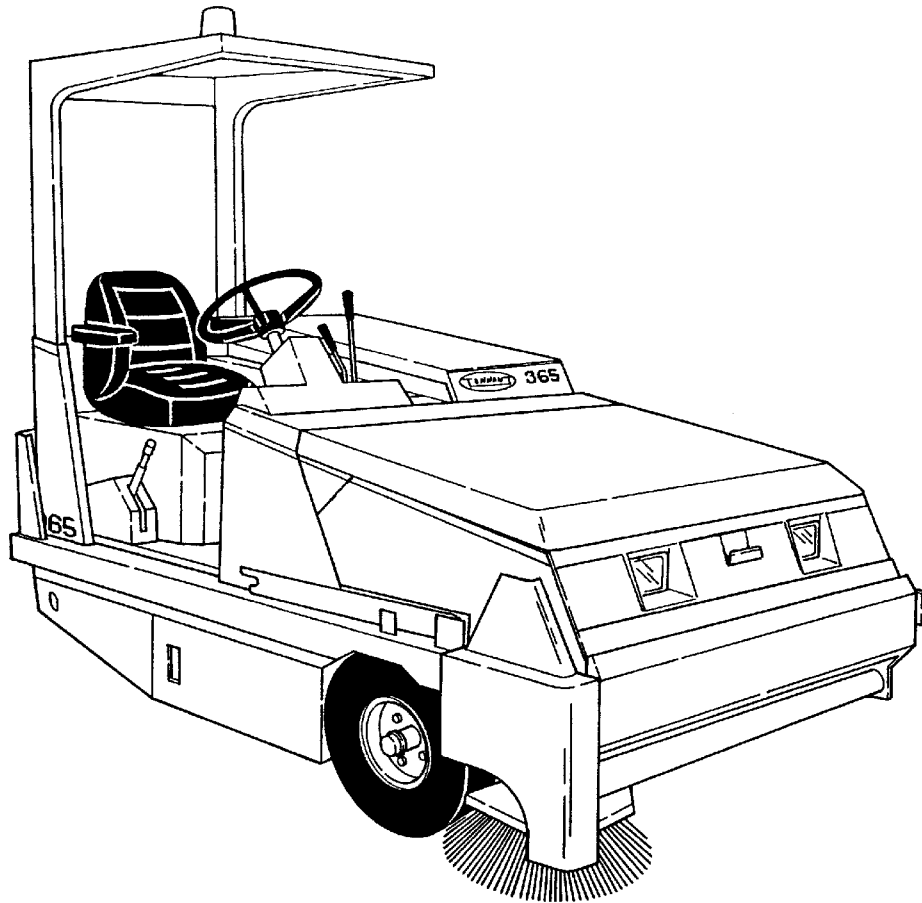




365

(Operator Manual)



MM173



This manual is furnished with each new TENNANT® Model . 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 instruction portion of the manual consists of the Specification, Operation, Maintenance, and Appendix sections. The parts portion consists of the Standard Model Parts; LPG Parts; Accessories; Hydraulic Components; Engine Parts; and Cross Reference; and Customer Documents 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.

Parts and supplies may be ordered by phone or mail from any Tennant Company parts and service center, distributor, or from any of the Tennant Company subsidiaries. Before ordering parts or supplies, be sure to have your machine model number and serial number handy. Fill out the data block below for future reference. The telephone numbers, telex numbers, mailing addresses, and locations of those outlets are listed in the Customer Documents section of the manual.

MACHINE DATA	
<i>Please fill out at time of installation.</i>	
Machine Serial Number –	_____
Engine Serial Number –	_____
Sales Representative –	_____
Customer Number –	_____
Date of Installation –	_____
Manual Number –	MM173
Revision:	09
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ABOUT THIS MANUAL

The machine manual that you received with your TENNANT machine contains valuable information about the operation and maintenance, and numerous sections filled with TENNANT part numbers for the repair of the machine. Please read through this section titled *ABOUT THIS MANUAL* to become familiar with the contents of the machine manual, making the information you are looking for easier to find.

The machine manual consists of several sections of reference information, and the remainder contain part number information for ordering repair parts for the machine. Each section has a shaded bar at the top of the page with the name of that section. Just as this section has the title *ABOUT THIS MANUAL* on the top of each page. This way you can tell which section you are in at all times.

REFERENCE SECTIONS

The reference information sections of the manual are; General Information, Specifications, Operation, Maintenance, and Appendix.

GENERAL INFORMATION – The General Information section of the manual contains the safety precautions, the location of the safety labels on the machine, and a table of contents of the entire manual. The Safety Precautions are an overview of the safety measures to be observed when operating and maintaining your machine. The location of the safety labels show the mounting location of the safety labels for use in the replacement of the labels. The table of contents in this section is a list of all the table of contents that appear in the front of each section in the manual. This can be used for easy reference to locate information in a particular section of the manual.

SPECIFICATIONS – The Specifications section of the manual contains machine specification information useful in the operation and maintenance of the machine. This section gives you specification information on the engine, electric motors, brake system, hydraulics, fluid capacities, and machine weight to mention a few. The section also has a illustration of the top and side view of the machine with the height and width dimensions displayed.

OPERATION – The Operation section of the manual contains information needed to operate the machine. This section will list the controls and instruments on the machine, overview the machine operation, and tell you how to transport and store the machine.

MAINTENANCE – The Maintenance section contains information on the suggested maintenance procedures and adjustments to keep your machine in top operating condition. The section includes a Maintenance Chart listing the maintenance schedule and the areas of the machine to be addressed. Each subject of maintenance is covered in more detail in such areas as Lubrication, Hydraulics, Engine, and Electrical System.

APPENDIX – The Appendix contains hardware and hydraulic information. Standard hardware torques and identification information is included, plus hydraulic torques if your machine is hydraulically controlled.

PART SECTIONS

The remaining sections of the manual contain part number information for ordering repair parts for your machine. The manual contains part number information on every type of machine model available in the model size of your particular machine. Therefore there will be part number information in your manual you will not need to refer to when wanting to place an order.

The main thing you need to know about your machine is what type of model is it. Is the machine powered by an engine or batteries? If the machine has an engine, is it fueled from gasoline, LPG, or gasoline? If it is a mid-sized or larger sweeper, is it multi-level or low dump? For the scrubbers, is it SRS® or standard. Determining this information about your machine will help guide you through the separate parts sections to find the repair part you need.

ABOUT THIS MANUAL

The smaller line of sweeper and scrubbers have less complicated part section arrangement, and are easier to find your way through the parts sections. The larger machines can have quite a variety of model types which significantly increases the size to the machine manual. Because of this, on the larger machine we made the first part section, Section 5, a part section which contains parts common to all type of the machine. If the machine has an engine, this section contains parts information on a gasoline powered machine.

The remaining sections contain only parts information which is unique to that particular machine type, such as unique diesel parts on the machine, or unique SRS® parts. Knowing the machine model type you have is important when searching for that part information you need for ordering repair parts. Start in that unique section first when looking for a part, then go to the first parts section, Section 5, if the part can't be found in the unique section.

MACHINE SERIAL NUMBERS

When a design change takes place to a machine, the changes are indicated in the parts sections with machine serial numbers. Know the serial number of your machine which can be found on the machine data plate mounted on the machine. Record this number on the inside front cover of your manual along with your customer number.

Machine number usage is recorded in the *Machine Serial Number* column of the parts lists in the parts sections of the manual. If the machine serial number column lists zeros on the left side of the dash, then this part is used on all machines; such as (000000–).

If the column lists zeros on the left of the dash and a number on the right of the dash, then the part is used on machines up to and including that machine serial number; such as (00000–002345).

For parts that are used on machines beginning at and continuing on from a certain serial number, the column would list a serial number on the left of the dash and have blank spaces on the right side of the dash; such as (002346–). This part would be used on machines starting with that machine serial number and greater.

Finally, parts can be used on machines with serial numbers in a certain block of numbers. In this situation there is a serial number on the left and right side of the dash. The part is then used on a machine with a serial number starting at the number on the left and up to and including the number on the right; such as (002346–008900).

PARTS ASSEMBLIES

A part assembly has parts within the assembly, such as a parking brake consisting of other smaller parts. What parts are contained in a part assembly can be determined by an indentation arrangement in the description column of the parts lists.

Here is an example of a part assembly, in this case we will use the parking brake mentioned previously:

Machine			
Serial Number	Description		Qty.
(000000–)	Parking Brake		1
(000000–)	Pin, Roll		1
(000000–)	Link		1
(000000–)	Spring, Compression		1
(000000–)	Pin, Roll		1
(000000–)	Support		1
(000000–)	Lever, Release		1
(000000–)	Rod, Parking Brake		1
(000000–)	Washer, 0.50"		3

In this example, the parts whose descriptions are indented under the parking brake are all parts of the parking brake. When you order the parking brake you will receive all the parts listed under it. You also can order any of the individual parts listed under the parking brake if it is the only part you need.

SUPPLIER COMPONENT BREAKDOWNS

TENNANT purchases certain components of the machine from suppliers. Some of these components are engines, hydraulic pumps and motors, electric motors, and solution pumps.


For those purchased components that are repairable, lists of parts for them appear in the later part of the parts sections. These are the supplier breakdowns. The engine breakdown contains both supplier and TENNANT parts numbers for repair parts. Breakdowns for hydraulic and electrical components have TENNANT part numbers for the parts TENNANT supplies. The serial numbers listed in any of the parts lists in these sections is a serial number the manufacturer uses to identify design changes in their particular component.

ORDERING REPAIR PARTS

Once you have located a part to order, there are several things you need to have to place the order. At the beginning of each parts section is an Ordering Repair Parts page which lists the information you will need to place your order. Review this list before placing the order.

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 modified for use in those areas.
 - In areas with possible falling objects unless equipped with overhead guard.
2. **Before starting machine:**
 - Check for fuel leaks (gasoline, LPG).
 - 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:**
 - Go slow on grades and slippery surfaces.
 - Use care when backing machine.
 - Do not carry riders on machine.
 - Always follow safety and traffic rules.
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 when working on machine.
 - Use TENNANT supplied or equivalent replacement parts.

 **WARNING: Engine emits toxic gases. Severe respiratory damage or asphyxiation can result. Provide adequate ventilation. Consult with your regulatory agency for exposure limits. Keep engine properly tuned.**

 **WARNING: Machine can emit excessive noise. Consult with your regulatory agency for exposure limits. Hearing loss can result. Wear hearing protection.**


 **WARNING: Machine hopper lifts to 108 in (2745 mm) when high dumping. Hopper can hit overhead wires or object. Electrical shock or falling debris can result. Be sure adequate clearance is available before raising hopper.**

 **WARNING: Machine can have static electricity charge. When pouring fuel, spark can ignite fuel causing fire or explosion. Connect wire attached to fuel can to machine to discharge spark before pouring fuel.**


 **WARNING: Machine moves when directional pedal linkage is out of adjustment. Severe personal injury or death can result. If machine creeps when the directional pedal is in neutral, adjust pedal linkage. Engage parking brake when stopped.**


 **WARNING: Falling hopper. Engage hopper support bar before working under hopper.**


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


 **WARNING: Avoid contact with battery acid. Battery acid can cause severe burns. Wash immediately and get medical attention if contact with acid occurs.**


GENERAL INFORMATION


 **WARNING: Fuel vapor is present when servicing fuel system. Fire or explosion can result. Keep flames and sparks away.**


 **WARNING: Machine moves when directional pedal linkage is out of adjustment. Severe personal injury or death can result. If machine creeps when the directional pedal is in neutral, adjust pedal linkage. Engage parking brake when stopped.**


 **WARNING: Machine is unstable on jack. Jack machine up at designated locations only. Block machine up with jack stands.**

 **WARNING: Machine is unstable on jack. Block machine tires before jacking machine up.**

 **WARNING: Leaking hydraulic fluid under pressure can penetrate skin. Severe infection or death can result. Do not use body to locate leak. Use cardboard to locate leak.**

 **WARNING: Hot engine coolant. Scalding can result. Do not open radiator cap or service cooling system until radiator and engine is cool to the touch.**

 **WARNING: Air or water under pressure. Severe eye or ear injury can result. Wear eye and ear protection.**

 **WARNING: LPG fuel is very cold. Frostbite can result. Wear gloves when connecting or disconnecting LPG hoses.**

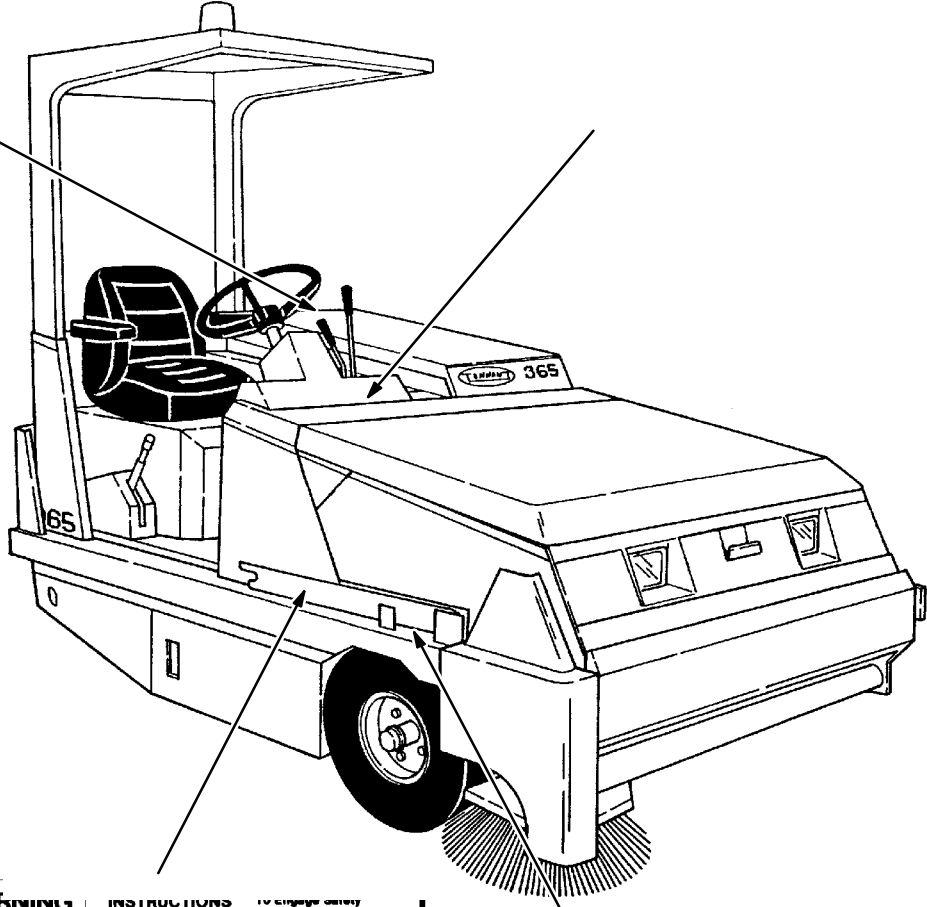
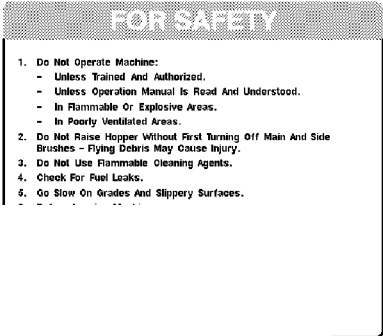
 **WARNING: Stay clear of hopper lift arms when they are in motion.**

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

ENGINE FAN LABEL – LOCATED ON RADIATOR SHROUD.



SAFETY LABEL – LOCATED ON LEFT SIDE OF OPERATOR COMPARTMENT.



HOPPER SUPPORT BAR LABEL – LOCATED ON HOPPER SUPPORT BAR AND ON EACH SIDE OF THE HOPPER.



HOPPER CLEARANCE LABEL – LOCATED ABOVE EACH FRONT WHEEL.

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MACHINE SPECIFICATIONS

POWER TYPE

Engine for machine below serial number 007000
 Type – piston
 Ignition – breaker–type spark
 Cycle – 4
 Aspiration – natural
 Cylinders – 4
 Bore – 3.19 in (81 mm)
 Stroke – 3.06 in (78 mm)
 Displacement – 98 cu in (1600 cc)
 Net power – 35 hp (26 kw) @ 2350 rpm governed
 47.5 hp (35 kw) @ 3600 rpm maximum
 Fuel – gasoline, 91 RON octane minimum,
 unleaded or LPG
 Cooling system – water/ethylene glycol antifreeze
 Electrical system – 12 V nominal, 37 A alternator

Engine for machine serial number 007000 and
 above
 Type – piston
 Ignition – breaker–type spark
 Cycle – 4
 Aspiration – natural
 Cylinders – 4
 Bore – 2.91 in (74 mm)
 Stroke – 2.97 in (75 mm)
 Displacement – 79 cu in (1300 cc)
 Net power – 29 hp (21.6 kw) @ 2400 rpm governed
 53.7 hp (40 kw) @ 4000 rpm maximum
 Fuel – gasoline, 87 octane minimum, unleaded or
 LPG
 Cooling system – water/ethylene glycol antifreeze
 Electrical system – 12 V nominal, 37 A alternator

POWER TRAIN

Propelling – hydraulic drive motor driven, rear
 wheel
 Main brush – hydraulic drive motor driven
 Side brush – hydraulic drive motor driven
 Vacuum fan – hydraulic drive motor driven

STEERING

Type – rear wheel, hydraulic cylinder and rotary
 valve controlled
 Power source – hydraulic accessory pump
 Emergency steering – manual

HYDRAULIC SYSTEM

Function – operates propelling, hopper lift,
 steering, main brush drive, side brush drive,
 vacuum fan drive

Control valve, main brush, side brush, lift cylinders
 – open center, solenoid operated

Control valve, steering – open center type, rotary,
 non–load reacting

Pump, propelling – variable displacement piston
 type, 1.24 cu in (20 cc) maximum displacement
 per revolution, 11.4 gpm
 (43 L/min) @ 2350 rpm

Propelling system relief pressure – 4000 psi
 (27,850 kPa)

Pump, accessories – gear type, 1.20 cu in
 (20 cc) displacement, 9.8 gpm (37 L/min)
 @ 2350 rpm

Side brush system relief pressure – 1200 psi (8275
 kPa)

Steering system relief pressure – 500 psi
 (3450 kPa)

Main brush and vacuum fan system relief pressure
 – 2300 psi (15,860 kPa)

Lifting cylinders system relief pressure – 2300 psi
 (15,860 kPa)

Motor, propelling – internal gear type, 19 cu in (310
 cc) displacement per revolution,
 3000 psi (20,685 kPa) maximum rated
 continuous pressure

Motor, main brush – internal gear type, 4.5 cu in
 (75 cc) displacement per revolution, 2400 psi
 (16,550 kPa) maximum rated continuous
 pressure

Motor, side brush – internal gear type, 2.8 cu in (45
 cc) displacement per revolution, 1500 psi
 (10,340 kPa) maximum rated continuous
 pressure

SPECIFICATIONS

Motor, vacuum fan – internal gear type,
0.194 cu in (3.2 cc) displacement per
revolution, 2300 psi (15,860 kPa) maximum
rated continuous pressure

Cylinder, hopper lift – double action type, 2.5 in (65
mm) bore x 12.62 in (320 mm) stroke, 1.25 in
(32 mm) diameter rod, 2500 psi (17,238 kPa)
maximum rated pressure

Cylinder, steering – double action type, 2 in
(50 mm) bore x 8 in (200 mm) stroke,
0.75 in (20 mm) diameter rod, 1500 psi (10,340
kPa) maximum rated pressure

BRAKING SYSTEM

Service brakes – hydraulic drum brakes (2), one
per front wheel, master cylinder foot brake
actuated.

Parking brakes – utilizes service brakes, cable
actuated

SUSPENSION SYSTEM

Front – two 5.70 x 8 pneumatic tires
two 6.00 x 9 solid tires with solid tire accessory

Rear – one 6.90/6.00 x 9 pneumatic tire
one 4.00 x 8 solid tire with solid tire accessory

SYSTEM FLUID CAPACITIES

Engine cooling system – radiator 4 qt (3.8 L)
total system – 8.4 qt (8 L)
total system with heater (accessory) –
9.3 qt (8.8 L)

Engine lubricating oil – 3.5 qt (3.3 L) with filter

Fuel tank – 10 gal (38 L) gasoline
33 lb (15 kg) LPG

Hydraulic system – reservoir 5.3 gal (20 L)
total system 6 gal (23 L)

GENERAL MACHINE DIMENSIONS/CAPACITIES

Length – 97 in (2460 mm)

Width – 58.3 in (1480 mm)

Height – 55 in (1400 mm)

Height with overhead guard/cab (accessory) – 81.6
in (2075 mm)

Height with overhead guard/cab and
rotating/flashing light (accessory) – 88.8 in
(2255 mm)

Track – 54.5 in (1385 mm)

Wheelbase – 54.5 in (1385 mm)

Main brush – diameter, 14 in (355 mm)
length, 48 in (1220 mm)

Side brush – diameter, 21 in (535 mm)

Sweeping path width – 48 in (1220 mm)

Sweeping path width with side brush – 60 in (1525
mm)

Hopper capacity – 1200 lb (545 kg)
16 cu ft (0.45 m³)

Dust filter area – 110 sq ft (10.2 m²)

MACHINE WEIGHTS

GVWR – 4300 lb (1950 kg)

GENERAL MACHINE PERFORMANCE

Maximum forward speed – 8.5 mph (13.7 km/h)

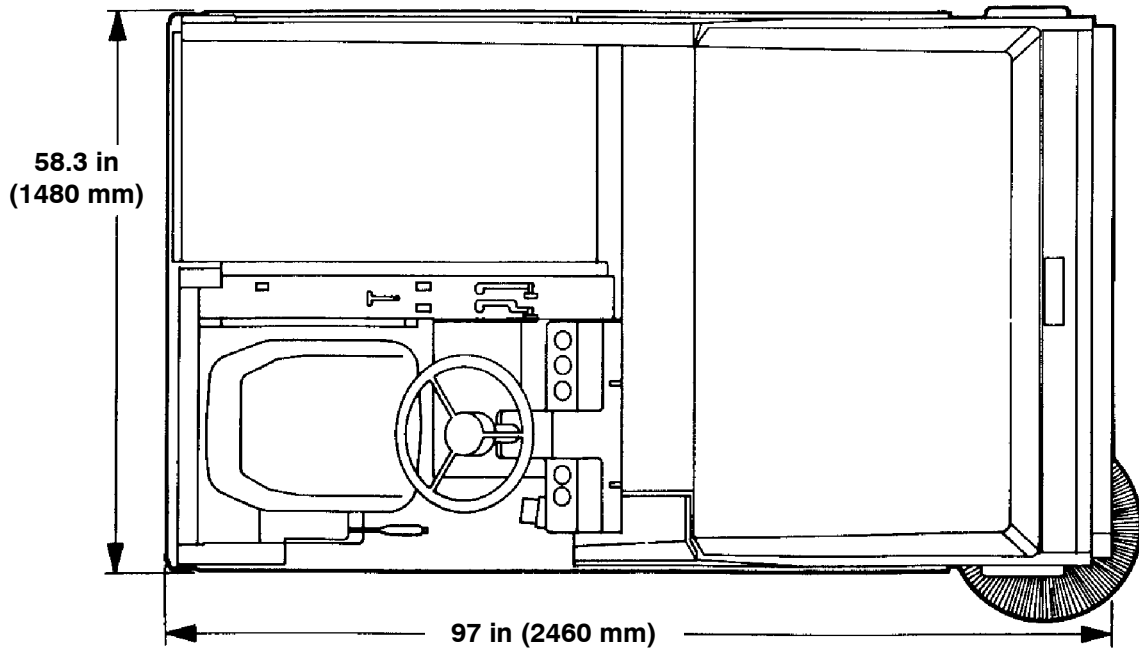
Maximum reverse speed – 3 mph (4.8 km/h)

Turning radius – right, 104 in (2640 mm)
left, 77 in (1955 mm)

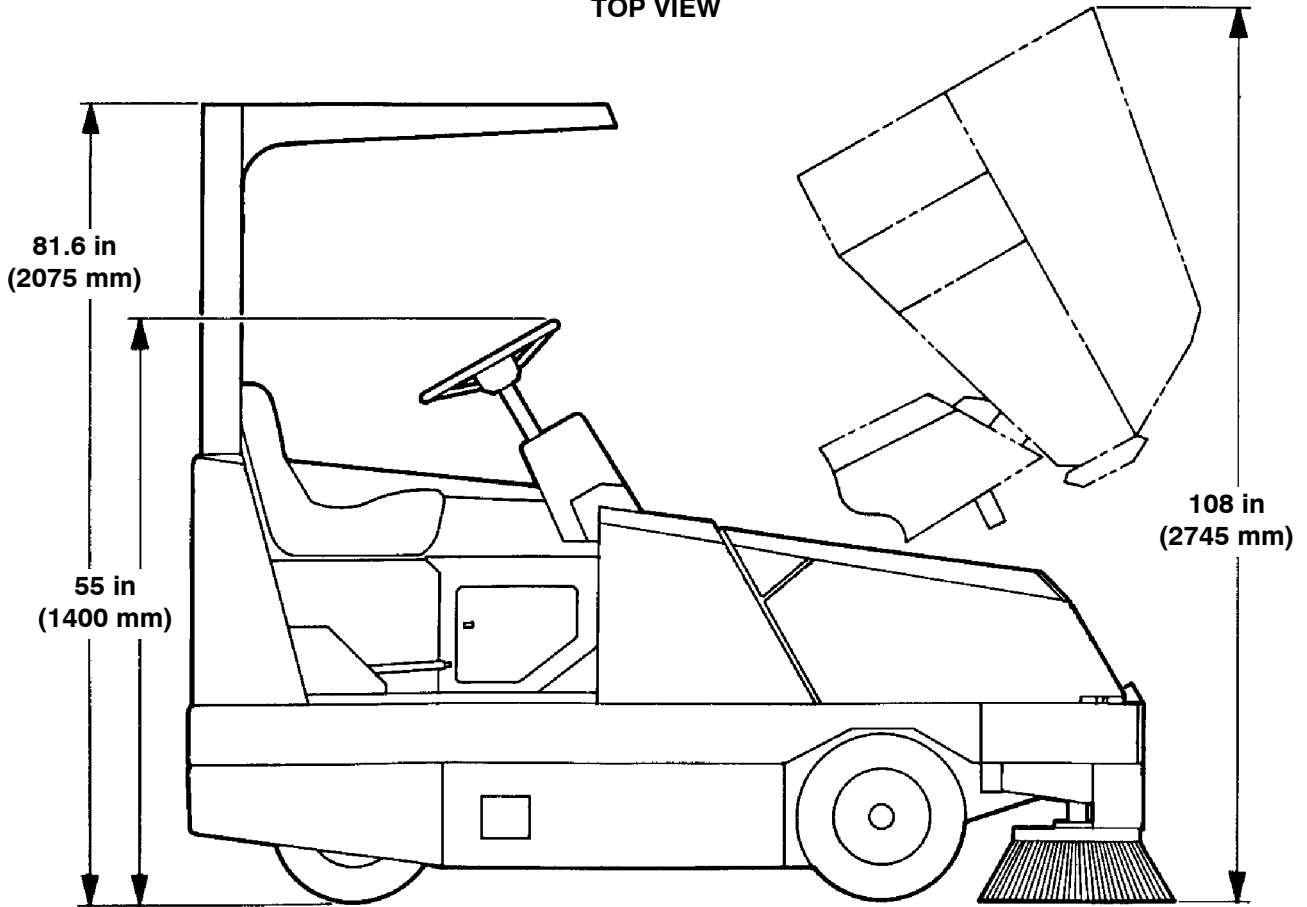
U–turn, 118.5 in (3010 mm)

