



527 II

Operator Manual

MM152
Rev. 07 (3-88)



This manual is furnished with each new TENNANT® Model 527 Series-2. It provides necessary operating and preventive maintenance instructions. Read this manual completely and understand the machine before operating or servicing it.

This manual covers all machine variations and standard accessories. The tabbed instruction portion of the manual consists of the Specification, Operation, Maintenance, and Appendix sections. The tabbed parts portion consists of the Standard Model Parts; LPG Parts; Diesel Parts; SRS® Model Parts; Accessories; Miscellaneous Components; Hydraulic Components; Engine Parts, Gasoline, LPG; Engine Parts, Diesel; Cross Reference; and Customer Documents sections.

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

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

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

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

MACHINE DATA	
<i>Please fill out at time of installation.</i>	
Machine Serial Number –	_____
Engine Serial Number –	_____
Sales Representative –	_____
Customer Number –	_____
Date of Installation –	_____
Manual Number –	MM152
Revision:	07
Published:	3-88

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INSTALLATION REPORT

MODEL 527 SERIES-2

NOTE: This report must be completed, signed and returned.

customer

date installed

address

machine serial
number

city

state

engine model
and serial number

telephone number

Tennant Company
Representative

OPERATION OF CONTROLS

- BRAKE PEDAL, PARKING BRAKE
- DIRECTIONAL CONTROL PEDAL
- SCRUB HEAD LOCK LEVER
- ENGINE CONTROLS/GAUGES
- SCRUB CONTROL LEVERS
- SOLUTION FLOW CONTROL LEVER

MACHINE OPERATION

- OPERATION MANUAL
- SAFETY PRECAUTIONS
- SELECTING DETERGENTS
- STARTING ENGINE
- SOLUTION APPLICATION
- SQUEEGEE APPLICATION
- TYPICAL SCRUBBING PROCEDURES
- DRAINING RECOVERY TANK
- EMPTYING DEBRIS HOPPER
- FUEL TANK

MAINTENANCE/SERVICING

- MAINTENANCE CHART
- HYDRAULIC RESERVOIR
- HYDRAULIC FILTER
- HYDRAULIC FLUID
- ENGINE OIL DIPSTICK
- ENGINE OIL FILTER
- ENGINE AIR FILTER
- ENGINE TUNE-UP
- ENGINE RADIATOR
- ENGINE GOVERNOR
- BELTS
- SCRUB BRUSH REPLACEMENT
- SQUEEGEE REPLACEMENT
- CLEANING RECOVERY TANK
- VACUUM HOSES
- MASTER BRAKE CYLINDER
- PARKING BRAKE

ORDERING REPLACEMENT PARTS

TENNANT COMPANY WARRANTY

SERVICE

PLANNED MAINTENANCE AGREEMENT

TED PROGRAM

I have checked the equipment and acknowledge that I have been instructed by a Tennant Company Representative and understand and will comply with all of the procedures and safety measures checked above.

customer signature


title


date

COMMENTS:


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.


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


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


 **WARNING:** Do not operate the machine until you have read and understood the operating instructions and are properly trained. Failure to do so could result in severe personal injury.


 **WARNING:** Before operating the machine, make sure all safety devices are in place and operating properly. Check the foot and parking brakes and the steering control for proper operation. Do not start machine unless you are in operator's seat, with a foot on the brake pedal, or have the parking brake engaged and the directional pedal in the "neutral" position. Failure to do so could result in severe personal injury.

 **WARNING:** Always travel slowly on grades to prevent machine instability. Do not exceed maximum rated ramp climb and descent angles.


 **WARNING:** Avoid moving parts of the unit. Do not wear loose jackets, shirts or sleeves when working on machine because of the danger of becoming caught in moving parts. Keep shields and guards in position. If adjustments must be made while the unit is running, use extreme caution around hot manifolds, moving parts, belts, etc.


 **WARNING:** Always park on a level surface, stop the engine, and engage the parking brake before working on the machine to keep it from rolling.


 **WARNING:** Use care when driving on wet surfaces to avoid loss of machine control. Moisture on surfaces may make them unpredictable.


 **WARNING:** Excessive noise may be generated by the machine when it is operated in certain confined or noisy areas or in certain conditions of disrepair. Hearing protection should be worn under such conditions to avoid hearing loss.


 **CAUTION:** Wear gloves to protect your hands when replacing brushes.


 **WARNING:** Do not operate machine in flammable or explosive environment. Machine is not designed for such an environment. It could cause ignition of flammable or explosive materials.


 **WARNING:** Do not operate machine in areas with possible falling objects unless machine is equipped with overhead guard.

 **WARNING:** Always follow safety and traffic rules of the area in which the machine is being operated to prevent serious injury.

 **WARNING:** Do not carry riders on machine. Machine is designed to carry one operator; riders could fall off and become seriously injured.

 **WARNING:** Machine should not creep when the directional control pedal is in the "neutral" position. Adjust control pedal linkage to stop machine creeping.

 **WARNING:** Use care when backing machine to prevent hitting and injuring persons behind machine.

 **WARNING:** Keep cigarettes, sparks, and open flame away from lead acid batteries. Batteries emit a highly explosive hydrogen gas that can be ignited by fire or electrical arcing.

! WARNING: Provide adequate ventilation to properly expel engine exhaust gases. Improper or inadequate ventilation will cause asphyxiation.

! WARNING: Do not fill the fuel tank while the engine is operating. Always be sure the fuel container and the machine are electrically connected before pouring fuel. Failure to electrically connect the fuel container to the machine may allow a static electricity spark to ignite the fuel, resulting in a fire or explosion.

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

! WARNING: If the engine coolant is hot or if the engine has been operating, let the coolant cool before removing radiator cap. Hot coolant could scald or cause severe burns. If in doubt, let the engine cool before releasing pressure in the cooling system.

! WARNING: If an LPG fuel leak is found, close the service valve immediately and notify the appropriate personnel to avoid fire or explosion.

! CAUTION: Always wear gloves when disconnecting the tank coupling to prevent escaping LPG fuel from freezing hands.

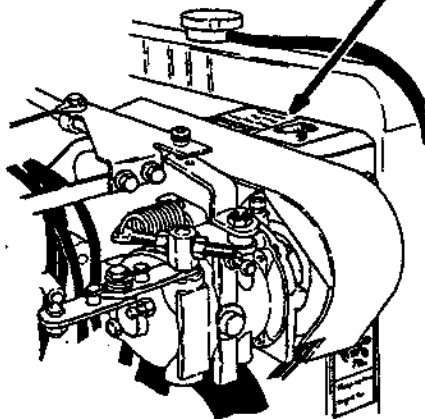
! WARNING: Do not use flammable or combustible cleaning agents when scrubbing to prevent fire or explosion and serious injury.

! WARNING: Keep hands and clothing away from powerful vacuum fan suction or fan intake.

! WARNING: Always engage the scrub head lock and block the scrub head up securely before working under it. Do not rely on the hydraulic cylinder to keep the scrub head up. The hydraulic system may leak internally, allowing the scrub head to lower and crush anything under it.

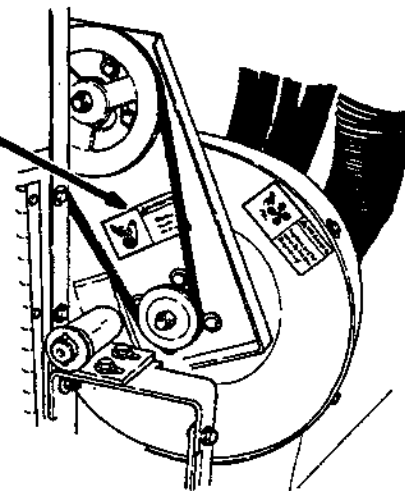
! CAUTION: Keep hands and feet away when lowering or raising the scrub head or the rear squeegee to prevent injury.

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



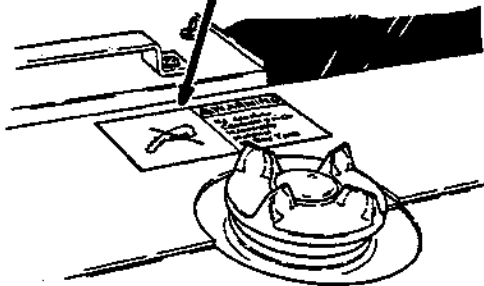
FAN BELT DECAL - LOCATED ON ENGINE FAN SHROUD.

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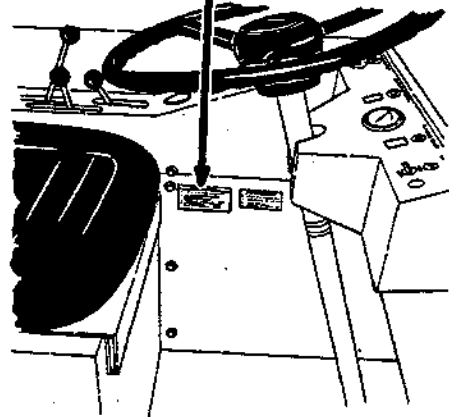


FAN BELT DECAL - LOCATED ON VACUUM FAN BELT GUARD.

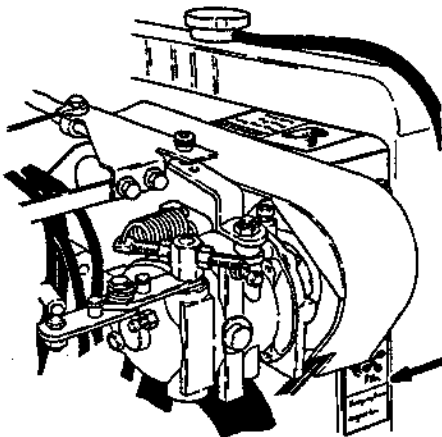
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02415
**SRS® MACHINES ONLY - CLEANING SOLUTION
 TANK DECAL - LOCATED NEXT TO CLEANING
 SOLUTION TANK CAP.**




02413
**SAFETY DECAL - LOCATED ON LEFT SIDE
 PANEL OF OPERATOR COMPARTMENT.**

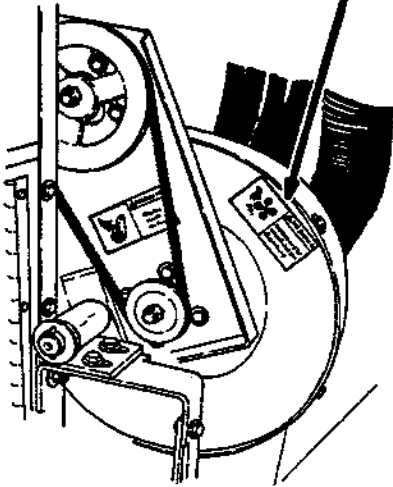


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**ENGINE FAN DECAL - LOCATED ON RADIATOR
 FAN SHROUD.**

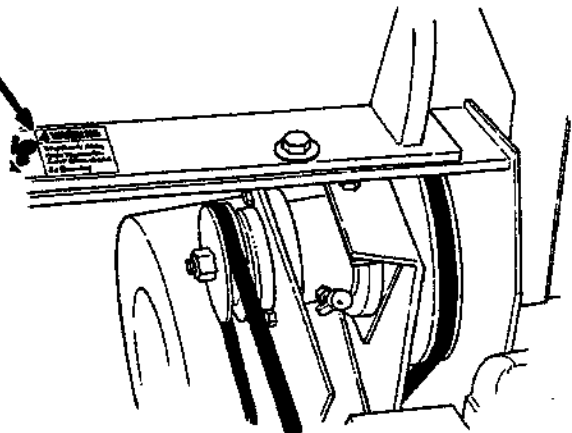




⚠ WARNING
Keep Hands Away
From Vacuum Fan
Inlet When Engine
Is Running.



VACUUM FAN SUCTION DECAL - LOCATED ON
VACUUM FAN HOUSING. 02414



VACUUM FAN SUCTION DECAL - LOCATED ON
MACHINE LINTEL. 02427

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MACHINE SPECIFICATIONS

POWER TYPE

Engine type - piston
Ignition - breaker-type spark
Cycle - 4
Aspiration - natural
Cylinders - 4
Bore - 3.19 in (81 mm)
Stroke - 3.06 in (78 mm)
Displacement - 98 cu in (1600 cc)
Net power - 35 hp (26 kw) @ 2400 rpm governed
Net power - 47.5 hp (35 kw) @ 3600 rpm maximum
Fuel - gasoline, 91 RON octane minimum, unleaded or LPG
Cooling system - water/ethylene glycol antifreeze
Electrical system - 12 V nominal, 37 A alternator

Engine 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) @ 2300 rpm governed
Net power - 43 hp (32 kw) @ 3000 rpm maximum
Fuels - #1 or #2 diesel fuel
Cooling system - water
Electrical system - 12 V nominal, 42 A alternator

POWER TRAIN

Propelling - hydraulic drive motors (2)
Scrub brush - hydraulic drive motors (2)
Vacuum fan - belt driven

STEERING

Type - front wheel controlled, worm and sector gear
Power source - manual

HYDRAULIC SYSTEM

Function - operates propelling, scrub head lift, squeegee lift, scrub brush drive.

Control valve, scrub head lift, scrub brush drive - open center type, two spool.

Control valve, squeegee lift - open center type, single spool, solenoid operated.

Pump, propelling - variable displacement piston type, 1.24 cu in (20 cc) maximum displacement per revolution, 11.4 gpm (43 L/min) @ 2400 rpm.

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

Pump accessories - gear type, 0.84 cu in (14 cc) displacement, 10.3 gpm (39 L/min) @ 2400 rpm.

Accessories system relief pressure - 2200 psi (15,170 kPa).

Motor, propelling - internal gear type, 6.2 cu in (100 cc) displacement per revolution, 4500 psi (31,028 kPa) maximum rated pressure.

Motor, scrub brush - internal gear type, 4.5 cu in (75 cc) displacement per revolution, 2500 psi (17,240 kPa) maximum rated pressure.

Cylinder, scrub head lift - single action type, 2 in (50 mm) bore x 9 in (230 mm) stroke, 1 in (25 mm) diameter rod, 2500 psi (17,240 kPa) maximum rated.

Cylinder, squeegee lift - single action type, 2 in (50 mm) bore x 9 in (230 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 each rear wheel, master cylinder foot brake actuated.

Parking brake - utilizes service brakes, cable actuated.

SUSPENSION SYSTEM

Front - one 12 in (305 mm) x 4 in (100 mm) solid tire

Rear - two 12 in (305 mm) x 4.5 in (115 mm) solid tires

SYSTEM FLUID CAPACITIES

Engine cooling system - radiator 4 qt (3.8 L)
Engine cooling system - total system 6.5 qt (6 L)

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

Fuel tank - 8 gal (30 L), gasoline
Fuel tank - 33 lb (15 kg), LPG

Hydraulic system - reservoir 5.5 gal (21 L)
Hydraulic system - total system 7 gal (26 L)

Standard solution tank - 65 gal (245 L)

Standard recovery tank - 68 gal (260 L)

SRS solution tank - 122 gal (465 L)

SRS cleaning solution tank - 4.9 gal (18.5 L)

GENERAL MACHINE DIMENSIONS/CAPACITIES

Length - 108.5 in (2755 mm)

Width - 51.5 in (1310 mm)

Height - 54.0 in (1370 mm)

Height - 84 in (2135 mm) with overhead guard
91.2 in (2315 mm) with overhead guard
and warning lamp

Track - 40.5 in (1030 mm)

Wheelbase - 36.75 in (925 mm)

Scrub brush - diameter 11 in (280 mm)

Scrub brush - length 43 in (1090 mm)

Rear squeegee width - 45 in (115 mm)

Debris hopper capacity - 1.5 cu ft (43 L)

MACHINE WEIGHTS

Net GVWR - 4500 lb (2040 kg)

GENERAL MACHINE PERFORMANCE

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

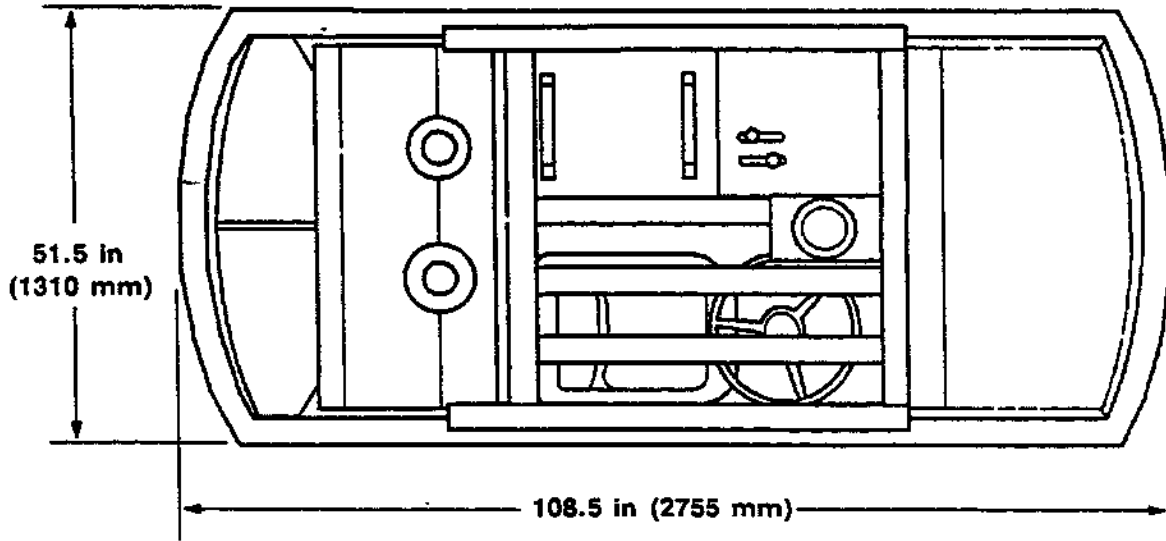
Maximum reverse speed - 4 mph (6.4 km/h)

Turning radius - right, 129 in (3275 mm)

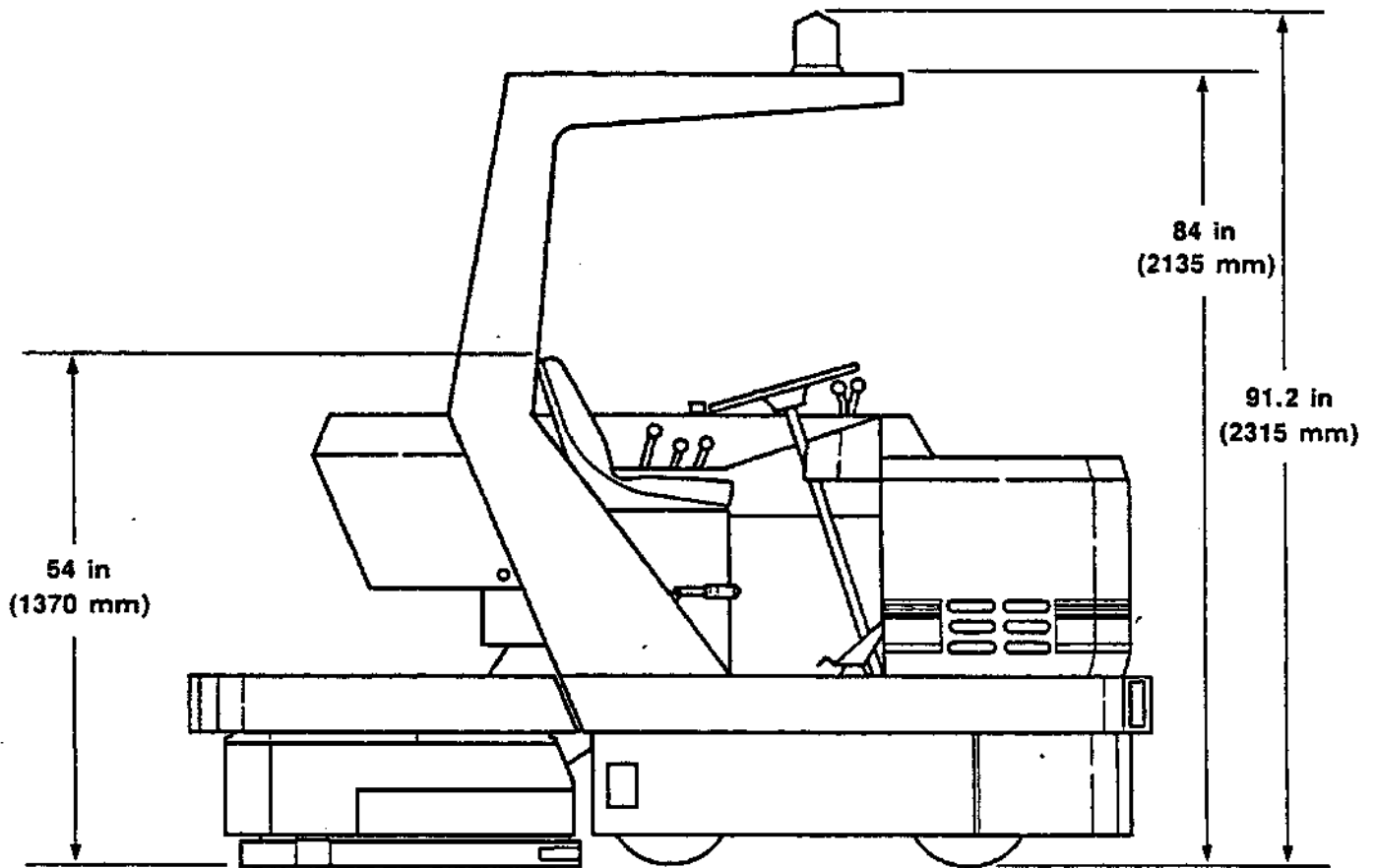
Turning radius - left, 132.5 in (3365 mm)

Minimum aisle turn width - 129 in (3275 mm)

MACHINE DIMENSIONS



TOP VIEW



SIDE VIEW

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PREPARATION FOR OPERATION

AFTER UNLOADING AND BEFORE OPERATING THE MACHINE:


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

 **WARNING:** Do not operate the machine until you have read and understood the operating instructions and are properly trained. Failure to do so could result in severe personal injury.

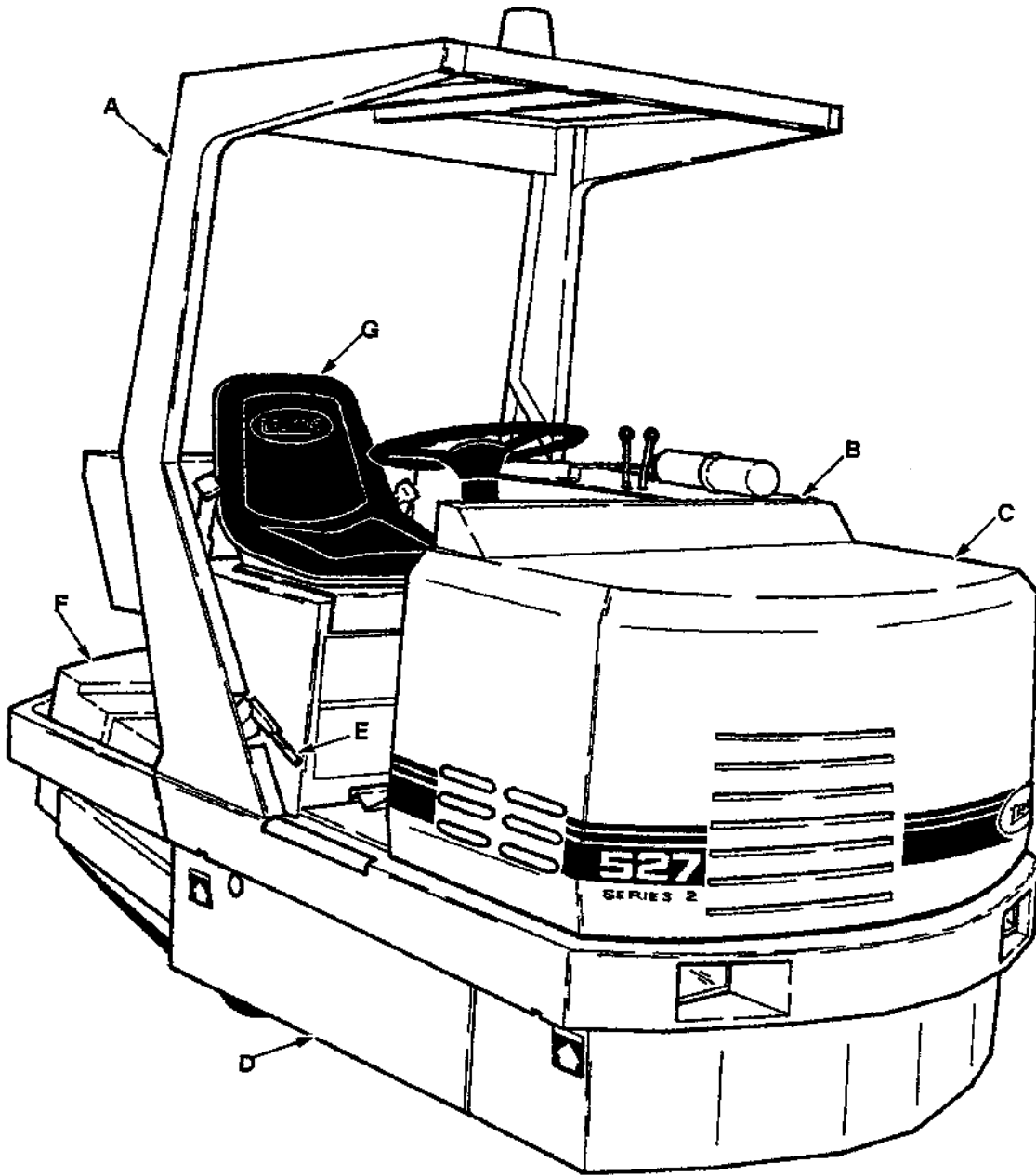
3. Check the hydraulic fluid level in the hydraulic fluid reservoir, using the dipstick provided. TENNANT® hydraulic fluid is recommended. If TENNANT® hydraulic fluid is not available, use only new, approved hydraulic fluid. See Hydraulics in the Maintenance section.
4. Check the engine oil level.
5. Check the radiator coolant level.

 **WARNING:** If the coolant is hot or the engine has been operating, let the engine cool. Hot coolant can scald or cause severe burns. If in doubt, let the coolant cool before releasing pressure on the cooling system.

6. Check the scrub brush adjustment, as described in Scrub Head in the Maintenance section.
7. Check the squeegee adjustment as described in Squeegees in the Maintenance section.
8. Fill the fuel tank, or install an LPG fuel tank on the machine.

 **WARNING:** Do not fill the fuel tank while the engine is operating. Always be sure the fuel container and the machine are electrically connected before pouring fuel. Failure to electrically connect the fuel container to the machine may allow a static electricity spark to ignite the fuel, resulting in a fire or explosion.

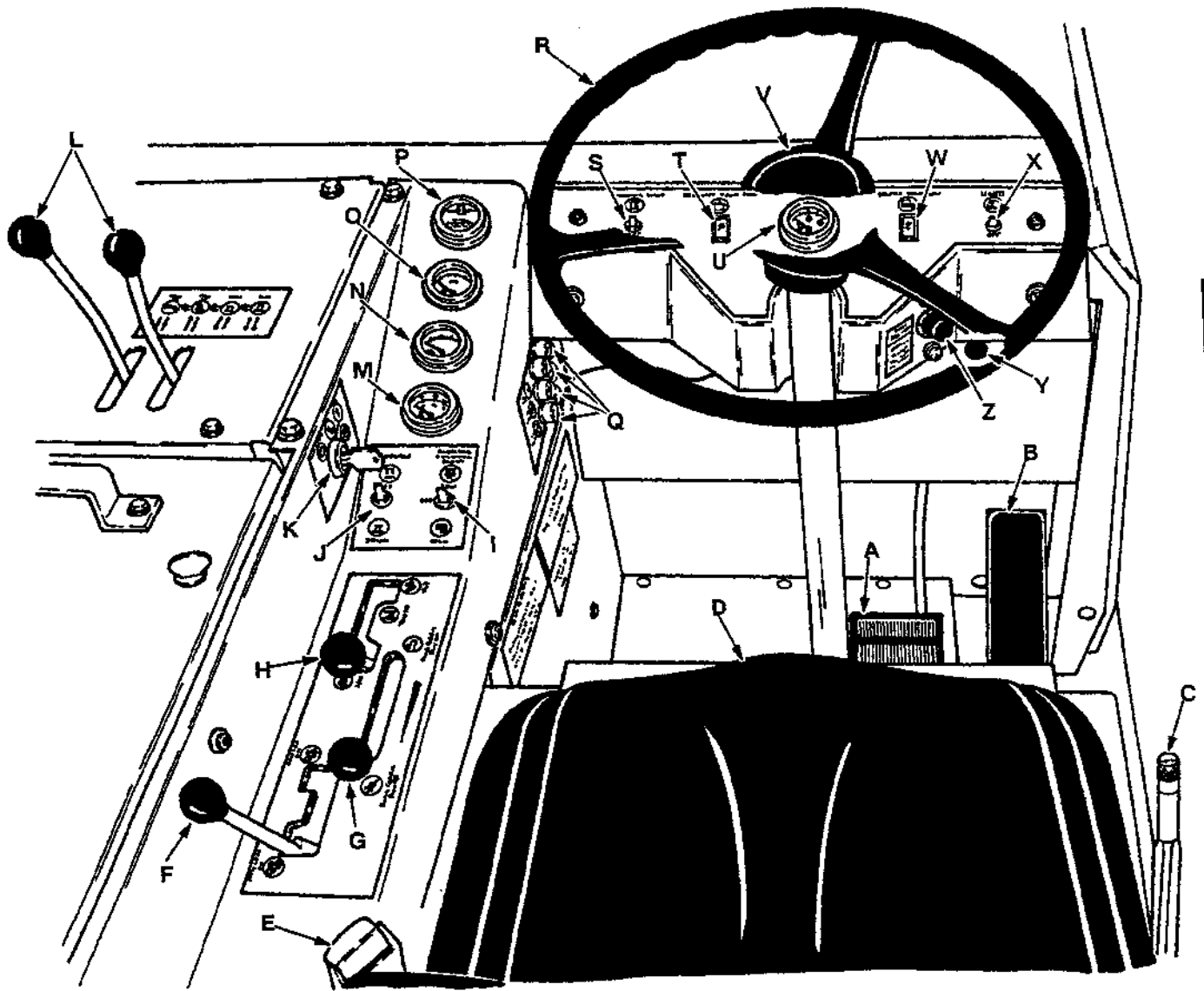
OPERATION OF CONTROLS



MACHINE COMPONENTS

- A. Overhead Guard
- B. Recovery Tank Cover
- C. Engine Cover
- D. Lower Access Door
- E. Parking Brake Lever
- F. Scrub Head Cover
- G. Operator Seat

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INSTRUMENTS AND CONTROLS

- | | |
|--|------------------------------|
| A. Brake Pedal | N. Battery Condition Gauge |
| B. Directional Control Pedal | O. Engine Oil Pressure Gauge |
| C. Parking Brake Lever | P. Hour Meter |
| D. Operator Seat | Q. Circuit Breakers |
| E. Seat Belt | R. Steering Wheel |
| F. Scrub Head Lock Lever | S. Warning Lamp Switch |
| G. Scrub Solution Flow Control Lever | T. Recovery Tank Full Lamp |
| H. Throttle Control Lever | U. Fuel Level Gauge |
| I. Cleaning Solution Flow Control Switch | V. Horn Button |
| J. Squeegee Switch | W. Solution Tank Low Lamp |
| K. Ignition Switch | X. Lights Switch |
| L. Scrub Control Levers | Y. Engine Choke Knob |
| M. Engine Coolant Temperature Gauge | Z. Fuel Level Pushbutton |

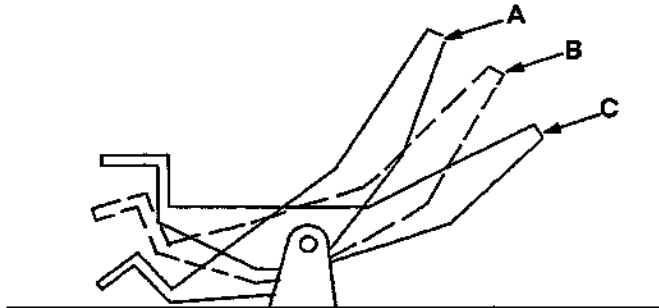
BRAKE PEDAL

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

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

DIRECTIONAL CONTROL PEDAL

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



DIRECTIONAL CONTROL PEDAL

00116

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

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

If the machine creeps when the pedal is in the "neutral" position, adjust the pedal as directed in Directional Control Pedal in the Maintenance section.

