

MM 115

5-89



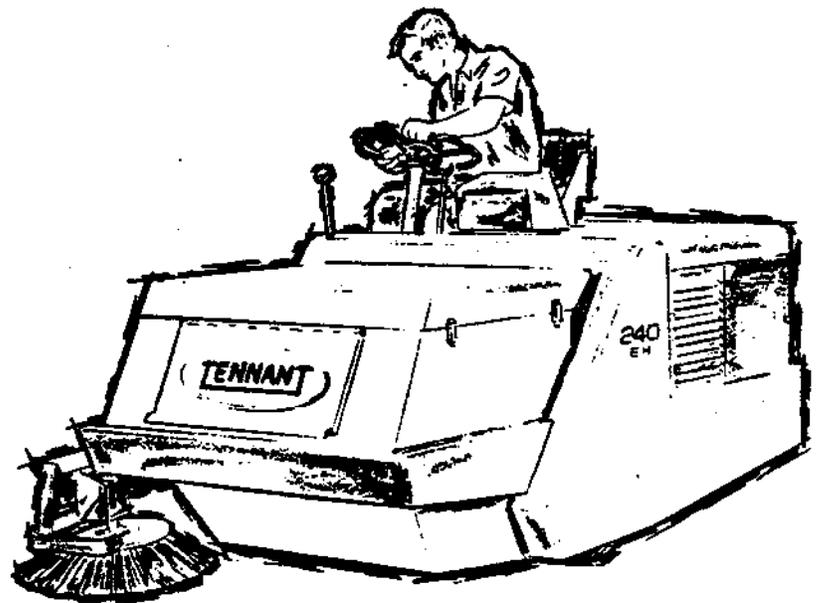
240EH

POWER SWEEPER

Includes High Dump Model

Operation, Maintenance, and Parts Manual

FIRST SERIAL NUMBER 2345





240EH

POWER SWEEPER

This manual is furnished with each new TENNANT® Model 240EH. The machine operators will easily learn how to operate the machine and understand its mechanical functions by following the directions and absorbing the information in the Operation section.

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

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

Parts and supplies may be ordered by phone or mail from any Tennant Company parts and service center, distributor, or from any of the Tennant Company subsidiaries.

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

MANUAL NO. MM115
Published: 5-89

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TENNANT COMPANY LIMITED WARRANTY

NEW MACHINES

Tennant Company warrants to the original purchaser for the period stated below that goods manufactured by it will be free from defects of workmanship and material, provided such goods are installed, operated, and maintained in accordance with Tennant Company's written manuals or other instructions. No warranty is made with respect to items supplied by Tennant Company on special order of purchaser. Tennant Company's sole obligation under this Warranty will be to repair and replace, at Tennant Company's option, parts that do not conform to this Warranty.

SIX-MONTH LABOR COVERAGE (U.S.A. AND CANADA ONLY)

For six (6) months in the U.S.A. or Canada, thirty (30) days elsewhere, from date of installation, Tennant Company will, at its option, provide labor for repair, pay for outside repair service, or pay the customer straight time in accordance with Tennant Company's flat rate schedule for particular warranty repairs. After six (6) months, Tennant Company's sole obligation shall be limited to the repair or replacement, at Tennant Company's option, of parts that do not conform to this Warranty according to the schedule below.

BATTERIES AND TIRES

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

BRUSHES

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

MACHINE WARRANTY PERIOD

Tennant Company warrants its equipment for a set number of months or for a set number of hours of use, whichever comes first. The warranty periods and hours of use vary depending upon the machine model. The warranty periods for Tennant Company's various machines are:

SCARIFIERS

Machine Model	Warranty Period	Machine Model	Warranty Period
G	12 months/500 hours	L2	12 months/500 hours
K4	12 months/500 hours	RS/TLR	12 months/500 hours
KDC	12 months/500 hours		

SCRUBBERS

Machine Model	Warranty Period	Machine Model	Warranty Period
426	12 months/500 hours	530E	18 months/2000 hours
432	12 months/500 hours	(except Duramer™ solution and recovery tanks 5 years/5000 hours)	
527-II	12 months/1500 hours	550	12 months/1500 hours
	(except engine and hydraulics— 24 months/2000 hours)	550E	12 months/1500 hours

SWEEPERS

Machine Model	Warranty Period	Machine Model	Warranty Period
140	12 months/500 hours	240EH SE	24 months/1750 hours
186	18 months/500 hours	255	18 months/1500 hours
215	18 months/750 hours	275/275SE	24 months/2000 hours
235	24 months/1250 hours	365	24 months/2000 hours
	(except Duramer™ hopper 5 years/5000 hours)	92 GR	12 months/1500 hours
240	12 months/1500 hours	95	24 months/2000 hours
		717	24 months/2000 hours

RECONDITIONED MACHINES

Tennant Company warrants to the purchaser of reconditioned equipment, purchased from Tennant Company, for the period of ninety (90) days from the date of delivery that the purchased equipment will be free from defects of workmanship and material, provided such equipment is operated and maintained according to Tennant Company written manuals or instructions. Tennant Company's sole obligation under this Warranty will be to repair and replace, at Tennant Company's option, parts that do not conform to this Warranty.

No warranty of any kind is extended to equipment that is sold for salvage.

LABOR COVERAGE

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

REPAIR PARTS

Repair parts supplied by Tennant Company are warranted against defects for the period stated below. Tennant Company's obligation is limited to the replacement of the warranted part, and Tennant Company shall not be obligated to provide labor (except certain engines also stated below) in installing such part.

ENGINES, SHORT BLOCKS, AND LONG BLOCKS

Manufacturer	Warranty Period	Manufacturer	Warranty Period
Continental	1 year or 1500 hours parts & labor	Perkins	1 year or 1500 hours parts & labor
Kohler	1 year or 1500 hours parts & labor (except Kohler Model K181S -500 hours)	Kubota	1 year or 1500 hours parts & labor
Briggs & Stratton	90 days or 200 hours parts & labor	Wisconsin	1 year or 500 hours parts & labor
Onan	1 year or 1500 hours parts & labor	Ford	1 year or 1500 hours parts only

- Engine part replacements such as water pumps, carburetors, and alternators are warranted for thirty (30) days parts only, no labor.
- Labor is to include only the time it takes to repair an engine. It does not include removal and replacement nor does it include travel time.

MAJOR HYDRAULIC COMPONENTS (PUMPS, MOTORS, CYLINDERS, AND CONTROL VALVES)

Manufacturer	Warranty Period	Manufacturer	Warranty Period
Cessna	1 year parts only	Oilgear	1 year parts only
Char-Lynn	1 year parts only	Gresen	90 days parts only
Victor (Dukes)	1 year parts only	MTE	90 days parts only
Ross	1 year parts only	Barnes	90 days parts only
Vickers	1 year parts only		

- All seal kits and replacement parts are warranted for thirty (30) days parts only.

MAJOR ELECTRIC MOTORS

Manufacturer	Warranty Period	Manufacturer	Warranty Period
Baldor	1 year parts only	Ohio Electric	1 year parts only
General Electric	1 year parts only	HK Porter	1 year parts only

All other repair parts are warranted for thirty (30) days only.

SERVICE LABOR

Labor performed by a Tennant Company service representative shall be warranted for thirty (30) days from the date the repairs are completed. This policy does not cover work performed by any service company, other than Tennant Company, and is restricted to the specific repair operation or component for which a claim is made.

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

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

SAFETY PRECAUTIONS

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

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

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

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

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

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

The following information signals potentially dangerous conditions to the operator or equipment. Read this manual carefully. Know when these conditions can exist. Then, take necessary steps to train machine operating personnel.

▲ WARNING Lead acid batteries emit a highly explosive hydrogen gas that can be ignited by electrical arcing or by smoking.

▲ CAUTION Avoid moving parts of the unit. Loose jackets, shirts or sleeves should not be permitted when working on machine because of the danger of becoming caught in moving parts. Make sure all nuts and bolts are secure. Keep shields and guards in position. If adjustments must be made while the unit is running, use extreme caution around moving parts, V-belts, etc.

▲ WARNING Lock scrubbing head in UP position using Safety Lock before working under head. See instructions on lock.

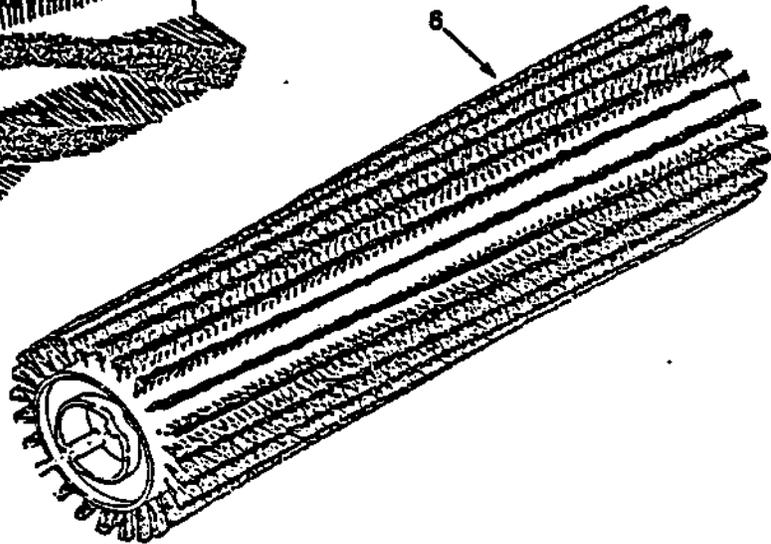
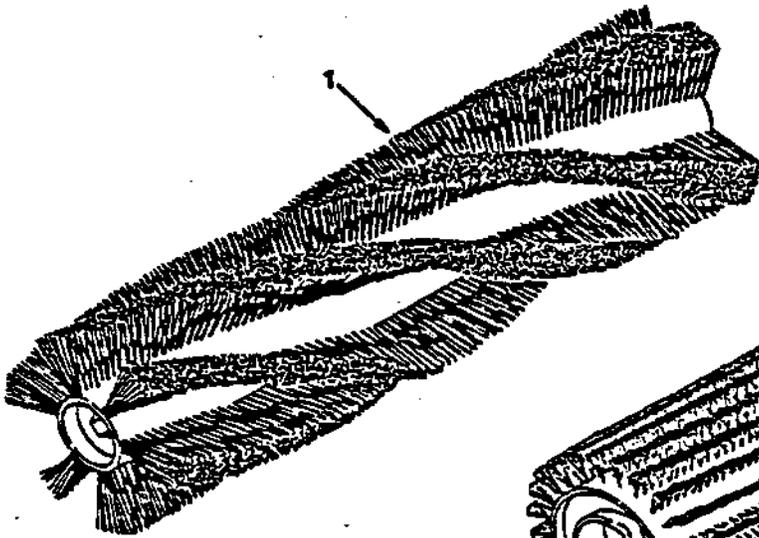
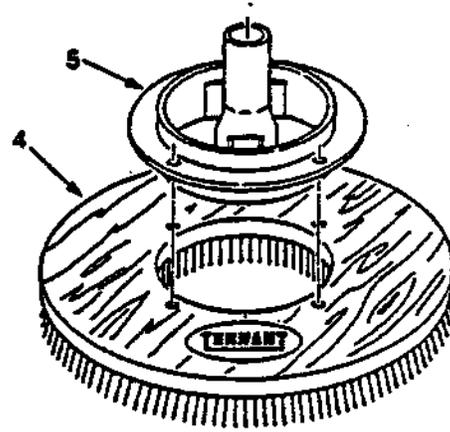
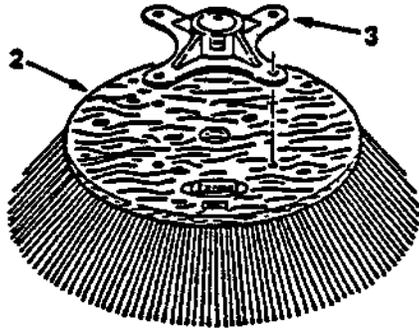
▲ CAUTION Disconnect positive battery terminal before removing instrument panel.

▲ CAUTION Do not start machine unless you are in driver's seat, with foot on brake pedal, or hand brake engaged, and directional pedal in neutral position.

▲ CAUTION Remember that the machine is steered by means of the rear wheel, and is very responsive. Take time to become familiar with this type of steering system.

▲ CAUTION Reduce machine speed when scrubbing on wet, slippery floors.

▲ CAUTION Reduce speed when driving Hi-dump machine on a ramp.



Replacement Brushes

Replacement Brushes

02794

Key	Tennant Part No.	Machine Serial Number	Description	Qty
1	24741	(000000-)	Main Brush, Snow	1
1	53063	(000000-)	Main Brush, 24 Row Wire and Fiber	1
1	53065	(000000-)	Main Brush, 8 Row Wire	1
1	53067	(000000-)	Main Brush, 8 Row Wire and Fiber	1
1	53068	(000000-)	Main Brush, 8 Row Nylon	1
1	53069	(000000-)	Main Brush, 5 Row Nylon	1
1	53070	(000000-)	Main Brush, 24 Row Nylon	1
1	53221	(000000-)	Main Brush, 8 Row Wire and Fiber	1
1	53231	(000000-)	Main Brush, 8 Row Polypropylene	1
	43708P	(000000-)	Side Brush Assembly, Polypropylene	1
2	09600P	(000000-)	Side Brush, Polypropylene	1
3	47501	(000000-)	Hub, Brush Adaptor	1
	43708N	(000000-)	Side Brush Assembly, Nylon	1
	09600N	(000000-)	Side Brush, Nylon	1
	47501	(000000-)	Hub, Brush Adaptor	1
	43708K	(000000-)	Side Brush Assembly, Flat Wire	1
	10712K	(000000-)	Side Brush, Flat Wire	1
	47501	(000000-)	Hub, Brush Adaptor	1
	46857	(000000-)	Side Brush Assembly, Scrub, Polypropylene	1
4	43148	(000000-)	Side Brush, Scrub, Polypropylene	1
5	43554	(000000-)	U-Joint, Side Brush Drive	1
	46858	(000000-)	Side Brush Assembly, Scrub, Polypropylene	1
	43593	(000000-)	Side Brush, Scrub, Polypropylene	1
	43554	(000000-)	U-Joint, Side Brush Drive	1
	46859	(000000-)	Side Brush Assembly, Scrub, Stainless Steel	1
	43417	(000000-)	Side Brush, Scrub, Stainless Steel	1
	43554	(000000-)	U-Joint, Side Brush Drive	1
6	43424	(000000-)	Scrub Brush, 24 Row Polypropylene	1
6	43428	(000000-)	Scrub Brush, 20 Row Stainless Steel	1
6	43592	(000000-)	Scrub Brush, 24 Row Polypropylene	1
6	43680	(000000-)	Scrub Brush, 24 Row Abrasive	1

RECOMMENDED GENERAL MAINTENANCE ITEMS

01963

KEY	TENNANT® PART NO.	MACHINE SERIAL NUMBER	DESCRIPTION	QTY.
	59465	(0000002345-	) REPLACEMENT PARTS PACKAGE, Low dump	1
	SK1511	(0000002345-	) REPLACEMENT KIT, Fusible link	1
	23275	(0000002345-	) SKIRT, Shroud	2
	23267	(0000002345-	) SKIRT, Rear	1
	23445-2	(0000002345-	) V-BELT, Set of 2	1
	44239-2	(0000002345-	) V-BELT, Set of 2	1
	50514	(0000002345-	) V-BELT, Powerband	1
	24662	(0000002345-	) V-BELT	1
	48060	(0000002345-	) LIP, Rubber	5
	23388	(0000002345-	) SEAL, Top pan	1
	23382	(0000002345-	) SEAL, Side pan	2
	67718-2	(0000002345-	) ELEMENT, Oil filter	1
	59467	(0000002345-	) REPLACEMENT PARTS PACKAGE, High dump	1
	SK1511	(0000002345-	) REPLACEMENT KIT, Fusible link	1
	23275	(0000002345-	) SKIRT, Shroud	2
	23267	(0000002345-	) SKIRT, Rear	1
	23445-2	(0000002345-	) V-BELT, Set of 2	1
	44239-2	(0000002345-	) V-BELT, Set of 2	1
	50514	(0000002345-	) V-BELT, Powerband	1
	24622	(0000002345-	) V-BELT	1
	35607	(0000002345-	) LIP ASSEMBLY	5
	23388	(0000002345-	) SEAL, Top pan	1
	37021	(0000002345-	) LIP, Side	1
	67718-2	(0000002345-	) ELEMENT, Oil filter	1
	23382	(0000002345-	) SEAL, Side pan	2

KEY	TENNANT® PART NO.	SCRUB ATTACHMENT SERIAL NUMBER	DESCRIPTION	QTY.
	59472	(-)	REPLACEMENT PARTS PACKAGE, Scrubber	1
	60014	(-)	BLADE, Squeegee, rear	2
	43324	(-)	BLADE, Back up, neoprene	1
	60013	(-)	BLADE, Squeegee, side	2
	43322	(-)	BLADE, Front, rubber	2

GENERAL INFORMATION

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**TENNANT COMPANY, TENNANT COMPANY
SUBSIDIARIES, AND MAJOR PARTS
AND SERVICE LOCATIONS DIRECTORY**

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SPECIFICATIONS

SPECIFICATIONS FOR STANDARD SWEEPER OR SCRUBBER

Sweeping Path (including side brush)	53 " (1,346 mm)
Sweeping Path (without side brush)	42" (1,067 mm)
Space Required for U-Turn (left)	102" (2,590 mm)
Space Required for U-Turn (right)	158" (4,013 mm)
Overall Length	86.5" (2,197 mm)
Overall Width	56.75" (1,441 mm)
Overall Height	50.75" (1,289 mm)
Machine Weight (No operator, empty hopper)	
Scrubber with batteries	4070 lbs (1845 kg)
Sweeper with batteries	3580 lbs (1623 kg)

SPECIFICATIONS FOR HI-DUMP MODEL

Sweeping Path (including side brush)	53" (1,346 mm)
Sweeping Path (without side brush)	42" (1,067 mm)
Space Required for U-Turn (left)	106" (2,692 mm)
Space Required for U-Turn (right)	158" (4,013 mm)
Overall Length	93" (2,362 mm)
Overall Width	57.75" (1,467 mm)
Overall Height	50.75" (1,289 mm)
Machine Weight (No operator, empty hopper)	4205 lbs (1906 kg)

GENERAL SPECIFICATIONS FOR STANDARD OR HI-DUMP MODELS

Machine Speed	0 to 5 mph (8 km/hr), infinitely variable
Battery Weight (total for 2 batteries) Exide 600 AH . . .	1550 lbs (703 kg)
Standard battery dimensions	19.38" long, 15.75" wide, 23.25" high (492 x 400 x 590 mm)
Battery, Standard	18 Volt, 600 amp-hours @ 6 hr. rt.
Electric Drive Motor	36-Volt, 2300 RPM, continuous duty. Open type - 7 hp, totally enclosed type 4 hp.
Propelling Drive	Variable volume hydraulic pump, belt driven from DC electric motor, and single rear wheel drive with fixed displacement, wheel-mounted hydraulic motor connected to pump by flexible hoses. Foot pedal con- nected to variable volume pump to control pump stroke and provide in- finitely variable speed.
Main Brush (length)	42" (1067 mm)
(diameter)	14" (355 mm)
(RPM)	380
(drive)	Belt drive from electric motor
Side Brush (diameter)	21" (533 mm)
(RPM)	100
(drive)	Hydraulic drive motor
Hopper	14 cu. ft. (0.4 m ³)
Filter Area	71 sq. ft. (6.6 m ²)
Fan (diameter)	9" (228 mm)
(RPM)	4500
(CFM)	350 maximum
Tire (rear)	16.25 x 6 x 11.25", Solid Type
(front)	16 x 3.50 x 12.13", Solid Type
Hydraulic Tank Capacity	5 gallons (18.9 liters)
Hydraulic System Capacity	6-1/2 gallons (24.6 liters)

ATTENTION!

If batteries are obtained from a supplier other than those listed in this manual, the batteries must meet these specifications.

UL BATTERY REQUIREMENTS FOR THE TYPE "E" MACHINE

Battery Enclosure:

1. The battery shall be provided with support and protection by means of a non-combustible enclosure which, if of metal, shall be no less than 0.053 in (1.35 mm) thick (No. 16MSG), and either shall be flanged not less than 0.50 in (12.7 mm) on all sides, or shall be provided with a construction that gives equivalent strength. A cover shall remain closed by the force of gravity, or shall be provided with a fastener.

Battery:

2. A battery furnished with a noncombustible tray and cover intended to form the ultimate enclosure for the battery shall comply with the requirements in paragraph 1.
3. The battery enclosure shall be ventilated so as to minimize the possibility of accumulation of explosive hydrogen-air mixtures above the battery.
4. Cells employing metal containers such as alkaline batteries, shall be insulated from one another and from a metal tray or metal battery compartment. Insulation of wood or other material shall be: treated or painted to minimize deterioration by the battery electrolyte, and constructed to minimize the risk of damage to the insulation in the normal operation and maintenance of the cleaning machine.
5. The connections shall be such that the potential between any two adjacent cells cannot be more than 24 Volts (nominal).
6. Means shall be provided as a part of the cleaning machine to restrain the battery from moving more than a total of 0.50 inch (12.7 mm) in a horizontal direction.
7. A battery for use with a Type E cleaning machine shall be marked with the battery nominal voltage, ampere-hour capacity, battery manufacturer's name, and the catalog designation or equivalent identification.

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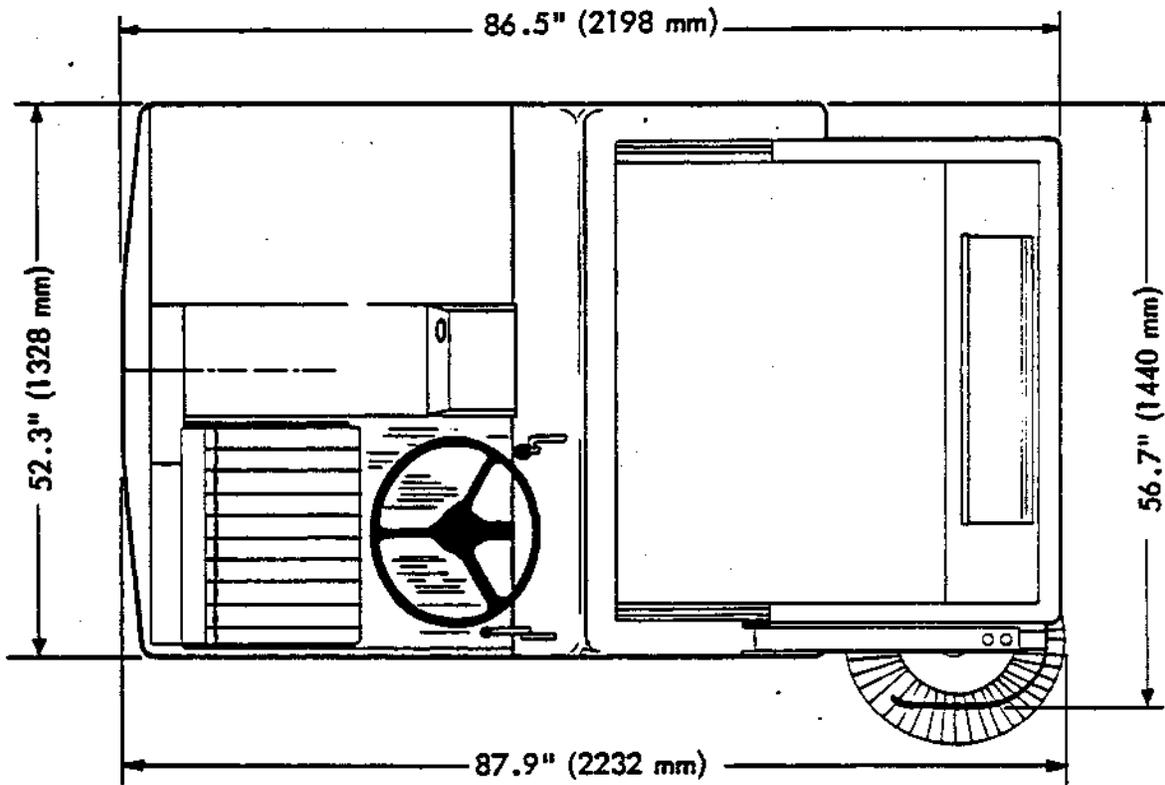
If batteries are obtained from a supplier other than those listed in this manual, the batteries must meet these specifications.

UL BATTERY REQUIREMENTS FOR TYPE "EE" MACHINES

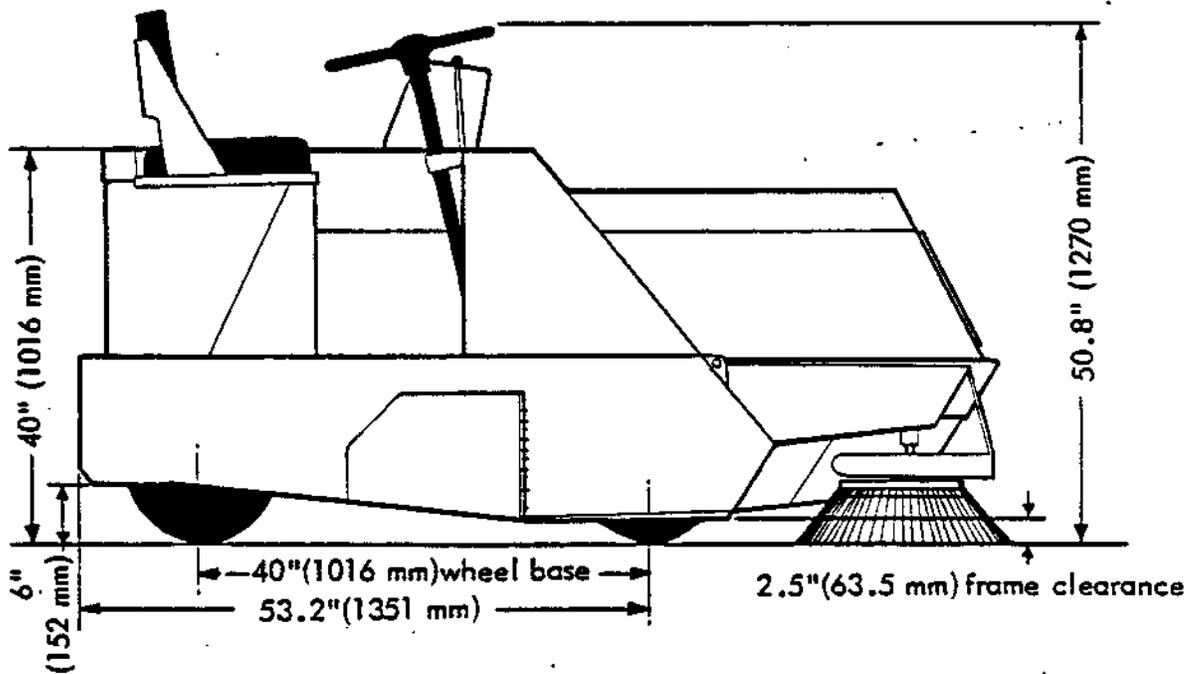
Battery Enclosure

1. The battery shall be provided with support and protection by means of a non-combustible enclosure which, if of metal, shall be no less than 0.052 inch (12.7 mm) thick (No. 16 MSG), and either shall be flanged not less than 0.50 inch (12.7 mm) on all sides or shall be provided with a construction that gives equivalent strength. A cover shall remain closed by the force of gravity, or shall be provided with a fastener.
2. The battery enclosure shall be provided with a cover with means for locking the cover in the closed position to deter opening by unauthorized persons. Insulation designed to prevent shorting of the terminals shall be secured to the inner surface of a metal enclosure over the terminals.
3. All upper openings shall be covered with a heavy gauge wire mesh, expanded metal, or a perforated cover. The size and shape of the opening shall prevent passage of a rod having a diameter greater than 0.50 inch (12.7 mm). If the distance between an insulated live part and the opening is greater than 4 inches (102 mm), the opening may be larger than previously mentioned, provided no opening passes a rod having a diameter greater than 0.75 inch (19 mm). The diameter of the wires of a screen shall not be less than 0.051 inch (1.295 mm) if the screen openings are 0.50 square inch (12.7mm²), or less in area and shall not be less than 0.081 inch (2.06 mm) for larger screen openings. Perforated sheet steel and sheet steel employed for expanded-metal mesh shall not be less than 0.042 inch (1.06 mm) inch thickness if uncoated (No. 18 MSG) and not less than 0.046 inch (1.17 mm) if zinc coated (No. 18 GSG) for mesh openings or perforations 0.50 inch squared (12.7 mm²) or less in area. They shall not be less than 0.080 inch (2.03 mm) if zinc-coated. Use No. 13 GSG for larger openings.
4. A battery for use with a Type EE cleaning machine shall be marked with the battery nominal voltage, ampere-hour capacity, battery manufacturer's name and the catalog designation or equivalent identification.

