GLOBALM4HSD

Service Manual

GS332073 **Mechanical Sweeper**

Revision A **March 2016**

GLOBALM4HSD

1st Ed
2016

GLOBALM4HSD Service Manual

Mechanical Sweeper

March 2016

GLOBAL
ENVIRONMENTAL PRODUCTS

Revision A

GLOBAL
M4

Global M4 Series
Mechanical Sweeper Broom
Service Manual

p/n: GS332073, March 2016

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Introduction

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Introduction

The information contained in this manual will help you better understand the operation of the sweeper. The Global M4 Series model sweeper represents the highest grade of craftsmanship and reliability that makes Global Environmental Products a world leader in sweeper technology. Careful attention to proper operating procedures will ensure efficient operation, maximum performance and total customer satisfaction.

How to Use This Manual

- ❑ Keep this manual in the cab buddy seat compartment as a permanent and convenient reference.
- ❑ Throughout this manual, you will find WARNINGS , CAUTIONS , and NOTES .
  - The WARNINGs reminds you to be especially careful to avoid possible personal injury.
  - The CAUTIONs are given to prevent you from making an error that could damage the sweeper or cause personal injury.
  - The NOTEs are suggestions that will help you make full use of the sweeper.
- ❑ A thumb tabbed quick reference guide is located on the title page of manual to assist you in locating a desired function.
- ❑ Procedure titles and chapters are positioned in margins for easy reference while flipping through the manual.

Important Information

All information in this manual is based on the latest product information available at the time of printing. Due to improvements in design, performance and reliability, there may be minor discrepancies between actual vehicle and the contents of this manual. Global Environmental Products, Inc. reserves the right to make changes at any time without notice and without incurring any obligation to make such changes to products manufactured previously. No liability can be accepted for any inaccuracies or omissions in this publication, although every endeavor is made to ensure that information contained in this manual is correct.

Global Environmental Products Technical Publications

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Service Assistance

To better serve you, the following information will be needed during a service call.

1. Name and address.
2. Complete model and serial number.
3. Description of procedure, function or problem.

NOTE: The identification nameplate is located inside the operator's cab on the right side - wall below the companion seat.

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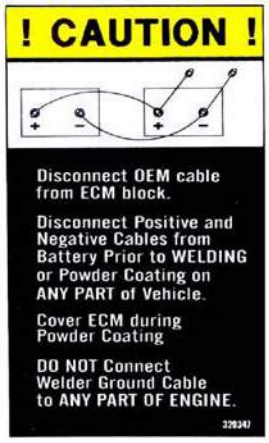
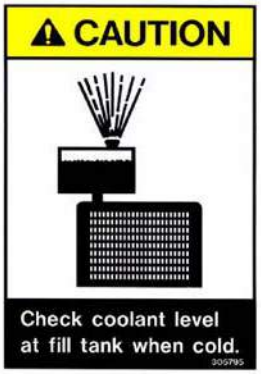
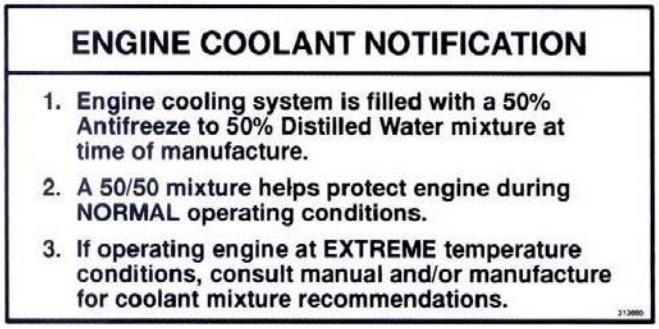
Safety Decals

Safety must always be the operator's utmost concern and responsibility. The operator must read and understand this manual and all safety decals on the sweeper before operating the vehicle. Failure to follow these safety precautions could result in damage to the equipment and/or personal injury or death. Decals are designed and installed on the sweeper for your protection. They are placed at appropriate areas on the sweeper to be constant reminders of the ever – present dangers. KNOW and ADHERE to the information they provide.

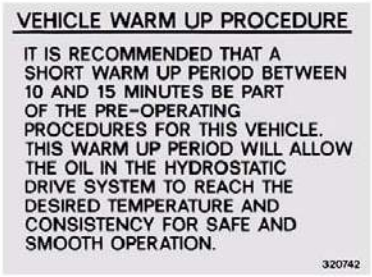





SAFETY INSTRUCTIONS
1. Before starting and operating this machine, read and thoroughly understand operators manual and additional warnings.
2. This unit must be operated with care due to tight turning radius and high center of gravity.
3. WEAR YOUR SEATBELT AT ALL TIMES.
4. Dump only on level surfaces away from power lines and building structures.
5. Do not drive unit with hopper raised.
6. Use approved method for servicing tires.
302944

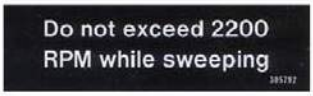

ENGINE COOLANT NOTIFICATION
1. Engine cooling system is filled with a 50% Antifreeze to 50% Distilled Water mixture at time of manufacture.
2. A 50/50 mixture helps protect engine during NORMAL operating conditions.
3. If operating engine at EXTREME temperature conditions, consult manual and/or manufacture for coolant mixture recommendations.


CAUTION
Do not Weld on Hopper. Inside of Hopper Polyurethane Coated.
320519


VEHICLE WARM UP PROCEDURE
IT IS RECOMMENDED THAT A SHORT WARM UP PERIOD BETWEEN 10 AND 15 MINUTES BE PART OF THE PRE-OPERATING PROCEDURES FOR THIS VEHICLE. THIS WARM UP PERIOD WILL ALLOW THE OIL IN THE HYDROSTATIC DRIVE SYSTEM TO REACH THE DESIRED TEMPERATURE AND CONSISTENCY FOR SAFE AND SMOOTH OPERATION.
320742


SPRAY BAR WATER FILTER
SERVICE EVERY 800 HOURS
323312


ATTENTION
ALL WHEEL LUGNUTS ARE RIGHT HAND THREADS.
325619

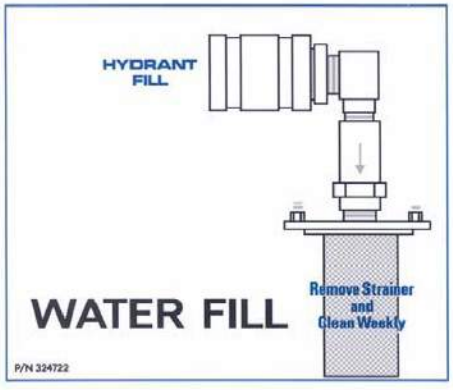

Do not exceed 2200 RPM while sweeping


Raise Step To Closed Position Before Driving
317712


WARNING
Turn off all sweeping functions before shutting engine off.


CAUTION!
After starting engine, PAUSE momentarily before shifting.
325457


ATTENTION !
GREASE CAVITY DAILY.
GB MOTOR
GREASE FITTING
GB DISH
325202


HYDRANT FILL
WATER FILL
Remove Strainer and Clean Weekly
P/N 324722


WATER PUMP MANUAL PURGE
CAUTION ! REMOVE KEYS FROM IGNITION PRIOR TO PURGING.
LIFT and HOLD SWITCH UNTIL PUMPS HAVE EMPTIED.
325423

Safety Precautions

The safety precautions listed in this manual and on the sweeper are not all-inclusive. Anyone using service procedures, methods, or tools, whether or not recommended by Global Environmental Products must satisfy himself thoroughly that neither personal safety nor vehicle safety will be jeopardized by the service methods or tools selected. Remember, your ability as a professional operator is critical to ensuring your safety and that of others around you.

Always follow local and state traffic laws. Drive defensively - the other driver may be wrong, but it is better to avoid collisions of any kind. Carefully study the following safety related operating suggestions.

1. Always fasten seat belts.
2. Always drive at a safe speed. Slow down for curves and downgrades.
3. Be extremely careful when maneuvering around parked cars.
4. Never make sudden starts, stops or turns.
5. Be very careful when backing up sweeper.
6. Do not use sweeper for towing.
7. Never operate sweeper with a known hydraulic leak. Repair leak immediately.
8. Check sweeper daily for hydraulic leaks.
9. Avoid sweeping near bystanders or in congested areas eliminating possible injury caused from sweeper brooms throwing debris.
10. If elevator becomes jammed, turn off elevator drive motor and stop engine before proceeding to clear debris.
11. Do not overload sweeper.
12. Whenever a mechanic, operator, inspector or any other person needs to perform work under a raised hopper, stop engine and install both safety props. Do not stand under raised hopper with engine running.
13. Never use a hydraulic cylinder or hydraulic mechanical mechanism to lift another object or part.
14. Never leave sweeper unattended with engine running and/or ignition key in vehicle.
15. Be certain sweeper is parked in a position allowing hopper to clear container before dumping hopper.
16. Be sure sweeper is parked on level ground and bystanders are clear before dumping hopper.
17. Stay clear of electrical power lines and other overhead obstructions to prevent injury or property damage when dumping hopper.
18. Always cover battery terminals during maintenance to prevent electrical short.
19. When operating at slow speed or whenever sweeper may cause traffic problems, operate beacon and rear flashers lights.
20. Never step on either gutter broom for any reason. Serious injury may result. Use provided step plates located on right front bumper and handle to enter cab.

Safety Summary

The following safety measures are essential and must be observed when servicing, repairing, or maintaining the **G**obal **M**4 Series sweeper.

- ❑ **JACK STANDS & CHOCKS –** Before jacking the vehicle, or releasing or adjusting the parking brake on a stationary sweeper, **always** chock the wheels. **Always** use safety (jack) stands when using hydraulic jacks or hoists to raise the vehicle. **Do not** rely on either the jack or the hoist to hold the load.

- ❑ **SAFETY GLASSES –** Safety glasses **must** be worn when using tools such as hammers, chisels, pullers and punches. Always wear safety glasses when working on the hydraulic system.

- ❑ **WELDING –** Wear welding gloves and goggles when welding or using an acetylene torch. Make sure that a metal shield separates the acetylene and oxygen bottles, both of which must be chained to a cart. **Do not** weld or heat areas near fuel tanks or fuel lines. Utilize proper shielding around hydraulic lines. **CAUTION: Disconnect battery terminals prior to welding**.

- ❑ **WORK AREA –** Organize your work area and keep it clean. To prevent slips and falls, promptly wipe clean any oil spills. Keep all tools and parts off the floor. After servicing the sweeper, reinstall all safety devices, guards and shields. Before starting the engine or moving the sweeper, check to make sure that all tools and servicing equipment are removed from the engine area.

- ❑ **CLOTHING & JEWELRY–** Wear close fitting clothing appropriate for the job. Use sturdy work shoes and rough–soled. Bare feet, sandals, or sneakers are **not** acceptable foot wear when adjusting and/or servicing the sweeper. **Do not** wear rings, wrist watches, neck chains, or loose–fitting clothing when working on the engine. Any of these items could catch on moving parts, causing serious injury.

- ❑ **COMPRESSED AIR –** To avoid serious injury or death, **do not** apply compressed air to any part of the body or clothing. Use only approved air guns that do not exceed 30 psi *(207 kPa).* Always wear safety glasses or goggles. Use proper shield to protect everyone in the work area.

- ❑ **PRESSURIZED FLUIDS –** Be extremely careful when dealing with fluids under pressure. Fluids under pressure can have enough pressure to penetrate the skin. These fluids can infect a minor cut or opening in the skin. If injured by escaping pressurized fluids, see a doctor at once. Serious infection or reaction can result without immediate medical treatment.

  When opening the radiator cap, always remove the coolant pressure control cap slowly, and only when the coolant is at room temperature. A sudden release of pressure from a heated cooling system can result in possible personal injury from the expulsion of hot coolant.

  Always use extreme caution while inspecting or working on the pressurized hydraulic systems. **Do not** attempt to look for hydraulic leaks without hand and eye protection. Oil can shoot from a pinhole in a fine jet at a velocity that can penetrate the skin and cause severe injury. **Never** attempt to block the oil flow with your hands or fingers.

Safety Summary

- ❑ **DIESEL FUEL –** Diesel fuel is highly flammable. Take extra precautions to avoid personal injury. **Do not** smoke when fueling the vehicle, or when servicing the engine or the fuel system. Store diesel fuel and other flammable fluids away from fire hazards.

- ❑ **HOT EXHAUST –** Engine produces extremely hot exhaust gases *(over 1200 degrees F).* To prevent the possibility of serious burns, always allow the engine and exhaust system to cool to ambient temperature before working on or servicing the engine or exhaust system. Engine exhaust fumes can cause sickness or death. Do not run engine in an enclosed area without exhaust pipe extension.

- ❑ **BATTERIES –** Electrical batteries give off highly explosive and flammable hydrogen gas when charging, and continue to do so for some time after receiving a steady charge. **Do not** smoke or allow an open flame or spark near the batteries – an explosion may result. Prevent battery explosions. Do not charge a frozen battery; it may explode. Warm battery to 16 degrees C *(60 degrees F).* Prevent acid burns. Avoid contact with sulfuric acid in battery electrolyte. Wear proper eye protection and wear rubber gloves when handling battery. Use voltmeter or hydrometer to check battery charge. To avoid the possibility of electrical shock, always remove the battery ground cable before working on the electrical system.

- ❑ **FIRE EXTINGUISHER –** Always keep a charged fire extinguisher within reach while working on or servicing the vehicle. Make sure the extinguisher is the correct type for the situation: a Type A extinguisher is for wood, paper, textiles and rubbish *(as might be found in the sweeper hopper)*; a Type B extinguisher is for flammable liquids such as solvents; and a Type C extinguisher is for electrical equipment.

- ❑ **HOPPER & ELEVATOR SAFETY –** A combination of a hydraulic system and an elevatable, heavy hopper present several safety concerns. The following cautions must be taken to avoid personal injury or damage to equipment:

  1. **Do not** raise the hopper unless the sweeper is parked on firm, level ground.

  2. Before raising the hopper, make sure that the vehicle is clear of overhead electrical power lines or other obstructions such as trees.

  3. Make sure that bystanders are well clear of the sweeper before dumping.

  4. Before working beneath a raised hopper, **always** install the safety props on both sides of scissor base. The safety props rest on the top edge of the cylinder body, positioned around the cylinder rod to keep the hopper from falling in the event of a hydraulic failure. **Never** position yourself beneath the hopper while installing or removing the safety props.

  5. **Always** stay clear of the running elevator while making adjustments. The moving equipment can easily grab clothing and cause personal injury.

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CHAPTER 1

General Information

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SWEEPER FUNCTIONS

The Global M4 model sweeper is a unique specially designed and manufactured mechanical type street sweeper. The operation of the sweeper encompasses the use of mechanical, hydraulic and electrical systems employing related components for the specific purpose of removal of debris from streets, highways, parking areas and other large paved locations. The sweeper is ruggedly constructed and durably designed to withstand the everyday operation as well as enabling the unit to sweep and pickup the heaviest of debris within its' published ratings and specifications.

Engine — A standard Cummins ISB-12 280 series engine, 6.7 liter *(409 cu. in.)* turbocharged diesel engine powers the M4 sweeper. This in – line six - cylinder engine delivers 280 peak horsepower at 2300 RPM with a maximum torque rating of 660 lb ft at 1600 RPM. The Cummins engine electronic *"Interact System"* features built in pronostics and diagnostics. A programmable electronic control module (ECM) allows for multi range setting of key performance parameters.

(Refer to Cummins Engine Owners Manual, Troubleshooting and Repair Manual, and Parts Catalog for service information)

Hydrostatic Traction — A hydrostatic traction system is used on the unit to meet the mobility requirements of the sweeper. The engine RPM is separate from the mile – per – hour speed to allow engine speed to be set at a high RPM to run sweeping operations while vehicle travel is kept at slow sweeping speed.

Three major components make up the traction system: hydraulic traction pump, hydraulic motor, and a rear axle. The traction pump consists of a single variable displacement hydrostatic pump accompanied with a fixed displacement charge pump. A variable displacement hydraulic motor enables the sweeper to shift in high range or low range which changes torque and mile – per – hour capabilities. A conventional heavy duty truck rear axle is the last link in the drive system. The rear axle is equipped with a two – speed gear drive of high and low range to enable the sweeper to reach speeds specified in the M4 Series specifications for highway travel.

(Global M4 Series sweeper major component locations) **Fig: 1.3 A**

Auxiliary Hydraulic Drive — The auxiliary hydraulic drive provides power and control to operate the sweep gear and other related systems. The auxiliary hydraulic system consists of a triple pump mounted on the rear of the hydrostatic pump that is driven by the engine. Hydraulic motors are used to drive the gutter brooms, pickup broom and elevator. Various hydraulic cylinders are used for lifting and lowering functions of the brooms and the hopper.

Operatror's Cab — The cab is designed for operators comfort inside a dust and weather protected interior. The operators driving position at the center of the sweeper provides excellent visibility while observing the sweeping path.

Cab Mounted Controls and Indicators — Operator controls and performance indicators are mounted in cab within easy reach and view of operator. A front console panel allows operator to monitor gauges and switches dedicated for driving operation. A set of side instrument panels allows operator to monitor gauges and switches dedicated for sweeping operation.

The engine RPM adjustment is controlled electronically using a rocker switch next to the shifter. A sweep/travel mode switch allows the engine RPM to be controlled independently during sweeping operations. The go–pedal *(similar to a gas pedal in a conventional truck)* controls sweeper speed and RPM speed simultaneously in travel mode. A built–in hydrostatic braking system activates when go–pedal is fully released. In addition, a mechanical brake pedal activates the wheel brakes and brake lights. The parking brake automatically engages when shifter is placed in park.

Water Tanks — The storage of water for the spray system consists of three inter–linked water tanks designed to be filled from a fire hydrant through a single filler hole and water fill strainer. A fire hydrant hose needed to fill water tanks is stored in the right hand center body panel.

Water Pumps — The pressure and flow requirements for the water system is met by the use of two 12–volt electric motor driven diaphragm pump units. The electric motor is a permanent magnet, fan cooled with an amperage draw of 10 amps. The electric power source is taken from the chassis battery. The self–priming pumps are designed to produce a flow rate of 4.0 gpm (per pump) at 0 head pressure. The pumps have a maximum pressure of 35 psi.

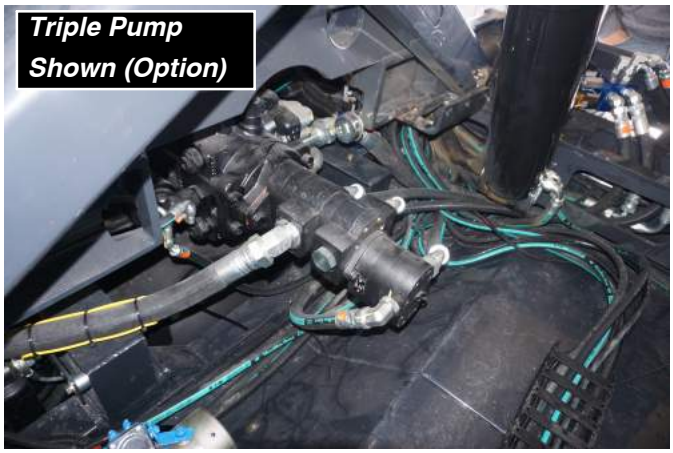


Fig: 1.4 A

Fig: 1.4 B

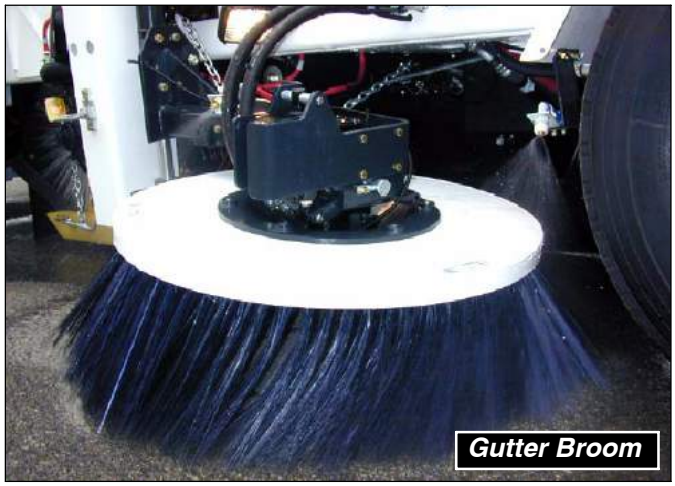


Fig: 1.4 C

Water Spray System — The water spray system is intended to control dust created when sweeping. Water nozzles spray in front of each gutter broom. A series of water nozzles mounted under the front bumper sprays water on debris being picked up by the sweeper. The water pump pressurizes the water spray system of the sweeper. The water control valves located behind the companion seat backrest are adjustable ball valves used to control the amount of water flow to the spray nozzles.

Hoppe r — The sweeper utilizes a hopper for storage of collected debris that has been swept. It is located basically at the center behind the cab. The hopper is designed and constructed from carbon steel *(a stainless steel option is also avalaible)* and is powder coated to reduce corrosion *(a Rhino lining option is also avalaible)*.

Elevator — The elevator assembly is used to transfer the swept debris from the pickup broom disposing it into the hopper. This conveyor type component is located in a near vertical position between the front of the hopper and the rear of the cab. The elevator has squeegee type design consisting of 7 or 11 flights of squeegees with replaceable corded rubber tips. The squeegees carry the debris up the backplate of the elevator and throws the debris into the hopper. The elevator consists of the squeegee bars, large rubber belts, sprocket pulleys and drive shafts. The elevator is powered by a hydraulic motor that works in conjunction with the pickup broom operation. When the switch in cab is actuated, both the broom and elevator operation is simultaneously activated. Because of close clearances of the squeegees the possibility exists that the elevator could stall or stop operating. This is usually caused by an obstruction of a larger than normal piece of debris that is wedged at some point on the elevator. When this condition occurs, an alarm buzzer sounds alerting the operator of the condition. The obstruction must be cleared before proceeding to sweep.

Gutter Brooms— The gutter broom is located on each side of the sweeper just behind the cab. The gutter broom measures 47 inches in diameter and is equipped with 12 brush segments of the Tuf–grip type with 26" wire bristles attached to the broom drive plate. A four brush segment is also avalaible. Each gutter broom is independently lowered and raised hydraulically and controlled from the cab. The direct connected hydraulic motor accomplishes the rotation motion of the brooms.The speed is based on the engine RPM. The broom down pressure can be selected to suit the specific type of sweeping being done. It is se lected by the control in the cab that consists of a gauge which indicates a HEAVY–LIGHT or UP range. The adjustment is made with the broom raised and by setting the needle on the gauge. Once set, this range remains until reset even if broom is raised and again lowered.

The M4 Series sweeper has the In–Cab Broom Tilt *(Option)* capability which allows the operator to easily adjust the broom to sweep various different road cambers without exiting the cab. The tilt option is a complete arm assembly.

Shock absorbers are installed on the horizontal movement of the gutter brooms. These are used as a protective device when the gutter broom is forced inward by hitting a curb or another type of obstacle. The shock absorbers also return the broom back to its' preset outward position.

Pickup Broom— The pickup broom is located underneath the unit just to the rear of the gutter brooms. The
broom is a two broom type, polypropylene filled and it is 32 inches in diameter by 58 inches in length. The purpose of the pickup broom is to sweep up the debris in the center portion of the path including the debris directed to the center by the gutter brooms and deposit it on the elevator. The broom rotates in the opposite direction of travel. The rotation is accomplished by use of a hydraulic motor and is controlled by the switch in the cab. The rotational speed is based on the engine RPM. The broom is raised and lowered hydraulically.

Dirt Shoes and Dust Flaps— A fabricated structure referred to as a dirt shoe is located on both sides of the pick up broom with the purpose of funnelling or containing the debris in front of the pickup broom and elevator. Without this component the debris would be thrown out from under the machine and left behind while sweeping. The dirt shoe is set to slightly drag and ride parallel to the sweeping surface. It is safety chained to the pickup broom and is lowered and raised as the broom is lowered and raised.

In an effort to control the dust and contain the debris being swept into the center of the sweep path by the gutter brooms, a rubberized flap deflector is located under the chassis and just to the rear of the front wheels. A dust flap is also located to the rear of the pickup broom to keep the debris and dust from escaping to the rear of the sweeper. In addition, a chain curtain is installed to reduce debris "cow plops" behind the sweeper.

Electrical System — A centralized, weatherproof system, equipped with a component identifying decal which allows accessibility to electrical components. Power source consists of dual batteries, 955 CCA @ 0 degrees Fahrenheit. A system voltage of 12 volt is circuit breaker protected. Electrical control unit is a sealed system locker with sealed sub compartments for high and low amperage components.

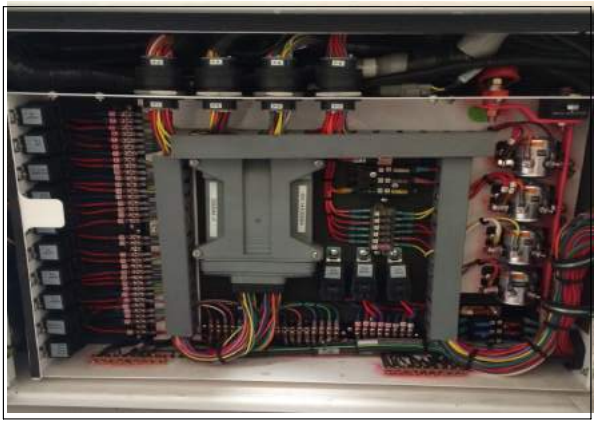


Fig: 1.6 A

WARNING

Always shield eyes and face from batteries.

PM –10 — The Global Environmental Products 4000 CNG sweeper has been tested and certified as being in compliance with the South Coast Air Quality Management District's Rule #1186 regulating collection and containment of PM10 *(Particle Matter 10 Microns).* The PM10 is a unique feature of dust suppression system using an array of water spray mist. The application of water spray mist in appropriate areas of sweeping is important for the efficiency of the PM10. Dust particle as small as 10 microns can be swept.

Fig: 1.6 B

In order to ensure compliance with Rule #1186 requirements, the sweeper must be operated and maintained in accordance with sweeper's PM10 specifications.

CAUTION

Do Not attempt to sweep with the water spray system inoperative.

(Refer to the PM10 maintenance and specifications section in the service and lubrication chapter in this manual.)

Table 1.1
Cab Mounted Controls and Indicators

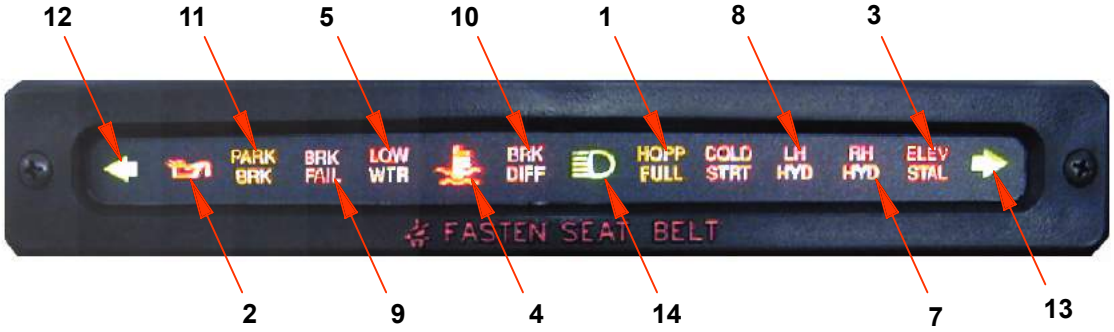
Index No.	Description	Function/Indication
1.	**Shifter**	Allows selection of two forward speeds, reverse, and park *(similar to an automatic transmission shifter in a conventional truck).*
	❑ **HI** Position	Selects high ratio of hydrostatic system. Sweeper travels forward at speeds up to 55 mph **(88 k**m/h**)**.
	❑ **LO** Position	Selects low ratio of hydrostatic system to provide greater torque to rear wheels. Sweeper travels forward at speeds up to 18 mph **(29k**m/h**)**.
	❑ **P** Position	Place shifter in park position to start engine. **Emergency brake is automatically activated when shifter is in park position.**
	❑ **R** Position	Allows sweeper to move in reverse direction.
		**DO NOT shift into REVERSE while sweeper is moving. Damage to hydrostatic traction may result.**
2	**Side Instrument Panels**	Allows operator to adjust and monitor sweeping operations.
3.	**Steering Wheel/Column**	Besides performing standard turning applications, steering wheel tilts and telescope for operator comfort and easy access in and out of cab. Refer to Table 1.5 for detailed explanation of steering wheel/column functions.
4.	**Front Console Panel**	Allows operator to monitor driving and engine performance. Refer to Table 1.2 for detailed explanation of front instrument panel.
5.	**Foot Brake Pedal**	Foot brake pedal applies wheel brakes and activates brake lights simultaneously.
6.	**Go-Pedal**	Controls sweeper speed and engine rpm simultaneously *(similar to a gas pedal in a conventional truck)* when vehicle is in travel mode. Hydrostatic braking occurs when go-pedal is released.
7.	**Engine RPM Switch**	Used to adjust engine rpm. RPM switch functions separate from go-pedal when vehicle is in sweeping mode. **Recommended sweeping RPM is 2100.**
8.	**Water Valves**	Valves control overall water flow to spray nozzles.
9.	**Hydraulic Temp Gauge**	Hydraulic temperature gauges allows the operator to monitor the oil temperatures of both left hand and right hand hydraulic tanks.
10.	**Mirror Controls (Option)**	Allows the operator to heat and defrost mirrors, and adjust left hand and right hand mirrors electronically.

Table 1.2
Front Console Controls and Indicator Panel

1- Temperature Gauge
2- Engine Oil Gauge
3- Motor Overspeed Light
4- Tachometer
5- Gutter Broom Tilt RH (Option)
6- Fuel Gauge
7- Power Source (Option)
8- Ignition Key Switch
9- Voltmeter Gauge
10- Wiper / Washer Switch
11- Headlight Switch
12- Gutter Broom Tilt LH (Option)
13- Speedometer
14- ABS Indicator Light Ass'y
15- Work Lights
16- Kysor AV-1000 System
17- Diagnostic Light Ass'y
18- Hopper Light
19- DDR Connectors
20- Traction Control Diag.Connector

Table 1.2 *(continued)*
Front Console Controls and Indicator Panel

Index No.	Description	Function/Indication
4.	**ABS Indicator Lamp**	When ignition switch is turned ON, ABS indicator lamp comes on momentarily then goes out, indicating System OK. Light stays on indicates fault in the system.
5.	**Voltmeter**	Indicates electrical system voltage. **Troubleshoot system if voltmeter constantly indicates an over or under charge.**
6.	**Fuel Gauge**	Indicates approximate amount of fuel remaining in the tank. Fuel tank capacity is 57 diesel equivalent gallons *(216 L)* @ 3600 PSI.
7.	**Temperature Gauge**	Indicates engine water temperature. Normal temperature reads between 180° and 225° Fahrenheit *(82 °and 99 °C).*
	CAUTION	**If ENGINE WATER TEMPERATURE gauge rises above 238° F (114° C), the engine shuts down automatically.**
8.	**Engine Oil Gauge**	Indicates engine oil pressure when the engine is running. Normal oil pressure is between 20 and 50 psi *(138 and 345 kPa).*
	CAUTION	**If ENGINE OIL PRESSURE goes below 8 psi (55 kPa) or above 55 psi (379 kPa), the engine will shut down automatically.**
9.	**Tachometer**	Indicates engine speed in hundreds of revolutions per minute *(rpm x 100).*
10.	**Power Source (Option)**	Used for 12 volt accessories.
11.	**Headlight Switch**	First extended position activates panel lights, running lights, clearance lights, and tail lights. Full extended position turns on the headlights. All lights are OFF with switch pushed in. Rotate switch clockwise to brighten or counterclockwise to dim panel lights.
12.	**Wiper/Washer**	Two speed switch controls windshield wiper motor and windshield washer.
13.	**Ignition Key Switch**	Used for activating solenoid to crank engine starter, normal engine ignition operation and powering accessories.
14.	**Gutter Broom Tilt LH (Option)**	Switch used to adjust broom angle of the left hand gutter broom.
15.	**Gutter Broom Tilt RH (Option)**	Switch used to adjust broom angle of the right hand gutter broom.
16.	**Gutter Broom Light Switchs**	Used to turn the GB & front bumber spot lights lights ON.
17.	**Motor Overspeed Light**	Indicates drive motor overspeed, warning to reduce the sweeper speed.



1. Hopper Full Indicator Light
2. Engine Oil Pressure Light
3. Elevator Stall Alarm Light
4. Engine Water Temperature Light
5. Low Engine Water Level Light
6. Not Used
7. Right Hydraulic Tank Level Light
8. Left Hydraulic Tank Level Light
9. Brake Fail Light
10. Brake Differential Light
11. Parking Brake Light
12. Left Turn Signal Light
13. Right Turn Signal Light
14. High Beam Light

(Controls and indicators on front console panel) **Fig: 1.10 A**

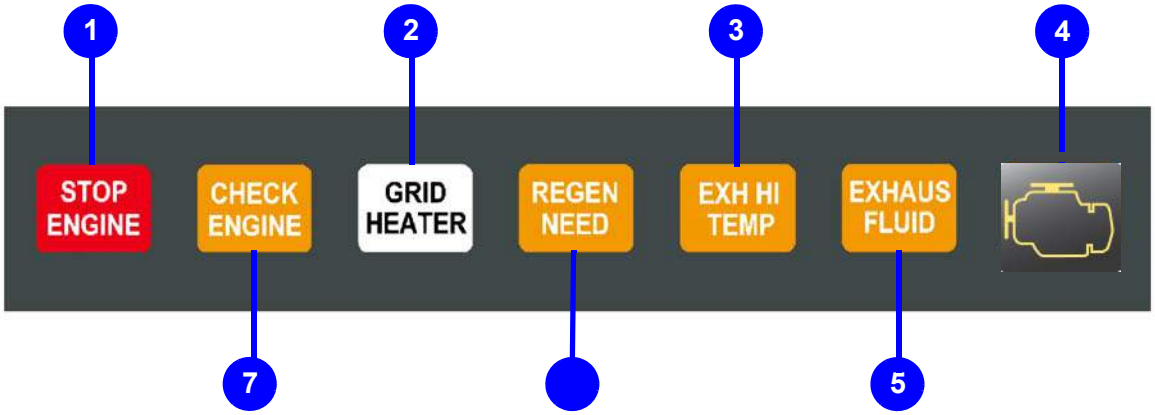
Table 1.3
Kysor AV-1000 Front Console Panel

Index No.	Description	Function/Indication
1.	**Hopper Full Indicator**	Light Indicates hopper reached full capacity.
2.	**Engine Oil Pressure**	Light indicates low engine oil pressure. The minimum engine oil pressure is 15 psi *(103 kPa)* @ idle. The maximum oil pressure is 55 psi *(379 kPa).*
	CAUTION	**If ENGINE OIL PRESSURE goes below 8 psi (55 kPa) or above 55 psi (379 kPa), the engine will shut down automatically.**
3.	**Elevator Stall Alarm**	Light Indicates the elevator stalled and an alarm will sound. *(Immediately bring sweeper to a full stop. Repair the elevator stall problem before proceeding to sweep).*
4.	**Engine Water Temperature**	The engine water temperature alarm comes on when the engine water temperature has reached 225° Fahrenheight, as a warning that the engine is begining to overheat.
	CAUTION	**If ENGINE WATER TEMPERATURE rises above 238° Fahrenheit (114° Celsius), the engine will shut down automatically.**

(continued)

Table 1.3 *(continued)*
Kysor AV-1000 Front Console Panel

Index No.	Description	Function/Indication
5.	**Low Engine Water Level**	Light indicates low engine coolant level. Check engine coolant level at deaeration tank.
		**If ENGINE COOLANT is low, the engine will shut down. Add necessary coolant at deaeration tank.**
6.	**Not Used**	N/A
7.	**Right Hydraulic Tank Level**	Light indicates low traction hydraulic oil level. Check right hand hydraulic tank.
8.	**Left Hydraulic Tank Level**	Light indicates low auxiliary hydraulic oil level. Check left hand hydraulic tank.
		**If HYDRAULIC AUXILIARY or TRACTION oil overheats, stop engine and correct overheating problem.**
9.	**Brake Fail**	Light indicates brake power boost system failure. A reserve electric motor provides the power source for the hydraulic booster. The pumps use is signaled by an internal flow switch.
10.	**Brake Differential**	Light indicates brake fluid system failure. The System is biased, front & rear. When the light is illuminated, the unit has only the front or rear brakes.
		**If BRAKE DEFFERENTIAL light illuminates, Stop sweeper. DO NOT drive for an extended period of time while Brake Fail indicator is ON.** **Correct the brake system failure immediately.**
11.	**Parking Brake**	Light indicates parking brake is ON.
12.	**Left Turn Signal**	When flashing, left front and left rear turn signals operate. All turn signals flash when hazard warning flasher switch is ON.
13.	**Right Turn Signal**	When flashing, right front and right rear turn signals operate. All turn signals flash when hazard warning flasher switch is ON.
14.	**High Beam Light**	Blue light indicates high beam headlights are ON.



Engine Diagnostic Warning Lights Panel

Index No.	Description	Function Indication
1.	**Stop Engine Warning Light**	Light indicates that the engine stopped. Light will stay ON momentarily until the ignition switch is turned to the ON position to start engine.
2.	**Grid Heater Warning Light**	Light indicates that the grid heater needs to warm the air prior to starting. Light will stay on until Grid Heater has reached its operating temperature. When the light goes off, the engine is ready to start.
3.	**Exhaust High Temperature**	The EXH HI TEMP light indicates that the exhaust temperatures are high due to regeneration of the diesel particulate filter. This light could illuminate during normal engine operation or during stationary regeneration.

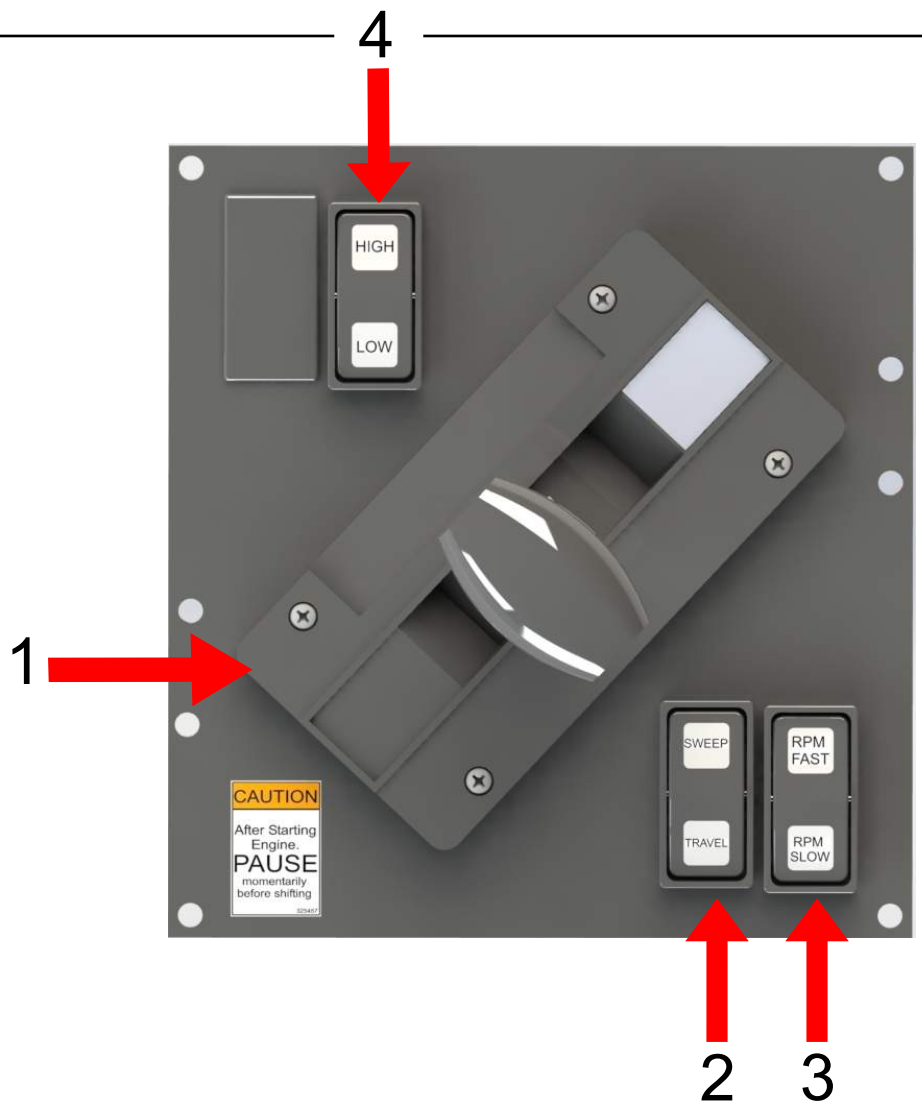
WARNING: When this light is illuminated, the exhaust gas temperature can reach 00 1,500 F), which is hot enough to ignite or melt some materials or make severe burns to people. -Keep the exhaust outlet away from people and anything that can bum, melt, or explode. **Nothing within 2 ft (0.6 m) of the exhaust outlet.**

-In an emergency, turn off the engine to stop the flow of exhaust.
NOTE: The **E H HI TEMP** light does not signify the need for any kind of vehicle or engine service; it merely alerts the operator to the high exhaust temperatures. It will be common for the **E H HI TEMP** light to illuminate on and off during normal vehicle operation as the engine completes regeneration.

4.	**Malfunctioning Warning Light-**	The MIL Illuminates when On-Board Diagnostics system detects a malfunction related to the emissions control system. The Illuminated MIL indicates that the engine and aftertreatment system should be diagnosed and serviced at your next availabe oppurtunity.

Engine Diagnostic Warning Lights Panel
(continued)

Index No.	Description	Function Indication
5.	**Low Level DEF Warning Light**	The DEF low level warning lamp illuminates when the DEF level is low. If the vehicle is operated such that one would run completely out of DEF, the vehicle power will be reduced enough to encourage the operator to refill the DEF tank. Once the tank has been refilled the engine will resume normal power levels.
6.	**Regeneration Needed Warning Light**	This light indicates when illuminated or flashing that the diesel particulate filter requires stationary regeneration. A **STEAD REGEN NEED** light indicates that the diesel particulate filter needs to be regenerated at the next possible opportunity. A **FLASHING REGEN NEED** light indicates that the **engine power may be reduced automatically**. The diesel particulate filter needs to be regenerated at the next possible opportunity. This can be accomplished by: **1)** Changing to a more challenging duty cycle, such as highway driving, for at least 20 minutes. **2)** Performing a stationary regeneration. A **FLASHING REGEN NEED** light combined with an **ILLUMINATED CHEC ENGINE** light indicates that the diesel particulate filter needs to be regenerated immediately. **Engine power will be reduced automatically**. When these lamps are illuminated a stationary regeneration is required. **NOTE:** If a stationary regeneration is not performed, the STOP ENGINE WARNING LIGHT will illuninate and the vehicle will need to be taken to an authorized repair location.
7.	**Check Engine Warning Light**	Light indicates an engine problem. The engine will require diagnostics by a qualified technician with the proper software. If the CHECK ENGINE warning light illuminates, you have approximately 30 seconds to pull over to a safe place before the engine shuts down. Notify a qualified technician to troubleshoot any malfunction.



1. Shifter
2. Sweep Travel Switch
3. RPM Switch
4. Axle Drive Switch

Table 1.8
Shifter Control Panel

Index No.	Description	Function/Indication
1.	**Shifter**	Allows selection of two forward speeds, reverse, and park *(similar to an automatic transmission shifter in a conventional truck).* High and low forward speeds vary the displacement of the hydraulic traction pump *(refer to Table 1.1)*.
2.	**Sweep Travel Switch**	In Sweep mode selection, engine RPM is independent from traction drive. In Travel mode, engine RPM is linked to the Go-Pedal.
3.	**RPM Switch**	Adjusts engine RPM in sweep mode.
4.	**Axle Drive Switch**	Selects rear axle gear ratio. When in High mode, sweeper will travel up to 65 mph. High/Low axle drive switch works independent from High/Low gear Shifter.