WARNING: Always use the brake pedal for normal stopping and controlling machine speed on down grades to prevent loss of machine control.

PARKING BRAKE LEVER

The parking brake lever controls a brake cable which is connected to the drum brakes on the two rear wheels. To engage the parking brake, pull the parking brake handle up. To disengage the parking brake, push the handle down. Always park on a level surface, stop the engine, and engage the parking brake before leaving the machine unattended and before working on the machine.

WARNING: Always park on a level surface, stop the engine, and engage the parking brake before leaving the machine unattended and before working on the machine to keep it from rolling.

OPERATOR SEAT

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

SEAT BELT

An automotive-type seat belt is provided as an accessory to secure the machine operator in the operator's seat. To lock the seat belt, insert the belt tongue into the belt buckle. To adjust seat belt, pull on the belt tail until the seat belt is snug. To release the seat belt, pull the seat belt buckle up.

SCRUB HEAD LOCK LEVER

The scrub head lock lever operates a cable which controls the scrub head lock mechanism. To lock the scrub head up, raise the scrub head and pull the scrub head lock lever back into the "on" position. To unlock the scrub head, raise the scrub head and push the scrub head lock lever forward into the "off" position.

To engage or disengage the scrub head lock, the scrub head must be fully raised.

Always engage the scrub head lock before working under the scrub head and whenever the machine will not be used for an extended period of time.

WARNING: Always engage the scrub head lock and block the scrub head up securely before working under the scrub head. Do not rely on the hydraulic system to keep the scrub head up. It may leak internally, allowing the scrub head to lower and crush anything under it.

SCRUB SOLUTION FLOW CONTROL LEVER

The scrub solution flow control lever operates a cable which controls the solution control valve and the solution pumps on SRS® models. The flow of solution to the floor is variable. To start solution flow, push the solution flow control lever slightly forward into the "on" position. To increase to full flow, push the lever all of the way forward into the "on" position. To stop solution flow, pull the lever back into the "off" position.

THROTTLE CONTROL LEVER

The throttle control lever operates a cable which controls the engine speed. To start and slow the engine before stopping it, push the throttle control lever into the "idle" position. To speed up the engine to operating speed, pull the lever back into the "full" position.

CLEANING SOLUTION FLOW CONTROL SWITCH

The cleaning solution flow control switch controls the cleaning solution pump. The pump meters cleaning solution into the scrub solution. To start cleaning solution flow, flip the switch toggle forward into the "low" position for normal cleaning, or flip the switch toggle backward into the "high" position for heavy duty cleaning. To stop cleaning solution flow, place the switch toggle in the middle, "off" position.

SQUEEGEE SWITCH

The squeegee switch, in conjunction with a hydraulic flow sensing device, and the scrub control levers, control the position of the rear squeegee.

To raise the rear squeegee, flip the switch toggle forward into the "up" position. This position cannot be overridden by the hydraulic flow sensing device.

To lower the rear squeegee, flip the switch toggle backward into the "down" position. Then, when the scrub control levers are placed in the "clean" position, the squeegee will lower. When traveling in the reverse direction, the hydraulic flow sensing device overrides the squeegee switch and raises the rear squeegee. This prevents the rear squeegee from being damaged when traveling backward.

IGNITION SWITCH

The key-operated ignition switch has four positions. Those positions are "accessories," "off," "on," and "start." To operate any electrical accessory without operating the engine, turn the switch to the "accessories" position. To start the engine, turn the key to the "start" position. 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. To stop the engine, turn the key to the "off" position.

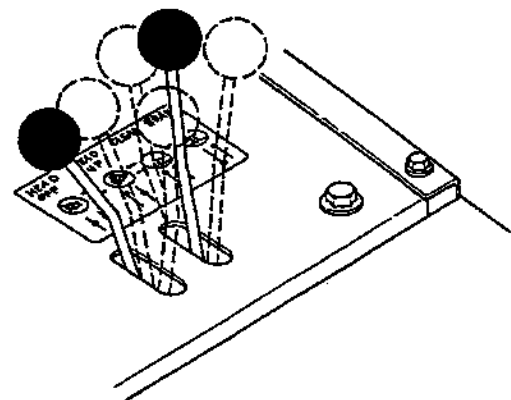
⚠ WARNING: Before operating the machine, make sure all safety devices are in place and operate properly. Check the foot and parking brakes and the steering control for proper operation. Do not start machine unless you are in operator's seat, with foot on the brake pedal or operational parking brake engaged and the directional control pedal in the "neutral" position. Failure to do so could allow the machine to move immediately upon start-up, resulting in severe personal injury.

SCRUB CONTROL LEVERS

The scrub control levers operate a double spool hydraulic control valve which controls the scrub head position, the rear squeegee position, and the rotation of the scrub brushes. Four lever positions are used to operate the equipment. The following describes each of the positions:

"HEAD UP"

The "head up" position is used to raise the scrub head off the floor when scrubbing is finished. It is also used to allow the scrub head lock to be engaged or disengaged. When the scrub control levers are in the "head up" position, the scrub brushes are motionless and the scrub head is raised.

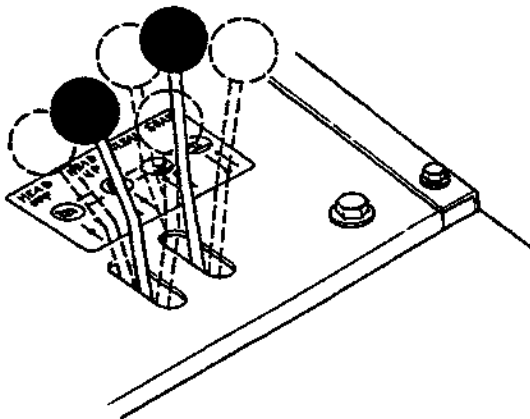


"HEAD UP" POSITION

02420

"HEAD OFF"

The "head off" position is used when the machine is to be parked for a period of time; for example, overnight or during lunch breaks. This position is also used when the machine is traveling to the area to be scrubbed. The scrub head should be raised and the scrub head lock engaged whenever the scrub control valves are in the "head off" position. When the scrub control levers are in this position, the scrub brushes are motionless.



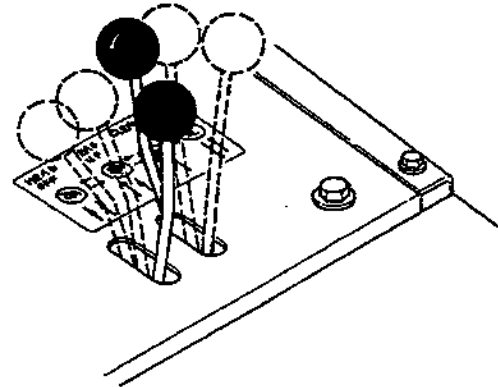
"HEAD OFF" POSITION

02421

"CLEAN"

The "clean" position is used for normal scrubbing. When the scrub control levers are in this position, the front scrub brush rotates counterclockwise, the rear scrub brush rotates clockwise, the rear squeegee is down, and the scrub head is down.

NOTE: Scrub brush rotation is as viewed from the scrub brush idler side of the machine.

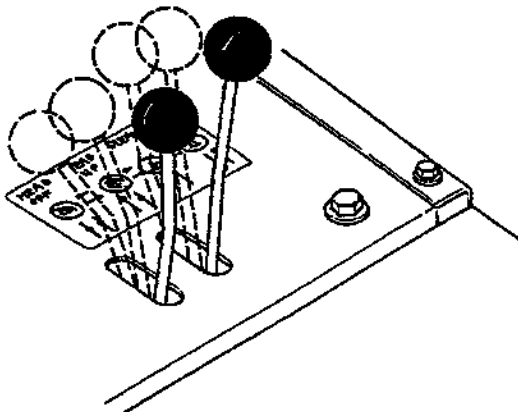


"CLEAN" POSITION

02423

"SOAK"

The "soak" position is used when double scrubbing. When the scrub control levers are in this position, both scrub brushes rotate in a counterclockwise direction, the rear squeegee is up, and the scrub head is down.



"SOAK" POSITION

02422

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 over-heating will always cause a coolant loss. If coolant loss does not occur, check for malfunction of the temperature sending unit.

BATTERY CONDITION GAUGE

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

ENGINE OIL PRESSURE GAUGE

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

NOTE: The engine is equipped with an oil pressure switch that will stop the engine if oil pressure drops below 5 psi (35 kPa).

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.

CIRCUIT BREAKERS

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

The circuit breakers are located below the steering console.

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

PROTECTIVE DEVICE	RATING	CIRCUIT PROTECTED
CB-1	10 A	Horn
CB-2	10 A	Squeegee
CB-3	10 A	Ignition, Gauges
CB-4	15 A	Warning Lamp
CB-5	15 A	SRS®
CB-6	15 A	Lights

STEERING WHEEL

The steering wheel operates a steering gear assembly which controls the front caster wheel through an arm and tie rod. The machine is very responsive to steering wheel movements. Use care until you become more experienced in guiding the machine. A horn button is located in the center of the steering wheel.

WARNING LAMP SWITCH

The warning lamp switch is present on machines with the warning lamp accessory. It controls the machine warning lamp. To turn the lamp on, flip the switch toggle forward into the "on" position. To turn the lamp off, flip the switch toggle backward into the "off" position.

RECOVERY TANK FULL LAMP

The recovery tank full lamp lights when the recovery tank is nearly full. Depending on the scrubbing conditions, there may be 10 to 15 minutes of scrubbing time left before the vacuum shut-off ball float stops the water vacuum.

FUEL LEVEL GAUGE

The fuel level gauge is present on machines equipped with the fuel level gauge accessory. It indicates how much fuel is left in the fuel tank.

SOLUTION TANK LOW LAMP

The solution tank low lamp lights when the solution tank is nearly empty. Depending on the scrubbing conditions, there may be 10 to 20 minutes of scrubbing time remaining before the solution tank is empty. Plan to return to the machine filling/dumping site when the solution tank low lamp lights.

OPERATING LAMPS SWITCH

The operating lamps switch is present on machines with the operating lamps accessory. It controls the headlamps and taillamps. To turn the lamps on, flip the switch toggle forward into the "on" position.

To turn the lamps off, flip the switch toggle backward into the "off" position.

ENGINE CHOKE KNOB

The engine choke knob operates a cable which controls the engine choke. To close the choke for cold starting, pull the choke knob out. To open the choke, push the knob in. It is not necessary to choke a warm engine.

FUEL LEVEL PUSHBUTTON

The fuel level pushbutton is present on all diesel powered machines. It is provided to check the fuel level in the fuel tank without starting the engine.

NOTE: Do not empty the fuel tank on diesel machines as the fuel system must then be bled free of air.

MACHINE OPERATION

NORMAL SCRUBBING OPERATION

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

Pre-Start Checklist lists things to check before starting the machine.

To Start the Machine lists the steps required to start the machine.

To Fill Solution Tank lists the steps required to fill the solution tank and the cleaning solution tank on the SRS® model machines.

To Scrub lists things to keep in mind before and during the scrubbing operation.

To Drain Recovery Tank and Empty Hopper lists the steps required to empty the debris hopper and the recovery tank.

Post Operation Checklist – 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 LPG fuel leak.

Check brakes and controls for proper operation.


Check service records to determine service requirements.

TO START MACHINE

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 control pedal in the "neutral" position and with a foot on the brake pedal or with the parking brake engaged.

 **WARNING:** Before operating the machine, make sure all safety devices are in place and operating properly. Check the foot and parking brakes and the steering control for proper operation. Do not start machine unless you are in operator's seat, with a foot on the brake pedal, or have the parking brake engaged and the directional pedal in the "neutral" position. Failure to do so could allow the machine to move immediately upon start-up, resulting in severe personal injury.

3. Gasoline powered machines: When the engine is cold, pull out the choke button 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.

4. Move the throttle control lever to the "idle" position.
5. Turn the ignition switch key to the "start" position until the engine starts. Do not operate the starter for more than a few seconds at a time or after the engine has started.

NOTE: Do not operate the starter motor for more 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. Disengage the machine parking brake.
8. Drive the machine to the solution filling site.

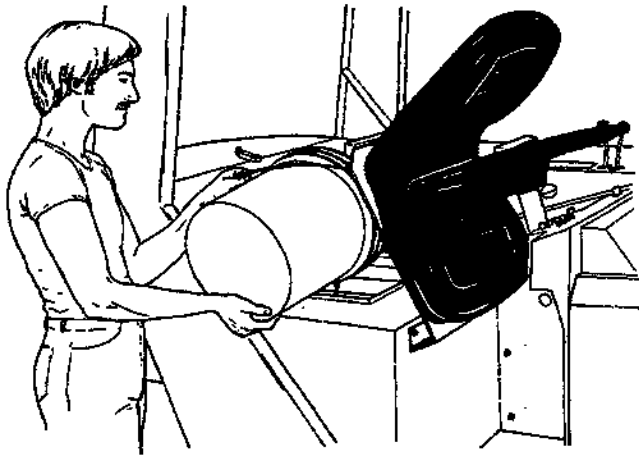
TO FILL SOLUTION TANK

1. Stop the engine and engage the parking brake.

WARNING: Always park on a level surface, stop the engine, and engage the parking brake before working on the machine to keep it from rolling.

2. Lift the operator seat forward.

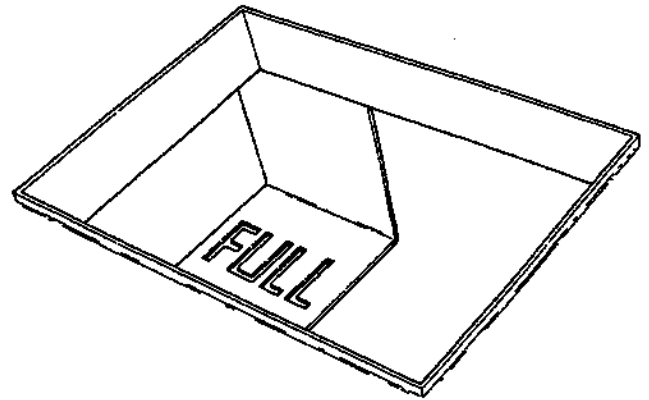
3. Standard model machines: Pour the required amount of detergent into the tank. Fill the tank with water to 1 in (25 mm) below the tank opening.



00025

ADDING DETERGENT TO SOLUTION TANK

SRS® model machines: Fill the tank with water up to the "full" mark. Fill the cleaning solution tank with cleaning solution.



00040

SOLUTION TANK FULL INDICATOR

4. Lower the seat.

TO SCRUB

Plan the scrubbing in advance. Try to arrange long runs with minimum stopping and starting. Do an entire floor or section at one time.

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

Allow a few inches overlap of brush paths.

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

Try to scrub as straight a path as possible. Avoid bumping into posts or scraping the sides of the machine.

1. Drive the machine to the area to be scrubbed.
2. Move the scrub head lock control lever to the "unlock" position.
3. Move the scrub control levers to the "head up" position to disengage the scrub head lock.
4. Move the scrub control lever to the "clean" position.
5. Place the squeegee switch in the "down" position.

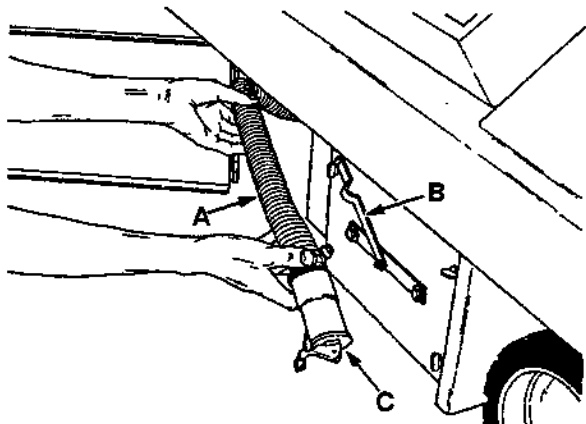
6. Move the scrub solution flow control lever to the desired position. Place the cleaning solution flow control switch to the desired flow rate position and move the solution flow control lever to the "on" position on SRS® machines.
7. Scrub as required. When the ball float shuts off machine vacuum, or the solution tank low lamp lights, return to the solution dump/filling site. Drain the recovery tank, empty the hopper, and refill the solution tank.

TO DRAIN RECOVERY TANK AND EMPTY HOPPER

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

⚠ WARNING: Always park on a level surface, stop the engine, and engage the parking brake before working on the machine to keep it from rolling.

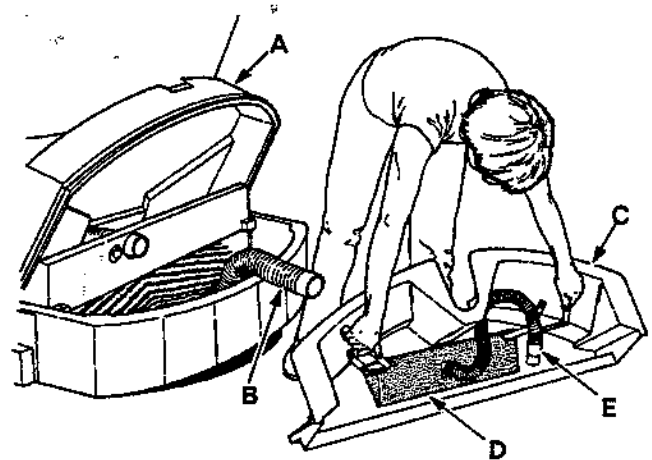
2. Open the lower left access door, both lower access doors on SRS® model machines.
3. Remove and unplug the drain hose(s) next to a floor drain.



DRAINING RECOVERY TANK

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

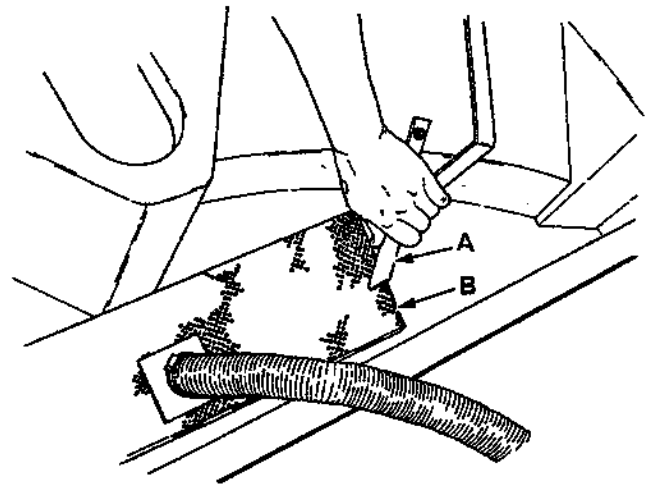
4. Open the scrub head cover.
5. Disconnect the squeegee and debris screen vacuum hoses.
6. Lift the hopper out of the machine.



REMOVING DEBRIS HOPPER

- A. Scrub Head Cover
- B. Squeegee Suction Hose
- C. Debris Hopper
- D. Debris Screen
- E. Screen Suction Hose

7. Remove and clean the debris screen.



REMOVING DEBRIS SCREEN

- A. Debris Screen Retainer
- B. Debris Screen

8. Reinstall the debris screen in the hopper.
9. Reinstall the hopper in the scrub head. Close the scrub head cover.
10. Plug and secure the drain hose(s) to the machine.
11. Close the access door(s).


POST OPERATION CHECKLIST – ENGINE OPERATING

Check scrub brush pattern for width and evenness.


Check squeegees for proper deflection.

TO STOP MACHINE

1. Return the directional control pedal to the “neutral” position. Apply the brake.
2. Move the solution flow control lever to the “off” position.
3. Move the scrub head lock lever to the “lock” position.
4. Move the scrub control levers to the “head up” position to allow the scrub head lock to engage.
5. Briefly move the scrub control levers into the “clean” position to make sure the scrub head lock is engaged.

 **WARNING:** Always engage the scrub head lock before leaving the machine. Do not rely on the machine hydraulic system to keep the scrub head in the “raised” position. The hydraulic system may leak internally, allowing the scrub head to lower, crushing anything under it.

6. Move the scrub control levers to the “head off” position.
7. Place the squeegee switch in the “up” position.
8. Turn the operating lamps off if used.
9. Place the throttle control lever in the “idle” position.
10. Engage the machine parking brake.
11. Turn the ignition key switch to the “off” position. Remove the key from the ignition switch.

 **WARNING:** Always park on a level surface, stop the engine, and engage the parking brake before leaving the machine unattended to keep it from creeping or rolling.

POST OPERATION CHECKLIST – ENGINE STOPPED

Check for wire or string tangled on scrub brushes.

Check squeegees for wear or damage.

Empty and clean debris hopper.

Drain and clean recovery tank.


Check vacuum hoses for debris or obstructions.

Fill fuel tank.

Check for leaks.


DOUBLE SCRUBBING OPERATION

Double scrubbing is a method of removing heavy accumulations of soilage, dirt, wax, or spills. It involves making two passes over the area to be cleaned. To double scrub, make a single pass over the surface being cleaned with the scrub control levers in the “soak” position. This dispenses solution and allows both brushes to rotate counterclockwise with the rear squeegee up. Allow the solution to soak on the floor for 15 to 20 minutes. Then make a second scrubbing pass in the normal manner with the scrub control levers in the “clean” position.

 **WARNING:** Use care when driving on wet surfaces to avoid loss of machine control.

OPERATION ON GRADES

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

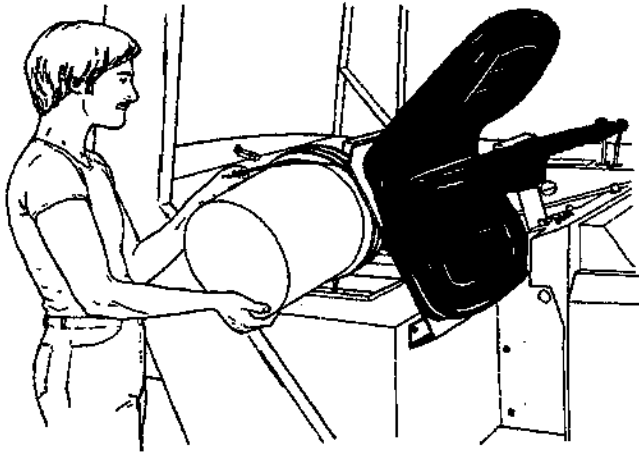
 **WARNING:** Always travel slowly on grades to prevent machine instability. Do not exceed maximum rated ramp climb angle.

The maximum rated ramp climb and descent angle is 10° with empty solution and recovery tanks, and 8° with full solution and recovery tanks.

SOLUTION TANK

The machine solution tank supplies the scrub brushes with a water and detergent solution. The solution tank on standard machines is located on the right side of the machine under the operator seat.

Access to the solution tank is through the opening in the top of the tank under the operator seat. To fill the tank, lift the operator seat forward, pour in the required amount of detergent and fill the tank with water to 1 in (25 mm) below the tank opening.



00025
ADDING DETERGENT TO SOLUTION TANK

DETERGENT RECOMMENDATIONS

Floor conditions, amount of soilage, type of soilage, brush action, and squeegee action all play an important role in determining the type and concentration of detergent to be used. For specific recommendations, consult the local Tennant Company Representative.

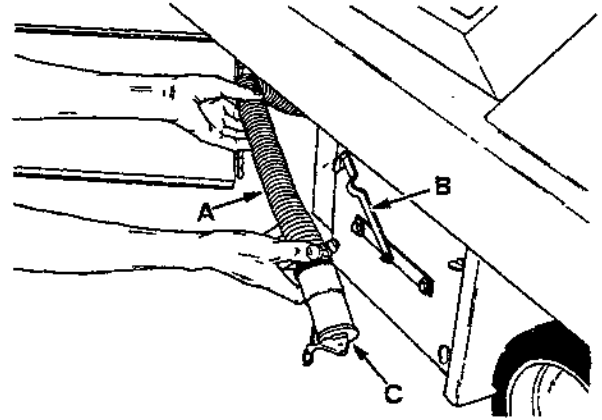
⚠ WARNING: Do not use flammable or combustible cleaning agents when scrubbing to prevent fire or explosion and serious injury.

RECOVERY TANK

The machine recovery tank stores the water solution picked up by the machine squeegee and vacuum fan. The recovery tank on standard machines is located to the left of the operator seat.

The recovery tank should be drained after the solution tank is empty and whenever the ball float rises and stops water vacuum. The recovery tank may fill before the solution tank empties if standing water is picked up in addition to the solution put down by the machine.

To drain the recovery tank, stop the engine, engage the parking brake, open the lower access door, and remove and unplug the drain hose next to a floor drain. The tank will not empty with the vacuum fan operating. Clean the recovery tank after every work shift.



00067
DRAINING RECOVERY TANK

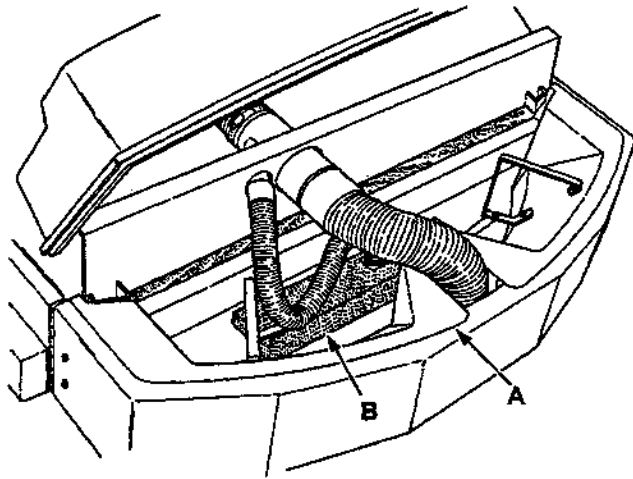
- A. Drain Hose
- B. Hose Retaining Clip
- C. Hose Plug

DEBRIS HOPPER

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

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

The debris hopper should be emptied and cleaned whenever the recovery tank is drained. To empty and clean the debris hopper, open the scrub head cover, disconnect the vacuum hoses, and lift the hopper out of the machine. Remove and clean the debris screen from the hopper. Reinstall the debris screen, debris hopper, and vacuum hoses when finished.



DEBRIS HOPPER

02473

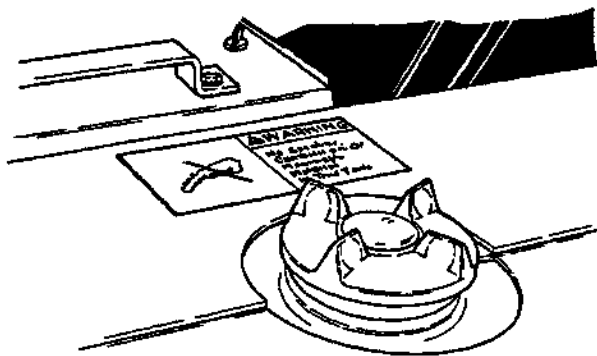
- A. Debris Hopper
- B. Debris Screen

SRS® CLEANING SOLUTION TANK

The SRS® cleaning solution tank supplies the scrub brushes with cleaning solution. The tank is mounted behind and to the left of the operator seat.

To fill the tank, open the tank cap, pour the liquid cleaning solution in and replace the cap. Do not use powdered detergent or any other detergent not designed for the SRS® application.

⚠ WARNING: Do not use the flammable or combustible cleaning agents when scrubbing to prevent fire or explosion and serious injury.



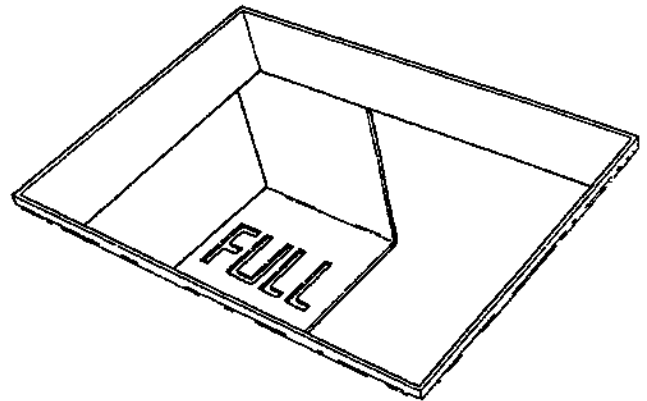
CLEANING SOLUTION TANK CAP

02415

SRS® SOLUTION TANK

The SRS® machine solution tank supplies the scrub brushes with a water and cleaning solution mixture. It also stores water picked up by the machine squeegees and vacuum fan.

Access to the SRS® solution tank is through the opening in the top of the tank under the operator's seat. To fill the tank, lift the operator seat forward and fill the tank with water up to the "full" mark.



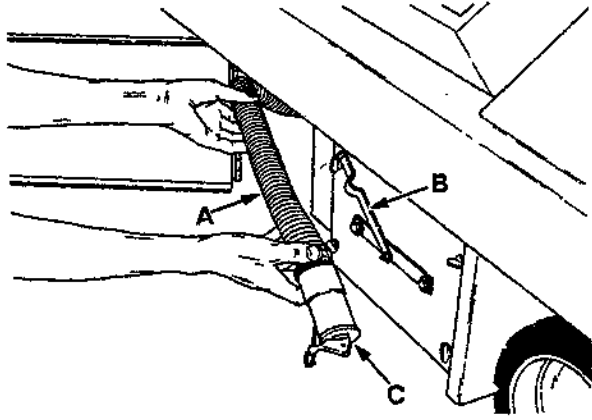
00040

SOLUTION TANK FULL INDICATOR

NOTE: If standing water is to be picked up in addition to the solution put down by the machine, do not fill the tank up to the "full" mark. This will allow more water to be picked up before the ball float shut-off is actuated.