DIMENSIONS



Model 240 EH Top View Dimensions



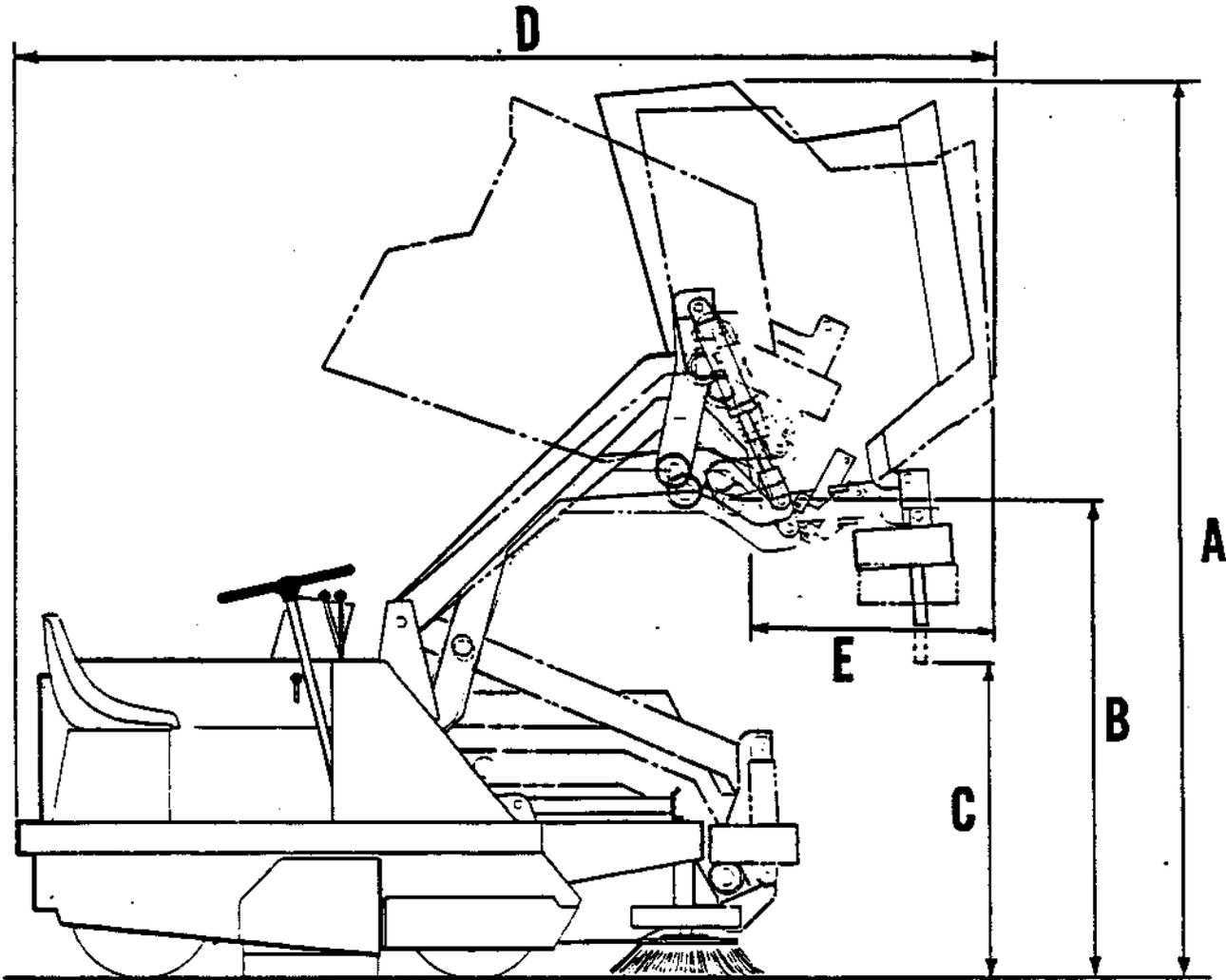
Side View Dimensions

Overhead Guard Height: 76.5" (1943 mm)

Cab Height: 76.5" (1949 mm)

Cab & Light Height: 85.75" (2178 mm)

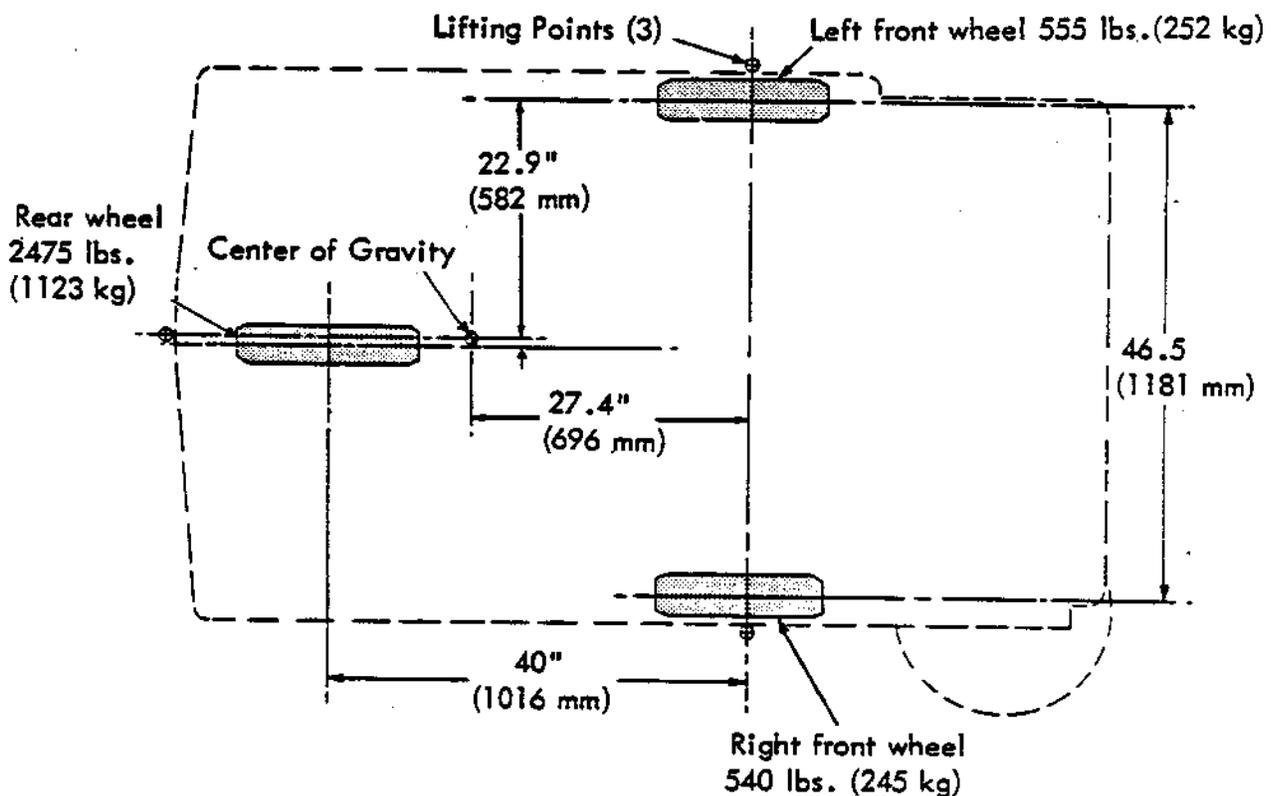
HI-DUMP MODEL DIMENSIONS



- A Maximum height (ceiling clearance during maximum lift rollout): 112 in. (2845 mm).
- B Maximum receptacle height clearance (without rollout): 62 in. (1575 mm).
- C Minimum door open height (at maximum height and maximum rollout): 44 in. (1118 mm).
- D Maximum length (with maximum rollout); 96 in. (2438 mm).
- E Forward dump clearance (receptacle width): 21 in. (533 mm).

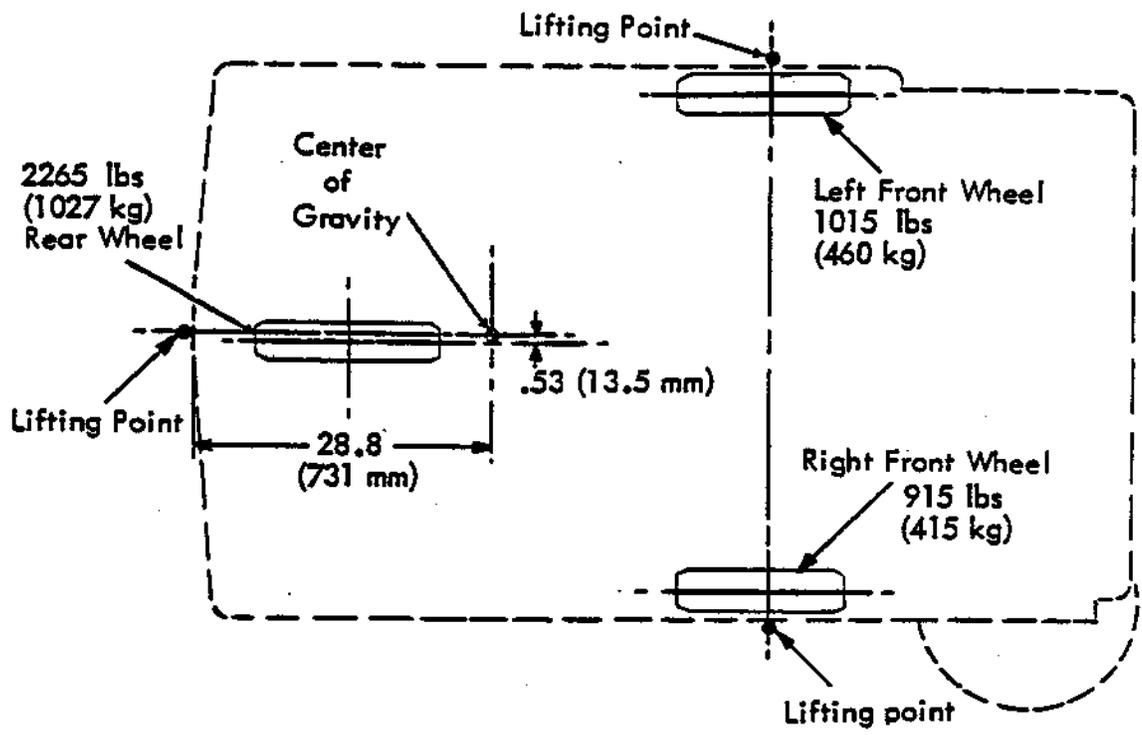
LIFTING INSTRUCTIONS

1. The approximate location of the three recommended lifting points are shown on the Center of Gravity Diagram.
2. Use lifting hooks or install eye-bolts at the location shown in the diagram. A small notch cut into the frame will prevent the lifting hooks from slipping.
3. Lift only from at or near the bottom of the bumper and side frame, not from the upper frame.
4. Use a spreader bar to prevent the lifting chains from pressing inward on the machine and damaging it.
5. The center of the lifting chain must be directly above the machine center of gravity, see diagram.
6. The location of the center of gravity is based on a machine with batteries installed, hopper empty, no operator, and hydraulic tank full.



LIFTING DIAGRAM FOR STANDARD MACHINE

Diagram of center of gravity and weight distribution. The location of the center of gravity is based on a machine weight of 3570 lbs. (1619 kg), batteries installed, hopper empty, no operator, and hydraulic tank full.



LIFTING DIAGRAM FOR HI-DUMP MACHINE

Diagram of center of gravity and lifting points. The location of the center of gravity is based on a dry machine with batteries installed, hopper empty, no operator.

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PREPARATION FOR OPERATION

Your TENNANT 240 EH Power Sweeper has been shipped complete. You can operate your machine after following these directions:

AFTER UNCRATING:

1. Install batteries as described under "Battery Installation" in the Maintenance Section of this manual.
2. Check oil level in hydraulic oil tank. The tank filler cap is located under a cover located just to the left of the operator's seat. Hydraulic oil should always be visible in the screened filler opening below the cap. TENNANT Hydraulic oil is recommended. See Maintenance Section for a complete description of TENNANT Hydraulic Oil. Capacity of the hydraulic oil tank is five gal. (19 L). Capacity of the complete system is 6.5 gal (24.6 L).
3. Check to be sure that the fusible link (part #SK1511) on the filter box fire door has not been broken in shipment. See section titled "Fusible Link Replacement" in Maintenance for replacement procedure.
4. Please read this manual carefully before attempting to operate your machine.
5. If scrubbing attachment is included with machine, align the attachment with the machine as described in Initial Alignment of New Scrubbing Unit to Machine.

ATTENTION! Batteries must be charged before operating machine for the first time.

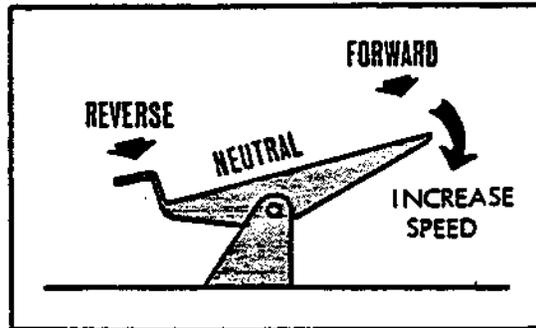
OPERATION OF CONTROLS

BRAKE PEDAL

The brake pedal operates the brakes on the two front wheels. To stop, return the direction control pedal to neutral, then apply pressure to the brake pedal.

DIRECTION CONTROL

A single foot pedal controls the hydraulic propelling drive and is used to select direction of travel and propelling speed of the machine, as shown on the sketch.



Gradually depress the "toe" portion of the pedal for forward travel or the "heel" portion, for reverse travel. Regulate the machine speed by varying pressure on the pedal.

If the machine creeps when the pedal is in neutral position, see "Adjusting Direction Control Pedal Neutral Position" in the Maintenance section.

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

KEY-OPERATED ON-OFF SWITCH

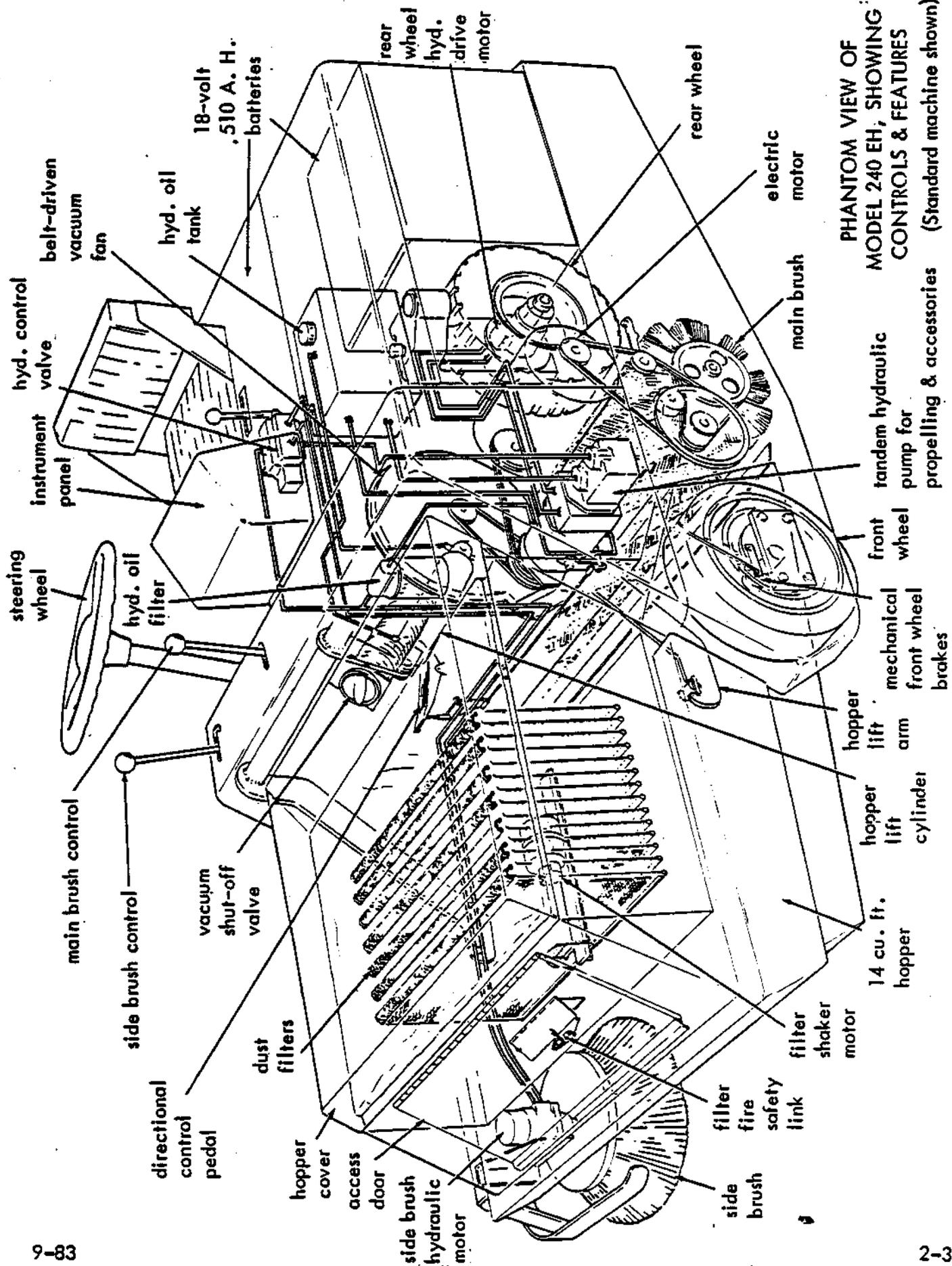
The key-operated "on-off" switch is located on the instrument panel. Turn the switch clockwise to "On" position in order to operate the starter button. The key should be removed when the machine is left unattended.

MOTOR START BUTTON

The starter button is located next to the on-off switch. Press the start button momentarily in order to start the main drive motor. The operator must be on the seat when starting so that the safety switch, located under the seat, is closed.

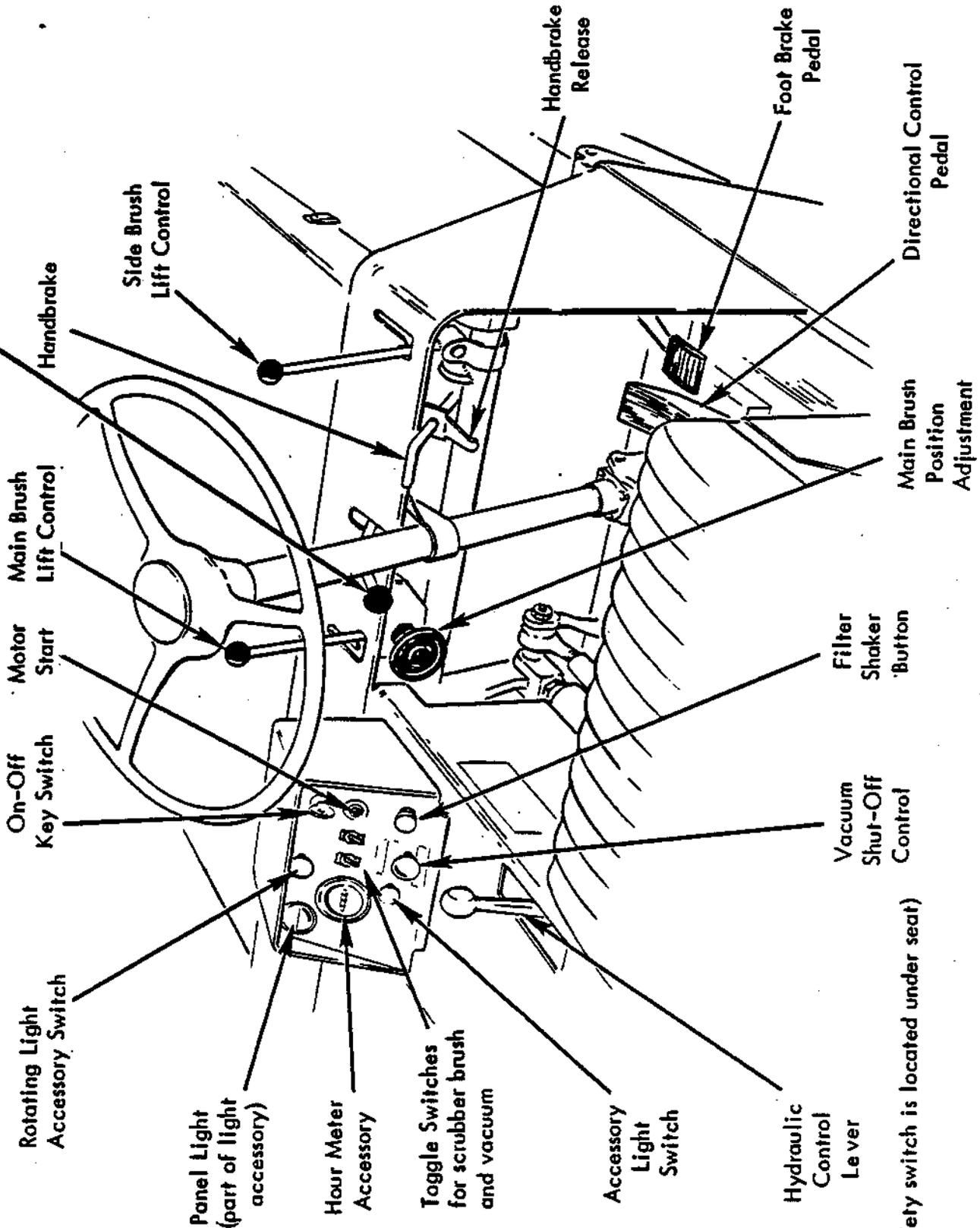
FOOT BRAKE PEDAL

The foot brake pedal operates, through a linkage, the mechanical brakes on the two front wheels.



PHANTOM VIEW OF
 MODEL 240 EH, SHOWING
 CONTROLS & FEATURES
 (Standard machine shown)

**Hopper Rollout Control
(Used on Hi-Dump Machines only)**

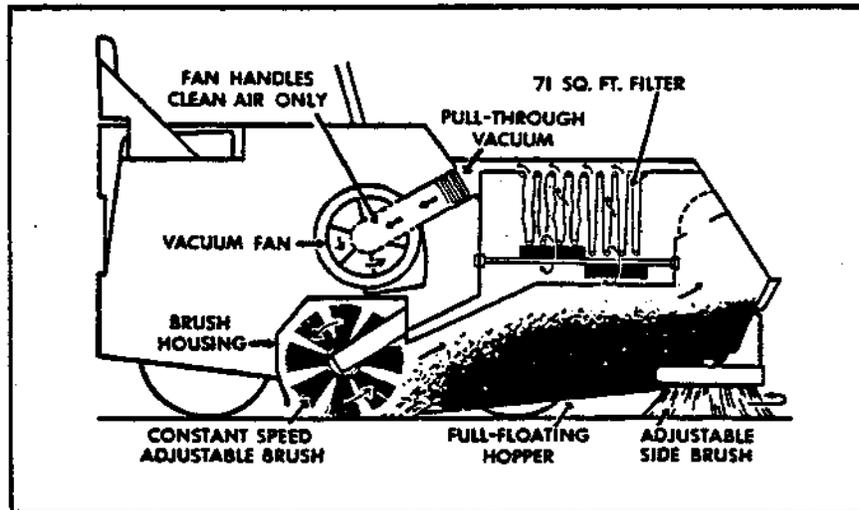


(Safety switch is located under seat)

VACUUM SHUT-OFF CONTROL

The vacuum control knob operates the valve in the vacuum duct between the filter box and fan. To shut off the vacuum, pull up on the knob located on the instrument panel, then turn the knob to lock in place. The vacuum must always be open whenever operating the machine. (The Scrubber Attachment includes an additional vacuum fan, which is controlled by a switch on the control panel. During scrubbing, the machine vacuum shut-off control should be closed.)

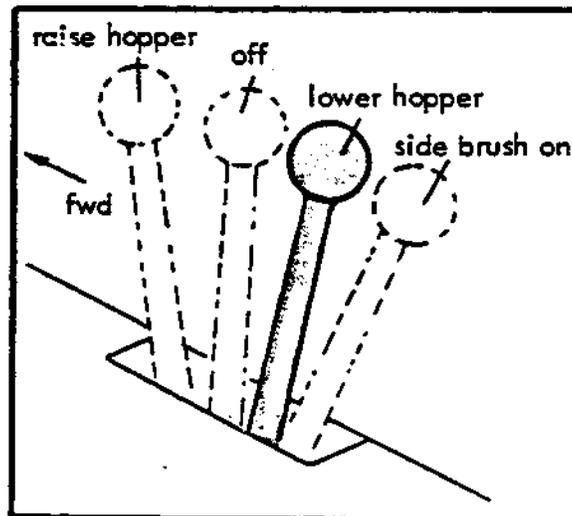
NOTE Vacuum is automatically shut off whenever hopper is raised.



FUNCTIONS OF THE HYDRAULIC CONTROL LEVER

HYDRAULIC CONTROL LEVER

The Hydraulic Control Lever operates a manual directional control valve. The lever has four positions: "raise hopper", "off", "lower hopper" and "sidebrush on". After raising hopper, the hopper will remain up when the control lever is placed in "off" position. (If it is necessary to reach under hopper, be sure to engage safety lock.)



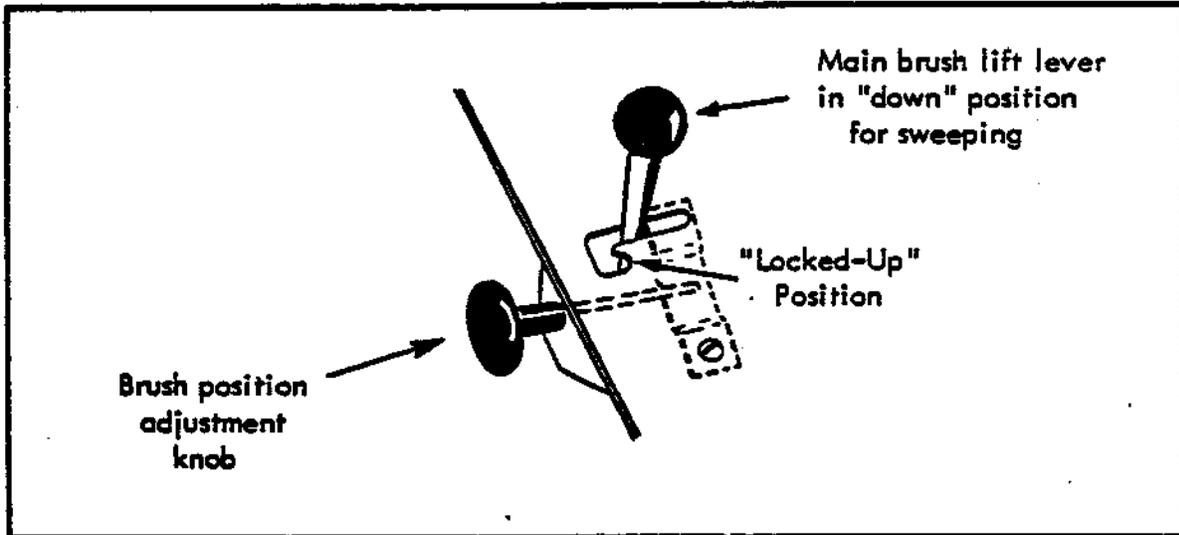
SWEEPING AND VACUUM SYSTEM

MAIN BRUSH LIFT LEVER

To lower the main sweeping brush, pull the lever back, then move the lever to the left and into the long slot. To raise the brush, pull the lever back, then to the right and into the small slot where it will be locked in place (see sketch).

BRUSH POSITION ADJUSTMENT

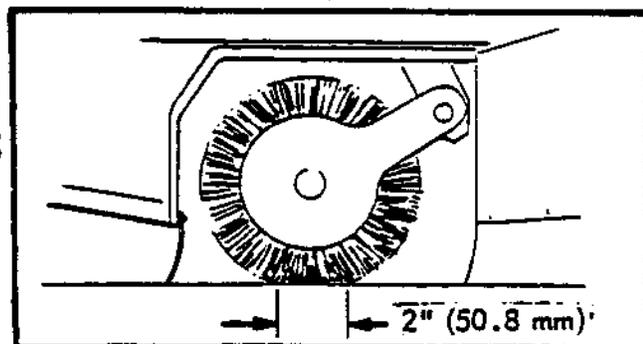
The "down" position of the brush can be adjusted to compensate for wear, changing conditions, etc. This is done by turning the adjustment knob shown in the sketch.



CONTROLS FOR LIFTING MAIN BRUSH AND ADJUSTING BRUSH POSITION

The main sweeping brush should never be operated in the unrestricted or "full down" position; that is, where the brush is allowed to "float" upon the floor. The brush position adjustment knob must always be set to restrict the brush down position, as follows:

The best method for checking the brush adjustment is to park the machine on a level surface, (with the brush up) then lower the brush and allow it to rotate against the floor for about one minute. Raise the brush and drive the machine off of the test area. The brush should leave a "polished mark" (see sketch) on the floor about two inches wide for the full length of the brush. If not, adjust the "brush position knob". This is the normal recommended adjustment. Various sweeping conditions and special brushes with stiffer bristles may require a different adjustment.



