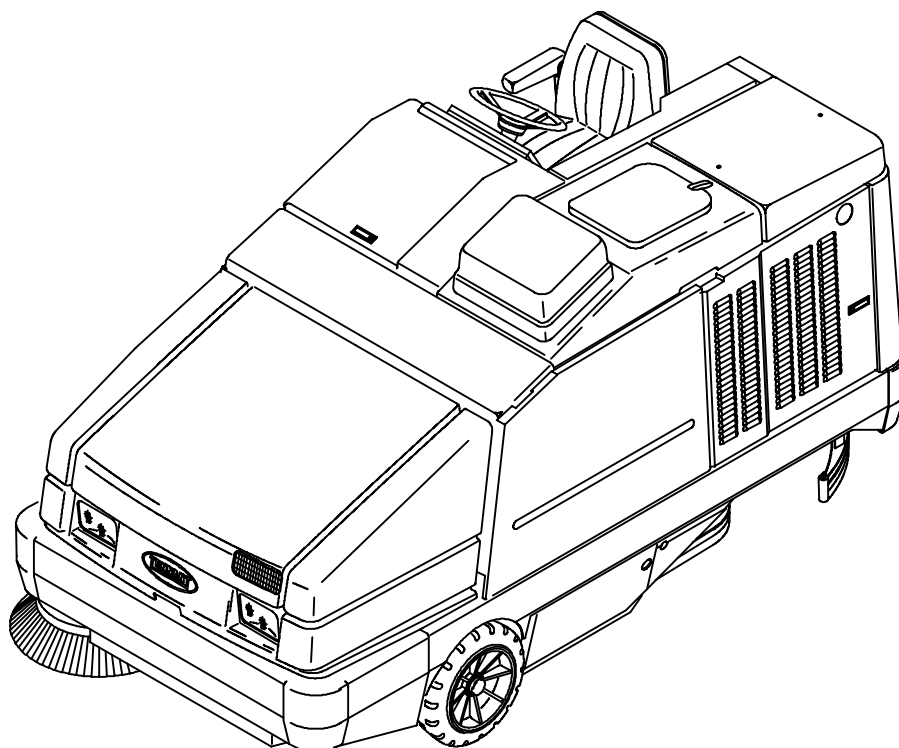




8400

Service Manual



MM338
Rev. 03 (4-02)



This service manual is intended to be an aid for the disassembly and reassembly of your TENNANT Model 8400.

The set is organized into eight major groups: General Information, Chassis, Sweeping, Scrubbing, Electrical, Hydraulics, Engine-G/LPG and Engine-D.

General Information: Machine transport, machine jacking, machine storage, machine specifications, and machine maintenance chart.

Chassis: Tire/wheel replacement, brake adjustment and replacement, chassis lubrication, steering adjustment and replacement, and cover/door adjustment.

Sweeping: Hopper repair/replacement, brush repair/replacement, skirt/seal repair/replacement, and sweeping troubleshooting.

Scrubbing: Scrubber head repair/replacement, brush repair/replacement, squeegee repair/replacement, and scrubber troubleshooting.

Electrical: Battery maintenance and replacement, instrument panel replacement, and electrical troubleshooting.

Hydraulics: Valve replacement/repair, motor replacement/repair, cylinder replacement/repair, pump replacement/repair, filter replacement, and hydraulics troubleshooting.

Engine - G/LPG: Air filter replacement, oil changing, cooling system maintenance/repair, fuel system maintenance/repair, governor adjustment/repair, engine repair, engine troubleshooting, and engine repairs.

Engine - D: Air filter replacement, oil changing, cooling system maintenance/repair, fuel system maintenance/repair, governor adjustment/repair, engine repair, engine troubleshooting, and engine repairs.

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CALIFORNIA PROPOSITION 65 WARNING:

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

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SAFETY PRECAUTIONS

The following precautions are used throughout this manual as indicated in their description:



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

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

The machine is suited to sweep disposable debris. Do not use the machine other than described in this Operator Manual. The machine is not designed for use on public roads.

The following information signals potentially dangerous conditions to the operator or equipment:



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



WARNING: Raised hopper may fall. Engage hopper support bar.



WARNING: Lift arm pinch point. Stay clear of hopper lift arms.



WARNING: Moving belt and fan. Keep away.



WARNING: Flammable materials can cause an explosion or fire. Do not use flammable materials in tank(s).



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



WARNING: Strong vacuum. Keep away from fan inlet when fan is running.



WARNING: Hot bumper. Keep away.

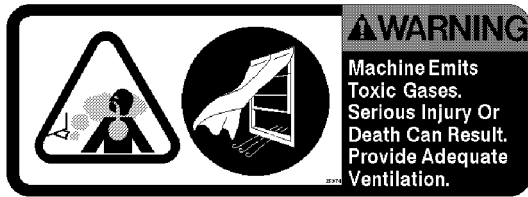
FOR SAFETY:

1. Do not operate machine:
 - Unless trained and authorized.
 - Unless operator manual is read and understood.
 - If it is not in proper operating condition.
 - In flammable or explosive areas unless designed for use in those areas.
 - In areas with possible falling objects unless equipped with overhead guard.
2. Before starting machine:
 - Check for fuel, oil, and liquid leaks.
 - Keep sparks and open flame away from refueling area.
 - Make sure all safety devices are in place and operate properly.
 - Check brakes and steering for proper operation.
3. When starting machine:
 - Keep foot on brake and directional pedal in neutral.
4. When using machine:
 - Use brakes to stop machine.
 - Go slow on inclines and slippery surfaces.
 - Use care when reversing machine.
 - Move machine with care when hopper is raised.
 - Make sure adequate clearance is available before raising hopper.
 - Do not carry passengers on machine.
 - Always follow safety and traffic rules.
 - Report machine damage or faulty operation immediately.
 - Follow mixing and handling instructions on chemical containers.
5. Before leaving or servicing machine:
 - Stop on level surface.
 - Set parking brake.
 - Turn off machine and remove key.

6. When servicing machine:
 - Avoid moving parts. Do not wear loose jackets, shirts, or sleeves.
 - Block machine tires before jacking machine up.
 - Jack machine up at designated locations only. Block machine up with jack stands.
 - Use hoist or jack that will support the weight of the machine.
 - Wear eye and ear protection when using pressurized air or water.
 - Disconnect battery connections before working on machine.
 - Avoid contact with battery acid.
 - Avoid contact with hot engine coolant.
 - Allow engine to cool.
 - Keep flames and sparks away from fuel system service area. keep area well ventilated.
 - Use cardboard to locate leaking hydraulic fluid under pressure.
 - Use Tennant supplied or approved replacement parts.
7. When loading/unloading machine onto/off truck or trailer:
 - Turn off machine.
 - Use truck or trailer that will support the weight of the machine.
 - Use winch. Do not drive the machine onto/off the truck or trailer unless the load height is 380 mm (15 in) or less from the ground.
 - Set parking brake after machine is loaded.
 - Block machine tires.
 - Tie machine down to truck or trailer.

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

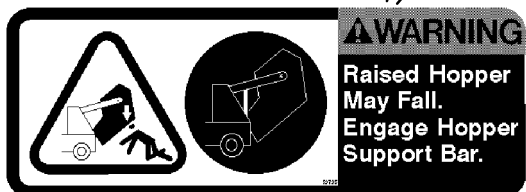
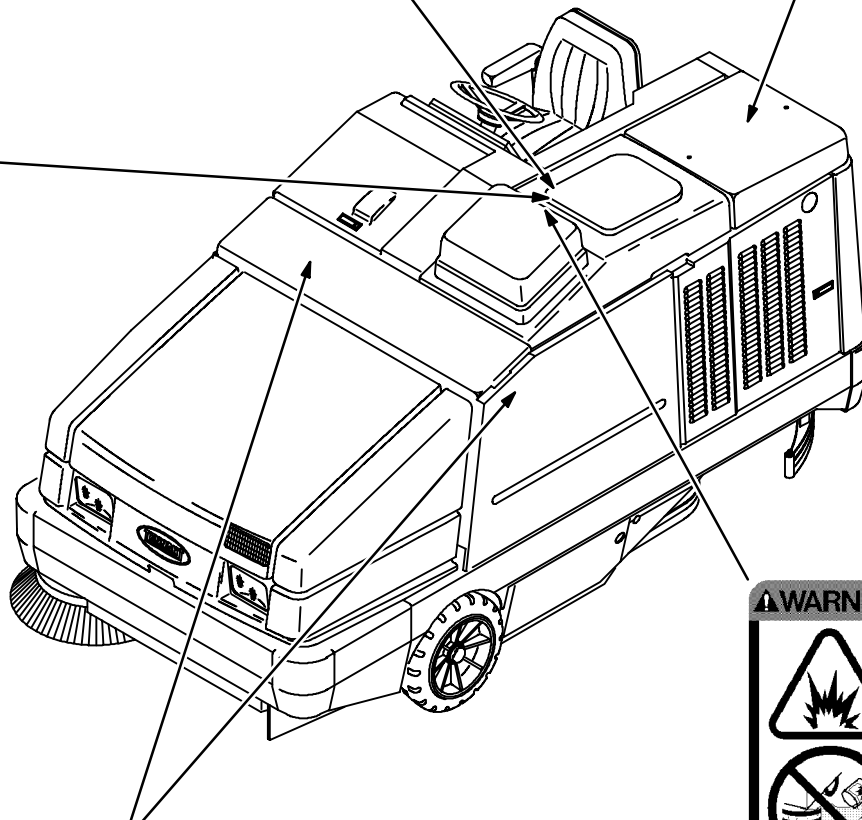
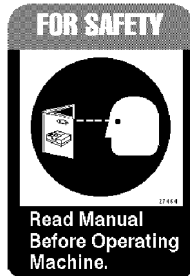
EMISSIONS LABEL - LOCATED ON THE SIDE PANEL OF THE OPERATOR COMPARTMENT.



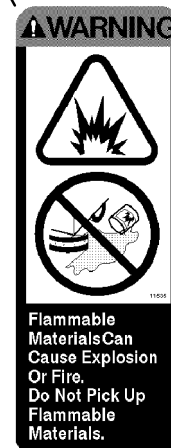
FAN AND BELT LABEL - LOCATED ON THE RADIATOR SHROUD.



FOR SAFETY LABEL - LOCATED ON THE SIDE PANEL OF THE OPERATOR COMPARTMENT.



HOPPER SUPPORT BAR LABEL - LOCATED ON THE HOPPER SUPPORT BAR AND ON BOTH HOPPER LIFT ARMS.

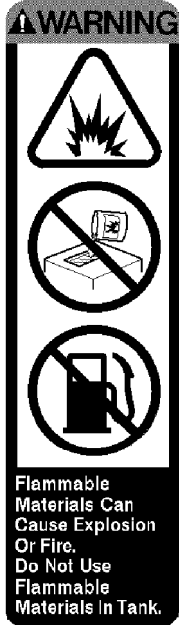


FLAMMABLE SPILLS LABEL - LOCATED ON THE SIDE PANEL OF THE OPERATOR COMPARTMENT.

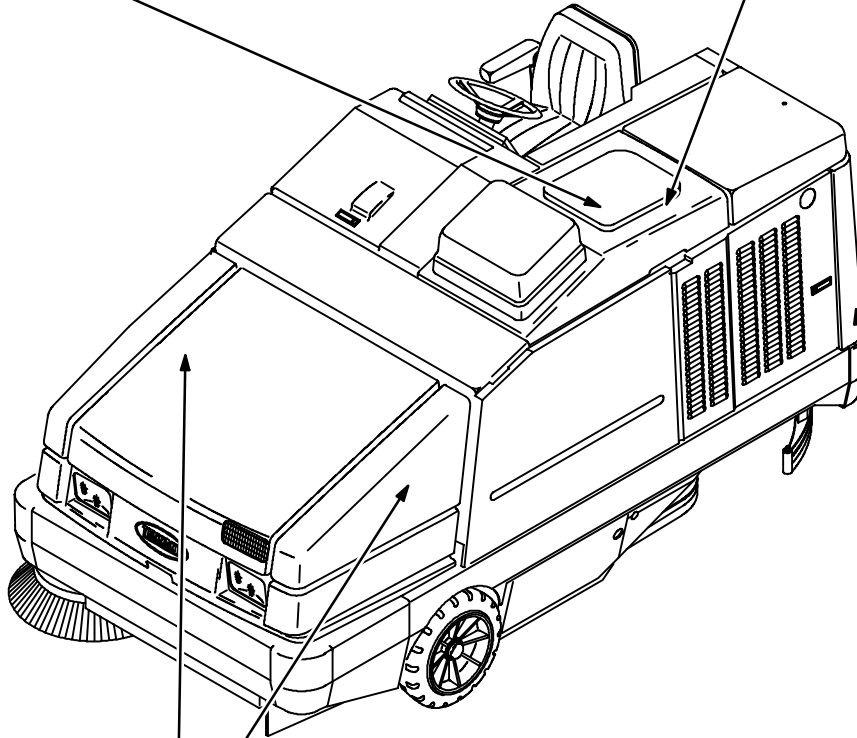
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GENERAL INFORMATION

FLAMMABLE MATERIALS LABEL - LOCATED ON THE SOLUTION TANK.



STRONG VACUUM LABEL - LOCATED ON THE VACUUM FAN HOUSING.



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HOPPER LIFT ARMS LABEL - LOCATED ON BOTH HOPPER LIFT ARMS.



HOT BUMPER LABEL - LOCATED ON THE REAR LEFT PANEL.

PUSHING OR TOWING MACHINE

The propelling pump has a towing valve to prevent damage to the hydraulic system when the machine is being towed. Turn the valve 90° clockwise before towing the machine.

You can push the machine from the front or rear, and tow it only from the rear.

ATTENTION! Do not push or tow the machine without using the towing valve, or the machine hydraulic system may be damaged.



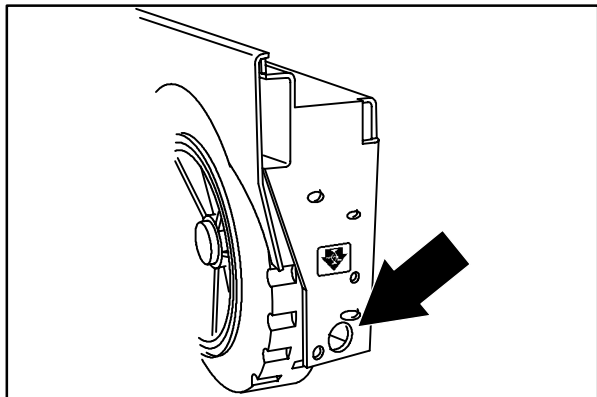
TIEING DOWN MACHINE

The machine can be tied down for transport using the tie-down holes at the front and brackets at the rear of the machine.

The front tie-down holes are located in front of the front tires.

Use lower lip of rear bumper to hook chain for tie-down.

When transporting the machine on a trailer or in a truck, be sure to set the parking brake and block the tires to prevent the machine from rolling.

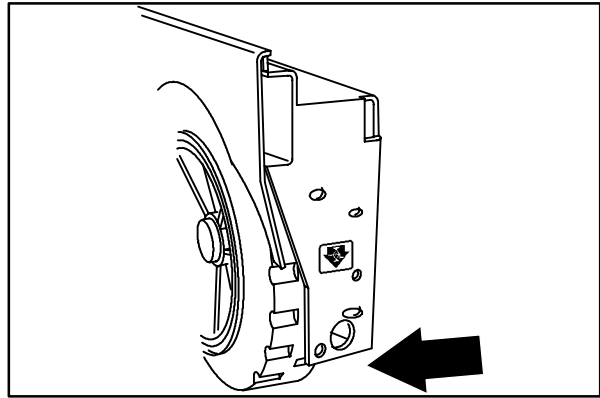


GENERAL INFORMATION

MACHINE JACKING

You can jack up the machine for service at the designated locations. Use a jack of adequate capacity and good working condition. Always stop the machine on a flat, level surface and block the tires before jacking the machine up.

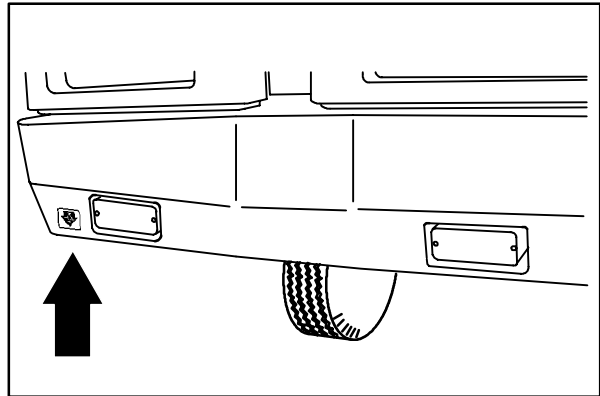
The front jacking locations are the flat bottom edge of the machine frame next to the front tires.



The rear jacking location is the left corner of the rear bumper.

FOR SAFETY: When Servicing Machine, Block Machine Tires Before Jacking Machine Up.

FOR SAFETY: When Servicing Machine, Jack Machine Up At Designated Locations Only. Block Machine Up With Jack Stands.



STORING MACHINE

Before storing the machine for an extended period of time, the machine needs to be prepped to lessen the chance of rust, sludge, and other undesirable deposits from forming. Contact TENNANT service personnel.

**GENERAL MACHINE
DIMENSIONS/CAPACITIES**

Item	Dimension/capacity
Length, Gasoline	2970 mm (117 in)
Length, LPG 15 kg (33 lb) tank	3070 mm (121 in)
Length, LPG 19.5 kg (43 lb) tank	3175 mm (125 in)
Width with side brush	1610 mm (63.5 in)
Height	1625 mm (64 in)
Height with overhead guard	2125 mm (83.7 in)
Track	1330 mm (52.38 in)
Wheelbase	1625 mm (63.88 in)
Main sweeping brush diameter	355 mm (14 in)
Main sweeping brush length	1145 mm (45 in)
Scrub brush diameter	405 mm (16 in)
Side brush diameter	585 mm (23 in)
Sweeping path width	1145 mm (45 in)
Sweeping path width with side brush	1525 mm (60 in)
Squeegee width	1490 mm (58.7 in)
Scrubbing path width	1220 mm (48 in)
Main sweeping brush pattern width	50 to 65 mm (2 to 2.5 in)
Hopper weight capacity	545 kg (1200 lb)
Hopper volume capacity	400 L (14 ft ³)
Dust filter area	6.9 m ² (74 ft ²)
Solution tank	227 L (60 gal)
Recovery tank	227 L (60 gal)
Detergent tank (option)	18.9 L (5 gal)
Total capacity with ES™ (option)	379 L (100 gal)
GVWR	3133 kg (6900 lb)
Ceiling height minimum dumping clearance	2490 mm (98 in)

GENERAL MACHINE PERFORMANCE

Item	Measure
Maximum forward speed	12.9 kmh (8 mph)
Maximum reverse speed	4.8 kmh (3 mph)
Minimum aisle turn width, left	3530 mm (139 in)
Minimum turning radius, right	3235 mm (128 in)
Minimum turning radius, left	2270 mm (90 in)
Maximum rated climb and descent angle	8°

GENERAL INFORMATION

POWER TYPE

Engine	Type	Ignition	Cycle	Aspiration	Cylinders	Bore	Stroke
Ford LSG 2.3	Piston	Breakerless-type spark	4	Natural	4	96 mm (3.78 in)	80 mm (3.126 in)
	Displacement		Net power, governed			Net power, maximum	
	2300 cc (140 cu in)		37.3 kw (50 hp) @ 2400 rpm			47 kw (63 hp) @ 2800 rpm	
	Fuel		Cooling system			Electrical system	
	Gasoline, 87 octane minimum, unleaded. Fuel tank: 35.2 L (9.3 gal)		Water/ethylene glycol antifreeze			12 V nominal	
	LPG, Fuel tank: 15 kg (33 lb)		Total: 16.7 L (4.4 gal)			50 A alternator	
			Radiator: 6.2 L (1.6 gal)				
	(Start) governed speed, under load		Idle speed, no load			(Fast) governed speed, under load	
	1350 ± 25 rpm		1100 ± 25 rpm			2400 ± 25 rpm	
	Spark plug gap		Firing order			Valve clearance, cold	
	1 to 1.1 mm (0.042 to 0.046 in)		1-3-4-2			0.025 to 0.068 mm (0.0010 to 0.0027 in) intake 0.038 to 0.081 mm (0.0015 to 0.0032 in) exhaust	

Engine	Type	Ignition	Cycle	Aspiration	Cylinders	Bore	Stroke	
Kubota V2203B-3	Piston	Diesel	4	Natural	4	87 mm (3.5 in)	92.4 mm (4 in)	
	Displacement		Net power, governed			Net power, maximum		
	2197 cc (134 cu in)		29.8 kw (40 hp) @ 2800 rpm			38 kw (51 hp) @ 2800 rpm		
	Fuel		Cooling system			Electrical system		
	Diesel Fuel tank:35.2 L (9.3 gal)		Water/ethylene glycol antifreeze			12 V nominal		
			Total: 16.7 L (4.4 gal)			50 A alternator		
			Radiator: 6.2 L (1.6 gal)					
	Idle speed, no load		Governed speed, under load					
	1500 ± 50 rpm		2400 ± 50 rpm					
	Engine lubricating oil with filter							
	6 L (6.3 qt) 10W30 SAE-CC/CD rated engine oil							

STEERING

Type	Power source	Emergency steering
Rear wheel, hydraulic cylinder and rotary valve controlled	Hydraulic accessory pump	Manual

HYDRAULIC SYSTEM

System	Capacity	Fluid Type
Hydraulic reservoir	37.8 L (10 gal)	TENNANT part no. 65869 - above 7° C (45° F)
Hydraulic total	53 L (14 gal)	TENNANT part no. 65870 - below 7° C (45° F)

BRAKING SYSTEM

Type	Operation
Service brakes	Mechanical drum brakes (2), one per front wheel, cable actuated
Parking brake	Utilize service brakes, cable actuated

TIRES

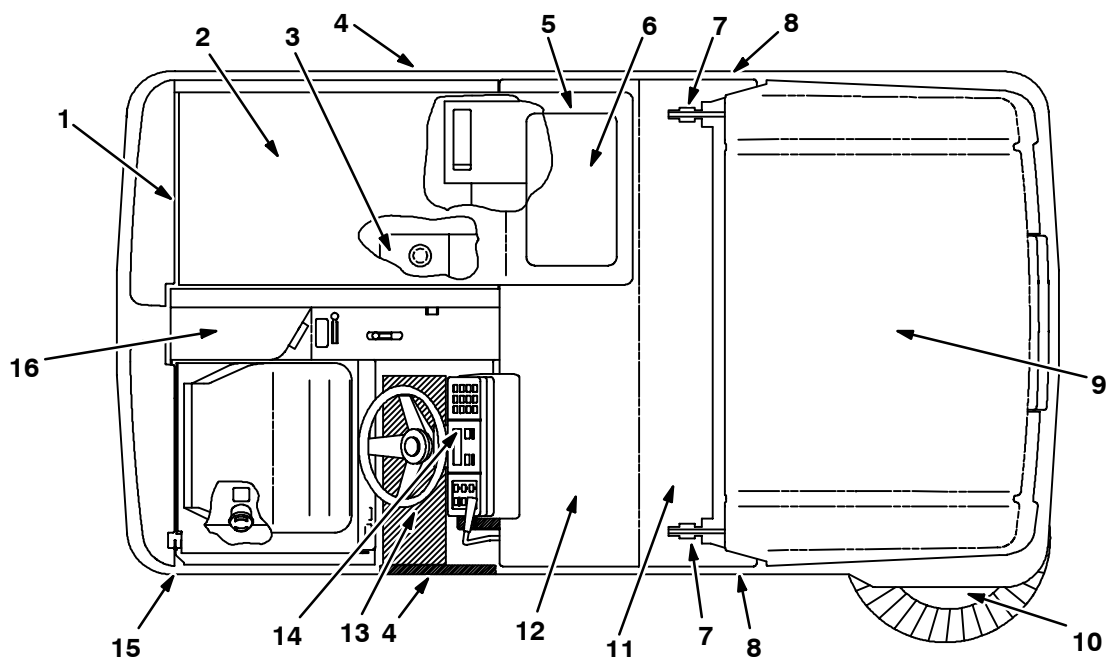
Location	Type	Size	Pressure
Front (2)	Solid	5 x 18 in	-
Rear (1)	Solid	6 x 18 in	-

ELECTRICAL SYSTEM

Battery: 12V, Cc Amps: 475 Wet (Gas/LPG)
Cc Amps; 600 Wet (Diesel)

Motors: 12V Filter shakers motors (2)

MAINTENANCE



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MAINTENANCE CHART

Interval	Key	Description	Procedure	Lubricant/ Fluid	No. of Service Points
Daily	2	Engine air filter	Check indicator	-	1
			Empty dust cap	-	1
	2	Engine crankcase	Check oil level	EO	1
	11	Brush compartment skirts	Check for damage, wear and adjustment	-	5
	9	Hopper lip skirts	Check for damage, wear and adjustment	-	3
	11	Main brush	Check for damage, wear, and adjustment	-	1
			Check brush pattern	-	1
	10	Side brush	Check for damage, wear, and adjustment	-	1
			Check brush pattern	-	1
	9	Hopper dust filter	Shake	-	2
	15	Rear Squeegee	Check for damage and wear	-	1
			Check deflection	-	1
	4	Side Squeegees	Check for damage and wear	-	2
	4	Scrub brushes	Check for damage and wear	-	1
	5	Recovery tank	Clean	-	1
50 Hours	12	Recovery tank, ES™ mode	Clean ES™ filter	-	1
	6	Solution tank, ES™ mode	Clean	-	1
100 Hours	11	Main brush	Rotate end-for-end	-	1
100 Hours	1	Radiator	Clean core exterior	-	1
			Check coolant level	WG	1
	2	Engine crankcase	Change oil and filter element	EO	1

GENERAL INFORMATION

Interval	Key	Description	Procedure	Lubricant/ Fluid	No. of Service Points
100 Hours	2	Engine	Check fan belt tension	-	1
			Check and adjust idle speed	-	1
			Check and adjust idle mixture	-	1
	9	Hopper dust filter	Check for damage, clean or replace	-	1
	3	Hydraulic fluid reservoir	Check fluid level	HYDO	1
200 Hours	8	Tires	Check for damage	-	3
	11	Main brush and hopper seals	Check for damage or wear	-	8
	15	Rear squeegee	Check leveling	-	1
	1	Radiator hoses and clamps	Check for tightness and wear	-	2
	14	Parking brake	Check adjustment	-	1
	14	Brake pedal	Check and adjust travel	-	1
400 Hours	16	Rear wheel support bearings	Lubricate	SPL	1
	10	Side brush guard	Rotate 90°	-	1
	7	Lift arm pivots	Lubricate	SPL	4
	9	Hopper door pivots	Lubricate	SPL	2
800 Hours	8	Front wheel bearings	Check, lubricate, and adjust	SPL	2
	1	Cooling system	Flush	WG	1
	2	Engine	Clean or replace and adjust spark plugs	-	4
			Replace PCV valve	-	1
			Check distributor	-	1
			Fuel filter, gasoline	-	2
1600 Hours	3	Hydraulic reservoir	Replace filler cap	-	1
			Replace suction strainer	-	1
			Change hydraulic fluid	HYDO	1
	3	Hydraulic fluid filter	Change filter element	-	1
	-	Hydraulic hoses	Check for wear and damage	-	All
	16	Propelling motor	* Torque shaft nut	-	1
	16	Rear wheel	* Torque wheel nuts	-	1
	13	Battery	* Clean and tighten battery cable connections	-	1
	2	Engine	Check electrolyte	DW	1
			Clean PCV hoses, tubes, and fittings	-	1
			Torque intake manifold bolts	-	8
			Check timing belt	-	1
1600 Hours	2	Engine	Replace timing belt	-	1

LUBRICANT/FLUID

EO Engine oil, SAE-SG/SH rated

HYDO . . . Tennant or approved hydraulic fluid

WG Water and permanent-type ethylene glycol anti-freeze, -34° C (-30° F)

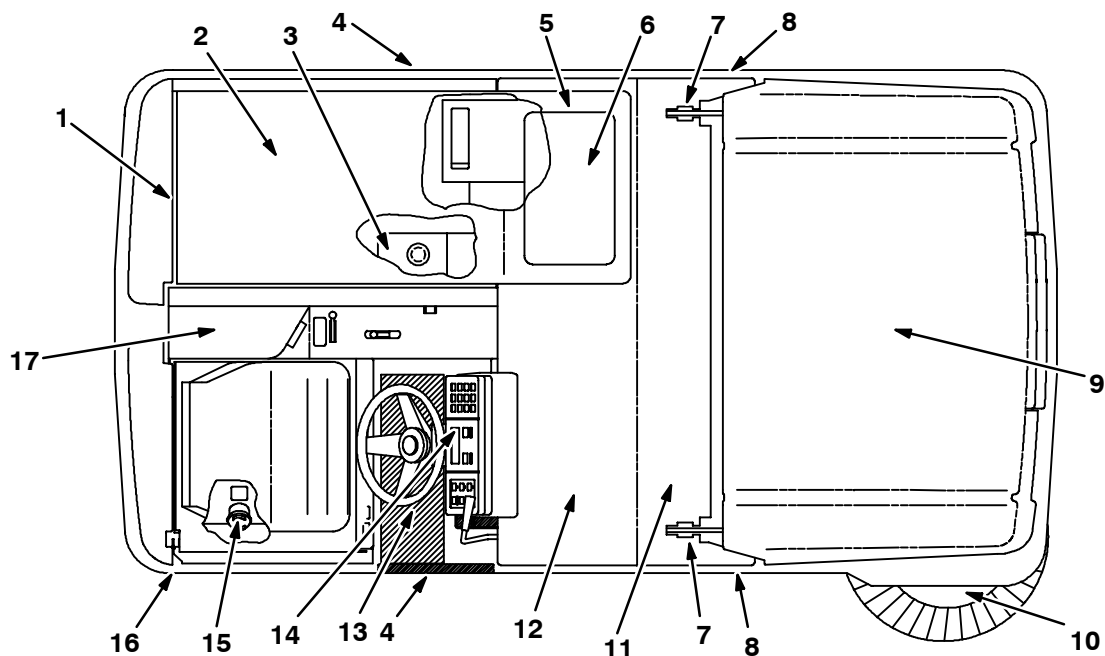
SPL Special lubricant, Lubriplate EMB grease (TENNANT part no. 01433-1)

DW Distilled water

NOTE: Also check procedures indicted () after the first 50-hours of operation.*

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

GENERAL INFORMATION



09076

MAINTENANCE CHART

Interval	Key	Description	Procedure	Lubricant/ Fluid	No. of Service Points
Daily	2	Engine air filter	Check indicator	-	1
	2	Engine crankcase	Empty dust cap	-	1
	2	Engine crankcase	Check oil level	EO	1
	11	Brush compartment skirts	Check for damage, wear and adjustment	-	5
	9	Hopper lip skirts	Check for damage, wear and adjustment	-	3
	11	Main brush	Check for damage, wear, and adjustment	-	1
	10	Side brush	Check brush pattern	-	1
			Check for damage, wear, and adjustment	-	1
			Check brush pattern	-	1
	9	Hopper dust filter	Shake	-	2
	16	Rear Squeegee	Check for damage and wear	-	1
			Check deflection	-	1
	4	Side Squeegees	Check for damage and wear	-	2
	4	Scrub brushes	Check for damage and wear	-	1
	5	Recovery tank	Clean	-	1
	12	Recovery tank, ES™ mode	Clean ES™ filter	-	1
	6	Solution tank, ES™ mode	Clean	-	1
50 Hours	11	Main brush	Rotate end-for-end	-	1
	2	Fuel pipes and clamps	Check for tightness and wear	-	1
	2	Engine crankcase	Change oil and filter	EO	1

GENERAL INFORMATION

Interval	Key	Description	Procedure	Lubricant/ Fluid	No. of Service Points
100 Hours	1	Radiator	Clean core exterior	-	1
			Check coolant level	WG	1
	2	Engine fan belt	Check tension	-	1
	9	Hopper dust filter	Check for damage, clean or replace	-	1
	3	Hydraulic fluid reservoir	Check fluid level	HYDO	1
	8	Tires	Check for damage	-	3
	11	Main brush and hopper seals	Check for damage or wear	-	8
	16	Rear squeegee	Check leveling	-	1
200 Hours	1	Radiator hoses and clamps	Check for tightness and wear	-	2
	14	Parking brake	Check adjustment	-	1
	14	Brake pedal	Check and adjust travel	-	1
	17	Rear wheel support bearings	Lubricate	SPL	1
	10	Side brush guard	Rotate 90°	-	1
	7	Lift arm pivots	Lubricate	SPL	4
	9	Hopper door pivots	Lubricate	SPL	2
400 Hours	8	Front wheel bearings	Check, lubricate, and adjust	SPL	2
	2	Fuel filter	Replace cartridge	-	1
	15	Fuel tank	Remove sediment	-	1
	1	Cooling system	Flush	WG	1
800 Hours	3	Hydraulic reservoir	Replace filler cap	-	1
			Replace suction strainer	-	1
			Change hydraulic fluid	HYDO	1
	3	Hydraulic fluid filter	Change filter element	-	1
	-	Hydraulic hoses	Check for wear and damage	-	All
	17	Propelling motor	* Torque shaft nut	-	1
	17	Rear wheel	* Torque wheel nuts	-	1
	13	Battery	* Clean and tighten battery cable connections	-	1
			Check electrolyte	DW	1

LUBRICANT/FLUID

EO Engine oil, SAE-CC/CD rated

HYDO . . Tennant Company or approved hydraulic fluid

WG . . . Water and permanent-type ethylene glycol anti-freeze, -34° C (-30° F)

SPL . . . Special lubricant, Lubriplate EMB grease (TENNANT part no. 01433-1)

DW Distilled water

NOTE: Also check procedures indicted () after
the first 50-hours of operation.*

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

GENERAL INFORMATION

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

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

METRIC BOLT TORQUE CHART

Thread Size (Nm)	Class 8.8 Torque ft lb (Nm)	Class 10.9 Torque ft lb
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.

BOLT IDENTIFICATION

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

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, 0.5 ml tube.

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

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CHASSIS

This section includes information on the main chassis related components for example the seat, steering, brakes and tires.

SEAT

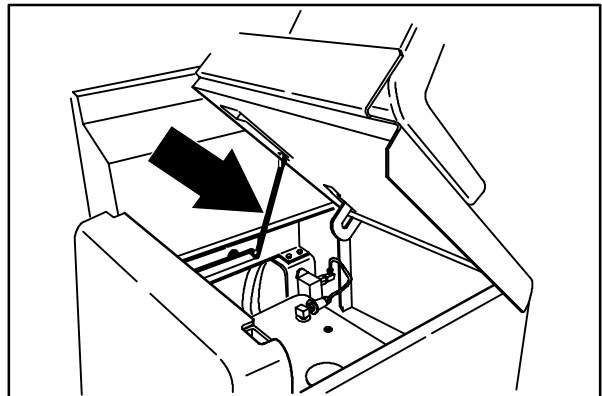
The seat assembly is removable and adjustable on the 8400.

The operator seat is a fixed back style with a forward-backward adjustment.

TO REMOVE SEAT ASSEMBLY

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

1. Tilt the seat assembly forward.
2. Slide the seat prop rod up and out of the rod slot.
3. Pull the hair cotter pin out of the pivot shaft.
4. Lift and slide the seat sideways off the machine.

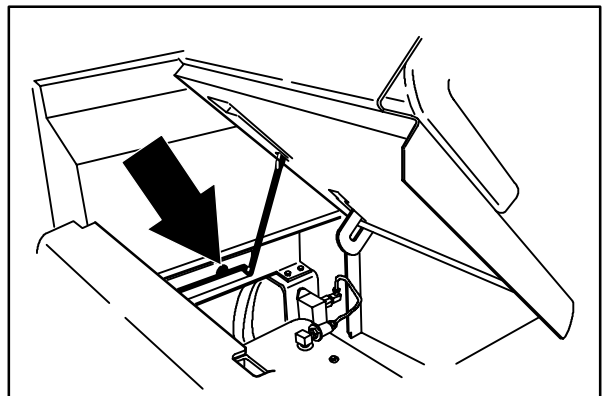


08052

TO REPLACE SEAT ASSEMBLY

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

1. Slide the seat assembly pins in the pivot holes on the seat support.
2. Slide the hair cotter pin in the hole on the pivot shaft to secure the seat.
3. Slide the seat rod through the large hole in the slot.
4. Lower the seat.

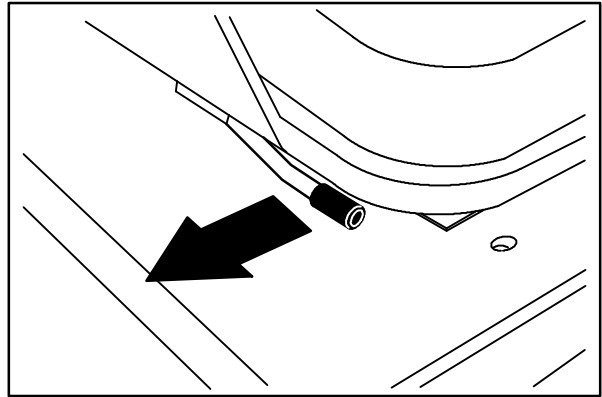


CHASSIS

TO ADJUST SEAT POSITION

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

1. Pull the lever out, slide the seat backward or forward to the desired position and release the lever.

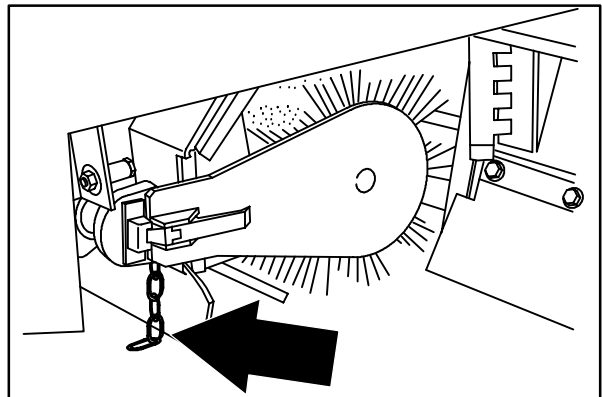


07797

STATIC DRAG CHAIN

A static drag chain prevents the buildup of static electricity in the machine. The chain is attached to the machine by a rear main brush skirt retaining bolt.

Make sure the chain is touching the floor at all times.

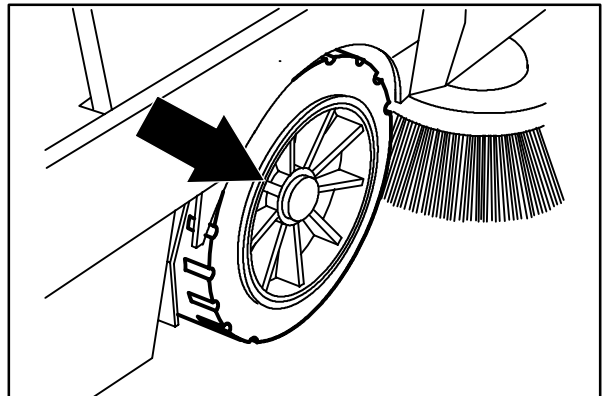


BRAKES AND TIRES

SERVICE BRAKES

The mechanical service brakes are located on the front wheels. The brakes are operated by the foot brake pedal.

Check the brake adjustment every 200 hours of operation.

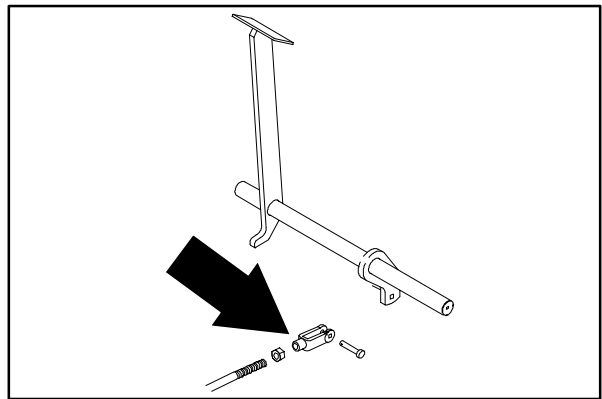
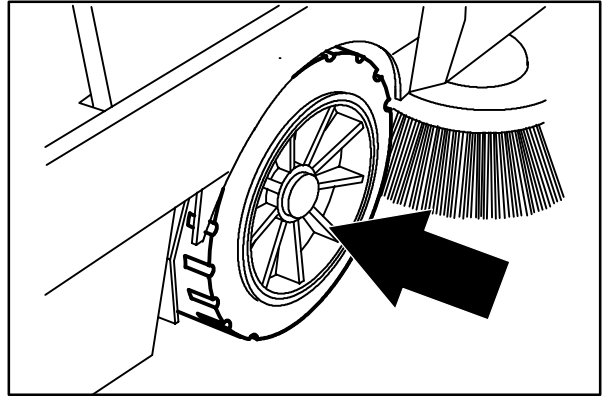


08006

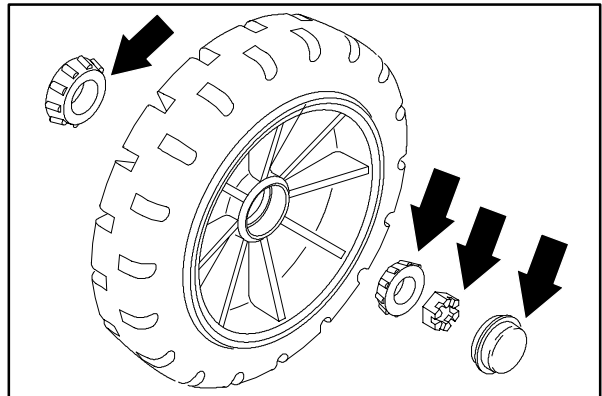
TO REPLACE BRAKE SHOES

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

1. Empty the debris hopper.
2. Turn the parking brake knurled knob counterclockwise until it stops. (early version machines only)
3. Disconnect the battery cables and remove the battery to access the floor plate hardware.
4. Remove floor plate from the machine.
5. Thread the brake cable clevis yoke toward the threaded rod to reduce brake cable tension.
6. Jack up one front corner of the machine. Place jack stands under machine.
7. Remove the hub cap.



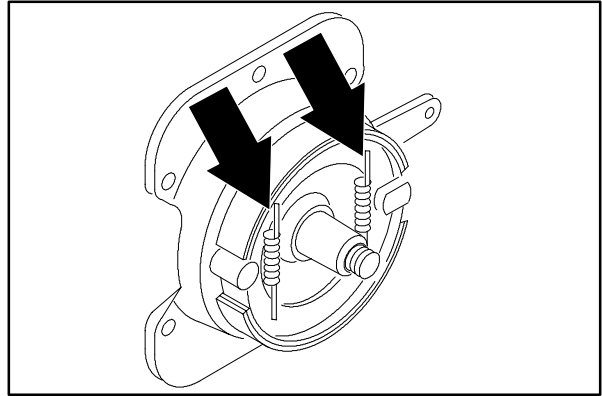
8. Remove the cotter pin, slotted nut, flat washer, and bearing cone.
9. Remove the front tire and wheel assembly from the machine.
10. Remove the two springs holding the brake shoes together. Remove the old brake shoes from the machine.
11. Position the new brake shoes on the machine.



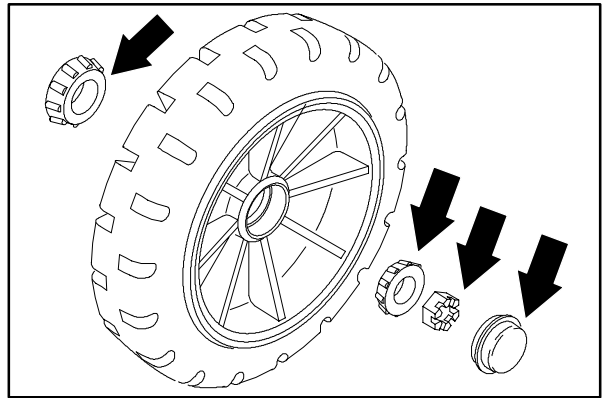
NOTE: Always replace brake shoes in sets.

CHASSIS

12. Reattach brake springs to the new brake shoes.
13. Pack the wheel bearings with Lubriplate EMB grease.
14. Slide the wheel on the axle.

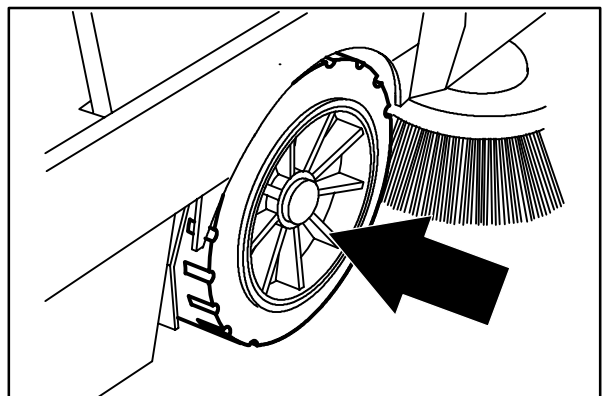
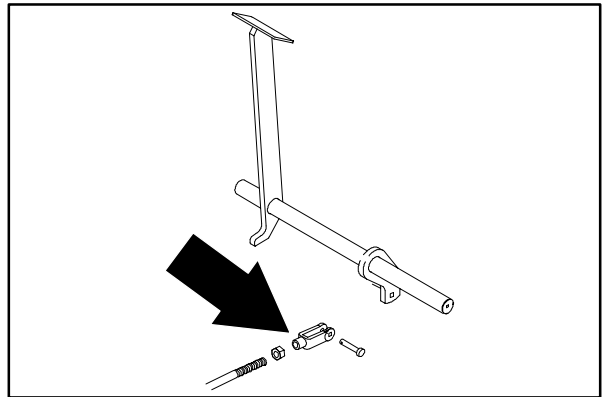


15. Slide the outer bearing, flat washer and nut on the shaft.
16. Tighten nut with hand wrench until wheel binds, then back the nut off to nearest hole.
17. Insert a new cotter pin through nut and hole.
18. After making sure the wheel spins freely, carefully install the hub cap.
19. Remove the jack stand and lower the machine. Repeat this procedure on the opposite side.



NOTE: Always replace brake shoes in sets.

20. Thread the brake cable clevis yoke away from the threaded rod until the brake pedal travels 25–50 mm (1–2 in) before engaging brakes.
21. Tighten the brake clevis jam nuts.
22. Reinstall the floor plate.
23. Install the battery and battery cables.
24. Lower the seat support.
25. Adjust the parking brake by turning the knurled knob clockwise until the parking brake properly holds the machine in place, (early version machines only).
26. Drive the machine and check the brakes for proper operation.



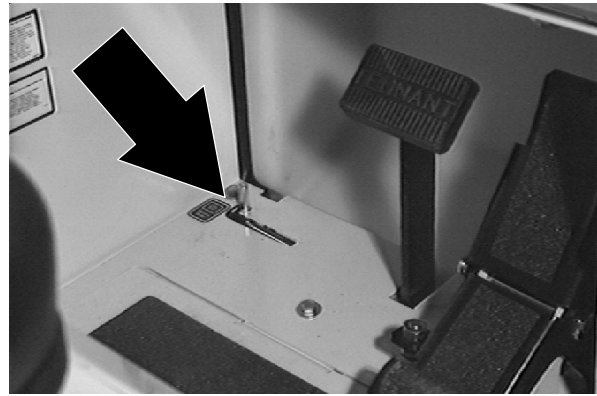
PARKING BRAKE LEVER (new version)

The parking brake lever sets and releases the front wheel brakes.

Set: Move the brake lever from the short to the long slot with your foot. Step on the brake pedal to lock the pedal in place.

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

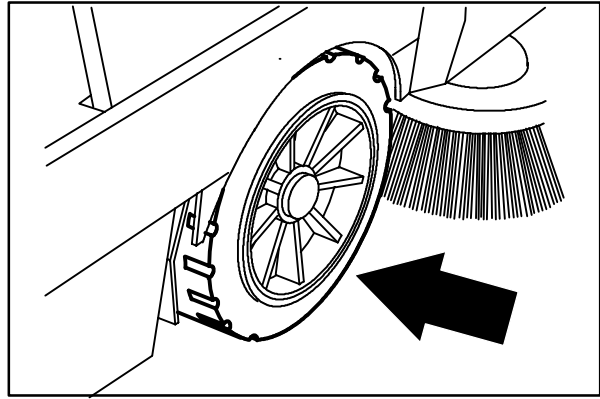
Release: Step on the brake pedal to release it, and move the brake lever to the left with your foot at the same time. Lock the lever in place in the short slot.



FRONT TIRES AND WHEELS

The machines front tires are semi-pneumatic.

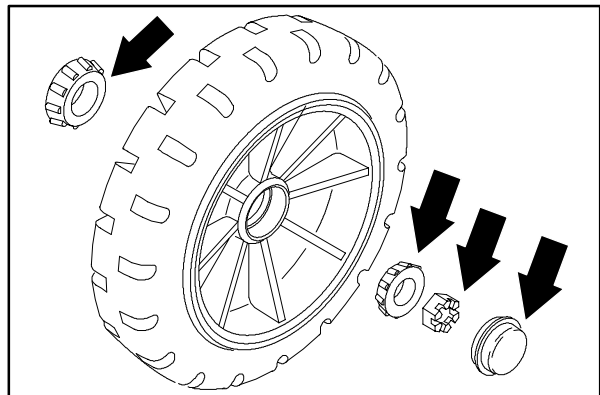
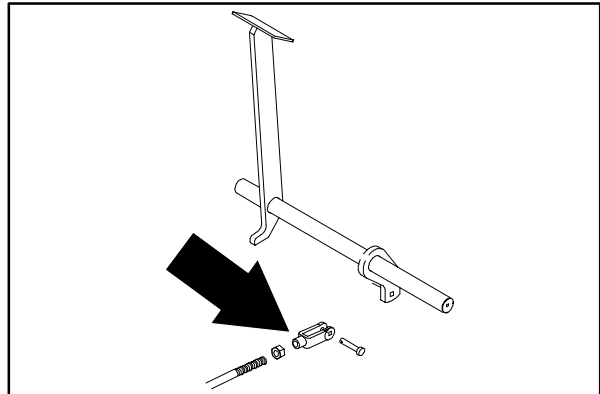
Inspect the front wheel bearings for seal damage, and repack and adjust every 1600 hours of operation. Use Lubriplate EMB grease (TENNANT part no. 01433-1).



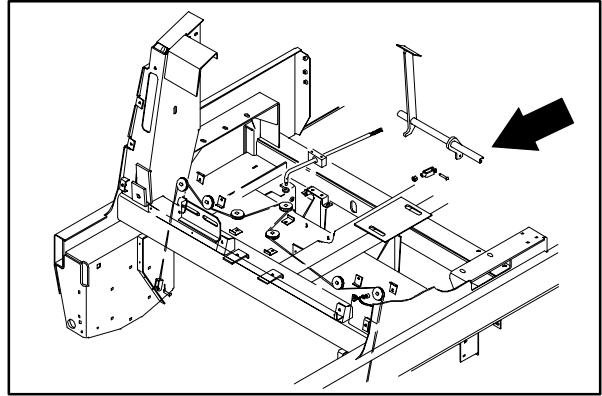
TO REPACK FRONT WHEEL BEARINGS

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

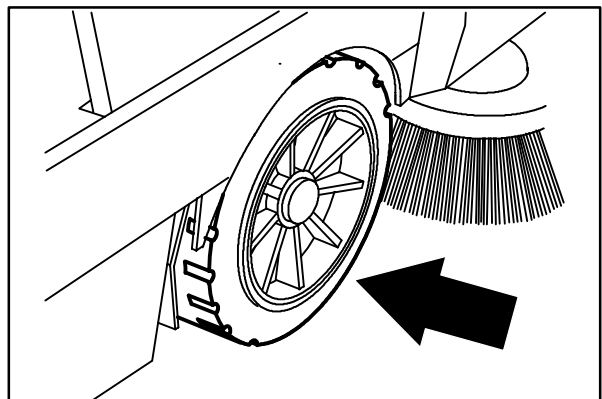
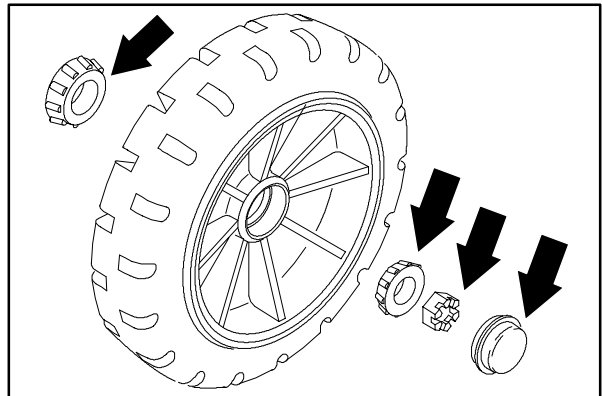
1. Empty the debris hopper.
2. Turn the parking brake knurled knob counterclockwise until it stops, (early version machines only).
3. Disconnect the battery cables and remove the battery to access the floor plate hardware.
4. Remove floor plate from the machine.
5. Thread the brake cable clevis yoke toward the threaded rod to reduce brake cable tension.
6. Jack up one front corner of the machine. Place jack stands under machine.
7. Remove the hub cap.
8. Remove the cotter pin, slotted nut, flat washer, and bearing cone.
9. Remove the front tire and wheel assembly from the machine.
10. Pack the wheel bearings with Lubriplate EMB grease.



11. Slide the wheel assembly back on the axle.
12. Slide the outer bearing, flat washer and nut onto the shaft.
13. Tighten the nut with hand wrench until the wheel binds, then back the nut off to the nearest hole.
14. Insert a new cotter pin through nut and hole.



15. After making sure the wheel spins freely, carefully install the hub cap. Repeat this procedure on the opposite side of the machine.
16. Remove the jack stand and lower the machine.
17. Thread the brake cable clevis yoke away from the threaded rod until the brake pedal travels 25–50 mm (1–2 in) before engaging brakes.
18. Tighten the brake clevis jam nuts.
19. Reinstall the floor plate.
20. Install the battery and battery cables.
21. Lower the seat support.
22. Adjust the parking brake by turning the knurled knob clockwise until the parking brake properly holds the machine in place, (early version machines only).
23. Drive the machine and check for proper operation.

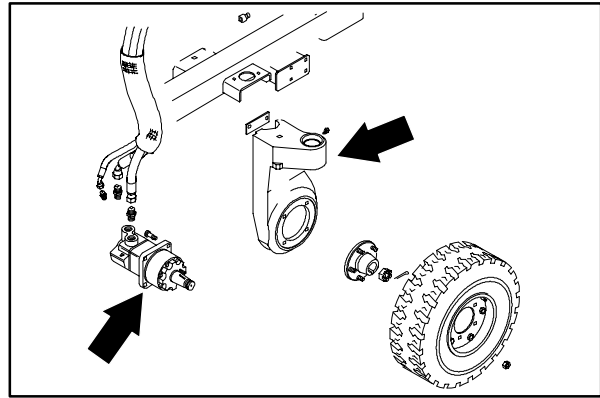


REAR WHEEL AND WHEEL SUPPORT

The rear wheel support pivots the rear wheel. The support has one grease fitting for the bearings. The rear wheel support bearings must be lubricated every 200 hours of operation. Use Lubriplate EMB grease (TENNANT part no. 01433-1).

Torque the rear wheel nuts to 142 – 156 Nm (105 – 115 ft lb) after the first 50-hours of operation, and every 800 hours thereafter.

Torque the rear wheel hub nut to (375 ft lb)



TO REPLACE REAR DRIVE MOTOR

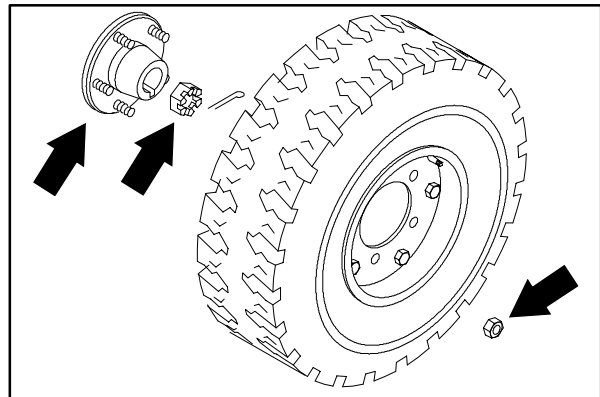
FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake, Turn Off Machine And Remove Key.

1. Engage the parking brake and block the front tires.
2. Jack up the rear of the machine. Use jack stands to support machine.

FOR SAFETY: Block machine tires before jacking machine up. Jack machine up at designated locations only. Block machine up with jack stands.

3. Remove the rear tire and wheel assembly.
4. Remove the slotted nut from drive wheel motor hub shaft.
5. Use a large puller to remove the drive hub from the motor shaft.

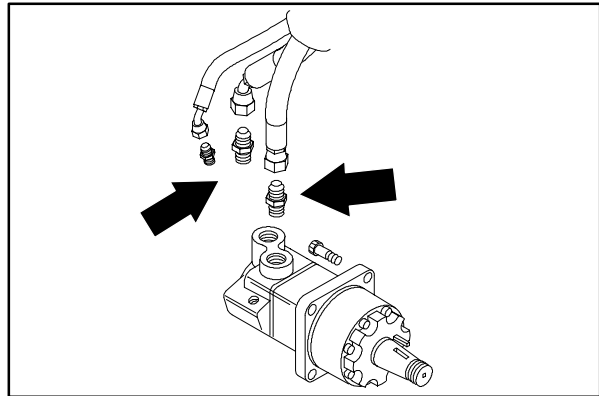
NOTE: Mark the hoses to make sure they are returned to the correct fitting when reassembled



6. Remove and plug the hydraulic hoses leading to the drive motor.

NOTE: Observe hydraulic cleanliness requirements when opening hydraulic lines.

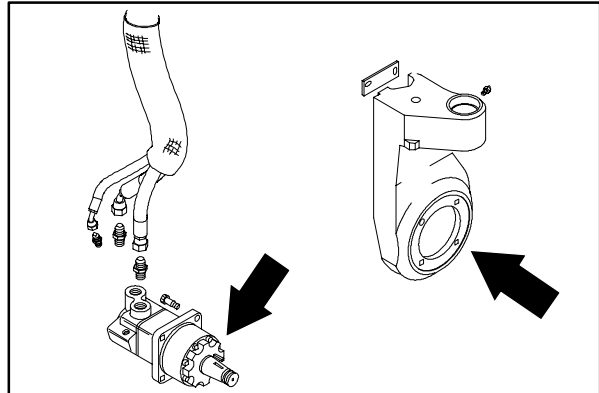
7. Remove the four drive motor mounting bolts.



8. Slide the motor out of the rear wheel housing.

NOTE: The orientation of the motor in the rear wheel housing.

9. Rebuild or replace drive motor. If you replace the drive motor, install the fittings on the new motor oriented the same as they were removed.

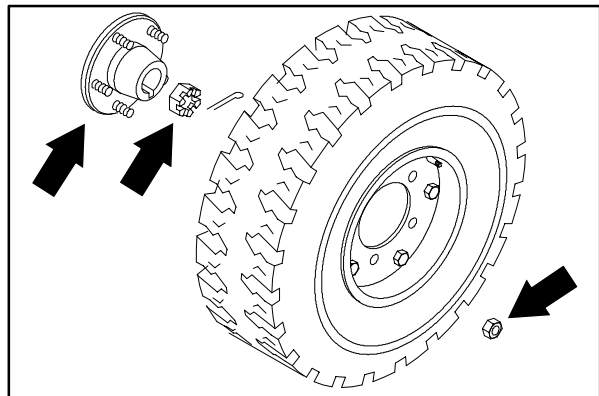


10. Slide the rebuilt or new motor in the rear wheel housing.

NOTE: The orientation of the motor in the rear wheel housing.

11. Install the four socket screws. Torque to 90 – 117 Nm (70 – 85 ft lb).
12. Reconnect the hydraulic hoses to the drive motor.

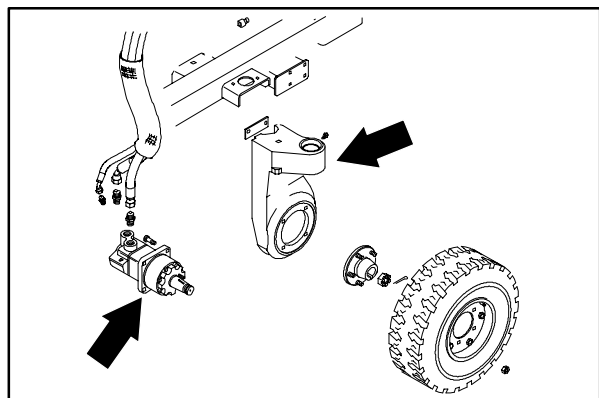
NOTE: Make sure the hoses are returned to the correct fitting when reassembled. See schematic in the HYDRAULICS section.



13. Install the drive hub to the tapered motor shaft. Tighten slotted nut to 500 Nm (375 ft lb). Install the cotter pin.

NOTE: Make sure the square key is in place on the tapered shaft before installing the drive hub.

14. Install rear tire and wheel assembly. Torque the rear wheel nuts to 142 – 156 Nm (105 – 115 ft lb).
15. Remove the jack stands and the lower machine.



16. Drive the machine and check for proper operation.

CHASSIS

TO REPLACE REAR WHEEL HOUSING PIVOT BEARINGS

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

1. Engage the parking brake and block the front tires.
2. Jack up the rear of the machine. Use jack stands to support machine.

FOR SAFETY: Block machine tires before jacking machine up. Jack machine up at designated locations only. Block machine up with jack stands.

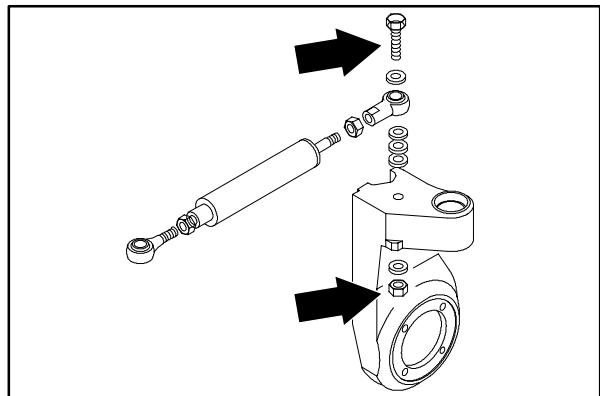
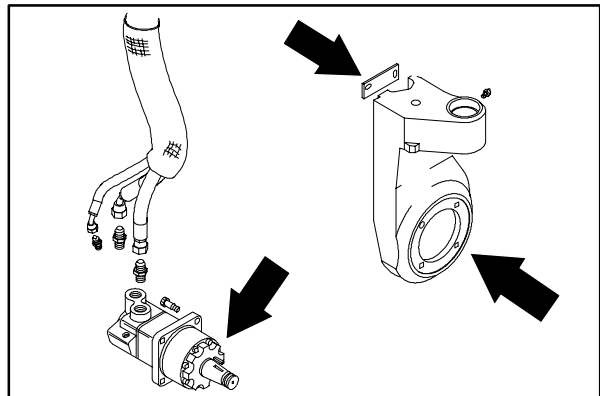
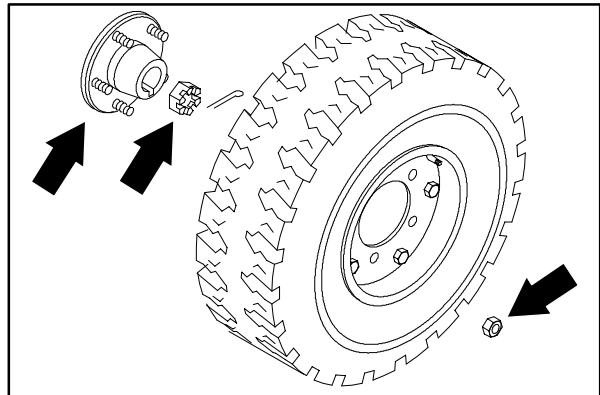
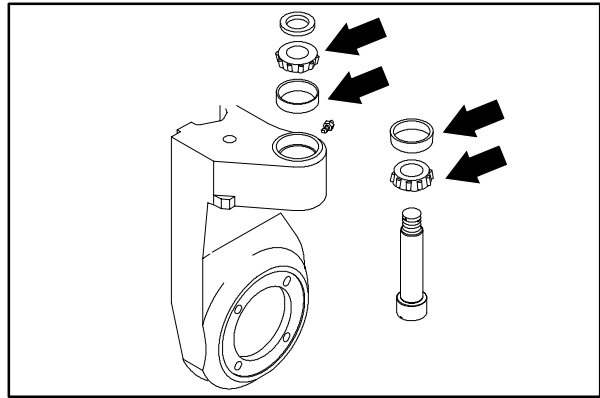
3. Remove the rear tire and wheel assembly.
4. Remove the slotted nut from drive wheel motor hub shaft.
5. Use a large puller to remove the drive hub from the motor shaft.
6. Remove the hose support plate from the rear wheel housing.

NOTE: The hydraulic hoses can remain connected to the drive motor

7. Remove the four drive motor mounting bolts.

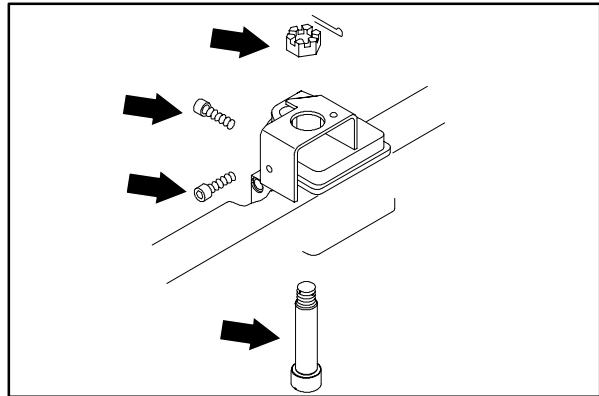
NOTE: The orientation of the motor in the rear wheel housing.

8. Slide the motor out of the rear wheel housing.
9. The hydraulic motor can moved out of the way to ease rear wheel housing removal.
10. Remove .750 inch hex screw attaching rod end of steering cylinder to rear wheel housing.

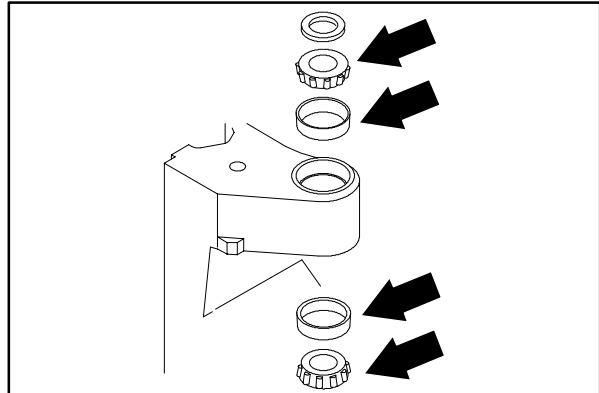


11. Remove the cotter pin and large slotted nut from the top of the pivot pin.
12. Loosen the two M10 socket head bolts that are pinching the pivot pin in the frame.
13. Remove the pivot pin from the machine.

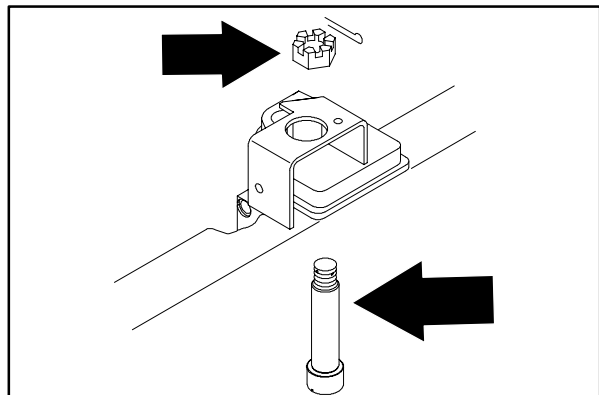
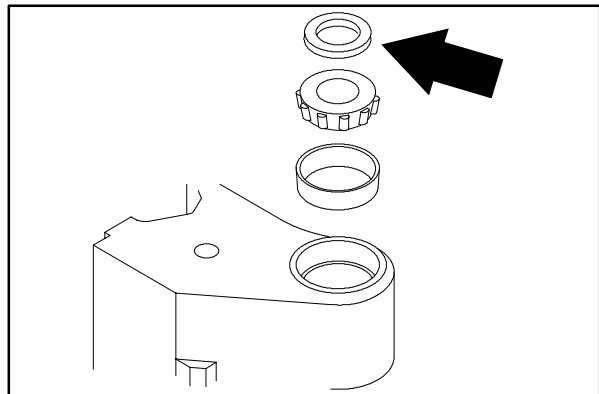
NOTE: The rear drive housing is heavy and will drop out of the machine frame when the pivot pin is removed.



14. Slide the wheel housing out of the main frame. Retain the thrust washer that is in place on top of the upper bearing cone.
15. Remove and discard both bearing cones.
16. Remove and discard the pressed in bearing cups by tapping them out with a hammer and drift punch.
17. Press the new bearing cups in by using a hydraulic press.
18. Pack the new bearing cones with Lubriplate EMB grease. Coat the new bearing cups with grease also.



19. Position the new bearings in the wheel housing.
20. Position the thrust washer on top of top bearing cone.
21. Position the wheel housing back in the machine frame.
22. Slide the pivot pin up through the hole in the frame and through the two bearings. Thread the castle nut on the pin. Tighten to 34 - 40 Nm (25 - 30 ft lb). Check for play. If pin is not seated, tap with rubber mallet and re-torque castle nut.
23. Torque the top socket screw with hand torque wrench to 100 - 115 Nm (73-85 ft lb).



CHASSIS

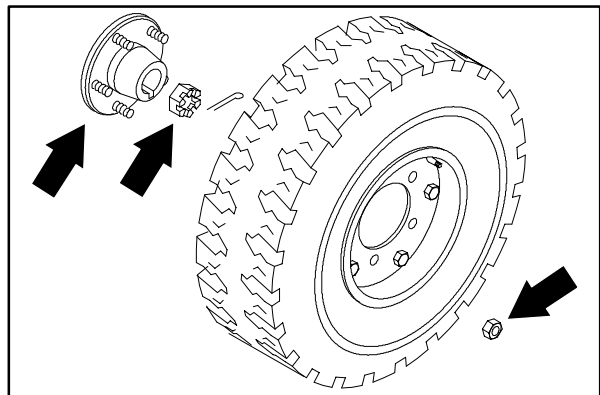
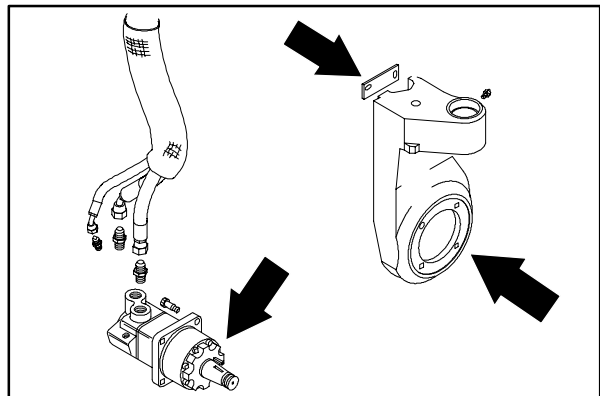
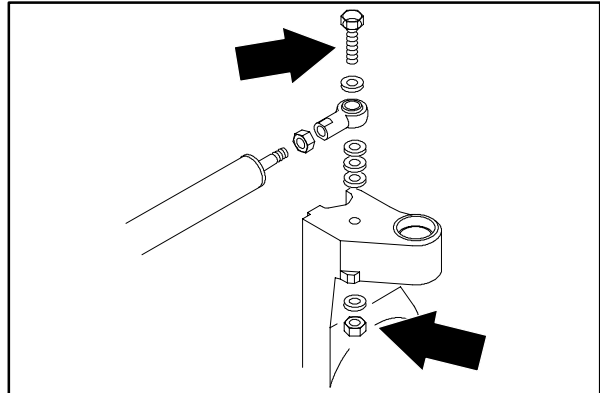
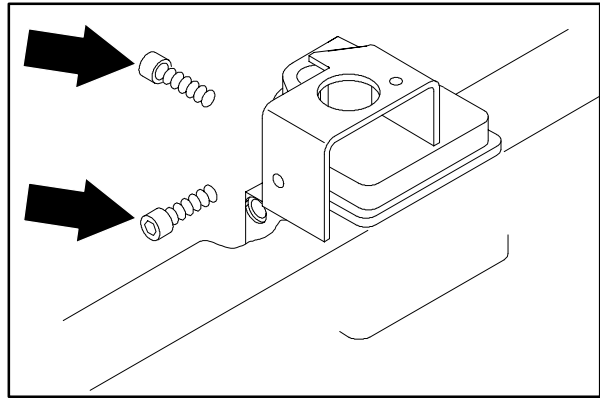
24. Tighten the castle nut to the next slot and insert the cotter pin. Torque not to exceed 100 Nm (75 ft lb).
25. Check the casting to see if it rocks or binds. If it does, loosen the top socket screw, move the casting to seat bearing, and re-tighten the socket screw to 100 – 115 Nm (73–85 ft lb).
26. Tighten the lower socket screw to 100 – 115 Nm (73–85 ft lb).
27. Reconnect the rod end of the steering cylinder to wheel casting using the .750x3.25 hex screw, nyloc nut, and four washers. Tighten to 270 – 300 Nm (200 – 220 ft lb).
28. Slide the rear drive motor in the wheel housing.

NOTE: The orientation of the motor in the rear wheel housing.

29. Install the four socket screws. Torque to 90 – 117 Nm (70 – 85 ft lb).
30. Reinstall the hose clamp to the drive housing. Tighten M8 hex screws to 18.5 – 24Nm (15 – 20 ft lb).
31. Install the drive hub to the tapered motor shaft. Tighten slotted nut to 500 Nm (375 ft lb). Install the cotter pin.

NOTE: Make sure the square key is in place on the tapered shaft before installing the drive hub.

32. Install rear tire and wheel assembly. Torque the rear wheel nuts to 142 – 156 Nm (105 – 115 ft lb).
33. Re-connect battery cables, start engine, run propelling in both directions, check for leaks.
34. Remove the jack stands and lower the machine.
35. Drive the machine and check for proper operation.



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INTRODUCTION

The side brush sweeps debris into the path of the main brush. The main brush sweeps debris from the floor into the hopper. The vacuum system pulls dust and air through the hopper and the hopper dust filter.

DEBRIS HOPPER

The debris hopper collects the debris swept up by the machine. The hopper includes the following main components: hopper dust filters, hopper dump door, and dust skirts. All adjustment have been made at the factory and require no regular maintenance. If the hopper components are repaired or replaced, some components may need to be readjusted for best performance. The hopper may need to be removed from the machine some repair or service work.

TO REMOVE HOPPER

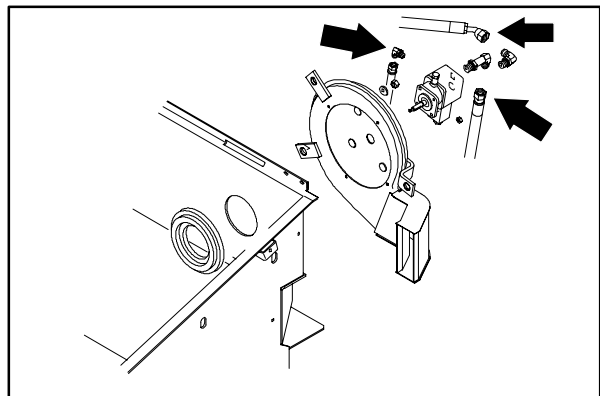
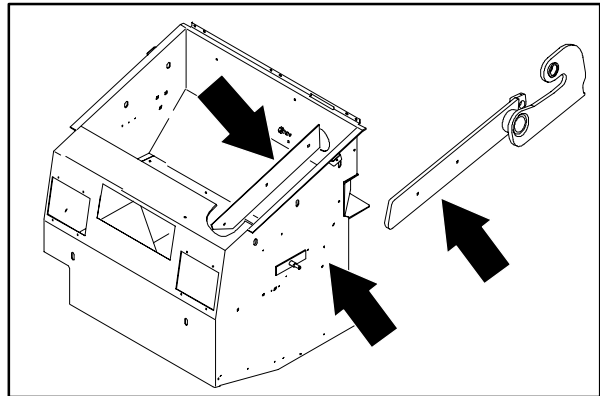
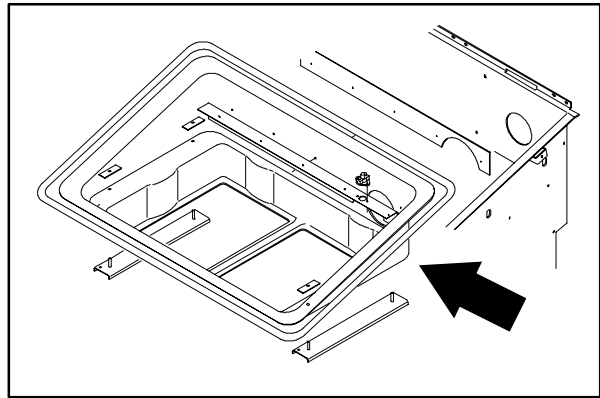
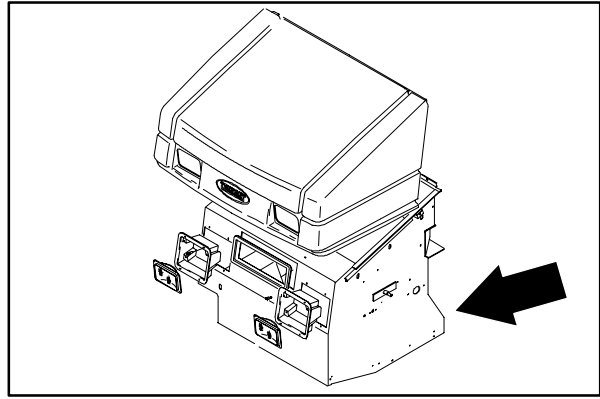
FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake, Turn Off Machine And Remove Key.

1. Engage the parking brake.
2. Start the engine and raise the hopper high enough to position two 4" tall blocks on the floor under the hopper. Lower the hopper down on these blocks. Shut off the engine.
3. Open the hopper cover, unplug the wires from the filter shaker and Thermo Sentry™.
4. Remove the filter carrier tray from the machine.
5. Remove the six M12 hex screws and nyloc nuts holding the lift arms to hopper sides.
6. Start the machine and carefully back it away from the hopper a few feet. Watch the right hand lift arm when backing up, it needs to clear the hopper solenoid valve on the way out.
7. After the machine is clear of the hopper, shut off engine and disconnect and plug hydraulic hoses leading from hopper to the machine.

NOTE: Observe hydraulic cleanliness requirements when opening hydraulic lines.

8. Disconnect the hopper wire harness from the main harness. Unplug the vacuum fan solenoid from the main harness.
9. The hopper can now be removed from the machine.

NOTE: Do not start engine with hydraulic hoses disconnected.



TO INSTALL HOPPER

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

1. Position the hopper in front of the machine. Move the hopper in close enough to reconnect the hydraulic hoses and the wire harness.

NOTE: Make sure the hopper cover is in the raised position.

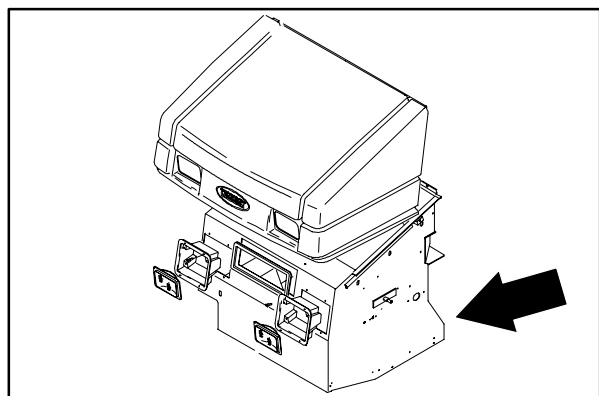
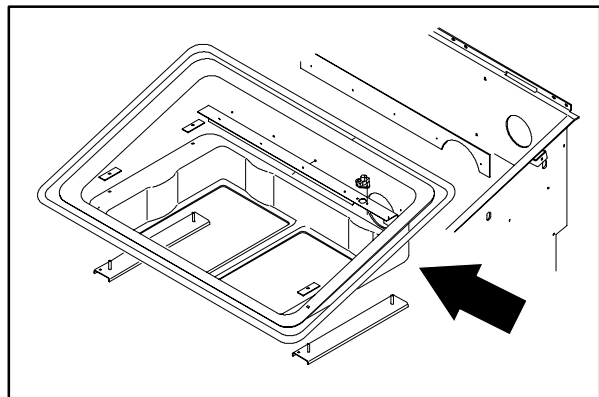
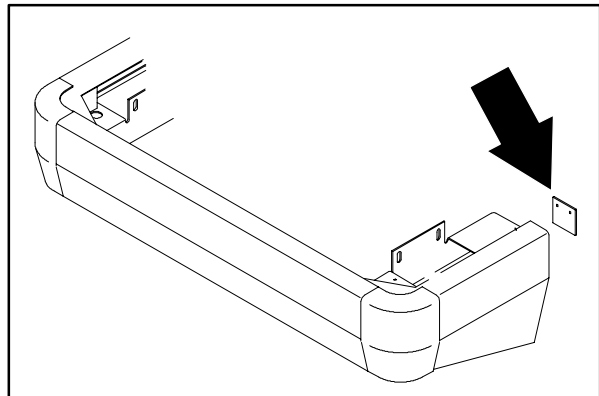
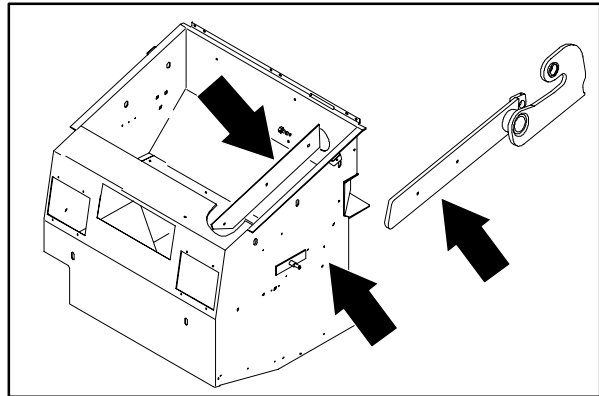
2. See the schematic in the HYDRAULICS section of this manual for proper hose connections.
3. See the schematic in the ELECTRICAL section of this manual for proper harness connections.
4. The machine can now be started and carefully inched forward. The right hand lift arm must clear the hopper solenoid valve when positioning hopper back in the machine.

NOTE: Be careful not to pinch hydraulic hoses or electrical wires during this procedure.

5. The hopper must go in until the rubber pads on the bumper hit the machine frame.
6. Remove the filter tray from the hopper.
7. Align the holes in lift arms with the holes in hopper sides. It may be necessary to use a pry bar for the final alignment.

NOTE: Hopper must be on 4" tall blocks for proper adjustment before installing hardware.

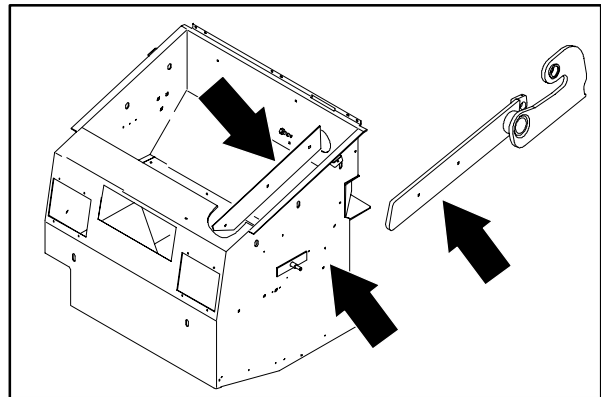
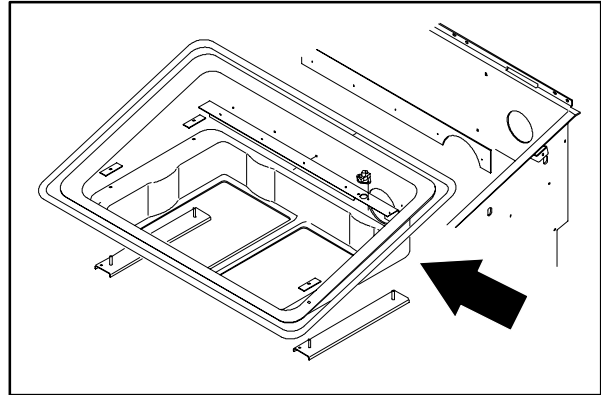
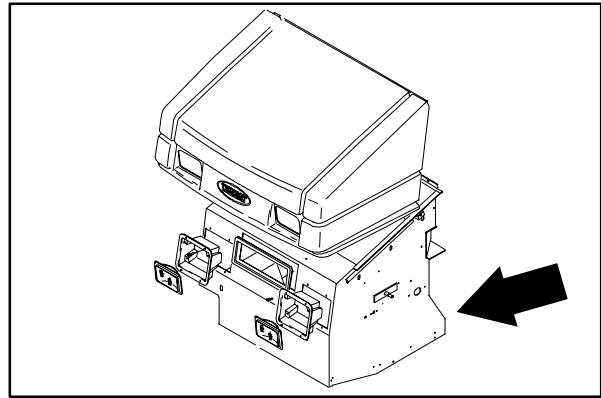
8. Install six M12 hex screws, nyloc nuts and Belleville washers along with the two hopper plates. Tighten to 90 - 117 Nm (65 - 85 ft lb).
9. Install the hydraulic hose clamps to the hopper lift arm.
10. Reinstall the filter tray back in the hopper and reconnect the wires to the filter shaker and Thermo Sentry™.
11. Start the engine and check for proper operation of the hopper vacuum fan, dump door, side brush rotation and side brush up and down.



TO ADJUST HOPPER

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

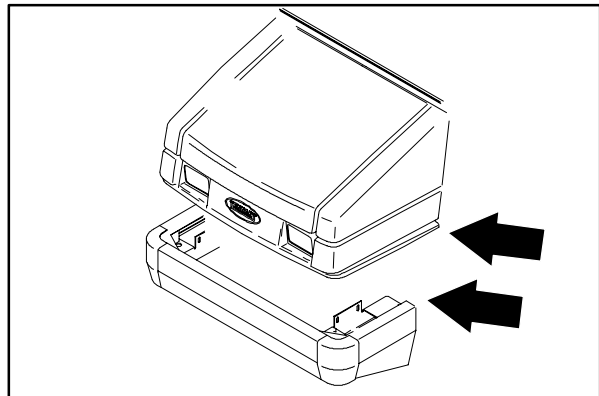
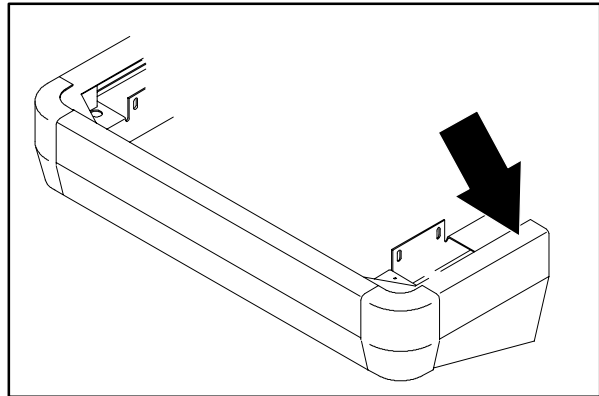
1. Engage the parking brake.
2. Start the engine and raise the hopper high enough to position two 4" tall blocks on the floor under the hopper. Lower the hopper down on these blocks. Shut off the engine.
3. Open the hopper cover, unplug the wires from the filter shaker and Thermo Sentry™.
4. Remove the filter carrier tray from the machine.
5. Loosen the six M12 hex screws and nyloc nuts holding lift arms to hopper. Make sure hopper arms drop down to the lowest position, and the hopper is all the way back against the main frame.
6. Tighten the six M12 hex screws and nyloc nuts to Tighten to 90 - 117 Nm (65 - 85 ft lb).
7. Reinstall the filter tray back in the hopper and reconnect the wires to the filter shaker and Thermo Sentry™.
8. Start the engine, raise the hopper high enough to remove the two 4" tall blocks. Lower the hopper and check for proper hopper to floor clearance.



TO ADJUST HOPPER BUMPER

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

1. Using a long straight edge, check the levelness of the hopper bumper to the machine frame. If there is more than an 1/8 in. difference; the bumper needs to be adjusted.
2. Use a hoist or a floor jack to hold up the bumper while loosening the six M10 hex screws holding it to the hopper.
3. Using the straight edge and hoist, re-align the bumper to the frame. Tighten the M10 hex screws to 52 - 67 Nm (39 - 51 ft lb).
4. Remove the hoist, shut the hopper cover, check the hood and bumper for proper alignment.



HOPPER DUMP DOOR

The hopper dump door is used to control the debris when dumping.

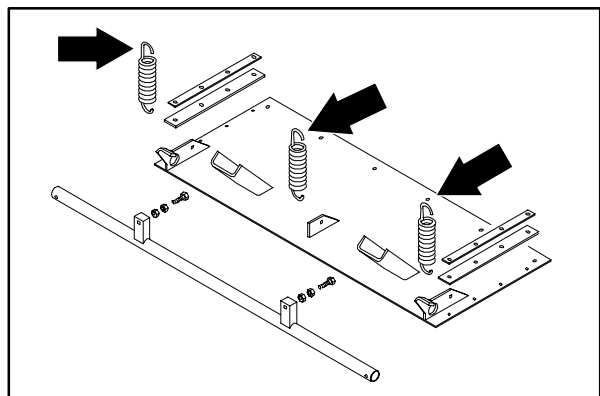
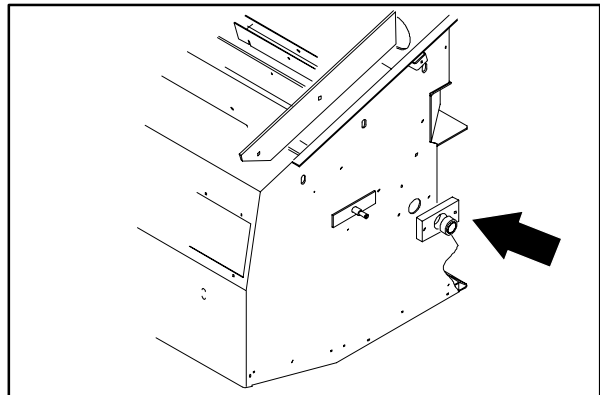
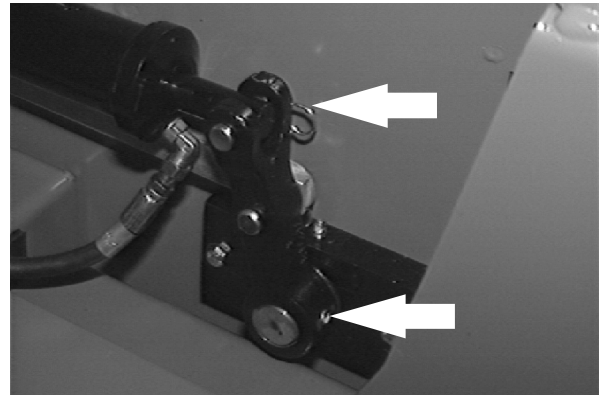
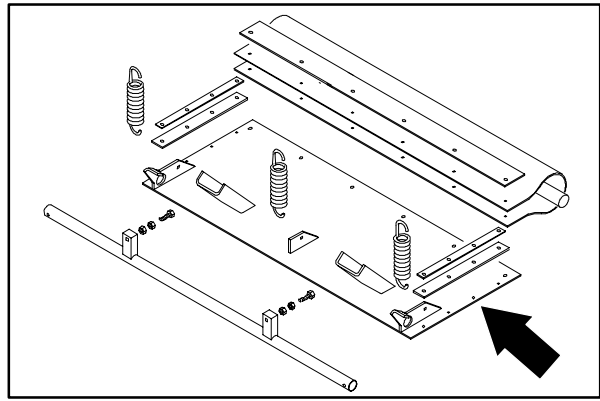
TO REMOVE HOPPER DUMP DOOR

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

1. Make sure the hopper is emptied of all debris. Engage the parking brake.
2. Open the dump door and hopper cover.
3. Remove the clevis pin holding the rod end of dump door cylinder and dust door pivot link to the dump door pivot yoke.
4. Using a hammer and punch; drive the roll pins out of the pivot yokes. Remove the pivot yokes from the machine.
5. Remove the four M8 hex screws and flange nuts holding the bearing pivot hubs to the hopper. Remove both hubs.
6. Close the hopper cover.
7. Raise the hopper and engage the safety arm.

⚠ WARNING: Raised Hopper May Fall. Engage Hopper Support Bar.

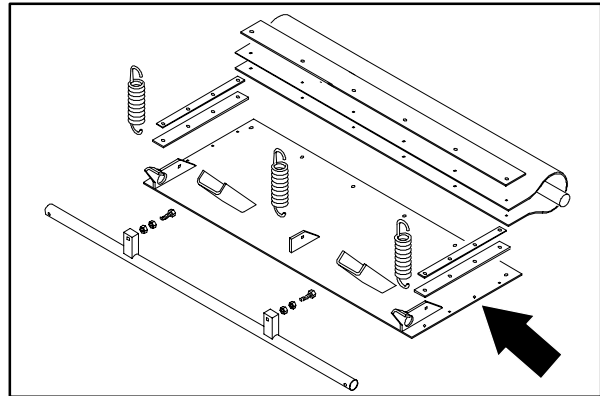
8. Completely loosen the two adjustment bolts on the dump door pivot rod.
9. Using a vice grip and a pry bar, remove the three springs from the dump door.
10. Slide the dump door all the way in either direction, drop one side down, remove the dump door from the machine.



TO INSTALL HOPPER DUMP DOOR

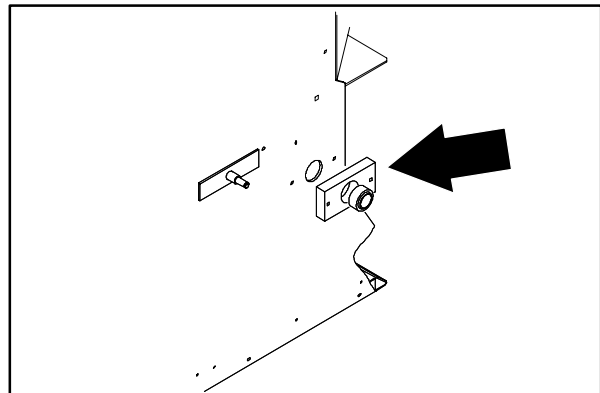
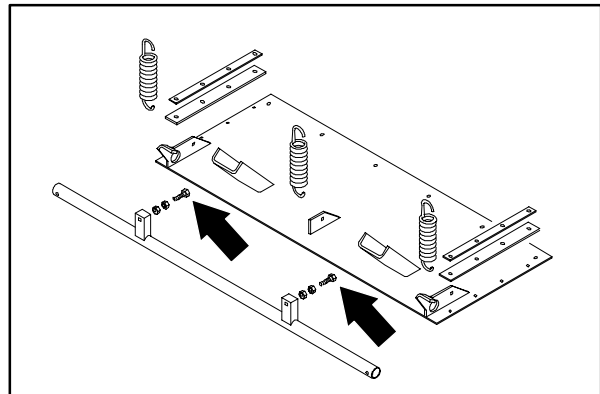
FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake, Turn Off Machine And Remove Key.

1. Make sure the hopper is emptied of all debris. Engage the parking brake.
2. Raise the hopper and engage safety arm.
3. Slide the pivot rod weldment in the holes on hopper dump door.

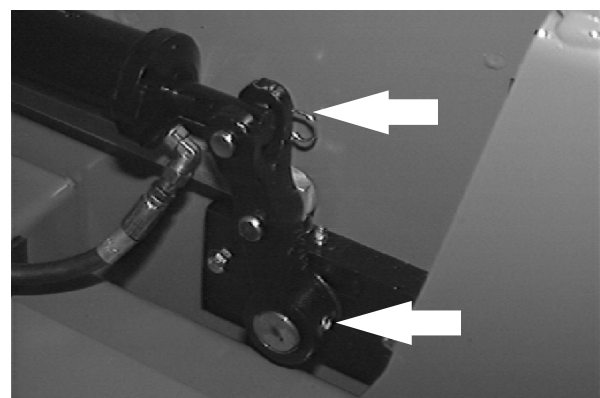


NOTE: Both of the bearing pivot blocks must be removed before the next step can be completed.

4. Place one end of dump door assembly in one of the holes in rear of hopper. Slide it all the way to one side, bring up the other end and place it in the other hole. Center the door in machine.
5. Reconnect the three tension springs from eye bolts in hopper to holes in brackets on dump door. Use a vice grips and a pry bar to hook the springs in the holes.
6. Set the adjustment bolts on the dump door to 3/4 in. from the head of the bolt to edge of the bracket.
7. Disengage the safety arm, lower the hopper and open hopper cover.
8. Reinstall both bearing pivot blocks using four M8 hex head screws and flange nuts. Tighten to 18 – 24 Nm (13 – 18 ft lb).
9. Install pivot yokes on the dump door rod with the smooth side towards the hopper.



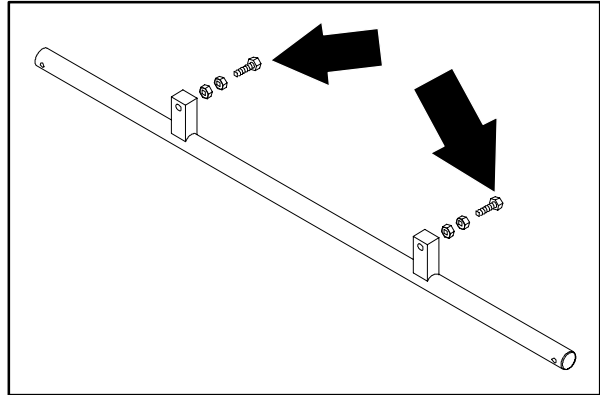
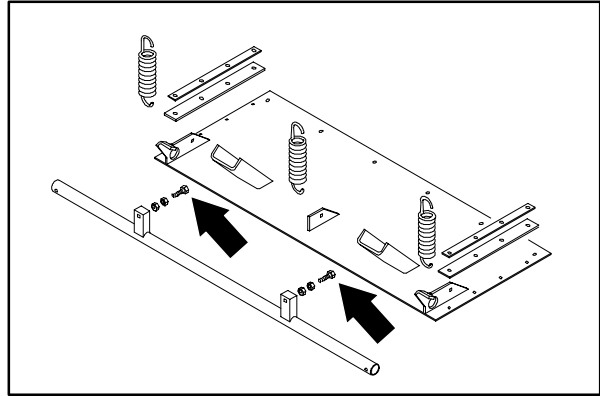
10. Align the holes in the rod with holes in the pivot yoke. Use a hammer to drive the roll pins in flush.
11. Reconnect the rod end of dump door cylinder and the dust door pivot link to dump door pivot yoke using the clevis pins and hair pins.
12. Start the machine and open and close the hopper door a few times checking for proper operation.



TO ADJUST HOPPER DUMP DOOR

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

1. Make sure the hopper is emptied of all debris. Engage the parking brake.
2. Open the dump door.
3. Raise the hopper and engage the safety arm.
4. Measure the opening between the inside of the dump door to the inside lower corner of the hopper. This dimension should be 10.5"
5. Use the two adjustment screws on the dump door to achieve this dimension.



HOPPER DUST FILTER

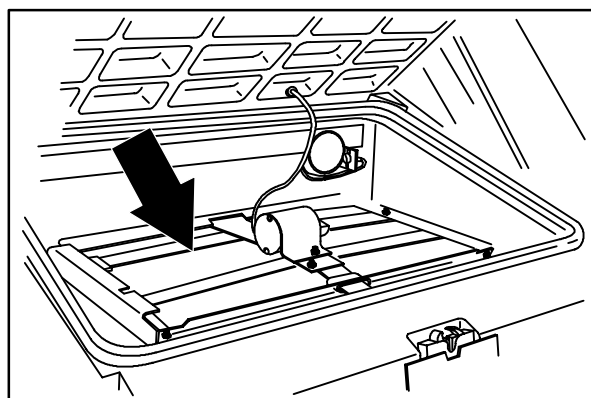
HOPPER DUST FILTER

The dust filters filter the air pulled up from the hopper. The dust filters are equipped with a shaker to remove the accumulated dust particles. The dust filters shaker is operated by the filter shaker switch.

Shake the dust filters before dumping the hopper and at the end of every work shift. Check and clean the dust filters every 50 hours of operation. Extremely dusty conditions may require more frequent cleaning of dust filters.

To clean the dust filters, use one of the following methods:

- **SHAKING** - Press the filter shaker switch.
- **TAPPING** - Tap the filter gently on a flat surface with the dirty side down. Do not damage the edges of the filter element or the filter will not seat properly in the filter frame.
- **AIR** - Blow compressed air through the dust filter opposite the direction of the arrows. This may be done with the dust filter in the machine. Always wear eye protection when using compressed air.



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

- **WATER** - Soak the dust filter in a water and mild detergent solution. Rinse the dust filter until it is clean. Air dry the wet dust filter; do not use compressed air.

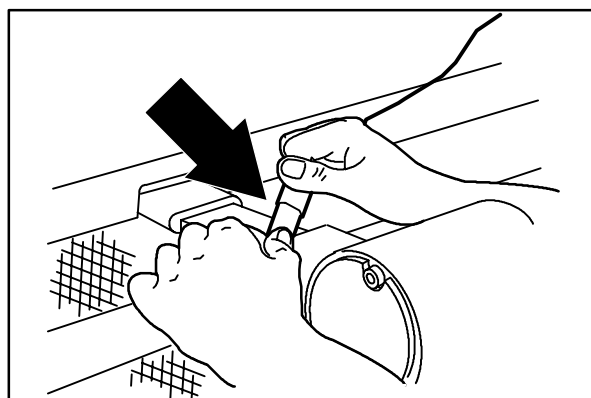
NOTE: Be sure the dust filter is dry before reinstalling it in the machine.

TO REMOVE OR REPLACE HOPPER DUST FILTER

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

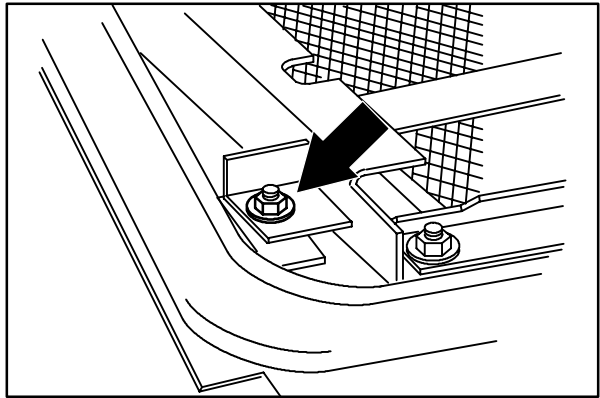
FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake, Turn Off Machine And Remove Key.

2. Open the hopper cover.



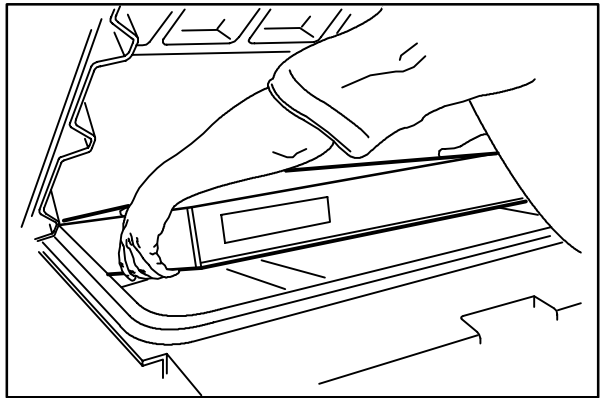
SWEEPING

3. Disconnect the shaker motor wire connectors.
4. Remove the four retaining screws from the filter shaker frame.
5. Pull the filter shaker frame out of the hopper.



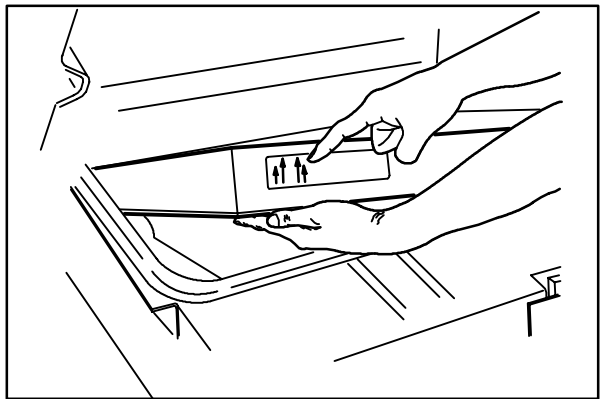
08014

6. Lift the dust filter element out of the hopper insert.



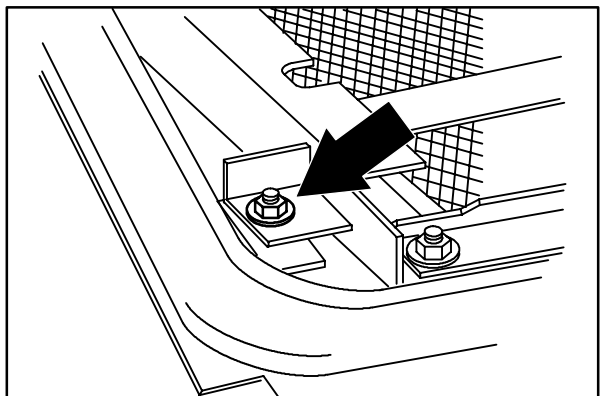
08012

7. Clean or discard the dust filter as required.
8. Put the cleaned or new dust filter in the hopper insert with the arrows pointing up.



08013

9. Install the four retaining screws and tighten.
10. Connect the shaker motor wire connectors.



08014

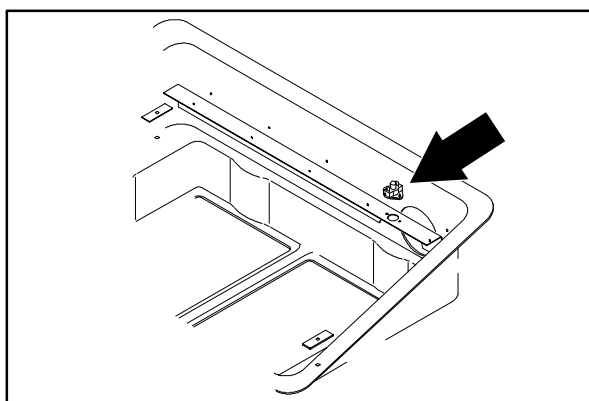
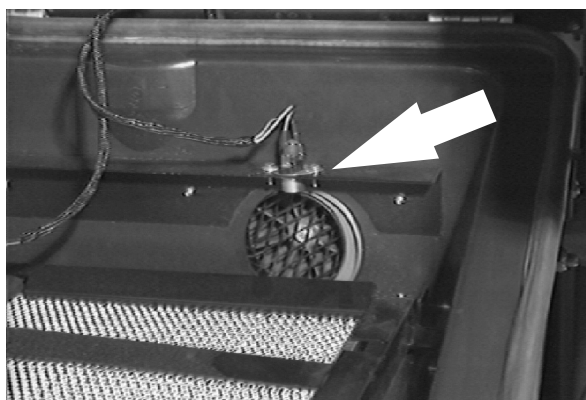
THERMO SENTRY™

The Thermo Sentry™ senses the temperature of the air pulled up from the hopper. If there is a fire in the hopper, the Thermo Sentry™ stops the vacuum fan and cuts off the air flow.

Reset the Thermo Sentry™ by pushing in its reset button.

TO REPLACE THERMO SENTRY™

1. Open the hopper cover.
2. Disconnect the Thermo Sentry™ from the hopper harness.
3. Remove the two screws holding the Thermo Sentry™ to the stiffener plate. Remove the Thermo Sentry™.
4. Mount the new Thermo Sentry™ to the stiffener plate with existing hardware.
5. Connect the new Thermo Sentry™ to the hopper wire harness.
6. Close the hopper cover.



BRUSHES

MAIN BRUSH

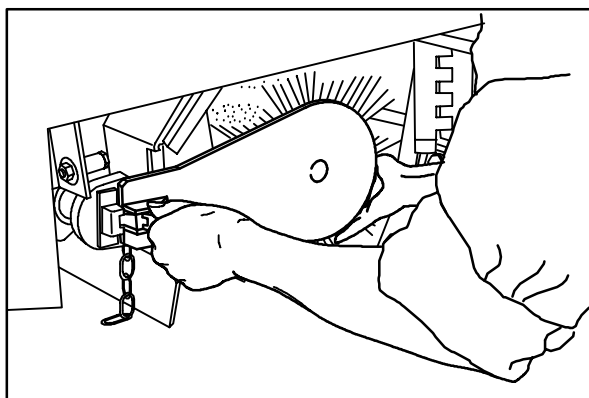
The main brush is cylindrical and spans the width of the machine, sweeping debris into the hopper.

Check the brush daily for wear or damage. Remove any string or wire tangled on the main brush, main brush drive hub, or main brush idler hub.

Check the main brush pattern daily. The pattern should be 65 to 75 mm (2.5 to 3.5 in) wide with the main brush in the **Down** position. Adjust the main brush pattern by turning the main brush pressure knob located in the operators compartment.

Rotate the main brush end-for-end every 50 hours of operation for maximum brush life and best sweeping performance.

Replace the main brush when the remaining bristles measure 25 mm (1 in) in length.



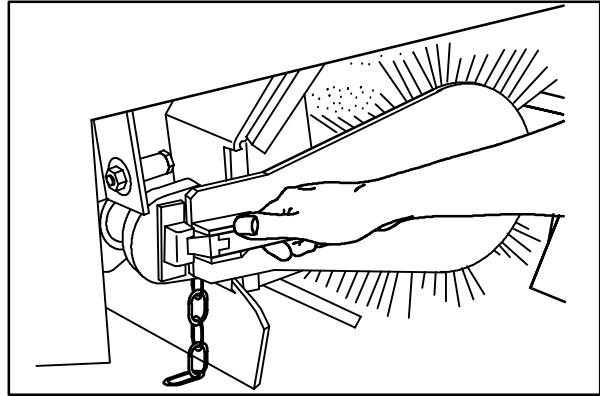
08018

SWEEPING

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

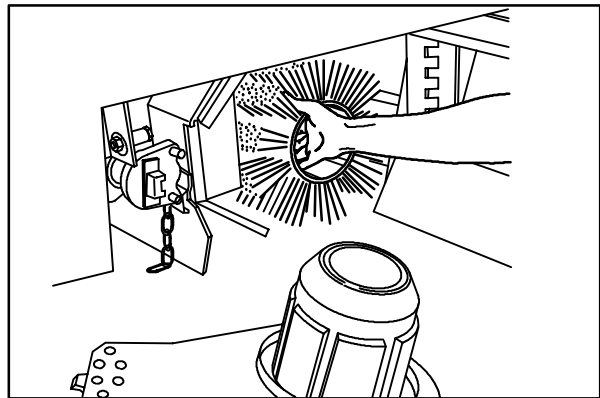
FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake, Turn Off Machine And Remove Key.

2. Raise the main brush.
3. Open the right side main brush access door.
4. Unlatch and remove the brush idler plate.



08016

5. Grasp the main brush; pull it off the brush drive plug and out of the main brush compartment.
6. Put the new or rotated end-for-end main brush on the floor next to the access door.
7. Slide the main brush onto the drive plug. Rotate the brush until it engages the drive plug, and push it all the way onto the plug.
8. Slide the main brush idler plate plug onto the main brush.
9. Latch the idler plate onto the machine frame.
10. Close the right side main brush access door.

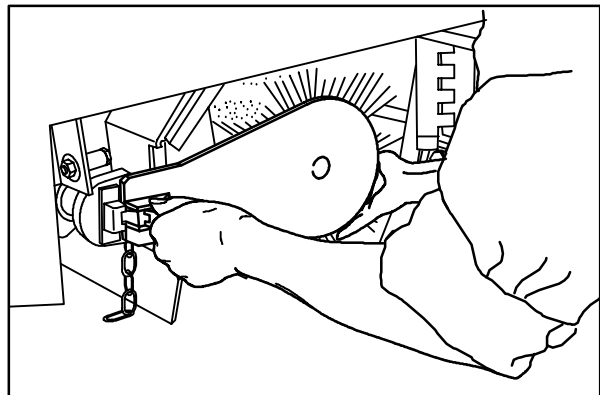


08017

TO CHECK AND ADJUST MAIN BRUSH PATTERN

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

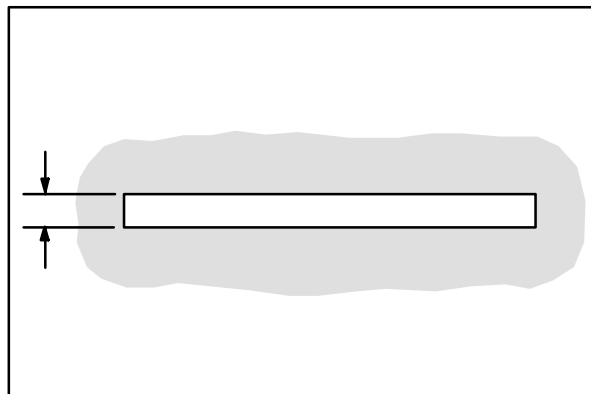
1. Apply chalk, or some other material that will not blow away easily, to a smooth, level floor.
2. Raise the side brush and main brush and position the main brush over the chalked area.
3. Start the main brush.
4. Lower the main brush for 15 to 20 seconds while keeping a foot on the brakes to keep the machine from moving. This will lower the rotating main brush.



08018

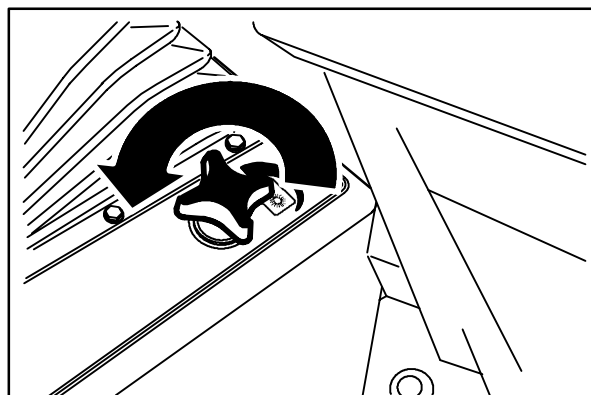
NOTE: If chalk or other material is not available, allow the brushes to spin on the floor for two minutes. A polish mark will remain on the floor.

5. Raise the main brush.
6. Stop the main brush.
7. Drive the machine off the test area.
8. Observe the width of the brush pattern. The proper brush pattern width is 65 to 75 mm (2.5 to 3.5 in).



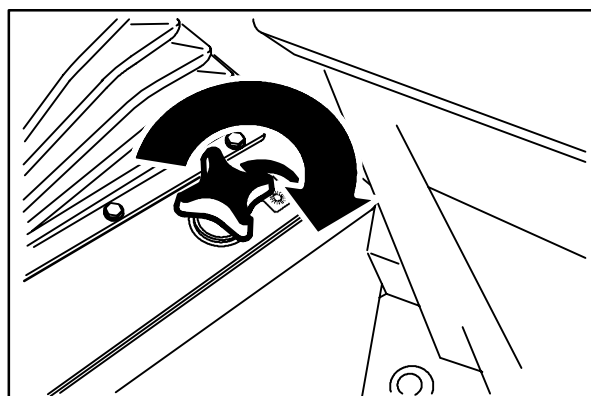
00582

9. To increase the width of the main brush pattern, turn the main brush down pressure knob counter-clockwise.



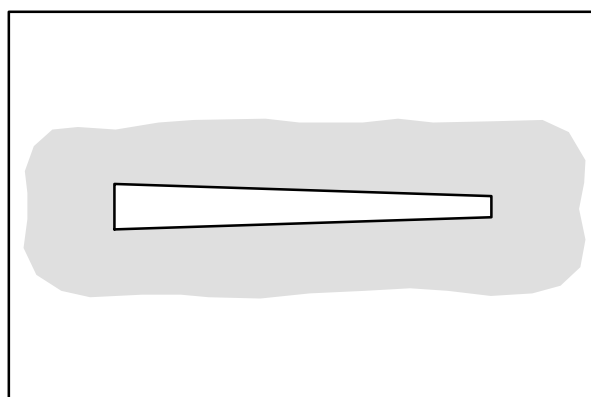
07787

10. To decrease the width of the main brush pattern, turn the main brush down pressure knob clockwise.



07788

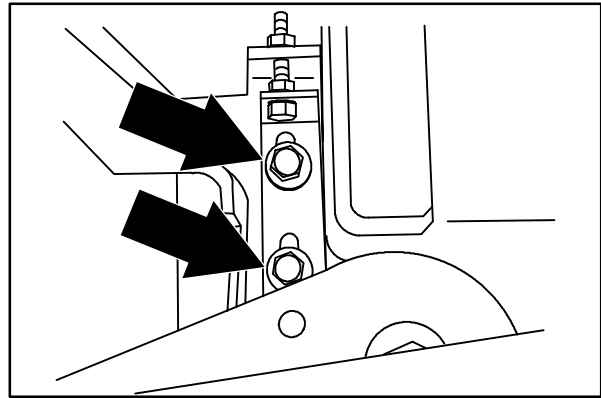
11. If the main brush pattern is tapered, more than 15 mm (0.5 in) on one end than the other, adjust taper.



