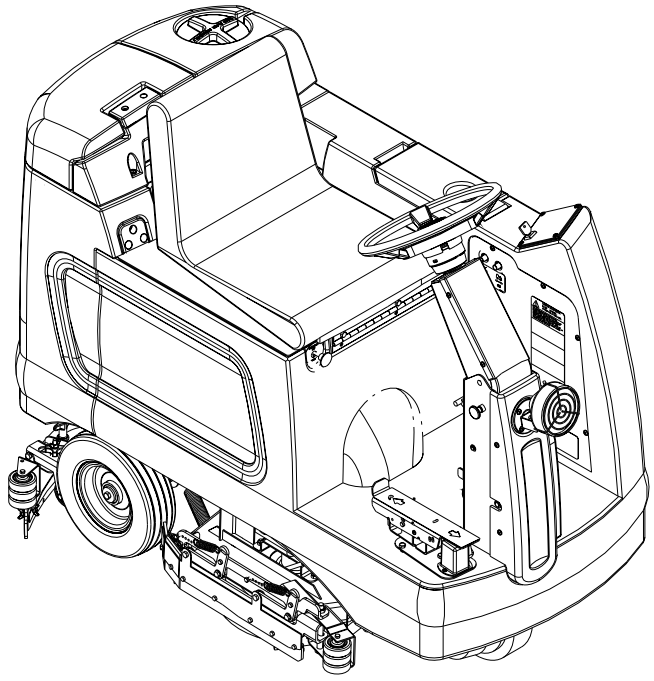
Hydro-Retriever™ 2800
BR 700 / BR 700C



SERVICE MANUAL

Advance MODELS 56412002(2800), 56412003(2800C)

Nilfisk MODELS 56412000(BR 700), 56412001(BR 700C)

Nilfisk Advance

setting standards

10/99 revised 2/05 Form Number 56043055

TABLE OF CONTENTS

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

GENERAL INFORMATION

INTRODUCTION

This manual will help you get the most from your **HR 2800 / BR 700**. Read it thoroughly before servicing the machine.
Note: Bold numbers in parentheses indicate an item illustrated on pages 6-7.
This product is intended for commercial use only.

PARTS AND SERVICE

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

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

(Dealer, affix service sticker here.)

NAME PLATE

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

MODEL NUMBER _____

SERIAL NUMBER _____

TRANSPORTING THE MACHINE

⚠ CAUTION!

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

- The machine is tied down securely - see tie-down location **(22)**.
- All access doors and covers are secured.
- The machine parking brake is set.

TOWING

⚠ CAUTION!

If the machine must be towed or pushed, make sure the Key Switch (Main Power) **(33)** 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.

OTHER MANUALS AVAILABLE FOR YOUR MACHINE

The following manuals are available from the Nilfisk-Advance Literature Service Department (order according to model name, number and machine's serial number):

- A Parts List and Operation Manual are available for each machine.
- The three Operation Manuals available for the BR 700 are multi-language: (Danish, Norwegian, Swedish, Finnish), (English, German, French, Netherlands) or (Spanish, Portuguese, Italian, Greek)

CAUTIONS AND WARNINGS

SYMBOLS

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

⚠ DANGER!

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

⚠ WARNING!

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

⚠ CAUTION!

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

GENERAL SAFETY INSTRUCTIONS

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

⚠ WARNING!

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

⚠ CAUTION!

- This machine is not approved for use on public paths or roads.
- This machine is not suitable for picking up hazardous dust.
- Do not use scarifier discs and grinding stones. Nilfisk-Advance will not be held responsible for any damage to floor surfaces caused by scarifiers or grinding stones (can also cause damage to the brush drive system).
- When operating this machine, ensure that third parties, particularly children, are not endangered.
- Before performing any service function, carefully read all instructions pertaining to that function.
- Do not leave the machine unattended without first turning the key switch off (O), removing the key and applying the parking brake.
- Turn the key switch off (O) before changing the brushes, and before opening any access panels.
- Take precautions to prevent hair, jewelry, or loose clothing from becoming caught in moving parts.
- Use caution when moving this machine in below freezing temperature conditions. Any water in the solution or recovery tanks or in the hose lines could freeze, causing damage to valves and fittings. Flush with windshield washer fluid.

SAVE THESE INSTRUCTIONS

SPECIFICATIONS

General Specifications	English (Metric)
Machine Length	61 in. (155 cm)
Machine Width with Squeegee	33 in. (84 cm)
Machine Height	51 in. (130 cm)
Machine Net Weight*	575 lbs. (261 kg)
Machine Gross Weight**	1052 lbs. (477 kg)
Cleaning Width (scrubbing path)	28 in. (71 cm)
Coverage Rate Per Hour (theory)	40,410 sq. ft. (3754 m^2)/ hour
Coverage Rate Per Hour (actual)	27,227 sq. ft. (2529 m^2)/ hour
Brush Disc type (qty of 2)	14 in. (43 cm) disc
Brush Cylindrical (qty of 2)	5-3/4 in. Dia. x 27 inches length (14.6 cm x 68.6 cm)
Brush Speed (Disc)	300 RPM
Brush Speed (Cylindrical)	900 RPM
Solution Tank Capacity	28 gal. (106 l)
Recovery Tank Capacity	28 gal. (106 l)
Vacuum Water Lift	60 inches (sealed) 15 inches (1 in. orifice)
Ramp Climbing Ability (gradeability)	Transport 14% grade (8 degrees) Cleaning 10% grade (6 degrees)
Sound Level	75 dB(A)/20uPa (at operator)
Transport Speed	3.8 mph (6.1 KPH)
Scrubbing Speed	3.3 mph (5.3 KPH)
Minimum Aisle Turning Width	65 inches (165 cm)
Power Source 24VDC Battery Pack	Qty (4) 6V, 395 AH batteries PN. 56388582
Battery Weight (each)	123 lbs. (55.8 kg)
Battery Compartment Size	
Height	19-1/2 in. (49.5 cm)
Width	16-3/16 in. (41 cm)
Length	23-5/8 in. (60 cm)
Battery Chargers	24V Auto 40 Amp (120V, 60Hz) 24V Auto 40 Amp (230V, 50Hz)
Wheel Drive Motor	24V, .8 hp, (35A)
Brush Drive Motor (disc)	24V, 1-1/2 hp, 50-65A***
Brush Drive Motor (cylindrical)	24V, 3/4 hp (2 used)
Vacuum Motor	24V, 3/4 hp, 23A***

***Net Weight:** Standard machine without options, empty solution and recovery tanks, without removable scrub brushes and no battery installed.

****Gross Weight:** Standard machine without options, full solution tank and empty recovery tank, with removable scrub brushes and maximum size battery.

***Average current draw under normal working loads.

MAINTENANCE SCHEDULE

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

MAINTENANCE ITEM	Daily	Weekly	Monthly	Yearly
Charge Batteries	•			
Check/Clean Tanks & Hoses	•			
Check/Clean/Rotate the Brushes/Pads	•			
Check/Clean/Adjust the Squeegee	•	•		
Check/Clean Vacuum Shut-Off Float	•			
Check/Clean the vacuum motor foam filter	•			
Check Each Battery Cell(s) Water Level		•		
Inspect Scrub Housing Skirts		•		
Inspect and clean Solution Filter		•		
Check Foot/ Parking Brake For Wear & Adjustment		•		
Lubrication - Grease Fittings			•	
* Check Carbon Brushes				•

Note: See the individual machine system sections for maintenance information.
* Have Nilfisk-Advance:
Check vacuum motor carbon brushes (Qty 2) once a year or after 300 operating hours.
Check brush motor carbon brushes (Qty 4) once a year or after 500 operating hours.
Note if the vacuum or brush motor brushes are 9.5mm (3/8 inches) or shorter, replace them.
Check wheel drive motor carbon brushes every 500 operating hours. The original length of each brush is 20mm (25/32 inches). Replace when shorter than 9.5 mm (3/8 inches) to obtain the same motor efficiency as a new brush.

⚠ WARNING!

Turn the key switch off, set the parking brake and disconnect the battery before servicing the machine.

BATTERIES AND CHARGERS

Attention: See the electrical system manual section for battery installation and charger system requirements.

WHEEL DRIVE MOTOR GREASE SPECIFICATION

If drive motor gear housing grease replacement is needed when repair services are performed (Example inspection shows grease contamination). Clean gear sets and housing and re-pack. Use a multi-purpose, high melting point Lithium based grease, containing additives to provide anti-oxidant, anti-corrosion and good lubricity properties. Use a total quantity of 4.9-5.6 oz. (140-160g) of grease to service gear case.

The grease to be used must have excellent mechanical stability, water resistance and high load carrying capacity. The MR 158 grease is particularly recommended for automotive applications including wheel-bearing lubrication. Available NLGI consistency 3.

Grade	Average Drop Point °C	Penetration ASTM Worked (mm / 10) at 25 °C	Base
MR 158 Grease	180	220 / 250	Lithium*

LUBRICATING THE MACHINE

Once a month, pump a small amount of grease into each grease fitting on the machine until grease seeps out around the bearings.

Grease fitting locations are:

- Squeegee Caster Wheel Axle & Swivel (2) per Assembly
- Steering Wheel Shaft Universal joint

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

- Steering Chain
- Squeegee Height Adjustment Caster Hardware
- General Pivot Points For the Squeegee & Brush Linkage

Advance Hydro Retriever 2800

Disc and Cylindrical

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	Steering		A B	
2	Drive Pedal Operation (check for Fwd/Rev Drive & any neutral creep)		A B D	
3	Seat Safety Switch		A D	
4	Brakes (Service & Parking)		A B W	
5	Drive System Performance (reference SVR Manual for Curtis drive programmer speed changes)		noisy sluggish	
6	Scrub System (Raise/Lower and auto scrubbing functions)		A B	
7	Scrub Brush (pressure settings Normal & Heavy)		A B	
8	Squeegee System (Raise/Lower and auto lift in reverse function)		A B	
9	Vacuum Performance (sealed water lift 60" and 1- inch open hole adapter 15 inches)		C L W	
10	Solution Control (On/Off and flow volume Min/Max)		A B L	
11	Emergency Battery Disconnect Control Knob		B D	
12	Pre-Sweep System Accessory (If applicable)		A B D	
13	Tilt Steering Mechanism and Seat Lever		A B	
14	Optional Accessories (headlight, safety beacon, back up alarm, etc.)		D	
15	Main Control Board Special Program Options (check all applicable program settings, reference SVR Manual 56043055); Example, Fault Recall Mode, Etc.		Program as needed	
16	Battery Charger Operation		D	

Ref	VISUAL INSPECTION ITEMS	Comments	OK	Defect Codes (circle)	Does Not Work
17	Scrub Brushes, check for wear and rotate			A B D W	
18	Scrub Brush Motor(s) and disc machine gearboxes	Carbon Brushes		B L W	
19	Scrub Brush Drive Belt, wear and tension (cylindrical only)			A D W	
20	Scrub Brush Deck Actuator Motor			A B D W	
21	Brush Drive Plate Retainer Clips			D M	
22	Scrub Deck Skirts			A B W	
23	Solution Solenoid Valve			C L	
24	Solution Flow Control Valve and Linkage			A B D W	
25	Solution Tank, Delivery Hoses & Filter			C L	
26	Vacuum Motor Carbon Brushes			W	
27	Vacuum Motor Gaskets and Filters			L W	
28	Vacuum Float Ball & Cage Assembly			C M	
29	Recovery Tank Cover Gasket			C D L	
30	Recovery Tank Drain Hose & Cap			C L	
31	Squeegee Pick-Up Tool & Hose	Back flush		C L	

2/21/2001

Ref	VISUAL INSPECTION ITEMS (continued)	Comments	OK	Defect Codes (circle)	Does Not Work
32	Squeegee Blades (clean & rotate)			A C D W	
33	Squeegee Casters (lubricate)			A C W	
34	Squeegee Lift Actuator Motor & Cable			A B D	
35	Battery Condition (clean & water)	Load Test		C W	
36	Front Drive Wheel Motor			C W	
37	Front Drive Tire (rim fastener torque)			W	
38	Brake Caliper Cable & Pad Wear			A B W	
39	Drive Pedal Linkage (neutral return)			A B	
40	Steering Chain (lubricate & tension)			A B C	
41	Steering Column (knob & plunger spring)			A D	
42	Rear Wheels			W	
43	Sweep Debris Tray (cylindrical only)			C	

NOTE: For additional service information see service manual form number 56043055 and operators manual form number 56041449.

Defect Codes

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

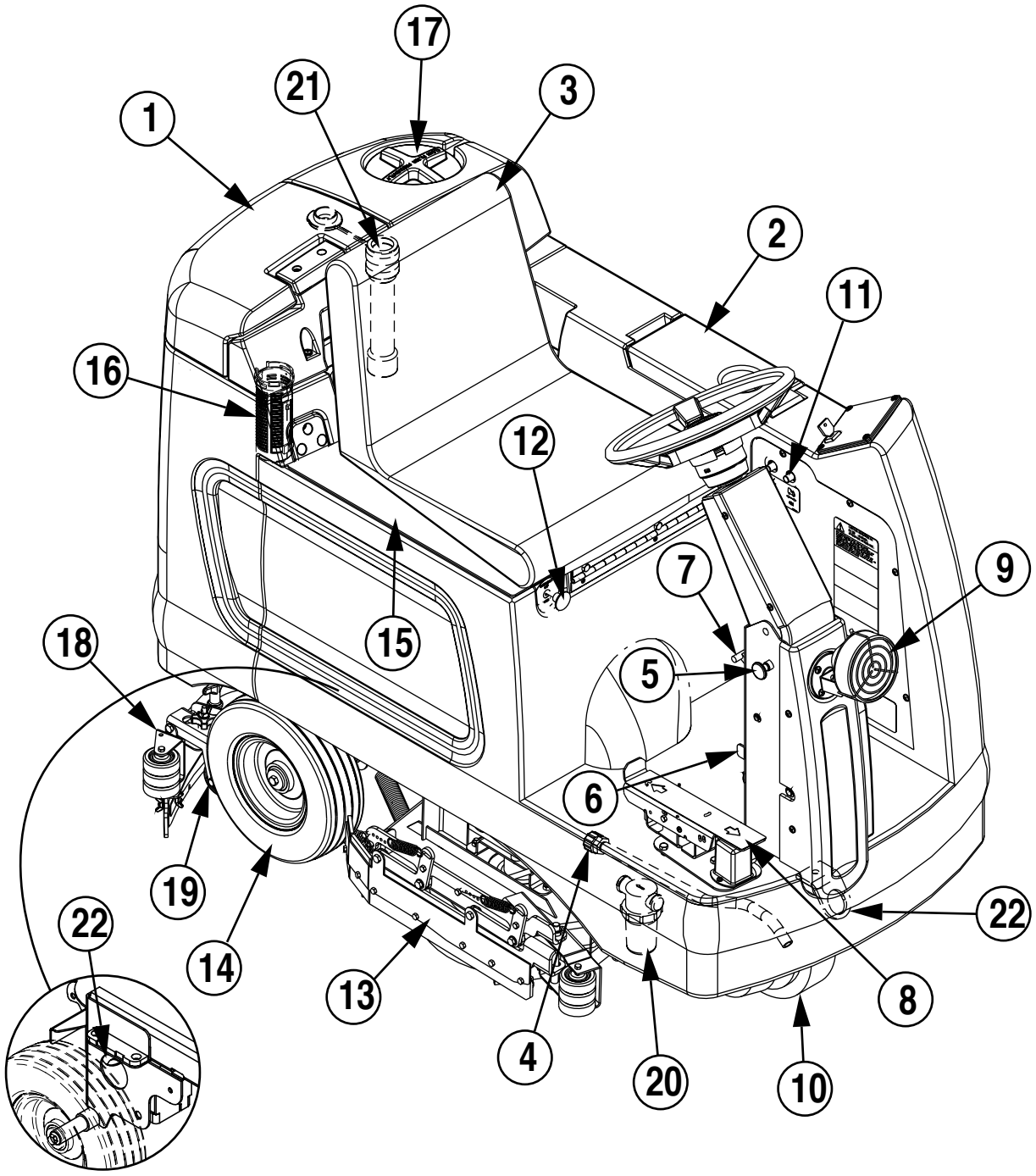
WORK COMPLETED BY:

ACKNOWLEDGED BY:

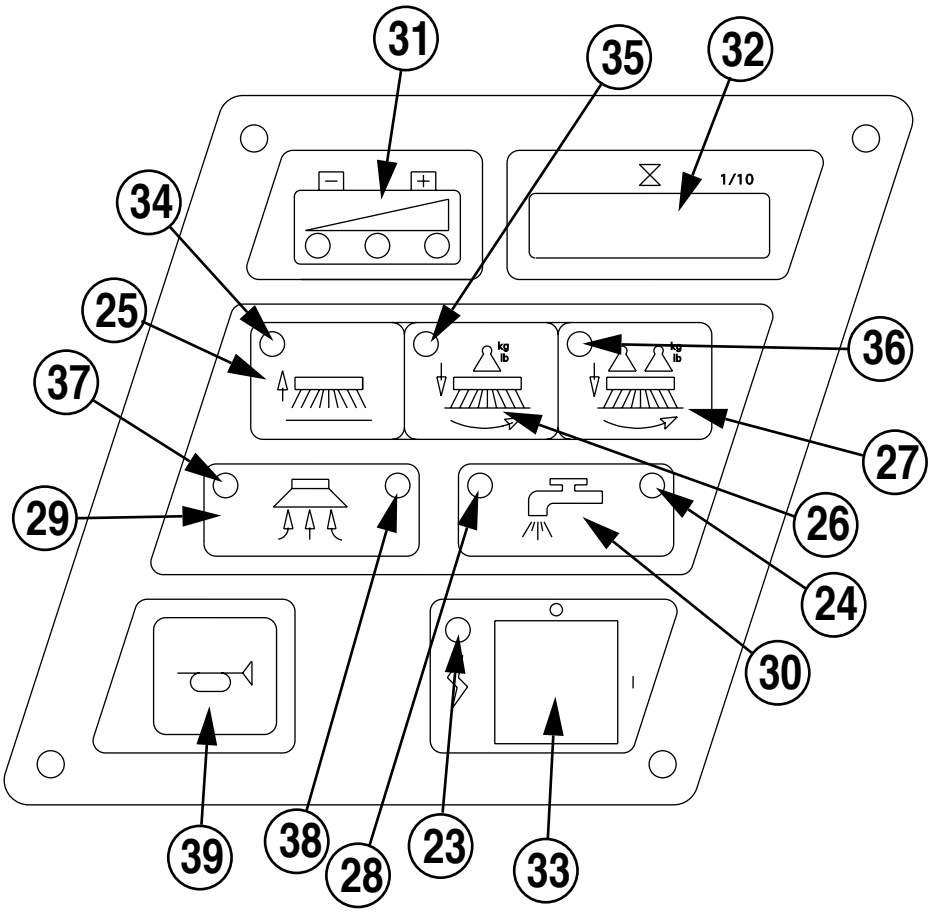
Service Technician Signature | Date | Customer Signature | Date

KNOW YOUR MACHINE

1 Recovery Tank Cover
2 Solution Tank Fill Cover
3 Operator Seat w/Safety Switch
4 Solution Tank Drain Hose
5 Steering Wheel Adj. Tilt Knob
6 Brake Pedal & Parking Brake Set/Release Lever
7 Solution Flow Control Lever
8 Drive Pedal Directional/Speed
9 Head Light
10 Drive and Steer Wheel
11 Circuit Breakers
12 Emergency Stop Switch / Battery Disconnect
13 Scrub Brush Deck And Side Skirts
14 Rear Wheel
15 Battery Compartment
16 Recovery Tank Shutoff Float
17 Vacuum Motor Filter Housing
18 Squeegee Assembly
19 Squeegee Casters
20 Solution Filter
21 Recovery Tank Drain Hose
22 Tie Downs (1) Front, (2) Rear



23 Main Power Indicator
24 Solution System Fault Indicator
25 Scrub Off Button
26 Normal Scrub Button
27 Heavy Scrub Button
28 Solution System Indicator
29 Vacuum Button
30 Solution Button
31 Battery Condition Indicator
32 Hourmeter/Status Display
33 Master On/Off Key Switch
34 Scrub Mode Off Indicator
35 Normal Scrub Mode Indicator
36 Heavy Scrub Mode Indicator
37 Vacuum System Indicator
38 Vacuum System Fault Indicator
39 Horn Button



KNOW YOUR MACHINE

FUNCTIONAL DESCRIPTION OF CONTROL BUTTONS:

The controls on the HR 2800 / BR 700 were designed with *one touch operation* in mind. For single pass scrubbing the user can simply depress one button and all systems on the machine will be ready to go.

For most single-pass scrubbing operations, the operator should only need to use the second row of three buttons on the control panel. These are the Scrub Mode Off, Normal Scrub, and Heavy Scrub buttons. For this reason these buttons are outlined in bright white on the control panel while the other buttons are outlined in a darker color.

Horn Button (39) - Pressing this button will activate the horn.

Scrub Off Button (25) - Pressing this button when the unit is in a scrub mode will cause the following to occur:

- The scrub brushes will turn off
- The scrub deck will raise to the UP position
- The solution flow will be stopped
- The first time that this button is pressed, the vacuum/squeegee 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 button is pressed a second time (pressed after the scrub mode has been turned off) the squeegee will raise and the vacuum will shut off after a 6 second delay.

NORMAL AND HEAVY SCRUB BEFORE SERIAL NUMBER 1362502

Normal Scrub Button (26) - Pressing this button will cause the normal scrub mode to be selected. In this mode a moderate amount of down pressure is applied to the scrub brushes. The following will occur when this button is pressed:

- The scrub deck will be lowered
- The vacuum and solution systems will be enabled (vacuum and solution modes = AUTO)
- As soon as a direction is commanded by the throttle (forward or reverse), the brushes will start turning and the vacuum will turn on. If the direction is forward, the squeegee will lower and the solution flow will start. If the direction is reverse, the squeegee will go to the up position and the solution flow will be stopped.

Heavy Scrub Button (27) - Pressing this button will cause the heavy scrub mode to be selected. In this mode a large amount of down pressure is applied to the scrub brushes. See the above description for further actions.

NOTE: See the Electrical System manual section for a full explanation of the special operator programming instructions for changing both normal and heavy scrub mode pressure adjustments for machines before SN 1362502.

NORMAL AND HEAVY SCRUB AFTER SERIAL NUMBER 1362501

Normal Scrub Button (26) - Pressing the normal scrub button will enable the scrub system and set the scrub pressure to the last selected value for the normal scrub mode. The status display will momentarily display the scrub pressure setting. This is indicated by "PA" followed by a number. Subsequent presses of the normal scrub button will step the pad pressure setting through the allowable range up to the maximum value programmed for the normal scrub mode. Once the maximum value is reached the pressure setting will step back to 1. The factory default maximum for the normal scrub mode is 4. The following will occur when this button is pressed:

- The scrub deck will be lowered
- The vacuum and solution systems will be enabled (vacuum and solution modes = AUTO)
- As soon as a direction is commanded by the throttle (forward or reverse), the brushes will start turning and the vacuum will turn on. If the direction is forward, the squeegee will lower and the solution flow will start. If the direction is reverse, the squeegee will go to the up position and the solution flow will be stopped.

Heavy Scrub Button (27) - Pressing the heavy scrub button will enable the scrub system and set the scrub pressure to the last selected value for the heavy scrub mode. The status display will momentarily display the scrub pressure setting. This is indicated by "PA" followed by a number. Subsequent presses of the heavy scrub button will step the pad pressure setting through the allowable range up to the maximum value programmed for the heavy scrub mode. Once the maximum value is reached the pressure setting will step back to (normal scrub limit + 1). The factory default maximum for the heavy scrub mode is 7 (cylindrical) or 9 (disc). The following will occur when this button is pressed:

- The scrub deck will be lowered
- The vacuum and solution systems will be enabled (vacuum and solution modes = AUTO)
- As soon as a direction is commanded by the throttle (forward or reverse) the brushes will start turning and the vacuum will turn on. If the direction is forward, the squeegee will lower and the solution flow will start. If the direction is reverse, the squeegee will go to the up position and the solution flow will be stopped.

NOTE: See the Electrical System manual section for a full explanation of the special operator programming instructions for changing both normal and heavy scrub mode pressure adjustments for machines after SN 1362501.

Vacuum Button (29) - This button is used to select the mode of operation for the vacuum/squeegee system. There are 3 modes of operation for this system. These modes are OFF, AUTO, ON. Following is a description of each mode and how they are selected.

OFF MODE: - In this mode the vacuum is off and the squeegee is in the up position. As mentioned above, when a scrub mode is selected, the vacuum system will be placed in the AUTO mode. If it is desired to double-scrub (scrub without recovering the solution) the vacuum system can be turned off by pressing this button.

AUTO MODE: - This mode is automatically selected when a scrub mode is selected. In this mode the squeegee will be in the down position unless the reverse direction is selected via the throttle. The vacuum will turn on if either direction is selected. While in this mode the vacuum will remain on for 10 seconds after the throttle returns to the neutral position. This is so that the solution in the squeegee and hose can be drawn into the tank. This mode can be selected independently of the scrub mode by pressing and releasing the vacuum button.

ON MODE: - In this mode the squeegee will remain in the UP position and the vacuum will be on regardless of the throttle position. This mode is selected by pressing and holding the vacuum button for approximately 1.5 seconds. *The vacuum mode must first be OFF before entering this mode.* This mode is included in the event an external wand is to be used with this machine or if the operator wants to clean the squeegee using the vacuum hose.

