TENNANT®

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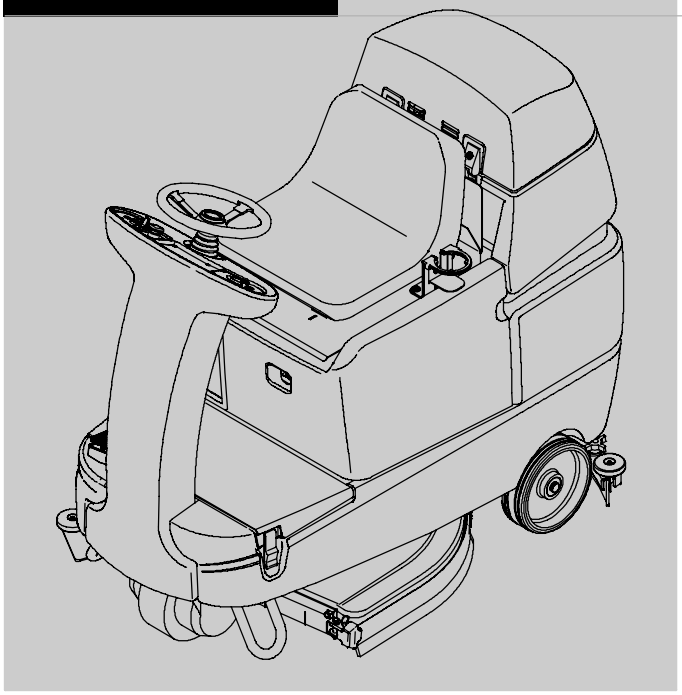


Rider-Scrubber
Service Information Manual

FaST®
Foam Scrubbing Technology

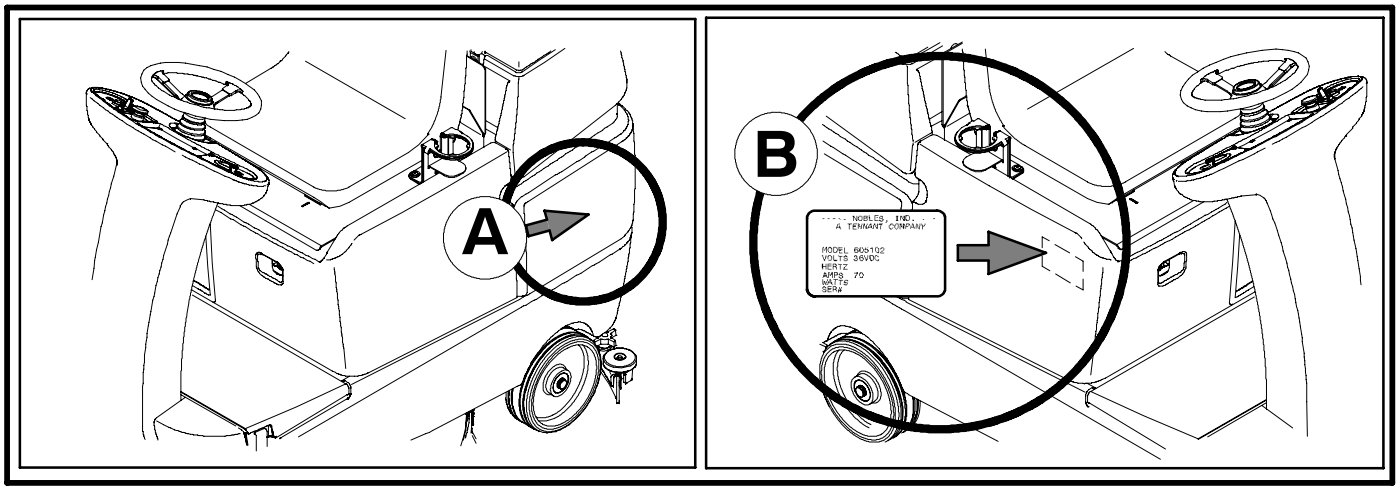
The Safe Scrubbing Alternative®

Hygenic® Fully Cleanable Tanks

North America / International

331045
Rev. 01 (09-2008)

www.tennantco.com



FOR REPLACEMENT PARTS

Identify machine model and serial number.

1. **(A)** Identify the machine model.
2. **(B)** Identify the machine serial number from the data plate.

Refer to the TENNANT Parts Manual.

NOTE: Only use TENNANT Company supplied or equivalent parts. Parts and supplies may be ordered online, by phone, by fax or by mail.

Tennant Company
PO Box 1452
Minneapolis, MN 55440
Phone: (800) 553-8033 or (763) 513-2850
www.tennantco.com

SAFETY PRECAUTIONS

The following symbols are used throughout this manual as indicated in the descriptions:

WARNING: To warn of hazards or unsafe practices that could result in severe personal injury or death.

FOR SAFETY: To identify actions that must be followed for safe operation of equipment.

This machine is designed solely for cleaning smooth flooring in an indoor environment. Tennant does not recommend using this machine in any other environment.

The following information signals potentially dangerous conditions to the operator or equipment. Read this manual carefully. Know when these conditions can exist. Locate all safety devices on the machine. Then, take necessary steps to train machine operating personnel. Report machine damage or faulty operation immediately. Do not use the machine if it is not in proper operating condition.

WARNING: Batteries emit hydrogen gas. Explosion or fire can result. Keep sparks and open flame away. Keep covers open when charging.

WARNING: Flammable materials can cause an explosion or fire. Do not use flammable materials in tank(s).

WARNING: Flammable materials or reactive metals can cause an explosion or fire. Do not pick up.

FOR SAFETY:

1. **Do not operate machine:**
   - **Unless trained and authorized.**
   - **With brake disabled.**
   - **Unless operation manual is read and understood.**
   - **In flammable or explosive areas.**
   - **In areas with possible falling objects.**
2. **Before starting machine:**
   - **Make sure all safety devices are in place and operate properly.**
   - **Check brakes and steering for proper operation.**
3. **When using machine:**
   - **Go slow on inclines and slippery surfaces.**
   - **Use care when backing machine.**
   - **Report machine damage or faulty operation immediately.**
   - **Follow mixing and handling instructions on chemical containers.**
4. **Before leaving or servicing machine:**
   - **Stop on level surface.**
   - **Turn off machine and remove key.**
5. **When servicing machine:**
   - **Do not push or tow the machine on inclines with the brake disabled.**
   - **Avoid moving parts. Do not wear loose jackets, shirts, or sleeves when working on machine.**
   - **Block machine tires before jacking machine up.**
   - **Jack machine up at designated locations only. Block machine up with jack stands.**
   - **Use hoist or jack that will support the weight of the machine.**
   - **Wear eye and ear protection when using pressurized air or water.**
   - **Wear protective gloves when handling batteries or battery cables.**
   - **Disconnect battery connections before working on machine.**
   - **Avoid contact with battery acid.**
   - **Do not power spray or hose off machine. Electrical malfunction may occur.**
   - **Use Tennant supplied or equivalent replacement parts.**
6. **When loading/unloading machine onto/off truck or trailer:**
   - **Drain tanks before loading machine.**
   - **Turn off machine.**
   - **Use truck or trailer that will support the weight of the machine.**
   - **Block machine tires.**
   - **Lower scrub head and squeegee before tying down machine.**
   - **Tie machine down to truck or trailer.**

GENERAL MACHINE INFORMATION

BEFORE CONDUCTING TESTS:

* Read and Follow ALL Safety Warnings and Precautions as mentioned at the beginning of this manual

* Always unhook Battery when removing or replacing components

DURING TESTS:

* Call Technical Services if Diagnostic Time Exceeds One Hour With Unknown Cause or Course of Action

NOTE: Troubleshooting charts may be shown with optional equipment. The optional equipment may not be specified in these charts. Some machines may not be equipped with all components shown.

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Component Locator

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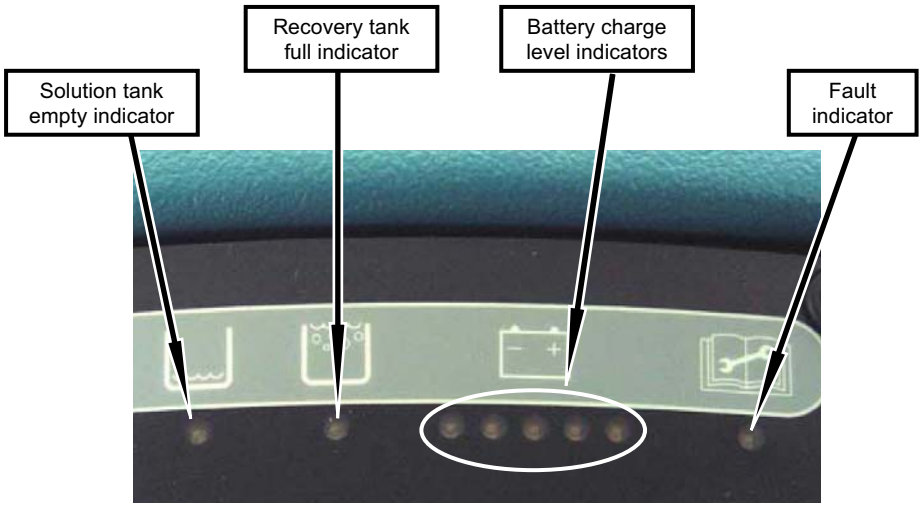
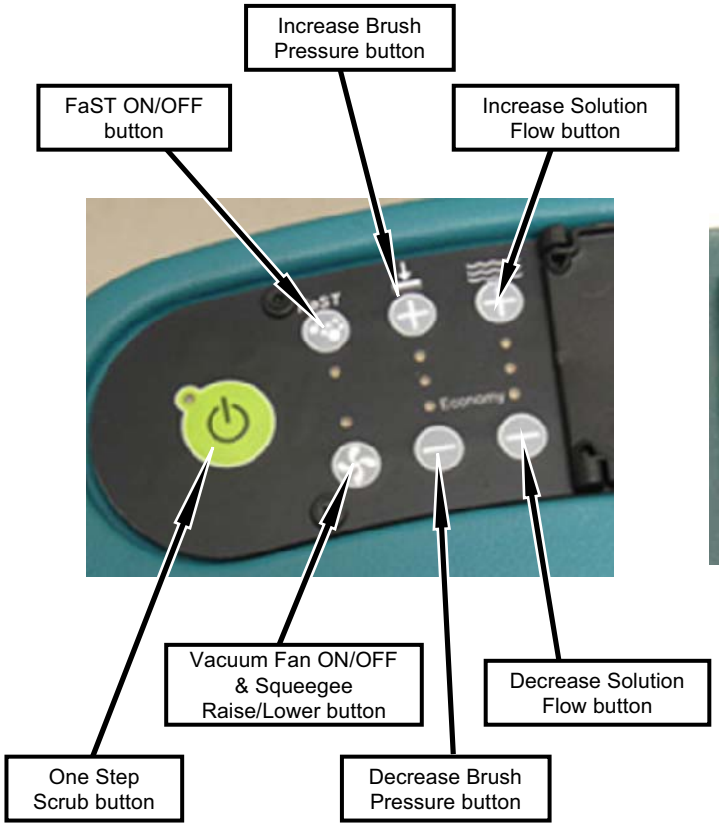
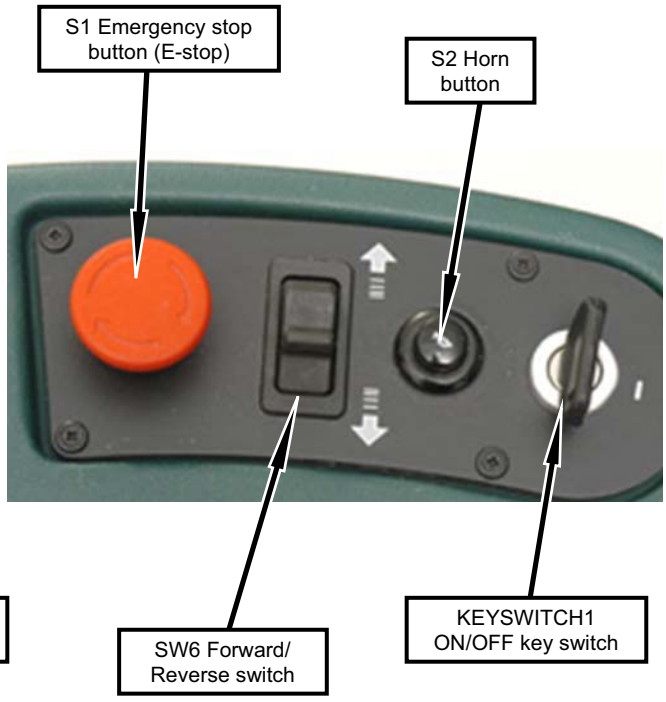
Operator Panel Details







Component Locator

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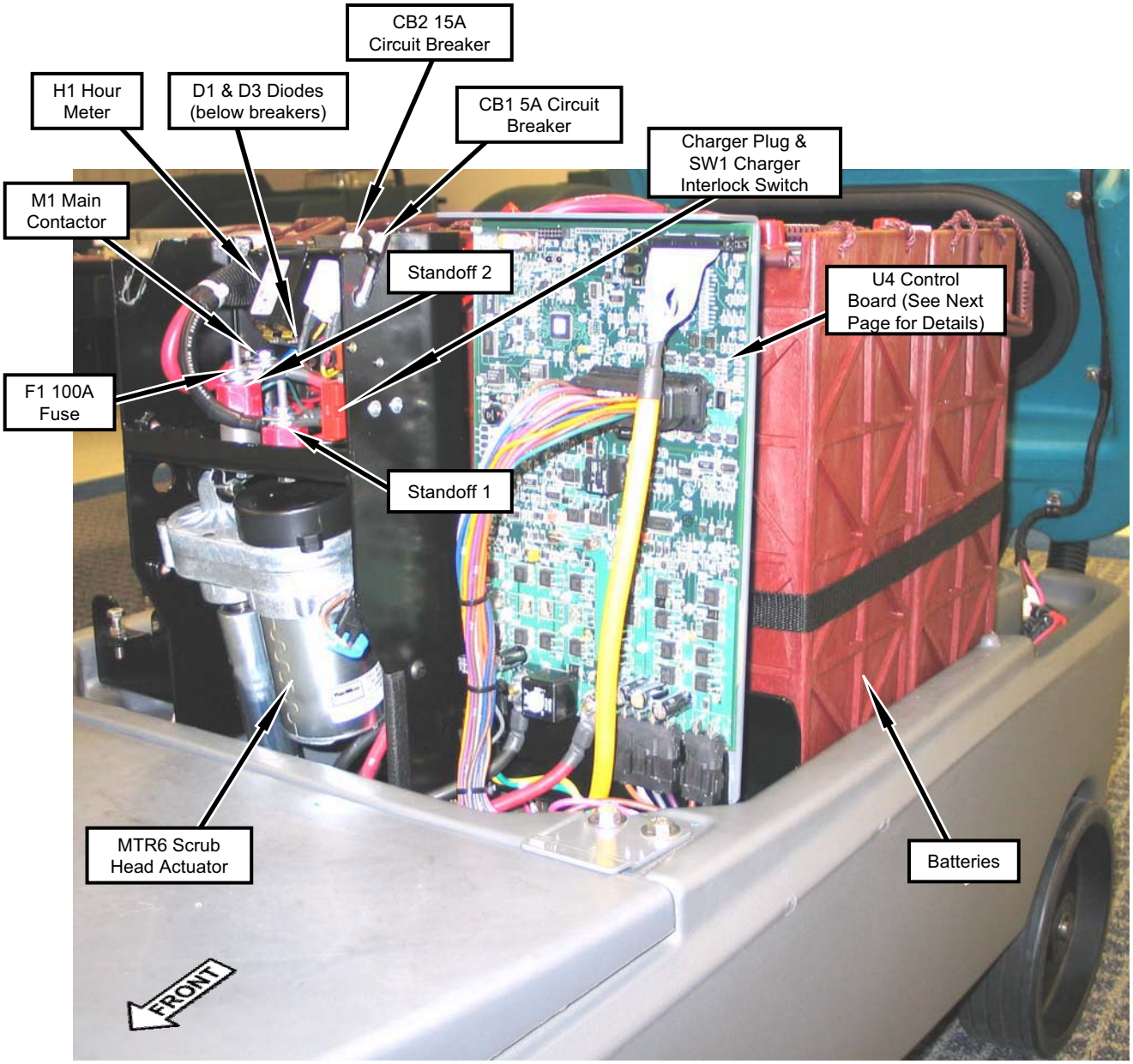
Electrical Panel Details



Shown with seat and battery shroud removed

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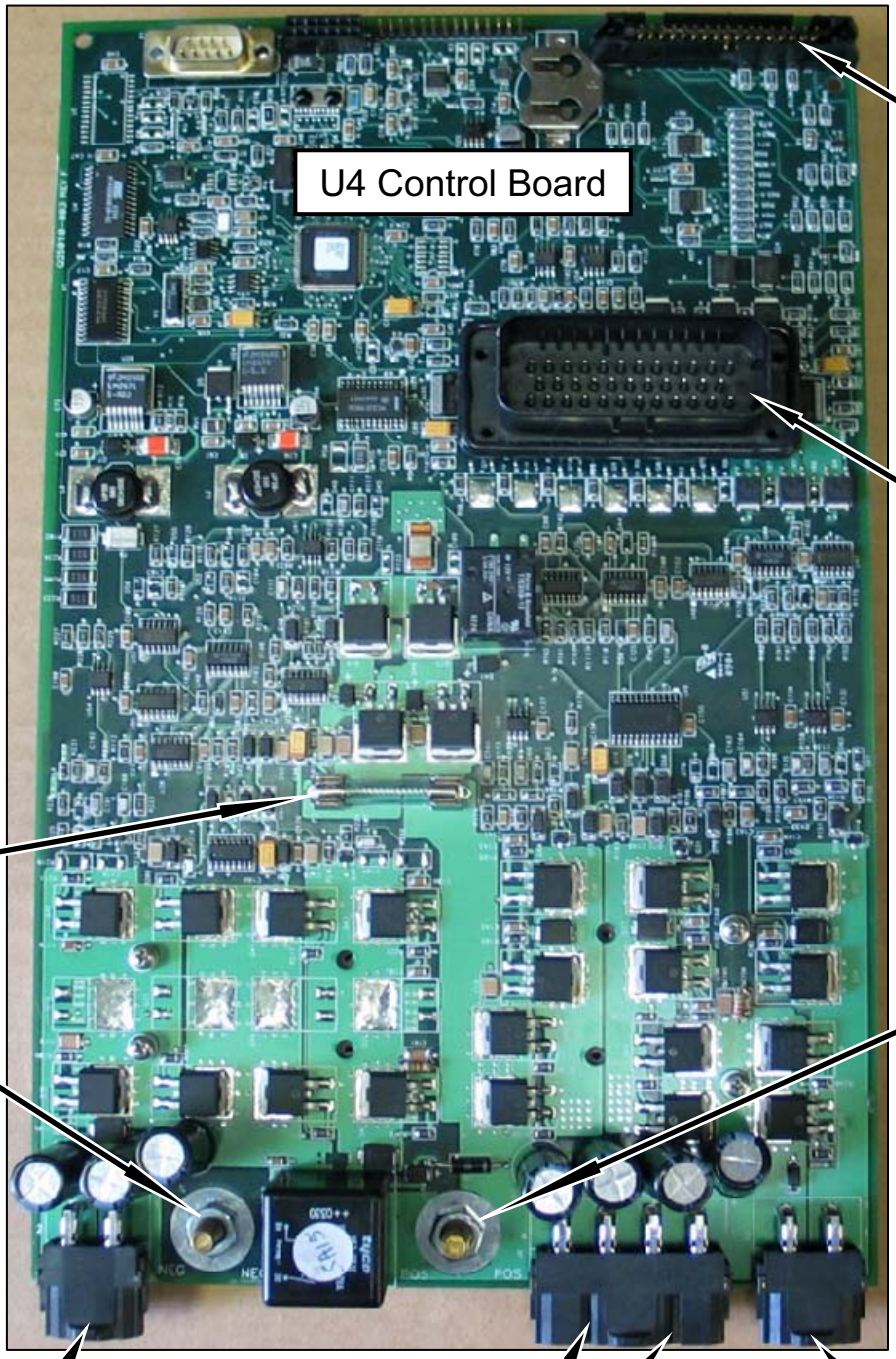
Component Locator

(Page 3 of 5)

Control Board Details



Component Locator

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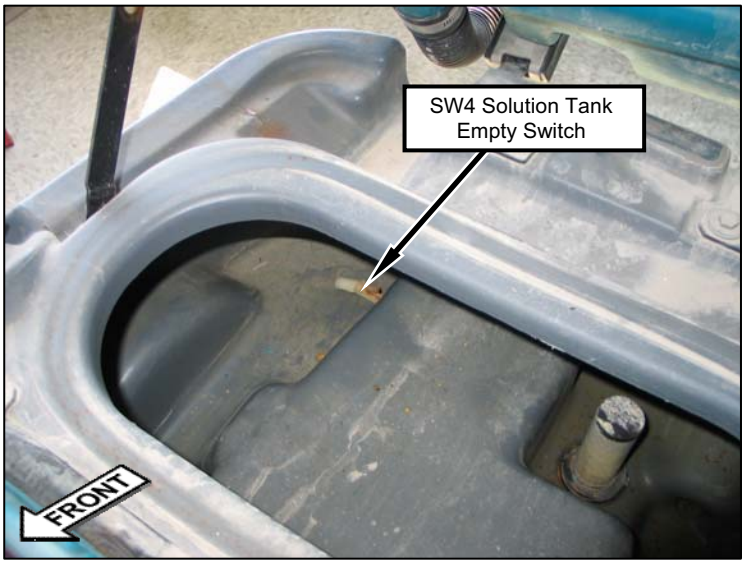
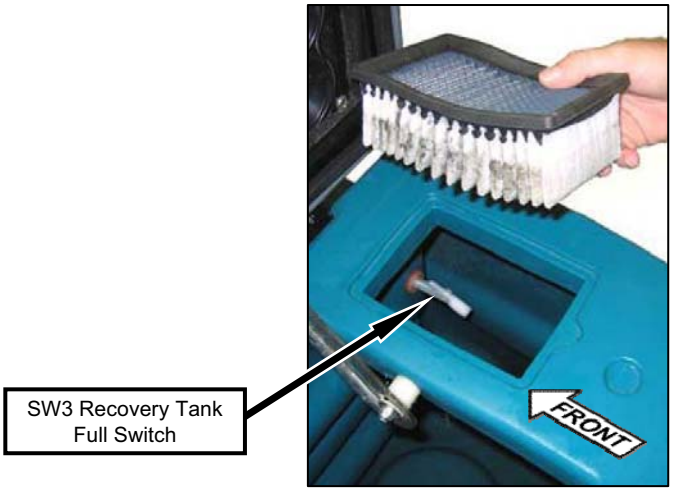
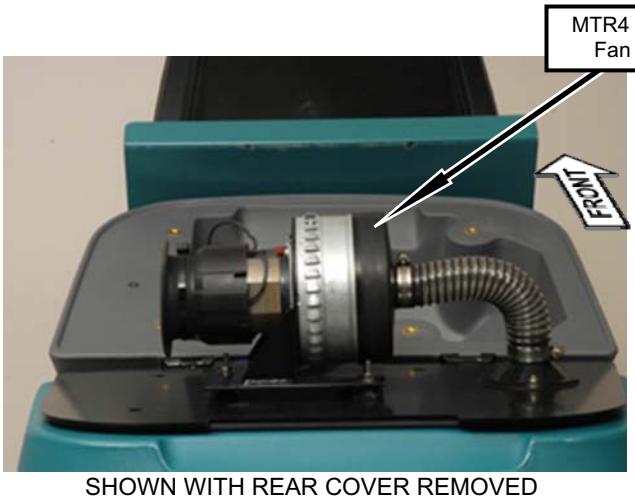
Rear Machine Area Details







SHOWN WITH REAR COVER REMOVED

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Component Locator

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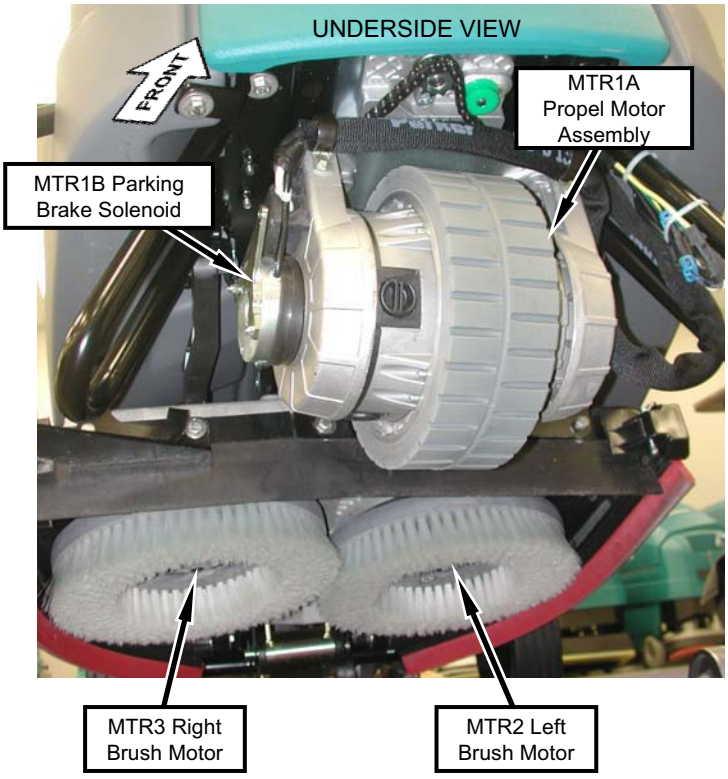

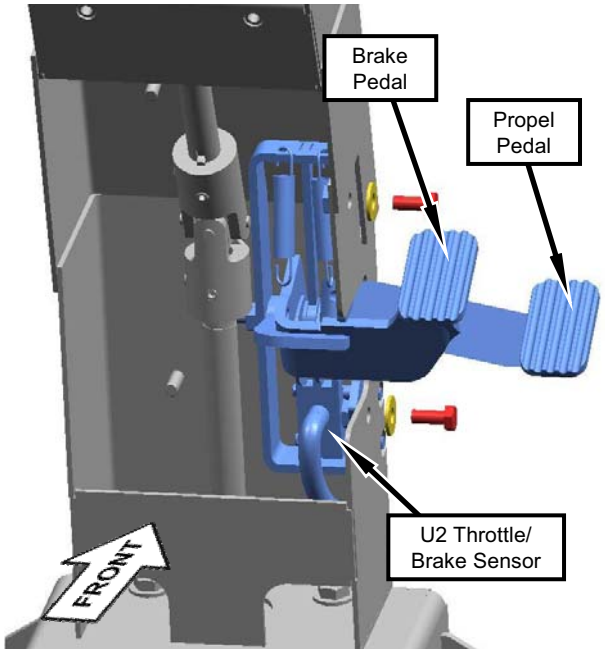

SHOWN WITH STEERING COLUMN COVER REMOVED

SPECIFICATIONS

GENERAL MACHINE DIMENSIONS/CAPACITIES

Item	Disk 650 mm (26 in)	Cylinderical 700 mm (28 in)	Disk 800 mm (32 in)	Cylinderical 800 mm (32 in)
Length	1520 mm (60 in)			
Height	1270 mm (50 in)			
Width / frame	740 mm (29 in)	810 mm (31.7 in)	740 mm (29 in)	810 mm (31.7 in)
Width / machine with scrub head	800 mm (31.5 in)	830 mm (32.5 in)	910 mm (36 in)	930 mm (36.5 in)
Width / rear squeegee (roller to roller)	850 mm (33.25 in)	850 mm (33.25 in)	1000 mm (39.25 in)	1000 mm (39.25 in)
Brush diameter	330 mm (13 in)	150 mm (6 in)	410 mm (16 in)	150 mm (6 in)
Brush length	–	700 mm (28 in)	–	800 mm (32 in)
Scrubbing path width	650 mm (26 in)	700 mm (28 in)	800 mm (32 in)	800 mm (32 in)
Solution tank capacity	110 L (29 gallons)			
Recovery tank capacity	110 L (29 gallons)			
Weight/net less batteries	265 Kg (585 lbs)	287 kg (632 lbs)	265 Kg (585 lbs)	296 kg (653 lbs)
Weight/with standard battery package	386 Kg (850 lbs)	407 kg (897 lbs)	386 Kg (850 lbs)	416 kg (918 lbs)
Weight/with heavy duty battery package	443 Kg (975 lbs)	464 kg (1022 lbs)	443 Kg (975 lbs)	473 kg (1043 lbs)
GVWR	675 Kg (1485 lbs)			
Operating Sound Level At Operator Ear	67 dB(A)	69 dB(A)	67 dB(A)	69 dB(A)
Vibration level at steering wheel	0.2 m/s^2			

GENERAL MACHINE PERFORMANCE

Item	Measure
Aisle turnaround width for 650 mm (26 in) scrub head	1730 mm (68.5 in)
Aisle turnaround width for 800 mm (32 in) scrub head	1840 mm (72.5 in)
Travel Speed (maximum)	6.4 Km/h (4 mph)
Maximum rated climb and descent angle with full tanks	6°/10.5%
Maximum rated climb and descent angle with empty tanks	11°/19.25%
Maximum rated climb and descent angle when scrubbing	4°/7%

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POWER TYPE

Type	Quantity	Volts	Ah Rating	Weight (Each)
Batteries (standard lead acid)	4	6	235 @ 20 hr rate	30.0 kg (66 lb)
Batteries (heavy duty aead acid)	4	6	335 @ 20 hr rate	44.5 kg (97.5 lb)
Batteries (Gel)	4	6	180 @ 20 hr rate	30.0 kg (66 lb)
Batteries (heavy duty Gel)	4	6	220 @ 20 hr rate	30.0 kg (66 lb)

Type	Use	VDC	kW (hp)
Electric Motors	Scrub brush (Disk)	24	0.45 kW (0.6 hp)
	Scrub brush (Cylinderical)	24	0.50 kW (0.75 hp)
	Vacuum fan	24	0.45 kW (0.6 hp)
	Propelling	24	0.85 kW (1.1 hp)

Type	VDC	amp	Hz	Phase	VAC
Chargers (Smart)	24	20	60	1	120
	24	25	60	1	120
Chargers (Gel/Agm)	24	20	60?	1	120
	24	20	50 / 60	1	240
Chargers (On-Board)	24	25	50 / 60	1	115

TIRES

Location	Type	Size
Front (1)	Solid	90 mm wide x 260 mm OD (3.5 in wide x 10 in OD)
Rear (2)	Solid	80 mm wide x 260 mm OD (3.0 in wide x 10 in OD)

FaST SYSTEM (OPTION)

Item	Measure
Solution pump	24 Volt DC, 5A, 5.7 LPM (1.5 GPM) open flow, 70 psi bypass setting
Solution flow rate	1.1 LPM (0.30 GPM)
Detergent to water dilution ratio	1:1000
Detergent flow rate	1.35 CC/Minute (0.046 Ounces/Minute)

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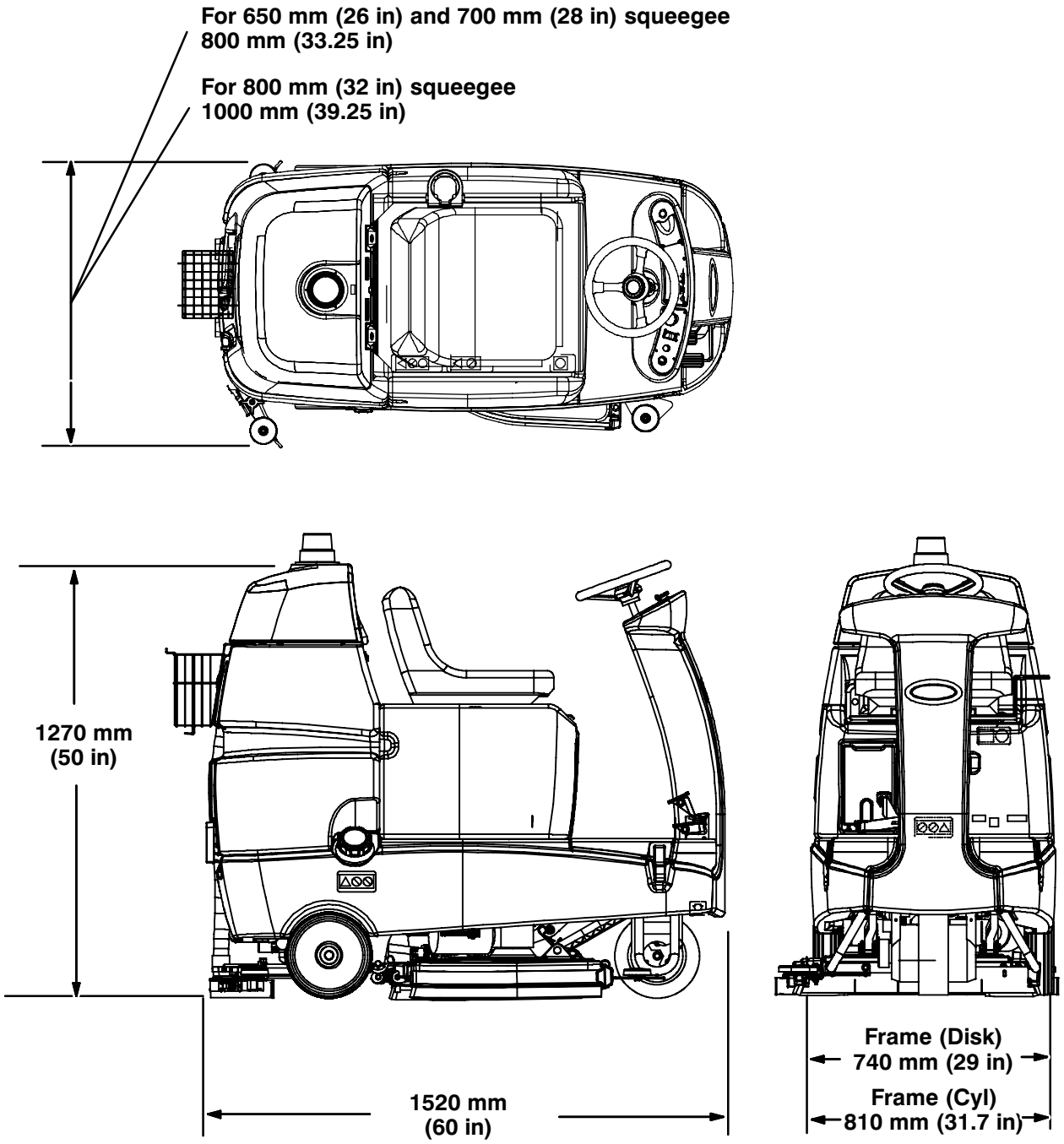
MACHINE DIMENSIONS



MAINTENANCE & REPAIR

BEFORE CONDUCTING TESTS:

* Read and Follow ALL Safety Warnings and Precautions as mentioned at the beginning of this manual
* Always unhook Battery when removing or replacing electrical components

DURING TESTS:

* Call Technical Services if Diagnostic Time Exceeds One Hour With Unknown Cause or Course of Action

NOTE: Troubleshooting charts may be shown with optional equipment. The optional equipment may not be specified in these charts. Some machines may not be equipped with all components shown.