Do not put detergent or cleaning solution directly into the SRS® solution tank. The cleaning solution should be put in the cleaning solution tank.

The SRS® solution tank should be drained and cleaned after every work shift. To drain the tank, stop the engine, engage the parking brake, open the lower access doors, and unplug the drain hoses next to a floor drain. The tank will not empty with the vacuum fan operating.



00067

DRAINING TANK

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

MACHINE TROUBLESHOOTING

Problem	Cause	Remedy
Trailing water – poor or no water pickup	Worn rear squeegee	Rotate or replace rear squeegee blade
	Rear squeegee out of adjustment	Adjust rear squeegee
	Worn side squeegee	Replace side squeegee blade
	Side squeegee out of adjustment	Adjust side squeegee
	Vacuum hose clogged	Flush vacuum hoses
	Recovery tank full	Drain tank
	Ball float stuck shutting off vacuum	Clean ball float and float guide
	Vacuum fan drive belts loose or broken	Adjust or replace and adjust drive belts
	Engine not operating at governed speed	Speed up engine to “full” speed and readjust governor
	Rear squeegee will not lower	See Hydraulic System Troubleshooting - Rear squeegee will not lower
	Debris caught on squeegee	Remove debris
	Debris hopper full	Empty hopper
	Foam filling recovery tank	Empty recovery tank; change detergent
	Vacuum hose to rear squeegee hose disconnected or damaged	Reconnect or replace vacuum
	Vacuum fan to recovery tank hose damaged	Replace hose
SRS® models: Operator seat tank seal not sealing	Remove obstruction or replace seal	
Little or no solution flow to floor	Solution tank empty	Fill solution tank
	Solution control cable broken or out of adjustment	Replace and/or adjust cable
	Solution supply lines, spreader tube or spray nozzle clogged	Flush solution supply lines, spreader tube, or spray nozzle
	SRS® models: Solution outlet screen clogged	Spray screens clean
	SRS® models: Solution pump clogged, broken, or lost prime	Flush, inspect, and prime pump
	SRS® models: Electrical problem preventing solution pump from operating	Trace electrical circuits for open contacts or broken components

Problem	Cause	Remedy
Poor scrubbing performance	Debris caught on scrub brushes	Remove debris
	Improper detergent or brushes used	Check with TENNANT® representative for advice
	Worn scrub brushes	Replace scrub brushes
	Scrub brushes out of adjustment	Adjust scrub brushes
	Scrub brush drive failure	See Hydraulic System Troubleshooting – Scrub brushes turn slowly or not at all
	Scrub head out of adjustment	Adjust scrub head
	SRS® models: Cleaning solution pump failure	Repair or replace cleaning solution pump
	SRS® models: Electrical problem preventing solution pump from operating	Trace electrical circuits for open contacts or broken components
	Debris hopper full	Empty hopper

ACCESSORIES OPERATION

VACUUM WAND

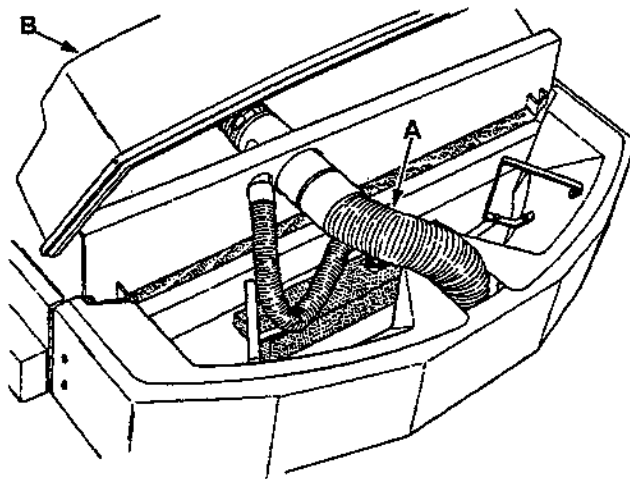
The vacuum wand accessory gives the machine the added flexibility of picking up spills not accessible by the machine. An 84 in (2140 mm) long hose utilizes the machine vacuum system.

TO OPERATE VACUUM WAND

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

⚠ WARNING: Always park on a level surface, stop the engine, and engage the parking brake before working on the machine to keep it from creeping or rolling.

2. Remove the vacuum wand equipment from the machine.
3. Open the scrub head cover.
4. Remove the large diameter squeegee suction hose from its hose connector.



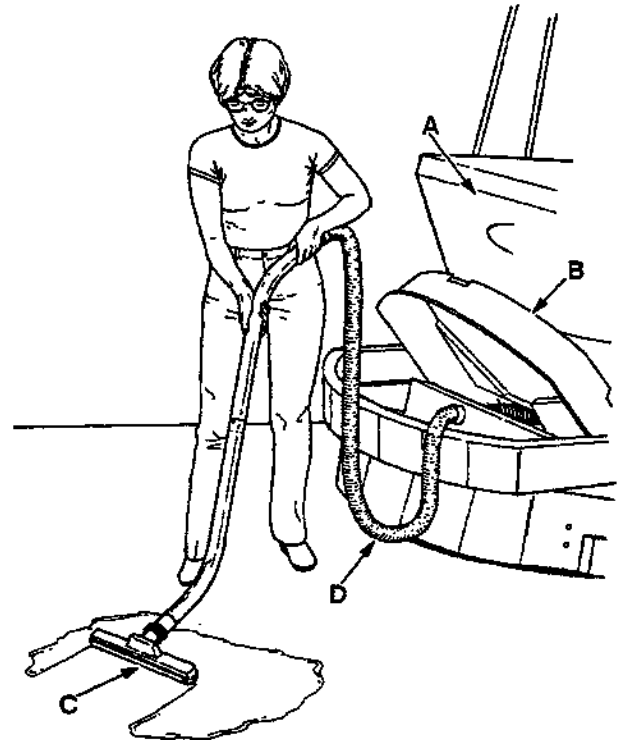
SQUEEGEE SUCTION HOSE

02473

- A. Suction Hose
- B. Scrub Head Cover

5. Push the vacuum wand hose into the hose connector.
6. Assemble the wand and hose.
7. Start the engine.
8. Place the throttle control in the "full" position.

9. Vacuum as required.



OPERATING VACUUM WAND

02425

- A. Rear Storage Door
- B. Scrub Head Cover
- C. Wand
- D. Hose

10. When finished, shut off the engine.
11. Remove the vacuum wand hose from the hose connector.
12. Reconnect the squeegee suction hose.
13. Clean and rinse off the squeegee wand and equipment as required.
14. Store the squeegee wand equipment in the proper locations.

TRANSPORTING MACHINE

PUSHING OR TOWING MACHINE

The machine may be pushed or towed from the front or the rear, using the bumpers provided, over short distances up to 1 mph (2 km/h).

Place a dolly under the rear wheels to travel distances greater than 1 mile (1 km) or speeds over 1 mph (2 km/h).

MACHINE JACKING

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

The rear jacking locations are next to the rear wheels. Open the access doors to allow the jack to contact the bottom of the bumper.

TO JACK UP MACHINE

1. Drain the solution and recovery tanks.
2. Stop the engine and engage the machine parking brake.

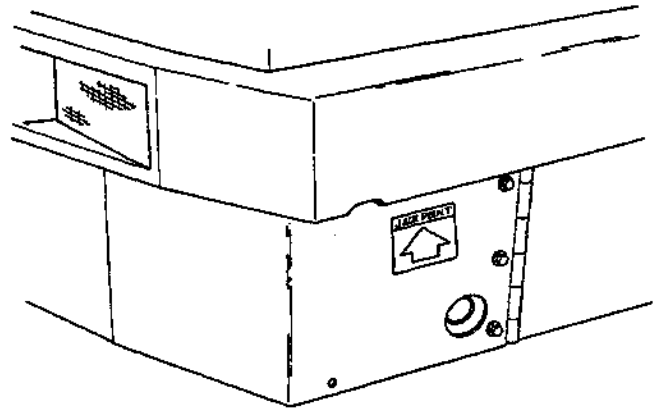
! WARNING: Always park on a level surface, stop the engine, and engage the parking brake before working on the machine to keep it from creeping or rolling.

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

! WARNING: Always block the machine tires before jacking the machine up to keep it from rolling off jack.

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

! WARNING: Jack machine up only at the designated locations to keep it from tipping.



00029

FRONT LEFT JACKING LOCATION

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

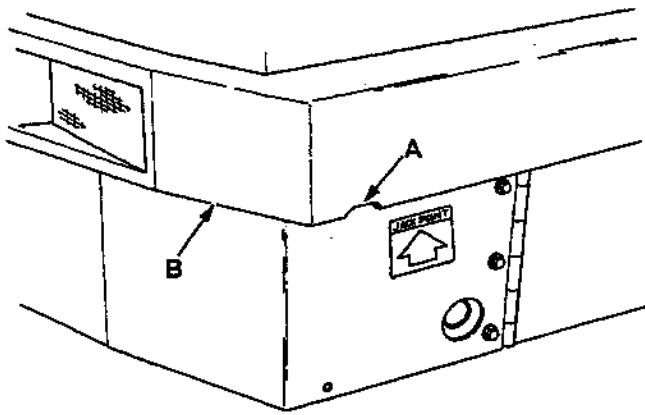
! WARNING: Always use jack stands or similar devices to hold the machine up. Scissors, ratchet, cable, or hydraulic-type jacks may slip or leak internally, allowing the machine to lower or fall, crushing anything under it.

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

MACHINE TIE-DOWNS

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

To tie the front of the machine down, use the tie-down slots provided. The front tie-down slots are located in the front corner of the machine frame.



00029

FRONT LEFT TIE-DOWN SLOT

- A. Tie-Down Slot
- B. Machine Bumper

To tie the rear of the machine down, wrap chains around each corner of the rear bumper. Then secure the other end of the chain to the trailer or truck bed tie-downs.

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, these procedures must be followed to lessen the chance of rust, sludge, and other undesirable deposits from forming:

1. Drain and clean the solution and recovery tanks.
2. Change engine oil.
3. Raise and lock the scrub head in the "up" position.
4. Park the machine in a cool and dry area.
5. Stop the engine.
6. Fill the hydraulic reservoir with hydraulic fluid to the full mark to prevent excessive condensation from forming in the reservoir.

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

1. Remove the spark plugs.
2. Pour 3 oz (90 cc) of clean engine oil into each 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 bowl by removing the carburetor bowl drain plug.
6. Replace the carburetor drain plug.

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

1. Remove the spark plugs.
2. Pour 3 oz (90 cc) of SAE 30 or SAE 40 engine oil into each of the spark plug holes.
3. Remove the ignition coil high tension wire. Operate the engine starter for at least a dozen revolutions. This distributes the oil over the cylinder walls. Replace the spark plugs.
4. Drain the engine oil from the engine oil pan.
5. Drain the coolant from the radiator and engine block.
6. Close the engine cooling system drain cocks.
7. Drain gasoline from the carburetor, fuel tank, and the fuel lines.
8. Seal the air cleaner inlet and the exhaust outlet with weatherproof masking tape.
9. Tighten the engine oil filler cap, the fuel tank cap, and the radiator cap to make certain they are securely in place.

SECTION 3 MAINTENANCE

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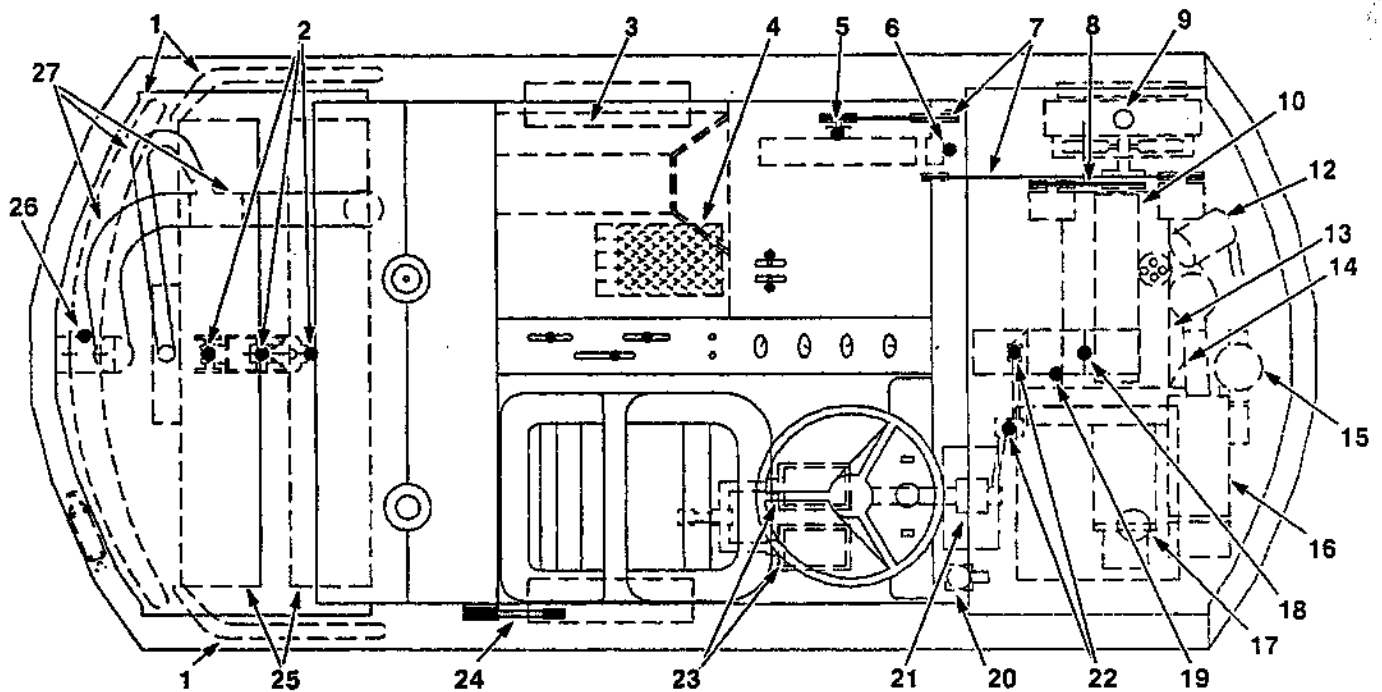
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RECOMMENDED FIRST 50-HOUR MACHINE INSPECTION

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

1. Perform the brush pattern test to check for correct brush adjustment.
2. Check the scrub head side squeegee blades for wear or damage.
3. Check the rear squeegee for worn or damaged blades or for incorrect adjustment.
4. Check the vacuum fan v-belt for correct tension adjustment.
5. Check the vacuum hoses for damage or loose connections.
6. Check engine ignition timing.
7. Torque cylinder head bolts to the proper specification.
8. Replace the hydraulic fluid filter element.
9. Perform all remaining 50-hour lubrication and maintenance procedures listed in the Maintenance Chart.
10. Gasoline and LPG powered machines: After the first 150 hours of operation, check and adjust the engine valve tappet clearance.

MAINTENANCE CHART



MAINTENANCE LOCATIONS

02426

Interval	Key	Description	Procedure	Lubricant	No. of Service Points
Daily	14	Engine crankcase	Check oil level	EO	1
	25	Brushes	Check for damage, wear and adjustment	-	2
	1	Squeegees	Check for damage, wear, and adjustment	-	3
	3	Recovery tank	Clean out	-	1
	27	Vacuum hoses	Clean out	-	3
	4	Laminar tube set	Flush	-	1
	23	SRS® tank screen filters	Clean	-	2
50 Hours	16	Engine air filter	Clean and inspect or replace element	-	1
	13	Engine crankcase, gasoline, LPG	Change oil	EO	1
	12	Engine oil filter, gasoline, LPG	Change filter element	-	1
	2	Scrub head pivots	Lubricate	MPGM	3
	26	Rear squeegee roller	Lubricate	SPC	1
	5	Vacuum fan shaft	Lubricate	SPC	1
	6	Vacuum fan jackshaft	Lubricate	SPC	1
	22	Steering arm rod ends	Lubricate	MPGM	2
	18	Front caster	Lubricate	MPGM	1
19	Front wheel bearing	Lubricate	MPGM	1	

Interval	Key	Description	Procedure	Lubricant	No. of Service Points	
100 Hours	9	Radiator	Check coolant level	WG	1	
			Clean radiator exterior	-	1	
	17	Hydraulic fluid reservoir	Check fluid level	HYDO	1	
	7	Vacuum fan belts	Check tension	-	2	
	8	Engine fan belt	Check tension	-	1	
	24	Parking brake	Check adjustment	-	1	
	13	Engine crankcase, diesel	Change oil	EO	1	
	12	Engine oil filter, diesel	Change filter element	-	1	
10	Engine, diesel	Clean fuel water trap	-	1		
400 Hours	20	Brake master cylinder	Check brake fluid level	BF	1	
			10	Engine, gasoline, LPG	Check and adjust valve clearances	-
			Check and adjust idle speed	-	1	
			Check and adjust idle mixture	-	1	
			Clean or replace and adjust spark plugs	-	4	
			Clean or replace and adjust distributor points. Lubricate felt.	-	1	
			Check and adjust timing	-	1	
			Replace in-line fuel filter	-	1	
			Replace PCV valve	-	-	
			Clean PCV hoses, tubes and fittings	-	-	
		10	Engine, diesel	Replace fuel filter element	-	1
		17	Hydraulic fluid reservoir	Change hydraulic fluid	HYDO	1
		15	Hydraulic fluid filter	Change filter element	-	1
		21	Steering gear	Check grease level	MPG	1
800 Hours	10	Engine	Torque intake manifold bolts	-	4	
			9	Cooling system	Flush	WG
	17	Hydraulic reservoir breather	Replace	-	1	
	17	Hydraulic reservoir strainer	Replace	-	1	

BF - Brake fluid

EO - Engine oil

HYDO - Tennant Company or approved hydraulic fluid

MPG - Multi-purpose calcium soap base grease

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

SPC - Special lubricant, Lubriplate EMB grease

WG - Water and permanent-type ethylene glycol anti-freeze, one-to-one ratio

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

LUBRICATION

ENGINE

Check the engine oil level daily.

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

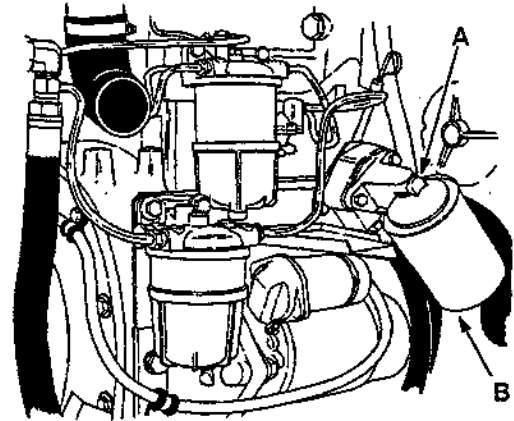
The engine oil capacity is 3.5 qt (3.3 L) including the oil filter. Add three drops of oil to the distributor shaft felt after every 400 hours of operation.

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

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

0° to 45°F (-18° to 7°C)	45° to 80°F (7° to 27°C)	Above 80°F (Above 27°C)
10W	20W/20	30

The engine oil capacity is 5 qt (4.7 L) including the oil filter.



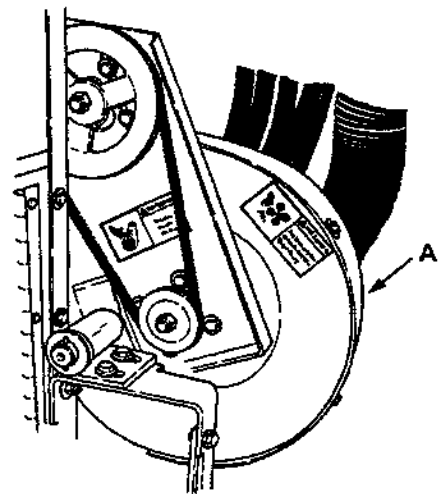
OIL FILTER

- A. Oil Filter Head
- B. Filter Element

01232

VACUUM FAN SHAFT

The vacuum fan shaft is supported by a bearing set. A grease fitting has been provided on the fan housing for lubrication purposes. Lubricate the bearings with a grease gun containing Lubriplate EMB grease (TENNANT® Part No. 01433-1) after every 50 hours of operation. After lubricating the bearings, wipe off all excess grease and replace the grease fitting cap.



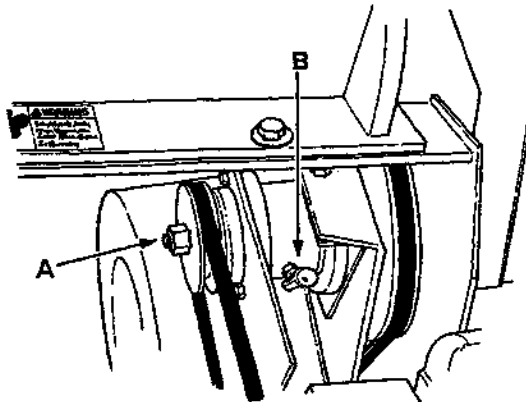
VACUUM FAN

- A. Vacuum Fan

02414

VACUUM FAN JACKSHAFT

The vacuum fan jackshaft transfers power from the engine crankshaft sheave to the vacuum fan sheave. A grease fitting has been provided on the jackshaft housing for lubrication purposes. Lubricate the jackshaft bearings with a grease gun containing Lubriplate EMB grease (TENNANT® Part No. 01433-1) after every 50 hours of operation. After lubricating the bearings, wipe off all excess grease and replace the grease fitting cap.



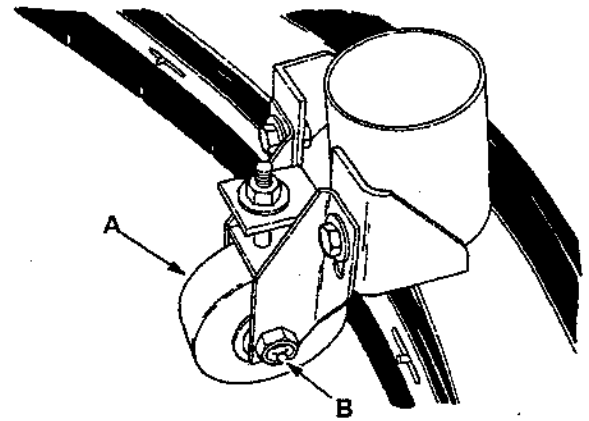
VACUUM FAN JACKSHAFT

- A. Jackshaft
- B. Grease Fitting

02427

REAR SQUEEGEE ROLLER

The rear squeegee roller supports the rear squeegee assembly. A grease fitting has been provided on the roller shaft for lubrication purposes. Lubricate the roller bearing with a grease gun containing Lubriplate EMB grease (TENNANT® Part No. 01433-1) after every 50 hours of operation. Spin the roller to distribute the grease.



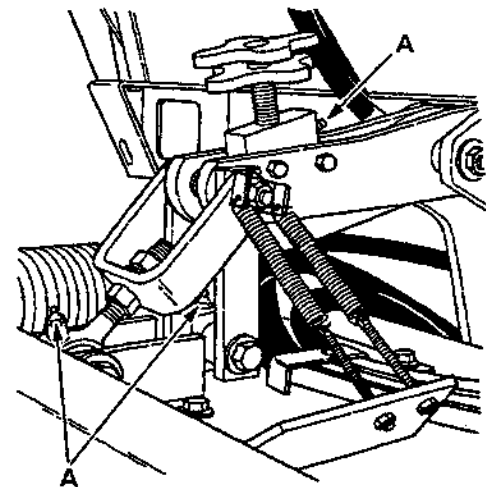
REAR SQUEEGEE ROLLER

- A. Caster
- B. Caster Grease Fitting

00022

SCRUB HEAD PIVOTS

The scrub head pivots when it is raised and lowered. Three grease fittings have been provided to lubricate the pivot points. Lubricate the pivots with a grease gun containing a multipurpose, water resistant, lithium base, moly-disulphide EP grease after every 50 hours of operation.



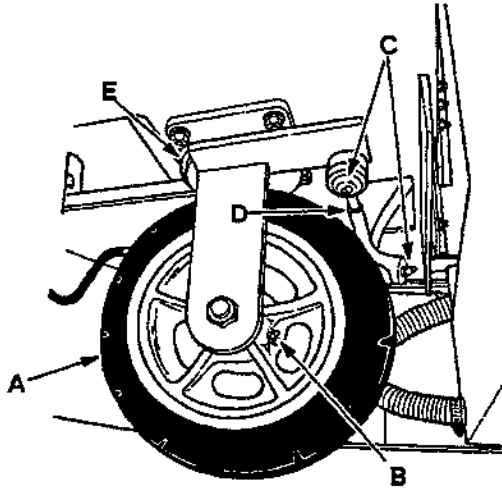
SCRUB HEAD PIVOT

- A. Grease Fittings

00089

FRONT CASTER AND WHEEL BEARING

The front caster wheel supports the weight of the front of the machine. A grease fitting has been provided on the wheel to lubricate the wheel bearings and on the front of the caster for its lubrication. Lubricate the front wheel bearings and caster with a grease gun containing a multipurpose, water resistant, lithium base, moly-disulphide EP grease after every 50 hours of operation.



FRONT CASTER AND STEERING ARM

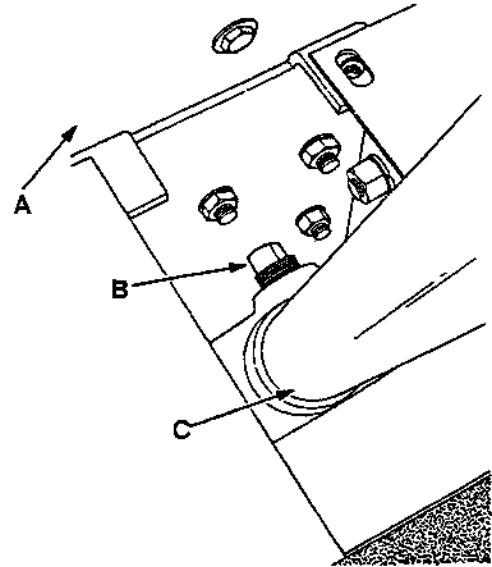
02474

- A. Front Wheel
- B. Wheel Bearing Grease Fitting
- C. Steering Arm Grease Fitting
- D. Steering Arm
- E. Caster Grease Fitting

STEERING GEAR

The steering gear controls the steering arm. A square head plug has been provided on the left side of the gear box to check the grease level and to allow filling.

Check the steering gear grease level after every 400 hours of operation. Fill the unit with multipurpose, calcium soap base grease.



STEERING GEAR

00013

- A. Firewall
- B. Plug
- C. Steering Column

STEERING ARM ROD ENDS

The steering arm steers the front caster. Each rod end is equipped with a grease fitting for lubrication purposes. Lubricate each steering arm rod end with a grease gun containing a multipurpose, water resistant, lithium base moly-disulphide EP grease after every 50 hours of operation.

HYDRAULICS

HYDRAULIC FLUID

Hydraulic fluid drives most of the moving components on the machine. The condition and quality of the hydraulic fluid play a very important role 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 HP1040 should be used in machines that are operated in areas which have ambient temperatures up to 90° F (32° C). Use the HP2060 rated hydraulic fluid in areas which have ambient temperatures above 90° F (32° C).

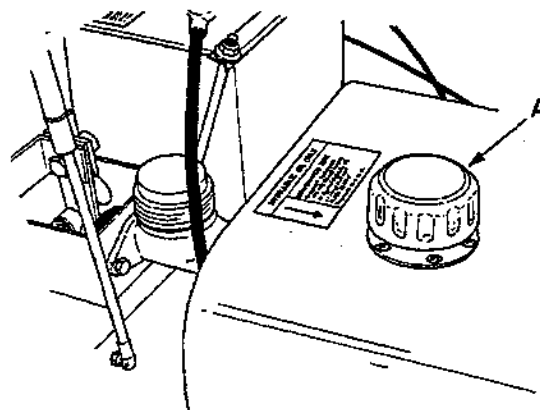
ATTENTION! If a locally-available hydraulic fluid is preferred, or if products of only one oil company are used, the hydraulic fluid used must match closely the viscosity specifications given in the chart for TENNANT® Hydraulic Fluid, as well as the other features described. Do not substitute automatic 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 5.5 gal (21 L) of hydraulic fluid. The reservoir is located in the engine compartment.

The reservoir is equipped with a breather-filler cap and fluid level dipstick mounted on the reservoir. See Hydraulic Fluid Reservoir Breather for breather service information.

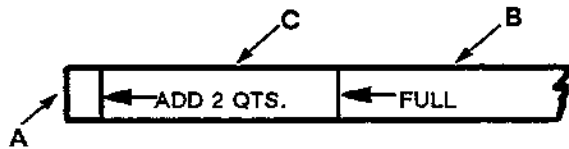


HYDRAULIC FLUID RESERVOIR
BREATH-FILLER CAP

A. Breather-Filler Cap

The hydraulic fluid level dipstick is built into the breather-filler cap. The end of the dipstick is marked with "full" and "add" levels. This indicates the level of hydraulic fluid in the reservoir.

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



02430

HYDRAULIC FLUID LEVEL DIPSTICK

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

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

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

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

TO DRAIN THE HYDRAULIC FLUID RESERVOIR

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

WARNING: Always park on a level surface, stop the engine, and engage the parking brake before working on the machine to keep it from creeping or rolling.

2. Allow the hydraulic fluid to cool.

WARNING: Always allow the hydraulic fluid to cool before draining. Hot fluid can cause severe burns.

3. Remove the reservoir drain plug located on the bottom of the reservoir to drain the hydraulic fluid. Discard the used hydraulic fluid.

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

4. Flush the reservoir with clean hydraulic fluid or suitable solvent. Do not use gasoline, kerosene, or diesel fuel.

5. Reinstall the reservoir drain plug.

TO FILL THE HYDRAULIC FLUID RESERVOIR

1. Raise the engine cover.
2. Remove the reservoir breather-filler cap.
3. Pour 5.5 gal (21 L) of new, approved hydraulic fluid through a 200 mesh screened funnel and into the reservoir filler neck.

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

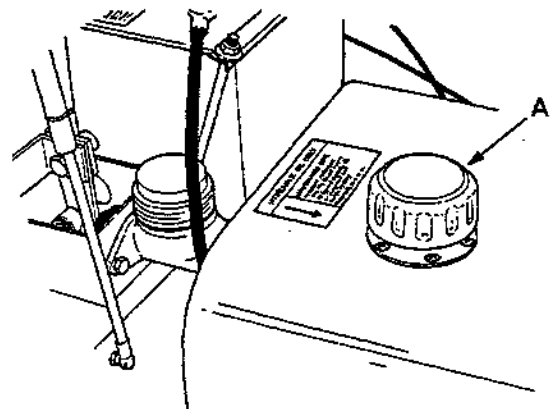
4. Check the hydraulic fluid level in the reservoir with the reservoir dipstick.
5. Add hydraulic fluid until the level in the reservoir is between the "add" and the "full" range. Do not overfill.

