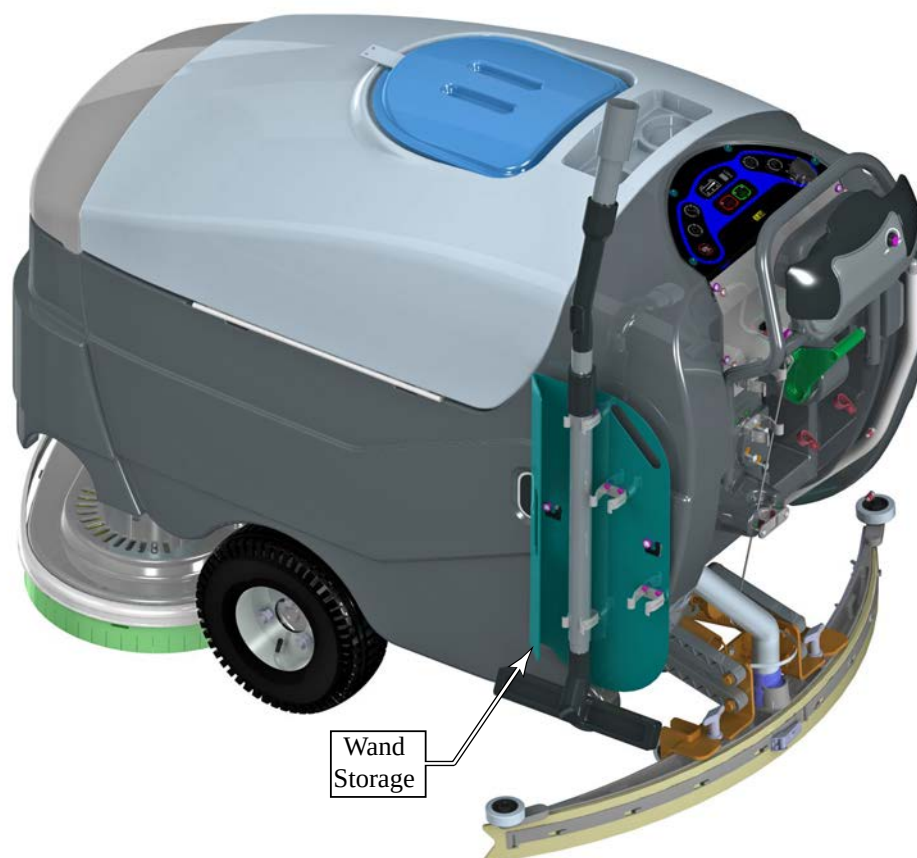
The wiring diagram below is a general representation of the wiring within all Warrior machine models up to the publication date of this manual. This diagram and actual machine wiring are subject to change. Some components are optional and may not be present on all machines. Some components are no longer offered on current machines, but are shown for reference to aid in servicing earlier machines.

Note: When the on-board battery charger is present, the red wire leading to the **F2** circuit breaker is replaced with the green wire from the battery charger's interlock. This disables the system during charging.



Options and Accessories

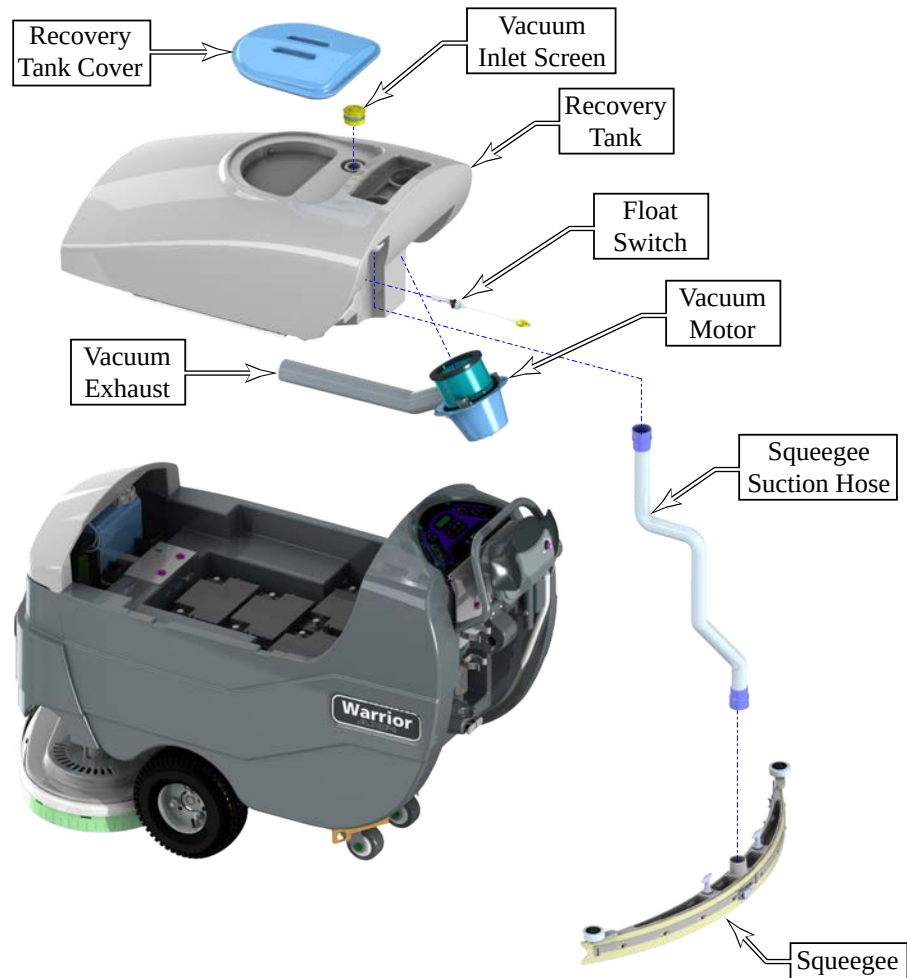
The Warrior machine is available in three basic configurations, ST, AXP, and EcoFlex. It also has a few options that may be added to these configurations, such as different sized scrub decks and squeegee assemblies. Refer to the parts manual for a complete list of accessories and components. The Wand option is an add-on accessory that may be added to any machine, and provides for spot cleanup in areas where the machine may not be able to reach.



Recovery System

Functional Description

The recovery system extracts wastewater from the floor and deposits it into the on-board 30 gallon recovery tank. The floor squeegee is wider than the swath of the scrub deck to ensure collection of all wastewater from the perimeter of the scrubbing area. The squeegee also pivots to the side to permit operation near walls and to keep the squeegee within the scrubbing path while turning the machine.

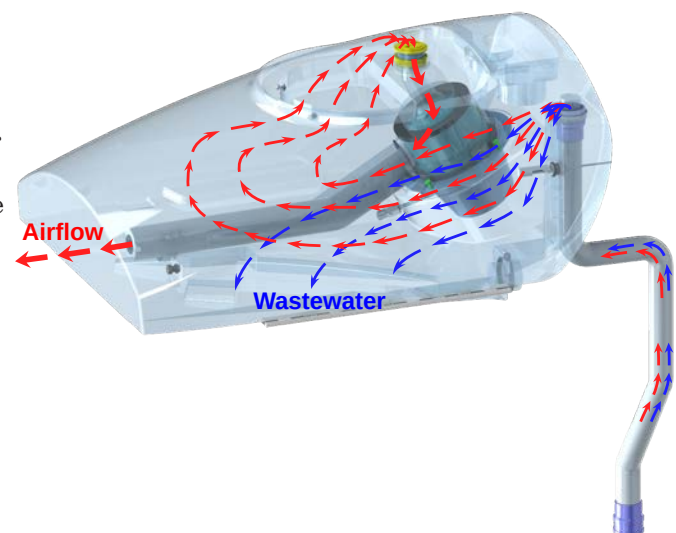


Vacuum Motor and Recovery Tank

The vacuum motor generates airflow through the recovery tank and suction hose to the squeegee. The high velocity air at the squeegee pulls the wastewater off the floor and up through the suction hose. As the mixture of air and water enters the recovery tank, the airflow slows down due to the larger space, and the water drops out of the airflow and into the tank.

The airflow passes through an inlet screen to prevent debris from entering the impeller of the vacuum motor. The exhaust air is expelled inside the machine so it can be dispersed without blowing directly on the operator or the work environment.

To prevent wastewater from entering the vacuum motor, a float switch shuts off the vacuum when the recovery tank is full.

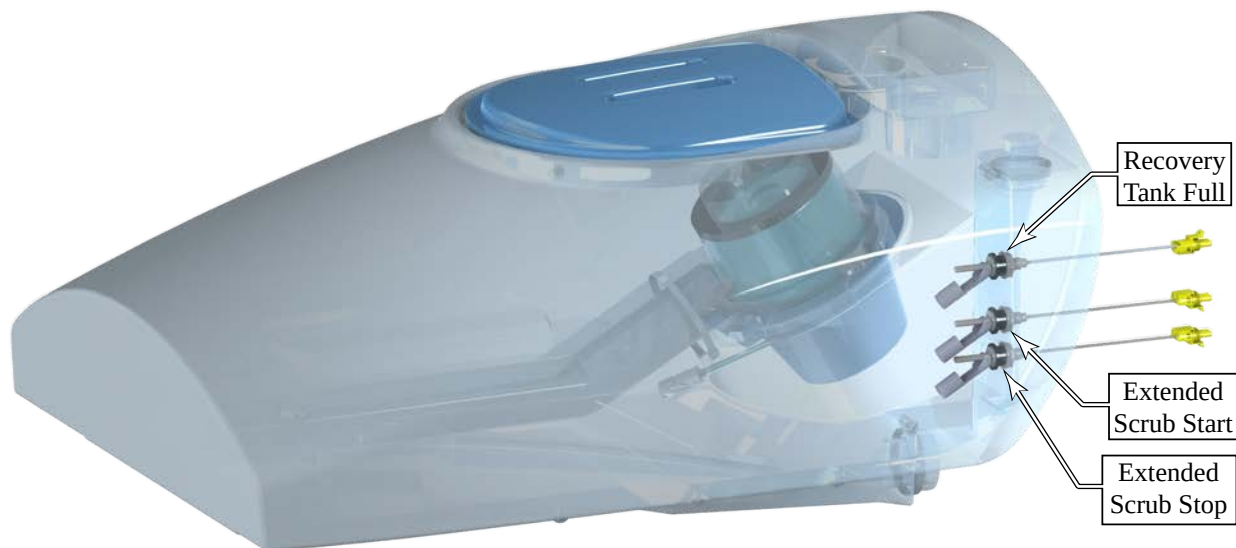
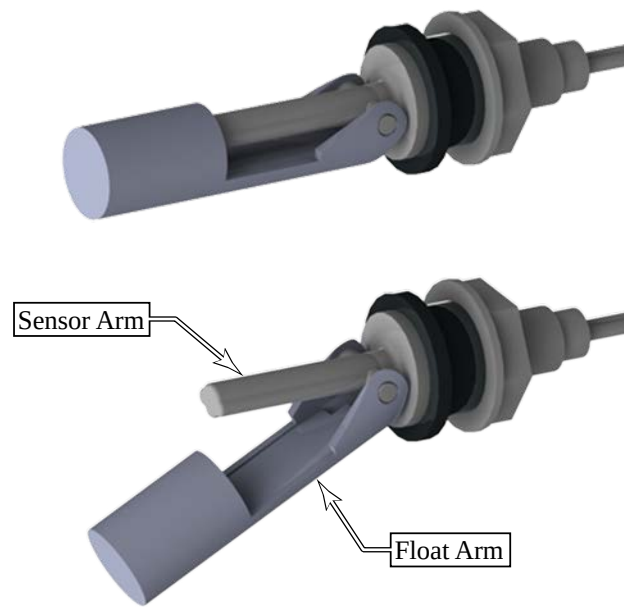


Float Switches

Depending on the machine configuration, there will be 1 or 3 float switches in the recovery tank. The recovery tank full switch is present on all machines and senses when water reaches the upper limit in the tank. The lower two switches are present only on machines equipped with the Extended Scrub option.

When the Extended Scrub option is present, the middle switch is for “Extended Scrub Start” which tells the machine there is enough solution to utilize the extended scrub function. The bottom switch is for “Extended Scrub Stop” which tells the machine there is not enough solution to utilize the extended scrub function.

The sensor arm of the float switch contains a non-contact reed switch. The float arm contains an embedded magnet. As the float arm moves upward into proximity to the sensor arm, the reed switch is magnetically pulled closed.



Troubleshooting

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

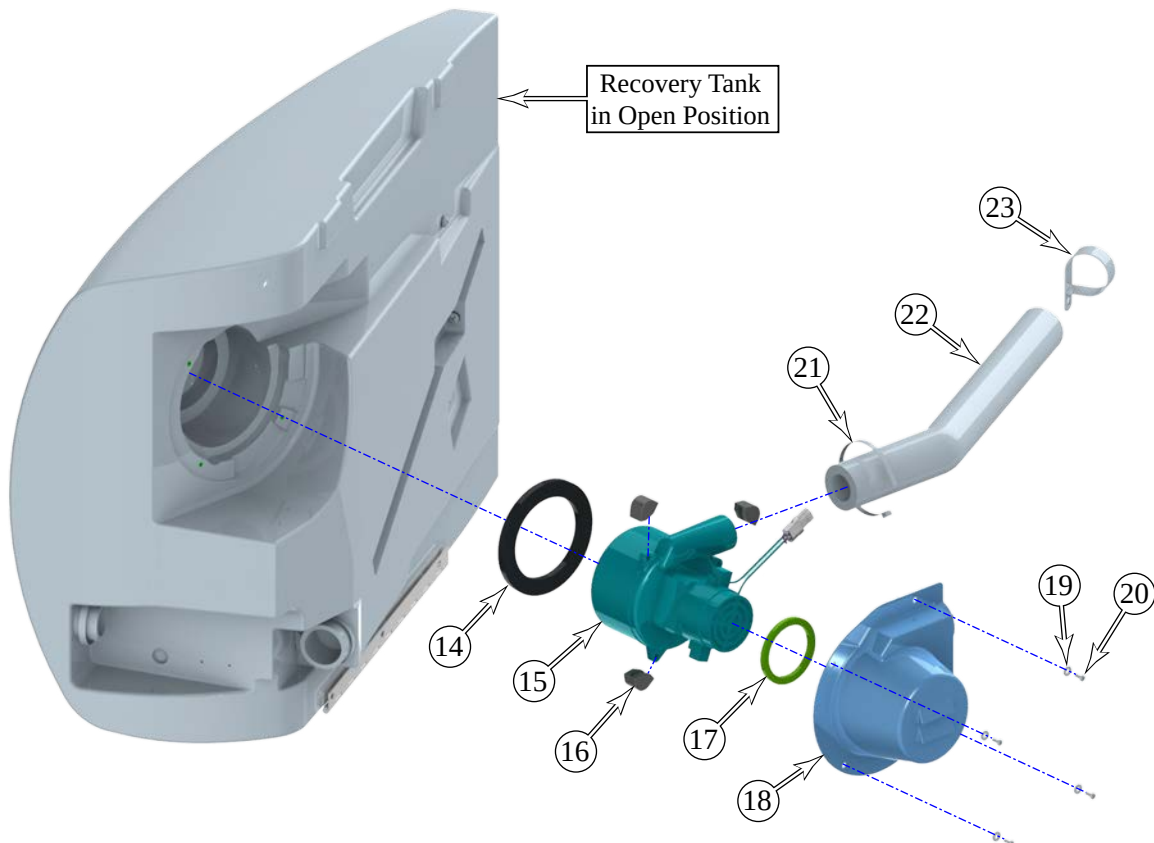
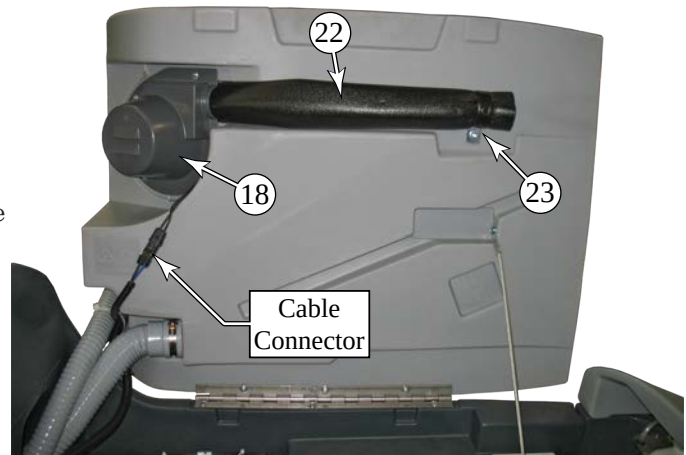
- Inspect and clean the vacuum motor float switch. Note that on current models, if the switch is closed (tipped up) the vacuum motor will not operate.
- Inspect the vacuum motor inlet screen and clean any built-up debris from the screen.
- Clean built-up dirt from the inside of the squeegee tool.
- Replace the squeegee blades if they are nicked or torn.
- Inspect the hose between the squeegee tool and the recovery tank and rinse any built-up dirt from the hose. Replace the hose if it is kinked or damaged.
- Inspect and make sure the gasket on the recovery tank cover is sealing and not damaged.
- Make sure that the recovery tank drain hose cap seals airtight.

Problem	Cause	Correction
No suction	Vacuum motor not running	• Inspect the recovery tank float switch for proper operation • Check the vacuum motor circuit breaker • Check the vacuum motor contactor for proper operation
Poor suction	Clogged vacuum	• Inspect and clean the vacuum motor inlet filter • Inspect the suction hose between the squeegee tool and the recovery tank • Inspect and clean the squeegee tool
	Vacuum leaks	• Inspect the gasket on the recovery tank cover • Inspect the suction hose between the squeegee tool and recovery tank for loose connection, holes, or damage • Inspect the squeegee blades for nicks, cuts, and damage • Inspect the recovery tank drain hose and cap for leaks • Inspect the vacuum motor mount for leaks

Removal and Installation

Vacuum Motor

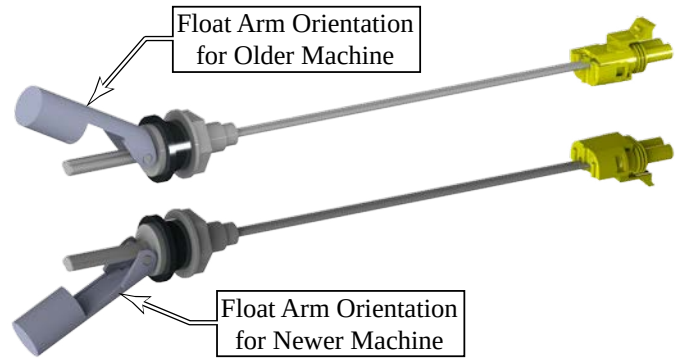
1. Turn off the key and disconnect the batteries.
2. Drain the recovery tank and move it to the open position.
3. Disconnect the vacuum motor cable connector.
4. Remove the screw and washer from the discharge hose clamp (23).
5. Remove the four screws (20) and washers (19) that secure the vacuum motor housing (18) to the recovery tank, and remove the housing. Be careful not to let the motor fall, as the housing is what holds it in place.
6. Remove the vacuum motor (15) and discharge hose (22). Take care not to lose the three vibration mounts (16).
7. If necessary, remove the cable tie (21) that secures the discharge hose to the motor outlet.
8. Inspect the main vacuum gasket (14) for damage and compressibility, and replace if necessary. Leaks in this gasket will reduce recovery system suction.
9. Inspect the motor ventilation gasket (17) for damage and compressibility. This gasket holds the vacuum motor assembly in position against the recovery tank.
10. Make service repairs to the vacuum motor as needed, and re-install by reversing the procedure steps.



Float Switches

Use this procedure to replace the float switches in the Recovery Tank. All machines will have a Recovery Tank Full switch. Machines with the Extended Scrub option will also have two additional switches (located below the tank-full switch) for Recycle Start and Recycle Stop.

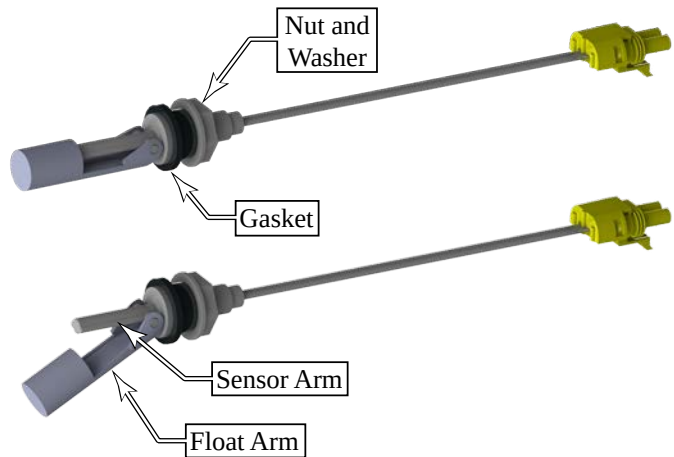
On some older machines, the recovery tank full float switch operated in the Normally Closed configuration (upper image to the right). When the tank is empty, the switch is in the closed position. For increased reliability, this switch orientation was later changed to operate in the Normally Open configuration (lower image to the right).



If the Warrior controller software revision level is above Revision level I for AXP machines, above Revision level E for ST machines, and for all EcoFlex machines, this switch orientation is configurable. If the machine being serviced is configurable for switch orientation, then it is recommended that the switch be installed in the Normally Open configuration with the Float Arm located below the sensor arm as shown. Make sure to check the setting as described in the *Recovery Tank-Full Switch Orientation* procedure in the Control System chapter.

For newer machines, and for all Extended Scrub sensors, orient the mechanical float to be below the sensor as shown in the lower image. To replace the float switch:

1. Turn off the key on the machine.
2. Disconnect the sensor cable connector.
3. Remove the nut and washer that secures the float switch to the recovery tank bulkhead, and remove the switch from inside the recovery tank.
4. When installing the switch, make sure the gasket is on the inside of the recovery tank, and the sensor is oriented correctly as described above.
5. If necessary, complete the *Recovery Tank-Full Switch Orientation* procedure described in the Control System chapter.