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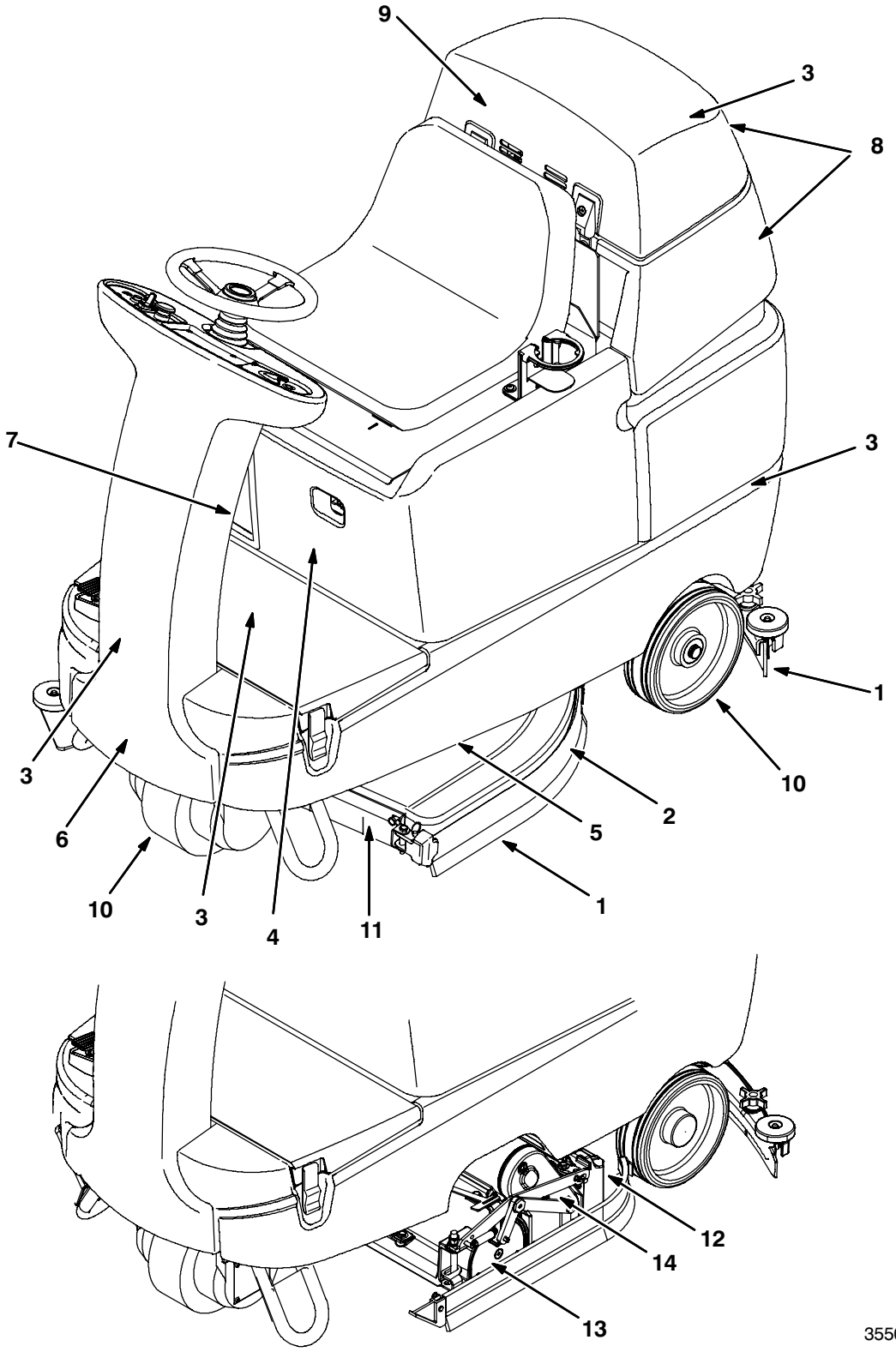
MAINTENANCE POINTS



MAINTENANCE CHART

Interval	Key	Description	Procedure	Lubricant/ Fluid	No. of Service Points
Daily	1	Side and rear squeegees	Check for damage and wear	–	3
			Check deflection and leveling	–	6
	2	Scrub brushes / pads	Check for damage, wear, debris	–	2
	8	Recovery tank	Clean tank, screen filter, and float sensor	–	1
	9	Vacuum fan filter	Clean	–	1
	7	FaST–PAK supply hose and connector (option)	Clean and connect hose to storing plug when not in use	–	1
	12	Debris tray (Cylindrical brushes)	Clean	–	1
50 Hours	4	Battery cells (Lead acid batteries)	Check electrolyte level	DW	3
	11	Disk scrub head floor skirt	Check for damage and wear	–	2
	13	Cylindrical brushes	Check taper and rotate front to rear	–	2
100 Hours	3	Vacuum Fan and tank seals	Check for damage and wear	–	3
	14	Cylindrical brush drive belts	Check tension	–	2
200 Hours	4	Battery terminals and cables	Check and clean	–	12
500 Hours	9	Vacuum fan motor(s)	Check motor brushes	–	1
	5	Scrub brush motors	Check motor brushes	–	2
	6	Propelling motor	Check motor brushes	–	1
	10	Tires	Check for damage and wear	–	3

LUBRICANT/FLUID

DW . . . . Distilled water

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BATTERIES

The batteries are designed to hold their power for long periods of time. The lifetime of the batteries is limited to number of charges the batteries receive. To get the most life from the batteries, recharge them immediately when the battery discharge indicator begins to blink.

FOR SAFETY: When servicing machine, wear protective gloves when handling batteries or battery cables. Avoid contact with battery acid.

After every 200 hours of use check for loose battery connections and clean the surface of the batteries, including terminals and cable clamps, using a strong solution of baking soda and water. Brush the solution sparingly over the battery tops. Do not allow any baking soda solution to enter the batteries. Use a wire brush to clean the terminal posts and the cable connectors. Wipe off all cleaning solution residue. After cleaning, apply a coating of clear battery post protectant to the terminals and the cable connectors. Keep the tops of the batteries clean and dry.

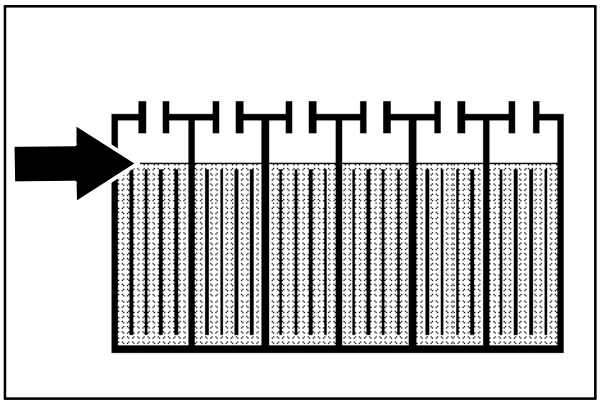
Objects made of metal can potentially short circuit the batteries. Keep all metallic objects off the batteries. Replace any worn or damaged wires. Replace any defective batteries. To dispose of batteries, contact a battery dealer or your Tennant Service representative.

GEL BATTERIES

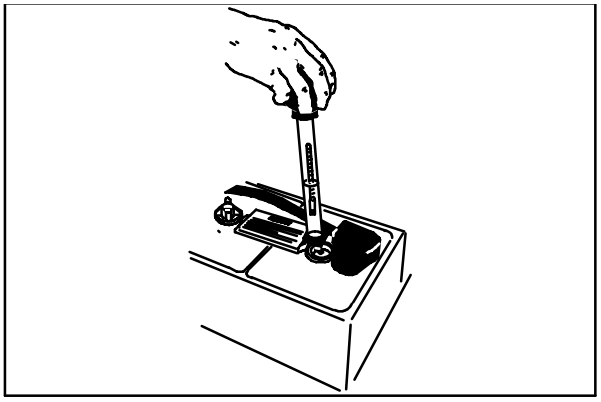
The Gel batteries are maintenance free and do not need to have the electrolyte level checked.

LEAD ACID BATTERIES

Check the electrolyte level in each battery cell before and after charging, and after every 50 hours of operation. Never add acid to the batteries. Add distilled water *only*. Always keep the battery caps on, except when adding water or taking hydrometer readings.



Using a hydrometer, measure the specific gravity to determine the charge level and condition of the batteries. If one or more of the battery cells test lower than the other battery cells (0.050 or more), the cell is damaged, shorted, or is near failure. Completely recharge the batteries and then retest.



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NOTE: Do not take readings immediately after adding distilled water. If the water and acid are not thoroughly mixed, the readings may not be accurate. Check the hydrometer readings against the following chart to determine the remaining battery charge level:

SPECIFIC GRAVITY at 27° C (80°F)	BATTERY CHARGE
1.265	100% Charged
1.223	75% Charged
1.185	50% Charged
1.148	25% Charged
1.110	Discharged

NOTE: If the readings are taken when the battery electrolyte is any temperature other than 27° C (80° F), the reading must be temperature corrected. Add or subtract to the specific gravity reading 0.004, 4 points, for each 6° C(10° F) above or below 27°C(80° F).

CHARGING THE BATTERIES WITH OFF-BOARD CHARGER

1. Drive the machine to a flat, dry surface.

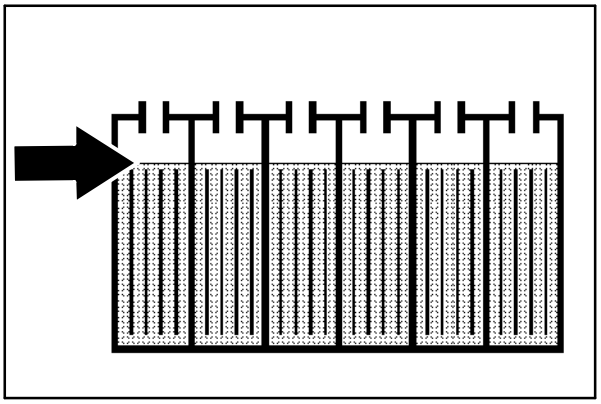
NOTE: Make sure the area is well ventilated.

2. Turn the machine *ON/OFF key switch* off.

FOR SAFETY: Before leaving or servicing machine, stop on level surface, and turn off machine.

3. Tilt the operator seat forward and hook the seat latch into place to hold up the seat

4. Lead acid batteries: Check the water level in all battery cells. If the level is low, add just enough distilled water to cover the plates. DO NOT OVERFILL. The batteries can overflow during charging due to expansion.

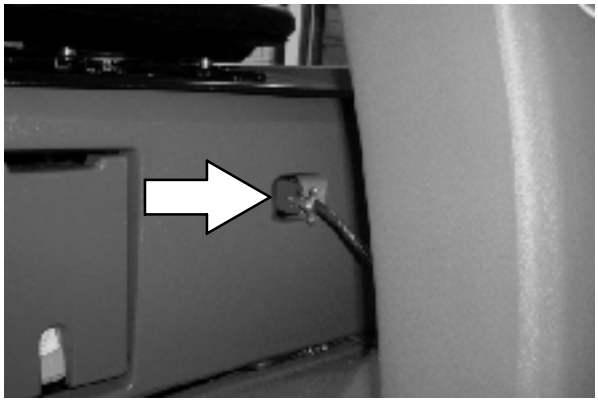


NOTE: Make sure the battery caps are in place while charging.

FOR SAFETY: When servicing machine, wear protective gloves when handling batteries or battery cables. Avoid contact with battery acid.

5. Plug the charger connector into the machine battery charging connector.

WARNING: Batteries emit hydrogen gas. Explosion or fire can result. Keep sparks and open flame away. Keep covers open when charging.



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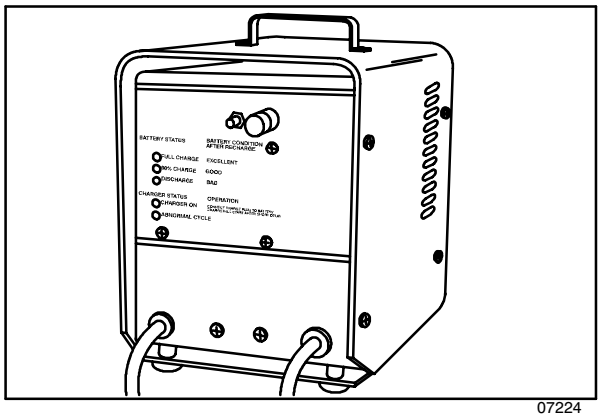
6. Plug the battery charger into the wall outlet.

NOTE: If the red "ABNORMAL CYCLE" lamp lights when the TENNANT charger is plugged into a wall outlet, the charger cannot charge the battery and there is something wrong with the battery.



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7. The TENNANT charger will start automatically. When the batteries are fully charged, the TENNANT charger will automatically turn off.

NOTE: Do not disconnect he charger's DC cord from the machine's battery charging connector when the charger is operating. Arcing may result. If the charger must be interrupted during charging, disconnect the AC power supply cord first.

8. After the charger has turned off, unplug the charger from the machine battery charging connector.

9. Lead acid batteries: Check the electrolyte level in each battery cell after charging. If needed, add distilled water to raise the electrolyte level to about 12 mm (0.4 in) below the bottom of the sight tubes.

10. Unhook the seat latch and lower the operator seat.

CHECKING ON-BOARD BATTERY CHARGER SETTINGS

If your machine is equipped with the on-board charger, the charger settings must be set for your battery type before charging. Failure to properly set will result in battery damage.

To determine your battery type, see battery label. Contact your battery supplier if not specified.

To verify the setting of the charger, connect the charger cord into an electrical receptacle. The charger will display a sequence of codes. One of the codes will either read "GEL" or "Acd".

GEL = Set for sealed/maintenance free batteries.
Acd = Set for wet/lead acid batteries.

To change the settings to use a different type of battery, contact your Tennant Service representative.

CHARGING THE BATTERIES WITH THE ON-BOARD CHARGER

NOTE: If your machine is equipped with the on-board battery charger, make sure that the charger is properly set for your battery type before charging (See CHECKING ON-BOARD BATTERY CHARGER SETTINGS).

1. Drive the machine to a flat, dry surface.

NOTE: Make sure the area is well ventilated.

2. Turn the machine *ON/OFF key switch* off.

FOR SAFETY: Before leaving or servicing machine, stop on level surface, and turn off machine.

3. Tilt the operator seat forward and hook the seat latch into place to hold up the seat

WARNING: Batteries emit hydrogen gas. Explosion or fire can result. Keep sparks and open flame away. Keep covers open when charging.

4. Connect the charger's AC power supply cord into a properly grounded wall outlet.

5. The charger will display a sequence of codes once the cord is connected.
   Three-digits + the following code:

A = Charging current
U = Battery Voltage
h = Charging time
C = Charging ampere-hours [Ah]
E = Energy used [Kwh]

6. Press the arrow button to review the codes.

Once the charging cycle begins, the indicator lights will progress from red, yellow to green. When the green indicator light comes on, the charging cycle is done. Unplug the charger cord.

If the charger detects a problem, the charger will display an error code. See *ON-BOARD BATTERY CHARGER ERROR CODES*.

ON-BOARD BATTERY CHARGER ERROR CODES

DISPLAY CODE	FAULT	SOLUTION
bat	Loose or damaged battery cable	Check battery cable connections.
	Battery exceeded maximum voltage level.	No action necessary.
E01	Exceeded maximum battery voltage allowed.	No action necessary.
E02	Safety thermostat exceeded maximum internal temperature.	Check if the charger vents are obstructed.
E03	Exceeded maximum time for charging phase leaving the batteries undercharged due to a sulfated or faulty battery.	Repeat the charging cycle and if the error code E03 reappears check battery or replace it.
SCt	Safety timer exceeded maximum charging time. Interrupts charging cycle.	Replace battery.
Srt	Possible internal short circuit.	Contact Service Center.

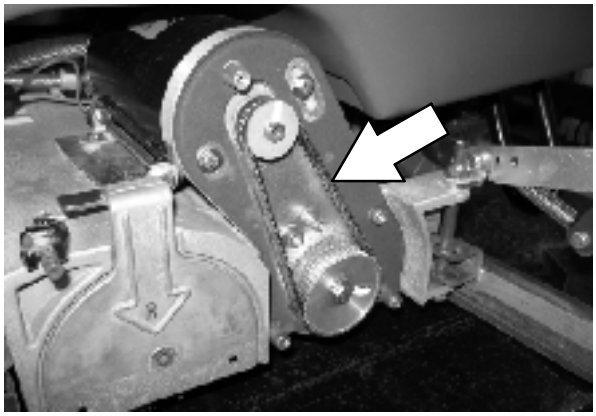
ELECTRIC MOTORS

The carbon brushes on the vacuum fan motor, the propelling motor, and the scrub brush motors should be inspected after the initial 500 hours of machine operation and then every 100 hours after the initial 500 hours.

BELTS (Cylindrical Models)

The two brush drive belts are located on the cylindrical brush scrub head. The belts drive the cylindrical brushes. Proper belt tension is a 6 mm (0.25 in) deflection from a force of 2.3 to 2.5 kg (5.0 to 5.4 lb) at the belt midpoint.

Check and adjust the belt tension every 100 hours of operation.



SCRUB BRUSHES AND PADS

The machine can be equipped with either *disk* or *cylindrical* scrub brushes, or cleaning pads. Check scrub brushes daily for wire or string tangled around the brush or brush drive hub. Also check for brushes damage and wear.

DISK BRUSHES

The scrub brushes should be replaced if a large number of bristles are missing or if bristle length is less than 10 mm (0.38 in).

Cleaning pads must be placed on pad drives before they are ready to use. The cleaning pad is held in place by a pad holder.

Cleaning pads need to be cleaned immediately after use with soap and water. Do not wash the pads with a pressure washer. Hang pads, or lie pads flat to dry.

NOTE: Always replace brushes and pads in sets. Otherwise one brush or pad will be more aggressive than the other.

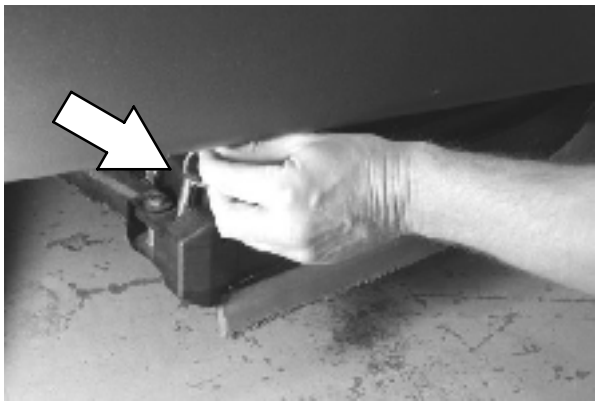
REPLACING DISK BRUSHES OR PAD DRIVER

1. Stop machine on a level surface. Make sure the scrub head is in the raised position.

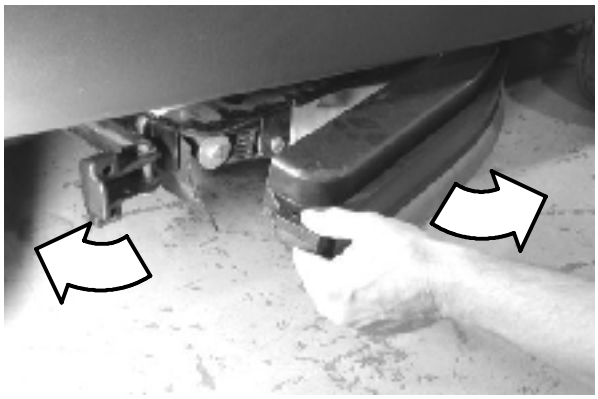
2. Turn the machine *ON/OFF key switch* off.

FOR SAFETY: Before leaving or servicing machine, stop on level surface, and turn off machine.

3. Pull the pin from the side squeegee retainer pivot.



4. Open the side squeegee retainer pivot toward the front of the machine, then pull the side squeegee toward the rear of the machine to access the scrub brushes or pads.



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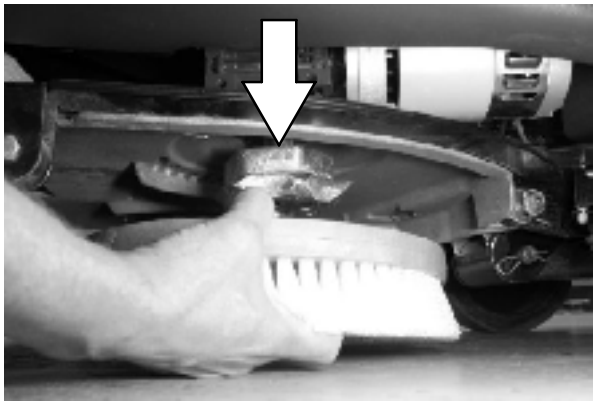
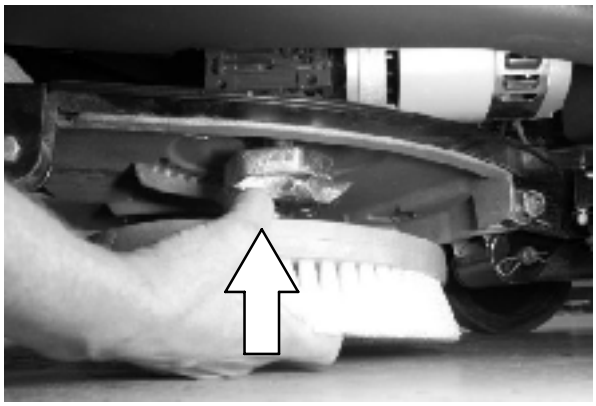
5. Pull the scrub brush/pad driver downward to remove it from the drive hub.

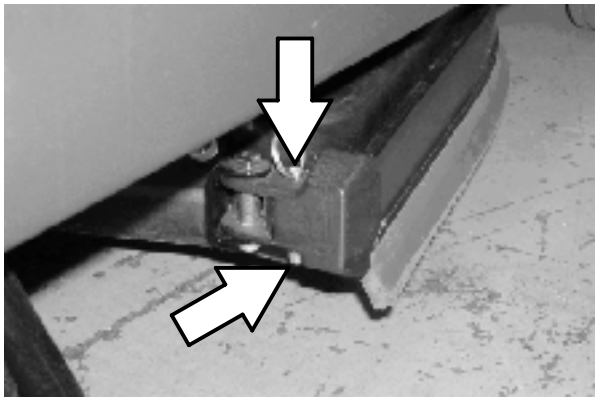


6. Place the new scrub brush/pad driver onto the drive hub. Ensure that it is securely mounted onto the brush drive hub.



7. Close the side squeegee and the retainer pivot, then insert the pin.

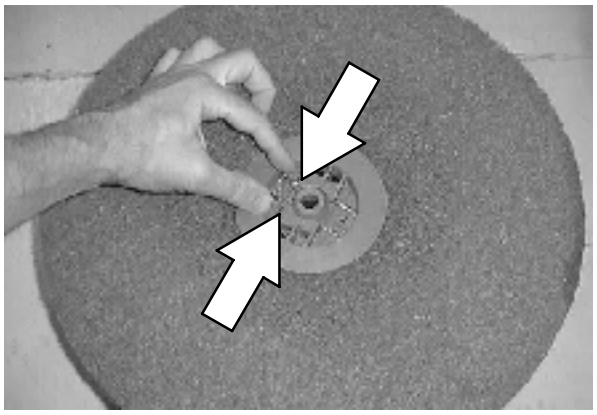
NOTE: Be sure the pin is inserted completely through the bottom.



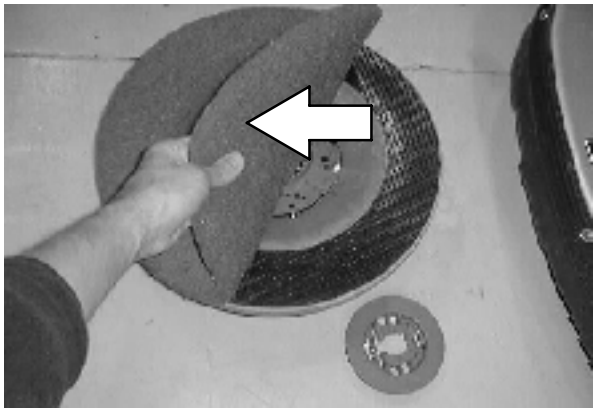
REPLACING DISK PADS

1. Remove the pad driver from the machine.

2. Squeeze the spring clip together to remove the center disk.



3. Flip or replace the scrub pad, center the scrub pad on the pad driver. Then reinstall the center disk to secure the pad in place on the pad driver.



4. Reinsert the pad driver into the machine.

CYLINDRICAL BRUSHES

Check the brush taper and rotate the brushes from front-to-rear every 50 hours of machine operation for maximum brush life and best scrubbing performance.

The cylindrical brushes should be replaced if large amounts of bristles are missing, or if the remaining bristle length is less than 15 mm (0.62 in).

NOTE: Replace worn brushes in pairs. Scrubbing with brushes of unequal bristle length will result in diminished scrubbing performance.

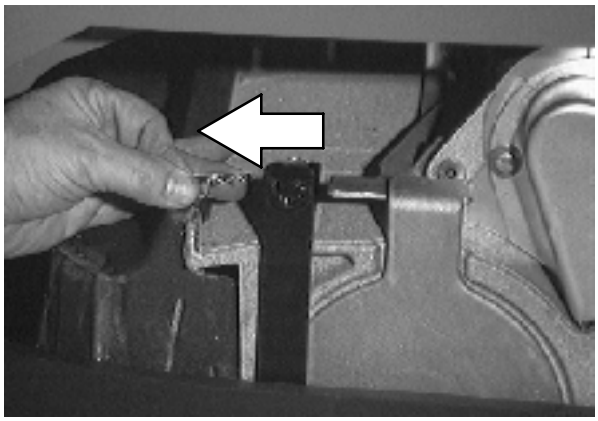
REPLACING OR ROTATING CYLINDRICAL BRUSHES

1. Stop machine on a level surface. Make sure the scrub head is in the raised position.

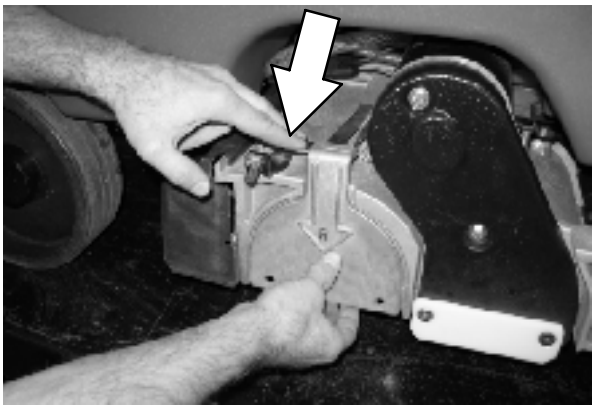
2. Turn the machine *ON/OFF key switch* off.

