1550

(Gas/LPG/Diesel)

Rider Scrubber

Operator **Manual**

Tennant*True*™ *Parts and Supplies*

North America / International

MM283
Rev. 22 (3-2011)

www.tennantco.com

This manual is furnished with each new model. It provides necessary operation and maintenance instructions.

Read this manual completely and understand the machine before operating or servicing it.

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 machine maintenance instructions provided.
- The machine is maintained with manufacturer supplied or equivalent parts.

PROTECT THE ENVIRONMENT

Please dispose of packaging materials, old machine components such as batteries, hazardous fluids including antifreeze and oil, in an environmentally safe way according to local waste disposal regulations.

Always remember to recycle.

MACHINE DATA

Please fill out at time of installation for future reference.

Model No. – _____

Serial No. – _____

Machine Options – _____

Sales Rep. – _____

Sales Rep. phone no. – _____

Customer Number – _____

Installation Date – _____

Tennant Company
PO Box 1452
Minneapolis, MN 55440
Phone: (800) 553-8033 or (763) 513-2850
www.tennantco.com

CALIFORNIA PROPOSITION 65 WARNING:

Engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

SRS is a US registered trademark of Tennant Company.

Specifications and parts are subject to change without notice.

Original instructions, Copyright © 1991, 2000, 2005, 2009, 2010, 2011 TENNANT Company. Printed in U.S.A.

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 unsafe practices that could result in minor or moderate personal injury.

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

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

WARNING: Engine Emits Toxic Gases. Severe Respiratory Damage Or Asphyxiation Can Result. Provide Adequate Ventilation. Consult With Your Regulatory Agency For Exposure Limits. Keep Engine Properly Tuned.

WARNING: Machine Can Emit Excessive Noise. Consult With Your Regulatory Agency For Exposure Limits. Hearing Loss Can Result. Wear Hearing Protection.

WARNING: Flammable Materials Can Cause An Explosion Or Fire. Do Not Pick Up Flammable Materials. Do Not Use Flammable Materials In Tank To Clean Floor.

WARNING: Flammable materials or reactive metals can cause explosion or fire. Do not pick up.

WARNING: Moving Belt. Keep Away.

WARNING: Moving Fan Blades. Keep Away.

WARNING: Raised Scrub Head May Fall. Block Scrub Head Up.

WARNING: Crush Hazard Between Front And Rear Halves Of Machine. Engage Pivot Lock.

WARNING: Heavy LP Tank May Fall. Remove LP Tank Before Opening Cover.

WARNING: Strong Vacuum. Keep Away From Fan Inlet When Fan Is Running.

CAUTION: LPG engine will run for a few seconds after key is turned off. Apply parking brake before leaving machine.

FOR SAFETY:

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

2. **Before Starting Machine:**
   - **Check For Fuel Leaks.**
   - **Keep Sparks And Open Flame Away From Refueling Area.**
   - **Make Sure All Safety Devices Are In Place And Operate Properly.**
   - **Check Brakes And Steering For Proper Operation.**

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

4. **When Using Machine:**
   - **Use Brakes To Stop Machine.**
   - **Go Slow On Grades And Slippery Surfaces.**
   - **Use Care When Backing Machine.**
   - **Do Not Carry Riders On Machine.**
   - **Always Follow Safety And Traffic Rules.**
   - **Report Machine Damage of Faulty Operation Immediately.**
   - **Follow mixing, handling and disposal instructions on chemical containers.**
   - **Follow safety guidelines concerning wet floors.**

Home Find... Go To..

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

6. **When Servicing Machine:**
   - **Avoid Moving Parts. Do Not Wear Loose Jackets, Shirts, Or Sleeves.**
   - **Block Machine Tires Before Jacking Machine Up.**
   - **Jack Machine Up At Designated Locations Only. Block Machine Up With Jack Stands.**
   - **Use A Hoist Or Jack That Will Support The Weight Of The Machine.**
   - **Wear Eye And Ear Protection When Using Pressurized Air Or Water.**
   - **Disconnect Battery Connections Before Working On Machine.**
   - **Avoid Contact With Battery Acid.**
   - **Avoid Contact With Hot Engine Coolant.**
   - **Allow Engine To Cool.**
   - **Keep Flames And Sparks Away From Fuel System Service Area. Keep Area Well Ventilated.**
   - **Use Cardboard To Locate Leaking Hydraulic Fluid Under Pressure.**
   - **Use TENNANT Supplied Or Approved Replacement Parts.**

7. **When loading/unloading machine onto/off truck or trailer:**
   - **Turn off machine.**
   - **Use truck or trailer that will support the weight of the machine.**
   - **Use winch. Do not drive the machine onto/off the truck or trailer unless the load height is 380 mm (15 in) or less from the ground.**
   - **Set parking brake after machine is loaded.**
   - **Block machine tires.**
   - **Tie machine down to truck or trailer.**

Home Find... Go To..

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.

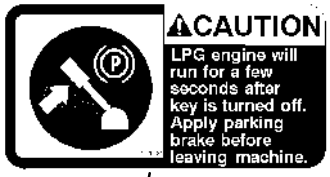
TRAVEL SPEED CAUTION DECAL - LOCATED ON THE SIDE OPERATOR PANEL

CAUTION
REDUCE TRAVEL SPEED ON INCLINES FOR SAFE OPERATION

FAN SUCTION DANGER DECAL - LOCATED ON THE SOLUTION TANK

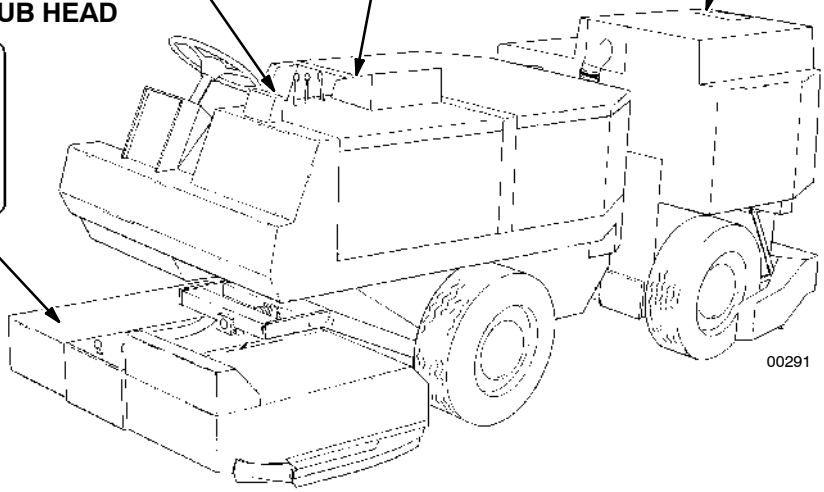
DANGER
FAN SUCTION IS VERY STRONG. NEVER RUN THE ENGINE AND BLOWER WITH THE VACUUM LINE REMOVE FROM THE BLOWER OR RECOVERY TANK.

LPG ENGINE WILL RUN LABEL - LOCATED NEXT TO THE IGNITION SWITCH ON THE INSTRUMENT PANEL.



SCRUB HEAD LOCK WARNING DECAL - LOCATED ON THE SCRUB HEAD

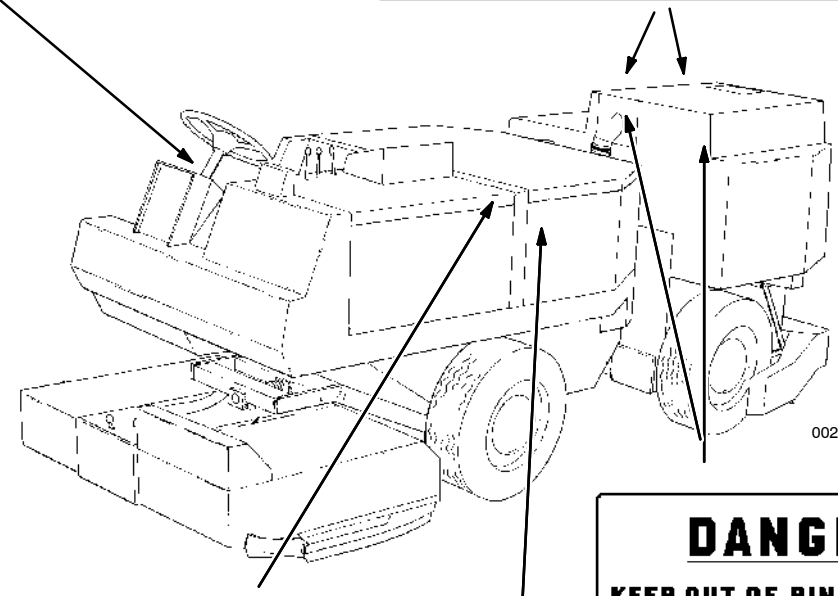
WARNING
USE SCRUBBER HEAD LOCK (FOUND IN OPERATOR'S COMPARTMENT) WHEN WORKING ON SCRUBBER HEAD.

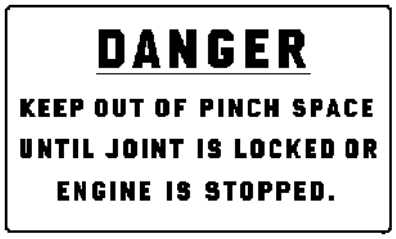


Home Find... Go To..

FLAMMABLE MATERIALS WARNING DECAL - LOCATED IN THE OPERATOR COMPARTMENT

FLAMMABLE MATERIALS WARNING DECAL - LOCATED ON THE SOLUTION TANKS





PINCH SPACE DANGER DECAL - LOCATED ON THE SOLUTION TANK

HEAVY LP TANK WARNING DECAL - LOCATED ON THE LEFT SIDE TOP ACCESS DOOR LIP

ENGINE FAN WARNING DECAL - LOCATED ON THE FAN SHROUD

Home Find... Go To..

CONTENTS

Page

GENERAL INFORMATION i
SAFETY PRECAUTIONS i

SPECIFICATIONS 1-1
MACHINE SPECIFICATIONS 1-3
POWER TYPE 1-3
GAS/LPG CONTINENTAL ENGINES – (For machines below serial number 001424) 1-3
GAS/LPG GM ENGINES – (For machines serial number 001424 and above) 1-3
DIESEL CONTINENTAL ENGINES – (For machines below serial number 001424) 1-3
DIESEL PERKINS ENGINES – (For machines serial number 001424 – 001505) 1-3
CAT ENGINES – (For machines serial number 001508 and above) 1-4
POWER TRAIN 1-4
STEERING 1-4
BRAKING SYSTEM 1-4
SUSPENSION SYSTEM 1-4
SYSTEM FLUID CAPACITIES 1-4
CONTINENTAL ENGINES (For machines below serial number 001424) 1-4
GAS/LPG GM ENGINES (For machines serial number 001424 – 001505) 1-4
GAS/LPG GM ENGINES (For machines serial number 001508 and above) 1-4
DIESEL PERKINS ENGINES (For machines serial number 001424 – 001505) 1-4
DIESEL CAT ENGINES (For machines serial number 001508 and above) 1-4
GENERAL MACHINE DIMENSIONS/CAPACITIES 1-5
MACHINE WEIGHTS 1-5
GENERAL MACHINE PERFORMANCE 1-5
MACHINE DIMENSIONS 1-6

OPERATION 2-1
PREPARATION FOR OPERATION 2-3
AFTER UNLOADING AND BEFORE OPERATING THE MACHINE: 2-3
OPERATION OF CONTROLS 2-4
MACHINE COMPONENTS 2-4
INSTRUMENTS AND CONTROLS – GAS/LPG and DIESEL ENGINES (For machines below serial number 001508) 2-5
INSTRUMENTS AND CONTROLS – GAS/LPG GM ENGINES (For machines serial number 001508 and above) 2-6

Page

INSTRUMENTS AND CONTROLS – DIESEL CAT ENGINES (For machines serial number 001508 and above) 2-7
BRAKE PEDAL 2-8
DIRECTIONAL PEDAL 2-8
OPERATOR SEAT 2-8
SCRUB HEAD LOCK LEVER 2-8
PIVOT LOCK PIN 2-9
PARKING BRAKE LEVER 2-9
AMMETER (For machines below serial number 001508) 2-9
CHARGING SYSTEM LIGHT (For machines serial number 001508 and above) 2-9
SQUEEGEE POSITION LAMP (For machines below serial number 001508) 2-9
CHECK ENGINE LIGHT (For machines serial number 001508 and above) . . 2-9
IGNITION SWITCH 2-9
DIESEL PRE-HEAT INDICATING LAMP 2-10
OPERATING LIGHTS SWITCH (OPTION) 2-10
ROTATING LIGHT SWITCH (OPTION) 2-10
HAZARD LIGHT SWITCH (OPTION) . 2-10
FUEL LEVEL GAUGE 2-10
PANEL LAMP (OPTION) 2-10
SCRUB BRUSH PRESSURE LAMP (OPTION) 2-10
ENGINE HOUR METER 2-10
FUSES (For machines below serial number 001508) 2-10
FUSES (For machines serial number 001508 and above) 2-10
GAS/LPG GM ENGINES 2-10
DIESEL CAT ENGINES 2-10
CIRCUIT BREAKERS (For machines serial number 001508 and above) 2-11
ENGINE OIL PRESSURE GAUGE – DIESEL,GAS/LPG CONTINENTAL ENGINES (For machines below serial number 001424) 2-11
ENGINE OIL PRESSURE GAUGE – GAS/LPG ENGINES (For machines serial number 001424 – 001505) 2-11
ENGINE OIL PRESSURE GAUGE – DIESEL PERKINS ENGINES (For machines serial number 001424 – 001505) 2-11
ENGINE OIL PRESSURE LIGHT – GAS/LPG GM ENGINES (For machines serial number 001508 and above) 2-11

Home Find... Go To..

Page

ENGINE OIL PRESSURE LIGHT – DIESEL CAT ENGINES (For machines serial number 001508 and above) 2-11
ENGINE COOLANT TEMPERATURE GAUGE 2-11
SQUEEGEE SWITCH 2-12
SCRUB BRUSH LEVER 2-12
SCRUB HEAD POSITION LEVER . . . 2-12
SRS LIQUID LOW LEVEL LAMPS . . . 2-12
SRS CLEANING SOLUTION FLOW KNOB 2-12
ENGINE CHOKE KNOB – CONTINENTAL ENGINES 2-12
THROTTLE LEVER – DIESEL, GAS/LP CONTINENTAL ENGINES (For machines serial number 001000 – 001423) 2-13
THROTTLE LEVER – DIESEL CAT ENGINES (For machines serial number 001508 and above) 2-13
THROTTLE SWITCH – DIESEL PERKINS ENGINES (For machines serial number 001424 – 001505) 2-13
THROTTLE SWITCH – GAS/LPG GM ENGINES (For machines serial number 001508 and above) 2-13
STEERING WHEEL 2-13
HORN BUTTON (For machines serial number 001508 and above) 2-13
TANK DRAIN LAMP 2-13
SOLUTION LEVER 2-13
MACHINE OPERATION 2-14
NORMAL SCRUBBING OPERATION 2-14
PRE-START CHECKLIST 2-14
TO START MACHINE 2-14
TO FILL SOLUTION TANK 2-15
TO SCRUB 2-15
TO DRAIN AND CLEAN SOLUTION TANK AND EMPTY HOPPER . 2-16
POST OPERATION CHECKLIST – ENGINE OPERATING 2-16
TO STOP MACHINE 2-16
POST OPERATION CHECKLIST – ENGINE STOPPED 2-17
DOUBLE SCRUBBING OPERATION 2-17
SOLUTION PICKUP OPERATION . . . 2-17
OPERATION ON GRADES 2-17
MACHINE TROUBLESHOOTING . . . 2-18
OPTIONS OPERATION 2-19
VACUUM WAND 2-19
TO OPERATE VACUUM WAND . . 2-19
DRAIN PUMP 2-19
TOWING AND TRANSPORTING THE MACHINE 2-20
TOWING THE MACHINE 2-20
TRANSPORTING THE MACHINE 2-20
MACHINE JACKING LOCATIONS 2-23

Page

MACHINE STORAGE 2-24
STORING MACHINE 2-24
GASOLINE POWERED MACHINES 2-24
DIESEL POWERED MACHINES . 2-26

MAINTENANCE 3-1
RECOMMENDED FIRST 50-HOUR MACHINE INSPECTION 3-3
MAINTENANCE CHART 3-4
LUBRICATION 3-6
ENGINE 3-6
GASOLINE AND LPG POWERED ENGINES 3-6
DIESEL POWERED ENGINES 3-6
VACUUM FAN SHAFT – GAS/LPG ENGINES (For machines below serial number 001508) 3-6
VACUUM FAN SHAFT – DIESEL ENGINES (For machines serial number 001000 and above) . 3-6
MACHINE PIVOT 3-7
SCRUB HEAD PIVOT 3-7
SCRUB HEAD HINGES 3-8
REAR SQUEEGEE CASTERS 3-8
SCRUB BRUSH IDLER PLUGS . . . 3-8
REAR WHEELS 3-8
HYDRAULICS 3-9
HYDRAULIC FLUID 3-9
HYDRAULIC FLUID RESERVOIR 3-9
TO DRAIN THE HYDRAULIC FLUID RESERVOIR 3-10
TO FILL THE HYDRAULIC FLUID RESERVOIR 3-10
HYDRAULIC FLUID RESERVOIR BREATHER 3-11
HYDRAULIC FLUID FILTER 3-11
TO REPLACE THE HYDRAULIC FLUID FILTER ELEMENT 3-11
HYDRAULIC FLUID LEAKS 3-11
HYDRAULIC COMPONENTS TROUBLESHOOTING 3-12
ENGINE 3-13
LUBRICATION 3-13
GASOLINE AND LPG POWERED ENGINES 3-13
DIESEL POWERED ENGINES . . . 3-13
COOLING SYSTEM 3-13
AIR INTAKE SYSTEM 3-14
AIR FILTER SERVICE INDICATOR 3-14
AIR FILTER 3-14
TO REPLACE AIR FILTER ELEMENT – CONTINENTAL ENGINES (For machines below serial number 001424) 3-15

Home Find... Go To..

Page
TO REPLACE AIR FILTER ELEMENT – GM GAS/LPG AND PERKINS OR CAT DIESEL ENGINES (For machines serial number 001424 and above) 3-16
FUEL SYSTEM – GASOLINE – CONTINENTAL ENGINES (For machines below serial number 001424) 3-17
FUEL FILTER 3-17
CARBURETOR 3-17
FUEL SYSTEM – GASOLINE – GM ENGINES (For machines serial number 001424 and above) 3-17
FUEL FILTER (For machines serial number 001000 – 001505) . 3-17
IN–LINE FUEL FILTER 3-17
ELECTRONIC FUEL INJECTION – GM ENGINES 3-17
FUEL SYSTEM – LPG 3-18
LPG FUEL SYSTEM 3-18
IN–LINE FUEL FILTER –GM ENGINES (For machines serial number 001424 and above) 3-18
FUEL TANKS 3-19
TO CHANGE AN LPG FUEL TANK 3-20
FUEL FILTER LOCK 3-21
VAPORIZER-REGULATOR 3-21
CARBURETOR – CONTINENTAL ENGINES (For machines below serial number 001424) 3-21
ELECTRONIC FUEL INJECTION SYSTEM – GM ENGINES (For machines serial number 001424 and above) 3-21
OIL PRESSURE SWITCH 3-21
LPG FUEL TROUBLESHOOTING 3-22
FUEL SYSTEM – DIESEL 3-23
FUEL WATER TRAP 3-23
TO CLEAN WATER TRAP 3-23
FUEL FILTER 3-23
TO REPLACE FUEL FILTER – CONTINENTAL ENGINES (For machines between serial number 001000–001055) 3-23
TO REPLACE FUEL FILTER – CONTINENTAL ENGINES (For machines between serial number 001056–001423) 3-24
TO REPLACE FUEL FILTER – PERKINS ENGINES (For machines serial number 001424 – 001505) 3-24
WATER SEPARATOR/FUEL FILTER CAT ENGINES (For machines serial number 001508 and above) 3-25

Page
IN–LINE FUEL FILTER – PERKINS ENGINES (For machines serial number 001424 – 001505) 3-25
FUEL INJECTION PUMP 3-25
FUEL INJECTORS 3-25
PRIMING THE FUEL SYSTEM – CONTINENTAL ENGINES (For machines serial number 001000–001055) 3-26
PRIMING THE FUEL SYSTEM – CONTINENTAL ENGINES (For machines serial number 001056–001423) 3-27
PRIMING THE FUEL SYSTEM – PERKINS ENGINES (For machines serial number 001424 – 001505) 3-27
GOVERNOR – GAS/LPG CONTINENTAL ENGINES (For machines serial number 001000–001423) 3-28
TO ADJUST GOVERNOR 3-29
GOVERNOR – GAS/LPG GM ENGINES (For machines serial number 001424 and above) 3-29
ELECTRICAL SYSTEM 3-30
SPARK PLUGS 3-30
DISTRIBUTOR 3-30
DISTRIBUTOR IGNITION TIMING 3-31
CYLINDER HEAD – GASOLINE, LPG 3-32
CYLINDER HEAD BOLT TIGHTENING CONTINENTAL ENGINES (For machines below serial number 001424) 3-32
VALVE TAPPET CLEARANCE . . . 3-32
CYLINDER HEAD BOLT TIGHTENING – GM ENGINES (For machines serial number 001424 and above) 3-32
CYLINDER HEAD – DIESEL 3-33
CYLINDER HEAD BOLT TIGHTENING CONTINENTAL ENGINES (For machines below serial number 001424) 3-33
CYLINDER HEAD BOLT TIGHTENING PERKINS ENGINES (For machines serial number 001424 – 001505) 3-33
VALVE TAPPET CLEARANCE . . . 3-34
PCV SYSTEM 3-34
TUNE-UP CHART – GASOLINE, LPG CONTINENTAL ENGINES (For machines below serial number 001424) 3-34
TUNE-UP CHART – GASOLINE, LPG GM ENGINES (For machines serial number 001424 and above) 3-34

Home Find... Go To..

Page
ELECTRICAL SYSTEM 3-35
BATTERY 3-35
BELTS AND CHAINS 3-36
VACUUM FAN DRIVE BELT – GAS/LPG ENGINES (For machines below serial number 001508) 3-36
VACUUM FAN DRIVE BELT – DIESEL ENGINES (For machines serial number 001000 and above) 3-36
TO ADJUST VACUUM FAN DRIVE BELT 3-36
ALTERNATOR AND RADIATOR FAN BELT 3-36
TO ADJUST ALTERNATOR AND RADIATOR FAN BELT 3-36
SCRUB HEAD 3-37
SCRUB HEAD 3-37
TO ADJUST SCRUB HEAD HEIGHT 3-37
TO ADJUST SCRUB BRUSH PATTERN 3-37
SCRUB BRUSHES 3-39
TO REPLACE SCRUB BRUSHES 3-39
SOLUTION SYSTEM 3-41
SRS WATER SPRAY DEFLECTOR . . 3-41
SRS SOLUTION TANK 3-42
SRS METERING SOLUTION PUMP3-43
TROUBLESHOOTING 3-43
SQUEEGEES 3-44
SIDE SQUEEGEES 3-44
SCRUB HEAD REAR SQUEEGEES . 3-44
REAR SQUEEGEE 3-45
TO REPLACE REAR SQUEEGEE BLADES 3-45
TO FACTORY ADJUST REAR SQUEEGEE 3-46
TO ADJUST REAR SQUEEGEE . 3-48
BRAKES AND TIRES 3-50
SERVICE BRAKES 3-50
PARKING BRAKES 3-51
TIRES 3-51
OPTIONS 3-52
DRAIN PUMP 3-52

APPENDIX 4-1
HARDWARE INFORMATION 4-3
STANDARD BOLT TORQUE CHART . 4-3
METRIC BOLT TORQUE CHART 4-3
BOLT IDENTIFICATION 4-3
THREAD SEALANT AND LOCKING COMPOUNDS 4-3
HYDRAULIC FITTING INFORMATION . . . 4-4
HYDRAULIC TAPERED PIPE FITTING (NPT) TORQUE CHART 4-4
HYDRAULIC TAPERED SEAT FITTING (JIC) TORQUE CHART 4-4
HYDRAULIC O-RING FITTING TORQUE CHART 4-4

Page
HOW TO USE THIS MANUAL 5-1
IMPORTANT INFORMATION 5-1
FINDING A TENNANT PART NUMBER . . 5-2
PLACING AN ORDER 5-3

STANDARD MODEL PARTS 6-1
Fig. 1 – Recommended General Maintenance Items 6-3
Fig. 2 – Replacement Brushes 6-7
Fig. 3 – Main Frame Group (001000–001505) 6-8
Fig. 4 – Main Frame Group 001508–) 6-10
Fig. 5 – Main Frame Cover and Door Group (001508–) 6-12
Fig. 6 – Main Frame Noise Insulation Group (001000–001505) 6-14
Fig. 7 – Seat Group 6-15
Fig. 8 – Scrub Head Lift Group 6-16
Fig. 9 – Scrub Head Hopper Group 6-18
Fig. 10 – Scrub Head Rear Squeegee Group 6-19
Fig. 11 – Scrub Head Right Side Squeegee Assembly 6-20
Fig. 12 – Scrub Head Left Side Squeegee Assembly 6-22
Fig. 13 – Scrub Head Solution Control Group 6-24
Fig. 14 – Scrub Head Front Brush Drive Components Group 6-26
Fig. 15 – Scrub Head Front Brush Idler Assembly 6-28
Fig. 16 – Scrub Head Rear Brush Idler Assembly 6-29
Fig. 17 – Scrub Head Rear Brush Drive Components Group 6-30
Fig. 18 – Steering Column Group (001000–001505) 6-32
Fig. 19 – Steering Column Group, Gas/LPG (001508–) . . . 6-33
Fig. 20 – Tire and Wheel Assembly 6-34
Fig. 21 – Rear Axle Group 6-35
Fig. 22 – Front Wheel Drive Group 6-36
Fig. 23 – Hydraulic Directional Pedal Group (001000–001103) 6-38
Fig. 24 – Hydraulic Directional Pedal Group Gas/LPG (001104–) . . . 6-40
Fig. 25 – Front Wheel Parking Brake Group 6-42
Fig. 26 – Brakes Group 6-43
Fig. 27 – Engine Group, Gas (001000–001423) 6-44
Fig. 28 – Engine Group, Gas/LPG (001424–001505) 6-46
Fig. 29 – Engine Group, Gas/LPG (001508–) 6-48
Fig. 30 – Engine Alternator Group, Gas/LPG (001424–001505) . . . 6-50

Page

Fig. 31 - Engine Alternator Group, Gas/LPG (001508-001537) . . . 6-52
Fig. 32 - Engine Alternator Group, Gas/LPG (001538-) 6-54
Fig. 33 - Engine EFI Group, Gas (001424-001505) 6-56
Fig. 34 - Engine EFI Group, Gas (001508-001537) 6-58
Fig. 35 - Engine EFI Group, Gas (001538-) 6-60
Fig. 36 - Engine Muffler Group (001000-001423) 6-62
Fig. 37 - Engine Muffler Group, Gas/LPG (001424-001505) 6-64
Fig. 38 - Engine Muffler Group, Gas/LPG (001508-001537) 6-66
Fig. 39 - Engine Muffler Group, Gas/LPG (001538-) 6-68
Fig. 40 - Engine Oil Filter and Drain Group, Gas/LPG (001424-) 6-70
Fig. 41 - Engine Radiator and Hydraulic Cooler Group (001000-001423) 6-72
Fig. 42 - Engine Radiator and Hydraulic Cooler Group, Gas/LPG (001424-001505) 6-74
Fig. 43 - Engine Radiator and Hydraulic Cooler Group, Gas/LPG (001508-) 6-76
Fig. 44 - Engine Fan and Pulley Group, Gas/LPG (001424-001505) . 6-78
Fig. 45 - Engine Air Cleaner Group, Gas (001000-001402) 6-80
Fig. 46 - Engine Air Cleaner Group, Gas (001403-001423) 6-81
Fig. 47 - Engine Air Cleaner Group, Gas/LPG (001424-001505) 6-82
Fig. 48 - Engine Air Cleaner Group, Gas (001508-) 6-84
Fig. 49 - Engine Fuel Tank Group, Gas (001000-001423) 6-86
Fig. 50 - Engine Fuel Tank Group, Gas (001424-001505) 6-88
Fig. 51 - Engine Fuel Tank Group, Gas (001508-001537) 6-90
Fig. 52 - Engine Fuel Tank Group, Gas (001538-) 6-92
Fig. 53 - Engine Battery Group, Gas/LPG 6-94
Fig. 54 - Electrical Schematic, Gas/LPG (001000-001423) 6-95
Fig. 55 - Electrical Schematic, Options (001000-001505) 6-96
Fig. 56 - Electrical Schematic, Specials (001000-001505) 6-97
Fig. 57 - Electrical Schematic, Gas/LPG (001424-001505) 6-98
Fig. 58 - Electrical Schematic, Gas/LPG (001508-001537) 6-102

Page

Fig. 59 - Electrical Schematic (001538-) 6-107
Fig. 60 - Electrical Wiring Diagram, Instrument Panel (001508) 6-113
Fig. 61 - Electrical Wire Harnesses Group (001000-001505) 6-116
Fig. 62 - Electrical Wire Harnesses Group, Gas/LPG (001508-) . . . 6-120
Fig. 63 - Instrument Panel Group, Gas/LPG (001000-001505) 6-132
Fig. 64 - Instrument Panel Group, Gas (001508-) 6-134
Fig. 65 - SRS Control Panel Assembly . 6-136
Fig. 66 - Hydraulic Schematic (001000-001103) 6-137
Fig. 67 - Hydraulic Schematic (001104-001505) 6-138
Fig. 68 - Hydraulic Schematic, Gas/LPG (001508-) 6-140
Fig. 69 - Hydraulic Hoses Group (001000-001103) 6-142
Fig. 70 - Hydraulic Hoses Group (001104-001505) 6-144
Fig. 71 - Hydraulic Hoses Group, Gas/LPG (001508-) 6-146
Fig. 72 - Hydraulic Propelling Motors Group 6-150
Fig. 73 - Hydraulic Reservoir Group (001000-001505) 6-149
Fig. 74 - Hydraulic Reservoir Group Gas/LPG (001508-) . . 6-150
Fig. 75 - Hydraulic Control Valves Group (001000-001505) 6-151
Fig. 76 - Hydraulic Control Valves Group, Gas/LPG (001508-) . . 6-152
Fig. 77 - Hydraulic Pumps Group (001000-001103) 6-154
Fig. 78 - Hydraulic Pumps Group (001104-001505) 6-155
Fig. 79 - Hydraulic Pumps Group, Gas/LPG (001508-) . . 6-156
Fig. 80 - Hydraulic Filters Group (001000-001103) 6-157
Fig. 81 - Hydraulic Filter Group (001104-001505) 6-158
Fig. 82 - Hydraulic Filter Group, Gas/LPG (001508-) 6-159
Fig. 83 - Hydraulic Solenoid Valve and Manifold Group, Gas/LPG (001508-) 6-160
Fig. 84 - Hydraulic Tow Bypass Group (001061-001103) 6-162
Fig. 85 - Rear Bumper Group 6-163
Fig. 86 - Vacuum Fan Assembly, Gas/LPG (001000-001505) 6-164
Fig. 87 - Vacuum Fan Group, Gas/LPG (001508-) 6-166
Fig. 88 - Trunnion Group 6-168
Fig. 89 - Solution Pumps Group 6-170

Home Find... Go To..

