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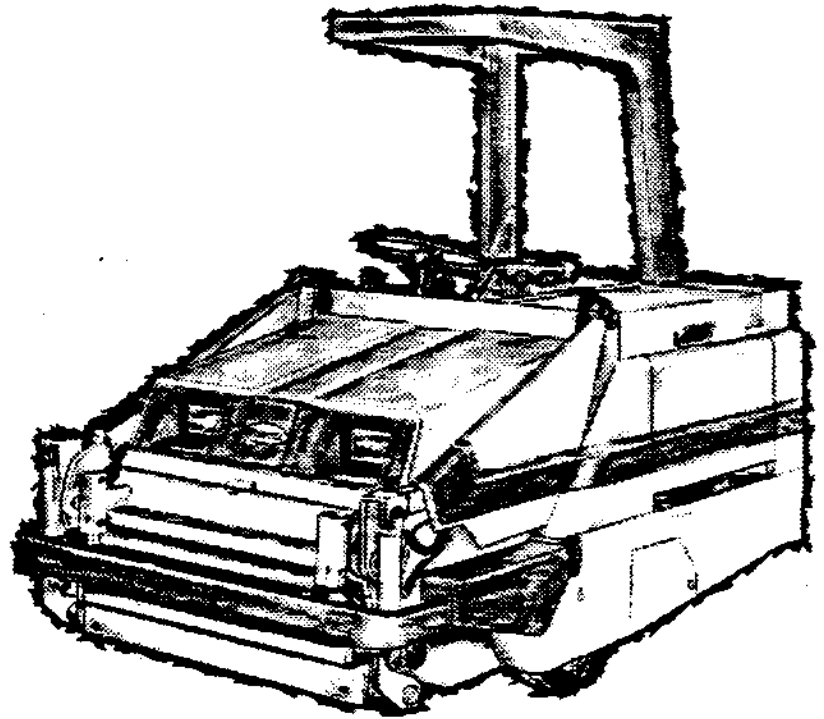
5-84



# 250 POWER SWEEPER

Operation, Maintenance, and Parts Manual

Operator Manual



**SPECIALIZED MAINTENANCE EQUIPMENT**  
SWEEPERS • SCRUBBERS • SCARIFIERS • FLOOR COATINGS



# 250

## POWER SWEEPER

This manual is furnished with each new TENNANT® Model 250. The machine operators will easily learn how to operate the machine and understand its mechanical functions by following the directions and absorbing the information in the Operation section.

This machine will give excellent service and sweeping results, and save maintenance expenses. However, as with all specially engineered mechanical equipment, best results are obtained at minimum costs if:

- The machine is operated with reasonable care and
- The machine is maintained regularly — per the maintenance instructions provided.
- Components used in this machine have been carefully selected for performance and safety. Use only 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.

The telephone, telex, mailing addresses, and locations are listed on the last page of the manual.

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Published: 5-84

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00539

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# TENNANT COMPANY WARRANTY POLICY

Tennant Company warrants to the original purchaser, for the period of one (1) year from the date of delivery, that goods manufactured by it will be free from defects of workmanship and material, provided such goods are installed, operated, and maintained in accordance with Tennant Company written manuals or other instructions.

Tennant Company's sole obligation, and Purchaser's sole remedy under this warranty for all claims arising out of the purchase and use of the goods, shall be limited to the repair or replacement, at Tennant Company's option, of parts that do not conform to this Warranty.

For thirty (30) days from date of installation, Tennant Company will, at its option, provide labor for repair, pay for outside repair service, or pay the customer straight time in accordance with Tennant Company's flat rate schedule for particular warranty repairs. Thereafter, Tennant Company's sole obligation shall be limited to the repair or replacement, at Tennant Company's option, of parts that do not conform to this Warranty.

Repair parts supplied by Tennant Company are warranted for the period of thirty (30) days following installation. Tennant Company's obligation is limited to the replacement of the warranted part, and Tennant Company shall not be obligated to provide labor in installing such part.

Battery and tires will be replaced if failure occurs due to defective material or workmanship within 90 days from date of purchase. Thereafter, a pro rata adjustment from date of purchase to 12 months will be made. The pro rata adjustment price of the new battery and/or the new tire will be the Tennant Company current price as of the adjustment request less 1/12th of that price for each month remaining in the 12-month period. All warranty applies only to batteries and tires purchased from Tennant Company and installed in vehicles used in normal service.

Brushes that fail due to defective material or workmanship will be replaced on a pro rata basis within the first 12 months of purchase. The replacement price will be calculated by multiplying the current Tennant Company price by the percentage of usable bristle remaining at the time of adjustment.

No Warranty is made with respect to items made by others when such items are warranted by their respective makers or when they are supplied by Tennant Company on special order.

This Warranty shall not cover:

- A. Floor materials or application, and models 140 and 140E.
- B. Maintenance items, adjustments, or installation of machines.
- C. Repairs required as a result of failure due to normal wear, accidents, misuse, abuse, negligence, or improperly installed repair parts.
- D. Products altered or modified in a manner not authorized by Tennant Company in writing.

**THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER EXPRESSED OR IMPLIED WARRANTIES INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS AND OF ALL OTHER OBLIGATIONS AND LIABILITIES ON THE PART OF TENNANT COMPANY, INCLUDING LIABILITIES FOR DIRECT, IMMEDIATE, SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE FAILURE OF ANY MACHINE OR PART OF IT TO OPERATE PROPERLY, INCLUDING THE COST OR EXPENSE OF PROVIDING SUBSTITUTE EQUIPMENT OR SERVICE DURING PERIODS OF MALFUNCTION OR NON-USE.**

This Warranty cannot be extended, changed, or modified by any representative of Tennant Company.

Dear Customer,

Keeping you as a satisfied customer is our primary concern. If for any reason you are not satisfied, please contact anyone of the persons listed below.

One of the addresses is your local engine dealer. We will handle replacements on all parts of our equipment but this dealer probably carries a more complete stock of engine parts than we do and should be able to give you faster service in this area. Try him first for engine parts. Also, your engine dealer should be contacted first for warranty claims pertaining to the engine.

If you find that you need an experienced mechanic, please contact anyone listed below and he will be happy to recommend a mechanic to you.

To get maximum trouble free service from your machine, you must perform maintenance checks as specified in the machine manual and arrange for maintenance on a regular basis. Remember that breakdowns are directly related to maintenance.

**TENNANT COMPANY**

Tennant Company
P. O. Box 1452
Minneapolis, MN 55440
(612) 540-1200

**TENNANT COMPANY REPRESENTATIVE**


**ENGINE DEALER**



## **ENGINE WARRANTY - GASOLINE AND LPG**

### **TELEDYNE CONTINENTAL MOTORS**

Industrial Products Division

#### **INDUSTRIAL AND MATERIAL HANDLING ENGINES**

Teledyne Continental Motors warrants each new engine or power unit manufactured by same to be free from defects in material and workmanship for a period of one (1) year of service or 1500 hours of service, whichever shall first occur.

The obligation of the Company, under this warranty, is limited to repairing or replacing with new or remanufactured parts, as the Company may elect, any part or parts which shall have been returned to a Distributor or licensee of the Company authorized to handle the engine covered by this warranty, and which upon examination is disclosed, to the Company's satisfaction, to have been defective in material or workmanship. Such repair or replacement of any part shall not extend this warranty beyond the original warranty coverage stated above.

This Warranty does not obligate the manufacturer to bear the cost of labor or transportation charges in connection with the replacement or repair of defective parts, nor shall it apply to an engine upon which repair or alterations have been made unless authorized by the manufacturer.

The manufacturer makes no Warranty in respect to trade accessories, such being subject to the Warranties of their respective manufacturers.

THIS WARRANTY, AND THE COMPANY'S OBLIGATION THEREUNDER IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, and all other obligations or liabilities, including consequential damages or contingent liabilities arising out of the failure of any engine or part to operate properly, and no person is authorized to give any other warranty or to assume any additional obligation on the Company's behalf unless made in writing and signed by an officer of the company.

Before consideration can be given to requests for adjustments covering field service and alleged defective material, the buyer shall furnish Teledyne Continental Motors with the following data:

Owner's name and address	Date actually placed in service
Engine Model, Specification number and Serial number	Accumulated days, hours, or miles of service
	Information as to the nature of the trouble

### **TELEDYNE CONTINENTAL MOTORS**

INDUSTRIAL PRODUCTS DIVISION

950 ARTHUR AVENUE, ELK GROVE VILLAGE, ILLINOIS 60007

PHONE: (312) 593-2000

## SAFETY PRECAUTIONS

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

**⚠ DANGER:** To warn of immediate hazards which will result in severe personal injury or death.

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

**⚠ CAUTION:** To warn of hazards or unsafe practices which could result in minor personal injury.

**⚠ ATTENTION!** To warn of unsafe practices which could result in extensive equipment damage.

*NOTE: To give important information or to warn of unsafe practices which could result in equipment damage.*

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.

**⚠ WARNING:** Keep cigarettes, sparks, and open flame away from lead acid batteries. Batteries emit a highly explosive hydrogen gas.

**⚠ WARNING:** Disconnect battery terminals before servicing electrical components. Only qualified personnel should work inside panels or on electrical system when the battery is connected to the machine.

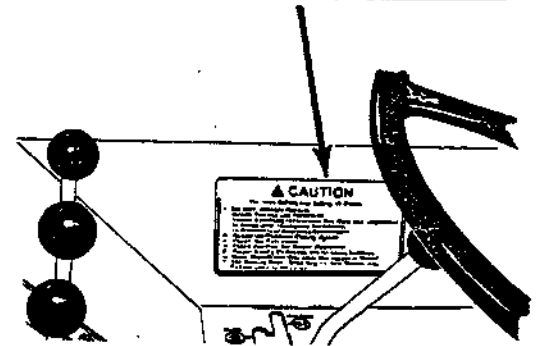
**⚠ CAUTION:** Avoid moving parts of the unit. Loose jackets, shirts or sleeves should not be permitted when working on the machine because of the danger of becoming caught in moving parts. Keep shield and guards in position. If adjustments must be made while the unit is running, use extreme caution around moving parts, v-belts, etc.

**⚠ WARNING:** Check brakes and steering control for proper operation. Do not start machine unless you are in the driver's seat, with foot on brake pedal and directional pedal in neutral. Parking brake must be engaged and ignition key removed before leaving the machine.

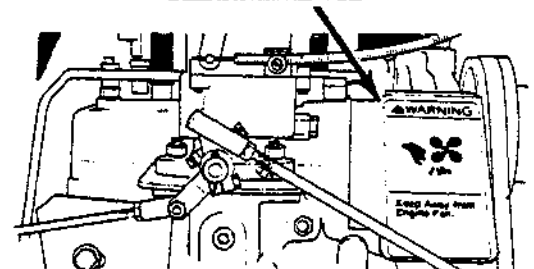
**⚠ WARNING:** Keep hands away from powerful vacuum fan suction or fan intake.

**⚠ WARNING:** Stay clear of the hopper when it is being raised or lowered.

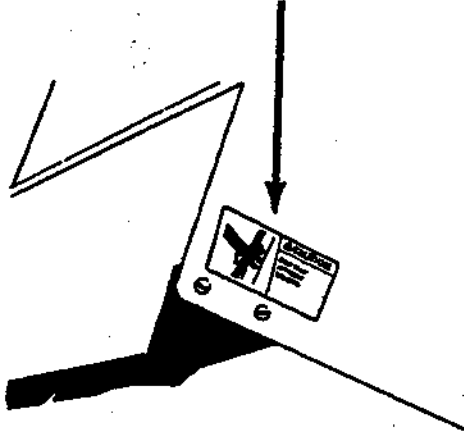
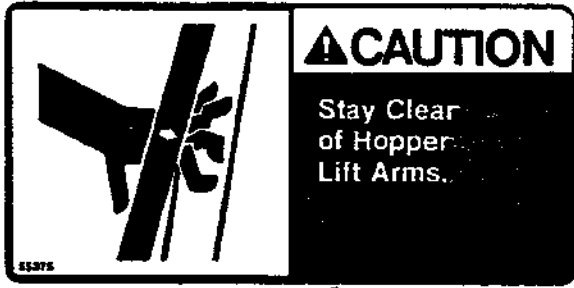
The following safety decals are mounted on the machine in the locations indicated. If these or any other decals become damaged or illegible, replace with new decals.



SAFETY DECAL (TENNANT® PART NO. 55378) 00574  
LOCATED ON FRONT INSTRUMENT PANEL.

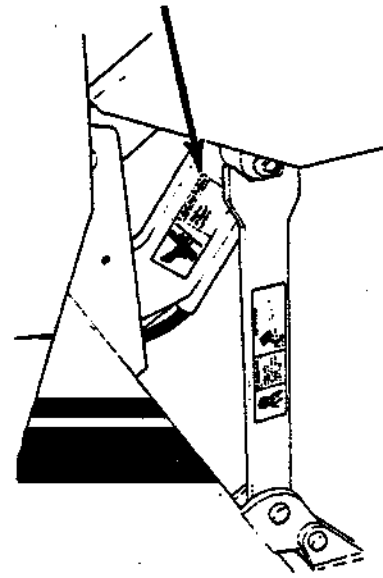
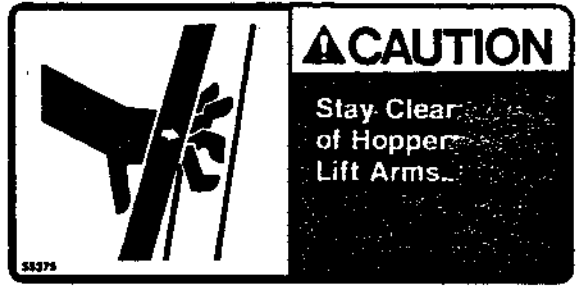


ENGINE FAN DECAL (TENNANT® PART NO. 55402) 00581  
LOCATED ON ENGINE FAN GUARD.



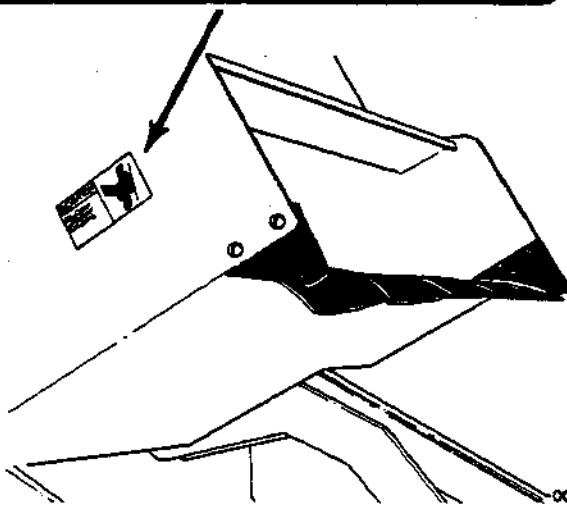
00811

**HOPPER LIFT ARM DECAL (TENNANT® PART NO. 55375) LOCATED ON LOWER RIGHT SIDE OF HOPPER.**



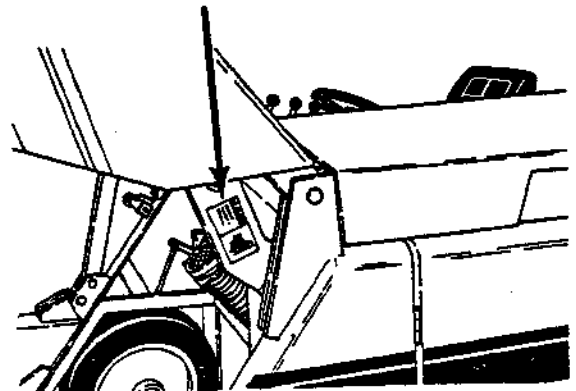
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**HOPPER LIFT ARM DECAL (TENNANT® PART NO. 55375) LOCATED ON RIGHT HOPPER LIFT ARM.**



00604

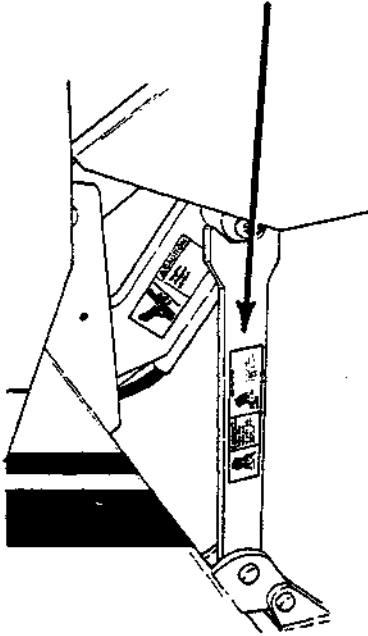
**HOPPER LIFT ARM DECAL (TENNANT® PART NO. 55372) LOCATED ON LOWER LEFT SIDE OF HOPPER.**



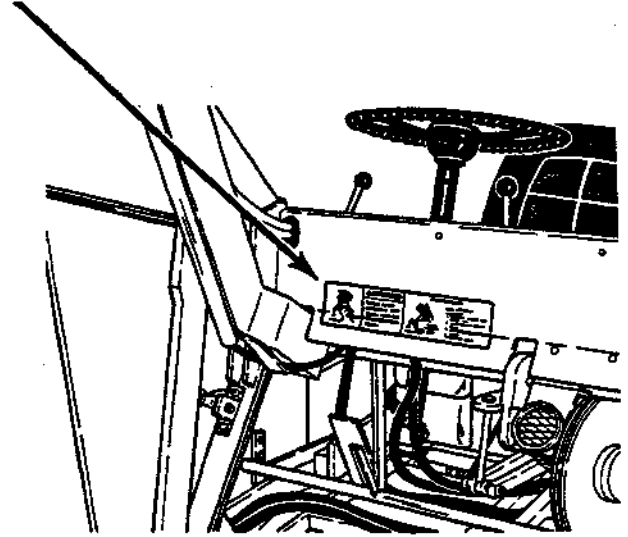
00612

**HOPPER LIFT ARM DECAL (TENNANT® PART NO. 55372) LOCATED ON LEFT HOPPER LIFT ARM.**

	<p><b>⚠ WARNING</b></p> <p>Engage Safety Support Bar per Instructions Before Working Under Hopper.</p>	<p><b>INSTRUCTIONS</b></p> <p>To Engage Safety Support Bar:</p> <ol style="list-style-type: none"> <li>1. Lift Hopper to Extreme Up Position.</li> <li>2. Raise Safety Support Bar.</li> <li>3. Lower Hopper Against Stop.</li> <li>4. Shut Off Engine.</li> </ol>
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<sup>00544</sup>  
**HOPPER SAFETY ARM DECAL (TENNANT® PART NO. 55381) LOCATED ON HOPPER SAFETY ARM.**



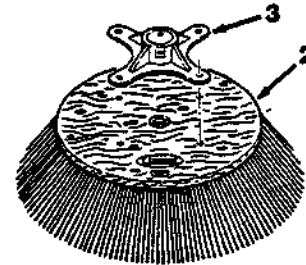
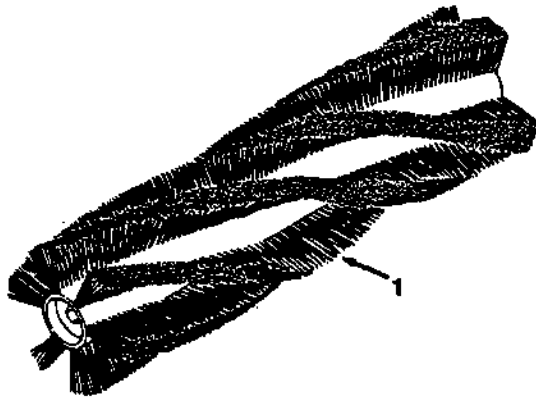
<sup>00613</sup>  
**HOPPER SAFETY ARM DECAL (TENNANT PART NO. 55381) LOCATED ON FRONT OF MACHINE LINTEL.**

## RECOMMENDED GENERAL MAINTENANCE ITEMS

00548

KEY	TENNANT® PART NO.	MACHINE SERIAL NUMBER	DESCRIPTION	QTY.
	59468	( - )	REPLACEMENT PARTS PACKAGE	1
	55997	( - )	CAP, Distributor	1
	53431	( - )	ELEMENT, Pressure relief filter	1
	41656	( - )	ELEMENT, Dust filter	2
	23792	( - )	ELEMENT, Air filter	2
	53055-2	( - )	ELEMENT, Oil filter	2
	55740	( - )	ELEMENT, Hydraulic fluid filter	1
	SK1511	( - )	LINK REPLACEMENT KIT, Fusible	1
	55996	( - )	TUNE-UP KIT, Distributor	1
	23382	( - )	SEAL, Pan, side	2
	23386	( - )	SEAL, Pan, top	1
	23275	( - )	SKIRT, Shroud	2
	35607	( - )	LIP ASSEMBLY	5
	37021	( - )	LIP, Side	2
	53298	( - )	SKIRT	1
	53137	( - )	SKIRT	1
	55994	( - )	SPARK PLUG	2
	55999	( - )	BELT, Engine fan	1
	37061	( - )	SEAL KIT, Dump door	1
	47069	( - )	SLEEVE, Foam	1
	55255	( - )	CIRCUIT BREAKER, 15 A	1
	55256	( - )	CIRCUIT BREAKER, 25 A	1
	55596	( - )	HOSE, Radiator, lower	1
	55616	( - )	HOSE, Radiator, upper	1
	SK1444	( - )	REPAIR KIT, Fuel filter lock	1
	55998	( - )	REPAIR KIT, Vaporizer	1
	32397-1	( - )	HYDRAULIC FLUID, 10W40, 1 gal (3.8 L)	1
	32397-55	( - )	HYDRAULIC FLUID, 10W40, 55 gal (208 L)	1
	32398-1	( - )	HYDRAULIC FLUID, 20W60, 1 gal (3.8 L)	1
	32398-55	( - )	HYDRAULIC FLUID, 20W60, 55 gal (208 L)	1





## REPLACEMENT BRUSHES

00647

KEY	TENNANT® PART NO.	MACHINE SERIAL NUMBER	DESCRIPTION	QTY.
1	53063	( - )	MAIN BRUSH, Wire and fiber, 24 row	1
1	53231	( - )	MAIN BRUSH, Proex, 8 row	1
1	53065	( - )	MAIN BRUSH, Wire, 8 row	1
1	53067	( - )	MAIN BRUSH, Wire and fiber, 8 row	1
1	53068	( - )	MAIN BRUSH, Nylon, 8 row	1
1	53069	( - )	MAIN BRUSH, Perlon, 5 row	1
1	53070	( - )	MAIN BRUSH, Nylon, 24 row	1
1	53221	( - )	MAIN BRUSH, Wire and fiber, 8 row	1
1	53433	( - )	MAIN BRUSH, Proex and wire	1
	43708P	( - )	SIDE BRUSH ASSEMBLY, Polypropylene	1
2	09600P	( - )	SIDE BRUSH, Polypropylene	1
3	47501	( - )	ADAPTER, Side brush	1
	43708N	( - )	SIDE BRUSH ASSEMBLY, Nylon	1
	09600N	( - )	SIDE BRUSH, Nylon	1
	47501	( - )	ADAPTER, Side brush	1
	43708K	( - )	SIDE BRUSH ASSEMBLY, Wire	1
	10712K	( - )	SIDE BRUSH, Wire	1
	47501	( - )	ADAPTER, Side brush	1
	43708J	( - )	SIDE BRUSH ASSEMBLY, Wire and fiber	1
	09600J	( - )	SIDE BRUSH, Wire and fiber	1
	47501	( - )	ADAPTER, Side brush	1



# GENERAL INFORMATION

## CONTENTS

	Page		Page
TENNANT® WARRANTY POLICY.....	i	To Dump Hopper.....	2-8
ENGINE WARRANTY - GASOLINE AND LPG.....	ii	Accessories Operation.....	2-10
SAFETY PRECAUTIONS.....	iii	Vacuum Wand Accessory.....	2-10
RECOMMENDED GENERAL MAINTENANCE ITEMS....	vi	To Operate Vacuum Wand.....	2-10
REPLACEMENT BRUSHES.....	vii	Dust Filter Bypass Accessory.....	2-11
		To Operate the Filter Bypass	
		Accessory.....	2-11
<b>SECTION 1 - SPECIFICATIONS</b>		Transporting Machine.....	2-12
Machine Specifications.....	1-1	Pushing or Towing Machine.....	2-12
Machine Dimensions.....	1-3	Machine Jacking Instructions.....	2-12
		Machine Tie-Down Instructions.....	2-13
<b>SECTION 2 - OPERATION</b>		Machine Storage.....	2-14
Preparation for Operation.....	2-1	Storing Machine.....	2-14
Operation of Controls.....	2-1		
Brake Pedal.....	2-1	<b>SECTION 3 - MAINTENANCE</b>	
Directional Control Pedal.....	2-1	Recommended First 50-Hour Inspection.....	3-1
Location of Controls and Instruments.....	2-2	Maintenance Chart.....	3-2
Main Brush Height Adjustment Knob.....	2-3	Lubrication.....	3-4
Operator Seat.....	2-3	Engine.....	3-4
Ignition Switch.....	2-3	Hopper Lift Bearings.....	3-4
Hazard Lamp Switch.....	2-3	Hopper Door Latches.....	3-4
Operating Lamps Switch.....	2-3	Steering Gear.....	3-5
Dust Filter Shaker Pushbutton Switch.....	2-3	Hopper Cover Latch.....	3-5
Throttle Control Lever.....	2-3	Brush Access Door Latches.....	3-5
Engine Choke Knob.....	2-3	Side Engine Door Latch.....	3-5
Engine Hour Meter.....	2-3	Hydraulics.....	3-6
Low Engine Oil Pressure Indicating Lamp...	2-3	Recommended Hydraulic Fluid.....	3-6
High Engine Coolant Temperature		Hydraulic Fluid Reservoir.....	3-6
Indicating Lamp.....	2-3	To Drain the Hydraulic Fluid Reservoir.....	3-6
Battery Condition Gauge.....	2-4	To Fill the Hydraulic Fluid Reservoir.....	3-7
Hopper Lift Control Lever.....	2-4	Hydraulic Fluid Reservoir Breather.....	3-7
Hopper Dump Control Lever.....	2-4	To Replace Hydraulic Fluid Reservoir	
Vacuum Fan, Main Brush and Side		Breather Element.....	3-7
Brush Control Lever.....	2-4	Hydraulics Fluid Filter.....	3-7
Main Brush Height Control Lever.....	2-5	To Replace the Hydraulic Fluid Filter	
Steering Wheel.....	2-5	Element.....	3-8
Side Brush Height Control Lever.....	2-5	Hydraulic Pumps.....	3-8
Parking Brake Lever.....	2-5	Hydraulic Pump Start-Up Procedure.....	3-8
Hopper Safety Support Arm.....	2-6	Directional Control Pedal "Neutral"	
To Engage Hopper Safety Support		Position Adjustment.....	3-9
Arm.....	2-6	Speed Limiter.....	3-9
To Disengage Hopper Safety Support		Hydraulic Schematic Diagram.....	3-10
Arm.....	2-6	Hydraulic Fluid Leaks.....	3-11
Circuit Breakers.....	2-6	Engine.....	3-12
Machine Operation.....	2-7	Engine Lubrication.....	3-12
Normal Sweeping Operation.....	2-7	Cooling System.....	3-12
To Start a Gasoline Machine.....	2-7	To Reverse Flush the Radiator.....	3-12
To Stop a Gasoline Machine.....	2-7	To Reverse Flush the Engine Water	
To Start an LPG Machine.....	2-7	Jacket.....	3-13
To Stop an LPG Machine.....	2-8	Replacing and Testing Thermostat.....	3-13
Operation on Grades.....	2-8		
Hopper Dumping.....	2-8		