FOR SAFETY: Before leaving or servicing machine, stop on level surface, and turn off machine.

3. Remove the cotter pin that holds the side squeegee in place. Swing the squeegee away from the scrub head.



4. Remove idler plate from the scrub head by pressing the spring tab downward.



5. Pull the old brush out of the scrub head.

6. Attach the idler plate to the new or rotated brush on the end that has the double row of bristles. Install the brush.

7. Push down on the door to catch the door in the scrub head, then pull up on the door to latch it into the spring.

8. Repeat for the other brush on the other side of the scrub head

NOTE: Each side of the scrub head is stamped with a letter. The idler door of that side of the scrub head is stamped with the same letter. Make sure the letter on the door matches the letter on the scrub head when replacing the doors.

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CHECKING CYLINDRICAL BRUSH PATTERN

1. Apply chalk, or a similar marking material, to a smooth and level section of the floor.

NOTE: If chalk or other material is not available, allow the brush to spin on the floor for two minutes. A polish mark will remain on the floor.

2. Raise the scrub head, then position the brushes over the chalked area.

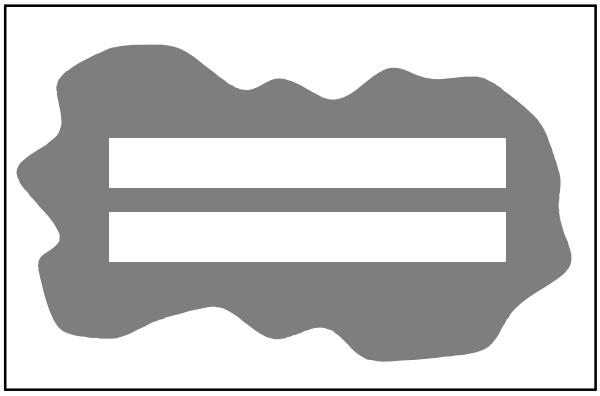
3. Block the front or rear wheels to prevent the machine from moving.

4. Lower the scrub head in the chalked area and slowly press the propel pedal until the scrub brushes start spinning. Allow the machine to scrub in the same place for 15 to 20 seconds.

5. Raise the scrub head and drive the machine away from the chalked area.

FOR SAFETY: Before leaving or servicing machine, stop on level surface, and turn off machine.

6. Observe the brush patterns. If the brush pattern is the same width across the entire length of each brush and both brushes are the same width, no adjustment is necessary.



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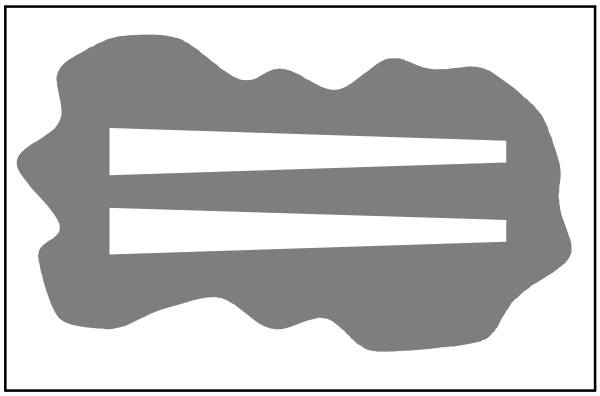
7. If the brush patterns are tapered, see *ADJUSTING CYLINDRICAL BRUSH TAPER* section of this manual.



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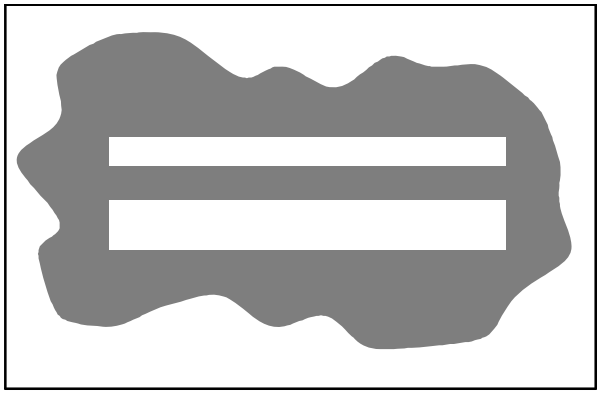
8. If the width of the brushes is not the same, see *ADJUSTING CYLINDRICAL BRUSH WIDTH* section of this manual.



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ADJUSTING CYLINDRICAL BRUSH TAPER

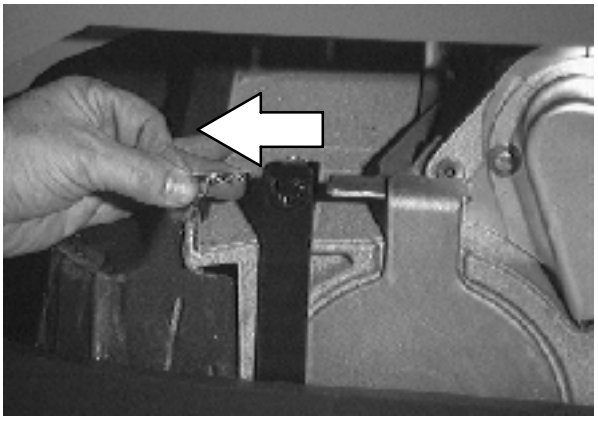
FOR SAFETY: Before leaving or servicing machine, stop on level surface, and turn off machine.

1. Stop machine on a level surface. Make sure the scrub head is in the raised position.

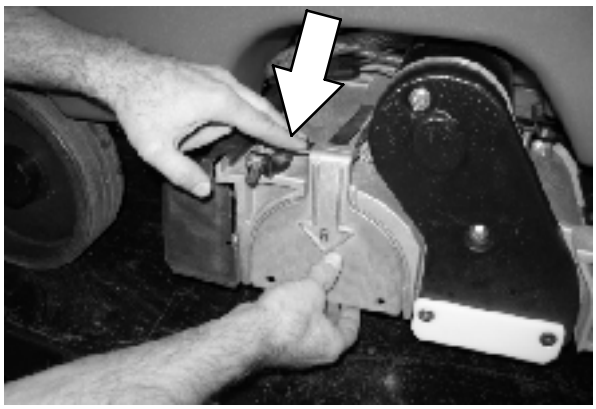
2. Turn the machine *ON/OFF key switch* off.

FOR SAFETY: Before leaving or servicing machine, stop on level surface, and turn off machine.

3. Remove the cotter pin that holds the side squeegee in place. Swing the squeegee away from the scrub head.

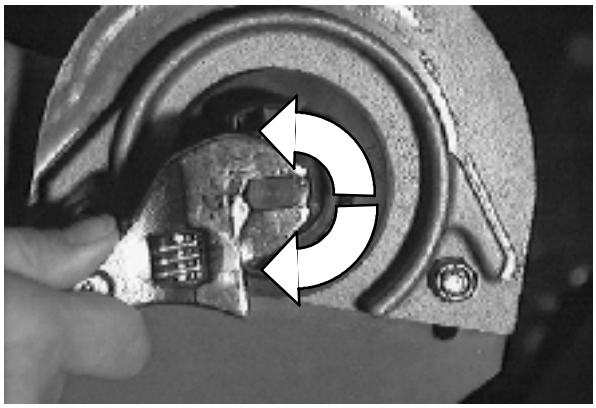


4. Remove idler plate from the scrub head by pressing the spring tab downward.



5. While holding the flat end of the idler shaft with a wrench, loosen the mounting screw on the outside of the idler door.

6. Turn the idler shaft to raise or lower the end of the brush as needed to straighten the brush pattern. Tighten the mounting screw.



7. Check the brush patterns again and readjust as necessary until both patterns are the same.

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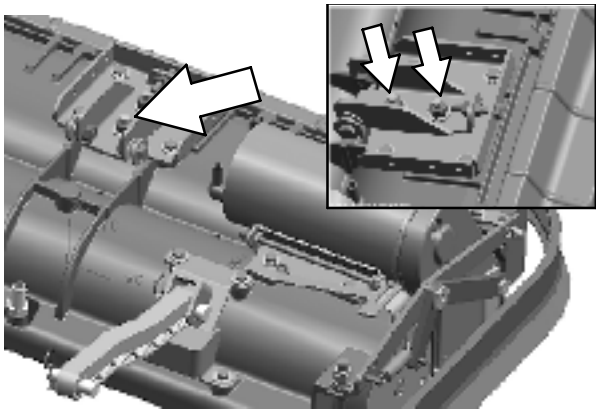
ADJUSTING CYLINDRICAL BRUSH WIDTH

1. Stop machine on a level surface. Make sure the scrub head is in the lowered position.

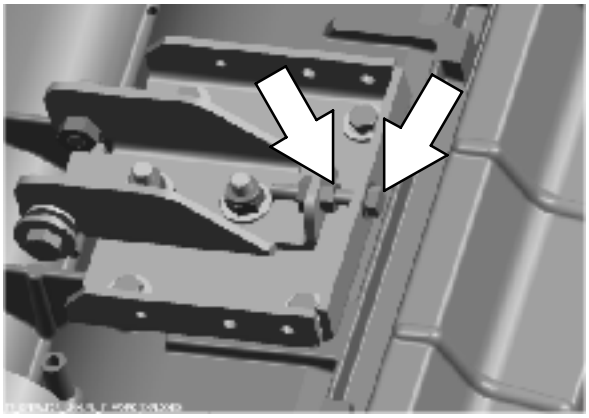
2. Turn the machine *ON/OFF key switch* off.

FOR SAFETY: Before leaving or servicing machine, stop on level surface, and turn off machine.

3. Loosen the two scrub head mounting screws.



4. Loosen the jam nut, then adjust the brush width adjustment screw. Tighten the jam nut and the two scrub head mounting screws when finished.



5. Check the brush patterns again and readjust as necessary until both brush patterns are the same.

REPLACING THE FaST-PAK (FaST Model)

1. Stop machine on a level surface.
2. Turn off the machine *ON/OFF key switch*.

FOR SAFETY: Before leaving or servicing machine, stop on level surface, and turn off machine.

3. Open the FaST-PAK compartment door and slide the empty FaST-PAK approximately half way out from the FaST-PAK compartment door.

4. Squeeze the button on the FaST supply hose connector, then pull the empty FaST-PAK out from the compartment.

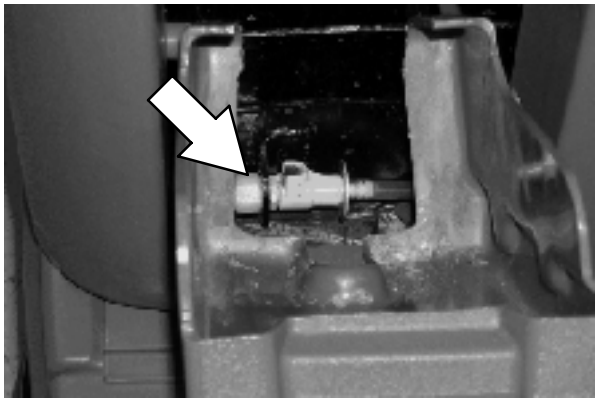
5. Remove the perforated knock outs from the new FaST-PAK carton. Do Not remove the bag from the carton. Pull out the hose connector located on the bottom of the bag and remove the hose cap from the connector.

NOTE: The FaST-PAK Floor Cleaning Concentrate is specially designed for use with the FaST system scrubbing application. NEVER use a substitute. Other cleaning solutions may cause FaST system failure.

6. Insert the new FaST-PAK approximately half way into the FaST-PAK compartment.
7. Connect the FaST-PAK hose connector to the FaST supply hose connector, slide the FaST-PAK the rest of the way into the FaST-PAK compartment, and close the FaST-PAK compartment door.
8. When replacing an empty FaST-PAK carton, you must scrub with the FaST system for a few minutes before the detergent will reach its maximum foaming.

FaST SUPPLY HOSE CONNECTOR

The FaST supply hose connector is located below the FaST-PAK holder. Soak the connector in warm water if detergent buildup is visible. When a FaST-PAK carton is not installed, store the supply hose connector on the storing plug to prevent the hose from clogging.



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SQUEEGEE BLADES

The side squeegees control water spray and channel water into the path of the rear squeegee. The side squeegee blades are not adjustable.

The rear squeegee assembly channels water into the vacuum fan suction. The front blade channels the water and the rear blade wipes the floor.

Check the squeegee blades daily for damage and wear. Rotate or replace the squeegee blades if the leading edge is torn or worn half-way through the thickness of the blade. Replace the side squeegee deflectors if they become worn.

The rear squeegee can be adjusted for leveling and deflection. The deflection and leveling of the squeegee blades should be checked daily, or when scrubbing a different type of floor.

The rear squeegee assembly can be removed from the squeegee pivot to prevent damage during transport of the machine.

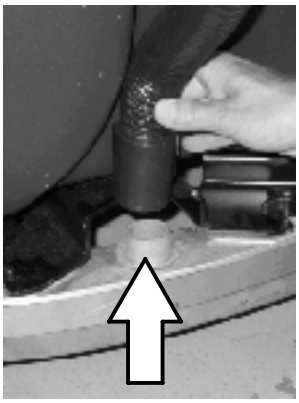
REPLACING (OR ROTATING) THE REAR SQUEEGEE BLADES

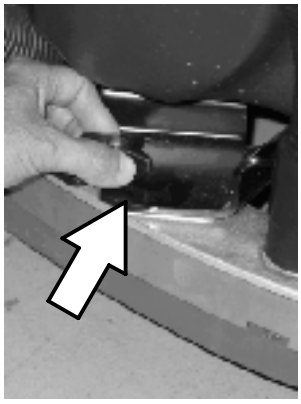
1. Stop machine on a level surface. Make sure the scrub head is in the raised position.

2. Turn the machine *ON/OFF key switch* off.

FOR SAFETY: Before leaving or servicing machine, stop on level surface, and turn off machine.

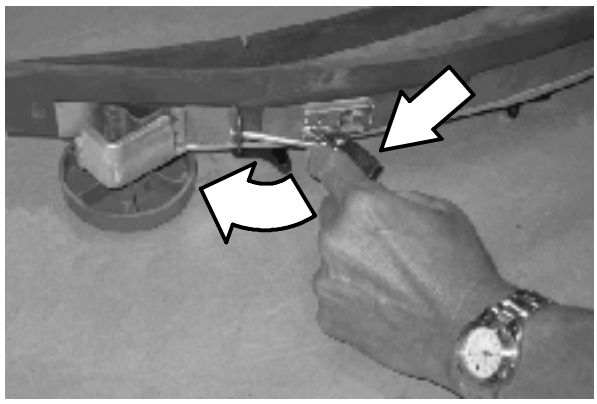
3. Remove the squeegee suction hose from the rear squeegee assembly. Then loosen both rear squeegee assembly mounting knobs.



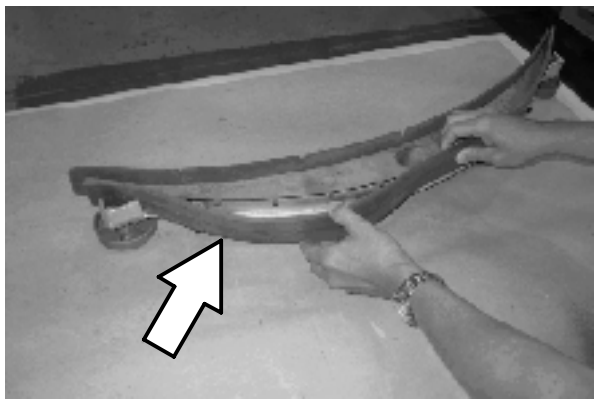


4. Pull the rear squeegee assembly from the machine.

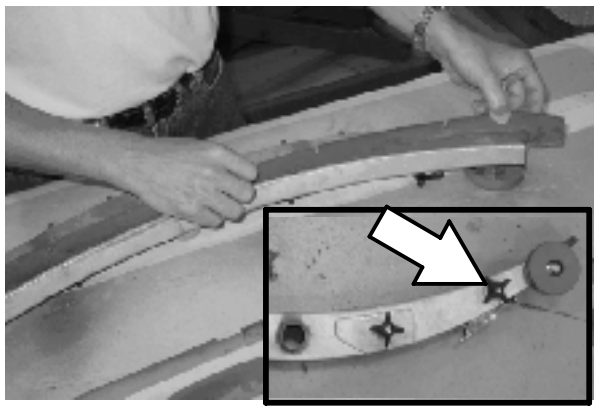
5. Loosen the rear squeegee retaining band tension latch and remove the retaining band.



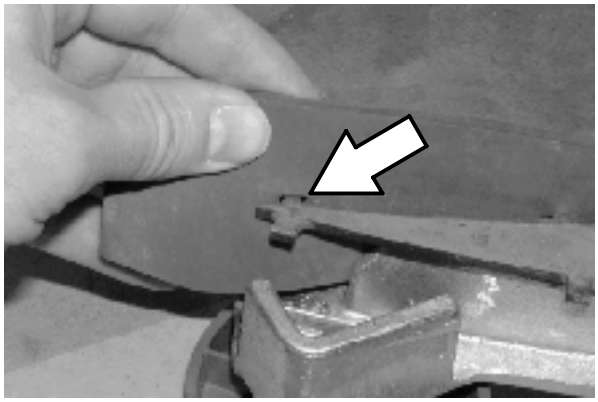
6. Remove rear squeegee blade from the rear squeegee assembly.



7. Loosen the two outer knobs on the rear squeegee assembly. Remove the front squeegee blade from the squeegee assembly.

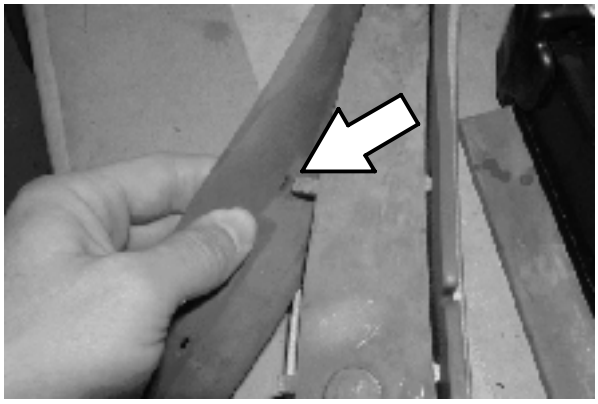


8. Install the new front squeegee blade or rotate the existing blade to the new edge. Be sure the holes in the front squeegee blade are hooked onto the tabs on the front blade clamp.

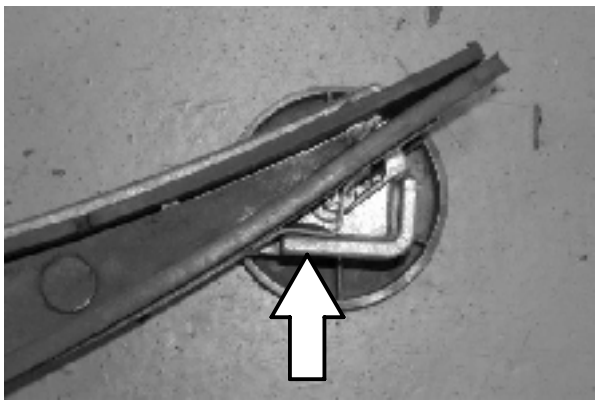


9. Lightly tighten the two outer knobs.

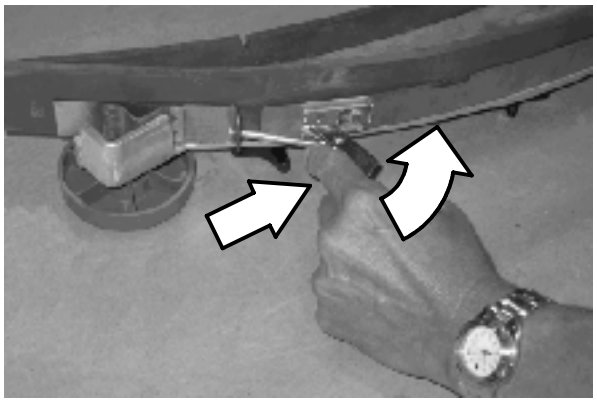
10. Install the new rear squeegee blade or rotate the existing blade to the new edge. Be sure the holes in the squeegee blade are hooked onto the tabs on the squeegee assembly.



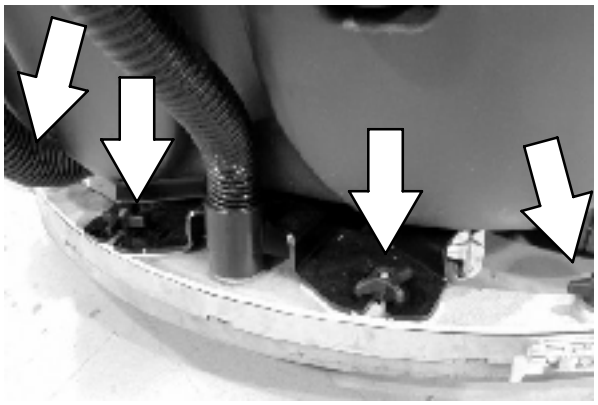
11. Reinstall the rear squeegee retaining band onto the squeegee assembly. Be sure each of the flanges on the retaining band are seated in the cut outs in the rear squeegee assembly.



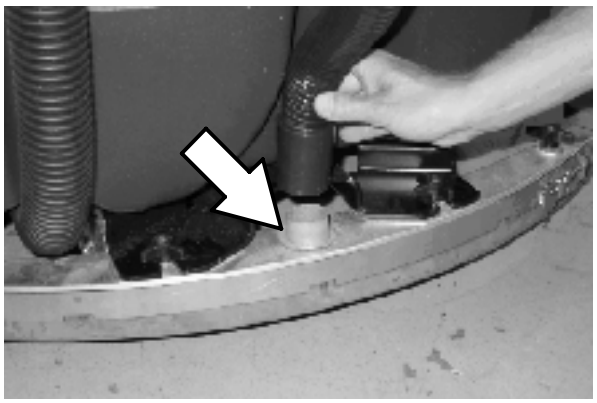
12. Tighten the rear squeegee retaining band tension latch.



13. Reinstall the rear squeegee under the squeegee mount bracket and tighten all four knobs.



14. Reinstall the squeegee suction hose onto the rear squeegee assembly.



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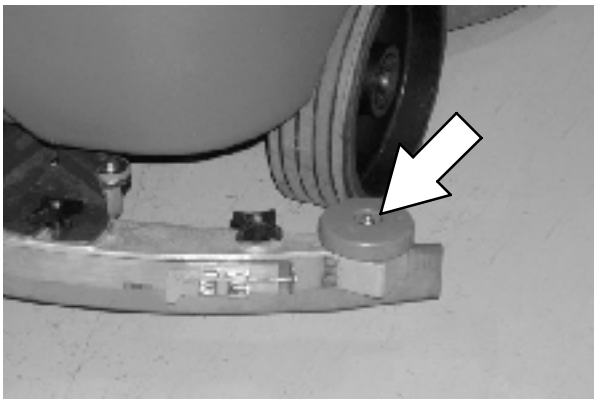
REPLACING SIDE SQUEEGEE BLADES

1. Open the side squeegee.
2. Pull the old side squeegee blade from the side squeegee retainer. Slide the new blade onto the retainer.

3. Close the side squeegee.

ADJUSTING THE SQUEEGEE GUIDE ROLLER

The squeegee guide rollers are located on both ends of the rear squeegee. The rollers guide the squeegee blade end along a wall. Loosen the nut located at the top of the guide roller and move the roller in or out to adjust how close the end of the squeegee blade is to the wall. The squeegee blade end should be further away from the wall when the floor curves up into the wall.



LEVELING THE REAR SQUEEGEE

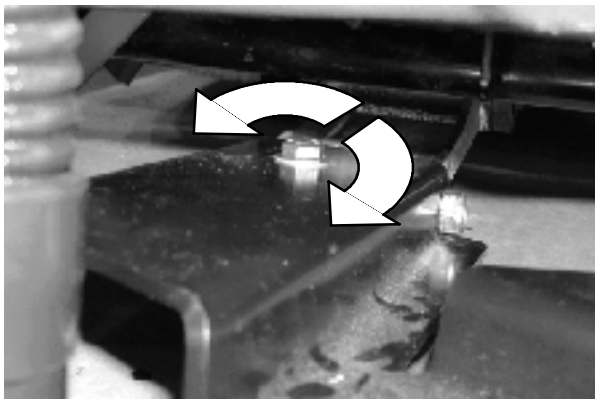
Leveling of the squeegee assures the entire length of the squeegee is in even contact with the surface being scrubbed. Perform this adjustment on an even and level floor.

1. Lower the squeegee and drive the machine forward a few feet.
2. Turn off the machine *ON/OFF key switch*.

FOR SAFETY: Before leaving or servicing machine, stop on level surface, and turn off machine.

3. Look at the deflection of the squeegee over the full length of the squeegee blade.
4. If the deflection is not the same over the full length of the blade, turn the squeegee leveling bolt to make adjustments.

   The squeegee leveling bolt is located directly behind the squeegee suction hose. ***DO NOT*** *disconnect the suction hose from the squeegee frame when leveling squeegee.*



   Turn the squeegee leveling bolt counter-clockwise to increase the deflection at the ends of the squeegee.

   Turn the squeegee leveling bolt clockwise to decrease the deflection at the ends of the squeegee blade.

5. Drive the machine forward with the squeegee down to recheck the squeegee blade deflection if adjustments were made.
6. Readjust the squeegee blade deflection if necessary.

ADJUSTING REAR SQUEEGEE BLADE DEFLECTION

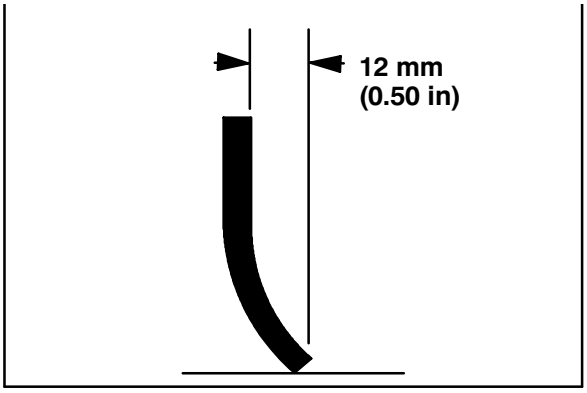
Deflection is the amount of curl the overall squeegee blade has when the machine moves forward. The best deflection is when the squeegee wipes the floor dry with a minimal amount of deflection.

1. Lower the squeegee and drive the machine forward a few meters (feet).

2. Turn off the machine *ON/OFF key switch*.

FOR SAFETY: Before leaving or servicing machine, stop on level surface, and turn off machine.

3. Look at the amount of deflection or “curl” of the squeegee blade. The correct amount of deflection is 12 mm (0.50 in) for scrubbing smooth floors and 15 mm (0.62 in) for rough floors.



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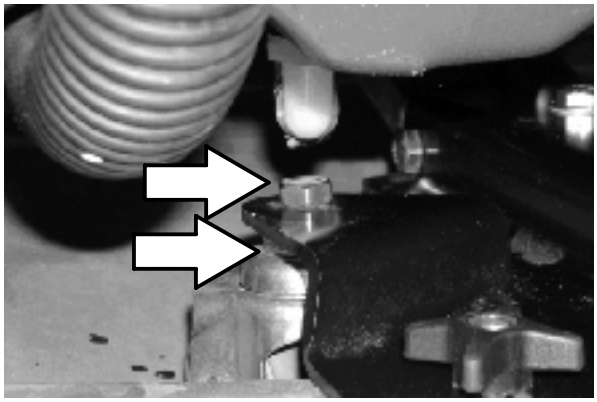
4. If the overall squeegee blade deflection needs to be adjusted, loosen the jam nuts on the squeegee casters and adjust the height.



5. Drive the machine forward again to recheck the squeegee blade deflection after adjustments are made.

6. Readjust the squeegee blade deflection if necessary.

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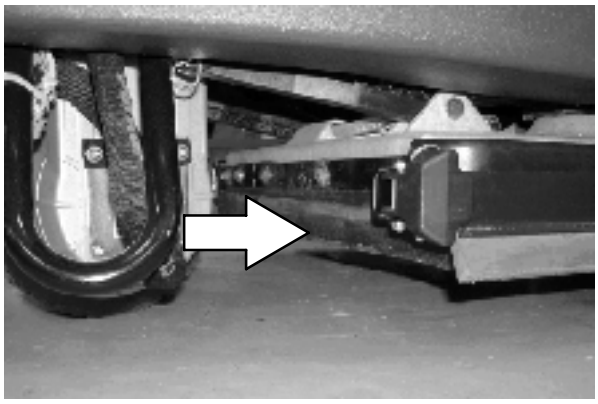
SKIRTS AND SEALS

DISK SCRUB HEAD FLOOR SKIRT

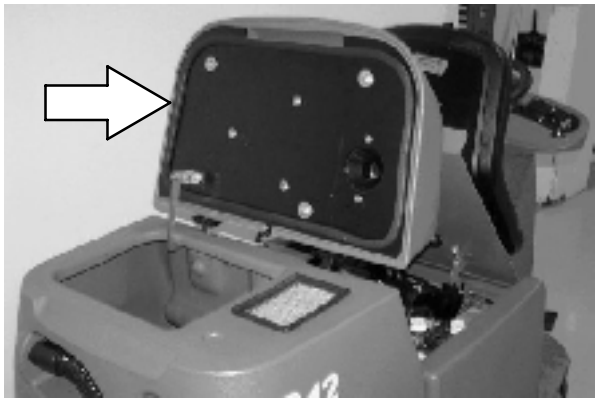
The skirt is located in front of the disc brush scrub heads. Check the skirt for damage and wear after every 50 hours of operation.



The skirts should clear the floor by 0 to 6 mm (0 to .25 in) when the scrub brushes are new and the scrub head is down.

RECOVERY TANK SEAL

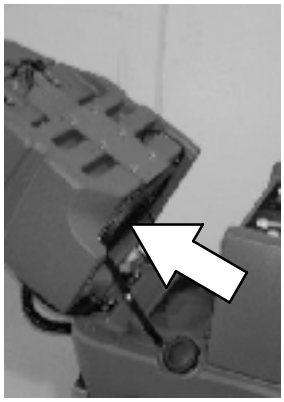
The recovery tank seal is located on the bottom of the recovery tank cover. Check the seal for damage and wear after every 100 hours of operation.



