TENNANT

95

Operation, Maintenance, and Parts Manual

MM141
Rev. 08 (09–89)

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

This manual covers all machine variations and standard accessories. The instruction portion of the manual consists of the Specification, Operation, Maintenance, and Appendix sections. The parts portion consists of the Low Dump Model Parts; LPG Parts; Diesel Parts, Continental ; Diesel Parts, Perkins; Diesel Parts, Kubota; Multi-Level Dump Model Parts; AA Model Parts; SE Model Parts; Accessories; Hydraulic Components; Engine Parts, Gasoline, LPG; ; Engine Parts, Diesel, Continental; Engine Parts, Diesel, Perkins; Engine Parts, Diesel, Kubota; and Cross Reference sections.

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

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

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

Parts and supplies may be ordered by phone or mail from any TENNANT parts and service center, distributor, or from any of the TENNANT subsidiaries. Before ordering parts or supplies, be sure to have your machine model number and serial number handy. Fill out the data block below for future reference.

MACHINE DATA

Please fill out at time of installation.

Machine Serial Number – _____

Engine Serial Number – _____

Sales Representative – _____

Customer Number – _____

Date of Installation – _____

Manual Number – MM141

Revision: 08

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03636

Acknowledgements: Technical information and/or illustrations supplied by Teledyne Continental Motors, Industrial Products Division, Inc.; Perkins Engines, Inc; Cessna Fluid Power Division; Eaton Corporation, Hydraulics Division.

ABOUT THIS MANUAL

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

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

REFERENCE SECTIONS

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

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

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

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

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

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

PART SECTIONS

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

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

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

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

MACHINE SERIAL NUMBERS

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

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

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

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

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

PARTS ASSEMBLIES

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

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

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

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

SUPPLIER COMPONENT BREAKDOWNS

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

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

ORDERING REPAIR PARTS

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

SAFETY PRECAUTIONS

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

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

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

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

FOR SAFETY:

1. **Do not operate machine:**
   - **Unless trained and authorized.**
   - **Unless operation manual is read and understood.**
   - **In flammable or explosive areas unless modified for use in those areas.**
   - **In areas with possible falling objects unless equipped with overhead guard.**

2. **Before starting machine:**
   - **Check for fuel leaks (gasoline, LPG, diesel).**
   - **Make sure all safety devices are in place and operate properly. See OPERATION section.**
   - **Check brakes and steering for proper operation.**

3. **When starting machine:**
   - **Keep foot on brake and directional pedal in neutral.**

4. **When using machine:**
   - **Go slow on grades and slippery surfaces.**
   - **Use care when backing machine.**
   - **Do not carry riders on machine.**
   - **Always follow safety and traffic rules.**

5. **Before leaving or servicing machine:**
   - **Stop on level surface.**
   - **Set parking brake (if so equipped).**
   - **Turn off machine and remove key.**

6. **When servicing machine:**
   - **Avoid moving parts. Do not wear loose jackets, shirts, or sleeves when working on machine.**
   - **Use Tennant Company supplied or equivalent replacement parts.**

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

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

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

WARNING: Brush throws debris. Severe personal injury can result. Stop motor before lifting hopper.

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

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

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

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

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

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

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

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

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

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

WARNING: Diesel atomizer spray can penetrate skin. Severe personal injury or death can result. Keep away from atomisers when engine is in operation.

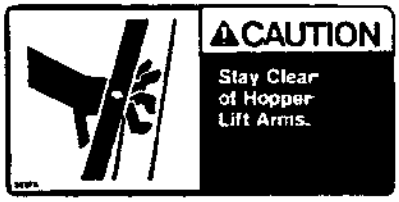
WARNING: Battery acid causes severe burns. Avoid contact. Wash immediately and get medical attention if contact occurs.

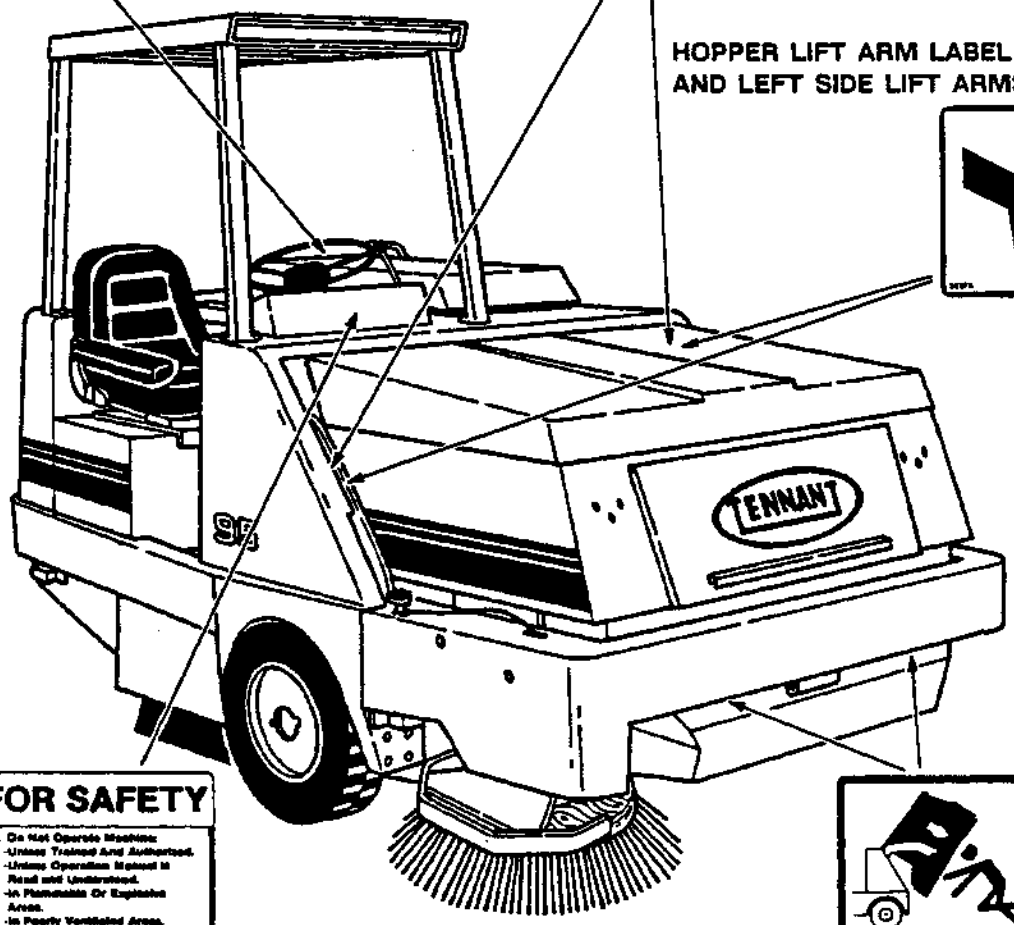
The following safety labels are mounted on the machine in the locations indicated. If these, or any, labels become damaged or illegible, install a new label in its place.

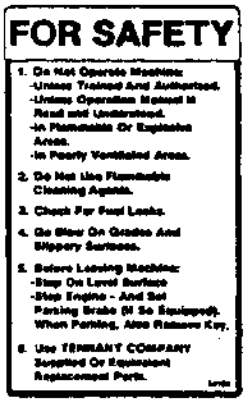
ENGINE FAN LABEL – LOCATED ON THE TOP AND SIDE OF THE RADIATOR FAN SHROUD.

FALLING HOPPER LABEL – LOCATED ON RIGHT AND LEFT SIDE LIFT ARMS. LOW DUMP MODEL ONLY.

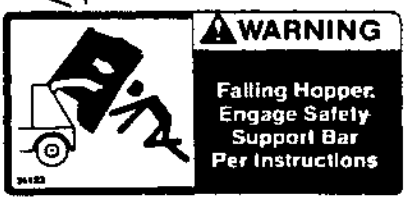
HOPPER LIFT ARM LABEL – LOCATED ON RIGHT AND LEFT SIDE LIFT ARMS.







SAFETY LABEL – LOCATED ON THE DRIVER COMPARTMENT PANEL.



FALLING HOPPER LABEL – LOCATED ON UNDER-SIDE OF FRONT BUMPER. LOW DUMP MODEL ONLY.

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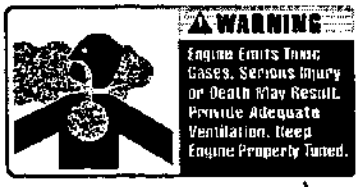
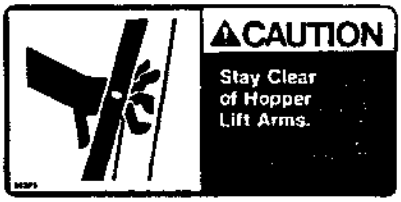
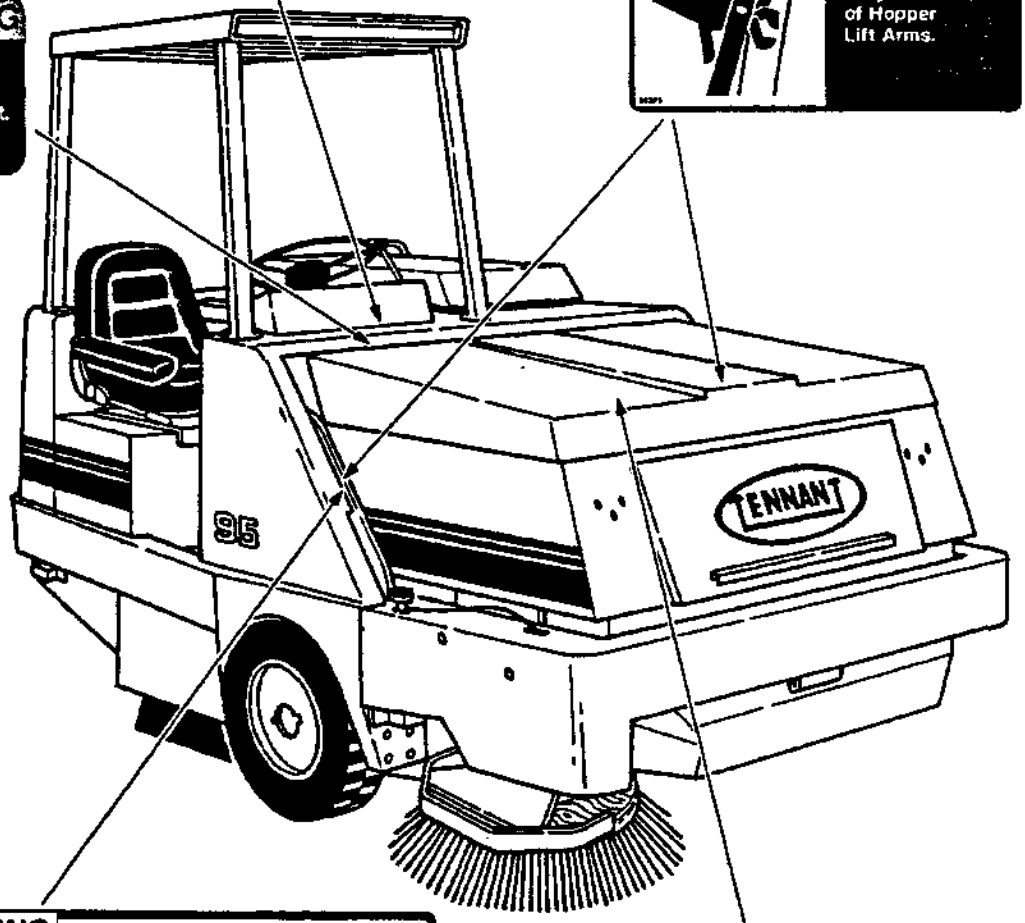
EMISSIONS LABEL – LOCATED ON THE DRIVER COMPARTMENT PANEL.



NOISE LABEL – LOCATED ON THE DRIVER COMPARTMENT PANEL.

HOPPER LIFT ARM LABEL – LOCATED ON RIGHT AND LEFT SIDE LIFT ARMS.





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FALLING HOPPER LABEL – LOCATED ON LEFT SIDE LIFT ARM AND ON HOPPER SAFETY SUPPORT BAR. MULTI-LEVEL DUMP, AA, SE MODELS ONLY.

FALLING HOPPER LABEL – LOCATED ON LINTEL/PUMP BAFFLE. MULTI-LEVEL DUMP, AA, SE MODELS ONLY.

CONTENTS

SECTION 1

CONTENTS

MACHINE SPECIFICATIONS

POWER TYPE

Engine Manufacturer/model – Continental TM27
Engine type – piston
Ignition – breakerless-type spark
Cycle – 4
Aspiration – natural
Cylinders – 4
Bore – 3.58 in (91 mm)
Stroke – 4.06 in (103 mm)
Displacement – 164 cu in (2680 cc)
Net power – 58 hp (43 kw) @ 2200 rpm governed
70 hp (52 kw) @ 3000 rpm maximum
Fuels – gasoline, 85 octane minimum, unleaded, or LPG
Cooling system – water
Electrical system – 12 V nominal, 37 A alternator, low dump, multi-level dump, AA models, 30 A totally enclosed alternator, SE model

Engine Manufacturer/model – Continental TMD27
Engine type – piston
Ignition – diesel
Cycle – 4
Aspiration – natural
Cylinders – 4
Bore – 3.58 in (91 mm)
Stroke – 4.06 in (103 mm)
Displacement – 164 cu in (2680 cc)
Net power – 51 hp (38 kw) @ 2200 rpm governed
66 hp (49 kw) @ 3000 rpm maximum
Fuels – #1 or #2 diesel fuel, 45 cetane minimum
Cooling system – water
Electrical system – 12 V nominal, 37 A alternator, low dump, multi-level dump, AA models, 30 A totally enclosed alternator, SE model

Engine Manufacturer/model – Perkins 4.108
Engine type – piston
Ignition – diesel
Cycle – 4
Aspiration – natural
Cylinders – 4
Bore – 3.125 in (79.4 mm)
Stroke – 3.5 in (88.9 mm)
Displacement – 108 cu in (1770 cc)
Net power – 35 hp (26 kw) @ 2200 rpm governed
43 hp (32 kw) @ 3000 rpm maximum
Fuels – #1 or #2 diesel fuel
Cooling system – water
Electrical system – 12 V nominal, 37 A alternator, low dump, multi-level dump, AA models, 30 A totally enclosed alternator, SE model

Engine Manufacturer/model – Kubota V1902
Engine type – piston
Ignition – diesel
Cycle – 4
Aspiration – natural
Cylinders – 4
Bore – 3.35 in (85 mm)
Stroke – 3.23 in (82 mm)
Displacement – 113.57 cu in (1861 cc)
Net power – 34 hp (25.4 kw) @ 2200 rpm
governed 38.5 hp (28.7 kw) @ 2800 rpm maximum
Fuels – #2 diesel fuel
Cooling system – water
Electrical system – 12 V nominal, 37 A alternator, low dump, multi-level dump, AA models, 30 A totally enclosed alternator, SE model

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, side brush drive, and vacuum fan drive.

Control valve, hopper dump, main brush drive, low dump model – open center, single spool.

Control valve, hopper lift, hopper dump, main brush drive, multi-level dump, AA, SE models – open center, two spool.

Control valve, side brush drive – open center, one spool.

Control valve, air assist drive, AA model – open center, one spool.

Propelling pump – variable displacement piston pump, 23.6 gpm (89 L/min) @ 2200 rpm

Propelling system rated pressure – 4500 psi (31,030 kPa)

Accessories pump – gear pump, 8 gpm (30 L/min) @ 2200 rpm.

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

Air assist pump, AA model – gear pump, 8 gpm (30 L/min) @ 2200 rpm.

Dump cylinder system rated pressure – 500 psi (3450 kPa).

Propelling motor – internal gear motor, 29.9 cu in (490 cc) displacement per revolution. 4500 psi (31,030 kPa) maximum rated pressure.

Main brush motor – internal gear motor, 4.5 cu in (80 cc) displacement per revolution. 2500 psi (17,240 kPa) maximum rated pressure.

Side brush motor – internal gear motor, 17.9 cu in (295 cc) displacement per revolution. 2500 psi (17,240 kPa) maximum rated pressure.

Vacuum fan motor – external gear motor, 0.26 cu in (4 cc) displacement per revolution. 3000 psi (20,685 kPa) maximum rated pressure

Air assist fan motor – external gear motor, 0.40 cu in (7 cc) displacement per revolution, 2000 psi (13,790 kPa) maximum rated pressure.

Hopper lift cylinder, low dump model – double action, 3 in (75 mm) bore x 11.8 in (300 mm) stroke, 1.37 in (35 mm) diameter rod, 2500 psi (17,240 kPa) maximum rated pressure.

Hopper lift cylinder, multi-level dump, AA, SE models – double action, 3.5 in (90 mm) bore x 20.7 in (525 mm) stroke, 1.5 in (40 mm) diameter rod, 2500 psi (17,240 kPa) maximum rated pressure.

Hopper dump cylinder, multi-level dump, AA, SE models (2) – double action, 2 in (51 mm) bore x 12 in (305 mm) stroke, 1 in (25 mm) diameter rod, 2500 psi (17,240 kPa) maximum rated pressure.

BRAKING SYSTEM

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

Parking brakes – utilizes service brakes, cable actuated

SUSPENSION SYSTEM

Front – two 21 x 5 x 12 solid tires
Rear, low dump model – one 6.90/6.00 x 9 pneumatic tire
Rear, multi-level dump, AA, and SE models – one 6.90/6.00 x 9 solid tire

SYSTEM FLUID CAPACITIES

Engine cooling system, gasoline, LPG – radiator 7.4 qt (7 L)
Engine cooling system, gasoline, LPG – total system 11.2 qt (10.6 L)

Engine cooling system, Continental diesel – radiator 7.4 qt (7 L)
Engine cooling system, Continental diesel – total system 11.2 qt (10.6 L)

Engine cooling system, Perkins diesel – radiator 7.4 qt (7 L)
Engine cooling system, Perkins diesel – total system 11 qt (10.4 L)

Engine cooling system, Kubota diesel – radiator 7.4 qt (7 L)
Engine cooling system, Kubota diesel – total system 14.6 qt (13.8 L)

Engine lubricating oil, gasoline, LPG – 7 qt (6.6 L) without filter
Engine lubricating oil, Continental diesel – 7 qt (6.6 L) with filter
Engine lubricating oil, Perkins diesel – 5 qt (4.7 L) with filter
Engine lubricating oil, Kubota diesel – 8.38 qt (9 L) with filter

Fuel tank, gasoline, diesel – 12.9 gal (50 L)
Fuel tank, LPG – 33 lb (15 kg)

Hydraulic system – reservoir 5 gal (19 L) total system 7 gal (26 L)

GENERAL MACHINE DIMENSIONS – CAPACITIES

Length – 111.5 in (2830 mm)

Width – 71 in (1805 mm)

Height, without overhead guard – 59 in (1500 mm)
Height, with overhead guard – 81.5 in (2070 mm)
Height, with overhead guard and hazard light – 90.5 in (2300 mm)

Track – front, 60.5 in (1535 mm)
Wheel base – 48.9 in (1240 mm)

Main brush, tubular diameter – 16 in (405 mm)
tubular length – 50 in (1270 mm)
Side brush, rotary diameter – 26 in (660 mm)

Sweeping path width, without side brush – 50 in (1270 mm)
Sweeping path width, with side brush – 66 in (1676 mm)

Hopper capacity – 1800 lb (815 kg) 26.7 cu ft (0.76 m^3)

Dust filter area – 162 sq ft (15 m^2)

MACHINE WEIGHTS

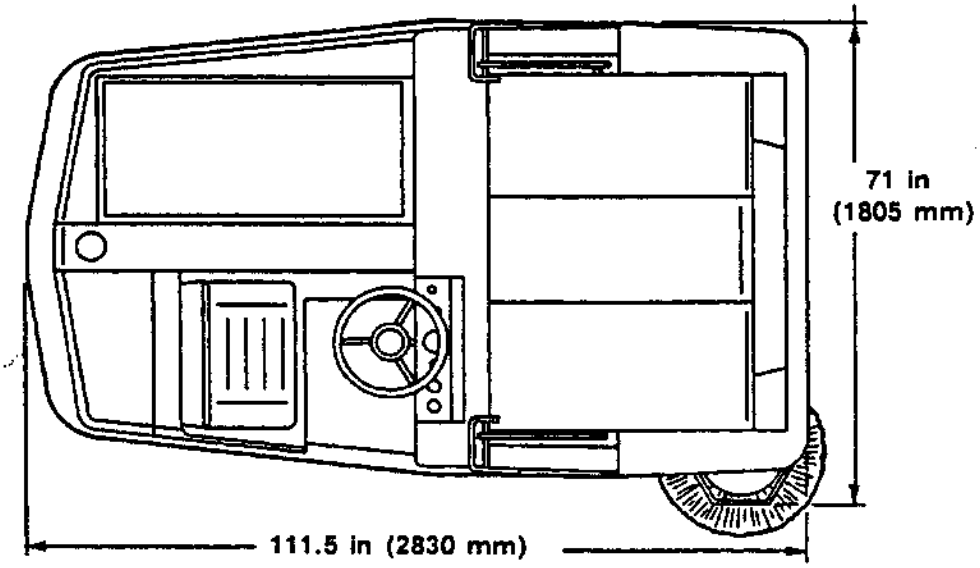
Net weight, dry, low and multi-level dump models – 4628 lb (2100 kg)
Net weight, dry, AA model – 4850 lb (2200 kg)
Net weight, dry, SE model – 4831 lb (2190 kg)

Net GVWR, low and multi-level dump models – 6628 lb (3005 kg)
Net GVWR, AA model – 6850 lb (3105 kg)
Net GVWR, SE model – 6831 lb (3100 kg)

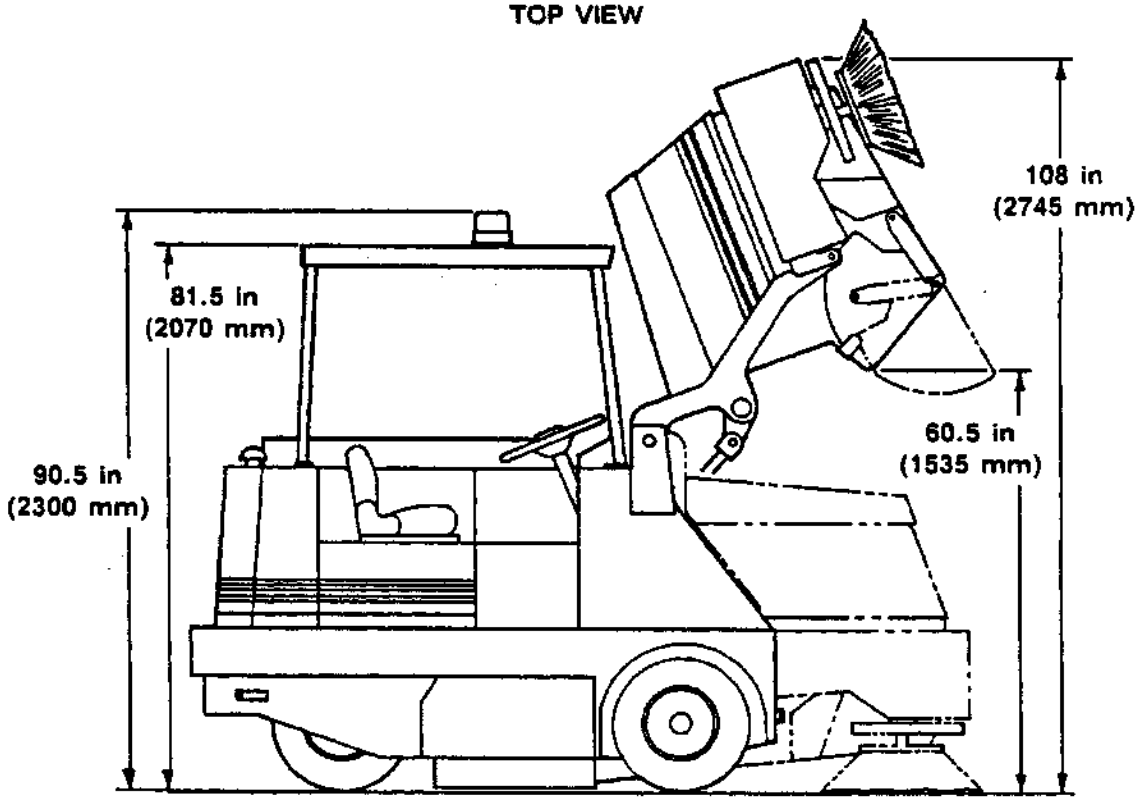
GENERAL MACHINE PERFORMANCE

Maximum forward speed – 10.7 mph (17 km/h)
Maximum reverse speed – 6 mph (10 km/h)
Turning radius, right – 91.5 in (2325 mm)
Turning radius, left – 70.75 in (1795 mm)

MACHINE DIMENSIONS



TOP VIEW



SIDE VIEW

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SECTION 2

CONTENTS

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.

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

3. Check the hydraulic fluid level in the hydraulic fluid reservoir using the sight gauge provided. TENNANT® hydraulic fluid is recommended. If TENNANT® hydraulic fluid is not available, use only new-approved hydraulic fluid. See *HYDRAULICS* in the *MAINTENANCE* section.

4. Check the engine oil level.

5. Check the radiator coolant level.

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

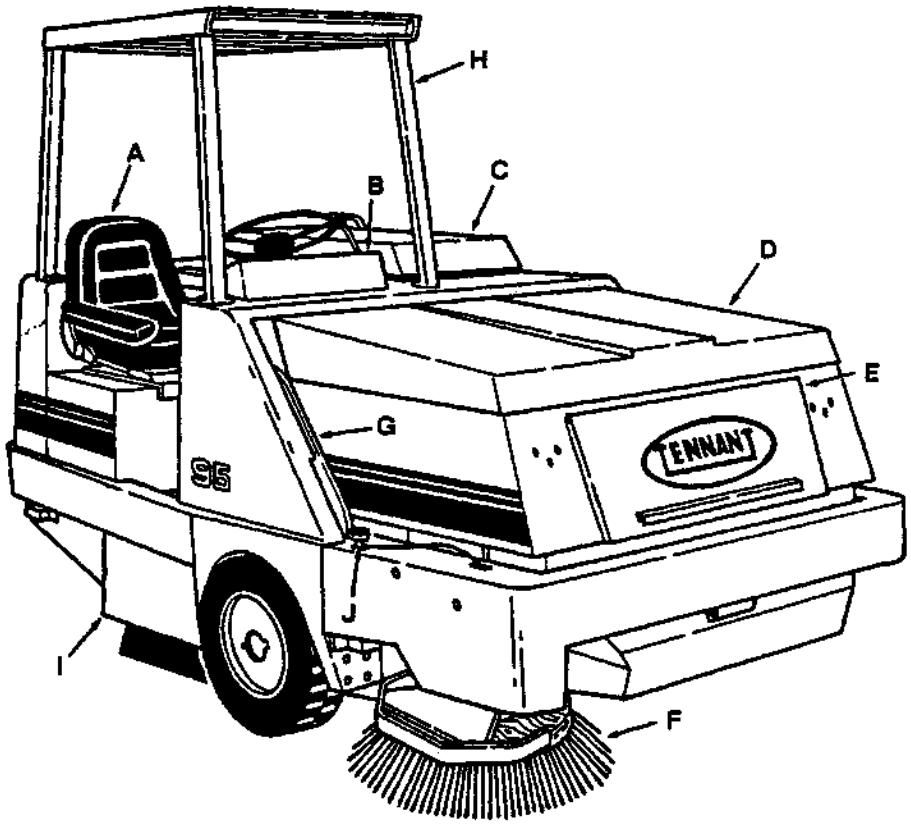
6. Check the brush adjustment, as described in *MAINTENANCE* section.

7. Check the air pressure of the rear tire, low dump model only.

8. Fill the fuel tank, or install an LPG fuel tank on the machine per the instructions in this manual.

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

OPERATION OF CONTROLS



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MACHINE COMPONENTS

A. Operator Seat
B. Instrument Panel
C. Engine Cover
D. Hopper
E. Hopper Inspection Door
F. Side Brush
G. Hopper Support Arm
H. Overhead Guard
I. Main Brush Access Door
J. Side Brush Height Adjustment Knob

INSTRUMENT PANEL SYMBOLS

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


Idle


Fast


Side Brush


Main Brush On

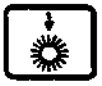

Hopper Up


Hopper Hold


Hopper Door Open


Hopper Door Close


Main Brush Free-float


Main Brush Down


Main Brush Up


Filter Clogged


Filter Shaker


Operational Lights

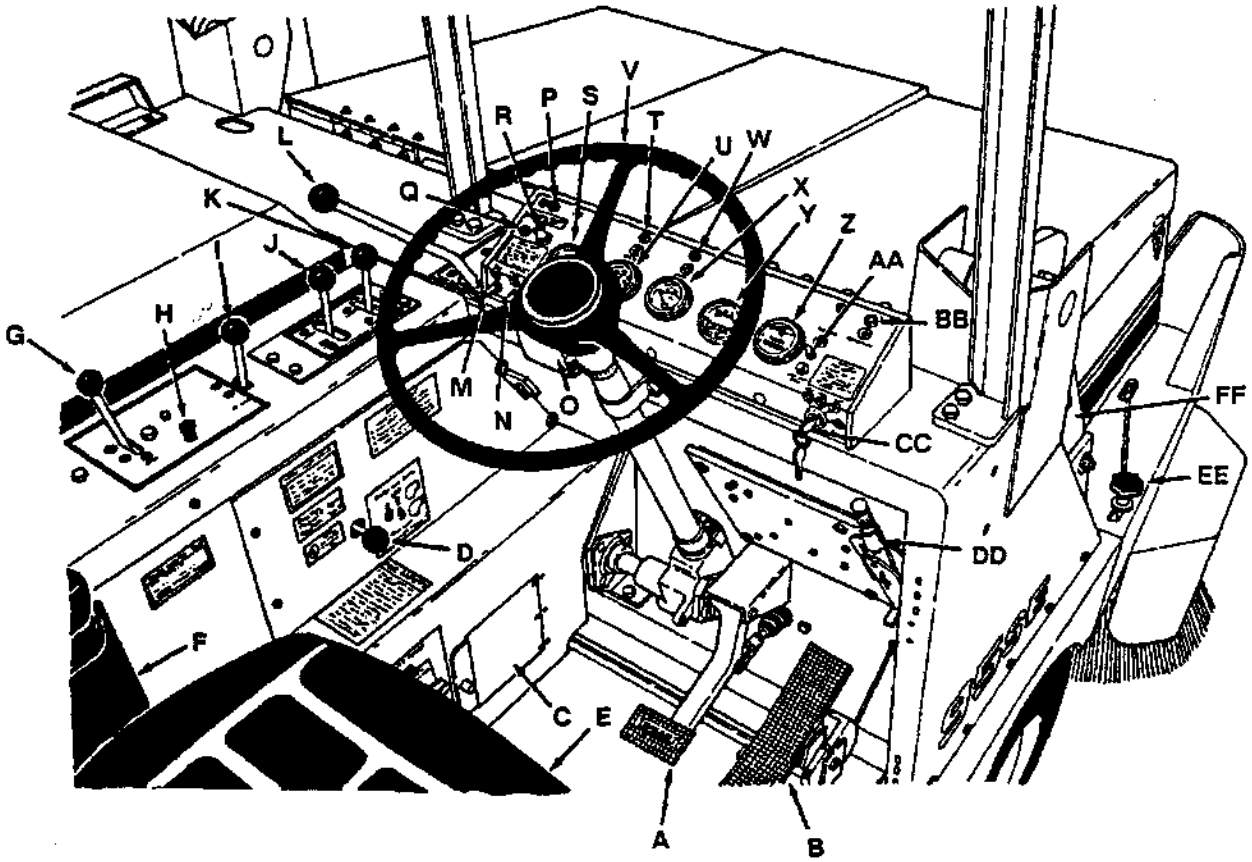

Hazard Light


Engine Water Temperature


Engine Oil Pressure


Diesel Preheat


Key Switch



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CONTROLS AND INSTRUMENTS

A. Brake Pedal
B. Directional Pedal
C. Main Brush Height Adjustment Knob
D. Air Assist Knob – AA Model
E. Operator Seat
F. Manual Pouch
G. Throttle Lever
H. Engine Choke Knob
I. Side Brush Lever
J. Main Brush and Hopper Lift Lever
K. Hopper Door Lever – Multi-Level Dump, AA, SE Models
L. Main Brush Position Lever
M. Operating Lamps Switch
N. Hazard Lamp Switch
O. Turn Signal Switch
P. Dump Door Indicating Lamp – Multi-Level Dump, AA, SE Models
Q. Clogged Dust Filter Indicating Lamp
R. Dust Filter Shaker Pushbutton Switch
S. Fuel Level Gauge
T. High Engine Coolant Temperature Indicating Lamp – SE Model
U. Engine Coolant Temperature Gauge
V. Steering Wheel
W. Low Engine Oil Pressure Indicating Lamp – SE Model
X. Oil Pressure Gauge
Y. Battery Condition Gauge
Z. Engine Hour Meter
AA. Side Brush Position Switch
BB. Diesel Pre-Heat Indicating Lamp – Perkins Continental and Diesel
BB. Diesel Pre-Heat Switch - Kubota Diesel
CC. Key-Operated Ignition Switch
DD. Parking Brake
EE. Side Brush Height Adjustment Knob
FF. Hopper Support Bar

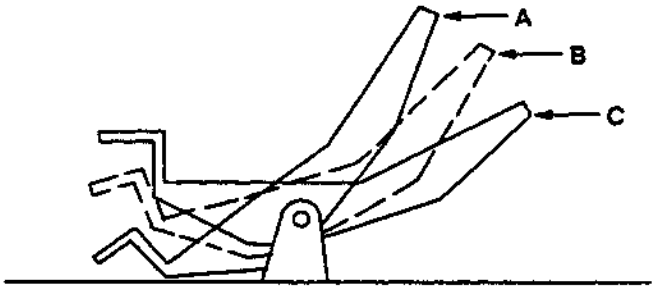
BRAKE PEDAL

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

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

DIRECTIONAL PEDAL

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.