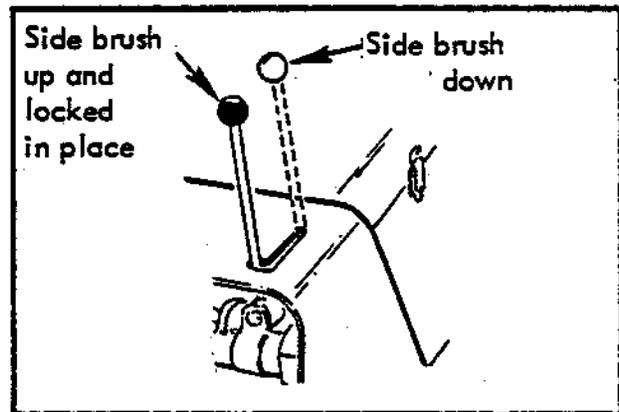
Correct brush position will make a "polished" mark on the floor about two inches wide.

SIDE BRUSH LIFT LEVER

To raise and lock up the side brush, pull the lever back, then move the lever to the left so that it is locked in place in the small slot, see sketch.

To lower the side brush, pull the lever back, then move it to the right and allow it to move through the long slot until the brush is down. Whenever the side brush is not needed, or when transporting the machine, be sure to raise and lock up the side brush.

SIDE BRUSH LIFT LEVER



SIDE BRUSH ROTATION

To start side brush rotation, turn hydraulic control lever to "side brush on" position. This position starts the hydraulic motor which drives the side brush.

MAIN BRUSH ROTATION

The main brush is driven continuously through two belts and the countershaft sheaves. However, the brush rotation is stopped whenever the hopper is raised. This is accomplished by a cable arrangement which releases pressure of the idler pulley against the brush drive belt whenever the hopper lift arm is raised.

HI-DUMP HOPPER ROLLOUT CONTROL

Use the Hopper Rollout Control to dump the hopper after it has been raised to the desired height. The control has two positions (forward rollout and reverse) with a spring - loaded return to neutral. The hopper can be rolled out at any height; but to avoid damage, the hopper must be at least 12 inches (305 mm) off the floor before being fully dumped.

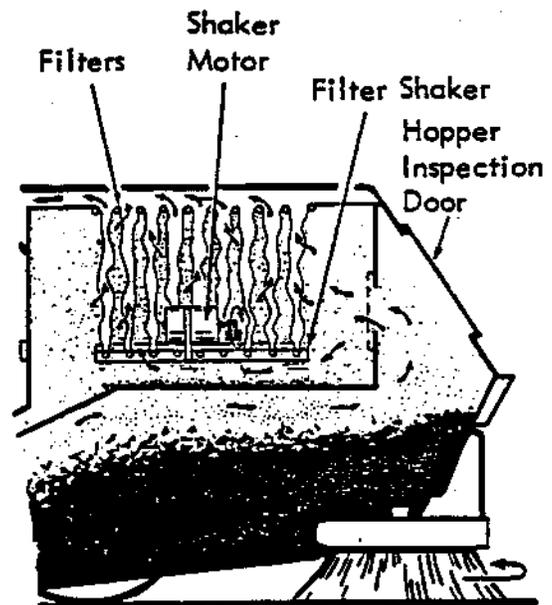
STEERING WHEEL

The automotive-type steering wheel controls the single rear wheel through an arm and tie rod arrangement. Since the machine is very responsive to movement of the steering wheel, the operator should use care until he becomes more experienced in guiding the machine.

FILTER SHAKER SWITCH

Press button to actuate shaker motor. Keep button depressed for 10 - 15 seconds -- or longer as needed to shake filter clean.

NOTE Activate shaker switch only with vacuum shut off and hopper in "DOWN" position. Vacuum must always be shut off when shaking filters (if not, dust will be drawn back into filter envelopes).



ACCESSORIES

HOUR METER AND BATTERY CONDITION INDICATOR

If provided, the accessory hour meter is located on the instrument panel. The meter records the number of hours the motor is operated and is useful in determining when to perform periodic maintenance procedures. A battery condition indicator is provided on the hour meter.

HEADLIGHT ACCESSORY LIGHT SWITCH

This switch controls the two headlights, the side brush spot-light, and the tail-light -- all of which are included in a Headlight Accessory Kit. The switch also turns on a panel illumination light.

ROTATING LIGHT ACCESSORY LIGHT SWITCH

This switch, located on the instrument panel, controls the Rotating Light Accessory.

OPERATION

TO START MACHINE

1. **▲WARNING** Do not attempt to start machine unless you are in the driver's seat (this will trip safety switch), with foot on brake pedal or hand brake engaged, with directional pedal in neutral position and hydraulic control in "off" position.
2. Turn key switch to "on", and press "start" button momentarily until motor starts. Release button as soon as motor starts.
3. **ATTENTION!** Never attempt to tow or push machine for a long distance. To do so may cause damage to hydraulic drive system.

TO OPERATE SWEEPER

To Propel Sweeper:

1. Start drive motor (driver must be on seat so that safety switch under seat is tripped).
2. Release parking brake.
3. Lower main and side brushes to floor. (Brush position should be set correctly.)
4. Engage side brush rotation. (Main brush is driven continuously.)
5. Open vacuum fan control.
6. Gently depress directional control pedal - with toe for forward direction, or - with heel for reverse.
7. Vary your foot pressure on pedal to obtain desired travel speed.
8. Be sure to follow "General Operating Instructions" information in next section.

To Stop Sweeper:

1. Return directional pedal to neutral (centered) position. (Pedal may not always automatically return to neutral when foot pressure is released).
2. Apply foot brake.
3. Apply foot brake for better control when going down inclines.
4. Apply handbrake when parking machine.

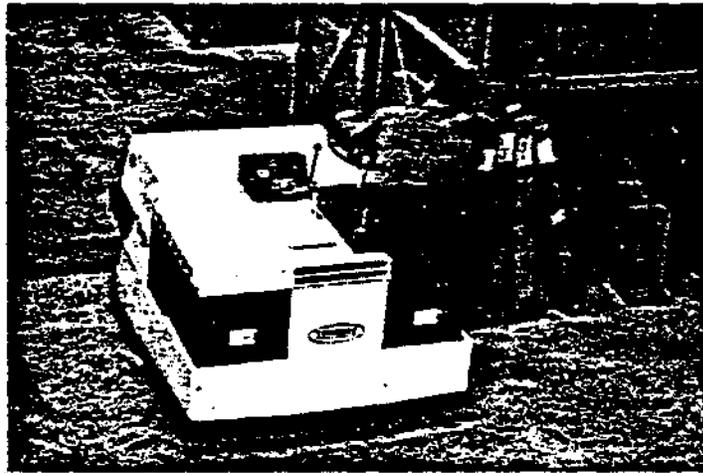
GENERAL OPERATING SUGGESTIONS

1. Plan your sweeping in advance. Try to arrange long runs with minimum stopping and starting. Sweep debris from narrow aisles out into main aisle ahead of time.
2. Do an entire floor, or section at one time.
3. Pick up oversize debris before sweeping. Flatten or remove bulky cartons, etc., from aisles before sweeping.
4. When driving a Hi-Dump machine up or down inclined ramps, reduce machine speed for better control.

5. **▲CAUTION** Do not turn steering wheel too sharply when machine is in motion. The sweeper is very responsive to movement of the steering wheel. Avoid sudden turns except in emergencies.

Never drive sweeper with hopper removed. Removing the hopper changes the machine center of gravity and affects balance. Do not back machine down ramps.

6. Try to sweep as straight a path as possible. Avoid bumping into post or scraping sides of sweeper.



7. When placing sweeper in motion, avoid moving the directional control pedal all the way forward suddenly. This is equivalent to starting out in "high" gear and puts needless strain on the drive system.

8. Periodically turn the main sweeping brush end for end to prevent the bristles from "setting" in one direction.

NOTE Replace brush when bristles are worn to 1 inch (25.4 mm) or less.

9. **ATTENTION!** The magnetic field produced by the motors in this machine may cause damage to computer memory devices (tapes, discs, etc.) if this machine is used in the same room while computers are being operated.

HOPPER GENERAL DESCRIPTION (STANDARD MACHINE ONLY - NOT HI-DUMP)

Hopper capacity is 14 cubic feet (0.40 m³). The hopper has a "floating" action which allows it to pivot slightly so that objects up to two inches in height can pass under the hopper and then be swept into the pan by the brush.

On the standard machine, an access door is provided at the front of the hopper so that the operator can inspect hopper contents. The door can also be used for inserting items which are too large for sweeping, or for flushing out the hopper.

A fusible link, located inside the the hopper behind the access door, will open if hopper debris should catch fire. The opening of this link allows a spring to close the fire door, which shuts off vacuum air flow through the hopper, thus preventing the ingestion of the fire into the filters.

Hopper floor clearance adjustments and fusible link replacement are covered in the Maintenance Section.

HI-DUMP HOPPER GENERAL DESCRIPTION

The Hi-Dump Model hopper has the same capacity as the standard machine (1/2 ton, 455 kg). Ceiling clearance height of the fully raised hopper is 9 ft. 4 in. (2845 mm).

A separate hand control lever is used to roll the hopper forward for dumping. The hopper door unlatches and opens automatically during rollout, and closes when the hopper is returned to its normal position.

When the hopper is raised to a height of 36 inches (914 mm), an automatic speed limiter is engaged which limits machine forward speed to no more than 2 mph (3.22 km/hr).

The Hi-Dump Hopper is provided with a fire safety fusible link, which will open if the hopper debris should catch fire.

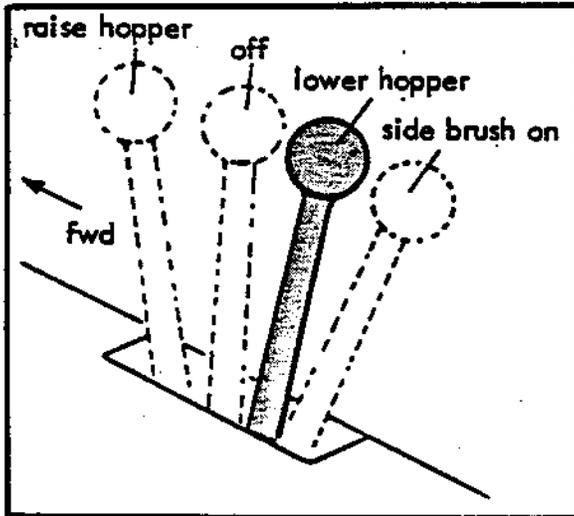
Hopper replacement and adjustments are described in the Maintenance Chapter.

There are certain cautions to be observed when dumping the Hi-Dump Hopper.

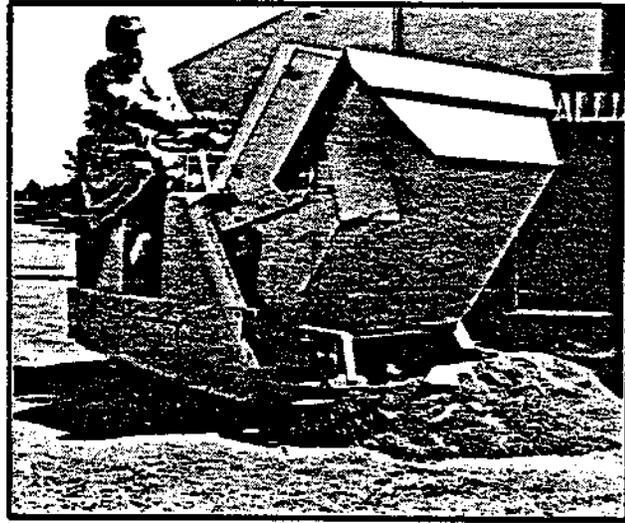
1. Before raising the hopper, make sure that there is sufficient clearance to lift the hopper and roll it forward (clearances are shown in the "Dimensions" drawing).
2. Remember that to avoid damage, the hopper must be at least 12 inches (305 mm) off the floor before rollout (hopper door or shear pin may be damaged).
3. Don't attempt to drive the machine any distance with the hopper raised (because of reduced visibility and danger of striking overhead objects).

TO DUMP HOPPER (Standard Machine Only - Not Hi-Dump)

1. Raise both main and side brushes.
2. Push filter shaker button to clean filter.
ATTENTION! Before shaking filter close vacuum shut-off.
3. Turn hydraulic control lever to "Raise Hopper" position (see sketch). The vacuum will shut off automatically when the hopper is raised.



Positions of the hydraulic control lever. After raising hopper, move lever to "off" position in order to hold hopper in place. Engage safety lock.



After dumping the hopper, back the machine away while turning to the left so that the side brush will clear the dirt pile which has been dumped.

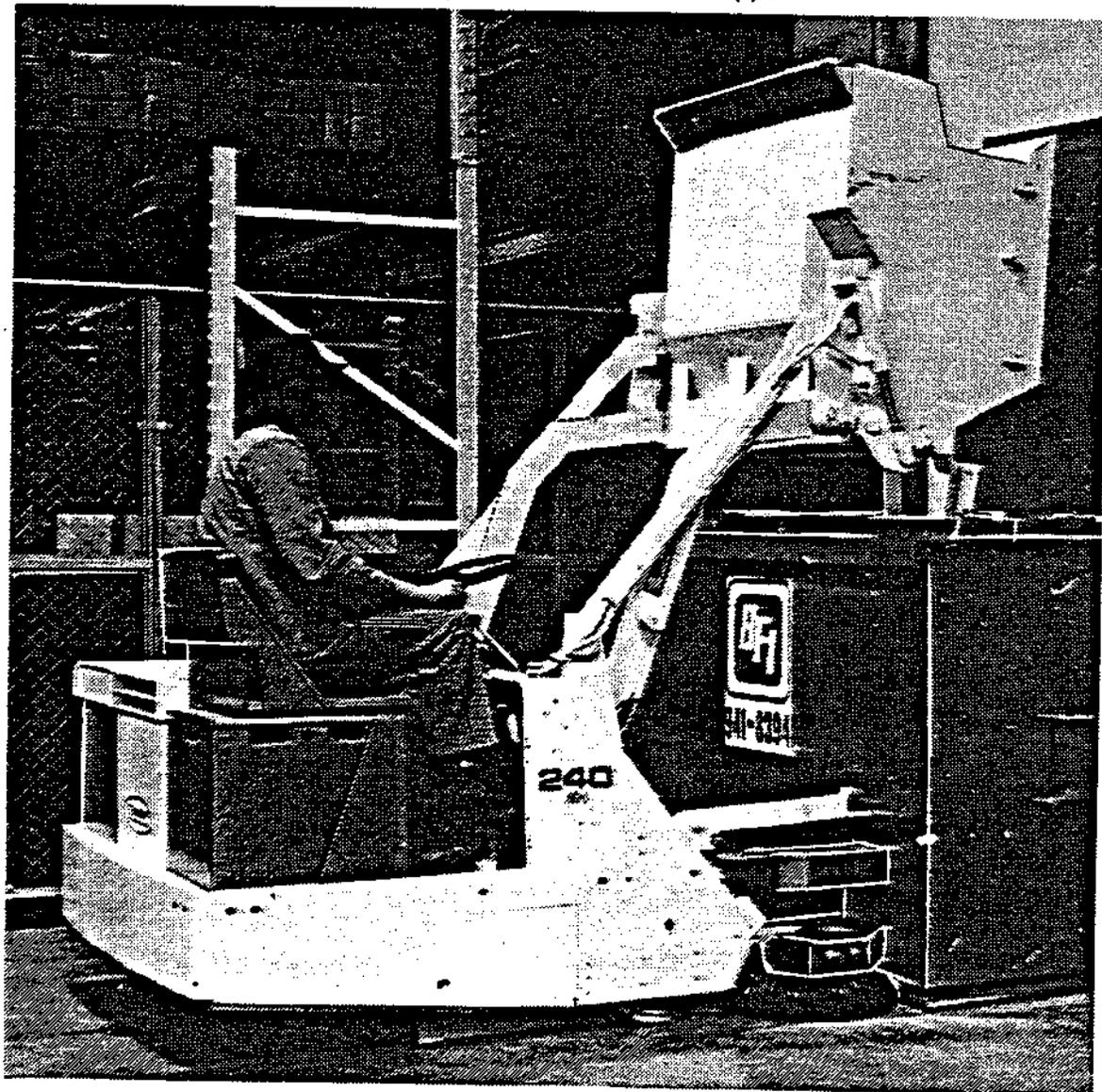
4. After hopper is emptied, back sweeper away and turn to left so that side brush will clear dirt pile.
⚠WARNING Never reach under upraised hopper without first engaging the safety lock.
5. Lower hopper to sweeping position by moving hydraulic control lever to "Lower Hopper".
6. Open the vacuum shut-off control.

TO DUMP HI-DUMP HOPPER

1. Raise both main and side brushes.
2. Raise hopper at least 1/4 of the way up to break vacuum seal.
3. Push filter shaker button to clean filter.
4. Raise hopper enough to clear waste receptacle during forward rollout.

⚠ WARNING When hopper is raised or lowered, lift arms cross creating a shear point. Stay clear of arms.

5. Drive machine carefully forward so that hopper is in position to dump properly into waste receptacle.
6. Move hopper rollout control to "Roll Out," hopper will move forward and dump.
7. Move hopper rollout control to "Roll In." After hopper returns to normal position, release control.
8. Back machine away from receptacle and lower hopper.



HOPPER SAFETY SUPPORT ARM (Standard Machine)

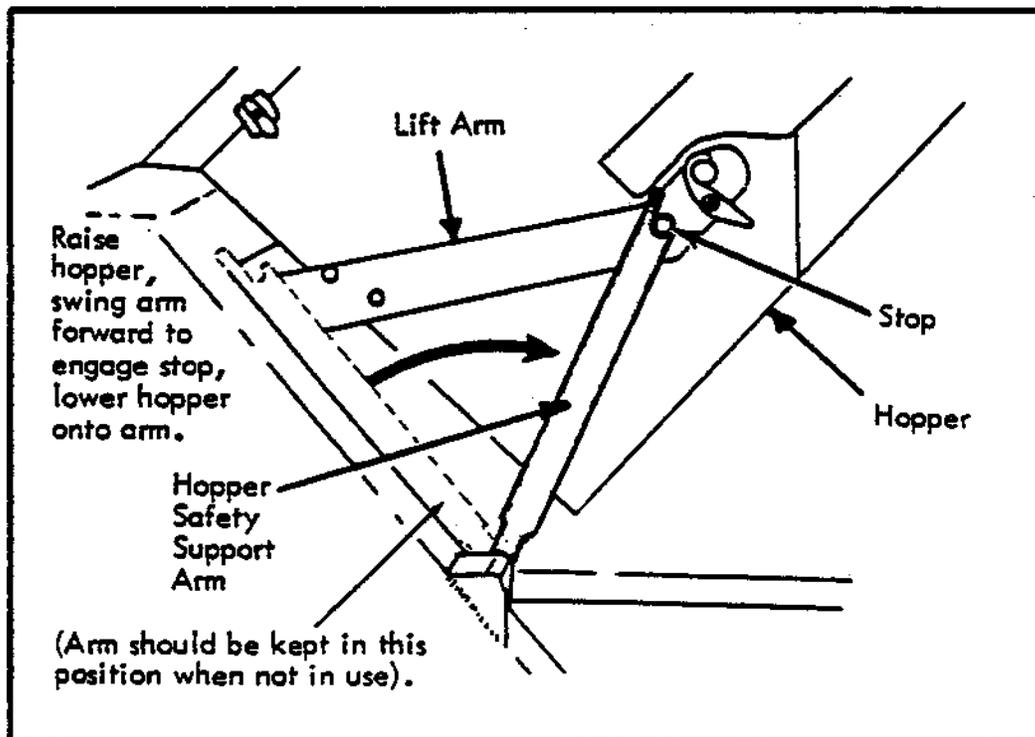
▲WARNING Never reach under the upraised hopper without first engaging the safety arm.

To Engage Hopper Safety Support Arm:

1. Lift hopper to extreme "up" position. Safety arm should be in raised position (see sketch) against frame.
2. Move safety support arm forward until it engages stop on hopper.
3. Lower hopper until it is supported by arm.
4. Shut engine off.

To Disengage Hopper Safety Support Arm:

1. Lift hopper to extreme "up" position.
2. Return safety support arm to unused position.
3. Lower hopper.



STANDARD MACHINE HOPPER SAFETY SUPPORT ARM

HOPPER SAFETY SUPPORT ARM (Hi-Dump Machines)

▲WARNING Never reach under upraised hopper without first engaging the safety arm. When hopper is raised or lowered, lift arms cross, creating a pinch point. Stay clear!

To Engage Hopper Safety Support Arm:

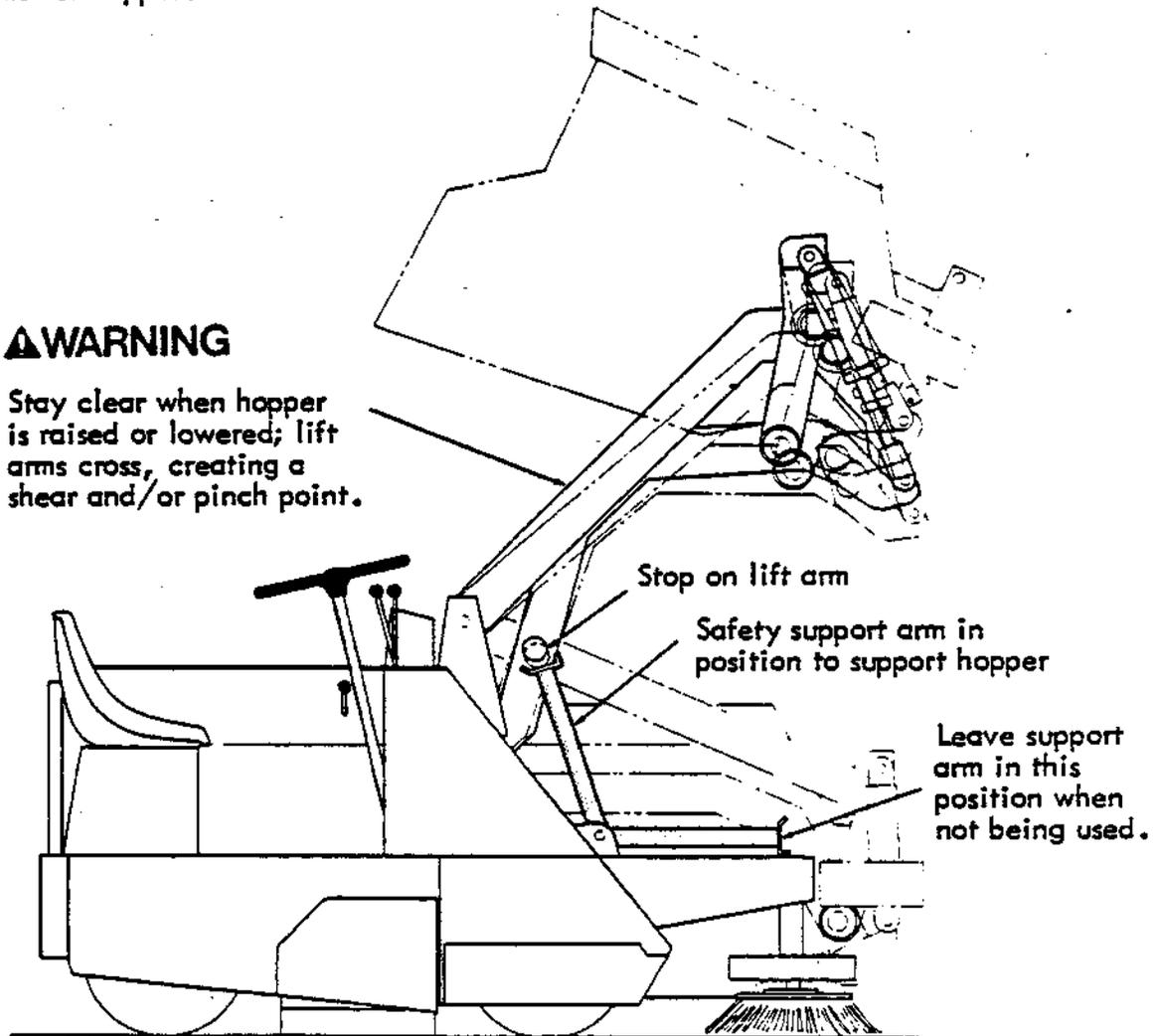
1. Lift hopper to extreme "up" position.
2. Raise and swing back safety arm until it engages stop on hopper (see sketch).
3. Lower hopper until it is supported by arm.
4. Shut engine off.

To Disengage Hopper Safety Support Arm:

1. Lift hopper to extreme "up" position.
2. Swing safety arm forward and down (see sketch).
3. Lower hopper.

▲WARNING

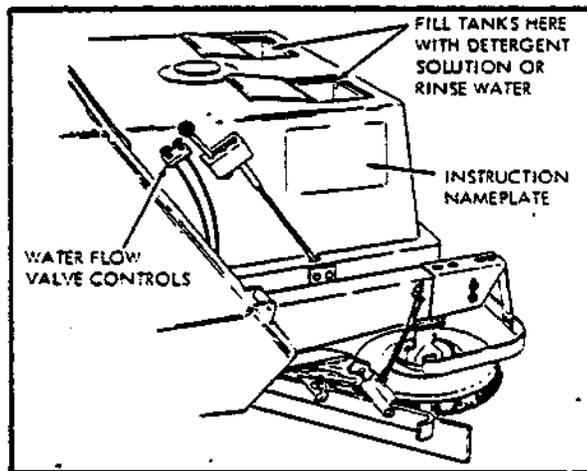
Stay clear when hopper is raised or lowered; lift arms cross, creating a shear and/or pinch point.



SCRUBBER OPERATING INSTRUCTIONS

Filling the Tanks:

1. The solution mixture required will depend upon the condition of the floor. Recommendations for detergent dilution are given on the TENNANT detergent container and on the nameplate mounted on the scrubber. TENNANT #622 (powder) or #670 (liquid) are recommended.
2. Shut off the water flow with the valve controls located on the right side of tank.
3. There are two separate upper tanks. One or both tanks may be used for detergent solution or rinse water. Fill both tanks with hot water when using both tanks for detergent solution; or fill one tank with solution and one with cold rinse water. The water flow can be approximately doubled by using both tanks at the same time, but this, of course, will require more frequent refilling.



Location of detergent solution tank and water flow controls.

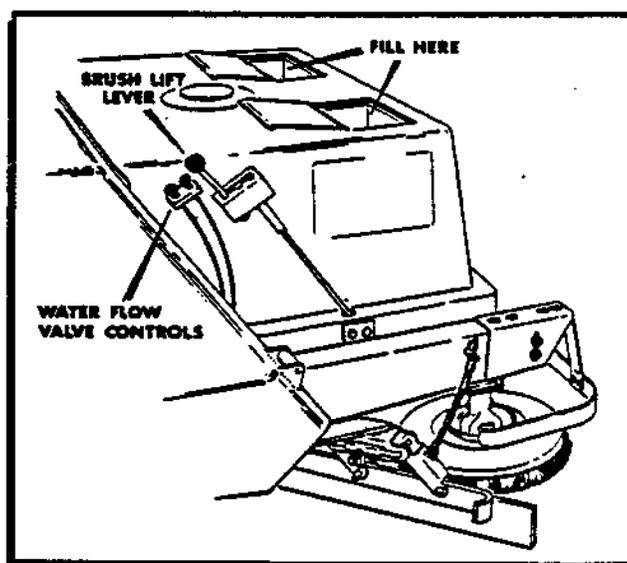
4. To avoid foaming, fill the tanks with hot water first, then add detergent and stir the solution.
5. The two water flow control valves may be used to combine the flow or to open either tank.
6. The rate of flow and the consumption of either detergent or rinse water is dependent upon scrubbing conditions and rate of travel.

TIRE CARE

If the machine is operated in areas where solvents, oils and other petroleum-base fluids may contact the tires, it is strongly recommended that the tires be cleaned after use. This will greatly prolong the life of the tires.

TYPICAL SCRUBBING CONTROL OPERATION SEQUENCE

1. Start the motor.
2. Engage the main scrubbing brush by pushing the switch located on the control panel.
3. Operate side brush by means of hydraulic control lever.
4. Press switch to start vacuum. (Shut off machine vacuum.)
5. Lower the main scrubbing brush (also called the rear pick-up brush) to the "down" position used for normal sweeping.
6. Lower the front scrubbing brush to the "down" position.



7. Lower the side brush...the side squeegee will also lower with the brush. Lower side squeegee if it is locked in up position.
8. Open the water flow control valves. The two control valves may be used to combine the flow, or to open either tank.
9. Lower the rear squeegee and place the lever in the "pressure" down position.

NOTE Always raise squeegee before reversing machine.

10. Depress the accelerator pedal and begin scrubbing.
NOTE For best scrubbing results and long battery life, reduce machine speed when scrubbing.
11. Shut off the solution about five feet before making a turn.
12. After the scrubbing operation is completed, raise all the brushes. Allow brushes to revolve for 30 seconds or more to throw off excess water.