# CONTENTS

	Page		Page
Radiator Pressure Cap .....	3-13	To Adjust Stabilizer Leg .....	3-33
Engine Fan Belt Tension .....	3-14	Brushes.....	3-34
Water Pump.....	3-14	Main Brush Replacement .....	3-34
Air Intake System .....	3-14	To Remove Main Brush .....	3-34
Air Filter.....	3-14	To Install Main Brush .....	3-34
To Replace Air Filter Element .....	3-14	Main Brush Pattern Adjustment.....	3-35
Fuel System - Gasoline.....	3-15	To Check and Adjust Main Brush	
Fuel.....	3-15	Pattern .....	3-35
Fuel Tank.....	3-15	Side Brush Replacement.....	3-36
Fuel Filter .....	3-15	To Remove Side Brush.....	3-36
Carburetor Choke .....	3-15	To Install Side Brush .....	3-36
Carburetor.....	3-15	Side Brush Pattern Adjustment.....	3-36
Mechanical Fuel Pump.....	3-15	To Adjust Side Brush Pattern .....	3-36
Fuel System - LPG.....	3-16	Skirts and Seals .....	3-37
LPG Fuel System Operation .....	3-16	Hopper Lip Skirts.....	3-37
LPG Maintenance and Safety Tips.....	3-16	To Replace Hopper Lip.....	3-37
LPG Fuel Tanks .....	3-17	Hopper Seals .....	3-37
Changing Machine LPG Tanks.....	3-18	To Replace Hopper Top Seal .....	3-37
To Change an LPG Fuel Tank .....	3-18	To Replace Hopper Side Seals .....	3-38
Storage of LPG Fuel Tanks .....	3-18	Brush Door Skirts .....	3-38
LPG Fuel Filter Lock.....	3-18	To Replace and Adjust Brush Door	
LPG Vaporizer-Regulator.....	3-18	Skirts.....	3-38
LPG Vaporizer-Regulator Quick		Rear Skirts .....	3-38
Check.....	3-18	To Replace and Adjust Rear Skirts .....	3-38
LPG Carburetor.....	3-19	Brakes and Tires .....	3-40
Oil Pressure Switch.....	3-19	Brake Adjustments.....	3-40
LPG Fuel Troubleshooting .....	3-19	To Adjust Brake Linkage.....	3-40
Governor .....	3-21	Brake Lining Replacement .....	3-40
Checking and Adjusting Governor		Tires.....	3-41
Linkage .....	3-21	Latches .....	3-42
Governor Adjustment .....	3-21	Hopper Cover Latch .....	3-42
Electrical Systems .....	3-21	To Adjust Hopper cover Latch .....	3-42
Spark Plugs.....	3-21		
Distributor Maintenance .....	3-22	<b>SECTION 4 - APPENDIX</b>	
Distributor Ignition Timing With Timing		Decimal-Metric Conversion Table .....	4-1
Light .....	3-23	Hardware Information .....	4-2
Distributor Ignition Timing Without		Standard Bolt Torque Chart.....	4-2
Timing Light (Emergency Method) .....	3-23	Exceptions to Torque Chart.....	4-2
Alternator .....	3-23	Bolt Identification .....	4-2
Cylinder Head .....	3-24	Hydraulic Fitting Information.....	4-3
Valve Tappet Clearance Adjustment.....	3-24	Hydraulic Tapered Pipe Fitting (NPT)	
Electrical Systems .....	3-25	Torque Chart .....	4-3
Batteries.....	3-25	Hydraulic Tapered Seat Fitting (JIC)	
Battery Replacement.....	3-25	Torque Chart .....	4-3
Electrical Schematic .....	3-26	Hydraulic O-Ring Fitting Torque Chart.....	4-3
Belts and Chains .....	3-27		
Engine Fan Belt .....	3-27	<b>SECTION 5 - PARTS</b>	
Static Drag Chain .....	3-27	<b>SECTION 6 - LPG PARTS</b>	
Hopper.....	3-28	<b>SECTION 7 - ACCESSORIES</b>	
Hopper Dust Filters .....	3-28	<b>SECTION 8 - HYDRAULIC COMPONENTS</b>	
To Remove Hopper Dust Filters.....	3-28	<b>SECTION 9 - ENGINE PARTS</b>	
To Install Hopper Dust Filters.....	3-29	TENNANT COMPANY, TENNANT COMPANY	
Hopper Fusible Link.....	3-29	SUBSIDIARIES, AND MAJOR PARTS AND	
To Replace Hopper Fusible Link .....	3-29	SERVICE LOCATIONS DIRECTORY	
Hopper Adjustment .....	3-30		
Stabilizer Leg .....	3-33		

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# SECTION 1 SPECIFICATIONS

## CONTENTS

Page

Machine Specifications .....	1-1
Machine Dimensions.....	1-3





## MACHINE SPECIFICATIONS

### MODEL 250 POWER SWEEPER

#### POWER TYPE

Engine type - piston  
Ignition - breaker type spark  
Cycle - 4  
Aspiration - natural  
Cylinders - 2  
Bore - 3.31 in (84 mm)  
Stroke - 3.50 in (89 mm)  
Displacement - 56 cu in (918 cc)  
Net power - 19 hp (14.2 kw) @ 2700 rpm governed  
25 hp (18.6 kw) @ 3600 rpm maximum  
Fuels - gasoline, 86 octane, leaded or unleaded, or  
LPG  
Cooling system - liquid  
Electrical system - 12 V nominal, 37 A alternator

#### POWER TRAIN

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

#### STEERING

Type - rear wheel controlled, automotive cam and lever  
Power source - manual  
Emergency steering - manual

#### HYDRAULIC SYSTEM

Function - operates propelling, hopper lift, hopper dump, main brush drive, and side brush drive.

Control valve, hopper lift, hopper dump, main brush drive, side brush drive - open center, three spool.

Propelling pump - variable displacement piston pump, 1.24 cu in (20.3 cc) maximum displacement, 14.5 gpm (54.9 L/min) @ 2700 rpm.

Propelling system rated pressure - 1400 psi (9653 kPa)

Accessories pump - gear pump, 0.70 cu in (11.5 cc) displacement, 8.2 gpm (31 L/min) @ 2700 rpm.

Accessories system rated pressure - 2000 psi (13,790 kPa).

Propelling motor - internal gear motor, 20.6 cu in (338 cc) displacement per revolution, 1400 psi (9653 kPa) maximum rated pressure.

Main brush drive motor - internal gear motor, 4.5 cu in (74 cc) displacement per revolution, 1400 psi (9653 kPa) maximum rated pressure.

Side brush drive motor - internal gear motor, 14.9 cu in (244 cc) displacement per revolution, 1000 psi (6895 kPa) maximum rated pressure.

Vacuum fan motor - gear motor, 0.3 cu in (5 cc) displacement per revolution, 2500 psi (17,238 kPa) maximum rated pressure.

Hopper lift cylinder - single action, 3.5 in (89 mm) bore x 8 in (203 mm) stroke, 1.25 in (32 mm) diameter rod, 2400 psi (16,548 kPa) maximum rated pressure.

Hopper dump cylinders (2) - double action, 2 in (51 mm) bore x 5.38 in (137 mm) stroke, 1 in (25 mm) diameter rod, 2400 psi (16,548 kPa) maximum rated pressure.

#### BRAKING SYSTEM

Service brakes - mechanical drum brakes (2), one per front wheel, solid linkage actuated.

Parking brake - utilizes service drum brakes, solid linkage actuated.

#### SUSPENSION SYSTEM

Front - two 16 x 3.5 x 12.12 solid tires  
Rear - one 5.70/5.00 x 8 pneumatic tire

#### SYSTEM FLUID CAPACITIES

Cooling system - radiator 3.7 qt (3.5 L)  
total system 6.8 qt (6.4 L)

Fuel tank - gasoline 8 gal (30.3 L)  
LPG 33 lb (15 kg)

Engine lubricating oil - 2 qt (1.9 L) w/o filter  
2.5 qt (2.4 L) w/filter

Hydraulic system - reservoir 7 gal (26.5 L)  
total system 9 gal (34 L)

#### GENERAL MACHINE DIMENSIONS/CAPACITIES

Length - 96 in (2438 mm)  
Width - 59.25 in (1505 mm)  
Height - 50 in (1270 mm) without overhead guard  
79 in (2007 mm) with overhead guard

Track, front - 46.5 in (1181 mm)  
Wheel base - 37.9 in (963 mm)  
Main brush - tubular width 42 in (1067 mm)  
outside diameter 14 in (356 mm)  
Side brush - rotary diameter 21 in (533 mm)  
Sweeping path width - 42 in (1067 mm) without side brush  
53 in (1346 mm) with side brush

Hopper capacity - 1000 lb (453 kg) 14 cu ft (0.42 m<sup>3</sup>)  
Dust filter area - 94 sq ft (8.7 m<sup>2</sup>)

#### MACHINE WEIGHTS

Net weight, dry - 2955 lb (1340 kg)  
Net GVWR - 4200 lb (1905 kg)

**GENERAL MACHINE PERFORMANCE**

**Maximum forward travel speed - 7.5 mph (12 km/h)**

**Maximum reverse speed - 4.0 mph (6.4 km/h)**

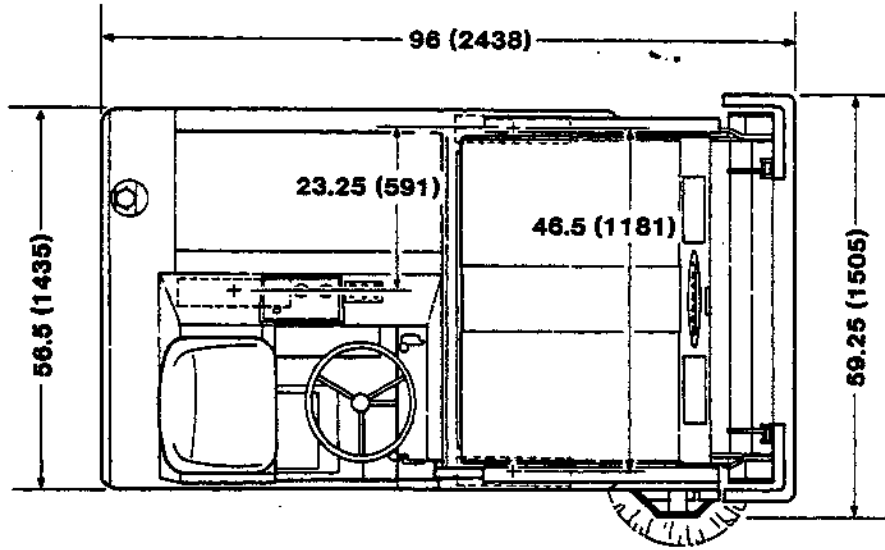
**Cleaning speed - 0 to 4 mph (0. to 6.4 km/h)**

**Turning radius - right 93.5 in (2375 mm)**

**left 66.38 in (1686 mm)**

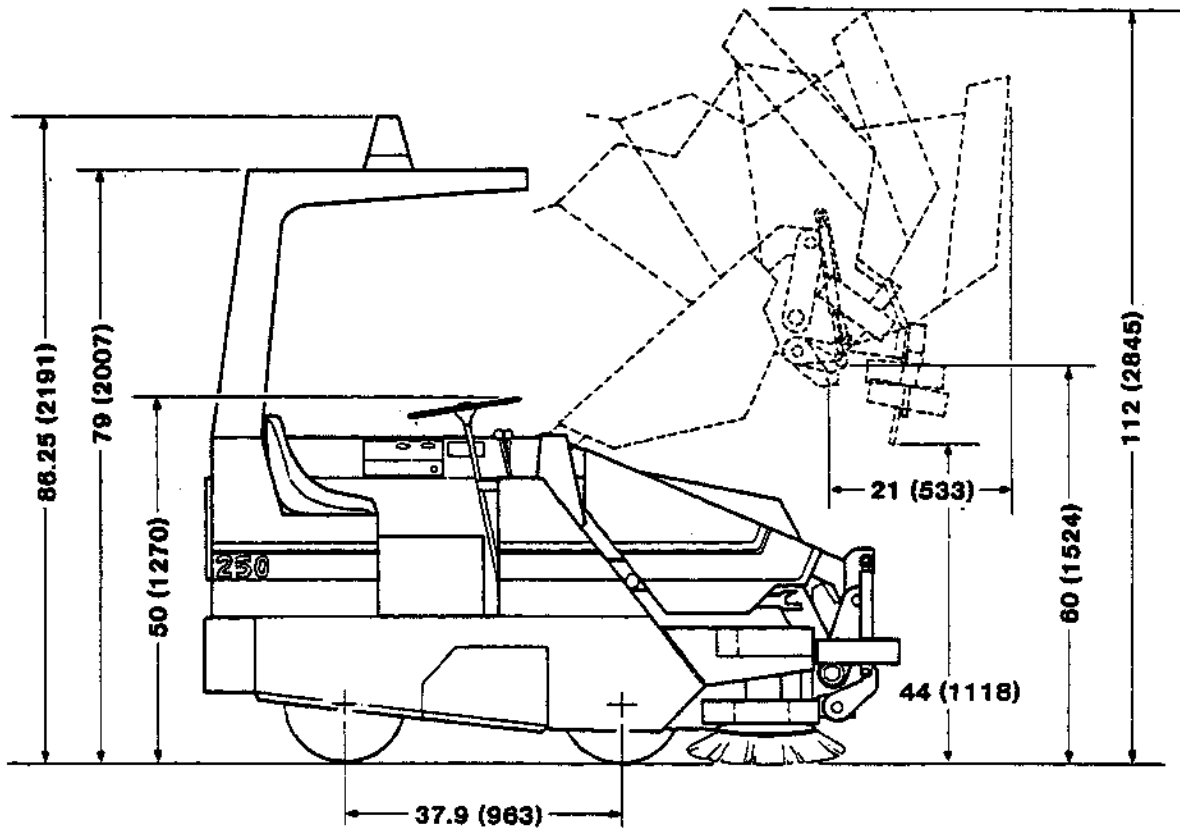


# MACHINE DIMENSIONS



TOP VIEW

NOTE: The first dimension is in inches, the second dimension in parenthesis is in millimeters.



SIDE VIEW



# SECTION 2 OPERATION

## CONTENTS

	Page		Page
Preparation for Operation.....	2-1	Machine Tie-Down Instructions.....	2-13
Operation of Controls.....	2-1	Machine Storage.....	2-14
Brake Pedal.....	2-1	Storing Machine.....	2-14
Directional Control Pedal.....	2-1		
Location of Controls and Instruments.....	2-2		
Main Brush Height Adjustment Knob.....	2-3		
Operator Seat.....	2-3		
Ignition Switch.....	2-3		
Hazard Lamp Switch.....	2-3		
Operating Lamps Switch.....	2-3		
Dust Filter Shaker Pushbutton Switch.....	2-3		
Throttle Control Lever.....	2-3		
Engine Choke Knob.....	2-3		
Engine Hour Meter.....	2-3		
Low Engine Oil Pressure Indicating Lamp ...	2-3		
High Engine Coolant Temperature Indicating Lamp.....	2-3		
Battery Condition Gauge.....	2-4		
Hopper Lift Control Lever.....	2-4		
Hopper Dump Control Lever.....	2-4		
Vacuum Fan, Main Brush and Side Brush Control Lever.....	2-4		
Main Brush Height Control Lever.....	2-5		
Steering Wheel.....	2-5		
Side Brush Height Control Lever.....	2-5		
Parking Brake Lever.....	2-5		
Hopper Safety Support Arm.....	2-6		
To Engage Hopper Safety Support Arm.....	2-6		
To Disengage Hopper Safety Support Arm.....	2-6		
Circuit Breakers.....	2-6		
Machine Operation.....	2-7		
Normal Sweeping Operation.....	2-7		
To Start a Gasoline Machine.....	2-7		
To Stop a Gasoline Machine.....	2-7		
To Start an LPG Machine.....	2-7		
To Stop an LPG Machine.....	2-8		
Operation on Grades.....	2-8		
Hopper Dumping.....	2-8		
To Dump Hopper.....	2-8		
Accessories Operation.....	2-10		
Vacuum Wand Accessory.....	2-10		
To Operate Vacuum Wand.....	2-10		
Dust Filter Bypass Accessory.....	2-11		
To Operate the Filter Bypass Accessory.....	2-11		
Transporting Machine.....	2-12		
Pushing or Towing Machine.....	2-12		
Machine Jacking Instructions.....	2-12		



## PREPARATION FOR OPERATION

### AFTER UNCRATING AND BEFORE OPERATING THE MACHINE:

1. Check the machine for shipping damage.
2. Read this manual carefully before operating or servicing the machine.
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 the Hydraulic section.
4. Check the engine oil level.
5. Check the radiator coolant level.
6. Check the brush adjustment, as described in Maintenance section.
7. Check the air pressure of the rear tire.
8. Fill the fuel tank, or install an LPG fuel tank on the machine per the instructions in this manual.

## OPERATION OF CONTROLS

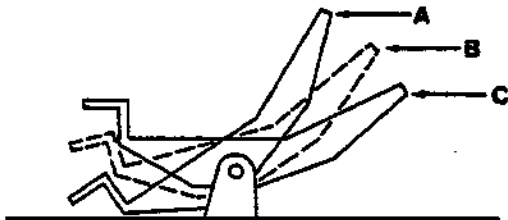
### BRAKE PEDAL

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

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

### DIRECTIONAL CONTROL PEDAL

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



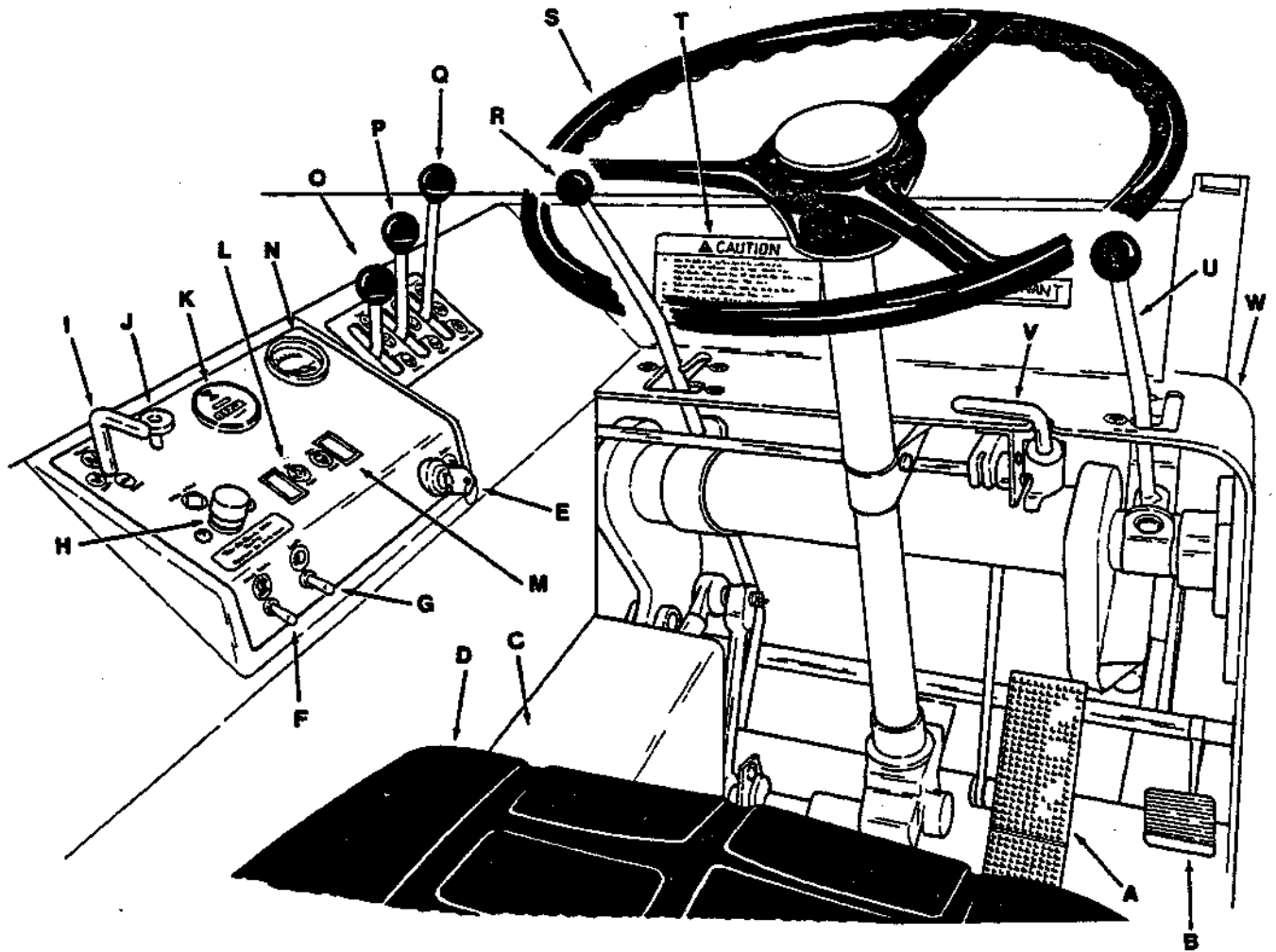
DIRECTIONAL CONTROL PEDAL 00118

- A. "Reverse" Position
- B. "Neutral" Position
- C. "Forward" Position

Gradually press the "toe" portion of the pedal for forward travel or 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 Adjusting Directional Control Pedal in the Maintenance section.

*NOTE: Always use the brake pedal for normal stopping and controlling machine speed on downgrades.*



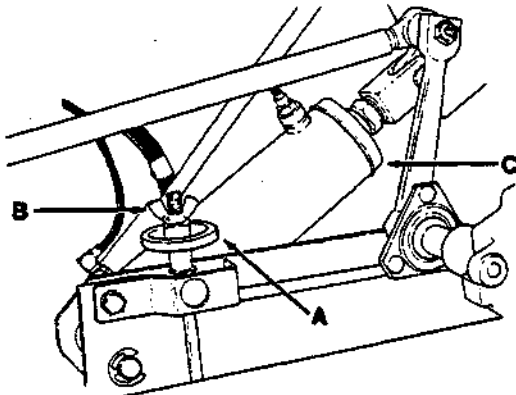
### LOCATIONS OF CONTROLS AND INSTRUMENTS

00562

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>A. Directional Control Pedal</li> <li>B. Brake Pedal</li> <li>C. Main Brush Height Adjustment Knob</li> <li>D. Operator Seat</li> <li>E. Ignition Switch</li> <li>F. Hazard Lamp Switch</li> <li>G. Operating Lamps Switch</li> <li>H. Dust Filter Shaker Pushbutton Switch</li> <li>I. Throttle Control Lever</li> <li>J. Engine Choke Knob</li> <li>K. Engine Hour Meter</li> <li>L. Low Engine Oil Pressure Indicating Lamp</li> </ul> | <ul style="list-style-type: none"> <li>M. High Engine Coolant Temperature Indicating Lamp</li> <li>N. Battery Condition Gauge</li> <li>O. Hopper Lift Control Lever</li> <li>P. Hopper Dump Control Lever</li> <li>Q. Vacuum Fan, Main Brush, and Side Brush Control Lever</li> <li>R. Main Brush Height Control Lever</li> <li>S. Steering Wheel</li> <li>T. Operator Safety Decal</li> <li>U. Side Brush Height Control Lever</li> <li>V. Parking Brake Lever</li> <li>W. Hopper Safety Support Arm</li> </ul> |
|--|--|

## MAIN BRUSH HEIGHT ADJUSTMENT KNOB

The main brush height adjustment knob is used to adjust the height of the main brush which determines the amount of contact the brush has with the floor. Threading the knob clockwise raises the main brush. Threading the knob counterclockwise lowers the main brush.



## MAIN BRUSH HEIGHT ADJUSTMENT KNOB

00563

- A. Main Brush Height Adjustment Knob
- B. Wing Nut
- C. Lift Cylinder

## OPERATOR SEAT

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

## IGNITION SWITCH

The key-operated ignition switch has four positions. These positions are: "accessories," "off," "on," and "start." To operate any electrical accessory without operating the engine, turn the key to the "accessories" position which is counterclockwise from the vertical "off" position. To start the engine, turn the key fully clockwise to the "start" position. Release the key as soon as the engine starts and the key will place itself in the "on" position.

*NOTE: Do not engage the starter for more than ten seconds at a time, or after the engine has started, as the starter may be damaged.*

## HAZARD LAMP SWITCH

This switch is present on machines with the hazard lamp accessory. Flip the switch toggle up to turn the lamp on. Flip the switch toggle down to turn the lamp off.

## OPERATING LAMPS SWITCH

This switch is present on machines with the operating lamps accessory. It controls the headlamps, taillamps, and the brush spot lamp. Flip the switch toggle upward to turn the lamps on. Flip the switch toggle down to turn the lamps off.

POWER SWEEPER - 250 MM138 (B-81) LITHO IN U.S.A.

## DUST FILTER SHAKER PUSHBUTTON SWITCH

The dust filter shaker pushbutton switch operates the shaker motors which are mounted on top of the hopper dust filters.

To operate the shaker motors, the hopper must be in the operating position. Then place the vacuum fan, main brush, and side brush control lever in the "off" position. Push and hold the pushbutton switch in for ten to fifteen seconds; then release the pushbutton to stop the shaker motors.

## THROTTLE CONTROL LEVER

The throttle control lever operates a rod which controls the engine governed speed. Rotating the lever clockwise speeds the engine to the maximum governed speed. Rotating the lever counterclockwise slows the engine to the idle speed.

*NOTE: The machine must always be operated with the engine operating at the maximum governed speed. Damage to the engine and hydraulic pump may result if the machine is not operated as such.*

## ENGINE CHOKE KNOB

This knob operates a cable which controls the engine choke. Pulling out on the knob closes the choke, aiding in the cold starting of the engine. Pushing in on the knob opens the choke, allowing the engine to turn normally at its operating temperature and speed. It is not necessary to choke a warm engine.

## 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.

## LOW ENGINE OIL PRESSURE INDICATING LAMP

The low engine oil pressure indicating lamp lights when the engine oil pressure drops below 7 psi (48 kPa). If the lamp should light, stop the engine immediately and determine the cause. Failure to stop the engine could result in severe engine damage.

**ATTENTION! Stop the engine immediately if the low engine oil pressure lamp lights. Failure to stop the engine could result in severe engine damage.**

## HIGH ENGINE COOLANT TEMPERATURE INDICATING LAMP

The high engine coolant temperature indicating lamp lights when the engine coolant temperature exceeds 225°F (107°C). Temperatures above this level indicate an overheating engine. This condition may arise from 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 a malfunction of the temperature sending unit.

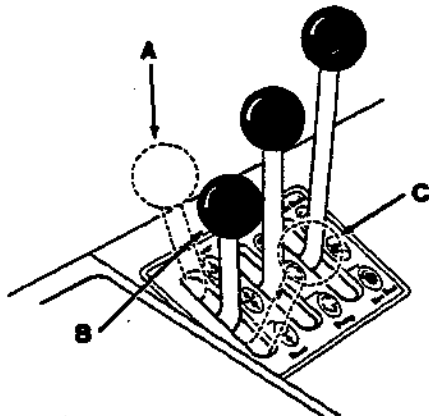
## BATTERY CONDITION GAUGE

The battery condition 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 is in need of repair.

## HOPPER LIFT CONTROL LEVER

The hopper lift control lever operates one spool of the three-spool hydraulic control valve. The control lever controls the height of the hopper. Pushing the control lever back into the "lower" position lowers the hopper to the normal "operating" position. Pulling the control lever forward into the "raise" position raises the hopper. The center position is the "hold" position. The "hold" position will keep the hopper at any height within its range. Do not rely on the "hold" position to keep the hopper raised when working under the hopper. Always use the hopper safety support arm.