Page

Fig. 90 – Solution and Recovery Tank Group, Front Side 6–172
Fig. 91 – Solution and Recovery Tank Group, Rear Side 6–174
Fig. 92 – Rear Squeegee Assembly 6–176
Fig. 93 – Label Group 6–178

LPG PARTS 7-1
Fig. 1 – Fuel Tank and Engine Group, LPG (001000–001423) 7-2
Fig. 2 – Engine Fuel Tank Group, LPG (001424–001505) 7-4
Fig. 3 – Engine Fuel Tank Group, LPG (001508–) 7-6
Fig. 4 – Engine EFI and Vaporizer Group, LPG (001424–001505 version 1) 7-8
Fig. 5 – Engine EFI and Vaporizer Group, LPG (001424–001505 version 2) 7-10
Fig. 6 – Engine EFI and Vaporizer Group, LPG (001508–) 7-12
Fig. 7 – Engine Air Cleaner Group, LPG (001000–001402) 7-14
Fig. 8 – Engine Air Cleaner Group, LPG (001403–001408) 7-15
Fig. 9 – Engine Air Cleaner Group, LPG (001508–) 7-16
Fig. 10 – Instrument Panel Group, LPG (001508–) 7-18
Fig. 11 – Engine Cover Group, LPG (001000–001423) 7-20

DIESEL PARTS 8-1
Fig. 1 – Engine Group, Diesel (001000–001423) 8-2
Fig. 2 – Engine Group, Diesel (001424–001505) 8-4
Fig. 3 – Engine Group, Diesel (001508–) 8-6
Fig. 4 – Engine Throttle Group, Diesel (001508–) 8-8
Fig. 5 – Engine Oil Filter and Drain Group, Diesel (001424–001505) 8-10
Fig. 6 – Engine Muffler Group, Diesel (001424–001505) 8-12
Fig. 7 – Engine Muffler Group, Diesel (001508–) 8-14
Fig. 8 – Engine Fuel Tank Group, Diesel (001000–001423) 8-16
Fig. 9 – Engine Fuel Tank Group, Diesel (001424–001505) 8-18
Fig. 10 – Engine Fuel Tank Group, Diesel (001508–) 8-20
Fig. 11 – Engine Alternator Group, Diesel (001424–001505) 8-22
Fig. 12 – Engine Radiator Group, Diesel (001000–001423) 8-23

Page

Fig. 13 – Engine Radiator and Hydraulic Cooler Group, Diesel (001424–001505) 8-24
Fig. 14 – Engine Radiator and Hydraulic Cooler Group, Diesel (001508–) 8-26
Fig. 15 – Engine Air Cleaner Group, Diesel (001000–001423) 8-28
Fig. 16 – Engine Air Cleaner Group, Diesel (001424–001505) 8-29
Fig. 17 – Engine Air Cleaner Group, Diesel (001508–) 8-30
Fig. 18 – Engine Glow Plug Control Group, Diesel (001000– 001423) 8-32
Fig. 19 – Engine Glow Plug Control Group, Diesel (001424–001505) 8-33
Fig. 20 – Engine Battery Group, Diesel (001000–001505) 8-34
Fig. 21 – Engine Battery Group, Diesel (001508–) 8-35
Fig. 22 – Steering Column Group, Diesel (001000–) 8-36
Fig. 23 – Hydraulic Directional Pedal Group, Diesel (001104–) 8-38
Fig. 24 – Hydraulic Schematic, Diesel (001000–) 8-40
Fig. 25 – Hydraulic Hoses Group, Diesel (001104–) 8-42
Fig. 26 – Hydraulic Control Valves Group, Diesel (001000–) 8-44
Fig. 27 – Hydraulic Reservoir Group, Diesel (001000–) 8-45
Fig. 28 – Hydraulic Pumps Group, Diesel (001104–) 8-46
Fig. 29 – Hydraulic Filter Group, Diesel (001104–) 8-47
Fig. 30 – Electrical Schematic, Diesel (001000–001423) 8-48
Fig. 31 – Electrical Schematic, Diesel (001424–001505) 8-50
Fig. 32 – Electrical Schematic, Diesel (001508–) 8-54
Fig. 33 – Electrical Wire Harnesses Group, Diesel (001508–) 8-57
Fig. 34 – Instrument Panel Group, Diesel (001508–) 8-64
Fig. 35 – Vacuum Fan Assembly, Diesel (001000–) 8-66

OPTIONS 9-1
Fig. 1 – Light Kit 9-2
Fig. 2 – Flashing Light Kit 9-4
Fig. 3 – Revolving Light Group 9-5
Fig. 4 – Revolving Light Kit, Overhead Guard 9-6
Fig. 5 – Overhead Guard Kit 9-7
Fig. 6 – Brush Pressure Warning Kit 9-8
Fig. 7 – Sludge Removal Tool Assembly9-9
Fig. 8 – Drain Pump Group 9-10

Home Find... Go To..

Page
Fig. 9 – Squeegee Wand Kit 9-12
Fig. 10 – Reserve LPG Tank Group with Filler Valve 9-14
Fig. 11 – Protectoseal Gasoline Cap . . . 9–15
Fig. 12 – Fire Extinguisher Kit (001000–001505) 9–15
Fig. 13 – Fire Extinguisher Group (001508–) 9–16
Fig. 14 – Wheel Assembly, Foam Filled 9–17
Fig. 15 – Solution Tank Drain Kit 9–17
Fig. 16 – Rear View Mirror Kit 9–18
Fig. 17 – Spark Arresting Muffler Kit . . . 9–18
Fig. 18 – Side Squeegees Extension Kit 9–19
Fig. 19 – Heavy Duty Air Filter Group (001403–001505) 9–20
Fig. 20 – Documentation Group 9–20

BREAKDOWNS 10-1
Fig. 1 – Solution Pump Breakdown, 33327 10-2
Fig. 2 – Metering Solution Pump Breakdown, 16485 10-3
Fig. 3 – Hydraulic Pump Breakdown, 34310 10-4
Fig. 4 – Hydraulic Pump Breakdown, 48880 10-20
Fig. 5 – Hydraulic Piston Pump Breakdown, 74163 10-5
Fig. 6 – Hydraulic Piston Pump Breakdown, 74163 10-6
Fig. 7 – Hydraulic Piston Pump Breakdown, 373404 10-10
Fig. 8 – Hydraulic Piston Pump Breakdown, 373404 10-12
Fig. 9 – Hydraulic Gear Pump Breakdown, 373245 10-14
Fig. 10 – Hydraulic Gear Pump Breakdown, 79078 10-16
Fig. 11 – Hydraulic Gear Pump Breakdown, 1014956 10-18
Fig. 12 – Manual Control Breakdown, 74273 10-20
Fig. 13 – Hydraulic Motor Breakdown, 27792 10-21
Fig. 14 – Hydraulic Motor Breakdown, 22604 10-22
Fig. 15 – Hydraulic Motor Breakdown, 61489 10-24
Fig. 16 – Hydraulic Steering Valve Breakdown, 57982 10-25
Fig. 17 – Hydraulic Steering Valve Breakdown, 74176 10-26
Fig. 18 – Hydraulic Solenoid Valve Breakdown, 31575 10-27
Fig. 19 – Hydraulic Valve Breakdown, 32761 10-28
Fig. 20 – Hydraulic Flow Switch Breakdown, 31556 10-29
Page
Fig. 21 – Hydraulic Cylinder Breakdown, 04431 10-30
Fig. 22 – Hydraulic Valve Breakdown, 48108A 10-31
Fig. 23 – Hydraulic Motor Breakdown, 1023322 10-32
Fig. 24 – Hydraulic Motor Breakdown, 1019272 10-33
Fig. 25 – Hydraulic Solenoid Valve Breakdown, 1020194 10-34
Fig. 26 – Hydraulic Solenoid Valve Breakdown, 1042535 10-35
Fig. 27 – LPG EFI Breakdown, 371663 . 10-36
Fig. 28 – Gasoline EFI Breakdown, 371645 10-37

CONTINENTAL ENGINE BREAKDOWN, GASOLINE, LPG 11-1
Fig. 1 – Engine Block Group 11-2
Fig. 2 – Cylinder Head Group 11-4
Fig. 3 – Camshaft Group 11-6
Fig. 4 – Crankshaft Group 11-8
Fig. 5 – Piston Group 11-9
Fig. 6 – Oil Pump Group 11-10
Fig. 7 – Gear Cover Group 11-11
Fig. 8 – Flywheel and Starter Group . . . 11-12
Fig. 9 – Intake and Exhaust Manifold Group 11-13
Fig. 10 – Water Pump Group 11-14
Fig. 11 – Water Header and Thermostat Group 11-15
Fig. 12 – Carburetor and Controls Group 11-16
Fig. 13 – Oil Filter Group 11-17
Fig. 14 – Distributor and Fuel Pump Group 11-18

GM ENGINE BREAKDOWN, GASOLINE, LPG 12-1
Fig. 1 – Cylinder Head, Valves Group . . . 12-2
Fig. 2 – Distributor and Ignition Group . . 12-4
Fig. 3 – Manifold Group 12-6
Fig. 4 – Engine Block and Piston Group . 12-8
Fig. 5 – Oil Pump and Oil Pan Group . . 12-10
Fig. 6 – Crankshaft Group 12-12
Fig. 7 – Camshaft and Water Pump Group 12-14

61697 CONTINENTAL ENGINE BREAKDOWN, DIESEL 13-1
Fig. 1 – Engine Block Group 13-2
Fig. 2 – Fuel System Group 13-4
Fig. 3 – Cylinder Head Group 13-6
Fig. 4 – Camshaft Group 13-8
Fig. 5 – Crankshaft Group 13-9
Fig. 6 – Piston Group 13-10
Fig. 7 – Oil Pump Group 13-11
Fig. 8 – Gear Cover Group 13-12
Fig. 9 – Flywheel and Starter Group . . . 13-13

Home Find... Go To..

Page

Fig. 10 – Intake and Exhaust Manifold Group 13-14
Fig. 11 – Water Pump Group 13-15
Fig. 12 – Water Header and Thermostat Group 13-16
Fig. 13 – Alternator Brackets and PCV Group 13-17
Fig. 14 – Oil Filter Group 13-18

65951 CONTINENTAL ENGINE BREAKDOWN,DIESEL 14-1
Fig. 1 – Engine Block Group 14-2
Fig. 2 – Fuel System Group 14-4
Fig. 3 – Cylinder Head Group 14-6
Fig. 4 – Camshaft Group 14-8
Fig. 5 – Crankshaft Group 13-9
Fig. 6 – Piston Group 14-10
Fig. 7 – Oil Pump Group 14-11
Fig. 8 – Gear Cover Group 14-12
Fig. 9 – Flywheel and Starter Group . . . 14-13
Fig. 10 – Intake and Exhaust Manifold Group 14-14
Fig. 11 – Water Pump Group 14-15
Fig. 12 – Water Header and Thermostat Group 14-16
Fig. 13 – Alternator Brackets and PCV Group 14-17
Fig. 14 – Oil Filter Group 14-18

PERKINS ENGINE BREAKDOWN, DIESEL 15-1
Fig. 1 – Cylinder Block Group 15-2
Fig. 2 – Crankshaft and Piston Group . . . 15-4
Fig. 3 – Cylinder Head Group 15-6
Fig. 4 – Rocker Shaft Group 15-8
Fig. 5 – Timing Gear, Cover and Camshaft . . Group 15-10
Fig. 6 – Timing Gear Cover Mount Group 15-12
Fig. 7 – Oil Pump Group 15-13
Fig. 8 – Auxiliary Drive Group 15-14
Fig. 9 – Fuel Injection Pipe Group 15-16
Fig. 10 – Fuel Injection Pump Breakdown 15-18
Fig. 11 – Flywheel Housing Group 15-19
Fig. 12 – Lubricating Oil Sump Group . . 15-20
Fig. 13 – Cylinder Head Cover Group . . 15-22
Fig. 14 – Water Pump and Thermostat Group 15-24
Fig. 15 – Manifold Group 15-26
Fig. 16 – Glow Plug and Engine Lift Group 15-27
Fig. 17 – Top Joints and Gaskets Group 15-28
Fig. 18 – Bottom Joints and Gaskets Group 15-29

Page

1011676 CAT ENGINE BREAKDOWN, DIESEL 16-1
Fig. 1 – Cylinder Block Group 16-2
Fig. 2 – Crankshaft and Piston Group . . . 16-4
Fig. 3 – Cylinder Head and Cover Group 16-6
Fig. 4 – Valve and Rocker Arm Group . . 16-8
Fig. 5 – Camshaft Group 16-9
Fig. 6 – Front Housing and Gear Group 16-10
Fig. 7 – Flywheel Housing and Starter Group 16-12
Fig. 8 – Auxiliary Drive Group 16-13
Fig. 9 – Oil Pan Group 16-14
Fig. 10 – Water Pump and Thermostat Group 16-16
Fig. 11 – Cooler Group 16-18
Fig. 12 – Manifold Group 16-20
Fig. 13 – Fuel Group 16-22
Fig. 14 – Fumes Disposal Group 16-24
Fig. 15 – Alternator Group 16-26
Fig. 16 – Glow Plug Group 16-27

1040607 CAT ENGINE BREAKDOWN, DIESEL 17-1
Fig. 1 – Cylinder Block Group 17-2
Fig. 2 – Crankshaft and Piston Group . . . 17-4
Fig. 3 – Cylinder Head and Cover Group 17-6
Fig. 4 – Valve and Rocker Arm Group . . 17-8
Fig. 5 – Camshaft Group 17-9
Fig. 6 – Front Housing and Gear Group 17-10
Fig. 7 – Flywheel Housing and Starter Group 17-12
Fig. 8 – Auxiliary Drive Group 17-13
Fig. 9 – Oil Pan Group 17-14
Fig. 10 – Water Pump and Thermostat Group 17-16
Fig. 11 – Cooler Group 17-18
Fig. 12 – Manifold Group 17-19
Fig. 13 – Fuel Group 17-20
Fig. 14 – Fumes Disposal Group 17-22
Fig. 15 – Alternator Group 17-23
Fig. 16 – Glow Plug Group 17-24

CROSS REFERENCE 18-1
PART NUMBER TO PAGE NUMBER CROSS REFERENCE LIST 18-2
PART DESCRIPTION TO PAGE NUMBER CROSS REFERENCE LIST 18-21

Home Find... Go To..

SECTION 1

CONTENTS

Page

MACHINE SPECIFICATIONS 1-3
- POWER TYPE 1-3
  - GAS/LPG CONTINENTAL ENGINES – (For machines below serial number 001424) 1-3
  - GAS/LPG GM ENGINES – (For machines serial number 001424 and above) . . 1-3
  - DIESEL CONTINENTAL ENGINES – (For machines below serial number 001424) 1-3
  - DIESEL PERKINS ENGINES – (For machines serial number 001424 – 001505) 1-3
  - CAT ENGINES – (For machines serial number 001508 and above) 1-4
- POWER TRAIN 1-4
- STEERING 1-4
- BRAKING SYSTEM 1-4
- SUSPENSION SYSTEM 1-4
- SYSTEM FLUID CAPACITIES 1-4
  - CONTINENTAL ENGINES (For machines below serial number 001424) 1-4
  - GAS/LPG GM ENGINES (For machines serial number 001424 – 001505) . . . 1-4
  - GAS/LPG GM ENGINES (For machines serial number 001508 and above) . . 1-4
  - DIESEL PERKINS ENGINES (For machines serial number 001424 – 001505) 1-4
  - DIESEL CAT ENGINES (For machines serial number 001508 and above) . . 1-4
- GENERAL MACHINE DIMENSIONS/CAPACITIES 1-5
- MACHINE WEIGHTS 1-5
- GENERAL MACHINE PERFORMANCE . . 1-5

MACHINE DIMENSIONS 1-6

MACHINE SPECIFICATIONS

POWER TYPE

GAS/LPG CONTINENTAL ENGINES – (For machines below serial number 001424)

Engine manufacturer/model – Continental TM27
Engine type – piston
Ignition – breaker–less type spark
Cycle – 4
Aspiration – natural
Cylinders – 4
Bore – 3.58 in (90 mm)
Stroke – 4.06 in (105 mm)
Displacement – 164 cu in (2.7 L)
Net power – 58 hp (43 kw) @ 2400 rpm
governed 70 hp (52 kw) @ 3000 rpm maximum
Fuels – gasoline, 85 octane unleaded, or LPG
Cooling system – water
Electrical system – 12 V nominal, 42 A alternator

GAS/LPG GM ENGINES – (For machines serial number 001424 and above)

Engine manufacturer/model – GM *Powertrain*
Engine type – piston
Ignition – solid state distributor
Cycle – 4
Aspiration – natural
Cylinders – 4
Bore – 4.00 in (101.60 mm)
Stroke – 3.60 in (91.44 mm)
Displacement – 181 cu in (3.0 L)
Net power: Gasoline
NA hp (kw) @ 2400 rpm governed
83 hp (62 kw) @ 3000 rpm maximum
Net power: LPG
65 hp (49 kw) @ 2400 rpm governed
NA hp (kw) @ NA rpm maximum
Fuels – gasoline, 85 octane unleaded, or LPG
Cooling system – water
Electrical system – 12 V nominal, 50 A alternator

DIESEL CONTINENTAL ENGINES – (For machines below serial number 001424)

Engine manufacturer/model – Continental TMD27
Engine type – piston
Ignition – diesel
Cycle – 4
Aspiration – natural
Cylinders – 4
Bore – 3.58 in (90 mm)
Stroke – 4.06 in (105 mm)
Displacement – 164 cu in (2.7 L)
Net power – 55 hp (40 kw) @ 2400 rpm
governed 66 hp (50 kw) @ 3000 rpm maximum
Fuels – #1 or #2 diesel fuel
Cooling system – water
Electrical system – 12 V nominal, 42 A alternator

DIESEL PERKINS ENGINES – (For machines serial number 001424 – 001505)

Engine manufacturer/model – Perkins 704–30 Series
Engine type – piston
Ignition – solid state distributor
Cycle – 4
Aspiration – natural
Cylinders – 4
Bore – 3.80 in (97.00 mm)
Stroke – 3.90 in (100.00 mm)
Displacement – 181 cu in (3.0 L)
Net power: – 63 hp (44.8 kw) @ 2400 rpm governed
63 hp (47 kw) @ 2400 rpm maximum
Fuels – Diesel
Cooling system – water/ethylene glycol antifreeze
Electrical system – 12 V nominal, 50 A alternator (std), 100 A alternator (HD)

CAT ENGINES - (For machines serial number 001508 and above)

Engine manufacturer/model - CAT 3044C
Engine manufacturer/model - CAT C3.4
Engine type - piston
Ignition - solid state distributor
Cycle - 4
Aspiration - natural
Cylinders - 4
Bore - 3.70 in (94.00 mm)
Stroke - 4.70 in (120.00 mm)
Displacement - 201 cu in (3.33 L)
Net power: - 62 hp (46.2 kw) @ 2400 rpm governed
63 hp (47 kw) @ 2600 rpm maximum
Fuels - Diesel
Cooling system - water/ethylene glycol antifreeze
Electrical system - 12 V nominal, 75 A alternator (std), 100 A alternator (HD)

POWER TRAIN

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

STEERING

Type - articulated frame
Power source - double action hydraulic cylinder
Emergency steering - manual

BRAKING SYSTEM

Service brakes - dual hydraulic caliper disc brakes (2), (two per front wheel) foot brake master cylinder actuated.

Parking brakes - mechanical caliper disc brakes (2), (one per front wheel), cable actuated.

SUSPENSION SYSTEM

Front - two 8.75 x 16.5 6-ply rating tubeless tires
Rear - two 8.75 x 16.5 6-ply rating tubeless tires

SYSTEM FLUID CAPACITIES

1550 recovery tank - 510 gal (1930 L)
SRS cleaning solution tank - 10 gal (40 L)

Fuel tank, gasoline, diesel - 15.3 gal (60 L)
Fuel tank, LPG - 33 lb (15 kg)

CONTINENTAL ENGINES (For machines below serial number 001424)

Hydraulic system, reservoir - 11.5 gal (45 L)
Hydraulic system, total system - 13.8 gal (52 L)

Engine cooling system:
radiator - 6.4 qt (6 L)
total system - 13.4 qt (13 L)

Engine lubricating oil with filter - 7 qt (6.6 L)

GAS/LPG GM ENGINES (For machines serial number 001424 - 001505)

Hydraulic system, reservoir - 11.5 gal (45 L)
Hydraulic system, total system - 13.8 gal (52 L)

Engine cooling system:
radiator/hoses - 8.75 qt (8 L)
total system - 12.75 qt (12 L)

Engine lubricating oil with filter - 5.0 qt (4.7 L)

GAS/LPG GM ENGINES (For machines serial number 001508 and above)

Hydraulic system, reservoir - 14.2 gal (54 L)
Hydraulic system, total system - 18.3 gal (69 L)

Engine cooling system:
radiator/hoses - 8.75 qt (8 L)
total system - 12.75 qt (12 L)

Engine lubricating oil with filter - 5.0 qt (4.7 L)

DIESEL PERKINS ENGINES (For machines serial number 001424 - 001505)

Hydraulic system, reservoir - 11.5 gal (45 L)
Hydraulic system, total system - 13.8 gal (52 L)

Engine cooling system:
radiator/hoses - 8.75 qt (8 L)
total system - 12.75 qt (12 L)

Engine lubricating oil with filter - 11 qt (10.4 L)

DIESEL CAT ENGINES (For machines serial number 001508 and above)

Hydraulic system, reservoir - 11.5 gal (45 L)
Hydraulic system, total system - 13.8 gal (52 L)

Engine cooling system:
radiator/hoses - 8.75 qt (8 L)
total system - 12.75 qt (12 L)

Engine lubricating oil with filter - 10.6 qt (10. L)

GENERAL MACHINE DIMENSIONS/CAPACITIES

Length – 198.0 in (5029 mm)

Width – 61.00 in (1550 mm)

Height – 71.50 in (1816 mm)
Height with overhead guard and light – 95.50 in (2426 mm)

Track, front – 46.7 in (1185 mm)
Track, rear – 45.3 in (1150 mm)

Wheel base – 90.0 in (2286 mm)

Scrub brush (2), path width – 50 in (1270 mm)
Scrub brush (2), diameter – 11 in (280 mm)

Rear squeegee path width – 56.5 in (1435 mm)

Debris hopper capacity – 2.6 cu ft (0.073 m3)

MACHINE WEIGHTS

GVWR – 11300 lb (5085 kg)

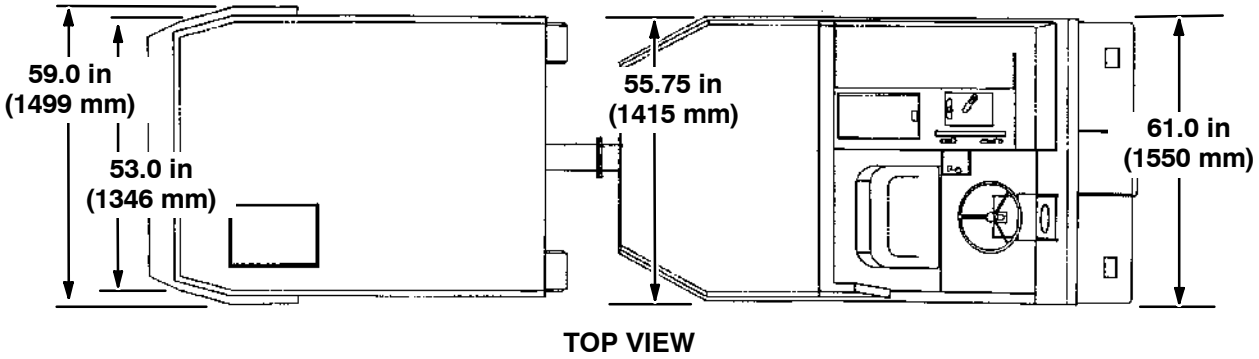
GENERAL MACHINE PERFORMANCE

Maximum forward speed – 9 mph (14.5 km/h)
Maximum reverse speed – 7 mph (11 km/h)

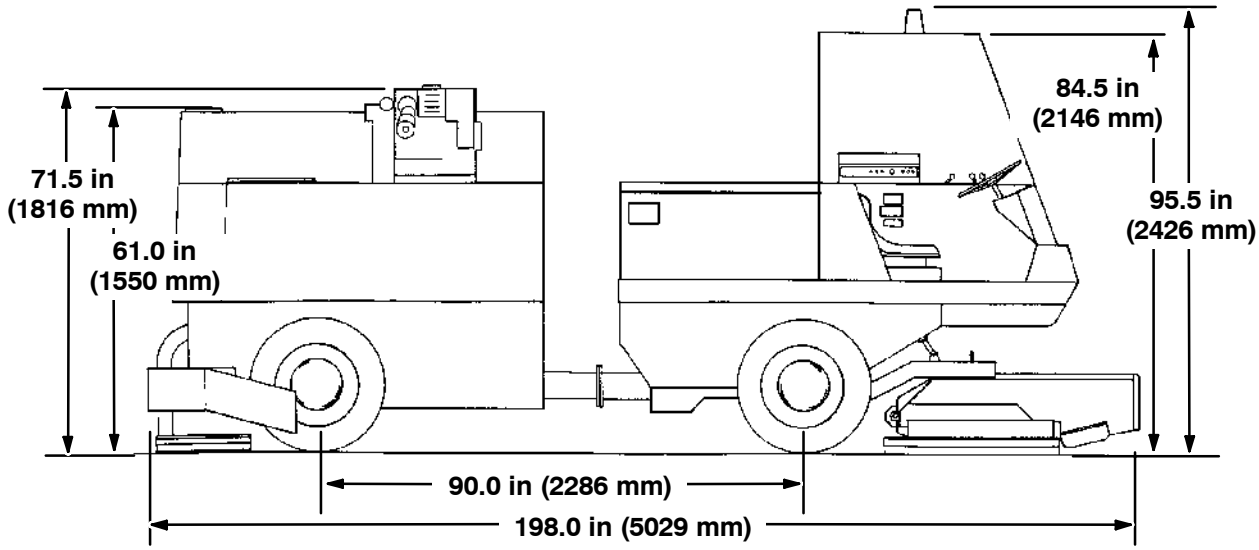
Turning radius – 136.9 in (3471 mm)

Maximum rated climb and descent angle with empty tanks – 8°
Maximum rated climb and descent angle with full tanks – 5°

MACHINE DIMENSIONS



TOP VIEW



SIDE VIEW

06962

SECTION 2

CONTENTS

Page

PREPARATION FOR OPERATION 2-3
AFTER UNLOADING AND BEFORE OPERATING THE MACHINE: 2-3
OPERATION OF CONTROLS 2-4
MACHINE COMPONENTS 2-4
INSTRUMENTS AND CONTROLS – GAS/LPG and DIESEL ENGINES (For machines below serial number 001508) 2-5
INSTRUMENTS AND CONTROLS – GAS/LPG GM ENGINES (For machines serial number 001508 and above) . . 2-6
INSTRUMENTS AND CONTROLS – DIESEL CAT ENGINES (For machines serial number 001508 and above) 2-7
BRAKE PEDAL 2-8
DIRECTIONAL PEDAL 2-8
OPERATOR SEAT 2-8
SCRUB HEAD LOCK LEVER 2-8
PIVOT LOCK PIN 2-9
PARKING BRAKE LEVER 2-9
AMMETER (For machines below serial number 001508) 2-9
CHARGING SYSTEM LIGHT (For machines serial number 001508 and above) 2-9
SQUEEGEE POSITION LAMP (For machines below serial number 001508) 2-9
CHECK ENGINE LIGHT (For machines serial number 001508 and above) 2-9
IGNITION SWITCH 2-9
DIESEL PRE-HEAT INDICATING LAMP . 2-10
OPERATING LIGHTS SWITCH (OPTION) 2-10
ROTATING LIGHT SWITCH (OPTION) . 2-10
HAZARD LIGHT SWITCH (OPTION) . . . 2-10
FUEL LEVEL GAUGE 2-10
PANEL LAMP (OPTION) 2-10
SCRUB BRUSH PRESSURE LAMP (OPTION) 2-10
ENGINE HOUR METER 2-10
FUSES (For machines below serial number 001508) 2-10
FUSES (For machines serial number 001508 and above) 2-10
GAS/LPG GM ENGINES 2-10
DIESEL CAT ENGINES 2-10
CIRCUIT BREAKERS (For machines serial number 001508 and above) 2-11
ENGINE OIL PRESSURE GAUGE – DIESEL,GAS/LPG CONTINENTAL ENGINES (For machines below serial number 001424) 2-11
ENGINE OIL PRESSURE GAUGE – GAS/LPG GM ENGINES (For machines serial number 001424 – 001505) . . 2-11

Page

ENGINE OIL PRESSURE GAUGE – DIESEL PERKINS ENGINES (For machines serial number 001424 – 001505) 2-11
ENGINE OIL PRESSURE LIGHT – GAS/LPG GM ENGINES (For machines serial number 001508 and above) 2-11
ENGINE OIL PRESSURE LIGHT – DIESEL CAT ENGINES (For machines serial number 001508 and above) 2-11
ENGINE COOLANT TEMPERATURE GAUGE 2-11
SQUEEGEE SWITCH 2-12
SCRUB BRUSH LEVER 2-12
SCRUB HEAD POSITION LEVER 2-12
SRS LIQUID LOW LEVEL LAMPS 2-12
SRS CLEANING SOLUTION FLOW KNOB 2-12
ENGINE CHOKE KNOB – CONTINENTAL ENGINES 2-12
THROTTLE LEVER – DIESEL, GAS/LPG CONTINENTAL ENGINES (For machines serial number 001000 – 001423) . . 2-13
THROTTLE LEVER – DIESEL CAT ENGINES (For machines serial number 001508 and above) 2-13
THROTTLE SWITCH – DIESEL PERKINS ENGINES (For machines serial number 001424 – 001505) 2-13
THROTTLE SWITCH – GAS/LPG GM ENGINES (For machines serial number 001508 and above) 2-13
STEERING WHEEL 2-13
HORN BUTTON (For machines serial number 001508 and above) 2-13
TANK DRAIN LAMP 2-13
SOLUTION LEVER 2-13
MACHINE OPERATION 2-14
NORMAL SCRUBBING OPERATION . . . 2-14
PRE-START CHECKLIST 2-14
TO START MACHINE 2-14
TO FILL SOLUTION TANK 2-15
TO SCRUB 2-15
TO DRAIN AND CLEAN SOLUTION TANK AND EMPTY HOPPER 2-16
POST OPERATION CHECKLIST – ENGINE OPERATING 2-16
TO STOP MACHINE 2-16
POST OPERATION CHECKLIST – ENGINE STOPPED 2-17
DOUBLE SCRUBBING OPERATION . . . 2-17
SOLUTION PICKUP OPERATION 2-17
OPERATION ON GRADES 2-17
MACHINE TROUBLESHOOTING 2-18

Page
OPTIONS OPERATION 2-19
VACUUM WAND 2-19
TO OPERATE VACUUM WAND . . 2-19
DRAIN PUMP 2-19
TOWING AND TRANSPORTING THE MACHINE 2-20
TOWING THE MACHINE 2-20
TRANSPORTING THE MACHINE . . . 2-20
MACHINE JACKING LOCATIONS . . . 2-23
MACHINE STORAGE 2-24
STORING MACHINE 2-24
GASOLINE POWERED MACHINES . 2-24
DIESEL POWERED MACHINES 2-26

PREPARATION FOR OPERATION

AFTER UNLOADING AND BEFORE OPERATING THE MACHINE:

1. Check the machine for shipping damage.

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

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

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

4. Check the engine oil level.

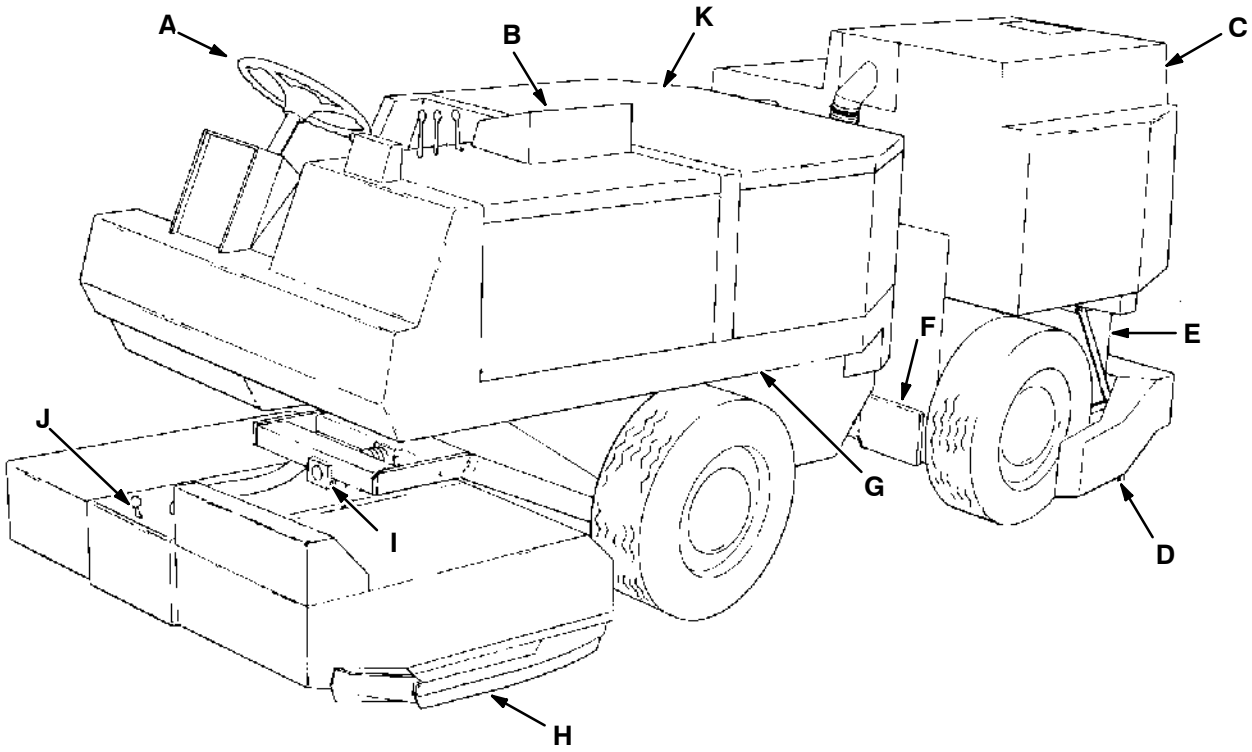
5. Check the radiator coolant level.