SOLUTION TANK SEALS

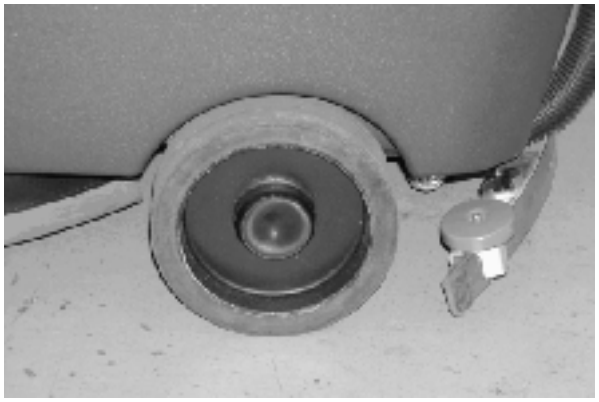
There are two solution tank seals. Check the seal for damage and wear after every 100 hours of operation.

A front seal is located on the bottom of the solution tank cover. A rear seal is located on the bottom of the recovery tank.



TIRES

The machine has three solid rubber tires: one tire is front and two are in the rear. Check the tires for damage and wear after every 500 hours of operation.



PUSHING, TOWING, AND TRANSPORTING THE MACHINE

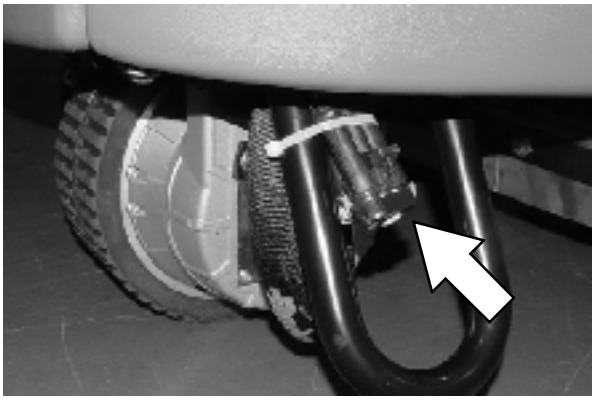
PUSHING OR TOWING THE MACHINE

If the machine becomes disabled, it can be pushed from the front or rear, but only tow it from the front.

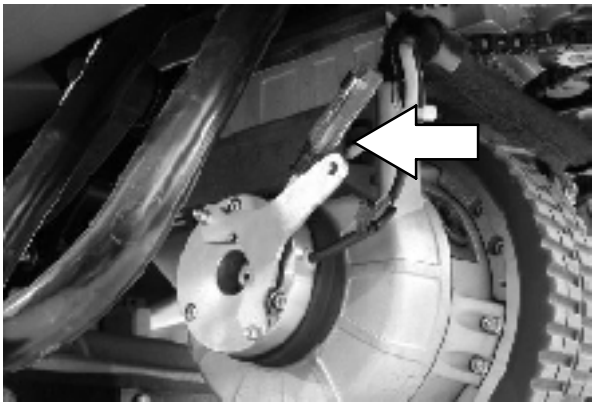
FOR SAFETY: When servicing machine, do not push or tow the machine on inclines with the brake disabled.

Before attempting to push or tow the machine, disconnect the propel motor harness and disengage the brake.

ATTENTION! Do not push or tow machine with the motor harness connected or the control board may fail.



To disengage the brake, insert the tip of a small screw driver between the electronic brake lever and the hub.



Only push or tow the machine on a level surface. Do not exceed 3.2 kp/h (2 mph). It is NOT intended to be pushed or towed at a high speed.

Immediately after pushing the machine, remove the screw driver to enable the parking brake and reconnect the propel motor harness. Never operate the machine with the brake disabled.

FOR SAFETY: Do not operate machine with the brake disabled.

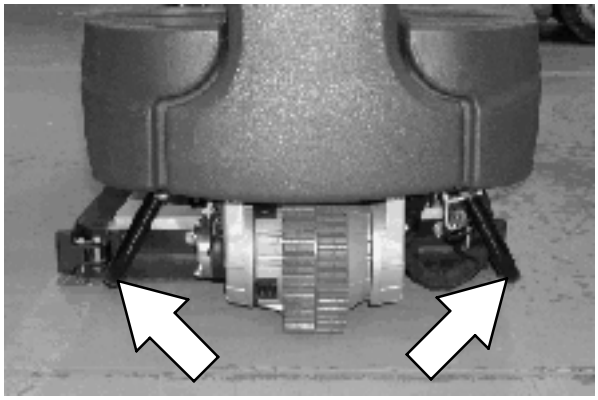
TRANSPORTING THE MACHINE

When transporting the machine by trailer or truck, be certain to follow the tie-down procedure below:

1. Raise the squeegee and scrub head.
2. Load the machine using a recommended loading ramp.

FOR SAFETY: When transporting machine, use a recommended ramp when loading/ unloading into/off truck or trailer.

3. Position the front of machine against the front of the trailer or truck.
4. Lower the scrub head and squeegee after the machine is positioned on the trailer or truck.
5. Place a block behind each wheel to prevent the machine from rolling.
6. Route the front tie-down straps through the stabilizer arms and then secure the tie-downs to the trailer or truck to prevent the machine from tipping.



NOTE: It may be necessary to install tie-down brackets to the floor of the trailer or truck.

FOR SAFETY: When transporting machine, use tie-down straps to secure machine to truck or trailer.

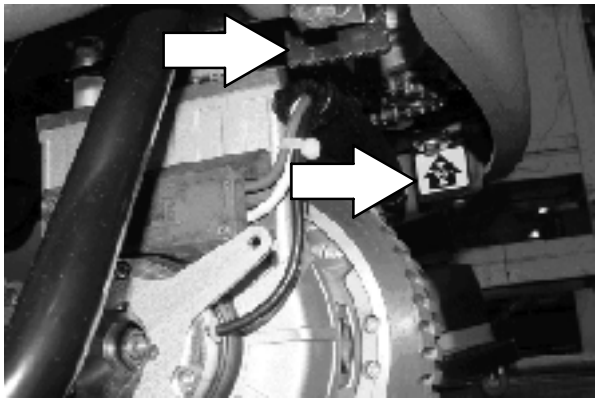
7. Route the rear tie-down straps through the opening at the center part of the rear axle.

M

MACHINE JACKING

Empty the recovery and solution tanks before jacking the machine. Jack up the machine for service at the designated locations. Use a hoist or jack capable of supporting the weight of the machine. Always stop the machine on a flat, level surface and block the tires before jacking up the machine.

Front jacking locations are located on both sides of the machine.



Rear jacking locations are located on both sides of the machine at the axles.

FOR SAFETY: Before leaving or servicing machine, stop on level surface.

FOR SAFETY: When servicing machine, block machine tires before jacking machine up. Use a hoist or jack that will support the weight of the machine. Jack machine up at designated locations only. Block machine up with jack stands.

STORAGE INFORMATION

The following steps should be taken when storing the machine for extended periods of time.

1. Drain and clean the solution and recovery tanks. Open the recovery tank cover to promote air circulation.
2. Park the machine in a cool, dry area. Do not expose the machine to rain. Store indoors.
3. Remove the batteries, or charge them every three months.

FREEZE PROTECTION

1. Be sure the solution tank is empty.
2. Pour 3.8 L (1 gal) of pre-mixed automotive-type windshield washer solution into the solution tank.
3. FaST models: Remove the FaST-PAK and store in temperatures above freezing.
4. Turn the machine power on.
5. Run the solution flow for about 15 seconds in the conventional mode and about 30 seconds in the FaST mode.
6. The washer solution does not need to be drained from the solution tank.

MACHINE TROUBLESHOOTING

Problem	Cause	Remedy
Trailing water–poor or no water pickup	Vacuum fan turned off	Turn vacuum fan on
	Worn squeegee blades	Rotate or replace squeegee blades
	Squeegee out of adjustment	Adjust squeegee
	Vacuum hose clogged	Flush vacuum hoses
	Vacuum fan filter dirty	Clean vacuum fan filter
	Vacuum fan cover seals worn	Replace seals
	Debris caught on squeegee	Remove debris
	Vacuum hose to squeegee or recovery tank disconnected or damaged	Reconnect or replace vacuum hose
	Recovery tank cover not completely closed	Check for obstructions and close cover
Vacuum fan will not turn on	Vacuum fan switch turned off	Turn vacuum switch on
	Recovery tank full	Drain recovery tank
	Foam filling recovery tank	Empty recovery tank
		Use less detergent
	Recovery tank sensor dirty or stuck	Clean or replace sensor
Little or no solution flow to the floor (Conventional Scrubbing Mode)	Solution tank empty	Fill solution tank
	Solution flow turned off	Turn solution flow on
	Solution supply lines plugged	Flush solution supply lines

M

Problem	Cause	Remedy
Poor scrubbing performance	One Step Scrub button not on	Turn One Step Scrub button on
	Improper detergent or brushes used	Contact Tennant service representative
	Recovery tank full	Empty recovery tank
	Solution tank empty	Fill solution tank
	Debris caught on scrub brushes or pads	Remove debris
	Worn scrub brush	Replace scrub brush
	Broken or loose brush drive belt (Cylindrical models)	Replace or tighten belt
	Brush pressure set too light	Increase brush pressure
	Low battery charge	Charge batteries until the charger automatically turns off
FaST System does not operate	FaST switch is turned off	Turn on the FaST switch
	Accessory circuit breaker tripped	Reset circuit breaker
	Clogged FaST-PAK supply hose and/or connector	Soak connector and hose in warm water and clean
	FaST-PAK carton is empty or not connected	Replace FaST-PAK carton and/or connect supply hose
	FaST system is not primed	To prime, operate the FaST solution system for a few minutes
	Clogged filter screen	Drain solution tank, remove and clean filter screen
	Faulty solution pump	Replace solution pump

ELECTRICAL

Troubleshooting Information

BEFORE CONDUCTING TESTS:

* Read and Follow ALL Safety Warnings and Precautions as mentioned at the beginning of this manual

* Always use an ESD (Electrostatic Discharge) strap when working near the Control Board

* Be cautious when working near Control Board – ***Battery voltage is always present, even with Key OFF***

* Always unhook Battery when removing or replacing components

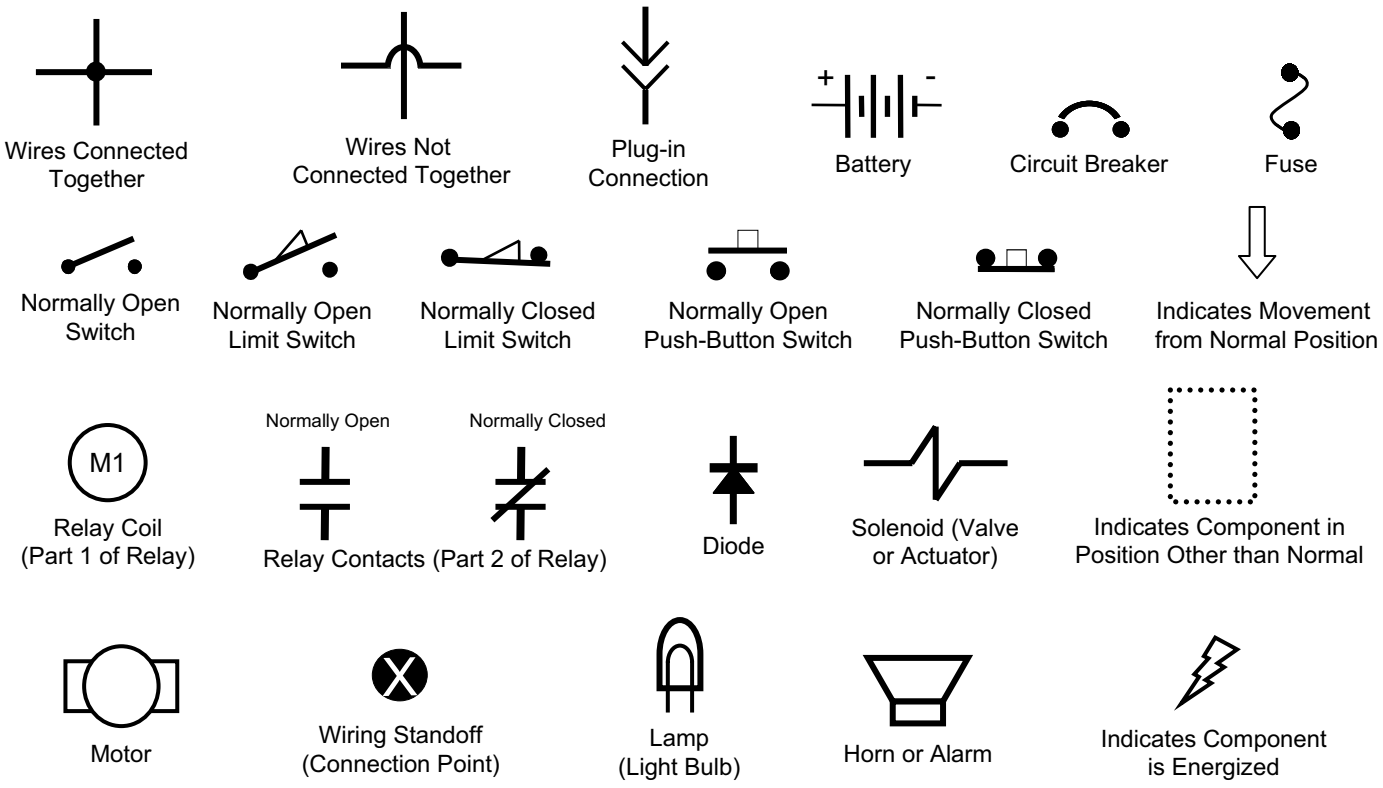
DURING TESTS:

* Call Technical Services if Diagnostic Time Exceeds One Hour With Unknown Cause or Course of Action

NOTE: Troubleshooting charts may be shown with optional equipment. The optional equipment may not be specified in these charts. Some machines may not be equipped with all components shown.

Commonly Used Electrical Symbols & Terms

NOTE: The term “NORMALLY” refers to the components’ “at rest” or “de-energized” position



E

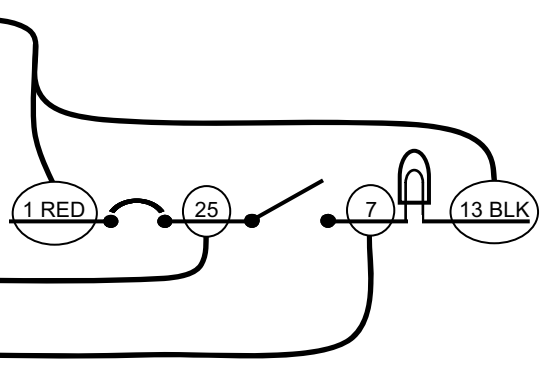
Terms & Abbreviations

BDI – Battery Discharge Indicator
Dynamic Braking – A method of using the generating nature of an electric motor to slow the machine
Hall Effect – A voltage developed as a result of current flow in the presence of a magnetic field
LED – Light Emitting Diode
PM – Permanent Magnet
PWM (Pulse Width Modulation) – A method of using controlled on/off times to regulate the voltage and current supplied to an electrical device

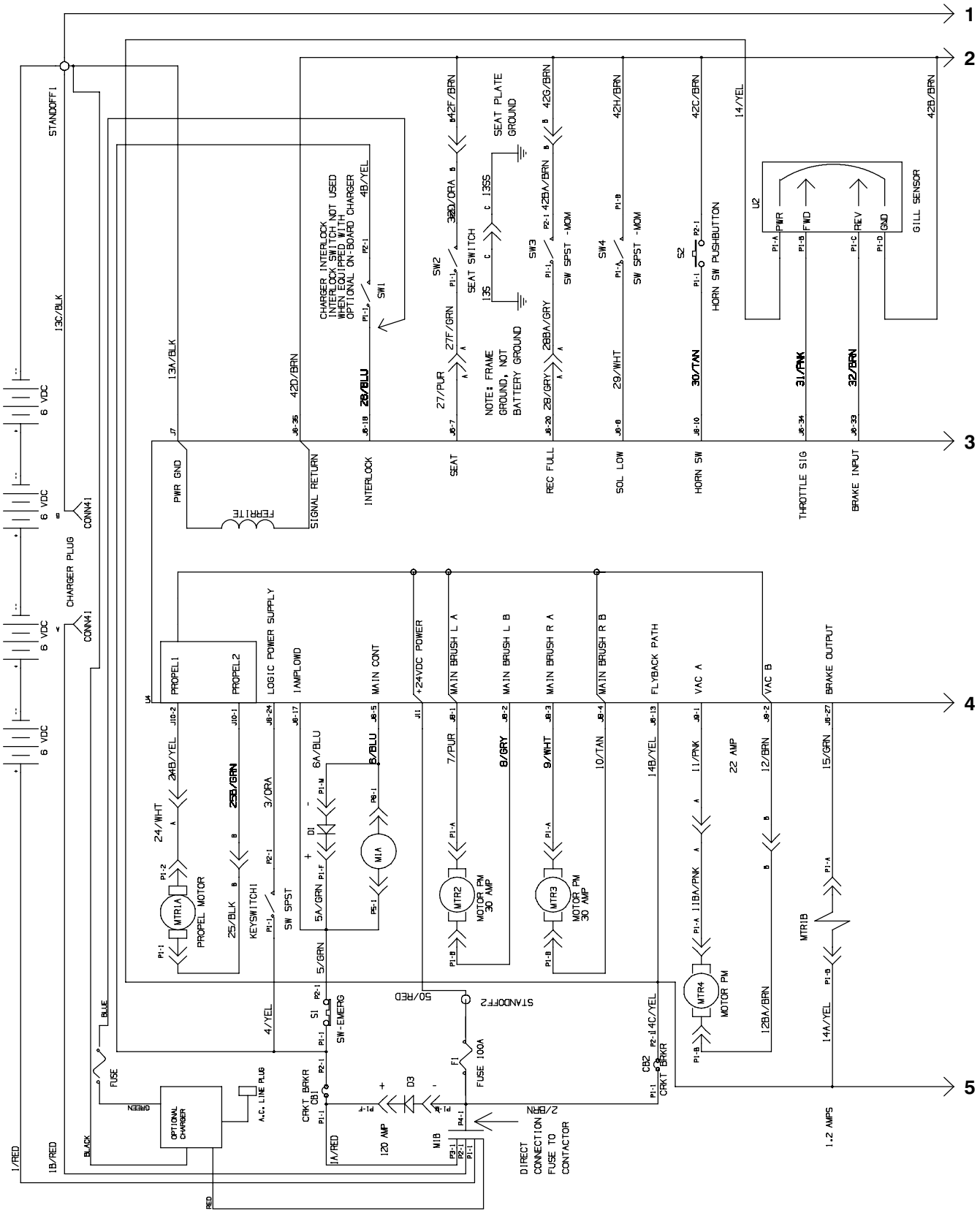
Example of Wiring Numbers & Colors:

Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White



Electrical Schematic (page 1 of 2)



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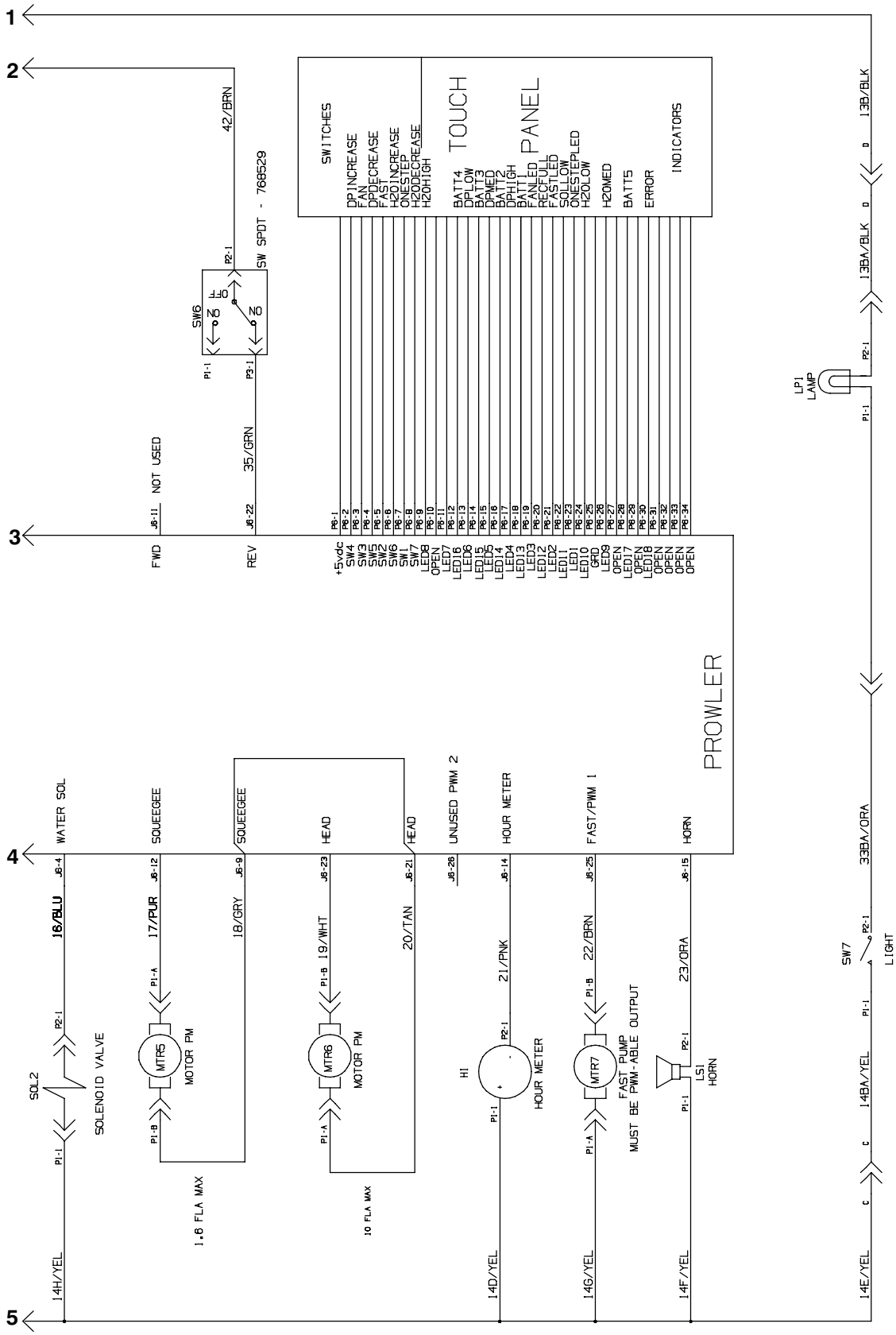
Electrical Schematic (page 2 of 2)



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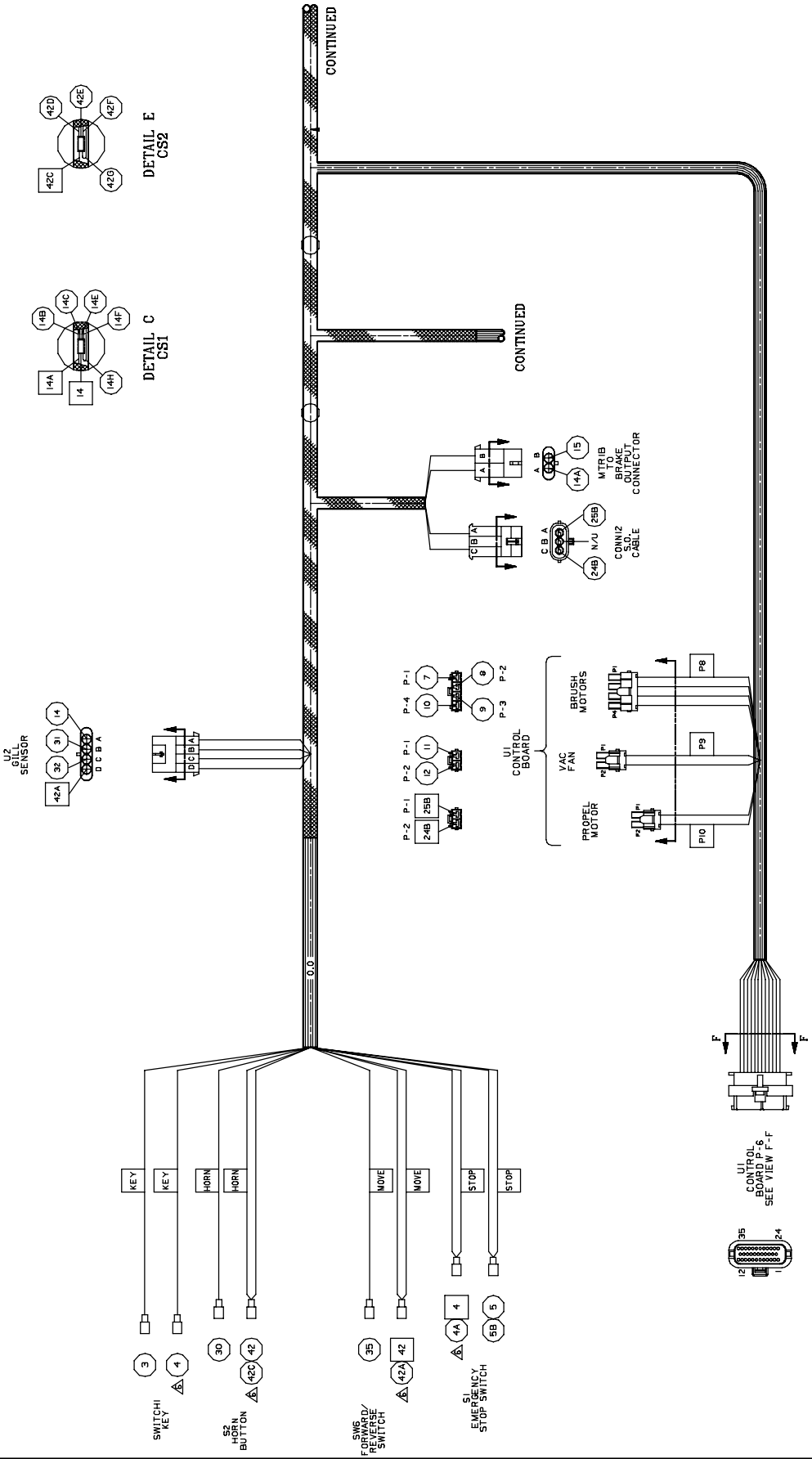
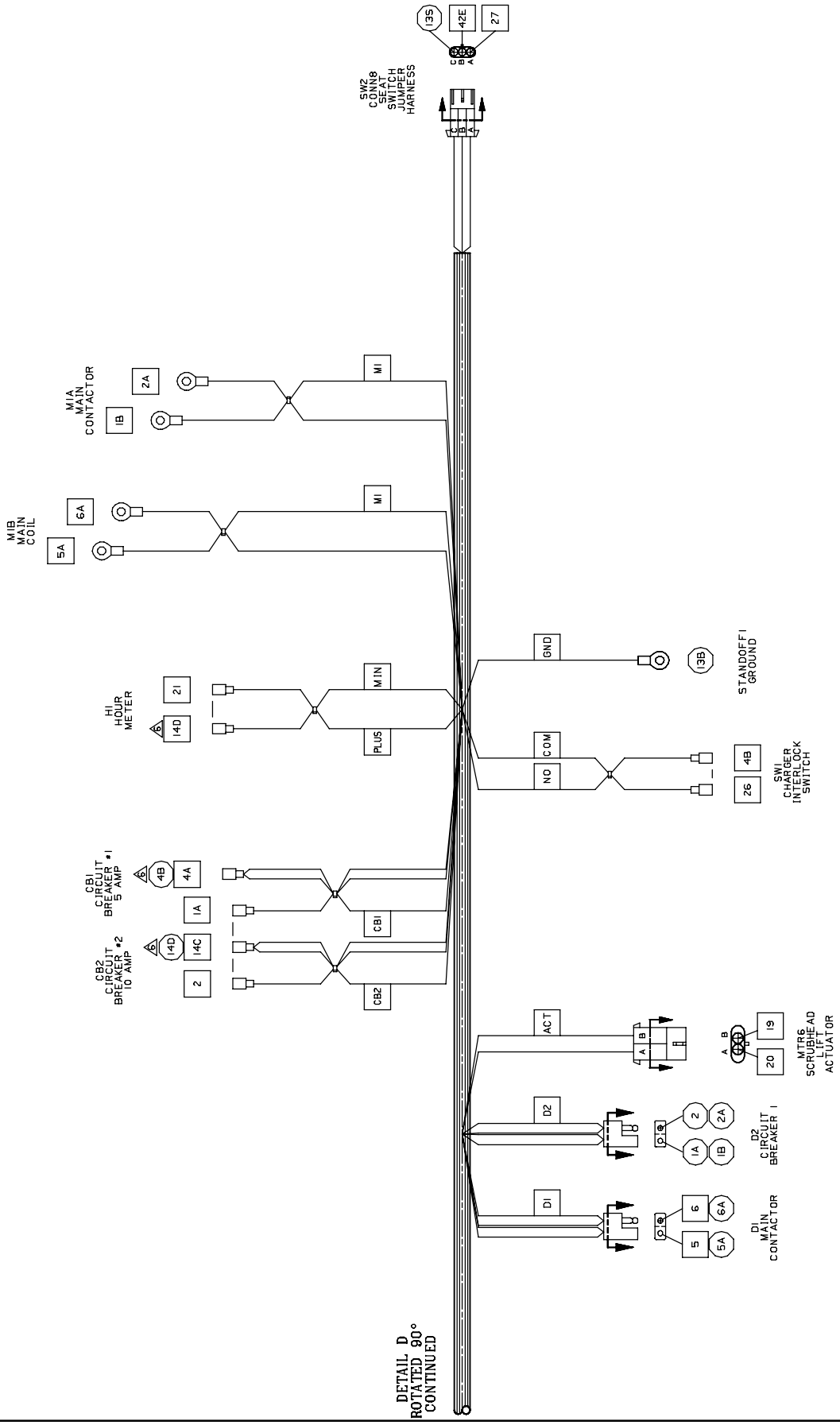
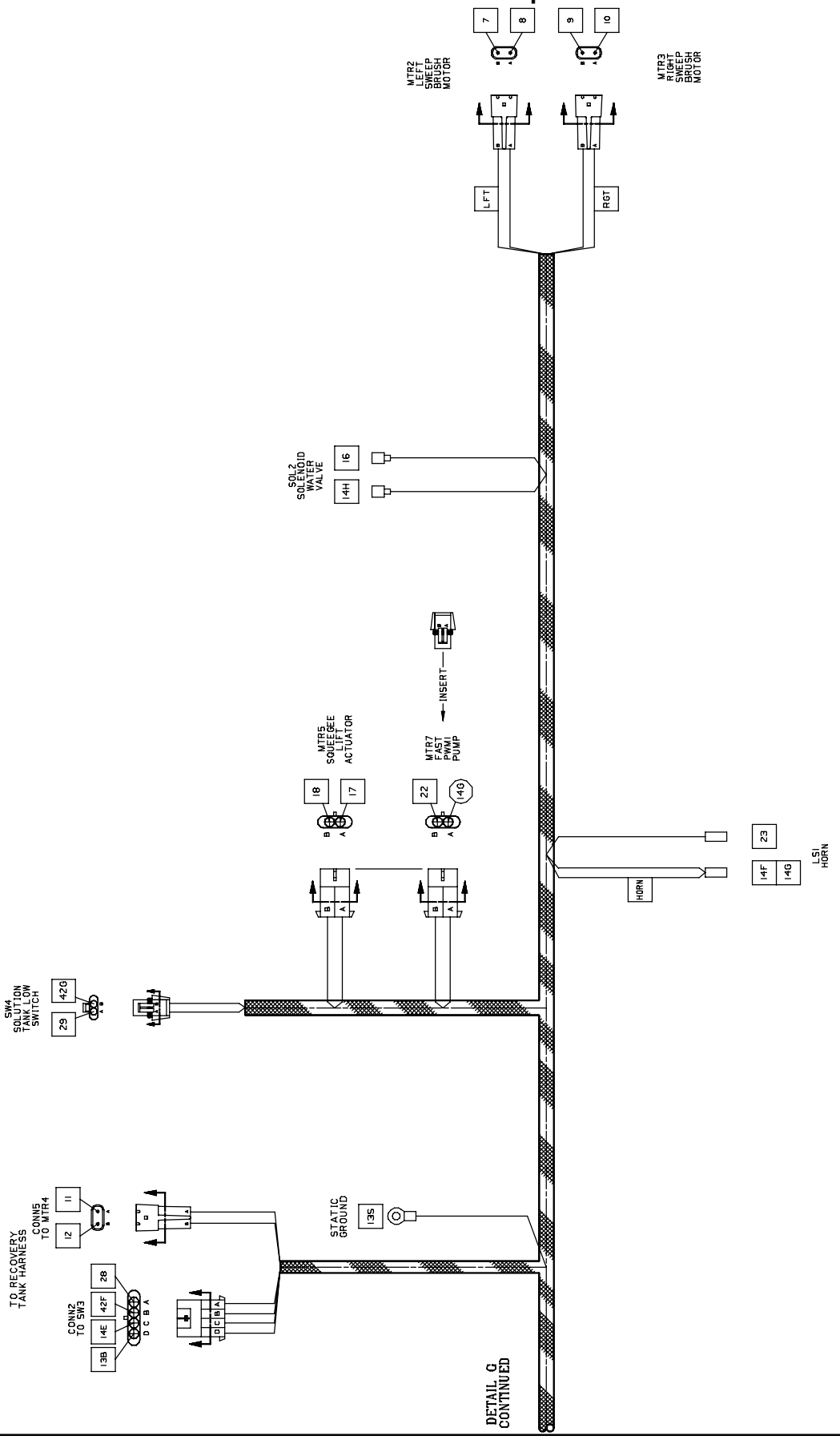
Wire Harness Group (page 1 of 7)