Specifications

Parameter	Range
Vacuum Lift	Blocked: 64 in.-H ₂ O 1-inch Orifice: 13 in.-H ₂ O

Scrub System, Cylindrical

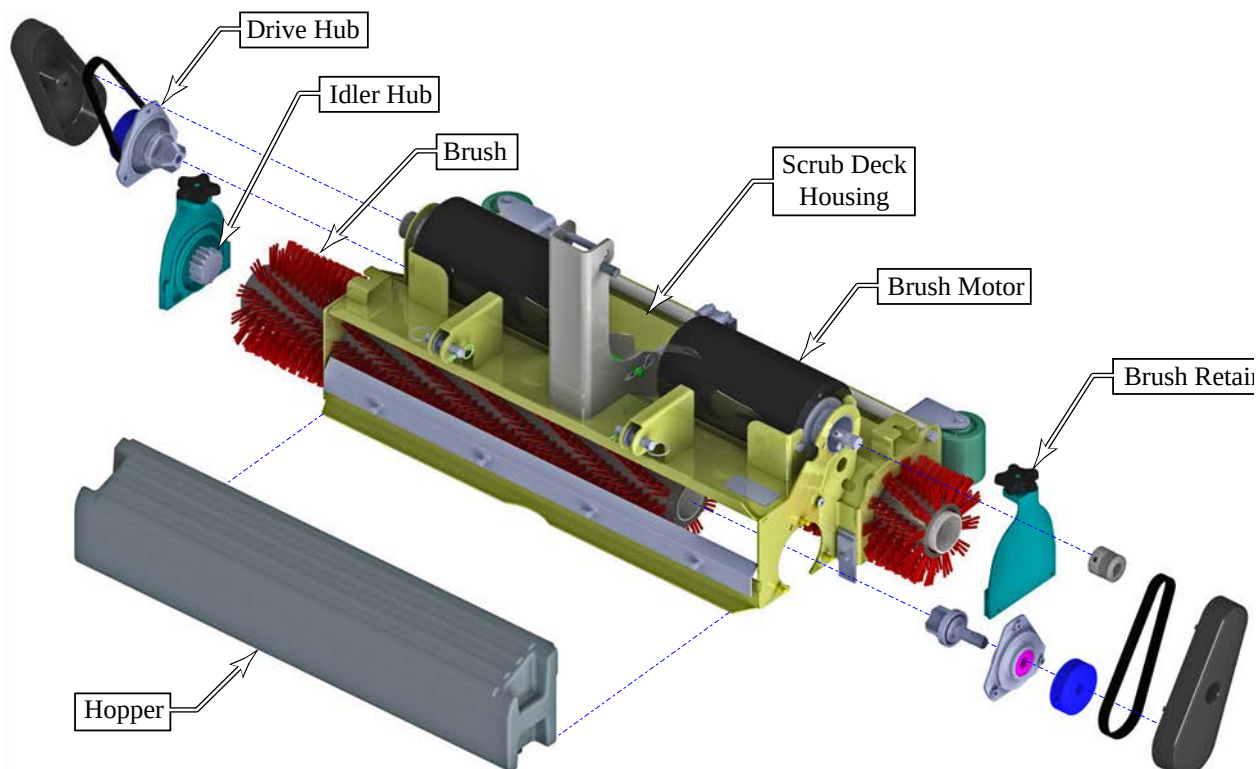
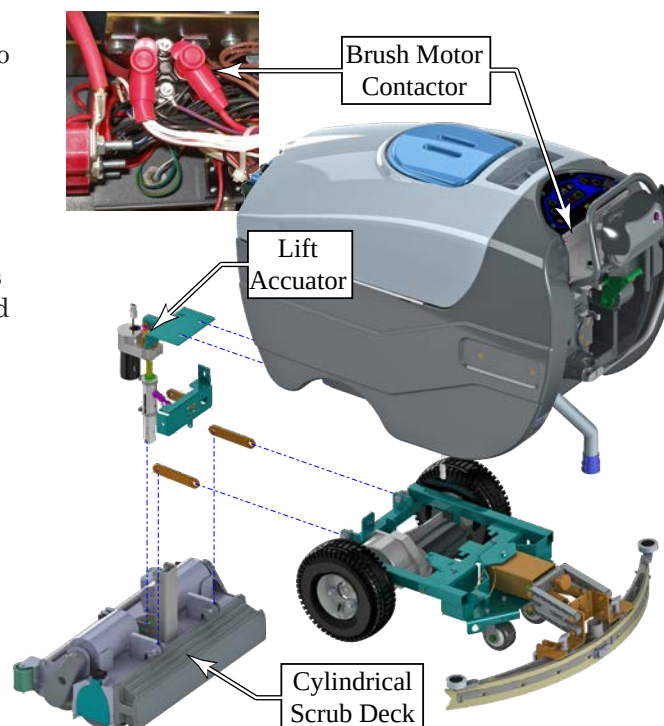
Functional Description

The scrub system consists of a motorized scrub deck that is raised and lowered with a lift actuator. The two counter rotating brushes are driven by independent motors with integral speed reduction gear boxes.

Brush Motors

Unlike most other motors in the Warrior system, the Brush motors are not PWM speed controlled, but are either full-on or full-off. The primary on/off function is controlled with the brush motor contactor (**K1**) located in the main electrical panel in front of the operator controls. (The contactor coil is PWM controlled to reduce the effective voltage, but this does not impact the speed of the motor.)

The Warrior controller measures the current through the motors by examining the voltage drop across the ground wire between the battery and the motor. (Wires are not perfect conductors, and will have a voltage drop.) This allows the controller to know how much scrub pressure is being applied.



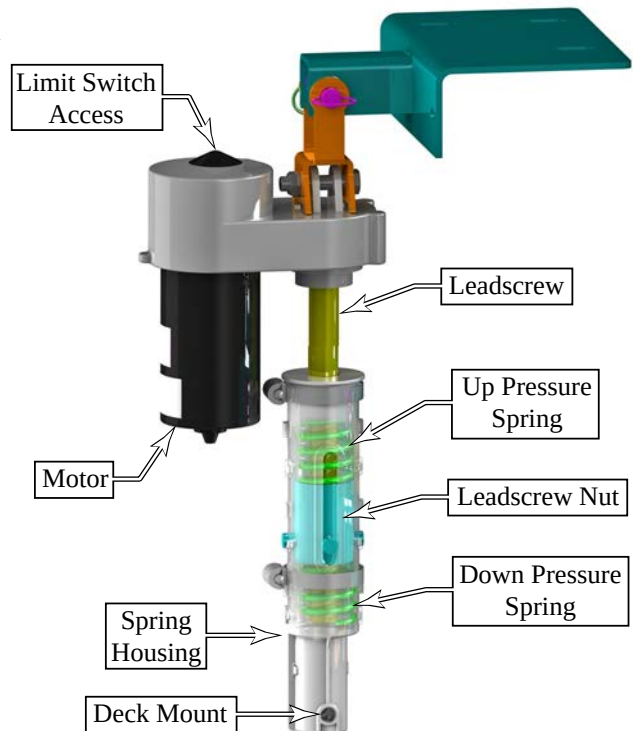
Brush Lift Actuator

The scrub deck is raised and lowered with a motorized actuator. The top of the actuator connects to the Solution Tank, and the bottom of the actuator connects to the scrub deck. A series of link arms connects the scrub deck to the drive chassis and solution tank to permit vertical movement while limiting lateral movement.

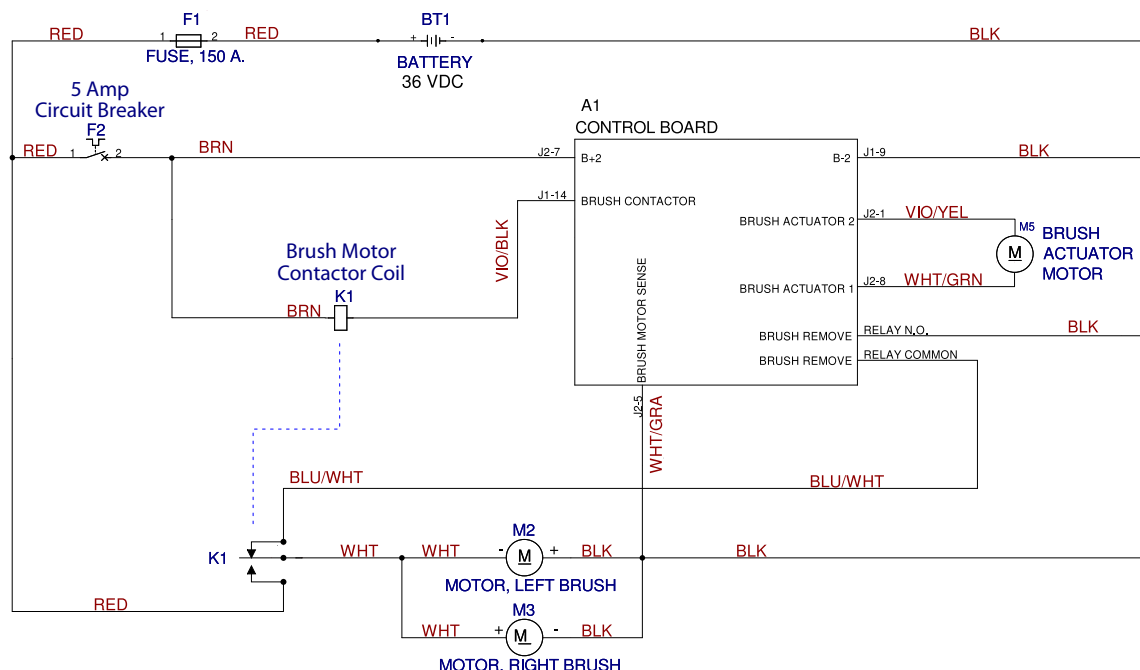
The electric motor rotates the leadscrew. Because the leadscrew nut is constrained to not rotate, it threads up and down the leadscrew as the leadscrew turns. Slots in the spring housing allow the leadscrew nut to move vertically without turning, however, the upper and lower pressure springs constrain the leadscrew nut to remain in the middle of the housing. When the scrub deck is lowered to the floor, the leadscrew continues turning for a short distance, compressing the down pressure spring. This maintains pressure on the scrub deck without being rigidly locked to the leadscrew nut position.

Inside the drive motor are two limit switches. These limit switches control the maximum travel of the leadscrew nut by limiting the number of revolutions that the leadscrew is permitted to make.

The controller monitors the scrub motor current (described above) and raises or lowers the scrub deck accordingly, to maintain the desired brush pressure. The lift actuator motor is controlled directly by the Warrior controller. An on-board relay is used to reverse the polarity to the motor for direction control. The controller also monitors the amperage of the lift motor and displays an error message if the amperage exceeds a maximum limit.



Circuit Overview

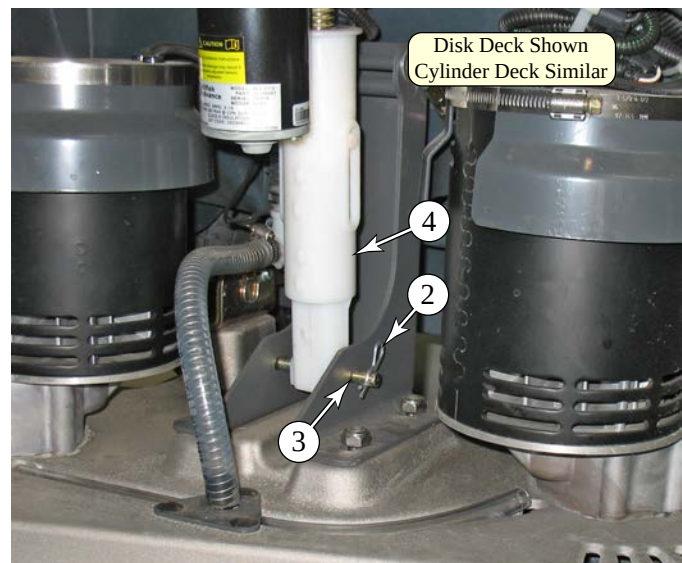
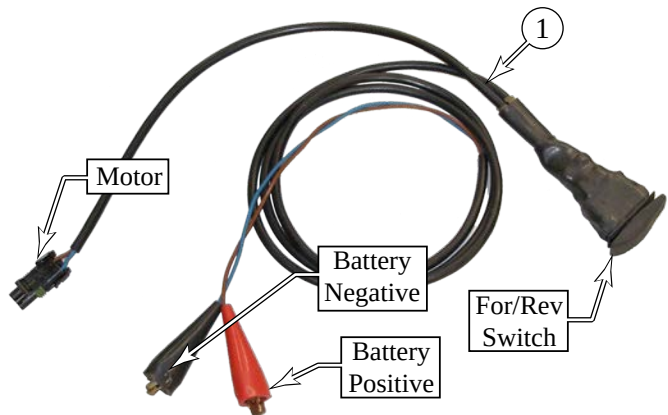


Maintenance and Adjustment

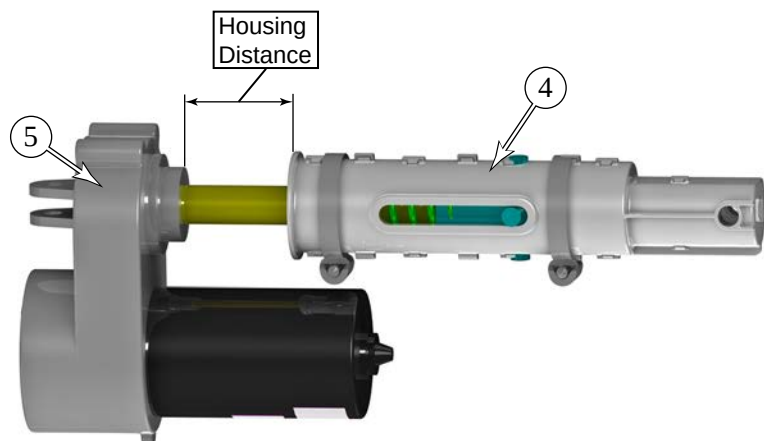
Lift Actuator Limit Adjustment

To protect the lift actuator from traveling too far, it contains two internal limit switches for minimum and maximum travel. The minimum travel is adjusted by turning the leadscrew nut, and the maximum travel (or length) is adjusted by turning the dial at the top of the leadscrew motor. This adjustment requires the use of the Actuator Power Cord Adapter (1) (PN 56407502) shown to the right.

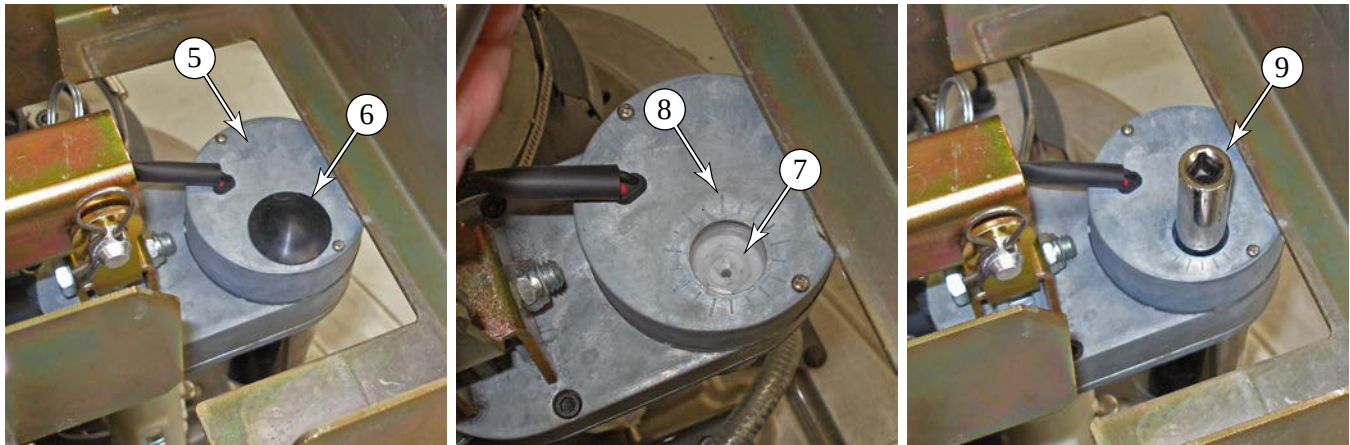
1. Remove the front nose from the machine.
2. Connect the Power Cord Adapter (1) to the positive and negative battery terminals of the Warrior machine.
3. Disconnect the power cable of the lift actuator from the machine, and connect the Power Cord Adapter into the cable leading to the lift actuator motor.
4. Press the For/Rev switch on the Adapter (1) to lower the lift actuator until the scrub deck is resting on the floor in a neutral position (no tension/pressure on the actuator).
5. Remove the retaining key (2) and link pin (3) that secures the spring housing (4) to the scrub deck to permit the actuator to swing freely.
6. While holding the spring housing (4) from turning, press the For/Rev switch on the Adapter (1) to raise the spring housing (4) toward the actuator gear housing (5) until the motor stops (minimum limit switch engaged).
7. Rotate the spring housing (4) until the distance between the spring housing and gear housing (5) is within the Upper Limit range listed in the table below.
 - The “Old Style” spring housing (4) is identifiable as a one-piece housing.
 - The “New Style” spring housing (4) is identifiable as split down the center.



	Housing Distances	
	Upper Limit	Lower Limit
New Style	$1\frac{3}{16}$ " - $1\frac{5}{16}$ " (21 - 23 mm)	$4\frac{7}{8}$ " - 5" (124 - 127 mm)
Old Style	$\frac{1}{16}$ " - $\frac{3}{16}$ " (2 - 5 mm)	$4\frac{1}{8}$ " - $4\frac{1}{4}$ " (105 - 108 mm)



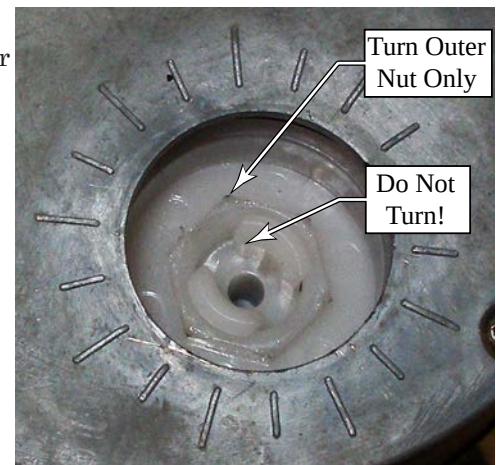
8. Hold the spring housing from rotating, and press the For/Rev button of the Adapter (1) to lower the actuator to its lowest position until the motor stops (maximum limit switch engaged).
9. Measure the Housing Distance as described above, but for the Lower Limit position, and compare this to the values shown in the table. If necessary, adjust the lower limit as described below.



10. Remove the dust cap (6) from the top of the gear housing (5) using your fingers or a small screw driver.
11. Place a 1/2" socket (9) over the limit adjustment nut (7) to turn the nut, and increase or decrease the lower limit as follows:

- **Important:** Even though the center of the adjustment nut looks like it will accept a screwdriver blade, this is the retainer for the adjustment nut. Do Not try to turn the retainer!
- Each “click” of the adjuster nut changes the Housing Distance by 1/16".
- To increase the Housing Distance, turn the nut clockwise.
- To decrease the Housing Distance, turn the nut counterclockwise.
- If you need to make large adjustments, it is recommended to move the actuator away from its limit position first.

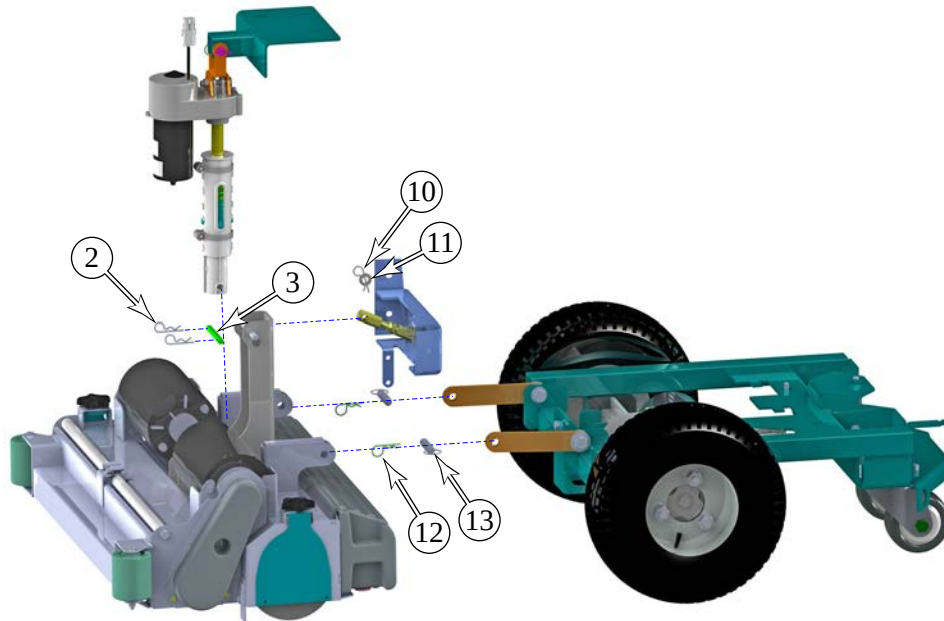
12. To check your adjustments, you must first raise the actuator away from the limit position before lowering it back to the limit position and re-measuring the Housing Distance for the Lower Limit.
13. After adjusting the Lower Limit, it is a good practice to confirm both limits by cycling the actuator to the upper and then lower limit.
14. Before disconnecting the Adapter cord (1), lower the lift actuator down to the scrub deck to make it easier to reinsert the link pin (3) and retaining key (2).
15. Reassemble the machine.