**⚠ WARNING:** Always use the hopper safety support arm to hold the hopper up when working under the hopper. Do not rely on the machine hydraulic system to hold the hopper up.



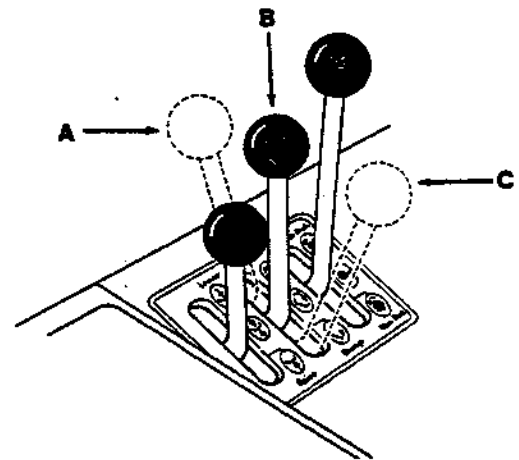
HOPPER LIFT CONTROL LEVER

00584

- A. "Lower" Position
- B. "Hold" Position
- C. "Raise" Position

## HOPPER DUMP CONTROL LEVER

The hopper dump control lever operates one spool of the three spool hydraulic control valve. The control lever controls the angle at which the hopper is positioned. Pushing the control lever back into the "return" position rotates the hopper into the normal "operating" position. Pulling the control lever forward into the "dump" position rotates the hopper into the vertical dumping position. The center position is the "hold" position. The "hold" position will keep the hopper at any position within the dumping range.



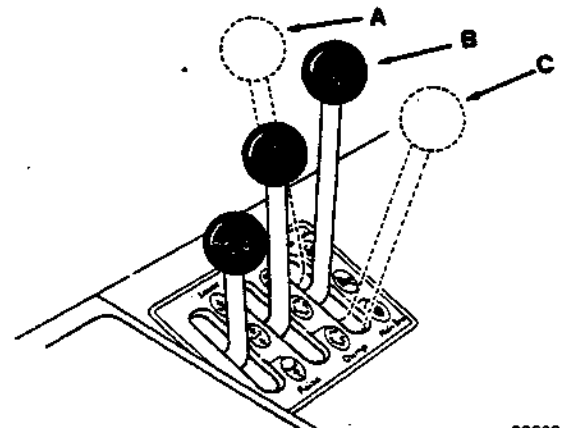
HOPPER DUMP CONTROL LEVER

00565

- A. "Return" Position
- B. "Hold" Position
- C. "Dump" Position

## VACUUM FAN, MAIN BRUSH, AND SIDE BRUSH CONTROL LEVER

The vacuum fan, main brush, and side brush control lever operates one of the spools of the three-spool hydraulic control valves. The control lever controls the operation of the vacuum fan, main brush, and the side brush. Pushing the control lever back into the "side brush" position operates the vacuum fan, main brush, and side brush. Pulling the control lever forward into the "main brush" position, operates the vacuum fan and the main brush. The enter position is the "off" position. The "off" position stops the vacuum fan, main brush, and the side brush from operating.



00566

## VACUUM FAN, MAIN BRUSH, AND SIDE BRUSH CONTROL LEVER

- A. "Side Brush" Position
- B. "Off" Position
- C. "Main Brush" Position

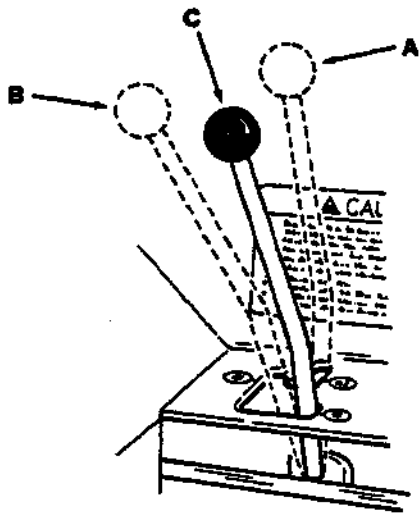


## MAIN BRUSH HEIGHT CONTROL LEVER

The main brush height control lever operates a linkage which controls the height of the main brush. Pulling the control lever back and to the left lowers the main brush. There are two positions in which the main brush may be operated. The positions are "normal" and "free-float." "Normal" position is used for most sweeping conditions. Operating in the "normal" position will result in much longer main brush life. "Free-float" position is used when extremely uneven areas are encountered. The "free-float" position allows the main brush to follow the uneven surfaces more closely.

Pulling the control lever back and to the right into the "raise" position raises the main brush off the floor.

**NOTE:** Always place the main brush control lever in the "raise" position when the machine is to sit unoperated for a period of time, for example—overnight.



## MAIN BRUSH HEIGHT CONTROL LEVER 00567

- A. "Free-Float" Position
- B. "Normal" Position
- C. "Raise" Position

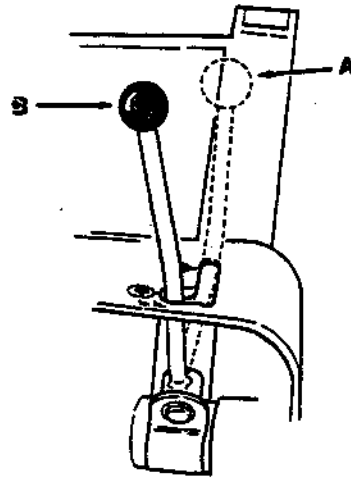
## STEERING WHEEL

The automotive-type steering wheel operates a steering gear assembly which controls the rear caster wheel through an arm and tie rod arrangement. The machine is very responsive to the movement of the steering wheel. The operator should use care until he or she becomes more experienced in guiding the machine.

## SIDE BRUSH HEIGHT CONTROL LEVER

The side brush height control lever operates a cable which controls the height of the side brush. Pulling the control lever back and to the right into the "lower" position lowers the side brush to the floor. Pulling the control lever back and to the left into the "raise" position, raises the side brush off the floor.

**NOTE:** Always place the side brush control lever in the "raise" position when the side brush is not being operated.



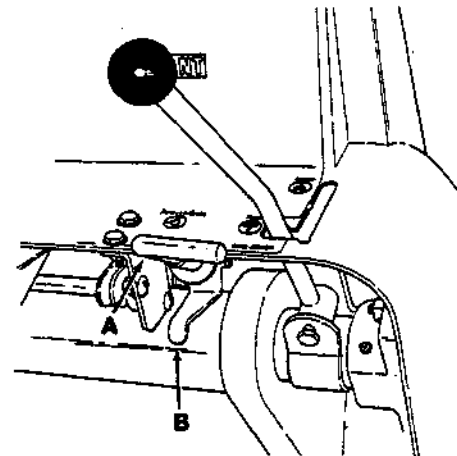
## SIDE BRUSH HEIGHT CONTROL LEVER 00568

- A. "Lower" Position
- B. "Raise" Position

## PARKING BRAKE LEVER

The parking brake lever operates the same brake linkage as the brake pedal. Pulling out the lever engages the brakes and a locking tab on the parking brake lever. Pulling the locking tab up and pushing in the lever disengages the brakes.

**CAUTION:** Always engage the parking brake before dismantling the machine.



## PARKING BRAKE LEVER 00543

- A. Brake Lever
- B. Brake Locking Tab

## HOPPER SAFETY SUPPORT ARM

The hopper safety support arm is present on the operator's side of the hopper. It 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:** Do not rely on the machine hydraulic system to keep the hopper raised when work is to be done under the hopper. Always engage the hopper safety support arm before working under the hopper.

### TO ENGAGE HOPPER SAFETY SUPPORT ARM

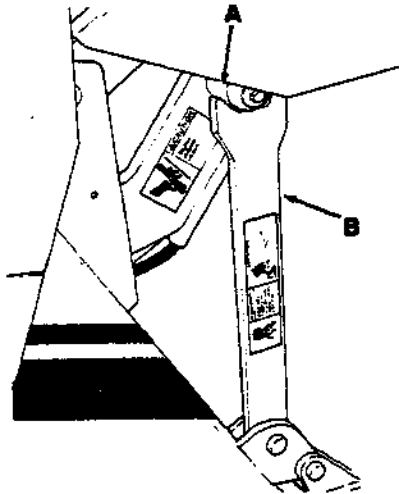
1. Engage the machine parking brake.

**⚠ CAUTION:** Always engage the machine parking brake before working on the machine.

2. Raise the hopper to the fully raised position.

**⚠ WARNING:** Never reach under a raised hopper without first engaging the hopper safety support arm. Stay clear of hopper lift arms when the hopper is raised or lowered. Lift arms cross when in motion, creating a pinch point.

3. Position the hopper safety arm under the hopper lift arm cam.



### ENGAGED HOPPER SAFETY ARM

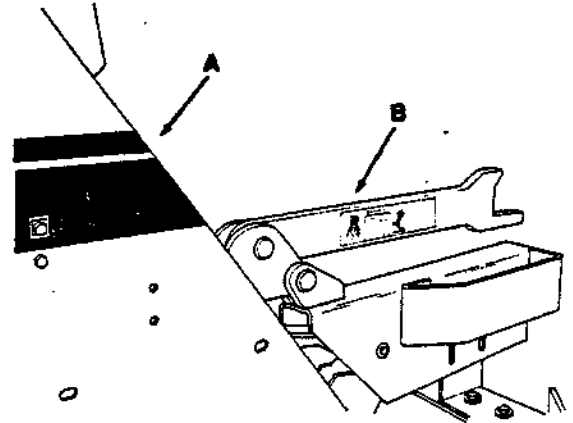
00544

- A. Lift Arm Cam
- B. Hopper Safety Arm

4. Slowly lower the hopper so the lift arm cam seats itself on top of the hopper safety arm.
5. Turn the engine off.
6. Check the hopper safety arm to make sure it is securely engaged.

### TO DISENGAGE HOPPER SAFETY SUPPORT ARM

1. Start the engine.
2. Place the engine throttle in the "fast" position.
3. Raise the hopper to the fully raised position.
4. Lower the hopper safety support arm to its storage location.



### DISENGAGED HOPPER SAFETY ARM

00569

- A. Machine Frame
- B. Hopper Safety Arm

5. Lower the hopper.

## CIRCUIT BREAKERS

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

Never substitute higher value circuit breakers than those specified in this manual. The chart below indicates the various circuit breakers and the electrical components they protect.

PROTECTIVE DEVICE	RATING	CIRCUIT PROTECTED	LOCATION
CB-1	25A	Dust Filter Shaker	Rear of Instrument Panel.
CB-2	15A	Hour Meter, Voltmeter, Engine Temperature Lamp, Oil Pressure Lamp.	Rear of Instrument Panel.
CB-3	15A	Horn, Headlamps, Tailamps, Spot Lamp, Windshield Wiper Motor.	Rear of Instrument Panel.

## MACHINE OPERATION

### NORMAL SWEEPING OPERATION


#### TO START A GASOLINE MACHINE

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

#### PRE-START CHECKLIST

Check under machine for leak spots.  
Check hydraulic fluid level using dipstick.  
Check engine lubricating oil level.  
Check engine air filter.  
Check engine coolant level.  
Check fuel level.  
Check brakes and controls for proper operation.  
Check service records to determine service requirements.

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

 **WARNING:** Do not attempt to start the machine unless the operator is in the operator's seat with the directional control pedal in the neutral position and with a foot on the brake pedal or with the parking brake engaged.

2. Cold engines: Pull out the choke button about three-fourths of the way. Push choke in after the engine has started and is running smoothly.
3. Move the throttle control lever to the "idle" position.
4. Turn the ignition switch key to the "start" position until the engine starts. Do not operate the starter for more than a few seconds at a time or after the engine has started.

**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.

5. Allow the engine and hydraulic system to warm up three to five minutes.
6. Disengage the machine parking brake.
7. Drive the machine to the area to be cleaned.
8. Clean as required.

#### TO STOP A GASOLINE MACHINE

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

#### POST OPERATION CHECKLIST - ENGINE OPERATING

Check sweeping brush pattern for width and evenness.

1. Return the directional control pedal to the "neutral" position. Apply the brake.
2. Turn the operating lamps off if used.
3. Place the throttle control lever in the "idle" position.
4. Engage the machine parking brake.
5. Turn the ignition key switch to the "off" position. Remove the key from the ignition switch.

 **CAUTION:** Always engage the parking brake before leaving the machine.

#### POST OPERATION CHECKLIST - ENGINE STOPPED

Check for wire or string tangled on scrub brushes.  
Empty debris hopper.  
Fill fuel tank.  
Check for leaks.

#### TO START AN LPG MACHINE

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


#### PRE-START CHECKLIST

Check under machine for leak spots.  
Check hydraulic fluid level using dipstick.  
Check engine lubricating oil level.  
Check engine air filter.  
Check engine coolant level.  
Check fuel level.  
Check for LPG odor indicating a leak.  
Check for frost on LPG hoses and components.  
Check to make sure liquid withdrawal LPG tank is to be used.  
Check brakes and controls for proper operation.

1. Check LPG fuel tank gauge to see if there is an adequate fuel supply.
2. 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 valve, wait a few seconds, and slowly open the valve once again.

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

 **WARNING:** Do not attempt to start the machine unless the operator is in the operator's seat with the directional control pedal in the neutral position and with a foot on the brake pedal or with the parking brake engaged.

4. Cold engines: Open the engine cover, press the primer button on the LPG vaporizer, close the engine cover.
5. Move the throttle control lever to the "idle" position.
6. Turn the ignition switch key to the "start" position until the engine starts. Do not operate the starter for more than 10 seconds at a time or after the engine has started.

*NOTE: Do not operate the starter motor for more than a few 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.*

7. Allow the engine and hydraulic system to warm up three to five minutes.
8. Disengage the machine parking brake.
9. Drive the machine to the area to be cleaned.
10. Clean as required.

#### TO STOP AN LPG MACHINE

*NOTE: Before stopping the machine, perform the post operation checks.*

#### POST OPERATION CHECKLIST - ENGINE OPERATING

Check sweeping brush pattern width and evenness.

1. Return the directional control pedal to the neutral position. Apply the brake.
2. Turn the operating lamps off if used.
3. Place the throttle control lever in the "idle" position.
4. Engage the machine parking brake.

 **CAUTION:** Always engage the parking brake before leaving the machine unattended.

5. Turn the ignition key switch to the "off" position. Remove the ignition key from the ignition switch.
6. Close the LPG tank liquid service valve.

#### POST OPERATION CHECKLIST - ENGINE STOPPED

Check for wire or string tangled on brushes.

Empty debris hopper.

Check to make sure LPG tank service valve is closed.

Check for LPG odor indicating a leak.

Check for frost on LPG hoses and components.

Check for leaks.

#### OPERATION ON GRADES

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


 **CAUTION:** Always travel slowly on grades.

The maximum rated ramp climb and descent angle is 10° with an empty hopper, and 8° with a full hopper.

#### HOPPER DUMPING

The hopper may be low dumped or high dumped.

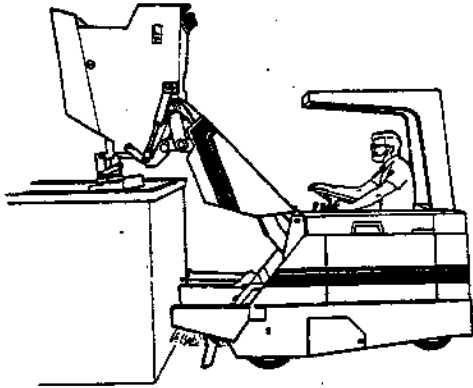
The maximum dumpster height is 60 in. (1524 mm). A vertical clearance of 112 in (2845 mm) is required to high dump the hopper.

 **CAUTION:** Be sure adequate vertical clearance is available before attempting to high dump the hopper.

#### TO DUMP HOPPER

1. Drive machine to the dump site or dumpster.
2. Turn off brushes.
3. Push the hopper lift control lever into the "raise" position to raise the hopper. Release the lever when the hopper is raised to the desired height.
4. Slowly drive the machine up to the dump site or dumpster.
5. Pull the hopper dump control lever into the "dump" position to dump the hopper. Release the lever when the hopper has rotated fully.

 **CAUTION:** Do not drive the machine for any distance with the hopper raised.



### **DUMPING HOPPER**

00545

6. Push the hopper dump control lever into the "return" position then rotate the hopper into the "horizontal" position. Release the lever when the hopper has rotated fully.
7. Slowly back the machine away from the dump site or dumpster.
8. Push the hopper lift control lever into the "lower" position to lower the hopper into the "operating" position. Release the lever when the hopper has lowered fully.
9. Continue operating the machine as required.

## ACCESSORIES OPERATION

### VACUUM WAND ACCESSORY

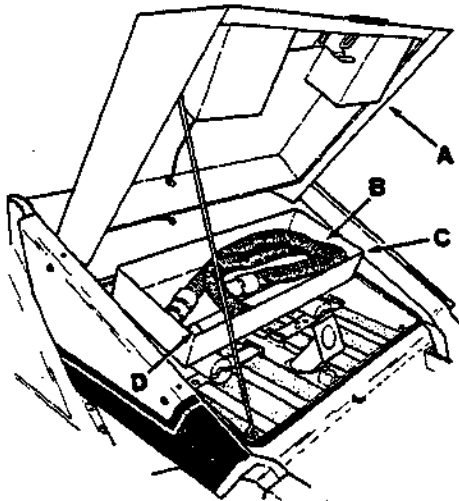
The vacuum wand accessory gives the machine the added flexibility of picking up spills not accessible by the machine. An 84 in (2137 mm) hose utilizes the machine vacuum system.

### TO OPERATE VACUUM WAND

1. Stop the machine close to the area to be cleaned.
2. Place the main brush and side brush in the "raise" position.
3. Stop the engine and engage the machine parking brake.

**CAUTION:** Always engage the parking brake before operating the vacuum wand.

4. Open and prop up the hopper cover.

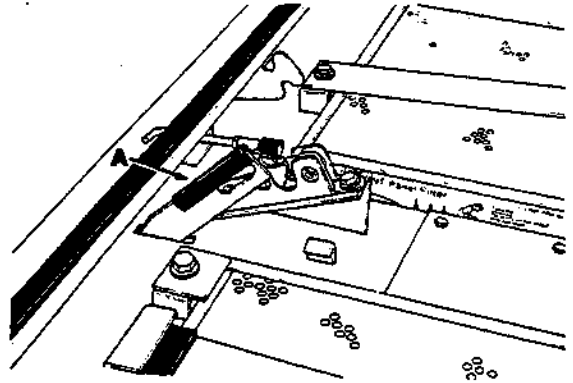


### VACUUM WAND STORAGE

00546

- A. Hopper Cover
- B. Vacuum Hose
- C. Storage Tray
- D. Vacuum Wand

5. Remove the vacuum wand and hose from their storage tray.
6. Push the fire door arm to the left and down, and then allow it to rise, closing the fire door.

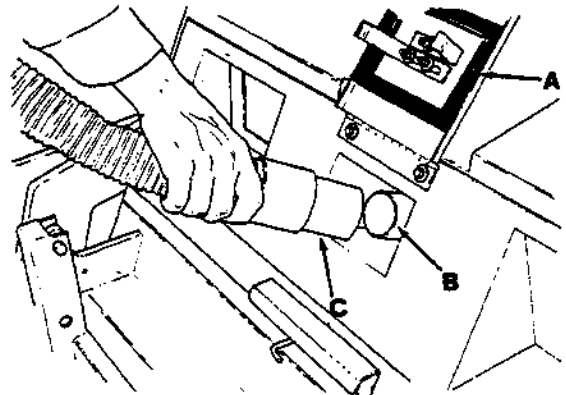


### FIRE DOOR ARM

00547

#### A. Fire Door Arm "Closed" Position

7. Push the hopper cover open, lower the prop arm, and close the hopper cover.
8. Open the vacuum wand hose coupling door.
9. Assemble the vacuum wand to the vacuum hose.
10. Push the vacuum hose onto the vacuum hose connection on the front of the hopper.

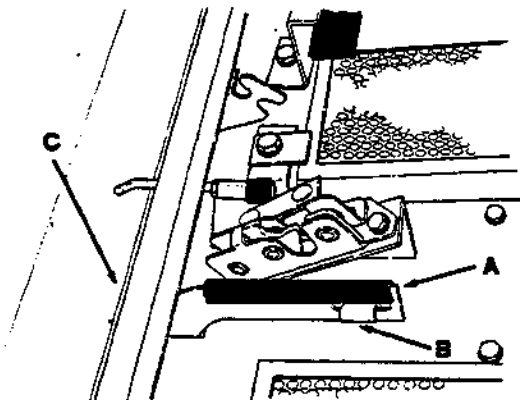


### VACUUM WAND HOSE CONNECTION

00548

- A. Vacuum Wand Hose Coupling Door
- B. Vacuum Hose Coupling
- C. Vacuum Hose

11. Start the engine.
12. Move the throttle control lever to the "full" position.
13. Pull the main brush control lever back into the "main brush" position to start the machine vacuum.
14. Vacuum the area as required.
15. When finished, push the main brush control lever into the "off" position to stop the machine vacuum.
16. Place the throttle control lever in the "idle" position.
17. Stop the engine.
18. Pull the vacuum hose out of the vacuum hose connection.
19. Close the vacuum wand hose coupling door.
20. Disassemble the vacuum wand and vacuum hose.
21. Open and prop up the hopper cover.
22. Return the vacuum wand and hose to their storage tray.
23. Open the fire door by pushing the fire door arm down and to the left inserting the fire door arm into the fire door retaining clip.



**FIRE DOOR ARM**

00570

- A. Fire Door Arm "Open" Position
- B. Retaining Clip
- C. Front of Hopper

24. Push the hopper cover open, lower and store the prop arm under its retaining clip and close the hopper cover.

## DUST FILTER BYPASS ACCESSORY

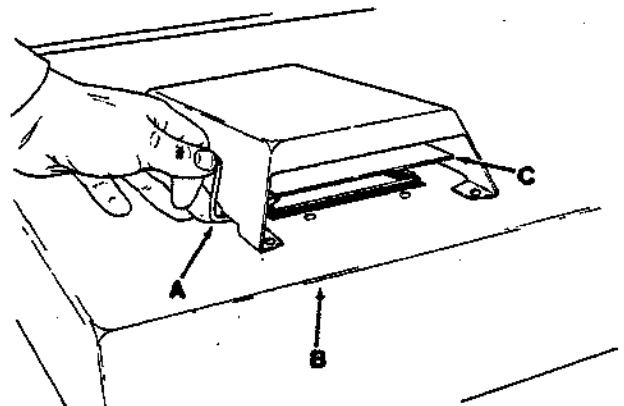
The dust filter by-pass accessory is designed to enable the machine to operate when damp or wet conditions exist. Wet or damp conditions may clog the dust filters. When the accessory is in use, the air which is normally drawn through the dust filters is drawn in the air scoop located on the hopper cover. This eliminates excessive moisture from contacting the dust filters and continues to allow the hydraulic fluid to be cooled by the vacuum air flow.

### TO OPERATE THE FILTER BYPASS ACCESSORY

1. Engage the machine parking brake.

**⚠ CAUTION: Always engage the machine parking brake before leaving the operator seat.**

2. Place the filter bypass control lever in the "open" position.



**FILTER BYPASS CONTROL LEVER**

00590

- A. Control Lever
- B. Hopper Cover
- C. Dust Filter Bypass "Open" Position

3. Release the parking brake.
4. Clean the area as required with the machine.
5. When finished cleaning the wet or damp area, engage the machine parking brake.
6. Place the filter bypass control lever in the "closed" position.
7. Release the parking brake and continue operating the machine as required.

## TRANSPORTING MACHINE

### PUSHING OR TOWING MACHINE

The machine may be pushed from the front or the rear, using the bumpers provided.

The machine may be towed only from the rear. Do not pull on the front bumper.

**ATTENTION!** Use care when pushing or towing from the rear as the machine hydraulic fluid reservoir is located behind the rear bumper.

The maximum pushing or towing distance is 0.5 mile (0.8 km) at up to a speed of 1 mph (1.6 km/h).

**ATTENTION!** Do not push or tow the machine for a distance greater than 0.5 mile (0.8 km) at speeds greater than 1 mph (1.6 km/h) or the machine hydraulic system may be damaged.

### MACHINE JACKING INSTRUCTIONS

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

**CAUTION:** Always engage the machine parking brake before working on the machine.

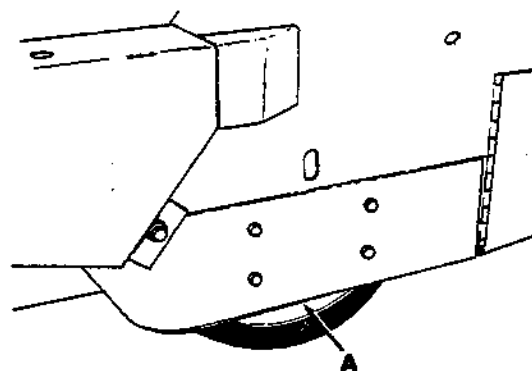
2. Empty the debris hopper before attempting to jack the machine up.
3. Block the tires which are not being jacked up to secure the machine's position.

**CAUTION:** Always block the machine tires before jacking the machine up.

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

**CAUTION:** Jack machine up only at the designated locations.

The front jacking locations are the bottom edge of the machine frame next to the machine tires.

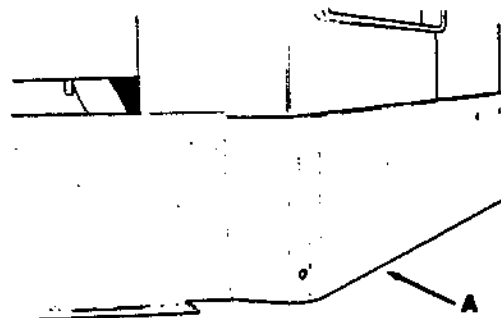


00559

### FRONT JACKING LOCATION (LEFT SIDE SHOWN)

#### A. Jacking Location

The rear jacking location is the bottom of the rear edge of the machine frame.



00571

### REAR JACKING LOCATION

#### A. Jacking Location

5. Block machine up with jack stands or similar devices to make sure machine is secure.

**WARNING:** Always use jack stands or similar devices to hold the machine up. Scissors or hydraulic type jacks may slip or "leak down" allowing the machine to lower or fall, crushing anything under it.

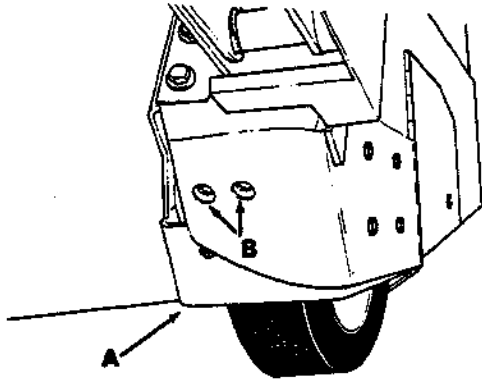
6. Lower the machine onto the jack stands.
7. Check to make sure the machine is secure.
8. Service the machine as required.
9. When finished servicing the machine, raise the machine up off the jack stands.
10. Remove the jack stands from under the machine.
11. Lower the machine.
12. Remove the blocks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



## MACHINE TIE-DOWN INSTRUCTIONS

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

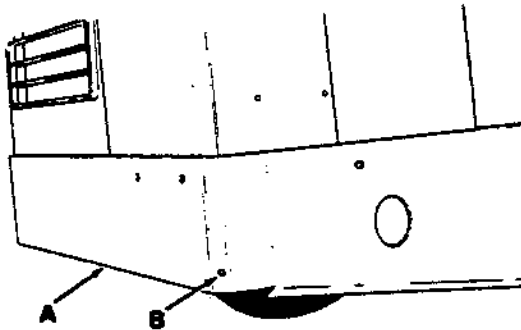
To tie the machine down, use the holes provided.