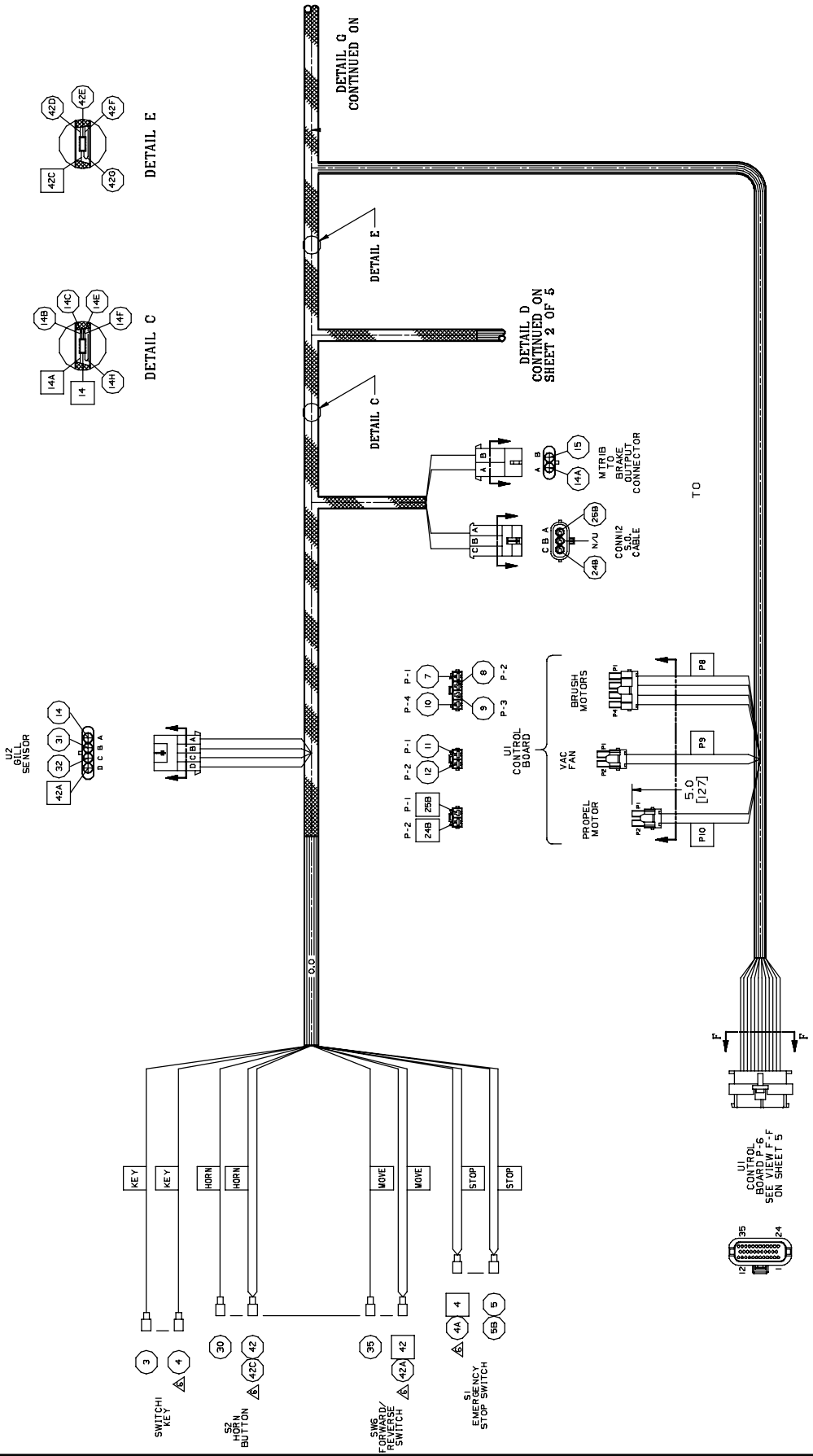
Wire Harness Group (page 2 of 7)



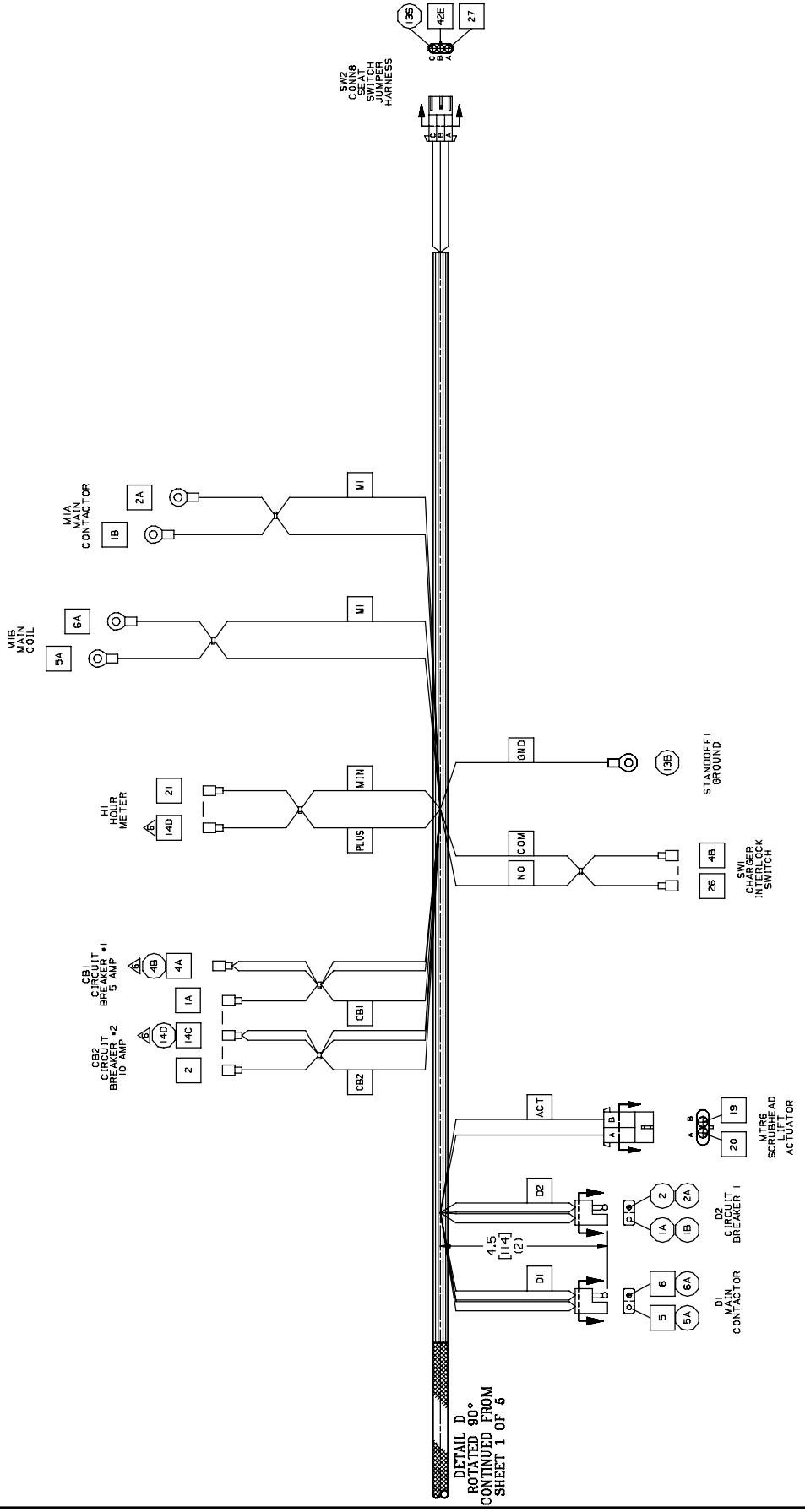
Wire Harness Group (page 3 of 7)



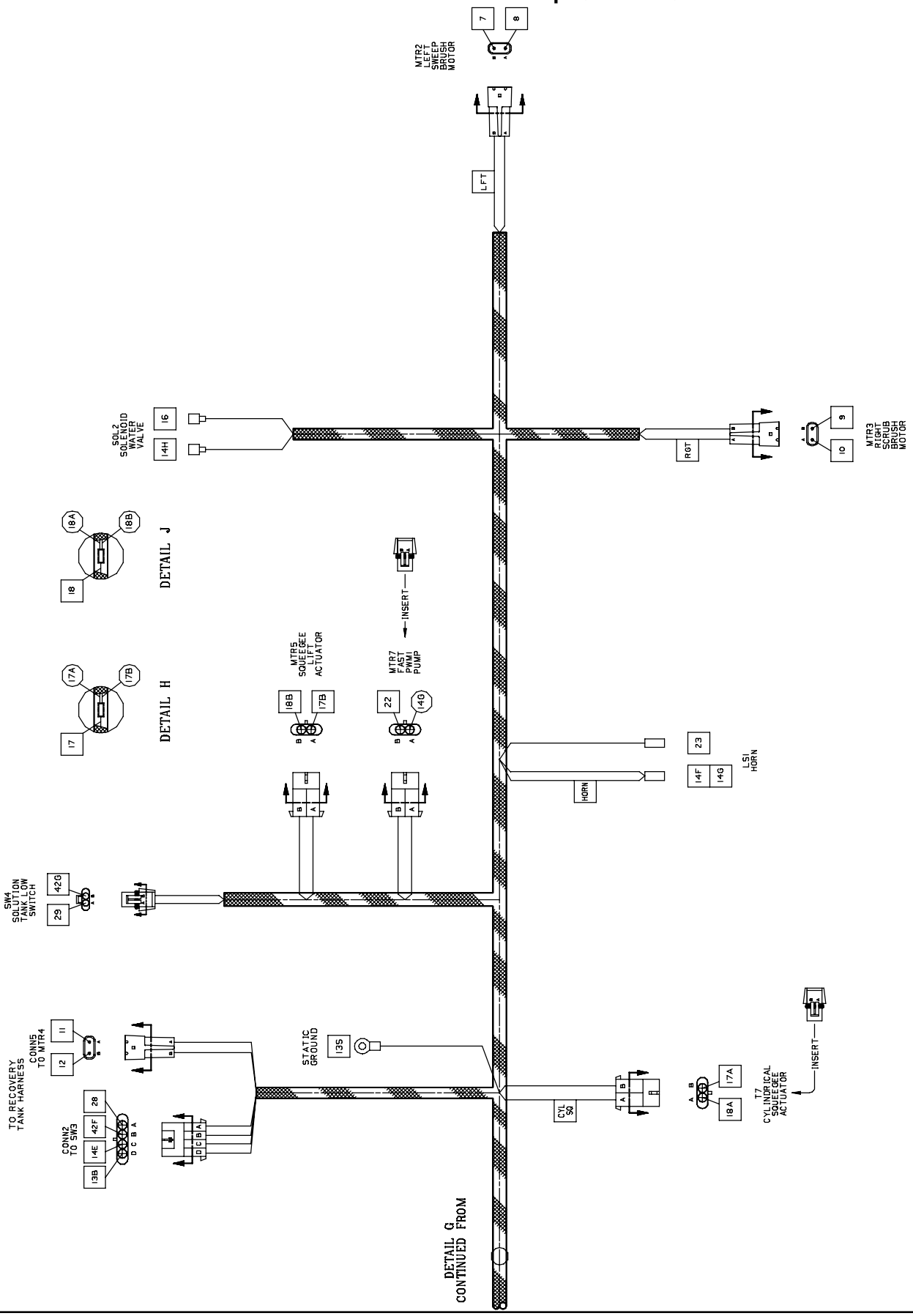
Wire Harness Group (page 4 of 7)



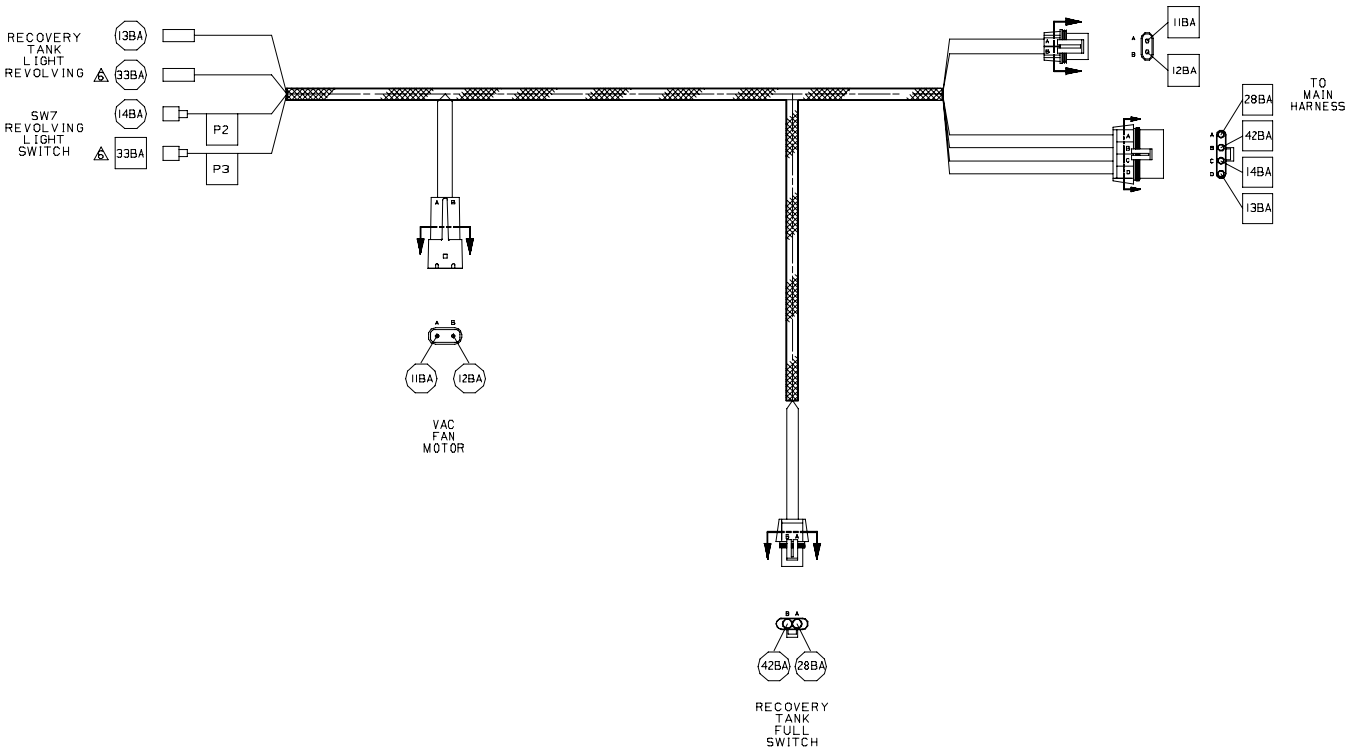
Wire Harness Group (page 5 of 7)



Wire Harness Group (page 6 of 7)

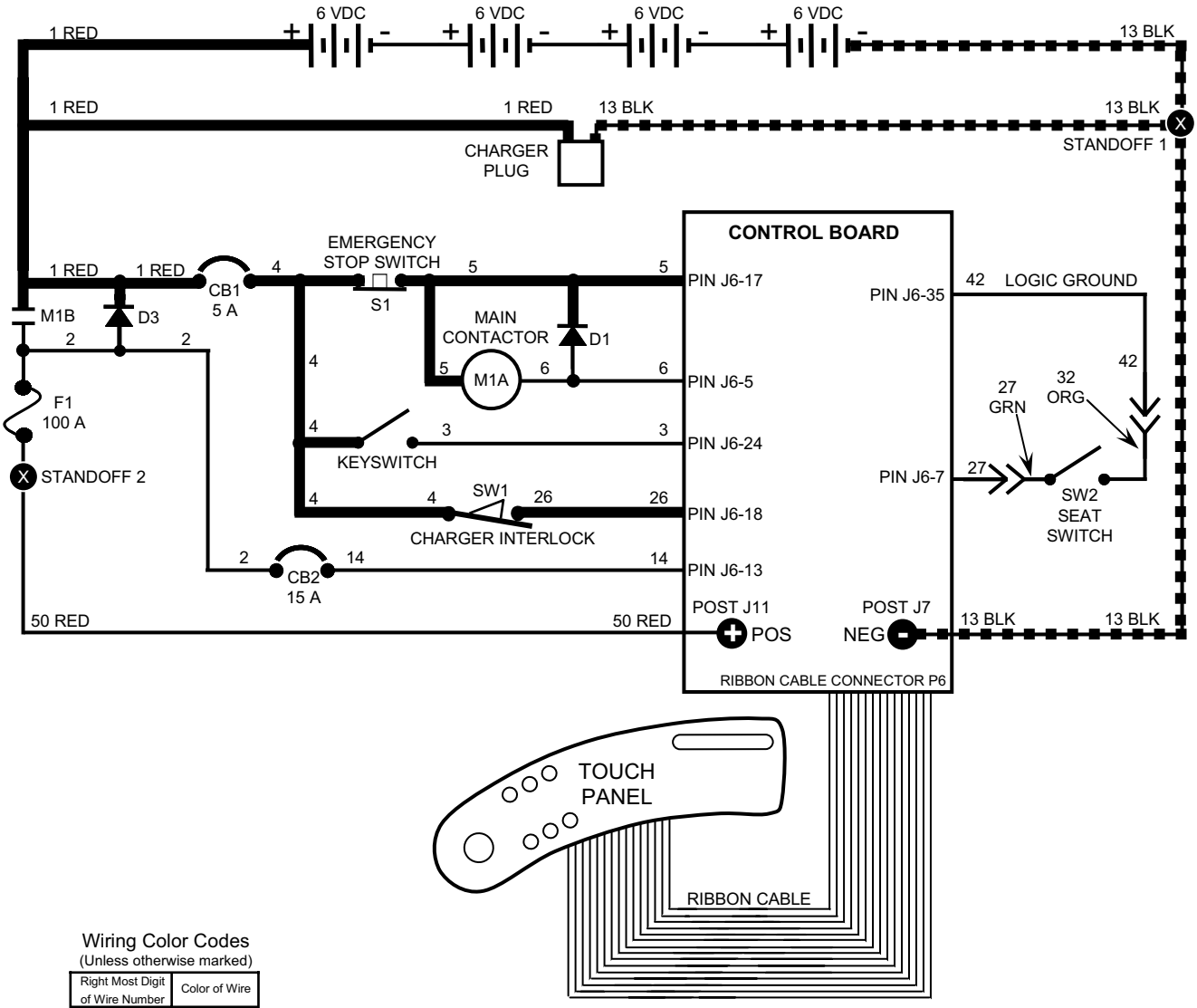


Wire Harness Group (page 7 of 7)



E

Key OFF, Operator NOT on Seat



Wiring Color Codes
(Unless otherwise marked)

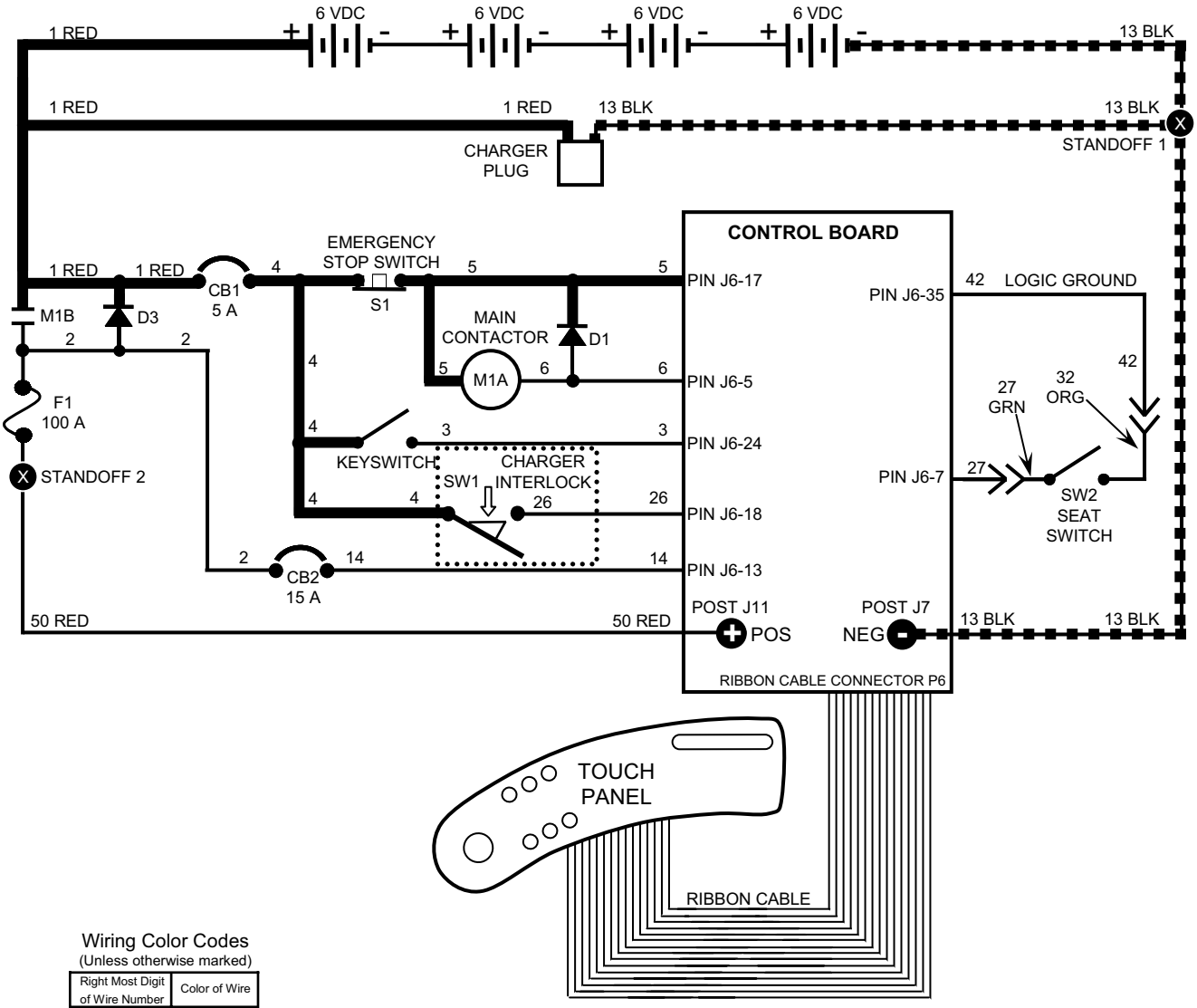
Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

= Battery Negative or Logic Ground

= Battery Positive or Positive Output

E

Key OFF, Battery Charger Plugged In



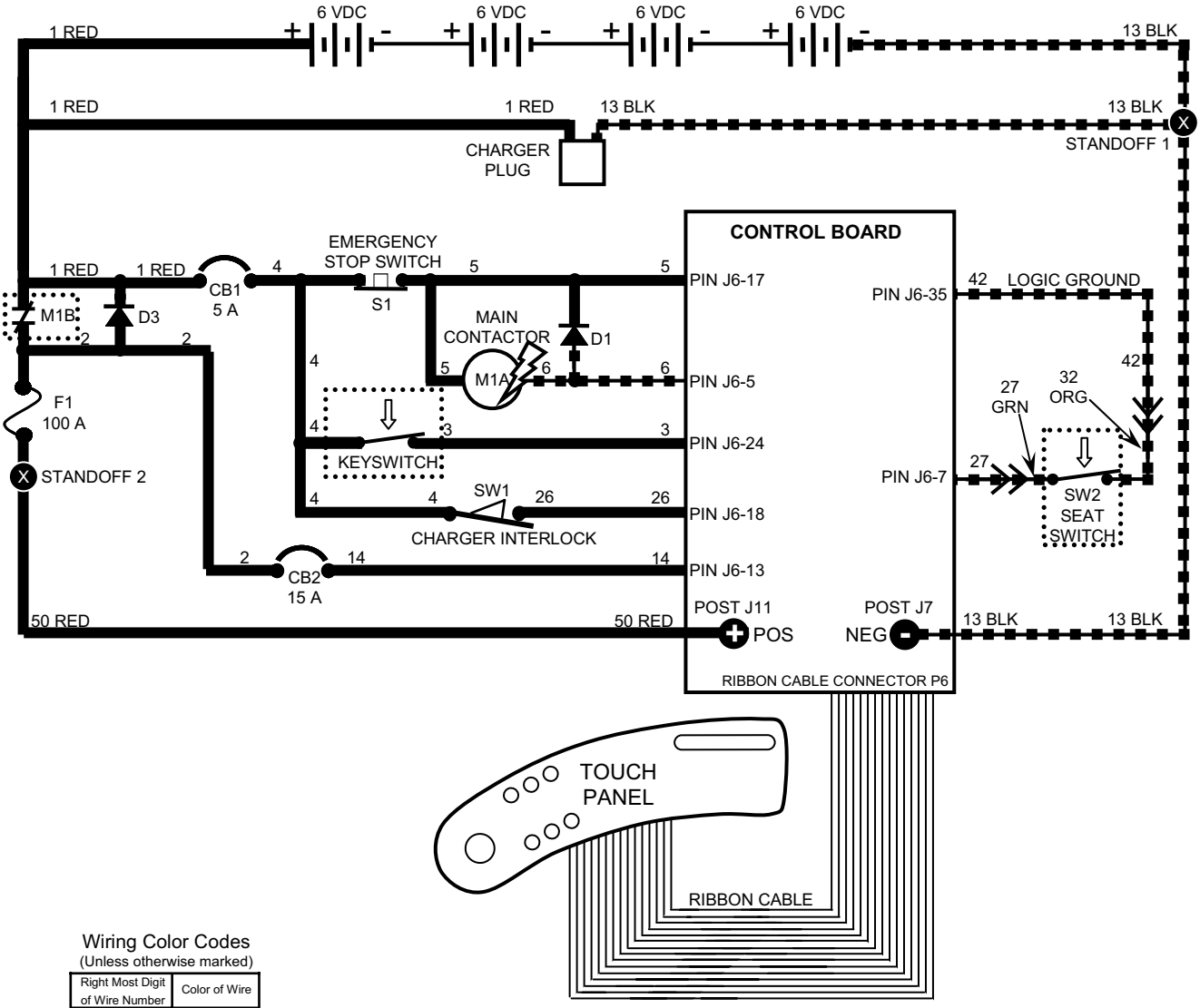
Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