Maximum rated climb/descent angle – 15° with
empty hopper, 10° with hopper full

MACHINE DIMENSIONS



TOP VIEW



SIDE VIEW

02146

SECTION 2

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PREPARATION FOR OPERATION

AFTER UNLOADING AND BEFORE OPERATING THE MACHINE:

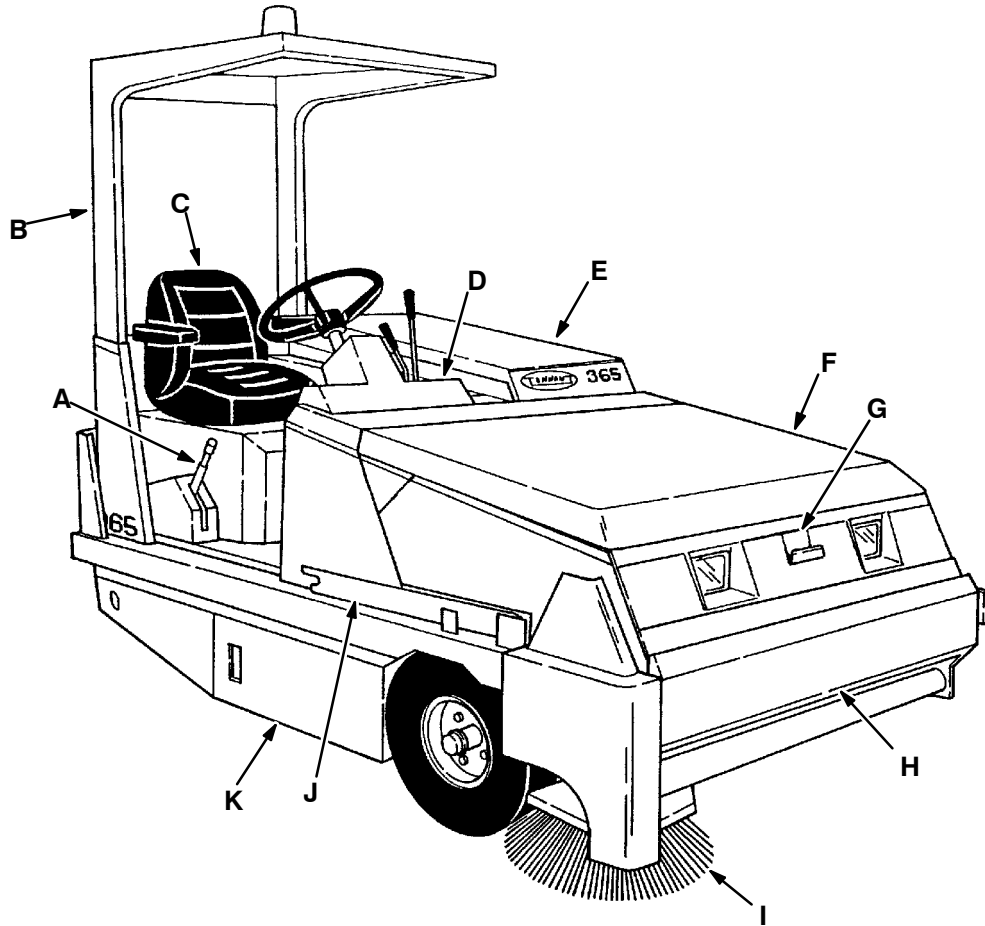
1. Check the machine for shipping damage.
2. Read this manual carefully before operating or servicing the machine.

FOR SAFETY: Do not operate the machine unless operation manual is read and understood.

3. Check the hydraulic fluid level in the hydraulic fluid reservoir, using the dipstick provided. TENNANT hydraulic fluid is recommended. If TENNANT hydraulic fluid is not available, use only new, approved hydraulic fluid. See *HYDRAULICS* in the *MAINTENANCE* section.
4. Check the engine oil level.
5. Check the radiator coolant level.
6. Check the brush adjustment, as described in *BRUSHES* in the *MAINTENANCE* section.
7. Check the air pressure of the tires. Pressure should be as listed in *BRAKES AND TIRES* in the *MAINTENANCE* Section.
8. Fill the fuel tank, or install an LPG fuel tank on the machine per the instructions in this manual.

 **WARNING: Machine can have static electricity charge. When pouring fuel, spark can ignite fuel causing fire or explosion. Connect wire attached to fuel can to machine to discharge spark before pouring fuel.**

OPERATION OF CONTROLS



MACHINE COMPONENTS

05958

- | | |
|----------------------------|---------------------------------------|
| A. Parking Brake | G. Vacuum Wand Connection Door |
| B. Overhead Guard | H. Hopper Door |
| C. Operator Seat | I. Side Brush |
| D. Steering Console | J. Hopper Support Bar |
| E. Engine Cover | K. Main Brush Access Door |
| F. Hopper Cover | |

INSTRUMENT PANEL SYMBOLS

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



Side Brush Down and On



Side Brush Up



Main Brush Free-Float



Main Brush Down



Main Brush Up



Hopper Door Close



Hopper Door Open



Hopper Down



Hopper Up



Main Brush 1



Main Brush 2



Vacuum Fan



Filter Shaker



Filter Clogged



Choke



Fast



Idle



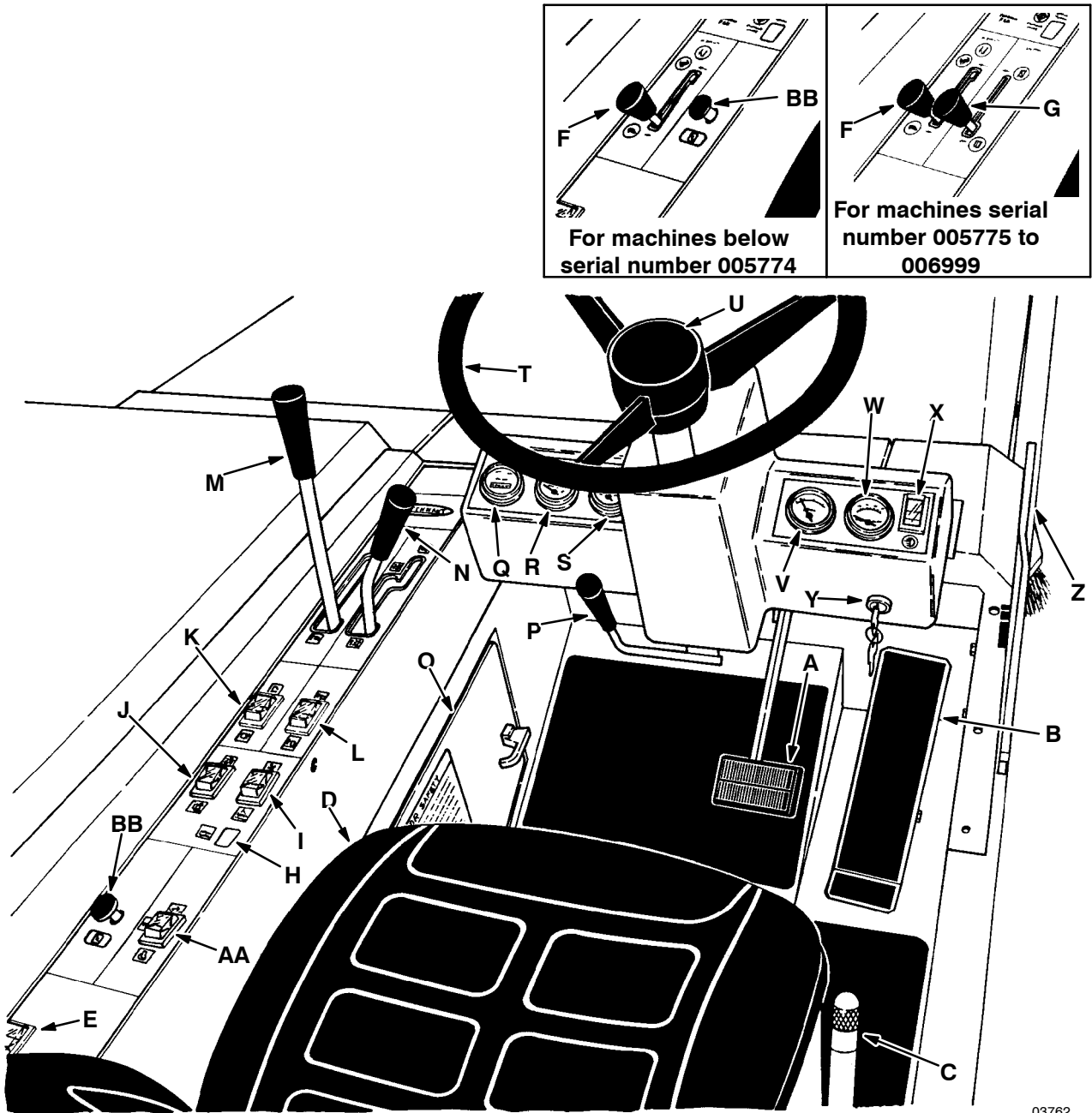
Engine Start



Hazard Light



Operational Lights



CONTROLS AND INSTRUMENTS

03762

- | | |
|---|--------------------------------------|
| A. Brake Pedal | O. Main Brush Height Adjustment Knob |
| B. Directional Control Pedal | P. Steering Tilt Lever |
| C. Parking Brake Lever | Q. Engine Hour Meter |
| D. Operator Seat | R. Engine Oil Pressure Gauge |
| E. Hazard Lamp Switch | S. Engine Coolant Temperature Gauge |
| F. Throttle Lever | T. Steering Wheel |
| G. Engine Choke Lever | U. Horn Button |
| H. Clogged Filter Indicator | V. Fuel Level Gauge |
| I. Vacuum Fan and Filter
Shaker Switch | W. Voltage Gauge |
| J. II Speed™ Switch | X. Operating Lights Switch |
| K. Hopper Door Switch | Y. Ignition Switch |
| L. Hopper Switch | Z. Hopper Support Bar |
| M. Side Brush Position Lever | AA. Throttle Switch |
| N. Main Brush Position Lever | BB. Engine Choke Knob |

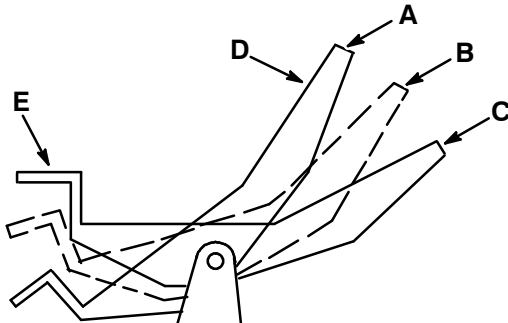
BRAKE PEDAL

The brake pedal operates the hydraulic drum brakes on the two front wheels.

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

DIRECTIONAL PEDAL

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



DIRECTIONAL CONTROL PEDAL

00116

- A. "Reverse" Position
- B. "Neutral" Position
- C. "Forward" Position
- D. Toe Portion
- E. Heel Portion

To travel forward, press the "toe" portion of the pedal; press the "heel" portion of the pedal for reverse travel. The propelling speed of the machine is regulated by varying the pressure on the pedal.

If the machine creeps when the pedal is in the "neutral" position, adjust the pedal as directed in *DIRECTIONAL PEDAL* in the *MAINTENANCE* section.

PARKING BRAKE LEVER

The parking brake lever controls the brakes on the front wheels. To set the parking brake, pull the brake handle up. To release the parking brake, push the brake 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 the machine and remove key.

OPERATOR SEAT

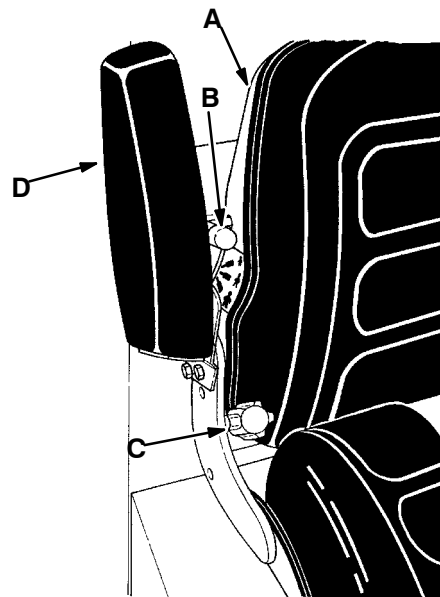
The operator seat is a three-way adjustable seat with armrests. It has adjustments to compensate for operator weight, to vary the backrest angle, and to vary the front-to-rear seat position.

The weight adjustment lever has three positions. One position is for light-weight operators, one for middle-weight operators, and one for heavy-weight operators. Pull the lever up for light-weight operators, position the lever horizontally for middle-weight operators, and down for heavy-weight operators.

The backrest angle is adjusted by rotating the knob clockwise to decrease the backrest angle or counterclockwise to increase the backrest angle.

The seat position is adjusted by pulling the seat position lever, located on the lower front edge of the seat. Pull the lever out to the left, sliding the seat forward or backward to a comfortable position, and releasing the lever.

The right side armrest may be rotated up and back to enter or exit from the operator seat.



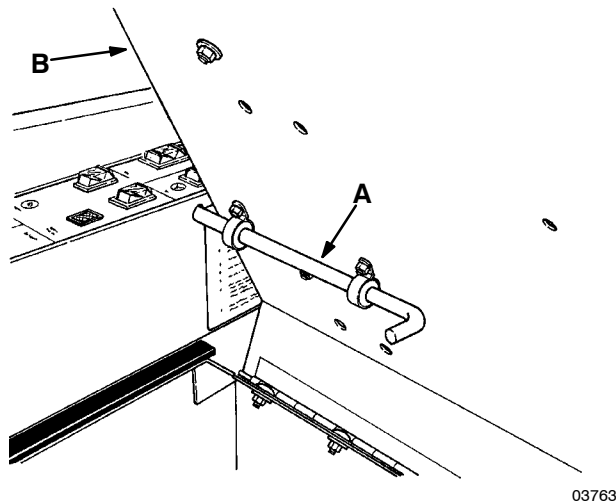
OPERATOR SEAT

01435

- A. Seat
- B. Weight Adjustment Lever
- C. Backrest Angle Knob
- D. Armrest


OPERATION

The operator seat also tilts forward to allow access to the gasoline fuel tank and hydraulic reservoir fill caps. A support rod has also been provided to hold the seat in the forward tilted position.



A. Support Rod
B. Seat Base




HAZARD LIGHT SWITCH

The hazard light switch  is present on machines with the rotating or flashing light accessory. To operate the light, place the switch in the top position. To turn the light off, place the switch in the bottom position.

THROTTLE LEVER

The throttle lever controls the engine governed speed on machines below serial number 007000. Push the lever forward to slow the engine to idle speed. Pull the lever back to speed the engine to the maximum governed speed.


THROTTLE SWITCH

The throttle switch controls the engine governed speed on machines serial number 007000 and above. To start the engine, place the switch in the bottom  (Engine Start) position. To slow the engine before stopping it, place the switch in the middle  (Idle) position. To speed up the engine to operating speed, place the switch in the top  (Fast) position.


ENGINE CHOKE LEVER

The engine choke lever is present on gasoline powered machines below serial number 005774. The lever controls the engine choke. To close the choke for cold starting, push the engine choke lever forward into the “FULL” position. After the engine starts and warms up, open the choke by pulling the choke lever back into the “RUN” position. It is not necessary to choke a warm engine.

ENGINE CHOKE KNOB



The engine choke knob  is present on gasoline machines serial number 005774 and above. The knob controls the engine choke. To close the choke for cold starting, pull the choke knob out. To open the choke, push the knob in.

CLOGGED FILTER INDICATOR



The clogged filter indicator  lights when the dust filter is clogged. Shake or clean the hopper dust filter whenever the indicator lights.

VACUUM FAN AND FILTER SHAKER SWITCH



The vacuum fan and filter shaker switch controls the vacuum fan and the hopper dust filter shaker.

To start the vacuum fan, place the switch in the top  (Vacuum Fan) position. To stop the vacuum fan, place the switch in the middle position. To shake the hopper dust filters, press the bottom  (Filter Shaker) of the switch.


II SPEED™ SWITCH

The II Speed™ switch controls the speed of the vacuum fan and the main brush. Place the switch in the bottom  (Main Brush 1) position for sweeping up normal debris. Place the switch in the top  (Main Brush 2) position for sweeping up light litter.


HOPPER DOOR SWITCH

The hopper door switch controls the hopper door position. To open the hopper door, press the bottom  (Hopper Door Open) of the switch. To close the hopper door, press the top  (Hopper Door Close) of the switch.

HOPPER SWITCH


The hopper switch controls the hopper position. To raise and dump the hopper, press and hold the bottom  (Hopper Up) of the switch. This will raise the hopper into the dump position. Press the switch until enough hopper-to-dumpster clearance is reached and release the switch. Continuing to press the switch will raise the hopper to the maximum dump height.


WARNING: Machine hopper lifts to 108 in (2745 mm) when high dumping. Hopper can hit overhead wires or object. Electrical shock or falling debris can result. Be sure adequate clearance is available before raising hopper.

To lower the hopper, place the switch in the top  (Hopper Down) position. This will lower and return the hopper to the operating position.

SIDE BRUSH POSITION LEVER

The side brush position lever controls brush position and rotation of the side brush.



To lower and start the side brush, pull the side brush position lever back and to the left; then release the lever into the  (Side Brush Down and On) position.


To raise and stop the side brush, pull the side brush position lever back to the right and release the lever into the  (Side Brush Up) position.

NOTE: The side brush will not rotate unless the main brush position lever is in the (Main Brush Down) or (Main Brush Free-Float) positions.

MAIN BRUSH POSITION LEVER

The main brush position lever controls the position and rotation of the main brush.

To lower and start the main brush, pull the main brush position lever back and to the left. Then release the lever into the  (Main Brush Down) position – allowing the lever to move forward and to the right will place the lever in the  (Main Brush Free-Float) position.

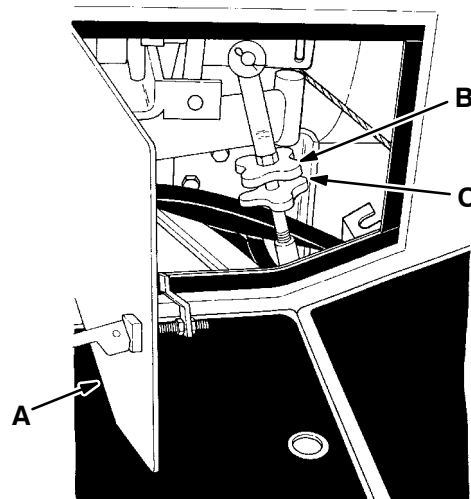
To raise and stop the main brush, pull the main brush position lever back to the right and release the lever into the  (Main Brush Up) position.

NOTE: Always place the main brush position lever in the (Main Brush Up) position when the machine is not being used for a period of time. This will prevent the main brush from getting a flat spot.

MAIN BRUSH HEIGHT ADJUSTMENT KNOB

The main brush height adjustment knob is located behind an access door next to the operator's left foot. The adjustment knob controls the amount of main brush contact with the floor.

To decrease the main brush floor contact, loosen the locking knob and thread the adjustment knob clockwise. To increase the main brush floor contact, loosen the locking knob and thread the adjustment knob counterclockwise. Retighten the locking knob after making any adjustment.



MAIN BRUSH HEIGHT ADJUSTMENT KNOB 02150

- A. Access Door**
- B. Adjustment Knob**
- C. Locking Knob**

STEERING TILT LEVER

The steering tilt lever controls the tilt angle of the steering console.

To adjust the angle of the steering console, push the lever forward, adjust the console to a comfortable angle, and release the lever.

OPERATION

ENGINE HOUR METER

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

ENGINE OIL PRESSURE GAUGE

The engine oil pressure gauge registers the engine oil pressure. Normal engine oil pressure ranges from 20 to 35 psi (140 to 240 kPa) at full engine throttle. If the gauge registers an oil pressure reading below 7 psi (50 kPa), stop the engine immediately and determine the cause. Failure to stop the engine will result in engine damage.

ENGINE COOLANT TEMPERATURE GAUGE

The engine coolant temperature gauge registers the engine coolant temperature. Normal engine coolant temperatures range up to 200° F (93 °C). Temperatures above this level indicate an over-heating engine. This condition may be due to a low coolant level, a clogged radiator, a loose fan belt, a defective thermostat, or other engine malfunctions. Engine overheating will always cause a coolant loss. If coolant loss does not occur, check for malfunction of the temperature sending unit.

STEERING WHEEL

The automotive-type steering wheel controls a steering cylinder connected to the rear wheel support. It is recommended that the steering wheel not be turned excessively when the engine is not operating. A horn button is located in the center of the steering wheel.


FUEL LEVEL GAUGE

The fuel level gauge is present on all gasoline powered machines. It indicates how much fuel is left in the fuel tank.

VOLTAGE GAUGE

The voltage gauge indicates the present voltage potential of the battery. Normal battery voltage is 10 to 14 volts. If the battery voltage exceeds 14 volts, it may be overcharging. If the battery voltage falls below 10 volts, it may not be accepting or getting a charge from the alternator. Overcharging and undercharging are indications that one or more electrical components are in need of repair.

OPERATING LIGHTS SWITCH

The operating lights switch  controls the headlights, taillights, and side brush spot light. To operate the lights, place the switch in the bottom position. To turn off the lights, place the switch in the top position.

IGNITION SWITCH

The key operated ignition switch starts the engine. To start the engine, turn the key clockwise. To turn the ignition off, turn the key counterclockwise.

NOTE: Do not operate the starter motor for more than 10 seconds at a time or after the engine has started. Allow the starter to cool between starting attempts. The starter motor may be damaged if it is operated incorrectly.

FOR SAFETY: Before starting machine, make sure all safety devices are in place and operate properly.

HOPPER SUPPORT BAR

The hopper support bar is present on the operator's side of the hopper. The support bar holds the hopper in a raised position to allow work to be done under the hopper. Do not rely on the machine hydraulic system to keep the hopper raised.

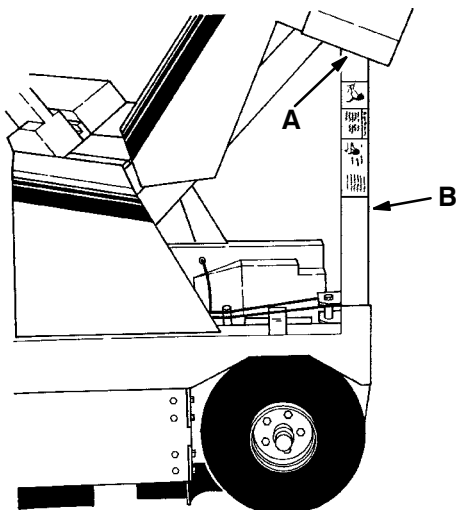
! WARNING: Falling hopper. Engage hopper support bar before working under hopper.

TO ENGAGE HOPPER SUPPORT BAR

1. Set the machine parking brake and start the engine.

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

2. Place the engine throttle control in the (Fast) position.
3. Raise the hopper to the fully raised position.
4. Lift and position the hopper support bar in the front bumper slot.



ENGAGED HOPPER SUPPORT BAR

02151

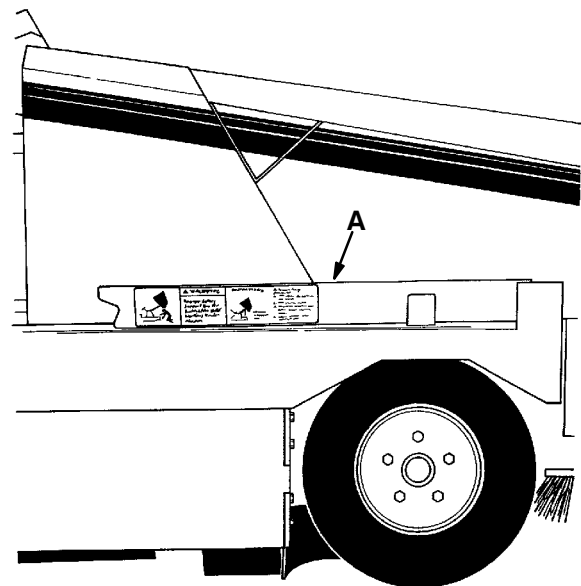
- A. Front Bumper Slot**
- B. Support Bar**

5. Slowly lower the hopper so the front bumper rests securely on the support bar.

6. Turn the engine off.
7. Check the support bar to make sure it is securely engaged.

TO DISENGAGE HOPPER SUPPORT BAR

1. Start the engine.
2. Place the engine throttle control in the (Fast) position.
3. Raise the hopper to the fully raised position.
4. Lower the support bar into its storage position.



DISENGAGED HOPPER SUPPORT BAR

02142

- A. Support Bar**

5. Lower the hopper.
6. Turn the engine off.

OPERATION

CIRCUIT BREAKERS

Circuit breakers are resettable circuit protection devices designed to stop the flow of current in the event of a circuit overload. Once tripped, circuit breakers must cool before they automatically 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.

The circuit breakers are located below the steering console.

The chart below shows the various circuit breakers and the electrical components they protect.

PROTECTIVE DEVICE	RATING	CIRCUIT PROTECTED
CB-1	15 A	Filter shaker
CB-2	15 A	Horn, hopper door
CB-3	15 A	Engine ignition, gauges
CB-4	15 A	Lights
CB-5	15 A	Brush drive, hopper lift, vacuum fan
CB-6	15 A	Cab heater, blower, wipers

MACHINE OPERATION

NORMAL SWEEPING OPERATION

A normal sweeping operation consists of seven typical operations: pre-start checklist, starting machine, sweeping, dumping hopper, post operation checklist – engine operating, stopping machine, and post operation checklist – engine stopped.

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

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

TO SWEEP lists things to keep in mind before and during the sweeping operation.

TO DUMP HOPPER lists the steps required to dump the hopper.

POST OPERATION CHECKLIST – ENGINE OPERATING lists things to check before stopping the machine engine.

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

POST OPERATION CHECKLIST – ENGINE STOPPED lists things to check after stopping the machine engine.

PRE-START CHECKLIST

Check under the machine for leak spots.

Check the engine lubricating oil level.

Check the engine air filter service indicator.

Check the fuel level.

Check for LPG odor, or frost on LPG hoses and components, indicating a leak.

Check the brakes and controls for proper operation.

Check the service records to determine service requirements.