SOME NOTES ON SCRUBBING OPERATIONS

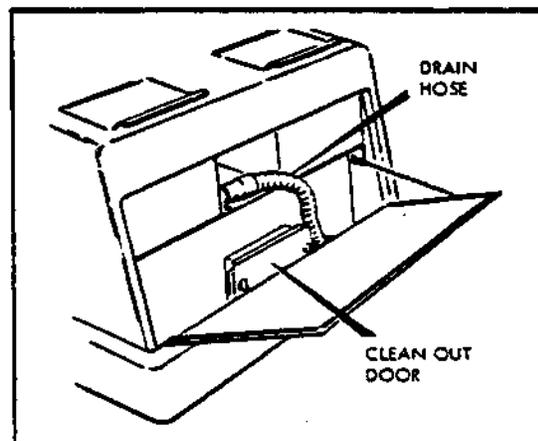
1. If the main scrub brush motor (located in the scrubber) becomes overheated, an overload relay located in the motor will open. This will cause the horn to sound, indicating to the operator that the motor has been overheated. (The horn will also sound if the scrubber switch is turned on when the scrubber has been disconnected.) If the horn sounds while scrubbing, turn off the scrubber motor switch, and determine the cause of the motor overheating.
2. **NOTE** Never use main sweeping brush for scrubbing - always replace main sweeping brush with the brush designed especially for scrubbing.

The front cylindrical brush performs the bulk of the scrubbing. The side brush is provided in order to scrub close to walls. The main (rear) brush provides secondary scrubbing and also sweeps light debris and water into the shallow trough located under the scrubber. A hose vacuums the water from this trough into the recovery tank in the scrubber. The rear squeegee provides a "vacuum cleaner" pickup on smooth floors and erases tire tracks.

3. Extremely dirty floors may require soaking with the detergent for a period of time. Apply the solution with the front and side scrub brushes down (the main brush, side squeegee and rear squeegee should be up). After soaking, pass over the same area with the main brush and squeegees down.
4. If rinsing is desired after scrubbing the floor, apply plain cold rinse water, scrub and pick up.
5. When scrubbing very rough floors, it may be desirable to raise the rear squeegee in order to prevent damage to the rubber blade. The main brush will provide adequate water pickup in this case.

DRAINING AND CLEANING RECOVERY TANK

1. Position front of scrubber adjacent to large floor drain or 40 gallon tank below the floor level.
2. Pull upper end of drain hose, (see sketch) off the plug and lower in the direction of the floor drain.
3. Open the clean out door to which the drain hose is attached and flush out any sludge accumulation.
4. Raise scrubber on dump arms and engage safety lock so that the lower trough may be cleaned and inspected.



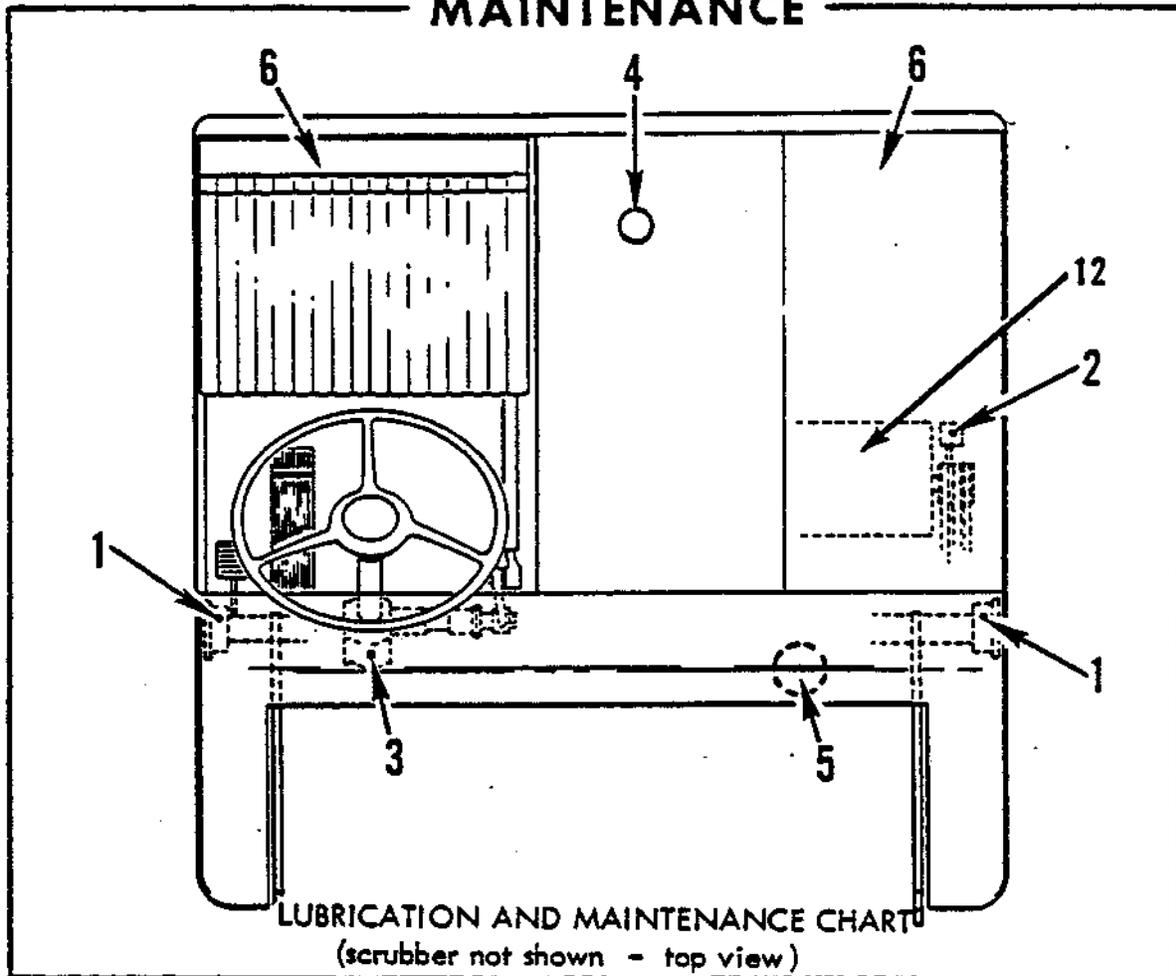
SECTION 3

MAINTENANCE

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MAINTENANCE



No.	Item and Location	Procedure	Interval (Hours)
1	Hopper lift bearings (2)	Apply grease **	50
2	Brush drive belt idler	Apply grease **	50
3	Steering gear box	Check level, (add grease*)	100
4	Hydraulic tank	Check oil level	8
	Hydraulic tank	Change hydraulic oil	500
		Tank capacity: 5 gals. (19 liters)	
		System capacity: 6-1/2 gals. (24.6 liters)	
		(Use TENNANT Hydraulic Oil.)	
5	Hydraulic oil filter	Change filter element	500
6	Batteries	Check electrolyte level	8
	Batteries	Check battery & cable condition	50
	Batteries	Check battery charge	100
7	Miscellaneous pivot, points, hinges, etc.	Apply SAE 20 Oil	50
8 (not shown)	Scrubber trough pivot	Apply grease **	8
9 (not shown)	Scrubber caster wheels	Apply grease **	200
10 (not shown)	Front brush drive gear box	Check oil level plug. Use SAE#140 gear oil	100
11 (not shown)	Rear wheel pivot bearing	Hand-pack w/ Lithium EP multi-grease	500
12	Electric Motor	Inspect brushes	250

*Saginaw Steering SSG4009

**Use Lithium-base, water-resistant, moly-disulfide grease.

ATTENTION!

RECOMMENDED FIRST 50 HOUR INSPECTION

1. Check tightness of nut holding rear wheel on hydraulic motor shaft (if necessary tighten to 200 - 250 ft. lbs. (271 - 339 Nm).
2. Check condition of cables and batteries (corrosion, etc.).
3. Check all V - Belts for correct tension, wear, etc.
4. Check adjustment and condition of brushes.
5. Check adjustment and condition of squeegees.

RECOMMENDED ASSEMBLY TORQUES

Rear Wheel Hub Nut

Nut holds rear wheel hub on rear axle - 200 to 250 ft. lbs. (271 to 339 Nm)

Rear Wheels

Rear wheel mounting nuts - 75 to 85 ft. lbs. (102 to 115 Nm).

Rear Wheel King Pin

Tighten rear king pin nut until resistance is felt. (Turn rear casting when steering is disconnected.) Back off nut to first slot but no more than 1/12th of a turn.

Pump Sheave Bushing

Oil threads of screws. Tighten them alternately to 108 inch pounds torque (12 Nm).

Electric Drive Motor Sheave Bushing

Oil threads of screws. Tighten them alternately to 80 inch pounds torque (9.04 Nm).

HYDRAULIC SYSTEM

The model 240EH sweeper is equipped with a hydraulic drive system. The propelling pump is a variable displacement piston type which drives a hydraulic motor mounted at the rear wheel.

The accessory pump is a vane-type pump which drives the side brush motor and the hopper dump cylinder. It is mounted in tandem on the propelling pump.

The hydraulic pumps and motors require no periodic maintenance; **BUT MAKE SURE** hydraulic oil level is adequate and that oil is clean.

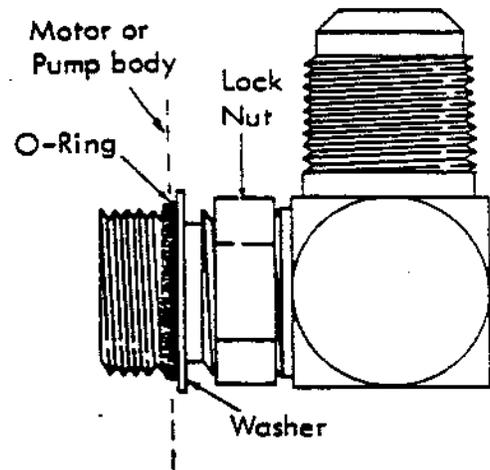
The hydraulic tank has a capacity of 5 gal (19 L). System capacity is 6.5 gal (24.6 L). An external in-line filter is provided. For average operating temperature up to 90° F (32° C), use Tennant Company Hydraulic Fluid #32397 (10W-40). For ambient temperature above 90°F (32°C), use Tennant Company #32398 (20W-60).

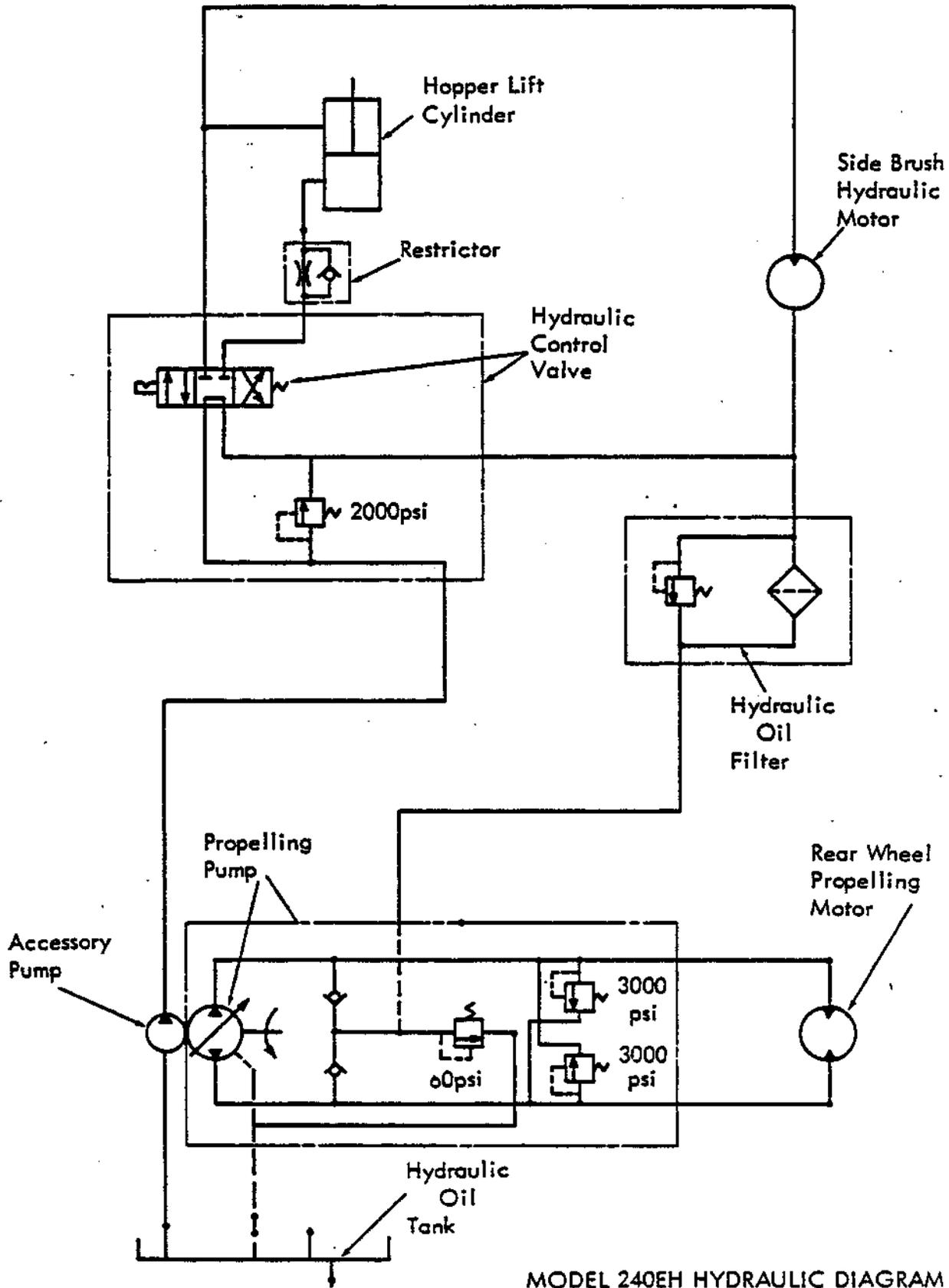
The "Hydraulic Components" Section of this manual gives parts breakdowns and service information for the pumps and motors used in this machine.

INSTALLING "O-RING" TYPE HYDRAULIC FITTINGS

(Used on most hydraulic components, such as pumps, motors, valves, etc.)

This type of fitting has straight threads. An O-Ring is used to seal the connection and prevent leaks. To install, turn the fitting in until the O-Ring contacts the component body, then tighten the lock nut up against the washer. Straight fittings do not have washers and lock nuts. An O-Ring fitting requires much less torque during installation than pipe-thread fittings. Tighten only enough to compress the O-Ring and seal the connection.





MODEL 240EH HYDRAULIC DIAGRAM

RECOMMENDED HYDRAULIC FLUID

TENNANT Hydraulic Fluid is recommended. It is a specially compounded hydraulic fluid with the following features not found in many hydraulic oils:

1. FLAT VISCOSITY CURVE
2. Additives to prevent corrosion
3. Additives to prevent oxidation
4. Rust inhibitors
5. Foam suppressors

TENNANT Hydraulic Oil Viscosity Specifications		
	Tennant No. 32397 (10W40)	Tennant No. 32398 (20W60)
SUS 100°F(38°C)	404-445	940-1010
SUS 210°F(99°C)	78-84	122-130

These restrict foaming of the hydraulic fluid and provide a high standard of lubrication to the components. For average operating temperature up to 90°F (32°C), use Tennant Hydraulic Fluid #32397 (10W-40). For ambient temperature above 90° F (32°C), use TENNANT #32398 (20W-60).

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

ATTENTION!

If a locally-available hydraulic fluid is preferred, or if you have standardized on the products of one oil company, the hydraulic oil used must match closely the viscosity specifications given in the chart for TENNANT Hydraulic Fluid, as well as the other features described.

TO CHECK HYDRAULIC OIL LEVEL AND REFILL TANK

The hydraulic fluid level should be between the "high" and "low" marks on the fluid level sight gauge when the fluid is at room temperature. As the hydraulic fluid heats up to its normal operating temperature, it expands. Always allow for this expansion when filling the hydraulic fluid reservoir. Do not overfill the reservoir.

(continued on next page)

TO CHECK HYDRAULIC OIL LEVEL AND REFILL TANK (continued)

The hydraulic tank filler cap is located under a cover next to the operator's seat. To check oil level, remove the filler cap (the cap is attached by a chain to prevent loss). Hydraulic oil must be visible in the filler screen-- if not, add oil to the tank to bring the level up to the required point. Capacity of the hydraulic tank is 5 gallons (19 liters). (System capacity is 6-1/2 gallons-24.6 liters).

ATTENTION! Before filling tank, always clean the filler cap and the area around the cap. Use a clean funnel with 200 mesh screen and container for the hydraulic oil. 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.

CHANGING HYDRAULIC OIL FILTER

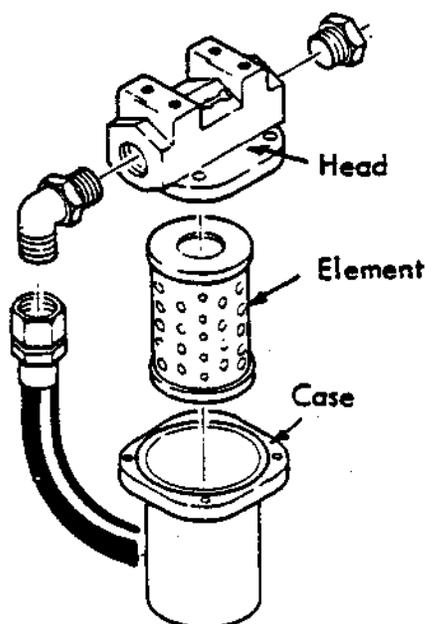
Change hydraulic oil and replace oil filter element at every 500 hours of operation.

The hydraulic oil filter is located below the lintel and just behind the hopper. In order to change the filter element, it will be necessary to remove the hopper.

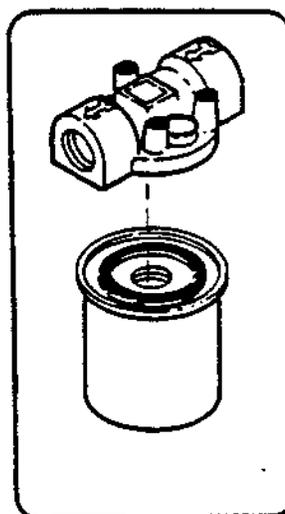
▲WARNING Do not attempt to change filter by reaching under upraised hopper.

The standard filter element is an automotive-type "spin-on" element. When installing the new element, apply a film of oil to the gasket. Turn element in until contact, then tighten an additional 1-1/2 turns. See instructions on element. Start the machine and check for leaks.

The alternate filter (Ripley), which may be used, has a replaceable cartridge located inside a case. Check your machine to determine which filter is used so that correct replacement elements can be ordered. Element part number is located on filter.



Alternate filter made by Ripley (Element #53348-1)

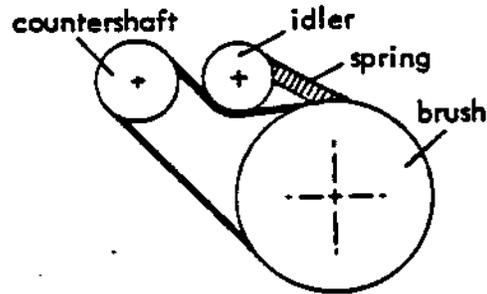


Standard Spin-on Type Filter made by Deluxe (Element #67718-2)

V-BELT TENSION ADJUSTMENTS

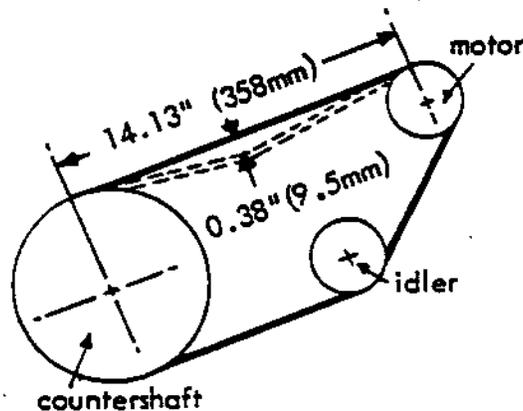
MAIN BRUSH DRIVE V-BELT TENSION ADJUSTMENT

In operating position, adjust spring length to 9.88 inch \pm 0.125 inch (251 \pm 3.18 mm).



DRIVE MOTOR TO COUNTERSHAFT V-BELT TENSION ADJUSTMENT

As shown in the sketch, apply a 6 lb (2.72kg) force at the center of span of one belt. If tension is correct, belt will deflect 0.38 in (9.5 mm). (Use an adjacent belt, taut string or straight edge as a reference). If necessary, adjust idler sheave position to obtain correct deflection.



PUMP DRIVE BELTS TENSION

Pump drive V-Belts are automatically tensioned by a spring in the pump mount assembly - there is no adjustment needed.

VACUUM FAN V-BELT TENSION

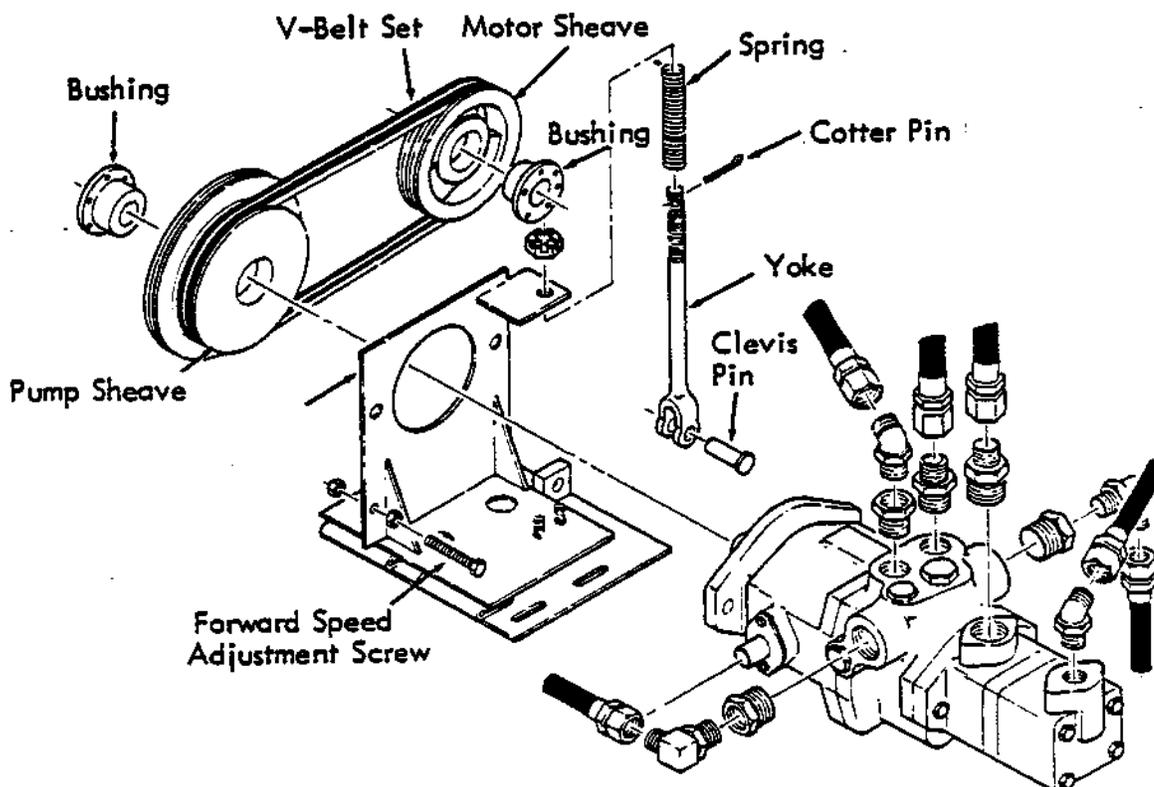
Vacuum fan V-Belt tension is automatically maintained by a spring on the fan housing assembly.

REPLACING PUMP DRIVE BELTS

Beginning with machine serial number 2345, a new type of pump mount was used with the Vickers hydraulic pump. The pump mount, shown in the drawing, incorporates a spring which automatically provides correct belt tension. Belt tension is not adjustable. The slotted nut on top of the spring stud is used only to loosen the belts for belt replacement. Normally the nut is kept backed off and locked in place with a cotter pin. This prevents anyone from mistakenly turning the nut down and loosening the belts.

To Replace The Pump Drive Belts:

1. Remove the cotter pin from the slotted nut and yoke.
2. Turn down the slotted nut until the belts are loose enough to be removed.
CAUTION Do not change pump mounting bracket position, because doing so would affect belt alignment.
3. Install the new V-Belt set.
4. Back off the slotted nut to the top of the threaded yoke, then lock the nut in place with the cotter pin.



HYDRAULIC PUMP REPLACEMENT

1. Raise or remove the hopper. Lift arms must be raised.

▲WARNING Always lock hopper in "Up" position, using Safety Lock, before working under the hopper.

2. Drain hydraulic tank. Disconnect batteries. Apply handbrake.
3. Disconnect and cap hydraulic lines to pump. Mark lines for correct reassembly.
4. Disconnect foot pedal linkage from pump control arm.
5. Turn down nut on pump bracket enough to remove V-belts.
6. To remove pump drive sheave, remove all screws from bushing in sheave hub. Insert screws in bushing tapped holes. (Loosen set screws holding key in place). Turn screws in until bushing comes loose. Remove sheave and bushing.
7. Remove two screws attaching pump to bracket.
8. Carefully remove pump. Do not change position of pump bracket. This could affect belt alignment.
9. Install new or repaired pump on bracket. Fill pump with Tennant Hydraulic Oil.
10. Clean sheave and bushing. Install bushing in sheave and position sheave on pump shaft. Align sheave correctly to motor sheave. Install key and lightly tighten set screw to hold key in place. Install oiled screws through untapped holes in bushing and into tapped holes in sheave.
11. Alternately tighten the screws using a torque wrench to 108 inch pounds (12.2 Nm) of torque. Check to make sure sheave is still aligned correctly to motor sheave. Tighten set screw to hold key in place.

NOTE If motor sheave is replaced, tighten its screws to 80 inch pounds (9.04 Nm).

12. Install pump drive V-belts and tension them by backing off the nut up to the top of the threaded yoke stud on the pump bracket.
13. Connect the directional pedal linkage to the pump control arm.
14. Connect hydraulic lines to pump, following markings made during disassembly to insure correct connections.

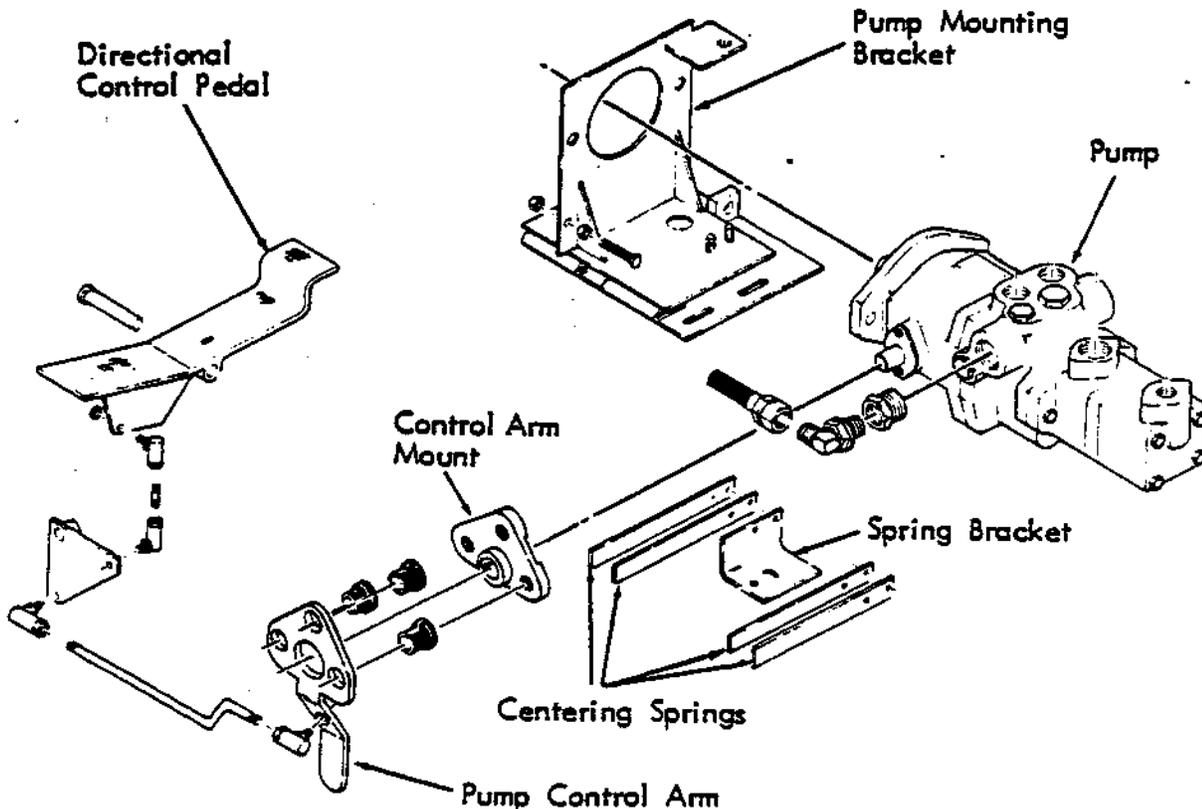
ATTENTION! Hydraulic connections must be kept clean.

