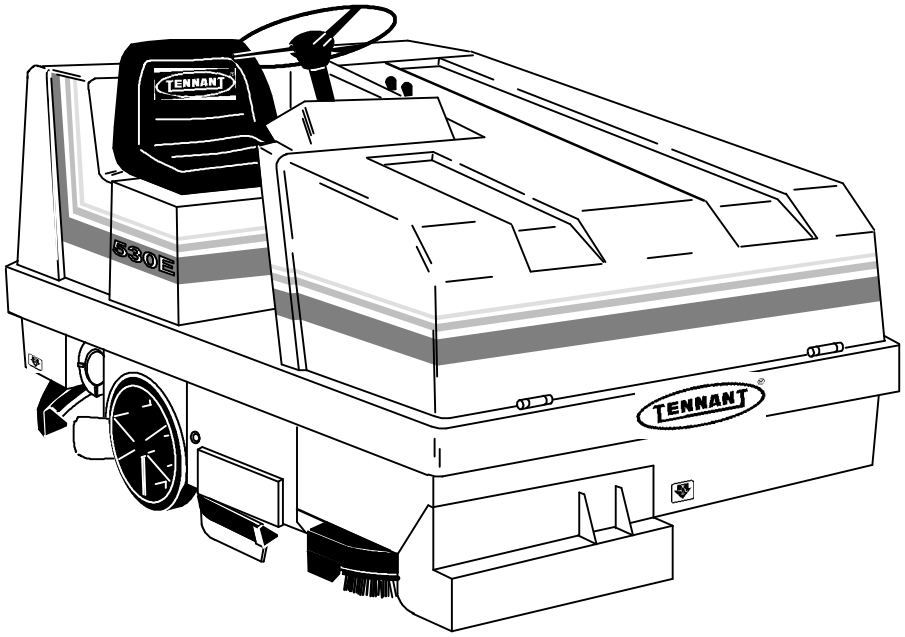
530E

(Operator Manual)



MM178

Rev. 16

This manual is furnished with each new TENNANT Model 530E. It provides necessary operating and preventive maintenance instructions. Read this manual completely and understand the machine before operating or servicing it.

This manual covers all machine variations and standard accessories. The tabbed instruction portion of the manual consists of the Specification, Operation, Maintenance, and Appendix sections. The tabbed parts section consists of the How To Use This Manual; Standard Model Parts; Options; Breakdowns; and Cross Reference sections.

All right side and left side references to the machine are determined by facing the direction of forward travel. All hardware considered to be of a common nature or locally available has been omitted from the parts sections. Be aware that this machine may contain metric hardware. Make sure you use equivalent hardware when replacement becomes necessary.

This machine will provide excellent service. However, the best results will be obtained at minimum costs if:

- The machine is operated with reasonable care.
- The machine is maintained regularly – per the maintenance instructions provided.
- The machine is maintained with Tennant Company supplied or equivalent parts.

MACHINE DATA

Please fill out at time of installation.

Machine Serial Number – _____

Engine Serial Number – _____

Sales Representative – _____

Customer Number – _____

Date of Installation – _____

Manual Number – MM178

Revision: 16

Published: 12–99

Acknowledgements: Technical information and/or illustrations supplied by Peerless–Winsmith Inc; Cessna Fluid Power Division; Eaton Corporation, Hydraulics Division.

SAFETY PRECAUTIONS

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

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

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

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.

FOR SAFETY:

1. **Do Not Operate Machine:**
   - **Unless Trained And Authorized.**
   - **Unless Operation Manual Is Read And Understood.**
   - **In Flammable Or Explosive Areas Unless Designed For Use In Those Areas.**
   - **In Areas With Possible Falling Objects Unless Equipped With Overhead Guard.**

2. **Before Starting Machine:**
   - **Make Sure All Safety Devices Are In Place And Operate Properly.**
   - **Check Brakes And Steering For Proper Operation.**

3. **When Starting Machine:**
   - **Keep Foot On Brake And Directional Pedal In Neutral.**

4. **When Using Machine:**
   - **Use Brakes To Stop Machine.**
   - **Go Slow On Inclines And Slippery Surfaces.**
   - **Use Care When Reversing Machine.**
   - **Do Not Carry Riders On Machine.**
   - **Always Follow Safety And Traffic Rules.**
   - **Report Machine Damage Or Faulty Operation Immediately.**
   - **Follow mixing and handling instructions on chemical container.**

5. **Before Leaving Or Servicing Machine:**
   - **Stop On Level Surface.**
   - **Set Parking Brake.**
   - **Turn Off Machine And Remove Key.**

6. **When Servicing Machine:**
   - **Avoid Moving Parts. Do Not Wear Loose Jackets, Shirts, Or Sleeves.**
   - **Block Machine Tires Before Jacking Machine Up.**
   - **Jack Machine Up At Designated Locations Only. Block Machine Up With Jack Stands.**
   - **Use Hoist Or Jack Of Adequate Capacity To Lift Machine.**
   - **Wear Eye And Ear Protection When Using Pressurized Air Or Water.**
   - **Disconnect Battery Connections Before Working On Machine.**
   - **Avoid Contact With Battery Acid.**
   - **Use Cardboard To Locate Leaking Hydraulic Fluid Under Pressure.**
   - **Use TENNANT Supplied Or Approved Replacement Parts.**

WARNING: Batteries Emit Hydrogen Gas. Explosion Or Fire Can Result. Keep Sparks And Open Flame Away. Keep Covers Open When Charging.

WARNING: Hazardous Voltage. Shock Can Result. Disconnect Batteries Before Working On Machine. Only Qualified Personnel Should Work Inside Panel.

WARNING: Moving Belt. Keep Away.

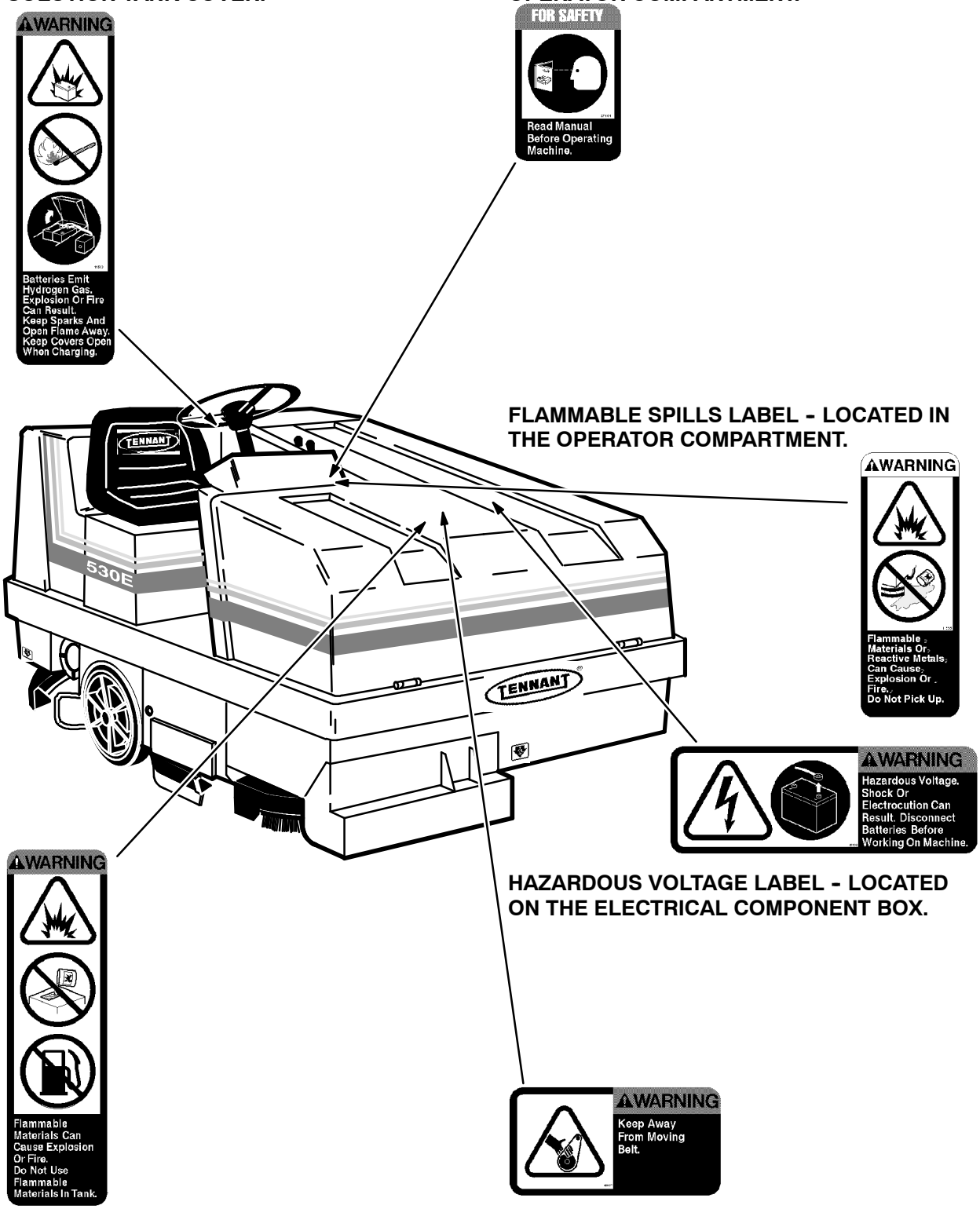
WARNING: Flammable Materials Can Cause An Explosion Or Fire. Do Not Use Flammable Materials In Tank(s).

WARNING: Explosion or fire could occur:
- If machine is used to pick up flammable spills from floors.
- If machine picks up reactive metals, such as aluminum or magnesium. Reactive metals and some detergents form explosive hydrogen gas. Contact Tennant Company for appropriate detergent selection.

The following safety labels are mounted on the machine in the locations indicated. If these, or any label becomes damaged or illegible, install a new label in its place.

CLEANING SOLUTION LABEL - LOCATED ON SOLUTION TANK COVER.

FOR SAFETY LABEL - LOCATED IN THE OPERATOR COMPARTMENT.



FLAMMABLE SPILLS LABEL - LOCATED IN THE OPERATOR COMPARTMENT.

HAZARDOUS VOLTAGE LABEL - LOCATED ON THE ELECTRICAL COMPONENT BOX.

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BATTERY CHARGING LABEL - LOCATED ON THE UNDERSIDE ON THE MACHINE HOOD.

FAN BELT LABEL - LOCATED ON THE VACUUM FAN MOTOR.

CONTENTS

SECTION 1

CONTENTS

MACHINE SPECIFICATIONS

POWER TYPE

Electric propelling motor –
nominal voltage 36 VDC
2 hp (1.5 kw) @ 2100 rpm, 65 A
Electric vacuum fan motor –
nominal voltage 36 VDC
3 hp (2.2 kw) @ 4000 rpm, 80 A
Electric main brush motor –
nominal voltage 36 VDC
2 hp (1.5 kw) @ 1500 rpm, 55 A
Electro-hydraulic power unit (standard for machines serial number 007500 and above) – nominal voltage 36 VDC
0.9 hp (0.7 kw) @ 1890 rpm, 20 A
Electric side brush motor (option for machines before serial number 007500) –
nominal voltage 36 VDC
0.4 hp (0.3 kw) @ 320 rpm, 14 A

Batteries, standard heavy duty (2) –
18 V, 600 A/h @ 6 hour rate
Battery charger options –
36 VDC 120 A, 208/240/480 VAC, 1ph input
36 VDC 120 A, 208/240/480 VAC, 3ph input

POWER TRAIN

Propelling – electric motor to gearbox driven

Main brushes – electric motor to chain driven

Side brush (option for machines before serial number 007500) – electric motor direct driven
Side brush (standard for machines serial number 007500 and above) – hydraulic drive motor

Vacuum fan – electric motor to belt driven

STEERING

Type – front wheel controlled, automotive cam and lever to rack and pinion
Power source – manual

HYDRAULIC SYSTEM

Function – operates side brush operation.

Control Valve – open center type, two spool, solenoid operated.

Electro-hydraulic power unit – fixed displacement gear type, 0.39 cu in (6.4 cc) maximum displacement per revolution, 3.1 gpm (11.7 L/min) @ 1890 rpm.

Motor, side brush – internal gear type, 2.8 cu in (46 cc) per revolution, 2500 psi (17,240 kPa) maximum rated pressure.

Cylinder, side brush lift – single action type, 2 in (50 mm) bore x 4 in (100 mm) stroke, 1 in (25 mm) diameter rod, 2500 psi (17,240 kPa) maximum rated pressure.

Cylinder, side brush swing – single action type, 2 in (50 mm) bore x 4 in (100 mm) stroke, 1 in (25 mm) diameter rod, 2500 psi (17,240 kPa) maximum rated pressure.

BRAKING SYSTEM

Service brakes – mechanical drum brakes (2) – 1 per rear wheel, linkage actuated
Parking brakes – utilizes service brakes, linkage actuated

SUSPENSION SYSTEM

Front – 16.25 x 6 solid tire (1)
Rear – 16 x 3.50 solid tires (2)

SYSTEM FLUID CAPACITIES

Gearbox grease capacity – 2.7 qt (2.6 L)

Solution tank capacity – 55 gal (210 L)
Recovery tank capacity – 55 gal (210 L)
Tank capacity with ES™ option – 80 gal (300 L)

Hydraulic system – 1 gal (3.8 L)
Hydraulic system, total – 1.5 gal (5.7 L)

GENERAL MACHINE DIMENSIONS - CAPACITIES

Length - 88 in (2235 mm)
Length (with side brush for machines before serial number 007500) - 99 in (2515 mm)

Width - 52.75 in (1340 mm)
Width (with side brush for machines before serial number 007500) - 56.9 in (1445 mm)

Height - 53 in (1345 mm) less overhead guard
Height - 79.3 in (2015 mm) with overhead guard

Track - rear 49.2 in (1250 mm)
Wheel base - 41 in (1040 mm)

Main brushes - 43 in (1090 mm) width
Front main brush - 6 in (150 mm) diameter
Rear main brush - 11 in (280 mm) diameter
Side brush - 13 in (330 mm) diameter

Scrubbing path width - 50 in (1270 mm) with side brush

Debris hopper capacity - 1.5 cu ft (0.42 m3)

Rear squeegee path width - 51 in (1295 mm)

MACHINE WEIGHTS

Net weight, dry - 1937 lb (880 kg)
GVWR - 4600 lb (2085 kg)

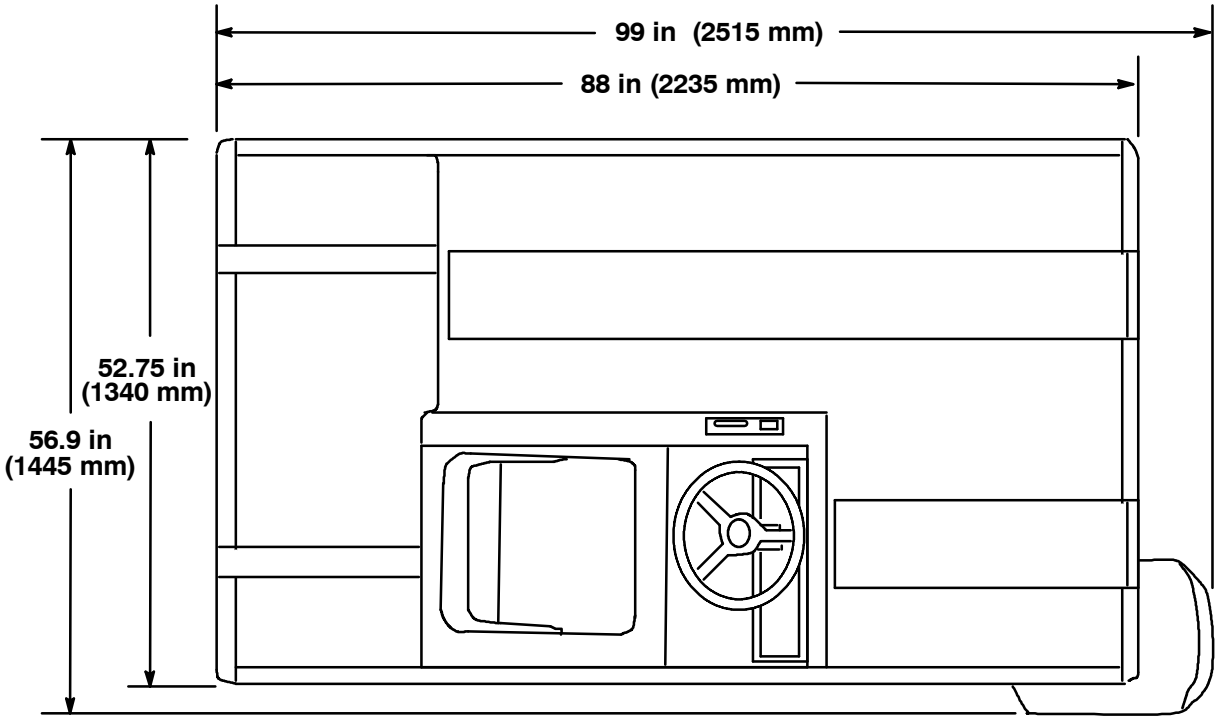
GENERAL MACHINE PERFORMANCE

Maximum forward speed - 4.5 mph (7 km/h)
Maximum reverse speed - 3 mph (5 km/h)

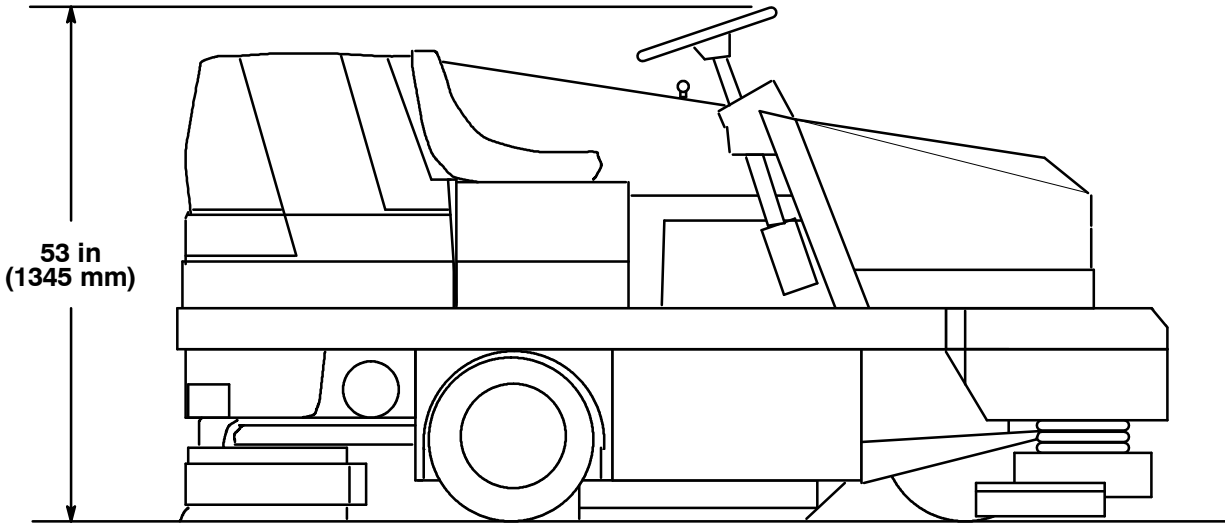
Aisle turnaround width -
right, 143 in (3630 mm)
left, 103 in (2615 mm)

Maximum rated ramp climb angle - 6°
Maximum rated ramp descent angle - 8°

MACHINE DIMENSIONS
(For machines below serial number 007500)



TOP VIEW



SIDE VIEW

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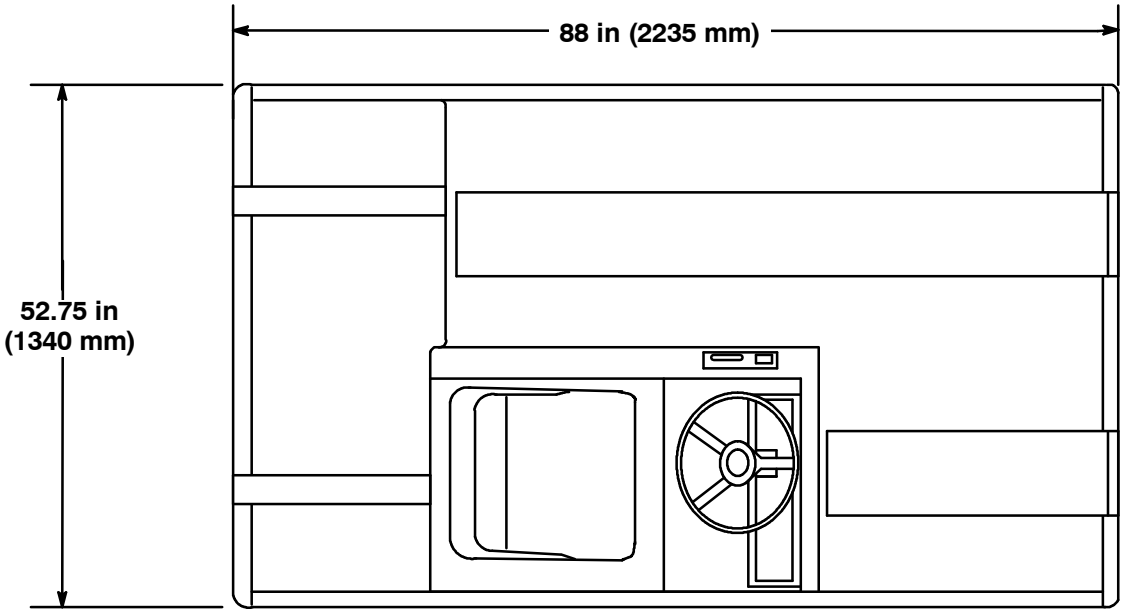
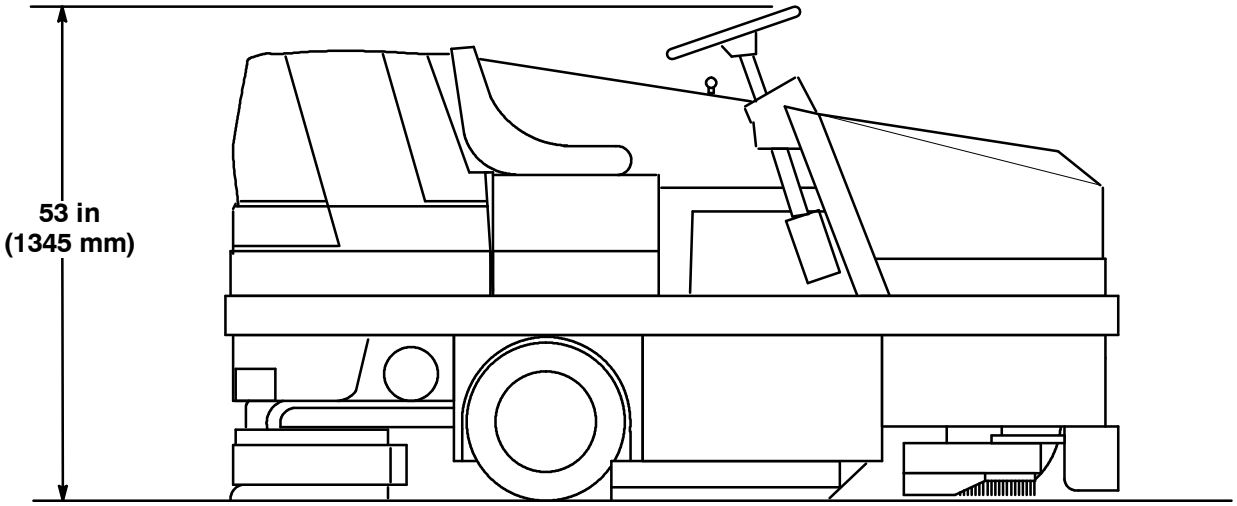
MACHINE DIMENSIONS
(For machines serial number 007500 and above)



TOP VIEW



SIDE VIEW

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SECTION 2

CONTENTS

PREPARATION FOR OPERATION

AFTER UNCRATING AND BEFORE OPERATING MACHINE:

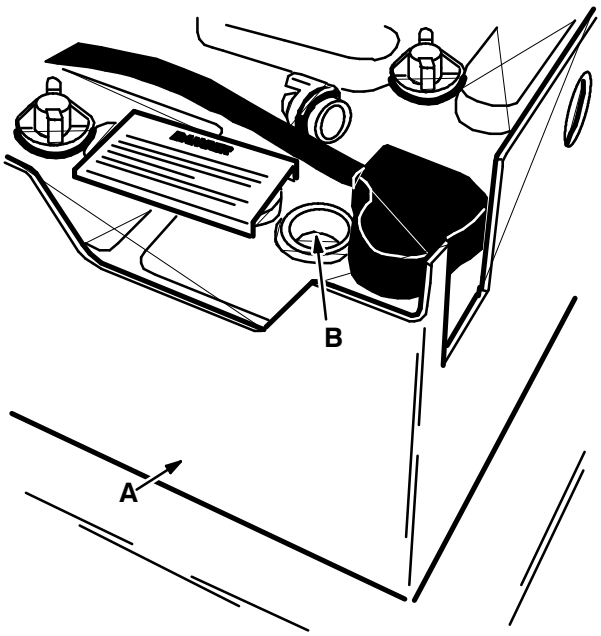
1. Check the machine for shipping damage.