TO START MACHINE

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

1. LPG machines: Slowly open the liquid service valve.

NOTE: Opening the service valve too quickly may cause the service valve check valve to stop the flow of LPG fuel. If the check valve stops the flow of fuel, close the service valve, wait a few seconds, and slowly open the service valve once again.

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

FOR SAFETY: Before starting machine, make sure all safety devices are in place and operate properly.

3. Cold gasoline engines: Move the choke lever forward into the "FULL" position, or pull out the choke knob about three-fourths of the way. Pull the choke lever back, or push the choke knob in, after the engine has started and is running smoothly.
4. Place the throttle control in the (Idle) position.
5. Turn the ignition switch key clockwise until the engine starts.

NOTE: Do not operate the starter motor for more than 10 seconds at a time or after the engine has started. Allow the starter to cool between starting attempts. The starter motor may be damaged if it is operated incorrectly.

6. Allow the engine and hydraulic system to warm up three to five minutes.
7. Release the machine parking brake.
8. Place the throttle control in the (Fast) position, and drive the machine to the area to be swept.

OPERATION

TO SWEEP

Plan the sweeping in advance. Try to arrange long runs with minimum stopping and starting. Sweep debris from very narrow aisles into main aisles ahead of time. Do an entire floor or section at one time.

Pick up oversize debris before sweeping. Flatten or remove bulky cartons from aisles before sweeping. Pick up pieces of wire, twine, string, etc., which could become entangled in brush or brush plugs. Overlap brush paths.

Avoid turning the steering wheel too sharply when the machine is in motion. The machine is very responsive to the movement of the steering wheel. Avoid sudden turns, except in emergencies.

Sweep as straight a path as possible. Avoid bumping into posts or scraping the sides of the sweeper.


Speed the main brush from (Main Brush 1) to (Main Brush 2) when light litter is to be swept up. Do not overuse the (Main Brush 2) speed in dusty environments because the machine dusting may clog the hopper dust filters. The (Main Brush 1) speed is best for sweeping up normal debris.

Stop the machine vacuum when sweeping in wet conditions to avoid soaking the hopper dust filter.

1. Place the vacuum fan and filter shaker switch in the top (Vacuum Fan) position.
2. Place the II Speed™ switch in the top (Main Brush 2) or the bottom (Main Brush 1) position depending on the debris to be picked up.
3. Move the main brush position lever to the (Main Brush Down) or (Main Brush Free-Free) position.
4. Move the side brush position lever to the (Side Brush Down and On) position.
5. Sweep as required.

TO DUMP HOPPER

1. Pull the side brush position lever back into the (Side Brush Up) position.
2. Pull the main brush position lever back into the (Main Brush Up) position.
3. Press the bottom (Filter Shaker) of the vacuum fan and filter shaker switch to shake the hopper dust filter. Place the switch in the middle position after the filter shaker stops.
4. Slowly drive the machine up to the dump site or dumpster.
5. Press the top (Hopper Door Close) of the hopper door switch to close the hopper door. Press the bottom (Hopper Up) of the hopper switch to raise and rotate the hopper into the dump position. Hold the switch down until the desired hopper height is reached.

 **WARNING: Machine hopper lifts to 108 in (2745 mm) when high dumping. Hopper can hit overhead wires or object. Electrical shock or falling debris can result. Be sure adequate clearance is available before raising hopper.**

6. Press the bottom (Hopper Door Open) of the hopper door switch to open the hopper door and empty the hopper.

NOTE: Lowering the hopper into the dumpster may help to control flying dust.

7. Press the bottom (Hopper Up) of the hopper switch to allow the hopper to raise and clear the dumpster.
8. Press the top (Hopper Door Close) or the hopper door switch to close the hopper door.
9. Slowly back the machine away from the dump site or dumpster.
10. Place the hopper switch in the top (Hopper Down) position to lower and rotate the hopper into the operating position.
11. Press the bottom (Hopper Door Open) of the hopper door switch to open the hopper door.

12. Place the vacuum fan and filter shaker switch in the top (Vacuum Fan) position.
13. Place the II Speed™ switch in the bottom (Main Brush 1) or the top (Main Brush 2) position depending on the debris to be picked up.
14. Move the main brush position lever to the (Main Brush Down) or (Main Brush Free-Free) position.
15. Move the side brush position lever to the (Side Brush Down and On) position.
16. Continue sweeping as required.

POST OPERATION CHECKLIST – ENGINE OPERATING

Check brush pattern for width and evenness.

TO STOP MACHINE

NOTE: Before leaving the machine, perform the post operation checks.

1. Return the directional control pedal to the “neutral” position. Apply the brake.
2. Pull the side brush position lever back into the (Side Brush Up) position.
3. Pull the main brush position lever back into the (Main Brush Up) position.
4. Place the vacuum fan and filter shaker switch in the middle position.
5. Turn the operating lights off if used.
6. Place the throttle control in the (Idle) position.
7. Set the machine parking brake.
8. Turn the ignition key switch counterclockwise. Remove the key from the ignition switch.

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

9. Close the LPG tank liquid service valve.

POST OPERATION CHECKLIST – ENGINE STOPPED

Check the skirts for damage, wear, and adjustment.

Check for wire or string tangled on the brushes.

Check for LPG odor, or frost on the LPG hoses and components, indicating a leak.

Check for leaks.

OPERATION ON GRADES

Drive the machine slowly on grades. Use the service brakes to control machine speed.

FOR SAFETY: When using machine, go slow on grades and slippery surfaces.

The maximum rated ramp climb and descent angle is 15° with an empty hopper, and 10° with a full hopper.

OPERATION

MACHINE TROUBLESHOOTING

Problem	Cause	Remedy
Excessive dusting.	Dust skirts and seals worn, damaged, not adjusted properly.	Replace or adjust skirts or seals.
	Thermo-Sentry™ tripped.	Reset Thermo-Sentry™.
	Dust filter clogged.	Shake and/or clean or replace filter.
Poor sweeping performance.	Brushes worn.	Replace brushes.
	Wrong brush for application.	Replace brush.
	Brushes not adjusted properly.	Adjust brushes.
	Main brush drive failure.	See <i>HYDRAULIC SYSTEM TROUBLESHOOTING</i> in the <i>MAINTENANCE</i> section: Main brush does not turn.
	Side brush drive failure.	See <i>HYDRAULIC SYSTEM TROUBLESHOOTING</i> in the <i>MAINTENANCE</i> section: Side brush does not turn.
	Hopper full.	Empty hopper.

ACCESSORIES OPERATION

VACUUM WAND ACCESSORY

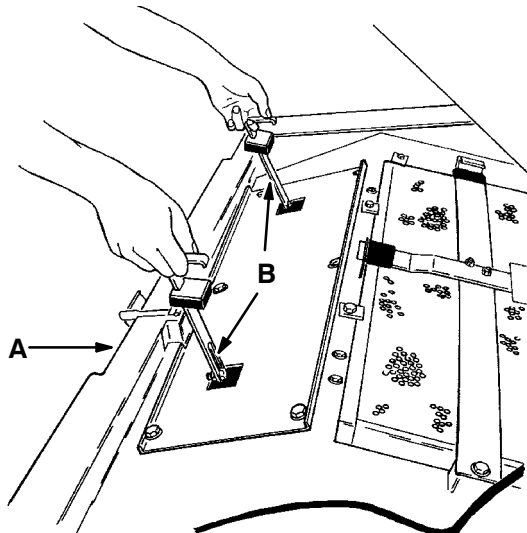
The vacuum wand accessory gives the machine the added flexibility of picking up debris not accessible to the machine. A 120 in (3050 mm) long hose utilizes the machine vacuum system.

TO OPERATE VACUUM WAND

1. Stop the machine close to the area to be cleaned.
2. Place the main brush position lever in the (Main Brush Up) and side brush position lever in the (Side Brush Up) position.
3. Stop the engine 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 vacuum wand and wand hose from their storage clips.
5. Open the hopper cover.
6. Pull the wand door handles up and lower them into the hopper to close the wand door.



CLOSING WAND DOOR

- A. Vacuum Wand Connection**
B. Wand Door Handles

7. Close the hopper cover.

8. Push one end of the wand hose onto the wand connection.
9. Push the other end of the wand hose onto the vacuum wand.
10. Start the engine.

! WARNING: Engine emits toxic gases. Severe respiratory damage or asphyxiation can result. Provide adequate ventilation. Consult with your regulatory agency for exposure limits. Keep engine properly tuned.

11. Place the throttle control in the (Fast) position.
12. Place the II Speed™ switch in the top (Main Brush 2) position.
13. Place the vacuum fan and filter shaker switch in the top (Vacuum Fan) position.
14. Vacuum the area as required.
15. When finished, place the vacuum fan and filter shaker switch in the middle position.
15. Place the throttle control in the (Idle) position.
16. Stop the engine.
17. Pull the vacuum hose out of the vacuum hose connection.
18. Disconnect the wand hose from the vacuum wand.
19. Pull the wand door handles up and sideways to open the wand door.

NOTE: The wand door must be reopened to allow the hopper vacuum system to operate.

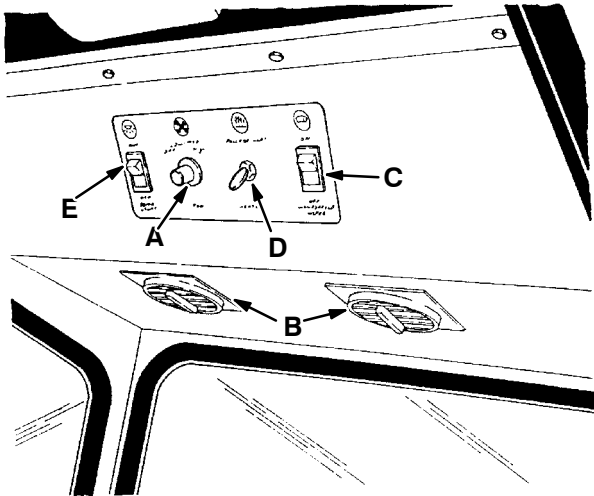
20. Close the hopper cover.
21. Return the vacuum wand and wand hose to their storage clips.

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OPERATION

CAB PRESSURIZER

The cab pressurizer is included in the cab accessory. The pressurizer includes a dome light, defroster/circulation fan and vent controls, windshield wiper control, and heater control for machines equipped with the cab heater accessory.



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CAB PRESSURIZER

- A. Defroster/Circulation Fan Switch
- B. Vent Controls
- C. Windshield Wiper Switch
- D. Heater Switch
- E. Dome Light Switch

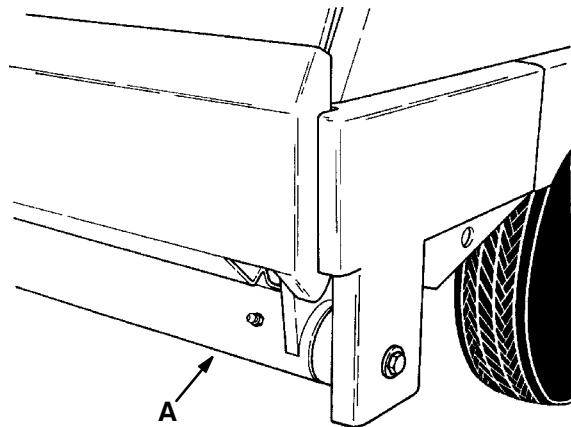
TRANSPORTING MACHINE

PUSHING OR TOWING MACHINE

The machine may be pushed from the front or the rear, using the bumpers provided, only after placing the rear wheel on a dolly.

The machine may be towed in either direction after placing the rear wheel on a dolly. Do not pull on the front bumper – pull on the hopper pivot tube.

ATTENTION! Do not push or tow the machine without placing the rear wheel on a dolly; the machine hydraulic system may be damaged.



FRONT TOW LOCATION

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A. Hopper Pivot Tube

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 locations are on the flat bottom edge of the machine frame in front of the front tires.

The rear jacking location is the middle flat bottom edge of the rear bumper.

TO JACK UP MACHINE

1. Empty the debris hopper.
2. Stop the engine and set the machine parking brake.

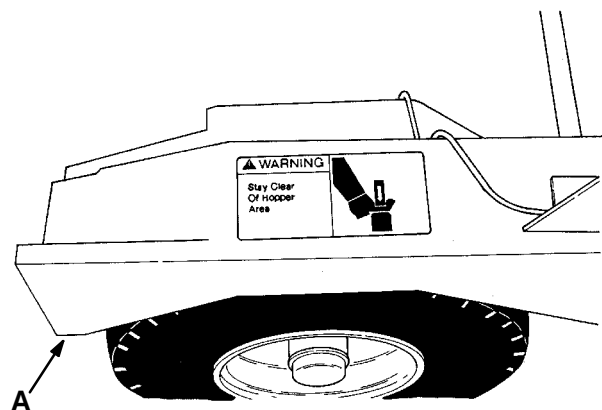
FOR SAFETY: Before leaving or servicing machine; stop on level surface, set parking brake, and turn off machine.

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

! WARNING: Machine is unstable on jack. 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.

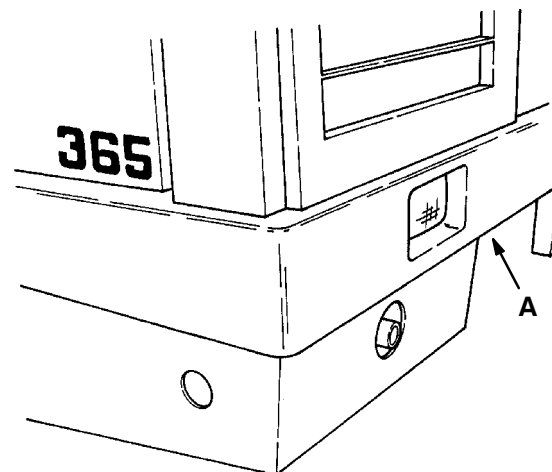
! WARNING: Machine is unstable on jack. Jack machine up at designated locations only. Block machine up with jack stands.



FRONT JACKING LOCATION

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A. Jacking Location



REAR JACKING LOCATION

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A. Jacking Location

OPERATION

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

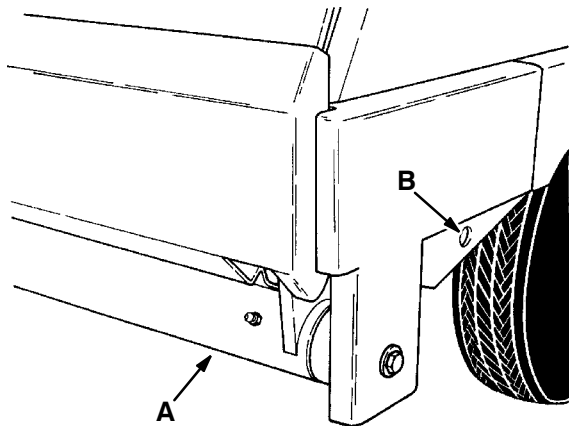
⚠ WARNING: Machine is unstable on jack. Jack machine up at designated locations only. Block machine up with jack stands.

- Lower the machine onto the jack stands.
- Check to make sure the machine is secure.
- Service the machine as required.
- When finished servicing the machine, raise the machine off the jack stands.
- Remove the jack stands from under the machine.
- Lower the machine.
- Remove the blocks from the tires.

MACHINE TIE-DOWNS

The machine may be tied down at each of the four corners of the machine at the locations specified.

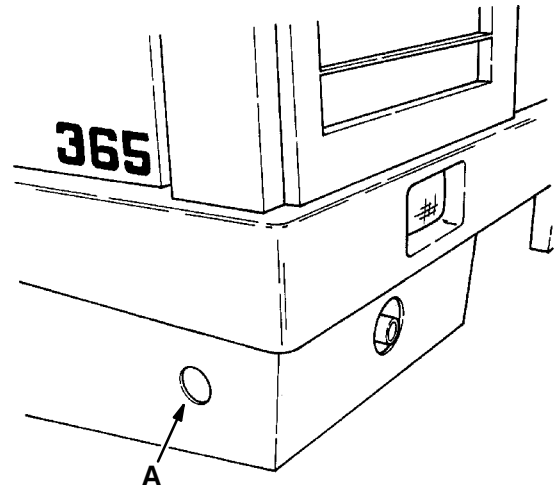
To tie the machine down, use the hopper pivot tube or front wheel pocket holes in the front and the holes in the lower rear machine frame in the back.



FRONT TIE-DOWN LOCATION

03765

- A. Hopper Pivot Tube**
- B. Pocket Hole**



REAR TIE-DOWN LOCATION

03764

A. Tie-Down Hole

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, and other undesirable deposits from forming.

1. Empty the debris hopper.
2. Change the engine oil.
3. Place the main brush position lever in the (Main Brush Up) position and side brush position lever in the (Side Brush Up) position.
4. Park the machine in a cool and dry area.
5. Stop the engine.
6. Fill the hydraulic reservoir with hydraulic fluid to the full mark on the dipstick to prevent excessive condensation from forming in the reservoir.

7A. To store the machine 30 to 90 days:

1. Remove the spark plugs.
2. Pour 3 oz (90 cc) of clean engine oil into each of the spark plug holes.
3. Remove the ignition coil high tension wire. Operate the engine starter motor for ten seconds. This distributes the oil over the cylinder walls.

NOTE: Before preparing the engine for storage, allow it to cool down to the surrounding temperature. Oil adheres to cold metal surfaces much better than hot surfaces.

4. Replace the high tension coil wire and spark plugs.
5. Drain the gasoline from the carburetor.

7B. To store the machine more than 90 days:

1. Remove the spark plugs.
2. Pour 3 oz (90 cc) of clean engine oil into each of the spark plug holes.
3. Remove the ignition coil high tension wire. Operate the engine starter motor for ten seconds. This distributes the oil over the cylinder walls.

NOTE: Before preparing the engine for storage, allow it to cool down to the surrounding temperature. Oil adheres to cold metal surfaces much better than hot surfaces.

4. Replace the high tension coil wire and spark plugs.
5. Drain the engine oil from the oil pan.
6. Drain the coolant from the radiator and engine block.
7. Close the engine cooling system drain cocks.
8. Drain gasoline from the carburetor, fuel tank, and the fuel lines.
9. Seal the air cleaner inlet and the exhaust outlet with weatherproof masking tape.
10. Tighten the engine oil filler cap, the fuel tank cap, and the radiator cap to make certain they are securely in place.

SECTION 3

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MAINTENANCE

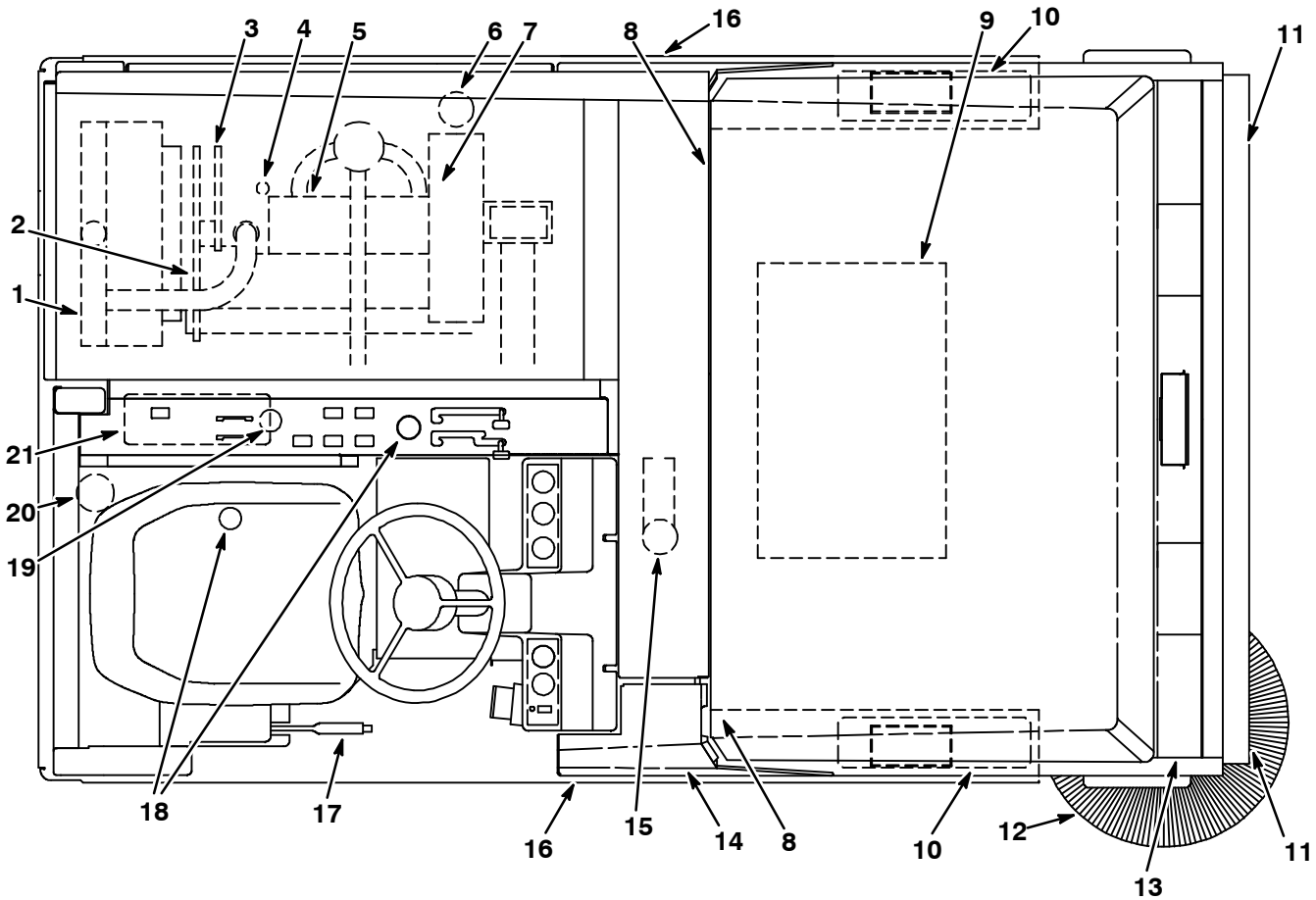
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RECOMMENDED FIRST 50-HOUR MACHINE INSPECTION

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

1. Check the brush pattern for correct brush adjustment.
2. Change the hydraulic fluid filter element.
3. Machines below serial number 007000: Check distributor ignition timing.
4. Machines below serial number 007000: Torque the cylinder head bolts to the proper specification.
5. Perform all 50-hour interval lubrication and maintenance procedures listed in the Maintenance chart.

MAINTENANCE CHART



03766

Interval	Key	Description	Procedure	Lubricant	No. of Service Points
Daily	7	Engine air filter	Check service indicator Empty dust cup	-	1 1
	4	Engine crankcase	Check oil level	EO	1
	16	Dust skirts	Check for damage, wear, and adjustment	-	7
	14	Main brush	Check for damage, wear, and adjustment	-	1
	12	Side brush	Check for damage, wear, and adjustment	-	1
50 Hours	4	Engine crankcase	Change oil and filter element	EO	1
	14	Main brush	Rotate end-for-end	-	1
100 Hours	8	Dust seals	Check for wear or damage	-	15
	9	Hopper dust filter	Inspect and clean or replace	-	1
	1	Radiator	Check coolant level	WG	1
			Clean exterior	-	1
	20	Hydraulic fluid reservoir	Check fluid level	HYDO	1
	10	Front tires	Check pressure	-	2
	21	Rear tire	Check pressure	-	1
	2	Engine fan belt (For machines serial number 007000 and above)	Check tension	-	1

Interval	Key	Description	Procedure	Lubricant	No. of Service Points
200 Hours	3	Alternator belt(For machines below serial number 007000)	Check tension	–	1
	2	Engine fan belt (For machines below serial number 007000)	Check tension	–	1
	13	Side brush pivot	Lubricate	MPGM	1
	17	Parking brake	Check adjustment	–	1
	19	Rear wheel support bearing	Lubricate	MPGM	1
	11	Hopper pivot	Lubricate	MPGM	2
	18	Steering cylinder end	Lubricate	MPGM	2
400 Hours	15	Brake master cylinder	Check fluid level	BF	1
	5	Engine (For machines below serial number 007000)	Check and adjust valve clearance	–	8
			Check and adjust idle speed	–	1
			Check and adjust idle mixture	–	1
			Clean or replace and adjust spark plugs	–	4
			Clean or replace and adjust distributor points	–	1
			Check and adjust timing	–	1
			Replace PCV valve	–	1
			Clean PCV hoses, tubes, and fittings	–	
			Lubricate distributor felt	EO	1
			5	Engine (For machines serial number 007000 and above)	Check and adjust valve clearance
			Check and adjust idle speed	–	1
			Check and adjust idle mixture	–	1
			Clean or replace and adjust spark plugs	–	4
			Replace PCV valve	–	1
		Clean PCV hoses, tubes, and fittings	–		
20	Hydraulic fluid reservoir	Change hydraulic fluid	HYDO	1	
6	Hydraulic fluid filter	Change filter element	–	1	
800 Hours	10	Front wheel bearings	Repack wheel bearings	MPGM	2
	5	Engine	Torque intake manifold bolts	–	5
	1	Cooling system	Flush	WG	1
	20	Hydraulic fluid reservoir	Replace breather	–	1

BF – Brake fluid

EO – Engine oil

HYDO – Tennant Company or approved hydraulic fluid

MPGM – Multipurpose, water resistant, lithium base, moly-disulphide EP grease

WG – Water and permanent-type ethylene glycol antifreeze, one-to-one ratio

NOTE: More frequent intervals may be required in extremely dusty conditions.

LUBRICATION

ENGINE

Check the engine oil level daily. Change the engine oil and oil filter after every 50 hours of operation. Use only SAE-SE/SF rated engine oil.

The following SAE-SE/SF rated oil grades are recommended for engines during changing seasonal temperatures:

MULTI-VISCOSITY OILS

Below 32°F (Below 0°C) 5W 30	-10° to 90°F (-23° to 32°C) 10W 30	-10° to above 90°F (-23 to above 32°C) 10W 40	Above 10°F (Above -12°C) 20W 40
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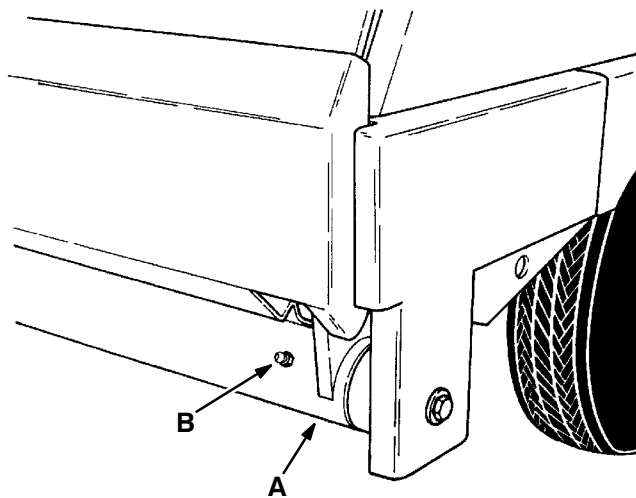
SINGLE VISCOSITY OILS

-10° to 32°F (-23° to 0°C) 10W	10° to 60°F (-12° to 16°C) 20W 20	32° to 90°F (0° to 32°C) 30	Above 60°F (Above 16°C) 40
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The engine oil capacity is 3.5 qt (3.3 L) including the oil filter.