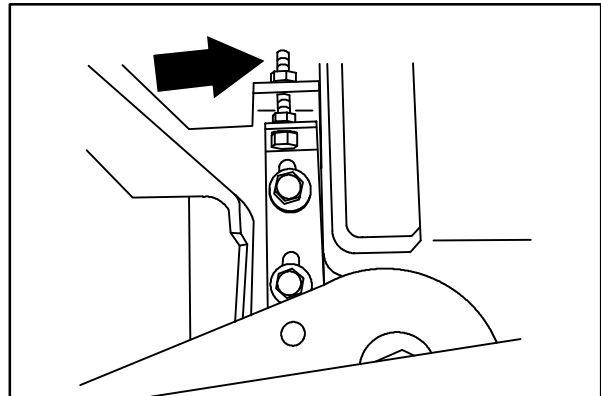
00601

SWEEPING

12. Loosen the bracket mounting bolts.
13. Turn the taper adjustment nut counter-clockwise to increase the pattern width at the brush drive end, and clockwise to decrease the pattern width at the brush drive end. Tighten the mounting bolts.
14. Check the main brush pattern and readjust as necessary. Then adjust the width of the main brush pattern.



08216

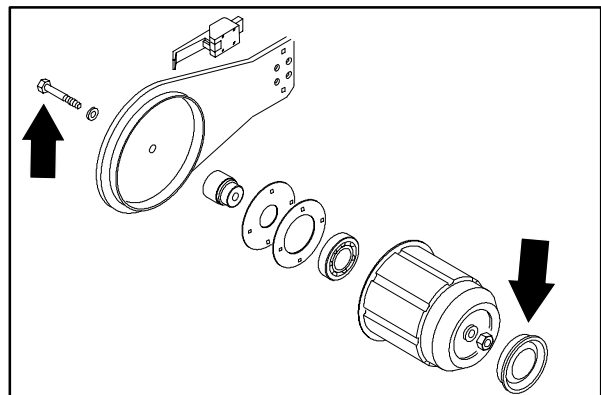
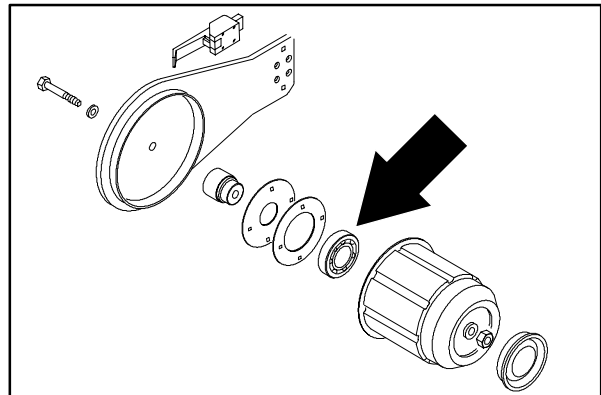


08215

TO REPLACE MAIN BRUSH IDLER PLUG BEARING

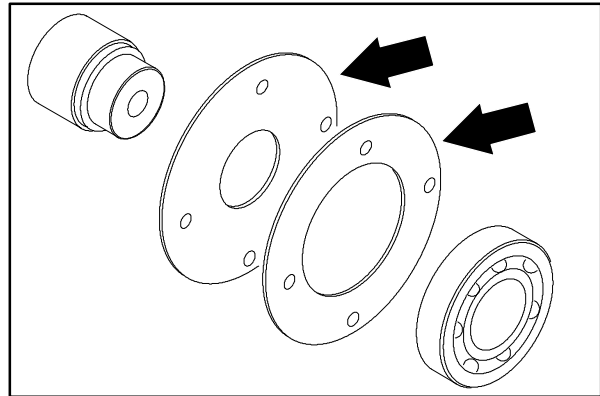
FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake, Turn Off Machine And Remove Key.

1. Open the right side brush door and remove the main brush idler arm from machine.
2. Remove the plastic cap from the idler plug.
3. Remove the M12 hex screw, nyloc hex nut, and washer holding the idler plug to the brush idler arm. Save the hardware.
4. Remove the four M6 hex screws holding the idler shaft in the idler plug. Remove the shaft. Save the hardware.
5. Remove the bearing seal plate, retainer and bearing.
6. Clean the inside of the idler plug.
7. Place a new bearing, the seal plate and the retainer in the idler.



8. Reinstall the four screws and flat washers.
9. Install the idler shaft and tighten the four M6 hex screws to 8–10 Nm (6–8 ft lb).
10. Position the idler plug and shaft on the brush idler arm. Reinstall the hardware removed earlier. Tighten to 68–81 Nm (50–60 ft lb).
11. Apply RTV to the area where plastic cap will fit in the end of idler plug. Snap plastic cap into place.

NOTE: If you replace idler arm latch, use blue locktite on hardware to hold in place.

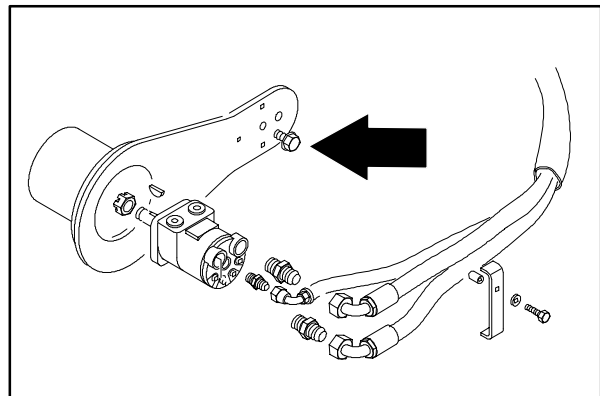


TO REPLACE BRUSH SHAFT BEARINGS

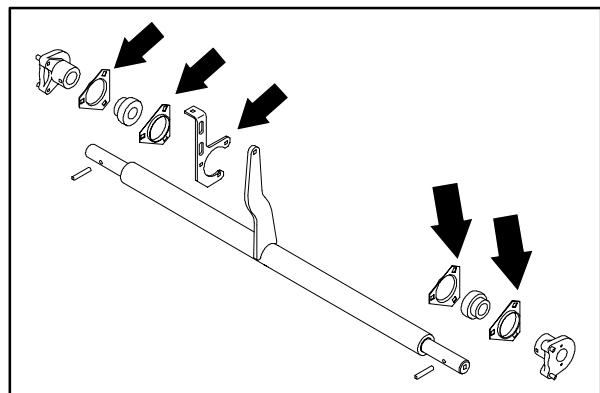
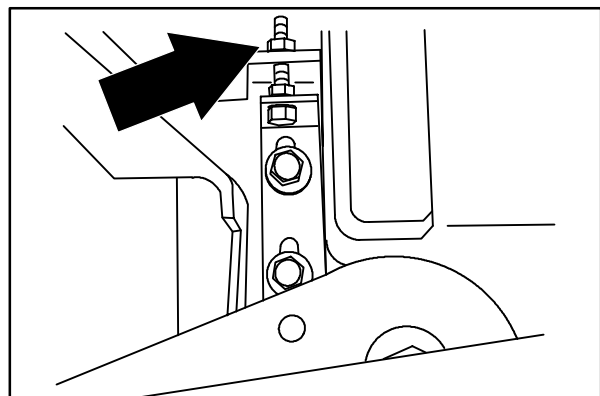
FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake, Turn Off Machine And Remove Key.

1. Remove the main brush and idler.
2. Remove the main brush motor mount plate from the brush shaft.

NOTE: The hydraulic hoses can be left hooked up to the motor when removing the mount plate.



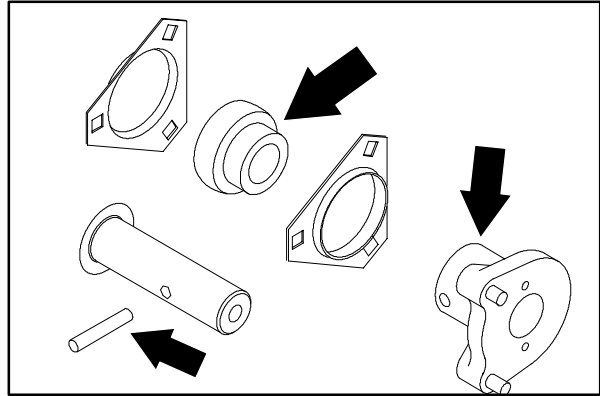
3. Remove the brush lift cable clevis from the brush shaft arm.
4. Loosen the main brush taper adjustment screw.
5. Remove the hardware holding each of the two brush shaft flange bearings.
6. Pull the brush shaft out of the machine.
7. Use a punch and a hammer to drive the brush hub roll pins out of the brush hubs.
8. Slide the brush hubs off the end of the shaft.
9. Remove the remaining hardware holding the bearing collars in place.
10. Loosen the bearing set screws and slide the bearings off the shaft.
11. Slide the new bearings on the shaft with the collar facing the ends of the shaft. Be sure to have a bearing flange on each side of the bearings.
12. Slide the brush hubs on each end of the brush shaft.



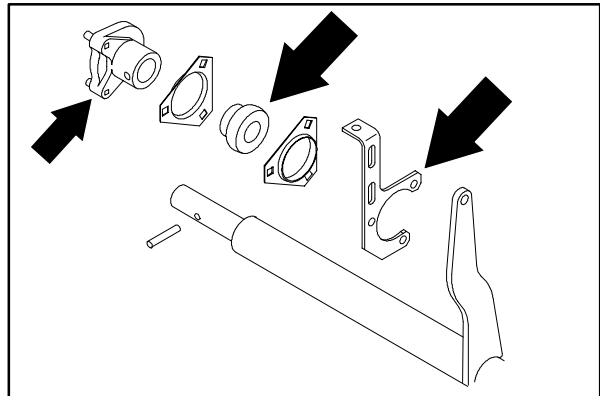
SWEeping

13. Align the hole in the hub with the hole in the shaft.
14. Use a hammer to pound the roll pin in flush.
15. Mount the main brush shaft plate to the right side bearing flange. Tighten the hardware to 22-27 Nm (16-20 ft lb).

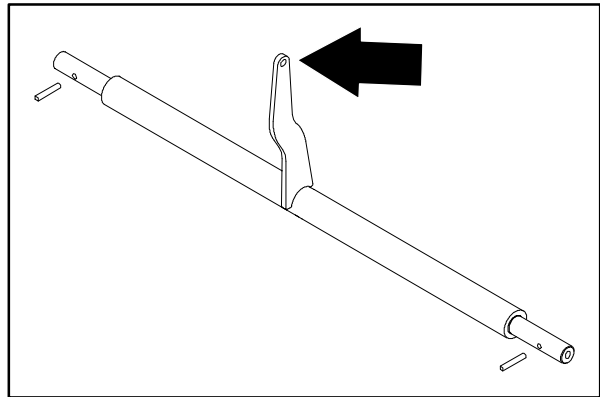
NOTE: If you are replacing the idler arm latch bracket, use blue locktite to hold the bolts in place. Tighten the bolts to 8-10 Nm (6-8 ft lb).



16. Center the brush shaft in the machine. Tighten the bearing collar set screws.
17. Connect the main brush lift cable to the brush shaft arm with the clevis pin removed earlier.
18. Reinstall the main brush hydraulic motor mount plate. Tighten the hex screw to 64 - 83 Nm (47 - 61 ft lb).
19. Reinstall the main brush and idler.



20. Check the main brush pattern for taper and width.



TO REPLACE MAIN BRUSH HYDRAULIC MOTOR

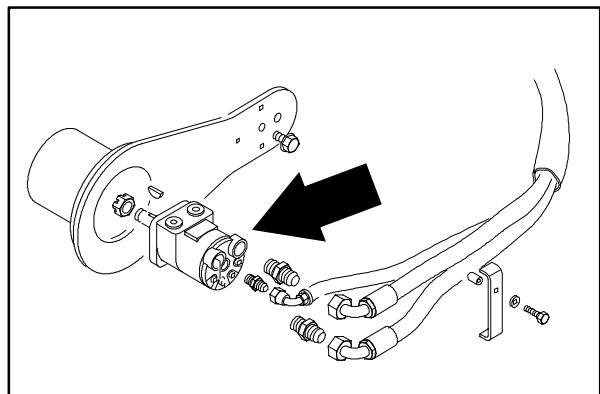
FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake, Turn Off Machine And Remove Key.

1. Raise the hopper and engage the hopper support bar.



WARNING: Raised Hopper May Fall. Engage Hopper Support Bar.

2. Remove the main brush.



3. Remove and plug the hydraulic hoses leading to the main brush motor.

NOTE: Observe hydraulic cleanliness requirements when opening hydraulic lines.

4. Remove the cotter pin from castle nut at the end of brush drive plug.
5. Hold the brush drive plug from turning and remove the castle nut.
6. A puller must be used to remove brush drive plug from the tapered shaft on the brush motor.
7. Remove the four .375 in. hex screws holding the main brush motor to the main brush motor arm. The brush motor can now be removed from the machine.

NOTE: Mark the orientation of the brush motor before removal for proper reassembly.

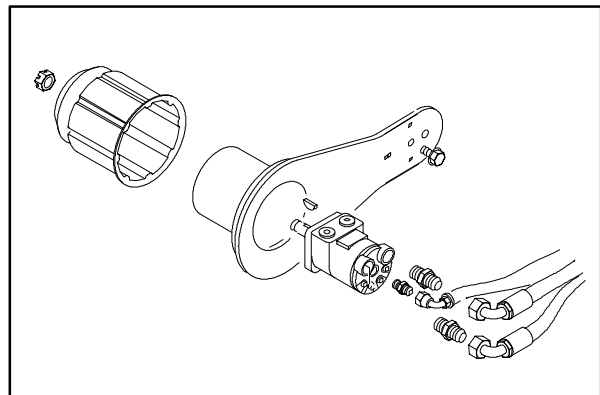
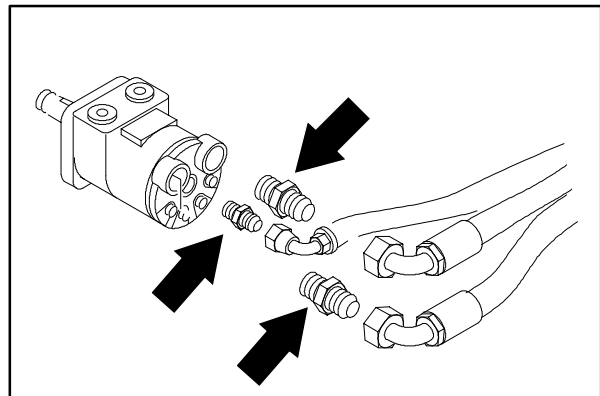
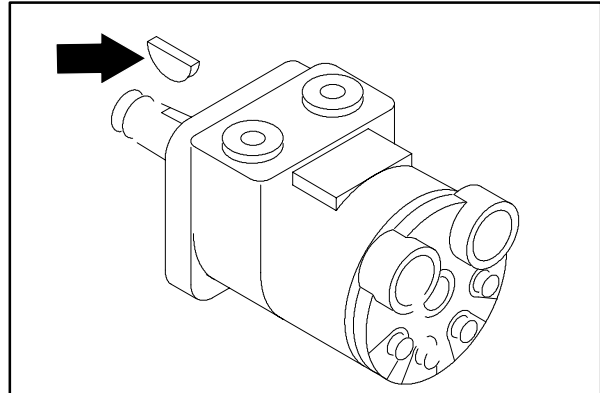
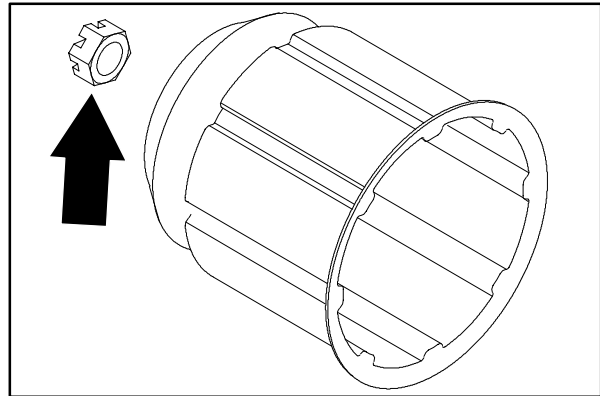
8. Remove the hydraulic fittings from the old motor.
9. Install a new or rebuilt main brush motor in the main brush arm. Reinstall the four .375 in. hex screws and tighten to (27 - 53 ft lb).

NOTE: Make sure the corners of brush motor line up with the slots in brush arm.

10. Reinstall the hydraulic fittings in the new motor.

NOTE: Make sure to orientate the fittings they way they were removed.

11. Reconnect the hydraulic hoses to the motor. See schematic in HYDRAULIC section.
12. Reinstall the brush drive plug on the tapered motor shaft. Make sure the square key is in place.
13. Reinstall the castle nut and tighten to 40 - 54 Nm (30 - 40 ft lb). Continue to tighten the castle nut until it lines up with the hole in brush motor shaft. Install a new cotter pin.
14. Reinstall the main brush.
15. Start the machine and run the main brush. Check for proper operation and leaks.



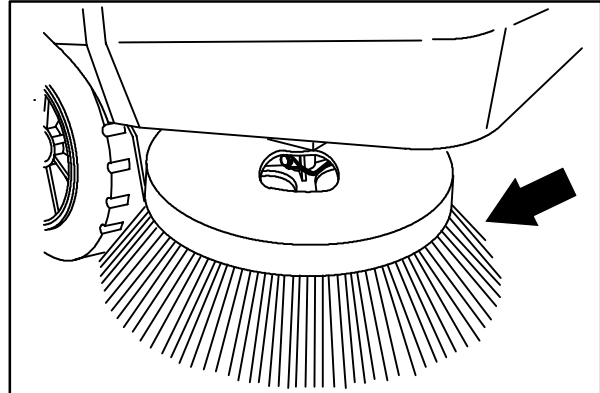
SIDE BRUSH

The side brush sweeps debris along edges into the path of the main brush.

Check the brush daily for wear or damage. Remove any string or wire found tangled on the side brush or side brush drive hub.

Check the side brush pattern daily. One-half of the side brush bristles should contact the floor when the brush is in motion. **Adjust** the side brush pattern by the side brush down pressure knob. Turn the knob counter-clockwise to increase the brush contact with the sweeping surface, and clockwise to decrease the brush contact with the sweeping surface.

The side brush should be replaced when it no longer sweeps effectively for your application. A guideline length is when the remaining bristles measure 50 mm (2 in) in length. You may change the side brush sooner if you are sweeping light litter, or wear the bristles shorter if you are sweeping heavy debris.



08019

TO REPLACE SIDE BRUSH

1. Empty the debris hopper.
2. Set the machine parking brake.
3. Raise the hopper and engage the hopper support bar.

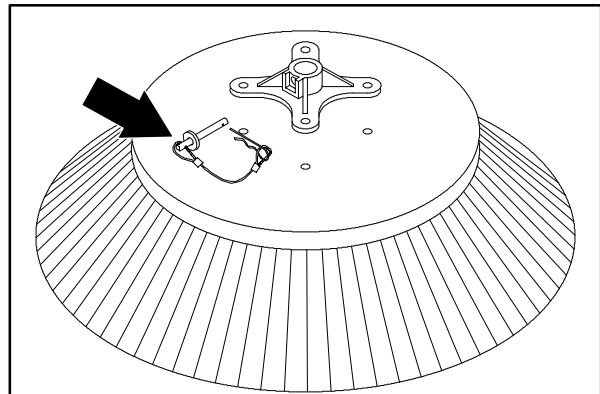


WARNING: Raised Hopper May Fall. Engage Hopper Support Bar.

4. Stop the engine.

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

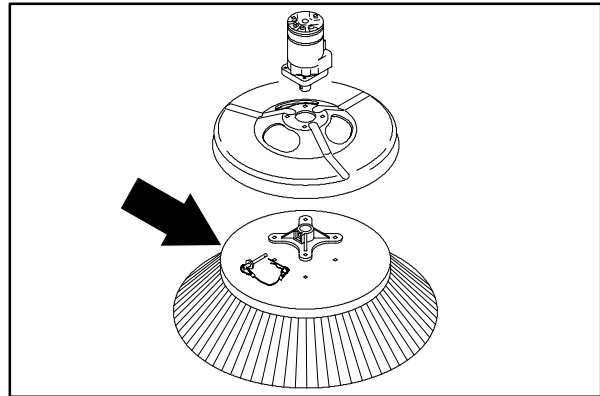
5. Remove the side brush retaining pin from the side brush drive shaft by pulling the pin keeper off and over the end of the pin.



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

NOTE: Remove the drive hub and put it on the new brush if one is not installed.

7. Slide the new side brush on the side brush drive shaft.
8. Insert the side brush retaining pin through the side brush hub and shaft.
9. Secure the pin by clipping the pin keeper over the end of the pin.
10. Disengage the hopper support bar and lower the hopper.
11. Adjust the side brush pattern with the side brush down pressure knob.



TO REPLACE SIDE BRUSH MOTOR

1. Empty the debris hopper.
2. Set the machine parking brake.
3. Raise the hopper and engage the hopper support bar.

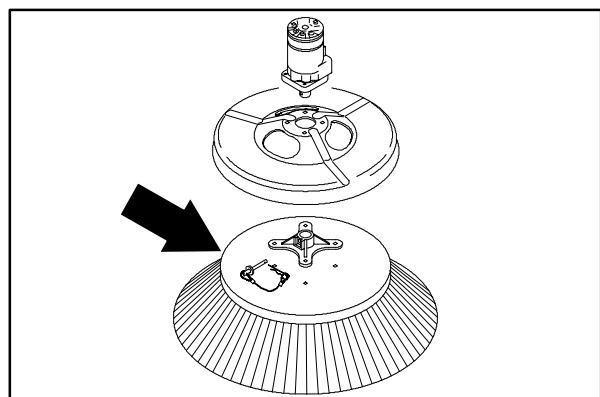
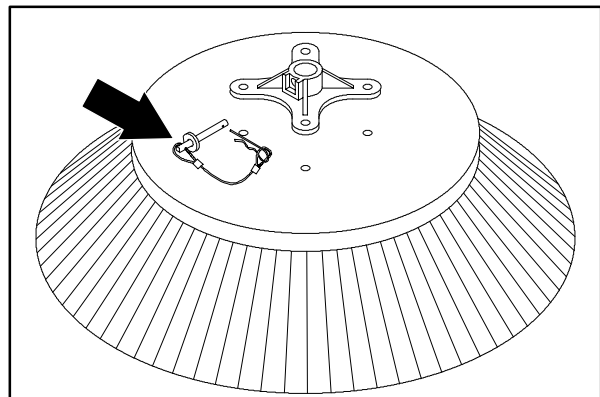
! WARNING: Raised Hopper May Fall. Engage Hopper Support Bar.

4. Stop the engine.

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

5. Remove the side brush retaining pin from the side brush drive shaft by pulling the pin keeper off and over the end of the pin.
6. Slide the side brush off the side brush drive shaft.
7. Remove and plug hydraulic hoses from side brush motor.

NOTE: Observe hydraulic cleanliness requirements when opening hydraulic lines.

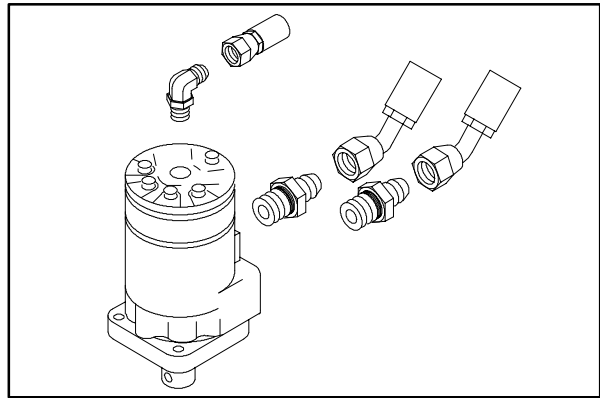
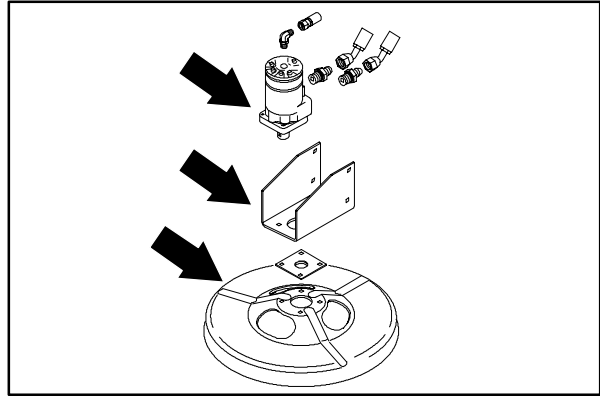


SWEEPING

8. Remove the four .375 in. hex screws from bottom of side brush motor. Remove the side brush guard and side brush motor from machine.
9. Remove hydraulic fittings from the old motor.
10. Install a new or rebuilt side brush motor and side brush guard with the four .375 in. hex screws. Tighten to 31 – 40 Nm (27 – 35 ft lb).
11. Reinstall the hydraulic fittings in the new motor.

NOTE: Make sure to orientate the fittings the way they were removed.

12. Reconnect the hydraulic hoses to the motor. See schematic in HYDRAULIC section.
13. Slide the side brush on the side brush drive shaft.
14. Insert the side brush retaining pin through the side brush hub and shaft.
15. Disengage the hopper support bar and lower the hopper.
16. Start the machine and run the side brush motor. Check for proper operation and leaks.



SIDE BRUSH GUARD

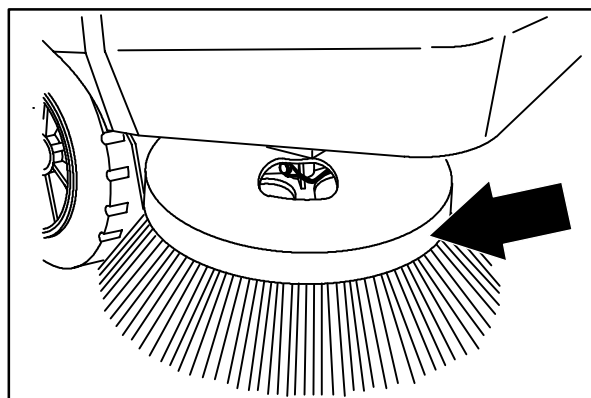
The side brush guard protects the side brush from objects along path of the machine. It deflects the side brush out of harms way.

Rotate the side brush guard 90 degrees every 200 hours of operation. Replace the brush guard after all four sides have been used.

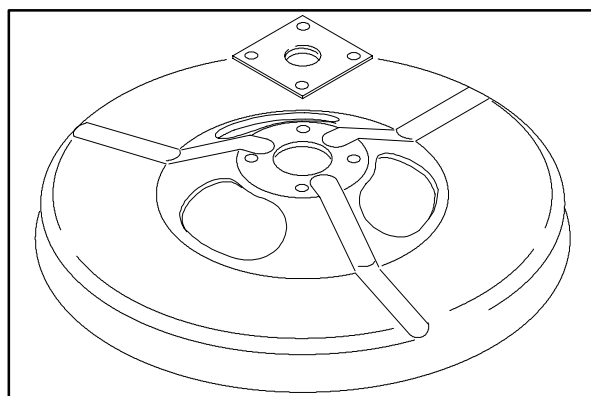
TO ROTATE OR REPLACE SIDE BRUSH GUARD

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

1. Remove the side brush.
2. Remove the four bolts holding the side brush guard to the side brush motor. Use care not to disturb the motor position.
3. Rotate or replace the side brush guard.
4. Reinstall the four .375 in. hex screws in the side brush motor. Tighten to 22-27 Nm (16-20 ft lb).
5. Install the side brush.



08019



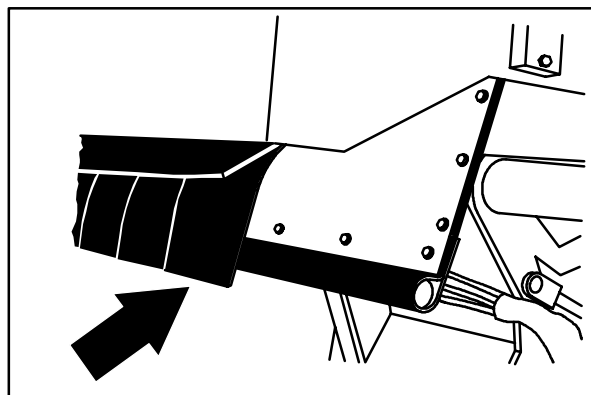
SKIRTS AND SEALS

HOPPER LIP SKIRTS

The hopper lip skirts are located on the bottom rear of the hopper. The skirts float over debris and help deflect that debris into the hopper. The hopper lip skirts consist of five bottom lip segments and two additional side lip segments.

Check the hopper lip skirts for wear or damage daily.

Replace the hopper lip skirts when they no longer touch the floor.



08020

TO REPLACE HOPPER LIP SKIRTS

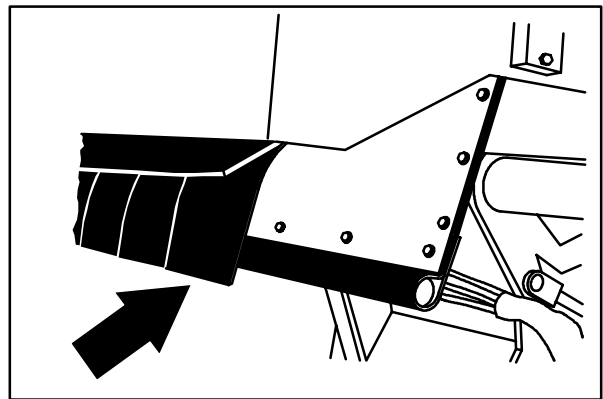
1. Dump the machine debris hopper.
2. Set the machine parking brake.
3. Raise the hopper and engage the hopper support bar.

! WARNING: Raised Hopper May Fall. Engage Hopper Support Bar.

4. Shut off the engine.

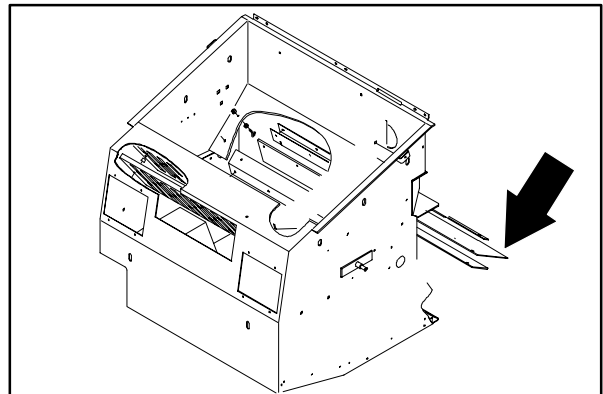
FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake, Turn Off Machine And Remove Key.

5. Remove the hopper lip skirt retaining strip mounting hardware.
6. Remove the hopper lip retaining strip, the hopper lip, and the back-up strip.



08020

7. Thread the retaining strip mounting bolts through the retaining strip, the new hopper lip skirt, the back-up strip, and in the hopper.
8. Tighten the mounting bolts to 8-14 Nm (6-10 ft lb).
9. Start the engine.
10. Disengage the hopper support bar and lower the hopper.
11. Check the skirt for proper adjustment. The skirt should be evenly touching the floor.



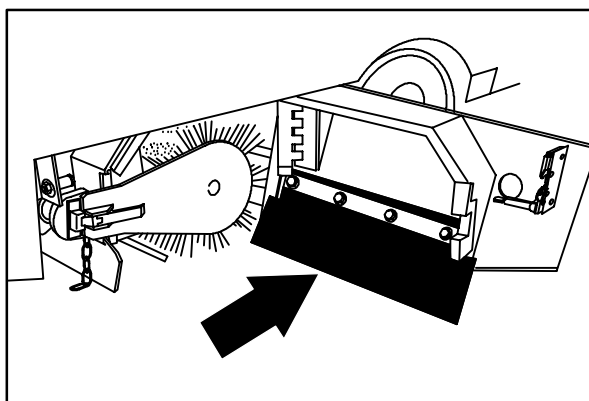
BRUSH DOOR SKIRTS

The brush door skirts are located on the bottom of each of the two main brush doors. They should clear the floor up to 5 mm (0.25 in) in dusty conditions, and touch the floor otherwise.

Check the skirts for wear or damage and adjustment daily.

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

NOTE: Rear tire pressure will affect skirt clearances.



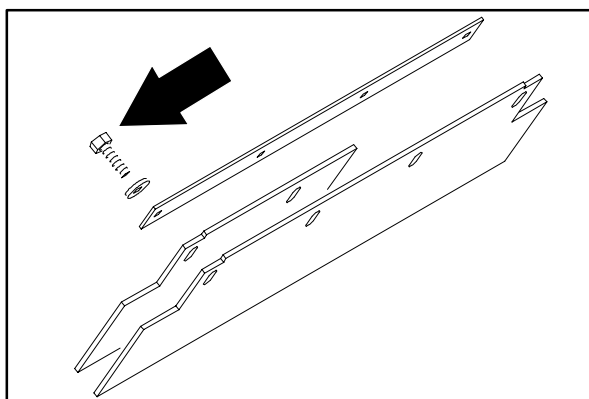
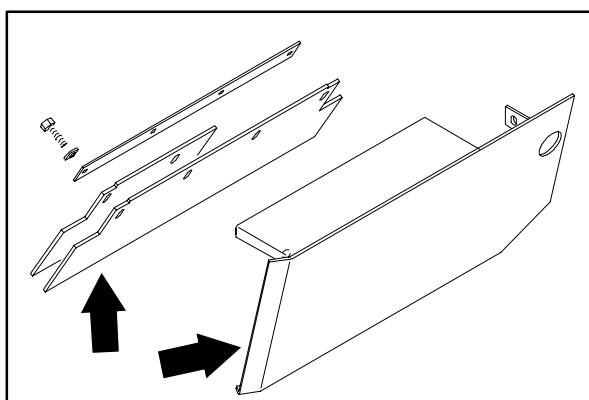
08001

TO REPLACE AND ADJUST BRUSH DOOR SKIRTS

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

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

3. Open the main brush doors.
4. Remove the brush door skirt retaining bolts.
5. Remove the skirt retaining strip and the door skirt.
6. Position the new door skirt and skirt retaining strip on the brush door with the flat edge forward and angled toward the back of the machine.
7. Place the new half-length skirt over the front half of the long skirt. Place the retainer over the skirts.

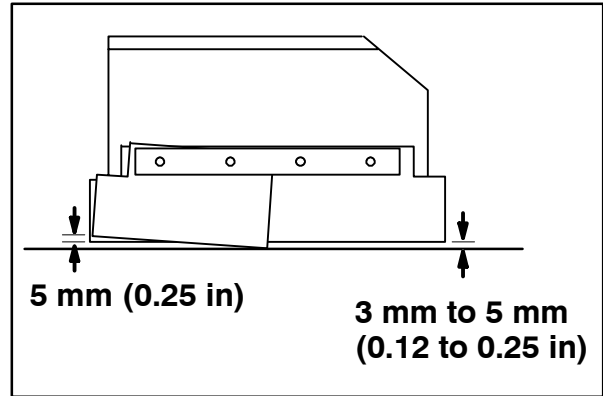


SWEEPING

8. Thread the skirt retaining bolts through the brush door, the door skirts, and into the skirt retaining strip.

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

9. Slide the long brush door skirt up or down so it will clear the floor by 3–5 mm (0.12 to 0.25 in). Secure the two bolts holding only one skirt.
10. Adjust the inner half-length skirt so the front edge of it is 5 mm (0.25 in) above the long skirt and the back half just touches the floor. tighten all four bolts to 6–8 ft lb (8–10 Nm).
11. Repeat for the other brush door.



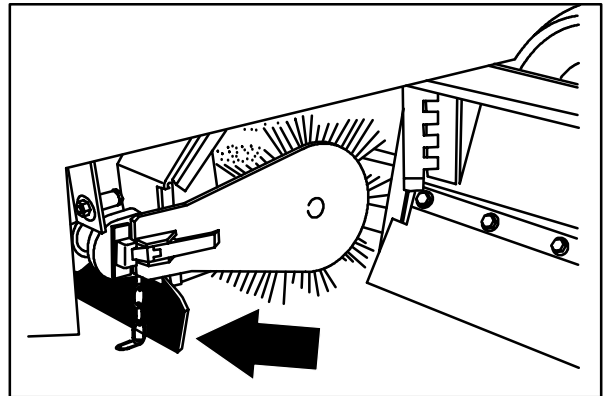
08128

REAR SKIRT AND DEFLECTOR BLADE

The rear skirt and the deflector blade are located on the bottom rear of the main brush compartment. The rear skirt should clear the floor up to 5 mm (0.25 in) in dusty conditions, and touch the floor otherwise. The deflector blade is spring loaded.

Check the skirt and blade for wear or damage and adjustment daily.

NOTE: Rear tire pressure will affect skirt clearances.

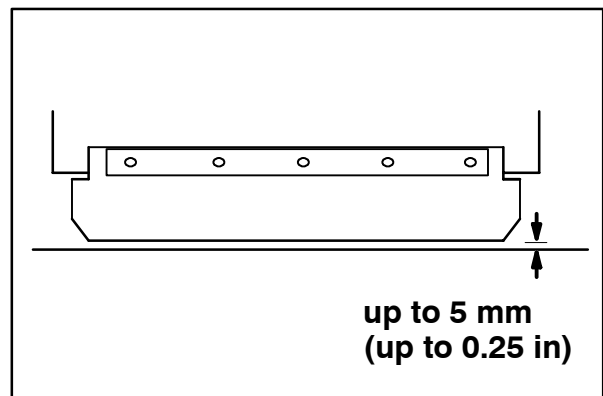


08021

TO REPLACE AND ADJUST THE REAR SKIRT AND DEFLECTOR BLADE

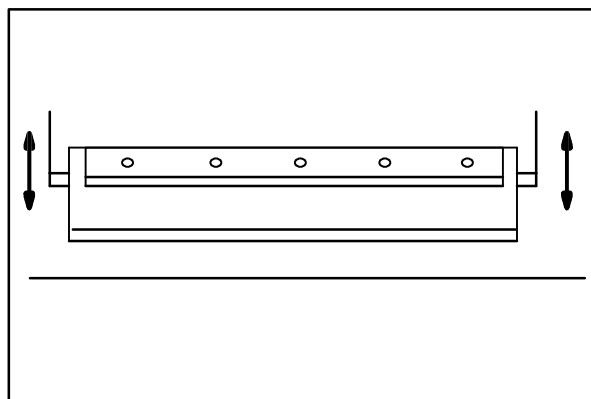
1. Park the machine on a smooth, level surface.
2. Stop the engine and set the machine parking brake.

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



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3. Open the main brush doors.
4. Remove the main brush.
5. Remove the retaining strip and floor skirt.
6. Thread the mounting bolts through the machine frame, the rear floor skirt, and the retaining strip toward the rear wheel.
7. Slide the rear floor skirt up or down so it clears the floor up to a maximum of 5 mm (0.25 in).
8. Tighten the rear floor skirt mounting bolts to 8–14 Nm (6–10 ft lb).
9. Remove the brush contact blade retaining strip and the brush contact blade.
10. Thread the mounting bolts through the mounting bracket, the brush contact blade, and the retaining strip.
11. Tighten the brush contact blade mounting bolts to 8–14 Nm (6–10 ft lb).
12. Make sure the deflector spring moves the blade into position freely.
13. Reinstall the main brush.
14. Close the main brush doors.

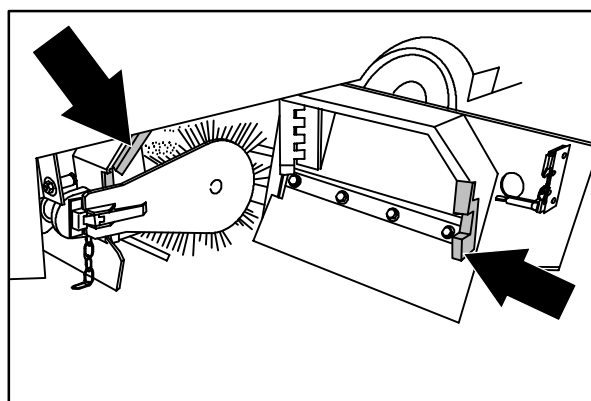


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BRUSH DOOR SEALS

The brush door seals are located on both main brush doors and on corresponding portions of the main frame. They seal the main brush compartment.

Inspect the seals for wear or damage every 100 hours of operation.



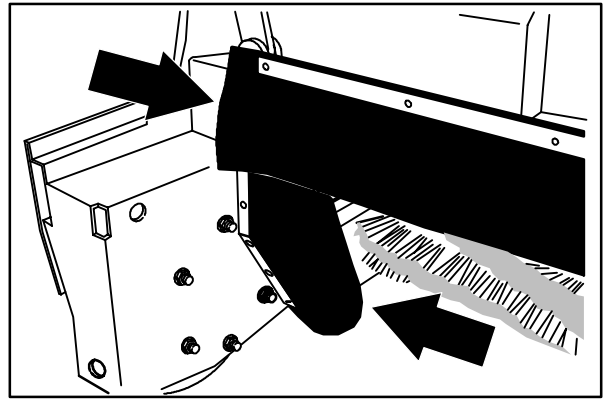
08022

SWEEPING

HOPPER SEALS

The hopper seals are located on the top and side portions of the machine frame that contact the hopper. They seal the main brush compartment. Tighten the seal hardware to 4–5 Nm (3–4 ft lb).

Inspect the seals for wear or damage every 100 hours of operation.



08023

TO REPLACE HOPPER SEALS

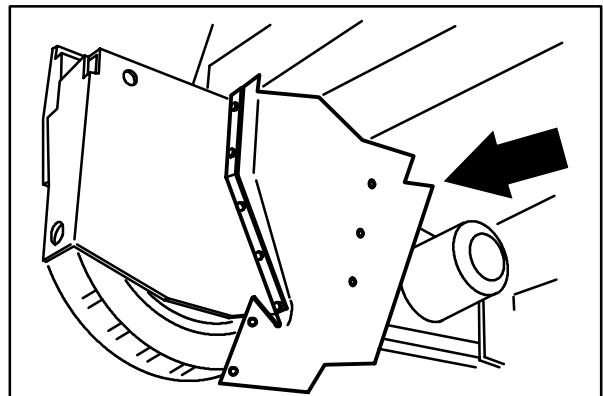
1. Park the machine on a smooth, level surface.
2. Stop the engine and set the machine parking brake.

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

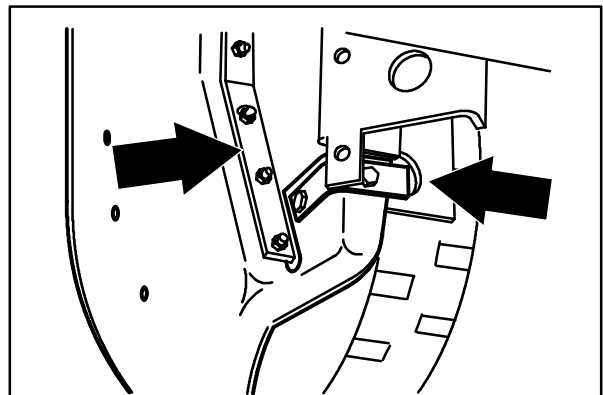
3. Raise hopper and engage hopper support bar.

⚠ WARNING: Raised Hopper May Fall. Engage Hopper Support Bar.

4. Open the main brush doors.
5. Remove the main brush.
6. Remove the skirt retainer and skirt on each side of the machine. Remove the plastic rivets by prying under the head.
7. Position new skirt and existing retainer on front of machine frame. Secure with plastic push-in rivets.
8. Pull skirt around inside of frame. Push skirt all of the way in its slots. Secure with existing angle retainer and two M6 bolts, flat washers, and Nyloc nuts. tighten bolts to 4–5 Nm (3–4 ft lb).

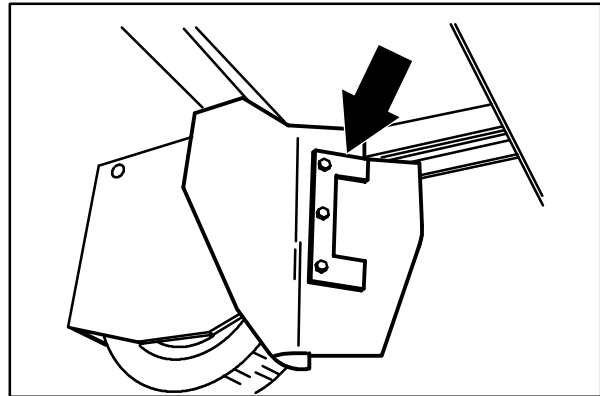


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9. Pull skirt toward the brush door. Secure it in place with the C-shaped retainer and bolts. Tighten the bolts to 8–10 Nm (6–8 ft lb).
10. Repeat for the other side of the main frame.

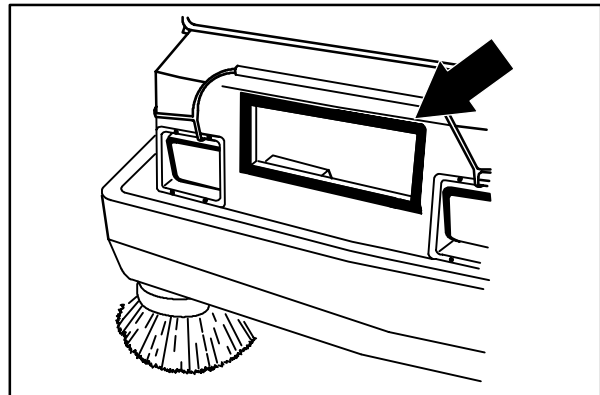


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HOPPER INSPECTION DOOR SEAL

The hopper inspection door seal is located on the hopper and seals the front of the debris hopper.

Check the seal for wear or damage every 100 hours of operation.

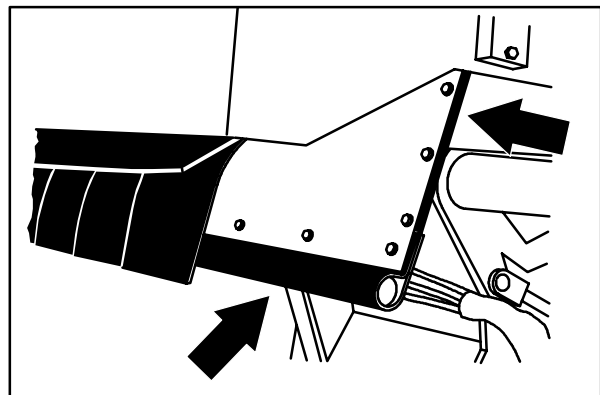


08024

HOPPER DOOR SEALS

The hopper door seals are located on the hopper door. They seal the hopper when the hopper door is closed. Use RTV between the sponge cord and door seal. Make sure the seals are straight. Tighten hardware to 3–4 Nm (2.5–3.5 ft lb). Hardware should be oriented with the nyloc nuts on the top side of the door.

Check the seals for wear or damage every 100 hours of operation.



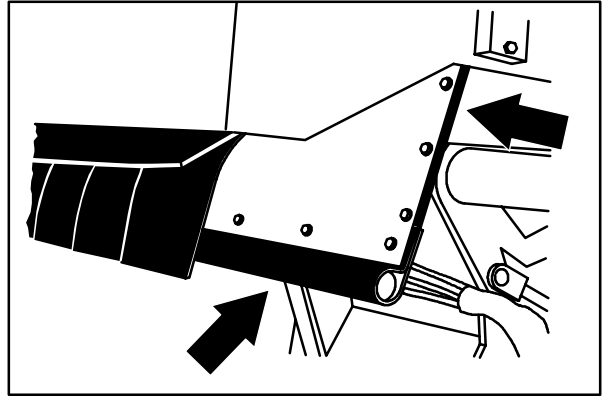
08025

SWEEPING

TO REPLACE HOPPER DOOR SEALS

1. Park the machine on a smooth, level surface.
2. Open the hopper dump door.
3. Stop the engine and set the machine parking brake.

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

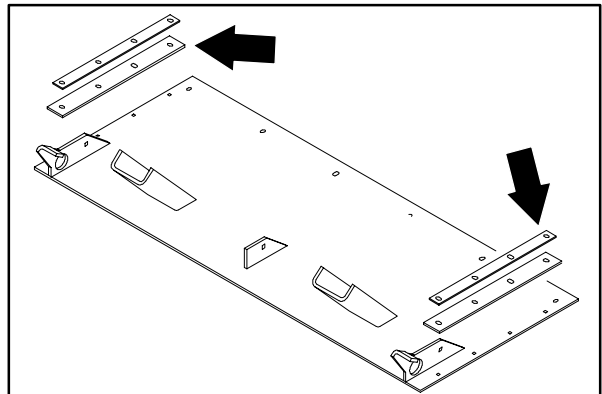
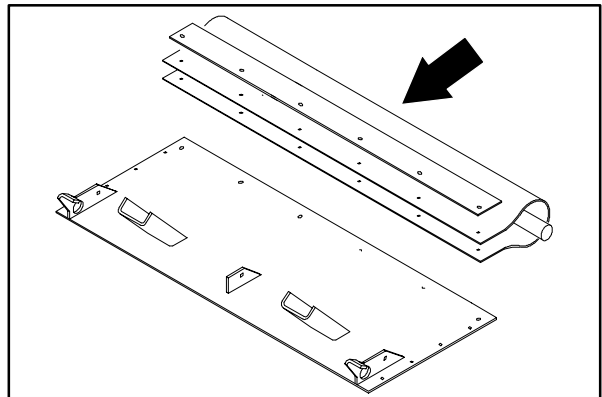


08025

4. Raise the hopper and engage the hopper support bar.

! WARNING: Raised Hopper May Fall. Engage Hopper Support Bar.

5. Remove the six M6 hex screws and nyloc nuts holding dump door seal, retainer, and sponge cord to dump door. Discard the seal.
6. Use black RTV to hold the sponge cord to the new dump door seal.
7. Align the holes in the new seal with holes on dump door and retainer. Reinstall the six M6 hex screws and nyloc nuts. Tighten to 3.3 – 4.4 Nm (30 – 39 In lb).
8. Remove the four M6 hex screws and nyloc nuts holding the dump door side seals and retainers to each side of the dump door. Note the direction of the hardware. Discard the seals.
9. Align the holes in the seal with the holes on the dump door and retainer. Reinstall the four M6 hex screws and nyloc nuts. Tighten to 3.3 – 4.4 Nm (30 – 39 In lb).



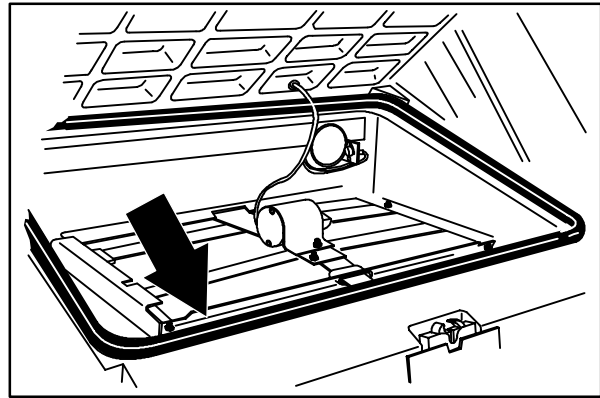
NOTE: Make sure the seals are lined up with the inside edge of the hopper when tightening.

10. Start the machine and lower the hopper.

HOPPER COVER SEAL

The hopper cover seal is located on the top edges of the hopper insert. It seals the hopper filter compartment when the hopper cover is in the down position.

Check the seal for wear or damage every 100 hours of operation.



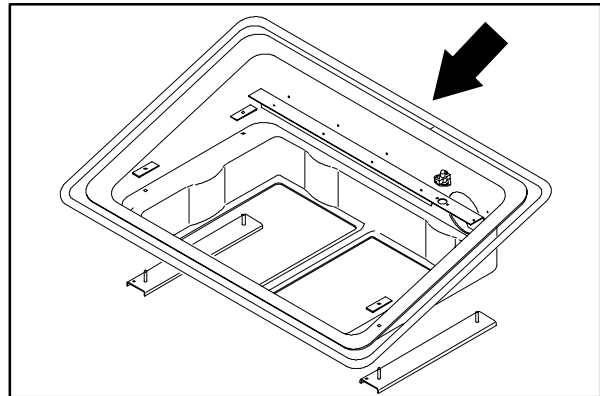
08026

TO REPLACE HOPPER COVER SEAL

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

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

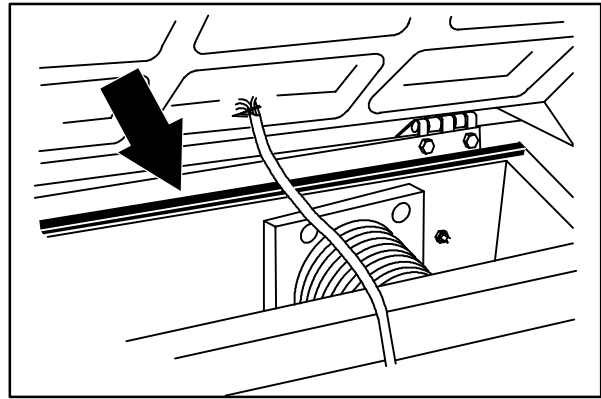
3. Raise the hopper cover, unplug the wires from filter shaker and thermo-sentry, remove the filter carrier tray from the hopper and set it on the floor.
4. Remove the old rubber bubble seal from the filter carrier tray. The seal is glued to the tray so a putty knife or a razor blade knife is needed for removal.
5. Make sure the new seal is cut to the same length as the old seal.
6. Use super glue in the groove of the new seal and install it, bubble side up, on the filter tray.
7. Reinstall the filter carrier tray back in the hopper. Reconnect the shaker motor and thermo-sentry to the hopper harness.
8. Close the hopper cover and operate the machine. Check the new seal for any air leaks.



HOPPER DUST SEAL

The hopper dust seal is located under the hopper insert along the top of the hopper.

Check the seal for wear or damage every 100 hours of operation. You can reach the seal by removing the hopper insert.



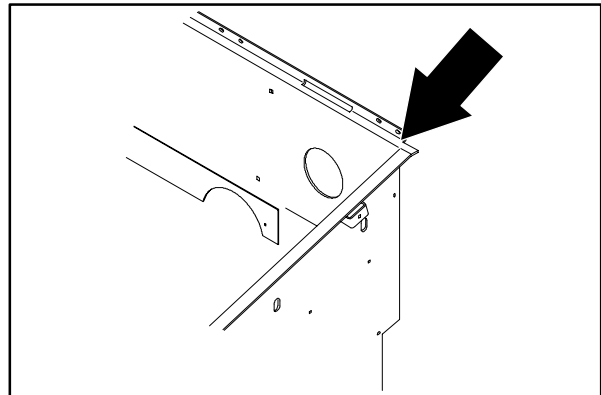
08153

TO REPLACE HOPPER DUST SEAL

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

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

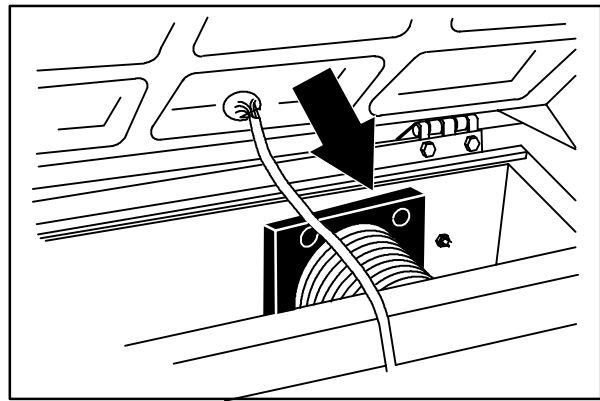
3. Raise the hopper cover, unplug the wires from filter shaker and thermo-sentry, remove the filter carrier tray from the hopper and set it on the floor.
4. Using a scraper or a putty knife, remove the old seal from the back of the hopper. Discard the old seal.
5. Make sure that all of the old seal is removed before attempting to glue the new one on.
6. Cut the new seal to length and use an industrial strength contact cement to attach it to the back of the hopper.
7. Reinstall the filter carrier tray back in the hopper. Reconnect the shaker motor and thermo-sentry to the hopper harness.
8. Close the hopper cover and operate the machine. Check the new seal for any air leaks.



HOPPER VACUUM FAN SEAL

The hopper vacuum fan seal is mounted on the inside of the hopper around the vacuum fan inlet.

Check the seal for wear or damage every 100 hours of operation. You can reach the seal by removing the hopper insert.



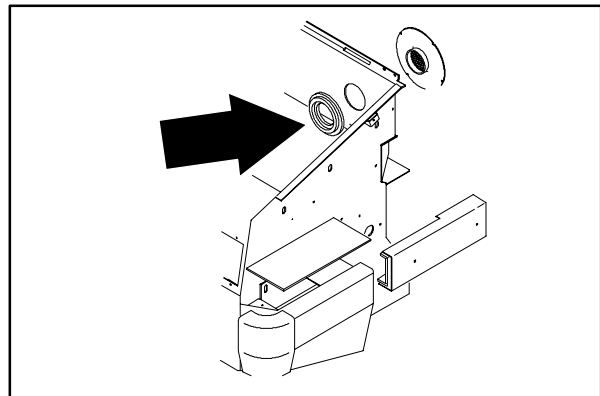
08150

TO REPLACE HOPPER VACUUM FAN SEAL

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

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

3. Raise the hopper cover, unplug the wires from filter shaker and thermo-sentry, remove the filter carrier tray from the hopper and set it on the floor.
4. Using a scraper or a putty knife, remove the old seal from the back of the hopper. Discard the old seal.
5. Make sure that all of the old seal is removed before attempting to glue the new one on.
6. Cut the new seal to length and use an industrial strength contact cement to attach it to the back of the hopper.
7. Reinstall the filter carrier tray back in the hopper. Reconnect the shaker motor and thermo-sentry to the hopper harness.
8. Close the hopper cover and operate the machine. Check the new seal for any air leaks.



HOPPER LIFT ARMS

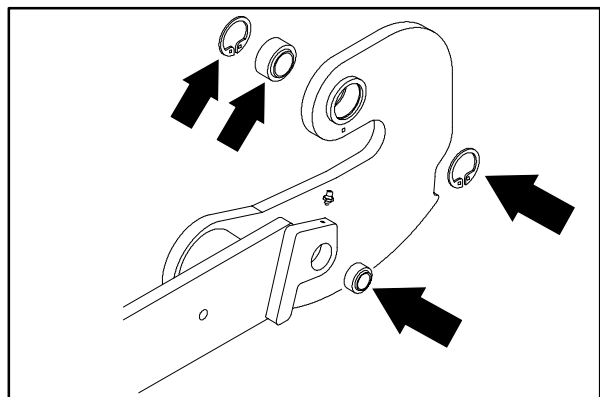
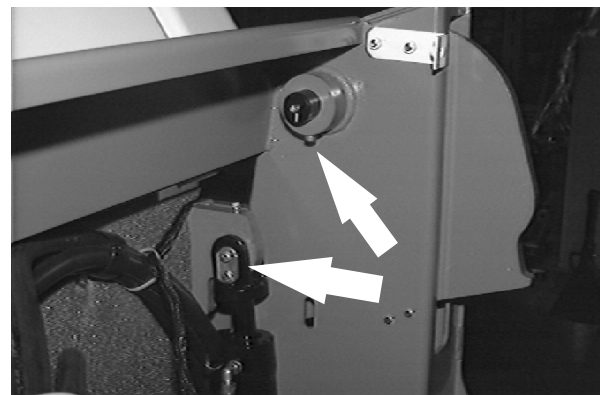
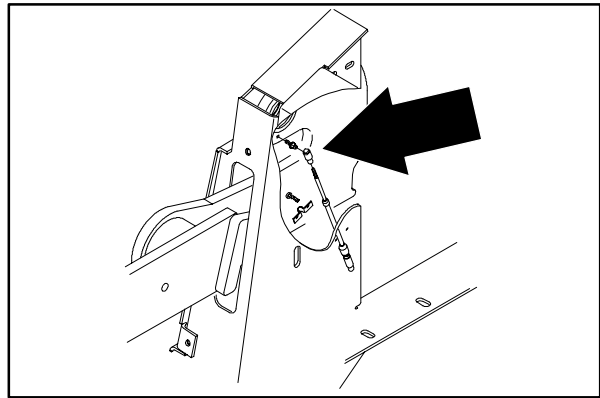
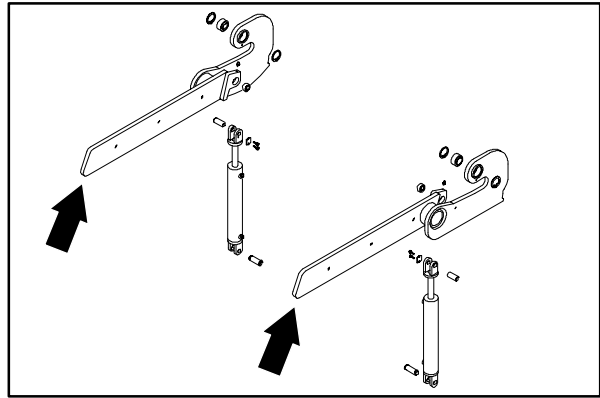
The hopper lift arms lift and lower the hopper assembly. They are held in place by two pins and self-aligning bearings with retaining rings.

TO REMOVE HOPPER LIFT ARMS

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

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

3. Remove the hopper. See TO REMOVE HOPPER instructions in this section.
4. Remove the RH and LH tank panels
5. Disconnect the speed limiter cable from RH side lift arm. The cable can be removed from the ball by pushing down on the sleeve around the ball joint end and prying it off.
6. Remove the M6 hex screw holding the cylinder pin plate to the cylinder clevis.
7. Raise up slightly on lift arm to take the pressure off the lift cylinder pin. Remove pin.
8. Remove the M8 socket screw from the upper lift arm pivot pin.
9. Raise up slightly on the lift arm to take pressure off the pivot pin. Remove the pivot pin and lift arm from the machine.
10. If the large self aligning bearing needs to be changed, remove the retaining rings and press the bearing out of the lift arm.
11. If the small self aligning bearing needs to be changed, press the bearing out of the lift arm.
12. Repeat this procedure on the LH side lift arm if needed.

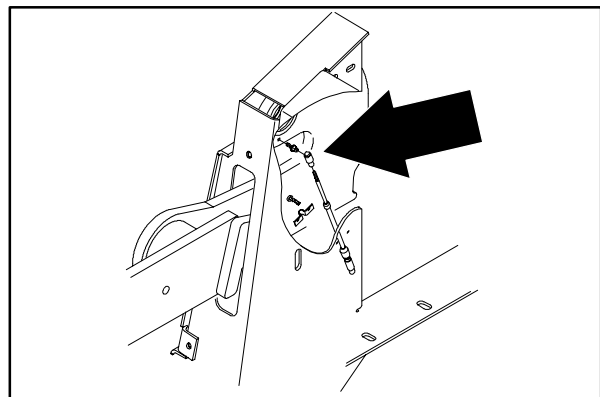
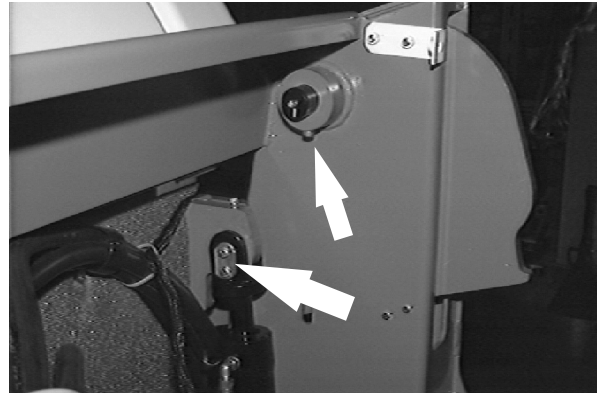
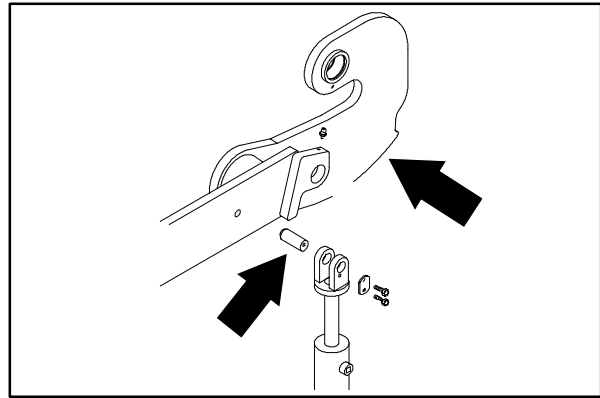


TO INSTALL HOPPER LIFT ARMS

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

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

3. Position the lift arm in the machine. Align the large bearing with the upper hole in the machine frame tower.
4. Install the lift arm pivot pin through the large bearing from the outside of machine.
5. Align the hole in lift arm pivot pin with the hole in the pin boss on the machine frame tower. Install the M8 socket head screw and tighten to 18 – 24 Nm (13 – 18 ft lb).
6. Align the small bearing in the lift arm with the hole in the lift cylinder clevis.
7. Install the lift cylinder pin plate through the bearing. Reinstall the M6 hex screw and tighten to 8 – 10 Nm (6 – 8 ft lb).
8. On the RH lift arm, reconnect the speed limiter cable to the ball end.
9. Repeat steps 3 – 7 on the opposite side.
10. Reinstall hopper. See: TO INSTALL HOPPER instructions in this section.



SWEEPING VACUUM FAN

The sweeping vacuum fan is located on the back of the debris hopper. It is used during sweeping to control dusting by pulling air through the filters.

TO REMOVE SWEEPING VACUUM FAN

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

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

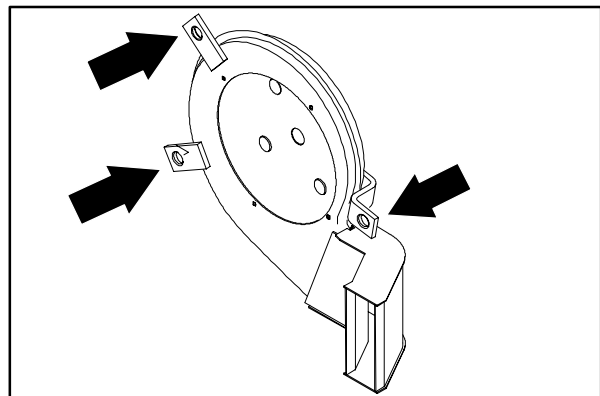
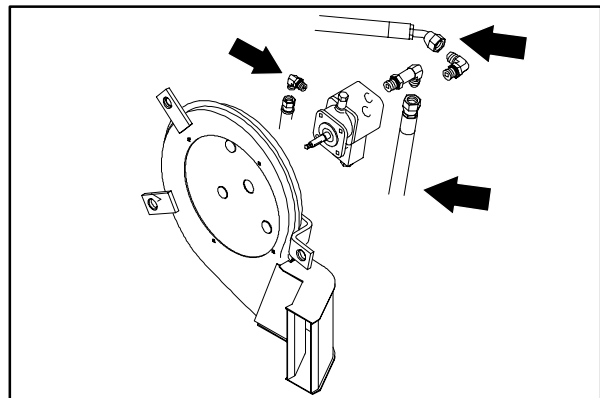
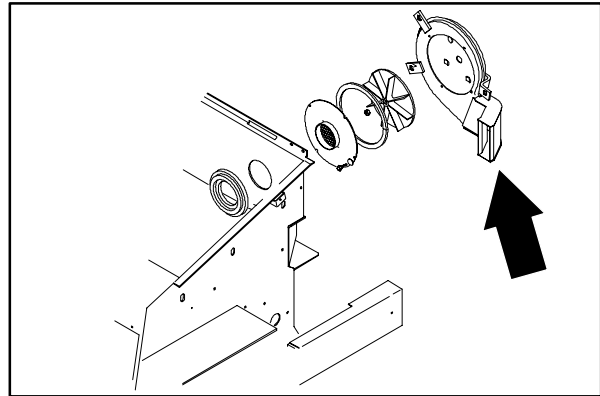
3. Raise the hopper cover, unplug the wires from filter shaker and thermo-sentry, remove the filter carrier tray from the hopper and set it on the floor.
4. Leave the hopper cover open and raise the hopper 1/3 of the way up or far enough to access the three M10 hex screws holding the vacuum fan to the back of the hopper.

NOTE: Hopper must be held in this position with a hoist, jack stands or a prop rod between hopper bumper and machine frame.

5. Disconnect and plug the three hydraulic hoses on the vacuum fan motor.

NOTE: Observe hydraulic cleanliness requirements when opening hydraulic lines.

6. Disconnect the wire harness from the fan motor solenoid.
7. Remove the three M10 hex screws holding vacuum fan to rear of hopper. Reach in from the left side of the hopper, under the hopper cover, to access the hex screws.
8. Remove the vacuum fan assembly from the machine and make the necessary repairs.



TO INSTALL SWEEPING VACUUM FAN

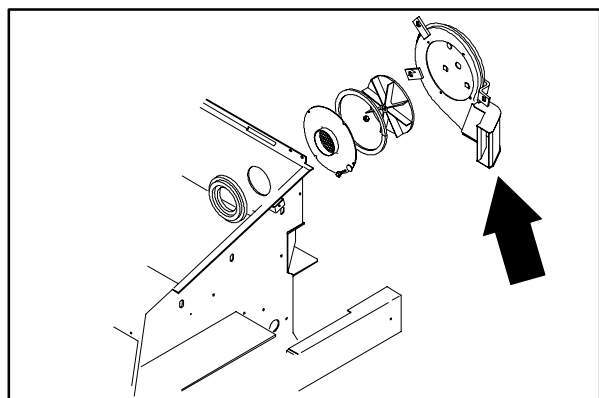
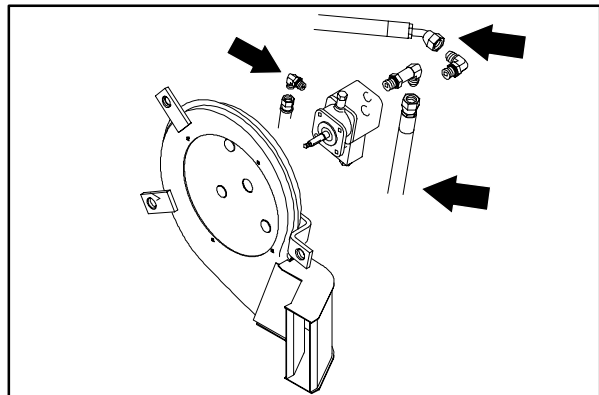
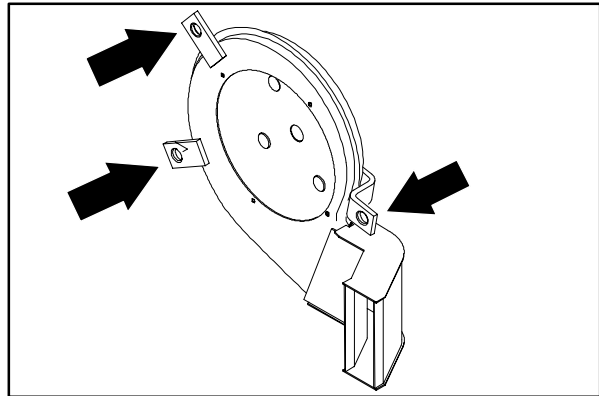
1. Park the machine on a smooth, level surface.
2. Stop the engine and set the machine parking brake.

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

3. Raise the hopper cover, unplug the wires from filter shaker and thermo-sentry, remove the filter carrier tray from the hopper and set it on the floor.
4. Leave the hopper cover open and raise the hopper 1/3 of the way up or far enough to access the three M10 hex screws holding the vacuum fan to the back of the hopper.

NOTE: Hopper must be held in this position with a hoist, jack stands or a prop rod between hopper bumper and machine frame.

5. Align the holes in fan isolators with the holes in the back of the hopper.
6. Reinstall the three M10 hex screws, washers and nyloc nuts with the nuts on the outside of the hopper. Tighten to 18 - 24 Nm (13 - 18 ft lb).
7. Reconnect hydraulic hoses. See schematic in HYDRAULICS section.
8. Reconnect the wire harness to the vacuum fan solenoid.
9. Make sure the wires and hoses are tied and clamped up properly.
10. Remove the hoist, jack stands or prop rod and lower the hopper.
11. Reinstall the filter carrier tray back in the hopper. Reconnect the shaker motor and thermo-sentry to the hopper harness.
12. Close the hopper cover and operate the machine. Check the sweeping vacuum fan for proper operation.

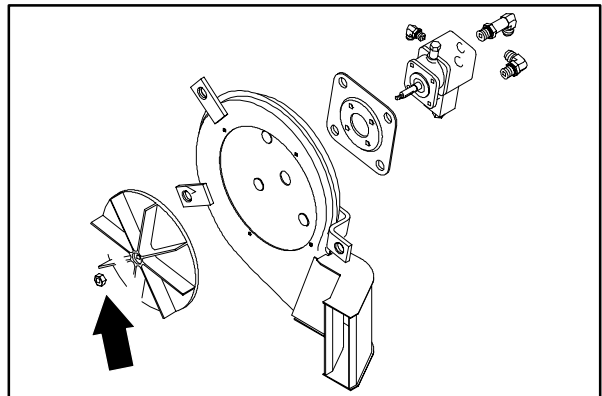
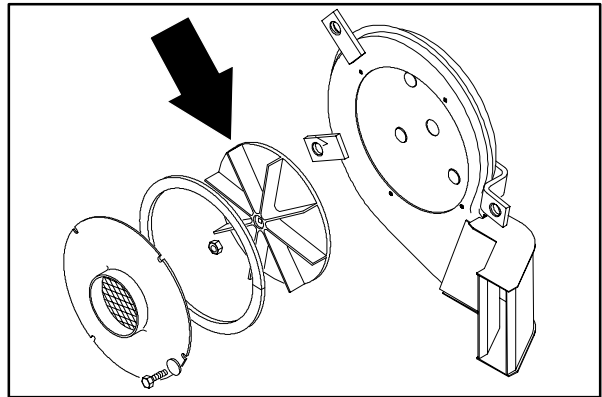
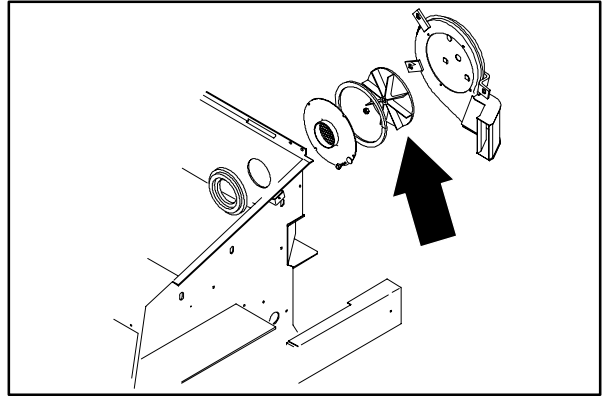


TO REPLACE SWEEPING VACUUM FAN IMPELLER

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

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

3. Remove the vacuum fan from the machine. See TO REMOVE SWEEPING VACUUM FAN instructions in this section.
4. Place the vacuum fan assembly in a vice.
5. Remove the four 0.25 in. hex screws and fender washers holding the inlet plate to the vacuum fan housing. Remove the plate.
6. Hold the impeller from turning and remove the 0.31 in. hex nut from the vacuum fan motor shaft.
7. Pull the impeller straight off the shaft. The impeller may have to be lightly pried off. Be careful not to loose the square key.
8. Put a small amount of grease on the motor shaft before installing the new impeller. Make sure the square key is in place.
9. Slide the impeller all the way on the shaft and spin it slowly. If the impeller rubs on housing pull it back off and place a 0.38 in. flat washer on shaft under impeller and re-assemble. Repeat this procedure until the impeller spins freely.
10. Hold the new impeller from turning and firmly tighten the 0.31 in. flex lock nut.
11. Reinstall the inlet plate using the four 0.25 in. hex screws and fender washers. Tighten to 11 - 14 Nm (7 - 10 ft lb).
12. Reinstall vacuum fan assembly to the rear of the hopper. See TO INSTALL SWEEPING VACUUM FAN instructions in this section. Follow steps 3 - 12.



TO REPLACE SWEEPING VACUUM FAN HYDRAULIC MOTOR

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

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

3. Remove the vacuum fan from the machine. See TO REMOVE SWEEPING VACUUM FAN instructions in this section.

4. Place the vacuum fan assembly in a vice.

5. Remove the four 0.25 in. hex screws and fender washers holding the inlet plate to the vacuum fan housing. Remove the plate.

6. Hold the impeller from turning and remove the 0.31 in. hex nut from the vacuum fan motor shaft.

7. Pull the impeller straight off the shaft. The impeller may have to be lightly pried off. Be careful not to loose the square key.

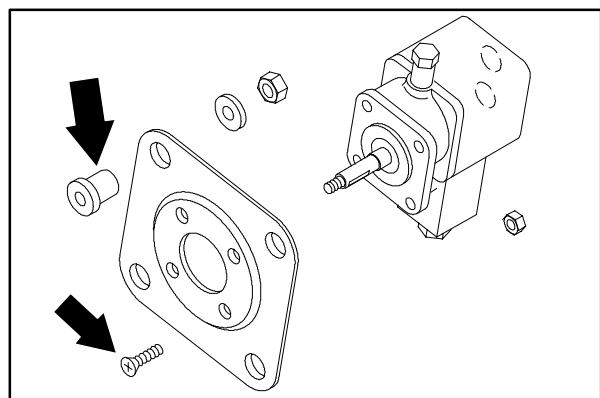
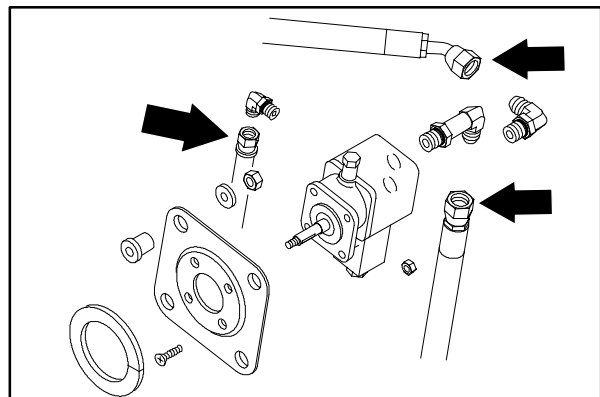
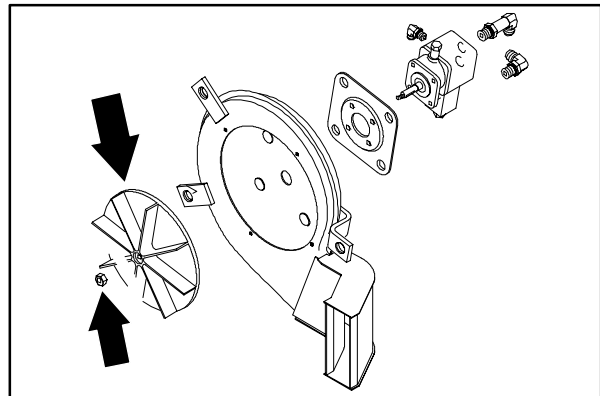
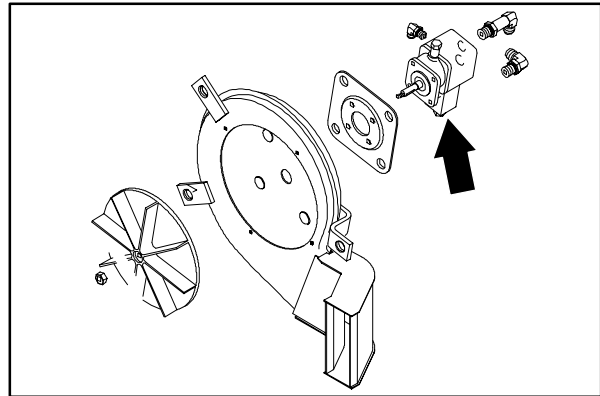
8. Remove the four M10 nyloc nuts holding the hydraulic motor plate to vacuum fan housing.

9. Remove the hydraulic motor and plate assembly from the vacuum fan housing.

10. Remove the four M8 flat head screws and nyloc nuts holding hydraulic fan motor to the motor plate.

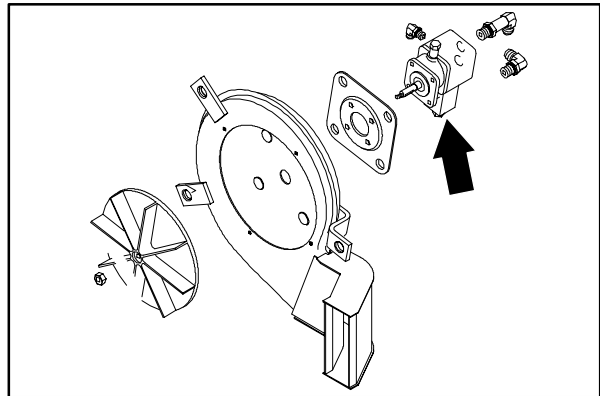
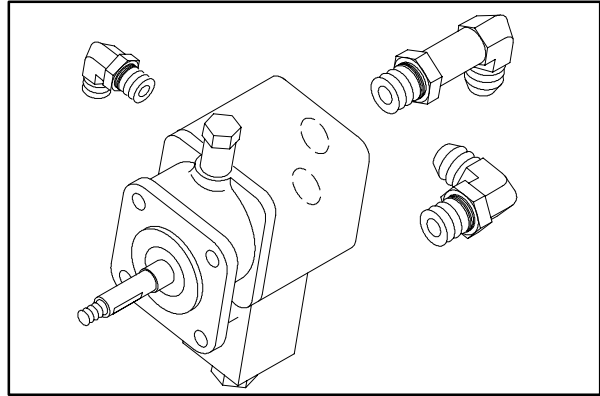
11. Remove the hydraulic fittings and install in the new or rebuilt fan motor. Keep the same orientation.

12. Install the new motor on the motor plate using the four M8 flat head screws and nyloc nuts. Tighten to 18 - 24 Nm (13 - 18 ft lb).



SWEEPING

13. Reinstall the hydraulic motor and plate assembly back on the fan housing using four M10 nyloc nuts and flat washers. Tighten to 18 – 24 Nm (13 – 18 ft lb). The motor should be oriented with case drain fitting pointing toward the fan exhaust outlet.
14. Put a small amount of grease on the motor shaft before installing the new impeller. Make sure the square key is in place.
15. Slide the impeller all the way on the shaft and spin it slowly. If the impeller rubs on housing pull it back off and place a 0.38 in. flat washer on shaft under impeller and re-assemble. Repeat this procedure until the impeller spins freely.
16. Hold the new impeller from turning and firmly tighten the 0.31 in. flex lock nut.
17. Reinstall the inlet plate using the four 0.25 in. hex screws and fender washers. Tighten to 11 – 14 Nm (7 – 10 ft lb).
18. Reinstall vacuum fan assembly to the rear of the hopper. See TO INSTALL SWEEPING VACUUM FAN instructions in this section. Follow steps 3 – 12.



MACHINE TROUBLESHOOTING

Problem	Cause	Remedy
<i>Poor sweeping performance</i>	Main brush worn out	Replace main brush
	Main brush not properly adjusted	Adjust main brush lift handle to obtain correct brush pattern
	Main brush not level with floor	Adjust brush pattern
	Hopper full	Empty hopper
	Dust filter clogged	Remove and clean dust filter
	Brush jammed with debris	Remove debris
	Hopper lip or dust skirt not properly adjusted	Adjust hopper lip or dust skirt
<i>Dusting</i>	Dust filter clogged	Remove and clean filter
	Filter not seated correctly against its seals	Remove and reinstall filter
	Dust filter damaged	Replace dust filter
	Hopper full	Empty hopper
	Clogged ducts	Clean ducts
	Ducts not engaging seals or seals damaged	Adjust or replace seals
	Dust skirts not properly adjusted or are damaged	Adjust or replace dust skirts
	Vacuum fan not operating	Fan drive sheave or impeller key is broken.
<i>Brush pattern not even</i>	Main brush not lowering evenly due to debris jam	Remove main brush and debris
	Bail arm not level	Adjust arm position
	Main brush spring arm may be out of adjustment	Adjust arm position
	Main brush not seated correctly on drive cups	Remove and reinstall main brush

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INTRODUCTION

When the scrubbing mode is used, water flows from the solution tank through the solution valve to the three disc scrub brushes. The brushes scrub the floor. As the machine is moved forward the squeegee wipes the dirty solution off the floor, which is then picked up and drawn into the recovery tank by the vacuum fan.

SOLUTION TANK

The solution tank holds the clean water and detergent mixture that will be applied to the floor during the scrubbing operation.

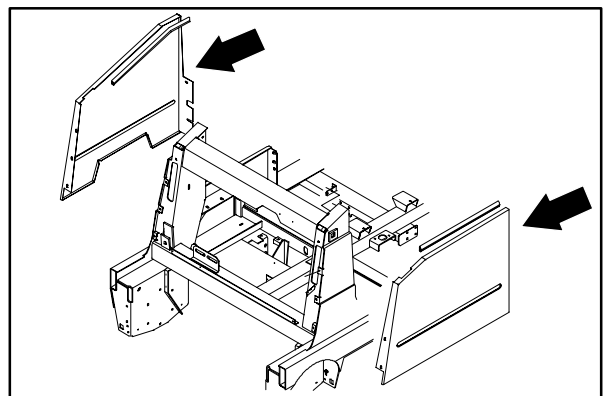
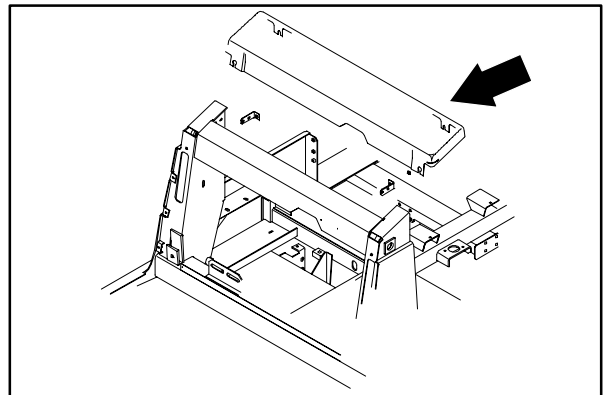
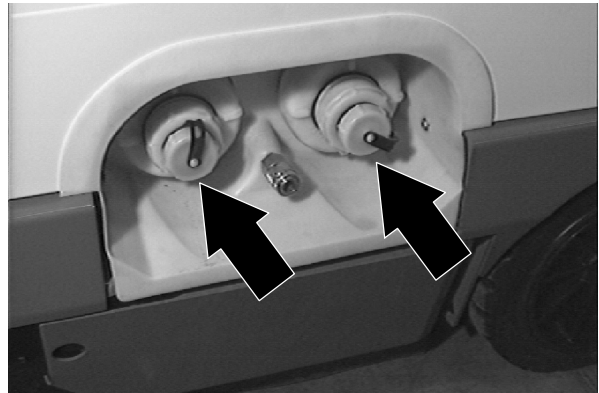
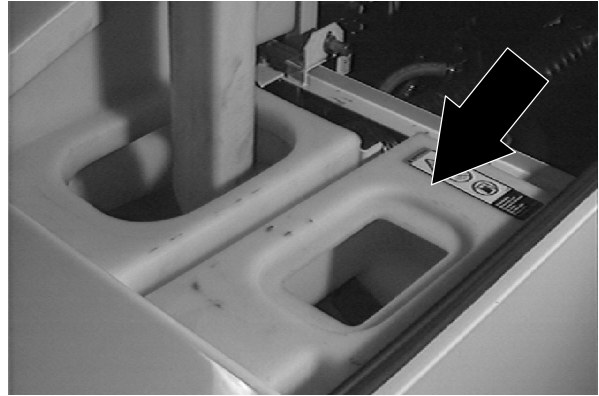
TO REMOVE SOLUTION TANK

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

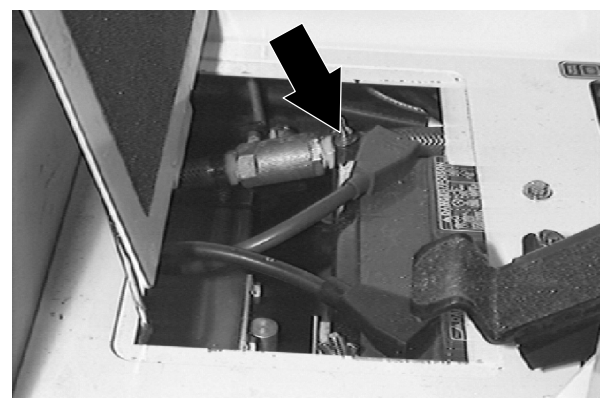
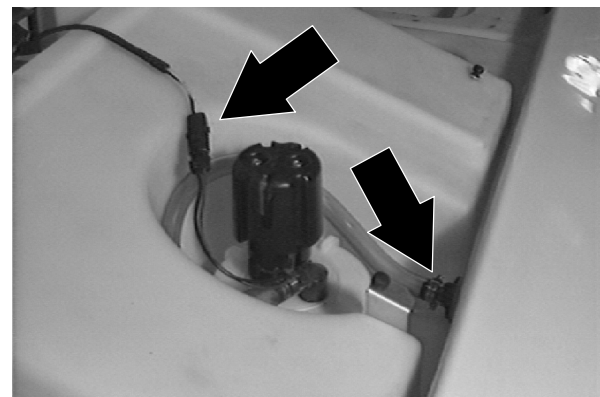
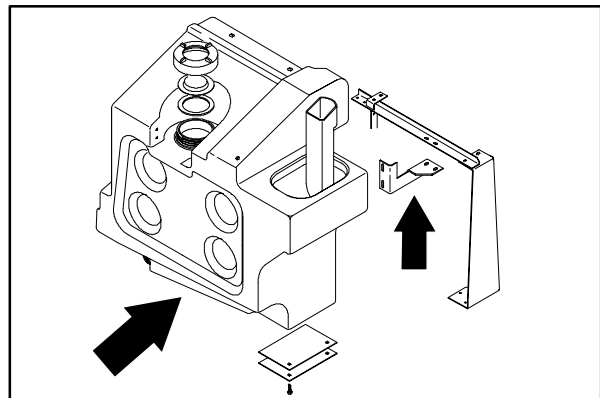
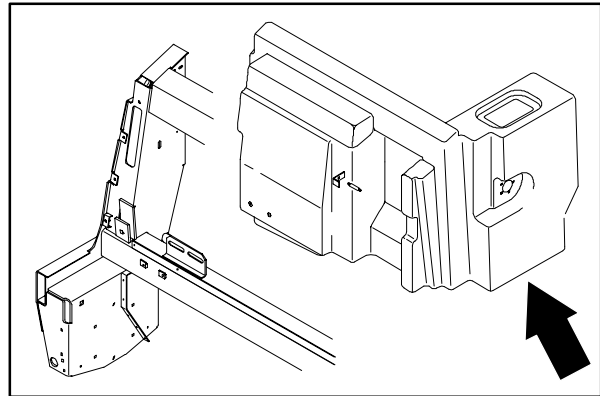
1. Drain the solution and recovery tanks. The recovery tank must be removed before the solution tank can be removed.
2. Open the engine/demister and recovery tank covers.
3. Loosen the four M8 hex screws holding the lintel cover to the machine. Remove the cover.
4. Start the engine, raise the hopper, and engage the safety leg.

⚠ WARNING: Raised Hopper May Fall. Engage Hopper Support Bar.

5. Remove the four M8 hex screws holding the recovery tank cover brackets to the top of the recovery tank. Remove the cover and spacer.
6. Remove the six M6 hex screws holding the LH side panel to the machine. Remove the panel.
7. Remove the three M6 hex screws holding the plastic clean out cover to the machine. Remove the drain hoses, caps and clean out cover. If the machine is equipped with the ES™ option, remove the solution hose from the brass fitting.
8. Remove the three M6 hex screws and one M8 hex screw holding the RH side panel to the machine. Remove the panel.
9. Remove the four M8 hex screws holding the solution tank to the machine. Make sure to retain the two plated clamps from the front of tank.



10. Remove the M8 hex screws holding the recovery tank to the machine. This hardware is located near tank drain opening and the center of the machine.
11. Remove the four M8 hex screws holding the tank bracket to the back of the recovery tank and frame. Remove the bracket.
12. Remove the vacuum hose from the back of the recovery tank.
13. Remove the black plastic check valve from the top of the solution tank.
14. If the machine is equipped with the ES option, remove the hose from the fitting on the back of the solution tank.
15. If the machine is equipped with the ES option, remove the wires connected to the float switches on each tank.
16. Open the battery cover and remove the hose from the front of the solution valve.
17. Remove the M8 nyloc nut and clamp holding the hydraulic hoses to the front of the solution tank.
18. The recovery tank can now be removed. Some careful maneuvering of the tank will be needed to get it to come out easily because of the tight fit. Lift the tank straight up and out of machine. Leave the outer ring of the tank cap on the threads to protect it from damage during removal.
19. The solution tank can now be removed. Lift the tank up and out of the machine. Be careful not to damage the face of the drain outlet hole. Leave the outer ring of the tank cap on the threads to protect it from damage during removal.



SCRUBBING

TO INSTALL SOLUTION TANK

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

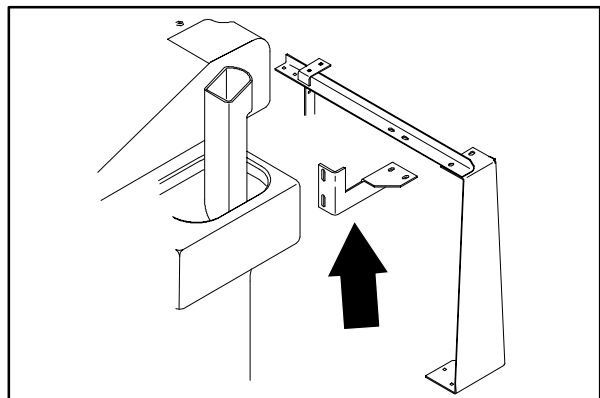
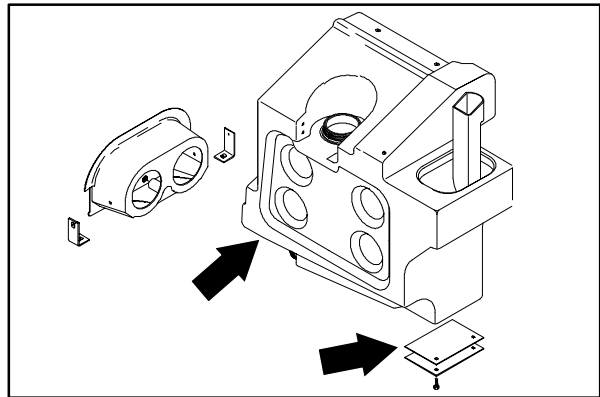
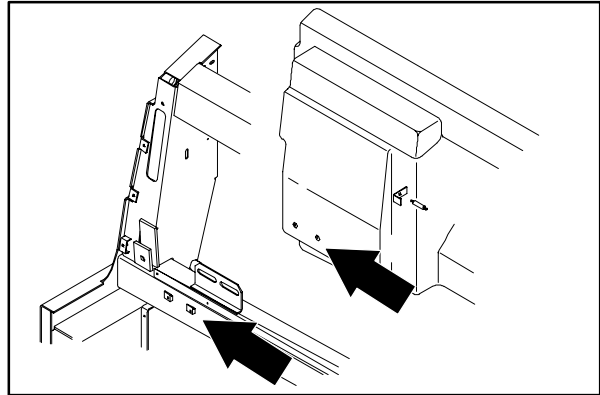
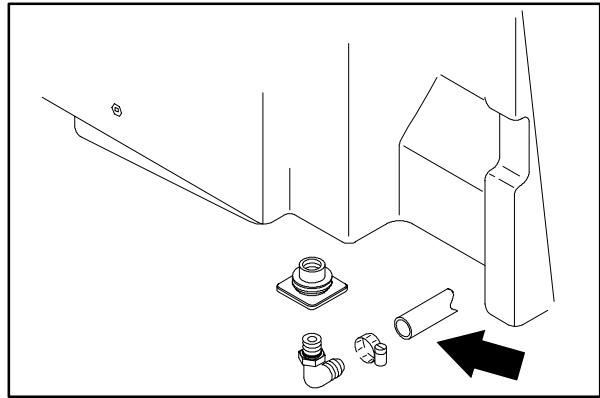
1. Make sure the solution hose is on the fitting at the bottom of the tank. Feed the hose back to the solution valve when installing the solution tank.
2. Position solution tank in the machine. Be careful not to damage the face of the drain outlet hole when placing tank in the machine. Do not install any hardware at this time.

NOTE: Be careful not to pinch any hydraulic hoses or electrical wires during this procedure.

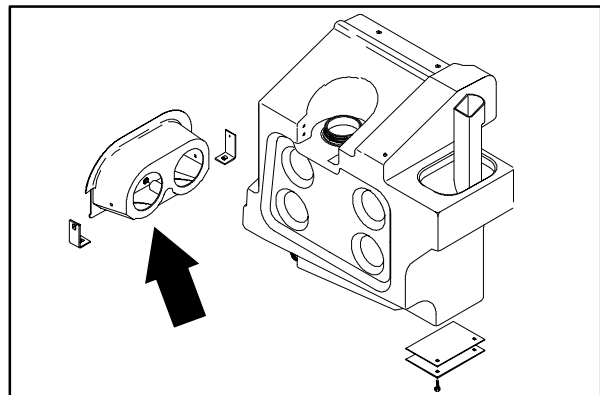
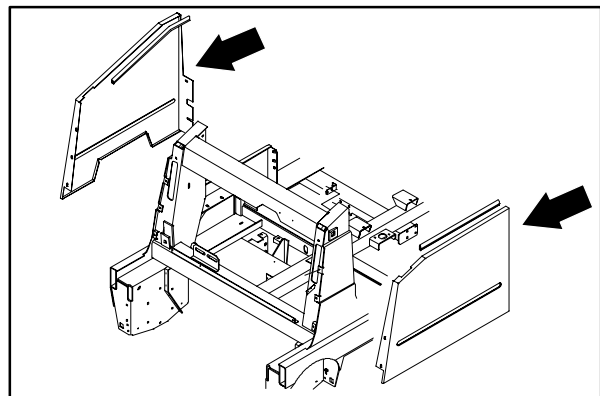
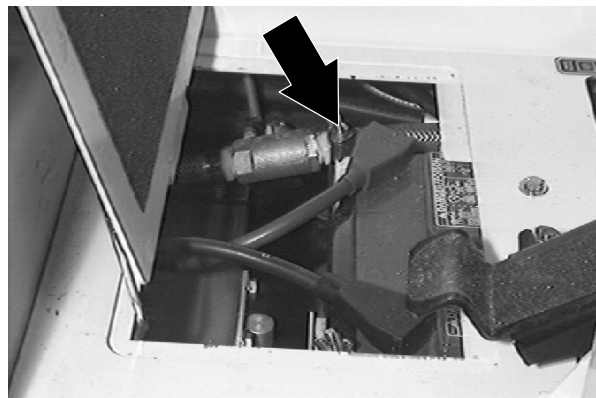
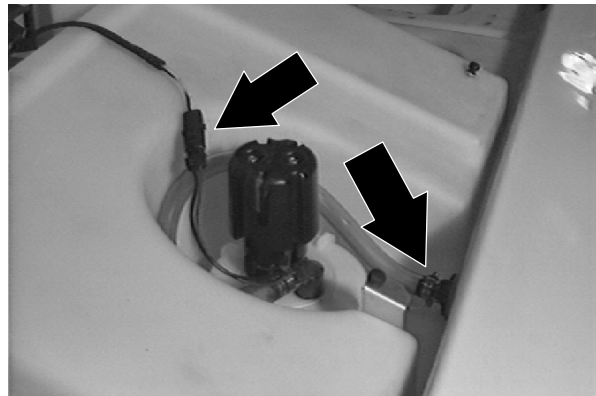
3. Position the recovery tank in the machine. This is a tight fit but with careful maneuvering the tank will slip in. Leave the outer ring of the tank cap on the threads to protect it from damage during installation.

NOTE: Be careful not to pinch any hydraulic hoses or electrical wires during this procedure.

4. Align the three holes in the right hand side of machine, near the tank drain hole area, with the three threaded inserts in the recovery tank. Install the three M8 SS hex screws and washers, leave loose for now.
5. Align the four holes in the front and on the left side of the solution tank with the holes in the machine frame. Install the four M8 hex screws, washers and two plated clamps. Tighten to 18 - 24 Nm (13 - 15 ft lb).
6. Reinstall the tank bracket to the back of the recovery tank and frame using the four M8 hex screws, washers and two flange nuts. Tighten to 18 - 24 Nm (13 - 15 ft lb).
7. Go back and tighten the three M8 hex screws on recovery tank near the tank drain area. Tighten to 18 - 24 Nm (13 - 15 ft lb).
8. Reinstall hydraulic hoses, clamp and M8 nyloc nut on the solution tank. Tighten to 18 - 24 Nm (13 - 15 ft lb).
9. Reinstall the vacuum hose to the back of the recovery tank.



10. Reinstall the black plastic check valve in the top of the solution tank.
11. If the machine is equipped with the ES™ option, Reinstall the hose to the fitting on the back of the solution tank.
12. Open the battery cover and reconnect the hose to the front of the solution valve.
13. If the machine is equipped with the ES™ option, reconnect the wires to the float switches on each tank. See schematic in the ELECTRICAL section.
14. Reinstall the recovery tank cover using the four M8 hex screws, washers and spacer. Tighten to 18 - 24 Nm (13 - 15 ft lb). Make sure the relay bracket is between the hinge and recovery tank.
15. Reinstall the LH side panel on the machine using the six M6 hex screws and washers. Tighten to 8 - 10 Nm (5 - 7 ft lb).
16. Reinstall the RH side panel on the machine using the three M6 hex screws and washers. Tighten to 8 - 10 Nm (5 - 7 ft lb). Also one M8 hex screw and washer. Tighten to 18 - 24 Nm (13 - 15 ft lb).
17. Reinstall the plastic clean out cover using the three M6 hex screws and washers. Tighten to 8 - 10 Nm (5 - 7 ft lb). Reinstall tank caps and hoses.
18. Start the engine, disengage the safety arm, and lower the hopper.
19. Reinstall the lintel cover and lightly hand tighten the four M8 hex screws.
20. Lower the engine/demister and recovery tank covers and check for proper alignment. Adjust the covers as necessary.



RECOVERY TANK

The recovery tank holds the used water and detergent solution pulled off the floor by the squeegee and scrubbing vacuum fan.

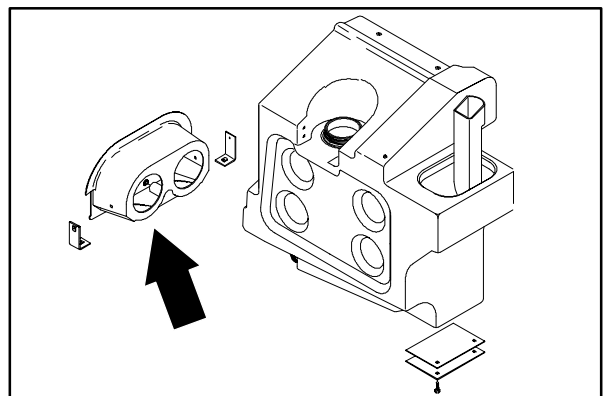
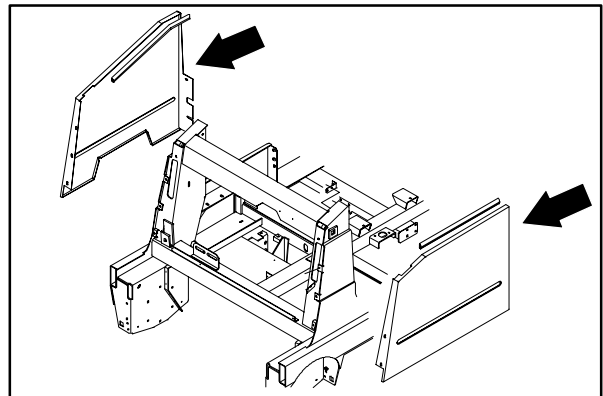
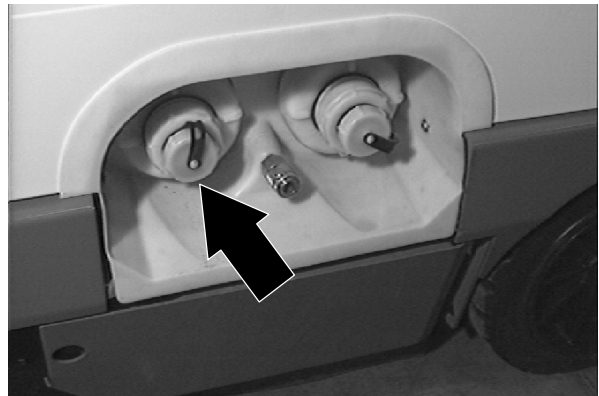
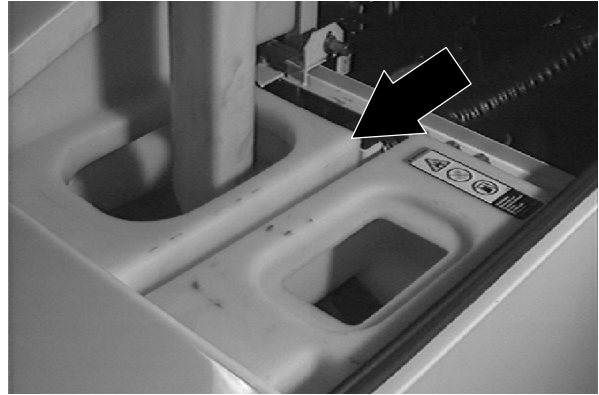
TO REMOVE RECOVERY TANK

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

1. Drain the recovery tank.
2. Open the engine/demister and recovery tank covers.
3. Loosen the four M8 hex screws holding the lintel cover to the machine. Remove the cover.
4. Start the engine, raise the hopper, and engage the safety leg.

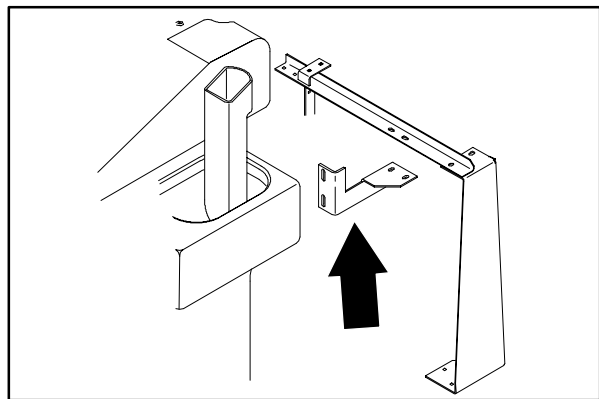
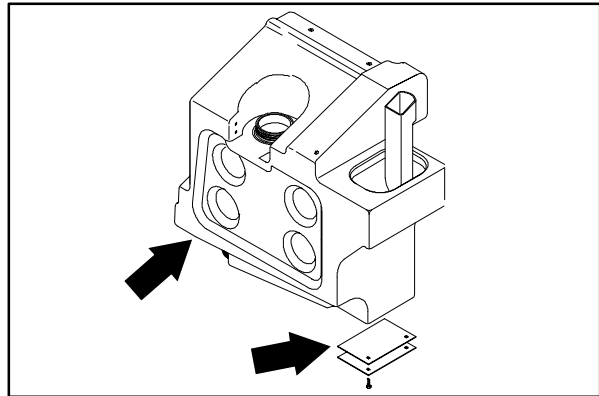
⚠ WARNING: Raised Hopper May Fall. Engage Hopper Support Bar.

5. Remove the four M8 hex screws holding the recovery tank cover brackets to the top of the recovery tank. Remove the cover and spacer.
6. Remove the six M6 hex screws holding the LH side panel to the machine. Remove the panel.
7. Remove the three M6 hex screws holding the plastic clean out cover to the machine. Remove the drain hoses, caps and clean out cover. If the machine is equipped with the ES option, remove the solution hose from the brass fitting.
8. Remove the three M6 hex screws and one M8 hex screw holding the RH side panel to the machine. Remove the panel.



9. Remove the M8 hex screws holding the recovery tank to the machine. This hardware is located near tank drain opening and the center of the machine.
10. Remove the four M8 hex screws holding the tank bracket to the back of the recovery tank and frame. Remove the bracket.
11. Remove the vacuum hose from the back of the recovery tank.
12. Remove black plastic check valve from the top of the solution tank.
13. If the machine is equipped with the ES™ option, remove the wires connected to the float switch on the recovery tank.
14. The recovery tank can now be removed. Some careful maneuvering of the tank will be needed to get it to come out easily because of the tight fit. Lift the tank straight up and out of machine. Leave the outer ring of the tank cap on the threads to protect it from damage during removal.

NOTE: The hardware can be loosened on the solution tank to ease removal of recovery tank.



SCRUBBING

TO INSTALL RECOVERY TANK

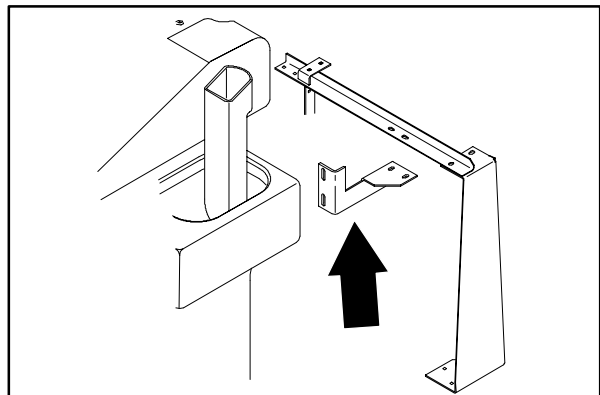
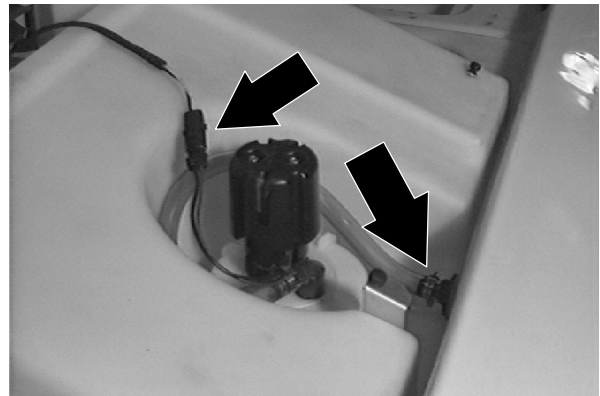
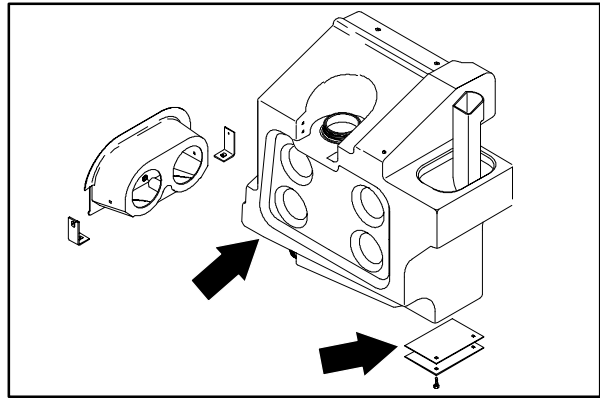
FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake, Turn Off Machine And Remove Key.

NOTE: Be careful not to pinch hydraulic hoses or electrical wires during this procedure.

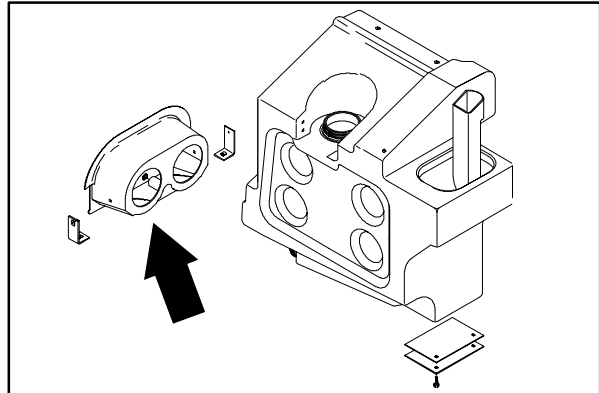
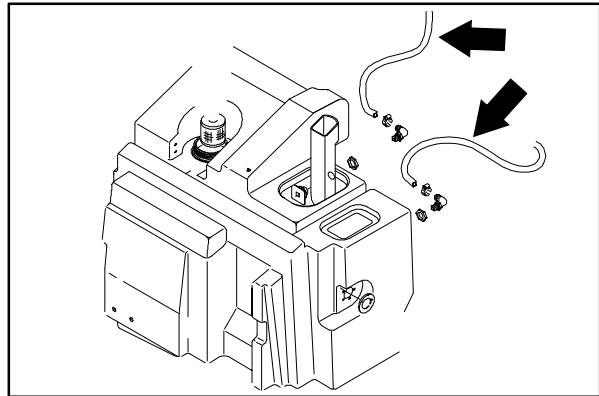
1. Position the recovery tank in the machine. This is a tight fit but with careful maneuvering the tank will slip in. Leave the outer ring of the tank cap on the threads to protect it from damage during installation.

NOTE: The hardware can be loosened on the solution tank to ease installation of recovery tank.

2. Align the three holes in the right hand side of machine, near the tank drain hole area, with the three threaded inserts in the recovery tank. Install the three M8 SS hex screws and washers, leave loose for now.
3. Reinstall the vacuum hose to the back of the recovery tank.
4. Reinstall the black plastic check valve in the top of the solution tank.
5. Reinstall the tank bracket to the back of the recovery tank and frame using the four M8 hex screws and washers. Tighten to 18 - 24 Nm (13 - 15 ft lb).
6. Go back and tighten the three M8 hex screws on recovery tank near the tank drain area. Tighten to 18 - 24 Nm (13 - 15 ft lb).



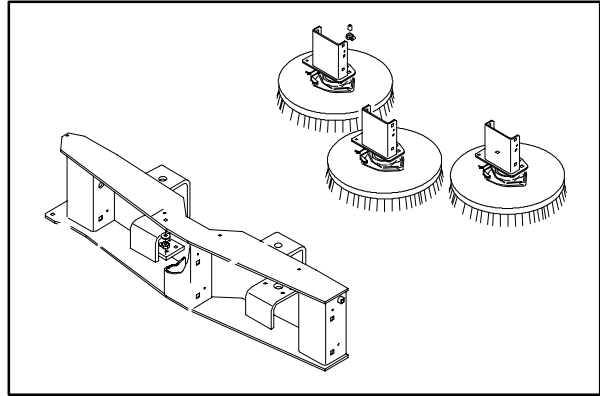
7. If the machine is equipped with the ES™ option, Reinstall the hoses to the fittings on the back of the solution tank.
8. If the machine is equipped with the ES™ option, reconnect the wires to the float switch on the right side of the tank. See schematic in the ELECTRICAL section.
9. Reinstall the LH side panel on the machine using the six M6 hex screws and washers. Tighten to 8 – 10 Nm (5 – 7 ft lb).
10. Reinstall the plastic clean out cover using the three M6 hex screws and washers. Tighten to 8 – 10 Nm (5 – 7 ft lb). Reinstall tank caps and hoses.
11. Start the engine, disengage the safety arm, and lower the hopper.
12. Reinstall the lintel cover and lightly hand tighten the four M8 hex screws.
13. Lower the engine/demister and recovery tank covers and check for proper alignment. Adjust the covers as necessary.



SCRUBBING

SCRUB HEAD

The scrub head contains three disc brushes, hydraulic motors, lift cylinders and side squeegees. Each brush has its own hydraulic motor and lift cylinder. There is also a hydraulic cylinder that can shift the scrub head over to the right for superior edge cleaning. Water from the solution tank flows to the center of each brush.



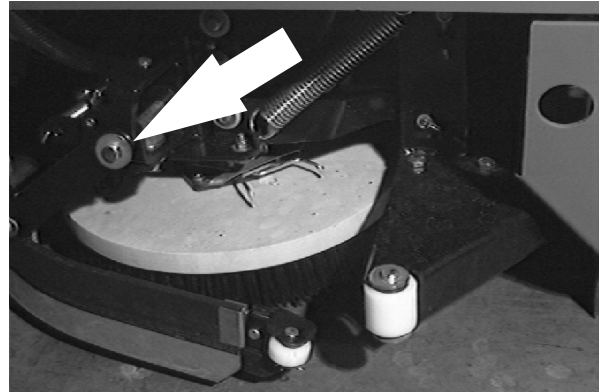
TO REMOVE SCRUB HEAD

1. Start the engine, lower and side shift the scrub head, shut off the engine.

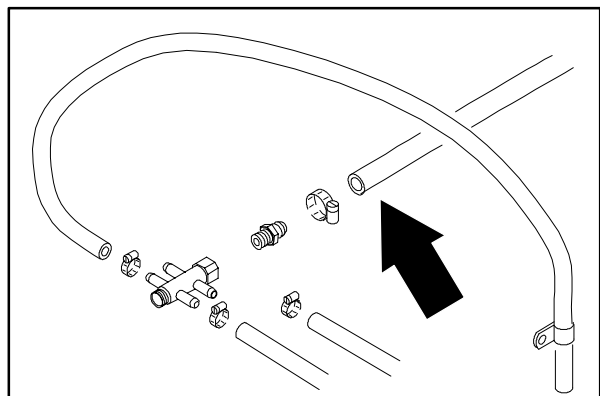
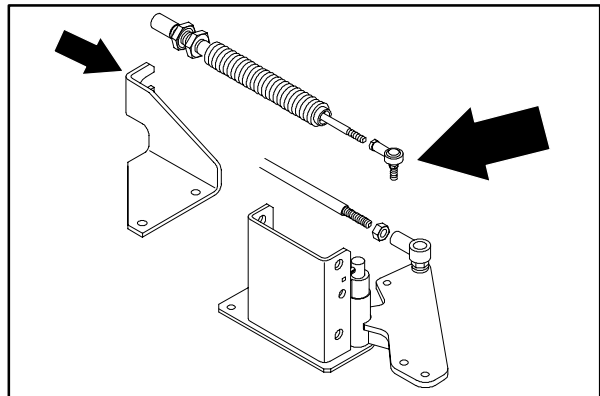
FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake, Turn Off Machine And Remove Key.

2. Raise the rear of machine using a hoist or floor jack.

FOR SAFETY: Block machine tires before jacking machine up. Jack machine up at designated locations only. Block machine up with jack stands.



3. Remove the cotter pin from the long horizontal clevis pin holding each side squeegee to the scrub head frame. Remove the clevis pins and squeegee assemblies from both sides.
4. Remove all three scrub brushes.
5. Remove the hex nut holding the balljoint and push-pull cable to the LH side squeegee bracket.
6. Loosen the large hex nut holding the cable to the cable bracket. Remove the cable from the bracket and place it out of the way for scrub head removal.
7. Locate the plastic water flow manifold on the scrub head. Remove the larger solution feed line from the manifold. Some of the plastic ties will have to be removed from the water flow lines to do this.