Solution Button (30) - This button is used to select the mode of operation for the solution system. There are 3 modes of operation for this system. The modes are OFF, AUTO, MOMENTARY ON. Following is a description of each mode and how they are selected.

OFF MODE: - In this mode the solution flow is turned off. As mentioned above, when a scrub mode is selected, the solution system will be placed in the AUTO mode. If it is desired to scrub without dispensing solution, the solution can be turned off by pressing this button.

AUTO MODE: - This mode is automatically selected when a scrub mode is selected. In this mode the solution flow will be turned on whenever the forward direction is selected via the throttle. The solution flow will be turned off otherwise.

MOMENTARY ON MODE: - This mode can only be selected when the scrub mode is OFF. Solution can be dispensed by pressing and holding the solution button. Solution will be dispensed for as long as the button is held. This is for pre-wetting the floor prior to scrubbing.

DESCRIPTION OF INDICATORS ON THE CONTROL PANEL:

In general, the following guidelines apply to the control panel indicators:
A steady red indicator means that the function is inhibited for some reason. For example, if the scrub system is off and the operator is not on the seat, the scrub system indicator will be red indicating that the system cannot be turned on until the operator is on the seat.
A flashing red indicator means that a fault has occurred in the particular system. An example of this would be an over-current fault.
A yellow indicator means that the particular function has been enabled but is not currently on. For example, if a scrub mode is selected and the throttle is in neutral, the scrub system, vacuum, and solution indicators will all be yellow indicating that the systems are enabled and ready to turn on when the throttle is moved to forward or reverse.
A green indicator means that the particular system is on.
A flashing green indicator means that the particular system is in a delayed-off condition. An example of this is when a scrub mode is selected and the throttle goes from forward or reverse to neutral. When this happens the vacuum indicator will flash green indicating that the vacuum is still on but that it will be turning off after the delay period.

Scrub Mode Off Indicator (34):

- This indicator will be RED if the scrub system is inhibited for any reason. Possible reasons are:
  - Seat switch is open
  - The scrub deck has not returned to the UP position.
  - A system fault
  - Low voltage condition
- This indicator will be GREEN if the system is ready to be placed in either the normal or heavy scrub modes.
- This indicator will be OFF if either the normal or heavy scrub modes have been selected.
- This indicator will flash RED if there is a fault in one of the scrub system components. This will be accompanied by an error indication on the Hour Meter / Status Display **(32).**

Normal Scrub Mode Indicator (35):

- This indicator will be YELLOW if the normal scrub mode has been selected but the scrub motor is off. This will be the case if the throttle is in the neutral position. The scrub motor will stay on for approximately 3 seconds after the throttle returns to the neutral position.
- This indicator will be GREEN if the normal scrub mode has been selected and the scrub motor is on.
- This indicator will be OFF if the scrub mode is off or if the heavy scrub mode has been selected.

Heavy Scrub Mode Indicator (36):

- This indicator will be YELLOW if the heavy scrub mode has been selected but the scrub motor is off. This will be the case if the throttle is in the neutral position. The scrub motor will stay on for approximately 3 seconds after the throttle returns to the neutral position.
- This indicator will be GREEN if the heavy scrub mode has been selected and the scrub motor is on.
- This indicator will be OFF if the scrub mode is off or if the normal scrub mode has been selected.

KNOW YOUR MACHINE

DESCRIPTION OF INDICATORS ON THE CONTROL PANEL (CONTINUED)

Vacuum System Indicator (37):

- This indicator will be YELLOW if the vacuum/squeegee system is in the AUTO mode and the throttle is in the neutral position. This indicates that the vacuum system is enabled but the vacuum is currently off.
- This indicator will be GREEN if the vacuum is currently on. This indicates that the system is in the AUTO mode and the throttle is not in neutral or that the vacuum system is in the ON mode.
- This indicator will FLASH GREEN if the shutoff delay is keeping the vacuum on. This occurs if the vacuum system is in the AUTO mode and the throttle goes to the neutral position. This will also occur if the vacuum system is turned off while it was in either the AUTO or ON modes. The shutoff delay will turn the vacuum off after the delay period.
- This indicator will be OFF if the vacuum/squeegee system if in the OFF mode.

Vacuum System Fault Indicator (38):

- This indicator will flash red if there is a fault in the vacuum or squeegee systems. This will be accompanied by an error indication on the Hour Meter / Status Display **(32).**
- This indicator will be RED and the Hour Meter / Status Display **(32)** will show "FULL" if the recovery tank float valve has closed. If this indication occurs and the tank is not full, see the *Troubleshooting* section.

Solution System Indicator (28):

- This indicator will be YELLOW if the solution system is in the AUTO mode and the throttle is in the neutral or reverse positions. This indicates that the solution system is enabled but the solution flow is currently off.
- This indicator will be GREEN if the solution system is in the AUTO mode and the throttle is in the forward position. It will also be GREEN if the solution system is in the MOMENTARY ON mode. This indicates that the solution flow is currently on.
- This indicator will be OFF if the solution system is in the OFF mode.

Solution System Fault Indicator (24):

- This indicator will flash red if there is a fault in the solution system. This will be accompanied by an error indication on the Hour Meter / Status Display **(32).**

Main Power Indicator (23):

- This indicator will be GREEN when the key switch is ON.
- This indicator will flash RED if there is a system fault that requires turning the Master ON/OFF Key Switch **(33)** off to reset.
- This indicator will flash fault codes from the Curtis Speed Control if a fault exists. This will be accompanied by an "Err03" indication on the Hourmeter/Status Display **(32)**.

DESCRIPTION OF THE BATTERY CONDITION INDICATORS

The battery condition indicators will give an indication of the state of charge of the batteries. The battery condition monitor will retain the state-of-charge even if the key has been turned off. The state-of-charge indication is reset to full charge when the batteries have been recharged. It is also possible to choose between two different low voltage thresholds depending on whether maintenance free or standard batteries are being used **(have qualified service engineer perform this selection*)**. NOTE: The following percentages are based on *useable* battery capacity not total battery capacity. Therefore, 100% discharge = 80% of total battery capacity for standard wet cell batteries or 70% of total battery capacity for maintenance free batteries.

Green Indicator = full charge down to 50% discharge
Green & Yellow Indicator = 50% discharge down to 75% discharge
Yellow Indicator = 75% discharge down to 90% discharge
Yellow & Red Indicator = 90% discharge down to 95% discharge
Red Indicator = 95% discharge down to 99% discharge
Flashing Red Indicator = 100% discharge - scrub system will automatically shut down

***Important Note:** See the *Main Control Board Special Program Options* manual section (located in the electrical system) and follow the instructions for setting the low voltage cutout threshold.

DESCRIPTION OF HOURMETER / STATUS DISPLAY

The 5 character display in the upper right corner of the control panel is primarily used as a display for the hourmeter function. This display is also used to display the following information depending upon which mode the control is in:

- Error codes*
- Brush pressure adjustment setting for normal scrub mode*
- Display of control system default parameters*
- Recovery tank FULL indicator*

* NOTE: Reference (in the Electrical System manual section) the Main Control Board Troubleshooting Guide and the Control Board Special Program Options sections. These sections will explain the machine error code descriptions and scrub system controller default parameter changes.

Emergency Stop Switch / Battery Disconnect (12): This will remove all power from the machine.

STEERING CHAIN REMOVAL AND TENSIONING

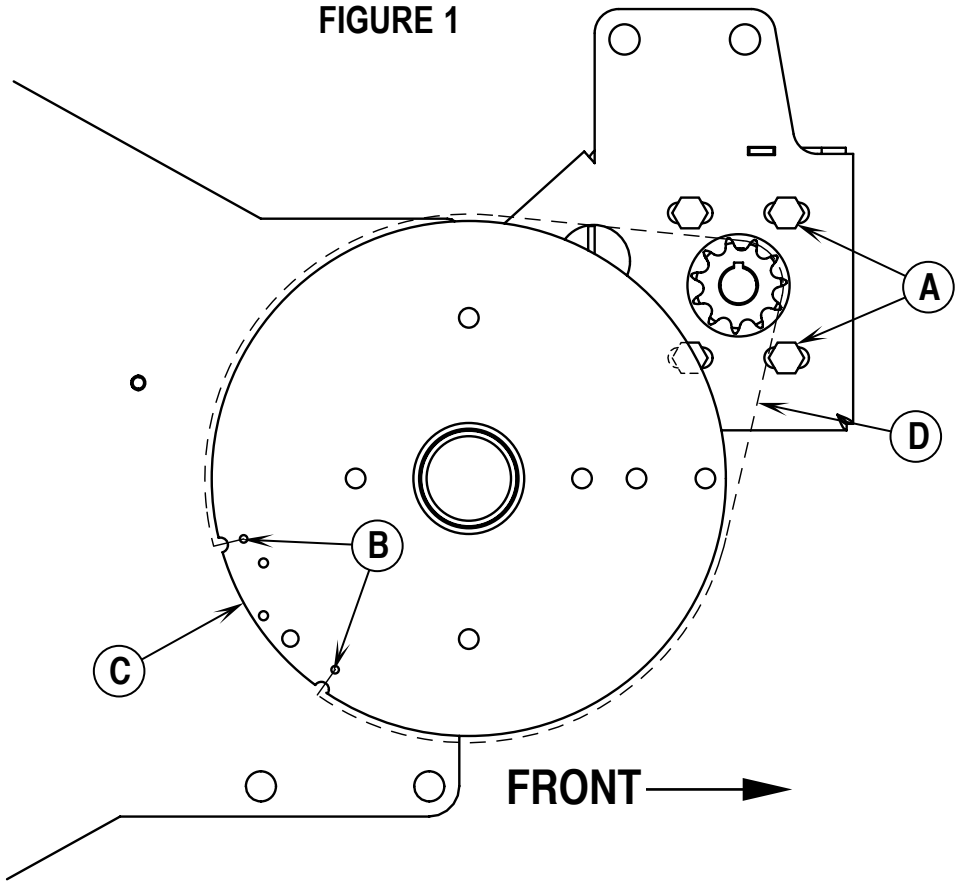
1 Turn the master key switch off and disconnect the battery pack connector **(12)**.

2 See Figure 1. Loosen the (4) Hex HD Screws **(A)** and push the lower steering column back towards the driver seat to release the steering chain tension.

3 Remove both Master Links **(B)** that secure the chain to the Steering Plate **(C)** then remove the chain from underneath the machine.

4 Reassemble parts in reverse order and adjust chain tension so that there is about 3/16" (5 mm) total deflection with moderate pressure applied at point **(D)** (as shown). **Service Tip Note:** Use a pry bar or shims between the chassis and steering column to help secure the tension adjustment when retightening the steering column mounting screws.

FIGURE 1



WHEEL DRIVE SYSTEM

WHEEL DRIVE MOTOR ASSEMBLY REMOVAL

1 Turn the key switch (main power) to the OFF position and then disconnect the battery pack connector **(12)**.

2 On the side of the drive motor remove the motor wiring cover and observe the (2) wires (red & black) connected to the motor (terminal connections for reassembling). Then remove the wires using a 13mm wrench.

3 Remove the brake cable linkage at the brake caliper arm then loosen the brake cable anchor nut and pull the cable away from the mount bracket.

4 See Fig. 1. Loosen the (4) hex HD Screws **(A)** and push the lower Steering Column **(B)** towards the driver's seat to release the steering chain tension.

5 Pry off the spindle nut access cover plate located on top of the drivers compartment floor.

6 Remove the cotter key from the spindle nut and using a 1-5/16 inch socket remove the castle nut from the shaft.

⚠ WARNING!

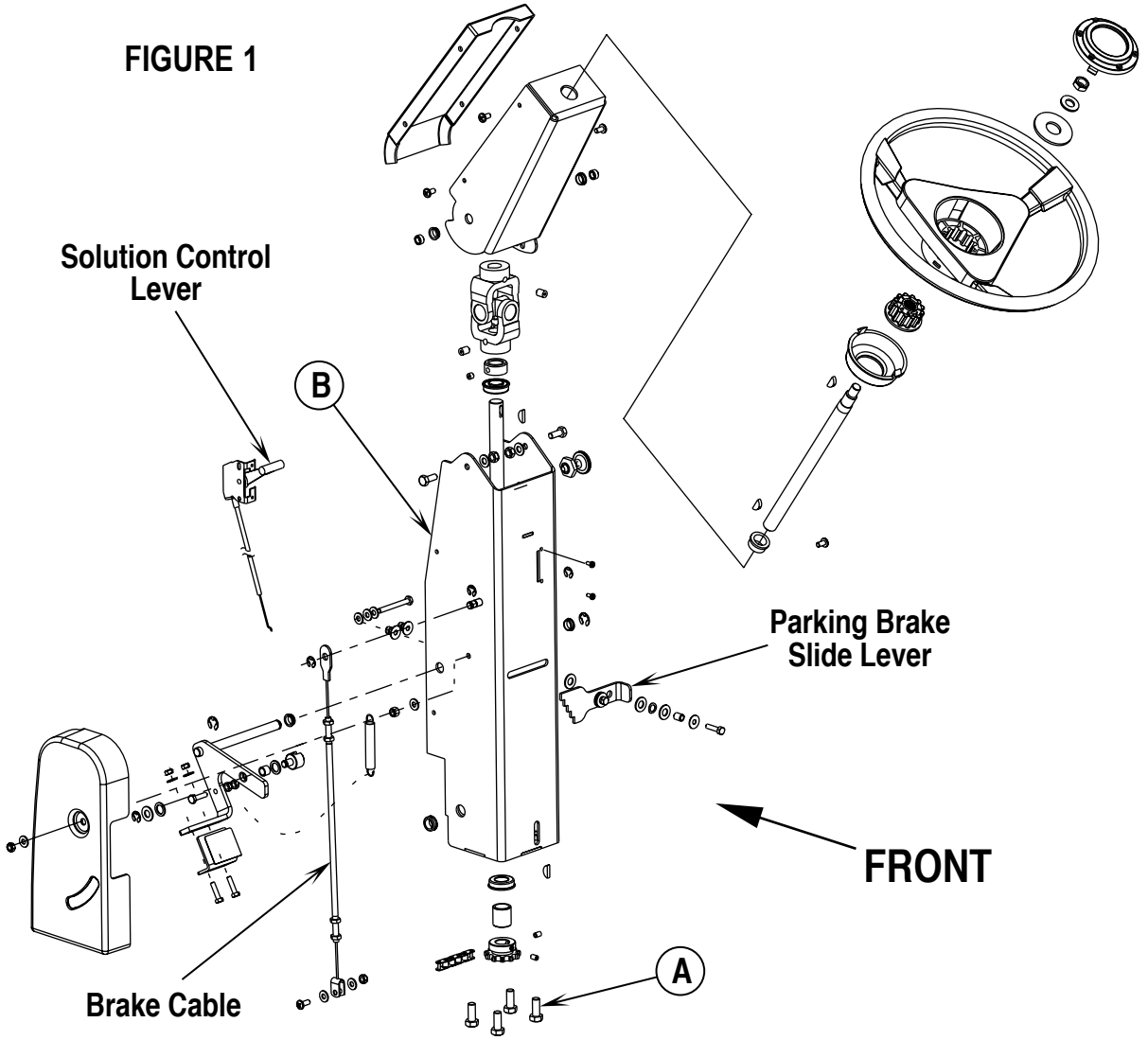
Never work under machine without safety stands or blocking to support the machine.

7 Block rear wheels so machine can't roll. Then safely jack up or lift the front of the machine about 3-4 inches (76-102 mm) and support the frame on both sides at the front corners.

8 See Figure 2. Pull the motor/wheel assembly out from underneath the machine enough to remove the brake and motor wiring cable clamps **(C)** & **(D)** from the top of the steer plate. Then finish removing the assembly from the machine.

9 See the *Drive Tire Removal* section for further disassembly steps.

FIGURE 1



DRIVE TIRE REMOVAL

1 See Figure 2. Using a 6mm hex key wrench remove the (4) Soc. HD Screws **(E)** that secure the Steer Plate **(F)**, Spindle Weldment **(G)** and Splash Guard **(H)** to the wheel motor mount then separate. **Service Tip Note:** Punch witness marks on all the above listed parts to help assist in correct re-assembly.

2 On the brake rotor side remove the (4) Soc. HD Screws **(I)** that fasten the end bell cover support to the wheel motor mount plate.

3 See Figure 3. Remove the external Retaining Ring **(S)** from the center of the brake rotor.

4 Remove the out board side brake pad and caliper arm assemble. Then pry off the brake rotor. **Note:** Don't loose the small rotor key.

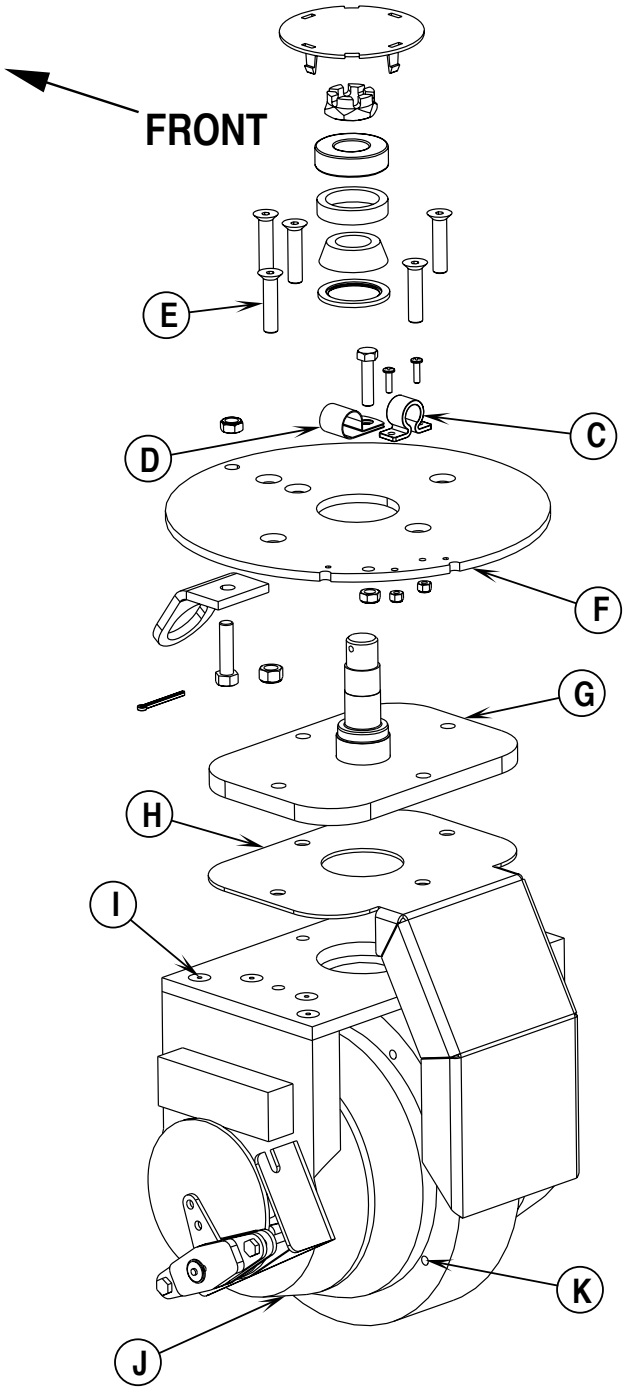
5 Carefully separate (tap off) the motor end bell assembly **(J)** from the motor housing. **Note:** Use a brass drift or piece of wood and strike the end bell edge evenly at points 120 degrees apart to slowly work it from the shaft.

6 Using a 5mm hex key wrench remove the (4) Soc. HD Cap Screws **(K)** that secure the drive tire to the center section of the motor case and remove the tire from the motor.

7 When reinstalling the drive motor assembly be careful not to damage the spindle threads when lowering the chassis onto the spindle shaft.

8 Install the castle nut and tighten nut to remove any play in the bottom tapered roller bearing then back off the castle nut enough to insert the cotter pin.

FIGURE 2



WHEEL DRIVE MOTOR CARBON BRUSH INSPECTION (500 HOURS)

- There are (6) carbon brush assemblies, (4) of them are located equally spaced on the outside diameter of motor end bell cover. Remove the inspection caps by carefully twisting the cap a 1/8 of a turn clockwise. The other (2) brushes are located behind the motor wiring terminal cover. Remove the black cover and terminal mounting hardware. **Note:** The (4) motor commutator brushes are secured with two slotted screws.
- A new carbon brush measures 20mm (.780 inches) in length. Replace the brushes when worn to a length less than 9.5mm (.375 inches).

WHEEL DRIVE SYSTEM

BRAKE ADJUSTMENT

Before making brake adjustment, inspect brake caliper and rotor for excessive wear and replace brake parts as needed. See *Brake Pad Replacement* section below, for instructions.

1 See Figure 3. Loosen both the Locking Nuts **(L)** that secure the brake cable to the Mount Bracket **(M)** (located on the wheel motor). **Note:** The brake cable is threaded at both ends remove the brake cover on the left side of the steering column if replacement is needed (See Figure 1).

2 Adjust the brake cable by shortening or lengthening, to obtain one inch of brake pedal travel (free play) before full brake pad engagement.

⚠ CAUTION!

Test-drive the machine and check for positive brake pedal and parking brake functions.

BRAKE PAD REPLACEMENT

1 See Figure 3. Remove the (2) brake caliper mounting Screws **(N)** and then pull the Caliper Assembly **(O)** off the Brake Rotor **(P)**.

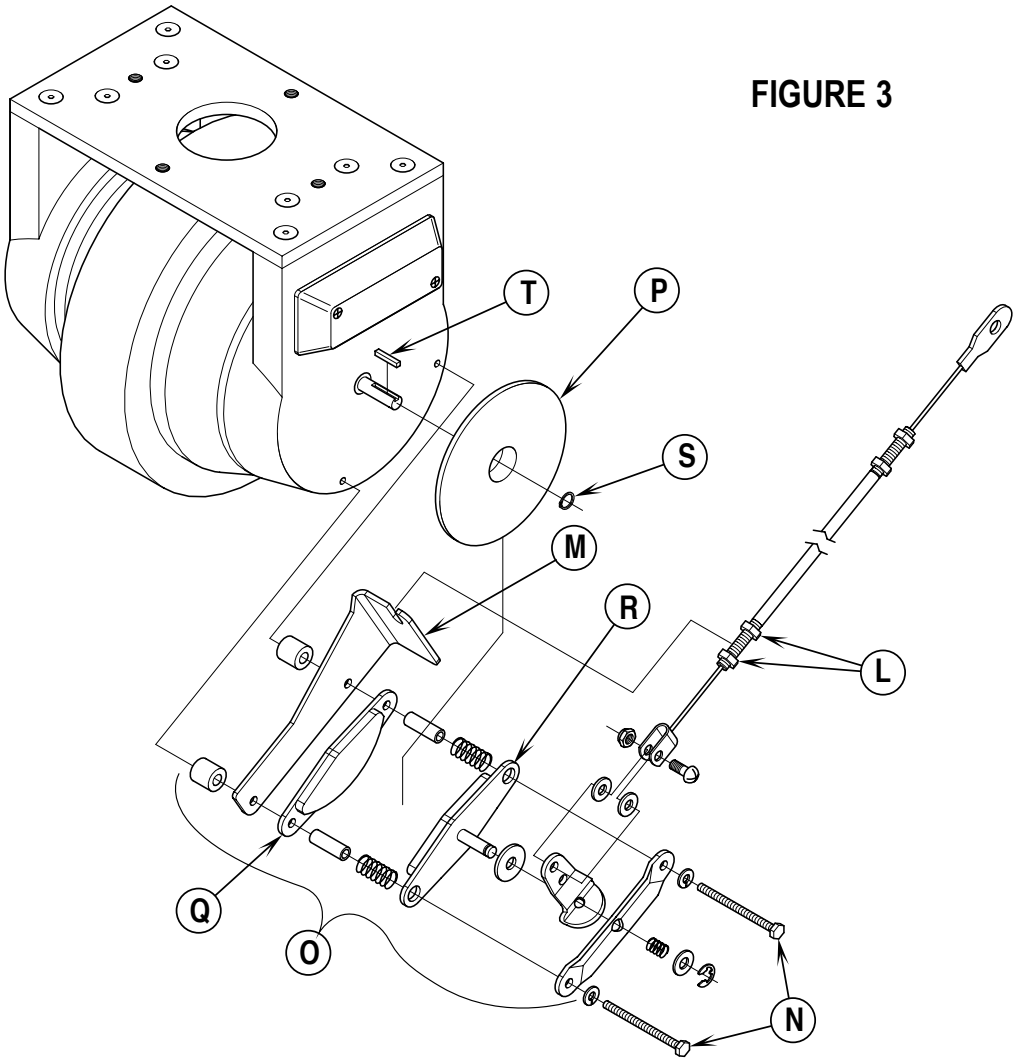
2 Separate the (worn) inboard and out board Brake Pads **(Q)** and **(R)** from the caliper assembly and discard.

3 Inspect the Brake Rotor **(P)** for excessive wear (deep grooves) and any signs of warpage (parallelism) replace as needed.

4 Important: To remove the rotor first remove the Retaining Ring **(S)** then carefully pry the rotor off from the motor shaft using (2) large pry bars. Note: Don't lose the Key Stock **(T)** which is needed to prevent the rotor from spinning on the motor shaft.

5 Reassemble the caliper assembly as shown using new brake pads. **Note:** Always replace the brake pads as a set. After installing the brake caliper assembly, readjust the brake setting by following the brake adjustment instructions shown above.