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

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

HYDRAULIC FLUID RESERVOIR BREATHER

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



02429

RESERVOIR BREATHER-FILLER CAP

- A. Breather-Filler Cap

HYDRAULIC FLUID FILTER

The machine hydraulic system is kept clean to a level of 10 microns by a hydraulic fluid filter. The hydraulic fluid filter is located in the front of the machine engine compartment.

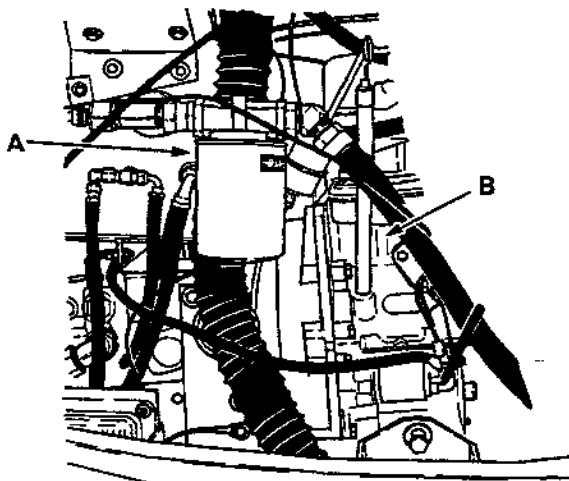
Replace the hydraulic fluid filter element after the first 50 hours of operation and then after every 400 hours of operation.

TO REPLACE HYDRAULIC FLUID FILTER ELEMENT

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

⚠ WARNING: Always park on a level surface, stop the engine, and engage the parking brake before working on the machine to keep it from creeping or rolling.

2. Open the engine cover.



HYDRAULIC FLUID FILTER

02475

- A. Hydraulic Fluid Filter Element
B. Engine

3. Unthread and discard the hydraulic fluid filter element.

NOTE: Be aware the hydraulic filter is below the top of the hydraulic fluid reservoir. Some hydraulic fluid will drain from the reservoir. Discard all hydraulic fluid drained from the system. Drained hydraulic fluid may contain foreign material harmful to the hydraulic system.

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

5. Thread and hand tighten the new hydraulic fluid filter element on the filter head.
6. Operate the machine and check for leaks. Correct any leaks found.
7. Check the hydraulic fluid reservoir level and fill as required.
8. Close the engine cover.

HYDRAULIC PUMPS

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

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

After repairing or replacing a hydraulic pump, 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. Engage the machine parking brake and block the front tire of the machine.

⚠ WARNING: Always engage the parking brake and block the machine tires before jacking the machine up to keep it from rolling or falling off jack.

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

⚠ WARNING: Jack the machine up only at the designated locations to keep it from falling off jack.

3. Block up the machine with jack stands in the designated locations. Make sure the rear tires clear the floor by 2 in (50 mm) and the floor is cleared of all obstacles within a 24 in (610 mm) radius.
4. Fill the hydraulic fluid reservoir with 5.5 gal (21 L) of new, approved hydraulic fluid.
5. Fill the hydraulic pump through the case drain port with hydraulic fluid.

6. Remove the engine coil wire from the engine distributor.
7. Operate the engine starter motor for three 10 second periods.
8. Replace the engine coil wire.
9. Start the engine and operate it at a low idle for two minutes.
10. Press the directional control pedal one-half of its travel in the "forward" direction while also operating the scrub brushes for one minute.
11. Stop the engine.
12. Raise the rear of the machine, remove the jack stands, and lower the machine.
13. Fill the hydraulic fluid reservoir with new, approved hydraulic fluid.
14. Check the hose routings to be sure the hoses do not contact any moving, hot, or sharp surfaces.
15. Replace the hydraulic fluid filter after the first hour of operation.

DIRECTIONAL CONTROL PEDAL

The directional control pedal controls the flow of hydraulic fluid to the hydraulic drive motor. The pedal has three positions – "forward," "neutral," and "reverse." The "forward" and "reverse" positions send hydraulic fluid to the drive motor to propel the machine.

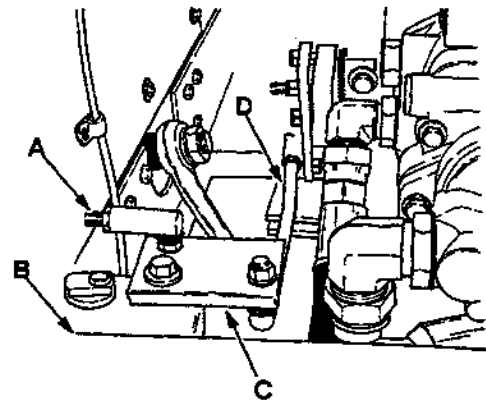
The "neutral" position is the position in which the propelling pump sends no hydraulic fluid to the propelling motor. The machine should not creep when the "neutral" position is correctly adjusted. Adjust the control pedal linkages whenever the machine creeps or after replacing the hydraulic propelling pump or pump linkages.

TO ADJUST DIRECTIONAL CONTROL PEDAL LINKAGE

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

! WARNING: Always park on a level surface, stop the engine, and engage the parking brake before working on the machine to keep it from creeping or rolling.

2. Hold the directional control pedal in the "reverse" position. Adjust the control rod between the pedal and the bell crank so there is 0.38 in (10 mm) between the bell crank and the side of the machine frame.



PUMP LINKAGE

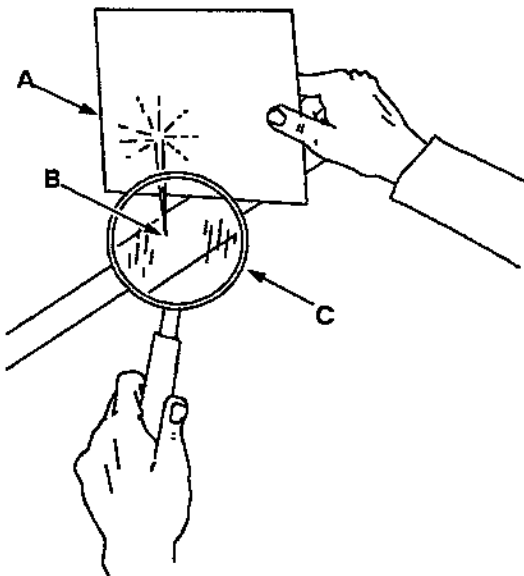
02490

- A. Pedal Rod
- B. Machine Frame
- C. Bell Crank
- D. Pump Rod

3. Adjust the pump rod and rod ball joints so the machine travels 4 mph (6.4 km/h) in "reverse." Make sure the adjustment also gives a full stroke in the forward speed.
4. Adjust the pump pintle arm centering springs so the machine will not creep when the pedal is in the "neutral" position.

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.



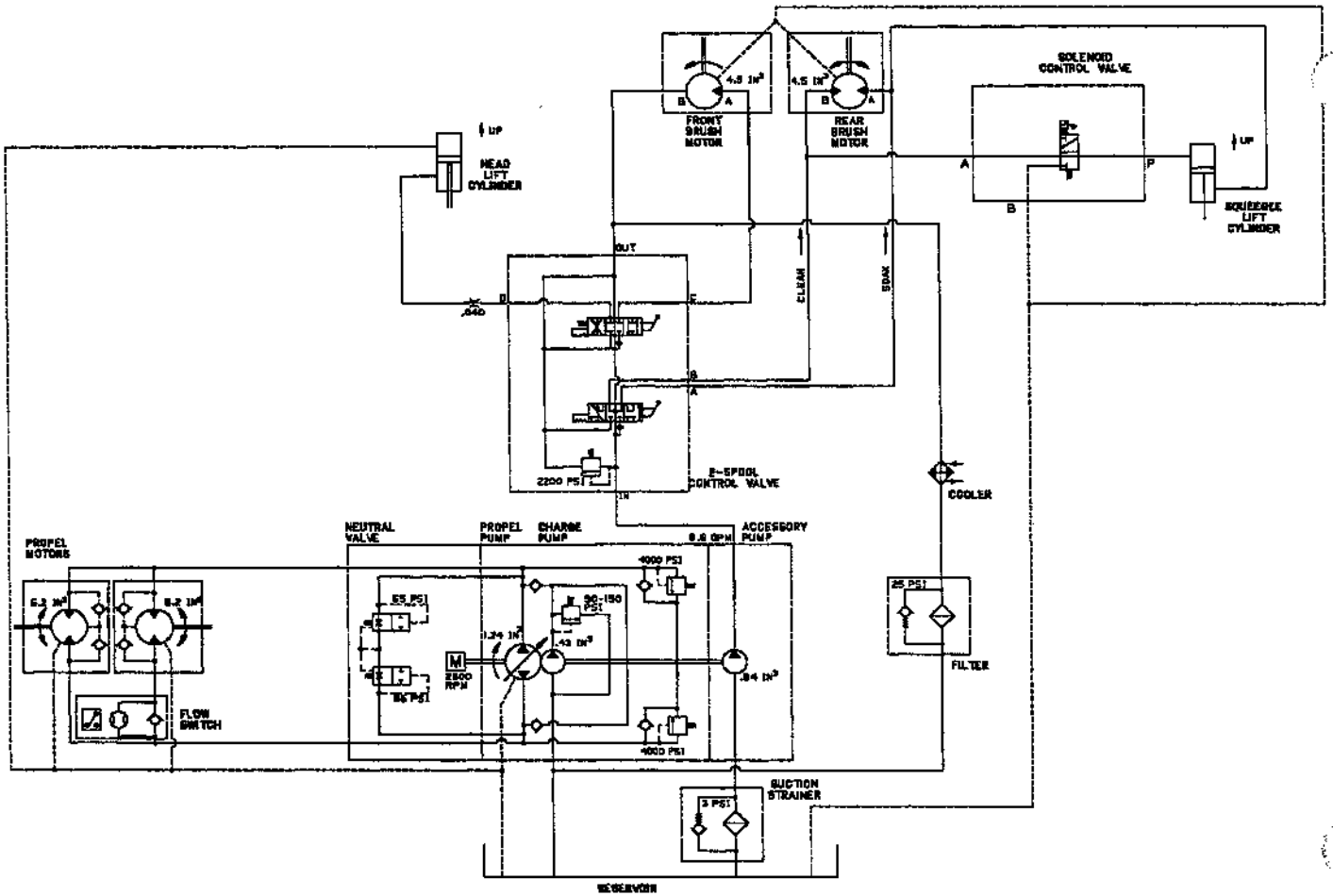
00002

HYDRAULIC PINHOLE LEAK

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

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

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



HYDRAULIC SCHEMATIC

02431

HYDRAULIC SYSTEM TROUBLESHOOTING

The machine utilizes two hydraulic fluid pressure sources to drive seven individual hydraulic circuits. The pressure sources are the variable displacement hydraulic piston pump and the hydraulic gear pump.

The variable displacement piston pump drives the forward and reverse propelling circuits. The gear pump drives the head up, head off, soak, and clean circuits.

A combination of mechanical and electrical devices control the hydraulic system. The following diagrams illustrate the specific mechanical or electrical means used to control the hydraulic circuits. Refer to the individual circuit diagrams and explanations to determine circuit flows. All specifications given are typical with the engine operating at full throttle.

PROPELLING-FORWARD CIRCUIT

The propelling-forward circuit moves the machine forward. This circuit is activated when the directional control pedal is pressed into the "forward" position. The variable displacement propelling pump then directs hydraulic fluid to the drive motor to propel the machine forward. The hydraulic fluid then returns to the pump. This is basically a closed loop circuit.

The propelling pump and drive motors are all equipped with case drains to bleed internal hydraulic fluid leakage to the reservoir to prevent excess pressure build up. Loss of hydraulic fluid to the reservoir is made up by pump suction from the hydraulic fluid filter.

TYPICAL CIRCUIT SPECIFICATIONS

Level ground:

Motor inlet pressure – 200 to 500 psi (1380 to 3450 kPa)

Volume – 13 gpm (49 L/min) @ maximum speed

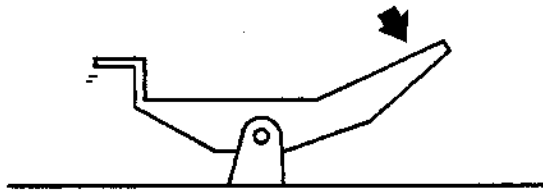
10° ramp:

Motor inlet pressure – 4000 to 4400 psi (27,580 to 30,340 kPa)

Volume @ maximum speed – 4.5 gpm (17 L/min)

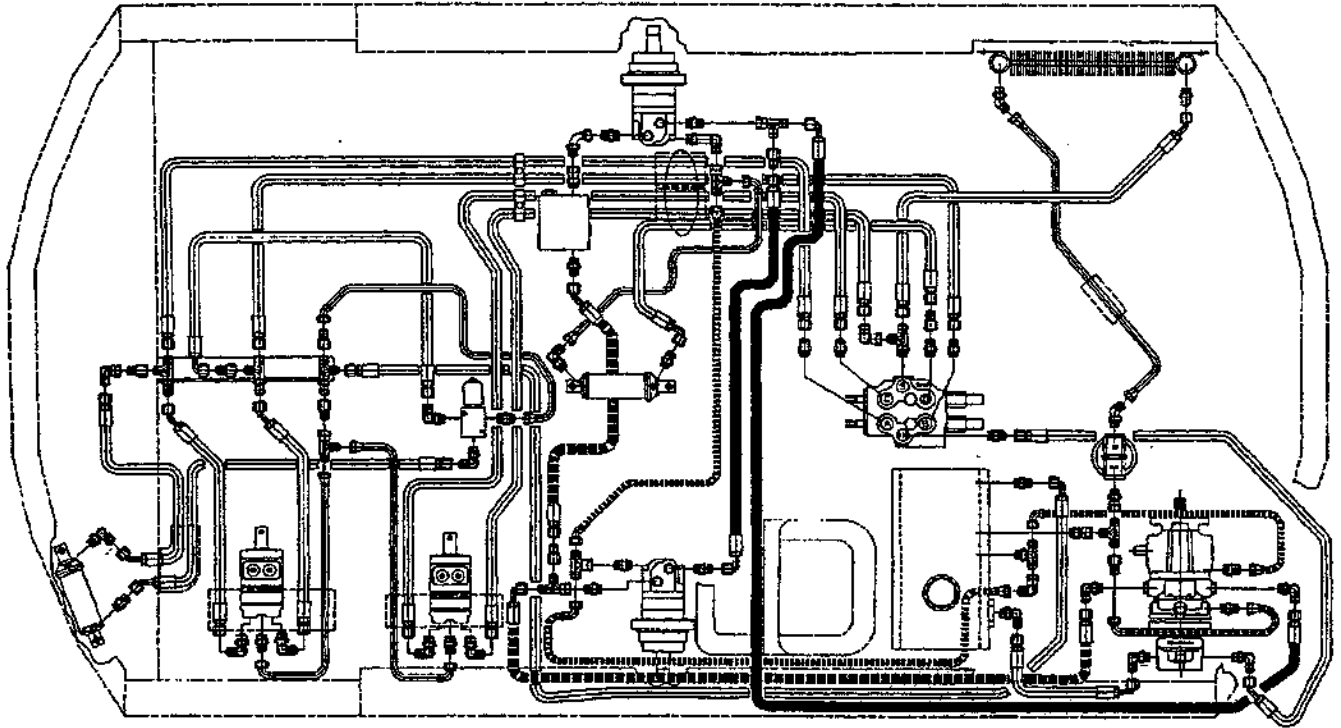
CIRCUIT TROUBLESHOOTING

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 for forward, one for reverse
	Motor failure	See Hydraulic Components Troubleshooting
	Pump failure	See Hydraulic Components Troubleshooting
	Hydraulic fluid level low	Fill hydraulic fluid reservoir
	Brakes dragging	Adjust brakes



02208

DIRECTIONAL CONTROL PEDAL IN "FORWARD" POSITION



02432

PROPELLING-FORWARD CIRCUIT HYDRAULIC FLOWS

PROPELLING-REVERSE CIRCUIT

The propelling-reverse circuit moves the machine backward. This circuit is activated when the directional control pedal is pressed into the "reverse" position. The variable displacement propelling pump then directs hydraulic fluid to the drive motor to propel the machine backward. The hydraulic fluid then returns to the pump. This is basically a closed loop circuit.

The propelling pump and drive motors are all equipped with case drains to bleed internal hydraulic fluid leakage to the reservoir to prevent excess pressure build up. Loss of the hydraulic fluid to the reservoir is made up by pump suction from the hydraulic fluid filter.

TYPICAL CIRCUIT SPECIFICATIONS

Level ground:

Motor inlet pressure – 200 to 500 psi (1380 to 3450 kPa)

Volume @ maximum limited speed – 6 gpm (23 L/min)

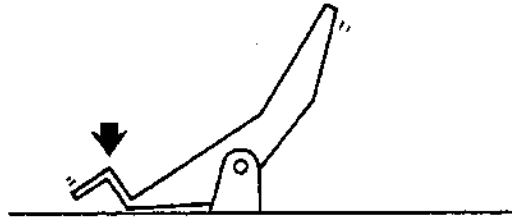
10° ramp:

Motor inlet pressure – 4000 to 4400 psi (27,580 to 30,340 kPa)

Volume @ maximum limited speed – 4.5 gpm (17 L/min)

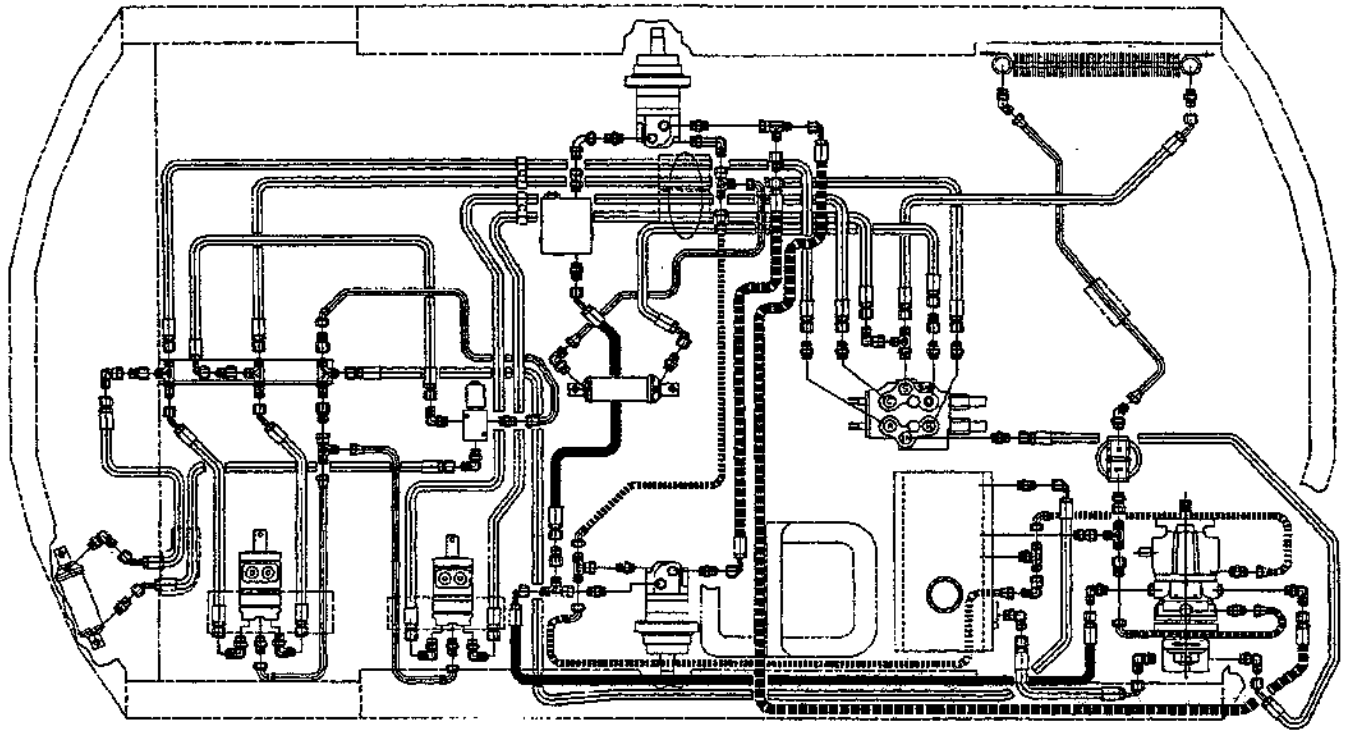
CIRCUIT TROUBLESHOOTING

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 for forward, one for reverse
	Motor failure	See Hydraulic Components Troubleshooting
	Pump failure	See Hydraulic Components Troubleshooting
	Hydraulic fluid level low	Fill hydraulic fluid reservoir
	Brakes dragging	Adjust brakes



02209

DIRECTIONAL CONTROL PEDAL IN "REVERSE" POSITION



02433

PROPELLING-REVERSE CIRCUIT HYDRAULIC FLOWS

HEAD UP CIRCUIT

The head up circuit raises the scrub head off the floor and stops scrub brush rotation.

This circuit is activated when the scrub control levers are placed in the "head up" position. The control valve directs hydraulic fluid from the gear pump to the rod end of the scrub head lift cylinder, lifting the scrub head. Displaced hydraulic fluid from the cylinder is drained back to the reservoir. Excess pressure to the cylinder is drained back through the cooler and filter to the reservoir by the control valve relief valve.

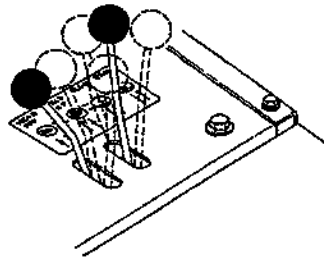
TYPICAL CIRCUIT SPECIFICATIONS

Maximum cylinder inlet pressure – 2200 psi (15,170 kPa)

Maximum relief valve pressure – 2200 psi (15,170 kPa)

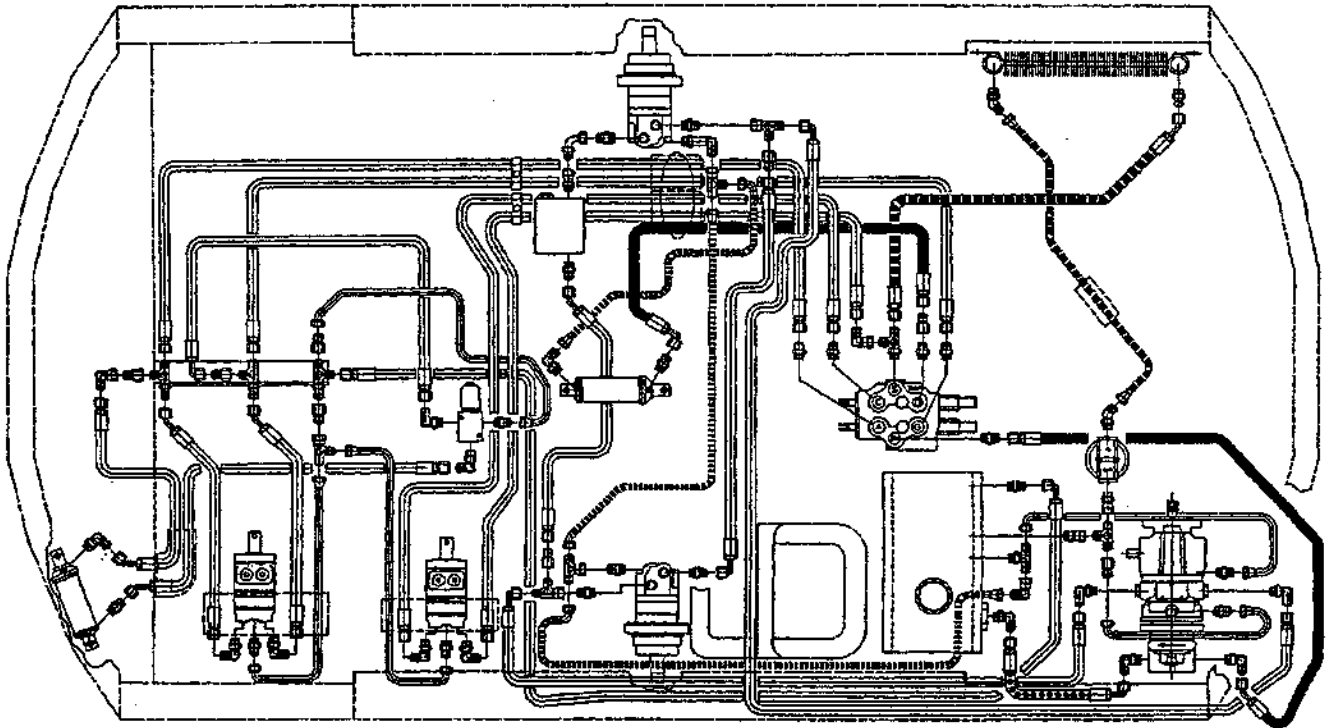
CIRCUIT TROUBLESHOOTING

Problem	Cause	Remedy
Scrub head will not lift	Control valve failure	See Hydraulic Components Troubleshooting
	Lift cylinder failure	See Hydraulic Components Troubleshooting
	Gear pump failure	See Hydraulic Components Troubleshooting
	Hydraulic orifice plugged at control valve	Replace orifice



02420

SCRUB CONTROL LEVERS IN "HEAD UP" POSITION



02434

HEAD UP CIRCUIT HYDRAULIC FLOWS

HEAD OFF CIRCUIT

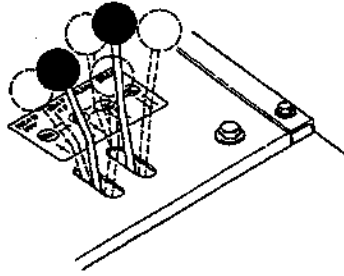
The head off circuit stops all movement on the scrub head—scrub brushes stop, scrub head is stationary. This circuit is activated when the scrub control levers are placed in the “head off” position. The control valve directs hydraulic fluid from the gear pump, through the cooler and filter, to the reservoir.

TYPICAL CIRCUIT SPECIFICATIONS

N/A

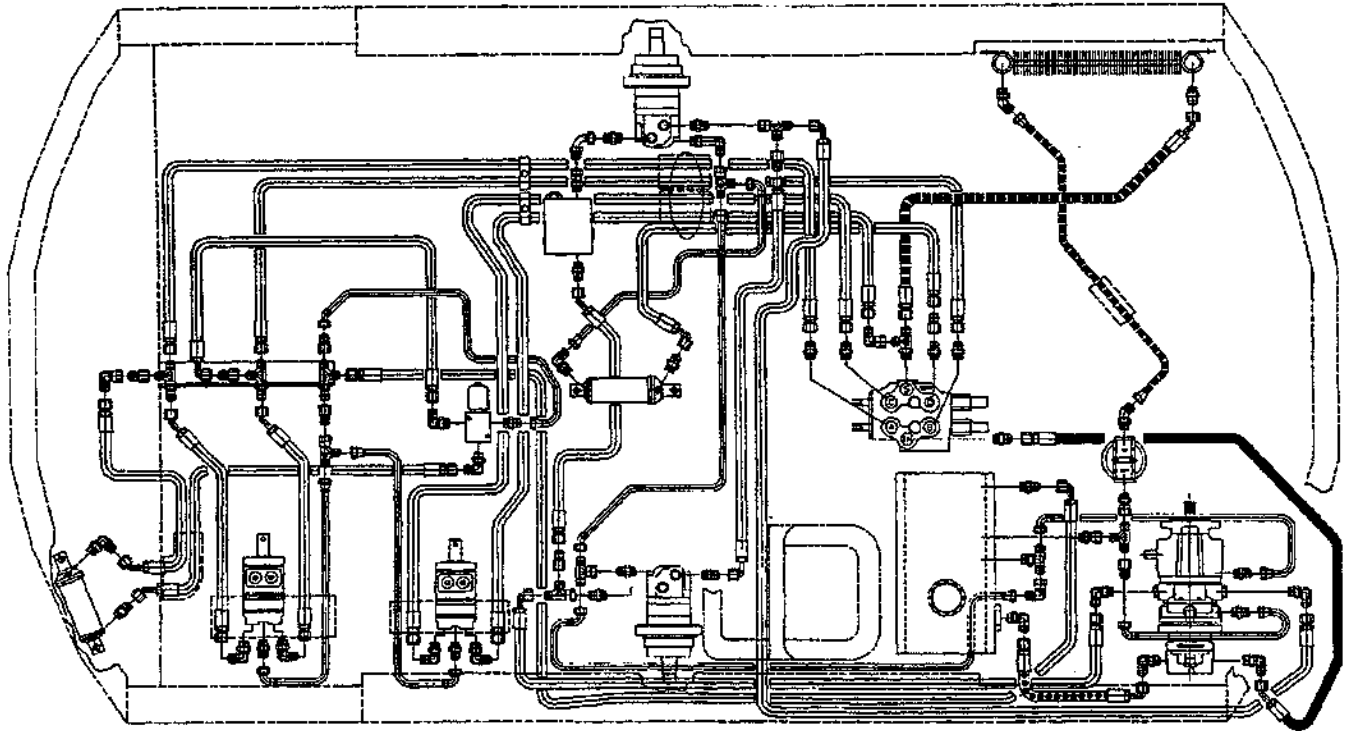
CIRCUIT TROUBLESHOOTING

Problem	Cause	Remedy
Scrub brushes will not stop	Control valve failure	See Hydraulic Components Troubleshooting
	Lift cylinder failure	See Hydraulic Components Troubleshooting
	Gear pump failure	See Hydraulic Components Troubleshooting



02421

SCRUB CONTROL LEVERS IN "HEAD OFF" POSITION



02435

HEAD OFF CIRCUIT HYDRAULIC FLOWS

SOAK CIRCUIT

The soak circuit lowers the scrub head, rotates both scrub brushes in a clockwise direction, as seen from the operator's side of the machine, and raises the rear squeegee. This circuit is activated when the scrub control levers are in the "soak" position. The control valve directs hydraulic fluid from the gear pump to the rear scrub brush motor, rotating the scrub brush. Hydraulic fluid then flows to the solenoid valve and back to the control valve. At the solenoid valve, the pressure differential causes the rear squeegee to raise mechanically. From the control valve, the fluid flows to the front scrub brush motor, rotating the scrub brush. From the front scrub brush motor, the fluid flows through the cooler and filter to the reservoir.

Excess pressure in the scrub brush motors is bled to the reservoir. Fluid also drains from the rod end of the scrub head lift cylinder to the reservoir to lower the scrub head.