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

7. Check the air pressure of the tires.

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

OPERATION OF CONTROLS

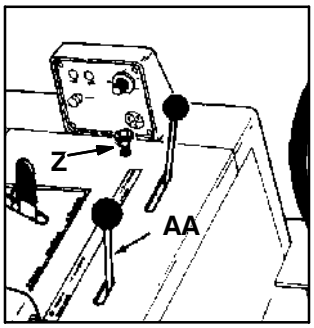


00291

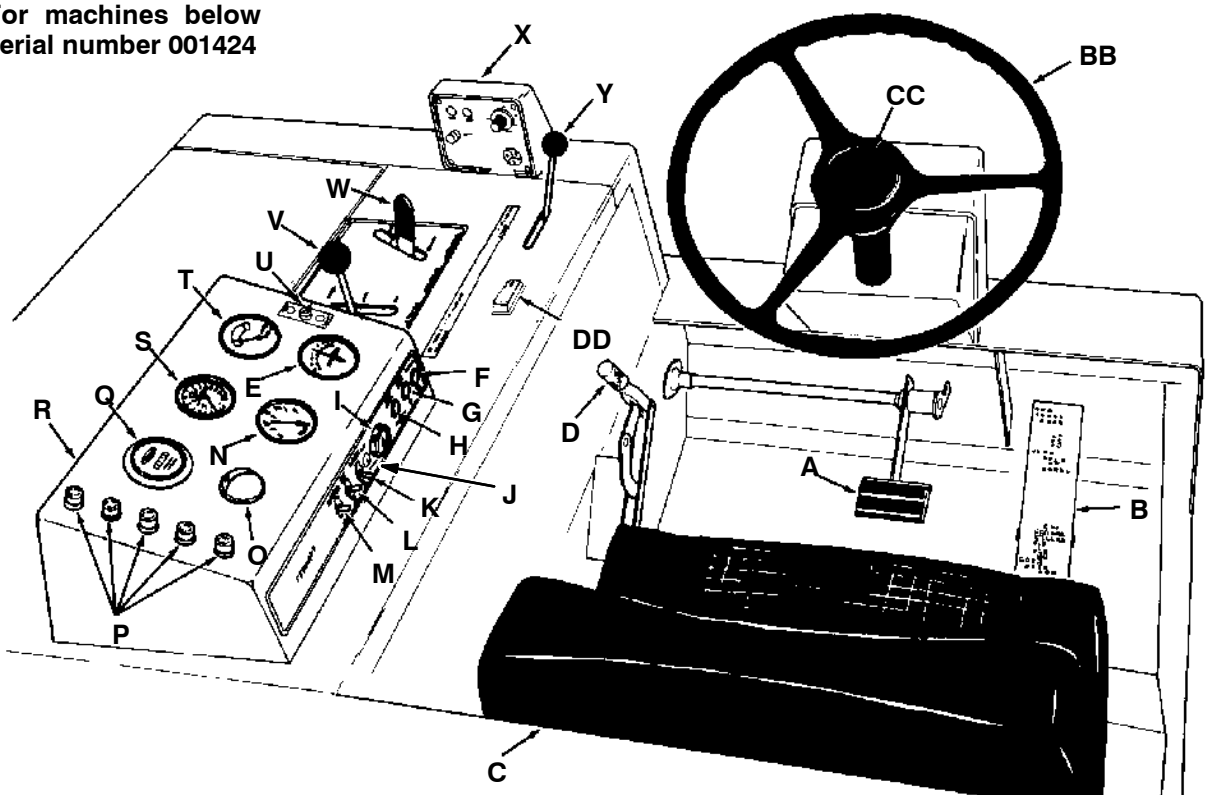
MACHINE COMPONENTS

A. Steering Wheel
B. Instrument Panel
C. Solution Tank
D. Rear Squeegee
E. Recovery Tank
F. Clean-out Door
G. Articulated Joint
H. Side Squeegee
I. Head Pivot
J. Debris Trough Release Lever
K. Fuel Tank

Home Find... Go To..



For machines below serial number 001424

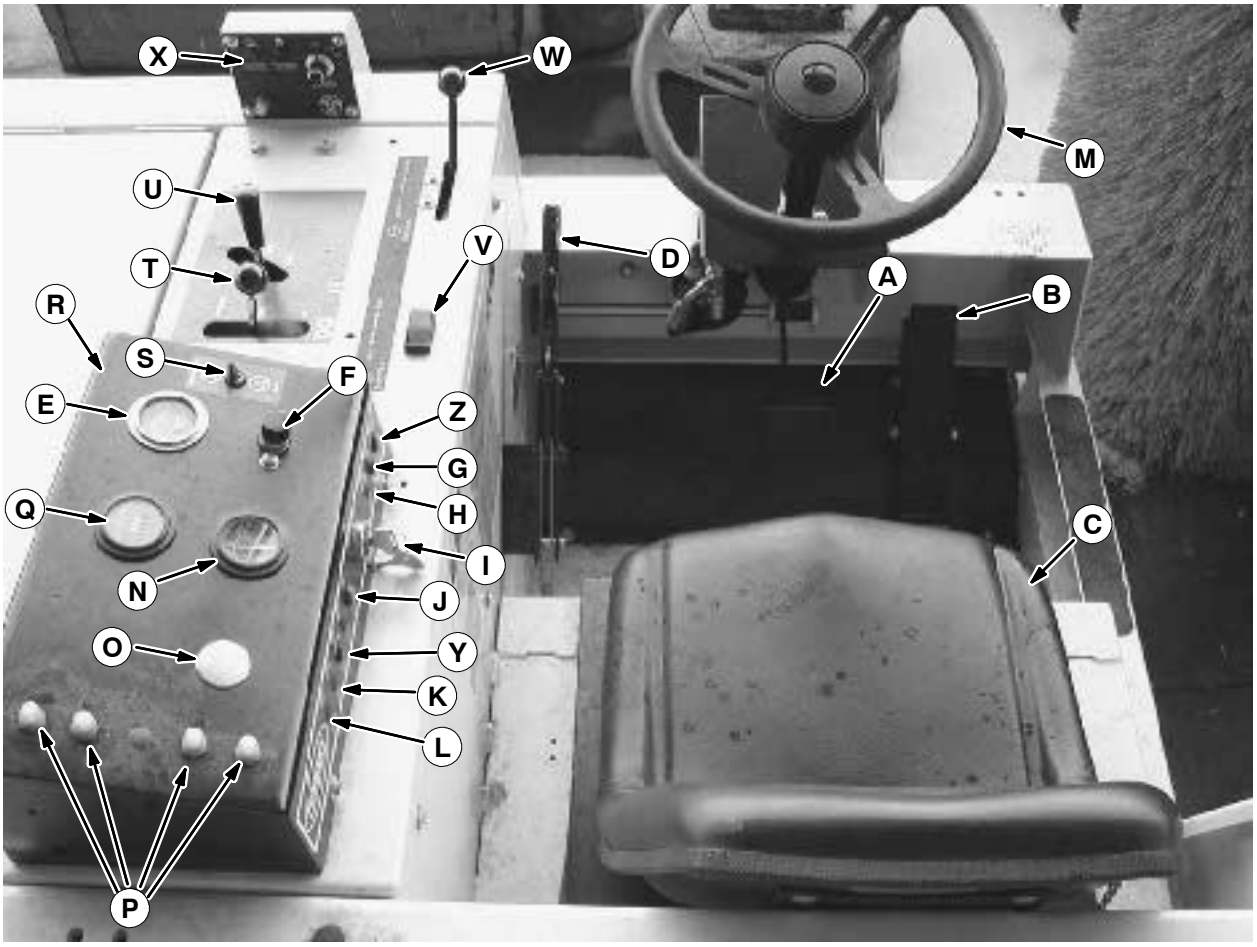


02353

INSTRUMENTS AND CONTROLS - GAS/LPG and DIESEL ENGINES (For machines below serial number 001508)

A. Brake Pedal
B. Directional Pedal
C. Operator Seat
D. Parking Brake Lever
E. Ammeter
F. Squeegee Position Lamp
G. Tank Drain Lamp
H. Scrub Brush Pressure Lamp (Option)
I. Ignition Switch
J. Diesel Pre-Heat Indicating Lamp
K. Operating Lights Switch (Option)
L. Rotating Light Switch (Option)
M. Hazard Light Switch (Option)
N. Fuel Level Gauge
O. Panel Lamp (Option)
P. Fuses
Q. Engine Hour Meter
R. Instrument Panel
S. Oil Pressure Gauge
T. Engine Coolant Temperature Gauge
U. Squeegee Switch
V. Scrub Brush Lever
W. Scrub Head Position Lever
X. SRS Panel
Y. Solution Lever
Z. Choke Knob (Continental)
AA. Throttle Lever
BB. Steering Wheel
CC. Horn Button
DD. Throttle Switch

Home Find... Go To..

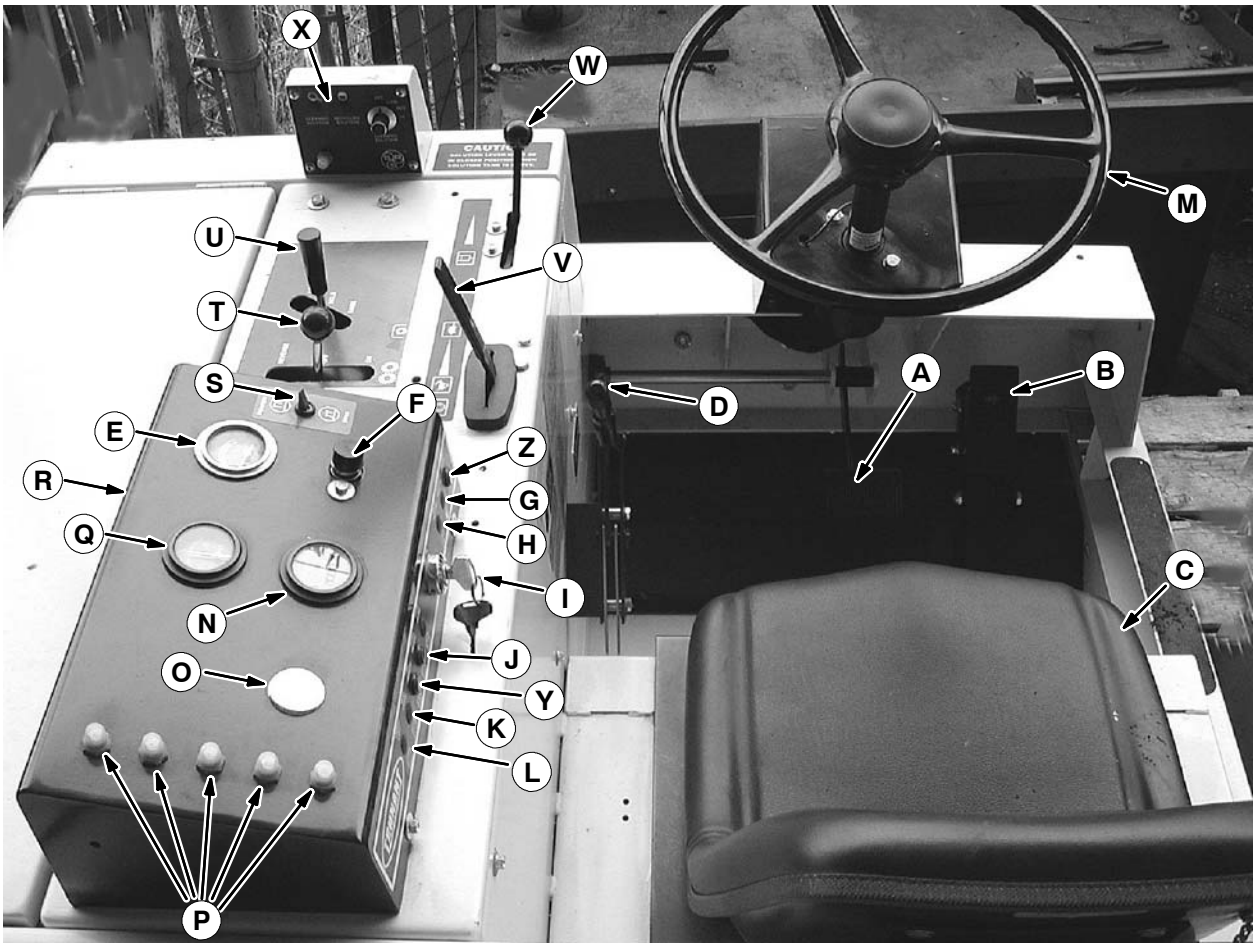


02353

INSTRUMENTS AND CONTROLS - GAS/LPG GM ENGINES (For machines serial number 001508 and above)

A. Brake Pedal
B. Directional Pedal
C. Operator Seat
D. Parking Brake Lever
E. Engine Coolant Temperature Gauge
F. Horn Button
G. Tank Drain Lamp
H. Scrub Brush Pressure Lamp (Option)
I. Ignition Switch
J. Check Engine Light
K. Operating Lights Switch (Option)
L. Rotating or Hazard Light Switch (Option)
M. Steering Wheel
N. Fuel Level Gauge
O. Panel Lamp (Option)
P. Circuit Breakers
Q. Engine Hour Meter
R. Instrument Panel
S. Squeegee Switch
T. Scrub Brush Lever
U. Scrub Head Position Lever
V. Throttle Switch
W. Solution Lever
X. SRS Panel
Y. Low Engine Oil Pressure Light
Z. Charging System Light

Home Find... Go To..



02353

INSTRUMENTS AND CONTROLS – DIESEL CAT ENGINES (For machines serial number 001508 and above)

A. Brake Pedal
B. Directional Pedal
C. Operator Seat
D. Parking Brake Lever
E. Engine Coolant Temperature Gauge
F. Horn Button
G. Tank Drain Lamp
H. Scrub Brush Pressure Lamp (Option)
I. Ignition Switch
J. Diesel Pre-Heat Indicating Lamp
K. Operating Lights Switch (Option)
L. Rotating or Hazard Light Switch (Option)
M. Steering Wheel
N. Fuel Level Gauge
O. Panel Lamp (Option)
P. Circuit Breakers
Q. Engine Hour Meter
R. Instrument Panel
S. Squeegee Switch
T. Scrub Brush Lever
U. Scrub Head Position Lever
V. Throttle Lever
W. Solution Lever
X. SRS Panel
Y. Low Engine Oil Pressure Light
Z. Charging System Light

Home Find... Go To..

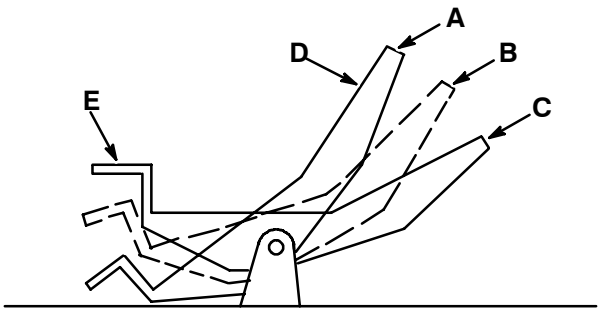
BRAKE PEDAL

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

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

DIRECTIONAL PEDAL

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



00116

DIRECTIONAL PEDAL

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

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

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

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.

SCRUB HEAD LOCK LEVER

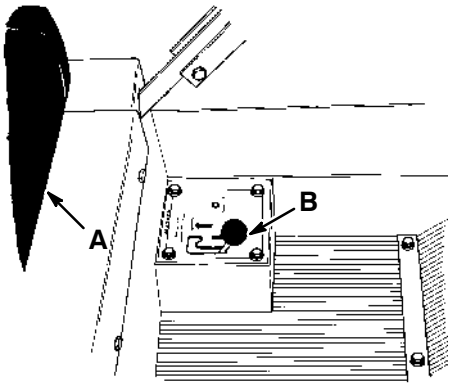
The scrub head lock lever controls the scrub head lock mechanism. This locks the scrub head, preventing it from lowering.

To set the scrub head lock, fully raise the scrub head. Then push the scrub head lock lever into the “LOCK” position.

To release the scrub head lock, fully raise the scrub head. Then pull the scrub head lock lever into the “UNLOCK” position.

Always set the scrub head lock before working under the scrub head. The scrub head lock must also be set whenever the machine will not be used for an extended period of time, overnight for example. Flat spots on the brushes will appear if the scrub head is left down for an extended period of time.

WARNING: Raised Scrub Head May Fall. Block Scrub Head Up.



01816

SCRUB HEAD LOCK LEVER

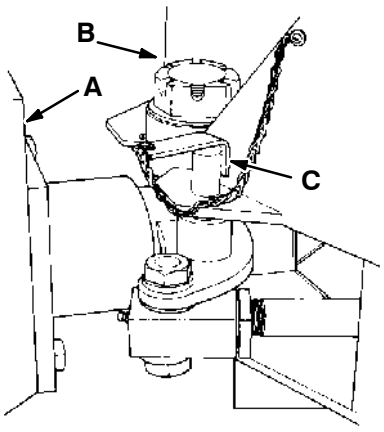
A. Operator Seat
B. Scrub Head Lock Lever

PIVOT LOCK PIN

The pivot lock pin is provided to lock the pivot joint between the front and rear machine sections. The pin is hung on the front section of the machine adjacent to the machine pivot.

To lock the sections, turn the machine so the pivot lock holes line up, then insert the pin in the lined up holes. The pin will prevent the machine from pivoting and creating a pinch area.

WARNING: Crush Hazard Between Front And Rear Halves Of Machine. Engage Pivot Lock.



00251

PIVOT LOCK PIN IN USE

A. Machine Trailer Section
B. Machine Tractor Section
C. Pivot Lock Pin

PARKING BRAKE LEVER

The parking brake lever controls the brakes on the two front wheels. To set the parking brake pull the brake handle up. To release the parking brake push the brake handle down. Always set the parking brake before leaving the machine unattended and before working on the machine.

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

AMMETER (For machines below serial number 001508)

The ammeter registers the charging current which is being passed to the battery by the alternator. It also registers battery discharge used by the machine when the alternator is not charging.

CHARGING SYSTEM LIGHT (For machines serial number 001508 and above)

The charging system light comes on when the existing voltage potential of the battery is not within normal range (10 to 14 Volts). Stop operating the machine. Locate the problem and have it corrected.

SQUEEGEE POSITION LAMP (For machines below serial number 001508)

The squeegee position lamp lights when the squeegee is either fully raised or lowered. This can be helpful to the operator when the squeegee is not visible.

CHECK ENGINE LIGHT (For machines serial number 001508 and above)

The check engine light comes on if the engine control system detects a fault during machine operation.

If the check engine light comes on while operating the machine, contact a TENNANT service representative.

IGNITION SWITCH

The key-operated ignition switch has three positions. Those positions are “off,” “run,” and “start.” To operate any electrical option without operating the engine, turn the switch to the “run” position.

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

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.

NOTE: When restarting GM engines, you must wait 15-20 seconds before the starter motor will engage again.

CAUTION: LPG engine will run for a few seconds after key is turned off. Apply parking brake before leaving machine.

NOTE: To protect the GM engine’s emission components on the LPG powered machines serial number 001508 and above, the engine will continue to operate for a few seconds after the ignition switch is turned off.

DIESEL PRE-HEAT INDICATING LAMP

The diesel pre-heat indicating lamp is present on diesel powered machines. The lamp lights when the diesel pre-heater is operating.

OPERATING LIGHTS SWITCH (OPTION)

The operating lights switch is present on machines with the operating lights option. It controls the headlights, taillights, and the brush spot light. Flip the switch toggle upward to turn the lights on. Flip the switch toggle down to turn the lights off.

ROTATING LIGHT SWITCH (OPTION)

The rotating light switch is present on machines with the rotating light switch option. Flip the switch toggle up to turn the light on. Flip the switch toggle down to turn light off.

HAZARD LIGHT SWITCH (OPTION)

The hazard light switch is present on machines with the hazard light option. Flip the switch toggle up to turn the light on. Flip the switch toggle down to turn the light off.

FUEL LEVEL GAUGE

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

NOTE: Do not use leaded fuels. The use of leaded fuels will cause permanent damage to the system's oxygen sensor and catalytic convertor

PANEL LAMP (OPTION)

The panel lamp is present on machines with the operating lights option. The lamp lights whenever the operating lights switch toggle is flipped up to turn on the operating lights.

SCRUB BRUSH PRESSURE LAMP (OPTION)

The scrub brush pressure lamp option lights when scrub brush down pressure is excessive, which may cause the brushes to stall. The operator should then check the brush position adjustment.

NOTE: This information holds true only after the hydraulic fluid has warmed up (about 10 to 15 minutes). If the light comes on after the oil is warm, the cause may be operating on a rough floor-use "restricted" brush down pressure.

ENGINE HOUR METER

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

FUSES (For machines below serial number 001508)

Fuses are a one-time circuit protection device designed to stop the flow of current in the event of a circuit overload. Never substitute higher value fuses than those specified in this manual. The chart below shows the various fuses and the electrical components they protect.

PROTECTIVE DEVICE	RATING	CIRCUIT PROTECTED
Fuse	80 A	Glow Plugs (Diesel)
Fuse	15 A	Auto-Squeegee
Fuse	1 A	SRS Tank Level Lamps
Fuse	15 A	Brush Pressure Lamp, Squeegee Pressure Lamps
Fuse	20 A	Rotating, Hazard Lights
Fuse	10 A	SRS Solution Pump

FUSES (For machines serial number 001508 and above)

Fuses are a one-time circuit protection device designed to stop the flow of current in the event of a circuit overload. Never substitute higher value fuses than those specified in this manual. The chart below shows the various fuses and the electrical components they protect.

GAS/LPG GM ENGINES

PROTECTIVE DEVICE	RATING	CIRCUIT PROTECTED
Fuse-1	5 A	Key Switch
Fuse-2	20 A	Main Power
Fuse-3	15 A	Auxilary Power
Fuse-4	15 A	Fuel Pump
	50 A	Alternator (In-line)

DIESEL CAT ENGINES

PROTECTIVE DEVICE	RATING	CIRCUIT PROTECTED
Fuse-1	150 A	Alternator
Fuse-2	15 A	Fuel Pump
Fuse-3	50 A	Glow Plugs

CIRCUIT BREAKERS (For machines serial number 001508 and above)

The circuit breakers are resetable electrical circuit protection devices. Their design stops the flow of current in the event of a circuit overload. Once a circuit breaker is tripped, it must be reset manually. Press the reset button after the breaker has cooled down.

If the overload that caused the circuit breaker to trip is still there, the circuit breaker will continue to stop current flow until the problem is corrected.

The chart lists the circuit breakers and the electrical components they protect.

Circuit Breaker	Rating	Circuit Protected
CB-1	15 A	Gauges
CB-2	20 A	Horn/Rotating, Hazard Lights/Turn Signal
CB-3	15 A	Operating Lights
CB-4	15 A	Squeegee
CB-5	15 A	SRS/Recovery Tank Level Lamps
CB-6	15 A	SRS Solution Pump

ENGINE OIL PRESSURE GAUGE - DIESEL, GAS/LPG CONTINENTAL ENGINES (For machines below serial number 001424)

The engine oil pressure gauge registers the engine oil pressure. Normal engine oil pressure ranges from 7 psi (50 kPa) at idle, to 35 psi (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 severe engine damage.

ENGINE OIL PRESSURE GAUGE - GAS/LPG GM ENGINES (For machines serial number 001424 - 001505)

The engine oil pressure gauge registers the engine oil pressure. Normal engine oil pressure ranges from 35 psi (240 kPa) at idle, to 40 psi (280 kPa) at full engine throttle. If the gauge registers an oil pressure reading below 30 psi (207 kPa), stop the engine immediately and determine the cause. Failure to stop the engine will result in severe engine damage.

ENGINE OIL PRESSURE GAUGE - DIESEL PERKINS ENGINES (For machines serial number 001424 - 001505)

The engine oil pressure gauge registers the engine oil pressure. Normal engine oil pressure ranges from 9 psi (65 kPa) at idle, to 70 psi (485 kPa) at full engine throttle. If the gauge registers an oil pressure reading below 9 psi (65 kPa), stop the engine immediately and determine the cause. Failure to stop the engine will result in severe engine damage.

ENGINE OIL PRESSURE LIGHT - GAS/LPG GM ENGINES (For machines serial number 001508 and above)

The engine oil pressure light comes on when the engine oil pressure falls below 5 psi (40 kPa). GM engines will automatically stop if the oil pressure gets this low. The GM engine can be restarted and operated for 30 seconds after this happens. Locate the problem and have it corrected.

ENGINE OIL PRESSURE LIGHT - DIESEL CAT ENGINES (For machines serial number 001508 and above)

The engine oil pressure light comes on when the engine oil pressure falls below 5 psi (40 kPa). Stop operating the machine. Locate the problem and have it corrected.

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. Continental, Perkins and Cat engines, stop operating the machine if if the water temperature gets this high. GM engines will automatically stop when the temperature gets too high. Over-heating may occur due to a low coolant level, a clogged radiator, a loose fan belt, a defective thermostat, or other engine malfunctions. Engine overheating will always cause a coolant loss. If coolant loss does not occur, check for malfunction of the temperature sending unit.

SQUEEGEE SWITCH

The squeegee switch, in conjunction with a hydraulic flow sensing device, and the scrub brush lever, controls the position of the rear squeegee.

To raise the squeegee, flip the switch toggle forward into the “Squeegee Up” position. This position cannot be overridden by the hydraulic flow sensing device.

To lower the squeegee, flip the switch toggle back into the “Down” position. The squeegee will lower when the machine starts moving in the forward direction. When traveling in the reverse direction, the hydraulic flow sensing device overrides the squeegee switch and raises the rear squeegee. This prevents the rear squeegees from being damaged when traveling in reverse. The squeegee switch should always be in the “Down” position when scrubbing.

SCRUB BRUSH LEVER

The scrub brush lever controls the scrub brush motors. To start the scrub brushes rotating in their normal direction, pull the lever into the “ON” position. To stop brush rotation, move the lever into the “OFF” position.

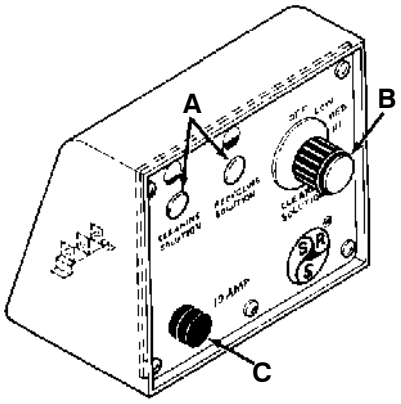
To start the scrub brushes rotating opposite their normal direction for double scrubbing, push the lever into the “REVERSE” position.

SCRUB HEAD POSITION LEVER

The scrub head position lever controls the position of the scrub head. To raise the scrub head, pull the lever back into the “RAISE” position. To stop scrub head movement move the lever to the “HOLD” position. To lower the scrub head, push the lever into the “LOWER” position.

SRS LIQUID LOW LEVEL LAMPS

The SRS liquid low level lamps include two indicating lamps. The cleaning solution lamp lights when the cleaning solution level is low. The recycling solution lamp lights when the recycling solution is low.



00351

SRS CONTROL PANEL

A. Liquid Low Level Indicator Lamps
B. Cleaning Solution Flow Knob
C. SRS Pump System Fuse (For machines below serial number 001508)
C. SRS Pump System Circuit Breaker (For machines serial number 001508 and above)

SRS CLEANING SOLUTION FLOW KNOB

The SRS cleaning solution flow knob controls the pumping of cleaning solution into the solution flow to the floor. The “LOW”, “MED”, and “HI” levels indicate the rate of cleaning solution flow.