FIGURE 3



POTENTIOMETER REMOVAL AND TESTING

⚠ WARNING!

Disconnect the machine's battery pack connector **(12)** before servicing.

Potentiometer Removal

1 See Figure 4. Remove the (3) Screws **(U)** securing the drive pedal mount assembly to the chassis then carefully lift the pedal assembly up and lay it on its side.

2 Observe the (3) wires connected to the Drive Pedal Potentiometer (pot) **(BB)** and note the proper wire colors and their terminal connections for re-assembly. Then disconnect wiring and remove the pedal mount assembly from the machine.

3 Remove the Link Rod **(V)** from the Pedal **(W)**. **Note:** Be careful not to lose the link rod mounting hardware items **(X)**.

4 Loosen the Nut **(Y)** and Screw **(Z)** at the drive pedal Throttle Lever **(AA)**. Then pry the lever off from the end of the item **(BB)** potentiometer shaft. Next remove the pot from the Mount Housing **(CC)**.

Testing the Potentiometer

Note: The pot doesn't have to be removed from the housing to test.

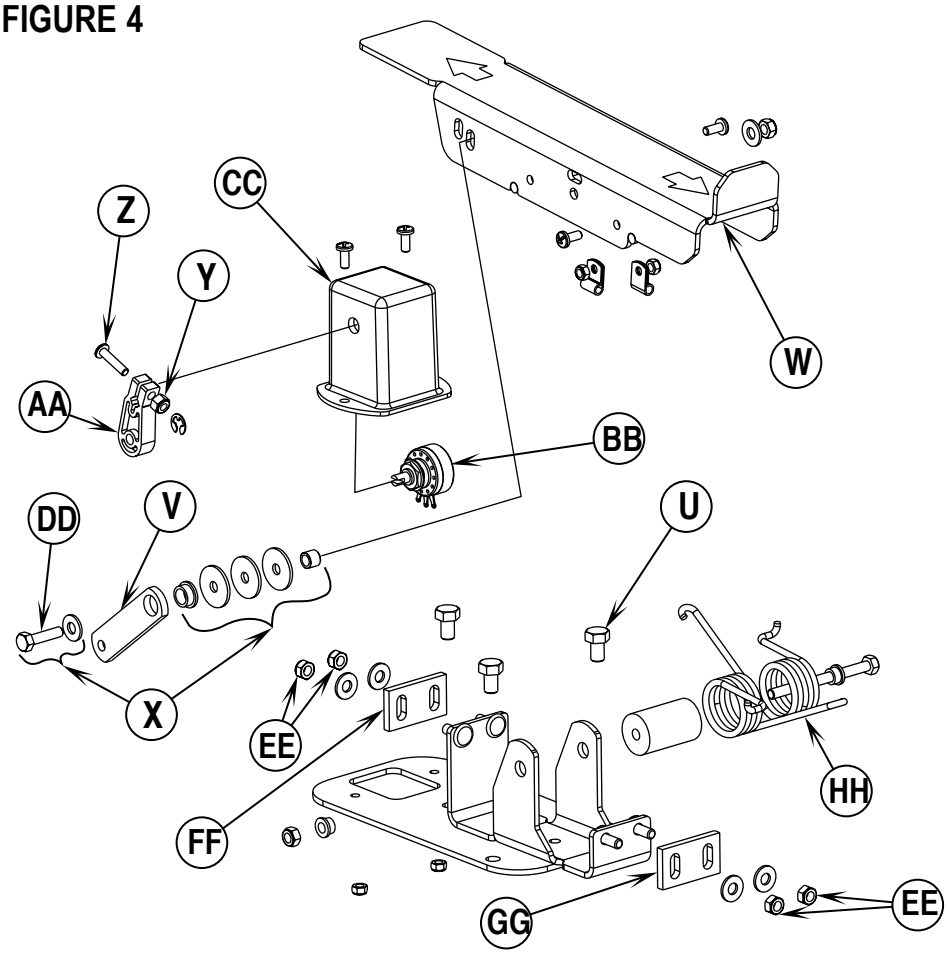
1 Test the potentiometer using an Ohmmeter (the pot specification is 5K Ohms).

2 Connect the meter leads to each of the outside connections on the potentiometer. The meter should read approximately 5000 Ohms (plus or minus 500 Ohms).

3 Next, move one of the test leads to the middle connection and turn the stem in both directions. The range of the readings should be approximately 0-5000 Ohms or 5000-0 Ohms increasing and decreasing through its full range.

4 If you do not get these readings replace the potentiometer.

FIGURE 4



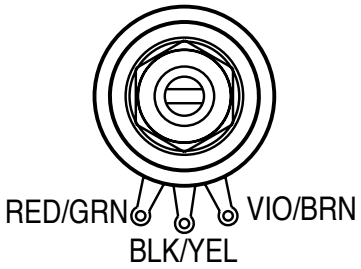
WHEEL DRIVE SYSTEM

POTENTIOMETER INSTALLATION AND ADJUSTMENT

The adjustment of the potentiometer is to set the drive pedal for a neutral drive motor operation. If the pot is not adjusted properly, the machine will creep in either FWD or REV.

1 See Figure 4. Install the pot into the Housing Mount **(CC)** and tighten the attachment nut.
2 Connect loosely together both the Link Rod **(V)** to the Pedal **(W)**, and the Throttle Lever **(AA)** to the potentiometer input shaft. Then tighten only the Link Rod **(V)** pedal mounting Hardware **(X)**. Note: Check the movement of the Foot Pedal **(W)** it must move freely in both Fwd and Rev.
3 See Figure 5. Attach test leads from a volt/ohm meter (set meter on 0x100 scale) to the RED/GRN and VIO/BRN wire connection points on the potentiometer to check it's total resistance (example 4800 Ohms).
4 Next connect the ohmmeter test leads to the BLK/YEL and VIO/BRN potentiometer connection points. Then using a small screwdriver, turn the shaft end on the pot to half the total resistance previously measured. Example: 4800 Ohms divided by 2 = 2400 Ohms. Then without turning the shaft, tighten the Screw **(Z)** and Nut **(Y)** to secure the setting at the Throttle Lever **(AA)** (Figure 4).
5 Follow steps 1-2 in reverse order (see Potentiometer Removal steps) to finish the installation. Then test-drive the machine for proper speed and FWD/REV directional control.

FIGURE 5



DRIVE PEDAL NEUTRAL ADJUSTMENT

If the drive pedal has been removed or replaced the neutral position for the pedal will have to be set. Follow the steps below to accomplish this.

⚠ WARNING!

Disconnect the machine's battery pack connector **(12)** before servicing.

1 Turn the master On/Off key switch **(33)** to the Off position, set the parking brake **(6)** and disconnect the battery pack **(12)**.
2 See Figure 4. Make sure Screw **(DD)** is loose and also the (4) Nuts **(EE)** as shown.
3 Press the Pedal **(W)** all the way Fwd then pull the front Plate Stop **(FF)** up so that the bottom of the pedal doesn't touch the top of the housing **(CC)** and then tighten both the Nuts **(EE)**.
4 Slide up the rear Stop Plate **(GG)** until it contacts the spring **(HH)** and tighten the (2) Nuts **(EE)**.
5 The pedal attachment Screw **(DD)** will center its self in the #2 slot in the drive pedal as shown. Tighten the Screw **(DD)** being careful not to pull on the linkage connected to the previously adjusted potentiometer (see potentiometer section) and disturb (move) its neutral setting. Note: A correctly adjusted drive pedal will have minimal amount of free play when selecting a drive pedal direction.
6 Reconnect the batteries and test the machine to make sure it does not "creep" forward or reverse when the pedal returns to neutral.

SCRUB BRUSH DECK REMOVAL (DISC)

1 Lower the scrub deck with the scrub brushes installed. Don't turn the key switch off until disconnecting the battery pack by using the emergency disconnect **(12)**. This procedure is done to prevent the scrub deck from automatically raising when the key is turned off.

2 See Figure 1. Remove the nut and screw that secure the Deck Down Limit Cable **(A)** at the deck mount bracket.

3 Remove the Retaining Ring **(B)** securing the lower actuator lift motor Mount Pin **(C)** and remove the pin from the scrub deck mount. Note the lift actuator motor needs only to be disconnected at the scrub deck mount bracket.

4 Cut the wire ties that secure the wiring harness for the solution solenoid valve and scrub brush motor. Then remove the two brush motor wires and unplug the wire connector for the solenoid valve. **Note:** The scrub brush motor wires are; red is positive and black is negative.

5 Remove the solution feed hose at the solenoid valve.

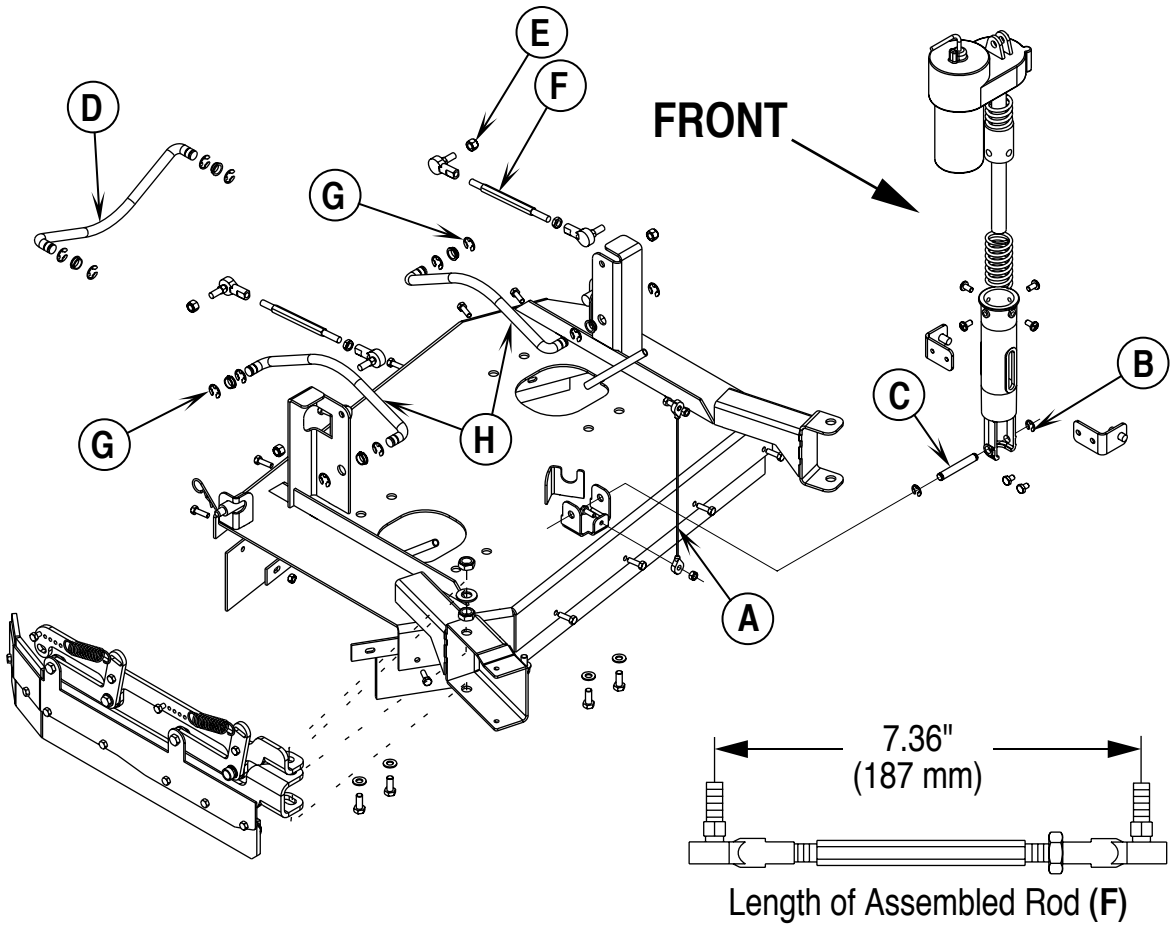
6 Remove the retaining ring from the Rear Support Arm **(D)** at the machine chassis mount bracket.

7 From the left and right side of the chassis remove the (2) Nuts **(E)** from the Scrub Deck Connecting Rods **(F)**, then pull the rods from their mounting holes.

8 From the left and right side of the chassis remove the (2) **(G)** Retainer Rings from the Scrub Deck Lift Rods **(H)** and pull the rods from their mounting holes.

9 Carefully slide the scrub deck out from underneath the machine chassis from the left or right side.

FIGURE 1



SCRUB BRUSH SYSTEM

SCRUB BRUSH MOTOR REMOVAL (DISC)

1 Follow steps 1-8 of the *Scrub Brush Deck Removal* section.
2 See Figure 2. Remove the scrub brushes from the Brush Holders **(I)**.
3 Remove the (3) **(J)** Screws from each Thermoid Disk (flexible coupler) **(K)** and remove the Brush Holders **(I)** from both **(L)** Hubs. Note: Use a 13mm socket wrench to remove Screws **(J)**.
4 Remove all (8) of hardware items **(M, N & O)** that secure the Gear Case Mount Brackets **(P)** to the scrub deck plate.
5 Remove the Gearbox / Motor Assembly **(Q)** from the scrub deck plate by pulling the assembly straight up.
6 Remove the (6) socket head cap screws securing the gearboxes and spacer to the brush motor and separate.
7 Re-assemble in reverse order and test for proper operation. **Note:** The proper brush motor installation position is where the two cable mounting bolts (wiring connections) face the front and right side on the scrub deck platform.

SCRUB BRUSH GEARBOX REMOVAL

Follow steps 1-8 of the *Scrub Brush Deck Removal* section and steps 1-6 of the *Scrub Brush Motor Removal* section.

1 See Figure 2. Remove the hardware items **(R & S)** that secure the Hub **(L)** to the output shaft on each gearbox. Then pull the hub from the shaft and save the key.
2 Remove the (3) **(T)** Screws and separate the Mount Bracket **(P)** from the gearbox that needs replacement.
3 Remove the (3) socket head cap screws securing the gearbox that needs replacement and separate from the brush motor.
4 Re-assemble in reverse order and test for proper operation. **Note:** Apply a small amount of grease or "Never Seize" to the gear box output shaft when reinstalling the drive Hub(s) **(L)**.

Note: The gearbox output shaft rotates the brush holders in the opposite direction of other Nilfisk-Advance auto scrubbers (see below).

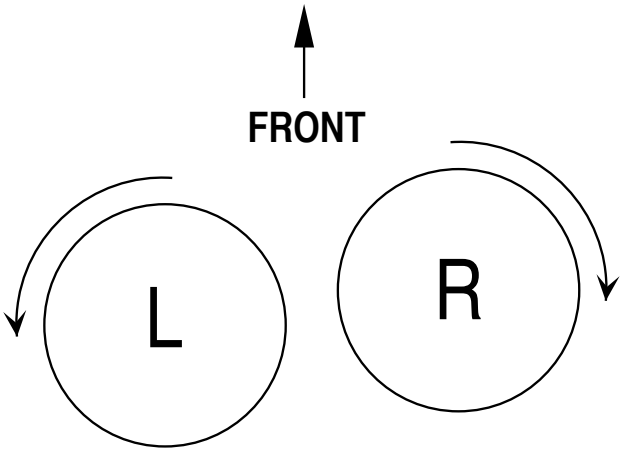
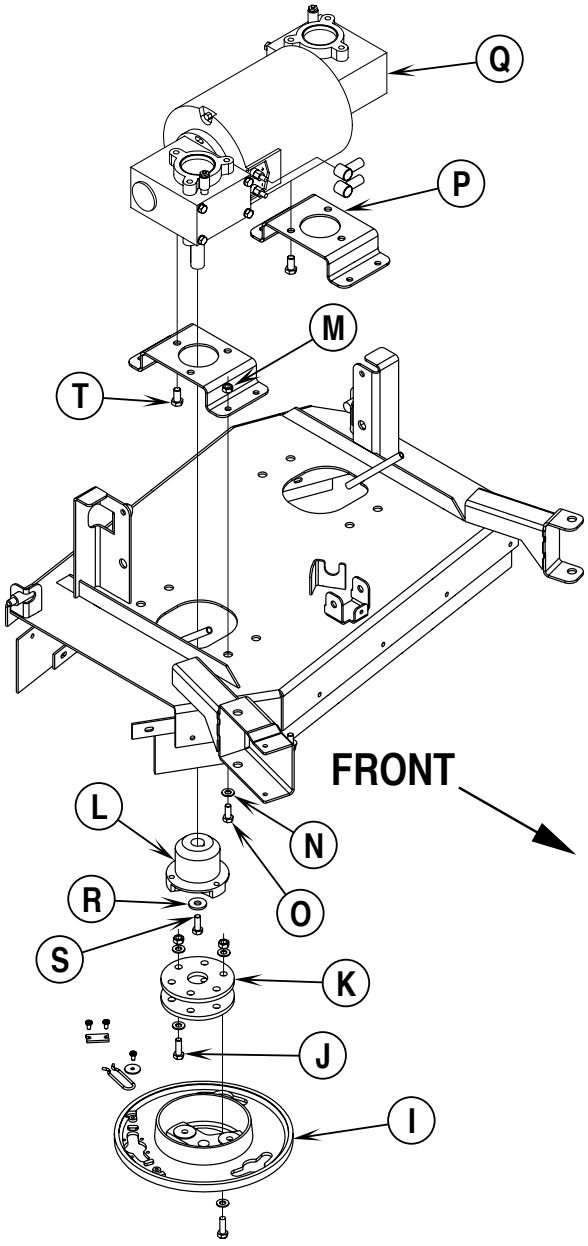


FIGURE 2



SCRUB BRUSH GEARBOX REPLACEMENT

If the need to replace a disc scrub drive gearbox should arise, please follow the re-assembly instructions below.

1 Installing the shaft keys-See Figure 3
Install (1) Shaft Key **(U)** into each end of motor shaft, you may need to use a hammer to complete this operation.

2 Applying Never Seize
Starting with the back-end of the motor. Apply some Never Seize onto the back-end shaft and key. The installation of Never Seize allows you to remove and replace the gearbox easily if the gearbox fails in the field.

3 Installing the Back-end Gearbox (V)
Visually Line-up the Key **(U)** (installed into the motor shaft) with the keyway **(W)** on the inside of the gearbox. Slide the gearbox onto the shaft as far as it will go. If the gearbox does not slide on completely (flush with back-end bracket), **DO NOT** use a hammer to pound the gearbox on the rest of the way. Using a hammer will damage the shaft and bearings inside the gearbox. Carefully wiggle the gearbox back and forth while pushing the gearbox the rest of the way onto the motor.

4 Installing mounting screws
After the gearbox is completely flush with the back-end bracket of the motor, install 3 Screws **(X)** with lock Washers **(Y)** through the gearbox mounting flange and into the pre-drilled mounting holes in the back-end bracket. **Important:** Make sure that the gearbox shaft is pointing in the correct direction before installing the mounting screws. The gearbox shafts should both be pointing left, if viewing the motor from the back end and the lead terminals are at 12:00. Tighten screws as much as possible with your fingers, **DO NOT** tighten the bolts yet as the gearboxes still need to be lined up.

5 Installing the Comm.-end Gearbox (Z)
Repeat the above process for the comm.-end gearbox. **Remember:** Before installing the mounting screws into the comm.-bracket, make sure that the gearbox shaft is pointing in the correct direction. Both gearbox shafts should be pointing LEFT, if viewing the motor from the back-end with the lead terminals at 12:00. Also, remember to not tighten the mounting bolts yet.

6 Lining Up the gearboxes-See Figure 4
After you have made sure that the gearbox shafts are pointing in the correct direction and you have installed all 6 mounting screws **(X)** (3 in the back-end gearbox and 3 in the comm.- end gearbox), you must Line-up the gearboxes. Re-install the Gearbox/Motor Assembly onto the scrub deck as shown. Install and tighten the (6) Screws **(AA)** first and then tighten the (6) Screws **(X)**.

SCRUB BRUSH SYSTEM

FIGURE 3

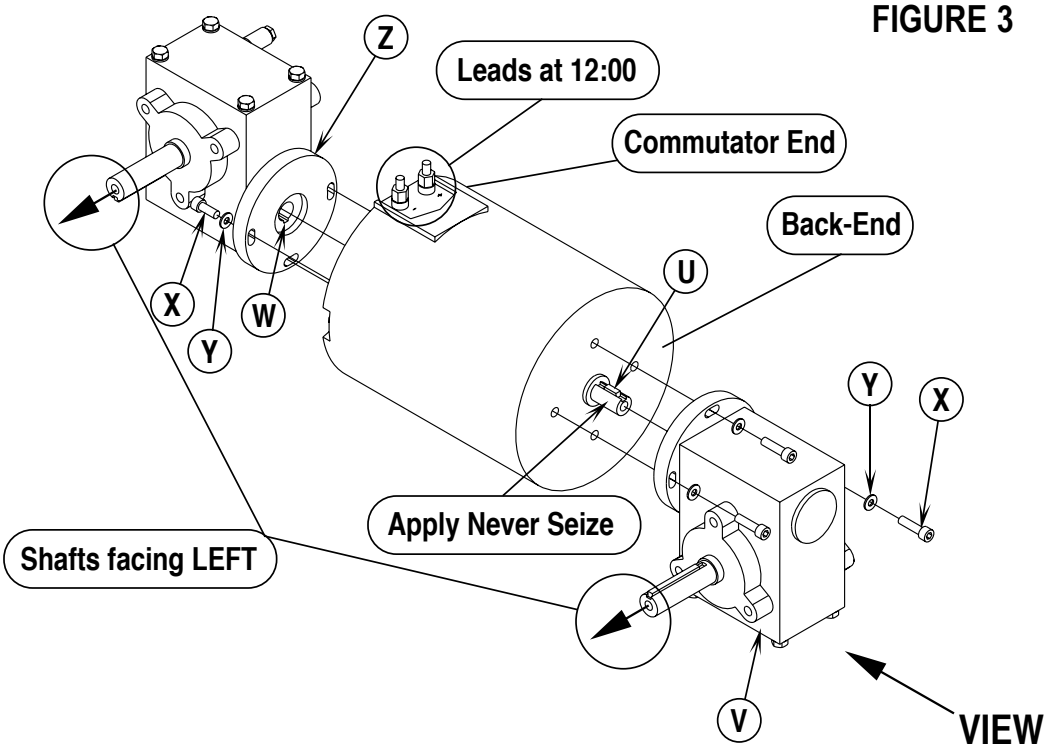
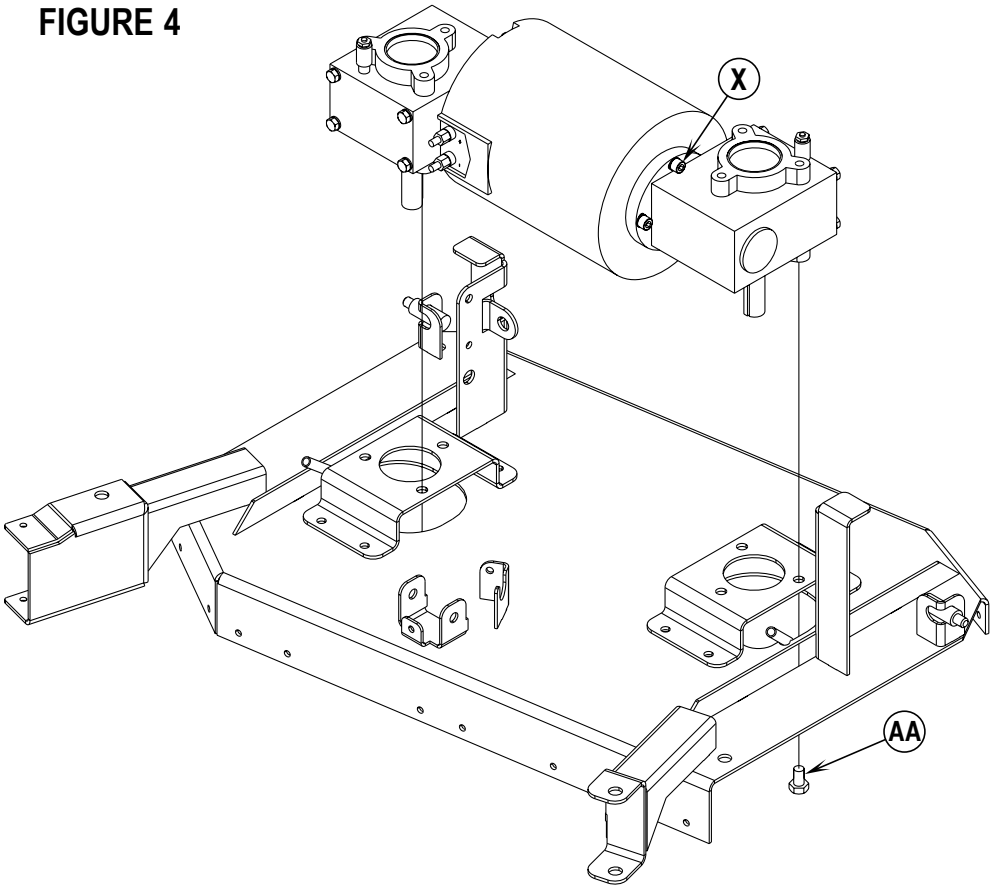


FIGURE 4



SCRUB BRUSH SKIRT REPLACEMENT

Disc and Cylindrical Side Skirt Maintenance General Overview

The side skirt's function is to channel the wastewater to the rear pick up squeegee, helping contain the water within the machine's cleaning path. The skirt height adjustment is automatic on this system using spring tension and movable arms to control the blade pressure (See Figure 5). The side skirt assemblies must move up and down freely for proper operation.