HOPPER PIVOT

The hopper pivot is near the front of the machine. Lubricate the pivot by applying a multipurpose, water resistant, lithium base, moly-disulphide EP grease to the two grease fittings after every 200 hours of operation.

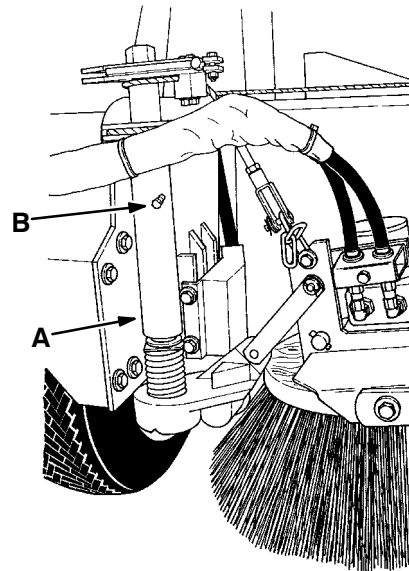


HOPPER PIVOT

- A. Hopper Pivot
- B. Grease Fitting

SIDE BRUSH PIVOT

The side brush mechanism pivots on a shaft near the inside right front corner of the machine. Lubricate the shaft by applying a multipurpose, water resistant, lithium base, moly-disulphide EP grease to the grease fitting after every 200 hours of operation.



SIDE BRUSH PIVOT

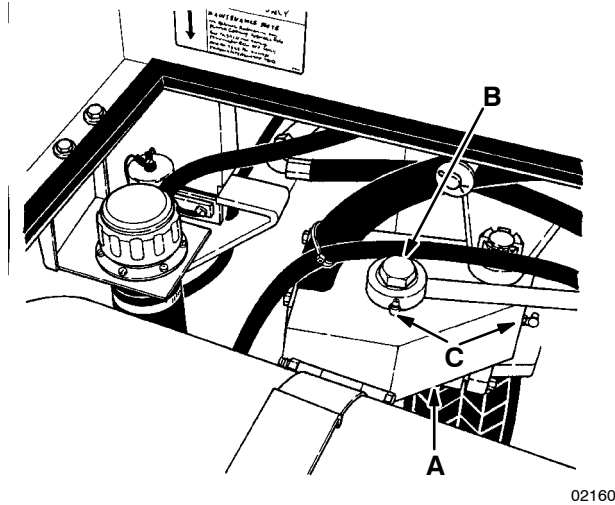
- A. Side Brush Pivot
- B. Grease Fitting

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REAR WHEEL SUPPORT

The rear wheel support pivots the rear wheel. Lubricate the rear wheel support bearing by applying a multipurpose, water resistant, lithium base, moly-disulphide EP grease to the grease fitting after every 200 hours of operation.



REAR WHEEL SUPPORT AND STEERING

- A. Rear Wheel Support**
- B. Steering Cylinder End**
- C. Grease Fitting**

STEERING CYLINDER ENDS

The steering cylinder ends pivot the rear wheel support. Lubricate the cylinder ends by applying a multipurpose, water resistant, lithium base, moly-disulphide EP grease to the grease fittings after every 200 hours of operation.

FRONT WHEEL BEARINGS

The front wheel bearings support the front half of the machine. They should be repacked with multipurpose, water resistant, lithium base, moly-disulphide EP grease after every 800 hours of operation.

HYDRAULICS

HYDRAULIC FLUID

TENNANT® Hydraulic Fluid is a specially compounded oil with the following features not found in many hydraulic fluids:

1. Flat viscosity curve.
2. Additives to prevent corrosion.
3. Additives to prevent oxidation.
4. Rust inhibitors.
5. Foam suppressors.

These features restrict foaming of the hydraulic fluid and provide a high standard of lubrication to the components.

TENNANT HYDRAULIC FLUID VISCOSITY SPECIFICATIONS

	TENNANT Hyd. Fluid No. 32397 (HP1040)	TENNANT Hyd. Fluid No. 32398 (HP2060)
SUS @ 100° F (38° C)	404–445	940–1010
SUS @ 210° F (99° C)	78–84	122–130

TENNANT Hydraulic Fluids have a very flat viscosity curve (synonymous with “high viscosity index”). The flat viscosity curve means that the thickness of the fluid is very constant over wide temperature ranges.

Hydraulic fluid with the viscosity rating of HP1040 should be used in machines that are operated in areas which have ambient temperatures up to 90° F (32° C). Use the HP2060 rated hydraulic fluid in areas which have ambient temperatures above 90° F (32° C).

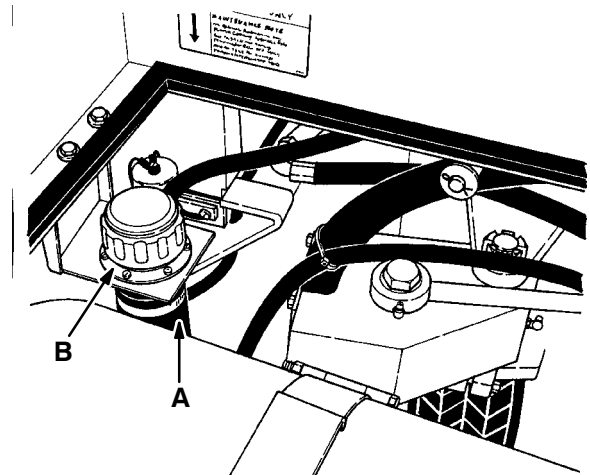
If a locally-available hydraulic fluid is preferred, or if products of only one oil company are used, the hydraulic fluid used must match closely the viscosity specifications given in the chart for TENNANT Hydraulic Fluid, as well as the other features described. Do not substitute automatic transmission fluid for hydraulic fluid.

ATTENTION! Hydraulic components depend on system hydraulic fluid for internal lubrication. If dirt or other contaminants are allowed to enter the hydraulic system, malfunctions, accelerated wear, and damage will result.

HYDRAULIC FLUID RESERVOIR

Hydraulic fluid is stored in the hydraulic fluid reservoir. The reservoir holds up to 5.3 gal (20 L) of hydraulic fluid. The reservoir is located under the operator seat.

The reservoir is equipped with a breather-filler cap and fluid level dipstick mounted on the filler neck. See *HYDRAULIC FLUID RESERVOIR BREATHER* for breather service information.



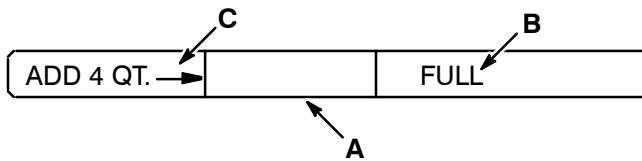
HYDRAULIC FLUID RESERVOIR

02160

- A. Filler Neck
- B. Breather-Filler Cap

The hydraulic fluid level dipstick is built into the breather-filler cap. The end of the dipstick is marked with “FULL” and “ADD” levels. This indicates the level of hydraulic fluid in the reservoir.

Check the hydraulic fluid level after every 100 hours of operation. It should be above the "ADD" marks on the dipstick, but not above the "FULL" mark when the hydraulic fluid is warm.



02164

HYDRAULIC FLUID LEVEL DIPSTICK

- A. Dipstick
- B. "FULL" Range
- C. "ADD" Range

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.

Drain, flush, and refill the hydraulic fluid reservoir with hydraulic fluid after every 400 hours of operation.

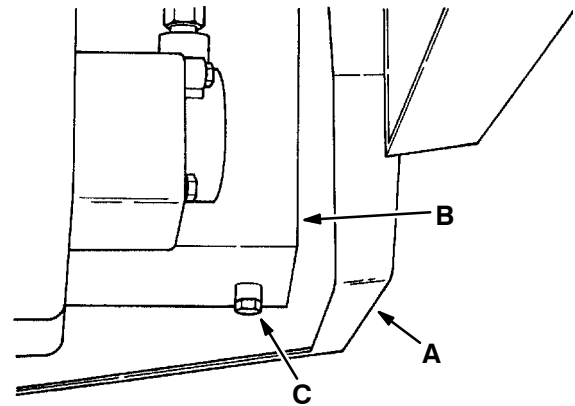
TO DRAIN HYDRAULIC FLUID RESERVOIR

1. Stop the engine 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 the operator seat.
3. Allow the hydraulic fluid to cool.
4. Loosen the breather-filler cap. Remove the reservoir drain plug located on the bottom of the reservoir to drain the hydraulic fluid. Discard the used hydraulic fluid.

NOTE: Always change the hydraulic fluid filter when draining the hydraulic fluid reservoir.



02165

HYDRAULIC FLUID RESERVOIR DRAIN PLUG

- A. Right Rear of Machine
- B. Hydraulic Fluid Reservoir
- C. Drain Plug

5. Flush the reservoir with clean hydraulic fluid or suitable solvent. Do not use gasoline, kerosene, or diesel fuel.
6. Reinstall the reservoir drain plug and breather-filler cap.
7. Lower the operator seat.

TO FILL HYDRAULIC FLUID RESERVOIR

1. Raise the operator seat.
2. Remove the reservoir breather-filler cap.
3. Pour 5 gal (19 L) of new, approved hydraulic fluid through a 200 mesh screened funnel and into the reservoir filler neck.

ATTENTION! Use only new, approved hydraulic fluid to fill the hydraulic fluid reservoir.

4. Check the hydraulic fluid level in the reservoir with the reservoir dipstick.

MAINTENANCE

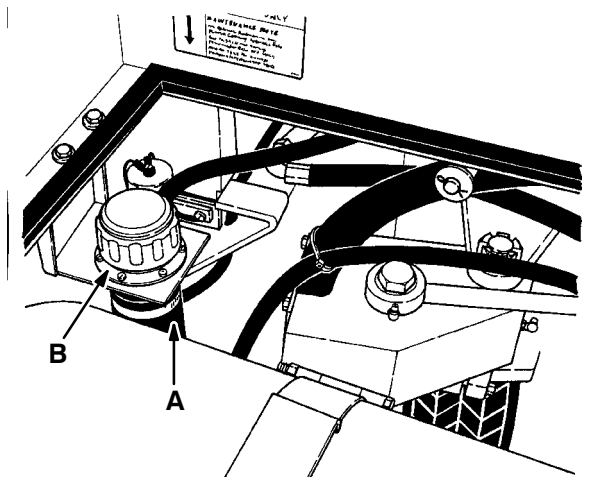
5. Add hydraulic fluid until the level in the reservoir is between the "ADD" and the "FULL" range. Do not overfill.

NOTE: Do not overfill the hydraulic fluid reservoir. As hydraulic fluid heats to its normal operating temperature, it expands. Always allow for this expansion when filling the hydraulic fluid reservoir.

6. Place the reservoir breather-filler cap securely on the reservoir filler neck.
7. Lower the operator seat.
8. Start engine and operate all of the hydraulic components. Then recheck the hydraulic fluid level.

HYDRAULIC FLUID RESERVOIR BREATHER

The hydraulic fluid reservoir is equipped with a breather. The breather relieves excess atmospheric pressure or vacuum in the reservoir. The breather is mounted on the hydraulic fluid reservoir filler neck located under the operator seat. The breather should be replaced after every 800 hours of operation.



RESERVOIR BREATHER-FILLER CAP

- A. Filler Neck
- B. Breather-Filler Cap

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 located in the left front of the machine engine compartment.

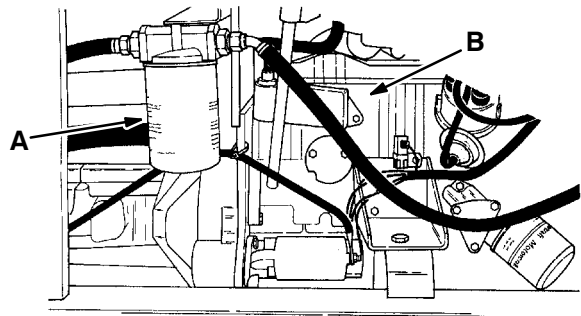
Replace the hydraulic fluid filter element after the first 50 hours of operation and then after every 400 hours of operation.

TO REPLACE HYDRAULIC FLUID FILTER ELEMENT

1. Stop the engine 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 side engine access door.



HYDRAULIC FLUID FILTER

- A. Hydraulic Fluid Filter Element
- B. Engine

3. Unthread and discard the hydraulic fluid filter element.

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. Operate the machine and check for leaks. Correct any leaks found.
7. Check the hydraulic fluid reservoir level and fill as required.
8. Close the side engine access door.

DIRECTIONAL PEDAL

The directional pedal controls the flow of hydraulic fluid to the hydraulic drive motor. The pedal has three positions: “forward,” “neutral,” and “reverse.” The “forward” and “reverse” positions send hydraulic fluid to the drive motor to propel the machine. The “neutral” position is the position in which the propelling pump sends no hydraulic fluid to the propelling motor. The machine should not creep when the “neutral” position is correctly adjusted. Adjust the pedal linkages whenever the machine creeps or after replacing the hydraulic propelling pump or pump linkages. The pedal linkages should also be adjusted whenever the reverse speed seems excessive or inadequate. The pedal linkage also includes a speed limiter. It limits forward speed to 2 mph (3.2 km/h) whenever the hopper is raised.

The “neutral” position is the position in which the propelling pump sends no hydraulic fluid to the propelling motor. The machine should not creep when the “neutral” position is correctly adjusted. Adjust the pedal linkages whenever the machine creeps or after replacing the hydraulic propelling pump or pump linkages. The pedal linkages should also be adjusted whenever the reverse speed seems excessive or inadequate. The pedal linkage also includes a speed limiter. It limits forward speed to 2 mph (3.2 km/h) whenever the hopper is raised.

TO ADJUST DIRECTIONAL PEDAL LINKAGE

1. Stop the engine 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. Block the machine tires and jack up the rear of the machine at the designated location.



WARNING: Machine is unstable on jack. Block machine tires before jacking machine up.

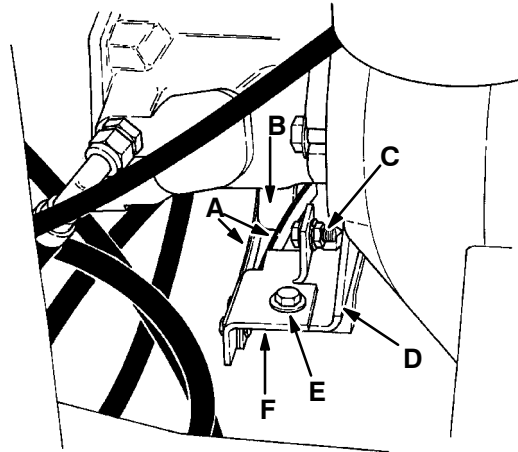
3. Block up the machine with jack stands near the designated jacking locations. Make sure the rear tire clears the floor by 2 in (50 mm) and all obstacles within a 24 in (610 mm) radius.



WARNING: Machine is unstable on jack. Jack machine up at designated locations only. Block machine up with jack stands.

4. Remove side engine access door.

5. Loosen the centering spring bracket retention bolts and adjustment bolt jam nut.



CENTERING SPRINGS

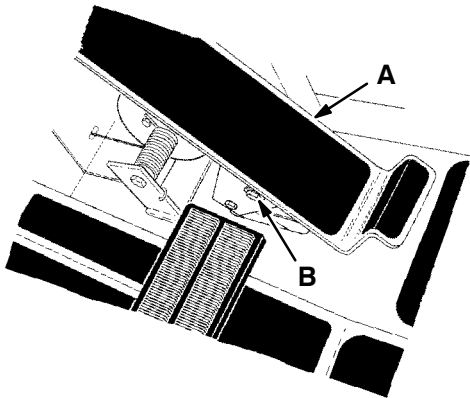
02167

- A. Centering Springs**
- B. Pump Pintle Arm**
- C. Adjustment Bolt**
- D. Stationary Bracket**
- E. Retaining Bolt**
- F. Spring Bracket**

6. Adjust the position of the spring bracket and adjustment bolt so the hydraulic pump pintle arm is held in a vertical position.
7. Snug the retention bolts.
8. Start the engine.
9. Move the directional control pedal into the “forward” position and release it. The rear wheel should stop rotating as soon as the pedal is released. Adjust the spring bracket as required.
10. Move the directional control pedal into the “reverse” position and release it. The rear wheel should stop rotating as soon as the pedal is released. Adjust the spring bracket as required.

MAINTENANCE

11. Stop the engine. Tighten the bolts.
12. Replace side engine access door.
13. Raise the rear of the machine, remove the jack stands, and lower the machine.
14. Loosen the bolt connecting the directional control pedal to the control linkage.



DIRECTIONAL CONTROL PEDAL

02168

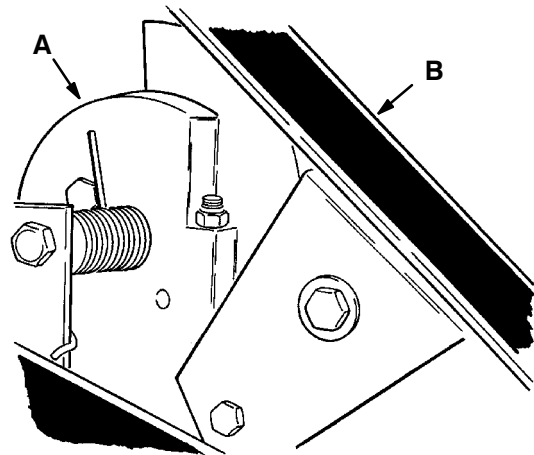
- A. Control Pedal
- B. Adjustment Bolt

15. Adjust the position of the directional control pedal so it will contact the floor when it is pressed backward. In this position the machine should not travel backward faster than 2.5 mph (4 km/h).
16. Tighten the directional control pedal bolt.
17. Start the engine and raise the hopper.
18. Engage the hopper support bar.



WARNING: Falling hopper. Engage hopper support bar before working under hopper.

19. Stop the engine.
20. Adjust the speed limiter cable so the cam under the directional control pedal is rotated 10° past vertical toward the rear of the machine. Slide the cam assembly forward or backward to allow full forward speed with the hopper down. Recheck the cable adjustment for limited forward speed with the hopper up.



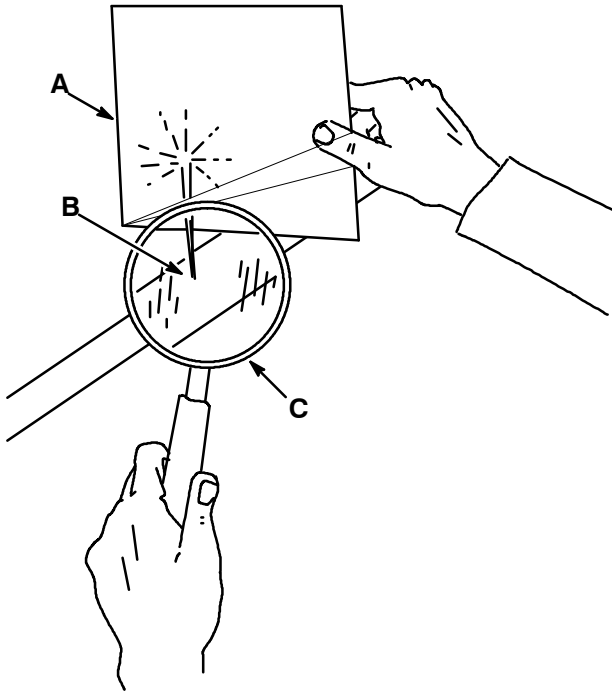
SPEED LIMITER CAM

03776

- A. Cam
- B. Directional Control Pedal

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.



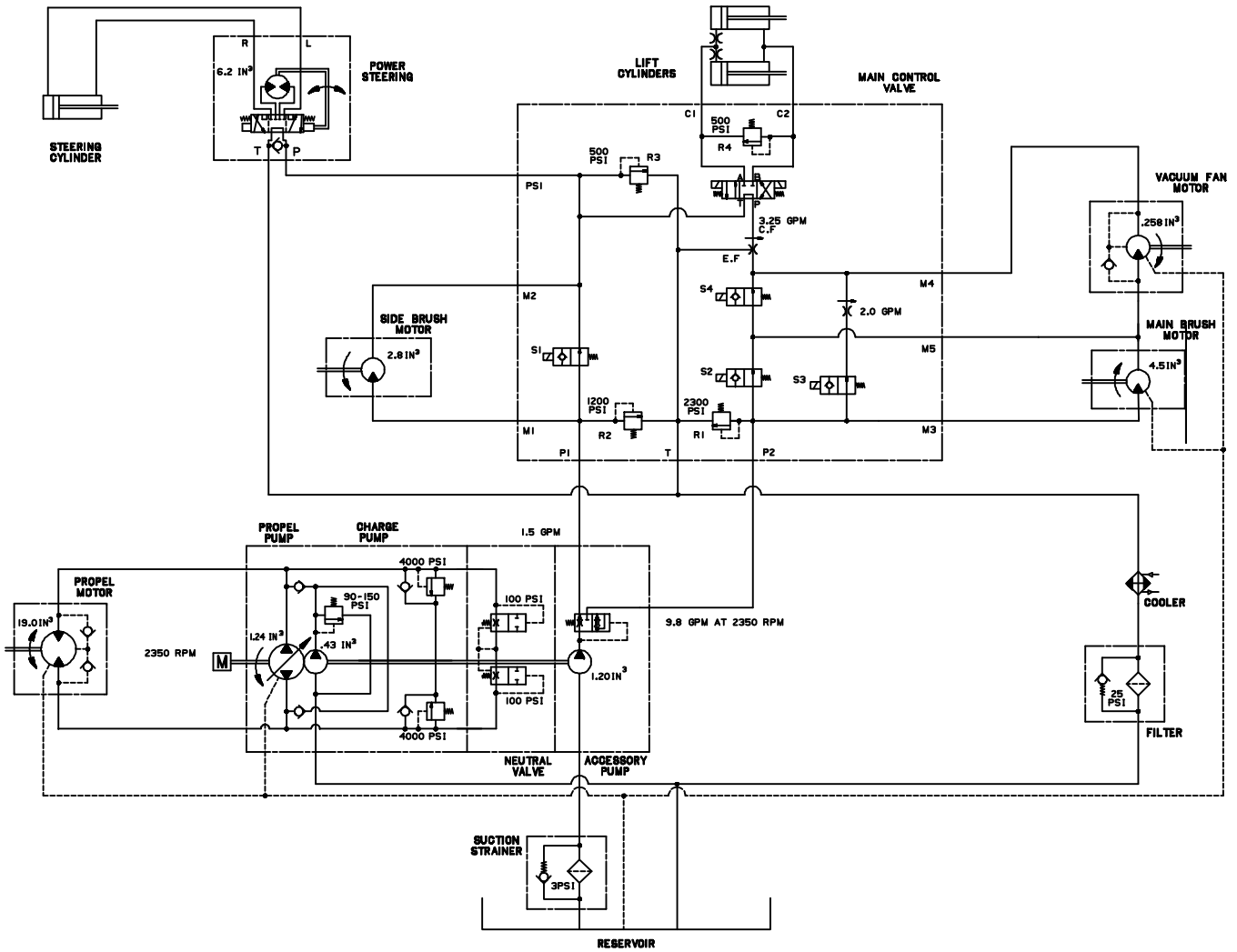
00002

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.

⚠ WARNING: Leaking hydraulic fluid under pressure can penetrate skin. Severe infection or death can result. Do not use body to locate leak. Use cardboard to locate leak.



HYDRAULIC SCHEMATIC

03767

HYDRAULIC SYSTEM TROUBLESHOOTING

Problem	Cause	Remedy
Main brush does not turn. Everything else works fine.	Bad coil at S2.	Replace coil.
	Bad seal at S2.	Replace seal.
	Bad electrical connection at S2.	Remake connection.
	Circuit breaker tripped CB-5.	Reset circuit breaker CB-5. Look for short circuit.
	Bad electrical relay M4.	Replace electrical relay M4.
	Hopper lift micro-switch not operating.	Check connection at micro-switch. Check adjustment of hopper and fan inlet bracket.
	Main brush micro-switch not operating.	Check connections at micro-switch on main brush handle.
	Bad relief valve at R1.	Replace relief cartridge R1.
Two speed function of main brush and vacuum fan does not work. Operates at slow speed only.	Bad coil at S3.	Replace coil.
	Cartridge stuck open at S3.	Replace cartridge.
	Bad electrical connection at S3.	Remake connection.
	Two-speed rocker switch not working.	Replace rocker switch or check electrical connections.
	Circuit breaker tripped CB-5.	Reset circuit breaker CB-5. Look for short circuit.
Vacuum fan does not turn. Everything else works fine.	Bad coil at S4.	Replace coil.
	Cartridge stuck open at S4.	Replace cartridge.
	Bad seal at S4.	Replace seal.
	Bad electrical connection at S4.	Remake connection.
	Hopper lift micro-switch not operating.	Check connection of micro-switch at hopper.
	Thermo-Sentry™ indicator tripped.	Reset Thermo-Sentry™ switch or replace it.
	Vacuum fan rocker switch not operating.	Replace rocker switch or check electrical connections.
Main brush and vacuum fan does not turn. Hopper does not lift.	Relief valve R1 is stuck open.	Replace valve R1.
	Circuit breaker tripped CB-5.	Reset circuit breaker CB-5.

MAINTENANCE

Problem	Cause	Remedy
Hopper lifts slow or does not lift at all.	Priority flow control F2 is stuck in shifted position.	Clean or replace control F2.
	Four-way, three-position solenoid valve has bad coil, or spool is stuck.	Manually shift valve, if hopper operates properly when manually shifted but not when electrically shifted, check electric circuit and coils. Replace coils or valve if necessary.
	Relief valve R4 has contamination holding poppet off its seat.	Clean or replace valve R4.
	Bad electrical connection at solenoid valve.	Remake connections at both coils.
Side brush does not turn.	Priority flow control pump is stuck.	Clean or replace valve in pump or replace entire pump.
	Bad coil at S1.	Replace coil.
	Cartridge stuck open at S1.	Replace cartridge.
	Bad seal at S1.	Replace seal.
	Relief valve R2 has contamination holding poppet off its seat.	Clean or replace R2.
	Bad electrical connection.	Remake connection.
	Side brush micro-switch not operating.	Check connection or replace micro-switch at side brush handle.
Power steering stiff. Not functioning properly.	Bad relay M4.	Replace relay M4.
	Relief valve R2 has contamination holding poppet off seat.	Clean or replace valve R2.
	Relief valve R3 has contamination holding poppet off seat.	Clean or replace valve R3.

ENGINE

ENGINE LUBRICATION

Check the engine oil level daily. Change the engine oil and oil filter after every 50 hours of operation. Use only SAE-SE/SF rated engine oil.