TYPICAL CIRCUIT SPECIFICATIONS

Normal front scrub brush inlet pressure – 600 psi (4140 kPa)

Normal rear scrub brush inlet pressure – 1200 psi (8275 kPa)

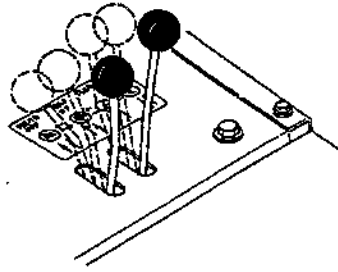
Relief valve pressure – 2200 psi (15,170 kPa)

Normal circuit volume – 8 gpm (30 L)

Maximum solenoid valve current – 2.5 A

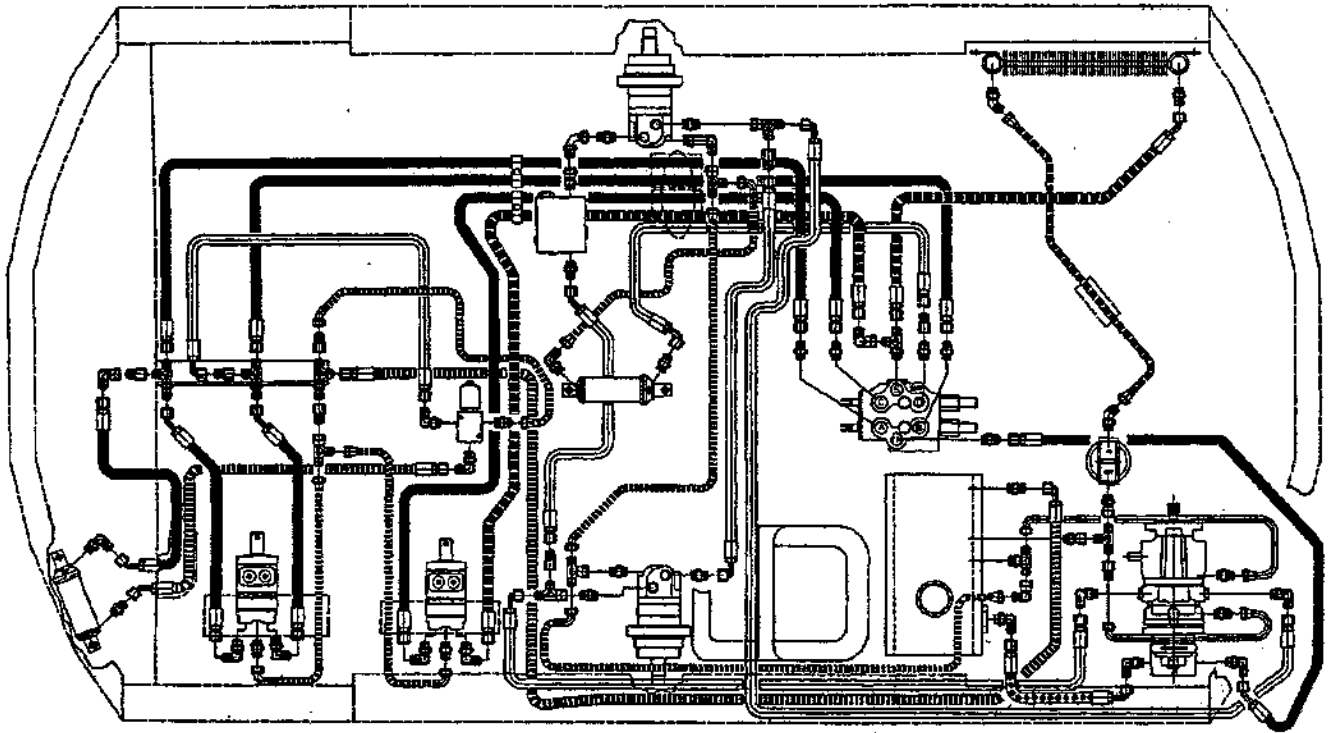
CIRCUIT TROUBLESHOOTING

Problem	Cause	Remedy
Scrub brushes turn slowly	Debris caught in drive mechanism	Free mechanism of debris
	Hydraulic control valve failure	See Hydraulic Components Troubleshooting
	Hydraulic motor failure	See Hydraulic Components Troubleshooting
	Gear pump failure	See Hydraulic Components Troubleshooting
Scrub head will not lower	Debris jammed in mechanism or under scrub head	Remove debris
	Hydraulic control valve failure	See Hydraulic Components Troubleshooting
	Hydraulic orifice plugged at control valve	Replace orifice
Rear squeegee will not raise	Debris caught in squeegee lift mechanism	Remove debris
	Hydraulic cylinder failure	See Hydraulic Components Troubleshooting
	Solenoid valve failure	See Hydraulic Components Troubleshooting
	Rear brush not turning or turning slowly so pressure differential not great enough to lift squeegee.	See Scrub brushes turn slowly



02422

SCRUB CONTROL LEVERS IN "SOAK" POSITION



02436

SOAK CIRCUIT HYDRAULIC FLOWS

CLEAN CIRCUIT – SQUEEGEE DOWN

The clean circuit lowers the scrub head, rotates the front scrub brush clockwise, rotates the rear scrub brush counterclockwise, as seen from the operator's side of the machine, and lowers the rear squeegee with the squeegee switch in the "down" position. This circuit is activated when the scrub control levers are in the "clean" position. The control valve directs hydraulic fluid from the gear pump to the rear scrub brush motor, rotating the scrub brush. Hydraulic fluid then flows to the rear squeegee cylinder and control valve. The rear squeegee lowers as fluid from the rod end of the cylinder flows through the solenoid valve to the reservoir. From the control valve, the fluid flows to the front scrub brush motor, rotating the scrub brush.

The fluid then flows through the cooler and filter to the reservoir. Excess case pressure in the scrub brush motors is bled to the reservoir. Fluid also flows from the rod end of the scrub head lift cylinder to the reservoir to lower the scrub head.

TYPICAL CIRCUIT SPECIFICATIONS

Normal front scrub brush inlet pressure – 600 psi (4140 kPa)

Normal rear scrub brush inlet pressure – 1200 psi (8275 kPa)

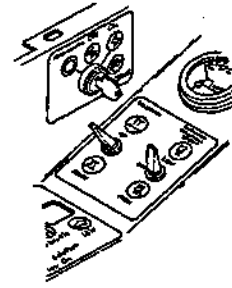
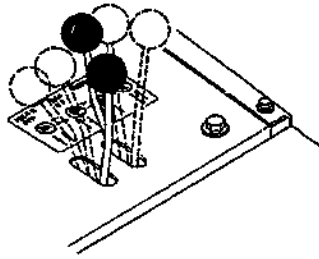
Relief valve pressure – 2200 psi (15,170 kPa)

Normal circuit volume – 8 gpm (30 L)

Maximum solenoid valve current – 2.5 A

CIRCUIT TROUBLESHOOTING

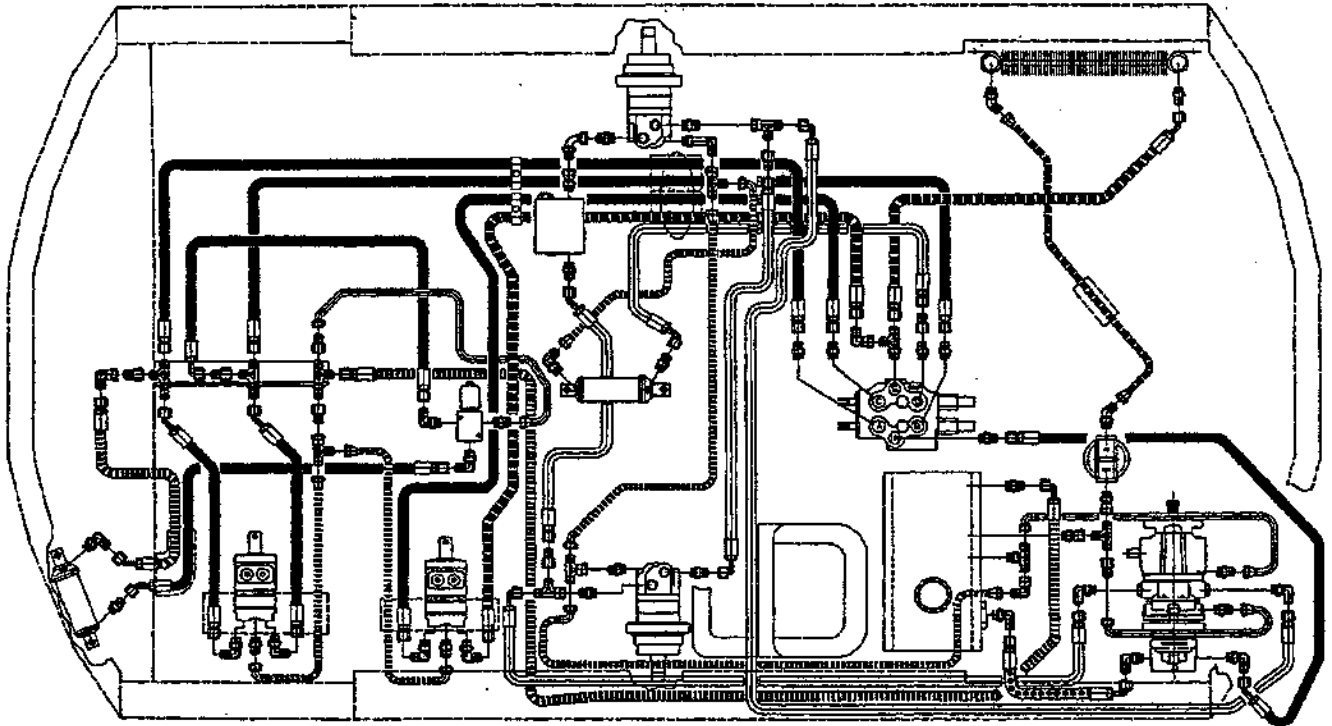
Problem	Cause	Remedy
Scrub brushes turn slowly or not at all	Debris caught in drive mechanism	Free mechanism of debris
	Hydraulic control valve failure	See Hydraulic Components Troubleshooting
	Hydraulic motor failure	See Hydraulic Components Troubleshooting
	Gear pump failure	See Hydraulic Components Troubleshooting
Scrub head will not lower	Debris jammed in mechanism or under scrub head	Remove debris
	Hydraulic control valve failure	See Hydraulic Components Troubleshooting
	Hydraulic orifice plugged at control valve	Replace orifice
Rear squeegee will not lower	Debris caught in squeegee lift mechanism	Remove debris
	Hydraulic cylinder failure	See Hydraulic Components Troubleshooting
	Solenoid valve failure	See Hydraulic Components Troubleshooting



02423

02438

SCRUB CONTROL LEVERS IN "CLEAN" POSITION WITH
SQUEEGEE SWITCH IN "DOWN" POSITION



02437

CLEAN/DOWN CIRCUIT HYDRAULIC FLOWS

CLEAN CIRCUIT – SQUEEGEE UP

The clean circuit lowers the scrub head, rotates the front scrub brush clockwise, rotates the rear scrub brush counterclockwise, and raises the rear squeegee if the squeegee switch is in the "up" position. This circuit is activated when the scrub control levers are in the "clean" position. The control valve directs hydraulic fluid from the gear pump to the rear scrub brush motor, rotating the scrub brush, and to the solenoid valve. From the solenoid valve, the fluid goes to the rod end of the squeegee lift cylinder, lifting the rear squeegee. Fluid from the rear scrub brush motor flows through the control valve to the front scrub brush motor, rotating the scrub brush. The fluid then flows through the cooler and filter to the reservoir. Excess case pressure in the scrub brush motors is bled to the reservoir. Fluid also flows from the rod end of the scrub head lift cylinder to the reservoir to lower the scrub head.

TYPICAL CIRCUIT SPECIFICATIONS

Normal front scrub brush inlet pressure – 600 psi (4140 kPa)

Normal rear scrub brush inlet pressure – 1200 psi (8275 kPa)

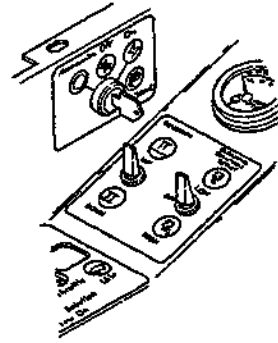
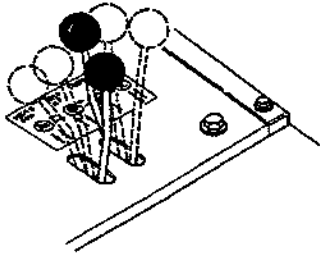
Relief valve pressure – 2200 psi (15,170 kPa)

Normal circuit volume – 8 gpm (30 L)

Maximum solenoid valve current – 2.5 A

CIRCUIT TROUBLESHOOTING

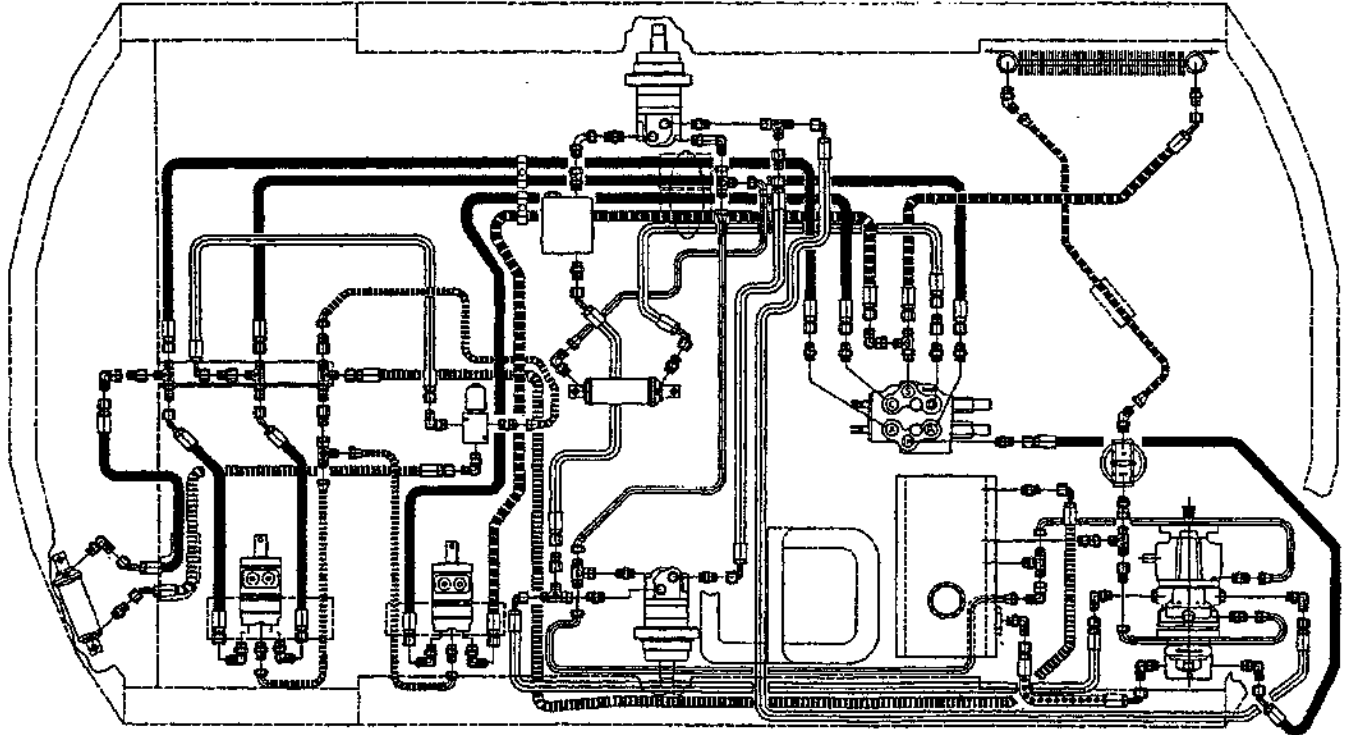
Problem	Cause	Remedy
Scrub brushes turn slowly or not at all	Debris caught in drive mechanism	Free mechanism of debris
	Hydraulic control valve failure	See Hydraulic Components Troubleshooting
	Hydraulic motor failure	See Hydraulic Components Troubleshooting
	Gear pump failure	See Hydraulic Components Troubleshooting
Scrub head will not lower	Debris jammed in mechanism or under scrub head	Remove debris
	Hydraulic control valve failure	See Hydraulic Components Troubleshooting
	Hydraulic orifice plugged at control valve	Replace orifice
Rear squeegee will not lower	Debris caught in squeegee lift mechanism	Remove debris
	Hydraulic cylinder failure	See Hydraulic Components Troubleshooting
	Solenoid valve failure	See Hydraulic Components Troubleshooting



02423

02440

SCRUB CONTROL LEVERS IN "CLEAN" POSITION WITH
SQUEEGEE SWITCH IN "UP" POSITION



02439

CLEAN/UP CIRCUIT HYDRAULIC FLOWS

HYDRAULIC COMPONENTS TROUBLESHOOTING

Problem	Cause	Remedy
Hydraulic cylinder failure	Piston seals leaking	Replace cylinder
	Barrel worn or rod bent	Replace cylinder
Hydraulic control valve failure	Valve seals leaking	Install seal kit
	Check valve sticking	Replace check valve
	Relief valve stuck open (leaking)	Clean or replace relief valve
Hydraulic solenoid valve failure	Valve seals leaking	Install seal kit
	Solenoid coil failure	Replace solenoid coil or valve
	Solenoid spool sticking	Replace valve
	Flow sensing switch failure	Repair or replace flow sensing switch
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
	Relief valve stuck	Replace back plate assembly
	Engine-to-pump coupling failure	Replace coupling
Hydraulic piston pump	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

ENGINE LUBRICATION

Check the engine oil level daily.

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

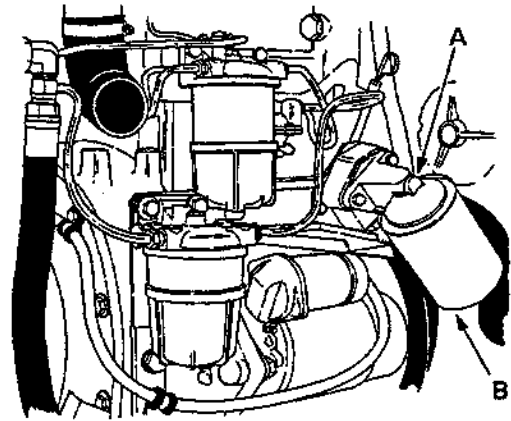
The engine oil capacity is 3.5 qt (3.3 L) including the oil filter. Add three drops of oil to the distributor shaft felt after every 400 hours of operation.

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

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

0° to 45°F (-18° to 7°C)	45° to 80°F (7° to 27°C)	Above 80°F (Above 27°C)
10W	20W/20	30

The engine oil capacity is 5 qt (4.7 L) including the oil filter.



OIL FILTER

- A. Oil Filter Head
- B. Filter Element

01232


COOLING SYSTEM

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

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

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

Engine overheating may also be caused by dirty radiator fins. The exterior fins of the radiator can be cleaned with an air or water hose. Check the radiator core exterior daily for debris.


 **CAUTION:** Always wear eye protection when using air or water hoses to prevent eye injury.

Blow or rinse all dust, which may have collected on the radiator, in through the grill and radiator fins, opposite the direction of normal air flow. Clean the radiator and cooler only after the radiator has cooled to avoid cracking.

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

NOTE: Overheating is always accompanied by loss of coolant water. If in doubt, check.

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:** If the coolant is hot or if the engine has been operating, let the engine cool. Hot coolant could scald or cause severe burns. If in doubt, let the coolant cool before releasing pressure in the cooling system.

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

AIR FILTER

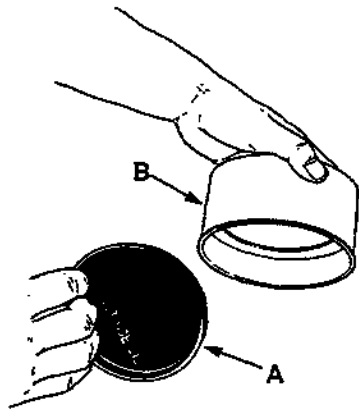
The engine air filter housing includes a dust cap and a dry cartridge-type air filter element. The dust cap must be emptied of dirt daily. The air filter element must be cleaned and inspected or replaced after every 50 hours of operation. The filter element must be replaced if it is damaged or has been cleaned three times.

TO REPLACE AIR FILTER ELEMENT

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

 **WARNING:** Always park on a level surface, stop the engine, and engage parking brake before working on the machine to keep it from creeping or rolling.

2. Open the engine cover.
3. Unscrew the clamp ring on the filter.
4. Remove the dust cap.
5. Remove the rubber insert from the dust cap.

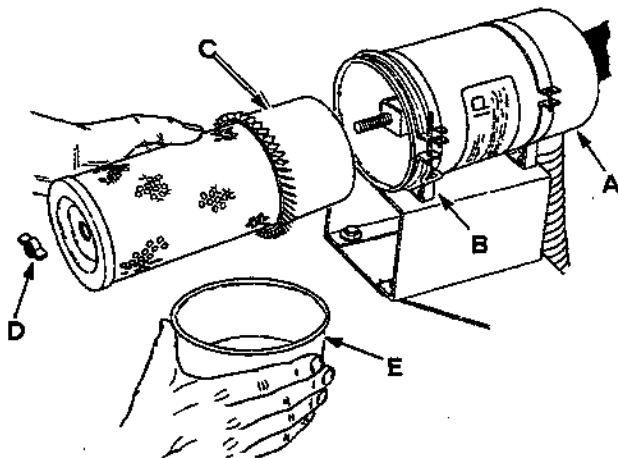


REMOVING RUBBER INSERT

02491

- A. Rubber Insert
- B. Dust Cap

6. Clean the dust cap and rubber insert with a damp cloth.
7. Reinstall the rubber insert in the dust cap.
8. Remove the filter wing nut.
9. Gently pull the filter element out of the filter housing.



REMOVING AIR FILTER ELEMENT

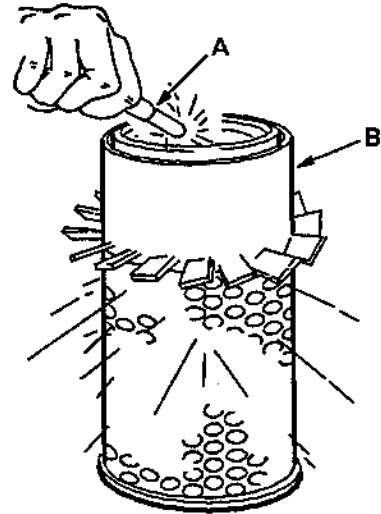
00044

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

10. Clean the interior of the air cleaner housing with a damp cloth. Clean the element housing seating surfaces.
11. Using an air hose, direct dry, clean air maximum 30 psi (205 kPa) up and down

pleats on the inside of the filter. Do not rap, tap, or pound dust out of the element.

! WARNING: Wear approved eye protection when using air hoses to prevent eye injury.

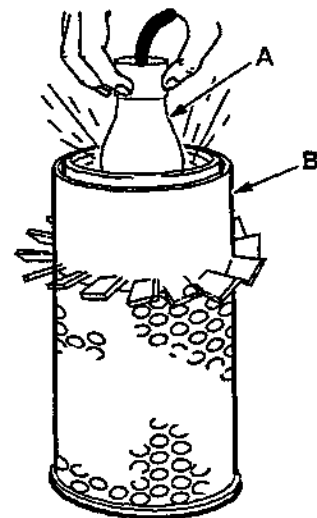


CLEANING AIR FILTER ELEMENT

00051

- A. Air Hose
- B. Filter Element

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

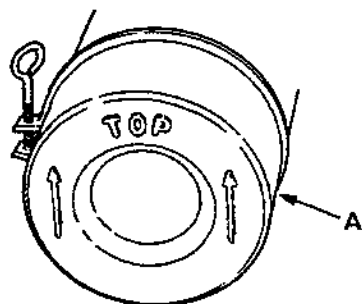


INSPECTING AIR FILTER ELEMENT

00350

- A. Bright Light
- B. Filter Element

13. 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 seated evenly. Tighten the element wing nut.
14. Install the dust cap with the arrows pointing up. Tighten the clamp ring to hold it in place. Check all intake hose connections for leaks or abrasion.



DUST CAP

02492

A. Dust Cap

15. Close the engine cover.

FUEL SYSTEM - GASOLINE

FUEL FILTER

The fuel filter traps fuel impurities. It is located under the fuel tank. Replace the filter element after the first 50 hours of operation and then as required.

CARBURETOR

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

! WARNING: Always wear eye protection and stay clear of engine fan and drive belts when working in the engine compartment with the engine operating to avoid severe personal injury.

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

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

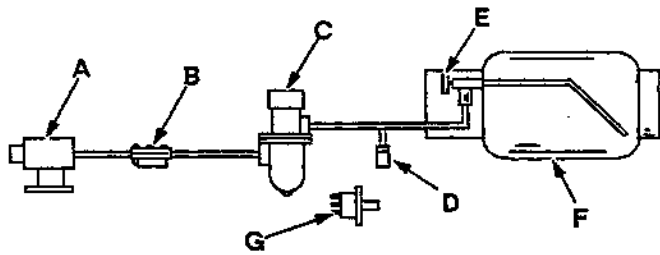
FUEL SYSTEM - LPG

LPG FUEL SYSTEM

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

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



LPG FUEL SYSTEM

03511

- 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:

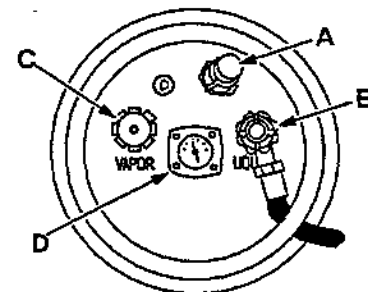
Filler Valve – Check for proper functioning and the presence of the handwheel. Valve must be closed except during filling.

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.



TYPICAL LPG LIQUID WITHDRAWAL FUEL TANK

03485

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

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, fittings, and the fuel lines and fittings for his own satisfaction. If abnormal wear is detected, the operator should report his findings to his supervisor for appropriate action.

TO CHANGE AN LPG FUEL TANK


1. Park the machine in a designated safe area.

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

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

 **WARNING:** Always park on a level surface, stop the engine, and engage the parking brake before working on the machine to keep it from creeping or rolling.

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

 **CAUTION:** Always wear gloves when disconnecting the tank coupling to prevent escaping LPG fuel from freezing hands.


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.


 **WARNING:** 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.

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

To check the fuel filter lock for proper operation:

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

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

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.

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

Check for proper operation. Use a pressure gauge to check the output of the regulator to make sure it is working per specifications.


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.

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

To check the oil pressure switch:

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

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-FILTER

The fuel water trap-filter separates water and impurities from the fuel. It is located on the front right engine mounting bracket. 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 when diesel fuel appears.

Clean the water trap after every 100 hours of operation.

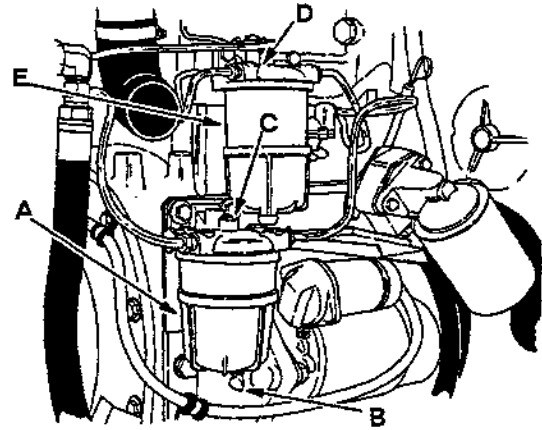
Replace the fuel filter element after every 400 hours of operation.

TO CLEAN THE WATER TRAP

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

⚠ WARNING: Always park and level surface, stop the engine, and engage parking brake before working on the machine to keep it from creeping or rolling.

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



WATER TRAP AND FUEL FILTER

01232

- A. Water Trap
- B. Drain Spigot
- C. Bowl Retaining Bolt
- D. Fuel Filter
- E. Filter Element

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

NOTE: Do not use gasoline to clean the bowl.

7. After cleaning the water trap bowl, fill the bowl with clean fuel. Hold the water trap bowl in position under the water trap head.
8. Secure the bowl retaining bolt.
9. Bleed the fuel system as described in To Prime Fuel System.

TO REPLACE FUEL FILTER ELEMENT

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

⚠ WARNING: Always park and level surface, stop the engine, and engage parking brake before working on the machine to keep it from creeping or rolling.

2. Open the engine hood.
3. Thoroughly clean the exterior of the fuel filter assembly.
4. Unscrew the filter bolt in the center of the head.

5. Lower the filter bowl and element (see illustration) and discard the fuel, together with the old element.
6. Thoroughly clean the filter bowl in cleaning fluid.

NOTE: Do not use gasoline as a cleaning fluid.

7. 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.
8. 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 To Prime Fuel System.

ENGINE STARTING AIDS

Only Perkins Engine Company-approved starting aids may be used to aid in starting a Perkins diesel engine. Use of ether or other starting aids not recommended by Perkins Engines voids the engine warranty and may cause severe engine damage.

Contact the local Perkins Engine repair center for information.

PRIMING FUEL SYSTEM

Priming the fuel system removes pockets of air in the fuel lines and fuel components. Air in the fuel system will prevent smooth engine operation.

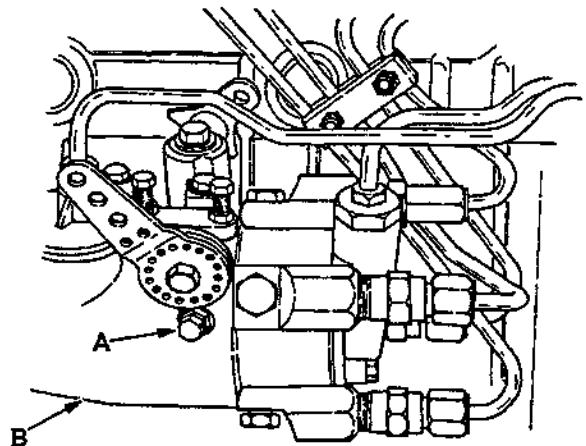
Prime the fuel system after running out of fuel, changing fuel filter elements or repairing a fuel system component.

TO PRIME FUEL SYSTEM

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

⚠ WARNING: Always park on a level surface, stop the engine, and engage the parking brake before working on the machine to keep it from rolling or creeping.