During normal usage the blades will wear in time and the operator will notice a small amount of water leaking out underneath the side skirts. Replace with new blades as shown in Figure 5.

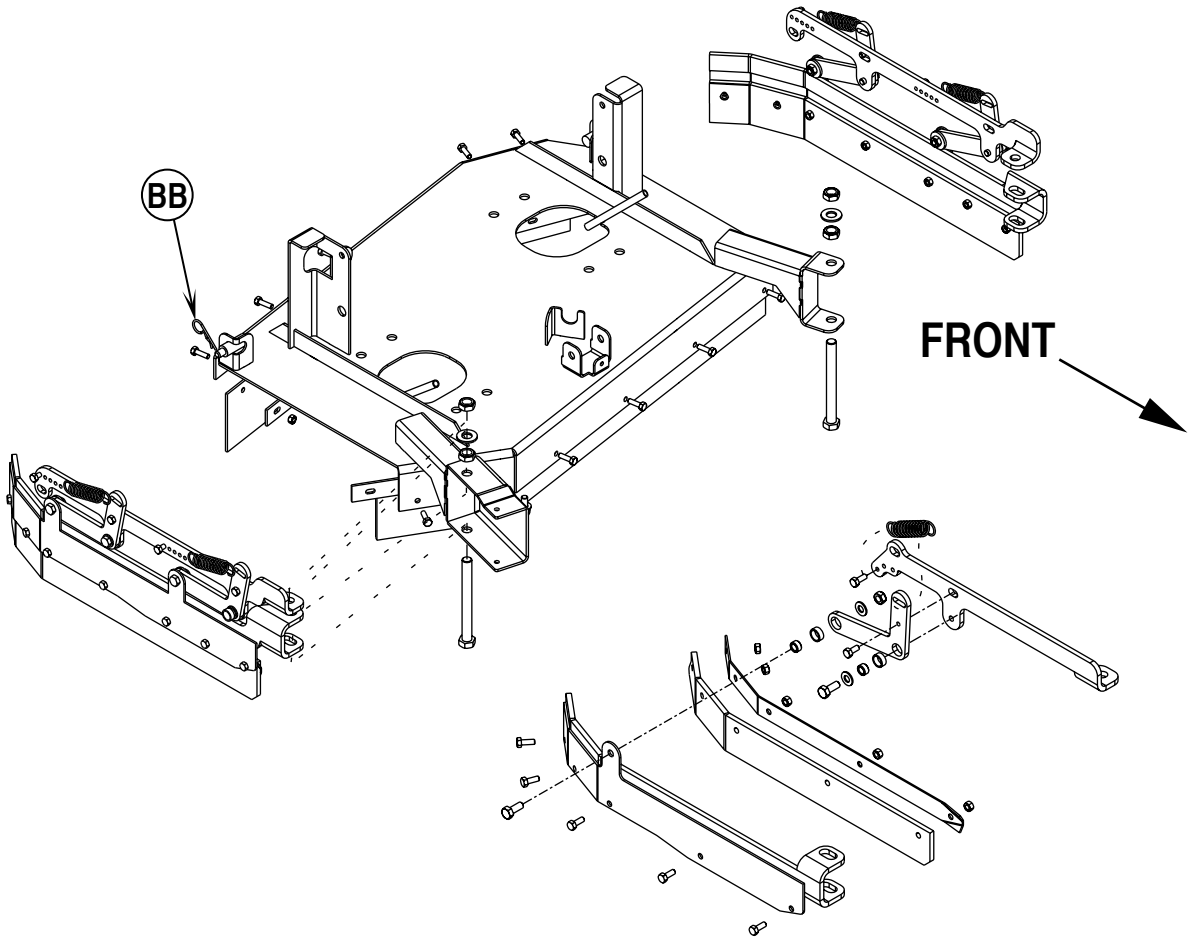
Note: Also inspect the front and rear scrub brush skirts as they also help contain the wastewater from splashing onto other machine system components located outside the scrub deck area.

Skirt replacement

1 Place the scrub deck in the Up position then remove the (2) Hairpins **(BB)** and swing the side skirt assemblies open.

2 Remove the screws and nuts from the skirt set needing replacement and separate the blade retainer strap(s) from the scrub deck. Replace blades that are nicked, torn or worn beyond their usable blade height.

FIGURE 5



SCRUB BRUSH SYSTEM

SCRUB BRUSH LIFT ACTUATOR REMOVAL

1 Lower the scrub deck with the scrub brushes installed. Don't turn the key switch off until disconnecting the battery pack by using the emergency disconnect **(12)**. This procedure is done to prevent the scrub deck from automatically raising when the key is turned off.

2 See Figure 6. Remove the nut and screw that secure the Deck Down Limit Cable **(OO)** at the deck mount bracket.

3 Remove the recovery tank (follow the steps in the *Recovery Tank Removal* section).

4 Swing open the drivers seat and from the rear of the machine using two people remove the batteries and battery tray from the machine. With the batteries and tray removed the brush lift actuator motor top mount is made accessible (located in the lower front in battery compartment).

5 See Figure 6. Remove the Retaining Ring **(CC)** securing the lower Brush Motor Mount Pin **(DD)** and remove the pin from the scrub deck mount.

6 Disconnect the brush lift motor wire harness at the motor.

7 Remove the Retainer Ring **(EE)** (closest to the motor) then slide the upper Mount Pin **(FF)** from the chassis mount bracket.

8 Remove the complete motor and drive nut assembly from underneath the machine. **Note:** Do not turn or reposition the drive nut on the actuator shaft, mark if needed.

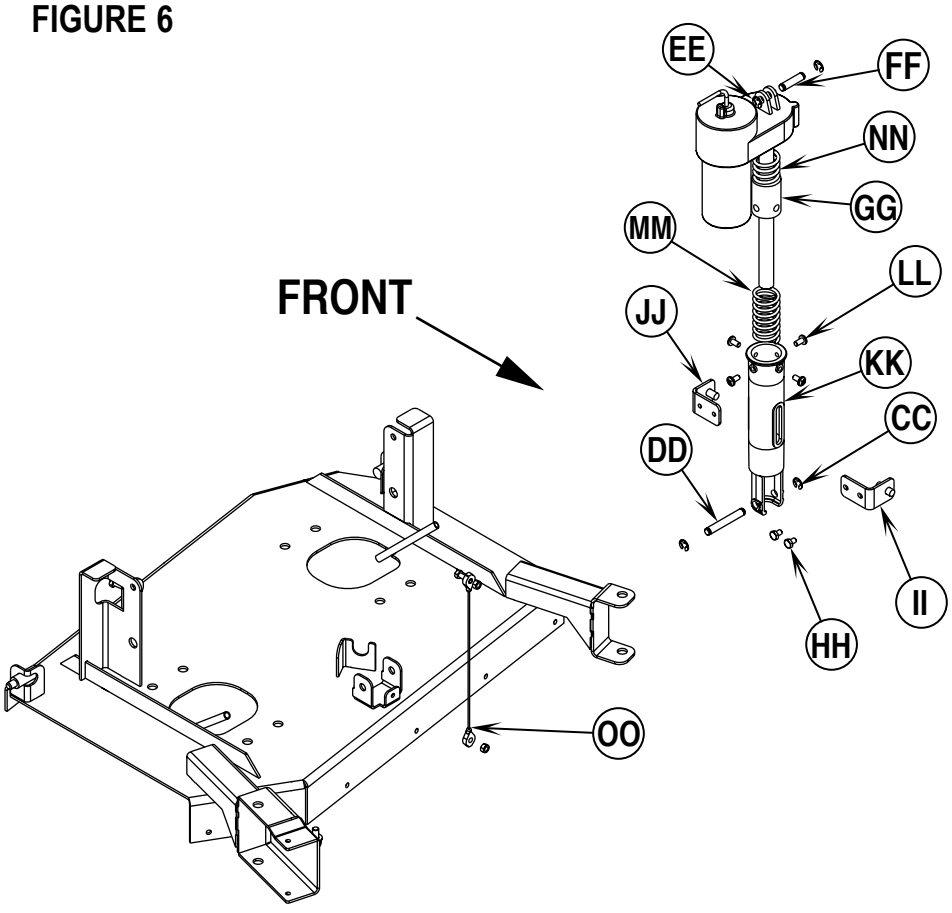
IMPORTANT: After removing the actuator motor and before replacing a new motor or drive nut the IN & OUT limit switches must be set (or checked) to there correct specifications (see the electrical section for the *Actuator Drive Nut Adjustment*).

10 To disassemble the Drive Nut **(GG)** from the actuator shaft, remove the (2) Screws **(HH)** and separate both Retainers **(II)** & **(JJ)** from the Spring Housing **(KK)**.

11 Remove the (4) Spring Housing Retainer Screws **(LL)** and slide the spring housing and (long) Compression Spring **(MM)** from the actuator shaft. Then spin the drive nut off the actuator shaft and remove the top (short) Compression Spring **(NN)**. **Note:** See the *Actuator Drive Nut Adjustment* section in this manual to properly install a new drive nut.

12 After adjusting the actuator drive nut follow steps 1-11 in reverse order to re-install the scrub lift motor in the machine.

FIGURE 6



SCRUB BRUSH SYSTEM (CYLINDRICAL)

SCRUB BRUSH SYSTEM MAINTENANCE

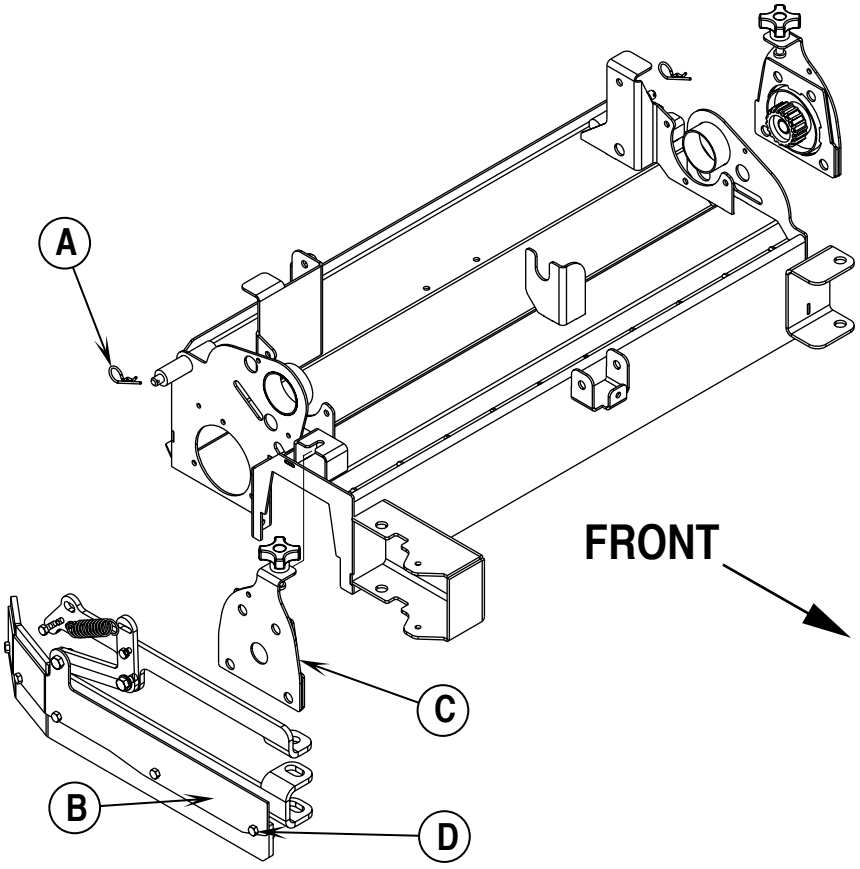
The scrubbing system must be serviced at regular intervals to maintain good scrubbing performance. Follow the maintenance steps listed below.

1. Empty hopper and rinse clean any built up debris from the hopper drain holes (daily).
2. Clean drain holes in the solution delivery trough on top of the scrub deck (weekly).
3. Clean built up dirt from the inside of the scrub brush housing (weekly).
4. Remove any string wrapped around the scrub brush, drive hub and idler hub (weekly).
5. Remove both the scrub brushes and rotate, turn end for end (weekly). See brush removal section below.
6. Inspect (monthly) the scrub brush bristles for wear, the brushes should be replaced when the bristle length is 1 inch (26 mm) or less.

SCRUB BRUSH REMOVAL AND INSTALLATION

1. Make sure the key switch is off and disconnect the battery pack connector **(12)** before servicing.
2. To access the brushes, swing open both the side skirt assemblies. See figure 1. Note: The skirt's are held in place by Hairpins **(A)** on each side, remove the pins and swing the Skirt Assemblies **(B)** out of the way.
3. Loosen the black knobs (one on each side) that secure the removable bearing idler support Plate **(C)** to the brush housing, then pull the plates down and out to remove. Grip the scrub brush and slide it from the housing end.
4. To install the brush slide it into the housing, lift slightly, push and turn until it seats into the drive end assembly.
5. Re-install the idler end plate assemblies, close the skirt assemblies and secure with the hairpins.

FIGURE 1



SCRUB BRUSH SYSTEM (CLYLINDRICAL)

SCRUB BRUSH DECK ASSEMBLY REMOVAL

1 Drain the solution tank.

2 Lower the scrub deck with the cylindrical brushes installed. Attention: Don't turn the key switch off until disconnecting the emergency battery disconnect **(12)** and then turn the key OFF. Note: This procedure is done to allow the scrub deck from automatically raising itself when the key is turned off.

3 See figure 2. Remove the Debris Hopper **(E)** from the machine.

4 Remove the nut and screw that secure the deck down limit Cable **(F)** at the deck mount bracket.

5 Remove the Retainer Ring **(G)** securing the lower lift motor mount Pin **(H)** and remove the pin from the deck mount bracket.

6 Disconnect the brush lift motor wire harness at the motor.

7 Remove the mounting hardware, Retainer Ring **(I)** and the Bearing Flange **(J)** then disconnect the Support Arm **(K)** from the machines out board frame mount bracket (right side of machine).

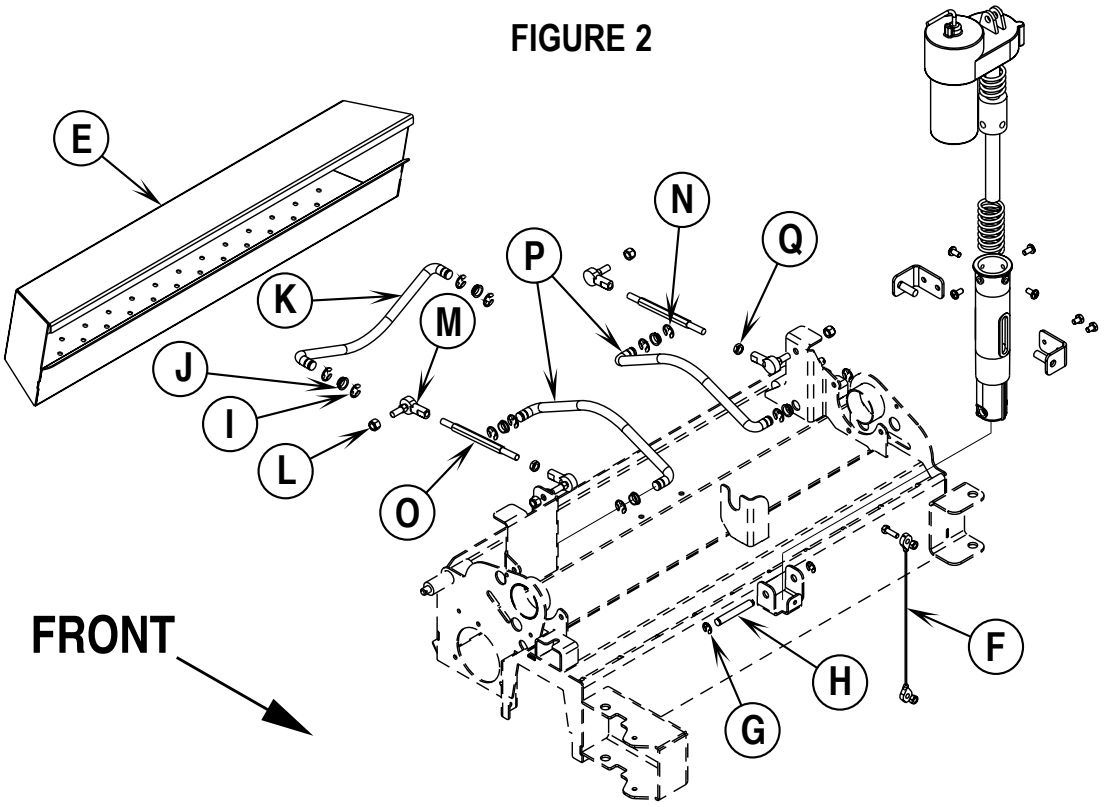
8 On both the left and right sides of the machine remove one each item **(L)** hex nuts from the ball joint ends **(M)** then separate the arms **(N)** from the machine frame.

9 On both the left and right sides of the machine remove both Retainer Rings **(O)** from the arm mount ends **(P)**, and then separate the support arms from the machine frame.

10 Cut the wire ties that secure the wiring harness for the solution solenoid valve and scrub brush motors. Next disconnect the two main electrical wires (one black & one red) at the brush motor terminals, and then unplug the wire connector for the water solenoid valve.

11 Remove the solution feed house at the solenoid valve, and then carefully slide the scrub deck assembly out from underneath the machine from the right side.

FIGURE 2



SCRUB BRUSH DECK LEVELING ADJUSTMENT

1 See Figure 3. On a level floor surface put the scrub deck in the raised (stored) position and measure the distance from the floor to the bottom edge of the scrub deck at all Four Corners as shown.

2 The four measurements should be approximately 1-1/8 inches (plus or minus 1/8"). To adjust loosen the Lock Nuts **(Q)** on the (qty 2) Connecting Rods **(O)** and turn the center section of the rod(s) to raise or lower (lengthen or shorten) the levelness of the brush deck. Note: The assembly length on the ball joint connecting rods are adjusted to 7-3/8 inch (187 mm) from center to center as shown.

3 Retighten the connecting rod lock nuts and lower the brush deck to the floor and check for an even brush pattern.

SCRUB BRUSH SYSTEM (CYLINDRICAL)

FIGURE 3

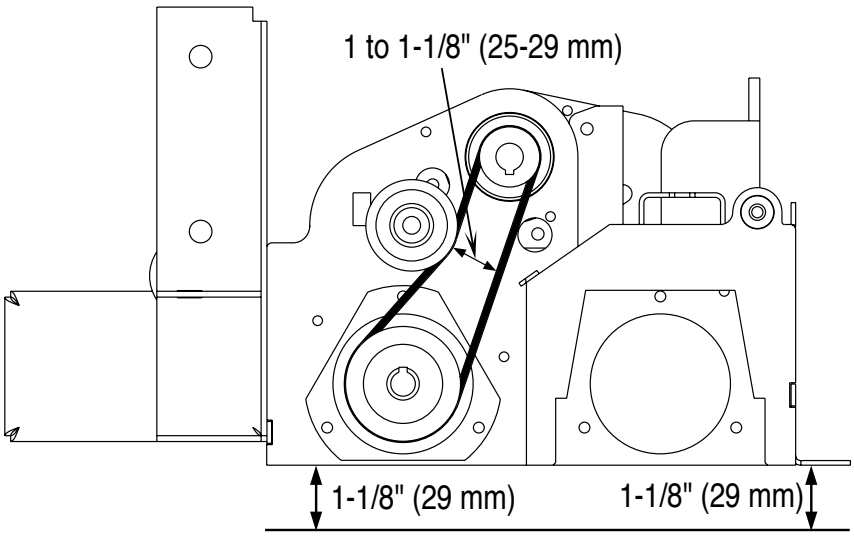
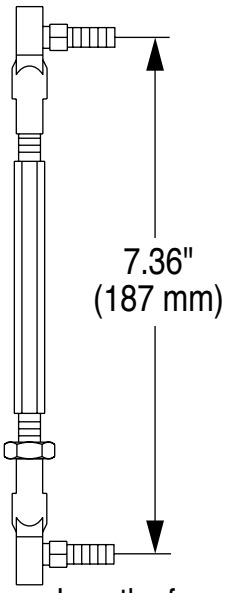


FIGURE 4



SCRUB BRUSH MOTOR REMOVAL

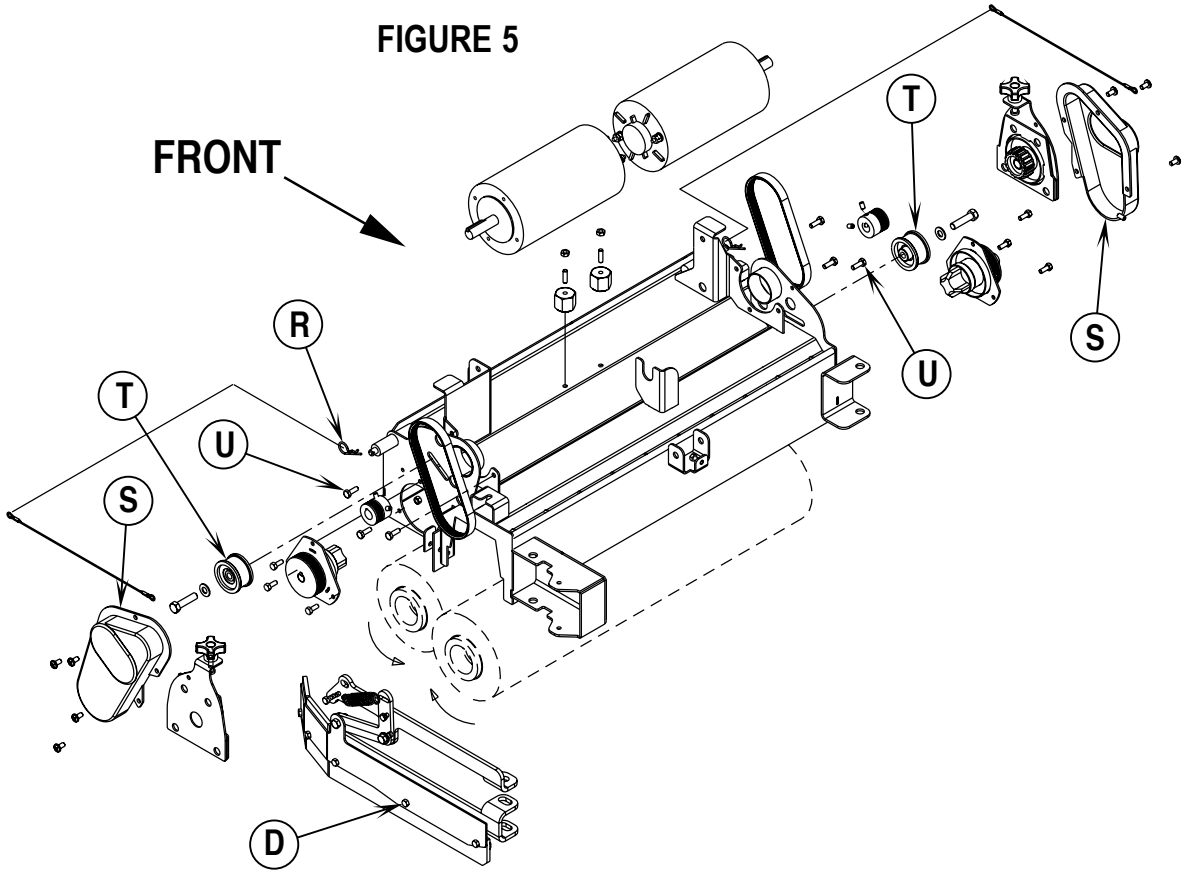
1 See Figure 5. Remove the Hairpin **(R)** and swing open the scrub deck skirt assembly and remove the Belt Guard **(S)** (4 screws).

2 Loosen the scrub brush belt tension hardware at the Belt Idler **(T)** using a 5/8-inch and 11/16-inch wrenches.

3 Disconnect the brush motor wiring at both the Pos. & Neg. terminal connectors and note the correct motor wiring connections (for reinstallation). Next remove the (3) Screws **(U)** and lift the motor out from the frame opening at the end(s) of the scrub deck.

4 Reassemble in reverse order and tension the belt as shown in figure 3.

FIGURE 5



SCRUB BRUSH SYSTEM (CLYLINDRICAL)

SCRUB BRUSH BELT REPLACEMENT

1 See Figure 5. Remove Hairpin **(S)** and swing open the scrub deck skirt assembly (right or left side) and remove the belt guard(s) **(P)** (4 screws each).

2 **Important Service Tip:** The left and right side drive belts are not the same lengths they must be ordered individually (P.N. 56407465, left side & P.N. 56407466, right side).

3 Loosen the scrub brush belt tension hardware on the Belt Idler Pulley **(Q)** (use a 5/8-inch & 11/16-inch wrenches). Pull the idler wheel away from the backside of the belt and roll the belt off both the motor and brush pulleys. Then inspect for wear and replace as needed.

4 Re-install the drive belt and tension the belt as shown in Figure 3. Then install the belt guard, reconnect the battery pack and test the scrub system for proper operation.

SIDE SKIRT MAINTENANCE

General Overview: The side skirts function is to channel the wastewater to the rear pick-up squeegee, helping contain the water within the machine's cleaning path. During normal use the blades will wear in time. The operator will notice a small amount of water leaking out underneath the side skirts. The skirt height adjustment is automatic on this system using spring tension and movable linkage arms to control the blade pressure. The side skirt assemblies must move up and down freely for proper operation.