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DIRECTIONAL PEDAL

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

Gradually press the "toe" position 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.

WARNING: Machine free-wheels when machine is moving and directional pedal is reversed. Severe personal injury or death can result. Use brakes to control machine speed.

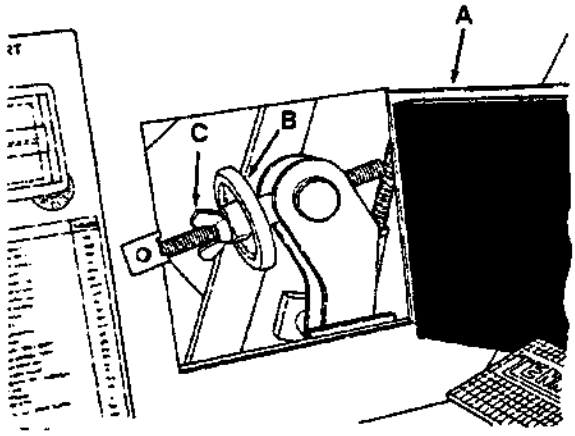
If the machine creeps when the pedal is in the neutral position, adjust the pedal as directed in *DIRECTIONAL PEDAL "NEUTRAL" POSITION ADJUSTMENT* in the *MAINTENANCE* section.

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

MAIN BRUSH HEIGHT ADJUSTMENT KNOB

The main brush height adjustment knob is located behind an access door next to the operator's left foot. It limits the main brush lift linkage travel. The greater the linkage travel, the greater the amount of floor contact the main brush will have.

Threading the knob clockwise raises the main brush, reducing the main brush floor contact. Threading the knob counterclockwise lowers the main brush, increasing main brush floor contact.



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MAIN BRUSH HEIGHT ADJUSTMENT KNOB

A. Access Door
B. Adjustment Knob
C. Wing Nut

AIR ASSIST KNOB – AA MODEL

The air assist knob is present only on the AA model. The air assist knob controls the air assist motor. Pulling the knob out starts the air assist fan. Pushing the knob in stops the air assist fan. The air assist enhances the loading of light litter. The air assist fan should not be used when picking up heavy debris such as gravel or sand.

OPERATOR SEAT

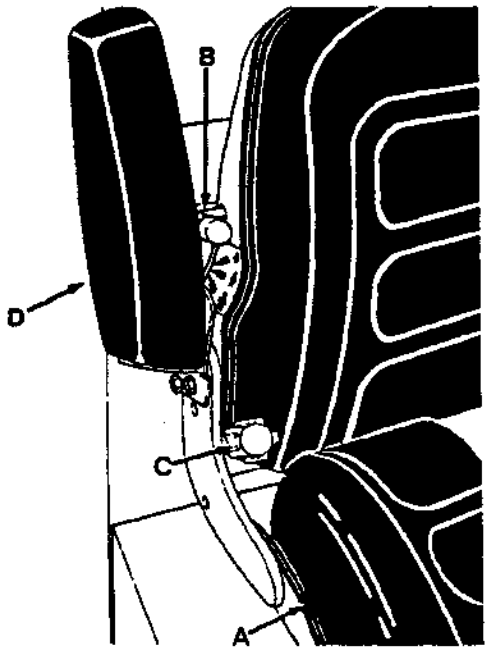
The operator seat is a three-way adjustable seat with armrests. It has adjustments to compensate for operator weight, to vary the backrest angle, and to vary the front to rear seat position.

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

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

The seat position is adjusted by pulling the seat position lever out to the left, sliding the seat forward or backward to a comfortable position, and releasing the lever.

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



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OPERATOR SEAT

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

THROTTLE LEVER

The throttle lever operates a rod which controls the engine governed speed. To slow the engine to idle speed, push the lever into the top (Idle) position. To speed the engine to the maximum governed speed, pull the lever back into the bottom (Fast) position.

ENGINE CHOKE KNOB

The engine choke knob is present on gasoline powered machines. It 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 the knob opens the choke, allowing the engine to run normally at its operating temperature and speed. It is not necessary to choke a warm engine.

SIDE BRUSH LEVER

The side brush lever controls the side brush motor. Pushing the lever into the top position starts the side brush rotating, provided that the main brush is also operating. Pulling the lever into the bottom position stops the side brush rotation.

MAIN BRUSH AND HOPPER LIFT LEVER

The main brush and hopper lift lever controls main brush rotation and the hopper height position.

To start the main brush, side brush, and vacuum fan, push the lever into the top (Main Brush On) position. To raise the debris hopper, pull the lever back into the (Hopper Up) position. To stop and hold the hopper in a raised position, pull the lever into the bottom (Hopper Hold) position. The lever position between Main Brush On and Hopper Up turns off the main brush, side brush, and vacuum and allows the hopper to lower.

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

HOPPER DOOR LEVER

The hopper door lever is present on multi-level dump, AA, and SE model machines. The lever controls the hopper door position. To open the hopper door into the operating position, push the lever into the top (Hopper Door Open) position. To close the hopper door so the hopper may be raised without allowing debris to spill out, pull the lever back into the bottom (Hopper Door Close) position.

Always sweep with the hopper door open in the operating position.

MAIN BRUSH POSITION LEVER

The main brush position lever controls the position of the main brush. There are two positions in which the main brush may be operated. The positions are normal and free-float. The normal sweeping position is used for most sweeping conditions. Operating in the normal position will extend main brush life. The free-float position is used when sweeping extremely uneven areas. The free-float position allows the main brush to follow the uneven surfaces more closely.

To lower the main brush for normal sweeping, pull the lever back and to the right into the (Main Brush Down) position.

To lower the main brush for sweeping extremely uneven surfaces, pull the lever back and to the right into the (Main Brush Free Float) position.

To raise the main brush, pull the lever all the way back then to the left into the (Main Brush Up) position.

NOTE: Always raise the main brush when the machine is not being operated for a period of time to prevent the main brush from taking a set.

OPERATING LAMPS SWITCH

The operating lamps switch is present on machines with the operating lamps accessory. It controls the headlights, taillights, 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.

HAZARD LAMP SWITCH

The hazard lamp 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.

TURN SIGNAL SWITCH

The turn signal switch is present on machines with the operating lamps accessory. It controls the turn signal lamps. Pushing the turn signal switch arm forward signals a right turn. Pulling the signal switch arm back signals a left turn.

DUMP DOOR INDICATING LAMP

The dump door indicating lamp is present on multi-level dump, AA, and SE model machines. The lamp lights when the hopper dump door is not fully open. The dump door should be fully open and indicating lamp off whenever debris is being picked up. It should be closed when raising the hopper to dump the debris.

Do not sweep with the dump door indicating lamp lighted.

CLOGGED DUST FILTER INDICATING LAMP

The clogged dust filter indicating lamp lights when the dust filters become clogged and excessively restrict vacuum air flow. Lower the hopper, shut off the main brush and vacuum fan, and push the dust filter shaker pushbutton switch to shake the dust filter. Shake the dust filters when necessary to remove the air restriction. It may be necessary to clean or replace the dust filters to remove the air restriction. Do not continue to sweep with the clogged dust filter indicating lamp lighted as dust pickup will be reduced.

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. Turn the main brush and side brush off. Push the pushbutton switch in to shake the dust filters. The filter shakers will operate for 30 seconds and shut off automatically.

FUEL LEVEL GAUGE

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

ENGINE COOLANT TEMPERATURE GAUGE

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

HIGH ENGINE COOLANT TEMPERATURE INDICATING LAMP – SE MODEL

The high engine coolant temperature indicating lamp is present only on the SE model. The lamp lights when the engine coolant temperature exceeds 225° F (107° C).

STEERING WHEEL

The automotive-type steering wheel operates the rear caster wheel through an arm and tie rod. The machine is very responsive to the movement of the steering wheel. Use care until you become more experienced in guiding the machine.

ENGINE OIL PRESSURE GAUGE

This gauge registers the engine oil pressure. Normal engine oil pressure ranges from 7 psi (48 kPa) at idle, to 35 psi (241 kPa) at full engine throttle. If the gauge registers an oil pressure reading below 7 psi (48 kPa), stop the engine immediately and determine the cause. Failure to stop the engine will result in severe engine damage.

LOW ENGINE OIL PRESSURE INDICATING LAMP – SE MODEL

The low engine oil pressure indicating lamp is present only on the SE model. The lamp lights when the engine oil pressure drops below 7 psi (50 kPa).

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.

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.

SIDE BRUSH POSITION SWITCH

The side brush position switch controls the side brush position. Flip the switch toggle up to raise the side brush on. Flip the switch toggle down to lower the side brush.

DIESEL PRE-HEAT INDICATING LAMP

The diesel pre-heat indicating lamp is present on Continental and Perkins diesel powered machines. The lamp lights when the diesel pre-heater is in operation.

DIESEL PRE-HEAT SWITCH

The diesel pre-heat switch is present on Kubota diesel powered machines. To operate the pre-heat, depress and hold the switch in for one minute.

KEY-OPERATED IGNITION SWITCH

The key-operated ignition switch starts the engine.

Gasoline and LPG powered machines: To start the engine, turn the key fully clockwise. Release the key as soon as the engine starts.

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.

Continental and Perkins diesel powered machines: To start the engine, turn the key clockwise. The diesel pre-heat indicating lamp may light. Wait until the lamp goes off and then turn the key fully clockwise to start the engine. Release the key as soon as the engine starts.

NOTE: The diesel pre-heater stops when the ignition key is advanced past the on position. To reactivate the diesel pre-heater, the key must be turned back to the off position to reset the pre-heat solenoid.

Kubota diesel powered machines: If the pre-heat switch is needed, depress and hold the switch for one minute. Release the pre-heat switch. To start the engine, turn the key fully clockwise. Release the key as soon as the engine starts.

PARKING BRAKE

The parking brake operates the two front wheel brakes. Pulling the brake handle up sets the parking brake. Pushing the brake handle to the left and down releases the parking brake. Always set the parking brake before leaving the machine unattended and before working on the machine.

HOPPER SUPPORT BAR

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

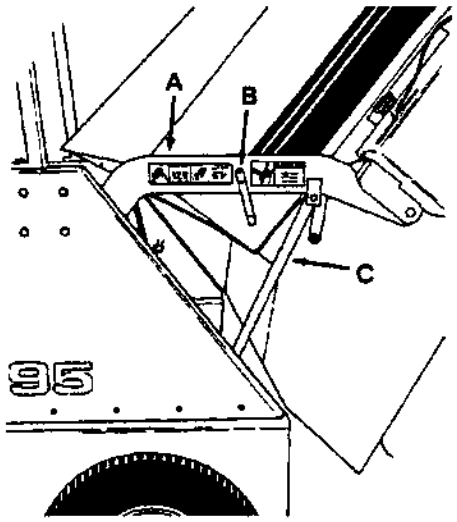
WARNING: Falling hopper. Engage hopper support bar before working under hopper.

TO ENGAGE LOW DUMP MODEL HOPPER SUPPORT BAR

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

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

2. Raise the hopper to the fully raised position.
3. Dislodge the hopper support bar from its storage clip.



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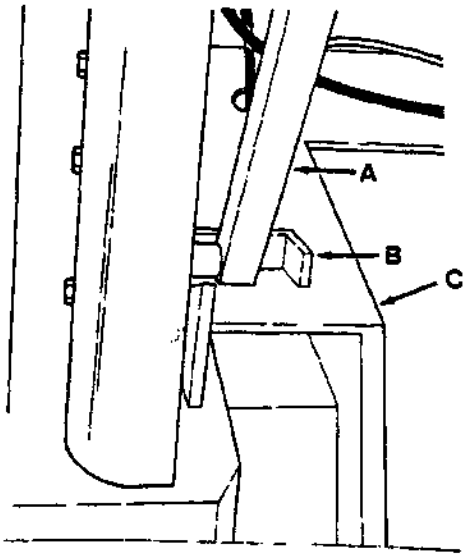
ENGAGED HOPPER SUPPORT BAR

A. Lift Arm
B. Storage Clip
C. Support Bar

4. Position the end of the support bar on the support bar stop on the machine frame.



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SUPPORT BAR STOP

A. Support Bar Hopper
B. Bar Stop
C. Machine Frame

5. Slowly lower the hopper so the support bar rests securely against the support bar stop.

6. Turn the engine off.

7. Check the support bar to make sure it is securely engaged.

TO DISENGAGE LOW DUMP MODEL HOPPER SUPPORT BAR

1. Start the engine.

2. Place the engine throttle lever into the bottom (Fast) position.

3. Raise the hopper to the fully raised position.

4. Raise the support bar into its storage position. Make sure the storage clip is holding the support bar in place.

5. Lower the hopper.

6. Turn the engine off.

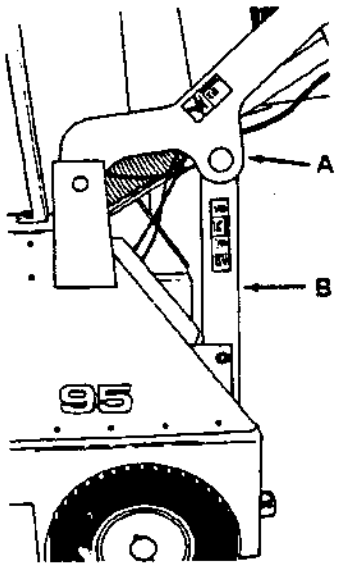
TO ENGAGE MULTI-LEVEL DUMP, AA, SE MODELS HOPPER SUPPORT BAR

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

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

2. Raise the hopper to the fully raised position.

3. Position the hopper support bar under the hopper lift arm cam.



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ENGAGED HOPPER BAR

A. Lift Arm
B. Hopper Support Bar

4. Slowly lower the hopper so the lift arm cam seats itself on top of the hopper support bar.

5. Turn the engine off.

6. Check the hopper support bar to make sure it is securely engaged.

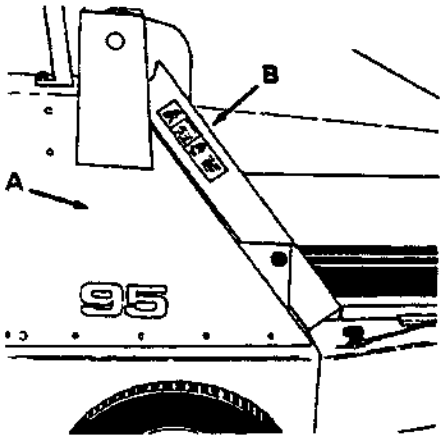
TO DISENGAGE MULTI-LEVEL DUMP, AA, SE MODELS HOPPER SUPPORT BAR

1. Start the engine.

2. Place the engine throttle lever into the bottom (Fast) position.

3. Raise the hopper to the fully raised position.

4. Lower the hopper support bar to its storage location.



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DISENGAGED HOPPER SUPPORT BAR

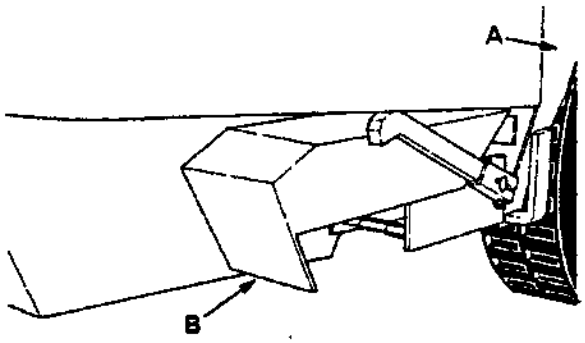
A. Machine Frame
B. Hopper Support Bar

5. Lower the hopper.

STABILIZER LEG

The machine stabilizer leg is present on multi-level dump, AA, and SE models.

The stabilizer leg is a safety device which, when the machine is being multi-level 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 multi-level dumped and is fully retracted when the hopper is in the "operating" position.



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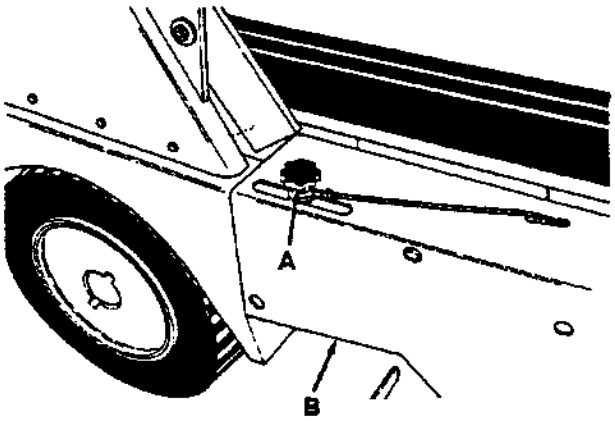
RETRACTED STABILIZER LEG

A. Machine Frame
B. Stabilizer Leg

SIDE BRUSH HEIGHT ADJUSTMENT KNOB

The side brush height adjustment knob is located just above the side brush on the front bumper. Loosening the knob and sliding it forward lowers the side brush, sliding it backward raises the side brush. Tighten the knob after setting the side brush height. The side brush should be raised before making an adjustment.



SIDE BRUSH HEIGHT ADJUSTMENT KNOB

A. Adjustment Knob
B. Side Bumper

FUSES AND CIRCUIT BREAKERS

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

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

If the overload which caused the circuit breaker to trip is still present in the circuit, the circuit breaker will continue to stop current flow until the overload is corrected. The chart below shows the various fuses and circuit breakers, the electrical components they protect, and their locations in the machine.

PROTECTIVE DEVICE	RATING	CIRCUIT PROTECTED
FU-1	50 A	Diesel Glow Plug
CB-1	25 A	Dust Shaker Motors
CB-2	15 A	Operating Lamps
CB-3	15 A	Gauges
CB-4	15 A	Actuator
CB-5	15 A	Turn Signal Lamps
CB-6	15 A	Heater, Defroster, Fan
CB-7	15 A	Back-up Alarm

MACHINE OPERATION

NORMAL SWEEPING OPERATION

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

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

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

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

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

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

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

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

PRE-START CHECKLIST

Check under machine for leak spots.

Check engine lubricating oil level.

Check fuel level.

Check for LPG odor or frosting on hoses or components indicating a leak.

Check brakes and controls for proper operation.

Check service records to determine service requirements.

TO START MACHINE

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

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

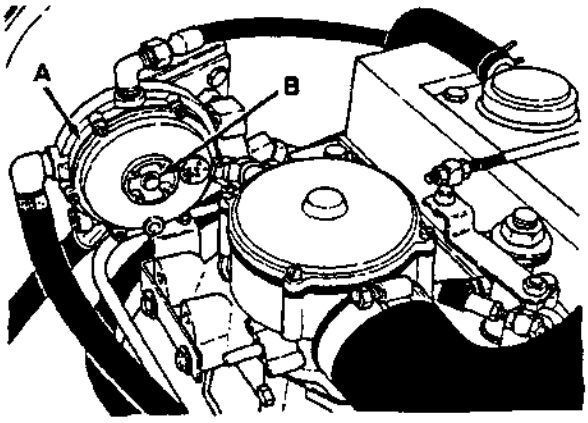
NOTE: Opening the service valve too quickly may cause the service valve check valve to stop the flow of LPG fuel. If the check valve stops the flow of fuel, close the valve, wait a few seconds, and slowly open the valve once again.

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

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

3. Gasoline powered machines: When the engine is cold, pull out the choke knob about three-fourths of the way. Push choke in after the engine has started and is running smoothly.

   LPG powered machines: When the engine is cold and exposed to cold temperatures, open the engine cover, press the primer button on the LPG vaporizer, close the engine cover.



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LPG VAPORIZER PRIMER BUTTON

A. Vaporizer
B. Primer Button

Kubota diesel powered machines: When the engine is cold and exposed to cold temperatures, depress and hold in the pre-heat switch for one minute.

4. Move the throttle lever into the top (Idle) position.

5. Turn the ignition switch key clockwise until the engine starts. Do not operate the starter for more than a few seconds at a time or after the engine has started.

   Continental and Perkins diesel powered machines: To start the engine, turn the key clockwise. The diesel pre-heat indicating lamp may light. Wait until the lamp goes off and then turn the key fully clockwise to start the engine. Release the key as soon as the engine starts.

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

6. Allow the engine and hydraulic system to warm up three to five minutes.

7. Release the machine parking brake.

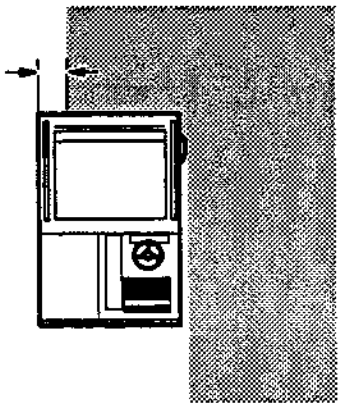
8. Move the throttle lever into the bottom (Fast) position, and drive the machine to the area to be swept.

TO SWEEP

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

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

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



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OVERLAPPING PATHS

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

1. Place the main brush and hopper lift lever into the top (Main Brush On) position and push side brush lever forward.

2. Move the main brush position lever back and to the right into the (Main Brush Down) position and flip the side brush position switch down to lower the side brush.

3. Sweep as required.

   AA model machines: Sweep wet debris with the air assist control turned off.

TO DUMP HOPPER

1. Pull the main brush position lever all the way back and to the left into the (Main Brush Up) position.

2. Flip the side brush position switch up to raise the side brush.

3. Press the filter shaker switch to shake the dust filters.

4. Slowly drive the machine up to the dump site or dumpster.

5. Low dump model machines: Pull the main brush and hopper lift lever back into the (Hopper Up) position to dump the hopper. Pull the lever into the bottom (Hopper Hold) position to keep the hopper in the dump position.

   Multi-level dump, AA, and SE model machines: Pull the hopper door lever into the bottom (Hopper Door Closed) position to close the hopper door so the hopper can be raised without debris spilling out. Pull the main brush and hopper lift lever back into the (Hopper Up) position to lift the hopper to the desired height. Be aware: The minimum hopper clearance needed to multi-level dump the hopper is 108 in (2745 mm).

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

   Multi-level dump, AA, and SE model machines: Pull the main brush and hopper lift lever back into the bottom (Hopper Hold) position to keep the hopper at the desired height; then push the hopper door lever into the top (Hopper Door Open) position to dump the debris from the hopper.

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

   Multi-level dump, AA, and SE model machines: Pull the hopper door lever back into the bottom (Hopper Closed) position to close the hopper door.

6. Slowly back the machine away from the dump site or dumpster.

7. Push the main brush and hopper lift lever into the position between the Main Brush On and Hopper Up to lower the hopper to its operating position.

   Multi-level dump, AA, and SE model machines: Push the hopper door lever into the top (Hopper Door Open) to open the hopper door.

POST OPERATION CHECKLIST – ENGINE OPERATING

Check brush patterns for width and evenness.

TO STOP MACHINE

1. Return the directional pedal to the "neutral" position. Apply the brake.

2. Pull the main brush position lever all the way back and to the left into the (Main Brush Up) position.

3. Flip the side brush position switch up to raise the side brush.

4. Pull the side brush lever back to stop the side brush rotation. Push the main brush and hopper lift lever into the position between the Main Brush On and Hopper Up.

5. Turn the operating lamps off if used.

6. Place the throttle lever into the top (Idle) position.

7. Set the machine parking brake.

8. Turn the ignition switch key counter-clockwise. Remove the key from the ignition switch.

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

9. LPG powered machines: Close the LPG tank liquid service valve.

POST OPERATION CHECKLIST – ENGINE STOPPED

Check skirts for damage, wear, and adjustment.

Check for wire or string tangled on brushes.

Check to make sure LPG tank service valve is closed.

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

Check for leaks.

OPERATION ON GRADES

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

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

The maximum rated ramp climb and descent angle is 15° with an empty hopper, and 13° with a full hopper.

ACCESSORIES OPERATION

VACUUM WAND ACCESSORY

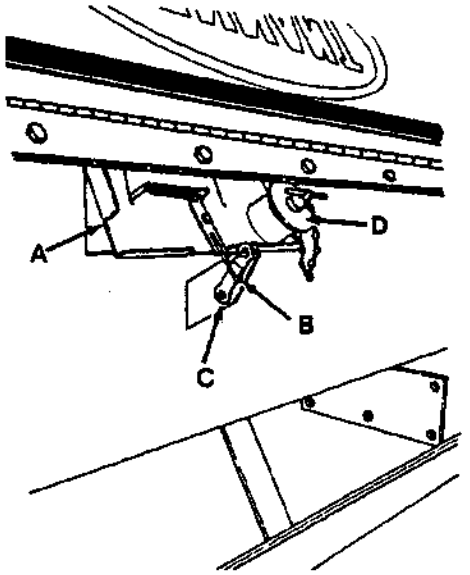
The vacuum wand accessory gives the machine the added flexibility of picking up debris not accessible by the machine. A 120 in (3050 mm) hose utilizes the machine vacuum system. The vacuum wand accessory is not available on the AA model.

TO OPERATE VACUUM WAND

1. Stop the machine close to the area to be cleaned.
2. Raise the main brush and side brush.
3. Stop the engine and engage the machine parking brake.

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

4. Open the hopper access door.
5. Disconnect the fire door hook from the fusible link and allow the fire door to close.



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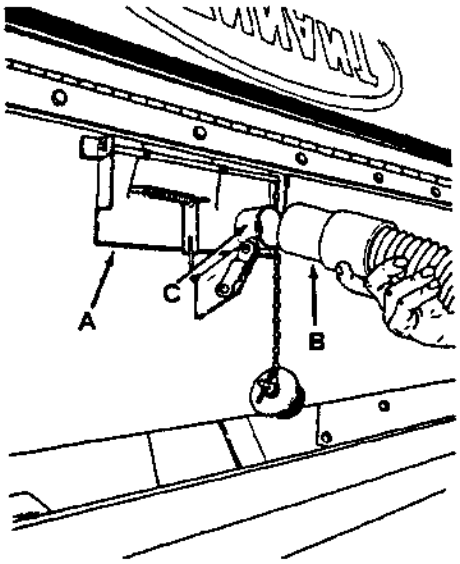
OPEN FIRE DOOR

A. Fire Door
B. Fire Door Hook
C. Fusible Link
D. Wand Hose Connection Plug

6. Remove the wand hose connection plug from the fire door.
7. Remove the vacuum wand and wand hose from their storage clips.
8. Push the wand hose onto the wand hose connection on the fire door.



01444

CONNECTING WAND HOSE

A. Fire Door
B. Wand Hose
C. Wand Hose Connection

9. Push the loose end of the wand hose onto the vacuum wand.
10. Start the engine.
11. Pull the throttle lever into the bottom (Fast) position.
12. Push the main brush and hopper lift lever into the top (Main Brush On) position to start the vacuum fan.
13. Vacuum the area as required.
14. When finished, push the main brush and hopper lift lever into the position between the Main Brush On and Hopper Up to stop the vacuum fan.
15. Push the throttle lever into the top (Idle) position.

16. Stop the engine.

17. Pull the vacuum hose out of the vacuum hose connection.

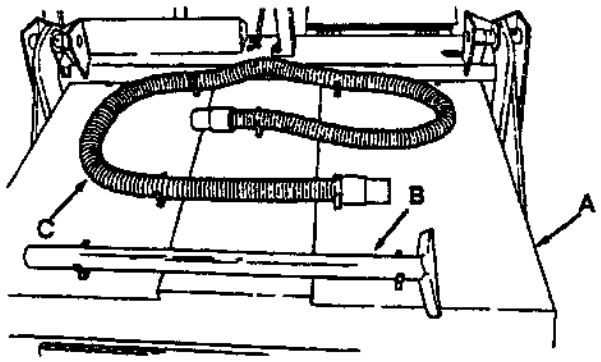
18. Disconnect the wand hose from the vacuum wand.

19. Push the wand hose connection plug into the wand hose connection.

20. Open the fire door and reposition the fire door hook over the middle of the fusible link.

21. Close the hopper access door.

22. Return the vacuum wand and wand hose to their storage clips.



01445

VACUUM WAND STORAGE LOCATIONS

A. Hopper Cover
B. Vacuum Wand
C. Wand Hose

HOPPER DOLLY ACCESSORY

The hopper dolly accessory makes the job of removing the debris hopper easy. The machine must be equipped with the snow blade hydraulic kit to allow the hydraulic connections to be disconnected in a timely manner.

TO REMOVE HOPPER WITH DOLLY

1. Set the parking brake. Start the engine and raise the hopper.

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

2. Engage the hopper support bar. Lower the hopper onto the support bar. Stop the engine.

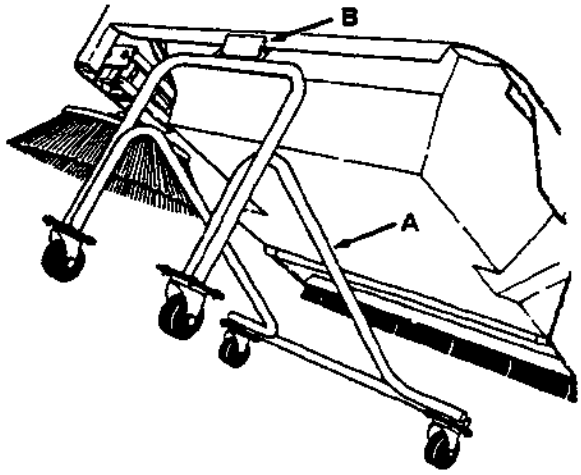
WARNING: Falling hopper. Engage hopper support bar before working under hopper.

3. Check the hopper support bar to make sure it is securely engaged.

4. Disconnect and plug all hoses and disconnect all wires between the hopper and the machine.

5. Start the engine, raise the hopper, place the hopper support bar in its storage location, and lower the hopper one-half of the way down.

6. Hook the hopper dolly on the hopper hook and lower the hopper. Stop the engine.

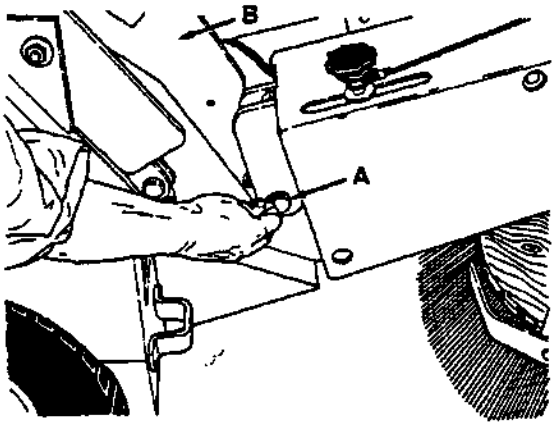


01446

HOPPER DOLLY HOOKED ON HOPPER

A. Hopper Dolly
B. Hopper Hook

7. Remove the two hopper lift arm release pins.



01447

LIFT ARM RELEASE PINS

A. Release Pin
B. Lift Arm

8. Push the lift arms down to release the hopper from the lift arms.

9. Roll the hopper and dolly away from the machine.

TO REINSTALL HOPPER WITH DOLLY

1. Position the hopper and dolly in the machine.

2. Raise the lift arms slightly to hook the lift arms onto the hopper brackets.

3. Install the two hopper lift arm release pins.

4. Raise the hopper, remove the hopper dolly, engage the hopper support bar, and lower the hopper onto the support bar.

5. Reconnect the hoses and wires between the hopper and the machine.

6. Raise the hopper, place the hopper support bar in its storage location, and lower the hopper.

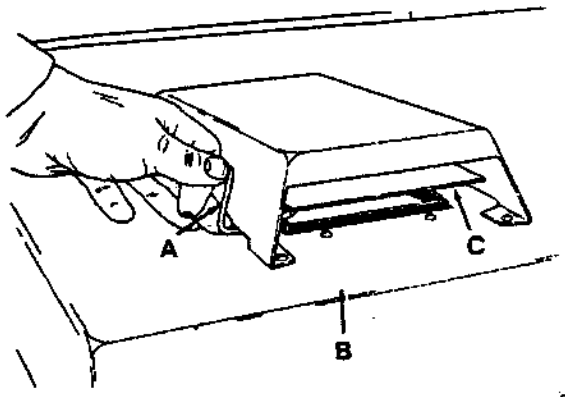
DUST FILTER BYPASS ACCESSORY

The dust filter bypass 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.

TO OPERATE FILTER BYPASS

1. Set the machine parking brake.

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



00560

FILTER BYPASS CONTROL LEVER

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.

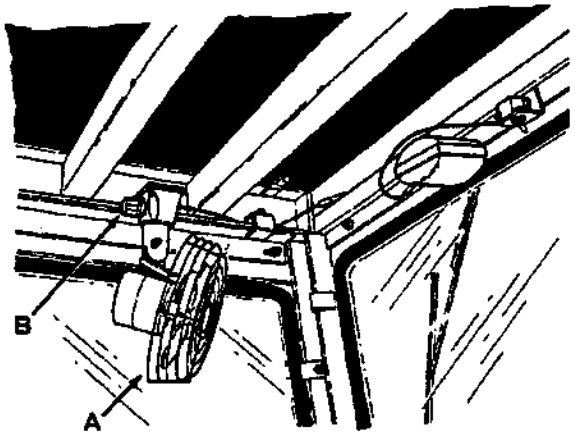
5. When finished cleaning the wet or damp area, set the machine parking brake.

6. Place the filter bypass control lever in the "closed" position.

7. Release the parking brake and continue operating the machine as required.

HEATER/DEFROSTER ACCESSORY

The heater/defroster accessory includes a fan powered heater and a defroster fan. A switch on the defroster fan base controls the defroster fan.