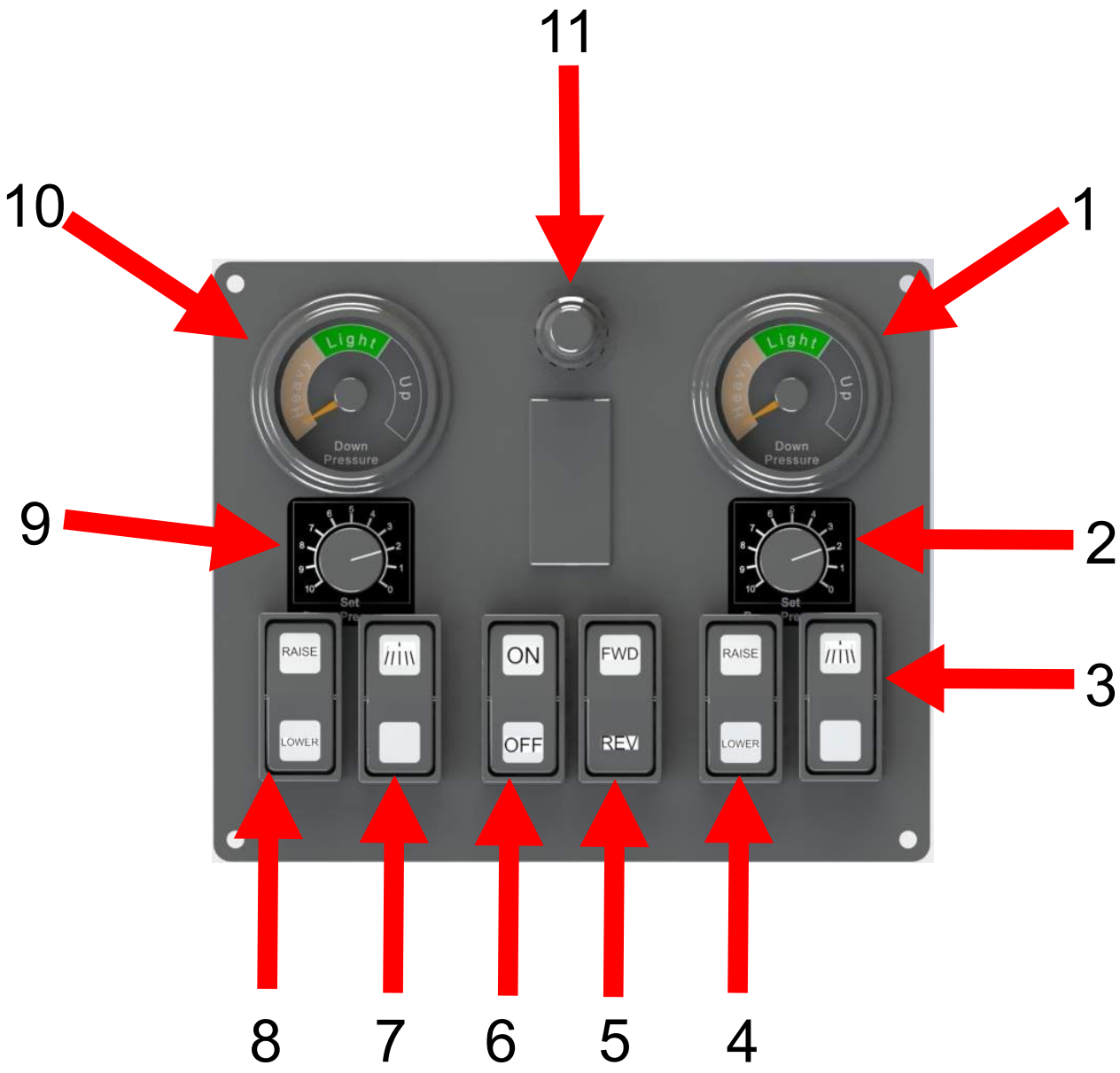


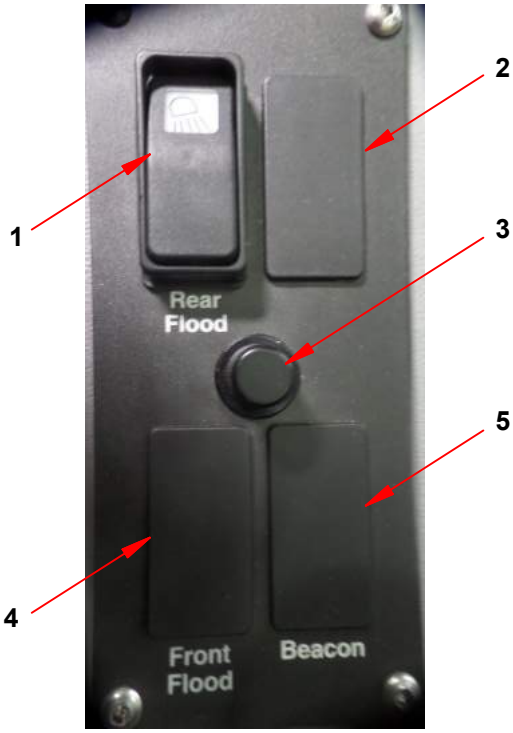
Table 1.6 Elevator/ Broom Control Panel

1- RH Gutter Broom Pressure Guage.
2- RH Gutter Broom Pressure Adjustment.
3- RH Gutter Broom Drive Switch.
4- RH Gutter Broom Raise/ Lower Switch
5- Elevator/ Pickup Drive Broom Low/Raise Switch
6-Ergo On/Off Switch
7-LH Gutter Broom Drive Switch
8- LH Gutter Broom Raise/ Lower Switch
9- LH Gutter Broom Pressure Adjustment
10- LH Gutter Broom Pressure Gauge
11- Gutter Broom Lights

Table 1. *(continued)*

Elevator Broom Control Panel

Index No.	Description	Function Indication
1.	**RH Gutter Broom Pressure Gauge**	Indicates the down pressure of the right hand side gutter broom.
		**DO NOT use the gutter broom as a step to climb onto the sweeper. Personal in ury may occur.**
2.	**RH Gutter Broom Pressure Ad ustment**	Increases or decreases the right hand side gutter broom pressure.
3.	**RH Gutter Broom Switch**	Drives the right hand gutter broom.
		**Stay clear of a rotating gutter broom. Personal in ury may occur.**
4.	**RH Gutter Broom Raise Lower Switch**	Raises or lower the right hand gutter broom to the desired adjustment.
5.	**Elevator Pickup Drive Broom Switch**	Drives the elevator and the pickup broom. Reversing the selection momentary runs the elevator backward (Used to un-clog and clean the elevator).
6.	**Ergo On/Off Switch**	Allows the operator to raise or lower sweep gear with-out readjusting sweep gear settings.
7.	**LH Gutter Broom Drive Switch**	Drives the left hand gutter broom and turns on the flood-light.
		**Stay clear of a rotating gutter broom. Personal in ury may occur.**
8.	**LH Gutter Broom Raise Lower Switch**	Raises or lower the left hand gutter broom to the desired adjustment.
9.	**LH Gutter Broom Pressure Ad ustment**	Increases or decreases the left hand side gutter broom pressure.
10.	**LH Gutter Broom Pressure Gauge**	Indicates the down pressure of the left hand side gutter broom.
11.	**Dash Light**	illuminates switches and gauges



1. Rear Flood Light Switch
2. (Not Used)
3. Dash Light
4. Not Used
5. Not Used

(Controls and indicators on side instrument panel) **Fig: 1.15 A**

Table 1.6
Light Switch Control Panel

Index No.	Description	Function/Indication
1.	**Rear Floodlight Switch**	Activates rear floodlights to illuminate rear.
2.	**(not used)**	
3.	**Dash Light**	Illuminates dash panel.
4.	**(not used)**	
5.	**Beacon Switch**	Activates rotating beacon light. **It is recommended to turn ON the beacon light while sweeping.**

1. Battery Master Disconnect
2. Circuit Breaker Manual Reset
3. Heat Temperature Control
4. Fan Switch
5. Air Circulation Control
6. AC ON/OFF Switch

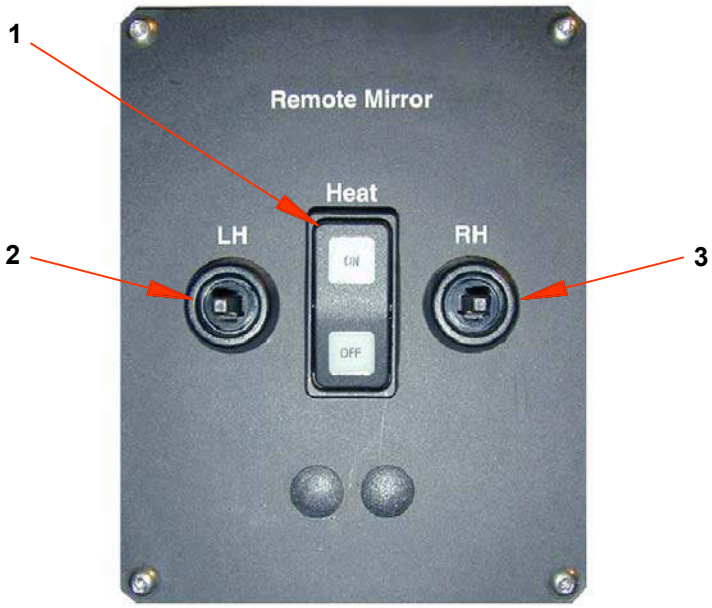
(Controls and indicators on side instrument panel) Fig: 1.16 A

Table 1.7
Master Shutoff Switch & Air Conditioner Control Panel

Index No.	Description	Function/Indication
1.	**Battery Master Disconnect**	Turn knob to ON or OFF to connect or disconnect battery.
2.	**(not used)**	N/A.
3.	**Heat Temperature Control**	Selects desired hot temperature of cab air by directing hot water through heater *(Turn off when using the A/C)*.
4.	**Fan Switch**	Turns heater/air conditioner fan On or Off and selects desired fan speed *(Low, Medium, High).*
5.	**Air Circulation Control**	Selection controls fresh air or recirculating air.
6.	**AC On/Off Switch**	Turns On/Off Air Conditioner.

Table 1.9
Hopper Switch Panel

Index No.	Description	Function Indication
1.	**Air Restriction Guage**	Indicates the restriction of the air flow from the air filter to the engine. This restriction is due to the accumulation of dirt on the air filter. If the gauge indicator is in red area (Above 30 in or 7.5 kPa) replace the air filter.
2.	**Hopper Dump/Retract swicth**	Tilts the hopper to dump and retacts the hopper back to its original position.
3.	**Hopper raise/lower Switch**	Raises the hopper to the dump position. Lowers the hopper to sweeping and driving positions.



1. Mirror Heater Switch
2. Mirror Adjustment, LH
3. Mirror Adjustment, RH

(Controls and indicators on the wall below side instrument panel) **Fig: 1.19 A**

Table 1.10
Remote Mirror Control Panel (Option)

Index No.	Description	Function/Indication
1.	**Mirror Heater Switch**	Heats and Defrosts both left and right mirrors.
2.	**Mirror Adjustment, LH**	Adjust Left Hand mirror in-and-out.
3.	**Mirror Adjustment, RH**	Adjust Right Hand mirror in-and-out.
	CAUTION	**DO NOT adjust the side view mirror while sweeper is in motion.**
	CAUTION	**Make sure you can see clearly through the side view mirror at all times. DO NOT allow anything to block your vision.**

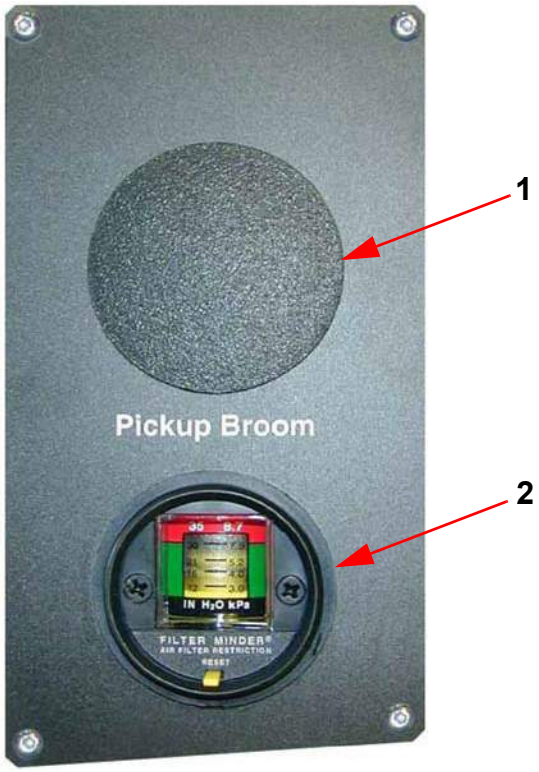


Table 1.11
Pickup Broom Odometer Air Restriction Gauge

Index No.	Description	Function Indication
1.	**Pickup Broom Odometer (Option)**	Indicates the miles swept by the pickup broom.
2.	**Air Restriction Gauge (Option)**	Indicates the restriction of the air flow from the air filter to the engine. This restriction is due to the accumulation of dirt on the air filter. If the gauge indicator is in red area (Above 30 in or 7.5 kPa) replace the air filter.

Fig: 1.22 A

Fig: 1.22 B

STEERING COLUMN CONTROLS

The sweeper has power steering to help you steer the sweeper easily. Never hold the steering wheel in the extreme left or right position for more than five seconds if the engine is running.

The following controls are located on the steering column:

- Turn Signal Lever — You can use the turn signal lever on the left side of the steering column to operate turn signals, turn the headlights to high beam or flash headlights.

  Usually, the turn signals turn off automatically after you turn the sweeper. If the turn signal continues to flash after you have made the turn, pull lever back to the neutral position.

  To indicate a lane change to the right, push the turn signal lever up slightly *(without latching)* and hold it in position. To indicate a lane change to the left, push the turn signal lever down slightly *(without latching)* and hold it in position. The lever will return to the Off position when you release it.

- High Beams — To turn on the high beams, turn the headlights on and push the turn signal lever away from you until it latches. When the high beams are on, the blue high beam indicator lights on the instrument panel is illuminated.

- Tilt Steering Wheel — Pull lever up to adjust steering wheel to desired position then release lever to lock steering wheel in place.

CAUTION

Do not adjust steering wheel while the sweeper is in motion.

- Telescope Steering Wheel — This is the same lever used for tilt steering wheel. To telescope steering push lever down and adjust steering height to comfortable position.

- Horn Pad — To sound the horn, press the center pad on the steering wheel firmly. Check the horn regularly to make sure it operates properly.

- Hazard Flasher Switch — The hazard flasher is used to alert other drivers to hazardous situations.

  The hazard flasher switch operates the same lights as the turn signal lever. When the hazard flasher is activated, all of these lights will flash on and off. The turn signal indicators cannot be used when the hazard lights are flashing. Operation of the hazard flashers does not affect operation of the brakelights.

  To use the hazard flasher, pull the HAZARD switch; you'll see the turn signal arrows flash.

  To stop the hazard flasher, push the HAZARD switch.

Fig: 1.23 A

SEAT ADJUSTMENTS

Perform weight, height, fore and aft seat adjustments prior to driving the sweeper.

- Weight/Ride Air Adjustment — With no weight on seat, set desired weight adjustment. On the bottom right side of seat, push and turn knob to raise/stiffen bounce and pull to lower/soften bounce.
- Height Adjustment—Height of seat is adjustable to four levels. To raise, pull lever on left side and lift seat until it automatically engages. To lower seat, pull lever and let weight of operator push seat down to next level.

  NOTE: *Adjust Tether Belt after changing seat height.*

- Fore and Aft Adjustment — Pull up on left side fore/aft adjustment bar and slide seat to desired position. The operator must be able to comfortably reach all cab controls.
- Arm Rests — Armrests may be positioned up or down. In up setting, arm rests are flush with seat backing.

SAFETY RESTRAINTS

Using safety belt will help to restrain you and your companion in case of rough ride or collision. In most states, the law requires their use.

- Seat Belt Adjustment — Seat belt is a common lift type release with a shoulder harness. Insert the tongue into the buckle until it snaps and locks into place. Adjust belt by pulling extra strap material through buckle.
- Tether Belt Adjustment — Tether belt is a safety device that allows seat to travel up to a maximum distance. Insert the tongue into the buckle until it snaps and locks into place. Adjust belt by pulling extra strap material through buckle.

NOTE: *Adjust tether strap tight enough to eliminate chance of operator from hitting roof of cab during a rough ride.*

SIDE VIEW MIRRORS

Close your door and adjust the driver's seat to the most comfortable position before you adjust the side view mirrors.

If you have a manually adjusting side view mirrors, you can adjust them in any direction by moving the mirror head.

CAUTION

Make sure you can see clearly through the side view mirror at all times. Do not allow anything to block your vision.

CAUTION

Be careful. The convex side view mirrors makes objects appear smaller and farther away than they actually are.

CAUTION

Do not adjust the side view mirror while the sweeper is in motion.

CHAPTER **2**

Sweeper Operation

Diesel Exhaust Fluid For Selective Catalytic Reduction (SCR) Aftertreatment.

If the MIL Lamp is illuminated with the red stop engine lamp, the vehicle should be stopped as soon as it is safe to do so. it should then be taken to an authorized Cummins location for repair.

Illuminated-
An illuminated DEF lamp is an indication that the DEF level is low. This can be corrected by refilling the DEF tank with Diesel Exhaust Fluid.

Flashing DEF-
A flashing DEF lamp indicates that the DEF level has fallen below a critical level. This can be corrected by refilling the DEF tank.

Flashing DEF lamp with Check Engine lamp/ Amber Warning lamp-
A flashing DEF lamp combined with an illuminated Check Engine lamp/ amber warning lamp indicates that the DEF level is critically low and you will experience a power loss. Normal engine power will be restored after refilling the DEF tank.

Flashing DEF lamp with Check Engine lamp/ Amber warning lamp and stop engine lamp-
When you Def gauge reads zero and the engine has been shut down, has idled for one hour after the DEF tank has been run dry or if the vehicle's diesel fuel tank is refilled without refilling the DEF tank, the Stop Engine lamp will also be illuminated, along with the flashing DEF lamp and the illuminated check engine lamp/amber warning lamp. Engine power will continue to be reduced automatically. The vehicle will also be limited to a speed of 5 miles (8km) per hour. Normal engine power and vehicle speed will be restored after refilling the DEF tank.

Diesel Particular Filter (DPR)

High Exhaust System Temperature (HEST) Lamp-
The HEST lamp illuminates to indicate that the high exhaust temperatures may exist due to aftertreatment regeneration. This is normal and does not ignify the need for any kind of vehicle service or engine service. When this lamp is illuminated, ensure that the exhaust pipe outlet is not directed at any combustible surface or material. Reference your Cummins Owners Manual for complete instructions.

Aftertreatment Diesel Particulate Filter (DPF) lamp-When illuminated or flashing, the aftertreatment DPF requires regeneration. This is accomplished by the following.

1. If the vehicle is equipped with a regeneration inhibit Switch, ensure that the switch is not in the inhibit posistion.

2. Perform a DPF regeneration by one of the following methods:

a. change to a more challenging duty cylce. such as highway, for atleast 20 minutes to increse exhaust temperatures.

b. Perform a parked regeneration.

Flashing Regeneration-
If a regeneration is not performed in a timely manner after the DPF lamp is illuminated, the DPF lamp will begin to flash. This indicates a higher level of PM in the DPF. In addition, engine power may be reduced automatically.

Flashing with check engine lamp/amber warning lamp-
Indicates that the aftertreatment DPF needs regeneration immediately. Engine power will be reduced automatically. A parked regeneration is required.

Stop Engine Lamp-
If a parked regeneration is not performed, the red stop engine lamp will illuminate. As soon as it is safe to do so, the vehicle should be stopped. It should then be taken to an authorized Cummins location for repair.

Regeneration Inhibit Switch

The purpose of this switch is to prevent or disable aftertreatment DPF regeneration. Reference the vehicle Owners Manual for complete operation and use of this switch. Unnecessary or excessive use of the Regeneration Inhibit Switch will result in a loss of fuel economy, or an increased need for parked regeneration.

How To **Perform A Parked (Stationary) Regeneration.**

If the vehicle has a Manual Regeneration Switch and the DPF Lamp is flashing:

■ Park vehicle in an appropriate location, set parking brake, and place transmission in Park (if provided) or Neutral, and allow up to one hour for the regeneration.

■ Set up a safe exhaust area. Confirm that nothing is on or near the exhaust system surfaces.

■ Ensure that your fast-idle and Power Take-Off switches are off before starting regeneration.

■ Push the Manual Regeneration Switch to begin a parked regeneration. Note: Engine speed will increase, and there may be a noticeable change to the sound of the turbocharger during the regeneration process.
Once the DPF is regenerated, the engine will automatically return to the normal idle speed.

■ Monitor the vehicle and surrounding area during regeneration. If any unsafe condition occurs, shut off the engine immediately. To stop a parked regeneration, depress the clutch, brake or throttle pedal.

■ Once regeneration is complete, exhaust gas and exhaust surface temperatures will remain elevated for 3 to 5 minutes.
Reference your Cummins Owners Manual and Vehicle Owners Manual for complete operating instructions.

Fuel, Oil And DEF.

■ Use only Ultra-Low Sulfur Diesel (ULSD) fuel.

■ CJ-4 (low ash) is the recommended oil.

■ Be sure to check the DEF gauge at every refueling. Cummins recommends topping off the DEF tank when refueling. DEF meeting ISO 22241-1 must be used.

■ Please read your vehicle manufacturer's Owners Manual to familiarize yourself with the location and capacity of the DEF tank.

■ Put only DEF in the DEF tank, which has a blue cap.

Cummins Care.

Our authorized service technicians are fully trained to promptly handle any type of service issue. Call Cummins Care at 1-800-DIESELS™ (1-800-343-7357), and you'll get 24/7/365 assistance from a Cummins Care representative. If you need service, your Cummins Care representative will locate the nearest available and authorized facility.

Items Driver Will Notice.

■ Under certain conditions (cold or very dry), condensation in the form of water vapor can be seen coming from the vehicle tailpipe. This is normal. It will clear within a few minutes of normal vehicle operation.

■ If the engine is left at idle for significant periods of time without reaching the minimum exhaust operating temperatures, the engine will automatically increase the engine idle speed for several minutes to maintain the condition of the particulate filter. This can be interrupted by pressing either the service brake or the clutch.

■ After prolonged idle, you may notice momentary white vapor and an odor. This is normal.

■ When the High Exhaust System Temperature Lamp is illuminated, you may notice an odor. This is normal. If the odor is excessive and you also notice white vapor, have the exhaust system inspected for leaks.

Tips For Efficient Driving.

1. Lower drive speeds – At interstate speeds, each 1.0 mph (1.6 kph) increase equals a 0.1 mpg (0.04 km/L) decrease. For example, driving at 65 mph instead of 70 mph can save 0.5 mpg (0.21 km/L) and create roughly a 7 percent improvement in fuel economy.

2. Run in top gear more than 90 percent of the time – Every 10 percent drop in time in top gear equals approximately a 3 percent to 5 percent decrease in fuel economy.

3. Decrease idle rpm and idling time – Using the lowest idle speed possible helps reduce fuel use by up to 0.5 gal/hr (1.89 L/hr). Every hour of idle time that you eliminate can increase your vehicle's fuel economy by as much as 1 percent.

4. Follow proper driving habits – Sudden braking, rapid acceleration, early downshifting and other poor driving habits can negatively impact fuel economy by as much as 30 percent.

Additional information is available in our "10 Tips To Maximize Fuel Economy" brochure, Bulletin 4971341, which can be downloaded at cumminsengines.com. Or ask your local Cummins distributor or dealer for a copy.

START–UP CHECKLIST

The condition of the sweeper prior to start–up is a very important factor as it directly affects the operator's safety as well as those around him. It should be a common practice to the operator to perform preliminary inspection on a daily basis. The purpose of the inspection is to keep the equipment in proper working condition and to detect any signs of malfunction. These inspections aid in trouble–free operation reducing wear and mechanical failure.

Daily Check List

1.	Lights	✓
2.	Tires	✓
3.	Water Spray Level	✓
4.	Fuel Level	✓
5.	DEF Fluid level	✓
6.	Air Cleaner Service Indicator	✓
7.	Radiator and Oil Cooler	✓
8.	Belts	✓
9.	Hydraulic Oil	✓
10.	Engine Oil	✓
11.	Engine Coolant	✓
12.	Coolant and Oil Leaks	✓
13.	Brake Fluid	✓
14.	Charge Air Cooler	✓
15.	Service and Lubrication	✓

1. Lights — It is a good idea to check the operation of the following lights frequently:

   ❑ Headlights

   ❑ Taillights

   ❑ Brakelights

   ❑ Hazard Flasher

   ❑ Turn Signal

   ❑ Flood Lights

   ❑ Beacon Lights

2. Tires — Visually check tires for correct inflation daily. Front-tire Manufacturer Recommended air pressure *(9R22.5F)*, Rear=tire Manufacurer recommended air pressure *(315/80R22.5J)*. If one tire looks lower than the others, check the pressure in all of them. Perform inflation checks when tires are cool.

   ❑ Keep your tires inflated to the recommended pressures.

   ❑ Stay within the recommended load limit.

   ❑ Drive sweeper at safe speeds

NOTE: *If you don't take these precautions, your tires may fail or go flat.*

3. Water Level — Check water spray level. Add water as required. *(ref–Filling Water Tank procedure in this chapter).*

4. Fuel Level — Turn ignition key to driving position and observe fuel gauge. Add fuel as required.

5. DEF Fluid Level --- Turn ignition key to driving position and observe DEF Fluid Level gauge. Add DEF Fluid as required.

. Air Cleaner Service Indicator — Check air cleaner service indicator daily. Clean or replace air cleaner filter element before yellow indicator spool reaches red line. Reset indicator after servicing air cleaner.

NOTE: *Frequent air cleaner cleaning is necessary when sweeping under severe dusty conditions.*

7. **Radiator and Oil Cooler** - Check radiator and oil cooler for leaks. Inspect radiator and oil cooler for damage, leaking weldments, and clogged fins. Repair all leaks and clean clogged fins. Visually check mounting screws for proper tightness.

NOTE: *Visually check and clean radiator daily.*

8. Belts — Check all engine driven belts *(commonly referred to as fan belts)* for wear and tension. Belts should reflect 1/2 inch free play when a force of 12 pounds is applied between pulleys. Adjust the AC belt tension as required. Replace worn belts.

9. Hydraulic Oil — Check oil level in each of the hydraulic tank sight gauges located outside of hopper towers. Sweeper must be on a level ground when checking oil level. With engine OFF add hydraulic oil *(ISO 46)* as required.

CAUTION

Do not attempt to check for HYDRAULIC OIL LEAKS without hand and eye protection. Hydraulic oil under pressure can penetrate skin and cause severe injury.

10. Engine Oil — Stop engine before checking engine oil level. Remove dipstick, wipe clean and re–insert into engine. Then remove dipstick and check oil level by observing gradient lines. Oil level should indicate between *Add* and *Full* marks. If necessary, add oil *(15W–40 Must Meet CES 20081)* by removing oil filler cap. Never over fill engine with oil *(Fig 2.4B)*.

NOTE: *When inserting, ensure that dipstick is fully seated to get a proper oil level reading and prevent contamination from entering engine.*

10. **Engine Coolant** — Check engine coolant level at
11. deaeration tank. If coolant is not visible in between maximum and minimum fill lines, wait for radiator to cool, remove filler cap and add coolant as required. *Shell Rotella Prediluted Extended Life Coolant -94042 (RELC)* When filling coolant, open coolant valve on top of engine. When beginning to fill, close valve and continue filling until air bubbles start to come out of engine plumbing.

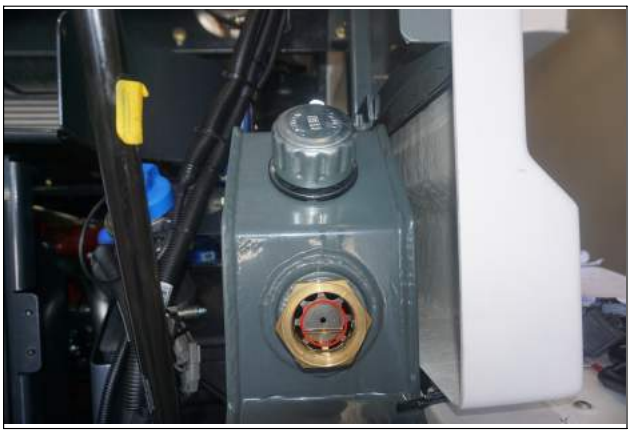


Fig. 2.4 A

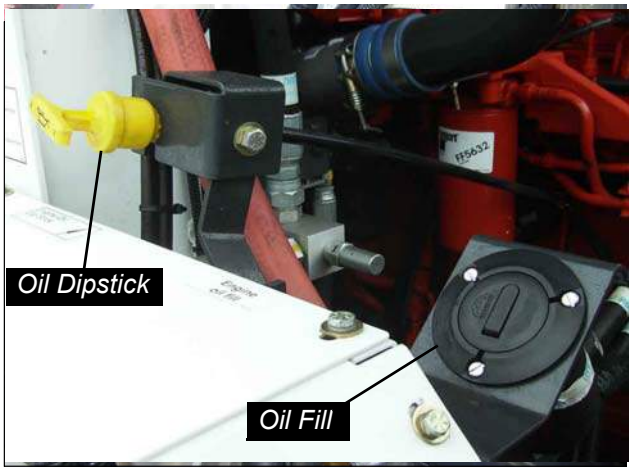


Fig: 2.4 B

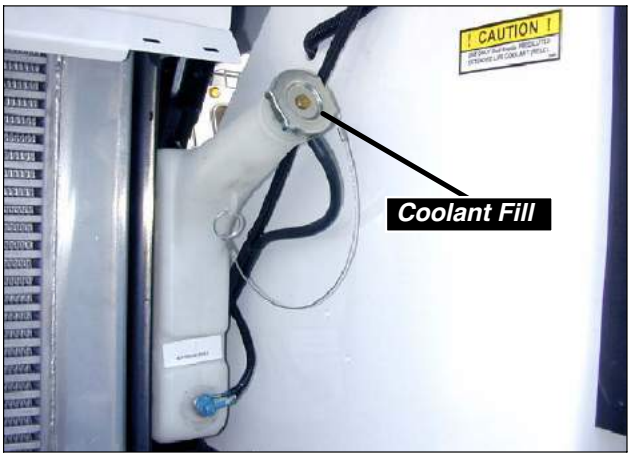


Fig: 2.4 C

WARNING

Never remove deaeration tank cap or any radiator hose when ENGINE COOLANT is hot.

12. **Coolant and Oil Leaks** — Check for fluid leaks by inspecting the surface beneath the sweeper for oil, coolant and other fluid drips.
13. **Brake Fluid** — Check the brake fluid level in the master cylinder. Fluid level should indicate between *Add* and *Full* marks. If necessary, add fluid *(Brake Fluid DOT 3 or equivalent)*.
14. Charge Air Cooler — Check charge air cooler for eaks.
15. **Service and Lubrication** — Perform all daily service and lubrication functions.

(Master Cylinder Reservoir) Fig: 2.5 A

Fig: 2.5 B

STARTING ENGINE

As previously indicated, it is important from a safe operational standpoint that you the operator know your sweeper before starting the engine. This means knowing the function of each control as to what happens when it is activated, how it might interact with other functions and any limitations that might exist. A good understanding of the controls and capabilities will enhance operation and assure maximum operating efficiency and safety.

Ignition Positions

The sweeper's ignition has four positions:

❑ OFF position allows you to shut off the engine and all accessories.

***NOTE:** The **OFF** position is the only position that allows you to insert and remove the key from the ignition.*

❑ ON position allow you to test the sweeper's warning lights to make sure they work before you start the engine. The key returns to the ON position once the engine is started and remains in this position while the engine runs.

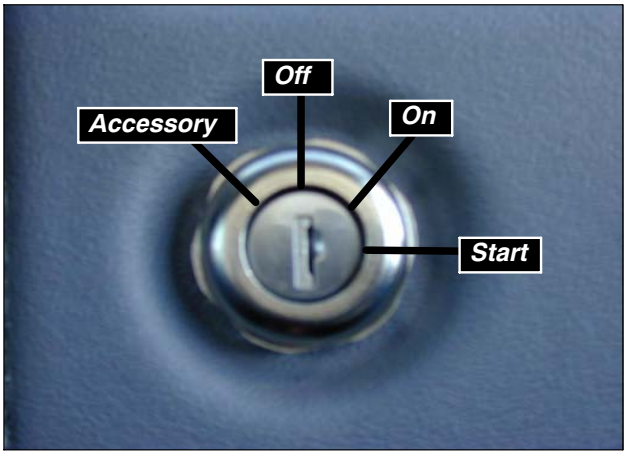


Fig: 2.5 C

CAUTION

Release the key once the engine starts so that you do not damage the starter.

❑ START position allows you to crank the engine. Release the key once the engine starts so that you don't damage the starter.

❑ ACCESSORY position allows you to operate some of the sweeper's electrical accessories while the engine is not running.

Before starting the Engine

Before you start the sweeper, always:

1. Make sure you close and lock the door.
2. Make sure you fasten your safety belt.
3. Make sure you adjust the rearview mirrors.
4. Make sure the sweep gear, headlights and other accessories are turned OFF when starting the engine.
5. Make sure that the shifter is in *Park (P)* position before you turn ON the ignition key.

Starting the Engine

Normal starting procedure will fire up the engine in most conditions. To start the engine:

1. Make sure the shifter is in *Park (P)* position. The engine will not start with shifter in any other position.
2. Place the Speed Travel Switch to *Travel* mode *(make sure that the GB switch is in the "OFF" position)*.
3. Insert and turn the Ignition Key Switch to ON position. Check the dash controls and monitor instruments.
4. Proceed to turn the Ignition Switch to the far right to engage starter. As soon as the engine has started, release ignition key switch allowing it to automatically return to ON position.

CAUTION

Do not engage the STARTER MOTOR for more than 30 seconds at a time. Allow the starter motor to cool for at least 3 minutes between starting attempts to avoid heat damage to the starter motor.

5. Do NOT press on the accelerator until the engine has started and the status indicator lights on the dash monitor have turned off, as this will enter an unnecessary fault code in the engines' computer system.
6. The engine oil pressure gauge should read 20 PSI minimum within 30 seconds. If the oil pressure is low, immediately turn the Ignition Key to OFF position. Notify a qualified mechanic to determine and correct cause of low oil pressure.
7. Allow the engine and hydraulic pumps to warm up for a few minutes before driving the sweeper or performing any hydraulic operations.

Vehicle Warm-up Procedure

It is recommended that a short warm–up period between 10 to 15 minutes be part of the pre–operating procedures for the sweeper. This warm–up period will allow the oil in the hydrostatic drive system to reach the desired temperature and consistency for safe and smooth operation.

Stopping the Engine

1. Allow the engine to idle 3 to 5 minutes before shutting it off after a full–load operation. This allows adequate cool down of pistons, cylinders, bearings, and turbo–charger components.
2. Turn OFF all the sweeping functions and accessories.
3. Turn the ignition keyswitch to the OFF position.

DRIVING THE SWEEPER

Always operate the sweeper within reasonable limits. Abrupt changes in acceleration, deceleration, turning, or combinations of both of these maneuvers can cause the sweeper to behave differently than anticipated, especially when road conditions vary.

Use greater care until you become accustomed to its features and characteristics.

There are two distinct methods of driving sweeper. One is the normal street or highway travel mode and the other is the sweep–driving mode. Sweep–driving mode is simply driving the unit with the sweep gear lowered and operating.

NOTE: *In a safe area designed specifically for training, first time operators should practice driving, turning, accelerating, stopping and familiarizing themselves with the G lobal-M4 Series sweeper.*

Observe all safety precautions while operating the sweeper.

Driving in Normal Conditions

1. Position yourself in the driver's seat and make adjustment to your comfort.

2. If necessary make adjustment to the steering wheel height *(telescope)* and tilt.

3. If necessary adjust your side view mirrors.

4. With the engine running, check that all sweep gear is in the OFF position. Press the hopper switch to lower to make sure it is completely down or traction system will not shift into gear with hopper out of travel position.

5. Actuate Travel/Sweep Switch to *Travel* position.

6. Select High or Low axle speed switch.

   ❑ The two speed axle switch High – Shifter Position Lo (L) maximum speed is 23-25 MPH (37 - 40 km/h).

   ❑ Speed axle switch Low – Shifter Position Lo (L) maximum speed is 15 - 17 MPH (24 - 27 km/h).

NOTE: *High and Low speed axle switch can only be changed while shifter is in Park (P) position.*

Do not shift to PARK while sweeper is in motion.

7. Place shifter to Hi (H) or Lo (L) position.

   ❑ Shifter Position Hi (H) – Speed axle switch High maximum speed is 54 - 57 MPH (87- 92 km/h).

   ❑ Shifter Position Hi (H) – Speed axle switch Low maximum speed is 42 - 46 MPH (67-74 km/h).

8. Activate accelerator pedal to regulate travel speed. Hold foot on accelerator pedal to stabilize speed.

9. When reducing sweeper speed, slowly remove pressure from the accelerator pedal.

When go-pedal is fully released, hydraulic drive system automatically applies hydrostatic braking. Wheel brake is applied with the foot brake pedal.

Do not drive sweeper with your foot resting on the brake pedal.

10. To drive in reverse, position shifter in *Reverse (R)* and step on the accelerator pedal. When backing up sweeper, warning alarms sounds and back up light illuminates cautioning bystanders to stay clear.

NOTE: *Make sure the sweeper is completely stopped before shifting into Reverse (R).*

Whenever sweeper is traveling at slow speed, Tuarn ON beacon flasher as a safety precaution.

Fig: 2.8 A

Driving in Hazardous Conditions

Adjust your driving to the weather and road conditions. When hazardous driving conditions are encountered, drive cautiously.

- ❑ Fog: If fog becomes so thick that you can barely see, pull completely off the road.
- ❑ Heavy rain or Snow: Slow down at the first sign of rain, drizzle, or snow on the road. This is when many road pavement surfaces are most slippery.
- ❑ Hills and Curves: When you encounter a steep hill or sharp curve, slow down enough to be able to stop.

CAUTION

If the sweeper breaks down on the road, pull over and turn ON your emergency flasher lights.

SWEEPING

The efficiency of a good sweeping operation is moving at a travel speed consistent with the type of debris and area to be swept. Too fast of a travel speed will only stir up the debris and result in a hit and miss operation. It is for this reason that rate of speed be minimized as dictated by your experience and sweeping conditions.

Filling the Water Tanks

1. Check that drain valves are closed as well as the water spray system control valves in the cab.
2. Remove cap from hydrant and using hydrant tool, open valve and allow water to run to flush out dirt and other foreign objects. Turn off hydrant.
3. Connect filler hose to hydrant and slowly open hydrant valve. Fill water tank.

WARNING

Stand clear from the fire hydrant hose when filling tanks. A high volume of water travels through hose under high pressure.

4. After filling slowly close hydrant valve, disconnect filler hose and drain water in hose. Replace hydrant cap and restore hose and tools in compartment.

CAUTION

Do not fill water tanks with CONTAMINATED water. Take extra care as high pressure exists in hydrant system.

Preliminary Sweeping Procedure

1. Check pickup broom pattern daily. An out–of–adjustment pickup broom will result in poor sweeping performance.

NOTE: *Pickup broom adjustments are made in the shop area by an experienced mechanics.*

2. Adjust gutter broom pressure using the gutter broom pressure adjustment knobs located inside the cab.

NOTE: *Careful attention to gutter broom pattern and arm angle will aid in maximum sweeping efficiency.*

3. Check water spray level. Fill water tanks if required.
4. Check water spray nozzle jets for obstruction.
5. Turn water pump switch ON.

Driving in Sweep Mode

With water tanks full and having arrived at the sweep area stop sweeper and set the various hydrostatic drive controls to the appropriate position for SWEEPING MODE.

1. Determine from your experience the best travel speed to enable an efficient and satisfactory sweep operation.

   ❑ Travel/Sweep Mode Switch – Place the switch in SWEEP position.

   ❑

   RPM Switch -- Adjust the engine RPM speed until TACHOMETER read out is around 2300 RPM. *(Do not exceed 2600 RPM)*

   ❑ Shifter – Move shifter to LO (L) position.

2. Turn ON Emergency Flashers, Rotating Beacon and other warning lights.

3. Lower gutter brooms to pavement by actuating the GB RIGHT and GB LEFT switches to LOWER. Hold down switch and check DOWN PRESSURE gauge for setting.

4. Actuate GB DRIVE switches to start rotation operation of brooms. One or both brooms may be used depending on the sweep application.

5. Lower the PICKUP broom by actuating the switch to LOWER.

6. Start operation of pickup broom and elevator by actuating DRIVE switch to FORWARD position. Both operate from same switch.

7. Activate water spray system by placing water pump switch to ON position.

8. Turn ON and adjust water volume to each spray bar of the gutter broom and front nozzle bar by controls located behind buddy seat.

9. Step on the go–pedal to start sweeping. Travel speed can be varied to maximum sweep speed by the accelerator pedal.

CAUTION

Remove large objects from the sweeping path and manually load large objects through the hopper access door.

10. Continuously monitor all instruments and gauges while sweeping.

11. Using the rear view mirrors, observe the swept path to ensure it is clean. If not, stop and determine the cause of the problem.

CAUTION

Observe all local and state traffic laws and regulations.

WARNING

Avoid sweeping near bystanders and take extra precautions in and around congested areas.

DUMPING

During the sweep operation or at the end of shift, it may be necessary to empty collected debris from the hopper. The hopper is designed to dump from the right hand side of the sweeper. The large hopper discharge door allows un-loading of debris into a trash bin at the sweep site or at the dump site.

Before Unloading the Sweeper

Before you unload the sweeper, always:

1. Make sure sweeper is parked firmly on level ground

2. Check overhead area above the sweeper for any obstructions such as trees, power lines, street lighting or street signs.

3. Make sure bystanders are clear from the sweeper.

Unloading Procedure

1. Place shifter in *Park (P)* position to engage parking brake.

2. Actuate hopper switch to *Raise* and continue to hold switch until hopper is fully elevated.

WARNING

Unloading a full hopper changes the sweeper's center of gravity and can tip the sweeper resulting in severe injury or property damage. DO NOT raise hopper unless sweeper is parked firmly on level ground.

CAUTION

Stay clear of electrical power lines and other overhead obstructions. A clearance of approximately 12 to 15 feet is required.

WARNING

As the hopper is being unloaded, debris in the hopper will be discharged. Be sure bystanders are clear from sweeper until hopper is emptied.

3. Once the hopper is empty and cleaned out, actuate the hopper switch to *Lower* position and hold until hopper is fully lowered.

NOTE: *Sweeper will not shift into gear with hopper still out of travel position.*

Raising the Hopper

Sometimes it is necessary to raise hopper in order to clean inside the hopper, check the engine, or check the elevator. When raising hopper other than unloading, install safety props on the both hopper cylinder rods.

CAUTION

Do not raise hopper unless sweeper is parked on firm, level ground.

1. Always use safety props when working on, around, or under raised hopper.

2. Always install safety props on both sides of scissor base.

3. Never position yourself under hopper while installing or removing safety props.

4. Be sure to clear any obstructions under the hopper and remove safety props before lowering the hopper.

WARNING

Hopper may drift downwards when lift cylinders are not fully extended.

Serious injury or death may result if hopper cylinders fail.

Auxiliary Hopper Lift

If engine is inoperable, the hopper can still be lifted using the auxiliary dumping ports and a portable hydraulic pump.

1. Connect suction port from hydraulic tank to an external portable hydraulic pump *(5 to 10 GPM @ 2500 PSI).*

2. To raise the hopper, connect return line to the lower port. *(Fig: 2.11A).*

3. To lower the hopper, connect return line to the upper port. *(Fig: 2.11A).*

4. Always install safety props when hopper is in raised or dump position.

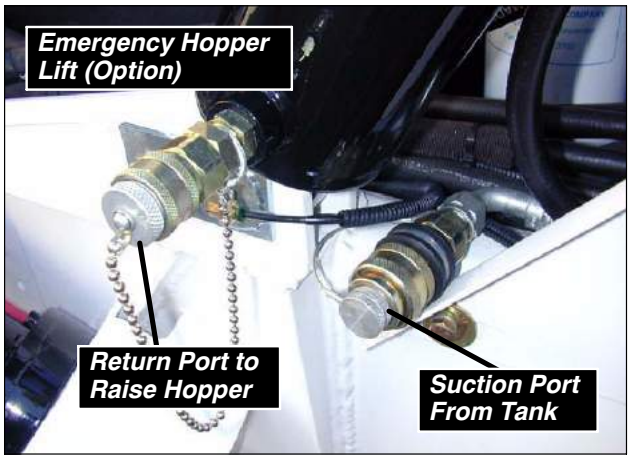


Fig: 2.11 A

Fig: 2.11 B

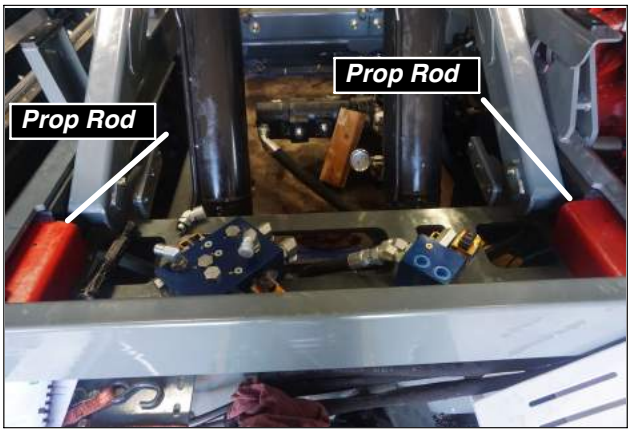


Fig: 2.11 C

ELEVATOR STALL

The M4HSD Series sweeper includes optional Elevator Stall Alarm. When the elevator is running a sensor continuously detects the target point on the sprocket and sends an impulse signal to the stall alarm system. Once the signal is interrupted, after a five second delay, an alarm will sound indicating the elevator has stalled. An elevator stall condition is usually caused by an obstruction in the eleva-tor. Clear obstruction from elevator area before proceed-ing to sweep.