The following SAE-SE/SF rated oil grades are recommended for engines during changing seasonal temperatures:

MULTI-VISCOSITY OILS

Below 32°F (Below 0°C) 5W 30	-10° to 90°F (-23° to 32°C) 10W 30	-10° to above 90°F (-23 to above 32°C) 10W 40	Above 10°F (Above -12°C) 20W 40
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SINGLE VISCOSITY OILS

-10° to 32°F (-23° to 0°C) 10W	10° to 60°F (-12° to 16°C) 20W 20	32° to 90°F (0° to 32°C) 30	Above 60°F (Above 16°C) 40
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The engine oil capacity is 3.5 qt (3.3 L) including the oil filter.

COOLING SYSTEM

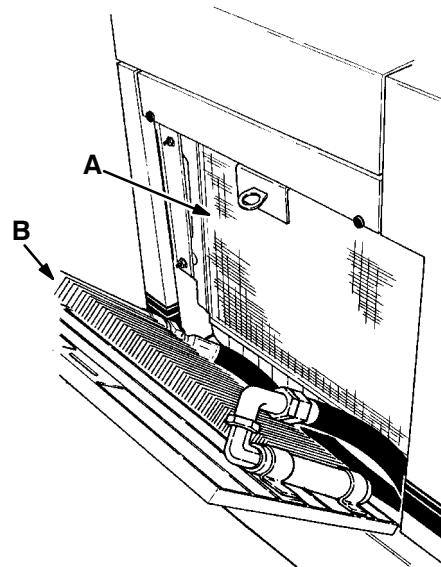
Maintaining cooling system efficiency is important. Engine temperatures must be brought up to and maintained within the satisfactory range for efficient operation. However, the engine must be kept from overheating in order to prevent damage to the valves, pistons, and bearings. Check the radiator coolant level after every 100 hours of operation.

Use soft, clean water mixed with permanent-type, ethylene glycol antifreeze in a one-to-one ratio to fill the cooling system. Deposits of sludge, scale, and rust prevent normal heat transfer. Flush the radiator and the cooling system after every 800 hours of operation, using a dependable cleaning compound. Follow the mixing procedure recommended by the compound manufacturer. This is important because of the difference in concentration and composition of the cleaning compounds. After cleaning, flush the system with clean water.

Whenever a cooling system is badly rust-clogged, as indicated by overflow loss or abnormally high operating temperatures, corrective cleaning by reverse flow flushing will most effectively remove the heavy deposits of sludge, rust, and scale. The reverse flow flushing should be performed immediately after draining the cleaning solution. Flush the radiator first, then the engine, to allow the engine to cool as much as possible.

Engine overheating may also be caused by dirty radiator fins. The exterior fins of the radiator can be cleaned with an air hose. Clean the radiator exterior after every 100 hours of operation or sooner if operating in a dusty environment.

Blow all dust, which may have collected on the radiator, in through the grill and radiator fins, opposite the direction of normal air flow. A tilt-out hydraulic cooler is provided to aid cleaning. Use care not to bend the cooling fins when cleaning. Clean thoroughly to prevent caking dust.



TILTED-OUT COOLER

02468

- A. Radiator**
- B. Hydraulic Cooler**

Clean the radiator and cooler after they have cooled to avoid cracking.

The engine is equipped with a 180° F (82° C) thermostat. Normal engine temperature is 200° F (93° C); temperatures up to 220° F (104° C) are allowable; temperatures over 200° F (93° C) indicate a problem exists.

MAINTENANCE

A pressure cap is used on the radiator to prevent overflow loss of water during normal operation. The spring-loaded valve in the cap closes the outlet to the overflow pipe of the radiator and thus seals the system. Pressure developing within the system raises the boiling point of the coolant and allows higher temperatures without overflow loss from boiling. The pressure valve opens at 7 psi (50 kPa), allowing steam and water to pass out the overflow pipe.

⚠ WARNING: Hot engine coolant. Scalding can result. Do not open radiator cap or service cooling system until radiator and engine is cool to the touch.

ATTENTION! Never pour cold water or cold antifreeze into the radiator of an overheated engine. Allow the engine to cool to avoid cracking the cylinder head or block. Keep the engine running while adding water.

AIR INTAKE SYSTEM

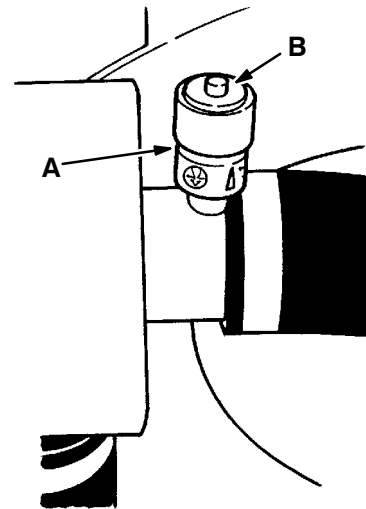
The importance of maintaining an air filter cannot be overemphasized. Dirt ingested through improperly installed, improperly serviced, or inadequate air filter elements wears out more engines than long hours of operation. Even a small amount of dirt will wear out a set of piston rings in just a few hours. Operating with a clogged air filter element also causes the fuel mixture to be richer, which can lead to formation of harmful sludge deposits in the engine. Always cover the air intake when the air filter is removed for servicing. Do not neglect servicing the air filter. Use only approved replacement parts. Keep all other air intake components secure and in good condition to prevent entrance of unfiltered air.

Over-maintenance can cause more damage than good. Removing the air filter element more often than is needed allows contaminants to enter the engine unnecessarily. Clean or replace the air filter element only when the restriction indicator indicates excessive restriction in the system.

AIR FILTER SERVICE INDICATOR

The air filter service indicator signals when to clean or replace the air filter element. Check the service indicator daily. The red line will move on the scale as the air filter element fills with dirt. Do not clean or replace the air filter element until the red line reaches 20 in H₂O (5 kPa) and the “Service when Red” window is filled with red. The service indicator red line may return to a lower reading on the scale when the engine is shut off. The red line will return to a correct reading when the engine is started.

Clean or replace the filter element when the service indicator reads 20 in H₂O (5 kPa). After cleaning or replacing the air filter element, reset the service indicator by pushing the reset button on the end of the indicator.



AIR FILTER SERVICE INDICATOR

02172

- A. Service Indicator**
- B. Indicator Reset Button**

AIR FILTER

The engine air filter housing includes a dust cap and a dry cartridge-type air filter element. The dust cap must be emptied of dirt daily. The air filter element must be cleaned and inspected or replaced whenever the air filter service indicator reads 20 in H₂O (5 kPa). The filter element must be replaced if it is damaged or has been cleaned three times.

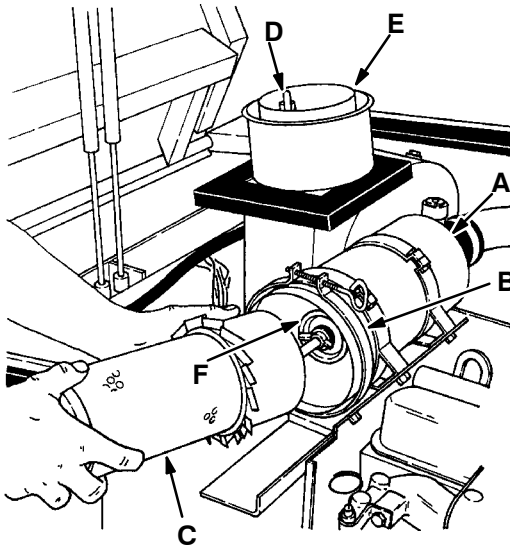
Service the air filter element only when the air filter service indicator shows excessive restriction in the system. Do not remove the air filter element unless it is restricting air flow.

TO REPLACE AIR FILTER ELEMENT

1. Stop the engine 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 left side and top engine access doors.
3. Unscrew the clamp ring on the filter.
4. Remove the dust cap.
5. Empty the dust cap.
6. Remove the filter wing nut.
7. Gently pull the filter element out of the filter housing.



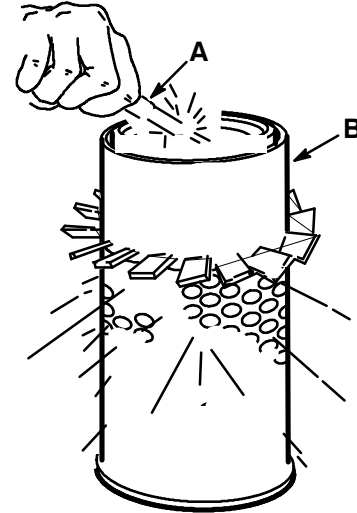
REMOVING AIR FILTER ELEMENT

- A. Filter Housing
- B. Clamp Ring
- C. Filter Element
- D. Wing Nut
- E. Dust Cap
- F. Safety Air Filter Element

NOTE: Machines with heavy-duty air cleaner accessory have a safety filter element. The safety filter element should be replaced, not cleaned, after the regular element has been damaged or has been cleaned three times.

8. Clean the interior of the air cleaner housing with a damp cloth. Clean the element housing sealing surfaces.
9. Using an air hose, direct dry, clean air maximum 30 psi (205 kPa) up and down pleats on the inside of the filter. Do not rap, tap, or pound dust out of the element.

! WARNING: Air or water under pressure. Severe eye or ear injury can result. Wear eye and ear protection.



CLEANING AIR FILTER ELEMENT

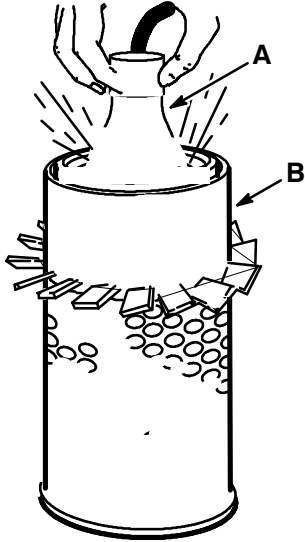
- A. Air Hose
- B. Filter Element

00051

02173

MAINTENANCE

10. After cleaning the air filter element, inspect it for damage by placing a bright light inside. The slightest rupture requires replacement of the filter. Clean and inspect the seals on the ends of the element. They should be unbroken and flexible. Remember, the element must be replaced after it has been cleaned three times.



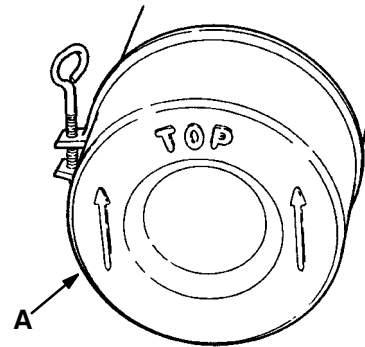
INSPECTING AIR FILTER ELEMENT

03500

- A. Bright Light**
- B. Filter Element**

11. Install the new or cleaned filter element so the fins on the element are at the intake end of the air cleaner. Use care so the fins are not damaged. Make sure the element is seating evenly. Tighten the filter wing nut.

12. Install the dust cap with the arrows pointing up. Tighten the clamp ring to hold it in place. Check all intake hose connections for leaks or abrasion.



DUST CAP

02492

- A. Dust Cap**

13. Reset the air filter service indicator.
14. Close the access doors.

FUEL SYSTEM – GASOLINE

FUEL FILTER

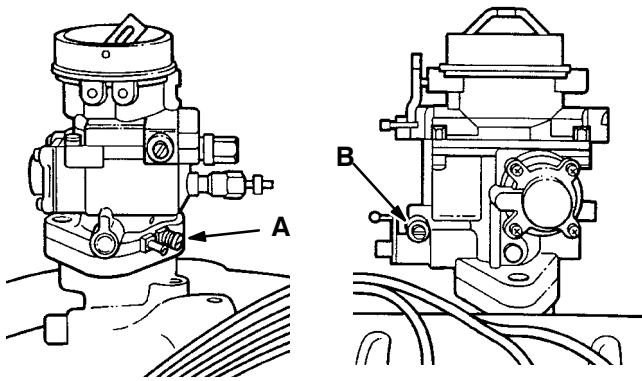
The fuel filter traps fuel impurities. The filter is located bear the fuel tank. Replace the fuel filter when needed.

CARBURETOR

The carburetor has two basic adjustments. Those adjustments are idle fuel mixture and idle speed. Check and adjust idle fuel mixture and idle speed after every 400 hours of operation. The idle fuel mixture is controlled by a screw located on the front of the carburetor. Turning the screw in, clockwise, leans the fuel mixture. Turning the screw counterclockwise, richens the fuel mixture.

FOR SAFETY: When servicing machine: avoid moving parts. Do not wear loose jackets, shirts, or sleeves when working on machine.

The idle speed is controlled by a screw located on the side of the carburetor next to the throttle linkage. Turning the screw clockwise increases engine speed. Turning the screw out, counterclockwise, decreases engine speed. Proper idle speed is 950 ± 50 rpm with all accessories in the “off” position.



CARBURETOR ADJUSTING SCREWS

- A. Idle Fuel Mixture Adjusting Screw
- B. Idle Speed Adjusting Screw

WARNING: Fuel vapor is present when servicing fuel system. Fire or explosion can result. Keep flames and sparks away.

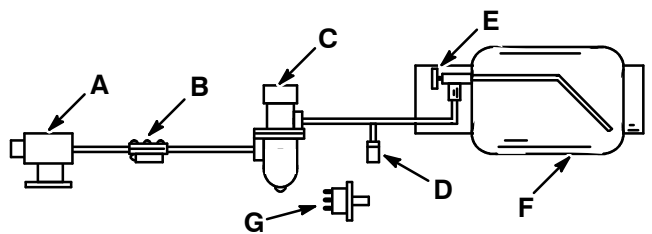
FUEL SYSTEM – LPG

LPG FUEL SYSTEM

The liquid withdrawal LPG fuel system consists of five components which are: the LPG fuel tank, pressure relief valve, fuel filter lock, vaporizer-regulator, and the carburetor.

Liquid LPG fuel flows from the LPG tank, under its own pressure, to the pressure relief valve. This valve is normally closed, preventing LPG fuel from escaping into the atmosphere. The valve opens to relieve pressure if the fuel pressure exceeds system limits. From the pressure relief valve, the liquid LPG fuel is piped to the fuel filter lock. The fuel filter lock filters unwanted tank scale and deposits out of the LPG fuel. The fuel filter lock also stops the flow of LPG fuel when the engine is not operating. The oil pressure switch controls the fuel filter lock. When the engine oil pressure is 4 psi (30 kPa) or greater, the oil pressure switch permits an electrical current to open the fuel filter lock which allows LPG fuel to flow on to the vaporizer-regulator. The oil pressure switch is bypassed when the engine is being started, allowing LPG fuel to flow.

The vaporizer section of the vaporizer-regulator converts the liquid LPG fuel into a gaseous LPG fuel. From the vaporizer section, the gaseous LPG fuel is sent to the primary regulator section of the vaporizer-regulator. The primary regulator section reduces the pressure of the LPG fuel. The secondary regulator section reduces the LPG fuel pressure to the level required by the carburetor. From the vaporizer-regulator, the LPG fuel is sent to the carburetor where it is finally metered into the air flow which is sent to the engine combustion chamber.



LPG FUEL SYSTEM

- A. Carburetor
- B. Vaporizer-Regulator
- C. Fuel Filter Lock
- D. Pressure Relief Valve
- E. Tank Service Valve
- F. LPG Fuel Tank
- G. Oil Pressure Switch

MAINTENANCE

Never operate an LPG powered machine if the LPG fuel system is leaking, or if any component in the fuel system is malfunctioning. Operating the machine under either of these conditions may cause a fire or explosion.

Check for frosting. If frosting occurs on or near any LPG component, there is a possibility of an LPG fuel leak or a malfunctioning component. To locate the leak, apply a soapy water solution to the suspected area. Watch for forming bubbles in the suspected area. This area may have an LPG fuel leak. Repair or replace the part. Use Loctite brand Stainless Steel PST thread sealant when reassembling. This epoxy-type sealant is not affected by aging or high humidity. Be sure to follow application directions and apply proper torque when reconnecting fittings. Never bypass safety components except to test. If the safety components are defective, replace them before operating the machine.

Check routings of all LPG hoses. Keep them away from sharp edges, exhaust manifolds, or other hot surfaces. Check for signs of abrasion or deterioration. Replace hoses found to be worn or damaged.

FUEL TANKS

The LPG fuel tanks should be inspected for sharp dents, gouges, leaks, and broken protecting rings whenever the tanks are refilled. All tank valves must be inspected for leaks using a soap solution. Valves must also be checked for dirt, paint, or other debris in the valve openings. The following specific checks must also be made:

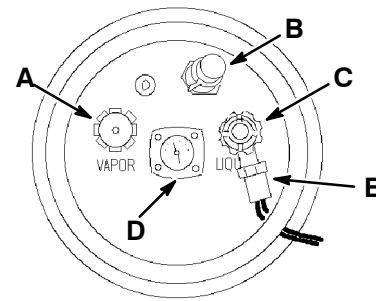
Filler Valve – Check for proper functioning and the presence of the handwheel. Valve must be closed except during filling.

Vapor and Liquid Tank Service Valves – Check for proper functioning and presence of the handwheel. The valve must be closed except when in service.

Tank Service Valve Coupling – Check for proper functioning, thread condition, and damaged or missing washers or o-rings.

Safety Relief Valve – Check for damage. Check for the presence of the relief valve elbow and the proper direction of the elbow. If the rain cap is missing, check for foreign matter and replace the rain cap. Do not tamper with the relief valve setting.

Magnetic Liquid Level Gauge – Check operation against the maximum filling point as determined by weight.



03485

TYPICAL LPG LIQUID WITHDRAWAL FUEL TANK

- A. Filler Valve**
- B. Safety Relief Valve**
- C. Liquid Tank Service Valve**
- D. Magnetic Liquid Level Gauge**
- E. Tank Service Valve Coupling**

An LPG fuel tank with any of the stated defects must be removed from service and be repaired or destroyed accordingly.

If an LPG fuel tank is damaged or leaking, it should be removed to a designated safe area, and the proper personnel should be notified. Do not attempt to make repairs to the tank, regardless of condition. Repairs or disposal must only be made by qualified personnel.

The care an LPG fuel tank receives has a direct bearing on how long that tank can be used safely. LPG fuel tanks must not be dropped or dragged across any surface. To move LPG fuel tanks, use a hand truck or roll the tank on its foot ring while it is being held in a position slightly off vertical.

Whether the storage is inside or outside, fuel tanks should not be stored in the vicinity of combustible materials or high temperature sources such as ovens and furnaces, since the heat may raise the pressure of the fuel to a point where the safety relief valves would function. Take care to insure that the tanks are stored in such a way that if the safety relief valves do function, they will relieve vapor, rather than liquid.

Valves on empty tanks must be closed during storage and transportation.

Similar precautions should be taken in storing machines fitted with LPG fuel tanks. The machines may be stored or serviced inside buildings, provided there are no leaks in the fuel system and the tanks are not overfilled. While machines are being repaired inside a building, the shut-off valve on the tank must be closed, except when the engine must be operated.


Changing the tank is a chance for the machine operator to carefully check the tank, fittings, and the fuel lines and fittings. If abnormal wear is detected, the operator should report the findings to the appropriate personnel.

TO CHANGE AN LPG FUEL TANK


1. Park the machine in a designated safe area. Set the machine parking brake.

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

2. Close the tank service valve.
3. Operate the engine until it stops from lack of fuel.

 **WARNING: Fuel vapor is present when servicing fuel system. Fire or explosion can result. Keep flames and sparks away.**

4. Put on gloves and remove the quick-disconnect tank coupling.

 **WARNING: LPG fuel is very cold. Frostbite can result. Wear gloves when connecting or disconnecting LPG hoses.**

5. Inspect the LPG fuel lines for wear or damage.
6. Remove the empty LPG fuel tank from the machine.
7. Check the tank for damage or wear.
8. Store the tank in a designated safe area.
9. Select a filled LPG fuel tank and inspect it for damage or leaks.

NOTE: Make sure the LPG fuel tank matches the fuel system (liquid tank with liquid system).

10. Carefully place the LPG tank in the machine so that the tank centering pin enters the aligning hole in the tank collar.

NOTE: If the pin cannot be engaged, make sure you have the correct LPG fuel tank and then adjust the pin locator in or out.

11. Fasten the tank hold-down clamp to lock the tank in position.
12. Connect the LPG fuel line to the tank service coupling. Make sure the service coupling is clean and free of damage. Also make sure it matches the machine service coupling.
13. Open the tank service valve slowly and check for leaks. If an LPG leak is found, close the service valve immediately and notify the appropriate personnel.
14. If no leaks are found, the engine is ready to start.

FUEL FILTER LOCK

The fuel filter lock filters the LPG fuel. The fuel filter lock also stops the flow of LPG fuel to the engine when the engine is not operating, or when the engine oil pressure is less than 4 psi (30 kPa).

Replace the fuel filter lock filter pack with the filter pack replacement kit if diminished gas flow indicates the filter is clogged. A drain plug is provided for purging the filter bowl. Clean out the bowl when replacing the filter pack.

VAPORIZER-REGULATOR

If any malfunction is noted, completely disassemble the vaporizer-regulator. Clean all of the parts in alcohol. Inspect all of the parts and replace where needed. Carefully reassemble the vaporizer-regulator with the seal repair kit. Check for proper operation.

MAINTENANCE

CARBURETOR

If any malfunction is noted, completely disassemble the carburetor. Clean all of the parts in alcohol.

Inspect all of the parts and replace when needed. Carefully reassemble the carburetor with the seal repair kit.

OIL PRESSURE SWITCH

The engine oil pressure switch requires no regular maintenance. Never bypass the oil pressure switch as this is a safety feature which prevents LPG fuel from flowing when the engine is not operating properly.

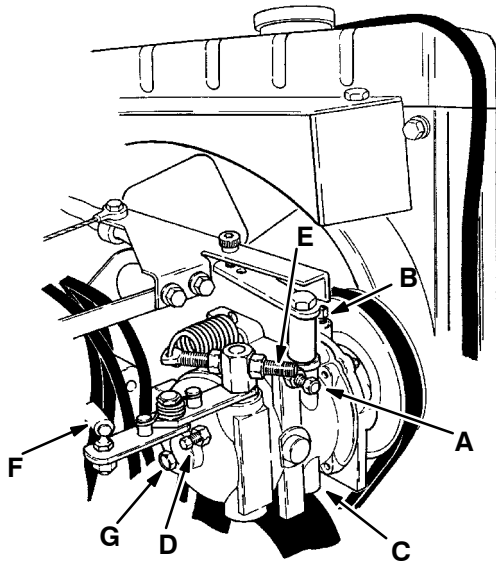
LPG FUEL TROUBLESHOOTING

Problem	Cause	Remedy
Engine will not start.	Out of fuel.	Replace fuel tank with full one.
	Service valve opened too quickly – engaging safety valve.	Close valve and reopen slowly.
	Plugged fuel filter.	Replace filter.
	Kinked or restricted fuel line.	Straighten or replace fuel line.
	Engine out of tune.	Tune-up engine.
	Oil pressure switch failure.	Replace oil pressure switch.
	Fuel lock valve failure.	Repair or replace fuel filter lock.
Vaporizer-regulator failure.	Repair or replace vaporizer – regulator.	
Engine runs unevenly or lacks power.	Wrong type of fuel tank – vapor withdrawal tank.	Replace vapor withdrawal tank with liquid withdrawal tank.
	Plugged fuel filter lock.	Replace filter pack.
	Kinked or restricted fuel line.	Straighten or replace fuel line.
	Engine out of tune.	Tune-up engine.
	Restricted air filter.	Clean or replace air filter element.
Vaporizer-regulator out of adjustment.	Adjust vaporizer-regulator.	

GOVERNOR (For machines below serial number 007000)

The governor controls engine speed. It is driven by a belt which spans the crankshaft sheave.

The governor is oil filled. It requires no regular inspections. Change the oil when performing major engine work. Use an SAE rated 10W30 or 10W40 engine oil.



GOVERNOR

03723

- A. High Speed Stop Screw**
- B. Oil Fill Plug**
- C. Governor**
- D. Surge Screw**
- E. Regulation Screw**
- F. Throttle Rod**
- G. Oil Level Plug**

The governor is factory set and should not be adjusted unless the engine speed varies from the specification or if the engine surges. The governor should be set so the engine operates at 2400 ± 50 rpm at “full” speed setting under load. A surge screw has been provided to compensate for surging — adjust it with care or governor damage may result. The regulation screw has been factory set and should not be tampered with.

TO ADJUST GOVERNOR (For machines below serial number 007000)

1. Operate the engine until it reaches normal operating temperature.
2. Park the machine on a level surface, stop the engine, 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. Check the fan belt tension as described in *ENGINE FAN BELT (For machines below serial number 007000)*.
4. Place the throttle control lever in the “high” position. There should be a 0.03 to 0.06 in (1 to 2 mm) space between the carburetor lever and the lever stop. Adjust the throttle rod as required.
5. Move the throttle control lever to the “idle” position. Start the engine and adjust the engine idle speed screw so the engine operates at 950 ± 50 rpm.
6. Lower and start the main brush and side brush rotating. Adjust the high speed stop screw so the engine operates at 2350 rpm. Then adjust the surge screw to bring the engine speed to 2400 rpm. Tighten all locknuts.

FOR SAFETY: When servicing machine: avoid moving parts. Do not wear loose jackets, shirts, or sleeves when working on machine.

7. Stop the engine.
8. Check and adjust the throttle cable position to allow full linkage movement.

GOVERNOR (For machines serial number 007000 and above)

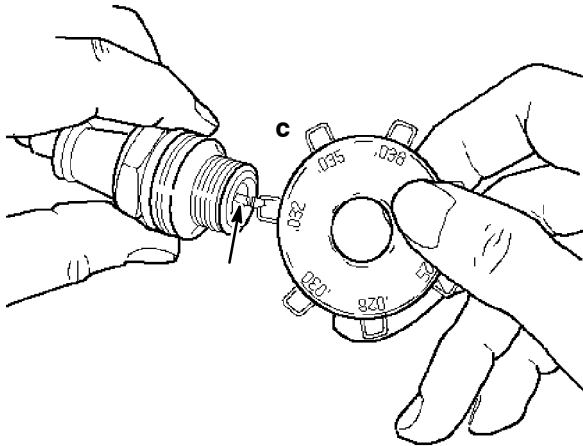
The electronic governor controls engine speed. The governor consists of a control box located to the left of the operator under the throttle switch, and an actuator mounted on the engine. The control box regulates the actuator, which in turn controls the throttle.

The electronic governor is factory set and is not user serviceable.

ELECTRICAL SYSTEM

SPARK PLUGS

Clean or replace and adjust spark plugs after every 400 hours of operation. A wire gauge is best for checking the spark plug gap. A flat gauge should not be used unless the electrode surfaces have been dressed with a small file to get parallel surfaces between the center and side electrodes. Set the spark plug gap by bending the side electrode. All spark plugs, new or used, should have the gaps checked and reset if necessary.



01174

GAPPING THE SPARK PLUG

- A. Spark Plug
- B. Gapping Tool
- C. Side Electrode
- D. Center Electrode

The proper spark plug gap is 0.032 in (0.8 mm) for machines below serial number 007000. The proper spark plug gap is 0.039 in (1 mm) for machines serial number 007000 and above.