Removal and Installation

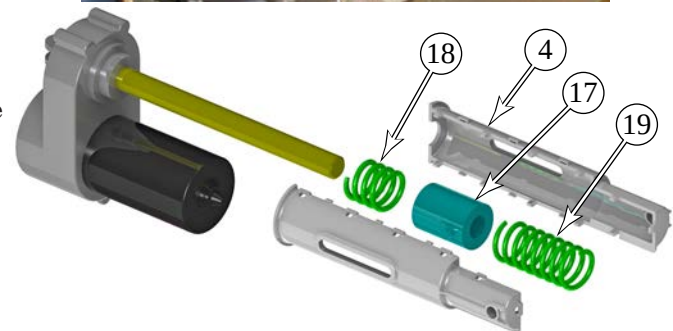
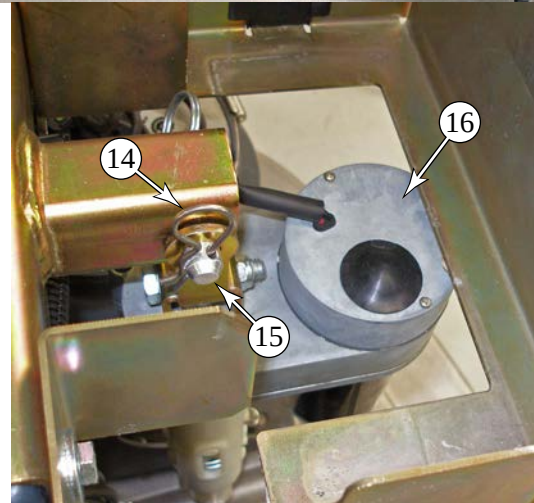
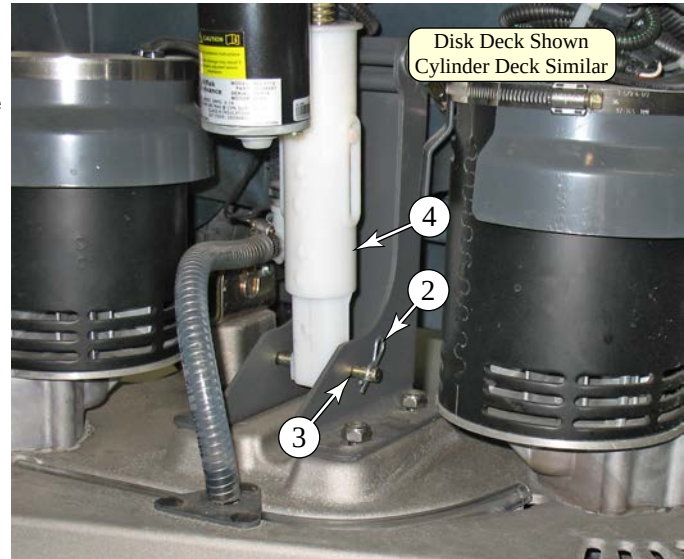
Scrub Deck

1. Remove the front nose from the machine.
2. Put the scrub deck in a neutral position by either lowering it to the floor or blocking it up to remove the weight.
3. Disconnect the main battery connector in the battery compartment.
4. Loosen the hose clamp and remove the solution line from the front of the scrub deck.
5. Disconnect the scrub brush motor power connectors, and free up the cables from any cable ties.
6. Remove the retaining key **(2)** and link pin **(3)** that secures the lift actuator to the scrub deck.
7. Remove the retaining key **(10)** and washer **(11)** that secure the scrub deck to the upper linkage.
8. Remove the two retaining keys **(12)** and link pins **(13)** that secure the scrub deck to the drive frame link arms.



Lift Actuator

1. Remove the front nose from the machine.
2. Put the scrub deck in a neutral position by either lowering it to the floor or blocking it up to remove the weight.
3. Disconnect the main battery connector in the battery compartment.
4. Disconnect the lift actuator power cable.
5. Remove the retaining key (2) and link pin (3) that secures the spring housing (4) to the scrub deck.
6. Remove the retaining key (14) and link pin (15) that secures the lift actuator to the upper mount, and remove the actuator.
7. If the replacement actuator is not pre-assembled, insert the smaller spring (18) onto the leadscrew, followed by the leadscrew nut (17) and larger spring (19), and then install the two halves of the spring housing (4) around the leadscrew nut.
8. Perform the *Lift Actuator Limit Adjustment* described earlier in this chapter. The limit adjustment may be performed before installing the actuator.

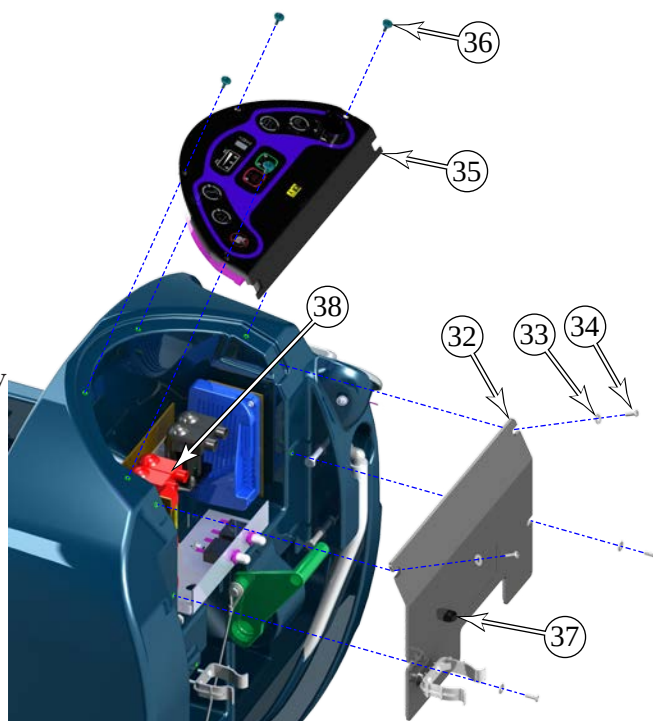


Brush Motor Contactor



Warning: Disconnect the battery connector before servicing machine.

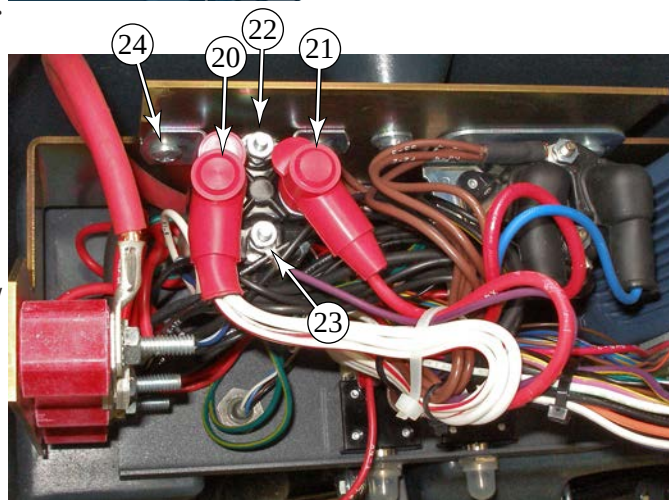
1. Turn off the key and disconnect the main battery connector.
2. Free the drive paddle control wire from the wire clamp (37) on the front of the electrical cover (32).
3. Remove the four screws (34) and washers (33) that secure the electrical cover to the solution tank, and remove the cover.
4. Remove the four screws (36) that secure the control panel (35) to the solution tank, and gently move the control panel to the side.



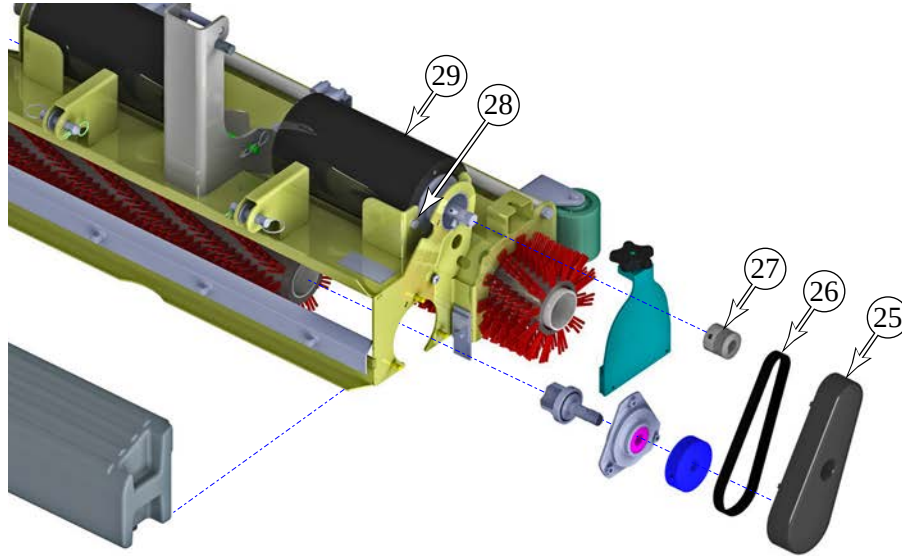
5. Disconnect the following wires from the contactor (38):

- Power to the motors (white bundle) (20)
- Power from the battery (red wire) (21)
- Control from the Warrior controller (violet/black wire) (23)
- Control from the battery (brown wire) (22)
- Shunt Brake from the Warrior controller (blue/white wire) (This wire is located on the bottom of the contactor and is not accessible until the contactor is partially removed.)

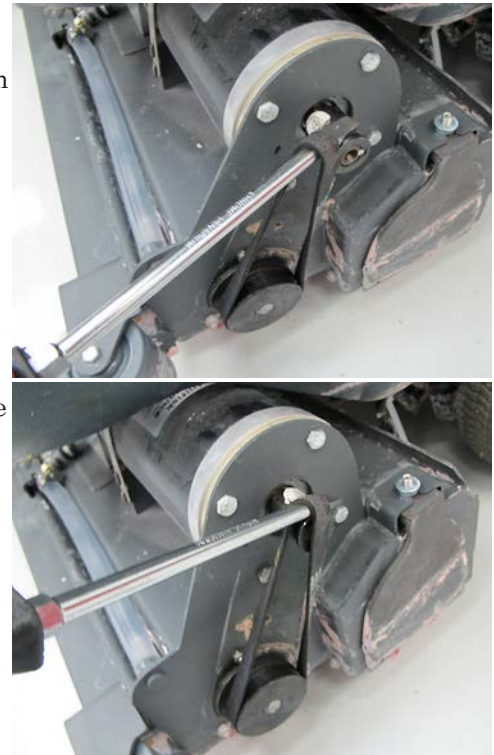
6. Remove the two screws (24) that secure the contactor to the electrical enclosure, and remove the contactor.



Scrub Brush Motor

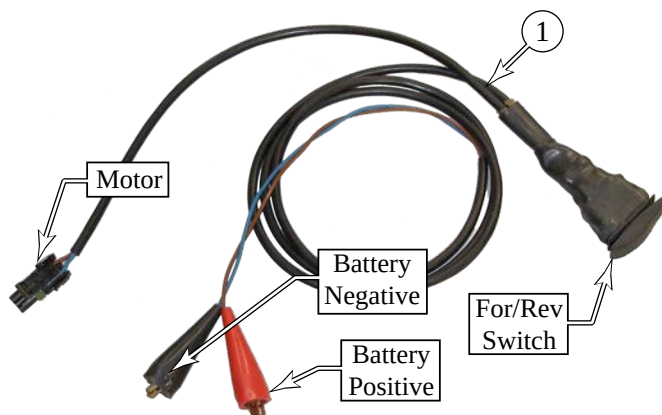


1. Turn off the key and disconnect the main battery connector.
2. Disconnect the motor cable connector and free up any cables from cable ties.
3. Remove the screw and washer that secure the drive belt cover (25) to the scrub deck, and remove the cover.
4. Remove the drive belt (26) by walking it off the motor pulley (27), and then off the brush pulley. **Hint:** When replacing the drive belt, use a screwdriver to assist you walking it back onto the motor pulley, as shown in the two images to the right.
5. Loosen the two setscrews that secure the motor pulley (27) to the motor shaft, and remove the pulley.
6. Remove the three bolts (28) that secure the brush motor (29) to the scrub deck, and remove the motor.



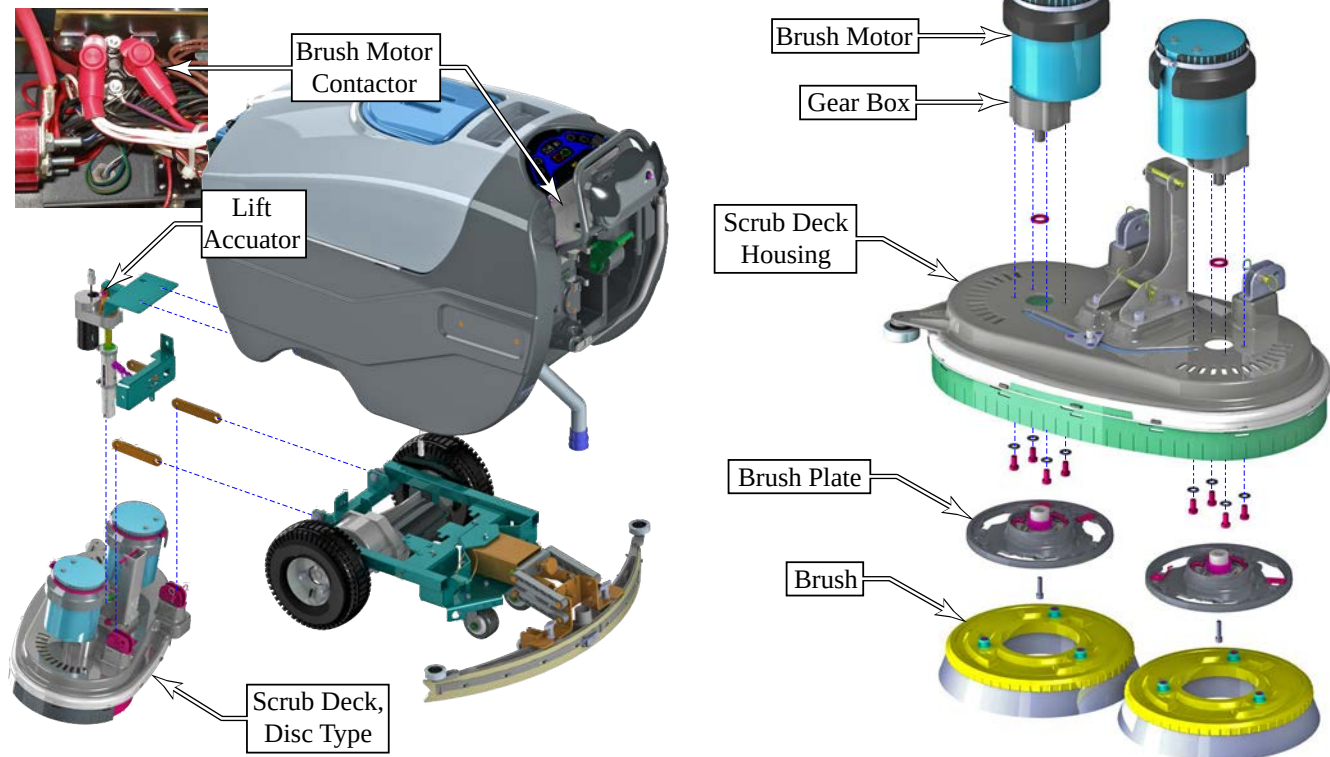
Special Tools

The Actuator Power Cord Adapter (1) (PN 56407502) is used to manually control the brush lift actuator.



Scrub System, Disc

Functional Description



The scrub system consists of a motorized scrub deck that is raised and lowered with a lift actuator. The two counter rotating brushes are driven by independent motors with integral speed reduction gear boxes.

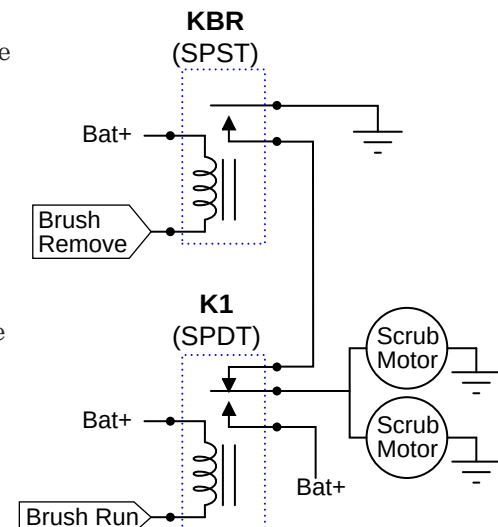
Brush Motors

Unlike most other motors in the Warrior system, the Brush motors are not PWM speed controlled, but are either full-on, full-off, or a special shunt-brake function to remove the brushes. The primary on/off function is controlled with the brush motor contactor (**K1**) located in the main electrical panel in front of the operator controls. This is a special motor contactor that also includes a set of normally closed contacts that are used for the “Brush Remove” function. This is a Single-Pole, Double-Throw (SPDT) relay. (A motor contactor is a name used for a relay that has high-power handling contacts necessary for the high amperage of a motor circuit.)

During normal operation, the brush remove relay (**KBR**) is not active and its contacts are normally open. When the scrub motor is turned off, it coasts to a stop.

When the brush remove function is active, the KBR relay closes, which connects to ground. When the scrub motor is turned off, both of its inputs are connected to ground. This is a short-circuit of the motor windings, which acts as a magnetic brake, bringing the motor to a stop very quickly. (An intentional short-circuit is called a shunt, so this is referred to as shunt-braking.) This rapid deceleration of the brushes causes them to spin off the brush plates.

The Warrior controller measures the current through the motors by examining the voltage drop across the ground wire between the battery and the motor. (Wires are not perfect conductors, and will have a voltage drop.) This allows the controller to know how much scrub pressure is being applied.



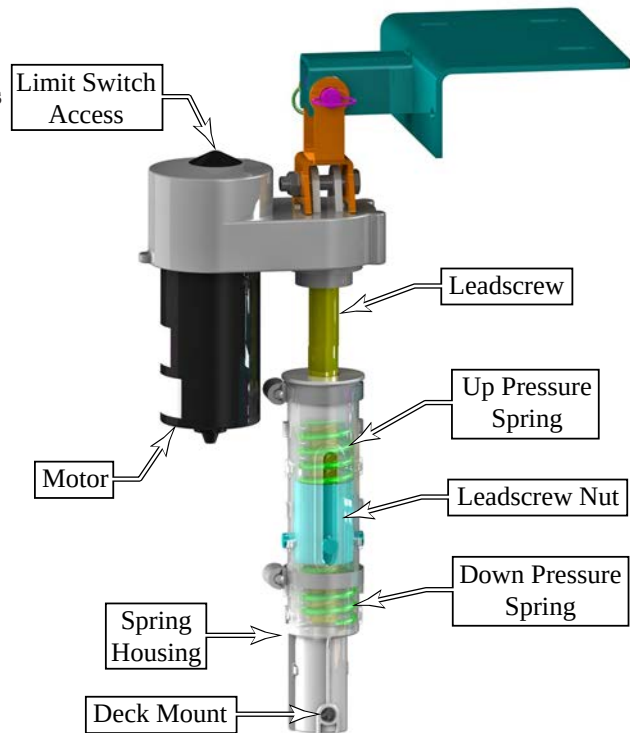
Brush Lift Actuator

The scrub deck is raised and lowered with a motorized leadscrew actuator. The top of the actuator connects to the Solution Tank, and the bottom of the actuator connects to the scrub deck. A series of link arms connects the scrub deck to the drive chassis and solution tank to permit vertical movement while limiting lateral movement.

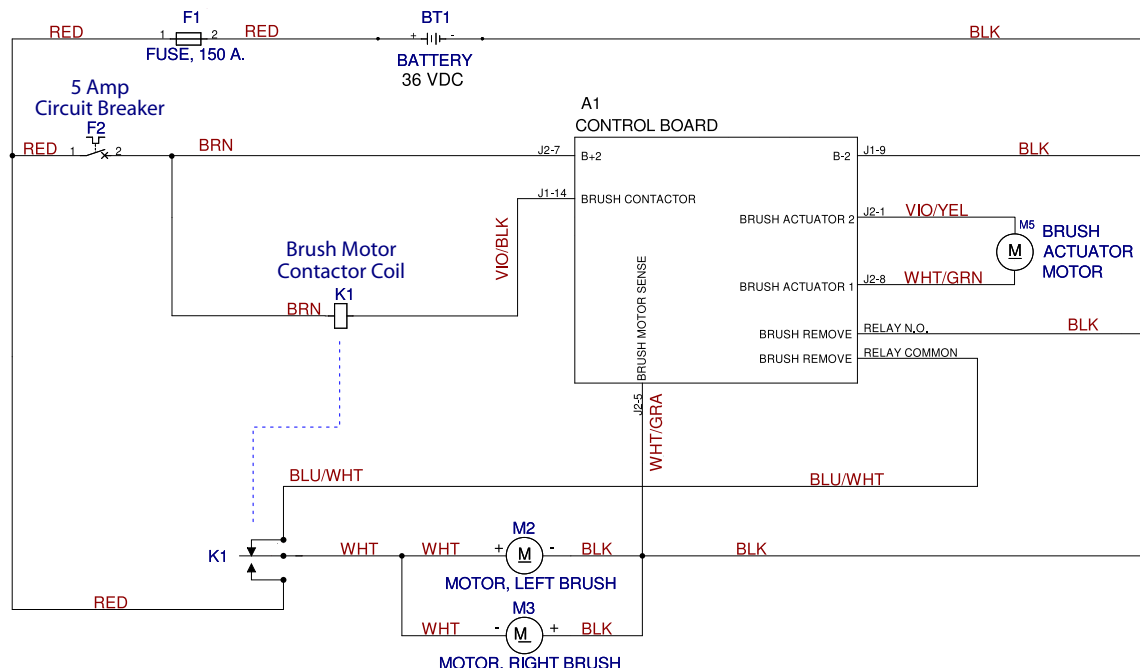
The electric motor rotates the leadscrew. Because the leadscrew nut is constrained to not rotate, it threads up and down the leadscrew as the leadscrew turns. Slots in the spring housing allow the leadscrew nut to move vertically without turning, however, the upper and lower pressure springs constrain the leadscrew nut to remain in the middle of the housing. When the scrub deck is lowered to the floor, the leadscrew continues turning for a short distance, compressing the down pressure spring. This maintains pressure on the scrub deck without being rigidly locked to the leadscrew nut position.

Inside the drive motor are two limit switches. These limit switches control the maximum travel of the leadscrew nut by limiting the number of revolutions that the leadscrew is permitted to make.

The controller monitors the scrub motor current (described above) and raises or lowers the scrub deck accordingly, to maintain the desired brush pressure depending on the loading of the scrub brush motor. The lift actuator motor is controlled directly by the Warrior controller. An on-board relay is used to reverse the polarity to the motor for direction control. The controller also monitors the amperage of the lift motor and displays an error message if the amperage exceeds a maximum limit.