00572

### FRONT TIE-DOWN HOLES (LEFT SIDE SHOWN)

- A. Machine Frame
- B. Tie-Down Hole



00558

### REAR TIE-DOWN HOLES (RIGHT SIDE SHOWN)

- A. Machine Frame
- B. Tie-Down Hole

When transporting the machine on a trailer or in a truck, be sure to engage 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 engine oil.
  3. Place the main brush and side brush height control lever in the "raise" 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 (0.09 L) of clean engine oil into each spark plug hole.
  3. Remove the ignition coil high tension wire. Operate the engine starter motor for at least a dozen revolutions. This distributes the oil over the cylinder walls.
  4. Replace the high tension coil wire and spark plugs.
  5. Drain the gasoline from the carburetor bowl by removing the carburetor bowl drain plug.

6. Replace the carburetor drain plug.

- 7B. To store the machine 90 days to 6 months:

*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.*

1. Remove the spark plugs.
2. Pour 3 oz (0.09 L) of SAE 30 or SAE 40 engine oil into each of the spark plug holes.
3. Remove the ignition coil high tension wire. Operate the engine starter for at least a dozen revolutions. This distributes the oil over the cylinder walls. Replace the spark plugs.
4. Drain the engine oil from the engine oil pan.
5. Drain the engine cooling system, the radiator, and the engine block of coolant.
6. Close the engine cooling system drain cocks.
7. Drain gasoline from the carburetor, fuel tank, and the fuel lines.
8. Seal the air cleaner inlet, the exhaust outlet, and the crankcase breather tube with weatherproof masking tape.
9. Tighten the engine oil filler cap, the fuel tank cap, and the radiator cap to make certain they are securely in place.

# SECTION 3 MAINTENANCE

## CONTENTS

	Page	Page	
Recommended First 50-Hour Inspection .....	3-1	LPG Fuel Tanks .....	3-17
Maintenance Chart .....	3-2	Changing Machine LPG Tanks .....	3-18
Lubrication .....	3-4	To Change an LPG Fuel Tank .....	3-18
Engine .....	3-4	Storage of LPG Fuel Tanks .....	3-18
Hopper Lift Bearings .....	3-4	LPG Fuel Filter Lock .....	3-18
Hopper Door Latches .....	3-4	LPG Vaporizer-Regulator .....	3-18
Steering Gear .....	3-5	LPG Vaporizer-Regulator Quick	
Hopper Cover Latch .....	3-5	Check .....	3-18
Brush Access Door Latches .....	3-5	LPG Carburetor .....	3-19
Side Engine Door Latch .....	3-5	Oil Pressure Switch .....	3-19
Hydraulics .....	3-6	LPG Fuel Troubleshooting .....	3-19
Recommended Hydraulic Fluid .....	3-6	Governor .....	3-21
Hydraulic Fluid Reservoir .....	3-6	Checking and Adjusting Governor	
To Drain the Hydraulic Fluid Reservoir .....	3-6	Linkage .....	3-21
To Fill the Hydraulic Fluid Reservoir .....	3-7	Governor Adjustment .....	3-21
Hydraulic Fluid Reservoir Breather .....	3-7	Electrical Systems .....	3-21
To Replace Hydraulic Fluid Reservoir		Spark Plugs .....	3-21
Breather Element .....	3-7	Distributor Maintenance .....	3-22
Hydraulics Fluid Filter .....	3-7	Distributor Ignition Timing With Timing	
To Replace the Hydraulic Fluid Filter		Light .....	3-23
Element .....	3-8	Distributor Ignition Timing Without	
Hydraulic Pumps .....	3-8	Timing Light (Emergency Method) .....	3-23
Hydraulic Pump Start-Up Procedure .....	3-8	Alternator .....	3-23
Directional Control Pedal "Neutral"		Cylinder Head .....	3-24
Position Adjustment .....	3-9	Valve Tappet Clearance Adjustment .....	3-24
Speed Limiter .....	3-9	Electrical Systems .....	3-25
Hydraulic Schematic Diagram .....	3-10	Batteries .....	3-25
Hydraulic Fluid Leaks .....	3-11	Battery Replacement .....	3-25
Engine .....	3-12	Electrical Schematic .....	3-26
Engine Lubrication .....	3-12	Belts and Chains .....	3-27
Cooling System .....	3-12	Engine Fan Belt .....	3-27
To Reverse Flush the Radiator .....	3-12	Static Drag Chain .....	3-27
To Reverse Flush the Engine Water		Hopper .....	3-28
Jacket .....	3-13	Hopper Dust Filters .....	3-28
Replacing and Testing Thermostat .....	3-13	To Remove Hopper Dust Filters .....	3-28
Radiators Pressure Cap .....	3-13	To Install Hopper Dust Filters .....	3-29
Engine Fan Belt Tension .....	3-14	Hopper Fusible Link .....	3-29
Water Pump .....	3-14	To Replace Hopper Fusible Link .....	3-29
Air Intake System .....	3-14	Hopper Adjustment .....	3-30
Air Filter .....	3-14	Stabilizer Leg .....	3-33
To Replace Air Filter Element .....	3-14	To Adjust Stabilizer Leg .....	3-33
Fuel System - Gasoline .....	3-15	Brushes .....	3-34
Fuel .....	3-15	Main Brush Replacement .....	3-34
Fuel Tank .....	3-15	To Remove Main Brush .....	3-34
Fuel Filter .....	3-15	To Install Main Brush .....	3-34
Carburetor Choke .....	3-15	Main Brush Pattern Adjustment .....	3-35
Carburetor .....	3-15	To Check and Adjust Main Brush	
Mechanical Fuel Pump .....	3-15	Pattern .....	3-35
Fuel System - LPG .....	3-16	Side Brush Replacement .....	3-36
LPG Fuel System Operation .....	3-16		
LPG Maintenance and Safety Tips .....	3-16		

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## CONTENTS

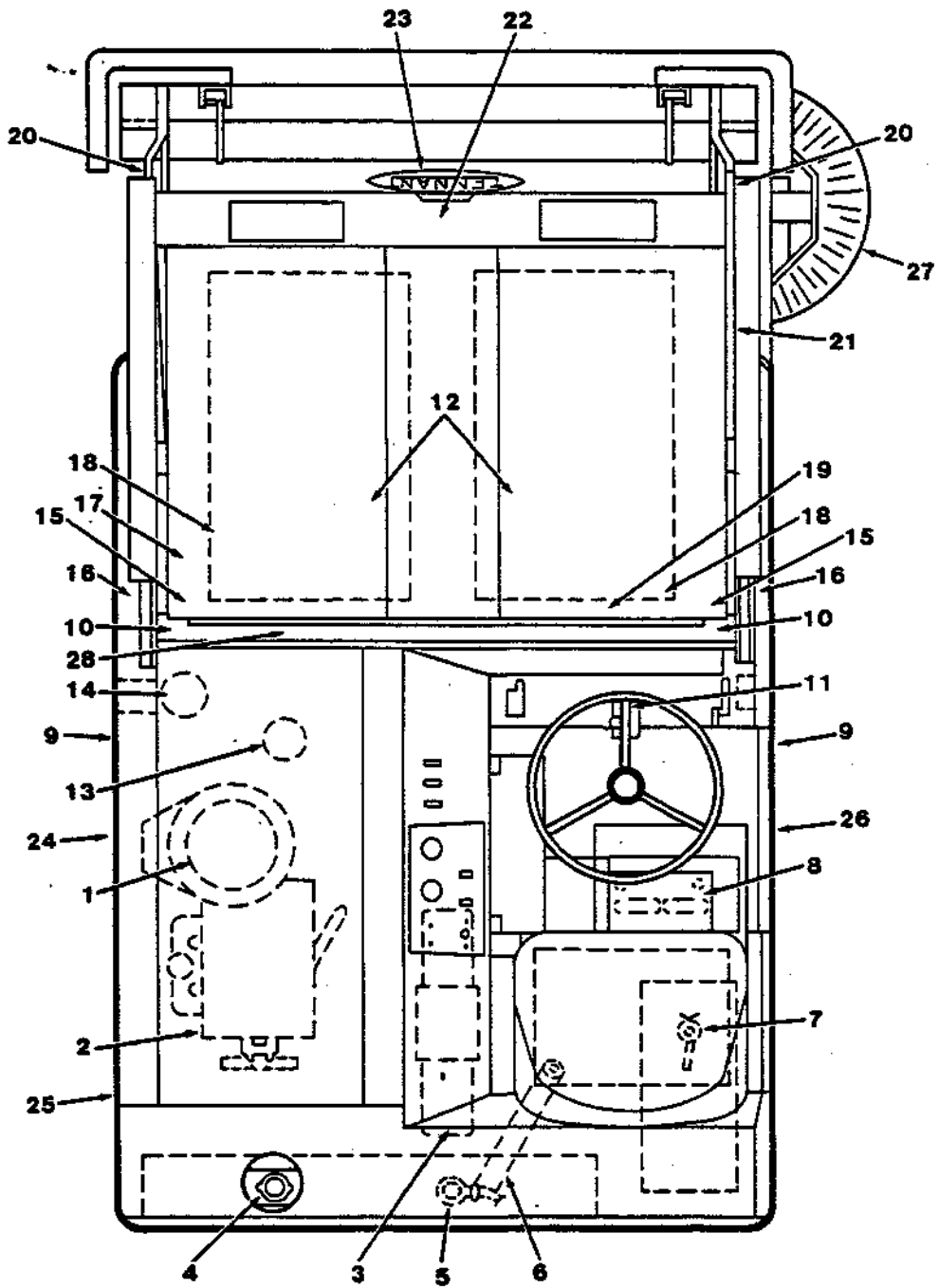
	Page
To Remove Side Brush.....	3-36
To Install Side Brush.....	3-36
Side Brush Pattern Adjustment.....	3-36
To Adjust Side Brush Pattern .....	3-36
Skirts and Seals.....	3-37
Hopper Lip Skirts.....	3-37
To Replace Hopper Lip .....	3-37
Hopper Seals.....	3-37
To Replace Hopper Top Seal .....	3-37
To Replace Hopper Side Seals .....	3-38
Brush Door Skirts.....	3-38
To Replace and Adjust Brush Door Skirts.....	3-38
Rear Skirts.....	3-38
To Replace and Adjust Rear Skirts .....	3-38
Brakes and Tires.....	3-40
Brake Adjustments .....	3-40
To Adjust Brake Linkage .....	3-40
Brake Lining Replacement .....	3-40
Tires .....	3-41
Latches.....	3-42
Hopper Cover Latch .....	3-42
To Adjust Hopper cover Latch .....	3-42

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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.
3. Check the engine valve tappet clearance.
4. Check the engine cylinder head cap screws and risers torque.
5. Check the vacuum hoses for damage or loose connections.
6. Perform all 50-hour interval lubrication and maintenance procedures listed in the Maintenance chart.



**MAINTENANCE CHART**

00573

# MAINTENANCE CHART

Key	Description	Procedure	Interval (Hours)					
			8	50	150	250	400	500
1	Engine air filter	Clean filter element_____		X				
		Replace filter element_____			X			
2	Engine	Check oil level_____	X					
		Change oil_____		X				
		Clean spark plugs, set gap_____				X		
		Check points, set gap_____				X		
		Lubricate distributor cam_____				X		
		Lubricate distributor shaft_____				X		
		Check fan belt tension_____		X				
		Adjust valve tappets_____						X
3	Rear tire	Check pressure_____	X					
4	Radiator	Check coolant level_____	X					
		Flush Cooling System_____					X	
5	LPG fuel system	Disassemble and clean_____					X	
6	Hydraulic fluid reservoir	Check hydraulic fluid level_____	X					
		Change hydraulic fluid_____					X	
7	Gasoline fuel bowl	Clean bowl_____			X			
8	Battery	Check electrolyte level_____		X				
		Clean battery top_____			X			
9	Brush door skirts	Inspect for damage, wear, and adjustment_____	X					
10	Hopper lift bearings	Apply grease to fitting_____		X				
11	Steering gear	Check lubricant level_____					X	
12	Hopper dust filters	Inspect and clean or replace_____			X			
13	Engine oil filter	Change filter element_____		X				
14	Hydraulic fluid filter	Change filter element_____					X	
15	Miscellaneous linkages	Oil_____				X		
16	Brake adjustment	Check and adjust brake linkage_____				X		
17	Hopper lip	Inspect for damage or wear_____				X		
18	Hopper seals	Inspect for damage or wear_____		X				
19	Hopper floor clearance	Check for proper adjustment_____				X		
20	Hopper door latches	Apply grease to fittings_____		X				
21	Hopper safety leg	Check for proper operation_____				X		
22	Hopper fusible link	Check installation_____			X			
23	Hopper cover latch	Lubricate_____				X		
24	Brush access door latches	Clean and lubricate_____				X		
25	Side engine door latch	Lubricate_____				X		
26	Main brush	Inspect for wear or damage_____	X					
		Check main brush pattern_____		X				
27	Side brush	Inspect for wear or damage_____	X					
		Check side brush pattern_____		X				
28	Static drag chain	Inspect for wear_____				X		

## LUBRICATION

### ENGINE

Check the engine oil level after every 8 hours of operation. Change the engine oil and oil filter after every 50 hours of operation. Use only SAE - SE rated engine oil.

The following SAE - SE oil grades are general recommendations for engines during changing seasonal temperatures:

BELOW 0°F. (-17°C)	0° to 32°F. (-17° to 0°C)	32° to 75°F (0° to 24°C)	ABOVE 75°F (24°C)
SAE 5W-20	10W	SAE 20W	SAE 30W

The multi-grade oil used should cover the single grade recommendation for the temperatures involved; SAE 10W-30 covers SAE -10W, SAE-20W, SAE 20W and SAE 30W.

The engine oil capacity is 2.5 qt (2.4 L) including oil filter. Add 3 to 5 drops of engine oil to the distributor shaft oil wick every 250 hours.

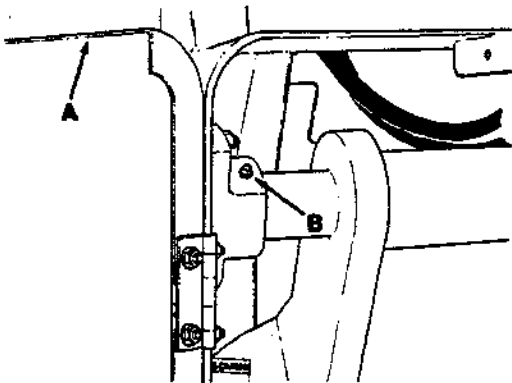
Lightly grease the distributor cam with distributor cam grease whenever the points are replaced.

### HOPPER LIFT BEARINGS

There are two grease fittings which are used to lubricate the hopper lift bearings. One grease fitting is located on each of the hopper lift bearings.

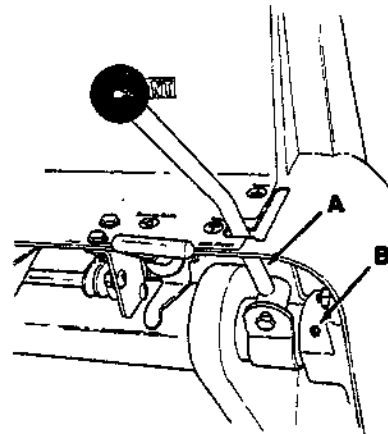
Access to the left side hopper lift bearing grease fitting is through the left side access door. The right side hopper lift bearing grease fitting is exposed to the operator compartment.

Apply grease to these fittings after every 50 hours of operation. Use a general purpose, water resistant, lithium base, moly-disulphide EP grease.



**LEFT HOPPER LIFT BEARING GREASE FITTING** 00549

- A. Left Side Access Door
- B. Grease Fitting



00543

**RIGHT HOPPER LIFT BEARING GREASE FITTING**

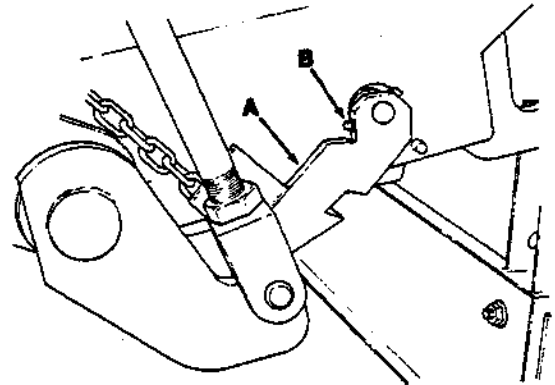
- A. Side Brush Height Control Lever
- B. Grease Fitting

### HOPPER DOOR LATCHES

There are two grease fittings used to lubricate the hopper door latches. One grease fitting is on each of the hopper door latches.

To gain access to the latch grease fittings, place the hopper in the "dump" position.

Apply grease to these fittings after every 50 hours of operation. Use a general purpose, water resistant, lithium base, moly-disulphide EP grease.



**HOPPER DOOR LATCH GREASE FITTING** 00550

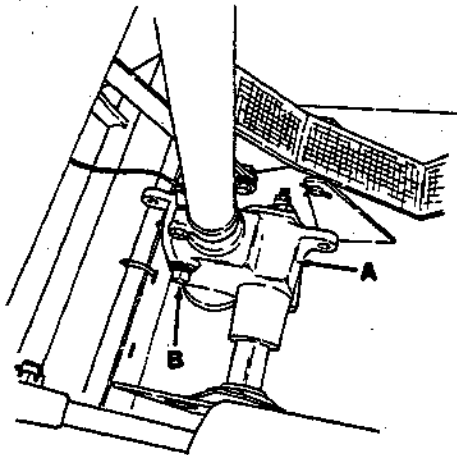
- A. Hopper Door Latch
- B. Grease Fitting



## STEERING GEAR

There is a square head plug located on the left side of the steering gearbox which is used to check the level of grease in the steering gear and to fill the steering gear with grease.

Check the steering gear grease level after every 500 hours of operation. Fill the unit with grease that meets S.S.G. specification 5676630.

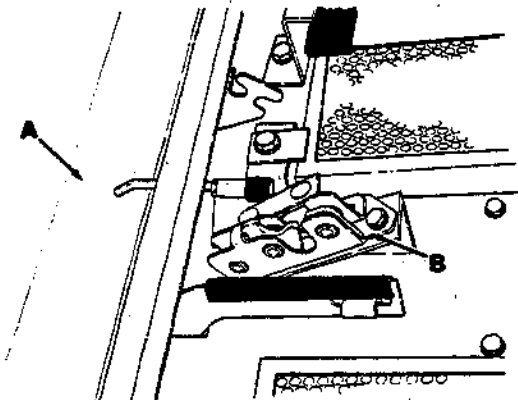


**STEERING GEAR LUBRICATION PLUG** 00551

- A. Steering Gearbox
- B. Fill Plug

## HOPPER COVER LATCH

The hopper cover latch is located under the hopper cover. Lubricate the latch with a dry lubricant after every 250 hours of operation.

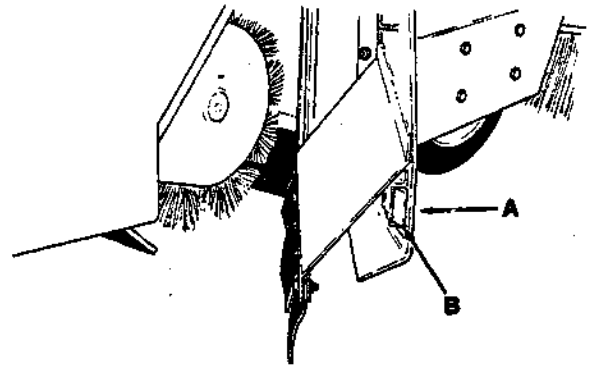


**HOPPER COVER LATCH** 00552

- A. Front of Hopper
- B. Hopper Cover Latch

## BRUSH ACCESS DOOR LATCHES

The brush access door latches are located on each of the two brush access doors. Clean and lubricate each of these latches with a dry lubricant after every 250 hours of operation.

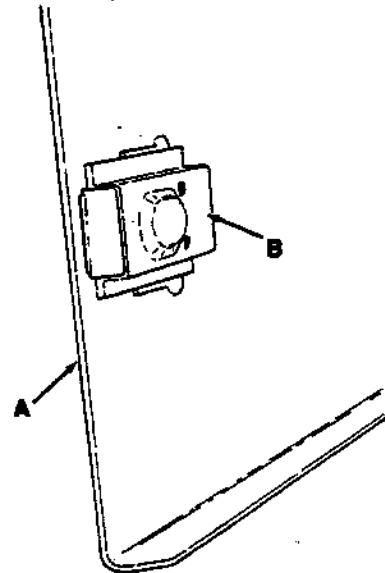


**BRUSH ACCESS DOOR LATCH** 00570

- A. Brush Access Door
- B. Door Latch

## SIDE ENGINE DOOR LATCH

The side engine door latch is located on the interior surface of the side engine door. Lubricate the latch with a dry lubricant after every 250 hours of operation.



**SIDE ENGINE DOOR LATCH** 00553

- A. Side Engine Door
- B. Door Latch

# HYDRAULICS

## RECOMMENDED 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 (10W40)	TENNANT® Hyd. Fluid No. 32398 (20W60)
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 10W40 should be used in machines that are operated in areas which have ambient temperatures up to 90° (32° C). Use the 20W60 rated hydraulic fluid in areas which have ambient temperatures above 90° (32° C).

**ATTENTION!** 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.

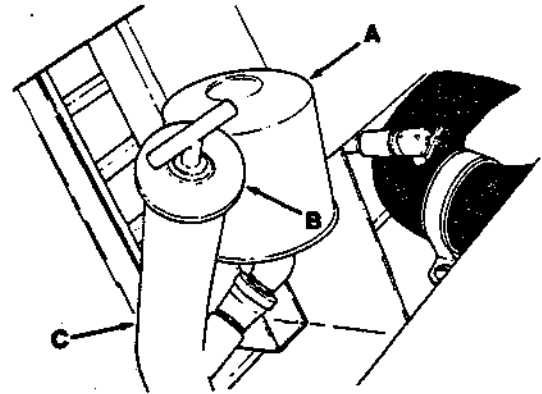
Change the hydraulic fluid and clean out the hydraulic fluid reservoir after every 500 hours of service.

## HYDRAULIC FLUID RESERVOIR

Hydraulic fluid is stored in the hydraulic fluid reservoir. The reservoir holds up to 7 gal (26.5 L) of hydraulic fluid. The reservoir is located in the lower rear of the machine.

The reservoir is equipped with a breather, a filler neck, and a fluid level dipstick. The reservoir breather is located on the reservoir filler neck.

See Hydraulic Reservoir Breather for breather service information.



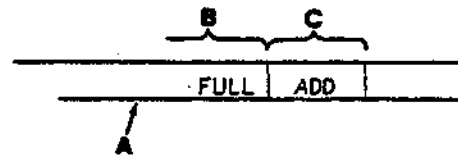
00554

## HYDRAULIC FLUID RESERVOIR FILLER NECK

- A. Hydraulic Reservoir Breather
- B. Reservoir Filler Neck Plug/Dipstick
- C. Reservoir Filler Neck

The filler neck is located under the operator seat. A fluid level dipstick is built into the filler neck plug. The end of the dipstick is marked with "full" and "add" levels. The dipstick is provided to indicate the level of hydraulic fluid in the reservoir.

Check the hydraulic fluid level daily. The hydraulic fluid level should be above the "add" mark on the dipstick, but not above the "full" mark when the hydraulic fluid is warm.



00555

## HYDRAULIC FLUID RESERVOIR DIPSTICK

- A. Dipstick
- B. Full Range
- C. Add Range

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

**ATTENTION!** Do not overfill the hydraulic fluid reservoir or operate the machine with a low level of hydraulic fluid in the reservoir. Either one may cause damage to the machine hydraulic system.

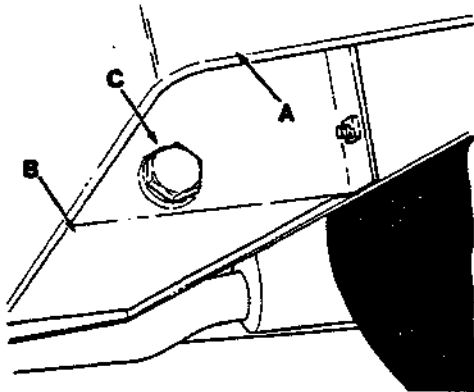
Drain the hydraulic fluid reservoir after every 500 hours of operation.

## TO DRAIN THE HYDRAULIC FLUID RESERVOIR

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

**⚠ CAUTION:** Always stop the engine and engage the parking brake before working on the machine.

2. Remove the reservoir drain plug located on the lower right side of the reservoir to drain the hydraulic fluid. Discard the used hydraulic fluid.



#### HYDRAULIC FLUID RESERVOIR DRAIN PLUG <sup>00556</sup>

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

3. Reinstall the reservoir drain plug.

#### TO FILL THE HYDRAULIC FLUID RESERVOIR

1. Raise the operator seat.
2. Remove the reservoir filler neck plug/dipstick.
3. Pour 7 gal (26.5 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 plug/dipstick.
5. Add hydraulic fluid until the level in the reservoir is in the "full" range. Do not overfill the reservoir.

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

6. Place the reservoir plug/dipstick securely in the reservoir filler neck.
7. Lower the operator seat.

#### HYDRAULIC FLUID RESERVOIR BREATHER

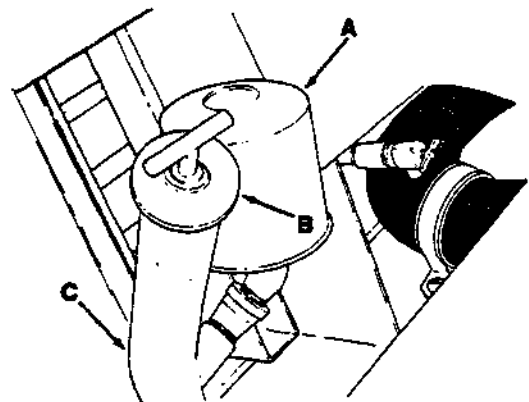
The hydraulic fluid reservoir is equipped with a breather. The breather relieves excess atmospheric pressure or vacuum in the reservoir. The breather is mounted on the hydraulic fluid reservoir filler neck under the operator seat. The breather element should be replaced after every 500 hours of operation.

#### TO REPLACE HYDRAULIC FLUID RESERVOIR BREATHER ELEMENT

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

**⚠ CAUTION:** Always stop the engine and engage the parking brake before working on the machine.

2. Raise the operator seat.
3. Rotate the breather element counterclockwise to separate it from its base. Discard the breather element.



#### HYDRAULIC FLUID RESERVOIR BREATHER <sup>00554</sup>

- A. Breather
- B. Reservoir Filler Neck Plug/Dipstick
- C. Reservoir Filler Neck

4. Thread the new breather element clockwise onto the breather element base.
5. Lower the operator seat.

#### 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 engine compartment of the machine.

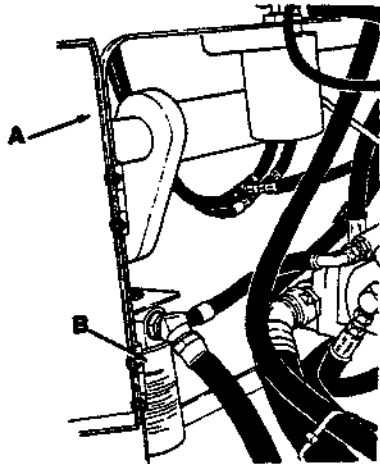
The hydraulic fluid filter should be changed after the first 50 hours of operation and then after every 500 hours of operation.