To get good performance from the spark plugs, follow these steps when installing the plugs:

1. Clean the spark plug seat in the cylinder head.
2. Use a new seat gasket and screw the plug in by hand.
3. Tighten the spark plugs to 22 to 28 ft lb (30 to 38 Nm) with a socket wrench of the correct size.

DISTRIBUTOR (For machines below serial number 007000)

The distributor operation is vital to the operation of the engine. The following items should be carefully inspected after every 400 hours of normal operation; however, dirt, dust, water, and high speed operation may cause more rapid wear and necessitate more frequent inspections:

1. Remove the distributor cap. Clean the cap and examine for cracks, carbon runners, or corroded terminals. If the vertical faces of the inserts are burned, install a new cap. If the horizontal faces of the inserts are burned, replace the cap and the rotor as this condition is caused by the rotor being too short.

NOTE: If replacing the rotor, be sure to use an overspeed rotor as indicated in the parts manual or it may damage the engine if the governor fails.

2. Check the centrifugal advance mechanism for "freeness" by turning the breaker cam in the direction of rotation and then releasing it. The advance springs should return the cam to its original position.
3. Lubricate the shaft felt, advance mechanism, breaker cam, and pivot. Make sure the breaker arm moves freely on its hinge. Special grease (with Moly) should be used sparingly on the breaker cam.

NOTE: Avoid excessive lubrication. Excess lubricant may get on the contact points and cause burning.

4. Clean and check or replace the ignition points and gap. If the points are pitted, burned, or worn to an unserviceable condition, install a new set of points. Badly pitted points may be caused by a defective or improper condenser capacity.

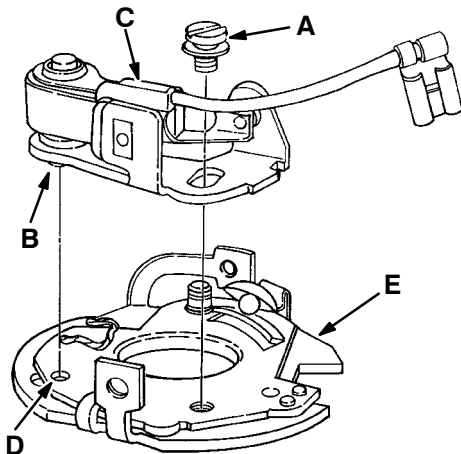
If the points are serviceable, they should be dressed down with a fine cut stone or point file. The file must be clean and sharp; never use emery cloth to clean contact points.

After filing, check the point gap and reset to 0.025 in (0.6 mm), 48° to 52° dwell. The breaker arm must be resting on the high point of the cam during this operation.

When replacing points, make sure they are aligned and make full contact. Bend the stationary arm to obtain proper alignment; do not bend the breaker arm.

TO REPLACE IGNITION POINTS (For machines below serial number 007000)

1. Remove the distributor cap and the rotor.
2. Disconnect the condenser wire from the ignition point assembly.

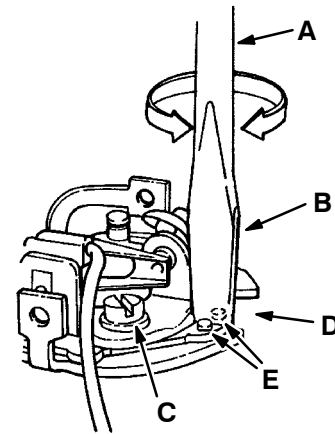


INSTALLING IGNITION POINTS

- A. Retaining Lockscrew
- B. Pin
- C. Ignition Point Assembly
- D. Hole
- E. Advance Plate

3. Remove the ignition points attaching screw and lift out the ignition point assembly.

4. Remove the condenser by removing the screw attaching the condenser to the distributor plate.
5. Install the new condenser.
6. Position the new ignition points on the advance plate and install the attaching screw.
7. Connect the condenser wire to the ignition points.
8. Adjust the ignition points to 0.025 in (0.6 mm). The dwell angle is 48° to 52°.



ADJUSTING IGNITION POINTS

- A. Screwdriver
- B. Screwdriver Blade
- C. Lockscrew
- D. Slot
- E. Boss

9. Replace the distributor cap and the rotor.

NOTE: If replacing the rotor, be sure to use an overspeed rotor as indicated in the parts manual or the engine will overspeed if the governor or governor belt fails.

00695

00694

MAINTENANCE

DISTRIBUTOR IGNITION TIMING (For machines below serial number 007000)

The distributor ignition timing must be checked with a timing light, using the timing points located on the front of the engine and the timing marks located on the crankshaft pulley. Distributor ignition timing should be checked after the first 50 hours of operation and after every 400 hours of operation thereafter.

To check and adjust the ignition timing with a scope, refer to the scope manufacturer's instructions. To check and adjust the timing with a timing light, proceed as follows:

TO CHECK AND ADJUST DISTRIBUTOR IGNITION TIMING (For machines below serial number 007000)

NOTE: Dwell angle must be correct or timing will not be accurate.

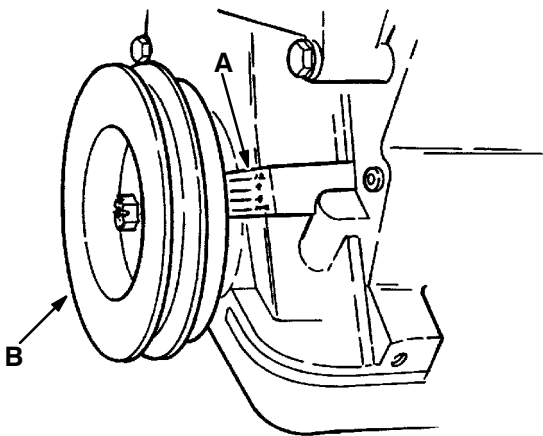
1. Stop the engine and set the machine parking brake.

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

2. Clean and mark the timing marks.

NOTE: Painting a white line on the front pulley timing marks will make them easier to see under the timing light.

3. Disconnect and plug the vacuum hose from the distributor.



ENGINE TIMING MARKS

00696

- A. Timing Pointer
- B. Crankshaft Pulley

4. Connect the timing light to the No. 1 cylinder spark plug wire. Connect a tachometer to the engine.

FOR SAFETY: When servicing machine: avoid moving parts. Do not wear loose jackets, shirts, or sleeves when working on machine.

5. Start the engine and reduce the idle speed to 600 rpm to be sure that the centrifugal advance is not operating. Adjust the initial ignition timing to 10° to 12° BTDC on gasoline engines, and 12° to 14° BTDC on LPG engines.

To advance the timing, turn the distributor body clockwise. To retard the timing, turn the distributor body counterclockwise.

6. Check the centrifugal advance for proper operation by starting the engine and accelerating it to approximately 2000 rpm. If the ignition timing advances, the centrifugal advance mechanism is functioning properly. Note the engine speed when the advance begins and the amount of total advance. Stop the engine.
7. Unplug the vacuum line and connect it to the distributor vacuum advance unit. Start the engine and accelerate it to approximately 2000 rpm. Note the engine speed when the advance begins and the total amount of advance. Advance of the ignition timing should begin sooner and advance farther than when checking the centrifugal advance alone. Stop the engine.
8. If the vacuum advance is not functioning properly, remove the distributor and check it on a distributor tester.
9. After adjusting timing, be sure to increase the engine idle speed to its normal setting.

ENGINE IGNITION TIMING (For machines serial number 007000 and above)

The ignition system does not require any mechanical external adjustments, however the spark plug high tension leads must be inserted correctly, if ever removed, at each numbered coil position to the corresponding spark plug number in the cylinder (front to rear #1, 2, 3, and 4).

The ESC module controls the timing position in the start mode at 10° BTDC until the rpm reaches 250 rpm, thereafter the sensors are processed and timing is set to be compatible with engine speed, crankshaft position, engine load, engine coolant temperature and overspeed by the module.

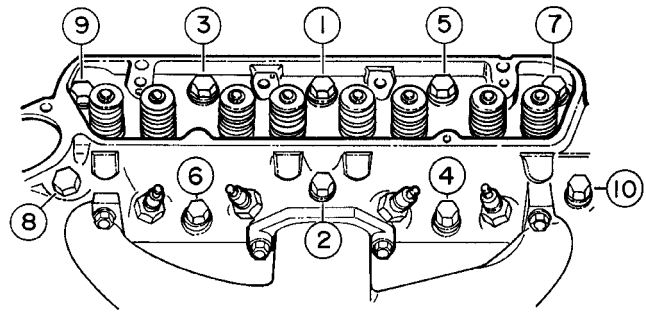
CYLINDER HEAD

CYLINDER HEAD

A three-stage torque procedure should be used when reassembling the cylinder head. The cylinder head bolts must be tightened after the first 50 hours of operation, for machines below serial number 007000, and seasonally thereafter for all machines.

Snug down cylinder head bolts in the proper sequence; first to 20 to 30 ft lb (27 to 41 Nm), then to 50 to 55 ft lb (68 to 75 Nm), and then to 65 to 70 ft lb (88 to 95 Nm).

Tighten the intake manifold bolts to 15 to 18 ft lb (20 to 24 Nm) after every 800 hours of operation.



00697

CYLINDER HEAD BOLT TIGHTENING SEQUENCE

The cylinder head bolts must be retorqued after the engine is put into operation and brought up to proper operating temperatures. To retorque head bolts, follow the correct sequence. Loosen one head bolt at a time one-quarter turn, 90 degrees; then retorque it to the correct value.

NOTE: Power wrench torque limit must be held at least 10 ft lb (14 Nm) below hand torque specification; then hand torque to the specifications.

MAINTENANCE

VALVE TAPPET CLEARANCE

The valve tappet clearance must be checked and adjusted if necessary after every 400 hours of operation.

To set the valve clearance, rotate the crankshaft until No. 1 cylinder is at the top of the compression stroke. Check the timing marks. It should read 0 or TDC. Both valves on No. 1 cylinder are now closed. Set the valve clearance on both valves. Next, rotate the crankshaft 180°, and set the valve lash on both valves on No. 2 cylinder. Again rotate the crankshaft 180°, and set the valve lash on both valves on No. 4 cylinder. Rotate the crankshaft another 180°, and set the valve lash on both valves on No. 3 cylinder.

Check and adjust, for machines below serial number 007000, the intake valve clearance from 0.008 to 0.010 in (0.20 to 0.25 mm) and the exhaust valve clearance from 0.018 to 0.020 in (0.45 to 0.50 mm) while the engine is cold.

Check and adjust, for machines serial number 007000 and above, the intake valve clearance from 0.009 in (0.22 mm) and the exhaust valve clearance from 0.013 in (0.32 mm) while the engine is cold.

CRANKCASE VENTILATION SYSTEM

Clean the crankcase ventilation hoses, tubes, and fittings and replace the PCV valve after every 400 hours of operation.

TUNE-UP CHART

Idle speed	950 ± 50 rpm
Maximum governed speed, under load	2350 ± 50 rpm
Maximum governed speed, no load	2700 ± 100 rpm
Spark plug gap (For machines below serial number 007000)	0.032 in (0.8 mm)
Spark plug gap (For machines serial number 007000 and above)	0.039 in (1 mm)
Ignition point gap (For machines below serial number 007000)	0.025 in (0.6 mm)
Dwell angle (For machines below serial number 007000)	48° to 52°
Timing (For machines below serial number 007000)	10° to 12° BTDC @ 600 rpm, gasoline 12° to 14° BTDC @ 600 rpm, LPG
Firing order counter-clockwise rotation	1-2-4-3,
Valve clearances, cold (For machines below serial number 007000)	0.008 to 0.010 in (0.20 to 0.25 mm) intake 0.018 to 0.020 in (0.45 to 0.50 mm) exhaust
Valve clearances, cold (For machines serial number 007000 and above)	0.009 in (0.22 mm) intake 0.013 in (0.32 mm) exhaust

ELECTRICAL SYSTEM

BATTERY

The battery is rated at 12 V, 475 ccA. It is located under the operator foot plate. When removing battery cables, remove the negative (-) cable before the positive (+) cable.

Do not allow the battery to remain in discharged condition for any length of time. Do not operate the machine if the battery is in poor condition or with only 25% of charge left.

Clean the top surface and the terminals of the battery periodically. Use a strong solution of baking soda and water. Brush the solution sparingly over the battery top, terminals, and cable clamps. Do not allow any baking soda solution to enter the battery. Use a wire brush to clean the terminal posts and the cable connectors. After cleaning, apply a coating of clear petroleum jelly to the terminals and the cable connectors. Keep the top of the battery clean and dry.

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

The electrolyte level in regular non-sealed batteries can be checked. It must always be above the battery plates. Add distilled water to maintain solution at the correct level above the plates, but do not overfill. Never add acid to batteries, only distilled water. Keep vent plugs firmly in place at all times, except when adding water or taking hydrometer readings.

 **WARNING: Battery acid causes severe burns. Avoid contact. Wash immediately and get medical attention if contact occurs.**

If when checking battery specific gravity, 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 this chart:

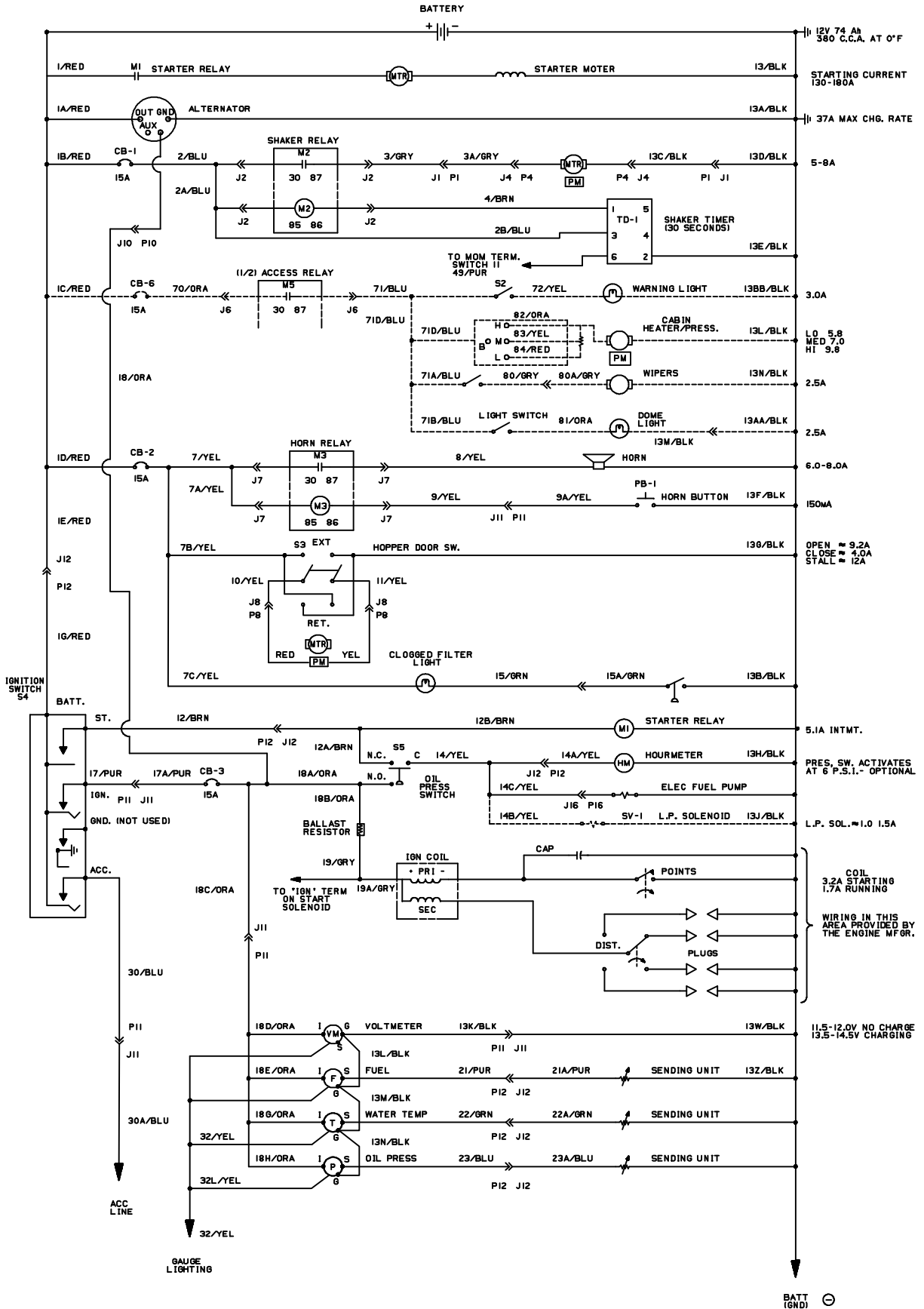
SPECIFIC GRAVITY at 80° F (27° C)	BATTERY CONDITION
1.260 – 1.280	100% charged
1.230 – 1.250	75% charged
1.200 – 1.220	50% charged
1.170 – 1.190	25% charged
1.110 – 1.160	Discharged

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):

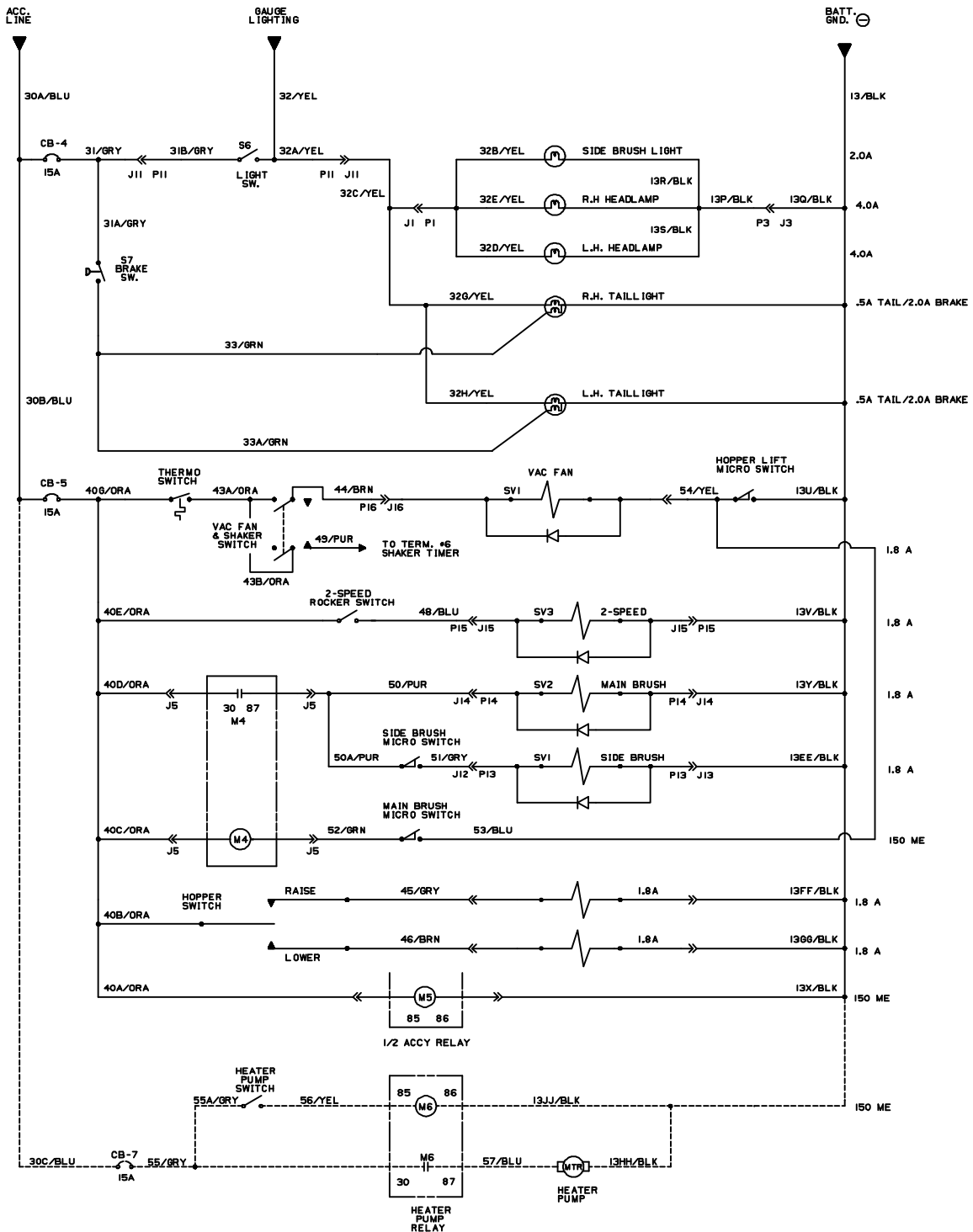
Add to the specific gravity reading 0.004, 4 points, for each 10° F (5° C) above 80° F (27° C).

Subtract from the specific gravity reading 0.004, 4 points for each 10° F (5° C) below 80° F (27° C).



ELECTRICAL SCHEMATIC
(For machines below serial number 007000)

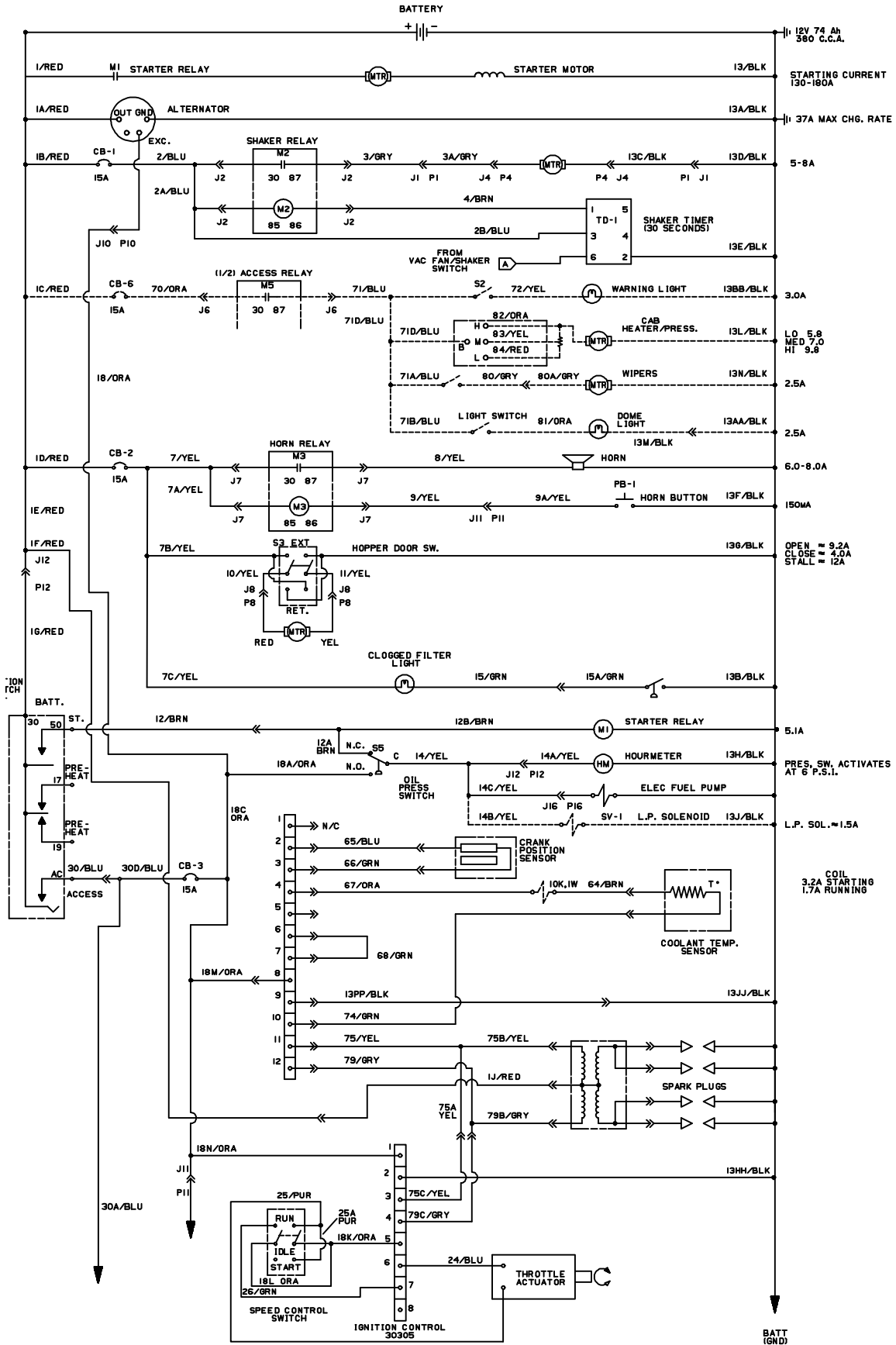
03768



LEGEND	
M	POWER RELAY
MTR	MOTOR
CB	CIRCUIT BREAKER
PM	PERMANENT MAGNET
J	JACK-FEM. SOCKET
P	PLUG-MALE PIN
PB	PUSHBUTTON
VM	VOLTMETER
HM	POWER RELAY
SV	SOLENOID VALVE
S	SWITCH
ACC	ACCESSORY
GND	GROUND, CHASSIS
C	COMMON
N.O.	NORMALLY OPEN
N.C.	NORMALLY CLOSED

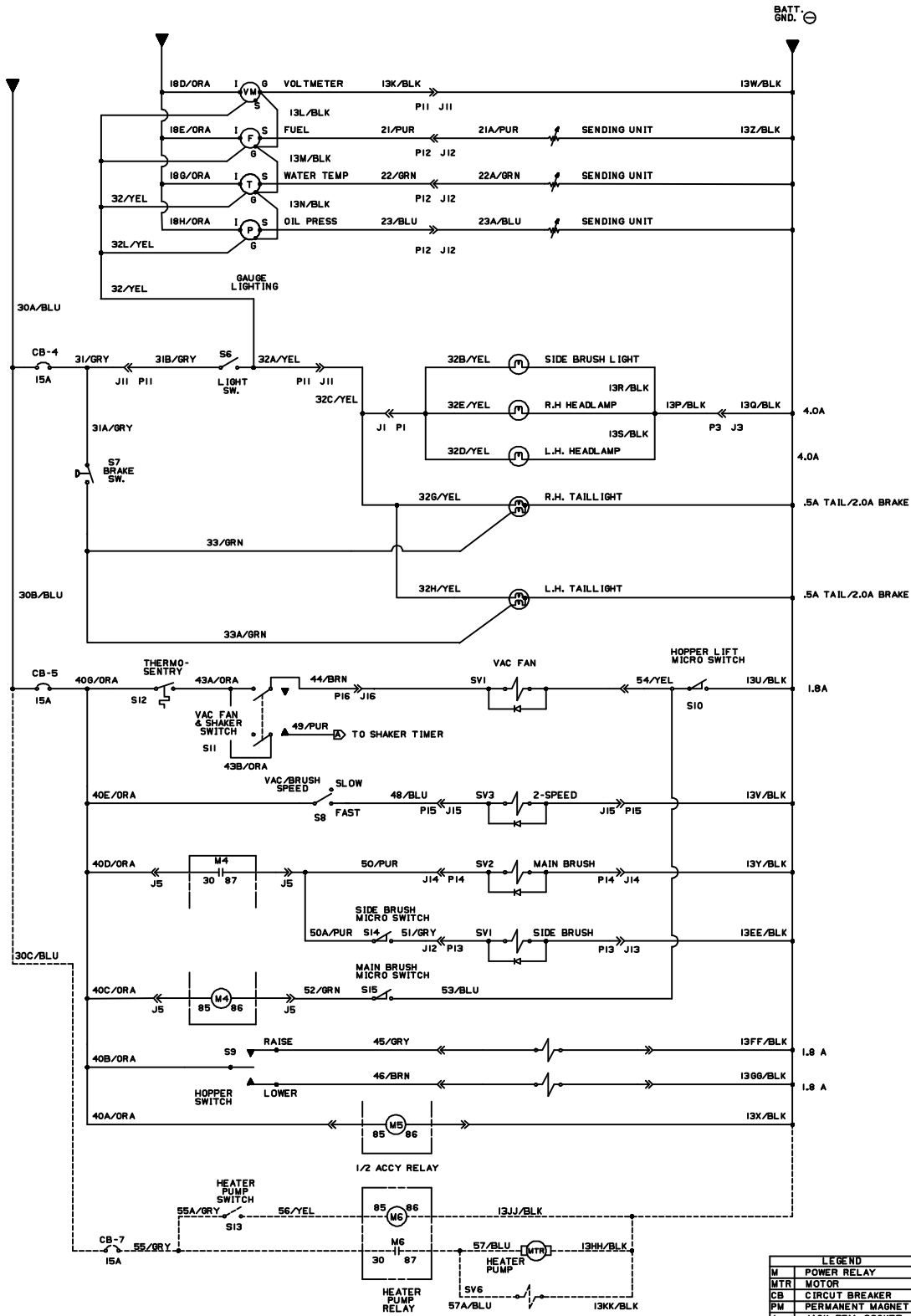
ELECTRICAL SCHEMATIC
(For machines below serial number 007000)

03768



ELECTRICAL SCHEMATIC
(For machines serial number 007000 and above)

03768



LEGEND	
M	POWER RELAY
MTR	MOTOR
CB	CIRCUIT BREAKER
PN	PERMANENT MAGNET
J	JACK-FEM. SOCKET
P	PLUG-MALE PIN
PB	PUSHBUTTON
VM	VOLTMETER
HM	POWER RELAY
SV	SOLENOID VALVE
S	SWITCH
ACC	ACCESSORY
GN	GROUND, CHASSIS
C	COMMON
N.O.	NORMALLY OPEN
N.C.	NORMALLY CLOSED

ELECTRICAL SCHEMATIC
(For machines serial number 007000 and above)

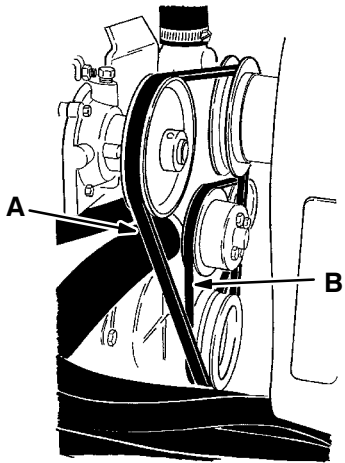
03768

BELTS AND CHAINS

ALTERNATOR BELT (For machines below serial number 007000)

The alternator belt is driven by the engine crankshaft sheave and drives the water pump and alternator sheaves. Check and adjust the alternator belt tension after every 200 hours of operation.