2. Read this manual carefully before operating or servicing the machine.

FOR SAFETY: Do Not Operate Machine Unless Operation Manual Is Read And Understood.

3. Open the hood.

4. Check the batteries electrolyte level as described in *BATTERIES* in the *MAINTENANCE* section.



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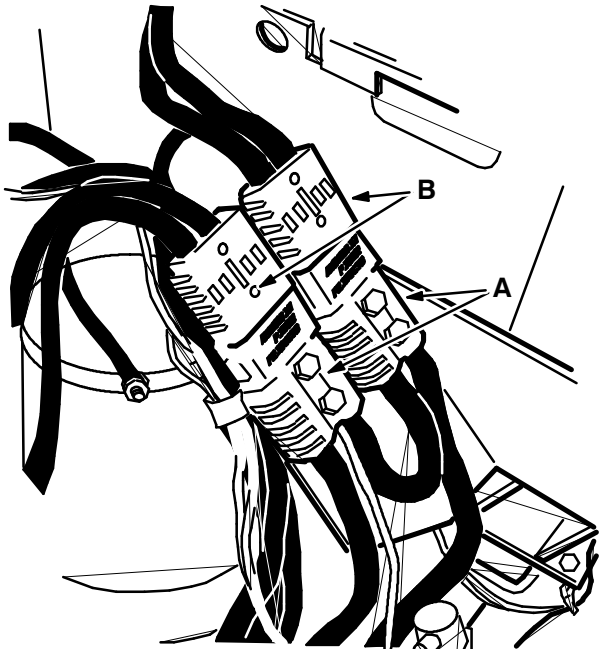
CHECKING BATTERY ELECTROLYTE LEVEL

A. Battery
B. Filling Hole

FOR SAFETY: When Servicing Machine, Avoid Contact With Battery Acid.

5. Check the battery specific gravity to determine the state of charge as described in *BATTERIES* in the *MAINTENANCE* section. Charge the batteries if necessary.

6. Connect the battery connectors to the machine connectors.



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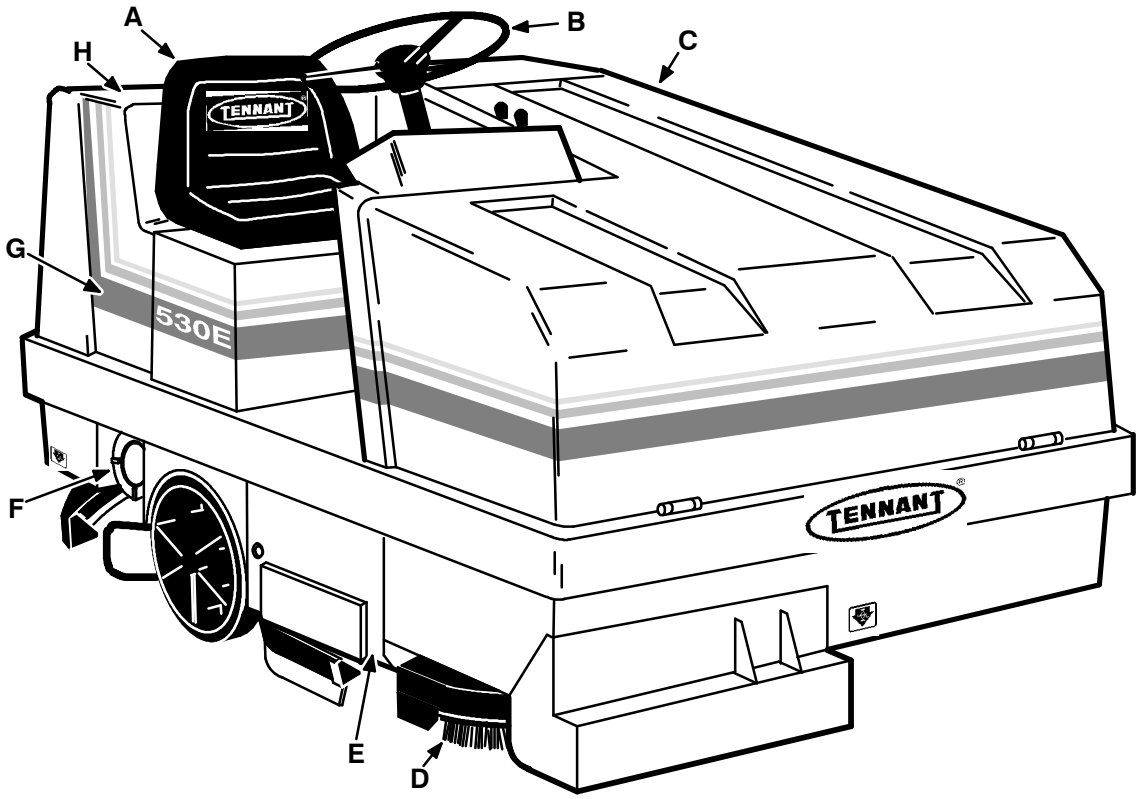
BATTERY CONNECTORS

A. Machine Connectors
B. Battery Connectors

OPERATION OF CONTROLS



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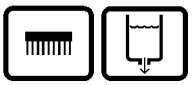
MACHINE COMPONENTS

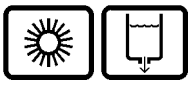
A. Operator Seat
B. Steering Wheel
C. Hood
D. Side Brush
E. Brush Access Door
F. Recovery Tank Cleanout Cap
G. Recovery Tank
H. Solution Tank

INSTRUMENT PANEL SYMBOLS

These symbols are used to identify controls and displays on the machine:


ES™


Side Brush Solution Flow


Main Brush Solution Flow


Variable Rate


Main Brush Up


Main Brush Down And On


Squeegee Up


Squeegee Down


Side Brush Retract


Side Brush Up


Side Brush Down And On


Recovery Tank Full


Operational Lights


Key-Operated On-Off Switch

Circuit Breaker #1

Circuit Breaker #2

Circuit Breaker #3

Circuit Breaker #4

Circuit Breaker #5

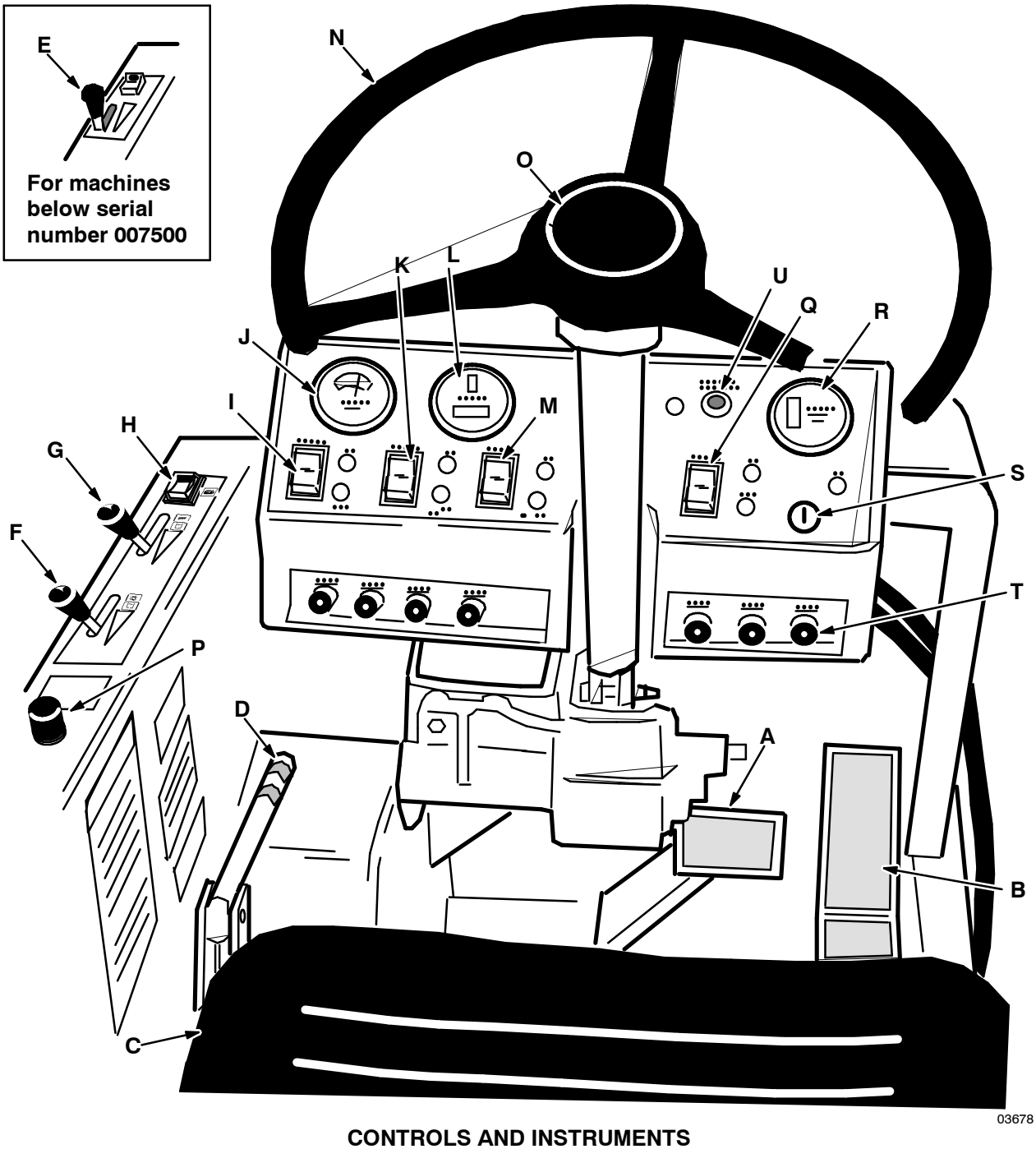
Circuit Breaker #6

Circuit Breaker #7

Circuit Breaker #8

Circuit Breaker #9

Circuit Breaker #10



CONTROLS AND INSTRUMENTS

A. Brake Pedal
B. Directional Pedal
C. Operator Seat
D. Parking Brake Lever
E. Solution Flow Lever
F. Main Brush Solution Flow Lever
G. Side Brush Solution Flow Lever
H. ES™ Switch
I. Main Brush Switch
J. Brush Pressure Gauge
K. Squeegee Switch
L. Hour Meter
M. Side Brush Switch
N. Steering Wheel
O. Horn Button (For machines below serial number 008832)
P. Horn Button (For machines serial number 008832 and above)
Q. Operational Lights Switch
R. Battery Condition Gauge
S. Key-Operated On-Off Switch
T. Circuit Breakers
U Recovery Tank Full Lamp

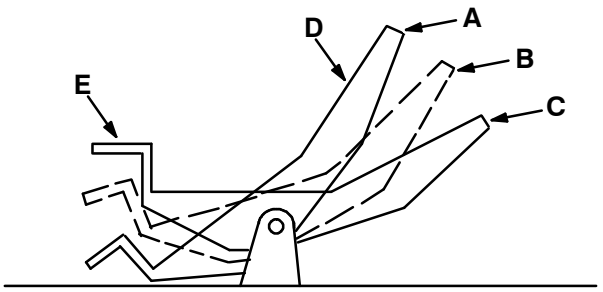
BRAKE PEDAL

The brake pedal operates the brakes on the two rear wheels.

To stop the machine, return the direction pedal to neutral, then apply pressure to the brake pedal.

DIRECTIONAL PEDAL

The directional pedal controls the propelling drive. It is used to select the direction of travel and the speed of the machine.



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DIRECTIONAL PEDAL POSITIONS

A. “Reverse” Position
B. “Neutral” Position
C. “Forward” Position
D. “Toe” Position
E. “Heel” Position

Gradually press the “toe” portion of the pedal for forward travel or the “heel” portion for reverse travel. Regulate the machine speed by varying the pressure on the pedal.

The machine will coast for a short distance before changing direction when it is moving and the directional pedal is reversed. Use the brakes to stop the machine.

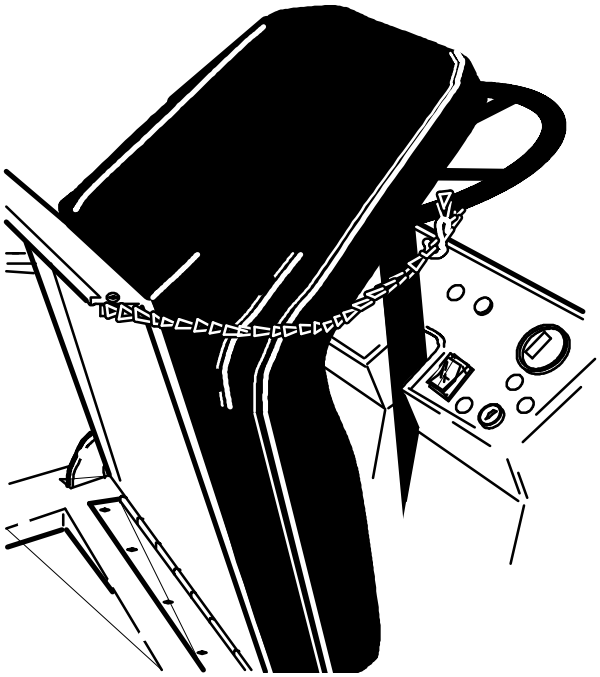
FOR SAFETY: When Using Machine, Use Brake To Stop Machine.

The propelling system has a safety interlock. It stops power from flowing to the propelling motor if the seat lifts disengaging the seat switch or the key-operated on-off switch is turned off. To restore power, the key-operated on-off switch must be on, the seat must be down tripping the seat switch, and the directional pedal must pass through the “neutral” position.

OPERATOR SEAT

The operator seat is of the fixed back style with a forward-backward adjustment. To adjust the seat, remove the seat mounting bolts, slide the seat to the position desired, and reinstall and tighten the bolts.

The seat is also equipped with a chain to hold it in the “up” position when working under it.



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OPERATOR SEAT

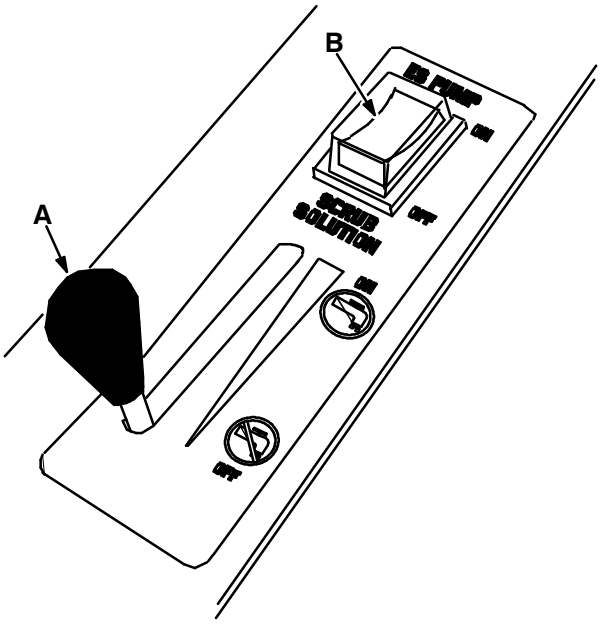
PARKING BRAKE LEVER

The parking brake lever operates the rear wheel brakes. To set the parking brake, pull the handle up. To release the parking brake, push the handle down. Always set the parking brake before leaving the machine unattended and before working on the machine.

FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake, And Turn Off Machine.

SOLUTION FLOW LEVER

The solution flow lever controls the flow of solution to the main brush and the side brush, on machines below serial number 007500, if equipped with the side brush accessory. To start solution flow, push the lever slightly forward into the “on” position. To increase to full flow, push the lever all of the way forward into the “on” position. To stop solution flow, pull the lever back into the “off” position.



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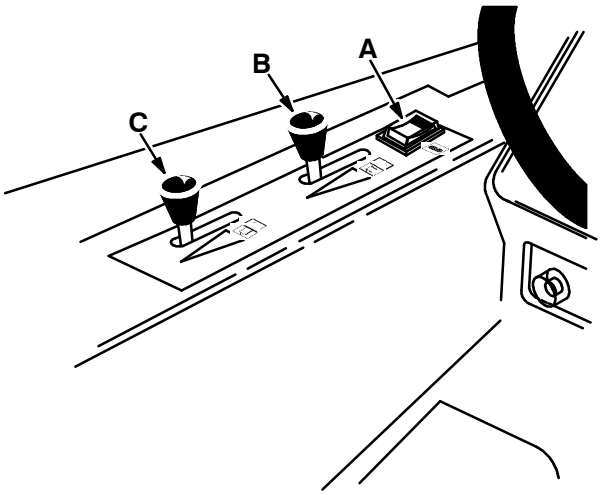
SOLUTION FLOW LEVER

A. Solution Lever
B. ES™ Switch

MAIN BRUSH SOLUTION FLOW LEVER

The main brush solution flow lever, on machines serial number 007500 and above, controls the flow of solution to the main brush. The flow of solution to the floor is variable. To start solution flow, push the solution flow lever slightly forward. To increase to full flow, push the lever all the way forward. To stop solution flow, pull the lever all the way back.



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SOLUTION FLOW LEVERS

A. ES™ Switch
B. Side Brush Solution Lever
C. Main Brush Solution Lever

SIDE BRUSH SOLUTION FLOW LEVER

The side brush solution flow lever, on machines serial number 007500 and above, controls the flow of solution to the side brush. The flow of solution to the floor is variable. To start solution flow, push the solution flow lever slightly forward. To increase to full flow, push the lever all the way forward. To stop solution flow, pull the lever all the way back.

ES™ SWITCH

The ES™ switch controls the solution recycling system on machines with the ES™ accessory. To start the system, place the switch in the top position. The system may not start operating right away, it will start when the tank fluid levels reach the proper levels. The system operates independently of the key-operated on-off switch. To stop the system, place the ES™ switch in the bottom position.

MAIN BRUSH SWITCH

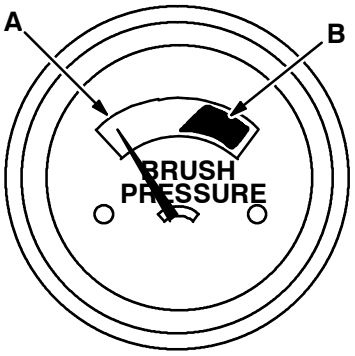
The main brush switch controls main brush position and rotation.

To lower and start the main brush turning, or to increase brush pressure, press and hold the switch in the bottom (Main Brush Down and On) position until the brush is at the desired position. Watch the brush pressure gauge – release the main brush switch before the gauge needle enters the red zone. Travel speed and floor conditions will affect the gauge reading.

To raise and stop the main brush, or to reduce brush pressure, press and hold the switch in the top (Main Brush Up) position until the brush is in the desired position.

BRUSH PRESSURE GAUGE

The brush pressure gauge indicates how hard the brush drive motors are working. Under normal conditions, the gauge needle should be in the white zone. Under harsh conditions, the gauge needle will be in the red zone indicating excessive brush pressure. Operation in the red zone will cause the brush circuit breaker to trip. Travel speed and floor conditions will affect the gauge reading.



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BRUSH PRESSURE GAUGE

A. White “Normal” Zone
B. Red “Excessive” Zone

SQUEEGEE SWITCH

The squeegee switch, in conjunction with a directional sensing device, controls the vacuum fan and the position of the rear squeegee.

To raise the rear squeegee and stop the vacuum fan, place the switch in the top (Squeegee Up) position.

To lower the rear squeegee and start the vacuum fan, place the switch in the bottom (Squeegee Down) position. When the directional control pedal is slightly in “reverse”, or when traveling backward, the directional sensing device overrides the squeegee switch and raises the rear squeegee and stops the vacuum fan. This prevents the rear squeegee from being damaged when traveling backward.

HOUR METER

The hour meter records the number of hours the machine has operated. This information is useful in determining when to service the machine.

SIDE BRUSH SWITCH

The side brush switch, on machines below serial number 007500, is present on machines with the side brush accessory. It controls side brush position and rotation. To lower and start the side brush turning, or to increase brush pressure, push the switch backward into the “down” position. The brush is fully lowered when you hear a ratcheting noise. To raise and stop the side brush, push the switch forward into the “up” position.

SIDE BRUSH SWITCH

The side brush switch, on machines serial number 007500 and above, controls the side brush position and operation. To lower, extend, and start the side brush, place the switch in the bottom (Side Brush Down and On) position. To retract, raise, and stop the side brush, press and hold the side brush switch in the top (Side Brush Retract) position until the side brush is fully retracted. Then release the side brush switch into the middle (Side Brush Up) position.

STEERING WHEEL

The steering wheel controls the front drive wheel. The machine is very responsive to the movement of the steering wheel. The operator should use care until he or she becomes experienced in guiding the machine. For machines below serial number 008832, a horn button is located in the center of the steering wheel. For machines serial number 008832 and above, the horn is located on the left panel of the operators compartment.

RECOVERY TANK FULL LAMP

The recovery tank full lamp lights when the recovery tank is full. The vacuum fan also stops when the lamp lights.

OPERATIONAL LIGHTS SWITCH

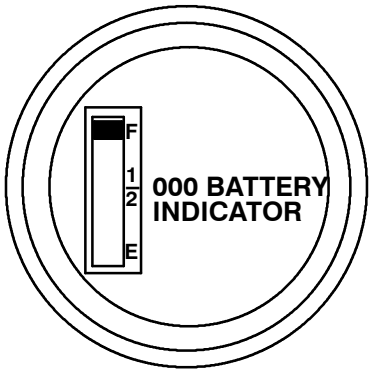
The operational lights switch operates the headlights, taillights and the revolving light if so equipped. To operate the lights, place the switch in the top position. To turn the lights off, place the switch in the bottom position.

BATTERY CONDITION GAUGE

The battery condition gauge indicates the present state of charge of the batteries. The display should be on the F mark of the gauge when the batteries are fully charged. As the batteries discharge, the display will move near the E mark and start to blink. The batteries should be recharged when the display gets to the 1/4 mark.

When the machine is left overnight with less than a full charge or the battery connectors have been disconnected and reconnected, the display may indicate a full charge. It is reading the surface charge level – not the true charge level. After running the machine a few minutes, the gauge will give the correct charge level.

NOTE: Do not charge the batteries more often than is necessary. This will prolong the life of the batteries. Do not allow the batteries to become fully discharged as this will also damage the batteries. See BATTERIES in the MAINTENANCE section.



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BATTERY CONDITION GAUGE

KEY-OPERATED ON-OFF SWITCH

The key-operated on-off switch controls all machine power. To allow the machine to operate, turn the key clockwise. To turn off the machine, turn the key counter-clockwise.

CIRCUIT BREAKERS AND FUSES

Circuit breakers are resetable circuit protection devices designed to stop the flow of current in the event of a circuit overload. Once tripped, circuit breakers must be manually reset. If the overload which caused the circuit breaker to trip is still present in the circuit, the circuit breaker will continue to stop current flow until the overload is corrected.

Fuses are a one-time circuit protection device designed to stop the flow of current in the event of a circuit overload. Never substitute higher value fuses than those specified in this manual.

Most of the circuit breakers are located on the bottom of the instrument panel. Circuit breakers for the main brush, side brush and cooling motors are located on the back of the speed controller panel. These breakers do not give an indication that they have tripped. They must cool before resetting. They are also hard to reset – use the palm of your hand. The propelling motor fuse is located in the speed controller box. The cooling fan motor fuse is located next to the fan.

The following chart shows the various circuit breakers and fuses, and the electrical components they protect.

PROTECTIVE DEVICE	RATING	CIRCUIT PROTECTED
CB-1	10 A	Horn
CB-2	80 A	Fan motor
CB-3	60 A	Main brush motor
CB-4	17.5 A	Electric Side brush motor
CB-4	30 A	Hydraulic Side brush motor
CB-5	15 A	Speed controller, hour meter
CB-6	10 A	Squeegee lift
CB-7	10 A	Main brush lift
CB-8	10 A	Side brush lift
CB-9	10 A	Float switches
CB-10	10 A	Accessories
FU-1	100 A	Propelling Motor
FU-2	20 A	SCR cooling fan

MACHINE OPERATION

NORMAL SCRUBBING OPERATION

A normal scrubbing operation consists of eight typical operations: pre-start checklist, starting machine, filling solution tank, scrubbing, draining recovery tank and emptying hopper, post operation checklist – machine on, stopping machine, and post operation checklist – machine off.

PRE-START CHECKLIST lists things to check before starting the machine.