## TO REPLACE THE HYDRAULIC FLUID FILTER ELEMENT

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

**⚠ CAUTION:** Always stop the engine and engage the parking brake before working on the machine.

2. Open the top and side engine access door.



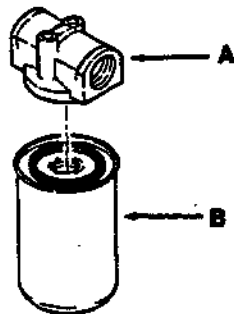
### HYDRAULIC FLUID FILTER LOCATION 00557

- A. Side Engine Access Door
- B. Hydraulic Fluid Filter

3. Unthread, remove, and discard the hydraulic fluid filter.

**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.



### HYDRAULIC FLUID FILTER 00330

- A. Filter Head
- B. Filter Element

5. Thread the new hydraulic fluid filter on the filter head.
6. Operate the machine and check for leaks. Correct any leaks found.
7. Close the top and side engine access doors.
8. Check the hydraulic fluid reservoir level and fill as required.

## HYDRAULIC PUMPS

The machine propelling pump is a variable displacement hydraulic piston pump. It is driven by the engine via a chain coupling.

The machine accessories pump is a hydraulic gear pump. It is tandem mounted to the hydraulic piston pump.

After repairing or replacing a hydraulic pump, the proper start-up procedure must be followed to prevent possible damage to the pump. The following outlines the procedure.

## HYDRAULIC PUMP START-UP PROCEDURE

1. Engage the machine parking brake and block the front tires of the machine.

**⚠ CAUTION:** Always engage the parking brake and block the machine tires before jacking the machine up.

2. Jack up the rear of the machine at the designated locations.

**⚠ CAUTION:** Jack the machine up only at the designated locations.

3. Block up the machine with jack stands.
4. Fill the hydraulic fluid reservoir with 8 gal (30 L) of new, approved hydraulic fluid.
5. Connect an air pressurizing device to the hydraulic reservoir fill neck and pressurize the reservoir to 5 psi (35 kPa). This will act as a pump primer.
6. Loosen the hydraulic fittings at the propelling pump case drain and inlet and the accessory pump inlet to bleed air from the hydraulic hoses.
7. As soon as hydraulic fluid appears at the fittings, retighten the fittings.
8. Remove the engine coil wire from the engine distributor.
9. Operate the engine starter motor for 15 seconds.
10. Replace the engine coil wire.

11. Start the engine and operate it at a low idle for 30 seconds.
12. Move the directional control pedal into the "forward" and "reverse" positions and observe the rear tire for the proper directional rotation.
13. Speed the engine to a fast idle.
14. Press the directional control pedal one-half of its travel in the "forward" direction for three minutes also doing the following:
  - A. Operate the main brush and side brush.
  - B. Raise and lower the hopper three times.
  - C. Dump and return the hopper to the operating position three times.
15. Check the directional control pedal "neutral" position adjustment.
16. Stop the engine.
17. Raise the rear of the machine, remove the jack stands, and lower the machine.
18. Fill the hydraulic fluid reservoir with new, approved hydraulic fluid.
19. Check the hose routings to be sure the hoses do not contact any moving, hot, or sharp surfaces.
20. Replace the hydraulic fluid filter after the first hour of operation.

#### DIRECTIONAL CONTROL PEDAL "NEUTRAL" POSITION ADJUSTMENT

After replacing the hydraulic pump or pump linkages, the pump control linkages must be adjusted.

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

**CAUTION:** Always stop the engine and engage the parking brake before working on the machine.

2. Jack up the rear of the machine at the designated locations.

**CAUTION:** Jack up the machine only at the designated locations.

3. Block up the machine with jack stands.
4. Loosen the bolt connecting the directional control pedal to the control linkage.
5. Position the middle of the directional control pedal 34° off the floor plate.
6. Tighten the bolt connecting the directional control pedal to the control linkage.

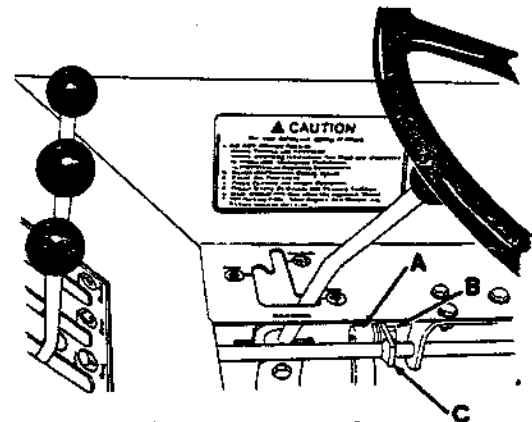
**NOTE:** If there is not enough adjustment in the slot, the pump linkage balljoints and speed limiter linkage must be adjusted.

7. Start the engine.
8. 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.
9. 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.
10. Stop the engine.
11. Raise the rear of the machine, remove the jack stands, and lower the machine.

#### SPEED LIMITER

The machine speed limiter limits the maximum speed the machine can travel when the hopper is raised. The speed limiter should be adjusted whenever the pump control linkage is adjusted. The machine should not travel more than 2 mph (3.2 km/h) with the hopper raised.

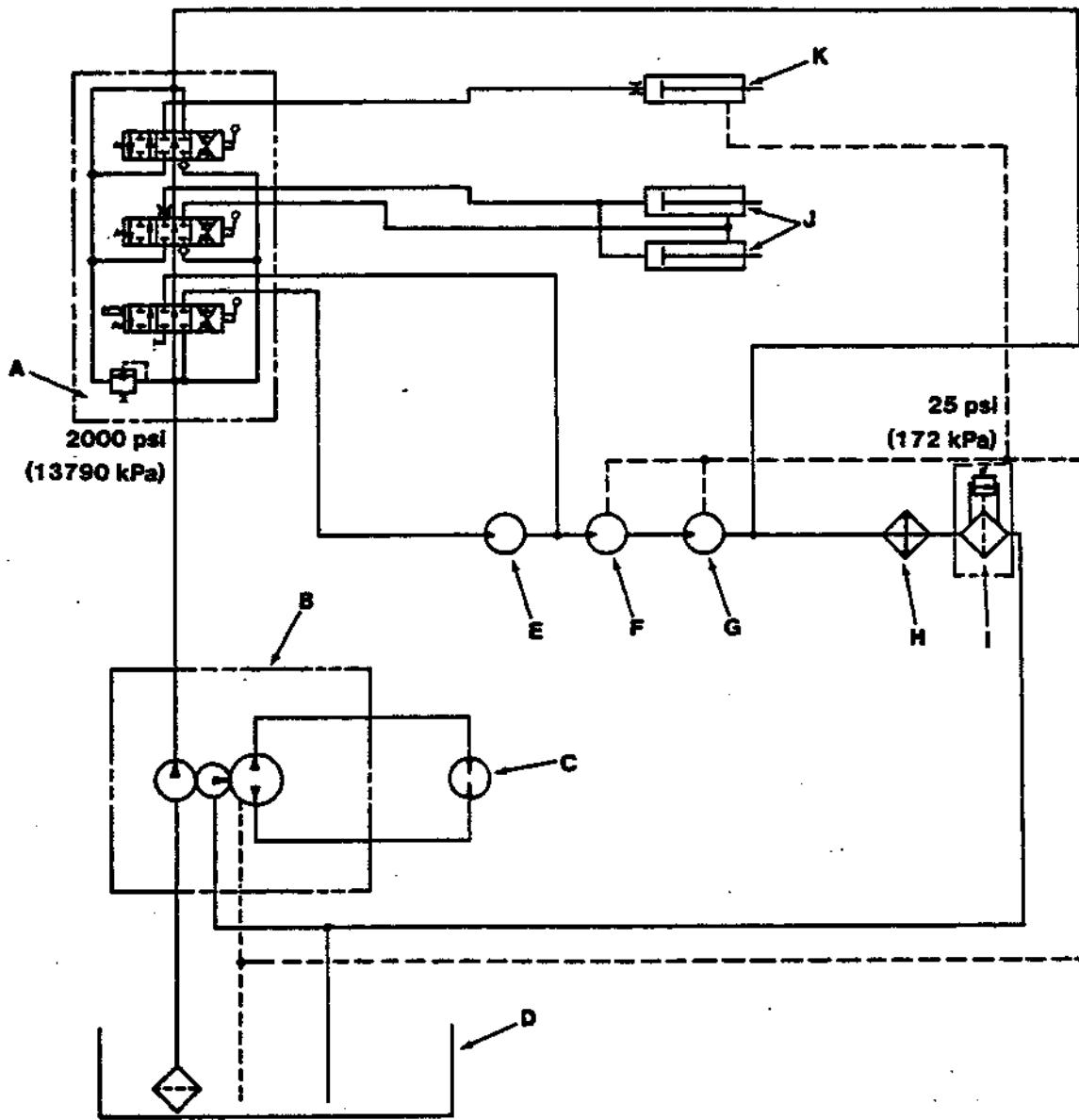
The speed limiter is adjusted by loosening the roller cam retaining nut which is mounted to the pump control linkage, moving it forward or backward in its mounting slot, and tightening the roller cam retaining nut.



**SPEED LIMITER CAM**

- A. Speed Limiter Cam
- B. Retaining Nut
- C. Pump Control Linkage

00574



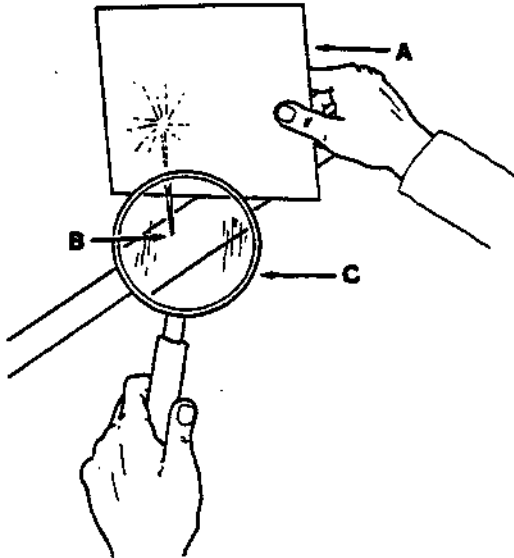
**HYDRAULIC SCHEMATIC DIAGRAM**

00575

- |                                     |                                  |
|-------------------------------------|----------------------------------|
| <b>A. Control Valve</b>             | <b>G. Vacuum Fan Motor</b>       |
| <b>B. Hydraulic Pump</b>            | <b>H. Heat Exchanger</b>         |
| <b>C. Propelling Motor</b>          | <b>I. Hydraulic Fluid Filter</b> |
| <b>D. Hydraulic Fluid Reservoir</b> | <b>J. Hopper Dump Cylinder</b>   |
| <b>E. Side Brush Motor</b>          | <b>K. Hopper Lift Cylinder</b>   |
| <b>F. Main Brush Motor</b>          |                                  |

## HYDRAULIC FLUID LEAKS

Fluid escaping from a very small hole can be almost invisible. Use a piece of cardboard or wood, rather than hands, to search for suspected leaks.



### HYDRAULIC PINHOLE LEAK

00002

- A. Cardboard
- B. Pinhole Leak
- C. Magnifying Glass

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

**⚠ WARNING:** Escaping hydraulic fluid under pressure can have sufficient force to penetrate the skin, causing serious personal injury. Before applying pressure to the system, be sure all connections are tight and that lines, pipes, and hoses are not damaged.

## ENGINE

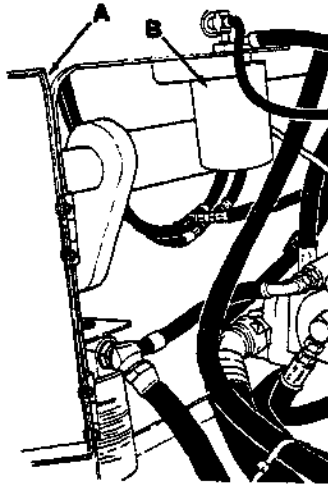
### ENGINE LUBRICATION

Check the engine oil level after every 8 hours of operation. Change the engine oil and oil filter after every 50 hours of operation. Change the engine oil more frequently if the environment is extremely dusty. Use only SE rated engine oil.

The following SAE oil grades are general recommendations for engines during the changing seasonal temperatures.

BELOW 0°F (BELOW -17°C)	0° to 32°F (-17° to 0°C)	32° to 75°F (0° to 24°C)	ABOVE 75°F (ABOVE 24°C)
SAE 5W-20	SAE 10W	SAE 20W	SAE 30W

Multi-grade oil should cover the single grade recommendation for the temperatures involved. The engine oil capacity is 2.5 qts (2.4 L) with filter.



**ENGINE OIL FILTER LOCATION**

00557

- A. Side Engine Access Door
- B. Engine Oil Filter

Add 3 to 5 drops of engine oil to the distributor shaft oil wick every 250 hours.

Lightly grease the distributor cam with distributor cam grease whenever the points are replaced.

### COOLING SYSTEM

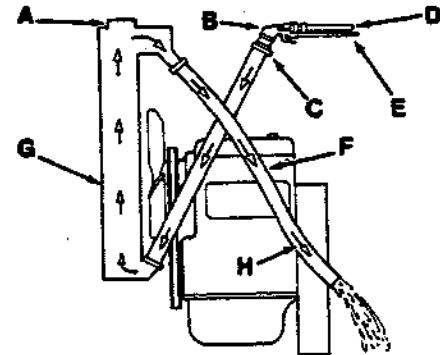
Maintaining cooling system efficiency is important. Engine temperatures must be brought up to and maintained within the satisfactory range for efficient operation. However, the engine must be kept from overheating in order to prevent damage to the valves, pistons, and bearings.

Use soft, clean water mixed with permanent-type, ethylene glycol antifreeze in a one-to-one ratio. Deposits of sludge, scale, and rust prevent normal heat transfer. Flush the radiator and the cooling system after every 500 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.

### TO REVERSE FLUSH THE RADIATOR

1. Disconnect the hoses at the engine.
2. Put the radiator cap on tight.
3. Clamp the flushing gun in the lower hose with a hose clamp.
4. Turn on the water and let it fill the radiator.



**REVERSE FLUSHING RADIATOR**

00578

- A. Closed Radiator Cap
- B. Flushing Gun
- C. Clamp
- D. Water Input
- E. Air Input
- F. New Hose
- G. Radiator
- H. Water and Air Flow

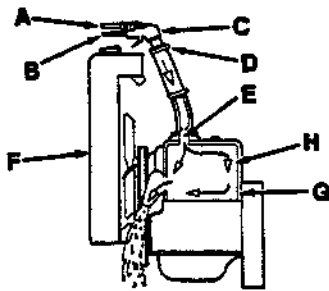
5. Apply air pressure gradually to avoid radiator damage.
6. Shut off the air, again fill the radiator with water, and apply air pressure—repeat until the flushing stream runs out clear.



- Clean and inspect the radiator cap.

#### TO REVERSE FLUSH THE ENGINE WATER JACKET

- Remove the thermostat.
- Clamp the flushing gun in the upper hose.
- Partly close the water pump opening to fill the engine jacket with water before applying the air.
- Follow the same procedure outlined above for the radiator by alternately filling the water jacket with water and forcing it out with air, 80 psi (551 kPa) until the flushing stream is clear.



#### REVERSE FLUSHING ENGINE

00576

- A. Water Input
- B. Air Input
- C. Flushing Gun
- D. Clamp
- E. Thermostat Removed
- F. Radiator
- G. Engine Block
- H. Water and Air Flow

Engine overheating may also be caused by dirty radiator fins. The exterior fins of the radiator can be cleaned with an air hose. Blow out all dust, dirt, etc., between the fins. This should be done only after the radiator has cooled off to avoid cracking caused by uneven cooling.

Before cleaning, remove the fan shroud from the radiator, then blow out all dust from outside the machine into the engine compartment (this is the opposite direction from normal air flow). After the radiator fins are clean, replace the fan shroud.

Engine thermostats begin to open at 180°F (82°C) and are fully open at 202°F (94°C). Operation of the engine in this temperature range is not harmful. However, temperature gauges are not always accurate and may sometimes indicate higher than actual temperature. This can lead operators to believe the engine is overheating when it is actually operating normally.

*NOTE: Overheating is always accompanied by loss of coolant water. In case of doubt, this should be checked.*

#### REPLACING AND TESTING THERMOSTAT

Remove the water elbow and the thermostat. Before testing, clean and examine the bellows for rupture or distortion. If the valve can be pulled or pushed off its seat with only a slight effort when cold, or it does not seat properly, the unit is defective and should be replaced.

The thermostat can be checked in the following manner:

- Hang the thermostat by its frame in a container of water so that the thermostat does not touch the bottom of the container.
- Heat the container of water and check the temperature with a thermometer.
- If the valve does not start to open at temperatures of 180°-200°F (82°-93°C) or if it opens well before the 180° (82°C) point is reached, the thermostat should be replaced.

When replacing the thermostat in the water outlet elbow, be sure the counterbore and all machined surfaces are clean.

Assemble the new water outlet elbow mounting gasket. The thermostat flange must seat in the counterbore with the gasket sealing the flange and the cylinder head.

When installing a new thermostat in the water outlet tube, make sure that the temperature sensing unit faces toward the cylinder head.

#### RADIATOR PRESSURE CAP

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 15 psi (103 kPa) allowing steam and water to pass out the overflow pipe; however, the boiling point of the coolant at this pressure is 230°F (110°C) at sea level.

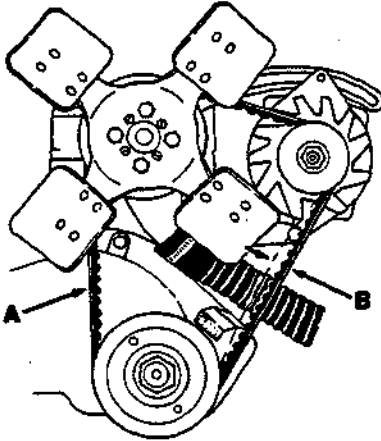
**CAUTION:** If the coolant is hot, or if the engine has been running, loosen the pressure cap to the first stop and let the pressure out of the cooling system before removing the radiator cap.

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

## ENGINE FAN BELT TENSION

When tightening fan belts, loosen the alternator adjusting bolts and pull out on the alternator by hand until the belt is just snug. Under no circumstances should a pry bar be used on the alternator to obtain fan belt tension, or damage to the bearings will result.

Proper belt deflection is obtained when the belt deflects 0.5 in (13 mm) from a force of 10 to 12 lbs (4.5 to 5.4 kg) applied at the midpoint of the longest span.



**ENGINE FAN BELT TENSION**

- A. Engine Fan Belt
- B. 0.5 in (13 mm)

00577

## WATER PUMP

The water pump is located in the front of the cylinder block and is driven by the fan belt from the crankshaft pulley. The inlet of the water pump is connected to the lower radiator connection and the outlet flow from the pump is through integral passages cast in the block.

No lubrication of the pump is required as the bearings are permanently sealed with a special lubricant for the life of the bearing.

## AIR INTAKE SYSTEM

The importance of maintaining an air filter in proper condition cannot be overemphasized. Dirt induced 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 cleaner is removed for servicing. Do not neglect servicing the air cleaner. Use only correct parts for replacement. Keep all other air intake components such as hoses, clamps, etc., secure and in good condition to prevent entrance of unfiltered air.

## AIR FILTER

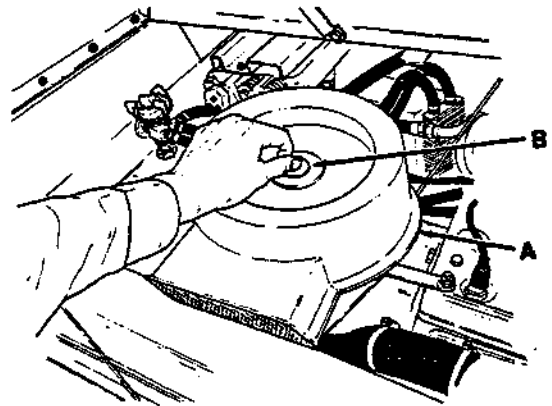
The engine air filter element is a dry cartridge-type filter. The air filter element must be cleaned and inspected after every 50 hours of operation. It must be replaced after it has been damaged, cleaned three times, or after 150 hours of operation.

### TO REPLACE AIR FILTER ELEMENT

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

**CAUTION:** Always stop the engine and engage the parking brake before working on the machine.

2. Raise the engine cover.
3. Remove the air filter retaining wing nut.

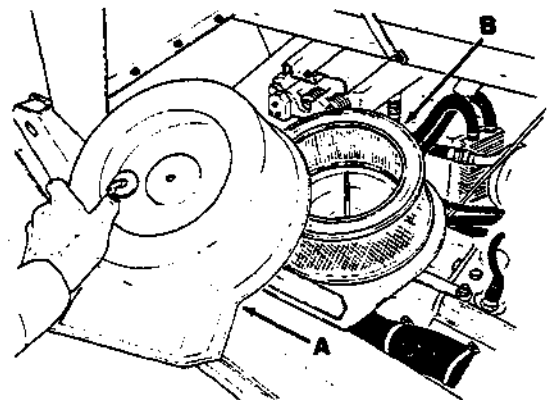


**REMOVING AIR FILTER COVER**

- A. Air Filter Cover
- B. Wing Nut

00578

4. Lift off the rear filter cover
5. Remove and clean or discard the air filter element.



**REMOVING AIR FILTER ELEMENT**

- A. Air Filter Cover
- B. Air Filter Element

00579

6. Wipe the inside of the air filter housing clean of any accumulated dirt.
7. Position the wider portion cleaned or new air filter on the air filter base.
8. Slide the air filter cover over the carburetor stud and into position over the air filter base.
9. Thread the air filter washer and wing nut onto the carburetor stud. Tighten the wing nut.
10. Lower the engine cover.

## FUEL SYSTEM - GASOLINE

### FUEL

Use clean, leaded or non-leaded gasoline of at least 86 octane.

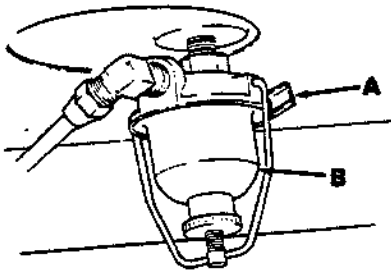
### FUEL TANK

Fill the fuel tank at the end of each day's operation to prevent condensation from forming in the fuel tank.

### FUEL FILTER

An in-line fuel sediment bowl has been provided to filter the fuel supply. It is located under the fuel tank. It is equipped with a fuel shutoff valve.

Clean the sediment bowl after every 150 hours of operation.



### FUEL SEDIMENT BOWL

00580

- A. Fuel Shut Off Handle
- B. Fuel Sediment Bowl

### CARBURETOR CHOKE

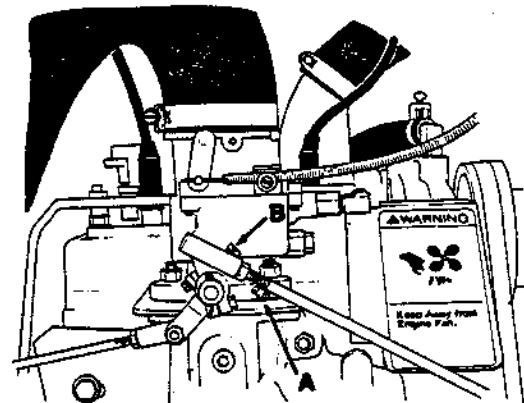
The manually operated choke is operated by a flexible cable control located on the left side control panel. It is important that the operator have the choke valve in wide open position when the engine operating temperature is reached.

**NOTE:** Do not use the choke to stop the engine. This causes raw fuel to wash lubricant from the cylinder walls.

## CARBURETOR

The carburetor has the following adjustments:

1. **Idle Fuel-Air Adjusting Needle** - The idle fuel-air adjusting needle controls the amount of fuel-air mixture discharged into the air stream. Turning the idle adjusting needle (in) results in a leaner mixture. Turning the idle adjusting needle (out) results in a richer mixture.
2. **Fixed High Speed Jet** - The high speed jet is not adjustable. For high altitude it may be exchanged for a smaller sized jet to lean the fuel to compensate for the lighter, thin air. The size must be carefully determined first by testing a smaller jet with 0.001 to 0.002 in (0.025 to 0.050 mm) smaller passage, depending on the elevation. Consult the local Teledyne Continental Motors distributor for the proper jet sizing.



### CARBURETOR ADJUSTMENTS

00581

- A. Idle Mixture Adjustment Needle
- B. Idle Speed Adjustment

3. **Idle Speed Adjusting Screw** - Adjust screw to recommended idle speed, 1000 rpm. Turn screw clockwise to increase speed or counter-clockwise to lower the rpm. Check the idle mix and reset the idle speed.

### MECHANICAL FUEL PUMP

Fuel pump pressure may be measured by installing a pressure gauge between the fuel pump and the carburetor. Fuel pump pressure at 1800 rpm should be 3-5 psi (21-34 kPa).

**WARNING:** No smoking or open flame should be allowed any time the fuel system is repaired or serviced. The area should be properly ventilated. Improper handling of fuel could result in an explosion or fire.

When pressures are below the pressure range, the pump should be disassembled and reconditioned with the special overhaul kits available.

Fuel pump trouble is of only two kinds—either the pump is supplying too little gas or, in rare cases, too much.

If the pump is supplying too little gas, the engine either will not run, or it will cough and falter. If the pump is supplying too much gas, the engine will not idle smoothly, and gas may drip from the carburetor.

If there is little or no flow of gas, check the following:

1. Look for a leaky bowl gasket or line connections—tighten them.
2. Remove and clean the gas strainer or screen inside the pump bowl with solvent.
3. Look for a clogged fuel line and blow it out with compressed air.
4. Make sure that all pump cover screws and external plugs are tight.

If it is getting too much gas, it is generally caused by trouble other than the fuel pump, so first check the following:

1. Excessive use of the hand choke.
2. Loosely connected fuel line or loose carburetor assembly screws.
3. Punctured carburetor float.
4. Defective carburetor needle valve.
5. Improper carburetor adjustment.

If none of these items corrects flooding, remove the fuel pump for replacement.

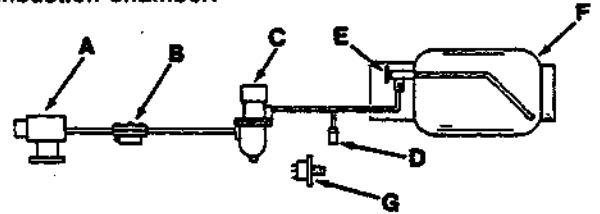
## FUEL SYSTEM - LPG

### LPG FUEL SYSTEM OPERATION

The liquid withdrawal LPG fuel system is made up of six 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 tanks, under its own pressure, to the pressure relief valve. This valve is normally closed, preventing LPG fuel from escaping into the atmosphere. 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 or being started. The oil pressure switch controls the fuel filter lock. When the engine oil pressure is 4 psi (27.6 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. The oil pressure switch is bypassed when the engine is started, allowing LPG fuel to flow.

The vaporizer converts the liquid LPG fuel into a gaseous LPG fuel. From the vaporizer, the gaseous LPG fuel is sent to the primary regulator. The primary regulator reduces the pressure of the LPG fuel and makes the flow more constant. The secondary regulator reduces the LPG gas pressure to the level required by the carburetor. From the secondary regulator, the LPG gas is sent to the carburetor where the LPG gas is finally metered into the air flow which is sent to the combustion chamber.