15. Fill the hydraulic fluid reservoir.
16. Jack rear wheel off floor and check to be sure that pump neutral position setting is correct. Adjust if necessary, following directions in "Adjusting Directional Control Pedal Neutral Position".
17. To bleed air from hydraulic system: Operate side brush and head lift cylinder. Raise and lower scrub brush and squeegee several times. With rear wheel off the floor, run in forward and reverse for two minutes. Check hydraulic tank oil level and refill if necessary. Check complete system for leaks.

ADJUSTING DIRECTIONAL CONTROL PEDAL NEUTRAL POSITION

1. Park machine on smooth, level floor surface. (With motor running, machine should not "creep" in either direction when operator's foot is off the control pedal).
2. If adjustment is required, stop motor.
3. To prevent creep of the machine when the pedal is in the neutral position, the neutral setting of the propelling pump control arm must be adjusted. The neutral position of the pump control arm is set by adjusting the bracket with the two spring arms which is located below the pump.
4. Loosen the two hex screws which attach the bracket to the machine frame (see illustration).
5. Shift the centering bracket in slotted holes until machine does not "creep" in either direction.
6. Then tighten bracket mounting bolts.

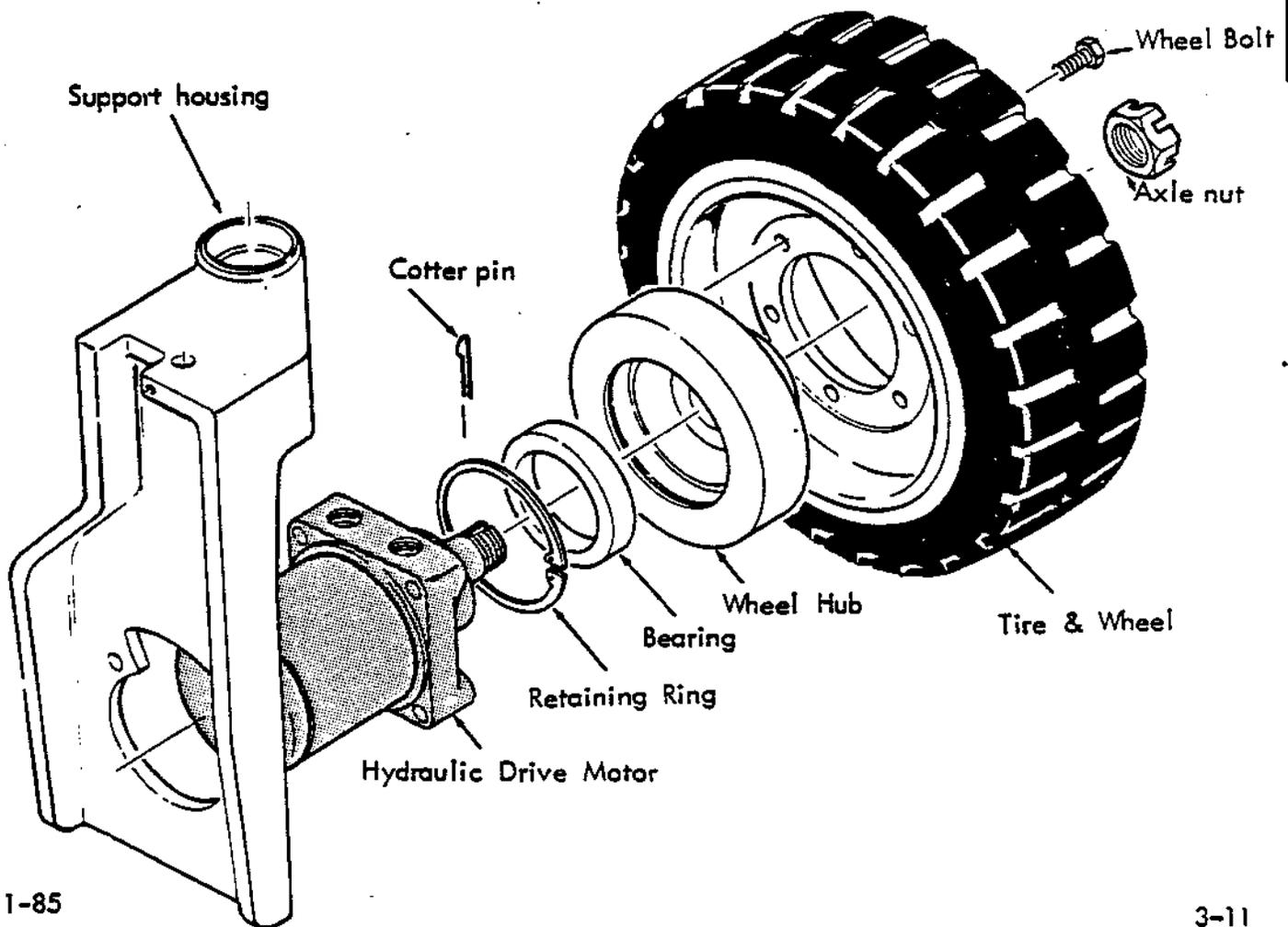
▲ CAUTION Do not make adjustment with motor running. Move the centering bracket in small increments and check by trial and error until correct adjustment is obtained.



REPLACING REAR WHEEL HYDRAULIC DRIVE MOTOR

1. Raise rear of machine and block up securely.
2. Remove cotter pin from wheel axle, then remove axle nut.
3. Carefully remove wheel and wheel hub from axle.
NOTE If wheel is difficult to remove from axle, use wheel puller. Do not pound on axle. To do so may damage the axle, which is the hydraulic motor output shaft.
4. Disconnect hydraulic lines (be sure to mark them for correct reassembly).
5. Remove screws attaching hydraulic motor to support housing and remove motor.
6. Install new or repaired motor and connect lines.
7. If wheel is replaced on hub, tighten 0.50 in wheel nuts to 75 - 85 ft lbs (102 - 115 Nm). Use torque wrench.
8. Install wheel and hub on axle. Tighten axle nut to 200-250 ft. lbs. (271-339 Nm) torque. Use torque wrench. Be sure to install new cotter pin to hold axle nut in place.

ATTENTION! After the first 50 hours of operation, check axle nut tightness. If nut loosens, hub or axle will be damaged.



TO REPLACE MAIN BRUSH

A. To Remove Brush

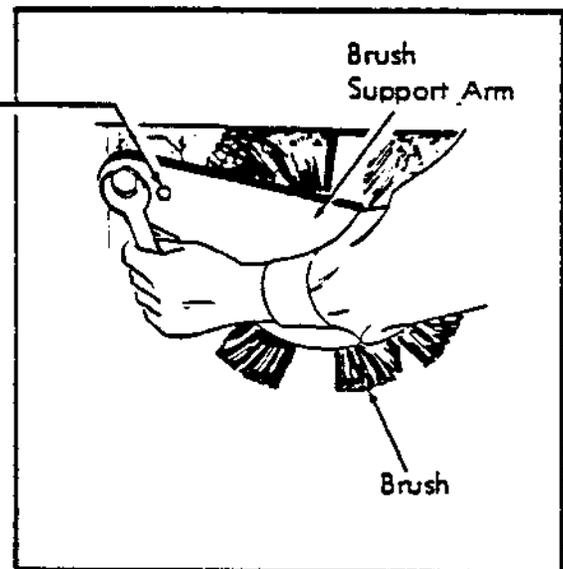
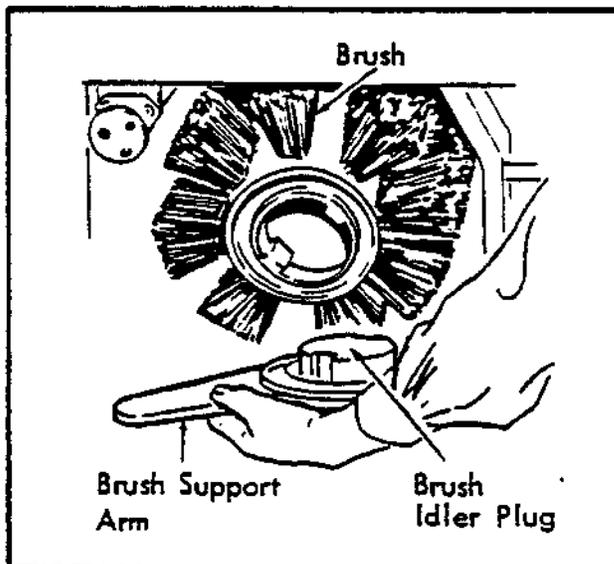
⚠ CAUTION Wear gloves to protect your hands. This is very important when changing brushes which contain wire bristles.

1. Lower main brush to floor with lift handle.
2. Open brush access door.
3. Remove the hex head screw which attaches the brush support arm.
4. Pull out and remove the support arm and brush idler plug from the end of the brush.

If the support arm does not come off easily, insert the arm screw into the tapped hole in the arm. Remove plastic plug in hole. Turn the screw in with a wrench to force the arm off - at the same time, pull and wiggle the arm to help it come loose. Do this very carefully to avoid injuring your hands if the arm should suddenly come off.

5. Grasp the brush and pull it off the opposite (drive) plug, then out the brush access door. (If the brush support arm idler plug is stuck in the brush, it may be easier to pull out both arm and brush at same time.)

If arm does not come off easily, remove plastic plug from this hole and screw in arm attaching screw to force arm off.

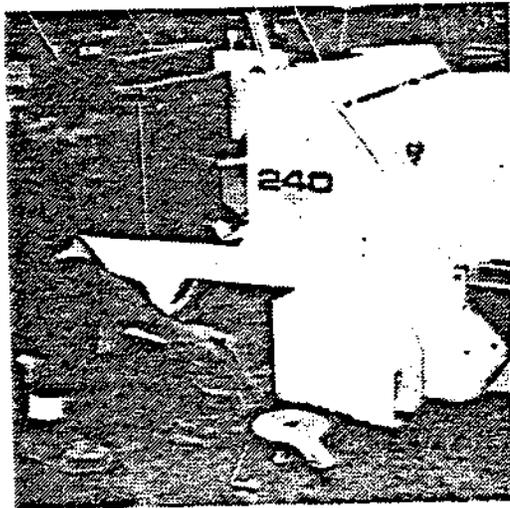


(continued on next page)

TO REPLACE MAIN BRUSH (continued)

B. To Install Brush

1. With brush lever in "Down" position, insert one end of brush through access opening and push in brush until it touches opposite brush plug.
2. Sight through brush tube (or align brush keys by "feel") to align brush keys with, and onto keyways on left side brush plug.
3. Replace right side brush support arm, with plug into open brush end. (To prevent the arm from sticking in place, apply a little grease to the arm pins.)
4. Insert hex screw with washer to hold support arm. Tighten screw securely.



TO REPLACE SIDE BRUSH:

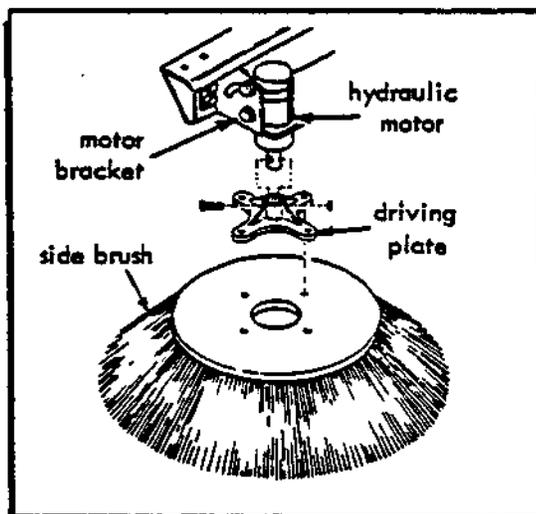
A. To Remove Brush

1. Be sure side brush hydraulic control lever is in "OFF" position.
2. Raise side brush to "UP" position.
3. Remove bolt from brush drive shaft. (Brush can then be lowered and removed.)

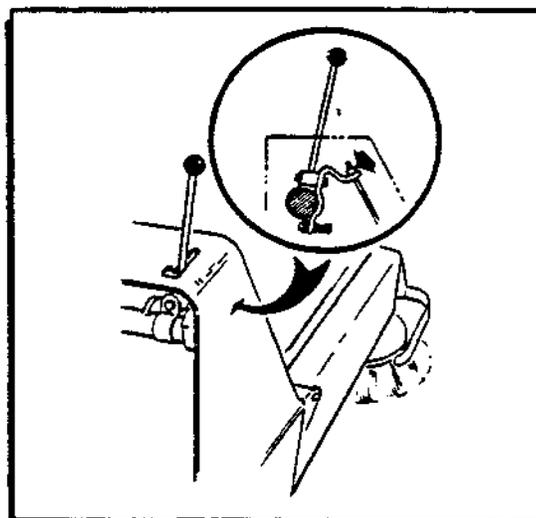
B. To Install Brush

If new or different side brush is to be installed, remove adapter plate from old side brush and mount in like manner on replacement brush.

1. With side brush still in "UP" position, slide brush onto drive shaft. Insert and tighten screw.
2. Using lift lever, lower side brush unit to "DOWN" (sweeping) position.
3. Loosen adjusting lug holding motor bracket to side brush arm. Slide motor and brush up or down until about 1/3 of the bristles touch the floor.
4. Readjust if dust streak is left by side brush, or if bristles are severely bent when sweeper is operated. (See "Side Brush Adjustments").



SIDE SWEEPING BRUSH ASSEMBLY



SIDE BRUSH LIFT CABLE ADJUSTMENT

TO REPLACE SIDE BRUSH LIFT CABLE:

1. Remove old cable by disconnecting lower and upper cable ends. Lower cable end has clevis and pin located just in front of front wheels. Remove lower cable end first.
2. Upper cable end is threaded through adjusting nuts. Remove adjusting nuts from upper cable end to free cable.

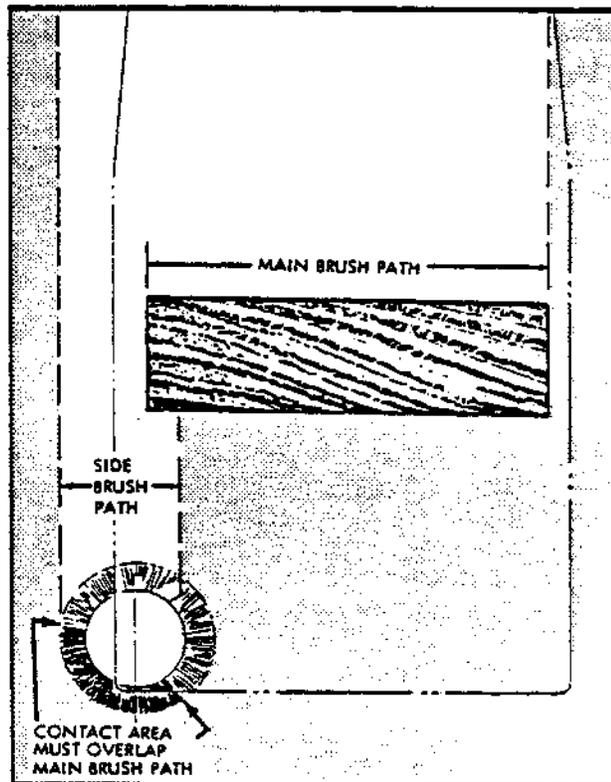
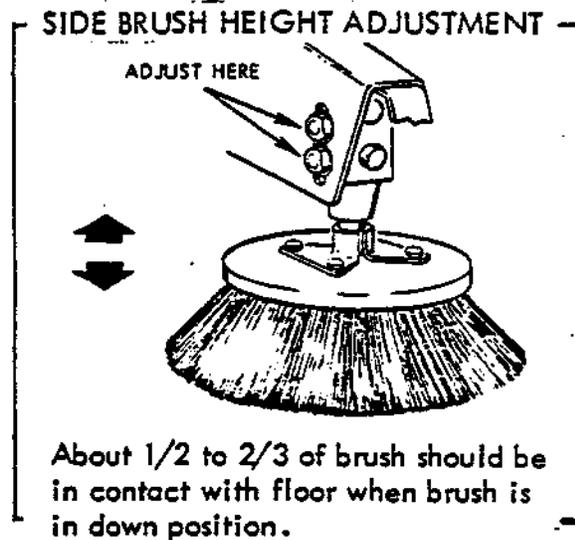
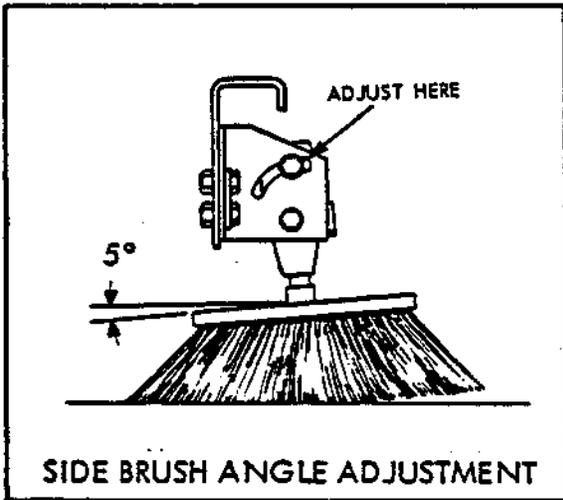
NOTE Adjust cable loosening adjusting nut at upper cable end. (See drawing)

SIDE BRUSH ADJUSTMENTS

Brush Height Adjustment

Height adjustment has been made at the factory. However, if you replace the lift cable, be sure to adjust the cable length properly. Proper cable adjustment should allow the full weight of the brush unit on the floor when brush lift lever is in "DOWN", or sweeping position -- but sufficient cable tension to allow clearance off the floor when the brush unit is lifted and not used for sweeping. (See sketch)

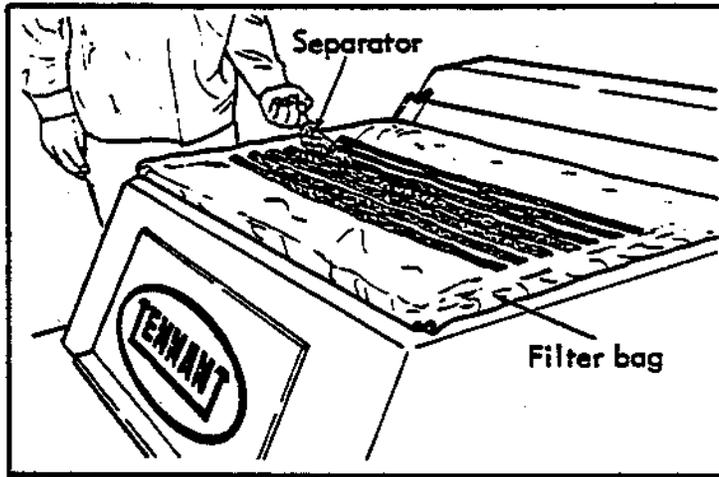
Brush Contact Angle -- should be adjusted as indicated in sketch. Approximately five degrees is the angle normally used. Special conditions may require changing the brush angle.



This sketch shows the relationship between the main brush and side brush sweeping paths.

TO REMOVE AND REPLACE FILTERS

1. Push shaker button to clean filters.
2. Remove filter box cover.
3. Lift out filter complete with filter rack. Clean or replace filter bag.
4. Replace filter and all other parts in same position as they were originally installed. Be sure all parts are assembled compactly and neatly in place to prevent leakage around cover.

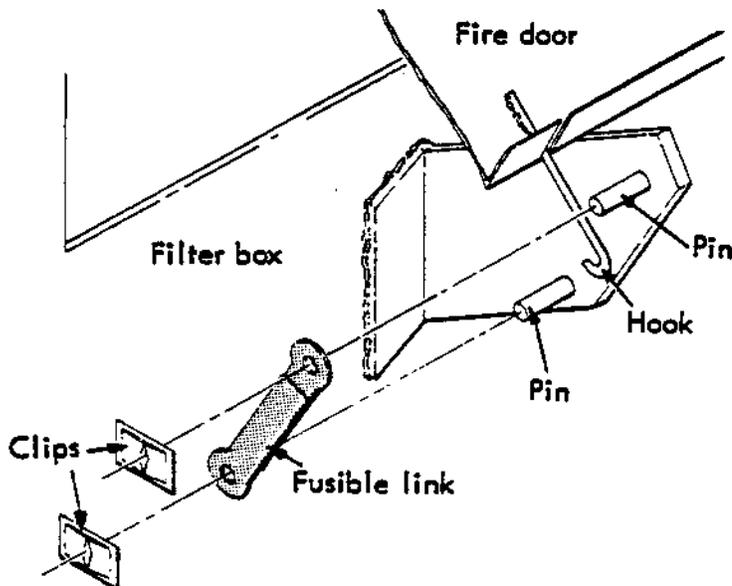


When replacing filter bag, make sure separators are in place between filter bag envelopes.

FUSIBLE LINK REPLACEMENT

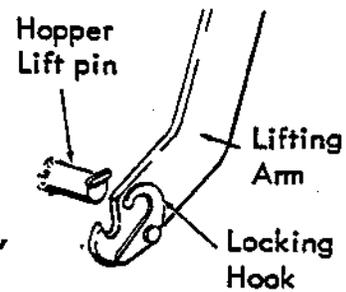
NOTE The filter system in your sweeper is protected, in the event of a fire in the hopper, by a fusible link. This will automatically prevent the passage of air through the filter system if the temperature exceeds the limit of the fuse.

If loss of dust control is noticed, check the fusible link (accessible by opening front access door) for breakage or failure due to heat.

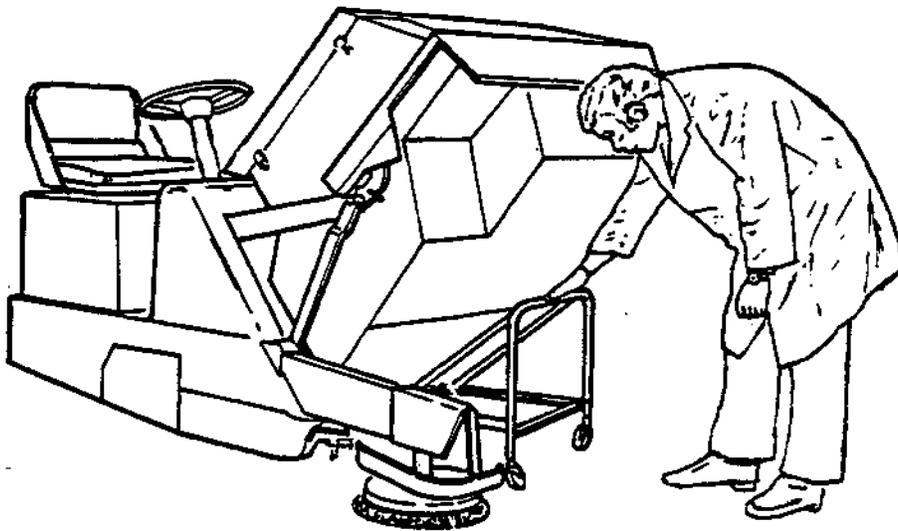


TO REMOVE SWEEPING HOPPER

1. Start motor.
 2. Raise hopper all the way.
- ▲WARNING** Engage safety lock on hopper lift arm.
3. Place dolly under hopper. (If dolly is not available, block up hopper.)



4. Swing aside locking hooks which attach hopper lifting pins to the lift arms.
5. Raise the hopper, disconnect the lift arm safety lock, and lower hopper onto dolly. Stop the motor. Place hydraulic control in "side brush on" position. Push down hopper lift arms until they clear the hopper lift pins.



Place dolly under hopper (or block up hopper), then disconnect lift arms.

TO REMOVE HI-DUMP HOPPER

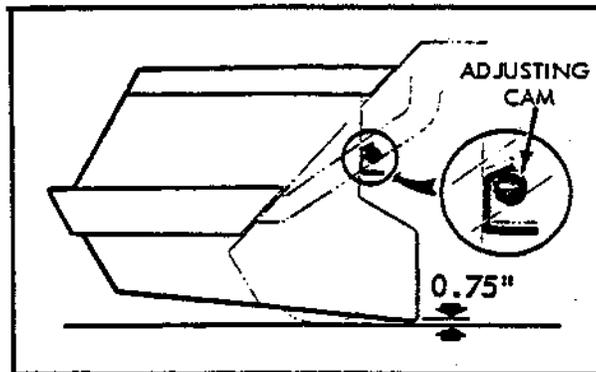
1. The hopper should be supported off the floor.
2. Disconnect the filter shaker motor lead at the point where it enters the hopper (bottom of hopper near side brush).
3. Pull pin at rod end of rollout cylinder (both sides).
4. Remove two bolts which attach right and left torque shaft to hopper.
5. Disconnect the door latch chains (at clevis pin).
6. Pull torque arms out of hopper.
7. Remove hopper.

HOPPER CLEARANCE ADJUSTMENT (For standard machine, not Hi-Dump)

The hopper has been factory adjusted so that it is level and has the correct clearance from the floor. If the hopper is out of adjustment, or is replaced, you can adjust horizontal leveling by turning eccentric adjusting cams on lift arms (see sketch). Make adjustments with the hopper empty.

The metal lip should be 0.75" to 0.88" (19 - 22 mm) from the floor.

The rubber lips and metal edge are removable and can be replaced when worn.

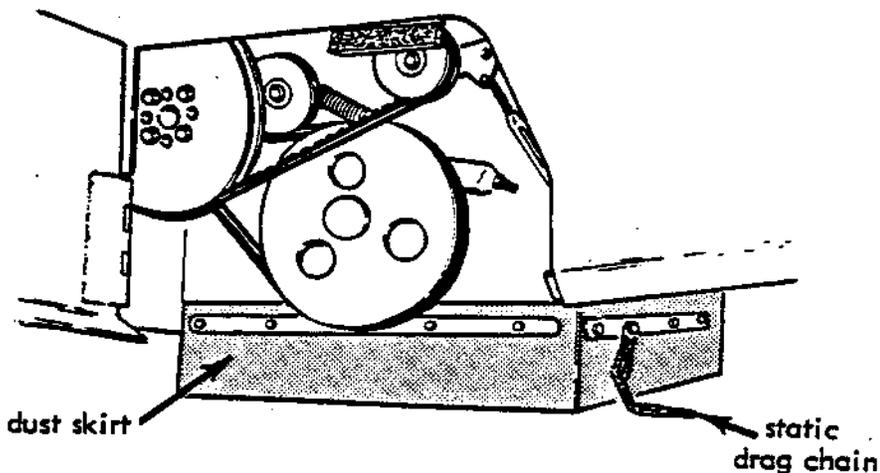


HOPPER FLOOR CLEARANCE ADJUSTMENT

STATIC DRAG CHAIN

A static drag chain is provided to prevent the build-up of static electricity in the machine. This chain is attached below the machine frame.

Check the chain periodically for wear. Make sure that it is making contact with the floor at all times.