TO START THE MACHINE lists the steps required to start the machine.

TO FILL SOLUTION TANK lists the steps required to fill the solution tank.

TO SCRUB lists things to keep in mind before and during the scrubbing operation.

TO DRAIN RECOVERY TANK AND EMPTY HOPPER lists the steps required to empty the debris hopper and the recovery tank.

POST OPERATION CHECKLIST – MACHINE ON lists things to check before stopping the machine motor.

TO STOP MACHINE lists the steps required to stop the machine.

POST OPERATION CHECKLIST – MACHINE OFF lists things to check after stopping the machine motor.

PRE-START CHECKLIST

Check under machine for leak spots.

Check brakes and controls for proper operation.

Check service records to determine service requirements.

TO START MACHINE

NOTE: Before starting machine, perform the pre-start checks.

1. The machine operator must be in the operator's seat with the directional control pedal in the "neutral" position and with a foot on the brake pedal or with the parking brake set.

FOR SAFETY: Before Starting Machine; Make Sure All Safety Devices Are In Place And Operate Properly.

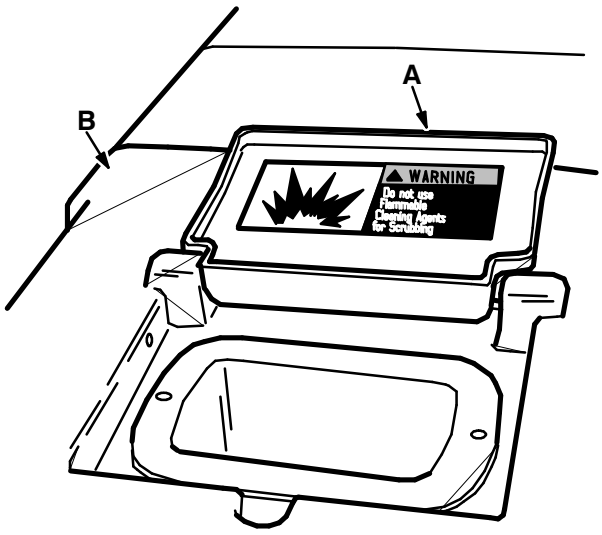
2. Turn the key-operated on-off switch clockwise to turn the machine on.
3. Release the machine parking brake.
4. Drive the machine to the solution filling site.

TO FILL SOLUTION TANK

1. Turn off the machine and set the machine parking brake.

FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake, And Turn Off Machine.

2. Open the solution fill door.



03679

SOLUTION TANK FILL DOOR

A. Fill Door
B. Solution Tank

3. Pour the required amount of detergent into the tank. Fill the tank with water to 1 in (25 mm) below the tank opening. The water must not be hotter than 130° F (54° C) or tank damage may occur.

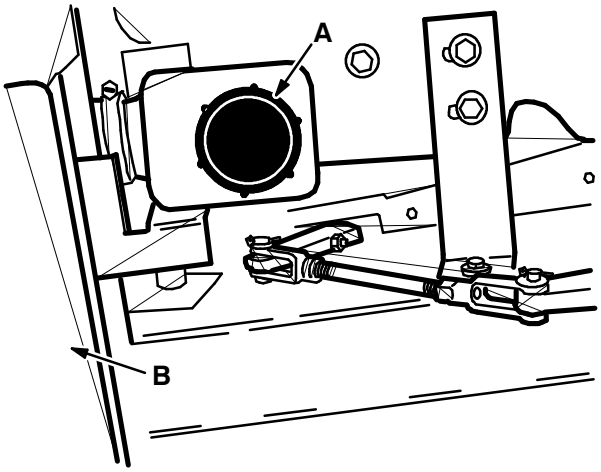
FOR SAFETY: Follow mixing and handling instructions on chemical container.

NOTE: Floor conditions, water condition, amount of soilage, type of soilage, brush action, and squeegee action all play an important role in determining the type and the concentration of detergent to be used. For specific recommendations, call your TENNANT representative.

WARNING: Flammable Materials Can Cause An Explosion Or Fire. Do Not Use Flammable Materials In Tank(s).

4. Close the solution fill door.

5. ES™ machines: Lift the seat, open the recovery tank fill cap and fill the recovery tank with water. Close cap and lower seat.



03684

RECOVERY TANK FILL CAP

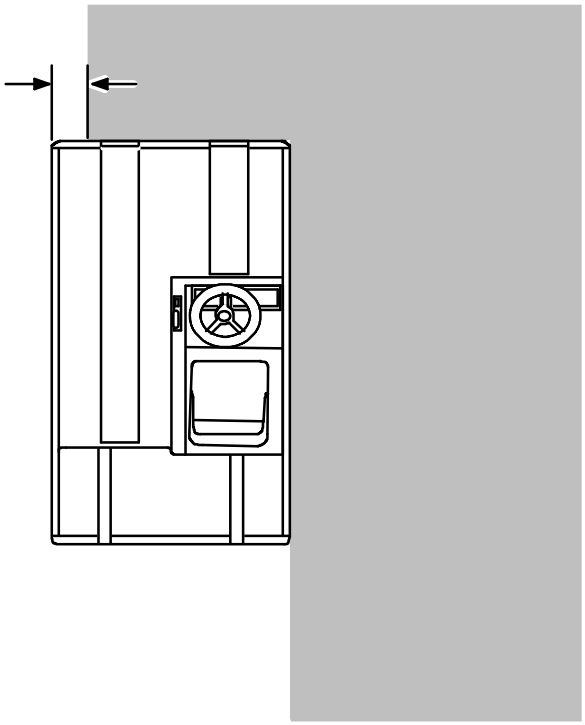
A. Fill Cap
B. Recovery Tank

TO SCRUB

Plan the scrubbing in advance. Try to arrange long runs with minimum stopping and starting. Do an entire floor or section at one time. When scrubbing dead end aisles, start at the end and scrub your way out of them.

Pick up oversize debris before scrubbing. Remove bulky debris from aisles before scrubbing. Pick up pieces of wire, twine, string, etc., which could become entangled in brush or brush plugs.

Allow a few inches overlap of brush paths.



03715

OVERLAPPING SCRUBBING PATHS

Do not turn steering wheel too sharply when the machine is in motion. It is very responsive to the movement of the steering wheel. Avoid sudden turns, except in emergencies.

Try to scrub as straight a path as possible. Stop solution flow to floor before making turns to minimize solution loss. Avoid bumping into posts or scraping the sides of the machine.

1. Drive the machine to the area to be scrubbed.

2. Press and hold the main brush switch in the bottom (Main Brush Down and On) position releasing it before the brush pressure gauge needle enters the red zone.

3. Place the side brush switch in the bottom (Side Brush Down and On) position. On machines below serial number 007500, hold the switch until you hear a ratcheting noise.

4. Place the squeegee switch in the bottom (Squeegee Down) position.

5. Move the solution flow levers forward.

WARNING: Explosion or fire could occur:
- If machine is used to pick up flammable spills from floors.
- If machine picks up reactive metals, such as aluminum or magnesium. Reactive metals and some detergents form explosive hydrogen gas. Contact Tennant Company for appropriate detergent selection.

ES™ machines: Place the ES™ switch into the top position.

6. Scrub as required. When the (Recovery Tank Full) lamp lights, return to the solution dump/filling site. Drain the recovery tank, empty the hopper, and refill the solution tank.

NOTE: The recovery tank full lamp will not light on ES™ machines when the ES™ switch is in the "on" position unless a large amount of standing water was picked up or the screen filter in the recovery tank becomes clogged.

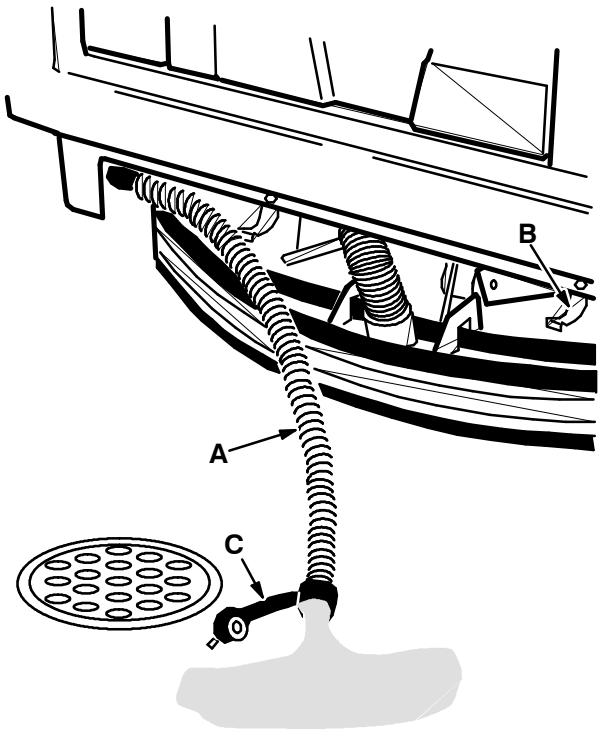
TO DRAIN AND CLEAN RECOVERY TANK AND EMPTY HOPPER

1. Place the squeegee switch in the top (Squeegee Up) position.

2. Turn off the machine and set the machine parking brake.

FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake, And Turn Off Machine.

3. Remove and unplug the drain hose next to a floor drain.

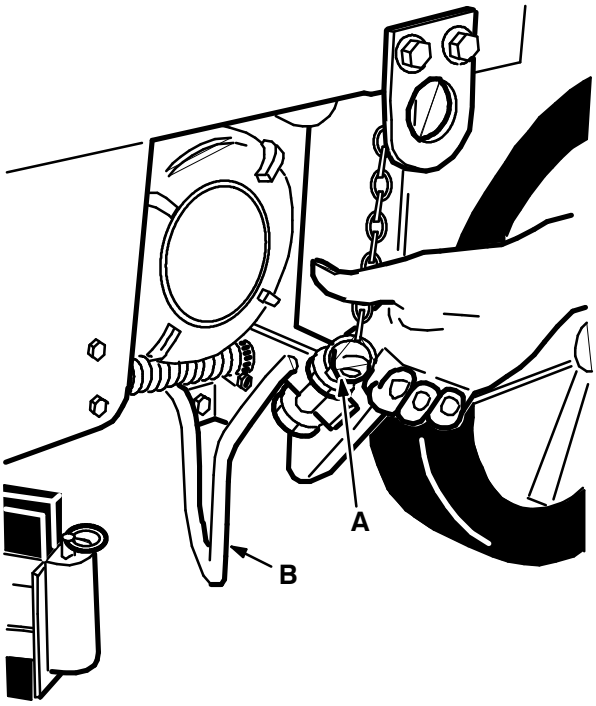


03689

DRAINING RECOVERY TANK

A. Drain Hose
B. Hose Retaining Clip
C. Hose Plug

4. Pull the squeegee and hopper assembly pin.



03682

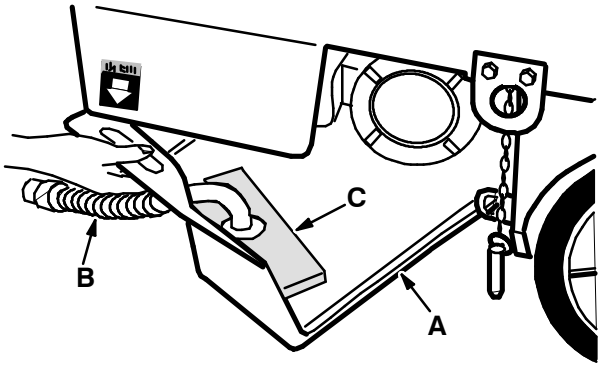
PULLING SQUEEGEE AND HOPPER ASSEMBLY PIN

A. Pin
B. Assembly Handle

5. Pull the assembly handle back to slide the squeegee and hopper assembly out the rear of the machine.

6. Disconnect the hopper vacuum hose.

7. Pull the hopper out of the machine.



03680

REMOVING DEBRIS HOPPER

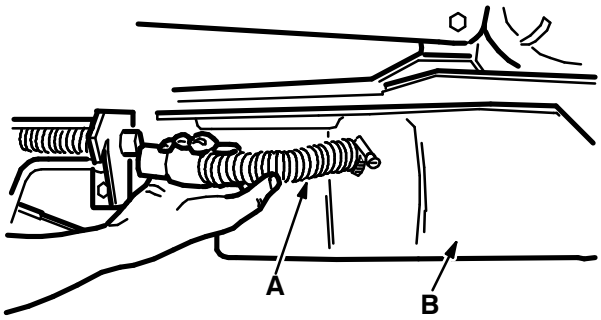
A. Debris Hopper
B. Hopper Vacuum Hose
C. Debris Screen

8. Clean the hopper and debris screen.

9. Rinse the hopper support and linkages.

10. Slide the hopper into the squeegee and hopper assembly.

11. Reconnect the hopper vacuum hose.



03681

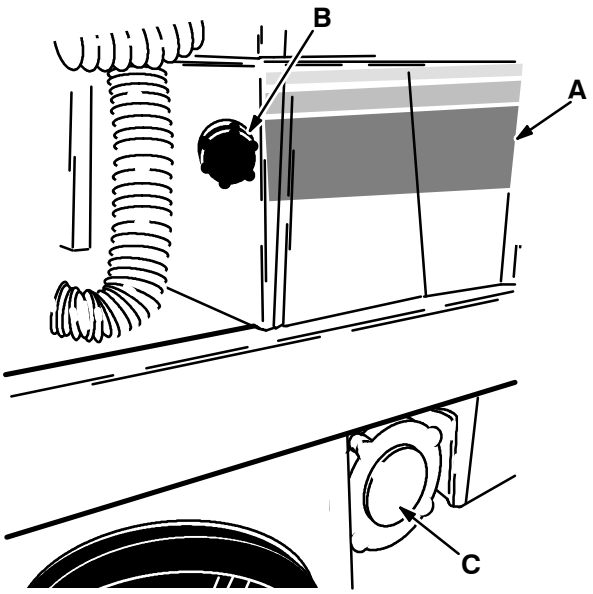
RECONNECTING VACUUM HOSE

A. Hopper Vacuum Hose
B. Hopper

12. Push the squeegee and hopper assembly forward.

13. Secure the assembly with the pin removed earlier.

14. Remove the Demister cap and the two recovery tank caps.



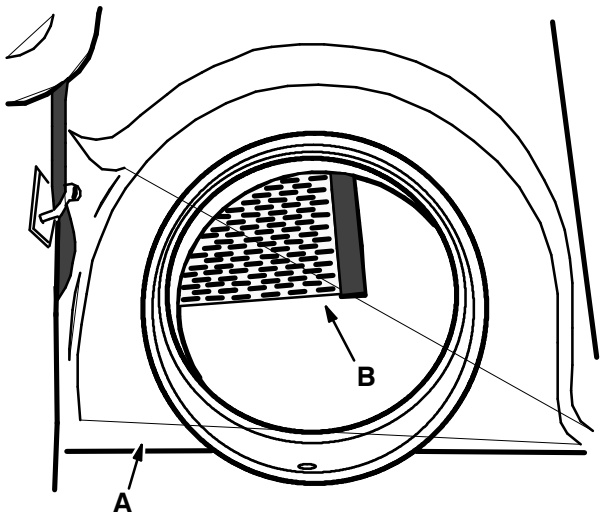
03716

TANK CAPS

A. Recovery Tank
B. Demister Cap
C. Recovery Tank Cap

15. Spray the inside of the demister and the tank with clean water. Do not use water hotter than 130° F (54° C) or use steam to clean the tank because damage may occur.

16. ES™ machines: Flush the screen filter with water. Then add enough water to cover the screen filter and operate the ES™ pump to flush the system.



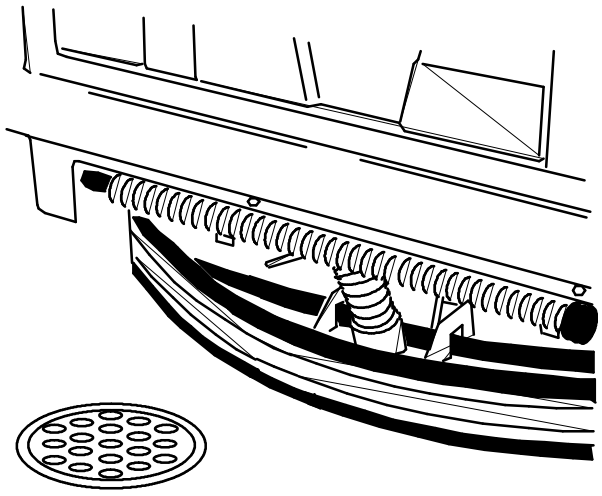
03686

SCREEN FILTER

A. Recovery Tank
B. Screen Filter

17. Clean and replace the Demister and tank caps.

18. Plug and secure the drain hose in the storage clip.



03720

SECURED DRAIN HOSE

POST OPERATION CHECKLIST – MACHINE ON

Check squeegees for proper deflection.

TO STOP MACHINE

1. Return the directional control pedal to the “neutral” position. Apply the brake.
2. Pull the solution flow levers all the way back to stop solution flow.

   ES™ machines: Place the ES™ switch into the bottom position.
3. Press and hold the main brush switch in the top (Main Brush Up) position until the main brush is fully raised and stopped.
4. Press and hold the side brush switch in the top (Side Brush Retract) position until the side brush is fully retracted.
5. Place the squeegee switch in the top (Squeegee Up) position.
6. Place the operational lights switch in the bottom position if used.
7. Turn off the machine and set the machine parking brake. Remove the key from the key-operated on-off switch.

FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake, Turn Off Machine And Remove Key.

POST OPERATION CHECKLIST – MACHINE OFF

Check for wire or string tangled on brushes.

Check squeegees for wear or damage.

Empty and clean debris hopper.

Drain and clean recovery tank.

Check vacuum hoses for debris or obstructions.

Check for leaks.

DOUBLE SCRUBBING OPERATION

Double scrubbing is a method of removing heavy accumulations of soilage, dirt, wax, or spills. It involves making two passes over the area to be cleaned. To double scrub, make a single pass over the surface being cleaned with the squeegee switch in the (Squeegee Up) position. This dispenses solution and allows the brush to rotate with the rear squeegee up. Allow the solution to soak on the floor for 15 to 20 minutes. Then make a second scrubbing pass in the normal manner with the squeegee switch in the (Squeegee Down) position.

FOR SAFETY: When Using Machine; Go Slow On Inclines And Slippery Surfaces.

OPERATION ON GRADES

Drive the machine slowly on grades. Use the brake pedal to control machine speed.

FOR SAFETY: When Using Machine; Go Slow On Inclines And Slippery Surfaces.

The maximum rated climb angle is 6°. The maximum rated descent angle is 8°.

MACHINE TROUBLESHOOTING

Problem	Cause	Remedy
Trailing water – poor or no water pickup.	Worn rear squeegee blade.	Rotate or replace rear squeegee.
	Rear squeegee out of adjustment.	Adjust rear squeegee.
	Worn side squeegee.	Replace side squeegee blade.
	Side squeegee out of adjustment.	Adjust side squeegee.
	Vacuum hose clogged.	Flush vacuum hoses.
	Recovery tank full.	Drain tank.
	Recovery tank demister clogged.	Flush and clean demister.
	Float stuck shutting off vacuum.	Clean float.
	Vacuum fan drive belt loose or broken.	Adjust or replace and adjust belt.
	Debris caught on squeegee.	Remove debris.
	Debris hopper full.	Empty hopper.
	Debris hopper screen and/or hose clogged.	Clean and flush screen and hose.
	Foam filling recovery tank.	Empty recovery tank; use less or change detergent.
	Vacuum hose to rear squeegee disconnected or damaged.	Reconnect or replace vacuum hose.
	Vacuum fan to recovery tank hose damaged.	Replace hose.
Little or no solution flow to floor.	Solution tank empty.	Fill solution tank.
	Solution control linkage broken or out of adjustment.	Replace and/or adjust linkage.
	Solution supply lines plugged.	Flush solution supply lines.
	Solution spreader holes plugged.	Flush spreader holes.
	ES™ switch off.	Turn ES™ switch on.
Poor scrubbing performance.	Debris caught on scrub brushes.	Remove debris.
	Improper detergent or brushes used.	Check with TENNANT representative for advice.
	Worn scrub brushes.	Replace scrub brushes.
	Scrub brushes out of adjustment.	Adjust scrub brushes.
	Broken scrub brush drive chain.	Replace chain.
	Broken scrub brush drive idler.	Replace idler.
	Scrub brush drive sprocket loose.	Tighten sprocket set screws.
	Debris hopper full.	Empty hopper.
	Brushes have flat spot.	Rotate brushes end-for-end.

OPTIONS OPERATION

VACUUM WAND

The vacuum wand accessory gives the machine the added flexibility of picking up spills not accessible by the machine. A 90 in (2280 mm) long hose utilizes the machine vacuum system.

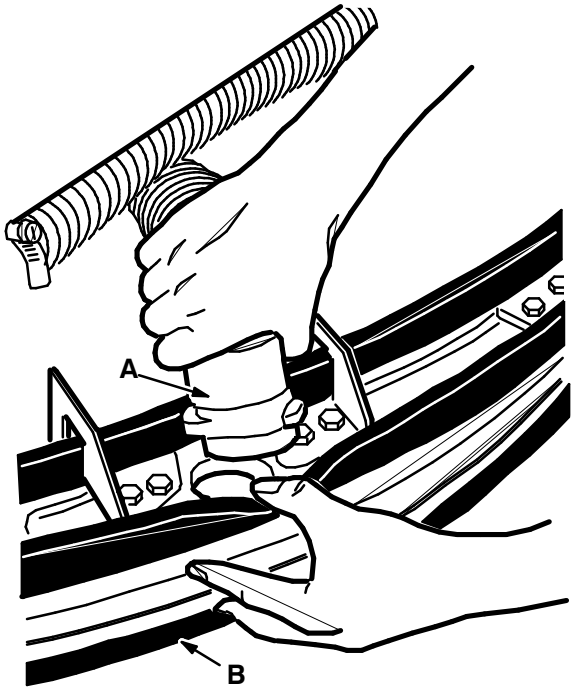
TO OPERATE VACUUM WAND

1. Turn off the machine and set the machine parking brake.

FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake, And Turn Off Machine.

2. Raise and chain up seat. Remove the vacuum wand equipment from the machine.

3. Turn and disconnect the squeegee vacuum hose from the squeegee assembly.



03685

DISCONNECTING SQUEEGEE SUCTION HOSE

A. Suction Hose
B. Squeegee

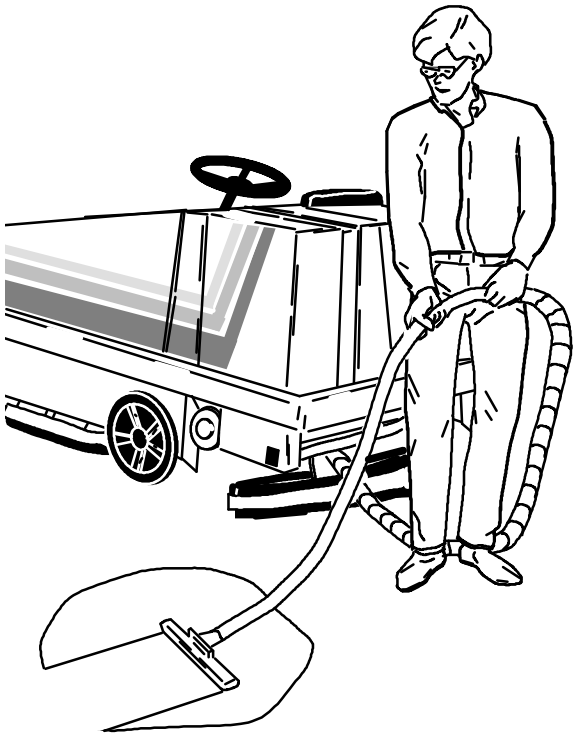
4. Push the vacuum wand hose connector into the squeegee vacuum hose.

5. Assemble the wand and hose.

6. Turn the key-operated on-off switch clockwise to turn the machine on.

7. Place the squeegee switch in the bottom (Squeegee Down) position to start the vacuum fan.

8. Vacuum as required.



03697

USING VACUUM WAND

9. When finished, place the squeegee switch in the top (Squeegee Up) position.

10. Remove the vacuum wand hose connector from the hose.

11. Reconnect the squeegee vacuum hose to the squeegee.

12. Clean and rinse off the vacuum wand and equipment as required.

13. Store the vacuum wand equipment in the proper locations. Lower the seat.

TRANSPORTING MACHINE

PUSHING OR TOWING MACHINE

The machine may be pushed or towed up to 4 mph (6 km/h) by the machine frame. Use care when attaching towing cables or chains to avoid damaging the machine.

MACHINE JACKING

The machine may be jacked up for service at the designated locations. Use a jack of adequate capacity and good working condition. Always stop the machine on a flat, level surface and block the tires before jacking the machine up.

The front jacking location is the middle flat bottom edge of the front bumper. The rear jacking locations are on the flat bottom edge of the rear of the machine frame.