To tighten the alternator belt, loosen the alternator mounting bolts and pull the alternator away from the engine until the belt is snug; then tighten the bolts. Do not use a pry bar on the alternator as it will damage the alternator. Proper belt tension is obtained when the belt deflects 0.09 in (2 mm) from a force of 7 to 10 lb (3 to 4.5 kg) applied at the midpoint of the longest span.



BELTS

03769

- A. Engine Fan Belt
- B. Alternator Belt

ENGINE FAN BELT (For machines below serial number 007000)

The engine fan belt is driven by the engine crankshaft sheave and drives the engine fan and governor sheaves. Check and adjust the engine fan belt tension after every 200 hours of operation.

To tighten the engine fan belt, loosen the governor mounting bolts, pull the governor away from the engine until the belt is snug, then tighten the bolts. Proper belt tension is obtained when the belt deflects 0.25 in (6 mm) from a force of 1 to 2 lb (0.5 to 0.9 kg) applied at the midpoint of the longest span. After adjusting the belt check the governor adjustment as described in *TO ADJUST GOVERNOR (For machines below serial number 007000)*.

ENGINE FAN BELT (For machines serial number 007000 and above)

The engine fan belt is driven by the engine crankshaft sheave and drives the engine fan and alternator. Check and adjust belt tension after every 100 hours of operation.

To adjust belt tension, loosen the alternator mounting bolts and pull the alternator away from the engine until the belt is snug; then tighten the bolts. Do not use a pry bar on the alternator as it may damage the alternator. Proper belt tension is obtained when the belt deflects 0.5 in (13 mm) from a force of 8 to 10 lb (4 to 5 kg) applied at midpoint of the longest span.

STATIC DRAG CHAIN

A static drag chain is provided to prevent the buildup of static electricity in the machine. The chain is attached to the machine by a rear brush skirt retaining bolt.

The chain should make contact with the floor at all times.

DEBRIS HOPPER

HOPPER DUST FILTER

The dust filter filters the air which is drawn up from the main brush compartment through the hopper. The dust filter is equipped with a shaker motor to remove the accumulated loose dust particles. The dust filter shaker motor is operated by the vacuum fan and filter shaker switch. Shake the dust filter before dumping the hopper and at the end of every work shift. Inspect and clean or replace the dust filter after every 100 hours of operation.

To clean the dust filter, use one of the following methods:

- **TAPPING** – Tap the filter gently on a flat surface with the dirty side down. Do not damage the edges of the filter element or the filter will not seat properly in the hopper.
- **AIR** – Blow compressed air, 35 psi (240 kPa) maximum, through the dust filter opposite the direction of the arrows. This may be done with the dust filter in the machine. Always wear eye protection when using compressed air.

⚠ WARNING: Air or water under pressure. Severe eye or ear injury can result. Wear eye and ear protection.

- **WATER** – Soak the dust filter in a water and mild detergent solution. Rinse the dust filter until it is clean. The maximum water pressure allowable is 40 psi (275 kPa). Air dry the wet dust filter; do not use compressed air.

NOTE: Be sure the dust filter is dry before reinstalling it in the machine.

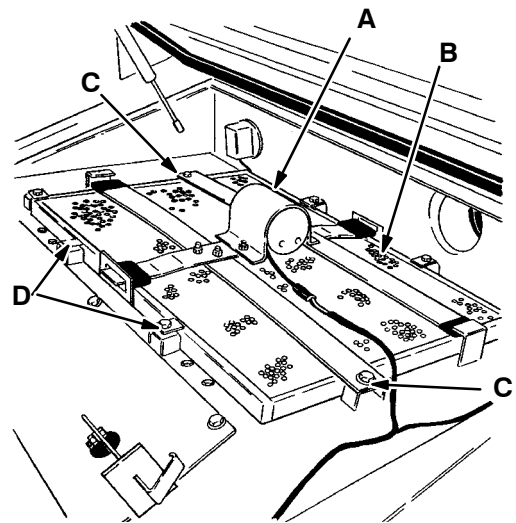
TO REMOVE HOPPER DUST FILTER

1. Stop the engine 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. Push the hopper cover latch release lever to open the hopper cover.

3. Disconnect the shaker motor wire connectors.



03770

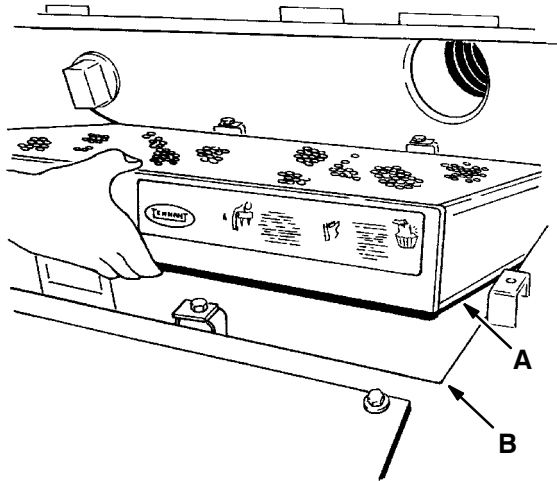
DUST FILTER SHAKER ASSEMBLY

- A. Dust Filter Shaker Assembly**
- B. Dust Filter**
- C. Spring Mounting Bolt**
- D. Filter Retaining Tab**

4. Remove the two dust filter spring mounting bolts.
5. Loosen the six dust filter retaining tab bolts.
6. Rotate the filter retaining tabs to allow the dust filter to be removed.
7. Lift the dust filter shaker assembly off the dust filter element.
8. Lift the dust filter element out of the hopper.
9. Clean or discard the dust filter element as required.

TO INSTALL HOPPER DUST FILTER

1. Place the cleaned or new dust filter in the hopper with the arrows pointing up.



INSTALLING DUST FILTER

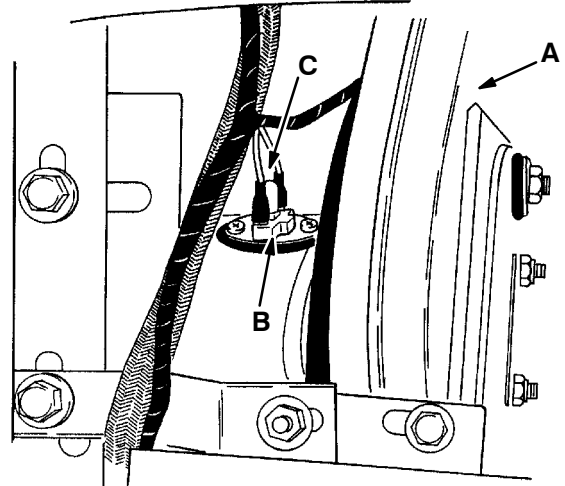
03771

- A. Dust Filter**
- B. Hopper**

2. Rotate the retaining tabs to hold the dust filter in the hopper.
3. Tighten the retaining tab bolts.
4. Slide the dust filter shaker assembly in position over the dust filter.
5. Thread the two bolts through the mounting springs and into the dust filter frame. Tighten the bolts.
6. Reconnect the shaker motor wire connectors.
7. Close the hopper cover.

THERMO-SENTRY™

The Thermo-Sentry™ is a thermostat that senses the temperature of the air drawn into the vacuum fan from the hopper. The thermostat controls the solenoid valve that directs hydraulic fluid to the vacuum fan motor. In the event of a fire in the hopper, the high air temperature would trip the thermostat stopping the electric current to the solenoid valve – stopping hydraulic flow to the vacuum fan motor and air flow to the fire. After the thermostat has tripped, it must be manually reset by pushing the reset button in.



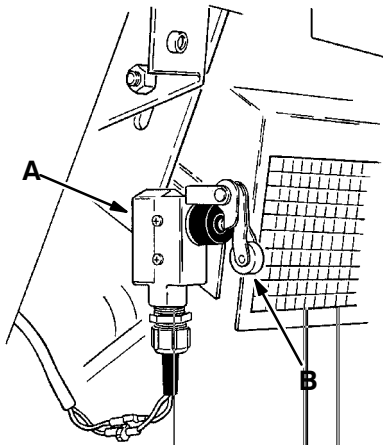
THERMO-SENTRY™

03777

- A. Vacuum Fan**
- B. Thermo-Sentry™**
- C. Reset Button**

VACUUM FAN AND MAIN BRUSH SHUT-OFF SWITCH

The vacuum fan and main brush shut-off switch stops the vacuum fan and main brush whenever the hopper is raised. The switch roller rides on the back of the hopper. When the hopper is raised, the switch loses contact with the hopper and stops hydraulic flow. Adjust the switch position after adjusting the hopper or if the vacuum fan and main brush do not stop when the hopper is raised.



SHUT-OFF SWITCH

03724

- A. Switch
- B. Switch Roller

DEBRIS HOPPER

The debris hopper collects all of the debris swept up by the machine. The hopper has four areas of adjustment. The adjustments are: hopper lift linkage, hopper stops, arm lock bracket, and hopper centering. All of the adjustments have been made at the factory and require no regular maintenance. In the event that the hopper components are repaired or replaced, the hopper must be readjusted for best performance.

The hopper adjustments must be made in the order specified. Make all adjustments with the engine off and parking brake set. If the adjustments are made with the hopper raised, be sure to engage the hopper safety support bar.

TO ADJUST HOPPER

NOTE: Empty the debris hopper and temporarily remove the hopper lift linkage side panels before making adjustments.

A. HOPPER LIFT LINKAGE

1. Stand clear and cycle the hopper up and down. Watch for signs of binding, sloppiness, or misalignment of the lift arm linkage. Reshim to remove binding, sloppiness, or misalignment of the linkage as necessary.



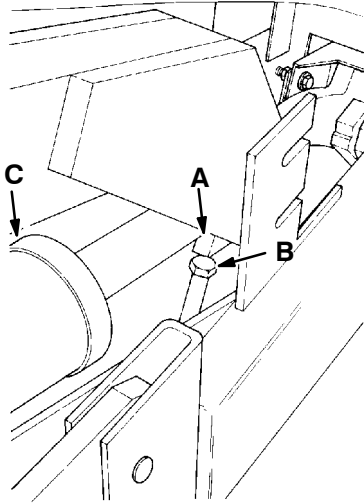
WARNING: Stay clear of hopper lift arms when they are in motion.

B. HOPPER STOPS

1. The two top hopper stop bolts, one on each side, prevent the lift cylinders from over extending. Adjust the stop bolts so the lift linkage stops against the bolts and still allows the hopper to raise to the required height.

MAINTENANCE

2. The bottom stop bolts prevent the lift cylinders from bottoming. Loosen the jam nut on each down stop bolt. Thread the bolts into the frame. Extend each hydraulic cylinder 0.38 in (10 mm) from its fully retracted position. Thread the stop bolt out of the frame until the bolt contacts the bottom of the lift linkage. Secure the stop bolt positions with the jam nuts.

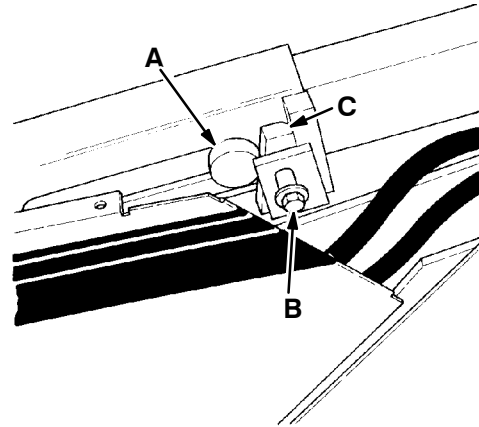


STOP BOLT

02179

- A. Lift Linkage
- B. Stop Bolt
- C. Hydraulic Cylinder

3. The upper arm wedge stop allows adjustment so both upper arm slider pins contact their stops at the same time as the hopper is being rolled out. Roll out the hopper and observe the slider pins. If they do not top out at the same time, loosen the wedge stop bolt on the top left lift arm and move the wedge stop to match the travel of the right slider pin. Tighten the wedge stop bolt and check to make sure the pins stop at the same time. Readjust as necessary.



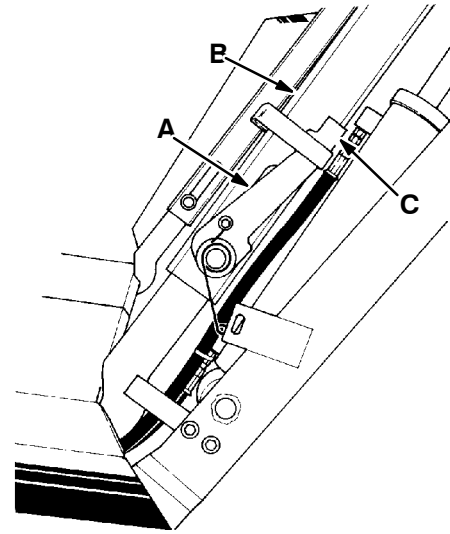
WEDGE STOP

02180

- A. Left Slider Pin
- B. Wedge Stop Bolt
- C. Wedge Stop

C. ARM LOCK BRACKET

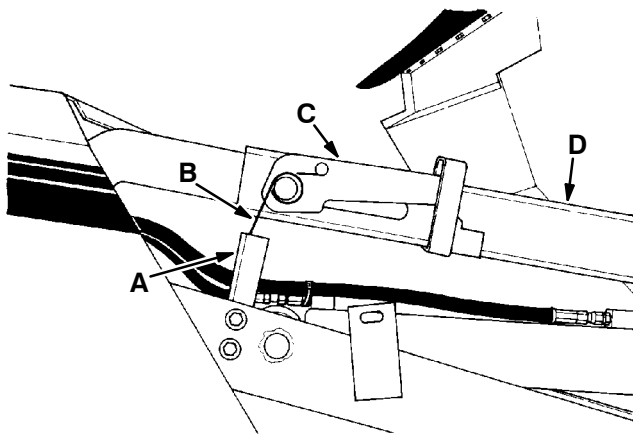
1. The arm lock bracket locks the upper lift arm in the fully extended position when the hopper is in the raised position. This prevents the hopper from rolling back in the event the operator tries to lower the hopper and it becomes jammed or hung up. The arm lock bracket must be adjusted so it drops and latches when the hopper is raised and unlatches when the hopper is lowered. Adjust the locking strip so the spring lifts the bracket as it comes in contact with the locking strip, and lowers the bracket as it loses contact with the locking strip.



02182

ENGAGED ARM LOCK BRACKET

- A. Arm Lock Bracket**
- B. Lift Arm**
- C. Lift Arm Stop**



02181

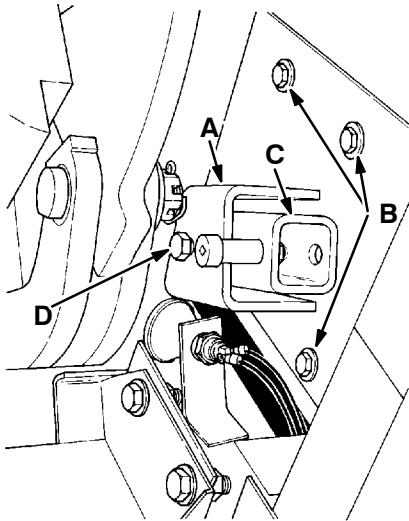
DISENGAGED ARM LOCK BRACKET

- A. Locking Strip**
- B. Spring**
- C. Arm Lock Bracket**
- D. Lift Arm**

D. HOPPER CENTERING

1. The side-to-side and front-to-back adjustments allow the hopper to be centered in the machine. Make sure the hopper does not interfere with any other parts when in motion. One bolt on each side of the hopper adjusts the side-to-side position. Loosen both bolts before making an adjustment. Tightening one bolt closes the gap on that side of the hopper. Tighten both bolts after the hopper is centered side-to-side with respect to the hopper lift arms.

Five bolts on each side of the hopper adjust the front-to-back position. Loosen all of the bolts, reposition the hopper, and tighten the bolts.

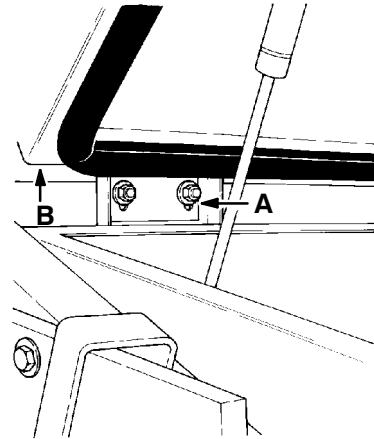


HOPPER POSITION ADJUSTMENT BOLTS

02183

- A. Hopper
- B. Front-to-Back Adjustment Bolts
- C. Hopper Pivot
- D. Side-to-Side Adjustment Bolt

2. The hopper cover hinges and latch determine the tightness of the hopper cover seal. Adjust the hinges and latch so the entire seal is compressed evenly. The hopper cover hinges have slots to allow adjustment.

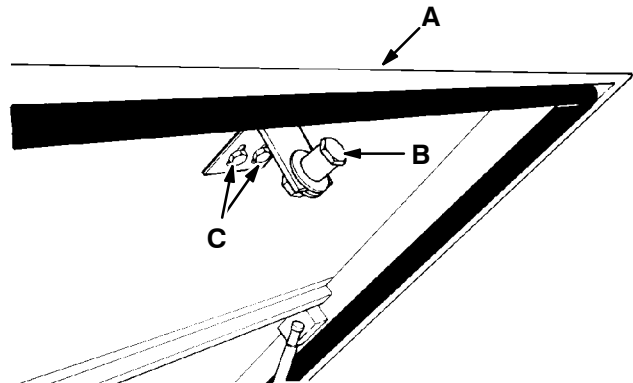


HOPPER COVER HINGE

02161

- A. Hinge
- B. Hopper Cover

The latch height is adjusted by loosening, repositioning, and tightening the latch striker. The latch position can also be adjusted by loosening, repositioning, and retightening the latch bracket mounting bolts.

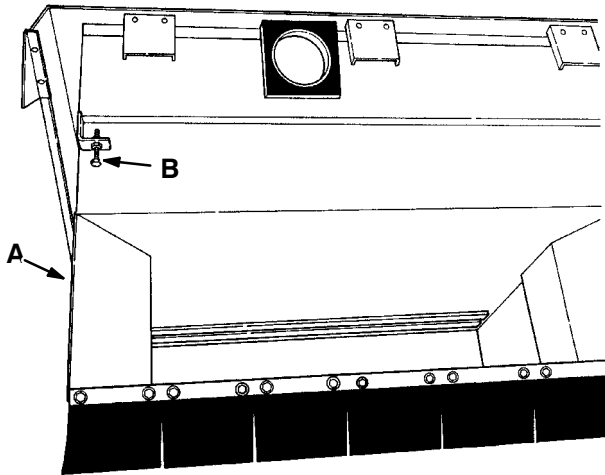


HOPPER COVER LATCH STRIKER

02184

- A. Hopper Cover
- B. Latch Striker
- C. Mounting Bolt

3. The two rear hopper stops determine the height of the rear of the hopper. Adjust the stop bolts so the rear of the hopper is 0.31 to 0.50 in (10 to 15 mm) lower than and parallel to the relay panel cover and the valve cover panel.



REAR HOPPER STOP BOLTS

03780

- A. Hopper**
- B. Stop Bolt**

The relay panel cover and valve cover panels should also be level side-to-side. Slots have been provided in the panel hinges to allow adjustment of the panel positions.

BRUSHES

MAIN BRUSH

The main brush is tubular and runs the width of the machine, sweeping debris into the debris hopper. The main brush should be inspected daily for wear or damage. Remove any string or wire found tangled on the main brush, main brush drive hub, or main brush idler hub.

Rotate the main brush end-for-end after every 50 hours of operation for maximum brush life and best sweeping performance.

The main brush pattern should be checked daily. The pattern should be 2 to 2.5 in (50 to 65 mm) wide with the main brush in the (Main Brush Down) position. Main brush pattern adjustments are made by turning the height adjustment knob behind the side shroud next to the operator's left leg.

The main brush should be replaced when the remaining bristles measure 1.5 in (40 mm) in length.

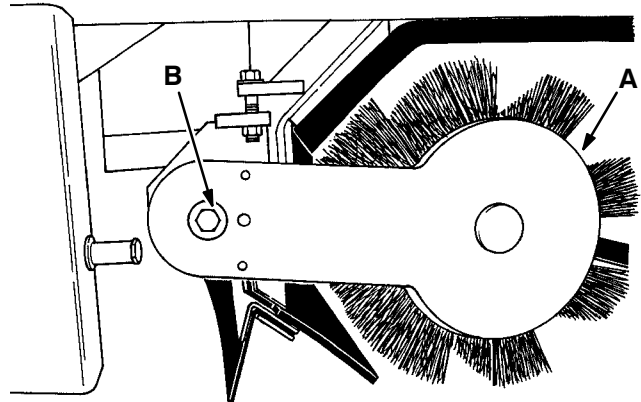
TO REPLACE MAIN BRUSH

1. Stop the engine 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. Place the main brush in the (Main Brush Free-Float) position.
3. Open the right side main brush door.

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



MAIN BRUSH IDLER ARM

03772

- A. Brush Idler Arm**
- B. Retaining Bolt**

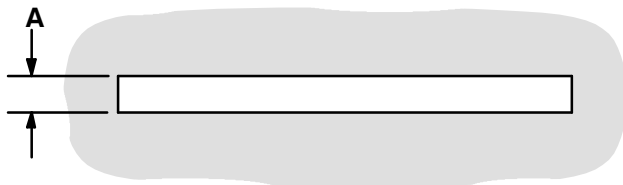
5. Pull the brush idler arm off the arm hub.
6. Pull The main brush off the brush drive plug and out of the main brush compartment.
7. Place the new or rotated end-for-end main brush on the floor next to the access door.
8. Slide the main brush into the brush compartment and onto the drive plug.
9. Slide the main brush idler plug into the main brush tube.
10. Slide the brush idler arm onto the arm hub.
11. Thread the brush idler arm retaining bolt through the idler arm and into the arm hub.
12. Tighten the brush idler arm retaining bolt.
13. Close the right side main brush door.
14. Check and adjust the main brush pattern as described in *TO CHECK AND ADJUST MAIN BRUSH PATTERN*.

TO CHECK AND ADJUST MAIN BRUSH PATTERN

1. Apply chalk, or some other material that will not blow away easily, to a smooth, level floor.
2. With the side brush in the (Side Brush Up) position, and main brush in the (Main Brush Up) position, position the main brush over the chalked area.
3. Place the main brush position lever in the (Main Brush Down) position for 15 to 20 seconds while keeping a foot on the brakes to keep the machine from moving. This will lower and start the main brush rotating.

NOTE: If chalk or other material is not available, allow the brushes to spin on the floor for two minutes. Do not spin brushes on a coated floor as it may be damaged.

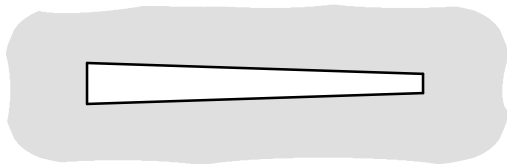
4. Place the main brush position lever in the (Main Brush Up) position.
5. Drive the machine off the test area.
6. Observe the width of the brush pattern. The proper brush pattern width is 2 to 2.5 in (50 to 65 mm).