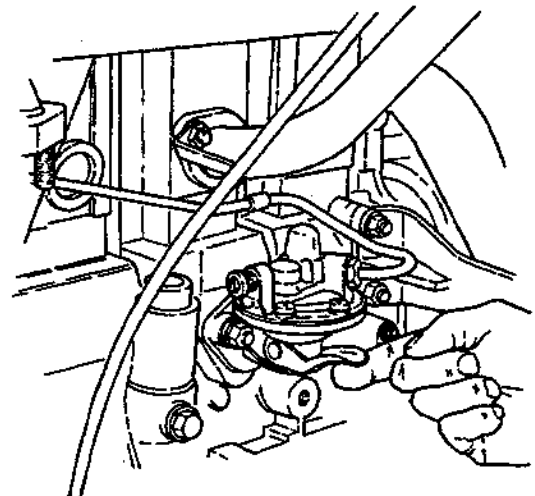
2. Unscrew the fuel pipe on top of the fuel filter cover, not the fuel return pipe to the tank, two or three turns.
3. Loosen the vent screw on the hydraulic head locking screw on the side of the fuel injection pump body.
4. Loosen the air vent screws near the side of the governor housing on the fuel injection pump.
5. Operate the priming lever of the fuel lift pump.



VENT SCREW ON GOVERNOR HOUSING

- A. Vent Screw
- B. Governor Housing

00207



OPERATING THE HAND PRIMER ON THE FUEL LIFT PUMP

00209

It may not be possible to operate the priming lever if the driving cam is in the maximum lift position. To rectify this condition, turn the engine one complete revolution until fuel, free from air bubbles, bleeds from each vent point.

Tighten the connections in the following order:

1. Filter cover fuel pipe.
2. Head locking screw on fuel injection pump.
3. Governor vent screw on fuel injection pump.

Slacken the pipe union nut at the fuel injection pump inlet. Operate the priming lever on the lift pump and retighten the pipe union when the fuel, free from air bubbles, bleeds from around the threads.

The entire operation must be carried out completely. No action to tighten connections must be made until all signs of air bubbles have disappeared. Unless care is taken with this operation, and this could take some four or five minutes of hand priming, failure to start will result.

Slacken the unions at the injector ends of the high pressure fuel pipes.

Set the accelerator in the fully-open position and ensure that the stop control is in the "run" position.

Rotate the engine with the starter motor until fuel oil, free from air bubbles, issues from all fuel pipes. 30 to 60 seconds of rotation may be necessary before this condition is reached. The time will depend upon the speed of rotation and the effectiveness of the bleeding operation described above. A fully-charged battery in a temperate or warm climate will rotate the engine approximately 280 rpm. Under these conditions, the remaining air should be expelled in under 30 seconds. Cold conditions or partially discharged batteries may take longer.

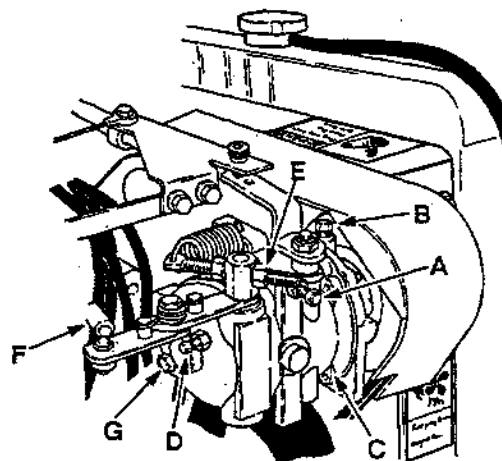
Tighten the unions on the fuel pipes and the engine is ready for starting.

If, after bleeding the fuel system, the engine starts and runs satisfactorily, but after a few minutes stops, then it can be assumed that air is trapped in the fuel injection pump and the bleeding procedure should be repeated. At the same time check for air leaks on the suction side, such as loose or faulty connections.

GOVERNOR - GASOLINE, LPG

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

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



GOVERNOR

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

02428

The governor is factory set and should not be adjusted unless the engine speed varies from the specification or if the engine surges. The governor should be set so the engine operates at 2200 + 50 rpm at "full" speed setting under load. A surge screw has been provided to compensate for surging — adjust it with care or governor damage may result. The regulation screw has been factory set and should not be tampered with.

TO ADJUST GOVERNOR

1. Operate the engine until it reaches normal operating temperature.
2. Park on a level surface, stop the engine, and engage the machine parking brake.

⚠ WARNING: Always park on a level surface, stop the engine, and engage the parking brake before working on the machine to keep it from rolling.

3. Check the governor belt tension as described in Governor Belt.
4. Place the throttle control lever in the "high" position. There should be a 0.03 to 0.06 in (1 to 2 mm) space between the carburetor lever and the lever stop. Adjust the throttle rod as required.
5. Move the throttle control lever to the "idle" position. Start the engine and adjust the engine idle speed screw so the engine operates at 950 + 50 rpm.
6. Place the scrub control levers in the "soak" position. Adjust the high speed stop screw so the engine operates at 2350 rpm. Then adjust the surge screw to bring the engine speed to 2400 rpm. Tighten all locknuts.

⚠ WARNING: Use extreme caution when working around an operating engine to prevent personal injury.

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

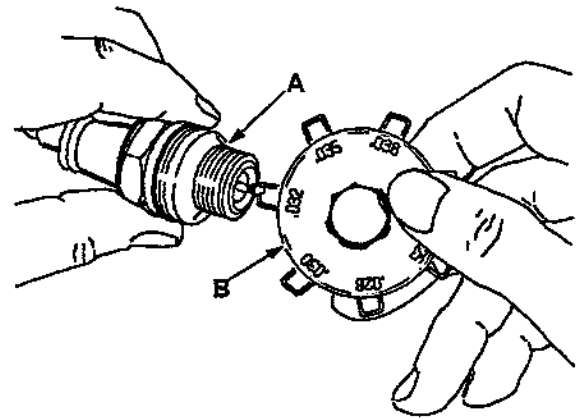
⚠ WARNING: Avoid moving parts of the machine. Do not wear loose jackets, shirts, or sleeves when working on machine because of the danger of becoming caught in moving parts. Keep shields and guards in position. Wear approved eye protection. If adjustments must be made while the engine is running, use extreme caution near hot manifolds, moving parts, belts, etc.

IGNITION SYSTEM - GASOLINE, LPG

SPARK PLUGS

Clean or replace and adjust spark plugs after every 400 hours of operation. Spark plug gaps are best checked with a wire gauge unless the plug is 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 a broken porcelain.

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



GAPPING SPARK PLUG

01174

- A. Spark Plug
- B. Gapping Tool

The proper spark plug gap is 0.032 in (0.8 mm).

Spark plugs must be correctly installed in order to obtain good performance. 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 the spark plugs to 22 to 28 ft lb (30 to 40 Nm) with a socket wrench of the correct size.

DISTRIBUTOR

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

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

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

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

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

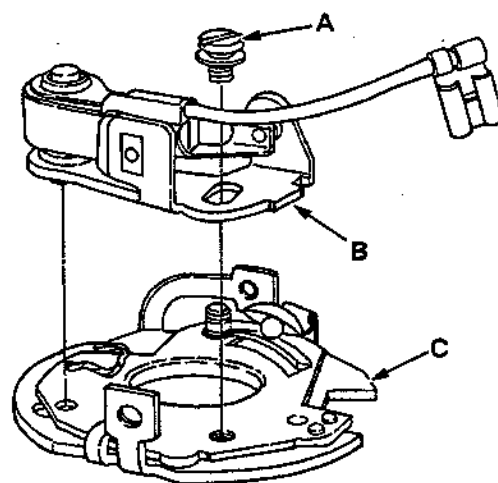
If the points are serviceable, they should be dressed down with a fine cut stone or point file. The file must be clean and sharp; never use emery cloth to clean contact points.

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

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

TO REPLACE IGNITION POINTS

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

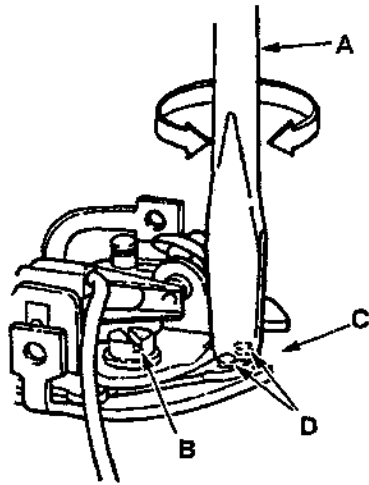


INSTALLING IGNITION POINTS

00694

- A. Retaining Lockscrew
- B. Ignition Point Assembly
- C. Advance Plate

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



ADJUSTING IGNITION POINTS

00695

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

ENGINE IGNITION TIMING

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

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

TO CHECK AND ADJUST IGNITION TIMING

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

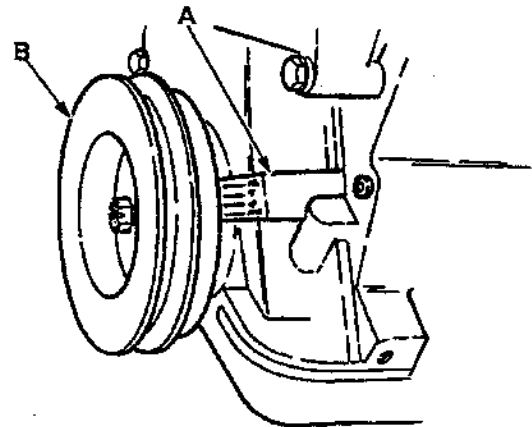
1. Stop the engine and engage the machine parking brake.

! WARNING: Always park on a level surface, stop the engine, and engage the parking brake before working on the machine to keep it from creeping or rolling.

2. Clean and mark the timing marks.

NOTE: Painting a white line on the front pulley timing marks will make them more visible under the timing light.

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



ENGINE TIMING MARKS

00696

- A. Timing Pointer
- B. Crankshaft Pulley

! CAUTION: Do not hold ignition wires with bare hands as electrical shocks or other injuries can result.

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

! WARNING: Always wear eye protection and stay clear of engine fan and drive belts when working in the engine compartment with the engine operating to avoid severe personal injury.

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

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

6. Check the centrifugal advance for proper operation by starting the engine and accelerating it to approximately 2000 rpm. If the ignition timing advances, the centrifugal advance mechanism is functioning properly. Note the engine speed when the advance begins and the amount of total advance. Stop the engine.

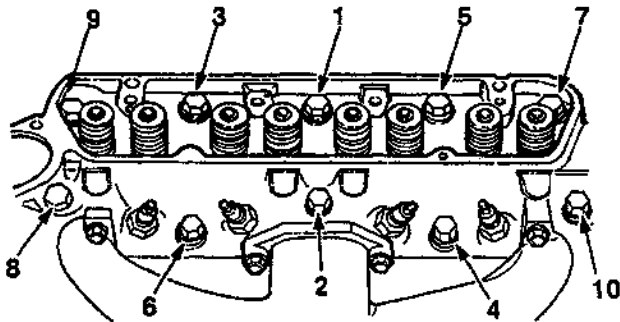
7. Unplug the vacuum line and connect it to the distributor vacuum advance unit. Start the engine and accelerate it to approximately 2000 rpm. Note the engine speed when the advance begins and the total amount of advance. Advance of the ignition timing should begin sooner and advance farther than when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

CYLINDER HEAD - GASOLINE, LPG

CYLINDER HEAD

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 in the proper sequence: first to one-third, then two-thirds, and then to the full torque specification of 65 to 70 ft lb (90 to 95 Nm).

Retighten the cylinder head bolts after the first 50 hours of operation and seasonally thereafter.



00697

CYLINDER HEAD BOLT TIGHTENING SEQUENCE

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

NOTE: Power wrench torque limit must be held at least 10 ft lb (15 Nm) below hand torque specification; then hand torque to the specification.

Tighten the intake manifold bolts to 15 to 18 ft lb (20 to 25 Nm) after every 800 hours of operation.

VALVE CLEARANCE

The valve clearance must be checked and adjusted if necessary after the first 150 hours of operation, and then after every 400 hours of operation and after retorquing the cylinder head bolts.

To set the valve clearance without the engine operating, rotate the crankshaft until no. 1 cylinder is at the top of the compression stroke. Check the timing marks. It should read 0 or TDC. Both valves on no. 1 cylinder are now closed. Set the valve clearance on both valves. Next, rotate the crankshaft 180°, and set the valve lash on both valves on no. 2 cylinder. Again rotate the crankshaft 180°, and set the valve lash on both valves on no. 4 cylinder. Rotate the crankshaft another 180°, and set the valve lash on both valves on no. 3 cylinder.

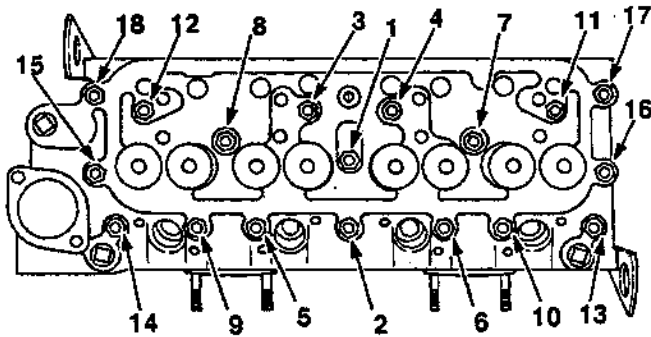
Check and adjust the intake valve clearance from 0.008 to 0.010 in (0.20 to 0.25 mm) and the exhaust valve clearance from 0.018 to 0.020 in (0.45 to 0.50 mm) while the engine is cold.

CYLINDER HEAD - DIESEL

CYLINDER HEAD

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

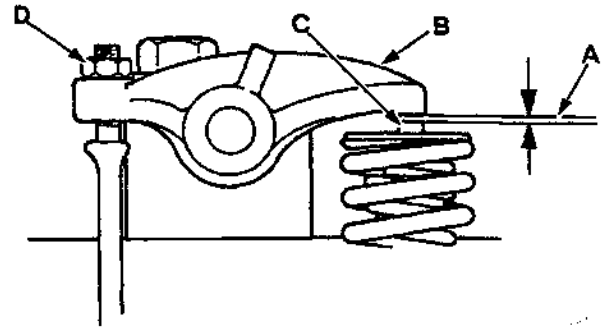
VALVE CLEARANCE

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. Locknut

CRANKCASE VENTILATION SYSTEM - GASOLINE, LPG

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

TUNE-UP CHART—GASOLINE, LPG	
Idle speed, no load	950 + 50 rpm
Maximum governed speed, under load	2400 + 50 rpm
Maximum governed speed, no load	2700 + 100 rpm
Spark plug gap	0.032 in (0.8 mm)
Ignition point gap	0.025 in (0.6 mm)
Dwell angle	48° to 52°
Timing	10° to 12° BTDC @ 600 rpm, gasoline
	12° to 14° BTDC @ 600 rpm, LPG
Firing order	1-2-4-3, counterclockwise rotation
Valve clearance, cold	0.008 to 0.010 in (0.20 to 0.25 mm) intake
	0.018 to 0.020 in (0.45 to 0.50 mm) exhaust

ELECTRICAL SYSTEM

BATTERY

The battery is rated at 12 V, 475 cca. It is located in the engine compartment. When removing battery cables, remove the negative (-) cable before the positive (+) cable.

CAUTION: Always remove the negative (-) battery cable before the positive (+) battery cable to prevent accidental electrical shorting and personal injury.

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

Do not operate the machine if the battery is in poor condition or discharged beyond 80%, specific gravity below 1.120.

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

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

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

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

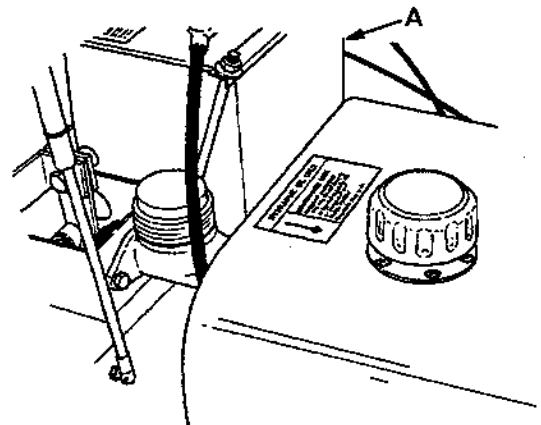
SPECIFIC GRAVITY AT 80° F (26.6° C)	BATTERY CONDITION
1.260 – 1.280	100% charged
1.230 – 1.250	75% charged
1.200 – 1.220	50% charged
1.170 – 1.190	25% charged
1.110 – 1.130	Discharged

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

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

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

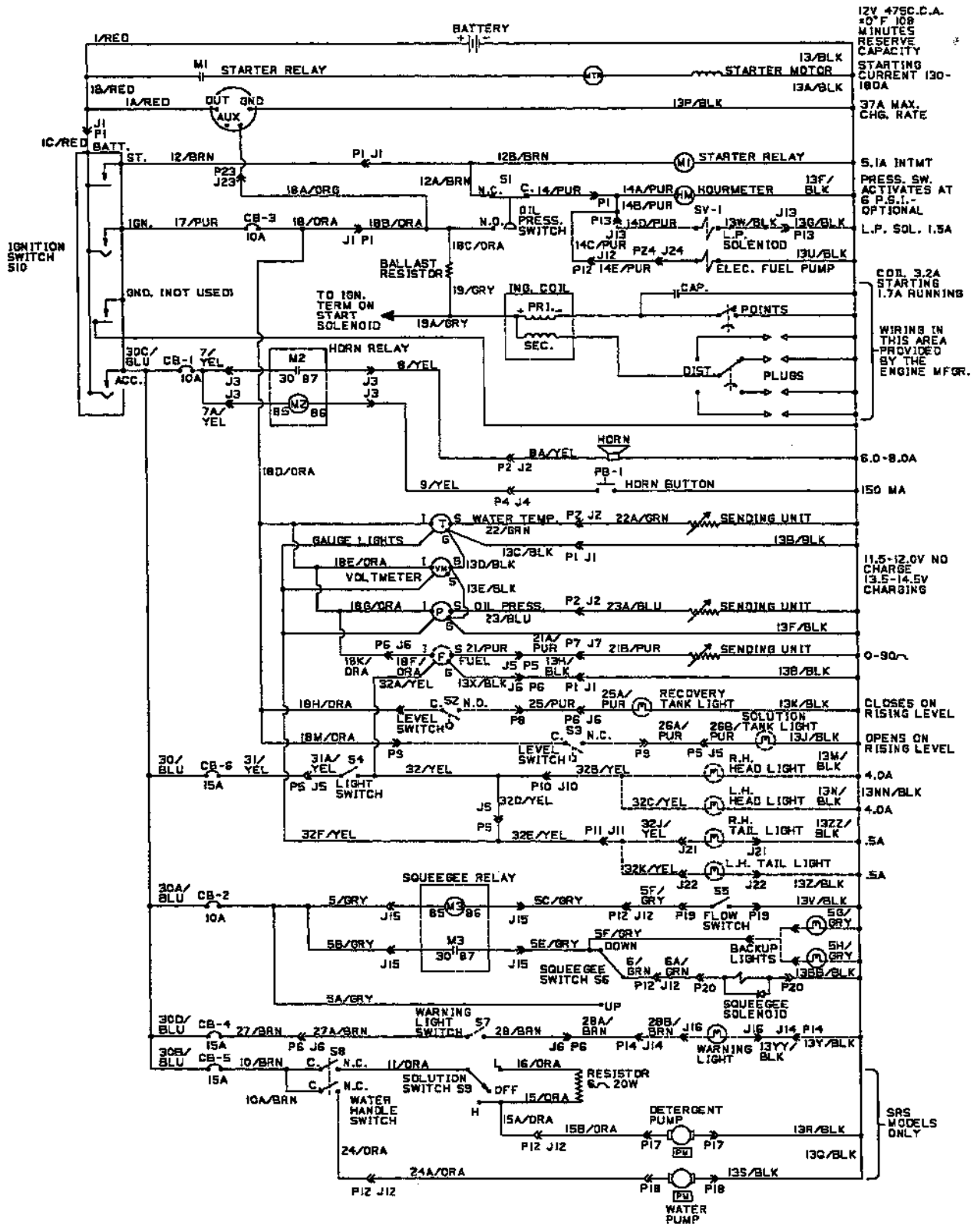
Subtract from the specific gravity reading 0.004 (4 points) for each 10° F (5.5° C) below 80° F (26.6° C).



BATTERY

A. Battery

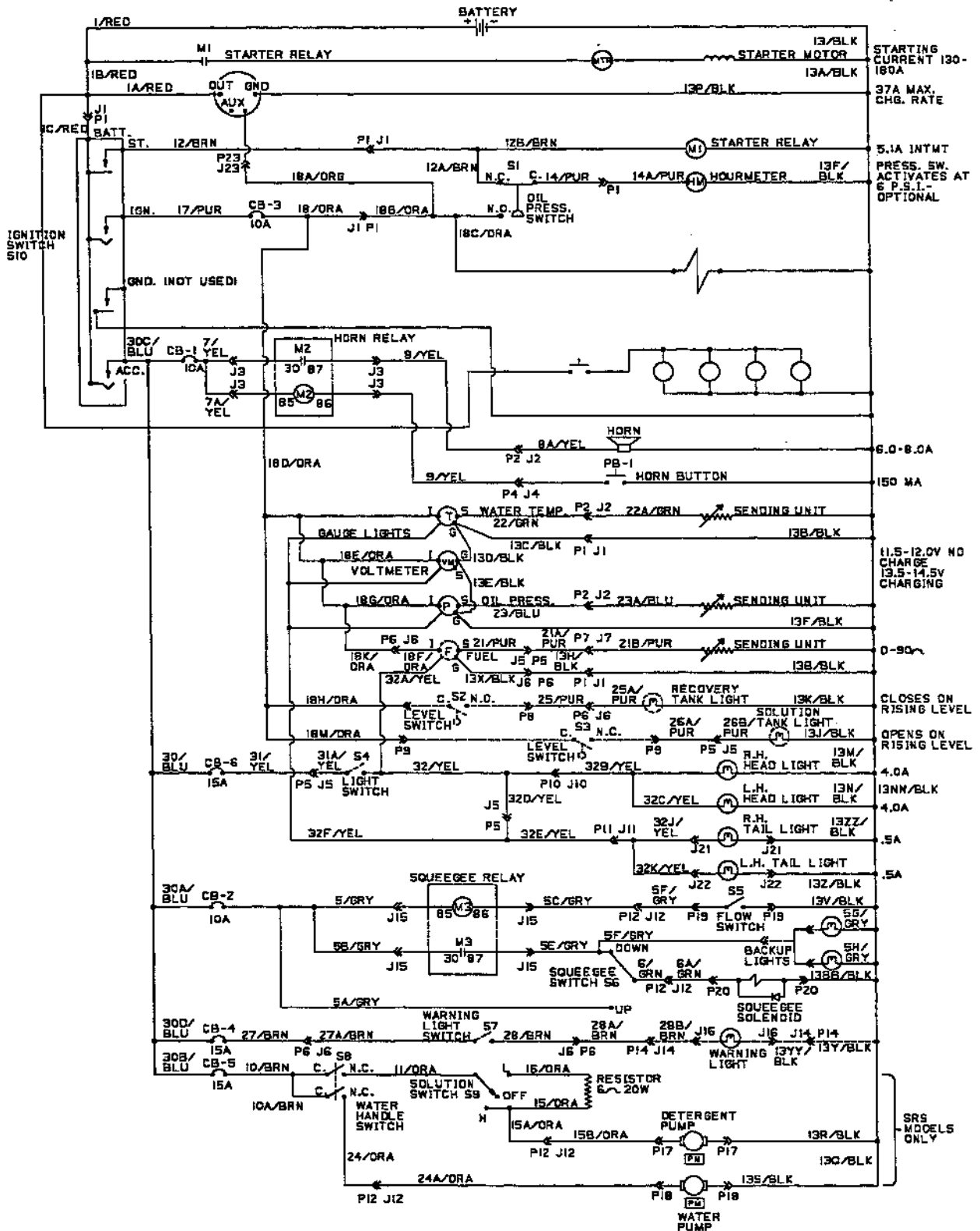
02429



LEGEND			
M	POWER RELAY	HM	HOURLMETER
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

ELECTRICAL SCHEMATIC, GASOLINE, LPG

02442



LEGEND			
M	POWER RELAY	HM	HOURLY METER
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

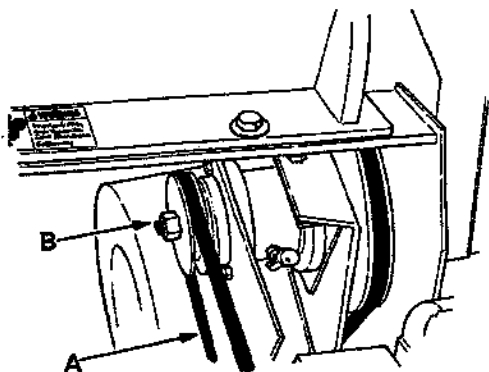
ELECTRICAL SCHEMATIC, DIESEL

BELTS AND CHAINS

ENGINE FAN BELT

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

To adjust engine fan belt tension, adjust the belt link. Proper belt tension is obtained when the belt deflects 0.28 in (7 mm) from a force of 5 lb (2.3 kg) applied at the belt midpoint.



ENGINE FAN BELT

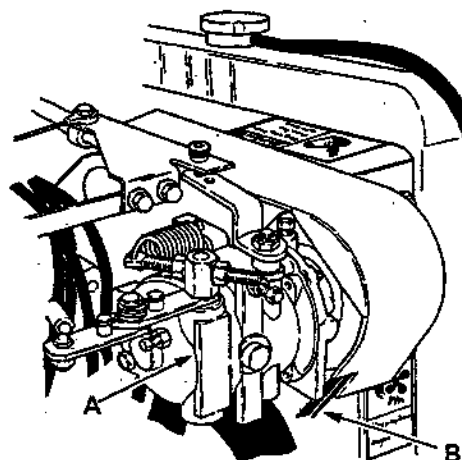
- A. Engine Fan Belt
- B. Vacuum Fan Jackshaft

02427

GOVERNOR BELT

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

To adjust the governor belt tension, loosen the alternator mounting bolts, pull the alternator away from the engine until the belt is snug, and tighten the bolts. Proper belt tension is obtained when the belt deflects 0.25 in (6 mm) from a force of 2 lb (1 kg) applied at the midpoint of the longest span.



GOVERNOR BELT

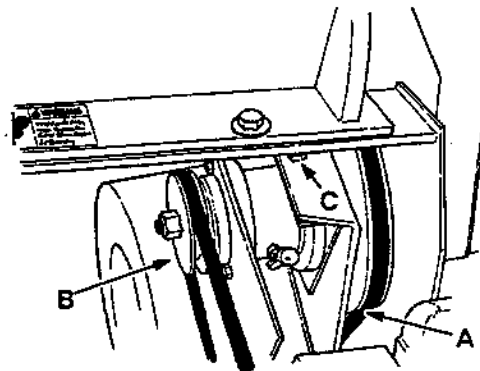
- A. Governor
- B. Belt

02428

VACUUM FAN BELT

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

To tighten the vacuum fan belt, loosen the four vacuum fan jackshaft bolts, adjust the stop screw to pull the jackshaft sheave up and tighten the bolts. Proper belt tension is obtained when the belt deflects 0.16 in (4 mm) from a force of 4 lb (2 kg) applied at the midpoint of the longest span.



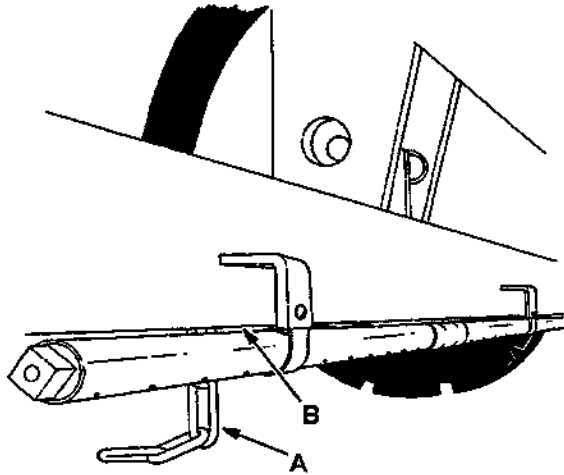
VACUUM FAN BELT

- A. Vacuum Fan Belt
- B. Jackshaft Sheave
- C. Stop Screw

02427

STATIC DRAG CHAIN

A static drag chain is provided to prevent the buildup of static electricity in the machine. The chain is attached on the rear of the machine frame and drags on the floor. Make sure that it is making contact with the floor at all times.



00033

STATIC DRAG CHAIN

- A. Static Drag Chain
- B. Machine Frame

SCRUB HEAD

SCRUB HEAD

The scrub head houses the two scrub brushes, their drive mechanisms, and the side and rear squeegee assemblies. The scrub head has one adjustment—scrub head leveling. The scrub head leveling adjustment levels the scrub head. It is factory set and should not be changed unless, due to a major parts replacement or machine damage, the head adjustment may have been altered. If the scrub head is not level, the brushes will bounce. There will also be excessive wear on the brush drive plugs and bearings.

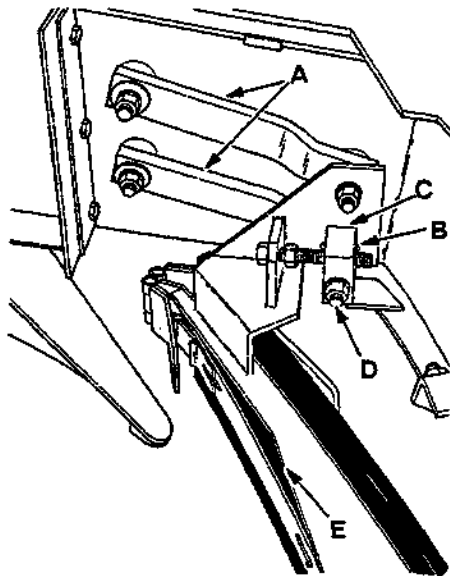
TO LEVEL SCRUB HEAD

1. Park the machine on a smooth level floor.
2. Stop the engine and engage the machine parking brake.

⚠ WARNING: Always park on a level surface, stop the engine, and engage the parking brake before working on the machine to keep it from rolling.

NOTE: The scrub head must be adjusted with new side and rear squeegees, and new scrub brushes.

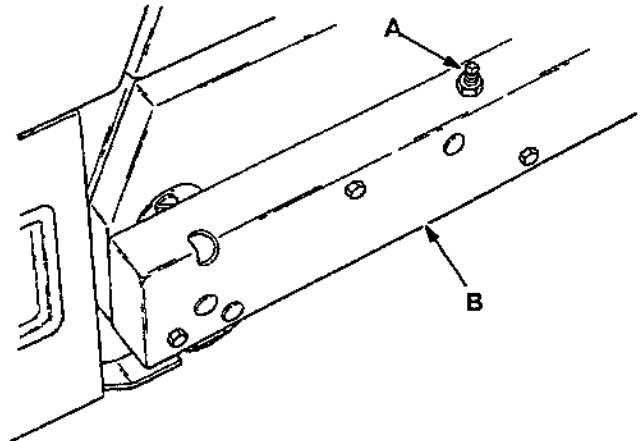
3. Center the rear squeegee tip adjusting block bolts in their slots.