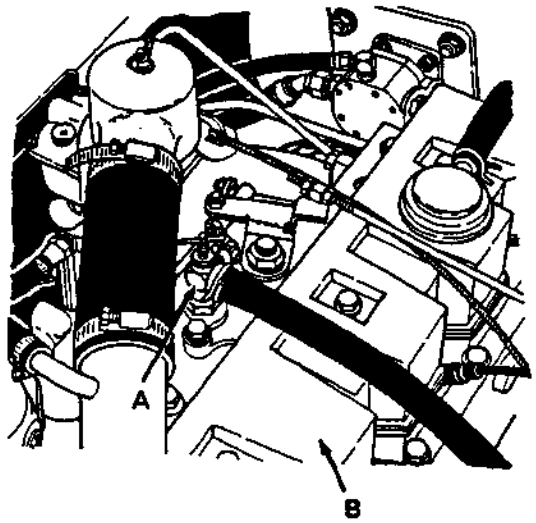
01448

DEFROSTER FAN

A. Fan
B. Switch

A switch on the front of the seat support controls the heater fan. A valve on the engine controls the hot coolant flow to the heater core. Turning the valve handle clockwise closes the valve and stops the hot coolant flow.

Turning the valve handle counterclockwise opens the valve and allows hot coolant to flow to the heater core.

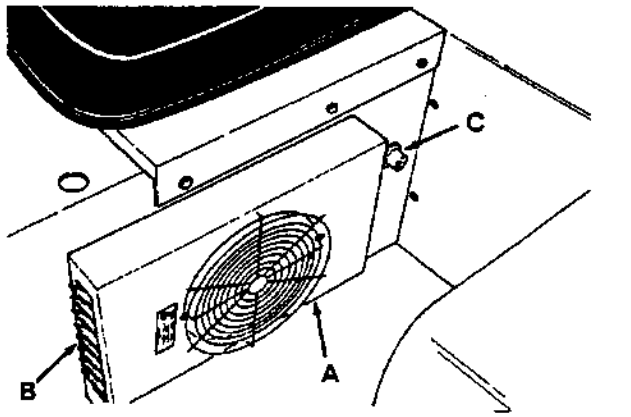


01449

HEATER VALVE

A. Valve
B. Engine

The air deflectors on the sides of the heater are repositionable to allow the air flow to be directed as desired.



01450

HEATER

A. Heater
B. Air Deflector
C. Heater Fan Switch

SNOW BLADE ACCESSORY

The snow blade accessory gives the machine the added flexibility to remove snow from walks and driveways.

TO INSTALL SNOW BLADE

1. Set the parking brake; start the engine, and raise the hopper.

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

2. Engage the hopper support bar. Lower the hopper onto the support bar. Stop the engine.

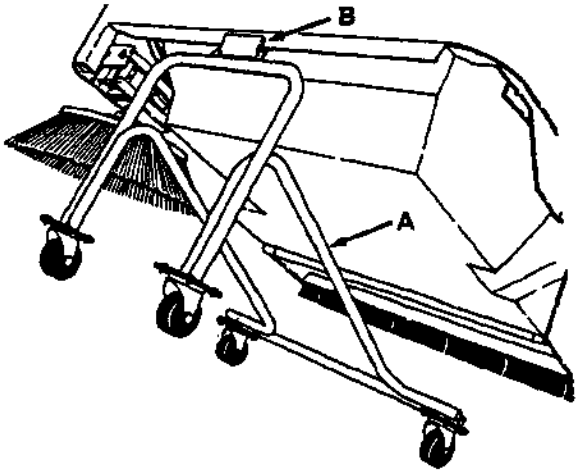
WARNING: Falling hopper. Engage hopper support bar before working under hopper.

3. Check the hopper support bar to make sure it is securely engaged.

4. Disconnect the hydraulic quick-disconnect fittings, large vacuum hose, and the wire connections. Label and remove the two small vacuum hoses.

5. Start the engine, raise the hopper, place the hopper support bar in its storage location, and lower the hopper one half of the way down.

6. Hook the hopper dolly on the hopper hook and lower the hopper. Stop the engine.

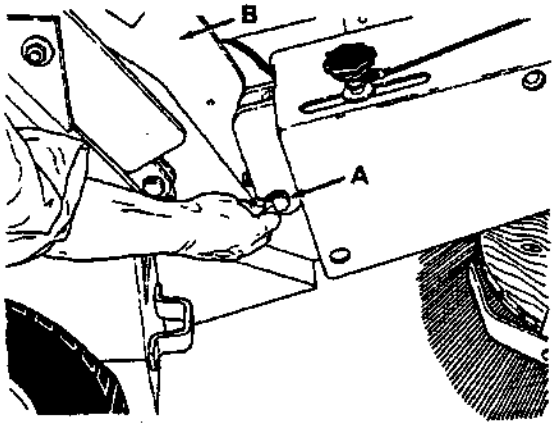


01446

HOPPER DOLLY HOOKED ON HOPPER

A. Hopper Dolly
B. Hopper Hook

7. Remove the two hopper lift arm release pins.



01447

LIFT ARM RELEASE PINS

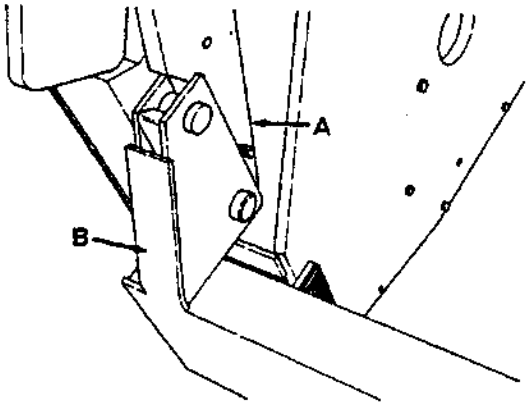
A. Release Pin
B. Lift Arm

8. Push the lift arms down to release the hopper from the lift arms.

9. Roll the hopper and dolly away from the machine.

10. Position the snow blade assembly so the upper cross bar pins engage the lift arm hooks.

11. Install clevis pins through the cross bar and the lift arms.



01451

LIFT ARM AND CROSS BAR

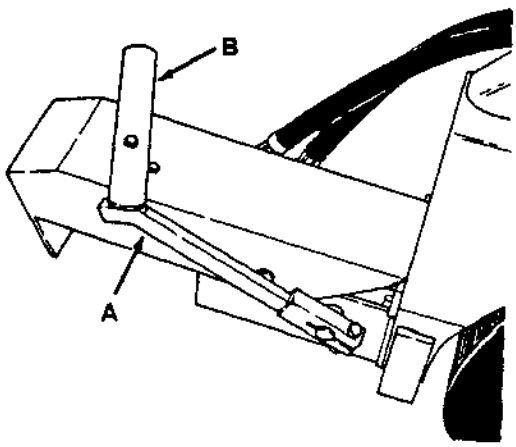
A. Lift Arm
B. Cross Bar

12. Loop the snow blade limiting chain over the lift arm tube and close the loop with the connecting link.

NOTE: Do not lift the snow blade without the limiting chain installed.

13. Install tire chains on the rear tire.

14. Position the stabilizer leg stop arm over the spring loaded stop lever to keep the leg raised on multi-level dump, AA, or SE models.

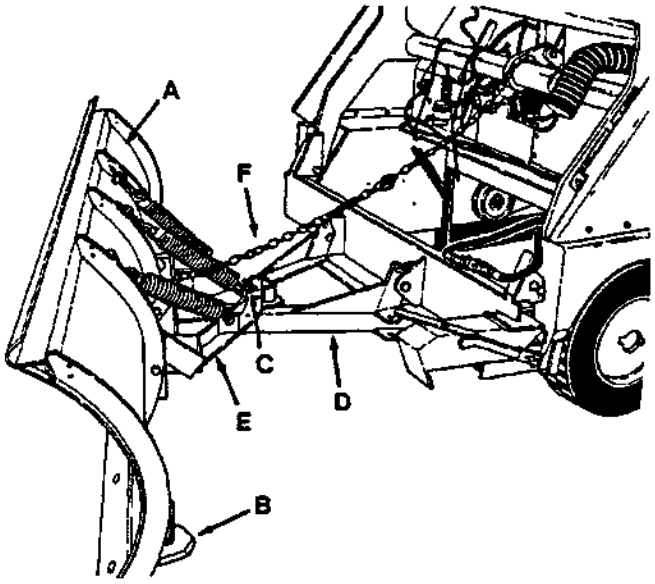


01453

STABILIZER LEG STOP ARM

A. Stop Lever
B. Stop Arm

15. Remove the sector pin from the A-frame, adjust the snow blade to the desired angle and replace the clevis pin.



01454

SNOW BLADE INSTALLATION

A. Snow Blade
B. Runner Spindle
C. Sector Pin
D. A-Frame
E. Quadrant
F. Limiting Chain

TO OPERATE SNOW BLADE

Operate the machine as normally done using the main brush and hopper lift lever to raise and lower the snow blade.

Begin plowing early when snow reaches 1 to 4 in (25 to 100 mm). Don't allow snow to accumulate. Heavy, wet snow can create hazards at even a 1 in (25 mm) accumulation. In heavier amounts, snow can be extremely difficult to handle. Do not allow snow to become packed and frozen. Crusted snow can hinder traction in future plowing. Choose the proper plowing speed. The heavier the snow, the slower the speed.

The plow blade should be set at the best angle for rolling the snow sideways and in the desired direction. Snow of any considerable depth cannot be pushed straight ahead for more than a short distance.

For best operation, the bottom edge of the snow blade should be slightly above the ground. If adjustments are needed, they can be made by adding flat washers to the runner spindles. Place additional washers under the runner bracket to raise the blade. Remove washers to lower the blade.

To change the angle of the blade, raise the blade as far as the limiting chain will permit. Pull out the sector pin and the blade can be moved to the desired position. Then replace the sector pin. The sector pin is designed to be a shear pin. If the plow strikes a solid, immovable object, the pin will shear, allowing the blade to swing away from the object before the equipment is damaged. The blade assembly is mounted on the hydraulic lift arms of the machine which are free to float upward if necessary.

Under some conditions, snow can be pushed to unused areas and stacked to a considerable height. To do this, place the blade in a straight-on position. Push the snow forward by raising the plow as you move into the pile.

Stack snow only with the blade in a straight-on position. Do not create a vertical wall, but slope the piles so that later snow may be pushed up the slope.

Clearing large open areas can be done best by using a combination of snow removal equipment, such as a snow blade and snow blower or loader of some type. The snow can be plowed into windrows or piles and then blown into or loaded onto trucks and carried away. However, if only a blade is available, the area can be cleared by using the proper technique and common sense.

As a guide to help determine how much snow the plow can handle, remember that with a 6 in (152 mm) snowfall, the plow can easily move that amount of snow in two passes. With more snow, it will handle less; with less snow, more.

A suggested method of plowing is as follows:

Make the first pass one blade width in from the outside edge.

Make the second pass around the outside edge, moving the snow to the edge of the area, then keep moving in. Double the blade width from edge of the snow covered area and move this amount to the outside edge.

TO REMOVE SNOW BLADE

1. Stop the engine and set the parking brake.

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

2. Position the stabilizer leg stop arm so the stabilizer leg is free to lower on multi-level dump, AA, or SE models.

3. Remove the tire chains.

4. Remove the limiting chain from the lift arm tube.

5. Remove the cross bar clevis pins and disconnect the cross bar from the lift arms.

6. Start the engine, then release the parking brake.

7. Back the machine away from the snow blade, then engage the parking brake.

8. Position the hopper and dolly in the machine.

9. Raise the lift arms slightly to hook the lift arms onto the hopper brackets.

10. Install the two hopper lift arm release pins.

11. Raise the hopper, remove the hopper dolly, engage the hopper support bar, and lower the hopper onto the support bar.

12. Reconnect the hoses and wires between the hopper and the machine.

13. Raise the hopper, place the hopper support bar in its storage location, and lower the hopper.

MACHINE TROUBLESHOOTING

Problem	Cause	Remedy
Excessive dusting	Dust skirts and seals worn, damaged, not adjusted properly	Replace or adjust skirts or seals
	Dust filter clogged	Shake and/or clean or replace filter
	Vacuum wand door closed	Open vacuum wand door
	Vacuum hose damaged	Replace vacuum hose
	Vacuum fan failure	See *HYDRAULIC SYSTEM TROUBLESHOOTING*: Poor or no vacuum to brush compartment
Poor sweeping performance	Brush bristles worn	Replace brushes
	Brushes not adjusted properly	Adjust brushes
	Debris caught in brush drive mechanism	Free mechanism of debris
	Main brush drive failure	See *HYDRAULIC SYSTEM TROUBLESHOOTING:* Main brush turns slowly or not at all
	Side brush drive failure	See *HYDRAULIC SYSTEM TROUBLESHOOTING*: Side brush turns slowly or not at all
	Hopper not adjusted properly	Adjust hopper floor clearance
	Hopper full	Empty hopper
	Hopper floor skirts worn, damaged	Replace skirts

NOTE: For more specific electro-hydraulic system troubleshooting information, see HYDRAULIC SYSTEM TROUBLESHOOTING *in the* MAINTENANCE *section.*

TRANSPORTING MACHINE

PUSHING OR TOWING MACHINE

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

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

MACHINE JACKING INSTRUCTIONS

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

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

2. Empty the debris hopper before attempting to jack the machine up.

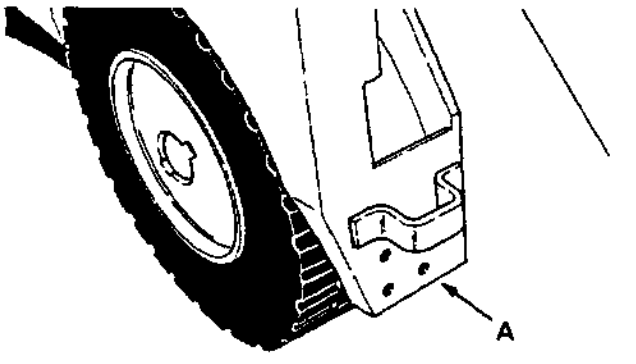
3. Block the tires which are not being jacked up to secure the machine's position.

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

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

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

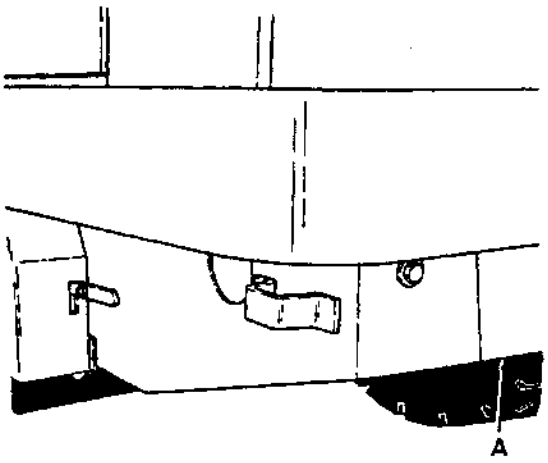


01455

FRONT JACKING LOCATION (RIGHT SIDE SHOWN)

A. Jacking Location

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



01456

REAR JACKING LOCATION

A. Jacking Location

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

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.

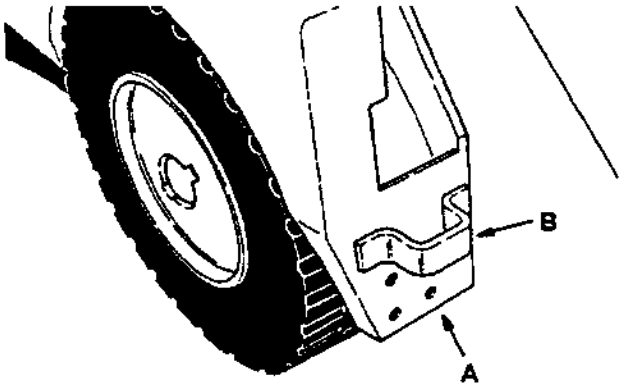
11. Lower the machine.

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.

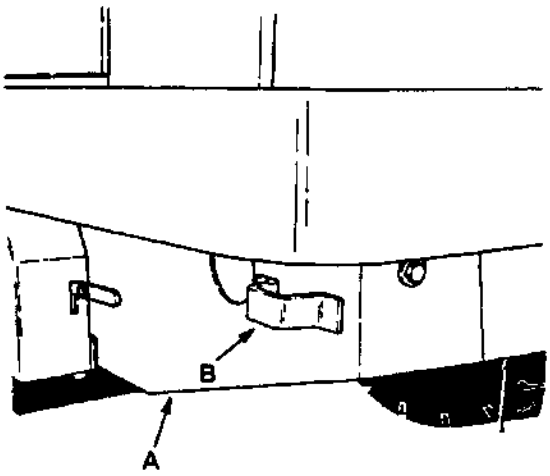
To tie the machine down, use the tie down lug provided.



01455

FRONT TIE-DOWN LUG (RIGHT SIDE SHOWN)

A. Machine Frame
B. Tie-Down Lug



01456

REAR TIE-DOWN LUG (LEFT SIDE SHOWN)

A. Machine Frame
B. Tie-Down Lug

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. Raise the main and side brushes.
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. Gasoline and LPG powered machines: To store the machine 30 to 90 days:

1. Remove the spark plugs.
2. Pour 3 oz (90 cc) of clean engine oil into each 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.

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

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

7B. Gasoline and LPG powered machines: To store the machine 90 days to 6 months:

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

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

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

7C. Diesel powered machines: To store machine:

1. Drain the coolant from the radiator and engine block.
2. Close the engine cooling system drain cocks.

SECTION 3

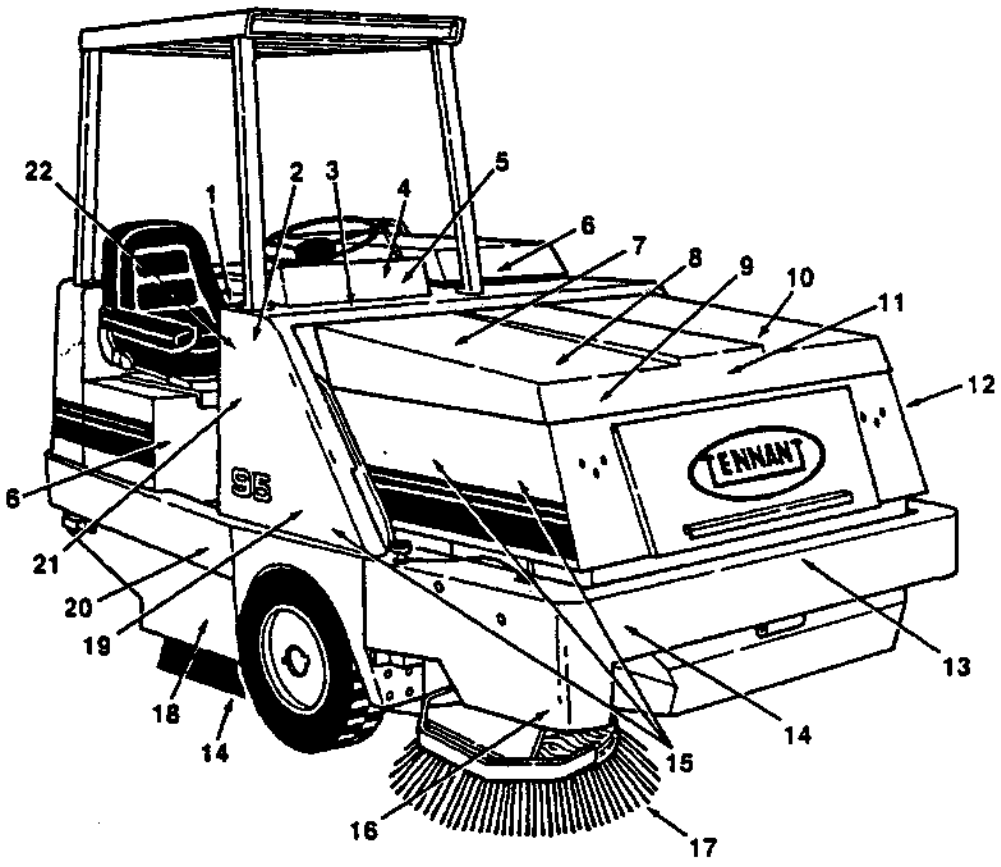
CONTENTS

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 valve tappet clearance on gasoline and LPG powered machines, after the first 250 hours on Continental and Perkins diesel powered machines.
4. Kubota diesel powered machines: Change the engine oil after the first 35 hours of operation.
4. Check the torque of the engine cylinder head cap screws.
5. Adjust the idle mixture on gasoline powered machines.
6. Check the engine vacuum and PCV hoses for damage or loose connections.
7. Perform all 50-hour interval lubrication and maintenance procedures listed in the Maintenance chart.

MAINTENANCE CHART



01432

Interval	Key	Description	Procedure	Material/ Lubricant	No. of Service Points
Daily	1	Engine air filter, low dump, multi-level dump, AA models	Empty dust cup	–	1
	3	Air filter restriction indicator	Check the restriction indicator	–	1
	7	Engine	Check oil level	EO	1
	14	Brush and hopper lip skirts	Check for damage wear, and adjustment	–	9(11)
	17	Side brush	Check for damage, wear, and adjustment	–	1
	18	Main brush	Check for damage, wear, and adjustment	–	1
	22	Fuel water trap, diesel	Drain water	–	1
50 Hours	5	Engine fan belt	Check tension	–	1
	7	Engine crankcase, Continental	Change oil and filter	EO	1
	12	Hopper	Check floor clearance	–	1
	18	Main brush	Rotate end-for-end and check adjustment	–	1
	20	Rear tire, low dump model	Check tire pressure	–	1

Interval	Key	Description	Procedure	Material/ Lubricant	No. of Service Points
100 Hours	2	Parking brake	Check adjustment	–	1
	4	Radiator	Check coolant level	WG	1
			Check core exterior for debris and clean	–	1
	9	Hydraulic fluid reservoir	Check fluid level	HYDO	1
	10	Hopper dust filter	Inspect, clean, or replace	–	2
	15	Dust seals	Check for damage or wear	–	5(6)
	22	Fuel water trap, diesel	Clean	–	1
	7	Engine crankcase, Perkins and Kubota	Change oil and filter	EO	1
200 Hours	7	Engine	Steam clean exterior	–	1
	7	Engine, Gasoline and LPG	Check governor linkage	–	1
			Clean or replace spark plugs	–	4
			Check distributor	–	1
	11	Hopper cover latch	Lubricate	DL	1
	13	Stabilizer leg pivot pin	Lubricate	MPGM	1
	16	Side brush pivot pins	Lubricate	MPGM	5
	21	Rear wheel support pivot	Lubricate	MPGM	1
400 Hours	6	Fuel filter	Replace	–	2
	7	Engine, Continental	Adjust valve tappets	–	8
	7	Engine, Gasoline and LPG	Adjust idle mixture	–	1
	9	Hydraulic fluid reservoir	Change hydraulic fluid	HYDO	1
	8	Hydraulic fluid filter	Change filter element	–	1
	19	Brake master cylinder	Check fluid level	BF	1
500 Hours	7	Engine, Gasoline and LPG	Check carburetor idle fuel-air adjusting needle	–	1
800 Hours	9	Hydraulic reservoir breather	Replace	–	1
	9	Hydraulic reservoir strainer	Replace	–	1
	4	Cooling system	Flush	WG	1

BF – Brake fluid
EO – Engine oil
HYDO – TENNANT or approved hydraulic fluid
MPGM – Multipurpose, water resistant, lithium base, moly-disulphide EP grease
WG – Water and permanent-type ethylene glycol anti-freeze, one-to-one ratio
DL – Dry lubricant

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

LUBRICATION

ENGINE

Check the engine oil level daily.

GASOLINE AND LPG POWERED ENGINES

Gasoline and LPG powered engines should be lubricated with SAE-SE/SF rated engine oil. Change the engine oil and oil filter after every 50 hours of operation.

The following oil grades are recommended for engines operating in the ambient temperatures listed.

MULTI-VISCOSITY OILS

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

SINGLE VISCOSITY OILS

-10° to 32°F (-23° to 0°C)	10° to 60°F (-12° to 16°C)	32° to 90°F (0° to 32°C)	Above 60°F (Above 16°C)
10W	20W 20	30	40

The engine oil capacity is 7 qt (6.6 L) including the oil filter.

DIESEL POWERED ENGINES

Diesel powered engines should be lubricated with SAE-CC/CD rated engine oil. Change the engine oil and oil filter after every 50 hours of operation for Continental engines, and every 100 hours of operation for Perkins and Kubota engines.

The following oil grades are recommended for engines operating in the ambient temperatures listed.

SINGLE AND MULTI-VISCOSITY OILS

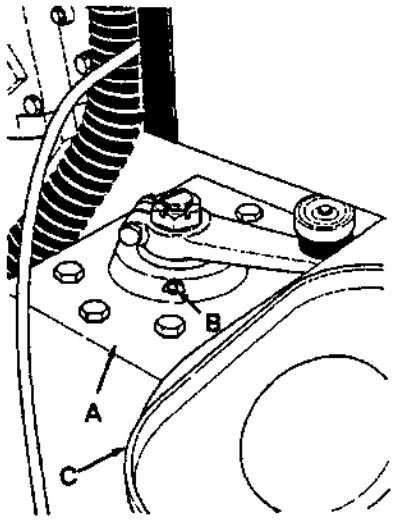
Below 32°F (Below 0°C)	32° to 77° F (0° to 25° C)	Above 77° F (Above 25° C)
10W	20	30
10W 30		

The engine oil capacity is 7 qt (6.6 L) including the oil filter for the Continental engine. The engine oil capacity is 5 qt (4.7 L) including the oil filter for the Perkins engine. The engine oil capacity is 8.38 qt (9 L) including the oil filter for the Kubota engine.

REAR WHEEL SUPPORT PIVOT

There is a grease fitting which is used to lubricate the rear wheel support pivot bearing.

Access to the grease fitting is through the left rear access door. Apply a general purpose, water resistant, lithium base, moly-disulphide EP grease after every 200 hours of operation.



01452

REAR WHEEL SUPPORT PIVOT

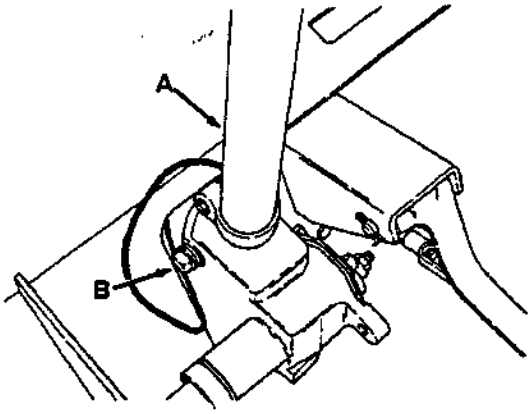
A. Wheel Support
B. Grease Fitting
C. Fuel Tank

STEERING GEAR

The steering gear has been lubricated at the factory and should not require any additional lubricant unless a massive leak occurs.

A square head plug located on the left side of the steering gearbox is provided to fill the steering gear with grease if necessary.

The proper lubricant is grade 1 calcium soap base EP grease.



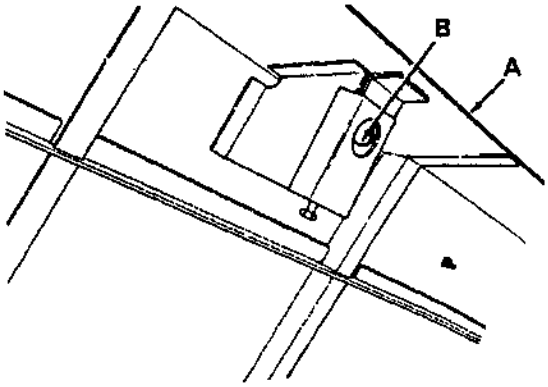
01457

STEERING GEAR LUBRICATION PLUG

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 200 hours of operation.



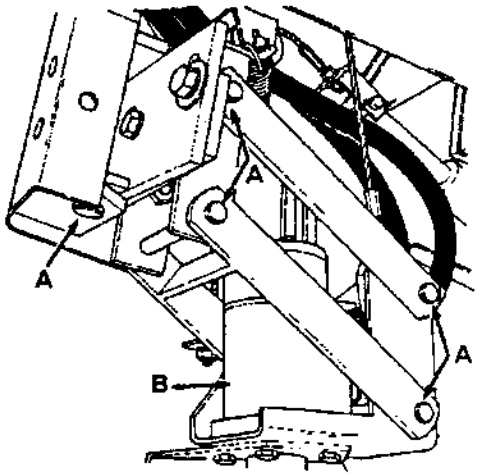
01458

HOPPER COVER LATCH

A. Hopper Cover
B. Hopper Cover Latch

SIDE BRUSH PIVOT PINS

The five side brush pivot pins should be lubricated with a general purpose, water resistant, lithium base, moly-disulphide EP grease after every 200 hours of operation.



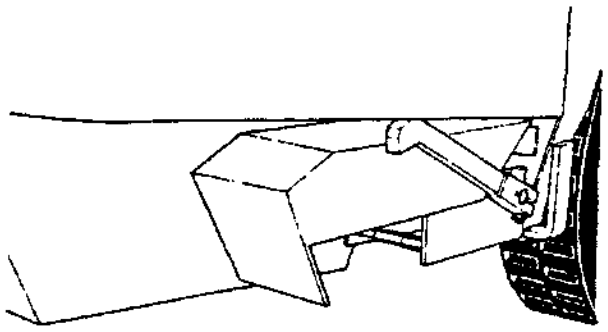
01459

SIDE BRUSH PIVOT PINS

A. Pivot Pin
B. Side Brush Motor

STABILIZER LEG PIVOT PIN

The stabilizer leg pivot pin should be lubricated with a general purpose, water resistant, lithium base, moly-disulphide EP grease after every 200 hours of operation.



01440

STABILIZER LEG

FRONT WHEEL BEARINGS

The front wheel bearings should be repacked with a good quality wheel bearing grease after every 2000 hours of operation.

HYDRAULICS

HYDRAULIC FLUID

Hydraulic fluid drives most of the moving components of the machine. The quality and condition of the hydraulic fluid play a very important tole in how well the machine operates. Tennant Company has developed its own hydraulic fluid to meet the special needs of its machines.

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

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

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

TENNANT® HYDRAULIC FLUID VISCOSITY SPECIFICATIONS

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

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

Hydraulic fluid with the viscosity rating of 10W40 should be used in machines that are operated in areas which have ambient temperatures up to 90° F (32° C). Use the 20W60 rated hydraulic fluid in areas which have ambient temperatures above 90° F (32° C).

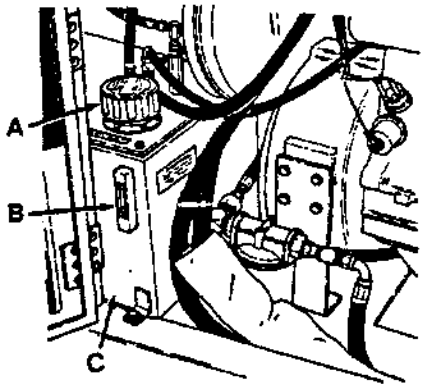
ATTENTION! If a locally-available hydraulic fluid is preferred, or if products of only one oil company are used, the hydraulic fluid used must match closely the viscosity specifications given in the chart for TENNANT® Hydraulic Fluid, as well as the other features described. Do not substitute automatic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

HYDRAULIC FLUID RESERVOIR

Hydraulic fluid is stored in the hydraulic fluid reservoir. The reservoir holds up to 5 gal (19 L) of hydraulic fluid. The reservoir is located in front of the engine.

The reservoir is equipped with a breather-filler cap and a sight gauge. The breather-filler cap requires no regular maintenance.



01461

HYDRAULIC FLUID RESERVOIR

A. Hydraulic Reservoir Breather-Filler Cap
B. Sight Gauge
C. Hydraulic Fluid Reservoir

The hydraulic fluid level sight gauge is located on the side of the hydraulic fluid reservoir. The sight gauge indicates the level of hydraulic fluid in the reservoir. Check the hydraulic fluid level every 100 hours of operation.

Do not overfill the hydraulic fluid reservoir. The hydraulic fluid expands as it heats up to its normal operating temperature. 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.

Change the hydraulic fluid after every 400 hours of operation.

TO DRAIN THE HYDRAULIC FLUID RESERVOIR

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

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

2. Raise the debris hopper to the fully raised position.

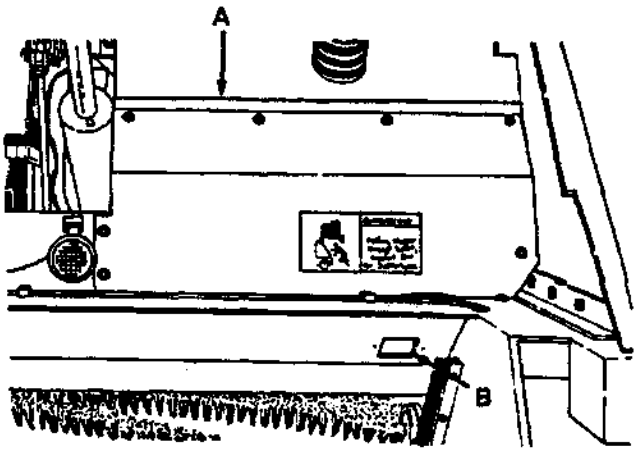
3. Position the hopper support bar under the lift arm.

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

4. Lower the hopper so the lift arm rests itself on top of the hopper support bar.

5. Stop the engine.

6. Remove the reservoir drain plug located on the bottom left side of the reservoir to drain the hydraulic fluid. Discard the used hydraulic fluid.



01462

HYDRAULIC FLUID RESERVOIR DRAIN ACCESS CUT-OUT

A. Reservoir Cover
B. Drain Access Cut-Out

7. Reinstall the reservoir drain plug.

TO FILL THE HYDRAULIC FLUID RESERVOIR

1. Open the left access door.

2. Remove the reservoir breather-filler cap.

3. Pour 5 gal (19 L) of new, approved hydraulic fluid through a 200 mesh screened funnel and into the reservoir filler neck.

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

4. Check the hydraulic fluid level in the reservoir with the sight gauge.

5. Add hydraulic fluid until the level in the reservoir is between the "hi" and "low" ranges. Do not overfill the reservoir.

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

6. Replace the breather-filler cap.

7. Close the access door.

HYDRAULIC FLUID RESERVOIR BREATHER

The hydraulic fluid reservoir is equipped with a breather. The breather relieves excess pressure in the reservoir. The breather is mounted on the hydraulic fluid reservoir. The breather should be replaced after every 800 hours of operation.

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.