TO JACK UP MACHINE

1. Empty the debris hopper, solution and recovery tanks.

2. Turn off the machine and set the machine parking brake.

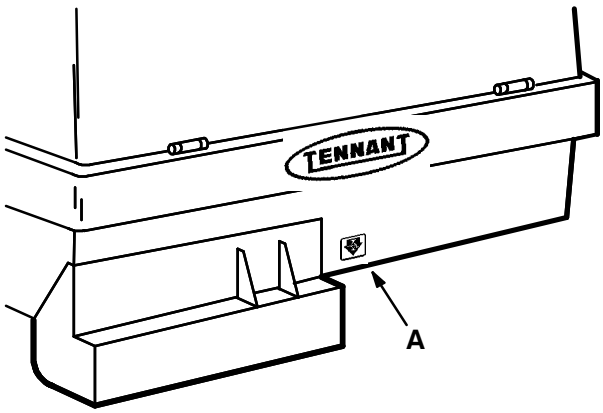
FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake, And Turn Off Machine.

3. Block the tires, which are not being jacked up, in order to secure the machine position.

FOR SAFETY: When Servicing Machine, Block Machine Tires Before Jacking Machine Up.

4. Use a jack of adequate capacity to raise the machine. Jack up the machine only at the designated locations.

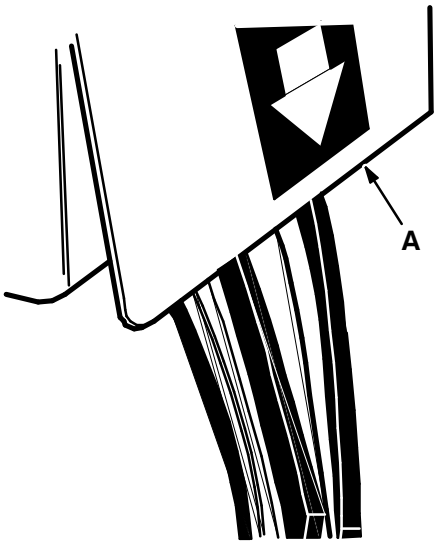
FOR SAFETY: When Servicing Machine, Jack Machine Up At Designated Locations Only. Block Machine Up With Jack Stands.



03701

FRONT JACKING LOCATION

A. Jacking Location



03976

REAR JACKING LOCATION

A. Jacking Location

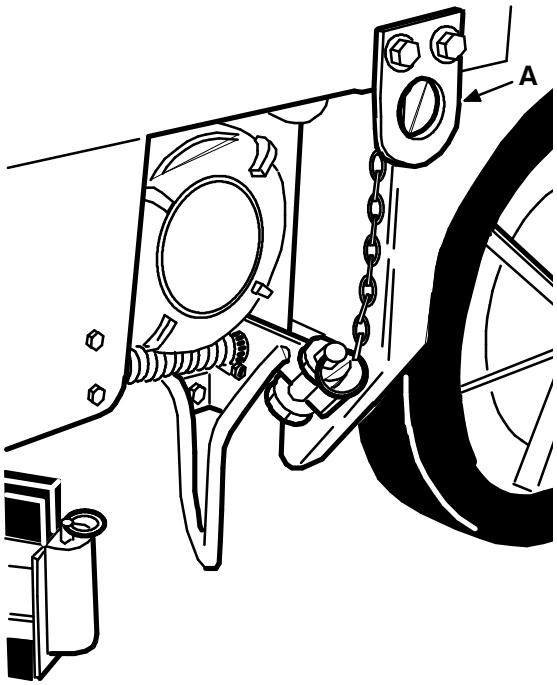
5. Block machine up with jack stands or similar devices near the designated locations to secure the machine.

FOR SAFETY: When Servicing Machine, Jack Machine Up At Designated Locations Only. Block Machine Up With Jack Stands.

6. Lower the machine onto the jack stands.
7. Check to make sure the machine is secure.
8. Service the machine as required.
9. When finished servicing the machine, raise the machine off the jack stands.
10. Remove the jack stands from under the machine.
11. Lower the machine.
12. Remove the blocks from the tires.

MACHINE TIE-DOWNS

The machine may be tied down at each corner of the main frame using the tie-down brackets supplied in the tie-down kit.



03690

REAR TIE-DOWN LOCATION

A. Tie-Down Bracket

When transporting the machine on a trailer or in a truck, be sure to set the machine parking brake and block the machine tires to prevent the machine from rolling.

MACHINE STORAGE

STORING MACHINE

When storing the machine for extended periods of time, the following procedures must be followed to lessen the chance of rust, sludge, or other undesirable deposits from forming.

1. Empty and clean debris hopper.
2. Drain and clean the solution and recovery tanks.
3. Raise both the main and side brushes.
4. Park the machine in a cool, dry area.
5. Fill the hydraulic reservoir with hydraulic fluid for machines with serial number 007500 and above. This prevents condensation from developing in the reservoir.
6. Remove or charge the batteries every three months.

SECTION 3

CONTENTS

RECOMMENDED FIRST 50-HOUR MACHINE INSPECTION

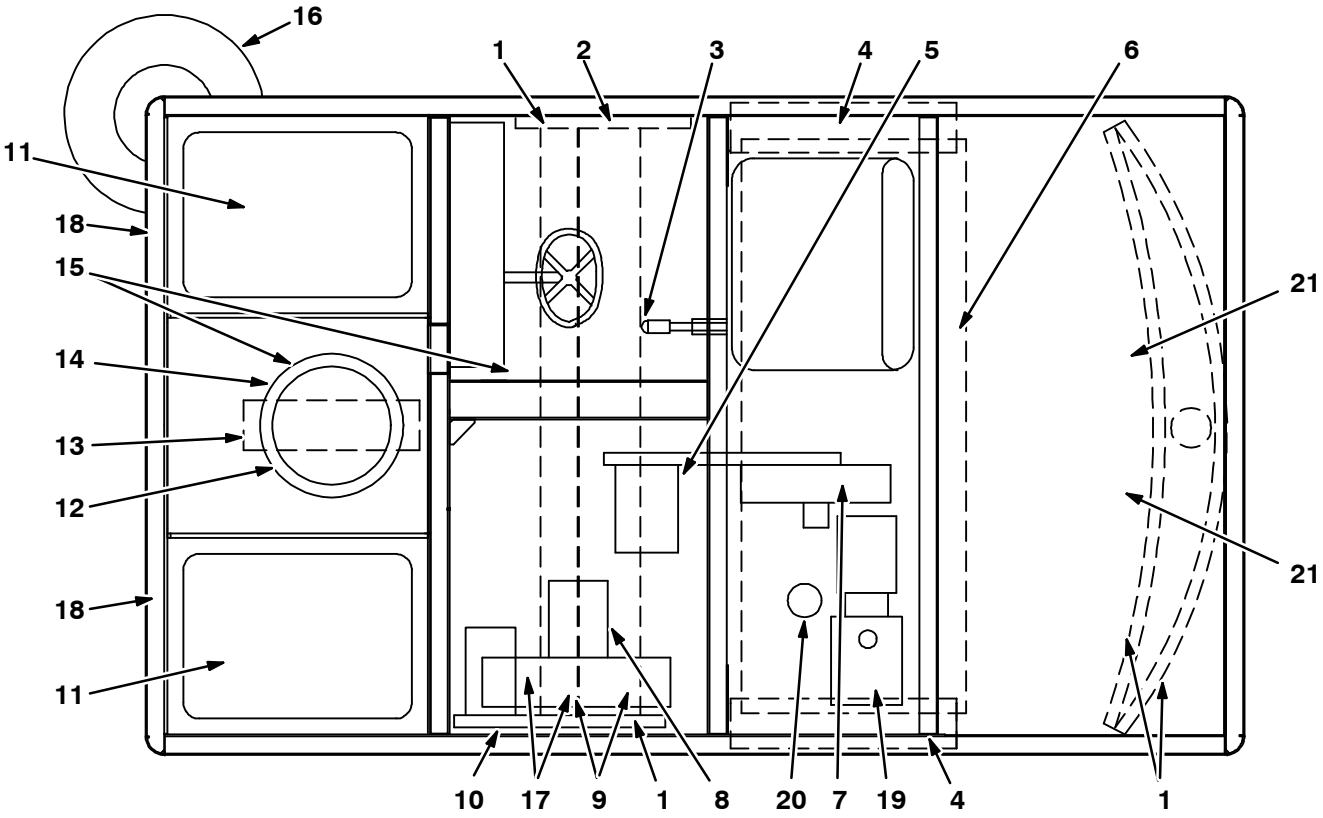
After the first 50 hours of operation, the following procedures are recommended:

1. Change the gearbox gear lubricant and the drain and fill/level plug seals.

2. Replace the hydraulic fluid filter element.

3. Perform all 50-hour interval lubrication and maintenance procedures listed in the *MAINTENANCE CHART*.

MAINTENANCE CHART



Interval	Key	Description	Procedure	Lubricant	No. of-Service Points
Daily	1	Squeegees	Check for damage and wear	–	4
	9	Main brushes	Check for damage and wear	–	2
	16	Side brush	Check for damage and wear	–	1
	6	Debris hopper	Clean	–	1
	6	Recovery tank	Clean	–	1
25 Hours	19	Hydraulic fluid reservoir	Check fluid level	HYDO	1
50 Hours	9	Main brushes	Rotate end-for-end	–	2
	7	Vacuum fan bearing	Lubricate	SPL	1
	11	Batteries	Check electrolyte level	–	2
	10	Main brush drive	Check lubricant level	GL	1
100 Hours	4	Rear tires	Inspect for wear	–	2
	13	Front tire	Inspect for wear	–	1
	14	Gearbox	Check lubricant level	GL	1
	21	Rear Caster	Lubricate	SPL	2

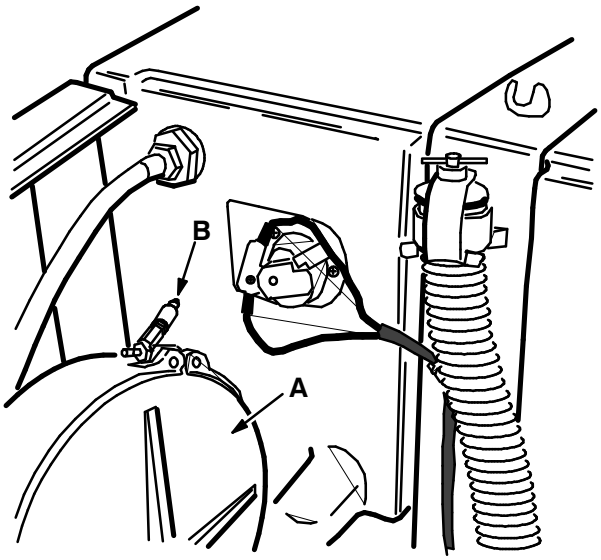
Interval	Key	Description	Procedure	Lubricant	No. of-Service Points
200 Hours	5	Vacuum fan belt	Check tension	–	1
	2	Brush arm bearings	Lubricate	SPL	2
	3	Parking brake	Check adjustment	–	1
	12	Front wheel support bearing	Lubricate	SPL	2
	15	Steering linkage	Lubricate	SPL	4
	17	Cooling fan filter	Clean	–	2
	18	Hood hinge	Lubricate	SPL	2
400 Hours	9	Main brush drive	Check chain tension	–	1
	5	Vacuum fan motor	Check motor brushes	–	1
	19	Hydraulic fluid reservoir	Change hydraulic fluid	HYDO	1
	20	Hydraulic fluid filter	Change filter element	–	1
1000 Hours	14	Gearbox	Change gear lubricant	GL	1
	10	Main brush motor	Check motor brushes	–	1
	16	Side brush motor	Check motor brushes	–	1
	14	Propelling motor	Check motor brushes	–	1
	8	Cooling fan motor	Check motor brushes	–	1

GL – SAE 90 Gear weight lubricant
SPL – Special lubricant, Lubriplate EMB grease (TENNANT Part No. 01433-1)
HYDO – TENNANT or approved hydraulic fluid

LUBRICATION

VACUUM FAN BEARING

The vacuum fan bearing supports the vacuum fan shaft. A grease fitting has been provided on the fan housing for lubrication purposes. Lubricate the bearing with three or four strokes of a hand grease gun containing Lubriplate EMB grease (TENNANT Part No. 01433-1) after every 50 hours of operation.



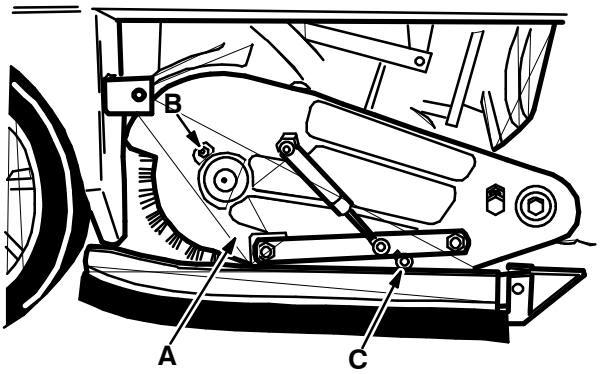
03688

VACUUM FAN

A. Vacuum Fan
B. Grease Fitting

BRUSH IDLER BEARINGS

The brush idler bearings support the idler side of the main brush. Two grease fittings have been provided for lubrication purposes. Lubricate the bearings with a grease gun containing Lubriplate EMB grease (TENNANT Part No. 01433-1) after every 200 hours of operation.



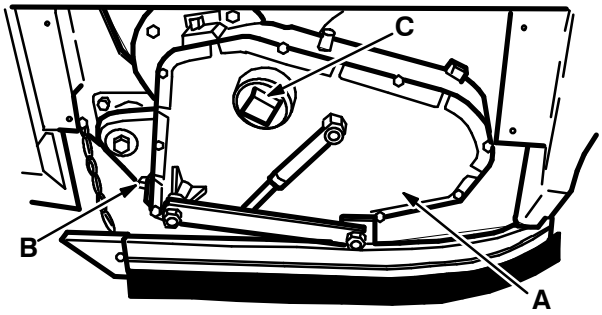
03687

REAR BRUSH IDLER GREASE FITTING

A. Brush Arm
B. Rear Brush Grease Fitting
C. Front Brush Grease Fitting

MAIN BRUSH DRIVE

The main brush drive assembly drives the two main brushes. It is lubricated by a chain case containing SAE 90 weight gear lubricant. Check the lubricant level through the level plug after every 50 hours of operation with the main brushes raised.



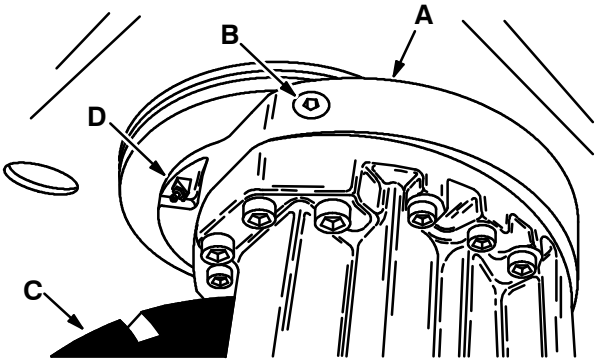
03683

BRUSH CHAIN CASE

A. Chain Case
B. Level Plug
C. Fill Plug

GEARBOX

The gearbox transfers power from the propelling motor to the front wheel. It is lubricated with SAE 90 weight gear lubricant. Check the lubricant level after every 100 hours of operation. Change the gear lubricant and the drain and fill/level plug seals after the first 50 hours of operation and then after every 1000 hours of operation.



GEARBOX

A. Gearbox
B. Fill Plug
C. Front Wheel
D. Support Grease Fitting

FRONT WHEEL SUPPORT BEARING

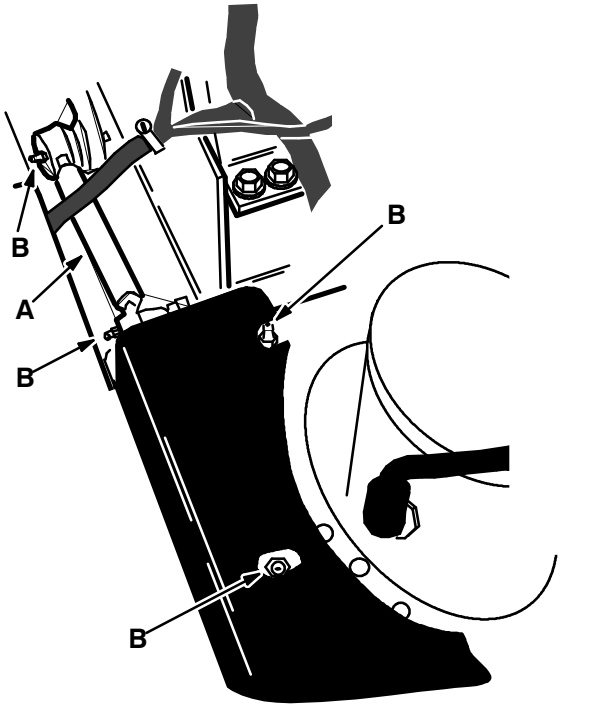
The front wheel support bearing allows the gearbox and front wheel assembly to rotate freely. Raise the machine so the front wheel is off the ground. Fill one grease fitting with Lubriplate EMB grease (TENNANT Part No. 01433–1) while rotating the gearbox from stop to stop. Fill the second grease fitting while rotating the gearbox back to the original position. The bearing cavity is full when grease comes out of the fittings or out of the top seal. Apply the lubricant after every 200 hours of operation, or after steam cleaning the gearbox area.

FOR SAFETY: When Servicing Machine, Block Machine Tires Before Jacking Machine Up.

FOR SAFETY: When Servicing Machine, Jack Machine Up At Designated Locations Only. Block Machine Up With Jack Stands.

STEERING LINKAGE

The steering linkage controls machine steering. A grease fitting is located on each of the two linkage ball joints, and two grease fittings are located on the gearbox mechanism for lubrication. The linkage should be lubricated by applying Lubriplate EMB grease (TENNANT Part No. 01433–1) to the grease fittings after every 200 hours of operation.



FRONT STEERING LINK

A. Steering Link
B. Grease Fitting

HOOD HINGES

The hood hinges allow the hood to open on front of the machine frame. Grease fittings are located under the hood on the inside of each hinge. Lubricate the hinges with a grease gun containing Lubriplate EMB grease (TENNANT Part No. 01433–1) after every 200 hours of operation.

HYDRAULICS

HYDRAULIC FLUID

The quality and condition of the hydraulic fluid play a very important role in how well the machine operates. TENNANT's hydraulic fluid is specially selected to meet the needs of TENNANT machines.

TENNANT's hydraulic fluids provide a longer life for the hydraulic components. There is one recommended fluid.

TENNANT part no.	Fluid Weight
65870	SHP 5/20

If a locally-available hydraulic fluid is used, make sure the specifications match TENNANT hydraulic fluid specifications. Using substitute fluids can cause premature failure of hydraulic components.

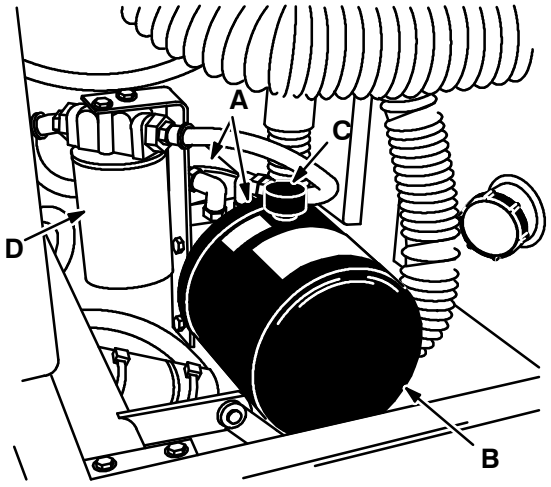
European manufactured machines are filled with locally available hydraulic fluids. Check the label on the hydraulic fluid reservoir.

ATTENTION! Hydraulic components depend on system hydraulic fluid for internal lubrication. Malfunctions, accelerated wear, and damage will result if dirt or other contaminants enter the hydraulic system.

HYDRAULIC FLUID RESERVOIR

Hydraulic fluid is stored in the hydraulic reservoir section of the electro-hydraulic power unit. The reservoir holds 1 gal (3.8 L) of hydraulic fluid. The reservoir is located under the hood in front of the solution and recovery tanks.

The fluid level is checked by opening the filler cap. The reservoir is full when the fluid level is 1 in (25 mm) from the top or is between the marks on the dipstick (if present on earlier style machines).



06126

HYDRAULIC FLUID RESERVOIR

A. Electro-hydraulic Power Unit
B. Hydraulic Reservoir
C. Filler Cap
D. Hydraulic Fluid Filter Element

Check the hydraulic fluid level after every 25 hours of operation. Change the hydraulic fluid after every 400 hours of operation. To remove the hydraulic fluid, insert a hand suction device through the fill opening.

Do not overfill the hydraulic fluid reservoir. The hydraulic fluid expands as it heats to its normal operating temperature. Always allow for expansion when filling the reservoir.

ATTENTION! Do not overfill the hydraulic fluid reservoir or operate the machine with a low level of hydraulic fluid in the reservoir. Damage to the machine hydraulic system may result.

HYDRAULIC FLUID FILTER

The machine hydraulic system is kept clean to a level of 10 microns by a hydraulic fluid filter. The hydraulic fluid filter is mounted to the electro-hydraulic power unit.

Replace the hydraulic fluid filter element after the first 50 hours of operation and then after every 400 hours of operation.

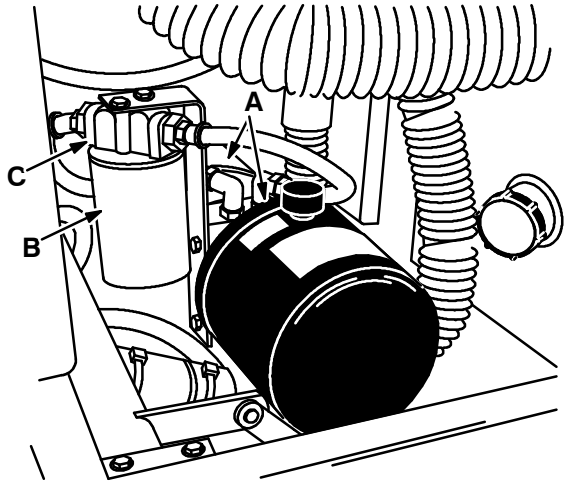
TO REPLACE HYDRAULIC FLUID FILTER ELEMENT

1. Turn off the machine and set the machine parking brake.

FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake, And Turn Off Machine.

2. Open the hood.

3. Unthread and discard the hydraulic fluid filter element.



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HYDRAULIC FLUID FILTER ELEMENT

A. Electro-hydraulic Power Unit
B. Hydraulic Fluid Filter Element
C. Filter Head

NOTE: Discard all hydraulic fluid drained from the system. Drained hydraulic fluid may contain foreign material harmful to the hydraulic system.

4. Apply a thin coat of hydraulic fluid to the seal of the new hydraulic fluid filter element.

5. Thread and hand tighten the new hydraulic fluid filter element on the filter head.

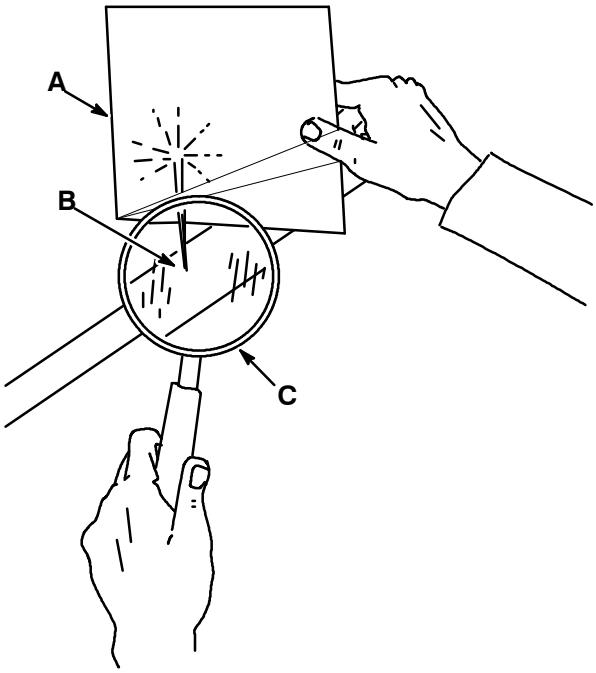
6. Close the hood.

7. Operate the machine and check for leaks. Correct any leaks found.

8. Check the hydraulic fluid reservoir level and fill as required.

HYDRAULIC FLUID LEAKS

Fluid escaping at high pressure from a very small hole can be almost invisible and can cause serious injuries. Use a piece of cardboard or wood, rather than hands, to search for suspected leaks.