To replace the scrub system side skirt(s)…

- See Figure 5. Remove the (2) Hairpins **(R)** and swing the skirt assemblies open. Remove the **(D)** Screws and nuts then remove the skirts and replace.

SCRUB BRUSH LIFT ACTUATOR REMOVAL

Attention: See the Scrub Brush Disc manual section for instructions on the scrub lift actuator removal. Note: Both lift systems are the same.

SOLUTION SOLENOID VALVE REMOVAL

Location: The solenoid valve is mounted on top-middle of the scrub deck.

1 Drain the solution tank using the solution tank drain hose **(4)**.
2 See Figure 1. Remove both the LH & RH Solution Hoses **(A)** & **(B)** at the solution Delivery Tubes **(C)**.
3 Loosen the hose clamp and remove the solution Feed Hose **(D)** from the barb fitting on the Solenoid Valve **(E)** (* see Service Tip Note).
4 Unplug the solenoid valve wire connection from the machine harness.
5 Loosen the anchor connector at the solution valve mount bracket and separate. Then work the valve/hose assembly from the scrub deck.
6 Salvage fittings and hose from the old valve and follow steps 1-5 in reverse order to reassemble.

***Service Tip Note:** The solution hoses are often difficult to remove from there barbed fittings. To help remove a hose, back probe the end of the hose with a screwdriver and apply a small amount of a spray lubricant at the hose fitting and pull firmly to remove.

SOLUTION FILTER AND FLOW CONTROL VALVE ASSEMBLY REMOVAL

1 Drain the solution tank using the solution tank drain hose.
2 See Figure 1. Loosen the (2) Hose Clamps **(F)** and pry off both the solution hoses (inlet & outlet) from the barbed plumbing fittings attached to the Solution Flow Control Valve **(G)** and Solution Filter Housing **(H)**.
3 Remove the (4) Screws **(I)** that secure the Solution Bracket **(J)** and pull the bracket away from the chassis and then loosen the solution Cable Clamp **(K)**.
4 Separate the solution cable end from the solution valve handle and complete the removal of the Filter **(H)** and Solution Flow Control Valve **(G)** from the machine.

SOLUTION SYSTEM TROUBLESHOOTING

Problem	Possible Cause
Inadequate or no solution flow	No solution in tank
	Flow control lever in the off position
	Defective solution solenoid valve
	Solution system fault in the main controller *
	Clogged Solution filter, valves and hoses

* **NOTE:** Reference the *Troubleshooting Guide* in the Electrical System section of this manual for further information.

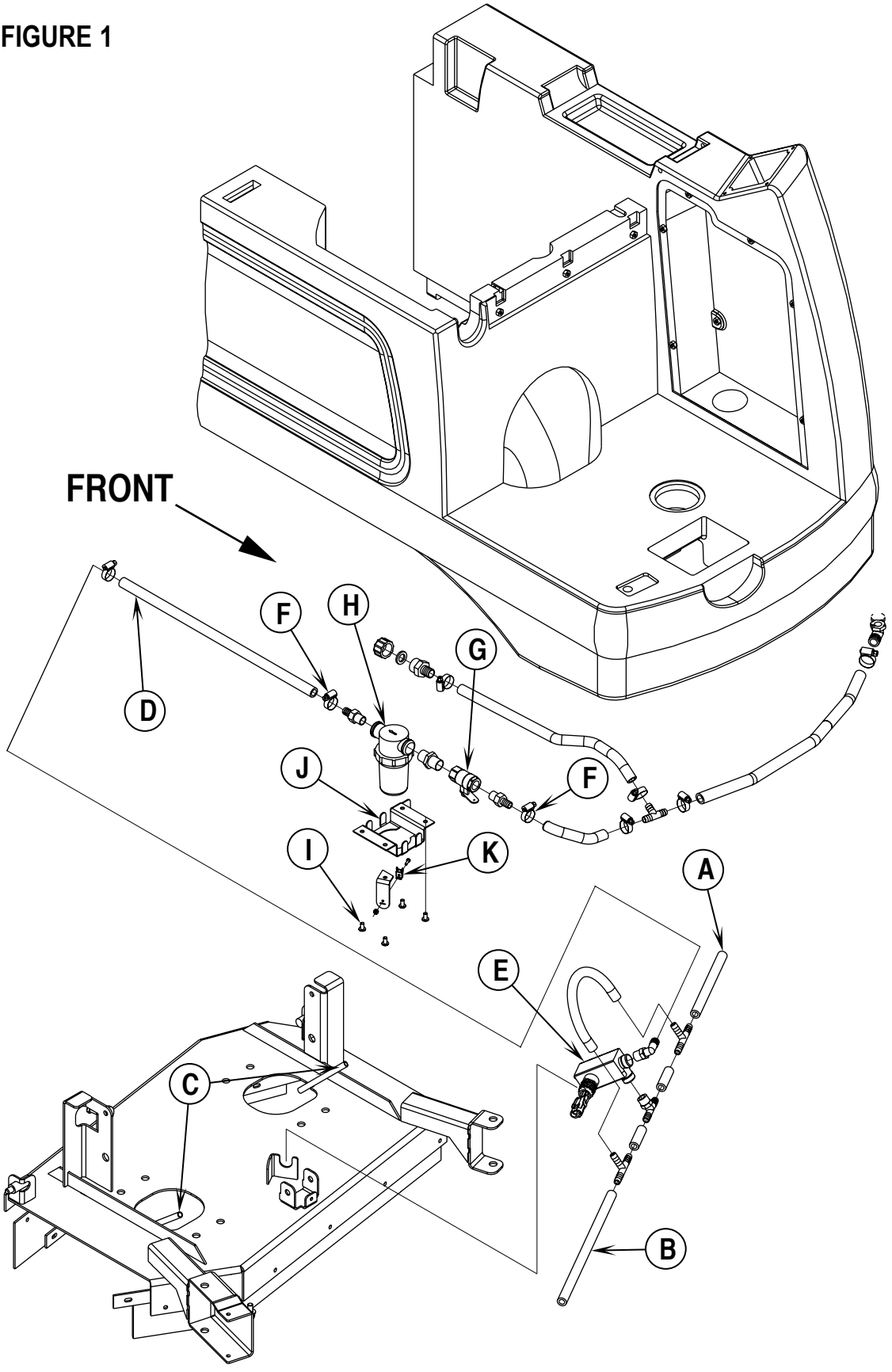
SOLUTION SYSTEM MAINTENANCE

Solution Tank
See the *Know Your Machine* manual section. Weekly empty the solution tank; remove the solution drain hose **(4)** from its storage area (located underneath the right front of machine chassis). Direct the hose to a designated "Disposal Site" and remove the threaded cap and flush the tank with clean water.

Solution Filter
Remove and clean the in line solution filter **(20)**. To access the filter housing for removal, work underneath the right front corner of the machine chassis. No tools are needed to remove the filter (just hand tighten only). Note: The solution tank must be empty to service the filter strainer. Flush the bowl housing and filter, then reassemble.

SOLUTION SYSTEM

FIGURE 1



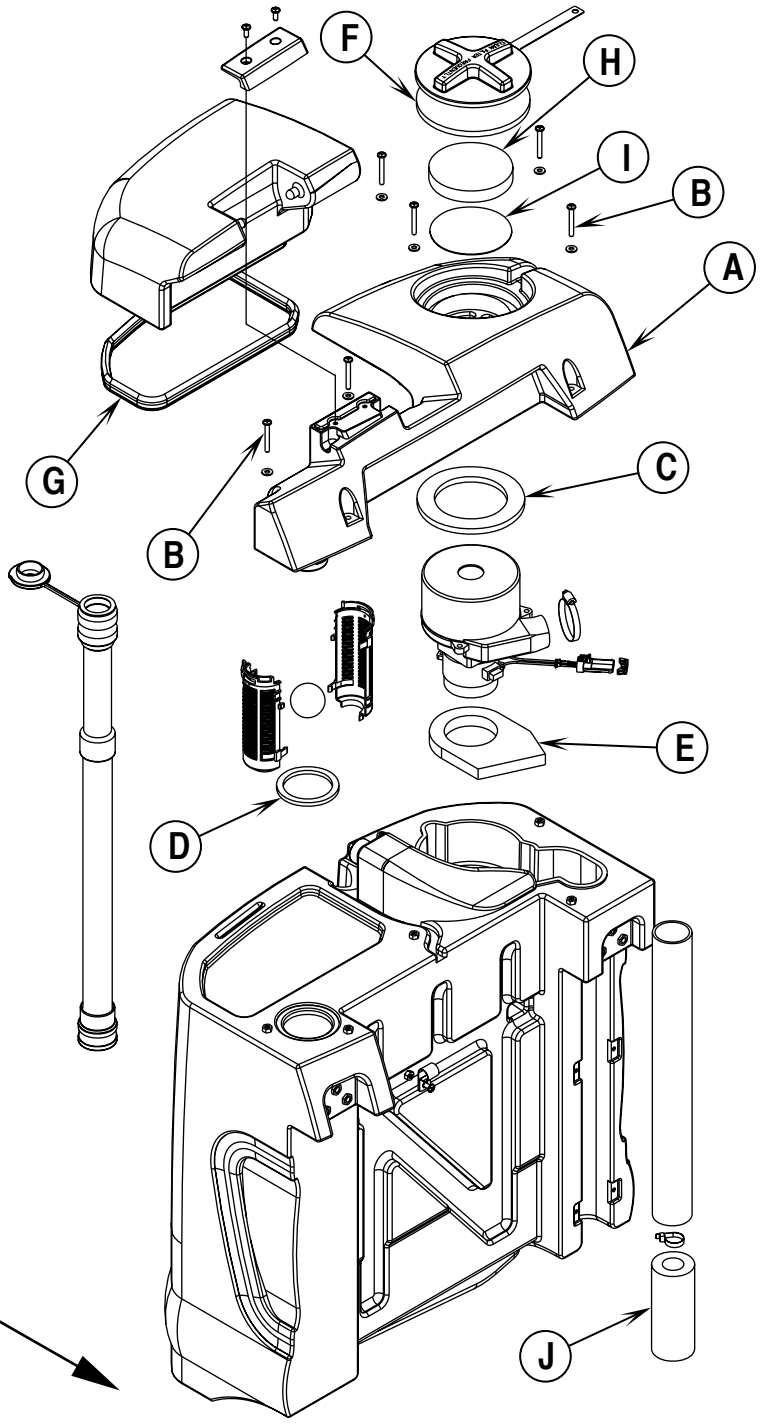
RECOVERY TANK REMOVAL

1 Drain the recovery tank using the recovery tank drain hose.
2 Disconnect the squeegee hose from the squeegee tool.
3 Swing forward the seat to open and at the rear of the battery compartment disconnect the vacuum motor wiring harness.
4 See Figure 1 below. Open the recovery tank cover and grip the top edge of the tank and pull straight up on the tank to separate it from the solution tank. Then guide the tank off the rear of the machine to the floor. **Note:** This method must be followed in order to release the tank mount brackets from the solution tank retainer pockets.

VACUUM MOTOR REMOVAL

1 Swing forward the seat to open and at the rear of the battery compartment disconnect the vacuum motor wiring harness.
2 See Fig. 1. Remove the Vacuum Duct Cover **(A)** that is secured to the recovery tank by a qty (6) Screws **(B)**.
3 Lift the vacuum motor from its mounting cavity and guide the wiring assembly through the opening at the rear tank wall.
4 Inspect all the vacuum/recovery system gaskets, items **(C)**, **(D)**, **(E)**, **(F)**, & **(G)**. Also clean the vac motor foam Filter **(H)**, Screen **(I)**, and Exhaust Acoustical Foam **(J)**.
5 Replace worn parts and reassemble in reverse order.

FIGURE 1



RECOVERY SYSTEM

VACUUM / RECOVERY SYSTEM SERVICE MAINTENANCE CHECKLIST

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

- ☐ 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, 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.
- ☐ Inspect and clean the vacuum motor filter and shut off float cage.
- ☐ Make sure that the recovery tank drain valve seals airtight.

TROUBLESHOOTING GUIDE

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

Vacuum Leak(s) – Air flowing into the vacuum system past a bad gasket or leaky hose, damaged tank, or a leaky drain valve. A vacuum leak below the water line will create turbulence in the recovery tank, causing water to enter the vacuum filter and motor.

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

Both leaks and restrictions decrease the quantity of air flowing through the squeegee tool. The air that does go through the squeegee tool moves slower, so it has less pick-up power.

RECOVERY SYSTEM TROUBLESHOOTING GUIDE

Problem	Possible Cause
Poor water pick-up	Recovery tank full
	Recovery tank float cage clogged
	Debris caught in squeegee tool and pickup hose
	Clogged vac motor inlet filter
	Recovery tank drain hose leak
	Recovery tank cover gasket leak
	Damaged or worn squeegee blades *
	Adjust squeegee tool *
Vacuum motor will not run	Vac motor solenoid defective
	Vac motor defective (worn carbon brushes)
	Vac switch defective (on control panel)
	Vacuum system fault in the main controller **

* Note: See the Squeegee System section of this manual for further information.

** Note: Reference the *Troubleshooting Guide* in the Electrical System section of this manual for further information.

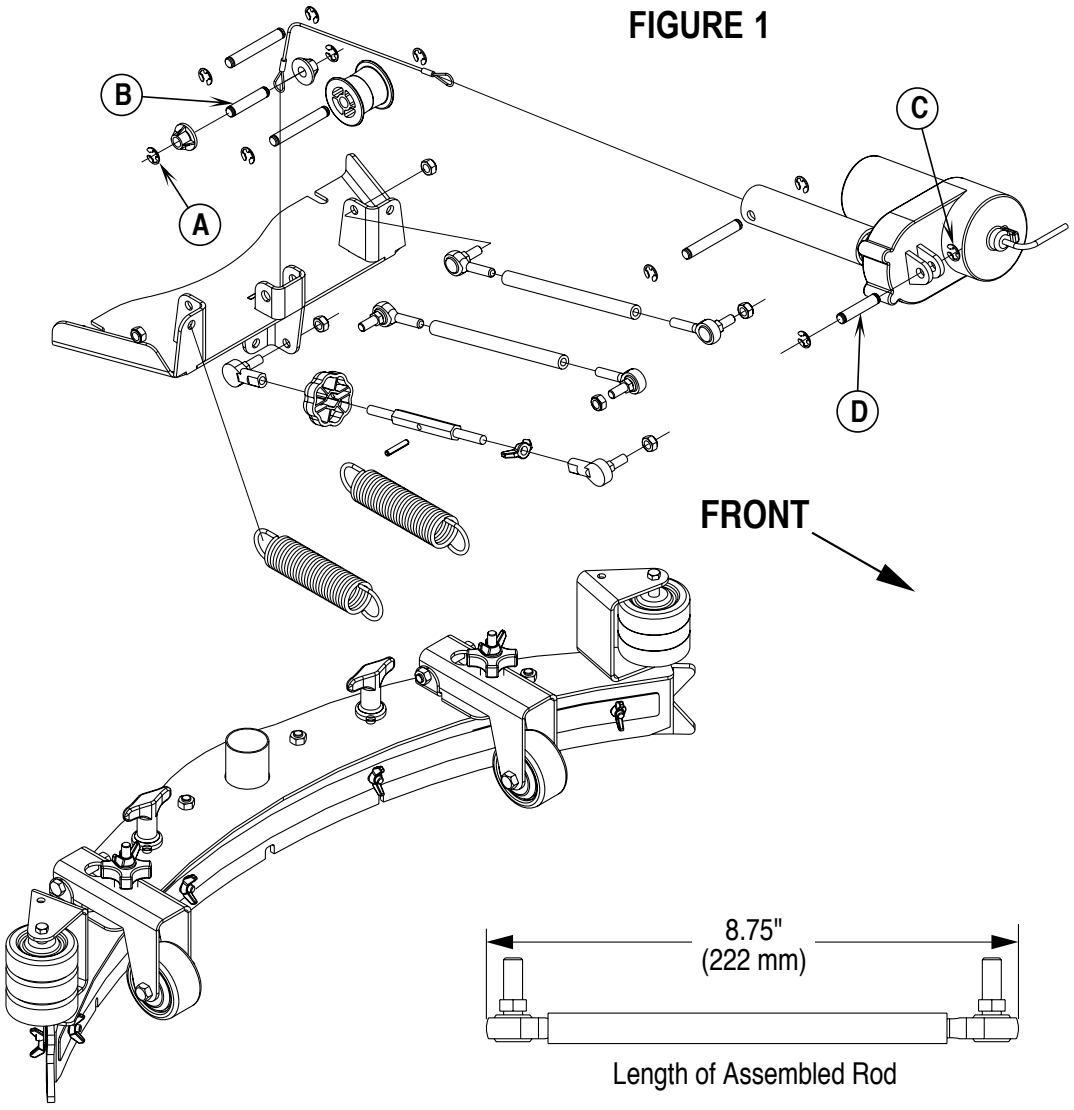
SQUEEGEE LIFT ACTUATOR MOTOR REMOVAL

1 Lower the squeegee tool to the floor and disconnect the battery pack connector.
2 See Figure 1. Remove the Retainer Ring **(A)** securing the Lift Cable Pin **(B)** and separate the cable from the squeegee mount.
3 Disconnect the squeegee lift motor wire harness at the motor.
4 Remove the Retainer Ring **(C)** (the one closest to the motor) and slide the Mount Pin **(D)** out from the chassis-mounting bracket. Then pull the lift motor forward to remove it from the chassis.

- **Note:** All new replacement actuator motors are not shipped with the lift nut preadjusted.
- **Important Service Note:** After removing any actuator motor and before installing a new motor or drive nut the IN and OUT motor limit switches must be set (or checked) to their correct specifications. Reference the Electrical section in this manual for the Actuator Drive Nut Adjustments and follow the instructions before replacing the actuator motor.

5 After setting the correct actuator nut adjustments for the squeegee lift motor follow the steps 1-4 in reverse order to reassemble.

FIGURE 1



Length of Assembled Rod

SQUEEGEE TOOL BLADE REPLACEMENT

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

To Reverse or Replace the Rear Squeegee Wiping Blade...

1 See Figure 2. Raise the squeegee tool off the floor, then unsnap the Center Latch **(E)** on the squeegee tool.
2 Remove the Wing Nut **(F)** from each end of the squeegee, then remove the Tension Straps **(G)**.
3 Slip the rear blade off the alignment pins.

SQUEEGEE SYSTEM

SQUEEGEE TOOL BLADE REPLACEMENT (CONTINUED)

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 Install the blade, following the steps in reverse order and adjust the squeegee.

To Reverse or Replace the Front Squeegee Blade...

1 Raise the squeegee tool off the floor, then loosen the (2) Thumb Nuts **(H)** on top of the squeegee and remove the squeegee tool from the mount.

2 Remove all the wing nuts that hold the front blade in place, then remove tension strap and blade.

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 Install the blade, following the steps in reverse order and adjust the squeegee.

SQUEEGEE ADJUSTMENT

There are two major squeegee tool adjustments, height and angle. The recommended adjustment steps are to set the tool angle first, then adjust the blade height.

Adjusting the Squeegee Angle

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

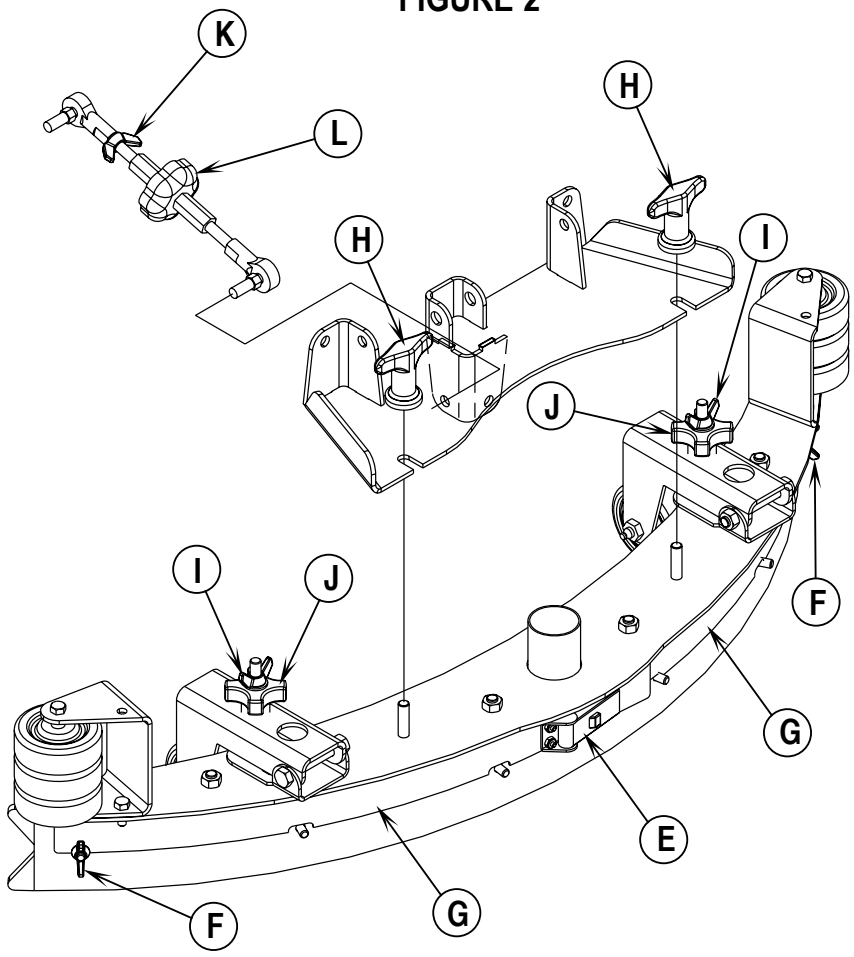
1 Park the machine on a flat, even surface and lower the squeegee. Then drive the machine forward enough to have the squeegee blades fold over to the rear.

2 See Figure 2. Loosen the Lock Wing Nut **(K)** (hand tightened). This secures the squeegee mount angle from easily vibrating out of adjustment.

3 Turn the Adjustment Knob **(L)** to tilt the tool forward or backwards, until the rear squeegee wiping blade touches the floor evenly across its entire width.

4 Re-tighten by hand the Lock Wing Nut **(K)**.

FIGURE 2



Adjusting the Squeegee Blade Height

Adjust the squeegee height whenever a blade is reversed or replaced, or if the squeegee is not wiping the floor dry. The squeegee blade height is easily adjustable at the caster wheels. To adjust...

1 Park the machine on a flat even surface and lower the squeegee. Then drive the machine forward enough to have the squeegee blades fold over to the rear.

2 Loosen both the lock adjustment Wing Nuts **(I)** (need to be hand tightened only) located on the top of the caster mount bracket.

3 Rotate the Adjustment Knobs **(J)** CW (clockwise) to lift the squeegee and CCW (counter clockwise) to lower it. A starting point when replacing the blades is to adjust the caster mounting bracket so it is level (parallel) to the top of the squeegee tool. Note: The Right and Left caster wheels must be adjusted equally to maintain level and even blade pressure.

4 Re-tighten the lock adjustment Wing Nuts **(I)** and test for proper squeegee pick-up.

BATTERY SPECIFICATIONS

Use a combination of multiple 2-volt cell units to construct a 24 Volt DC battery pack system.

Nilfisk-Advance recommended battery pack capacity is a 395 AH @ 20 Hour Rate deep cycle battery system. Note: The battery pack must fit the battery compartment size listed below.

Battery compartment size	
Height	19-1/2 inches (49.5 cm)
Width	16-3/16 inches (41 cm)
Length	23-5/8 inches (60 cm)
Maximum Battery Weight	540 lbs. (245 kg)

BATTERY CHARGER SPECIFICATIONS

Use a 24 Volt DC output charger matching the AC input line voltage supply to be used.

Always when selecting a battery charger 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 395 AH battery should be matched to a 24V, 40 Amp output charger.

INSTALL THE BATTERIES

⚠ WARNING!

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 inside the batteries through openings in the battery caps. This gas can be ignited by any electrical arc, spark or flame.

When Servicing Batteries...

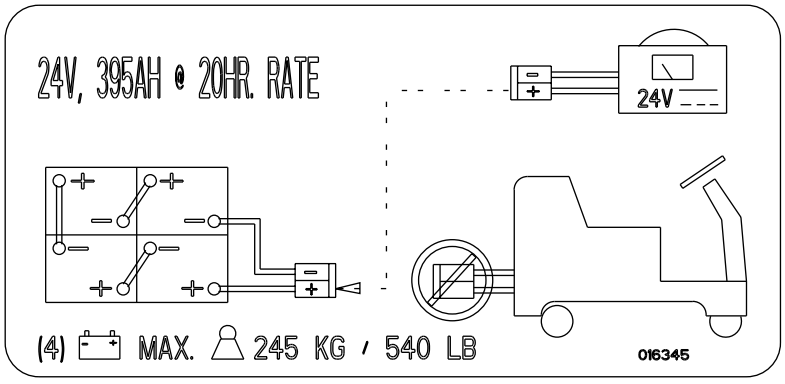
- Remove all jewelry.
- Do not smoke.
- Wear chemical goggles, rubber gloves and a protective apron.
- Work in a well-ventilated area.
- Do not allow tools to touch more than one battery terminal at a time.

⚠ CAUTION!

Electrical components in this machine can be severely damaged if the batteries are not installed and connected properly. Batteries should be installed by Nilfisk-Advance or by a qualified electrician.