DUST SKIRTS AND STATIC DRAG CHAIN

DUST SKIRTS

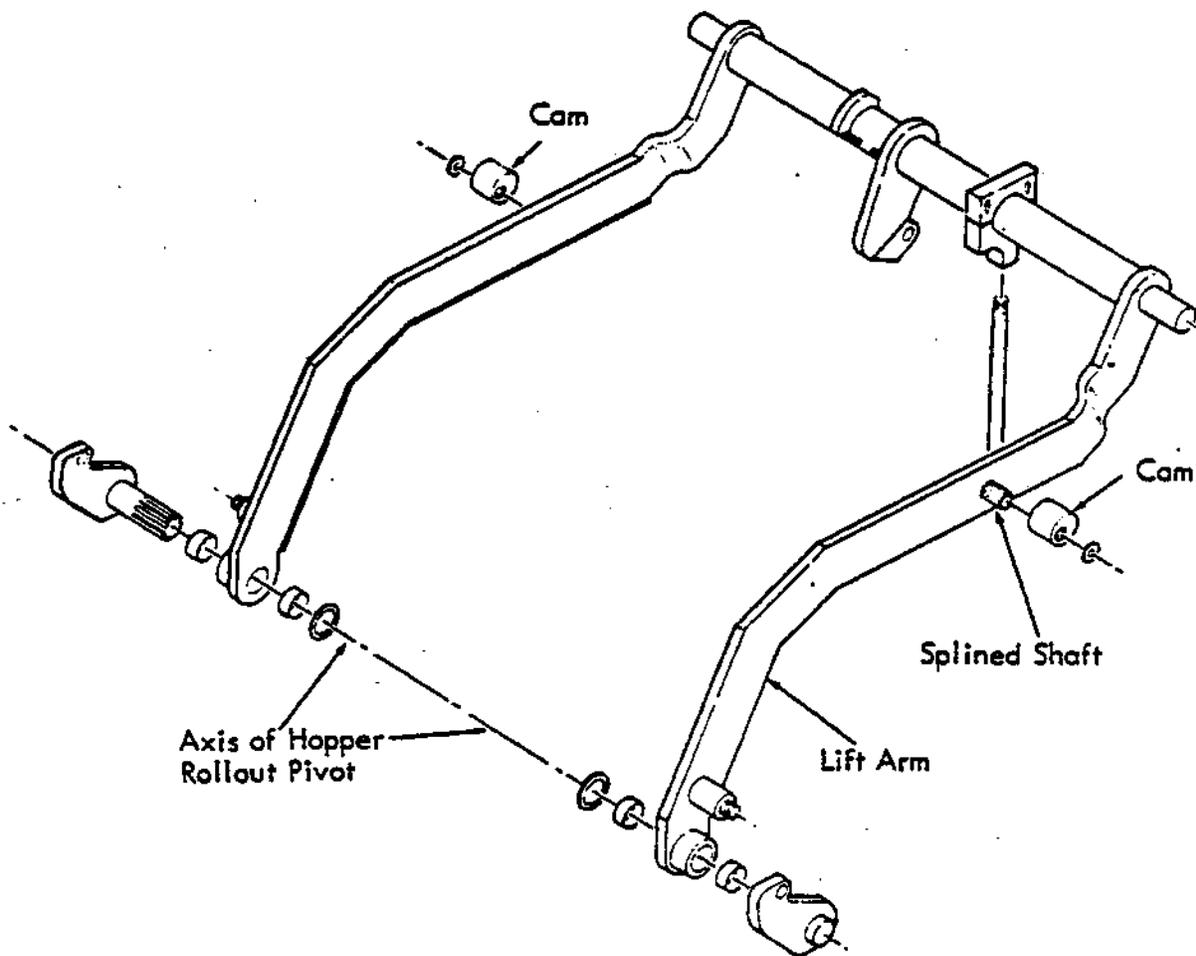
All dust skirts have slotted screw openings to provide adjustment for skirt clearance from floor. This clearance should be adjusted to allow 1/8 inch between skirt edge and floor. Be sure when making this, or other floor clearance adjustments, that you have machine on a level surface.

HI-DUMP MACHINE ADJUSTMENTS

The following are factory adjustments which should be necessary only if the hopper, lift arms, or other parts have been replaced or repaired. The adjustments should be performed in the following order:

HOPPER LIFT ARM ADJUSTMENT

1. The axis of the hopper rollout pivot should be $6.25" \pm 0.13"$ ($159\text{mm} \pm 3.2\text{ mm}$) from the floor (both sides).
2. When the hopper is at the required dimension, adjust the two cams on the main lift arms so that they contact the front, sloping edge of the main frame. The cams are mounted on splined shafts and, once they are adjusted, should not require readjustment.



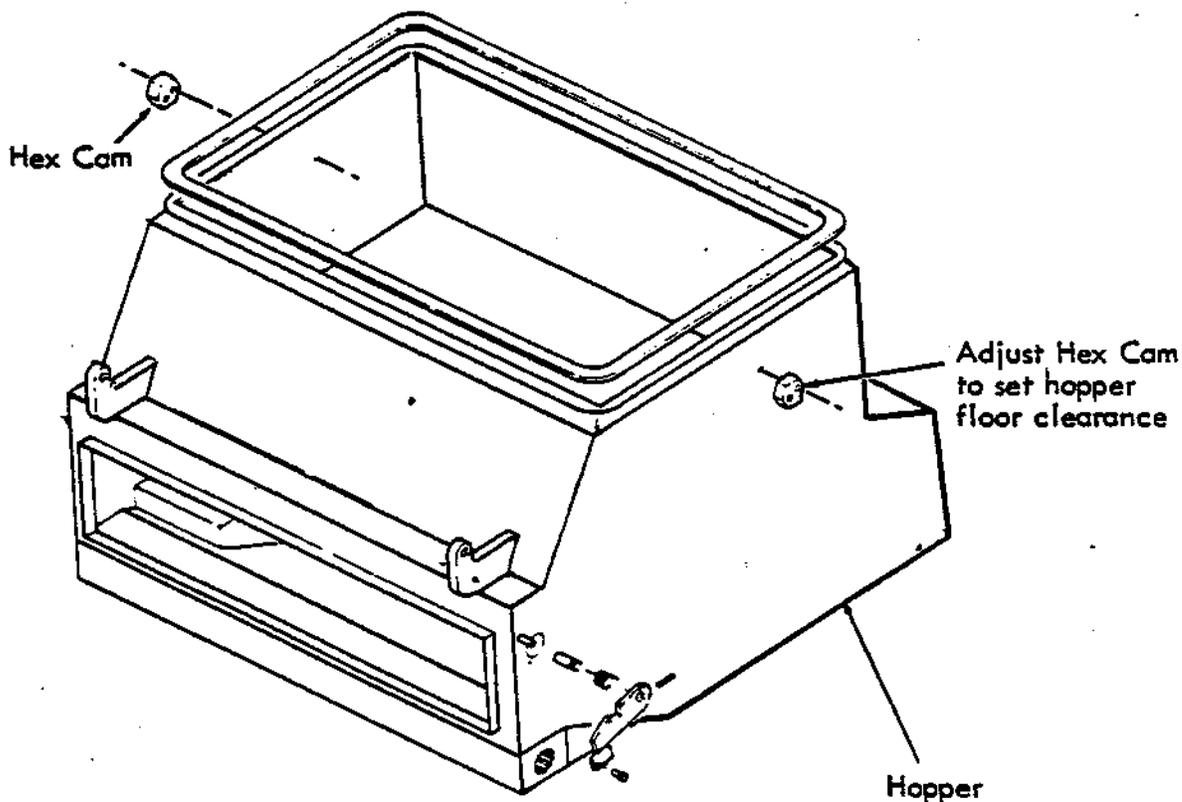
MAIN LIFT CYLINDER

1. After the lift arm has been adjusted as described above, adjust the clevis on the main lift cylinder so that the cylinder is fully retracted. To do this, loosen the jam nut on the cylinder piston rod, then turn the rod by means of a pin inserted through the hole in the rod.

HI-DUMP MACHINE ADJUSTMENTS (continued)

HOPPER ADJUSTMENT FOR FLOOR CLEARANCE

1. After performing the adjustments described above, disconnect the rollout cylinders at their lower pivot point.
2. Level the hopper and position it so that the rear hopper bottom is 3 in. \pm 0.13 in. (76.2 mm \pm 3.2 mm) from the floor.
3. At this point, adjust the hex cam (one on each side of the hopper) so that they make contact with the top surface of the main lift arms.



ROLLOUT CYLINDER ADJUSTMENT

After above adjustments are completed, adjust the rollout cylinders as follows: Retract the cylinders completely. Then adjust each cylinder clevis until the 0.75 in. dia. pin can be inserted through the clevis and torque arm. Lock the clevis in place with the jam nut.

SPEED LIMITER ADJUSTMENT

Adjust the speed limiter cam position so that it restricts forward speed to 1.5 - 2 mph when the hopper is raised to any point over 36 inch (914 mm) from the floor.

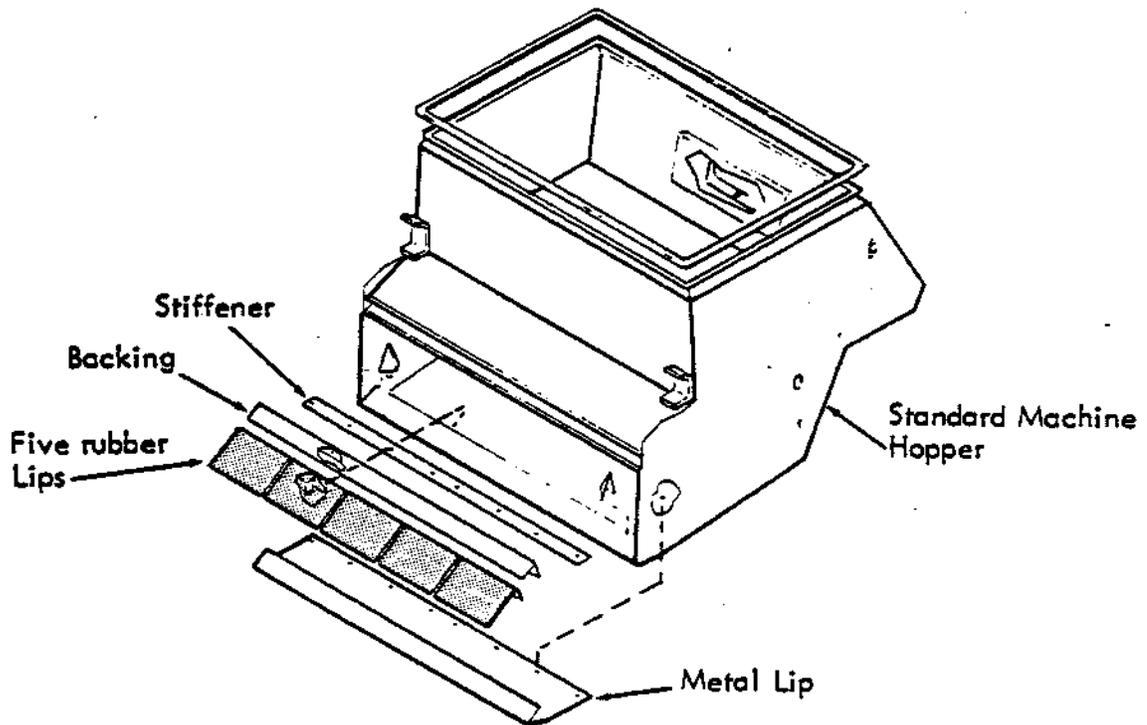
HI-DUMP MACHINE ADJUSTMENTS (continued)

HI-DUMP HOPPER DOOR LATCHES ADJUSTMENT

- A. The latching bracket should be shimmed so that when the door is slammed shut, the latches will fully engage and hold the door closed tightly.
- B. When the hopper is fully raised and rolled in, the latches should be fully engaged. Adjustment is made by means of eye-bolts at end of each chain. The latches should release at the same time.

HOPPER LIP REPLACEMENT

Both the Standard machine and the Hi-Dump model hoppers have five replaceable rubber lips which should be checked occasionally and replaced if worn or damaged.

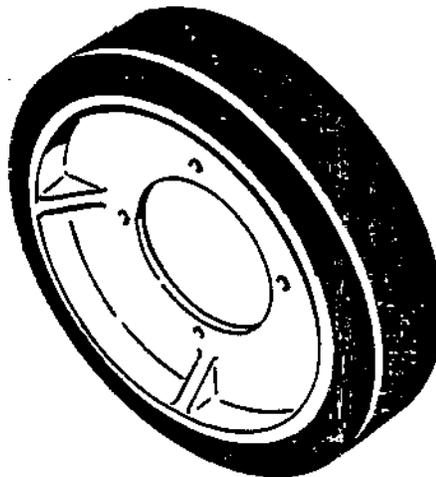


TIRE REPLACEMENT

Front Tires:

The front tires are solid and are bonded to a rim. To replace a tire:

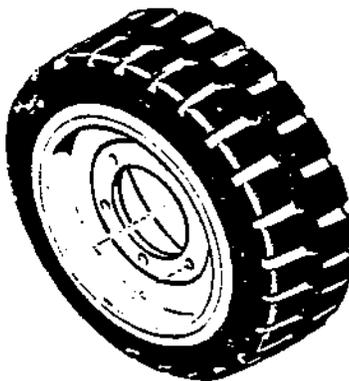
1. Raise and block up front of machine.
2. Raise or remove hopper. (If hopper is raised, use safety lock.)
3. Remove cotter pin, retaining ring and wheel.
4. Remove bolts attaching wheel to hub.
5. Remove old tire and rim assembly.
6. Bolt new tire and rim assembly to hub.
7. Install wheel.



Rear Tire Replacement:

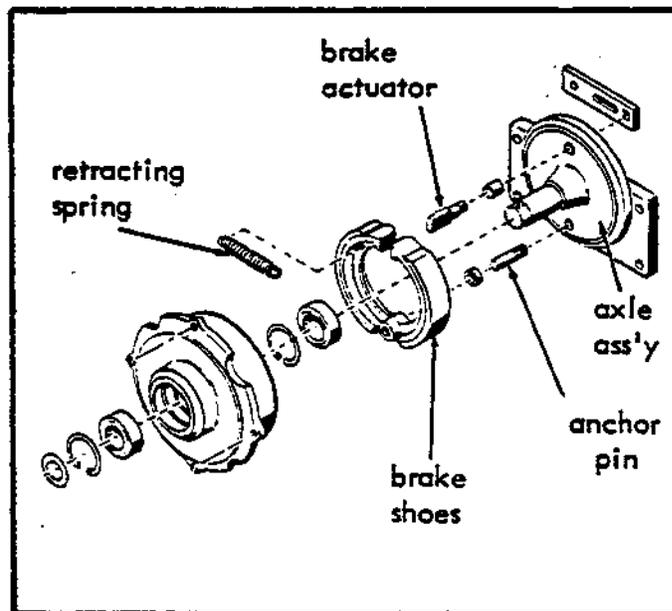
The rear tire is solid, bonded to a rim, 16.25 in dia. (413 mm) by 6 in. (152 mm) wide.

1. Raise and block up rear of machine.
2. Remove cotter pin and nut from motor shaft.
3. Remove wheel from motor shaft. Use wheel puller if wheel is difficult to remove from motor tapered shaft. Do not pound on motor shaft.
4. Press old tire off the wheel.
5. Press new tire on wheel. Use hydraulic press.
6. Install wheel on motor shaft.
7. Install nut. Torque to 300-400 ft. lbs (407-542 Nm)
8. Insert cotter pin.
9. Re-torque nut after 50 hours operation.



TO REPLACE FRONT WHEEL BRAKE SHOES

1. Raise machine and block up securely.
2. Remove wheel.
3. Disconnect and remove brake shoe retracting spring.
4. Remove brake shoes.
5. Inspect brake shoe actuator for wear and replace if necessary.
6. Clean brake assembly and brake drum.
7. Position new brake shoes on anchor pin and install shoe retracting spring.
8. Install wheel.



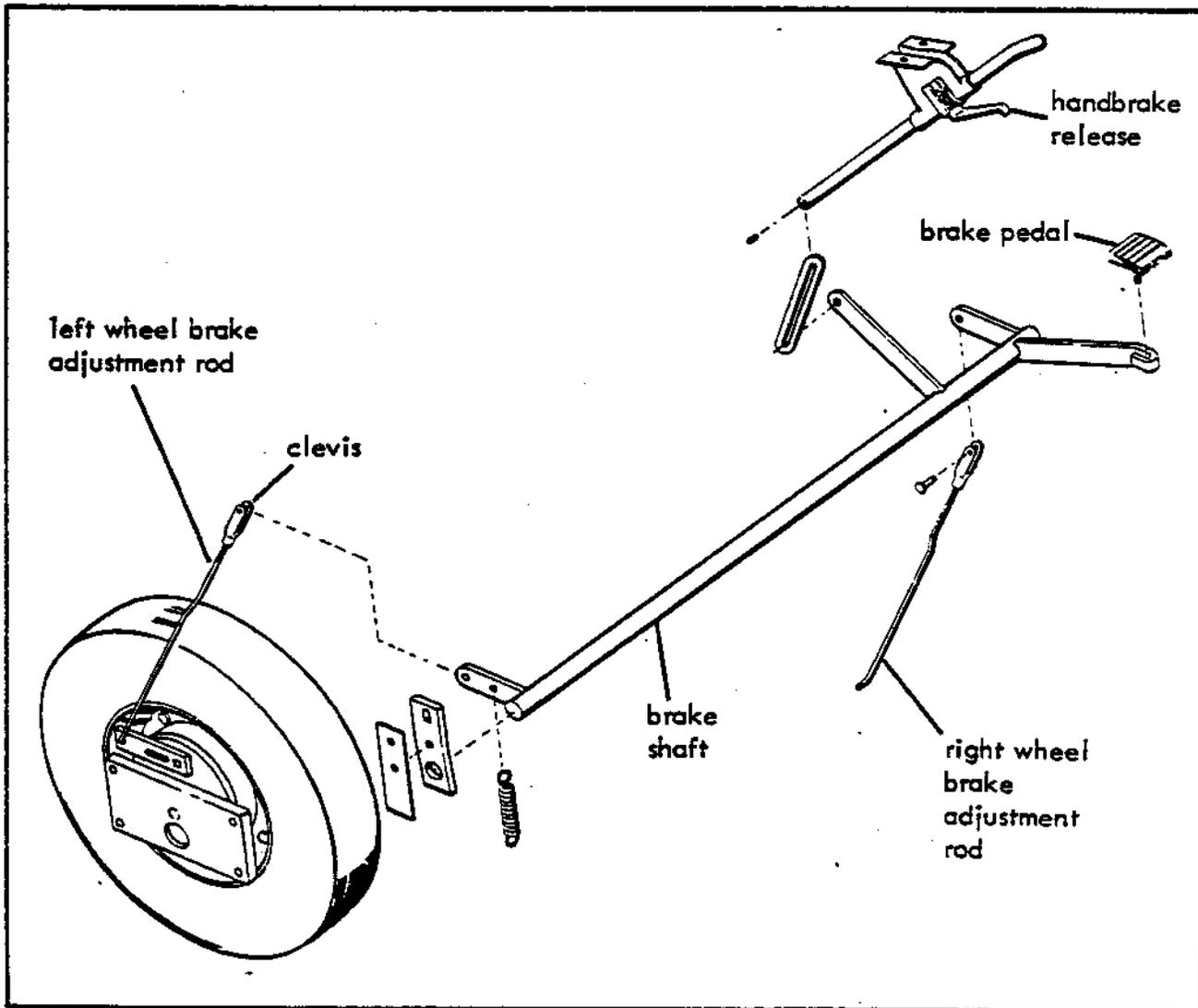
FRONT WHEEL BRAKES

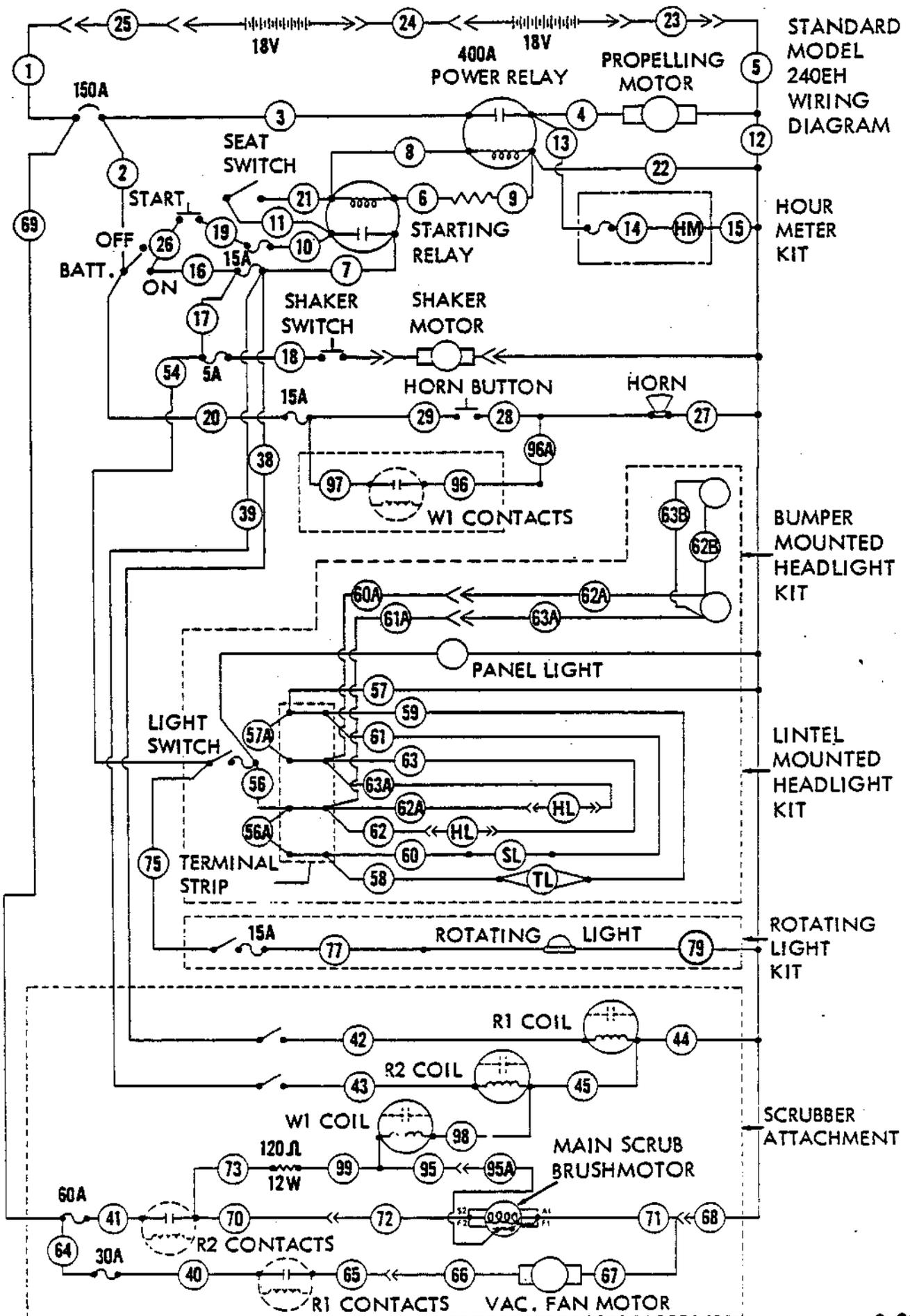
BRAKE ADJUSTMENT

The mechanical, drum-type front wheel brakes are operated by a foot pedal, and also by a handbrake lever for parking.

To Adjust Brakes:

1. Raise and block up sweeper so that the front wheels are off the floor. Raise hopper and engage safety lock.
2. Adjust the brakes by turning the adjustment rod for each wheel (see drawing). Adjust each rod an equal amount.
3. Check to be sure brake shoes are not dragging by spinning each wheel.
4. Periodically, use air hose to blow dirt from between brake shoes and wheel. A hole is provided for this purpose on the outside of the machine next to each wheel.





LOCATION OF FUSES AND CIRCUIT BREAKERS

A fuse panel is located inside the instrument panel enclosure. Other fuses are located on the back side of the light switches. To replace fuses, remove the screws attaching the instrument panel rear cover and lift off the cover.

A 5-amp fuse is used in the shaker motor circuit. 15-amp fuses are used to protect the horn circuit, and the accessory circuits such as the headlights, rotating light, hour meter, etc. Before replacing a blown fuse, try to determine the cause. If the machine is equipped for the Scrubbing Attachment, on-off switches and circuit breakers are provided on the instrument panel for the main scrub brush and vacuum fan motors. If these motors are overloaded, the circuit breaker will automatically trip, stopping the motor. Determine the cause of the overload before continuing scrubbing.

NOTE

If the main scrub brush motor in the scrubbing attachment becomes overheated, an overload relay located in the motor will open. This will cause the horn to sound, indicating to the operator that the motor has been overheated. If the horn sounds while scrubbing, turn off the scrubber motor switch and determine the reason for the motor overheating. (The horn will also sound if the scrubber switch is turned on when the scrubber has been disconnected, or if the scrubber is on the machine but leads # 95 and 95A have not been connected). It is also possible that the thermal-sensing overload switch ("Mighty-Mite") on the scrub brush motor may be defective.

ELECTRIC MOTORS

The electric motor brushes should be inspected and the brush dust should be blown out of the motor after every 250 hours of operation. If the brushes have been worn to less than 0.75" (20 mm) in length (0.38" or 10 mm in length for scrub attachment vacuum fan motor brushes), they should be replaced.

If the commutator is worn or rough, the armature should be removed. The commutator should be turned in a lathe, the mica recut, and commutator polished. Reassemble and seat the new brushes, using a brush seating stone. Be sure the rocker arm is set on the neutral mark.

BATTERIES

The machine batteries provide all of the energy used by the machine. They require regular maintenance to keep them operating their best.

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

Do not operate machine if batteries are in poor condition or discharged beyond 80%.

Check the battery cables for loose connections on the battery terminals daily. Inspect the cables for corrosion damage.

Clean the top surface and the terminals of the batteries after every 80 hours of operation. Use a strong solution of baking soda and water. Brush the solution sparingly over the battery top, terminals, and cable clamps. Do not allow any baking soda solution to enter the battery. Use a wire brush to clean the terminal post and the cable connectors. After cleaning, apply a coating of clear petroleum jelly to the terminals and the cable connectors. Keep the tops of the batteries clean and dry.

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

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

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

Use a hydrometer to check the electrolyte specific gravity after every 20 hours of operation.

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

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

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

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

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

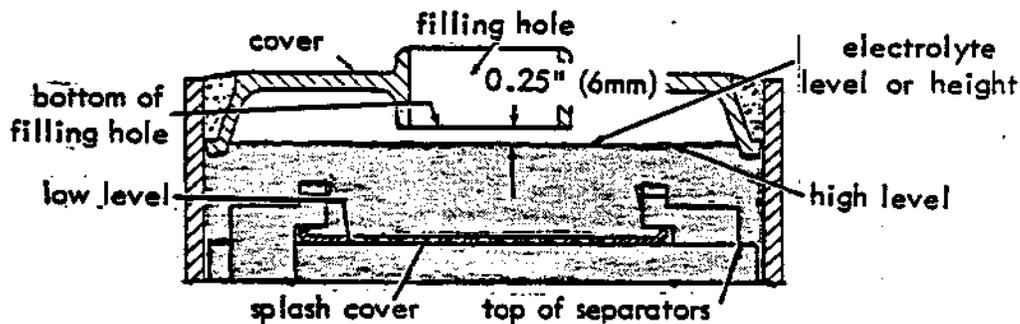
Subtract from the specific gravity reading 0.004, 4 points, for each 10°F (5.5°C) below 80°F (26.6°C).

ADDING WATER

Always keep electrolyte level above the splash plate, but avoid over-filling.

Check electrolyte level daily until a regular interval for adding water is established.

When adding water, it is necessary to visually gauge when to stop. Keep the top level of the electrolyte no less than 0.38 in (9.7mm) on 510 A/hr batteries, 0.25 in (6mm) on 600 A/hr batteries, below bottom of filling hole as shown in the sketch. All the cells of a battery should require about the same amount of water.



BATTERY REPLACEMENT

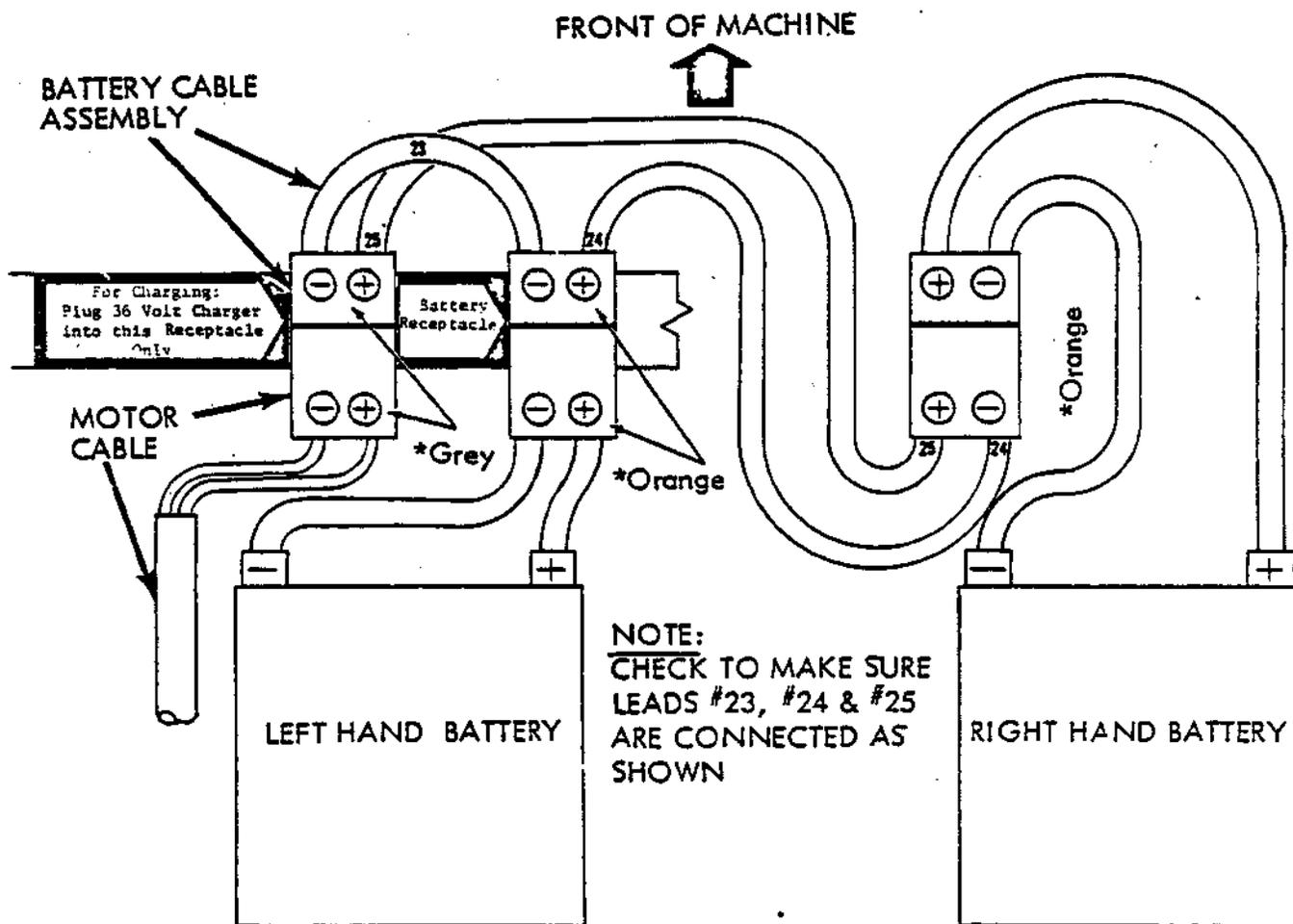
The standard battery for the Model 240 EH was a 9-cell, 18-volt, 510 amp hour (at 6-hour rate) type. It is currently a 9-cell, 18-volt, 600 amp hour (at a 6-hour rate) type battery.