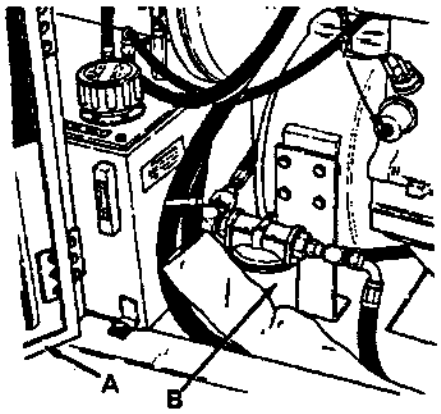
Replace the hydraulic fluid filter element after the first 50 hours of operation and then after every 400 hours of operation.

TO REPLACE THE HYDRAULIC FLUID FILTER ELEMENT

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

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

2. Open the side engine access door.



01461

HYDRAULIC FLUID FILTER

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

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

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

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

5. Thread the new hydraulic fluid filter on the filter head.

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

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

8. Close the side engine access door.

HYDRAULIC PUMPS

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

The machine accessories pump on low dump, multi-level dump, and SE models is a hydraulic gear pump. It is tandem mounted to the hydraulic piston pump.

The AA model accessories pump is a double hydraulic gear pump. It is tandem mounted to the hydraulic piston pump.

After repairing or replacing a hydraulic pump, or when system contamination is likely, change the hydraulic fluid in the reservoir and the hydraulic fluid filter. Then the proper start and break-in procedure must be followed to prevent possible damage to the pump. *TO START AND BREAK-IN HYDRAULIC PUMP* outlines the procedure.

TO START AND BREAK-IN HYDRAULIC PUMP

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

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

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

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

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

3. Block up the machine with jack stands.

4. Fill the hydraulic fluid reservoir with 5 gal (19 L) of new-approved hydraulic fluid.

5. Fill the pump case drain with hydraulic fluid. Connect an air pressurizing device to the hydraulic reservoir fill neck and pressurize the reservoir to 5 psi (35 kPa).

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 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: Operate the main brush and side brush; raise and lower the hopper three times; 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 50 hours 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 set the machine parking brake.

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

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

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

3. Block up the machine with jack stands.

4. Loosen the rod end nut 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 rod end nut connecting the directional control pedal to the control linkage.

7. Start the engine.

8. Loosen the pump centering springs mounting bracket bolts. Center the pump arm around the plate springs. Tighten the bolts.

9. Move the directional control pedal into the "forward" position and release it. The rear wheel should stop rotating as soon as the pedal is released. Adjust the spring mounting bracket position to the rear wheel stops when the pedal is released.

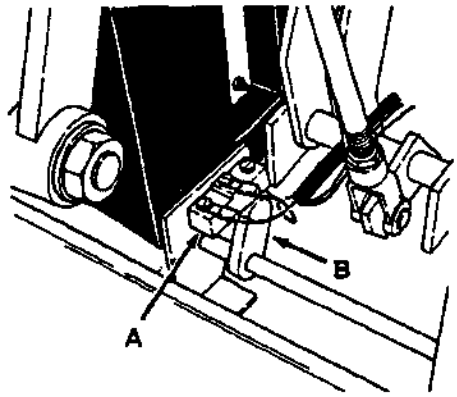
10. Move the directional control pedal into the "reverse" position and release it. The rear wheel should stop rotating as soon as the pedal is released. Adjust the spring mounting bracket position so the rear wheel stops when the pedal is released. Recheck the "forward" position adjustment as in step 9.

11. Stop the engine.

12. Raise the rear of the machine, remove the jack stands, and lower the machine.

13. Adjust the extended shock absorber rod ball joints so the machine does not travel above 6 mph (9.7 km/h) in reverse.

14. SE model: Adjust the neutral start switch so that the switch is actuated by the control rod link only when the directional control pedal is in the "neutral" position.



01510

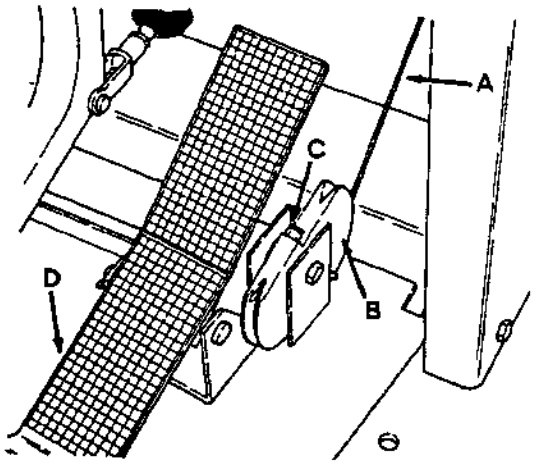
NEUTRAL START SWITCH

A. Switch
B. Link

SPEED LIMITER

The machine speed limiter is present on multi-level dump, AA, and SE models. It 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 tightening or loosening the speed limiter cable. One threaded end of the cable is located on the right lift arm. The other end of the cable, which is also threaded, is located on a flat sided sheave next to the directional control pedal. Tighten the cable to reduce the machine speed when the hopper is raised. Loosen the cable to increase the machine speed when the hopper is raised.



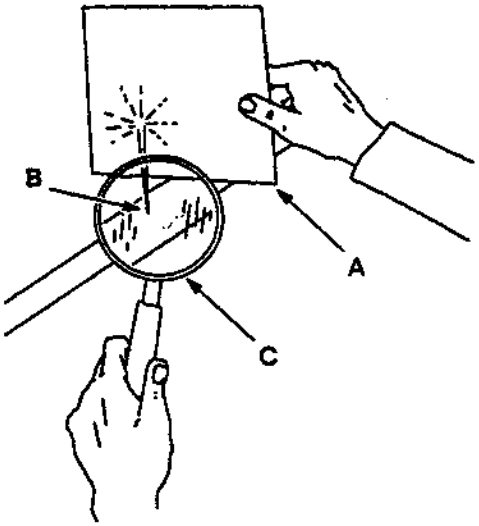
01463

SPEED LIMITER CABLE

A. Speed Limiter Cable
B. Flat Sided Sheave
C. Cable Adjusting Nut
D. Directional Control Pedal

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.



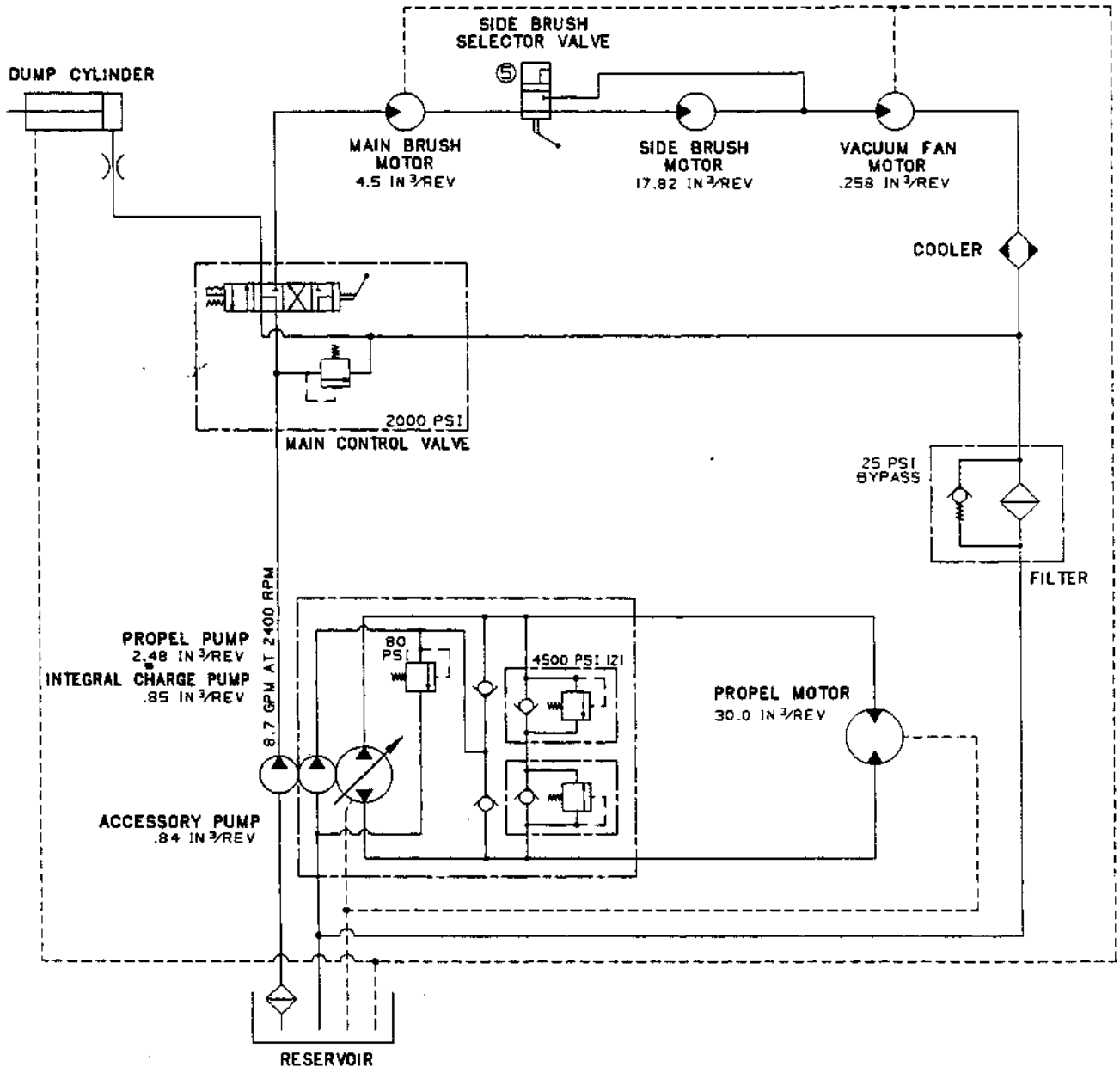
00002

HYDRAULIC PINHOLE LEAK

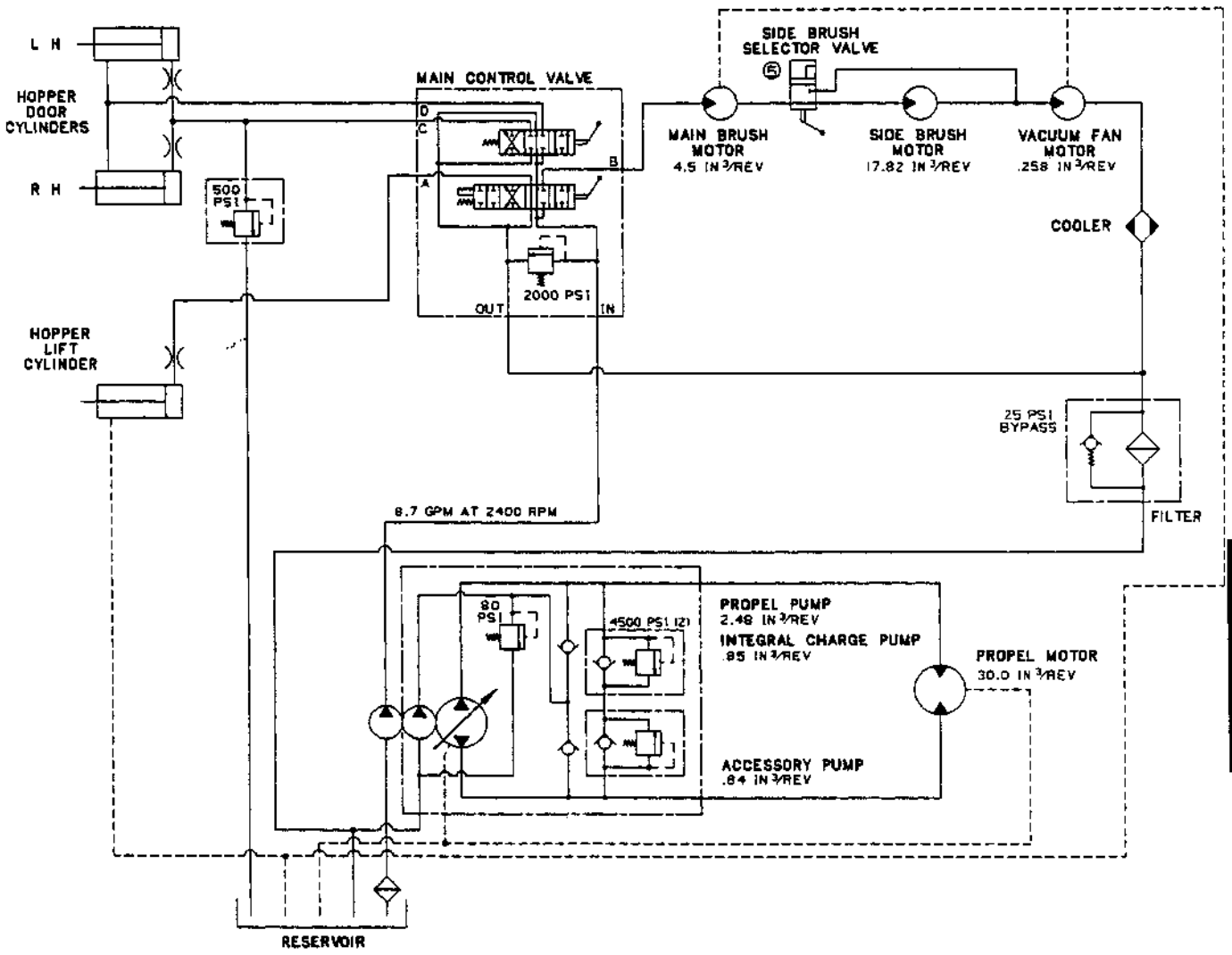
A. Cardboard
B. Pinhole Leak
C. Magnifying Glass

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

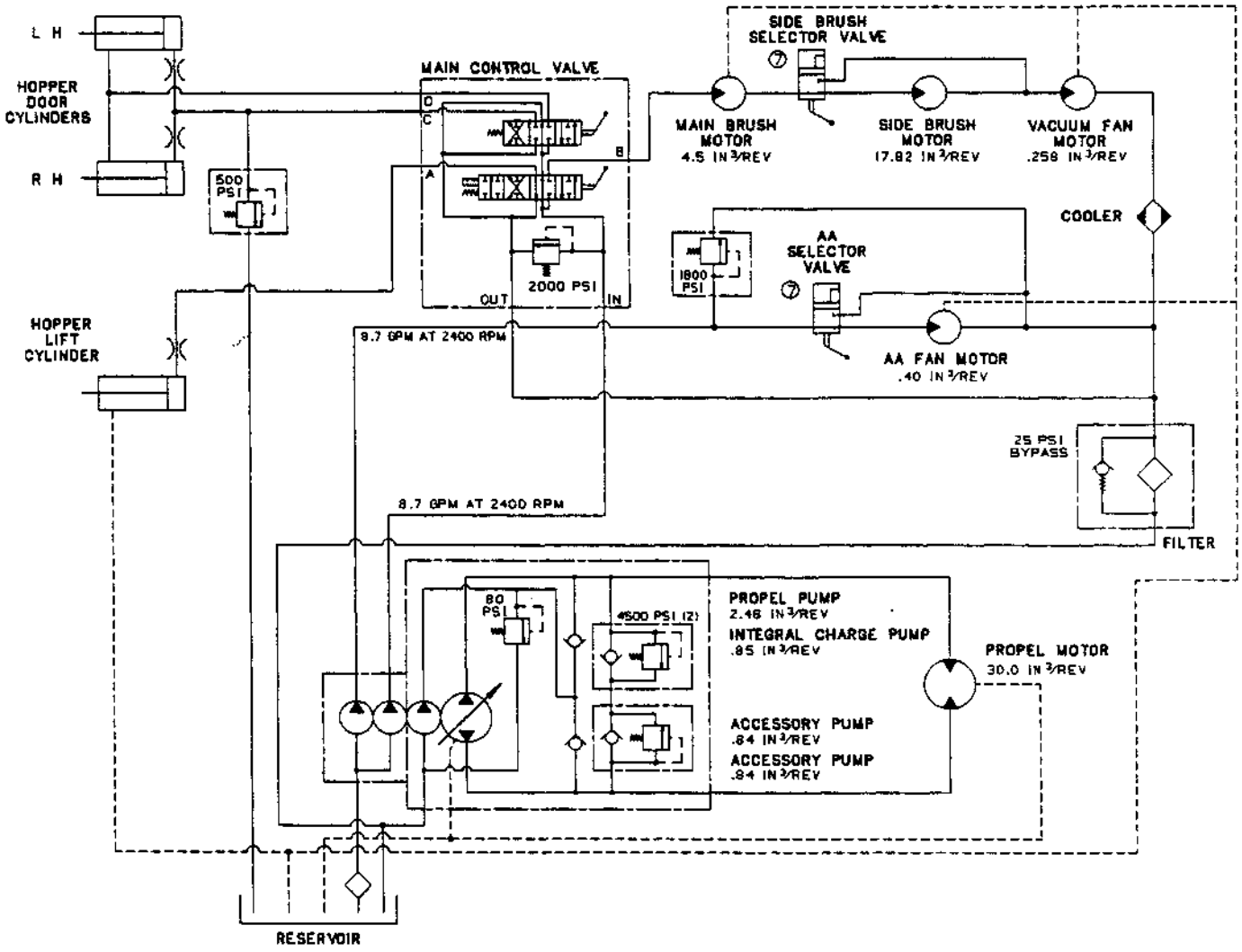


HYDRAULIC SCHEMATIC - LOW DUMP MODEL



01465

HYDRAULIC SCHEMATIC – MULTI-LEVEL DUMP, SE MODELS



01466

HYDRAULIC SCHEMATIC – AA MODEL

HYDRAULIC SYSTEM TROUBLESHOOTING

Problem	Cause	Remedy
Machine travels slowly or not at all	Parking brake engaged	Release parking brake
	Control linkage broken or not adjusted properly	Replace and/or adjust linkage
	Relief valve stuck open (leaking)	Clean or replace relief valve – one forward, one reverse
	Motor failure	See *HYDRAULIC COMPONENTS TROUBLESHOOTING*
	Pump failure	See *HYDRAULIC COMPONENTS TROUBLESHOOTING*
	Hydraulic fluid level low	Fill hydraulic fluid reservoir
Main brush turns slowly or not at all	Hydraulic control valve failure	See *HYDRAULIC COMPONENTS TROUBLESHOOTING*
	Hydraulic motor failure	See *HYDRAULIC COMPONENTS TROUBLESHOOTING*
	Gear pump failure	See *HYDRAULIC COMPONENTS TROUBLESHOOTING*
Side brush turns slowly or not at all	Hydraulic control valve failure	See *HYDRAULIC COMPONENTS TROUBLESHOOTING*
	Hydraulic motor failure	See *HYDRAULIC COMPONENTS TROUBLESHOOTING*
	Relief valve in control valve sticking	Clean or replace relief valve
	Gear pump failure	See *HYDRAULIC COMPONENTS TROUBLESHOOTING*
Poor or no vacuum to brush compartment	Hydraulic control valve failure	See *HYDRAULIC COMPONENTS TROUBLESHOOTING*
	Hydraulic motor failure	See *HYDRAULIC COMPONENTS TROUBLESHOOTING*
	Gear pump failure	See *HYDRAULIC COMPONENTS TROUBLESHOOTING*
Hopper will not lift	Hydraulic control valve failure	See *HYDRAULIC COMPONENTS TROUBLESHOOTING*
	Hydraulic orifice at lift cylinder plugged	Replace orifice
	Lift cylinder failure	See *HYDRAULIC COMPONENTS TROUBLESHOOTING*
	Gear pump failure	See *HYDRAULIC COMPONENTS TROUBLESHOOTING*
	Hopper overloaded	Empty hopper
	Lift arms binding	Replace and/or adjust lift arm linkage

Problem	Cause	Remedy
Hopper will not lower	Hydraulic control valve failure	See *HYDRAULIC COMPONENTS TROUBLESHOOTING*
	Lift cylinder failure	See *HYDRAULIC COMPONENTS TROUBLESHOOTING*
	Gear pump failure	See *HYDRAULIC COMPONENTS TROUBLESHOOTING*
	Lift arms binding	Replace and/or adjust lift arm linkage
Hopper door will not roll out	Hydraulic control valve failure	See *HYDRAULIC COMPONENTS TROUBLESHOOTING*
	Lift cylinder failure	See *HYDRAULIC COMPONENTS TROUBLESHOOTING*
	Gear pump failure	See *HYDRAULIC COMPONENTS TROUBLESHOOTING*
	Lift arms binding	Replace and/or adjust lift arm linkage

HYDRAULIC COMPONENTS TROUBLESHOOTING

Problem	Cause	Remedy
Hydraulic cylinder failure	Piston seals leaking	Install seal kit
	Barrel worn or rod bent	Replace cylinder
Hydraulic control valve failure	Valve seals leaking	Install seal kit
	Relief valve stuck open (leaking)	Clean or replace relief valve
Hydraulic motor failure	Motor leaking	Install seal kit
	Drive link failure	Replace drive link
	Gerotor worn	Replace gerotor set
	Output shaft failure	Replace output shaft and bearings
Hydraulic gear pump failure	Pump leaking	Install seal kit
	Gear set failure	Replace gear set
	Shaft failure	Replace gear set
	Flow divider failure	Replace back plate assembly
	Engine-to-pump coupling failure	Replace coupling
Hydraulic piston pump failure	Pump leaking	Install seal kit
	Relief valve stuck	Clean or replace relief valve
	Integral charge pump failure	Replace charge pump
	Rotating group worn	Replace rotating group
	Shaft failure	Replace shaft
	Backplate worn	Replace backplate
	Engine-to-pump coupling failure	Replace coupling

ENGINE

LUBRICATION

Check the engine oil level daily.

GASOLINE AND LPG POWERED ENGINES

Gasoline and LPG powered engines should be lubricated with SAE-SE/SF rated engine oil. Change the engine oil and oil filter after every 50 hours of operation.

The following oil grades are recommended for engines operating in the ambient temperatures listed.

MULTI-VISCOSITY OILS

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

SINGLE VISCOSITY OILS

-10° to 32°F (-23° to 0°C)	10° to 60°F (-12° to 16°C)	32° to 90°F (0° to 32°C)	Above 60°F (Above 16°C)
10W	20W 20	30	40

The engine oil capacity is 7 qt (6.6 L) including the oil filter.

DIESEL POWERED ENGINES

Diesel powered engines should be lubricated with SAE-CC/CD rated engine oil. Change the engine oil and oil filter after every 50 hours of operation for Continental engines, and every 100 hours of operation for Perkins and Kubota engines.

The following oil grades are recommended for engines operating in the ambient temperatures listed.

SINGLE AND MULTI-VISCOSITY OILS

Below 32°F (Below 0°C)	32° to 77° F (0° to 25° C)	Above 77° F (Above 25° C)
10W	20	30
10W 30		

The engine oil capacity is 7 qt (6.6 L) including the oil filter for the Continental engine. The engine oil capacity is 5 qt (4.7 L) including the oil filter for the Perkins engine. The engine oil capacity is 8.38 qt (9 L) including the oil filter for the Kubota engine.

COOLING SYSTEM

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

Check the coolant level in the radiator every 100 hours of operation. 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 800 hours of operation using a dependable cleaning compound. Follow the mixing procedure recommended by the compound manufacturer. This is important because of the difference in concentration and composition of the cleaning compounds. After cleaning, flush the system with clean water.

Whenever a cooling system is badly rust-clogged as indicated by overflow loss or abnormally high operating temperatures, corrective cleaning by reverse flow flushing will most effectively remove the heavy deposits of sludge, rust, and scale. The reverse flow flushing should be performed immediately after draining the cleaning solution. Flush the radiator first, then the engine, to allow the engine to cool as much as possible.
Engine overheating may also be caused by dirty radiator fins. The exterior fins of the radiator can be cleaned with an air hose. Check them for clogging after every 100 hours of operation. Blow out all dust, dirt, etc., between the fins, if necessary. 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.

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

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 (100 kPa), allowing steam and water to pass out the overflow pipe.

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

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

AIR INTAKE SYSTEM

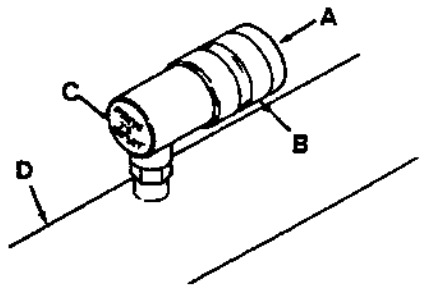
The importance of maintaining an air filter in proper condition cannot be overemphasized. Dirt induced through improperly installed, improperly serviced, or inadequate air filter elements wears out more engines than long hours of operation. Even a small amount of dirt will wear out a set of piston rings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

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

AIR FILTER RESTRICTION INDICATOR

The air filter restriction indicator signals when to change the air filter element. Check the restriction indicator daily. The red indicator gradually becomes visible as the air filter element loads with dirt. Do not clean or replace the air filter element until the red indicator reaches the top of the service indicator and locks into position.

When the red indicator is locked in the visible position, the indicator may return to the non-visible position when the engine is shut off. It will return to the visible position when the engine is started. After cleaning or replacing the air filter element, reset the service indicator by pushing the "reset" end of the indicator.



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AIR CLEANER SERVICE INDICATOR

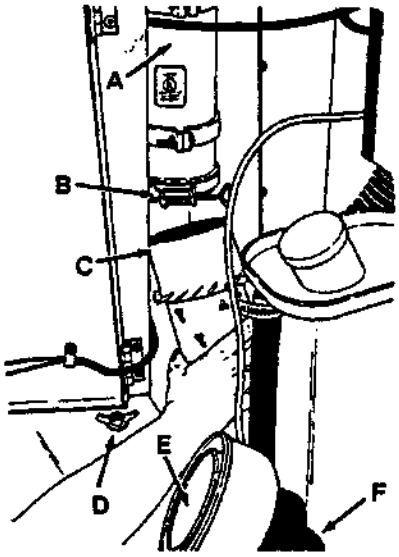
A. Service Indicator
B. Red Indicator Window
C. Indicator Reset
D. Air Intake Tube

AIR FILTER

The engine air filter element is a dry cartridge-type filter. The air filter element on low dump, multi-level dump, and AA models must be cleaned and inspected or replaced whenever the red indicator of the air filter restriction indicator locks in the visible position. It must be replaced after it has been damaged or cleaned three times. The air filter element on the SE model should not be cleaned, but replaced when the red indicator of the air filter restriction indicator locks in the visible position.

The air filter on low dump, multi-level dump, and AA models is equipped with a rubber dust cup on the base of the housing. Flex the dust cup daily to empty it of accumulated dirt. The SE model air filter is equipped with a self-cleaning pre-cleaner in lieu of the dust cup.

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



01467

REPLACING AIR FILTER ELEMENT

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

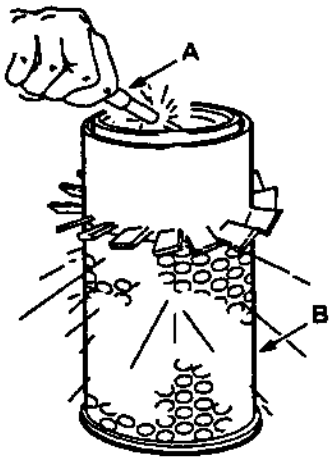
TO REPLACE AIR FILTER ELEMENT – LOW DUMP, MULTI-LEVEL DUMP, AA MODELS

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

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

2. Open the left side access door.
3. Unscrew the clamp ring on the filter.
4. Remove the dust cup.
5. Remove the wing nut.
6. Gently pull the element out of the filter housing.
7. Carefully clean out the dust cup and interior of the air cleaner housing with a damp cloth. Clean the element housing sealing surfaces.
8. Using an air hose, direct dry, clean air, maximum 30 psi (205 kPa), up and down pleats on the inside of the filter. Do not rap, tap, or pound dust out of the element. Remember, elements may only be safely cleaned three times before they must be replaced.

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

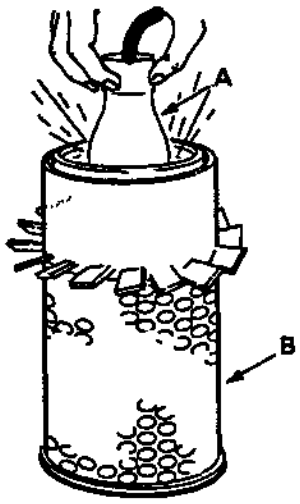


00051

CLEANING AIR FILTER ELEMENT

A. Air Hose
B. Filter Element

9. After cleaning the air filter element, inspect it for damage by placing a bright light inside. The slightest rupture requires replacement of the filter. Clean and inspect the seals on the end of the element. They should be unbroken and flexible.



00051

INSPECTING AIR FILTER ELEMENT

A. Bright Light
B. Filter Element

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

11. Install the dust cup and tighten the clamp ring to hold it in place. Check all intake hose connections for leaks or abrasion.

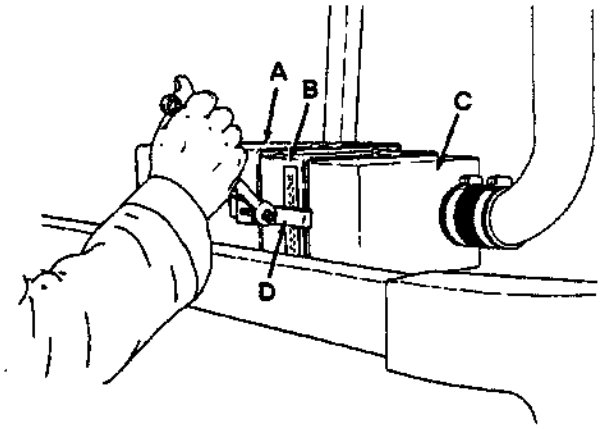
12. Reset the restriction indicator and close the access door.

TO REPLACE AIR FILTER ELEMENT – SE MODEL

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

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

2. Loosen the air filter clamp nuts.



01468

DISASSEMBLING AIR FILTER

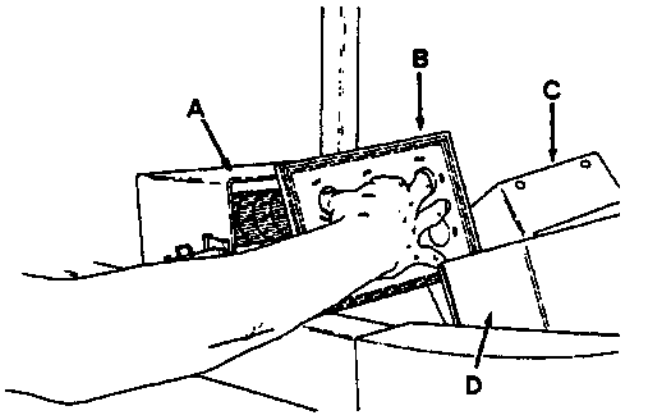
A. Air Filter Housing
B. Pre-Cleaner
C. Pre-Cleaner Cover
D. Air Filter Clamp

3. Remove the two air filter clamps and swing the pre-cleaner cover out of the way.

4. Remove the pre-cleaner.

5. Slide the air filter element out of the filter housing. Discard it – do not attempt to clean the filter element.

6. Slide a new filter element into the filter housing, rounded end first.



INSTALLING AIR FILTER ELEMENT

A. Filter Housing
B. Air Filter Element
C. Pre-Cleaner
D. Pre-Cleaner Cover

7. Position the pre-cleaner on the filter housing.

8. Position the pre-cleaner cover on the pre-cleaner with the air filter clamps.

9. Tighten the air filter clamp nuts to 75 in lb (8 Nm).

FUEL SYSTEM - GASOLINE

FUEL FILTER

There are two in-line fuel filters.

One in-line fuel filter is located under the fuel tank and the other is mounted on the carburetor.

Replace the fuel filters after every 400 hours of operation.

CARBURETOR

The carburetor has the following adjustments:

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. Check after every 500 hours of operation.

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.

Idle Speed Adjusting Screw - Adjust screw to recommended idle speed, 600 rpm. Turn screw clockwise to increase speed or counterclockwise to lower the rpm. Check the idle mix and reset the idle speed.

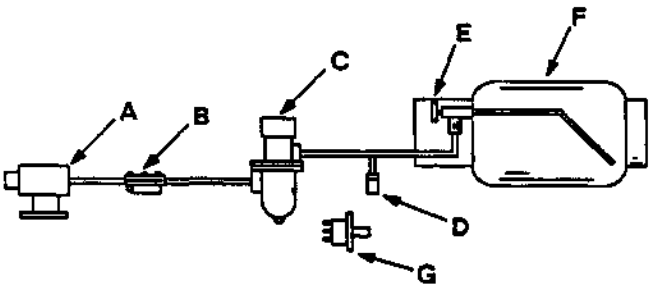
FUEL SYSTEM - LPG

LPG FUEL SYSTEM OPERATION

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

Liquid LPG fuel flows from the LPG 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-regulator. The oil pressure switch is bypassed when the engine is started, allowing LPG fuel to flow.

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



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LPG FUEL SYSTEM

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

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

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

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

FUEL TANKS

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

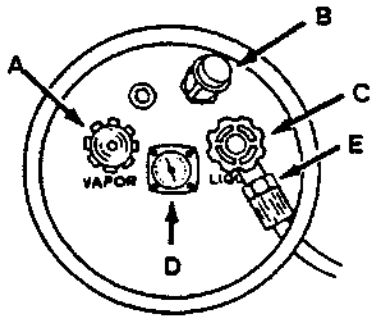
Filler Valve – Check for proper functioning and the presence of the handwheel. Valve must be closed except during filling.

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

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

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

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



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TYPICAL LPG LIQUID WITHDRAWAL FUEL TANK

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

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

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

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

Whether the storage is inside or outside, fuel tanks should not be stored in the vicinity of combustible materials or high temperature sources such as ovens and furnaces, since the heat may raise the pressure of the fuel to a point where the safety relief valves would function. Care should be taken to insure that the tanks 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.