= Battery Negative or Logic Ground

= Battery Positive or Positive Output

Key ON, Operator on Seat



Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

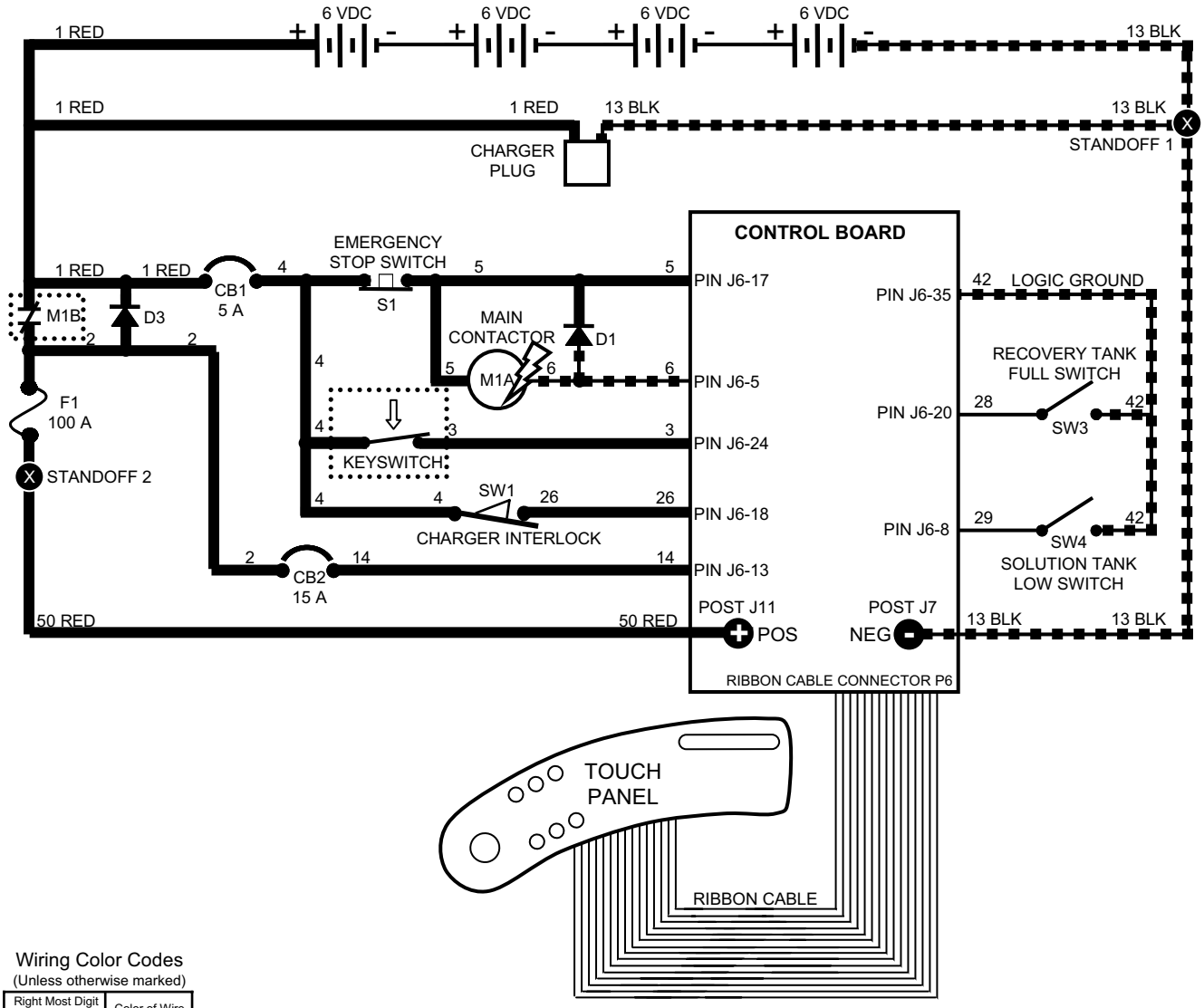
= Battery Negative or Logic Ground

= Battery Positive or Positive Output

E

Tank Level Switches

CONDITIONS: **key ON**



Tank Level Switches Logic Chart

Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

= Battery Negative or Logic Ground

= Battery Positive or Positive Output

Recovery Tank Full Switch ***closes*** when recovery tank is full

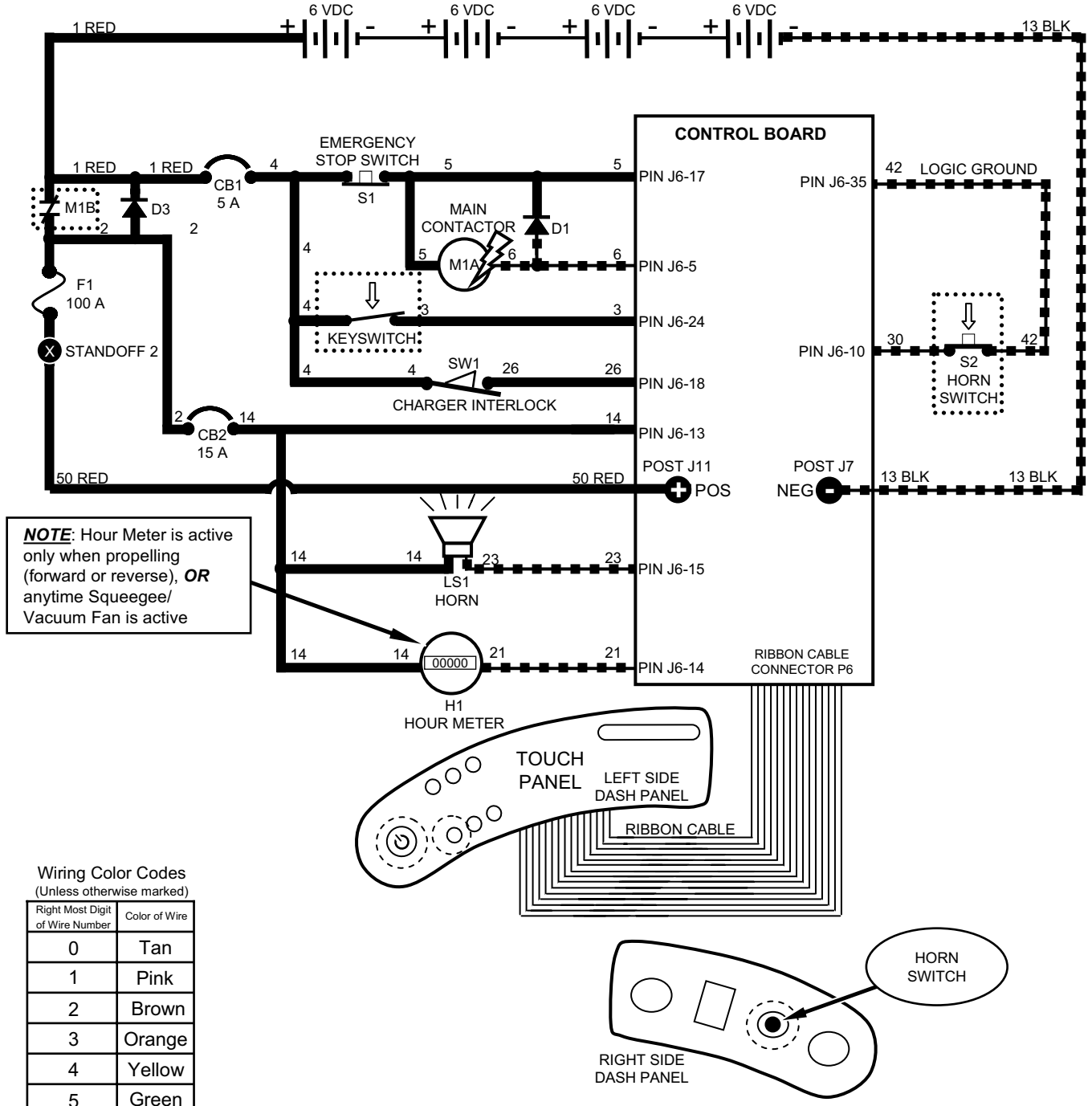
Solution Tank Low Switch ***opens*** when solution tank is low

Tank Level Switches are ALWAYS in the OPEN position with low or empty tank

Tank Level Switches are ALWAYS in the CLOSED position with full tank

Horn & Hour Meter Systems

CONDITIONS: **key ON, operator on seat, in motion *OR* Vacuum Fan running (for Hour Meter)**



NOTE: Hour Meter is active only when propelling (forward or reverse), ***OR*** anytime Squeegee/ Vacuum Fan is active

Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

= Battery Negative or Logic Ground

= Battery Positive or Positive Output

ⓘ Horn pulses ON & OFF when Directional Switch is in REVERSE

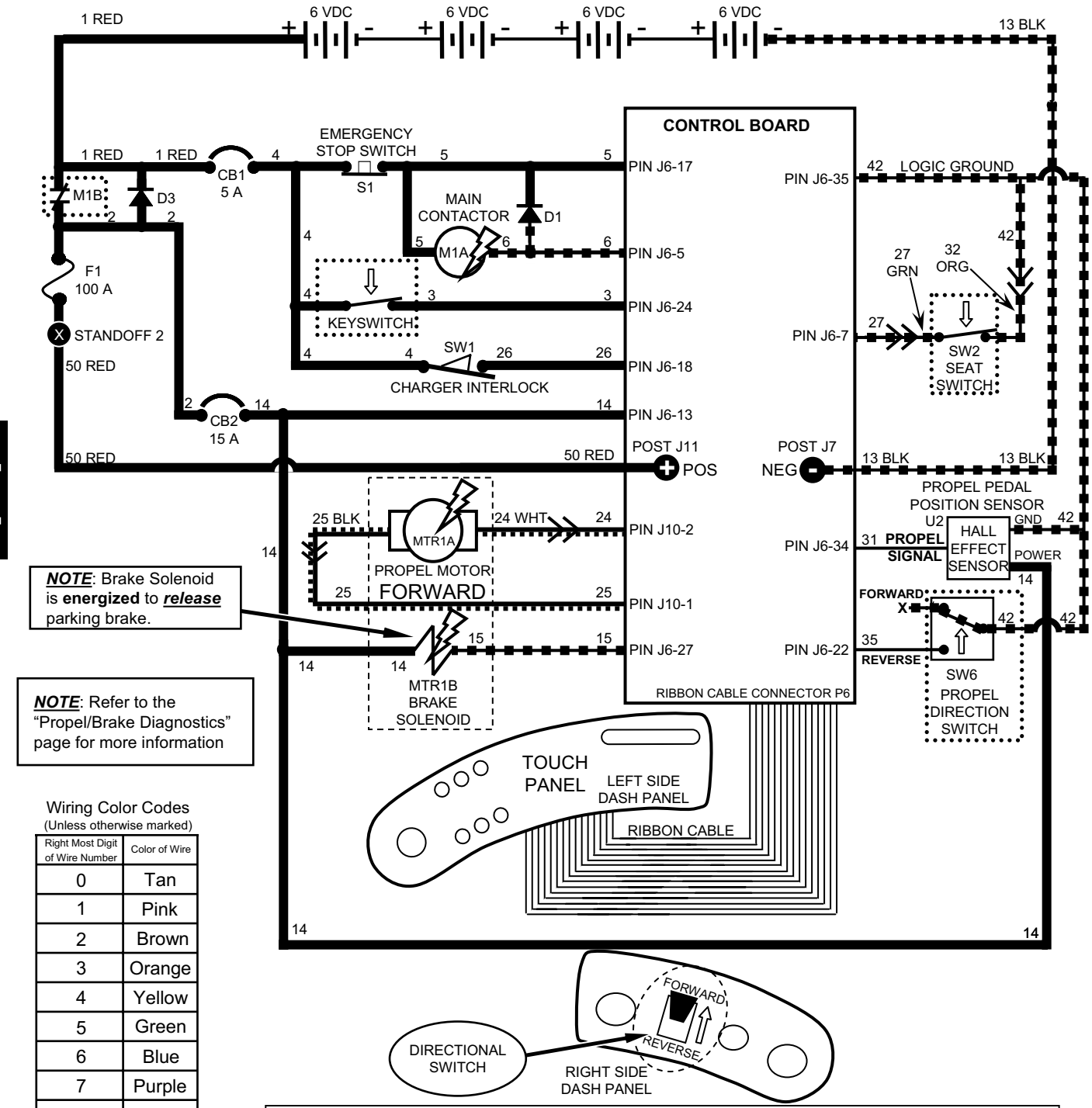
Hour Meter is ON only when propelling (forward or reverse), or anytime Squeegee/Vacuum Fan is ON

Horn pulses when a fault is detected (Directional Switch must be in FORWARD Position) – refer to “Diagnostic/Beep Code” chart

E

Propel Forward System

CONDITIONS: **key ON, operator on seat, propel pedal depressed**



NOTE: Brake Solenoid is **energized** to ***release*** parking brake.

NOTE: Refer to the "Propel/Brake Diagnostics" page for more information

Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

= Battery Negative or Logic Ground

= Battery Positive or Positive Output

= Output that can Change Polarity

Typical Propel Motor Current Draw: 1 to 20 Amps in motion, higher at start-up

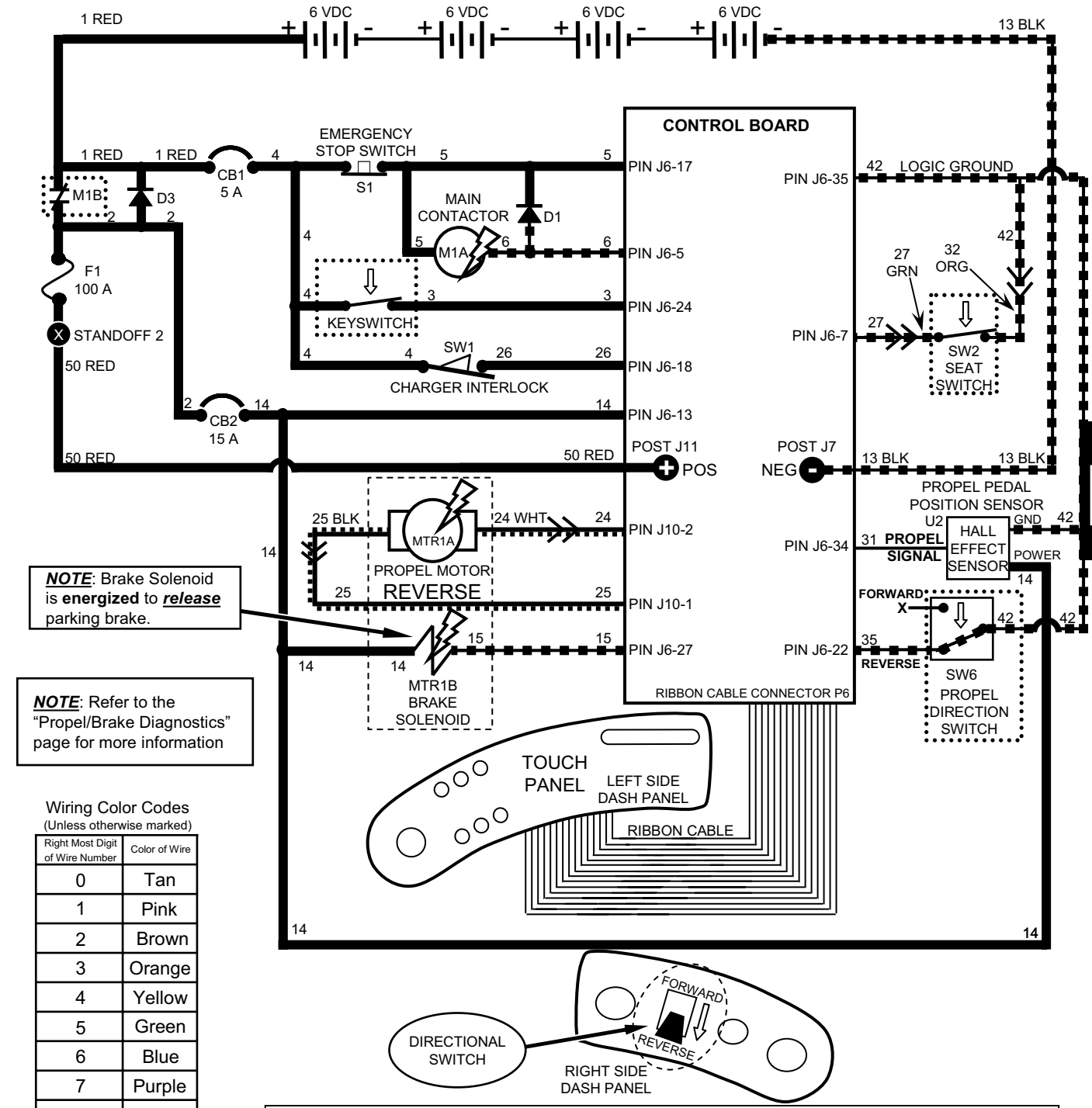
Propel Motor Voltage: 0 to 24 VDC - FORWARD
Approx. 0 to 17 VDC - REVERSE

Propel Motor is controlled by PWM (Pulse Width Modulation)

The Propel Pedal Position HALL EFFECT Sensor sends a varying voltage signal (1 to 4 Volts) to control board, based upon position of the propel pedal

Propel Reverse System

CONDITIONS: **key ON, operator on seat, propel pedal depressed**



NOTE: Brake Solenoid is **energized** to ***release*** parking brake.

NOTE: Refer to the "Propel/Brake Diagnostics" page for more information

Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

= Battery Negative or Logic Ground

= Battery Positive or Positive Output

= Output that can Change Polarity

Typical Propel Motor Current Draw: 1 to 20 Amps in motion, higher at start-up

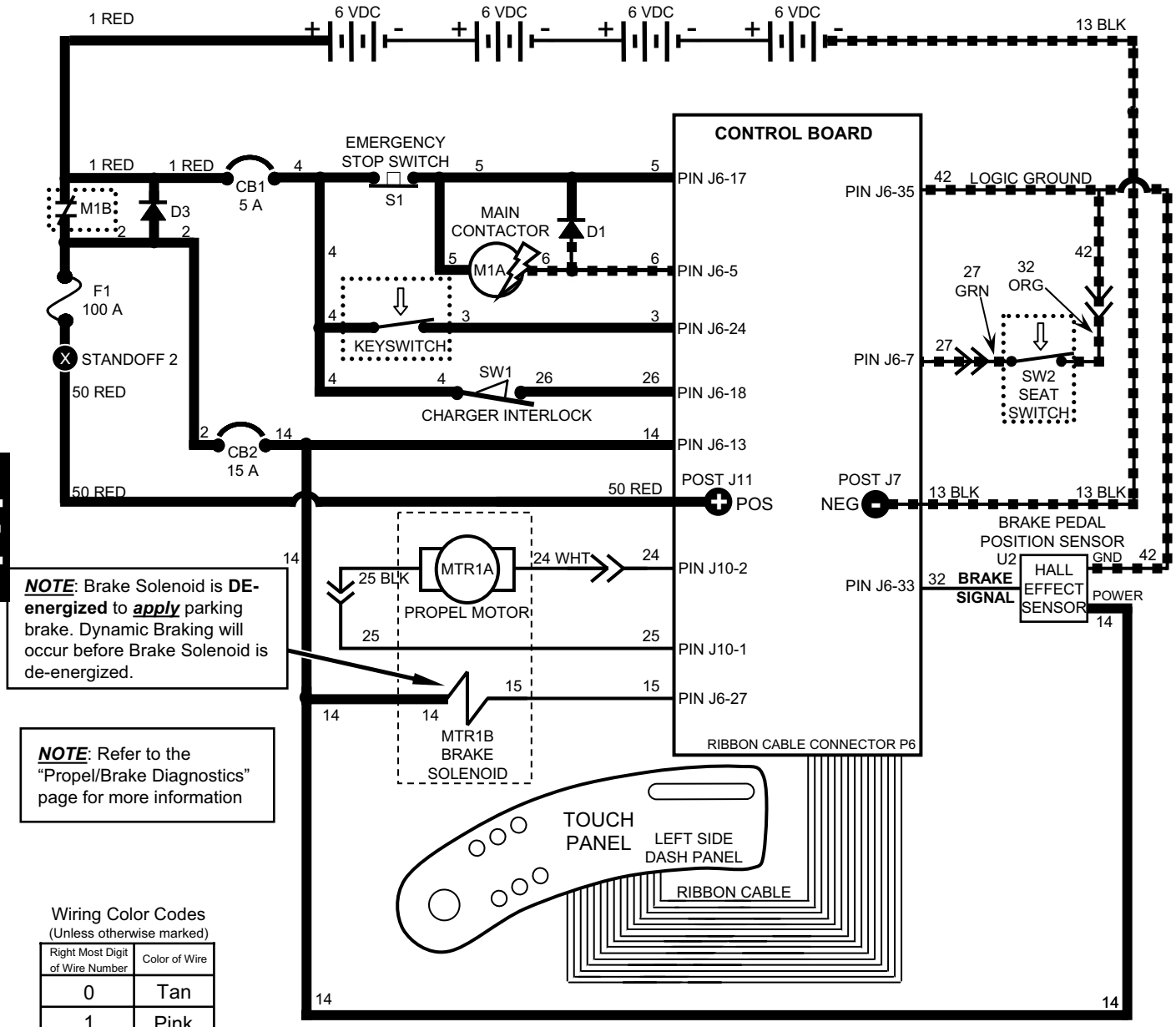
Propel Motor Voltage: 0 to 24 VDC - FORWARD
Approx. 0 to 17 VDC - REVERSE

Propel Motor is controlled by PWM (Pulse Width Modulation)

The Propel Pedal Position HALL EFFECT Sensor sends a varying voltage signal (1 to 4 Volts) to control board, based upon position of the propel pedal

Braking System

CONDITIONS: **key ON, operator on seat, brake pedal depressed**



NOTE: Brake Solenoid is **DE-energized** to ***apply*** parking brake. Dynamic Braking will occur before Brake Solenoid is de-energized.

NOTE: Refer to the "Propel/Brake Diagnostics" page for more information

Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

= Battery Negative or Logic Ground

= Battery Positive or Positive Output

The brake pedal position HALL EFFECT sensor sends a varying voltage signal (1 to 4 Volts) to control board, based upon position of the brake pedal

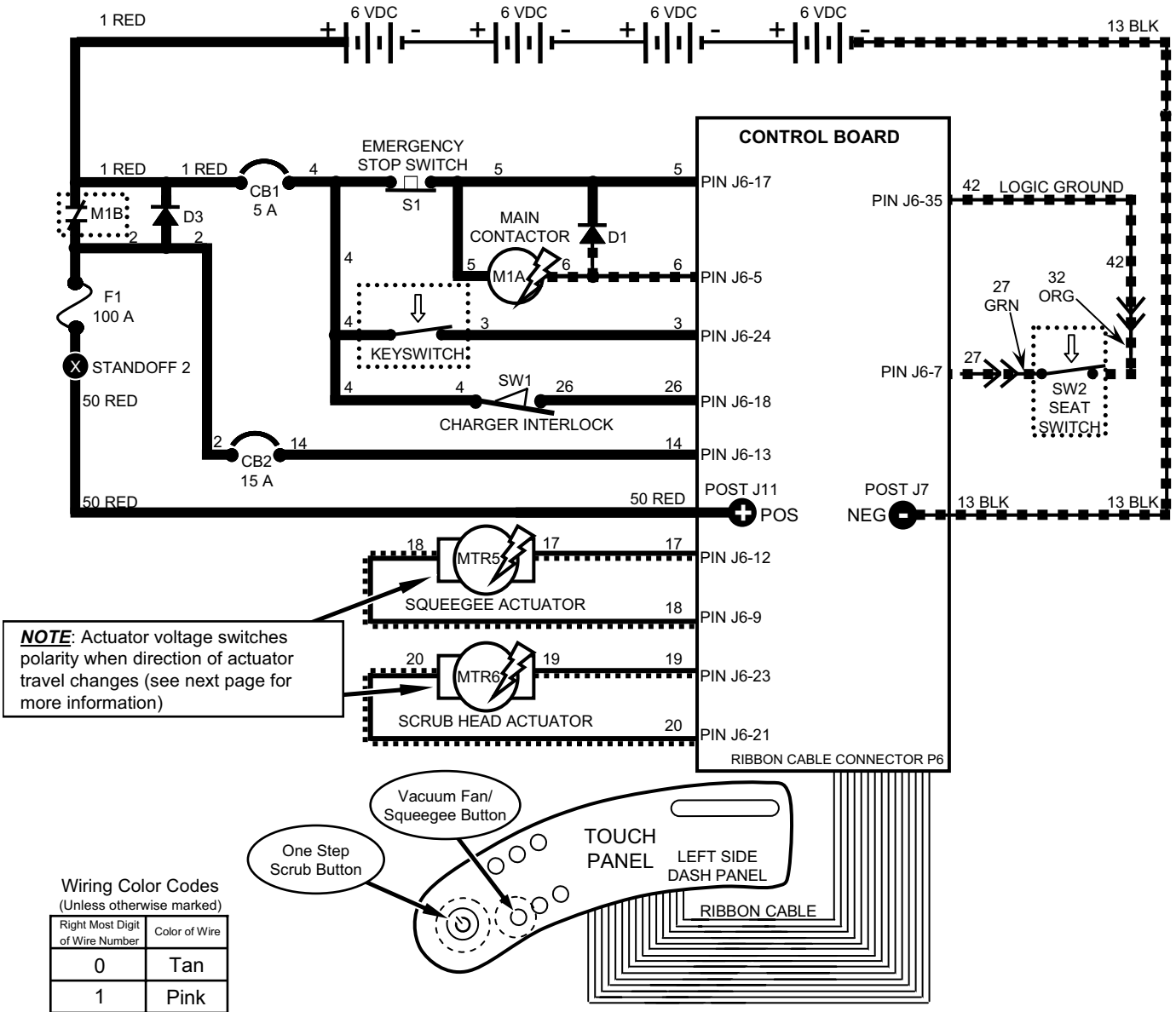
Brake Solenoid is **DE-energized** to ***apply*** brake.

Dynamic Braking will occur before Brake Solenoid is de-energized.

Scrub Head & Squeegee Actuator Systems

(page 1 of 2)

CONDITIONS: **key ON, operator on seat, forward travel, propel pedal depressed, One Step Scrub Button pressed**



NOTE: Actuator voltage switches polarity when direction of actuator travel changes (see next page for more information)

Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

= Battery Negative or Logic Ground

= Battery Positive or Positive Output

= Output that can Change Polarity

Pressing the “One Step Scrub Button” will lower the squeegee and scrub head

Only one actuator will be energized at any given time – squeegee is lowered first, then the scrub head

Squeegee actuator uses internal limit switches to stop travel in upward and downward travel

Scrub head actuator travel is controlled by monitoring actuator current in upward travel and brush motor current in downward travel

Squeegee actuator can also be operated by pressing the “Vacuum Fan/ Squeegee Button”, without operating scrub brushes

E

Scrub Head & Squeegee Actuator Systems

(page 2 of 2)

Actuator Voltage Data

Actuator	Travel Direction	Wire #	Color	Polarity	Notes
Squeegee	DOWN	17	Purple	−	Voltage at actuator connector will be approx. 24 VDC for 2 seconds, then approx. 12 VDC for 2 seconds for both UP & DOWN travel
		18	Gray	+	
	UP	17	Purple	+	
		18	Gray	−	
Scrub Head	DOWN	19	White	−	Voltage at actuator connector will be approx. 24 VDC for 4 seconds
		20	Tan	+	
	UP	19	White	+	Voltage at actuator connector will be approx. 24 VDC for 4 seconds, then approx. 11 to 12 VDC for 2 to 4 seconds
		20	Tan	−	

E

Pressing the “One Step Scrub Button” will lower the squeegee and scrub head

Only one actuator will be energized at any given time – squeegee is lowered first, then the scrub head

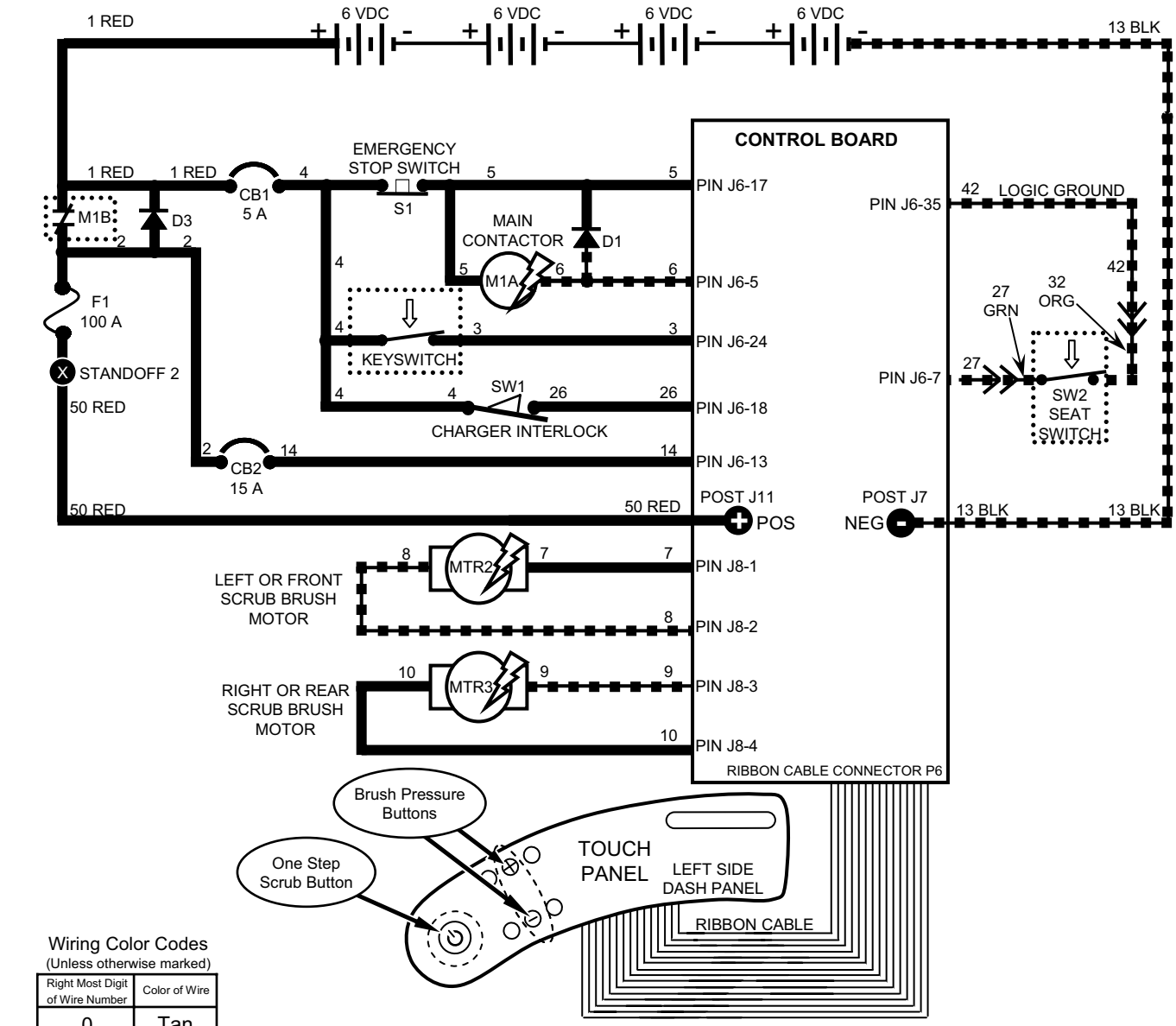
Squeegee actuator uses internal limit switches to stop travel in upward and downward travel

Scrub head actuator travel is controlled by monitoring actuator current in upward travel and brush motor current in downward travel

Squeegee actuator can also be operated by pressing the “Vacuum Fan/ Squeegee Button”, without operating scrub brushes

Scrub Brush Motors System

CONDITIONS: **key ON, operator on seat, forward travel, propel pedal depressed, One Step Scrub Button pressed**



Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

= Battery Negative or Logic Ground

= Battery Positive or Positive Output

Brush Motor Current Draw: Approx. 10 to 20 Amps per motor, varying upon selected brush pressure setting

Brush Motor Voltage: Approx. 18 VDC in Economy Mode
Approx. 21.5 VDC in All Other Modes

Scrub Brush Motors are controlled by PWM (Pulse Width Modulation)