Each battery weighs approximately 775 lbs (350 kg). Each battery is enclosed in a steel case provided with a hinged cover and lifting holes located near the top of the case.

NOTE Because of clearance limitations between the battery and machine the best method of lifting the batteries and installing them is to:

1. Lift the left-hand battery with the lifting hooks in the end holes.
2. Lift the right-hand battery (the battery under the seat) with the lifting hooks in the side holes.

To gain access to the right-hand battery, remove the seat cushion and tilt the seat forward against the steering wheel. For the left-hand battery, simply lift the cover over the battery.



NOTE:
CHECK TO MAKE SURE
LEADS #23, #24 & #25
ARE CONNECTED AS
SHOWN

MODEL 240 EH BATTERY CONNECTIONS

*New recommended color coding system.

CHARGING BATTERIES

ATTENTION! When charging batteries, connect charger to receptacle provide to charge both batteries at the same time on a 36 Volt charger. Do not charge batteries separately.

Check battery water level before charging.

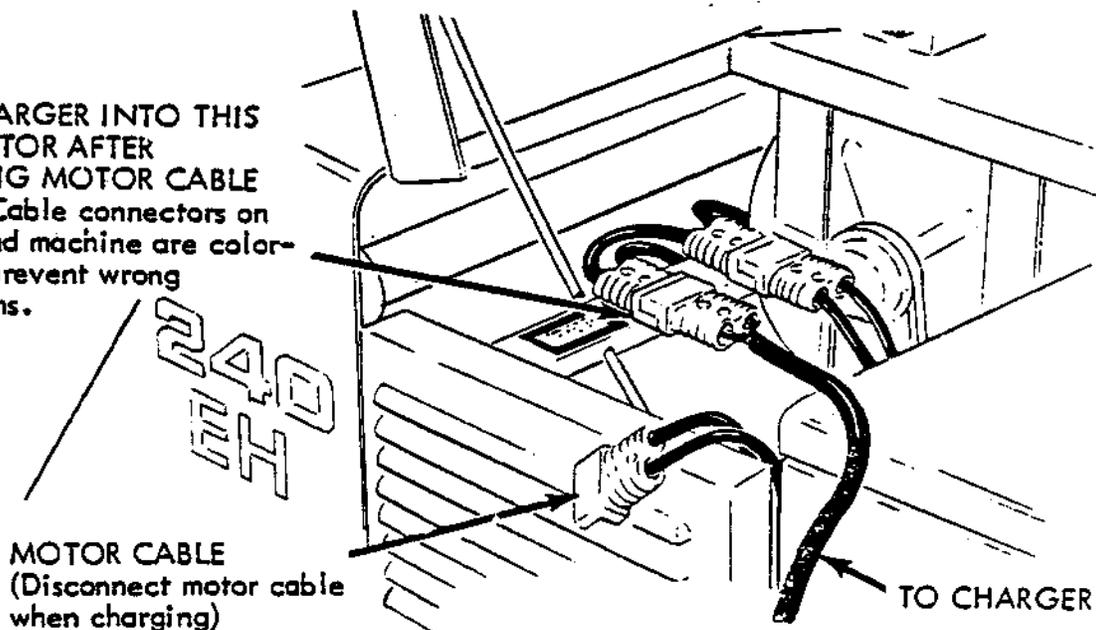
1. Disconnect machine cable from battery receptacle (on metal strap above motor). Battery receptacle is labeled (see illustration).
2. Connect charger to suitable A.C. power source. Recommended chargers are listed in the "Accessories Parts Section".
3. Plug charger fitting into battery receptacle. Note both batteries will be charged at once, since they are connected together by other wiring.
4. To charge a fully discharged battery set timer at 6 to 8 hours.
5. On about every 5th time battery is charged, set timer at full 12 hours. This will equalize all cells and bring battery up to peak capacity.

The recommended charger should be fully automatic in that the charge rate tapers off by itself as the battery is charged. There is little likelihood of overcharging. Set the timer for full charge time if there is doubt of charge left in battery.

⚠ WARNING Do not smoke or light matches, or bring open flame into area when battery is being charged. Keep covers open over battery. Provide adequate ventilation.

PLUG CHARGER INTO THIS CONNECTOR AFTER REMOVING MOTOR CABLE

NOTE Cable connectors on charger and machine are color-coded to prevent wrong connections.



CHARGING BATTERIES

TROUBLE SHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
Motor runs, but machine will not move.	<ol style="list-style-type: none"> 1. Foot pedal and/or linkage jammed or not adjusted. 2. Front wheels jammed or brakes locked. 3. Hydraulic pump drive belts loose or broken. 4. Hydraulic pump or drive motor sheaves loose on shaft. 5. Hydraulic pump trouble, such as relief valve failure, leakage, etc. 6. Rear wheel hydraulic motor trouble such as broken shaft key, broken shaft, etc. 	<ol style="list-style-type: none"> 1. Check pedal and linkage. 2. Check wheels. 3. Adjust or replace belts. 4. Check for broken keys, etc. 5. See "Hydraulic Components" Section. 6. See "Hydraulic Components" Section for parts information.
Machine moves slowly.	<ol style="list-style-type: none"> 1. Batteries weak. 2. Low hydraulic oil level. 3. Front wheels: Brakes dragging, wheels jamming, tires softened from contact with oil or solvent. 4. Hydraulic pump drive belts loose. 5. Hydraulic oil temperature too high--oil is too thin. May be caused by: operating with excessive load or drag, prolonged ramp climbing, high temperature operation, or worn pump. 6. Worn hydraulic pump or rear drive wheel motors. 	<ol style="list-style-type: none"> 1. Recharge. 2. Add oil. 3. Check wheels, repair or replace. See Maintenance instructions. 4. Tighten belts - See Maintenance instructions. 5. Use TENNANT No. 23825 - 20W60 Hydraulic Oil. Check pump -- See "Hydraulic Components" Section. 6. See "Hydraulic Components" Section for parts information.
Hopper dumps slowly or will not dump.	<ol style="list-style-type: none"> 1. Pump drive belts loose. 2. Load in hopper too heavy. 3. Lift arms or hopper binding. 4. Wear or failure in manually-operated control valve. 	<ol style="list-style-type: none"> 1. Check belt tension. 2. Empty more often. 3. Check for binding or obstructions. 4. Check valve.

TROUBLE SHOOTING (Continued)

TROUBLE	PROBABLE CAUSE	REMEDY
	5. Defective dump cylinder, seals leaking.	5. Repair cylinder.
	6. Accessory portion of tandem hydraulic pump worn or damaged.	6. Check "Hydraulic Components" Section for parts.
No vacuum -- poor dust pick-up.	1. Dust skirts worn or not adjusted correctly. 2. Fusible link on filter box fire door may have failed. 3. Dust filters clogged. 4. Vacuum fan V-Belt slipping or broken. 5. Failure in fan drive such as sheave key broken, etc.	1. Check dust skirts, adjust to clear floor by 1/8 inch. 2. Replace fusible link. 3. Clean filters. 4. Replace V-Belts. 5. Repair sheaves.
Poor sweeping.	1. Sweeping brushes not adjusted correctly. 2. Sweeping brushes worn. 3. Dust skirts not adjusted or worn. 4. Filters clogged. 5. Main brush drive belts slipping. 6. Side brush hydraulic motor worn. 7. Brush driving plugs worn or damaged.	1. See "Side and Main Brush Adjustment" in Maintenance Section. 2. Replace brushes--see Maintenance Sections. 3. Replace or adjust dust skirts. 4. Clean filters. 5. Check both brush drive belts for correct tension--see Maintenance Section. 6. Check motor--see "Hydraulic Motor Trouble Shooting". 7. Check plugs.

TROUBLE SHOOTING (Continued)

TROUBLE	PROBABLE CAUSE	REMEDY
Hydraulic pump making excessive noise.	1. Partially clogged pump inlet line.	1. Check the inlet line to pump and tank inlet. If oil is dirty, drain system and flush thoroughly. Refill with clean TENNANT Hydraulic fluid.
	2. Air leak at pump intake line connections.	2. Pour fluid on connections to check for leaks--listen for change in pump sound level. Tighten connections which are loose.
	3. Air bubbles in hydraulic fluid.	3. Check for low hydraulic fluid or loose connections in hydraulic lines.
	4. Hydraulic pump is worn or damaged.	4. See "Hydraulics Components" Section.
Hydraulic Motor operates slowly.	1. Worn pump.	1. Repair or replace pump.
	2. Worn Hydraulic motor.	2. Replace seals and repair motor.
	3. High hydraulic oil temperature.	3. Change to higher viscosity oil.
	4. Clogged hydraulic oil filter.	4. Change filter cartridge.
Hydraulic Motor will not turn over.	1. Shaft seized in housing.	1. Replace housing and shaft assembly.
	2. Large contaminating particles in hydraulic oil.	2. Flush out system, change oil and filter element.
	3. Broken shaft.	3. Replace shaft.
Hydraulic Motor runs without turning shaft.	1. Broken parts in motor.	1. Disassemble motor and check parts.

TROUBLE SHOOTING (Continued)

TROUBLE	PROBABLE CAUSE	REMEDY
Hydraulic Motor leaks at shaft.	1. Worn or cut shaft seal.	1. Replace shaft seal. (Polish shaft at seal area--check for rough area or burrs).
Leak between flange and housing in Hydraulic Motor.	1. Loose flange screws. 2. O-Ring worn or damaged. 3. Housing plug O-Ring leaking. (On side brush motor only.)	1. Tighten screw. 2. Replace O-Ring. 3. Replace plug O-Ring.
Leak between housing and plate or plate and gerotor in Hydraulic motor.	1. End cap screws loose. 2. O-Rings worn or damaged	1. Tighten end cap screws 2. Replace O-Rings.
Leak between gerotor and end cap.	1. Dirt between surfaces. 2. Scratches, nicks, burrs. 3. O-Ring worn or damaged.	1. Disassemble, clean parts. 2. Polish parts 3. Replace O-Rings.

TROUBLE SHOOTING ELECTRICAL TESTS

These tests can pin-point problem areas - for example - if the amp draw for the main brush only test was excessive and the motor itself was normal, check the mechanical linkage. The bearings, belts, belt tension, and brush plugs should be checked for binding. Repair or replace the binding item and re-test the amp draw.

NOTE On scrubber attachments the horn will sound if the front scrub brush motor overheats. The cause of the overload should be found before continuing operation of the machine.

A better way to measure the work capability of a machine per battery charge is to consider the amount of square feet that can be swept, rather than how many hours it will operate.

One easy way to increase the amount of area swept per battery charge is to make sure that the machine does not travel long distances between sweeping jobs. This can be done by choosing circular routes from the parking place and back, rather than having the machine go long stretches merely traveling before the sweeping is started.

A. The first test should be checking batteries.

If the batteries are o.k. then check the amp draw per test #1 for the sweeper or scrubber. If these readings are normal, then there is nothing that can be done to extend the sweeping or scrubbing time per battery charge, except to get another set of batteries to be used for completing the job.

However, if the amp draw for test #1 is excessive, then proceed as follows to test the rest of the machine to determine the problem area.

B. AMP DRAW TESTS

1. For Machine Equipped for Sweeping:

Fully charge batteries and warm up electric motor before testing (the machine tested for these figures had a 22071A - natural fiber main brush with a 2" (50.8 mm) brush pattern).

(Continued on next page)

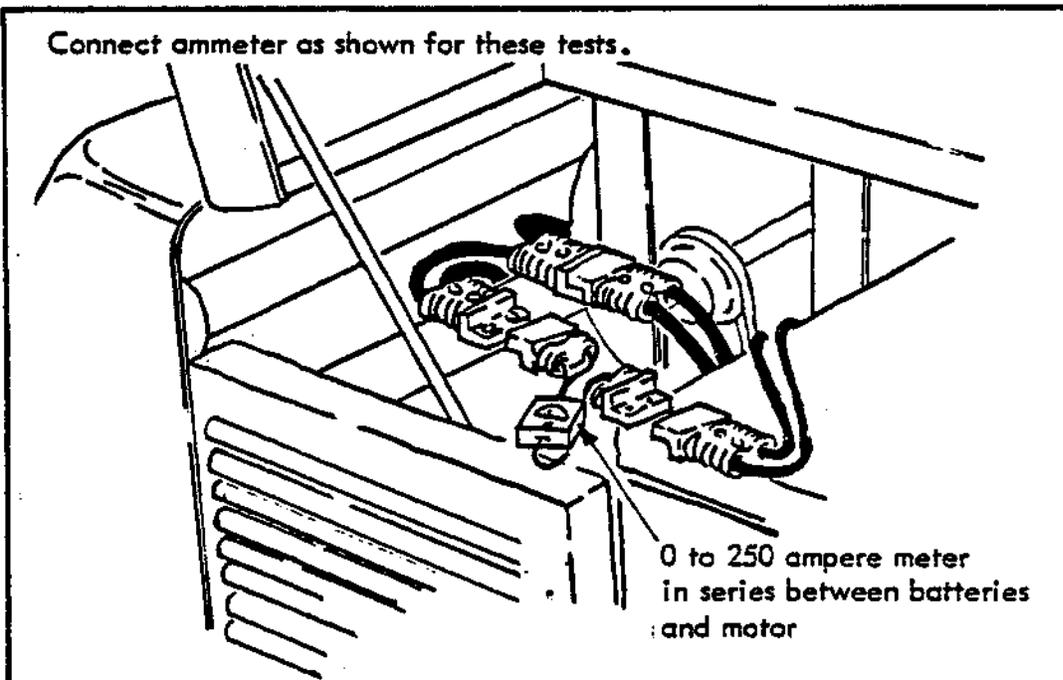
Test
Number

Test Description

Normal AMP.
Draw (see ammeter
hook-up shown
below)

- | | | |
|----|--|-------|
| 1. | Brush (main & side) rotating and down.
Machine going full speed on smooth
level floor. | 110 |
| 2. | Remove main brush drive belt at motor.
Turn side brush off. Drive pedal in
neutral. | |
| | A. Vacuum control closed | 58 |
| | B. Vacuum control open | 70 |
| 3. | Leave main brush drive belt off and remove
vacuum fan belt. Drive in neutral. | |
| | A. Side Sweep on and up. | 55 |
| | B. Side Sweep on and down. | 59 |
| 4. | Raise and turn off side brush.
Leave fan and main brush belts off. | |
| | A. Machine in neutral. | 53-54 |
| | B. 1-MPH on Smooth level floor | 57-58 |
| | C. Top speed on Smooth level floor | 85 |
| 5. | Remove all belts from electric motor. | 16 |
| 6. | Replace main brush belt.
Lower brush and set for 2" (50.8 mm) brush pattern. | 32 |

(continued on next page)



11 Amp Draw Tests for Machine with Scrubbing Attachment installed:

Brushes Used

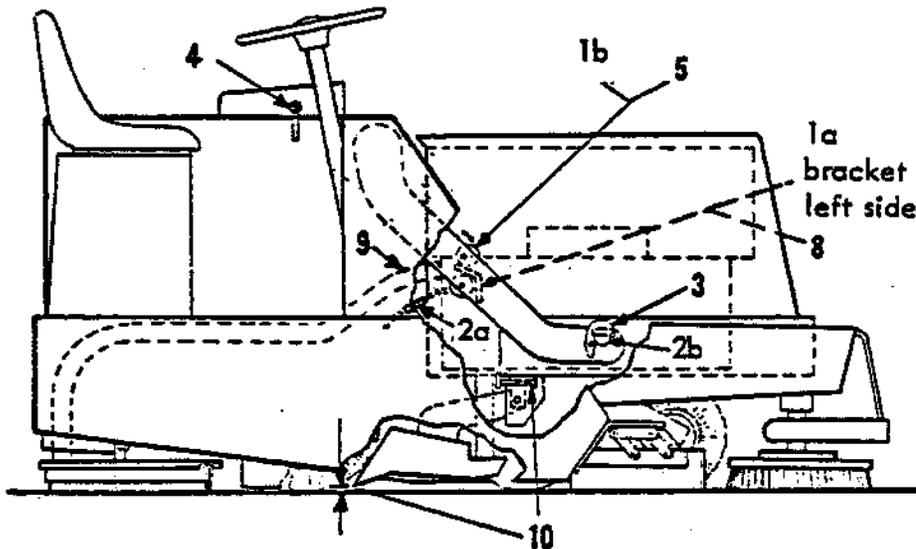
- 3 in. (76 mm) pattern on main brush - 8 double row nylon spiral.
- 2 in. (51 mm) pattern on front scrub brush - 24 single row poly.

<u>Test Number</u>	<u>Description</u>	<u>Normal AMP Draw</u>
1.	Machine scrubbing with 622 detergent, all brushes on and down, scrubber vacuum motor on, sweeper vacuum control closed:	
	A. Propelling pedal in neutral.	118
	B. Machine moving 1 mph	125
	C. Machine moving 2 mph	133
	D. Machine moving 3 mph	137
	Scrubber unit test only - Main Motor Off.	
2.	Front scrub brush down, 2" (51 mm) pattern and running in detergent and water on smooth level floor.	20
3.	Brush running, but not touching floor.	11
4.	Remove brush - motor only running.	10
5.	Scrubber vacuum motor only, no hoses connected.	21

INITIAL ALIGNMENT OF NEW SCRUBBING UNIT TO MACHINE

MODEL 240EH ONLY

ATTENTION! New scrubbing units may require alignment to the machine. Follow these instructions carefully.



ALIGNING SCRUBBING UNIT TO MACHINE:

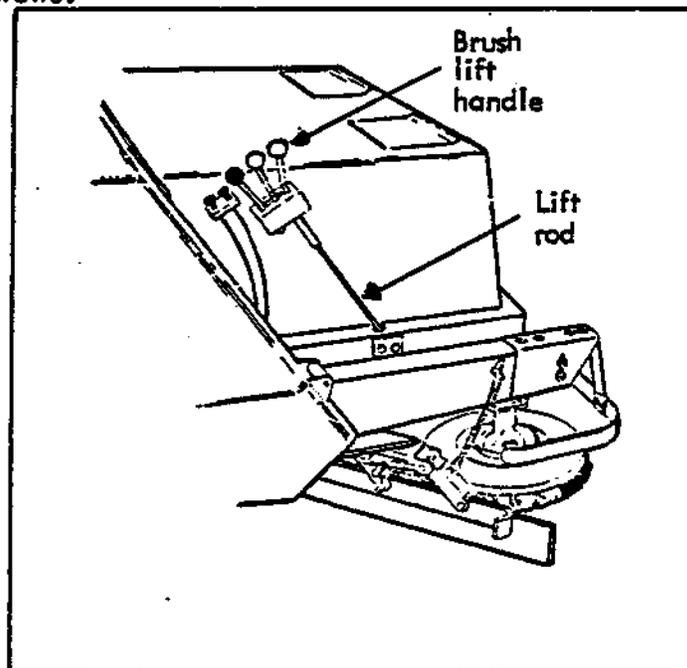
1. a. Loosen bracket on left rear side of scrubber.
b. Loosen top cam on the right hand lift arm and rotate back.
NOTE Do not loosen lower cam.
2. a. Move scrubber near to position and connect electrical plug.
b. Move scrubber into place and line up lift pins over slots in lifting arms.
3. Start motor. Engage lift pins on lift arms and swing locking hooks over pins.
4. Operate hydraulic control to lift scrubber all the way up.
⚠WARNING Engage safety lock.
5. Rotate top cam on right hand lift arm to contact ear of scrubber and tighten bolt.

ALIGNING SCRUBBING UNIT TO MACHINE (Continued):

6. Fold up the four support legs by pulling out the locking knob and **▲WARNING** Do not work under scrubber unless safety lock is engaged.
7. Release safety lock and lower scrubber to down position.
8. Lower bracket on left hand rear side of scrubber to contact cam on arm and tighten bolts.
9. Connect vacuum hose to scrubber from squeegee.

TROUGH ADJUSTMENT

10. The correct clearance of the trough lip is from 0.38" to 0.50" (9.65 to 12.7 mm) from the floor. Adjust by turning 0.50" (12.7 mm) square head set screws.
11. The correct clearance of the trough in the up position is from 1" to 1.13" (25.4 to 28.7 mm) from the floor. Adjust by turning 0.38" (12.7 mm) square head set screws.



BRUSH ADJUSTMENT

1. Release brush lift handle and allow brush to rest on floor.
2. Loosen clevis lock nut on lift rod, then turn lift rod until adjustment is correct.
3. Tighten clevis lock nut.

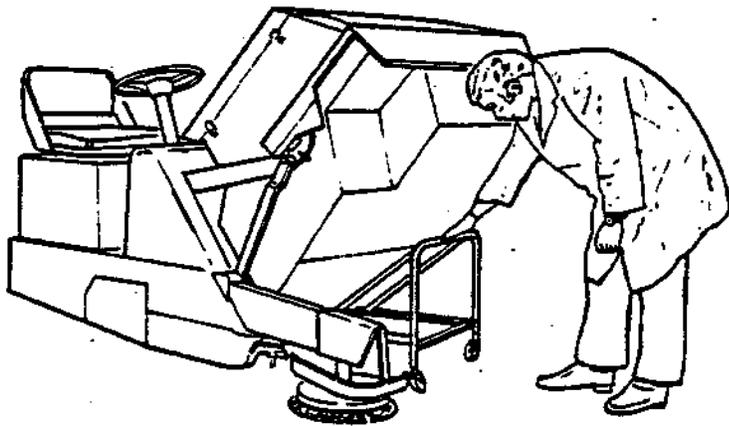
A. TO REMOVE SWEEPING HOPPER (BEFORE INSTALLING SCRUBBER)

1. Start motor.

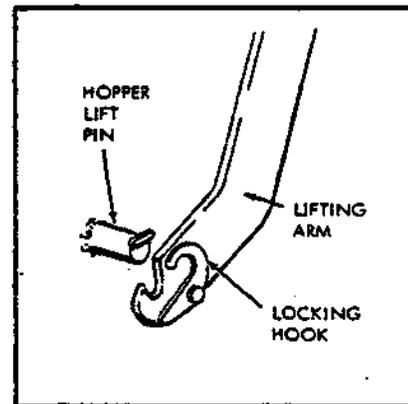
2. Raise hopper all the way.

▲WARNING: Engage mechanical safety lock on hopper lift arm.

3. Place dolly under hopper.



Use dolly to support hopper.



Disconnect hopper from lifting arms by moving locking hooks away from hopper lift pins.

4. Swing aside locking hooks which attach hopper lifting pins to the lift arms.

5. Raise the lift arms, disconnect the lift arm safety lock, and lower hopper onto dolly. Stop the motor. Place hydraulic control in "side brush on" position. Push down hopper lift arms until they clear the hopper lift pins.

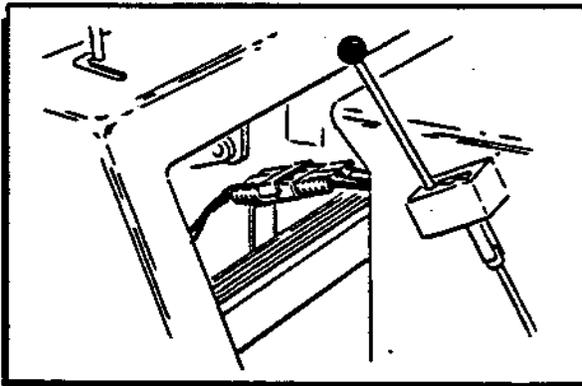
6. Move hopper out from machine slightly and disconnect the wire to the shaker motor mounted on the hopper. Complete the removal of the hopper.

7. Remove the side sweeping brush by removing the bolt attaching it to the motor shaft. The brush will drop down to the floor.

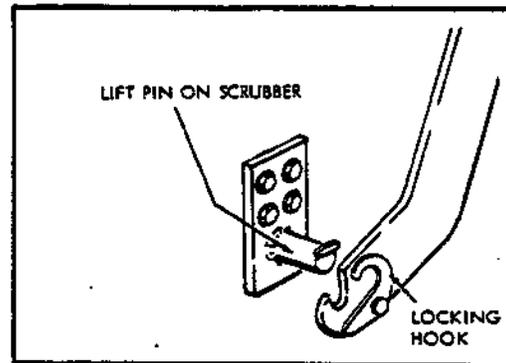
8. Remove main sweeping brush.

8. TO INSTALL SCRUBBING UNIT (AFTER REMOVING SWEEPING HOPPER)

1. Do not fill scrubber tanks before installing scrubber on machine.
The scrubbing unit is mounted on folding support legs equipped with wheels. Carefully roll the scrubber into position between the lift arms, but allow enough room between the machine and the scrubber so that the electric cable can be connected in the next step.
2. Connect the electric cable between the scrubber and the machine. Also connect the single wire located next to the connectors.

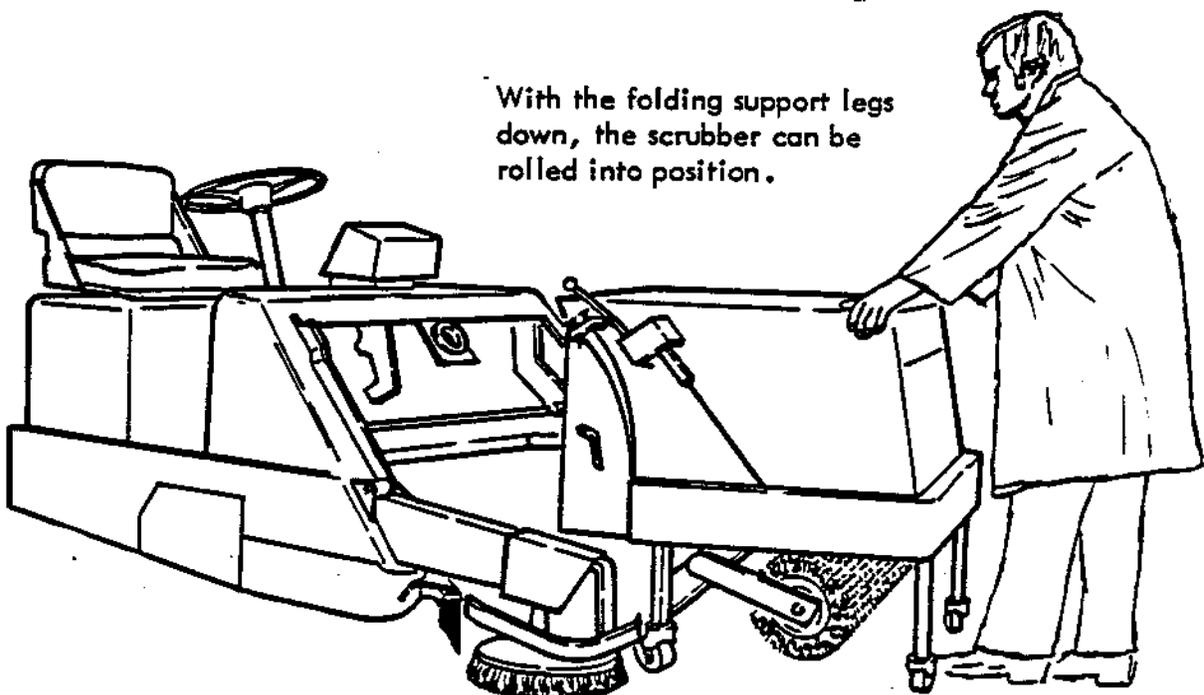


Make the electrical connections between the scrubber and machine.



Use locking hooks to lock scrubber to lift arms.