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

TO CHANGE AN LPG FUEL TANK

1. Park the machine in a designated safe area.

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

2. Close the tank service valve.
3. Operate the engine until it stops from lack of fuel, then engage the machine parking brake.

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

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

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

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

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

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

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

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

FUEL FILTER LOCK

The fuel filter lock filters the LPG fuel. 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 (30 kPa).

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

VAPORIZER-REGULATOR

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

CARBURETOR

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

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

OIL PRESSURE SWITCH

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

LPG FUEL TROUBLESHOOTING

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

FUEL SYSTEM – DIESEL

DIESEL FUEL SYSTEM

The diesel fuel system is made up of five basic components which are: fuel tank, fuel water trap-filter, fuel pump, injection pump, and injectors.

Fuel flows from the fuel tank through the fuel water trap-filter. The water trap-filter separates water and impurities from the fuel. From the fuel water trap-filter, fuel is drawn through the electric fuel pump and pumped to the injection pump. The injection pump pressurizes and sends fuel to the injectors. The injectors atomize and inject proper amounts of fuel into the combustion chamber at the proper times. Excess fuel is returned to the fuel tank through an overflow pipe.

FUEL WATER TRAP, CONTINENTAL AND PERKINS DIESEL

The fuel water trap separates water from the fuel. It is located next to the fuel tank on the Continental diesel and on the side of the engine on the Perkins diesel.

Drain the water trap of water daily. To drain the water trap, loosen the drain knob on the bottom of the unit. First water, then diesel fuel will drain. Tighten the drain knob when diesel fuel appears.

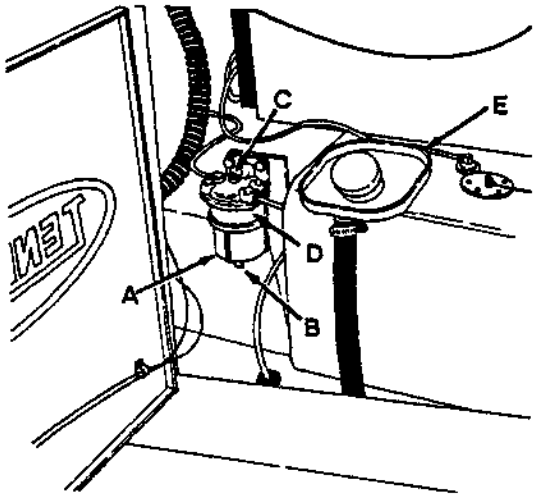
After every 100 hours of operation, the water trap must be cleaned as described in *TO CLEAN WATER TRAP*.

TO CLEAN WATER TRAP, CONTINENTAL AND PERKINS DIESEL

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

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

2. Thoroughly clean the exterior of the water trap.
3. Unscrew the bowl retaining bolt in the center of the water trap head.



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WATER TRAP

A. Water Trap
B. Drain Knob
C. Bowl Retaining Bolt
D. Fuel Filter Element
E. Fuel Tank

4. Lower the bowl from the water trap head.
5. Thoroughly clean the water trap bowl in cleaning fluid.

NOTE: Do not use gasoline to clean the bowl.

6. After cleaning the water trap bowl, fill the bowl with clean fuel. Hold the water trap bowl in position under the water trap head.
7. Secure the bowl retaining bolt.
8. Prime the fuel system as described in *PRIMING THE FUEL SYSTEM*.

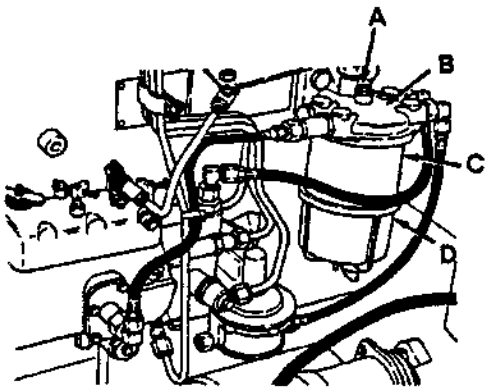
FUEL FILTER, CONTINENTAL AND PERKINS DIESEL

The fuel filter is mounted on the top right side of the of the Continental diesel engine and on the left side of the Perkins diesel engine. The fuel filter should be replaced after every 400 hours of operation.

TO REPLACE THE FUEL FILTER

1. Thoroughly clean the exterior of the fuel filter assembly.

2. Unscrew the filter bolt in the center of the head.



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FUEL FILTER

A. Filter Bolt
B. Filter Head
C. Filter Element
D. Filter Bowl

3. Lower the filter bowl and element and discard the fuel, together with the old element.

4. Thoroughly clean the filter bowl in cleaning fluid.

NOTE: Do not use gasoline as a cleaning fluid.

5. Place the new element and sealing rings in position, fill with clean fuel, and push the bowl up firmly and squarely so that the top rim of the filter element locates centrally against the sealing ring in the filter head.

6. Hold in this position while the securing bolt is located and tightened. If the bowl is located correctly, no excessive tightening will be required to obtain a leak-proof seal.

   After the fuel filter has been reassembled, it is necessary to remove air from the fuel system. See *PRIMING THE FUEL SYSTEM*.

FUEL WATER TRAP FILTER, KUBOTA DIESEL

The fuel water trap filter separates water and impurities from the fuel. It is located next to the fuel tank. The bottom portion of the unit is the water trap, the middle portion is the filter element.

Drain the water trap of water daily. To drain the water trap, loosen the drain knob on the bottom of the unit. First water, then diesel fuel will drain. Tighten the drain knob with diesel fuel appears.

Replace the fuel filter element and clean the water trap after every 400 hours of operation.

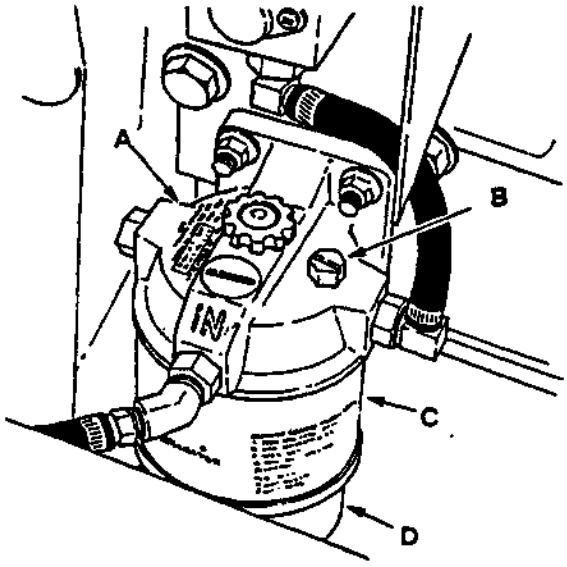
TO REPLACE THE FUEL FILTER ELEMENT, KUBOTA DIESEL

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

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

2. Open the right-hand rear door.

3. Loosen the unit vent plug and open the water trap drain to drain diesel fuel.



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FUEL WATER TRAP FILTER

A. Filter Head
B. Vent Plug
C. Filter Element
D. Water Trap Bowl

4. Remove the filter element and the water trap from the filter head.

5. Remove the water trap bowl from the filter element.

6. Clean the water trap bowl.

7. Lubricate the o-ring and spin the water trap bowl onto the new filter element.

8. Lubricate the o-ring and spin the filter element and water trap onto the filter head.

9. Prime the fuel system as described in *PRIMING THE FUEL SYSTEM.*

10. Close the right-hand rear door.

FUEL INJECTION PUMP

The fuel injection pump controls the engine speed.

The maximum speed screw is set and sealed by the manufacturer and must not be altered in any way unless factory authority is first obtained. Any adjustments should be carried out by experienced fuel pump technicians. The unauthorized removal of any seals on the pump may void the warranty.

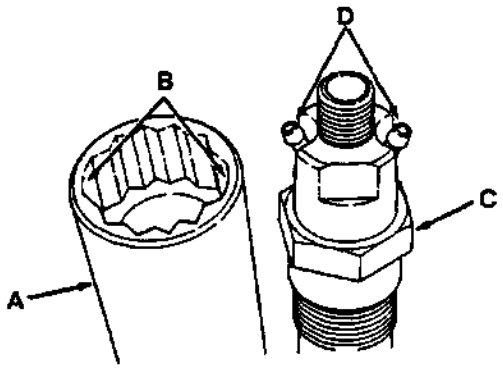
ATTENTION! Unless proper test equipment and trained technicians are available, adjustment or maintenance of the fuel injection pump should not be attempted.

FUEL INJECTORS

When replacing injectors in the cylinder head, it is essential that a new, correct-type heat shield washer be fitted between the nozzle cap and the cylinder head.

Care should be used when replacing the fuel injectors to prevent loosening the injector leak-off nipples.

Be sure to cut a relief in the inside of your socket for clearance. This will prevent an interference between the socket and the leak-off nipple.



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SOCKET RELIEF CLEARANCE

A. Socket
B. Relief
C. Injector
D. Leak-Off Nipple

Tighten injectors evenly to 52 ft lb (70 Nm).

Injectors should be taken out only if engine is malfunctioning as outlined below:

A. Misfiring
B. Knocking in one (or more) cylinders
C. Engine overheating
D. Loss of power
E. Smoky exhaust (black or white)
F. Increased fuel consumption

The faulty injector or injectors may be located by loosening the line fitting nut on each, in turn, with the engine running at a fast idle. This allows the fuel to escape and not enter the cylinder. The injector least affecting the engine performance should be removed from the cylinder head and reconditioned or replaced.

WARNING: Diesel atomizer spray can penetrate skin. Severe personal injury or death can result. Keep away from atomizers when engine is in operation.

NOTE: No attempt should be made to adjust the injection pressure without a proper testing pump and pressure gauge. It is impossible to adjust the setting of the injector with any degree of accuracy without proper equipment.

WARNING: Do not start the engine with loose injector securing nuts; this may result in the injector flying out.

PRIMING THE FUEL SYSTEM

Priming is necessary on initial installation of the fuel injection system, after any subsequent removal, or if the system was drained by running out of fuel.

Before priming and venting, ensure that the outside of the vent screws and surrounding area is thoroughly clean to prevent dirt and foreign matter entering the system.

NOTE: Electrical equipment such as starters should be shielded during priming to prevent fuel entry.

Carry out steps 1 and 2 while operating the fuel lift pump priming lever.

1. Operate the fuel lift pump priming lever and loosen the filter outlet connection until fuel flows free of air.
2. Continue operating the fuel lift pump priming lever while loosening the top vent valve and the vent screw on the governor housing. When fuel flows free of air, tighten the connections. Stop operating the priming lever and place it in the vertical position.

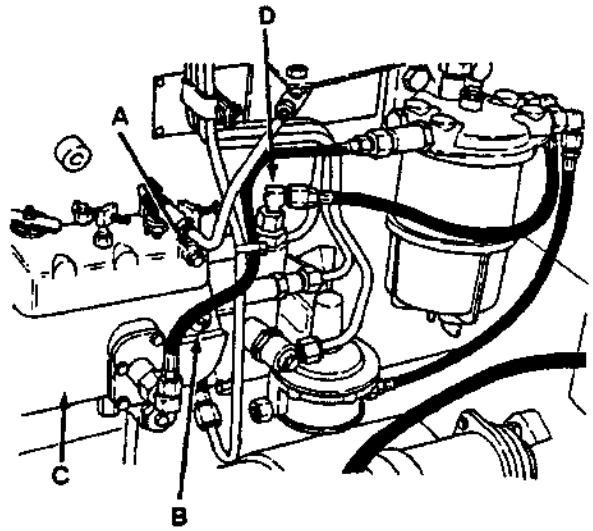
NOTE: Leaving the priming lever in the horizontal position will lock the pump action stopping the fuel supply.

3. Loosen any two injector high pressure pipe nuts at the injector end. Set the accelerator to the fully "open" position and ensure that the stop control is in the "run" position. Crank engine until fuel is free of air bubbles. Tighten nuts.

NOTE: The bleeding operation may take a considerable amount of cranking with the starter to purge all air. It is important that the battery be in good operating condition when bleeding.

If the engine will not start after bleeding, or any other time, it may be an indication of a low battery charge. If the voltage to the fuel shutoff solenoid falls below 8 volts, the valve will shut off fuel to the engine. This may happen during cranking if the battery charge is low. The condition may not be readily apparent since cranking speed might still be good.

4. Start the engine.



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INJECTION PUMP VENTS

A. Top Vent Valve
B. Governor Housing Vent Valve
C. Injection Pump
D. Fuel Pump Inlet Connection

DIESEL FUEL TROUBLESHOOTING

Problem	Cause	Remedy
Engine will not start	Out of fuel	Fill fuel tank
	Filter plugged	Clean filter
	Air in fuel	Bleed fuel lines
	Water in fuel	Drain water trap
	Fuel too thick	Change fuel grade
	Battery discharged	Charge or replace battery
	Clogged fuel nozzle	Clean or replace nozzle
	Valve clearance wrong	Adjust valves
	Leaking valves	Grind valves
	Timing wrong	Adjust timing
	Low compression	Repair engine
Engine runs unevenly or lacks power	Dirty air filter	Clean or replace filter
	Plugged fuel filter	Clean filter
	Water in fuel	Drain water trap
	Fuel too thick	Change fuel grade
	Clogged fuel nozzle	Clean or replace nozzle
	Low compression	Repair engine
	Engine overheating	Check radiator
		Check lubricating system
	Timing wrong	Check timing
	Valve clearance wrong	Adjust valves
	Fuel pressure wrong	Adjust pressure
	Injection pump worn	Repair or replace pump
Engine stops suddenly	Fuel leak	Check fuel system
	Out of fuel	Fill fuel tank
	Fuel nozzle bad	Replace nozzle
	Engine overheating	Check radiator
		Check lubricating system
	Timing wrong	Check timing
Exhaust color bad	Fuel governor failure	Repair or replace
	Bad fuel	Change fuel grade
	Fuel nozzle bad	Replace nozzle
	Timing wrong	Check timing
	Low compression	Repair engine
	Valve clearance wrong	Adjust valves
	Injection pump worn	Repair or replace pump

GOVERNOR - GASOLINE, LPG

GOVERNOR

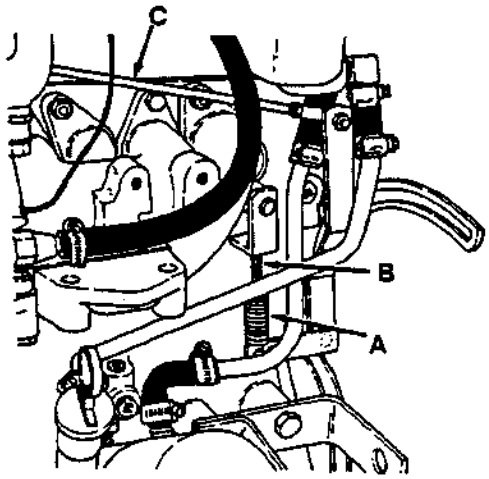
The engine governor is of the cam gear variety.

When the governor is driven at increasing speeds by the engine, the hardened steel balls move outward, forcing the conical upper race and lever assembly toward a closed throttle position.

An externally mounted spring imposes tension on the lever assembly toward the open throttle position. As the engine speed increases, the centrifugal force created by the balls will increase until a balanced condition between the governor force and the spring force exists and the governing lever remains stationary, holding a constant engine rpm. The desired engine speed is obtained by increasing or decreasing the governor spring tension.

Check the governor linkage for binding after every 200 hours of operation.

Linkage Adjustment - With the engine stopped and spring tension about normal, the governor should hold the throttle (butterfly) in the wide open position.



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GOVERNOR LINKAGE

A. Spring
B. Adjusting Screw
C. Governor to Carburetor Control Rod

The governor to carburetor control rod should be adjusted in length so that the throttle stop lever is 0.02 to 0.03 in (0.4 to 0.8 mm) off the stop pin.

Make certain that all linkages at the governor and the carburetor operate freely with no binding.

Speed Adjustment - To increase speed, increase spring tension by use of the adjusting screw. To decrease speed, decrease spring tension by use of the adjusting screw. Idle, no load speed is 600 ± 50 rpm. Full governed speed is 2200 ± 50 rpm.

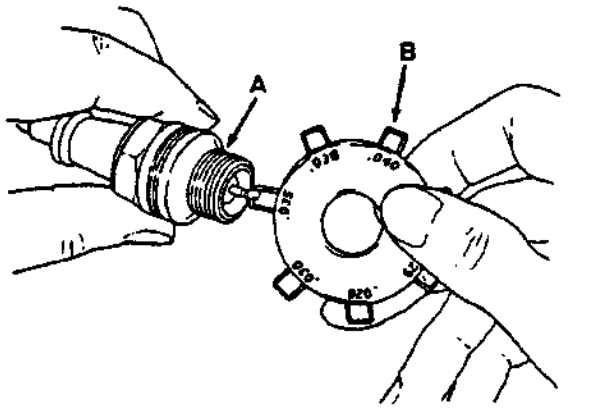
ELECTRICAL SYSTEM - GASOLINE, LPG

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.

Clean or replace, and set the gap of the spark plugs after every 200 hours of operation.

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



01471

GAPPING THE SPARK PLUG

A. Spark Plug
B. Gapping Tool

The proper spark plug gap is 0.035 in (0.9 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 30 ft lb (41 Nm) with a socket wrench and torque wrench of the correct size.

DISTRIBUTOR

The distributor operation is vital to the operation of the engine. The distributor is of the breakerless variety. The following procedures should be done after every 200 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 distributor shaft in the direction of rotation and then releasing it. The advance springs should return the shaft to its original position.

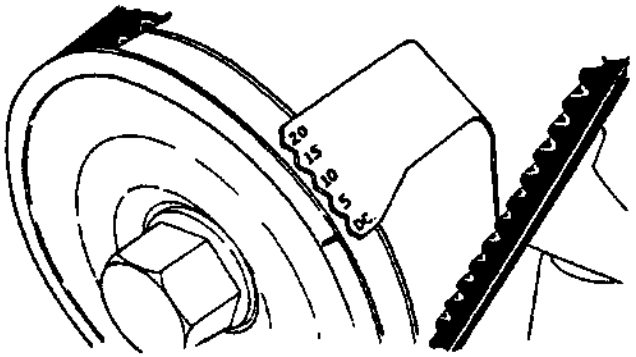
3. The diaphragm in the vacuum advance unit and the line to the manifold should be checked periodically for leakage. If the diaphragm is ruptured, the vacuum advance housing and linkage must be replaced.

4. Lubricate the distributor shaft.

DISTRIBUTOR IGNITION TIMING

NOTE: The following sequence is for a 12 V timing light. If a 110 V 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.



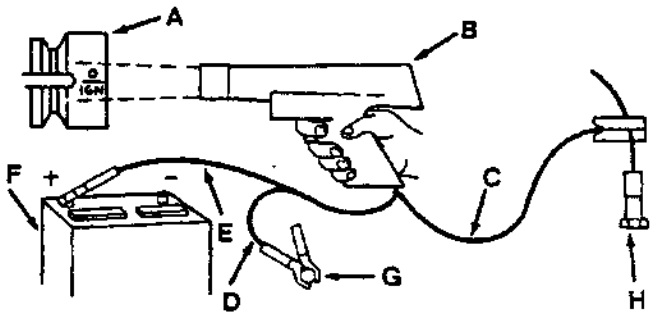
00054

CRANKSHAFT PULLEY TIMING MARK

1. Remove and plug the vacuum hose at the distributor.

2. Clip the secondary lead of light to the #1 spark plug. Leave the spark plug wire on the plug.

3. Connect the primary positive lead to the positive terminal of the battery.



00059

TIMING LIGHT HOOKUP

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

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

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

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

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

6. Direct the timing light on the crankshaft pulley and note the timing marks as the light flashes.

7. Timing is 2° BTDC at 400 rpm for gasoline engines and is 5° BTDC at 400 rpm for LPG engines.

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

9. When the timing is correct, tighten the distributor clamp screw securely. Then recheck timing again with the light.

10. This operation is best performed in a shaded area so the timing light is visible.

11. Unplug and replace the distributor vacuum hose.

12. Set the engine idle speed to 600 rpm.

IGNITION SYSTEM

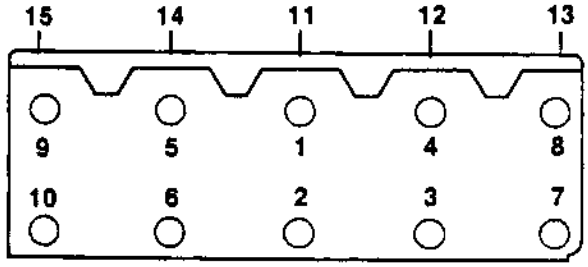
The engine ignition system is the breakerless type. The ignition system needs no regular maintenance. The only adjustment is the ignition air module gap which should be set at 0.006 to 0.010 in (0.002 to 0.003 mm) for the Prestolite distributor, and 0.010 to 0.075 in (0.003 to 0.009 mm) for the Per-Lux distributor.

CYLINDER HEAD - GASOLINE, LPG

CYLINDER HEAD

The proper sequence and torque values should be used when reassembling the cylinder head. The cylinder head bolts must be tightened in the proper sequence after the first 50 hours of operation.

Hand torque cold M10 bolts to 50 to 55 ft lb (68 to 75 Nm) and M12 bolts to 80 to 85 ft lb (108 to 115 Nm) in the correct order.



01472

CYLINDER HEAD BOLT TIGHTENING SEQUENCE

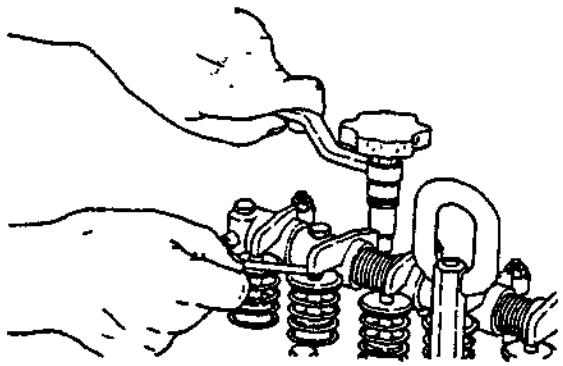
The cylinder head cap screws and risers must be re-torqued after the engine is put into operation and brought up to proper operating temperatures. To re-torque cap screws, follow the correct sequence. Loosen one head cap screw or riser at a time one quarter turn (90 degrees); then re-torque it to the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

NOTE: Power wrench torque limit must be held at least 10 ft lb (15 Nm) below torque specification. Hand tighten to specification.

VALVE TAPPET CLEARANCE ADJUSTMENT

The valve tappet clearance must be checked after the first 50 hours of operation and after every 400 hours of operation.

Check and adjust the intake valve tappets to 0.014 in (0.36 mm) clearance and the exhaust valve tappets to 0.018 in (0.46 mm) clearance when the engine is warm and is operating at idle speed.



01473

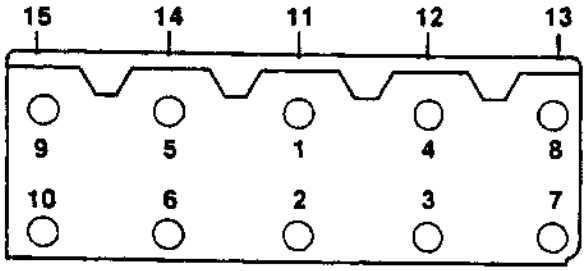
ADJUSTING VALVE TAPPET CLEARANCE

CYLINDER HEAD - DIESEL

CYLINDER HEAD, CONTINENTAL DIESEL

The proper sequence and torque values should be used when reassembling the cylinder head. The cylinder head bolts must be tightened in the proper sequence after the first 50 hours of operation.

Hand torque cold M10 bolts to 50 to 55 ft lb (68 to 75 Nm) and M12 bolts to 80 to 85 ft lb (108 to 115 Nm) in the correct order.



01472

CYLINDER HEAD BOLT TIGHTENING SEQUENCE

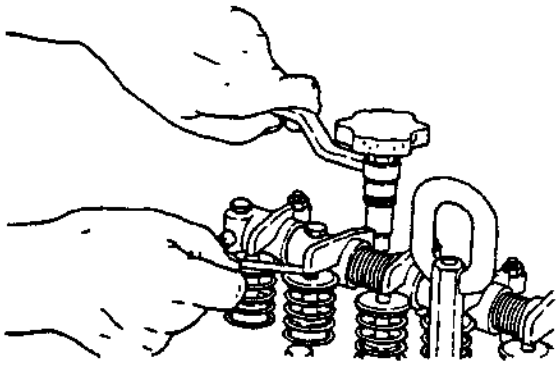
The cylinder head cap screws and risers must be re-torqued after the engine is put into operation and brought up to proper operating temperatures. To re-torque cap screws, follow the correct sequence. Loosen one head cap screw or riser at a time one quarter turn (90 degrees); then re-torque it to the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

NOTE: Power wrench torque limit must be held at least 10 ft lb (15 Nm) below torque specification. Hand tighten to specification.

VALVE TAPPET CLEARANCE ADJUSTMENT, CONTINENTAL DIESEL

The valve tappet clearance must be checked after the first 50 hours of operation and after every 400 hours of operation.

Check and adjust the intake valve tappets to 0.014 in (0.36 mm) clearance and the exhaust valve tappets to 0.018 in (0.46 mm) clearance when the engine is warm and is operating at idle speed.



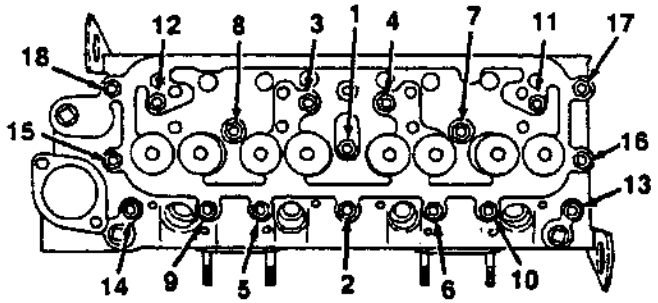
01473

ADJUSTING VALVE TAPPET CLEARANCE

CYLINDER HEAD, PERKINS DIESEL

The cylinder head must be properly torqued after servicing to ensure proper operation. A three-stage torque procedure should be used. Snug down the cylinder head bolts and nuts in the proper sequence; first to one-third, then two-thirds, and then to the full torque specification of 55 to 60 ft lb (75 to 80 Nm). Retighten the bolts and nuts after operating the engine for 30 minutes.

NOTE: Power wrench torque limit must be held at least 10 ft lb (15 Nm), below torque specification. Hand tighten to specification.



01235

CYLINDER HEAD BOLT TIGHTENING SEQUENCE

VALVE CLEARANCE, PERKINS DIESEL

The valve clearance must be properly adjusted after servicing or retorquing the cylinder head bolts to ensure proper operation. Measure valve clearance with a feeler gauge after aligning each cylinder on the compression top dead center stroke.

Adjust them with the engine cool to 0.012 in (0.3 mm).

Set valve clearances as follows:

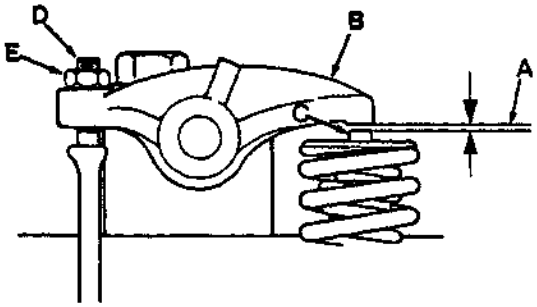
1. With the valves rocking on No. 4 cylinder (i.e., the period between the opening of the intake valve and the closing of the exhaust valve), set the valve clearances on No. 1 cylinder.

2. With the valves rocking on No. 2 cylinder, set the valve clearances on No. 3 cylinder.

3. With the valves rocking on No. 1 cylinder, set the valve clearance on No. 4 cylinder.

4. With the valves rocking on No. 3 cylinder, set the valve clearances on No. 2 cylinder.

5. With the engine running at fast idle, check to make sure that there is satisfactory oil flow to the rocker assembly.



00207

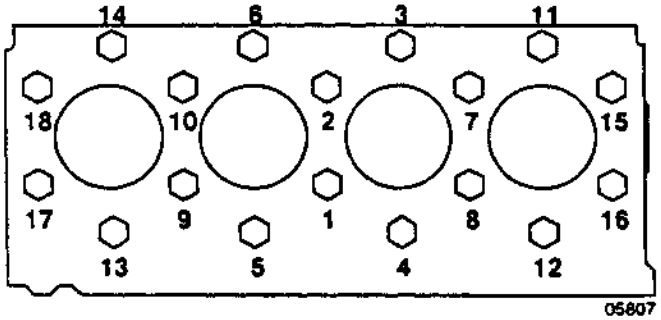
SETTING VALVE CLEARANCE

A. Valve Clearance
B. Rocker Arm
C. Valve Stem Top
D. Adjusting Screwdriver
E. Locknut

CYLINDER HEAD, KUBOTA DIESEL

The cylinder head must be properly torqued after servicing to ensure proper operation. A three-stage torque procedure should be used. Snug down the cylinder head bolts and nuts in the proper sequence; first to one-third, then two-thirds, and then to the full torque specification of 58 to 68 ft lb (79 to 83 Nm). Retighten the bolts and nuts after operating the engine for 30 minutes.

NOTE: Power wrench torque limit must be held at least 10 ft lb (15 Nm) below torque specification. Hand tighten to specification.



CYLINDER HEAD BOLT TIGHTENING SEQUENCE

VALVE CLEARANCE, KUBOTA DIESEL

The valve clearance must be properly adjusted after servicing or retorquing the cylinder head bolts to ensure proper operation. Measure the clearance with a feeler gauge after aligning each cylinder with the top dead center of compression.

Adjust them with the engine cool to 0.0071 to 0.0087 in (0.18 to 0.22 mm) in the firing order of 1-3-4-2.

TUNE-UP CHART – GASOLINE, LPG	
Idle speed, no load	600 ± 50 rpm
Maximum Governed speed	2200 ± 50 rpm
Spark plug gap	0.035 in (0.9 mm)
Timing	2° BTDC @ 400 rpm, gasoline 5° BTDC @ 400 rpm, LPG
Firing order	1-3-4-2
Valve clearances	0.014 in (0.36mm) intake 0.018 in (0.46mm) exhaust

ELECTRICAL SYSTEM

BATTERY

The battery in gasoline and LPG powered machines is rated at 12 V, 540 ccA. The battery on diesel powered machines is rated at 12 V, 625 ccA. It is located under the operator seat. When removing battery cables, remove the negative (-) cable before the positive (+) cable.

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

Do not operate the machine if the battery is in poor condition or with only 25% of the charge left.

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

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

The electrolyte level 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.