Pressing the “One Step Scrub Button” will turn on the Scrub Brush Motors (after lowering squeegee and scrub head)

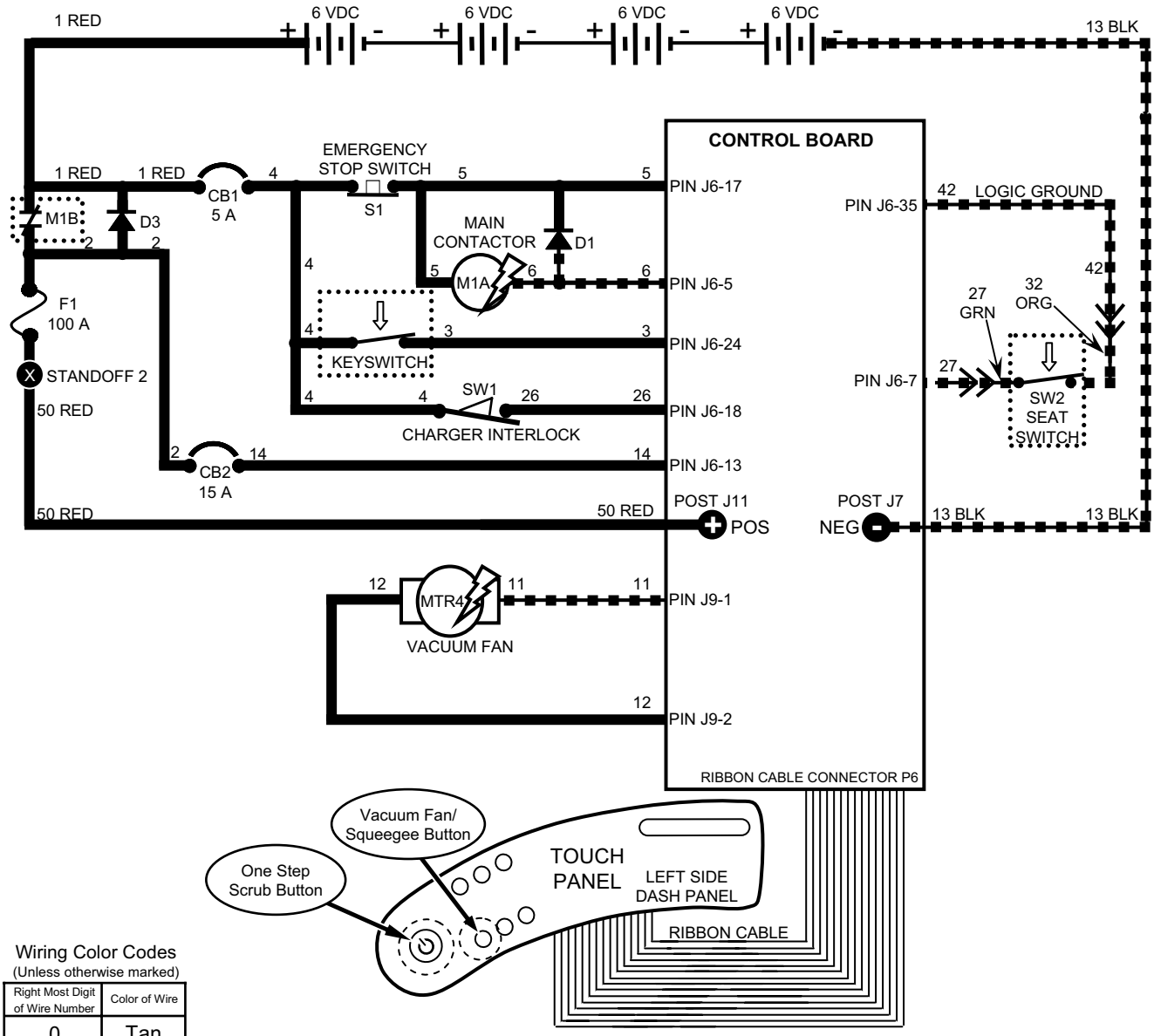
Scrub Brush Motors will function only when propelling either forward or reverse

Scrub Brush Pressure is controlled by monitoring brush motor current

E

Vacuum Fan System

CONDITIONS: **key ON, operator on seat, forward travel, One Step Scrub Button pressed**



Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

= Battery Negative or Logic Ground

= Battery Positive or Positive Output

Vacuum Fan Motor Current Draw: Approx. 18 to 21 Amps

Vacuum Fan Motor Voltage: Approx. 18 VDC in Economy Mode
Approx. 21.5 VDC in All Other Modes

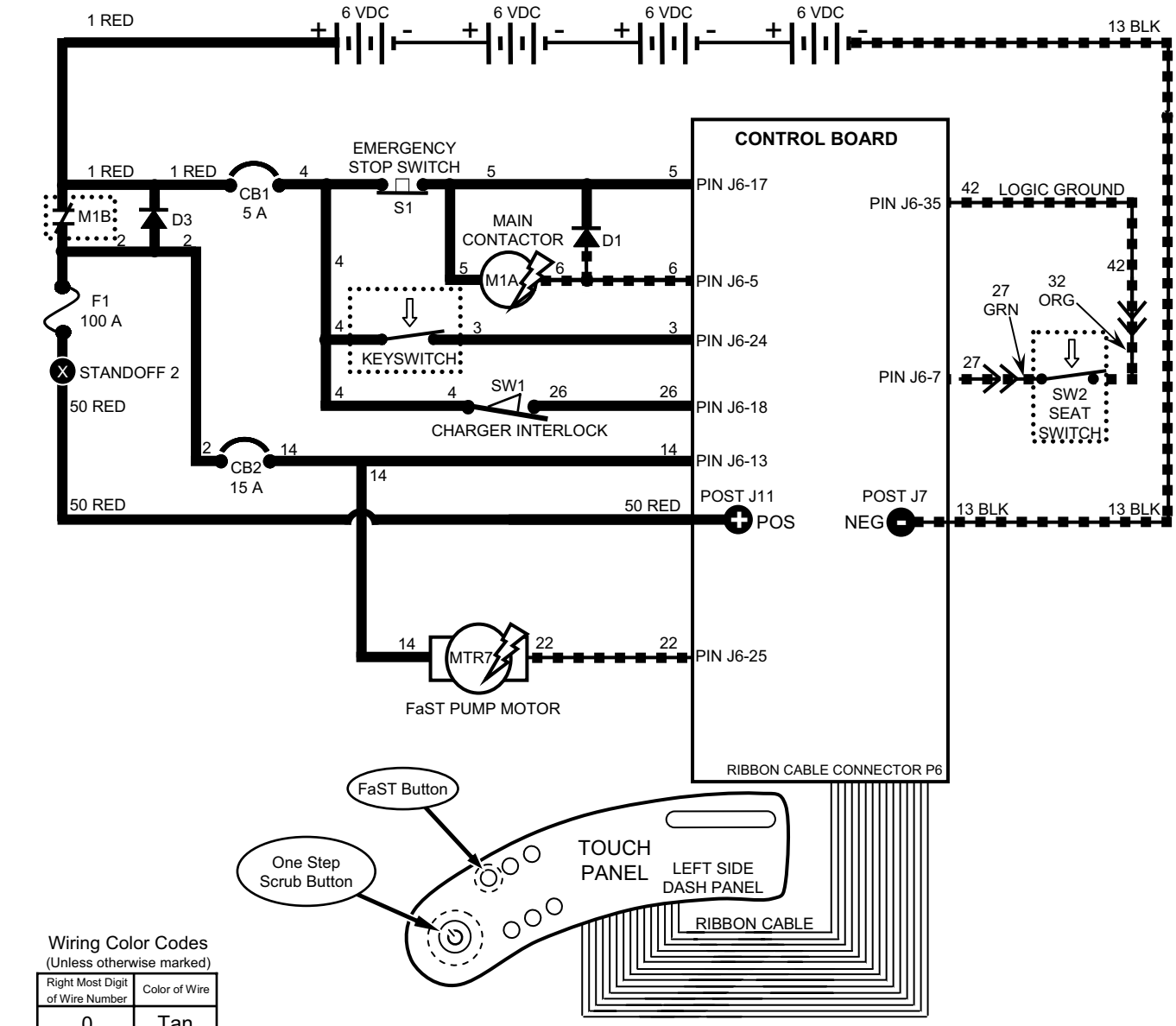
Vacuum Fan Motor is controlled by PWM (Pulse Width Modulation)

Pressing the “One Step Scrub Button” will activate Vacuum Fan

Vacuum Fan can also be operated by pressing the “Vacuum Fan/Squeegee Button”, without operating scrub brushes

FaST System

CONDITIONS: **key ON, operator on seat, forward travel, propel pedal depressed, One Step Scrub Button pressed**



Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

= Battery Negative or Logic Ground

= Battery Positive or Positive Output

Pressing the “One Step Scrub Button” will activate FaST Pump Motor ***OR*** Solution Solenoid Valve as Scrub Brush Motors engage

Pressing the FaST button will toggle from FaST scrubbing to Conventional scrubbing

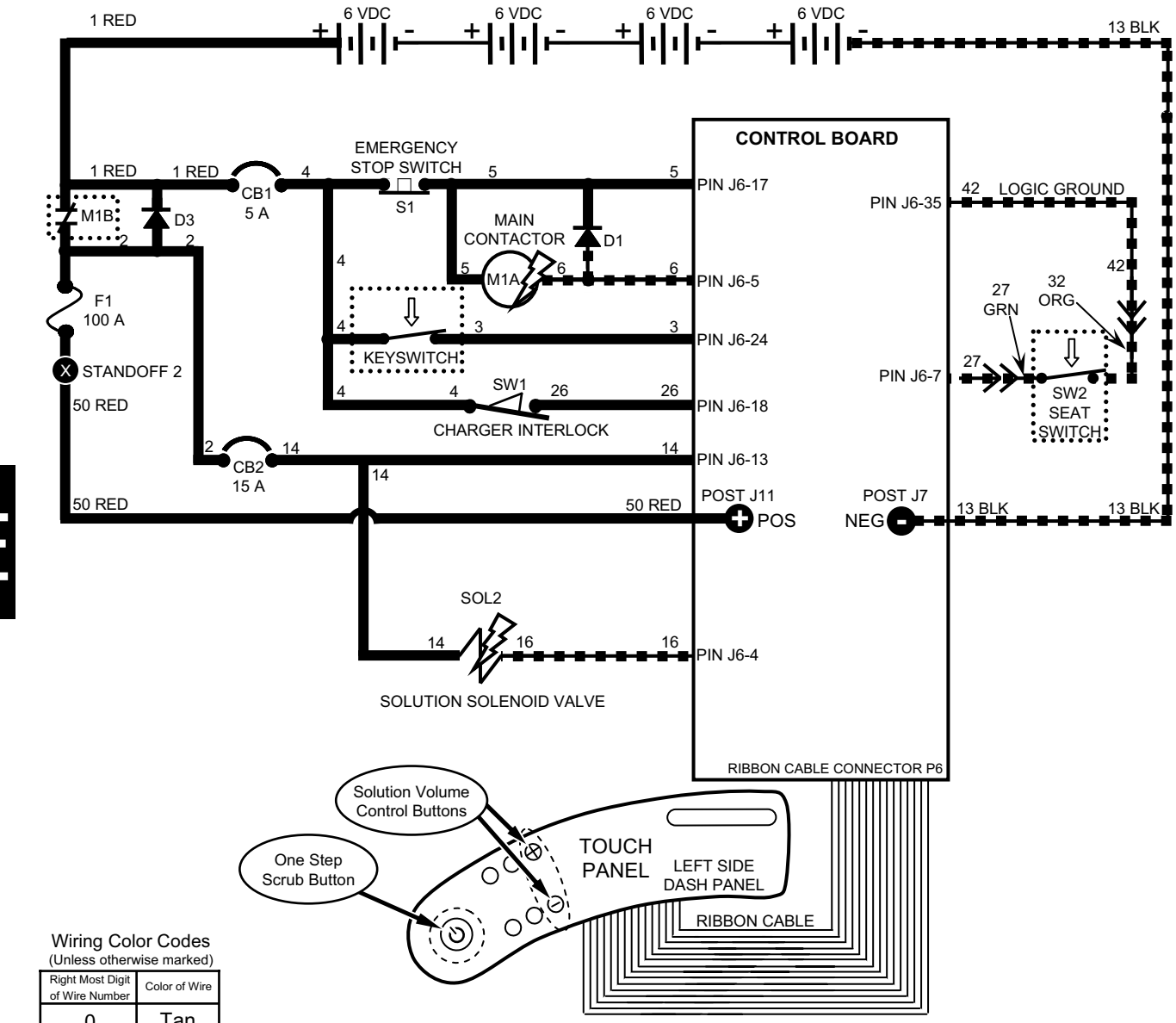
FaST system will operate ***ONLY*** if FaST LED is ON

Solution Volume Control Buttons will ***NOT*** operate & Solution Volume Control LED’s will be ***OFF*** during FaST scrubbing

E

Conventional Solution System

CONDITIONS: **key ON, operator on seat, forward travel, propel pedal depressed, One Step Scrub Button pressed**



Wiring Color Codes
(Unless otherwise marked)

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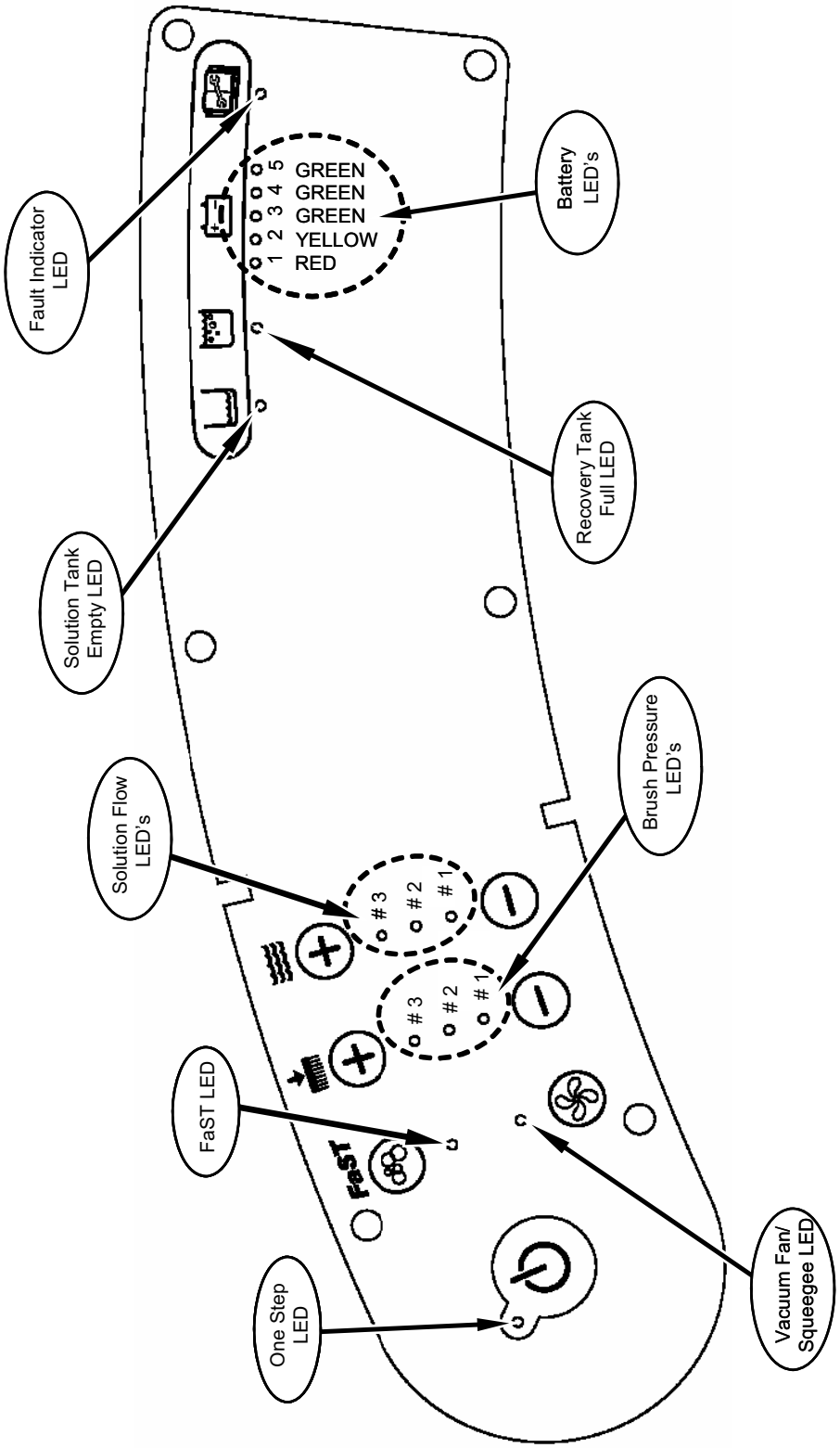
Pressing the “One Step Scrub Button” will activate FaST Pump Motor ***OR*** Solution Solenoid Valve as Scrub Brush Motors engage

Pressing the FaST button will toggle from FaST scrubbing to Conventional scrubbing

Conventional Solution system will operate ***ONLY*** if FaST LED is OFF

Solution Volume Control Buttons & LED’s will operate ***ONLY*** during Conventional scrubbing

LED Locations & Descriptions



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Operational Modes & Interlocks

Mode	Entry Sequence	Indicator	Function
Forward	−Directional Switch Forward −Propel Pedal Depressed	−Directional Switch in Forward position	Forward movement of machine
Reverse	−Directional Switch Reverse −Propel Pedal Depressed	−Directional Switch in Reverse position −Horn Sounding continuously ON & OFF (except in "Hospital" mode)	Reverse movement of machine
Scrub Mode	−Press One Step Scrub Button (ON)	−One Step Scrub LED ON	Activate Scrub Brush, Squeegee, Vacuum Fan & Solution Flow operations
FaST Mode	−Press One Step Scrub Button (ON) −Press FaST Button (ON)	−One Step Scrub & FaST LED's ON −Solution Flow LED's OFF	Activate FaST foam solution flow when scrub and propel are engaged
Conventional Solution Mode	−Press One Step Scrub Button (ON) −Press FaST Button (OFF)	−One Step Scrub & Solution Flow LED(s) ON −FaST LED OFF	Activate Conventional solution flow when scrub and propel are engaged
Double Scrub (no water pickup)	−Press One Step Scrub Button (ON) −Press Vacuum Fan/ Squeegee Button (OFF)	−One Step Scrub LED ON −Vacuum Fan/Squeege LED OFF	Apply cleaning solution with no water pickup
Water pickup (no Scrub)	−Press Vacuum Fan/ Squeegee Button (ON)	−One Step Scrub LED OFF −Vacuum Fan/Squeegee LED ON	Collect solution on floor with squeegee, without scrubbing floor
Low Power Mode	−Press Brush Pressure Decrease (-) to one LED −Press Solution Flow Decrease (-) to one LED	−Lower Brush Pressure (#1) LED ON; Middle (#2) & Upper (#3) LED's OFF −Lower Solution Flow (#1) LED ON; Middle (#2) & Upper (#3) LED's OFF	Reduce Scrub Brush and Fan speeds (to prolong battery life, reduce noise, lower water usage)
Low Power Mode w/ FaST	−Press Brush Pressure Decrease (-) to one LED −Press FaST Button (ON)	−Lower Brush Pressure (#1) LED ON; Middle (#2) & Upper (#3) LED's OFF −FaST LED ON (Solution Flow LED's OFF)	Reduce Scrub Brush and Fan speeds (to prolong battery life, reduce noise, lower water usage)
Solution Tank Empty	−Solution Tank Empty (Float Switch Open)	−Solution Tank Empty LED ON	Disable Scrub function (Operator can get an additional minute of operation by re-engaging scrub system with One Step button)
Recovery Tank Full	−Recovery Tank Full (Float Switch Closed)	−Recovery Tank Full LED ON	Disable Scrub function (Operator can get an additional minute of operation by re-engaging scrub system with One Step button)
Battery Discharged	−Battery voltage at or below full discharge voltage	−Red LED (on Battery Gauge) blinking	Disable Scrub function (Operator can get an additional minute of operation by re-engaging scrub system with One Step button)
Accessory Motor High Current Fault	−Controller sensed an Over Current condition in the Scrub Brush Motors or Vacuum Fan Motor	−Refer to "High Current Faults" chart on next page	Prevent damage to Scrub Brush Motors or Vacuum Fan Motor – Scrub function shuts off

Diagnostic & Fault Alarms

High Current Faults

Fault	Entry Sequence	Indicator
Excessive Propel Motor Current	Propel Motor Current Higher than 40 Amps for 15 min. ***OR*** Higher than 55 Amps for 6 min. ***OR*** Higher than 68 Amps for 4 min.	Blinking FAULT LED, Propel disabled
Excessive Brush Motor Current	Disk Scrub Head: RIGHT brush motor <OR> Cylindrical Scrub Head: REAR brush motor Current Higher than 30 Amps	Blinking FAULT LED, Blinking Brush Pressure LED #3
Excessive Brush Motor Current	Disk Scrub Head: LEFT brush motor <OR> Cylindrical Scrub Head: FRONT brush motor Current Higher than 30 Amps	Blinking FAULT LED, Blinking Brush Pressure LED #1
Excessive Vacuum Fan Motor Current	Vacuum Fan Motor current higher than 27 Amps	Blinking FAULT LED, Blinking Vacuum Fan/Squeegee LED

Alarm Codes

Mode	Directional Switch	Entry Sequence	Alarm Sequence	Function
Back-Up Alarm	REVERSE	Directional switch placed in REVERSE	Horn sounds **1** beep cycle (repeats)	Alerts nearby persons of machine backward movement (Note: Back-up alarm will not sound when machine is placed in "Hospital" mode)
Propel Interlock: Seat Switch Released	FORWARD	Propel Pedal depressed with operator NOT on seat	Horn sounds **2** beep cycle (repeats)	Prevents movement of machine when operator not in place
Propel interlock: High Pedal Disable	FORWARD	Key switch turned ON with Propel Pedal engaged	Horn sounds **4** beep cycle (repeats)	Prevents movement of machine when key switched ON while throttle depressed
Propel Interlock: Throttle Fault	FORWARD	Controller sensed an out-of range Throttle signal	Horn sounds **5** beep cycle (repeats) (Also FAULT and FaST LED's blink)	Prevents movement of machine with invalid throttle voltage. Scrub function shuts off.
Propel Interlock: Parking Brake Fault	FORWARD	Controller sensed an out-of range Brake signal	Horn sounds **6** beep cycle (repeats) (Also FAULT and Vacuum Fan/ Squeegee LED's blink)	Prevents movement of machine with invalid brake voltage. Scrub function shuts off.
Propel Interlock: Parking Brake Unplugged	FORWARD	Controller sensed open circuit on parking brake	Horn sounds **7** beep cycle (repeats) (Also FAULT and Lower Solution Flow LED's blink)	Prevents movement of machine with ineffective parking brake. Scrub function shuts off.
Propel Interlock: E-STOP Switch Activated	FORWARD	Controller sensed open circuit on Emergency Stop Switch circuit	Horn sounds **8** beep cycle (repeats) (When in Input Display Mode, FAULT LED will also blink)	Disables all functions (Note: To reset, key switch must be cycled OFF and ON after the E-STOP switch has closed)
Propel Interlock: Charger Plugged In	FORWARD	Battery charger plugged into machine with Key Switch ON	Horn sounds **9** beep cycle (repeats)	Prevents movement of the machine with charger plugged in

Diagnostic & Configuration Modes

Mode	Entry Sequence	Indicator	Function
Display Software Revision Mode **(REFER TO PAGE 65)**	Press and hold One Step Button, turn key switch ON, wait 10 seconds, release One Step Button	Upper Brush Pressure LED blinks Tens of days, Upper Solution Flow LED blinks Single day Middle Brush Pressure LED blinks Tens of months, Middle Solution Flow LED blinks Single month Lower Brush Pressure LED blinks Tens of years, Lower Solution Flow LED blinks out Single year	Blinking Brush Pressure and Solution Flow LED's indicate revision date
Self Test Mode **(REFER TO PAGE 66)**	Press and hold FaST and Vacuum Fan/Squeegee Buttons, turn key switch ON, wait 10 seconds, release buttons	Start of test - Left Scrub Brush turns ON End of test - Horn sounds	Solid lit One Step LED indicates OK, A Flashing LED indicates an OPEN Fault, A Solid lit LED (other than One Step) indicates a SHORT Fault
Input Display Mode **(REFER TO PAGE 67)**	Press and hold Decrease Solution Flow (-) Button, turn key switch ON, release button after forth battery LED starts to blink	Battery LED #4 (green) blinks	Shows state of control board inputs from various switches and sensors
Manual Mode **(REFER TO PAGE 68)**	Press and hold Decrease Brush Pressure (-) Button, turn key switch ON, release after Lowest Brush Pressure LED starts to blink.	Lowest down pressure LED will blink	Allows operation of individual functions without the safety interlocks affecting or controlling them
Propel/Brake Diagnostic Mode **(REFER TO PAGE 69)**	Press and hold FaST and Increase Brush Pressure (+) Buttons, turn key switch ON, release after battery LED's are OFF	FaST LED ON if in Forward ***OR*** Vacuum Fan/Squeegee LED ON if in Reverse - Solution Flow LED's display position of Propel Pedal, Brush Pressure LED's display position of Brake Pedal, Battery LED's display Propel Motor current level	Provides information regarding brake pedal signal, propel pedal signal, and propel motor current
Battery Select Mode **(REFER TO PAGE 70)**	Press and hold the Increase Solution Flow (+) Button, turn key switch ON, release after one Battery LED starts to blink	Any one of lower 4 battery LED's blinks	Allows selection of battery type. See "Battery Select Mode Settings" table.
Reverse Alarm Select Mode **(REFER TO PAGE 71)**	Put directional switch in Reverse, press & hold Horn Button, turn key switch ON	Horn sounds or is silent	Allows enable/disable of Backup alarm (Hospital Mode)
Propel Speed Selection Mode **(REFER TO PAGE 71)**	Press and hold FaST Button, turn key switch ON, release after selecting desired Brush Pressure LED setting	Brush Pressure Lower, Middle, and Upper LED's represents LOW, MEDIUM and HIGH maximum Forward Propel Speed selection	Allows selection of maximum forward speed during scrubbing LOWER (#1) LED = 2.0 mph / 3.2 kph MIDDLE (#2) LED = 2.7 mph / 4.3 kph UPPER (#3) LED = 3.5 mph / 5.5 kph

Display Software Revision Mode

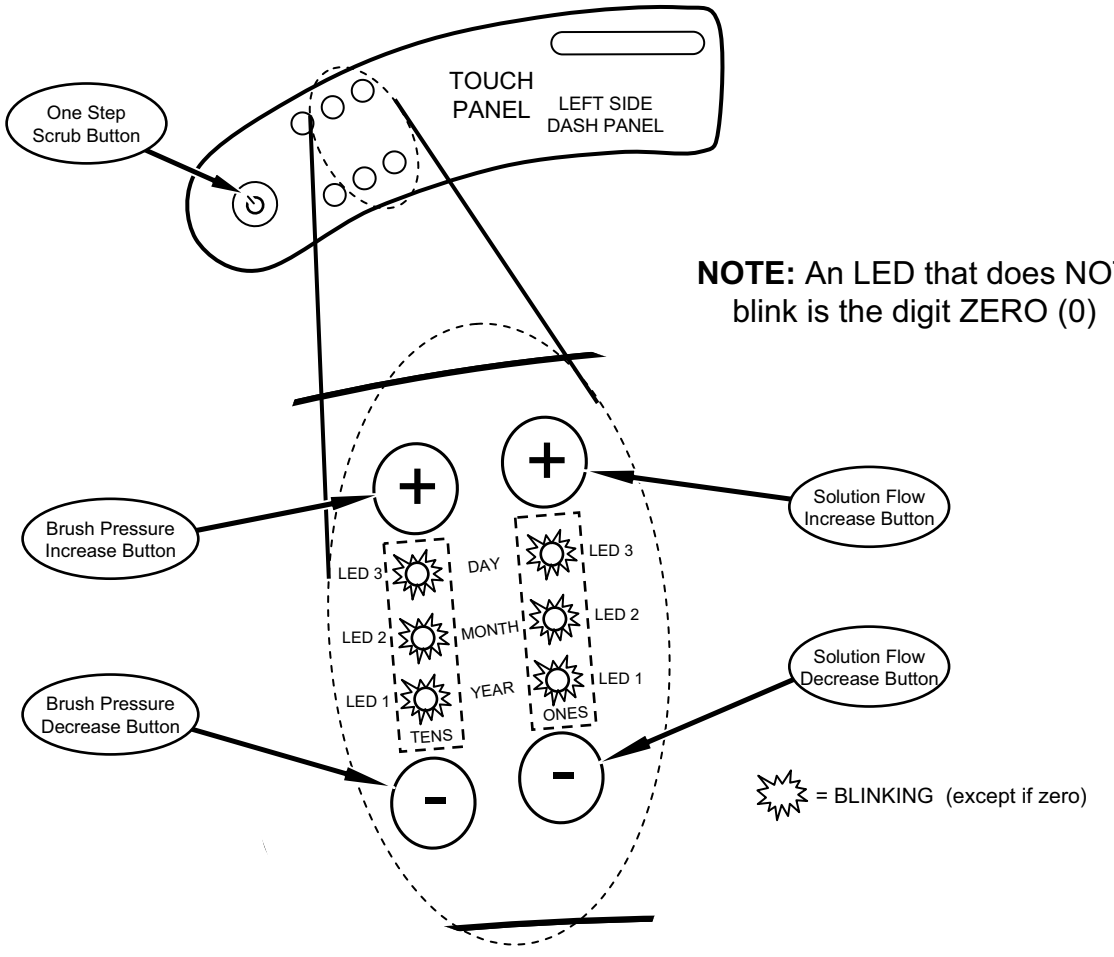
TO ENTER:

- Press and hold One Step Button
- Turn key switch ON, wait 10 seconds
- Release One Step Button

READING THE SOFTWARE REVISION:

- Upper Brush Pressure LED blinks TENS of DAYS, Upper Solution Flow LED blinks SINGLE DAY
- Middle Brush Pressure LED blinks TENS of MONTHS, Middle Solution Flow LED blinks SINGLE MONTH
- Lower Brush Pressure LED blinks TENS of YEARS, Lower Solution Flow LED blinks SINGLE YEAR

Example	Brush Pressure LED's	# of Blinks	Solution Flow LED's	# of Blinks	**Revision Date**
Day	# 3 (Upper)	2	# 3 (Upper)	6	**26th**
Month	# 2 (Middle)	1	# 2 (Middle)	1	**November**
Year	# 1 (Lower)	0 (LED OFF)	# 1 (Lower)	4	**2004**



NOTE: An LED that does NOT blink is the digit ZERO (0)

Self Test Mode

TO ENTER:

- Press and hold FaST & Vacuum Fan/Squeegee Buttons
- Turn key switch ON, wait 10 seconds
- Release Buttons
- The entire Self Test takes approximately 40 seconds

AFTER THE SELF TEST IS COMPLETE:

- If the One Step LED is lit solid, NO FAULTS were found
- If any LED is blinking, an OPEN FAULT was found – refer to table below
- If any LED (other than One Step) is lit solid, a SHORT FAULT was found – refer to table below

Self Test Results

LED (Flashing = OPEN, Solid = SHORT)	System at Fault
One Step LED	No Faults Found
FaST LED	Fast Pump
Vacuum Fan/Squeegee LED	Vacuum-Fan
# 3 (Upper) Brush Pressure LED	Right Brush
# 2 (Middle) Brush Pressure LED	Left Brush
# 1 (Lower) Brush Pressure LED	Head Actuator
# 3 (Upper) Solution Flow LED	Water Valve
# 2 (Middle) Solution Flow LED	Squeegee Actuator
# 1 (Lower) Solution Flow LED	Brake
Recovery Tank Full LED	Horn/Back-up Alarm

Input Display Mode

The purpose of the Input Display Mode is to show the condition of various control board inputs

TO ENTER:

- Press and hold the Decrease Solution Flow (-) Button
- Turn key switch ON
- Release Button after the # 4 Battery LED blinks
- Turn key switch OFF when testing is complete.