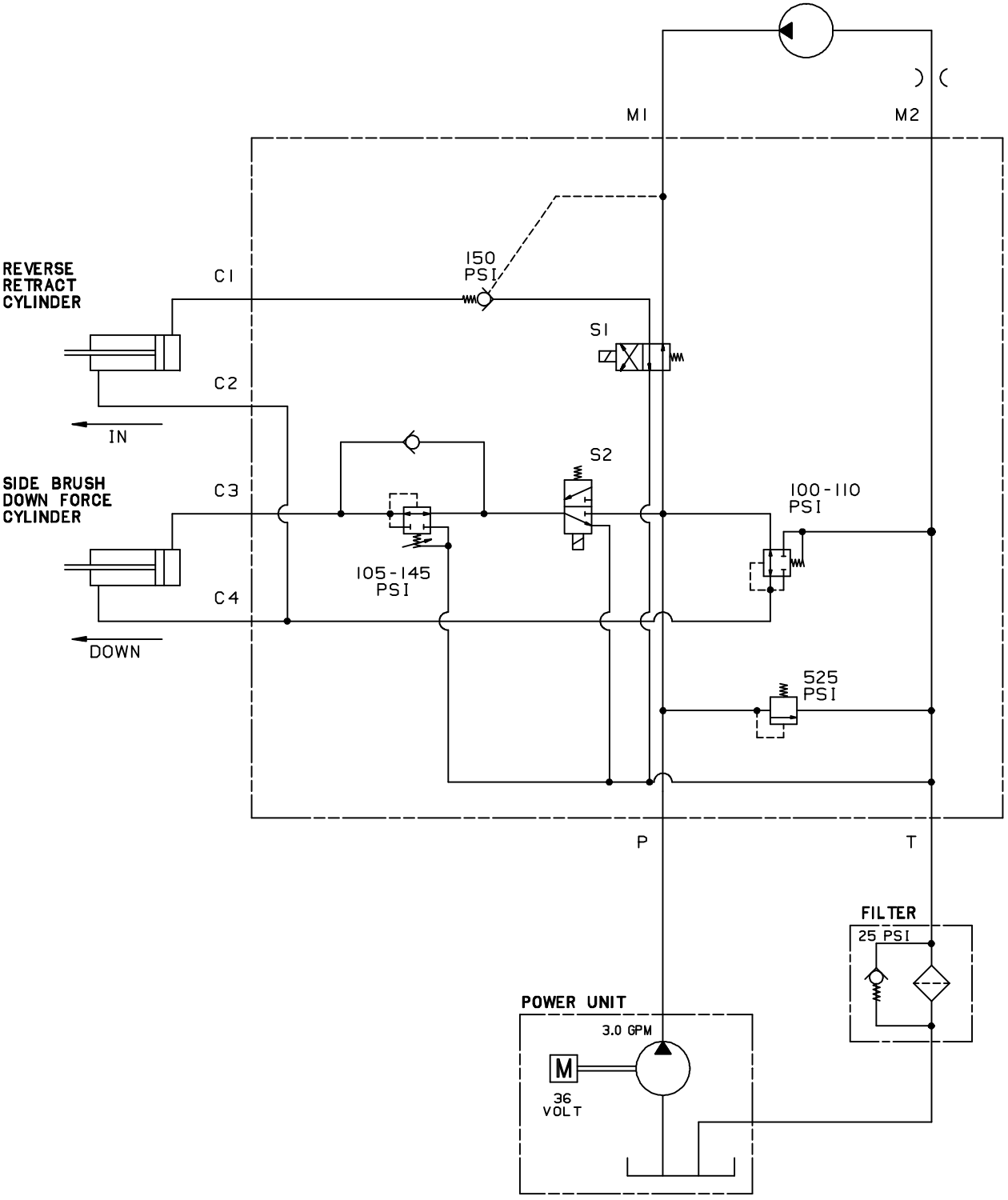
00002

HYDRAULIC PINHOLE LEAK

A. Cardboard
B. Pinhole Leak
C. Magnifying Glass

If injured by escaping hydraulic fluid, see a doctor at once. Serious infection or reaction can develop if proper medical treatment is not administered immediately.

FOR SAFETY: When Servicing Machine, Use Cardboard To Locate Leaking Hydraulic Fluid Under Pressure.



HYDRAULIC SCHEMATIC

HYDRAULIC SYSTEM TROUBLESHOOTING

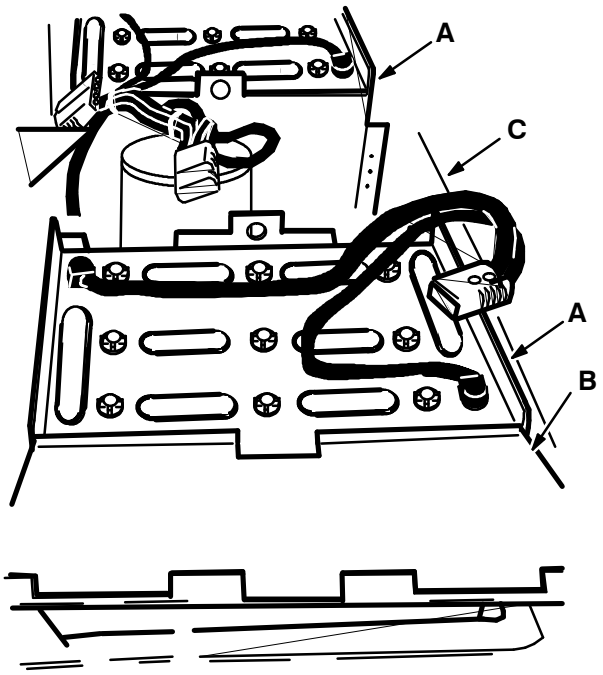
Problem	Cause	Remedy
Side brush does not turn or turns slowly.	Bad electrical connection.	Remake connection.
	Bad rocker switch S25.	Replace switch.
	Bad relay M15.	Replace relay.
	Bad electro-hydraulic power unit.	Service or replace.
Side brush turns but does not go down.	Bad electrical connection.	Remake connection.
	Bad rocker switch S25.	Replace switch.
	Bad coil SV2.	Replace coil.
	Cartridge valve spool stuck closed at SV2.	Clean or replace cartridge.
	Fixed pressure reducing PR2 valve stuck open.	Clean or replace cartridge.
	Adjustable pressure reducing PR1 valve stuck closed.	Clean or replace cartridge.
Side brush does not retract manually.	Bad electrical connection at CB8, S25, or solenoid valve.	Remake connection.
	Bad coil SV1.	Replace coil.
	Check valve stuck closed.	Clean or replace cartridge.
	Bad hydraulic cylinder.	Replace cylinder.
Side brush does not retract in reverse.	Bad micro reverse switch S26.	Replace switch.
Side brush stays retracted.	Bad relay M15.	Replace relay.
	Cartridge valve spool SV1 stuck in activated position.	Clean or replace cartridge.
	Check valve stuck closed.	Clean or replace cartridge.
	Bad hydraulic cylinder.	Replace cylinder.
Side brush stays down and will not come up.	Bad rocker switch S25.	Replace switch.
	Adjustable check valve closed.	Clean or replace cartridge.
	Cartridge valve spool SV2 stuck in shifted position.	Clean or replace cartridge.
Too much down force on side brush.	Pressure setting of adjustable pressure reducing valve is too high.	Turn adjustment knob counterclockwise and lock in place with lock knob.
	Fixed pressure reducing valve malfunctioning, spool stuck in relieving mode.	Replace cartridge.
	Adjustable pressure reducing valve malfunctioning, spool stuck in spring held position.	Replace cartridge.
Not enough down force on side brush.	Pressure setting of adjustable pressure reducing valve is too low.	Turn adjustment knob clockwise and lock in place with lock knob.
	Fixed pressure reducing valve malfunctioning.	Replace cartridge.
	Adjustable pressure reducing valve malfunctioning	Replace cartridge.

ELECTRICAL SYSTEM

BATTERIES

The batteries provide all of the energy used by the machine. The standard batteries are rated at 600 A/h at a 6-hour rate. The maximum battery size is 15.75 in (400 mm) in width and 19.44 in (495 mm) in length. They require regular maintenance to keep them operating their best.

When installing new or replacement batteries, be sure to set them in the machine with the battery covers opening from the inside to the outside of the machine.



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BATTERY INSTALLATION

A. Battery
B. Battery Cover
C. Front Machine Frame

Do not allow batteries to remain in discharged condition for any length of time.

Do not operate machine if batteries are in poor condition or have a charge level below 25%, specific gravity below 1.162.

If using a battery not supplied by TENNANT, make sure the battery cables are not longer than 18 in (450 mm) or they could rub on the drive motor studs, wear through the cables and cause a direct short.

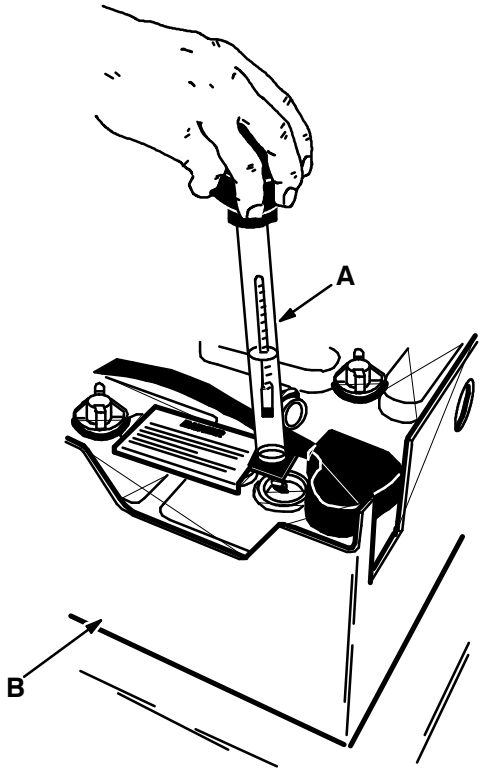
Periodically clean the top surface and check for loose connections. Use a strong solution of baking soda and water. Brush the solution sparingly over the battery top. Do not allow any baking soda solution to enter the battery. Keep the tops of the batteries clean and dry.

Keep all metallic objects off the top of the batteries, as they may cause a short circuit. Replace worn or damaged wires.

Check the electrolyte level in each battery cell before and after charging the batteries and after every 50 hours of operation. Never add acid to batteries, only distilled water. Do not overfill. Keep vent plugs firmly in place at all times, except when adding water or taking hydrometer readings.

FOR SAFETY: When Servicing Machine, Avoid Contact With Battery Acid.

Use a hydrometer to check the electrolyte specific gravity.



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CHECKING BATTERY SPECIFIC GRAVITY

A. Hydrometer
B. Battery

If one or more battery cells tests lower than the other battery cells, (0.050 or more) the cell is damaged, shorted, or is about to fail.

NOTE: Do not take readings immediately after adding water–if the water and acid are not thoroughly mixed, the readings may not be accurate. Check the hydrometer readings against the following chart:

SPECIFIC GRAVITY at 80°F (27°C)	BATTERY CONDITION
1.315	100% charged
1.264	75% charged
1.213	50% charged
1.162	25% charged
1.110	Discharged

NOTE: If the readings are taken when the battery electrolyte is any temperature other than 80°F (27°C), the reading must be temperature corrected.

To determine the corrected specific gravity reading when the temperature of the battery electrolyte is other than 80°F (27°C):

Add to the specific gravity reading 0.004, 4 points, for each 10°F (6°C) above 80°F (27°C).

Subtract from the specific gravity reading 0.004, 4 points, for each 10°F (6°C) below 80°F (27°C).

BATTERY CHARGING

The machine batteries are specially made for this machine application. They are unique in that they hold their power for long periods of time, but they can only be recharged a certain number of times. To get the most life from the batteries, charge them when their charge level is below 25%.

Eight to twelve hours is generally enough time to charge a discharged set of batteries. If the batteries are not fully discharged, charge for a period of time that is proportionally less than what is required for a fully discharged set of batteries, ie: half discharged heavy duty batteries need seven to eight hours of charging time.

Do not expose the battery charger to water. Do not touch uninsulated battery terminals or unnecessarily expose any portion of your body to the batteries when making electrical connections.

TO CHARGE BATTERIES

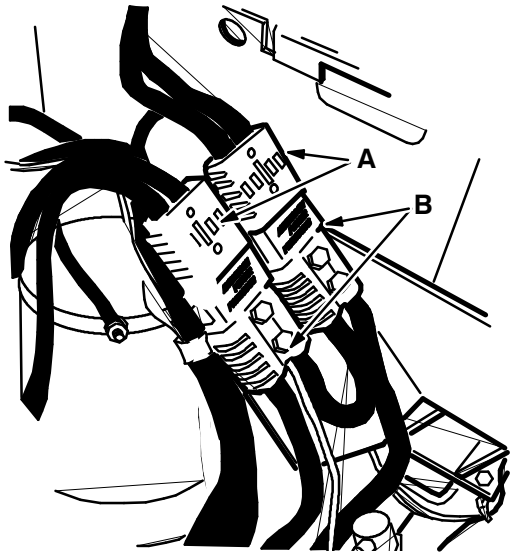
1. Park the machine on a flat, dry surface next to the charger and set the machine parking brake. Turn off the machine.

FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake, And Turn Off Machine.

2. Open the hood and battery covers.

WARNING: Batteries Emit Hydrogen Gas. Explosion Or Fire Can Result. Keep Sparks And Open Flame Away. Keep Covers Open When Charging.

3. Unplug the machine connectors from the battery connectors.



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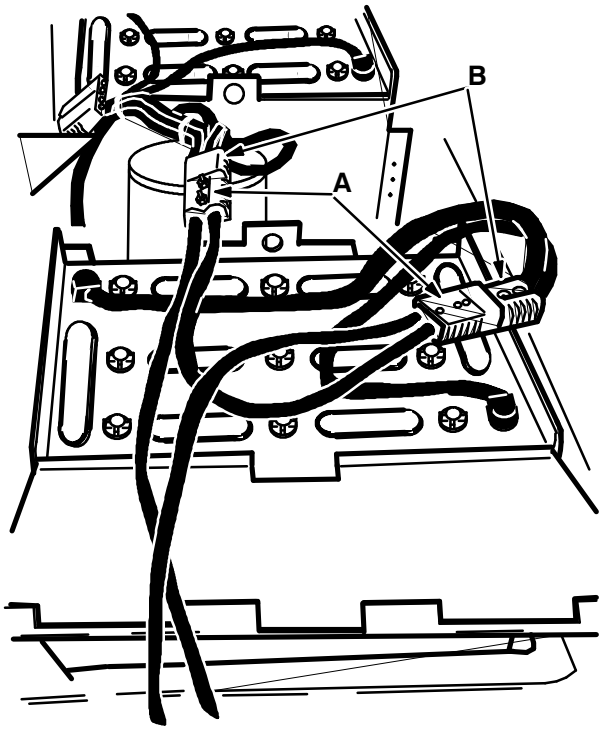
BATTERY CONNECTORS

A. Battery Connectors
B. Machine Connectors

4. Check the electrolyte level in the batteries. Before charging, add just enough distilled water to cover the plates. Then, after charging is completed, add enough water to bring the electrolyte up to 0.25 in (5 mm) below the bottom of the filling hole. If the water level is topped off before charging, normal expansion of the electrolyte may cause an overflow, resulting in loss of acid balance and acid damage to the machine area around the batteries.

5. Replace battery caps and leave them in place while charging.

6. Plug the charger connectors into the battery connectors from the batteries.



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CHARGING BATTERIES

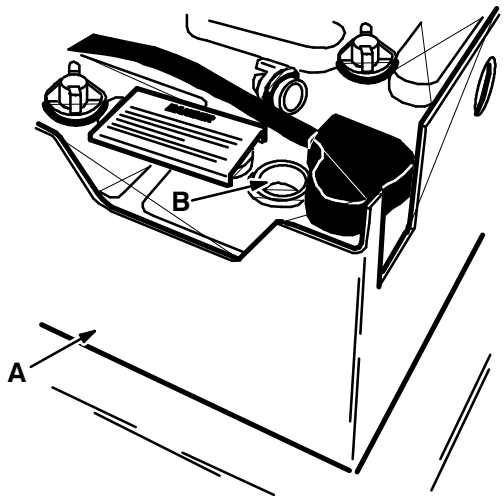
A. Charger Connectors
B. Battery Connectors

7. The charger gauge will indicate the charger is operating. The batteries will be fully charged when charger turns off.

8. Unplug the charger connector from the battery connector.

9. Reconnect the machine connector to the battery connector.

10. Check the electrolyte level of the batteries; it should be 0.25 in (5 mm) below the bottom of the filling hole.



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CHECKING BATTERY ELECTROLYTE LEVEL

A. Battery
B. Filling Hole

11. Lower the battery covers and hood.

ELECTRIC MOTORS

The electric motors are repairable.

Blow out the dust and inspect the motor brushes in the vacuum fan motor after every 400 hours of operation and in all the other motors after every 1000 hours of operation.

If the brushes are broken, cracked, chipped, or have been worn to less than 0.62 in (15 mm) in length on the short side on the propelling motor, or 0.38 in (10 mm) in length on the short side on the main and side brush drive, cooling fan or vacuum fan motors, replace them. Remember to always replace brushes in sets.

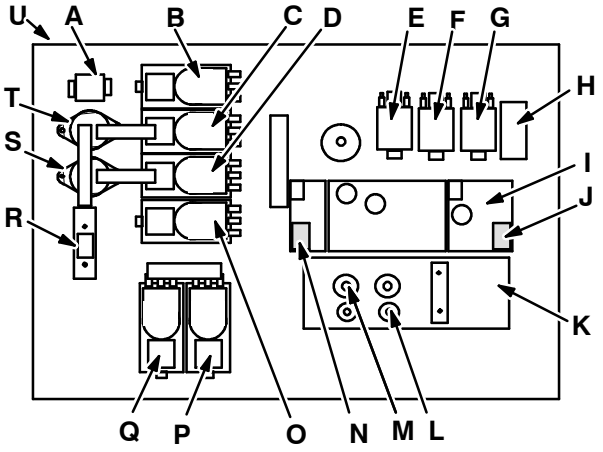
If the commutator is worn or rough, the motor armature should be removed and serviced.

PROPELLING CIRCUIT

The propelling circuit is made up of contactors and an SCR controller. They control the forward and reverse speed of the machine and are located in the controller panel. The circuit is not user serviceable – only trained personnel should be allowed to work on it. Do not steam clean or spray the panel with water as it may damage the electrical system.

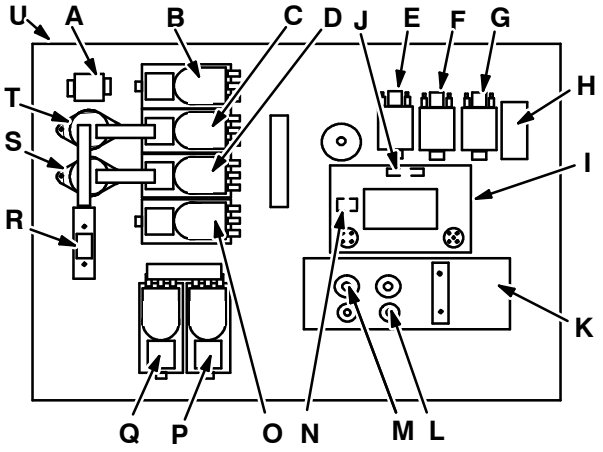
Inside the controller panel are two cooling fan inlet filters. Remove, clean, and reinstall the filters after every 200 hours of operation.

The SCR controller is a solid state speed control device. It supplies the drive motor with a smooth flow of energy. It does this by sending the motor short bursts or pulses of energy that through the machine we feel is continuous. The directional control pedal controls the number of pulses. The harder the pedal is pressed, the greater number of pulses, the faster the machine travels. The pulsing is where the whine of the propelling system comes from. The SCR is the heart of the controller. It is a high speed, high current capacity switch.



SCR CONTROLLER (For machines below serial number 007500)

- **A. Side Brush Motor Circuit Breaker, CB4**
- **B. Side Brush Contactor, M10**
- **C. Main Brush Contactor, M6**
- **D. Fan Contactor, M5**
- **E. Squeegee Lower Contactor, M7**
- **F. Squeegee Lift Contactor, M8**
- **G. Cooling Fan Contactor, M11**
- **H. Vacuum Fan Motor Soft-Start Timer**
- **I. Logic Board**
- **J. Logic Plug A**
- **K. Controller**
- **L. Battery Negative Post**
- **M. Plugging Diode, D2**
- **N. Logic Plug B**
- **O. Fan Contactor, M4**
- **P. Reverse Contactor, M3**
- **Q. Forward Contactor, M2**
- **R. Propelling Motor Fuse, 100 A**
- **S. Vacuum Fan Motor Circuit Breaker, CB2**
- **T. Main Brush Motor Circuit Breaker, CB3**
- **U. Controller Panel**



SCR CONTROLLER (For machines serial number 007500 and above)

- **A. Side Brush Motor Circuit Breaker, CB4**
- **B. Side Brush Contactor, M10**
- **C. Main Brush Contactor, M6**
- **D. Fan Contactor, M5**
- **E. Squeegee Lower Contactor, M7**
- **F. Squeegee Lift Contactor, M8**
- **G. Cooling Fan Contactor, M11**
- **H. Vacuum Fan Motor Soft-Start Timer**
- **I. Logic Board**
- **J. Logic Plug A**
- **K. Controller**
- **L. Battery Negative Post**
- **M. Plugging Diode, D2**
- **N. Logic Plug B**
- **O. Fan Contactor, M4**
- **P. Reverse Contactor, M3**
- **Q. Forward Contactor, M2**
- **R. Propelling Motor Fuse, 100 A**
- **S. Vacuum Fan Motor Circuit Breaker, CB2**
- **T. Main Brush Motor Circuit Breaker, CB3**
- **U. Controller Panel**

WARNING: Hazardous Voltage. Shock Can Result. Disconnect Batteries Before Working On Machine. Only Qualified Personnel Should Work Inside Panel.

If you choose to troubleshoot the system yourself, see *PROPELLING SYSTEM TROUBLESHOOTING*.

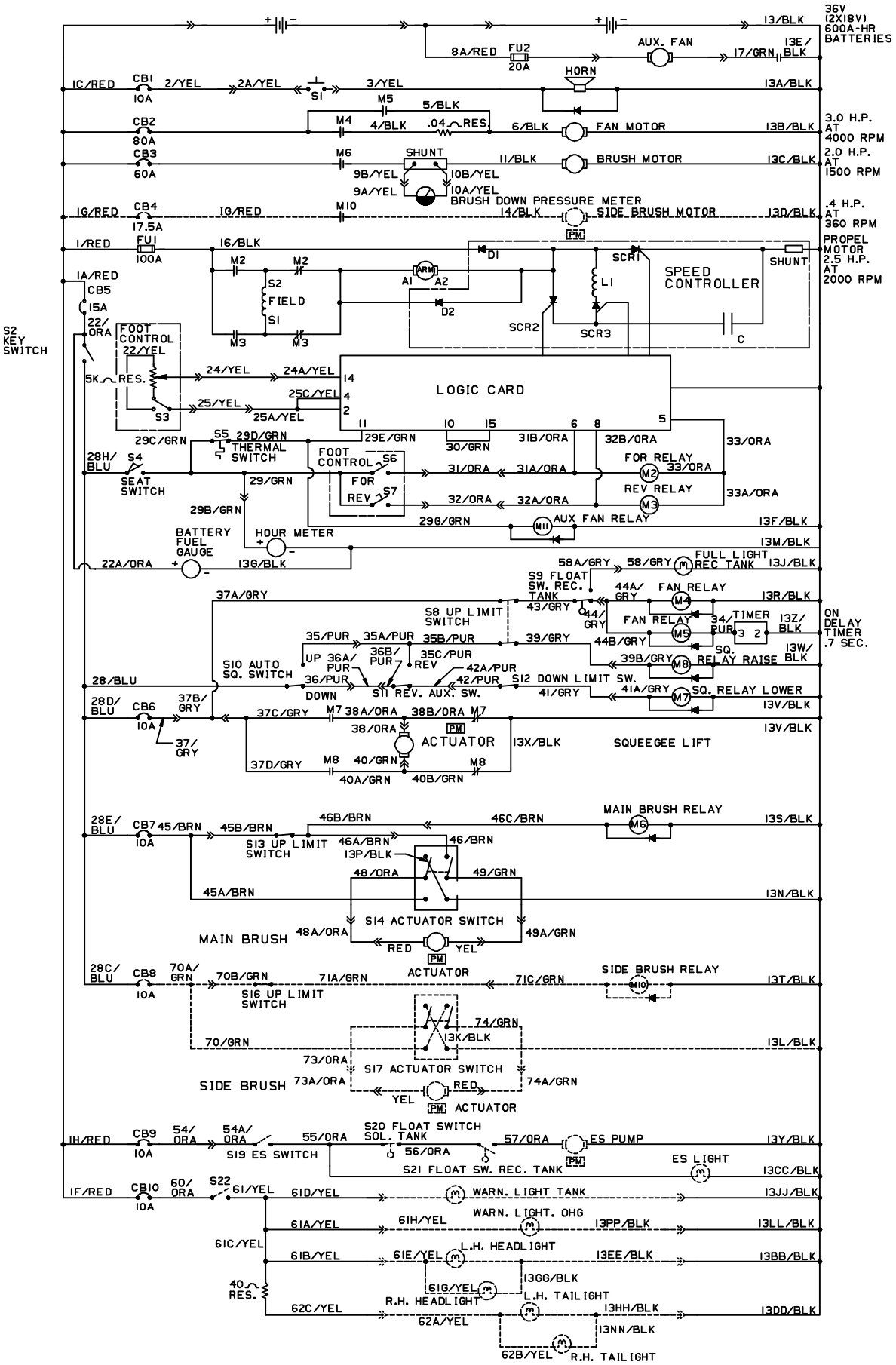
PROPELLING SYSTEM TROUBLESHOOTING

NOTE: Check items in the order they appear.