8. Locate the side shift gas spring and return cable on the top, front, center of the scrub head frame. Remove the small clip holding the gas spring ball end to the scrub head. Pop the gas spring off the ball end.

9. Remove the cotter pin and clevis from the return cable at the cylinder bracket.

NOTE: Mark the hoses for proper reassembly

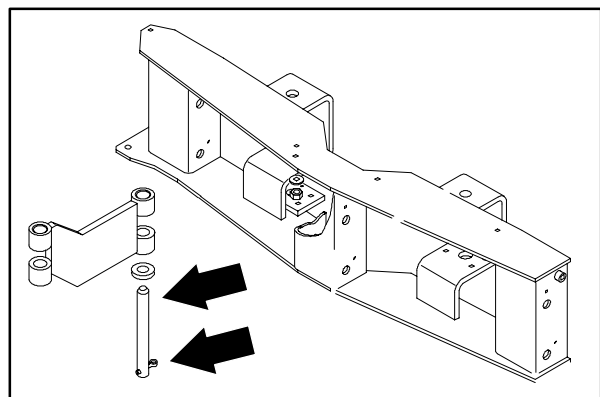
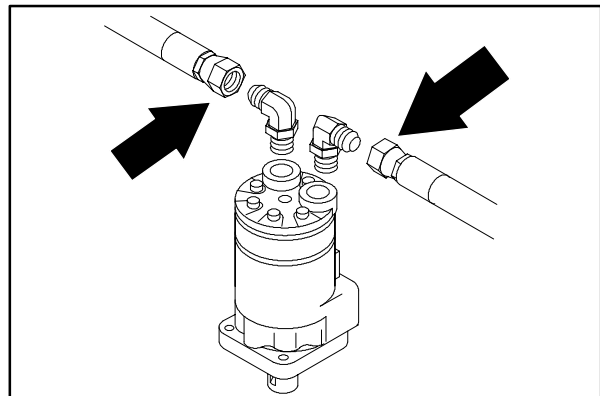
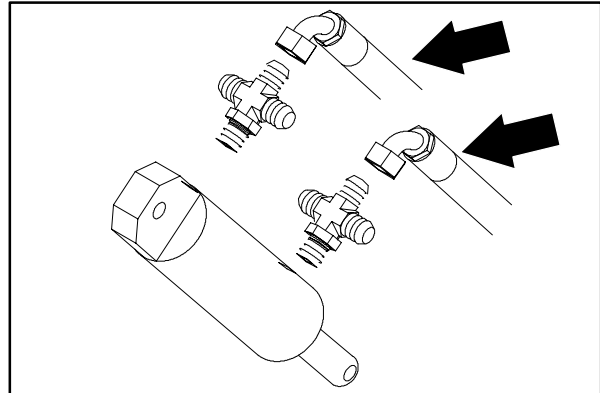
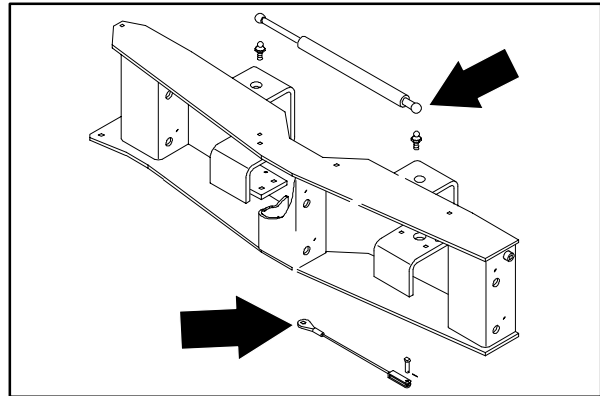
10. Disconnect and plug the two #4 hydraulic hoses leading from the control valve to the center scrub brush lift cylinder.

NOTE: Observe hydraulic cleanliness requirements when opening hydraulic lines.

11. Disconnect and plug the two #8 hydraulic hoses leading from the control valve to the RH and LH scrub brush motors.

NOTE: Place a floor jack under the scrubber head to help hold it up when pins are removed.

12. Remove the M6 hex screw and washer holding the cotter pin into the scrub head pin on the scrub head frame. Remove both pins.
13. The scrub head can now be removed from the machine.



SCRUBBING

TO INSTALL SCRUB HEAD

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

1. Raise the rear of machine using a hoist or floor jack.

FOR SAFETY: Block machine tires before jacking machine up. Jack machine up at designated locations only. Block machine up with jack stands.

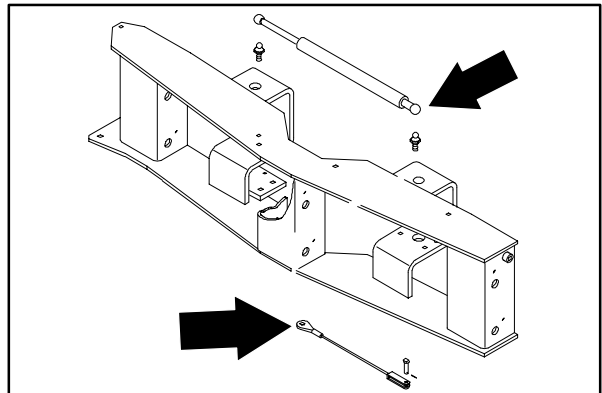
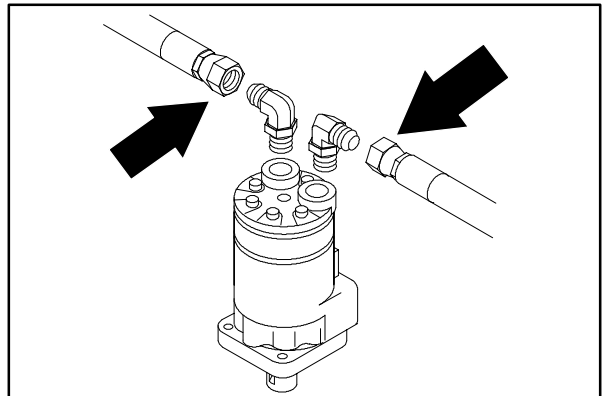
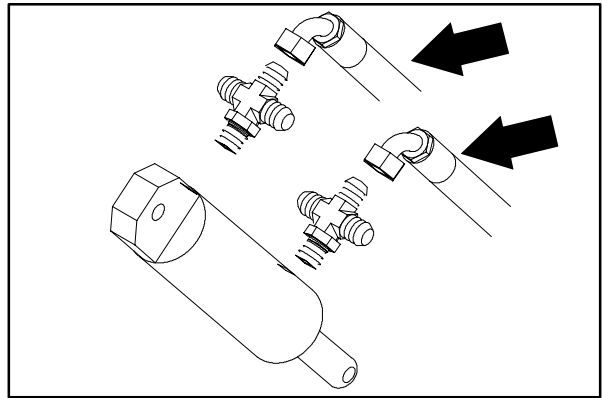
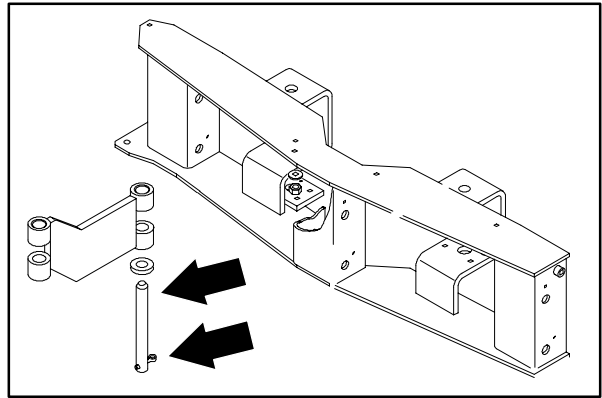
2. Position the scrub head under the machine using a floor jack.
3. Raise the head up and align the holes in the scrub head frame with holes in edge scrub link. Install the scrub head pins in from the bottom.
4. Align the hole in the pin with the cotter pin and hole in scrub head frame. Reinstall the M6 hex screw and washer through the hole in cotter pin. Tighten to 8 - 10 Nm (5 - 7 ft lb).

5. Reconnect the two #4 hydraulic hoses to the center lift cylinder and the two #8 hoses to the outside brush motors. See schematic in HYDRAULICS section.

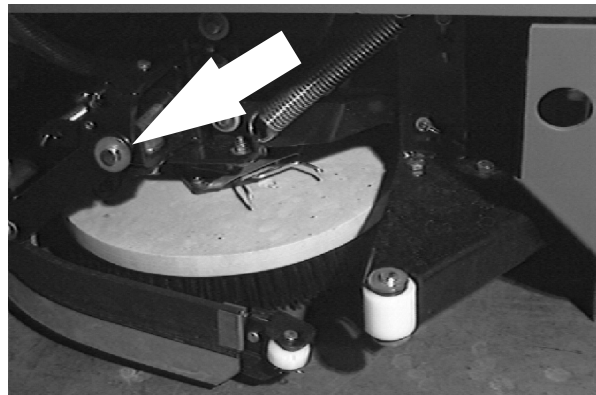
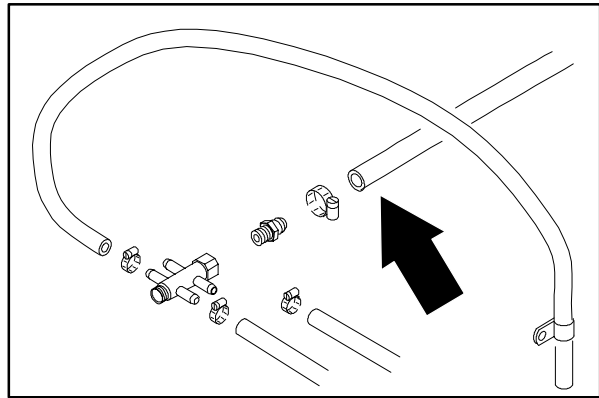
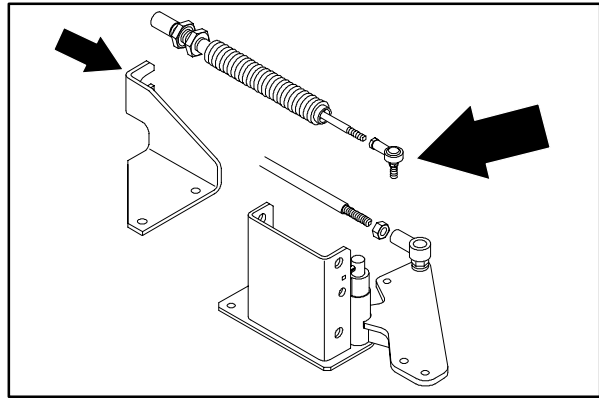
NOTE: Make sure the scrub head is pulled over all the way to the right for the next operation.

6. Reconnect the side shift cable to the cylinder pivot bracket.
7. Install the gas spring ball end back on the ball on the scrub head. Make sure to reinstall the locking clip.
8. Reconnect the main solution feed line to the plastic, water manifold.

NOTE: Make sure to reinstall any clamps or plastic ties that were removed during disassembly.



9. Position push-pull cable back in the mounting bracket and hand tighten large nut. Do not change the adjustment.
10. Reinstall the ball joint end of the push-pull cable back in the hole on side squeegee bracket. Tighten 0.31 in. hex nut to 18 - 24 Nm (13 - 18 ft lb).
11. Reinstall the three disc brushes.
12. Reinstall the LH and RH side squeegees with the long clevis pins and cotter pins.
13. Lower the machine. Start the engine and check for any leaks and for proper operation of the scrub brushes and side shift.



SCRUBBING

TO REPLACE SCRUB BRUSH LIFT CYLINDER

1. Start the engine, lower and side shift the scrub head, shut off the engine.

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

2. Raise the rear of machine using a hoist or floor jack.

FOR SAFETY: Block machine tires before jacking machine up. Jack machine up at designated locations only. Block machine up with jack stands.

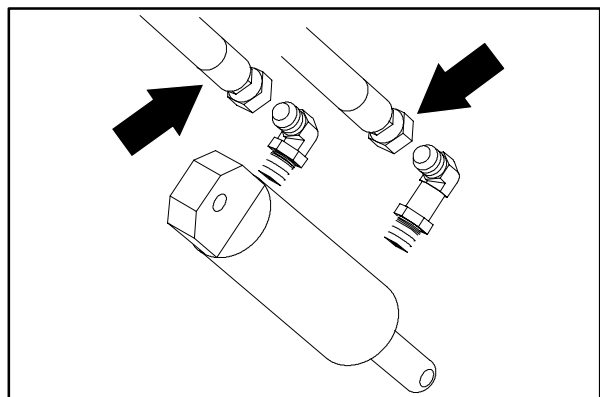
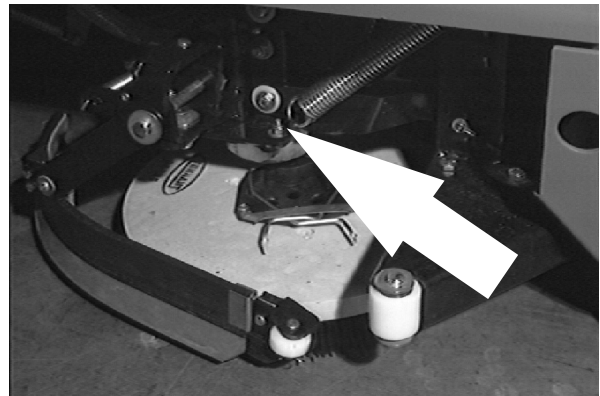
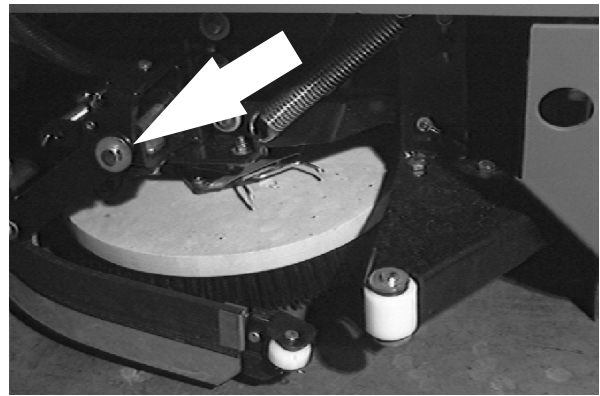
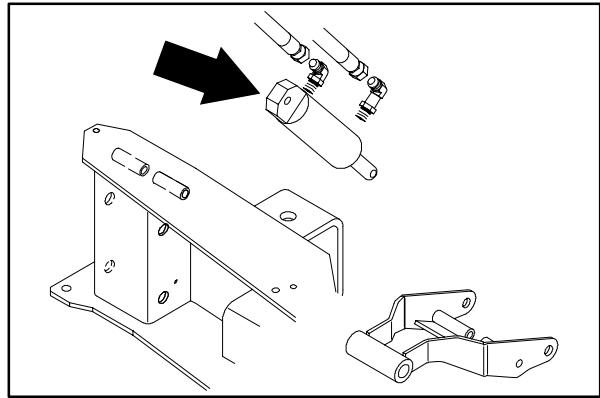
3. Remove the cotter pin from the long horizontal clevis pin holding each side squeegee to the scrub head frame. Remove the clevis pins and squeegee assemblies from both sides.
4. Remove all three scrub brushes.
5. Remove the 0.25 in. eye bolt holding the tension spring to the scrub brush motor bracket.

NOTE: Mark the hoses for proper reassembly

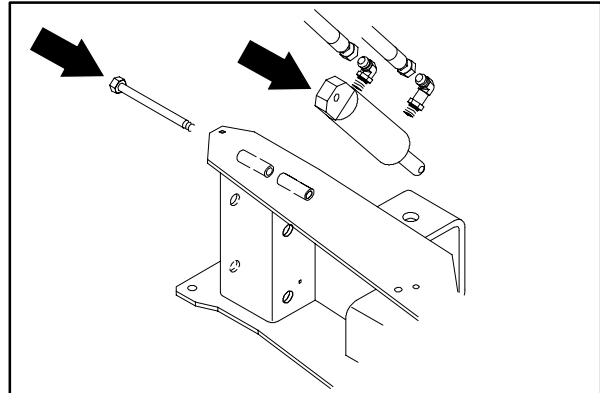
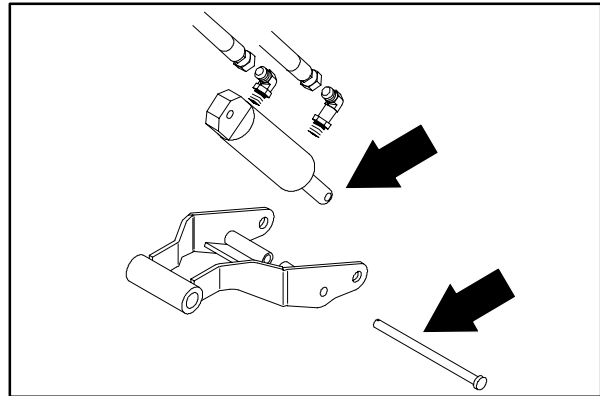
6. Remove and plug the hydraulic hoses connected to the scrub brush lift cylinder.

NOTE: Observe hydraulic cleanliness requirements when opening hydraulic lines.

7. Remove the cotter pin from the clevis pin holding the rod end of cylinder to the lower link. Remove the clevis pin.
8. Remove the 0.38 in. nyloc nut, washer, and hex screw holding the piston end of the lift cylinder to the top of the squeegee frame. The lift cylinder can now be removed from the scrub frame.
9. Remove the hydraulic fittings from the old cylinder and install in the same orientation in the new or rebuilt lift cylinder.



10. Position the new lift cylinder back in the scrub head frame. Align the hole in the piston end of the cylinder with the hole in the top of the frame. Reinstall the 0.38 in. hex screw, washers, and nyloc nut. Firmly tighten the hardware.
11. Raise the lower link up until the hole in the rod end of the lift cylinder lines up with the hole in the bracket. Reinstall the clevis pin and cotter pin.
12. Reconnect the hydraulic hoses to the lift cylinder. See the schematic in HYDRAULIC section.
13. Reinstall the eye bolt and tension spring. Firmly tighten the nyloc nut.
14. Reinstall the three disc brushes.
15. Reinstall the LH and RH side squeegees with the long clevis pins and cotter pins.
16. Lower the machine. Start the engine and check for any leaks and for proper operation of the scrub brush lift cylinder.



SCRUBBING

TO REPLACE SCRUB BRUSH HYDRAULIC MOTOR

1. Start the engine, lower and side shift the scrub head, shut off the engine.

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

2. Raise the rear of machine using a hoist or floor jack.

FOR SAFETY: Block machine tires before jacking machine up. Jack machine up at designated locations only. Block machine up with jack stands.

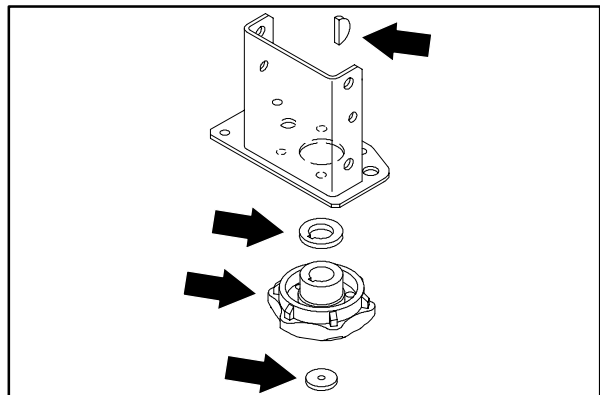
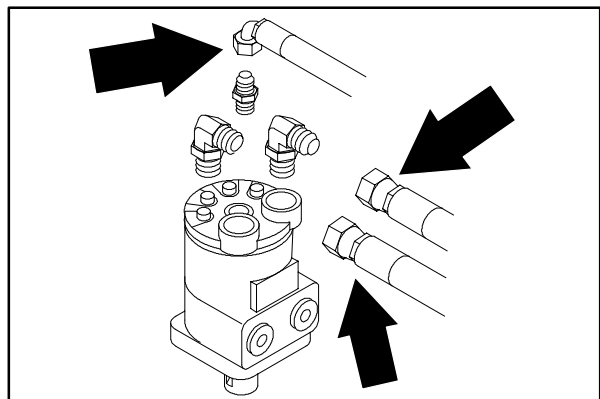
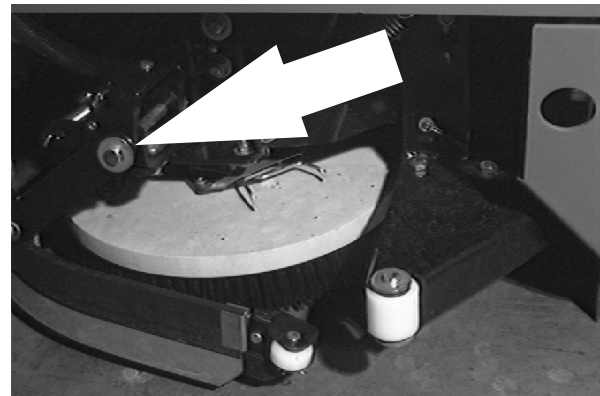
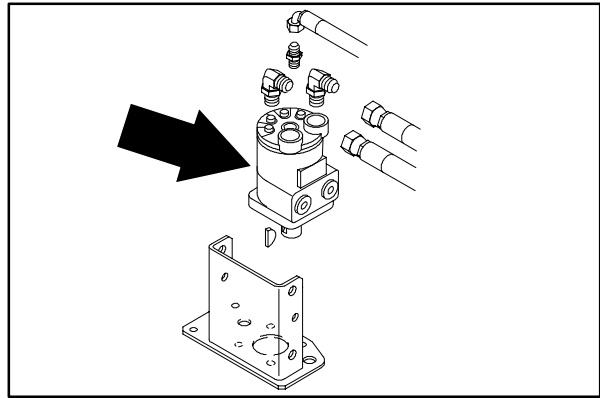
3. Remove the cotter pin from the long horizontal clevis pin holding each side squeegee to the scrub head frame. Remove the clevis pins and squeegee assemblies from both sides.
4. Remove all three scrub brushes.

NOTE: Mark the hoses for proper reassembly

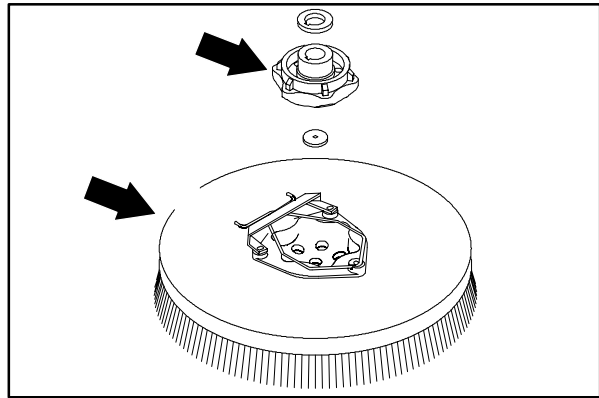
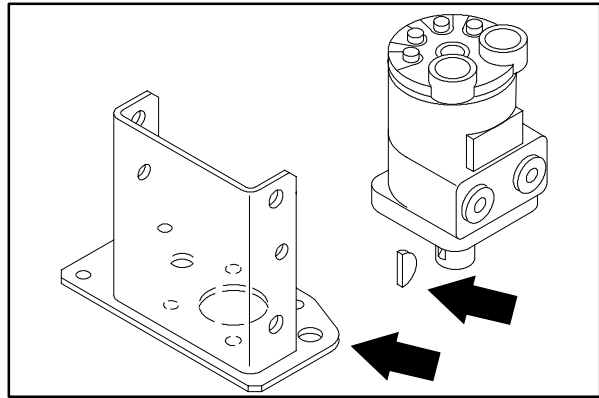
5. Remove and plug the hydraulic hoses connected to brush motor.

NOTE: Observe hydraulic cleanliness requirements when opening hydraulic lines.

6. Remove the 0.25 in. hex screw and spacer washer holding the brush drive hub to the brush hydraulic motor. Remove hub, spacer, and key.
7. Remove the four 0.38 in. hex screws holding the brush motor to the bracket. Note the orientation of the motor in the bracket and remove.
8. Remove the hydraulic fittings from the old motor and install in the same orientation in the new or rebuilt motor.
9. Install the new motor in the bracket in the same orientation it came out. Reinstall the four 0.38 in. hex screws and tighten to 31 - 40 Nm (27 - 35 ft lb).



10. Reinstall the spacer, key, hub, washer, and 0.25 in. hex screw in the new brush motor shaft. Use blue loctite 242 in threads of the hex screw. Tighten to 11 - 14 Nm (7 - 10 ft lb).
11. Reconnect hydraulic hoses to brush motor. See schematic in HYDRAULICS section.
12. Reinstall the three disc brushes.
13. Reinstall the LH and RH side squeegees with the long clevis pins and cotter pins.
14. Lower the machine. Start the engine and check for any leaks and for proper operation of the scrub brushes.



SCRUBBING

TO REPLACE SCRUB HEAD SIDE SHIFT HYDRAULIC CYLINDER

1. Start the engine, lower and side shift the scrub head, shut off the engine.

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

2. Raise the rear of machine using a hoist or floor jack.

FOR SAFETY: Block machine tires before jacking machine up. Jack machine up at designated locations only. Block machine up with jack stands.

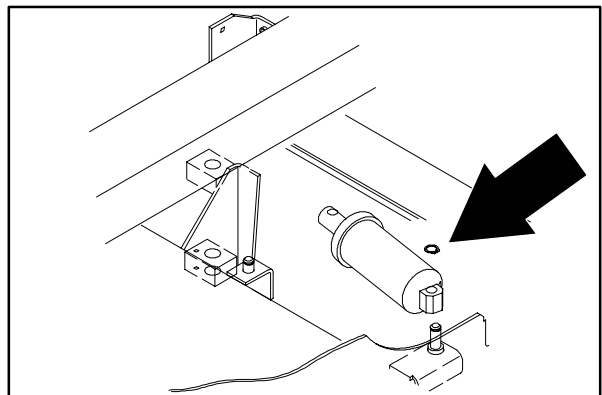
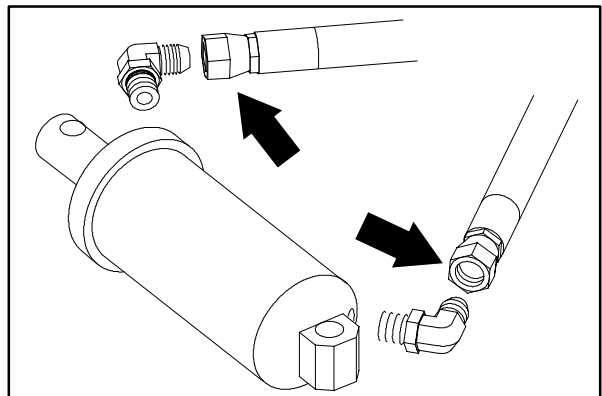
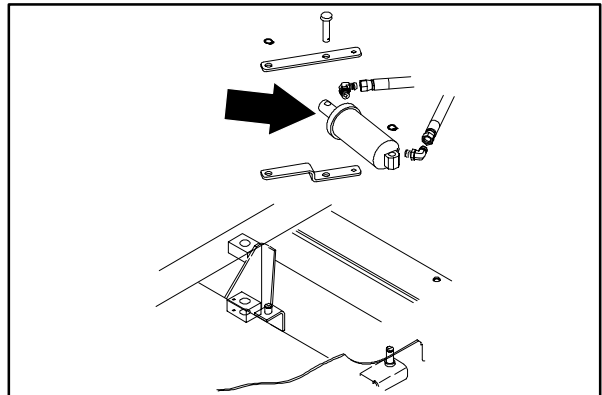
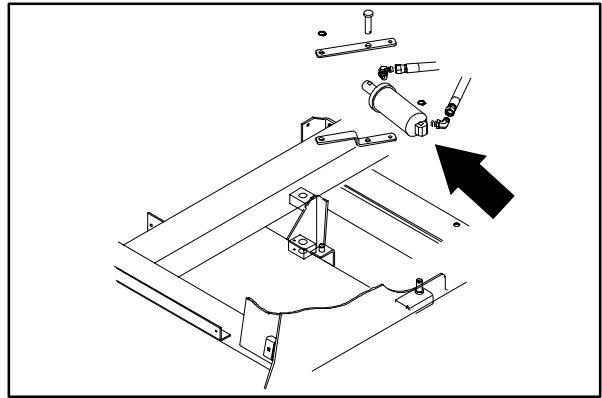
3. Remove the solution and recovery tanks from the machine. See TO REMOVE SOLUTION TANK FROM MACHINE instructions in this section.
4. Once the tanks are removed, locate the side shift cylinder on the left side of machine, behind the hydraulic control valve.

NOTE: Mark the hoses for proper reassembly

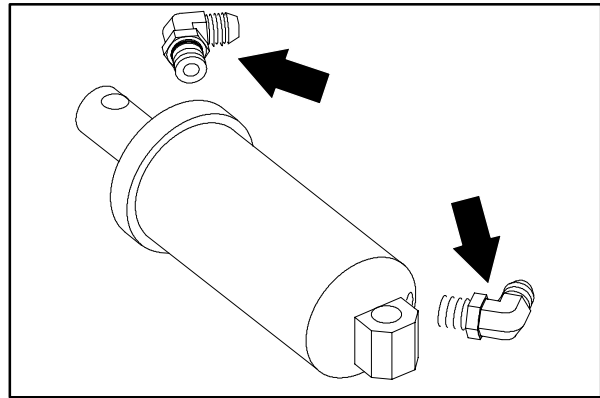
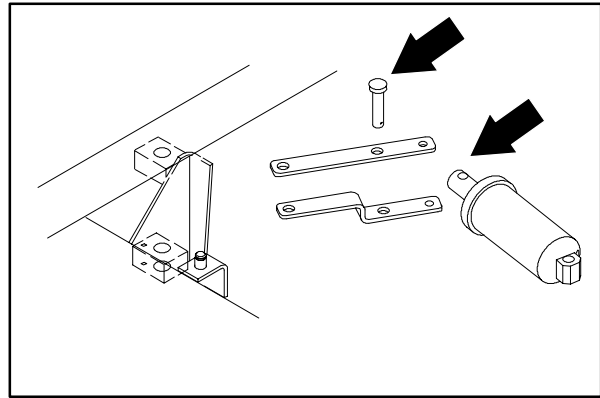
5. Remove and plug the hydraulic hoses connected to side shift cylinder.

NOTE: Observe hydraulic cleanliness requirements when opening hydraulic lines.

6. Remove the retaining ring that is holding the piston end of side shift cylinder to the mount pin on the machine frame.
7. Remove the cotter pin and clevis pin holding the rod end of side shift cylinder to edge scrub pivot lever.



8. The side shift cylinder can now be pulled up and off the mount pin and removed from the machine.
9. Remove the hydraulic fittings and install in the new cylinder in the same orientation.
10. Position the new cylinder back in the machine. Place the hole in the piston end of the side shift cylinder on the mount pin on the machine frame. Reinstall the snap ring retainer.
11. Align the hole in the rod end of the side shift cylinder with hole in edge scrub pivot lever. Reinstall the clevis and cotter pin.
12. Reconnect the hydraulic hoses to the side shift cylinder. See the schematic in the HYDRAULICS section.
13. Reinstall the solution and recovery tanks. See TO INSTALL SOLUTION TANK instructions in this section.
14. Lower the machine. Start the engine and check for any leaks and for proper operation of the side shift function.



SCRUBBING

TO REPLACE SIDE SHIFT CABLE

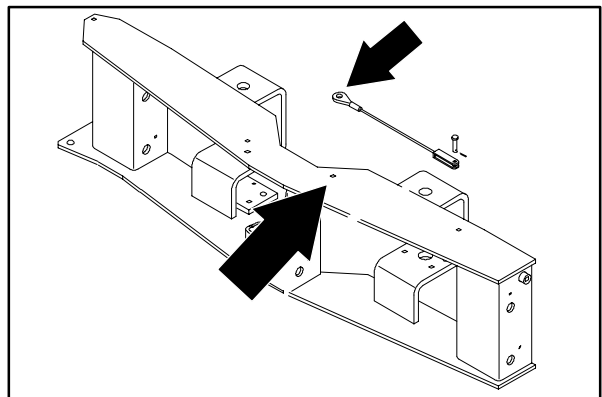
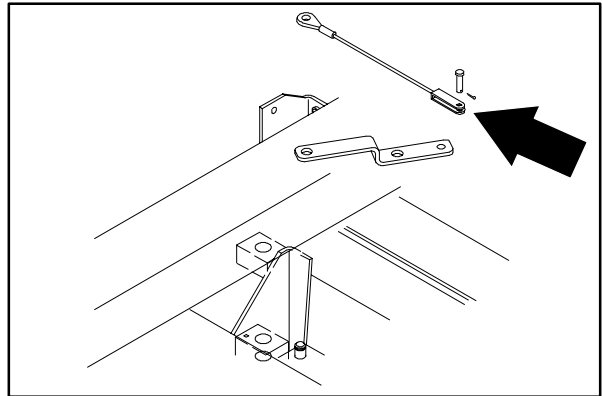
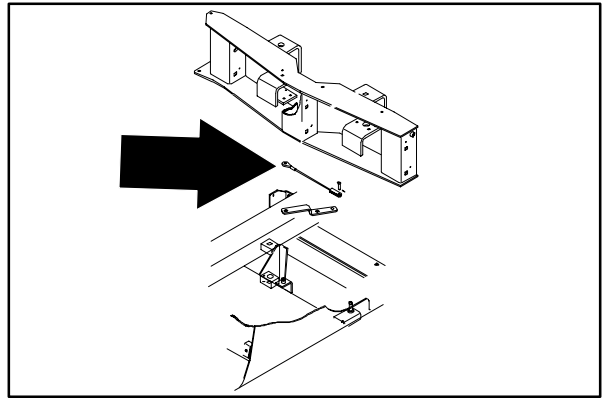
1. Start the engine, lower and side shift the scrub head, shut off the engine.

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

2. Raise the rear of machine using a hoist or floor jack.

FOR SAFETY: Block machine tires before jacking machine up. Jack machine up at designated locations only. Block machine up with jack stands.

3. Go under the machine on the left side. Look up above the left hand scrub brush motor and to the right of the control valve. Locate the clevis pin holding the side shift cable to the pivot bracket. Remove the cotter and clevis pin.
4. Go under the machine on the right side and locate the M8 hex screw holding the other end of the side shift cable to the scrub head frame. Remove the M8 hex screw, nyloc nut, and cable from the machine.
5. Position the new cable back in the machine. Align the hole in the ring end of cable with the hole in scrub head frame. Reinstall the M8 hex screw and lightly tighten. The cable must be able to swivel after tightening
6. Go under the machine on the left side and align the clevis end of the cable with the hole in the pivot bracket. Reinstall the clevis and cotter pin.
7. Lower the machine. Start the engine and check for proper side shift function.

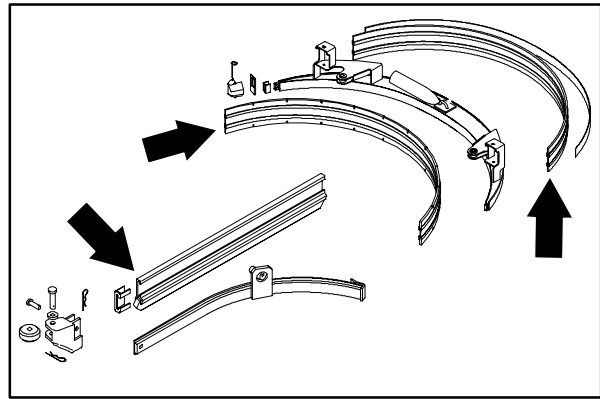


SQUEEGEES

The squeegee channels water to the vacuum fan suction. The front blade channels the water, and the rear blade wipes the floor.

The rear squeegee has two squeegee blades. Each blade has four wiping edges.

The side squeegees control water spray and channel water into the path of the rear squeegee. Check the side squeegees for damage and wear daily.



TO REPLACE SQUEEGEE PUSH-PULL CABLE

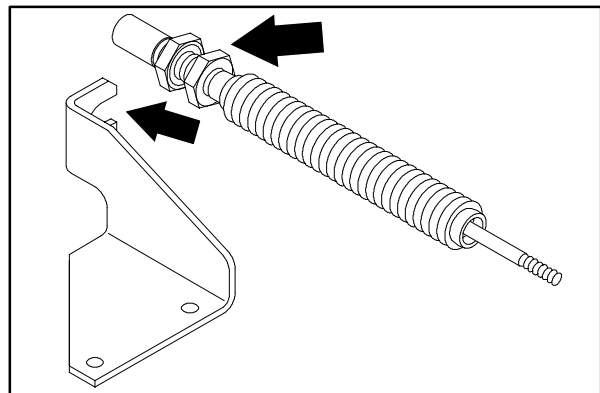
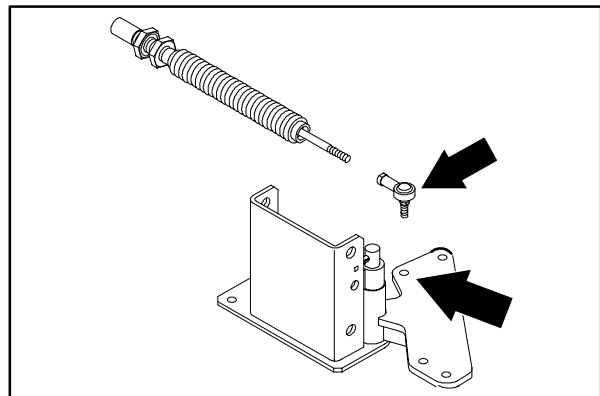
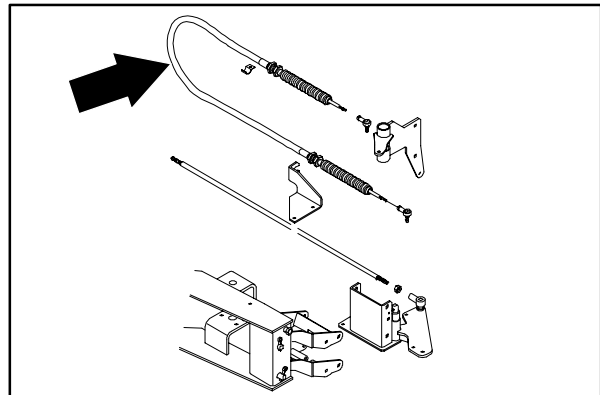
1. Start the engine, lower and side shift the scrub head, shut off the engine.

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

2. Raise the rear of machine using a hoist or floor jack.

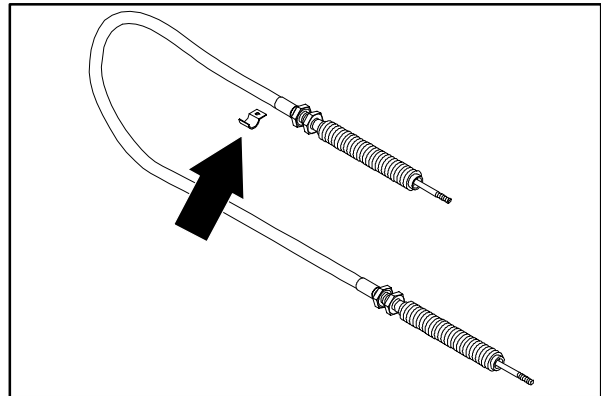
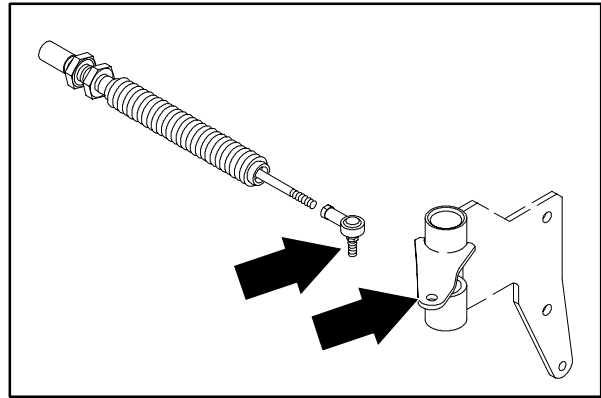
FOR SAFETY: Block machine tires before jacking machine up. Jack machine up at designated locations only. Block machine up with jack stands.

3. Remove the 0.31 in. nyloc nut holding the balljoint and push-pull cable to the LH side squeegee bracket.
4. Loosen the large hex nuts holding the cable to the cable bracket. Remove the cable from the bracket.
5. Remove the 0.31 in. nyloc nut holding the balljoint on the other end of the push-pull cable to the left hand rear squeegee pivot bracket.
6. Remove the M6 thread roller hex screw holding the clamp to the machine frame.



SCRUBBING

7. Remove the balljoints and jam nuts from the old cable and install on the new one. Run the jam nut and balljoint all the way on the threads.
8. Install the new cable in the machine. Make sure the cable is routed between the tie rod and scrub head frame.
9. Adjust the *rear* squeegee end of the cable at 8.25 inches from the center line of the balljoint to the edge of bracket with the cable in the retracted position.
10. Adjust the *side* squeegee end of cable at 8.25 inches from the center line of the balljoint to the edge of bracket with the cable in the retracted position. Firmly tighten all four large hex nuts.
11. Reinstall the cable clamp and M6 thread rolling hex screw to the bottom of the machine frame.
12. Reinstall the balljoints in the holes in both rear and side squeegee brackets. Tighten the 0.31 in. hex screw to 18 – 24 Nm (13 – 18 ft lb).
13. Lower machine and check for proper scrub head side shift operation.



TO REPLACE SQUEEGEE LIFT CABLE

1. Start the engine, lower the rear squeegee, shut off the engine.

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

2. Raise the rear of machine using a hoist or floor jack.

FOR SAFETY: Block machine tires before jacking machine up. Jack machine up at designated locations only. Block machine up with jack stands.

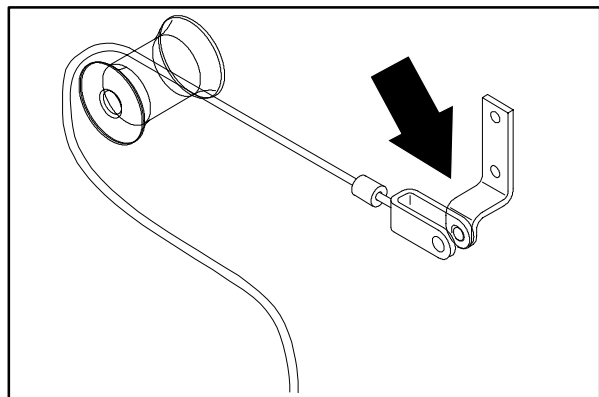
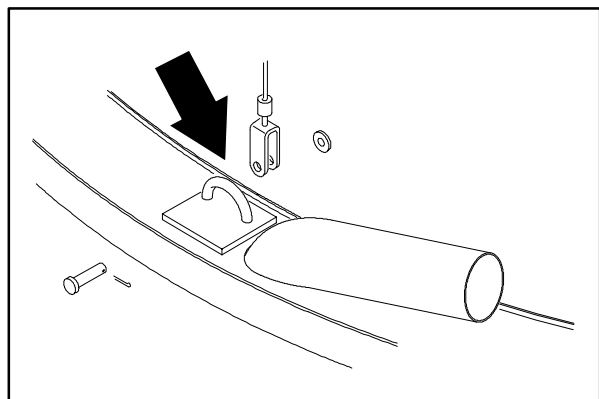
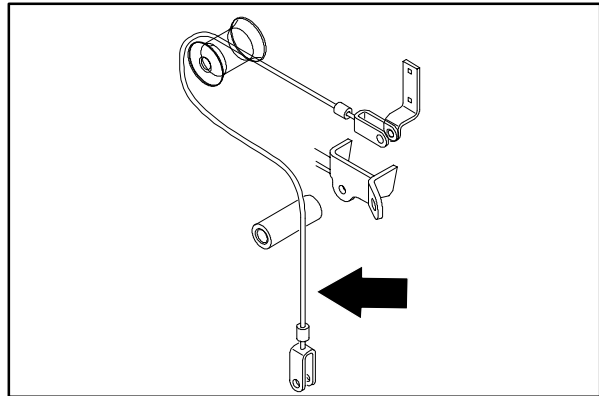
3. Remove the M8 hex screw, nyloc nut, and spacer tube from the rear squeegee lift cable where it attaches at the center of the rear squeegee frame.

NOTE: The squeegee frame will drop down when the hex screw is removed.

4. Remove the clevis pin holding the lift cable to the upper cable bracket.

NOTE: When installing the new cable, make sure to route it around the plastic rollers in the same manner as it was removed.

5. Align the hole in the upper end of the new cable with the hole in the upper cable bracket. Reinstall the clevis pin and cotter pin.
6. Lift the squeegee assembly up until the hole in the lower end of the lift cable lines up with the hole in the squeegee frame. Reinstall the clevis pin and cotter pin.
7. Lower machine and check for proper rear squeegee lift cable operation.



SCRUBBING

TO REPLACE SQUEEGEE LIFT CYLINDER

1. Start the engine, lower the rear squeegee, shut off the engine.

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

2. Raise the rear of machine using a hoist or floor jack.

FOR SAFETY: Block machine tires before jacking machine up. Jack machine up at designated locations only. Block machine up with jack stands.

3. Remove the M8 hex screw, nyloc nut, and spacer tube from the rear squeegee lift cable where it attaches at the center of the rear squeegee frame.

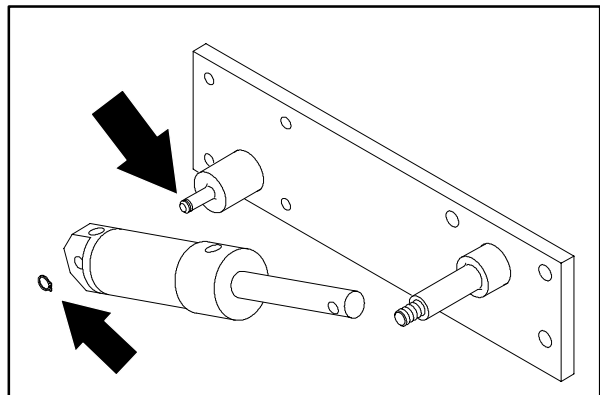
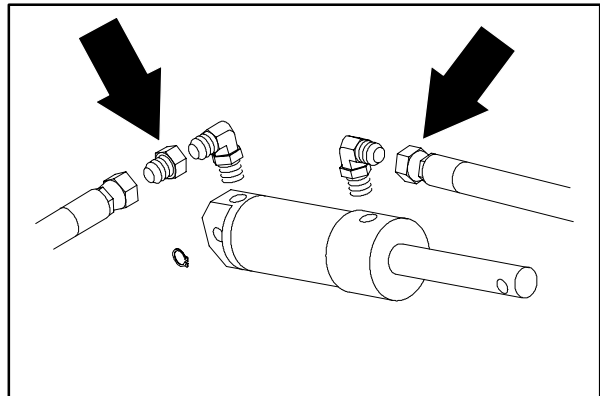
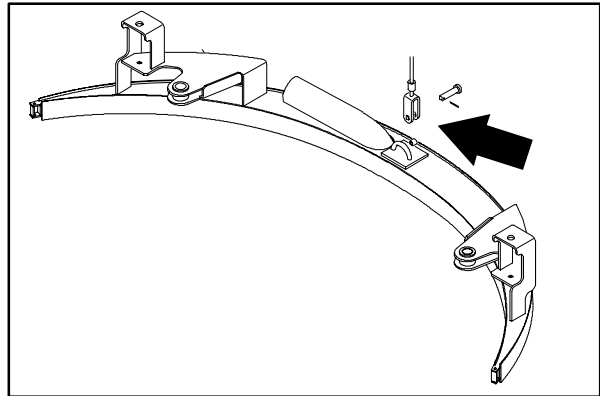
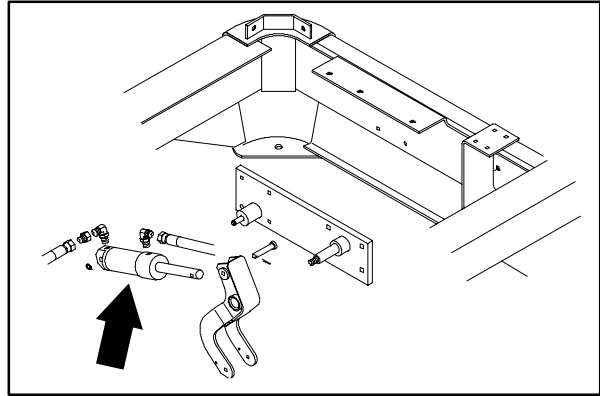
NOTE: The squeegee frame will drop down when the hex screw is removed.

NOTE: Mark the hoses for proper reassembly

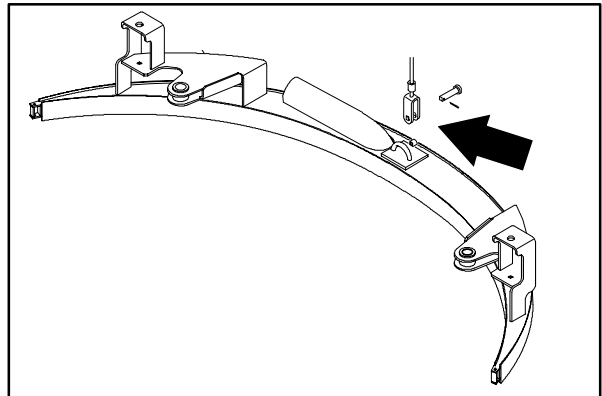
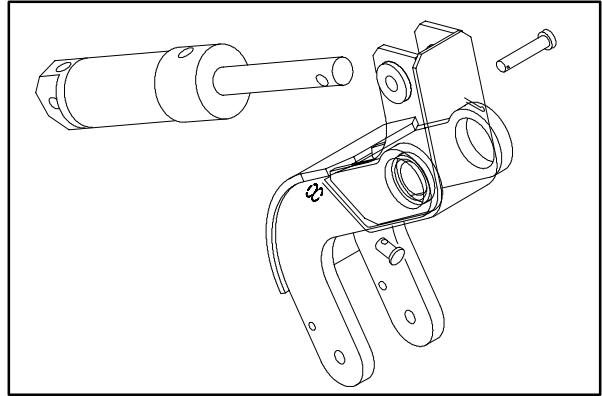
4. Remove and plug the hydraulic hoses connected to the rear squeegee lift cylinder.

NOTE: Observe hydraulic cleanliness requirements when opening hydraulic lines.

5. Remove the snap retaining ring from the grooved pin on the pivot plate on the piston end of the squeegee lift cylinder.
6. Remove the cotter pin and clevis pin from the rod end of the lift cylinder and squeegee lift bellcrank.
7. The squeegee lift cylinder can now be pulled off the mount pin and removed from the machine.
8. Remove the hydraulic fittings and install in the new cylinder in the same orientation.



9. Position the new cylinder back in the machine. Place the hole in the piston end of the squeegee lift cylinder on the grooved mount pin on frame. Reinstall the snap ring retainer.
10. Align the hole in the rod end of the new squeegee lift cylinder with hole in the squeegee lift bellcrank. Reinstall the clevis and cotter pin.
11. Reconnect the hydraulic hoses to squeegee lift cylinder. See the schematic in the HYDRAULICS section.
12. Lift the squeegee assembly up until the hole in the lower end of the lift cable lines up with the hole in the squeegee frame. Reinstall the M8 hex screw, nyloc nut, and spacer tube. Tighten to 18 - 24 Nm (13 - 18 ft lb).
13. Lower machine and check for proper rear squeegee lift cylinder operation.



SCRUBBING

TO REMOVE REAR SQUEEGEE FRAME

1. Start the engine, lower the rear squeegee, shut off the engine.

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

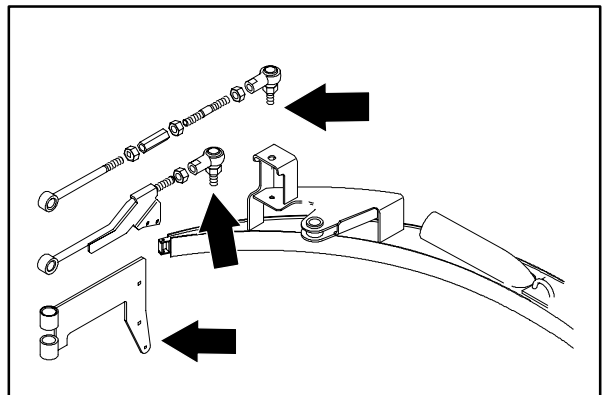
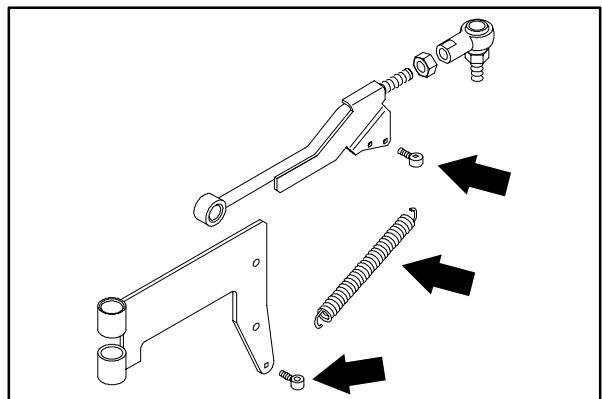
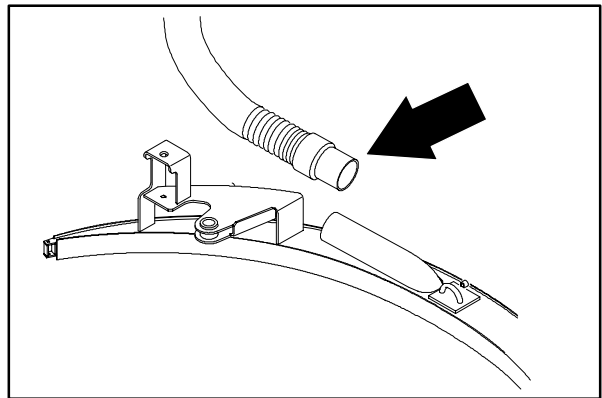
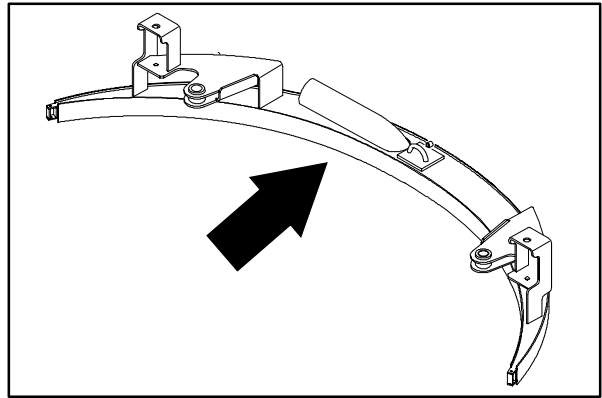
2. Raise the rear of machine using a hoist or floor jack.

FOR SAFETY: Block machine tires before jacking machine up. Jack machine up at designated locations only. Block machine up with jack stands.

3. Remove the M8 hex screw, nyloc nut, and spacer tube from the rear squeegee lift cable where it attaches at the center of the rear squeegee frame.

NOTE: The squeegee frame will drop down when the hex screw is removed.

4. Remove the vacuum hose from the squeegee frame.
5. Remove the two tension springs connecting the squeegee upper link rods to the squeegee pivot brackets.
6. Remove the M10 hex screw, washers sleeve, thrust washers, and nyloc nut holding each of the four link rods to the squeegee pivot brackets.
7. The squeegee assembly can now be removed from the machine.



TO INSTALL REAR SQUEEGEE FRAME

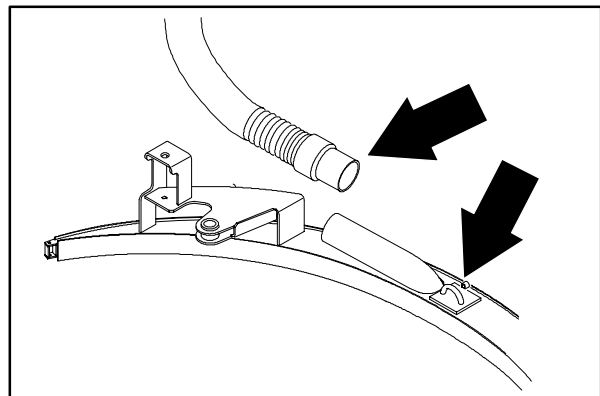
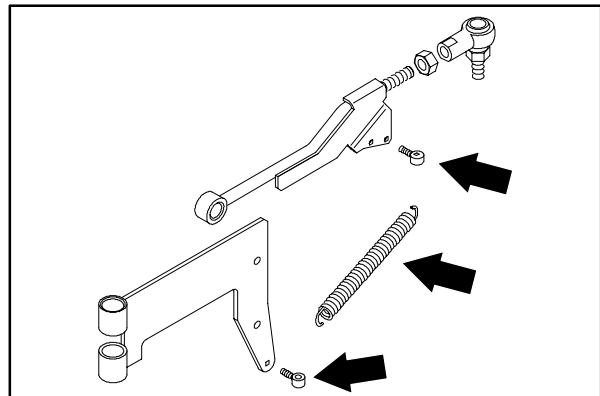
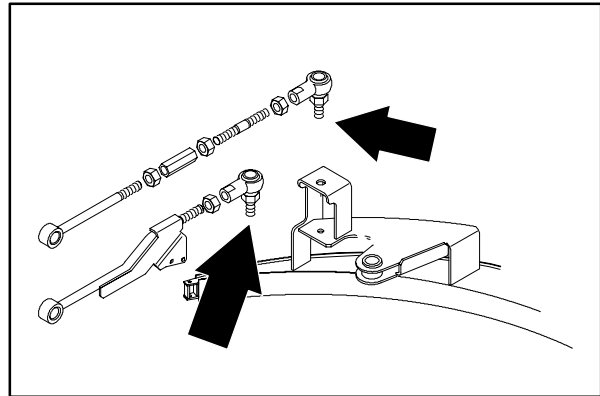
1. Start the engine, lower the rear squeegee, shut off the engine.

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

2. Raise the rear of machine using a hoist or floor jack.

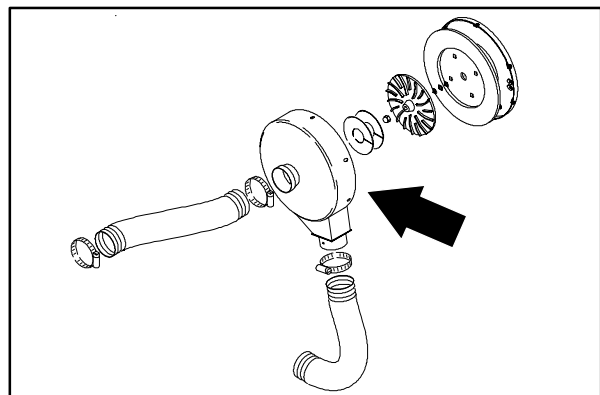
FOR SAFETY: Block machine tires before jacking machine up. Jack machine up at designated locations only. Block machine up with jack stands.

3. Position the squeegee assembly under the rear of the machine.
4. Align the holes in the end of squeegee link rods to the holes in the squeegee pivot brackets. Install the M10 hex screws, washers, sleeves, thrust washers, and nyloc nuts. Tighten to 37 – 48 Nm (25 – 53 ft lb).
5. Reconnect the tension springs from the lower link rod to the squeegee pivot bracket.
6. Lift the squeegee assembly up until the hole in the lower end of the lift cable lines up with the hole in the squeegee frame. Reinstall the M8 hex screw, nyloc nut, and spacer tube. Tighten to 18 – 24 Nm (13 – 18 ft lb).
7. Lower machine and check for proper rear squeegee operation.



SCRUB VACUUM FAN

The scrub vacuum fan, when activated, creates a vacuum in the recovery tank. The recovery tank is sealed to the demister tank/engine cover when it is the down position. Water is pulled from the rear squeegee to the demister tank through a vacuum hose.



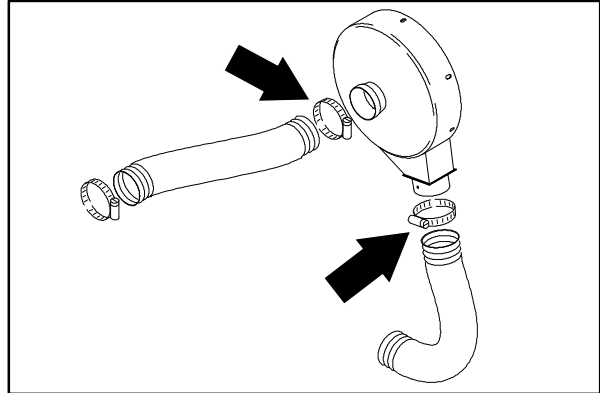
SCRUBBING

TO REMOVE SCRUB VACUUM FAN

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

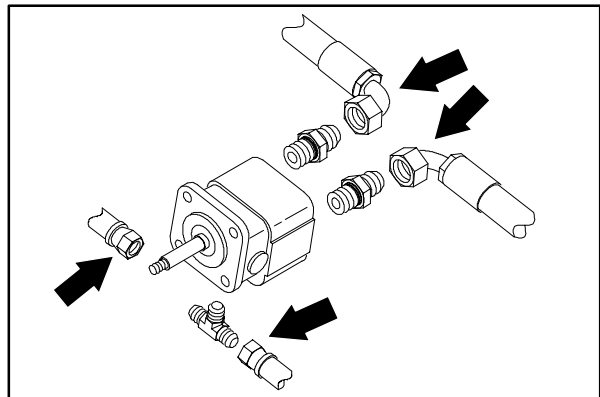
1. Raise the demister tank/engine cover.
2. Open the engine side door.
3. Loosen the hose clamp and remove the vacuum hose leading from recovery tank to the inlet tube of the scrub vacuum fan.
4. Loosen the hose clamp and remove the vacuum hose from the exhaust outlet of scrub vacuum fan.

NOTE: Mark the hoses for proper reassembly



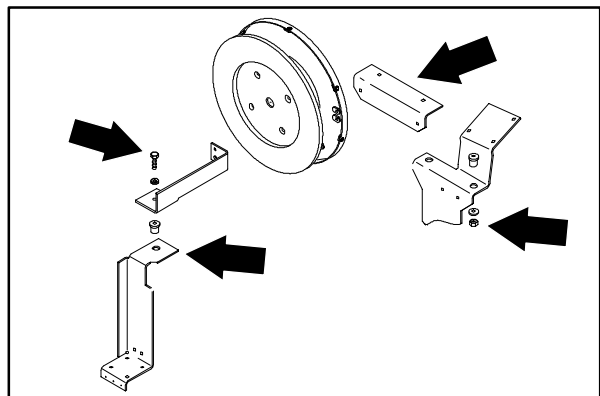
5. Remove and plug the hydraulic hoses connected to the scrub vacuum fan motor. Access to these hoses is between air cleaner and vacuum fan housing.

NOTE: Observe hydraulic cleanliness requirements when opening hydraulic lines.



6. Remove the three M10 hex screws, washers, and nyloc nuts holding the vacuum fan to mounting brackets.

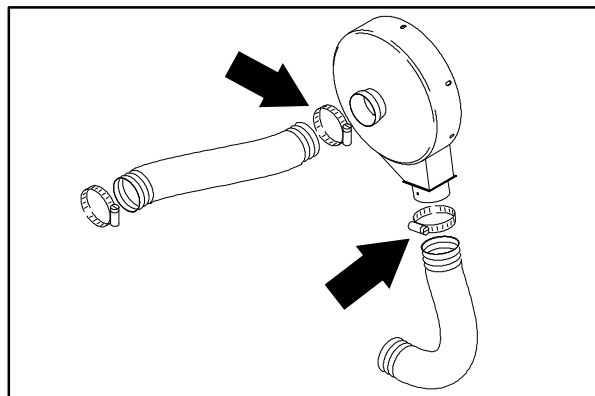
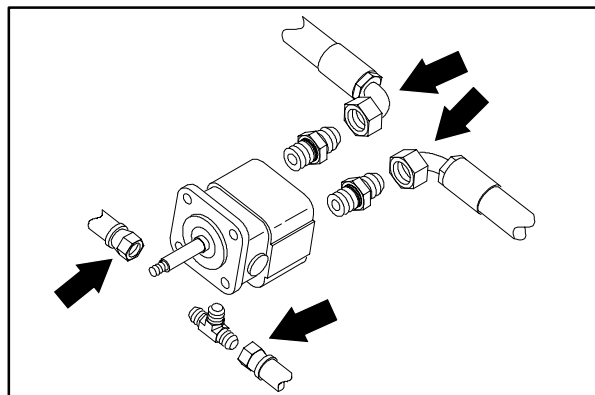
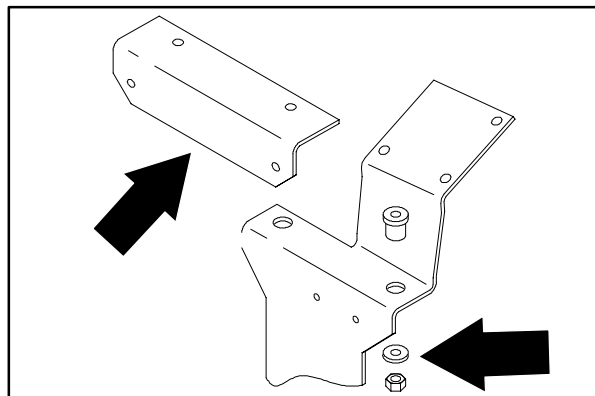
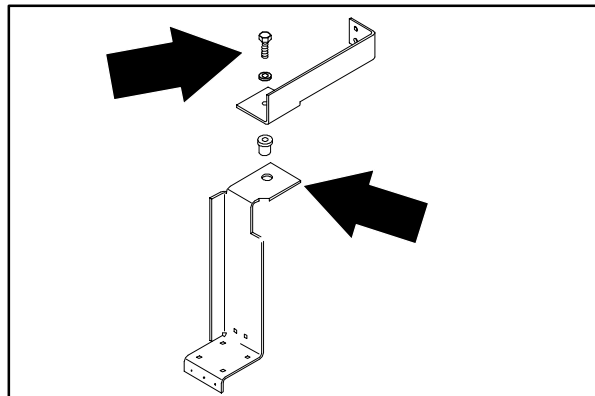
7. Remove the vacuum fan assembly from the machine.



TO INSTALL SCRUB VACUUM FAN

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

1. Raise the demister tank/engine cover.
2. Open the engine side door.
3. Position the vacuum fan assembly in the machine.
4. Align the three mounting holes in the vacuum fan housing with the three rubber isolators in the mounting brackets. Reinstall the three M10 hex screws, washers, and nyloc nuts. Tighten to 18 - 24 Nm (13 - 18 ft lb).
5. Reconnect the hydraulic hoses to the vacuum fan motor. See the hydraulic schematic in the HYDRAULIC section. Access to these hoses is between air cleaner and vacuum fan housing.
6. Reinstall the vacuum hose on the exhaust outlet of vacuum fan housing. Firmly tighten the hose clamp.
7. Reinstall the vacuum hose from recovery tank to the inlet tube on the vacuum fan housing. Firmly tighten the hose clamps.
8. Start engine and turn on the vacuum fan. Check for leaks and proper operation.



SCRUBBING

TO REPLACE SCRUB VACUUM FAN HYDRAULIC MOTOR

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

1. Remove the scrub vacuum fan from the machine. See TO REMOVE SCRUB VACUUM FAN instructions in this section.
2. Place the vacuum fan assembly in a vice or other holding device.
3. Remove the six hex screws holding the front housing to the rear housing. Remove the front housing.

NOTE: The orientation of front housing to rear housing is very important. Mark both the front and rear housing for proper reassembly.

4. Remove the crown nut on the impeller shaft. Slide the impeller off the shaft.

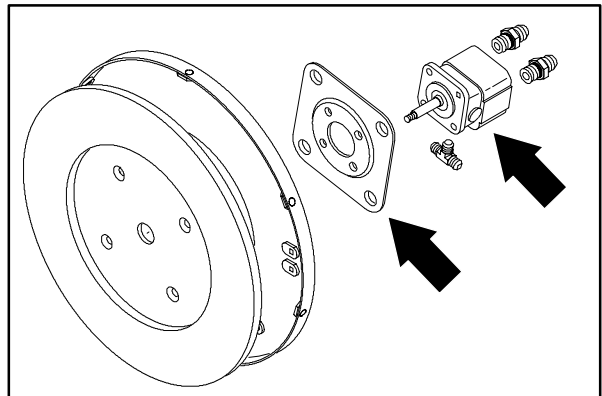
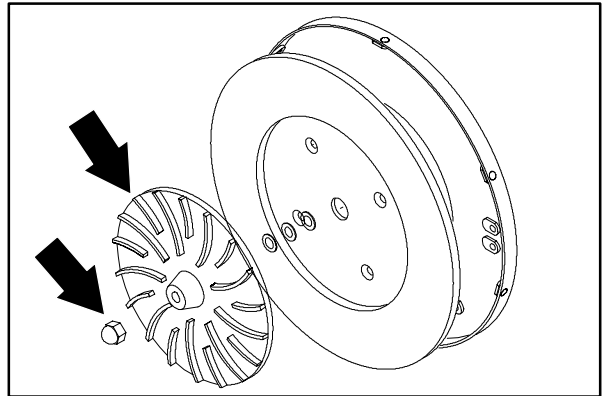
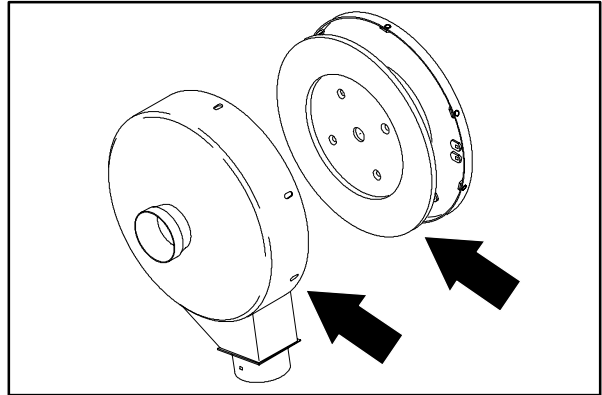
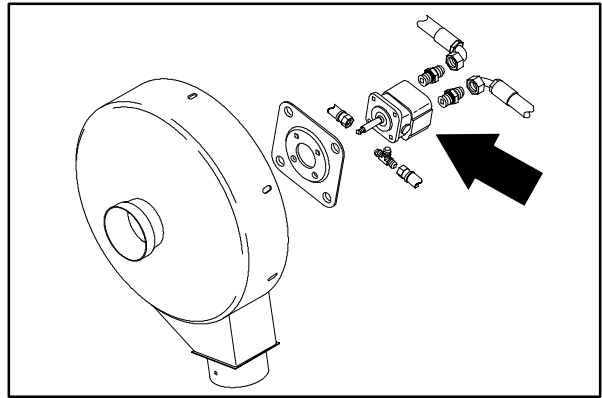
NOTE: Remove and save the square key and any shims on the shaft under the impeller.

5. Turn the bottom housing over and remove the four nyloc nuts and washers from the motor mount plate. Remove the plate from the housing.

NOTE: Mark the orientation of hydraulic motor and fittings.

6. Remove the four flat head screws and nyloc nuts holding the hydraulic fan motor to the mounting plate.
7. Install a new motor on the mounting plate. Tighten the four flat head screws to 9 – 13 Nm (7 – 10 ft lb).
8. Remove the hydraulic fittings from the old motor. Install these fittings in the new motor in the same orientation as they were removed.
9. Reinstall the new motor and mounting plate on the rear housing. Tighten the four nyloc nuts to 16 – 22 Nm (12 – 16 ft lb).

NOTE: Make sure the motor is installed on the rear housing with the hydraulic motor in the correct orientation.



10. Turn the rear housing over and reinstall the shims, key, fan impeller, and crown nut. Tighten nut to 34 – 47 Nm (25 – 35 ft lb).

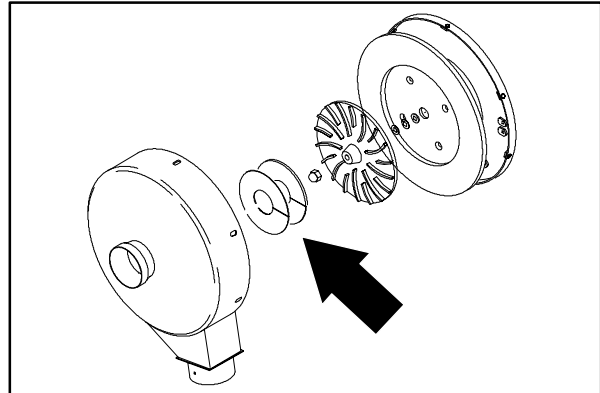
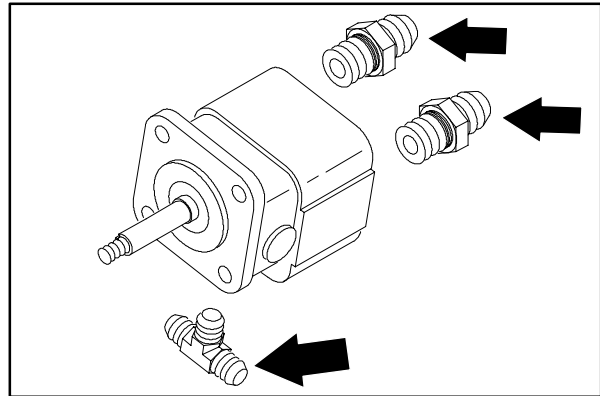
NOTE: Be sure the key is on the shaft. Super gluing the key helps keep it in place.

NOTE: Use blue loctite 242 on shaft threads.

11. Reinstall the front housing to the rear housing. Reinstall the six hex screws and tighten to 22 – 27 Nm (16 – 20 ft lb).

NOTE: Tennant part no. 57543 plastic shims must be used for proper fan to housing clearance. Remove these shims after housing has been tightened.

12. Reinstall the vacuum fan assembly back in the machine. See TO INSTALL SCRUB VACUUM FAN instructions in this section.



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ELECTRICAL SYSTEM

The machine electrical system consists of the battery, alternator, instrument panels, and related components. This section includes information on these components and their troubleshooting.

BATTERY

The battery used in the machine is a low maintenance battery. It has been constructed with special materials and has extra electrolyte to reduce or eliminate maintenance. Its design reduces electrolyte loss and contamination. Do not add water, remove the battery vent plugs, or check the battery specific gravity. For specific instructions, see the battery label.

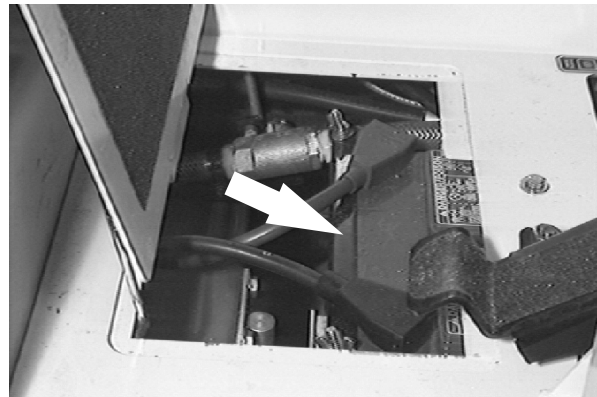
Do not allow the battery to remain in discharged condition for any time. Do not operate the machine if the battery is in poor condition or discharged beyond 80%, specific gravity below 1.120.

Periodically clean the top surface of the batteries and the terminals, and check for loose connections. Use a strong solution of baking soda and water. Brush the solution sparingly over the battery tops, terminals, and cable clamps. Do not allow any baking soda solution to enter the batteries. Use a wire brush to clean the terminal posts and the cable connectors. After cleaning, apply a coating of clear battery post protectant 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, which may cause a short circuit. Replace any worn or damaged wires.

The electrolyte level in regular non-sealed batteries can be checked. The level must always be above the battery plates. Never add acid to the batteries, only distilled water. Keep the battery caps on the batteries always except when adding water or taking hydrometer readings.

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



ELECTRICAL

Using a hydrometer to measure the specific gravity is a way to determine the charge level and condition of the batteries. If one or more of the battery cells test 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 distilled water. If the water and acid are not thoroughly mixed, the readings may not be accurate. Check the hydrometer readings against the following chart to determine the remaining battery charge level:

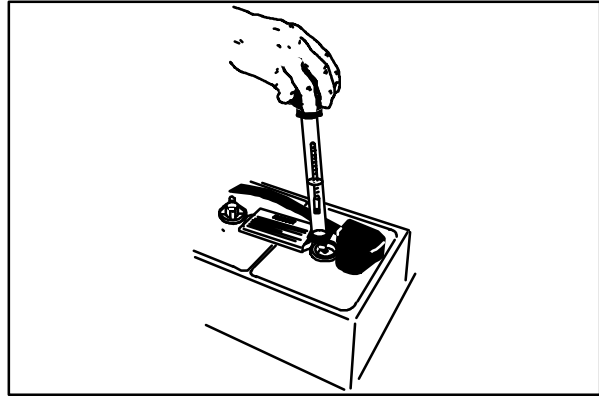
SPECIFIC GRAVITY at 27° C (80° F)	BATTERY CHARGE
1.260 - 1.280	100% Charged
1.230 - 1.250	75% Charged
1.200 - 1.220	50% Charged
1.170 - 1.190	25% Charged
1.110 - 1.160	Discharged

NOTE: If the readings are taken when the battery electrolyte is any temperature other than 27° C (80° F), the reading must be temperature corrected. Add or subtract to the specific gravity reading 0.004, 4 points, for each 6° C (10° F) above or below 27° C (80° F).

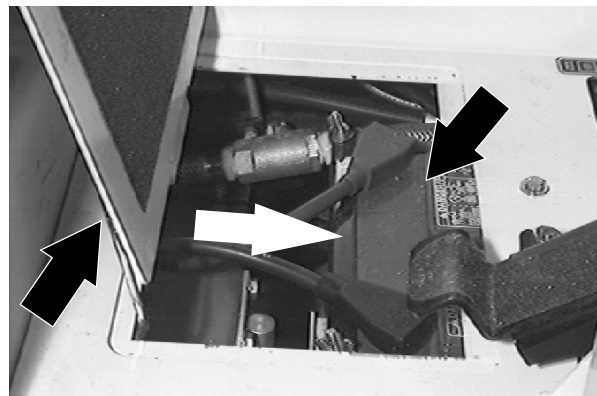
TO REPLACE BATTERY

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

1. Open the battery cover on the floor of the operators compartment.
2. Disconnect the negative cable first and then the positive battery cable.
3. Remove the battery hold down bracket from the machine.
4. Tilt the battery back and lift it out of the machine.
5. Clean the old cables and the posts on the new battery and install it in the machines battery tray.
6. Reinstall the battery hold down bracket.
7. Reconnect the positive cable and then the negative battery cable. Close the battery cover.



04380



INSTRUMENT PANEL

The instrument panel consists of a circuit board, a touch panel, and a water/dust resistant plastic enclosure. The touch panel controls various machine functions, while its indicator lights keep the operator informed on machine performance.

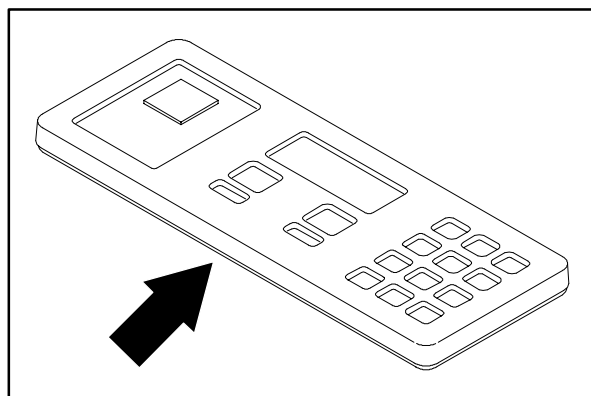
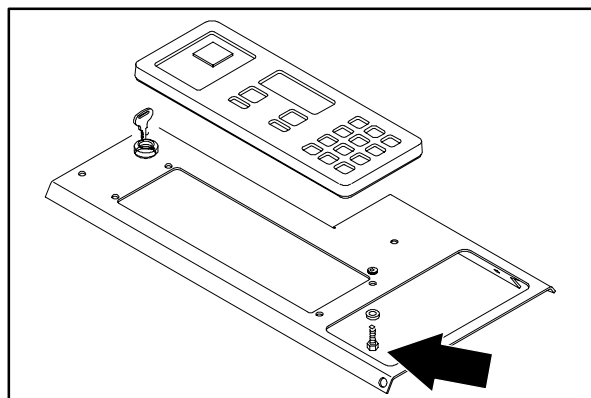
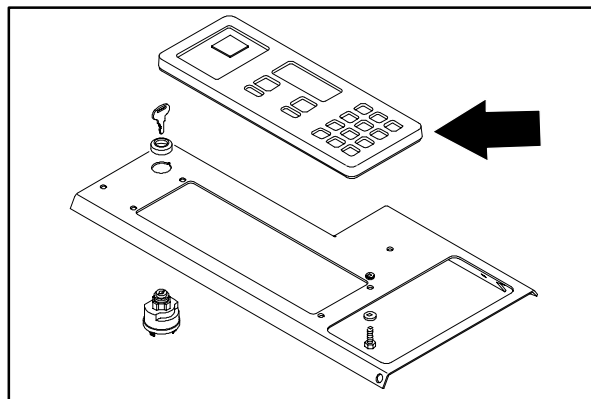
TO REPLACE MAIN INSTRUMENT PANEL

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

1. Disconnect the battery cables from the machine.
2. Put the steering wheel in the lowest position.
3. Remove the four M8 hex head screws holding the dash panel to the machine.
4. Pull the dash panel back away from the machine.
5. Remove the four M5 pan head screws holding the instrument panel to the dash panel.
6. Loosen the allen head screw in center of wire harness plug. Unplug the harness.
7. Remove the instrument panel from the machine.
8. Install the new instrument panel back on the dash panel using the four M5 pan head screws and washers. Lightly hand tighten.
9. Push the harness plug back in the instrument panel plug.

NOTE: The slot in the panel plug must line up with the notch on the harness plug. Firmly hand tighten the allen head screw.

10. Position the dash panel back on the machine using the four M8 hex screws and washers. Tighten to 18 - 24 Nm (13 - 18 ft lb).
11. Reconnect the battery cables.
12. Start the machine and check for proper instrument panel operation.



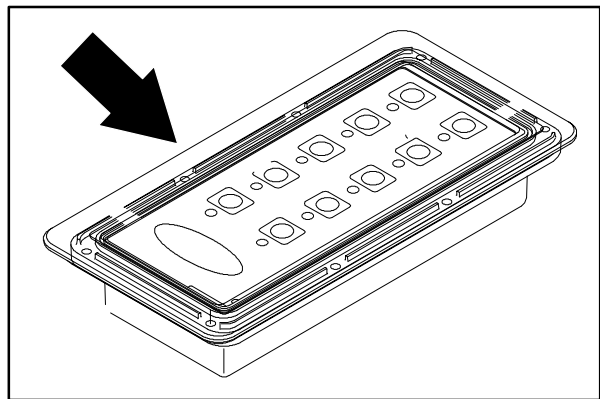
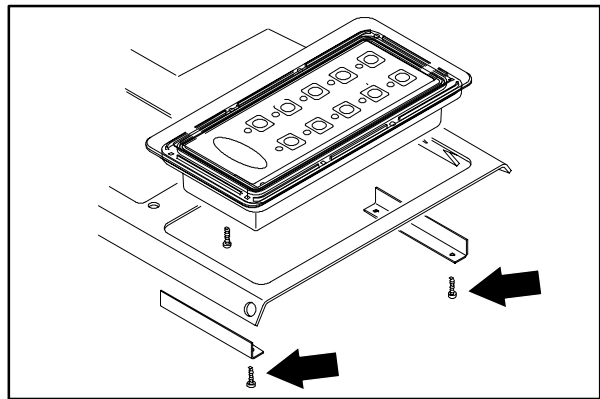
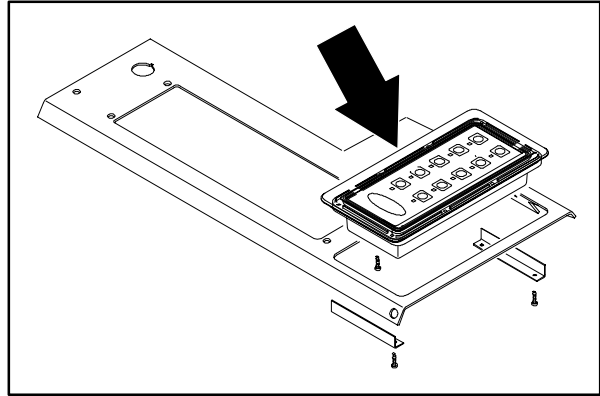
TO REPLACE AUXILIARY INSTRUMENT PANEL

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

1. Disconnect the battery cables from the machine.
2. Put the steering wheel in the lowest position.
3. Remove the four M8 hex head screws holding the dash panel to the machine.
4. Pull the dash panel back away from the machine.
5. Remove the two M4 pan head screws and bracket holding the top of the auxiliary instrument panel to the dash panel. Loosen the screws on the bottom of the panel.
6. Install the new auxiliary instrument panel back on the dash panel using the four M5 pan head screws and washers. Lightly hand tighten.
7. Push the harness plug back in the auxiliary instrument panel plug.

NOTE: The slot in the panel plug must line up with the notch on the harness plug. Firmly hand tighten the allen head screw.

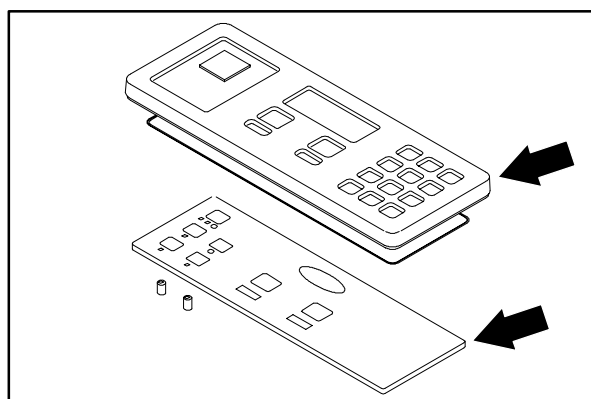
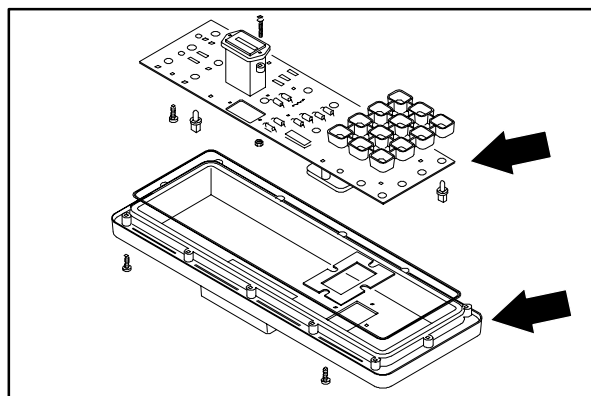
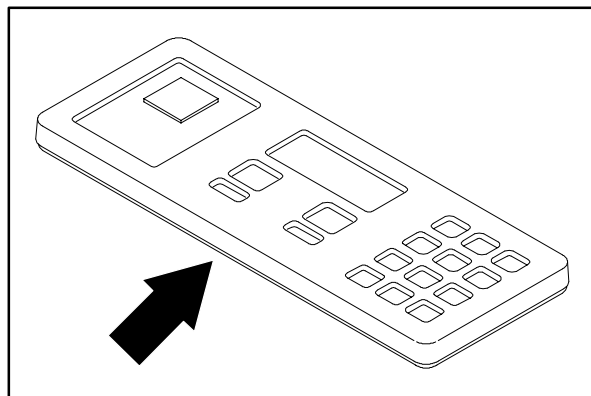
8. Position the dash panel back on the machine using the four M8 hex screws and washers. Tighten to 18 - 24 Nm (13 - 18 ft lb).
9. Reconnect the battery cables.
10. Start the machine and check for proper auxiliary instrument panel operation.



TO DISASSEMBLE MAIN INSTRUMENT PANEL

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

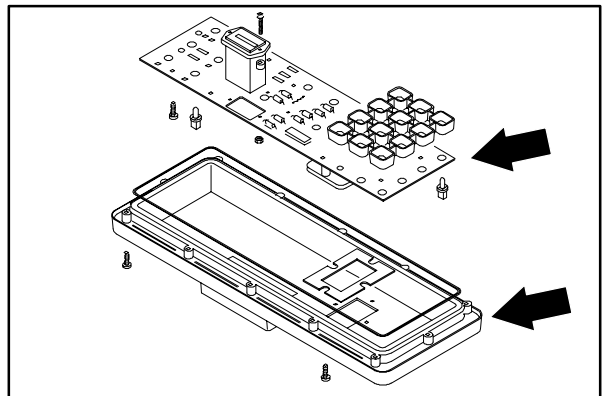
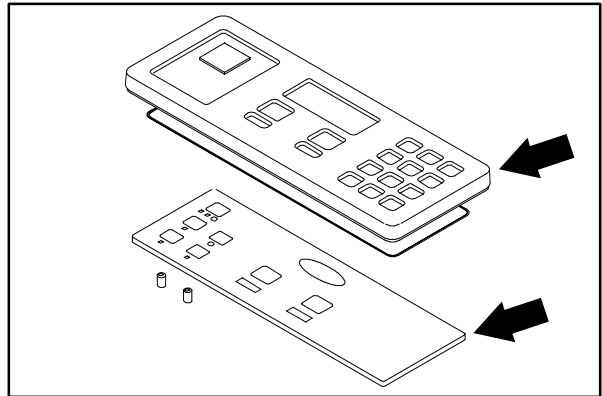
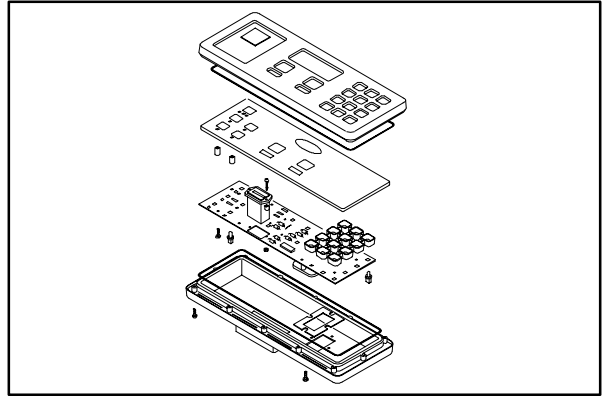
1. Remove the main instrument panel from the machine. See TO REPLACE MAIN INSTRUMENT PANEL instructions.
2. Place the main instrument panel face down and remove the twelve larger pan head screws holding it together.
3. The main instrument panel cases can now be separated.
4. Remove the four smaller pan head screws to completely disassemble touch panel case.
5. Remove the case box from the circuit board and touch panel assembly.
6. The o-ring and connector gaskets can now be replaced in the case box if necessary.
7. Remove the eight pan head screws and unplug the flat connector and ground strap to remove the touch panel from the circuit board.
8. Any burned-out lamps can now be changed by turning them 1/4 turn counterclockwise and lifting them out.
9. To replace the hour meter, unplug the two wires and remove the two pan head screws.



TO REASSEMBLE MAIN INSTRUMENT PANEL

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

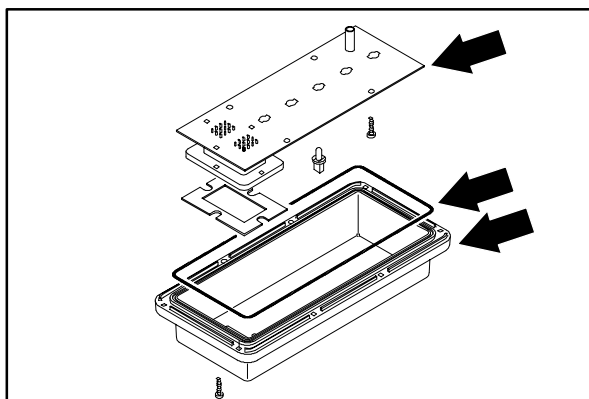
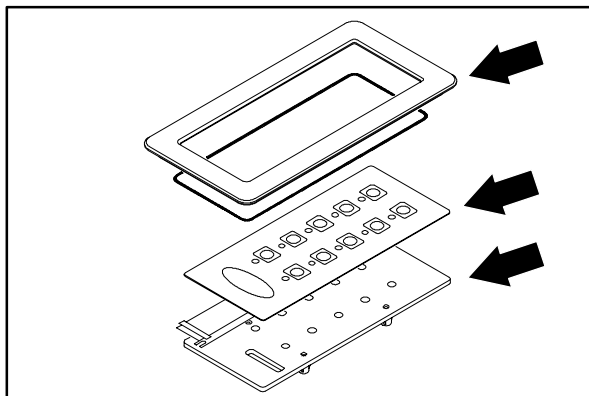
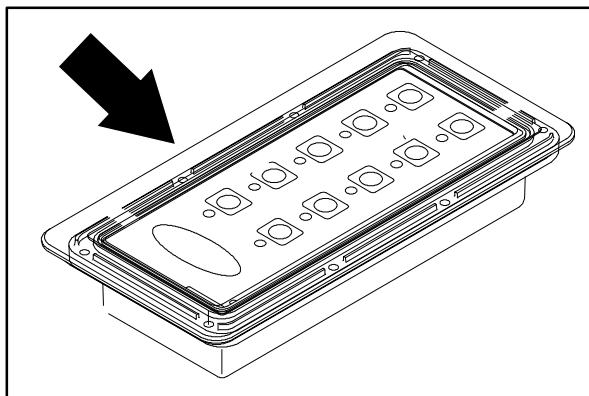
1. Position the circuit board over the touch panel. Feed the flat connector from the panel through the slot in the board. Plug the flat connector in and reconnect the ground strap.
2. Reinstall the eight pan head screws and lightly hand tighten.
3. Turn the circuit board assembly over and place it back in the case box.
4. Reinstall the four smaller pan head screws in the center of the case box.
5. Reinstall the touch panel case to the outer case.
6. Reinstall the twelve pan head screws and lightly hand tighten.
7. The instrument panel is now ready to reinstall on the machine. See TO REPLACE MAIN INSTRUMENT PANEL instructions.



TO DISASSEMBLE AUXILIARY INSTRUMENT PANEL

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

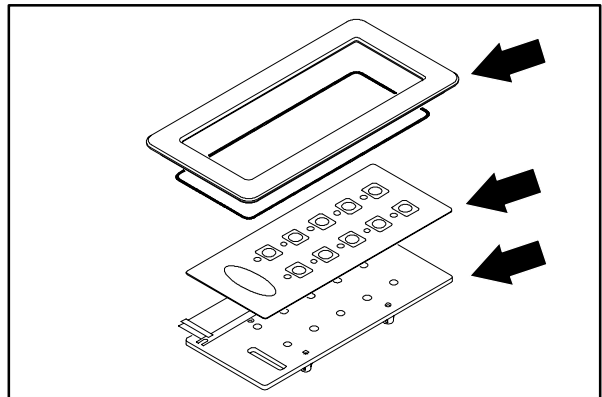
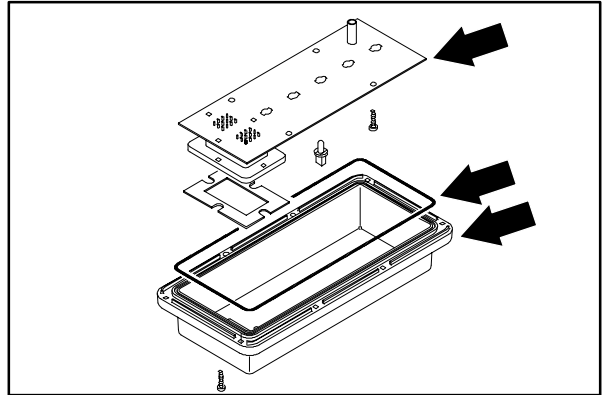
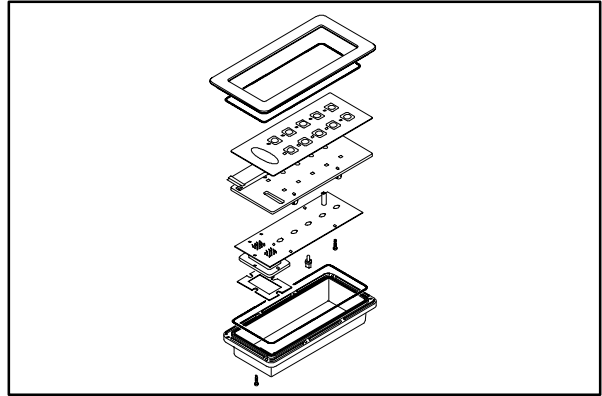
1. Remove the auxiliary instrument panel from the machine. See TO REPLACE AUXILIARY INSTRUMENT PANEL instructions.
2. Place the auxiliary instrument panel face down and remove the eight pan head screws holding it together.
3. The auxiliary instrument panel cases can now be separated.
4. Remove the four smaller pan head screws to completely disassemble touch panel case.
5. Remove the case box from the circuit board and touch panel assembly.
6. The o-ring and connector gaskets can now be replaced in the case box if necessary.
7. Remove the four pan head screws and unplug the flat connector and ground strap to remove the touch panel from the circuit board.
8. Any burned-out lamps can now be changed by turning them 1/4 turn counterclockwise and lifting them out.
9. To replace the hour meter, unplug the two wires and remove the two pan head screws.



TO REASSEMBLE AUXILIARY INSTRUMENT PANEL

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

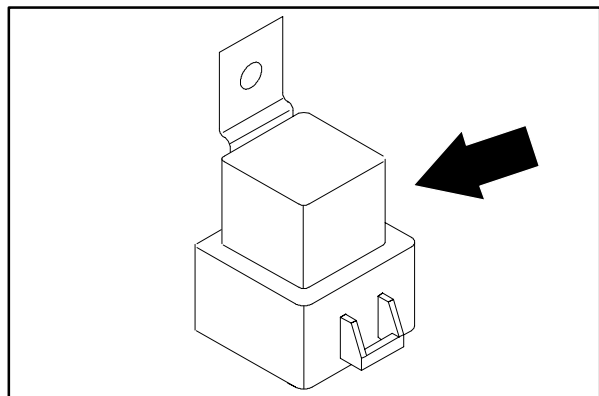
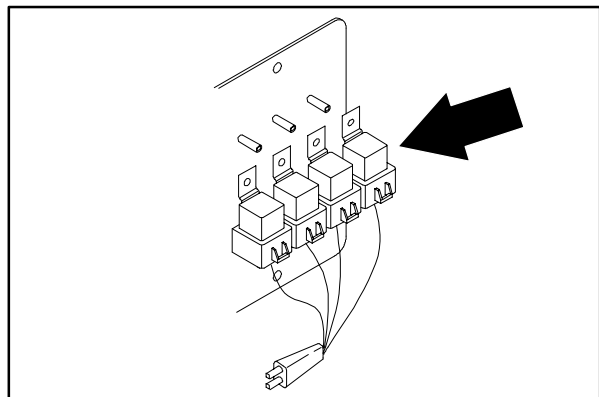
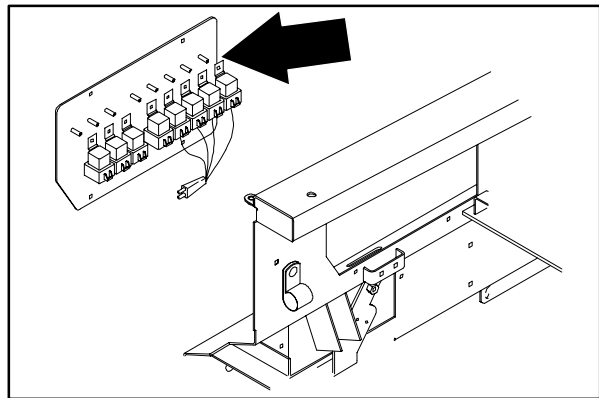
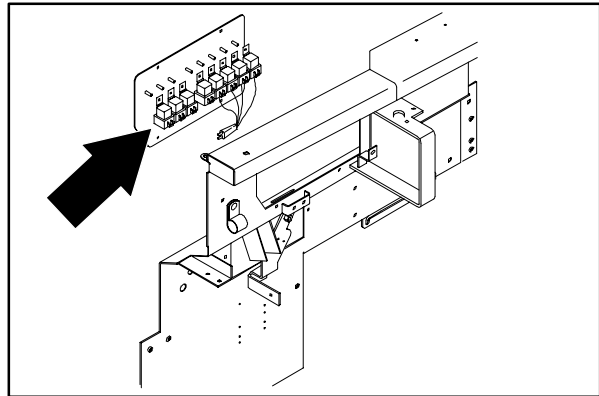
1. Position the circuit board over the touch panel. Feed the flat connector from the panel through the slot in the board. Plug the flat connector in and reconnect the ground strap.
2. Reinstall the four pan head screws and lightly hand tighten.
3. Turn the circuit board assembly over and place it back in the case box.
4. Reinstall the four smaller pan head screws in the center of the case box.
5. Reinstall the touch panel case to the outer case.
6. Reinstall the eight pan head screws and lightly hand tighten.
7. The instrument panel is now ready to reinstall on the machine. See TO REPLACE AUXILIARY INSTRUMENT PANEL instructions.



TO REPLACE MACHINE RELAY IN ENGINE COMPARTMENT

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

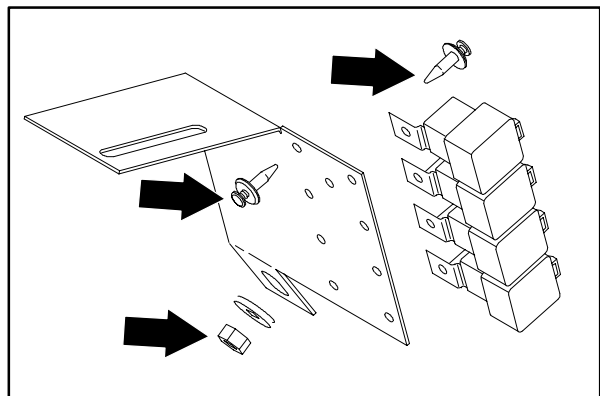
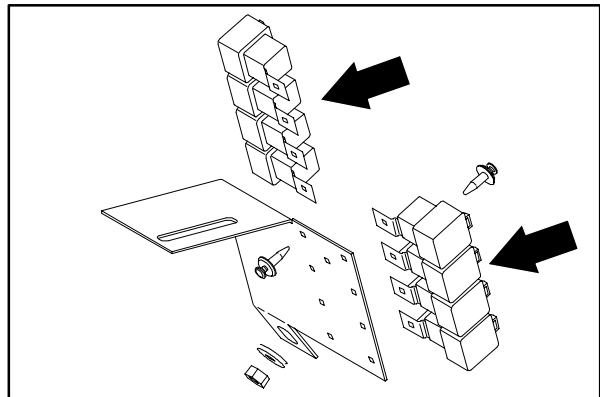
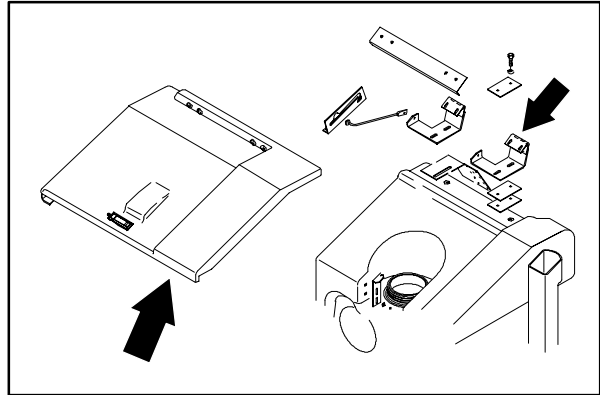
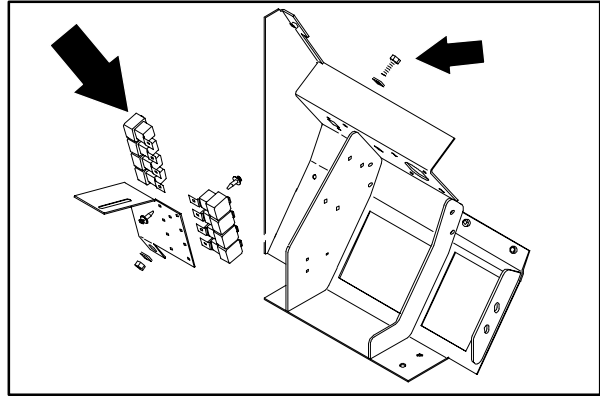
1. Disconnect the battery cables from the machine.
2. Open the engine cover and side door.
3. Locate the problem relay on the back side of the operators compartment.
4. If the machine is a G/LP; the governor control box may need to be removed if the problem relay is one of the five relays located behind it. See TO REPLACE GOVERNOR CONTROL BOX instructions.
5. Remove the M6 nyloc nut from the top of the problem relay. Pull the relay off the stud.
6. Disconnect the relay from the main electrical harness. Discard the relay.
7. Plug the new relay in the electrical harness.
8. Position the new relay on the stud. Reinstall the M6 nyloc nut and firmly hand tighten.
9. Reinstall the governor box if it was removed earlier. See TO REPLACE GOVERNOR CONTROL BOX instructions.
10. Reconnect the battery cables and operate the machine. Check for proper operation.



TO REPLACE MACHINE RELAY BEHIND RECOVERY TANK

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

1. Disconnect the battery cables from the machine.
2. Open the recovery tank cover.
3. Remove the four hex screws holding the recovery tank cover and hinges to the recovery tank.
4. Go in the operators compartment and remove the M6 hex screw holding the bottom of the relay mount bracket to the dash panel.
5. Carefully pull the relay mount bracket up from behind the recovery tank.
6. Locate the problem relay on the mount bracket.
7. Remove the black plastic rivet.
8. Disconnect the relay from the main electrical harness. Discard the relay.
9. Plug the new relay in the electrical harness.
10. Reinstall the new relay on the relay mount bracket.
11. Position the relay mount bracket back down behind the recovery tank.
12. Go in the operators compartment and reinstall the M6 hex screw that holds the bottom of the relay mount bracket to the dash panel. Leave loose for now.
13. Reinstall the recovery tank cover and hinges to the recovery tank. Firmly tighten all the hardware. Lower the recovery tank cover.
14. Reconnect the battery cables and operate the machine. Check for proper operation.



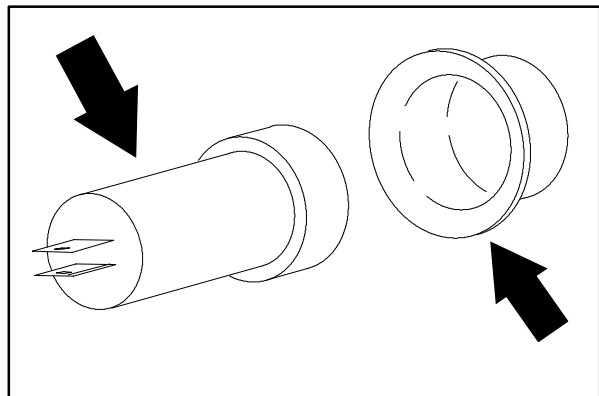
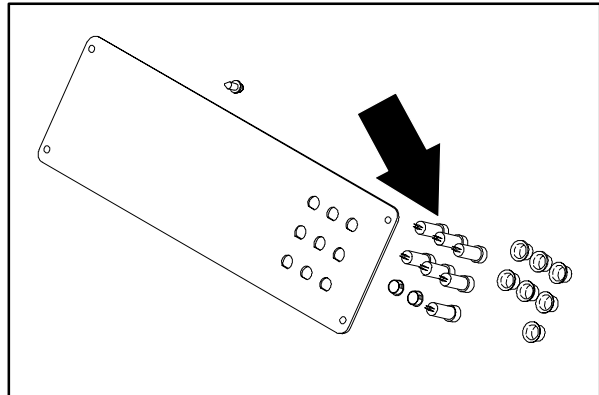
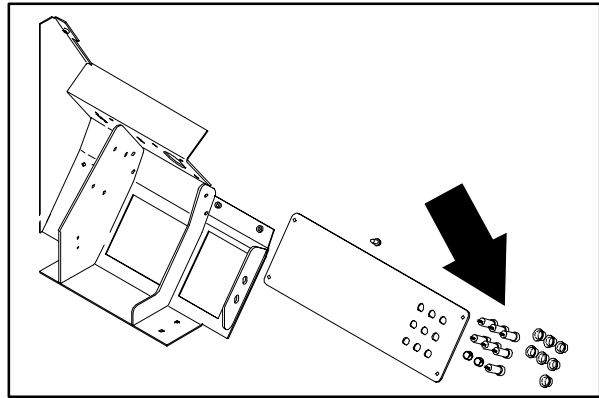
TO REPLACE MACHINE CIRCUIT BREAKER

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

1. Disconnect the battery cables from the machine.
2. Go in the operators compartment and remove the four black plastic rivets holding the circuit breaker mount bracket to the dash panel. Retain the rivets.
3. Pull the circuit breaker mount bracket back to expose the circuit breakers.
4. Locate the problem circuit breaker and disconnect it from the main electrical harness.
5. Remove and retain the rubber boot from the front of the circuit breaker.
6. Remove and discard the metal retaining ring from the back of the circuit breaker.
7. Push the old circuit breaker out of the mount panel. Discard the circuit breaker.
8. Position the new circuit breaker in the mount panel.

NOTE: The hole in the mount panel is "D" shaped. Make sure to install the new circuit breaker in the correct orientation.

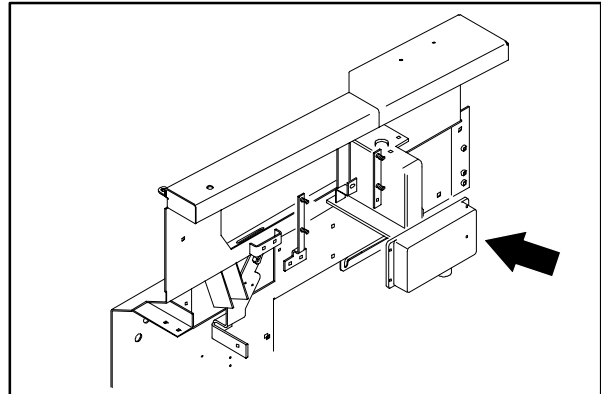
9. Install the new retaining ring on the new circuit breaker. Push the retaining ring all the way down the circuit breaker.
10. Reconnect the circuit breaker to the main electrical harness. See schematic in the ELECTRICAL section.
11. Reinstall the rubber boot on the front of the new circuit breaker.
12. Position the circuit breaker mount panel to the dash panel. Reinstall the four plastic rivets.
13. Reconnect the battery cables and operate the machine. Check for proper operation.



TO REPLACE GOVERNOR CONTROL BOX (G/ LP ONLY)

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

1. Disconnect the battery cables from the machine.
2. Open the engine cover and side door.
3. Locate the governor control box on the back side of the operators compartment.
4. Remove the four nuts holding the control box to the mount brackets.
5. Pull the control box back off the studs and disconnect it from the main electrical harness. Remove the control box from the machine.

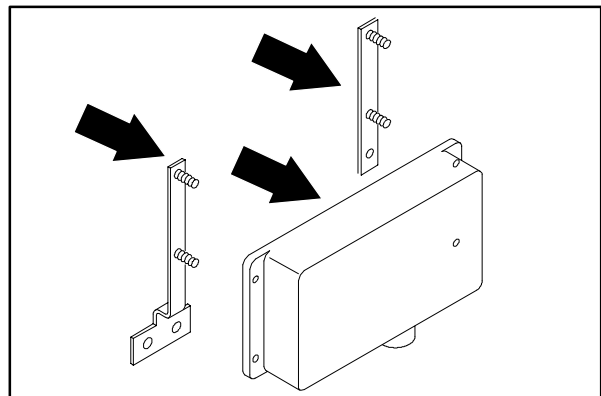


NOTE: You may have to cut a few plastic ties holding the harness from the control box to the main harness.

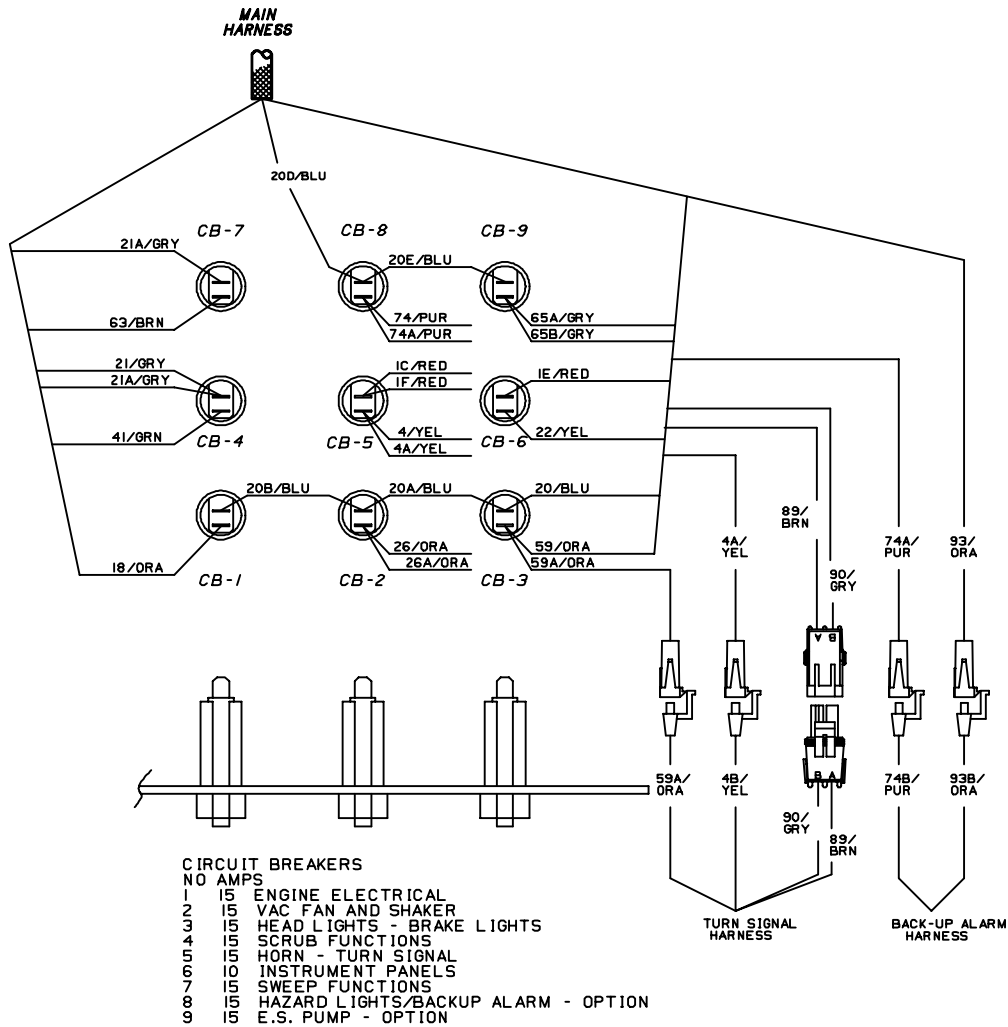
6. Position the new control box in the engine compartment.
7. Connect the new control box to the main electrical harness. See schematic in the ELECTRICAL section.
8. Position the control box on the studs and reinstall the four nuts. Lightly hand tighten.

NOTE: Reinstall any plastic ties that were removed earlier.