3. With lift arms lowered, carefully move scrubber into position so that lifting pins on scrubber will engage their sockets on the lift arms. Swing locking hook on each arm over scrubber lifting pins, locking them onto lift arms.
4. Start motor and operate hydraulic control to lift scrubber.

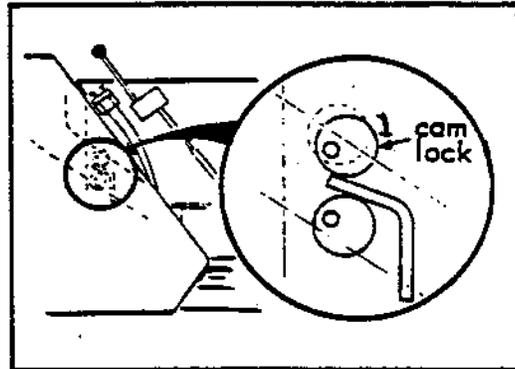
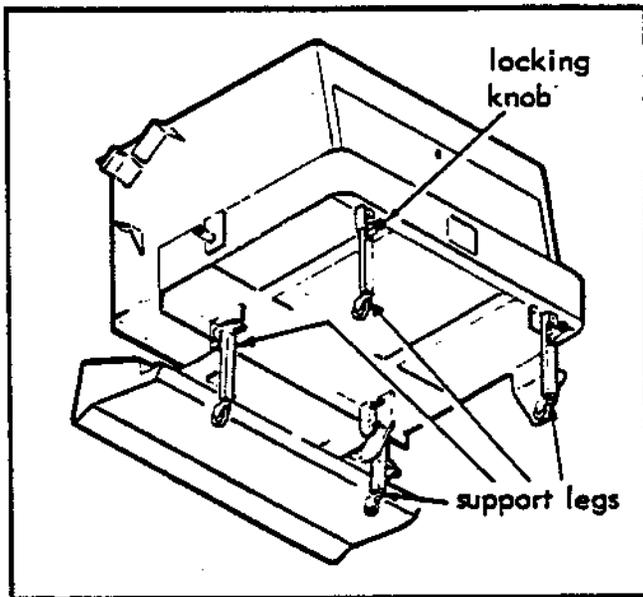


With the folding support legs down, the scrubber can be rolled into position.

INSTALLING SCRUBBER (Continued)

5. Fold up the four support legs by pulling out the locking knob and swinging each leg up.

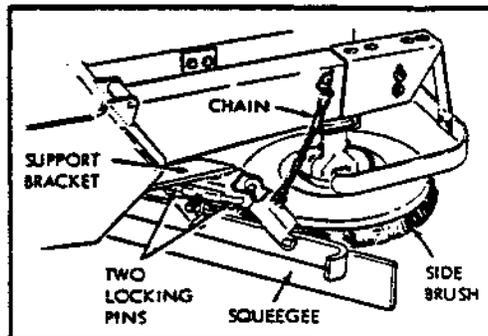
▲WARNING Engage safety lock on lift arm before reaching under scrubber.



Rotate the cam lock to the down position as shown here. This is the correct position of the lock when the scrubber is installed.

6. Loosen bolt attaching cam lock to right-hand lift arm and rotate cam into position against lip on scrubber. Use wrench provided for removing main brush. This cam lock will prevent scrubber from tilting forward.
7. Make sure that end of suction hose is in pick-up trough located at bottom of scrubber.
8. Start engine and lift scrubber enough so that safety lock on lift arm can be released. Lower the scrubbing unit.
9. Install side brush squeegee assembly on support bracket and lock in place by inserting two locking pins. Turn ends of pins under the clamp which is held in place by a spring.

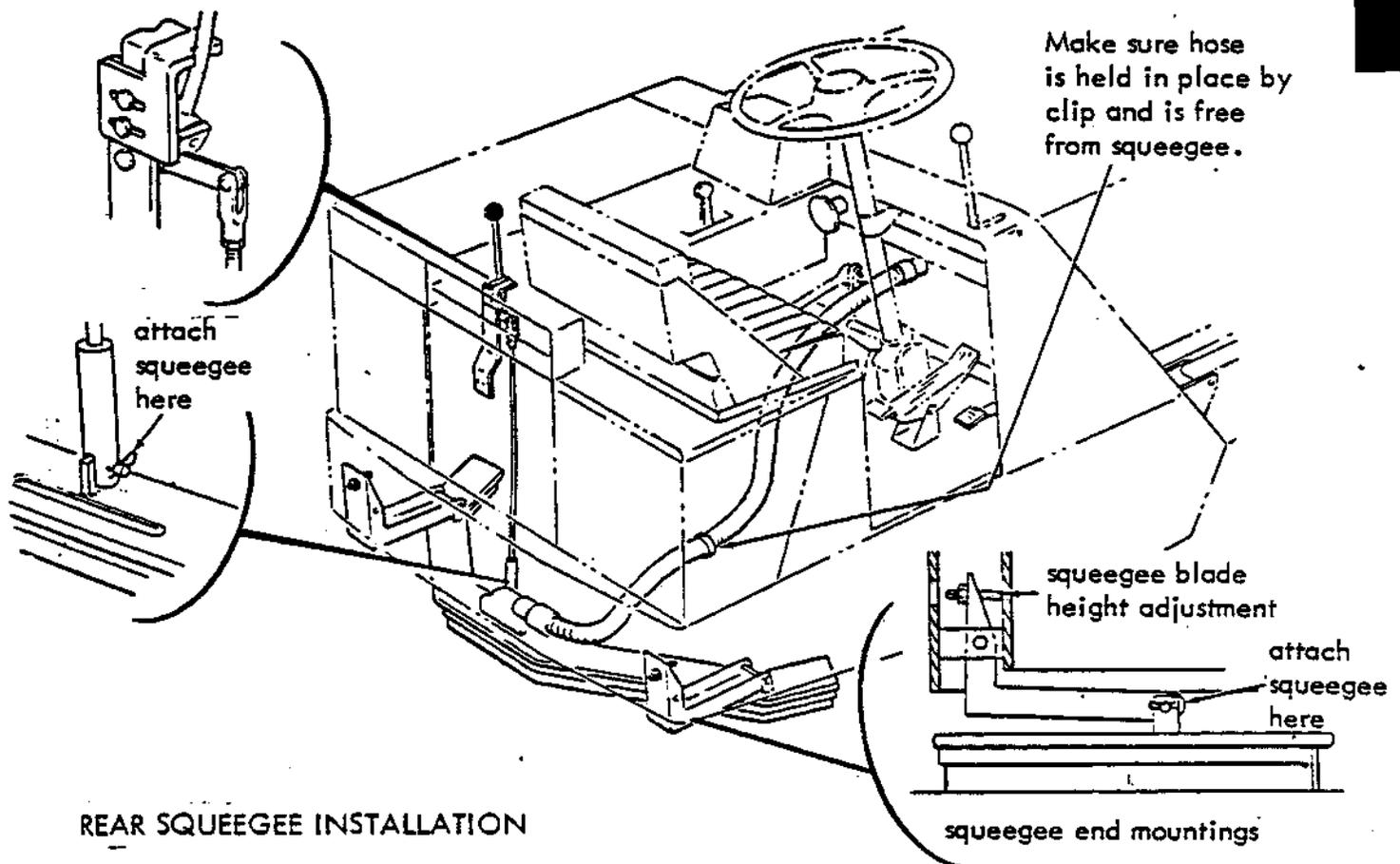
Install the side brush squeegee on the support bracket as shown here.



10. Attach chain from squeegee to side brush arm. Adjust chain so that squeegee is lifted when side brush is lifted.

INSTALLING SCRUBBING UNIT (Continued)

11. Position side scrubbing brush on motor shaft and lock in place with bolt and nut.
 12. If necessary, adjust motor height until full weight of the arm is on the brush when the side brush lift is fully released.
 13. If side squeegee is not level with floor, adjust as described in Maintenance Instructions.
 14. Attach hose from squeegee to recovery tank inlet as shown in drawing.
-
15. Check condition of rear squeegee rubber blade and replace it if necessary. See Maintenance Instructions. If rear squeegee blade assembly is not on machine, install it as shown in drawing. The squeegee is attached to the two outboard pivot brackets and the center lift mechanism by means of three clevis pins and cotter pins.
 16. Install the main scrubbing brush (also called rear pick-up brush) in the same manner as a sweeping brush is installed.
 17. The Scrubber is now completely installed. Please refer to "Scrubber Operating Instructions" next.



C. TO REMOVE SCRUBBING UNIT FROM MACHINE

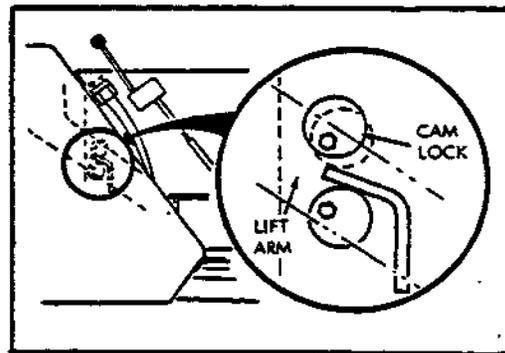
1. Drain recovery tank as explained in Operating Instructions.
2. Remove rear main scrubbing brush in same manner as sweeping brush is removed.
3. Remove side scrubbing brush by removing bolt attaching it to the motor shaft.
4. Remove side brush squeegee by pulling out the two lock pins and unhooking chain. Leave squeegee mounting bracket attached to machine.
5. Start motor and raise scrubbing unit.
▲WARNING Engage lift arm safety lock before reaching under unit.
6. Swing down the four scrubber support legs -- make sure they are locked in place.
7. Loosen bolt attaching the cam lock to the right-hand lift arm, and swing lock away from lip on scrubber. Tighten lock attaching bolt.
8. Operate hydraulic control to lift scrubber. Release safety lock, then lower scrubber to floor. Stop motor. Place hydraulic control in "side brush on" position.
9. Swing aside locking hooks which hold scrubber lifting pins to lift arms.
10. Push lift arms down and carefully roll scrubber away from machine for a short distance so that electrical cable can be disconnected.
11. Disconnect the electrical cable between scrubber and machine. Disconnect rear squeegee suction hose from scrubber (end of hose can be placed in clip under seat).
12. The rear squeegee can remain attached to machine in "up" position during sweeping -- provided that machine is not used over rough surfaces which could damage the squeegee rubber blade. To remove squeegee, pull out the three attaching pins.

D. TO INSTALL SWEEPING HOPPER AFTER REMOVING SCRUBBER

1. Position hopper on dolly between lift arms near machine, but allow enough room to connect the wire to the shaker motor. Connect the shaker wire. Move hopper up to the machine.
2. Start motor and raise lift arms so that lift pins on hopper will contact their sockets on the lift arms.
3. Close the locking hooks over the lifting pins.

NOTE The cam lock on right-hand arm must be positioned away from the hopper so that it does not restrict hopper movement.

When the sweeping hopper is used, the cam lock must be set at the "up" position



4. Raise hopper slightly.

▲WARNING Engage safety lock.

5. Remove dolly from under the hopper.
6. Raise hopper slightly in order to release safety lock, then lower hopper to floor.
7. Install main sweeping brush.

SCRUBBER TROUBLE SHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
Poor water pickup at squeegees	<ol style="list-style-type: none"> 1. Side or rear squeegees are worn or damaged. 2. Clogging in water pickup trough of rear squeegee, or in suction hose to recovery tank. 3. Air leaks in suction hose and connections. 4. Poor vacuum. 	<ol style="list-style-type: none"> 1. Examine squeegee rubber blades and back-up strips for cuts or worn areas. Replace blades if necessary. 2. Clean out rear squeegee and hose. 3. Repair or replace hose and connections. 4. Check vacuum fan and motor in scrubber.
Water spills from side of scrubber	<ol style="list-style-type: none"> 1. Side squeegee blades worn or damaged. 2. Too much solution being applied. 	<ol style="list-style-type: none"> 1. Replace squeegee blades. 2. Cut down solution flow 5 to 10 feet before making turns.
Little or no vacuum suction at rear squeegee	<ol style="list-style-type: none"> 1. Clogged suction hose or pickup trough in rear squeegee. 2. Loose connections between squeegee and suction hose, or between suction hose and tank. Damaged connection or hose. 3. Scrubber vacuum fan not operating. 	<ol style="list-style-type: none"> 1. Disconnect suction hose from squeegee, wash squeegee and hose thoroughly. 2. Check all hose connections for looseness or damage. Check suction hose for damage. 3. Check for suction at suction hose to recovery tank. Next, check for air discharge from vacuum fan. If no air discharge, impeller or V-Belt drive are at fault.

SCRUBBER TROUBLE SHOOTING (Continued)

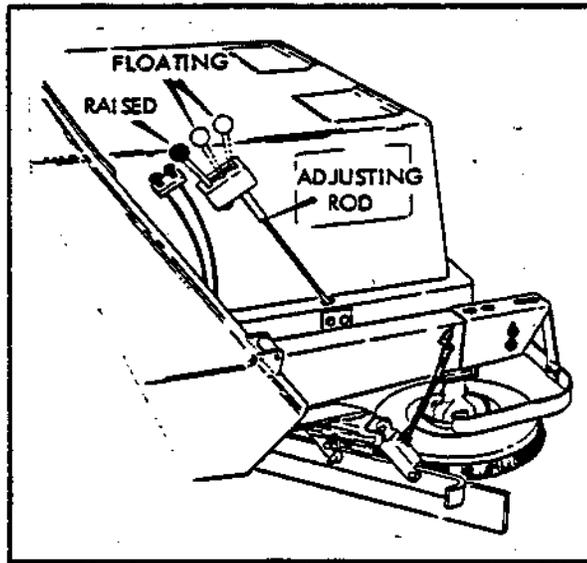
TROUBLE	PROBABLE CAUSE	REMEDY
<p>Poor scrubbing action</p>	<ol style="list-style-type: none"> 1. Worn scrubbing brushes. 2. Incorrect method of operation. 3. Wrong detergent or mixture. 	<ol style="list-style-type: none"> 1. Inspect brushes. If bristles are badly worn, replace brush. 2. Check scrubbing procedures, brush pressure adjustment, solution flow, etc. If floor is extremely dirty, two passes may be needed. 3. Use TENNANT Detergents. See "TENNANT Detergent Selection and Dilution Guide."
<p>Poor solution distribution</p>	<ol style="list-style-type: none"> 1. Clogged outlet holes in distribution tube. 2. Clogged or pinched hose from solution tank to valve. 3. Jammed solution valve or cable to valve. 	<ol style="list-style-type: none"> 1. Clean out tube and outlet holes. 2. Check hose. 3. Check cable and valve for free operation.

MAINTENANCE INSTRUCTIONS

FRONT SCRUB BRUSH ADJUSTMENT

The front brush control has two positions:

- Back - To raise Front Brush.
- Forward - Lowers brush to scrubbing position.



An adjustment for brush wear is provided on the lift rod beneath the brush control handle. Loosen the jam nut on the clevis and turn the adjusting rod just below it until the control handle is in the "down" position when the brush is resting on floor.

NOTE Be sure jam nut against lower clevis is tight to prevent drift of adjustment.

FRONT SCRUB BRUSH REPLACEMENT

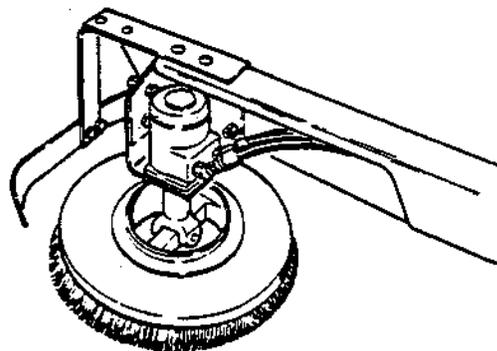
The front brush is removed and replaced in the same manner as the main sweeping brush. See "To Replace Main Brush" in Maintenance Instructions Section of this manual.

WATER SPREADER TUBE

The small holes in the water spreader tube may become clogged. Loosen set screw of tube hanger and remove hoses. Slide tube out of hangers and clean with hot water and brush.

SIDE SCRUB BRUSH REPLACEMENT

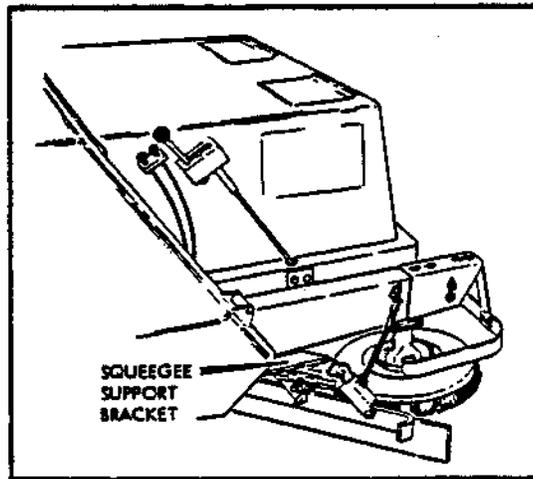
The side brush is replaced and adjusted for wear in the same manner as the side sweeping brush. See "To Replace Side Brush" in Maintenance Instructions.



SIDE BRUSH USED FOR SCRUBBING

SIDE SQUEEGEE LEVELING ADJUSTMENT:

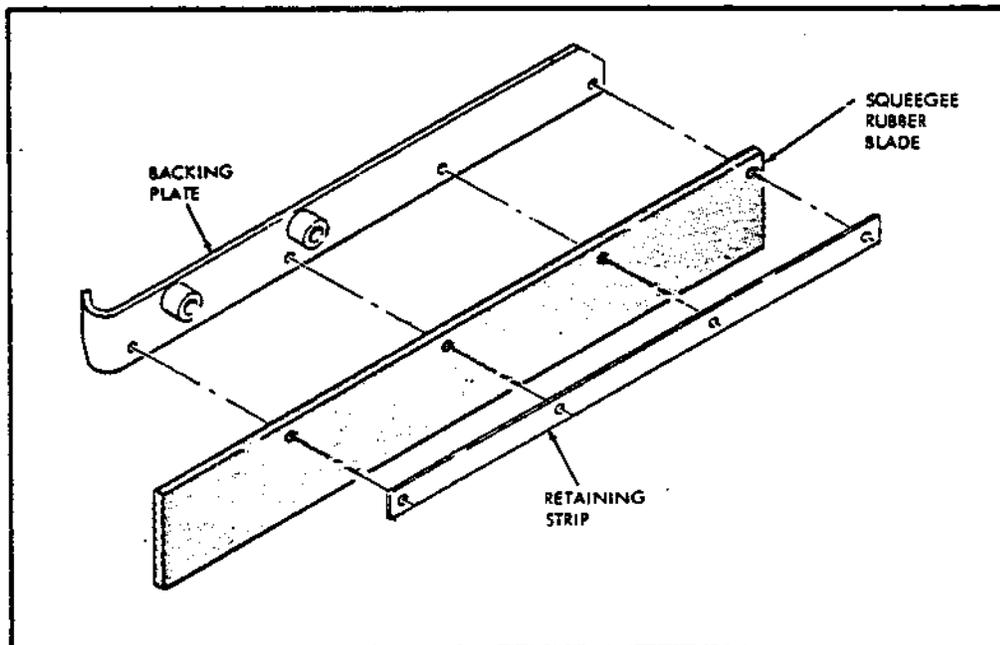
Check to be sure that the squeegee blade is level with the floor. If adjustment is required, loosen the two support bracket mounting screws and twist the bracket slightly until the blade is level. Then tighten mounting screws.



Level the side squeegee by loosening the support bracket screws and moving the bracket.

SIDE SQUEEGEE RUBBER REPLACEMENT:

Remove five retaining clamp bolts, install new rubber strip, and replace retaining clamp. Replace the rubber when the leading edge is worn and is no longer wiping floor correctly.



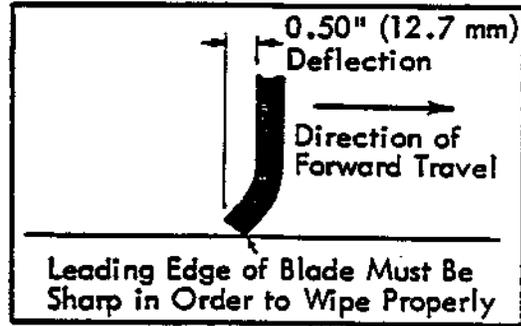
SIDE SQUEEGEE BLADE REPLACEMENT

REAR SQUEEGEE MAINTENANCE

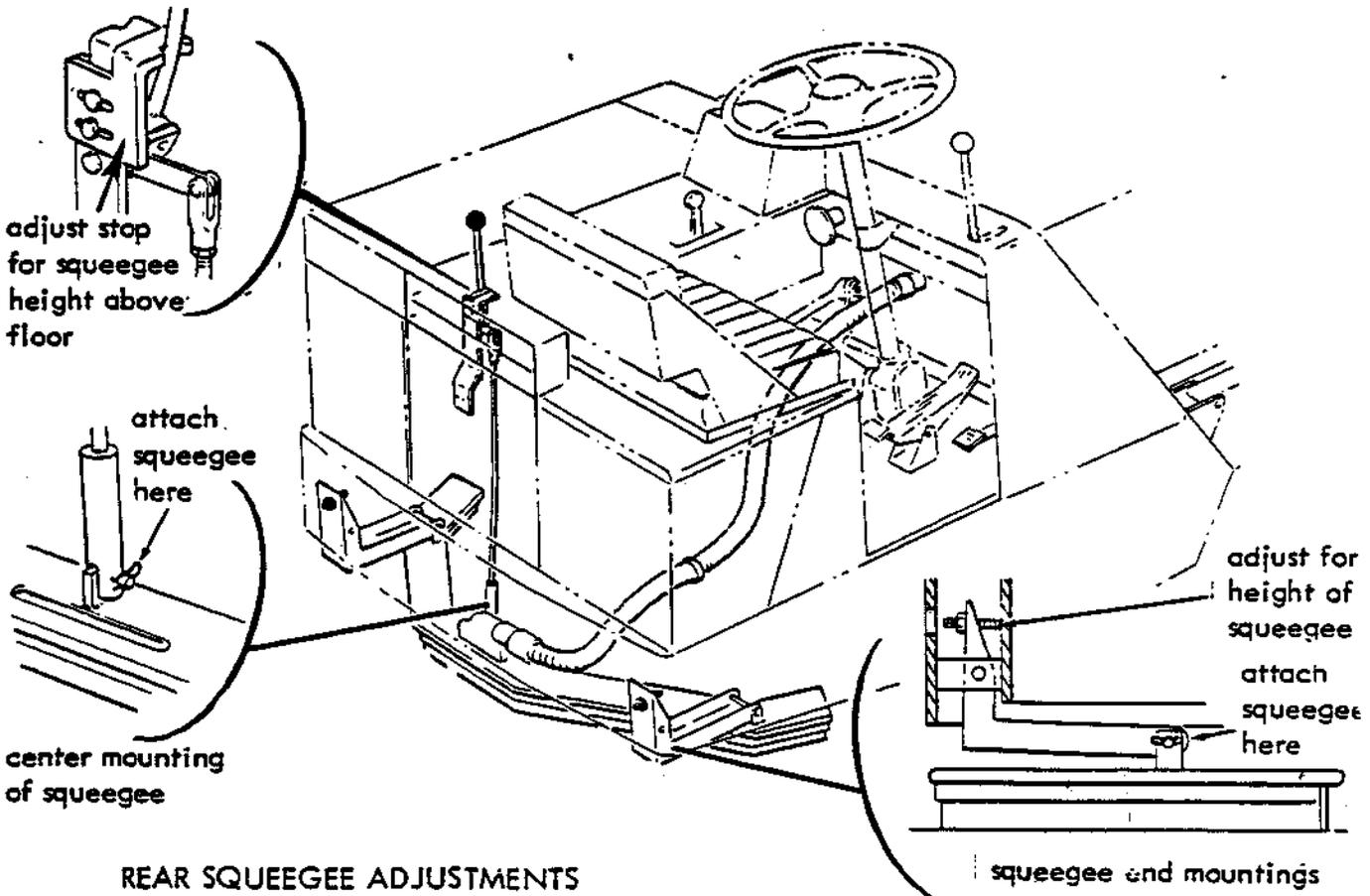
To Check and Adjust Rear Squeegee Rubber Blade:

As shown in sketch, the leading edge of the squeegee rubber does the entire wiping job. If this edge is worn, the rubber must either be replaced, or turned around if the opposite edge is not worn. Adjusting a worn blade to a lower position will not improve wiping action.

The squeegee rubber blade must be adjusted as shown here.



In order to work properly, the rubber squeegee blade must be deflected 0.5 in. (12.7 mm) as it moves across the floor -- this is shown in sketch. This deflection should be uniform across the full length of the squeegee. The deflection of the blade is set by adjusting the stops and linkage as shown below. This adjustment is correctly made at the factory and should not normally be required again. In the "up" position the squeegee should just touch the frame at three places: the rear and two ends.



REAR SQUEEGEE ADJUSTMENTS

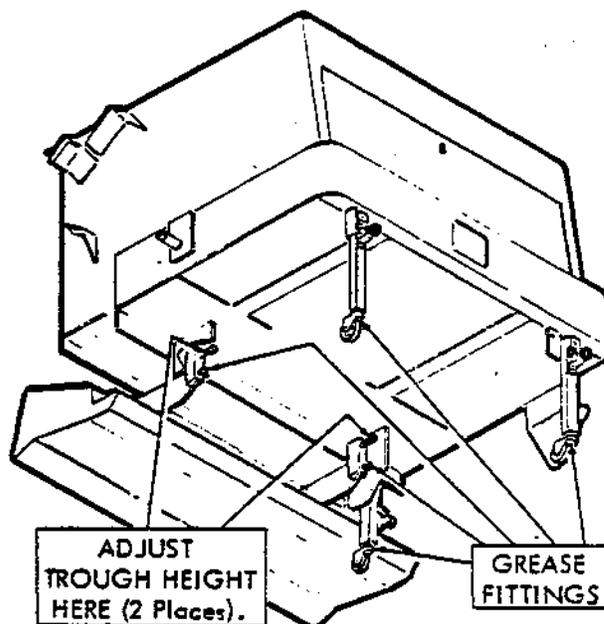
LUBRICATION OF SCRUBBER

<u>Grease Fittings</u>	<u>Location</u>	<u>Lube Period</u>
2	Lower trough pivot	8 hours
4	Caster wheels	200 hours

Apply light grease to threads on front brush lift rod every 200 hours.

▲WARNING Never reach under upraised scrubber attachment without engaging safety lock.

SPEED REDUCER, Main Brush: Oil level check plug is on side of speed reducer. Check oil level every 100 hours. Fill with SAE #140 Gear Oil to level check plug, but do not overfill.



TO ADJUST PICK-UP TROUGH HEIGHT:

1. Park machine on smooth level surface.
2. Check clearance between lip of pick-up trough and floor. Clearance is 0.38" (9.65 mm).
3. If adjustment is required:
 - (a) Raise scrubber attachment to extreme "up" position and engage lift cylinder safety lock.
 - (b) Referring to drawing, loosen lock nut and adjust bolts until correct clearance is obtained. Then tighten lock nuts.

NOTE After each adjustment is made, it will be necessary to lower scrubber attachment to check clearance.

Be sure that lip of trough is never allowed to touch floor or needless wear to the trough will result.

SECTION 4 APPENDIX

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Hydraulic O-Ring Fitting Torque Chart ...	4-2



HARDWARE INFORMATION

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

STANDARD BOLT TORQUE CHART

Thread Size	SAE Grade 5 Torque ft lb (Nm)	SAE Grade 8 Torque ft lb (Nm)
0.25 in	7-10 (9-14)	10-13 (14-18)
0.31 in	15-20 (20-27)	20-26 (27-35)
0.38 in	27-35 (37-47)	36-47 (49-64)
0.44 in	43-58 (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	215-260 (291-380)	313-407 (424-552)
1.00 in	500-650 (678-881)	757-984 (1026-1334)

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

METRIC BOLT TORQUE CHART

Thread Size	Class 8.8 Torque ft lb (Nm)	Class 10.9 Torque ft lb (Nm)
M4	2 (3)	3 (4)
M5	4 (5)	6 (8)
M6	7 (9)	10 (14)
M8	18 (24)	25 (34)
M10	32 (43)	47 (64)
M12	58 (79)	83 (112)
M14	94 (127)	133 (180)
M16	144 (195)	196 (265)
M20	260 (352)	336 (455)
M24	470 (637)	664 (900)

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

Exceptions to the above chart:

- Rear wheel hub nut - 200 to 250 ft. lb. (271 to 339 Nm).
- Rear wheel lug nuts - 85 to 95 ft. lb. (115 to 129 Nm).
- Vacuum fan impeller nut - 20 in. lb. (2 Nm).
- Engine vibration damper bolts - 25 to 30 ft. lb. (34 to 41 Nm).

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:

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

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

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

HYDRAULIC FITTING INFORMATION

HYDRAULIC TAPERED PIPE FITTING (NPT) TORQUE CHART

NOTE: Ratings listed are when using teflon thread seal.

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

HYDRAULIC 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

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)