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

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

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

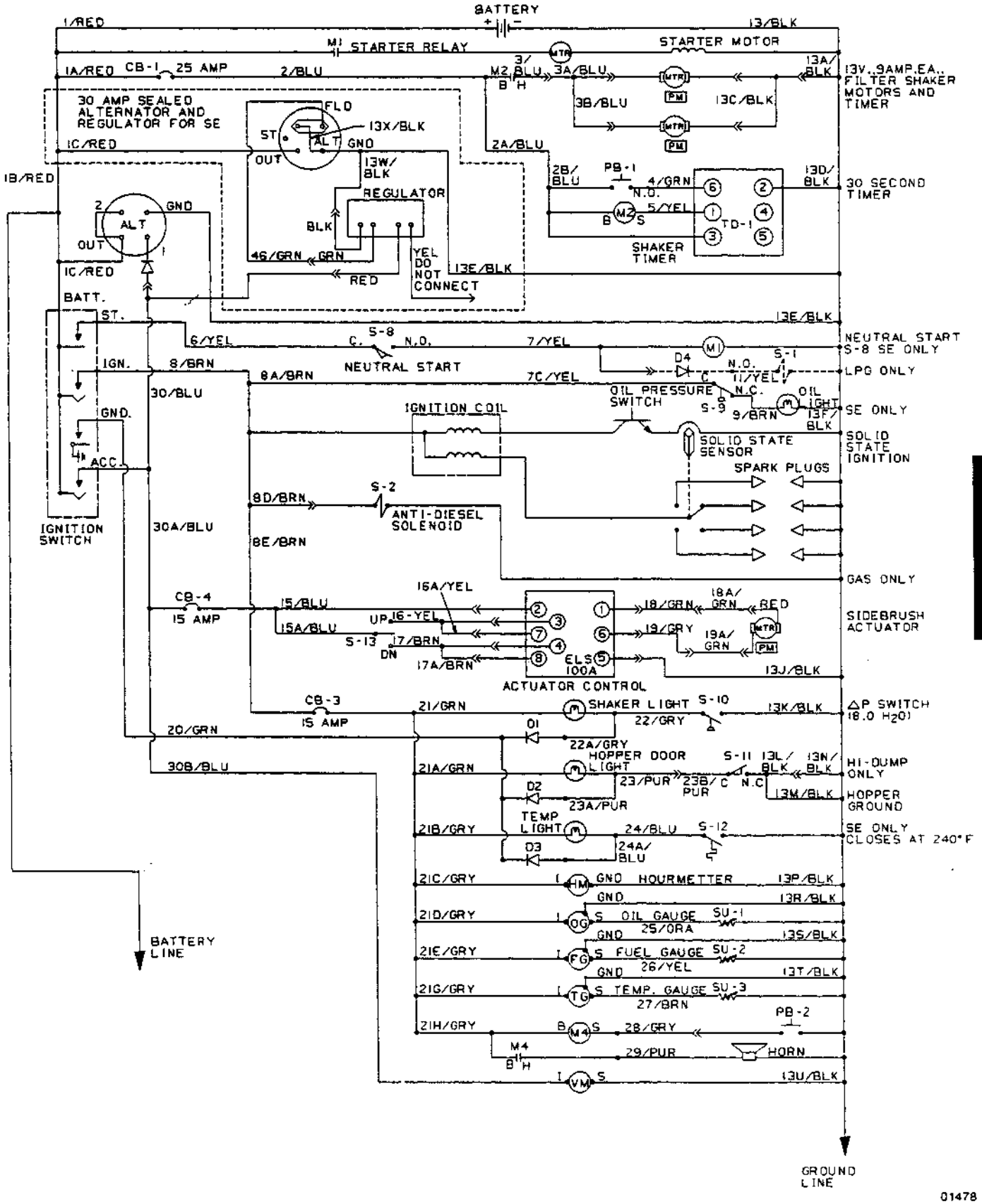
SPECIFIC GRAVITY AT 80° F (27° C)	BATTERY CONDITION
1.260 - 1.280	100% charged
1.230 - 1.250	75% charged
1.200 - 1.220	50% charged
1.170 - 1.190	25% charged
1.110 - 1.160	Discharged

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

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

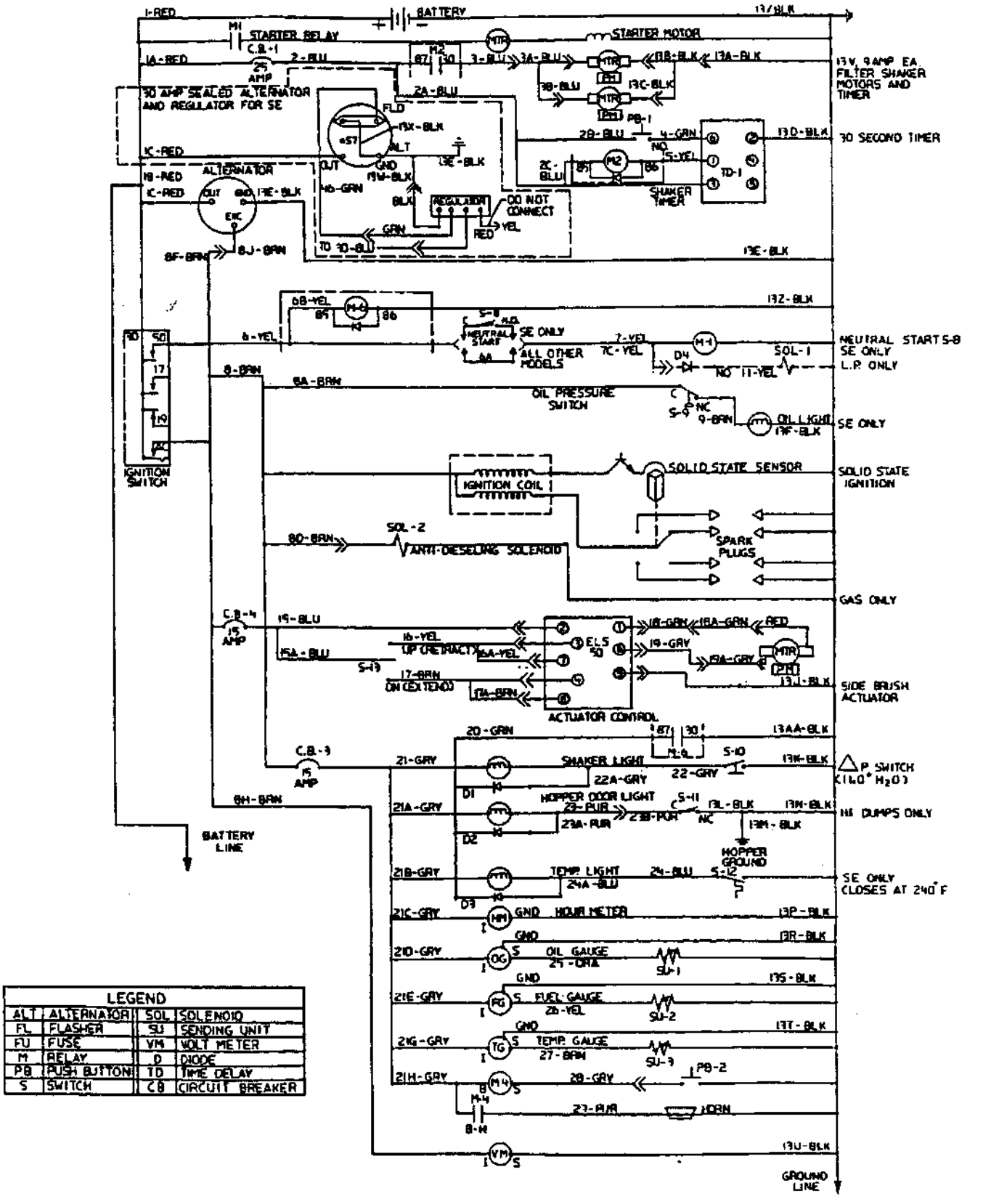
Add to the specific gravity reading 0.004, 4 points, for each 10° F (6° C) above 80° F (27° C).

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



01478

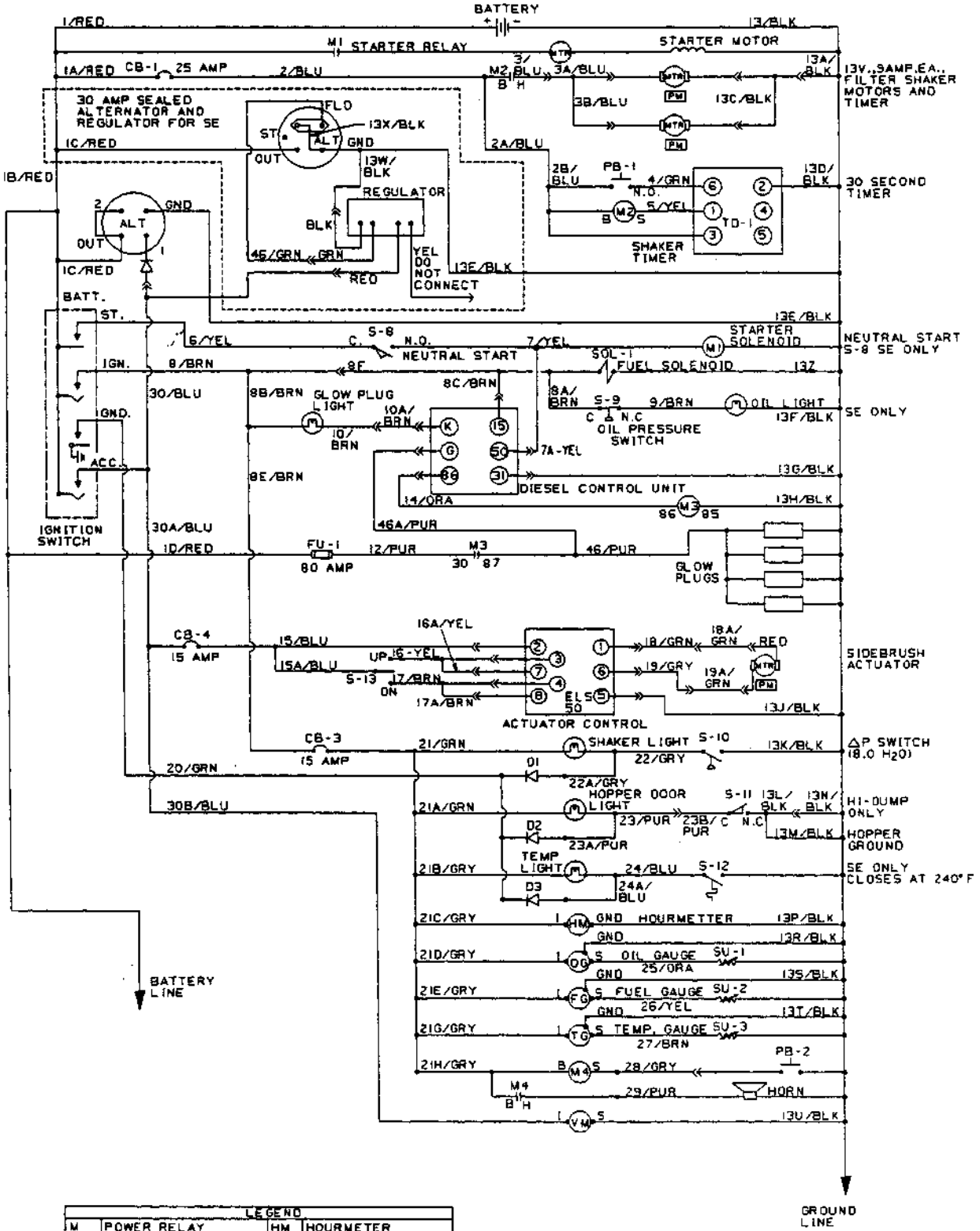
ELECTRICAL SCHEMATIC, GASOLINE AND LPG
(For machines below serial number 004576)



LEGEND			
ALT	ALTERNATOR	SOL	SOLENOID
FL	FLASHER	SU	SENDING UNIT
FU	FUSE	VM	VOLT METER
M	RELAY	D	DIODE
PB	PUSH BUTTON	TD	TIME DELAY
S	SWITCH	CB	CIRCUIT BREAKER

01478

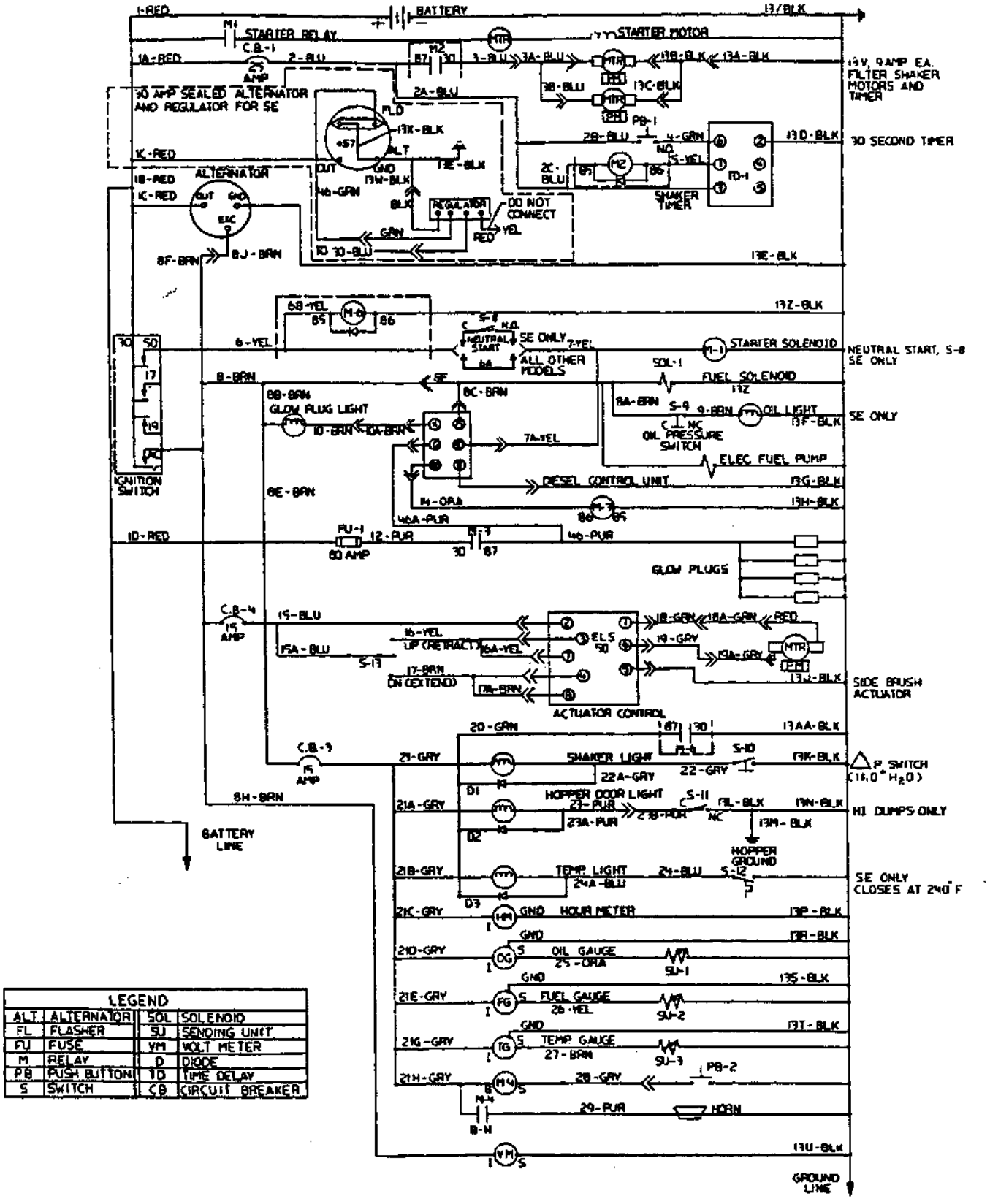
ELECTRICAL SCHEMATIC, GASOLINE AND LPG
(For machines serial number 004576 and above)



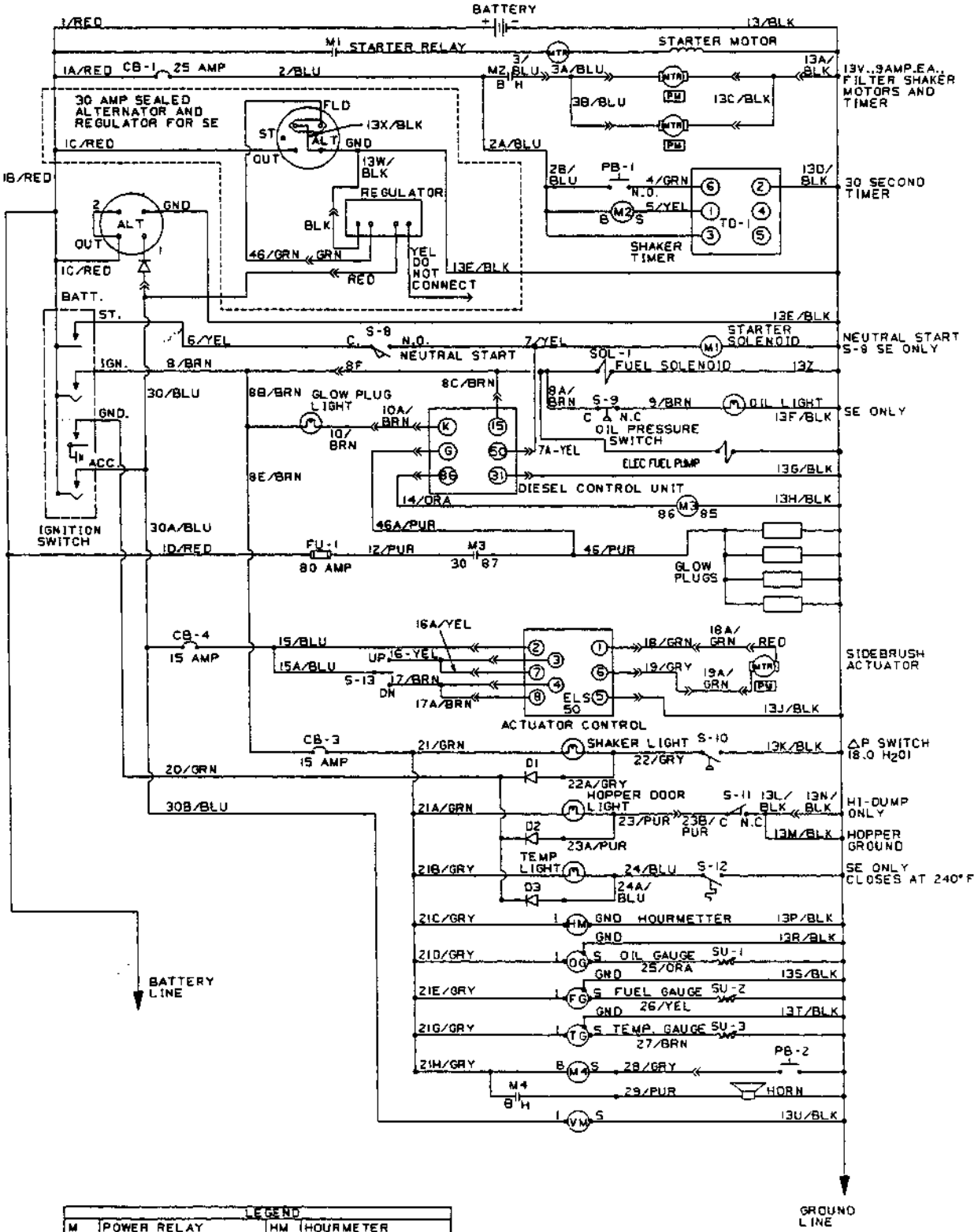
LEGEND			
M	POWER RELAY	HM	HOURMETER
MTR	MOTOR	SV	SOLENOID VALVE
CB	CIRCUIT BREAKER	S	SWITCH
PM	PERMANENT MAGNET	ACC	ACCESSORY
J	JACK-FEM. SOCKET	GND	GROUND CHASSIS
P	PLUG-MALE PIN	C	COMMON
PB	PUSHBUTTON	N.O.	NORMALLY OPEN
VM	VOLTMETER	N.C.	NORMALLY CLOSED
FU	FUSE		

01501

ELECTRICAL SCHEMATIC, PERKINS DIESEL
(For machines below serial number 004576)



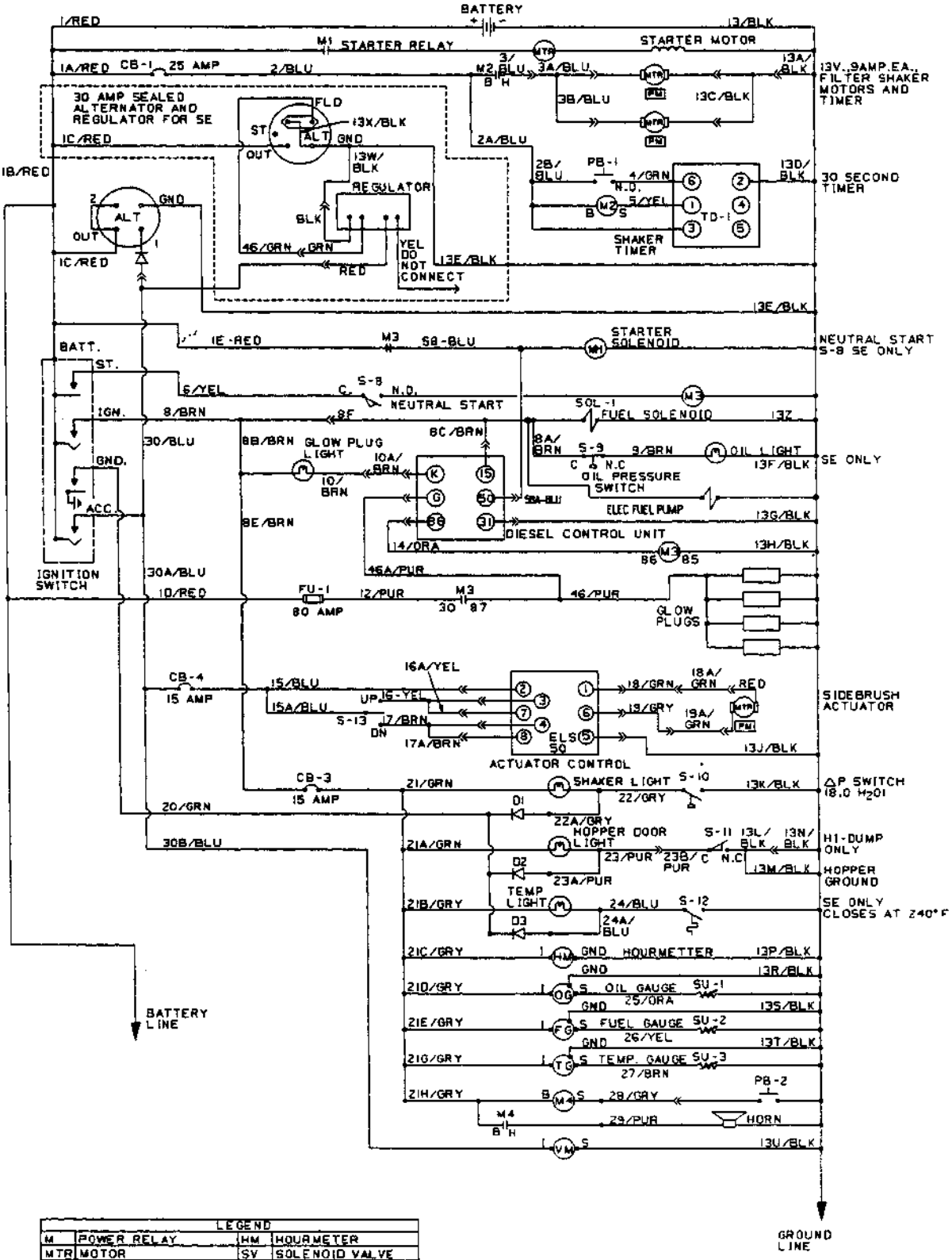
ELECTRICAL SCHEMATIC, PERKINS DIESEL
(For machines serial number 004576 and above)



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

01501

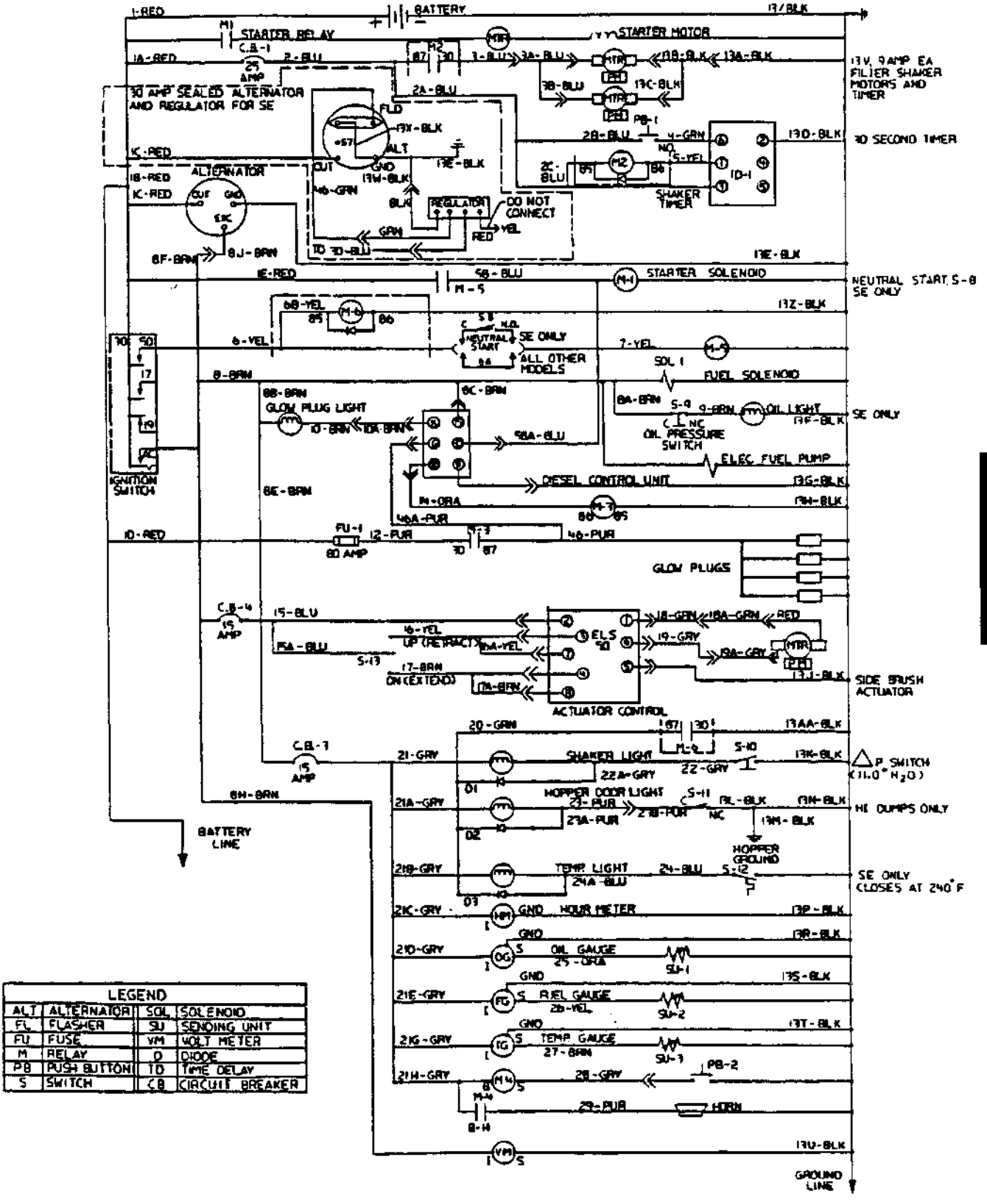
ELECTRICAL SCHEMATIC, CONTINENTAL DIESEL
(For machines below serial number 003040)



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

02680

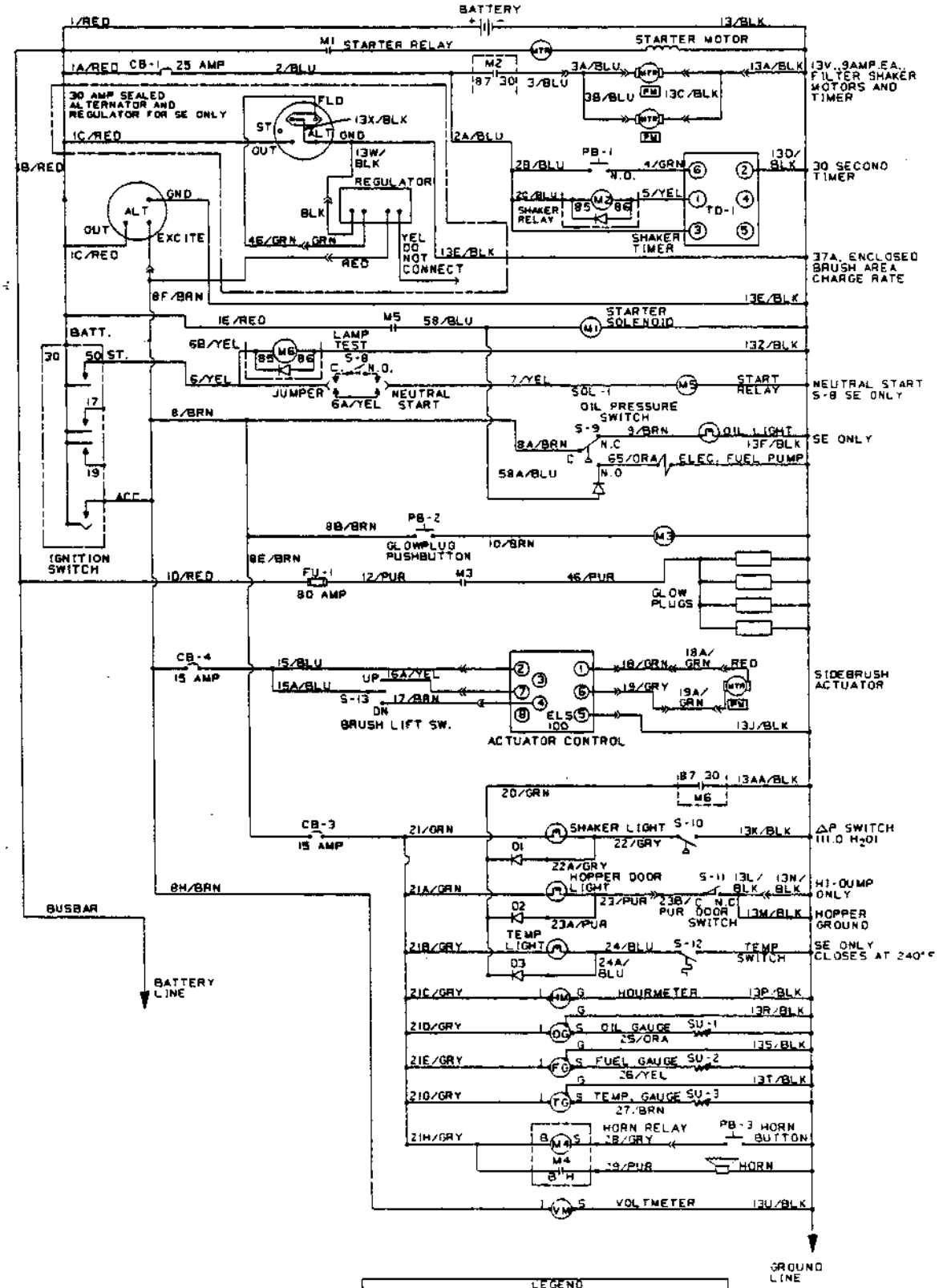
ELECTRICAL SCHEMATIC, CONTINENTAL DIESEL
(For machines serial number 003040 to 004575)



LEGEND			
ALT	ALTERNATOR	SOL	SOLENOID
FL	FLASHER	SU	SENDING UNIT
FU	FUSE	VM	VOLT METER
M	RELAY	D	DIODE
PB	PUSH BUTTON	TD	TIME DELAY
S	SWITCH	CB	CIRCUIT BREAKER

02680

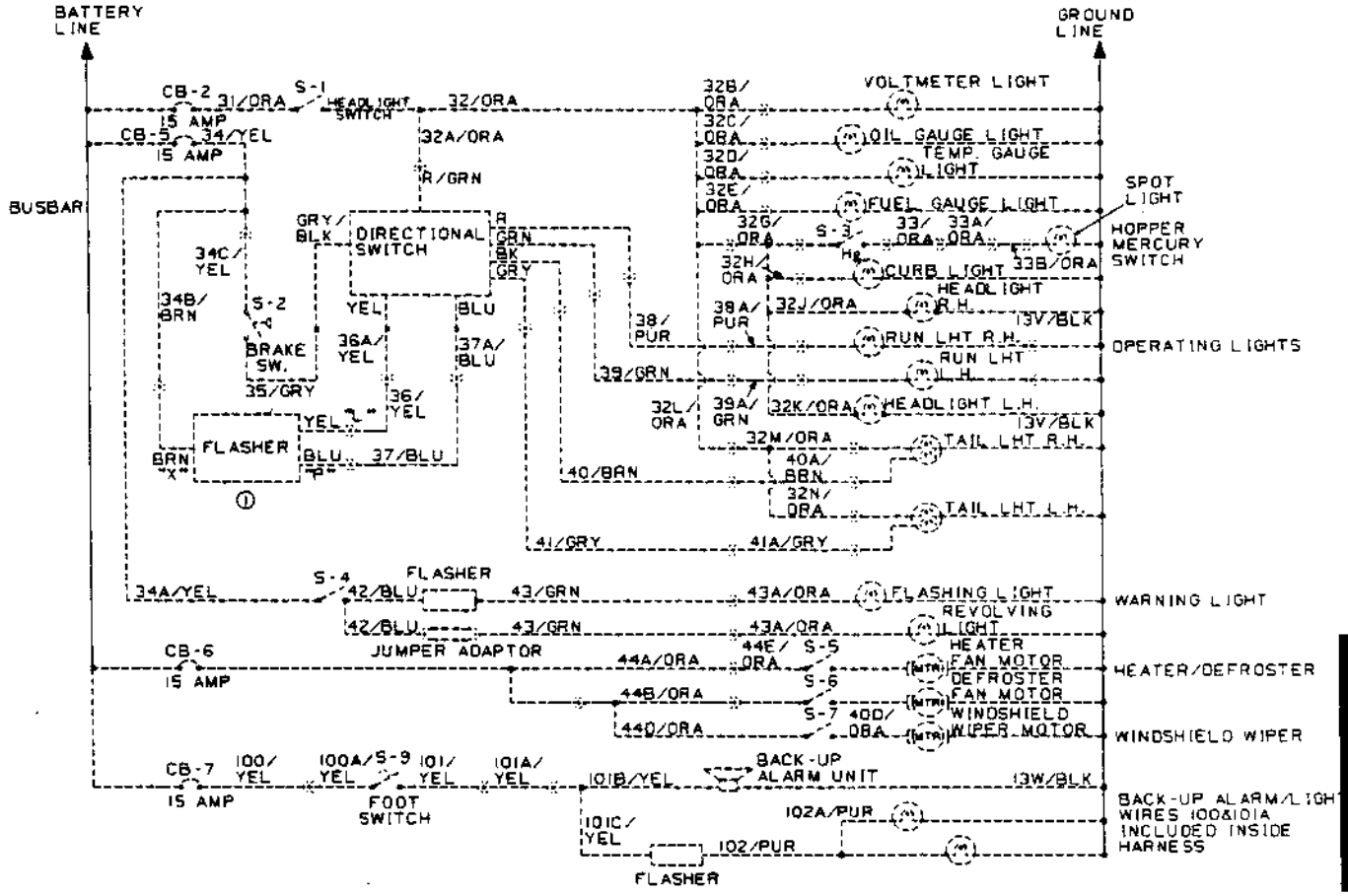
ELECTRICAL SCHEMATIC, CONTINENTAL DIESEL
(For machines serial number 004576 and above)



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

05526

ELECTRICAL SCHEMATIC, KUBOTA DIESEL



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

01502

ELECTRICAL SCHEMATIC, ACCESSORIES

BELTS AND CHAINS

ENGINE FAN BELT

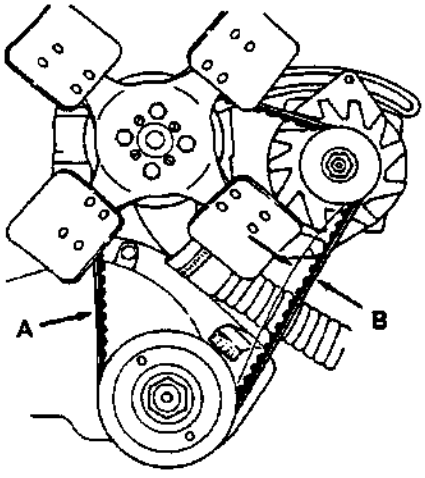
To tighten the fan belt, loosen the alternator adjusting bolts and pull out on the alternator by hand until the belt is just snug. Under no circumstances should a pry bar be used on the alternator to obtain fan belt tension, as damage to the bearings will result. Then tighten the alternator adjusting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

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

Continental gasoline and diesel powered machines: Proper belt tension is obtained when the belt deflects 0.5 in (13 mm) from a force of 10 to 12 lb (4.5 to 5.4 kg) applied at the midpoint of the longest span.