Problem	Verification/Cause	Remedy
No propelling – direction contactors do not operate.	Incorrect startup sequence used.	Restart machine.
	Low battery charge.	Recharge batteries.
	Plugs or wires loose.	Reconnect plugs or wires.
	Direction contactor welded – check contactor bar moves freely.	Replace contactor.
	Check voltage to SCR panel – key-operated on-off and seat switch on, check voltage on logic plug B pin 11 (wire 29E) to battery negative. Should read battery voltage – if not, check key-operated on-off, seat, and thermal switches and wiring.	Replace key-operated on-off switch, seat switch or allow thermal switch to cool and clean filters and repair fan, or repair wiring.
	Check voltage to foot control – key-operated on-off and seat switch on, check voltage on foot control plug pin 7 (wire 29) to battery negative. Should read battery voltage – if not, check foot control and wiring.	Repair or replace foot control or repair wiring to foot control.
	Check voltage to live end of forward contactor coil – key-operated on-off and seat switch on, push directional pedal forward. Check voltage on live end of forward contactor coil (wire 31A) to battery negative and logic plug B pin 6 (wire 31B) to battery negative. Should read battery voltage – if not, check foot control and wiring.	Repair foot control or repair wiring to foot control.
	Check continuity of forward contactor coil. Should have some resistance – if not, contactor faulty.	Replace forward contactor.
	Check continuity of reverse contactor coil. Should have some resistance – if not, contactor faulty.	Replace reverse contactor.
	Check continuity of wiring from forward and reverse contactors to logic plug B pin 5 (wire 33 and wire 33A).	Repair wiring.
	Logic board faulty.	Replace logic board.

Problem	Verification/Cause	Remedy
No propelling – direction contactors close.	Low battery charge.	Recharge batteries.
	Fuse FU–1 blown.	Replace fuse.
	Check wiring from forward contactor – key-operated on-off and seat switch on, push directional pedal forward. Check voltage on logic plug B pin 6 (wire 31B) to battery negative. Should read battery voltage – if not, wiring faulty.	Repair wiring from forward contactor to logic plug B pin 6 (wire 31B).
	Check wiring from reverse contactor – key-operated on-off and seat switch on, push directional pedal into reverse. Check voltage on logic plug B pin 8 (wire 32B) to battery negative. Should read battery voltage – if not, wiring faulty.	Repair wiring from reverse contactor to logic plug B pin 8 (wire 32B).
	Check logic board – key-operated on-off and seat switch on, push directional pedal forward to mid position. Check voltage on logic plug B pin 14 (wire 24A) to battery negative. Should read 10 to 12 V. Check voltage on logic plug B pin 2 (wire 25A) to battery negative. Should read 7 to 8 V. If it does, logic board faulty.	Replace logic board.
	Check operation of foot control speed potentiometer – check resistance across directional pedal plug pin 1 (wire 24B) and pin 2 (wire 25B) as pedal is pressed. Should be 4.5K to 5K Ohms down to 0 Ohms in forward, 4.5K to 5K Ohms down to 1.2K Ohms in reverse. If not, speed in reverse. If not, speed potentiometer in foot pedal faulty.	Replace potentiometer or foot control.
	Check wiring from foot control to panel – check continuity from logic plug B pin 2 (wire 25A) to directional pedal plug pin 2 (wire25) and from logic plug B pin 14 (wire 24A) to directional pedal plug pin 1 (wire 24).	Repair wiring.
	Main SCR or diodes faulty.	Replace SCR panel.
Machine moves short distance rapidly – direction contactor closes and immediately opens.	Plugs, power cables, or wires loose.	Reconnect plugs or wires.
	Logic board faulty.	Replace logic board.
	SCR faulty.	Replace SCR panel.

Problem	Verification/Cause	Remedy
Machine does not move – direction contactor closes and immediately opens. No arcing of contactor.	Power wiring faulty.	Repair wiring.
	Direction contactor contacts faulty.	Replace contactor.
	Motor has open circuit. Disconnect power cables to motor and check resistance across field and armature. Should be less than 1 Ohm from A1 to A2 and from S1 to S2.	Repair motor.
	Motor brushes faulty.	Repair brushes.
	Logic board faulty.	Replace logic board.
Machine moves slowly – will not accelerate.	Low battery charge.	Recharge batteries.
	Plugs or wires loose.	Reconnect plugs or wires.
	Foot control pedal faulty.	Repair or replace foot control.
	Control panel overheated – check cooling fan and filters.	Allow to cool. Clean filters and/or repair fan.
	Logic board faulty.	Replace logic board.
Machine accelerates – no control with foot pedal.	Plugs or wires loose – check continuity of foot control plug pin 2 (wire 25) to logic plug B pin 2 (wire 25A), foot control plug pin 1 (wire 24) to logic plug B pin 14 (wire 24A).	Reconnect or repair plugs or wires.
	Check operation of foot control speed potentiometer – check resistance across directional pedal receptacle pin 1 (wire 24B) and pin 2 (wire 25B) as pedal is pressed. Should be 4.5K to 5K Ohms down to 0 Ohms in forward, 4.5K to 5K Ohms down to 1.2K Ohms in reverse. If not, speed potentiometer in directional pedal faulty.	Replace potentiometer or foot control.
	Logic board faulty.	Replace logic board.
Machine stops rapidly when removing foot from pedal.	Power cable connections from plugging diode D2 to contactors and motor faulty.	Repair connections.
	Light wire from plugging diode cathode to logic plug A (white wire) faulty.	Repair wire.
	Logic board faulty.	Replace logic board.
	Plugging diode faulty.	Replace SCR panel.



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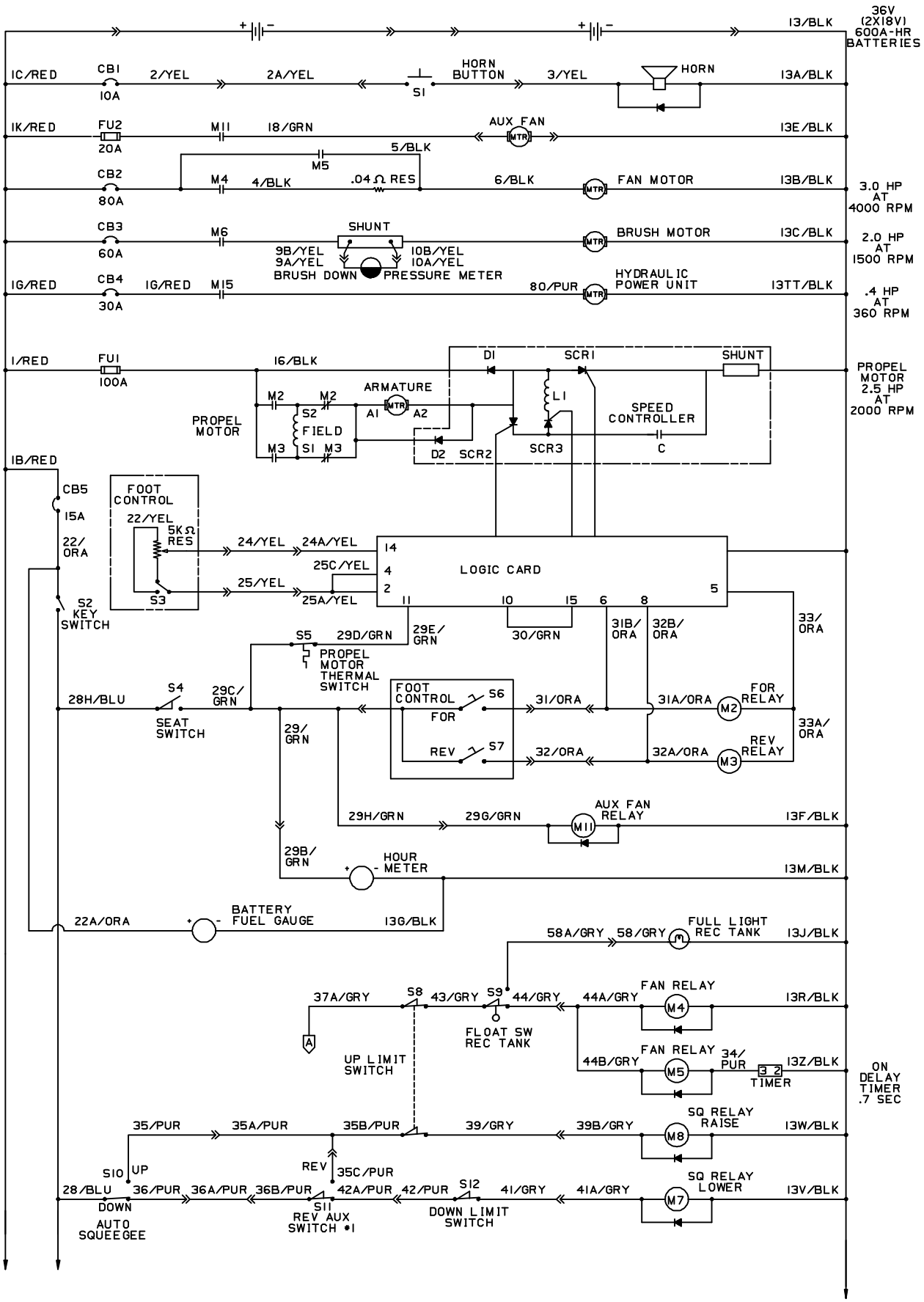
ELECTRICAL SCHEMATIC (For machines below serial number 007500)



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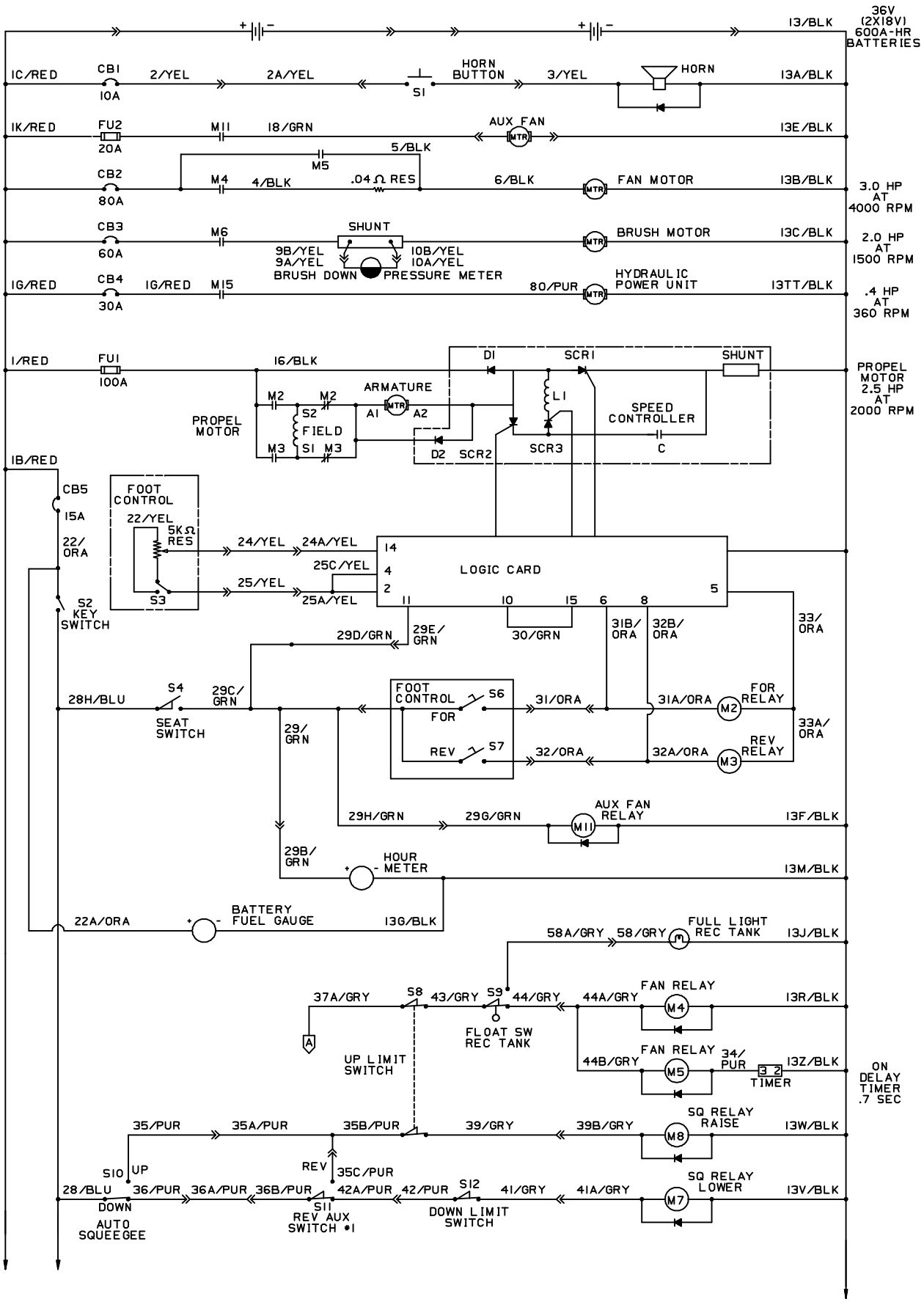
ELECTRICAL SCHEMATIC (For machines serial number 007500 to 007892)



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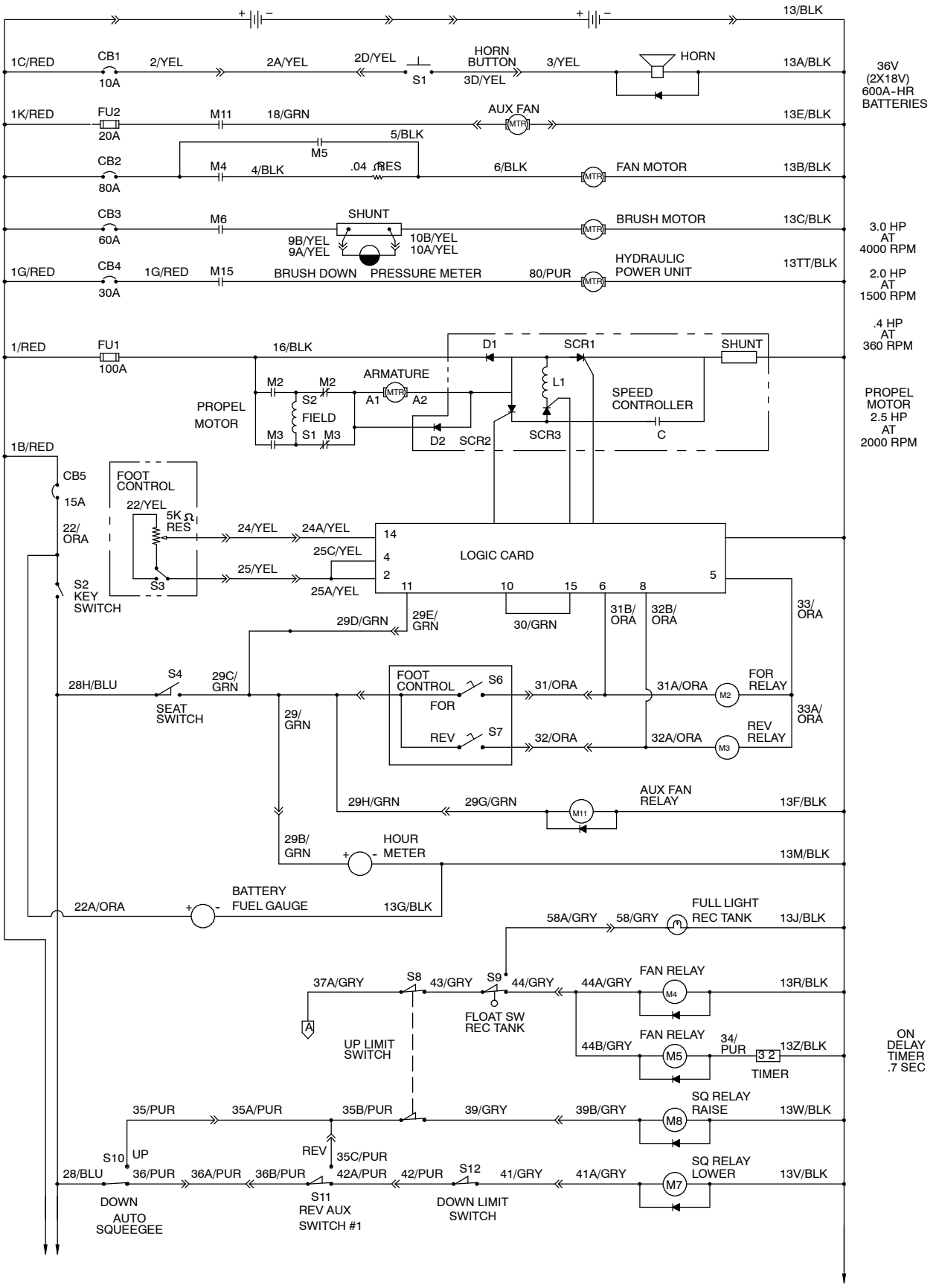
ELECTRICAL SCHEMATIC (For machines serial number 007893 to 008831)



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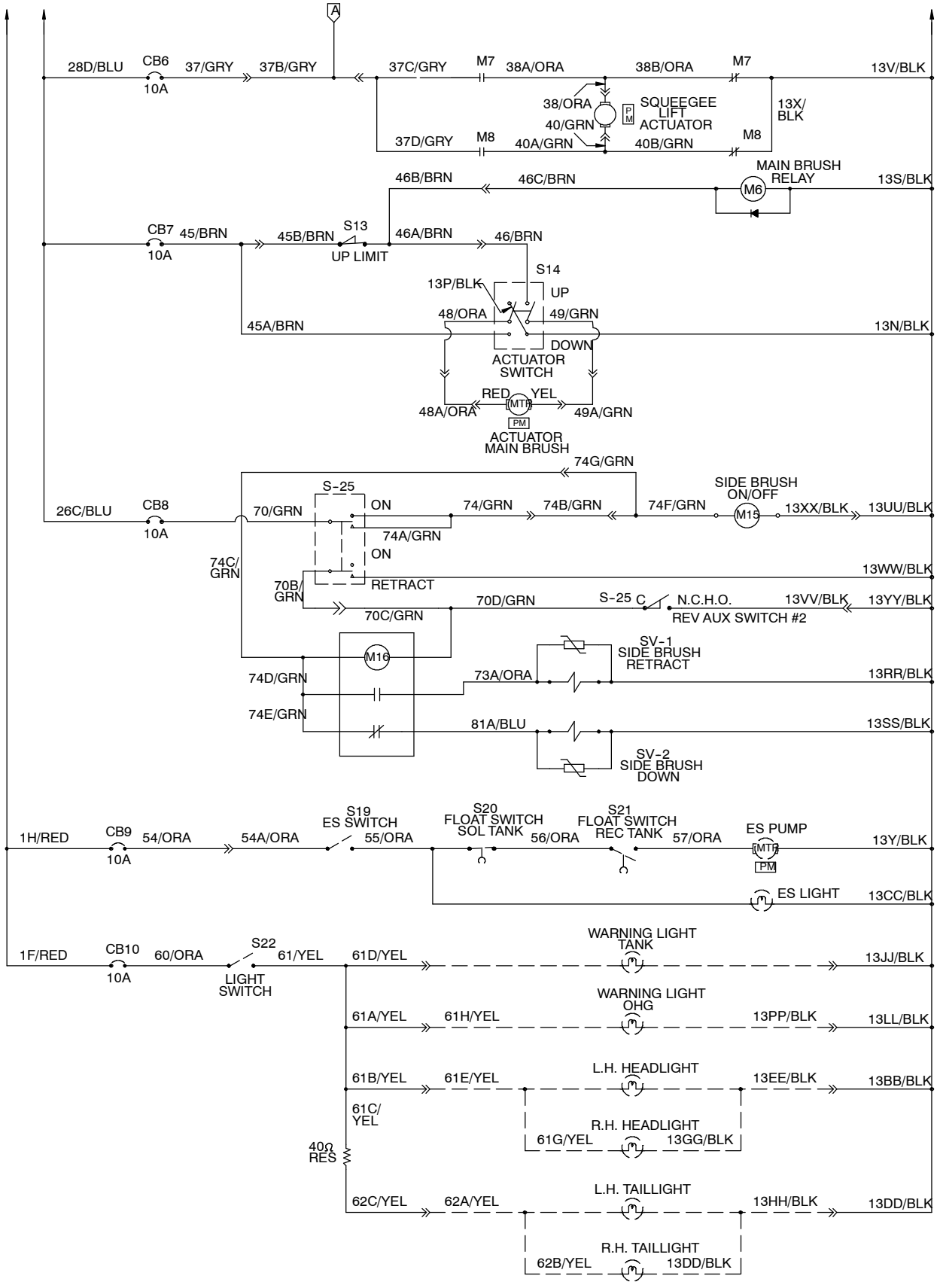
ELECTRICAL SCHEMATIC (For machines serial number 008832 and above)



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ELECTRICAL SCHEMATIC (For machines serial number 007500 and above)

BELTS AND CHAINS

VACUUM FAN BELT

The vacuum fan belt transfers power from the motor sheave to the vacuum fan. Check the belt condition after every 200 hours of operation. The belt is tensioned by a tensioning block.

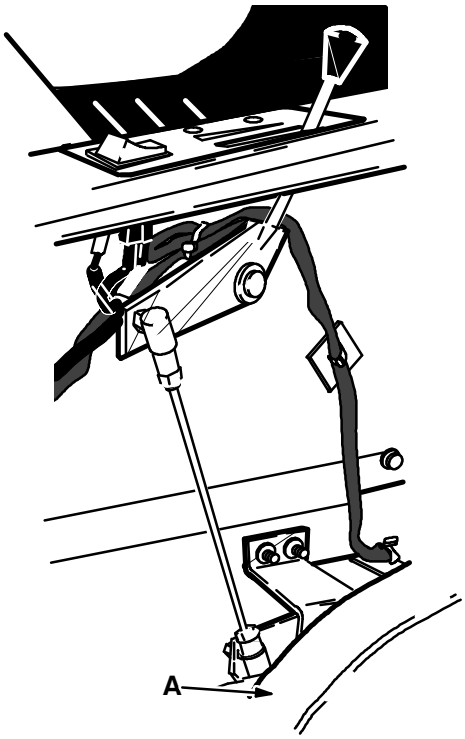
TO REPLACE VACUUM FAN BELT

1. Turn off the machine and set the machine parking brake.

FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake, And Turn Off Machine.

2. Open the hood and disconnect the battery connectors.

3. Remove the belt guard.



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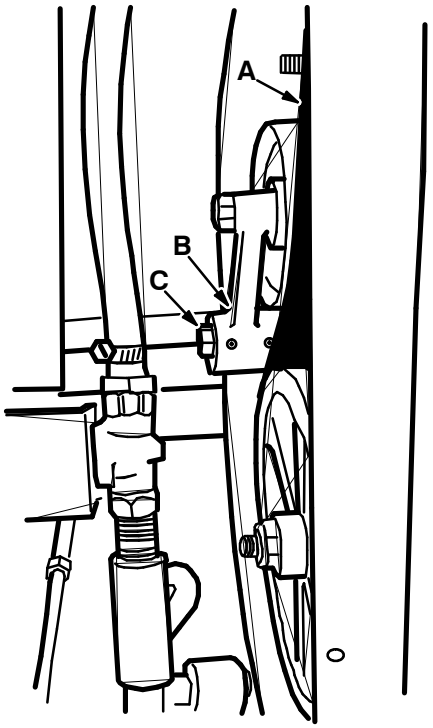
BELT GUARD

A. Guard

4. Push the tensioning block down and remove the belt.



03708

VACUUM FAN BELT

A. Vacuum Fan Belt
B. Tensioning Block
C. Block Bolt

5. Loosen the tensioning block bolt.

6. Install a new belt. Move the tensioning block to tighten belt. Mark the position of the sheave on the housing.

7. Remove the belt from the tensioning block sheave.

8. Position the tensioning block sheave 0.75 in (20 mm) further into the assembly so as to increase belt tension. Then tighten the tensioning block bolt.