ADJUSTING BLOCK BOLTS

- A. Parallel Arms
- B. Slot
- C. Tip Adjusting Block
- D. Block Bolt
- E. Squeegee

4. Check to make sure the rear squeegee link pivots and lift pivot rotate freely.
5. Loosen the rear squeegee frame lift stud balljoint jam nuts.
6. Thread the two balljoints onto the stud as far as possible.
7. The front blade of the rear squeegee should be $0.25 + 0.06$ in ($6 + 2$ mm) off the floor when the rear blade is resting on the floor uncurled.
8. Adjust the side squeegee adjusting bolts so that the dimensions from the top of the bolt to the top of the squeegee frame is $1.5 + 0.06$ in ($38 + 2$ mm).



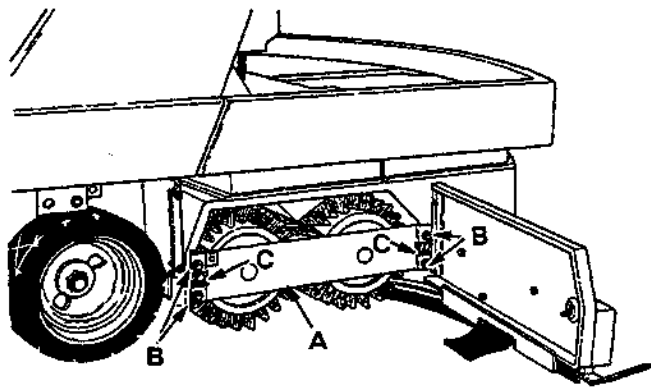
SQUEEGEE ADJUSTING BOLT

00084

- A. Adjusting Bolt
- B. Side Squeegee Frame

9. Adjust the spray deflector upward until it contacts the scrub head.
10. Loosen the four brush idler plate mounting bolts.

00011

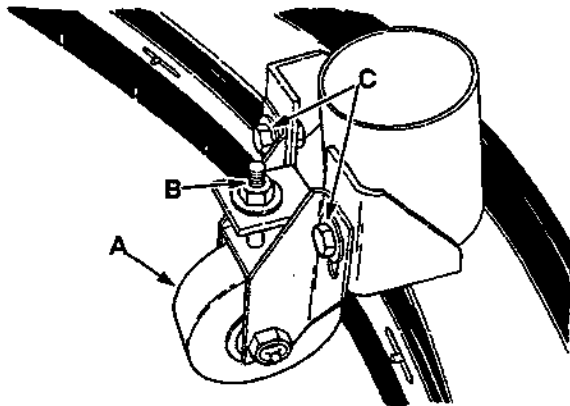


00049

BRUSH IDLER PLATE

- A. Brush Idler Plate
- B. Mounting Bolts
- C. Adjusting Cams

11. Set both of the brush adjusting cams to the center position (rectangular portion of cam horizontal).
12. Tighten the four brush idler plate bolts.
13. Lower the scrub head to the floor so the rear squeegee rests on the floor but is not curled.
14. Adjust the rear squeegee caster down to the floor. Make sure it is squarely positioned on the floor, then tighten the adjusting bolts.

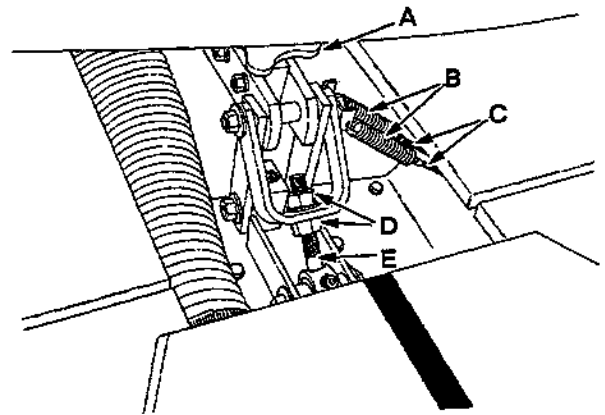


00022

REAR SQUEEGEE CASTER

- A. Caster Wheel
- B. Caster Adjustment Screw
- C. Locking Screw

15. Start the engine, release the parking brake, and move the machine forward to deflect the squeegee blades.
16. Place the scrub brush control levers in the "clean" position.
17. The scrub head should be parallel to the floor from side to side within 0.12 in (3 mm). If the head is too high on the left side, evenly increase the tension on the head leveling springs. If the scrub head is too high on the right side, evenly decrease the tension on the head leveling springs.



00070

SCRUB HEAD ADJUSTMENTS

- A. Head Adjustment Knob
- B. Leveling Spring
- C. Spring Adjuster
- D. Jam Nut
- E. Adjustable Yoke

18. The scrub head should be parallel to the floor from the front to the rear within 0.25 in (6 mm). If the head is too high in the front, shorten the adjustable yoke. If the head is too low in the front, lengthen the adjustable yoke. Retighten the yoke jam nut.
19. The scrub head should be parallel to the floor from the front to the rear within 0.25 in (6 mm). If the head is too high in the front, shorten the adjustable yoke. If the head is too low in the front, lengthen the adjustable yoke. Retighten the yoke jam nut.
20. Check the scrub brush width and squeegee adjustments.

SCRUB BRUSHES

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

The scrub brushes may be rotated front-to-rear to increase brush life. They cannot be turned end-for-end. Replace the scrub brushes when there is 0.5 in (13 mm) of brush bristle left.

The scrub brush patterns should be checked daily. They should be 2 to 3 in (50 to 75 mm) wide. The scrub brush pattern is adjusted by turning the adjustment knob on top of the scrub head or the adjustment cams on the brush idler plate. See To Check and Adjust Scrub Brush Pattern.

TO REPLACE SCRUB BRUSHES

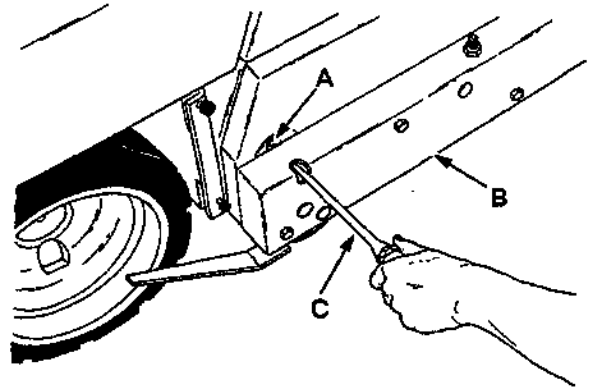
1. Raise scrub head and engage scrub head lock.

WARNING: Always engage the scrub head lock and block the scrub head up securely before working under it. Do not rely on the hydraulic cylinder to keep the scrub head up. The hydraulic system may leak internally, allowing the scrub head to lower and crush anything under it.

2. Stop engine and engage parking brake.

WARNING: Always park on a level surface, stop the engine, and engage the parking brake before working on the machine to keep it from rolling.

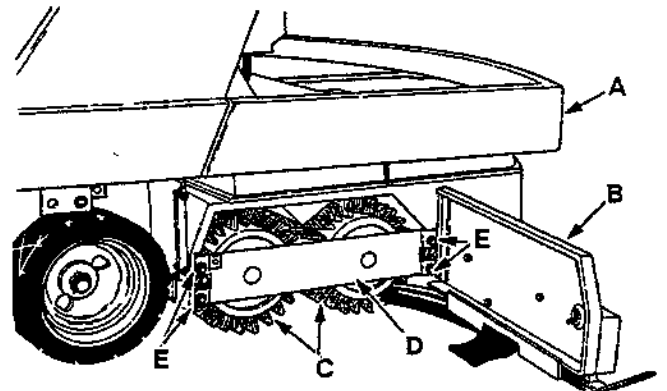
3. Raise and chain up the rear bumper.
4. Open the lower left access door and the left scrub head access door with a screwdriver. The door fastener head has a screwdriver slot.



00048
OPENING LEFT SCRUB HEAD ACCESS DOOR

- A. Door Fastener
- B. Side Squeegee Cover
- C. Screwdriver

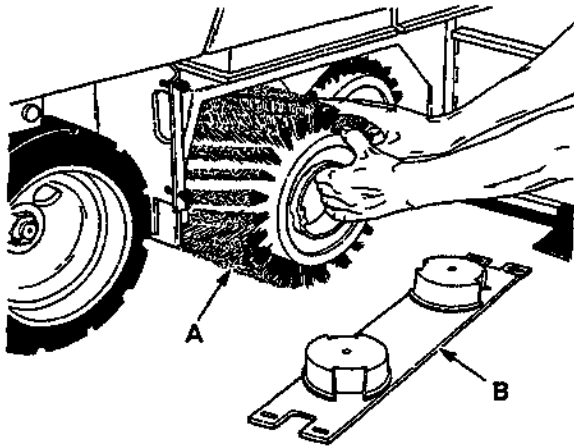
5. Remove the four brush idler plate bolts.



00049
BRUSH IDLER PLATE

- A. Rear Bumper
- B. Left Side Access Door
- C. Brush
- D. Brush Idler Plate
- E. Plate Bolts

6. Remove the brush idler plate.
7. Pull out the front brush and then the rear brush.

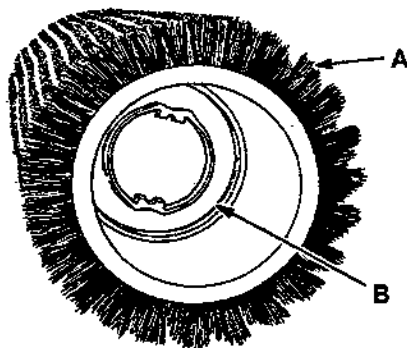


REMOVING FRONT SCRUB BRUSH

00058

- A. Front Scrub Brush
- B. Brush Idler Plate

8. Place the scrub brush control levers in the "clean" position. This locks the brush drive plugs in position.
9. Determine which is the drive end of the scrub brush—the drive end of the brush has its drive plug recessed 6.37 in (160 mm).

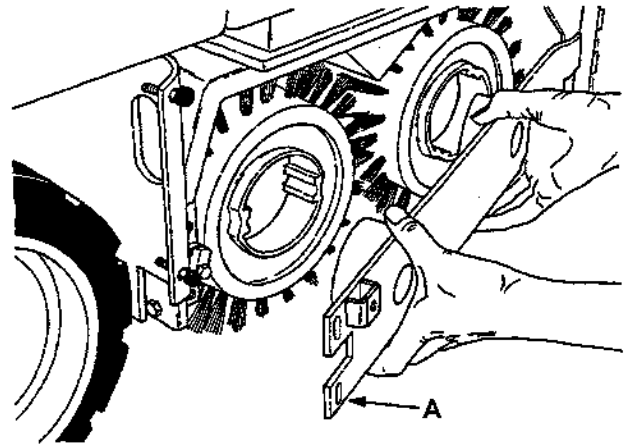


DRIVE END OF BRUSH

00047

- A. Brush
- B. Recessed Brush Drive Socket

10. Line up the drive end socket of the brush with the rear brush drive plug. Slide the scrub brush onto the rear brush drive plug.
11. Line up the drive end socket of the brush with the front brush drive plug. Slide the scrub brush onto the front brush drive plug.
12. After the two brushes have engaged the drive plugs, slide the brush idler plate into position.



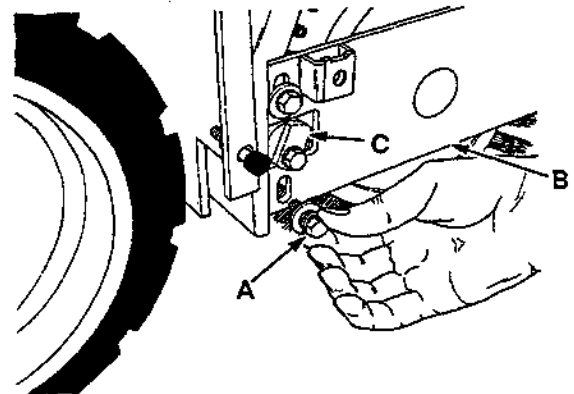
SLIDING BRUSH IDLER PLATE INTO POSITION

00055

- A. Brush Idler Plate

NOTE: Do not force the brush idler plate onto the brushes. It will easily slip into place if the brushes and brush drive plugs are aligned properly.

13. Install the four idler plate mounting bolts.



INSTALLING BRUSH IDLER PLATE MOUNTING BOLTS

00056

- A. Mounting Bolt
- B. Brush Idler Plate
- C. Adjusting Cam

14. Adjust the brush pattern as described in To Check and Adjust Scrub Brush Pattern.

TO CHECK AND ADJUST SCRUB BRUSH PATTERN

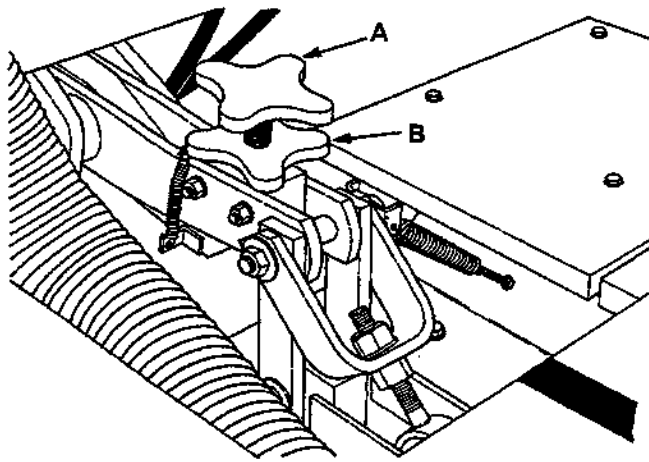
1. Apply chalk, or some other material that will not blow away easily, on a smooth, level floor.
2. With the scrub head up, position the machine scrub head over the test area.

3. Place the scrub brush control levers in the "clean" position, while keeping a foot on the brakes.
4. Lower the scrub head, allowing the brushes to spin on the floor in one spot for 15 to 20 seconds.

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

5. Raise the scrub head after 15 to 20 seconds, and remove the machine from the test area.
6. The scrub brush pattern should be 2 in (50 mm) across the full length of the brush. To adjust the width of the pattern, first loosen the lock knob. Turn the adjustment knob counterclockwise to increase the width of pattern. Turn the knob clockwise to decrease the width of pattern. Tighten the lock knob after adjusting the brush pattern.

NOTE: If either brush pattern is tapered, adjust the brush adjusting cams before attempting to get a full length brush pattern, to avoid damaging the brushes.



HEAD ADJUSTMENT KNOB

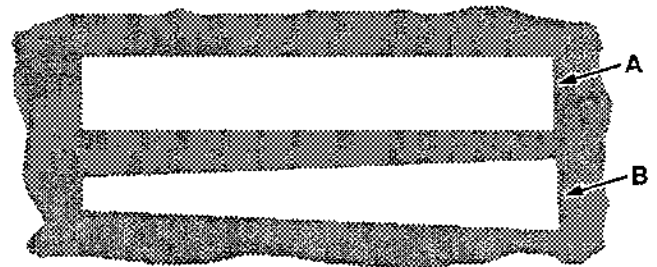
- A. Head Adjustment Knob
- B. Lock Knob

7. If one or both of the brush patterns are tapered, the brush adjusting cam positions must be adjusted.

Turning the cam lobe up raises the idler side of the brushes. Turning the cam lobe down lowers the idler side of the brushes. Adjust the brushes to give an even brush pattern over the length of each of the brushes.

NOTE: Each cam has more of an influence on the closest brush. However, it does have some influence on the other brush. Take this into consideration when adjusting the cams. Make an adjustment with the engine off and the parking brake engaged. Tighten the adjustment and run a test pattern. Check the test pattern and readjust the cam(s) if necessary, with the engine off and the parking brake engaged.

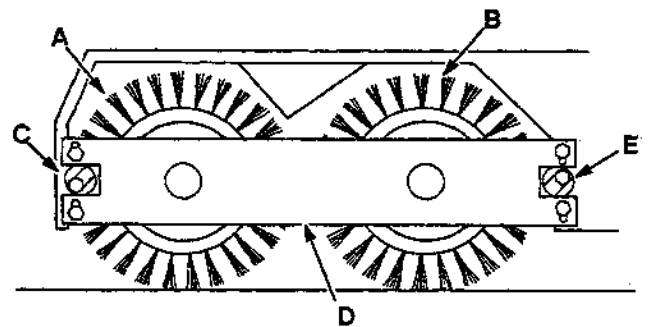
WARNING: Always park on a level surface, stop the engine, and engage the parking brake before working on the machine to keep it from creeping or rolling.



TAPERED REAR BRUSH PATTERN

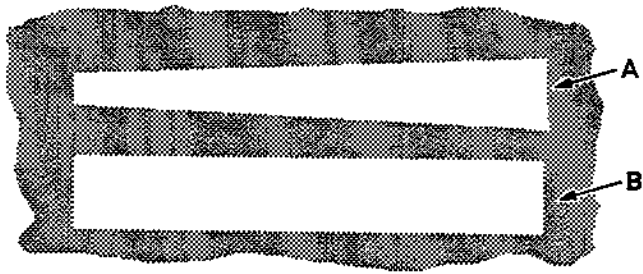
- A. Front Brush Pattern
- B. Rear

To correct this condition: Adjust the front cam lobe up; adjust the rear cam lobe down.



CORRECTING TAPERED REAR BRUSH PATTERN

- A. Front Brush
- B. Rear Brush
- C. Front Cam
- D. Idler Plate
- E. Rear Cam

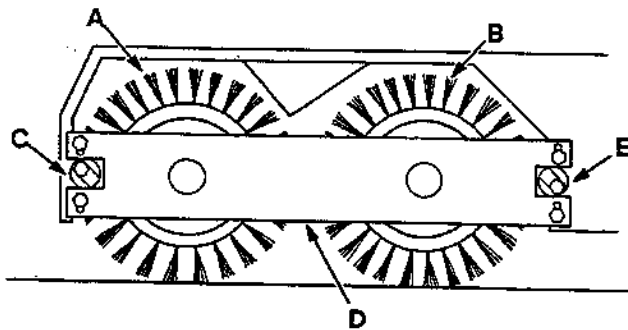


TAPERED FRONT BRUSH PATTERN

00082

- A. Front Brush Pattern
- B. Rear Brush Pattern

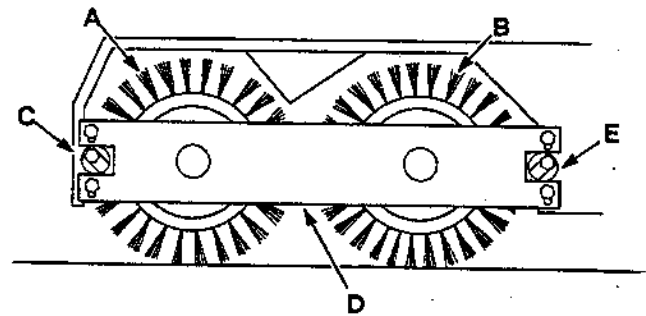
To correct this condition: Adjust the front cam lobe down; adjust the rear cam lobe up.



CORRECTING TAPERED FRONT BRUSH PATTERN

00069

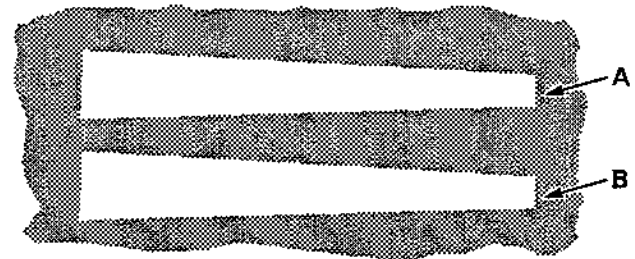
- A. Front Brush
- B. Rear Brush
- C. Front Cam
- D. Idler Plate
- E. Rear Cam



CORRECTING TAPERED BRUSH PATTERNS

00069

- A. Front Brush
- B. Rear Brush
- C. Front Cam
- D. Idler Plate
- E. Rear Cam

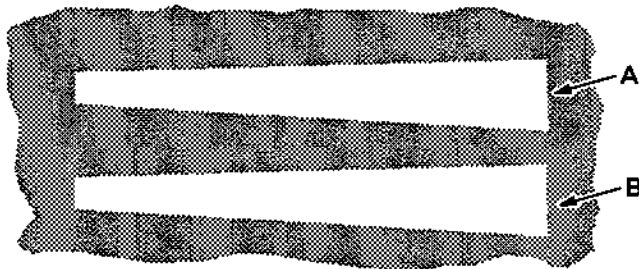


TAPERED BRUSH PATTERNS

00082

- A. Front Brush Pattern
- B. Rear Brush Pattern

To correct this condition: Adjust both cam lobes up.

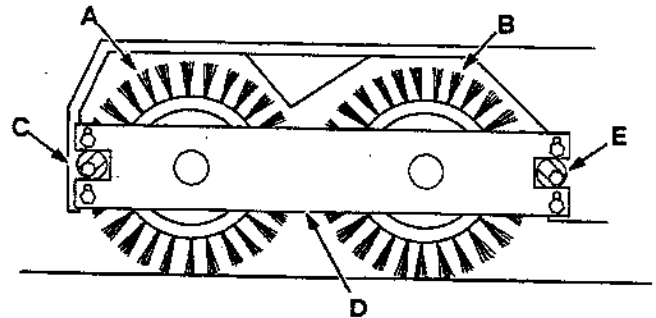


TAPERED BRUSH PATTERNS

00082

- A. Front Brush Pattern
- B. Rear Brush Pattern

To correct this condition: Adjust both brush cam lobes down.



CORRECTING TAPERED BRUSH PATTERNS

00068

- A. Front Brush
- B. Rear Brush
- C. Front Cam
- D. Idler Plate
- E. Rear Cam

NOTE: If the front and rear brush patterns are not equal in width, the head must be readjusted as described in To Level Scrub Head.

SIDE SQUEEGEES

The side squeegees control water spray and channel water into the path of the rear squeegee. Check the side squeegees for damage, wear, and adjustment daily. Replace the side squeegee blades and back-up strips whenever they become damaged or lose their shape or resiliency.

TO REPLACE SIDE SQUEEGEE BLADES

1. Raise the scrub head.
2. Place the squeegee switch in the "up" position.
3. Stop the engine and engage the machine parking brake.

WARNING: Always park on a level surface, stop the engine, and engage the parking brake before working on the machine to keep it from rolling.

4. Open the side squeegee latch and remove the side squeegee band, bridge, back-up strip, and blade.
5. Place the new side squeegee blade over the pins of the squeegee frame.
6. Place the squeegee back-up strip on the pins over the squeegee blade.
7. Position the blade bridge on the squeegee frame pins. Be sure the tapered edge is facing the front of the machine.
8. Clip the rear of the retaining band over the rear of the squeegee and the blade bridge.
9. Latch the side squeegee latch.

NOTE: Make sure the band is snug to the squeegee, the back-up strip, and the blade bridge—adjust if necessary.

10. Adjust the side squeegee as described in To Adjust Side Squeegees.

TO ADJUST SIDE SQUEEGEES

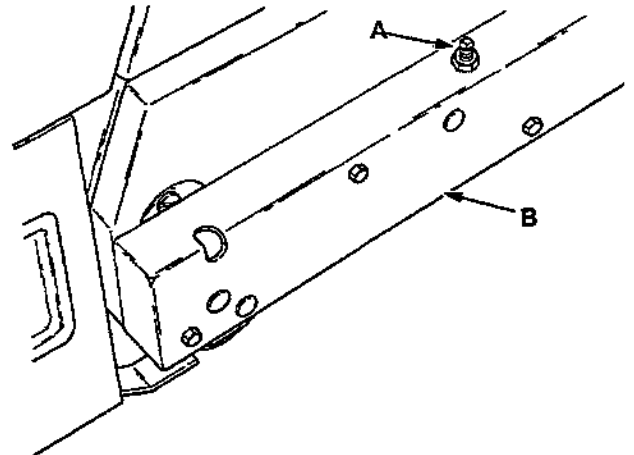
1. Lower the scrub head and move the machine forward.
2. Stop the engine and engage the machine parking brake.

WARNING: Always park on a level surface, stop the engine, and engage the parking brake before working on the machine to keep it from rolling.

3. Check the squeegee blade deflection. It should deflect 0.5 in (13mm). Adjust the squeegees as needed.
4. To adjust squeegee blade deflection, first loosen the lock nut. To increase squeegee blade deflection, thread the down pressure adjustment screw into the assembly.

To decrease squeegee blade deflection, unthread the down pressure adjustment screw from the assembly.

Tighten lock nut to set the adjustment.



00084
SIDE SQUEEGEE BLADE ADJUSTMENT BOLT

- A. Adjustment Bolt
- B. Side Squeegee Frame

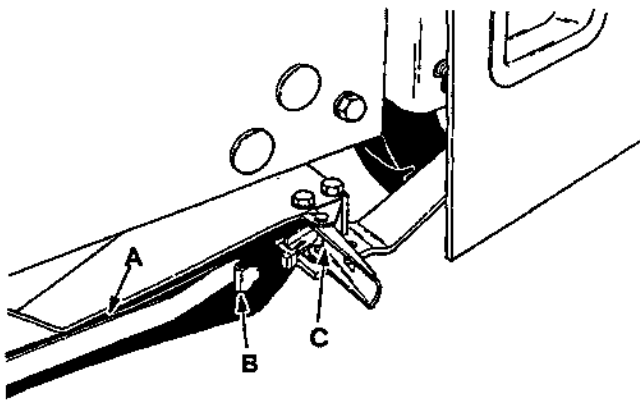
NOTE: A side squeegee benchmark adjustment is as follows: Adjust the down pressure adjustment bolt so that the distance from the top of the bolt to the top of the side squeegee frame is $1.5 + 0.06$ in ($38 + 2$ mm). The side squeegees can be adjusted as required after the initial setting.

SIDE SQUEEGEE LATCHES

The side squeegee latches hold the side squeegee blade assembly in place. Adjust the latches when the squeegee band does not hold the squeegee blade assembly snug or if the latch will not latch completely.

To tighten the side squeegee band, thread the latch hook into the latch pivot.

To loosen the side squeegee band, unthread the latch hook out of the latch pivot.



SIDE SQUEEGEE LATCH

00065

- A. Squeegee Band
- B. Latch Hook
- C. Latch Pivot

REAR SQUEEGEE

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

Replace the front blade of the rear squeegee whenever the blade has become damaged or when the blade no longer contacts the floor.

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

Each rear blade has four wiping edges. To use them all, start with one wiping edge. To use the next wiping edge, swap the squeegee end-for-end. To use the next wiping edge, rotate the top edges down, bottom edges up. To use the last edge, swap the squeegee end-for-end. Replace the back-up strips if they become damaged or if they lose their resiliency.

TO REPLACE OR ROTATE REAR BLADE

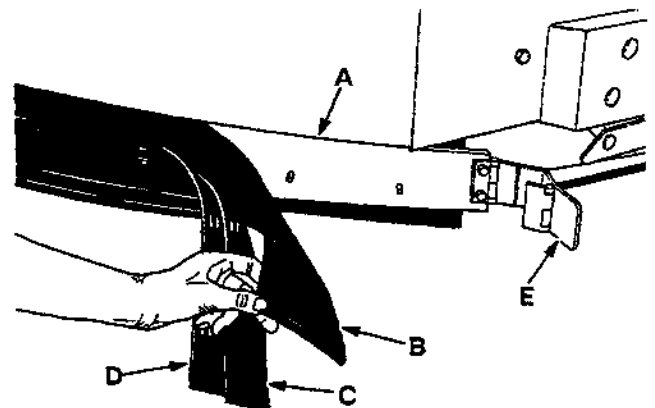
1. Lower the rear squeegee.
2. Raise the scrub head. Lock the scrub head in the "raised" position.

WARNING: Always engage the scrub head lock and block the scrub head up securely before working under it. Do not rely on the hydraulic cylinder to keep the scrub head up. The hydraulic system may leak internally, allowing the scrub head to lower and crush anything under it.

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

WARNING: Always park on a level surface, stop the engine, and engage the machine parking brake before working on the machine to keep it from rolling.

4. Open the rear band clamp and remove the two squeegee back-up strips and the squeegee blade.
5. Replace or rotate the rear blade to allow a new edge of the blade to face the front of the machine.
6. Place the squeegee blade over the pins of the squeegee frame.
7. Place the squeegee back-up strips on the pins; inner strip using top holes, outer strip using lower holes.



00020

INSTALLING REAR SQUEEGEE BLADE

- A. Squeegee Frame
 - B. Rear Squeegee Blade
 - C. Inner Back-up Strip
 - D. Outer Back-up Strip
 - E. Retaining Band Clamp
8. Position the squeegee retaining band over the outer back-up strip.
 9. Latch the retaining band clamp.

NOTE: Make sure the band is snug to the squeegee and the back-up strips-adjust if necessary.

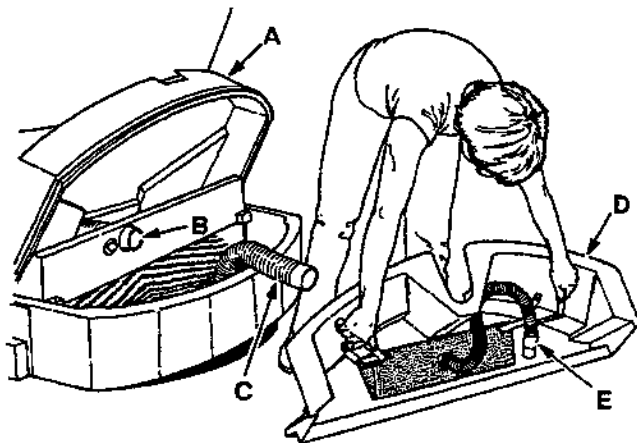
- Adjust the rear squeegee as described in To Adjust Rear Squeegee.

TO REPLACE FRONT BLADE

- Lower the rear squeegee.
- Lower the scrub head so the rear squeegee is just off the floor.
- Stop the engine and engage the machine parking brake.

⚠ WARNING: Always park on a level surface, stop the engine, and engage the parking brake before working on the machine to keep it from rolling.

- Disconnect the rear squeegee and debris screen suction hoses from the scrub head frame vacuum connections.
- Remove the debris hopper.

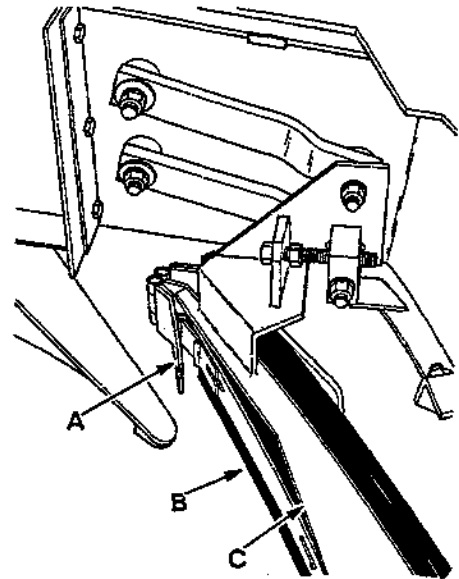


REMOVING DEBRIS HOPPER

02424

- A. Scrub Head Cover
- B. Vacuum Connection
- C. Squeegee Suction Hose
- D. Debris Hopper
- E. Debris Screen Suction Hose

- Open the front band clamp and remove the front squeegee band and blade.