The “LOW” level causes the pump to deliver one-fourth flow capacity, “MED” level one-half capacity, and “HI” level full pump capacity of cleaning solution into the solution flow to the floor. The “OFF” position shuts off the cleaning solution flow.

ENGINE CHOKE KNOB - CONTINENTAL ENGINES

The engine choke knob is present on gasoline powered machines. The knob controls the engine choke. To aid the starting of a cold engine, close the engine choke by pulling the knob out. After the engine has warmed up, push the knob in to open the engine choke, allowing the engine to run normally at its operating temperature and speed. Using the choke on a warm engine is not necessary.

THROTTLE LEVER - DIESEL, GAS/LPG CONTINENTAL ENGINES (For machines serial number 001000 - 001423)

The throttle lever controls the engine governed speed on a gasoline and LPG powered machine. The throttle level controls the engine governed speed and stops the engine on a diesel powered machine. To speed the engine to the maximum governed speed, move the lever into the “FULL” position. To slow the engine to idle speed, move the lever to the “IDLE” position. To stop the engine on a diesel powered machine, move the lever to the “STOP” position.

THROTTLE LEVER - DIESEL CAT ENGINES (For machines serial number 001508 and above)

The throttle level controls the engine governed speed and stops the engine. To speed the engine to the maximum governed speed, move the lever into the “FULL” position. To slow the engine to idle speed, move the lever to the “IDLE” position. To stop the engine, move the lever to the “STOP” position.

THROTTLE SWITCH - DIESEL PERKINS ENGINES (For machines serial number 001424 - 001505)

The throttle switch controls the engine governed speed. To speed the engine to the maximum governed speed, move the switch into the “FULL” position. To slow the engine to idle speed, move the switch to the “IDLE” position.

THROTTLE SWITCH - GAS/LPG GM ENGINES (For machines serial number 001508 and above)

The throttle switch controls the engine governed speed. To speed the engine to the maximum governed speed, move the switch into the “FULL” position. To slow the engine to idle speed, move the switch to the “IDLE” position.

STEERING WHEEL

The steering wheel controls a steering cylinder which is mounted between the two halves of the machine. Do not turn the steering wheel excessively when the engine is not running. An articulated trunnion connects the front and rear sections of the machine so that the rear section always follows the path of the front section. (For machines below serial number 001508) a horn button is located in the center of the steering wheel.

HORN BUTTON (For machines serial number 001508 and above)

The horn button operates the horn. To sound the horn press the button.

TANK DRAIN LAMP

The tank drain lamp lights when the recovery tank is nearly full. The machine operator can then plan to return to a draining location.

SOLUTION LEVER

The solution lever controls the solution control valve. To stop solution flow to the floor, push the lever into the “CLOSED” position. To start solution flow, pull the lever into the “OPEN” position.

MACHINE OPERATION

NORMAL SCRUBBING OPERATION

A normal scrubbing operation consists of eight typical operations: pre-start checklist, starting machine, filling solution tank, scrubbing, draining solution 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 MACHINE lists the steps required to start the machine.

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

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

TO DRAIN SOLUTION TANK AND EMPTY HOPPER lists the steps required to empty the debris hopper and the solution 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 the machine for leak spots.

Check the engine lubricating oil level.

Check the engine air filter restriction indicator.

Check the fuel level.

Check for LPG odor indicating a leak.

Check for frosting on the LPG hoses and components.

Check to make sure a liquid withdrawal LPG tank is to be used.

Check the brakes and controls for proper operation.

Check the service records to determine service requirements.

TO START MACHINE

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

1. LPG machines: Check the LPG fuel tank gauge to see if there is an adequate fuel supply.

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

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

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

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

4. Cold CONTINENTAL gasoline engines: Pull out the choke button about three-fourths of the way. Push choke in after the engine has started and is running smoothly.

NOTE: Machines with GM engines have an ECU (Electronic Control Unit) which does not require any cold starting procedures.

   Cold diesel engines: Turn the ignition key to the "on" position to start the diesel pre-heater. Wait until the pre-heater lamp goes off, then proceed to start the engine.

   ATTENTION! Do Not Use A Cold Engine Starting Aid Such As Ether Unless Directed To By A Representative Of The Engine Manufacturer.

5. Move the throttle to the "IDLE" position.

6. Turn the ignition switch key to the “start” position until the engine starts. Do not operate the starter for more than ten seconds at a time or after the engine has started.

NOTE: When restarting GM engines, you must wait 15-20 seconds before the starter motor will engage again.

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

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

8. Release the machine parking brake.

9. Drive the machine to the solution filling site.

TO FILL SOLUTION TANK

1. Stop the engine and set the parking brake.

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

2. Open the solution tank fill door or cap.

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

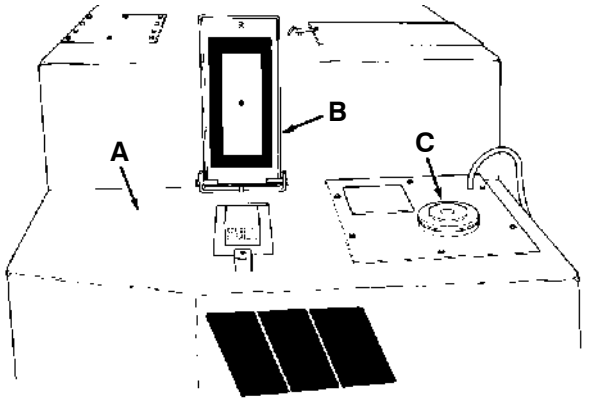
3. Fill the tank with water to 1 in (25 mm) below the tank opening. The water must not be hotter than 130°F (54°C) or tank damage may occur.

NOTE: If standing water is to be picked up in addition to the solution put down by machine, do not fill tank all of the way. This will allow more water to be picked up before the ball float shutoff is actuated.

FOR SAFETY: When using machine, follow mixing and handling instructions on chemical containers.

4. Pour liquid detergent into the cleaning solution tank – not the solution tank. Do not use powdered detergent or any other detergent not designed for the SRS application. Replace the cleaning solution tank fill cap.

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



SRS TANK

A. Solution Tank
B. Solution Fill Door
C. Cleaning Solution Fill Cap

5. Close the solution fill door.

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 position lever to the “RAISE” position to release the scrub head lock.

3. Move the scrub head lock lever to the “UNLOCK” position.

4. Place the squeegee switch in the “Down” position.

5. Turn the cleaning solution knob to the desired cleaning solution flow.

6. Move the scrub brush lever to the “ON” position.

7. Scrub as required.

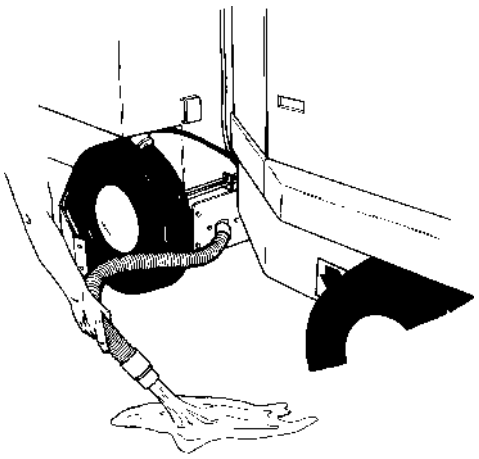
WARNING: Flammable materials or reactive metals can cause explosion or fire. Do not pick up.

TO DRAIN AND CLEAN SOLUTION TANK AND EMPTY HOPPER

1. Stop the engine and set the parking brake.

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

2. Remove and unplug the tank drain hose next to a floor drain.

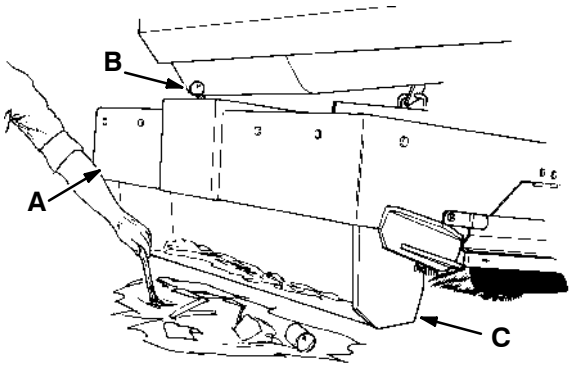


00343

DRAINING SRS TANK

3. Pull the debris trough lever to dump the debris trough.

NOTE: If a more gentle dumping action is desired, the trough can be dumped with the scrub head lowered; then the head can be raised hydraulically to slowly tip the trough.



00283

DUMPING DEBRIS TROUGH

A. Scrub Head
B. Debris Trough Lever
C. Debris Trough

4. Clean the trough screen.

5. Clean the channel above the debris trough. If debris builds up in this area, the trough will not swing all the way up and latch properly. Remove any debris which has accumulated on top of the rail.

6. Close the debris trough.

7. Plug and secure the drain hose to the machine after tank is drained.

8. Partially fill the solution tank with clean water. Run the SRS pump for a few minutes to flush the solution hoses.

POST OPERATION CHECKLIST - ENGINE OPERATING

Check the scrub brush pattern for width and evenness.

Check the squeegees for proper deflection.

TO STOP MACHINE

1. Return the directional pedal to the “neutral” position. Apply the brake.

2. Turn the cleaning solution knob to the “OFF” position.

3. Move the scrub head position lever to the “RAISE” position to set the scrub head lock.

4. Move the scrub head lock lever to the “LOCK” position.

5. Move the scrub brush lever to the “OFF” position.

6. Place the squeegee switch in the “Squeegee Up” position.

7. Turn off the operating lights if used.

8. Place the throttle in the “IDLE” position.

9. Set the machine parking brake.

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

10. Turn the ignition key switch to the “off” position. Remove the ignition key from the ignition switch.

11. Diesel powered machines: Hold the throttle lever in the “STOP” position to stop the engine.

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

POST OPERATION CHECKLIST – ENGINE STOPPED

Check for wire or string tangled on the scrub brushes.

Check the squeegees for wear or damage.

Empty and clean the debris hopper.

Drain and clean the solution tank.

Check the vacuum hoses for debris or obstructions.

Fill the fuel tank.

Check for leaks.

DOUBLE SCRUBBING OPERATION

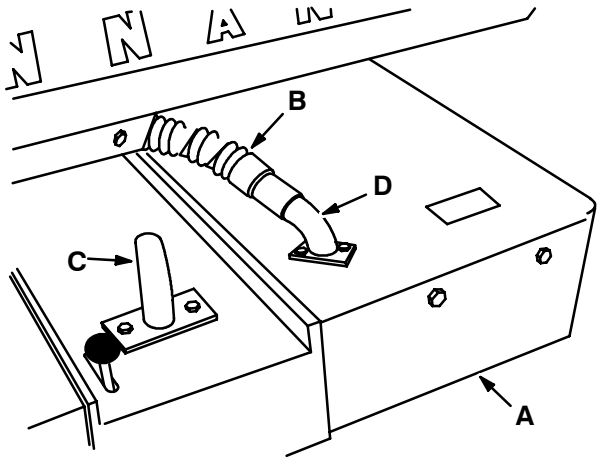
Double pass scrubbing should be necessary only for heavy soilage and build-up of dirt, wax, etc. Operate the machine as desired for normal scrubbing but keep the rear squeegee up while making the first scrubbing pass. Allow the solution to soak on the floor for 15 to 20 minutes. Then make a second pass in the normal manner with the rear squeegee down.

FOR SAFETY: When Using Machine, Go Slow On Grades And Slippery Surfaces.

SOLUTION PICKUP OPERATION

Water or other non-flammable solutions can be picked up without utilizing the scrubbing features. Operate the machine by lowering the rear squeegee while leaving the scrub head up and the solution off. To increase the vacuum to the rear squeegee, disconnect the vacuum hose going to the debris trough and re-connect it to the to the vacuum diffuser on the scrub head.

WARNING: Flammable materials or reactive metals can cause explosion or fire. Do not pick up.



VACUUM DIFFUSER

A. Scrub Head
B. Vacuum Hose
C. Vacuum Port To Debris Trough
D. Vacuum Diffuser

OPERATION ON GRADES

Drive the machine slowly on grades. Some loss of rear wheel steering traction could occur when braking with empty solution tanks.

The maximum rated climb and descent angle with empty tanks is 8°.The maximum rated climb and descent angle with full tanks is 5°.

FOR SAFETY: When Using Machine, Go Slow On Grades And Slippery Surfaces.

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
	Float stuck shutting off vacuum	Clean float
	Vacuum fan drive belt loose or broken	Adjust, or replace and adjust belt
	Debris caught on squeegee	Remove debris
	Foam filling solution tank	Empty solution tank; use less or change detergent
	Vacuum hose to rear squeegee disconnected or damaged	Reconnect or replace vacuum hose
	Vacuum fan to solution tank hose damaged	Replace hose
Little or no solution flow to floor	Solution tank empty	Fill solution tank
	Solution control linkage broken or out of adjustment	Replace and/or adjust linkage
	Solution supply lines plugged	Flush solution supply lines
	Solution spreader holes plugged	Flush spreader holes
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
	Debris hopper full	Empty hopper
	Brushes have rotation set	Rotate brushes end-for-end
	Scrub brush drive failure	See HYDRAULIC COMPONENTS TROUBLESHOOTING – Hydraulic Motor Failure, in the MAINTENANCE section

OPTIONS OPERATION

VACUUM WAND

The vacuum wand option gives the machine the added flexibility of picking up spills not accessible by the machine. The hose and wand utilizes the machine vacuum system.

TO OPERATE VACUUM WAND

1. Set the machine parking brake.

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

2. Remove the vacuum wand and hose from storage on the machine.
3. Remove the rear squeegee vacuum hose plate from the rear of the tank.
4. Attach the vacuum wand hose plate to the rear of the tank using the toggle clamps provided.
5. Start the engine.
6. Move the throttle to the “FULL” position.
7. Operate the vacuum wand as required.
8. When finished, stop the engine, and remove the vacuum wand hose plate from the rear of the tank.
9. Reconnect the rear squeegee vacuum hose plate to the rear of the tank using the toggle clamps provided.
10. Clean and rinse off the vacuum wand, hose, and related equipment as required.
11. Store the vacuum wand equipment in the proper locations.

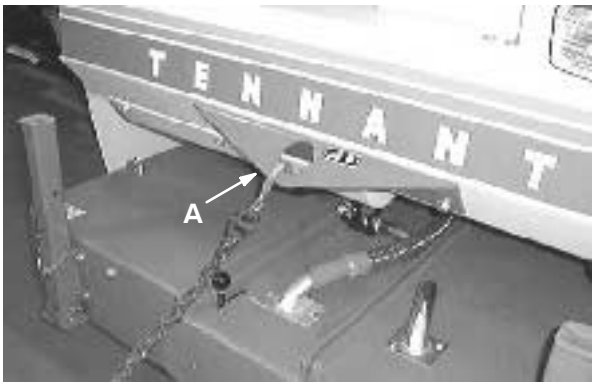
DRAIN PUMP

The drain pump option gives the machine the ability to rapidly drain the solution tank. Refer to the drain pump manufacturer’s manual for operation of the pump.

TOWING AND TRANSPORTING THE MACHINE

TOWING THE MACHINE

If the machine becomes disabled, it can be towed from the front or rear using the towing brackets located at the front or rear of the machine. This machine is not designed to be pushed.



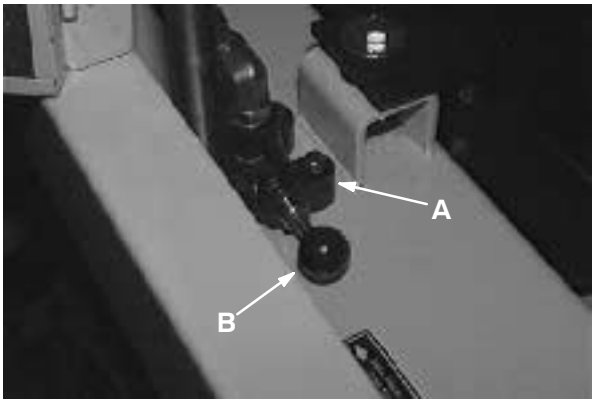
TOWING BRACKET

A. Towing Bracket

Machines serial number 001061 and above have abypass valve to prevent damage to the hydraulic system when the machine is being towed. This valve allows a disabled machine to be moved a *very short distance* and at a speed to not exceed 1.6 kp/h (1 mph). The machine is NOT intended to be towed a long distance or at a high speed.

ATTENTION! Do not tow machine for a long distance and without using the bypass valve, or the machine hydraulic system may be damaged.

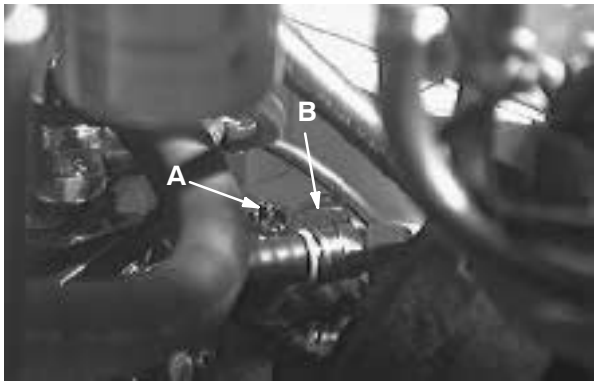
Machines serial number 001061 to 001103 have the bypass valve located on the side of the frame. Pull the handle out to tow the machine.



BYPASS VALVE

A. Bypass Valve
B. Handle

Machines serial number 001104 and above have a bypass valve on the propelling pump. Turn the bypass valve 90° from the normal position before towing the machine.



BYPASS VALVE

A. Bypass Valve
B. Propelling Pump

TRANSPORTING THE MACHINE

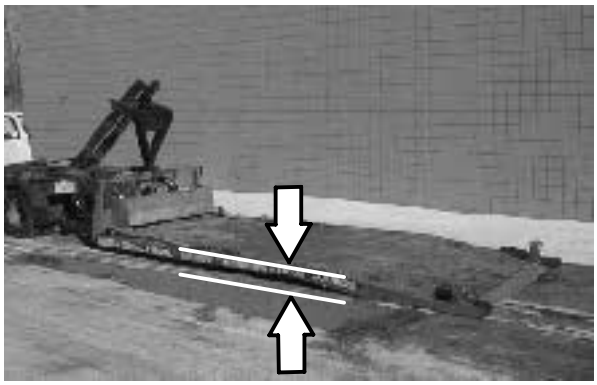
1. Position the machine at the loading edge of the truck or trailer.

   FOR SAFETY: Use truck or trailer that will support the weight of the machine.

NOTE: Empty the recovery and solution tanks before transporting the machine.

2. If the loading surface is not horizontal or is higher than 380 mm (15 in) from the ground, use a winch to load machine.

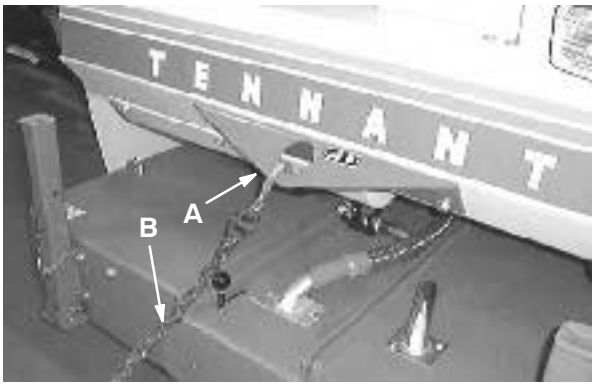
   If the loading surface is horizontal AND is 380 mm (15 in) or less from the ground, the machine may be driven onto the truck or trailer.



LOADING SURFACE

A. Loading Surface Height

3. To winch the machine onto the truck or trailer, attach the winching chain to the towing bracket.



ATTACH WINCHING CHAIN

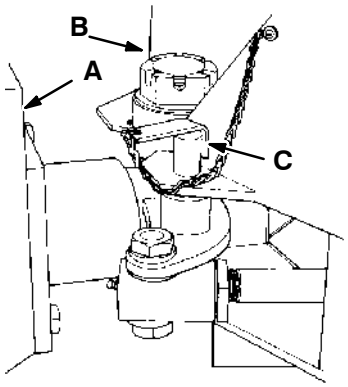
A. Towing Bracket
B. Winching Chain

4. Open the bypass valve before winching the machine onto the truck or trailer. See *TOWING THE MACHINE* section of this manual. Make sure the machine is centered.

FOR SAFETY: When loading machine onto truck or trailer, use winch. Do not drive the machine onto the truck or trailer unless the loading surface is horizontal AND is 380 mm (15 in) or less from the ground.

5. Turn the machine so the pivot lock holes line up, then insert the pin in the lined up holes. The pin will prevent the machine from pivoting and creating a pinch area. See *PIVOT LOCK PIN* section of this manual.

WARNING: Crush Hazard Between Front And Rear Halves Of Machine. Engage Pivot Lock.



00251

PIVOT LOCK PIN IN USE

A. Machine Trailer Section
B. Machine Tractor Section
C. Pivot Lock Pin

6. Position the machine onto the truck or trailer as far as possible. If the machine starts to veer off the centerline of the truck or trailer, stop and turn the steering wheel to center the machine.

7. Set the parking brake, lower the scrub head and block the machine tires. Tie down the machine to the truck or trailer at the six tie down locations before transporting.

8. Tie the front of the machine at the two corners of the front frame.

FRONT TIE DOWN LOCATION

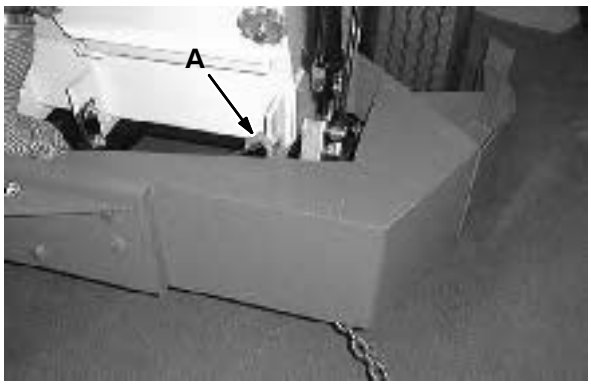
A. Front Tie Down Holes

9. Tie the middle of the machine on the tie down bracket on the rear of the tractor frame.

MIDDLE TIE DOWN LOCATION

A. Middle Tie Down Bracket

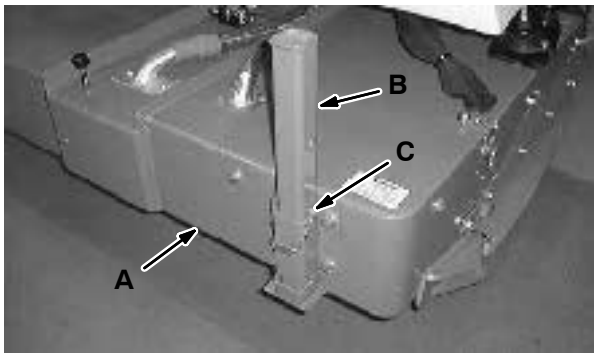
10. Tie the rear of the machine under the rear bumper at the two bumper mounts.



REAR TIE DOWN LOCATION

A. Rear Bumper Mounts

11. If the machine is equipped with the optional scrub head support legs, pull the pins to lower the legs. Lock them into position again by replacing the pins.



OPTIONAL SCRUB HEAD SUPPORT LEG

A. Scrub Head
B. Support Leg
C. Pin

12. If the loading surface is not horizontal or is higher than 380 mm (15 in) from the ground, use a winch to unload machine.

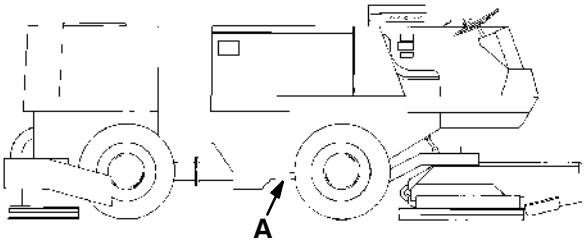
    If the loading surface is horizontal AND is 380 mm (15 in) or less from the ground, the machine may be driven off the truck or trailer.

    FOR SAFETY: When unloading machine off truck or trailer, use winch. Do not drive the machine off the truck or trailer unless the loading surface is horizontal AND 380 mm (15 in) or less from the ground.

MACHINE JACKING LOCATIONS

Empty the recovery and solution tanks before jacking the machine. The machine jacking locations are labeled with a label. The tractor jacking locations are behind each of the front wheels, and the tank jacking locations are in front of the rear wheels.

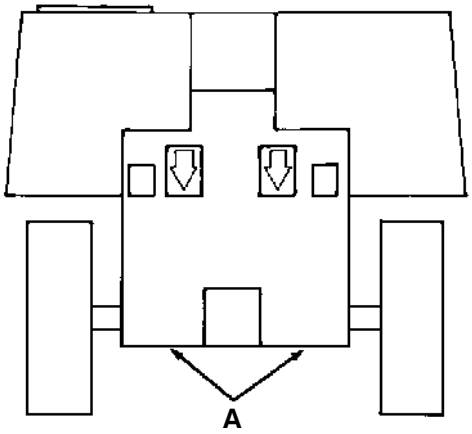
FOR SAFETY: When Servicing Machine, Block Machine Tires Before Jacking Machine Up. Jack Machine Up At Designated Locations Only. Block Machine Up With Jack Stands. Use A Hoist Or Jack That Will Support The Weight Of The Machine.



00362

TRACTOR JACKING LOCATION

A. Jacking Location



01820

TANK JACKING LOCATION

A. Jacking Location

Home Find... Go To..

MACHINE STORAGE

STORING MACHINE

When storing the machine for extended periods of time, the following procedures must be followed to reduce the chance of rust, sludge, and other undesirable deposits to form:

1. Drain and clean out the solution tanks.
2. Add 'Stabil' or equivalent fuel conditioner to the fuel tank as recommended on the bottle. Run the engine approximately 10 to 15 minutes to insure that the treated fuel is completely through the fuel system.
3. Park the machine in a cool and dry area.
4. Stop the engine and set the machine parking brake.

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

   LPG powered machines: Close the LPG tank liquid service valve.
5. Raise and lock the scrub head.
6. Fill the hydraulic reservoir with hydraulic fluid to the full mark on the dipstick, to prevent excessive condensation from forming in the reservoir.

GASOLINE POWERED MACHINES

To store the machine 30 to 90 days:

1. Park the machine in a cool and dry area.
2. Stop the engine and set the machine parking brake.

   FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake, Turn Off Machine And Remove Key.
3. Change engine oil and oil filter.
4. Remove the spark plugs.
5. Pour 3 oz. (90 cc) of clean engine oil into each spark plug hole.
6. 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.

7. Disconnect and remove battery.
8. Replace the high tension coil wire and spark plugs.
9. Drain the gasoline from the carburetor.
10. Seal the air cleaner inlet, the exhaust outlet, and the crankcase breather tube with weatherproof masking tape.
11. Tighten the engine oil filler cap, the fuel tank cap, and the radiator cap to make certain they are securely in place.

To store the machine 90 days to 6 months:

1. Park the machine in a cool and dry area.

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

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

3. Remove the spark plugs.

4. Pour 3 oz. (90 ml) of clean engine oil into each spark plug hole.

5. 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.

6. Replace the high tension coil wire and spark plugs.

7. Disconnect and remove battery.

8. Drain the engine oil.

9. Drain the engine coolant from the radiator, and the engine block.

10. Close the drain cocks.

11. Drain gasoline from the carburetor, fuel tank, and the fuel lines.

12. Seal the air cleaner inlet, the exhaust outlet, and the crankcase breather tube with weatherproof masking tape, to protect outlets from water entry.

13. Tighten the engine oil filler cap, the fuel tank cap, and the radiator cap to make certain they are securely in place.

DIESEL POWERED MACHINES

To store the machine for 30 days or more:

1. Change the engine oil and filter.
2. Drain all fuel from the fuel tank and the fuel filters. Pour 1 gal (4 L) of new, clean #1 diesel fuel in tank.
3. Prime the fuel system.
4. Seal the air vent in the fuel tank or filler cap with waterproof tape.
5. Drain engine coolant.
6. Remove the injectors and pour a small amount of pure castor oil into the cylinder bores.
7. Replace the injectors (using new copper sealing washers) and slowly rotate the crankshaft one complete revolution to evenly distribute the lubricant. Do not rotate crankshaft further so as not to destroy protective film on bore walls.
8. Remove the engine air filter and carefully seal the intake orifice with waterproof tape or some other suitable medium.
9. Remove the exhaust pipe and seal the manifold outlet.
10. Remove valve rocker cover. Lubricate the rocker gear with engine oil and replace the cover. Be sure that the gasket is correctly fitted.
11. Clean the engine breather pipe. Seal the end with waterproof tape or a cork.
12. Remove all of the belts from the engine and save for future use. Attach them to the engine to prevent loss.

Home Find... Go To..