1. Turn the Key Switch **(33)** off (O) and remove the key. Then swing open the Battery Compartment Cover **(15)**.
2. Using (2) people and an appropriate lifting strap, carefully lift the (4) 6-volt batteries into the compartment tray exactly as shown. Use decal 56016345 battery cable layout.
3. See Figure 1. Coat the battery posts with grease, install battery cables as shown and tighten the nuts on the battery terminals.
4. Install the battery boots and secure tightly to the battery cables with the supplied tie straps.
5. Connect the battery pack connector **(12)** to the machine connector and close the battery compartment cover.

FIGURE 1 (4) 6V batteries 24V system



ELECTRICAL SYSTEM

DESCRIPTION OF THE BATTERY CONDITION INDICATORS

The battery condition indicators will give an indication of the state of charge of the batteries. The battery condition monitor will retain the state-of-charge even if the key has been turned off. The state-of-charge indication is reset to full charge when the batteries have been recharged. It is also possible to choose between two different low voltage thresholds depending on whether maintenance-free or standard batteries are being used. **Have qualified service engineer perform this selection***. NOTE: The following percentages are based on *useable* battery capacity not total battery capacity. Therefore, 100% discharge = 80% of total battery capacity for standard wet cell batteries or 70% of total battery capacity for maintenance free batteries.

Green Indicator = full charge down to 50% discharge
Green & Yellow Indicator = 50% discharge down to 75% discharge
Yellow Indicator = 75% discharge down to 90% discharge
Yellow & Red Indicator = 90% discharge down to 95% discharge
Red Indicator = 95% discharge down to 99% discharge
Flashing Red Indicator = 100% discharge - scrub system will automatically shut down

*** Important Note:** See the *Main Control Board Special Program Options* manual section (located in the electrical system) and follow the instructions for setting the low voltage cutout threshold.

CHARGING THE BATTERIES

Charge the batteries each time the machine is used, or whenever the Battery Condition Meter **(31)** is showing anything other than a green indicator light.

To Charge the Batteries...

1. Depress the Battery Disconnect **(12)**.
2. Open the Battery Compartment Cover **(15)** to provide proper ventilation.
3. Push the connector from the charger into the Battery Connector connected to the battery pack.
4. Follow the instructions on the battery charger.
5. Check the fluid level in all battery cells after charging the batteries. Add distilled water, if necessary, to bring the fluid level up to the bottom of the filler tubes.

⚠ WARNING!

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

⚠ CAUTION!

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

BATTERY MAINTENANCE

Proper maintenance of electric vehicle batteries can greatly extend their life. Well-maintained batteries may last up to 3 years, but failure after 1 year is common if maintenance has been poor.

There are 3 simple rules for good battery maintenance:

- **Maintain Proper Electrolyte Level** - Use distilled water in batteries whenever possible. If batteries are discharged, add just enough water to cover the plates in each cell. If batteries are fully charged, fill each cell to the bottom of the filler tube. **Do not 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". Almost all 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 over-filled 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.

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 cell" in the battery system- that is, one (or more) cell that is putting out less voltage than the other cells.

Note: Always charge batteries before testing.

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 with the scrub drive motor running. The battery with the dead cell will read 1 or 2 volts lower than the other batteries in the system.

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

ELECTRICAL SYSTEM

ACTUATOR DRIVE NUT ADJUSTMENT

This manual section explains the steps for adjusting the drive nut settings for the machine's two lift actuator motors. Reference the chart below to find the IN & OUT dimensional specification for the specific actuator motor needing adjustment.

Part #	Actuator Motor	Drive Nut IN Position	Drive Nut OUT Position
56393303	Scrub Brush Lift (Disc)	2-3/8" (60 mm)	5-3/4" (146 mm)
56393303	Scrub Brush Lift (Cyl)	2-3/8" (60 mm)	5-3/4" (146 mm)
56412072	Squeegee Lift	7/8" (22 mm)	2-3/4" (70 mm)

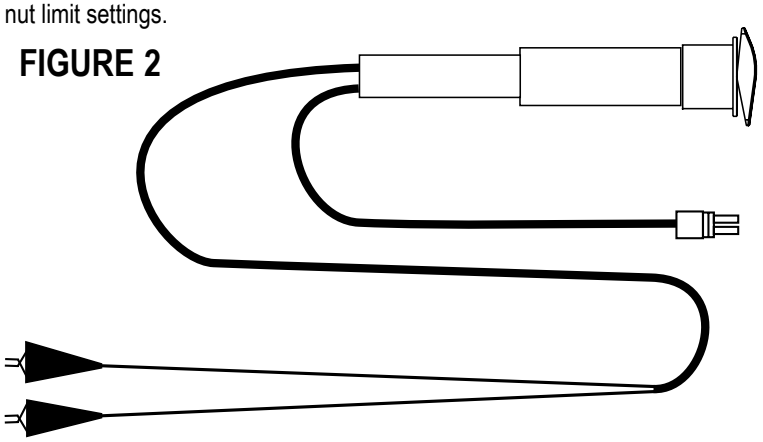
General Instructions for All Actuator Motors

1 See Figure 2. This shows the special actuator power cord adapter **(PN 56407200)** that is needed to connect the machine's battery pack and actuator motor for setting the drive nut limit settings.

2 Open the machine battery compartment and disconnect the battery connector. The battery pack is needed to power the lift actuator motor to properly set the IN & OUT limit switches.

3 Connect the actuator motor to be tested to the power cord adapter end. Then connect the alligator clips from the cord adapter (red clip to the positive and black to negative) to battery connector or battery posts. The rocker switch is used to change the motor rotation in setting the correct drive nut dimension.

FIGURE 2



Instructions for Squeegee Lift Actuator Drive Nut Adjustment

4 See Figure 3. Hold onto the Actuator Drive Nut **(A)** and press the rocker switch to run the drive motor and retract the nut towards the motor housing (it's IN limit).

5 Measure the position of the drive nut on the actuator shaft. Manually turn the steel tube to the IN position as shown in the chart.

6 Hold the drive nut then press the adapter cord rocker switch to run the drive motor to the OUT position (wait until the motor stops).

7 Measure the position of the drive nut on the shaft and compare the measurement with the OUT position shown in the chart.

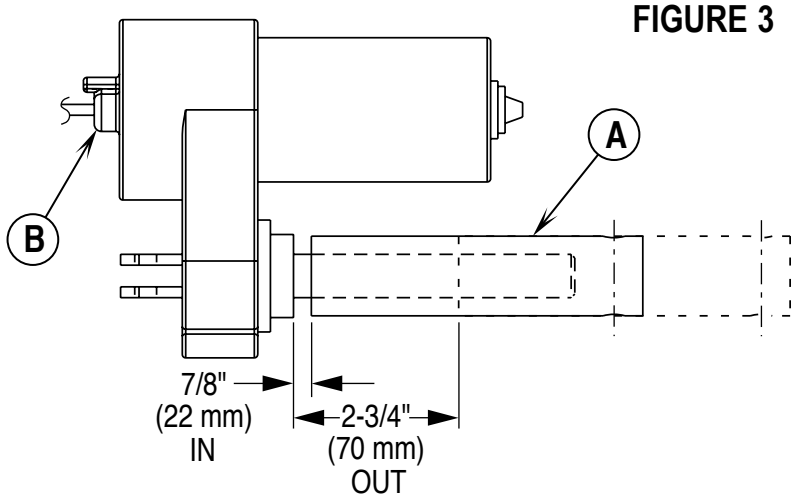
8 When the measurement doesn't match the dimension shown in the chart it is necessary to remove the Adjuster Cover **(B)** and adjust the Out position.

9 To increase the travel of the drive nut, turn the adjuster clockwise. To decrease the travel of the nut, turn the adjuster counter clockwise.

NOTE: Use a 5/16" (8 mm) wrench to turn the adjuster. Each click of the adjuster will change the nut travel 1/16 inch (1.6 mm).

10 After each adjustment, hold the drive nut, run the actuator IN & OUT and check both dimensions. After checking that the drive nut limits are set correctly then replace the adjuster cover. **Service Tip Note:** Use the above power cord adapter to help position the drive nut (in or out) for ease in actuator motor installations.

FIGURE 3



Instructions for Scrub Brush Lift Actuator Drive Nut Adjustment

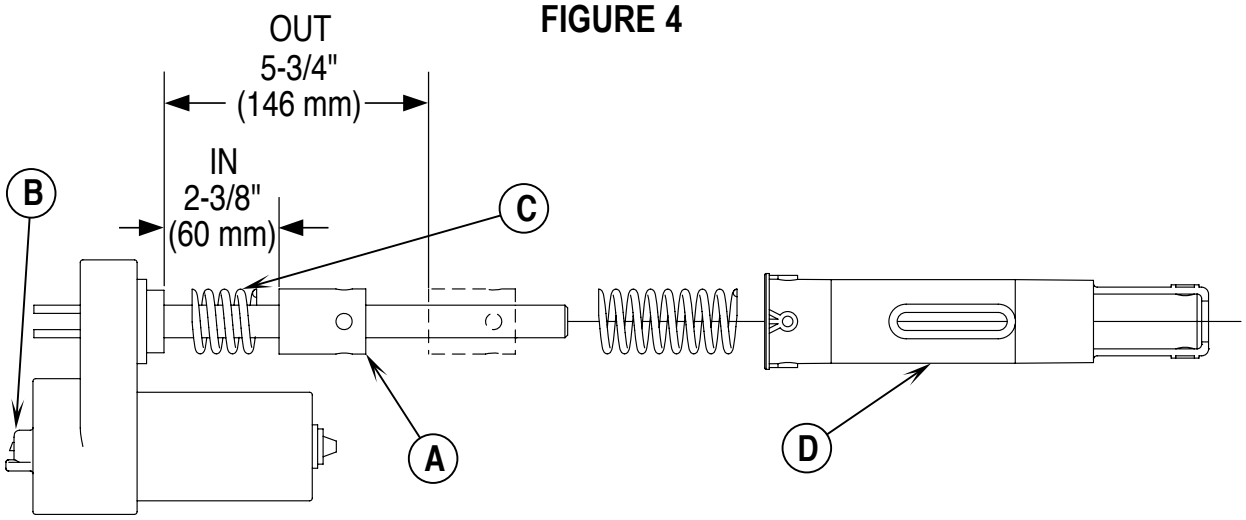
1 See Figure 4. On a new scrub lift actuator motor remove (spin-off) the Drive Nut **(A)** and install the short compression Spring **(C)** onto the actuator (lead screw) shaft first. Next reinstall the plastic drive nut as shown (with the nut pin pocket away from the motor).

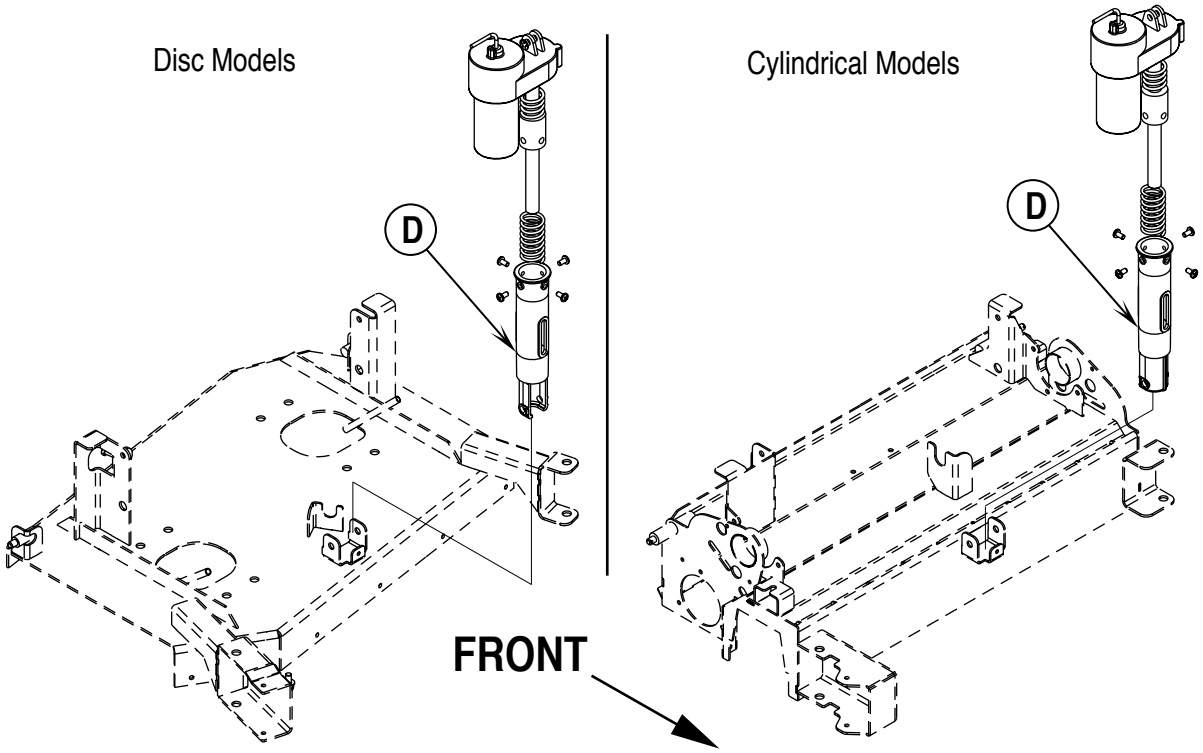
2 Follow steps 4-10 in the section labeled *Instructions for Squeegee Lift Actuator Drive Nut Adjustment* (reference previous page).

3 After adjusting the actuator drive nut (dimensions) follow steps 10 and 11 (in the *Scrub Brush Lift Actuator Removal* manual section) to reassemble.

Service Tip: See Figure 4. Note the correct orientation of the Spring Housing **(D)** when installing the complete motor assembly and also run the drive nut to the OUT (extended) position for machine installation.

FIGURE 4





ELECTRICAL SYSTEM

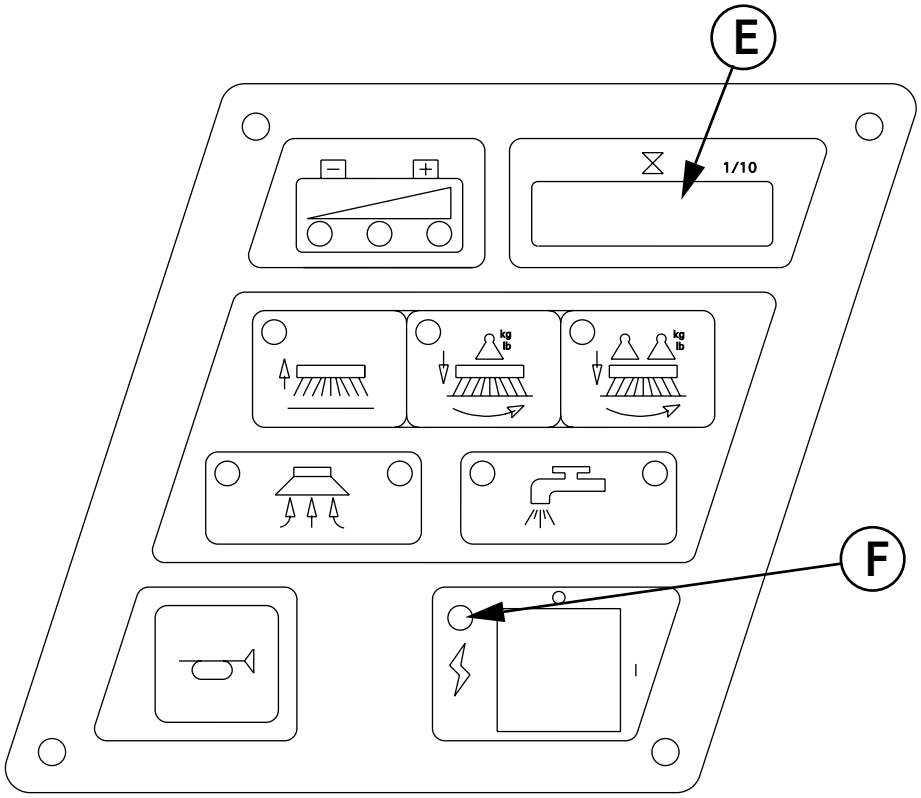
CURTIS CONTROLLER

The HR 2800 / BR 700 wheel drive system uses a .8 horsepower, 24V, DC permanent magnet motor. The system uses a Curtis Model 1235 solid-state controller to regulate the speed and direction of the drive wheel. The controller unit is located to the left of the operator seat, behind the louvered electrical access panel. The signal input to the controller is regulated by a potentiometer attached to the foot activated drive pedal.

FUNCTION OF THE SPEED CONTROLLER STATUS LIGHT AND DISPLAY

The Curtis 1235 speed control will output a fault code if there is a problem associated with the speed control and wheel drive system. See Figure 1. If a speed control fault occurs, the Hourmeter/Status display **(E)** will indicate "Err 03". When the Err03 is being displayed and detects a fault the Red Indicator **(F)** located by the key switch will flash a special error code sequence until the fault is corrected. See table 1 for a description of the fault indications and descriptions. **Service Note:** Instructions on how to read the error code status light. Example, OO O = two light flashes, a short pause. One flash, long pause and the code will be repeated.

FIGURE 5



STATUS LED FAULT CODES (TABLE 1)

LED CODE	STATUS LIGHT DISPLAY	EXPLANATION	POSSIBLE CAUSE
1,1	O O	Output fault	1. Short in motor or in motor wiring. 2. Controller failure.
		Overcurrent fault	1. Short in motor or in motor wiring. 2. Controller failure.
1,2	O OO	EEPROM fault	1. EEPROM failure or fault.
		Main contactor fault	1. Main contactor welded. 2. Main contactor driver fault. 3. Main contactor coil fault.
		Precharge fault	1. Internal controller fault. 2. Low battery voltage.
		Motor voltage fault	1. Motor voltage does not correspond to throttle request. 2. M1 or M2 output shorted to B- or B+. 3. Internal motor short. 4. Controller failure.
2,2	OO OO	HPD fault	1. Improper sequence of KSI, power enable, and throttle inputs. 2. Misadjusted throttle pot.
2,3	OO OOO	HPD fault present for > 5 sec.	1. Misadjusted throttle. 2. Broken throttle pot. 3. Broken throttle mechanism.
2,4	OO OOOO	Speed limit pot fault	1. Speed limit pot wiper wire broken. 2. Broken speed limit pot.
3,3	OOO OOO	Throttle fault	1. Throttle input wire open. 2. Throttle input wire shorted to B- or B+. 3. Throttle pot defective. 4. Wrong throttle type selected.
4,1	OOOO O	Low battery voltage	1. Battery voltage <16 volts (24V models). 2. Corroded or loose battery terminal. 3. Loose controller terminal.
4,2	OOOO OO	Overvoltage	1. Battery voltage >36 volts (24V models). 2. Vehicle operating with charger attached.
4,3	OOOO OOO	Over / Under-temp. cutback	1. Temperature >95°C (203°F) or<-25°C (-13°F). 2. Excessive load on vehicle. 3. Improper mounting of controller. 4. Operation in extreme environments.

Note: A KSI (key switch input) type HPD (high pedal disable) is an operational fault caused by the operator activating the Fwd/Rev drive pedal before turning on the main key switch. This can be cleared by removing the operators foot from the pedal and cycling the key switch ON and OFF.

ELECTRICAL SYSTEM

FUNCTIONAL OVERVIEW OF MAIN CONTROL BOARD

The primary function of the main control board is to position the scrubbing brush(s) with respect to the floor surface using a lift actuator motor to maintain the correct brush pressure and current draw of the brush motor. When the normal scrub or heavy scrub switch is depressed this will lower the scrub deck to the operating position and by activating the foot pedal start the brush motor. The controller is continuously monitoring the current to the brush motor and when it senses a current draw out of the desired range it automatically raises or lowers the brush deck by turning on the brush actuator motor. This process is repeated until the brush motor is shut off. The controller also manages the other supportive systems such as the squeegee lift, solution on/off, and vacuum motor. Note: See the Know Your Machine system in this manual for a complete explanation of the machine's operation.

The secondary function of the main control is to detect any system failures and display an error code on the hour meter display or store it in the main control board's recall memory mode. The error code(s) are used to help the serviceperson 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 Special Program Options* section in this manual for further information.

TROUBLESHOOTING GUIDE

Any error codes detected by main control board will be displayed on the hour meter LED display as they occur. If more than one-error exists the display will sequence through the error codes at one-second intervals. The error display will show on the hour meter as the letters Err followed by a two-digit code. EX: Err01 would be a non-fatal control fault. When troubleshooting any fault description noted with a double asterisk (**) follow the instructions for temporarily disabling the control boards special fault protection program. See the *Main Control Board Special Program Options* section in this manual.

MAIN CONTROLLER ERROR CODES

Error Code	Fault Description	Troubleshooting Action
Err01	Non fatal main controller fault (**)	1. Turn key off. 2. Turn key on. 3. If error fault returns, go into the **Fault Recall Mode*** (*Main Control Board Special Program Options*) to further investigate other possible causes. Make repairs to all electrical system faults found in the fault recall check. Replace control board only as the last step when troubleshooting.
Err02	Fatal main controller fault (**)	Same as Err01. Check **Fault Recall Mode***. Replace control board. Follow troubleshooting actions listed for Err01.
Err03	Wheel drive motor overload or speed control fault	1. Check for a tripped drive motor circuit breaker (45 amp). Investigate reason for possible mechanical over load. Examples: sticking brakes, parking brake slide lever not released, prolonged ramp climbing. 2. See Curtis drive motor controller section To further troubleshoot the drive system.
Err04	Brush lift actuator overload	Check for binding of brush lift linkage and excessive weight on scrub brush deck. Repair.
Err05	Brush lift actuator severe overload	1. Check for binding or frozen brush lift linkage and excessive weight on brush deck. 2. Check for short circuit in brush motor and wiring. Repair or replace.

***** See the *Main Control Board Special Program Options* section to activate the Fault Recall function.

MAIN CONTROLLER ERROR CODES (CONTINUED)

Error Code	Fault Description	Troubleshooting Action
Err06	Brush lift actuator open circuit (**)	Check for disconnected actuator wiring, open in wiring or defective actuator motor. Repair or replace.
Err07	Brush motor overload	Check for binding in rotation of brushes or improper brush lift actuator operation. 2. Check the negative supply cable at the brush motor for a wiring problem or improper modifications (this is a special cable and must be replaced with the original OEM PN 56412181).
Err08	Brush motor severe overload	1. Check for short circuit in brush motor or wiring. 2. Inspect gearbox for failure. Repair or replace.
Err09	Brush motor circuit open (**)	1. Check for open in brush motor wiring or defective motor. 2. Check the negative supply cable at the brush motor for a wiring problem or improper modifications (this is a special cable and must be replaced with the original OEM PN 56412181).
Err10	Brush solenoid contacts shorted	Check solenoid for welded contacts (continuity test). If welded replace solenoid.
Err12	Brush solenoid coil overload	1. Check diode for continuity in one direction only, if bad, replace diode. 2. Check for proper installation of diode (silver band is wired to positive side of coil) 3. Check for wiring problems. 4. Check coil resistance if below 41 ohms replace solenoid.
Err13	Brush solenoid coil severe overload	1. Same as error code 12. 2. Shorted coil. Replace
Err14	Brush solenoid coil open (**)	1. Check for an open in the coil wiring 2. Check solenoid coil for high resistance (infinity). Repair or replace.
Err15	Brush current too high	1. Check for proper brush lift actuator operation (actuator linkage). 2.Check for free rotation of brush drive assembly.
Err16	Brush current too low	1. Check for improper, too low brush pressure (see brush pressure adjustment section). 2. No brushes installed 3. Check proper brush lift actuator operation.
Err17	Brush motor cable thermistor failure	Machine exposed to a very cold or hot operating temperature. Allow machine to be warmed or cooled to room temperature. Temp range 56°F to 180°F (13 to 82°C) 2. Cable failure, replace the brush motor negative cable assemble (this is a special cable and must be replaced with an original OEM PN 56412181).

ELECTRICAL SYSTEM

MAIN CONTROLLER ERROR CODES (CONTINUED)

Error Code	Fault Description	Troubleshooting Action
Err18	Squeegee actuator overload	Check for binding of squeegee lift linkage and excessive weight on squeegee. Repair
Err19	Squeegee actuator severe overload	Check for binding or frozen squeegee lift linkage and excessive weight on squeegee. 2. Check for short circuit in wiring or actuator motor. Repair or replace.
Err20	Squeegee actuator circuit open (**)	Check for disconnected actuator wiring, open in wiring or defective actuator motor, Repair or replace.
Err24	Vacuum motor overload	1. Check for debris in vac motor 2. Worn carbon brushes 3. Defective motor bearings. Repair or replace.
Err25	Vacuum motor severe overload	Check for short circuit in vac motor or wiring.
Err26	Vacuum motor circuit open (**)	Check for disconnected vacuum motor wiring, open in wiring or defective vacuum motor. Repair or replace.
Err27	Vacuum solenoid contacts shorted	Check solenoid for welded contacts (continuity test). If welded replace solenoid.
Err29	Vacuum solenoid coil overload	1. Check diode for continuity in one direction only, if not, replace diode. 2. Check for proper installation of diode (silver band is wired to positive side of coil) 3. Check for correct wiring. 4. Check coil resistance if below 41 ohms replace solenoid.
Err30	Vacuum solenoid coil severe overload	1. Same as error code 29. 2. Check for a short circuit in wiring or solenoid coil. Repair or replace.
Err31	Vacuum solenoid coil open (**)	1. Check for open in coil wiring. 2. If wiring checks OK, replace solenoid.
Err32	Solution solenoid overload	1. Check for a wiring problem. 2. Check coil resistance if below 50 ohms replace solenoid.
Err33	Solution solenoid severe overload	Check for a short circuit in wiring or solenoid valve. Repair or replace.
Err34	Solution solenoid open (**)	Check for disconnected solenoid wiring plug, open in wiring or defective solenoid. Repair or replace.
Err35	External wiring fault (power input to controller)	Identify the 4 wire pin connector on the control board (2 Red/Brn, 1 Blk, 1 Wht/Brn). Check the 2 Red/Brn wires for 24 volts input to the connector. Repair
Err36	No accessory output voltage (components affected brush, vacuum, headlight, beacon and horn)	Identify the same 4 wire pin connector called out in Err35. Check the Wht/Brn wire for 24 volts (output) and all component load connections down line. Repair

ADDITIONAL ERROR CODE TROUBLESHOOTING INFORMATION

When entering the main controller error fault recall mode and a fault Err01 or Err02 has been detected, the service person may see a second set of error codes. Refer to the chart below that shows the additional fault error codes by machine system.