NORMAL MAIN BRUSH PATTERN

00582

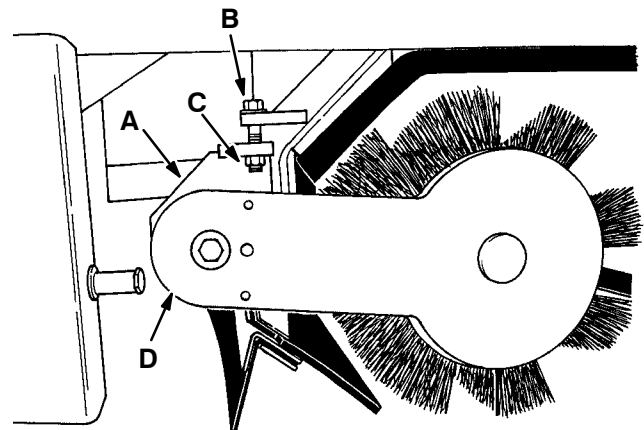
A. Brush Pattern Width



TAPERED MAIN BRUSH PATTERN

00601

If the main brush pattern is tapered, remove the main brush idler arm. Loosen the right side main brush cross shaft bearing mounting bracket bolts and brush leveling bolt jam nut. Adjust the brush leveling bolt and pivot the bearing mounting bracket to level the cross shaft. Tighten the right side main brush cross shaft bearing mounting bracket bolts and the brush leveling jam nut. Replace the main brush idler arm. Check the main brush pattern and readjust as necessary. Then adjust the width of the main brush pattern.



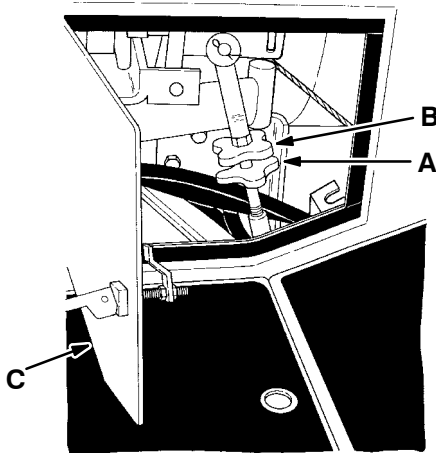
03772

MAIN BRUSH LEVELING BOLT

- A. Bearing Mounting Bracket**
- B. Leveling Bolt**
- C. Jam Nut**
- D. Idler Arm**

MAINTENANCE

To widen the main brush pattern, loosen the main brush height adjustment lock knob and turn the height adjustment knob counterclockwise from the top. To reduce the width of the main brush pattern, loosen the lock knob and turn the adjustment knob clockwise from the top. Tighten the lock knob against the adjustment knob and recheck the main brush pattern. Repeat the procedure until the main brush pattern is within specified range.



02150

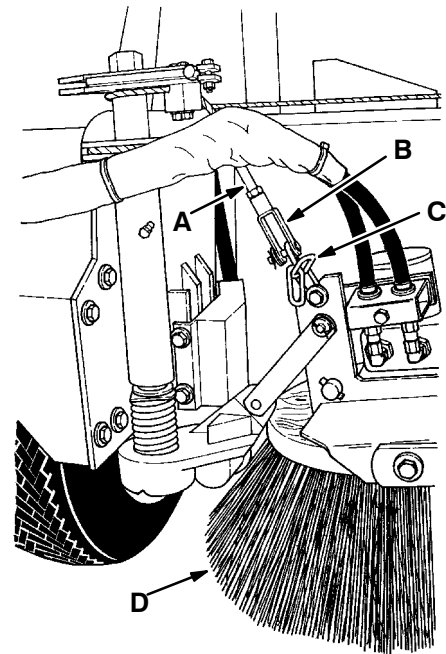
MAIN BRUSH HEIGHT ADJUSTMENT KNOB

- A. Height Adjustment Knob**
- B. Lock Knob**
- C. Access Door**

SIDE BRUSH

The side brush sweeps debris from curbs or gutters into the path of the main brush. 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 pattern should be checked daily. The side brush should just contact the floor when the brush is in motion. Side brush pattern adjustments are made by adjusting the clevis on the side brush lift cable or by connecting the clevis to a different link of the side brush lift chain.

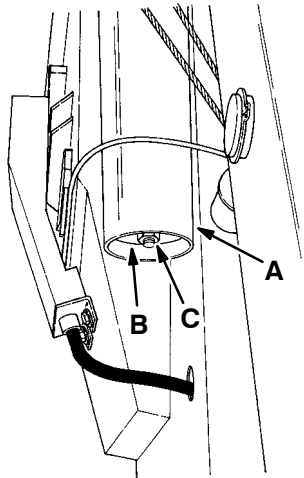


02158

SIDE BRUSH LIFT CHAIN AND CLEVIS

- A. Lift Cable**
- B. Clevis**
- C. Lift Chain**
- D. Side Brush**

Two other cables control the in-out movement of the side brush. They require no regular adjustment. When replacing the cable which pulls the side brush in as the hopper raises, adjust the cable so the front of the side brush swings in and measures even with the front of the machine frame. When replacing the cable which pulls the side brush out, adjust the cable so the spring backing plate is 0.5 in (15 mm) inside of the spring tube when the side brush is in the operating position and the hopper is in the rolled out and lowered position.



SPRING BACKING PLATE

02190

- A. Spring Tube
- B. Backing Plate
- C. Cable Adjustment Nut

The side brush should be replaced when the remaining brush bristle measures 2.5 in (65 mm) in length.

TO REPLACE SIDE BRUSH

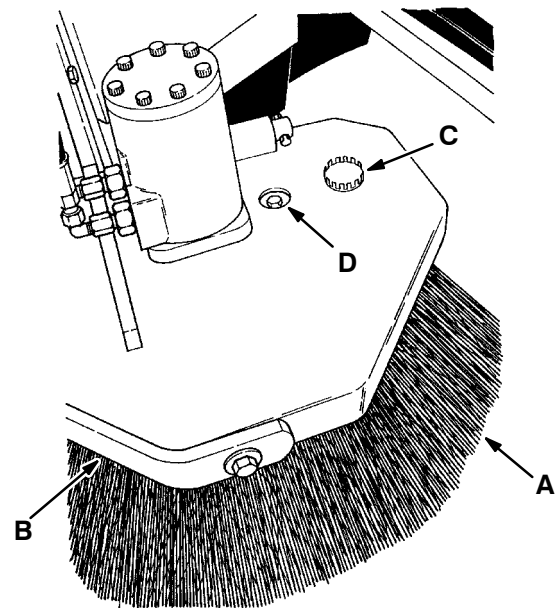
1. Empty the debris hopper.
2. Raise the hopper, engage the hopper support bar, and lower the hopper onto the support bar.

! WARNING: Falling hopper. Engage hopper support bar before working under hopper.

3. Place the main brush position lever in the (Main Brush Down) position.
4. Stop the engine and set the machine parking brake.

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

5. Remove the plugbutton from the top of the side brush bumper.



SIDE BRUSH

02191

- A. Side Brush
- B. Side Brush Bumper
- C. Plugbutton
- D. Side Brush Retaining Bolt

6. Rotate the side brush by hand until a bolt appears through the hole in the side brush bumper. Remove the bolt.

MAINTENANCE

7. Remove the other three side brush retaining bolts in the same manner and remove the side brush.
8. Position the new side brush under the side brush bumper. Line up one of the four side brush mounting holes with the hole in the side brush bumper and side brush adapter.
9. Secure the side brush to the side brush adapter with the bolts removed earlier.
10. Adjust the side brush pattern.
11. Disengage the hopper support bar and lower the hopper.

SKIRTS AND SEALS

HOPPER LIP SKIRTS

The hopper lip skirts are located on the bottom rear of the hopper. The lip skirts float over debris, control dust and help deflect the debris into the hopper.

The hopper lip skirts should be inspected for wear or damage daily.

TO REPLACE HOPPER LIP SKIRTS

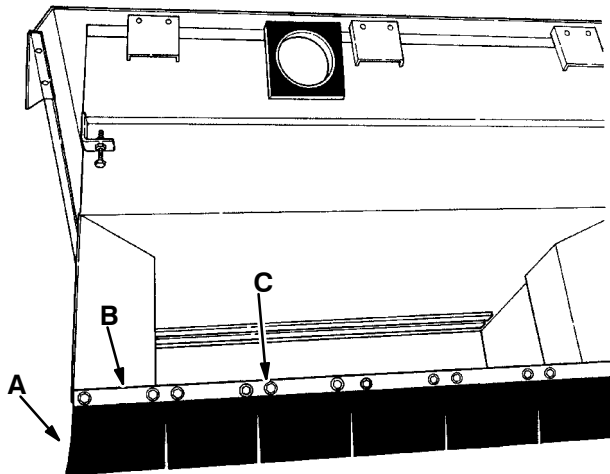
1. Empty the machine debris hopper.
2. Stop the machine on a level surface and set the machine parking brake.
3. Raise the hopper, engage the hopper support bar, and lower the hopper onto the hopper support bar.

! WARNING: Falling hopper. Engage hopper support bar before working under hopper.

4. Stop the engine.

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

5. Remove the skirt retaining strip mounting bolts.



HOPPER LIP SKIRTS

03780

- A. Hopper Lip Skirts**
- B. Retaining Strip**
- C. Retaining Strip Mounting Bolt**

6. Remove the skirt retaining strip and the worn or damaged skirts.
7. Thread the retaining strip mounting bolts through the retaining strip, the skirts, and into the hopper.
8. Tighten the mounting bolts.
9. Start the engine.
10. Raise the hopper, lower the hopper support bar, and lower the hopper.
11. Stop the engine.

BRUSH DOOR SKIRTS

The brush door skirts are located on the bottom of each of the two main brush doors. The skirts seal the main brush compartment. The skirts should be inspected for wear or damage, and adjustment daily.

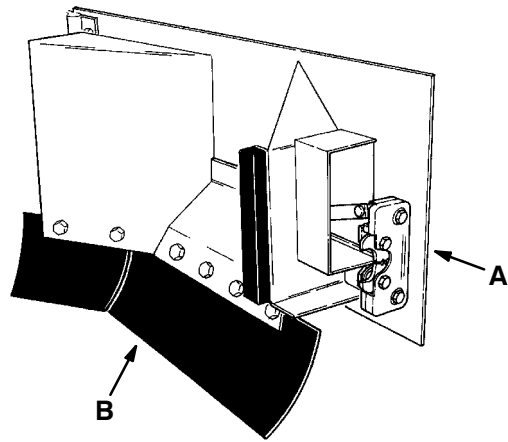
TO REPLACE AND ADJUST BRUSH DOOR SKIRTS

1. Stop the machine on a smooth, level surface.
2. Stop the engine 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 main brush doors.

- Remove the brush door skirt retaining bolts.



BRUSH DOOR SKIRT

- A. Brush Door**
- B. Brush Door Skirt**

- Remove the skirt retaining strip and the door skirt.
- Position the new door skirt and skirt retaining strip on the brush door.
- Thread the skirt retaining bolts through the brush door, the door skirt, and into the skirt retaining strip.

NOTE: The brush door skirts have slotted holes to allow for a ground clearance adjustment. The door must be closed for proper adjustment.

- Slide the brush door skirt up or down so that the skirt clears the floor 0.12 to 0.25 in (5 to 10 mm).
- Tighten the skirt retaining bolts.
- Close the brush doors.

REAR SKIRTS

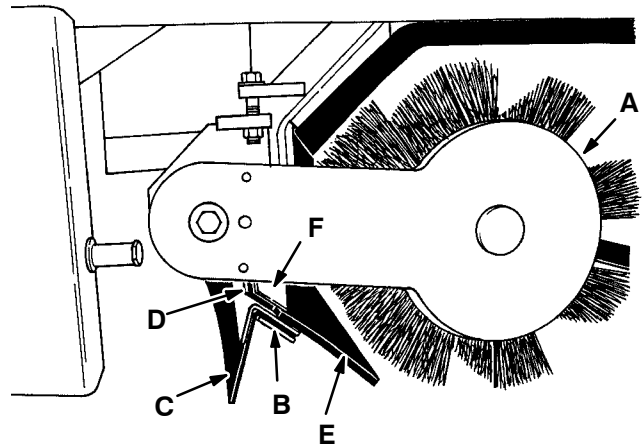
The skirts are located on the bottom rear of the main brush compartment. They seal the main brush compartment. The seals should be inspected for wear or damage, and adjustment daily.

TO REPLACE AND ADJUST REAR SKIRTS

- Stop the machine on a smooth, level surface.
- Stop the engine and set the machine parking brake.

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

- Open the main brush doors.



REAR SKIRTS

- A. Brush Idler Arm**
- B. Skirt Retaining Strip**
- C. Rear Floor Skirt**
- D. Skirt Mounting Angle**
- E. Brush Contact Skirt**
- F. Skirts Mounting Bracket**

- Remove the main brush as described in *TO REPLACE MAIN BRUSH*.
- Remove the front skirts mounting bracket retaining bolts. Remove the skirts assembly in one piece.
- Disassemble the skirts assembly.
- Reassemble the skirts assembly with a new floor skirt and brush skirt.

8. Reinstall the skirts assembly in the machine.
9. Slide the rear floor skirt up or down so that the skirt clears the floor 0.12 to 0.25 in (5 to 10 mm).
10. Tighten the retaining bolts.
11. Reinstall the main brush.

HOPPER SIDE SKIRTS

The hopper side skirts are located on the bottom front sides of the main brush compartment. The skirts seal the main brush compartment. The skirts should be inspected for wear or damage, and adjustment daily.

TO REPLACE AND ADJUST HOPPER SIDE SKIRTS

1. Empty the machine debris hopper.
2. Stop the machine on a level surface and set the machine parking brake.
3. Raise the hopper, engage the hopper support bar, and lower the hopper onto the hopper safety support bar.

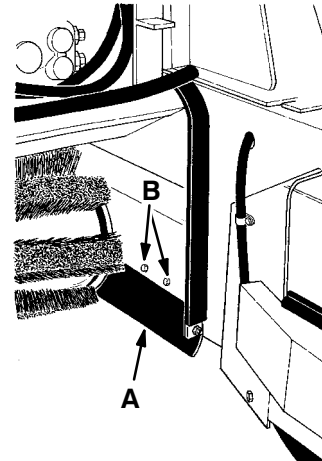
⚠ WARNING: Falling hopper. Engage hopper support bar before working under hopper.

4. Stop the engine.

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

5. Open the main brush doors.
6. Remove the hopper side skirt retaining strips.

7. Remove the side skirts.



HOPPER SIDE SKIRTS

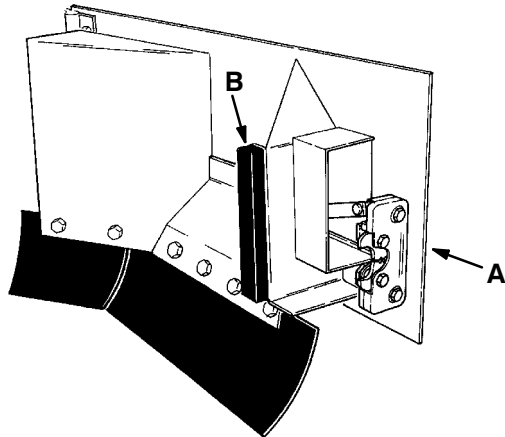
03773

- A. Side Skirt**
- B. Retaining Bolt**

8. Loosely install new side skirts with the retaining strips.
9. Slide the skirt up or down so the skirt clears the floor 0.12 to 0.25 in (5 to 10 mm).
10. Tighten the retaining bolts.
11. Start the engine.
12. Raise the hopper, disengage the support bar, and lower the hopper.
13. Stop the engine.

MAIN BRUSH DOOR SEALS

The main brush door seals are located on both main brush doors and on corresponding portions of the main frame. They seal the main brush compartment. The seals should be inspected for wear or damage after every 100 hours of operation.



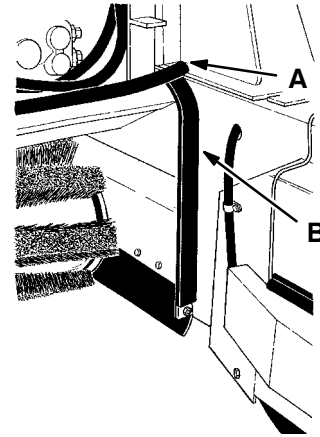
MAIN BRUSH DOOR SEALS

03778

- A. Main Brush Door
- B. Door Seals

HOPPER SEALS

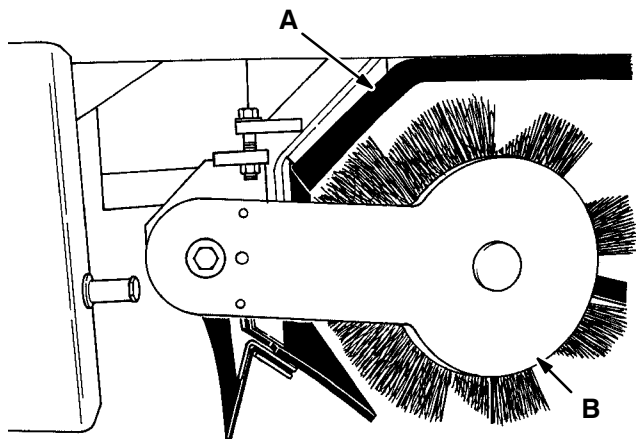
The hopper seals are located on the top and side portions of the machine frame which contacts the hopper. They seal the main brush compartment. The seals should be inspected for wear or damage after every 100 hours of operation.



HOPPER SEALS

03773

- A. Top Seal
- B. Side Seal



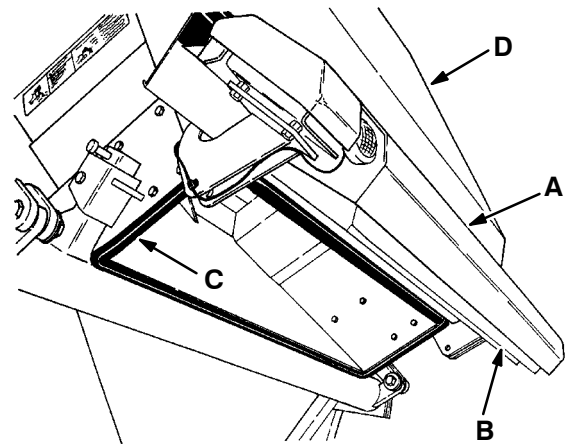
MAIN BRUSH COMPARTMENT SEALS

03772

- A. Door Seals
- B. Main Brush Idler Arm

HOPPER DOOR SEALS

The hopper door seals are located on the top and side door contact edges of the hopper and the bottom edge of the hopper door. They seal the hopper door. The seals should be checked for wear or damage after every 100 hours of operation.



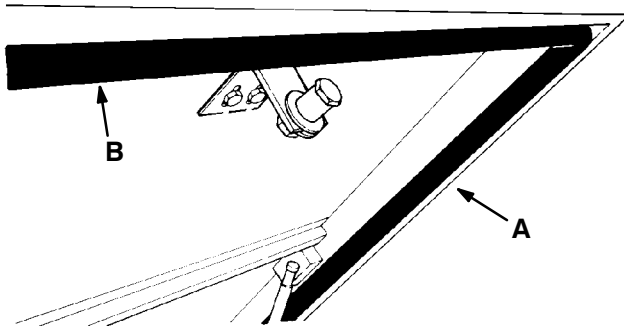
HOPPER DOOR SEALS

03722

- A. Hopper Door
- B. Bottom Seal
- C. Hopper Mounted Seals
- D. Hopper

HOPPER COVER SEAL

The hopper cover seal is located on the bottom of the hopper cover. It seals the hopper filter compartment. The seal should be checked for wear or damage after every 100 hours of operation. Check to make sure the seal is evenly compressed. Adjust the hopper cover hinges and latch striker to adjust seal compression.



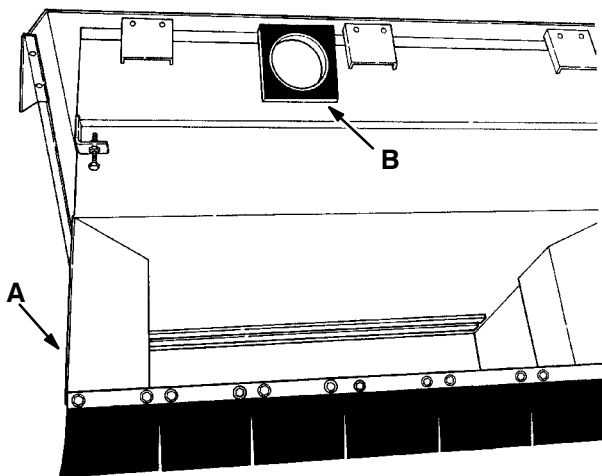
HOPPER COVER SEAL

02184

- A. Hopper Cover**
- B. Cover Seal**

HOPPER VACUUM FAN SEAL

The hopper vacuum fan seal is located on the rear of the hopper. It seals the hopper filter compartment to the vacuum fan intake bracket. The seal should be checked for wear or damage after every 100 hours of operation. Check to make sure that the seal is making good contact with the vacuum fan intake bracket. The seal should be compressed 0.12 in (5 mm) by the contact.

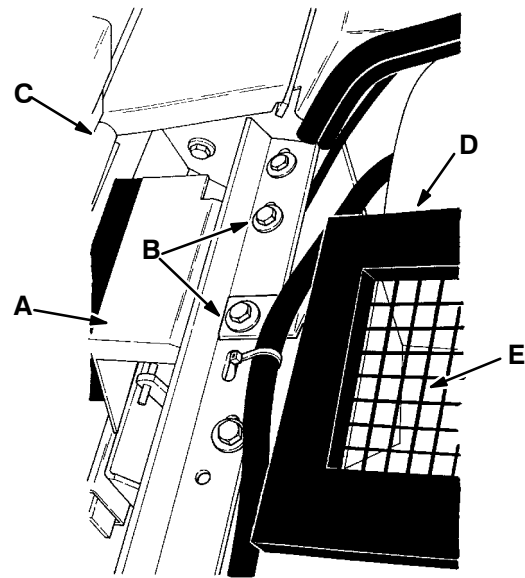


HOPPER VACUUM FAN SEAL

03780

- A. Hopper**
- B. Seal**

To adjust seal contact, loosen the vacuum fan intake bracket mounting bolts. Pivot the bracket into the correct position and retighten the bolts.



VACUUM FAN INTAKE BRACKET

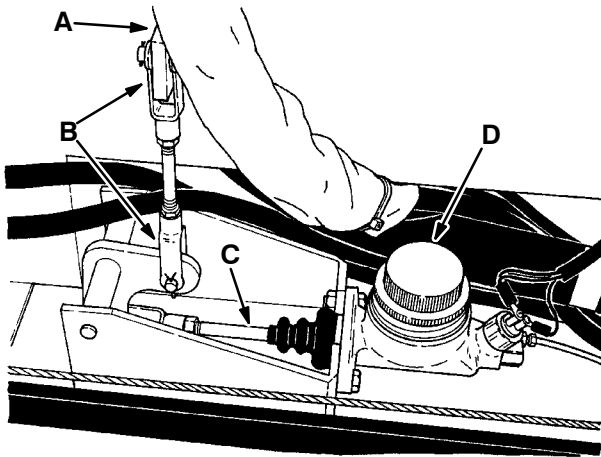
03721

- A. Intake Bracket**
- B. Bracket Bolt**
- C. Engine Cover**
- D. Fan Exhaust Seal**
- E. Vacuum Fan**

BRAKES AND TIRES**SERVICE BRAKES**

The service brakes are hydraulically activated by a master brake cylinder. Check the master brake cylinder fluid level after every 400 hours of operation and add brake fluid as needed. The master brake cylinder is located in front of the operator station. If, due to wear or replacement, the brakes need adjustment, an automotive-type tightening mechanism has been provided on each brake assembly. A mechanism is located behind a plugbutton on each side of the inner main frame.

If necessary, adjust the brake clevis on the master cylinder push rod so that the brake pedal is in a horizontal position when the cylinder push rod starts to engage the master cylinder piston.



02197

BRAKE LINKAGE

- A. Brake Pedal**
- B. Brake Clevis**
- C. Master Cylinder Push Rod**
- D. Master Cylinder**

Brakes require bleeding whenever air enters the system, lowering the effective braking pressure. Air can enter when the master cylinder or wheel cylinders are serviced or if the fluid in the reservoir runs dry. Air can also enter through a leaky brake line or hose. Find the leaking line and replace it before bleeding the system.

Whenever handling brake fluid, do not get any on the brake shoes, drums, or body paint. Brake pads will be permanently damaged, requiring replacement. Body paint can also be damaged unless the area is wiped with a clean cloth and washed with a soapy solution immediately.

TO BLEED THE BRAKES

1. Make sure that the brake fluid reservoir is full and that the vent in the cap is open.
2. Connect a plastic or rubber tube to the bleeder valve on the left front wheel. Suspend the other end of the tube in a jar or bottle filled with a few inches of brake fluid. During the remaining steps, keep this end submerged at all times and never let the level in the brake fluid reservoir drop below one half full.
3. Open the bleeder valve on the left front wheel about one turn. Have an assistant press the brake pedal slowly to the floor. As soon as the pedal is all the way down, close the bleeder valve and let the pedal up. Repeat this step as many times as necessary, until fluid free of air bubbles flows from the tube.
4. Bleed the right front wheel in the same manner as described in the steps above. Keep checking the brake fluid reservoir to be sure it doesn't run out of fluid.
5. When all wheels are bled, discard the brake fluid in the jar or bottle; never reuse such fluid.
6. Fill the brake fluid reservoir with clean fluid.

PARKING BRAKES

The parking brakes are mechanically activated by the parking brake lever and two cables.

The parking brakes should be adjusted whenever the machine rolls after setting the parking brake, when it becomes very easy to set the parking brake, or after every 200 hours of operation. The parking brake may be routinely tightened by turning the knurled knob on the end of the parking brake clockwise. If the knob adjustment is inadequate, fully loosen the knob, loosen the brake cable mounting nuts located under the operator seat, thread the lower nuts closer to the end of the cable, and retighten the top nuts. Be sure to thread each of the nuts out the same number of turns.

TIRES

The standard front machine tires are pneumatic. The proper tire air pressure is 50 to 55 psi (345 to 380 kPa).

The standard rear machine tire is pneumatic. The proper tire air pressure is 80 to 85 psi (550 to 590 kPa). Check the air pressure of the tires after every 100 hours of operation.

Solid tires are available as accessories. No regular maintenance is required on these tires.

SECTION 4

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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:

Main brush drive plug nut – 30 ft lb (40 Nm) then tighten to next slot.

Front wheel nut – 10 to 12 ft lb (14 to 16 Nm) while turning wheel, tighten to spec, then backoff, retighten by hand till snug, then turn to next slot.

Rear wheel hub nut – 200 to 250 ft lb (270 to 340 Nm).

Rear wheel lug nuts – 85 to 95 ft lb (115 to 130Nm).

BOLT IDENTIFICATION

Identification Grade Marking	Specification and Grade
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SAE–Grade 5



SAE–Grade 8



ISO–Grade 8.8



ISO–Grade 10.9

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THREAD SEALANT AND LOCKING COMPOUNDS

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

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

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

Loctite 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**

Tube 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) *10 ft lb (14 Nm)	20 ft lb (27 Nm) 12 ft lb (16 Nm)
0.50	0.75-16	20 ft lb (27 Nm) *21 ft lb (28 Nm)	30 ft lb (41 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