SECTION 3

CONTENTS

Page

RECOMMENDED FIRST 50-HOUR MACHINE INSPECTION 3-3
MAINTENANCE CHART 3-4
LUBRICATION 3-6
ENGINE 3-6
GASOLINE AND LPG POWERED ENGINES 3-6
DIESEL POWERED ENGINES 3-6
VACUUM FAN SHAFT – GAS/LP ENGINES (For machines below serial number 001508) 3-6
VACUUM FAN SHAFT – DIESEL ENGINES (For machines serial number 001000 and above) 3-6
MACHINE PIVOT 3-7
SCRUB HEAD PIVOT 3-7
SCRUB HEAD HINGES 3-8
REAR SQUEEGEE CASTERS 3-8
SCRUB BRUSH IDLER PLUGS 3-8
REAR WHEELS 3-8
HYDRAULICS 3-9
HYDRAULIC FLUID 3-9
HYDRAULIC FLUID RESERVOIR 3-9
TO DRAIN THE HYDRAULIC FLUID RESERVOIR 3-10
TO FILL THE HYDRAULIC FLUID RESERVOIR 3-10
HYDRAULIC FLUID RESERVOIR BREATHER 3-11
HYDRAULIC FLUID FILTER 3-11
TO REPLACE THE HYDRAULIC FLUID FILTER ELEMENT 3-11
HYDRAULIC FLUID LEAKS 3-11
HYDRAULIC COMPONENTS TROUBLESHOOTING 3-12
ENGINE 3-13
LUBRICATION 3-13
GASOLINE AND LPG POWERED ENGINES 3-13
DIESEL POWERED ENGINES 3-13
COOLING SYSTEM 3-13
AIR INTAKE SYSTEM 3-14
AIR FILTER SERVICE INDICATOR . . 3-14
AIR FILTER 3-14
TO REPLACE AIR FILTER ELEMENT – CONTINENTAL ENGINES (For machines below serial number 001424) 3-15
TO REPLACE AIR FILTER ELEMENT – GM GAS AND PERKINS OR CAT DIESEL ENGINES (For machines serial number 001424 and above) 3-16

Page

FUEL SYSTEM – GASOLINE – CONTINENTAL ENGINES (For machines below serial number 001424) 3-17
FUEL FILTER 3-17
CARBURETOR 3-17
FUEL SYSTEM – GASOLINE – GM ENGINES (For machines serial number 001424 and above) 3-17
FUEL FILTER (For machines serial number 001000 – 001505) 3-17
IN–LINE FUEL FILTER 3-17
ELECTRONIC FUEL INJECTION – GM ENGINES 3-17
FUEL SYSTEM – LPG 3-18
LPG FUEL SYSTEM 3-18
IN–LINE FUEL FILTER –GM ENGINES (For machines serial number 001424 and above) 3-18
FUEL TANKS 3-19
TO CHANGE AN LPG FUEL TANK . . 3-20
FUEL FILTER LOCK 3-21
VAPORIZER-REGULATOR 3-21
CARBURETOR – CONTINENTAL ENGINES (For machines below serial number 001424) 3-21
ELECTRONIC FUEL INJECTION SYSTEM – GM ENGINES (For machines serial number 001424 and above) 3-21
OIL PRESSURE SWITCH 3-21
LPG FUEL TROUBLESHOOTING 3-22
FUEL SYSTEM – DIESEL 3-23
FUEL WATER TRAP 3-23
TO CLEAN WATER TRAP 3-23
FUEL FILTER 3-23
TO REPLACE FUEL FILTER – CONTINENTAL ENGINES (For machines between serial number 001000–001055) . . . 3-23
TO REPLACE FUEL FILTER – CONTINENTAL ENGINES (For machines between serial number 001056–001423) . . . 3-24
TO REPLACE FUEL FILTER – PERKINS ENGINES (For machines serial number 001424 – 001505) 3-24
WATER SEPARATOR/FUEL FILTER – CAT ENGINES (For machines serial number 001508 and above) 3-25
IN–LINE FUEL FILTER – PERKINS ENGINES (For machines serial number 001424 – 001505) . 3-25

Page
FUEL INJECTION PUMP 3-25
FUEL INJECTORS 3-25
PRIMING THE FUEL SYSTEM – CONTINENTAL ENGINES (For machines serial number 001000–001055) 3-26
PRIMING THE FUEL SYSTEM – CONTINENTAL ENGINES (For machines serial number 001056–001423) 3-27
PRIMING THE FUEL SYSTEM – PERKINS ENGINES (For machines serial number 001424 – 001505) 3-27
GOVERNOR – GAS/LP CONTINENTAL ENGINES (For machines serial number 001000–001423) 3-28
TO ADJUST GOVERNOR 3-29
GOVERNOR – GAS/LP GM ENGINES (For machines serial number 001424 and above) 3-29
ELECTRICAL SYSTEM 3-30
SPARK PLUGS 3-30
DISTRIBUTOR 3-30
DISTRIBUTOR IGNITION TIMING . . . 3-31
CYLINDER HEAD – GASOLINE, LPG . . 3-32
CYLINDER HEAD BOLT TIGHTENING CONTINENTAL ENGINES (For machines below serial number 001424) 3-32
VALVE TAPPET CLEARANCE 3-32
CYLINDER HEAD BOLT TIGHTENING – GM ENGINES (For machines serial number 001424 and above) . . . 3-32
CYLINDER HEAD – DIESEL 3-33
CYLINDER HEAD BOLT TIGHTENING CONTINENTAL ENGINES (For machines below serial number 001424) 3-33
CYLINDER HEAD BOLT TIGHTENING PERKINS ENGINES (For machines serial number 001424 – 001505) 3-33
VALVE TAPPET CLEARANCE 3-34
PCV SYSTEM 3-34
TUNE-UP CHART – GASOLINE, LPG CONTINENTAL ENGINES (For machines below serial number 001424) 3-34
TUNE-UP CHART – GASOLINE, LPG GM ENGINES (For machines serial number 001424 and above) 3-34
ELECTRICAL SYSTEM 3-35
BATTERY 3-35

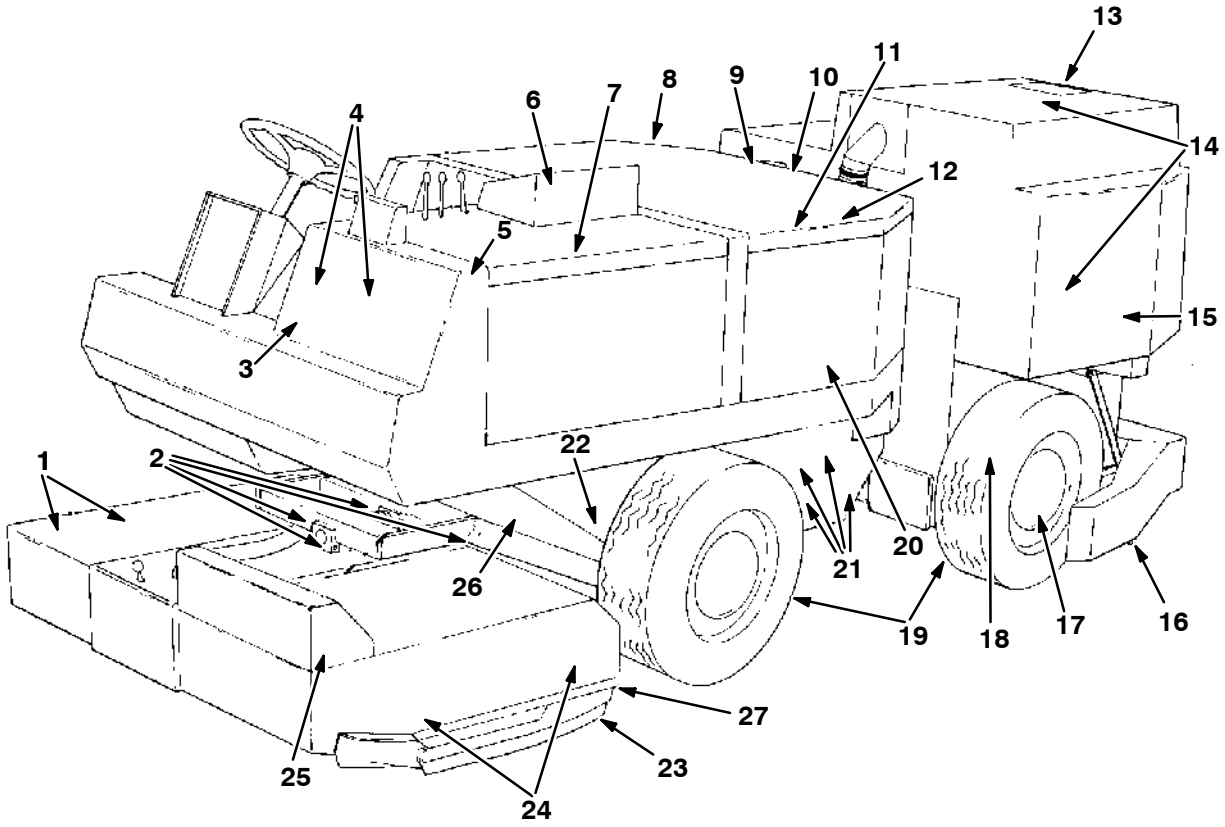
Page
BELTS AND CHAINS 3-36
VACUUM FAN DRIVE BELT – GAS/LPG ENGINES (For machines below serial number 001508) 3-36
VACUUM FAN DRIVE BELT – DIESEL ENGINES (For machines serial number 001000 and above) 3-36
TO ADJUST VACUUM FAN DRIVE BELT 3-36
ALTERNATOR AND RADIATOR FAN BELT 3-36
TO ADJUST ALTERNATOR AND RADIATOR FAN BELT 3-36
SCRUB HEAD 3-37
SCRUB HEAD 3-37
TO ADJUST SCRUB HEAD HEIGHT 3-37
TO ADJUST SCRUB BRUSH PATTERN 3-37
SCRUB BRUSHES 3-39
TO REPLACE SCRUB BRUSHES . . . 3-39
SOLUTION SYSTEM 3-41
SRS WATER SPRAY DEFLECTOR 3-41
SRS SOLUTION TANK 3-42
SRS METERING SOLUTION PUMP 3-43
TROUBLESHOOTING 3-43
SQUEEGEES 3-44
SIDE SQUEEGEES 3-44
SCRUB HEAD REAR SQUEEGEES 3-44
REAR SQUEEGEE 3-45
TO REPLACE REAR SQUEEGEE BLADES 3-45
TO FACTORY ADJUST REAR SQUEEGEE 3-46
TO ADJUST REAR SQUEEGEE 3-48
BRAKES AND TIRES 3-50
SERVICE BRAKES 3-50
PARKING BRAKES 3-51
TIRES 3-51
OPTIONS 3-52
DRAIN PUMP 3-52

RECOMMENDED FIRST 50-HOUR MACHINE INSPECTION

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

1. Check the air filter element. Tighten all connections on intake hose, air filter, etc.
2. Change engine oil and filter.
3. Check for the correct alternator and vacuum fan belt tension.
4. Check the scrub brush pattern.
5. Check the scrub head side squeegee blades for wear or damage.
6. Check the rear squeegee for worn or damaged blades or for incorrect adjustment.
7. Check vacuum hoses for damage or loose connections.
8. Check engine valve tappet clearance.
9. Diesel powered machines: Remove the rocker assembly and tighten the cylinder head nuts in the correct sequence and to the correct torque.
10. Torque the cylinder head bolts to the proper specification.
11. Perform all remaining 50-hour lubrication and maintenance procedures listed in the *MAINTENANCE CHART*.

MAINTENANCE CHART



00291

Interval	Key	Description	Procedure	Lubricant/ Fluid	No. of Service Points
Daily	7	Engine air filter	Check service indicator	–	1
	11	Engine crankcase	Check oil level	EO	1
	11	Water trap, diesel	Check and drain	–	1
	16	Rear squeegee	Check for damage, wear, and adjustment	–	1
	23	Side squeegees	Check for damage, wear, and adjustment	–	2
	27	Scrub head rear squeegees	Check for damage, wear, and adjustment	–	2
	24	Scrub brushes	Check for damage, wear, and adjustment	–	2
	19	Tires	Check air pressure	–	4
	13	SRS Solution tank and metering pump	Empty and clean Flush laminar tubes	–	1
50 Hours	11	Engine crankcase	Change oil and oil filter element	EO	1
	24	Scrub brushes	Rotate brushes	–	2
	21	Machine pivot	Lubricate	SPC	4
	2	Scrub head pivot	Lubricate	SPC	4
	22	Scrub head hinges	Lubricate	SPC	2
	18	Rear squeegee casters	Lubricate	SPC	3
	1	Scrub brush idler plugs	Lubricate	SPC	2
	6	Vacuum fan shaft	Lubricate	SPC	1

Interval	Key	Description	Procedure	Lubricant/ Fluid	No. of Service Points
50 Hours	10	Radiator	Clean exterior	–	1
	25	Solution dispensing tube	Flush	–	1
	8	Vacuum fan drive belt	Check tension	–	1
100 Hours	11	Water trap, diesel	Clean	–	1
	8	Intermediate drive belt	Check tension	–	1
	12	Alternator belt	Check tension	–	1
	5	Hydraulic fluid reservoir	Check fluid level	HYDO	1
	10	Radiator	Check coolant level	WG	1
200 Hours	11	Engine, gasoline, LPG	Clean or replace and adjust spark plugs	–	4
			Clean or replace and adjust distributor points (F163 only)	–	1
			Clean PCV hoses, tubes, and fittings	–	1
			Lubricate distributor felt	EO	1
	26	Parking brake	Check adjustment	–	1
	14	Spray deflectors	Check for wear	–	2
	19	Wheels	Tighten lug nuts	–	4
	11	Fuel filter, Gas (GM) [1]	Replace filter element	–	1
400 Hours	3	Brake master cylinder	Check fluid level	BF	1
	11	Engine, gasoline, LPG (CONTINENTAL)	Adjust valve tappets	–	8
			Torque cylinder head bolts	–	15
	11	Engine, diesel	Adjust valve tappets	–	8
	11	In–line fuel filter (CONTINENTAL)	Replace filter elements	–	1
	11	Fuel filter, diesel	Replace filter elements	–	2
	11	Water trap filter, diesel	Replace filter element	–	1
	11	Fuel filter, LPG (GM)	Replace filter elements	–	2
800 Hours	5	Hydraulic reservoir breather	Replace	–	1
	10	Cooling system	Flush	–	1
	11	Fuel filter, Gas (GM) [2]	Replace filter element	–	1
1200 Hours	4	Hydraulic fluid filters	*Change filter element	–	1
2000 Hours	17	Rear wheel bearings	Re-pack with lubricant	WBG	2
2400 Hours	5	Hydraulic fluid reservoir	* Replace suction strainer	–	1
			* Change hydraulic fluid	HYDO	1

NOTE: Change the hydraulic fluid, filter, and suction strainer, indicated (**), after every 800 hours for machines NOT originally equipped with **Tennant*True*** *premium hydraulic fluid. (See Hydraulics section).*

BF – Brake fluid
EO – Engine oil, API diesel classification CG–4 or better
HYDO . **Tennant*True*** premium hydraulic fluid or equivalent
SPC – Special lubricant, Lubriplate EMB grease, TENNANT Part No. 01433–1
WBG – Wheel bearing grease
WG – Water and permanent-type ethylene glycol antifreeze, one-to-one ratio

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

[1] For machines Serial Number (001000–001505)
[2] For machines Serial Number (001508–)

LUBRICATION

ENGINE

Check the engine oil level daily.

GASOLINE AND LPG POWERED ENGINES

Gasoline and LPG powered engines should be lubricated with SAE-SG/SH rated engine oil. Change the engine oil and oil filter after every 50 hours of operation. Change the engine oil more frequently if the environment is extremely dusty.

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

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

The engine oil capacity for the Continental TM27 engine (machines below serial number 001424) is 7 qt (6.6 L) with filter.

The engine oil capacity for the Gas/LPG GM engine (machines serial number 001424 and above) is 5 qt (4.7 L) with filter. On GM engines, the oil fill is under the breather cap.

DIESEL POWERED ENGINES

Change the engine oil and oil filter after every 50 hours of operation. Change the engine oil more frequently if the environment is extremely dusty.

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

SINGLE AND MULTI-VISCOSITY OILS		
Below 32°F (Below 0°C) 10W 10W 30	32° to 77° F (0° to 25° C) 20	Above 77° F (Above 25° C) 30

The engine oil capacity for the Diesel Continental TMD27 engine (machines below serial number 001424) is 7 qt (6.6 L) with filter.

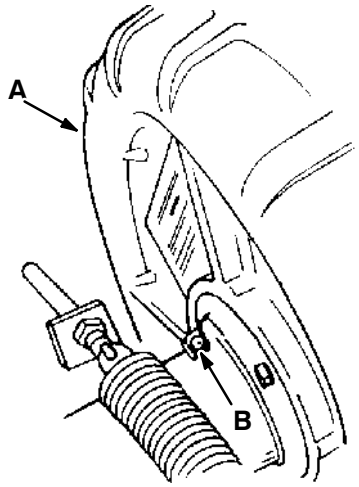
The engine oil capacity for the Diesel Perkins engine (machines serial number 001424 - 001505) is 11 qt (10.4 L) with filter.

The engine oil capacity for the Diesel Cat engine (machines serial number 001508 and above) is 10.6 qt (10.0 L) with filter.

VACUUM FAN SHAFT - Gas/LPG ENGINES (For machines below serial number 001508)

VACUUM FAN SHAFT - DIESEL ENGINES (For machines serial number 001000 and above)

There is one grease fitting which is used to lubricate the vacuum fan shaft. Grease the vacuum fan bearings after every 50 hours of operation. The vacuum fan grease fitting is covered with a plastic cap. Snap the cap open and apply Lubriplate EMB grease (TENNANT Part No. 01433-1) to the vacuum fan grease fitting. Wipe off all excess grease and replace the grease fitting cap.



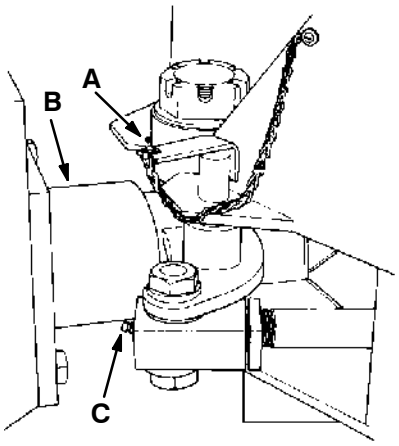
03789

VACUUM FAN

A. Vacuum Fan
B. Grease Fitting

MACHINE PIVOT

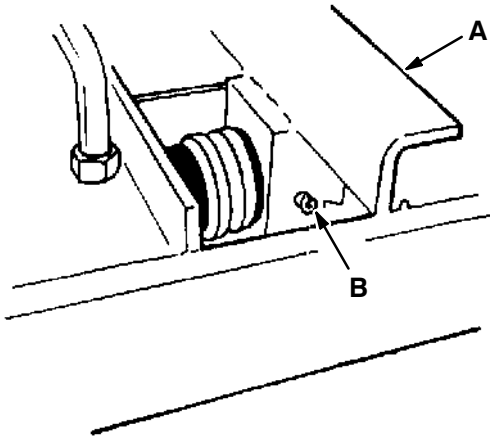
There are four grease fittings which are used to lubricate the machine pivot assembly. There is an upper bearing grease fitting, a lower bearing grease fitting, and a grease fitting on each rod end of the steering cylinder. Apply grease to these fittings after every 50 hours of operation. Use a Lubriplate EMB grease (TENNANT Part No. 01433–1).



00251

MACHINE PIVOT

A. Upper Bearing Grease Fitting
B. Machine Pivot
C. Steering Cylinder Rod End Grease Fitting



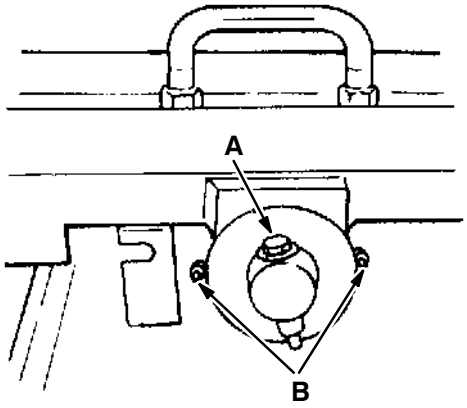
03791

SCRUB HEAD PIVOT

A. Scrub Head
B. Grease Fitting

SCRUB HEAD PIVOT

There are four grease fittings which are used to lubricate the scrub head pivot assembly--one on each of the four scrub head pivot blocks. Apply grease to these fittings after every 50 hours of operation. Use a Lubriplate EMB grease (TENNANT Part No. 01433–1).



03790

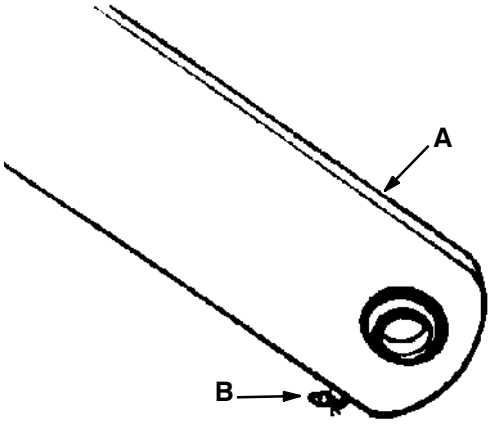
SCRUB HEAD PIVOT

A. Pivot
B. Grease Fitting

Home Find... Go To..

SCRUB HEAD HINGES

There are two grease fitting which are used to lubricate the scrub head hinges. One grease fitting is located on the underside of each of the hinges. Apply grease to these fittings after every 50 hours of operation. Use a Lubriplate EMB grease (TENNANT Part No. 01433-1).



03792

SCRUB HEAD HINGE

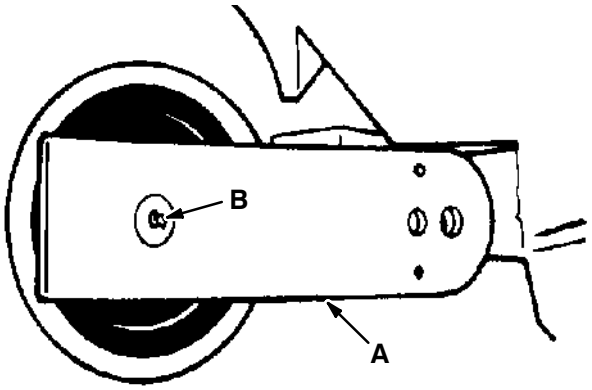
A. Scrub Head
B. Grease Fitting

REAR SQUEEGEE CASTERS

Lubricate the rear squeegee casters after every 50 hours of operation. Use Lubriplate EMB grease (TENNANT Part No. 01433-1).

SCRUB BRUSH IDLER PLUGS

There are two grease fittings which are used to lubricate the brush idler plugs. They are located in the center of each idler plug and are covered with plastic caps. Snap the caps open to apply grease to the fittings. Use a Lubriplate EMB grease (TENNANT Part No. 01433-1). Wipe off all excess grease and replace the plastic cap. Apply grease to the fittings after every 50 hours of operation.



03793

BRUSH IDLER PLUG

A. Idler Arm
B. Grease Fitting

REAR WHEELS

The rear wheels have automotive-type bearings. Re-pack the bearings with automotive-type wheel bearing grease after every 2000 hours of operation.

HYDRAULICS

HYDRAULIC FLUID

The quality and condition of the hydraulic fluid plays a very important role in how well the machine operates. TENNANT's hydraulic fluid is designed to meet the special needs of its machines.

TENNANT's hydraulic fluids provide longer life of the hydraulic components. There are two fluids available for two different temperature ranges:

Tennant*True* premium hydraulic fluid (Extended Life)			
Part number	Ambient temperature	ISO Grade	Capacity
1057710	above 7° C (45° F)	100	3.8 L (1 gal)
1057711	above 7° C (45° F)	100	19 L (5 gal)
1057707	below 7° C (45° F)	32	3.8 L (1 gal)
1057708	below 7° C (45° F)	32	19 L (5 gal)

The higher temperature fluid is designed with a higher viscosity and should not be used at the lower temperatures. Possible damage to the hydraulic pumps may occur because of improper lubrication.

The lower temperature fluid is a thinner fluid designed for colder temperatures.

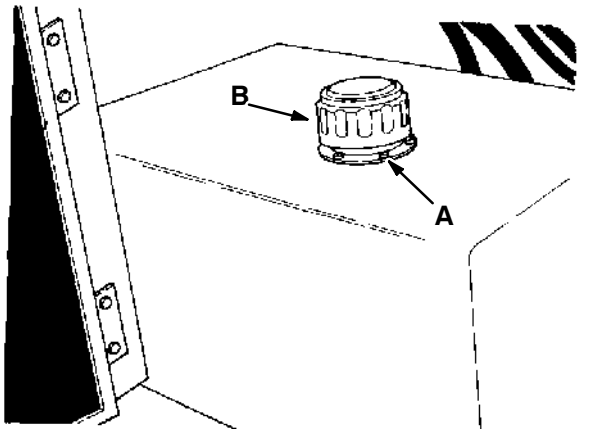
If a locally-available hydraulic fluid is preferred, or if products of only one oil company are used, contact TENNANT Technical Customer Service to check the specifications of the substitute fluid. Using substitute fluids can cause premature failure of hydraulic components.

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. For Gas/LPG (machines below serial number 001508) the reservoir holds up to 11.5 gal (44 L) of hydraulic fluid. For Gas/LPG (machines serial number 001508 and above) the reservoir holds up to 14.2 gal (54 L) of hydraulic fluid. For Diesel (machines serial number 001000 and above) the reservoir holds up to 11.5 gal (44 L) of hydraulic fluid.The reservoir is located in the front left corner of the machine.

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

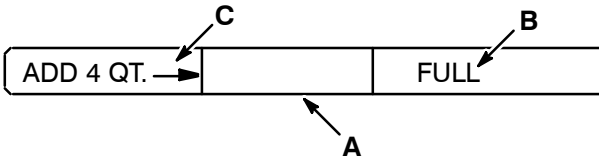


HYDRAULIC FLUID RESERVOIR BREATHER-FILLER CAP

A. Filler Neck
B. Breather-Filler Cap

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

Check the hydraulic fluid level after every 100 hours of operation. It should be above the “add” mark on the dipstick, but not above the “full” mark when the hydraulic fluid is at operating temperature.



HYDRAULIC FLUID LEVEL DIPSTICK

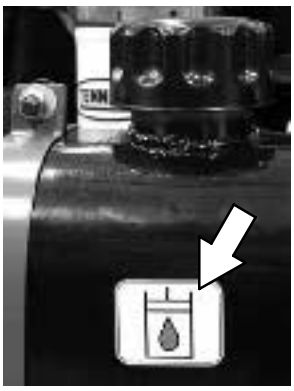
A. Dipstick
B. Full Range
C. Add Range

Lubricate the filler cap gasket with a film of hydraulic fluid before putting the cap back on the reservoir.

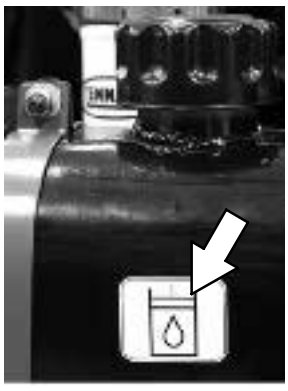
Do not overfill the hydraulic fluid reservoir. The hydraulic fluid expands as it heats to its normal operating temperature. Always allow for expansion when filling the reservoir.

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

Drain and refill the hydraulic fluid reservoir with new **Tennant*True*** premium hydraulic fluid after every 2400 hours of operation. Machines have a blue colored drop (left photo) on the hydraulic fluid label if originally equipped with **Tennant*True*** premium hydraulic fluid.



Tennant*True* Fluid



Previous Fluid

NOTE: Change the hydraulic fluid, filter, and suction strainer after every 800 hours for ALL machines that have NOT consistently used **Tennant*True*** *premium hydraulic fluid or equivalent.*

TO DRAIN THE HYDRAULIC FLUID RESERVOIR

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

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

2. Allow the hydraulic fluid to cool.

3. Open the left side access door.

4. Loosen the breather-filler cap. Remove the reservoir drain plug located on the bottom of the reservoir to drain the hydraulic fluid. Discard the used hydraulic fluid.

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

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

6. Reinstall the reservoir drain plug and breather-filler cap.

7. Close the left side access door.

TO FILL THE HYDRAULIC FLUID RESERVOIR

1. Open the left side access doors.

2. Remove the breather-filler cap.

3. Pour the new hydraulic fluid into the hydraulic fluid reservoir through a 200 mesh screened funnel. Watch the hydraulic fluid level on the sight gauge. Do not overfill the reservoir.

   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. Close the access doors.

The reservoir has a built-in strainer outlet that filters hydraulic fluid before it enters the system. Replace the strainer after every 2400 hours of operation.

HYDRAULIC FLUID RESERVOIR BREATHER

The hydraulic fluid reservoir is equipped with a breather. The breather is built into the filler cap on top of the reservoir. It maintains atmospheric pressure in the reservoir. The breather should be replaced after every 800 hours of operation.

HYDRAULIC FLUID FILTER

The hydraulic fluid filter is located in the engine compartment. Replace the filter element after every 1200 hours of operation or if the clogged hydraulic filter light remains on. Check the hydraulic fluid level and refill as needed.

TO REPLACE THE HYDRAULIC FLUID FILTER ELEMENT

1. Park the machine on a flat surface, stop the engine, and set the machine parking brake.

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

2. Open the left side access doors.

3. Unthread and discard the hydraulic fluid filter elements.

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

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

5. Thread and hand tighten the new hydraulic fluid filter elements on the filter heads.

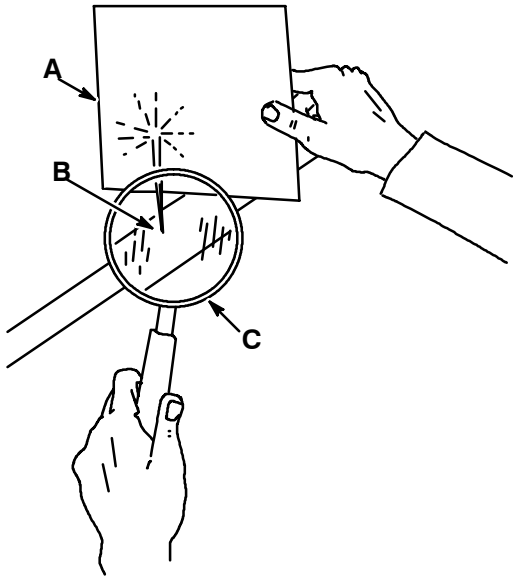
6. Operate the machine and check for leaks. Correct any leaks found.

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

8. Close the access doors.

HYDRAULIC FLUID LEAKS

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



00002

HYDRAULIC PIN HOLE LEAK

A. Cardboard
B. Pin Hole Leak
C. Magnifying Glass

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

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

HYDRAULIC COMPONENTS TROUBLESHOOTING

Problem	Cause	Remedy
Hydraulic cylinder failure	Piston seals leaking	Install seal kit
	Barrel worn or rod bent	Replace cylinder
Hydraulic control valve failure	Valve seals leaking	Install seal kit
	Solenoid failure	Replace solenoid
	Solenoid spool sticking	Replace valve section
	Check valve sticking	Replace valve
	Relief valve stuck open (leaking)	Clean or replace relief valve
Hydraulic steering valve failure	Valve leaking	Install seal kit
	Drive link failure	Replace drive link
	Thrust bearing worn	Replace thrust bearing
	Gerotor worn	Replace gerotor set
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 vane pump failure	Pump leaking	Install seal kit
	Vane set failure	Replace vane set
	Relief valve stuck	Replace relief valve
	Engine-to-pump coupling failure	Replace coupling
Hydraulic piston pump failure	Pump leaking	Install seal kit
	Relief valve stuck	Clean or replace relief valve
	Integral charge pump failure	Replace charge pump
	Rotating group worn	Replace rotating group
	Shaft failure	Replace shaft
	Backplate worn	Replace backplate
	Engine-to-pump coupling failure	Replace coupling

ENGINE

LUBRICATION

Check the engine oil level daily.

GASOLINE AND LPG POWERED ENGINES

Gasoline and LPG powered engines should be lubricated with SAE-SE/SF rated engine oil. Change the engine oil and oil filter after every 50 hours of operation. Change the engine oil more frequently if the environment is extremely dusty.

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

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

The engine oil capacity for the Continental TM27 engine (machines below serial number 001424) is 7 qt (6.6 L) with filter.

The engine oil capacity for the Gas/LPG GM engine (machines serial number 001424 and above) is 5 qt (4.7 L) with filter. On GM engines, the oil fill is under the breather cap.

DIESEL POWERED ENGINES

Change the engine oil and oil filter after every 50 hours of operation. Change the engine oil more frequently if the environment is extremely dusty.

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

SINGLE AND MULTI-VISCOSITY OILS		
Below 32°F (Below 0°C) 10W 10W 30	32° to 77° F (0° to 25° C) 20	Above 77° F (Above 25° C) 30

The engine oil capacity for the Diesel Continental TMD27 engine (machines below serial number 001424) is 7 qt (6.6 L) with filter.

The engine oil capacity for the Diesel Perkins engine (machines serial number 001424 - 001505) is 11 qt (10.4 L) with filter.

The engine oil capacity for the Diesel Cat engine (machines serial number 001508 and above) is 10.6 qt (10.0 L) with filter.