Circuit Overview

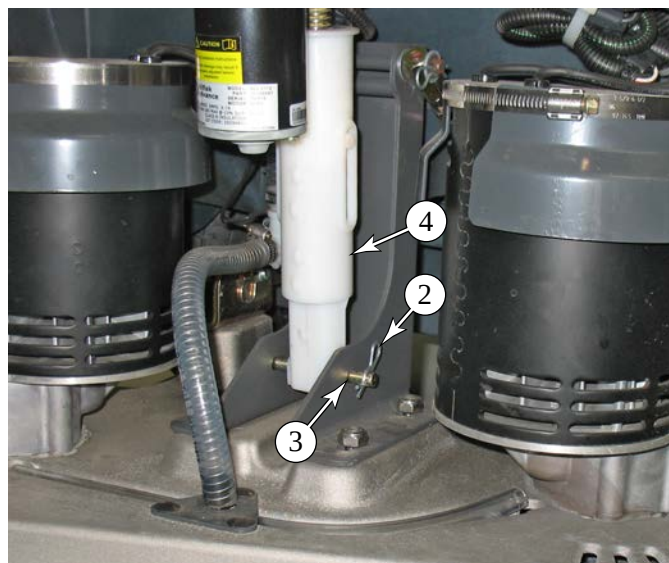
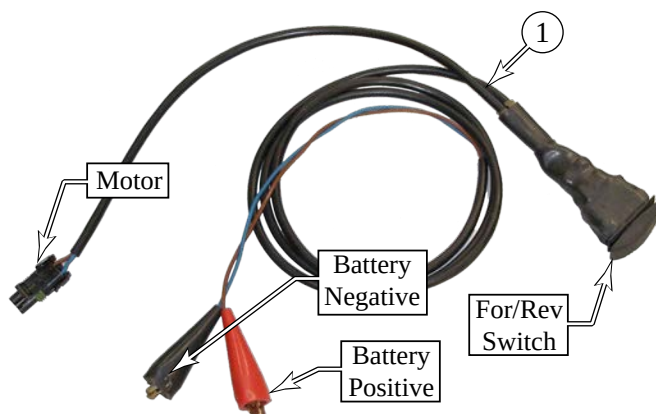


Maintenance and Adjustment

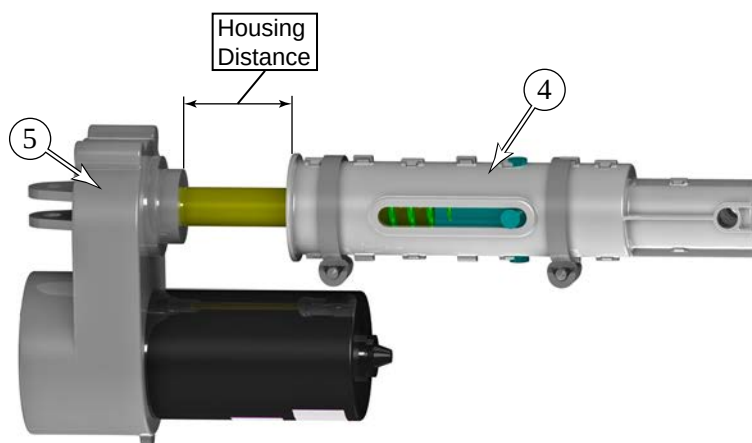
Lift Actuator Limit Adjustment

To protect the lift actuator from traveling too far, it contains two internal limit switches for minimum and maximum travel. The minimum travel is adjusted by turning the leadscrew nut, and the maximum travel (or length) is adjusted by turning the dial at the top of the leadscrew motor. This adjustment requires the use of the Actuator Power Cord Adapter (1) (PN 56407502) shown to the right.

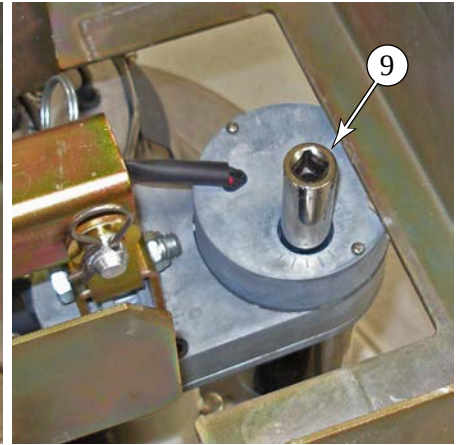
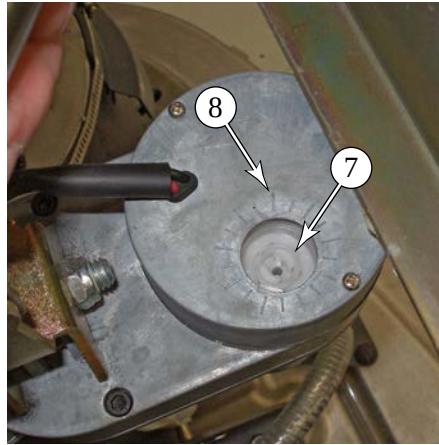
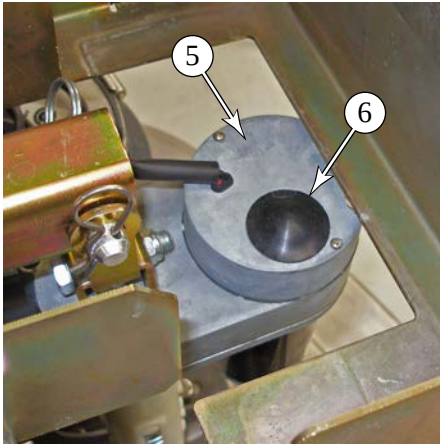
1. Remove the front nose from the machine.
2. Connect the Power Cord Adapter (1) to the positive and negative battery terminals of the Warrior machine.
3. Disconnect the power cable of the lift actuator from the machine, and connect the Power Cord Adapter into the cable leading to the lift actuator motor.
4. Press the For/Rev switch on the Adapter (1) to lower the lift actuator until the scrub deck is resting on the floor in a neutral position (no tension/pressure on the actuator).
5. Remove the retaining key (2) and link pin (3) that secures the spring housing (4) to the scrub deck to permit the actuator to swing freely.
6. While holding the spring housing (4) from turning, press the For/Rev switch on the Adapter (1) to raise the spring housing (4) toward the actuator gear housing (5) until the motor stops (minimum limit switch engaged).
7. Rotate the spring housing (4) until the distance between the spring housing and gear housing (5) is within the Upper Limit range listed in the table below.
 - The “Old Style” spring housing (4) is identifiable as a one-piece housing.
 - The “New Style” spring housing (4) is identifiable as split down the center.



	Housing Distances	
	Upper Limit	Lower Limit
New Style	$1\frac{3}{16}" - 1\frac{5}{16}"$ (21 - 23 mm)	$4\frac{7}{8}" - 5"$ (124 - 127 mm)
Old Style	$\frac{1}{16}" - \frac{3}{16}"$ (2 - 5 mm)	$4\frac{1}{8}" - 4\frac{1}{4}"$ (105 - 108 mm)



8. Hold the spring housing from rotating, and press the For/Rev button of the Adapter (1) to lower the actuator to its lowest position until the motor stops (maximum limit switch engaged).
9. Measure the Housing Distance as described above, but for the Lower Limit position, and compare this to the values shown in the table. If necessary, adjust the lower limit as described below.



10. Remove the dust cap (6) from the top of the gear housing (5) using your fingers or a small screw driver.
11. Place a 1/2" socket (9) over the limit adjustment nut (7) to turn the nut, and increase or decrease the lower limit as follows:

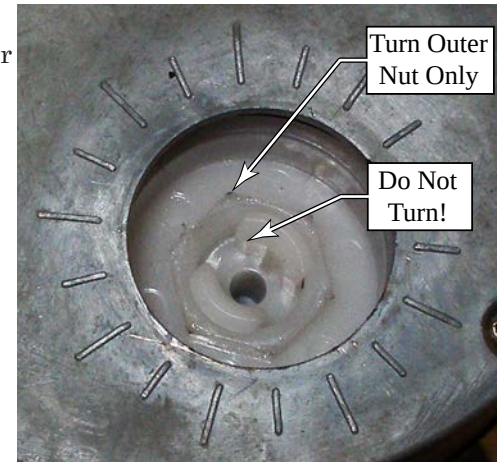
- **Important:** Even though the center of the adjustment nut looks like it will accept a screwdriver blade, this is the retainer for the adjustment nut. Do Not try to turn the retainer!
- Each “click” of the adjuster nut changes the Housing Distance by 1/16".
- To increase the Housing Distance, turn the nut clockwise.
- To decrease the Housing Distance, turn the nut counterclockwise.
- If you need to make large adjustments, it is recommended to move the actuator away from its limit position first.

12. To check your adjustments, you must first raise the actuator away from the limit position before lowering it back to the limit position and re-measuring the Housing Distance for the Lower Limit.

13. After adjusting the Lower Limit, it is a good practice to confirm both limits by cycling the actuator to the upper and then lower limit.

14. Before disconnecting the Adapter cord (1), lower the lift actuator down to the scrub deck to make it easier to reinsert the link pin (3) and retaining key (2).

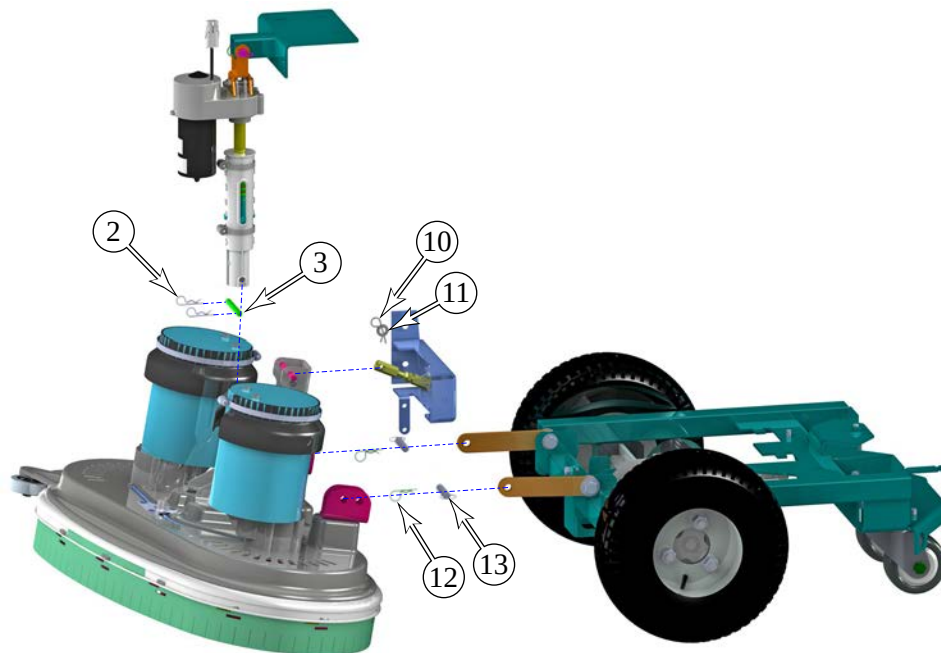
15. Reassemble the machine.



Removal and Installation

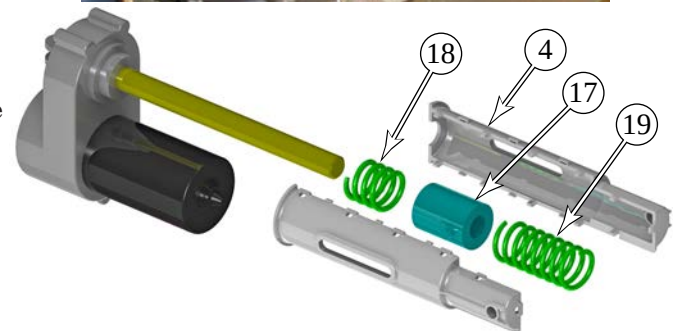
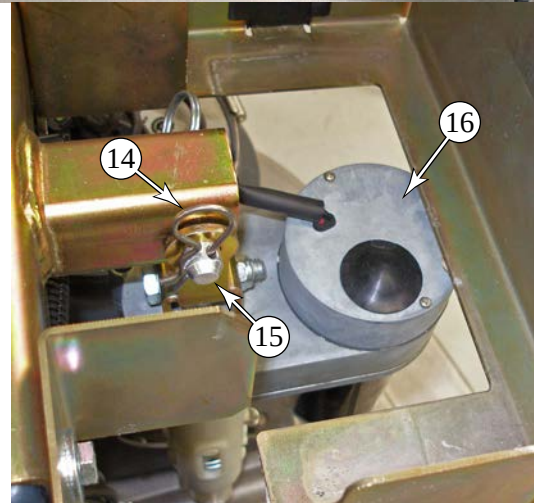
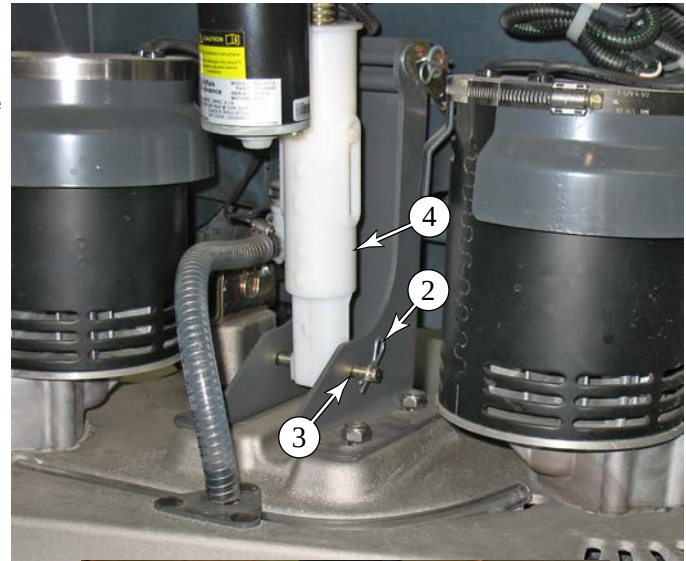
Scrub Deck

1. Remove the front nose from the machine.
2. Put the scrub deck in a neutral position by either lowering it to the floor or blocking it up to remove the weight.
3. Disconnect the main battery connector in the battery compartment.
4. Loosen the hose clamp and remove the solution line from the front of the scrub deck.
5. Disconnect the scrub brush motor power connectors, and free up the cables from any cable ties.
6. Remove the retaining key (2) and link pin (3) that secures the lift actuator to the scrub deck.
7. Remove the retaining key (10) and washer (11) that secure the scrub deck to the upper linkage.
8. Remove the two retaining keys (12) and link pins (13) that secure the scrub deck to the drive frame link arms.



Lift Actuator

1. Remove the front nose from the machine.
2. Put the scrub deck in a neutral position by either lowering it to the floor or blocking it up to remove the weight.
3. Disconnect the main battery connector in the battery compartment.
4. Disconnect the lift actuator power cable.
5. Remove the retaining key (2) and link pin (3) that secures the spring housing (4) to the scrub deck.
6. Remove the retaining key (14) and link pin (15) that secures the lift actuator to the upper mount, and remove the actuator.
7. If the replacement actuator is not pre-assembled, insert the smaller spring (18) onto the leadscrew, followed by the leadscrew nut (17) and larger spring (19), and then install the two halves of the spring housing (4) around the leadscrew nut.
8. Perform the *Lift Actuator Limit Adjustment* described earlier in this chapter. The limit adjustment may be performed before installing the actuator.

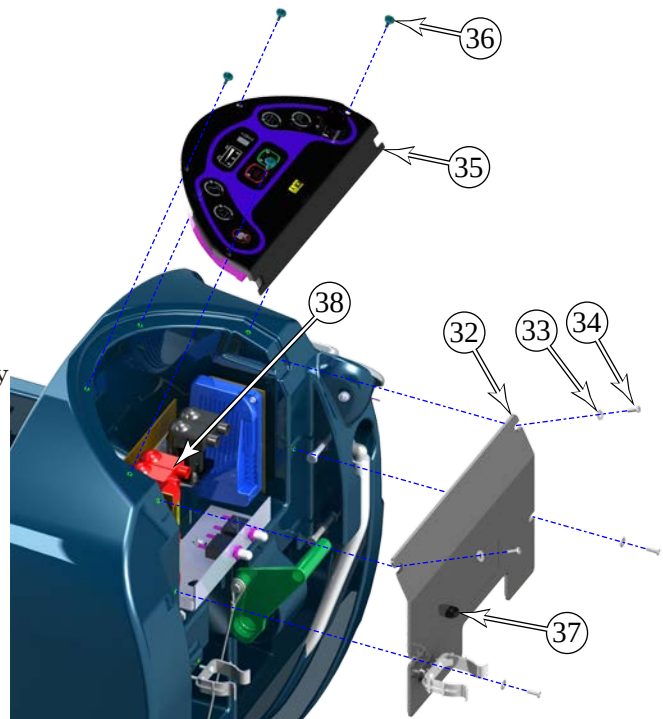


Brush Motor Contactor



Warning: Disconnect the battery connector before servicing machine.

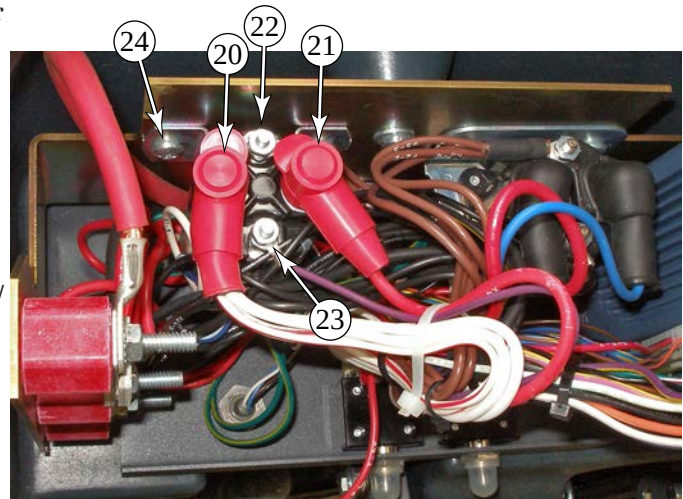
1. Turn off the key and disconnect the main battery connector.
2. Free the drive paddle control wire from the wire clamp (37) on the front of the electrical cover (32).
3. Remove the four screws (34) and washers (33) that secure the electrical cover to the solution tank, and remove the cover.
4. Remove the four screws (36) that secure the control panel (35) to the solution tank, and gently move the control panel to the side.



5. Disconnect the following wires from the contactor (38):

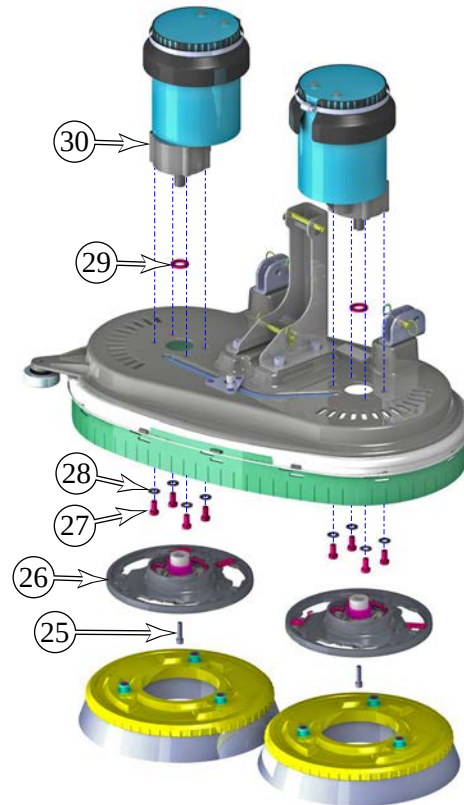
- Power to the motors (white bundle) (20)
- Power from the battery (red wire) (21)
- Control from the Warrior controller (violet/black wire) (23)
- Control from the battery (brown wire) (22)
- Shunt Brake from the Warrior controller (blue/white wire) (This wire is located on the bottom of the contactor and is not accessible until the contactor is partially removed.)

6. Remove the two screws (24) that secure the contactor to the electrical enclosure, and remove the contactor.



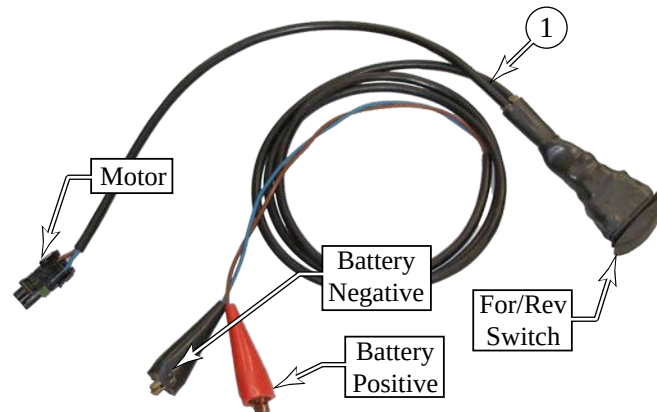
Scrub Brush Motor

1. Turn off the key and disconnect the main battery connector.
2. Disconnect the motor cable connector and free up any cables from cable ties.
3. You may find it easier to access the mounting screws with the scrub deck removed, as described earlier in this chapter.
4. Remove the scrub brushes.
5. Using a 1/4" hex key, remove the bolt (25) that secures the brush holder (26) to the gearbox shaft. Take care not to lose the shaft key.
6. Using a 9/16" wrench, remove the four bolts (27) and washers (28) that secure the motor/gearbox to the scrub deck, and remove the motor.