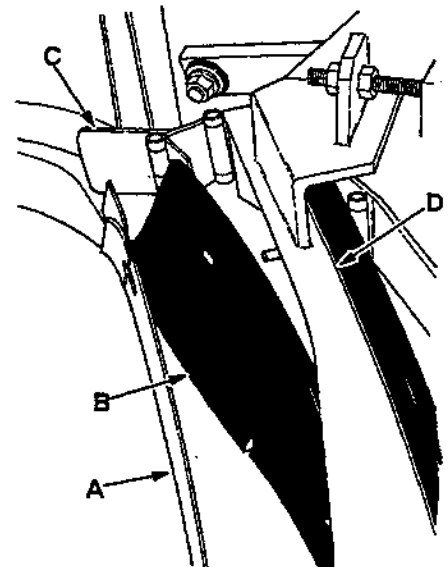


FRONT BAND CLAMP

00011

- A. Clamp
- B. Front Blade
- C. Squeegee Frame

- Place the new squeegee blade over the pins of the squeegee frame.
- Position the squeegee retaining band over the squeegee on the pins of the squeegee frame.



INSTALLING FRONT SQUEEGEE BLADE

00017

- A. Retaining Band
- B. Front Blade
- C. Band Clamp
- D. Squeegee Frame

- Engage the retaining band clamp.

NOTE: Make sure the band is snug to the squeegee-adjust if necessary.

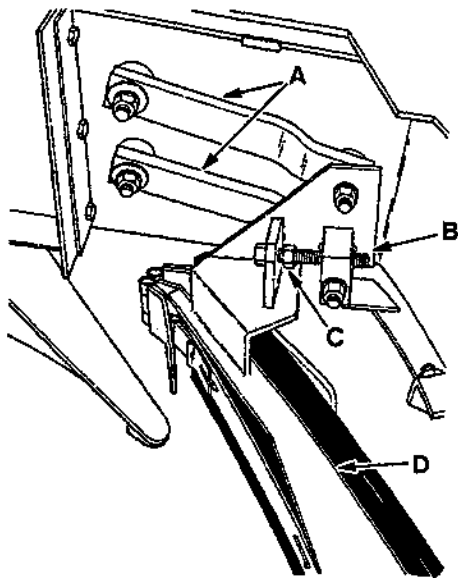
- Adjust the rear squeegee as described in To Adjust Rear Squeegee.

TO ADJUST REAR SQUEEGEE

- Lower the scrub head and the rear squeegee.
- Stop the engine and engage the machine parking brake.

! WARNING: Always park on a level surface, stop the engine, and engage the parking brake before working on the machine to keep it from rolling.

- Loosen the four squeegee tip adjuster lock nuts and the squeegee caster adjustment screws.

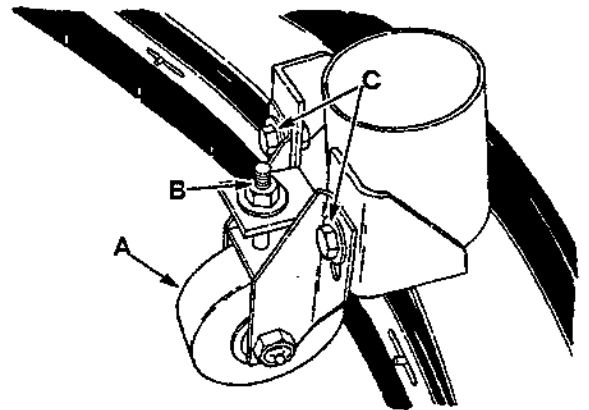


REAR SQUEEGEE LINKAGE

- A. Parallel Arms
- B. Tip Adjusting Screw
- C. Tip Adjuster Lock Nut
- D. Squeegee Frame

00011

- Position the squeegee so the blade just touches the floor from end to end. To do this, adjust the squeegee tip adjusting screws to raise or lower the squeegee tips; tightening the screws brings the tips down, loosening the screws brings the tips up.
- Tighten the four squeegee tip adjusting locknuts.
- Slide a 0.50 in (13 mm) thick block under the squeegee caster.
- Position the squeegee so the rear blade just touches the floor. Tighten the squeegee caster screws.



REAR SQUEEGEE CASTER

- A. Caster Wheel
- B. Caster Adjustment Screw
- C. Locking Screw

00022

- Remove the block from under the squeegee caster.
- Start the engine and disengage the parking brake.
- Move the machine forward with the rear squeegee down, the brushes on, and the scrub head down.
- Stop the engine with the scrub head down.
- Engage the machine parking brake.

13. Inspect the rear squeegee blade deflection. The squeegee blade should be evenly deflected 0.62 + 0.12 in (16 + 3 mm). The squeegee ends should have a gap of 0.12 + 0.06 in (3 + 2 mm) between the front blade and the rear blade.

If the squeegee blade is deflected too much at the center, lower the caster accordingly. If the center is deflected too little, raise the caster accordingly.

If the squeegee blade tips are too high or too low, loosen the squeegee tip locknuts and adjust the squeegee tips, adjusting screws accordingly.

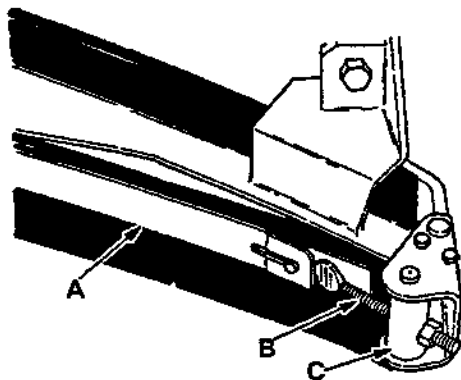
14. Check the scrub brush pattern after making adjustments.

REAR SQUEEGEE RETAINING BAND CLAMPS

The retaining band clamps on the front and rear blades of the rear squeegee hold the squeegee bands and squeegees in place. The clamps may have to be adjusted periodically to keep the bands snug.

To tighten the retaining band, unthread the thumbscrew out of the adjuster bracket.

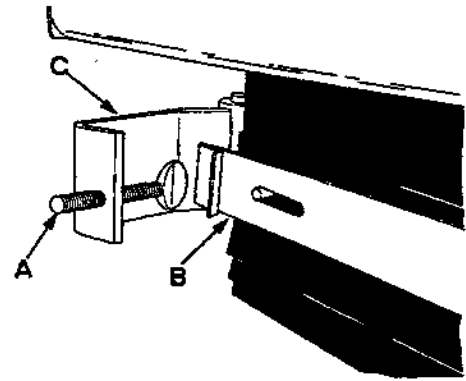
To loosen the retaining band, thread the thumbscrew into the adjuster bracket.



00016

FRONT BLADE RETAINING BAND THUMBSCREW

- A. Retaining Band
- B. Thumbscrew
- C. Adjuster Bracket



00021

REAR BLADE RETAINING BAND THUMBSCREW

- A. Thumbscrew
- B. Retaining Band
- C. Adjuster Bracket

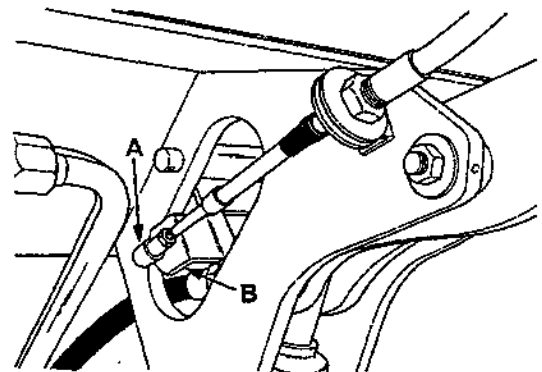
SCRUB HEAD LOCK

The scrub head lock mechanically locks the scrub head up to allow work under the scrub head. Do not rely on the hydraulic cylinder to keep the scrub head up.

The scrub head lock mechanism must lock the scrub head up in the "locked" position; it must allow the scrub head to move up or down when the scrub head lock is in the "unlocked" position.

To adjust the scrub head lock linkage, adjust the ball joint located on the head lock mechanism near the front of the scrub head.

⚠ WARNING: Always engage the scrub head lock and block the scrub head up securely before working under it. Do not rely on the hydraulic system to keep the scrub head up. The hydraulic system may leak internally, allowing the scrub head to lower and crush anything under it.



00019

SCRUB HEAD LOCK

- A. Ball Joint
- B. Scrub Head Lock Mechanism

SOLUTION AND RECOVERY TANKS

SOLUTION TANK

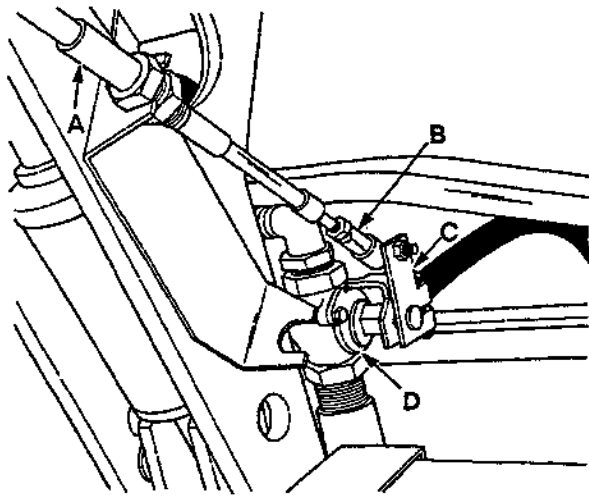
The machine solution tank supplies the scrub brushes with a water and detergent solution. The solution tank on standard machines is located on the right side of the machine under the operator seat.

Access to the solution tank is through the opening in the top of the tank, under the operator seat.

The solution tank requires no regular maintenance. If detergent cakes on the bottom of the tank, remove the deposits with a strong blast of water.

SOLUTION CONTROL VALVE

The solution control valve controls the flow of solution to the scrub brushes. The valve linkage should provide the valve with two positions—fully open and fully closed. To adjust the linkage, adjust the ball joint on the water valve lever, located on the valve.



SOLUTION CONTROL VALVE

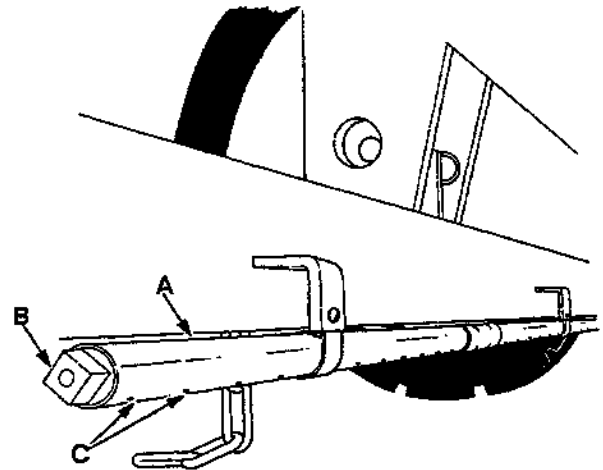
- A. Control Cable
- B. Ball Joint
- C. Water Valve Lever
- D. Water Valve

SOLUTION SPREADER TUBE

The solution spreader tubes distribute scrub solution to the scrub brushes. They may be flushed out if they become clogged with soap or other debris. A drain plug is located on each end of the spreader tube.

Before cleaning the solution spreader tube, make sure that the solution control valve is opening fully when the scrub solution flow control lever is moved to the "open" position.

A brush and hot water may be needed to remove stubborn clogs. A sharp instrument may be used to clear the small distribution holes in the spreader tube.



SOLUTION SPREADER TUBE

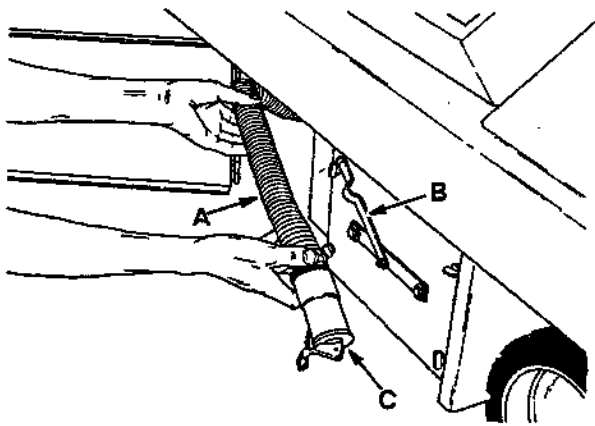
- A. Spreader Tube
- B. Tube Plug
- C. Distribution Holes

RECOVERY TANK

The machine recovery tank stores the water solution picked up by the machine squeegee and vacuum fan. The recovery tank on standard machines is located to the left of the operator seat.

The recovery tank should be drained after the solution tank is empty and whenever the ball float rises and stops the water vacuum.

To drain the recovery tank, stop the engine, engage the parking brake, open the lower access door, and unplug the drain hose next to a floor drain. The tank will not empty with the vacuum fan operating. Clean the recovery tank after every work shift.



00067

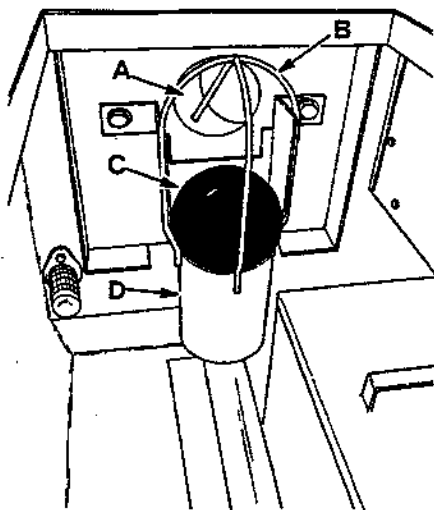
DRAINING RECOVERY TANK

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

Two doors have been provided to make the tank cleaning job easier. One door is located on top of the recovery tank. The other door is located behind the lower left side access door.

Spray the inside of the tank with clean water. Remove all sludge and debris from the bottom of the tank, out the lower clean-out door.

Spray the ball float. Make sure the float guides are free of dirt and debris which may cause the float to stick.



02476

RECOVERY TANK BALLFLOAT

- A. Vacuum Fan Inlet
- B. Ball Float Guide
- C. Ball Float
- D. Ball Float Screen on Bottom of Ball Float Guide

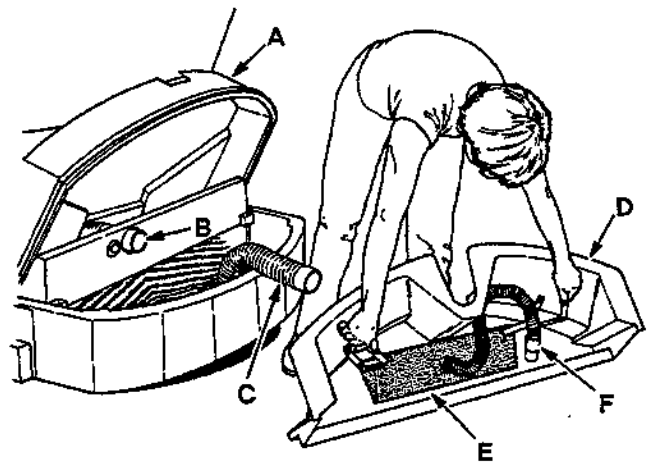
Keep vacuum hoses and nozzles clean. Clogged hoses are a common cause of poor water pickup.

DEBRIS HOPPER

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

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

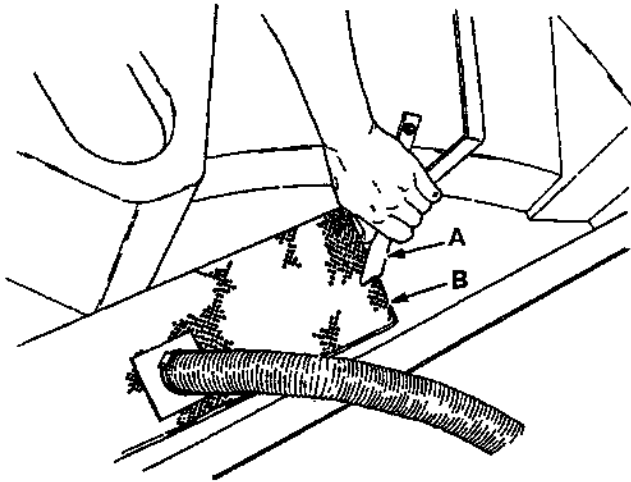
The debris hopper should be emptied and cleaned whenever the recovery tank is drained. To empty and clean the debris hopper, open the scrub head cover, disconnect the vacuum hoses, and lift the hopper out of the machine. Remove and clean the debris screen from the hopper. Reinstall the debris screen, debris hopper, and vacuum hoses when finished.



02424

REMOVING DEBRIS HOPPER

- A. Scrub Head Cover
- B. Suction Tube
- C. Squeegee Suction Hose
- D. Debris Hopper
- E. Debris Screen
- F. Debris Screen Suction Hose



REMOVING DEBRIS SCREEN

00027

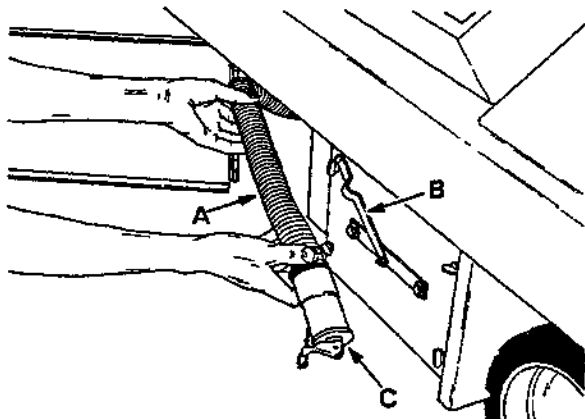
- A. Debris Screen Retainer
- B. Debris Screen

SRS® SOLUTION TANK

The SRS® machine solution tank supplies the scrub brushes with a water and cleaning solution mixture. It also stores water picked up by the machine squeegees and vacuum fan.

Access to the SRS® solution tank is through the opening in the top of the tank, under the operator's seat.

The SRS® solution tank should be drained and cleaned after every work shift. To drain the tank, stop the engine, engage the parking brake, open the lower access doors, and unplug the drain hoses next to a floor drain. The tank will not empty with the vacuum fan operating.



DRAINING TANK

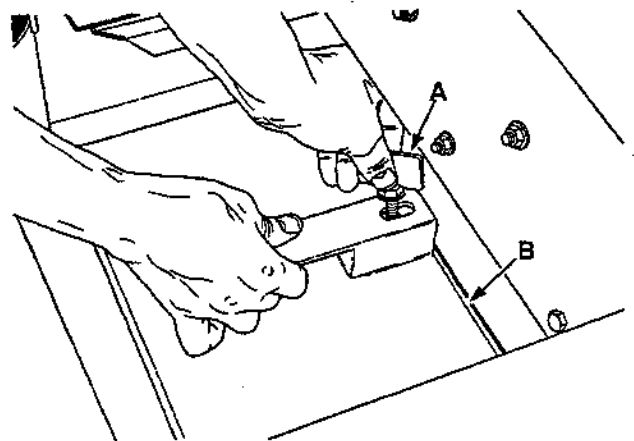
00067

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

Four doors have been provided to make the cleaning job easier. One door is located under the seat; this is also the water fill door. The second door is located on top of the tank next to the machine operator. The third door is located behind the bottom left side access door. The fourth door is located behind the bottom right side access door.

Spray the inside of the tank with clean water. Remove all sludge and debris from the bottom of the tank. Remove the laminar filter cover and spray the filters clean.

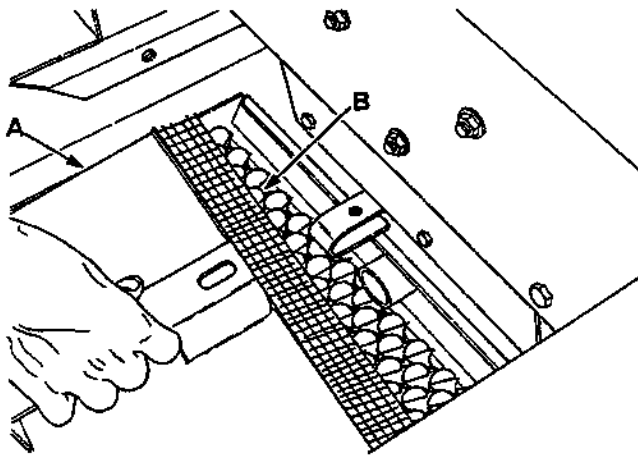
NOTE: The laminar filter may be removed from the tank by removing the thumbscrew holding the filter cover in place. Then lift the filter straight up.



REMOVING LAMINAR FILTER COVER THUMBSCREW

00066

- A. Thumbscrew
- B. Laminar Filter Cover

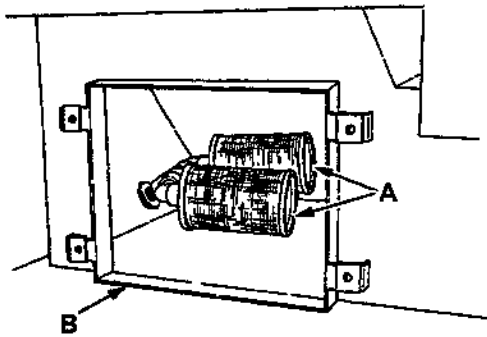


REMOVING LAMINAR FILTER COVER

00031

- A. Laminar Filter Cover
- B. Laminar Filter Tubes

Spray the solution outlet screens with clean water to remove all dirt and debris.

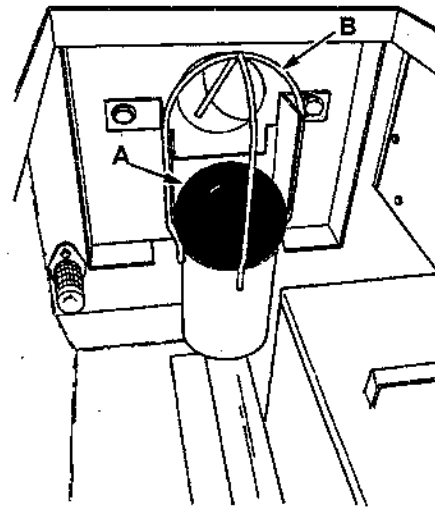


SOLUTION OUTLET SCREENS

00001

- A. Outlet Screens
- B. Lower Right Access Door Opening

Spray the ball float clean. Make sure the float guides are free of dirt and debris which may cause the float to stick. Check the vacuum hoses for clogging or damage.



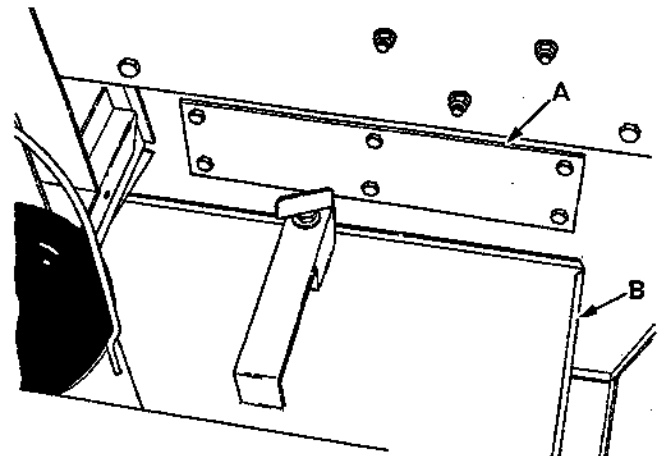
RECOVERY TANK BALL FLOAT

02476

- A. Ball Float
- B. Ball Float Guide

The SRS® solution tank has also been equipped with a foam cross-over door. It has been provided in case a large amount of foaming regularly occurs, and flows out of the vacuum fan. With the foam cross-over door removed, this foam will dissipate into the tank.

When operating the machine with the cross-over door removed, the solution tank must not be filled with water above the two cross-over tubes located under the cross-over door.



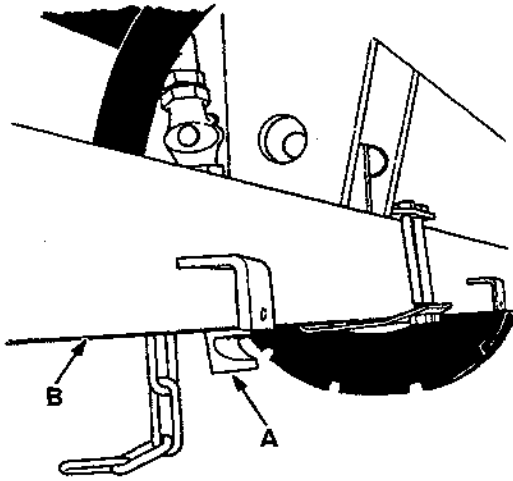
FOAM CROSS-OVER DOOR

00057

- A. Foam Cross-Over Door
- B. Laminar Filter Cover

SRS® SOLUTION SPRAY NOZZLE

The SRS® solution spray nozzle distributes scrub solution to the scrub brushes. It requires no regular maintenance. The spray nozzle should be adjusted so that the spray is centered across the front brush.



00012

SOLUTION SPRAY NOZZLE

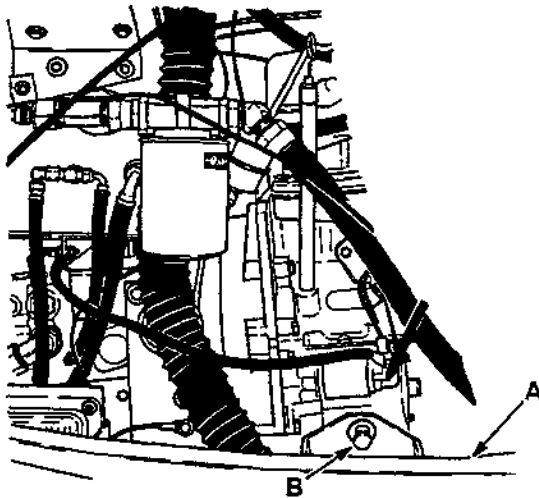
- A. Solution Spray Nozzle**
- B. Machine Frame**

LATCHES

ENGINE COVER LATCH

The engine cover latch keeps the engine cover in place when the machine is in operation. Pushing the latch lever to the right releases the latch. It can be lubricated with a dry lubricant. The latch should be adjusted to keep the cover down when latched.

The latch mechanism is in a fixed position; to adjust the latching action, the latch striker must be loosened, repositioned, and tightened.



ENGINE COVER LATCH STRIKER

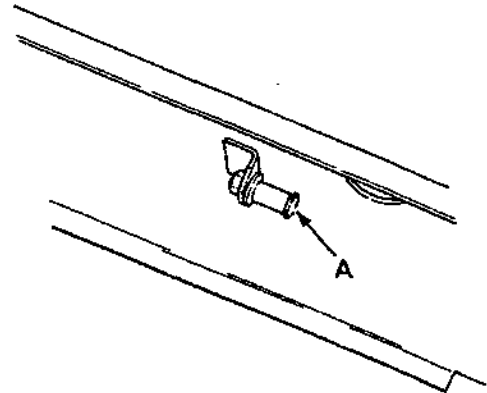
02475

- A. Front Bumper
- B. Striker

ACCESS DOOR LATCHES

The access door latches keep the tank cleanout access doors closed when the machine is in operation. Pulling the latch lever up releases the latch. The latch can be lubricated with a dry lubricant. It should also be adjusted to keep the doors closed when latched.

The latch mechanism is in a fixed position; to adjust the latching action, the latch striker must be loosened, repositioned, and tightened.



02444

ACCESS DOOR LATCH STRIKER

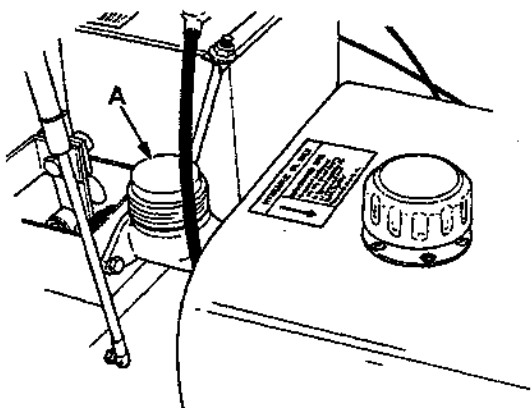
- A. Striker

BRAKES AND TIRES

SERVICE BRAKES

The service brakes are hydraulically activated by a master brake cylinder. Check the master brake cylinder fluid level after every 400 hours of operation and add brake fluid as needed. The master brake cylinder is located in front of the operator in the engine compartment.

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



MASTER CYLINDER

A. Master Cylinder

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

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

TO BLEED BRAKES

1. Make sure that the brake fluid reservoir is full and that the vent in the cap is open.
2. Connect a plastic or rubber tube to the bleeder valve on the left rear 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. This is to keep air from being drawn into the system.
3. Open the bleeder valve on the left rear wheel about one turn. Have an assistant press the brake pedal slowly to the floor. As soon as the pedal is all the way down, close the bleeder valve and let the pedal up. Repeat this step as many times as necessary, until fluid free of air bubbles flows from the tube.
4. Bleed the right rear wheel in the same manner as described in the steps above. Keep checking the brake fluid reservoir to be sure it doesn't run out of fluid.
5. When all wheels are bled, discard the brake fluid in the jar or bottle; never reuse such fluid.
6. Fill the brake fluid reservoir with clean fluid.
7. Check the brakes for proper operation.

PARKING BRAKES

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

The parking brakes should be adjusted whenever it becomes very easy to engage the parking brake, when the machine rolls after engaging the parking brake, and after every 100 hours of operation. The parking brake may be tightened by turning the knurled knob on the end of the parking brake clockwise.

TIRES

The machine tires are solid. Periodically, wash off the tires to remove built-up detergent and floor grime.

SECTION 4 APPENDIX

CONTENTS

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HARDWARE INFORMATION

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

STANDARD BOLT TORQUE CHART

Thread Size	SAE Grade 5 Torque ft lb (Nm)	SAE Grade 8 Torque ft lb (Nm)
0.25 in	7-10 (9-14)	10-13 (14-18)
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:

Rear wheel hub nut - 175 ft lb (240 Nm)

BOLT IDENTIFICATION

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

01995

THREAD SEALANT AND LOCKING COMPOUNDS

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

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

Loctite 242 blue - medium strength thread locking compound. TENNANT® Part No. 32676, 5 ml tube.

Loctite 271 red - high strength thread locking compound. TENNANT® Part No. 19857, 5 ml tube.

HYDRAULIC FITTING INFORMATION

HYDRAULIC TAPERED PIPE FITTING (NPT) TORQUE CHART

NOTE: Ratings listed are when using teflon thread seal.

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

HYDRAULIC TAPERED SEAT FITTING (JIC) TORQUE CHART

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

HYDRAULIC O-RING FITTING TORQUE CHART

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

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

*Aluminum bodied components