These secondary codes give information on a specific failure that is internal on the control board circuit. Therefore it is important to follow through with all troubleshooting actions of any system faults that support an internal controller circuit failure before replacing a new main control board. Example: A shorted solution solenoid valve causes a control fault 01 or 02 which appears on the machine's hour meter / status display. The service person brings up the fault recall memory and sees additional two digit number(s) as shown in error code range in the chart below. A complete check of that fault area would be completed before installing a new main control board.

	Error Code	Fault Area By Machine System	Re-check troubleshooting actions for Main Controller Error Codes
A	60 61 89	Vacuum Motor Solenoid	Err24 – Err31
B	62 63 96	Brush Motor Solenoid	Err07 – Err17
C	74	Squeegee Actuator	Err18 – Err20
D	80	Brush Lift Actuator	Err04 – Err06
E	84	Solution Solenoid	Err32 – Err34

ELECTRICAL SYSTEM

MAIN CONTROL BOARD SPECIAL PROGRAM OPTIONS FOR MACHINES BEFORE SERIAL NUMBER 1362502

SELECTION OF LOW VOLTAGE CUTOUT THRESHOLD:

The HR 2800 / BR 700 is equipped a low voltage cutout feature to prevent over-discharging the batteries. This feature will automatically shut down the scrub system when the battery voltage falls to the selected threshold. The cutout level is adjustable. The standard setting is 21 volts (1.75 volts per cell) and the so called maintenance free setting is 22 volts (1.83 volts per cell). The standard setting should be used unless the battery manufacturer specifies the higher cutout voltage. *It is important to mote that some maintenance free batteries (including some gelled electrolyte cells) are capable of being safely discharged down to 1.75 volts per cell.* To select between the two types:

1. Turn the master on/off key switch to the off position.
2. Press and hold the scrub off switch.
3. While holding the scrub off switch turn the master on/off key switch to the on position.
4. Continue to hold the scrub off switch until the scrub off indicator turns green and the hourmeter/status display shows “Std” or “FrEE”.
5. Release the scrub off switch.
6. Pressing and releasing the scrub off switch will now select between the two options. For standard wet cell batteries select “Std” and for maintenance free batteries select “FrEE”.
7. To save the new setting, turn the master on/off key switch to the off position.
8. The new setting will be saved and will remain in effect until it is changed again.

ADJUSTMENT OF NORMAL SCRUB MODE PAD PRESSURE:

The default pad pressure setting when the normal scrub option is selected is adequate for most scrubbing operations. If it is desired to increase or decrease the amount of pad pressure for the normal scrub mode perform the following steps. NOTE: At the maximum pad pressure setting for the normal scrub mode, the pad pressure will still be less than the pad pressure when in the heavy scrub mode.

1. Turn the master on/off key switch to the off position.
2. Press and hold the normal scrub switch.
3. While holding the normal scrub switch turn the master on/off key switch to the on position.
4. Continue to hold the normal scrub switch until the scrub off indicator and/or the normal scrub indicator turns green and the hourmeter/status display shows “PA 0” (the factory default setting).
5. Release the scrub off switch.
6. Pressing and releasing the scrub off switch will now decrease the pad pressure setting. If a setting below the factory default setting is chosen the display will show “PA -X” where X is a number from -1 to -4. The minimum amount of pad pressure is selected when the display shows “PA -4”.
7. Pressing and releasing the normal scrub switch will now increase the pad pressure setting. If a setting above the factory default setting is chosen the display will show “PA X” where X is a number from 1 to 2. The maximum amount of pad pressure is selected when the display shows “PA 2”.
8. To save the new setting, turn the master on/off key switch to the off position.
9. The new setting will be saved and will remain in effect until it is changed again.

MAIN CONTROL BOARD SPECIAL PROGRAM OPTIONS FOR MACHINES BEFORE SERIAL NUMBER 1362502 (CONTINUED)

RECALL OF STORED ERROR (FAULT) CODES:

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

1. Turn the master on/off key switch to the off position.
2. Press and hold the heavy scrub switch.
3. While holding the heavy scrub switch turn the master on/off key switch to the on position.
4. Continue to hold the heavy scrub switch until the hourmeter/status display shows “Error”.
5. Release the heavy scrub switch.
6. If there were previously no error codes stored, the display will now show “nonE”. Go to step 12.
7. If error codes were stored, the display will now show the stored code(s) and the heavy scrub indicator will now be green.
8. To clear the stored codes press and release the heavy scrub switch.
9. The hourmeter/status display will now show “ErASE” and the scrub off indicator will be red.
10. To clear the stored codes, press and release the heavy scrub switch one more time. To return to the error code display without clearing the codes press the scrub off switch.
11. If the heavy scrub switch was pressed the error codes will have been cleared and the display will show “nonE”.
12. To exit the error code recall mode, turn the master on/off key switch to the off position.

ENABLING OR DISABLING THE VACUUM AUTOMATIC SHUTOFF OPTION:

The HR 2800 / BR 700 is equipped with a feature that will automatically shut off the vacuum and display “FULL” on the hourmeter/status display if the recovery tank becomes filled. If problems are encountered with the vacuum automatic shutoff feature, such as the vacuum shutting off even if the recovery tank is not full, this feature can be disabled. To enable or disable this feature perform the following steps:

1. Turn the master on/off key switch to the off position.
2. Press and hold the vacuum switch.
3. While holding the vacuum switch turn the master on/off key switch to the on position.
4. Continue to hold the vacuum switch until the hourmeter/status display shows “OFF” or “on” and the vacuum indicator is green.
5. Release the vacuum switch.
6. Pressing and releasing the vacuum switch will now select between “on” or “OFF”. On means that the vacuum automatic shutoff feature is enabled, off means that the feature is disabled.
7. To save the new setting, turn the master on/off key switch to the off position.
8. The new setting will be saved and will remain in effect until it is changed again.

ENABLING OR DISABLING SOLUTION FLOW WHILE IN REVERSE:

Normally while scrubbing, the solution flow is stopped while in reverse to prevent flooding of the floor due to the fact that the squeegee raises when backing up. If it is desired to allow solution flow while in reverse this feature can be enabled. To enable or disable this feature, perform the following steps:

1. Turn the master on/off key switch to the off position.
2. Press and hold the solution switch.
3. While holding the solution switch turn the master on/off key switch to the on position.
4. Continue to hold the solution switch until the hourmeter/status display shows “OFF” or “on” and the solution indicator is green.
5. Release the solution switch.
6. Pressing and releasing the solution switch will now select between “on” or “OFF”. On means that the solution flow will be on while in reverse, off means that the solution flow will be stopped while in reverse.
7. To save the new setting, turn the master on/off key switch to the off position.
8. The new setting will be saved and will remain in effect until it is changed again.

ELECTRICAL SYSTEM

MAIN CONTROL BOARD SPECIAL PROGRAM OPTIONS FOR MACHINES BEFORE SERIAL NUMBER 1362502 (CONTINUED)

VACUUM OFF WHEN SCRUB OFF SWITCH PRESSED OPTION:

Normally, when the scrub system is turned off the vacuum is left on to allow recovery of any solution left on the floor and solution that will drip off of the scrub brushes/pads. If it is desired to have the vacuum system shut off when the scrub off switch is pressed this option can be selected. If this option is selected the squeegee will remain down until the scrub deck is in the up position. Once the scrub deck is up, the squeegee will raise and the vacuum motor will shut off approximately 10 seconds later. This is so that any residual water left in the vacuum hose will be recovered. To enable or disable this option perform the following steps:

1 Turn the master on/off key switch to the off position.
2 Press and hold the scrub off switch and the vacuum switch.
3 While holding both switches turn the master on/off key switch to the on position.
4 Continue to hold both switches until the hourmeter/status display shows “OFF” or “on” and the vacuum green and red indicators are lit.
5 Release both switches.
6 Pressing and releasing the vacuum switch will now select between “on” or “OFF”. On means that the vacuum will stay on when the scrub off switch is pressed, Off means that the vacuum will shut off after the scrub deck has raised and the 10 second delay has elapsed.
7 To save the new setting, turn the master on/off key switch to the off position.
8 The new setting will be saved and will remain in effect until it is changed again.

RAMP MODE FEATURE:

Under normal conditions the operator will use the throttle for accelerating and decelerating/stopping. This works well unless the machine is used to scrub on an inclined surface. In this case, using the throttle to decelerate (such as braking while going down hill) will cause the squeegee to raise and the solution flow to shut off; or allowing the throttle to go to neutral (such as coasting down hill) will cause the scrub brushes to stop. To prevent this the control unit can be placed into a “ramp mode”. If the ramp mode is enabled *and selected*, the scrub brushes will continue to operate as will the vacuum and solution system even if the throttle is in neutral or reverse. In addition, the squeegee will not raise when in reverse. The ramp mode is *deselected* by pressing any of the three scrub switches (scrub off, normal scrub, heavy scrub) or if the operator gets off the seat. In order to be able to *select* the ramp mode, it must first be enabled. To enable this feature perform the following steps:

1 Turn the master on/off key switch to the off position.
2 Press and hold the scrub off and the normal scrub switches.
3 While holding both switches turn the master on/off key switch to the on position.
4 Continue to hold both switches until the hourmeter/status display shows “OFF” or “on” and the scrub off and normal scrub indicators are green.
5 Release both switches.
6 Pressing and releasing the scrub off switch will now select between “on” or “OFF”. On means that the ramp mode is enabled, off means that the ramp mode is disabled.
7 To save the new setting, turn the master on/off key switch to the off position.
8 The new setting will be saved and will remain in effect until it is changed again.

Once the ramp mode is enabled, it can be *selected* by pressing and holding either the normal or heavy scrub switches (whichever is currently selected) for approximately 1 second while scrubbing. The scrub motor must already be on to enter the ramp mode. While the ramp mode is active, the scrub indicator (either normal or heavy) will alternately flash between green and yellow. As mentioned above, pressing any of the scrub switches or getting off the seat will *deselect* the ramp mode.

MAIN CONTROL BOARD SPECIAL PROGRAM OPTIONS FOR MACHINES BEFORE SERIAL NUMBER 1362502 (CONTINUED)

ENABLING OR DISABLING FAULT DETECTION:

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

1. Turn the master on/off key switch to the off position.
2. Press and hold the scrub off switch and the solution switch.
3. While holding both switches turn the master on/off key switch to the on position.
4. Continue to hold both switches until the hourmeter/status display shows “OFF” or “on” and the solution red and green indicators are illuminated.
5. Release both switches.
6. Pressing and releasing the solution switch will now select between “on” or “OFF”. On means that the fault checking option is enabled, off means that the option is disabled.
7. To save the new setting, turn the master on/off key switch to the off position.
8. The new setting will be saved and will remain in effect until it is changed again.

BRUSH TYPE SELECTION:

The HR 2800 / BR 700 can be equipped with two different scrub deck options. One uses cylindrical brushes and the other uses disc type brushes and pads. This function configures the control unit current settings for each of the scrub deck types. To change from one type to the other:

1. Turn the master on/off key switch to the off position.
2. Press and hold the scrub off and heavy scrub switches.
3. While holding both switches turn the master on/off key switch to the on position.
4. Continue to hold both switches until the heavy scrub indicator turns green and the hourmeter/status display shows “dISC” or “CYL”.
5. Release both switches.
6. Pressing and releasing the heavy scrub switch will now select between the two options. For the cylindrical brush unit select “CYL” and for the disc type unit select “dISC”.
7. To save the new setting, turn the master on/off key switch to the off position.
8. The new setting will be saved and will remain in effect until it is changed again.

BACK-UP ALARM VOLUME CONTROL:

The HR 2800 / BR 700 is equipped with an audible warning device which functions as both a horn and a back-up alarm. The volume of the back-up alarm can be adjusted to one of ten settings. Off is the minimum setting and 9 is the maximum setting. To change the back-up alarm volume perform the following steps:

1. Turn the master on/off key switch to the off position.
2. Press and hold the horn switch.
3. While holding the horn switch turn the master on/off key switch to the on position.
4. Continue to hold the horn switch until the hourmeter/status display shows “OFF” or a number from one to nine depending on the current volume setting.
5. Release the horn switch.
6. Pressing and releasing the horn switch will now select the volume level. The level will increment from OFF to 9, 9 being the loudest. To hear the back-up alarm volume select the reverse direction by pressing lightly on the throttle.
7. To save the new setting, turn the master on/off key switch to the off position.
8. The new setting will be saved and will remain in effect until it is changed again.

ELECTRICAL SYSTEM

MAIN CONTROL BOARD SPECIAL PROGRAM OPTIONS FOR MACHINES AFTER SERIAL NUMBER 1362501

SCRUB MODE DESCRIPTION:

On the 2800/BR700, both the normal and heavy scrub modes are independently programmable to have user adjustable or fixed scrub pressure settings.

If the adjustable option is selected (factory default), the operator will be able to vary the amount of scrub pressure while operating the machine. Maximum pressure limits can be programmed for both the normal and heavy scrub modes. This can be used to prevent the use of too much pressure while still allowing the operator some adjustment of the scrub pressure.

If the fixed option is selected, a pre-set scrub pressure will be used for each mode (normal/heavy). The pre-set pressure settings can be selected by a special key sequence described later. This would allow a supervisor to set up two different scrub pressures (normal/heavy) thereby preventing the operator from having the capability to vary the pressure throughout the full range.

The scrub pressure can be set from 1 to 7 for cylindrical brush machines and 1 to 9 for disc brush/pad machines. The allowable range for the normal scrub mode is 1 through 4 and the range for the heavy scrub mode is (normal limit + 1) through 7 or 9 depending on model. This number is a relative indication of scrubbing effort. The actual pressure applied will vary depending on the floor surface and the type of pad/brush used.

SCRUB MODE OPERATION (ADJUSTABLE):

If the adjustable option is selected (factory default) the scrub mode operation is as follows:

Pressing the normal scrub button will enable the scrub system and set the scrub pressure to the last selected value for the normal scrub mode. The status display will momentarily display the scrub pressure setting. This is indicated by “PA” (Pressure Adjustment) followed by a number.

Subsequent presses of the normal scrub button will step the pad pressure setting through the allowable range up to the maximum value programmed for the normal scrub mode. Once the maximum value is reached the pressure setting will step back to 1. The factory default maximum for the normal scrub mode is 4.

Pressing the heavy scrub button will enable the scrub system and set the scrub pressure to the last selected value for the heavy scrub mode. The status display will momentarily display the scrub pressure setting. This is indicated by “PA” followed by a number.

Subsequent presses of the heavy scrub button will step the pad pressure setting through the allowable range up to the maximum value programmed for the heavy scrub mode. Once the maximum value is reached the pressure setting will step back to (normal scrub limit + 1). The factory default maximum for the normal scrub mode is 7 (cylindrical) or 9 (disc).

SCRUB MODE OPERATION (FIXED):

If the fixed option is selected the scrub mode operation is as follows:

Pressing the normal scrub button will enable the scrub system and set the scrub pressure to the pre-set normal scrub pressure setting. The operator will not be able to adjust the pressure for the normal scrub mode. The status display will momentarily display the scrub pressure setting. This is indicated by “PA” followed by a number.

Pressing the heavy scrub button will enable the scrub system and set the scrub pressure to the pre-set heavy scrub pressure setting. The operator will not be able to adjust the pressure for the heavy scrub mode. The status display will momentarily display the scrub pressure setting. This is indicated by “PA” followed by a number.

MAIN CONTROL BOARD SPECIAL PROGRAM OPTIONS FOR MACHINES AFTER SERIAL NUMBER 1362501 (CONTINUED)

SCRUB MODE PROGRAMMING FOR USER ADJUSTABLE SCRUB PRESSURE:

To program the normal scrub mode for user adjustable scrub pressure perform the following steps:

1. Turn the master key switch off.
2. Press and hold the normal scrub button.
3. Turn the master key switch on while continuing to hold the normal scrub button until the status display shows “PA * “, where * is a number from 1 to 4.
4. Press and release the normal scrub button until the display shows “adjustable”.
5. Press and release the scrub off button to save the setting.
6. The display will now change to “PA” followed by a number in the range of 1 to 4. This is the maximum pressure that will be allowed for the normal scrub mode.
7. Press and release the normal scrub button to select the desired limit.
8. Press and release the scrub off button to save the pressure level.
9. The display will now show “done” indicating that the normal scrub mode is programmed.
10. Turn the master key switch off.

To program the heavy scrub mode for user adjustable scrub pressure perform the following steps:

1. Turn the master key switch off.
2. Press and hold the heavy scrub button.
3. Turn the master key switch on while continuing to hold the heavy scrub button until the status display shows “PA * “, where * is a number from 2 to 9.
4. Press and release the heavy scrub button until the display shows “adjustable”.
5. Press and release the scrub off button to save the setting.
6. The display will now change to “PA” followed by a number in the range of (normal scrub limit + 1) to 7 (cylindrical) or 9 (disc). This is the maximum pressure that will be allowed for the heavy scrub mode.
7. Press and release the heavy scrub button to select the desired limit.
8. Press and release the scrub off button to save the pressure level.
9. The display will now show “done” indicating that the heavy scrub mode is programmed.
10. Turn the master key switch off.

SCRUB MODE PROGRAMMING FOR FIXED (NON-ADJUSTABLE) SCRUB PRESSURE:

To program the normal scrub mode for fixed scrub pressure perform the following steps:

1. Turn the master key switch off.
2. Press and hold the normal scrub button.
3. Turn the master key switch on while continuing to hold the normal scrub button until the status display shows “PA * “, where * is a number from 1 to 4.
4. Press and release the normal scrub button until the display shows “non-adjustable”.
5. Press and release the scrub off button to save the setting.
6. The display will now change to “PA” followed by a number in the range of 1 to 4. This is the scrub pressure that will be used for the normal scrub mode.
7. Press and release the normal scrub button to select the desired pressure.
8. Press and release the scrub off button to save the pressure level.
9. The display will now show “done” indicating that the normal scrub mode is programmed.
10. Turn the master key switch off.

ELECTRICAL SYSTEM

MAIN CONTROL BOARD SPECIAL PROGRAM OPTIONS FOR MACHINES AFTER SERIAL NUMBER 1362501 (CONTINUED)

To program the heavy scrub mode for fixed scrub pressure perform the following steps:

1. Turn the master key switch off.
2. Press and hold the heavy scrub button.
3. Turn the master key switch on while continuing to hold the heavy scrub button until the status display shows “PA * “, where * is a number from 2 to 9.
4. Press and release the heavy scrub button until the display shows “non-adjustable”.
5. Press and release the scrub off button to save the setting.
6. The display will now change to “PA” followed by a number in the range of (normal scrub limit + 1) to 7 (cylindrical) or 9 (disc). This is the scrub pressure that will be used for the heavy scrub mode.
7. Press and release the heavy scrub button to select the desired limit.
8. Press and release the scrub off button to save the pressure level.
9. The display will now show “done” indicating that the heavy scrub mode is programmed.
10. Turn the master key switch off.

NOTE: Either scrub mode (normal/heavy) may be programmed for adjustable or fixed scrub pressure independently. They do *not* have to be programmed the same.

RESTORING THE SCRUB MODES AND PRESSURES TO FACTORY DEFAULT SETTINGS:

FACTORY DEFAULT: Normal scrub = adjustable, limit = 4; Heavy scrub = adjustable, limit = 7 or 9 depending on scrub deck type.

If it is desired to restore the normal and heavy scrub modes and pressure settings back to the factory default settings, perform the following steps:

1. Turn the master on/off key switch to the off position.
2. Press and hold the normal scrub and heavy scrub switches.
3. While holding both switches turn the master on/off key switch to the on position.
4. Continue to hold both switches until the hourmeter/status display shows “donE”.
5. Release both switches.
6. The scrub modes and pressures have now been restored.
7. Turn the master on/off key switch to the off position.

SELECTION OF LOW VOLTAGE CUTOUT THRESHOLD:

FACTORY DEFAULT: STD

The 2800/BR700 is equipped with a low voltage cutout feature to prevent over-discharging the batteries. This feature will automatically shut down the scrub system when the battery voltage falls to the selected threshold. The cutout level is adjustable. The standard setting is 21 volts (1.75 volts per cell) and the so-called maintenance free setting is 22 volts (1.83 volts per cell). The standard setting should be used unless the battery manufacturer specifies the higher cutout voltage. *It is important to note that some maintenance free batteries (including some gelled electrolyte cells) are capable of being safely discharged down to 1.75 volts per cell.* To select between the two types:

1. Turn the master on/off key switch to the off position.
2. Press and hold the scrub off switch.
3. While holding the scrub off switch turn the master on/off key switch to the on position.
4. Continue to hold the scrub off switch until the scrub off indicator turns red and the hourmeter/status display shows “Std” or “FrEE”.
5. Release the scrub off switch.
6. Pressing and releasing the scrub off switch will now select between the two options. For standard wet cell batteries select “Std” and for maintenance free batteries select “FrEE”.
7. To save the new setting, turn the master on/off key switch to the off position.
8. The new setting will be saved and will remain in effect until it is changed again.

MAIN CONTROL BOARD SPECIAL PROGRAM OPTIONS FOR MACHINES AFTER SERIAL NUMBER 1362501 (CONTINUED)

RECALL OF STORED ERROR (FAULT) CODES:

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

1. Turn the master on/off key switch to the off position.
2. Press and hold the scrub off and horn switches.
3. While holding both switches turn the master on/off key switch to the on position.
4. Continue to hold both switches until the hourmeter/status display shows “Err *”. (* will be a letter indicating the revision level of the control unit)
5. Release both switches.
6. If there were previously no error codes stored, the display will now show “nonE”. Go to step 12.
7. If error codes were stored, the display will now show the stored code(s) and the scrub off indicator will now be green.
8. To clear the stored codes press and release the scrub off switch.
9. The hourmeter/status display will now show “ErASE” and the heavy scrub indicator will be yellow.
10. To clear the stored codes, press and release the scrub off switch one more time. To return to the error code display without clearing the codes press the heavy scrub switch.
11. If the scrub off switch was pressed the error codes will have been cleared and the display will show “nonE”.
12. To exit the error code recall mode, turn the master on/off key switch to the off position.

ENABLING OR DISABLING THE VACUUM AUTOMATIC SHUTOFF OPTION:

FACTORY DEFAULT: ON

The 2800/BR700 is equipped with a feature that will automatically shut off the vacuum and scrub systems and display “FULL” on the hourmeter/status display if the recovery tank becomes filled. If problems are encountered with the vacuum automatic shutoff feature, such as the vacuum shutting off even if the recovery tank is not full, this feature can be disabled. To enable or disable this feature perform the following steps:

1. Turn the master on/off key switch to the off position.
2. Press and hold the vacuum switch.
3. While holding the vacuum switch turn the master on/off key switch to the on position.
4. Continue to hold the vacuum switch until the hourmeter/status display shows “OFF” or “on” and the vacuum indicator is green.
5. Release the vacuum switch.
6. Pressing and releasing the vacuum switch will now select between “on” or “OFF”. On means that the vacuum automatic shutoff feature is enabled, off means that the feature is disabled.
7. To save the new setting, turn the master on/off key switch to the off position.
8. The new setting will be saved and will remain in effect until it is changed again.

ENABLING OR DISABLING SOLUTION FLOW WHILE IN REVERSE:

FACTORY DEFAULT: OFF

Normally while scrubbing, the solution flow is stopped while in reverse to prevent flooding of the floor due to the fact that the squeegee raises when backing up. If it is desired to allow solution flow while in reverse this feature can be enabled. To enable or disable this feature, perform the following steps:

1. Turn the master on/off key switch to the off position.
2. Press and hold the solution switch.
3. While holding the solution switch turn the master on/off key switch to the on position.
4. Continue to hold the solution switch until the hourmeter/status display shows “OFF” or “on” and the solution indicator is green.
5. Release the solution switch.
6. Pressing and releasing the solution switch will now select between “on” or “OFF”. On means that the solution flow will be on while in reverse, off means that the solution flow will be stopped while in reverse.
7. To save the new setting, turn the master on/off key switch to the off position.
8. The new setting will be saved and will remain in effect until it is changed again.