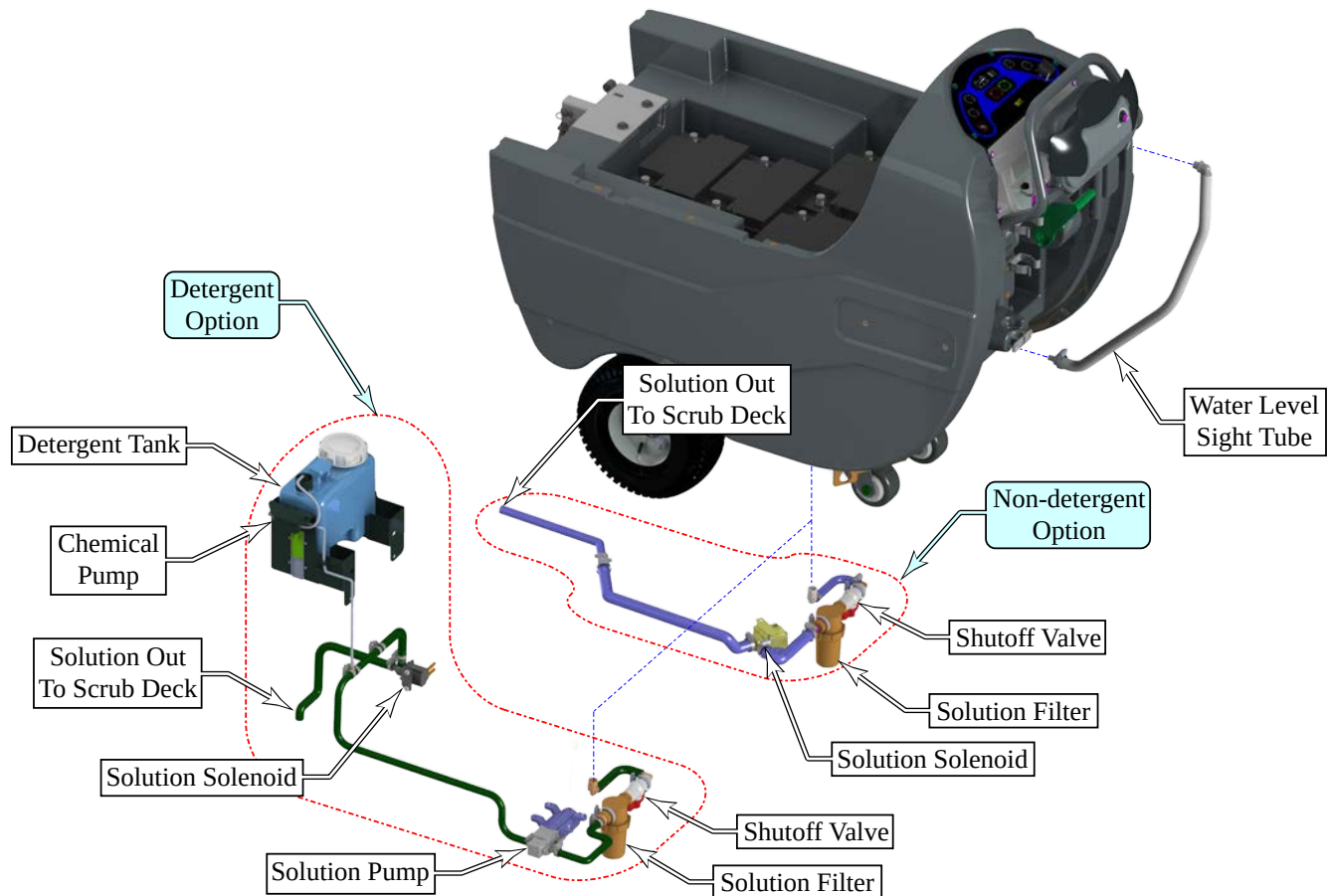
Special Tools

The Actuator Power Cord Adapter (1) (PN 56407502) is used to manually control the brush lift actuator.



Solution System

Functional Description



The Warrior machine has a 30-gallon (114 liter) solution tank incorporated into the main body of the machine. A clear tube on the right side of the machine below the fill cap serves as a water level indicator for the tank. At the outlet of the solution tank, under the machine, is a manual shutoff valve followed by a serviceable solution filter that prevents debris from entering the rest of the solution system.

Non-detergent Models

Machines that do not have detergent mixing (Warrior ST Model) use a gravity-fed solution system to the scrub deck. A solution solenoid, located downstream from the solution filter, activates to allow solution to flow to the scrub deck. To prevent pooling of excess water on the floor when the machine is stationary, the solenoid output from the controller is disabled when the wheel drive is not active (via pin 6 from the Curtis Controller). The rate of solution flow is controlled by cycling the solution solenoid on and off at varying duty cycles with a 6-second cycle period.

Solution Indicator	Flow Rate	Solenoid On-Time	Solenoid Off-Time
One Bar	0.3 gpm	2 sec	4 sec
Two Bars	0.6 gpm	4 sec	2 sec
Three Bars	0.9 gpm	6 sec	0 sec

Detergent Models

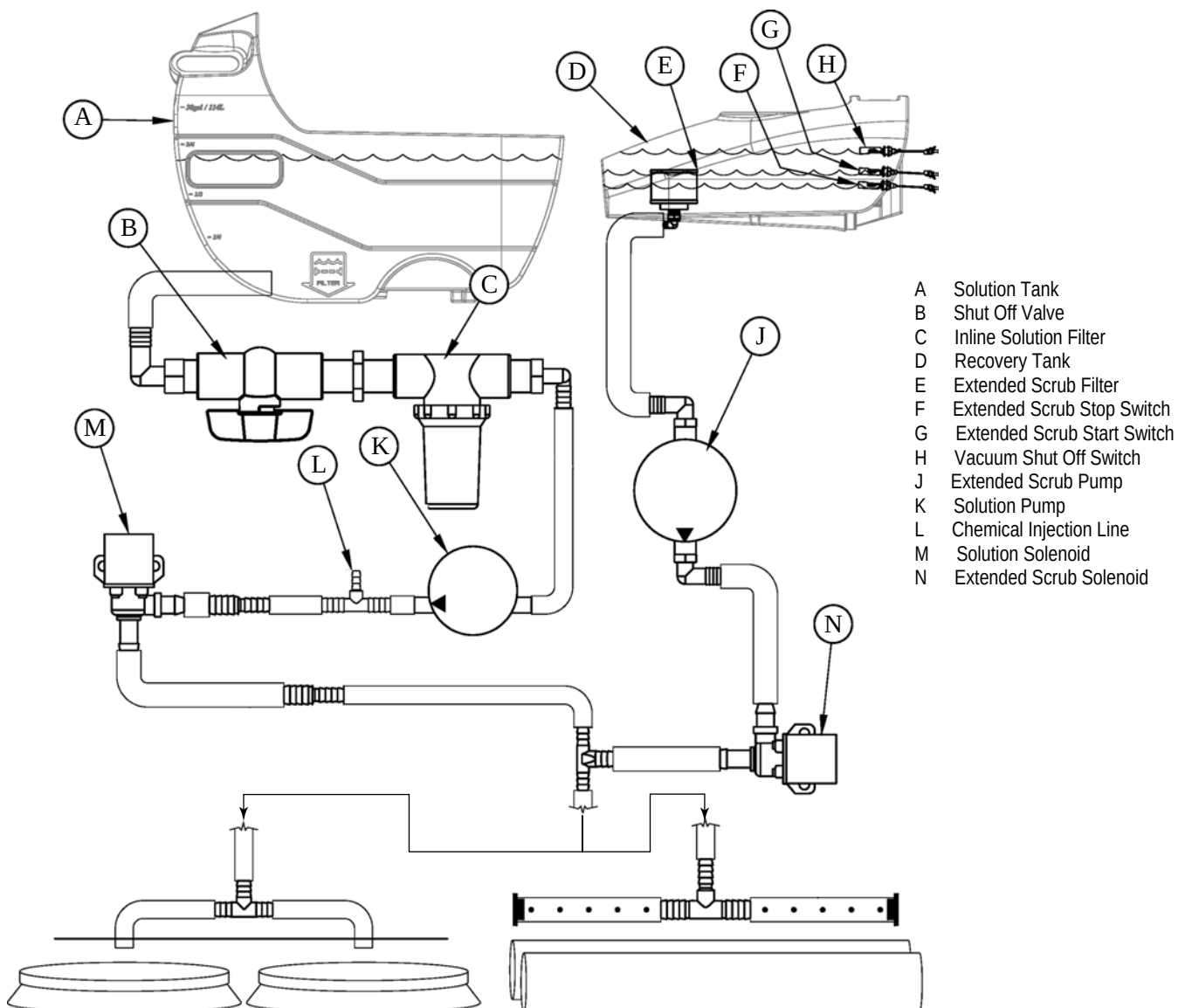
Machines that have on-board detergent mixing (AXP and EcoFlex Models) use a pump driven solution system to the scrub deck. The solution pump's 3 speeds are controlled by Pulse Width Modulation (PWM) from the Warrior controller. Positive power is always present at the solution pump terminal, and the Warrior controller switches the battery negative power at 3 varying duty cycles (13%, 38%, 59%) at a cycle rate of 5kHz.

Downstream from the solution pump is the chemical (detergent) injection system. The detergent is stored in the removable detergent tank, which has a suction hose from the chemical pump. The chemical pump draws the liquid from the detergent tank and injects it into the solution line between the solution pump and the solution solenoid. The flow rate of the detergent is controlled by the Warrior controller using PWM.

Downstream from the chemical injection system is the solution solenoid. Unlike the non-detergent system, this solenoid does not need to meter the solution flow rate, and is operated in a simple On/Off manner. The solution then passes on to the solution deck for application.

Extended Scrub Models

Extended scrub was an option that was available on early models. It increases the operation time of the machine by recycling a portion of the spent solution that has been recovered from the floor. Two additional float sensors are added to the recovery tank. The Start switch (G) is active when there is sufficient solution in the recovery tank to operate extended scrub. The Stop switch (F) turns off extended scrub when there is insufficient solution in the tank to operate. The previously used solution is drawn through a filter (E) and into the Extended Scrub Pump (J). The flow rate is metered at the pump by PWM control. A solenoid valve (N) turns the solution on and off. The recycled solution is mixed with the fresh solution before passing on to the scrub deck.



Circuit Overview

Solenoid Valve Circuit

The positive terminal (brown wire) of the solution solenoid receives unswitched +36V battery power through the 5 amp circuit breaker (**F2**). The negative terminal (red/green wire) of the solution solenoid is connected to the Warrior controller at **J1-11**. The solenoid is active when the controller forces the **J1-11** terminal to GND.

The solenoid output (**J1-11**) is inhibited unless the Warrior controller (**A1**) receives a GND signal on the Forward/Reverse (**J1-5**) terminal from the Curtis Drive Controller. This prevents solution from flowing when the machine is not in motion.

Solution Pump Circuit

The positive terminal (red wire) of the solution pump receives unswitched +36V battery power through the 5 amp circuit breaker (**F2**). The negative terminal (green/black wire) of the solution pump is connected to the Warrior controller at **J1-8**. The solution pump is active when the controller forces the **J1-8** terminal to GND.

The solution pump output (**J1-8**) is inhibited unless the Warrior controller (**A1**) receives a GND signal on the Forward/Reverse (**J1-5**) terminal from the Curtis Drive Controller. This prevents solution from flowing when the machine is not in motion.

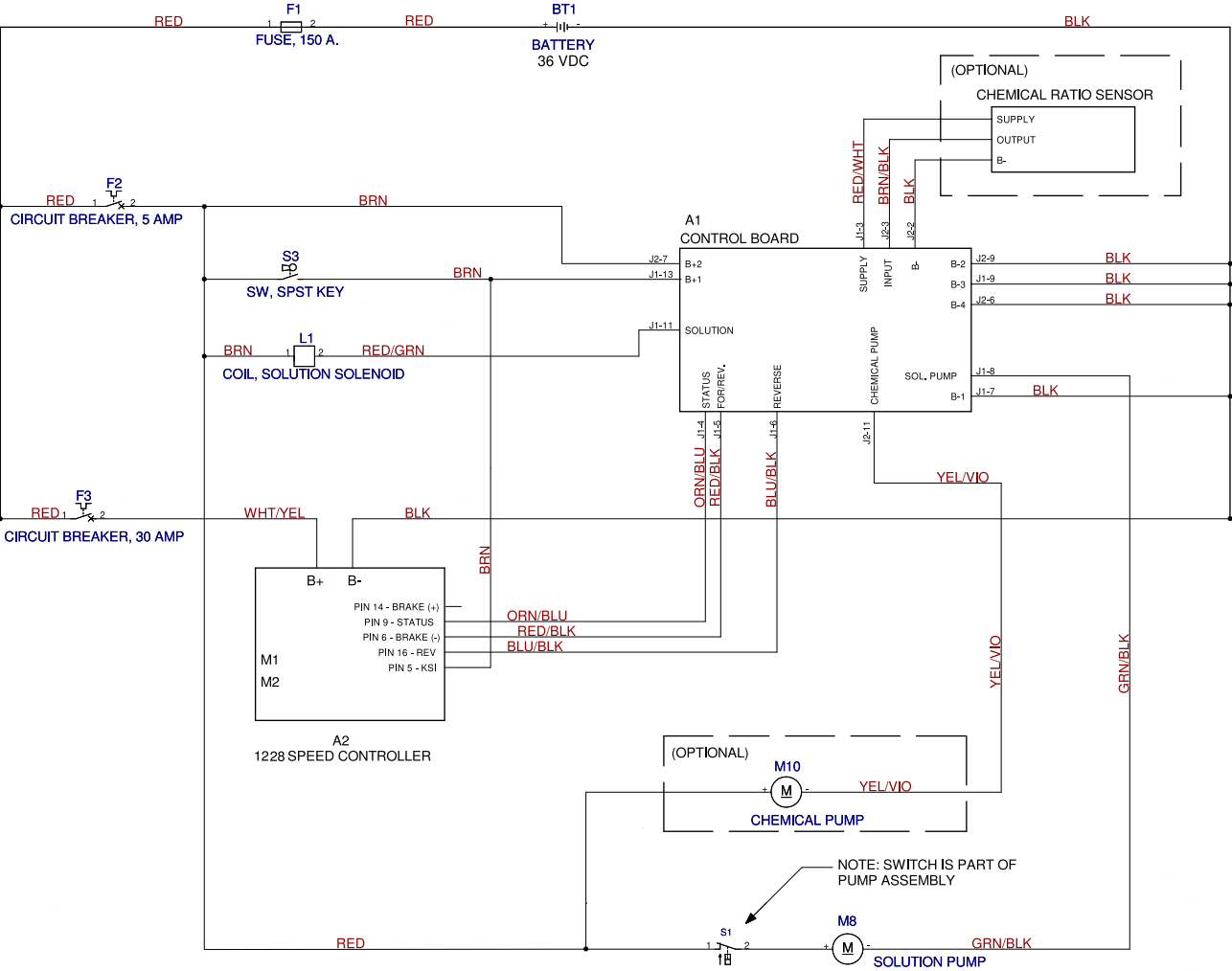
The solution pump also contains an over-pressure cutout switch (**S1**) that is integral to the pump. This switch opens during an over-pressure condition, and self-resets when the over-pressure condition is removed.

Detergent (Chemical) Pump

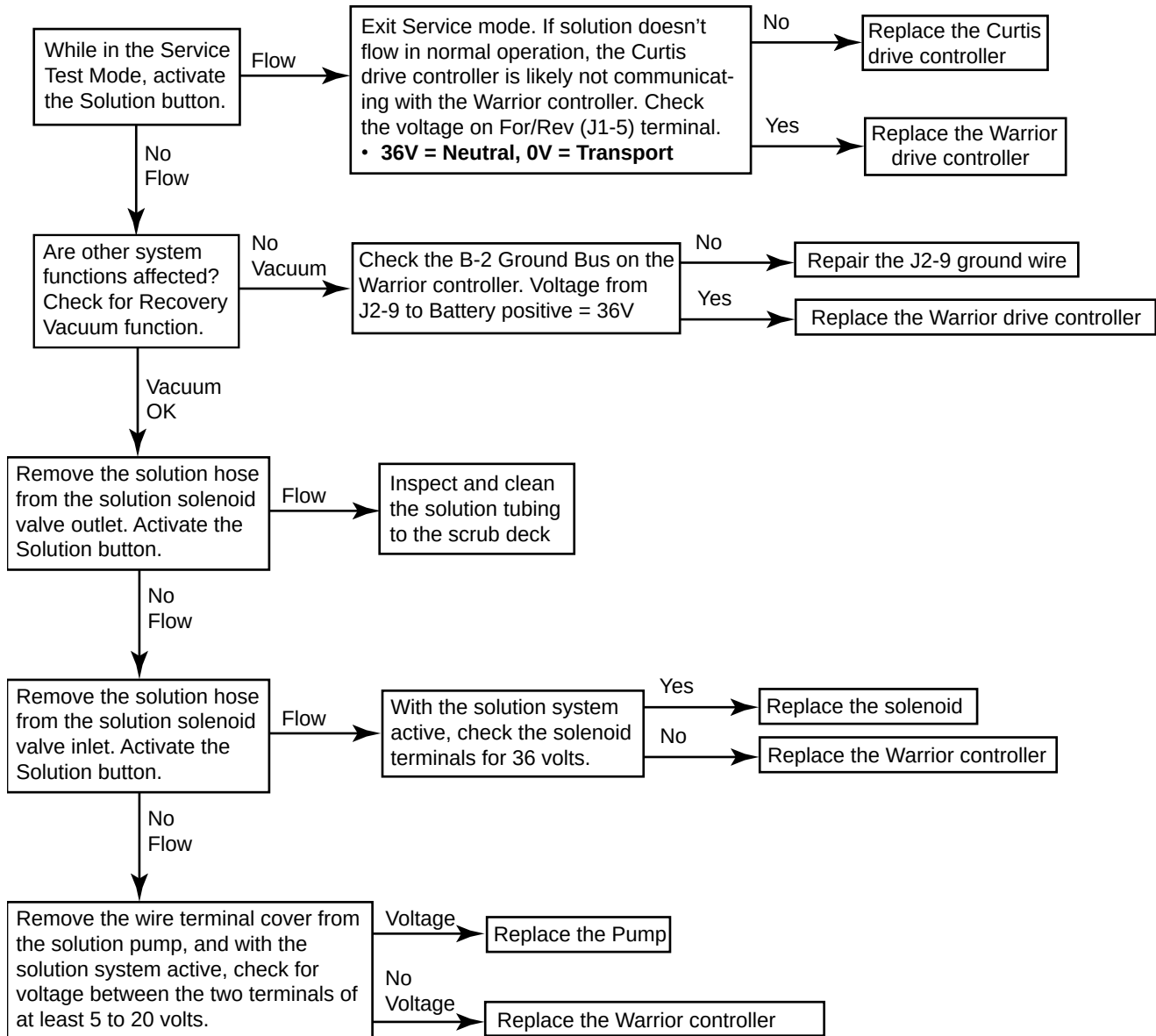
The positive terminal (red wire) of the detergent (chemical) pump receives unswitched +36V battery power through the 5 amp circuit breaker (**F2**). The negative terminal (yellow/violet wire) of the detergent pump is connected to the Warrior controller at **J2-11**. The detergent pump is active when the controller forces the **J2-11** terminal to GND.

The detergent pump output (**J2-11**) is inhibited unless the Warrior controller (**A1**) receives a GND signal on the Forward/Reverse (**J1-5**) terminal from the Curtis Drive Controller. This prevents detergent/solution from flowing when the machine is not in motion. The flow rate of the detergent pump is controlled by PWM at varying rates depending on the desired mixing ratio.

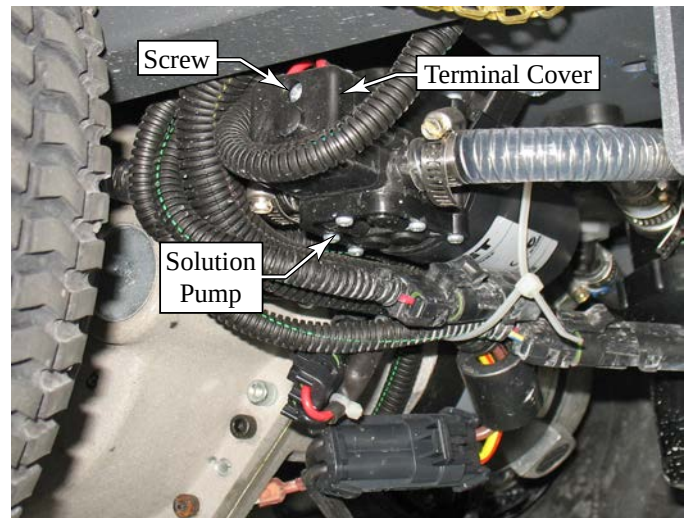
Solution System Schematic



Troubleshooting



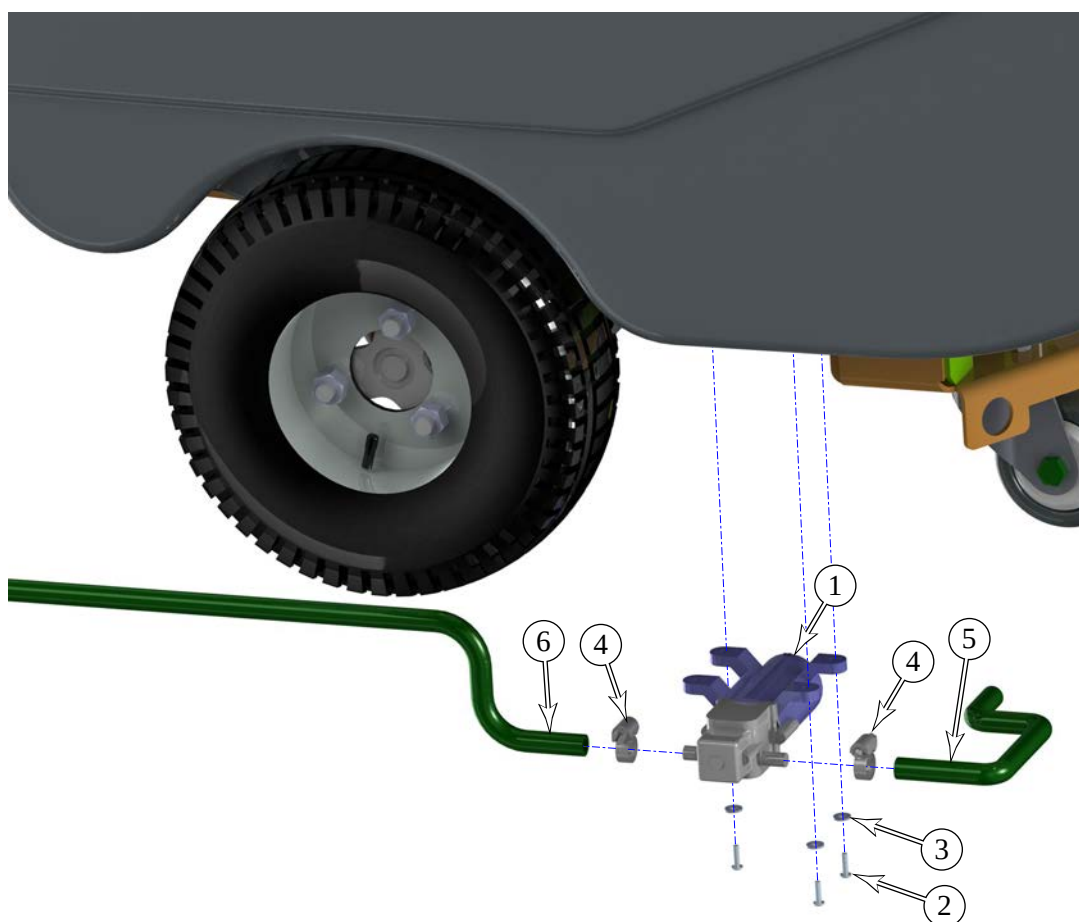
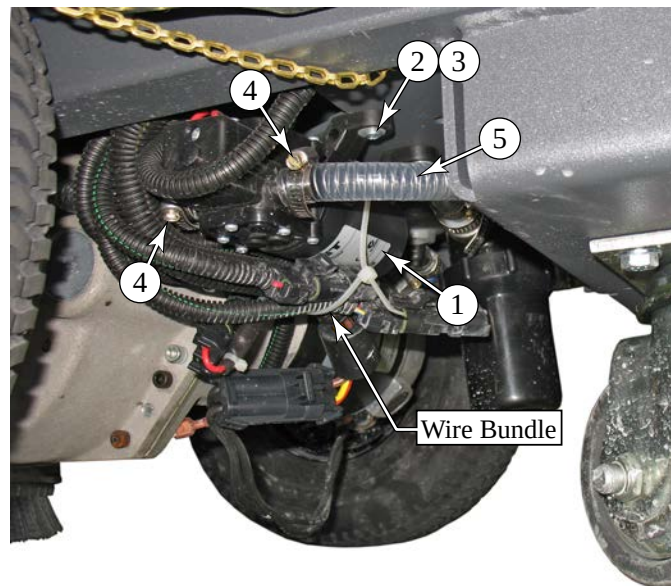
Solution Pump Terminals