9. Reconnect the battery cables and operate the machine. Check for proper operation.

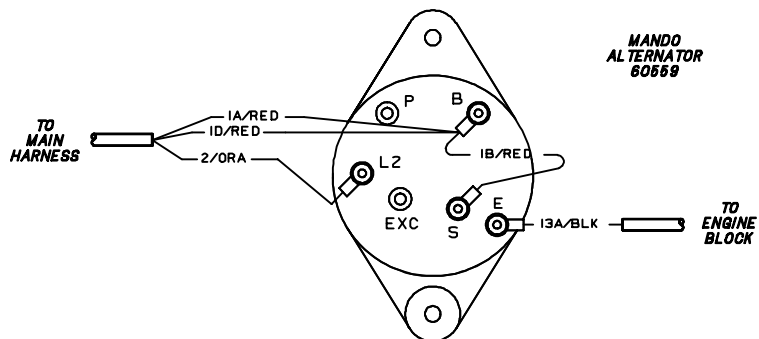


Wire Harness Group

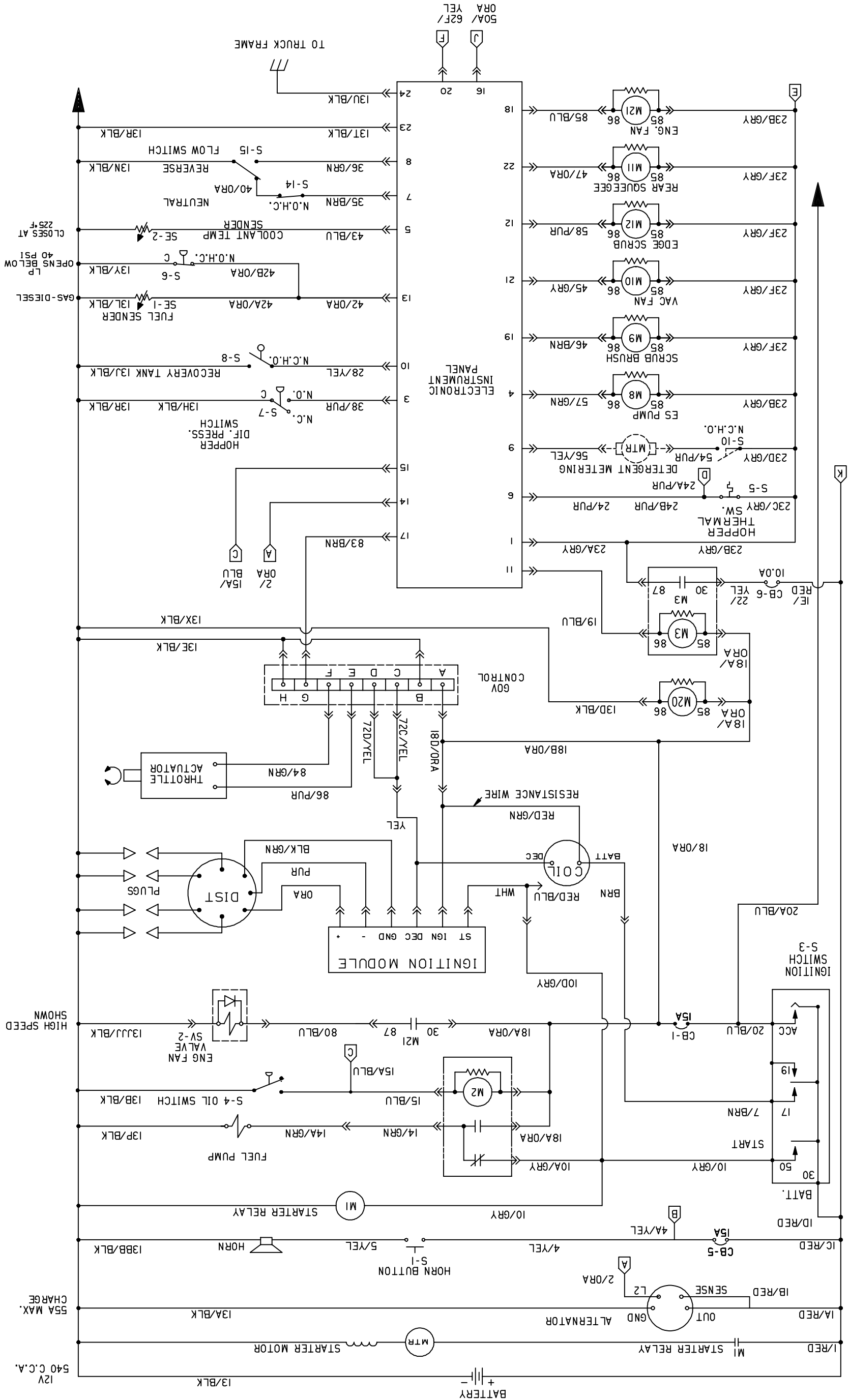


CONNECTOR WIRING

SOC. NO.	CONN. A.	CONN. B.
1	23A/GRY	23K/GRY
2	PLUG	31/YEL
3	38/PUR	34/GRN
4	57/GRN	37/BRN
5	43/BLU	51/PUR
6	24/PUR	52/YEL
7	35/BRN	PLUG
8	36/GRN	PLUG
9	56/YEL	PLUG
10	28/YEL	PLUG
11	19/BLU	50B/ORA
12	58/PUR	33/BLU
13	42/ORA	53/BRN
14	2/ORA	49A/BLU
15	15A/BLU	PLUG
16	50A/ORA	62G/YEL
17	83/BRN	PLUG
18	85/BLU	PLUG
19	46/BRN	75/BRN
20	62F/YEL	60/GRN
21	45/GRY	25/BRN
22	47/ORA	29/GRN
23	13T/BLK	13TT/BLK
24	13U/BLK	13UU/BLK

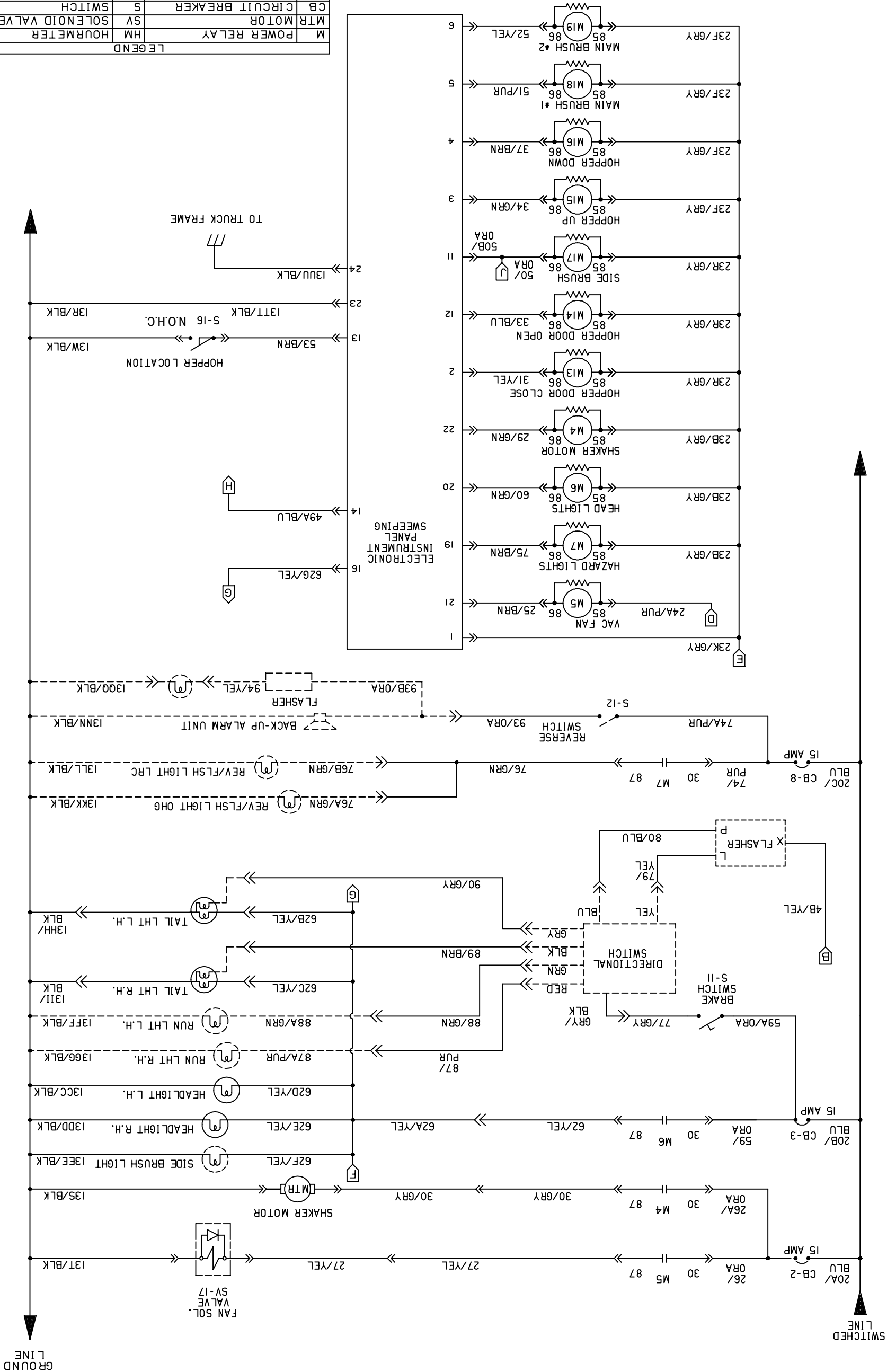


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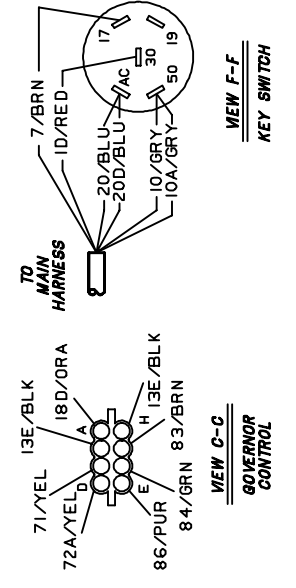
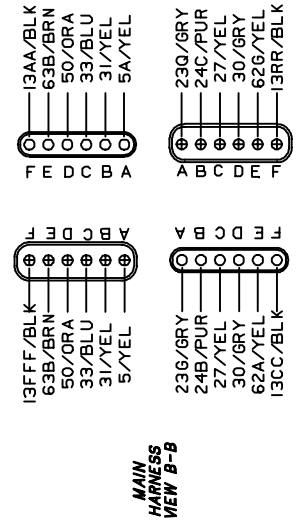
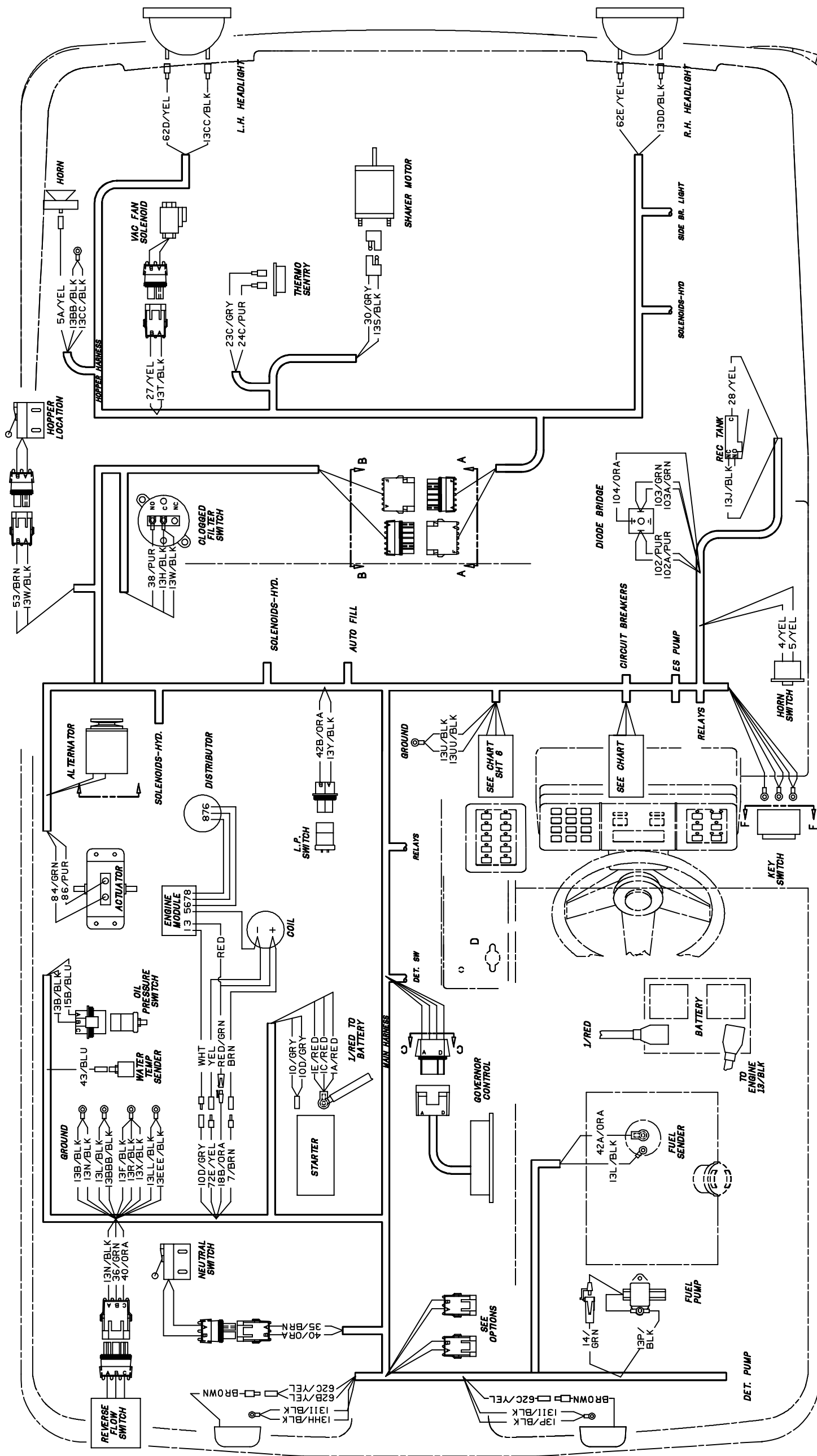


ELECTRICAL SCHEMATIC

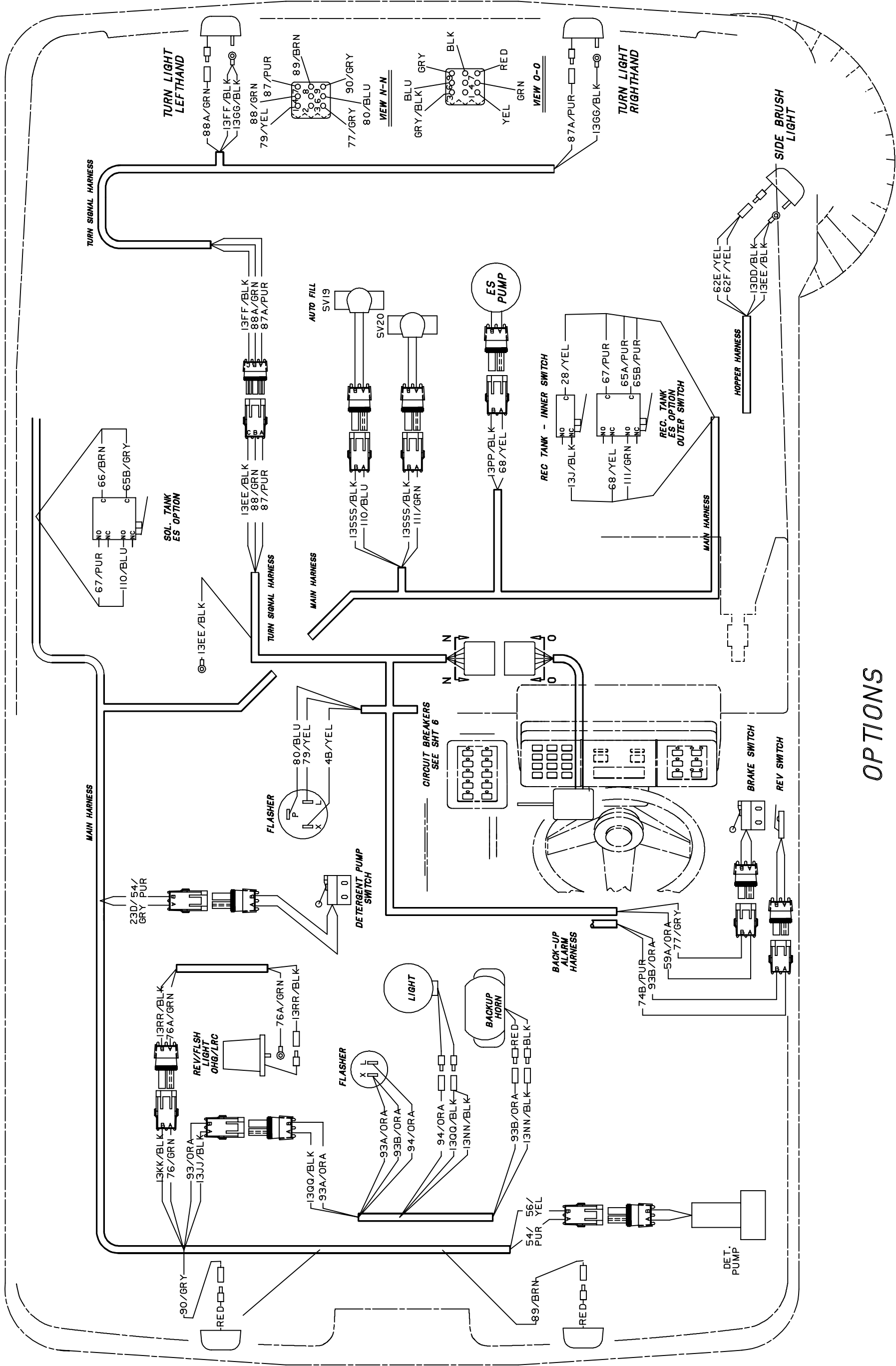
M	POWER RELAY	HM	HOURMETER
CB	CIRCUIT BREAKER	SV	SOLENOID VALVE
PM	PERMANENT MAGNET	S	SWITCH
J	JACK-FEM. SOCKET	ACC	ACCESSORY
P	PLUG-MALE PIN	GND	GROUND CHASSIS
PB	PUSHBUTTON	C	COMMON
VM	VOLTMETER	N.O.	NORMALLY OPEN
FU	FUSE	N.C.	NORMALLY CLOSED



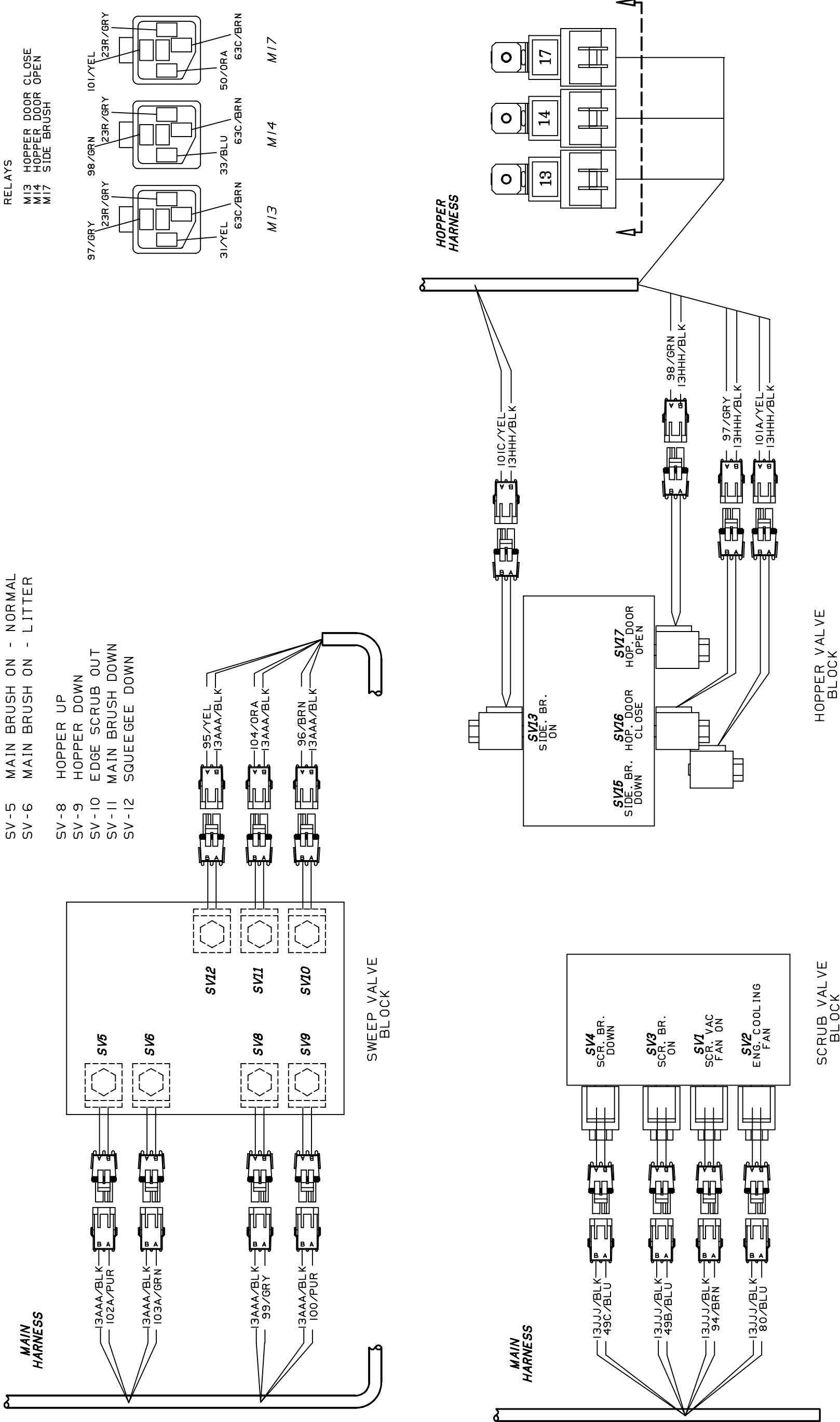
ELECTRICAL SCHEMATIC



Wire Harnesses Group



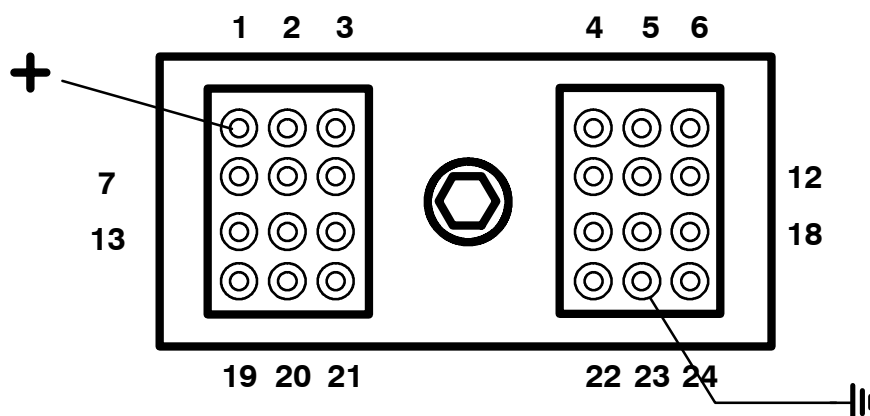
OPTIONS



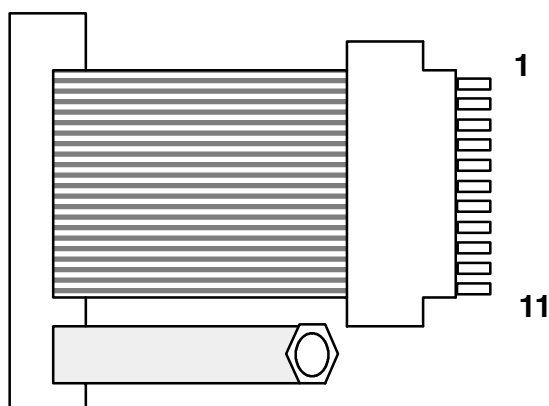
TROUBLESHOOTING

The troubleshooting charts that follow are organized so they lead you through the circuits. They include flow charts and instructions for you as to where to insert your test instruments.