Clearing Obstruction from the Elevator

To clear obstruction from the elevator:

1. Bring the sweeper to a complete stop.
2. Place the shifter in *Park (P)* position.
3. Adjust the engine speed to approximately 1500 RPM.
4. Jog elevator/pickup broom switch to *Reverse*, *Off*, then *Forward* every few seconds until obstruction is cleared.

NOTE: If stall condition continues after several attempts to remove obstruction, drive sweeper to dump site and empty hopper.

With the hopper raised:

1. Stop the engine.
2. Install the hopper safetly props on scissor base .
3. Remove the obstruction from the elevator.

WARNING

Stay clear of running elevator. Personal injury may occur.

NOTE: With hopper raised, install safety prop on scissor base. Safety prop rests on top scissor base. Install safety props on both sides.

PARKING THE SWEEPER

Park sweeper in an area designated only for large vehicles. Abide all local and state highway parking rules and regulations.

Always come to a complete stop before you place the shifter to *Park (P)* position. This position automatically engages the parking brake and prevents the wheels from turning.

Pa rking procedures

1. Bring sweeper to a complete stop.
2. Place shifter to *Park (P)* automatically activating parking brake.
3. Raise sweep gear and turn off elevator.

CAUTION

Damage may occur to bristles if sweeper is parked with brooms down.

4. Turn Off all switches including headlights, floodlights, beacon lights and rear flashers.
5. Turn off water pump switch and shut-off water spray valves
6. Allow the engine to idle for 3 to 5 minutes before turning off the ignition.

WARNING

Turn off the ignition whenever you leave the sweeper. Do not leave the sweeper unattended while the engine is running.

NOTE: *When parking the sweeper always make sure to raise the pickup broom and the gutter brooms to their up position.*

Fig: 2.12 A

Fig: 2.12 B

Fig: 2.12 C

TOWING THE SWEEPER

If towing is necessary, Global Environmental Products, Inc. recommends having it done by a commercial tow–truck service. Proper lifting and towing procedures are necessary to prevent damage to the sweeper. State and local laws applicable to vehicle in tow must be followed. Do not tow sweeper without strict adherence to instructions in this manual. Strict procedures must be performed before towing to alleviate further damage to inoperable sweeper.

Emergency Towing

CAUTION

Do Not tow sweeper more than 100 feet using the emergency towing procedure. Serious damage may occur.

NOTE: *The rear wheels will not turn during emergency towing procedure due to parking brake engagement. Rear tires will skid as the sweeper is being dragged.*

1. Hitch front end of sweeper to towing vehicle *(use rigid tow hitch).*

2. Tow vehicle out of emergency situation.

NOTE: *An alternative to towing is to transport the sweeper on a flat bed truck or trailer*.

Special Towing Instructions

1. Follow all state and local laws that apply to vehicle in tow including warning signals, night illumination, speed, etc.

2. Always use safety chains.

3. Sweeper should not be towed at speeds in excess of 20 mph (32km/h).

4. Remove any loose or protruding parts of sweeper prior to moving.

5. A safety chain system completely independent of the primary lifting and towing attachment must be used.

Fig: 2.13 A

Fig: 2.13 B

Fig: 2.13 C

6. Use only equipment designed for this purpose.

7. No towing operation should be attempted that for any reason jeopardizes the safety of the operator or any bystanders or other motorists.

Rear End Towing Procedure

CAUTION

Do Not tow sweeper more than 100 feet using the emergency towing procedure. Serious damage may occur.

Only tow sweeper from rear using a proper tow bar spreader.

Do not exceed over 20 mph while towing sweeper. Use extreme caution. Use proper tow-vehicle lighting. Observe local towing regulations.

1. Using a proper tow bar spreader, hitch the rear end of the sweeper to the towing vehicle through tow bars on the back of sweeper.

2. With the rear of the sweeper hitched to the towing vehicle, raise the rear wheels off ground.

3. Ensure that the front wheels spin freely.

4. Make sure that the front wheels are aligned in the straight ahead position and the steering wheel is securely locked.

CAUTION

Secure steering wheel when towing sweeper from the rear otherwise serious damage may occur.

Unhitching the Sweeper From the Towing Vehicle (Rear End Towing)

1. Lower sweeper to ground and unhitch tow bar from sweeper.

2. Remove tow bar and chain from towing vehicle.

Front End Towing Procedure

WARNING

Chock wheels before preparing sweeper for towing.

First remove axle shafts, then release parking brake before towing sweeper.

1. Chock the rear wheels.

2. Remove the axle shafts from left and right wheel hubs. With axle shafts removed, axle ends must be capped to prevent dirt and water from entering axle. Store axle shafts and related parts in rear fender tool box.

NOTE: *An alternative method to preparing sweeper for towing is to remove the drive shaft and universal joints (instead of axle shafts) from rear axle differential.*

3. Hitch the front end of the sweeper to the towing vehicle *(use rigid tow hitch).*

CAUTION

Use proper tow-vehicle lighting. Observe local towing regulations.

4. Disengage the parking brake by mechanically un–screwing the parking brake turnbuckle counterclockwise *(relative to brake canister)*, until the spring is compressed. Screw turnbuckle clockwise to engage parking brake.

5. With the front end of sweeper hitched to towing vehicle, raise the front wheels off ground.

6. Ensure that the rear wheels spin freely with axle shafts removed and parking brake disengaged.

7. Remove the wheel chocks.

NOTE: *Remove the front magnet or front basket option before towing sweeper from the front.*

Unhitching the Sweeper From the Towing Vehicle (Front End Towing)

1. Install the wheel chocks after towing transportation is complete.

WARNING

Chock the wheels before unhitching sweeper from tow vehicle.

First engage the parking brake, then replace sweeper the axle shafts.

2. Remove the parking brake hairpin from linkage screw. Engage the parking brake by mechanically screwing the parking brake turnbuckle clockwise *(relative to brake canister)* until spring is de-compressed.

3. Replace the parking brake release hairpin in linkage the screw.

4. Lower the sweeper to ground and unhitch it from the towing vehicle.

5. Check the parking brakes for proper operation.

6. Remove the axle end caps and replace the axle shafts. Torque the axle end cap nuts at 65 to 75 foot pounds.

7. Remove the wheel chocks.

JACKING THE SWEEPER

There will come a time when it may be necessary to safely jack the sweeper to a position where you can either, access components under the sweeper, remove one or more wheel(s), raise the sweeper to lower vehicle components when otherwise impossible *(ie. rear axle)* or just replacing components which will make it easier to service the sweeper raised up. In any case, it is recommended that the operator must always read and understand the sweeper's manual before attempting any service items. You will be required to know and identify the factory approved "jack points". These jacking points can be found under Jacking Procedure in the Service's Manual.

- Jack – stands and a floor jack must be strong enough to lift and support the sweeper's weight (about 16,600 lbs for an empty sweeper).

- Before you consider jacking up a sweeper, find as flat/level a work area as possible. This is essential as you do not want to have a sweeper leaning while up on jack stands.

CAUTION

If you can not find a nearly level work area, DO NOT attempt to jack the sweeper up!

- If you are jacking the rear of the sweeper, be sure to chock the front wheels.

- If you are jacking the front of the sweeper, be sure to chock the rear wheels.

NOTE: *The basic concept with chocking and locking the wheels (brakes) is to prevent the sweeper from shifting or rolling during the jacking procedure and through out the entire servicing procedure.*

CAUTION

Safety is everyone's responsibility. Do not take any chances to compromise personal safety and/or others around you.

Fig: 2.15 A

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CHAPTER **3**

Sweeper Adjustments

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PICKUP BROOM ADJUSTMENTS

There are several adjustments that must be checked in order to maintain satisfactory sweeping. Learn the procedures carefully to obtain the best results.

Pressure adjustment and Coning adjustment to the pickup broom must be checked daily to ensure sweeping efficiency and achieve maximum broom life. Pressure adjustment needs to be performed daily. Coning adjustments on the other hand, *(also referred as leveling)* rarely requires adjustment but it should also be checked regularly.

The broom pattern is the width and length of the polished area made on the ground by the pickup broom when the broom is turning while the sweeper is standing still.

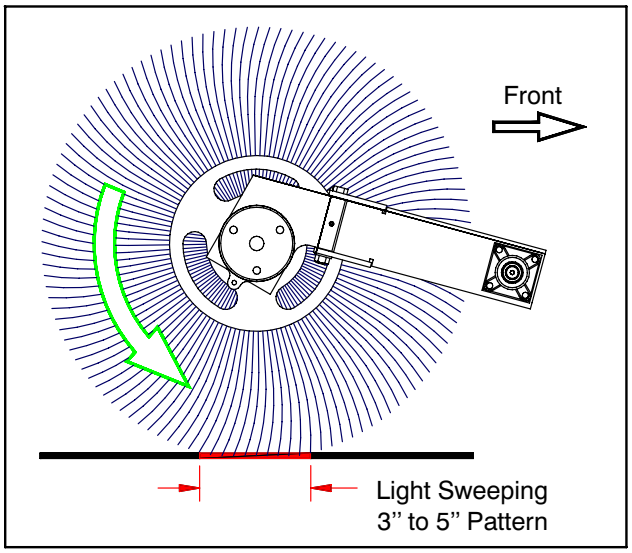


Fig: 3.3 A

Pickup Broom — Pressure Adjustment

Check tire pressure prior to testing pickup broom pattern to ensure proper adjustment. Recommended pickup broom pressure patterns are 3 to 5 inches for light sweeping and 5 to 7 inches for heavy sweeping *(Fig:3.3 A&B)*. Too much broom pressure produces a wide pattern causing broom life to be significantly cut down. If pattern is too narrow, broom will not sweep cleanly. To test broom pattern, proceed as follows:

1. On level ground, select a test area to run a broom pattern test. With all brooms off and raised, drive sweeper onto test site. Stop machine and place shifter in *Park (P)*.

2. Turn *ON* the elevator/pickup broom drive switch. Run for approximately 10 seconds at maximum1800 RPM.

3. Turn *OFF* elevator/pickup broom switch. Raise pickup broom and drive sweeper clear from pattern test area.

4. Place shifter in *Park*, shut down sweeper and exit cab to examine pattern.

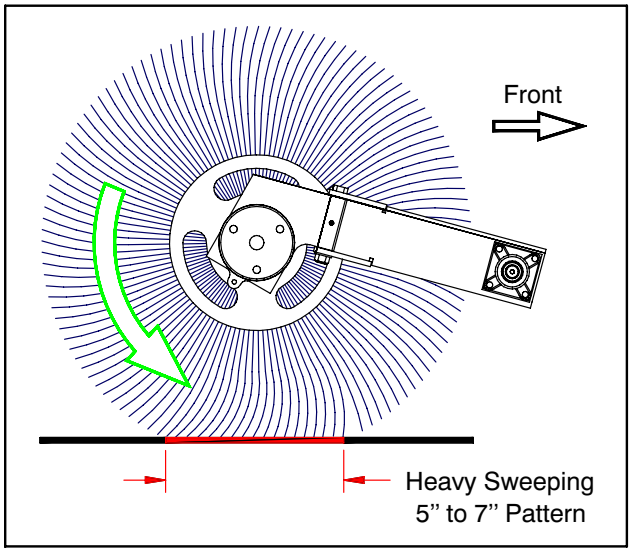


Fig: 3.3 B

5. Measure pattern *(Fig: 3.3 A&B)*.

   a. If not enough pressure exists, measurement is narrow and broom does not sweep clean.

   b. If too much pressure exists, measurement is wide and excessive broom wear results.

   c. If pattern measurement is not equal on both sides, repeat steps 1–5 with sweeper facing opposite direction and broom under the same test

site. If pattern is unequal on the opposite side, pickup broom coning exists *(ref – Coning Adjustment)*. If the pattern is unequal on the same side, test surface is not level.

6. Adjust pickup broom pressure from left side of sweeper by changing position of float spring linkage on threaded adjustment bolt *(Fig: 3.4B)*.

7. If narrow pattern exists, increase pickup broom pressure.

   a. Turn pickup broom spring linkage adjustment bolt clockwise to increase broom pressure *(Fig: 3.4B)*.

8. If wide pattern exists, decrease pickup broom pressure.

   a. Turn pickup broom spring linkage adjustment bolt counterclockwise to decrease broompressure *(Fig: 3.4B)*.

CAUTION

Do not over-adjust bolt counterclockwise. If pin shears, adjustment rod will pull out from bottom of bracket.

9. Repeat steps 7, 8 and 9 until desired pickup broom pressure pattern is achieved.

***NOTE**: Adjust pickup broom pressure by raising or lowering spring linkage adjustment bolt on left side of sweeper. Turn clockwise to increase broom pressure and counterclockwise to decrease broom pressure.*

Pickup Broom — Snubber Adjustment

Snubber adjustment *(broom free play)* controls side to side pickup broom movement. Properly adjusted freeplay helps eliminate broom bounce while sweeping as well as reduce wear on pickup broom bristles by allowing it to spin concentric. The adjustable pickup broom shaft collar is on the right side of sweeper opposite of the hydraulic drive motor.

1. Follow standard procedures for lowering the pickup broom. Turn *Off* engine.

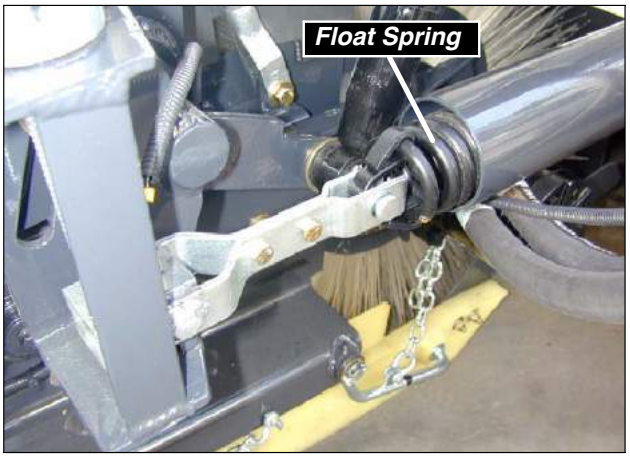


Fig: 3.4 A

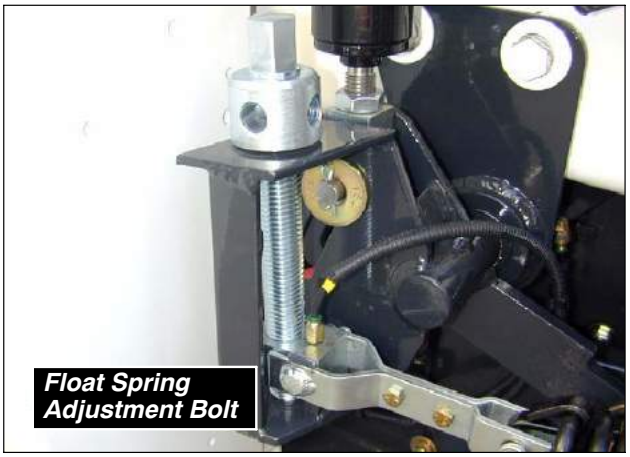


Fig: 3.4 B

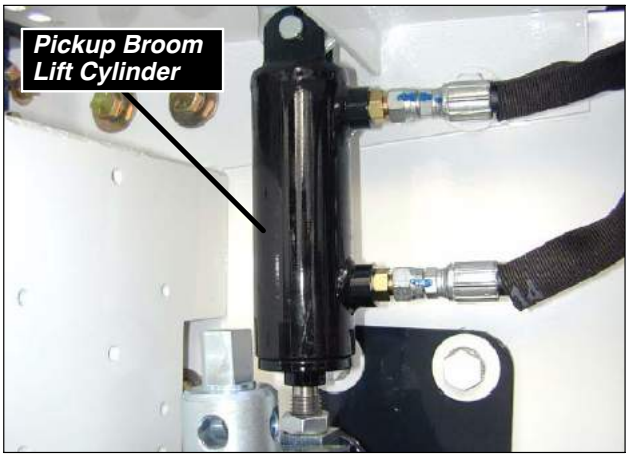


Fig: 3.4 C

2. On the four (4) bolt flange bearing an adjustment collar *(snubber)* is located inward from the shaft. Loosen two set of grub screws on adjustment collar behind shaft nut *(Fig: 3.5B)*.

3. Remove cotter pin from pickup broom shaft nut and adjust assembly free play by turning shaft nut. Tighten to reduce free play and loosen to increase free play. Correct free play adjustment is set at 1/32 of an inch *(or slight drag)*.

4. Check pickup broom snubber for proper clearance. The broom should slightly drag when spun.

5. Replace broom shaft cotter pin.

6. Tighten two grub screws on collar.

NOTE: *Pickup broom shaft has several cotter pin holes located at various thread depths to allow proper snubber adjustment.*

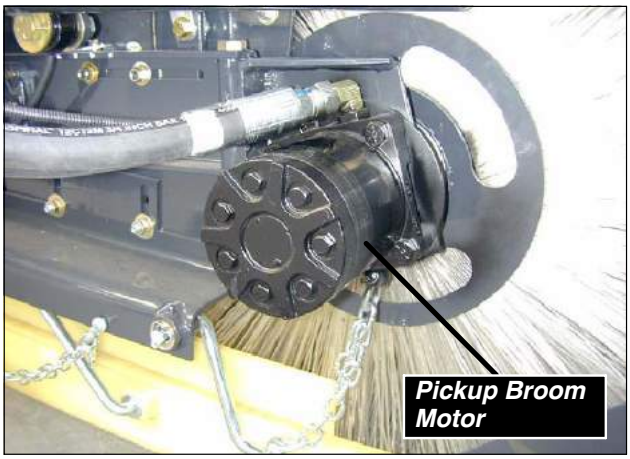


Fig: 3.5 A

Fig: 3.5 B

Pickup Broom — Coning Adjustment

A level pickup broom will increase broom life as well as improve sweeper performance. The pickup broom requires coning adjustment if either of the following conditions exist:

- ❑ Broom pattern measures wider on one side.
- ❑ Broom bristles are wearing quicker on one end.

Measure the length of bristles on each end of broom. If bristles vary slightly, an immediate adjustment will correct problem and extend broom life. However, if bristles on each end of pickup broom vary more than a 1/2 inch, it may be difficult adjusting the broom to wear evenly again.

Pickup broom arms are connected to a shaft and adjustable clevis assemblies. The clevis assemblies are separate from the float spring linkage on left side of the sweeper. Although both left and right clevis assemblies are adjustable, it is common to only adjust the right side when leveling the pickup broom *(Fig: 3.6A)*.

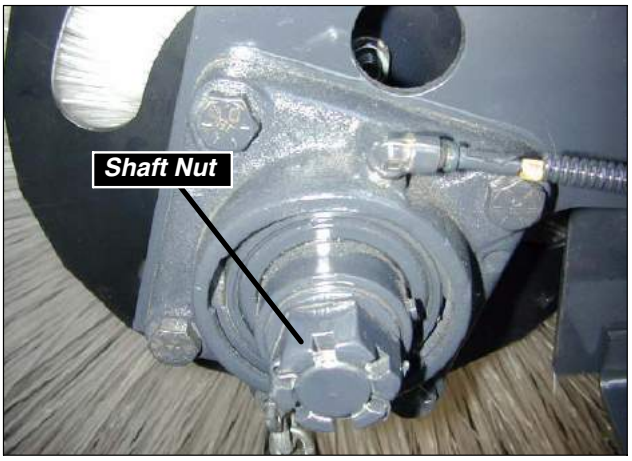


Fig: 3.5 C

Proceed as follows to make adjustments:

1. Park sweeper on a clean, level surface and raise pickup broom.

NOTE: *Pickup broom arm measurement is dependent on a flat level surface.*

2. Measure distance from left pickup broom arm to level surface. Then measure distance from right pickup broom arm to level surface.

3. If right and left measurements are not equal, adjust the right clevis assembly that connects right pickup broom arm to lift assembly.

   a. Loosen lock nut and turn clevis to adjust length of clevis assembly until left and right *"arm to ground"* measurements are equal.

   b. Tighten lock nut against clevis.

NOTE: *Adjust pickup broom coning by raising or lowering right side of broom assembly. Turn adjustable clevis clockwise to raise and counterclockwise to lower right side of broom.*

CAUTION

Stay clear from running pickup broom. Personal injury may occur.

Fig: 3.6 A

Fig: 3.6 B

Fig: 3.6 C

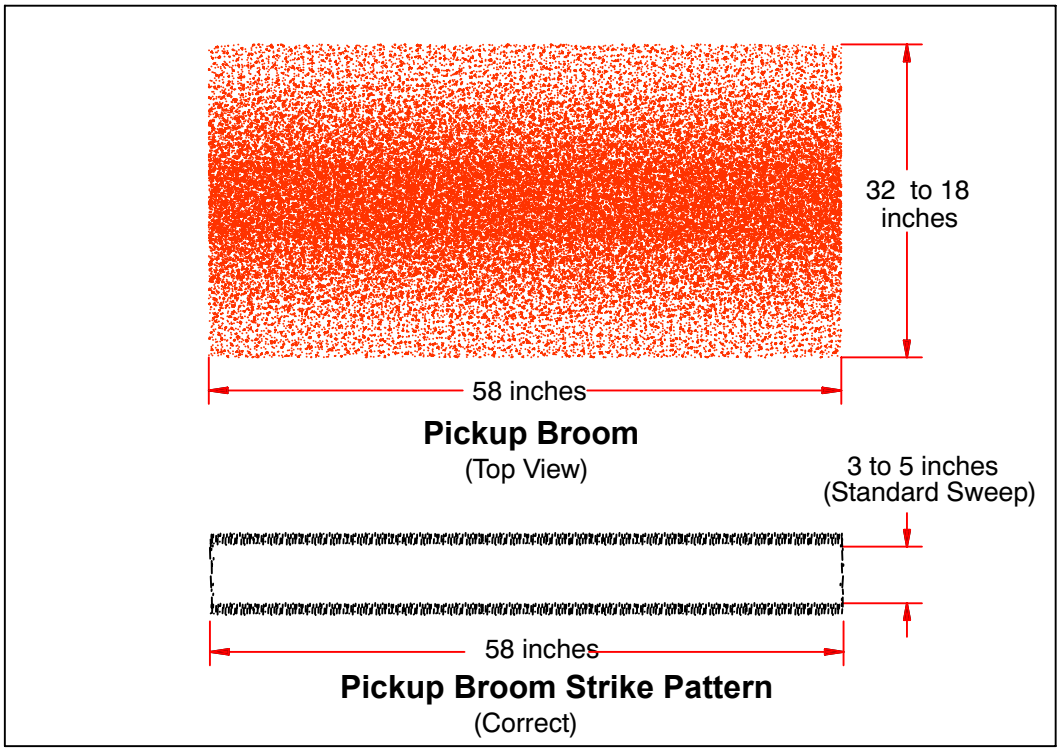


Fig: 3.7 A

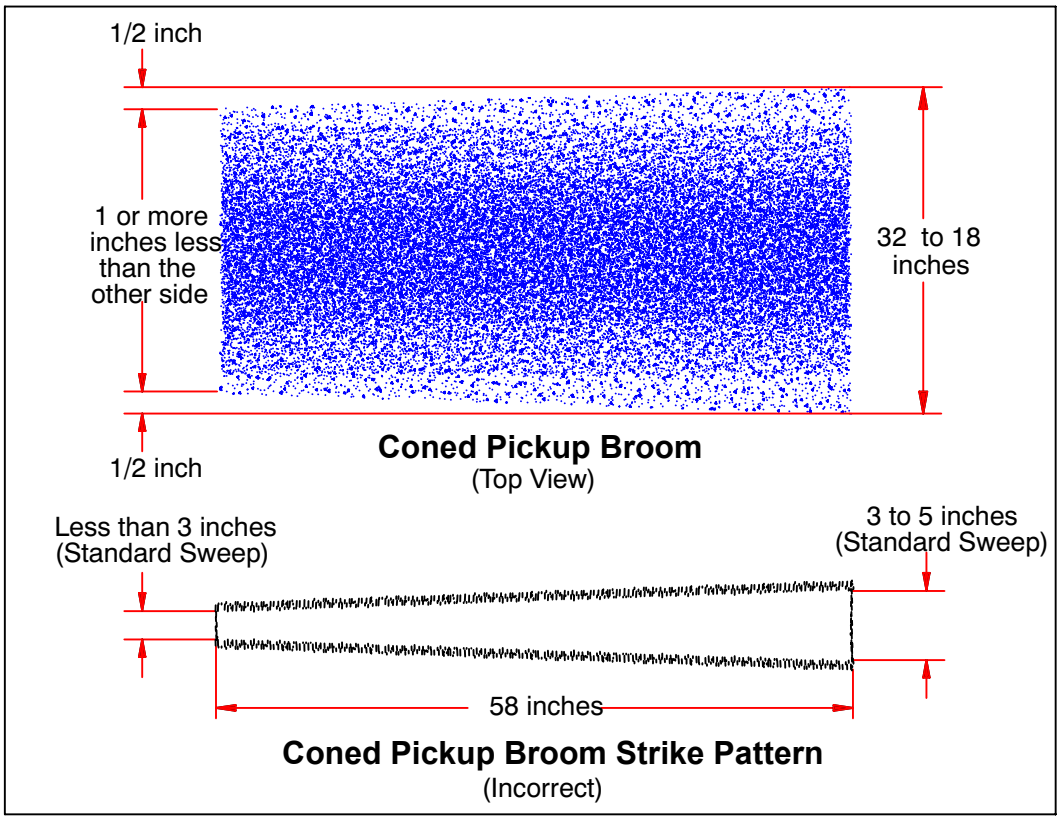


Fig: 3.7 B

Pickup Broom — Dirt Shoe Lift Adjustment

Dirt shoes funnel debris in front of elevator and pickup broom. An *"out of adjustment"* dirt shoe causes debris to be thrown out from under machine and left behind while sweeping.

1. Lower pickup broom and check dirt shoe to ground clearance at front and back of dirt shoe.

2. Start with the first hole at the bottom of the dirt shoe pivot mounting holes.

3. Push down back end of the dirt shoe bracket to make even contact with the road surface. Adjust front of dirt shoe to no more than 1/8 of an inch from the ground.

4. Dirt shoe level adjustment is accomplished by lifting or lowering the two adjustment slots.

5. Lift and lower pickup broom several times and re–check adjustment with broom in down position. Properly adjusted dirt shoes slightly drag and ride parallel to sweeping surface.

6. Repeat steps 2, 3, & 4 to adjust dirt shoe on opposite side of sweeper.

NOTE: *Dirt shoe safety chain helps eliminate damage to dirt shoe assembly caused while driving sweeper in reverse. Safety chain seldom requires adjustment.*

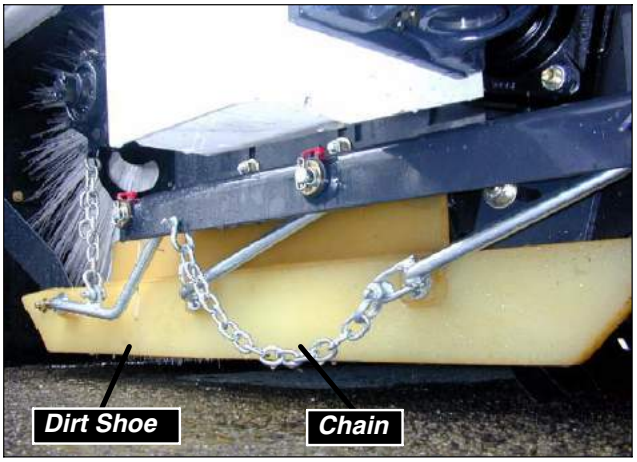


Fig: 3.8 A

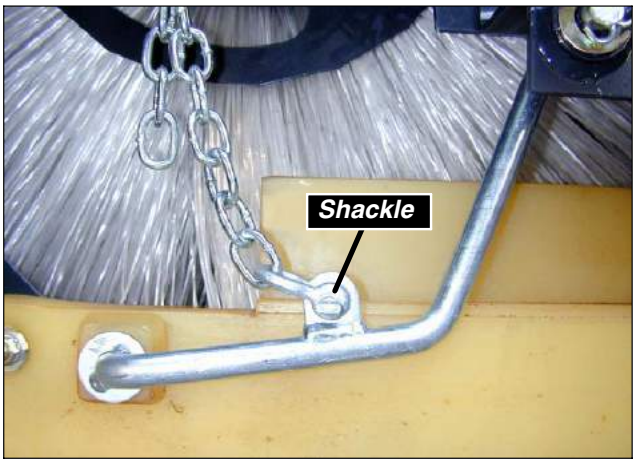


Fig: 3.8 B

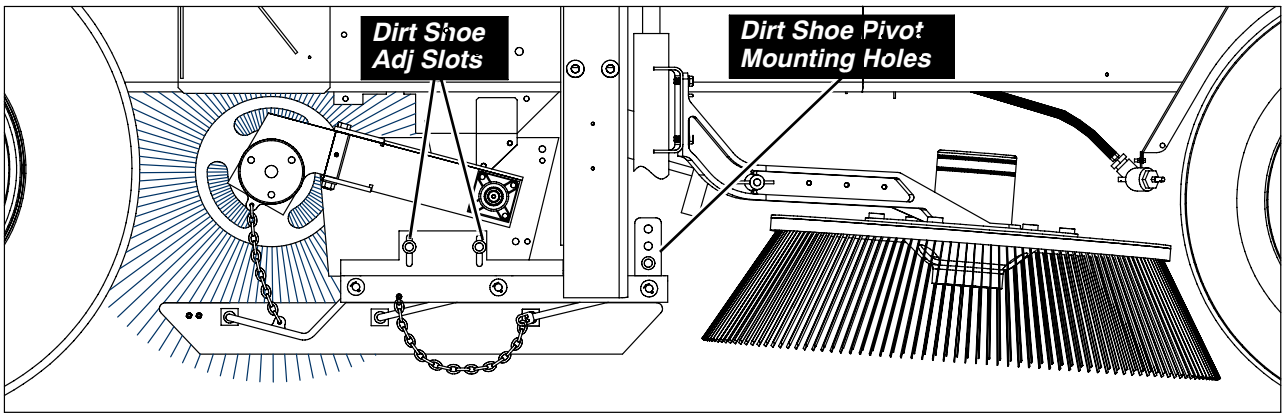


Fig: 3.8 C

GUTTER BROOM ADJUSTMENTS

Properly adjusted gutter brooms are essential in sweeper performance. Each gutter broom requires three adjustments: broom angle in relation to street and curb and broom pressure. Broom angle and pressure require frequent readjusting caused by broom wear and sweeping conditions. Forward tilt adjustment is factory set and should remain correct indefinitely under normal sweeping conditions. All gutter broom adjustment procedures apply to both right and left sides.

Gutter Broom — Wear Adjustment

The gutter broom wear adjustment is automatically compensted for the wear of the broom wire. Maintaining proper adjustment will insure effective sweeping thoughout the life of the broom. When a proper adjustment has been maintained, it not only gives more effective sweeping job but also extends broom life by distributing the weight over a greater number of broom wires. It is recommended that a 12" long broom wire can be used until worn down to approximately 4" long.

Gutter Broom — Tilt Adjustment

Manual angle adjustment is controlled by position of gutter broom arm in relation to the vertical bracket. A correctly adjusted gutter broom allows bristles to sweep at a 90 degree angle where street and curb meet *(gutter broom plate is parallel to gutter) (ref–Fig: 3.9 A&B)*. A In–Cab Broom Tilt option, which allows the the operator to easily adjust the broom tilt without exiting the cab, is also avalaible.

***NOTE:** Gutter broom pillow block bearing is designed to pivot. Bolts **should not** be loosened while adjusting gutter broom angle.*

***NOTE:** When sweeping conditions are severe such as a heavy overlay of asphalt on gutter or a high crown on street, increase gutter broom angle to transfer debris away from curb.*

Gutter Broom — Ground Pressure

The pressure by which the broom contacts or rides against the ground is called *ground pressure*. The amount of pressure is adjustable and how much or how little will vary depending on the type of sweeping to be performed. A Murphy gauge is located in the cab panels and has a readout of Heavy – Light – Up and is controlled by the knob on the gauge.

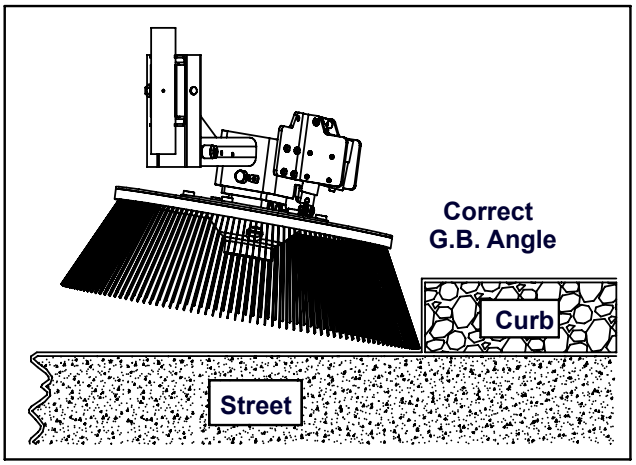


Fig: 3.9 A

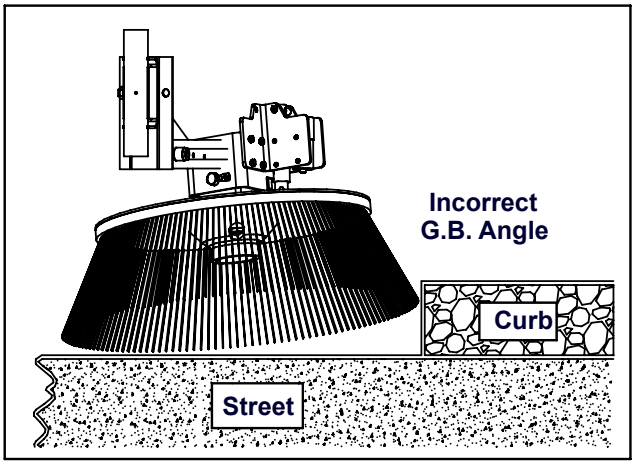


Fig: 3.9 B

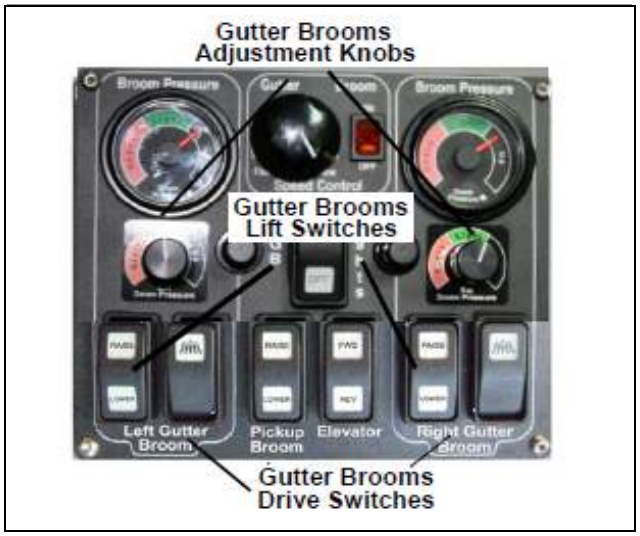


Fig: 3.9 C

An accumulator is installed in the system to establish and maintain the amount of pressure being applied to the broom. It balances out the pressure in the cylinder rod side. The gauge is equipped with an electrical contact switch that will enable the broom to be lowered to the same pressure as previously preset. This electric signal opens or closes the lowering valve unless the gauge is in Up position.

Gutter Broom — Pressure Adjustment

Gutter broom pressure is altered using left and right gutter broom pressure adjustment switches in cab *(Fig: 3.9C)*. Use the following procedures to test gutter broom pressure.

1. On level ground, select a test area to run broom pressure test. With all brooms off and raised, drive sweeper onto test site. Stop machine and place shifter in *Park*.

2. Run engine at 1800 rpm and perform the following procedures *(a thru f):*

   a. Lower gutter brooms. Pickup broom should be off.

   b.Turn *On* gutter broom drive switches and run for approximately 30 seconds (DO NOT exceed 1800 RPM).

   c.Turn *Off* and raise gutter brooms. Drive sweeper forward a few feet.

   d. Lower pickup broom. Gutter brooms should be off.

   e. Turn *On* elevator/pickup broom drive switch and run for approximately 30 seconds.

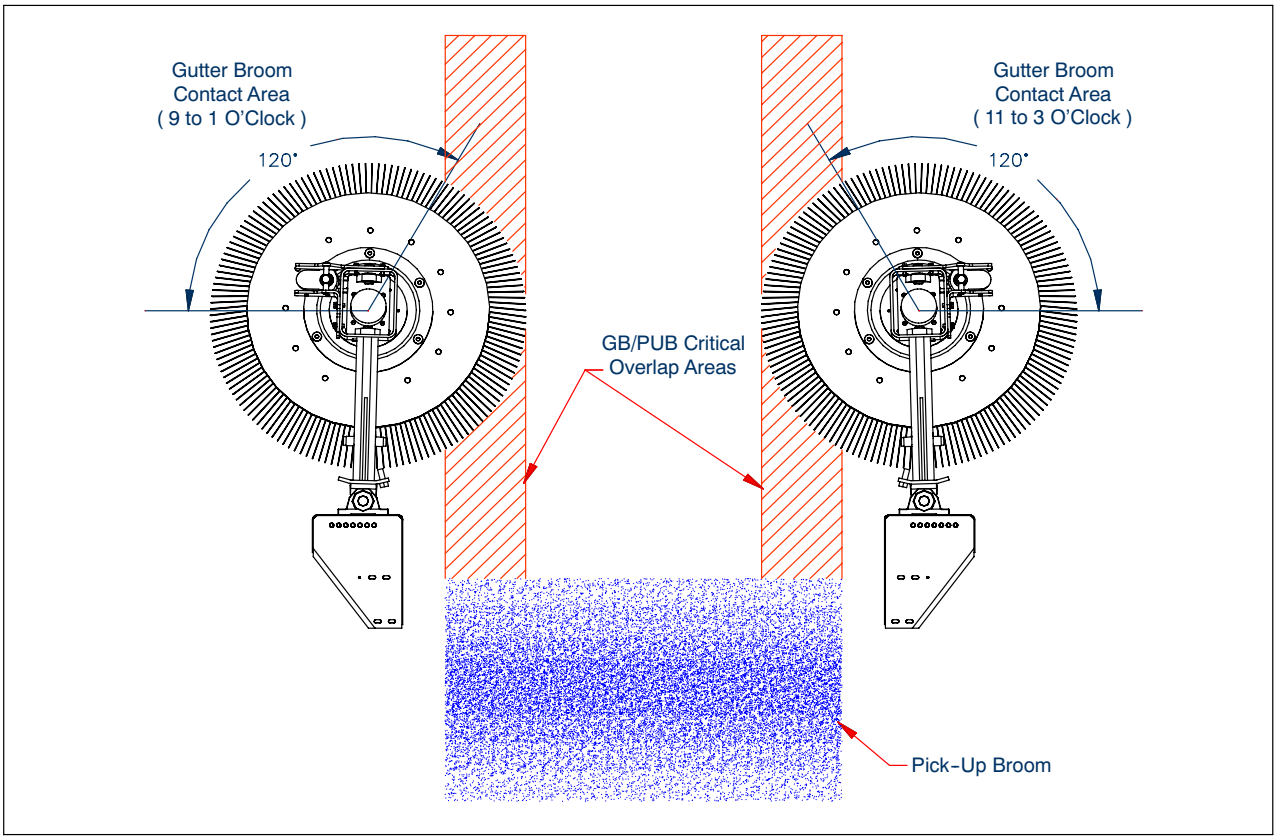


Fig: 3.10 A

f. Turn *Off* and raise elevator/pickup broom. Drive sweeper forward, clear of test site.

3. Place shifter in *Park*, shut down sweeper and exit cab to examine patterns. Each gutter broom pattern is 120 degrees when properly adjusted. The critical area is where the gutter broom pattern overlaps the pickup broom pattern *(Fig: 3.10A)*.

NOTE: *Insufficient gutter broom/pickup broom overlap results in streaking and poor sweeping performance.*

4. Adjust gutter brooms using the pressure gauge adjustment knobs in operators cab panel *(Fig: 3.9C)*.

   a. If broom pattern is too light: broom is not scrubbing ground hard enough causing broom bouncing and streaking.

   b. If broom pattern is too heavy: broom is scrubbing ground too hard causing excessive wear.

NOTE: *Gutter broom pressure adjustment is designed to return to pre-selected setting each time lowered.*

5. Repeat test procedures 1, 2, & 3 after re–adjustments.

Fig: 3.11 A

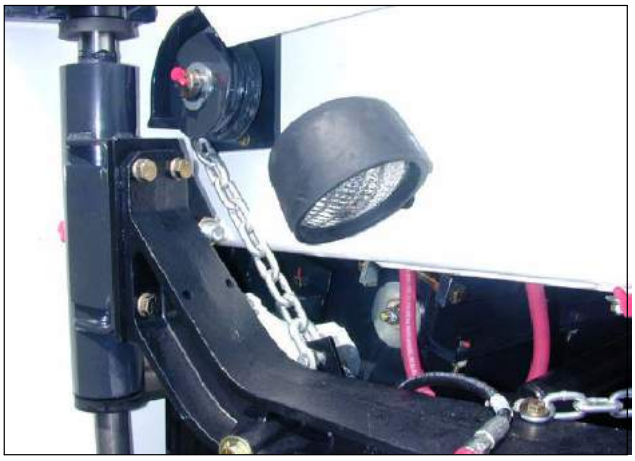


Fig: 3.11 B

Gutter Broom — Ergo Switch Option

1. Depressing the ***RAISE*** position of the Ergo switch:

   ❑ Suspends all of the sweeping functions.

   ❑ Stows the gutter brooms and the pickup broom.

   ❑ Turns the elevator ***OFF***.

   ❑ Turns the water spray ***OFF***.

Fig: 3.11 C

2. Depressing the ***LOWER*** position of the Ergo switch:

- ❑ Turns the water spray back ***ON***.
- ❑ Turns the elevator back ***ON***.
- ❑ Returns the gutter brooms and the pickup broom to the previously selected positions.
- ❑ Resumes all of the previous sweeping functions.

WARNING

When restarting with ergo switch ON, stay clear from rotating gutter broom. Personal injury may occur.

NOTE: *Ergo switch will resume previous sweep gear setting, ensure bystander are clear from rotating brooms when you restart engine.*

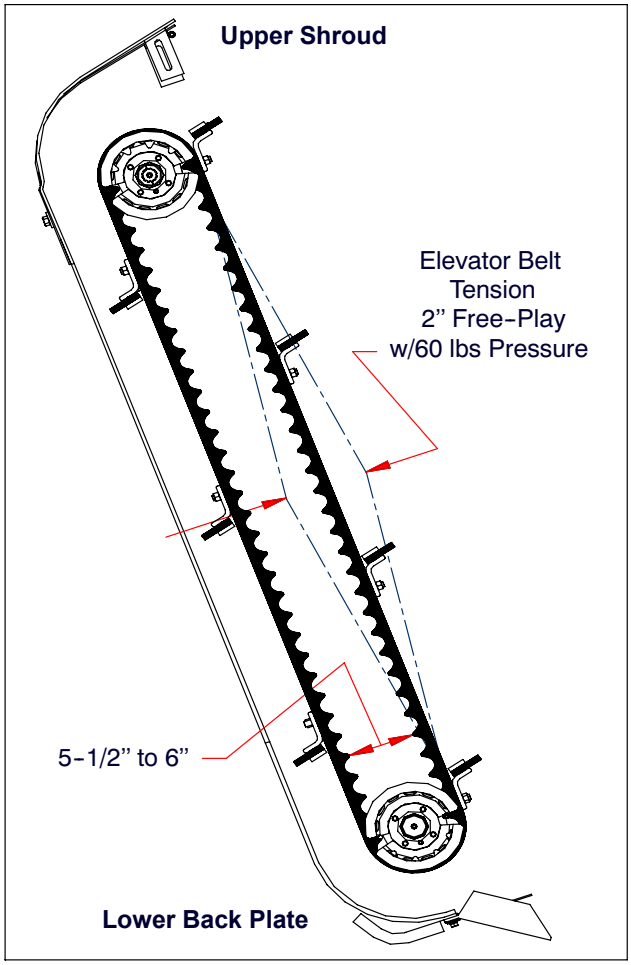


Fig: 3.12 A

ELEVATOR ADJUSTMENTS

The elevator assembly transfers dirt and debris from pickup broom into the hopper. The channel type chute is positioned almost vertically between the front of hopper and rear of operators cab.

Squeegee bars, large rubber belts, sprocket pulleys, split drive shafts and a hydraulic drive motor are all internally part of the elevator assembly. Sprocket pulley shields aid in preventing debris from building up between belt teeth and sprocket pulley teeth.

Preventing structural damage, the elevator automatically raises if large obstructions on the street are swept.