Removal and Installation

Solution Pump

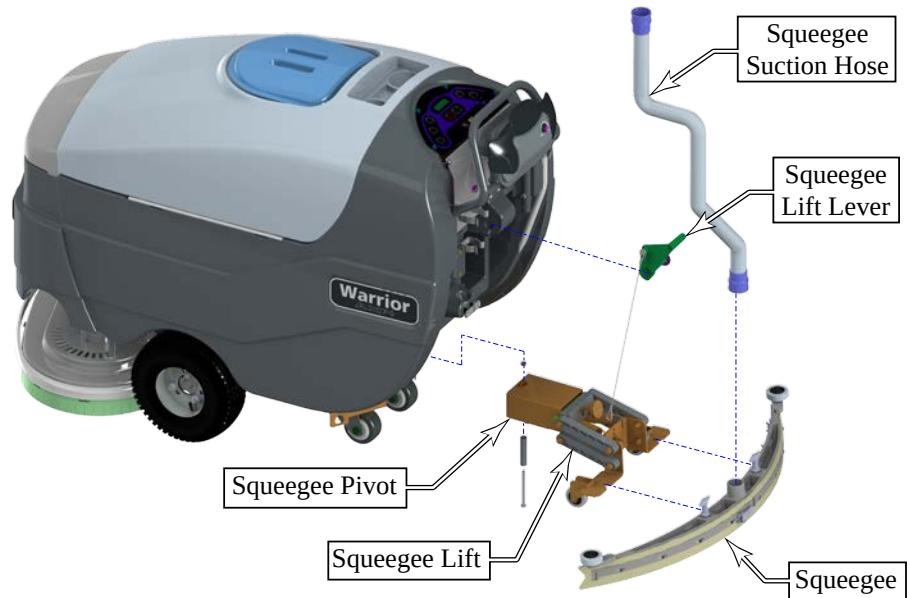
1. Turn off the key and disconnect the battery.
2. Free up the wire bundle from around the solution pump and disconnect the pump's power connector.
3. Loosen the two hose clamps (4) that secure the infeed (5) and outfeed (6) hoses to the solution pump, and remove the hoses.
4. Remove the three screws (2) and washers (3) that secure the solution pump to the machine frame, and remove the pump.



Squeegee System

Functional Description

The squeegee tool collects wastewater from the floor for the recovery system to lift the water into the recovery tank. The floor squeegee is wider than the swath of the scrub deck to ensure collection of all wastewater from the perimeter of the scrubbing area. The squeegee also pivots to the side to permit operation near walls and to keep the squeegee within the scrubbing path while turning the machine.

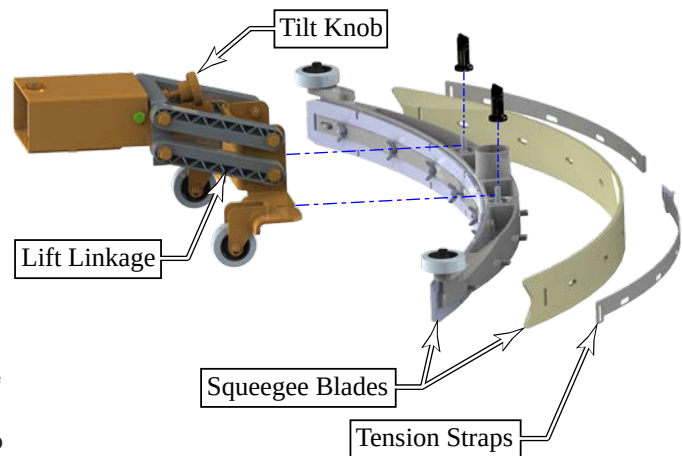


Squeegee

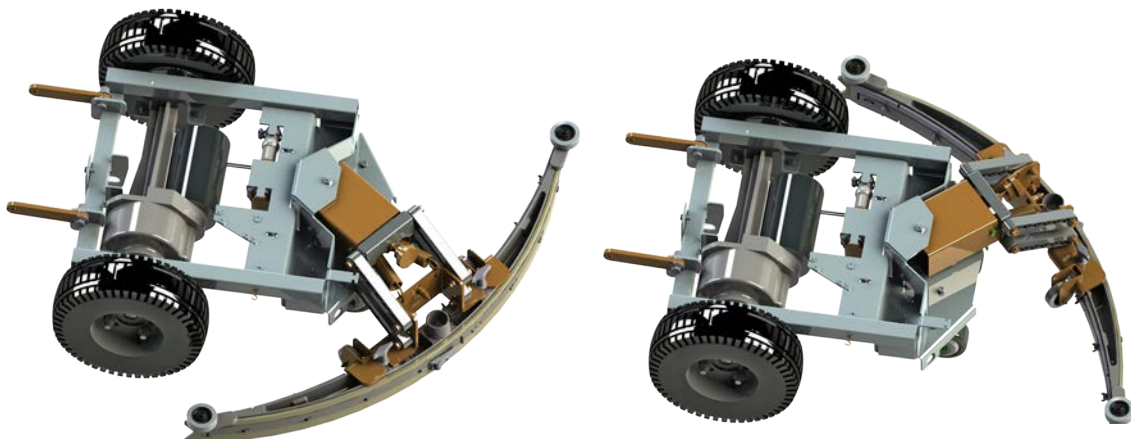
The squeegee tool has a front and rear squeegee blade, creating a vacuum area in between where water can be drawn up from the fast moving airflow. The squeegee tool attaches to the lift/pivot assembly with two knobs.

Squeegee Lift/Pivot

Because the squeegee is curved, it is important for it to remain parallel to the floor as it moves up and down. This is accomplished with a 4-link parallelogram linkage system. To adjust the squeegee to be parallel to the floor, the tilt knob changes the pitch of the forward 4-link mounting plate, which also translates to the squeegee's pitch.



Because the squeegee is wider than the machine, and to keep the squeegee positioned within the wetted area during turning, the squeegee pivots about a vertical axis. .Because this pivot point is approximately 14 inches away from the squeegee, it allows the squeegee to rotate to the side without striking the wheels or appreciably increasing the swath on the pivoted side.



Maintenance and Adjustment

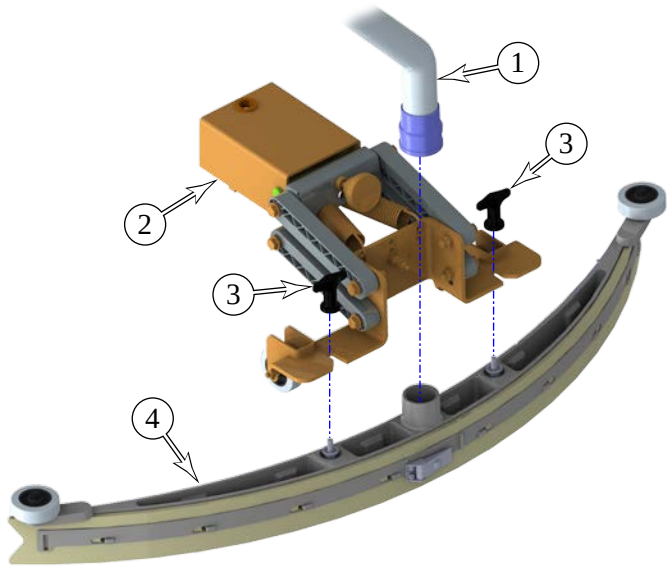
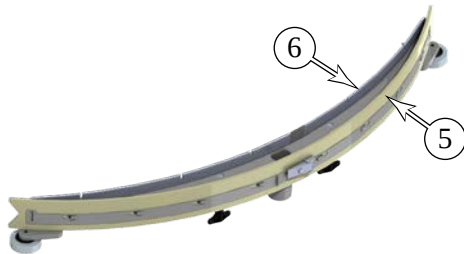
Squeegee Blade Cleaning and Inspection

Periodically clean and inspect the squeegee tool (4) and blades (5&6). Remove the squeegee tool from the pivot/lift assembly (2) by removing the suction hose (1) and loosening the two thumb nuts (3).

Clean the squeegee blades (5&6) and suction area with soap and water.

Inspect the squeegee blades for nicks, tears, and worn leading edges. If a squeegee blade is worn or damaged, it may be turned around with a fresh edge facing down/forward up to four times before complete replacement is required.

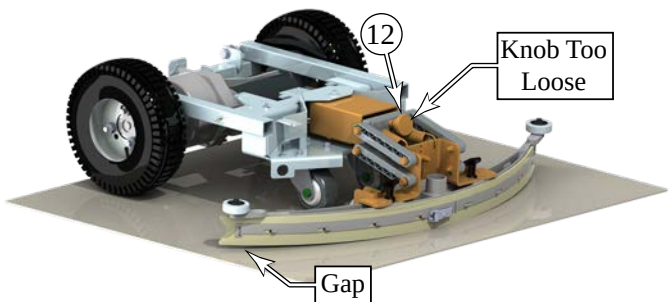
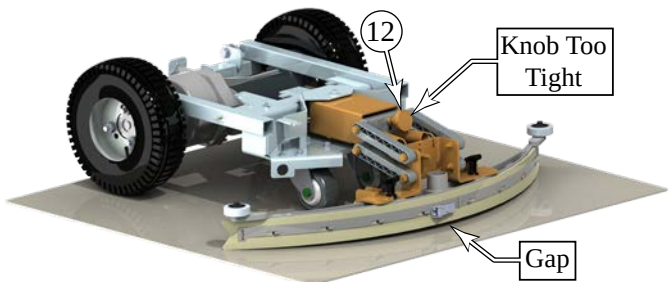
When reinstalling the squeegee tool (4) to the pivot/lift assembly (2), tighten the two thumb nuts (3) only hand tight.



Squeegee Trim Adjustment

The squeegee trim needs to be checked or adjusted whenever the squeegee blades are replaced, or if the squeegee is not fully wiping the floor. Misadjustment symptoms include water streaks at the center or edges of the squeegee path.

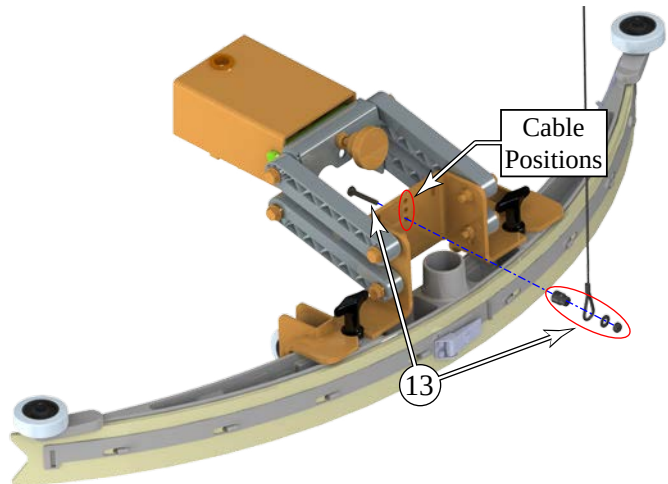
1. Park the machine on a flat, even surface.
2. Gradually lower the squeegee tool until the blade is barely making contact with the floor surface, and inspect for gaps at either the center or edges.
3. Tighten (clockwise) or loosen (counterclockwise) the squeegee trim adjustment knob (12) to level the squeegee across its length.
 - If there is a gap in the center, loosen the adjustment knob.
 - If there are gaps at the outside, tighten the adjustment knob.



Squeegee Lift Adjustment

The squeegee tool's storage and operation positions are adjustable. In the operation (down) position the lifting cable should be slacked, yet still have sufficient travel to lift the squeegee too off the floor when not in use.

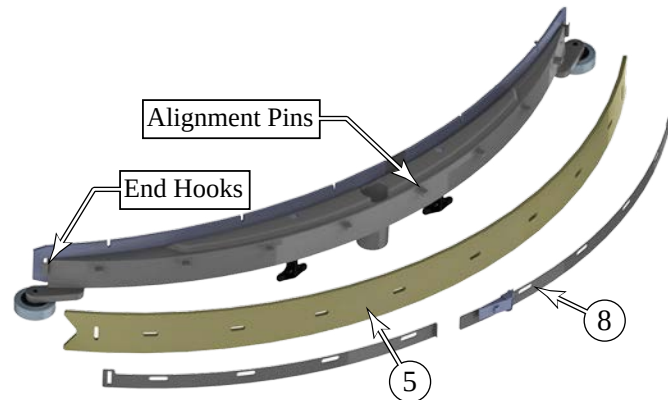
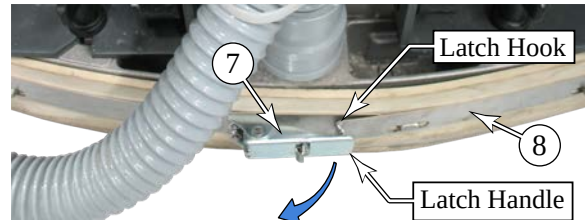
1. Lower the squeegee tool to the floor.
2. Remove the cable mount (13) and reposition the cable in one of the 3 mounting holes to raise or lower the position as needed.



Removal and Installation

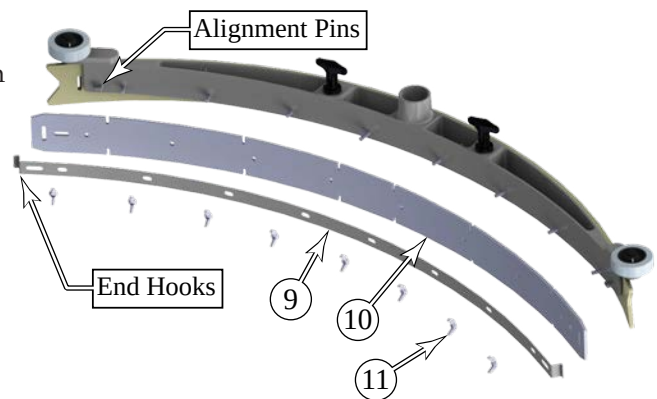
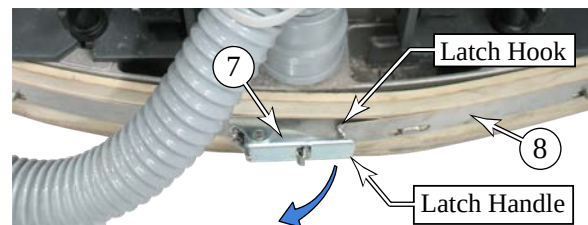
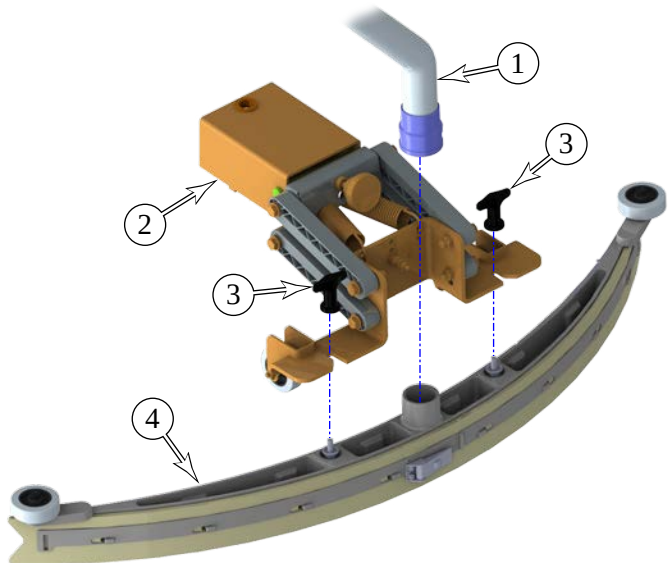
Rear Squeegee Blade Reversal or Replacement

1. Raise the squeegee off the floor and release the squeegee center latch (7) by pulling back on the latch handle and freeing the latch hook from the tension strap (8).
2. Remove the two tension straps from the end hooks, and remove the squeegee blade (5).
3. The squeegee blade has 4 working edges. Turn the blade so a clean, undamaged edge points toward the front of the machine. Replace the blade if all 4 edges are nicked, torn or worn to a large radius.
4. Reinstall the squeegee blade and tension straps, and tighten the center latch.
5. After installing the squeegee blade, check the Squeegee Tilt and Height Adjustments described in this section.



Front Squeegee Blade Reversal or Replacement

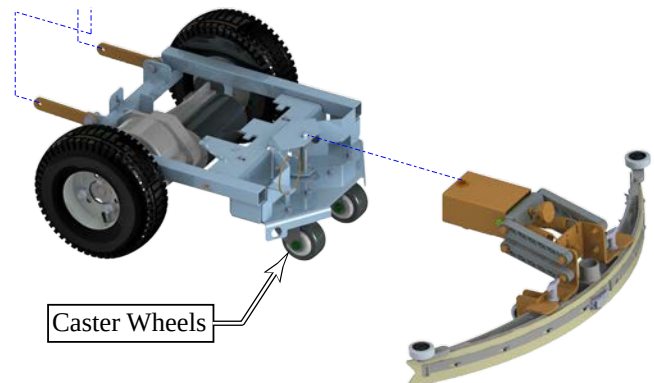
1. Raise the squeegee off the floor and remove the squeegee tool (4) from the pivot/lift assembly (2) by removing the suction hose (1) and loosening the two thumb nuts (3).
2. It is necessary to remove the rear tension straps (8) in order to remove the front tension strap (9) because the end hooks are connected together. Release the squeegee center latch (7) by pulling back on the latch handle and freeing the latch hook from the tension strap (8), and remove the two rear tension straps (8) from the end hooks of the front tension strap (9).
3. Remove the 8 wing nuts that secure the front tension strap (8), and remove the strap and front squeegee blade (10).
4. The squeegee blade has 4 working edges. Turn the blade so a clean, undamaged edge points toward the front of the machine. Replace the blade if all 4 edges are nicked, torn or worn to a large radius.
5. Reinstall the squeegee blade, front tension strap, and wing nuts.
6. Reinstall the rear tension strap.
7. After installing the squeegee blade, check the Squeegee Tilt and Height Adjustments described in this section.



Wheel System, Non-Traction

Functional Description

The Warrior machine is propelled by the drive wheels. The rear caster wheels add stability and ease of turning.

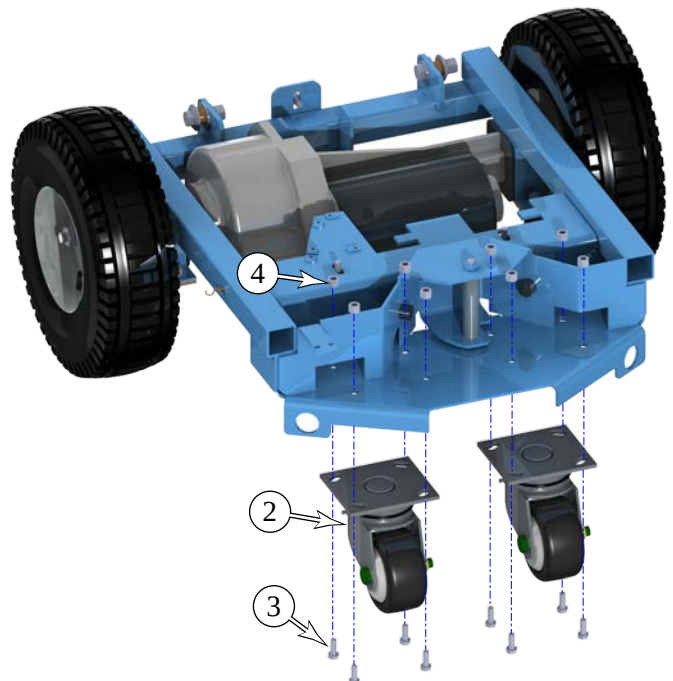
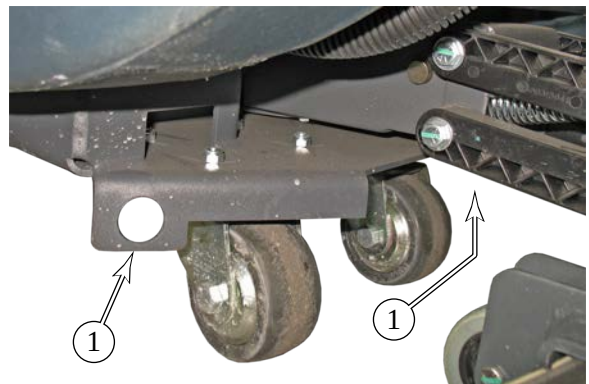


Removal and Installation



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

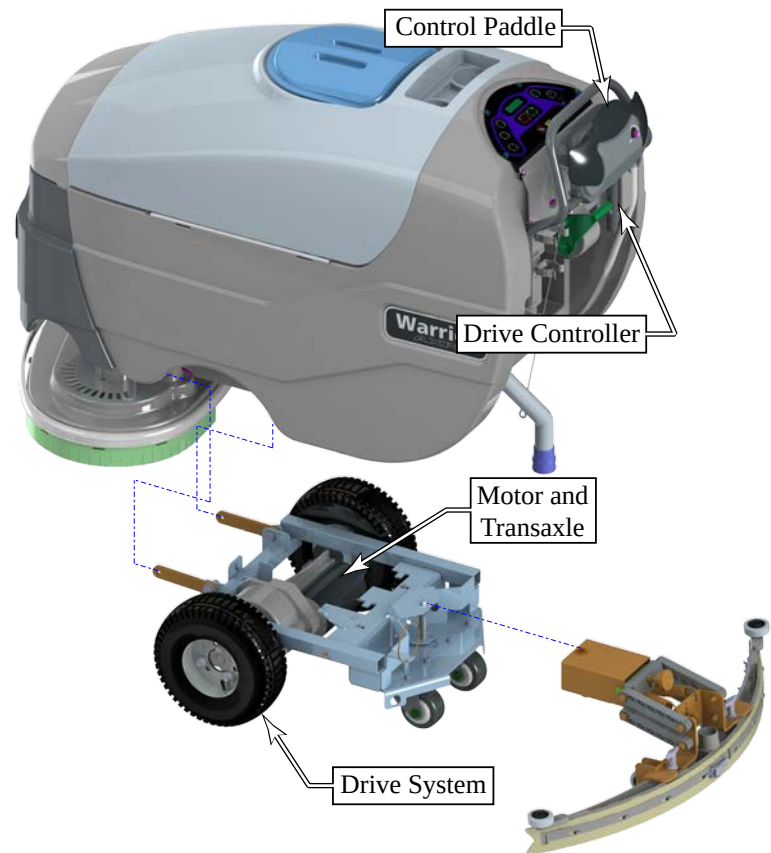
1. To reduce the weight of the machine, drain both the recovery and solution tanks.
2. Block both sides of the machine at the rear lifting points (1) near the casters to keep the machine stable and prevent it from rolling.
3. Remove the four bolts (3) and nuts (4) that secure the caster to the frame, and remove the caster.