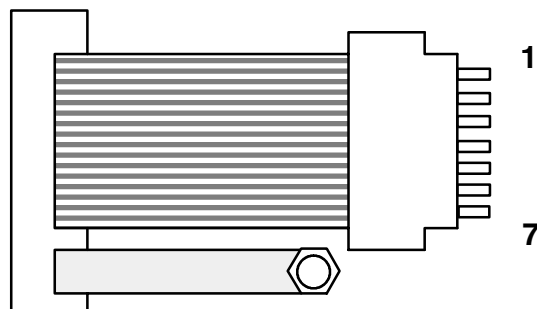
**CONTROL PANEL
PLUG 1**



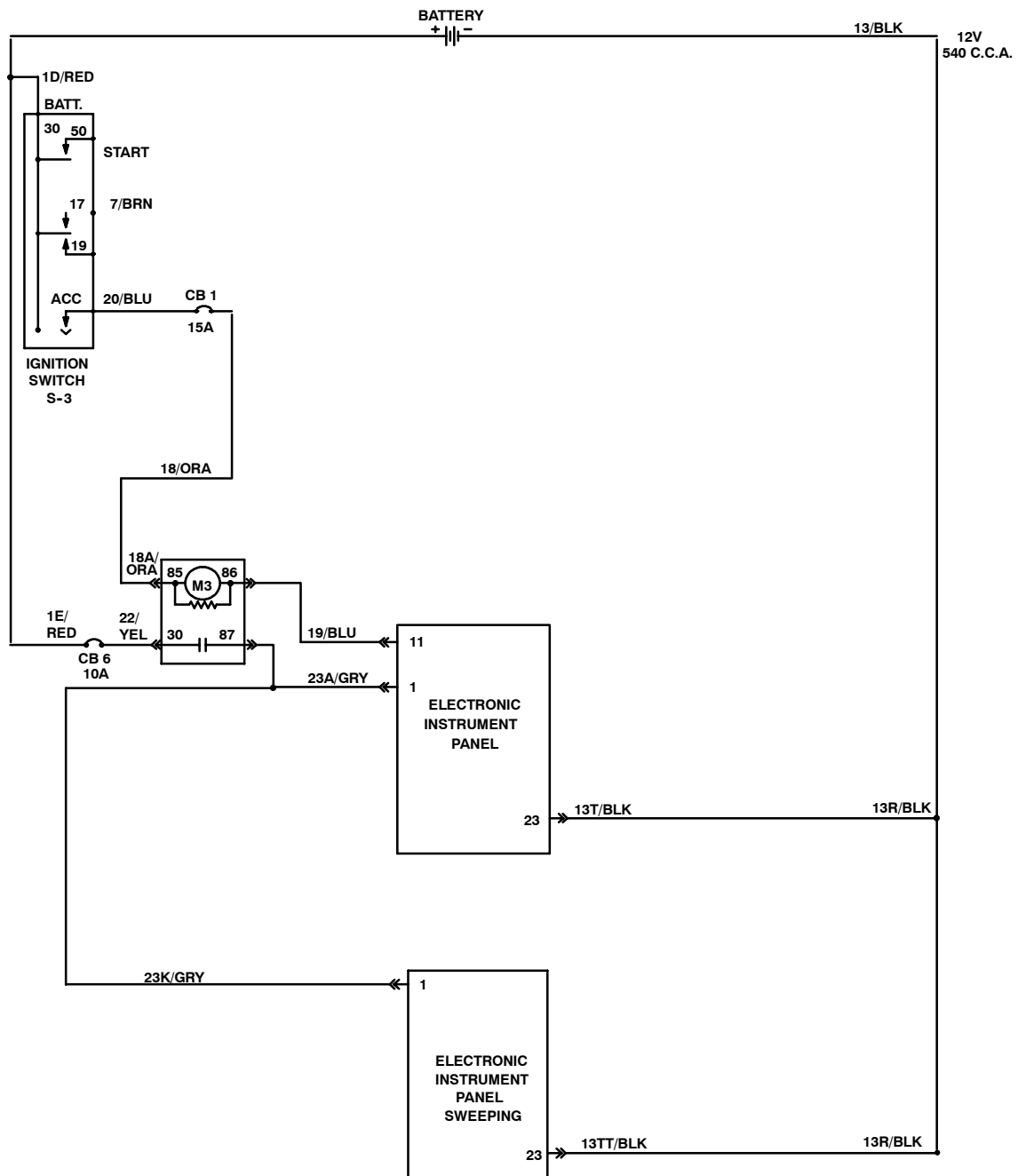
**SWEEP
TOUCH PANEL
PLUG 2**



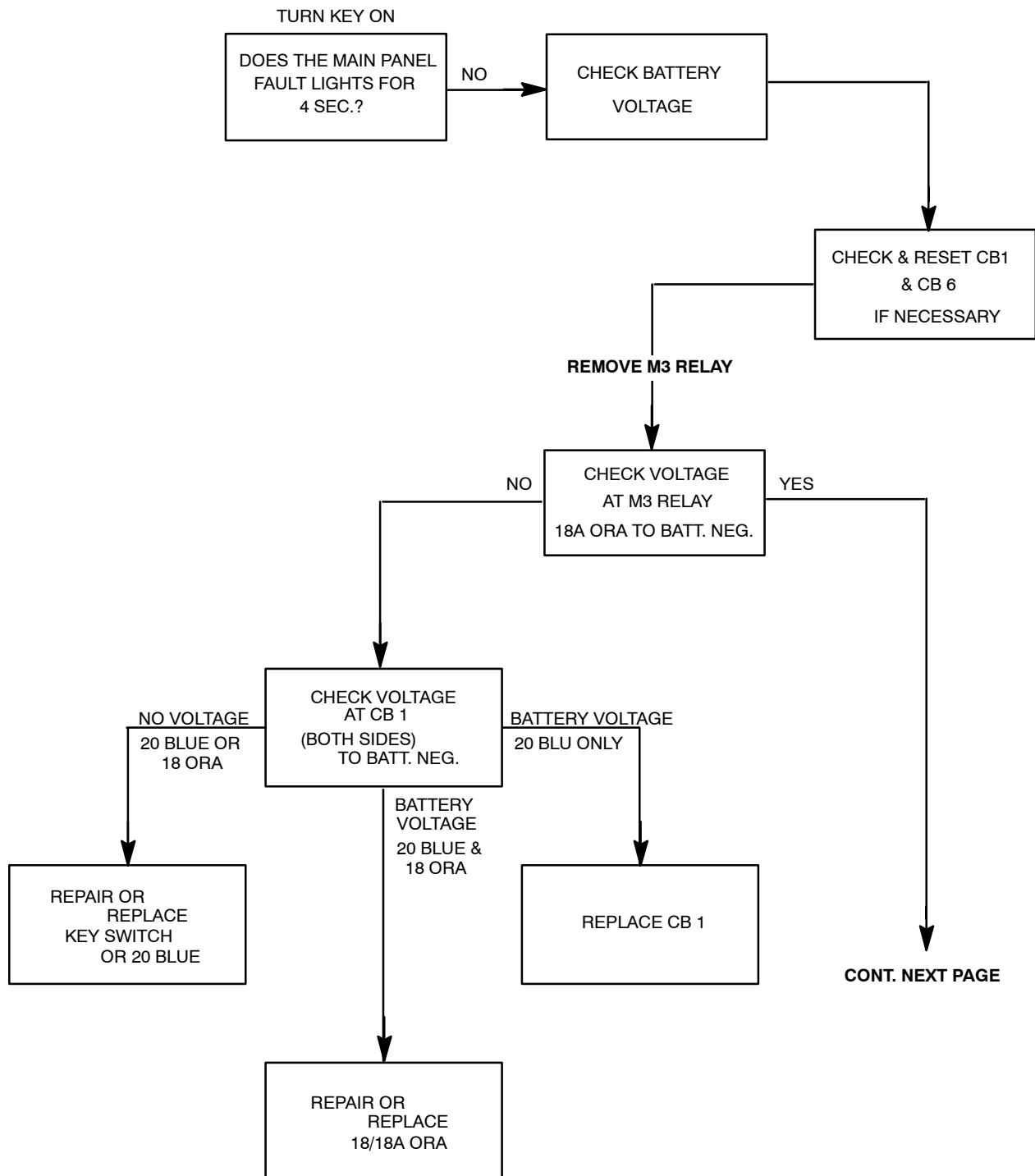
**SCRUB
TOUCH PANEL
PLUG 3**

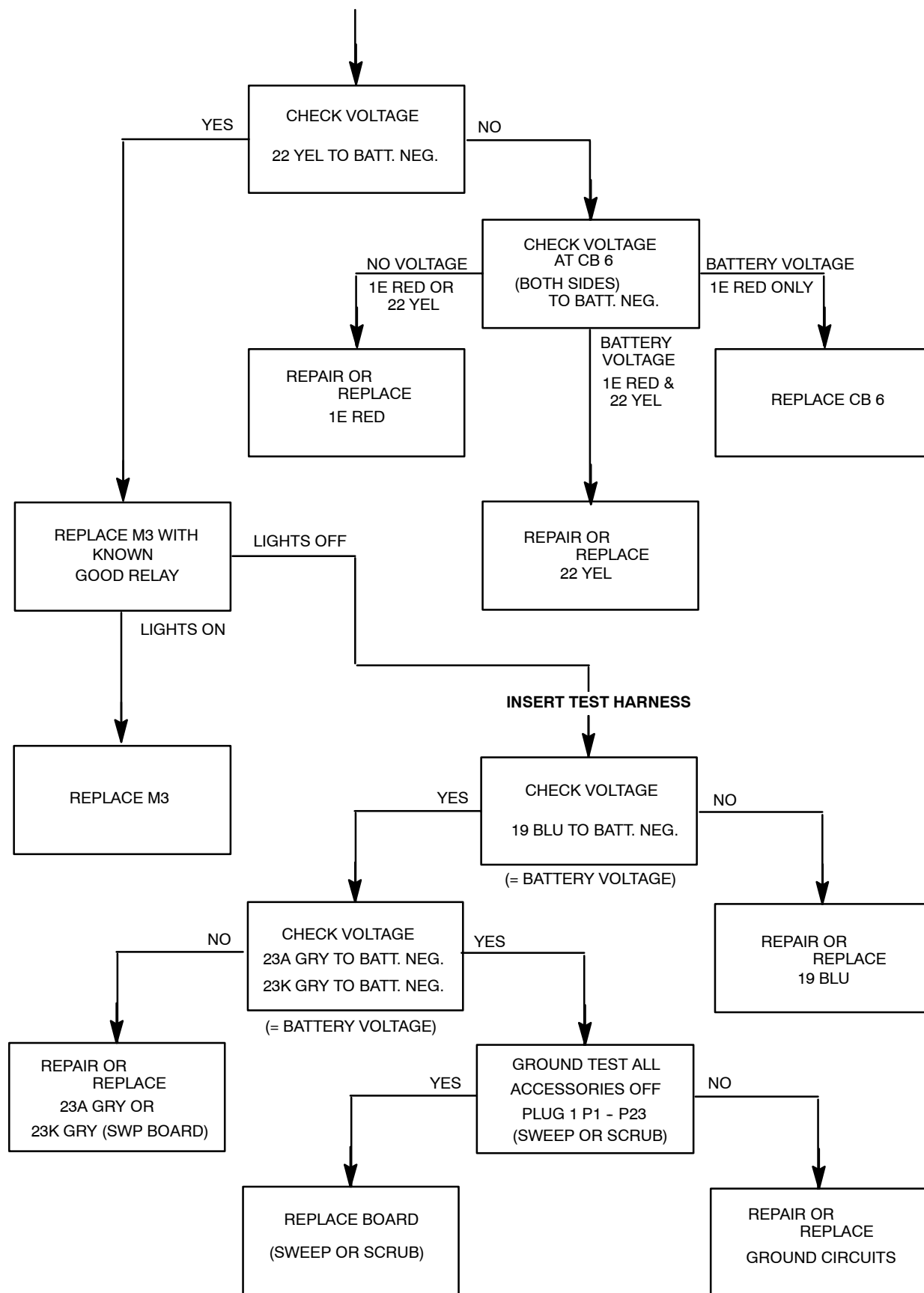


POWER UP CIRCUIT

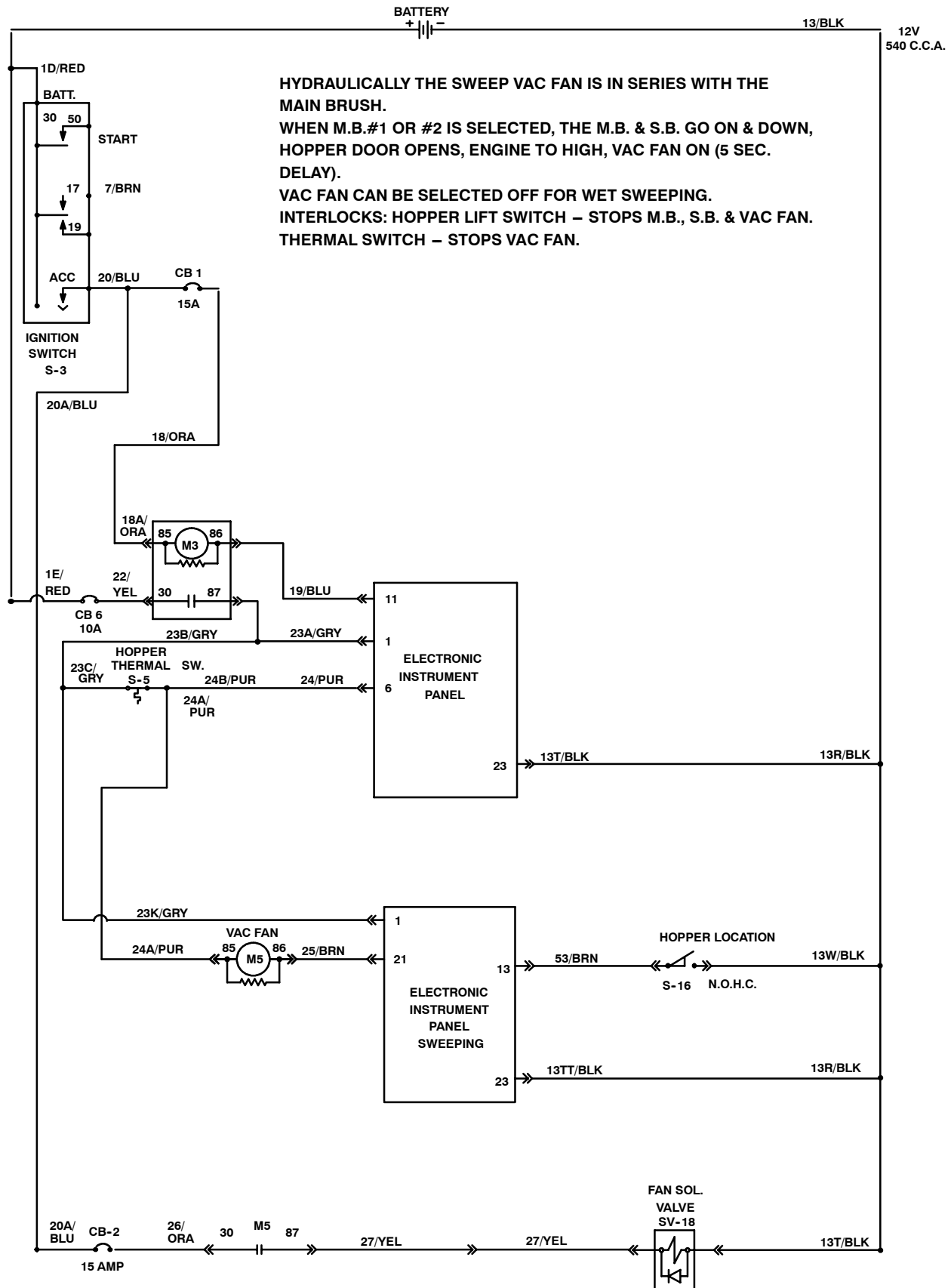


POWER UP TESTING

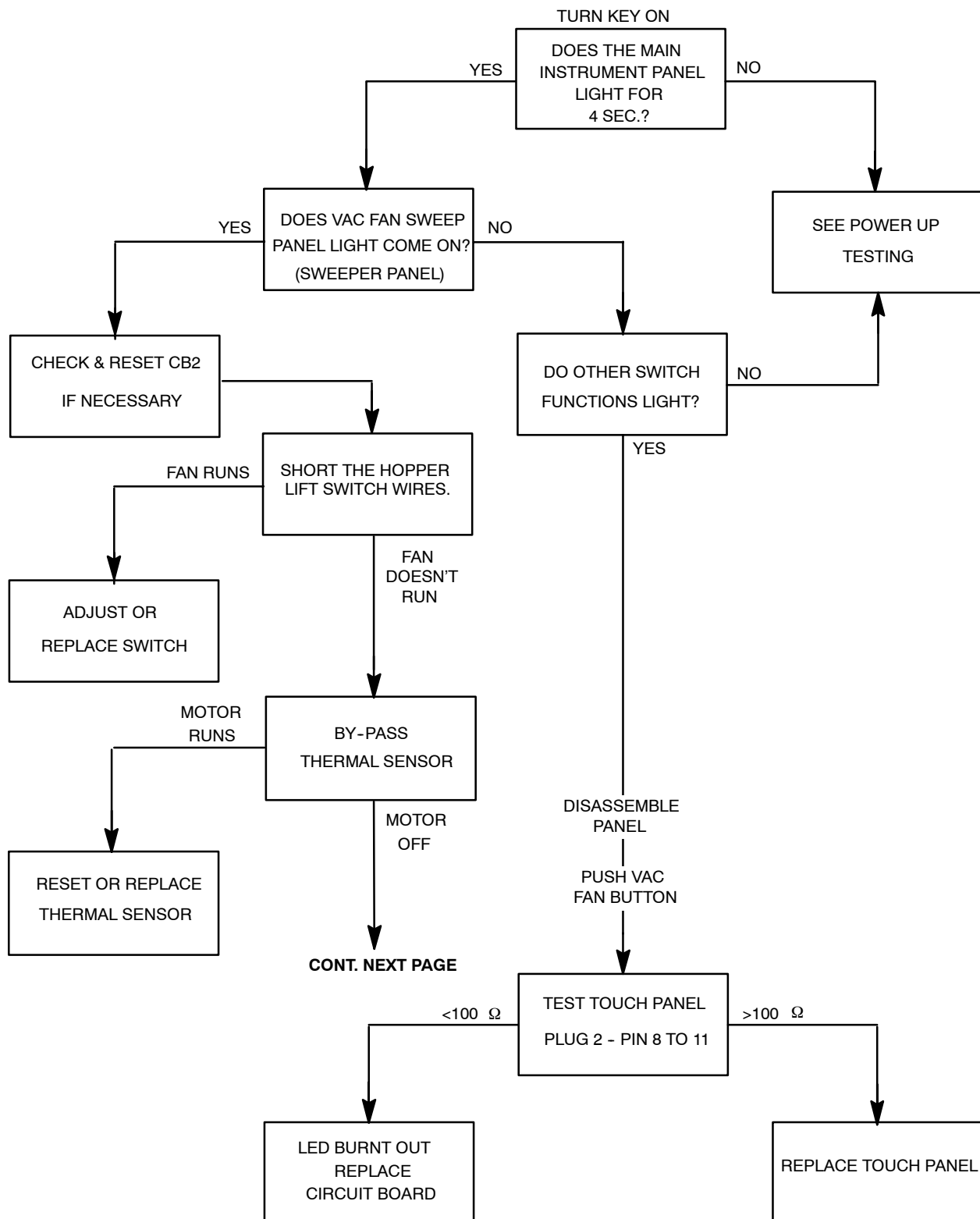


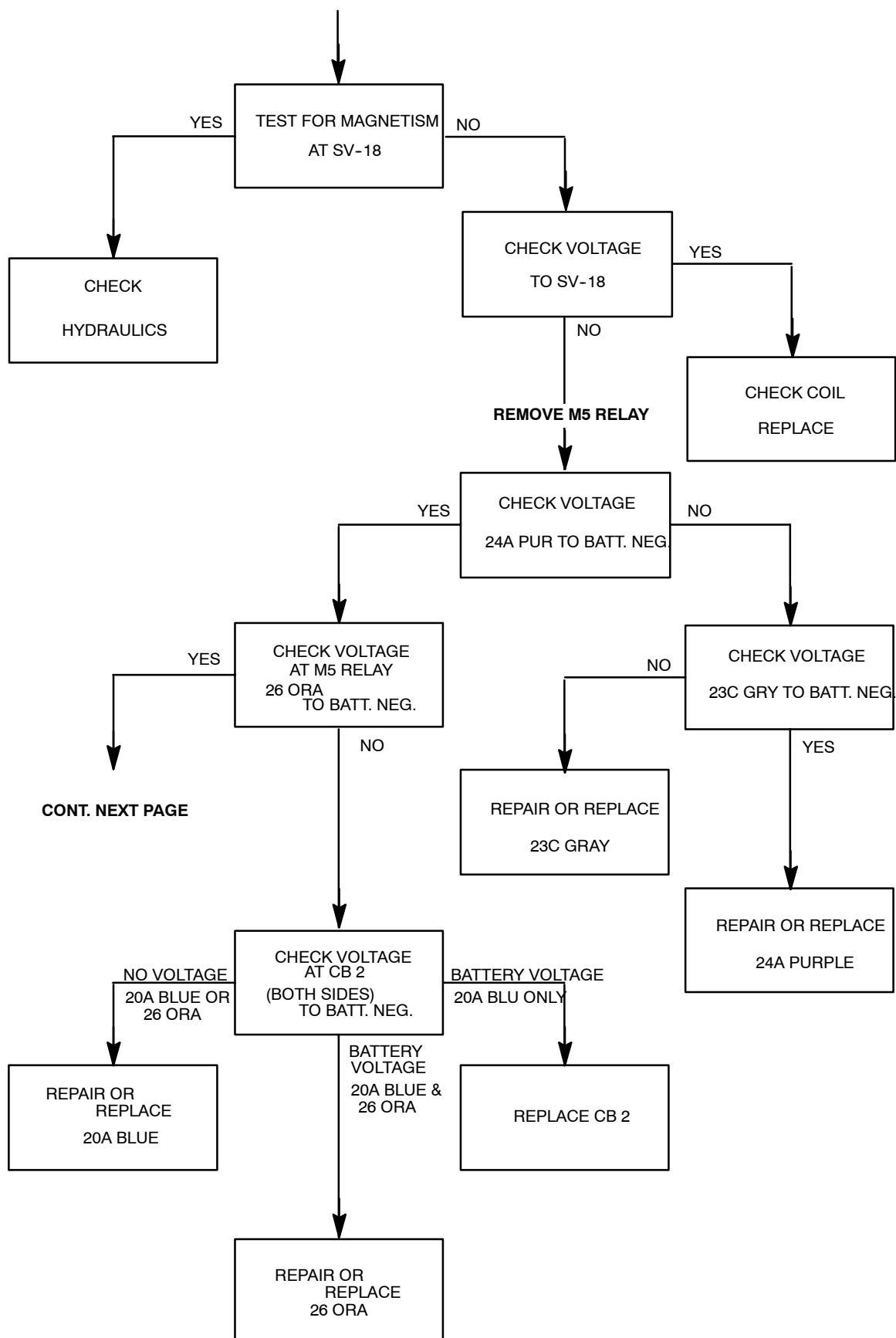


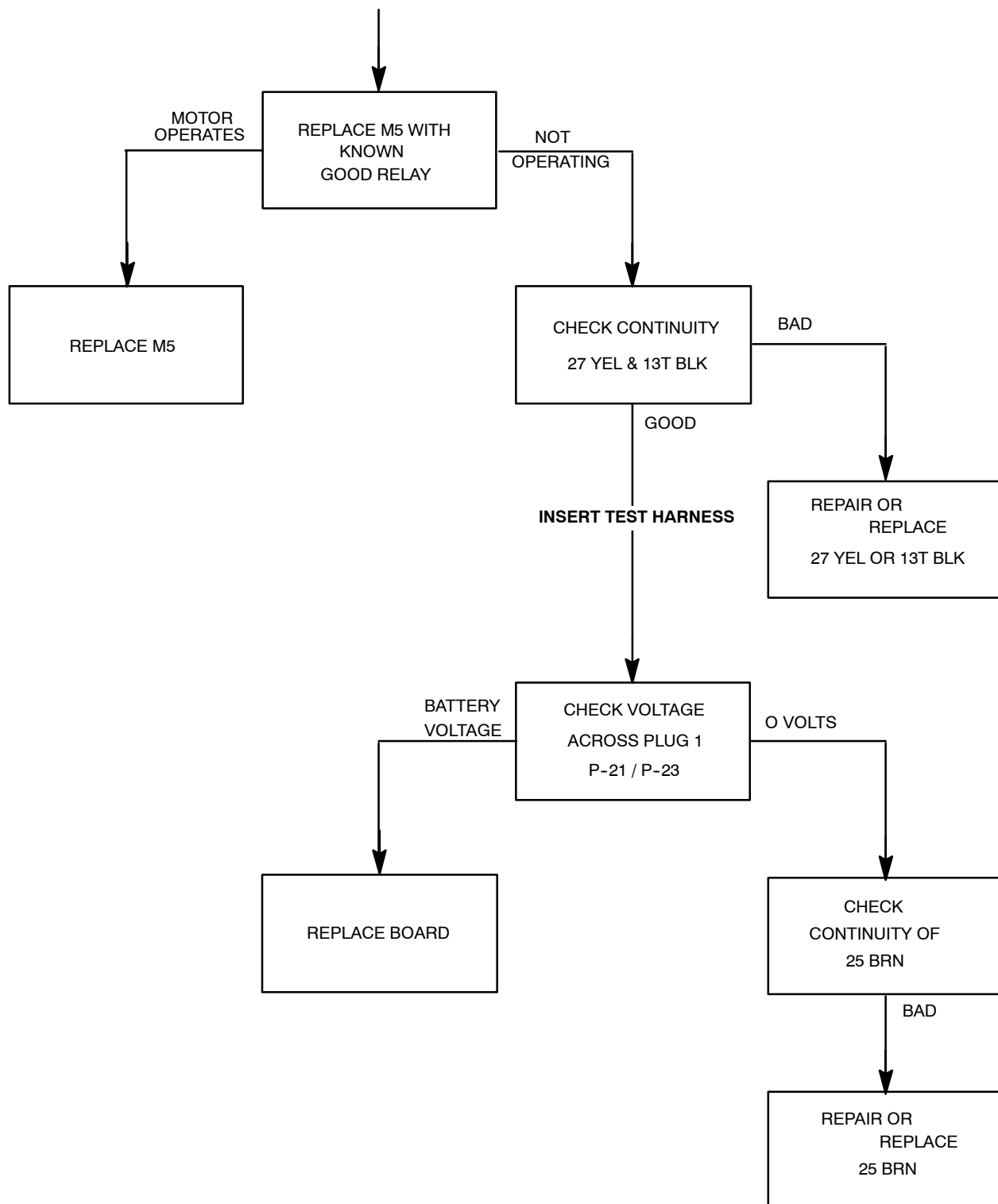
!!VAC FAN - SWEEP CIRCUIT



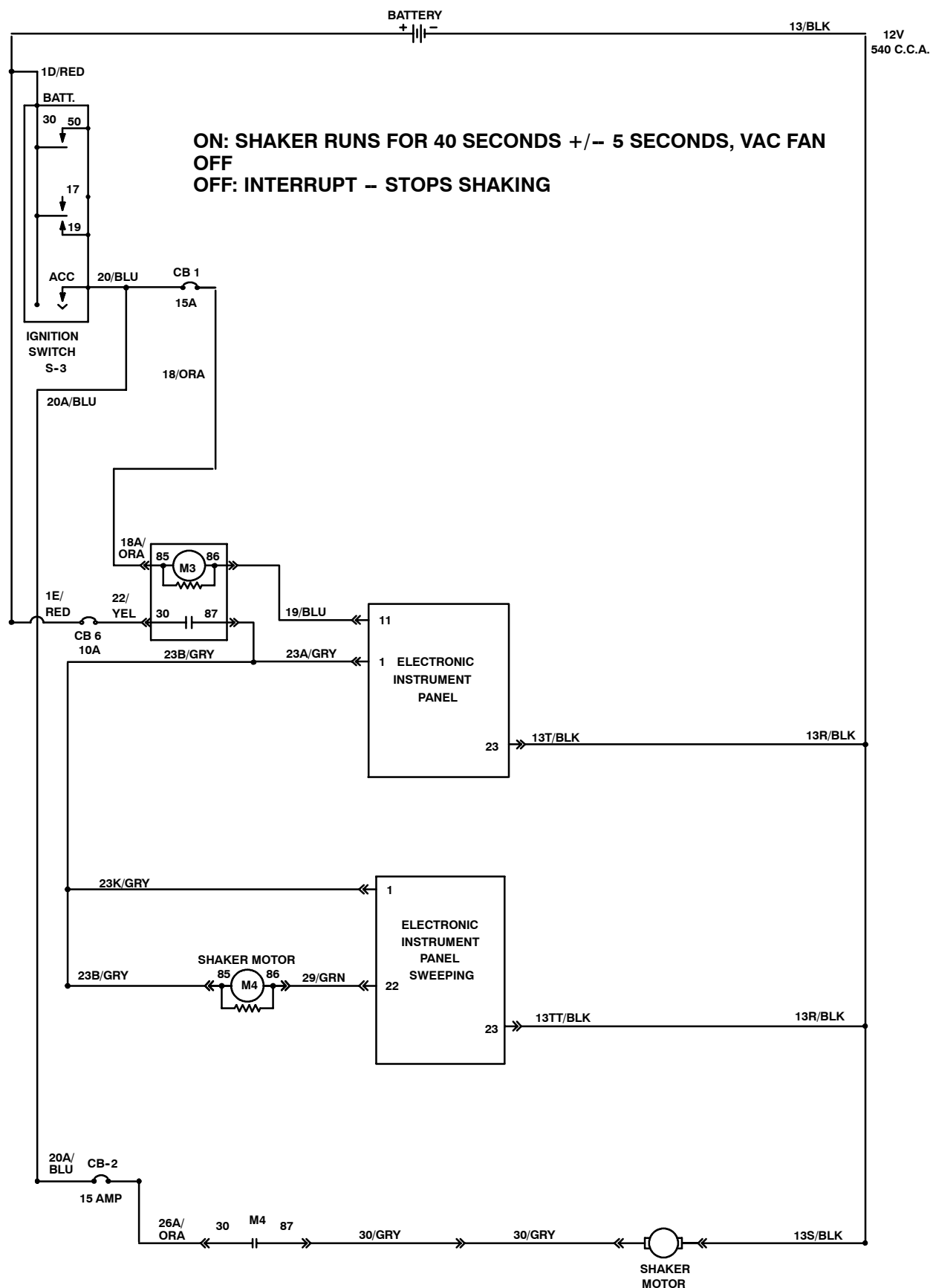
VACUUM FAN FAILURE



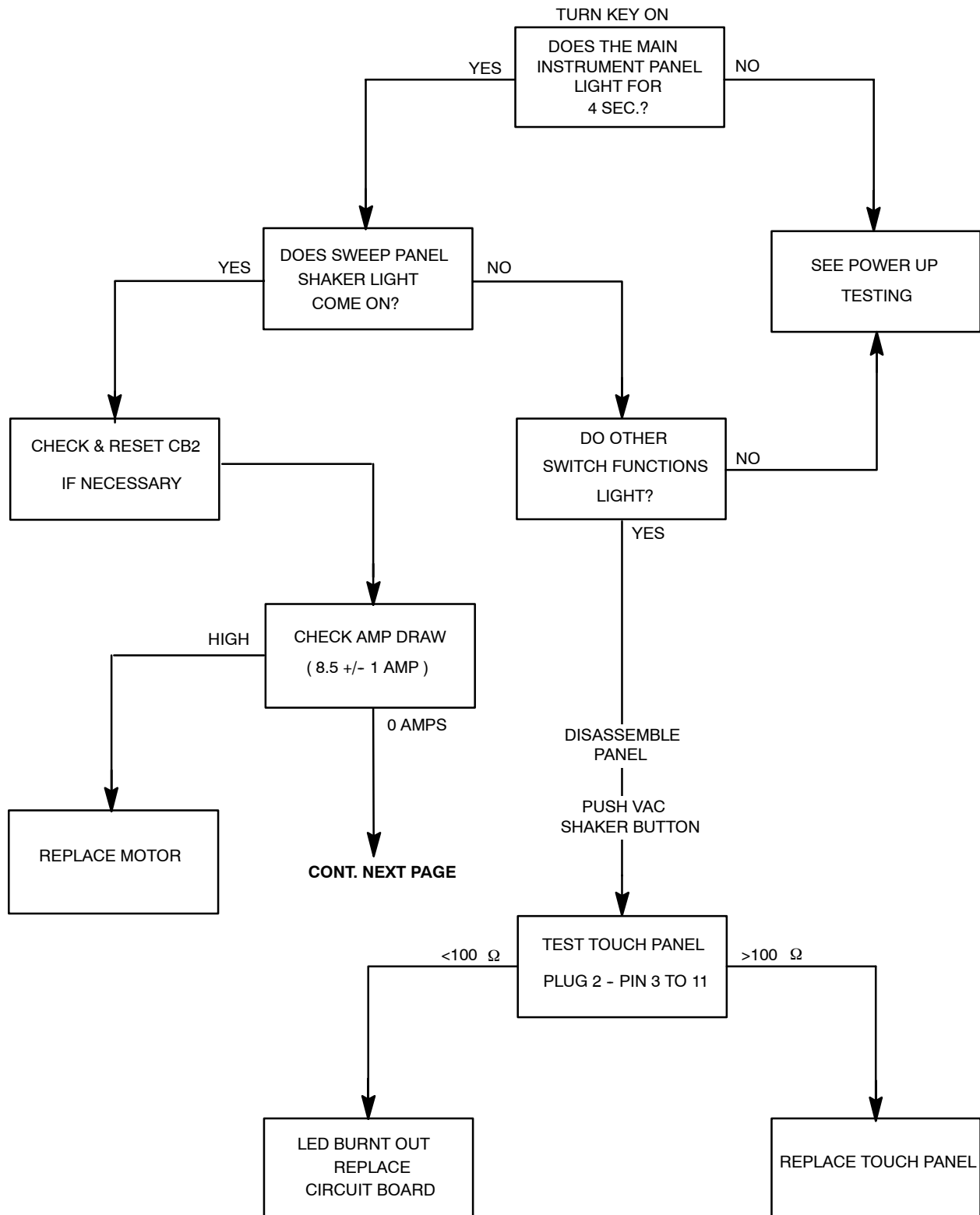


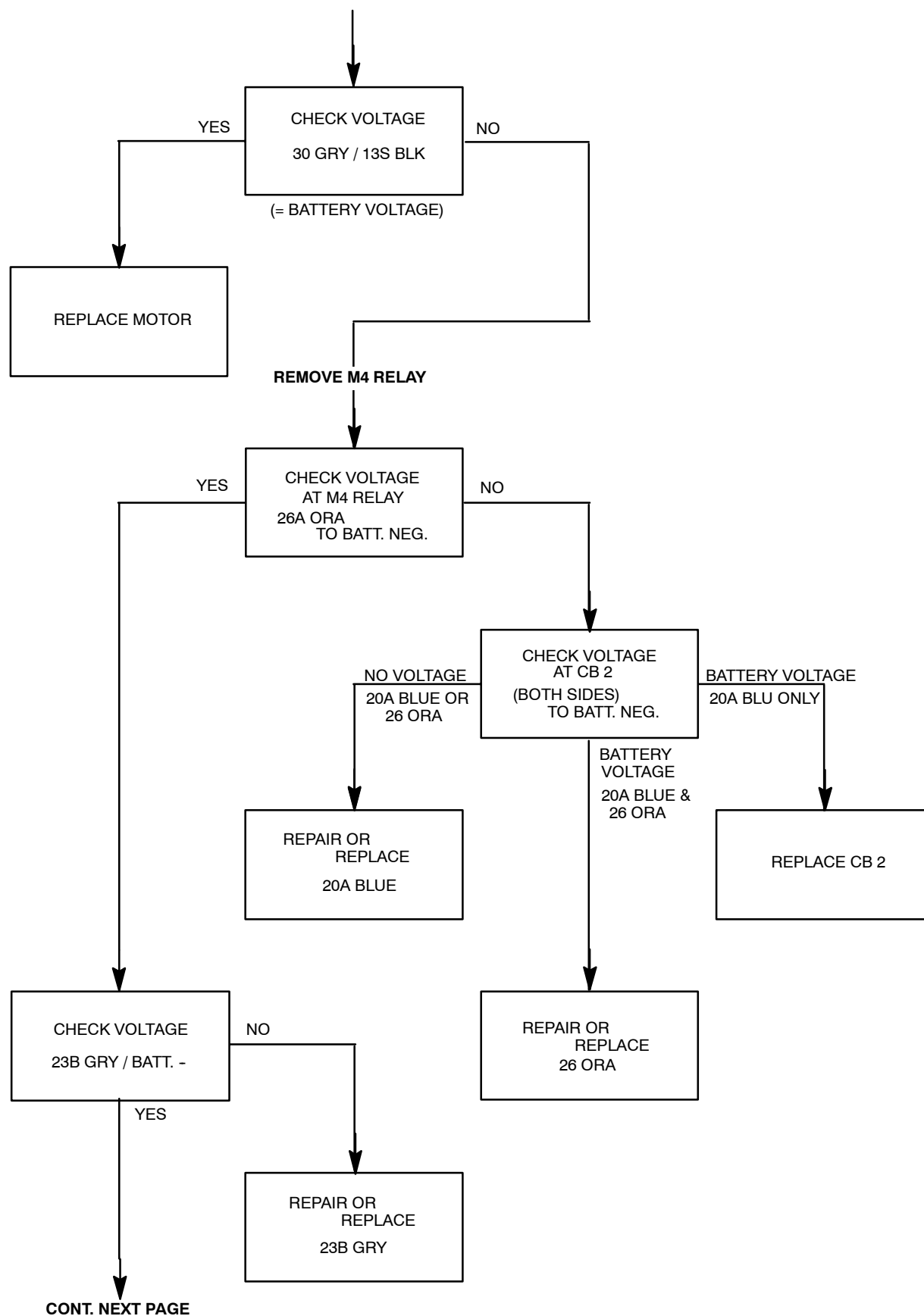


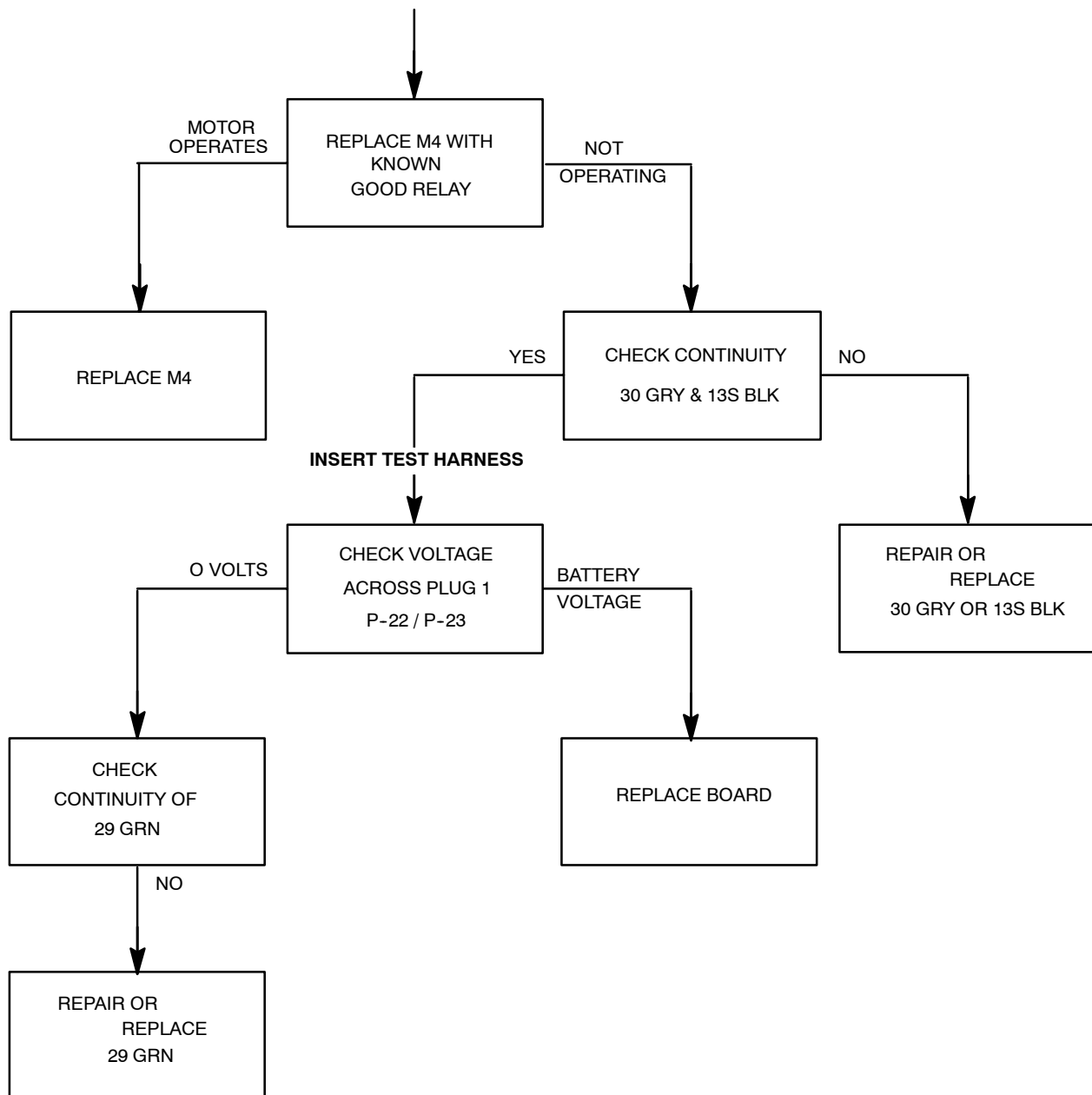
SHAKER CIRCUIT



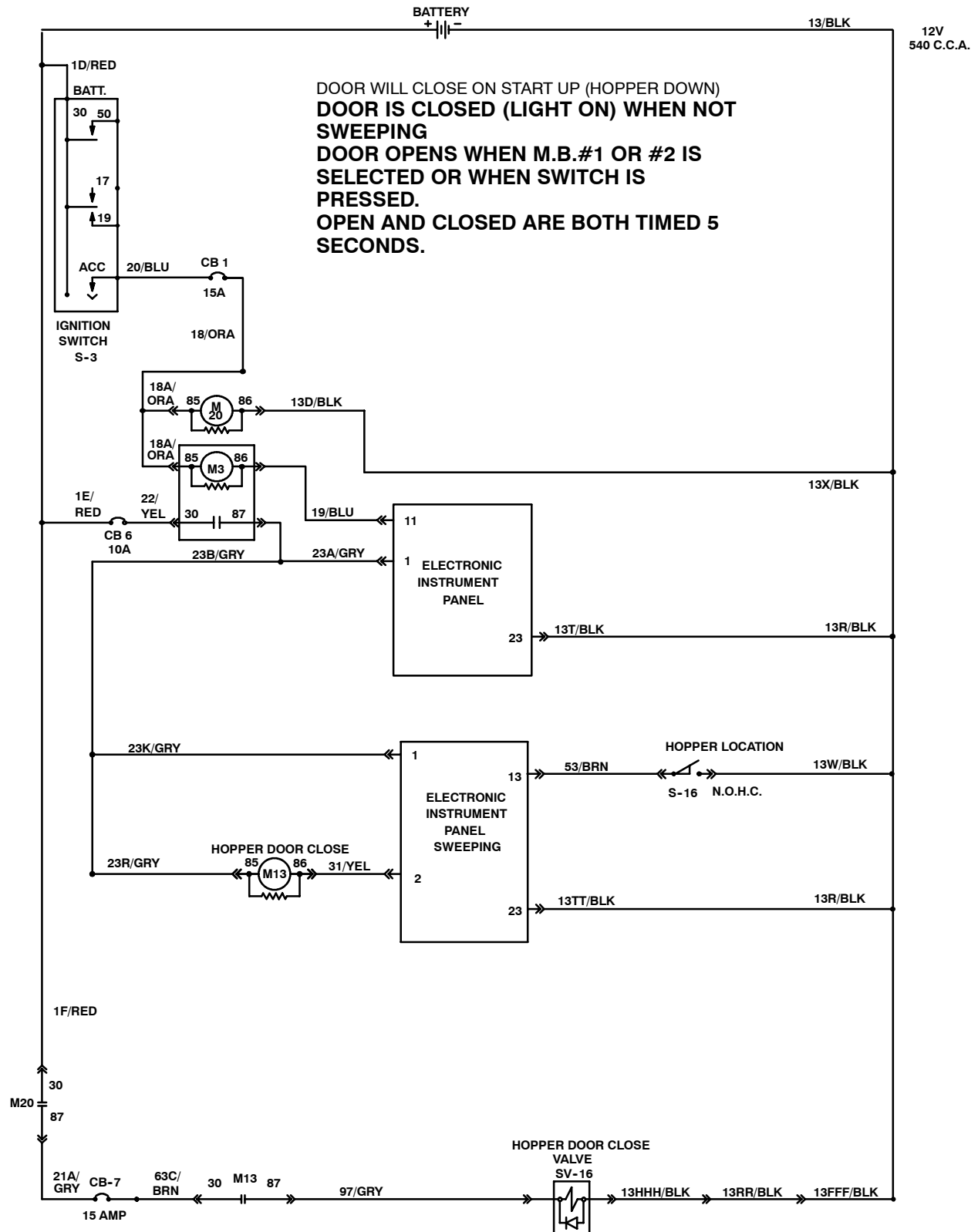
SHAKER FAILURE



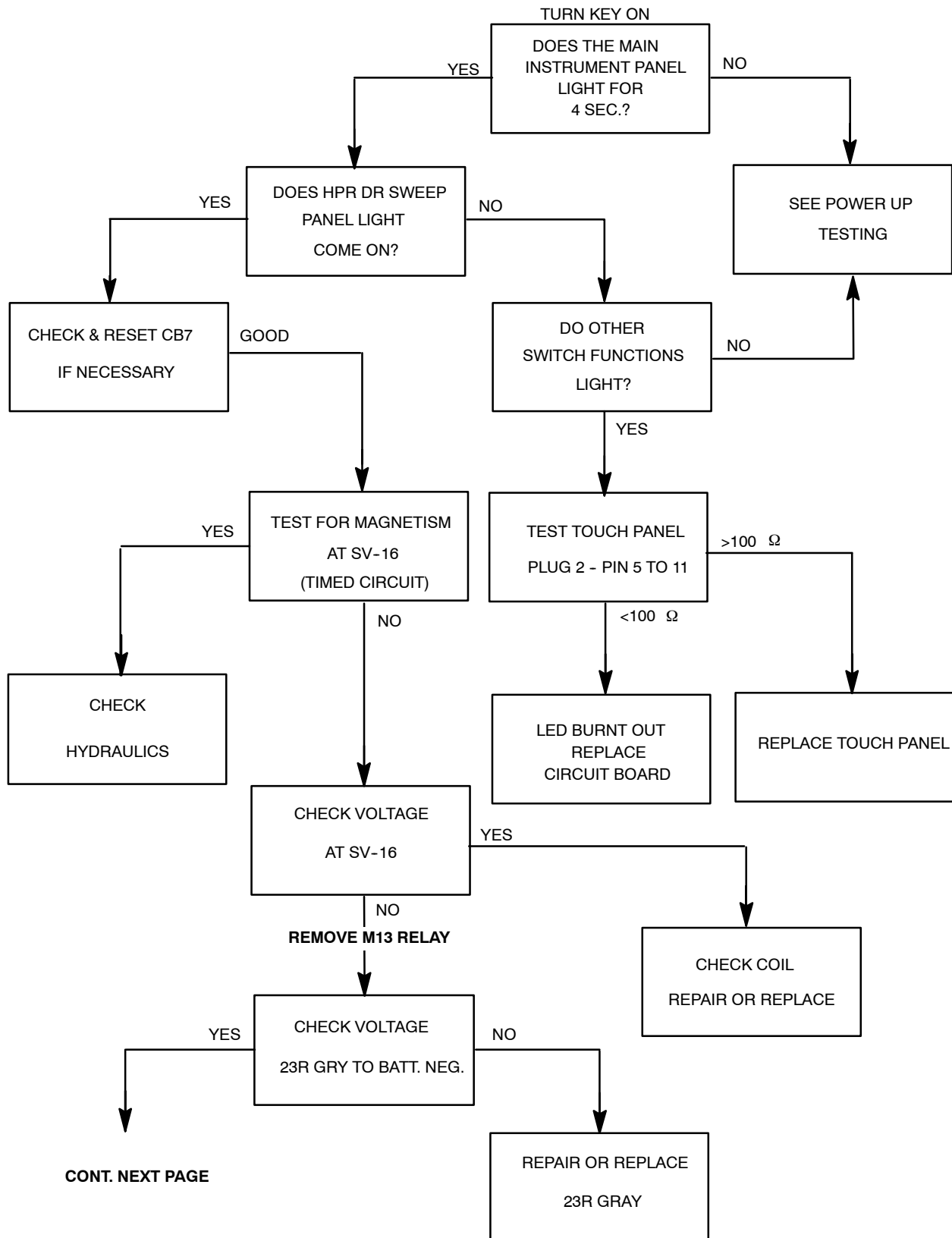


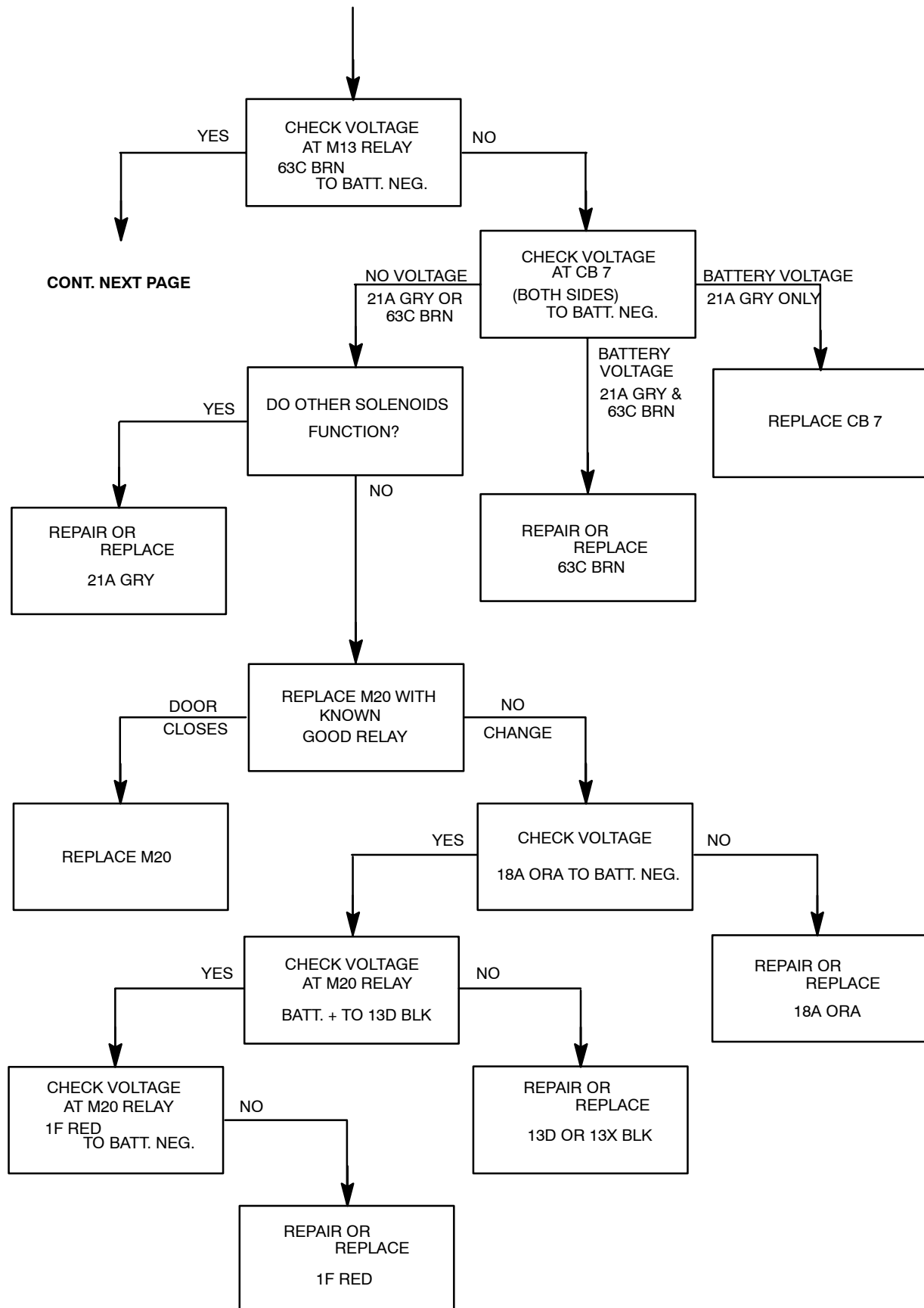


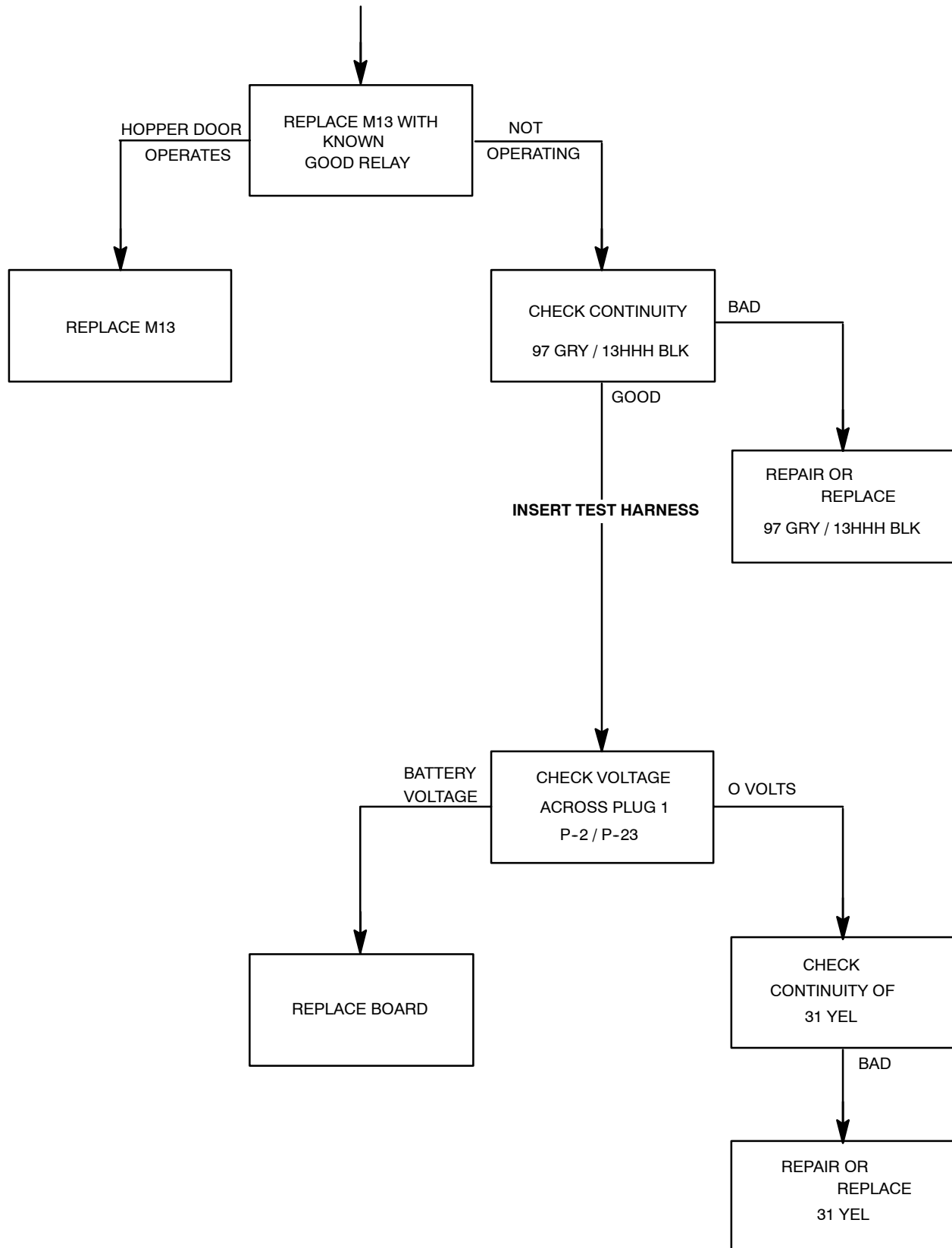
HOPPER DOOR CLOSE CIRCUIT



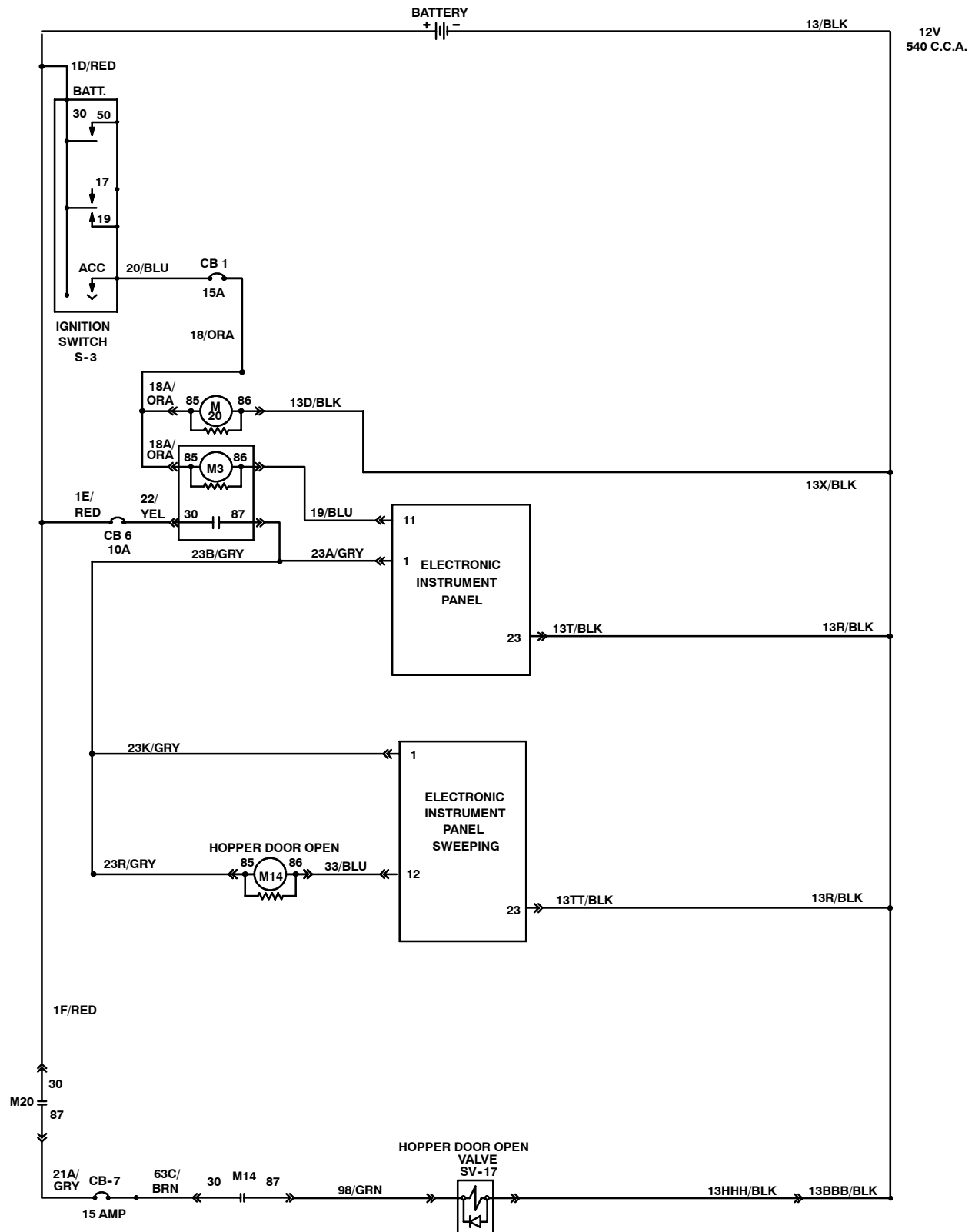
HOPPER DOOR WON'T CLOSE



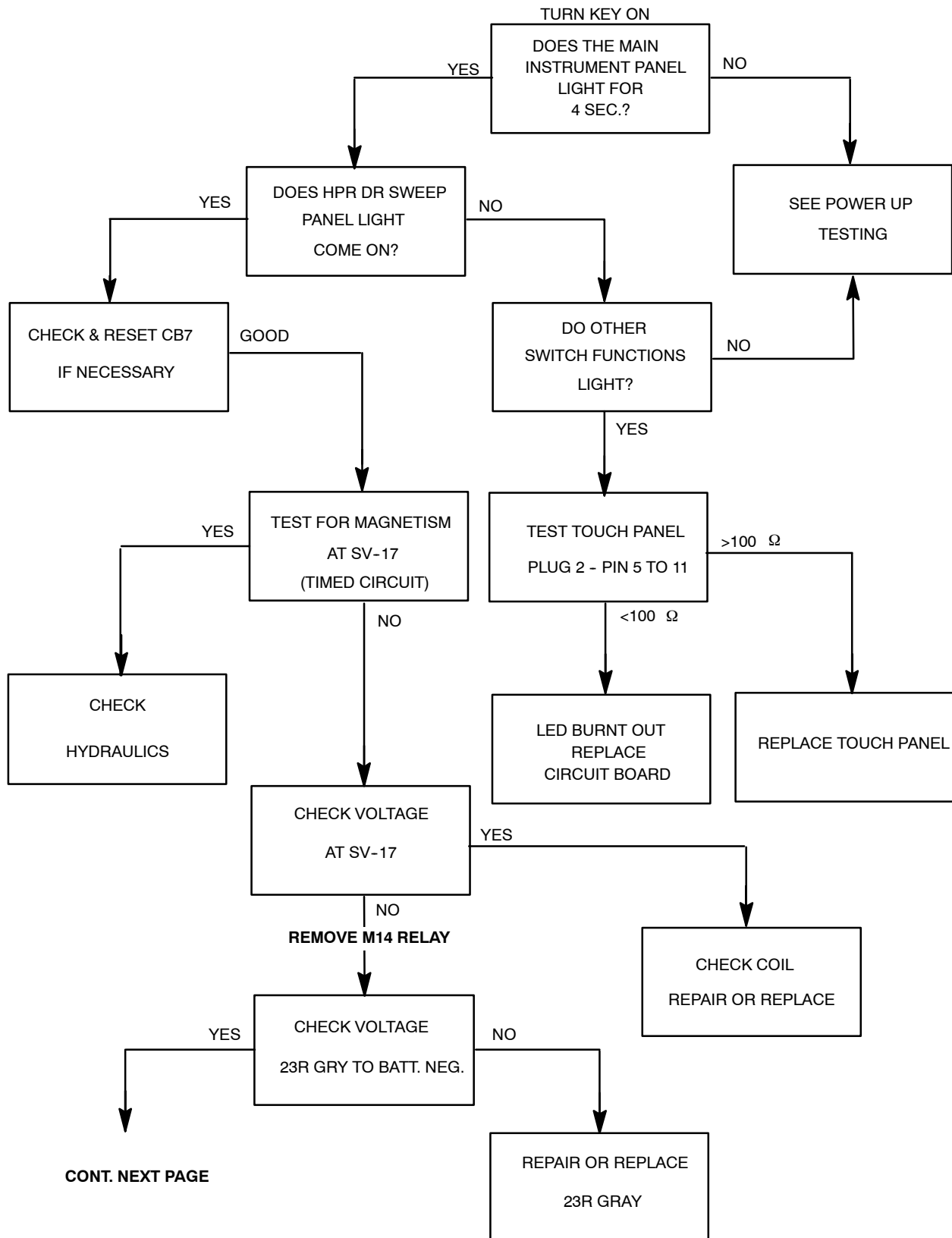


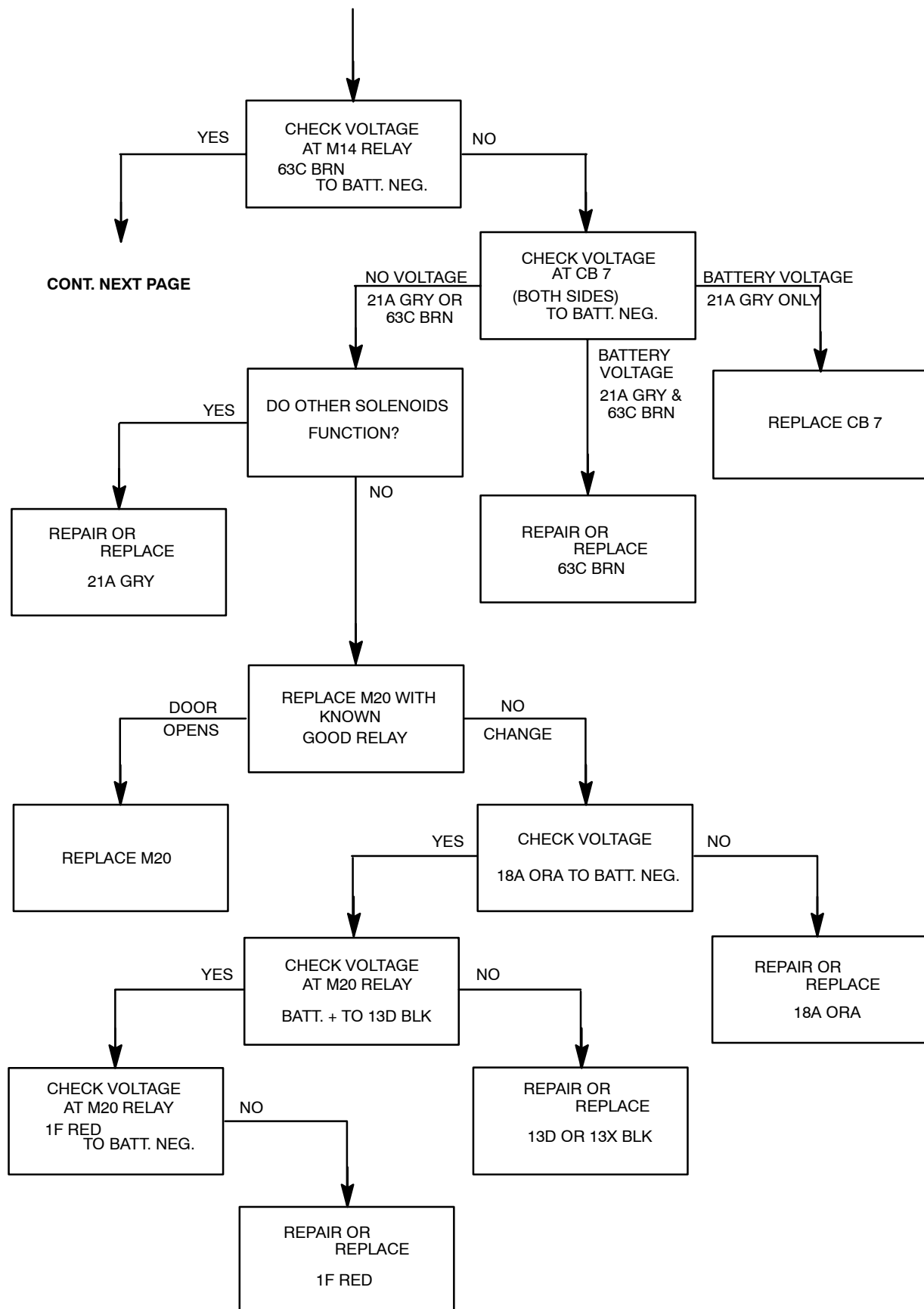


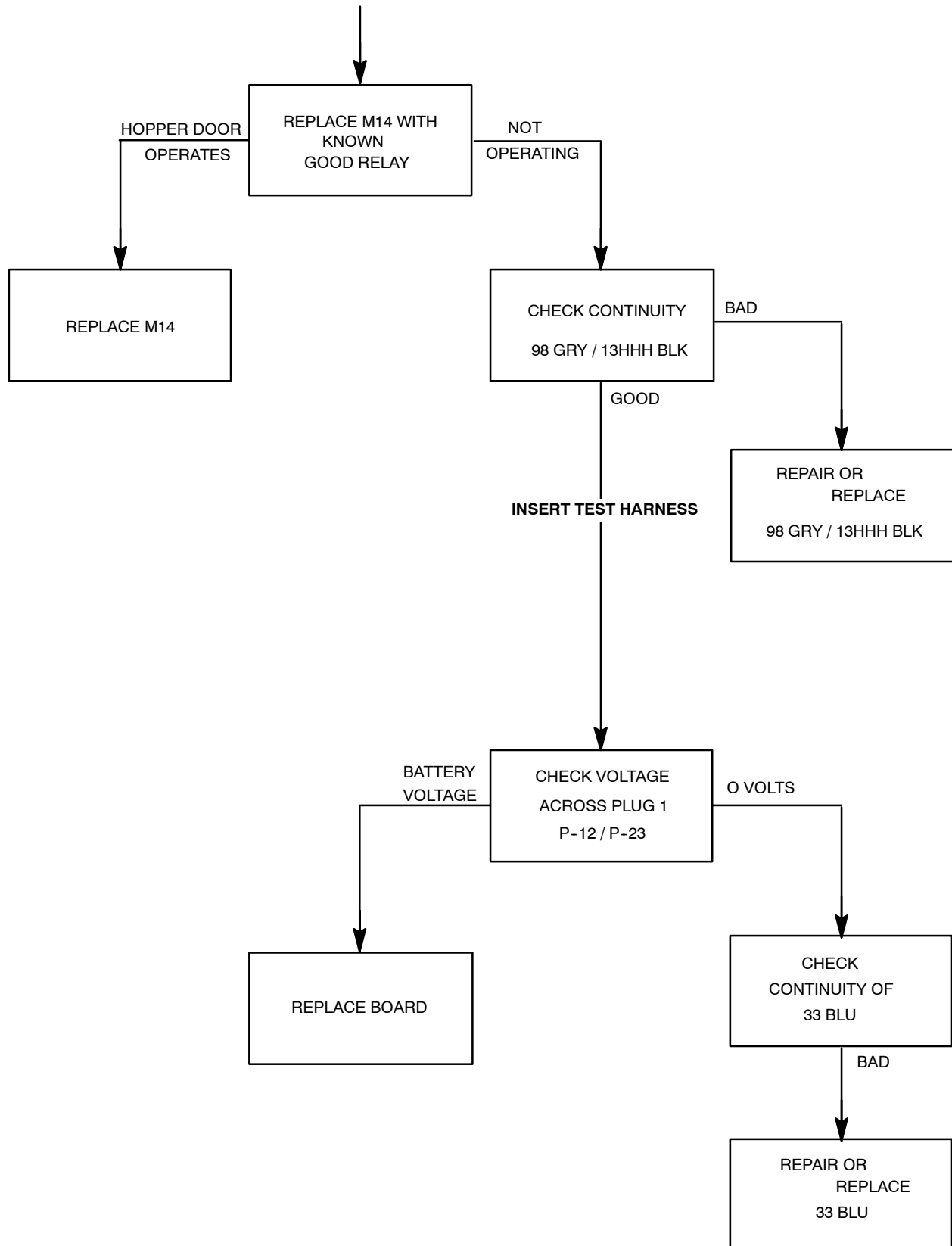
HOPPER DOOR OPEN CIRCUIT



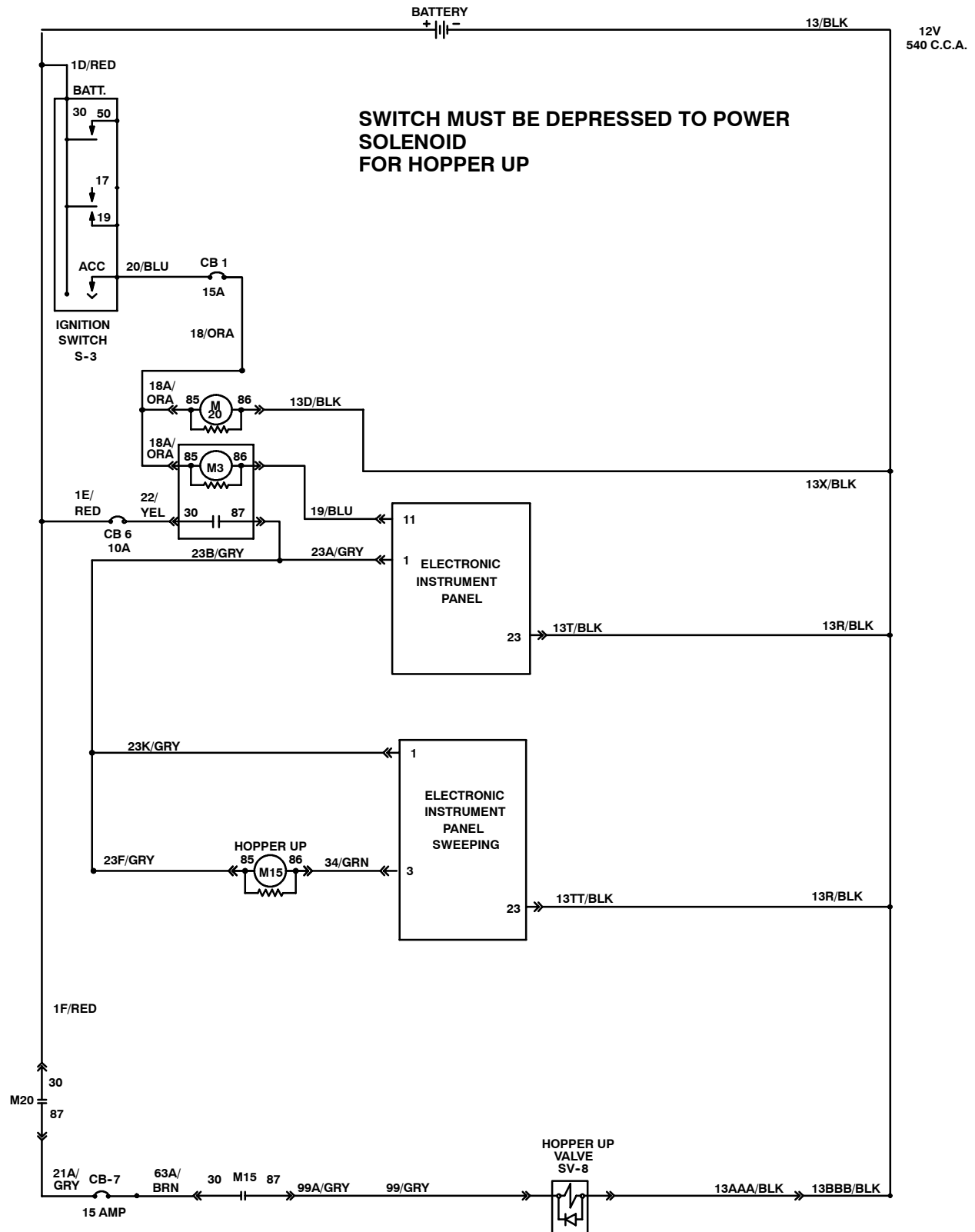
HOPPER DOOR WON'T OPEN



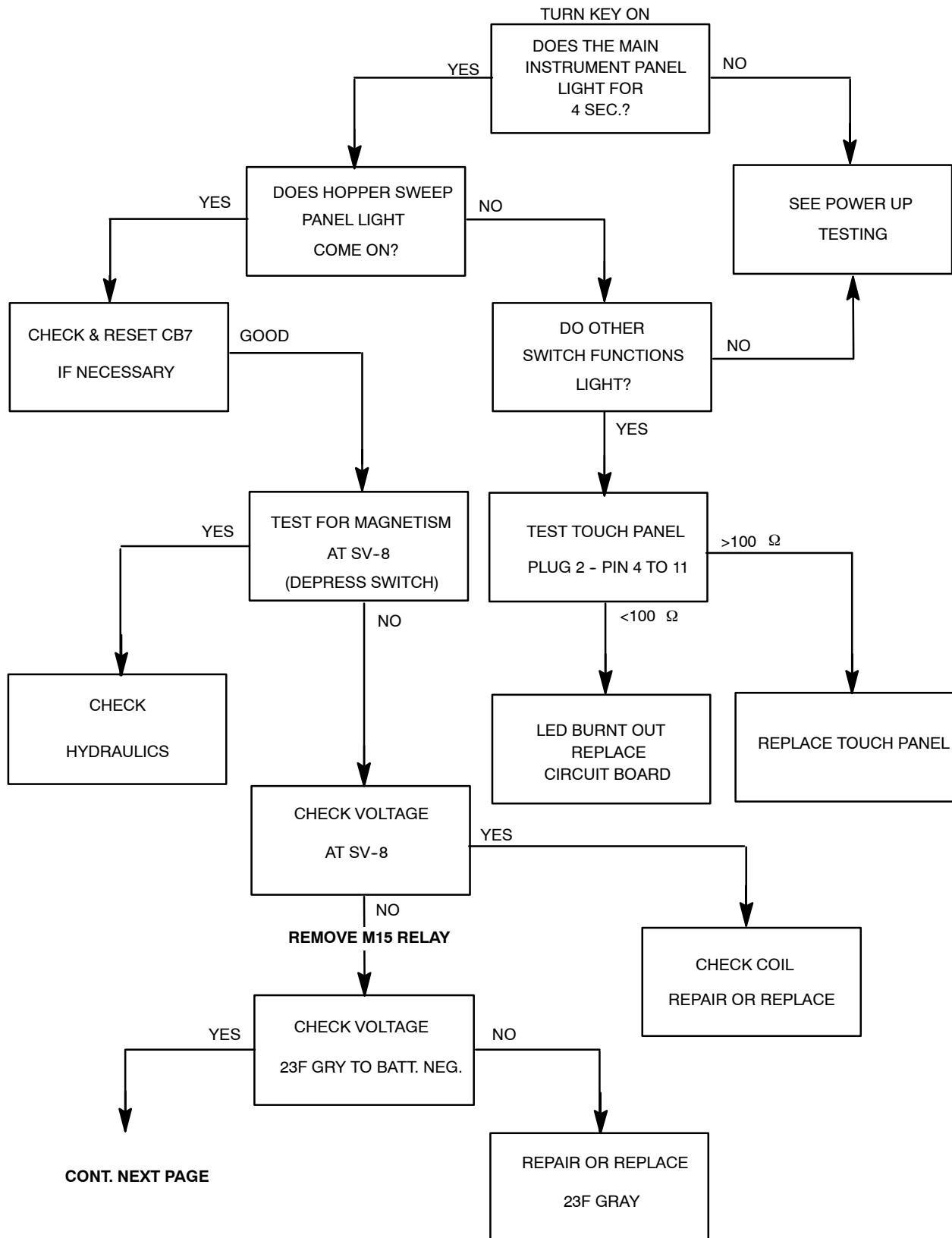


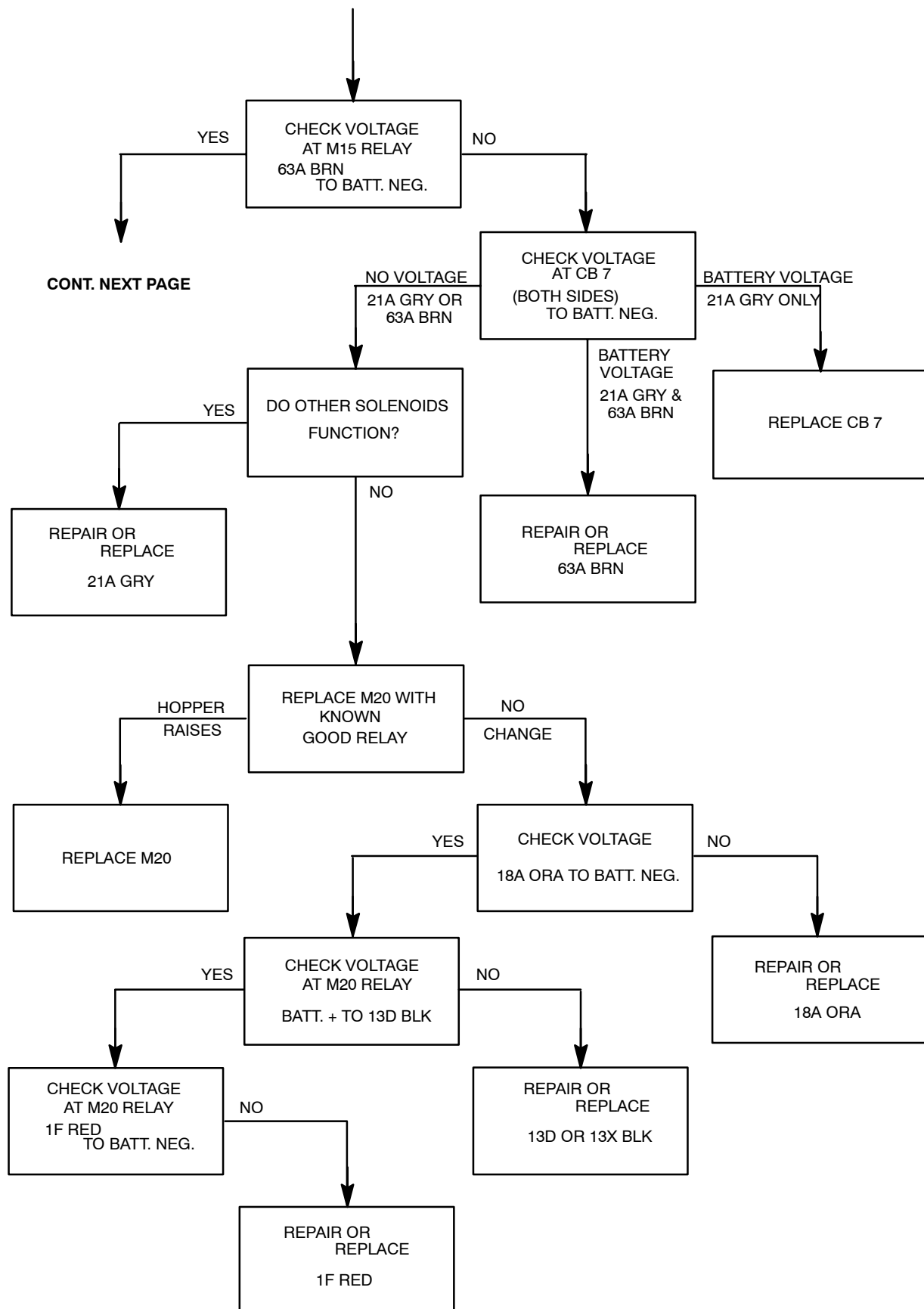


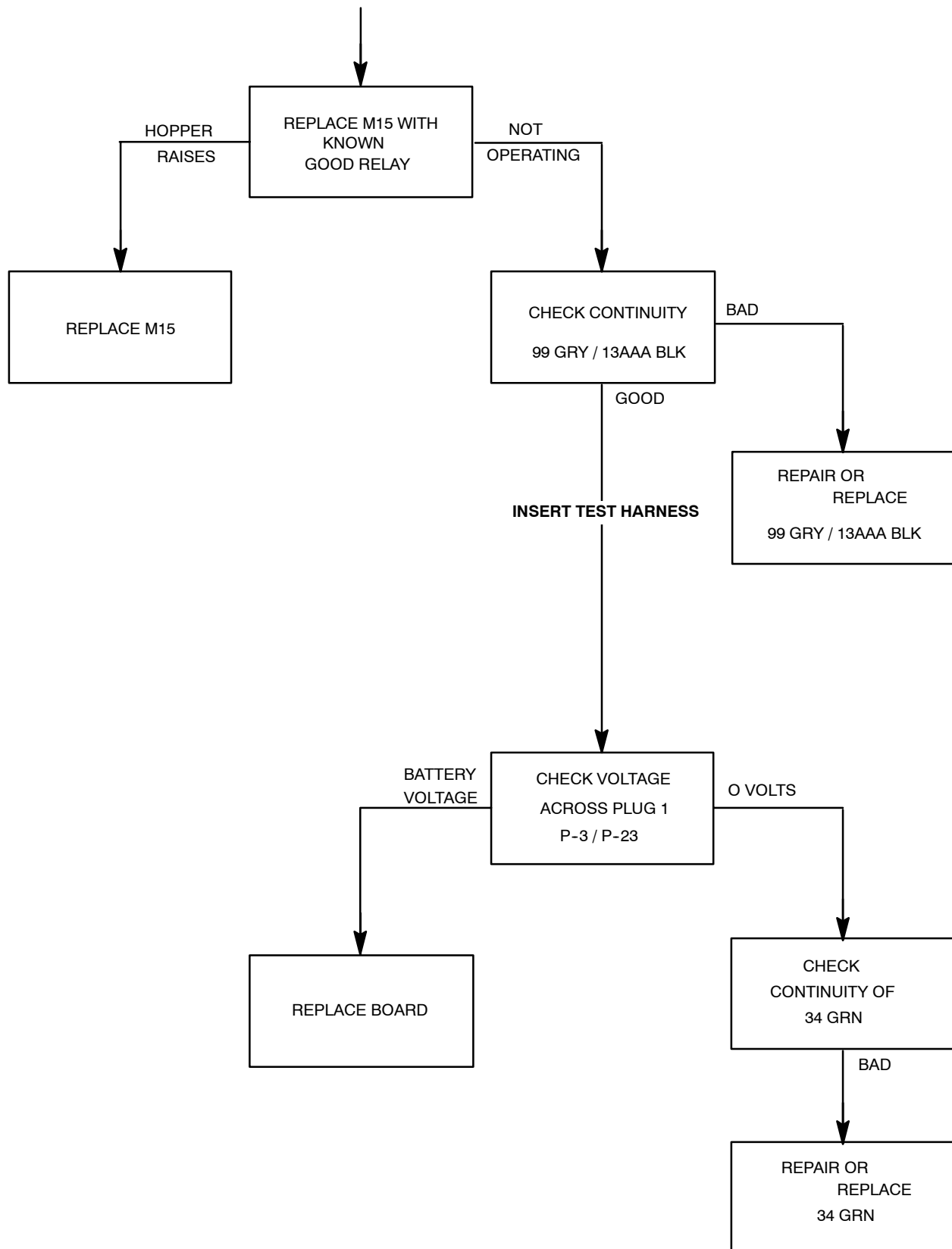
HOPPER UP CIRCUIT



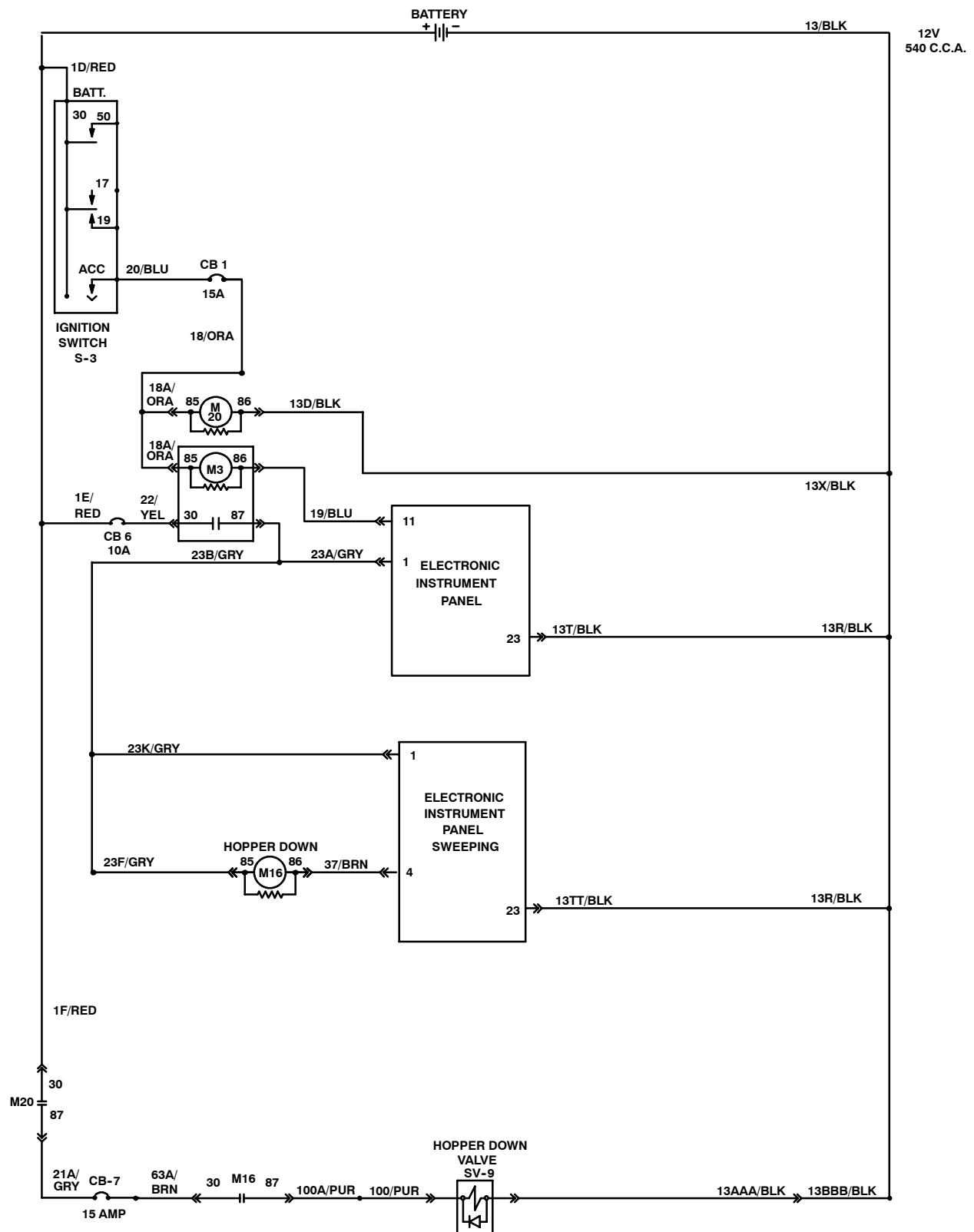
HOPPER WON'T RAISE



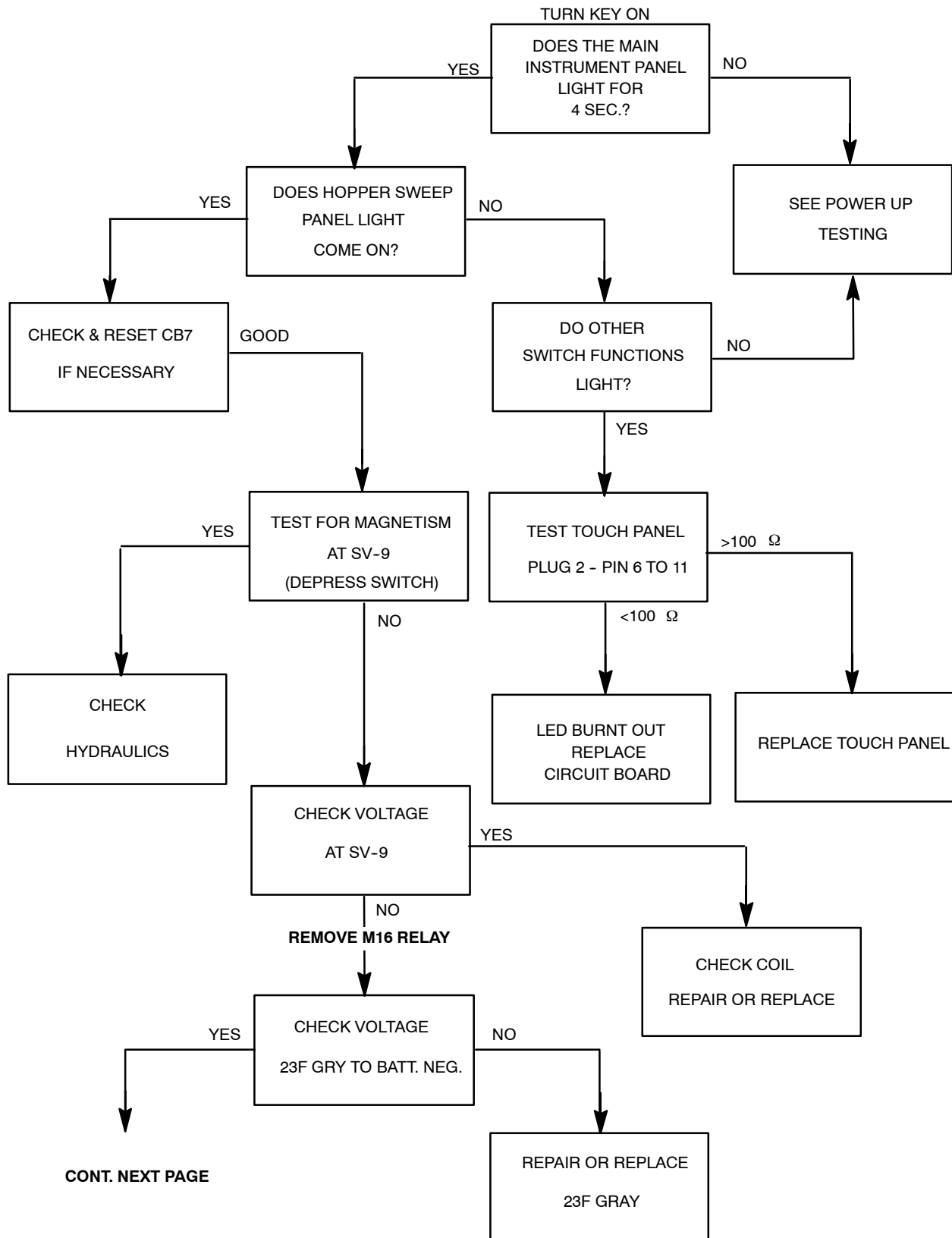


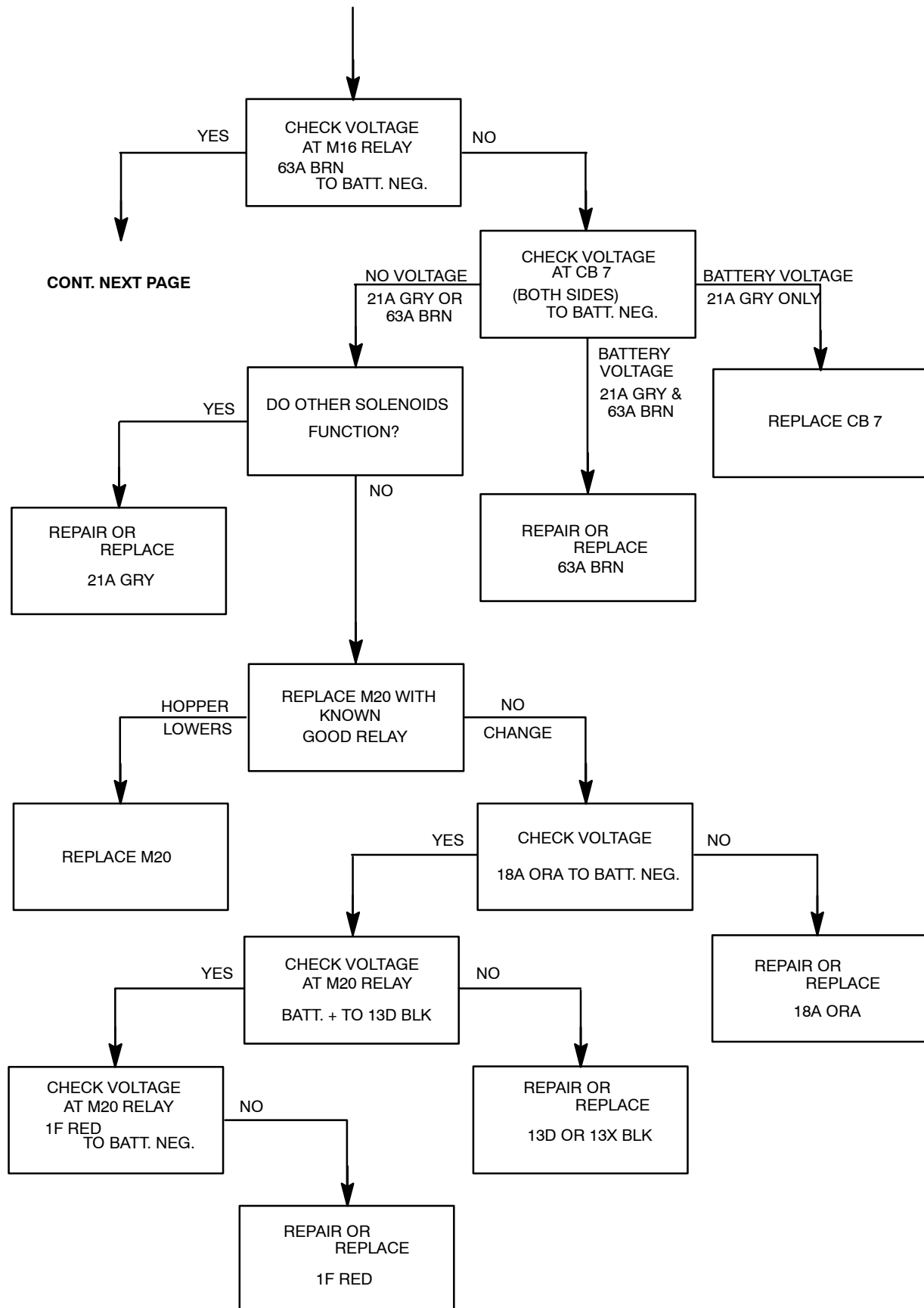


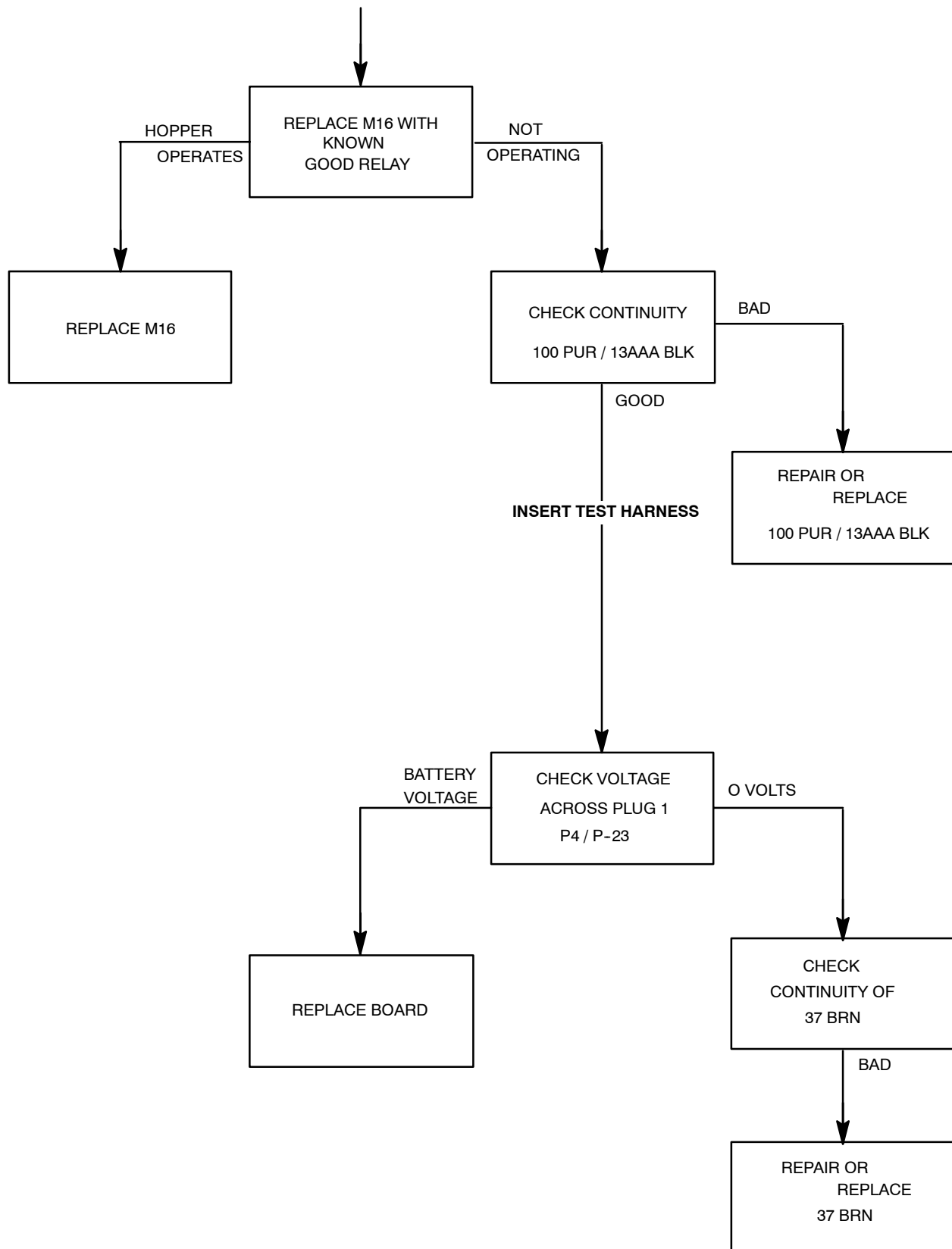
HOPPER DOWN CIRCUIT



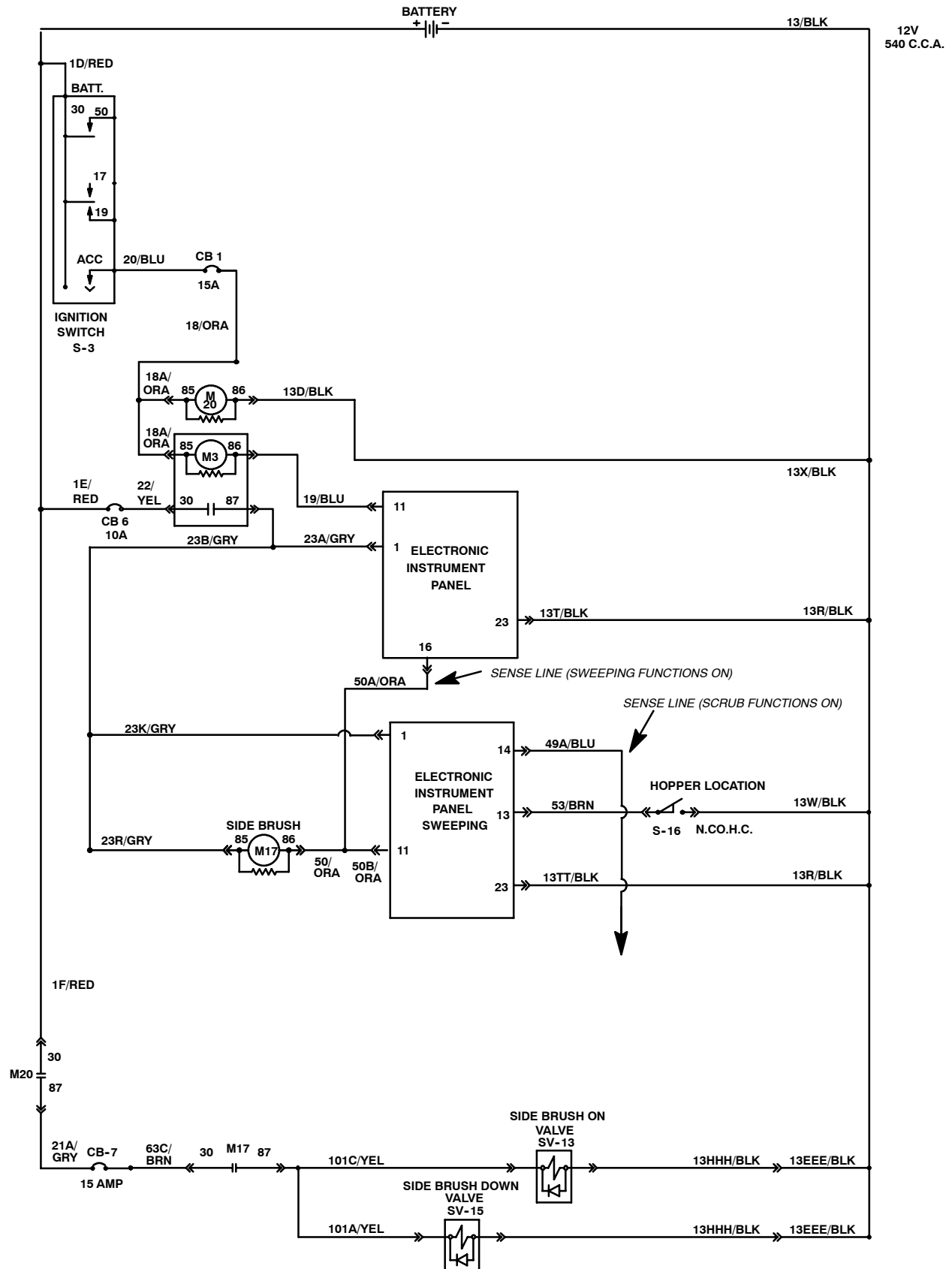
HOPPER WON'T LOWER



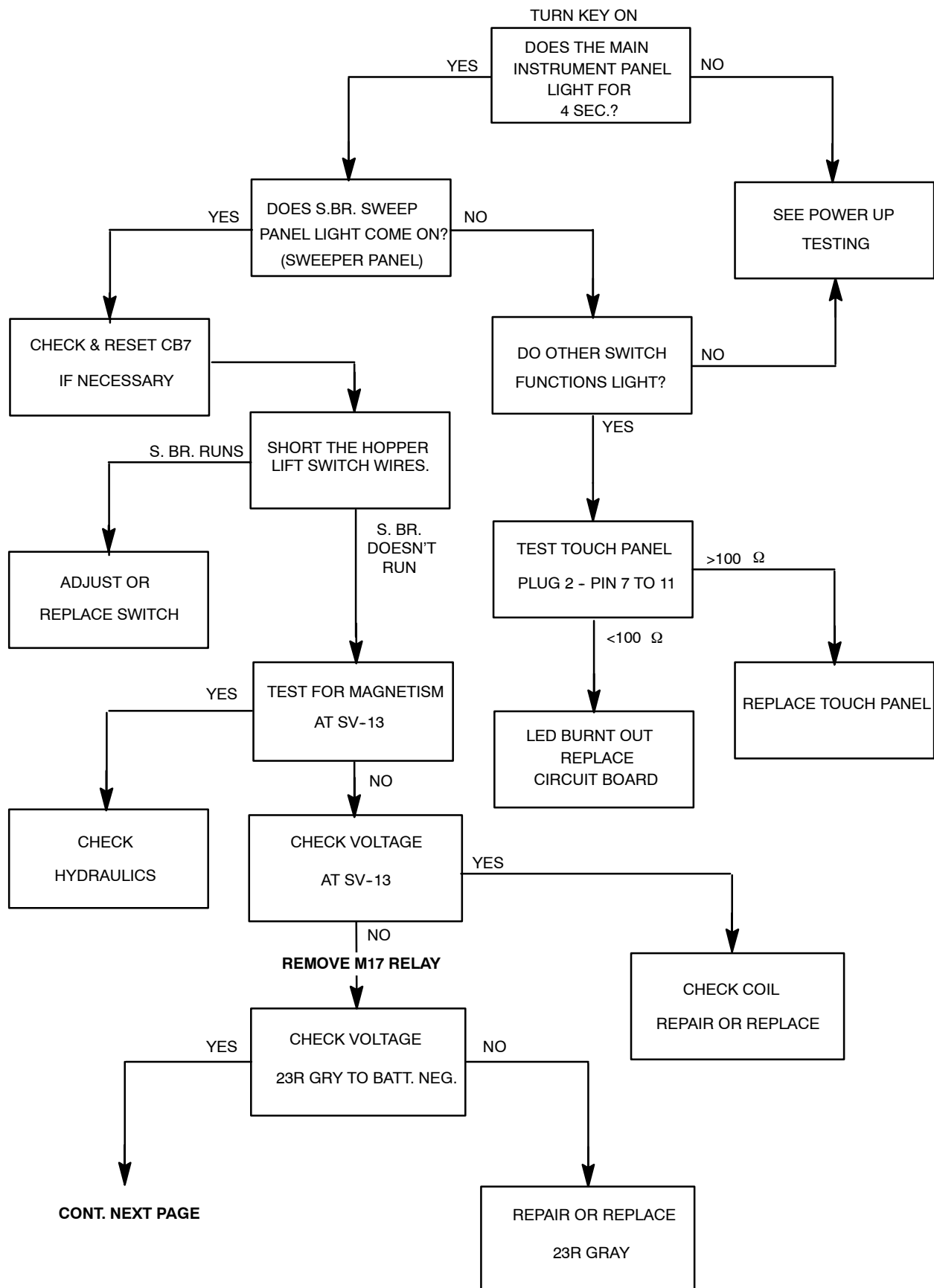


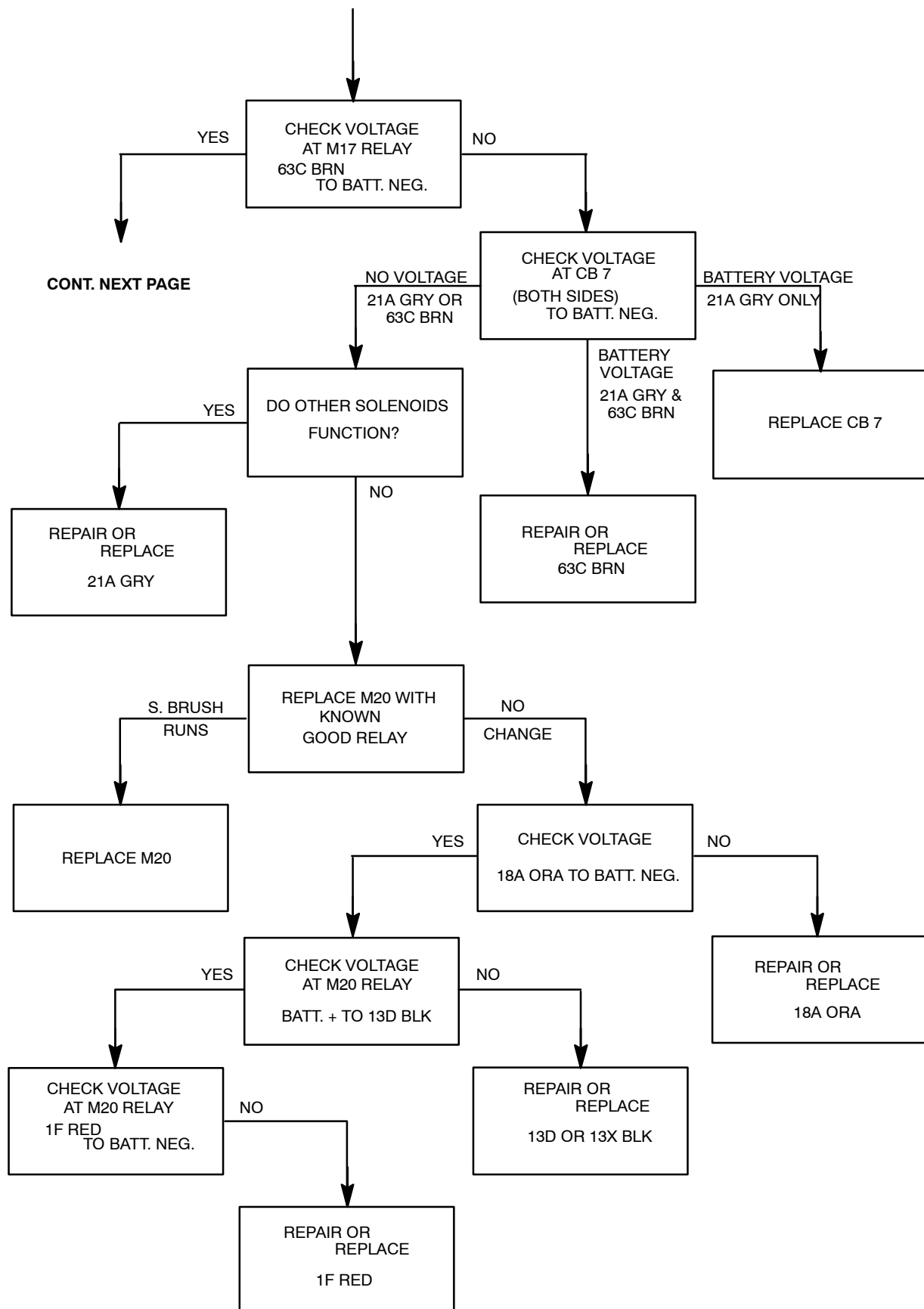


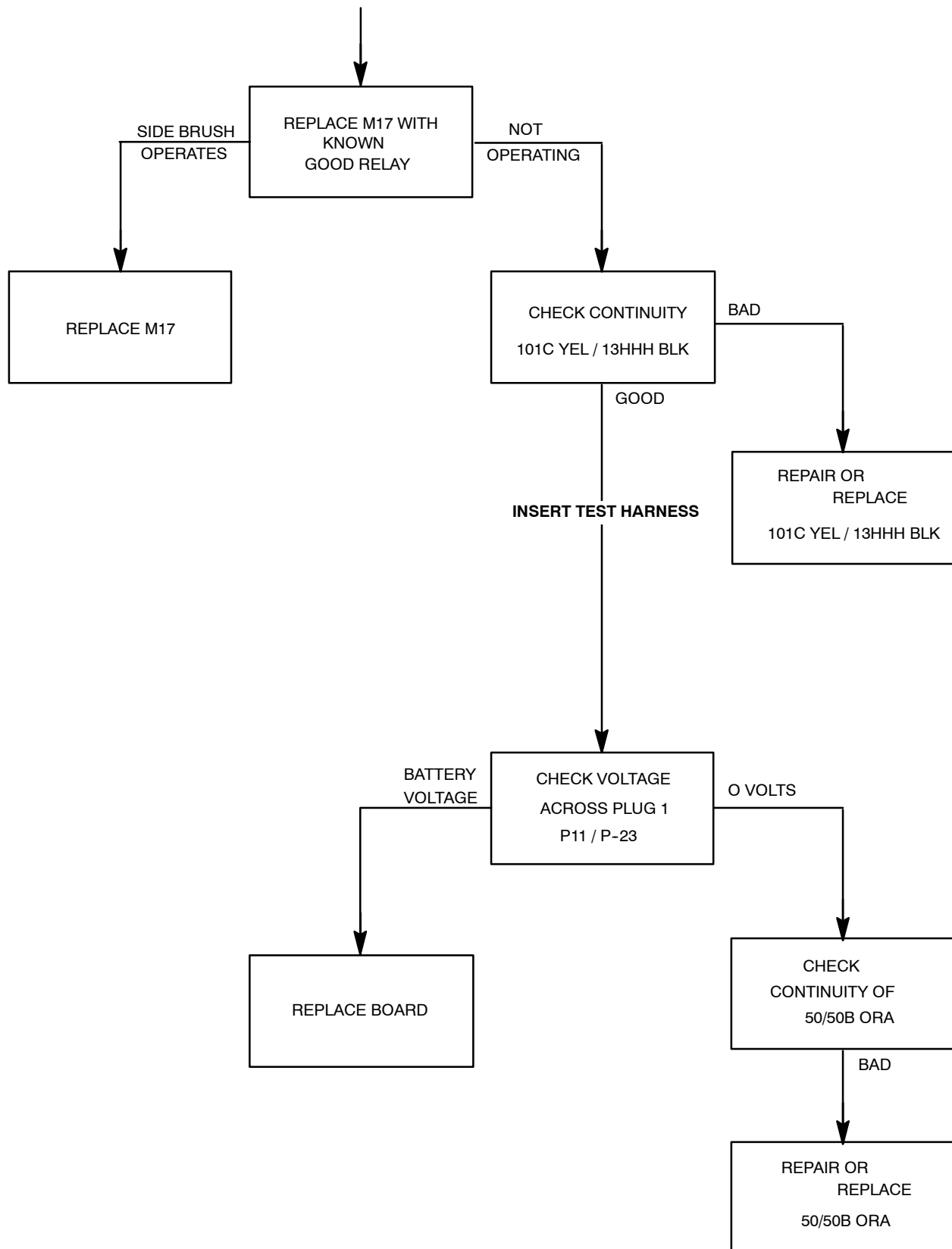
SIDE BRUSH DOWN & ON CIRCUIT



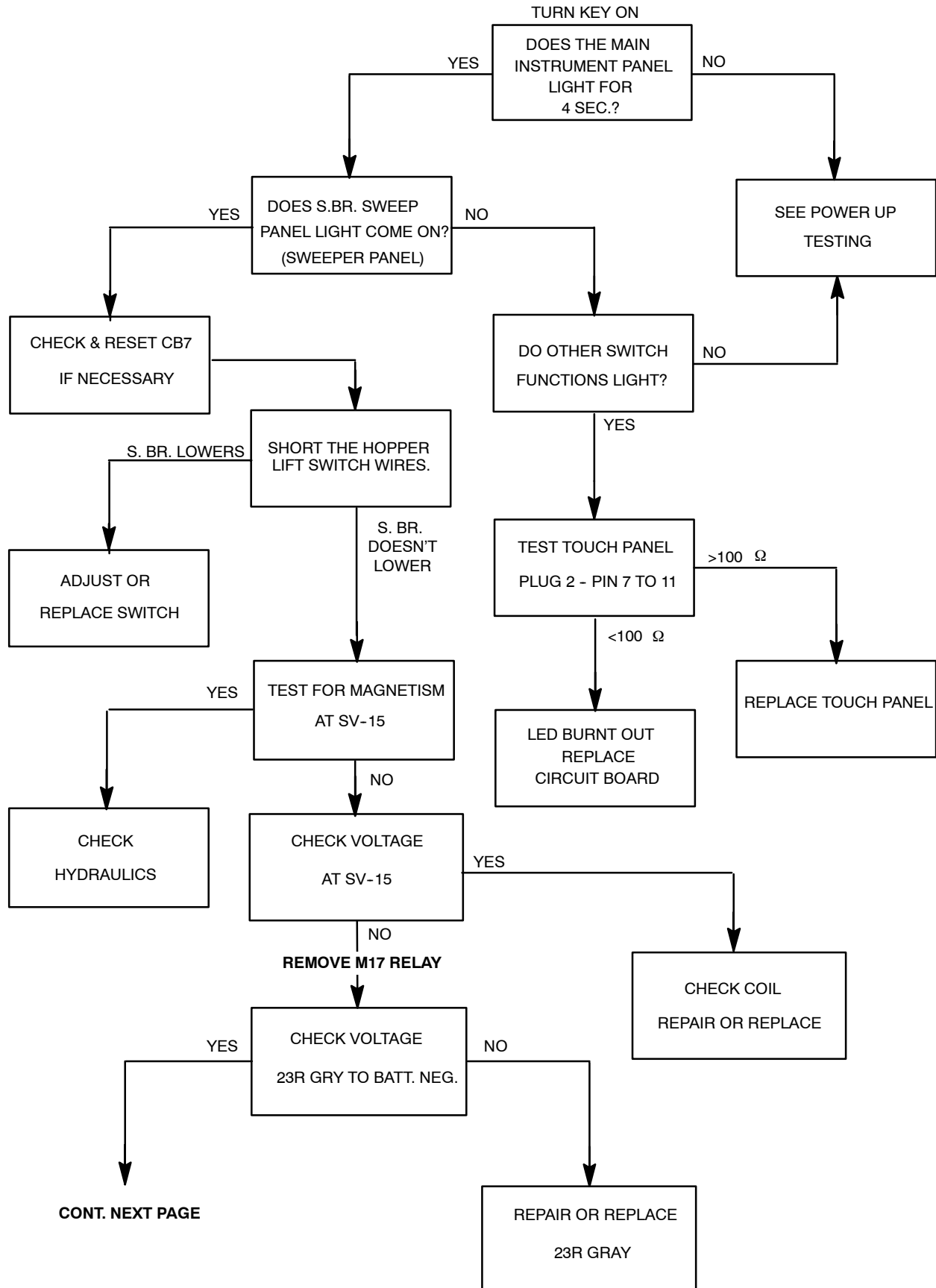
SIDE BRUSH DOESN'T GO ON

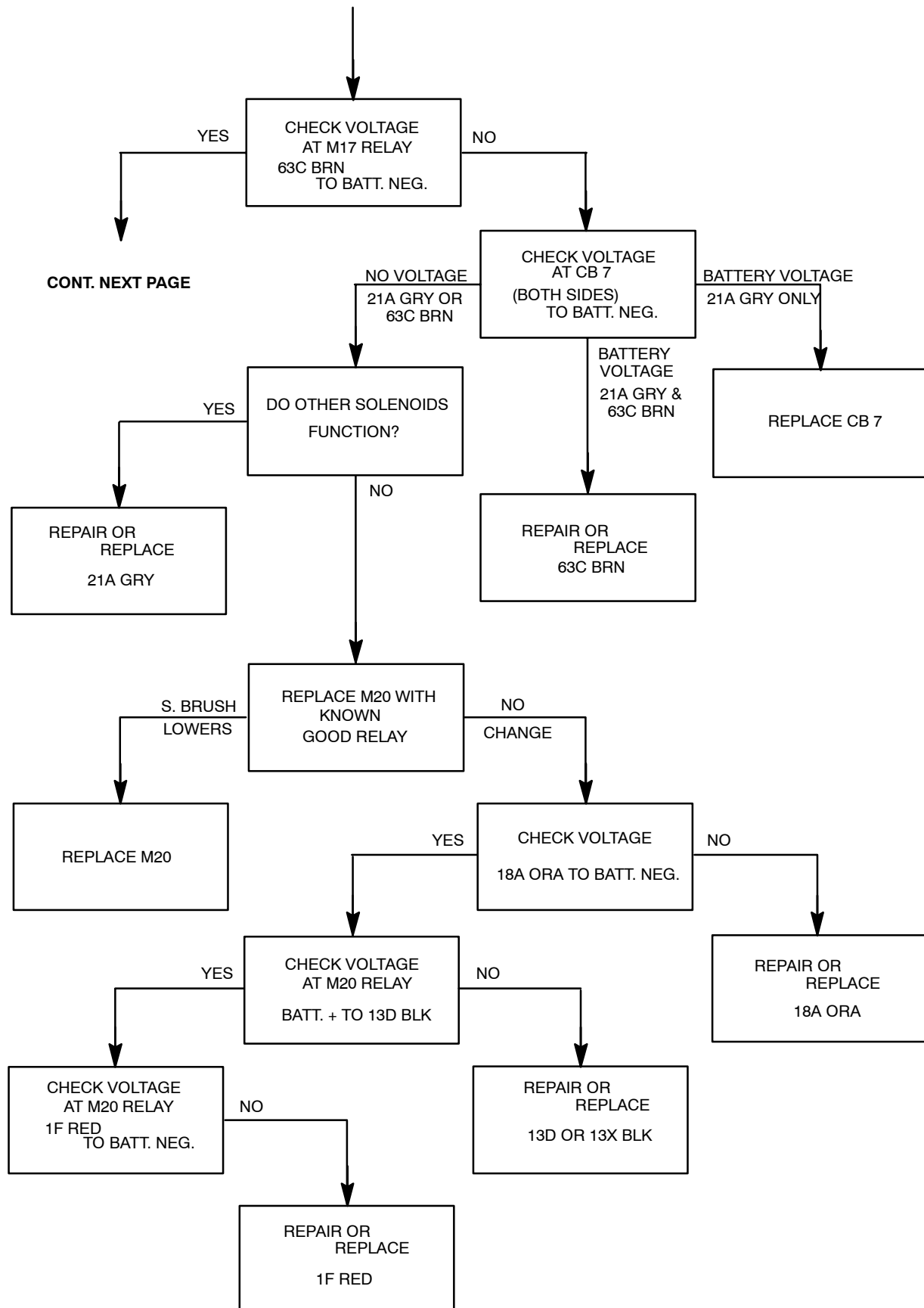


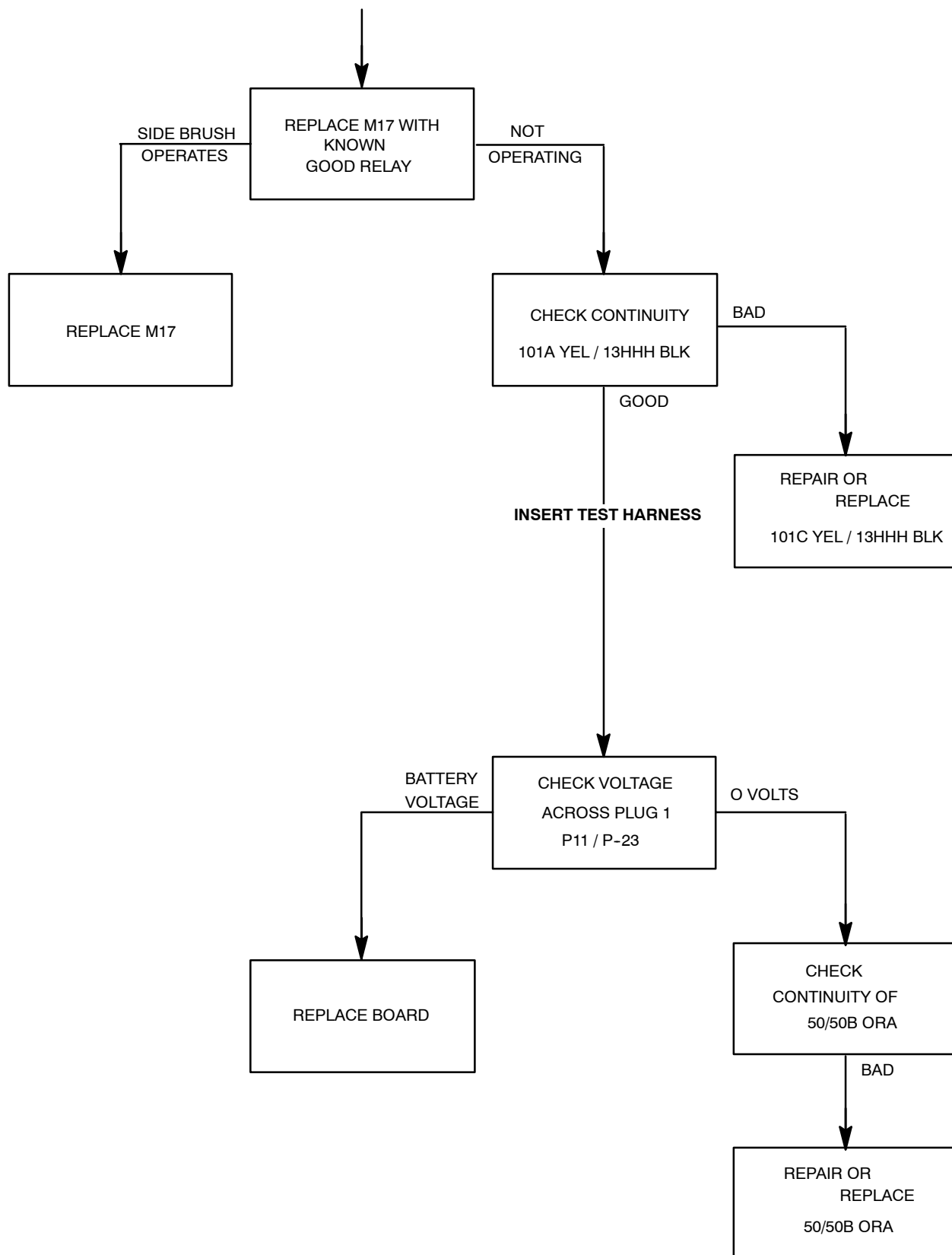




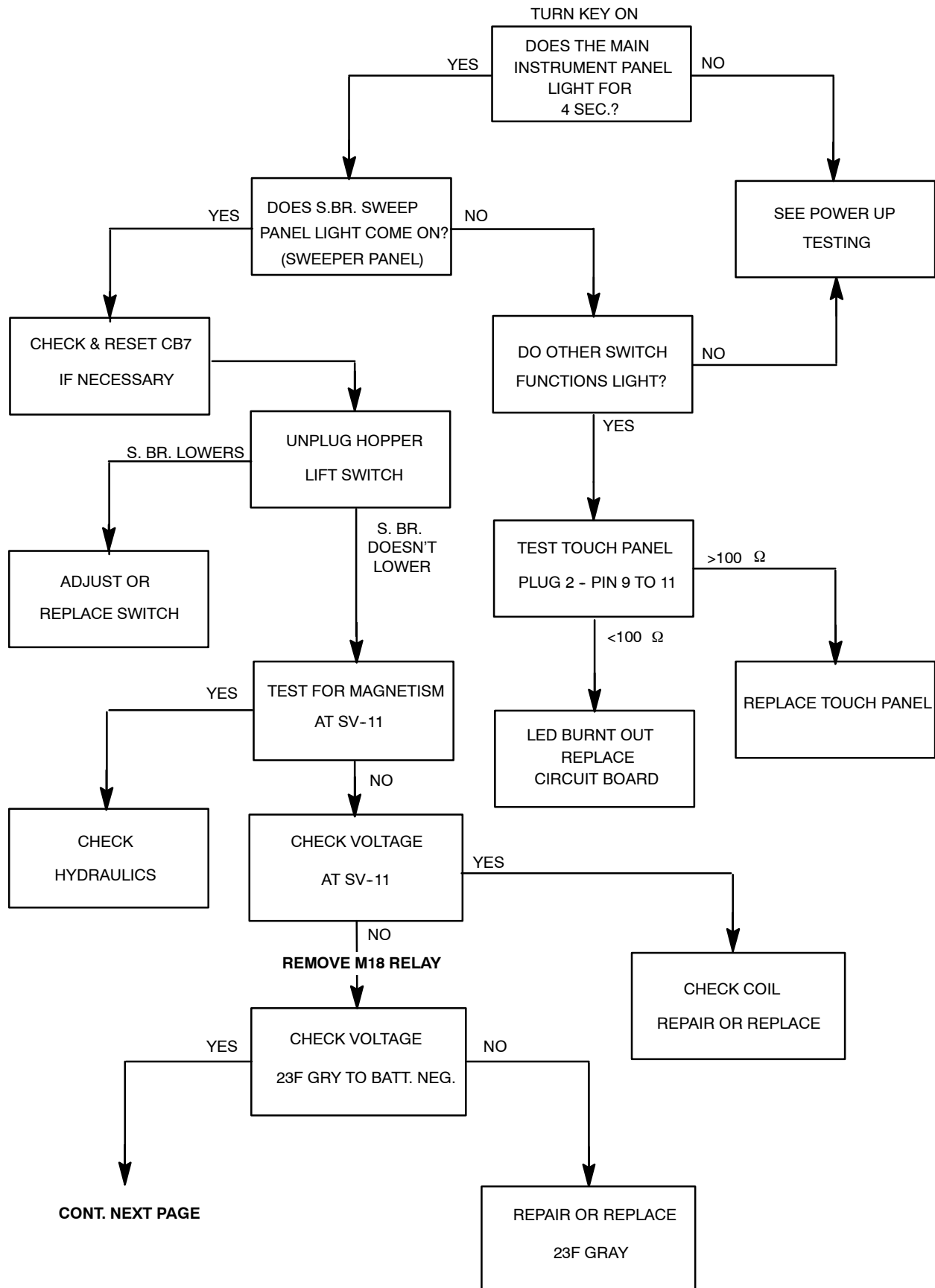
SIDE BRUSH DOESN'T GO DOWN

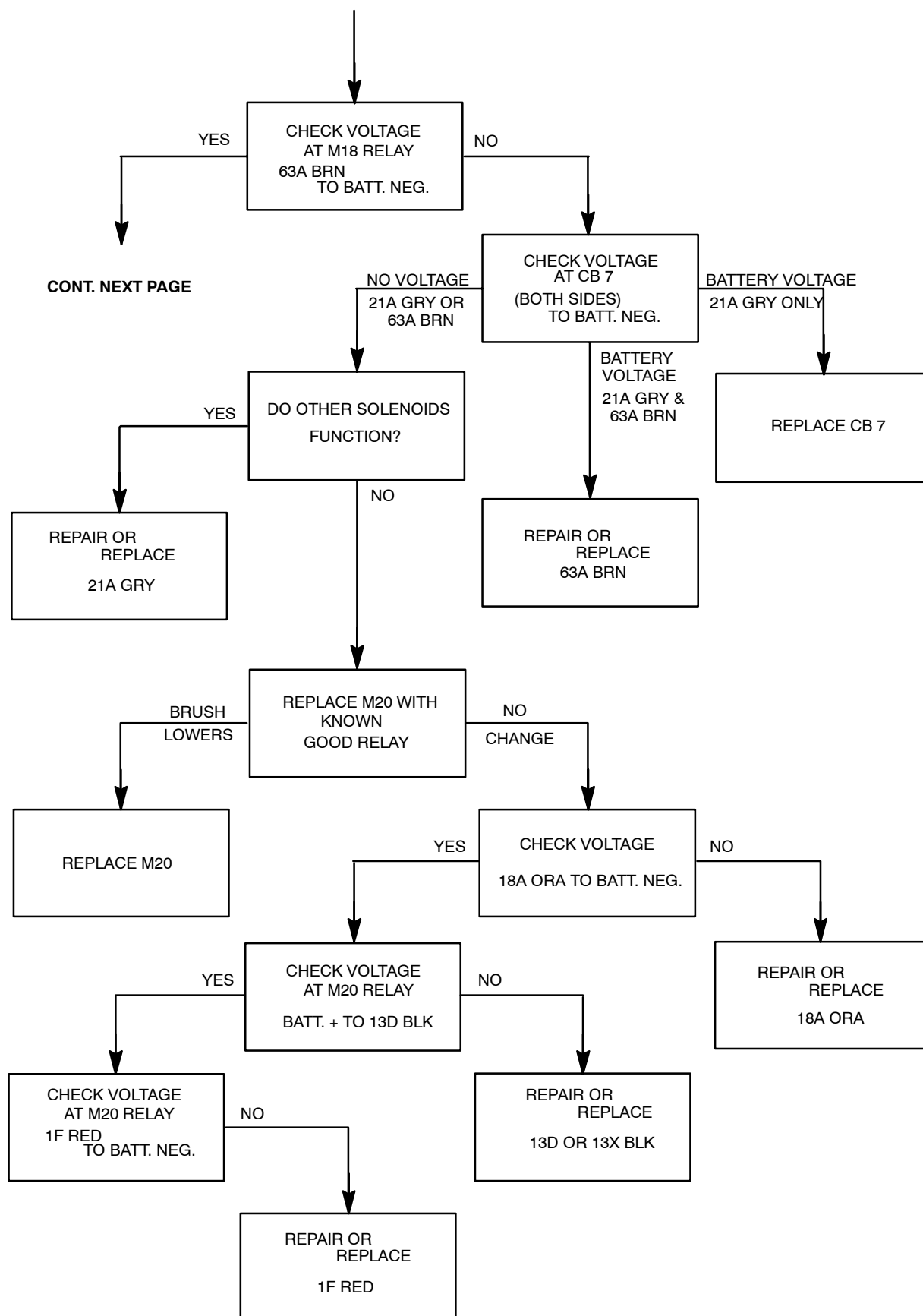


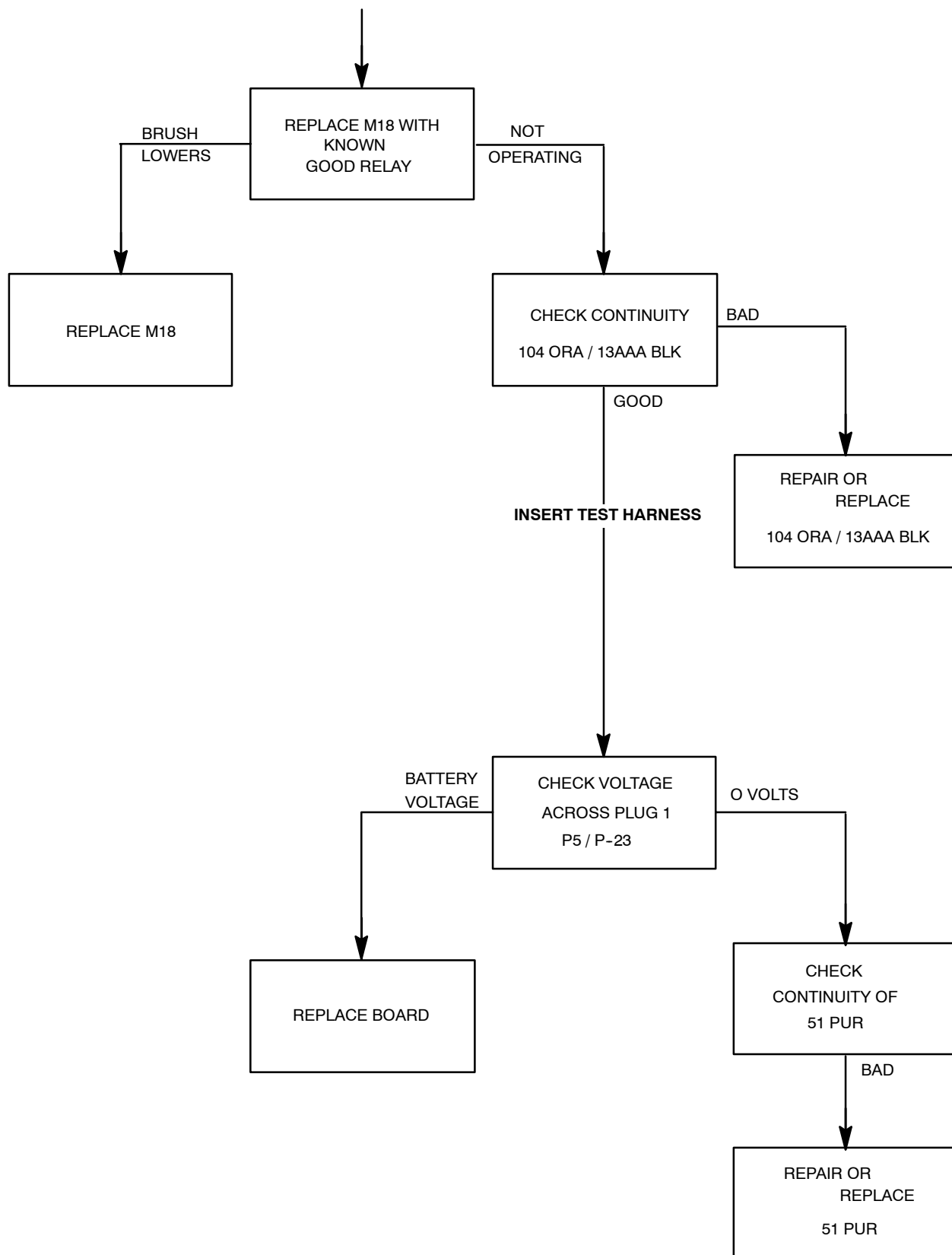




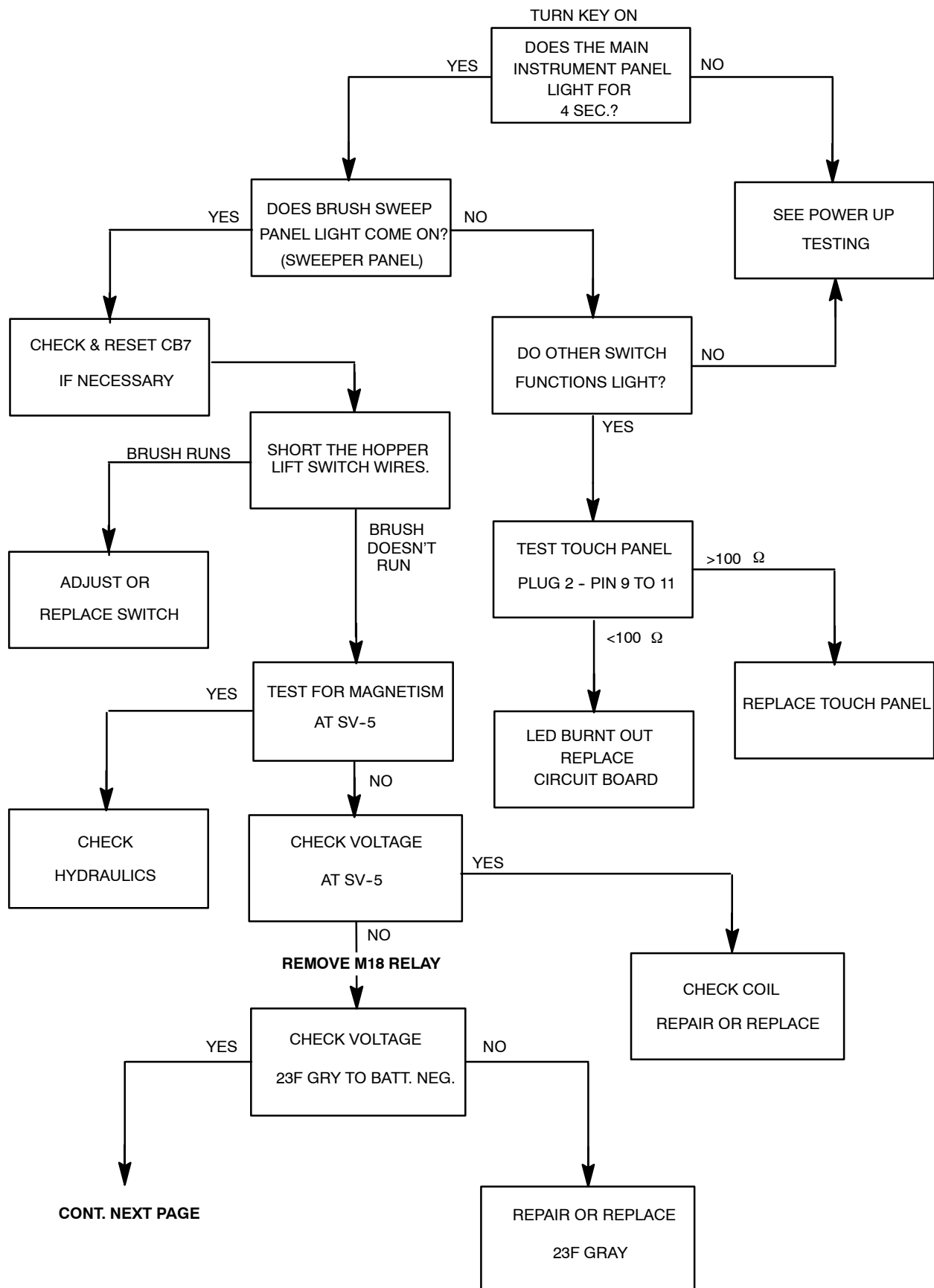
BRUSH DOES NOT GO DOWN

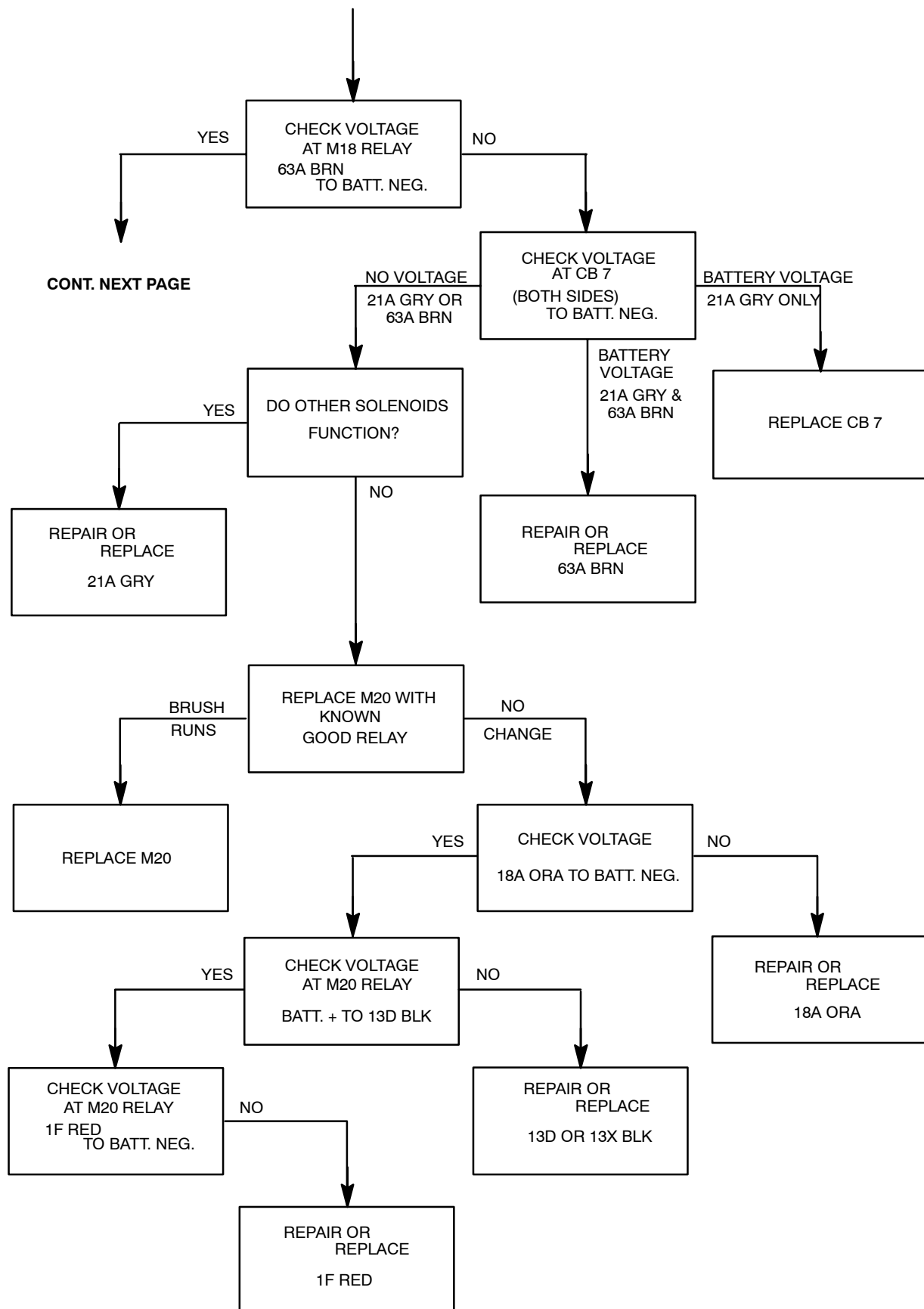


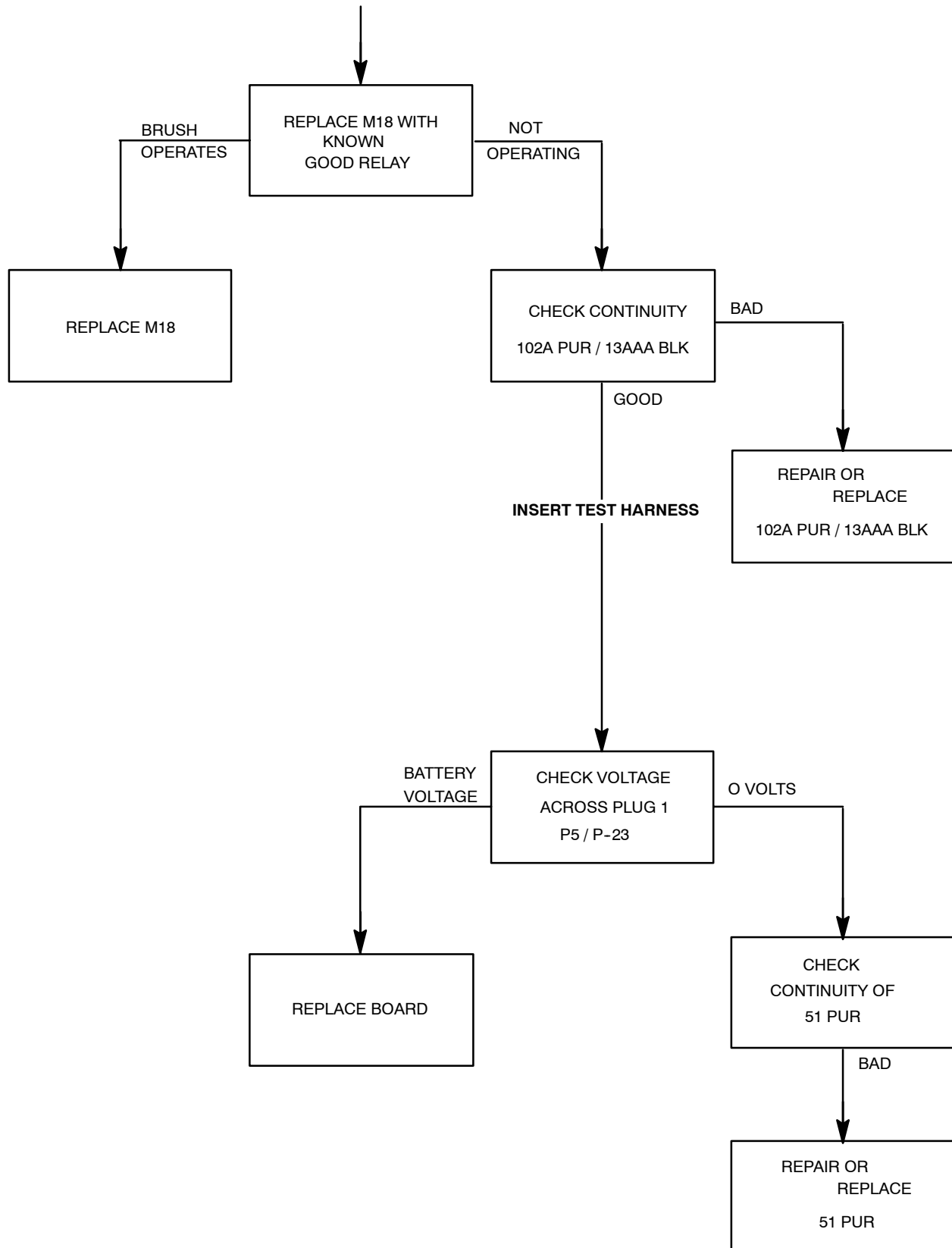




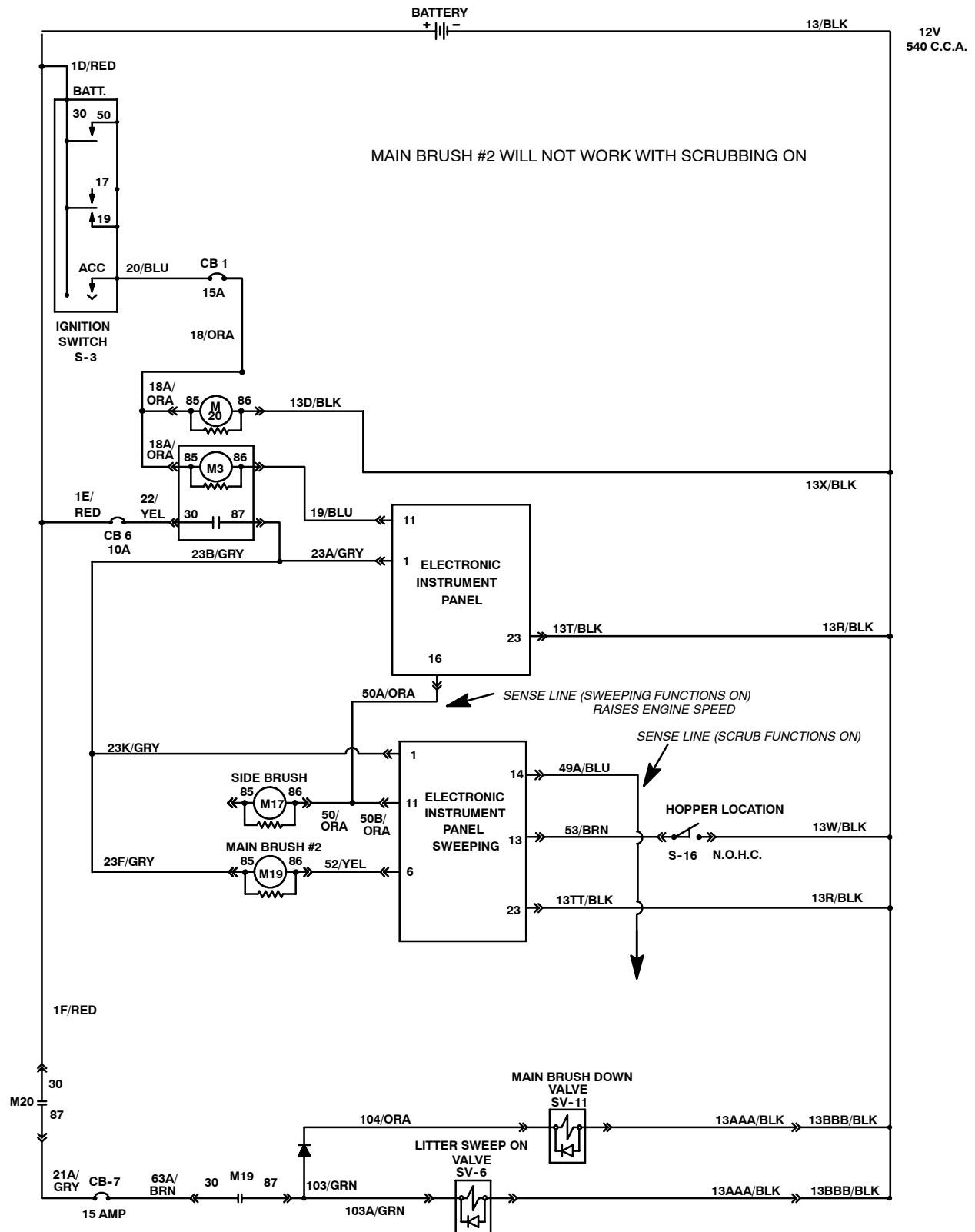
BRUSH DOES NOT RUN - SPD 1



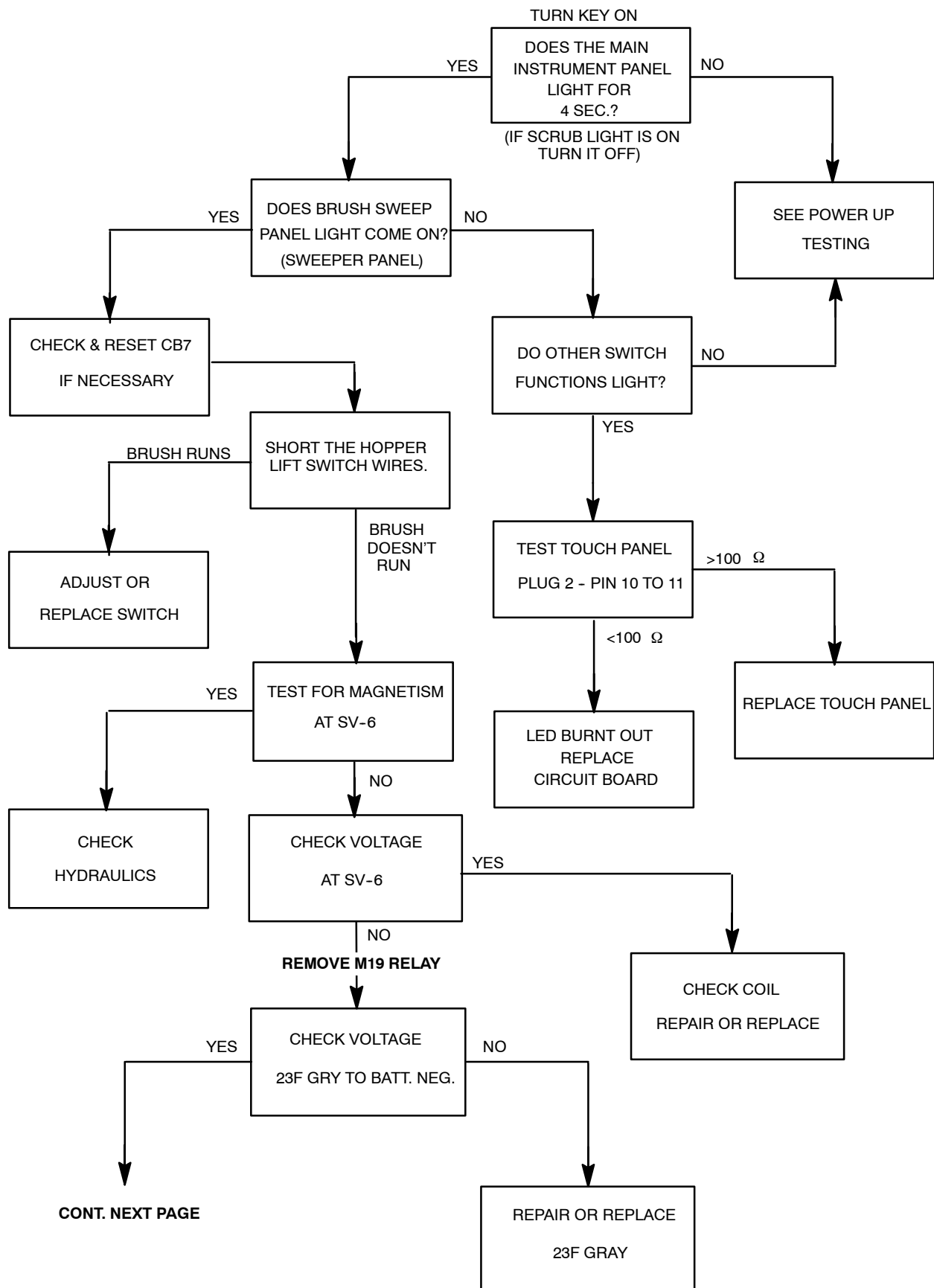


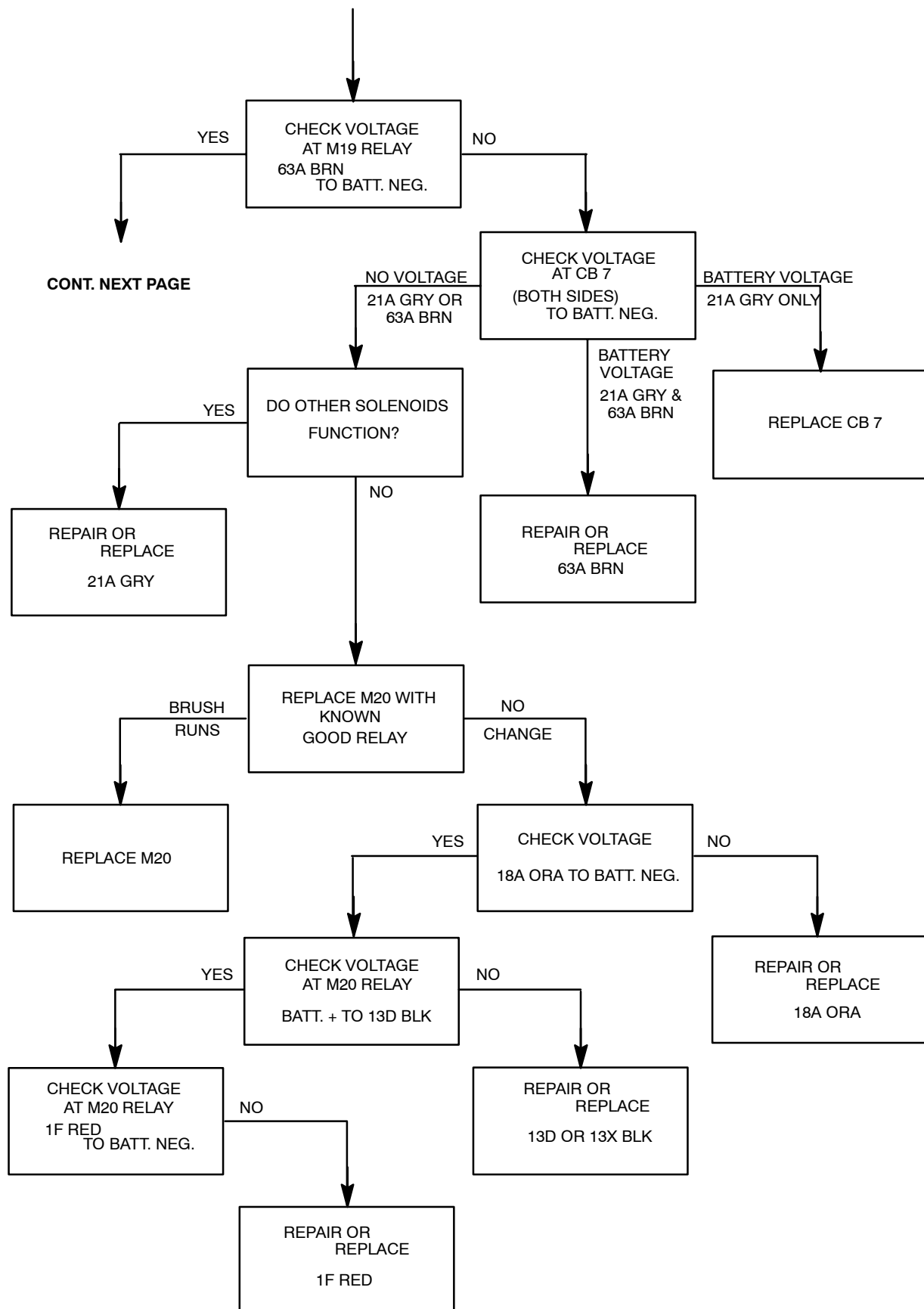


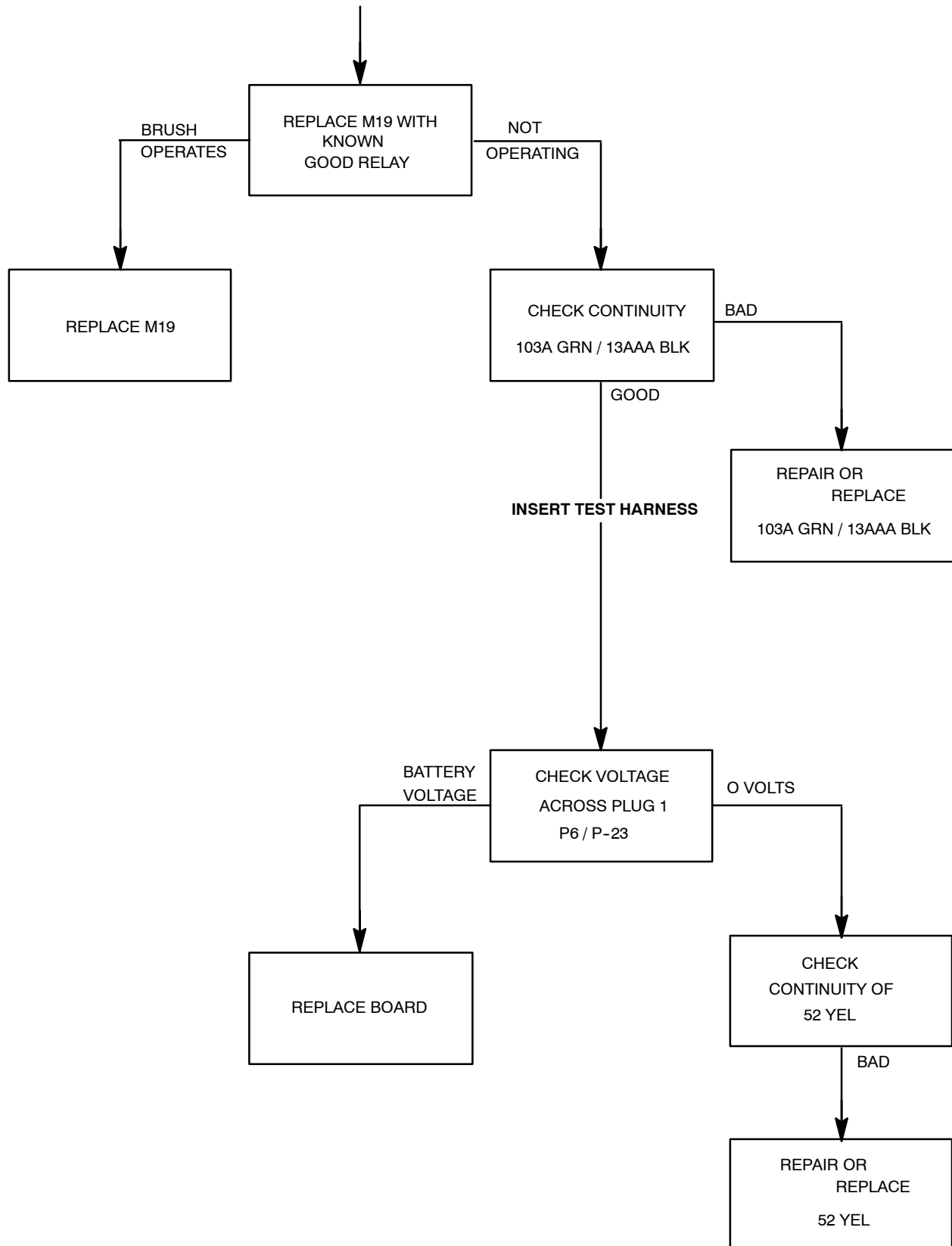
MAIN BRUSH #2 CIRCUIT



BRUSH DOES NOT RUN - SPD 2

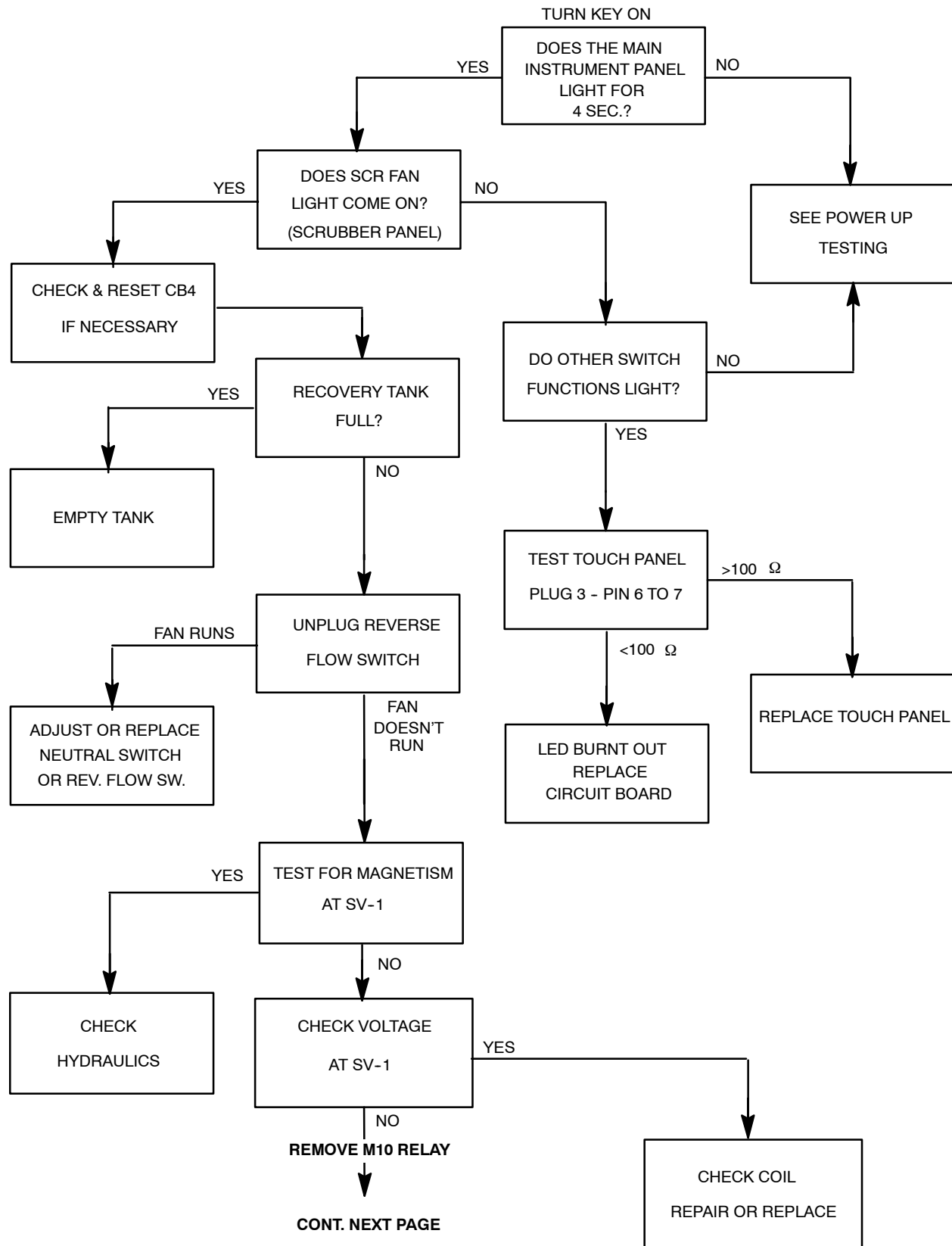


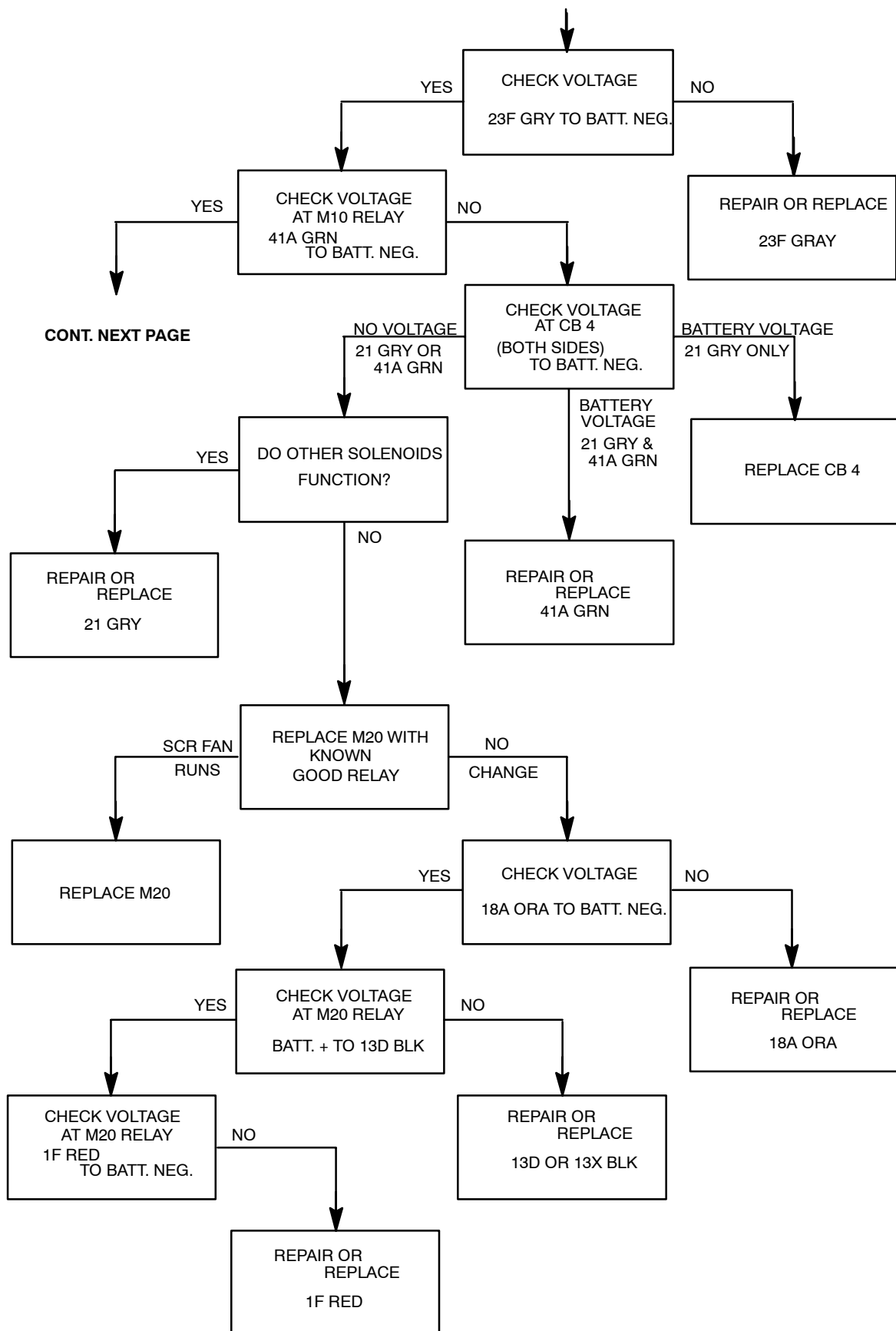


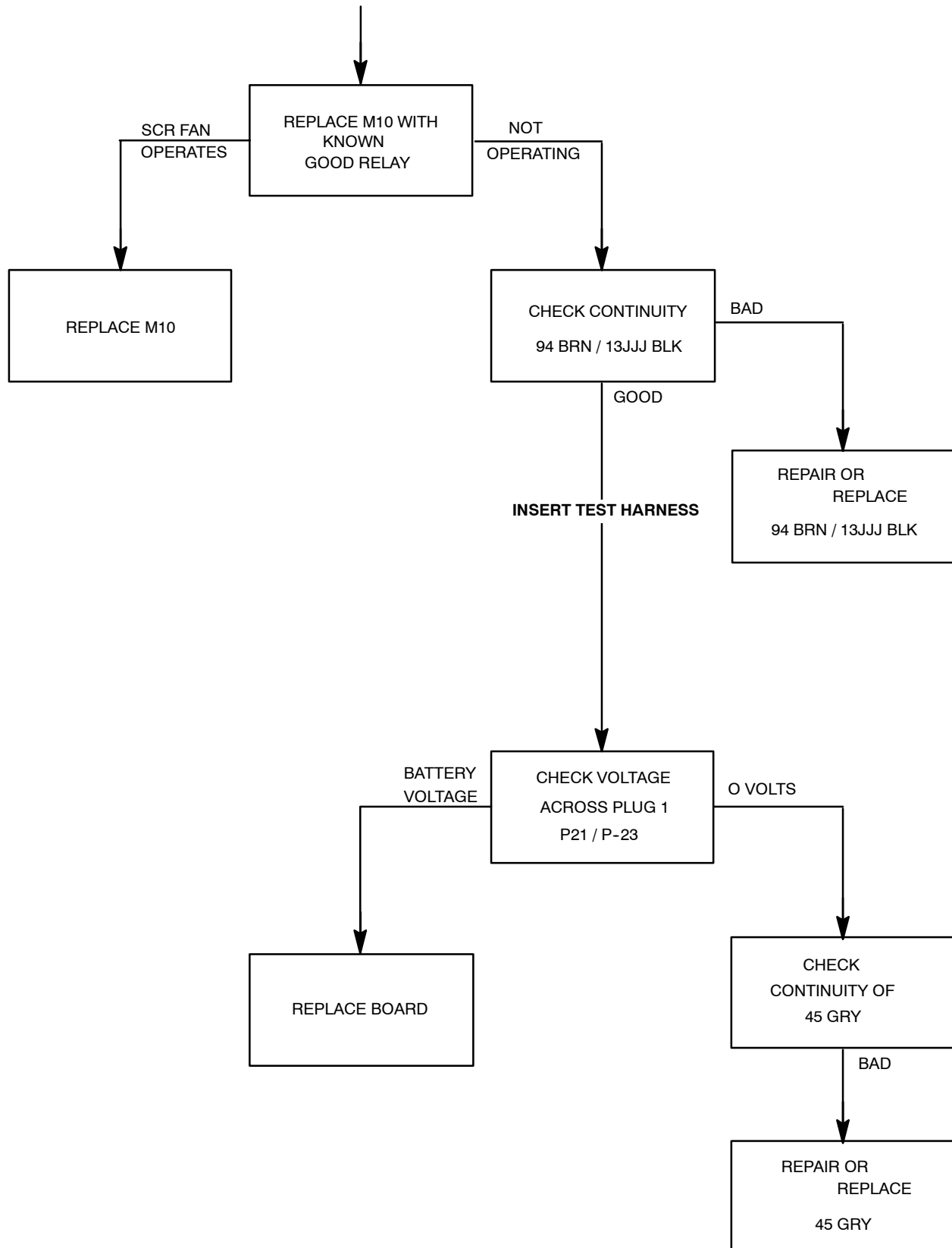




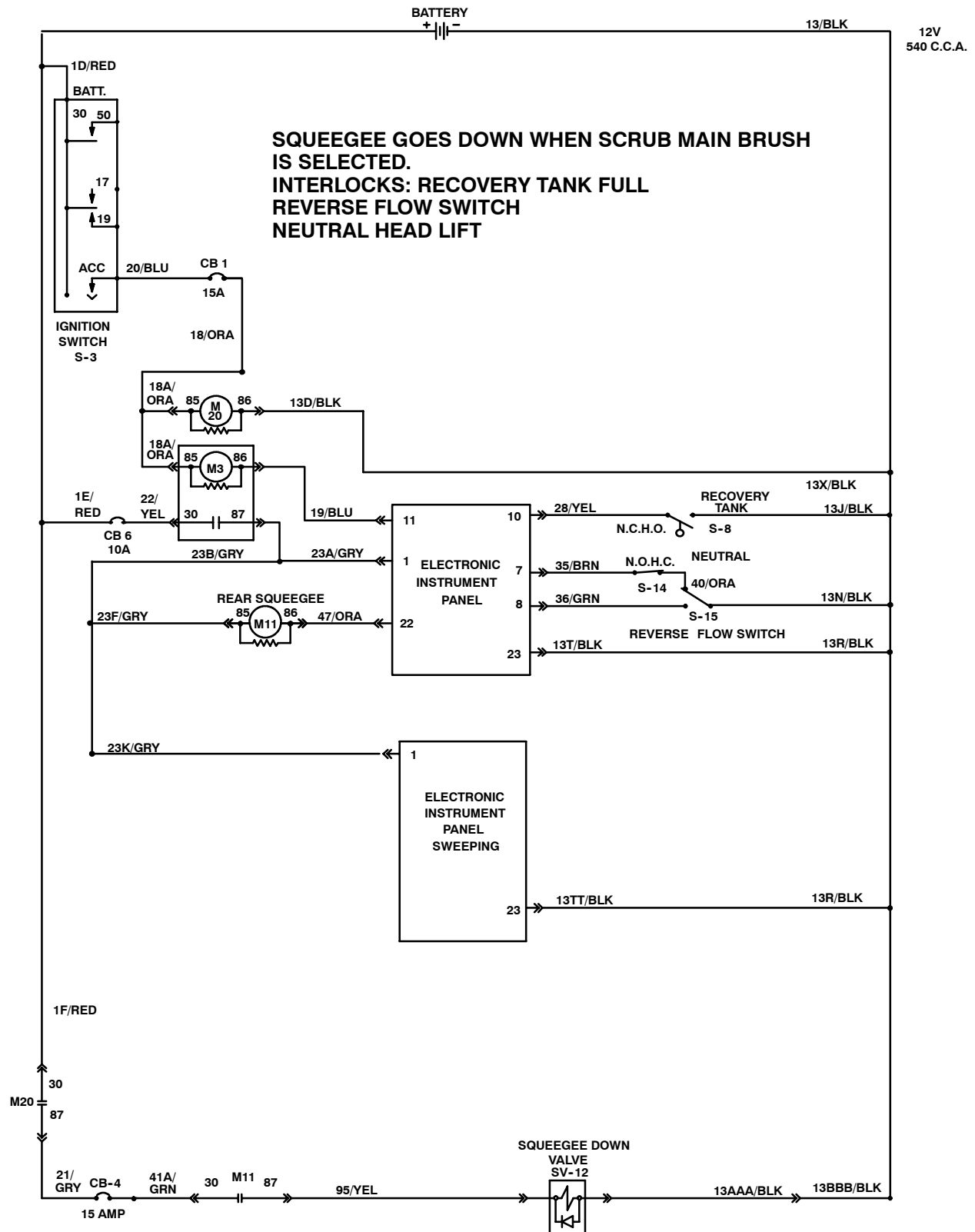
SCRUBBER FAN DOESN'T RUN



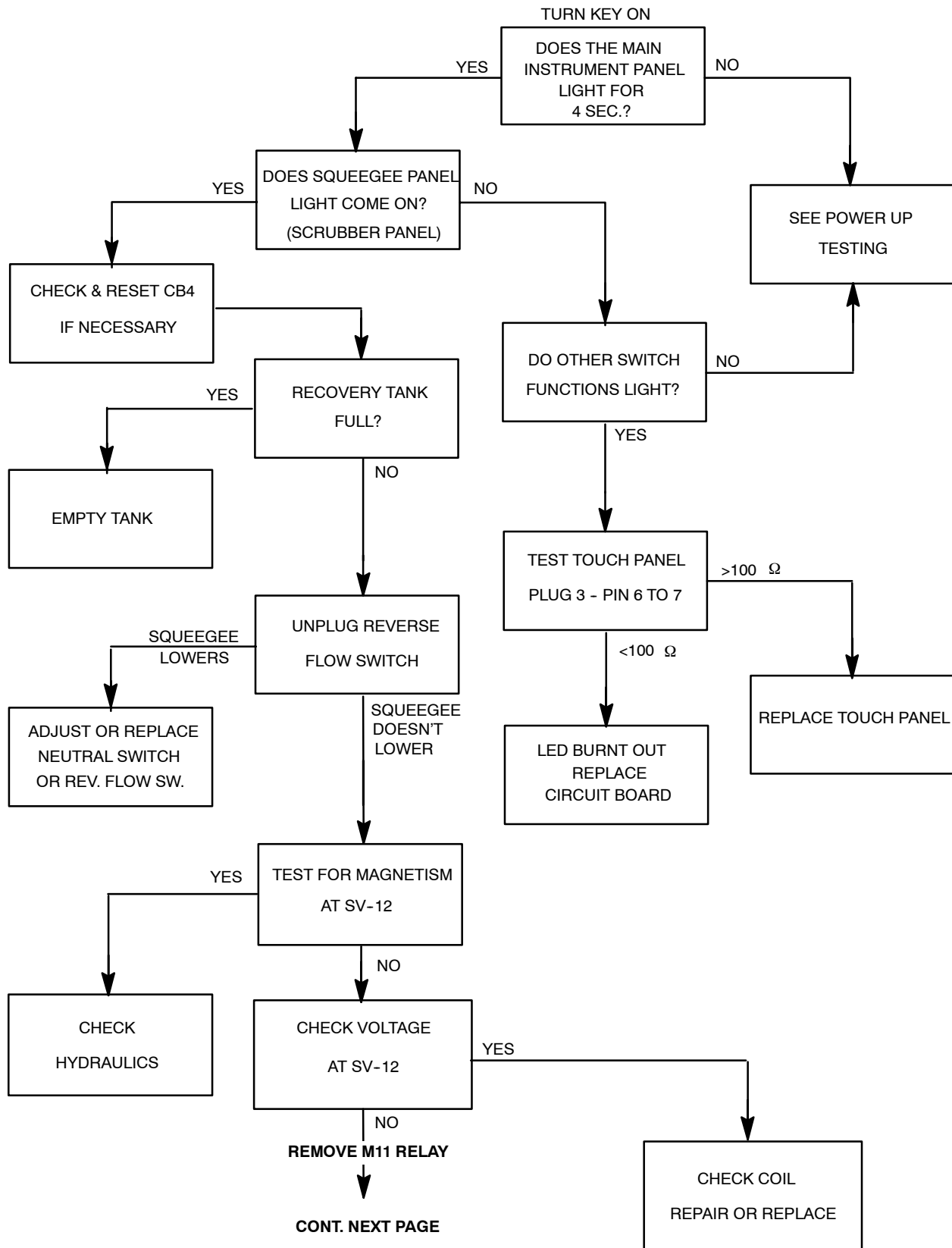


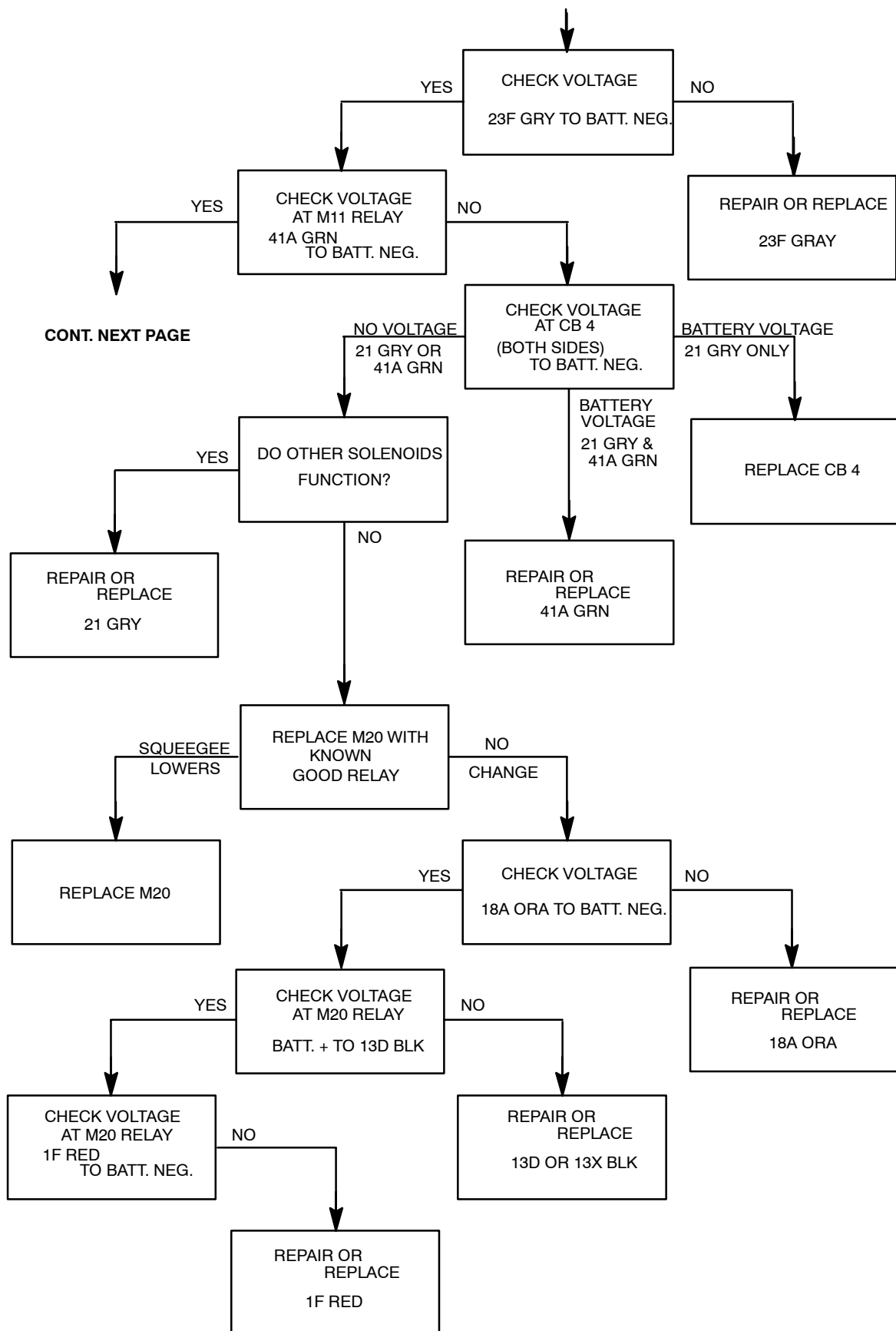


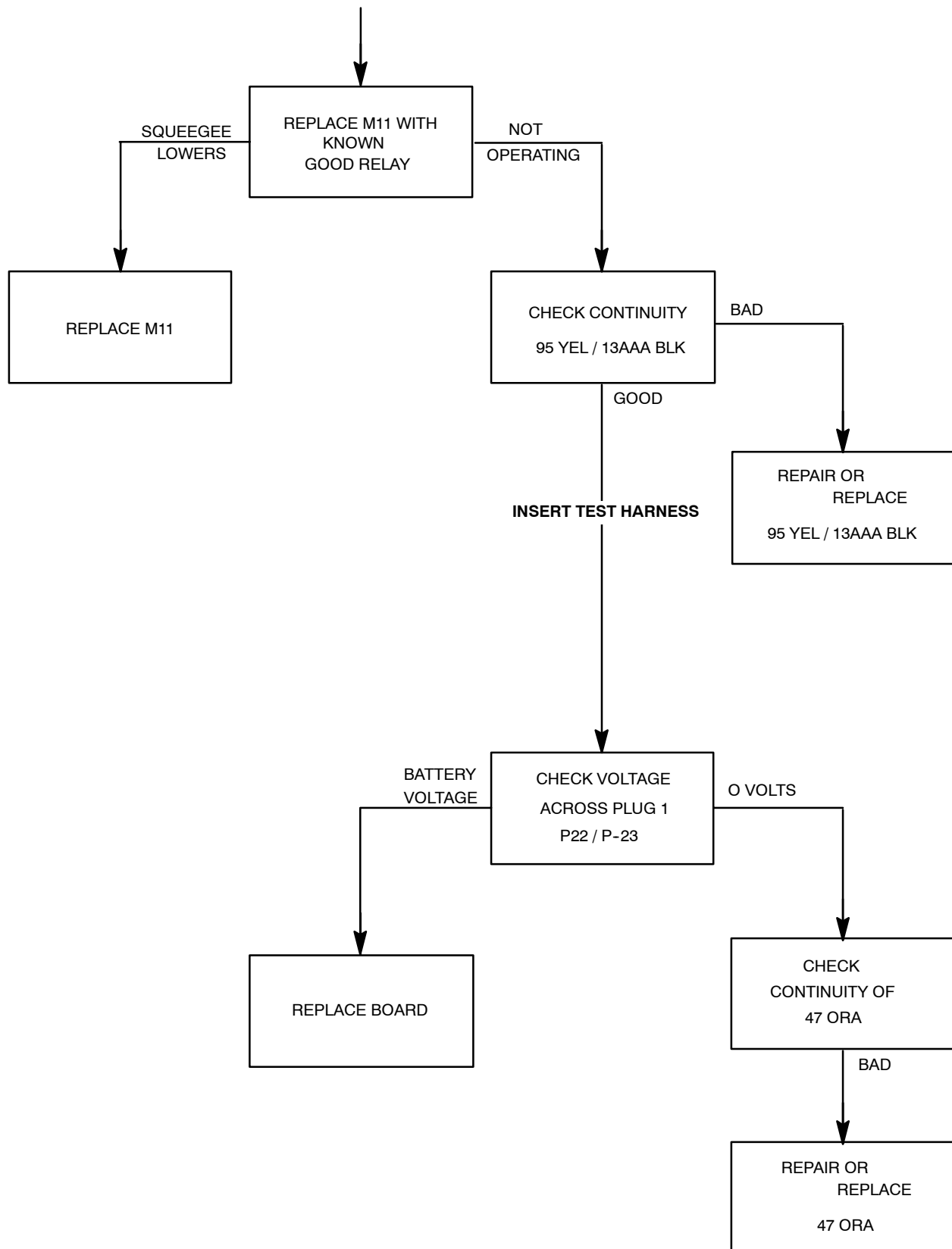
SQUEEGEE CIRCUIT



SQUEEGEE DOESN'T LOWER

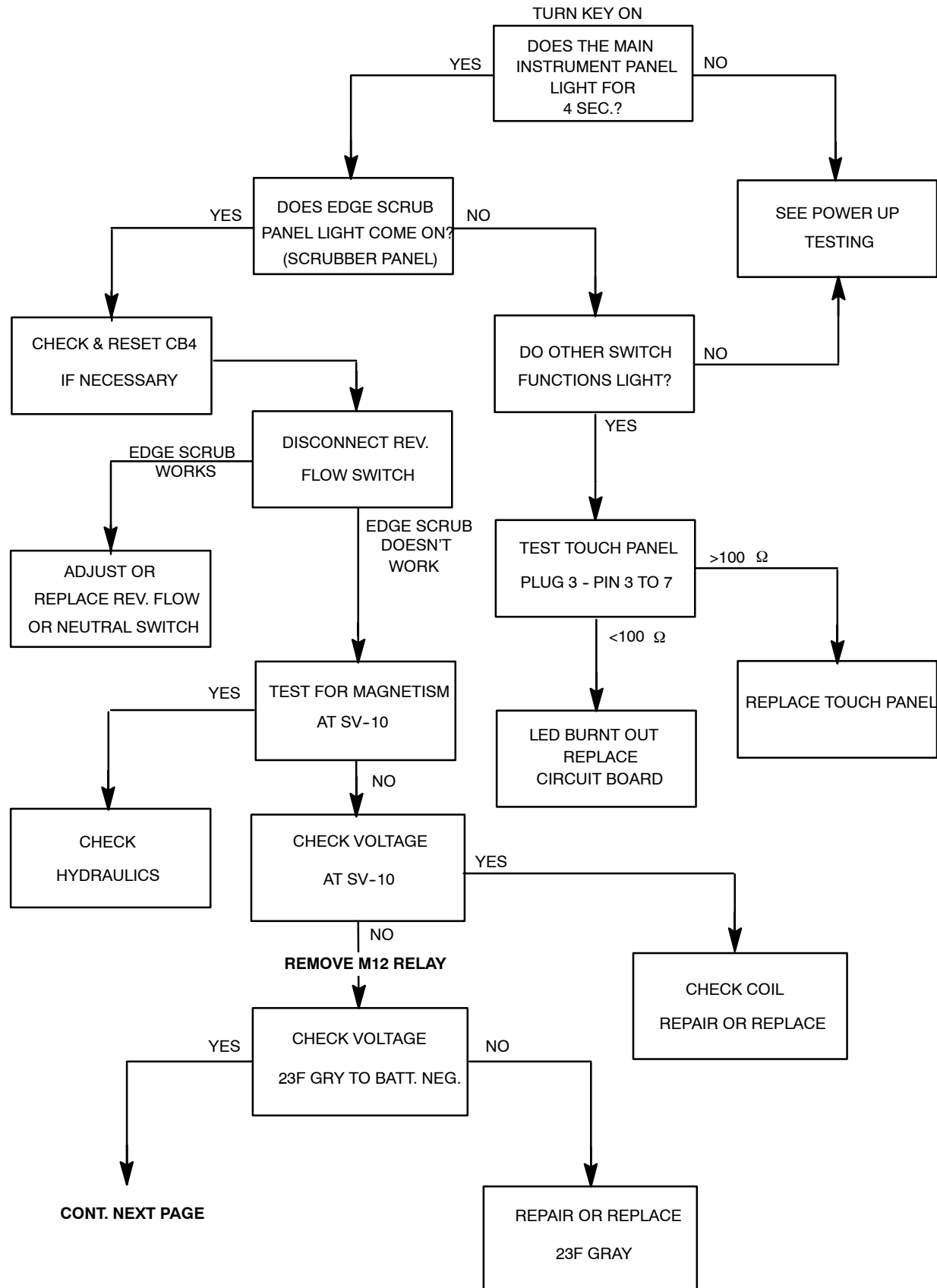


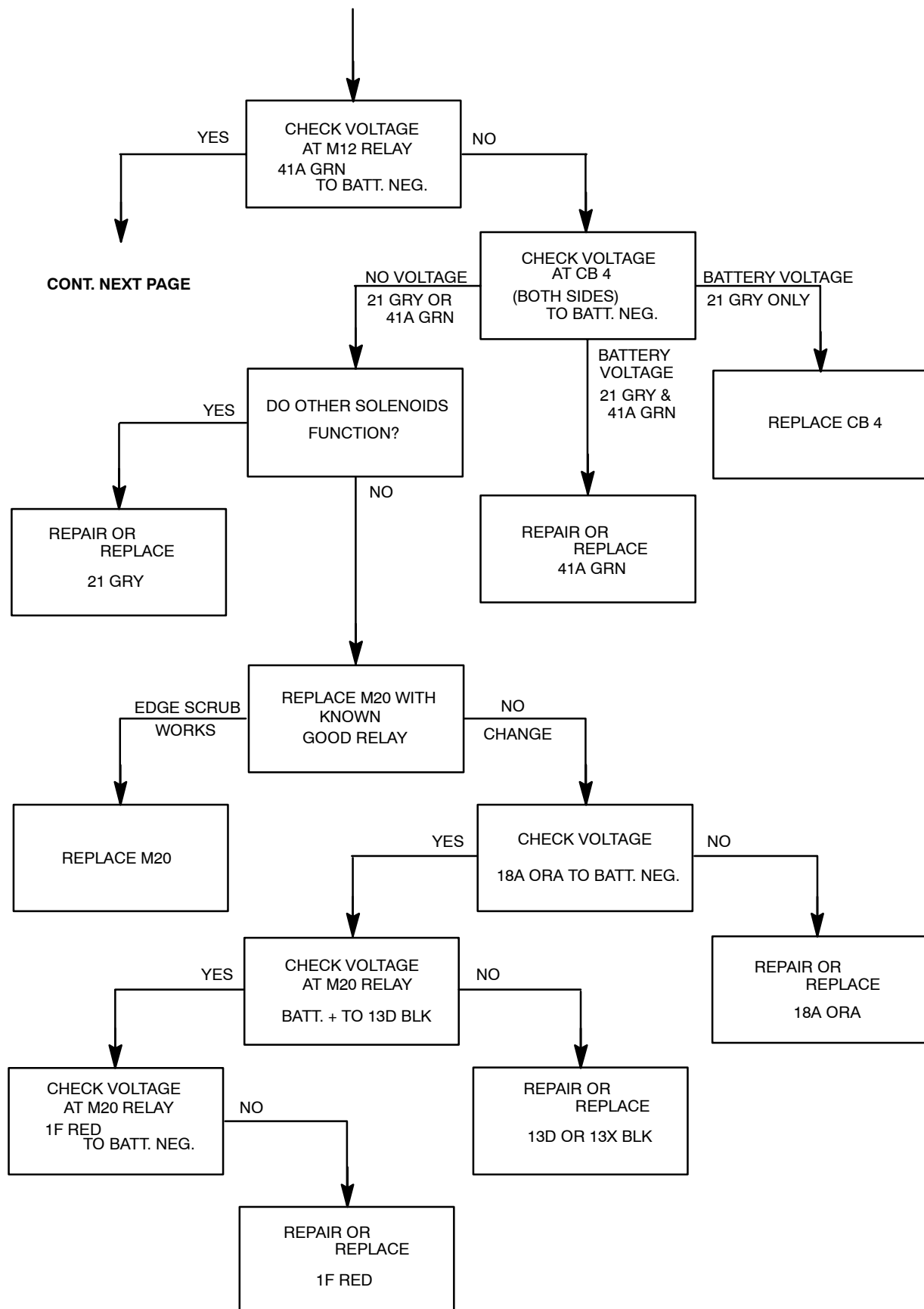


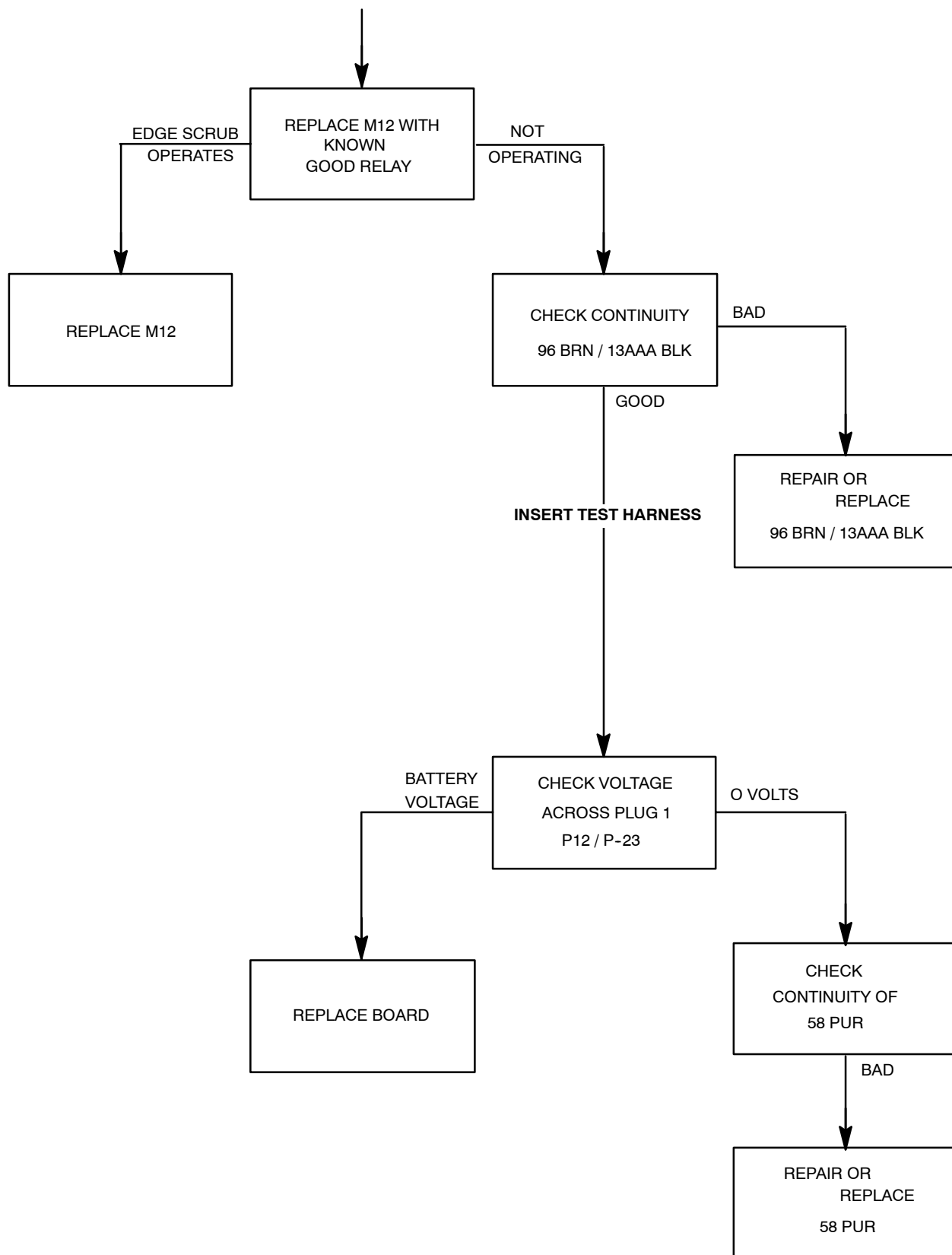




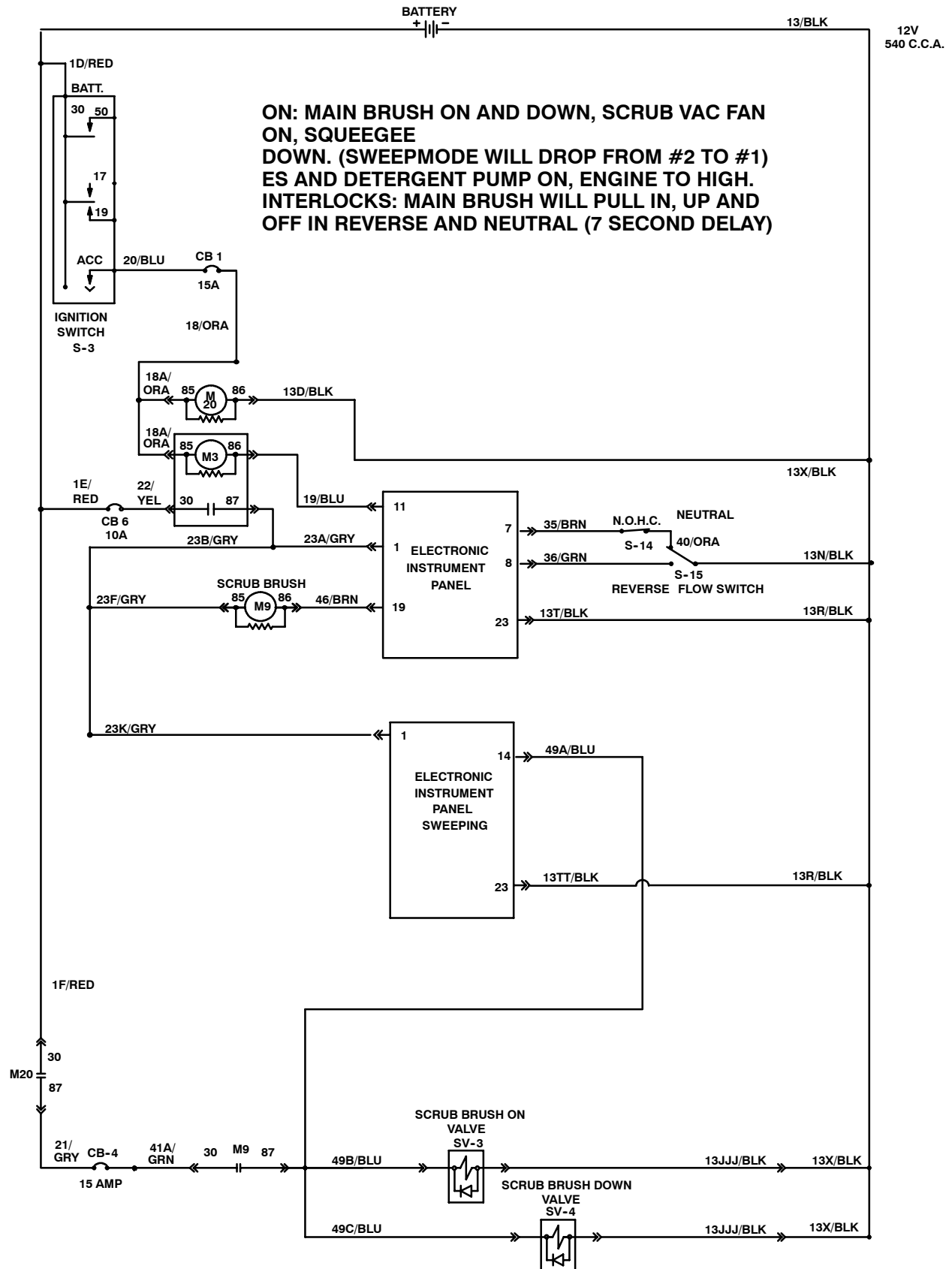
EDGE SCRUB DOESN'T WORK



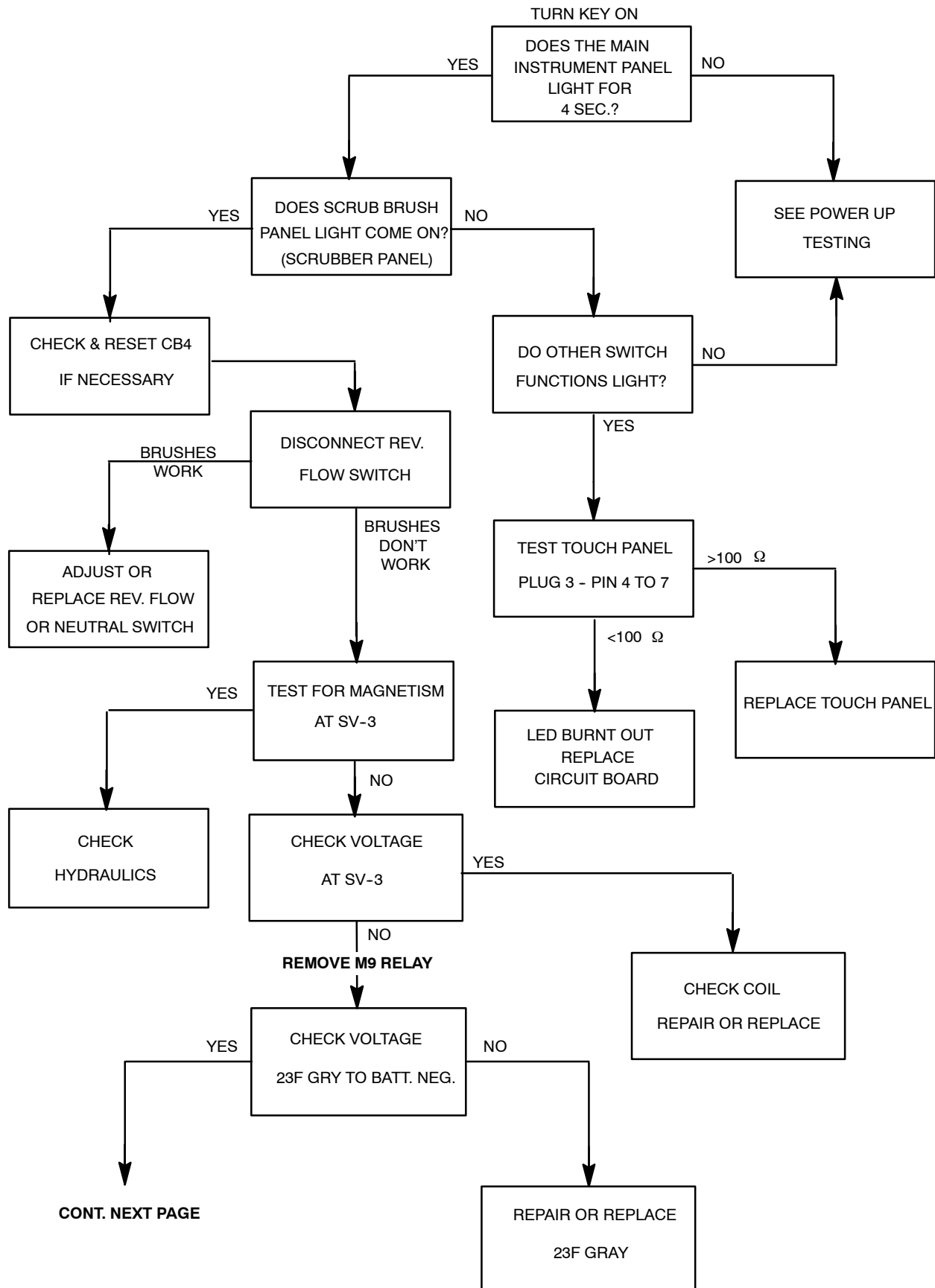


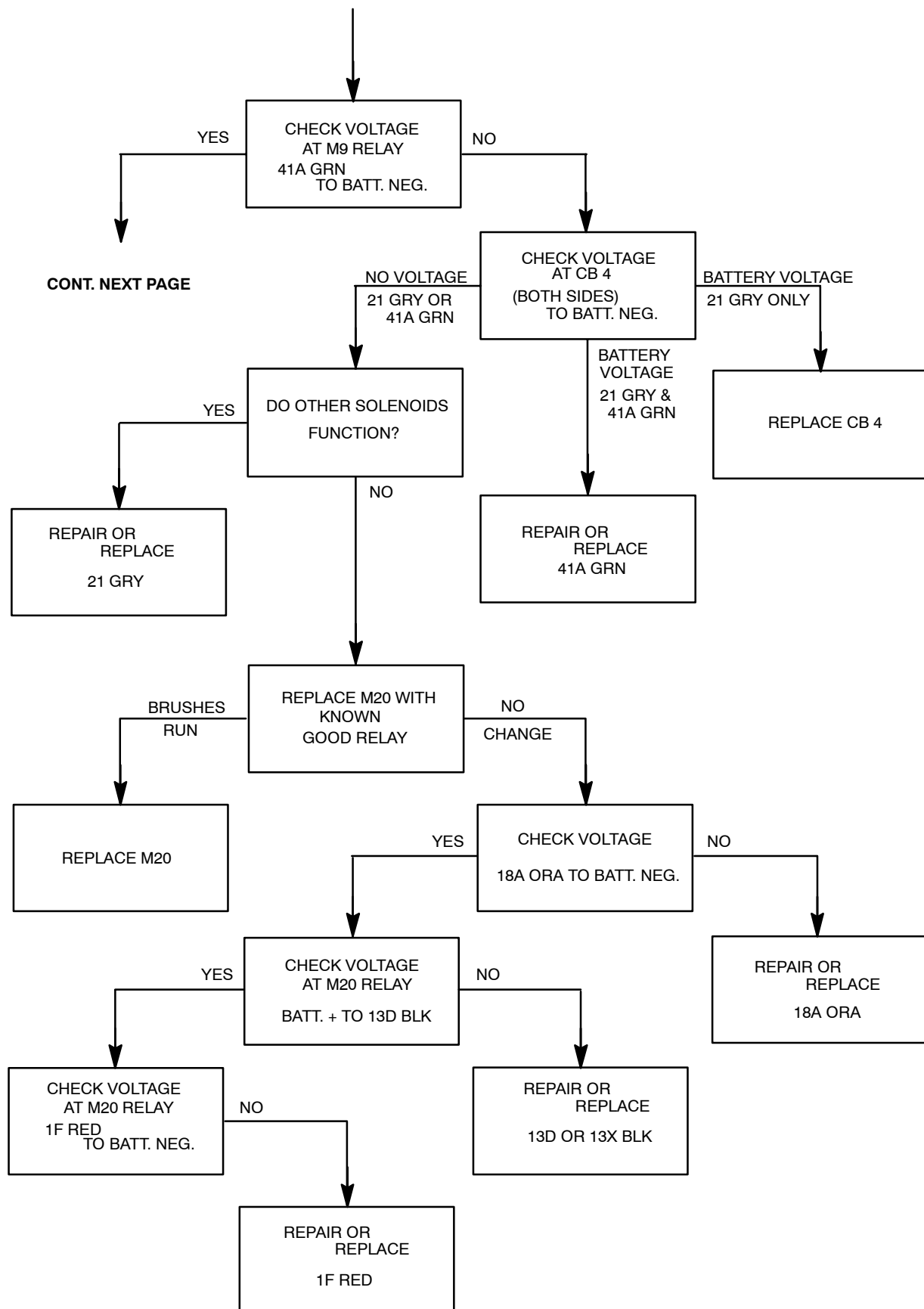


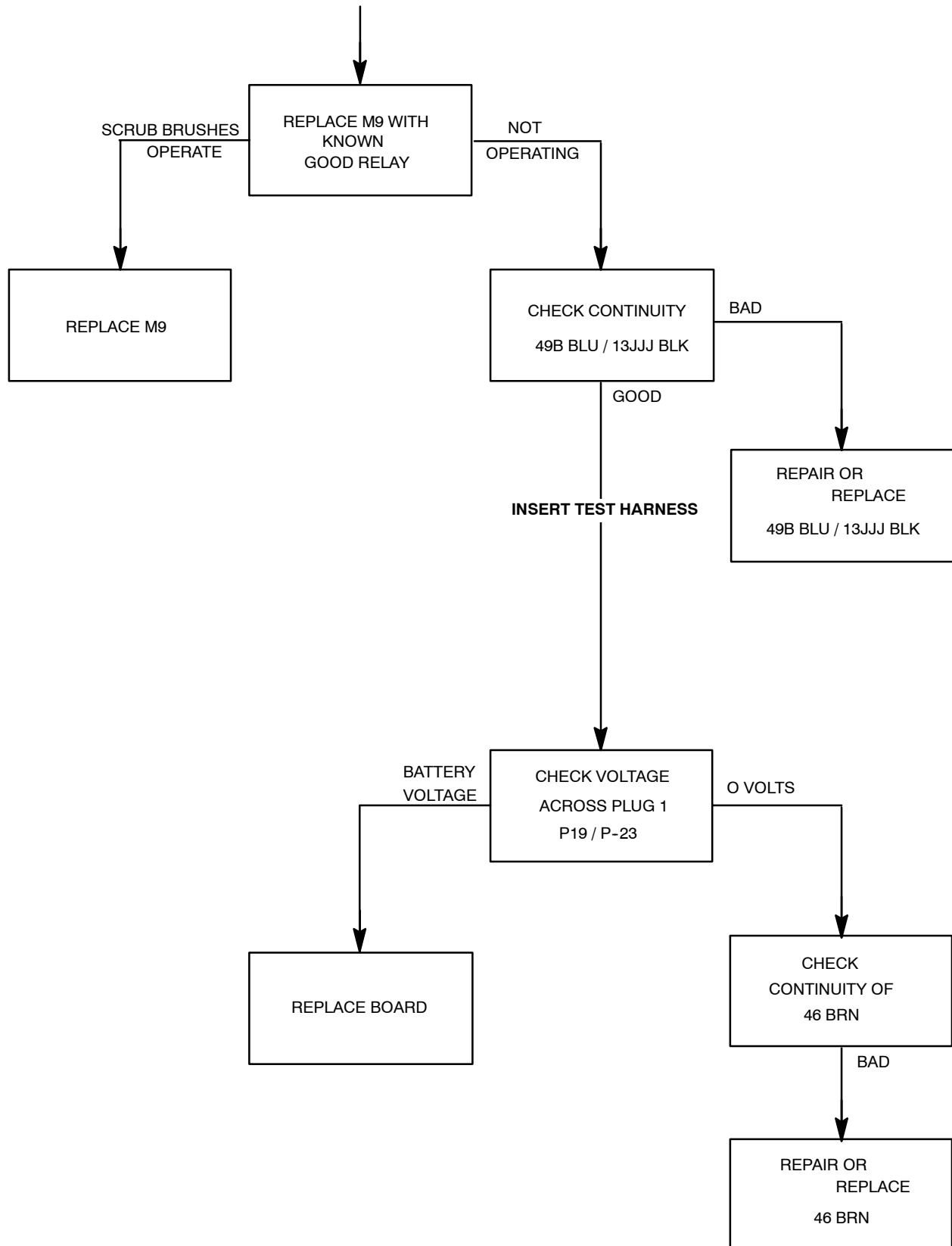
SCRUB BRUSH DOWN & ON CIRCUIT



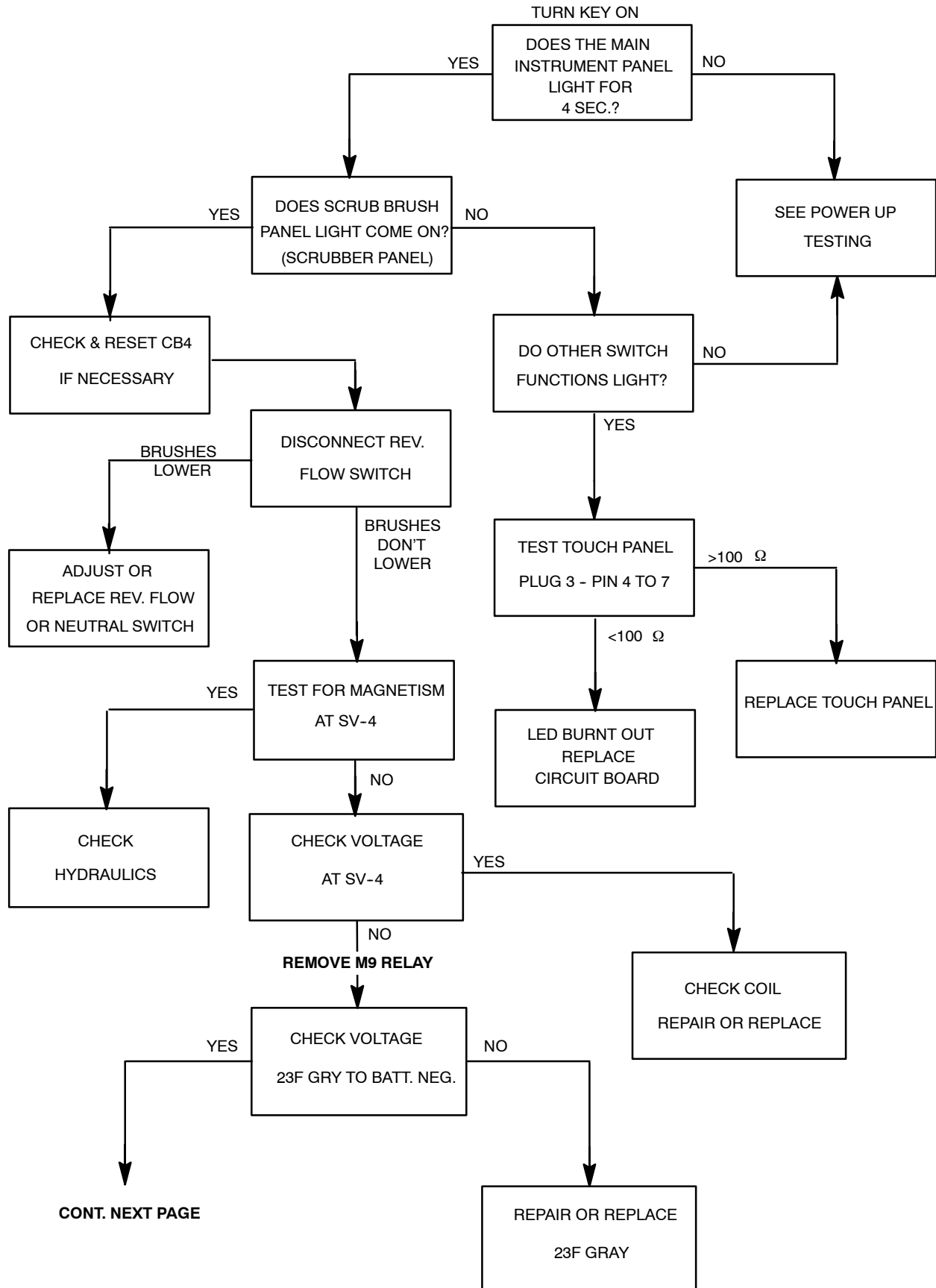
SCRUB BRUSH DOES NOT GO ON

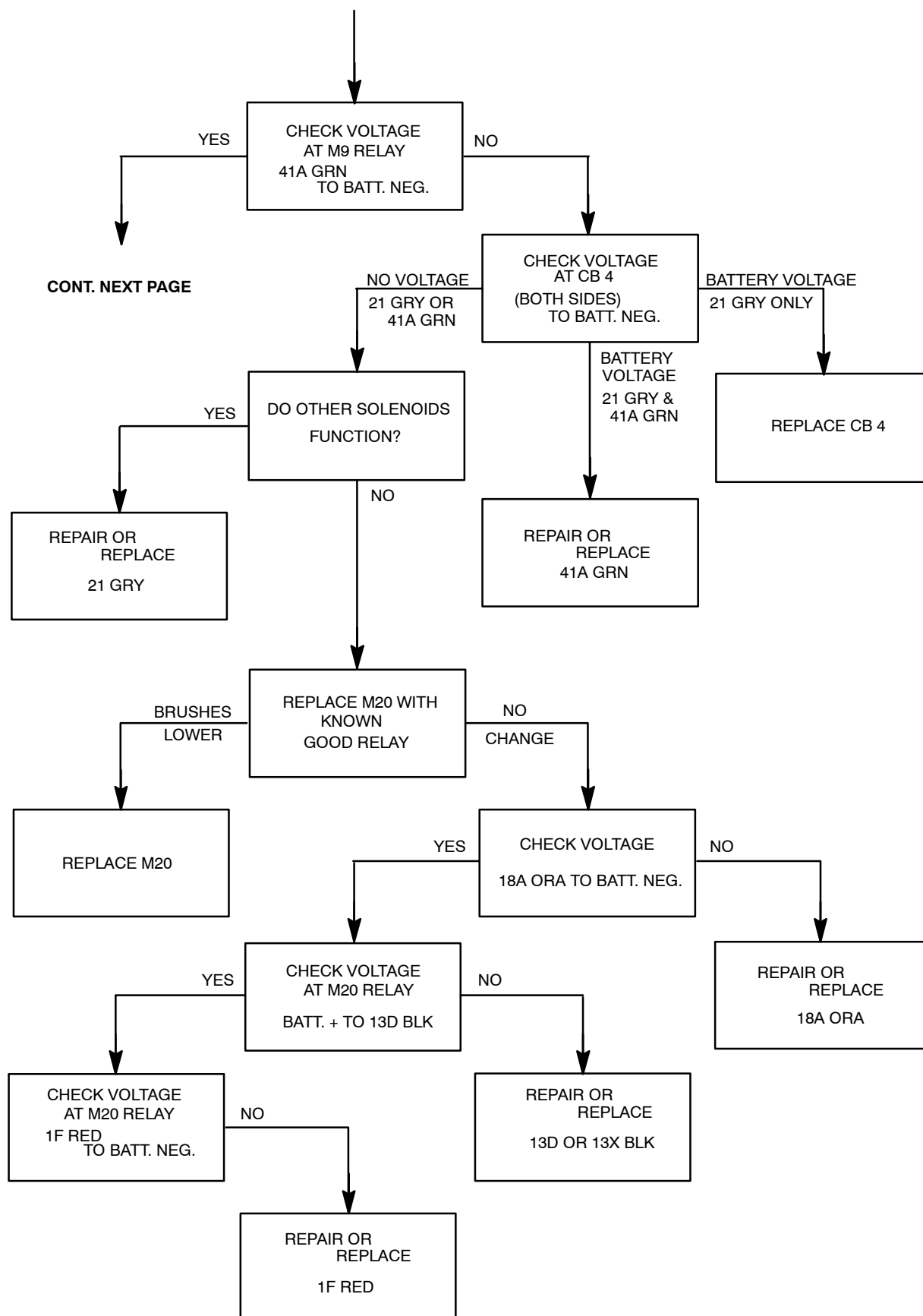


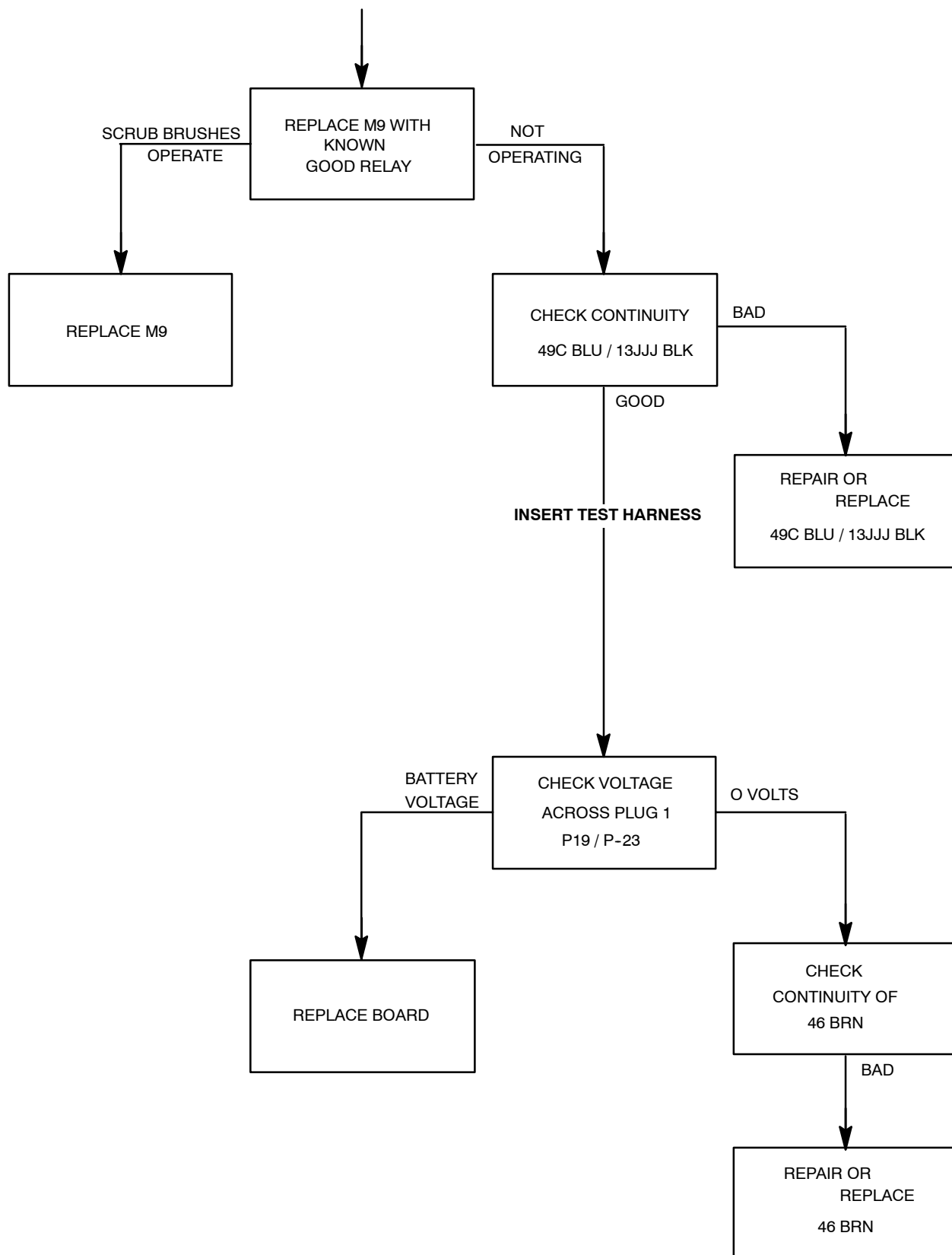




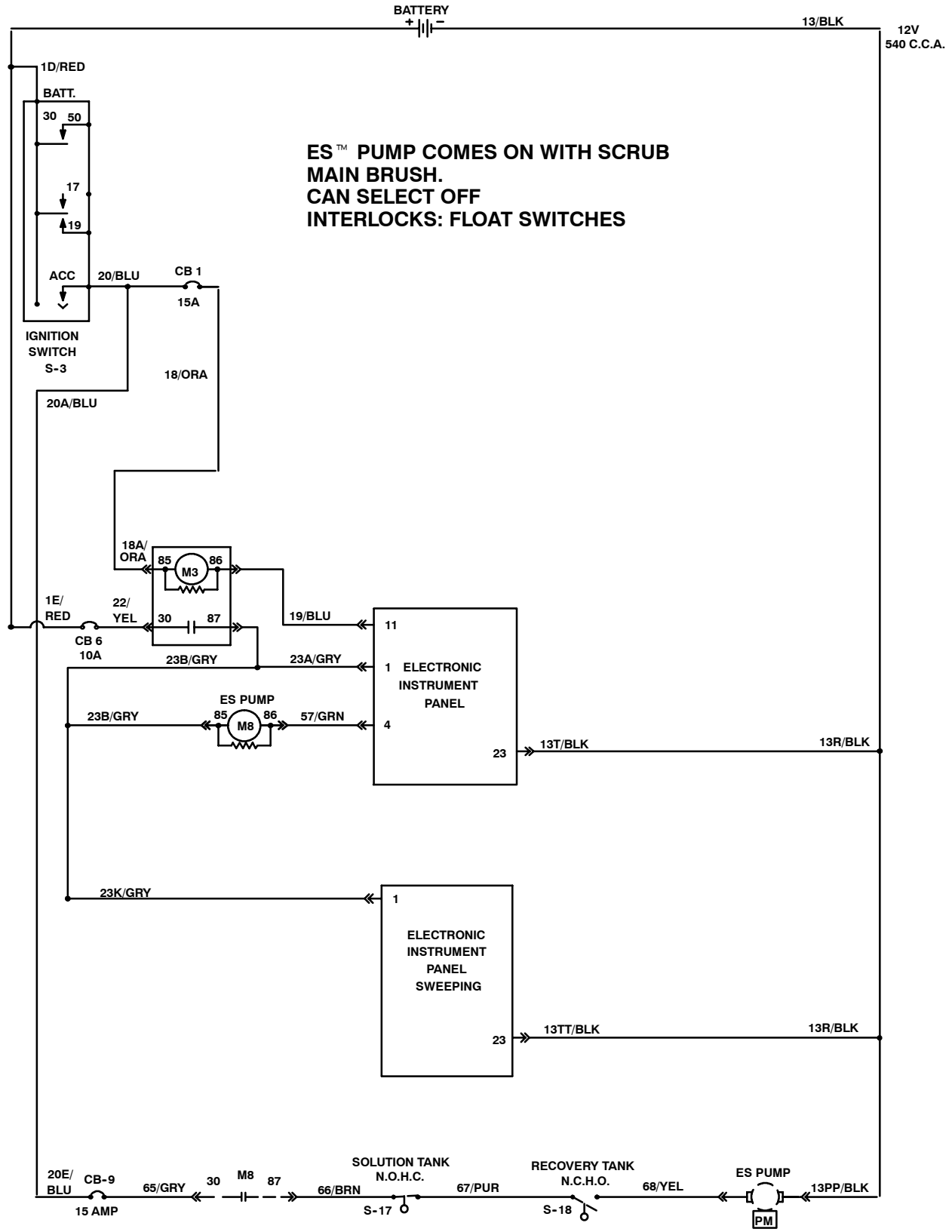
SCRUB BRUSHES DO NOT GO DOWN



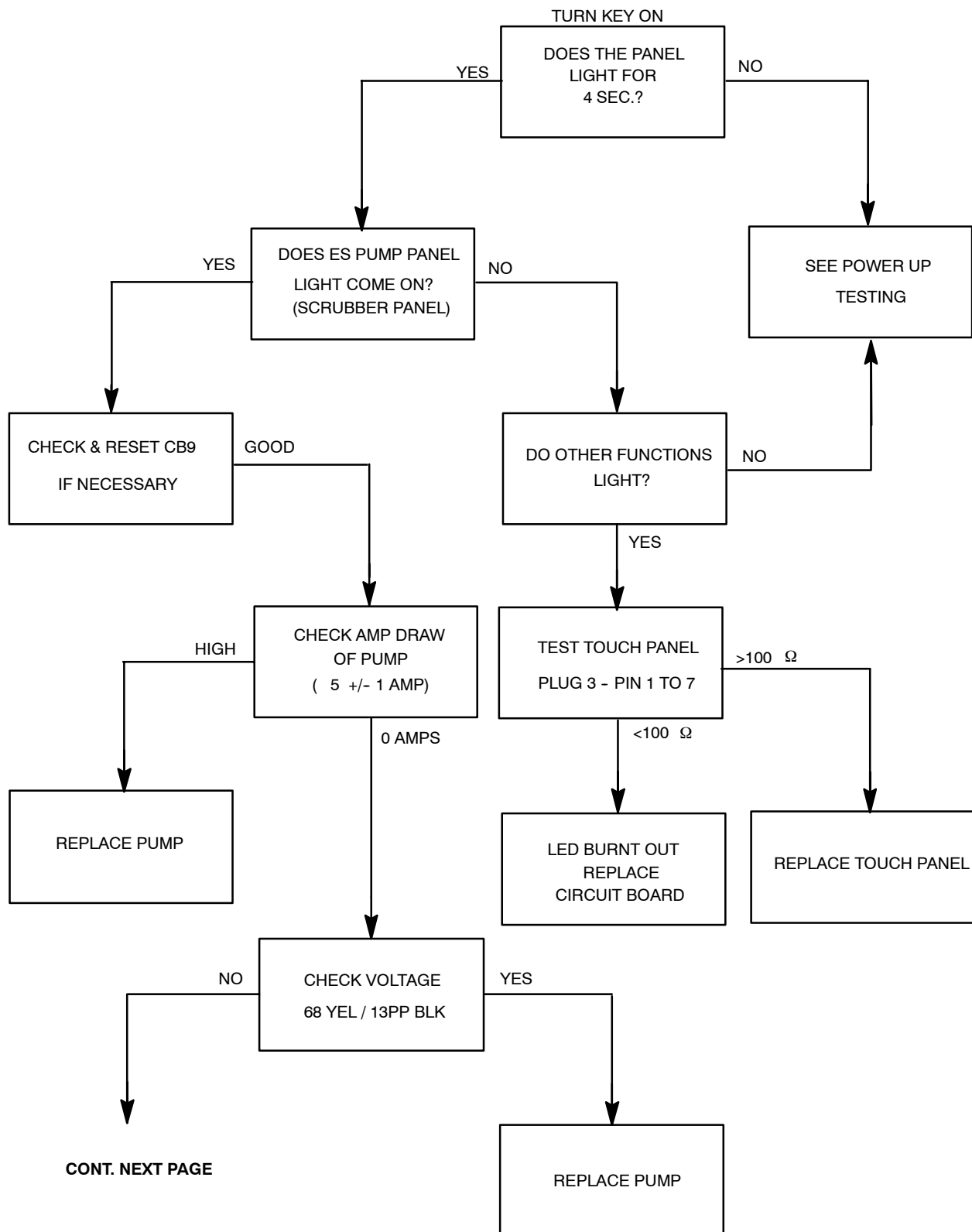


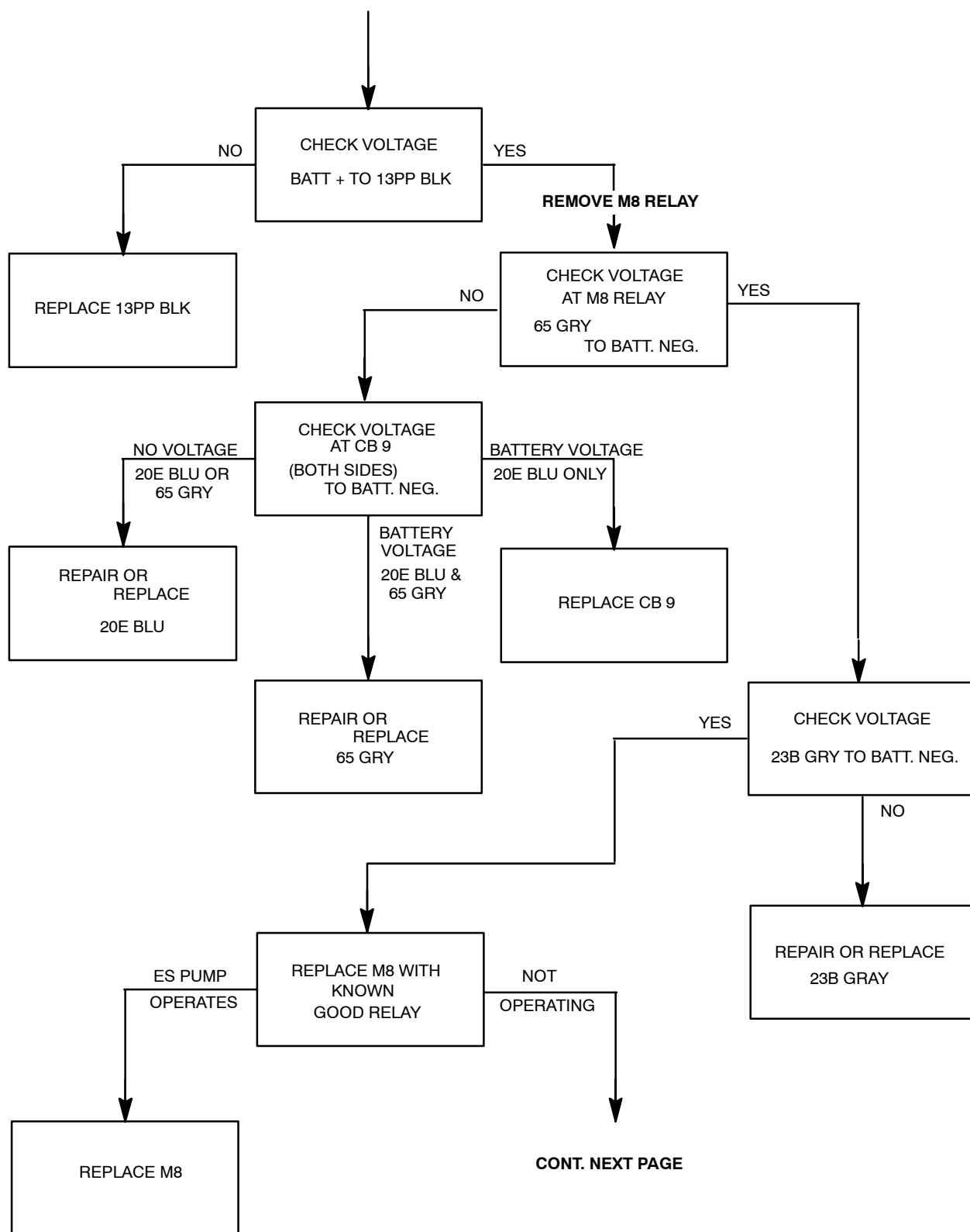


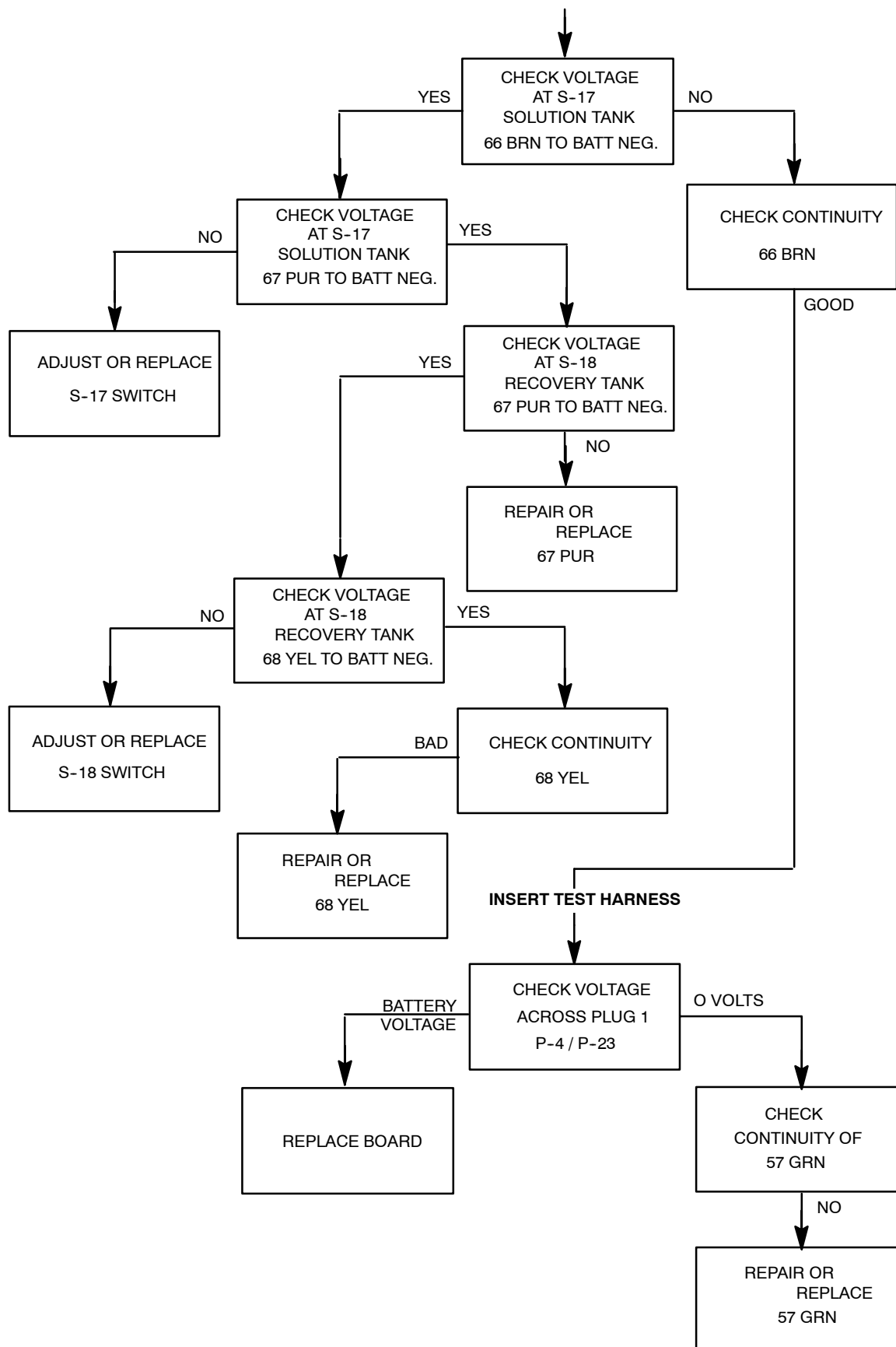
ES™ PUMP CIRCUIT



ES™ PUMP DOES NOT RUN







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HYDRAULIC FLUID RESERVOIR

The reservoir is located in the engine compartment next to the radiator.

Mounted on top of the reservoir is a filler cap with a built-in breather and fluid level dipstick. Replace the cap every 800 hours of operation.

Check the hydraulic fluid level at operating temperature every 100 hours of operation. Make sure the hopper is down when checking hydraulic fluid level. The end of the dipstick is marked with FULL and ADD levels to indicate the level of hydraulic fluid in the reservoir.

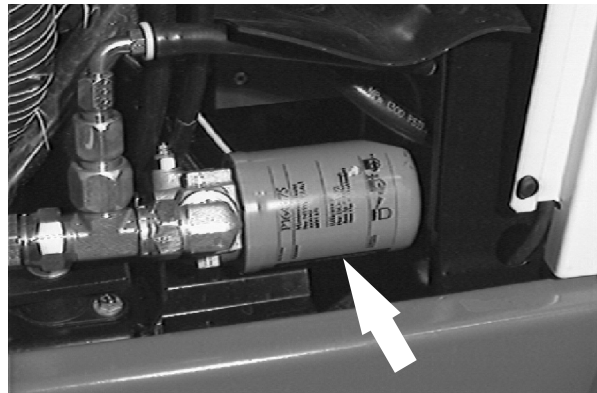
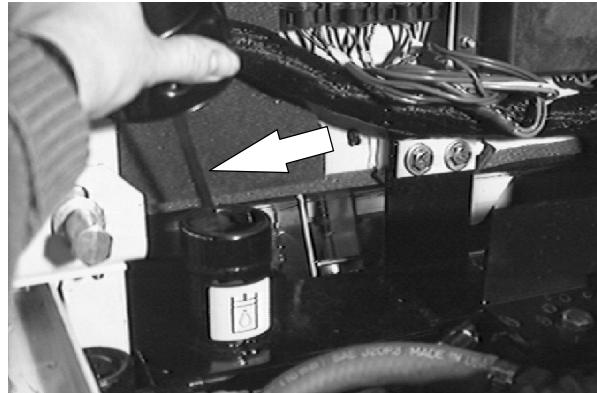
Lubricate the filler cap gasket with a film of hydraulic fluid before putting the cap back on the reservoir.

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

Drain and refill the hydraulic fluid reservoir with new hydraulic fluid every 800 hours of operation.

The hydraulic fluid filter is located at the bottom of the engine compartment. Replace the filter element every 800 hours of operation.

The reservoir has a built-in strainer outlet that filters hydraulic fluid before it enters the system. Replace the strainer every 800 hours of operation.



HYDRAULIC FLUID

The quality and condition of the hydraulic fluid play a very important role in how well the machine operates. Tennant's hydraulic fluid is specially selected to meet the needs of Tennant machines.

HYDRAULICS

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

Tennant part no.	Ambient Temperature
65869	above 7° C (45° F)
65870	below 7° C (45° F)

The higher temperature fluid has a higher viscosity and should not be used at the lower temperatures. Damage to the hydraulic pumps may occur because of improper lubrication.

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

If a locally-available hydraulic fluid is used, make sure the specifications match Tennant hydraulic fluid specifications. Using substitute fluids can cause premature failure of hydraulic components.

European manufactured machines are filled with locally available hydraulic fluids. Check the label on the hydraulic fluid reservoir.

ATTENTION! Hydraulic components depend on system hydraulic fluid for internal lubrication. Malfunctions, accelerated wear, and damage will result if dirt or other contaminants enter the hydraulic system.

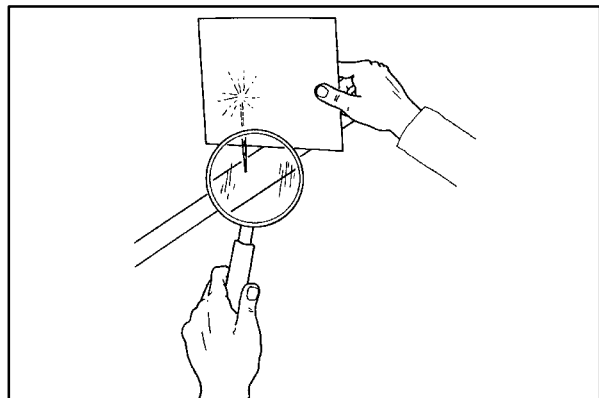
HYDRAULIC HOSES

Check the hydraulic hoses every 800 hours of operation for wear or damage.

Fluid escaping at high pressure from a very small hole can be almost invisible, and can cause serious injuries.

See a doctor at once if injury results from escaping hydraulic fluid. Serious infection or reaction can develop if proper medical treatment is not given immediately.

FOR SAFETY: When servicing machine, use cardboard to locate leaking hydraulic fluid under pressure.



00002

TO REPLACE DIRECTIONAL PEDAL CENTERING SPRING

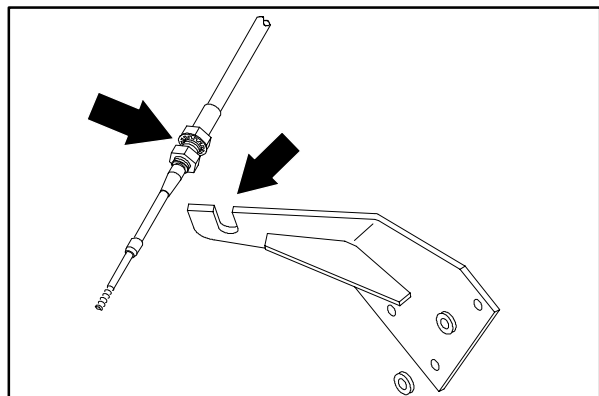
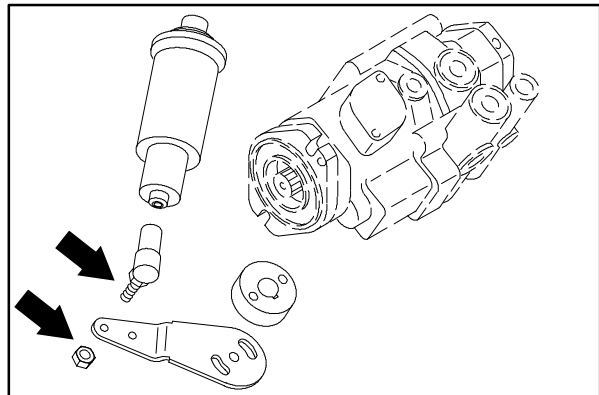
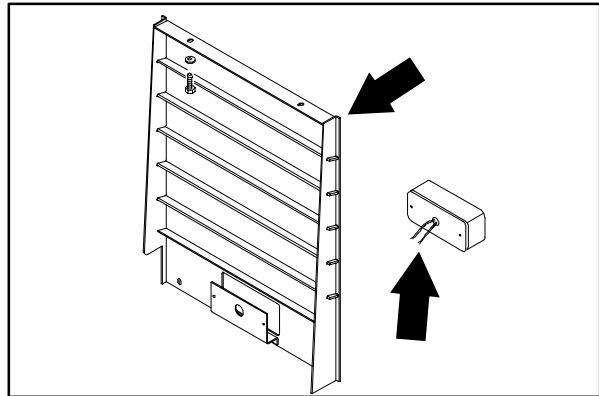
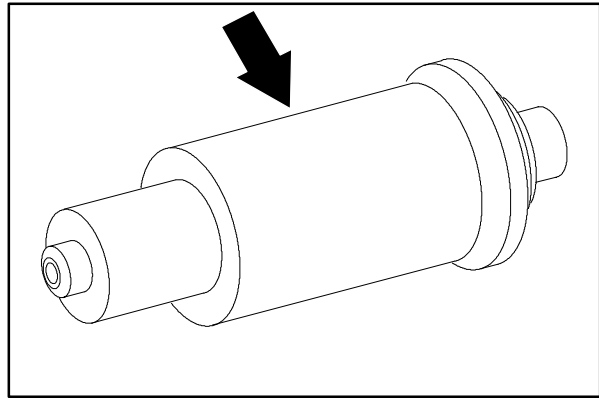
1. Shut off the engine and engage the parking brake.

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

2. Remove the four M8 hex screws holding the rear radiator grill to the machine. Disconnect the taillight and remove the grill from the machine.
3. Remove the nyloc nut holding the centering spring balljoint to the directional control arm.
4. Loosen the large jam nut holding the directional cable to the propel bracket.
5. Remove the spring assembly from the propel bracket and place it outside the back of the machine.
6. Remove the ball joint and jam nuts.
7. Unscrew the directional spring assembly from the directional control cable.

NOTE: The directional cable will have to be held to keep it from turning

8. Thread a new directional spring assembly all the way on the directional control cable. Leave 0.25 in of threads showing on the 0.62 in diameter threads.
9. Install two 0.25 in. jam nuts on the end of the directional cable. Tighten one to the housing and the other one to the balljoint, leaving 0.06 in. between them.
10. Use the large jam nut to lock directional spring assembly in place.

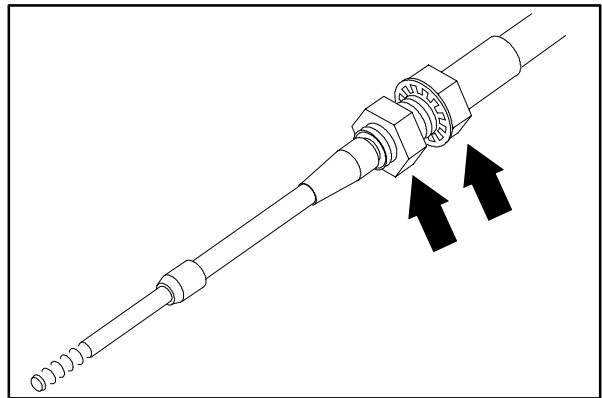
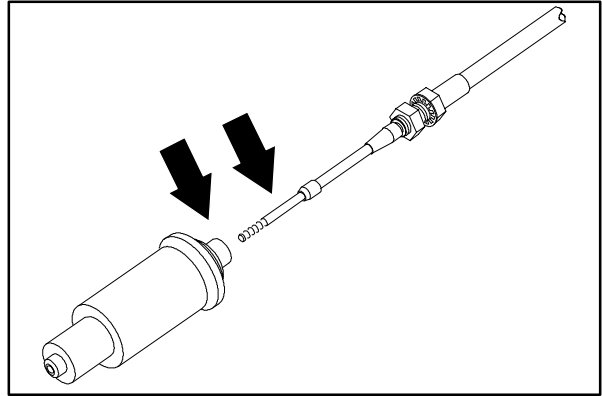


HYDRAULICS

11. Reinstall the balljoint to the directional control arm. Tighten the 0.25 in. nyloc nut to 11 – 14 Nm (7 – 10 ft lb).
12. Jack up the rear of the machine.

FOR SAFETY: Block machine tires before jacking machine up. Jack machine up at designated locations only. Block machine up with jack stands

13. Check the neutral centering of the propel pump by starting the machine and observing the rear tire for any rotation. If tire is rotating; See TO ADJUST DIRECTIONAL CONTROL instructions.
14. Once the neutral centering has been set; reinstall the rear grill panel. Tighten the four M8 hex screws to 18 – 24 Nm (15 – 20 ft lb). Lower the machine and test drive.

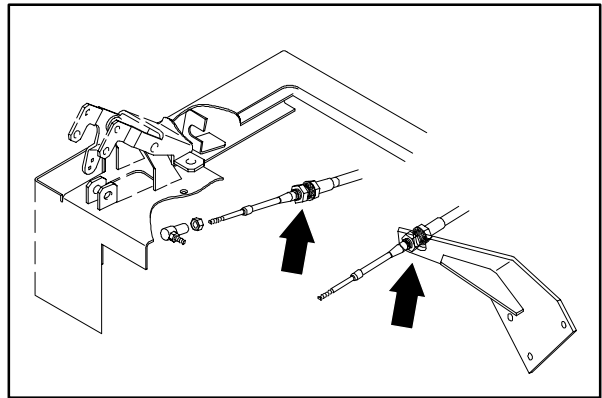


TO REPLACE DIRECTIONAL CONTROL CABLE

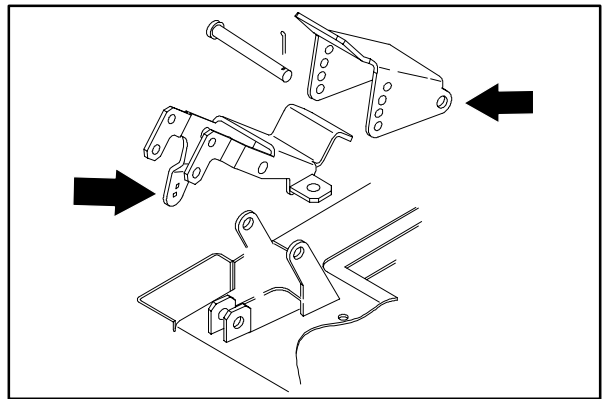
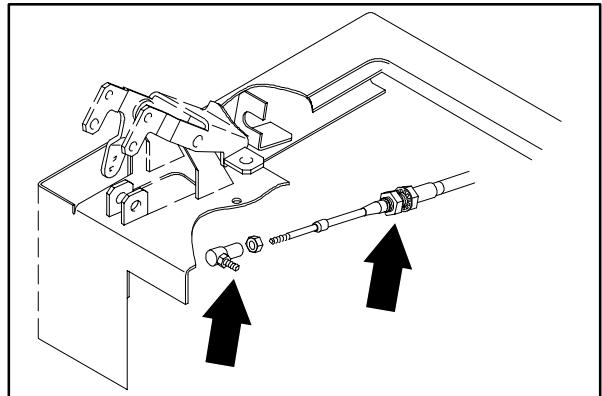
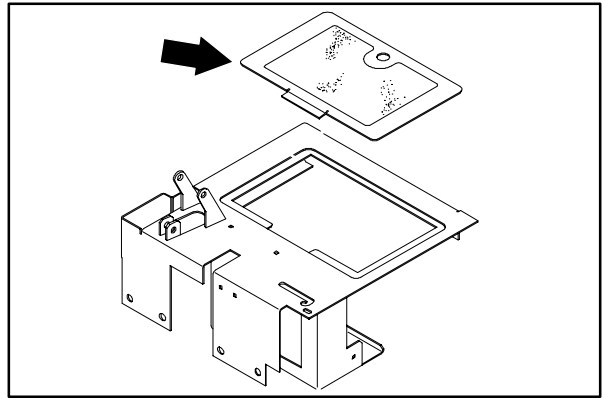
1. Shut off the engine and engage the parking brake.

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

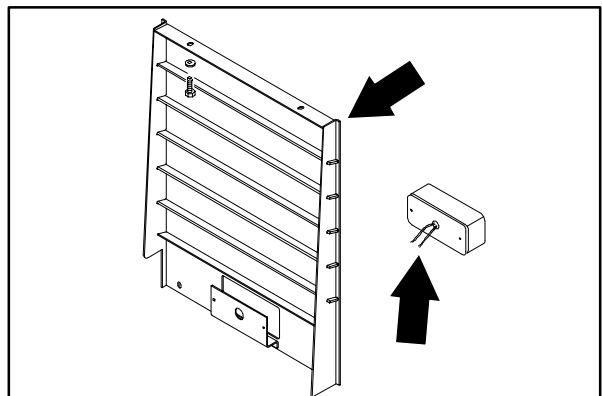
2. Lift the battery cover and disconnect the battery cables.



3. Remove the battery hold down bracket and remove the battery.
4. Remove the 0.25 nyloc nut holding the control cable balljoint to the directional pedal assembly.
5. Remove the cotter pin and clevis pin from the directional control pedal. Remove the pedal from the machine.
6. Loosen the two large hex nuts holding the control cable to the mount bracket on the floor plate.
7. Go under machine on operators side and locate the two M5 hex screws holding the clamp on the speed limiter cable. Remove screws and clamp.
8. Go under machine and remove any clamps or plastic ties holding control cable to the machine frame.



9. Remove four M8 hex screws holding the rear radiator grill to the machine. Unplug the taillight and remove the grill from the machine.
10. Remove the 0.25 in. nyloc nut holding the centering spring balljoint to the directional control arm on the propel pump.
11. Loosen the large jam nuts holding the directional cable to mount bracket on the propel pump.



HYDRAULICS

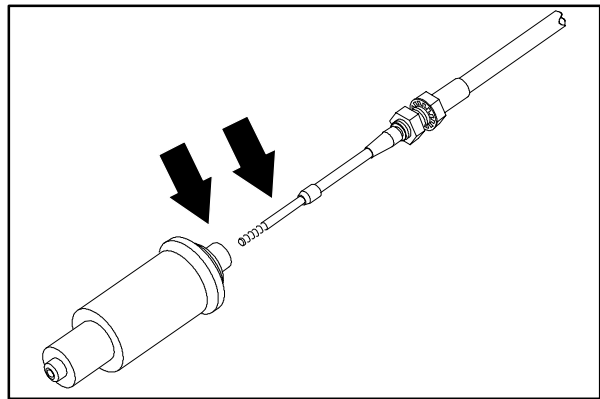
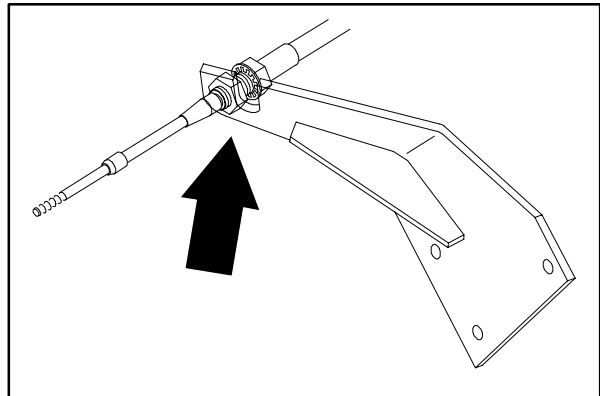
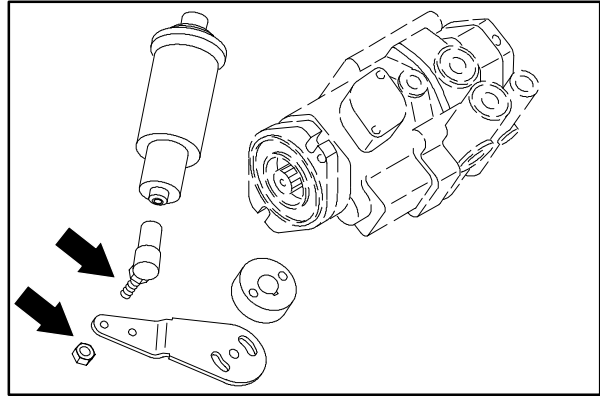
12. Remove the cable from the bracket and position it outside the back of the machine.
13. Unscrew the directional spring assembly from the directional control cable.

NOTE: Control cable will have to be held to keep it from turning

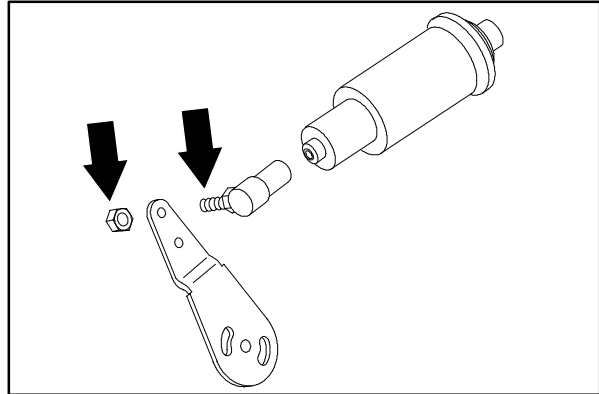
14. The old control cable can now be removed from the machine and a new one installed. Remove one of the jam nuts and thread the other one all the way on.

NOTE: The end of the cable with 1.5 in of thread goes to the directional spring.

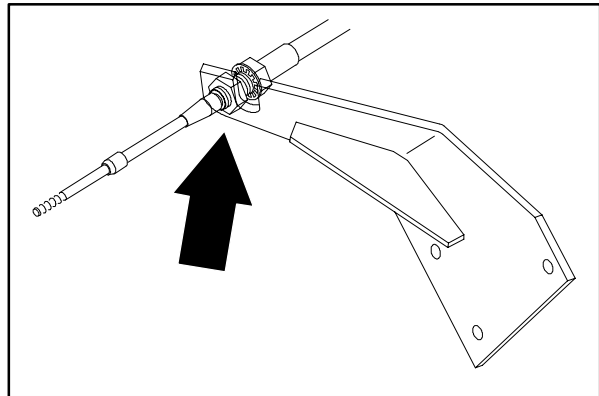
15. Make sure to route the cable between the square tube of the frame and the scrub head.
16. Thread the directional spring assembly all the way back on the directional control cable. Leave 0.25 in of threads showing on the 0.62 in diameter threads.



17. Install two 0.25 in jam nuts on the end of the cable. Tighten one to the housing and the other one to the balljoint, leaving 0.06 (1/16 in.) between them.
18. Reconnect the balljoint to the propel pump control arm using the 0.25 nyloc nut. Tighten to 11 - 14 Nm (7 - 10 ft lb).
19. Position the control cable back in the cable mount bracket on the propel pump. Firmly hand tighten large jam nut.



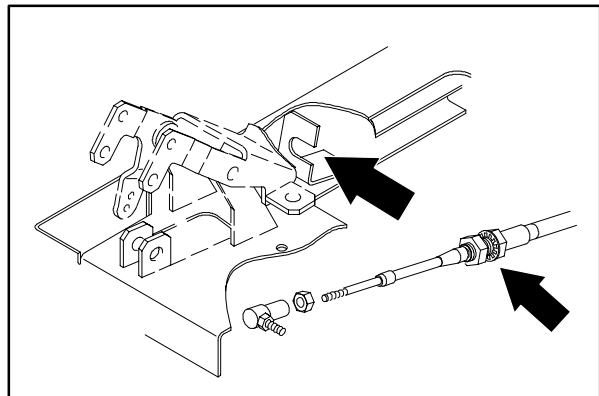
20. Install the control cable back in the mount bracket on the bottom of the floor plate. Firmly hand tighten large jam nuts so there is an equal amount of threads showing on both sides of bracket.
21. Reinstall the foot pedal with the clevis pin and cotter pin.
22. Reinstall the 0.25 in. jam nut and balljoint on the pedal end of control cable. Adjust it so there is 1.5 in. of movement between jam nut and rubber seal.



23. Reconnect the directional control cable balljoint to foot pedal with 0.25 nyloc nut. Tighten to 11 - 14 Nm (7 - 10 ft lb).

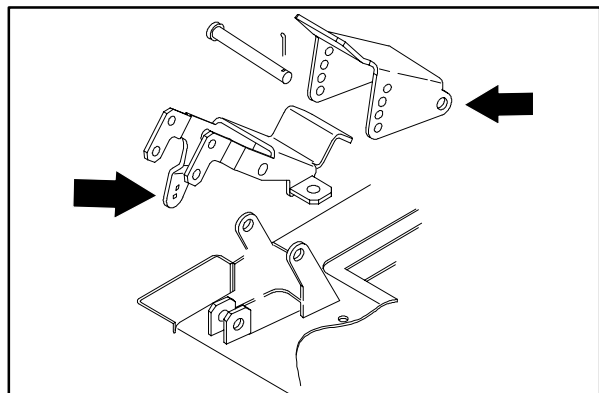
24. Jack up the rear of the machine.

FOR SAFETY: Block machine tires before jacking machine up. Jack machine up at designated locations only. Block machine up with jack stands



25. Check the neutral centering of the propel pump by starting the machine and observing the rear tire for any sign of rotation. If the tire is rotating See TO ADJUST DIRECTIONAL CONTROL instructions.

26. Once the neutral centering has been set, reinstall the rear grill panel. Tighten the four M8 hex screws to 18 - 24 Nm (15 - 20 ft lb). Lower the machine.



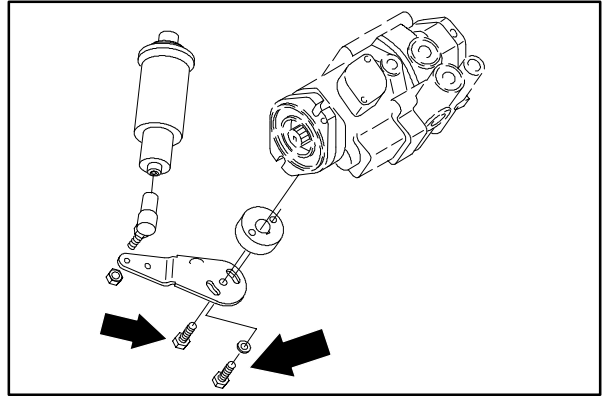
TO ADJUST DIRECTIONAL CONTROL

1. Set the emergency brake and start the engine.

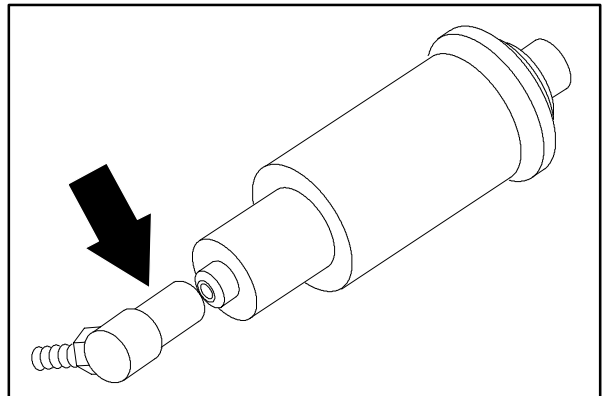
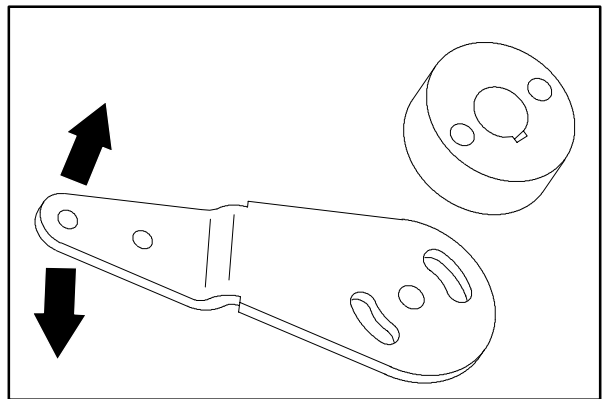
FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake, Turn Off Machine And Remove Key.

2. Jack up the rear of machine.

FOR SAFETY: Block machine tires before jacking machine up. Jack machine up at designated locations only. Block machine up with jack stands.



3. Check the neutral centering of the pump by observing the rear tire for any rotation.
4. If the rear tire is rotating, shut off the engine and go under the machine by the engine muffler.
5. Look up at the propel pump and locate the three hex screws holding the pump control arm to the pump hub. Loosen these hex screws.
6. Start the machine and observe the rear tire for any rotation. If the tire is rotating in either direction, move the pump control arm until the rotation stops. Hand tighten the control arm hardware for now. Shut off the engine.
7. Once all rotation has been eliminated, tighten the two outside M8 hex screws to 18 - 24 Nm (15 - 20 ft lb). Tighten the center 0.31 in. hex screw to 18 - 24 Nm (15 - 20 ft lb).
8. For fine adjustments the balljoint can be rotated in or out a few turns.
9. Lower the machine to the ground and operate. Check to see if the machine creeps in either direction.



TO REPLACE PROPEL PUMP

1. Start the engine and lower the squeegee.

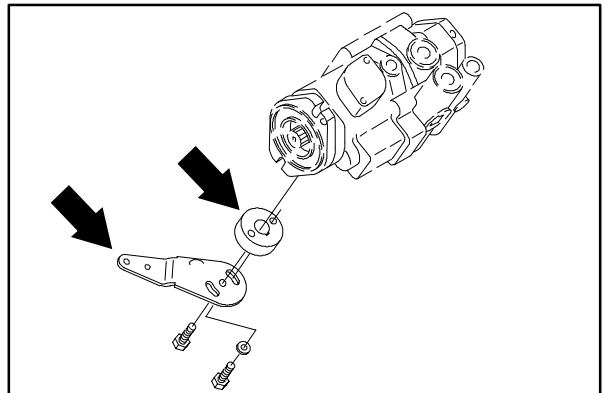
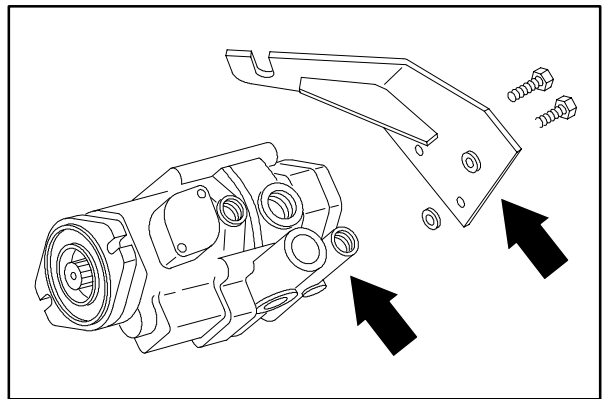
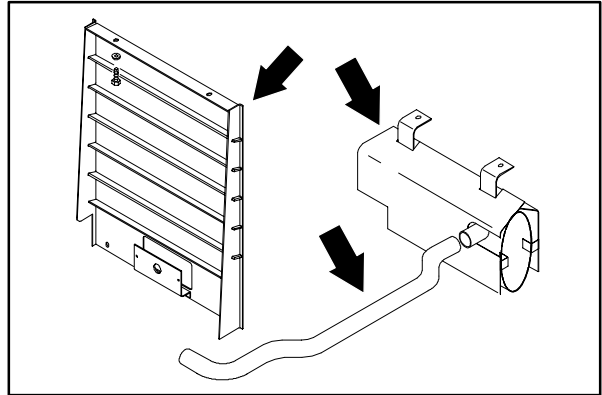
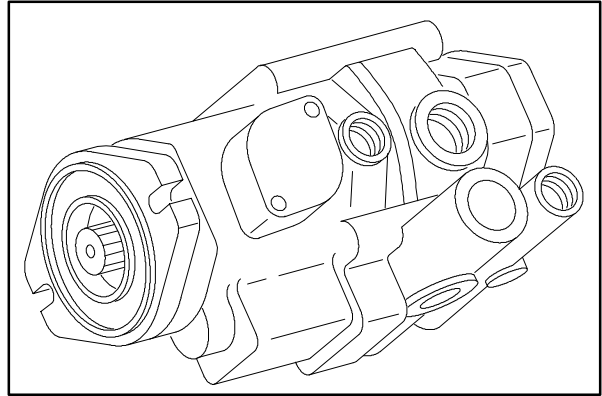
FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake., Turn Off Machine And Remove Key.

2. Disconnect the battery cables from the battery.
3. Jack up the rear of the machine.

FOR SAFETY: Block machine tires before jacking machine up. Jack machine up at designated locations only. Block machine up with jack stands.

4. Remove four M8 hex screws holding the rear radiator grill to the machine. Unplug the taillight and remove the grill from the machine.
5. Open the engine cover and side door.
6. Remove the muffler and exhaust pipe.
7. Remove two 0.38 in. hex screws holding directional control cable mount bracket to the back of propel pump.
8. Remove the three hex screws holding the propel pump arm to the pump hub.
9. Unplug the pump switch from main harness.
10. Move the pump arm, cable mount bracket, and control cable back out of the way.
11. Remove and plug the four hydraulic hoses leading to the propel pump.

NOTE: *Observe hydraulic cleanliness requirements when opening hydraulic lines.*



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12. Remove the two 0.38 in. hex screws holding the propel pump to the load sensing pump.
13. Move the flow switch and mounting bracket out of the way.
14. The propel pump can now be pulled back and out of the load sensing pump.

NOTE: Be careful not to loose or damage the o-ring or the pump coupler

15. Remove the propel pump from the machine.

16. Remove the hydraulic fittings from the old pump and install them in the new one. Make sure the fittings are installed in the same orientation as they were removed.

17. Remove hub from the pump shaft on the old propel pump. A puller may needed to break the hub loose.

18. Remove the two #10 hex screws holding the switch bracket to the old propel pump. Remove the bracket and install it on the new pump. Discard the hardware that came with the new pump. Reinstall the #10 hex screws and tighten to 5 - 7 Nm (4 - 5 ft lb).

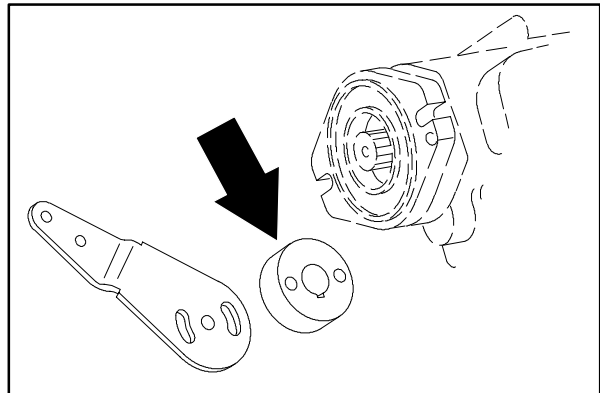
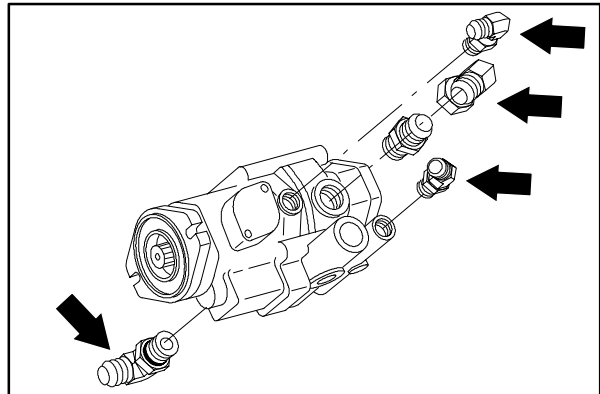
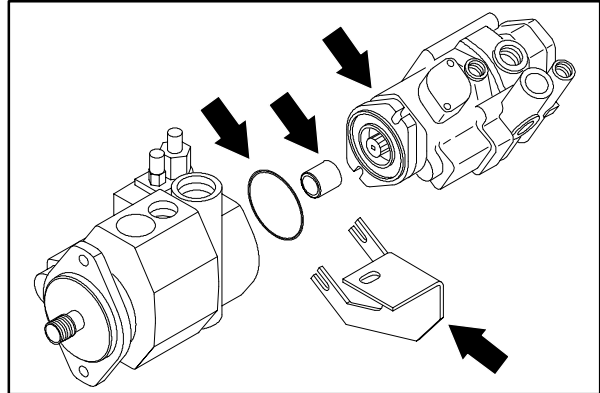
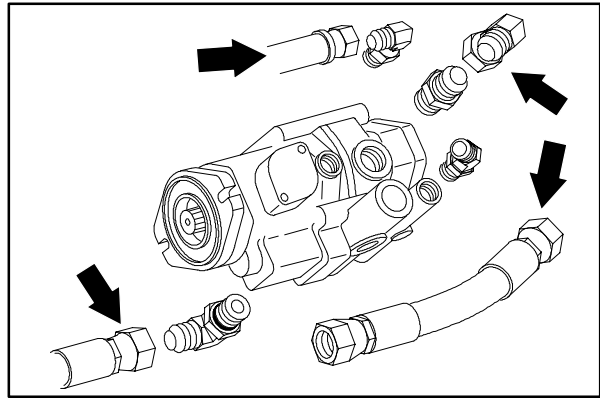
19. Install the hub on the new pump shaft. Use the new key already on the pump shaft. Lightly tap the hub on the taper shaft with a hammer so it will stay in place until the hardware is installed.

20. Position pump back in the machine. Make sure the o-ring and coupler are in place. Reinstall the 0.38 in. hex screws with blue loctite 242. Place the flow switch bracket under the bolt heads. Tighten to 31 - 40 Nm (27 - 35 ft lb).

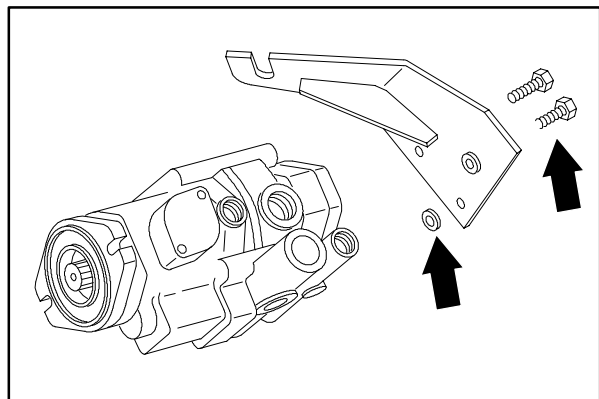
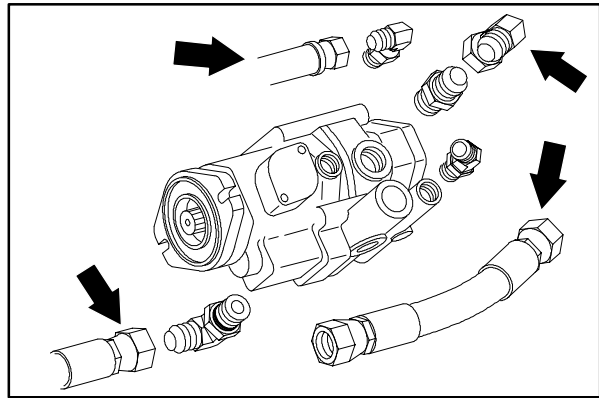
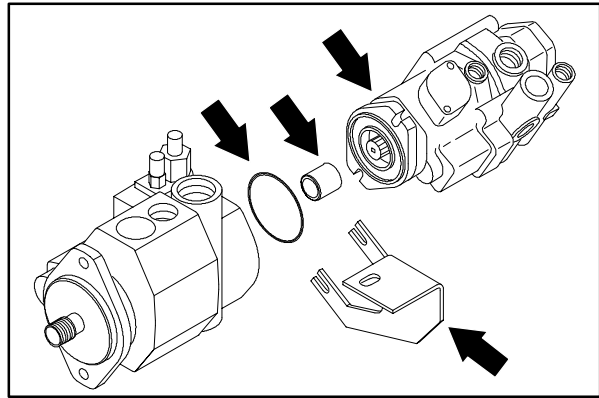
NOTE: Be careful not to loose or damage the o-ring or the pump coupler

21. Reconnect the hydraulic hoses. See the schematic in this section.

NOTE: Observe hydraulic cleanliness requirements when opening hydraulic lines.



22. Place the control cable, cable mount plate, and the pump arm back in position.
23. Align the mount holes in the cable plate with the holes in the back of the propel pump. Reinstall the 0.38 in. hex screws and washers. Make sure to put one washer between the plate and pump under each hex screw. Use blue loctite 242 and tighten to 31 - 40 Nm (27 - 35 ft lb).