Perkins diesel powered machines: Proper belt tension is obtained when the belt deflects 0.38 in (10 mm) from a force of a thumb applied at the midpoint of the longest span.

Kubota diesel powered machines: Proper belt tension is obtained when the belt deflects 0.28 in (7 mm) from a force of a finger applied at the midpoint of the longest span.



00577

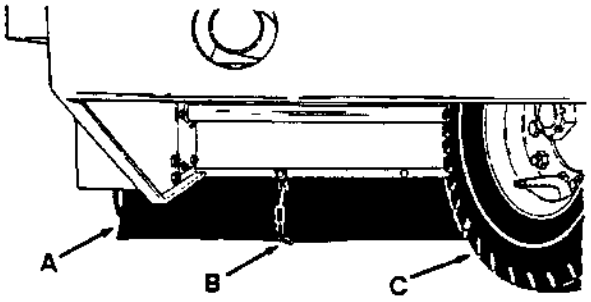
ENGINE FAN BELT

A. Fan Belt
B. Belt Deflection

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



01479

STATIC DRAG CHAIN

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

DEBRIS 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 100 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. This may be done with the dust filters in the machine.
- WATER – Soak the dust filter in a water and mild detergent solution. Rinse the dust filter until it is clean. The maximum water pressure allowable is 40 psi (275 kPa). Air dry the wet dust filter; do not use compressed air.

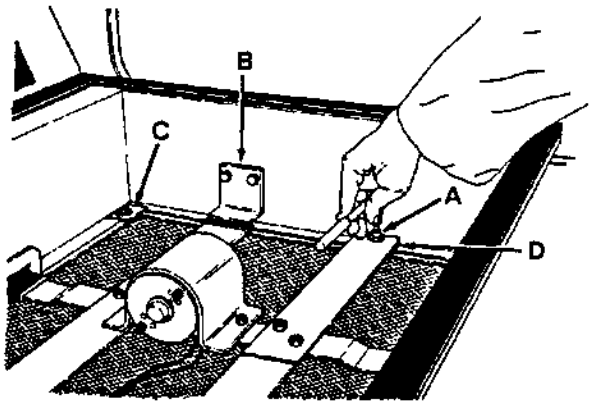
NOTE: Be sure the dust filters are dry before reinstalling them in the machine.

TO REMOVE HOPPER DUST FILTERS

1. Place the hopper in the "operating" position.
2. Stop the engine and set the machine parking brake.

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

3. Push the hopper cover latch release button and 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. Disconnect the shaker motor wire connectors.
7. Remove the two dust filter spring mounting bolts from each spring set with a 0.25 in allen wrench.

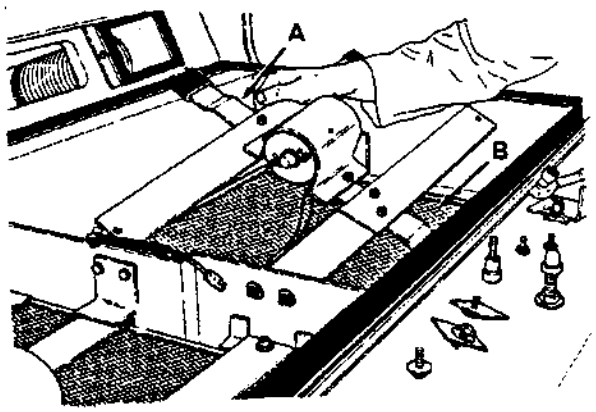


0148

REMOVING SPRING MOUNTING BOLTS

A. Spring Bolt
B. L Bracket
C. Retaining Tab
D. Shaker Shim

8. Remove the two dust filter retaining tabs on each dust filter.
9. Remove the two side L brackets.
10. Lift the dust filter shaker assembly off each of the dust filter elements.



01481

REMOVING DUST FILTER SHAKER ASSEMBLY

A. Dust Filter Shaker Assembly
B. Dust Filter Element

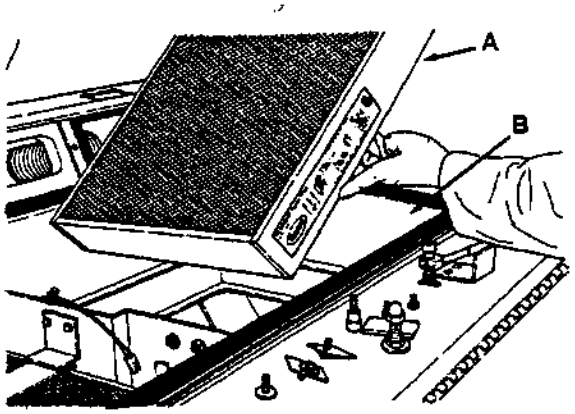
11. Lift the shaker shims off the filters and filter frames.

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

13. Clean or discard the dust filters as required.

TO INSTALL HOPPER DUST FILTERS

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



01482

INSTALLING DUST FILTER

A. Dust Filter
B. Dust Filter Frame

2. Place the four shaker shims in position.

3. Slide the dust filter shaking assemblies in position over the dust filters.

4. Thread the two allen head socket bolts through the mounting springs and into the dust filter frames of each filter. Tighten the bolts.

5. Replace the two side L brackets and four filter retaining tabs.

6. Reconnect the shaker motor wire connectors.

7. 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 inspection door.
On AA models, an additional fire door and fusible link are positioned between the hopper and the air assist motor assembly. It is also accessible through the hopper inspection door.

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

TO REPLACE HOPPER FUSIBLE LINK - LOW DUMP, MULTI-LEVEL DUMP, SE MODELS

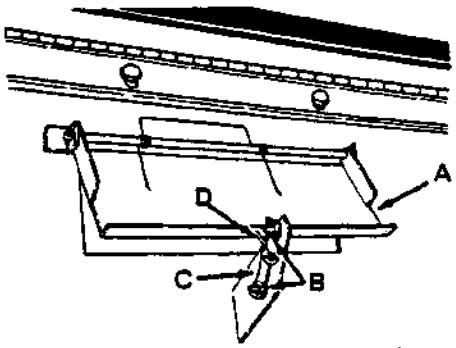
1. Stop the engine and set the machine parking brake.

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

2. Open the hopper inspection door.

3. Remove the existing pieces of fusible link and their retaining clips.

4. Slide a new fusible link over the link mounting pins.



01483

FUSIBLE LINK INSTALLATION

A. Fire Door
B. Retaining Clip
C. Fusible Link
D. Fire Door Hook

5. Push the link retaining clips onto the mounting pins.

6. Open the fire door.

7. Place the fire door hook over the middle of the fusible link.

8. Close the hopper inspection door.

TO REPLACE HOPPER FUSIBLE LINKS – AA MODEL

1. Place the hopper in the "operating" position.

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

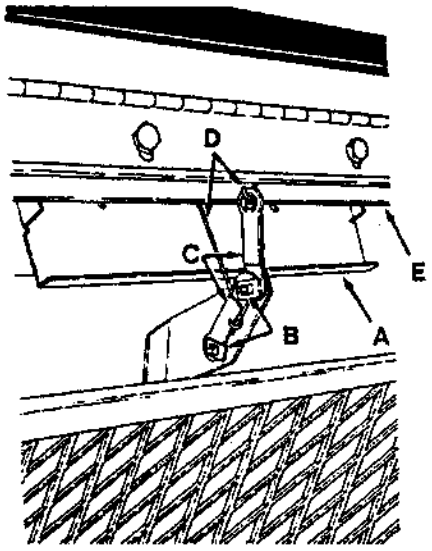
FOR SAFETY: Before leaving or servicing machine; stop on level surface, set parking brake, and turn off machine and remove key.

3. Open the hopper inspection door.

4. Remove the existing pieces of fusible links and their retaining clips.

5. Slide a new fusible link over the air assist fire door hook and the top link mounting pin.

6. Slide a new fusible link over the link mounting pins.



01484

FUSIBLE LINK INSTALLATION

A. Fire Door
B. Retaining Clip
C. Fusible Link
D. Fire Door Hook
E. Air Assist Fire Door

7. Push the link retaining clips onto the mounting pins.

8. Open the fire door.

9. Place the fire door hook over the middle of the fusible link.

10. Close the hopper inspection door.

DEBRIS HOPPER

The low dump model debris hopper has three adjustments. They are: front bumper alignment, hopper centering adjustment, and hopper floor clearance adjustment.

The multi-level dump, AA, and SE model debris hoppers have six adjustments. They are: front bumper alignment, hopper centering adjustment, dump height adjustment, dump door and switch adjustment, dump door stop bolts adjustment, and hopper floor clearance adjustment.

All of the adjustments have been made at the factory. Only the hopper floor clearance adjustment should be checked after every 50 hours of operation. In the event that the hopper, the hopper lift arms, or other integral hopper components are repaired or replaced, the hopper must be readjusted for best performance.

The hopper adjustments must be made in the order specified. After making these adjustments, check the side brush adjustments too.

TO ADJUST HOPPER

A. FRONT BUMPER ALIGNMENT – LOW DUMP, MULTI-LEVEL DUMP, AA, SE MODELS

1. Empty the debris hopper.

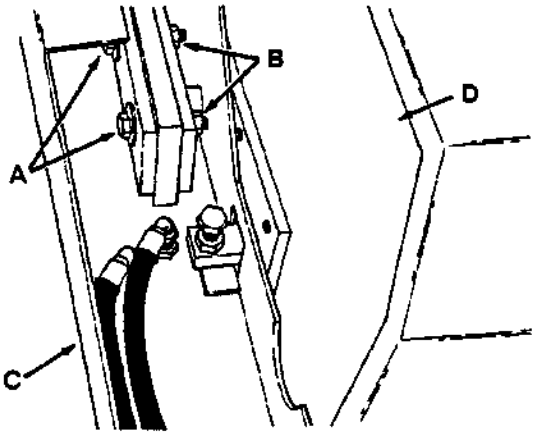
2. Place the hopper in the "operating" position.

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

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

4. Position a 24 in (610 mm) long straight edge with one-half of the straight edge on the top of the front bumper, and one-half on the machine side bumper. The bumpers should be level within 0.09 in (2 mm).

   To adjust the front bumper, loosen the alignment bolt jam nuts on the side which is most out of alignment. Rotate the alignment bolts until the bumper is level and tighten the jam nuts. Repeat the procedure on the other side if necessary.



01485

FRONT BUMPER ALIGNMENT BOLT

A. Alignment Bolt
B. Jam Nut
C. Front Bumper
D. Hopper

B. HOPPER CENTERING ADJUSTMENT – LOW DUMP, MULTI-LEVEL DUMP, AA, SE MODELS

Measure the distance between the right and left side of the hopper and the main frame. The distance measured should be equal within 0.2 in (5 mm).

To adjust the hopper position, raise the hopper and engage the hopper support bar.

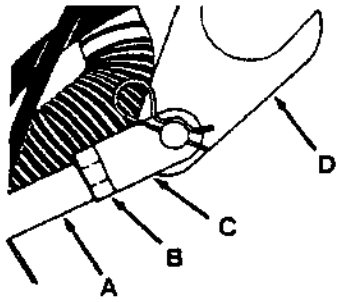
WARNING: Falling hopper. Engage hopper support bar before working under hopper.

Turn the set screw inside the hopper adjuster plate recess counterclockwise on the side with less space between the hopper and the frame. Turn the set screw on the other side clockwise to reduce the space between the hopper and the frame.

C. DUMP HEIGHT ADJUSTMENT – MULTI-LEVEL DUMP, AA, SE MODELS

Close the hopper dump door. Measure the distance between the floor and the lowest point on the hopper. It should be 60.5 in (1535 mm).

To adjust the dump height, loosen the lift cylinder clevis jam nut and turn it as far as it will go back towards the cylinder. Continue to rotate the nut to rotate the cylinder rod to adjust the dump height. Loosen the jam nut and retighten it against the cylinder clevis.



01508

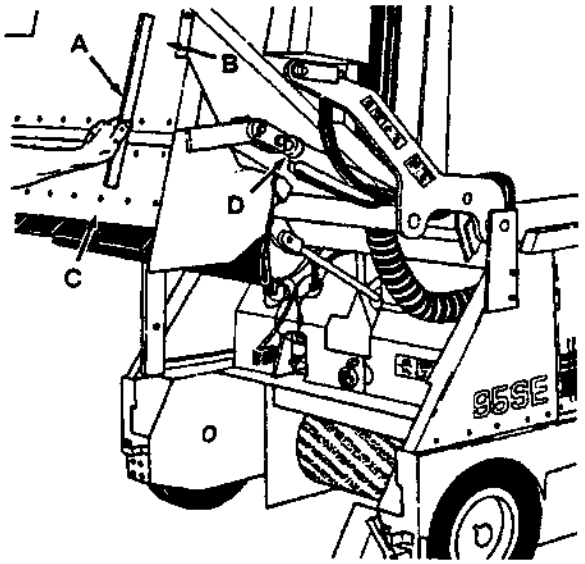
LIFT CYLINDER CLEVIS

A. Lift Cylinder Rod
B. Jam Nut
C. Clevis
D. Lift Arm

NOTE: Be sure to keep the clevis thread fully engaged to prevent clevis separation.

D. DUMP DOOR AND SWITCH ADJUSTMENT – MULTI-LEVEL DUMP, AA, SE MODELS

Open the dump door. Position a straight edge on the bottom of the hopper and the dump door. The dump door should be flat with respect to the bottom of the hopper.



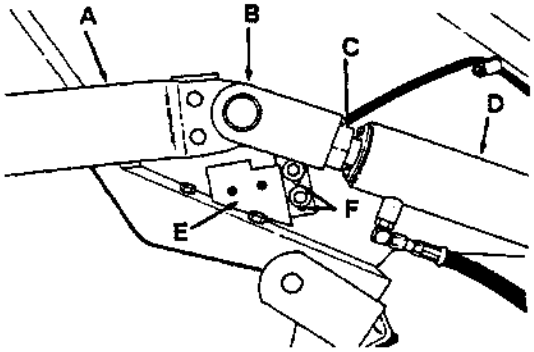
00179

CHECKING DUMP DOOR

A. Straight Edge
B. Hopper Bottom
C. Dump Door
D. Dump Cylinder

To adjust the dump door; loosen the dump cylinder clevis jam nuts and turn them as far as they will go back towards the cylinder. Rotate the cylinder rod in the clevis end to adjust the dump door open position. Tighten the jam nuts when the dump door base is flat with respect to the hopper bottom.

NOTE: Be sure to keep the clevis thread fully engaged.



01505

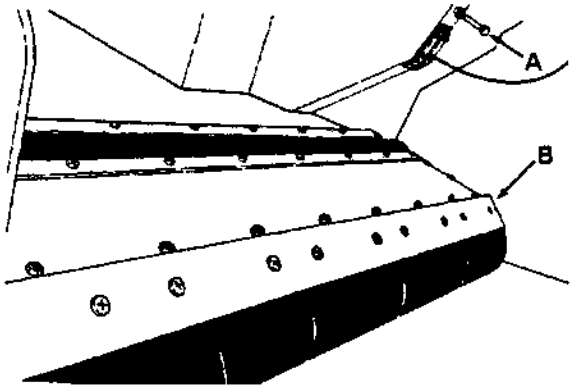
DUMP DOOR CYLINDER AND SWITCH

A. Dump Door Arm
B. Clevis
C. Jam Nut
D. Dump Door Cylinder
E. Switch Bracket
F. Adjustment Slot

Adjust the dump door switch by loosening the bolts, sliding the switch and bracket up or down, and tightening the bolts so that the switch contacts close when the dump door is fully open.

E. DUMP DOOR STOP BOLTS ADJUSTMENT – MULTI-LEVEL DUMP, AA, SE MODELS

Adjust the two dump door stop bolts so they are 3.1 in (80 mm) long. This will stop the door in the correct "closed" position.



01487

DUMP DOOR STOP BOLT

A. Stop Bolt
B. Dump Door

F. HOPPER FLOOR CLEARANCE ADJUSTMENT – LOW DUMP, MULTI-LEVEL DUMP, AA, SE MODELS

The hopper floor clearance should be checked after every 50 hours of operation. Proper floor clearance must be maintained to prevent the hopper from trailing debris.

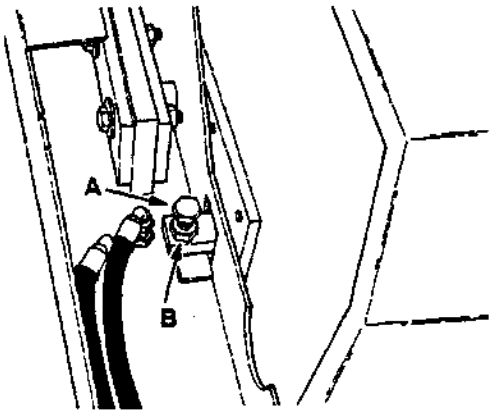
TO CHECK AND ADJUST HOPPER FLOOR CLEARANCE

1. Place the hopper in the "operating" position, stop the engine, and set the parking brake.

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

2. Slide a 1.5 in (40 mm) thick block under each side of the rear of the hopper. This is the amount of floor clearance needed by the hopper. If the hopper needs adjustment, continue.

3. Loosen the floor clearance bolt jam nut on each side of the hopper.



01485

FLOOR CLEARANCE ADJUSTMENT BOLT

A. Adjustment Bolt
B. Jam Nut

4. Thread the adjustment bolts in to increase the floor clearance or thread the adjustment bolts out to decrease floor clearance.

5. Tighten the jam nuts.

G. OTHER ADJUSTMENTS

After replacing an integral hopper component and making the previous adjustments, also readjust the side brush, the hopper dust dump door, and the hinged top hopper seal on multi-level dump, AA, and SE models.

STABILIZER LEG

The machine stabilizer leg is a safety device which, when the machine is being multi-level dumped, projects downward to act as an anti-tipping device. Check the stabilizer leg daily to be sure it is down when the machine is being multi-level dumped and is fully retracted when the hopper is in the "operating" position. Check for proper operation daily. Lubricate the leg pivot pin after every 200 hours of operation.

TO ADJUST STABILIZER LEG

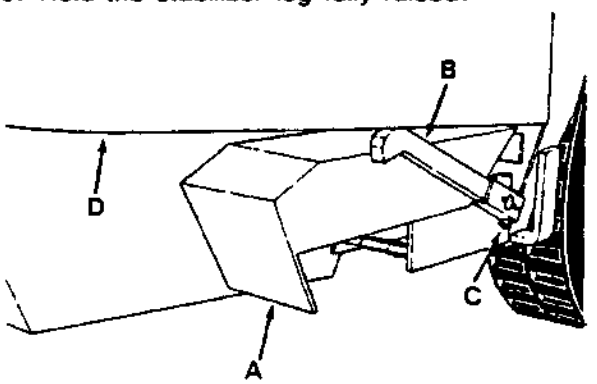
1. Place the hopper in the "operating" position.

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

3. Check to see if the front bumper is not resting on the stabilizer leg assembly. If it is, loosen the leg assembly mounting bolts, slide the assembly down, and retighten the bolts.

4. Loosen the activating arm pinch bolt.

5. Hold the stabilizer leg fully raised.



01440

STABILIZER LEG

A. Stabilizer Leg
B. Arm
C. Pinch Bolt
D. Bumper

6. Position the arm so it contacts the bottom of the front bumper and tighten the pinch bolt.

7. Start the engine and raise the hopper. Check to make sure the stabilizer leg is lowered.

8. Lower the hopper and check to make sure the leg is fully retracted and raised.

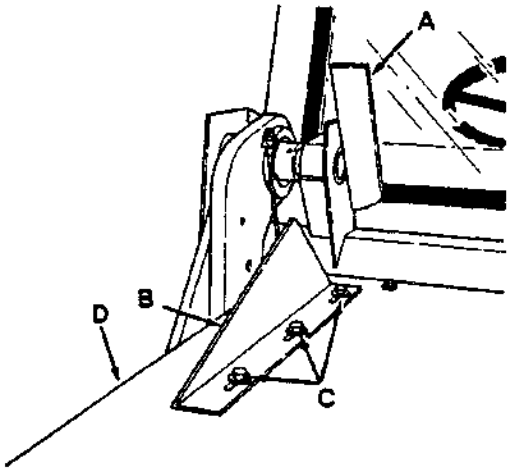
AIR ASSIST FAN MOTOR ADJUSTMENT – AA MODEL

When installing a new or rebuilt air assist fan motor, proper clearance must be maintained between the fan impeller and the transition. That clearance should be 0.06 to 0.18 in (2 to 5 mm). The clearance is varied by adding or deleting gaskets between the impeller housing and the motor assembly mounting plate. To break in a new or rebuilt motor, operate the engine at low speed to warm the hydraulic fluid to operating temperature, and slowly open the air assist control valve. Operate the motor at this slow speed for five minutes.

HOPPER COVER OVER-TRAVEL STOP – AA MODEL

The hopper cover over-travel stop is present only on AA models. It prevents the hopper cover from opening and striking the overhead guard or cab. The stop needs no regular maintenance. Adjust it only after readjusting the hopper or replacing the hopper cover.

To adjust the stop, loosen the three stop bolts so the stop will just slide. With the hopper cover latches latched, raise the hopper to its maximum "raised" position. Slide the stop so the stop clears the lift arm tower angle by 0.06 in (2 mm). Then tighten the three bolts. Lower and raise the hopper, and recheck the clearance.



015

HOPPER COVER OVER-TRAVEL STOP

A. Lift Arm Tower Angle
B. Over-Travel Stop
C. Stop Bolt
D. Hopper Cover

BRUSHES

MAIN BRUSH

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 (30 mm) in length.

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

TO REMOVE MAIN BRUSH

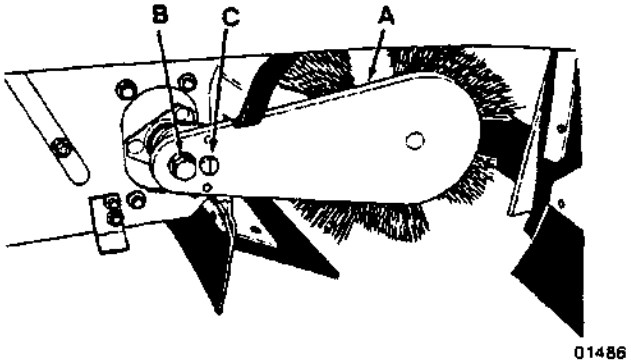
1. Stop the engine and set the machine parking brake.

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

2. Place the main brush position lever in the top (Main Brush Free Float) position.

3. Open the right side brush access door.

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



MAIN BRUSH IDLER ARM

A. Brush Idler Arm
B. Arm Retaining Bolt
C. Plastic Screw

5. 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.

6. 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.

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 *TO CHECK AND ADJUST MAIN BRUSH PATTERN*.

TO CHECK AND ADJUST MAIN BRUSH PATTERN

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

2. With the side brush and main brush in the raised, 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.

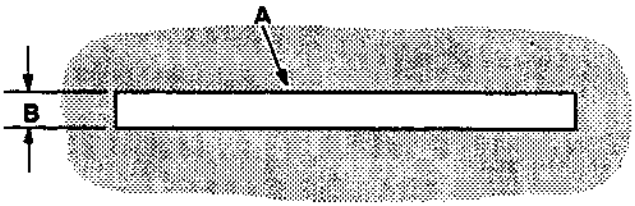
4. Lower the main brush to the floor for 15 to 20 seconds.

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.

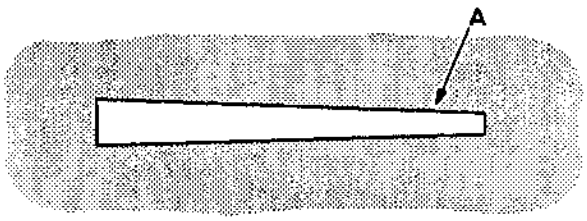
7. Observe the width of the brush pattern. The proper brush pattern width is 2 to 2.5 in (51 to 54 mm).



00582

NORMAL MAIN BRUSH PATTERN

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



00601

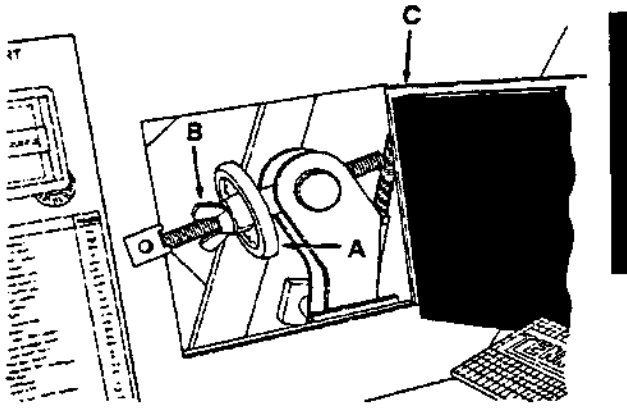
TAPERED MAIN BRUSH PATTERN

A. Main Brush Pattern

If the main brush pattern is tapered, loosen the left main brush cross shaft bearing mounting brackets and 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 main brush height adjustment knob counterclockwise 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.



01434

MAIN BRUSH HEIGHT ADJUSTMENT KNOB

A. Main Brush Height Adjustment Knob
B. Wing Nut
C. Knob Access Door

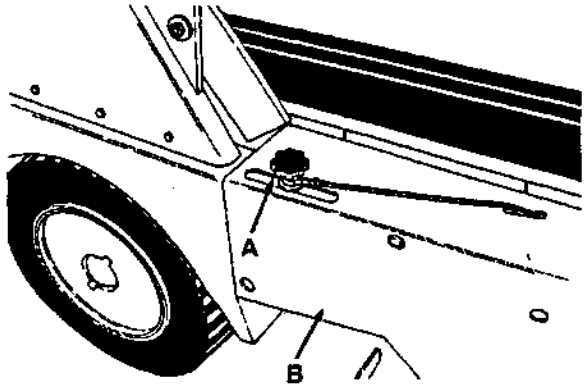
SIDE BRUSH

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 (65 mm) in length.

The side brush has four adjustments. The only adjustment which requires regular attention compensates for side brush wear. It is controlled by the side brush height adjustment knob and cable.

To adjust the lowered height, lower the side brush. Loosen the side brush knob. Slide it forward to lower the side brush, or slide it backward to raise the side brush. Tighten the knob after the desired height is reached.



01441

SIDE BRUSH HEIGHT ADJUSTMENT KNOB

A. Adjustment Knob
B. Side Brush Bumper

The other three adjustments are the maximum raised height adjustment, the side brush height angle adjustment, and the side brush bumper clearance adjustment. These adjustments should be done after replacing any major component of the side brush lift mechanism and after readjusting the hopper.

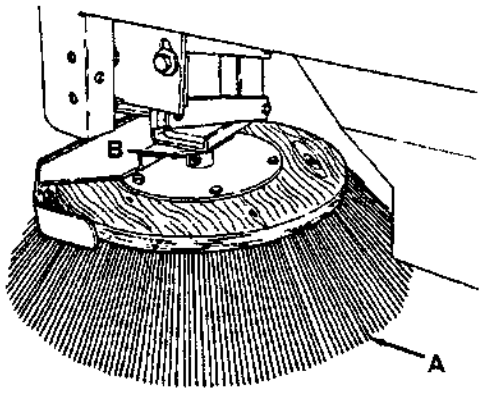
TO REMOVE SIDE BRUSH

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

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

2. Flip the side brush position switch toggle up to raise the side brush.

3. Remove the side brush retaining bolt and nut from the side brush hub and shaft.



01460

SIDE BRUSH

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 the 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 *TO ADJUST SIDE BRUSH MAXIMUM RAISED HEIGHT*.

TO ADJUST SIDE BRUSH MAXIMUM RAISED HEIGHT

1. Empty the hopper.

2. Park the machine on a level surface and set the parking brake.

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

3. Raise the hopper, engage the hopper support bar, and lower the hopper onto the support bar.

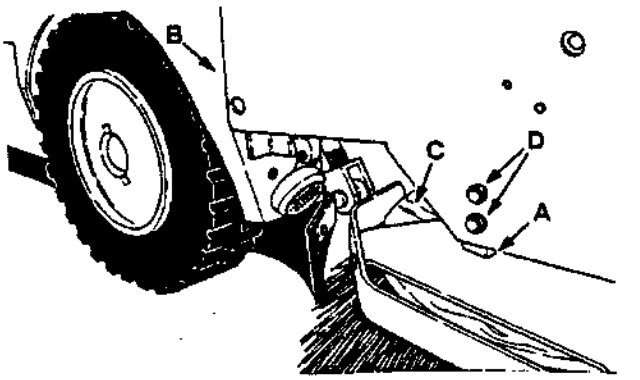
WARNING: Falling hopper. Engage hopper support bar before working under hopper.

4. Stop the engine.

5. Lower the side brush.

6. Loosen the side brush stop bolts.

7. Position the side brush stop down so the bottom of the side brush is 1 in (25 mm) from the floor when it is in the raised position. Tighten the stop bolts.



SIDE BRUSH STOP

A. Stop
B. Bumper
C. Side Brush Back
D. Stop Bolt

8. Check the side brush raised height.

9. Start the engine, raise the hopper, disengage the hopper support bar, and lower the hopper.

10. Stop the engine.

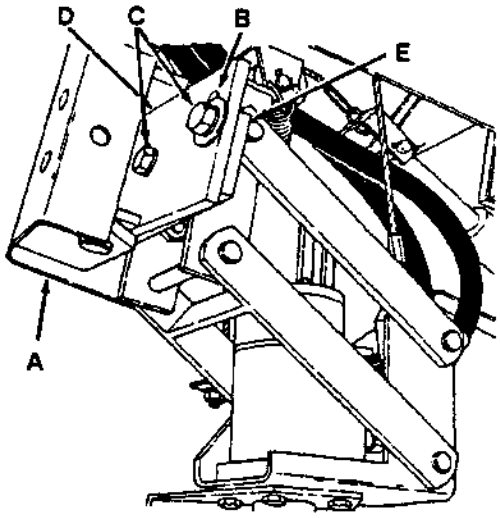
TO ADJUST SIDE BRUSH HEIGHT ANGLE

1. Raise the side brush.

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

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

3. Loosen the two side brush angle adjustment bolts.



SIDE BRUSH ANGLE ADJUSTMENT

A. Side Brush Bumper
B. Adjustment Slot
C. Angle Adjustment Bolt
D. Side Edge of Side Brush Pivot
E. Side Edge of Side Brush Suspension Bracket

4. Line up the side edges of the side brush pivot and the side brush suspension bracket to set the side brush angle at 5°.

NOTE: The side brush normally operates at a 5° angle. The angle may be changed to a different angle if the application requires.

5. Tighten the two side brush angle adjustment bolts.

TO ADJUST SIDE BRUSH BUMPER CLEARANCE

1. Empty the hopper.

2. Park the machine on a level surface and set the parking brake.

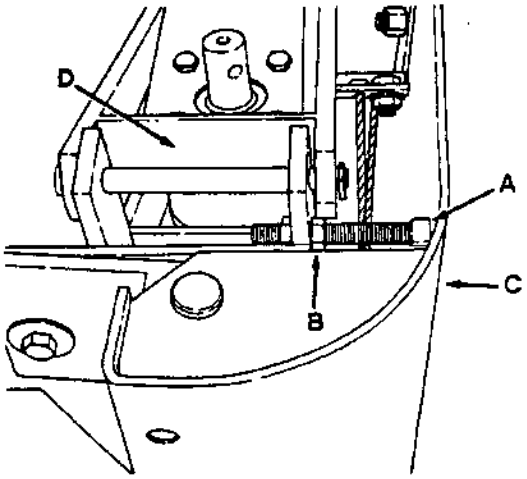
FOR SAFETY: Before leaving or servicing machine; stop on level surface and set parking brake.

3. Raise the hopper, engage the hopper support bar, and lower the hopper onto the support bar.

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

4. Stop the engine.

5. Loosen the bumper clearance bolt jam nut and adjust the bolt so there is 2.45 in (60 mm) clearance between the bumper and the side brush assembly. Tighten the jam nut.



01507

SIDE BRUSH BUMPER CLEARANCE BOLT

A. Clearance Bolt
B. Jam Nut
C. Bumper
D. Side Brush Assembly

6. Start the engine, raise the hopper, disengage the hopper support bar, and lower the hopper.

7. Stop the engine.

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.

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

TO REPLACE HOPPER LIP

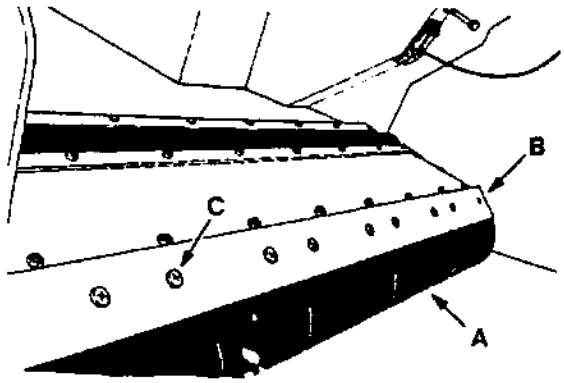
1. Empty the machine debris hopper.
2. Park the machine on a level surface and set the machine parking brake.

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

3. Raise the hopper, engage the hopper support bar, and lower the hopper onto the hopper support bar.

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

4. Stop the engine.
5. Remove the hopper lip retaining strip retaining bolts.
6. Remove the hopper lip retaining strip and worn or damaged hopper lip segments.



01487

HOPPER LIP SKIRT

A. Hopper Lip Skirts
B. Retaining Strip
C. Retaining Bolts

7. Thread the retaining strip mounting bolts through the retaining strip, the hopper lip segments, and into the hopper.
8. Snug the mounting bolts.
9. Start the engine. Raise the hopper, lower the hopper support bar, and lower the hopper.
10. Stop the engine.

HOPPER SIDE SEALS

There are two seals, located on the machine frame, that serve as hopper seals. They are the left and right hopper side seals. The seals should be inspected for wear or damage after every 100 hours of operation.