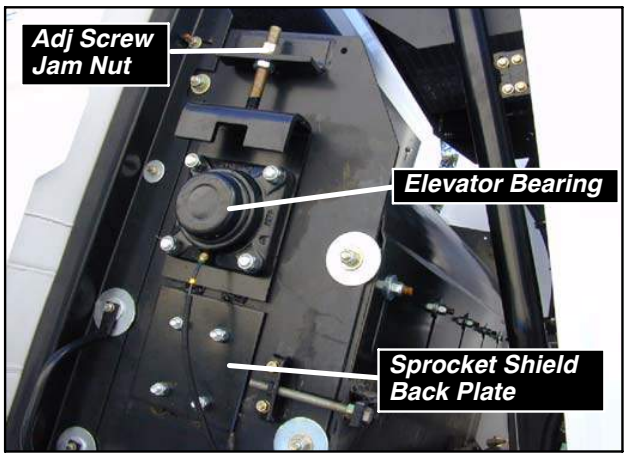


Fig: 3.12 B

Elevator — Belt Tension Adjustment

Both elevator belts work together; therefore, tension adjustment on each belt must be equal. If one belt is misaligned, the entire elevator assembly will run off center toward the belt with the least amount of tension. As a result of unequal belt tension, sweeper performance and belt life will be greatly reduced.

NOTE: *Due to the crown in the street, elevator belts run slightly toward curb side of sweeper. However, adjust elevator belt tension on a level surface. Adjust each elevator belt separately.*

1. Check elevator belt tension by applying 60 lbs of push/pull pressure to center of belt assembly. A properly adjusted belt will give about 2 inches in either direction *(Fig: 3.11A)*. Inside measurement of the belt is between 5 1/2 and 6 inches. If belt is properly adjusted, go to step 10.

2. On side of elevator, loosen four nuts securing upper elevator bearing bracket to side plate.

3. On side of elevator, loosen four nuts securing upper elevator sprocket shield to side plate.

4. Loosen jam nuts on elevator bracket adjusting screw. To adjust belt tension, raise *(or lower)* bearing bracket by changing position of jam nuts on top of bearing bracket.

5. Tighten jam nuts on elevator bracket adjusting screw.

6. Tighten nuts securing upper elevator bearing bracket to side plate.

7. Adjust sprocket shield to allow the cleaning finger to be positioned inside sprocket without rubbing.

8. Tighten nuts securing upper sprocket shield to side plate.

9. Adjust opposite elevator belt by repeating steps 1–8.

10. Run Elevator for several minutes. Check elevator belt tension on both sides. Repeat steps 2–9 if readjustment is necessary.

WARNING

Stay clear from running elevator.
Personal injury may occur.

11. Adjust elevator upper arch *(ref–Upper Arch Adj)*.

Elevator — Belt Timing Adjustment

As a general rule, belt timing only requires adjustment if an object lodges between a belt tooth and the sprocket causing the belt to jump ahead.

Visually check timing by observing that each squeegee bar remains parallel to elevator lip as it runs over sprocket pulleys. Adjust belt timing as required.

1. On each side of elevator assembly, loosen four bolts securing upper elevator bearing brackets to side plates.

2. Loosen jam nuts on elevator bracket adjusting screw. Relieve belt tension by either loosening or tightening of jam nuts, and lowering the bearing bracket.

3. Actual belt timing is accomplished from within elevator. Place a 1/2 inch thick by 3 inch wide by 12 inch long *(approximately)* piece of solid rubber between one belt and sprocket pulley.

4. Rotate sprocket pulley slowly and jump belt ahead or behind one tooth.

NOTE: *Properly tracking belts ride on sprocket with 1/4 inch clearance between side of belt and sprocket flange.*

5. Repeat procedure until squeegee bars are parallel to lip of elevator.

6. Adjust elevator belt tension *(ref–Elevator Belt Tension Adjustment procedure)*.

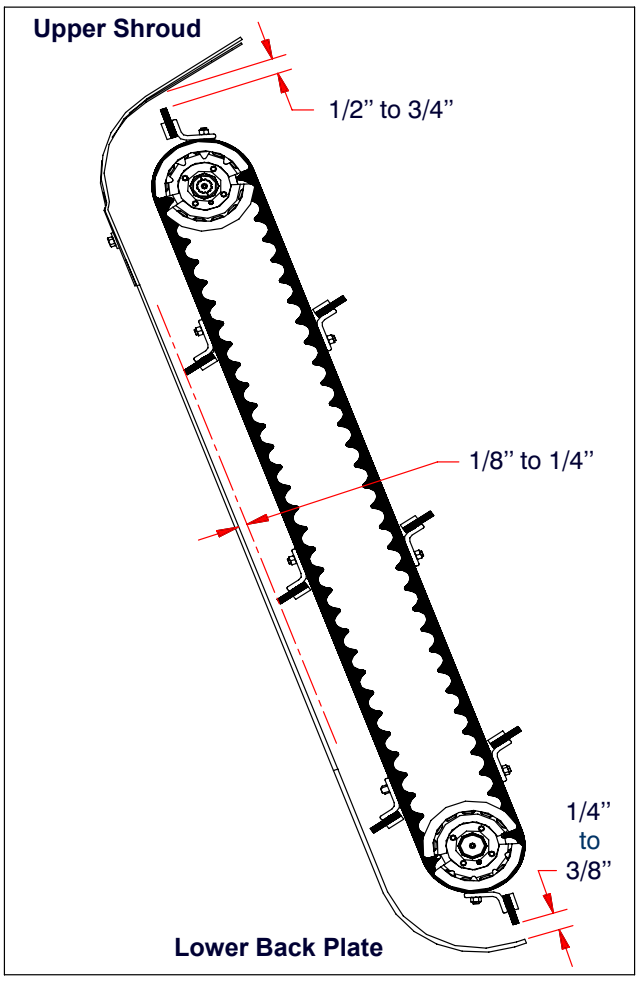


Fig: 3.14 A

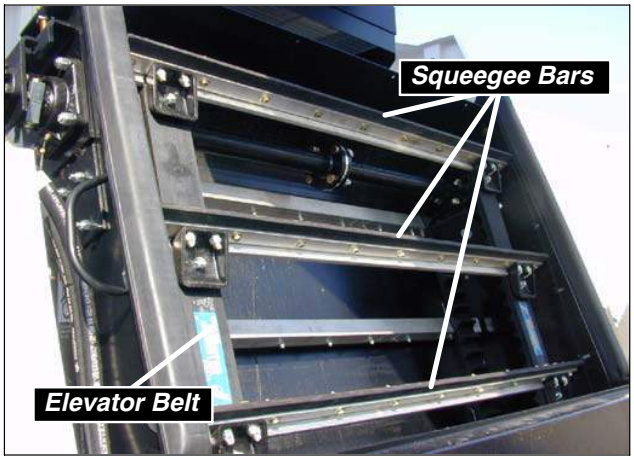


Fig: 3.14 B

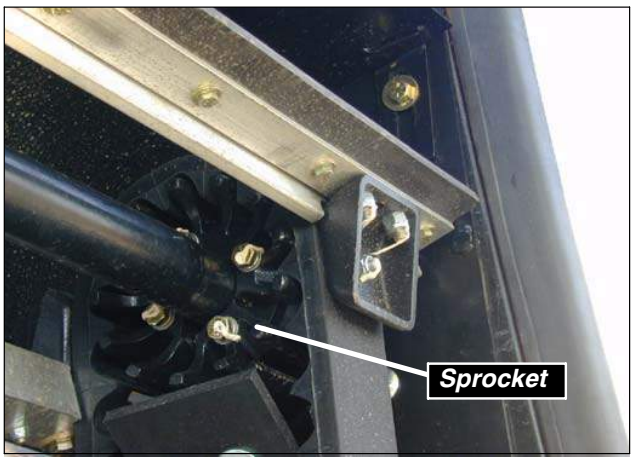


Fig: 3.14 C

Elevator — Upper Arch Adjustment

Elevator upper arch usually needs adjustments after elevator belts and/or squeegee bars have been replaced or altered. Rubber squeegee bars should maintain 1/2 to 3/4 inch clearance around entire inside of upper elevator shroud.

1. From the back side of elevator, loosen five slotted adjuster nuts securing elevator upper arch to elevator back plate.

2. On upper inside of elevator plate, loosen two slotted adjuster nuts.

NOTE: *There are a total of 7 upper arch adjuster nuts.*

3. Adjust both sides of elevator upper arch to achieve a 1/2 to 3/4 inch clearance from squeegee bar to shroud. Position upper arch to be parallel to squeegee bar. Top measuring point is on upper elevator shroud perpendicular to the elevator shaft axis and where the back plate connects to the upper arch.

4. From back side of elevator assembly, tighten five nuts securing elevator upper arch to elevator back plate.

5. Tighten two slotted adjuster nuts inside each upper corner of elevator upper arch.

6. Double check squeegee clearance.

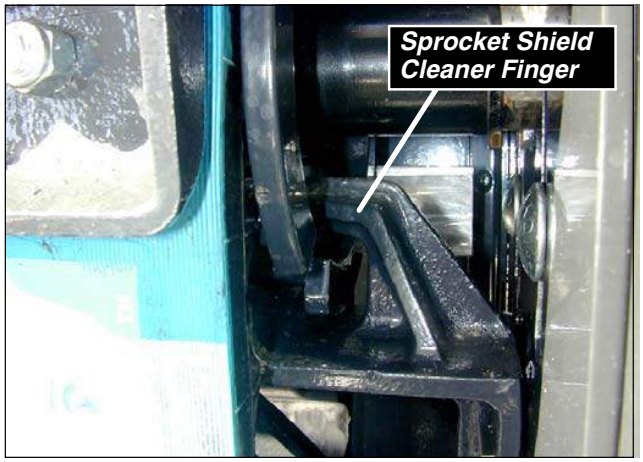


Fig: 3.15 A

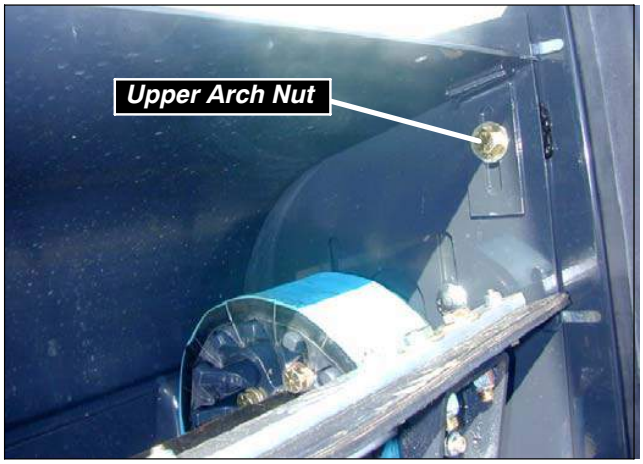


Fig: 3.15 B

Fig: 3.15 C

Fig: 3.15 D

Elevator — Back Plate Adjustment

This back plate panel reaches from the lower part of the elevator and connects to the upper arch panel. Properly adjusted squeegee bars have 1/4 inch clearance around entire inside of lower elevator back plate. Check squeegee bar clearance adjustment on a regular basis because of wear on elevator squeegees, back plate, and upper arch.

1. On each side of elevator assembly, loosen 12 (6 on each side) slotted back plate nuts *(Fig. 3.16 A & B)* securing elevator back plate to elevator side plate.

3. Using the 6 (3 on each side) jack screws *(Fig. 3.16 B & C)*, adjust both sides of elevator back plate to achieve a 1/4 inch clearance from squeegee bar to shroud.

4. On each side of elevator assembly, tighten 12 sloted back plate nuts securing elevator back plate to the upper arch.

6. Double check squeegee clearance.

WARNING

Stay clear from running elevator.
Personal injury may occur.

NOTE: *Run elevator for several minutes, turn elevator and engine off. Re-check squeegee bar adjustment.*

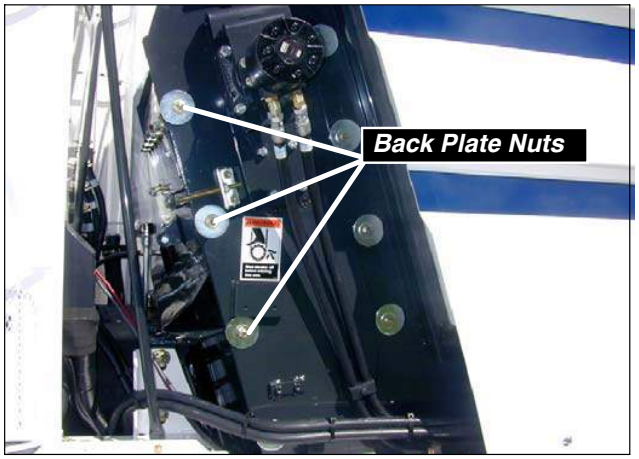


Fig: 3.16A

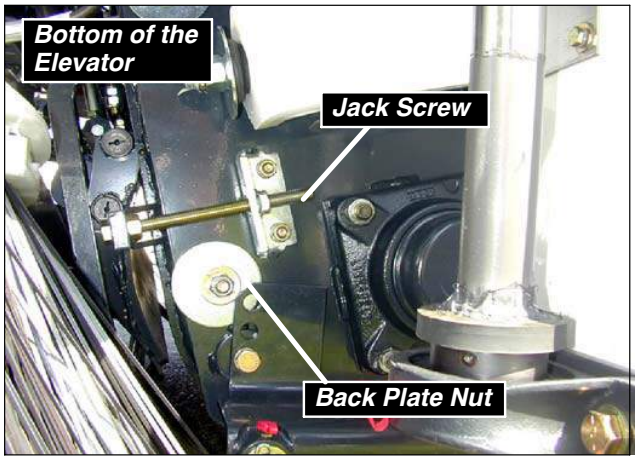


Fig: 3.16 B

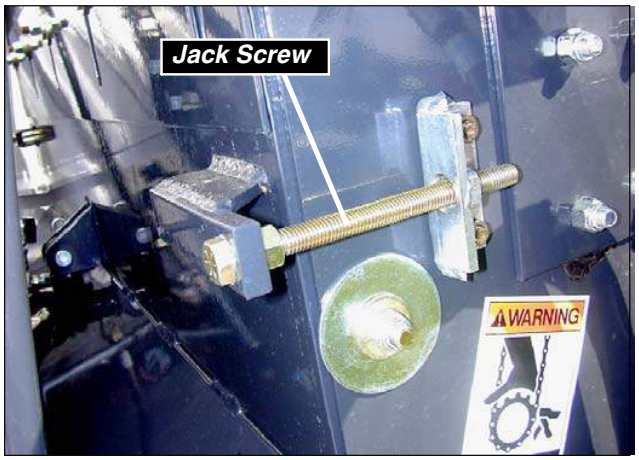


Fig: 3.16 C

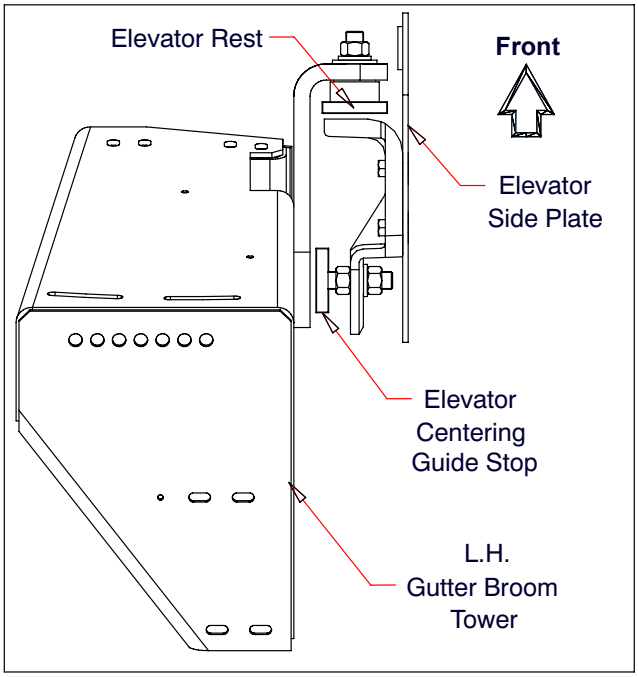


Fig: 3.16 D

Elevator — Centering & Side Adjustment

Elevator centering and side adjustments control the position of the elevator between frame rails and the side to side free play. Centering adjustment guides are mounted on elevator side plates and rub against an inside bracket attached to the gutter broom mounting tower *(Fig: 3.16D).*

1. Measure the distance from the right side of elevator to the sweeper frame. Measure the distance from the left side of elevator to the sweeper frame.

2. Compare the two measurements and prepare to adjust centering guide bolts accordingly.

3. Loosen lock nuts on left and right guide bolts *(Fig: 3.16D)*. Adjust round guides to center elevator between frame rails.

4. Repeat steps 1, 2, & 3 until elevator is centered and guide bolts slightly touch gutter broom towers.

5. Tighten lock nuts on guide bolts

Anti–Lock Braking System (ABS)

The Global M4 Series sweeper is equipped with an Anti–Lock Braking System (ABS). ABS helps prevent wheel lock–up during braking to increase sweeper stability and operator control. There is no regularly scheduled maintenance required for ABS. However, ABS does not change the current sweeper maintenance requirements. For example, it is important that the sweeper brake fluid level be properly maintained. The ABS must be examined in the course of every periodic brake inspection by making a visual check for damaged components.

Principle of Operation

The operational principle of the Anti–Lock Braking System (ABS) is that ABS takes over control of the hydraulic pressure whenever a wheel starts to lock up. Sensors continuously monitor wheel speed and send this information to an Electronic Control Unit (ECU). When a wheel starts to lock, the ECU, using the wheel–speed information and programmed data, sends output signals to control the operation of the ABS valves. The ECU causes the ABS valves to adjust hydraulic pressure supplied to the wheel cylinders to control braking and prevent wheel lockup.

The ABS system usually tests itself everytime the sweeper is started and every time the brakes are applied. The system evaluates its own signals. If a defect is detected, the system turns off, leaving normal braking unaffected.

When troubleshooting or testing the ABS system, do not damage the connector terminals.

NOTE: *An ABS indicator lamp on the sweeper dash alerts the operator to a possible system fault and provides blink code information to diagnose the system.*

ABS Indicator Lamp

If the ABS indicator lamp does not come ON after the ignition is turned ON, or it comes ON but does not go out after three seconds, check all ABS fuses or circuit breakers and replace if necessary. Check the wiring to the ABS diagnostic switch and indicator lamp and repair or replace wiring as required.

When checking the indicator lamp:

1. Check voltage potential at the lamp socket.
2. Check continuity of the wires to the socket.
3. Replace the bulb.

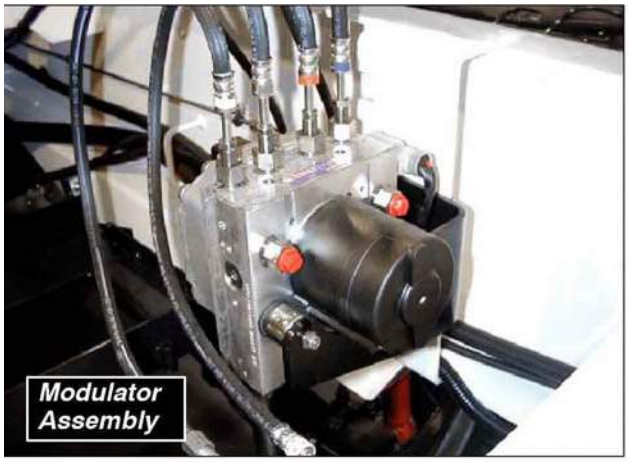


Fig: 3.19 A

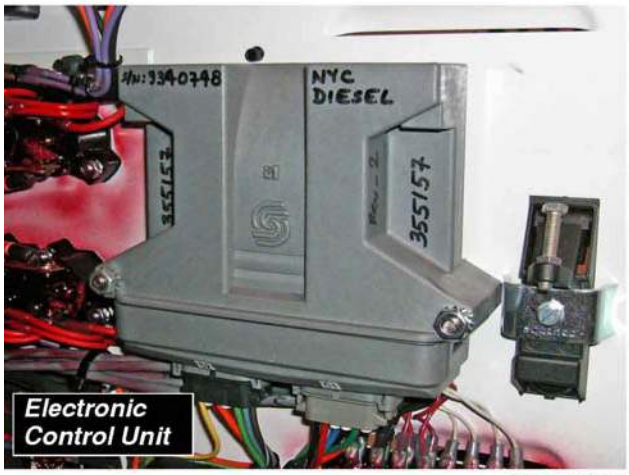


Fig: 3.19 B

Fig: 3.19 C

Modulator Assembly

The Modulator Assembly houses the ABS solenoid control valves *(one inlet valve and one outlet valve per wheel)*, a pump motor and two accumulators *(Fig: 3.22A)*.

During an ABS stop, a solenoid valve in the modulator assembly is rapidly pulsed: that is, it opens and closes several times per second to control the brake pressure. When this occurs, operators may notice a pulsation of the brake pedal.

CAUTION

The Modulator Assembly contains brake fluid, a caustic substance. Remove the valve carefully so that fluid does not leak and cause skin irritation or cause damage to components.

NOTE: *Whenever any hydraulic system fitting is loosened or disconnected, the entire system must be bled to remove any air that may have entered the system.*

Electronic Control Unit (ECU)

The ECU processes sensor signal and generates solenoid valve commands to reduce, maintain or reapply brake pressure. If the wheels start to lock, the ECU signals the modulator assembly to regulate the brake pressure of each locking wheel.

NOTE: *Manual braking is also available in the event both the power and reserve system are inoperative.*

ABS Sensors

The ABS sensors measures the speed of a tooth wheel rotating with the sweeper wheel. The sensors produces an output voltage proportional to wheel speed. The sensors generate signals that are transmitted to Electronic Control Unit.

CAUTION

In the unlikely event of an ABS system malfunction, the ABS in the affected wheel will be disabled and will return to normal braking. The other sensed wheel will retain their ABS function.

NOTE: *If the indicator lamp comes on while sweeping, operators may continue to sweep but are instructed to have the sweeper serviced as soon as possible.*

ABS System Diagostics

Use Meritor WABCO's PC–based diagnostic program, TOOLBOX Software, or standard blink codes to diagnose hydraulic ABS faults.

If you have TOOLBOX Software installed on your computer, use it to identify system faults. Then, follow the on–screen repair information to make necessary repairs or replacements.

NOTE: *For complete instructions using this program, contact Global Environmental Products or Visit the Meritor Wabco website at www.arvinmeritor.com*

NOTE: *Refer to Meritor Wabco maintenance and service manuals on Hydraulic Anti-Lock Braking System (ABS) for blink codes and additional maintenance and service information.*

WARNING

To avoid damage to the electrical system or ABS components, when welding on an ABS-equipped sweeper disconnect the power connector from the ECU.

Brake Bleeding Procedures

The following brake bleeding methods explain how to bleed the hydraulic ABS modulator assembly during installation, or in the event of air in the brake system.

NOTE: *The modulator assembly must be handled with appropriate care and should not be exposed to excessive impact or compressed air at the hydraulic ports prior to assembly.*

WARNING

Failure to bleed the system whenever any hydraulic system fitting is loosened or disconnected will allow air to remain in the system.

This will prevent the hydraulic pressure in the brake system from rising enough to apply the brakes properly. This will cause the stopping distance to increase and can result in serious personal injury.

Pressure Fill and Bleed

Pressure fill and bleed is the preferred method for bleeding the brake system. It requires the use of a special pressure bleeder kit, consisting of a tank, pressure pump and valve, gauge, tubing and adapter.

Pressure Fill and Bleed Procedures

1. Block wheels using wheel chocks.Turn *Off* the ignition and disconnect battery terminals.

NOTE: *The ignition must remain off for the entire bleeding procedures.*

2. Fill the pressure bleeder with hydraulic brake fluid.
3. Connect the pressure bleeder to the master cylinder.
4. Set Filling pressure to 20 to 30 PSI.
5. Turn *On* bleeding equipment until fluid level in the reservoir reaches approximately .875–inches.
6. Release pressure for 3 to 5 seconds. Apply pressure for 5 to 10 seconds.
7. Repeat steps 5 and 6 approximately 10 times. After releasing the pressure, air bubbles should rise up into the reservoir.

WARNING

Do not let the brake master cylinder fluid get below the minimum level during the bleeding operation.

Failure to keep the brake reservoir level above the minimum could result in more air entering the system, making it impossible to bleed the system.

8. Bleed the brake system:
    - Set Filling pressure to 20 to 30 PSI.
    - Put wrench on the brake actuator bleeder fitting. Start with the farthest to the nearest from the modulator, then attach a length of clear plastic tubing to the bleeder fitting.

9. Submerge the tubing in a container of clean hydraulic brake fluid. Loosen the bleeder fitting until the fluid begins to flow *(about 3/4 turn).* Let the hydraulic fluid fow out of the fitting until free of air bubbles.

10. Tighten firmly to secure the fitting.

11. Repeat Steps 5 through 8 to bleed the remaining three brake actuators.

NOTE: *Bleed in sequence of the longest to shortest from the modulator assembly.*

Manual Bleed Procedures

1. Block wheels using wheel chocks.Turn *Off* the ignition and disconnect battery terminals.

NOTE: *The ignition must remain off for the entire bleeding procedures.*

2. Fill the pressure bleeder with hydraulic brake fluid.

3. Depress the brake pedal five times using the stroke between 1/3 travel and maximum travel in 5 seconds.

4. Release the pedal for 5 to 10 seconds. Air bubbles will rise into the reservoir while depressing and releasing pedal.

5. Repeat Steps 3 and 4 approximately three times, or until sufficient pedal resistance is felt.

WARNING

Do not let the brake master cylinder fluid get below the minimum level during the bleeding operation.

Failure to keep the brake reservoir level above the minimum could result in more air entering the system, making it impossible to bleed the system.

6. Bleed the brake system. Put a wrench on the brake actuator bleeder fitting. Start with the farthest from the modulator.

7. Submerge the tubing in a container of clean hydraulic brake fluid.

8. Depress the brake pedal 10 to 15 times, using the maximum available stroke.

9. Loosen the bleeder fitting until the fluid begins to flow *(about 3/4 turn)*, while depressing the brake pedal through its maximum available stroke.

10. Tighten the fitting firmly prior to releasing the brake pedal.

11. Repeat Steps 6 through 8 several times until the discharged fluid is free of air bubbles.

12. Repeat Steps 3 through 9 to bleed the remaining three brake actuators.

NOTE: *Bleed in sequence of the longest to shortest from the modulator assembly.*

13. Check the travel of the brake pedal. If a firm resistance is felt the manual bleeding procedure is complete.

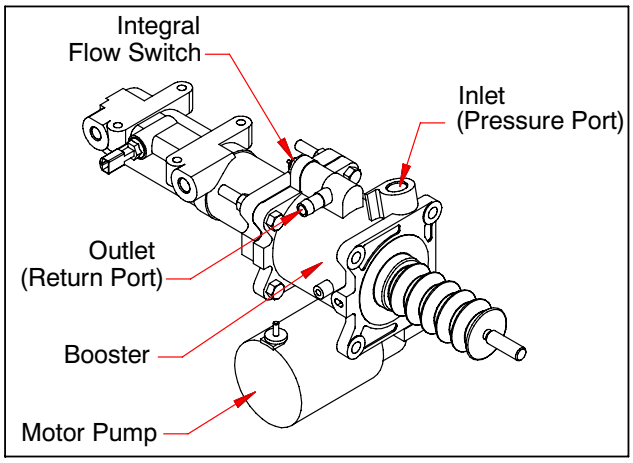
14. Check the fluid level in reservoir and fill if necessary. Replace reservoir cap and dispose of used brake fluid properly.

15. Remove wheel chocks.

WARNING

Failure to bleed the system whenever any hydraulic system fitting is loosened or disconnected will allow air to remain in the system.

This will prevent the hydraulic pressure in the brake system from rising enough to apply the brakes properly. This will cause the stopping distance to increase and can result in serious personal injury.



(Master Cylinder Components) Fig: 3.22 A

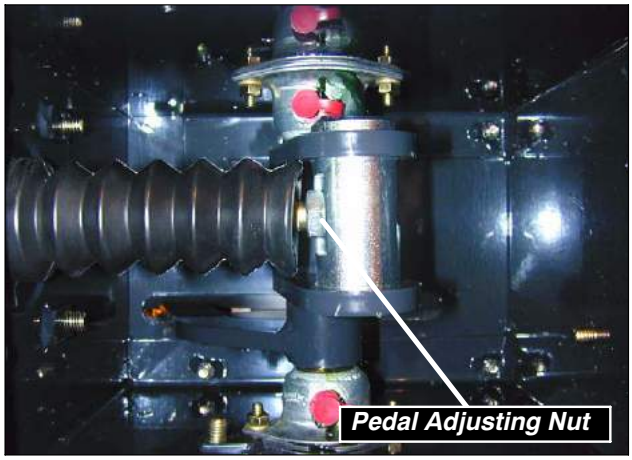


Fig: 3.22 B

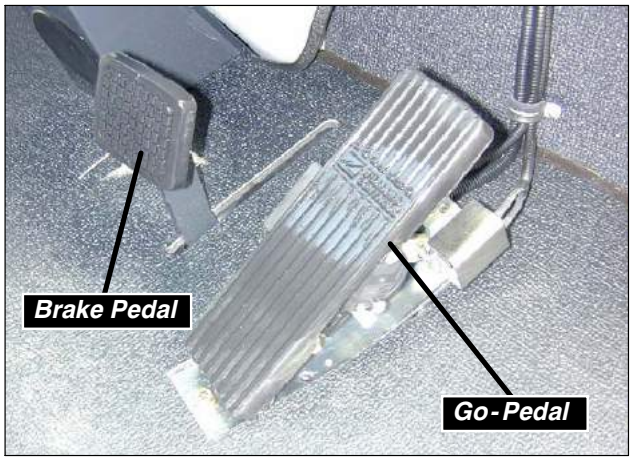


Fig: 3.22 C

Master Cylinder & Brake Booster

The hydraulically powered booster in conjuction with the master cylinder, provides a power assist for applying hydraulic brakes. The brake system is composed of the following:

- ❑ A hydraulically powered Booster
- ❑ A reserve electric motor pump
- ❑ A Hydraulic master cylinder
- ❑ An integral flow sensing warning switch

The pedal stop must be adjusted such that, when brake pedal is fully released, there is no load on the rubber grommet that retains the pedal rod to the master cylinder and brake booster. When the brake pedal is fully released, the spring load must not be greater than that required to support the pedal weight. The reason for a properly adjusted pedal stop and for the limitation on the spring load is to prevent the spring from pulling on the rubber grommet and damaging the grommet.

Brake Pedal Adjustment

1. Position sweeper on clean, level surface with front wheels pointing forward. Place shifter in *Park* and stop engine. Block wheels using wheel chocks.
2. Measure free play in brake pedal where arm goes through floor inside operators cab. If free play is 1/8 inch , go to step 6.
3. From under the sweeper cab, remove brake pedal box bottom panel *(6 bolts)* to gain access to brake pedal and go–pedal linkage *(Fig: 3.25B)*.
4. Loosen lock nuts on both ends of adjusting tube between pedal linkage and master cylinder *(Fig: 3.25B)*. Take care not to damage any linkage parts while loosening lock nuts. Turn adjusting tube by hand to achieve 1/8 inch free play in brake pedal.
5. Tighten lock nuts and replace side panel.
6. Remove wheel chocks.

Parking Brake Adjustment

Parking Brake Adjustment

NOTE: *Make sure the brake shoe adjustment is checked before the parking brake adjustment is done.*

The parking brake is used to hold the brakes continuously in the applied position. The parking brake employs the hydraulic actuator to engage parking brakes when shifter is placed in *Park (P)* position *(spring apply)*.

WARNING

Chock wheels before releasing parking brake.

1. Position sweeper on clean, level surface. Place shift lever in *Park,* stop engine and chock wheels.

2. Start engine and place shifter into a forward gear.

WARNING

Parking brake actuator is under internal compressed spring loaded. DO NOT disassemble or service. Serious injury or fatality may result.

3. At parking brake canister, measure free play in cable assembly where it connects to hydraulic parking brake actuator. If free play is 1/4 inch , go to step 6.

4. Remove parking brake release hair pin from linkage screw. Screw parking brake turnbuckle achieving 1/8 inch free play. Relative to brake canister, counterclockwise achieves more free play and clockwise achieves less free play.

5. Replace parking brake release hair pin in linkage screw.

6. Place gear shifter in *Park* and turn off engine.

7. Check parking brake engagement and adjustment for proper operation.

8. Remove wheel chocks.

Fig: 3.24 A

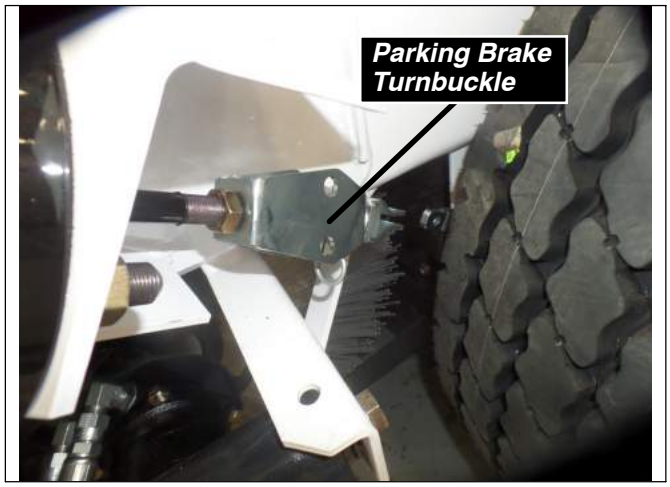


Fig: 3.24 B

Fig: 3.24 C

CHAPTER **4**

Sweeper Service Lubrication

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SERVICE & LUBRICATION

How good is any of the equipment you own? It is only as good as it is maintained. Even the finest equipment manufactured requires attention and care.
The M4 Series sweeper is no different. A good well planned preventive maintenance program will enhance a properly operating sweeper as well as providing safety to those operating the equipment.

It is very important to establish a good maintenance program. Costly repairs can often be avoided by planning ahead, setting a regular schedule, and excercising good preventive maintenance techniques.

Lubrication

Strict adherence to a detailed lubrication schedule is as important as timely preventive maintenance. The recommended lubrication schedule in the following charts, figures and tables is based on average sweeper use under normal sweeping and whether conditions.

Abnormal use such as sweeping in dusty, dirty conditions, or in extremely hot or cold climates, requires lubricants to be checked and changed more frequently than suggested in lubrication schedule. Also, short–haul driving may cause acids to form in engine and hydraulic oil. These acids are injurious to moving parts and may cause abnormal wear similar to that caused by dirty lubricants.

Lack of lubrication on bearings and cables make control operation difficult in addition to causing premature wear. However, lubricants should be used sparingly with excess oil and grease wiped away to prevent the attraction of additional dirt.

Engine Oil and Viscosity

The engine oil viscosity specification depends on the temperature of the engine oil at the time of starting the engine. Viscosity recommendations for various starting temperature are shown in the *"Engine Oil Viscosity Chart."*

When choosing an oil, consider the range of temperature your sweeper will operate in before the next oil change. Then select the recommended oil viscosity from the chart. *(Refer to Chart 4.1).*

NOTE: *Using oil other than API Service classified SE or CD, or not changing the oil and filter often enough could reduce engine life.*

Break-In Engine Oil

Special *"break–in"* engine lubricating oils are NOT recommended for new or rebuilt Cummins engines. Use the same type oil during the *"break–in"* as that which is used in normal condition. *(Refer to Section V of Cummins ISB10 Engine Owners Manual)*

CAUTION

Damage to engines due to improper maintenance or use of incorrect oil quality and/or viscosity is not covered by the warranty.

Maintenance

Listed below are sweeper routine checks which should be made periodically by a qualified mechanic to ensure proper performance and safety of the sweeper.

WARNING

For your safety and that of others, any of the safety-related components that are damaged should be checked and necessary repairs performed before operating the sweeper.

At a minimum, these routine checks should be made every six months or every 500 hours whichever comes first. Whenever repairs are necessary, have them completed before operating the sweeper.

❑ Parking Brake – Park on a fairly steep hill and put shifter in *"P" Park* position. This checks holding ability. Parking brake automatically engages when shifter is put on *"P" Park.* Before checking Parking Brake be sure to have enough room around the sweeper.

❑ Parking Brake Actuator – Check free play in cable assembly where it connects to hydraulic actuator. If free play is more than 1/8 inch see chapter 3 for adjustment. Check every 250 hours.

❑ Brakes – Be alert on changes to braking action, unusual sounds when braking or increased brake pedal travel. Any of these conditions could indicate the need for brake system inspection and/or service.

❑ Brake Linings and Pads – Check Drum brake linings and disc brake pads for wear and cracks every 250 hours. Replace cracked and worn out brake linings and pads. Failure to do so can result in expensive damage to the brake system or a serious accident.

❑ Brake Drum and Rotor – Check brake drums and rotors for wear or damage every 250 hours of service.

❑ Brake Lines and Hoses – Check brake lines and hoses for leaks, cracks, chafing etc. every 500 hours. When rubbing or wear is noted on brake lines and hoses, correct the problem at once.

❑ Steering – Be alert for any changes in steering action. An inspection or service is required when the steering wheel is harder to turn or has too much free play or when there are strange sounds when turning.

❑ Wheel Alignment, Balance, and Tires – Check tires for abnormal wear or damage. A pull to the left or to the right on a straight and level road may show the need for a wheel alignment. Too much vibration of the steering wheel may mean wheel balancing is needed. Check tire pressure for correct inflation. Perform inflation checks when tires are *"Cold".*

❑ Wheel Nut Torque – Be sure wheels are not bent or cracked and that wheel nuts have been tightened to specified torque every 500 hours.

Specified Tightening Torque:

- Torque Front Lug Nuts to 400–420 ft lbs.
- Torque Rear Lug Nuts to 450–500 ft lbs.

❑ Leaf Spring U–Bolt Torque – Tighten U–bolt to the specified torque the first 50 hours and every 500 hours thereafter.

Specified Tightening Torque:

- Torque Nuts to 350 ft lbs.

❑ Cab – Check interior and exterior of the cab. Keep interior of the cab clean at all times. Check daily.

❑ Safety Restraints – Check seat belts system *(including buckles, latch plates, and anchors)* for proper operation.

❑ Seat Adjuster – Check seat adjustment prior to driving the sweeper. Do not attempt to adjust the seat when the sweeper is in motion.

❑ Horn – Sound horn periodically to be sure it works.

❑ Mirrors – Check mirrors to make sure you can see clearly through the side mirror at all times. Look for broken, scratched, dirty or damaged mirrors that could reduced the view or visibility. Replace, clean or repair promptly.

❑ Lights – Check panel lighting, warning lamps, indicator lamps and interior lamps. On the outside check: headlights, taillights, brakelights, turn signal, backup lights, hazard flasher, flood lights and beacon lights.

❑ Sun Visor – Check that friction joints hold sun visor in place.

❑ Windshield Wipers and Washers – Check operation and condition of the wiper blades. Replace worn out wiper blades. Check the flow and aim of the windshield washer spray.

❑ Door Latches – Check that doors close, latch, and lock tightly.

❑ Fluid Leaks – Check for fuel, water, oil, coolant, and other fluid drips by looking at the surface beneath the sweeper after it has been parked for a while.

❑ Air Cleaner System – Check air cleaner service indicator on the LH instrument panel inside the cab. Clean or replace air cleaner filter element.

❑ Water Spray System – Check water level. Add water as required. Check to make sure all nozzles spray cleanly.

❑ Engine – *(For engine information, refer to Cummins ISB12 Engine Owners Manual, Troubleshooting & Repair Manual, and Parts Catalog)*

❑ Belts – Check all engine driven belts *(commonly referred to as fan belts)* for wear and tension. Replace worn

belts.

❑ Fuel Filter – Replace filter every 250 hours or 12 months whichever occurs first, or more frequently if the filter is clogged.

❑ Batteries – Keep battery securely mounted, top clean and dry. Keep terminals and connections clean and tight and coated with petroleum jelly. check batteries every 100 hours.

❑ Electrical Control Unit (ECU) – Check wirings and connections. Make sure door to ECU box is secured tightly to prevent dust from accumulating. Check every 100 hours.

❑ Exhaust System – Check the complete exhaust system every 250 hours of operation. Look for broken, damaged, missing or out–of position parts. Check for holes, loose connections or other conditions which could cause fumes to leak. Be alert for any changes in the sound of the exhaust system or any smell of fumes. These are signs that system may be leaking. Have it checked and/or repaired immediately.

❑ Radiator – Every 500 hours Sample &analyze the engine cool-ant by opening the drain cock at the bottom of the radiator core, flush and refill the engine cooling system with a new engine coolant. *(Clean Radiator Daily)*

❑ Charge Air Cooler – Inspect charge air cooler for external damage, leaks, and clogged fins. Repair all leaks and clean clogged fins. Check every 250 hours.

❑ Oil Cooler – Inspect charge oil cooler for damage, leaks, and clogged fins. Repair all leaks and clean clogged fins. Check Daily.

❑ Deaeration Tank – Visually check engine coolant at deaeration tank. Add coolant as required. Do not allow coolant to go below the minimum level. Check every 50 hours.

❑ Air Conditioner – Check compressor, condenser, evaporator, receiver/drier and control knobs to ensure its safe and reliable operation. Check every 250 hours.

❑ Elevator – Check squeegee bars, large rubber belts, sprocket pulleys, split drive shafts and hydraulic motors for any signs of damage. Elevator should be checked daily and needed repair should be made prior to sweeping. *(Refer to Chapter 3 for Elevator Adjustment)*

❑ Elevator Belt Tension – Measure 2" free play with 60 lbs. pressure.

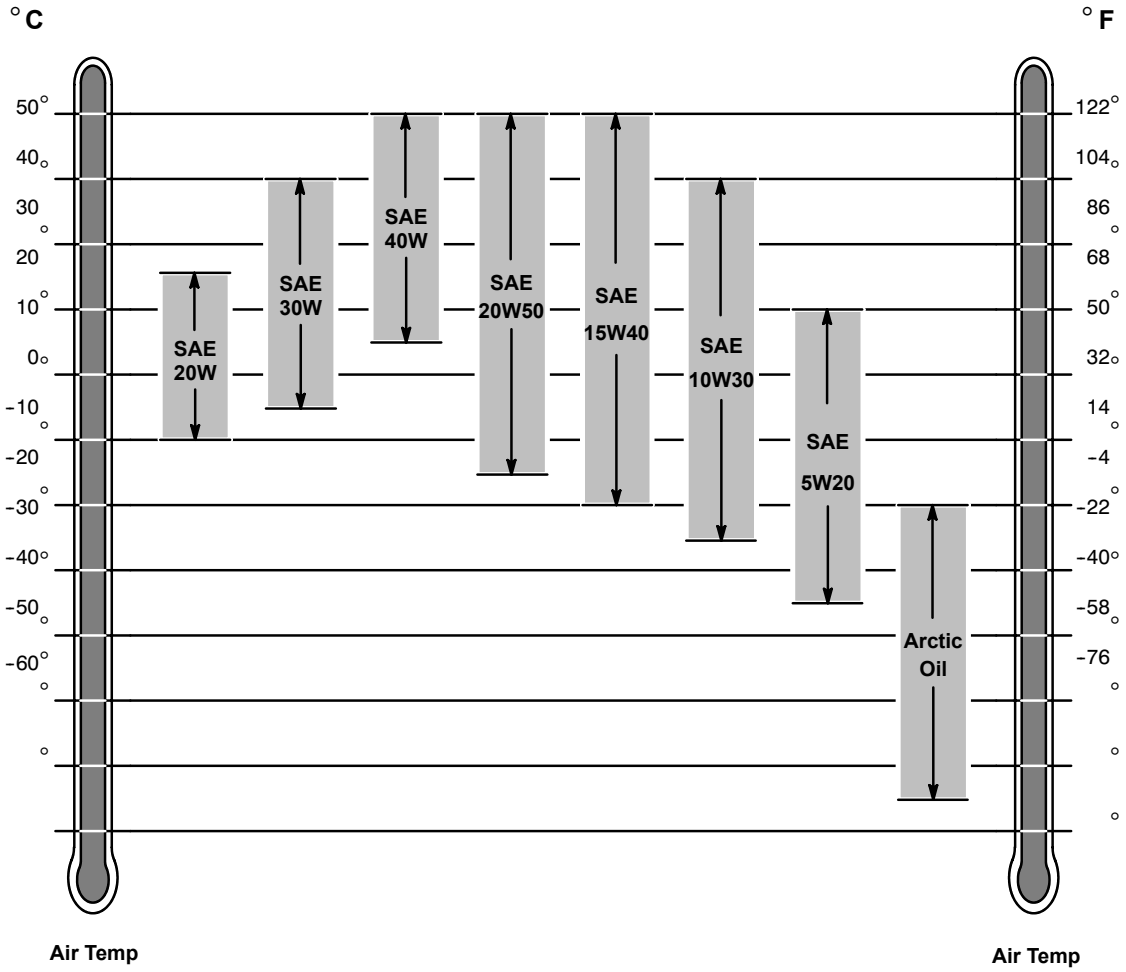
❑ Gutter Broom – Check gutter brooms daily. Broom wire should be replaced when the length is less than 4 inches long.*(Refer to Chapter 3 for Gutter Broom Adjustment)*

❑ Pickup Broom – Check pickup broom pattern daily prior to sweeping. *(Refer to Chapter 3 for Pickup Broom Adjustment)*

❑ Dirt Shoe – If sweeper is not equipped with an automatic lubricating system, lubricate dirt shoe bushings on the left and right pivots every 50 hours.