24. Reinstall the pump arm to the pump hub using the two M8 hex screws on the outside and one 0.31 in. hex screw in the center. Tighten to 18 - 24 Nm (15 - 20 ft lb).
25. Reconnect the pump switch to the main electrical harness.
26. Reinstall the muffler and exhaust pipe.
27. Reconnect the battery cables.
28. Check the neutral centering of the new propel pump by starting the machine and observing the rear tire for any rotation. If tire is rotating See TO ADJUST DIRECTIONAL CONTROL instructions in this section.
29. Once the neutral centering has been set, reinstall rear grill panel. Tighten four M8 hex screws to 18 - 24 Nm (15 - 20 ft lb). Lower the machine.

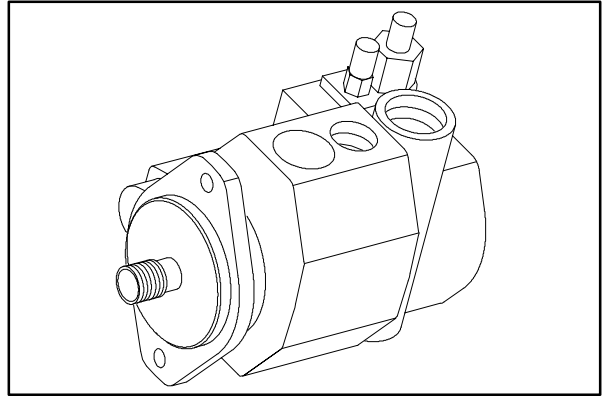


TO REPLACE LOAD SENSING PUMP

1. Start the engine and lower the squeegee.

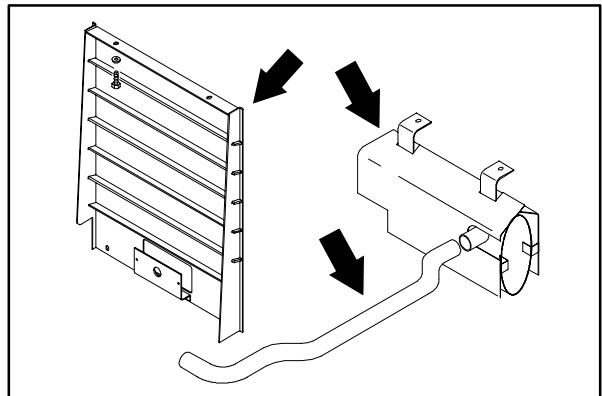
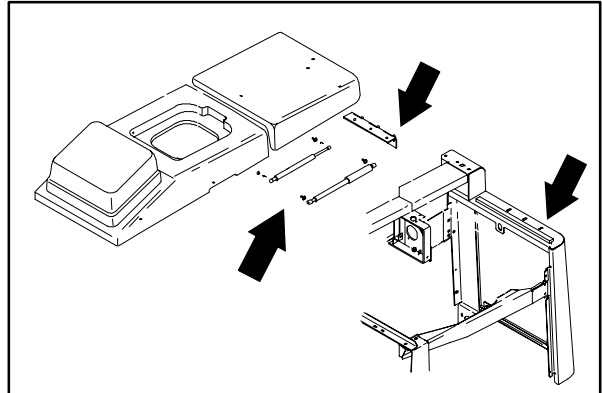
FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake., Turn Off Machine And Remove Key.

2. Disconnect the battery cables from the battery.
3. Jack up the rear of the machine.

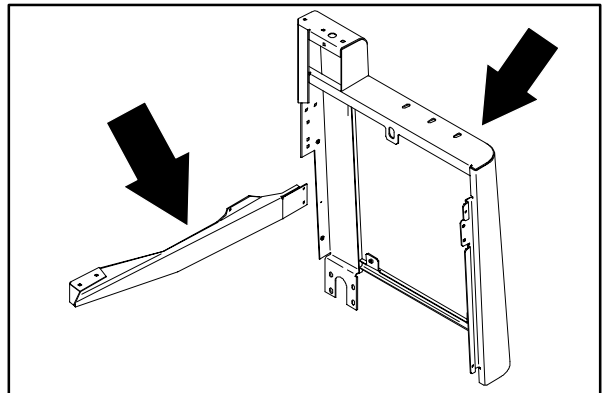


FOR SAFETY: Block machine tires before jacking machine up. Jack machine up at designated locations only. Block machine up with jack stands.

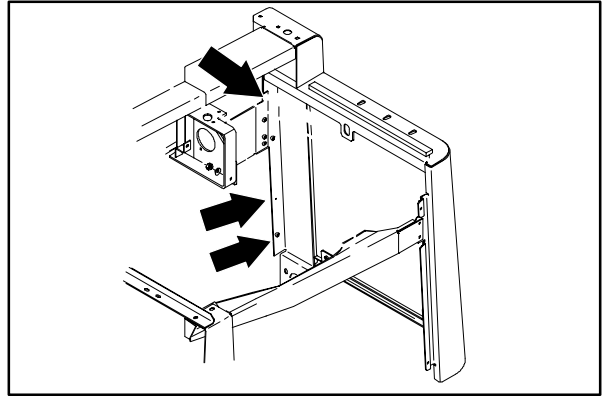
4. Prop up the engine cover and remove the gas springs.
5. Remove the three nyloc nuts holding engine cover hinge to the LH tower. Remove the engine cover from the machine.
6. Lift the engine side door off the hinges and put it aside.
7. Remove four M8 hex screws holding the rear radiator grill to the machine. Unplug the taillight and remove the grill from the machine.
8. Remove the muffler and exhaust pipe.
9. Drain the hydraulic tank.
10. Remove the four M8 hex screws holding the side brace to the LH tower and the LH angle brace. Remove the brace from machine.



11. There are 14 M8 hex screws and 1 M10 hex screw holding the LH tower to the machine frame.
12. Go under the machine by the rear squeegee pivot and remove the four M8 hex screws holding the LH tower to the frame.



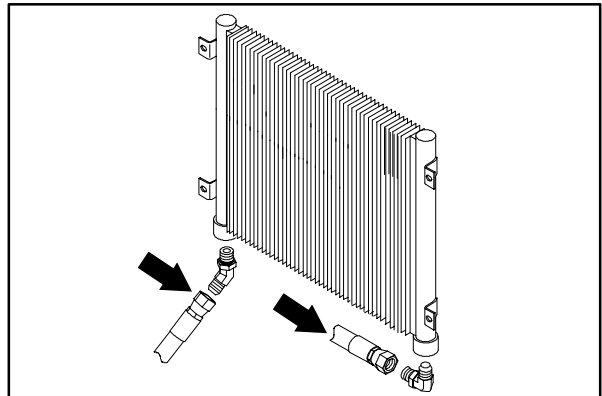
13. Remove the two M8 hex screws in the lower left corner of LH tower.
14. Remove the M8 hex screw in the center of the radiator on top.
15. Go to the right side of the radiator and remove seven M8 hex screws holding the LH tower to the seat support.
16. Remove the M10 hex screw and flange nut that connects the very top of the LH tower to the side panel assembly.



17. The LH tower can now be carefully lifted off the machine and set aside.
18. Remove and plug hydraulic hoses going to the hydraulic oil cooler that sits behind engine radiator.

NOTE: Observe hydraulic cleanliness requirements when opening hydraulic lines.

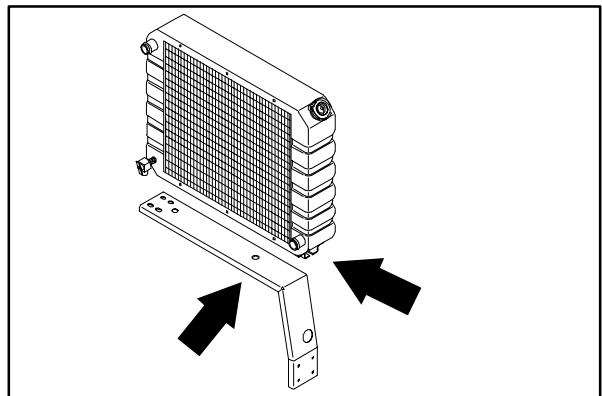
19. Drain the radiator and disconnect the radiator hoses from the radiator.



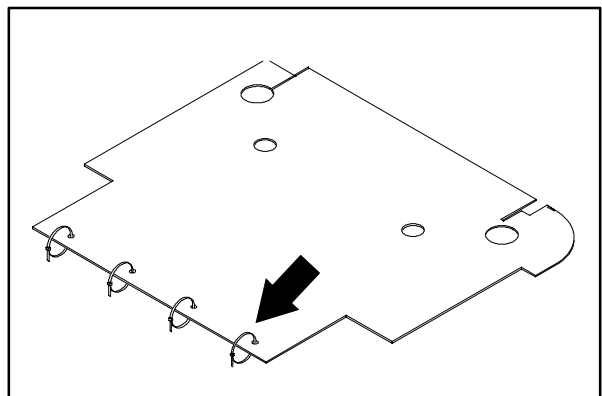
20. Remove the two nyloc nuts holding the bottom of the radiator to the mounting channel.
21. Remove and plug the hydraulic hoses going to the engine cooling fan hydraulic motor.

NOTE: Observe hydraulic cleanliness requirements when opening hydraulic lines.

22. The radiator assembly can now be carefully lifted out and set aside.



23. Cut any plastic ties holding the lower rubber skirt to the engine. Remove the skirt from the machine.
24. Remove the six M8 hex screws holding the mounting channel to the frame. Remove the channel.



HYDRAULICS

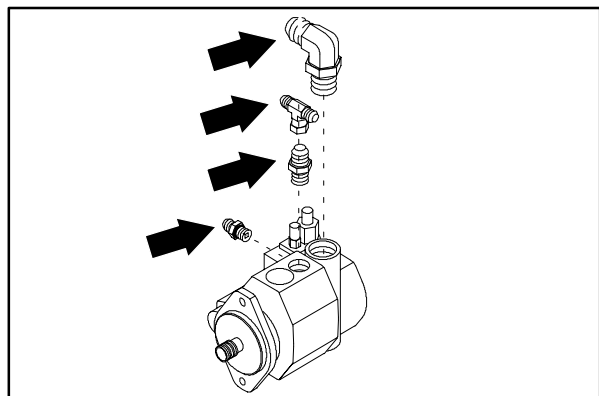
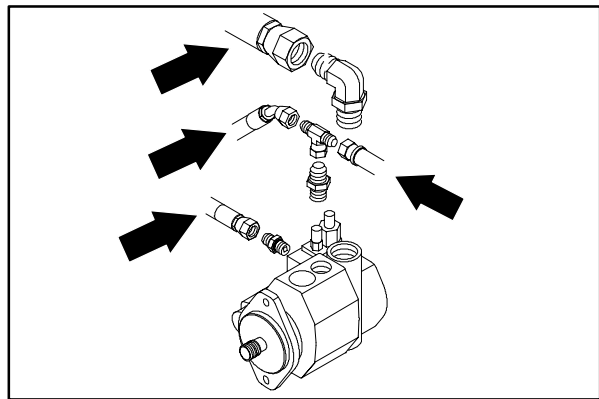
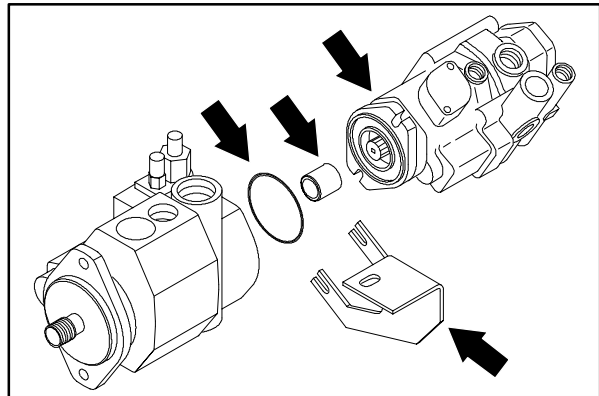
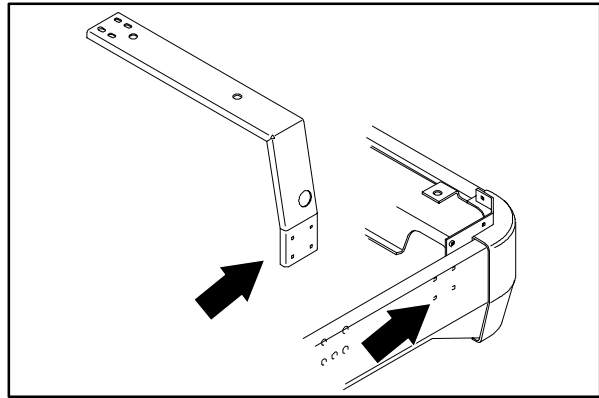
25. Remove the two 0.38 in. hex screws holding the propel pump to the load sensing pump.
26. Move the flow switch and mounting bracket out of the way.
27. The propel pump can now be pulled back out of the load sensing pump.

NOTE: Be careful not to loose or damage the o-ring or the pump coupler

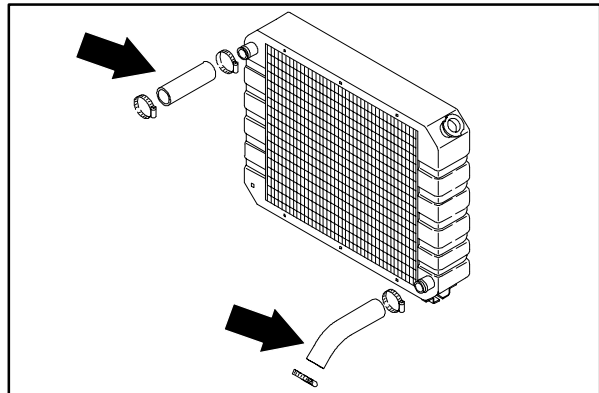
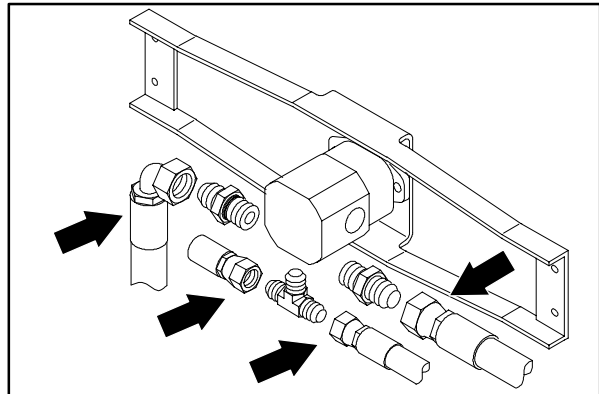
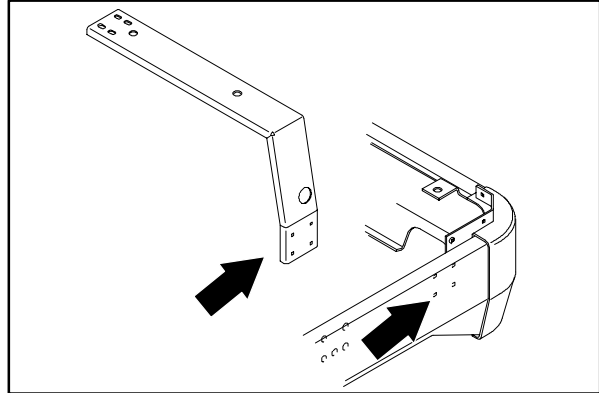
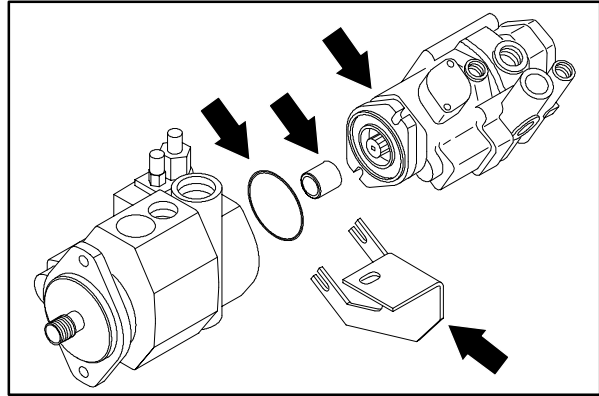
28. Remove and plug the hydraulic hoses going to the load sensing pump.

NOTE: Observe hydraulic cleanliness requirements when opening hydraulic lines.

29. Remove the two M12 hex screws holding the load sensing pump to the bellhousing.
30. The load sensing pump can now be pulled back out of the flywheel coupler and removed from the machine.
31. Remove the fittings from the old pump and install in the new pump in the same orientation they were removed.
32. Place a small amount of grease on the splines of the new pump and install it back in the machine.
33. Align the holes in pump flange with holes in bellhousing. Install the two M12 hex screws with blue loctite 242 and tighten to 31 – 40 Nm (27 – 35 ft lb).
34. Reconnect the hydraulic hoses to the load sensing pump. See the schematic in this section.
35. Position the propel pump back in the load sensing pump. Make sure o-ring and coupler are in place. Reinstall the 0.38 in. hex screws with blue loctite 242. Place the flow switch bracket back under the bolt heads. Tighten to 31 – 40 Nm (27 – 35 ft lb).

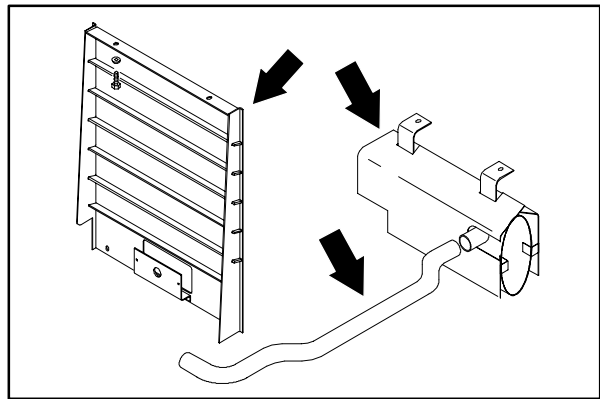
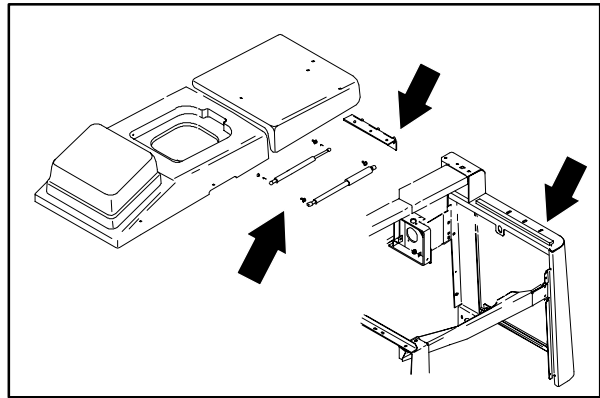
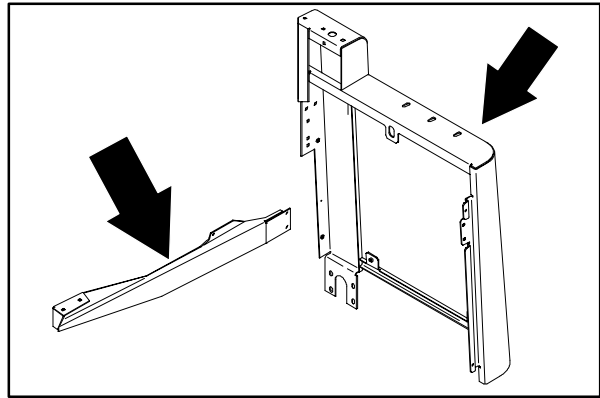


36. Reinstall the radiator mounting channel using six M8 hex screws. Tighten to 18 - 24 Nm (15 - 20 ft lb).
37. Reinstall the rubber skirt to the radiator mount channel using new plastic ties.
38. Place the radiator assembly back on the mount channel. Reinstall the two M10 nyloc nuts and washers and tighten to 18 - 24 Nm (15 - 20 ft lb).
39. Reconnect the hydraulic hoses to the engine cooling fan motor. See the schematic in this section.
40. Reconnect the hydraulic hoses to the hydraulic oil cooler. See the schematic in this section.
41. Reconnect the radiator hoses to the radiator.
42. Position the LH tower back on the machine. Reinstall the 14 M8 hex screws and one M10 hex screws connecting LH tower to the machine frame, seat support, and center panel. Make sure the tower is perpendicular to the machine frame before tightening the hardware.
43. Tighten the M8 hex screws to 18 - 24 Nm (15 - 20 ft lb). Tighten the M10 hex screw to 52 - 67 Nm (39 - 51 ft lb).
44. Reinstall the black side brace. Tighten the four M8 hex screws and washers to 18 - 24 Nm (15 - 20 ft lb).
45. Reinstall the muffler and exhaust pipe.
46. Refill the engine radiator with coolant.



HYDRAULICS

47. Refill the hydraulic fluid reservoir with the proper grade of hydraulic fluid.
48. Using a hoist or other lifting device; position the engine cover back on the LH tower. Use the three M10 nyloc nuts and washers. Leave hardware loose until the cover is properly aligned with side panel. Tighten to 37 - 48 Nm (26 - 34 ft lb).
49. Reconnect the gas springs to the engine cover.
50. Reinstall the engine side door.
51. Reconnect the battery cables.
52. Start the engine and check for proper operation and leaks.
53. Once the neutral centering has been set, reinstall rear grill panel. Tighten four M8 hex screws to 18 - 24 Nm (15 - 20 ft lb). Lower the machine.



TO REPLACE STEERING CYLINDER

1. Start the engine and lower the scrub head. Shut off the engine.

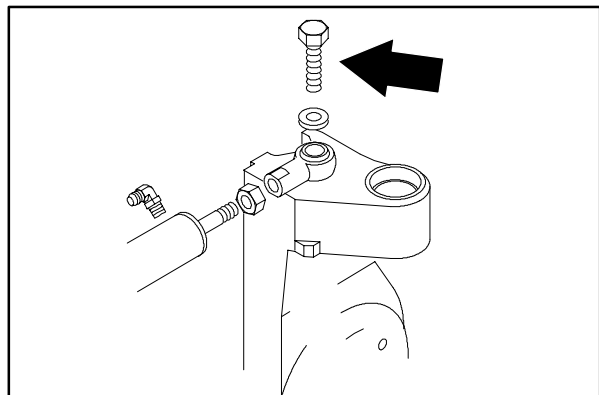
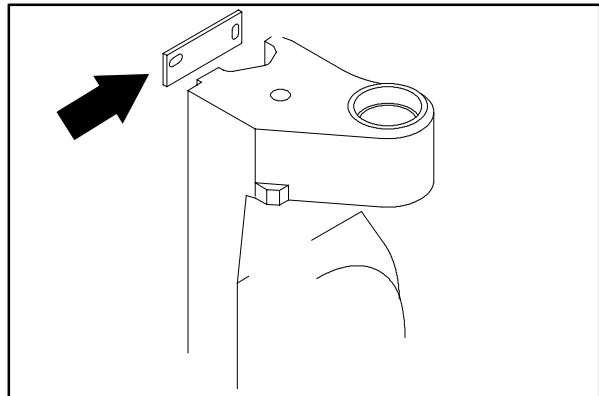
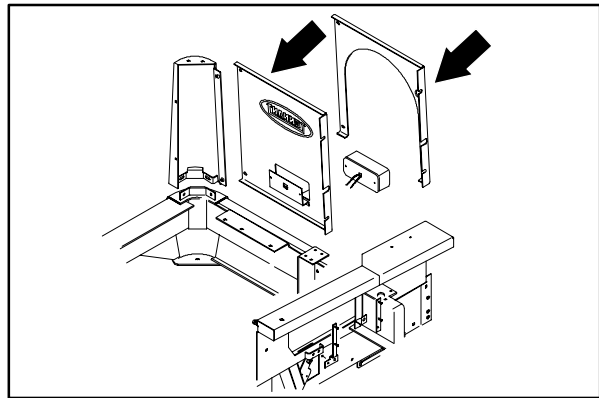
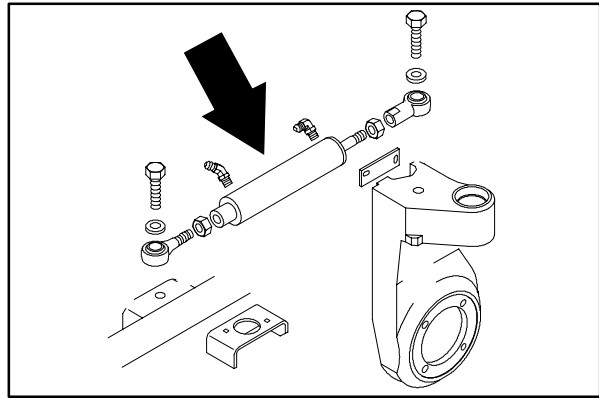
FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake., Turn Off Machine And Remove Key.

2. Jack up the rear of the machine.

FOR SAFETY: Block machine tires before jacking machine up. Jack machine up at designated locations only. Block machine up with jack stands.

3. Disconnect the battery cables and remove the battery from machine.
4. **LPG machines;** Disconnect the LP tank and remove from the machine.
5. **Gas and Diesel machines;** Remove the four hex screws holding the right rear panel. Unplug the tail light and remove the panel. Disconnect the fuel lines at the tank. Remove the two tank straps and the fuel tank.
6. Turn the steering wheel half way to the left so the rear drive casting can be accessed from the fuel tank area of the machine.
7. Remove the clamp holding the drive motor hoses to rear casting. Move the hoses for access to steering cylinder attachment bolt.
8. Using a torque multiplier wrench; remove the .750" X 3.25" hex screw and nyloc nut holding the rod end of steering cylinder to the drive casting. Discard the hardware.
9. Using the access through the battery tray area; remove and plug the hydraulic hose near the rod end of the steering cylinder.

NOTE: Always observe hydraulic cleanliness requirements when opening hydraulic lines.

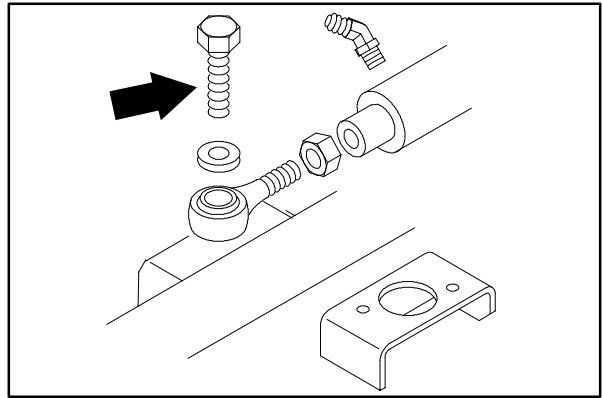


HYDRAULICS

10. Go under the machine from the operators compartment side. Remove and plug the hydraulic hose near the piston end of the steering cylinder.

NOTE: Always observe hydraulic cleanliness requirements when opening hydraulic lines.

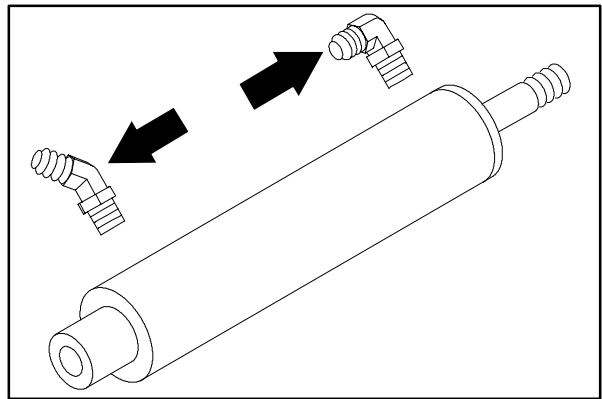
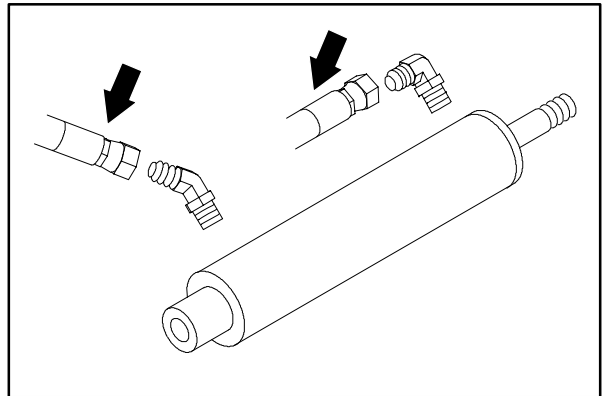
11. Go under the machine from the engine side and locate the .750" X 3.25" hex screw and nyloc nut holding the piston end of the steering cylinder to machine frame.



12. Using the torque multiplier wrench, a 16" extension, and a long breaker bar, loosen and remove the .750" X 3.25" hex screw. Access to the nyloc nut is through the battery tray area. Discard the hardware.

NOTE: An extension should be added to the handle of the torque multiplier so it can be rested against the rear tire for leverage.

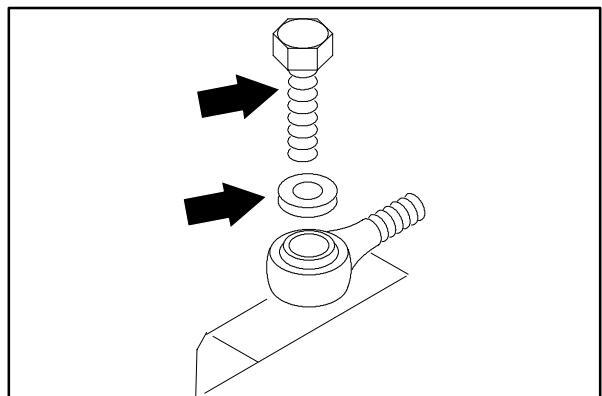
13. Remove the steering cylinder from the machine.
14. Remove the fittings from the old cylinder and install in the new cylinder. Install in the same orientation.
15. Position the new cylinder and balljoint assembly in the machine with the rod end toward the rear drive casting.
16. Install one new .750" X 3.25" hex screw and nyloc nut along with three washers between the balljoint and frame and one washer between the balljoint and nyloc nut in the piston end of the new steering cylinder.



NOTE: Washers must be installed for proper cylinder to frame clearance

17. Using the torque multiplier wrench, a 16" extension, and a long ft lb torque wrench; tighten the .750" X 3.25" hex screw to 200-220 ft lb. Access to the nyloc nut is through the battery tray area.

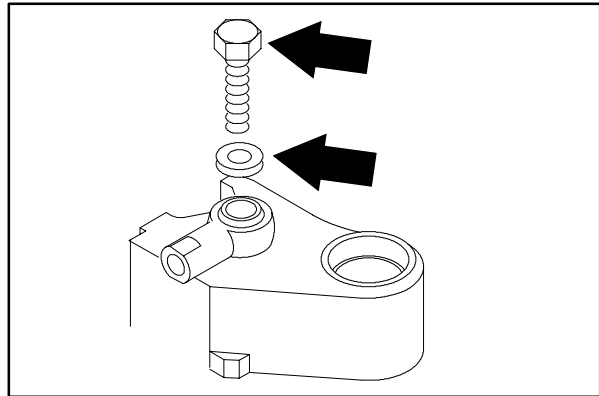
NOTE: An extension should be added to the handle of the torque multiplier so it can be rested against the rear tire for leverage.



18. Go to the rear of the machine and install a new .750" X 3.25" hex screw and nyloc nut along with three washer between balljoint and casting and one washer between balljoint and hex screw in the rod end of the new steering cylinder.

NOTE: Washers must be installed for proper cylinder to frame clearance

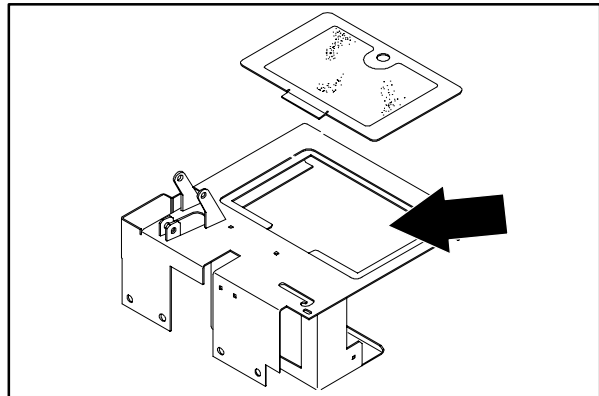
19. Using the torque multiplier and a long ft lb torque wrench; tighten the .750" X 3.25" hex screw to 200-220 ft lb.



20. Use the access in the battery tray area and reconnect the hydraulic hose near the rod end of steering cylinder.

NOTE: Always observe hydraulic cleanliness requirements when opening hydraulic lines.

21. Go under the machine from the operators compartment side and reconnect the hydraulic hose near the piston end of steering cylinder.



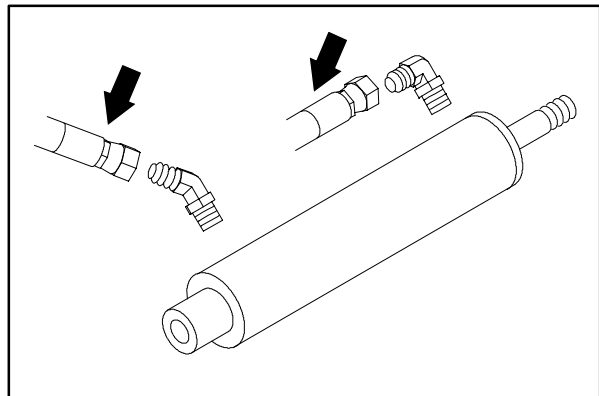
22. Reinstall the clamp holding the drive motor hoses to the rear casting.

23. **LPG machines;** Reinstall the LP tank.

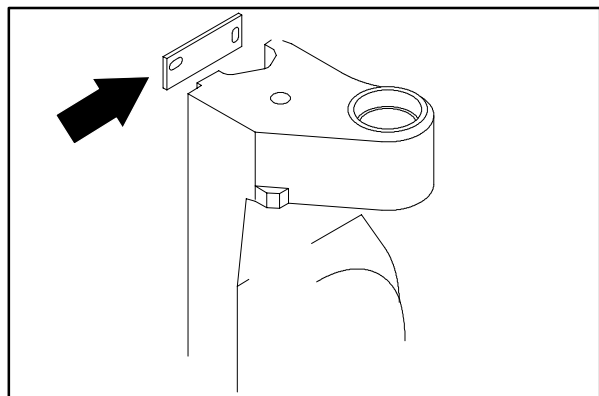
24. **Gas and Diesel machines;** Reinstall the fuel tank and straps. Reconnect the fuel lines. Reinstall the rear panel and hardware. Reconnect the tail light wires.

25. Reinstall the battery and reconnect the cables.

26. Remove the jack stands and lower the machine.



27. With the seat in the raised position, start the machine and turn steering wheel in both directions. Observe steering cylinder for any leaks.



TO REPLACE HYDRAULIC STEERING VALVE

1. Turn off the engine and engage the parking brake.

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

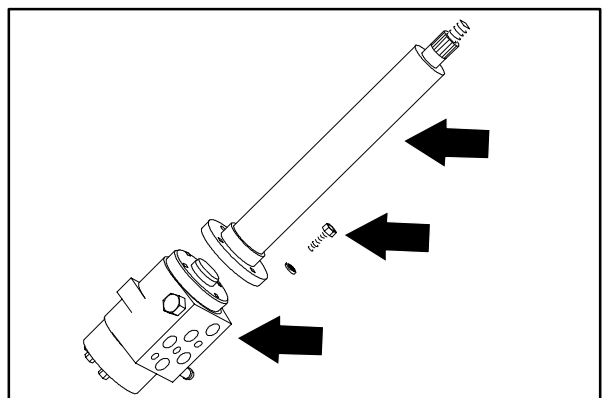
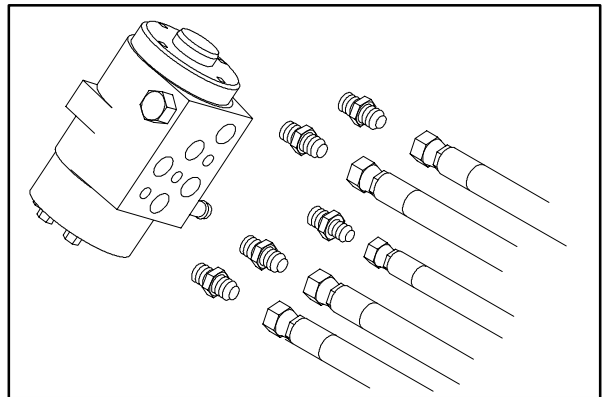
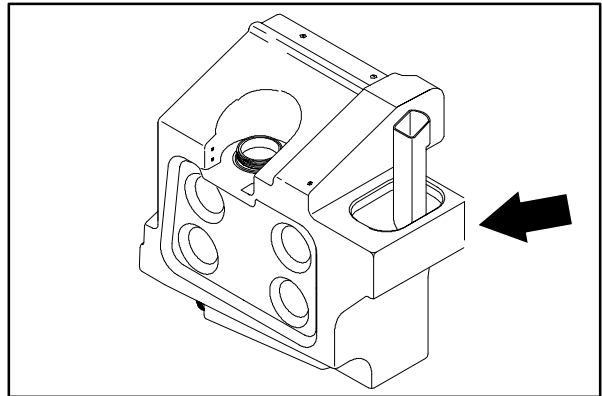
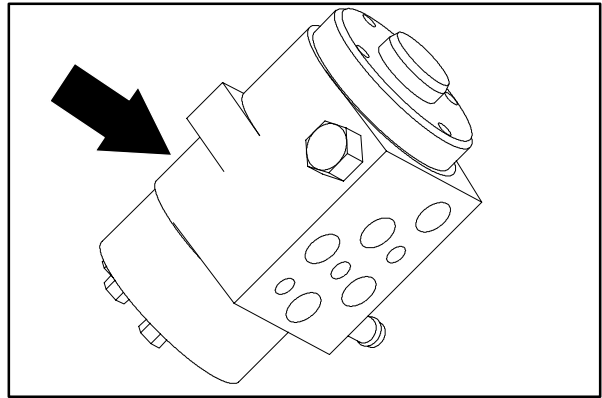
2. Remove the battery cables from the battery.
3. Remove the recovery tank. See TO REMOVE RECOVERY TANK instructions in the SCRUBBING section.
4. Remove and plug the five hydraulic hoses leading to the steering control motor.

NOTE: Observe hydraulic cleanliness requirements when opening hydraulic lines.

5. Remove the four M6 hex screws holding the hydraulic steering valve to the steering column.
6. The hydraulic steering valve can now be removed from machine.
7. Remove the hydraulic fittings from the old control motor. Install in the new or rebuilt control motor in the same orientation as they were removed.

NOTE: Remember to orientate the fittings as close as possible to the way they came out.

8. Install the new hydraulic steering valve assembly back in the machine. Position the ports in the same orientation as it was removed. Reinstall the four M6 hex screws and tighten to 8 - 10 Nm (5 - 7 ft lb).
9. Reconnect the five hydraulic hoses to the hydraulic steering valve. See the schematic in this section.
10. Reconnect battery cables. Start engine and move the steering wheel back and forth, checking for leaks and proper operation.
11. Reinstall the recovery tank. See TO INSTALL RECOVERY TANK instructions in the SCRUBBING section.



TO REPLACE MAIN BRUSH LIFT CYLINDER

1. Start the engine and lower the main brush. Shut off the engine.

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

2. Remove the solution and recovery tanks. See TO REMOVE SOLUTION TANK instructions in the SCRUBBING section.
3. Locate the clevis pin holding the main brush lift cable to the main brush lift arm. Remove the cotter pin and clevis pin.
4. Start the engine and raise the main brush. Shut off the engine.
5. Locate the two M10 hex nuts holding the two plastic tubes to the rod end of the main brush lift cylinder.

NOTE: Make sure cylinder is all the way retracted before removing springs.

6. Remove the hex nuts, tension springs, plastic tubes, main brush lift cable and threaded rod.
7. Disconnect and plug the two hydraulic hoses leading to the main brush lift cylinder.

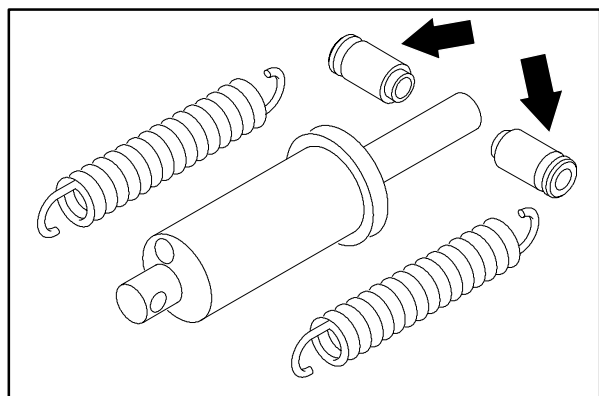
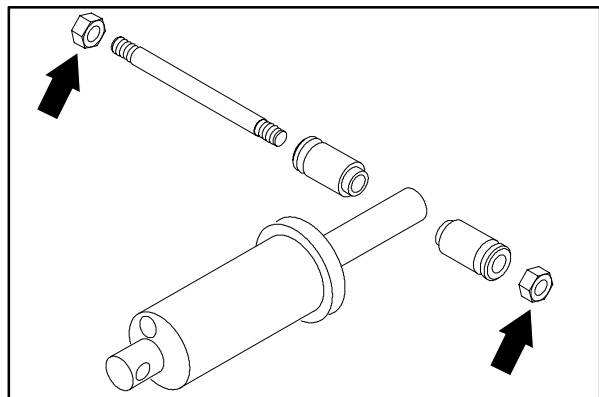
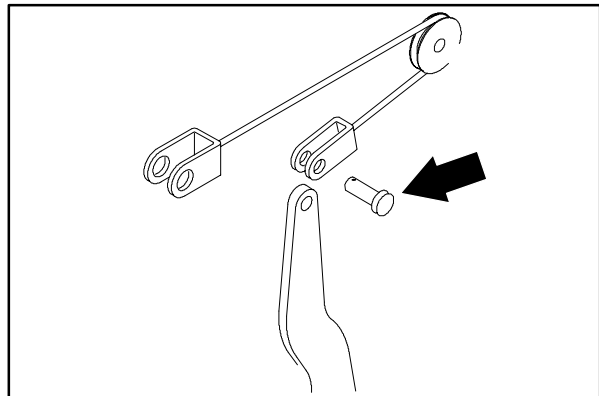
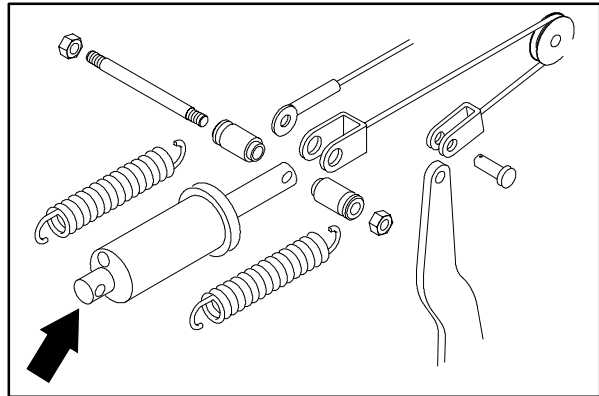
NOTE: Observe hydraulic cleanliness requirements when opening hydraulic lines.

8. Remove the cotter pin and clevis pin holding the piston end of the main brush lift cylinder to the machine frame.

9. Remove the lift cylinder from the machine.

NOTE: Remember to orientate the fittings as close as possible to the way they came out.

10. Remove the hydraulic fittings from old main brush lift cylinder and install in the new cylinder in the same orientation.

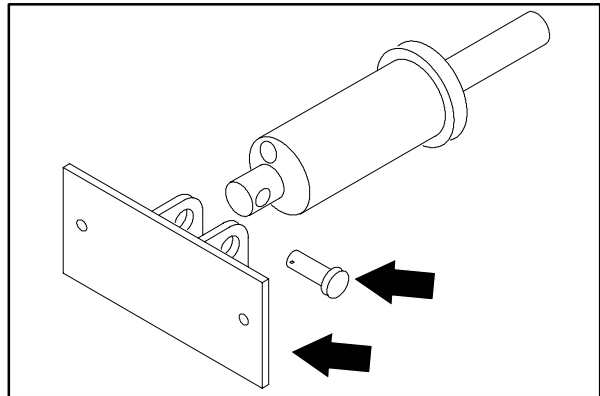
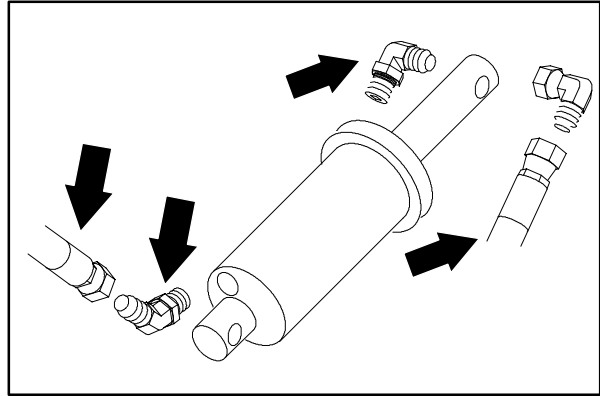


HYDRAULICS

11. Position the new main brush lift cylinder in the machine. Align the mount hole in piston end of the lift cylinder with hole in the mount bracket on the machine frame.
12. Reinstall the clevis pin and cotter pin.

NOTE: Make sure cylinder is all the way retracted before installing springs.

13. Reinstall the threaded rod, plastic tubes, main brush lift cable, M10 hex nuts, and tension springs to the rod end of the lift cylinder. Hand tighten hex nuts.
14. Reconnect the hydraulic hoses to the main brush lift cylinder. See the schematic in this section.
15. Start engine and lower the main brush. Shut off the engine.
16. Reconnect the main brush lift cable to the main brush lift arm using the clevis pin and cotter pin.
17. Start the engine and run the main brush up and down. Check for leaks and proper operation.
18. Reinstall solution and recovery tanks. See TO INSTALL RECOVERY TANK instructions in the SCRUBBING section.

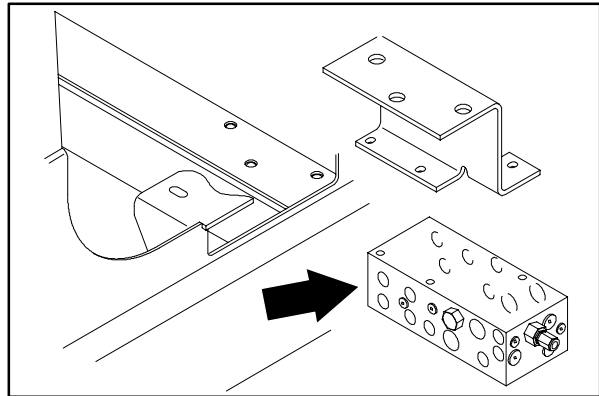


TO REPLACE MAIN HYDRAULIC VALVE

NOTE: Do Not replace complete valve unless the manifold block has cracked, otherwise replace individual component cartridge.

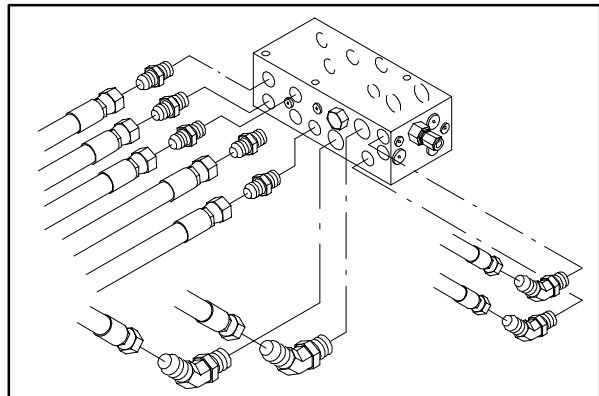
FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake., Turn Off Machine And Remove Key.

1. Jack up the rear of the machine.



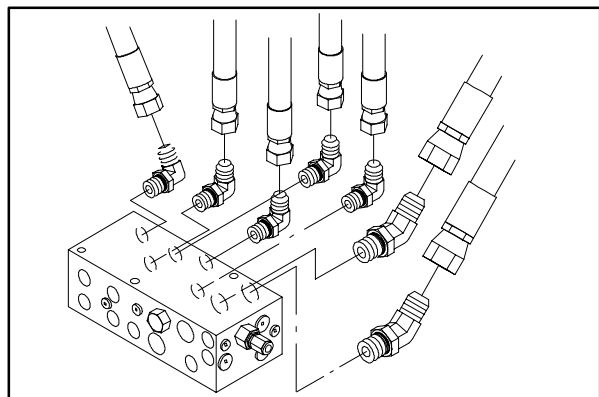
FOR SAFETY: Block machine tires before jacking machine up. Jack machine up at designated locations only. Block machine up with jack stands

2. Remove the battery cables from the battery.
3. Go under the machine on left side and locate the main hydraulic valve. Disconnect the electrical solenoids from the main harness.
4. Remove and cap the hydraulic hoses on the main hydraulic valve. Start with the hoses nearest the outside of the machine and work toward the center.



NOTE: Observe hydraulic cleanliness requirements when opening hydraulic lines.

5. Remove the three M8 hex screws holding the main valve to the mount bracket.
6. The main valve can now be dropped down and out of the machine.
7. Carefully place the valve in a vice. Note the orientation of fittings.

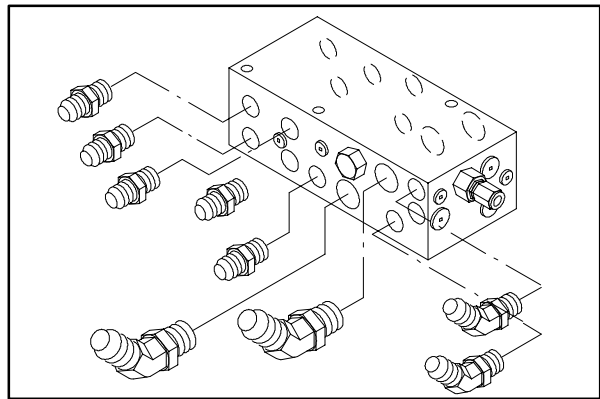
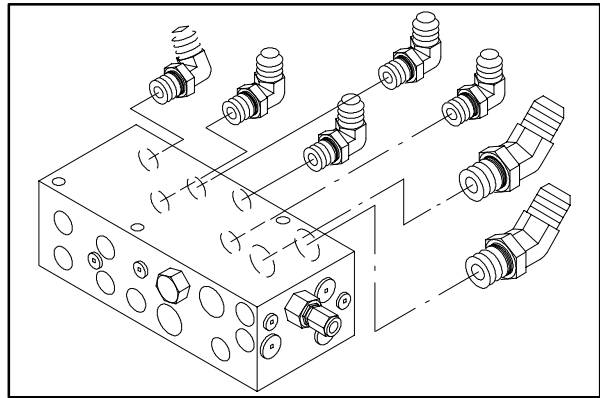
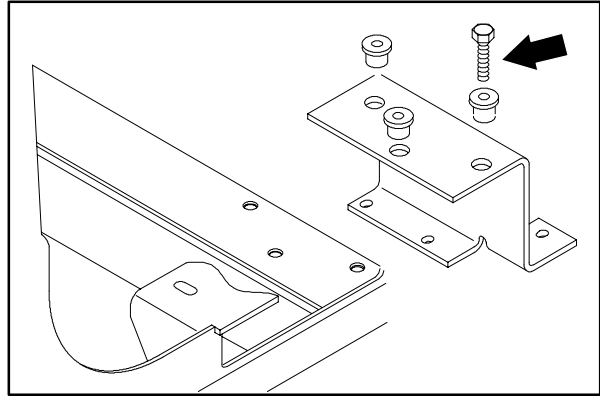


HYDRAULICS

8. Remove the hydraulic fittings from old valve and install in the new valve in the same orientation.

NOTE: Install the fittings in the new valve in the same orientation as they were removed.