COOLING SYSTEM

Maintaining cooling system efficiency is important. Engine temperatures must be brought up to and maintained within the satisfactory range for efficient operation. However, the engine must be kept from overheating in order to prevent damage to the valves, pistons, and bearings. Check the 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. Deposits of sludge, scale, and rust prevent normal heat transfer. Flush the radiator and the cooling system after every 800 hours of operation using a dependable cleaning compound. Follow the mixing procedure recommended by the compound manufacturer. This is important because of the difference in concentration and composition of the cleaning compounds. After cleaning, flush the system with clean water.

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

Engine overheating may also be caused by dirty radiator fins. The exterior fins of the radiator can be cleaned with an air hose. Clean the radiator exterior after every 50 hours of operation.

Blow all dust, which may have collected on the radiator, in through the grill and radiator fins, opposite the direction of normal air flow. This should be done only after the radiator has cooled, to avoid cracking.

FOR SAFETY: When Servicing Machine, Wear Eye And Ear Protection When Using Pressurized Air Or Water.

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 220° F (104° 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.

FOR SAFETY: When Servicing Machine, Avoid Contact With Hot Engine Coolant.

AIR INTAKE SYSTEM

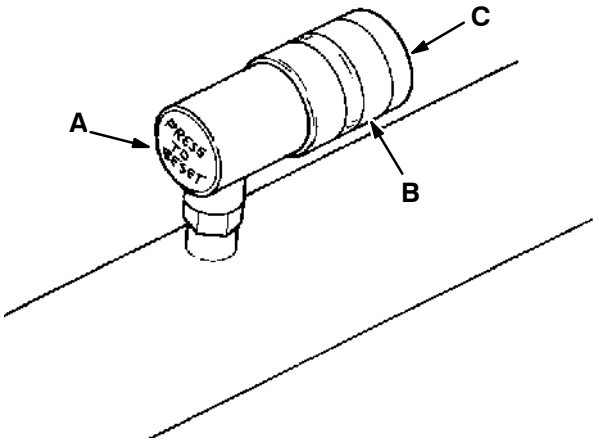
The importance of maintaining an air filter cannot be overemphasized. Dirt ingested through improperly installed, improperly serviced, or inadequate air filter elements wears out more engines than long hours of operation. Even a small amount of dirt will wear out a set of piston rings in just a few hours.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

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

AIR FILTER SERVICE INDICATOR

The air filter service indicator signals when to replace the air filter element. Check the service indicator daily. The red line will move on the scale as the air filter element fills with dirt. Do not replace the air filter element until the red line reaches 20 in H_2O (5 kPa) and the “Service when Red” window is filled with red. The service indicator red line may return to a lower reading on the scale when the engine is shut off. The red line will return to a correct reading when the engine is started.

Replace the filter element when the service indicator reads 20 in H_2O (5 kPa). After replacing the air filter element, reset the service indicator by pushing the reset button on the end of the indicator.



00212

AIR FILTER RESTRICTION INDICATOR

A. Indicator Reset Button
B. Indicator Window
C. Restriction Indicator

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 inspected or replaced whenever the air filter service indicator reads 20 in H_2O (5 kPa). The filter element must be replaced if it is damaged.

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

TO REPLACE AIR FILTER ELEMENT - CONTINENTAL ENGINES (For machines below serial number 001424)

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

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

2. Open the left side and top engine access doors.

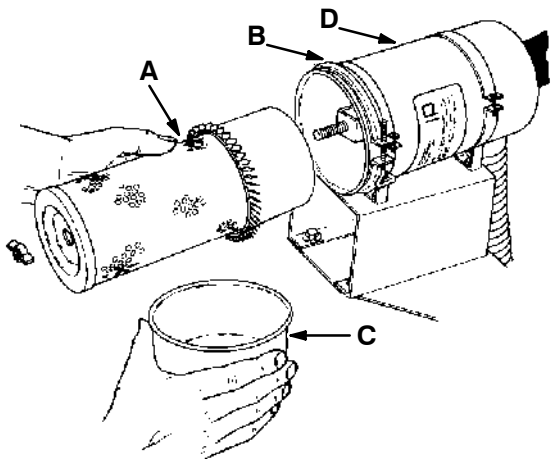
3. Unscrew the clamp ring on the filter.

4. Remove the dust cap.

5. Empty the dust cap.

6. Remove the filter wing nut.

7. Gently pull the filter element out of the filter housing.



00044

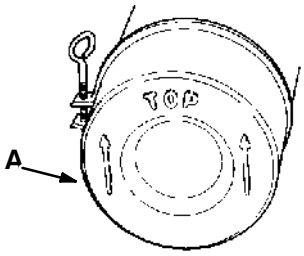
REMOVING AIR FILTER ELEMENT

A. Filter Element
B. Clamp Ring
C. Dust Cap
D. Filter Housing

8. Clean the interior of the air cleaner housing with a damp cloth. Clean the element housing sealing surfaces.

9. Install the new filter element so the fins on the element are at the intake end of the air cleaner. Use care so the fins are not damaged. Tighten the wing nut attaching the element.

10. 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.



02492

DUST CAP

A. Dust Cap

11. Reset the air filter service indicator.

12. Close the access doors.

Home Find... Go To..

TO REPLACE AIR FILTER ELEMENT - GM GAS AND PERKINS OR CAT DIESEL ENGINES (For machines serial number 001424 and above)

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

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

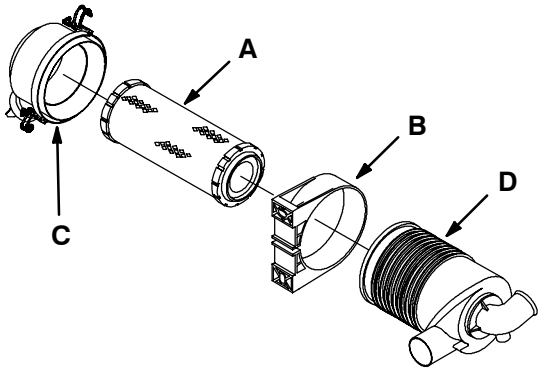
2. Open the left side and top engine access doors.

3. Unlock the side clamps on the filter.

4. Remove the dust cap.

5. Empty the dust cap.

7. Gently pull the filter element out of the filter housing.



REMOVING AIR FILTER ELEMENT

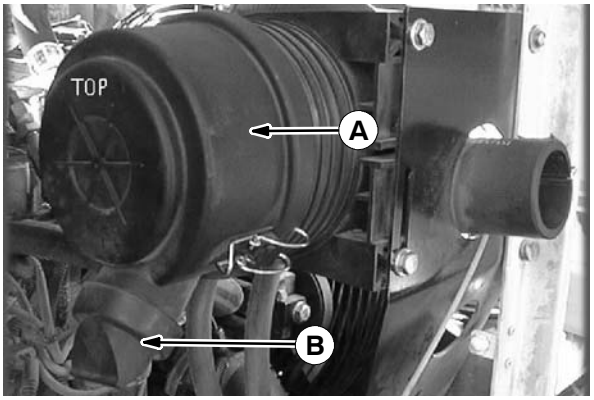
A. Filter Element
B. Mounting Clamp
C. Dust Cap
D. Filter Housing

8. Clean the interior of the air cleaner housing with a damp cloth. Clean the element housing sealing surfaces.

9. Install the new filter element so the open end of the filter is pressed over the intake hose inside the filter housing.

10. (Machines serial number xxxxxx and above) have a heavy duty safety element inside the standard element. Replace this element, do not clean it, after the regular element has been damaged or changed three times.

11. Install the dust cap with the arrows pointing up and the rubber dust cap on the bottom. Lock the side clamps onto the filter to hold it in place. Check all intake hose connections for leaks or abrasion.



DUST CAP

A. Dust Cap
B. Rubber Dust Cap

12. Reset the air filter service indicator.

13. Close the access doors.

FUEL SYSTEM - GASOLINE -CONTINENTAL ENGINES (For machines below serial number 001424)

FUEL FILTER

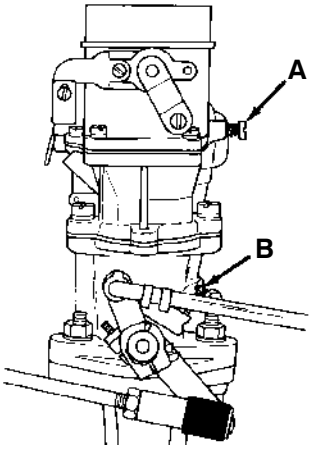
The in-line fuel filter is located under the fuel tank. Clean the fuel filter as required.

CARBURETOR

The carburetor has three basic adjustments. They are idle fuel mixture, fixed high speed jet, and idle speed adjustment.

The idle fuel-air adjusting needle controls the idle mixture. Turning the idle adjusting needle clockwise results in a leaner mixture. Turning the idle adjusting needle counterclockwise results in a richer mixture.

The high speed jet is not adjustable. For high altitude it may be exchanged for reduction in size to lean the fuel to compensate for the lighter, thin air. The size must be carefully determined first by testing a smaller jet with 0.001 to 0.002 in (0.025 to 0.050 mm) smaller passage, depending on the elevation.



00052

CARBURETOR ADJUSTMENTS

A. Idle Mixture Adjustment Needle
B. Idle Speed Adjustment

The idle speed is adjusted by turning the screw clockwise to increase speed or counterclockwise to lower the speed.

WARNING: Engine Emits Toxic Gases. Severe Respiratory Damage Or Asphyxiation Can Result. Provide Adequate Ventilation. Consult With Your Regulatory Agency For Exposure Limits. Keep Engine Properly Tuned.

FUEL SYSTEM - GASOLINE - GM ENGINES (For machines serial number 001424 and above)

FUEL FILTER (For machines serial number 001000 - 001505)

The fuel filter is located under the fuel tank. Clean the fuel filter as required. Replace the filter after every 400 hours.

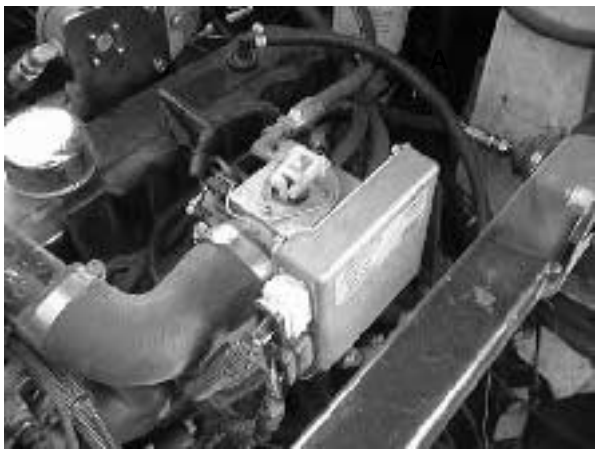
IN-LINE FUEL FILTER

The in-line fuel filter is located on the end of the fuel pump, between the fuel pump and the fuel line. (For machines serial number 001000-001505) Replace the fuel filter every 200 hours of operation. (For machines serial number 001508-) Replace the fuel filter every 800 hours of operation.

ELECTRONIC FUEL INJECTION - GM ENGINES

The electronic fuel injection system requires no adjustment.

The fuel injected system is equipped with a "manifold absolute pressure sensor" (MAP Sensor). The MAP sensor senses barometric pressure and automatically corrects the fuel system calibration for changes in altitude. This means the air/fuel mixture will always be optimized, regardless of elevation (or barometric pressure), however, the engine will still lose 3.5% power for every 1000 ft increase in elevation.



ELECTRONIC FUEL INJECTION

WARNING: Engine Emits Toxic Gases. Severe Respiratory Damage Or Asphyxiation Can Result. Provide Adequate Ventilation. Consult With Your Regulatory Agency For Exposure Limits. Keep Engine Properly Tuned.

FUEL SYSTEM – LPG

LPG FUEL SYSTEM

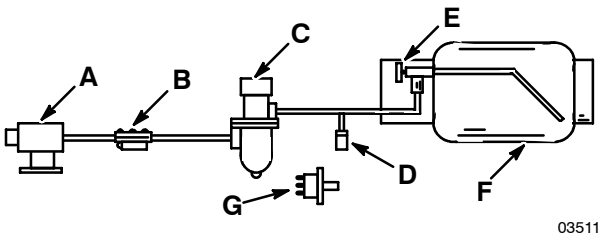
The liquid withdrawal LPG fuel system is made up of five components which are: the LPG fuel tank, pressure relief valve, fuel filter lock, vaporizer-regulator, and the carburetor.

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.

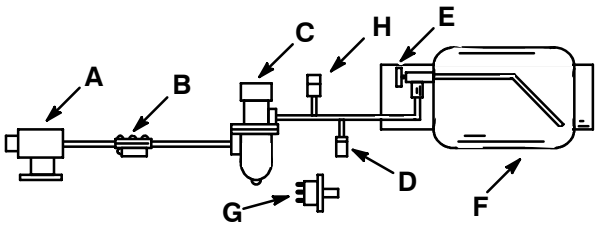
IN–LINE FUEL FILTER –GM ENGINES (For machines serial number 001424 and above)

The in–line fuel filter is located between the lock–off solenoid and the fuel line leading to the vaporizer–regulator. Replace the fuel filter every 400 hours of operation.



LPG FUEL SYSTEM – CONTINENTAL ENGINES (For machines below serial number 001424)

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



LPG FUEL SYSTEM – GM ENGINES (For machines serial number 001424 and above)

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

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 the suspected area. This area may have an LPG fuel leak. Repair or replace the part. Use Loctite brand Stainless Steel PST thread sealant when reassembling. This epoxy-type sealant is not affected by aging or high humidity. Be sure to follow application directions and apply proper torque when reconnecting fittings. Never bypass safety components except to test. If the safety components are defective, replace them before operating the machine.

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

FUEL TANKS

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

Tank Size – The recommended tank size is a 33 lb (15 kg) tank. Larger tanks may impair the vision of the machine operator.

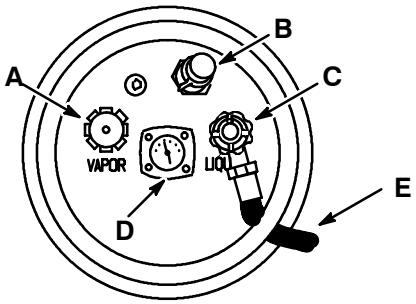
Filler Valve – Check for proper functioning and the presence of the handwheel. Valve must be closed except during filling.

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

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.

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



03485

TYPICAL LPG LIQUID WITHDRAWAL FUEL TANK

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

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

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

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

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

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

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

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

TO CHANGE AN LPG FUEL TANK

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

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

2. Close the tank service valve.

3. Operate the engine until it stops from lack of fuel.

WARNING: Engine Emits Toxic Gases. Severe Respiratory Damage Or Asphyxiation Can Result. Provide Adequate Ventilation. Consult With Your Regulatory Agency For Exposure Limits. Keep Engine Properly Tuned.

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

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: The recommended tank size is a 33 lb (15 kg) tank. Larger tanks may impair the vision of the machine operator.

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 mounting bracket up or down.

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

12. Connect the LPG fuel line to the tank service coupling. Make sure the service coupling is clean and free of damage. Also make sure it matches the machine service coupling.

13. Open the tank service valve slowly and check for leaks. If an LPG leak is found, close the service valve immediately and notify the appropriate personnel.

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

FUEL FILTER LOCK

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

Replace the fuel filter lock filter pack with the filter pack replacement kit every 400 hours or if diminished gas flow indicates the filter is clogged. A drain plug is provided for purging the filter bowl. Clean out the bowl when replacing the filter pack.

VAPORIZER-REGULATOR

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

CARBURETOR – CONTINENTAL ENGINES (For machines below serial number 001424)

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.

ELECTRONIC FUEL INJECTION SYSTEM – GM ENGINES (For machines serial number 001424 and above)

The electronic fuel injection system requires no regular maintenance. If any malfunction is noted contact TENNANT service personel.

OIL PRESSURE SWITCH

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

LPG FUEL TROUBLESHOOTING

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

FUEL SYSTEM - DIESEL

FUEL WATER TRAP

The fuel water trap is located next to the fuel tank. The water trap should be drained of water daily. To drain the water trap, unscrew the spigot on the bottom of the water trap. Drain the water trap of water. As fuel appears, tighten the spigot to stop the flow. It may be necessary to bleed the fuel system of air after draining the water trap.

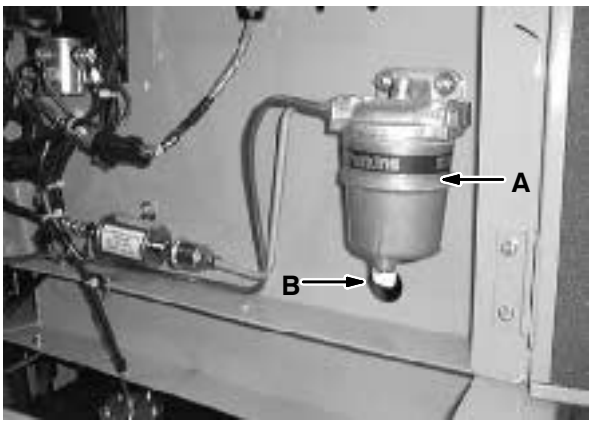
After every 100 hours of operation, the water trap must be cleaned as described in *TO CLEAN THE WATER TRAP*. Replace the water trap filter element after every 400 hours of operation.

TO CLEAN WATER TRAP

1. Thoroughly clean the exterior of the water trap.
2. Unscrew the bowl retaining bolt in the center of the water trap head.
3. Lower the bowl from the water trap head. Replace the filter element if it is due to be replaced.
4. Thoroughly clean the water trap bowl in cleaning fluid.

NOTE: Do not use gasoline to clean the bowl.

5. After cleaning the water trap bowl, fill the bowl with clean fuel. Hold the water trap bowl in position under the water trap head.
6. Secure the bowl retaining bolt.



WATER TRAP - PERKINS ENGINES (For machines serial number 001424 - 001505)

A. Water Trap
B. Spigot

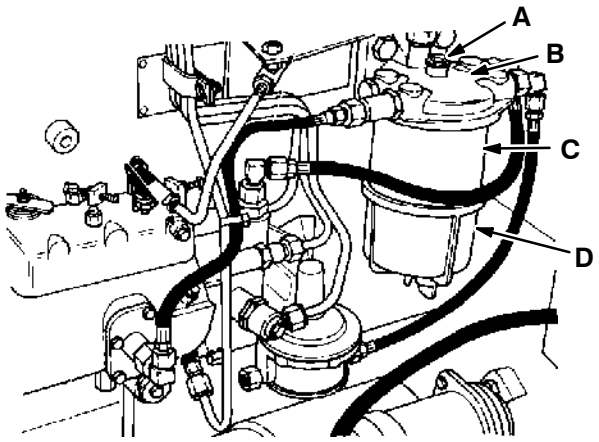
7. Prime the fuel system as described in *PRIMING THE FUEL SYSTEM*.

FUEL FILTER

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

TO REPLACE FUEL FILTER - CONTINENTAL ENGINES (For machines between serial number 001000-001055)

1. Thoroughly clean the exterior of the fuel filter assembly.
2. Unscrew the filter bolt in the center of the head.



FUEL FILTER - CONTINENTAL ENGINES (For machines between serial number 001000-001055)

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

3. Lower the filter bowl and element and discard the fuel, together with the old element.
4. Thoroughly clean the filter bowl in cleaning fluid.

NOTE: Do not use gasoline as a cleaning fluid.

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

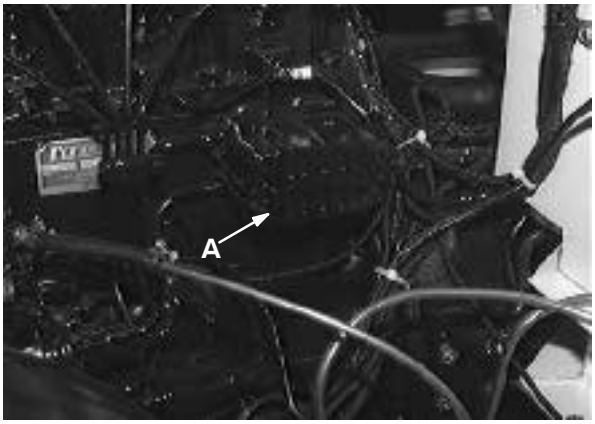
6. Hold in this position while the filter bolt is located and tightened. If the bowl is located correctly, no excessive tightening will be required to obtain a leak-proof seal.

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

TO REPLACE FUEL FILTER – CONTINENTAL ENGINES (For machines between serial number 001056–001423)

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

2. Release the two spring claps on either side of the metal canister element and pull the element off the filter bracket.



FUEL FILTER – CONTINENTAL ENGINES – (For machines between serial number 001056–001423)

A. Fuel Filter Element

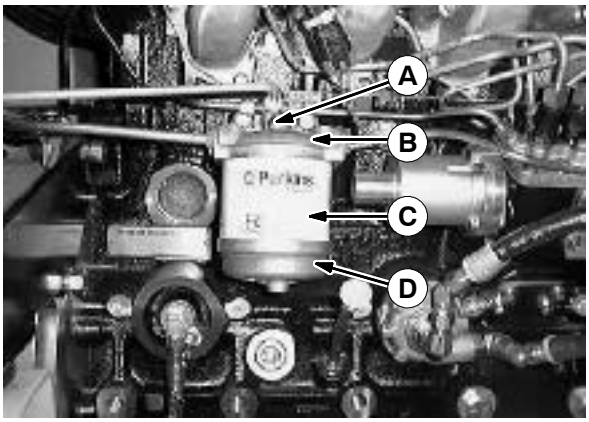
3. Lubricate the new element grommets with clean diesel fuel, and push the element into place. Snap the spring clamps into position.

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

TO REPLACE FUEL FILTER – PERKINS ENGINES (For machines serial number 001424 – 001505)

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

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



FUEL FILTER – PERKINS ENGINES – (For machines serial number 001424 –001505)

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

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

4. Thoroughly clean the filter bowl in cleaning fluid.

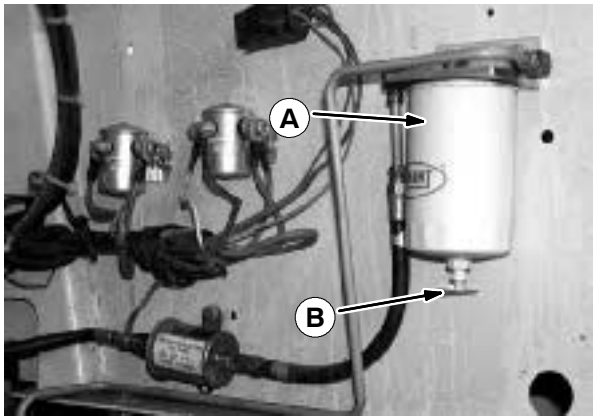
NOTE: Do not use gasoline as a cleaning fluid.

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

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

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

WATER SEPARATOR/FUEL FILTER – CAT ENGINES (For machines serial number 001508 and above)



WATER SEPARATOR/FUEL FILTER – CAT ENGINES – (For machines serial number 001508 and above)

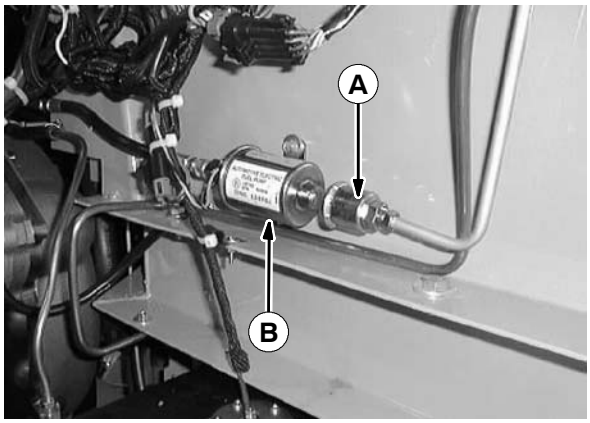
A. Water Separator/Fuel Filter
B. Drain Cock

The water separator/fuel filter filters impurities from the fuel and separates any water from the fuel system. It is located on the right side of the engine compartment. Water can be drained from the drain cock at the bottom as needed.

Replace the water separator/fuel filter element every 400 hours of operation.

IN–LINE FUEL FILTER – PERKINS ENGINES (For machines serial number 001424 – 001505)

The in–line fuel filter is located on the end of the fuel pump, between the fuel pump and the fuel line leading to the water trap. Replace the fuel filter every 400 hours of operation.



IN–LINE FUEL FILTER – PERKINS ENGINES (For machines serial number 001424 – 001505)

A. In–Line Fuel Filter
B. Fuel Pump

FUEL INJECTION PUMP

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

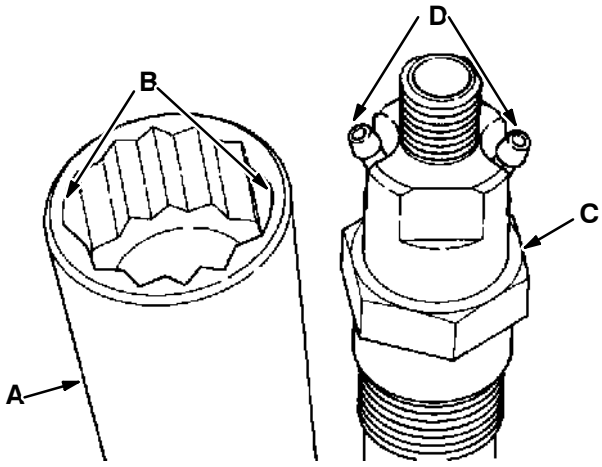
NOTE: Unless proper test equipment and trained technicians are available, adjustment or maintenance of the fuel injection pump should not be attempted.

FUEL INJECTORS

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

Use care when replacing the fuel injectors to prevent loosening the injector leak-off nipples.

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



SOCKET RELIEF CLEARANCE

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

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

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

Misfiring

Knocking in one (or more) cylinders

Engine overheating

Loss of power

Smoky exhaust (black or white)

Increased fuel consumption

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

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

PRIMING THE FUEL SYSTEM – CONTINENTAL ENGINES (For machines serial number 001000–001055)

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

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

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

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

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

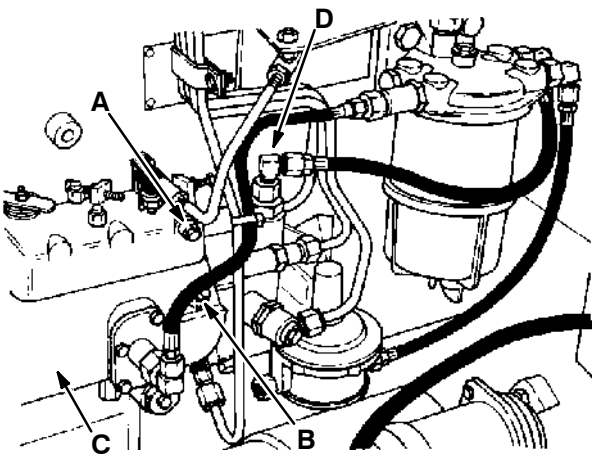
NOTE: Leaving the priming lever in the horizontal position will lock the pump action stopping the fuel supply.

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

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

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

4. Start the engine.



01475

INJECTION PUMP VENTS

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

PRIMING THE FUEL SYSTEM – CONTINENTAL ENGINES (For machines serial number 001056–001423)

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

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

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

1. Turn the ignition switch to the “on” position.

2. Loosen the filter outlet connection to the fuel injection pump inlet connection, whichever is higher, and allow the fuel to flow until free of air. Tighten the connection.

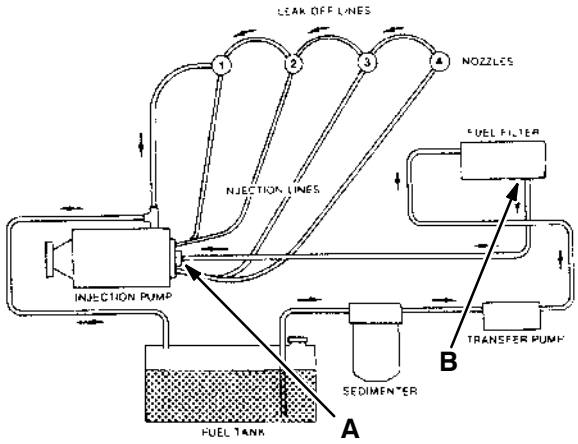
NOTE: If the filter outlet connection can not be reached due to the type of filter being used, loosen the fuel injection pump inlet connection.

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

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

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

4. Start the engine.



FUEL SYSTEM SCHEMATIC

A. Fuel Injection Pump Inlet Connection
B. Filter Outlet Connection

PRIMING THE FUEL SYSTEM – PERKINS ENGINES (For machines serial number 001424 – 001505)

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

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

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

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

2. Fill the fuel tank.

3. Open the side and top engine access doors.

4. Loosen the vent screw on the top of the fuel filter.

5. Turn the ignition switch on.

6. Allow the fuel pump to operate until fuel, free from air, comes through the filter vent point.

FOR SAFETY: When servicing machine, keep flames and sparks away from fuel system service area. Keep area well ventilated.

7. Tighten the filter vent screw.

8. Loosen all four of the high pressure fuel line connections at the atomizers.

9. Operate the starter motor until fuel, free from air, comes from the line connections.

10. Tighten the high pressure fuel line connections. The engine is now ready to start.

11. Close the access doors.

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

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

NOTE: If the engine runs correctly for a short time and then stops, or runs roughly, check for air in the fuel system. If there is air in the system, there is probally a leak in the low pressure system.

11. Turn the ignition switch off.

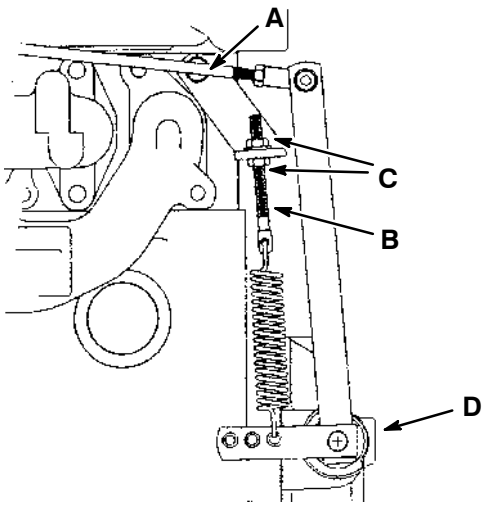
GOVERNOR - Gas/LPG CONTINENTAL ENGINES (For machines serial number 001000-001423)

The TM27 cam gear governor differs from a conventional centrifugal governor, mainly in the round steel balls used as the actuating force producer instead of pivoting masses of weight. When the governor is driven at increasing speeds by the engine, the hardened steel balls move outward forcing the conical upper race and lever assembly toward a closed throttle position.

The lever assembly is pulled towards the open position by an externally mounted spring. As the speed increases, the centrifugal force created by the balls will increase until a balanced condition between the governor force and the spring force exits, and the governing lever remains stationary — holding constant engine RPM.

This built-in cam-gear governor is sealed, dust proof, engine lubricated, compact and easily adjusted. The control shaft floats on two needle bearings to remove friction for closer and more accurate control through the whole power range.

The idle surge adjusting screw, if supplied, should be adjusted “in” just far enough to eliminate any tendency of the engine to surge.