Recommended Fluids Lubricants

Usage	Fluids Lubricants
Engine Oil	15W40 *(Must meet CES 20081)*
Hydraulic Oil	ISO 68
Steering Fluid	ISO 68
Brake Fluid	Dot 3 or equivalent
Engine Coolant	ELC 94042-(RELC).
Differential Oil	80W90
DEF Fluid	API, ISO 22241-1
Grease	NLGI 1 & NLGI 2
Windshield Washer	Windshield Washer Solvent
Cab-Door Hinges	General Purpose Grease
Battery Terminals	Petroleum Jelly
Diesel Fuel	Grade 1-D or 2-D
AC Refrigerant	R134a
Front Wheel Bearing	High Temperature Roller Bearing Grease.

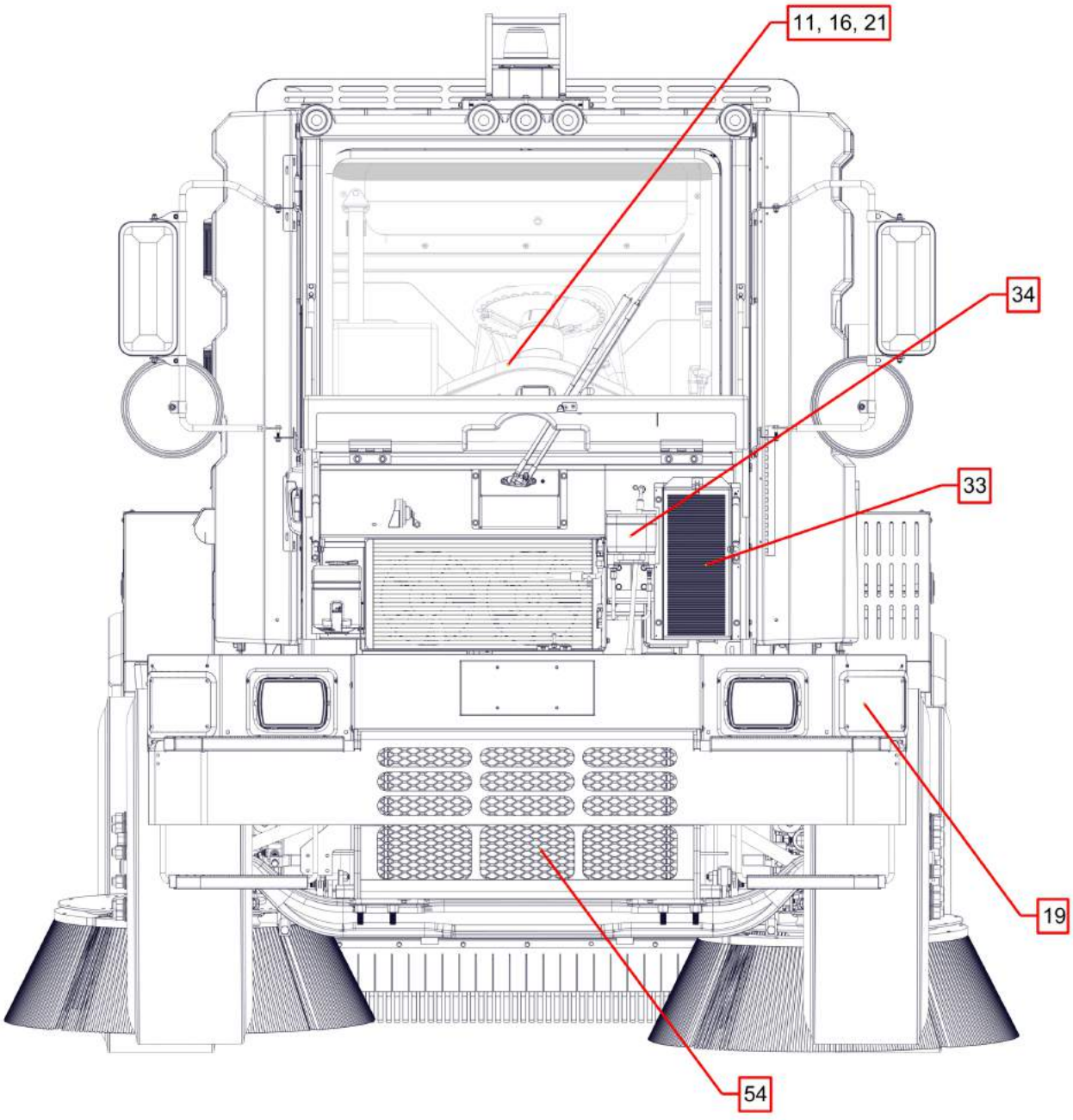


Engine Oil Viscosity

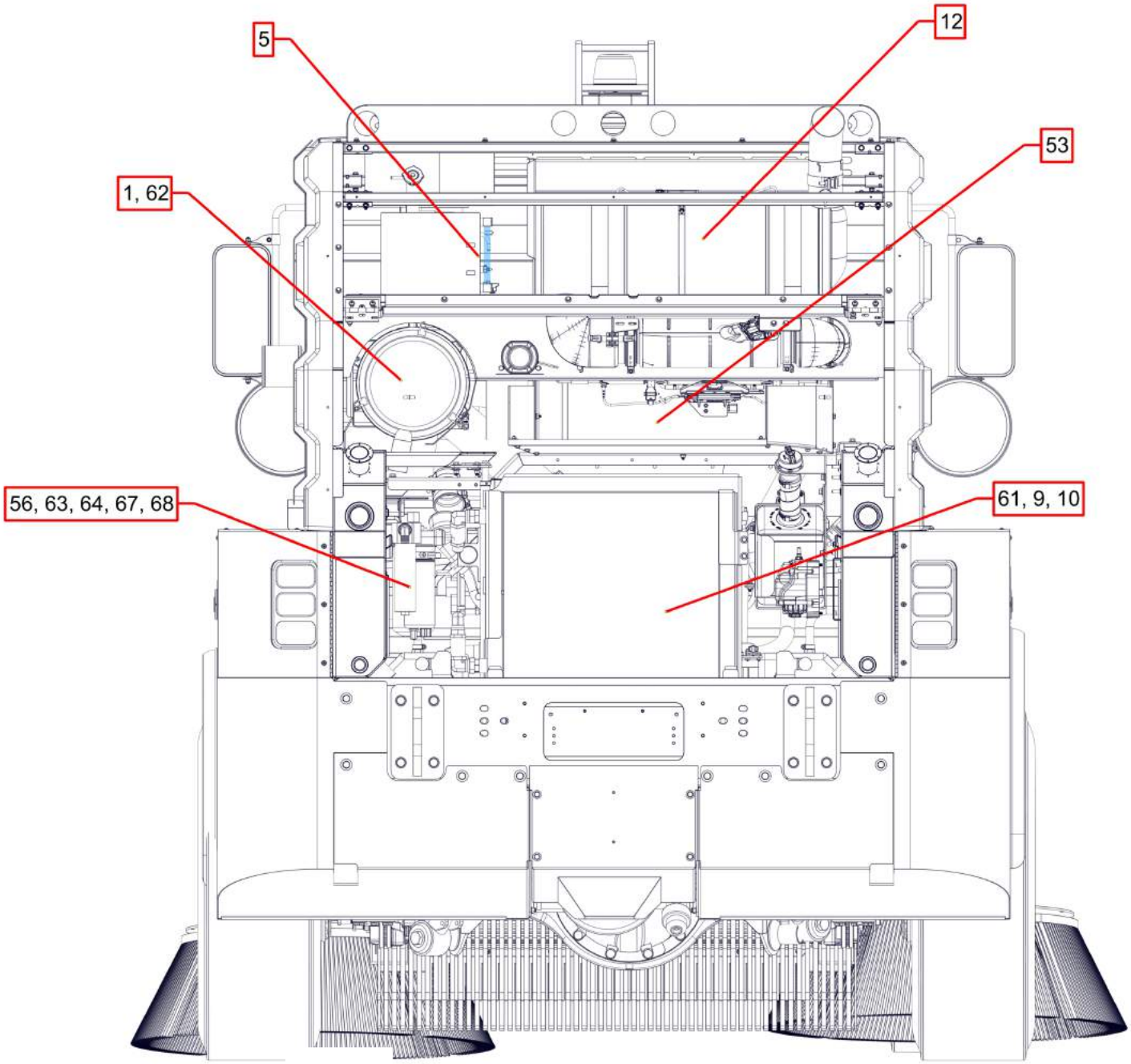
Chart 4.1 – Choose the proper engine oil viscosity based on expected air temperature range during sweeper operation. All oils used must meet API Service Classification SE or CD. SAE 5W20 and arctic oil viscosity grades meeting API Service Classification CC may be used, but oil and filter must be changed twice as often. A slight increase in oil consumption is expected when low viscosity oils are used; therefore, check oil level more frequently. An oil engine heater is required when ambient air temperature is less than 14° F (–10° C).

MAINTENANCE & LUBRICA TION CHART

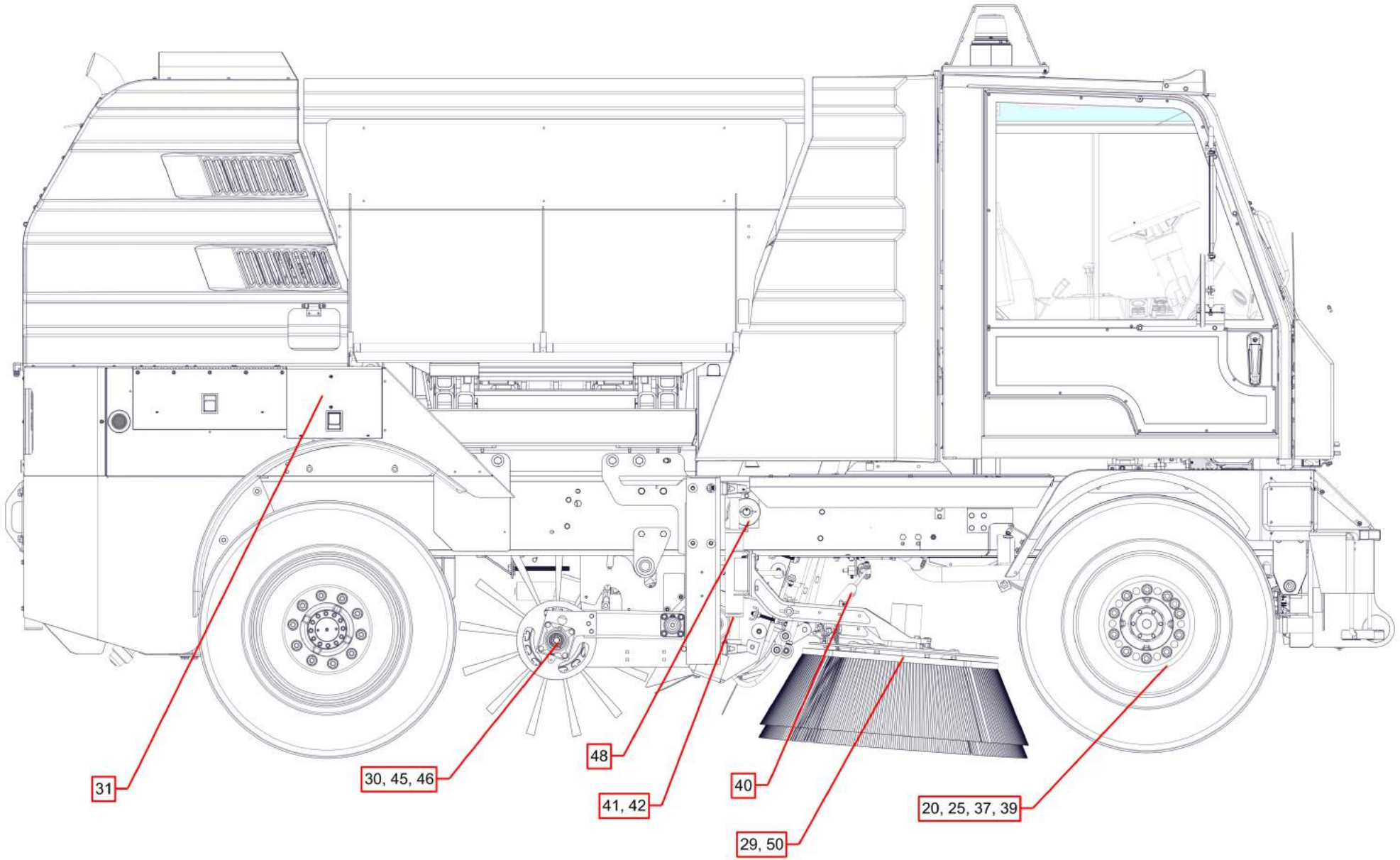
Note: *Perform daily maintenance before each work shift. If a problem is discovered, notify a qualified mechanic to repair machine.*



Note: The * denotes maintenance is required on both sides of the sweeper.



REAR VIEW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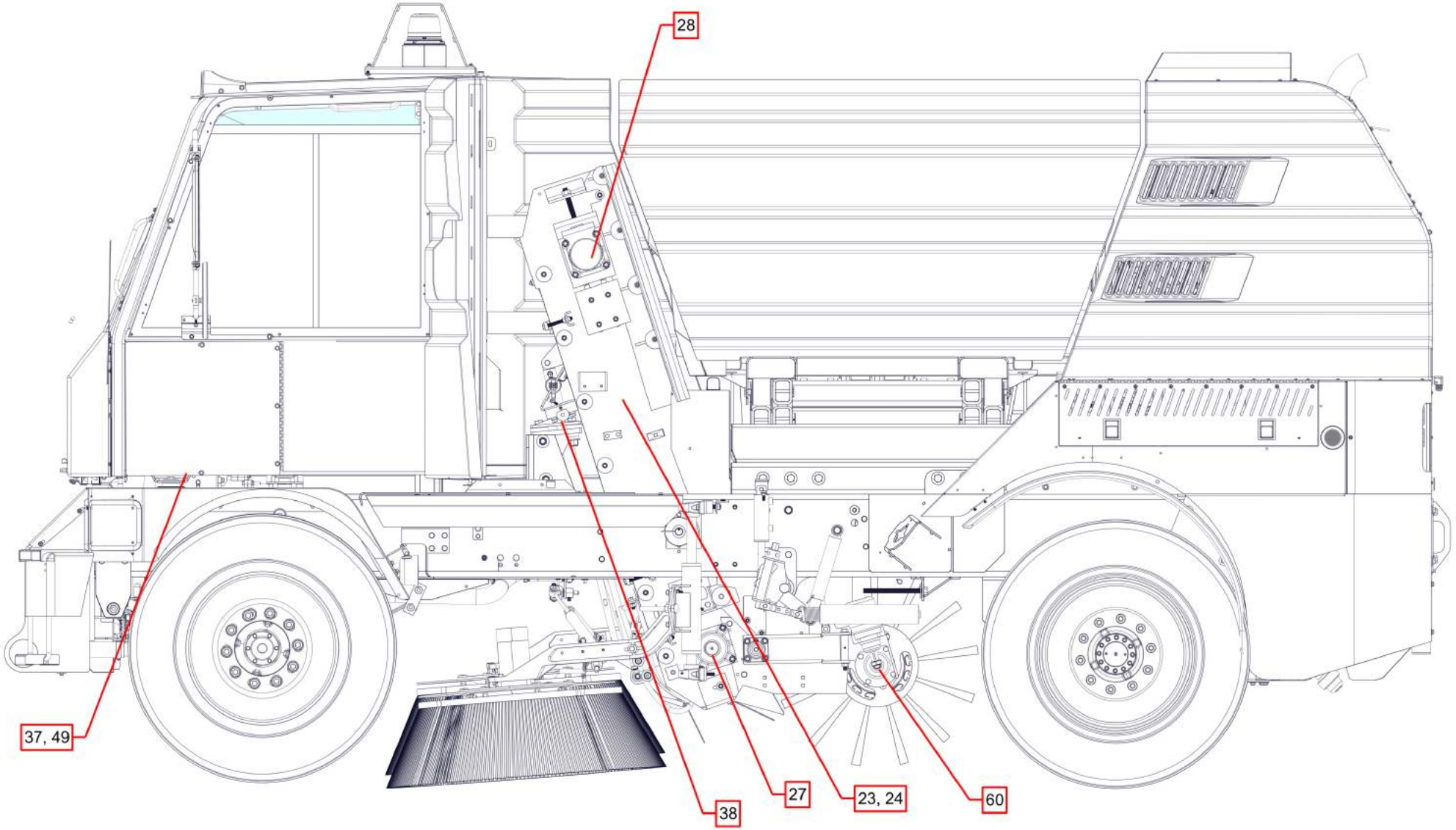
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37, 49
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23, 24
60

No.	Maintenance Operation	Sevice Interval				
		Daily	50 - Hour	100 - Hour	250 - Hour	500 - Hour
	Check: ✓					
1	Air Cleaner Filter	○				
2	Air Cleaner Service Indicator	○				
3	Hyd. Oil Suction Gauge	○				
4	Water Pump Strainer (Check & Clean)	○				
5	Coolant Level	○				
6	Coolant Leakage	○				
7	Hyd. Oil / Water Separator Filter	○				
8	Engine Oil Level	○				
9	Engine Oil Leakage	○				
10	Fan Belt Tension	○				
11	Fuel Level	○				
12	Exhaust System	○				
13	Oil Cooler (Check / Wash)	○				
14	Hyd. Oil Filter Gauge, Differential	○				
15	Hyd. Oil Filter Indicator, High Press.	○				
3					○	
16	Hydraulic Oil Level	○				
17	Hydraulic Oil Leakage	○				
18	Auto Lube Level & Operation	○				
19	Lights	○				
20	Tire Pressure	○				
21	Water Spray Level	○				
22	Water Spray Nozzles	○				
23	Elevator Inspection	○				
24	Elevator Washdown	○				
25	Front Wheel Oil	○				
26	Dirt Shoe Bushings	○				
27	Elevator Bearings, Lower (RH & LH) ★	○				
28	Elevator Bearings, Upper (RH & LH) ★	○				
29	Gutter Broom Motor/Dish Cav. ★	○				
30	Pickup Broom Bearings ★	○				
31	Battery Corrosion		○			
32	Air Cleaner Hoses & Conn. ✓		○			
33	Air Conditioner Filter		○			
34	Brake Fluid Level		○			
35	Differential Oil Level		○			
36	Hydraulic Hoses, Visual Insp.		○			

Note: The 100, 250 and 500 hour maintenance intervals are to be performed in a shop environment by qualified personnel.

Manually Lubricate

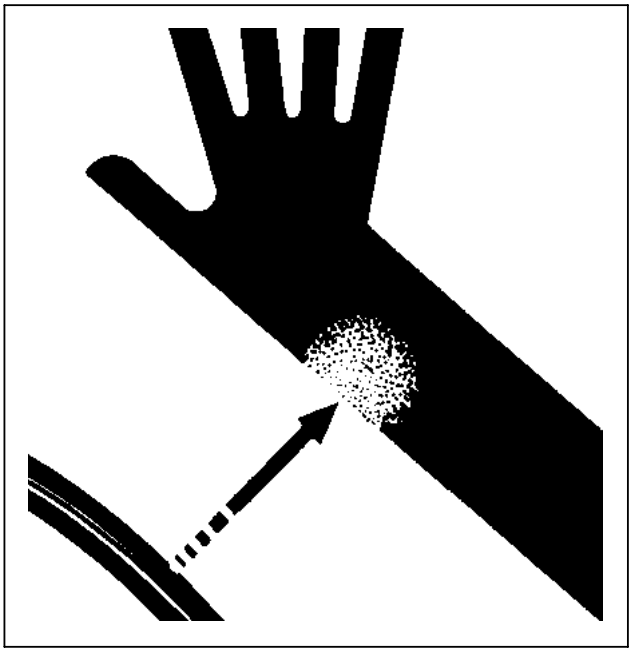
★ **Verify Lube Delivery**

No.	Maintenance Operation	Sevice Interval				
		Daily	50 - Hour	100 - Hour	250 - Hour	500 - Hour
37	Steering Ball Joints ★		○			
38	Elevator Bearings, Pivot ★		○			
39	Front Leaf Spring Bearings ★		○			
40	Gutter Broom Shock Absorber ★		○			
41	Gutter Broom Lift Bearings ★		○			
42	Gutter Broom Swing Bearings ★		○			
45	Pickup Broom Arm Linkage ★		○			
46	Pickup Broom Pivot Linkage ★		○			
48	Gutter Broom Pulleys, RH & LH ★		○			
49	Steering Shaft		○			
50	Gutter Broom Tilt Zerks		○			
51	Drive Line		○			
52	Brake Pedal Bearings		○			
57	Spray Lube		○			
60	Pickup Broom Motor Hinge		○			
	Service - Clean:					
53	Charge Air Cooler	○				
54	Radiator	○				
55	Water Fill Strainers (Check & Clean)		○			
56	Fuel Filter, Primary, Water Sep.	○				
	Service - Change:					
58	Differential Oil					○
59	Engine Oil				○	
25	Front Wheel Beaing Oil					○
61	Hydraulic Oil Cooler- Wash				○	
	Service - Replace:					
62	Air Cleaner, Primary & Safety Elements				○	
63	Engine Oil Filter				○	
64	Fuel Filter, Primary, Water Separator				○	
65	Fuel Filter, Secondary				○	
66	Hydraulic Oil Filter, High Diff. Pressure				○	
67	Hydraulic Oil Filter, High Pressure				○	
68	Hydraulic Oil Filter, Water Separator				○	
69	Hydraulic Oil Compostion				○	

Note: The 100, 250 and 500 hour maintenance intervals are to be performed in a shop environment by qualified personnel.

Manually Lubricate

★ **Verify Lube Delivery**



WARNING

Do not attempt to check for hydraulic oil leaks without hand and eye protection. Oil under pressure can penetrate skin and cause severe injury.

Do not attempt to block oil flow with hands or fingers.

Oil can shoot from a pinhole in a fine jet at a velocity sufficient to penetrate skin causing serious injury.

Use extreme caution when inspecting hydraulic system for oil leaks.

Always wear appropriate clothing and eye protection when working on or near hydraulic system.

Fig: 4.7 A

CAUTION

Keep all dirt, grime, dust and debris from contaminating hydraulic oil when working on hydraulic system.

SERVICE ROUTINE

Normal Sweeper Use Routine

The sweeper service maintenance instructions are based on the assumption that the sweeper will be subjected to an average use. A sweeper that is extensively exposed to abusive conditions requires more frequent attention. A G lobal M 4 sweeper that spends months non – operating also requires periodic maintenance. Rust, dirt and corrosion cause unnecessary damage if the sweeper is neglected. The following routine service maintenance suggestions will help avoid expensive repairs.

1. Air Cleaner Filter – Check and clean air cleaner filter daily. Replace the engine air cleaner filter under normal operations every 250 hours. Operation of sweeper in dusty areas will necessitate more frequent filter replacement.

2. Air Intake Sy s tem – Check daily if air cleaner, filters, hoses and ducts are in good condition.

3. Air Cleaner Service Indicator – Check air cleaner service indicator daily.

4. Air Clea ner & Sa fety Ele ments – Clean air cleaner safety element when required or change at least every third time the primary elements is replaced.

5. Brake Fluid Le vel – Check the fluid in brake fluid reservoir every 50 hours and add fluid *(Use SAE Brake Fluid DOT 3 or equivalent)* as required.

6. Engine Coo ling Sys tem – Check coolant level daily. Every 50 hour intervals clean exterior of radiator, tighten hose clamps and inspect condition of all cooling and heater hoses. Replace hoses if cracked, swollen or deteriorated.

7. Engine Coolant Leakage – Visually check cooling system for leaks. Look at the surface beneath the sweeper after it has been parked for a while for any signs of leakage.

8. Engine Oil and Filter – Check engine oil level-daily. Replace oil and filter every 100 hours of service.

9. Engine Oil Leakage – Visually check engine for oil leaks and repair as required.

10. Belts – Check all engine driven belts for cracks, fraying, wear and tension every 50 hours. Replace worn belts.

11. Fuel System – Check Fuel level daily. Inspect the fuel tank, cap for proper sealing. and fuel lines for damage which could cause fuel leakage. Check every 250 hours intervals.

12. Fuel Filter, Pre-filter – Replace fuel filter element every 250 hours of operation.

13. Fuel Filter, Water Separator – Clean and drain fuel filter every 100 hours of operation.

14. Fuel Filter, Water Separator – Replace fuel filter element every 250 hours of operation.

❑ Water Level – Check water level indicator inside the cab for water spray system.

15. Water Spray System – Check water spray nozzle jets for obstruction. Clean, repair or replace clogged nozzles. Check for water leaks. Check the following daily:

❑ Water Tanks – Check for leaks.

❑ Water Pumps – Check water pumps for operation.

❑ Strainers – Clean two Water Strainers: 1st-next to the engine (rear right hand side of the engine), 2nd-under elbow on top of water tank.

16. Hydraulic Oil – Check oil level daily in each hydraulic tank at sight glass located on outside of hopper towers. With engine turned off add hydraulic oil as required *(ISO 46)*. Sweeper must be warmed to operating temperature when checking oil level. Be sure sweeper is on a level ground when checking oil level.

17. Hydraulic Oil Leakage – Check hydraulic oil system for leaks daily and repair as required.

18. Hydraulic Oil Filter High Pressure – If sweeper is new or any components *(motors or pumps)* have been replaced, change filters after 50 hours of operation. Thereafter, replace hydraulic oil filters every 100 Hours. If the filter gauge indicator is in RED, replace the filter, regardless of the filter operational hours.

19. Hydraulic Oil Filter (Low Pressure) – If sweeper is new or any components *(motors or pumps)* have been replaced, change filter after 50 hours of operation. Thereafter, replace the low pressure hydraulic oil filter every 100 Hours. If the pop-up indicator on the filter shows RED, replace the filter.

20. Hydraulic Oil Composition – Run engine for 15 minutes while operating several hydraulic components such as brooms, elevator or hopper dump. Turn engine off. Clean a convenient hydraulic fitting and using a kit *(P/N 381930)*, provided by Global Environmental Products, draw sample of hydraulic oil and send container to Global Environmental Products for results. Perform the test every 500 hours of operation.

. Front Wheel Bearing Grease – Check and replenish if necessary every 500 hours.

22. Steering Ball Joints – Lubricate steering cross-linkage and steering drive linkage every 50 hours.

23. Steering Spindle Bearing – Lubricate steering box, ering universal ball joints and steering spindle input shaft every 50 hours.

24. Differential Oil Level – Change differential oil every ⁻00 hours of operation. Operate engine and differential for 15 minutes before draining oil. Do not run engine while changing oil.

25. Rear Axle Grease – If sweeper is new or the rear axie has been rebuilt change grease after 50 hours. Thereafter, replace rear axle grease every 500 hours.

26. Tire Pressure – Check tires daily for excessive or abnormal wear, or damage. Also, check tire pressure and adjust to proper inflation.

❑ Front Tires - (Manufacturer Recommended Tire Pressure) - 9R22.5F

❑ Rear Tires - Manufacturer Recommended Tire Pressure - 315/80R22.5J

27. Door Hinge & Latch – Check that door closes, latches, and locks tightly. Check broken, damaged, or missing parts that might prevent from tight latching. Lubricate hinges.

28. DEF (Diesel Exhaust Fluid) – Check DEF tank daily. Inspect the DEF tank cap for proper sealing.

Fig: 4.9 A *Autolube Option Lubrication Points.*

29. Elevator Bearings, Lower – Lubricate left and right lower bearings. *(Automatic lubrication if equipped with the Autolube option)*

30. Elevator Bearings, Upper – Lubricate left and right upper bearings. *(Automatic lubrication if equipped with the Autolube option)*

31. Elevator Pivot – Lubricate left and right pivot located between cab and elevator. *(Automatic lubrication if equipped with the Autolube option)*

32. Gutter Broom Lift Bearings – Lubricate left and right gutter broom arm and pulley. *(Automatic lubrication if equipped with the Autolube option)*

33. Gutter Broom Swing Bearings – Lubricate upper and lower pivot bearings. *(Automatic lubrication if equipped with the Autolube option)*

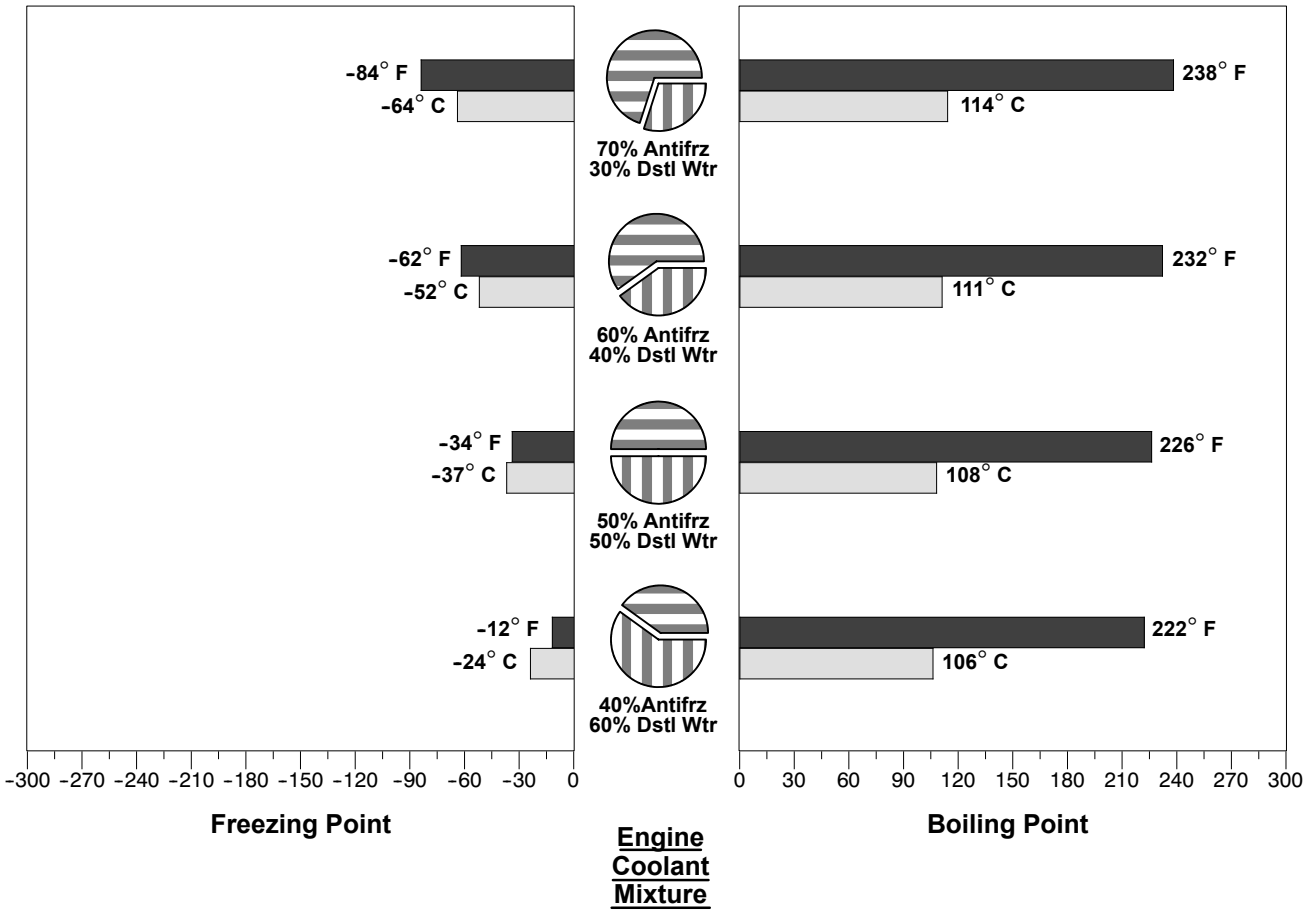
34. Gutter Broom Motor/Dish Cavity – Lubricate left and right motor/dish cavity. *(Automatic lubrication if equipped with the Autolube option)*

35. Pickup Broom Arms Linkage – Lubricate left and right arms and pivot linkage. *(Automatic lubrication if equipped with the Autolube option)*

36. Pickup Broom Bearings – Lubricate bearings. *(Automatic lubrication if equipped with the Autolube option)*

37. Pickup Broom Pivot Linkage – Lubricate left and right pivot linkage. *(Automatic lubrication if equipped with the Autolube option)*

48. Dirt Sh oe Bushings – Lubricate left and right pivots.



CAUTION

Do not use methyl alcohol base antifreeze. Do not use methoxy propanol antifreeze. Damage may occur to rubber seals on cylinder liners which are in contact with coolant.

NOTE: *Some types of ethylene glycol antifreeze commonly available on the open market are intended for automotive use. These products are often labeled for use in aluminum engines and usually contain more than 0.1 percent anhydrous metasilicate. Use of this type of antifreeze can cause a gel-like deposit to form which reduces heat transfer and coolant flow. When wet, gel becomes the same color as coolant. When dry, gel is a white, powdery deposit. Check container label or consult with antifreeze supplier before using.*

Chart 4.2 - Engine coolant mixture consist of a ethylene glycol type antifreeze and distilled water. The ethylene glycol type antifreeze cannot contain more than 0.1 percent anhydrous metasilicate and must meet General Motors Performance Specification GM1899M or be formulated to GM6038M. Antifreeze to distilled water coolant mixture is determined by required boiling and freezing points.

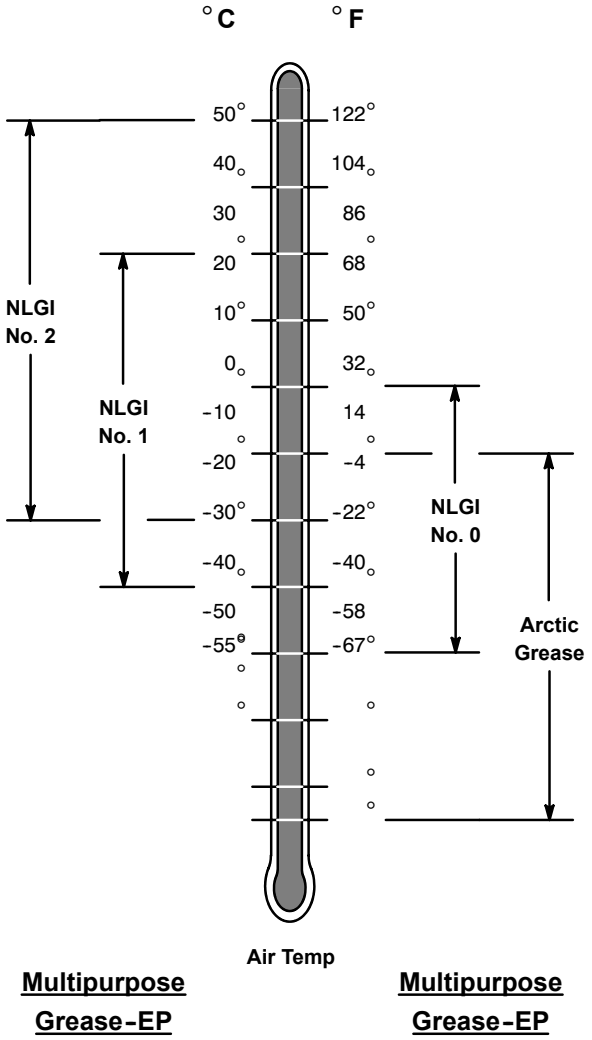


Chart 4.3 - Choose the proper Multipurpose Extreme Pressure (EP) grease based on expected air temperature range during sweeper operation. All grease used must meet SAE Multipurpose EP (MPG) service classification or SAE Multipurpose EP with Molybdenum Disulfide (MPGM) service classification. The consistency property of grease determines it's classification which is the measure of relative hardness expressed in terms of a National Lubricating Grease Institute (NLGI) consistency number.

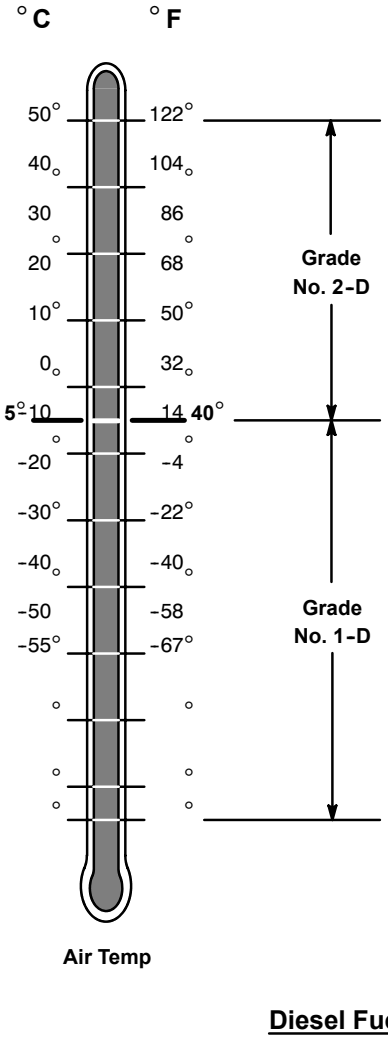


Chart 4.4 - Either Grade No. 1-D or Grade No. 2-D diesel fuel, as defined by ASTM designation D975, is required for diesel engines. Choose the correct EPA certified diesel fuel corresponding to air temperature at the time motor is started. When sweeper is operating at altitudes above 5000 ft (1500 m), use Grade No. 1-D for all temperatures. If sweeper is frequently being shutdown and restarted, use Grade No. 1-D for all temperatures.

PM–10 OPTION

To maintain optimal PM–10 efficiency, the operator must inspect the hopper and elevator seals for proper sealing. Water spray system must also be in proper working condition. Checked all PM 10 components on a daily basis. Prior to sweeping, the following functions must be set and checked:

a. Check water level and make sure water gauge indicates adequate water level.

b. Water control valves behind the buddy seat must be turned ON.

c. Pickup broom and gutter broom must be down and rotating.

d. Elevator switch must be in the ***FORWARD*** position and water pump switch must be ***ON*** or the water spray system will not function.

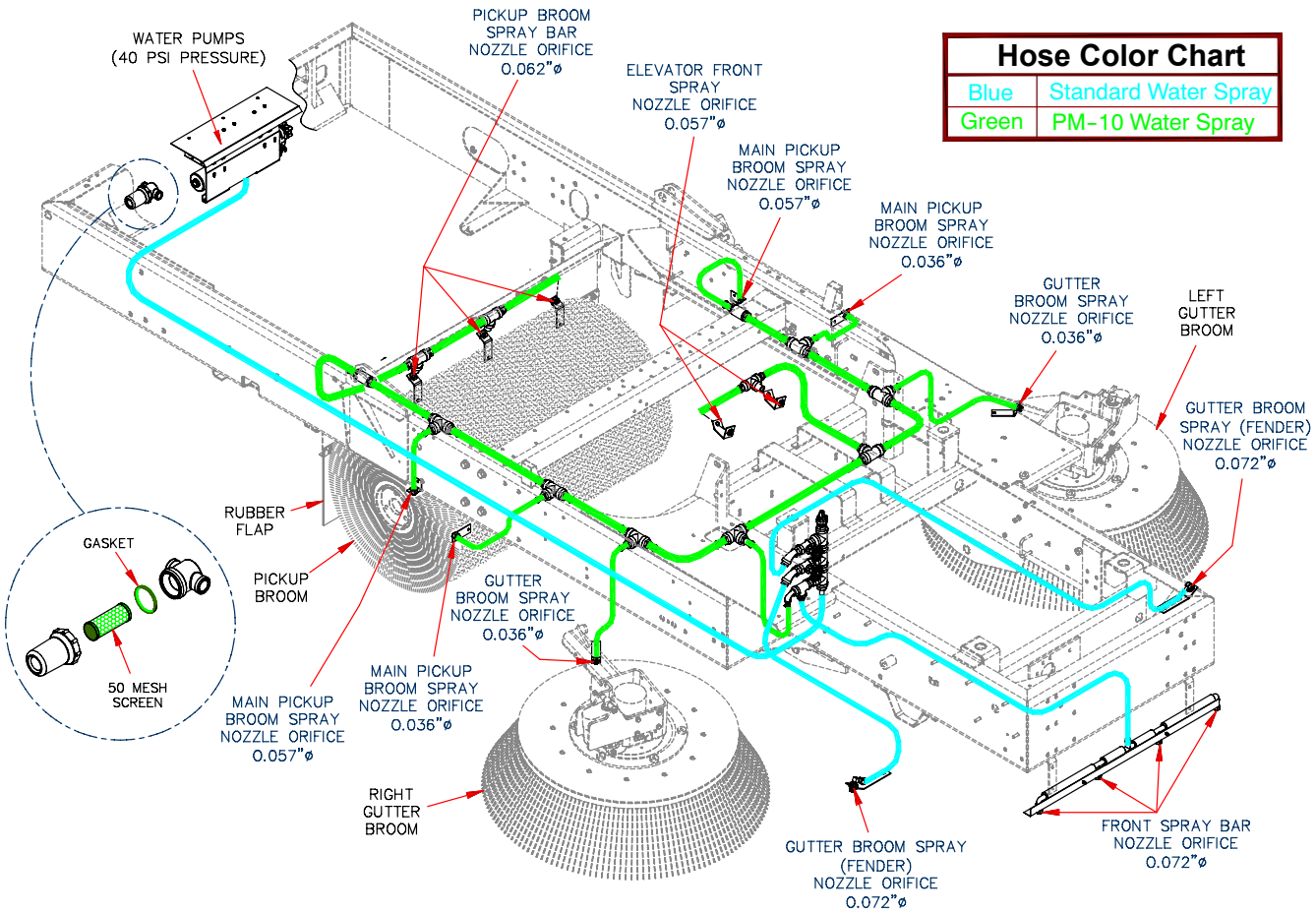
e. With the unit stationary and the water spray operating, visually inspect all nozzles are spraying cleanly.

CAUTION

Do not attempt to sweep if water gauge indicates below empty.

CAUTION

Do not attempt to sweep with the water spray system inoperative.



(PM 10 Water Plumbing Schematic) Fig: 4.18 A

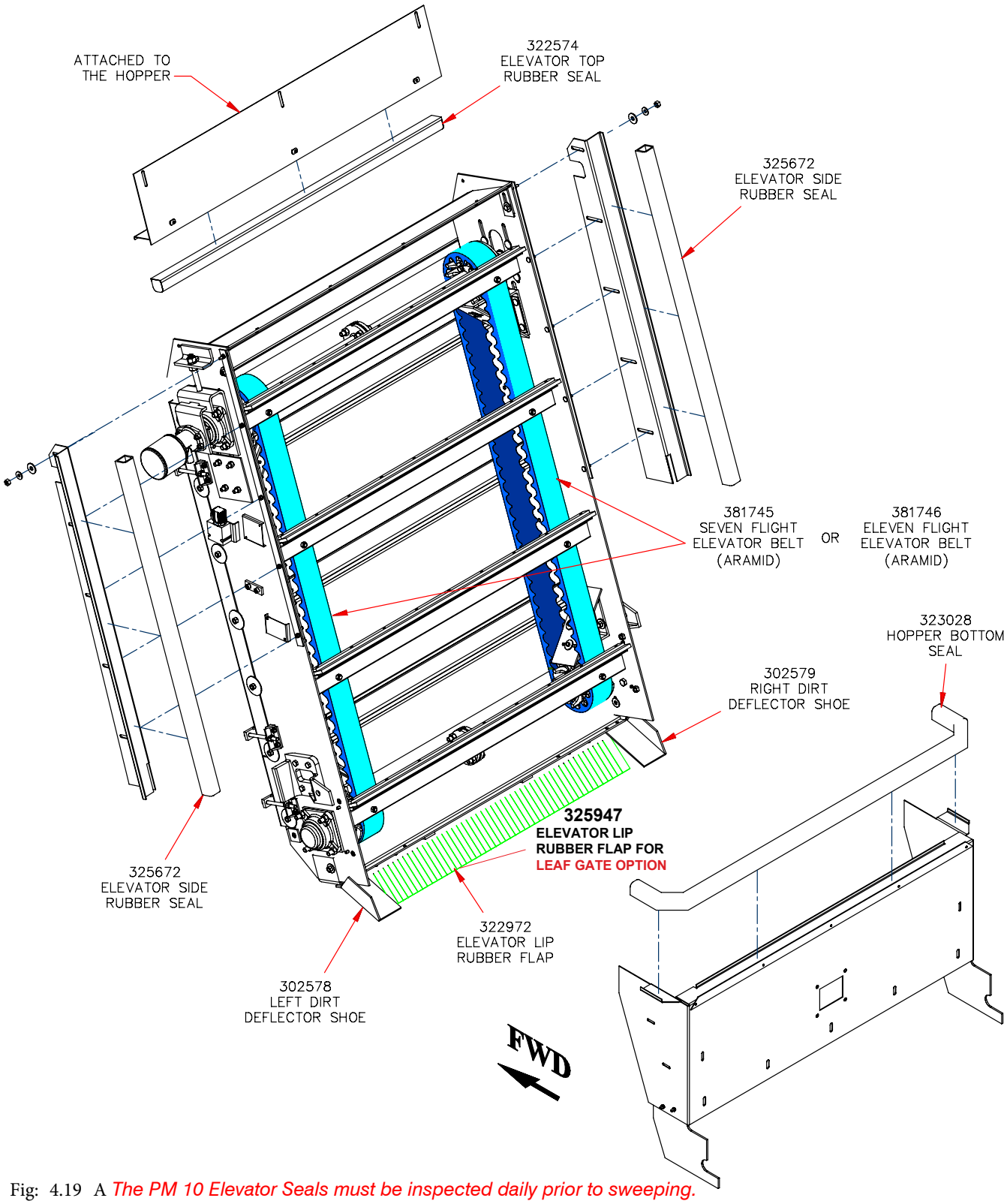


Fig: 4.19 A *The PM 10 Elevator Seals must be inspected daily prior to sweeping.*

WASHDOWN

Because your job and responsibility is to primarily operate the equipment does not prevent you from focusing some attention on the cleanliness of the unit. Keeping the machine in a clean condition will help prolong the life of some components. If the unit is exposed to high dust level, washdown the machine after use. Do not let dirt accumulate. Washdown sweeper after every sweeping shift.