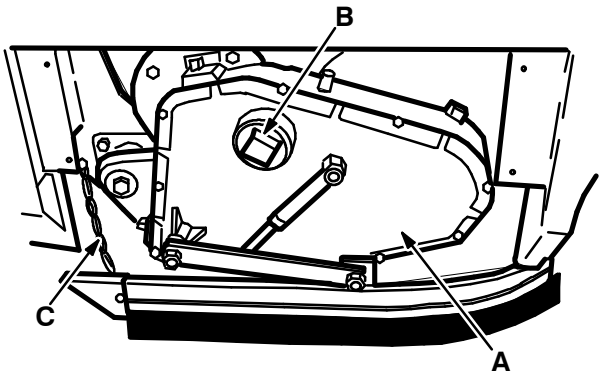
9. Hold the tensioning block down and install a new belt.

10. Replace the belt guard.

11. Reconnect the battery connectors and lower the hood.

MAIN BRUSH CHAIN

The main brush chain transfers power from the main brush motor to the brush drive plugs. Check chain tension after every 400 hours of operation. To check chain tension, loosen the sprocket bolt, lightly press the sprocket down by hand, and retighten the bolt. Then replace the inspection plug.



CHAIN CASE

A. Chain Case
B. Inspection Plug
C. Static Drag Chain

STATIC DRAG CHAIN

The static drag chain prevents the buildup of static electricity in the machine. It is attached to the main frame in front of the main brush chain case.

Make sure that the chain is making contact with the floor at all times.

BRUSHES

MAIN BRUSHES

The main brushes are tubular and span the width of the machine, sweeping debris into the debris hopper while they scrub the floor. The brushes should be inspected daily for damage or wear. Remove any string or wire found tangled on the brushes, brush drive or idler hubs.

Rotate the brushes end-for-end after every 50 hours of operation. Replace the main brushes when there is 0.75 in (20 mm) of brush bristle left. Always replace the main brushes in a set or they will perform poorly and wear at an accelerated pace.

TO REPLACE OR ROTATE MAIN BRUSHES

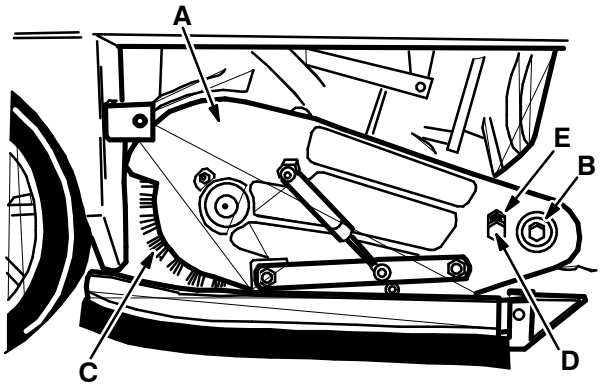
1. Press and hold the main brush switch in the bottom (Main Brush Down and On) position until the brushes just contact the floor.

2. Turn off the machine and set the machine parking brake.

FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake, And Turn Off Machine.

3. Open the brush access door.

4. Remove the brush idler arm retaining bolt from the arm hub.



03687

MAIN BRUSH IDLER ARM

A. Brush Idler Arm
B. Arm Retaining Bolt
C. Main Brush
D. Press Bolt
E. Jam Nut

5. Pull the brush idler arm off the arm hub.

NOTE: If the brush idler arm does not come off easily, loosen the jam nut and thread the press bolt into the idler arm. Tighten the bolt until it forces the arm loose. Then thread the bolt out of the arm until the end of the bolt is flush with the inside of the idler arm. Tighten the jam nut.

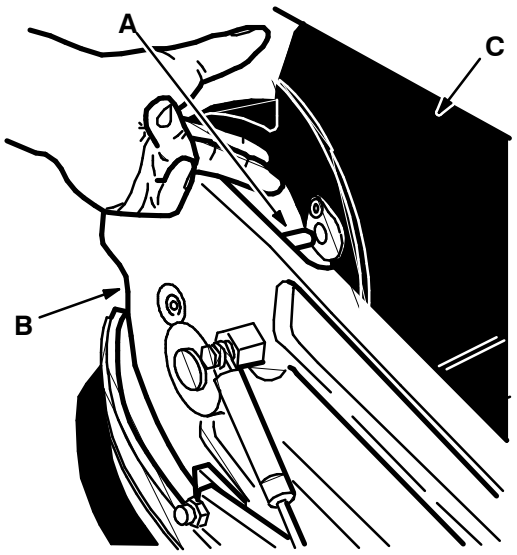
6. Grasp the main brushes, pull them off their drive plugs and out of the main brush compartment.

7. Slide the new or rotated brushes into the brush compartment.

8. After the brushes are aligned with the drive plugs, slide the brush idler arm onto the large brush, then the small brush.

NOTE: Do not force the brush idler arm onto the brushes. It will easily slip into place if the brushes and brush drive plugs are aligned properly. Lubricating the mounting surfaces will make it easier to remove and mount the brush idler arm.

9. Line up the two idler arm pins with the holes on the brush scroll and push the idler arm up to the brush scroll.



03709

LINING UP PINS

A. Pin
B. Idler Arm
C. Brush Scroll

10. Thread the idler arm retaining bolt through the idler arm and into the arm hub.

11. Tighten the idler arm retaining bolt.

12. Check the brush pattern as described in *TO CHECK AND ADJUST MAIN BRUSH PATTERN*.

13. Close and secure the brush access door.

TO CHECK AND ADJUST MAIN BRUSH PATTERN

1. Apply chalk, or some other material that will not blow away easily, on a smooth, level floor.

2. With the brushes raised, stop the machine with the main brush over the test area.

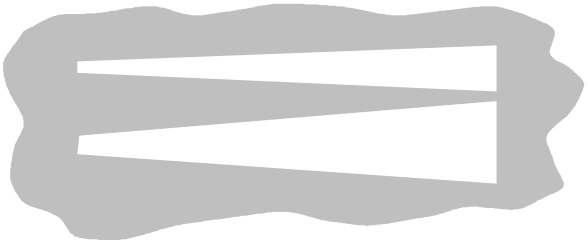
3. While keeping a foot on the brakes, press and hold the main brush switch in the bottom (Main Brush Down and On) position until the brushes are in the normal scrubbing position. After 15 to 20 seconds, press and hold the main brush switch in the top (Main Brush Up) position and remove the machine from the test area.

NOTE: If no chalk or other material is available, allow the brushes to spin on the floor approximately two minutes. Do not spin brushes on a coated floor as it may be damaged.

4. Inspect the pattern.

03710

NORMAL MAIN BRUSH PATTERN



03711

TAPERED MAIN BRUSH PATTERN

The front brush pattern should be 0.0 to 1.5 in (0 to 40 mm) wide. The rear brush pattern should be 2 to 3 in (50 to 75 mm) wide. The pattern width should be equal across its length when the brush pressure gauge needle is near the red zone. If the main brush pattern is not to specification or is tapered, wider on one side by 0.50 in (15 mm) or more than the other side, perform the following procedure:

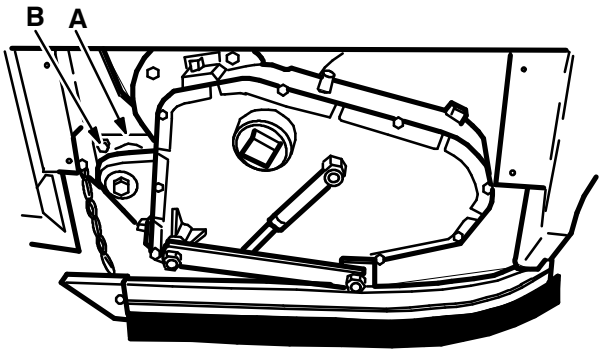
A. Park the machine on a level surface and lower the main brushes.

B. Turn off the machine and set the machine parking brake.

FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake, And Turn Off Machine.

C. Remove the left side access door.

D. Loosen the cross shaft bearing flange bolts.



03683

CROSS SHAFT BEARING FLANGE

A. Flange
B. Bolt

E. Move the cross shaft so the brushes will have an equal pattern width of the correct size across the floor and tighten the bolts.

F. Recheck the main brush pattern. Repeat as necessary.

G. Replace the left side access door.

SIDE BRUSH

The side brush scrubs debris from edges into the path of the main brushes. It should be inspected daily for wear or damage. Remove any string or wire found tangled on the side brush or side brush drive hub.

The side brush should be replaced when the remaining brush bristle measures 0.5 in (15 mm) in length.

The down pressure of the side brush is adjustable for machines serial number 007500 and above. The brush pressure can be adjusted to increase cleaning performance of the side brush.

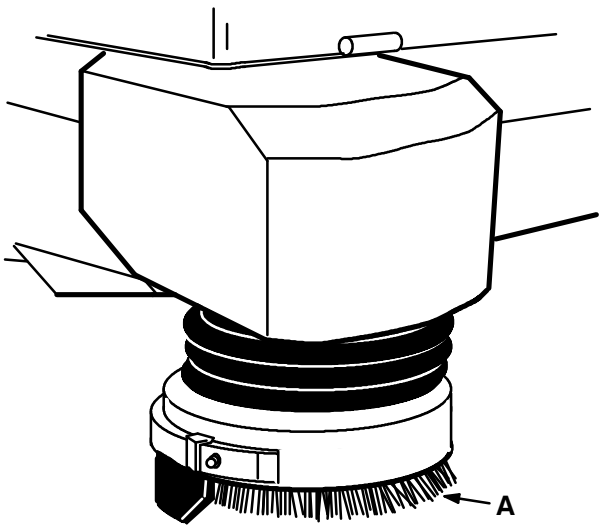
TO REMOVE SIDE BRUSH (For machines below serial number 007500)

1. Place the side brush in the “up” position.

2. Turn off the machine and set the machine parking brake.

FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake, And Turn Off Machine.

3. Pull the side brush down at each of the three retaining pin locations.



03712

SIDE BRUSH

A. Side Brush

4. Slide the side brush out from under the hub.

TO INSTALL SIDE BRUSH (For machines below serial number 007500)

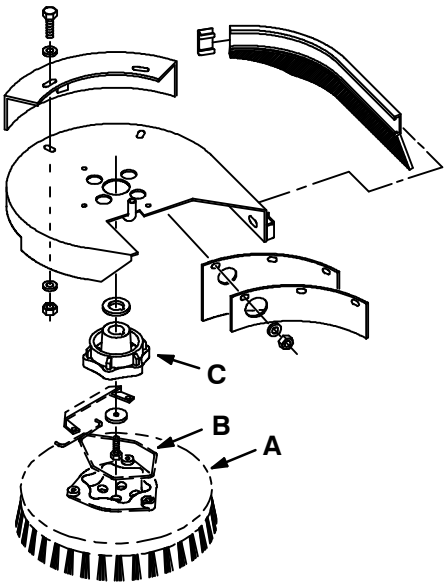
1. Position the side brush under the drive hub.
2. Lift the brush to engage the retaining pins.
3. Spin the brush by hand to make sure pins are engaged.

TO REMOVE SIDE BRUSH (For machines serial number 007500 and above)

1. Pull the side brush solution flow lever all the way back to stop solution flow to the floor.
2. Place and hold the side brush switch in the top (Side Brush Retract) position until the side brush is fully retracted.
3. Turn off the machine and set the machine parking brake.

FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake, And Turn Off Machine.

4. Press the brush spring clip together with a thumb and index finger, and apply downward pressure to the scrub brush to release it from the brush drive hub.



05857

SIDE BRUSH

A. Side Brush
B. Spring Clip
C. Drive Hub

5. Slide the side brush out from under the hub.

TO INSTALL SIDE BRUSH (For machines serial number 007500 and above)

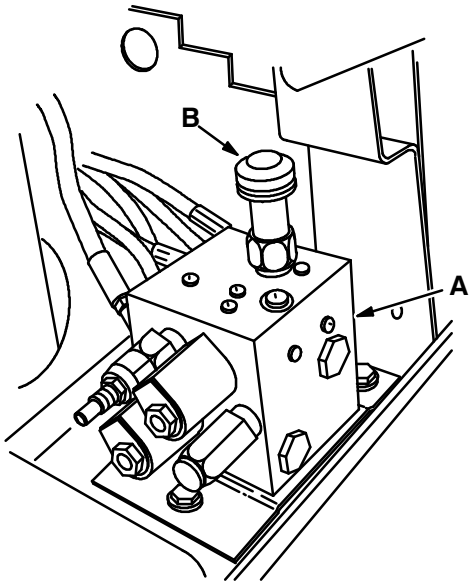
1. Position the side brush under the drive hub.
2. Line up the hex socket of the scrub brush with the hex on the drive hub.
3. Press the brush spring clip together and lift the scrub brush into place over the brush drive hub. Release the spring clip when the brush is in place.

TO ADJUST DOWN PRESSURE (For machines serial number 007500 and above)

1. Turn off the machine and set the machine parking brake.

FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake, And Turn Off Machine.

2. Open the machine hood.
3. Locate the hydraulic solenoid valve in front of the machine.



06123

SIDE BRUSH DOWN PRESSURE ADJUSTMENT

A. Hydraulic Solenoid Valve
B. Adjustment Knob

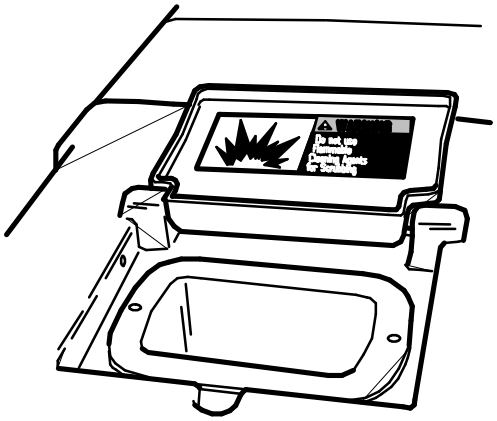
4. To decrease down pressure on the side brush, turn the adjustment knob counter-clockwise on the hydraulic solenoid valve. Turn the adjustment knob clockwise to increase down pressure on the side brush.

SOLUTION AND RECOVERY TANKS

SOLUTION TANK

The solution tank supplies the brushes with a water and detergent solution. It is the top tank located behind the operator seat.

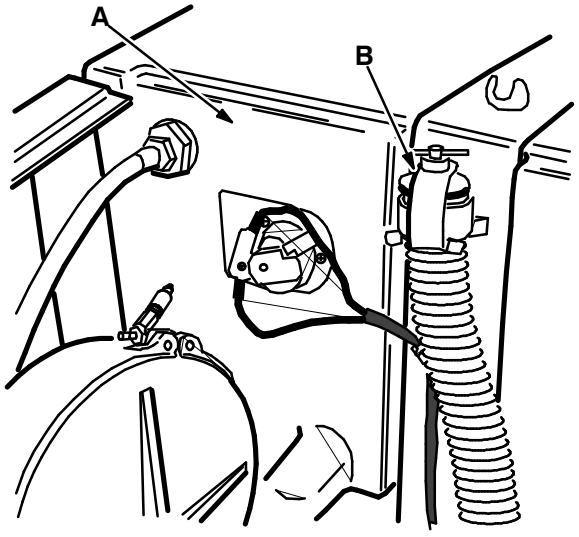
Access to the solution tank is through the opening in the top of the tank.



03679

SOLUTION TANK DOOR

The solution tank requires no regular maintenance. If detergent cakes on the bottom of the tank, remove the deposits with a strong blast of warm water. Do not use water hotter than 130° F (54° C) or use steam to clean the tank because damage may occur. A tank drain hose has been provided to allow the tank to be drained for cleaning and storage.



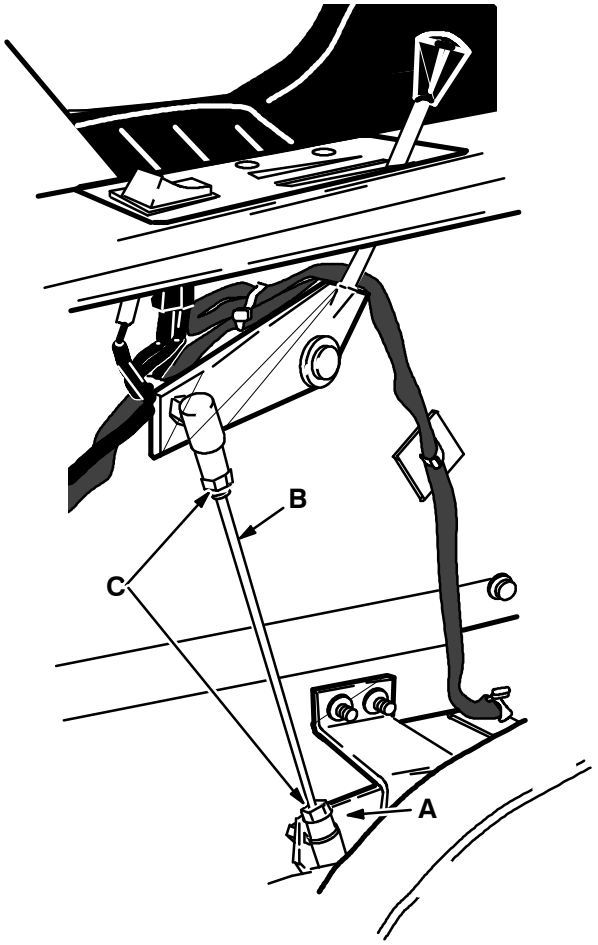
03688

TANK DRAIN HOSE

A. Solution Tank
B. Drain Hose

SOLUTION VALVE

The solution valve controls the flow of solution to the scrub brushes. The valve linkage should be adjusted, on machines below serial number 004831, at the solution valve rod ball joints to provide full flow and no flow to the scrub brushes.



03718

SOLUTION VALVE (For machines below serial number 004831)

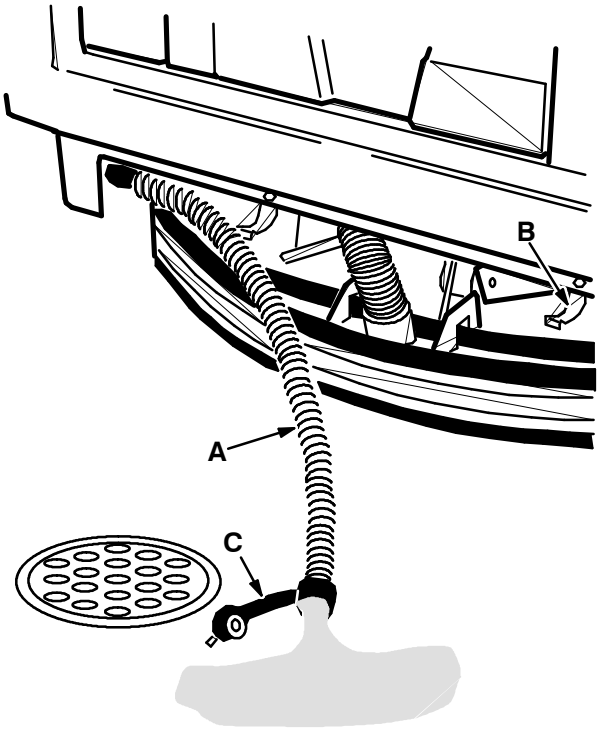
A. Valve
B. Rod
C. Ball Joints

RECOVERY TANK

The recovery tank stores the water solution picked up by the machine squeegee and vacuum fan. The recovery tank is located under the solution tank.

The recovery tank should be drained after the solution tank is empty and whenever the float stops the vacuum fan or the recovery tank lamp lights.

To drain the recovery tank, turn the machine off, set the parking brake, remove and unplug the drain hose next to a floor drain. The tank will not empty with the vacuum fan operating.

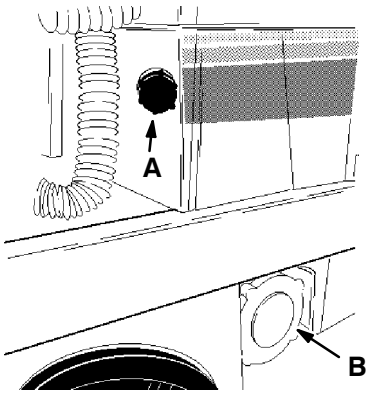


03689

DRAINING RECOVERY TANK

A. Drain Hose
B. Hose Retaining Clip
C. Hose Plug

Clean the demister and recovery tank whenever draining the tank. A demister cap and two tank caps have been provided to make the job easier.



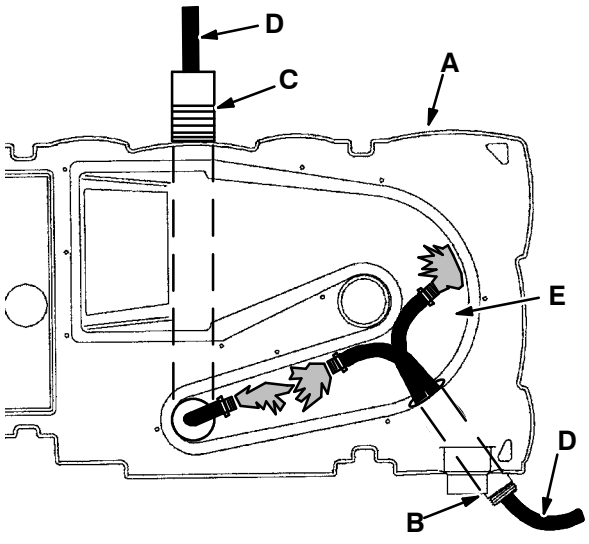
03716

CAPS

A. Demister Cap
B. Tank Cap

Spray the inside of the demister and the inside of the tank with clean water.

Remove accumulated sediment in the demister by feeding a flowing garden hose into the demister through the cleanout port both to the left and to the right of the opening. Another way to clean the demister is to remove the squeegee suction hose and feed a flowing garden hose up the squeegee suction hose and into the demister.



05164

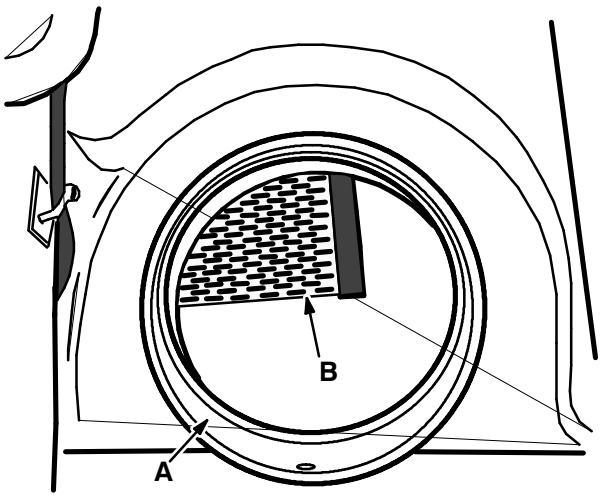
CLEANING OUT DEMISTER (TOP VIEW)

A. Recovery Tank
B. Demister Cleanout Port
C. Squeegee Suction Hose
D. Garden Hose
E. Demister

Remove all sludge and debris from the bottom of the tank. Do not use water hotter than 130° F (54° C) or use steam to clean the tank because damage may occur.

Spray the floats. Make sure they are free of dirt and debris which may cause them to stick.

ES™ equipped machines also have a screen filter which filters debris from solution before sending it to the solution tank. Spray it clean whenever draining the recovery tank. Then add enough water to cover the screen filter and operate the ES™ pump to flush the system.

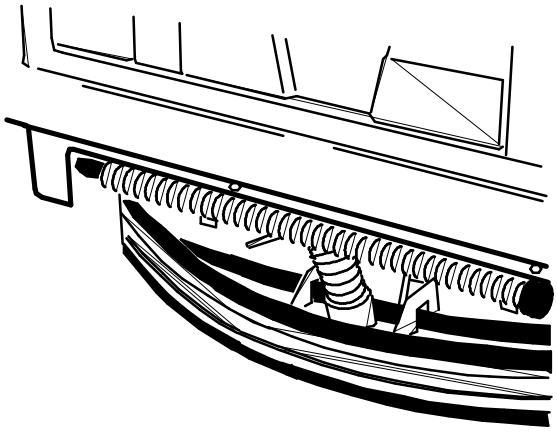


03686

ES™ SCREEN FILTER

A. Recovery Tank
B. ES™ Screen Filter

Keep vacuum hoses and nozzles clean. Clogged hoses are a common cause of poor water pickup. Replace the caps and return the drain hose to its storage position.