### LPG FUEL SYSTEM

00582

- A. Combination Carburetor & Secondary Regulator
- B. Combination Water Heated Vaporizer and Primary Regulator
- C. Combination Fuel Line Filter & Electric Lock-Off Valve
- D. Pressure Relief Valve
- E. Tank Service Valve
- F. LPG Fuel Tank
- G. Oil Pressure Switch

### LPG MAINTENANCE AND SAFETY TIPS

To ensure safer operation of LPG equipment, regular maintenance and frequent inspections are important. Listed below are some suggested maintenance tips, as well as general tips, to promote added safety and efficiency in the operation of an LPG machine:

- Check for frosting. If frosting occurs on any LPG component or object near an LPG component, there is a possibility of an LPG fuel leak. To locate the leak, apply a soapy water solution to the suspected area. Watch for bubbles forming in a confined area. This area will contain a pinhole. Replace the part which contains the pinhole.
- Check the vaporizer for proper operation.  
  
Turn on the ignition switch, short out the oil pressure switch leads, and open the radiator cap and check the coolant for bubbles. If bubbles are present, the vaporizer may have a leaking gasket or may have developed a pinhole leak, allowing LPG fuel to enter the cooling system.
- Check all components for proper operation. Replace LPG components when needed. Never bypass defective safety components.

- 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.

- Check the fuel filter lock for proper operation:

Start the engine.

Remove the wire going to the solenoid section of the fuel filter lock. This should cause the solenoid to close, shutting off the fuel supply and stopping the engine. If the engine continues to operate, replace the fuel filter lock.

If the engine stopped as it should have, allow the machine to stand with the LPG tank valve open and the wire removed from the fuel filter lock. After 10 minutes, operate the starter motor. If the engine starts or fires, LPG fuel has leaked by the fuel filter lock and the fuel filter lock should be replaced. If the engine just turned over, the fuel filter lock is operating correctly.

- Check for gas odor before and during starting operations. If gas odor is noticed, stop and check for leaks or component malfunction.
- Never use a match or open flame when searching for an LPG fuel leak. Always use the soap bubble method.
- Replace electrical wiring if insulation shows signs of abrasion or deterioration.
- Make sure the LPG tank is free of dents or gouges.
- Make sure the service coupling is clean and free of damage. Make sure the service coupling of the tank matches the machine service coupling.
- Perform regular maintenance as recommended.
- Every 400 hours or 3 months, whichever comes first, or if any malfunction is noted:

Completely disassemble the vaporizer-regulator. See machine manual for instructions and replacement parts.

Clean all parts in alcohol.

Inspect parts and replace where needed.

Carefully reassemble and reinstall them in the machine.

Check for proper operation as follows:

Remove the LPG hose in which LPG fuel exits from the regulator. Using a monometer or pressure gauge, check the output of the regulator, making sure that it is working according to its proper output specifications. Then, after checking and adjusting or replacing a defective regulator or regulator components, carefully replace the removed LPG hose.

- Check the oil pressure switch.

Turn the ignition switch to the "on" position. If a click in the fuel filter lock is heard, the oil pressure switch is not operating properly. If no click is heard, remove the wire from the "c" terminal and touch it to the "no" terminal. This shorts the switch out. The fuel filter lock should click when the switch is shorted out if the switch is working properly.

- Every 400 hours, replace the filter in the filter fuellock. See machine manual for instructions and replacement parts.
- Keep the engine properly tuned.
- Make sure the LPG tank matches the fuel system (liquid tank with liquid system).

### LPG FUEL TANKS

The LPG fuel tanks should be inspected for sharp dents, gouges, leaks, and broken protecting rings whenever they 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:

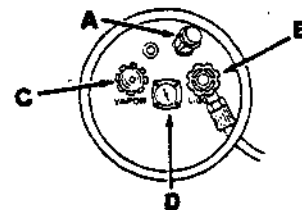
**Filler Valve** - Check for proper functioning and the presence of the handwheel. Valve must be closed except during filling.

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

**Cylinder 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 cap. Do not tamper with the relief valve setting.

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



TYPICAL LPG LIQUID WITHDRAWAL FUEL TANK

- A. Safety Relief Valve
- B. Liquid Service Valve
- C. Filler Valve
- D. Liquid Level Gauge

00115

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

If an LPG 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 cylinder, regardless of condition. Repairs must be made by qualified personnel.

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


### CHANGING MACHINE LPG TANKS

Refueling machines with LPG tanks is an important function. Refueling is accomplished by replacing the empty LPG tank with a full one.

The tank changing operation presents an opportunity for the machine operator to carefully observe the tank, fittings, and the fuel lines and fittings for his own satisfaction. If abnormal wear is detected, the operator should report his findings to his supervisor for appropriate action.

### TO CHANGE AN LPG FUEL TANK

1. Park the machine in a designated safe area.
2. Operate the engine until it stops from lack of fuel and engage the machine parking brake.


 **CAUTION:** Always allow the engine to stop and engage the parking brake before working on the machine.

3. Close the tank service valve.
4. Remove the quick-disconnect tank coupling.
5. Inspect the LPG fuel lines for wear or damage.
6. Remove the empty LPG tank from the machine.
7. Check the LPG tank for damage or wear.
8. Store the LPG tank in a designated safe area.
9. Select a filled LPG tank and inspect it for damage or leaks.
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, adjust the pin locator.*

11. Fasten the tank hold-down clamps to lock the tank in position.

12. Connect the LPG fuel line to the tank service coupling.
13. Open the tank service valve slowly and check for leaks.

 **CAUTION:** If a leak is found, close the valve immediately and notify the appropriate personnel.

14. If no leaks are found, the engine is ready to start.

### STORAGE OF LPG FUEL TANKS

Whether the storage is inside or outside, 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. Care should be taken to insure that the cylinders are stored in such a manner 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. They 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.

### LPG FUEL FILTER LOCK

The fuel filter lock filters the LPG fuel. It 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 (27.6 kPa).

A drain plug is provided for purging the filter bowl. Clean out the bowl when necessary. Replace the filter pack after every 400 hours of operation or when diminished gas flow indicates the filter is clogged.

 **WARNING:** Do not bypass the fuel filter lock unless testing is being done. A potential fire hazard may be created if the filter fuellock is bypassed.

 **CAUTION:** Check the completed converter under pressure with soapsuds or testing solution to detect possible leaks.

### LPG VAPORIZER-REGULATOR QUICK CHECK

Turn on the ignition switch, short out the oil pressure switch leads, open the radiator cap, and check the coolant for bubbles. If bubbles are present, the vaporizer may have a leaking gasket or may have developed a pinhole leak, allowing LPG fuel to enter the cooling system.

## LPG CARBURETOR

Service information on the LPG carburetor is very limited. The carburetor manufacturer prefers to have their equipment serviced only by trained and qualified personnel. Do not attempt to service an LPG carburetor unless you are trained and have adequate experience.

## 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.

**⚠ WARNING:** Never bypass the oil pressure switch unless testing of other components is being done. A fire hazard may be created if it is bypassed.

## LPG FUEL TROUBLESHOOTING

	Will Not Start	Runs Unevenly & Lacks Power	Stops During Operation
(1) Fuel Tank	<p>Check fuel tank type and fuel supply (vapor tank for vapor withdrawal system).</p> <p>Be sure tank hand valve is open (always open valve slowly). If hand valve is opened too fast, shut-off valve in tank will automatically shut off fuel supply. If this happens, close the hand valve and then re-open it slowly.</p>	<p>Out of fuel</p> <p>Check fuel tank type and fuel supply (liquid tank for liquid withdrawal system).</p>	<p>Tank valve not opened sufficiently.</p> <p>Check fuel tank type and fuel supply (liquid tank for liquid withdrawal system).</p>
(2) Fuel Lines	<p>Check hoses, connections, leaks, etc., using soap bubble test method.</p> <p>When changing LPG fuel tanks, always be sure fuel is getting into carburetor. Crank engine briefly and push primer button until vapor fumes are smelled or are visible at carburetor, or around air filter.</p> <p>Check fuel tank and lines for frosting up. To relieve frosting, open shut-off valve slowly (approximately one-fourth open). Start engine and idle until warm. Then open tank valve completely before loading the engine. If frost forms on connection fittings, check for fuel leakage, kinked lines, or restriction at frost points.</p> <p>Check fuel filter. Remove and clean it if dirty filter is restricting fuel line. Check quick-disconnect fitting at LPG tank: if LPG tank valve is not properly seated, no fuel will flow through the line. A broken fuel line or loose connection could cause the tank shut-off valve to close.</p>	<p>Broken fuel line or loose fuel line connection could cause tank internal shut-off valve to close automatically and shut off the fuel supply.</p>	<p><i>NOTE: Always check through the LPG fuel system in order of numerical sequence.</i></p>

	Will Not Start	Runs Unevenly & Lacks Power	Stops During Operation
(3) Ignition System	<p>Remove and check spark plug to be sure it is the correct type with proper gap.</p> <p>Check ignition points and condenser.</p> <p>Check ignition coil.</p> <p>Check ignition switch.</p> <p>Check wiring for loose connections or wire breakage. Check battery terminals for corrosion or loose ground cable. Check for possible shorts in wiring.</p> <p>Battery dead.</p> <p>No current to fuel filter lock solenoid valve or possible defective solenoid.</p>	<p>Check electrical system for loose connections or intermittent shorts.</p> <p>Check spark and electrical system for malfunction of condenser, points, etc.</p> <p>Check for broken wires or defective relay. Relay can be checked by bypassing relay and directly energizing the solenoid valve in fuel filter lock.</p>	<p>Check ignition for poor connections or weak or worn ignition parts.</p>
(4) Carburetor	<p>Always check carburetor for proper settings before tampering with regulator adjustment.</p> <p>Flooded carburetor - Shut off LPG tank valve with ignition switch "on"; crank engine through a few times. If the engine starts, then slowly open tank valve to provide fuel flow through line. If engine does not start before opening fuel tank valve, then choke engine and use standard starting procedure.</p>	<p>Restricted air cleaner.</p> <p>Clean or replace filter element.</p>	<p>Check carburetor setting.</p> <p>Check ignition system.</p>
(5) Regulator	<p>Be sure carburetor is properly adjusted before attempting to adjust regulator setting.</p> <p>Check vaporizer regulator. Be sure it is functioning properly. In troubleshooting, be sure all of the previous five check points have been checked thoroughly before making any adjustment to regulator.</p>	<p>Only after checking the carburetor setting should the regulator be checked (too rich or too lean). Could very definitely affect operation if carburetor adjustment is correct.</p>	<p>Could be improper setting. Allow too rich or too lean mixture to carburetor. Check and adjust only after checking carburetor adjustment.</p>
(6) Engine	<p>Under ordinary circumstances, an engine should start easily if the components previously mentioned have been checked through and properly adjusted. On an older engine, if proper adjustment on other components are correct, it is possible that major repairs may be required to the basic engine.</p>		

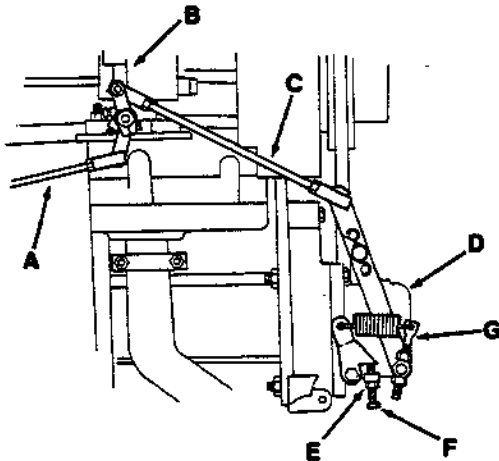


## GOVERNOR

### CHECKING AND ADJUSTING GOVERNOR LINKAGE

The following is a step-by-step procedure to follow in checking and adjusting the governor linkage:

1. With the engine stopped, the governor should hold the throttle in the open position. The governor to carburetor control rod should be adjusted in length so the throttle stop lever is 0.01 to 0.03 in (0.2 to 0.8 mm) off the pin.
2. Make certain that all linkage is movable with the governor spring attached. Disconnect the governor spring and check movement of levers and rods.
3. The hinged lever governor eliminates the need for a spring loaded throttle lever on the carburetor. As the carburetor lever is forced to idle position by the speed control lever, this in turn pivots the spring loaded arm, slowing the engine to idle.



### MECHANICAL GOVERNOR LINKAGE

00584

- A. Throttle to Carburetor Rod
- B. Carburetor
- C. Carburetor to Governor Rod
- D. Governor
- E. Locking Nut
- F. Speed Adjustment Screw
- G. Sensitivity Screw

### GOVERNOR ADJUSTMENT

1. Engage the machine parking brake.



**CAUTION:** Always engage the parking brake before working on the machine.

2. Start the engine and allow it to warm up.



**CAUTION:** Keep clear of engine fan when making governor adjustments.

3. With the engine warmed up, adjust the idle speed approximately 150 rpm higher than the required speed under load by turning the speed screw in or out, thus either increasing or decreasing pull on the spring.

4. Apply the desired load and readjust the speed screw in order to obtain the required speed under load.

Release load and note rpm at which the engine settles out.

Again apply load and observe the drop in rpm before the governor opens throttle to compensate.

5. The range of a governor's action is indicated by the differential between rpm under load and that under no load.

This can be varied and the sensitivity of the governor is changed by changing the length of the sensitivity screw.

6. To broaden the range of the governor and produce a more stable action, lengthen the sensitivity screw and compensate for this change by turning the speed screw in to restore the speed.

7. To narrow the range and increase the sensitivity of the governor, reverse the procedure outlined in step 6. (Changing the length of the sensitivity screw has the same effect as using a stronger or weaker spring.)

8. With the governor adjusted for desired performance, release the load and allow the engine to run at governed speed with no load. If a surge is noted, lengthen the sensitivity screw at spring anchor and readjust the speed screw to obtain desired no load rpm

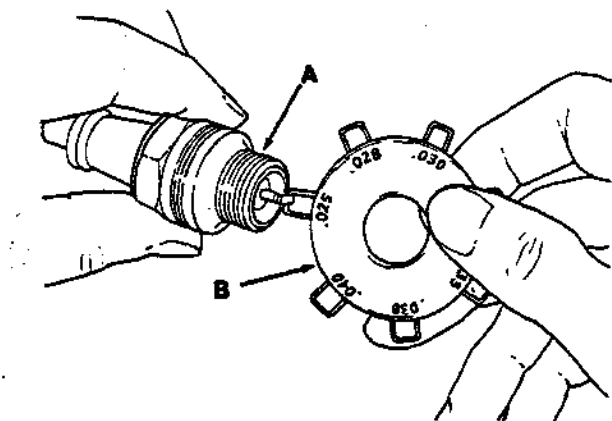
9. When governor adjustment is completed, make sure that all lock nuts are tight in order to maintain the adjustment.

### ELECTRICAL SYSTEM

#### SPARK PLUGS

Spark plug gaps are best checked with a wire gauge unless the points are dressed to obtain a correct reading with a flat gauge. The adjustment should always be made on the side electrode and never on the center electrode, which may cause the porcelain to be broken.

"Gapping" the electrode tip is more easily done with the proper tools.



#### GAPPING THE SPARK PLUG

00054

- A. Spark Plug
- B. Gapping Tool

The proper spark plug gap is 0.025 in (0.6 mm).

Spark plugs must be correctly installed in order to obtain good performance from them. It is a simple but important matter to follow these procedures when installing 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 all 18 mm plugs to 35 ft lbs (47 Nm) with a socket wrench and torque wrench of the correct size.

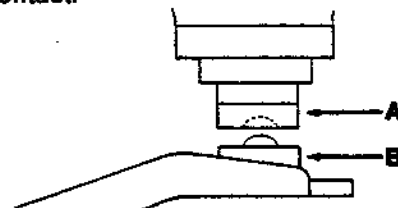
#### DISTRIBUTOR MAINTENANCE

The distributor operation is vital to the operation of the engine and the following items should be carefully inspected every 250 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.
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. Inspect the breaker 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.

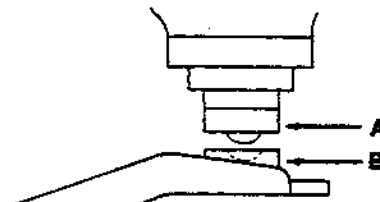
If the condenser capacity is too high, a crater (depression) will form in the positive contact; and, if the condenser is too low, a crater will form in the negative contact.



#### OVER CAPACITY CONDENSER

00003

- A. Contact Bracket
- B. Breaker Arm



#### UNDER CAPACITY CONDENSER

00003

- A. Contact Bracket
- B. Breaker Arm

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 0.020 in (0.5 mm). 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 that they make full contact. Bend the stationary arm to obtain proper alignment; do not bend the breaker arm.

4. Lubrication is required at the shaft, advance mechanism, breaker cam, and pivot. The shaft may be either oil or grease cup lubricated and should be given attention after every 250 hours of operation. Make sure the breaker arm moves freely on its hinge. Apply a drop of light oil or a trace of ball bearing lubricant to the breaker arm hinge after every 250 hours of operation.

Sparingly apply special grease (with Moly) to the breaker cam after every 250 hours of operation.

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

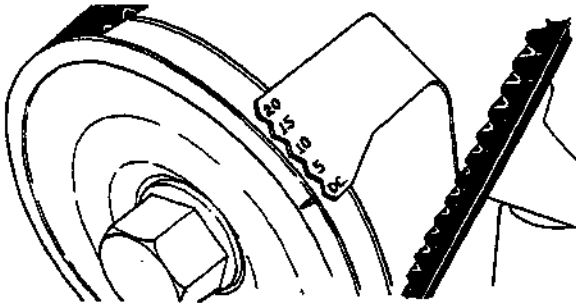
## DISTRIBUTOR IGNITION TIMING WITH TIMING LIGHT

There are two methods of checking ignition timing: with or without a timing light.

The preferred method is to use a timing light in the following sequence:

**NOTE:** The following sequence is for a 12 volt timing light. If a 110 volt timing light is to be used, follow the timing light manufacturer's instructions.

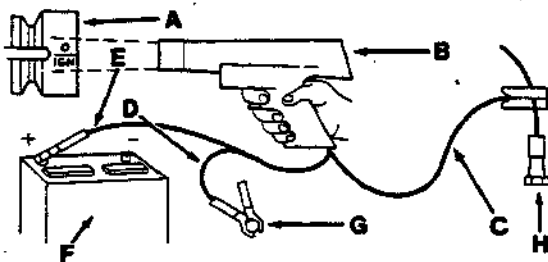
**NOTE:** Painting a line on the front pulley will make the timing mark more legible under the timing light.



**CRANKSHAFT PULLEY TIMING MARK** 00054

**CAUTION:** Do not hold ignition wires with bare hands since shocks or other injuries can result. Sparks or flames near a battery could cause an explosion or fire. Battery acid can cause corrosive burns. Always wear eye protection.

1. Clip the secondary lead of light to the #1 spark plug. Leave the spark plug wire on the plug.
2. Connect the primary positive lead to the positive terminal of the battery.



**TIMING LIGHT HOOKUP** 00059

- A. Crankshaft Pulley
- B. Timing Light
- C. Blue
- D. Black
- E. Red
- F. Battery
- G. Head Bolt
- H. Spark Plug

3. Connect the primary negative lead (black) to the cylinder head cap screw or the alternator bracket.

4. Start the engine and run it at idle speed. Then slow engine to 400 rpm or lower, so the automatic advance of the distributor is completely retarded.

**NOTE:** The engine must be operating at or below 400 rpm to obtain the correct engine timing.

5. Direct the timing light on the crankshaft pulley and note the timing marks as the light flashes.
6. Timing is TDC at engine idle. To advance the timing, turn the distributor body clockwise. To retard the timing, turn the distributor body counter-clockwise.
7. When the timing is correct, tighten the distributor clamp screw securely. Then recheck timing again with the light.

**NOTE:** This operation is best performed in a shaded area so the timing light is visible.

8. Set the engine idle speed to 1000 rpm.

## DISTRIBUTOR IGNITION TIMING WITHOUT TIMING LIGHT (EMERGENCY METHOD)

For breaker-type ignition, an alternative method, without timing light, is as follows:

1. Remove #1 Spark Plug - put your thumb over the spark plug hole and crank the engine by hand until air is exhausting.
2. Set piston on top dead center by slowly cranking until "DC" mark on crankshaft pulley line up with the pointer on the gear cover.
3. Loosen the distributor clamp bolt and rotate the distributor body until the contact points just start to open.

This may be more accurately checked by means of a test lamp connected between the distributor primary lead and the negative terminal of the battery. When the points are closed, the light will be "on" and as soon as the points break, the light will go "off."

## ALTERNATOR

Precautions to be observed when testing or servicing the alternator system:

1. Disconnect the battery before connecting or disconnecting test instruments (except voltmeter) or before removing or replacing any unit or wiring. Accidental grounding or shorting at the alternator, ammeter, or accessories will cause severe damage to the units and/or wiring.
2. The field circuit must never be grounded on this system between the alternator and the regulator. Grounding of the field terminal either at the alternator or regulator will damage the regulator.

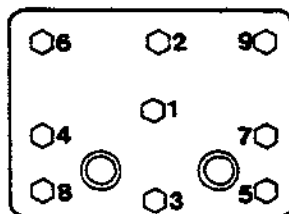
3. The alternator must not be operated on open circuit with the rotor winding energized.
4. Do not attempt to polarize the alternator—no polarization is required. Any attempt to do so may result in damage to the alternator, regulator, or circuits.
5. Grounding of the alternator output terminal may damage the alternator and/or circuit and components.
6. Reversed battery connections may damage the rectifiers, wiring, or other components of the charging system. Battery polarity should be checked with a voltmeter before connecting the battery.
7. If a booster battery or fast charger is used, its polarity must be connected correctly to prevent damage to the electrical system components (positive to positive, negative to negative) and to prevent battery explosion.

**⚠ CAUTION:** Battery connections to chargers must be made with correct polarity. Battery explosions may result if incorrect connections are made.

### CYLINDER HEAD

A three-stage torque procedure should be used when reassembling the cylinder head. The cylinder head cap screws and risers must be tightened in the proper sequence after the first 50 hours of operation:

1. Snug down cap screws and risers in the proper sequence.
2. Tighten the cap screws and risers to one-half of the specified value.
3. Torque to 45 to 48 ft lbs (61 to 65 Nm).



00555

### CYLINDER HEAD BOLT TIGHTENING SEQUENCE

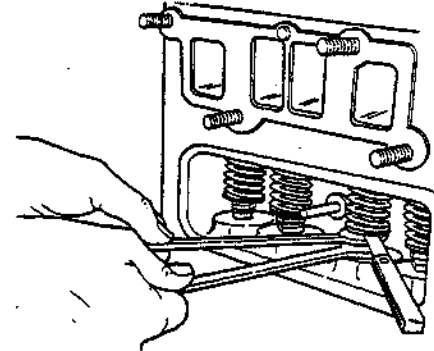
The cylinder head cap screws and risers must be re-torqued after the engine is put into operation and brought up to proper operating temperatures. To re-torque cap screws, follow the correct sequence. Loosen one head cap screw or riser at a time one quarter turn (90 degrees); then re-torque it to the correct value.

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

### VALVE TAPPET CLEARANCE ADJUSTMENT

The valve tappet clearance must be checked after the first 50 hours of operation and after every 500 hours of operation.

Check and adjust the intake valve tappets to 0.012 in (0.3 mm) clearance and the exhaust valve tappets to 0.020 in (0.5 mm) clearance when the engine is warm.



00585

### ADJUSTING VALVE TAPPET CLEARANCE

#### TUNE-UP CHART

Idle speed	1000 ± 50 rpm
Maximum governed speed	2700 ± 50 rpm
Spark plug gap	0.025 in (0.6 mm)
Ignition point gap	0.020 in (0.5 mm)
Timing	TDC @ 400 rpm
Firing order	1-2
Valve clearances, warm	0.012 in (0.3 mm) intake 0.020 in (0.5 mm) exhaust

# ELECTRICAL SYSTEM

## BATTERIES

The battery used in the machine is a low maintenance battery. Do not add water, remove the battery vent plugs, or check the battery specific gravity. For specific instructions, see the battery label.

The following information applies to regular maintenance replacement batteries.

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 discharged beyond 80%, specific gravity below 1.120.

Clean the top surface and the terminals of the battery after every 150 hours of operation. 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.

Check the electrolyte level in each battery cell after every 50 hours of operation. The electrolyte level 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 water. Keep vent plugs firmly in place at all times, except when adding water or taking hydrometer readings.

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

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

SPECIFIC GRAVITY AT 80° F (26.6° 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 - 1.130 .....	Discharged

*NOTE: If the readings are taken when the battery electrolyte is any temperature other than 80° F (26.6° C), the reading must be temperature corrected.*

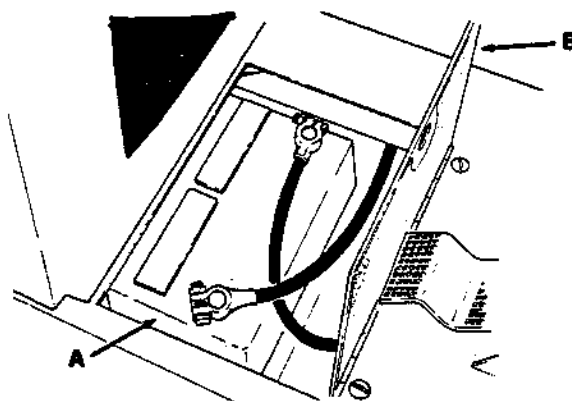
To determine the corrected specific gravity reading when the temperature of the battery electrolyte is other than 80° F (26.6° C):

Add to the specific gravity reading 0.004, 4 points, for each 10° F (5.5° C) above 80° F (26.6° C).

Subtract from the specific gravity reading 0.004, 4 points for each 10° F (5.5° C) below 80° F (26.6° C).

## BATTERY REPLACEMENT

The standard battery is a 12-Volt, 84-A/h battery. It is located under the floor plate beneath the operator's feet.



**BATTERY LOCATION**

00588

- A. Battery
- B. Floor Plate



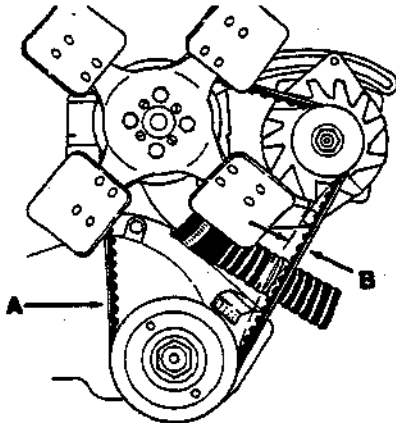
## BELTS AND CHAINS

### ENGINE FAN BELT

To tighten the fan belt, loosen the alternator adjusting bolts and pull out on the alternator by hand until the belt is just snug. Under no circumstances should a pry bar be used on the alternator to obtain fan belt tension, as damage to the bearings will result. Then tighten the alternator adjusting bolts.

Check the fan belt tension after every 50 hours of operation.

Proper belt deflection is obtained when the belt deflects 0.5 in (13 mm) from a force of 10 to 12 lbs (4.5 to 5.4 kg) applied at the midpoint of the longest span.



ENGINE FAN BELT

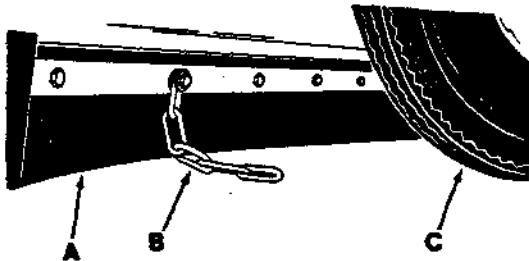
00577

- A. Fan Belt
- B. 0.5 in (13 mm)

### 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.

Check the chain for wear after every 250 hours of operation. Make sure that it is making contact with the floor at all times.