Washdown Procedure

1. Park the sweeper on a level surface.

2. Raise hopper. Install prop rods.

WARNING

Falling hopper can cause severe injury or death. The prop rod must be in position before anyone goes under hopper.

3. Attach the fire hydrant hose located at the center body panel to a high volume water source such as a fire hydrant.

4. Attach the high pressure hose provided in the tool box to the fitting next to the filler hose.

WARNING

Stand clear from the fire hydrant hose when filling tanks or attaching water hose. A high volume of water travels through hose under high pressure.

5. Turn ON the built–in elevator washdown water spray system.

6. Lower the PUB to sweeping position. Start rotation of the elevator.

7. With the elevator running, use a high pressure water hose *(connected to a high volume source)* to flush the elevator.

8. Flush out the hopper, all undercarriage parts, side broom(s), and dirt shoes.

9. Use a high pressure hose to dislodge material between the lower sprocket and the edge of the squeegee bar. Flush the lower sprocket from both sides of the sweeper.

CAUTION

An engine must never be washed or steam cleaned while it is running. Cold water on a hot manifold could crack the manifold.

CAUTION

A high pressure hose should never be used to clean a radiator or oil cooler. The high pressure water can damage cores.

CAUTION

A high pressure hose should never be aimed directly at solenoid valves, particularly when they are hot.

CAUTION

DO NOT spray high pressure water at or around ECM or fuse/relay box.

10. Before washing down the engine compartment, be certain that the engine is cool. Be sure to clean out the engine radiator, oil cooler and other engine external components.

11. After the washdown, visually inspect for damage or unusual signs of wear.

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CHAPTER **5**

Maintenance Overhaul

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GENERAL INFORMATION

This chapter contains procedures for the removal, repair, overhaul, and installation of component parts of the Global M4 Series sweeper. Refer to the supplied Cummins Engine manual to perform service, maintenance, overhaul or troubleshooting procedures on the engine.

Throughout this chapter, Front and Rear refer to the front and rear of the vehicle. The front of any component is determined by the area, which is towards the front of vehicle when assembled on the sweeper. Left and Right sides of the vehicle refer to the orientation of a person sitting in the driver's cab facing forward.

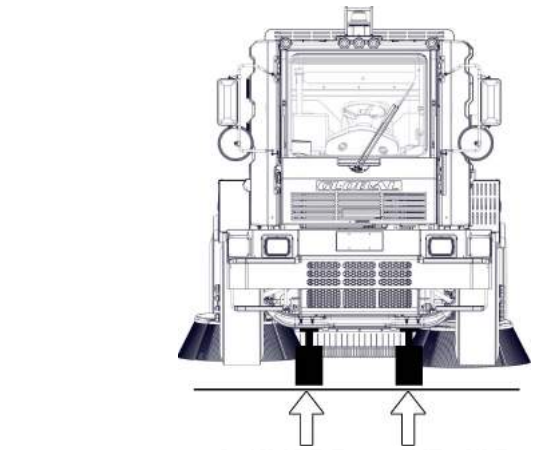
Be aware that the engine is actually situated in the sweeper frame backwards *(the flywheel is toward the front of the sweeper and the alternator, water pump and cooling fan are toward the rear of the sweeper).*

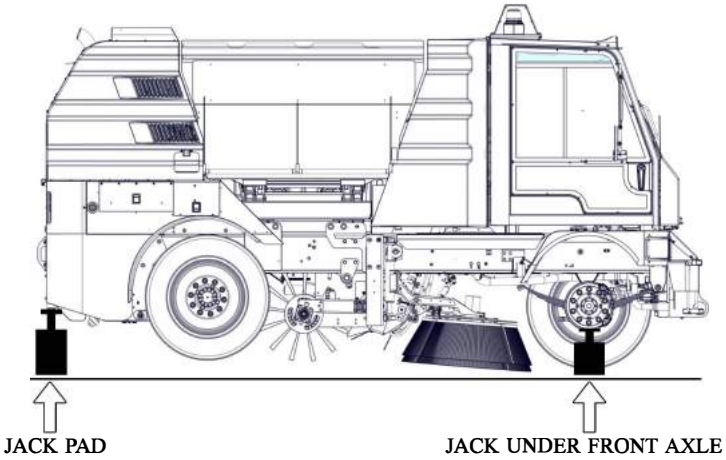
During disassembly and assembly, remember that force is rarely needed. If parts have a tight fit, such as a bearing in a case, there is usually a tool designed to do the job. Never use a screwdriver to pry apart any parts with machined surfaces. You will mar the surfaces and leaks will result after the parts are reassembled.

Most procedures are straightforward and are accompanied by illustrations and/or photographs. If a more detailed parts description or an assembly illustration is required, refer to the accompanying parts manual. Hydraulic and electrical schematics are located in the Appendix section of the Service Manual.

Perform preventive maintenance and overhaul tasks when they are required, so as to avoid additional expensive repairs that will result from damage caused by operating a malfunctioning sweeper. It has been proven that a well–maintained sweeper has increased reliability and improved long term, overall performance.

Table 5.1
Jacking Procedures





Equipment Required

- 5–ton hydraulic jack with an adjustable stroke of 9 inches minimum to 19 inches maximum
- Wheel chocks
- Jackstands

Procedures

1. Position the sweeper on a level surface.
2. Place the shifter in *Park (P)* setting the parking brake.
3. Stop the engine.
4. Jacking the front:
   a. Chock rear wheels.
   b. Place the jack under the front axle.
5. Jacking the rear:
   a. Chock the opposite rear and front wheels.
   b. Place the jack under the rear jack pad.
6. Place jackstands under the vehicle. Do not trust a hydraulic jack to hold the sweeper up by itself.

CAUTION

If you can not find a nearly level work area, DO NOT attempt to jack the sweeper up!

FRONT & REAR AXLES

Front Wheel – *Removal/Installation*

1. Position the sweeper on a hard level surface.
2. Set the parking brake, stop the engine, and jack the ve hicle in accordance with the Jacking Procedures in Table 5.1.

WARNING

To prevent death or accidental injury, always place jack – stands to support a raised vehicle.

3. With the front tire slightly off the ground, clean the area around the wheel and hub.
4. Remove the wheel lug nuts.
5. Remove the wheel assembly from the front hub.
6. Remove the tire from the wheel, and repair the tire as required, using standard procedures.
7. With the tire dismounted, inspect the wheel for signs of damage such as a rough area that might damage the mounted tire. Repair the wheel as required.
8. Using standard procedures, remount the tire to the wheel. Inflate the mounted tire to 105 psi.
9. Place the assembled wheel on the front hub, and install and hand tighten the lug nuts. Tighten the lug nuts in the numerical order shown in Fig: 5.4 A. Final torque specification of front wheel lug nuts is 400–420 ft lbs.
10. Adjust the magnetic sensor to .010–.015 in. gap from the timing plate.
11. Remove the jack–stands and lower the sweeper to the ground.
12. Remove the jack and wheel chocks.

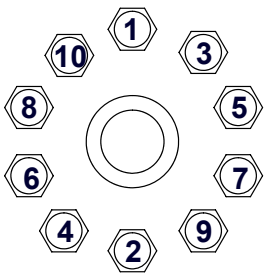
Rear Wheel – *Removal/Installation*

1. Position the sweeper on a hard level surface.
2. Set the parking brake, stop the engine, and jack the vehicle in accordance with the Jacking Procedures in Table 5.1.

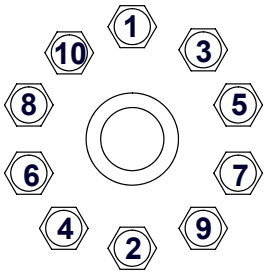
WARNING

To prevent death or accidental injury, always place jack – stands to support a raised vehicle.

3. With the rear tire slightly off the ground, clean the area around the wheel and hub.
4. Remove the wheel lug nuts.
5. Remove the wheel assembly from the rear hub.
6. Remove the tire from the wheel, and repair the tire as required, using standard procedures.
7. With the tire dismounted, inspect the wheel for signs of damage such as a rough area that might damage the mounted tire. Repair the wheel as required.
8. Using standard procedures, remount the tire to the wheel. Inflate the mounted tire to 120 psi.
9. Place the assembled wheel on the rear hub, and install and hand tighten the lug nuts. Tighten the lug nuts in the numerical order shown in Fig: 5.4 A. Final torque specification of rear wheel lug nuts is 450–500 ft lbs.
10. Remove the jack–stands and lower the sweeper to the ground.
11. Remove the jack and wheel chocks.



Front Lug Nut Torque Pattern (400-420 ft lbs)



Rear Lug Nut Torque Pattern (450-500 ft lbs)

Fig: 5.4 A *Lug nut tightening sequence for replacing the front and rear wheels. Torque the first and second lug nuts to properly seat in the wheel recess before tightening down other lug nuts. Tighten in the sequence order shown.*

Shock Absorber – ***Removal/Installation***

1. Position the sweeper on a level surface and follow the Jacking Procedure in Table 5.1. Jack the front of the sweeper to extend the shock absorber.
2. Remove the nut, screw, washers and spacer *(Fig: 5.5A: 1, 2, 3 & 4)* from the bottom mount of the shock absorber.
3. Detach the lower mount of the shock absorber from the hanger weldment *(6)*.
4. Remove the nut, screw, washers and spacer *(1, 2, 3 & 5)* from the top mount of the shock absorber.
3. Detach the upper mount of the shock absorber from the frame.
4. Remove the shock absorber *(7)*.
5. Install the shock absorber by reversing the steps.

***NOTE**: Check the spacers for proper fit in the rubber grommet mounts prior to installing the shock absorber.*

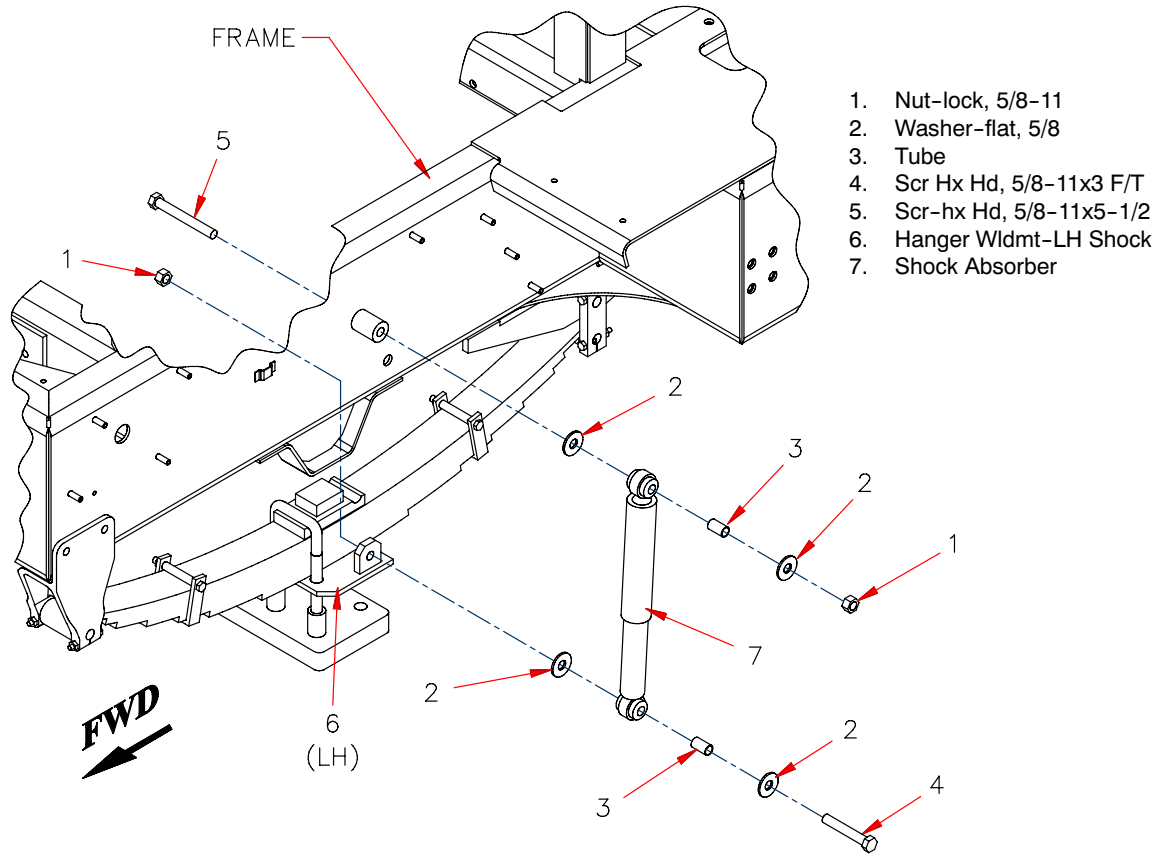
Steering Gear Assembly –***Removal/Installation***

1. Position the sweeper on a level surface.
2. Place the shifter in the *Park (P)* position, setting the parking brake.
3. Stop the engine.
4. Chock the rear wheels.
5. Clean the area around the steering shaft and gear assembly.
6. Identify the hoses connected to the steering gear assembly.

   ***NOTE:** Provide a container to catch the excess hydraulic fluid from the steering gear assembly prior to removing the hoses.*

7. Disconnect both hose assemblies from each elbow.
8. Temporarily plug the disconnected hydraulic hoses.

   ***NOTE:** If replacing the steering gear assembly, remove both elbows.*



1. Nut-lock, 5/8-11
2. Washer-flat, 5/8
3. Tube
4. Scr Hx Hd, 5/8-11x3 F/T
5. Scr-hx Hd, 5/8-11x5-1/2
6. Hanger Wldmt-LH Shock
7. Shock Absorber

Fig: 5.5 A *The Front Shock Absorber Removal/Installation procedure is the same for both left and right sides. The top mount of the shock fastens to the frame and the bottom mount fastens to the hanger weldment, which is bolted to the front axle spring.*

NOTE: Tighten according to tor ue specifications included in Parts Manual, Chapter 1, drawing 32433 . Rev .

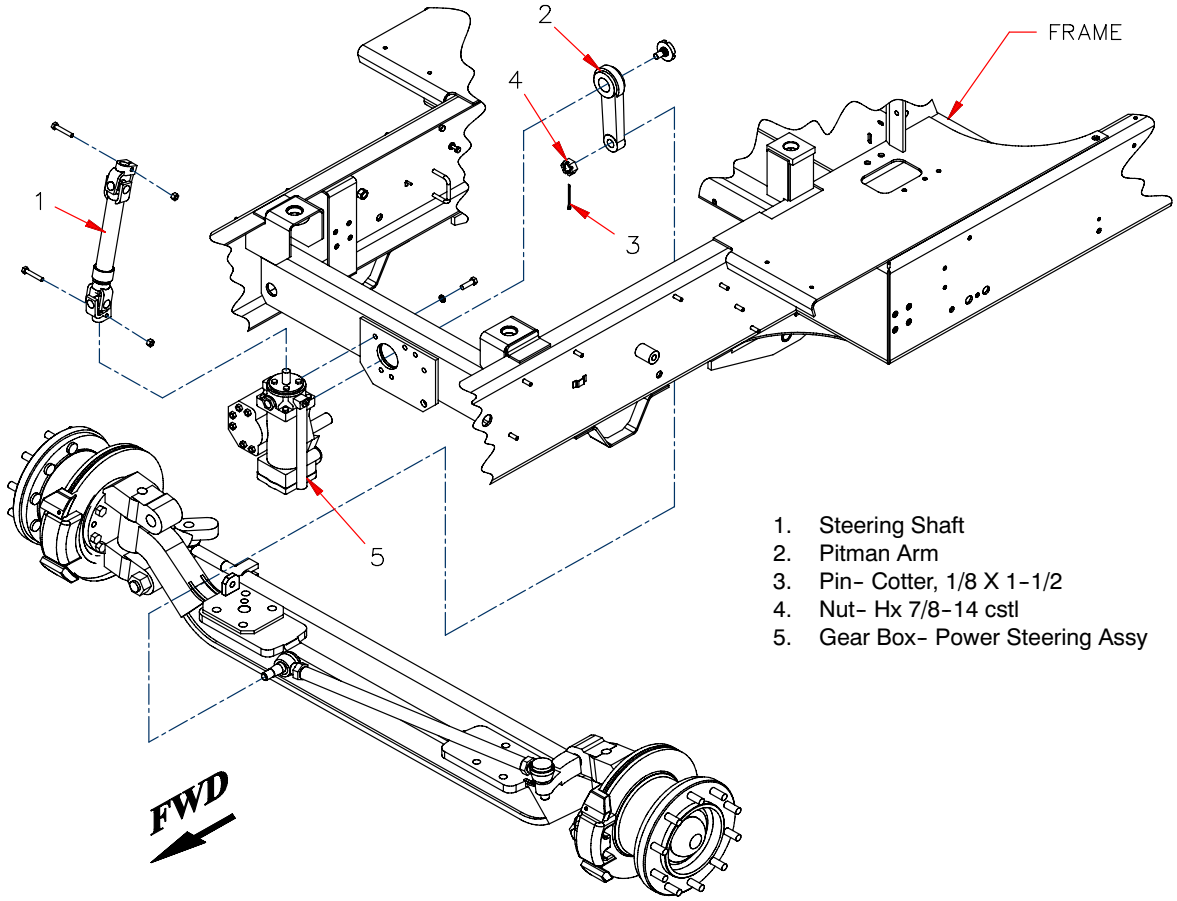


Fig: 5.6 A *The Steering Gear Assembly is bolted to the steering gear frame bracket, which is welded to the frame. Prior to removal, identify the position of the steering arm as it relates to the spine shaft. Replace the arm in a similar position and adjust the linkage.*

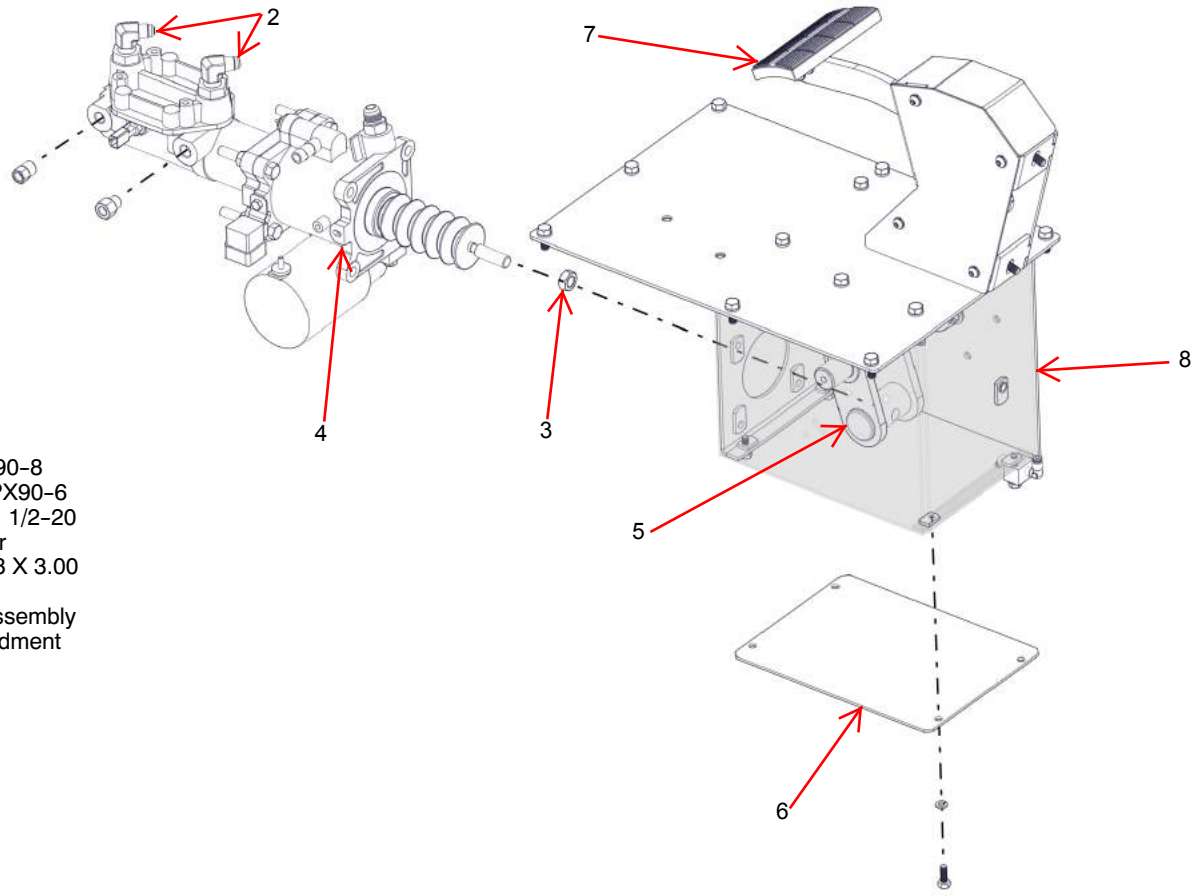
9. Remove the lock nut and cap screw securing the upper swivel joint of the lower steering shaft to the steering column shaft *(Fig: 5.6A: 1)*. When disconnected, the upper half slides into the lower half of the shaft.
10. Remove the hex nut and cap screw securing the lower joint of the lower steering shaft to the steering gear assembly.
11. Remove the lower steering shaft *(1)*.
12. Remove cotter pin and loosen the castle nut. Pull the steering pitman arm *(2)* from the output shaft of the steering gear assembly.
13. Remove the screw and lock washers securing the steering gear assembly *(5)* to the steering gear frame bracket.
14. Remove the steering gear assembly *(5)*.
15. Install the steering gear assembly by reversing the steps.

Master Brake Cylinder – ***Removal/Installation***

1. Position the sweeper on a level surface.
2. Place the shifter in the *Park (P)* position, setting the parking brake.
3. Stop the engine.
4. Chock the rear wheels.
5. Clean the area around the booster/master cylinder assembly and the brake pedal.
6. Identify the hydraulic hoses connected to the booster/master cylinder assembly and the electrical leads connected to the flow switch, differential pressure switch, brake relay and pump.

   NOTE: *Before removing the hoses, provide a container to catch the excess hydraulic fluid from the booster/master brake cylinder.*
7. Disconnect hydraulic hoses from the master cylinder.

NOTE: Tighten according to tor ue specifications included in Parts Manual, Chapter 1, drawing 32433 . Rev .



1. Elbow- MJ-FJ90-8
2. Elbow- MJ-MPX90-6
3. Jam- Nut, Pltd, 1/2-20
4. Master Cylinder
5. Pin- Pivot, 1.38 X 3.00
6. Plate- Cover
7. Brake Pedal Assembly
8. Brake Box Weldment

Fig: 5.7 A *The Booster/Brake Master Cylinder is located under the front hood and extends back under the operator's cab. The master cylinder is accessible from the front of the vehicle and the linkage is accessible from the right side of the vehicle between the bottom of the cab and the top of the front fender.*

8. Temporarily plug the disconnected hydraulic hoses.
9. Disconnect the electrical leads from the master cylinder.
10. Remove the brake box bottom cover *(Fig: 5.7 A: 6)* and remove the return spring from the brake pedal.
11. Remove the nuts, washers and screws securing the brake lever weldment and flange bearing.
12. Loosen the jam nut *(3)* and remove pivot pin *(5)* connecting rear end shaft of the master cylinder.
13. Remove the nuts and washers securing the front mounting plate.
14. Remove nut and disconnect push/pull cable.
15. Remove the master cylinder *(4)* with the front mounting plate intact.
16. Remove the nuts and washers securing the plate to the master cylinder.
17. Install the front mounting plate and the new or rebuilt booster/master cylinder by reversing steps 10 through 17.
18. Adjust the jam nut *(3)* to the shaft on the rear end of the master cylinder.

    NOTE: *Do not tighten the jam nut until step 20.*
19. Screw the shaft on the rear end of the master cylinder to the pivot pin and adjust the position of the brake lever weldment and secure flange bearing.
20. Tighten the jam nut *(3)*.
21. Install the electrical leads and hydraulic hoses by reversing steps 6 thru 9. Fill the booster/master cylinder with approved brake fluid.

    NOTE: *Bleed the brake system anytime the booster/master cylinder assembly or hydraulic hoses are replaced or repaired.*
22. Adjust the brake system following the adjustment procedure in Chapter 3.

NOTE: Tighten according to tor ue specifications included in Parts Manual, Chapter 4, drawing 325452. Rev C.

1. Actuator- Parking Brake
2. Elbow- MB-MJX90-8
3. Nut- Jam, Plated, 5/8-18
4. Nut- Lock, Plated, 5/8-18
5. Washer- Lock, Split, Plated, 5/8
6. Washer- Flat, SAE, Plated, 5/8
7. Turn Buckle Weldment
8. Hairpin- 5/8 Dia.
9. Clevis Pin- 3/8 X 1 1/8
10. Cotter Pin- Plated, 1/8 X 1
11. Cleavis Weldment, LH Thread
12. Clevis Weldment

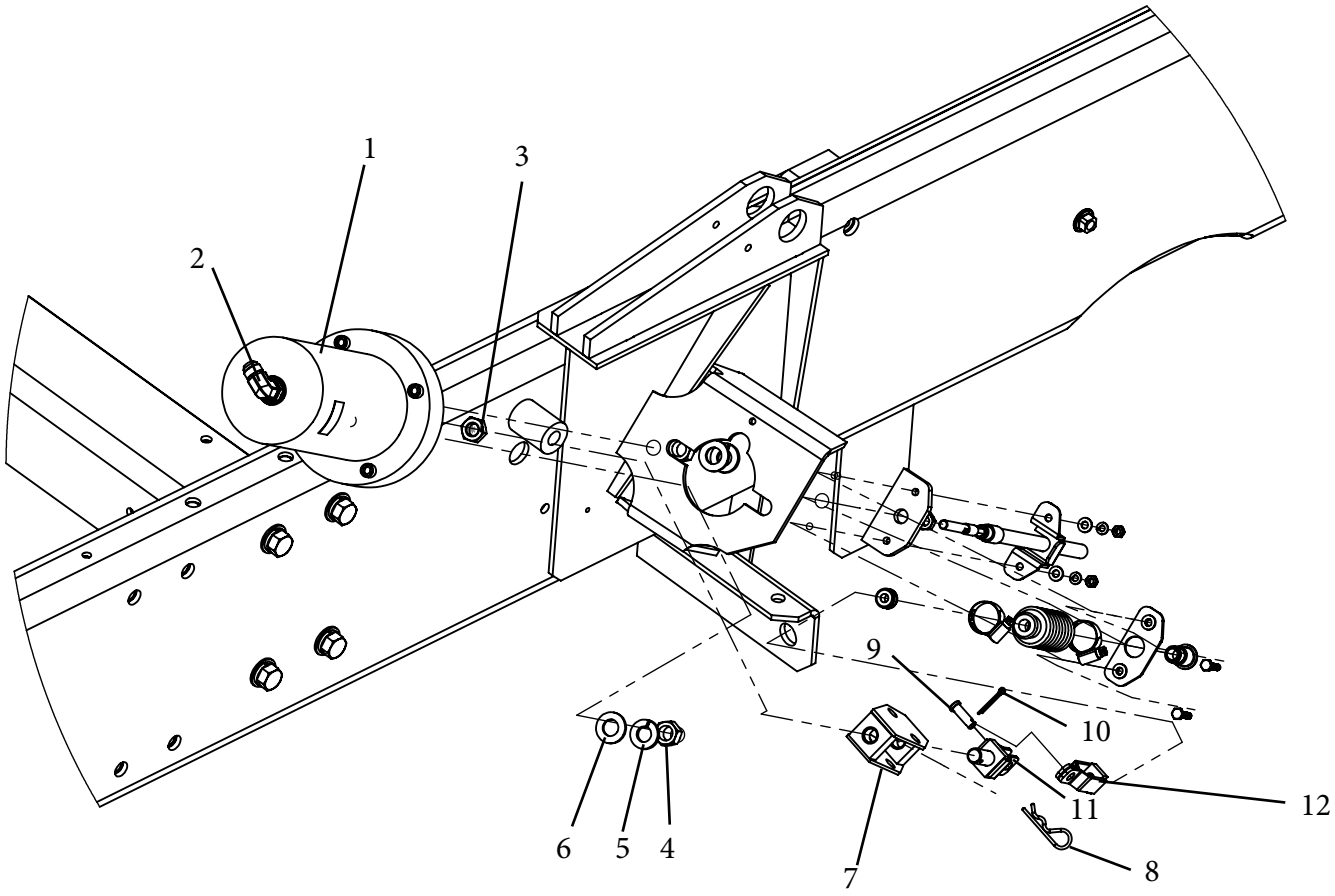


Fig: 5.8 A *The Parking Brake Actuator is located in front of the left rear fender. Do not cut into, disassemble or torch the canister. The spring is under compressed force. The actuator canister is not repairable and must be replaced if a failure occurs.*

NOTE: Tighten according to tor ue specifications included in Parts Manual, Chapter 1,

Parking Brake Actuator
- *Removal/Installation*

1. Position sweeper on a level surface.
2. Chock the rear wheels.
3. Clean the area around the Parking Brake Actuator, cables and connecting hardware.
4. With an assistant in cab, have them turn ignition *ON,* place shifter in the *Low (L)* position, releasing the parking brake and engage the brake pedal.

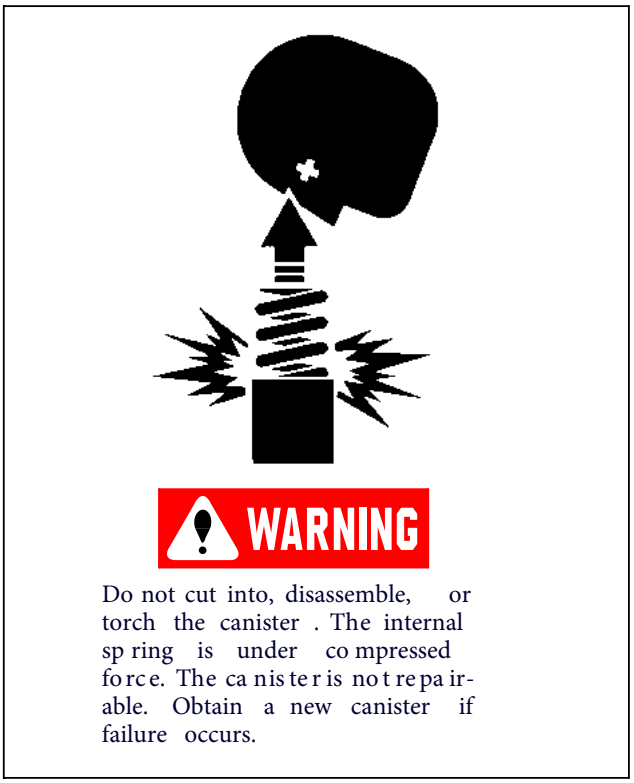


Fig: 5.9 A

5. Remove the parking brake release cotter pin and the clevis *(Fig: 5.8A: 9 & 10)* from the clevis weldment *(11).*
6. Loosen the locking nut *(3).* Using the gutter broom angle adjustment tool, mechanically unscrew the parking brake clevis weldment *(7) turnbuckle* and remove it from the actuator *(1).*
7. Turn off engine.
8. Disconnect the hydraulic hose from the elbow *(2)* on the front of the actuator. Plug the hose.

   NOTE: *Before removing the hydraulic hose, provide a container to catch the excess hydraulic fluid from the parking brake actuator.*
9. Remove the nuts and flat washers securing the actuator to the frame. Remove the actuator *(1).*
10. Install the parking brake actuator by reversing the steps.

Hydraulic pressure is present with parking brake activated. Do not remove hydraulic hoses with shaft protruding out of cannister.

Parking Brake Cable
- *Removal/Installation*

1. Position sweeper on a level surface.
2. Chock the rear wheels.
3. Clean the area around the Parking Brake Actuator, cables and connecting hardware.
4. With an assistant in cab, have them turn ignition *ON,* place shifter in the *Low (L)* position, releasing the parking brake and engage the brake pedal.
5. Remove the parking brake release cotter pin and the clevis *(Fig: 5.8A: 9 & 10)* from the clevis weldment *(11).*
6. Loosen the locking nut *(3).* Using the gutter broom angle adjustment tool, mechanically unscrew the parking brake clevis weldment *(7) turnbuckle* and remove it from the actuator *(1).*
7. Turn off engine.
8. Remove the cotter pins and clevis pins from the parking brake cable clevis*(13).*
9. Loosen the lock nuts on the cable. Unscrew the clevis from the cable.
10. Remove the wheel end of the cable from the rear park brake assembly.
11. Remove the brake cable clamps.
12. Remove the brake cable *(15 & 16).*
13. Install the cable by reversing the steps.
14. Use the procedure in Chapter 3 to adjust the brake system.
15. Remove the nuts, lock washers, screws and clamps from the cable assembly. Remove drivelin4e brake drum

CAB

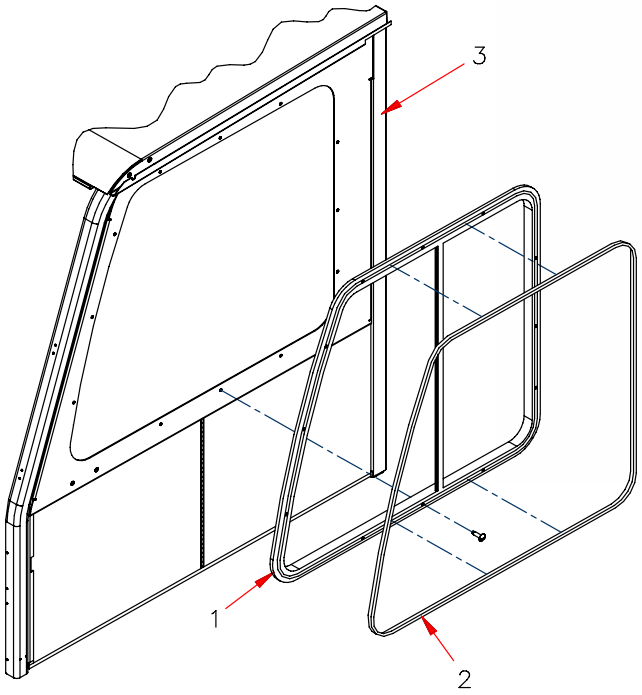
WINDOW & DOOR MECHANISM

Left Window
- *Removal/Installation*

1. Position the sweeper on a level surface.
2. Place the shifter in the *Park (P)* position, setting the parking brake.
3. Remove silicone sealant and rubber *(2)* to gain access to the self tapping screws securing the window frame to the cab.

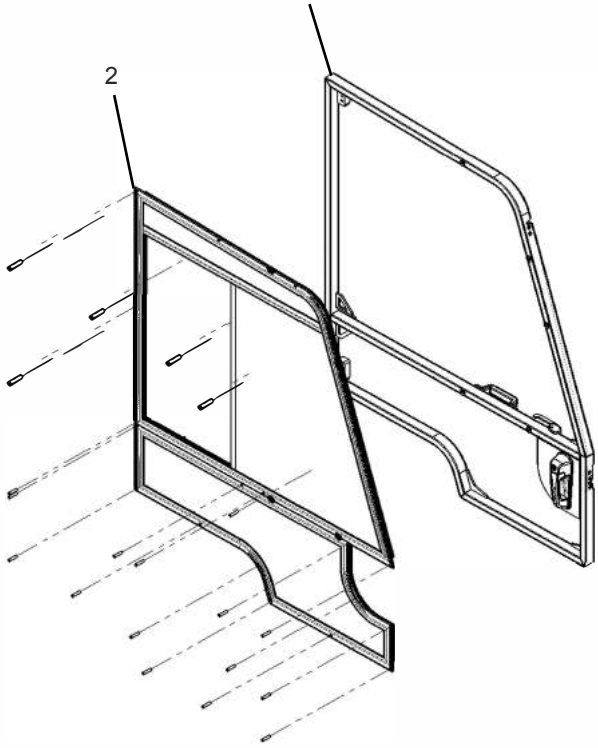
   NOTE: *Sealant may make it difficult to take out rubber seal around the window frame.*

4. Remove self tapping screws securing window *(Fig: 5.10A; 1).*
4. Slide window to left or right to remove from cab frame.
5. Install the left window by reversing the steps.



1. Window– Operator, LH
2. Rubber–.25 X .75,Closed Cell
3. Cab Frame
4. Silicone Black Sealant (Not Shown)

Fig: 5.10 A *Always take extra precaution when handling left cab glass window to avoid breaking.*



1. Window– Operator, RH
2. Rubber
3. Cab Door Weldment
4. Silicone Black Sealant (Not Shown)

Fig: 5.10 B *Right Cab Door is heavy. Removal may require two mechanics.*

Right Window
- *Removal/Installation*

1. Position the sweeper on a level surface.
2. Place the shifter in the *Park (P)* position, setting the parking brake.
3. Remove the screws securing the panel brackets to the top and front edges of the window frame inside the cab door.
4. Remove upholstery door trims from the operator's cab door.
5. Remove the pan head screws securing the window assembly to the door *(Fig: 5.10B; 3).*
7. Remove the window assembly *(1).*
8. Install the right window by reversing the steps.

   NOTE: *Use a sealing compound on the window seal when installing left and right windows.*

1	DOOR LOCK
2	OPEN & LOCK PLATE
3	HANDLE PANEL
4	LATCH
5	HANDLE
6	RUBBER DOOR HANDLE
7	DOOR HANDLE MOUNT,
8	OUTER
9	PULL
10	ROTARY LATCH, RH
11	DOOR RELEASE LATCH ASSY

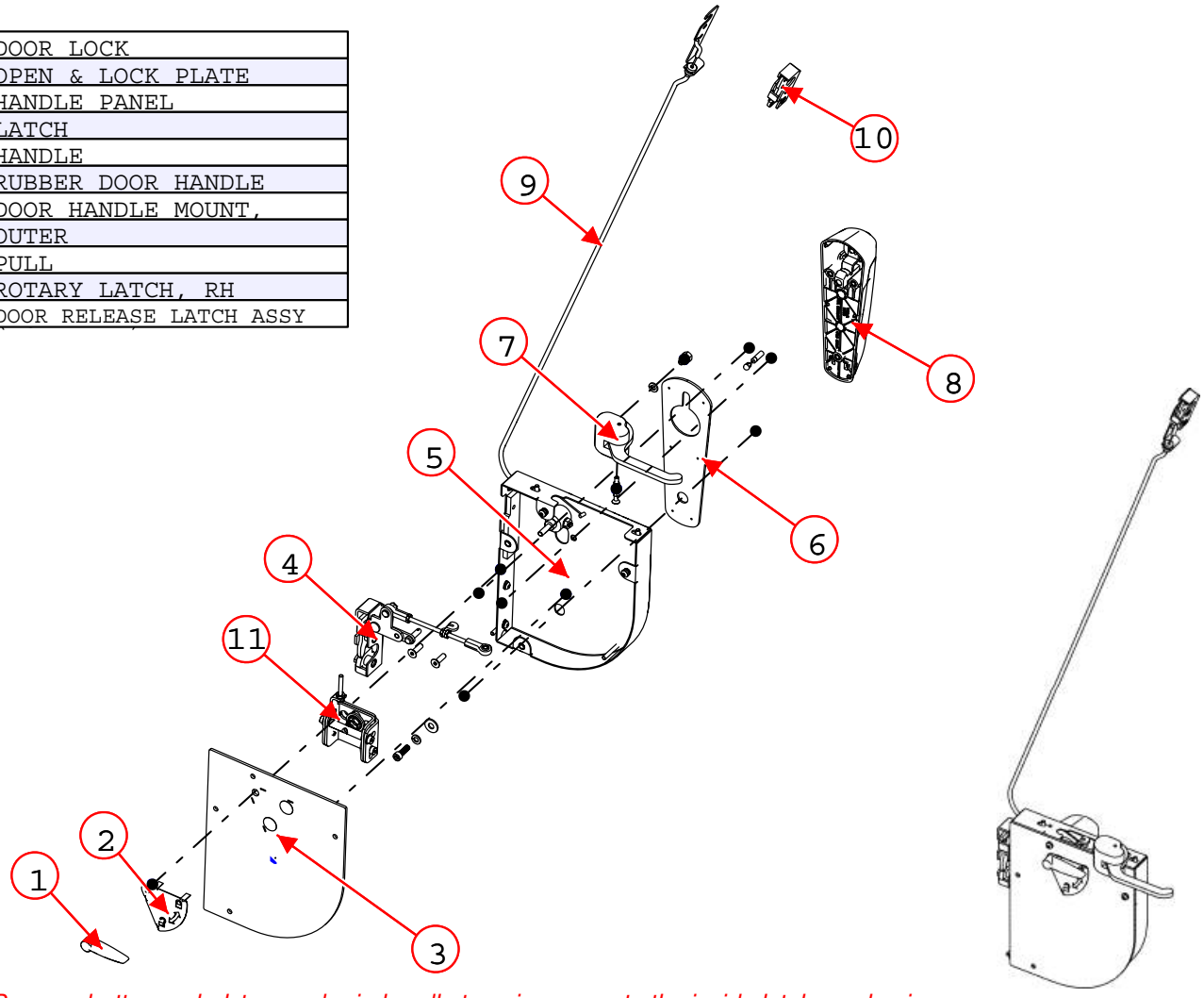


Fig: 5.11 A *Remove bottom upholstery and grip handle to gain access to the inside latch mechanism.*

DOOR ASSEMBLY LATCH MECHANISM

Inside Latch

– *Removal/Installation*

1. Position the sweeper on a level surface.
2. Place the shifter in the *Park (P)* position, setting the parking brake.
3. Remove screws and washers *(Fig: 5.11A; 2 & 3)* securing the door latch cover plate *(3)* inside the door.
4. Remove bottom upholstery clipped to the door.
5. Remove cotter pins and clevis pins securing inside door latch.
6. Remove flat socket head screws.
7. Remove the inside paddle latch mechanism.
8. Install the inside paddle latch assembly by reversing the steps.

NOTE: *If necessary, adjust the position of the two rod assemblies that attach to the latch mechanism assembly.*

Exterior Lock Latch

– *Removal/Installation*

1. Position the sweeper on a level surface.
2. Place the shifter in the *Park (P)* position, setting the parking brake.
3. Remove the four truss head screws securing the outside paddle lock *(8)* to the door.
4. Remove screws and washers *(Fig: 5.11A; 2 & 3)* securing the door latch cover plate *(3)* inside the door.
5. Remove bottom upholstery clipped to the door.
6. Remove cotter pins and clevis pins securing inside door latch.
7. Remove the outside latch with key *(8)*.
8. Install the outside latch with key assembly by reversing the steps.

HEATER/AIR CONDITIONER

NOTE: *Only the EPA certified technicians may work with refrigerants.*

The air conditioning system consists of a condenser, a compressor, an evaporator, a receiver/dryer and an AC control panel.

Use manifold gauges, charging hoses and other air conditioning service tools when checking the refrigerant system. Use Refrigerant Recovery System or equivalent before removing or replacing any air conditioning parts.

CAUTION

Improper service methods may cause injury. Air Conditioning System is to be serviced by qualified personnel only. Consult the A/C service manual.

CAUTION

The maximum operating charge is 4.0 lbs. of R-134A refrigerant.

Air Conditioner – *Evacuation by Vacuum Pump*

WARNING

DO NOT allow air conditioner refrigerant to escape into atmosphere.

1. Position the sweeper on a level surface.
2. Place the shifter in the *Park (P)* position, setting the parking brake.
3. Clean the area around the air conditioner and connecting hardware.

WARNING

Before connecting the manifold, close the gauge valves. Serious injury may occur if escaping refrigerant touches your skin.