03720

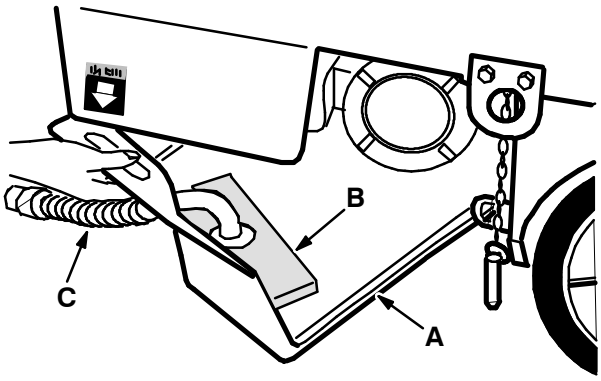
SECURED DRAIN HOSE

DEBRIS HOPPER

The debris hopper collects debris picked up by the main brushes. It is located behind the main brushes.

A vacuumized debris screen is located on the bottom of the debris hopper to draw water solution out of the debris collected in the hopper.

The debris hopper should be emptied and cleaned whenever the recovery tank is drained. To empty and clean the debris hopper, pull the squeegee and hopper assembly pin, pull the assembly out to the rear of the machine, disconnect the hopper vacuum hose, and pull the hopper out of the machine. Clean the debris screen. Reinstall the debris hopper, vacuum hose, squeegee and hopper assembly, and the assembly pin when finished.



03680

REMOVING DEBRIS HOPPER

A. Debris Hopper
B. Debris Screen
C. Hopper Vacuum Hose

SQUEEGEES

SIDE SQUEEGEES

The side squeegees control water spray and channel water into the path of the rear squeegee. Check the side squeegees for damage and wear daily. Replace the side squeegee blades whenever they become damaged or lose their shape or resiliency. Replace the squeegee deflectors whenever replacing squeegee blades.

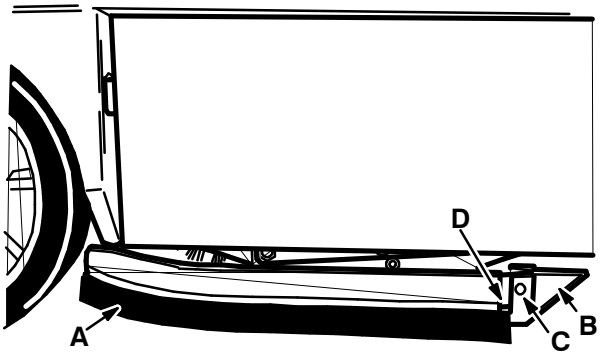
TO REPLACE SIDE SQUEEGEE BLADES

1. Press and hold the main brush switch in the top (Main Brush Up) position until the main brush is fully raised and stopped.

2. Turn off the machine and set the machine parking brake.

FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake, And Turn Off Machine.

3. Remove the cotter pin, clevis pin, chain, deflector, and the clip from the front of the side squeegee.



SIDE SQUEEGEE

A. Squeegee
B. Deflector
C. Clevis Pin
D. Clip

4. Pull the squeegee blade off the front of the squeegee frame.

5. Slide the new squeegee blade onto the frame.

NOTE: Lubricating the squeegee frame where the squeegee makes contact will make for easier squeegee installation.

6. Replace the clip, deflector, chain, clevis pin, and cotter pin.

7. Repeat for the other side.

REAR SQUEEGEE

The rear squeegee assembly channels water into the vacuum fan suction. The front squeegee blade channels the water, and the rear blade wipes the floor. Check the rear squeegee assembly for damage, wear, and adjustment daily.

Rotate or replace either squeegee blade if its leading edge is torn or worn half-way through the thickness of the blade.

Each blade has four wiping edges. To use them all, start with one wiping edge. To use the next wiping edge, rotate the squeegee end-for-end. To use the next wiping edge, rotate the top edges down, bottom edges up. To use the last edge, rotate the squeegee end-for-end.

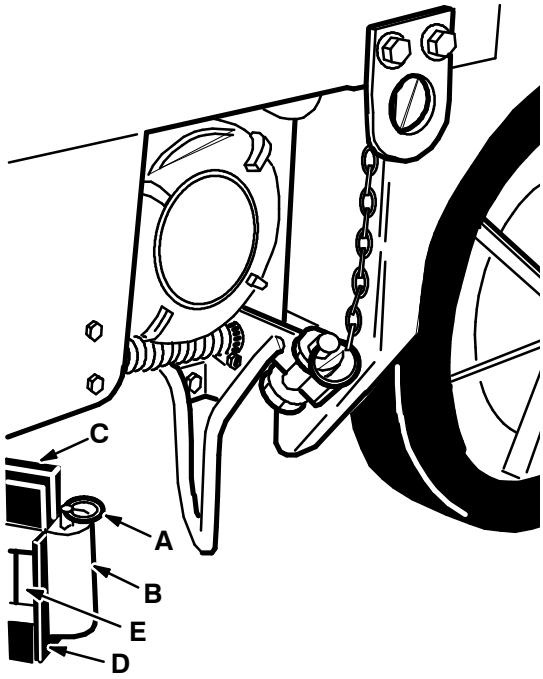
TO REPLACE OR ROTATE BLADE

1. Place the squeegee switch in the top (Squeegee Up) position.

2. Turn off the machine and set the machine parking brake.

FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake, And Turn Off Machine.

3. Remove the ringed pin, deflector, gasket, and clip from the end of the squeegee.



03690

SQUEEGEE

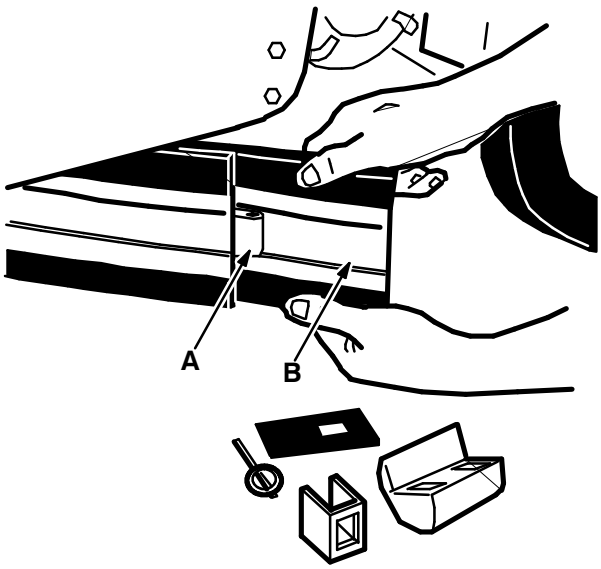
A. Ringed Pin
B. Deflector
C. Squeegee
D. Gasket
E. Clip

4. Pull the squeegee blade off the squeegee frame.

5. Replace or rotate the squeegee to allow a new edge to face the front of the machine.

6. Slide the squeegee blade onto the squeegee frame.

NOTE: Lubricating the squeegee frame where the squeegee makes contact will make for easier squeegee installation.

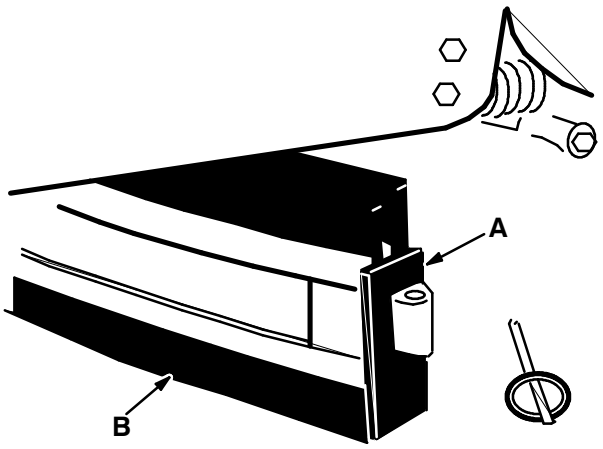


03691

REPLACING SQUEEGEE BLADE

A. Squeegee Frame
B. Squeegee Blade

7. Place the clip and squeegee gasket on the end of the squeegee frame with the long end down and back.



03692

SQUEEGEE GASKET

A. Gasket
B. Squeegee

8. Replace squeegee deflector and ringed pin.

9. Adjust the rear squeegee as described in *TO ADJUST REAR SQUEEGEE*.

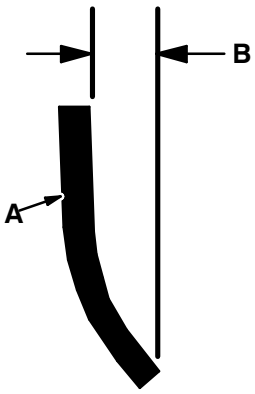
TO ADJUST REAR SQUEEGEE TIPS

1. Place the squeegee switch in the bottom (Squeegee Down) position and move the machine forward.

2. Turn off the machine and set the machine parking brake.

FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake, And Turn Off Machine.

3. Observe the squeegee. It should deflect 0.62 to 0.75 in (15 to 20 mm) across its entire width.

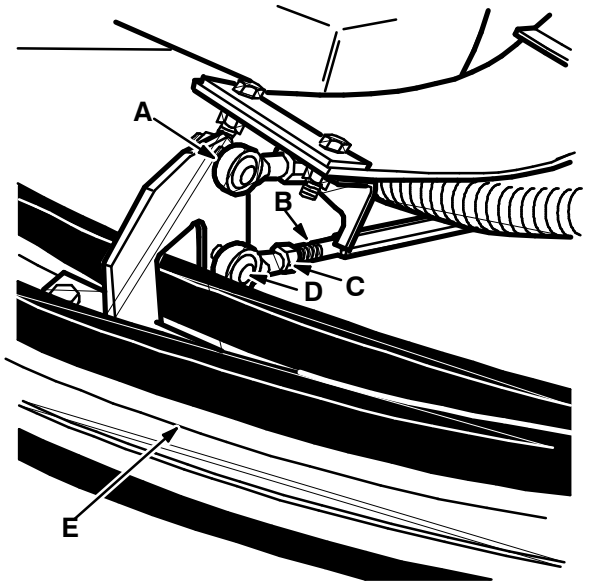


03719

SQUEEGEE DEFLECTION

A. Squeegee
B. Deflection

If the tips of the squeegee are not deflecting enough, loosen the lower link ball joint jam nuts, and turn the link to lengthen the lower links. If the tips of the squeegee are deflecting too much, loosen the lower link ball joint jam nuts, and turn the link to shorten lower links. Tighten the jam nuts when done.

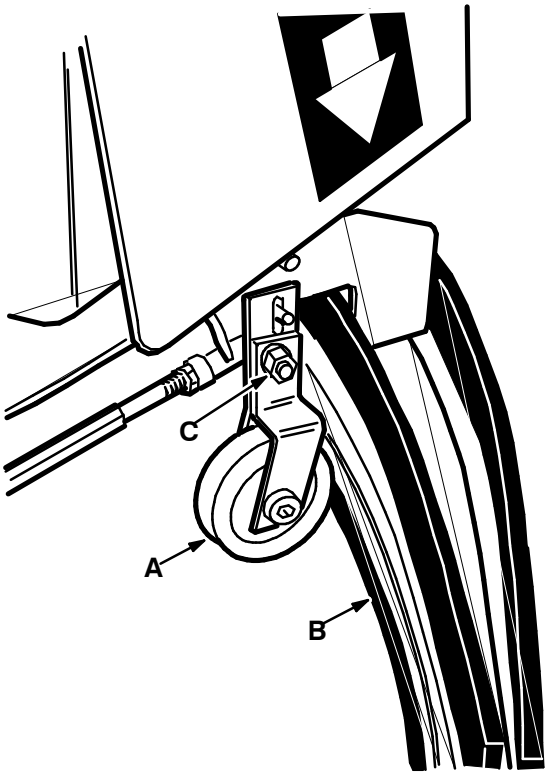


03714

SQUEEGEE LINKS

A. Upper Link
B. Lower Link
C. Jam Nut
D. Ball Joint
E. Squeegee

To Adjust The Squeegee Deflection On Machines Below Serial Number 007767: If the squeegee is not deflecting enough, loosen the caster nut and raise the squeegee casters slightly. If the squeegee is deflecting too much, loosen the caster nut and lower the squeegee casters slightly. If starting from scratch, raise and lower the squeegee. It should not be deflected. Then loosen the caster nuts and set the casters 0.25 in (5 mm) off the floor. Tighten the caster nuts when done. Recheck deflection after making any adjustments.

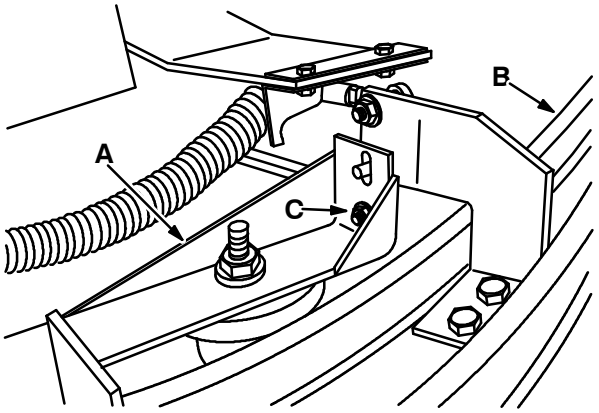


03693

SQUEEGEE CASTER

A. Caster
B. Squeegee
C. Caster Nut

To Adjust The Squeegee Deflection On Machines Serial Number 007767 And Above: If the squeegee is not deflecting enough, loosen the caster bracket nut on each side of the caster bracket, and raise the squeegee caster bracket slightly. If the squeegee is deflecting too much, loosen the caster bracket nut on each side of the caster bracket, and lower the squeegee caster bracket slightly. The If starting from scratch, raise and lower the squeegee. It should not be deflected. Then loosen the caster bracket nuts and set the casters 0.25 in (5 mm) off the floor. Tighten the caster bracket nuts when done. Recheck deflection after making any adjustments.



08946

SQUEEGEE CASTER BRACKET

A. Caster Bracket
B. Squeegee
C. Caster Bracket Nut

SIDE BRUSH SQUEEGEE

The side brush squeegee is part of the side brush. It controls water spray and channels water into the path of the scrub brushes. Check the squeegee and spray deflector for damage and wear daily. Replace the side squeegee blades and spray deflector whenever they become damaged or lose their shape or resiliency.

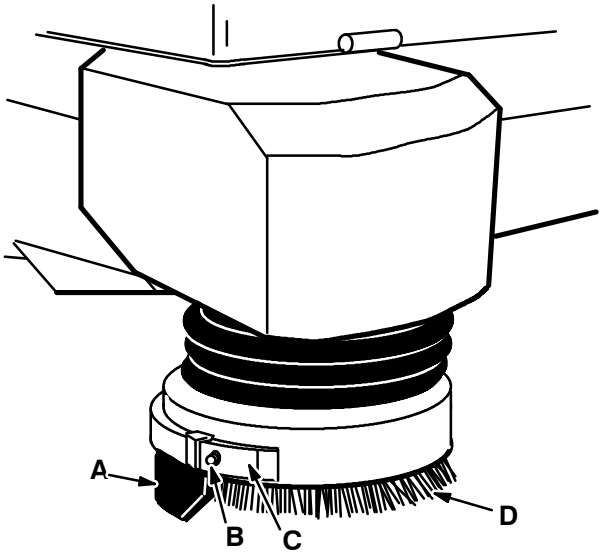
TO REPLACE SIDE BRUSH SQUEEGEE
(For machines below serial number 007500)

1. Place the side brush switch in the “up” position.

2. Turn off the machine and set the machine parking brake.

FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake, And Turn Off Machine.

3. Remove the retaining bolt, deflector and clip.



SIDE BRUSH SQUEEGEE

A. Squeegee
B. Retaining Bolt
C. Deflector
D. Side Brush

4. Pull the squeegee blade off the front of the squeegee frame.

5. Slide the new squeegee blade onto the frame.

NOTE: Lubricating the squeegee frame where the squeegee makes contact will make for easier squeegee installation.

6. Replace the clip, deflector and the retaining bolt.

TO REPLACE SIDE BRUSH SQUEEGEE
(For machines serial number 007500 and above)

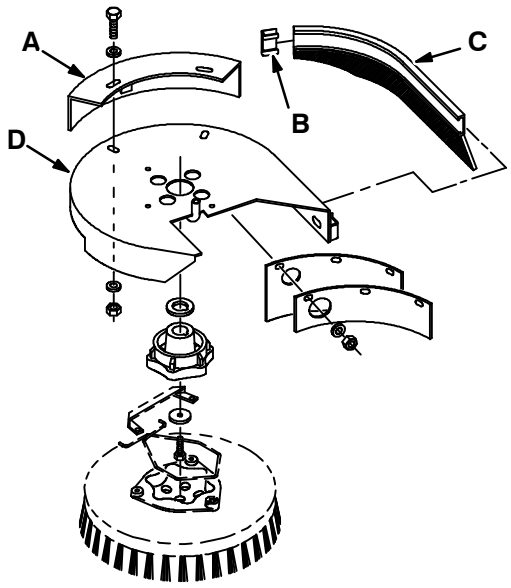
1. Pull the side brush solution flow lever all the way back to stop solution flow to the floor.

2. Place and hold the side brush switch in the top (Side Brush Retract) position until the side brush is fully retracted.

3. Turn off the machine and set the machine parking brake.

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

4. Remove the side brush guard.



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SIDE BRUSH SQUEEGEE

A. Side Brush Guard
B. Squeegee Retainer
C. Squeegee Blade Assembly
D. Side Brush Frame

5. Remove the squeegee retainer.

6. Pull the squeegee blade assembly off the front of the side brush frame.

7. Slide the new squeegee blade assembly onto the side brush frame.

NOTE: Lubricating the side brush frame where the squeegee makes contact will make it easier to install the squeegee blade assembly.

8. Replace the squeegee retainer.

9. Remount the side brush guard.

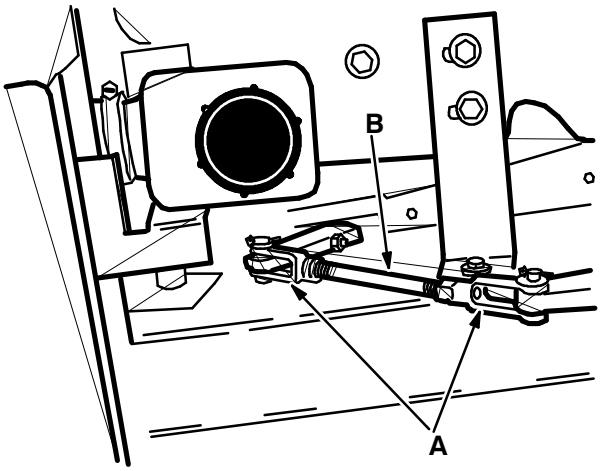
BRAKES AND TIRES

BRAKES

The foot brake and the parking brake operate the linkage which controls the brakes on the rear wheels. Use them daily to avoid corrosion and dirt buildup on the brake shoes.

The foot brake needs no regular adjustment. The parking brake should be adjusted after every 200 hours of operation or whenever it becomes very easy to engage it.

To adjust the parking brake, turn the knurled knob on the end of the parking brake clockwise. If the knob adjustment is inadequate, remove the clevis pin from each brake assembly, turn the clevis ends an equal amount, reconnect the clevis pins, and readjust the parking brake knob.



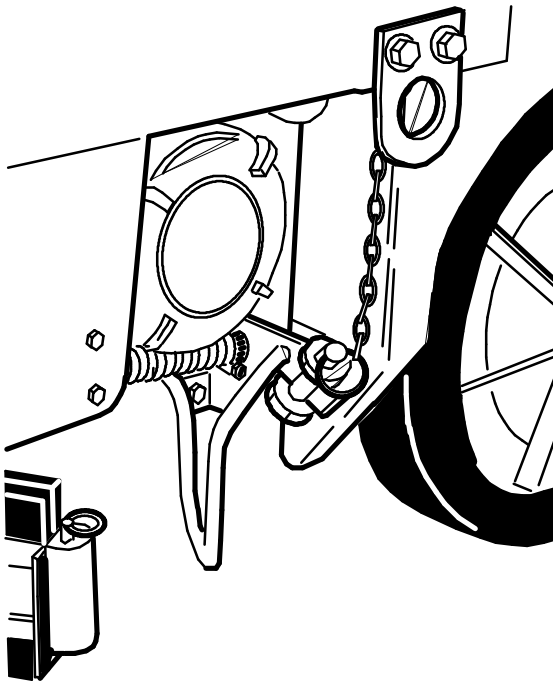
03684

BRAKE LINKAGE

A. Clevis
B. Brake Rod

TIRES

All of the machine tires are solid. They should be inspected for wear after every 100 hours of operation.



03690

REAR TIRE

FRONT WHEEL

If replacing the front wheel, torque it in a star pattern to 135 – 160 Nm (100 – 120 ft lb).

SECTION 4

CONTENTS

HARDWARE INFORMATION

The following charts state standard plated hardware tightening ranges for normal assembly applications. Decrease the specified torque by 20% when using a thread lubricant. Do not substitute lower grade hardware for higher grade hardware. If higher grade hardware than specified is substituted, tighten only to the specified hardware torque value to avoid damaging the threads of the part being threaded into, as when threading into speed nuts or weldments.

STANDARD BOLT TORQUE CHART

Thread Size	SAE Grade 5 Torque ft lb (Nm)	SAE Grade 8 Torque ft lb (Nm)
0.25 in	7–10 (9–14)	10–13 (14–38)
0.31 in	15–20 (20–27)	20–26 (27–35)
0.38 in	27–35 (37–47)	36–47 (49–64)
0.44 in	43–56 (58–76)	53–76 (72–103)
0.50 in	65–85 (88–115)	89–116 (121–157)
0.62 in	130–170 (176–231)	117–265 (159–359)
0.75 in	215–280 (291–380)	313–407 (424–552)
1.00 in	500–650 (678–881)	757–984 (1026–1334)

NOTE: Decrease torque by 20% when using a thread lubricant.

METRIC BOLT TORQUE CHART

Thread Size	Class 8.8 Torque ft lb _Nm)	Class 10.9 Torque ft lb (Nm)
M4	2 (3)	3 (4)
M5	4 (5)	6 (8)
M6	7 (9)	10 (14)
M8	18 (24)	25 (34)
M10	32 (43)	47 (64)
M12	58 (79)	83 (112)
M14	94 (127)	133 (180)
M16	144 (195)	196 (265)
M20	260 (352)	336 (455)
M24	470 (637)	664 (900)

NOTE: Decrease torque by 20% when using a thread lubricant.

Exceptions to the above chart:

Check the machine for exceptions!

BOLT IDENTIFICATION

Identification Grade Marking	Specification and Grade
	SAE–Grade 5
	SAE–Grade 8
	ISO–Grade 8.8
	ISO–Grade 10.9

01395

THREAD SEALANT AND LOCKING COMPOUNDS

Thread sealants and locking compounds may be used on this machine. They include the following:

Locktite 515 sealant – gasket forming material. TENNANT Part No. 75567,15 oz (440 ml) cartridge.

Locktite 242 blue – medium strength thread locking compound. TENNANT Part No. 32676, 0.5 ml tube.

Locktite 271 red – high strength thread locking compound. TENNANT Part No. 19857, 0.5 ml tube.

HYDRAULIC FITTING INFORMATION

HYDRAULIC TAPERED PIPE FITTING (NPT) TORQUE CHART

NOTE: Ratings listed are when using teflon thread seal.

Size	Minimum Torque	Maximum Torque
1/4 NPT	10 ft lb (14 Nm)	30 ft lb (41 Nm)
1/2 NPT	25 ft lb (34 Nm)	50 ft lb (68 Nm)
3/4 NPT	50 ft lb (68 Nm)	100 ft lb (136 Nm)

HYDRAULIC TAPERED SEAT FITTING (JIC) TORQUE CHART

Tibe O.D. (in)	Thread Size	Maximum Torque
0.25	0.44-20	9 ft lb (12 Nm)
0.38	0.56-18	20 ft lb (27 Nm)
0.50	0.75-16	30 ft lb (41 Nm)
0.62	0.88-14	40 ft lb (54 Nm)
0.75	1.12-12	70 ft lb (95 Nm)
1.0	1.31-12	90 ft lb (122 Nm)

HYDRAULIC O-RING FITTING TORQUE CHART

Tube O.D. (in)	Thread Size	Minimum Torque	Maximum Torque
0.25	0.44-20	6 ft lb (8 Nm)	9 ft lb (12 Nm)
0.38	0.56-18	13 ft lb (18 Nm)	20 ft lb (27 Nm)
		*10 ft lb (14 Nm)	12 ft lb (16 Nm)
0.50	0.75-16	20 ft lb (27 Nm)	30 ft lb (41 Nm)
		*21 ft lb (28 Nm)	24 ft lb (33 Nm)
0.62	0.88-14	25 ft lb (34 Nm)	40 ft lb (54 Nm)
0.75	1.12-12	45 ft lb (61 Nm)	70 ft lb (95 Nm)
1.0	1.31-12	60 ft lb (81 Nm)	90 ft lb (122 Nm)

NOTE: Do not use sealant on o-ring threads.

*Aluminum bodied components