11123

GOVERNOR LINKAGE

A. Carburetor to Governor Rod
B. Speed Adjustment Screw
C. Lock Nut
D. Governor

TO ADJUST GOVERNOR

1. Set the machine parking brake.

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

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

   The governor to carburetor control rod should be adjusted in length so that the throttle stop lever is 0.4 to 0.8 mm (0.02 to 0.03 in) off the stop pin. Be sure that the bumper screw, if supplied, is backed out so it doesn't interfere.

   Make sure that all the linkage at the governor and carburetor operate freely — without binding.

3. Speed adjustment: To increase the speed, increase the spring tension using the adjusting screw. To decrease the speed, decrease the spring tension using the adjusting screw.

4. Idle surge adjustment: (When the surge screw is supplied) Turn the governor idle surge adjusting screw "in" or to the right until corrected.

5. Continue surging: This may indicate an excessive looseness or binding of the governor linkage, and sometimes too lean a fuel mixture.

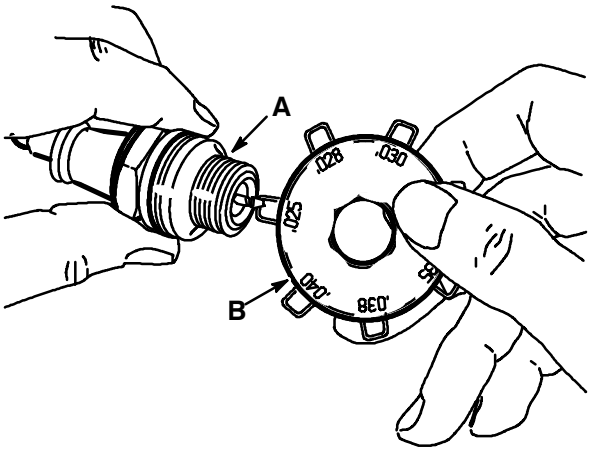
GOVERNOR - Gas/LPG GM ENGINES (For machines serial number 001424 and above)

The integral governor for the electronic fuel injection system requires no adjustment.

ELECTRICAL SYSTEM

SPARK PLUGS

Clean or replace and adjust spark plugs after every 200 hours of operation. A wire gauge is best for checking the spark plug gap. A flat gauge should not be used unless the electrode surfaces have been been dressed with a small file to get parallel surfaces between the center and side electrodes. Set the spark plug gap by bending the side electrode. All spark plugs, new or used, should have the gaps checked and reset if necessary.



00054

GAPPING THE SPARK PLUG

A. Spark Plug
B. Gapping Tool

The proper spark plug gap for TM27 engines (machines below serial number 001424) is 0.035 in (0.9 mm).

The proper spark plug gap for GM engines (machines serial number 001424 and above) is 0.040 in (1.0 mm).

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

1. Clean the spark plug seat in the cylinder head.

2. Use a new seat gasket and screw the plug in by hand.

3. Tighten the spark plugs to 22 to 28 ft lb (30 to 38 Nm) with a socket wrench of the correct size.

DISTRIBUTOR

The distributor operation is vital to the operation of the engine and the following items should be carefully inspected every 200 hours of normal operation; however, dirt, dust, water and high speed operation may cause more rapid wear and necessitate more frequent inspections:

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

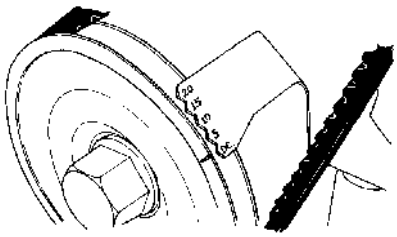
2. Check the centrifugal advance mechanism for “freeness” by turning the distributor shaft in the direction of rotation and then releasing it. The advance springs should return the shaft to its original position.

DISTRIBUTOR IGNITION TIMING

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

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

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

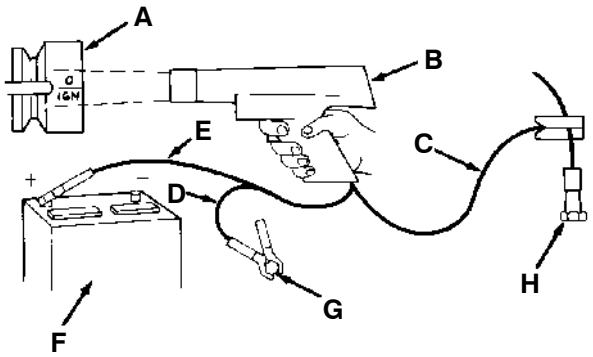


03944

CRANKSHAFT PULLEY TIMING MARK

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

2. Connect the primary red positive lead to the positive terminal of the battery.



00059

TIMING LIGHT HOOKUP

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

3. Connect the black primary negative lead to the cylinder head cap screw or the alternator bracket. Disconnect the vacuum line from the distributor to the manifold, and clamp the end of the line leading to the manifold.

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

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

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

6. Timing is 2° for gasoline TM27 engines, and 5° for LPG TM27 engines.

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

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

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

10. After setting the timing, remove the clamp and reconnect the rubber tube to the vacuum advance unit on the distributor.

Home Find... Go To..

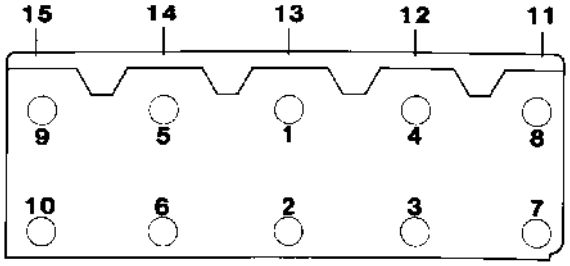
CYLINDER HEAD - GASOLINE, LPG

CYLINDER HEAD BOLT TIGHTENING
CONTINENTAL ENGINES
(For machines below serial number 001424)

A three-stage torque procedure should be used when reassembling the cylinder head. The cylinder head cap screws and risers must be tightened in the proper sequence after the first 50 hours of operation and after every 400 hours of operation.

Snug down cap screws and risers in the proper sequence. Tighten the cap screws and risers to one-half of the specified value.

TM27 engines: Hand torque cold M10 bolts to 50 to 55 ft lb (68 to 75 Nm) and M12 bolts to 80 to 85 ft lb (108 to 115 Nm) in the correct order.



01472

TM27 CYLINDER HEAD BOLT TIGHTENING SEQUENCE - CONTINENTAL ENGINES (For machines below serial number 001424)

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

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

VALVE TAPPET CLEARANCE

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

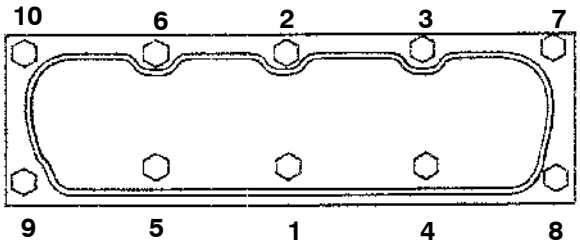
TM27 engines: Check and adjust the intake tappets to 0.014 in (0.36 mm) clearance and the exhaust valve tappets to 0.018 in (0.46 mm) clearance when the engine is warm and is operating at idle speed.

CYLINDER HEAD BOLT TIGHTENING -
GM ENGINES (For machines serial number 001424 and above)

A two-stage torque procedure should be used when reassembling the cylinder head. The cylinder head cap screws and must be tightened in the proper sequence after the first 50 hours of operation and after every 400 hours of operation.

Install the cylinder head bolts finger tight.

Hand torque the cylindrical head bolts to 90 ft lb (122 Nm) in the correct order.



CYLINDER HEAD BOLT TIGHTENING SEQUENCE - GM ENGINES (For machines serial number 001424 and above)

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

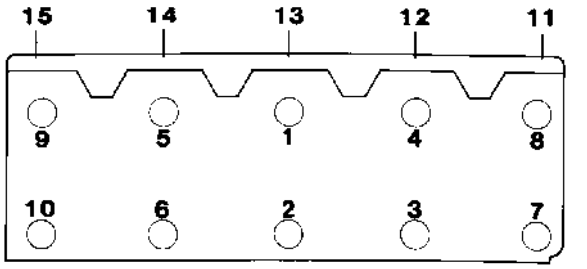
NOTE: Power wrench torque limit must be held at least 10 ft lb (14 Nm) below hand torque specification; then hand torque to the specifications.

CYLINDER HEAD - DIESEL

CYLINDER HEAD BOLT TIGHTENING
CONTINENTAL ENGINES
(For machines below serial number 001424)

The proper sequence and torque values should be used when reassembling the cylinder head. The cylinder head bolts must be tightened in the proper sequence after the first 50 hours of operation and after every 400 hours of operation.

Hand torque cold M10 bolts to 50 to 55 ft lb (70 to 75 Nm) and M12 bolts to 90 to 95 ft lb (120 to 130 Nm) in the correct order.



CYLINDER HEAD BOLT TIGHTENING SEQUENCE

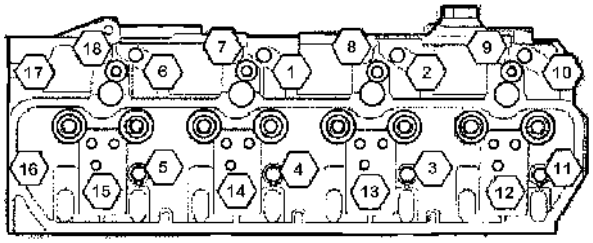
The cylinder head cap screws and risers must be re-torqued after the engine is put into operation and brought up to proper operating temperatures. To re-torque cap screws, follow the correct sequence. Loosen one head cap screw or riser at a time one quarter turn (90 degrees); then re-torque it to the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

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

CYLINDER HEAD BOLT TIGHTENING
PERKINS ENGINES
(For machines serial number 001424 - 001505)

The proper sequence and torque values should be used when reassembling the cylinder head. The cylinder head bolts must be tightened in the proper sequence after the first 50 hours of operation and after every 400 hours of operation.

Gradually and evenly tighten the setscrews to 52 ft lb (70 Nm) in the correct order.



CYLINDER HEAD BOLT TIGHTENING SEQUENCE

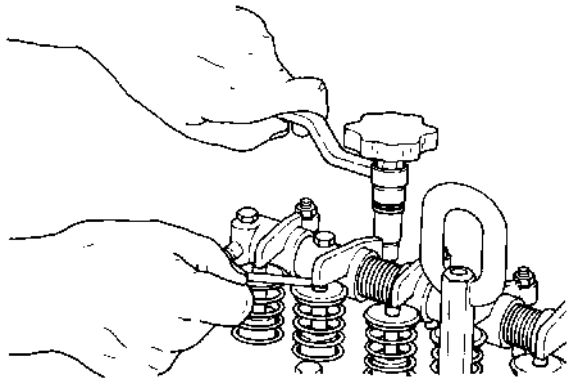
Tighten the four additional setscrews with a 14mm extended socket spanner. Gradually and evenly tighten the four setscrews to 74 ft lb (100 Nm). Repeat the procedure to ensure that all setscrews are tightened to the correct torque.

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

VALVE TAPPET CLEARANCE

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

Check and adjust the intake valve tappets to 0.014 in (0.35 mm) clearance and the exhaust valve tappets to 0.018 in (0.45 mm) clearance when the engine is warm and is operating at idle speed.



01473

ADJUSTING VALVE TAPPET CLEARANCE

PCV SYSTEM

Check the PCV system after every 200 hours of operation. Check all connections. They are to be airtight. To service the system, clean the PCV valve and the air inlet. Check all hoses for wear or plugging.

TUNE-UP CHART - GASOLINE, LPG CONTINENTAL ENGINES (For machines below serial number 001424)

Idle speed, no load	600 ± 50 rpm
Maximum governed speed	2400 ± 50 rpm
Spark plug gap, TM27	0.035 in (0.9 mm)
Timing, TM27 gasoline	15° BTDC @ 1850 rpm
Timing, TM27 LPG	18° BTDC @ 1850 rpm
Firing order	1–3–4–2
Valve clearances, TM27 warm	intake 0.014 in (0.36 mm)
	exhaust 0.018 in (0.46 mm)

TUNE-UP CHART - GASOLINE, LPG GM ENGINES (For machines serial number 001424 and above)

Idle speed, no load (For machines serial number 001424–001505)	1350 ± 50 rpm
Idle speed, no load (For machines serial number 001508 and above)	950 ± 50 rpm
Maximum governed speed	2400 ± 50 rpm
Spark plug gap	0.040 in (1.0 mm)
Timing, gasoline	0° @ static condition*
Timing, LPG	0° @ static condition*
Firing order	1–3–4–2
Valve clearance (Lash)	1/2 to 1 turn down from 0 Lash

* ECU controls engine timing

ELECTRICAL SYSTEM

BATTERY

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

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

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

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

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

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

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

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

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

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

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

Add to the specific gravity reading 0.004, 4 points, for each 10° F (5.5° C) above 80° F (27° C).

Subtract from the specific gravity reading 0.004, 4 points, for each 10° F (5.5° C) below 80° F (27° C).

BELTS AND CHAINS

VACUUM FAN DRIVE BELT - Gas/LPG ENGINES (For machines below serial number 001508)

VACUUM FAN DRIVE BELT - DIESEL ENGINES (For machines serial number 001000 and above)

The vacuum fan drive belt tension should be checked after every 50 hours of operation. The proper belt tension for gasoline and LPG machines is obtained when the midpoint of the belt deflects 0.34 in (9 mm) from a force of 7 to 8 lb (3.2 to 3.6 kg). The proper belt tension for diesel machines is obtained when the midpoint of the belt deflects 8 to 9 lb (3.6 to 4.0 kg).

TO ADJUST VACUUM FAN DRIVE BELT

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

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

2. Raise the engine cover.

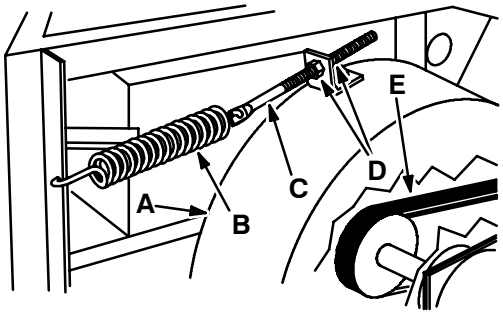
   FOR SAFETY: When Servicing Machine, Avoid Moving Parts. Do Not Wear Loose Jackets, Shirts, Or Sleeves When Working On Machine.

3. Loosen the jam nuts on the tension spring eyebolt.

4. Thread the tension spring eyebolt in to tighten the vacuum fan drive belt or out to loosen the vacuum fan drive belt to get the desired belt tension.

5. Tighten the tension spring eyebolt jam nuts.

6. Lower the engine cover.



06973

ADJUSTING VACUUM FAN BELT

A. Vacuum Fan Housing
B. Tension Spring
C. Tension Spring Eyebolt.
D. Jam Nut
E. Vacuum Fan Drive Belt

ALTERNATOR AND RADIATOR FAN BELT

The alternator and radiator fan belt tension should be checked after every 100 hours of operation. The proper belt tension is obtained when the midpoint of the belt's longest span deflects 0.50 in (13 mm) from a force of 10 to 12 lb (5 to 6 kg).

TO ADJUST ALTERNATOR AND RADIATOR FAN BELT

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

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

2. Open the left rear engine access door.

3. Loosen the alternator clamp bolt.

4. Push the alternator out to tighten the belt.

   ATTENTION! Do not use a pry bar against the alternator to tighten the belt. Using a pry bar may damage the alternator.

5. Tighten the alternator clamp bolt.

6. Check the belt deflection; adjust if necessary.

7. Close the left rear engine access door.

SCRUB HEAD

SCRUB HEAD

The scrub head houses the two scrub brushes and the brush drive mechanisms. The scrub head has two adjustments; scrub head height, and scrub brush pattern.

The scrub head height adjustment sets the minimum scrub head height. The height adjustment should not be changed unless, due to a major parts replacement or collision, the head adjustment may have been altered. If the head height is too low, excessive brush wear, engine overheating, brush bounce, or excessive brush drive plug and bearing wear may occur.

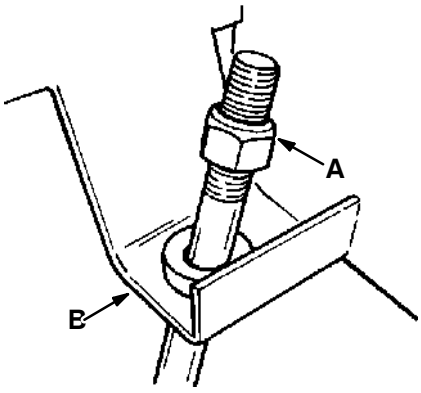
The scrub brush pattern adjustment determines the amount of contact the brush has with the floor. The brush pattern should be checked daily.

TO ADJUST SCRUB HEAD HEIGHT

1. The head height adjustment must be made with a full solution tank and tires correctly inflated; 55 psi (380 kPa) front, 35 psi (240 kPa) rear.

NOTE: Using a different sized tire on the machine, other than standard, will affect the head height adjustment.

2. The head height adjusting nut is located under the operator's seat. The nut is accessible by lifting up the seat. Hold the seat up by attaching its chain to the steering wheel.

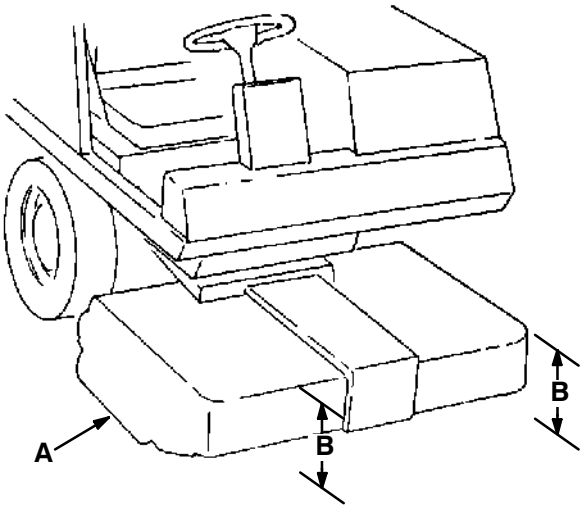


03734

ADJUSTMENT NUT

A. Nut
B. Scrub Head Link

3. Adjust the nut so that the top front of the head is 13.62 in to 13.75 in (345 to 350 mm) from the floor.



01822

SCRUB HEAD ADJUSTMENT

A. Scrub Head
B. 13.62 to 13.75 in (345 to 350 mm)

4. If the scrub head is lower than 13.62 in (345 mm), washers should be added below the adjusting nut.

TO ADJUST SCRUB BRUSH PATTERN

1. The machine must have correct tire pressures, full solution tank, and correct scrub head height adjustment.

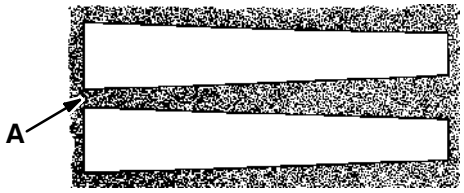
2. On a smooth, level floor, apply chalk or some other material that won't blow away easily.

3. With the scrub head raised, move the machine over the test area. Start the brush rotation, apply the foot brakes, and lower the scrubber head, allowing the brushes to spin in one spot for 15 to 20 seconds. With no chalk or other material on the floor, allow the brushes to spin approximately two minutes.

4. Polish marks made by both brushes should be visible. They should be about 1.5 in (40 mm) wide the full length of the brush. With a soft brush the polish mark should not exceed 3 in (75 mm) wide, evenly, the full length of the brush.

Home Find... Go To..

5. The rear brush polish mark is the most critical and should be adjusted first. If the polish mark is uneven or cone shaped from one end to the other, the brush leveling spring located at the operator side of the head lift, should be adjusted. The spring compensates for the weight of the brush drive motors. Loosen the top nut first to make the adjustment.

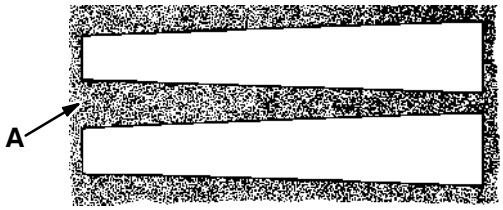


00082

TAPERED BRUSH PATTERN

A. Operator Side

Lower the brush leveling adjusting nut if the polish mark is too wide on the operator's side.

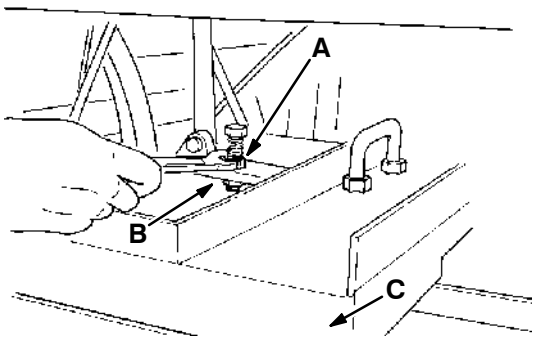


00082

TAPERED BRUSH PATTERN

A. Operator Side

Raise the brush leveling adjusting nut if the polish mark is too narrow on the operator's side. Re-tighten the top nut after making adjustments.

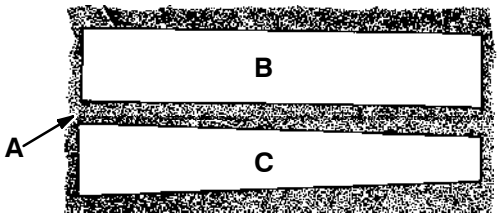


00285

LEVELING BRUSH

A. Top Nut
B. Brush Leveling Adjusting Nut
C. Operator Side of Scrub Head

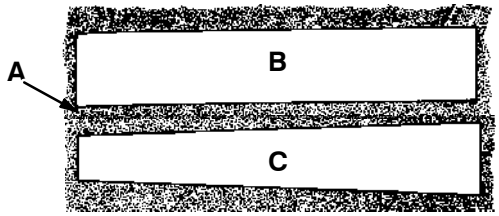
6. The polish mark of the front brush should match the polish mark of the rear brush. If the front brush polish mark is uneven, the narrow side should be shimmed. Add shims to the shaft bearing mount located on the underside of the scrub head. Remove the debris trough, loosen the bolts holding the bearing protector, and loosen the flat socket head bolts that hold the bearing mounting bracket before installing shims. One 0.12 in (3 mm) thick shim will add about 0.50 in (13 mm) width to the polish mark.



00082

TAPERED BRUSH PATTERN

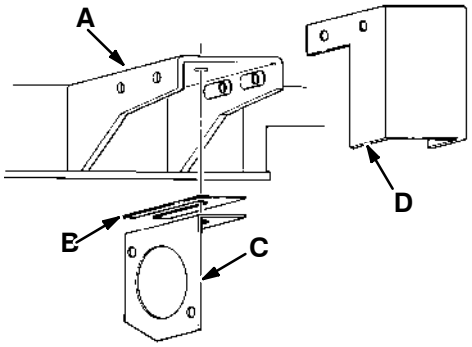
A. Operator Side
B. Rear Brush Marks
C. Front Brush Marks



00082

TAPERED BRUSH PATTERN

A. Operator Side
B. Rear Brush Marks
C. Front Brush Marks



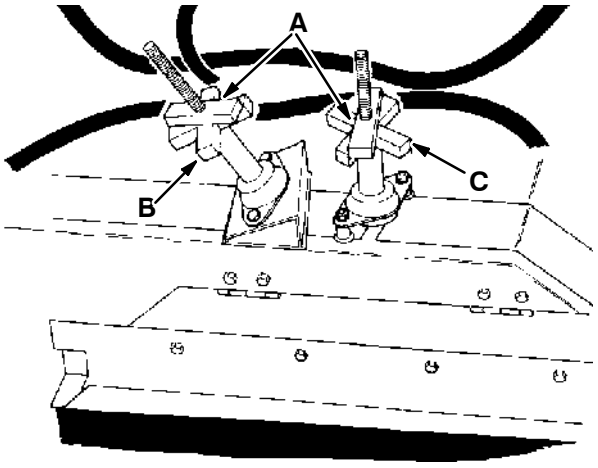
00284

BRUSH SHAFT MOUNTING

A. Scrub Head
B. Shim
C. Bearing Mounting Bracket
D. Bearing Protector

7. Recheck the brush polish marks to see if the front and rear match, and are even across the full length of the brush.

8. The width of the rear brush polish mark can vary more than the desired 2 to 3 in (50 to 75 mm). There are adjusting knobs located on the drive side of the scrub head. Turn the knob clockwise to decrease the width of the polish mark and counterclockwise to increase the width of the polish mark. The polish mark should not exceed 3 in (75 mm). Use the locking strips to keep the adjusting knobs in place.



BRUSH ADJUSTMENT KNOBS

A. Locking Strips
B. Front Brush Adjusting Knob
C. Rear Brush Adjusting Knob

9. For maximum brush life, rotate the brushes from front-to-rear after every 50 hours of operation.

SCRUB BRUSHES

The scrub brushes are tubular and run 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.

Rotate the scrub brushes from front-to-rear after every 50 hours of operation for maximum brush life and best scrubbing performance.

The scrub brush patterns should be checked daily. The width of the patterns should be 2 to 3 in (50 to 75 mm). The scrub brush pattern is adjusted by turning the adjustment knobs on top of the scrub head. See *TO ADJUST SCRUB BRUSH PATTERN*.

TO REPLACE SCRUB BRUSHES

1. Raise scrub head and set scrub head lock.

WARNING: Raised Scrub Head May Fall. Block Scrub Head Up.

2. Stop engine and set parking brake.

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

3. Open right side door on scrub head and use the chain to hold the door in the raised position.

4. Use wrench to remove hex head bolt attaching the brush arm.

NOTE: If arm does not come off easily, insert bolt in the adjacent threaded hole and screw in until arm comes off.

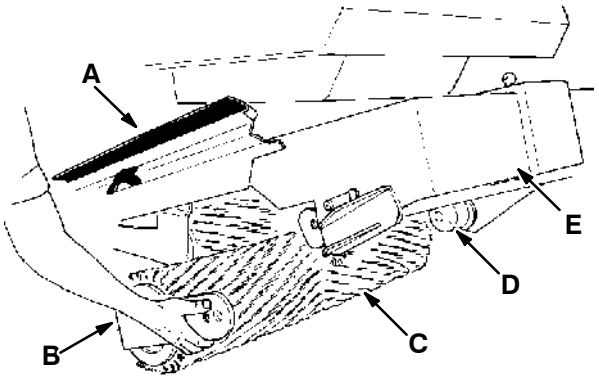
5. The brush arm and brush can then be pulled out.

6. Repeat steps 4 and 5 to remove other brush.

7. Insert one end of brush through access door and push the brush in until it touches the drive plug.

   It is helpful to have a second person guide the other brush end onto the drive plug while you are pushing and turning the brush until it engages the drive keyway on the plug.

8. Install the brush arm with the hex head bolt.



REPLACING BRUSH

A. Door
B. Brush Arm
C. Brush
D. Brush Drive Plug
E. Raised Scrubber Head

9. Repeat the steps 7 and 8 for the other brush.

10. Unhook the chain and lower the access door.

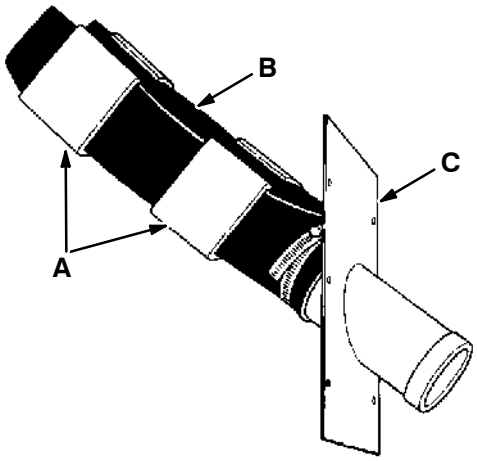
11. Release the scrub head lock before lowering the scrub head.

SOLUTION SYSTEM

SRS WATER SPRAY DEFLECTOR

The SRS solution tank has two spray deflectors; a lower spray deflector located on the rear squeegee discharge tube inside the tank, and a top spray deflector located in the top rear of the tank. The spray deflectors deflect the spray of water and small debris away from the walls of the solution tank. The deflectors should be checked for wear after every 200 hours of operations.

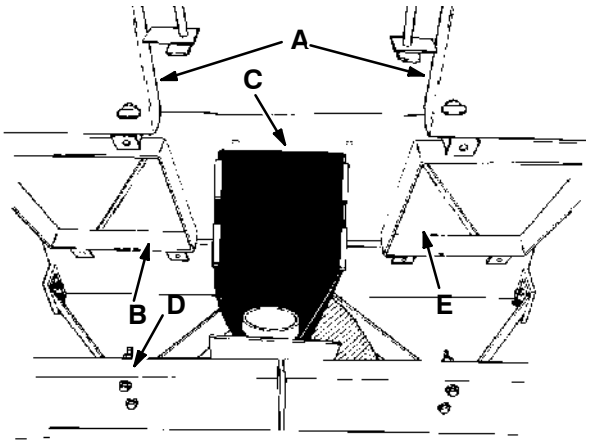
To check the lower spray deflector for wear, the rear squeegee discharge tube must be removed from the rear of the tank. Be sure to save the rubber seal washers which are located on the inside the tank. Inspect the spray deflector for wear. If replacement is necessary, install a new deflector into the spray deflector frames, and mount the deflector to the rear squeegee discharge tube. Reinstall the discharge tube into the rear of the tank. Use a new discharge tube gasket if the existing one is damaged.



00339

CORRECT POSITIONING OF LOWER SPRAY DEFLECTOR

A. Spray Deflector Frames
B. Spray Deflector
C. Rear Squeegee Discharge Tube

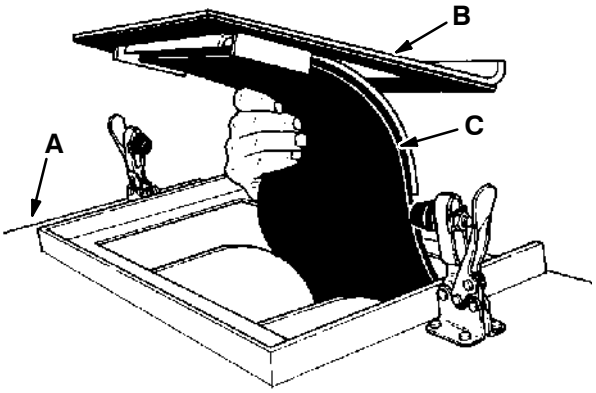


00353

INSTALLING LOWER SPRAY DEFLECTOR

A. Top Rear Clean-Out Doors
B. Bottom Clean-Out Door
C. Spray Deflector
D. Rear Bumper
E. Bottom Clean-Out Door

To check the top spray deflector for wear, remove the top access cover at the top rear of the solution tank. Inspect the deflector for wear. Remove the deflector if replacement is necessary. Replace the top access cover gasket if the gasket is damaged. To install the spray deflector back into the tank, slide the bottom of the deflector down the back of the tank. Then, with the top cover gasket in place on the solution tank, position the deflector to follow the curvature of the bottom of the access cover. Clamp the top access cover in place.



00346

INSTALLING TOP SPRAY DEFLECTOR

A. Solution Tank
B. Top Access Cover
C. Spray Deflector

Home Find... Go To..