NOTE: *The following procedures requires the use of a Refrigerant Recovery System or a manifold with three charging hoses, a compound gauge and pressure gauge.*

4. Remove the compression valve port caps and stem covers.
5. Connect the compound gauge to the compressor suction port with the hose. Connect the pressure gauge to the compressor discharge port with the hose.
6. Hook the hose to the vacuum pump.
7. Back out both compressor valve port stems completely and turn the valve stems two turns to a slightly open position.
8. Open the gauge valves and turn on the vacuum pump.
9. Operate the vacuum pump for 30 minutes. Close the gauge valves, stop the pump, and disconnect the hose from the vacuum pump.
10. The reading on the compound gauge should remain constant at 28 inches of vacuum. Let the system remain idle for 15 minutes.

NOTE: *If the reading remains constant, the system is ready for charging. If the vacuum drops off, it is an indication of a leak. The leak must be located and sealed before charging.*

WARNING

Should Refrigerant-134A contact your eye(s), do not rub the affected eye(s). Instead, splash with fresh clean cold water. Consult a doctor immediately.

Fig: 5.13 A

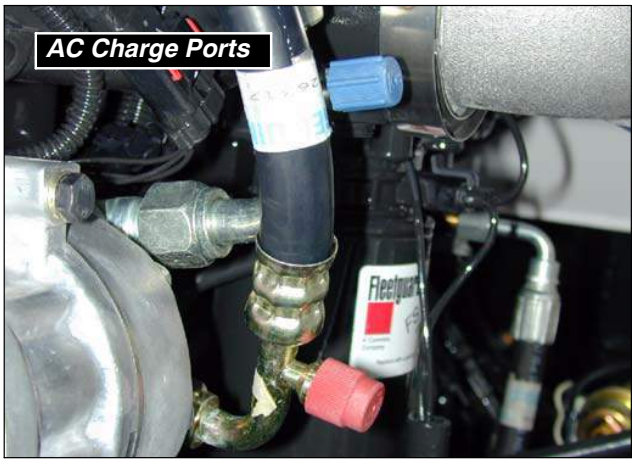


Fig: 5.13 B

Fig: 5.13 C

Air Conditioner
– *Charging or Adding Refrigerant*

1. Position the sweeper on a level surface.
2. Place the shifter in the *Park (P)* position, setting the parking brake.
3. Clean the area around the air conditioner and connecting hardware.

NOTE: *The following procedures requires the use of a Refrigerant Recovery System or a manifold with three charging hoses, a compound gauge and pressure gauge.*

WARNING

Before connecting the manifold, close the gauge valves. Serious injury may occur if escaping refrigerant touches your skin.

4. Remove the compression valve port caps and stem covers.
5. Connect the compound gauge to the compressor suction port with the hose. Connect the pressure gauge to the compressor discharge port with the hose.
6. Turn in the compressor discharge valve and suction valve port stems.
7. Bleed air from the hoses by slightly opening the shutoff valves slowly and individually for three seconds each. Then close each valve.
8. Install the valve on a refrigerant per the manufacturer's instructions and connect it to the center hose.
9. Open the valve at the refrigerant and bleed air from the center hose at the manifold. Retighten the center hose couplings.

CAUTION

The maximum operating charge is 4.0 lbs. of R–134A refrigerant.

10. Open both gauge valves. When the gauge readings are equal, close the pressure gauge valve. Check for leaks in the system.
11. When the refrigerant is empty, close the compound gauge valve. Close the refrigerant valve. Remove and discard the empty container. Attach another refrigerant. Open the refrigerant valve and the compound gauge valve.

CAUTION

The low pressure side suction gauge should not exceed 40 psi.

Fig: 5.14 A

Fig: 5.14 B

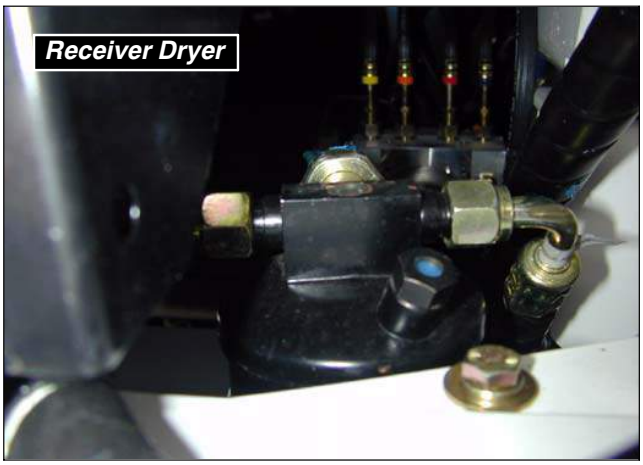


Fig: 5.14 C

12. Start the engine and set the throttle at fast idle. Position the fan switch to *On* and turn the cool switch to maximum.
13. Repeat step 8 until the sight glass on the receiver/dryer is clear and free of bubbles.
14. Close the compound gauge valve and the refrigerant valve. Slowly disconnect the center hose from the refrigerant.
15. Back out the compressor discharge valve port stem and open the pressure gauge shut off valve. Back out the compressor suction valve port stem.
16. Disconnect the hose from the refrigerant hose. Disconnect the hoses from the compressor valve port caps and stem covers.
17. In the A/C panel located in the operator's cab, position the fan switch to *Off* and stop the engine.

Air Conditioner –*Leak Detection*

WARNING

Avoid breathing the refrigerant fumes. They are toxic and may cause death or severe injury.

1. Leaks of refrigerant can be detected and located by using an electronic leak detection device with a sniffing tube tip for drawing air samples. If a leak is detected, the device will beep rapidly.
2. Explore the refrigerant system by passing the open end of the sniffing tube tip close to every joint.
3. If a leak is detected at a connection, tighten the fitting carefully. Recheck for leaks. If any leak is still apparent,

   discharge system and replace damaged components.

Air Conditioner Condenser – *Removal/Installation*

1. Position the sweeper on a level surface.
2. Place the shifter in the *Park (P)* position, setting the parking brake.
3. Raise the front grille.
4. Clean area around the air conditioner condenser and connecting hardware.
5. Discharge the air conditioner system *(refer to previous procedures).*

WARNING

Serious injury may occur if the escaping refrigerant touches the skin.

6. Remove hoses from the condenser.
7. Unscrew bolts and nuts securing air conditioner condenser. Remove the condenser.
8. Install the condenser by reversing steps.
9. Evacuate and charge the air condition system *(refer to previous procedures).*

Air Conditioner Receiver Dryer – ***Removal/Installation***

1. Position the sweeper on a level surface.
2. Place the shifter in the *Park (P)* position, setting the parking brake.
3. Raise the front grille.
4. Clean area around the air conditioner receiver dryer and connecting hardware.
5. Discharge air conditioner system prior to removing components for service.

WARNING

Serious injury may occur if the escaping refrigerant touches the skin.

6. Disconnect two hoses from the receiver/dryer.
7. Remove bolts, lock washers, and clamps securing the receiver dryer. Remove the receiver dryer.
8. Install receiver/dryer by reversing the steps.
9. Evacuate and charge the air condition system *(refer to previous procedures).*

Air Conditioner Evaporator – ***Removal/Installation***

1. Position the sweeper on a level surface.
2. Place the shifter in the *Park (P)* position, setting the parking brake.
3. Raise the left hand side cover.
4. Clean area around the air conditioner evaporator and connecting hardware.
5. Discharge air conditioner system prior to removing components for service.

WARNING

Serious injury may occur if the escaping refrigerant touches the skin.

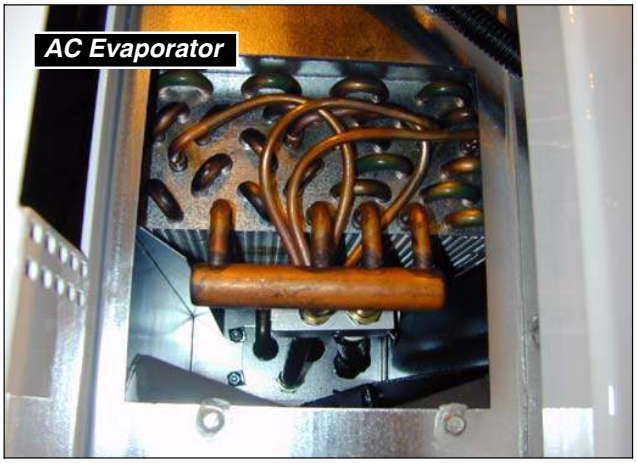


Fig: 5.15 A

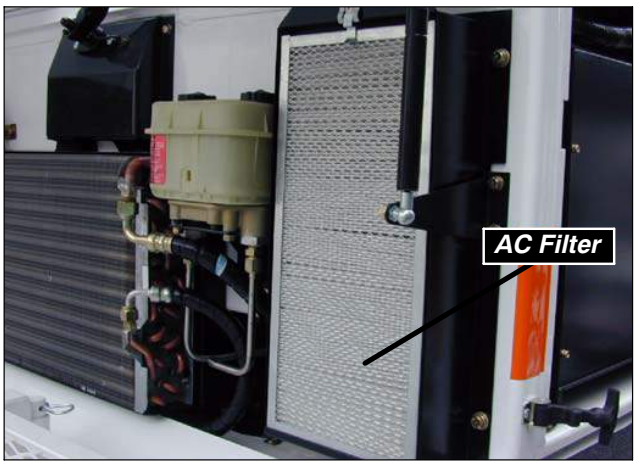


Fig: 5.15 B

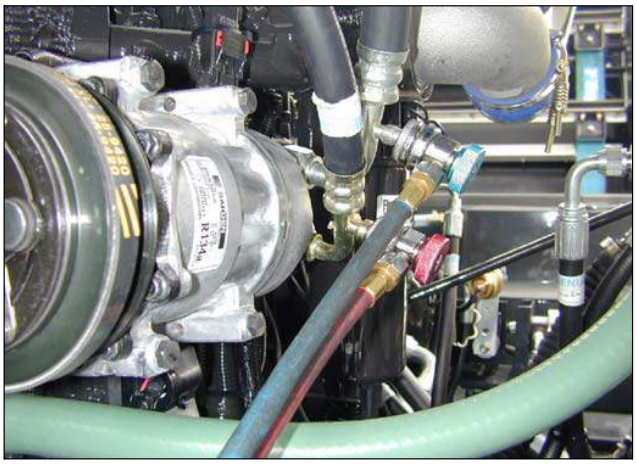


Fig: 5.15 C

6. Disconnect electrical leads and remove hose clamps- from the evaporator.
7. Remove bolts, lock washers, and clamps securing the evaporator. Remove the evaporator.
8. Install evaporator by reversing the steps.
9. Evacuate and charge the air condition system *(refer to previous procedures).*

Air Conditioner Compressor –***Removal/Installation***

1. Position the sweeper on a level surface.
2. Place the shifter in the *Park (P)* position, setting the parking brake.
3. Working from the rear of the sweeper, swing out and latch the radiator.
4. Clean the area around the air conditioner compressor and connecting hardware.
5. Have the air conditioning system discharged *(refer to previous procedure)*.

NOTE: *Before removing components for service or before recharging refrigerant, always discharge the air conditioner system.*

6. Disconnect the air conditioner hoses from the compressor.
7. Remove the electrical leads from the compressor.
8. Loosen the lock nut and turn the adjusting bolt to allow the compressor to slide toward the engine relieving V–belt tension.
10. Remove the V–belt from the compressor pulley.
11. Remove compressor bracket bolts & lock washers.
12. Remove the compressor.
13. Install the compressor by reversing the steps.
14. Use the following procedure to adjust the “V–belt” tension.

    a. Tighten the bolts securing the compressor to the engine bracket.

    b. With the lock nut loose, turn the adjusting bolt to move the compressor away from the engine increasing the belt tension.

NOTE: *The properly–adjusted tension on the V–belts is a 1/2 inch deflection with a 12 pound force applied.*

    c. Tighten the lock nut.

    d. Tighten the bolt and nut securing compressor to the bracket.

    e. Have the air conditioning system evacuated and recharged *(refer to the previous procedures).*

ELEVATOR GROUP

Elevator Hydraulic Motor - ***Removal/Installation***

1. Position the sweeper on a level surface.
2. Place the shifter in the *Park (P)* position, setting the parking brake.
3. Clean the area around the hydraulic motor and connecting hardware.
4. Remove the hydraulic hoses from the elbows on the hydraulic motor *(Fig: 5.17A; 1)*. Drain the fluid into a clean container.

CAUTION

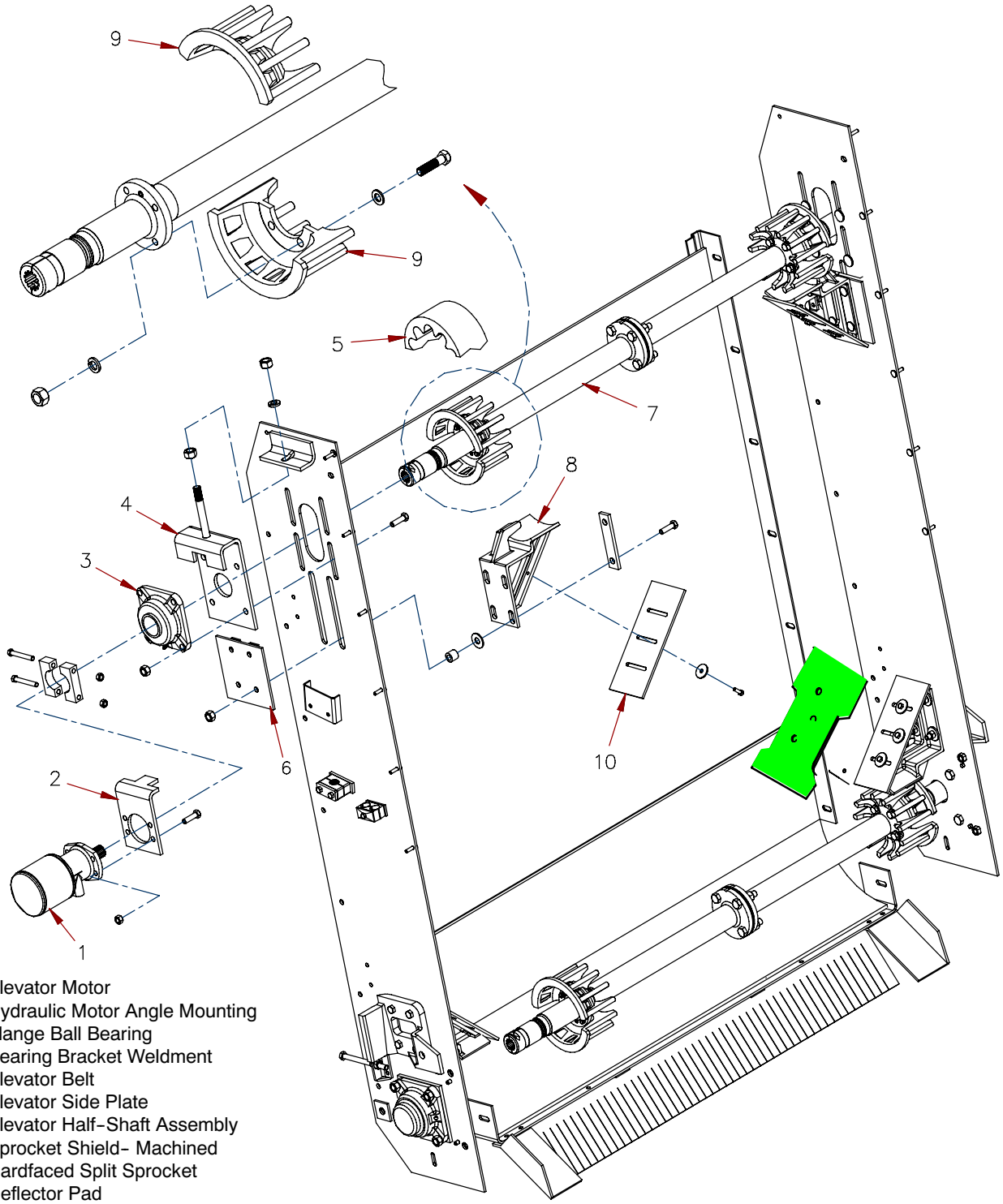
Plug all hoses and open ports to prevent foreign matter from entering the system.

NOTE: *Before removing the hoses, provide a container to catch the excess hydraulic fluid from the elevator motor.*

5. Remove the elbows from the hydraulic motor.
6. Remove the lock nuts and bolts securing the hydraulic motor to the mount plate.
7. Loosen the lock nut on the collar to allow the motor shaft to slide out.
8. Remove the hydraulic motor with the collar in place.
9. Install the elevator motor by reversing the steps.

Elevator Self-Align Bearings - ***Removal/Installation***

1. Position the sweeper on a level surface.
2. Place the shifter in the *Park (P)* position, setting the parking brake.
3. Raise the hopper and install the safety props.



1. Elevator Motor
2. Hydraulic Motor Angle Mounting
3. Flange Ball Bearing
4. Bearing Bracket Weldment
5. Elevator Belt
6. Elevator Side Plate
7. Elevator Half-Shaft Assembly
8. Sprocket Shield- Machined
9. Hardfaced Split Sprocket
10. Deflector Pad

Fig: 5.17 A *Elevator Assembly. This assembly is located behind the operator cab and extends to the ground in front of the pickup broom. Elevator removal/Installation requires two experienced mechanics and an overhead crane.*

WARNING

INSTALL safety props. DEATH or serious INJURY may result if the hopper cylinders fail.

4. Stop the engine.
5. Clean the area around the self–aligned bearings.
6. Remove the elevator hydraulic motor *(refer to the previous procedure).*
7. Release tension on the elevator rubber belt *(Fig: 5.17A; 5)* by loosening the top carriage bolts, jam nut, and hex nut counterclockwise on the bearing bracket weldment *(4).*
8. Remove the nuts, washers and bolts securing the bearing *(3)* to the elevator side wall.

   NOTE: *Make a note where the elevator bearing grease fittings are located since the bearing needs to be remounted in the same position. The top bearings have grease fittings facing down and the bottom bearings have grease fittings facing to the back.*
9. Remove the self–align bearing *(3)*.
10. Install the elevator bearings by reversing the steps.

Elevator
– ***Removal/Installation***

1. Position the sweeper on a level surface under an overhead crane or hoist capable of lifting the elevator assembly.
2. Place the shifter in the *Park (P)* position, setting the parking brake.
3. Raise the hopper and install the safety props

WARNING

INSTALL safety props. DEATH or serious INJURY may result if the hopper cylinders fail.

4. Stop the engine.
5. Clean the area around the elevator.
6. Remove the bolts securing the center body panels to the elevator.
7. Remove the center body panels from the elevator.
8. Remove the hydraulic hoses from the elbows on the hydraulic motor. Drain the fluid into a container.
9. Disconnect hose mounts from the elevator housing.

Safety Under the Hopper

Before attempting to do any inspections or repairs under a raised hopper, make sure that BOTH Auto Props are resting on the hopper clyinder rods.

WARNING

INSTALL safety props. DEATH or serious INJURY may result if the hopper cylinders fail.

INSTALL safety props when working on, around or under raised hopper.

NEVER position yourself under hopper while installing or removing safety props.

NOTE: *With hopper raised, install safety prop on hopper cylinder rod. Safety prop rests on top edge of cylinder body. Install safety props on both hopper cylinders.*

CAUTION

Plug all hoses and open ports to prevent foreign matter from entering the system.

10. Remove the nuts and bolts securing the left and right dirt shoe bracket assembly to the lower sides of the elevator.
11. Remove the center deflector chain.
12. Attach the hoist securely to the elevator and place a slight tension on the hoist chain.

    NOTE: *The elevator assembly is only attached at two pivot points and rests on two rubber stops.*
13. Remove the bolts, lock washers and pivot block caps securing the elevator assembly to the elevator pivot weldments *(behind the operator's cab).*

NOTE: *Check for removal of the elevator components that attach the assembly to the frame.*

14. Use the hoist to slowly raise the elevator from the sweeper. When the elevator clears the frame, move the assembly to a clean work area.
15. If required, remove the right and left elevator pivot weldments.
16. Remove the bolts, lock nuts and washers securing the pivot weldments to the cross frame.
17. Remove the bolts and nuts securing the pivot weldments to the main frame.
18. Remove the pivot weldments.

    NOTE: *Replace all worn or defective parts on the elevator assembly. Refer to replacement procedures of squeegee bar, sprockets and belts in Chapter 3.*
19. Install the elevator by reversing the steps.

    NOTE: *Coat each end of the upper and lower elevator shafts with anti–seize compounds before installing the self–aligned bearings.*
20. Adjust the elevator assembly *(refer to the adjustment procedure in chapter 3)*.

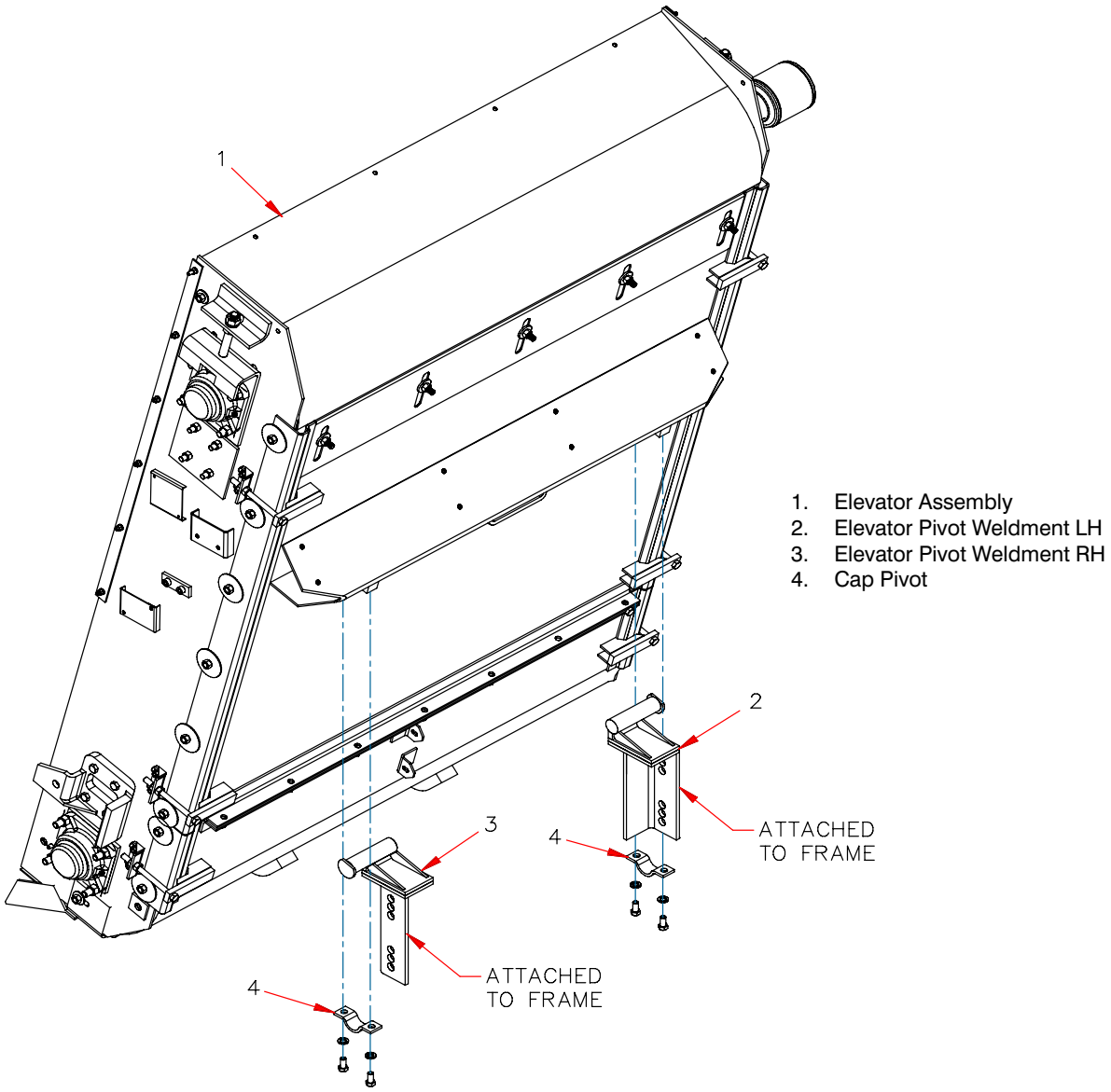


Fig: 5.19 A *Removal and installation of the Elevator Assembly requires an overhead crane and a sling to hoist.*

Elevator – Sprocket Pulley – ***Removal/Installation***

The elevator sprocket pulleys are split–type with each half secured to a mounting hub. Frequently check for sprocket pulley wear. Continued operation with a worn sprocket pulley shortens the life of the elevator belt.

1. On each side of the elevator assembly, loosen the eight bolts securing the upper elevator bearings and brackets to the side plates *(Fig: 5.16A; 3 & 4)*.
2. Loosen the jam nuts to bearing bracket weldment *(4)*. Lower the bearing bracket by loosening the adjustment nuts on the screw in the bearing bracket until the belt tension is relieved.
3. Rotate the elevator belt until the sprocket pulley and mounting bolts are accessible. Position the sprocket pulley split line horizontal with the ground. The belt teeth will be linked in only the top half sprocket pulley.
4. Remove the bolts and washers securing the bottom half sprocket pulley. Remove the half sprocket pulley.

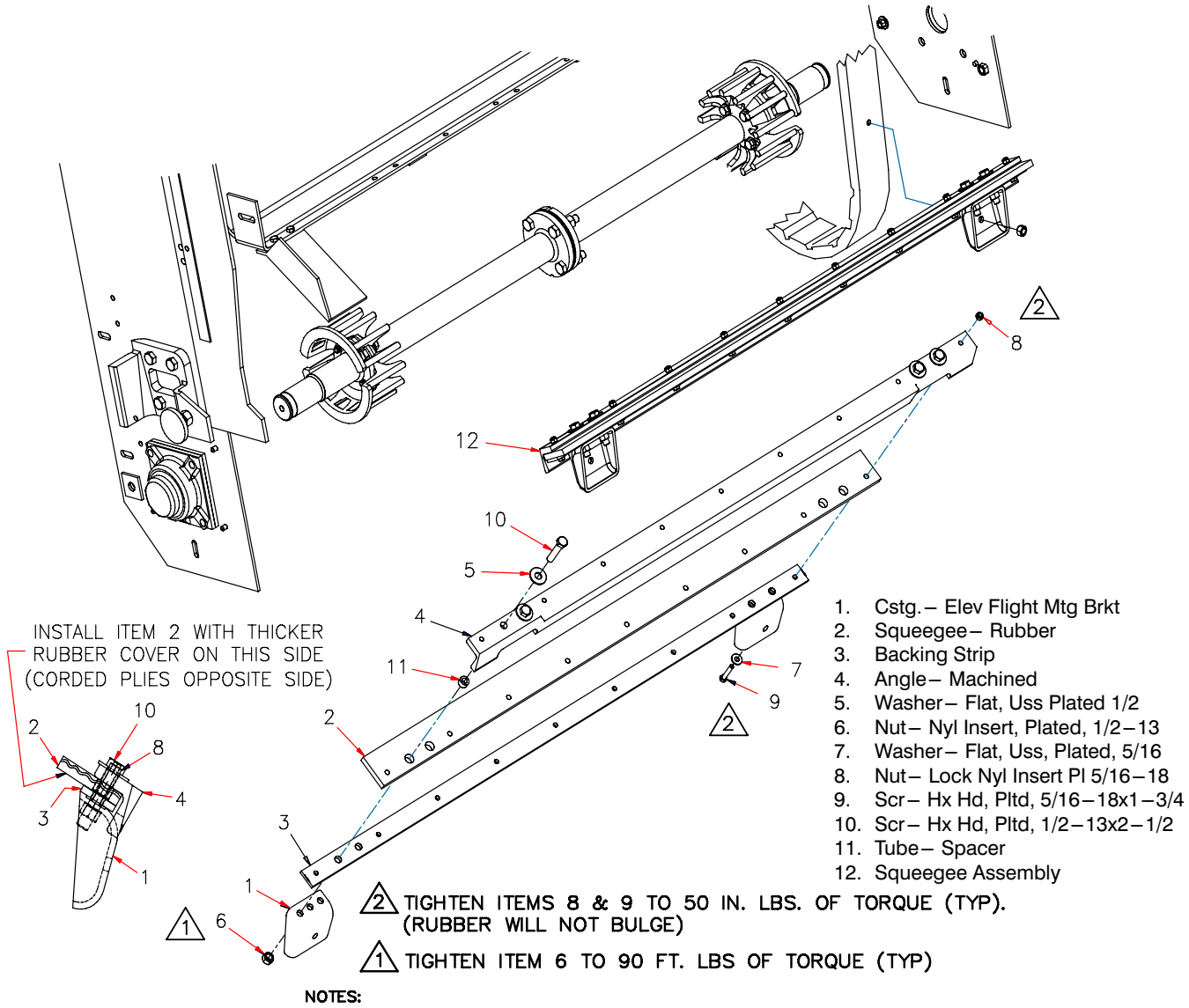


Fig: 5.20 A *Each Elevator Squeegee Bar Assembly is attached to the left and right elevator belts. It is not necessary to remove the elevator belt se bly i m the elevator to replace queegees.*

5. Thoroughly clean the tapped screw holes in the hub. Remove any accumulation of dirt and debris. The threads may need to be re–tapped.

   NOTE: *Make sure the new sprocket pulley half has the same number of teeth as the one being removed. A different size sprocket pulley will not work. Always use new cap screws when replacing the sprocket pulleys.*

6. Assemble the new half sprocket pulley on the hub and secure with new bolts. Torque the bolts to 105–110 foot–pounds *(142–149 Nm).*
7. Rotate the elevator belt until the opposite half sprocket pulley and mounting bolts are accessible. Position the sprocket pulley split line perpendicular to the elevator shaft. The belt teeth will be linked in only the new top half sprocket pulley.
8. Replace the second half sprocket pulley repeating steps 4, 5 and 6.
9. Repeat replacement procedure steps 3 thru 8 for all worn sprocket pulleys.
10. After the worn sprocket pulleys have been replaced, adjust the elevator belt tension *(refer to the Elevator – Belt Tension Adjustment procedure in Chapter 3)*.

Elevator – Squeegee Bar – ***Removal/Installation***

The squeegee bars are rubber strips mounted onto the brackets. Parallel to the elevator shafts, each bar assembly end connects to the elevator belts. When the squeegee bars require replacement, always replace nuts, screws and locking tabs.

1. Remove the nuts and washers attaching squeegee bar assembly to belts *(Fig: 5.20A; 12)*.
2. Inspect the angles and hardware that attach squeegee bar assembly to elevator belt. Replace all worn or damaged parts.
3. Remove the bolts, washers, nuts, the backing strip and the squeegee bar.
4. Replace squeegee bar *(2)* by installing rubber edge toward outside *(edge that scrapes on elevator back plate)*. Inside edge has a cord exposed.
5. Assemble in the reverse order of disassembly. Torque the bolts and nuts *(6)* to 90 foot–pounds. Torque bracket bolts and nuts *(8 & 9)* to 50 foot–pounds.
6. Adjust the elevator to squeegee bar clearance and elevator upper arch clearance *(refer to the Elevator–Squeegee Bar Clearance Adjustment and Elevator–Upper Arch Adjustment–Chapter 3)*.

PICKUP BROOM GROUP

Pickup Broom Hydraulic Motor – ***Removal/Installation***

1. Position the sweeper on a level surface.
2. Place the shifter in the *Park (P)* position, setting the parking brake.
3. Stop the engine.
4. Clean the area around the hydraulic motor and connecting hardware.
5. Remove the hydraulic hoses from the elbows on the hydraulic motor. Drain the fluid in a container.

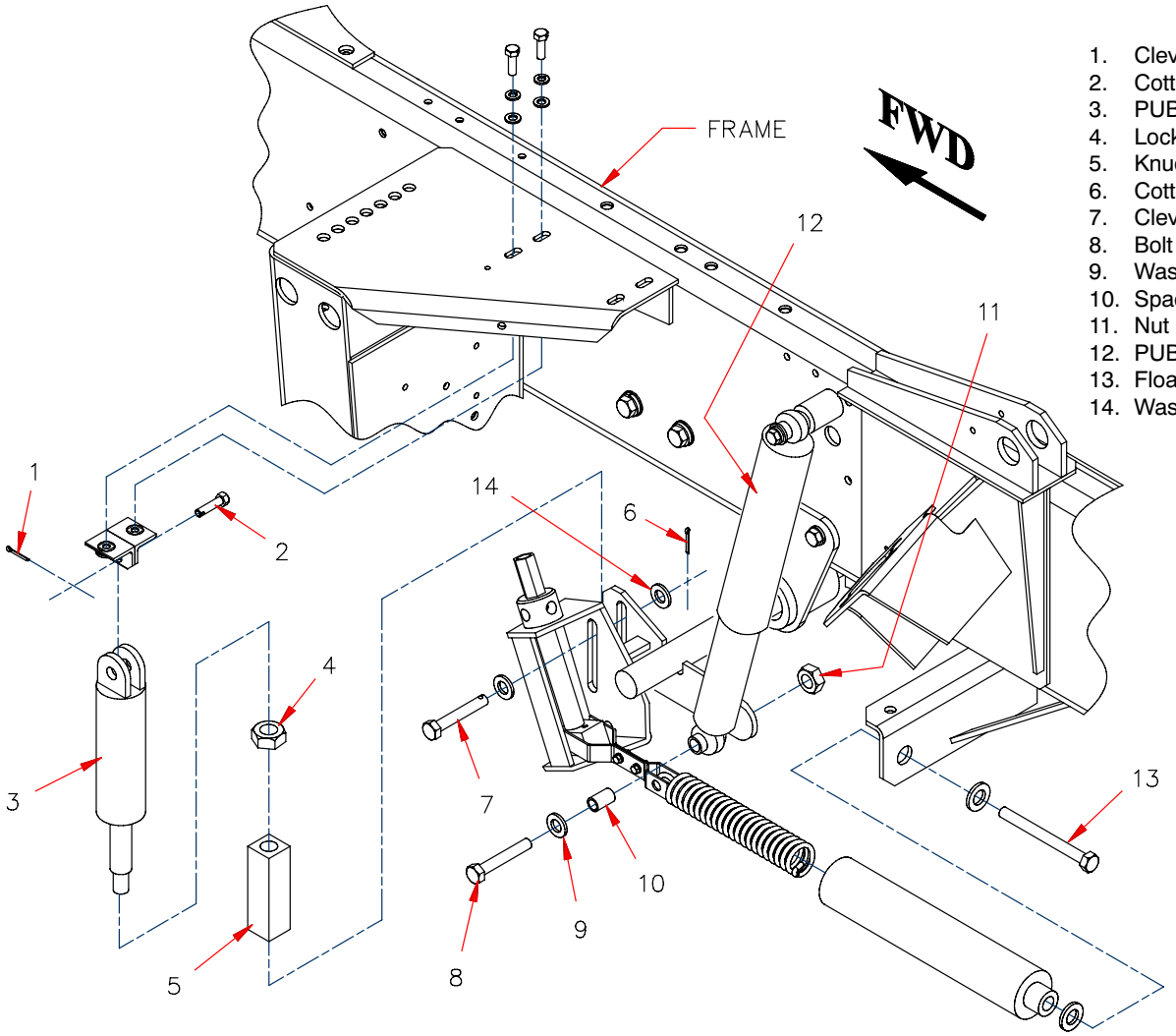
   NOTE: *Before removing the hoses, provide a container to catch the excess hydraulic fluid from the pickup broom motor.*

6. Remove the elbows from the hydraulic motor.
7. Unscrew the float adjusting bolt *(Fig: 5.22A; 13)* from the spring about 3 to 3 1/2 inches.
8. Remove the Pickup Broom *(refer to Pickup Broom Removal/Installation procedure on the following pages)*.
9. Remove the nut and washer securing the broom hub and the end plate of the pickup broom.
10. Remove the four bolts, nuts and lock washers securing the hydraulic motor to the left arm and bushing assembly.
11. Remove the hydraulic motor.
12. Install the pickup broom motor by reversing the steps.

    NOTE: *Be careful to align the holes in the end plate and pickup broom wheel hub prior to tightening the bolts. The broom core must align with the three holes in the end plate assembly. Torque the motor shaft hex nut from 300 to 310 foot–pounds.*

Pickup Broom Hydraulic Cylinder – ***Removal/Installation***

1. Position the sweeper on a level surface.
2. Place the shifter in the *Park (P)* position, setting the parking brake.
3. Stop the engine.
4. Clean the area around the hydraulic cylinder and connecting hardware.



1. Clevis Pin
2. Cotter Pin
3. PUB Lift Cyl
4. Lock Nut
5. Knuckle
6. Cotter Pin
7. Clevis
8. Bolt
9. Washer
10. Spacer
11. Nut
12. PUB Shock
13. Float Adj Bolt
14. Washer

Fig: 5.22 A *The pickup broom hydraulic cylinder and shock absorber are located on the left side of the sweeper. When working on or around the broom, be aware that spring tension exists.*

5. Remove the hydraulic hoses from the elbows on the hydraulic cylinder *(Fig: 5.22A; 3)*. Drain the fluid in a container.

   NOTE: *Before removing the hoses, provide a container to catch the excess hydraulic fluid from the hydraulic lift cylinder.*

   CAUTION

   Plug all hoses and open ports to prevent foreign matter from entering hydraulic system.

6. Remove the elbows from the hydraulic cylinder.

7. Remove the cotter pin and clevis pin *(1 & 2)* securing the top of the hydraulic cylinder to the frame bracket.

   WARNING

   To avoid personal injury, the float adjusting bolt must be turned out of the spring cover to release the tension on the broom.

8. Unscrew the adjusting rod from the floating spring connecting linkage to gain access to the cylinder clevis pin.
9. Remove the cotter pin, washers and clevis pin *(6, 7 & 14)* securing the bottom of the cylinder to the connecting linkage.

10. Remove the hydraulic cylinder *(3)* with the knuckle attached.
11. Loosen the lock nut holding the knuckle to the threaded shaft of the cylinder.
12. Remove the knuckle and lock nut *(4 & 5)* from the cylinder.
13. Install the pickup broom cylinder by reversing the steps.
14. Adjust the distance between the mounting holes of the hydraulic cylinder and the knuckle on the cylinder shaft to 11 inches.
15. Adjust the pickup broom floating position to the midpoint of travel measuring the knuckle in relation to the slots of the shaft and linkage assembly.

Pickup Broom Shock Absorber – ***Removal/Installation***

1. Position the sweeper on a level surface.
2. Place the shifter in the *Park (P)* position, setting the parking brake.
3. Lower the pickup broom to relieve tension on the shock absorber.
4. Stop the engine.
5. Clean the area around the shock absorber and connecting hardware.
6. Remove the lock nuts *(Fig: 5.22A; 11)* on each end of the shock absorber. Remove the bolts *(8)*, flat washers *(9)*, and spacers *(10)*.
7. Remove the shock absorber *(12)*.
8. Install the pickup broom shock absorber by reversing the steps.

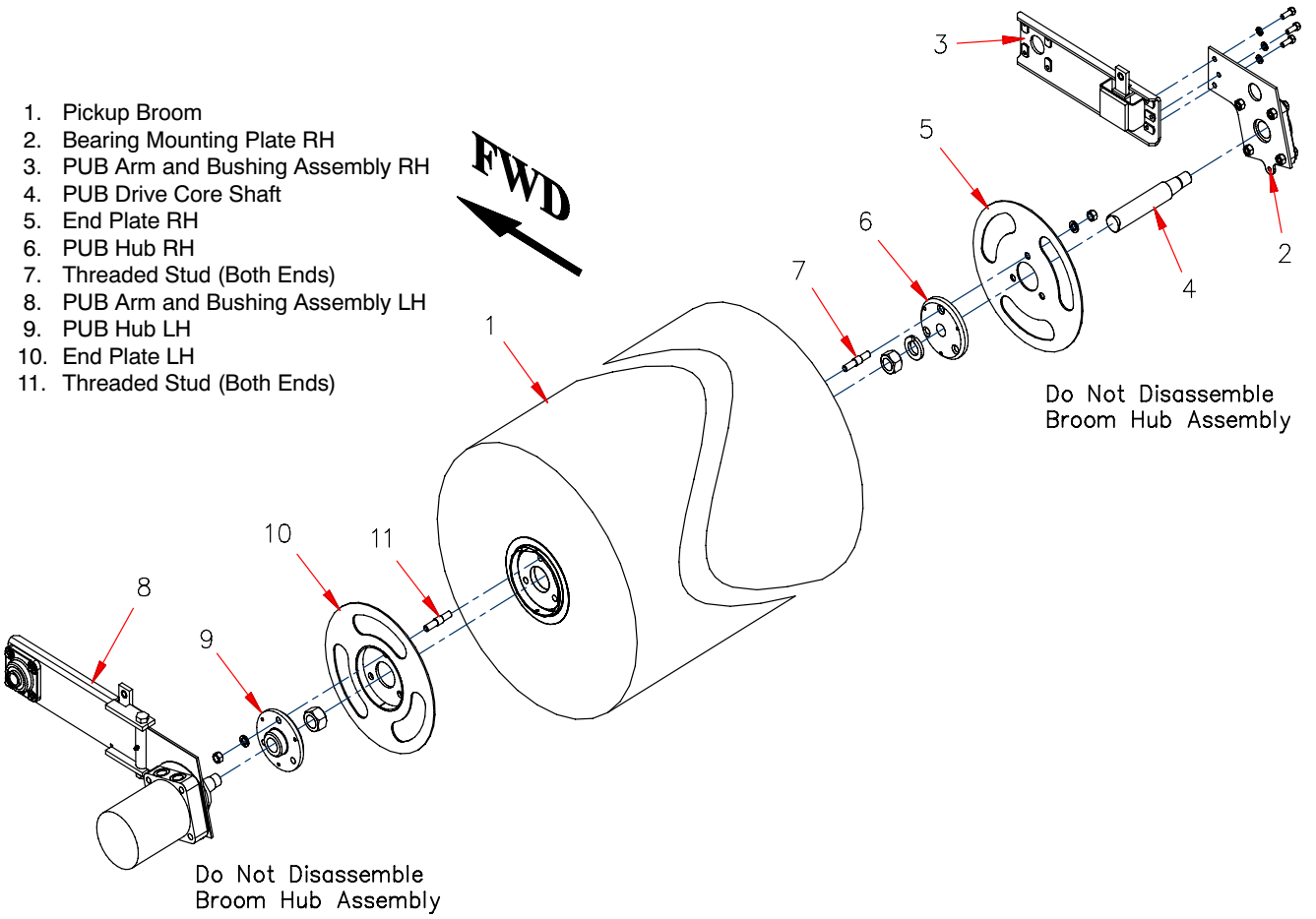


Fig: 5.23 A *Pickup Broom Assembly. The Pickup Broom is removed from the right side of the sweeper.*

Pickup Broom – *Replacement*

Pickup broom replacement should only be performed by an experienced mechanic. Park the sweeper on a clean, level surface and proceed as follows.

WARNING

To avoid personal injury, the float adjusting bolt must be turned out of the spring cover to release the tension on the broom.

1. Unscrew the float adjusting bolt *(Fig: 5.22A; 13)* about 3 to 3–1/2 inches from the spring.
2. Remove the three hex nuts and lock washers securing the right broom hub to the core of the broom *(Fig: 5.23A; 5,6,9 & 10)*. Do not disassemble the broom hub and pivot bearing assemblies.
3. Remove the cotter pin securing the clevis pin. Remove the clevis pin from the adjustable connecting link and pickup broom arm.
4. Remove the two hex head screws and lock washers securing the side plate and one hex head screw and lock washer securing the support bracket on the pickup broom arm.
5. Remove the assembled side plate, pickup broom arm, support bracket and dirt shoe.
6. Remove the three hex nuts and lock washers securing the left end plate and wheel hub to the pickup broom. DO NOT disassemble the Pickup Broom motor assembly.
7. Pull out the pickup broom *(1)* from the right side of sweeper.
8. Slide in the new pickup broom from the right side of the sweeper. Position the broom so the core aligns with the assembled end plate and wheel hub. Attach the left end plate, wheel hub and core using the three hex nuts and lock washers. Tighten the hex nuts securely.
9. Replace the assembled side plate, pickup broom arm, support bracket and dirt shoe. The bearing, end plate and wheel hub must align with the three holes in the core of the pickup broom.
10. Attach the side plate with two hex head screws and lock washers. Attach the support bracket using a single screw and lock washer.
11. Attach the end plate and wheel hub to the core of the broom using three hex nuts and lock washers.
12. Connect the adjustable connecting rod to the pickup broom arm with the clevis pin. Secure the clevis pin with the cotter pin.
13. Test the broom pattern *(refer to Pattern Adjustment, Chapter 3)* and coning adjustment *(refer to Leveling Adjustment, Chapter 3)*.

GUTTER BROOM GROUP

The right and left gutter brooms are similar in construction. Mounting each broom on its respective side of the sweeper requires minor changes. The following procedure cov ers only the right gutter broom.