Wheel System, Traction

Functional Description

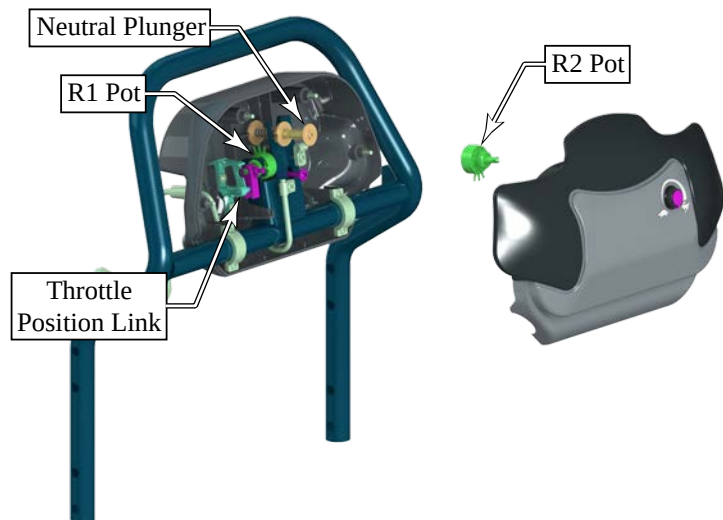
The Warrior machine is driven by an electrically powered transaxle. A 1/2 hp, permanent magnet, 36V motor drives the transaxle. A Curtis PMC solid state speed controller (A2) regulates the speed and direction of the wheel drive motor. The motor speed controller is located in the electrical compartment of the rear handle (operator controls) housing. There are two potentiometers that control the speed parameters of the drive controller. The first potentiometer (R1), controls both the speed setting of the machine (throttle) and direction, as the operator pushes or pulls the control paddle. This potentiometer is located inside the paddle assembly. The second potentiometer (R2) controls the maximum speed setting (speed limit). This potentiometer is located on the front of the operator controls and is set by the operator.



Throttle Position Potentiometer

The throttle position potentiometer (R1 pot) is a variable resistor connected to the Pin-4 input of the speed controller. As the resistance changes, the speed controller increases or decreases drive motor speed. (See Speed Controller Potentiometer Function below for additional description.)

The body of the potentiometer is mounted to a fixed bracket on the frame supporting the operator controls. When the operator moves the control paddle, it rotates a link arm connected to the potentiometer, changing the resistance.

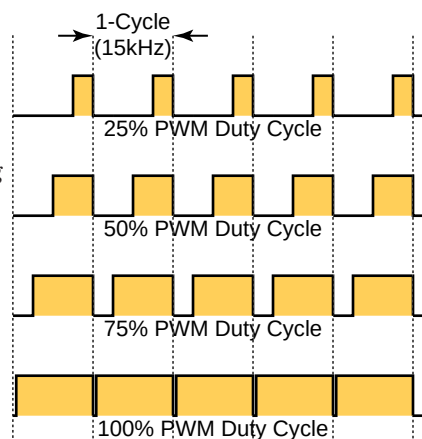


Speed Limiting Potentiometer

The speed limiting potentiometer (R2 pot) is a variable resistor connected to the pin-18 input of the speed controller. This pot sets the upper speed limit of the controller so the operator can press the paddle at full deflection but limit the machine speed to the desired speed for the task, such as scrubbing versus transport speeds..

Drive Motor System Function

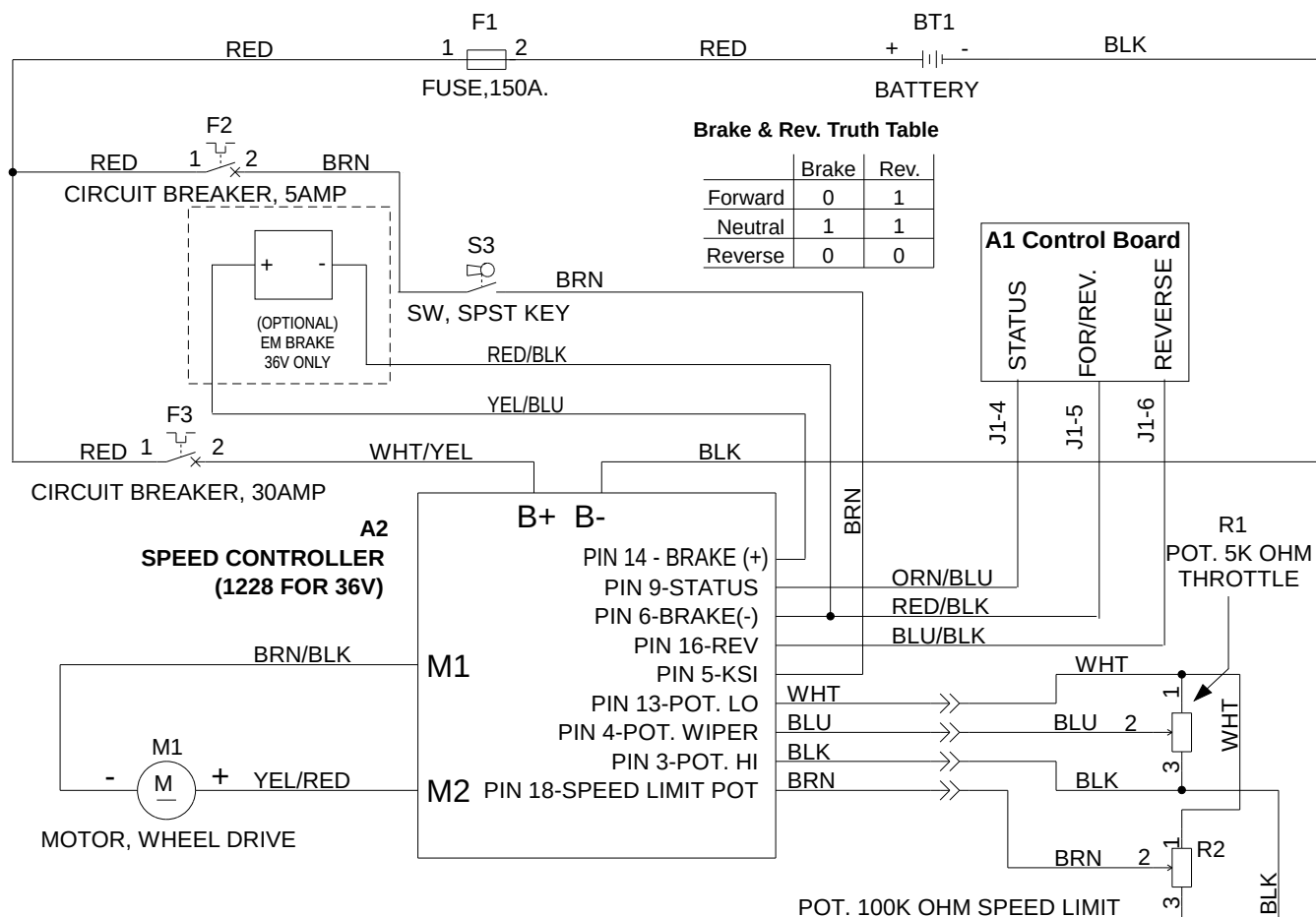
The drive motor is controlled from a Curtis PMC 1228 controller, which is a pulse-width-modulation speed controller designed specifically for permanent magnet DC motors. Pulse-width-modulation (PWM) is a form of motor speed control that alters the power to a motor by rapidly turning the power on and off. The ratio (also called “duty cycle”) between the On and Off states determines how much power the motor receives. The shorter the “off-time” the closer to full power the motor will receive. This switching occurs so fast (15kHz for this controller) that the motor simply sees it as a reduction in power (voltage) instead of the rapid on/off. PWM is a standard motor control technique because it is easier to turn power all the way on and all the way off, than it is to vary the magnitude of the power. Varying the magnitude would create a lot of heat that would need to be dissipated.



Drive power (**B+**, **B-**) is always present at the speed controller (**A2**) from the battery, but the positive battery input (**B+**) is fused through the circuit breaker (**F3**) at 30 amps. When the key switch (**S3**) is closed, 36V control power is provided to the speed controller via the Brown wire (Pin 5-KSI).

The two potentiometers (**R1** and **R2**) control the internal “clock” of the controller, which determines the PWM duty cycle described above and also the polarity to the motor outputs (**M1** and **M2**). (Refer to the discussion and diagram on the following page for further information).

When the drive is active (either forward or reverse) the Curtis controller pulls the “Brake” output (Forward/Reverse at the Warrior controller) to GND. To signify the direction of travel, the “Reverse” output is at GND for reverse, and at +Battery when either moving forward or in neutral.

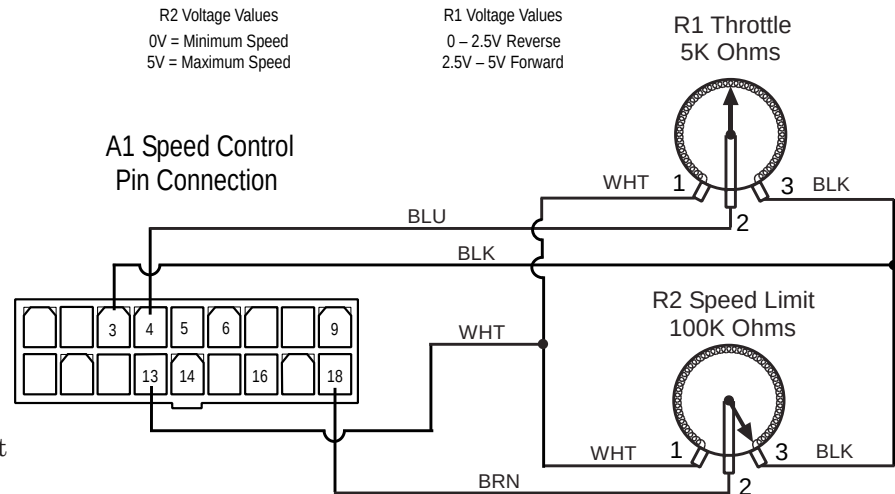


Speed Control Potentiometer Function

The two potentiometers on the operator control paddle are set up in a voltage-division scheme across the Pot-Low (0V) and Pot-High (5V) outputs of the speed controller. As the potentiometer wiper moves through its resistance range, the wiper voltage varies from 0V to 5V. This wiper signal is returned to the speed controller for Throttle and Speed Limit control. (The actual voltages will be slightly less than 5.0 Volts.)

When the throttle potentiometer is in the center position, the wiper voltage is 2.5 volts. The speed controller interprets this voltage as neutral (midway between 0 and 5 volts) and the output to the motor will be zero. Forward or Reverse movement of the drive paddle rotates the potentiometer shaft and the wiper voltage is increased for forward travel, or decreased for reverse travel. The magnitude of the voltage difference away from the neutral point also determines the speed that the motor will be driven.

The speed limit potentiometer operates in a similar manner except there is no significance of the middle/neutral position. The speed limit potentiometer scales the machine throttle across the full range of throttle positions to limit the upper speed. When the potentiometer is in its maximum position (clockwise rotation), the wiper voltage will be 5 volts, and the speed range will be maximum. In the full counterclockwise position, the wiper voltage will be 0 volts, and the speed range will be at minimum.



Speed Controller J10 Pinout Functions

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

Troubleshooting

Problem	Cause	Correction
Wheel drive motor will not run in either forward or reverse.	Wheel drive motor circuit breaker (F3) tripped	Reset the 30A circuit breaker
	Control circuit circuit breaker (F2) tripped ()	Reset the 5A circuit breaker
	Defective wheel drive motor	- Check motor connections - Inspect motor brushes - Replace motor
	Throttle potentiometer (R1) problem	- Make sure the paddle is in the neutral position and cycle the keyswitch - Inspect the potentiometer wires and mechanical linkage - Check the potentiometer neutral adjustment
	Drive controller problem	Check the Status LED for a fault code and refer to the Drive Controller Troubleshooting below
Wheel drive motor will run in only one direction but not the other	Throttle potentiometer (R1) problem	- Inspect the potentiometer wires and mechanical linkage - Make sure the linkage clamping screw (21) is tight
	Drive controller problem	Controller can't change electrical polarity to wheel motor. Replace the speed control (A1).
Display LED panel shows an error 03 fault code.	Drive controller problem	Refer to the Drive Controller Troubleshooting below

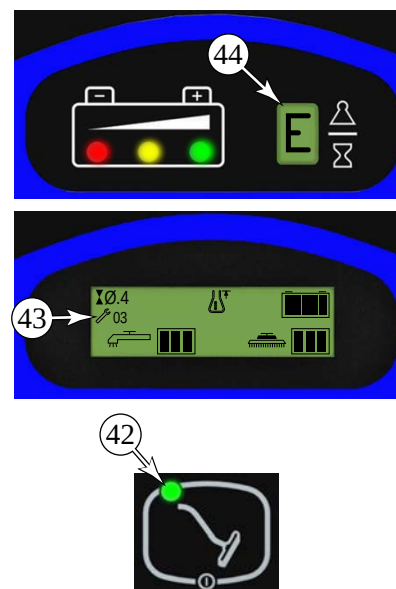
Drive Controller (Curtis 1228)

The Warrior machine controller **(A1)** communicates with the Curtis drive controller **(A2)** through the Brake (For/Rev), Status, and Reverse outputs of the Curtis controller. The Warrior controller interprets these signals and passes them on to the operator through the display interface.

When the Curtis controller presents an error to the Warrior controller, the display will indicate an “E03” error designated as a drive controller error. On a standard display, the single character display **(44)** will flash out E...0...3 to indicate a drive controller error. On an advanced display, the error symbol **(43)** (wrench) will be succeeded by “03” to indicate a drive controller error.

When an error is present, the Status LED **(42)** will flash out the 2-digit code for the specific type of error. The LED will flash a number of times representing the first digit, then a short pause before flashing a number of times representing the second digit, and then a longer pause before repeating the sequence.

This flash code is generated by the Curtis Controller **(pin-9)**, and is passed directly to the Status LED **(42)** when an error is present. There may be multiple faults, but only one fault is indicated at a time.



Status Led Fault Codes		
Code	Explanation	Possible Cause
1,1	Over/under-temperature cutback	• Temperature >92°C or < -25°C • Excessive load on vehicle • Operation in extreme environments • Electromagnetic brake not releasing
1,2	Throttle fault	• Throttle input wire open or shorted • Throttle pot defective • Wrong throttle type selected
1,3	Speed limit pot fault	• Speed limit pot wire(s) broken or shorted • Broken speed limit pot
1,4	Battery voltage too low	• Battery voltage <17 volts • Bad connection at battery or controller
1,5	Battery voltage too high	• Battery voltage >48 volts • Vehicle operating with charger attached • Intermittent battery connection
2,1	Main contactor driver Off fault	• Main contactor driver failed open
2,3	Main contactor fault	• Main contactor welded or stuck open • Main contactor driver fault • Brake coil resistance too high
2,4	Main contactor driver On fault	• Main contactor driver failed closed
3,1	Fault present for >10 sec.	• Misadjusted throttle • Broken throttle pot or throttle mechanism • The keyswitch must be cycled before this fault can clear
3,2	Brake On fault	• Electromagnetic brake driver shorted • Electromagnetic brake coil open
3,3	Precharge fault	• Low battery voltage • Throttle engaged when KSI (keyswitch input) turned on
3,4	Brake Off fault	• Electromagnetic brake driver open • Electromagnetic brake coil shorted
3,5	HPD (High Pedal Disable) fault	• Improper sequence of throttle and KSI (keyswitch input) • Misadjusted throttle pot
4,1	Current sense fault	• Short in motor or in motor wiring • Controller failure • The keyswitch must be cycled before this fault can clear
4,2	Motor voltage fault (hardware failsafe)	• Motor voltage does not correspond to throttle request • Short in motor or in motor wiring • Controller failure • The keyswitch must be cycled before this fault can clear
4,3	EEPROM fault	• EEPROM failure or fault • The keyswitch must be cycled before this fault can clear
4,4	Power section fault	• EEPROM failure or fault • Short in motor or in motor wiring • Controller failure • The keyswitch must be cycled before this fault can clear

Throttle Potentiometer Testing and Adjustment

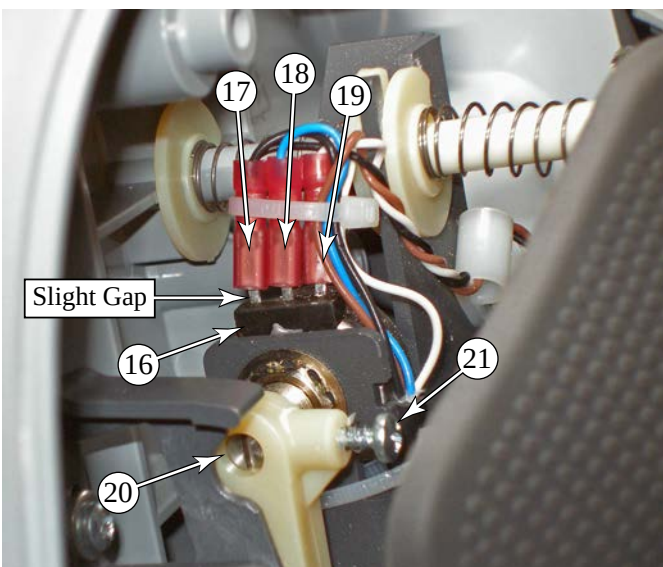
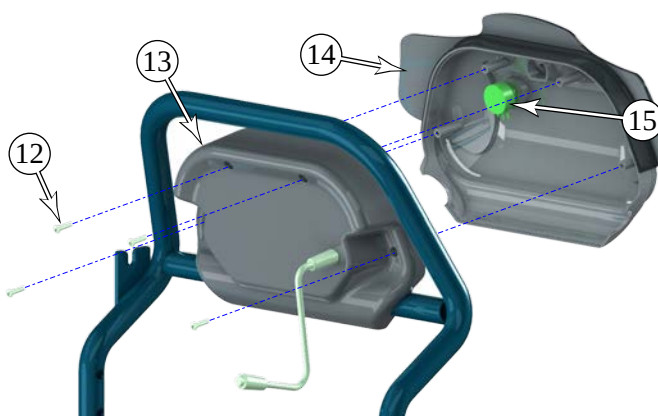
The drive motor speed controller has several safety protocols to prevent unwanted drive operation in the event of faulty input signals from the throttle potentiometer (16). If the total resistance of the throttle potentiometer is out of range, the drive controller will fault. If the potentiometer is not at a midpoint resistance when the drive paddle is in the neutral position, when the key switch is turned on, the controller will fault. These conditions can be tested with an ohmmeter.

Note: Use this procedure for fine tuning the position of the potentiometer without disconnecting the wires. Refer to the replacement procedure later in this chapter for the coarse adjustment procedure that is used when removing or replacing the potentiometer.

1. Turn off the key while disassembling the paddle to avoid unexpected machine movement.
2. Turn the speed limit potentiometer to its lowest setting. (Part of this procedure is completed with the key turned on, and the machine may move unexpectedly.)
3. Remove the four screws (12) that secure the paddle front cover (14) to the paddle back housing (13), and remove the front cover. Be careful with the wires to the speed limit potentiometer.
4. Using a small instrument screwdriver, gently pry the three wire terminals (17, 18, 19) slightly off the potentiometer (16) to expose enough of the potentiometer posts to connect a volt meter.
5. Turn the key on. Make sure there is ample room in front of and behind the machine in case it moves unexpectedly.

Note: Take care when using the voltmeter on active circuits. However, accidentally shorting the potentiometer terminals with the voltmeter will not damage the drive controller.