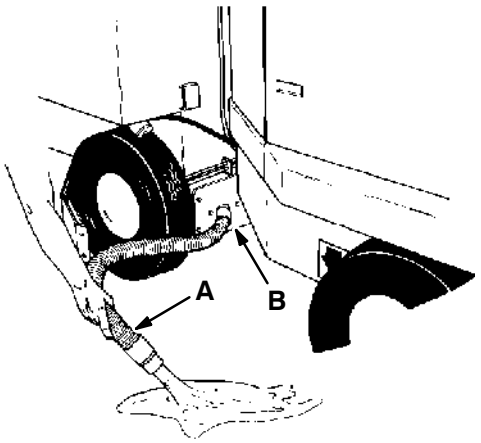
SRS SOLUTION TANK

The tank has a capacity of 510 gal (1930 L). When the tank is full, a ball float will rise and shut off the vacuum to the tank. A 72 in (1830 mm) long drain hose for the solution tank is located on the front of the tank. You can determine the water level in the tank by lowering the hose end until water appears–this will then be the water level in the tank, (engine must be off; this stops vacuum). To drain the tank, lower the hose and place in suitable floor drain.

Empty and clean the solution tank and flush the laminar tubes after every shift.

Partially fill the solution tank with clean water. Run the SRS pump for a few minutes to flush the solution hoses.

NOTE: The water must not be hotter than 130°F (54°C) or tank damage may occur.



00343

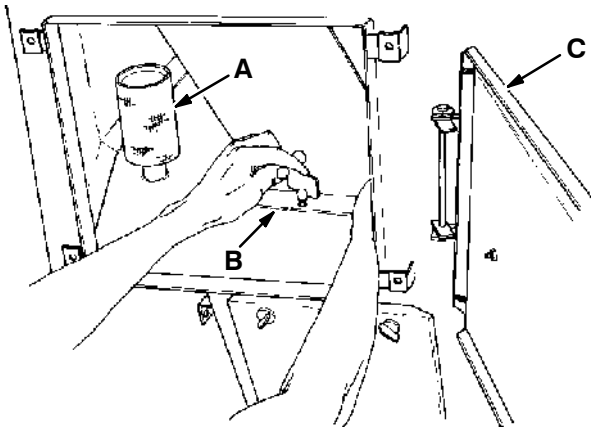
DRAINING SOLUTION TANK

A. Drain Hose
B. Clean-out Door

Six clean-out doors are provided on the tank: two at the front, two at the upper rear, and two at the lower rear of the tank. Using the sludge removal tool, remove all sand, sludge, debris, etc., from the tank. Remove the two large plugs above the tank tires near the upper front of the tank. Flush the sediment from all compartments of the tank and the wire mesh filters. Check for dirt buildup in the laminar flow tubes. To clean tubes, remove and flush. Also, check the return hoses and connections for clogging or damage.

NOTE: The clean-out door seal will leak if small particles of debris are caught between the door edge and rubber seal.

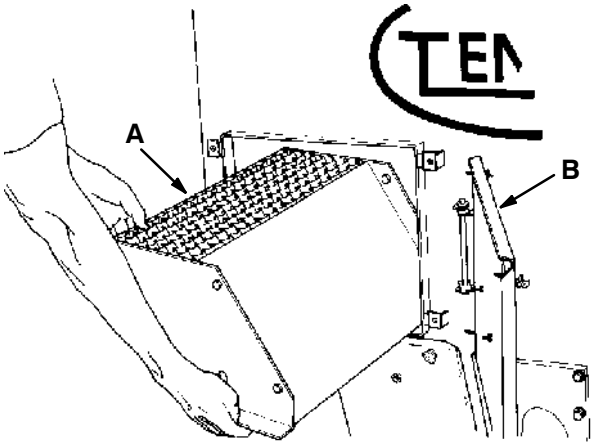
NOTE: When replacing the clean-out doors, the thumbscrews should be tightened to 20 - 50 in lb (2.26 - 5.65 Nm). Do not over-tighten. Too much torque on the thumbscrews will cause the clean-out doors to bow and cut the door seals.



00345

REMOVING LAMINAR TUBES

A. Solution Outlet Filter
B. Laminar Tube Set Fastener
C. Upper Rear Clean-Out Door



00342

REMOVING LAMINAR TUBES

A. Laminar Tube Set
B. Upper Rear Clean-Out Door

NOTE: Keep laminar tube sections facing the outside of the machine.

SRS METERING SOLUTION PUMP

A bellows pump meters cleaning solution into the recycling solution at rates of one-quarter, one-half and one percent. The cleaning solution is introduced to the recycling solution at a point just before the spray nozzle. Clean the metering pump daily when cleaning the solution tank.

TROUBLESHOOTING

Low Flow

1. Poppet valves dirty, dried cleaning solution residue on valves.
2. Restriction in cleaning solution lines.
3. Air leak at pump intake.
4. Defective wiring or motor.

Motor Fails to Turn On

1. Loose wiring connection.
2. Defective motor.

Motor Operates, But No Pump Discharge

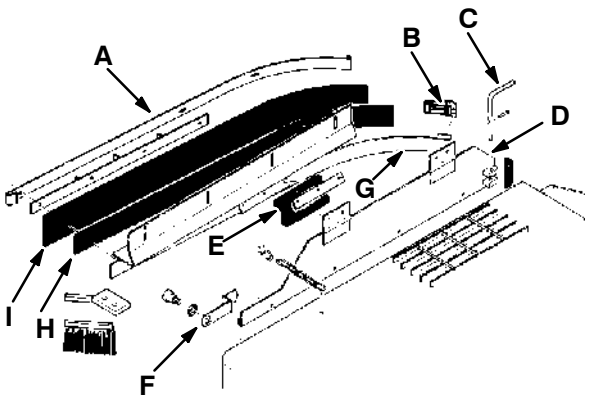
1. Damaged bellows.
2. Restriction in cleaning solution lines.
3. Air leak in intake line.
4. Unprimed pump.
    a. Remove pump inlet hose.
    b. Fill pump chamber with approximately one ounce SRS solution.
    c. Reinstall pump inlet hose.
    d. Pump should start metering tank solution after 3 to 4 minutes run time.

SQUEEGEES

SIDE SQUEEGEES

The side squeegees control scrub brush water spray. They consist of a squeegee blade, backup strip, band, and clamp. Check the side squeegee blades for damage or wear daily. Replace squeegee blade by opening the quick-release latch and removing the band. Remove the bracket, old blade, and backup strip. Replace the squeegee blade and backup strip if the blade is worn.

Adjust the squeegee clamp so that there is adequate pressure to hold the squeegee blade in place. The squeegee blade should be held so that it cannot be pulled from between the locating pins.



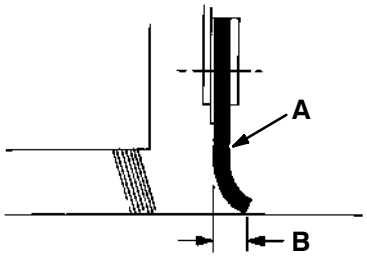
00302

SIDE SQUEEGEE ASSEMBLY

A. Retaining Band
B. Latch
C. Door Locking Pin
D. Door
E. Flap
F. Door Latch
G. Squeegee Frame
H. Backup Strip
I. Squeegee Blade

The side squeegee frame is attached to the squeegee door with four screws. The screw mounting holes are slotted, allowing vertical adjustment of the squeegee blade by simply loosening the screws and moving the squeegee up or down. Check the side squeegee blades adjustment daily.

Lower the head and adjust the squeegee so that the blade deflects 0.50 in (13 mm). The squeegee should deflect evenly across its entire length.



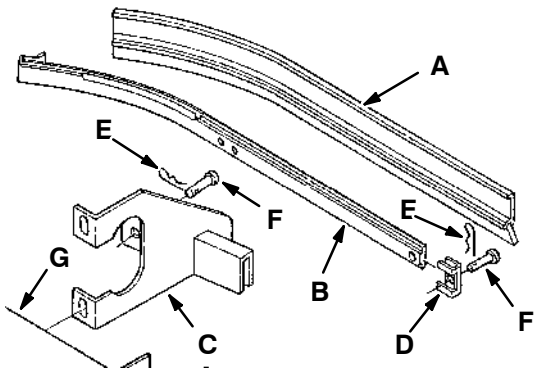
00289

SQUEEGEE BLADE DEFLECTION

A. Squeegee Blade
B. 0.50 in (13 mm) Deflection

SCRUB HEAD REAR SQUEEGEES

The scrub head rear squeegees control scrub brush water spray and channels water into the rear squeegee path. Check the squeegee blades for damage or wear daily. Replace the squeegee blade if it is worn by removing the cotter pin and clevis pin which hold the squeegee assembly to the mounting bracket. Then remove the cotter pin, clevis pin and retaining clip which holds the squeegee blade onto the squeegee frame.



06941

SCRUB HEAD REAR SQUEEGEES

A. Squeegee Blade
B. Squeegee Frame
C. Mounting Bracket
D. Retaining Clip
E. Cotter Pin
F. Clevis Pin
G. Scrub Head

The scrub head rear squeegee assemblies are each mounted to the scrub head with two screws. The mounting brackets have slots in them for vertical adjustment. Loosen the two screws and adjust the squeegee assemblies to get the proper deflection. Then tighten the screws. Check the squeegee blade adjustment daily.

REAR SQUEEGEE

The rear squeegee assembly channels water into the vacuum fan suction. When properly maintained, the squeegee should leave floors nearly dry. The assembly consists of a front and rear blade held in place by bands and clamps. Two back-up strips are used with the rear blade. Check the rear squeegee for damage or wear and adjustment daily.

The rear squeegee has been factory adjusted. The factory adjustments need to be done only after replacing a major component of the rear squeegee assembly. Regular squeegee adjustments are covered in *TO ADJUST REAR SQUEEGEE*.

TO REPLACE REAR SQUEEGEE BLADES

1. Stop the engine and set the parking brake.

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

2. Open the band clamp and remove all parts.

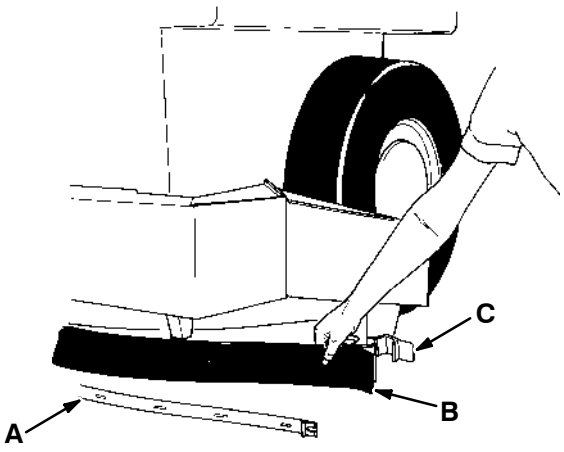
3. Place the new squeegee blade over the pins on the frame.

4. Next, fit the two back-up strips on the pins. Inner strip down, outer strip up.

5. Position the retaining band in place and engage the clamp.

6. The front blade is replaced in the same manner, except that backup strips are not used.

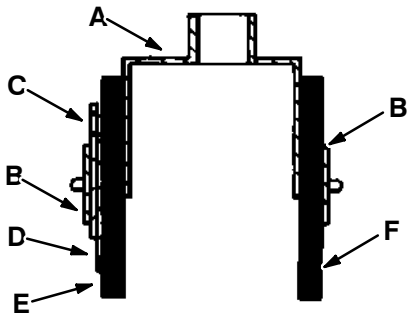
7. Adjust the squeegee clamp so that there is adequate pressure to hold the squeegees in place. The squeegee blades should be held so they cannot be pulled from between the locating pins. After proper adjustment is made, lock each adjusting screw with a jam nut.



00290

REAR SQUEEGEE

A. Band
B. Blade and Back-Up Strips on Pins
C. Clamp



00151

REAR SQUEEGEE CROSS-SECTION

A. Squeegee Frame
B. Band
C. Outer Back-Up Strip
D. Inner Back-Up Strip
E. Rear Blade
F. Front Blade

NOTE: Install back-up strips with outer strip up, inner strip down.

Home Find... Go To..

TO FACTORY ADJUST REAR SQUEEGEE

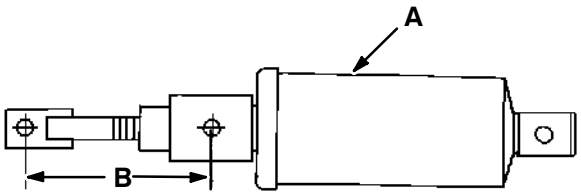
NOTE: The solution tank must be full, and the tires must be correctly inflated to properly adjust the rear squeegee.

1. LINKAGE PIVOTS

   Check the squeegee linkage pivot points and, if necessary, tighten the locknuts on each bearing joint in the linkage. Tighten each locknut until the joint is just short of locking up. The linkage must be snug, but still free enough to rotate the linkage by hand.

2. SQUEEGEE LIFT CYLINDER

   The squeegee lift cylinder rod end should be adjusted so there is 6.00 ± 0.12 in (150 ± 3 mm) between the cylinder rod hole and the rod end hole.



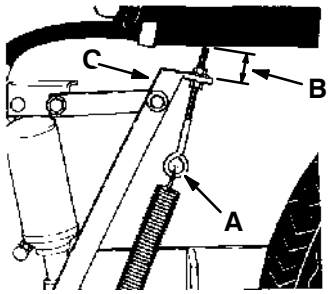
01725

SQUEEGEE LIFT CYLINDER

A. Cylinder
B. 6.00 ± 0.12 in (150 ± 3 mm)

3. EYEBOLTS

   The eyebolts should be adjusted so there is 1.38 ± 0.12 in (35 ± 3 mm) between the end of the eyebolt and the top of the arm on each side of the squeegee.



01726

EYEBOLT

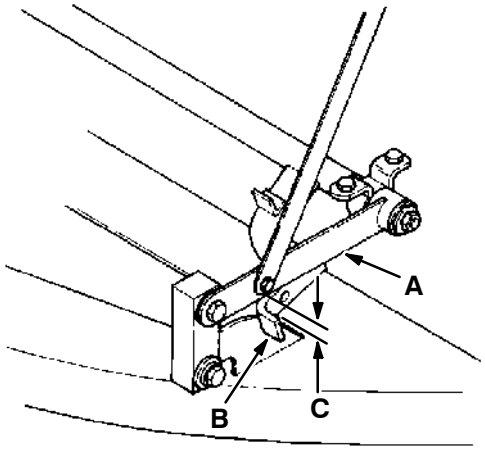
A. Eyebolt
B. 1.38 ± 0.12 in (35 ± 3 mm)
C. Arm

4. CASTERS

   The caster should be in good condition and be free to spin. The center caster should be 0.25 ± 0.06 in (6 ± 2 mm) off the floor with the squeegee blade perpendicular to the floor. The tip casters should touch the floor with the squeegee blade perpendicular to the floor.

5. ARM CLEARANCE

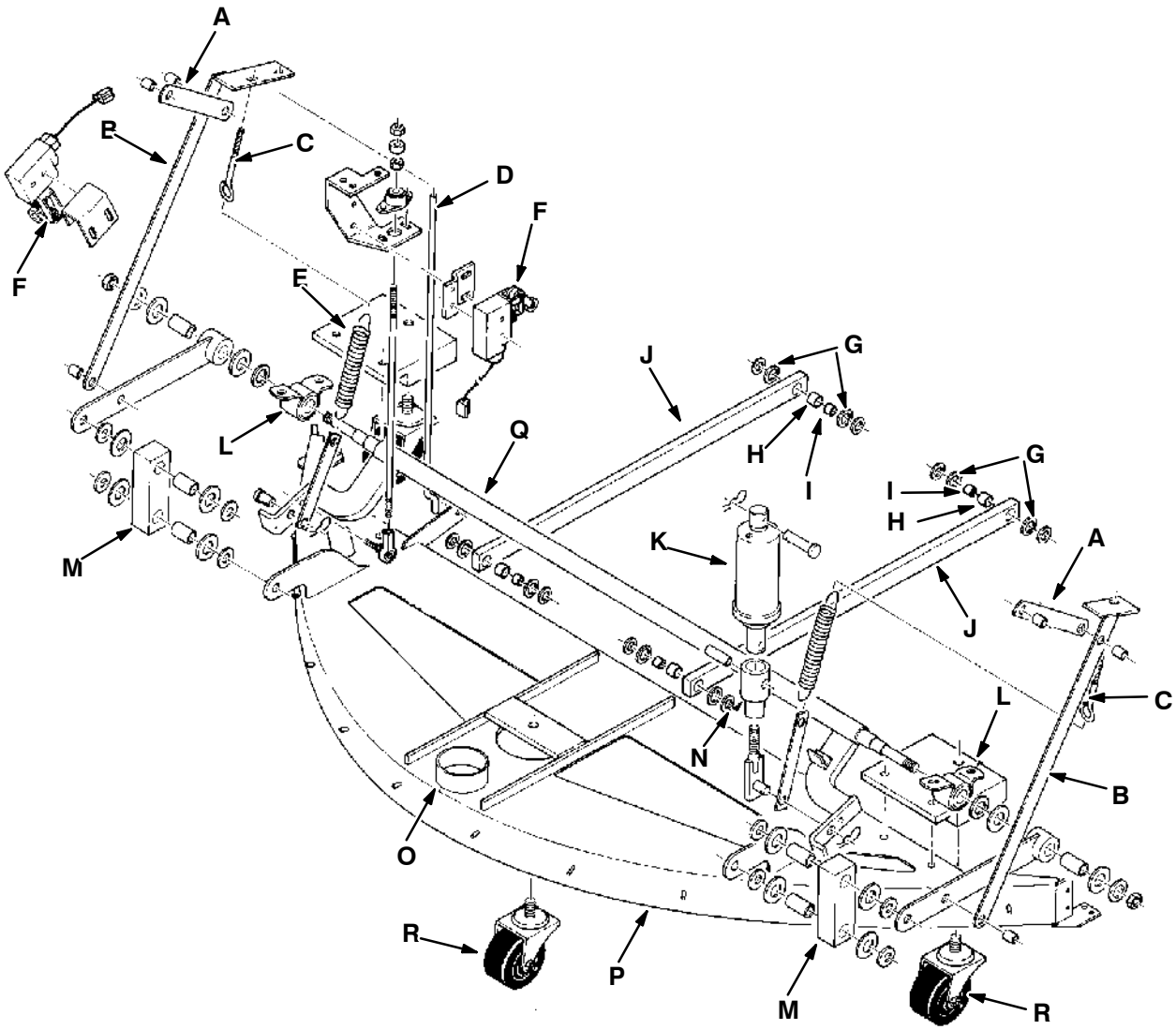
   The distance between the arm assembly and the squeegee lift shaft arm should be 1 to 1.25 in (25 to 30 mm) with the squeegee blade down and perpendicular to the floor.



01728

ARM CLEARANCE

A. Arm Assembly
B. Squeegee Lift Shaft Arm
C. 1 to 1.25 in (25 to 30 mm)

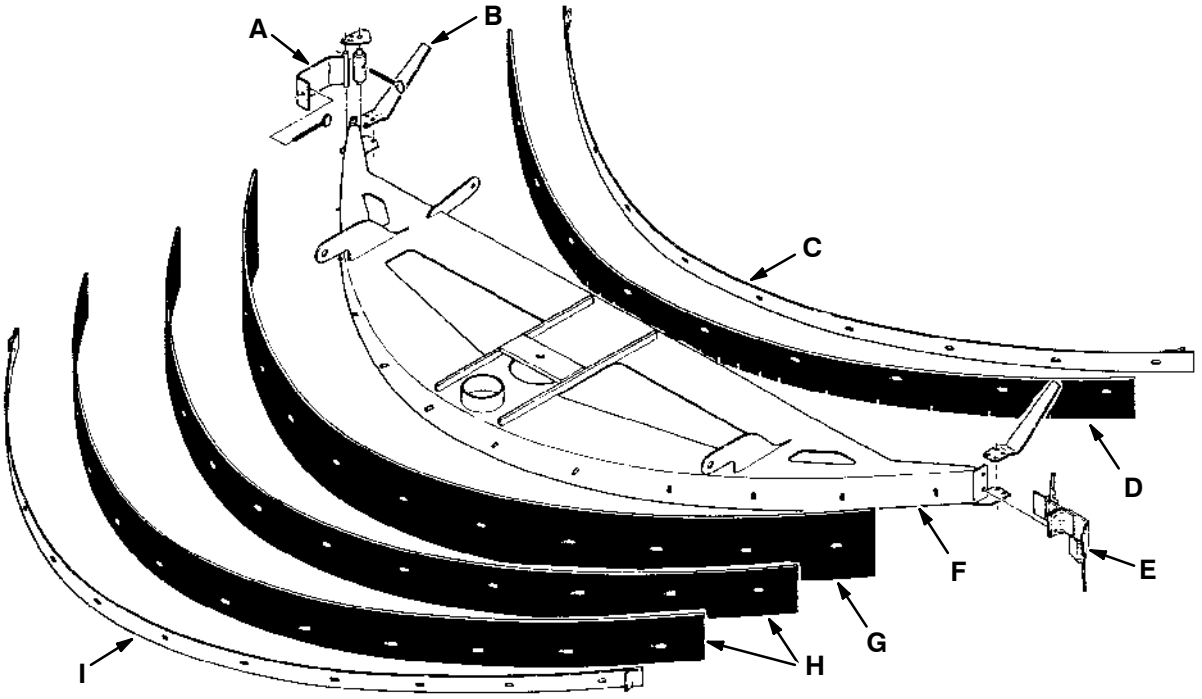


00191

REAR SQUEEGEE LINKAGE

A. Link
B. Arm
C. Eyebolt
D. Squeegee Tip Lift Rod
E. Down Pressure Spring
F. Roller Switch
G. Fiberglide Washer
H. Bearing
I. Sleeve
J. Front Drag Link
K. Squeegee Lift Cylinder
L. Bearing
M. Block Link
N. Cylinder Rod End
O. Vacuum Hose Connection
P. Squeegee Frame
Q. Lift Shaft
R. Caster

Home Find... Go To..



00196

REAR SQUEEGEE

A. Adjuster
B. Spring Guide
C. Front Band
D. Front Blade
E. Band Clamp
F. Frame
G. Rear Blade
H. Back-Up Strip
I. Band

TO ADJUST REAR SQUEEGEE

1. Lower the rear squeegee and drive the machine slowly forward to observe the squeegee roll-out. Adjust the squeegee roller height adjustment stud or add or remove washers from the caster to get an even roll-out. The top nut acts as a locknut. The nut just under the squeegee frame is the adjusting nut. Loosen the locking nut and turn the adjusting nut clockwise to increase down pressure, or counterclockwise to decrease pressure. Tighten the locknut after adjusting the adjusting nut.

2. Lower the rear squeegee and drive the machine slowly forward to observe the tips of the squeegee.

   a. If both tips are too low, tighten both eyebolts which increases the down pressure on the back side of the squeegee frame to lift both tips.

   b. If both tips are too high, loosen both eyebolts which decreases the down pressure on the back side of the squeegee frame to lower both tips.

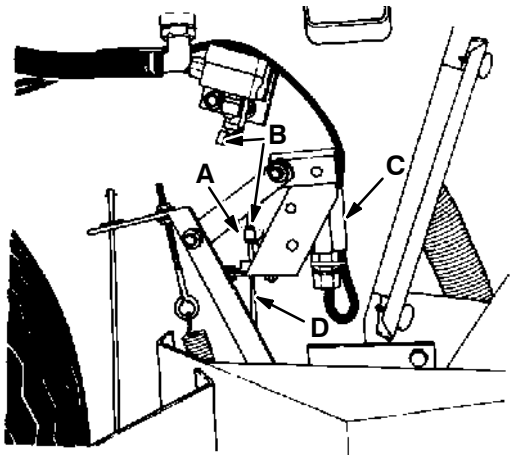
   c. If just one tip is too low, loosen the eyebolt on the side that is too low. If the tip is still too low, tighten the eyebolt on the opposite side.

   d. If just one tip is too high, tighten the eyebolt on the side that is too high. If the tip is still too high, loosen the eyebolt on the opposite side.

NOTE: The number of washers on the squeegee tip casters may need to be changed to properly adjust the squeegee tips.

3. After the tips are adjusted, make sure the eyebolt adjustments are locked in place. The center of the squeegee may have to be readjusted to get an even roll-out across the squeegee. If the squeegee roll-out is set too small, the squeegee will skip when traveling on a uneven floor.

4. Lower the rear squeegee. The lower squeegee switch roller should be in line and tripped by the top of the trip barrel. Adjust the trip barrel position on the threaded rod to adjust.

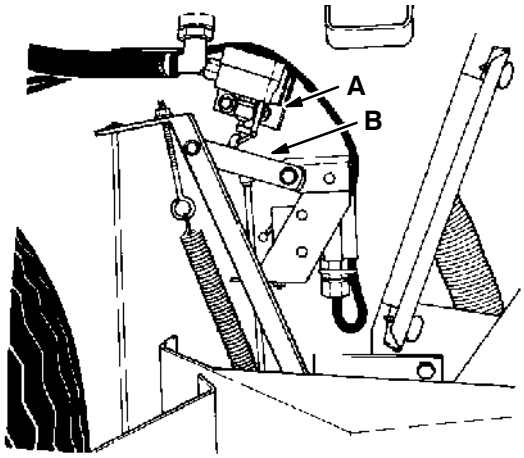


02357

LOWERED SQUEEGEE

A. Trip Barrel
B. Switch Roller
C. Lower Switch
D. Threaded Rod

Raise the rear squeegee. The upper squeegee switch roller should be tripped by the squeegee link. The lower squeegee switch roller should be free standing.



02358

RAISED SQUEEGEE

A. Upper Switch
B. Link

After both switches are properly adjusted with the engine operating, put the instrument panel squeegee switch in the “Down” position. The squeegee should lower. Press the directional pedal into the “reverse” direction. The squeegee should rise as soon as the machine moves backward. Press the directional pedal into the “forward” direction. The squeegee should lower.

Home Find... Go To..

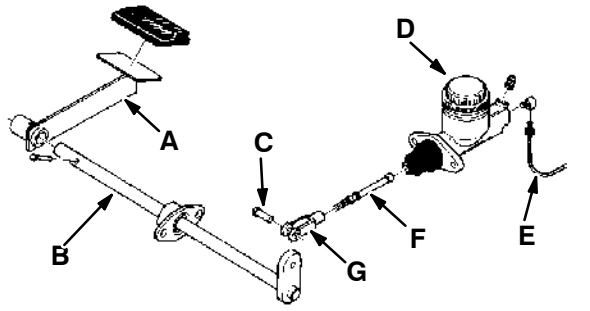
BRAKES AND TIRES

SERVICE BRAKES

The service brakes are hydraulically activated by a master brake cylinder.

Check the master brake cylinder fluid level after every 400 hours of operation and add brake fluid as needed. The master brake cylinder is located at the front of the machine. Open the front compartment door for access to the master cylinder.

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



00105

BRAKE SYSTEM COMPONENTS

A. Brake Pedal
B. Shaft
C. Pin
D. Master Brake Cylinder
E. Brake Line
F. Push Rod
G. Clevis

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

Whenever handling brake fluid, do not get any on the brake pads, brake discs, calipers, or body paint. Brake pads will be permanently damaged, requiring replacement. Body paint can be damaged also unless you wipe the area with a clean cloth and wash it with a soapy solution immediately.

1. Make sure that the brake fluid reservoir is full and that the vent in the cap is open.
2. Connect a plastic or rubber tube to the bleeder valve on the left front wheel. Suspend the other end of the tube in a jar or bottle filled with a few inches of brake fluid. During the remaining steps, keep this end submerged at all times and never let the level in the brake fluid reservoir drop below one half full.
3. Open the bleeder valve and plug on the left front wheel about one turn. Have an assistant press the brake pedal slowly to the floor. As soon as the pedal is all the way down, close the bleeder valve and let the pedal up. Repeat this step as many times as necessary, until fluid with no air bubbles exits from the tube.
4. Bleed the right front wheel in the same manner as described in the steps above. Keep checking the brake fluid reservoir to be sure it doesn't run out of fluid.
5. When all wheels are bled, discard the brake fluid in the jar or bottle; never reuse such fluid.
6. Top up the brake fluid reservoir with clean fluid.

PARKING BRAKES

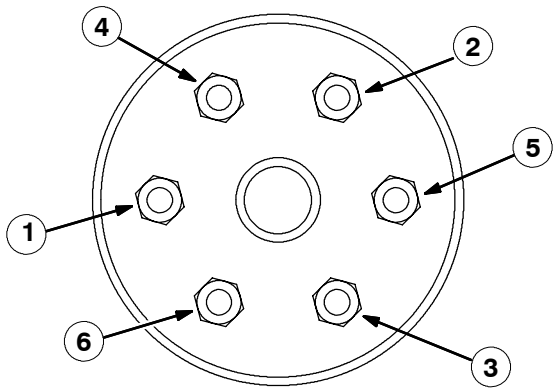
The parking brakes are mechanically activated by the parking brake lever and two cables.

The parking brake cables should be adjusted after every 200 hours of operation or whenever the machine rolls after setting the parking brake or when it becomes very easy to set the parking brake. To adjust the brake cables, turn the knurled knob on the end of the parking brake clockwise. Tighten the brake cable enough to make the parking brake slightly resist being set.

TIRES

The machine is equipped with four pneumatic tires. The air pressure in these tires is critical to machine performance. Check the tire pressure daily. The correct tire pressures are: 60 psi (415 kPa) front, 70 psi (485 kPa) rear.

Tighten the wheel lug nuts in the pattern shown, after every 200 hours of operation. Tighten lug nuts 85 to 95 ft lb (115 to 130 Nm).



OPTIONS

DRAIN PUMP

The drain pump option requires some periodic maintenance to keep it operating properly. Refer to the drain pump manufacturer's manual for the maintenance of the pump.

SECTION 4

CONTENTS

	Page
HARDWARE INFORMATION	4-3
STANDARD BOLT TORQUE CHART	4-3
METRIC BOLT TORQUE CHART	4-3
BOLT IDENTIFICATION	4-3
THREAD SEALANT AND LOCKING COMPOUNDS	4-3
HYDRAULIC FITTING INFORMATION	4-4
HYDRAULIC TAPERED PIPE FITTING (NPT) TORQUE CHART	4-4
HYDRAULIC TAPERED SEAT FITTING (JIC) TORQUE CHART	4-4
HYDRAULIC O-RING FITTING TORQUE CHART	4-4

HARDWARE INFORMATION

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

STANDARD BOLT TORQUE CHART

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

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

METRIC BOLT TORQUE CHART

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

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

Exceptions to the above chart:

Check the machine for exceptions!

BOLT IDENTIFICATION

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

01395

THREAD SEALANT AND LOCKING COMPOUNDS

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

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

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

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

HYDRAULIC FITTING INFORMATION

HYDRAULIC TAPERED PIPE FITTING (NPT) TORQUE CHART

NOTE: Ratings listed are when using teflon thread seal.

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

HYDRAULIC TAPERED SEAT FITTING (JIC) TORQUE CHART

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

HYDRAULIC O-RING FITTING TORQUE CHART

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

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

*Aluminum bodied components