9. Position the new valve back under machine. Reinstall the three M8 hex screws and washers. Tighten to 18 – 24 Nm (15 – 20 ft lb).
10. Reconnect the hydraulic hoses to the new valve. See the hydraulic schematic in this section. Start from the side of the valve nearest the center of the machine and work toward the outside.
11. Reconnect the electric solenoids to the main harness. See the schematic in the ELECTRICAL section of this manual.
12. Reinstall the brush guard using the two M12 hex screws. Tighten to 64 – 83 Nm (50 – 60 ft lb).
13. Remove the jack stands and lower the machine.
14. Reconnect the battery cables to the battery.
15. Start the machine and check the hydraulic components for proper operation.



TO REPLACE HYDRAULIC SCRUBBER VALVE

NOTE: Do Not replace complete valve unless the manifold block has cracked, otherwise replace individual component cartridge.

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

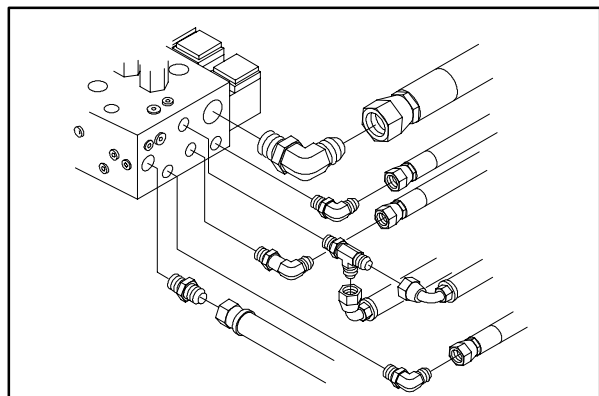
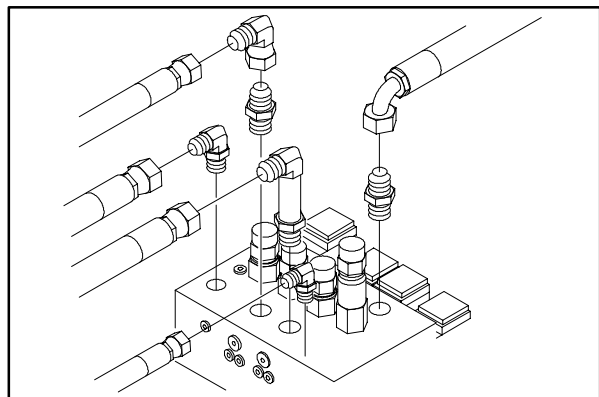
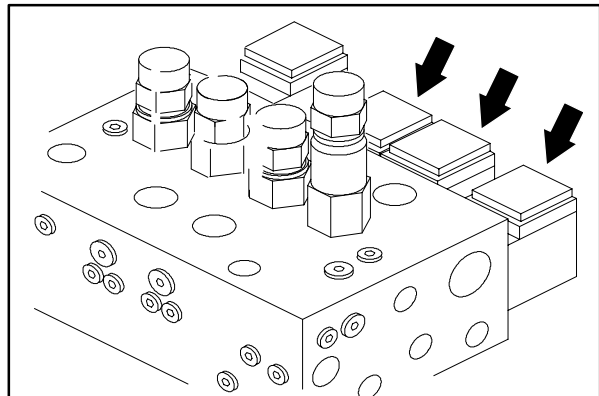
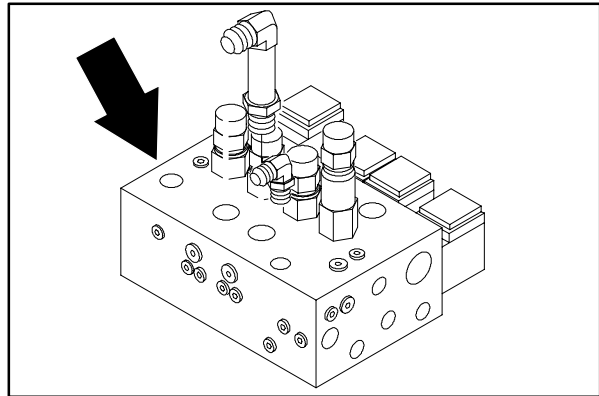
1. The solution and recovery tanks must be removed in order to service the scrubber valve. See TO REMOVE SOLUTION TANK instructions in the SCRUBBING section of this manual.
2. Remove the battery cables from the battery.
3. Remove the main brush from the machine.
4. Locate the scrub valve on top of the machine frame near the front left tower.
5. Disconnect the electrical solenoids from main harness.

6. Remove and cap the hydraulic hoses on the scrub valve.

NOTE: Observe hydraulic cleanliness requirements when opening hydraulic lines.

7. Open the the brush door on the left side of the machine.
8. Remove the three M10 hex screws, washers, and nyloc nuts holding the scrubber valve assembly to the machine frame.
9. Remove the scrubber valve from machine and place it in a vice upside down.
10. Remove the three M8 hex screws holding the two mounting plates to the valve.
11. Turn the valve over in the vice and remove the hydraulic fittings.
12. Install fittings in the new valve in the same orientation.

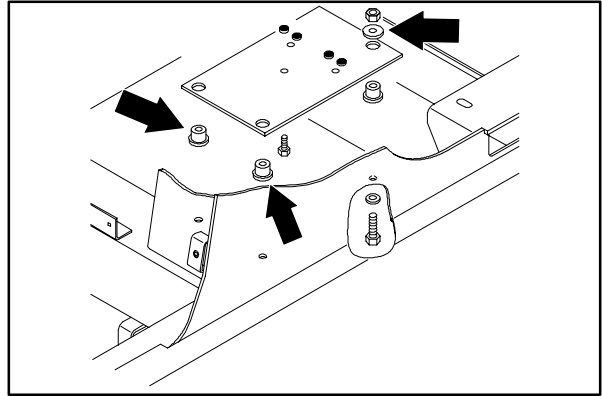
NOTE: Install the fittings in the new valve in the same orientation as they were removed.



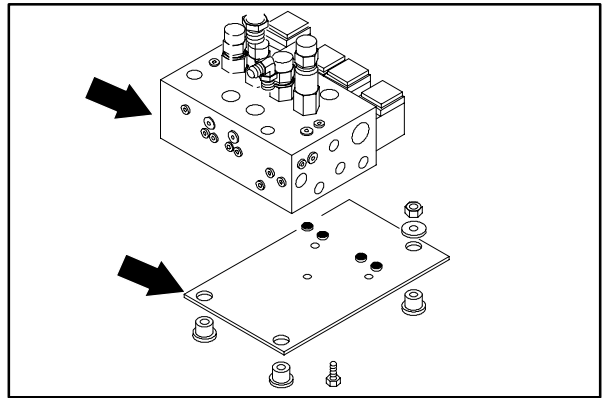
HYDRAULICS

13. Reinstall the two mounting plates to the new scrubber valve. Reinstall the three M8 hex screws and tighten to 18 - 24 Nm (15 - 20 ft lb).
14. Position the new scrubber valve assembly back in the machine. Reinstall the three M10 hex screws, washers, and nyloc nuts. Tighten to 37 - 48 Nm (26 - 34 ft lb).

NOTE: Remember to put hex screws in from under the machine so the nyloc nuts are on valve side.



15. Reconnect the hydraulic hoses to scrubber valve. See the hydraulic schematic in this section.
16. Reconnect the electric solenoids to the main harness. See the schematic in the ELECTRICAL section of this manual.
17. Reconnect the battery cables to the battery.
18. Start the machine and operate the hydraulic scrubbing functions. Check the scrubber valve for any leaks and for proper operation.
19. Reinstall solution and recovery tanks. See TO INSTALL SOLUTION TANK instructions in the SCRUBBING section of this manual.



TO REPLACE SOLENOID VALVE CARTRIDGE

1. Shut off the engine and engage the parking brake.

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

2. Remove the battery cables from the battery.
3. Locate and identify the cartridge to be replaced. Unplug the solenoid from the main harness.
4. Remove the hex nut and rubber o-ring from the cartridge stem.
5. Slide electrical coil and rubber o-ring off the valve stem.

NOTE: Oil will run out of the valve when the cartridge is removed.

6. Remove the cartridge stem from the valve body.

NOTE: Observe hydraulic cleanliness requirements when opening hydraulic lines.

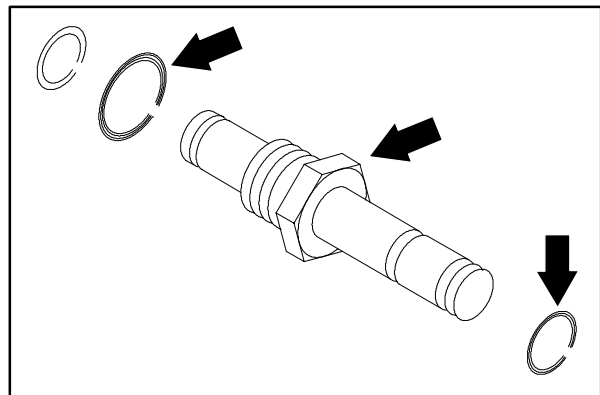
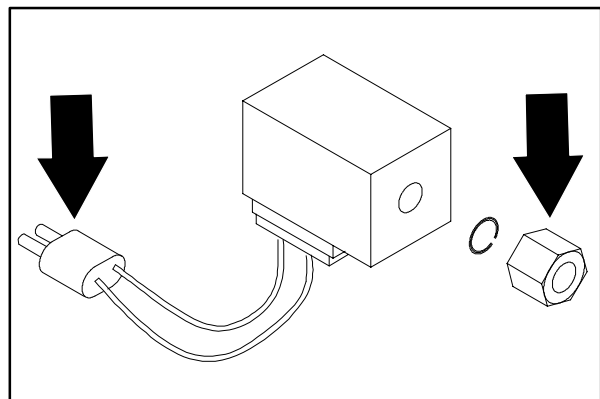
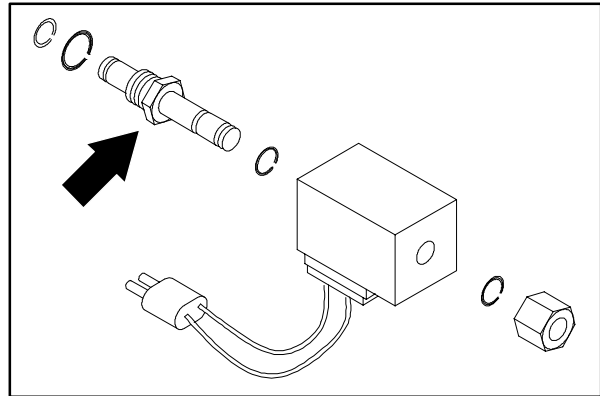
7. Install a new cartridge stem back in the valve port. Firmly hand tighten.

NOTE: Make sure the new cartridge had an o-ring installed and oiled.

8. Slip the o-ring and coil back over the new stem.
9. Install the o-ring and hex nut on the new stem. Lightly hand tighten.

NOTE: Do not over tighten--snug only.

10. Plug the solenoid coil back in the main harness. See schematic in ELECTRICAL section.
11. Reconnect the battery cables to the battery.
12. Start the machine and check the new cartridge for leaks.



TO REPLACE ENGINE COOLING FAN HYDRAULIC MOTOR

1. Shut off the engine and engage the parking brake.

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

2. Remove the battery cables from the battery.
3. Open the engine cover and side door.
4. Prop up the engine cover and remove the outer gas spring from the lower ball.
5. Remove the four M8 hex screws holding the side channel brace to the machine. Remove the channel brace from the machine.
6. Remove and plug the hoses connected to the cooling fan motor.

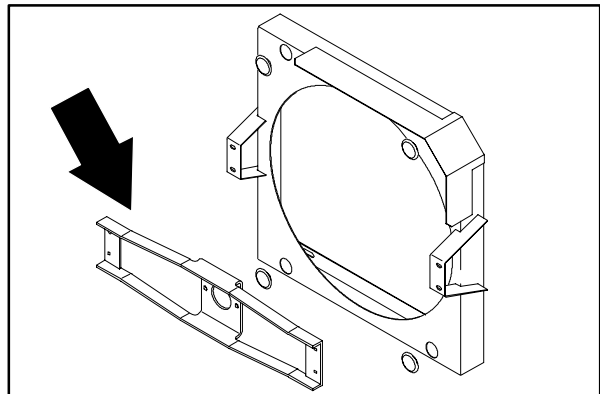
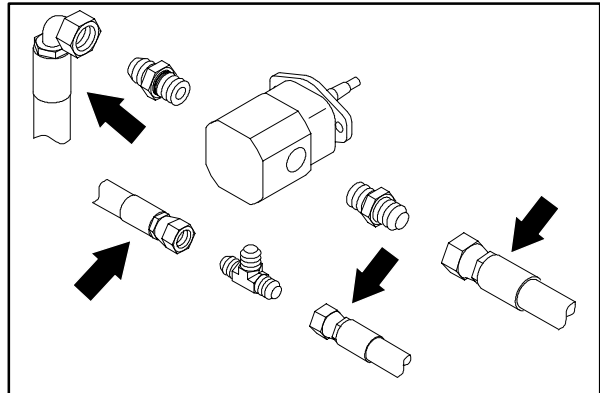
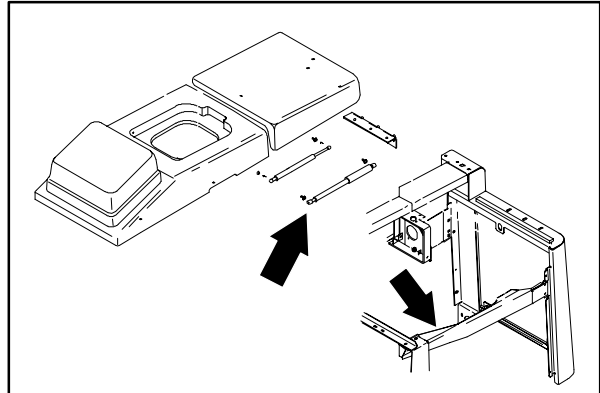
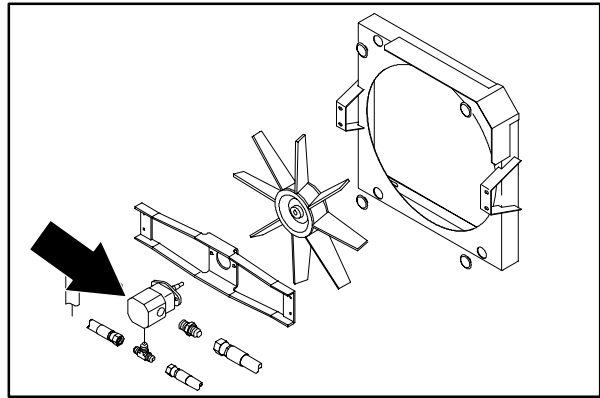
NOTE: Observe hydraulic cleanliness requirements when opening hydraulic lines.

7. Remove the four M6 hex screws and nyloc nuts holding the fan motor mount channel to the fan housing. Remove the cooling fan assembly from the machine.
8. Remove the hex nut from the fan motor shaft in center of fan blade.
9. Remove the fan blade from the motor shaft.

NOTE: A puller must be used to remove fan blade from tapered motor shaft.

10. Remove the four M8 hex screws holding the fan motor to mount channel. Remove the motor.
11. Remove the fittings from the old fan motor and install in the new one.

NOTE: Install the fittings in the new valve in the same orientation as they were removed.



12. Install a new cooling fan motor on the mount channel. Reinstall the four M8 hex screws. Tighten to 18.5 – 24 Nm (16 – 21 ft lb).
13. Reinstall the fan blade back on the fan motor shaft.

NOTE: Make sure key is in place on motor shaft.

14. Reinstall the hex nut and tighten to 18.5 – 24 Nm (16 – 21 ft lb).
15. Reinstall the fan motor assembly back on the fan housing. Reinstall the four M6 hex screws and nyloc nuts. Tighten to 7.6 – 9.9 Nm (5 – 7 ft lb).
16. Reconnect the hydraulic hoses to the new cooling fan motor. See the hydraulic schematic in this section.
17. Reinstall the side channel brace. Reinstall the four M8 hex screws and washers. Tighten to 18.5 – 24 Nm (16 – 21 ft lb).
18. Reconnect the engine cover outer gas spring to lower ball.
19. Reconnect the battery cables to the battery.
20. Start the machine and check the new cooling fan motor for leaks.

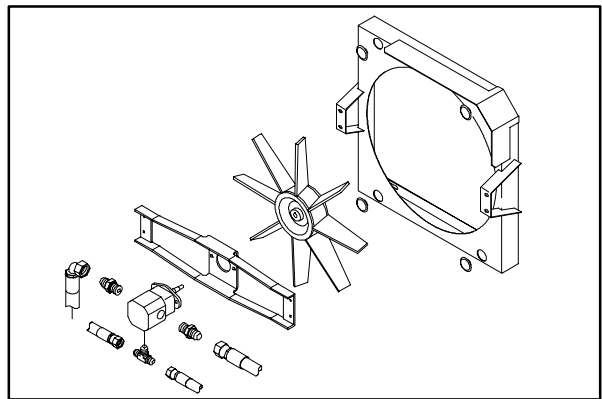
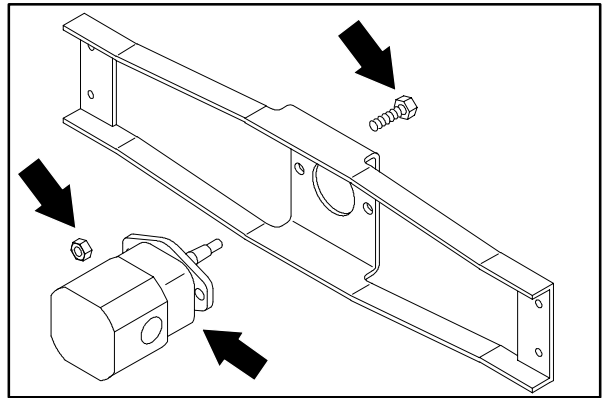
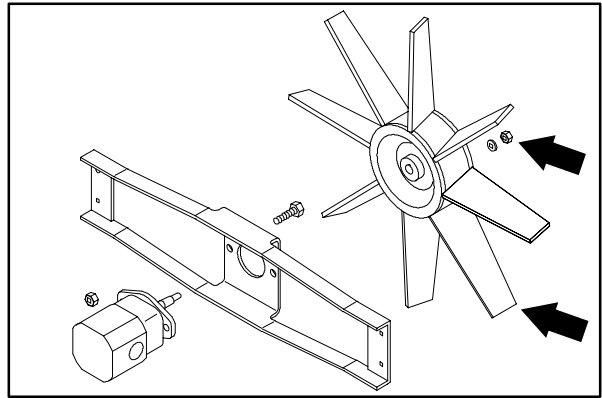


Fig. 1 – Hydraulic Schematic

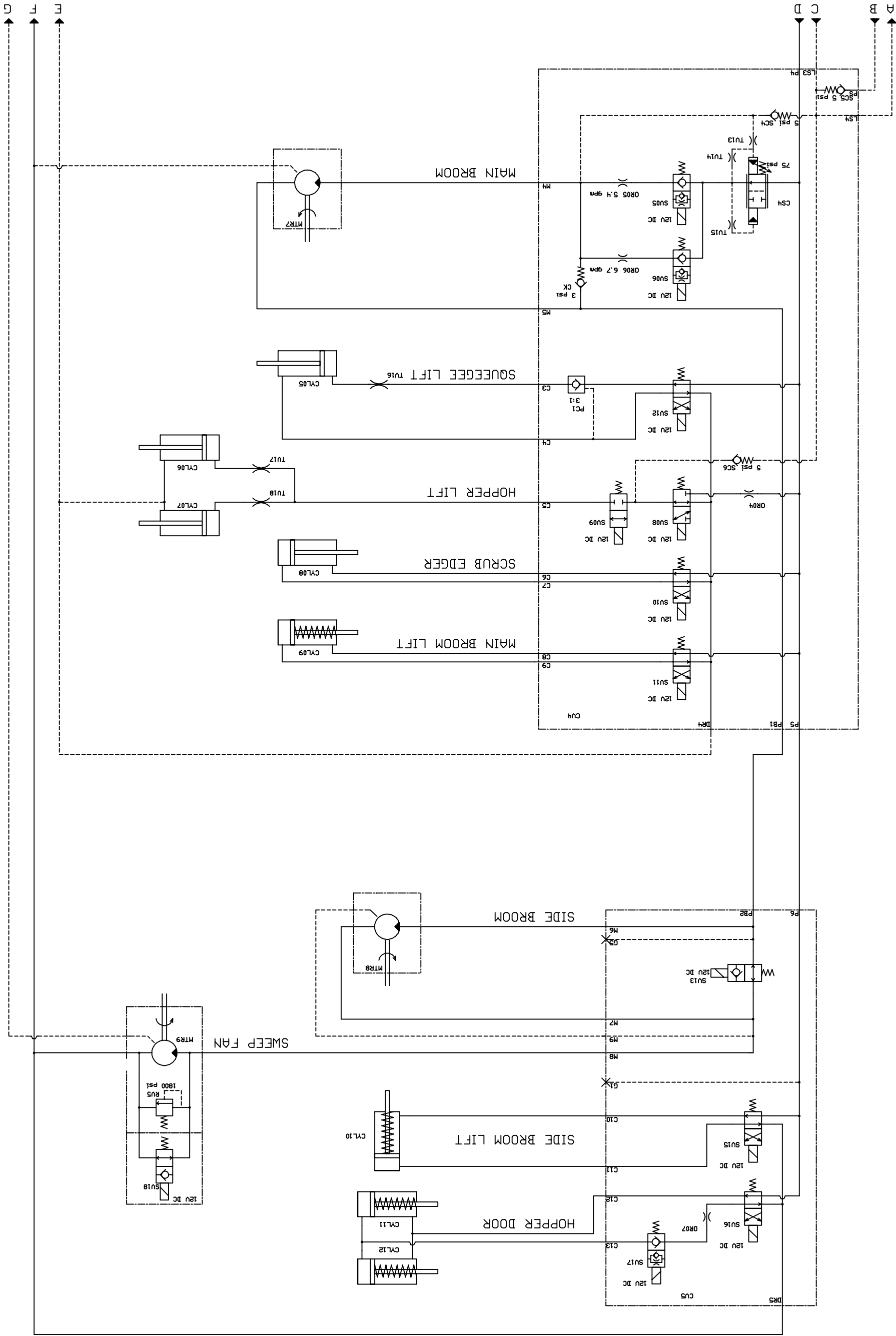


Fig. 1 – Hydraulic Schematic

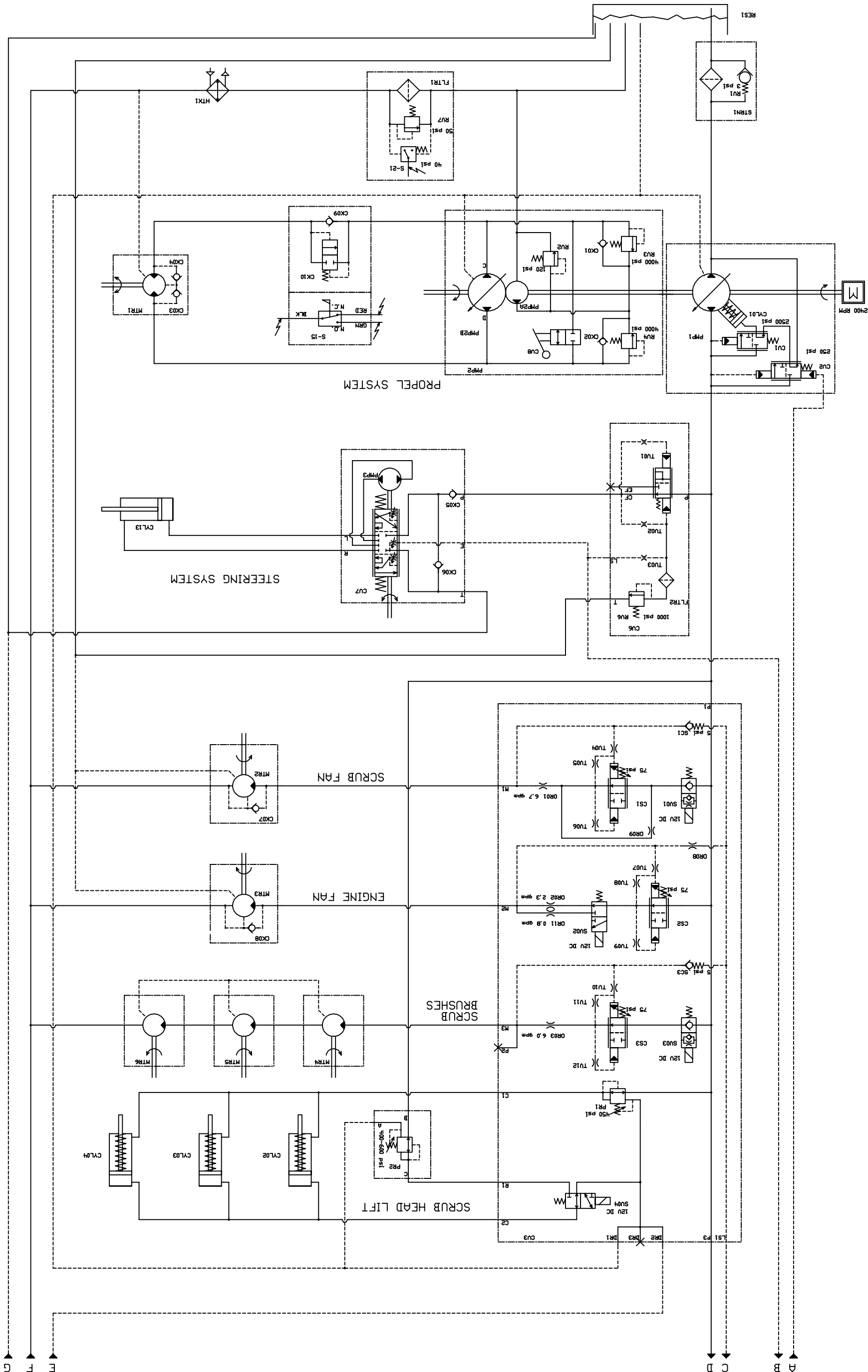


Fig. 2 - Hydraulic Hose Group

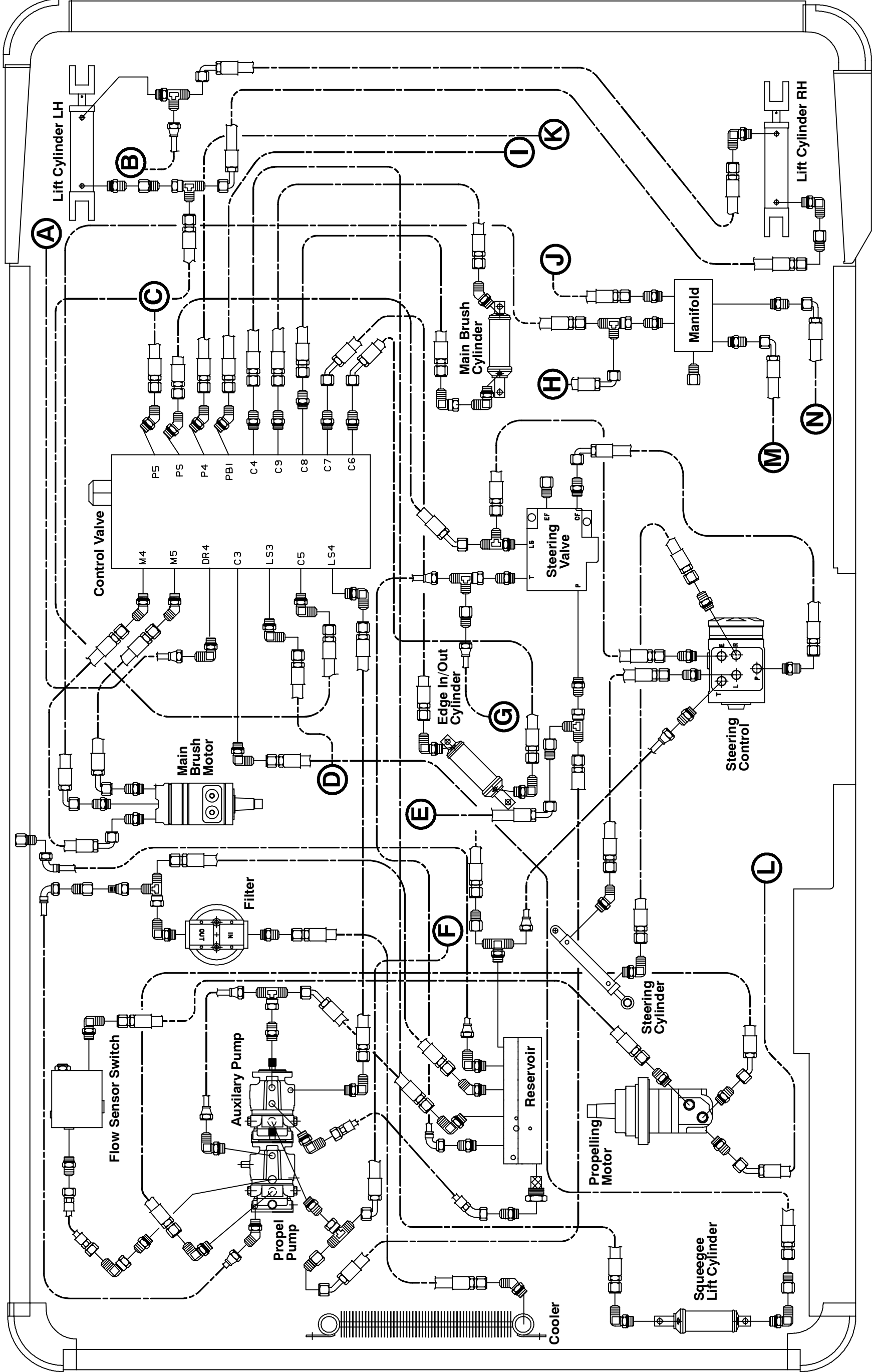
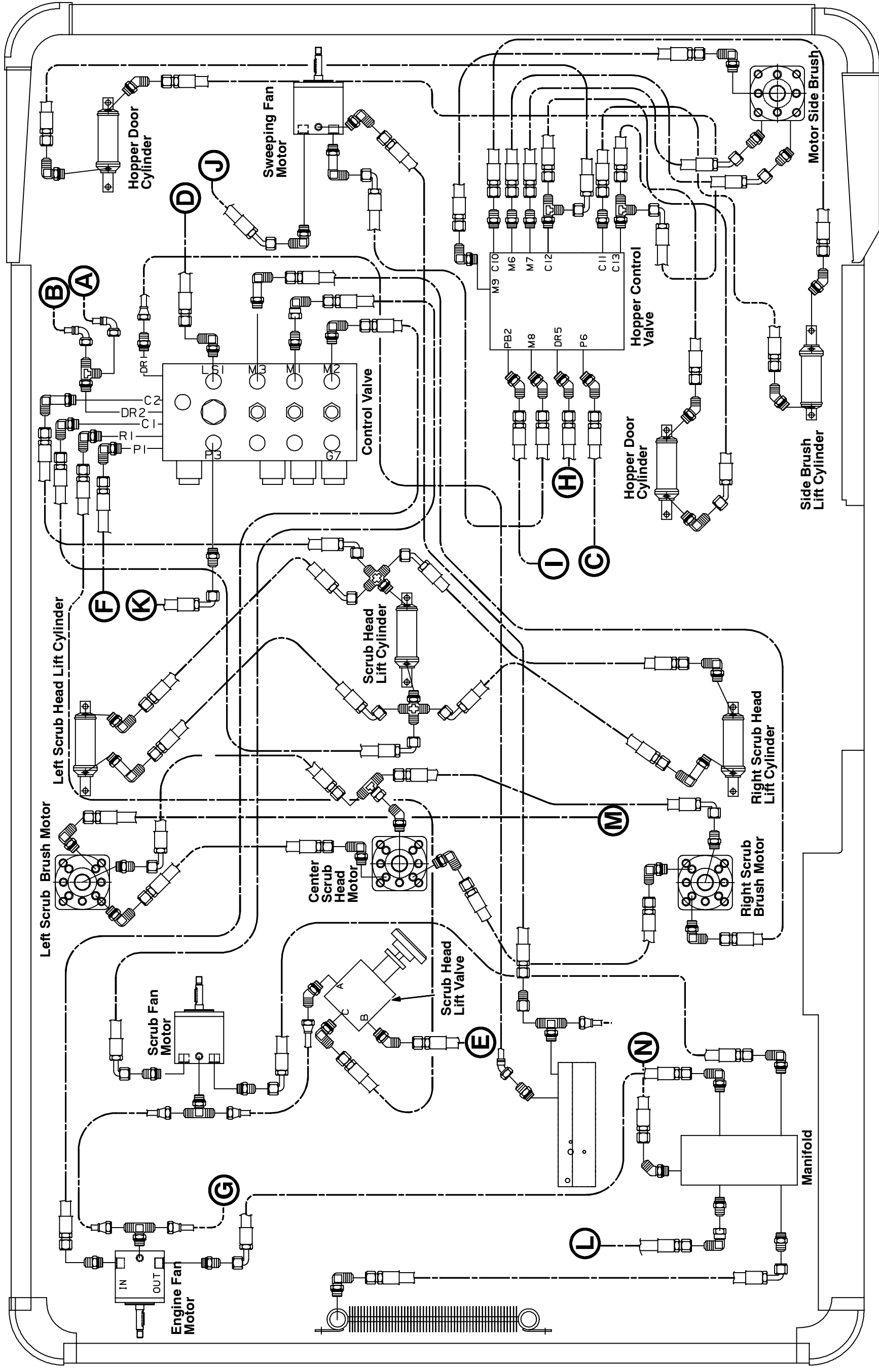


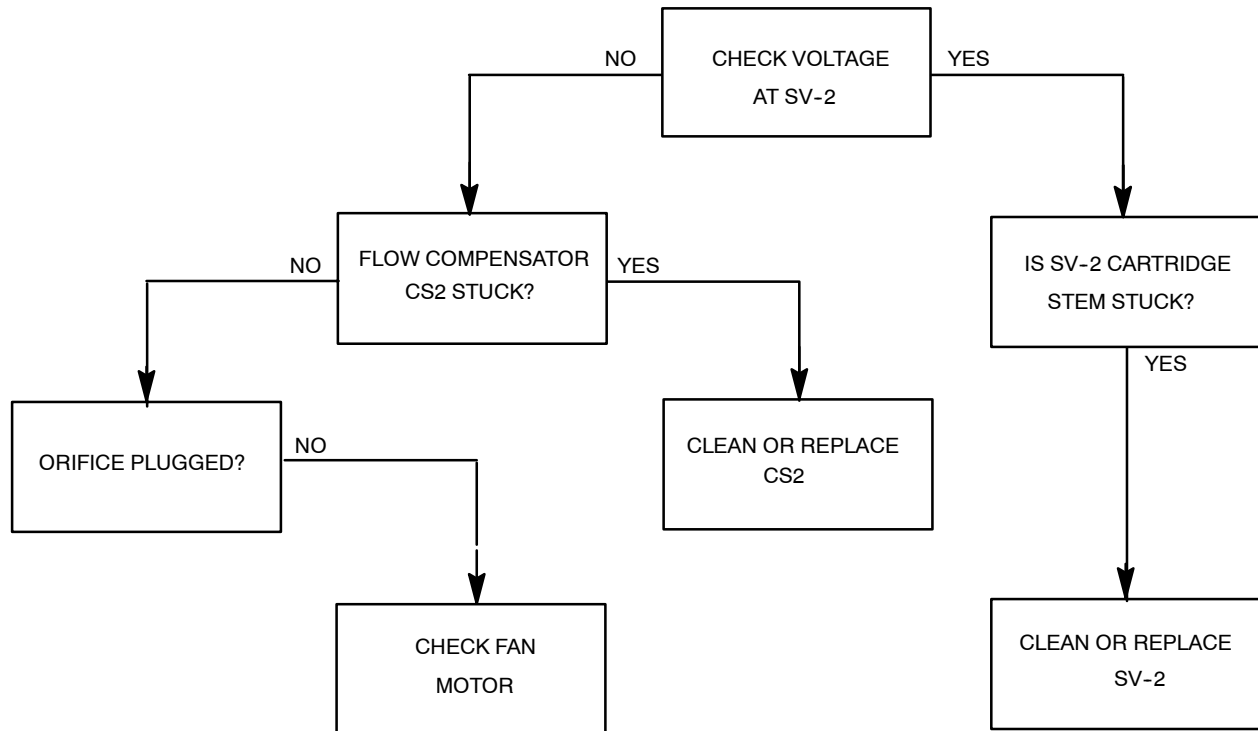
Fig. 3 - Hydraulic Hose Group

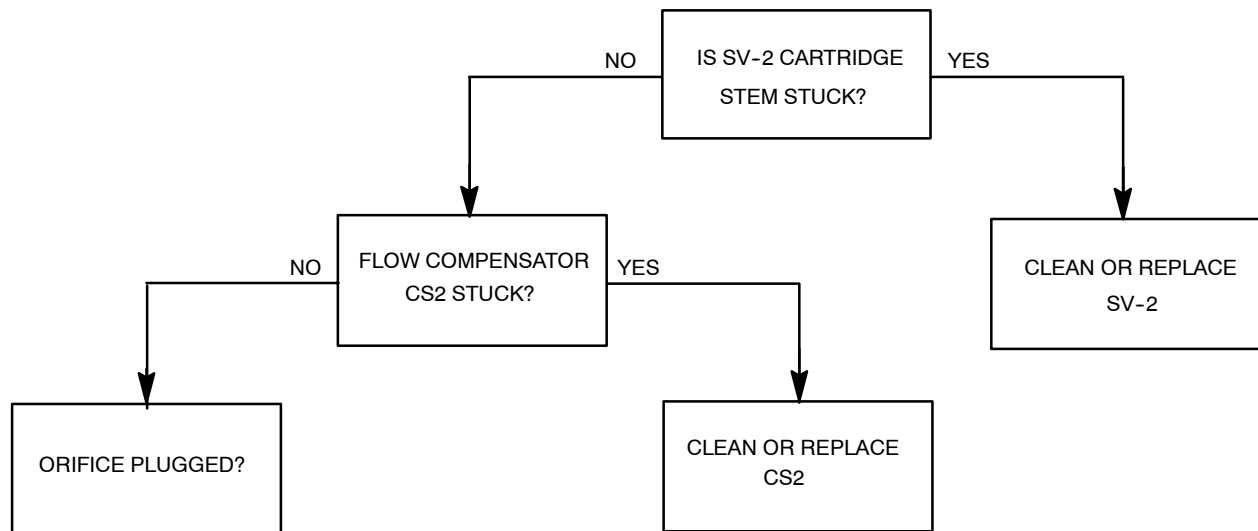


TROUBLESHOOTING

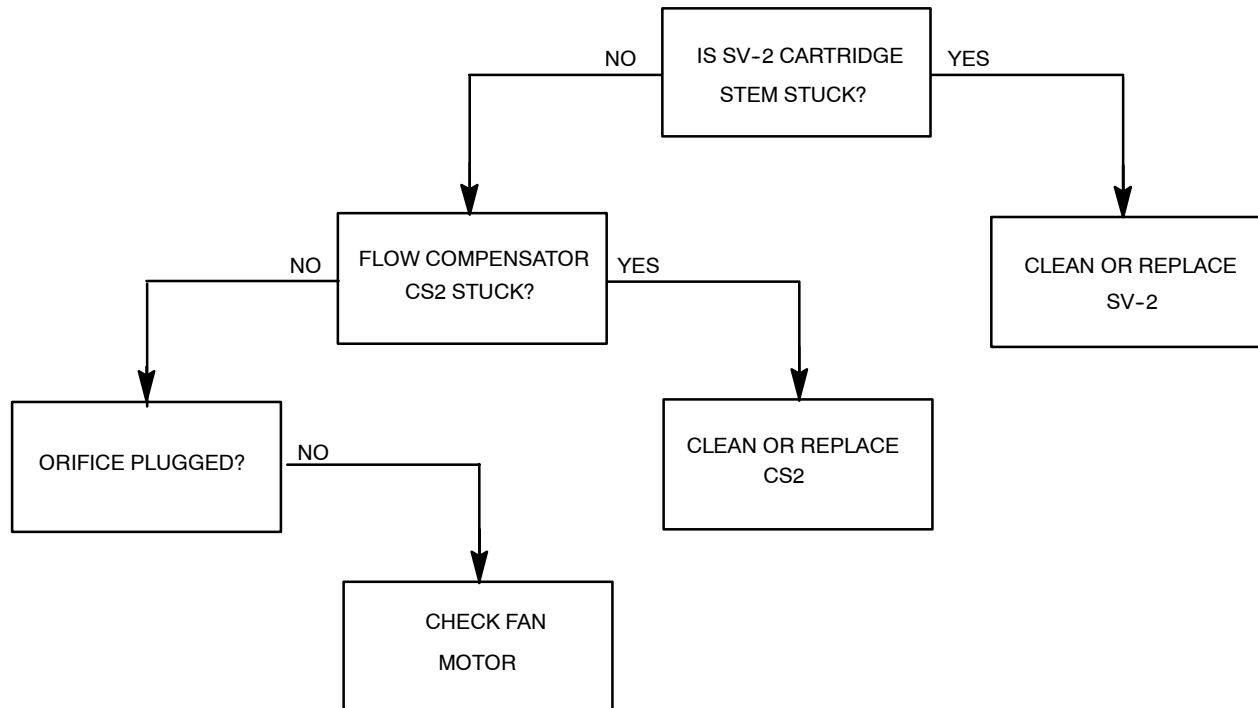
The troubleshooting charts that follow are organized so they lead you through the circuits. They include flow charts and instructions for you as to where to insert your test instruments.

ENGINE FAN DOESN'T RUN

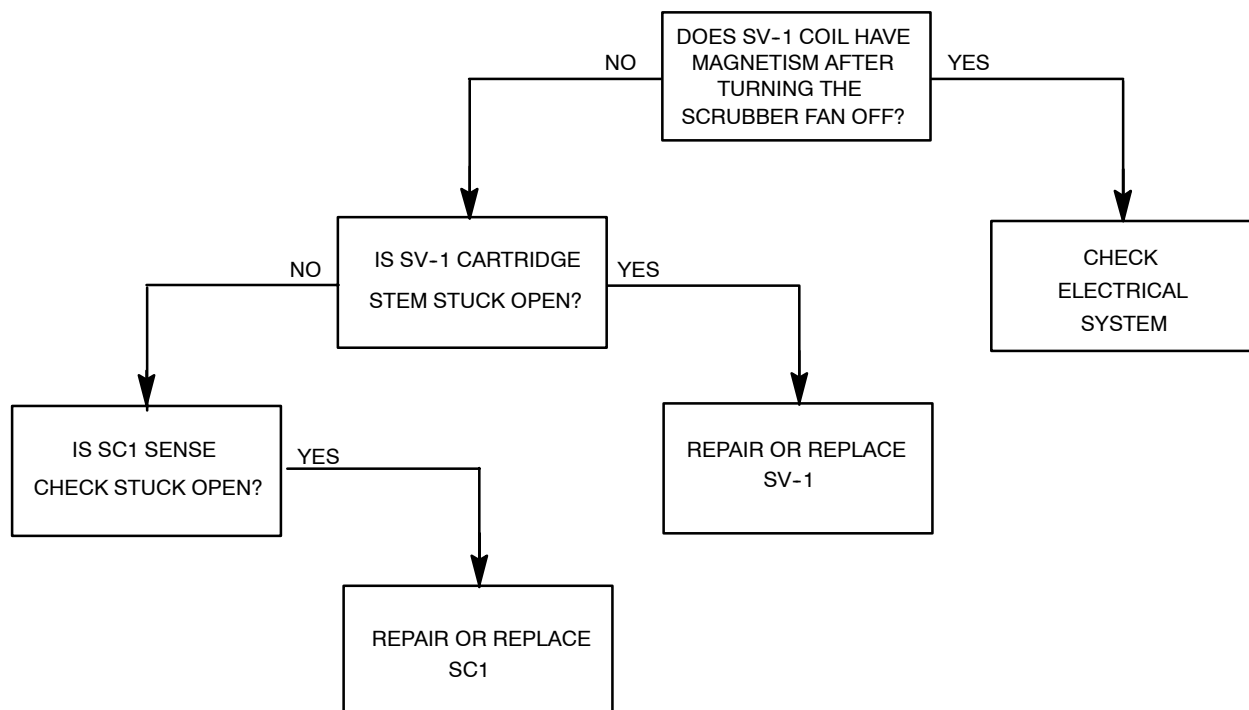


ENGINE FAN ALWAYS RUNS FAST

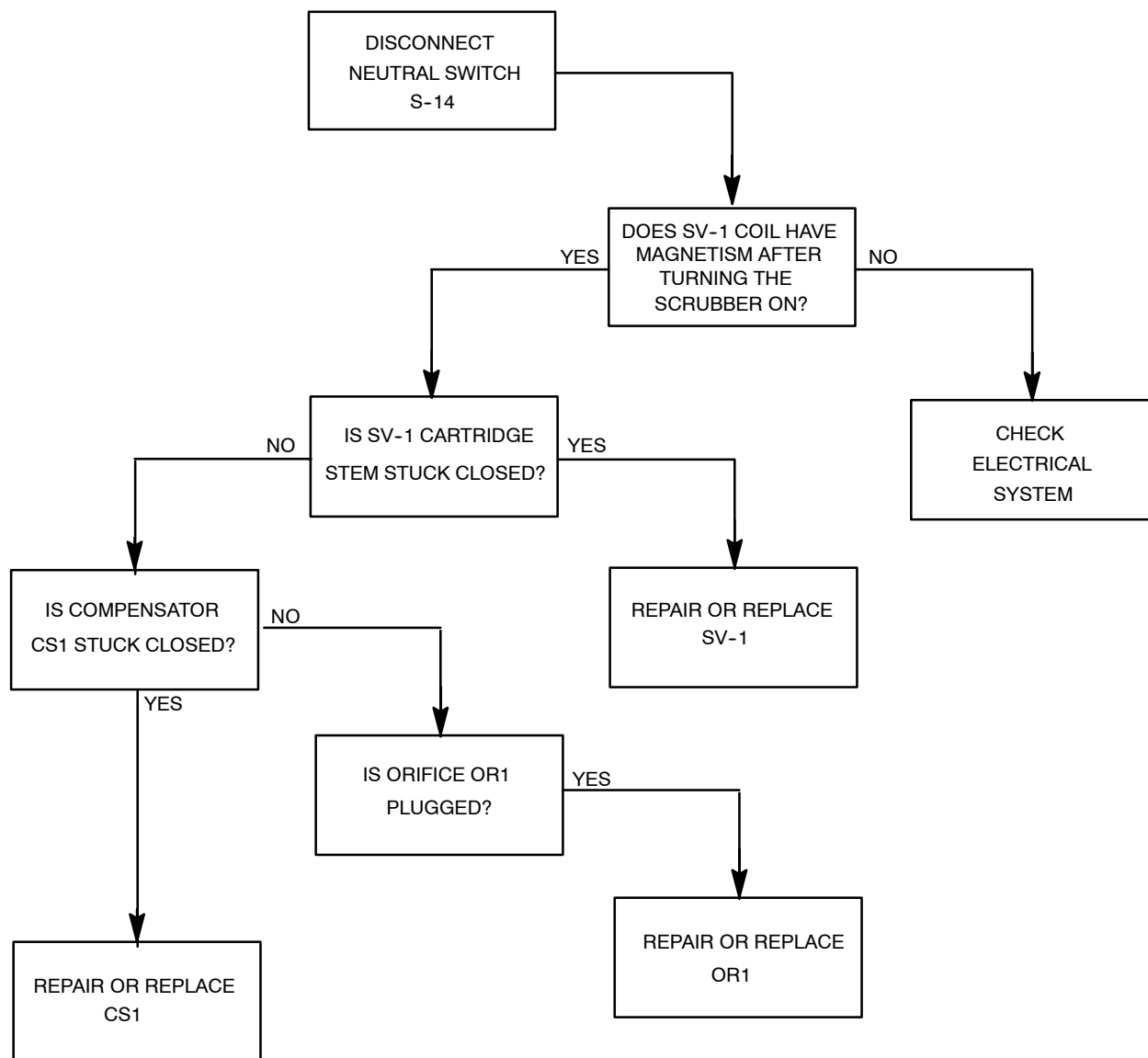
ENGINE FAN ALWAYS RUNS SLOW

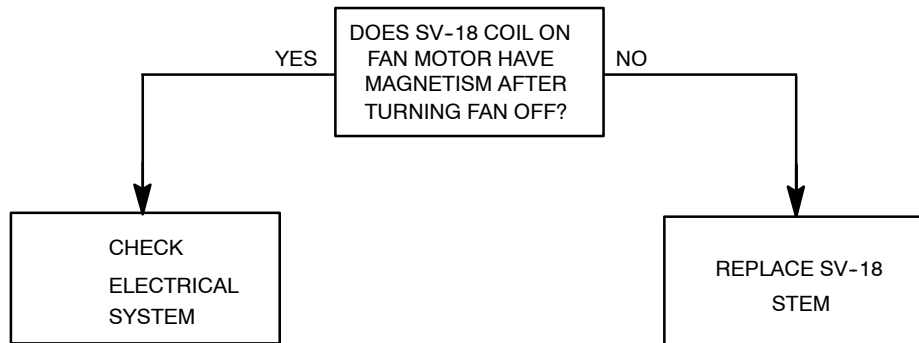


SCRUB FAN DOESN'T TURN OFF

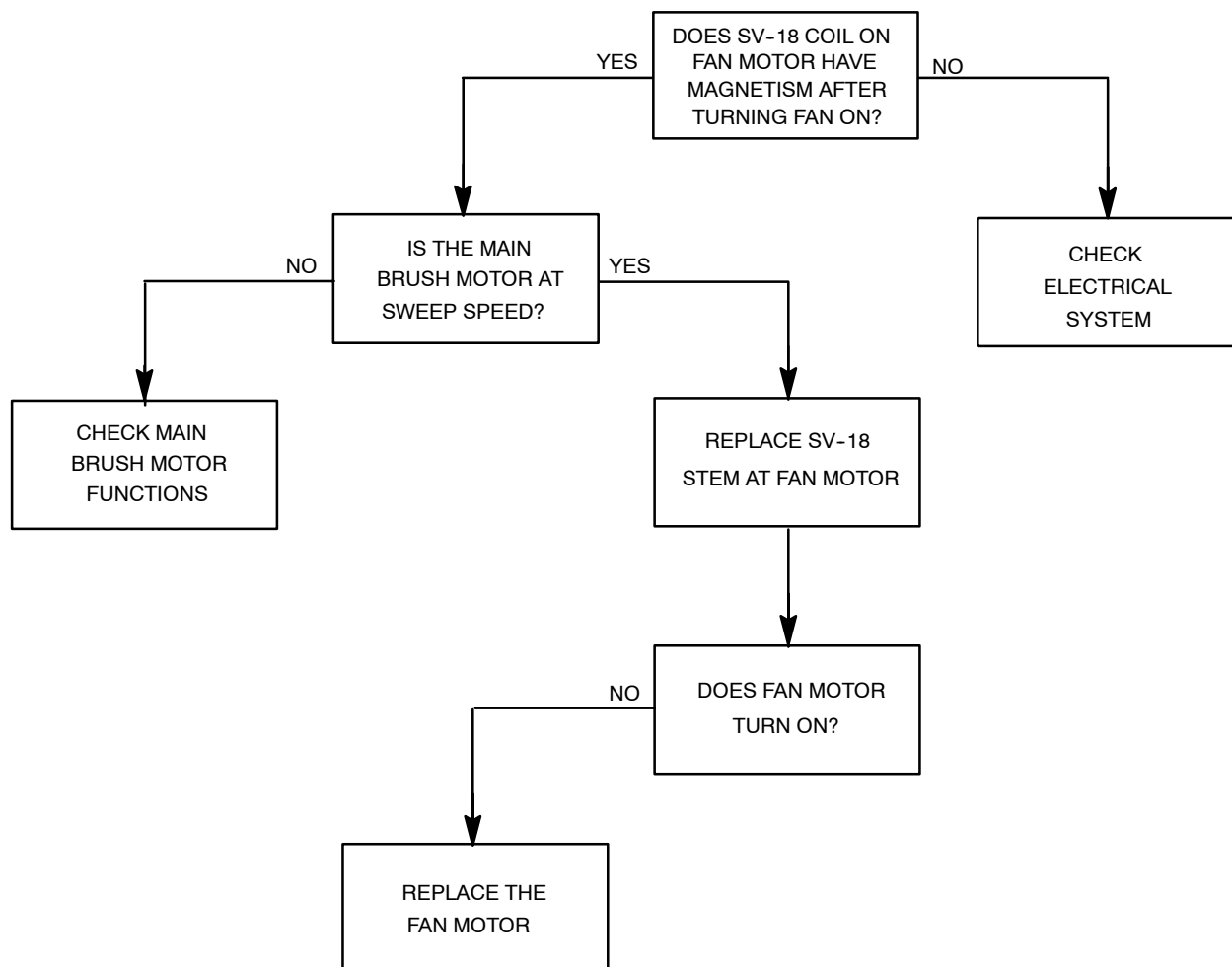


SCRUB FAN DOESN'T TURN ON

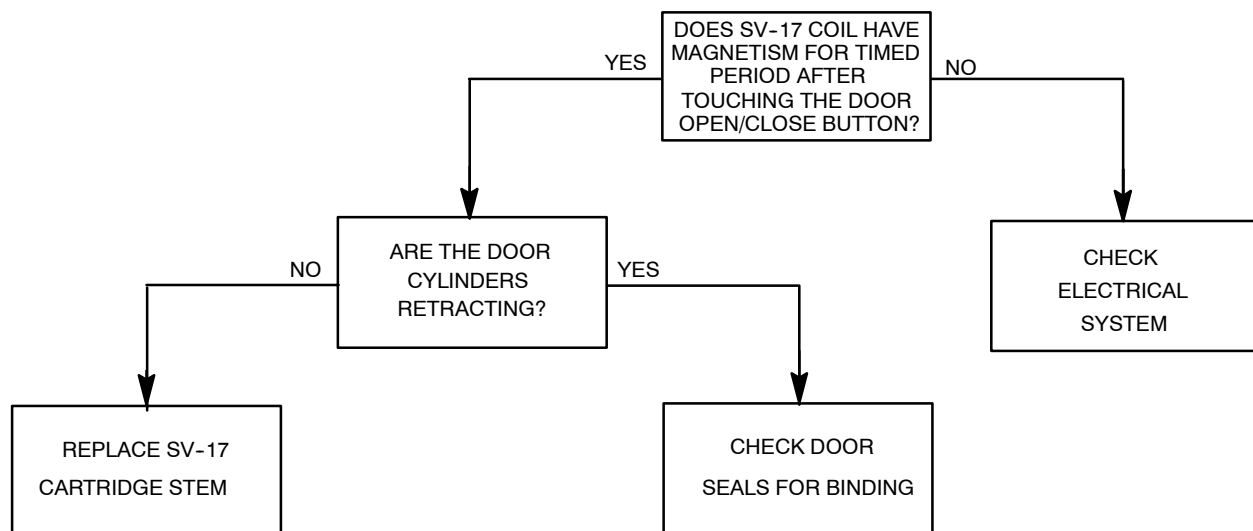


SWEEPER FAN DOESN'T TURN OFF

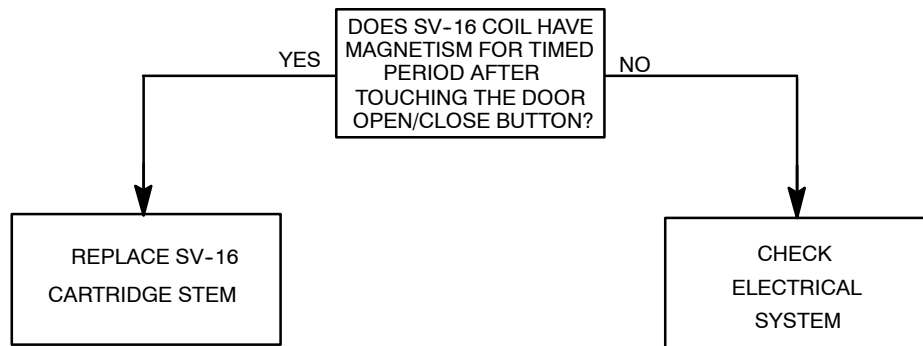
SWEEPER FAN DOESN'T TURN ON

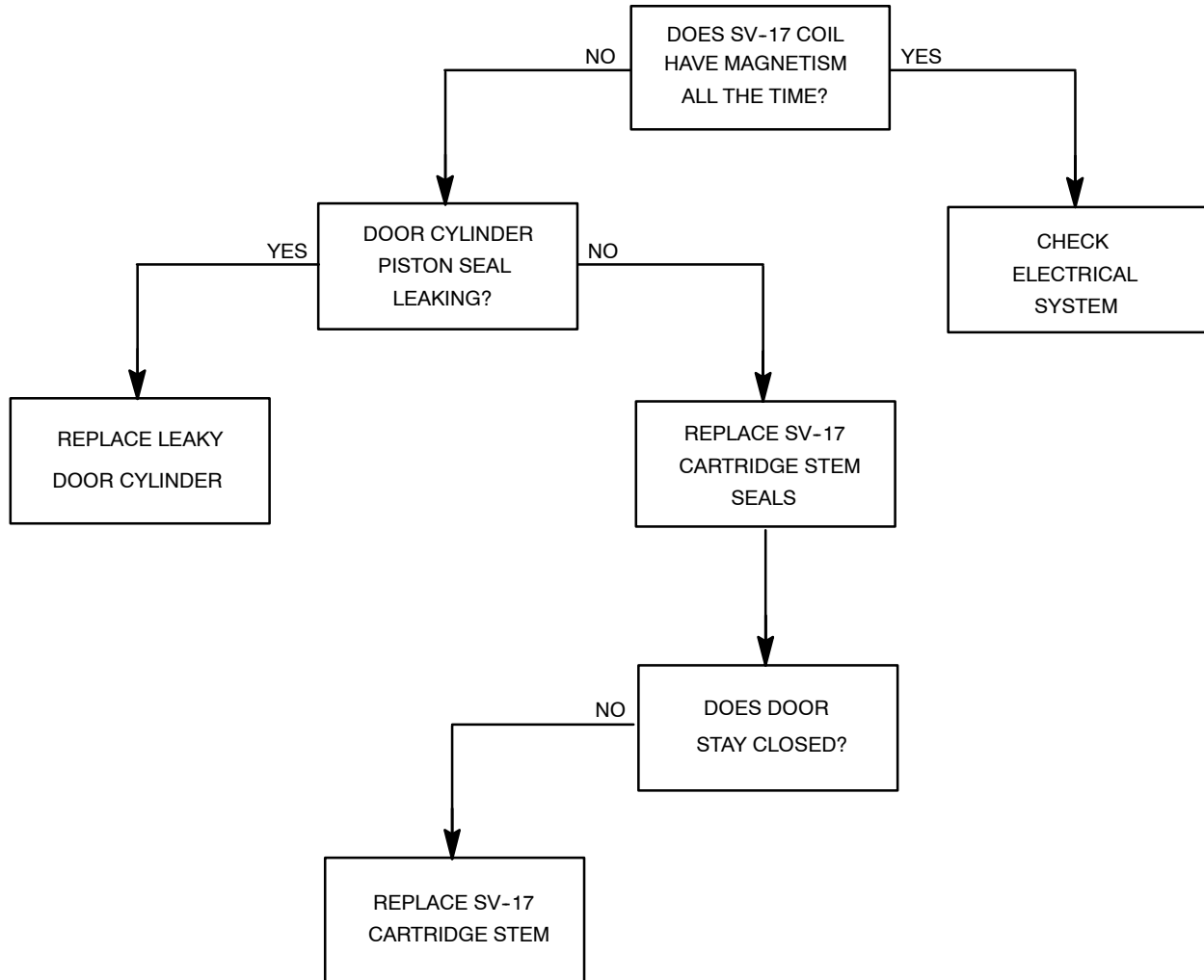


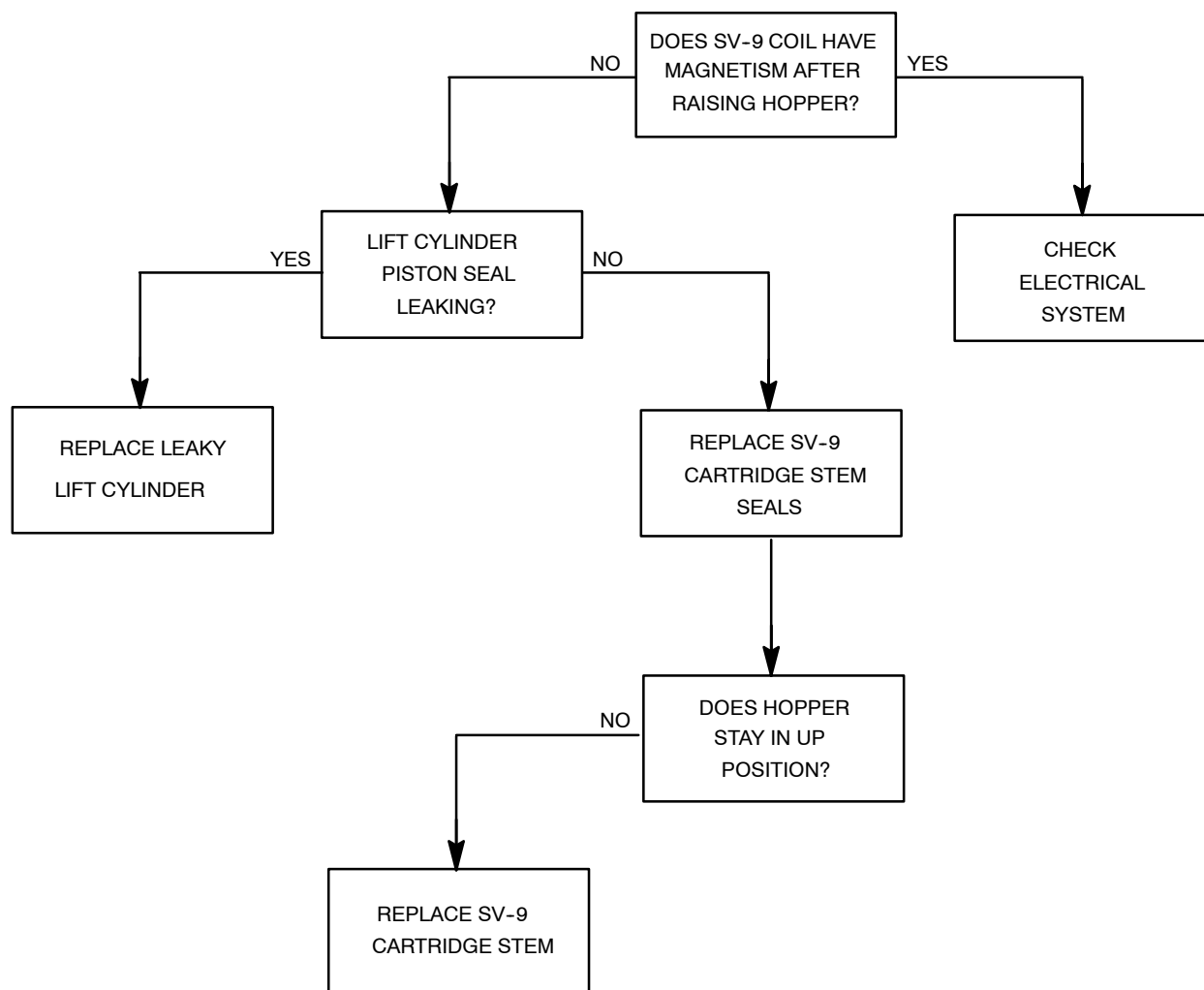
HOPPER DOOR DOESN'T OPEN

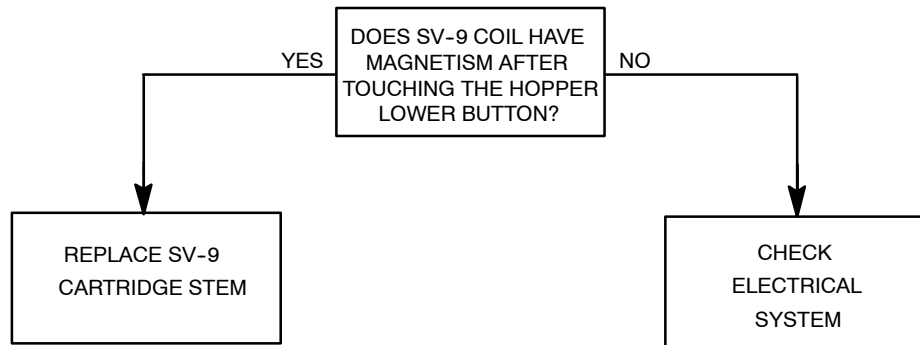


HOPPER DOOR DOESN'T CLOSE

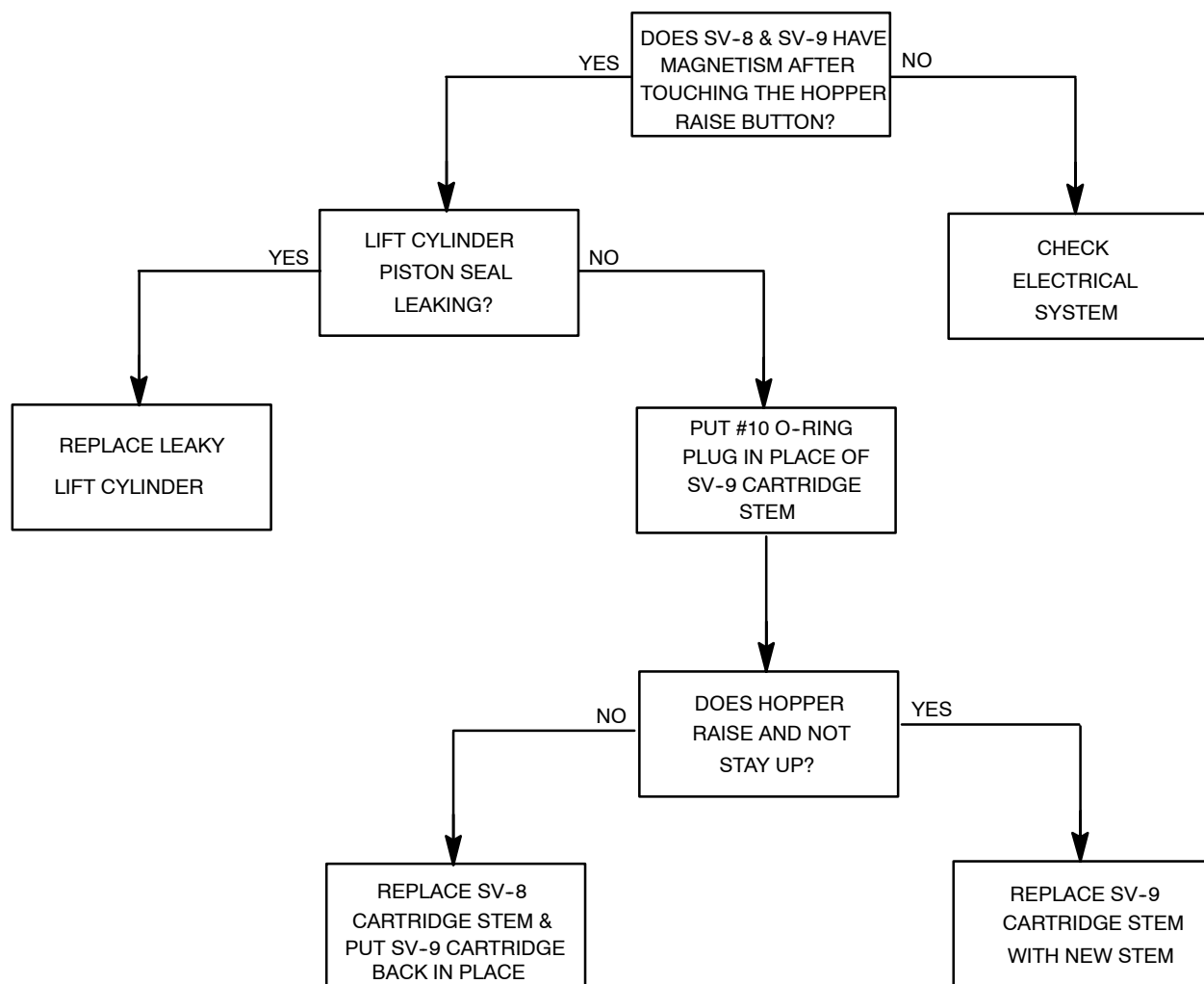


**HOPPER DOOR DOESN'T
STAY CLOSED**

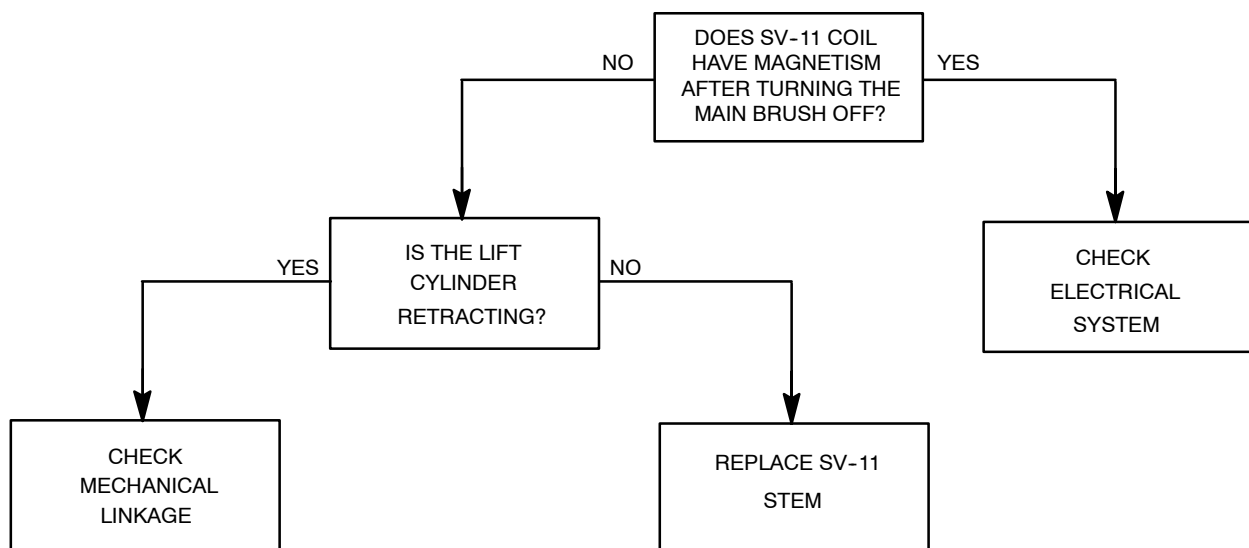
**HOPPER DOESN'T
HOLD UP POSITION**

HOPPER DOESN'T LOWER

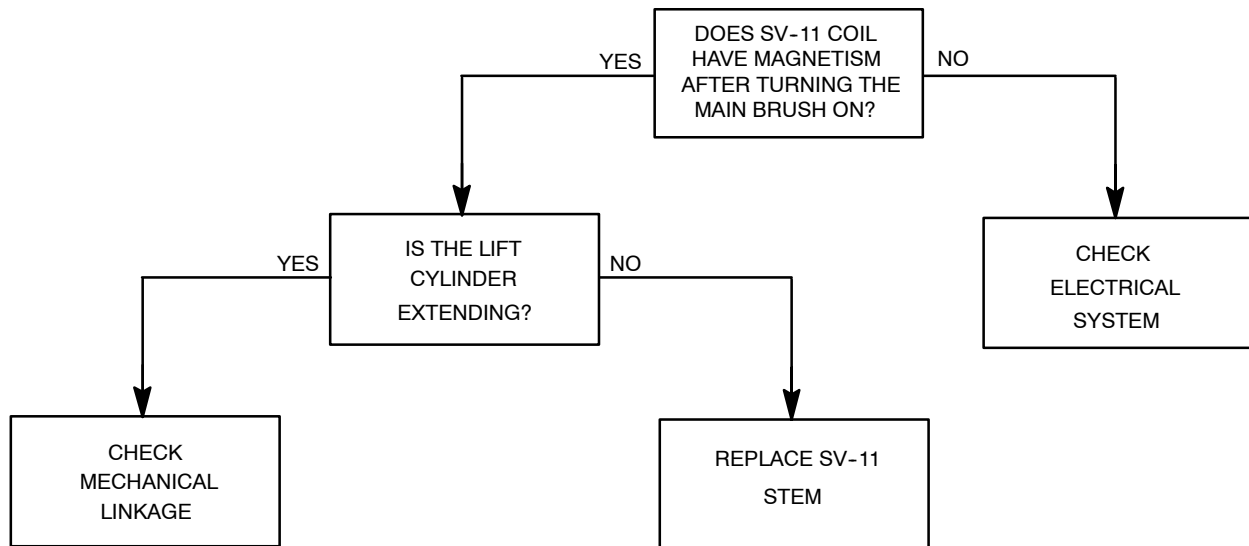
HOPPER DOESN'T RAISE

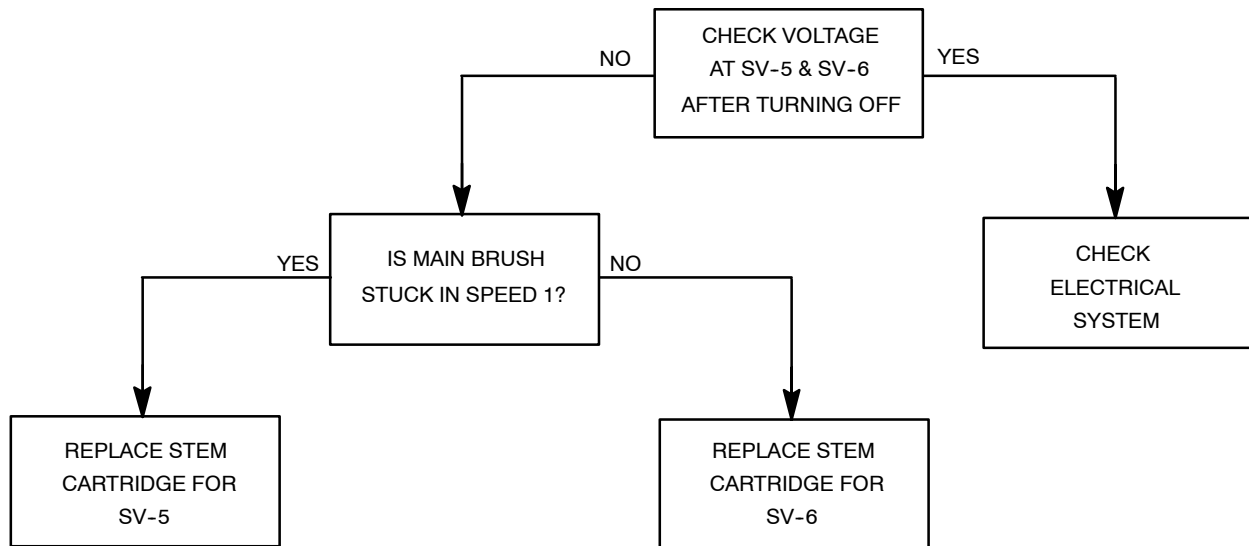


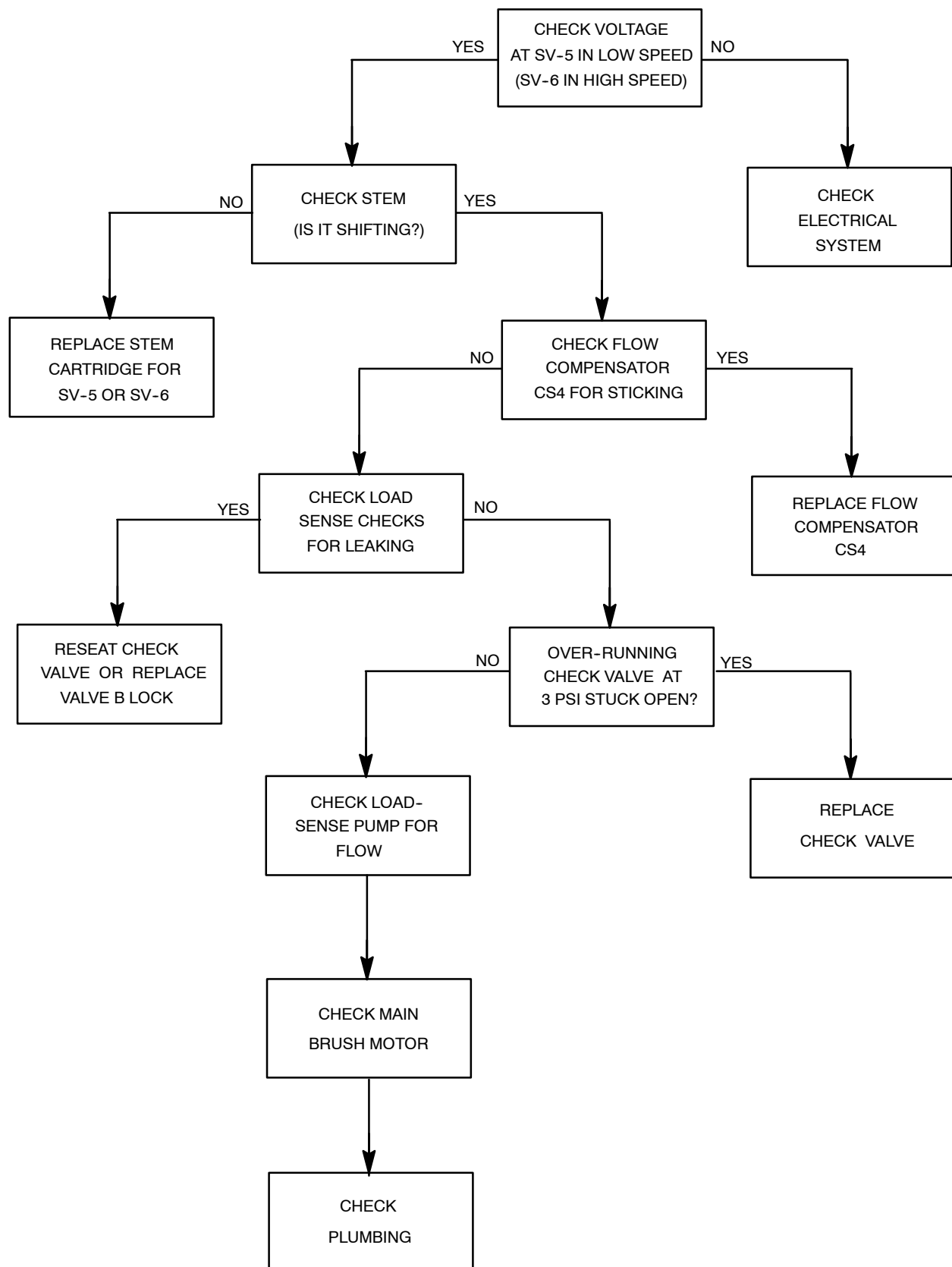
MAIN BRUSH DOESN'T RAISE



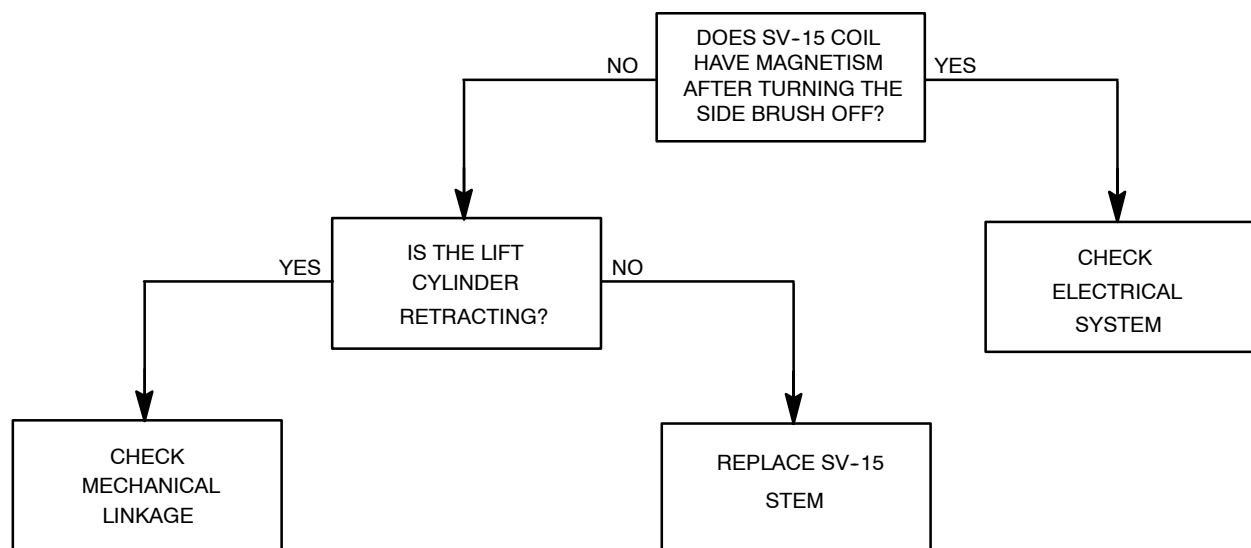
MAIN BRUSH DOESN'T LOWER



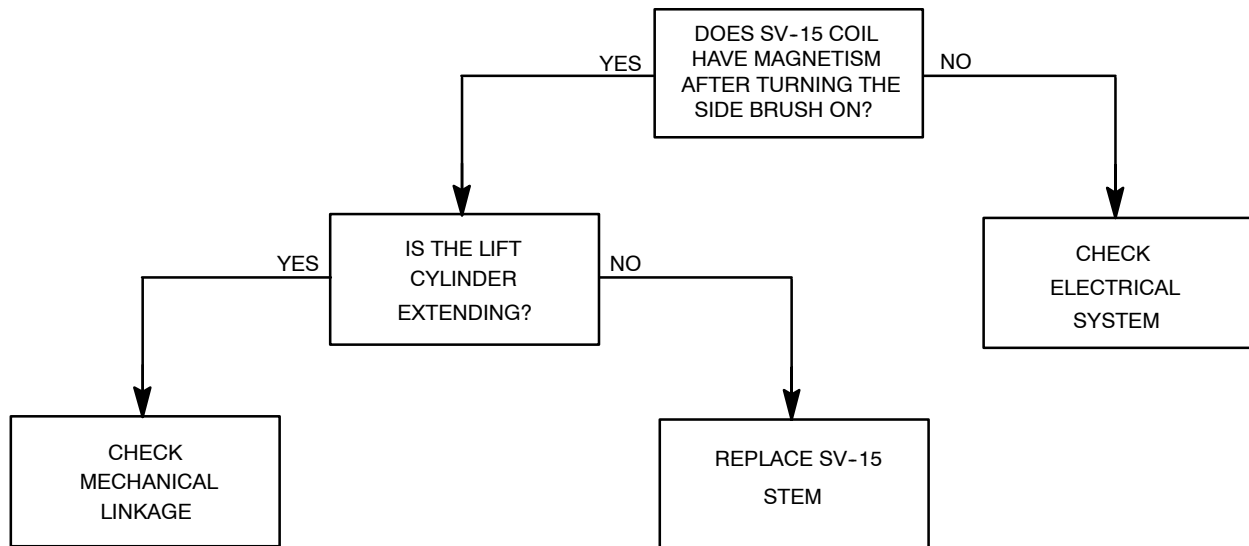
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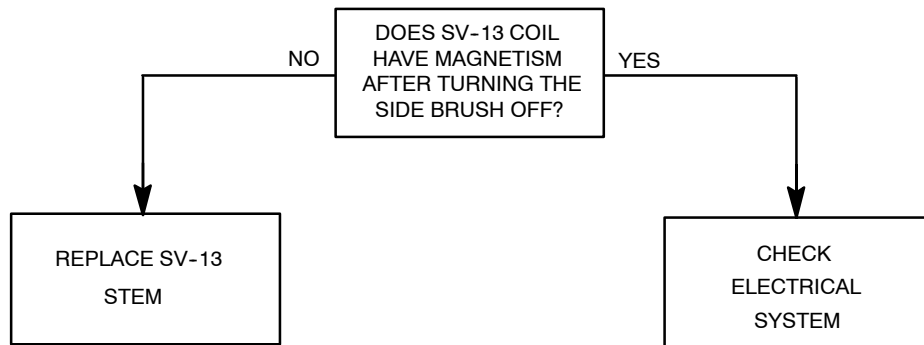
**MAIN BRUSH DOESN'T
TURN ON**

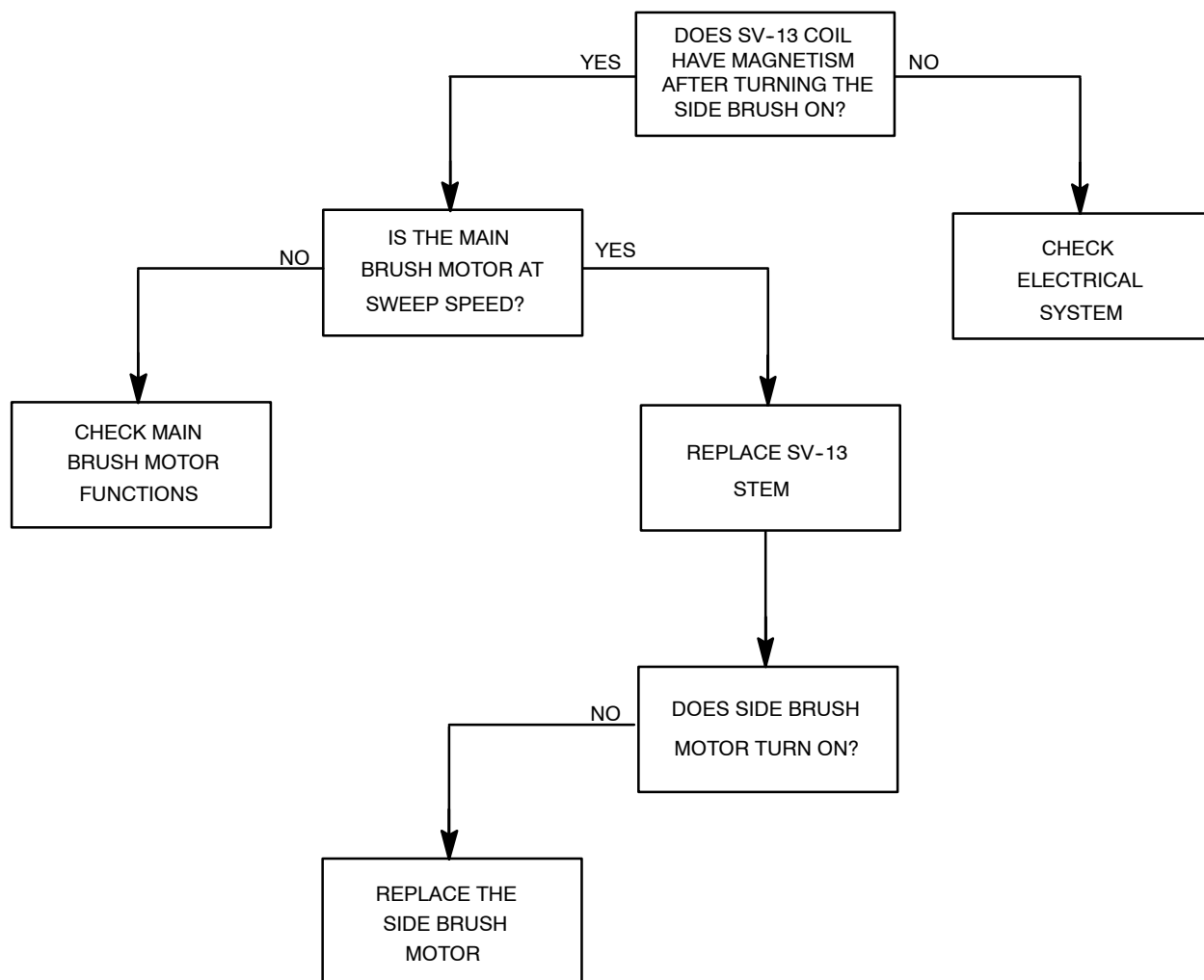
SIDE BRUSH DOESN'T RAISE



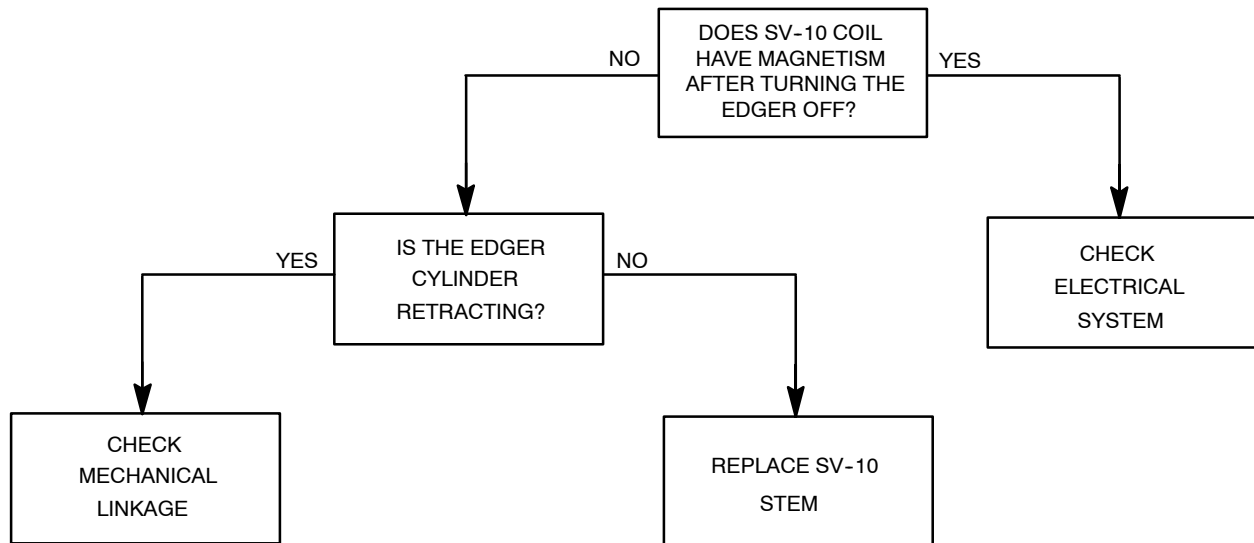
SIDE BRUSH DOESN'T LOWER



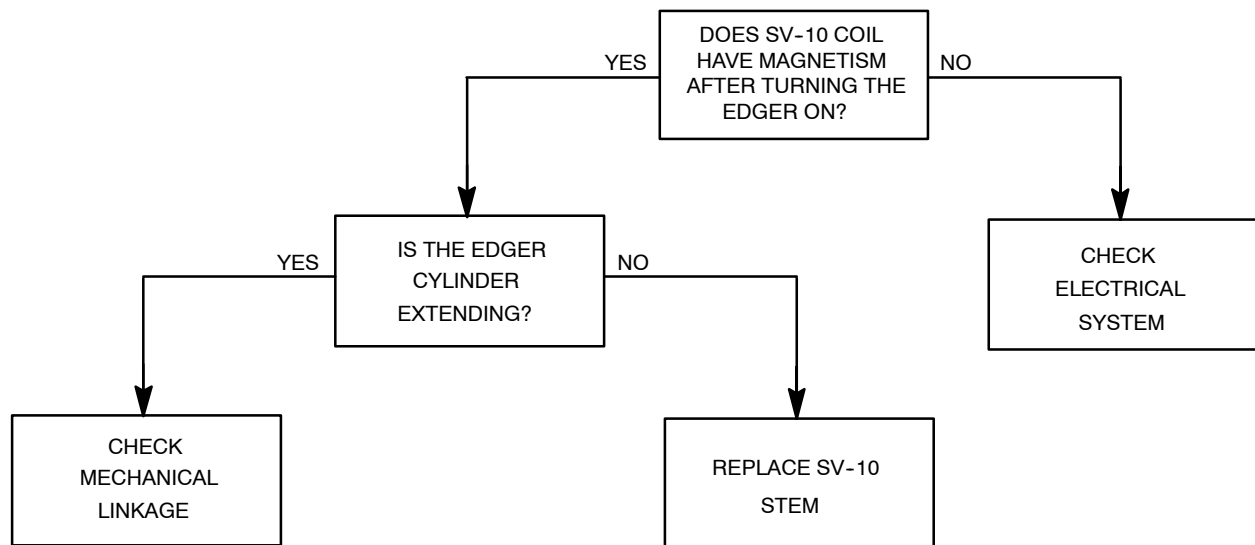
**SIDE BRUSH DOESN'T
TURN OFF**

**SIDE BRUSH DOESN'T
TURN ON**

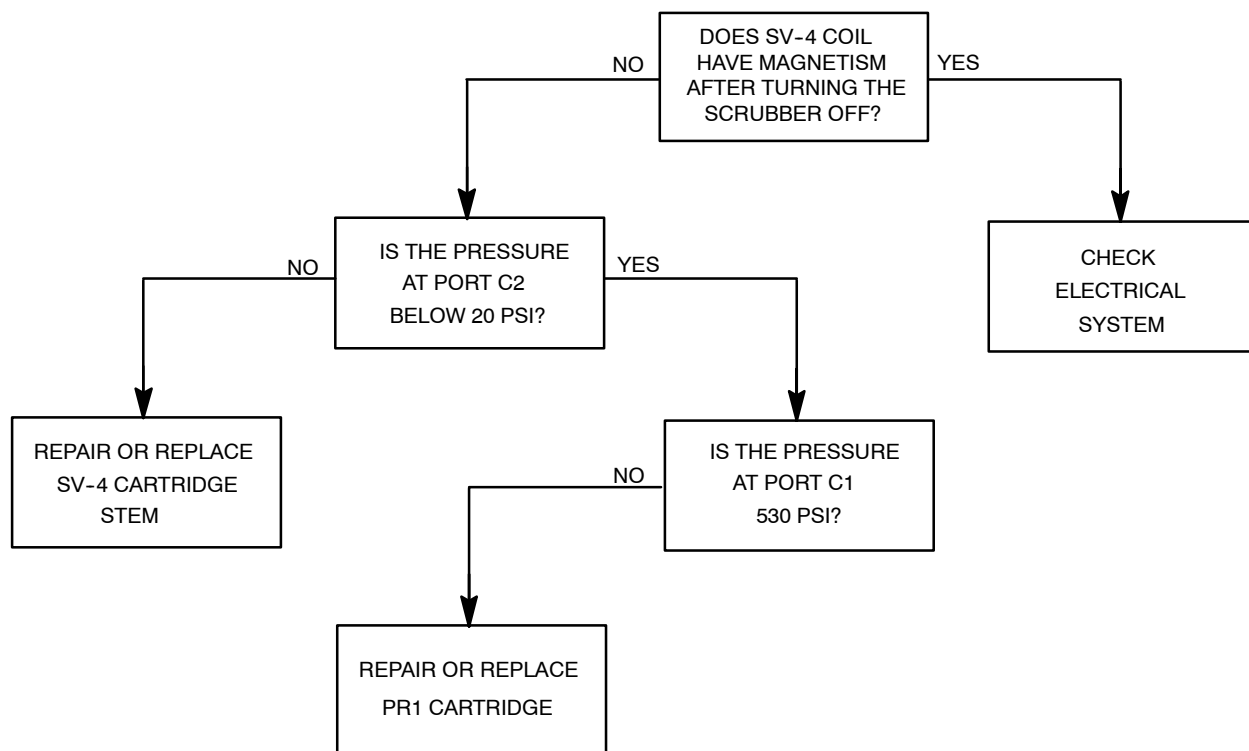
SCRUB HEAD DOESN'T GO IN



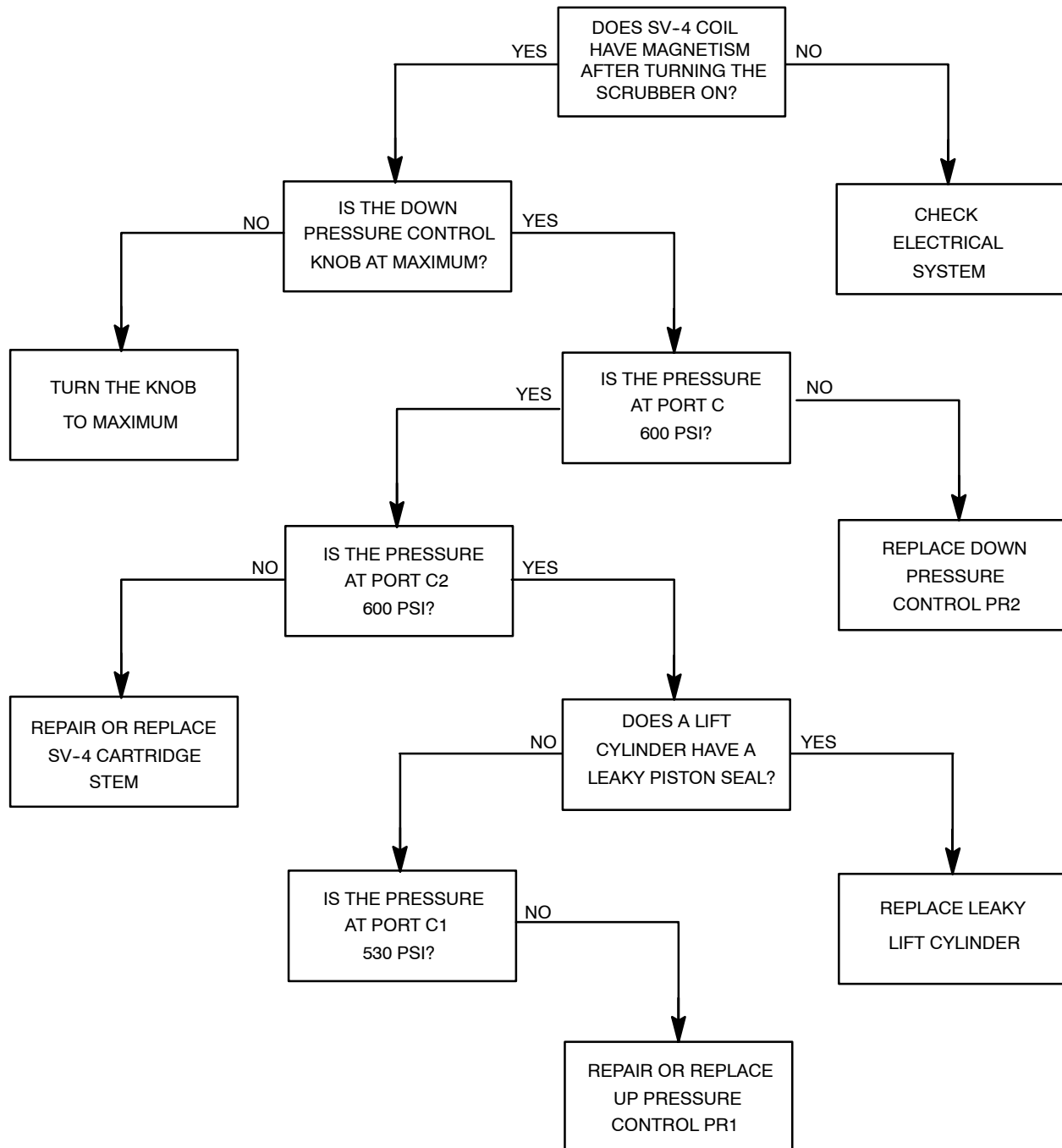
SCRUB HEAD DOESN'T GO OUT

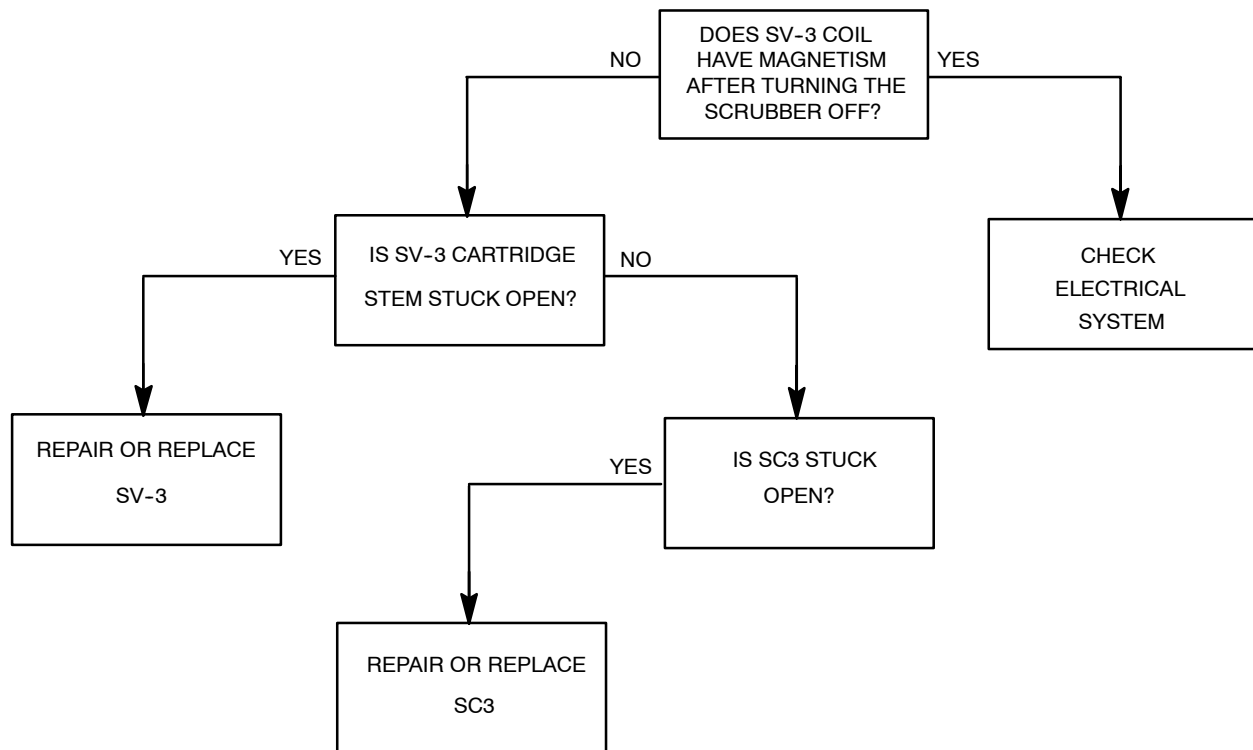


SCRUB HEADS DO NOT RAISE

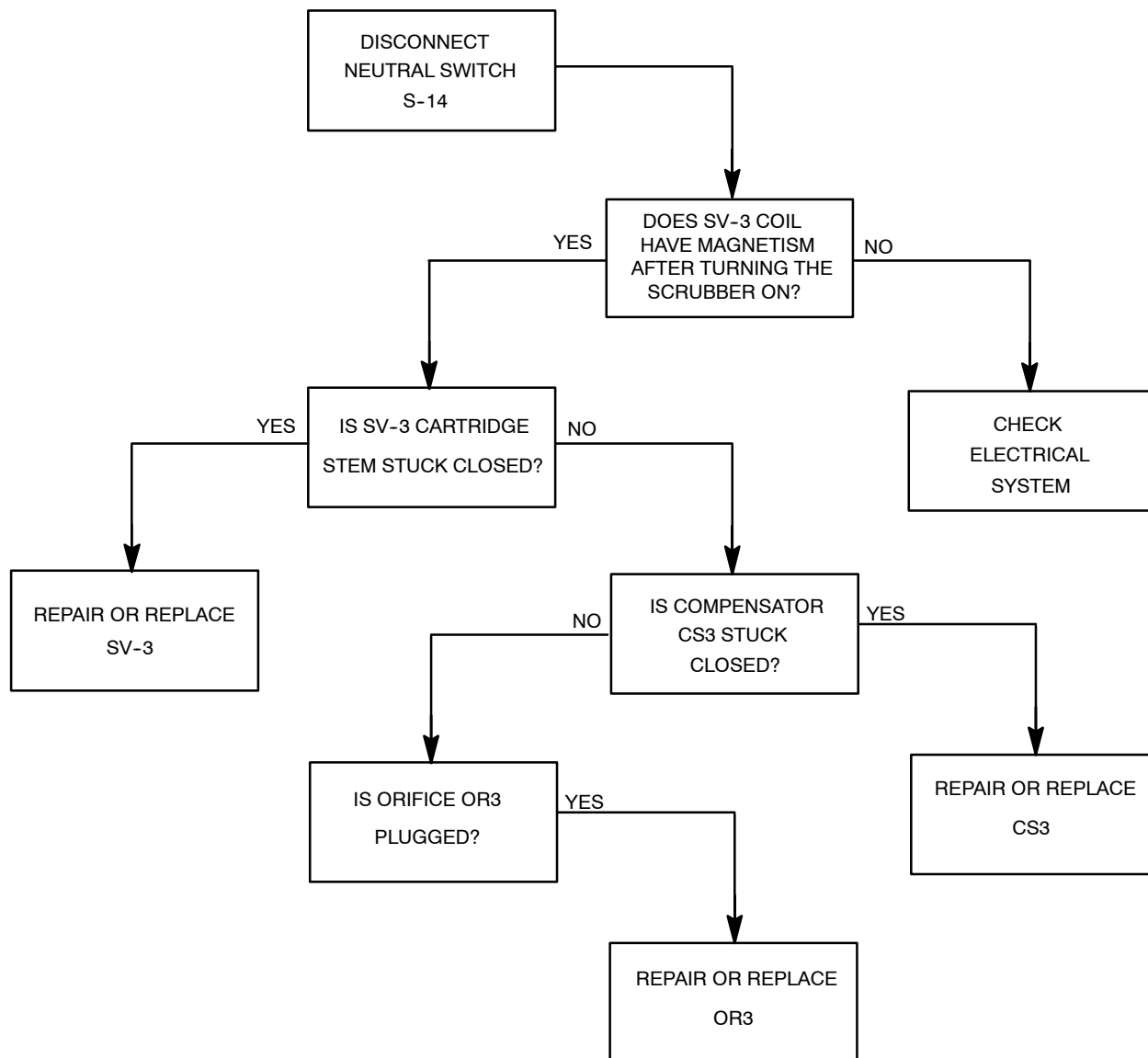


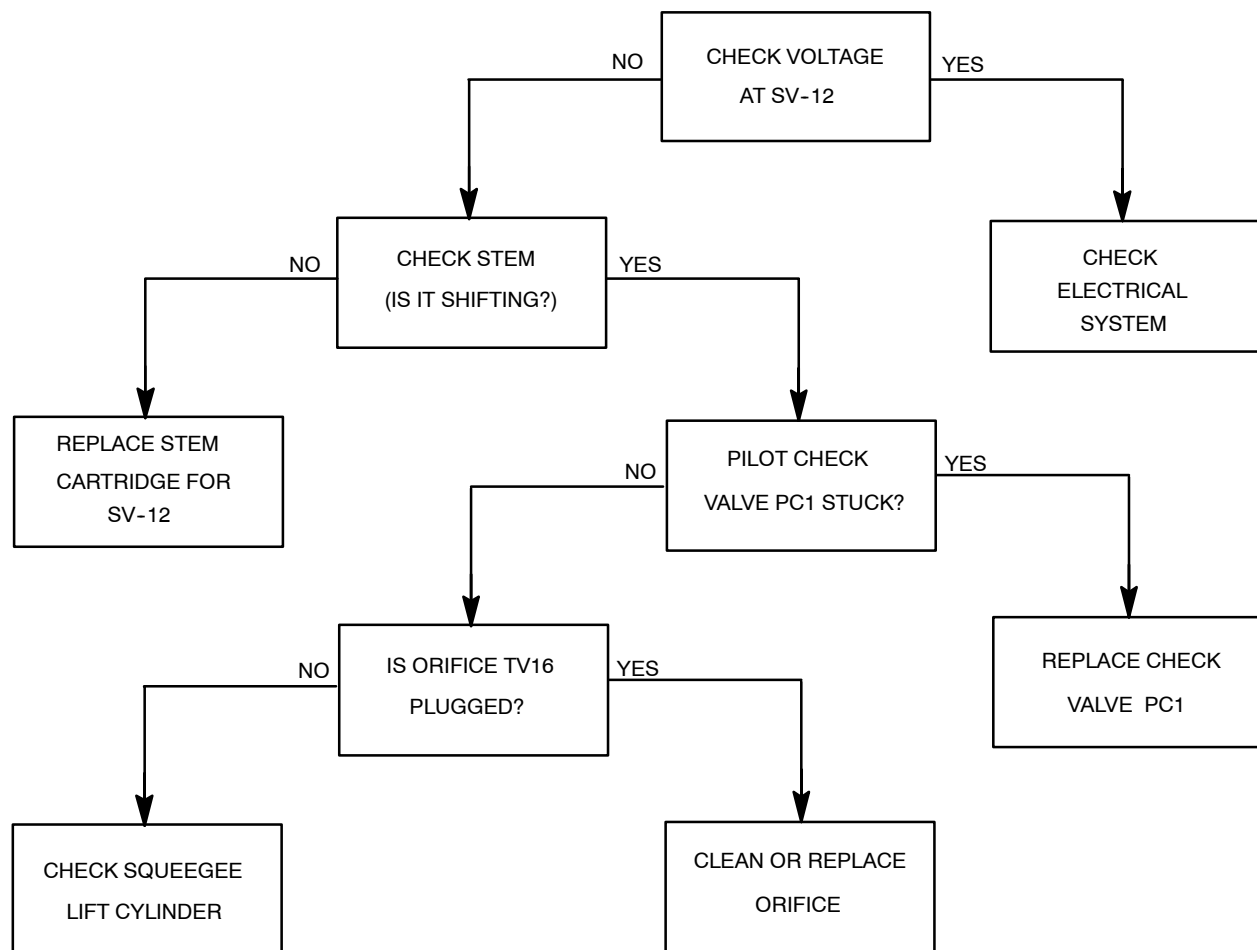
SCRUB HEADS DO NOT LOWER



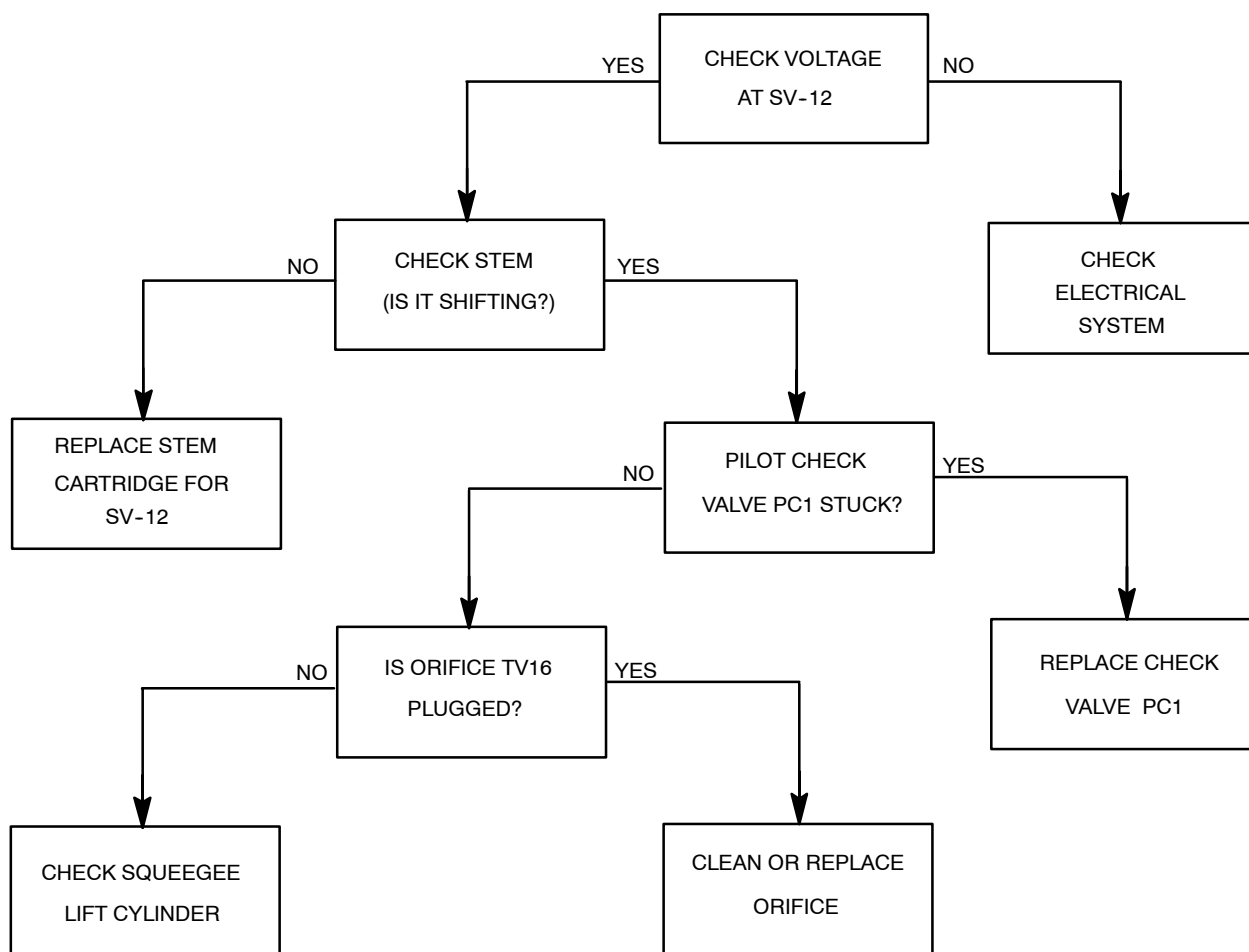
**SCRUB BRUSHES DO NOT
TURN OFF**

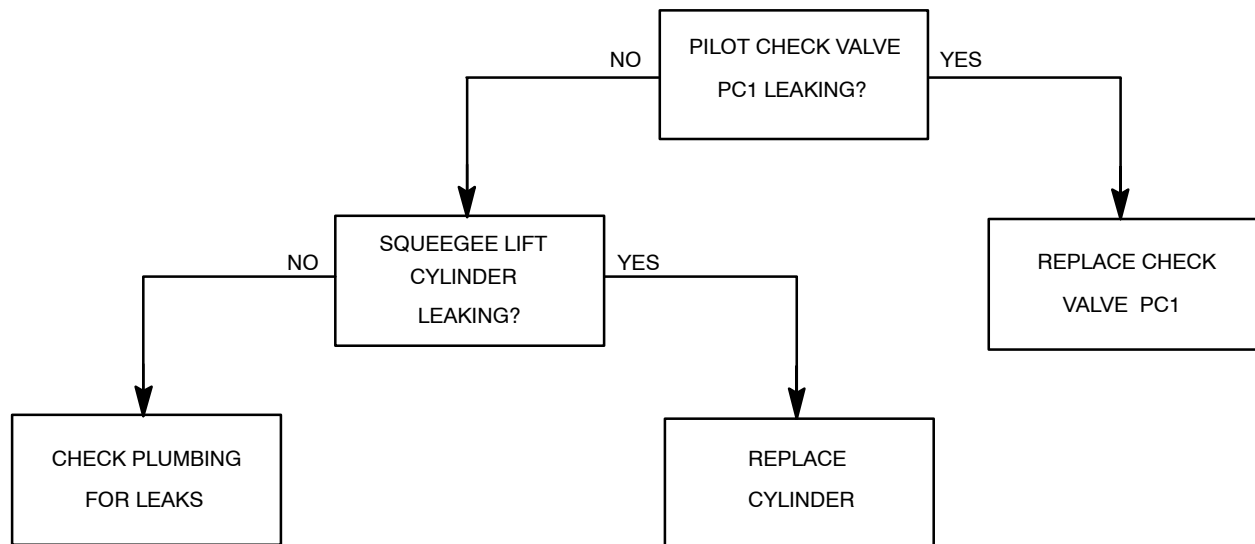
SCRUB BRUSHES DO NOT TURN ON



SQUEEGEE DOESN'T RAISE

SQUEEGEE DOESN'T LOWER



**SQUEEGEE DOESN'T HOLD
UP POSITION**

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GAS ENGINE SERVICE MANUALS

FORD LSG-423 (2.3 Liter)
TENNANT Part Number 61875

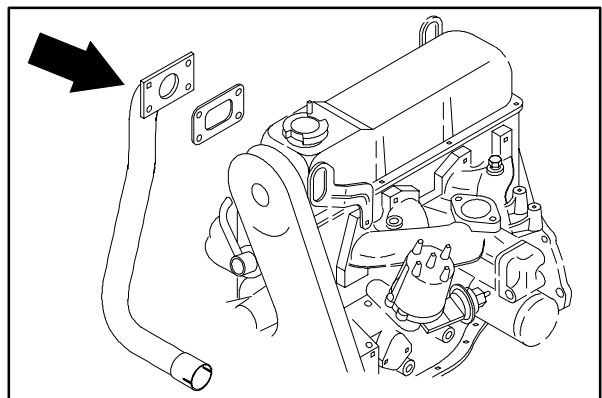
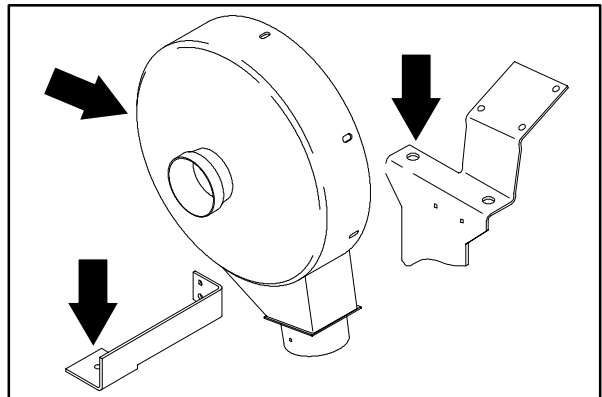
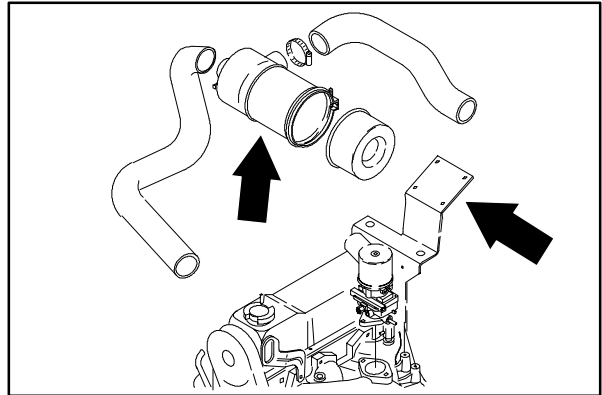
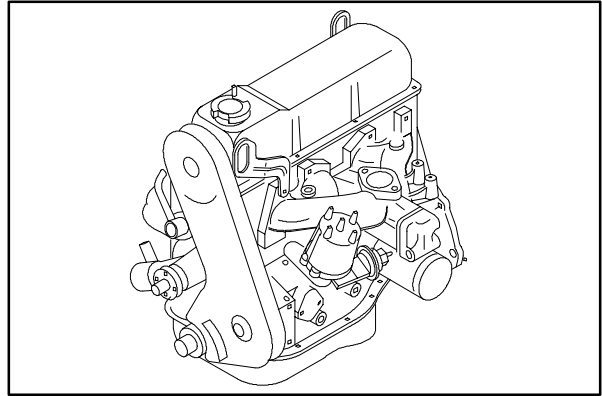
TO REMOVE GAS / LPG ENGINE

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

1. Remove the engine cover and side door.
2. Remove the battery cables from the battery.
3. Drain the radiator.
4. Drain the engine oil.
5. Remove the air cleaner assembly from the mounting bracket.
6. Disconnect and plug the hydraulic hoses on the scrubber vacuum fan motor.