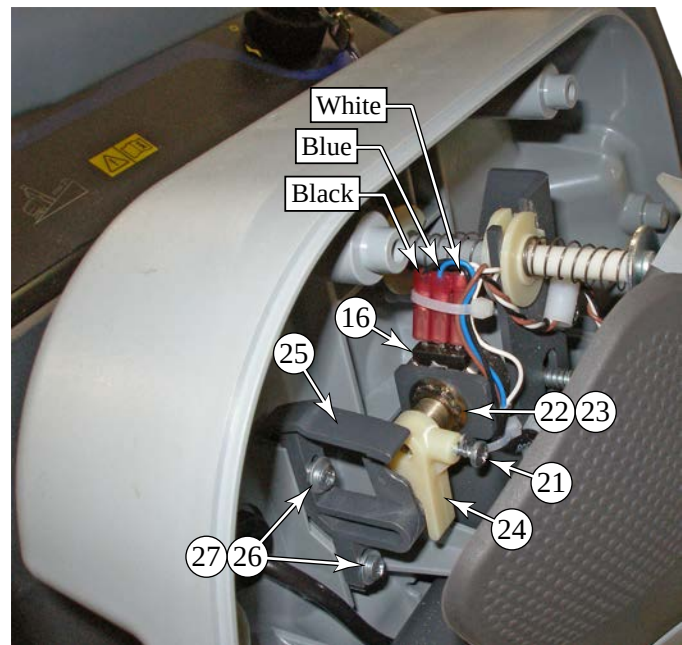
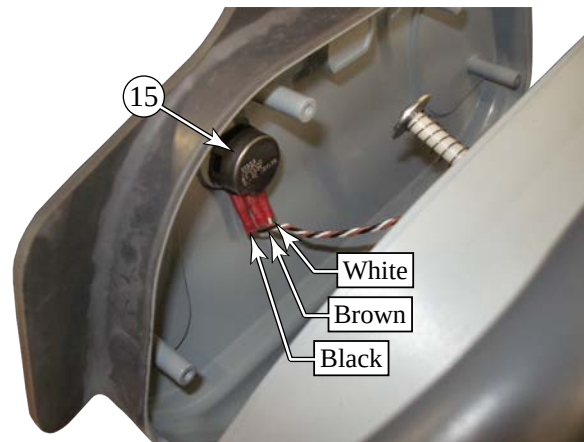
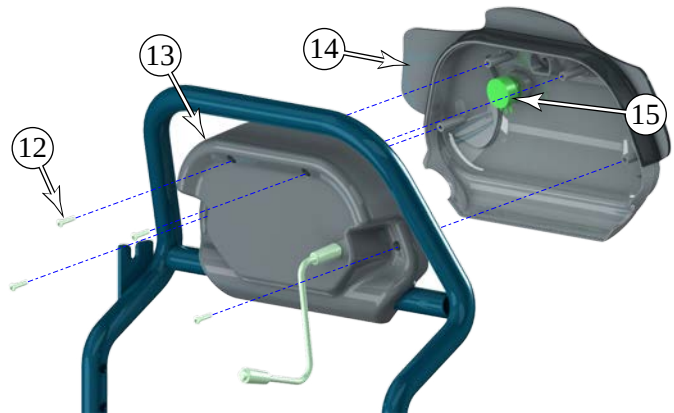
6. Using a voltmeter, measure the total voltage across the potentiometer at the outside pins (17 & 19). This voltage should be approximately 5 volts, but will vary from controller to controller.
7. Divide this voltage reading by 2. This is the target voltage that you will adjust the potentiometer wiper voltage to achieve.
8. With The drive paddle in the neutral position, measure the voltage from the center wiper terminal (18) to either of the outside terminals (17 or 19). This voltage should be 1/2 the voltage you recorded between terminals 17 and 19. (Alternatively, the voltage between 17 and 18 should be equal to the voltage between 18 and 19.)
9. To adjust the potentiometer, loosen the clamping screw (21) and turn the potentiometer shaft (20) with a small screwdriver. **Hint:** turn the potentiometer shaft toward the terminal (17 or 19) that had the highest voltage.
10. Verify that the voltage readings are centered (equal) within 0.1 volts or less, and reassemble the machine. (The actual Neutral Deadband range is ± 0.35 Volts, but your adjustment should be as close to center as possible.)



Removal and Installation

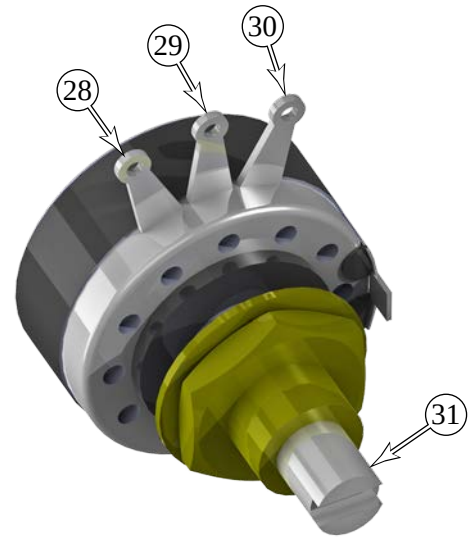
Throttle Potentiometer

1. Turn the key switch to the off position.
2. Remove the four screws (12) that secure the paddle front cover (14) to the paddle back housing (13), and remove the front cover. Be careful with the wires to the speed limit potentiometer.
3. Disconnect the 3 wires from the speed limit potentiometer (15), and set the paddle front cover (14) aside.
 - Hint: Use a small instrument screwdriver to gently pry the three wire terminals off the potentiometer.
 - Make note of the wire colors for replacement.
4. Remove the two screws (26) and washers (27) that secure the cam controller (25) to the paddle back cover, and remove the cam controller.
5. Loosen the clamping screw (21) that secures the potentiometer fork (24) to the potentiometer's shaft, and slide the fork off the shaft.
6. Disconnect the three wires from the throttle potentiometer (16).
 - Hint: Use a small instrument screwdriver to gently pry the three wire terminals off the potentiometer.
 - Make note of the wire colors for replacement.
7. Remove the nut (22) and lockwasher (23) that secure the potentiometer to the handlebar frame, and remove the potentiometer.



Before installing the potentiometer, it is necessary to locate the shaft midpoint position, where the resistance between the wiper and outer terminals is equal. This coarse adjustment makes it easier to set the neutral point of the drive controller later.

8. Using an ohmmeter, measure the resistance between the outer terminals **(28 & 30)**. This is the total resistance of the potentiometer. This value must be between 4.5 k Ω and 7.0 k Ω . If the total resistance is outside of these bounds, then replace the potentiometer.
9. Divide the total resistance of the potentiometer by 2. This value is used to set the midpoint position of the potentiometer.
10. Rotate the potentiometer shaft **(31)** until the resistance between the center terminal **(29)** and either (both) of the outer terminals **(28 & 30)** equals the total resistance divided by 2 from above. Mark this position of the shaft for reference.
11. With the potentiometer in its midpoint position, reassemble the control paddle. If desired, re-confirm the midpoint position with an ohmmeter before connecting the wires to the potentiometer (you cannot check resistance after the wires are connected).
12. Before reinstalling the paddle front cover **(14)**, perform the final adjustment procedure (or confirmation) described previously in this chapter.



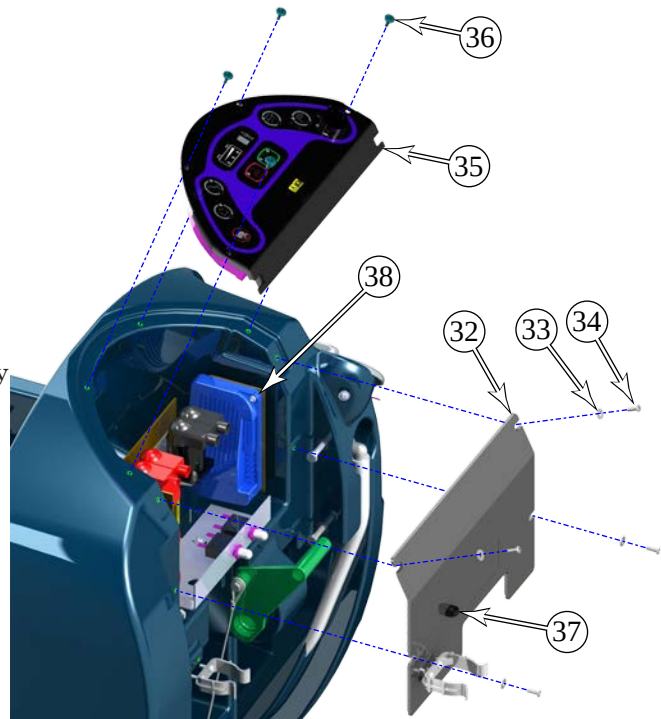
Drive Controller



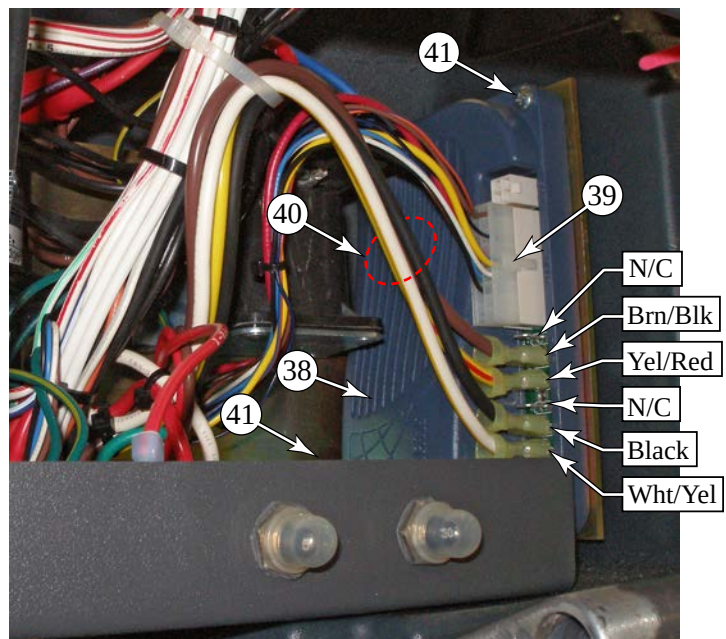
Warning: Disconnect the battery connector before servicing machine.

Note: Drive controllers are factory pre-programmed for the Warrior machine. Use only factory authorized replacement controllers.

1. Turn off the key and disconnect the main battery connector.
2. Free the drive paddle control wire from the wire clamp (37) on the front of the electrical cover (32).
3. Remove the four screws (34) and washers (33) that secure the electrical cover to the solution tank, and remove the cover.
4. Remove the four screws (36) that secure the control panel (35) to the solution tank, and gently move the control panel to the side.



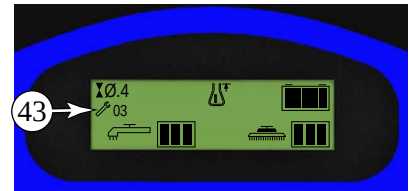
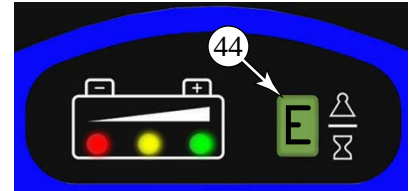
5. Disconnect the controls cable connector (39) from the J10 connector on the drive controller (38).
6. Remove the four power/motor wires (40) from the drive controller terminals. Note the color coding for later replacement.
7. Remove the two screws (41) that secure the drive controller (38) to the electrical panel, and remove the drive controller.



Follow-up Testing

After replacing the drive controller, perform this follow-up testing procedure to ensure safe operation of the controller.

1. Before reconnecting the battery, either block the wheels off the ground or move the machine to an open area without obstructions.
2. Reconnect the battery connector and turn on the key switch.
3. Check the display for a drive controller error.
 - Machines with the advanced display will show the wrench symbol and code “03” (43). Machines with a standard display will flash out the code E_0_3 on the status display (44).
4. If a drive controller error exists, the accessory wand indicator LED (42) will flash out the specific error code. Refer to the Status LED Fault Code Table in the Troubleshooting section of this chapter for interpretation of the fault code.
5. If no drive controller error is present, then operate the machine to test for proper function.
 - a. With the speed limit potentiometer set to its lowest setting, operate the paddle in the forward and reverse directions, and make sure the machine accelerates, decelerates, and stops as expected. Make sure the speed for the minimum setting is acceptable.
 - b. With the speed limit potentiometer set to its highest setting, operate the paddle in the forward and reverse directions, and make sure the machine accelerates, decelerates, and stops as expected. Make sure the speed for the maximum setting is acceptable.
 - c. With the paddle in the forward direction and the speed limit potentiometer at its lowest setting, ramp the speed limit potentiometer to its maximum setting and return to its minimum setting. Make sure the machine accelerates smoothly through its entire range. Repeat this for the reverse direction.



Wheels

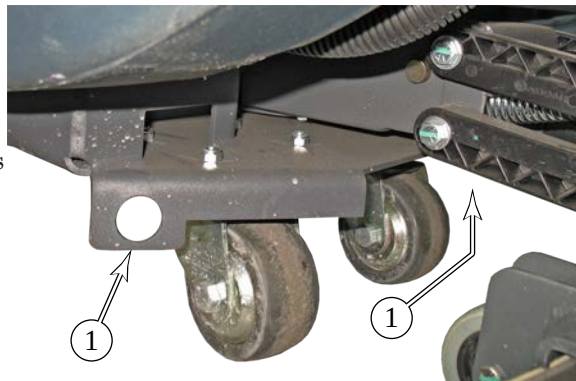


Warning: Disconnect the battery connector before servicing machine.



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

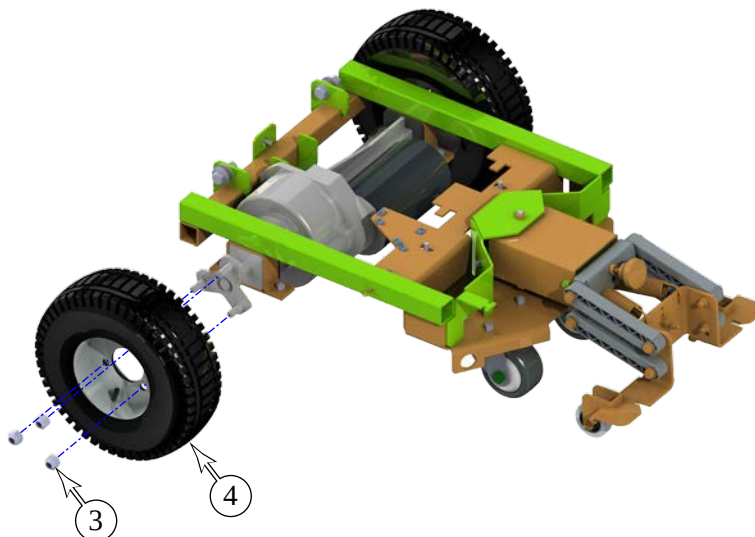
1. Turn off the key and disconnect the batteries.
2. To reduce the weight of the machine, drain both the recovery and solution tanks.
3. Block both sides of the machine at the rear lifting points **(1)** near the casters to keep the machine stable and prevent it from rolling.



4. Raise the front of the machine by jacking at the center front lifting point **(2)**.



5. Remove the three lug nuts **(3)** that secure the wheel **(4)** to the transaxle, and remove the wheel..



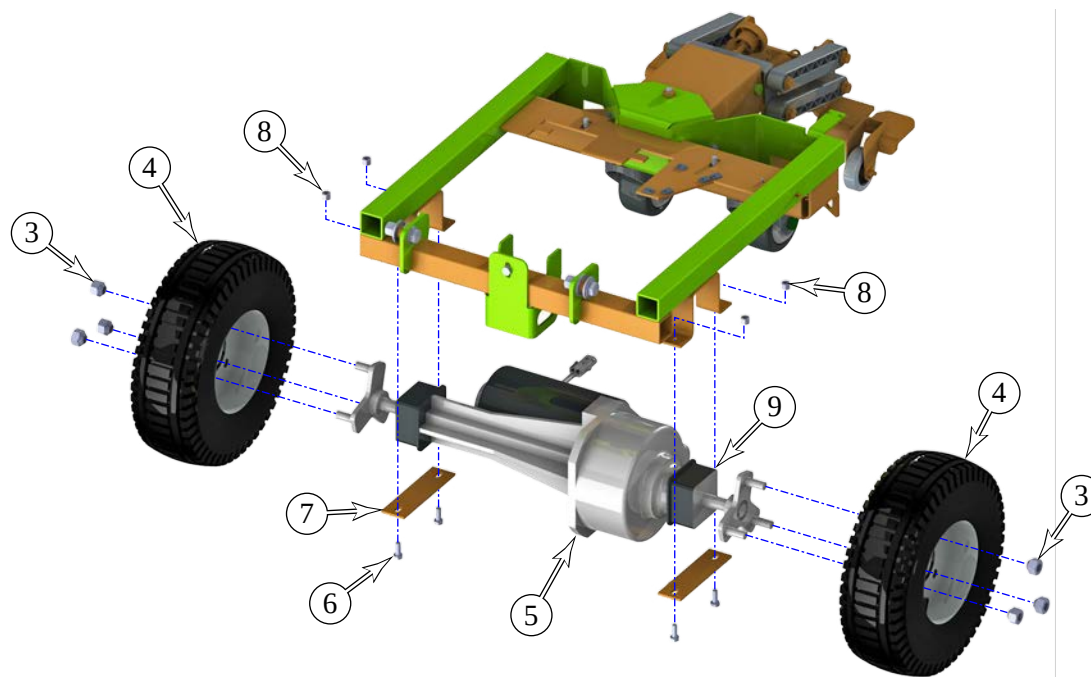
Drive Motor and Transaxle



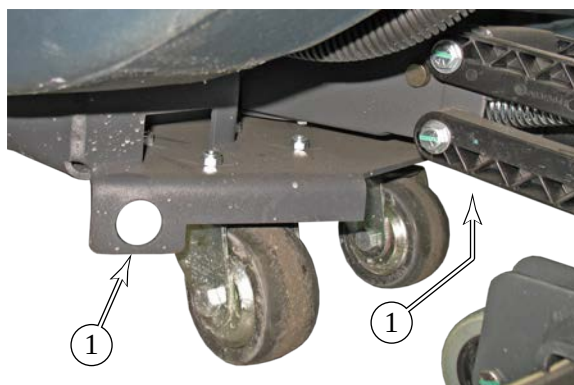
Warning: Disconnect the battery connector before servicing machine.



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



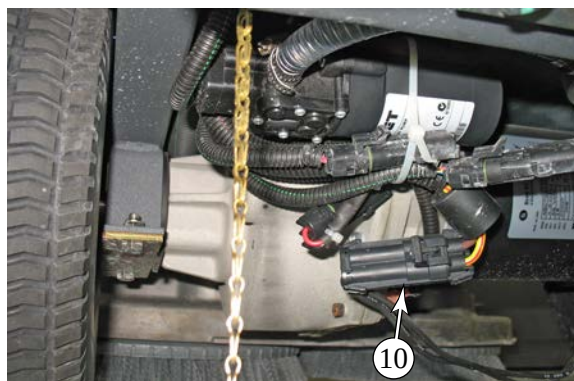
1. Turn off the key and disconnect the batteries.
2. To reduce the weight of the machine, drain both the recovery and solution tanks.
3. Block both sides of the machine at the rear lifting points (1) near the casters to keep the machine stable and prevent it from rolling.



4. Depending on the height that you are able to raise the machine, you may wish to remove the scrub deck for easier access to the transaxle components. Refer to the procedure in the scrub system chapter of this manual.
5. Raise the front of the machine by jacking at the center front lifting point (2).
6. Remove the six lug nuts (3) and both wheels (4) from the axle.

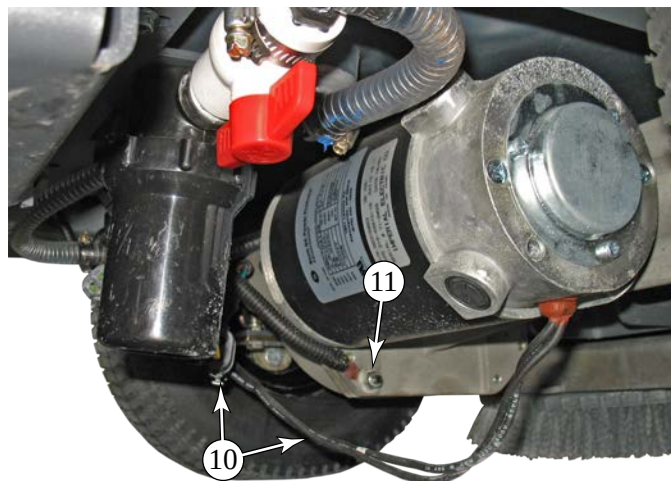


7. Disconnect the motor connector (10) from the main wiring harness.

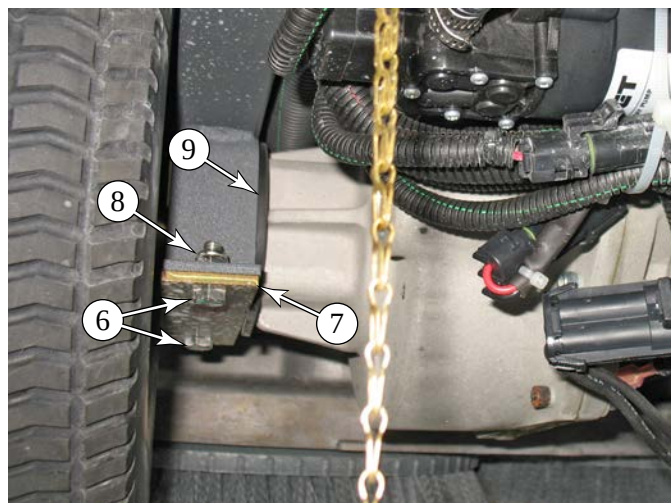


8. Remove the ground wire (11) from the transaxle housing.

Note: During reassembly, make sure all wires are secured and not dragging below the machine.



9. Support the transaxle from below so it does not fall when the mounting bolts are removed.
10. Remove the two bolts (6), nuts (8), and retaining plate (7) that secure each side of the transaxle at the urethane vibration mounts (9).
11. Carefully lower the transaxle to the floor and then slide it out from under the machine.



Special Tools

Curtis 1311 Programmer

The Curtis 1311 Programmer (or the 1307 predecessor) may be used to display drive controller error codes and program the drive controller. With a programmer, diagnostics and troubleshooting is more direct than with the Warrior display alone. The programmer presents complete diagnostic information in plain language without codes to decipher. Faults are displayed in the Diagnostic Menu, and the status of the controller inputs/outputs is displayed in the Test Menu.

The handheld programmer can also be used to access the drive controller's diagnostic history file. This file contains the history of cleared error codes, which may be helpful in determining the functional status of the machine between service intervals.

Refer to the Curtis 1311 Programmer manual for further information regarding the use and operation of the handheld programmer.