STATIC DRAG CHAIN

00588

- A. Rear Dust Skirt
- B. Static Drag Chain
- C. Rear Tire

## HOPPER

### HOPPER DUST FILTERS

There are two dust filter cartridges located inside of the hopper. The dust filters filter the air which is drawn up from the main brush compartment through the hopper. The dust filters are equipped with shaker motors to remove the accumulated loose dust particles. The dust filter shaker motors are operated by a pushbutton switch located on the instrument panel. Shake the dust filters before dumping the hopper and at the end of every work shift. Inspect and clean or replace the dust filters after every 150 hours of operation.

To clean the dust filters 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 filter frame.
- **AIR** - Blow compressed air, 100 psi (690 kPa) maximum, through the dust filter opposite the direction of the arrows.
- **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 (276 kPa). Air dry the wet dust filter; do not use compressed air.

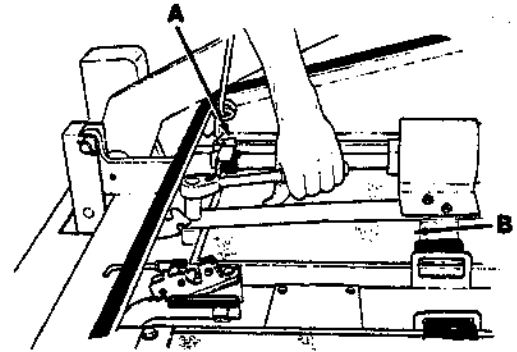
**NOTE:** Be sure the dust filters are dry before re-installing them in the machine.

### TO REMOVE HOPPER DUST FILTERS

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

**CAUTION:** Always stop the engine and engage the parking brake before working on the machine.

2. Pull the hopper cover latch release lever.
3. Lift the hopper cover.
4. Dislodge the hopper cover prop arm from its storage and position it in the hopper cover prop arm receptacle.
5. Lower the hopper cover onto the prop arm.
6. Loosen the two dust filter retaining tab bolts on each dust filter.

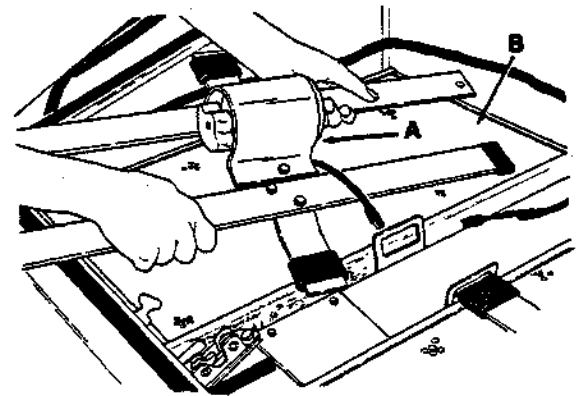


00588

### LOOSENING DUST FILTER RETAINING TABS

- A. Dust Filter Retaining Tab
- B. Dust Filter

7. Swing the retaining tabs away from the dust filter.
8. Remove the two dust filter spring mounting bolts from each spring set.
9. Lift the dust filter shaker assembly off each of the dust filter elements.



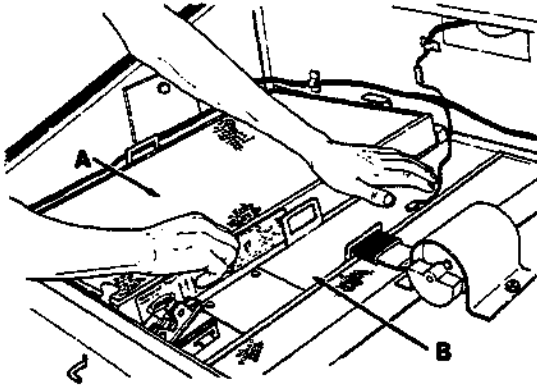
00590

### REMOVING DUST FILTER SHAKER ASSEMBLY

- A. Dust Filter Shaker Assembly
- B. Dust Filter



- Lift the dust filter elements out of the dust filter frames.



#### REMOVING DUST FILTERS

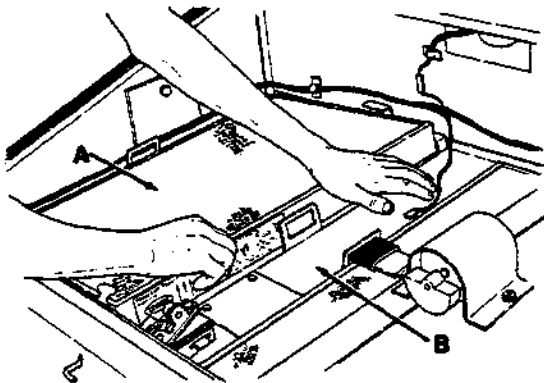
00591

- A. Dust Filter
- B. Dust Filter Frame

- Clean or discard the dust filters as required.

#### TO INSTALL HOPPER DUST FILTERS

- Place the cleaned or new dust filters in the hopper dust filter frames with the arrows pointing up.



#### INSTALLING DUST FILTER

00591

- A. Dust Filter
- B. Dust Filter Frame

- Slide the dust filter shaking assemblies into position over the dust filters.
- Thread the two dust filter spring mounting bolts through the mounting springs and into the dust filter frames. Tighten the bolts.
- Swing the dust filter retaining tabs into position over the dust filters. Tighten the bolts.
- Push the hopper cover open, lower and store the prop arm under its retaining clip, and close the hopper cover.

#### HOPPER FUSIBLE LINK

The hopper fusible link is a device which, in case of a fire in the hopper, allows the hopper fire door to close, cutting off air to the fire.

The fusible link is positioned between the hopper fire door and the hopper frame. It is accessible through the hopper dump door. Check the fusible link after every 150 hours of operation.

If a loss of dust control is noticed, check the fusible link for breakage or failure due to heat.

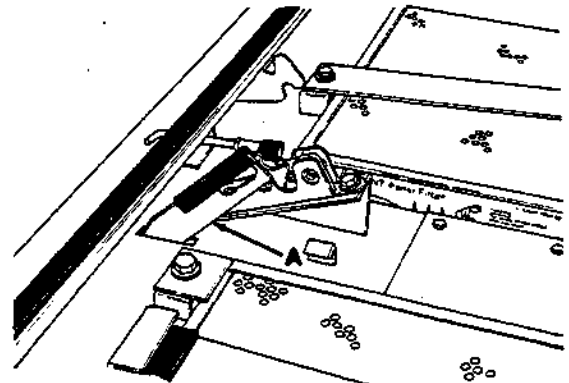
**ATTENTION!** The hydraulic fluid may overheat if the hopper fire door is closed for an extended period of time. The fire door may be closed if the machine is being operated with the dust filter bypass kit in operation.

#### TO REPLACE HOPPER FUSIBLE LINK

- Stop the engine and engage the machine parking brake.

**CAUTION:** Always stop the engine and engage the parking brake before working on the machine.

- Open the hopper cover.
- Prop the hopper cover open with the hopper cover prop arm.
- Push the fire door arm to the left and down and then allow it to rise, closing the fire door.



#### FIRE DOOR ARM

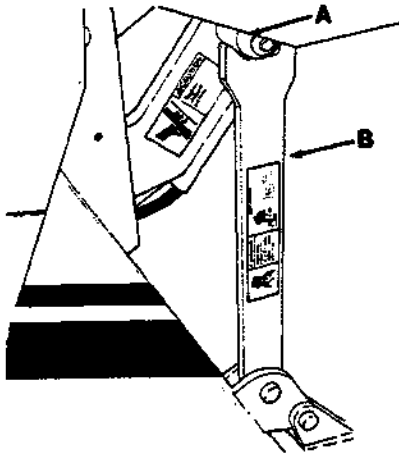
00547

- A. Fire Door Arm "Closed" Position

- Close the hopper cover.
- Start the engine.
- Raise the hopper.
- Position the hopper safety arm under the hopper lift arm cam.

**⚠ WARNING:** Always engage the hopper safety arm before working under the hopper. Do not rely on the machine hydraulic system to keep the hopper in the "raised" position.

- Lower the hopper onto the hopper safety arm.

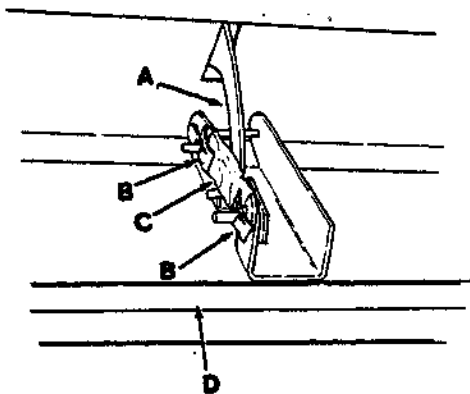


**ENGAGED HOPPER SAFETY ARM**

00544

- A. Hopper Lift Arm Cam
- B. Hopper Safety Arm

- Check to make sure the hopper is resting securely on the hopper safety arm.
- Place the hopper in the "dump" position.
- Look inside the open hopper dump door and locate the fusible link.
- Remove the existing pieces of fusible link and their retaining clips.
- Slide the new fusible over the link mounting pins.

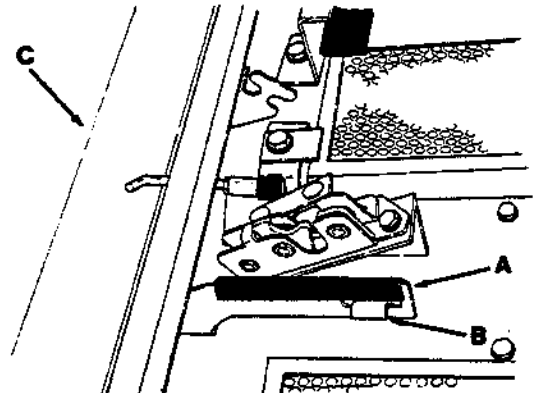


**FUSIBLE LINK INSTALLATION**

00592

- A. Fire Door Arm
- B. Retaining Clip
- C. Fusible Link
- D. Fire Door

- Push the link retaining clips onto the mounting pins.
- Start the engine.
- Stand clear of the hopper, raise the hopper, lower the hopper safety arm, lower the hopper, and return the hopper to the "operating" position.
- Stop the engine.
- Open the hopper cover.
- Prop the hopper cover open with the hopper cover prop arm.
- Open the fire door by pushing the fire door arm down and to the left inserting the fire door arm into the fire door retaining clip.



**FIRE DOOR ARM**

00552

- A. Fire Door Arm "Open" Position
- B. Retaining Clip
- C. Front of Hopper

- Push the hopper cover open and put the hopper cover prop arm in its storage location.
- Close the hopper cover.

**HOPPER ADJUSTMENT**

The hopper has basically been adjusted at the factory for the best possible performance. Only the hopper lip may need adjusting from time to time.

In the event that the hopper, the hopper lift arms, or other integral hopper components are repaired or replaced, the hopper must be realigned to insure its best performance.

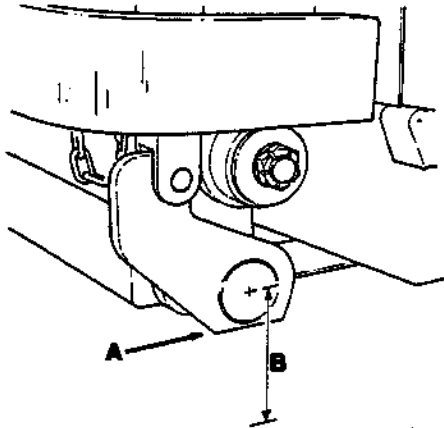
*NOTE: The hopper adjustments must be made in the order in which they appear with the machine fully assembled.*

**1. HOPPER LIFT ARM ADJUSTMENT**

- A. Stop the machine on smooth, level surface.
- B. Stop the engine and engage the machine parking brake.

**CAUTION:** Always stop the engine and engage the parking brake before working with machine.

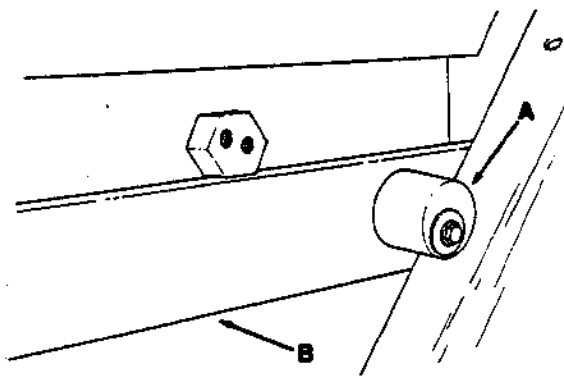
C. Measure the distance from the center of each of the torque shafts to the floor with the hopper in the "operating" position.



**TORQUE SHAFT HEIGHT** 00593

- A. Torque Shaft
- B.  $6.43 \pm 0.12$  in ( $163 \pm 3$  mm)

D. The distance measured should be  $6.43 \pm 0.12$  in ( $163 \pm 3$  mm). To adjust the height, remove one or both of the splined lift arm cams and rotate it or them until the proper dimension is achieved. The cams must rest on the sloping edge of the main frame.



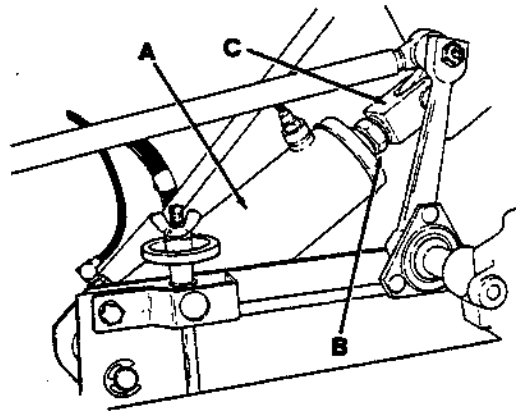
**LIFT ARM CAM** 00594

- A. Lift Arm Cam
- B. Lift Arm

E. Tighten the lift arm cam bolt(s).

**2. HOPPER LIFT CYLINDER ADJUSTMENT**

A. Loosen the clevis jam nut on the cylinder rod.



**HOPPER LIFT CYLINDER** 00563

- A. Hopper Dump Cylinder
- B. Jam Nut
- C. Cylinder Clevis

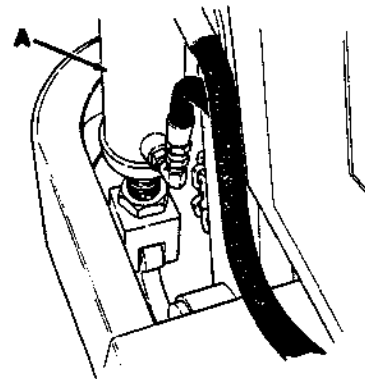
B. Adjust the cylinder clevis so that the cylinder is fully retracted by inserting a pin through the cylinder rod and rotating the rod.

C. Tighten the clevis jam nut against the clevis.

**3. HOPPER FLOOR CLEARANCE**

The hopper floor clearance should be inspected after every 250 hours of operation. Proper floor clearance must be maintained to prevent the hopper from trailing debris.

A. Remove the clevis pins holding the hopper dump cylinders clevis ends to the torque arms.

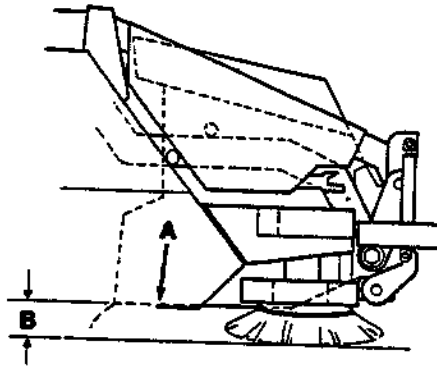


**HOPPER DUMP CYLINDER** 00595

A. Hopper Dump Cylinder

B. Disconnect the dump cylinder clevis ends from the torque arms.

C. Place a  $3.43 \pm 0.12$  in ( $87 \pm 3$  mm) block under each of the rear sides of the hopper.

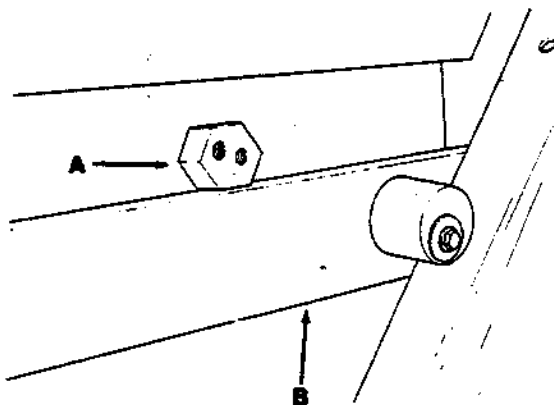


#### ADJUSTING HOPPER FLOOR CLEARANCE 00596

- A. Hopper Bottom
- B.  $3.43 \pm 0.12$  in ( $87 \pm 3$  mm)

D. Check and adjust, if necessary, the hexagon hopper cams on each side of the hopper so they contact the top surface of the hopper lift arms.

E. Tighten the hexagon hopper cam bolts.

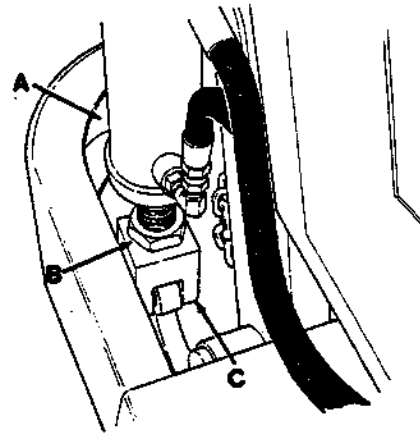


#### HEXAGON HOPPER CAM 00594

- A. Hexagon Hopper Cam
- B. Hopper Lift Arm

#### 4. DUMP CYLINDERS ADJUSTMENT

- A. Start the engine.
- B. Retract the dump cylinders completely.
- C. Stop the engine.
- D. Loosen the cylinder clevis jam nuts.



#### HOPPER DUMP CYLINDER 00595

- A. Hopper Dump Cylinder
- B. Jam Nut
- C. Cylinder Clevis

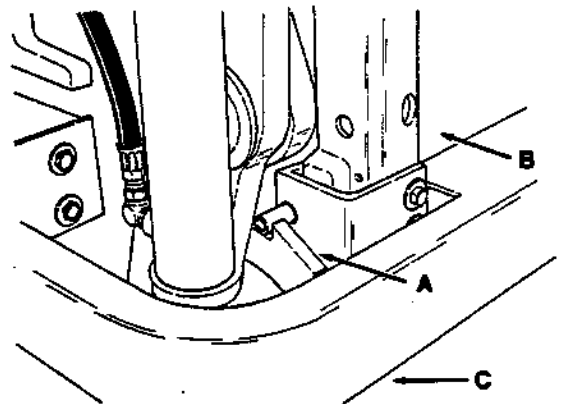
E. Adjust the cylinder clevis so the clevis pin which connects the dump cylinder clevis and torque arm can be passed freely through the clevis and torque arm.

F. Tighten the clevis jam nuts.

G. Secure the clevis pins in place with their retaining rings.

#### 5. DUMP DOOR LATCHES ADJUSTMENT

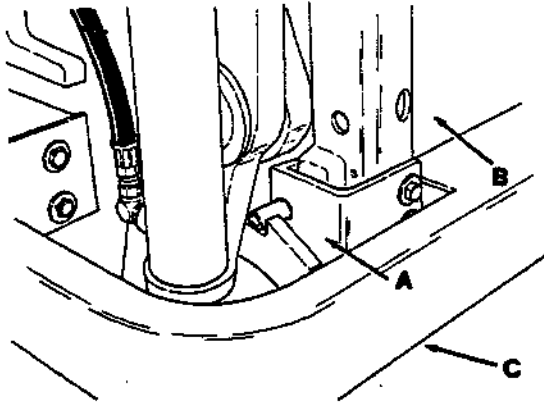
- A. Start the engine.
- B. Dump the hopper.
- C. Return the hopper to the "operating" position. Stop the engine.
- D. Check the hopper door latches to be sure the latches are fully engaged and the hopper door is closed tightly.



#### HOPPER DUMP DOOR LATCH 00597

- A. Hopper Dump Door Latch
- B. Hopper Door
- C. Bumper

- E. Shim the hopper door latching bracket to adjust the hopper door latches engagement and hopper door seal.



**HOPPER DOOR LATCHING BRACKET** 00597

- A. Hopper Door Latching Bracket  
B. Hopper Door  
C. Bumper

- F. Start the engine.

- G. Dump the hopper and observe the unlatching of the hopper door. The latches should release at the same time. Adjust the latch chain eyebolts if necessary.

#### STABILIZER LEG

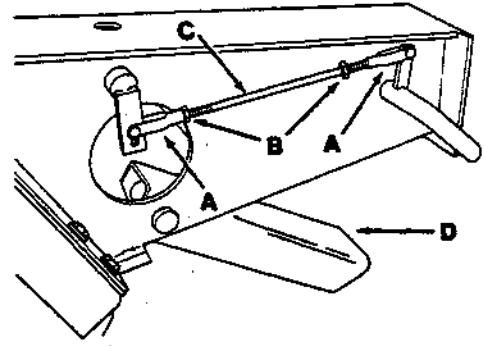
The machine stabilizer leg is a safety device which, when the machine is being hi-dumped, projects forward to act as an anti-tipping device. Check the stabilizer leg to be sure it is projecting forward when the machine is being hi-dumped and is fully retracted when the hopper is in the "operating" position after every 250 hours of operation.

#### TO ADJUST STABILIZER LEG

1. Raise the hopper, engage the hopper safety arm, and lower the hopper onto the safety arm.

**⚠ WARNING:** Always engage the hopper safety arm before working under a raised hopper.

2. Loosen the clevis jam nut.



**STABILIZER LEG** 00598

- A. Clevis  
B. Jam Nut  
C. Threaded Rod  
D. Stabilizer Leg

3. Thread the clevis into the threaded rod to raise the stabilizer leg or thread the clevis out of the threaded rod to lower the stabilizer leg.
4. Tighten the jam nut against the clevis.
5. Raise the hopper, disengage and lower the hopper safety arm and lower the hopper.
6. Check the position of the stabilizer leg.
7. Readjust the stabilizer leg as required.

## BRUSHES

### MAIN BRUSH REPLACEMENT

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 main brush life.

The main brush should be replaced when the remaining bristle measures 1.25 in (32 mm) in length.

### TO REMOVE MAIN BRUSH

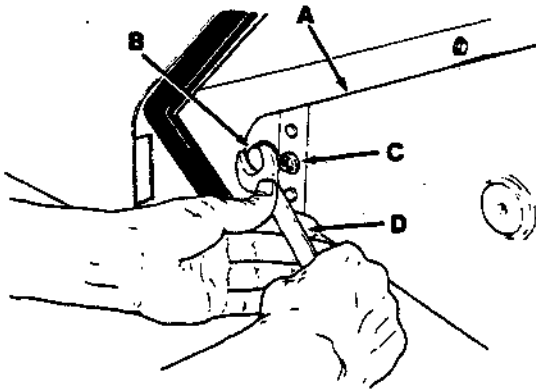
1. Stop the engine and engage the machine parking brake.

**CAUTION:** Always stop the engine and engage the parking brake before working on the machine.

2. Place the main brush in the "free-float" position.

**CAUTION:** Wear gloves when replacing the main brush to protect your hands.

3. Open the right side brush access door.
4. Remove the brush removal wrench from the inside of the access door.
5. Remove the brush idler arm retaining bolt from the arm hub with the brush removal wrench.



### REMOVING BRUSH IDLER ARM

- A. Brush idler Arm
- B. Arm Retaining Bolt
- C. Plastic Screw
- D. Brush Removal Wrench

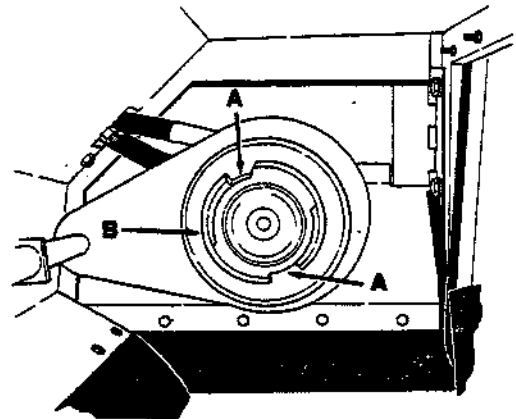
6. Pull the brush idler arm off the arm hub.

**NOTE:** If the brush idler arm does not come off easily, remove the plastic screw which is located next to the hole where the brush idler arm retaining bolt was mounted. Thread the brush idler arm retaining bolt into the threaded hole where the plastic screw was mounted. Tighten the retaining bolt until it forces the brush idler arm loose. Remove the brush idler arm retaining bolt and replace it with the plastic screw.

7. Grasp the main brush, pull it off the brush drive plug, and out of the main brush compartment.

### TO INSTALL MAIN BRUSH

1. Place the main brush on the floor next to the access door.
2. Align the main brush drive slots with the drive keys on the main brush drive plug.



### MAIN BRUSH DRIVE SLOTS

- A. Drive Slot
- B. Brush Drive Hub

3. Slide the main brush into the brush compartment and onto the drive plug. Make sure the drive slots and keys mate.
4. Align the main brush idler plug slots with the main brush keys.
5. Slide the main brush idler plug into the main brush tube.
6. Slide the brush idler arm onto the arm hub.
7. Thread the brush idler arm retaining bolt through the idler arm and into the arm hub.
8. Tighten the brush idler arm retaining bolt.
9. Close the right side brush access door.
10. Check and adjust the main brush pattern as described in Main Brush Pattern Adjustment.

## MAIN BRUSH PATTERN ADJUSTMENT

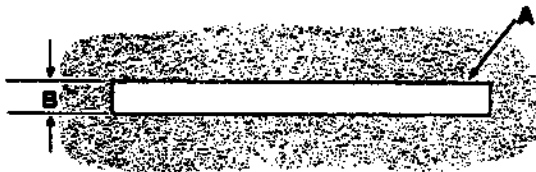
The main brush pattern should be checked after every 50 hours of operation. The main brush pattern should be 2 to 2.5 in (51 to 64 mm) wide with the main brush in the "restricted down" position. Main brush pattern adjustments are made by turning the height adjustment knob behind the side shroud next to the operator's left leg.

### 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 and main brush in the "raised" position, position the main brush over the chalked area.
3. Start the main brush rotating, while keeping a foot on the brakes to keep the machine from moving.
4. Lower the main brush to the floor for 15 to 20 seconds.

**NOTE:** If no chalk or other material is available, allow the brushes to spin for two minutes.

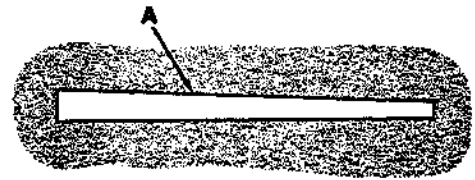
5. Raise the main brush after it has been spinning on the chalk marks for 15 to 20 seconds.
6. Drive the machine off the test area.
7. Observe the width of the brush pattern made. The proper brush pattern width is 2 to 2.5 in (51 to 54 mm).