INPUT	ASSOCIATED LED	LED IS ON WHEN:	LED IS OFF WHEN:	NOTES
Charger Interlock Switch	FaST LED	Battery charger IS NOT plugged in (switch is CLOSED)	Battery charger IS plugged in (switch is OPEN)	FaST system will still operate, but without indicator
Seat Switch	# 5 (Green) Battery LED	Operator IS NOT sitting on seat (switch is OPEN)	Operator IS sitting on Seat (switch is CLOSED)	
Recovery Tank Float Switch	Recovery Tank Full LED	Recovery tank IS FULL (switch must be CLOSED for 5 to 7 seconds)	Recovery tank IS NOT FULL (switch is OPEN)	Opening switch and pushing the the One Step Button turns LED off again
Solution Tank Float Switch	Solution Tank Empty LED	Solution tank IS EMPTY (switch must be OPEN for 5 to 7 seconds)	Solution tank IS NOT EMPTY (switch is CLOSED)	Closing switch and pushing the the One Step Button turns LED off again
Emergency Stop Switch	Fault Indicator LED (Blinking)	Emergency Stop Switch IS ACTIVATED (switch is OPEN)	Emergency Stop Switch IS NOT ACTIVATED (switch is CLOSED)	Horn will repeat 8 beep cycle when Emergency Stop Switch is activated
One Step Button	One Step LED	Scrub system IS ACTIVATED	Scrub system IS NOT ACTIVATED	
Vacuum Fan/Squeegee Button	Vacuum Fan/Squeegee LED	Vacuum Fan & Squeegee ARE ACTIVATED	Vacuum Fan & Squeegee ARE NOT ACTIVATED	
Battery Voltage	# 1 (Red) Battery LED	Battery needs charging (LED is BLINKING)	Battery has sufficient charge level	

Left Scrub Brush

Low Pressure	# 1 (Lower) Brush Pressure LED	LOW scrub brush current sensed	Scrub system IS NOT ACTIVATED	
Medium Pressure	# 2 (Middle) Brush Pressure LED	MEDIUM scrub brush current sensed		
High Pressure	# 3 (Upper) Brush Pressure LED	HIGH scrub brush current sensed		

Right Scrub Brush

Low Pressure	# 1 (Lower) Solution Flow LED	LOW scrub brush current sensed	Scrub system IS NOT ACTIVATED	
Medium Pressure	# 2 (Middle) Solution Flow LED	MEDIUM scrub brush current sensed		
High Pressure	# 3 (Upper) Solution Flow LED	HIGH scrub brush current sensed		

NOTE: For Propel & Brake signal troubleshooting, refer to the Propel Diagnostics Mode page

Manual Mode

The purpose of the Manual Mode is to allow functioning of the individual systems on the machine without regard of most safety interlocks

TO ENTER:

- Press and hold the Decrease Brush Pressure (-) Button
- Turn key switch ON
- Release Button after # 1 (Lower) Brush Pressure LED blinks
- Turn key switch OFF when testing is complete.

FUNCTION	BUTTON	ACTION	INDICATOR	NOTES
Lower Scrub Head	One Step	Press & Hold	One Step LED ON	Scrub head will continue to lower as long as button is held
CAUTION: Do not hold One Step Button down too long - actuator stall will occur, possibly damaging actuator or control board				
Operate Scrub Brushes	One Step	Release button after lowering scrub head	One Step LED ON	Scrub head stops lowering after One Step Button is released
Turn OFF Scrub Brushes and Raise Scrub Head	One Step	Press & Release	One Step LED OFF	Scrub head raises to to top of stroke and stops
Turn ON Vacuum Fan and Lower Squeegee	Vacuum Fan/ Squeegee	Press & Release	Vacuum Fan/ Squeegee LED ON	In this mode, pressing the One Step Button during lowering of the squeegee will stop squeegee travel
CAUTION: In this mode, automatic raising of the squeegee when in REVERSE is disabled				
Turn OFF Vacuum Fan and Raise Squeegee	Vacuum Fan/ Squeegee	Press & Release	Vacuum Fan/ Squeegee LED OFF	In this mode, pressing the One Step Button during raising of the squeegee will stop squeegee travel
Turn ON FaST pump	FaST	Press & Release	FaST LED ON	
Turn OFF FaST pump	FaST	Press & Release	FaST LED OFF	
Increase Solution Flow Rate	Increase Solution Flow (+)	Press & Release	Solution Flow LED's	In this mode, the Solution Flow automatic ON/OFF interlock is disabled
Decrease Solution Flow Rate	Decrease Solution Flow (-)	Press & Release	Solution Flow LED's	In this mode, the Solution Flow automatic ON/OFF interlock is disabled
ADDITIONAL NOTES				
• When the Recovery Full switch is CLOSED for 5 to 7 seconds, the Recovery Full LED will light				
• When the Solution Empty switch is OPEN for 5 to 7 seconds, the Solution Empty LED will light				
• If the Recovery Full LED or the Solution Empty LED is ON, and the Scrub System or Vacuum Fan/Squeegee system is activated, the Recovery Full LED and Solution Empty LED will turn OFF and the sensing of both switches will be disabled for about a minute				
• With the Directional Switch in REVERSE, the Back-up Alarm will sound but automatic raising of the squeegee is disabled				
• For safety considerations, the "High Pedal Disable" and "Seat Switch Disable" interlocks & alarms are still active in Manual Mode				

Propel/Brake Diagnostics

TO ENTER:

- Press and hold FaST & Increase Brush Pressure (+) Buttons
- Turn key switch ON
- Release Buttons after FaST LED (if in Forward) or Vacuum Fan/Squeegee LED (if in Reverse) is lit

TEST	ACTION	INDICATOR	NOTES
Directional Switch - Forward	Place Directional Switch in Forward Propel position	FaST LED ON	LED will be illuminated if the controller senses the Directional Switch in Forward Position - Machine will not propel if any of the Brake LED's are illuminated
Directional Switch - Reverse	Place Directional Switch in Reverse Propel position	Vacuum Fan/ Squeegee LED ON	LED will be illuminated if the controller senses the Directional Switch in Reverse Position - Machine will not propel if any of the Brake LED's are illuminated
Brake Pedal	Depress Brake Pedal	Brush Pressure LED's	LED's will display the sensed position of the brake pedal - No LED's indicate pedal is released, 3 LED's indicate that the pedal is fully depressed
Accelerator Pedal	Depress Accelerator Pedal	Solution Flow LED's	LED's will display the sensed position of the accelerator pedal - No LED's indicate the pedal is released, 3 LED's indicate that the pedal is fully depressed
Propel Motor Current	Depress Accelerator Pedal	Battery LED's	Battery gauge LED's display the current level being drawn by the Propel Motor - Each LED represents 7 Amps of current (ex: 3 LED's = 21 Amps)

E

Propelling System Data

Direction	Wire #	Color	Polarity	Notes	
Forward	25	Green	–	Voltage during FORWARD travel will vary between 0 to 24 VDC	Releasing the Propel Pedal will initiate Dynamic Braking; As machine slows to a halt, the Brake solenoid is De-energized, applying the Parking Brake
	24	Yellow	+		
Reverse	25	Green	+	Voltage during REVERSE travel will vary between approximately 0 to 17 VDC	
	24	Yellow	–		

Propel & Brake Pedal Data

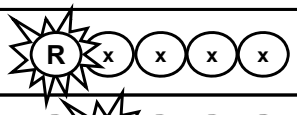
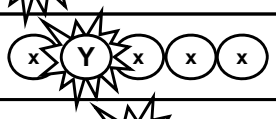
Pedal	LED group	Lit LED's	Pedal Position	Input Voltage Level	Notes
Propel	Solution Flow	0	Released	below 1.35 VDC	Machine must be in Propel Diagnostic Mode when testing; LED's will display the sensed position of the pedal; No LED's indicate pedal is released; 3 LED's indicate pedal is fully depressed
		1	Slightly Depressed	1.35 to 1.89 VDC	
		2	Halfway Depressed	1.89 to 2.27 VDC	
		3	Fully Depressed	2.27 to 4.0 VDC	
Brake	Brush Pressure	0	Released	below 1.5 VDC	
		1	Slightly Depressed	1.5 to 1.89 VDC	
		2	Halfway Depressed	1.89 to 2.27 VDC	
		3	Fully Depressed	2.27 to 4.0 VDC	

Battery Select Mode & Voltage Levels

Battery Select Mode

TO ENTER:

- Press and hold Increase Solution Flow (+) Button
- Turn key switch ON
- Release Button after one of the Battery LED's begins blinking
- Battery Location/Type can be changed by pressing the Solution Flow (-) until the desired setting is selected.
- Turn key switch OFF to save setting.

Location / Type	BDI Indicator LED's
Worldwide / Wet	
Europe** / Wet	
TNV** / Wet	
Worldwide / Gel	

LED's: R=RED Y=YELLOW G=GREEN (x)=OFF =BLINKING

**Used only under instruction of battery manufacturer

Voltage Levels*

Battery Level	Worldwide Voltage (Wet)	European** Voltage (Wet)	TNV** Voltage (Wet)	Worldwide Voltage (Gel)	BDI Indicator LED's
Full Battery Voltage	24.5	24.5	24.5	24.5	R Y G G G
Level 4	23.8	23.9	23.9	24.0	R Y G G x
Level 3	23.1	23.2	23.3	23.5	R Y G x x
Level 2	22.4	22.6	22.7	23.0	R Y x x x
Level 1	21.7	21.9	22.1	22.6	R x x x x
Full discharge	21.0	21.3	21.6	22.2	R x x x x

LED's: R=RED Y=YELLOW G=GREEN x=OFF =BLINKING

*Voltage measured at circuit board - Assume 0.5 Volts higher at batteries (under load)

**Used only under instruction of battery manufacturer

Reverse Alarm & Propel Speed Select Modes

Reverse Alarm Select Mode

Reverse Alarm Select Mode allows enabling or disabling of the Backup Alarm

TO ENTER:

- Put directional switch in Reverse
- Press & Hold Horn Button
- Turn key switch ON
- If Back-up Alarm is silent, Hospital (Quiet) Mode has been selected
- If Back-up Alarm is sounding, Normal mode has been selected
- Cycle key switch OFF, then ON again
- Verify correct mode has been chosen

Propel Speed Select Mode

Propel Speed Select Mode allows selection of maximum forward speed during scrubbing

TO ENTER:

- Press and hold FaST Button
- Turn key switch ON
- Release Buttons after selecting desired Brush Pressure LED
- Refer to table below for speed selection
- Turn key switch OFF to save setting.

BRUSH PRESSURE LED(s) LIT	MAXIMUM SCRUB SPEED
# 1 (Lower) LED	2.0 mph / 3.2 kph
#1 & # 2 LEDs	2.7 mph / 4.3 kph
#1, #2, & # 3 LEDs	3.5 mph / 5.5 kph

Inputs & Outputs Table

Inputs and the Outputs they Control		Inputs													
		Key Switch (ON)	Seat Switch (Operator on seat)	Charger Switch (Charger plugged in to machine)	Emergency Stop Switch (Pressed)	One Step Switch (ON)	FaST Switch (ON)	Vacuum Fan/ Squeegee Switch (ON)	Recovery Tank Full Switch (Tank Full)	Solution Tank Empty Switch (Tank Empty)	Directional Switch Forward	Directional Switch Reverse	Throttle Input (Pedal pressed)	Brake Input (Pedal pressed)	Horn Button (Pressed)
Outputs	Main Contactor	E		D	D										
	Propel Forward	E	E	D	D						E	D	E	D	
	Propel Reverse	E	E	D	D						D	E**	E	D	
	Dynamic Braking Force - Increase	E	E		D									E	
	Parking Brake			E	E								D	E***	
	Scrub Motors	E		D	D	E			D	D			E	D	
	Scrub Head Pressure Control	E		D	D	E			D	D			E	D	
	Vacuum Motor	E		D	D			E	D	D					
	Squeegee Down	E		D	D			E	D	D	E	D			
	FaST System	E		D	D	E	E		D	D			E	D	
	Solution Solenoid	E		D	D	E									
	Hour Meter Operation	E						E*					E*		
	Horn	E									E**				E
	Battery Gauge Reset			E											

E = Input that will ENABLE Output

D = Input that will DISABLE Output

* Activating Vacuum Fan ***OR*** Propelling machine will enable the Hour Meter

** Horn will sound when Directional Switch is selected for Reverse (**except** in Hospital Mode)

*** Parking Brake activated after timer has expired

AMER DRIVE MOTOR

BEFORE CONDUCTING TESTS:

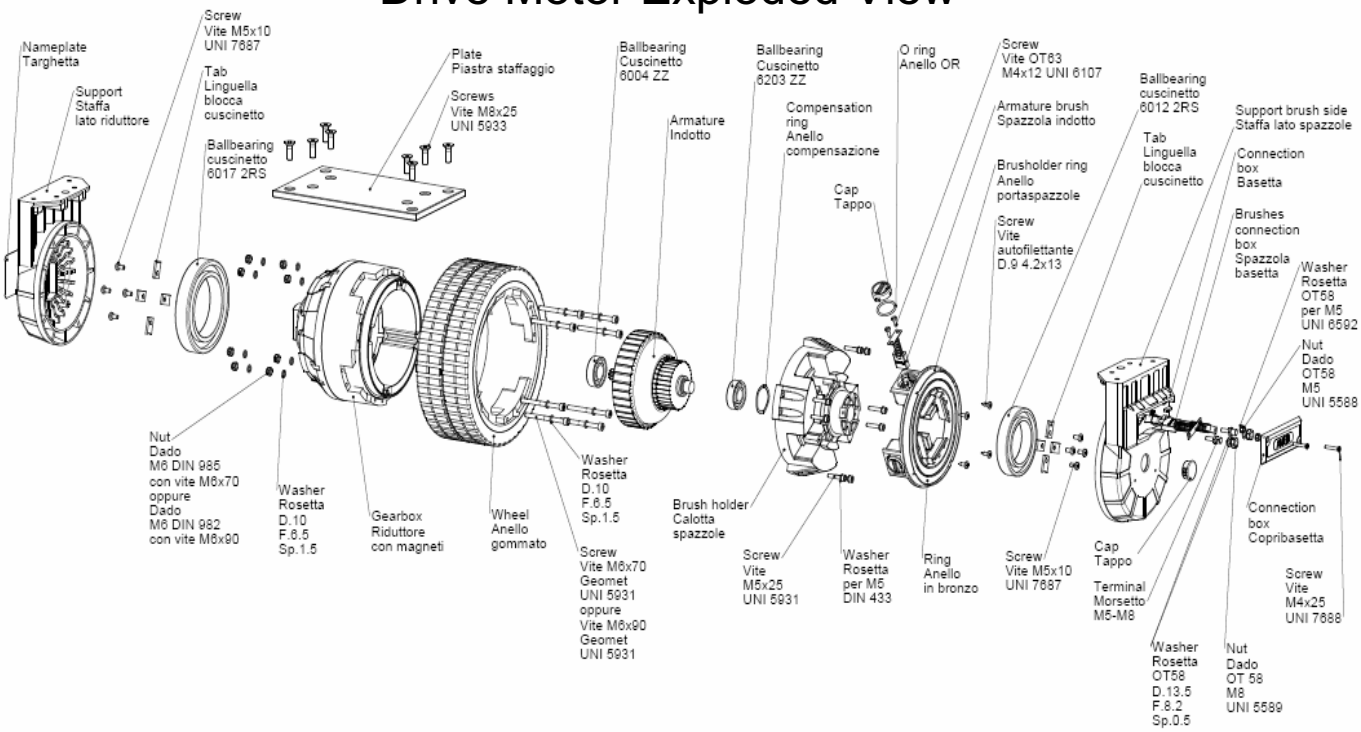
* Read and Follow ALL Safety Warnings and Precautions as mentioned at the beginning of this manual
* Always unhook Battery when removing or replacing electrical components

DURING TESTS:

* Call Technical Services if Diagnostic Time Exceeds One Hour With Unknown Cause or Course of Action

NOTE: Troubleshooting charts may be shown with optional equipment. The optional equipment may not be specified in these charts. Some machines may not be equipped with all components shown.

Drive Motor Exploded View



Performance Specifications

Watts
Speed
Volts
Amps
} Nominal Values

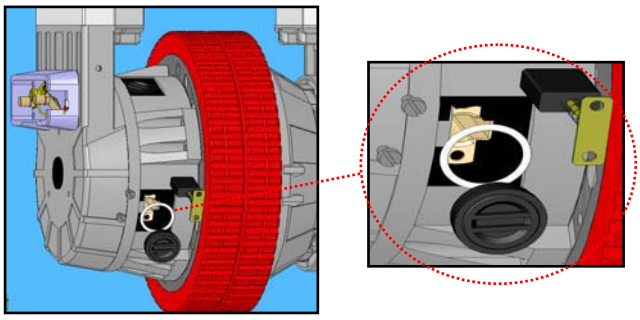
Tennant Part Number
Gear Ratio
Duty Cycle
Date Made
Serial Number

Amp draw with drive wheel off of the floor should not exceed:

24volt	*7.5 amps*
36volt	*6.5 amps*

A

Commutator Brush Replacement



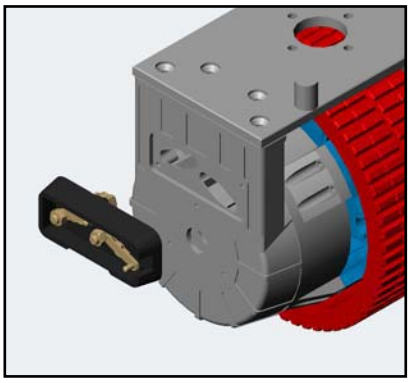
•Clean using high pressure air to remove dust and dirt.

•Check brushes at least every 500 Hours.

•Change brushes when they reach a length of *12/13 mm (0.50 inches).*

•Do not allow sleeve to come out when brush is removed. Two of the four brush sleeves use brass nuts as spacers which may drop into assembly.

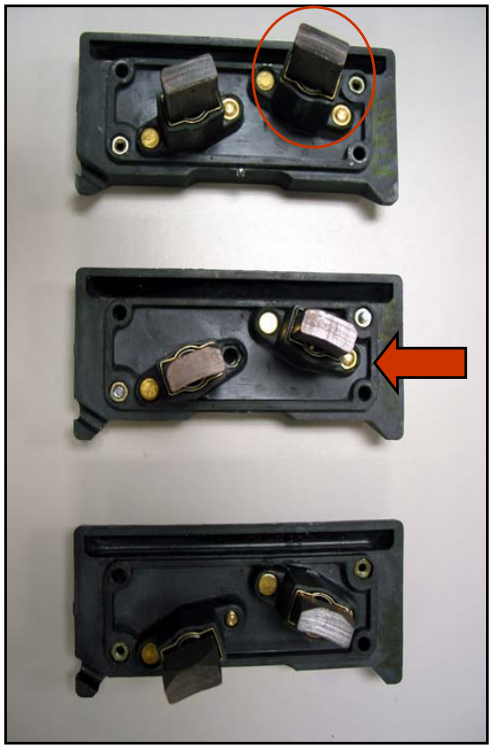
Contact Ring Carbon Brush Access



Always remove the complete box to service the contact ring carbon brushes.

A

Contact Ring Carbon Brushes

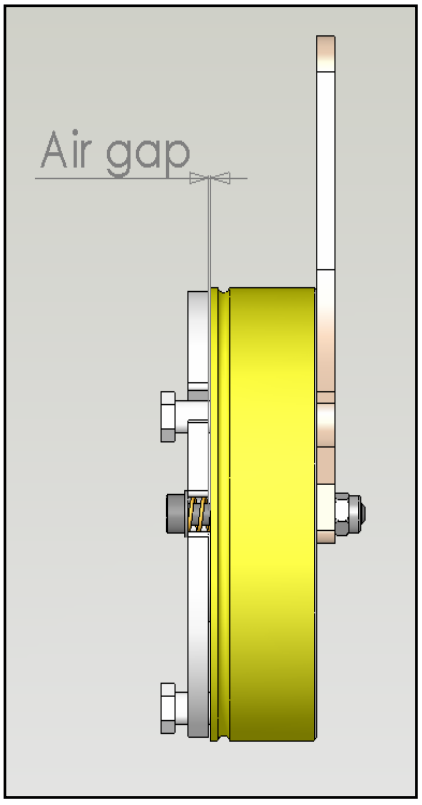


First style:
•Square carbon brush
•Loose backing nut

Second style:
•Curved carbon brush
•Loose backing nut

Third style:
•Curved carbon brush
•Fixed backing nut

Brake Solenoid



The air gap should be
.31mm(.012in) to ~~.019mm~~ .20mm (.008in).

Measurement is taken from three different angles while the brake is mounted to the drive motor.

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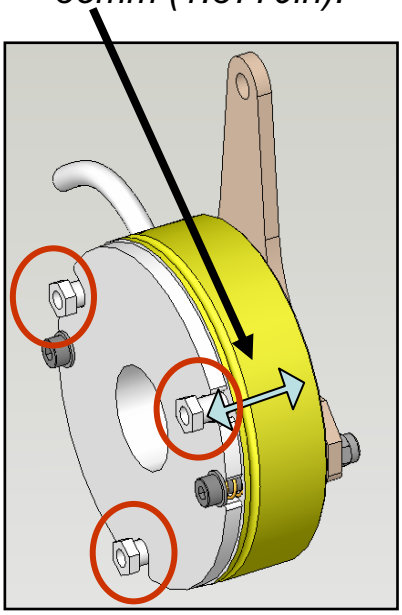
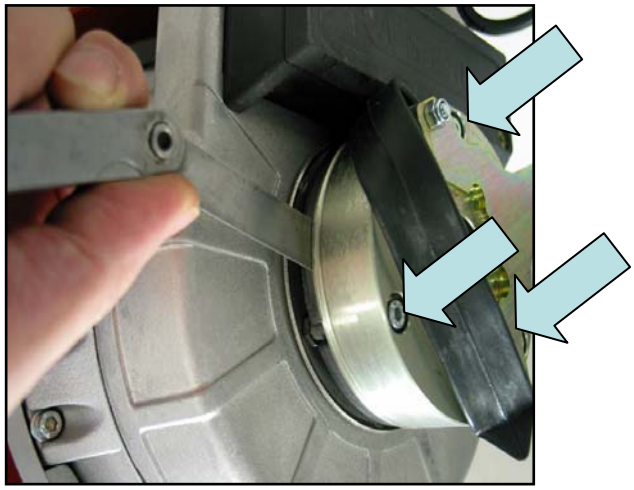
Brake Solenoid (continued)

Original spacer length set at *35mm (1.3779in).*



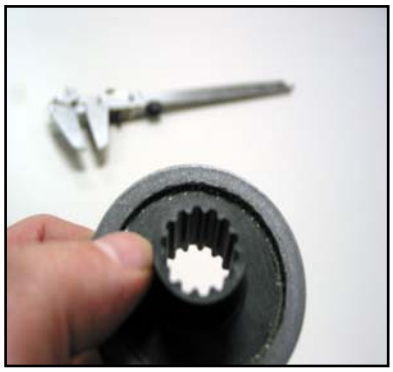
Three Adjustable Spacers

Tighten 3 mounting allen screws to 3*N/m*



Gap adjustment is made with the brake assembly removed by turning each adjustable spacer an equal amount

Brake Rotor



A new brake rotor is *6.35mm (0.25in)* thick.

It is lined with braking material *2mm* deep on both sides.

Measuring total thickness, replace when worn to *4mm (0.1718in),* or *1mm* or less on each side .

Brake dragging may be caused by:

- Air gap too narrow
- Intermittent electrical connection
- Debris in air gap

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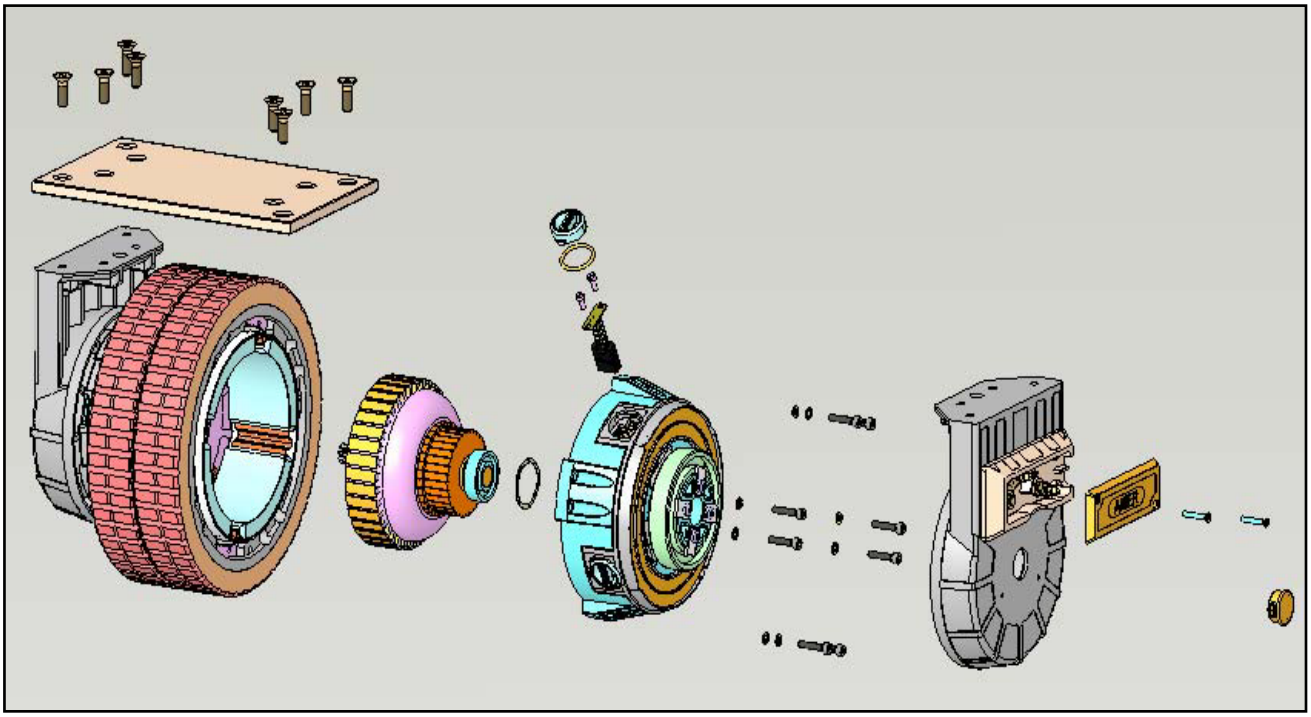
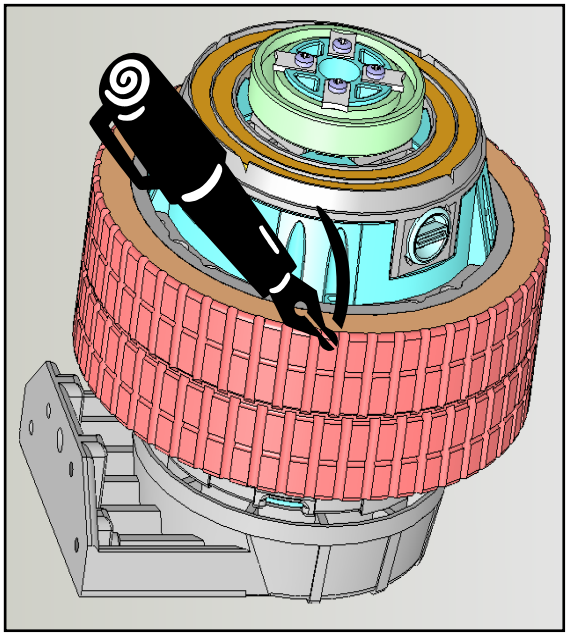
Drive Motor Disassembly & Repair





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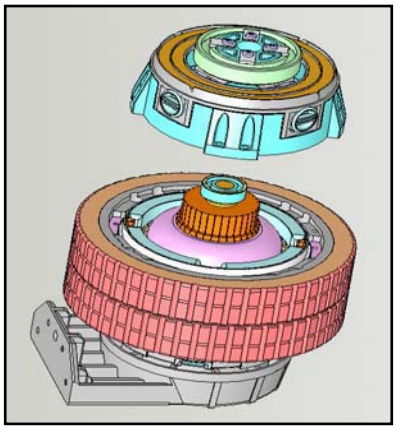
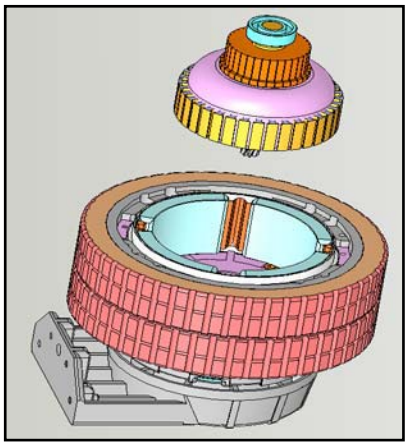
IMPORTANT: before removing the brush holder assembly mark with a marking pen a point of reference between the rubber wheel and the brush holder, in order to make easier the correct reassembly and avoid the mounting with the wrong rotation of the motor wheel.

To make the reassembly of the brush holder assembly easier unscrew the caps and remove the carbon brushes.

Drive Motor Disassembly & Repair (continued)



IMPORTANT: during this phase do not remove the stator from the original position.



Keep the gearbox side bracket on the table and remove the armature. Pay attention: the oil must not come out from the gearbox otherwise it will damage the o ring.

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