TO REPLACE HOPPER SIDE SEALS

1. Empty the machine debris hopper.
2. Park the machine on a level surface and set the machine parking brake.

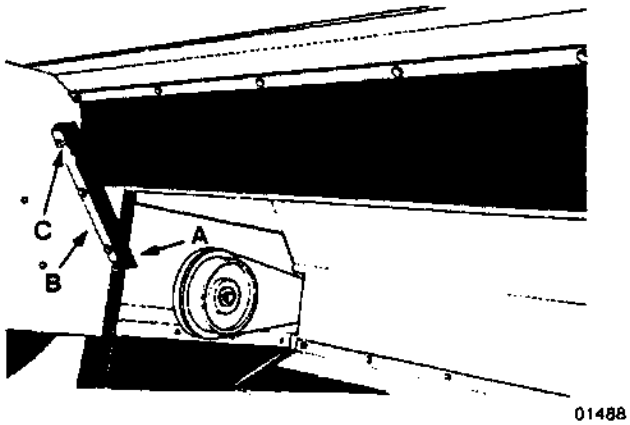
FOR SAFETY: Before leaving or servicing machine; stop on level surface and set parking brake.

3. Raise the hopper, engage the hopper support bar, and lower the hopper onto the hopper support bar.

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

4. Stop the engine.

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



HOPPER SIDE SEALS

A. Hopper Side Seal
B. Seal Retaining Strip
C. Retaining Bolt

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. Raise the hopper, lower the hopper support bar, and lower the hopper.

11. Stop the engine.

BRUSH DOOR SKIRTS

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

TO REPLACE AND ADJUST BRUSH DOOR SKIRTS

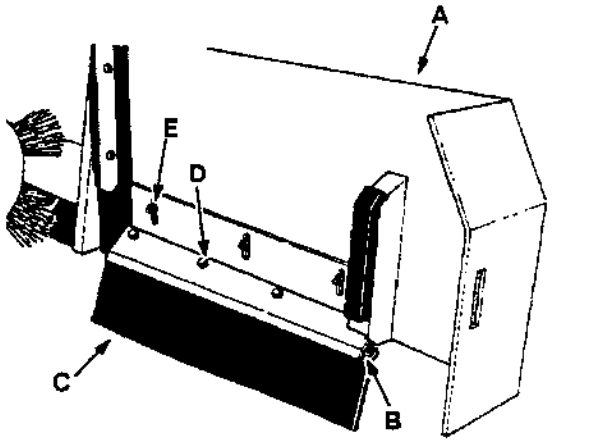
1. Park the machine on a smooth, level surface.

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

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

3. Open the brush door.

4. Remove the brush door skirt retaining bolts.



BRUSH DOOR SKIRT

A. Brush Door
B. Skirt Retaining Strip
C. Brush Door Skirt
D. Retaining Bolt
E. Height Adjustment Bolt

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.

8. Tighten the skirt retaining bolts.

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

9. Loosen the side brush skirt height adjustment bolts.

10. 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).

11. Tighten the side brush skirt height adjustment bolts.

12. Close the brush door.

REAR SKIRTS

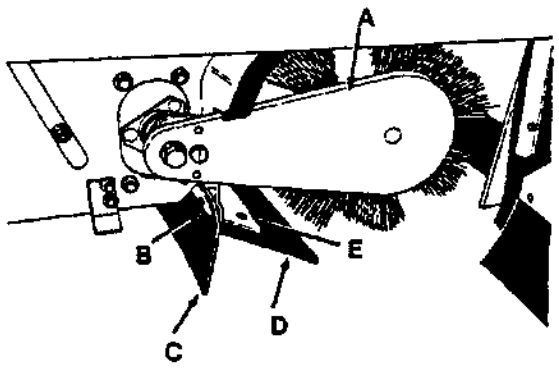
The rear skirts are located on the bottom rear of the brush compartment. These skirts seal the brush compartment. The seals should be inspected for wear or damage daily.

TO REPLACE AND ADJUST REAR SKIRTS

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

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

3. Open the two brush compartment doors.
4. Remove the main brush as described in *TO REMOVE MAIN BRUSH*.
5. Remove the front skirt mounting bracket retaining bolts.
6. Remove the skirt mounting bracket, the rear floor skirt, and the brush contact skirt.



01486

REAR SKIRTS

A. Brush Idler Arm
B. Skirt Retaining Strip
C. Rear Floor Skirt
D. Brush Contact Skirt
E. Skirt Mounting Bracket

7. Remove the brush contact skirt from the skirt mounting bracket.
8. Mount a new brush contact skirt to the skirt mounting bracket.
9. Position a new floor skirt, floor skirt retaining strip, and the brush contact skirt and mounting bracket on the machine.
10. Thread the skirt mounting bracket retaining bolts through the skirts mounting bracket, the floor contact skirt, the floor contact retaining strip and into the nuts.
11. 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).
12. Tighten the retaining bolts.
13. Install the brush as described in *TO INSTALL MAIN BRUSH*.

HOPPER DUST DUMP DOOR SEAL

The hopper dust dump door seal seals the rear opening of the filter cavity. The door opens when the hopper is dumped to allow dust shaken out of the dust filters to exit the filter cavity. The door is made up of a seal and an actuating lever assembly. Check the seal for wear, damage, and adjustment after every 100 hours of operation.

TO REPLACE DUST DUMP DOOR SEAL

1. Empty the hopper.
2. Park the machine on a level surface and set the machine parking brake.

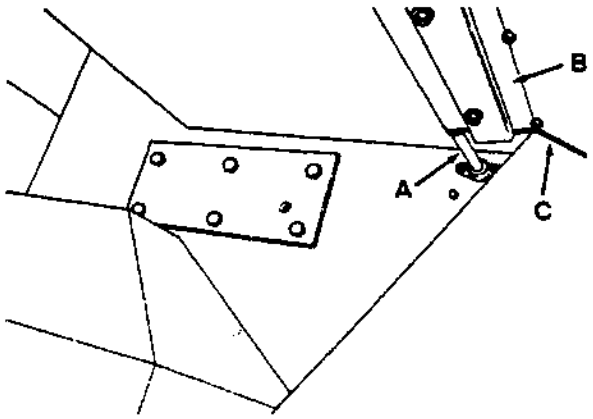
FOR SAFETY: Before leaving or servicing machine; stop on level surface and set parking brake.

3. Raise the hopper, engage the hopper support support bar, and lower the hopper onto the support bar.

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

4. Stop the engine.

5. Unbolt the seal and seal backing plate from the cross shaft.



01506

HOPPER DUST DUMP DOOR SEAL

A. Cross Shaft
B. Seal Backing Plate
C. Seal

6. Remove the seal from the seal backing plate.

7. Install a new seal on the backing plate.

8. Bolt the seal and backing plate to the cross shaft.

9. Check the seal adjustment as described in *TO CHECK AND ADJUST HOPPER DUST DUMP DOOR SEAL.*

TO CHECK AND ADJUST HOPPER DUST DUMP DOOR SEAL

1. Empty the hopper.

2. Park the machine on a level surface and set the machine parking brake.

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

3. Raise the hopper, engage the hopper support bar, and lower the hopper onto the support bar.

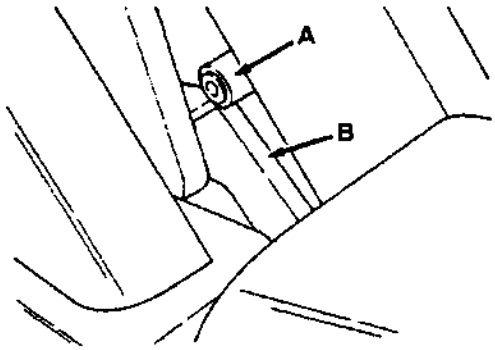
WARNING: Falling hopper. Engage hopper support bar before working under hopper.

4. Stop the engine.

5. Check the seal for wear or damage, replace if necessary.

6. Start the engine, raise the hopper, and disengage the hopper support bar.

7. Have an assistant watch the dust dump door cam follower as the hopper lowers. The cam should contact the upper corner and ride on top of the main frame and close the dust dump door.



01509

CAM FOLLOWER

A. Cam Follower
B. Main Frame

To adjust the cam position, loosen the cam arm stop bolt, adjust the position and retighten. Use care when making adjustments. If the cam strikes the main frame at too low an angle, it may be damaged. If the cam strikes the main frame at too high an angle, the dust dump door will not close fully.

TOP HOPPER SEAL – LOW DUMP MODEL

The low dump model top hopper seal is located on the top edge of the main brush opening. It seals the top rear edge of the hopper. The seal should be inspected for wear or damage after every 100 hours of operation.

TO REPLACE TOP HOPPER SEAL

1. Empty the machine debris hopper.

2. Park the machine on a level surface and set the machine parking brake.

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

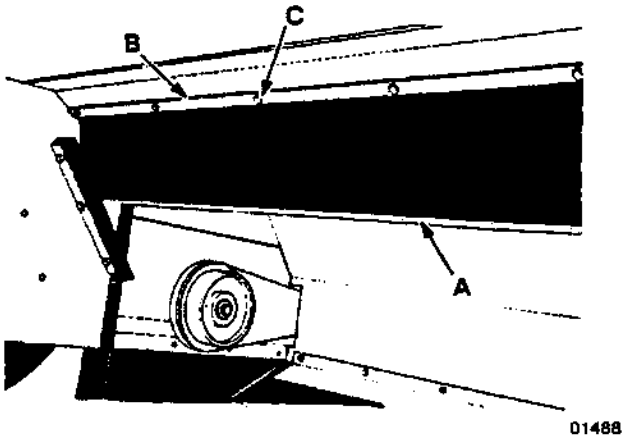
3. Raise the hopper, engage the hopper support bar, and lower the hopper onto the hopper support bar.

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

4. Stop the engine.

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

6. Remove the hopper top seal retaining strip and hopper top seal.



TOP HOPPER SEAL

A. Top Hopper Seal
B. Seal Retaining Strip
C. Retaining Bolt

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. Raise the hopper, lower the hopper support bar, and lower the hopper.

10. Stop the engine.

HINGED TOP HOPPER SEAL – MULTI-LEVEL DUMP, AA, SE MODELS

The hinged top hopper seal is located on the top of the rear hopper opening. It keeps debris in the hopper while the hopper is being raised before the hopper dump door is opened. The seal should be inspected for wear or damage after every 100 hours of operation.

TO REPLACE AND ADJUST HINGED TOP HOPPER SEAL

1. Empty the hopper.

2. Park the machine on a level surface and set the parking brake.

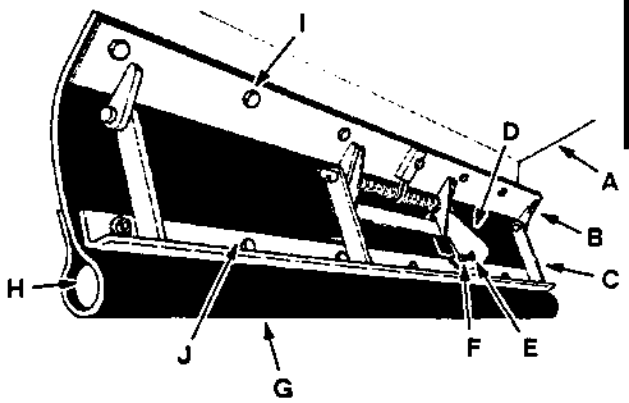
FOR SAFETY: Before leaving or servicing machine; stop on level surface and set parking brake.

3. Raise the hopper, engage the hopper support bar, and lower the hopper onto the hopper support bar.

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

4. Stop the engine.

5. Remove the stationary hinge bracket mounting bolts to remove the hinged top seal assembly.



HINGED TOP HOPPER SEAL

A. Hopper
B. Stationary Hinge Bracket
C. Movable Hinge Bracket
D. Shell Cam
E. Adjustment Bolt
F. Jam Nut
G. Top Hopper Seal
H. Sponge Core
I. Stationary Hinge Bracket Mounting Bolt
J. Movable Hinge Bracket Mounting Bolt

6. Remove the movable hinge bracket bolts to remove the top seal.

7. Mount the new top seal with the sponge core on the movable hinge bracket.

8. Mount the new top seal and stationary hinge bracket to the hopper.

9. Start the engine, raise the hopper, disengage the hopper support bar, and lower the hopper.

10. Open the right brush door.

11. Remove the main brush as described in *TO REMOVE MAIN BRUSH*.

12. Looking through the right brush door opening, check to make sure approximately three-fourths of the top seal is making contact with the machine frame. If three-fourths of the seal is not making contact, raise the hopper, engage the hopper support bar, loosen the shell cam jam nut, and turn the adjustment bolt counterclockwise to increase the amount of contact or clockwise to decrease the amount of contact.

NOTE: If too much of the top hopper seal contacts the machine frame, the hopper may not be able to seat in the "operating" position, causing poor debris pickup.

Tighten the jam nut, raise the hopper, disengage the hopper support bar, lower the hopper and recheck the seal contact. Repeat the procedure as necessary.

HOPPER DOOR HINGE SEAL - MULTI-LEVEL DUMP, AA, SE MODELS

The multi-level dump hopper door hinge seal seals the area between the hopper door and the hopper. Check the seal for wear or damage after every 100 hours of operation.

TO REPLACE HOPPER DOOR HINGE SEAL

1. Empty the hopper.

2. Park the machine on a level surface and set the parking brake.

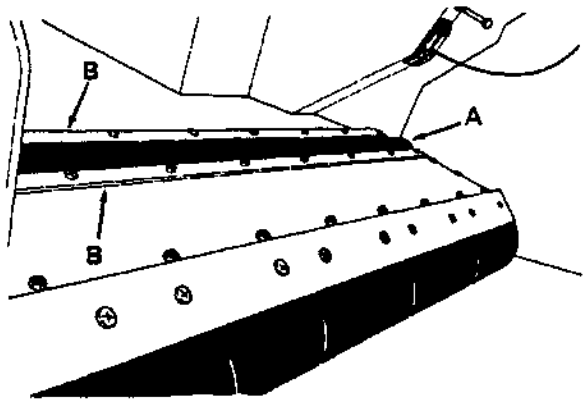
FOR SAFETY: Before leaving or servicing machine; stop on level surface and set parking brake.

3. Raise the hopper, engage the hopper support bar, and lower the hopper onto the hopper support bar.

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

4. Stop the engine.

5. Remove the two seal retainers and the old hinge seal.



01487

HOPPER DOOR HINGE SEAL

A. Hinge Seal
B. Seal Retainer

6. Position the new seal between the hopper door and the hopper.

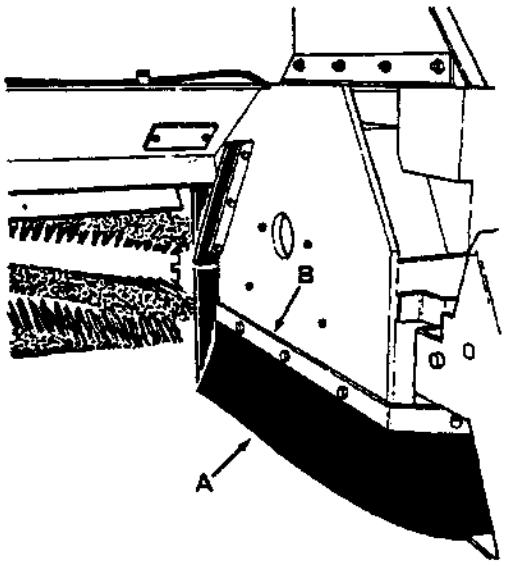
7. Secure the seal with the seal retainers and hardware.

8. Start the engine, raise the hopper, disengage the hopper support bar, and lower the hopper.

9. Stop the engine.

DEBRIS DEFLECTOR SKIRTS - AA MODEL

The debris deflector skirts are present on AA models and are available as an accessory on other models. The debris deflector skirts deflect light debris out of the way of the front tires into the path of the main brush. Check the debris deflector skirts for wear or damage daily.



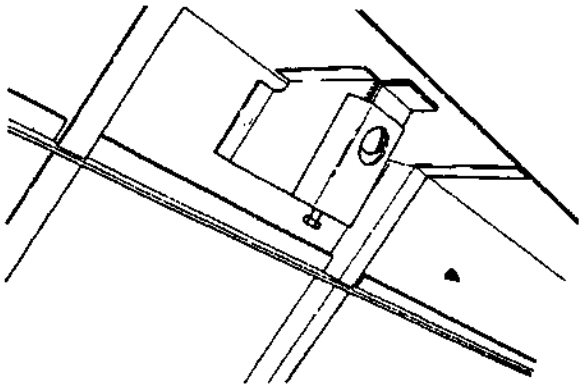
LEFT SIDE DEBRIS DEFLECTOR

A. Debris Deflector Skirt
B. Skirt Retainer

LATCHES

HOPPER COVER LATCH

The hopper cover latch should be lubricated with a dry lubricant after every 200 hours of operation. If the hopper cover does not close easily, or if the latch components are replaced, adjust the latch as described.



01458

HOPPER COVER LATCH

TO ADJUST HOPPER COVER LATCH

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

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

2. Push the hopper cover latch release button and lift the hopper cover.

3. Dislodge the hopper cover prop arm from its storage and position it in the hopper cover prop arm receptacle.

4. Lower the hopper cover onto the prop arm.

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

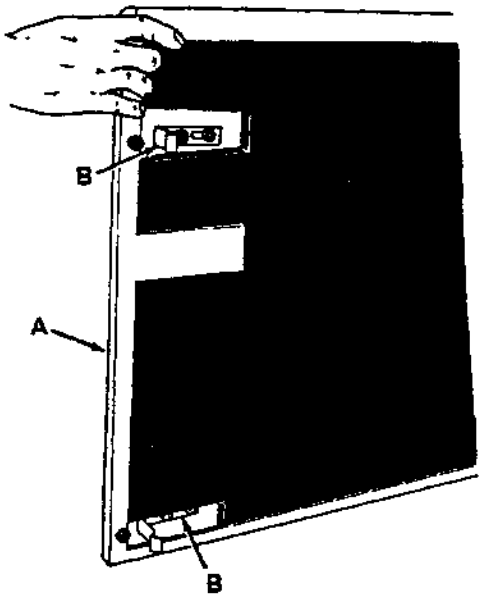
5. Loosen the latch stud jam nut.

6. Thread the stud out of the hopper if the latch does not latch. Thread the stud into the hopper if the latch catches but is loose.

7. Tighten the jam nut and check the latch tightness. Readjust if necessary.

SIDE DOOR LATCHES

The side door latches need no regular maintenance. They should be adjusted whenever the door does not latch properly. Loosen the latch nuts, slide the latch in or out to adjust, and tighten the latch nuts.



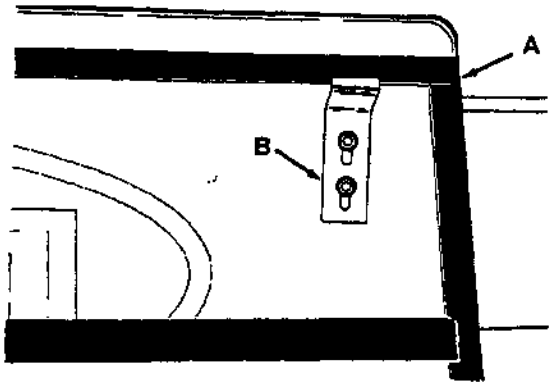
01492

SIDE DOOR LATCHES

A. Side Door
B. Latch

HOPPER INSPECTION DOOR LATCH

The hopper inspection door latches need no regular maintenance. They should be adjusted whenever the door does not latch properly. Loosen the latch nuts, slide the latch up or down to adjust, and tighten the latch nuts.



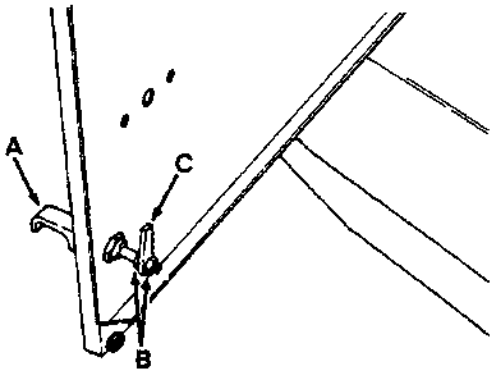
01493

HOPPER INSPECTION DOOR LATCH

A. Hopper Inspection Door
B. Latch

REAR ACCESS DOOR LATCH

The rear access door latch needs no regular maintenance. It should be adjusted whenever the door does not latch properly. Loosen the latch nuts, thread them in or out to move the latch tongue, and tighten the latch nuts.



01494

REAR ACCESS DOOR LATCH

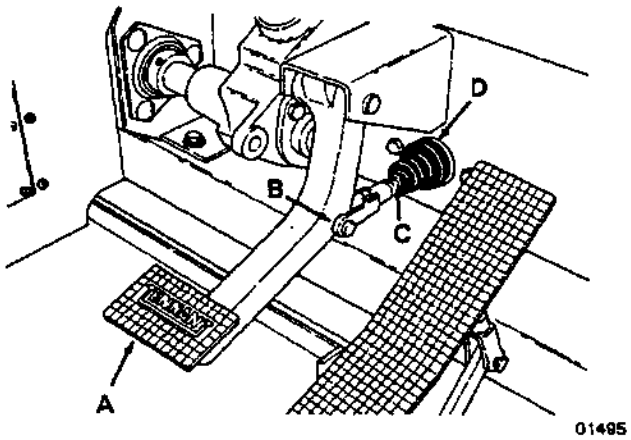
A. Latch
B. Nuts
C. Latch Tongue

BRAKES AND TIRES

SERVICE BRAKES

The service brakes are hydraulically activated by a master brake cylinder. Check the master brake cylinder fluid level after every 400 hours of operation and add brake fluid as needed. The master brake cylinder is located at the front of the machine, behind the hopper.

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



BRAKE PEDAL

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

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

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

1. Make sure that the brake fluid reservoir is full and that the vent in the cap is open.

2. Connect a plastic or rubber tube to the bleeder valve on the left front wheel. Suspend the other end of the tube in a jar or bottle filled with a few inches of brake fluid. During the remaining steps, keep this end submerged at all times and never let the level in the brake fluid reservoir drop below one half full.

3. Open the bleeder valve on the left front wheel about one turn. Have an assistant press the brake pedal slowly to the floor. As soon as the pedal is all the way down, close the bleeder valve and let the pedal up. Repeat this step as many times as necessary, until fluid, free of air bubbles, exits from the tube.

4. Bleed the right front wheel in the same manner as described in the steps above. Keep checking the brake fluid reservoir to be sure it doesn't run out of fluid.

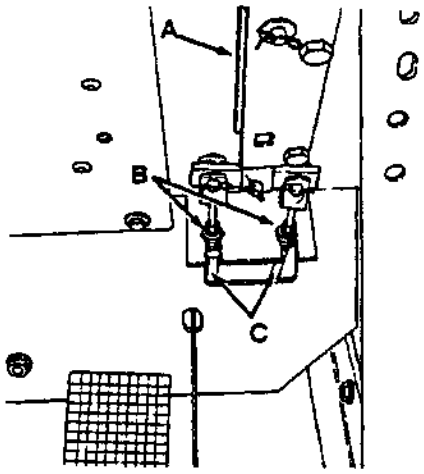
5. When all wheels are bled, discard the brake fluid in the jar or bottle; never reuse such fluid.

6. Top up the brake fluid reservoir with clean fluid.

PARKING BRAKES

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

The parking brakes should be adjusted whenever the machine rolls after engaging the parking brake, or when it becomes very easy to engage the parking brake, and after every 50 hours of operation. The parking brake may be routinely tightened by turning the knurled knob on the end of the parking brake clockwise. If the knob adjustment is inadequate, fully loosen the knob, loosen the brake cable mounting nuts, thread the lower nuts closer to the end of the cable, and retighten the top nuts. Be sure to thread the nuts out the same number of turns. Adjust the parking brake enough to make the parking brake slightly resist being engaged.



01496

PARKING BRAKE

A. Parking Brake
B. Cable Nut
C. Brake Cable

TIRES

The front machine tires are solid and require no regular maintenance.

The standard rear machine tire on the low dump model is pneumatic. The proper tire pressure is 50 to 55 psi (345 to 380 kPa). Observe the tire daily to see if it appears to be low. Check the tire air pressure after every 50 hours of operation.

An optional Super Rib pneumatic tire is available. The proper tire air pressure is 50 to 55 psi (345 to 380 kPa). Check the tire air pressure after every 50 hours of operation.

An optional foam-filled or a solid rear tire is also available. No regular maintenance is required on either of these tires.

The rear machine tire on multi-level dump, AA, and SE models is solid and requires no regular maintenance.

ACCESSORIES

AIR FILTER ACCESSORY

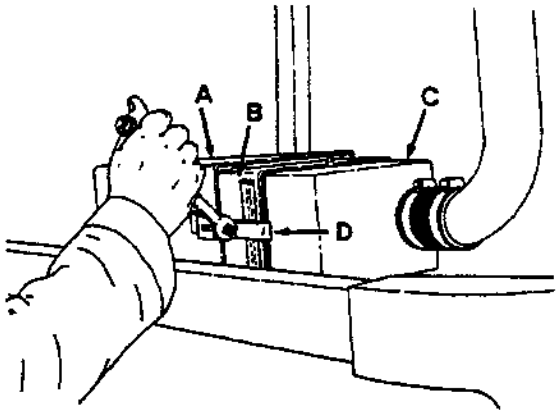
An air filter accessory is available on low dump, multi-level dump, and AA models. It is standard on the SE model. It is a heavy duty dry cartridge-type filter. The air filter element must be replaced whenever the red indicator of the air filter restriction indicator locks in the visible position.

TO REPLACE AIR FILTER ELEMENT

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

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

2. Loosen the air filter clamp nuts.



01468

DISASSEMBLING AIR FILTER

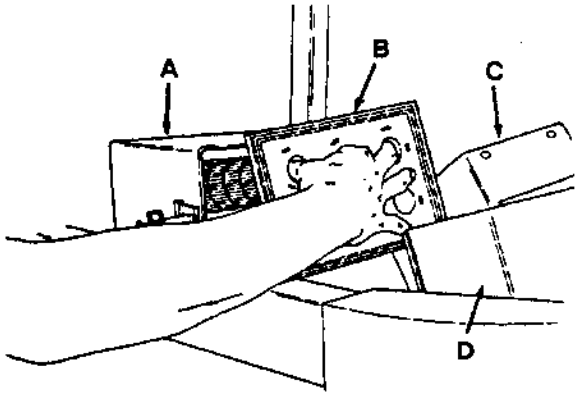
A. Air Filter Housing
B. Pre-Cleaner
C. Pre-Cleaner Cover
D. Air Filter Clamp

3. Remove the two air filter clamps and swing the pre-cleaner cover out of the way.

4. Remove the pre-cleaner.

5. Slide the air filter element out of the filter housing.

6. Slide a new filter element into the filter housing, rounded end first.



01469

INSTALLING AIR FILTER ELEMENT

A. Filter Housing
B. Air Filter Element
C. Pre-cleaner
D. Pre-Cleaner Cover

7. Position the pre-cleaner on the filter housing.

8. Position the pre-cleaner cover on the pre-cleaner with the air filter clamps.

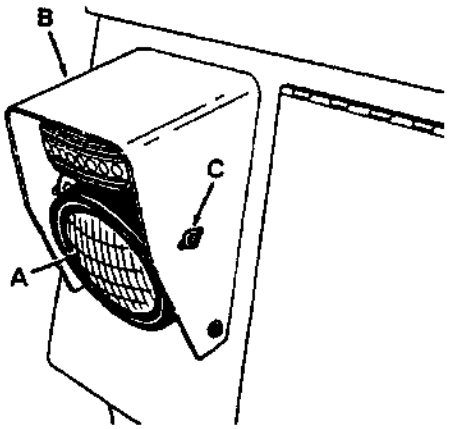
9. Tighten the air filter clamp nuts to 75 in lb (8 Nm).

OPERATING LIGHTS ACCESSORY

The operating lights accessory includes headlights, taillights, turn signal lights, side brush spotlight and on multi-level dump, AA, and SE models, a dumpster spotlight.

HEADLIGHT

The headlight mounting brackets have an adjustment screw and slot to allow the headlight beam to be directed closer or further away from the front of the machine. Loosen the adjustment screws, reposition the headlight, and retighten the screws to adjust the head light beam.



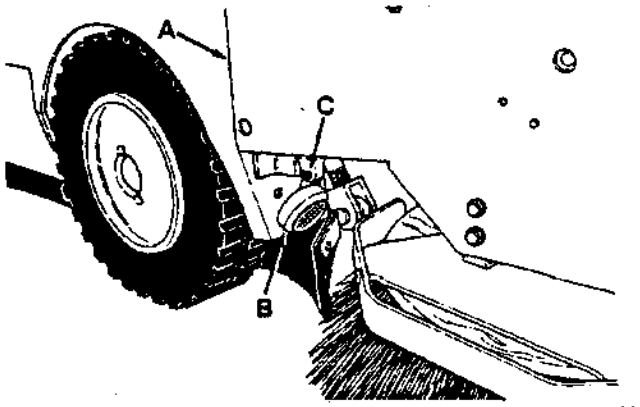
01497

HEADLIGHT

A. Headlight
B. Headlight Mounting Bracket
C. Adjustment Screw and Slot

SIDE BRUSH SPOTLIGHT

The side brush spotlight may be adjusted by loosening the angle adjustment nut or by loosening the mounting bolt. Retighten the bolts after adjusting the spotlight.



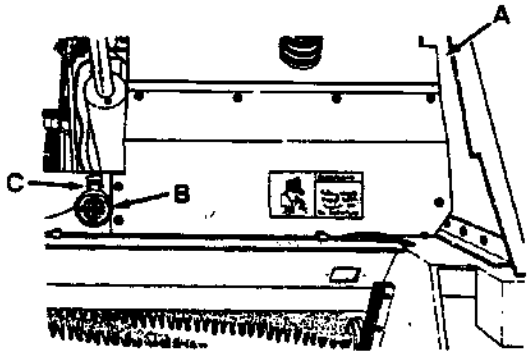
01498

SIDE BRUSH SPOTLIGHT

A. Side Brush Bumper
B. Spotlight
C. Angle Adjustment Nut

DUMPSTER SPOTLIGHT

On multi-level dump, AA, and SE models, the dumpster spotlight may be adjusted by loosening the angle adjustment nut. Retighten the nut after adjusting the spotlight.

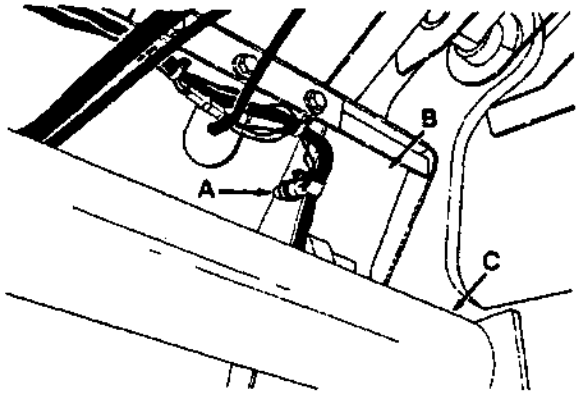


01462

DUMPSTER SPOTLIGHT

A. Lintel
B. Spotlight
C. Adjustment Nut

The dumpster spotlight is turned on and off by a mercury switch located at the top rear of the hopper. The mercury switch should be adjusted so that when the hopper is in the operating position the spotlight is off, and when the hopper is raised the spotlight is on.



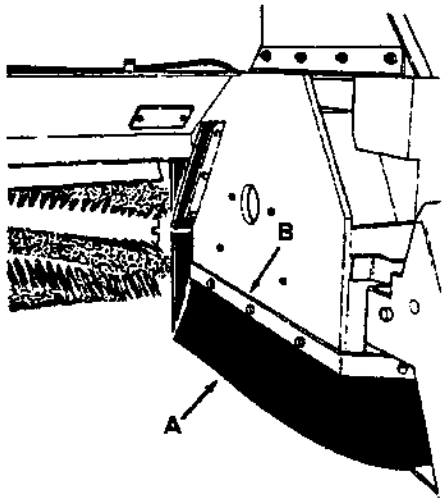
01500

SPOTLIGHT MERCURY SWITCH

A. Mercury Switch
B. Hopper
C. Lift Arm Tube

DEBRIS DEFLECTOR ACCESSORY

The debris deflector accessory is available on low dump, multi-level dump, and SE models. It is standard on the AA model. It consists of two skirts which deflect light debris out of the way of the front tires into the path of the main brush. Check the debris deflector skirts for wear or damage daily.



01491

LEFT SIDE DEBRIS DEFLECTOR

A. Debris Deflector Skirt
B. Skirt Retainer

SIDE BRUSH DUST CONTROL ACCESSORY

The side brush dust control accessory helps control side brush dust in extremely dusty conditions. The accessory consists of a number of skirts which are positioned along the outside of the hopper and totally enclose the side brush. Check all of the skirts for wear or damage daily.

SECTION 4

CONTENTS

HARDWARE INFORMATION

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

STANDARD BOLT TORQUE CHART

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

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

METRIC BOLT TORQUE CHART

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

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

Exceptions to the above chart:

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

Brake unit to hub sockethead screw - 9 to 12 ft lb (12 to 16 Nm) with Locktite 242 blue.

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

Damper solenoid nut - 20 to 23 in lb (2.5 to 3 Nm).

Pitman arm to steering column nut - 160 ft lb (215 Nm).

Propelling motor shaft thin nylon lock nut - 7 to 10 ft lb (9 to 14 Nm).

Propelling motor adapter bolts - 16 to 21 ft lb (21 to 28 Nm) with Locktite 242 blue on threads. Use Locktite 515 sealant on the pilot fillet of the motor and the adapter.

BOLT IDENTIFICATION

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

01395

THREAD SEALANT AND LOCKING COMPOUNDS

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

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

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

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

HYDRAULIC FITTING INFORMATION

HYDRAULIC TAPERED PIPE FITTING (NPT) TORQUE CHART

NOTE: Ratings listed are when using teflon thread seal.

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

HYDRAULIC TAPERED SEAT FITTING (JIC) TORQUE CHART

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

HYDRAULIC O-RING FITTING TORQUE CHART

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

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

*Aluminum bodied components