NOTE: Observe hydraulic cleanliness requirements when opening hydraulic lines.

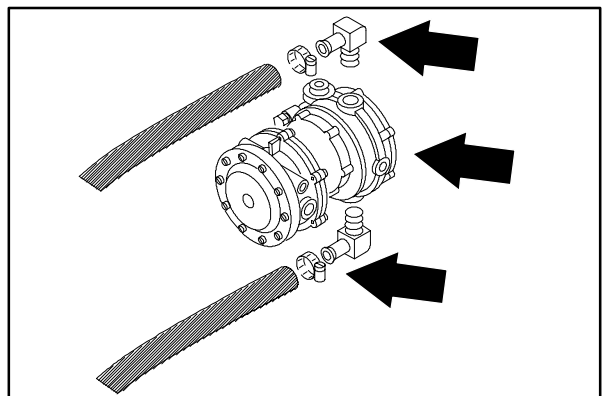
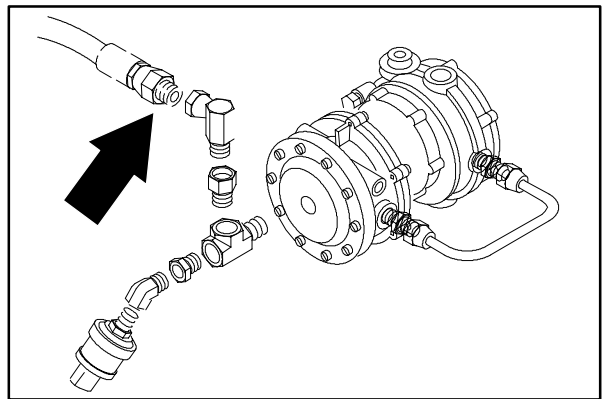
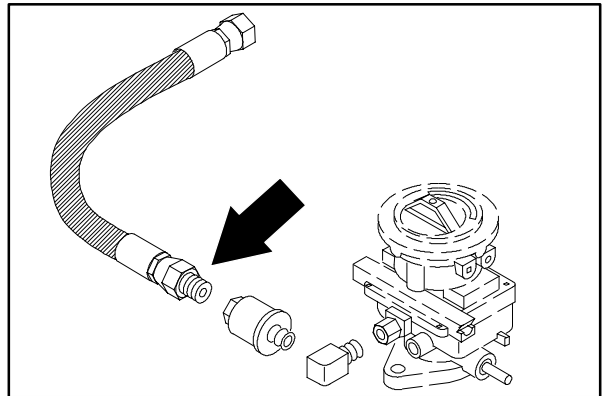
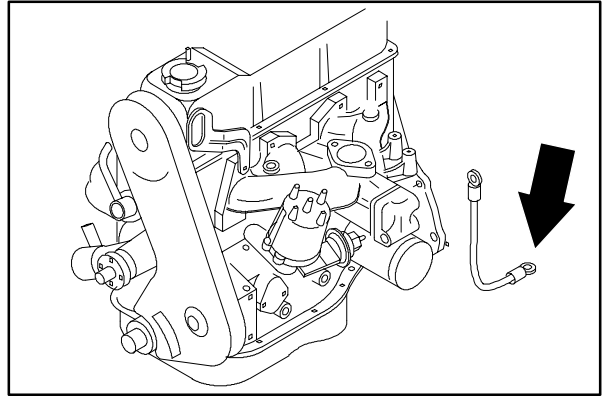
7. Remove the scrubber vacuum fan assembly and vacuum hose.
8. Remove the vacuum fan/air cleaner mount bracket from the engine.
9. Remove the radiator hoses from the engine.
10. Disconnect the exhaust pipe at the engine manifold.
11. Disconnect the main electrical wire harness from all engine components and place it out of the way.
12. Disconnect the engine ground strap from the machine frame.
13. On a **GAS** machine; disconnect the fuel line at the fuel pump. On an **LPG** machine; disconnect line from the lpg tank at the fuel lockoff / vaporizer assembly.



ENGINE-G/LPG

14. On an **LPG** machine; remove the two coolant and two fuel lines connected to the lockoff / vaporizer assembly.
15. Remove the lockoff/vaporizer assembly from the machine.
16. Remove the LH side panel.
17. Remove the side channel brace.
18. Remove the two hex screws holding the hydraulic priority valve to the side door mounting bracket.
19. Remove the side door mounting bracket from the machine.
20. Remove the left rear grill panel for access to the hydraulic pump assemblies.
21. Remove the two M12 hex screws holding the load sensing / propel pump assembly to the flywheel housing.
22. Pull the load sensing / propel pump assembly back and out of flywheel housing.
23. Using an overhead hoist; hook a chain through the two pick-up points on engine. Put a slight amount of tension on the chain.
24. Remove the four M12 hex screws holding the motor mounts to the rubber isolators.
25. The engine can now be carefully lifted out.

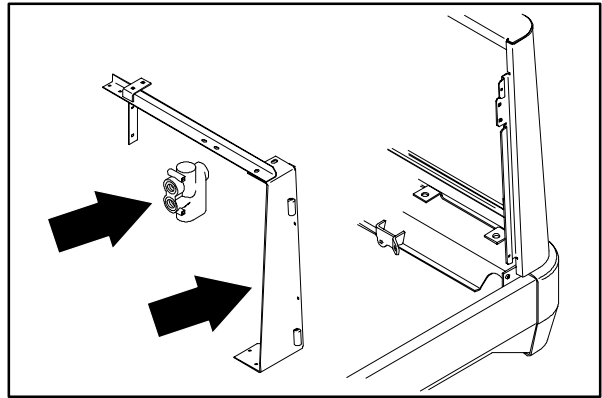
NOTE: Be sure to disconnect engine oil drain hose from oil pan before lifting engine completely out of the machine.



TO INSTALL GAS / LPG ENGINE

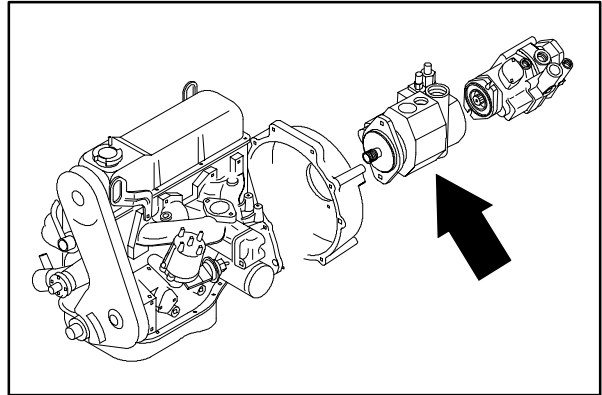
FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake., Turn Off Machine And Remove Key.

1. Hook a chain through the two pick-up points on the engine. Use an over head hoist to lift the engine in the engine compartment.
2. Carefully lower the engine assembly down on the motor mounts.



NOTE: Make sure the hoses, wire harness, exhaust pipe, and load sensing pump are pulled back out of the way when lowering the engine assembly in place.

3. Reinstall the M12 hex screws in the four engine motor mounts. Tighten to 64 – 83 Nm (50 – 60 ft lb).
4. Reconnect the ground cable from the bellhousing to the machine frame.
5. Reinstall load sensing pump back in the bellhousing. Reinstall the M12 hex screws. Tighten to 64 – 83 Nm (50 – 60 ft lb).

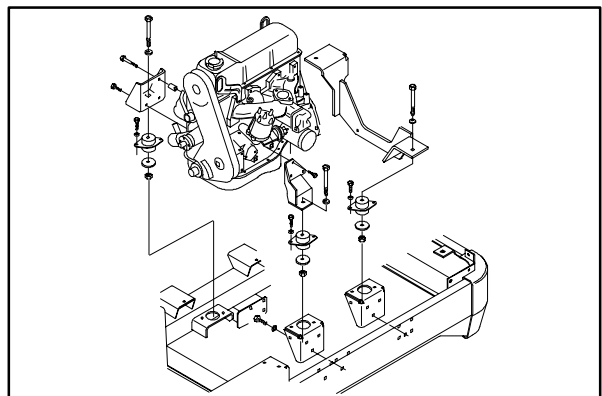
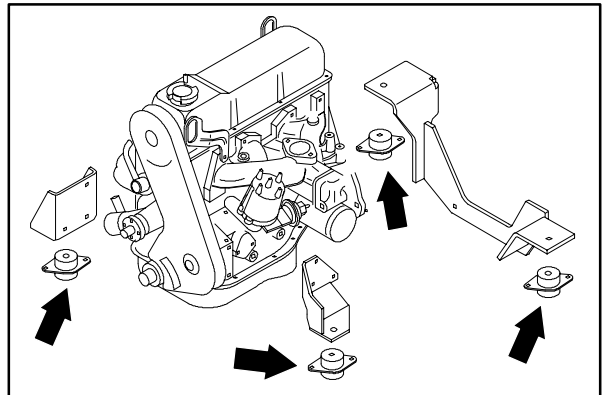


NOTE: Make sure the splines on pump line up with splines in coupler when installing pump.

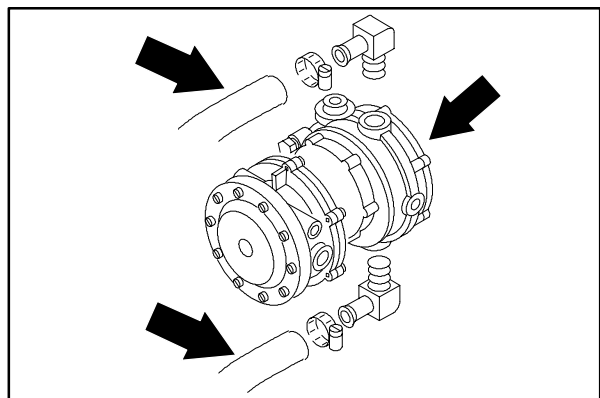
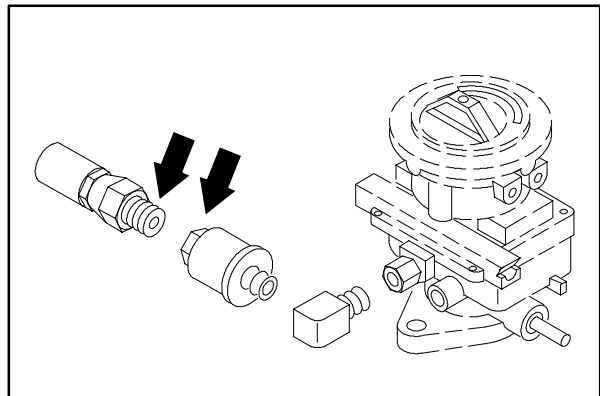
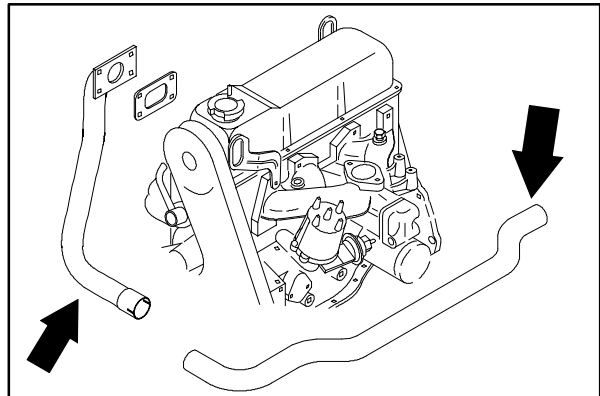
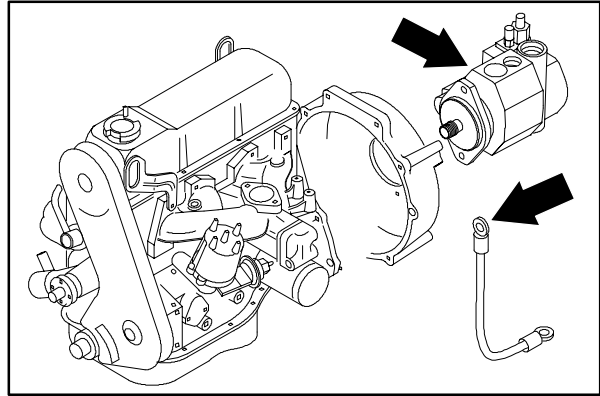
6. Reinstall exhaust pipe back on the engine manifold. Reinstall the four M10 hex screws. Tighten to 52 – 67Nm (39 – 51 ft lb).

NOTE: Make sure the steel gasket is in place when installing exhaust pipe.

7. Reconnect the fuel lines
8. On an **LPG** machine; reinstall the lockoff/vaporizer assembly on the machine.
9. On an **LPG** machine; reconnect the two coolant and two fuel lines to the lockoff/vaporizer assembly.



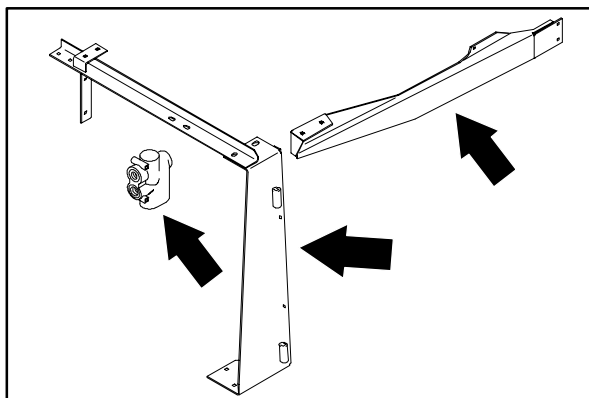
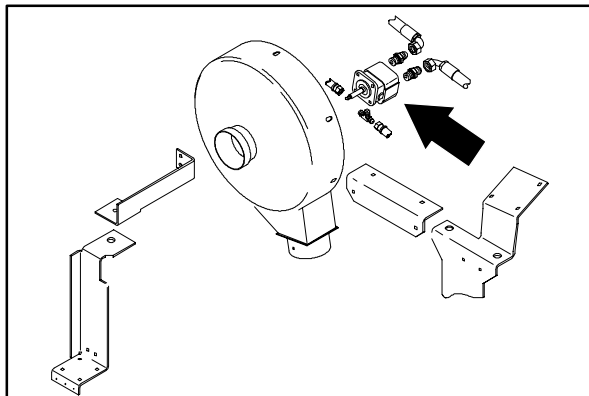
10. Fill the engine with proper grade of motor oil.
11. Reconnect wire harness to the engine components: alternator, starter, governor actuator, oil switch, temperature sender, distributor, and ignition module.
12. Reinstall the radiator hoses to engine and fill the radiator with coolant.
13. Reinstall the vacuum fan/air cleaner mount bracket to bellhousing. Reinstall the two M10 hex screws and tighten to 37 – 48 Nm (26 – 34 ft lb).
14. Reinstall the vacuum fan assembly to the mount bracket. Reinstall the three M10 hex screws, six washers, and three nyloc nuts. Tighten to 34 – 44 Nm (24 – 28 ft lb).
15. Reconnect the hydraulic hoses to the scrubbing vacuum fan motor. See the schematic in the HYDRAULICS section of this manual.
16. Reinstall the air cleaner assembly.
17. Reinstall the side door mounting bracket to the machine. Reinstall the five M8 hex screws and washers. Tighten to 18 – 24 Nm (15 – 20 ft lb).
18. Reinstall the hydraulic priority valve to the side door mounting bracket. Reinstall the two M8 hex screws and nyloc nuts. Tighten to 18 – 24 Nm (15 – 20 ft lb).
19. Reinstall the LH side panel using the three M6 hex screws and washers and two M8 hex screws and washers. Tighten the M6 hex screws to 11 – 14 Nm (7 – 10 ft lb). Tighten the M8 hex screws to 18 – 24 Nm (15 – 20 ft lb).



20. Reinstall the side channel brace. Reinstall the four M8 hex screws and washers. Tighten to 18 - 24 Nm (15 - 20 ft lb).
21. Reinstall the left rear grill panel to the machine. Reinstall the four M8 hex screws and washers. Tighten to 18 - 24 Nm (15 - 20 ft lb).
22. Reinstall the engine cover and side door.
23. Reconnect the battery cables to the battery.
24. Jack up the rear of the machine.

FOR SAFETY: Block machine tires before jacking machine up. Jack machine up at designated locations only. Block machine up with jack stands

25. Start the engine and check for any leaks.

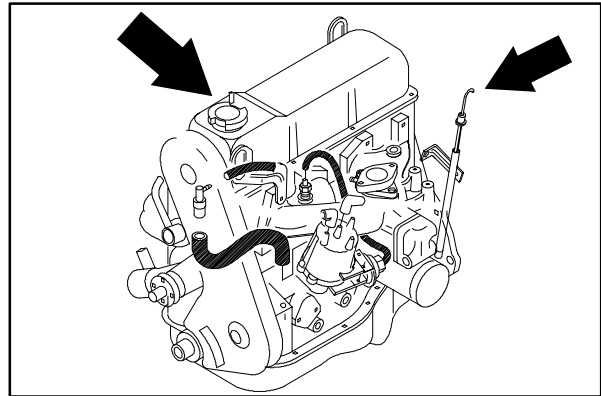


LUBRICATION

ENGINE OIL

Check the engine oil level daily. Change the engine oil and oil filter every 100 hours of machine operation. Use 10W30 SAE-SG/SH rated engine oil.

Fill the engine with oil to the level indicated on the oil dipstick. The engine oil capacity is 4.7 L (5 qt) including the oil filter.



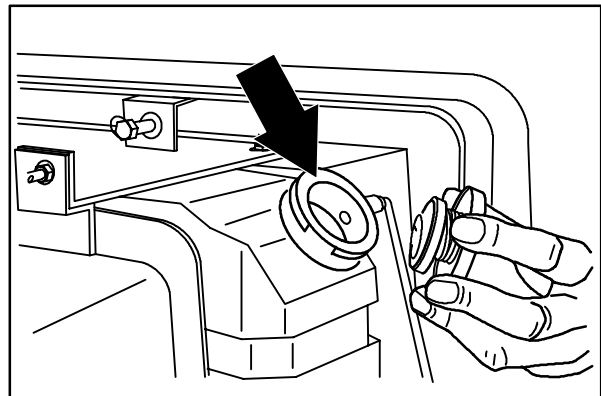
COOLING SYSTEM

RADIATOR

Check the radiator coolant every 100 hours of operation. Use clean water mixed with a permanent-type, ethylene glycol antifreeze to a -34°C (-30°F) rating.

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

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



08432

Check the radiator hoses and clamps every 200 hours of operation. Tighten the clamps if they are loose. Replace the hoses and clamps if the hoses are cracked, harden, or swollen.

Check the radiator core exterior and hydraulic cooler fins for debris every 100 hours of operation. Blow or rinse all dust, which may have collected on the radiator, in through the grille and radiator fins, opposite the direction of normal air flow. The grille and hydraulic cooler open for easier cleaning. Be careful not to bend the cooling fins when cleaning. Clean thoroughly to prevent the fins becoming encrusted with dust. Clean the radiator and cooler only after the radiator has cooled to avoid cracking.

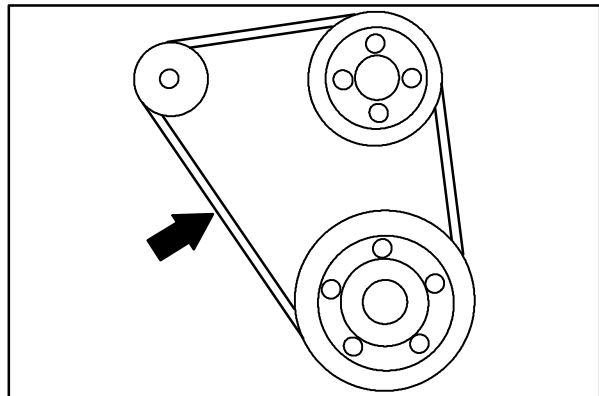
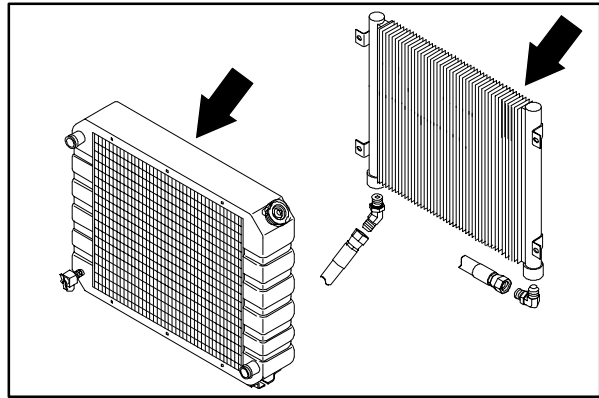
FOR SAFETY: When Servicing Machine, Wear Eye And Ear Protection When Using Pressurized Air Or Water.

Flush the radiator and the cooling system every 400 hours of operation, using a dependable cleaning compound.

ENGINE FAN BELT

The engine fan belt is driven by the engine crankshaft pulley and drives the alternator pulley. Proper belt tension is 9 to 10 mm (0.35 to 0.39 in) for a new belt and 10 to 11 mm (0.39 to 0.43 in) for a used belt with a force of 10 kg (22 lb).

Check and adjust the belt tension every 100 hours of operation.



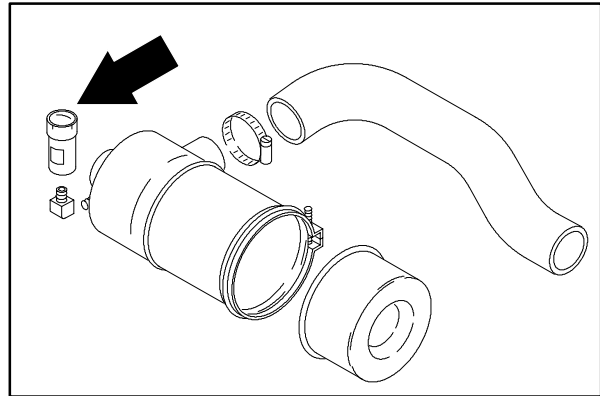
08935

AIR INTAKE SYSTEM

AIR FILTER INDICATOR

The air filter indicator shows when to clean or replace the air filter element. Check the indicator daily. The indicator's red line will move as the air filter element fills with dirt. Do not clean or replace the air filter element until the red line reaches 5 kPa (20 in H₂O) and the "SERVICE WHEN RED" window is filled with red. The indicator's red line may return to a lower reading on the scale when the engine shuts off. The red line will return to a correct reading after the engine runs for a while.

Reset the air filter indicator by pushing the reset button on the end of the indicator after cleaning or replacing the air filter element.

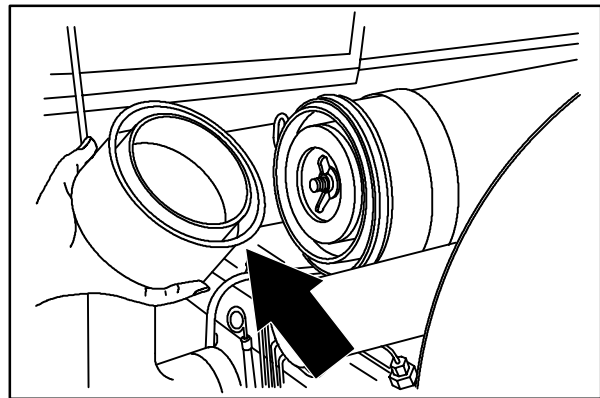


AIR FILTER

The engine air filter housing has a dust cap and a dry cartridge-type air filter element. Empty the dust cap daily. The air filter must be replaced whenever the filter element is damaged or has been cleaned three times.

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

Machines with the heavy duty air filter option have a safety element. It is inside the standard element. Replace, do not clean this element after the regular element has been damaged or cleaned three times.



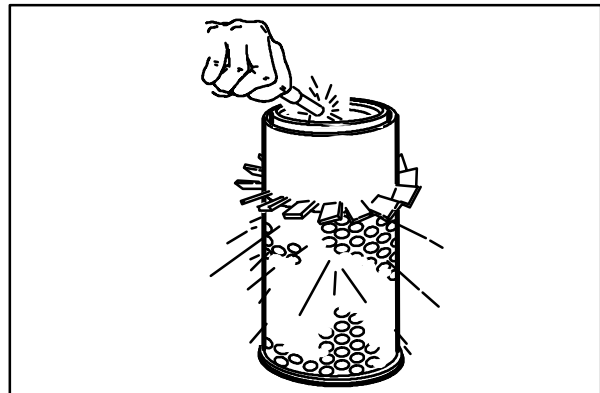
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TO REPLACE AIR FILTER ELEMENT

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

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

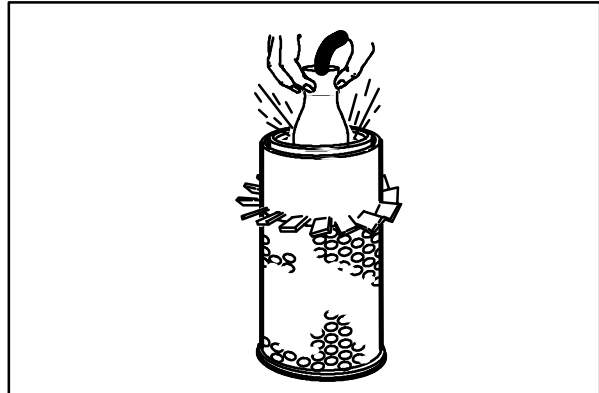
2. Open the left side and top engine access doors.
3. Unscrew the clamp ring on the filter assembly.
4. Remove the dust cap.
5. Empty the dust cap.



00051

6. Remove the filter wing nut.
7. Gently pull the filter element out of the filter housing.
8. Clean the interior of the air cleaner housing with a damp cloth. Clean the element housing sealing surfaces.
9. Using an air hose, direct dry, clean air maximum 205 kPa (30 psi) up and down pleats on the inside of the filter. Do not rap, tap, or pound dust out of the element.

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

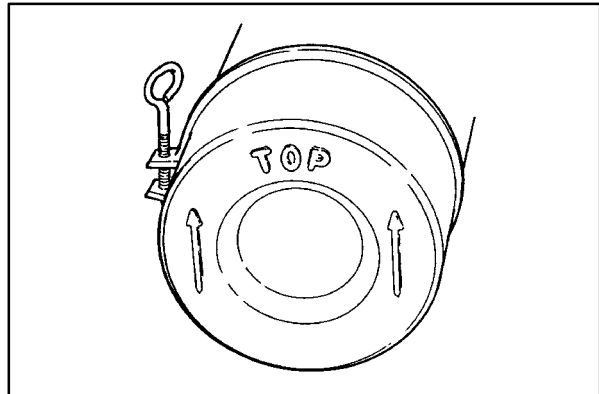


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10. After cleaning the air filter element, inspect it for damage by placing a bright light inside. The slightest rupture requires replacement of the filter. Clean and inspect the seals on the ends of the element. They should be unbroken and flexible.

NOTE: Remember to replace the element after cleaning it three times.

11. Install the new or cleaned filter element so the fins on the element are at the intake end of the air cleaner. Be careful not to damage the fins. Make sure the element is seating evenly. Tighten the element wing nut.
12. Install the dust cap with the arrows pointing up. Tighten the clamp ring to hold it in place. Check all intake hose connections for leaks or abrasions.
13. Reset the air filter restriction indicator.
14. Close the access doors.



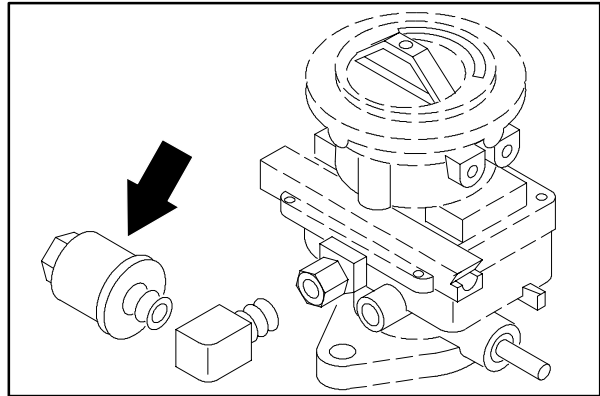
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FUEL SYSTEM - GASOLINE

FUEL FILTERS

The fuel filter trap fuel contaminants. The filter is located on the fuel line going into the carburetor.

Replace the filter elements every 400 hours of operation.

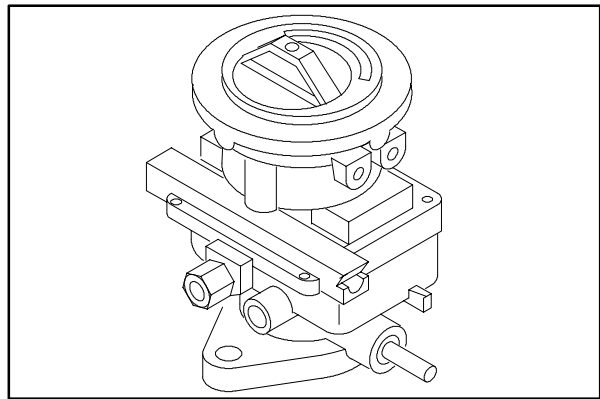


CARBURETOR

The carburetor has two basic adjustments. Those adjustments are idle fuel mixture and idle speed. Check and adjust idle fuel mixture and idle speed every 100 hours of operation.

FOR SAFETY: When Servicing Machine, Keep Flames And Sparks Away From Fuel System Service Area. Keep Area Well Ventilated.

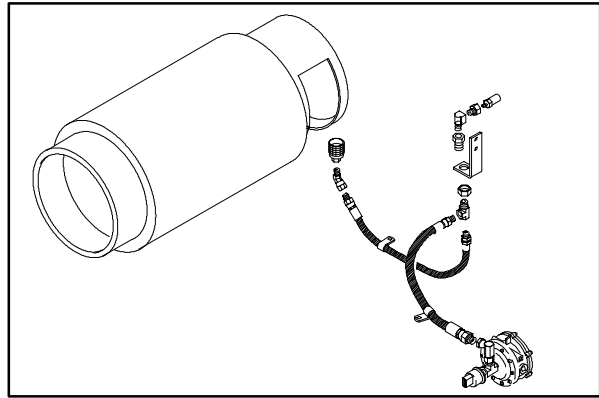
The idle speed is controlled by a screw located on the side of the carburetor next to the throttle linkage. Increase the engine speed by turning the screw clockwise. Decrease the engine speed by turning the screw counter-clockwise. Proper idle speed is 950 ± 50 rpm with all accessories off.



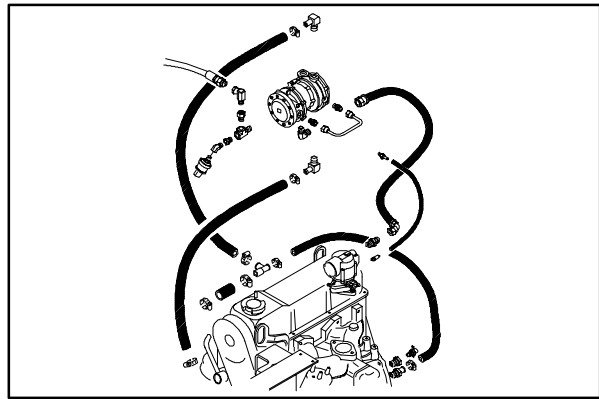
FUEL SYSTEM - LPG

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

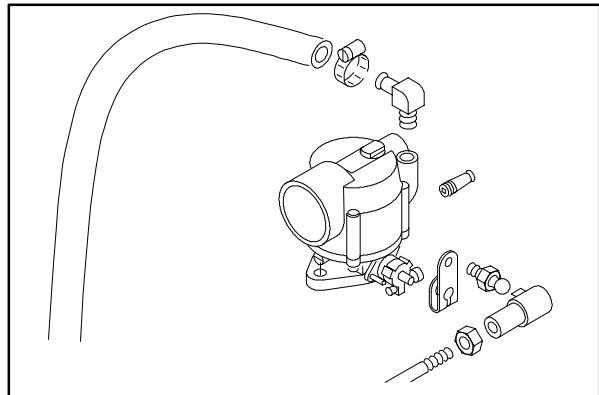
Liquid LPG fuel flows from the LPG tank under its own pressure, to the pressure relief valve. Usually this valve is closed, preventing LPG fuel from escaping into the atmosphere. The valve opens to relieve pressure if the fuel pressure exceeds system limits. From the pressure relief valve, the liquid LPG fuel flows to the fuel filter lock.



The fuel filter lock filters unwanted tank scale and deposits out of the LPG fuel. The fuel filter lock also stops the flow of LPG fuel when the engine is not operating. The oil pressure switch controls the fuel filter lock. When the engine oil pressure is 35 kPa (5 psi) or greater, the oil pressure switch permits an electrical current to open the fuel filter lock which allows LPG fuel to flow on to the vaporizer-regulator. The oil pressure switch is bypassed when the engine is being started, allowing LPG fuel to flow.



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



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

Check for frosting. If frosting occurs on or near any LPG component, there is a possible LPG fuel leak or malfunctioning component.

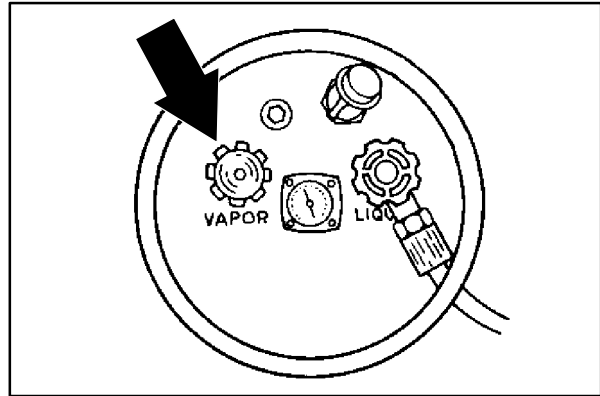
To locate the leak, apply a soapy water solution to the suspected area. Watch for bubbles forming in this suspected area. This area may have an LPG fuel leak. Repair or replace the part. Use Loctite brand Stainless Steel PST thread sealant when reassembling. Aging or high humidity does not affect this epoxy-type sealant. Be sure to follow application directions and apply proper torque when reconnecting fittings. Never bypass safety components except to test. If they are defective, replace them before operating the machine. Frosting does not occur before the engine reaches operating temperature. Check after engine reaches operating temperature.

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

FUEL TANKS

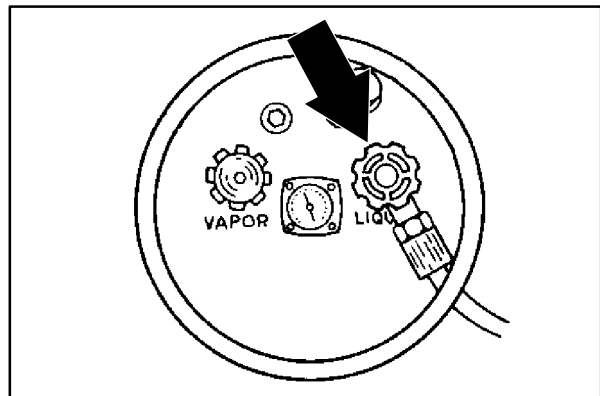
The LPG fuel tanks should be inspected for sharp dents, gouges, leaks, and broken protecting rings whenever the tanks are refilled. All tank valves must be inspected for leaks using a soap solution. Valves must also be checked for dirt, paint, or other debris in the valve openings. The following specific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

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



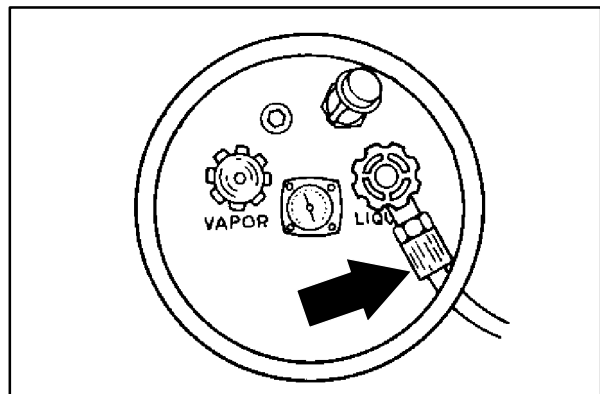
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Liquid Service Valves – Check the valve for proper functioning and presence of the handwheel. The valve must be closed except when in service.



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



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ENGINE-G/LPG

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

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

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

If an LPG fuel tank is damaged or leaking, it should be removed to a designated safe area. Do not attempt to make repairs to the tank, regardless of condition. Qualified personnel must make repairs or disposal.

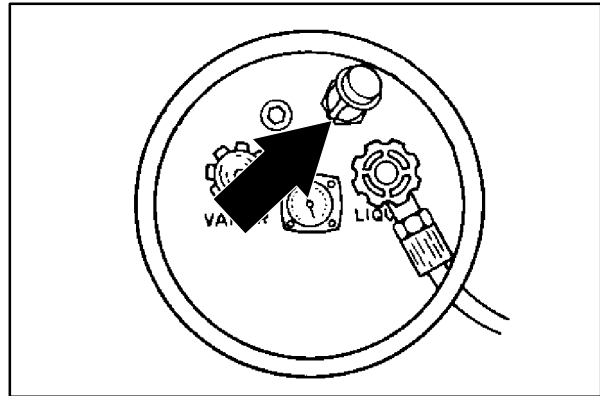
The care an LPG fuel tank receives has a direct bearing on how long that tank can be used safely. LPG fuel tanks must not be dropped or dragged across any surface. To move LPG fuel tanks, use a hand truck or roll the tank on its foot ring while it is being held in a position slightly off the vertical.

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

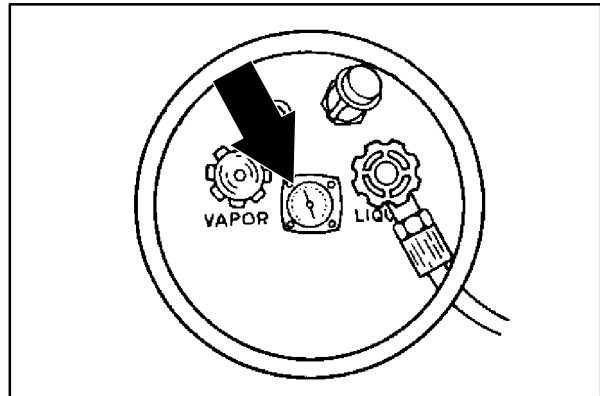
Valves on empty tanks must be closed during storage and transportation.

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

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



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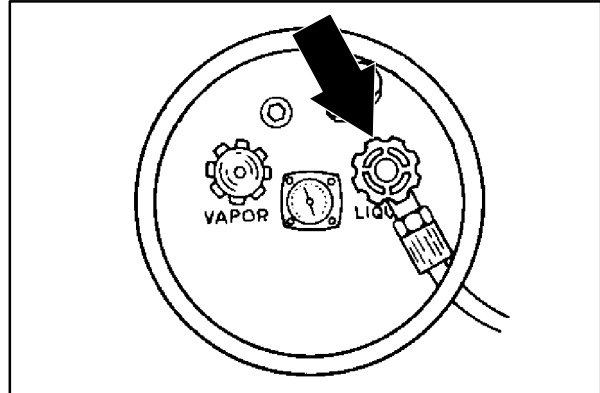
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TO CHANGE LPG FUEL TANK

1. Park the machine in a designated safe area.
2. Close the tank service valve.
3. Operate the engine until it stops from lack of fuel, then set the machine parking brake.

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

4. Put on gloves and remove the quick-disconnect tank coupling.
5. Inspect the LPG fuel lines for wear or damage.
6. Remove the empty LPG fuel tank from the machine.
7. Check the tank for damage or wear.
8. Store the tank in a designated, safe area.
9. Select a filled LPG fuel tank and inspect it for damage or leaks.



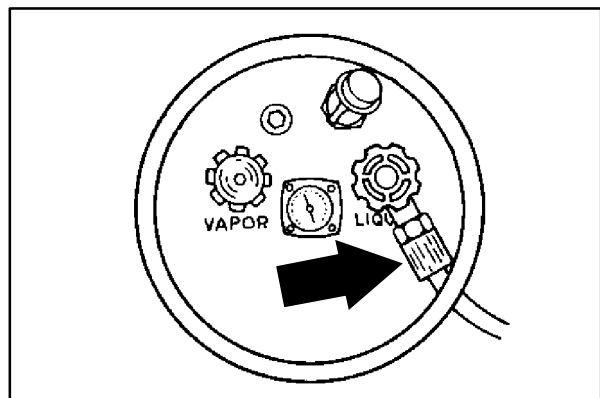
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NOTE: Make sure the LPG fuel tank matches the fuel system (liquid tank with liquid system).

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

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

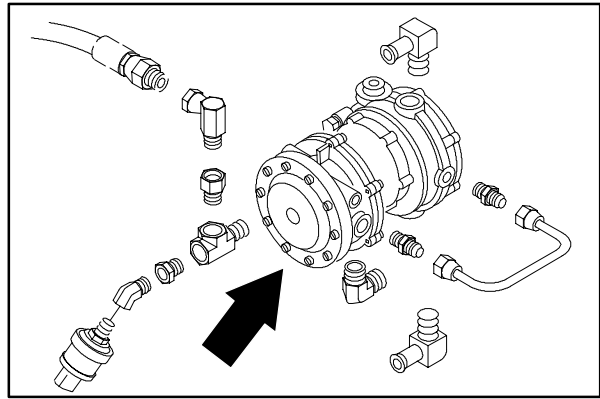
11. Fasten the tank hold-down clamp to lock the tank in position.
12. Connect the LPG fuel line to the tank service coupling. Make sure the service coupling is clean and free of damage. Also make sure it matches the machine service coupling.
13. Open the tank service valve slowly and check for leaks.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



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FUEL FILTER LOCK

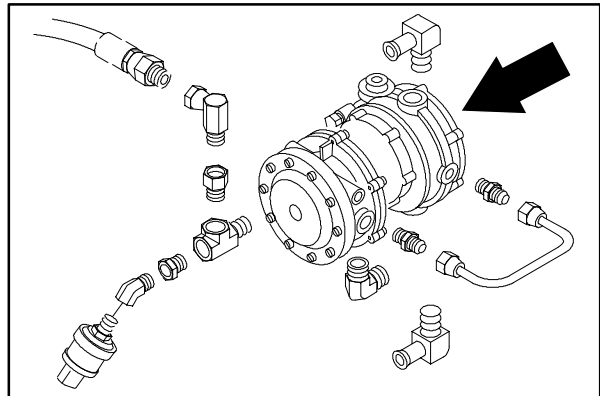
The fuel filter lock filters the LPG fuel. It also stops the flow of LPG fuel to the engine when the engine is not operating or when the engine oil pressure is less than 35 kPa (5 psi).



VAPORIZER-REGULATOR

The vaporizer-regulator. If any malfunction is found, completely disassemble the vaporizer-regulator. Clean all the parts in alcohol.

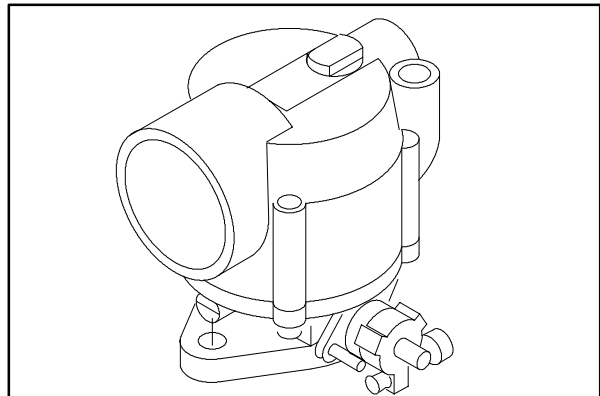
Inspect all the parts and replace where needed. Carefully reassemble the vaporizer-regulator with the seal repair kit. Check for proper operation.



CARBURETOR

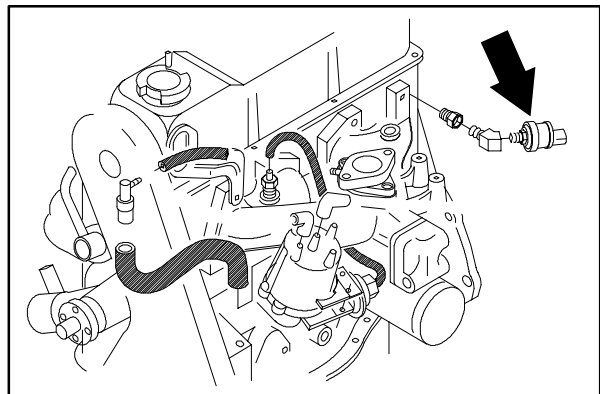
The carburetor. If any malfunction is found, completely disassemble the carburetor. Clean all the parts in alcohol.

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



OIL PRESSURE SWITCH

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



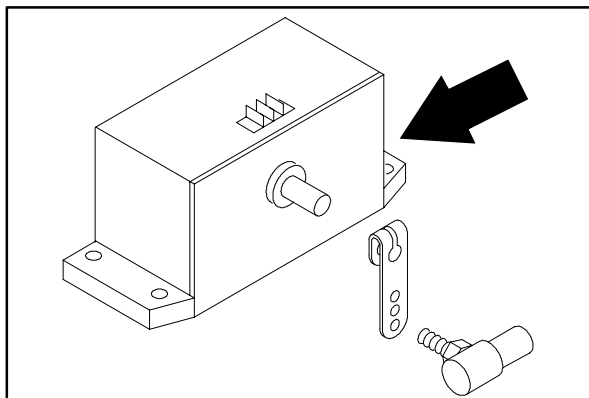
LPG FUEL TROUBLESHOOTING

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

GOVERNOR

The electronic governor controls the engine speed. The governor consists of an ignition control assembly, a control box, and an actuator mounted on the engine. The ignition control assembly and control box regulate the actuator, which in turn controls the throttle.

The electronic governor is factory set and is not user serviceable.



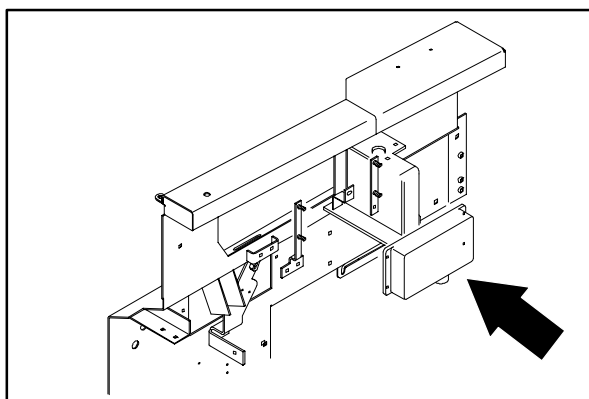
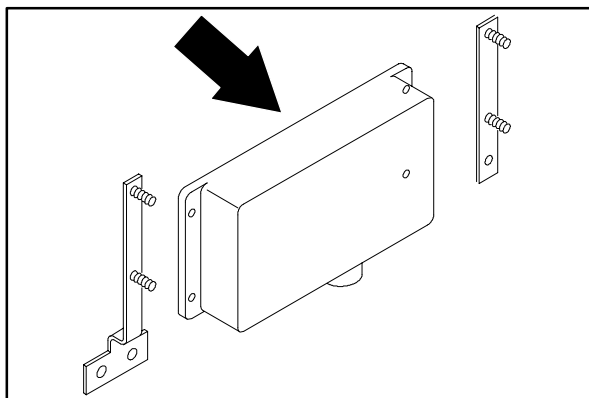
TO ADJUST GOVERNOR

FOR SAFETY: Before Leaving Or Servicing Machine: Stop On Level Surface, Set The Parking Brake.

1. Raise the rear of the machine until the drive wheel is off the floor.

FOR SAFETY: Block machine tires before jacking machine up. Jack machine up at designated locations only. Block machine up with jack stands.

2. Start the engine and warm to operating temperature.
3. Move the speed switch to idle, all accessories off.
4. Move speed switch to fast position.
5. If more than three engine speed surges occur, turn the surge adjustment screw (located on back of governor control box under hole plug) counterclockwise one-eighth of a turn.
6. Repeat this procedure until less than three engine surges occur.
7. Replace the hole plug if removed for adjustment.



GOVERNOR TROUBLESHOOTING

1. The first step in this troubleshooting is to disconnect the throttle linkage at the carburetor and work the throttle at the carburetor by hand.

If you can run the engine by hand and it works with no problems, go to step four.

If the problem continues, it is not with the governor, it is with the ignition signal, fuel systems or the engine itself.

2. The idle speed is the governor position. This is 1100 – 1500 RPM and is controlled by the governor, *NOT THE IDLE STOP SCREW ON THE CARBURETOR!* In order to adjust the idle mixture and (SHUTOFF SPEED) on the carburetor, either of the wires on the actuator box below the carburetor must be disconnected. After warming up the engine, adjust the shutoff speed to 850 ± 25 RPM and adjust the idle mixture for optimum idle quality. After doing this, shut off the engine and reattach the wires to the actuator. It is important that the shutoff speed not be set any higher than 900 RPM or the engine will (diesel) when it is shut off. Again, the idle speed screw on the carburetor does not control the start/idle speed of a correctly setup engine.

3. Fuel System

A common problem that has been encountered on LPG machines is a restricted fuel hose (a clogged fuel filter can have the same effect).

If the governor opens the carburetor wide open and the engine loses speed, the problem is not in the governor. The fuel system is at fault. The purpose of the governor is to open the carburetor and to bring the engine to set RPM's depending on where you have the speed control switch set at.

4. Linkage Adjustment

The next step in troubleshooting is to ensure that the linkage between the carburetor and actuator is correct. The linkage must move freely with no interference from binding ball joints, hoses, wires, etc.

To check this, disconnect the linkage, rotate the actuator and carburetor levers back and forth to ensure that they move smooth with no “binding.”

The actuator has the only throttle return spring in the system. It must pull the carburetor lever against the idle stop. This is adjusted by first adjusting the idle speed to 850 RPM. Then, with the engine off, remove the link rod from the carburetor ball joint. The rod length should be adjusted so that when the carburetor lever is against the idle stop and the actuator lever is against the idle stop, the length is such that it fits exactly between the carburetor and actuator. Add two turns of the ball joint to provide pre-load of the carburetor lever against the idle stop.

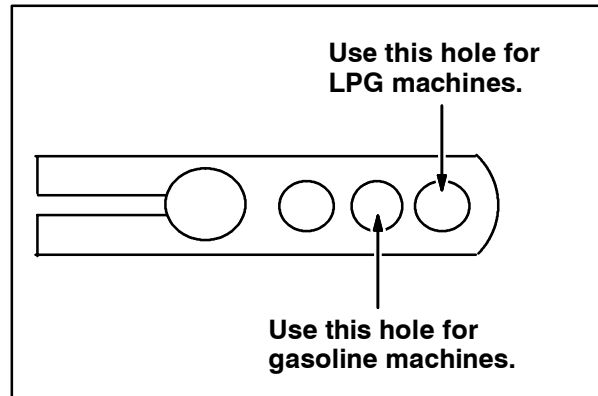
NOTE: The LPG carburetors require that the link be extended for pre-load. The gasoline carburetors require that the link be shortened two turns.

If the engine tends to “hunt” at no load but not when the accessories are turned on, the link may have more than two turns of pre-load.

If the engine responds sluggishly to switch changes, the link may have less than two turns of pre-load.

If the engine seems to wander in the start position, the pre-load against the idle stop is probably not adequate.

On units with the gasoline-fueled Ford engine, the carburetor levers are adjustable. Locate the carburetor lever so that it is horizontal when the carburetor is against the idle stop. On gasoline units, the governor lever should also be horizontal, to slightly below, when the link is disconnected. To pre-load the linkage, shorten the rod by turning the ball joints in two turns from the neutral point as before. The link rod should be installed in the middle hole on the governor arm.



On units with LP-fueled Ford engines, the carburetor levers are also adjustable and should be located approximately 25° above horizontal. The governor lever should also be at a similar angle in the idle position. Make sure that the carburetor lever does not go “over center” and lock up in the full throttle position. If it does, raise both levers slightly until the condition is corrected. To pre-load the linkage in the idle position, extend the ball joints two turns to force the carburetor lever against the idle stop. The link rod should be installed in the outer (1.9”) hole on the governor arm.

NOTE: These are approximate starting points to ensure proper operation.

Manually run the linkage through its full stroke to ensure that the rod does not hit the intake manifold, that the rod ends are free with no binding, and that the levers go through their full stroke.

5. System Grounds

The wire harness grounds are routed to the stud on the alternator, and from there, a separate cable is routed to the bolt on the bell housing where the battery cable is attached.

If a bad ground is present, the engine will tend to run over speed.

The machine must have good grounds throughout from the battery cable to the control box.

The battery cable must be clean and tight.

The actuator is internally isolated and does not require that the cable be grounded.

6. Start-Up Check

With the throttle switch in the engine start position, turn the ignition switch to the on position. The actuator should cycle the carburetor lever once.

NOTE: A cycle is to move from the off or idle position to the open position and then return to the off or idle position.

If this does not happen, the power wiring to the control box is probably at fault or the control box is faulty. IT IS RARE TO HAVE A FAULTY CONTROL BOX, so proceed with the following voltage checks BEFORE REPLACING IT.

7. Throttle Control Switch Check

If the engine doesn't respond to the throttle switch control:

- a. With the engine running, disconnect Wire 86, purple wire, at the actuator.
- b. Connect a jumper wire from the battery terminal on the starter to the terminal where you removed Wire 86, purple wire, from the actuator.

The engine should come up to operating speed. If the engine comes up to speed, replace the throttle control switch.

- a. Hunts at running speed with the accessories off.
- b. Responds very sluggishly to switch changes, an adjustment change in the control box may be necessary.

Cut and remove the RTV seal on the back of the box.

A slight adjustment of the sensitivity screw may be necessary to correct the conditions mentioned above. Turn the screw approximately 2° at a time and wait for 30 seconds to verify the change. Be careful. Only a slight change is necessary, and the “pot” can be broken if too much force is used.

After the control throttle response is achieved, verify that the operating speeds are correct and adjust, if necessary. After the speeds are reset, the sensitivity screw may have to be readjusted.

In general, if a new box is being installed, a gasoline-equipped machine may require that the sensitivity be reduced slightly.

When the sensitivity is adjusted, the run speed should not be affected. If the adjustment is too great, the start speed will be affected. Verify that the start speed is correct.

If too much sensitivity is adjusted in, the engine will either hunt in a no load condition or over speed severely when the speed switch is actuated.

The engine speed should not drop off, but you can have the three hunts of the engine.

If, for some reason, the sensitivity adjustment became grossly maladjusted, a good starting point can be obtained by rotating the pot fully counterclockwise and then back clockwise 45°.

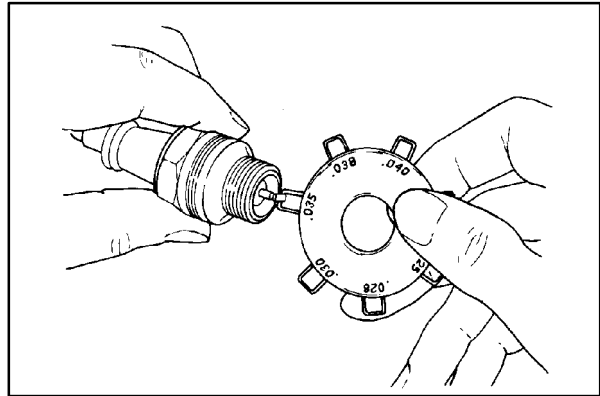
After the adjustments are made and verified, reassemble the back plate and reseal the plate with a bead of RTV to keep dust and moisture out of the box.

IGNITION SYSTEM

SPARK PLUGS

Clean or replace, and set the gap of the spark plugs every 400 hours of operation. A wire gauge is best for checking the spark plug gap. A flat gauge should not be used unless the electrode surfaces have been dressed with a small file to get parallel surfaces between the center and side electrode. Set the spark plug gap by bending the side electrode. All spark plugs, new or used, should have the gaps checked and reset if necessary.

The proper spark plug gap is 1 mm (0.040 in).



CYLINDER HEAD

CYLINDER HEAD

A three-stage torque procedure should be used when reassembling the cylinder head. Tighten the cylinder head bolts seasonally. See Ford LSG 2.3 Engine Service Manual at the end of this section.

VALVE TAPPET CLEARANCE

The valve tappet clearance must be checked and adjusted if necessary every 400 hours of operation. See Ford LSG 2.3 Engine Service Manual.

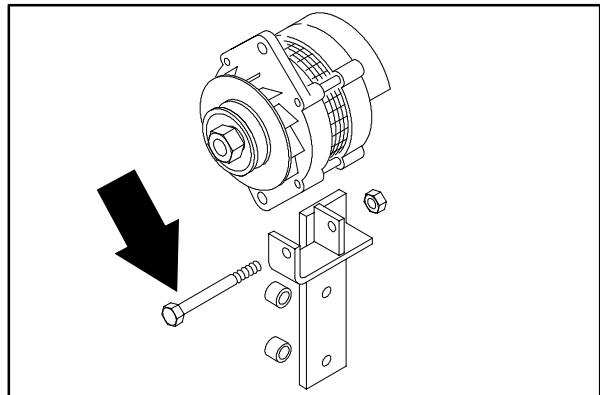
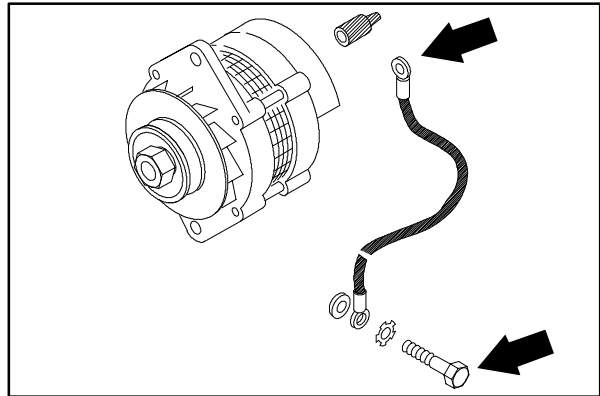
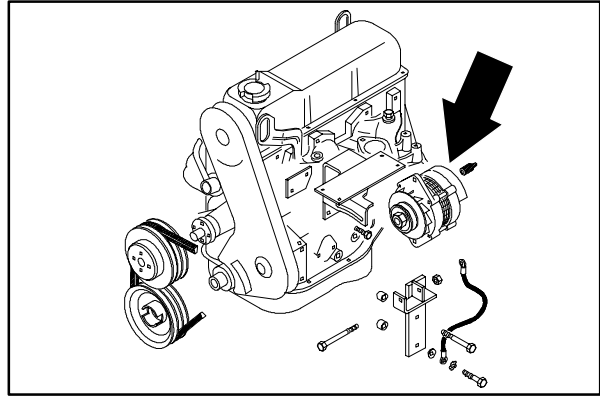
Clean the crankcase ventilation hoses, tubes, and fittings and replace the PCV valve every 400 hours of operation.

ENGINE ELECTRICAL SYSTEM

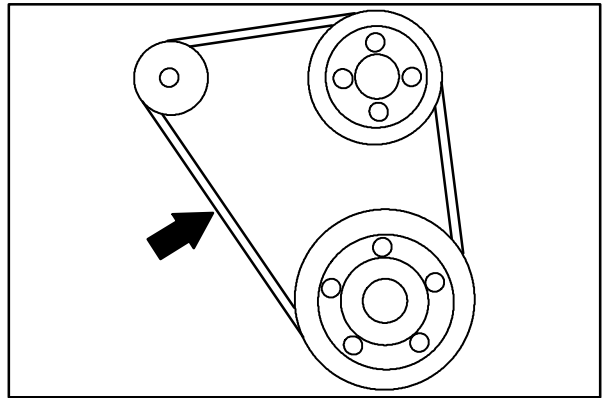
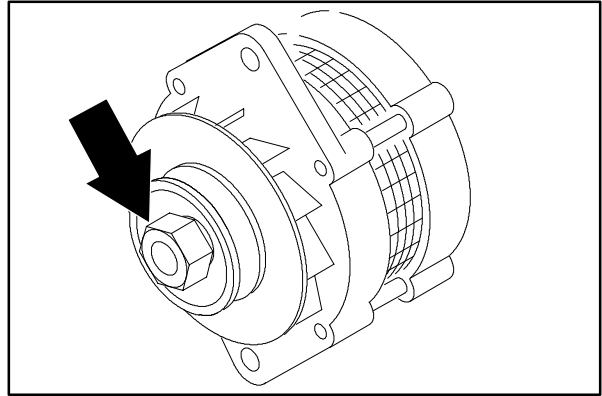
TO REPLACE ALTERNATOR

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

1. The solution and recovery tanks must be removed from machine to replace the alternator. See TO REMOVE SOLUTION TANK FROM MACHINE instructions in the SCRUBBING section of this manual.
2. Disconnect the battery cables from the battery.
3. Open the engine cover and side door.
4. Disconnect the wires on the back of the alternator.
5. Remove the 0.31 in. hex screw holding the top of the alternator to the upper mount bracket. Push the alternator toward the engine and remove the v-belt.
6. Remove the 0.38 in. hex screw and nyloc nut holding the bottom of the alternator to the lower mount bracket.
7. The alternator can now be removed. Bring the alternator forward and out through the area of the solution tanks.
8. If the new or rebuilt alternator needs a drive pulley; remove the pulley from the old alternator by holding pulley from turning and using an impact wrench to remove hex nut.
9. Install pulley, washer, and hex nut on the new alternator. Hand tighten the nut with an impact wrench.



10. Install the new alternator back in the machine. Align the bottom hole in the alternator with hole in the lower mount bracket. Reinstall the 0.38 in. hex bolt, washer, and sleeve. Leave loose for now.
11. Place the v-belt back on the alternator pulley.
12. Reinstall the 0.31 in. hex screw in the top hole of the alternator through the upper mounting bracket. Pull alternator toward the outside of machine to tighten belt. Tighten the hex screw to 18 – 24 Nm (13 – 18 ft lb).
13. The engine fan belt is driven by the engine crankshaft pulley and drives the alternator pulley. Proper belt tension is 9 to 10 mm (0.35 to 0.39 in) for a new belt and 10 to 11 mm (0.39 to 0.43 in) for a used belt with a force of 10 kg (22 lb).
14. Tighten the bottom 0.38 in. hex screw to 31 – 40 Nm (27 – 35 ft lb).
15. Reconnect the wires to the back of alternator. See the schematic in the ELECTRICAL section.
16. Reconnect the battery, start the engine, and check for proper operation of the alternator.



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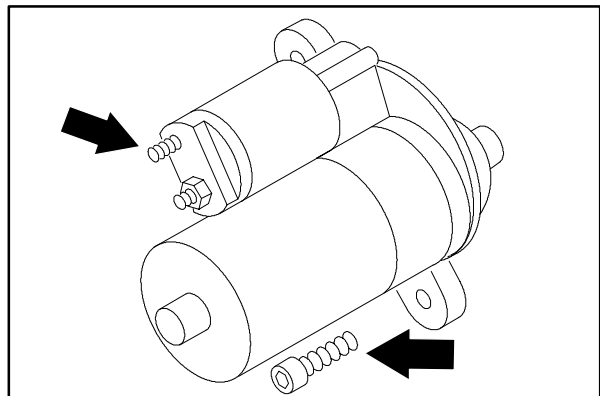
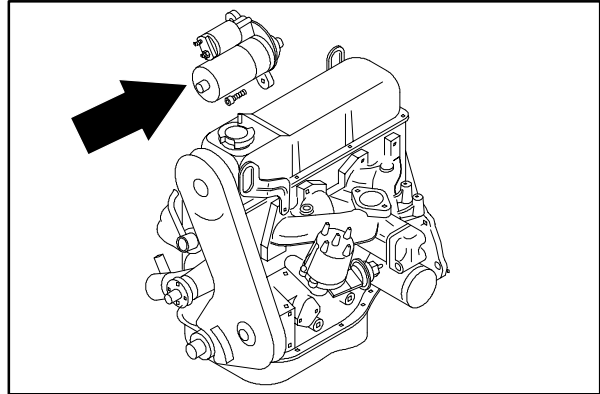
TO REPLACE STARTER

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

1. Remove all three scrub brushes.
2. If the machine will start, activate the scrub mode to lower the scrub head. Shut off the engine. If the machine will not start, place a drain pan under the middle and left hand scrub brush motors. Loosen the hydraulic hoses at the cylinder rod end fittings. Push the two scrub heads all the way down and block them in this position using a piece of wood. Re-tighten the two hydraulic hoses.
3. Disconnect the battery cables from the battery.
4. Remove the side brush so it will not get damaged when the rear of the machine is raised.
5. Raise the rear of machine using a hoist or floor jack.

FOR SAFETY: Block machine tires before jacking machine up. Jack machine up at designated locations only. Block machine up with jack stands.

6. The starter must be accessed from under the machine. Go under from the engine side.
7. The hardware holding the positive battery cable and starter wires to the starter is difficult to reach when its bolted in the engine. Remove the three M10 hex screws holding the starter to the engine. Use a 17 MM thin wall socket and swivel on the top screw. Tip the starter down and remove the hardware holding the cable and wires to starter.



8. Swing the rear squeegee all the way to the left and slide the starter out through the space between the oil pan and the squeegee link plate.
9. Bring the new starter under machine and reconnect positive battery cable and starter wires to it. See the schematic in the ELECTRICAL section. Hand tighten the hardware.
10. Position the new starter, with wires connected, back in the bellhousing. Align the holes and reinstall the three M10 hex screws. Tighten to 37 – 40 Nm (26 – 34 ft lb). Use a 17 MM thin wall socket and swivel on the top screw.
11. Remove the wood blocks from the middle and left hand scrub heads. Remove the jack stands, lower the machine, and reinstall the side brush.
12. Reconnect battery cables to battery, start the engine, raise the scrub head and reinstall the three scrub brushes.

TO CHANGE ENGINE TIMING BELT

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

1. Disconnect the battery cables from machine.
2. Open the engine cover and side door.
3. Remove the engine spark plugs.

NOTE: Make sure the timing pointer on the timing belt cover is lined up with the "O" mark on the crank shaft damper before removing the timing belt.

4. Loosen the engine alternator and remove the V-belt.

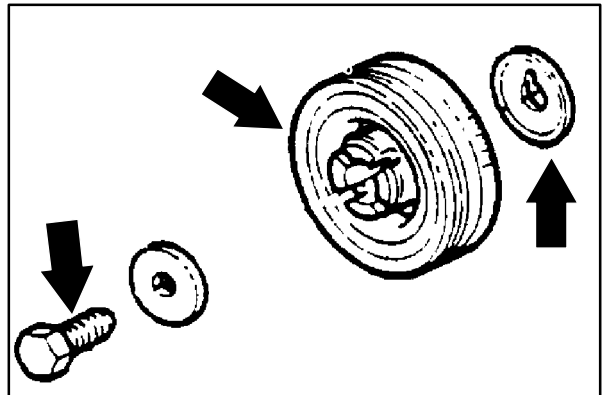
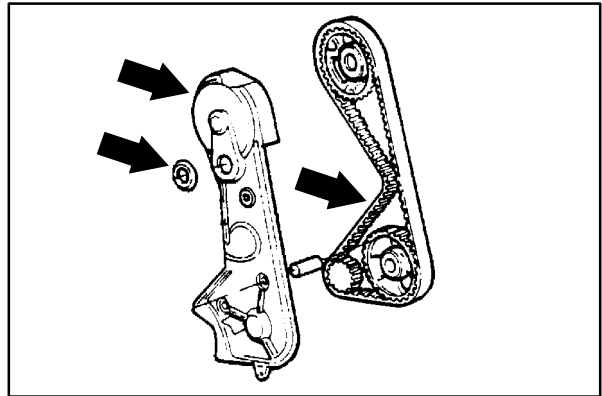
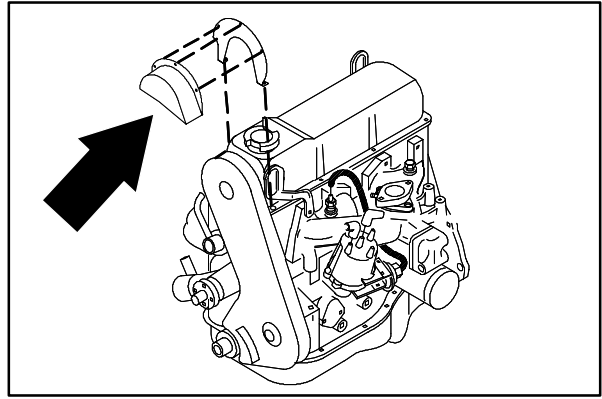
NOTE: If the engine is equipped with a smaller top timing belt cover; it needs to be removed before the larger timing belt cover can be removed

5. Remove the three M6 hex screws and nyloc nuts holding the smaller top cover to the engine. Remove and retain the smaller cover.
6. Remove the crankshaft damper pulley.
7. Pull the belt guide off the end of the crankshaft where the damper was removed.
8. Remove the five hex screws holding the large timing belt cover to the engine. Remove and retain the large cover.

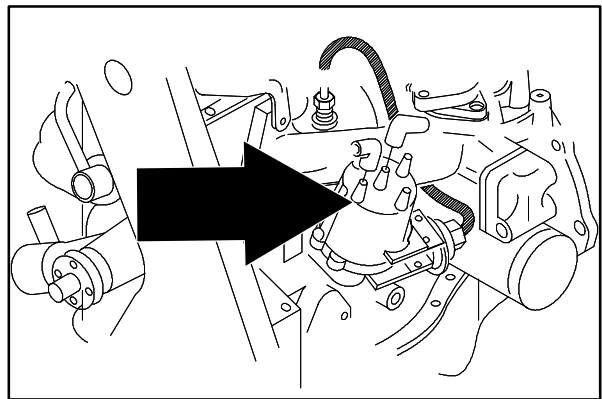
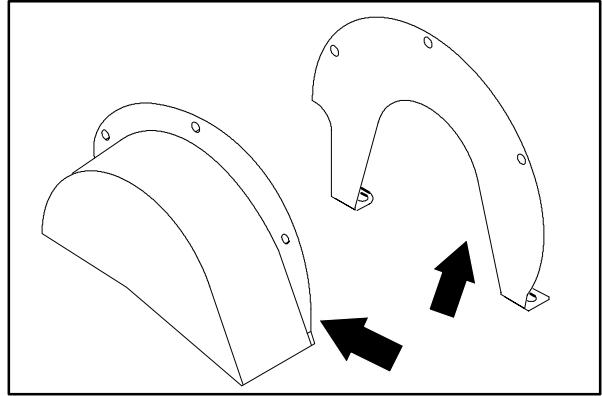
NOTE: The tension on the timing belt needs to be released before the belt can be removed.

9. Loosen the belt tensioner adjustment screw and release the tension on the timing belt. Once the tension is released, re-tighten the tensioner adjustment screw.

NOTE: A special tension release tool is available from FORD. The part number is T74P-6254-A. A small pry bar may be used in place of this tool.



10. Remove the old timing belt from the engine.
11. Before installing a new timing belt, make sure the camshaft sprocket timing mark lines up with the timing pointer on the engine.
12. Remove the distributor cap and set the distributor rotor to number 1 firing position by turning the auxiliary shaft sprocket. Reinstall the distributor cap.
13. Install the new timing belt over the crankshaft sprocket and then counterclockwise over the the auxiliary and camshaft sprockets. Align the belt fore and aft on each sprocket.
14. Loosen the tensioner adjustment bolt to allow the tensioner to move against the belt.
15. Rotate the crankshaft two complete turns in normal rotation to remove the slack from the belt.
16. Re-check the alignment of the timing marks.
17. Reinstall the belt guide and damper to the crankshaft.
18. Reinstall the timing belt cover and the five hex screws.
19. Reinstall the small, top cover on the timing belt cover. Hand tighten the three M6 hex screws and nyloc nuts.
20. Reinstall the spark plugs.
21. Reinstall the alternator V-belt, pull the alternator to tension the belt, tighten the alternator mount bolts.
22. Reconnect the battery cables. Start the engine and check the timing. The timing should be set at 10 degrees BTDC with the engine at idle speed.



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DIESEL ENGINE SERVICE MANUALS

KUBOTA V2203-B

TENNANT Part Number 73032

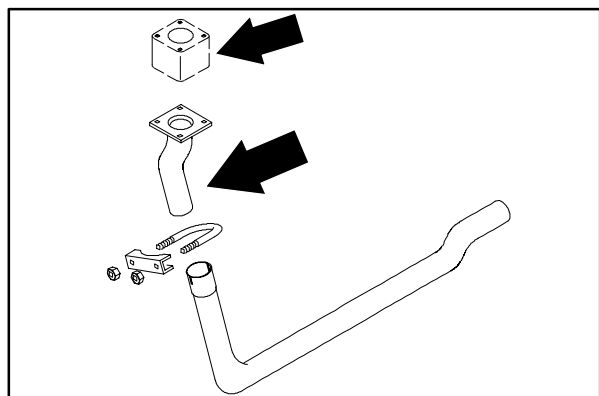
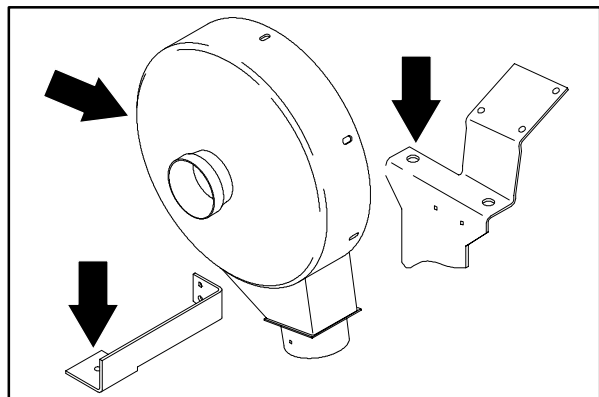
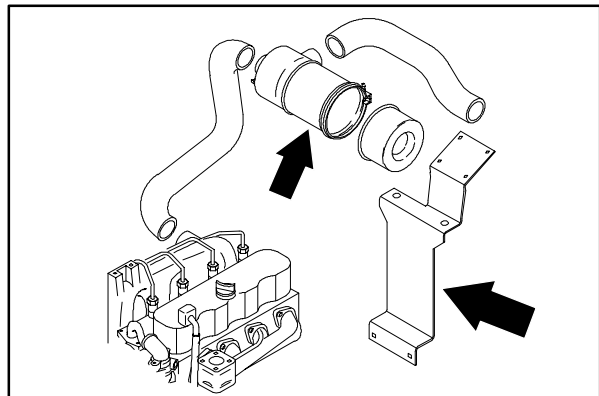
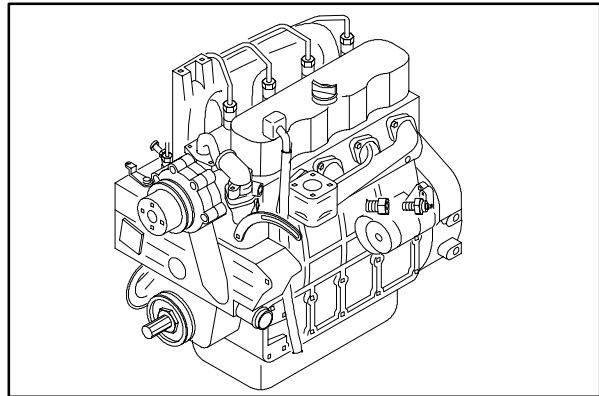
TO REMOVE DIESEL ENGINE

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

1. Remove the engine cover and side door.
2. Remove the battery cables from the battery.
3. Drain the radiator.
4. Drain the engine oil.
5. Remove the air cleaner assembly from the mounting bracket.
6. Disconnect and plug the hydraulic hoses on the scrubber vacuum fan motor.

NOTE: Observe hydraulic cleanliness requirements when opening hydraulic lines.

7. Remove the scrubber vacuum fan assembly and vacuum hose.
8. Remove the vacuum fan/air cleaner mount bracket from the engine.
9. Remove the radiator hoses from the engine.
10. Disconnect the exhaust pipe at the engine manifold.
11. Disconnect the main electrical wire harness from all engine components and place it out of the way.
12. Disconnect the engine ground strap from the machine frame.
13. Disconnect both the fuel line and the return line coming from the fuel tank and attaching to the engine.
14. Disconnect throttle cable from engine.



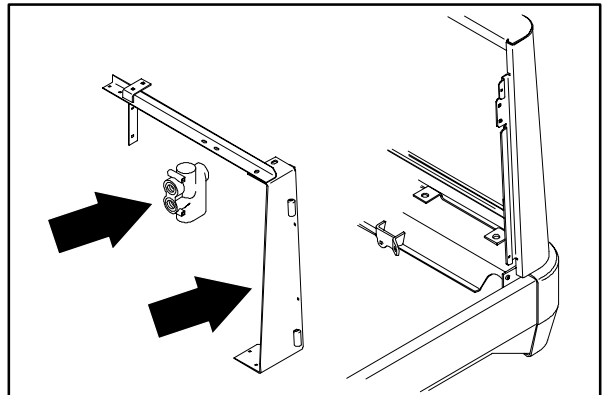
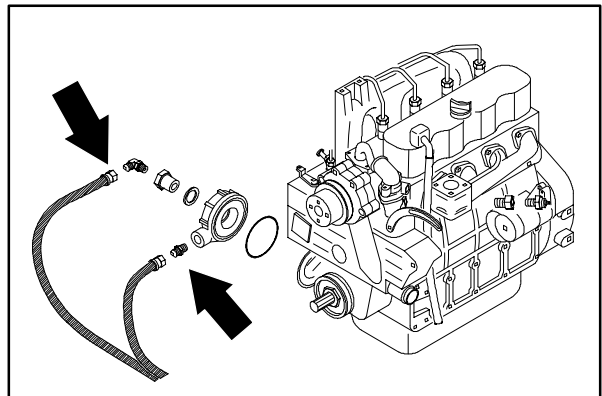
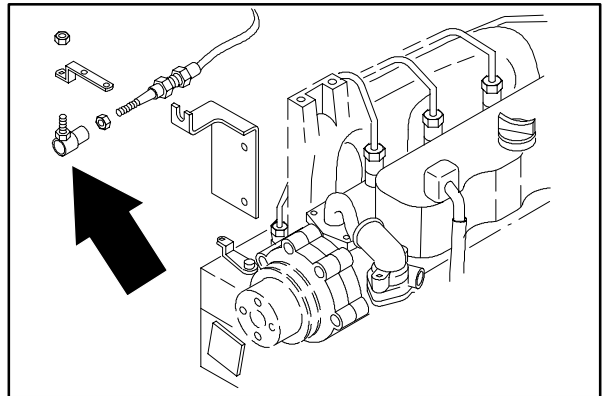
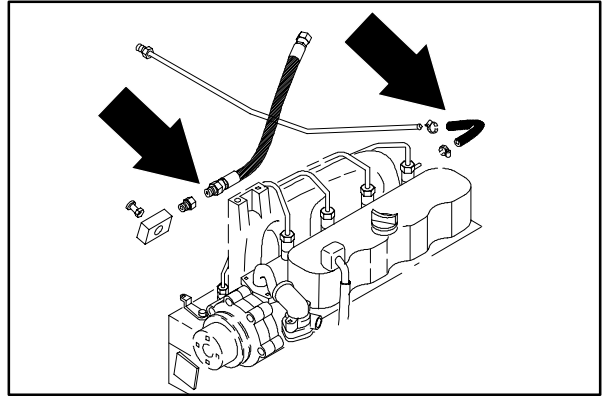
ENGINE-D

15. Disconnect and plug the two engine oil lines, coming from the remote oil filter, at the engine oil filter adaptor.

NOTE: Observe engine oil cleanliness requirements when opening remote filter lines.

16. Remove the LH side panel.
17. Remove the side channel brace.
18. Remove the two hex screws holding the hydraulic priority valve to the side door mounting bracket.
19. Remove the side door mounting bracket from the machine.
20. Remove the left rear grill panel for access to the hydraulic pump assemblies.
21. Remove the two M12 hex screws holding the load sensing / propel pump assembly to the flywheel housing.
22. Pull the load sensing / propel pump assembly back and out of flywheel housing.
23. Using an overhead hoist; hook a chain through the two pick-up points on engine. Put a slight amount of tension on the chain.
24. Remove the four M12 hex screws holding the motor mounts to the rubber isolators.
25. The engine can now be carefully lifted out.

NOTE: Be sure to disconnect engine oil drain hose from oil pan before lifting engine completely out of the machine.



TO INSTALL DIESEL ENGINE

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

1. Hook a chain through the two pick-up points on the engine. Use an over head hoist to lift the engine in the engine compartment.
2. Carefully lower the engine assembly down on the motor mounts.

NOTE: Make sure the hoses, wire harness, exhaust pipe, and load sensing pump are pulled back out of the way when lowering the engine assembly in place.

3. Reinstall the M12 hex screws in the four engine motor mounts. Tighten to 64 – 83 Nm (50 – 60 ft lb).
4. Reconnect the ground cable from the bellhousing to the machine frame.
5. Reinstall load sensing pump back in the bellhousing. Reinstall the M12 hex screws. Tighten to 64 – 83 Nm (50 – 60 ft lb).

NOTE: Make sure the splines on pump line up with splines in coupler when installing pump.

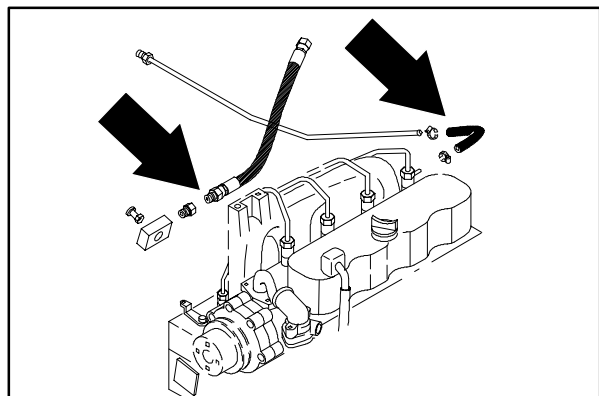
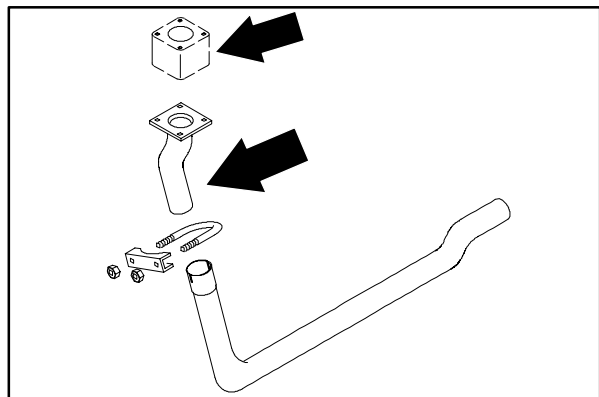
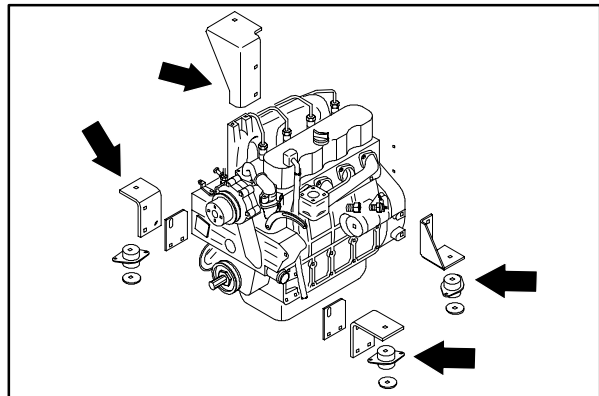
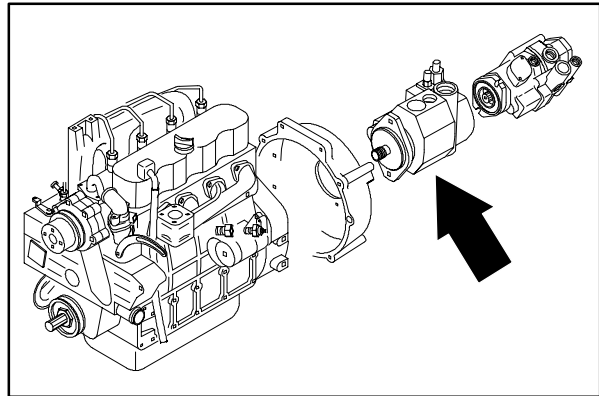
6. Reinstall exhaust pipe back on the engine manifold. Reinstall the four M10 hex screws. Tighten to 52 – 67Nm (39 – 51 ft lb).

NOTE: Make sure the steel gasket is in place when installing exhaust pipe.

7. Reconnect the fuel lines
8. Reconnect the two engine oil lines to the remote oil filter adaptor on the engine.

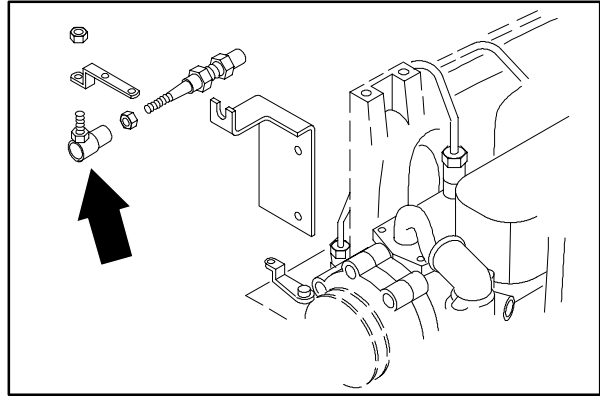
NOTE: Observe engine oil cleanliness requirements when opening remote filter lines.

9. Reconnect the throttle cable to the engine.

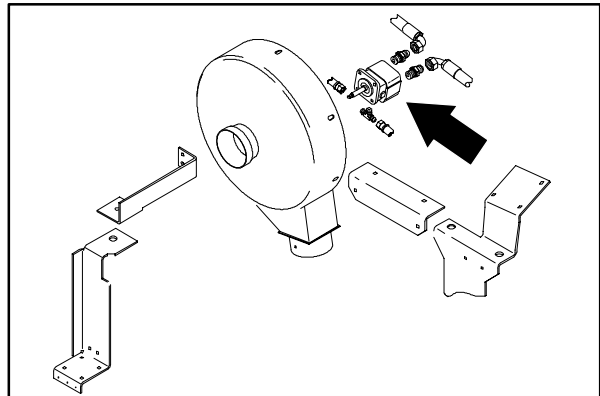


ENGINE-D

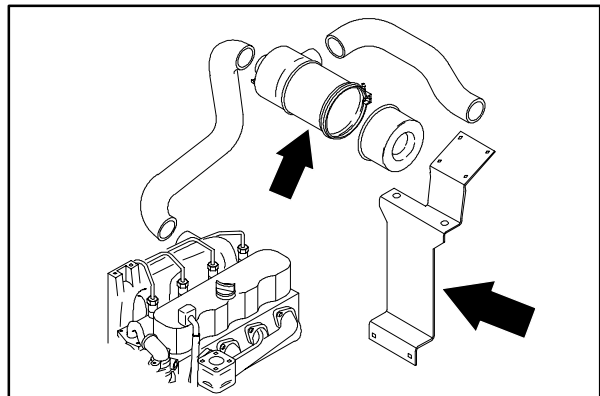
10. Fill the engine with proper grade of motor oil.
11. Reconnect wire harness to the engine components: alternator, starter, oil switch, temperature sender.
12. Reinstall the radiator hoses to engine and fill the radiator with coolant.
13. Reinstall the vacuum fan/air cleaner mount bracket to bellhousing. Reinstall the two M10 hex screws and tighten to 37 – 48 Nm (26 – 34 ft lb).



14. Reinstall the vacuum fan assembly to the mount bracket. Reinstall the three M10 hex screws, six washers, and three nyloc nuts. Tighten to 34 – 44 Nm (24 – 28 ft lb).
15. Reconnect the hydraulic hoses to the scrubbing vacuum fan motor. See the schematic in the HYDRAULICS section of this manual.
16. Reinstall the air cleaner assembly.



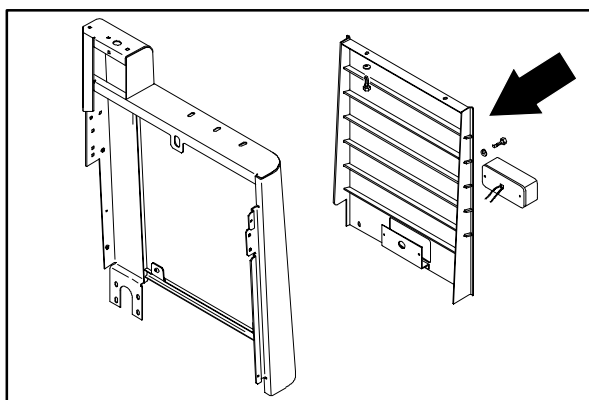
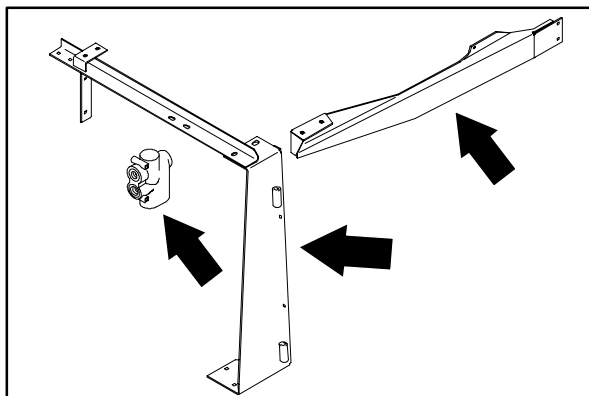
17. Reinstall the side door mounting bracket to the machine. Reinstall the five M8 hex screws and washers. Tighten to 18 – 24 Nm (15 – 20 ft lb).
18. Reinstall the hydraulic priority valve to the side door mounting bracket. Reinstall the two M8 hex screws and nyloc nuts. Tighten to 18 – 24 Nm (15 – 20 ft lb).
19. Reinstall the LH side panel using the three M6 hex screws and washers and two M8 hex screws and washers. Tighten the M6 hex screws to 11 – 14 Nm (7 – 10 ft lb). Tighten the M8 hex screws to 18 – 24 Nm (15 – 20 ft lb).



20. Reinstall the side channel brace. Reinstall the four M8 hex screws and washers. Tighten to 18 - 24 Nm (15 - 20 ft lb).
21. Reinstall the left rear grill panel to the machine. Reinstall the four M8 hex screws and washers. Tighten to 18 - 24 Nm (15 - 20 ft lb).
22. Reinstall the engine cover and side door.
23. Reconnect the battery cables to the battery.
24. Jack up the rear of the machine.

FOR SAFETY: Block machine tires before jacking machine up. Jack machine up at designated locations only. Block machine up with jack stands

25. Start the engine and check for any leaks.

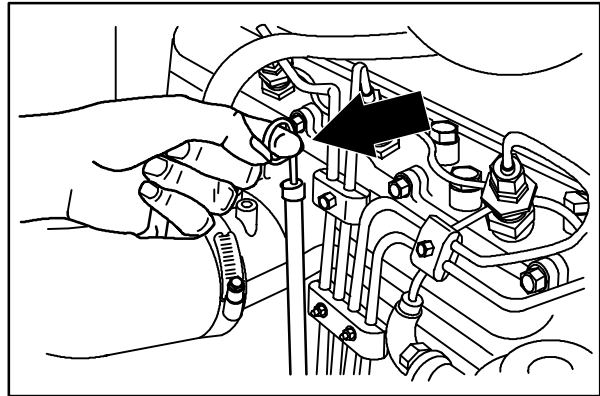


LUBRICATION

ENGINE OIL

Check the engine oil level daily. Change the engine oil and oil filter every 100 hours of machine operation. Use 10W30 SAE-CC/CD rated engine oil.

Fill the engine with oil to the level indicated on the oil dipstick. The engine oil capacity is 6 L (6.3 qt) with out the oil filter.



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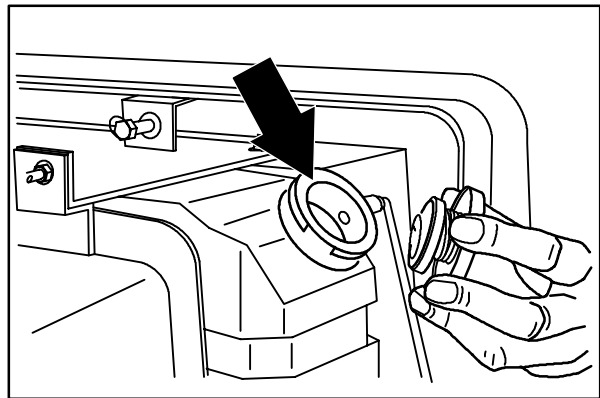
COOLING SYSTEM

RADIATOR

Check the radiator coolant level every 100 hours of operation. Use clean water mixed with a permanent-type, ethylene glycol antifreeze to a -34°C (-30°F) rating.

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

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



08432

Check the radiator hoses and clamps every 200 hours of operation. Tighten the clamps if they are loose. Replace the hoses and clamps if the hoses are cracked, harden, or swollen.

Check the radiator core exterior and hydraulic cooler fins for debris every 100 hours of operation. Blow or rinse all dust, which may have collected on the radiator, in through the grille and radiator fins, opposite the direction of normal air flow. The grille and hydraulic cooler open for easier cleaning. Be careful not to bend the cooling fins when cleaning. Clean thoroughly to prevent the fins becoming encrusted with dust. Clean the radiator and cooler only after the radiator has cooled to avoid cracking.

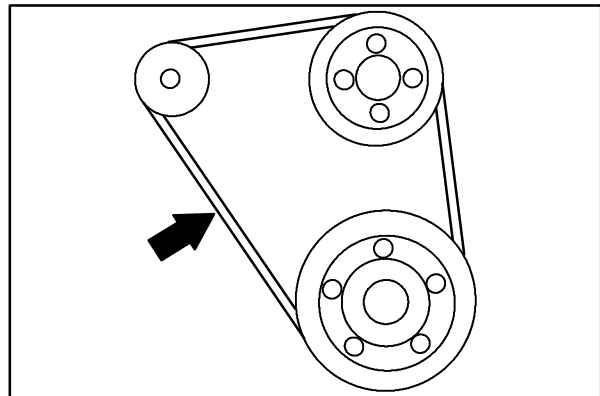
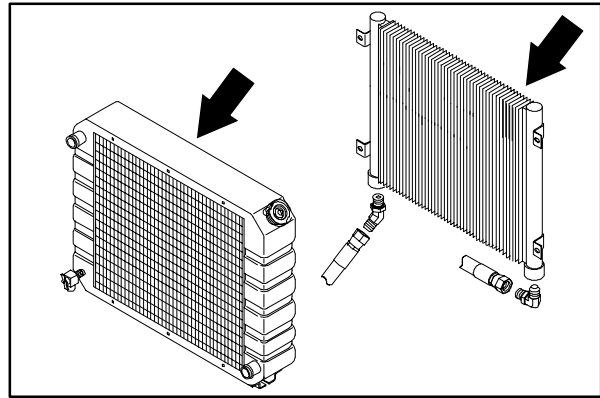
FOR SAFETY: When Servicing Machine, Wear Eye And Ear Protection When Using Pressurized Air Or Water.

Flush the radiator and the cooling system every 400 hours of operation, using a dependable cleaning compound.

ENGINE FAN BELT

The engine fan belt is driven by the engine crankshaft pulley and drives the alternator pulley. Proper belt tension is 13 mm (0.50 in) from a force of 4 to 5 kg (8 to 10 lb) applied at the mid-point of the longest span.

Check and adjust the belt tension every 100 hours of operation.



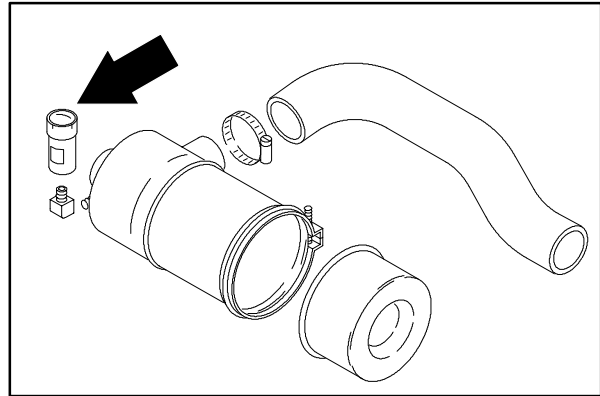
08935

AIR INTAKE SYSTEM

AIR FILTER INDICATOR

The air filter indicator shows when to clean or replace the air filter element. Check the indicator daily. The indicator's red line will move as the air filter element fills with dirt. Do not clean or replace the air filter element until the red line reaches 5 kPa (20 in H₂O) and the "SERVICE WHEN RED" window is filled with red. The indicator's red line may return to a lower reading on the scale when the engine shuts off. The red line will return to a correct reading after the engine runs for a while.

Reset the air filter indicator by pushing the reset button on the end of the indicator after cleaning or replacing the air filter element.

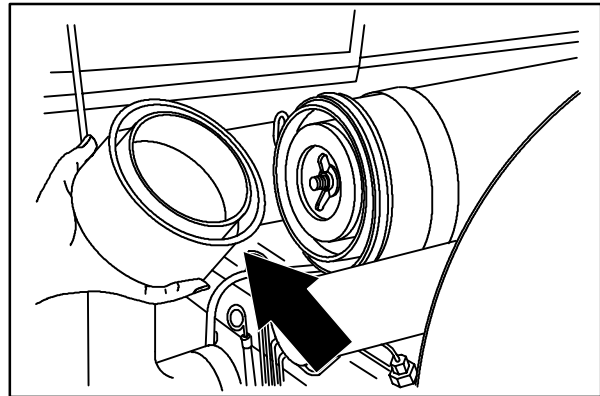


AIR FILTER

The engine air filter housing has a dust cap and a dry cartridge-type air filter element. Empty the dust cap daily. The air filter must be replaced whenever the filter element is damaged or has been cleaned three times.

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

Machines with the heavy duty air filter option have a safety element. It is inside the standard element. Replace, do not clean this element after the regular element has been damaged or cleaned three times.



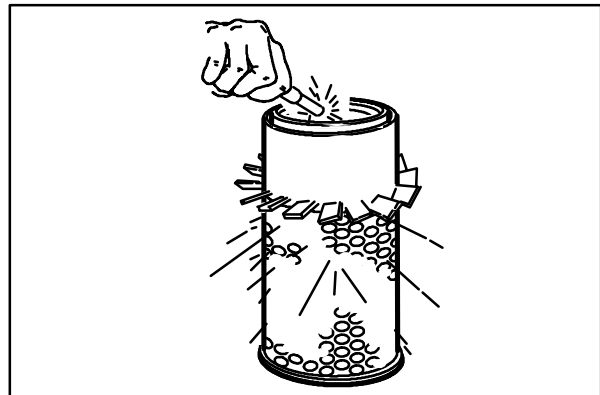
08455

TO REPLACE AIR FILTER ELEMENT

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

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

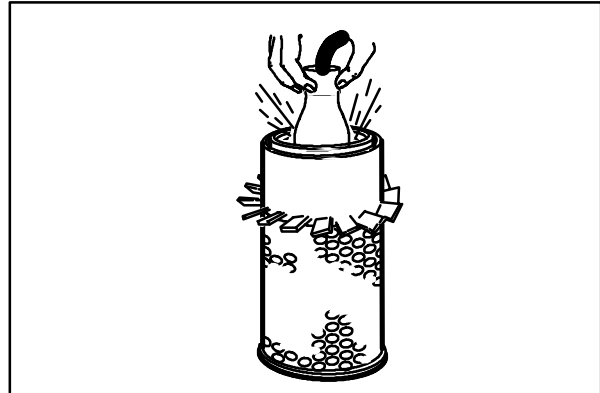
2. Open the left side and top engine access doors.
3. Unscrew the clamp ring on the filter assembly.
4. Remove the dust cap.
5. Empty the dust cap.



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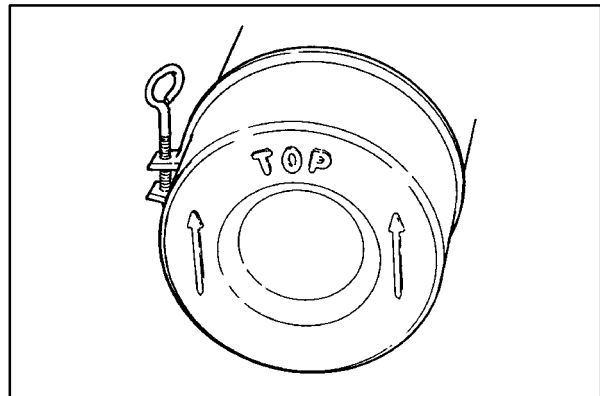
6. Remove the filter wing nut.
7. Gently pull the filter element out of the filter housing.
8. Clean the interior of the air cleaner housing with a damp cloth. Clean the element housing sealing surfaces.
9. Using an air hose, direct dry, clean air maximum 205 kPa (30 psi) up and down pleats on the inside of the filter. Do not rap, tap, or pound dust out of the element.

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



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10. After cleaning the air filter element, inspect it for damage by placing a bright light inside. The slightest rupture requires replacement of the filter. Clean and inspect the seals on the ends of the element. They should be unbroken and flexible. *Remember to replace the element after cleaning it three times.*
11. Install the new or cleaned filter element so the fins on the element are at the intake end of the air cleaner. Be careful not to damage the fins. Make sure the element is seating evenly. Tighten the element wing nut.
12. Install the dust cap with the arrows pointing up. Tighten the clamp ring to hold it in place. Check all intake hose connections for leaks or abrasion.
13. Reset the air filter restriction indicator.
14. Close the access doors.



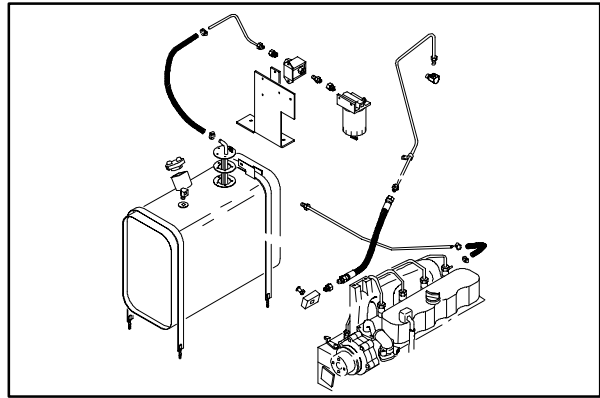
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FUEL SYSTEM - DIESEL

DIESEL FUEL SYSTEM

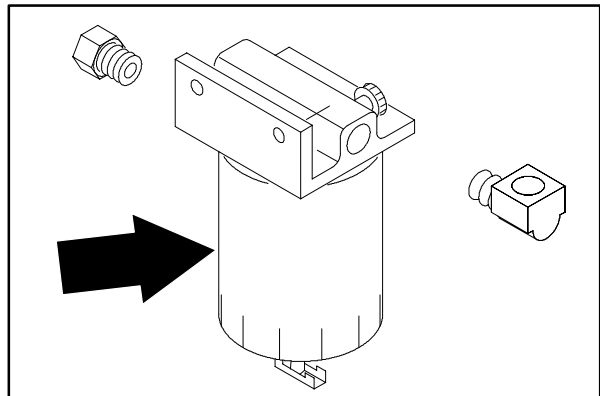
The diesel fuel system is made up of five basic components which are: fuel tank, fuel filter, fuel water trap filter, fuel pump, injection pump, and injectors.

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



FUEL FILTER

The fuel filter cartridge filters impurities from the fuel. It is located at the back of the machine.

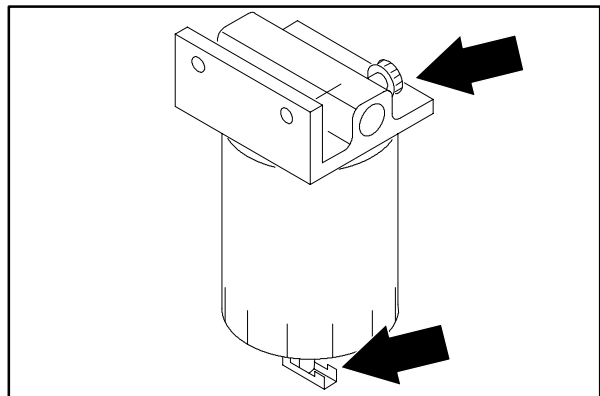


TO REPLACE THE FUEL FILTER CARTRIDGE

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

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

2. Loosen the unit vent plug and open the water trap drain to drain diesel fuel.
3. Remove the filter cartridge from the filter head.
4. Lubricate the o-ring of the new filter cartridge and spin it onto the filter head.
5. Bleed the fuel lines of air as described in *TO PRIME FUEL SYSTEM*.

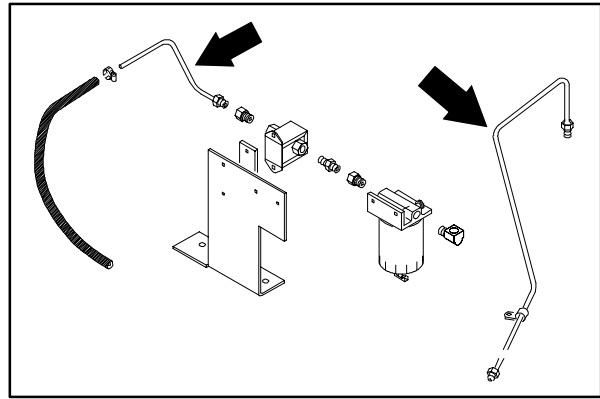


FUEL LINES

Check the fuel lines every 50 hours of operation. If the clamp band is loose, apply oil to the screw of the band, and securely tighten the band.

Made of rubber, the fuel lines become worn out whether the engine has been used much or not. Replace the fuel lines and clamp bands every two years.

If the fuel lines and clamp bands are found worn or damaged before two years' time, replace or repair them at once. Bleed the fuel system after replacement of any of the fuel lines, see *TO PRIME THE FUEL SYSTEM*. When the fuel lines are not installed, plug both ends with clean cloth or paper to prevent dirt from entering the lines. Dirt in the lines can cause fuel injection pump malfunction.



PRIMING FUEL SYSTEM

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

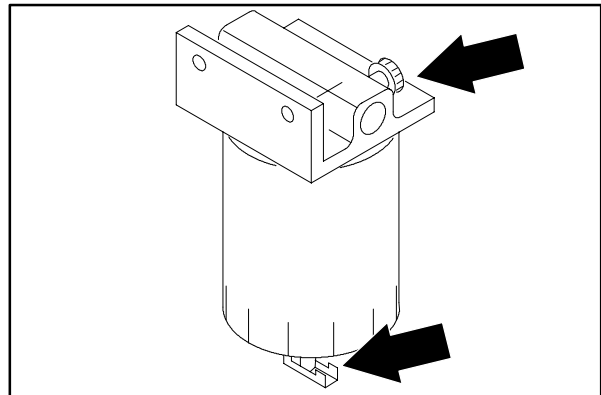
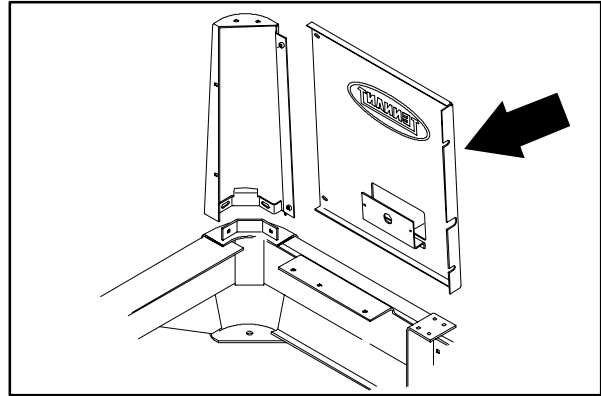
Prime the fuel system after running out of fuel, changing fuel filter elements or repairing a fuel system component.

TO PRIME FUEL SYSTEM

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

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

2. Make sure the fuel tank is full.
3. Raise the seat up.
4. Unplug the RH tail light from the main harness.
5. Loosen the two M8 hex screws holding the RH rear panel to the center tower.
6. Go to the back of the machine and remove the two M8 hex screws holding the rear panel to the RH corner tower.
7. Remove the rear panel for access to the fuel filter.
8. Open the air vent on top of the fuel filter.
9. Start the engine, operate it for one minute, then stop it; or operate the starter motor in ten-second intervals until a steady stream of fuel flows from the vent.
10. Close the air vent and shut off the engine.
11. Position the RH rear access panel back on the machine, Reinstall the two M8 hex screws and tighten to 18 - 24 Nm (15 - 20 ft lb).
12. Go under the seat and tighten the two M8 hex screws to 18 - 24 Nm (15 - 20 ft lb).
13. Reconnect the tail light to the main harness.
14. Lower the seat.

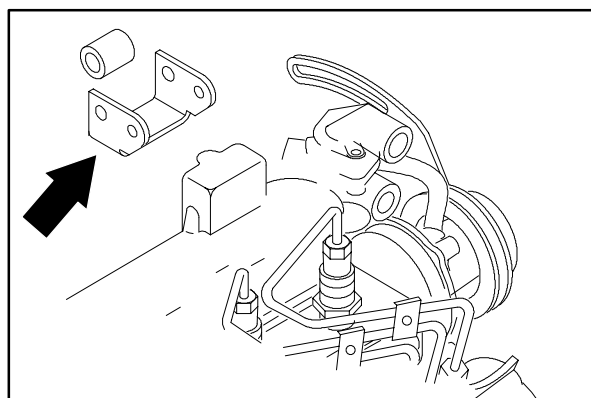
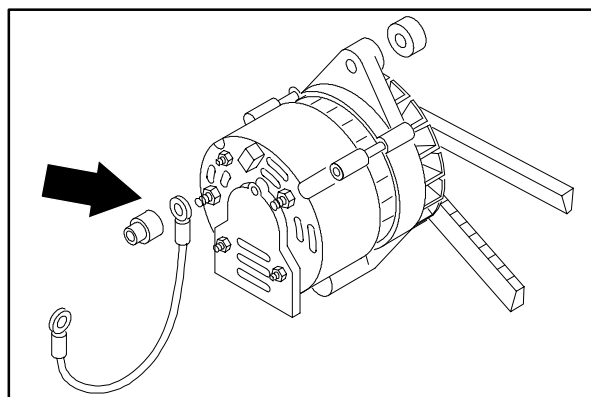
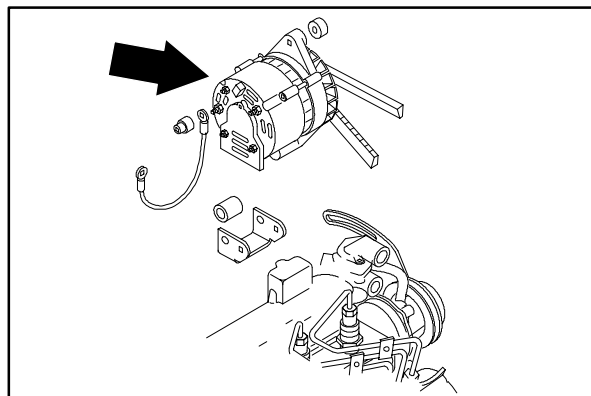


ENGINE ELECTRICAL SYSTEM

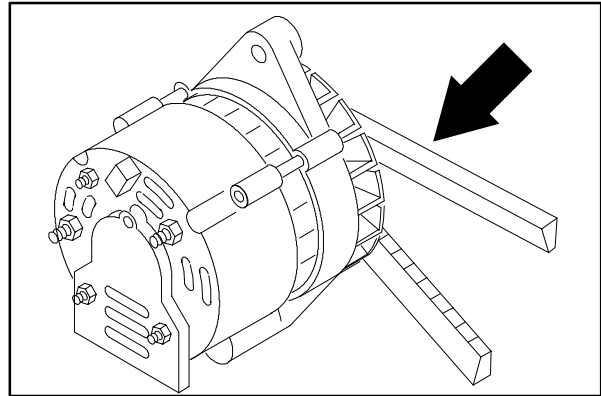
TO REPLACE ALTERNATOR

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

1. Disconnect the battery cables from the battery.
2. Open the engine cover and side door.
3. Disconnect the wires on the back of the alternator.
4. Remove the hex screw holding the top of the alternator to the upper mount bracket. Push the alternator toward the engine and remove the v-belt.
5. Remove the hex screw and nyloc nut holding the bottom of the alternator to the lower mount bracket.
6. The alternator can now be removed. Bring the alternator up and out of the machine.
7. If the new or rebuilt alternator needs a drive pulley; remove the pulley from the old alternator by holding pulley from turning and using an impact wrench to remove hex nut.
8. Install pulley, washer, and hex nut on the new alternator. Hand tighten the nut with an impact wrench.



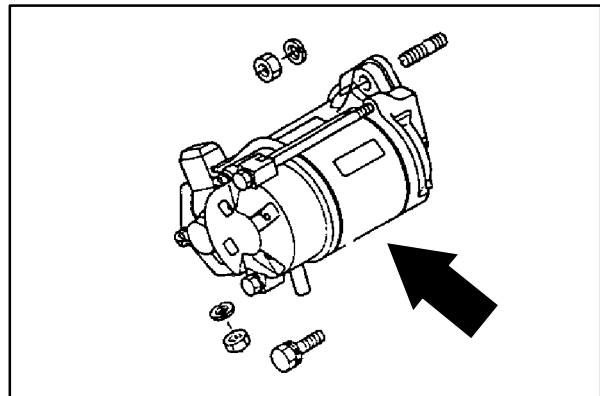
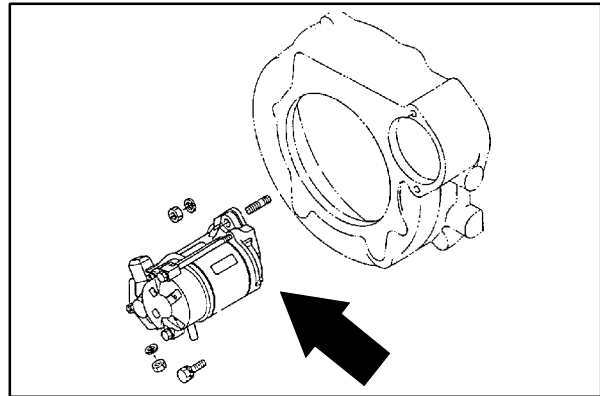
9. Install the new alternator back in the machine. Align the bottom hole in the alternator with hole in the lower mount bracket. Reinstall the hex bolt, washer, and sleeve. Leave loose for now.
10. Place the v-belt back on the alternator pulley.
11. Reinstall the hex screw in the top hole of the alternator through the upper mounting bracket. Pull alternator toward the outside of machine to tighten belt. Tighten the hex screw to 18 - 24 Nm (13 - 18 ft lb).
12. Tighten the bottom hex screw to 31 - 40 Nm (27 - 35 ft lb).
13. Reconnect the wires to the back of alternator. See the schematic in the ELECTRICAL section.
14. Reconnect the battery, start the engine, and check for proper operation of the new alternator.



TO REPLACE STARTER

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

1. Disconnect the battery cables from the battery.
2. Open the engine cover and side door.
3. Remove the vacuum hose from the exhaust side of scrubbing vacuum fan.
4. Remove the M8 hex nut holding positive battery cable to the starter. Remove the cable and unplug the starter wires.
5. Remove one hex nut and one hex screw holding the starter to the bellhousing. Remove the starter from machine.
6. Position the new starter back in the machine. Align the top hole in the starter with the stud on bellhousing.
7. Reinstall one hex nut and one hex screw. Firmly hand tighten.
8. Reconnect the battery cable and starter wires to starter. See the schematic in the ELECTRICAL section.
9. Reinstall the vacuum hose to the exhaust side of scrubbing vacuum fan.
10. Reconnect the battery cables to the battery. Start the engine to check the new starter for proper operation.





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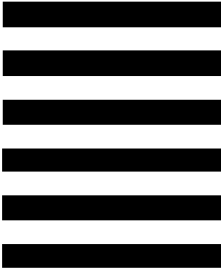
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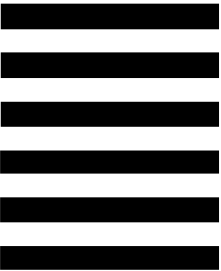
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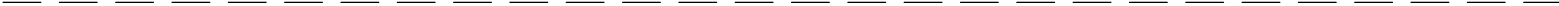
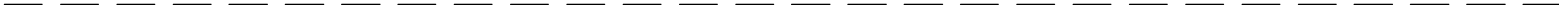
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