ELECTRICAL SYSTEM

MAIN CONTROL BOARD SPECIAL PROGRAM OPTIONS FOR MACHINES AFTER SERIAL NUMBER 1362501 (CONTINUED)

VACUUM OFF WHEN SCRUB OFF SWITCH PRESSED OPTION:

FACTORY DEFAULT: ON

Normally, when the scrub system is turned off the vacuum is left on to allow recovery of any solution left on the floor and solution that will drip off of the scrub brushes/pads. If it is desired to have the vacuum system shut off when the scrub off switch is pressed this option can be selected. If this option is selected the squeegee will remain down until the scrub deck is in the up position. Once the scrub deck is up, the squeegee will raise and the vacuum motor will shut off approximately 10 seconds later. This is so that any residual water left in the vacuum hose will be recovered. To enable or disable this option perform the following steps:

1. Turn the master on/off key switch to the off position.
2. Press and hold the scrub off switch and the vacuum switch.
3. While holding both switches turn the master on/off key switch to the on position.
4. Continue to hold both switches until the hourmeter/status display shows “OFF” or “on” and the vacuum yellow indicator is lit.
5. Release both switches.
6. Pressing and releasing the vacuum switch will now select between “on” or “OFF”. On means that the vacuum will stay on when the scrub off switch is pressed, Off means that the vacuum will shut off after the scrub deck has raised and the 10 second delay has elapsed.
7. To save the new setting, turn the master on/off key switch to the off position.
8. The new setting will be saved and will remain in effect until it is changed again.

ENABLING OR DISABLING FAULT DETECTION:

FACTORY DEFAULT: ON

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

1. Turn the master on/off key switch to the off position.
2. Press and hold the scrub off switch and the solution switch.
3. While holding both switches turn the master on/off key switch to the on position.
4. Continue to hold both switches until the hourmeter/status display shows “OFF” or “on” and the solution yellow indicator is lit.
5. Release both switches.
6. Pressing and releasing the solution switch will now select between “on” or “OFF”. On means that the fault checking option is enabled, off means that the option is disabled.
7. To save the new setting, turn the master on/off key switch to the off position.
8. The new setting will be saved and will remain in effect until it is changed again.

BRUSH TYPE SELECTION:

FACTORY DEFAULT: cyl (cylindrical), disc (disc)

The 2800/BR700 can be equipped with two different scrub deck options. One uses cylindrical scrub brushes and the other uses standard disc type scrub brushes. This function configures the control unit current settings for each of the scrub deck types. To change from one type to the other:

1. Turn the master on/off key switch to the off position.
2. Press and hold the scrub off and heavy scrub switches.
3. While holding both switches turn the master on/off key switch to the on position.
4. Continue to hold both switches until the heavy scrub yellow indicator is lit and the hourmeter/status display shows “Cyl” or “dISC”
5. Release both switches.
6. Pressing and releasing the heavy scrub switch will now select between the two options.
7. To save the new setting, turn the master on/off key switch to the off position.
8. The new setting will be saved and will remain in effect until it is changed again.

MAIN CONTROL BOARD SPECIAL PROGRAM OPTIONS FOR MACHINES AFTER SERIAL NUMBER 1362501 (CONTINUED)

RAMP MODE FEATURE:

Under normal conditions the operator will use the throttle for accelerating and decelerating/stopping. This works well unless the machine is used to scrub on an inclined surface. In this case, using the throttle to decelerate (such as braking while going down hill) will cause the squeegee to raise and the solution flow to shut off; or allowing the throttle to go to neutral (such as coasting down hill) will cause the scrub brushes to stop. To prevent this the control unit can be placed into a "ramp mode". If the ramp mode is enabled *and selected*, the scrub brushes will continue to operate as will the vacuum and solution system even if the throttle is in neutral or reverse. In addition, the squeegee will not raise when in reverse. The ramp mode is *deselected* by pressing any of the three scrub switches (scrub off, normal scrub, heavy scrub) or if the operator gets off the seat. In order to be able to *select* the ramp mode, it must first be enabled. To enable this feature perform the following steps:

1. Turn the master on/off key switch to the off position.
2. Press and hold the horn and the normal scrub switches.
3. While holding both switches turn the master on/off key switch to the on position.
4. Continue to hold both switches until the hourmeter/status display shows "OFF" or "on" and the normal scrub green and yellow indicators are lit.
5. Release both switches.
6. Pressing and releasing the normal switch will now select between "on" or "OFF". On means that the ramp mode is enabled, off means that the ramp mode is disabled.
7. To save the new setting, turn the master on/off key switch to the off position.
8. The new setting will be saved and will remain in effect until it is changed again.

Once the ramp mode is enabled, it can be *selected* by pressing and holding either the normal or heavy scrub switches (whichever is currently selected) for approximately 1 second while scrubbing. The scrub motor must already be on to enter the ramp mode. While the ramp mode is active, the scrub indicator (either normal or heavy) will alternately flash between green and yellow. As mentioned above, pressing any of the scrub switches or getting off the seat will *deselect* the ramp mode. NOTE: when selecting the ramp mode, the scrub pressure will increment as soon as the scrub switch is pressed. After the one second delay the pressure will automatically be decremented to the original value.

BACK-UP ALARM VOLUME CONTROL:

The 2800/BR700 is equipped with an audible warning device which functions as both a horn and a back-up alarm. The volume of the back-up alarm can be adjusted to one of ten settings. Off is the minimum setting and 9 is the maximum setting. To change the back-up alarm volume perform the following steps:

1. Turn the master on/off key switch to the off position.
2. Press and hold the horn switch.
3. While holding the horn switch turn the master on/off key switch to the on position.
4. Continue to hold the horn switch until the hourmeter/status display shows "OFF" or a number from one to nine depending on the current volume setting.
5. Release the horn switch.
6. Pressing and releasing the horn switch will now select the volume level. The level will increment from OFF to 9. 9 being the loudest. To hear the back-up alarm volume select the reverse direction by pressing lightly on the throttle.
7. To save the new setting, turn the master on/off key switch to the off position.
8. The new setting will be saved and will remain in effect until it is changed again.

ELECTRICAL SYSTEM

SERVICE TEST MODE FOR MACHINES AFTER SERIAL NUMBER 1362501

To assist in the troubleshooting and servicing of the electrical system and related components on the 2800/BR700 scrubbers, a special test mode which allows independent control of the various outputs and monitoring of the various inputs has been incorporated.

To enter the service test mode perform the following steps:

1. Turn the master on/off key switch to the off position.
2. Press and hold the scrub off and normal scrub switches.
3. While holding both switches turn the master on/off key switch to the on position.
4. Continue to hold both switches until the hourmeter/status display shows “test”.
5. Release both switches.
6. The function of each switch and indicator is described below.
7. To exit this mode turn the master on/off key switch to the off position.

Input Indicators:

Battery status red indicator (1):
Speed control status signal. This is an output from the speed control to the main control unit that indicates the status of the speed control. Normally this indicator will be on whenever the key is on. If there is a speed control fault this indicator will flash the fault code produced by the speed control. This is an active high signal. (High state = approximately 24 volts, low state = approximately 0 volts).

Battery status yellow indicator (2):
Speed control forward/reverse signal. This is an output from the speed control to the main control unit that indicates when the throttle has been moved from the neutral position either forward or reverse. The yellow indicator will be lit if this signal is active low. (High state = approximately 24 volts, low state = approximately 0 volts).

Battery status green indicator (3):
Speed control forward signal. This is an output from the speed control to the main control unit that indicates when the throttle has been moved in the forward direction. The green indicator will be lit if this signal is active high. (High state = approximately 24 volts, low state = approximately 0 volts).

Status Display (4):

If no over-current faults are present, the status display will show the battery voltage. This display is accurate to within +/- 0.15 volts. Therefore, the voltage displayed may not correlate precisely to a high-accuracy, calibrated voltmeter.

The leftmost digit of the display is used to indicate the current direction for the pad/brush lift actuator and squeegee lift actuators. This will be described in detail in the sections pertaining to the control of the actuator outputs.

If over-current faults are present, the status display will indicate the fault codes.

Output Controls:

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

Horn switch (20): Used to jog actuators.
Scrub off switch (15): Controls pad/brush motor.
Normal scrub switch (16): Controls pad/brush lift actuator.
Heavy scrub switch (17): Controls squeegee lift actuator.
Vacuum switch (18): Controls vacuum.
Solution switch (19): Controls solution solenoid.

SERVICE TEST MODE FOR MACHINES AFTER SERIAL NUMBER 1362501 (CONTINUED)

Horn Switch (20):
This switch is used to momentarily activate either the pad/brush lift actuator or the squeegee lift actuator. See the descriptions below for more details.

Scrub Off Switch (15):
This switch is used to toggle the state of the pad/brush motor. Pressing and releasing this switch will alternately turn the pad/brush motor on and off . The indicator (9) provides the following status information:
Off - Pad/brush output is off and there is no current flow through the contactor coil and no pad/brush motor current sensed.
Green - Pad/brush output is on and there is normal current flow through the contactor coil and normal pad/brush motor current sensed.
Flashing red - Either the pad/brush motor output is off and there is current flow through the coil or pad/brush motor current is sensed (shorted output driver, control error, shorted contactor, wiring error) or the pad/brush motor output is on and there is no current flow through the coil or no pad/brush motor current is sensed (open circuit, open relay coil, open contactor contacts, wiring error or open output driver).

Normal Scrub Switch (16):
This switch is used to control the output to the pad/brush 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
3 - output off, direction = down
4 - output on, direction = up

When the output is in state 1, the actuator output is turned off. The pad actuator up indicator (5) will be lit and the normal scrub indicator (10) should be off. If the indicator (10) is flashing yellow, this indicates that the control is sensing current flow through the actuator (shorted output driver, control error). If the up indicator (5) is flashing, this indicates that the pad/brush lift system is currently selected. This means that it is possible to momentarily activate the actuator output using the horn switch (20) 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 pad actuator down indicator (6) will be lit and the normal scrub indicator (10) 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 horn switch has no effect in this state.

When the output is in state 3, the actuator output is turned off. The pad actuator down indicator (6) will be lit and the normal scrub indicator (10) should be off. If the indicator (10) is flashing yellow, this indicates that the control is sensing current flow through the actuator (shorted output driver, control error). If the down indicator (6) is flashing, this indicates that the pad/brush lift system is currently selected. This means that it is possible to momentarily activate the actuator output using the horn switch (20) 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 pad actuator up indicator (5) will be lit and the normal scrub indicator (10) 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 horn switch has no effect in this state.

ELECTRICAL SYSTEM

SERVICE TEST MODE FOR MACHINES AFTER SERIAL NUMBER 1362501 (CONTINUED)

Heavy Scrub Switch (17):
This switch is used to control the output to the squeegee 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
3 - output off, direction = down
4 - output on, direction = up

When the output is in state 1, the actuator output is turned off. The squeegee actuator up indicator (7) will be lit and the heavy scrub indicator (11) should be off. If the indicator (11) is flashing yellow, this indicates that the control is sensing current flow through the actuator (shorted output driver, control error). If the up indicator (7) is flashing, this indicates that the squeegee lift system is currently selected. This means that it is possible to momentarily activate the actuator output using the horn switch (20) 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 squeegee actuator down indicator (8) will be lit and the heavy scrub indicator (11) 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 horn switch has no effect in this state.

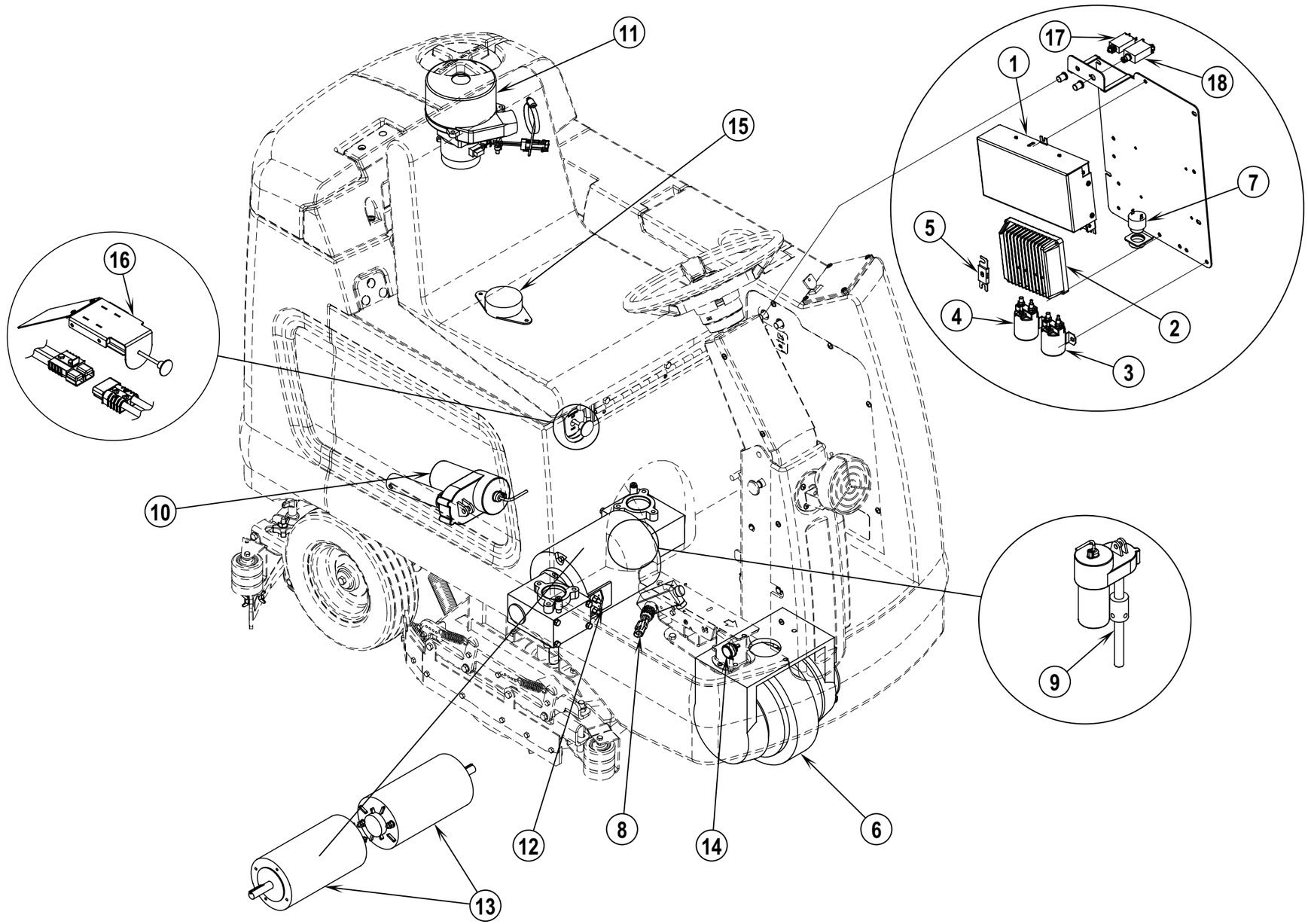
When the output is in state 3, the actuator output is turned off. The squeegee actuator down indicator (8) will be lit and the heavy scrub indicator (11) should be off. If the indicator (11) is flashing yellow, this indicates that the control is sensing current flow through the actuator (shorted output driver, control error). If the down indicator (8) is flashing, this indicates that the squeegee lift system is currently selected. This means that it is possible to momentarily activate the actuator output using the horn switch (20) 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 squeegee actuator up indicator (7) will be lit and the heavy scrub indicator (11) 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 horn switch has no effect in this state.

Vacuum Switch (18):
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 (12) provides the following status information:
Off - Vacuum output is off and there is no current flow through the contactor coil and no vacuum motor current sensed.
Green - Vacuum output is on and there is normal current flow through the contactor coil and normal vacuum motor current sensed.
Flashing yellow - Either the vacuum motor output is off and there is current flow through the coil or vacuum motor current is sensed (shorted output driver, control error, shorted contactor, wiring error) or the vacuum motor output is on and there is no current flow through the coil or no vacuum motor current is sensed (open circuit, open relay coil, open contactor contacts, wiring error or open output driver).

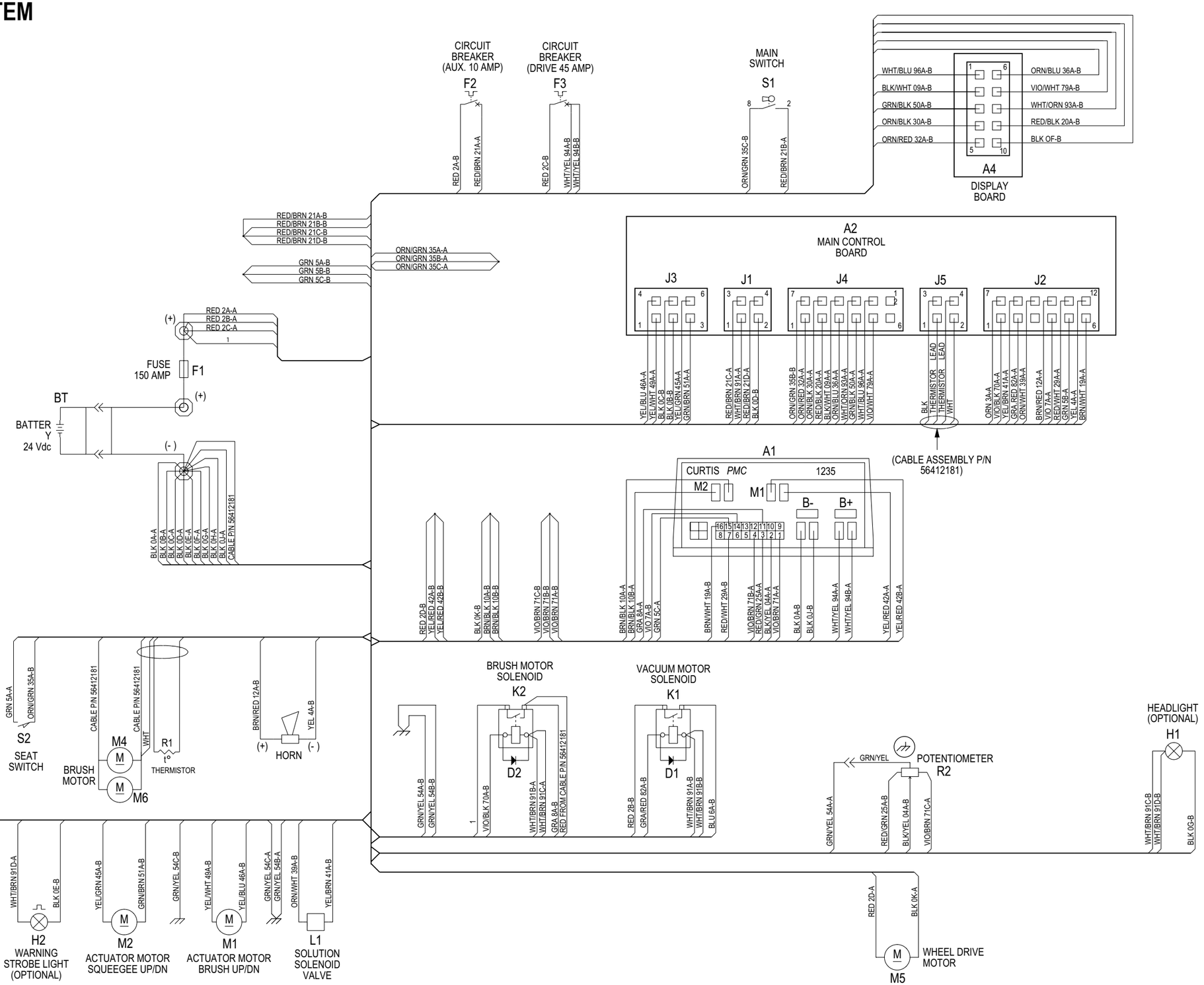
Solution Switch (19):
This switch is used to toggle the state of the solution solenoid. Pressing and releasing this switch will alternately turn the solution solenoid on and off. The indicator (13) provides the following status information:
Off - Solenoid output is off and there is no current flow through the solenoid coil.
Green - Solenoid output is on and there is normal current flow through the solenoid coil.
Flashing yellow - Either the solenoid output is off and there is current flow through the coil (shorted output driver or control error) or the solenoid output is on and there is no current flow through the coil (open circuit, open solenoid coil, or open output driver).

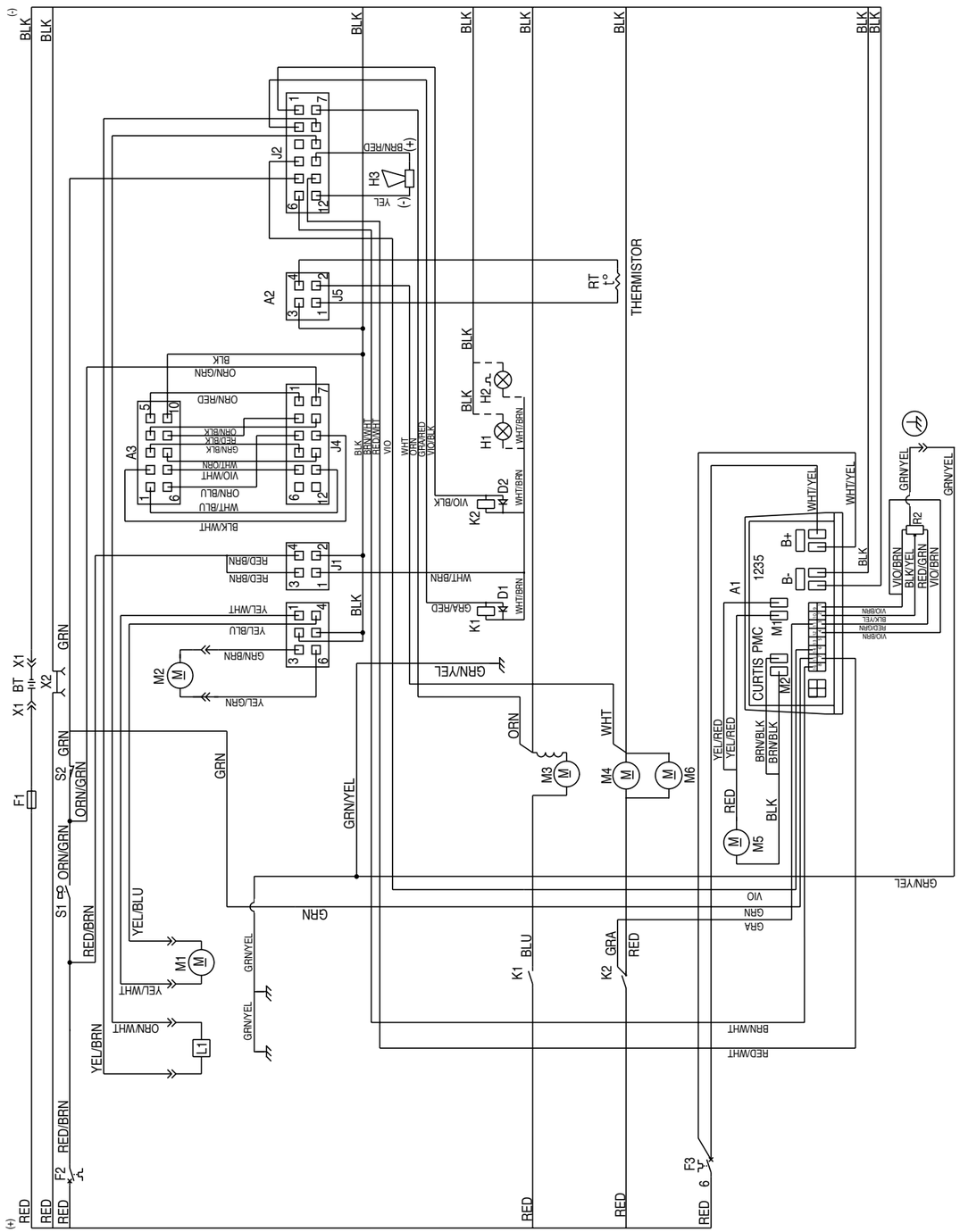
COMPONENT LOCATION



Item	Description
1	Control Box Assembly **(Main)**
2	Controller, Speed
3	Contactor **(Brush Motor)**
4	Contactor **(Vac Motor)**
5	150 Amp Fuse
6	Wheel Motor
7	Horn / Back-Up Alarm
8	Water Solenoid Valve
9	Brush, Lift Actuator Motor
10	Squeegee, Lift Actuator Motor
11	Vac Motor
12	Brush Motor **(Disc)**
13	Brush Motors **(Cylindrical)**
14	Throttle Potentiometer
15	Seat Switch
16	Emergency Disconnect, Battery
17	Circuit Breaker 10 Amp
18	Circuit Breaker 45 Amp

ELECTRICAL SYSTEM





SCHEMATIC / WIRING DIAGRAM

A1	Controller, Speed	L1	Valve, Solution Solenoid
A2	Main Control Board		
A3	Display PCB Assembly	M1	Lift Actuator (Brush)
		M2	Lift Actuator (Squeegee)
BT	Battery, 24V	M3	Motor (Vac)
		M4	Motor, Brush (Disc) – (Cylindrical)
D1	Diode	M5	Motor, Wheel Drive
D2	Diode	M6	Motor, Brush (Cylindrical Only)*
F1	Fuse Clamp, 150 Amp	R1	Thermistor
F2	Circuit Breaker, 10 Amp (Control)	R2	Potentiometer 5K Ohm
F3	Circuit Breaker, 45 Amp (Wheel Drive)		
		S1	Switch (Key)
H1	Headlight Kit (Optional)	S2	Switch (Seat)
H2	Beacon kit (Optional)		
H3	Horn / Back-Up Alarm 24V	X1	Battery Plug Assembly
		X2	Charger Plug Assembly
K1	Solenoid (Vac Motor)		
K2	Solenoid (Brush Motor)		

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