**NORMAL MAIN BRUSH PATTERN**

00582

- A. Main Brush Pattern**  
**B. 2 to 2.5 in (51 to 54 mm)**



**TAPERED MAIN BRUSH PATTERN**

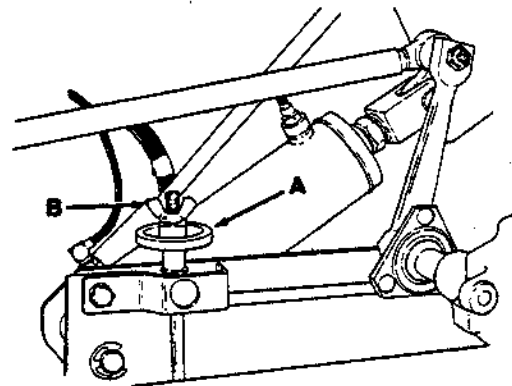
00601

### A. Main Brush Pattern

If the main brush pattern is tapered on a flat, level surface, loosen the main brush left cross shaft bearing mounting brackets and the bearing flanges. Pivot the bearing mounting bracket to level the cross shaft. Tighten the bearing mounting bracket and the bearing flanges. Check the main brush pattern and readjust as necessary. Then adjust the width of the main brush pattern.

To widen the main brush pattern, loosen the locking wing nut and turn the adjustment knob counter clockwise from the top. To narrow the main brush pattern, loosen the locking wing nut and turn the adjustment knob clockwise from the top.

Tighten the locking wing nut and recheck the main brush pattern. Repeat the procedure until the main brush pattern is within the specified range.



**MAIN BRUSH HEIGHT ADJUSTMENT KNOB**

00583

- A. Main Brush Height Adjustment Knob**  
**B. Wing Nut**

## SIDE BRUSH REPLACEMENT

The side brush should be inspected daily for wear or damage. Remove any string or wire found tangled on the side brush or side brush drive hub.

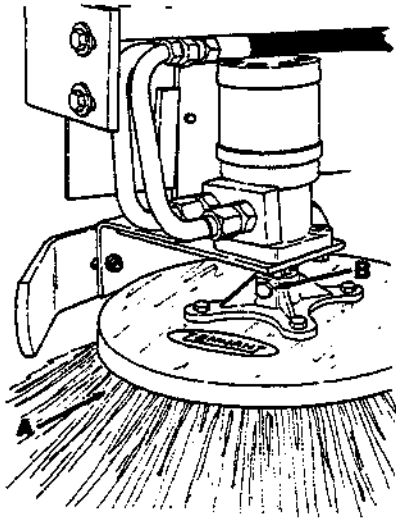
The side brush should be replaced when the remaining brush bristle measures 2.5 in (64 mm) in length.

### TO REMOVE SIDE BRUSH

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

**CAUTION:** Always stop the engine and engage the parking brake before working on the machine.

2. Place the side brush in the "raised" position.
3. Remove the side brush retaining bolt from the side brush hub and shaft.



**SIDE BRUSH REMOVAL**

00602

- A. Side Brush
- B. Retaining Bolt

4. Slide the side brush off the side brush drive shaft.

### TO INSTALL SIDE BRUSH

1. Slide the side brush onto the side brush drive shaft.
2. Insert the side brush retaining bolt through the side brush hub and shaft.
3. Thread a nut onto the threads of the bolt.
4. Tighten the nut and bolt to secure the side brush.
5. Adjust the side brush height as described in Side Brush Height Adjustment.

## SIDE BRUSH PATTERN ADJUSTMENT

The side brush pattern should be checked after every 50 hours of operation. The side brush is properly adjusted when between one-third and one-half of its bristles contact the floor.

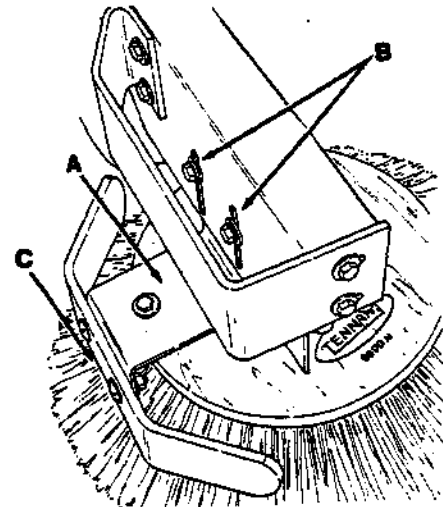
Side brush pattern adjustments are made by relocating the side brush assembly retaining bolts.

### TO ADJUST SIDE BRUSH PATTERN

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

**CAUTION:** Always stop the engine and engage the machine parking brake before working on the machine.

2. Loosen the two side brush assembly retaining bolts.



00603

**SIDE BRUSH ASSEMBLY RETAINING BOLTS**

- A. Side Brush Assembly
- B. Side Brush Assembly Retaining Bolts
- C. Side Brush Bumper

3. Slide the side brush assembly up or down until between one-third and one-half of the side brush bristles contact the floor.
4. Tighten the two side brush assembly retaining bolts.



## SKIRTS AND SEALS

### HOPPER LIP SKIRTS

The hopper lip skirts are located on the bottom rear of the hopper. Their purpose is to float over debris and help deflect that debris into the hopper. The hopper lip skirts are made up of five bottom lip segments and two side lip segments.

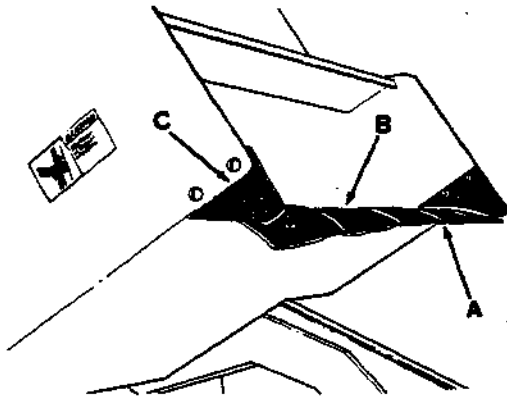
The hopper lip skirts should be inspected for wear or damage after every 50 hours of operation.

#### TO REPLACE HOPPER LIP

1. Empty the machine debris hopper.
2. Stop the machine on a level surface and engage the machine parking brake.
3. Raise the hopper, engage the hopper safety arm, and lower the hopper onto the hopper safety arm.
4. Stop the engine.

**⚠ CAUTION:** Always stop the engine and engage the parking brake before working on the machine.

5. Remove the hopper lip retaining strip mounting bolts.



HOPPER LIP SKIRTS

- A. Hopper Lip Skirts
- B. Retaining Strip
- C. Hopper Lip Side Skirt

00604

6. Remove the hopper lip retaining strip and worn or damaged hopper lip segments.
7. Thread the retaining strip mounting bolts through the retaining strip, the hopper lip segments, and into the hopper.
8. Tighten the mounting bolts.
9. Start the engine.
10. Raise the hopper, lower the hopper safety arm, and lower the hopper.
11. Stop the engine.

POWER SWEEPER - 250 MM138 (5-83) LITHO IN U.S.A.

### HOPPER SEALS

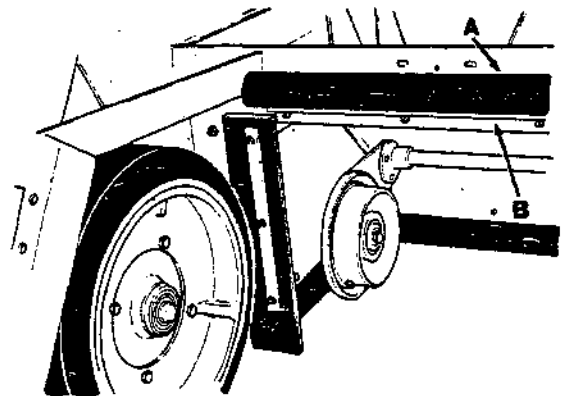
There are three seals located on the machine frame that serve as hopper seals. They are the hopper top seal, the hopper left side seal, and the hopper right side seal. These seals seal the hopper to the machine frame. The seals should be inspected for wear or damage after every 50 hours of operation.

#### TO REPLACE HOPPER TOP SEAL

1. Empty the machine debris hopper.
2. Stop the machine on a level surface and engage the machine parking brake.
3. Raise the hopper, engage the hopper safety arm, and lower the hopper onto the hopper safety arm.
4. Stop the engine.

**⚠ CAUTION:** Always stop the engine and engage the machine parking brake before working on the machine.

5. Remove the hopper top seal retaining strip mounting bolts.



HOPPER TOP SEAL

- A. Hopper Top Seal
- B. Seal Retaining Strip

00605

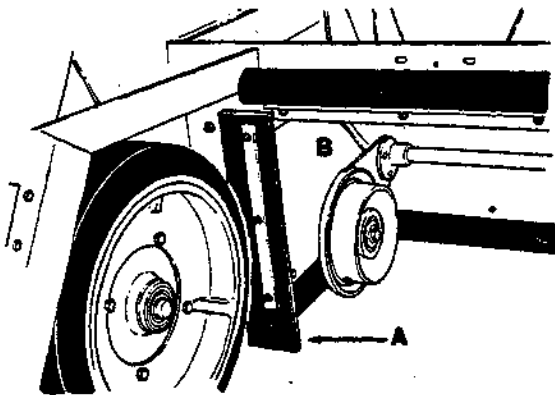
6. Remove the hopper top seal retaining strip and hopper top seal.
7. Thread the retaining strip mounting bolts through the retaining strip, the hopper top seal, and into the machine frame.
8. Tighten the mounting bolts.
9. Start the engine.
10. Raise the hopper, lower the hopper safety arm, and lower the hopper.
11. Stop the engine.

## TO REPLACE HOPPER SIDE SEALS

1. Empty the machine debris hopper.
2. Stop the machine on a level surface and engage the machine parking brake.
3. Raise the hopper, engage the hopper safety arm, and lower the hopper onto the hopper safety arm.
4. Stop the engine.

**CAUTION:** Always stop the engine and engage the machine parking brake before working on the machine.

5. Remove the hopper side seal retaining strip mounting bolts.



### HOPPER SIDE SEALS

00605

- A. Hopper Side Seal
- B. Seal Retaining Strip

6. Remove the hopper side seal retaining strip and hopper side seal.
7. Thread the retaining strip mounting bolts through the retaining strip, the hopper side seal, and into the machine frame.
8. Tighten the mounting bolts.
9. Start the engine.
10. Raise the hopper, lower the hopper safety arm, and lower the hopper.
11. Stop the engine.

## BRUSH DOOR SKIRTS

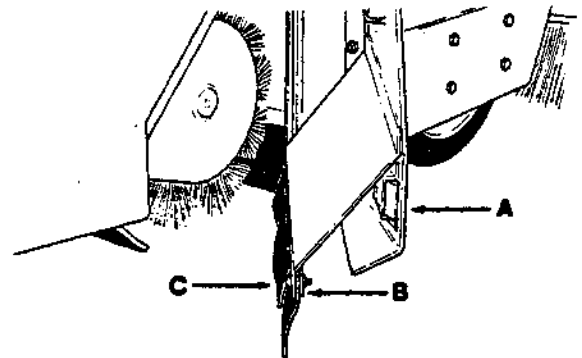
The brush door skirts are located on the bottom of each of the two brush compartment doors. These skirts seal the brush compartment. The seals should be inspected for wear or damage after every 50 hours of operation.

### TO REPLACE AND ADJUST BRUSH DOOR SKIRTS

1. Stop the machine on a smooth, level surface.
2. Stop the engine and engage the machine parking

**CAUTION:** Always stop the engine and engage the parking brake before working on the machine.

3. Open the brush door.
4. Remove the brush door skirt retaining bolts.



### BRUSH DOOR SKIRT

00570

- A. Brush Door
- B. Skirt Retaining Strip
- C. Brush Door Skirt

5. Remove the skirt retaining strip and the door skirt.
6. Position the new door skirt and skirt retaining strip on the brush door.
7. 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.

8. Slide the brush door skirt up or down so that the skirt clears the floor up to a maximum clearance of 0.12 in (3 mm).
9. Tighten the skirt retaining bolts.
10. Close the brush door.

## REAR SKIRTS

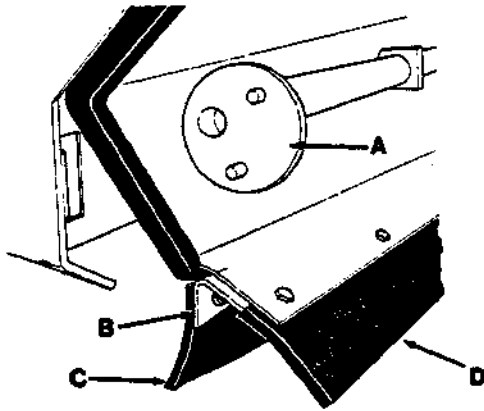
The rear skirts are located on the bottom rear of the brush compartment. These skirts seal the brush compartment. The seals should be inspected for wear or damage after every 50 hours of operation.

### TO REPLACE AND ADJUST REAR SKIRTS

1. Stop the machine on a smooth, level surface.
2. Stop the engine and engage the machine parking brake.

**CAUTION:** Always stop the engine and engage the parking brake before working on the machine.

3. Open the two brush compartment doors.
4. Remove the main brush as described in Main Brush Replacement.
5. Remove the skirts mounting bracket retaining bolts.



#### REAR SKIRTS

00606

- A. Brush Idler Arm Hub
- B. Skirt Retaining Bracket
- C. Rear Floor Skirt
- D. Brush Contact Skirt

6. Remove the skirts mounting bracket and the brush contact skirt.
7. Remove the rear floor skirt retaining strip from the skirts mounting bracket.
8. Remove the rear floor skirt from the skirts mounting bracket.
9. Thread the rear floor skirt retaining strip mounting bolts through the retaining strip, the new rear floor skirt, and into the skirts mounting bracket.
10. Do not tighten the mounting bolts at this time.
11. Thread the skirts mounting bracket retaining bolts through the skirts mounting bracket, the brush contact skirt, and into the machine frame.
12. Tighten the retaining bolts.
13. Slide the rear floor skirt up or down so that the skirt clears the floor up to a maximum clearance of 0.12 in (3 mm).
14. Tighten the rear floor skirt mounting bolts.
15. Install the brush as described in Main Brush Replacement.

## BRAKES AND TIRES

### BRAKE ADJUSTMENTS

The mechanical drum brakes located on the two front wheels are operated by a linkage which is controlled by a foot pedal and a hand-operated parking brake.

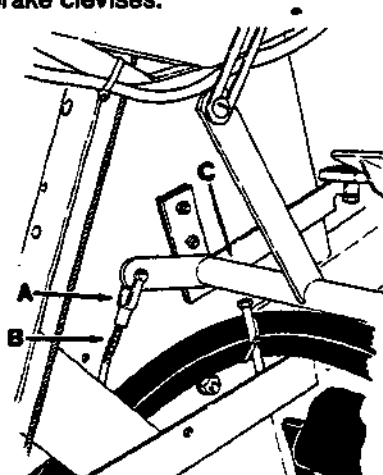
After every 250 hours of operation, check and adjust, if necessary, the brake linkage. The brake pedal should travel no more than 1 in (25 mm) to fully engage the brakes. At the same time, use a pressurized air hose to blow dirt from between the brake shoes and the brake hub. A hole is provided on each side of the machine for this purpose.

#### TO ADJUST BRAKE LINKAGE

1. Raise the hopper.
2. Engage the hopper safety arm.
3. Lower the hopper onto the hopper safety arm.
4. Check to make sure the hopper is resting securely on the hopper safety arm.
5. Stop the engine and block the machine wheels.

**CAUTION:** Always stop the engine and block the machine wheels before working on the machine.

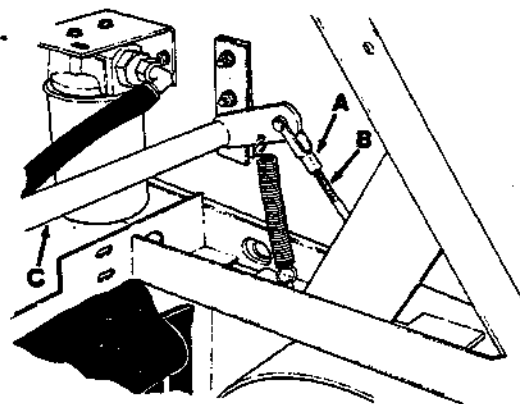
6. Remove the clevis pins from the left and right side brake clevises.



#### RIGHT BRAKE ADJUSTMENT

00607

- A. Right Brake Adjusting Clevis
- B. Threaded Rod
- C. Brake Cross Shaft



#### LEFT BRAKE ADJUSTMENT

00608

- A. Left Brake Adjusting Clevis
- B. Threaded Rod
- C. Brake Cross Shaft

7. Thread the clevis out to decrease the amount of brake pedal travel, or in to increase the amount of brake pedal travel. Both clevises must be turned the same amount.
8. Adjust the brake linkage so that the brake pedal travels no more than 1 in (25 mm) to fully engage the brakes.
9. Reinstall the brake clevis clevis pins.
10. Start the engine.
11. Raise the hopper.
12. Lower the hopper safety arm.
13. Lower the hopper.
14. Stop the engine.
15. Remove the machine wheel blocks.

#### BRAKE LINING REPLACEMENT

1. Park the machine on a flat surface.
2. Raise the hopper.

**NOTE:** The hopper must be empty.

3. Engage the hopper safety arm.
4. Lower the hopper onto the safety arm.
5. Check the hopper to be sure it is resting securely on the hopper safety arm.
6. Stop the engine.
7. Block the rear tire.

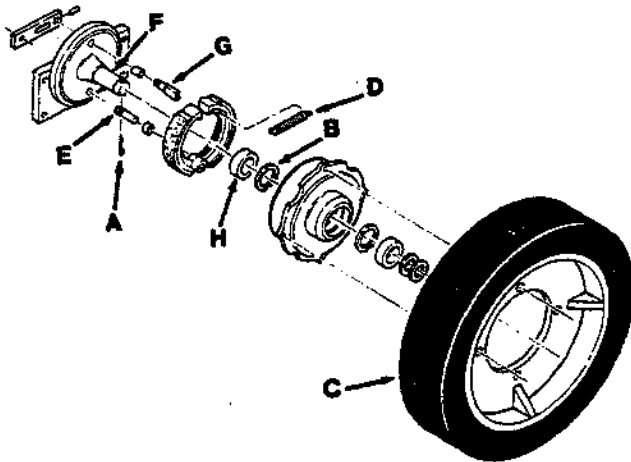
**⚠ WARNING:** Always block the rear tire before raising the front of the machine to keep the machine from rolling.

8. Jack up the front of the machine at the designated locations. Place jack stands or similar devices under the machine.

**⚠ WARNING:** Always use jack stands to block the machine up. Do not rely on scissors, automotive, or hydraulic jacks as they may slip, allowing the machine to fall.

*NOTE: The parking brake must be disengaged.*

9. Remove the cotter pin and washer from the end of the shaft.



#### **BRAKE ASSEMBLY**

00609

- A. Cotter Pin
- B. Retaining Ring
- C. Tire and Hub Assembly
- D. Retracting Spring
- E. Anchor Pin
- F. Spindle Shaft
- G. Brake Actuator
- H. Bearing

10. Pull the tire and hub assembly off the shaft.

*NOTE: Keep the wheel bearings clean unless they are to be replaced.*

11. Disconnect and remove the brake shoe retracting spring.
12. Slide the brake shoes off the anchor pin.
13. Clean and inspect the brake hub.
14. Inspect the brake actuator for wear and replace it if necessary.

15. Inspect and replace the bearings if they are worn or contaminated with dirt.
16. Pack the bearings with wheel bearing grease.
17. Slide the new brake shoes on the anchor pin.
18. Install the brake shoe retracting spring.
19. Slide the tire and hub assembly onto the shaft.
20. Install the hub retaining ring.
21. Install the washer and a new cotter pin on the wheel shaft.
22. Jack the machine up, remove the jack stands or similar devices, and lower the machine to the floor.
23. Adjust the brake linkage as described in Brake Adjustments.

#### **TIRES**

The front tires are solid and do not require regular maintenance.

The standard rear tire is pneumatic. Check the rear tire air pressure after every 8 hours of operation. The correct air pressure is 80 to 85 psi (552 to 586 kPa).

## LATCHES

### HOPPER COVER LATCH

The hopper cover latch should be lubricated with a dry lubricant after every 250 hours of operation. If the hopper cover does not close easily, or if the latch components are replaced, adjust the latch as described.

#### TO ADJUST HOPPER COVER LATCH

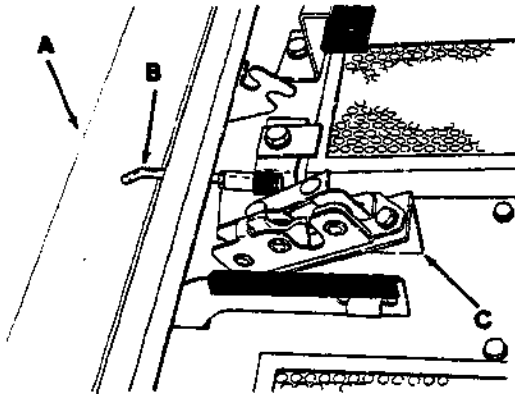
1. Stop the engine and engage the machine parking brake.

**CAUTION:** Always stop the engine and engage the parking brake before working on the machine.

2. Open the hopper cover.
3. Prop the hopper cover open with the cover prop rod.

**NOTE:** All hopper cover seals must be in place before adjusting the latch.

4. Center the cover latch in the adjusting slots.

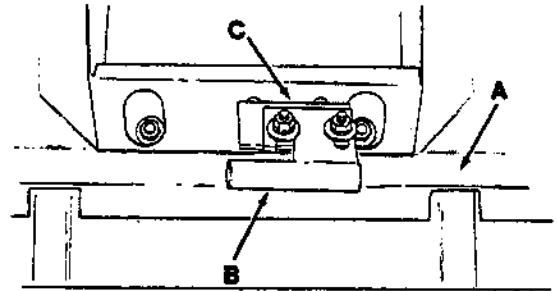


HOPPER COVER LATCH

00552

- A. Front of Hopper
- B. Latch Release Lever
- C. Hopper Cover Latch

4. Loosen the hopper cover striker mounting bolts and the striker mounting bracket bolts.



HOPPER COVER STRIKER

00610

- A. Hopper Cover
- B. Hopper Cover Striker
- C. Striker Mounting Bracket

5. Lower the hopper cover to 3 in (76 mm) open and position the striker pin over the latch opening.
6. Loosely retighten the four bolts.
7. Slide the striker all of the way down in the mounting slots.
8. Close and push down on the hopper cover.
9. Pull the hopper cover latch release lever, open the hopper, and tighten the striker retaining bolts.
10. Lubricate the latch with a dry lubricant.

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# SECTION 4 APPENDIX

## CONTENTS

	Page
Decimal-Metric Conversion Table .....	4-1
Hardware Information .....	4-2
Standard Bolt Torque Chart.....	4-2
Exceptions to Torque Chart .....	4-2
Bolt Identification.....	4-2
Hydraulic Fitting Information.....	4-3
Hydraulic Tapered Pipe Fitting (NPT)	
Torque Chart .....	4-3
Hydraulic Tapered Seat Fitting (JIC)	
Torque Chart .....	4-3
Hydraulic O-Ring Fitting Torque Chart.....	4-3







## DECIMAL - METRIC CONVERSION TABLE

1/2	1/4	1/8	1/16	1/32	1/64	Decimals	Millimeters
				1	1	0.015625	0.396875
				1	3	0.031250	0.793750
			1		5	0.046875	1.190625
				3	7	0.062500	1.587500
					9	0.078125	1.984375
				5	11	0.093750	2.381250
					13	0.109375	2.778125
		1			15	0.125000	3.175000
				7	17	0.140625	3.571875
					19	0.156250	3.968750
			3		21	0.171875	4.365625
				9	23	0.187500	4.762500
					25	0.203125	5.159375
				5	27	0.218750	5.556250
					29	0.234375	5.953125
				7	31	0.250000	6.350000
					33	0.265625	6.746875
				9	35	0.281250	7.143750
					37	0.296875	7.540625
			5		39	0.312500	7.937500
				11	41	0.328125	8.334375
					43	0.343750	8.731250
				3	45	0.359375	9.128125
					47	0.375000	9.525000
				9	49	0.390625	9.921875
					51	0.406250	10.318750
				5	53	0.421875	10.715625
					55	0.437500	11.112500
				7	57	0.453125	11.509375
					59	0.468750	11.906250
				15	61	0.484375	12.303125
					63	0.500000	12.700000
				9	65	0.515625	13.096875
					67	0.531250	13.493750
				5	69	0.546875	13.890625
					71	0.562500	14.287500
				11	73	0.578125	14.684375
					75	0.593750	15.081250
				3	77	0.609375	15.478125
					79	0.625000	15.875000
				9	81	0.640625	16.271875
					83	0.656250	16.668750
				5	85	0.671875	17.065625
					87	0.687500	17.462500
				11	89	0.703125	17.859375
					91	0.718750	18.256250
				3	93	0.734375	18.653125
					95	0.750000	19.050000
				9	97	0.765625	19.446875
					99	0.781250	19.843750
				5	101	0.796875	20.240625
					103	0.812500	20.637500
				11	105	0.828125	21.034375
					107	0.843750	21.431250
				3	109	0.859375	21.828125
					111	0.875000	22.225000
				9	113	0.890625	22.621875
					115	0.906250	23.018750
				5	117	0.921875	23.415625
					119	0.937500	23.812500
				11	121	0.953125	24.209375
					123	0.968750	24.606250
				3	125	0.984375	25.003125
					127	1.000000	25.400000
2	4	8	16	32	64		

## HARDWARE INFORMATION

### STANDARD BOLT TORQUE CHART

#### STANDARD BOLT TIGHTENING REQUIREMENTS FOR NORMAL ASSEMBLY APPLICATIONS

Bolt Thread Size (in)	SAE Gr. 5 Minimum Torque Ft Lbs (Nm)		SAE Gr. 8 Minimum Torque Ft Lbs (Nm)		Carr Bolts & B RH SSQ Bolts Minimum Torque Ft Lbs (Nm)
	Plain	Plated	Plain	Plated	
0.25	8(11)	7(10)	12(16)	10(14)	4(5)
0.31	18(24)	15(20)	26(35)	21(29)	8(11)
0.38	31(42)	25(34)	48(65)	39(53)	15(20)
0.44	53(72)	43(58)	75(102)	60(81)	26(35)
0.50	82(111)	66(90)	115(156)	92(125)	38(52)
0.56	170(231)	140(190)	235(319)	190(258)	70(95)
0.75	290(393)	230(312)	415(563)	330(448)	130(176)
0.88	430(583)	340(461)	600(814)	480(651)	140(190)
1.0	640(868)	510(692)	900(1220)	720(976)	210(285)

**NOTE:** Increase the torque by 20% when using engine oil or chassis grease as a thread lubricant.

#### EXCEPTIONS TO TORQUE CHART:

Drive motor shaft nut: 300-400 ft lbs (407-542 Nm)



Main brush motor porting block socket head bolts:  
18-20 ft lbs (24-27 Nm)

Vacuum fan shaft nut: 15-20 ft lb (20-27 Nm)

Rear wheel mounting nuts: 85-95 ft lb (115-129 Nm)

Front vertical lift arm nuts: Tighten to 30-40 ft lb (41-54 Nm), then back off to 5-15 ft lb (7-20 Nm).

#### BOLT IDENTIFICATION

Identification Grade Marking	Specification and Grade
	SAE-Grade 5 ASTM-A 449
	SAE-Grade 8 ASTM-A 354 Grade 8D

All hardware is of grade 5 unless specifically stated otherwise.

## 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 lbs (14 Nm)	30 ft lbs (41 Nm)
1/2 NPT	25 ft lbs (34 Nm)	50 ft lbs (68 Nm)
3/4 NPT	50 ft lbs (68 Nm)	100 ft lbs (136 Nm)

### HYDRAULIC TAPERED SEAT FITTING (JIC) TORQUE CHART

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

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