Gutter Broom Hydraulic Motor – *Removal/Installation*

1, Position the sweeper on a level surface.
2. Place the shifter in the *Park (P)* position, setting the parking brake.
3. Stop the engine.
4. Clean the area around the hydraulic motor and connecting hardware.
5. Remove the hex nut *(Fig: 5.25A: 1)* securing the gutter broom plate assembly and dish assembly to the hydraulic motor. Lower the assembly to the floor.
6. Disconnect the hydraulic hoses from the elbows. Remove the elbows and connectors from the hydraulic motor.

***NOTE:** Before removing the hoses, provide a container to catch the excess hydraulic fluid from the gutter broom motor.*

CAUTION

Plug all hoses and open ports to prevent foreign matter from entering hydraulic system.

WARNING

The GB Motor will separate from the collar once free. Take care so that the GB motor does not fall on you.

7. Place protective plugs in the ports of the hydraulic motor and on the hoses to prevent dirt from entering the system.

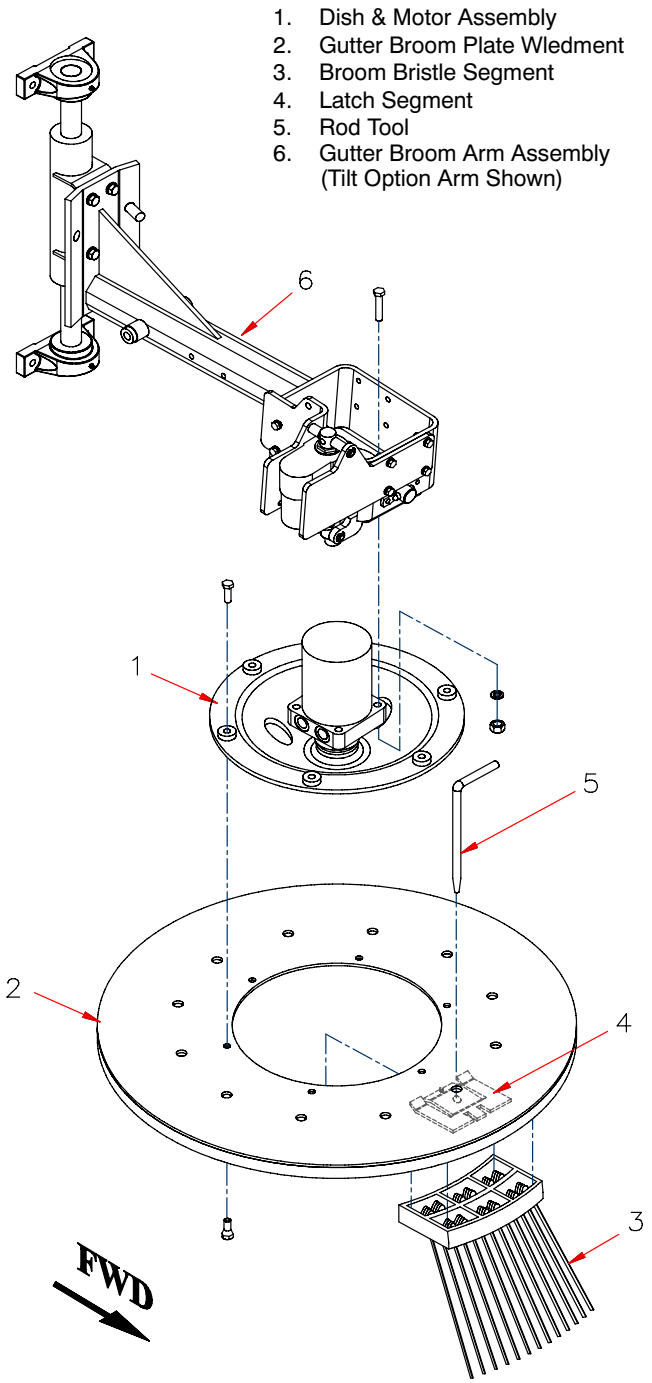


Fig: 5.25 A *Gutter Broom Plate/Brush Removal and Installation are basically the same on both sides.*

8. Remove the four hex nuts, lock washers, flat washers, and bolts securing the hydraulic motor to the gutter broom arm.
9. Remove the hydraulic motor and separate the dish assembly. Inspect the dish assembly for rust or damage. Replace the parts.
10. Install the gutter broom motor by reversing the steps.
11. Before installing the plate assembly and dish assembly, make sure the woodruff key is positioned in the gutter broom motor shaft. Install the motor shaft hex nut and torque from 300 to 310 foot–pounds.

Gutter Broom Plate & Brush Assembly – ***Removal/Installation***

1. Position the sweeper on a level surface.
2. Place the shifter in the *Park (P)* position, setting the parking brake.
3. Raise the gutter broom.
4. Stop the engine.
5. Clean the area around the gutter broom and connecting hardware.
6. Using the rod tool *(Fig: 5.25 A; 5)*, unlock the bristle segment *(3)* from the gutter broom plate.
7. Steam clean the gutter broom segment plate, removing all dirt and debris.
8. Remove the hex nut securing the gutter broom plate assembly, plate and mounting dish to the hydraulic motor. Lower the assembly to the floor making sure the shaft key stays in place.
9. Remove the six bolts securing the mounting dish to the plate.
10. Remove the mounting dish.

NOTE: *Inspect the mounting dish threads for damage. Replace the mounting dish if damaged. Inspect the threads on the bolts for damage, and re place as necessary.*

12. Install the gutter broom plate assembly by reversing the steps.

NOTE: *Be careful to position the woodruf key in the gutter broom motor shaft before installing the plate assembly and mounting dish. Torque the mo tor shaft hex nut from 300 to 310 foot–pounds.*

13. Re–adjust the gutter broom pressure.

Gutter Broom Hydraulic Lift Cylinder – ***Removal/Installation***

1. Position the sweeper on a level surface.
2. Place the shifter in the *Park (P)* position, setting the parking brake.
3. Lower the gutter broom.
4. Stop the engine.
5. Remove the two bolts and lock washers securing the cover over the hydraulic lift cylinder. Remove the cover.
6. Clean the area around the hydraulic cylinder *(Fig: 5.26A: 1)* and the connecting hardware.
7. Disconnect the hydraulic hose assembly *(3)* from the elbow fitting *(4)*.

NOTE: *Before disconnecting the hydraulic hose, provide a container to catch the excess hydraulic fluid from the gutter broom hydraulic cylinder.*

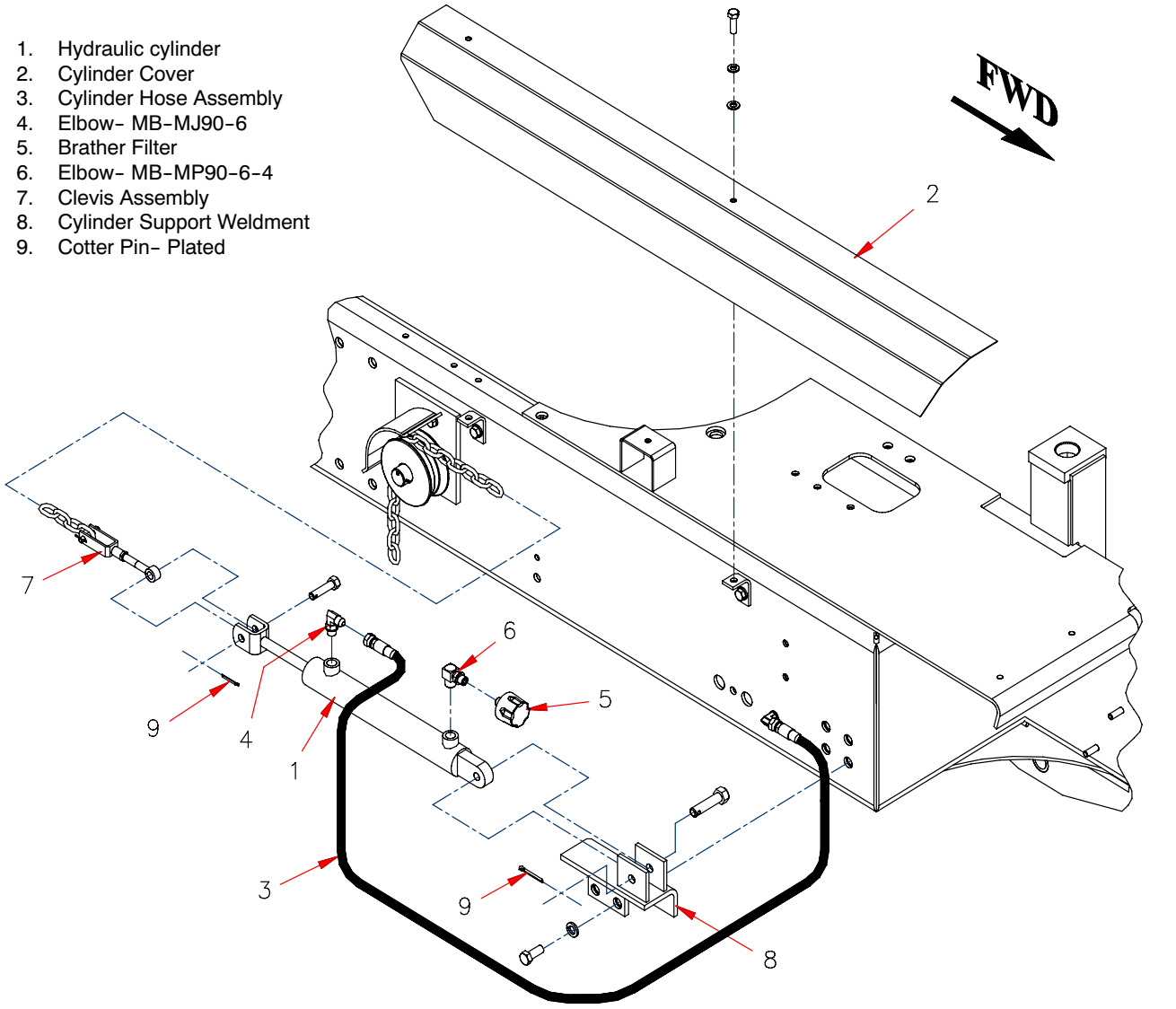


Fig: 5.26 A *The Gutter Broom Lift Cylinder is located outside of the frame rail. A cable chain is connected to the cylinder and runs through a pulley down to the gutter broom arm.*

CAUTION

Plug all hoses and open ports to prevent foreign matter from entering hydraulic system.

8. Remove the elbow fitting from the hydraulic cylinder.

9. Place protective plugs in the port of the hydraulic cylinder and on the hose to prevent dirt from entering the system.

10. Place a hydraulic jack under the gutter broom and raise just enough to release pressure off the cable.

11. Remove the cotter pin and clevis pin from the shaft end of the cylinder, freeing the cable and the shaft end of the lift cylinder.

12. Remove the cotter pin and clevis pin from the body end of the cylinder securing it to the sweeper frame. Retain the two flat washers for re–installation.

13. Remove the hydraulic cylinder.

14. Remove the breather and elbow from the hydraulic cylinder.

15. Install the gutter broom lift cylinder by reversing these steps

Gutter Broom Arm Assembly – ***Removal/Installation***

1. Position the sweeper on a level surface.

2. Place the shifter in the *Park (P)* position, setting the parking brake.

3. Stop the engine.

4. Clean the area around the gutter broom and connecting hardware.

5. Remove the gutter broom motor and plate assembly *(refer to previous procedures)*.

6. Disconnect the shock absorber from the arm assembly by removing the nut, flat washer, bushing, and bolt from clevis weldment *(Fig: 5.29A; 5)*.

7. Remove the nut, flat washer and lower bearing from the clevis.

8. Remove the clevis and upper hardware.

9. Disconnect and remove tension spring *(3)*.

NOTE: *When performing installation procedure close the spring loops after connecting the spring to the chain and frame.*

10. Remove the lock nuts, cap screws and washers attaching the shock absorber bracket and chain to the gutter broom arm.

NOTE: *Inspect the spring, chain and cable for damage. Replace as necessary.*

11. Place a hydraulic jack under the gutter broom and raise just enough to release the pressure off the lift cable.

12. Remove the nut, washer and bolt securing the lift cable bracket to the gutter broom arm.

NOTE: *Record the number of top and bottom spacers between the pillow blocks and the bracket weldment. A correct installation requires the same spacing.*

NOTE: *In disassembly, remove only the top pillow block bearing (so that the arm assembly is still supported).*

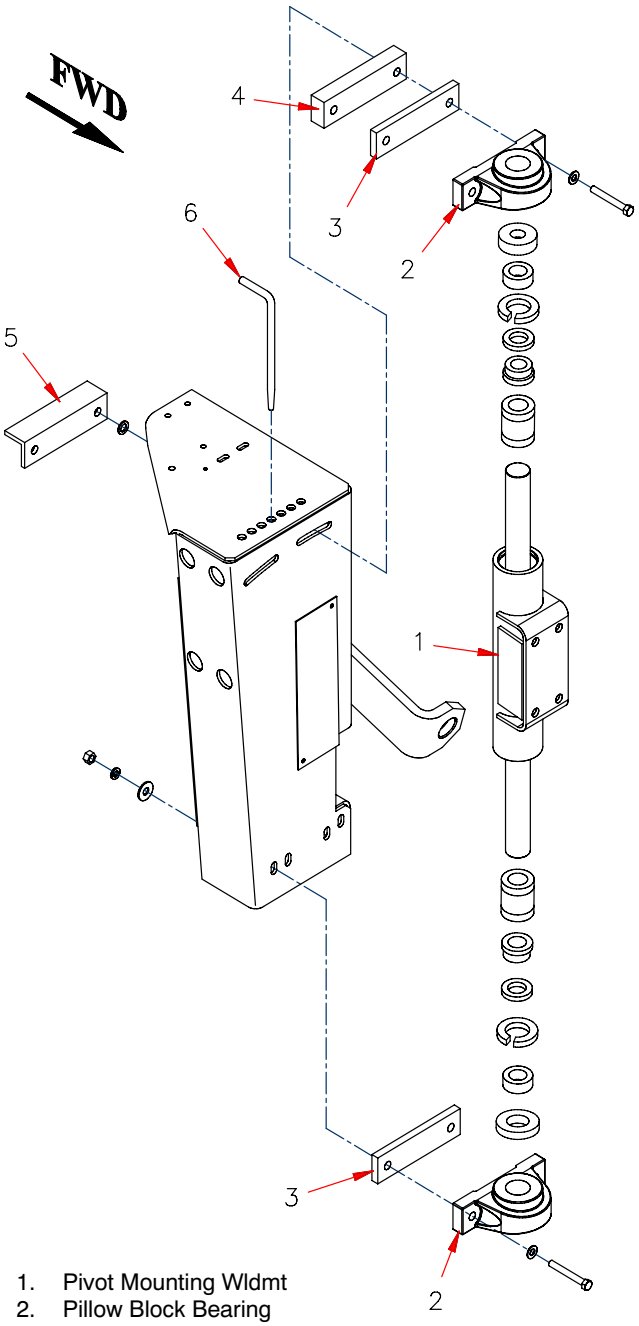
13. Remove the screws, washers and nuts securing the gutter broom arm to the lift shaft pivot assembly.

14. Remove the gutter broom arm assembly *(1)* from the the lift shaft pivot assembly.

NOTE: *Before installation of the arm assembly, check the fit of the shaft in the pillow block bearings. Inspect the shaft for scoring, rust, or other damage. Replace as necessary.*

WARNING

The GB Arm will separate from the GB bracket weldment once free. Take extra precautions so that the GB arm does not fall on your feet.



1. Pivot Mounting Wldmt
2. Pillow Block Bearing
3. Gutter Broom Arm Spacer
4. Spacer
5. Angle Wldmt
6. Chain Assembly

Fig: 5.28 A *Removal of the Gutter Broom Arm requires the use of a jack to hold up the assembly while spring tension is being released.*

NOTE: *During each overhaul, always replace the bumpers, housing wipers and wiper rings. Install the bumpers against the bearing collars.*

15. Install gutter broom arm assembly by reversing steps.
16. Grease pillow block bearing fittings after installation.

CAUTION

Plug all hoses and open ports to prevent foreign matter from entering hydraulic system.

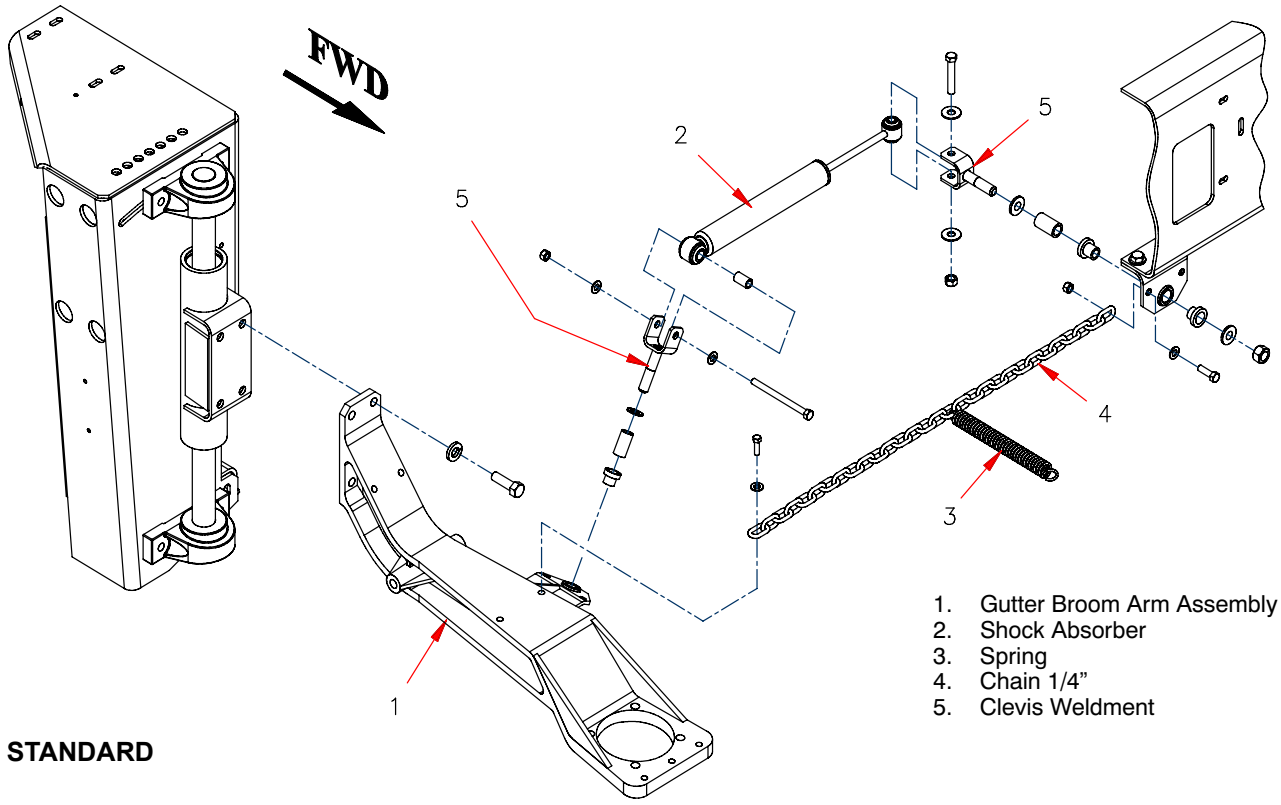
Gutter Broom Shock Absorber – ***Removal/Installation***

1. Position the sweeper on a level surface.
2. Place the shifter in the *Park (P)* position, setting the parking brake.
3. Lower the gutter broom.
4. Stop the engine.
5. Clean the area around the shock absorber and connecting hardware.
6. Remove the nut, flat washers, bushing, and bolt from both ends of the shock absorber, securing the absorber to the gutter broom arm and frame.
7. Remove the shock absorber .

NOTE: *If either clevis requires replacement, go to step 8. Otherwise go to step 10.*

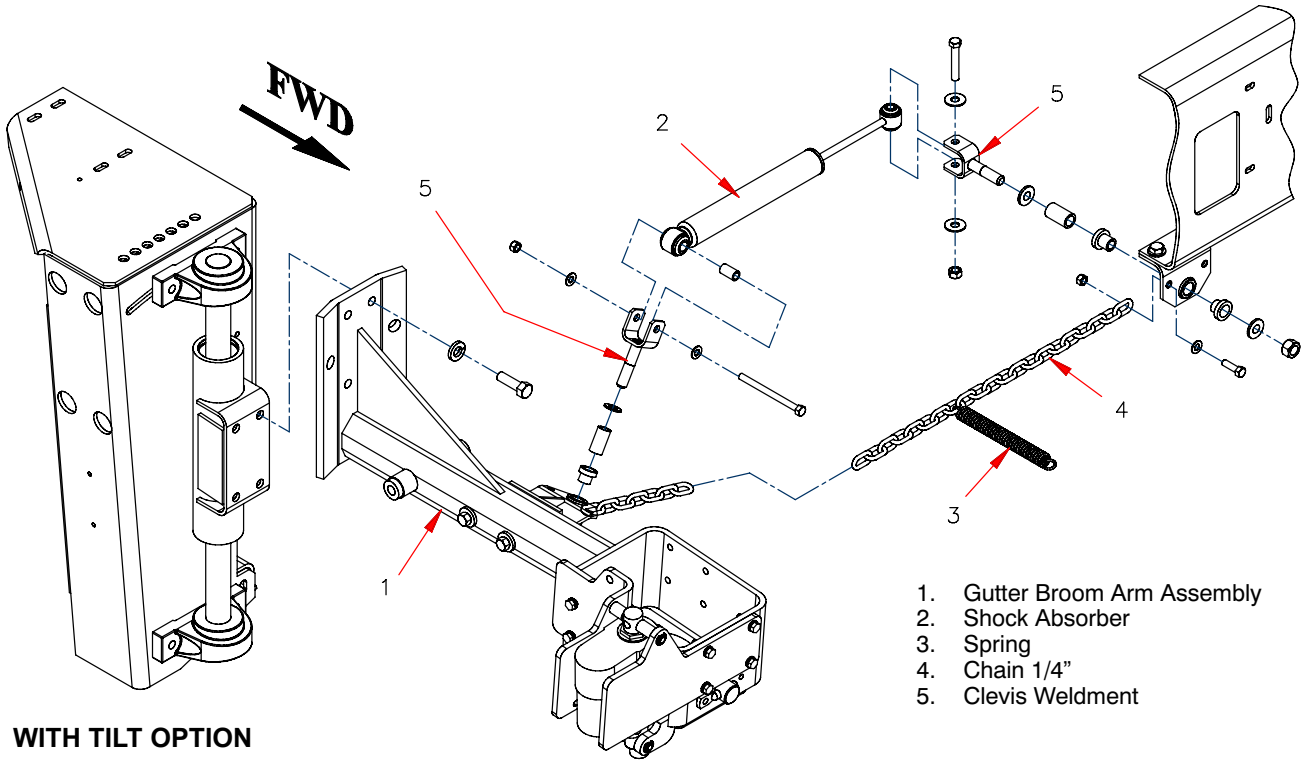
8. Remove the nut, washer and lower bearing from the clevis.
9. Remove the clevis and separate the washer, sleeve, and upper bearing from the clevis shaft.
10. Before replacing the shock absorber, collapse the new shock and rotate it to the "R" setting until it clicks.
11. Partially extend the shock and rotate the ends until the eyes align with each clevis.
12. Proceed with shock absorber installation by reversing the above steps.

NOTE: *Tighten the lock nuts securing the shock to each clevis just enough to allow free rotation.*



STANDARD

Fig: 5.29 A *The gutter broom arm shock absorber mounts to the gutter broom arm and to the frame. A jack may be required when working on the gutter broom arm assembly to relieve the spring tension.*



WITH TILT OPTION

Fig: 5.29 B *The gutter broom arm shock absorber mounts to the gutter broom arm and to the frame. A jack may be required when working on the gutter broom arm assembly to relieve the spring tension.*

ENGINE GROUP

The engine group section in this chapter provides instructions on the removal and installation of the engine external components. Refer to ISB-12 280 Cummins Engine Troubleshooting and Reapair Manual to repair and overhaul the engine.

Fuel Filters/Water Separator – ***Removal/Installation***

The purpose of the fuel filters are to keep fuel clean, to filter any dirt particles that can cause wear on the fuel system, and to separate any water from the fuel. The primary fuel filter is mounted on the right side of to the engine towards the front of the sweeper. The pre–filter is mounted on the wall inside RH hydraulic tower next to the engine.

Condensation can easily build up in the fuel tank. When the condensed water in the fuel filter/water separator comes to a warning level on the indicator, drain the fluid from the drain plug located at the bottom of the fuel filter/water separator.

The filter element should always be replaced with new. Never try to clean the filter element.

1. Position the sweeper on a level surface.
2. Place the shifter in the *Park (P)* position, setting the parking brake.
3. Raise the hopper.
4. Stop the engine.
5. Clean area at the right front of engine and fuel filter.

   NOTE: *Before removing the fuel filter strainer, provide a container to catch the excess fuel.*
6. On the right front of the engine, unscrew the fuel filter strainer from the filter head.
7. Remove the fuel filter element and gasket.

   NOTE: *The engine fuel system may require priming the first time the engine is started after working on the fuel system.*
8. Replace the fuel filter element and gasket by reversing the steps.

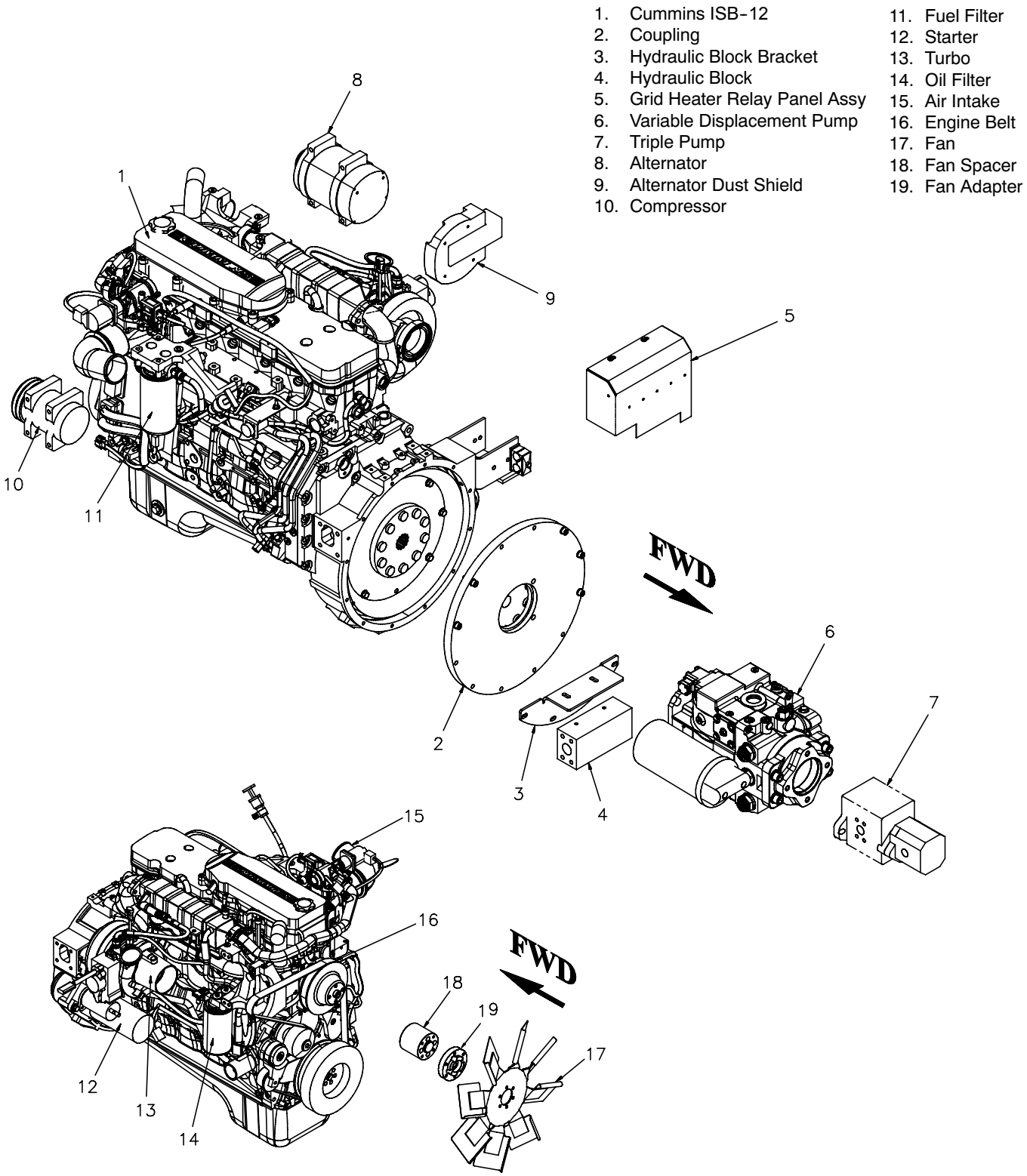
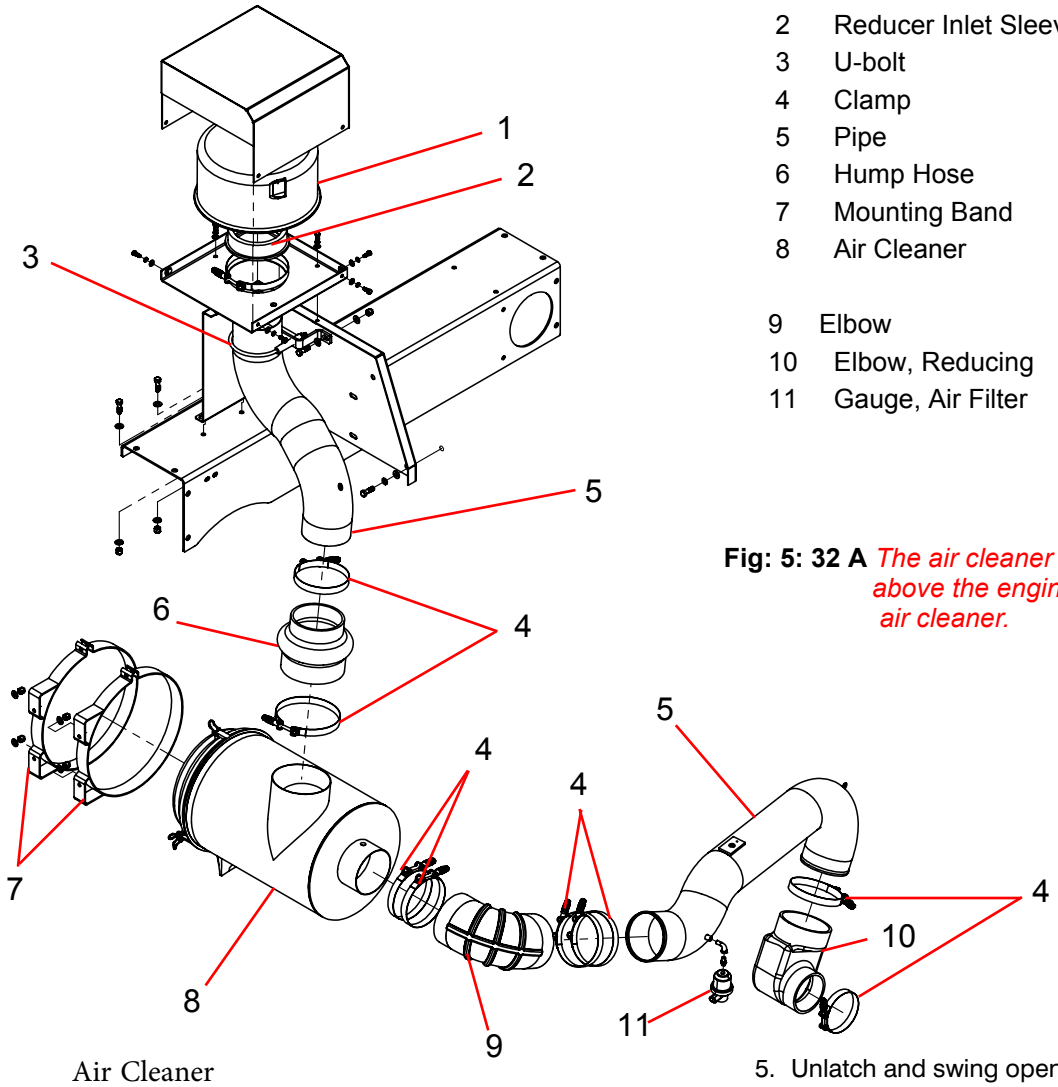


Fig: 5.31 A *The engine is situated in the sweeper frame backwards — that is the flywheel is toward the front of the sweeper and the radiator cooling fan is toward the rear of the sweeper.*



1 Precleaner
2 Reducer Inlet Sleeve
3 U-bolt
4 Clamp
5 Pipe
6 Hump Hose
7 Mounting Band
8 Air Cleaner

9 Elbow
10 Elbow, Reducing
11 Gauge, Air Filter

Fig: 5: 32 A *The air cleaner assembly is located above the engine next to the charge air cleaner.*

Air Cleaner – ***Removal/Installation***

WARNING

Hot exhaust systems present burn and fire hazards. Do not work on or near the engine or muffler until all components are cool.

1. Position the sweeper on a level surface.
2. Place the shifter in the *Park (P)* position, setting the parking brake.
3. Raise the hopper and install the safety props.

WARNING

INSTALL safety props. DEATH or serious INJURY may result if the hopper cylinders fail.

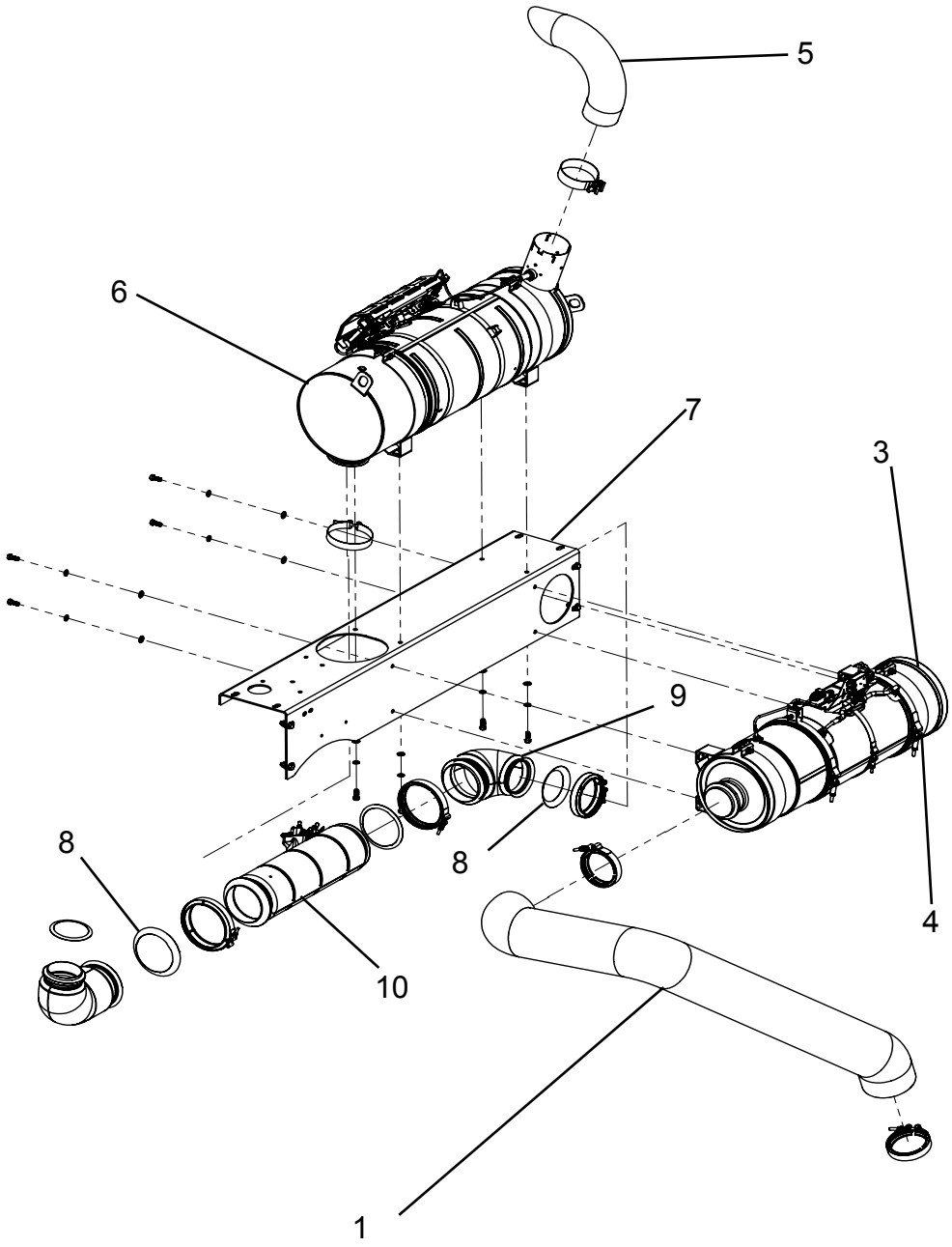
4. Stop the engine.
5. Unlatch and swing open the radiator.
6. Clean the area around the air cleaner.
7. Remove the wing nut securing the front cap of the air cleaner housing.
8. Remove the front cap and the air cleaner element from the housing.

   NOTE: *Replace the filter element if required. The following steps refer to replacement of the housing.*

9. Disconnect the filter indicator hose from the housing.
10. Loosen the hose clamp and disconnect the air intake elbow from the housing.

    NOTE: *Support the air cleaner housing before removing it from the mounting plate.*

11. From the top of the air cleaner housing, loosen the hose clamp and remove the air inlet hood.
12. Remove the bolts and washers that secure the air cleaner housing clamps to the mounting plate.
13. Remove the air cleaner housing assembly.
14. Install the air cleaner assembly by reversing the steps.



1 Exhaust Cover
2 Turbo to DPF Tubing
3 DPF (Diesel Fuel Atomizer)
4 DPF Clamps
5 Exhaust Pipe
6 SCR (Selective Catalytic Reduction)
7 Channel
8 Gasket
9 Elbow Fitting
10 Decomposition Reactor

Fig: 5:33 A *The Aftertreatment system is located at the rear above the engine on top of the Charge Air Cooler.*

WARNING

INSTALL the safety props. DEATH or serious IN UR may result if the hopper cylinders fail.

WARNING

Do not work on the exhaust system until the components completely cool down.

SCR (Selective Catalytic Reduction)

- Removal

1. Position the sweeper on a level surface.

2. Place the shifter in the Park(P)position, setting the parking brake.

3. Raise the hopper and install the safety props.

4. Stop the engine.

5. Remove the clamp (item 16) joining the exhaust pipe (item 5) to the SCR.

6. Remove the clamp (item 17) joining the SCR to the elbow (item 14).

7. Loosen the straps (item 7).

8. Remove the SCR.

- Installation

Install the SCR by reversing the steps and replace the gasket (item 15) with a new one.

REACTOR (Decomposition Reactor)

- Removal

1. Position the sweeper on a level surface.

2. Place the shifter in the Park(P)position, setting the parking brake.

3. Raise the hopper and install the safety props.

4. Stop the engine.

5. Remove the clamp (item 17) joining the SCR (item 6) to the elbow (item 14).

6. Remove the clamp (item 18) joining the elbow (item 14) to the REACTOR (item 12).

7. Remove the clamp (item 19) joining the REACTOR (item 12) to the elbow (item 10).

8. Remove the REACTOR.

- Installation

Install the REACTOR by reversing the steps and replace the gaskets (items 11, 13 and 15) with new ones.

DPF (Diesel Particulate Filter)

- Removal

1. Position the sweeper on a level surface.

2. Place the shifter in the Park(P)position, setting the parking brake.

3. Raise the hopper and install the safety props.

4. Stop the engine.

5. Remove the clamp (item 20) joining the elbow (item 10) to the DPF (item 3).

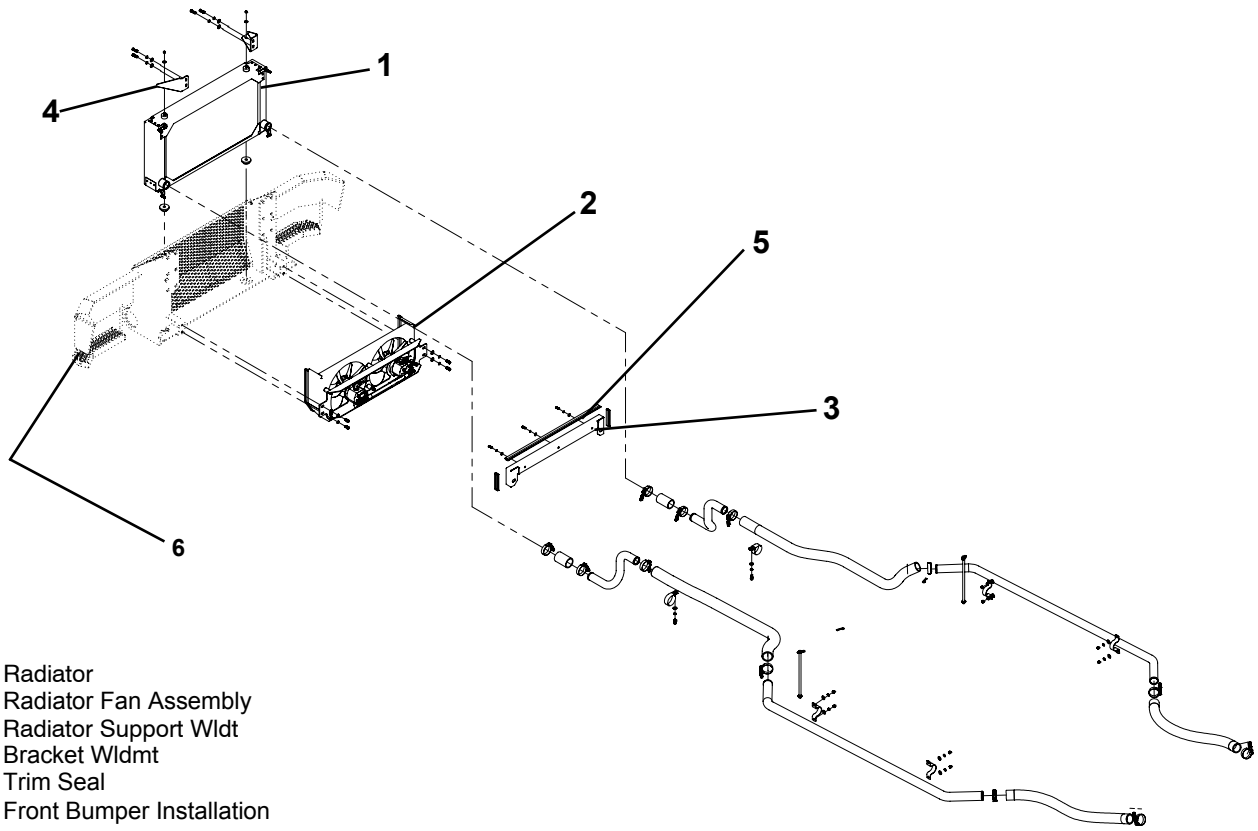
6. Remove the clamp (item 22) joining the tubing (item 2) to the DPF (item 3).

7. Loosen the straps (item 4).

8. Remove the DPF.

- Installation

Install the DPF by reversing the steps and replace the gasket (item 20) with a new one.



1. Radiator
2. Radiator Fan Assembly
3. Radiator Support Wldt
4. Bracket Wldmt
5. Trim Seal
6. Front Bumper Installation

Radiator - ***Removal/Installation***

1. Position the sweeper on a level surface.
2. Place the shifter in the *Park (P)* position, setting the parking brake.
3. Stop the engine.

WARNING

To prevent burn injury, allow the engine to completely cool down before working on or around the Radiator.

4. Remove the baffle guard and the fans.
5. Remove the hydraulic hoses from the fittings on the upper side of the cooler.
6. Pull the Radiator out the rear of the shroud.

CAUTION

Before removing any mounting hardware, support the oil cooler to prevent the assembly from dropping.

7. Install the Radiator by reversing the steps.
8. Fill the hydraulic oil tanks *(refer to service/lubrication procedure).*

Fig: 5.35 A *The Radiator Assembly is located at the Front of the sweeper. Use a hoist to remove radiator.*

Deaeration Tank
- Removal Installation

1. Position the sweeper on a level surface.
2. Place the shifter in the Park (P) position, setting the parking brake.
3. Stop the engine.

WARNING

To prevent burn in ury, allow the engine to completely cool down before working on or around the Radiator.

4. Working from the rear of the sweeper, open rear grille and swing out the radiator.
5. Remove electrical wirings connected to deaeration tank (item 1).
6. Remove the deaeration tank cap.

   NOTE: Provide a container to drain the coolant from the deaeration tank.

7. Drain the coolant from the deaeration tank.
8. Remove the overflow hose from the overflow nipple on the deaeration tank (item 6).
9. At the bottom of the deaeration tank, loosen the hose clamp securing the engine water inlet hose (item 3).
10. On the side of the deaeration tank, loosen the hose clamp securing the EGR valve hose (item 4) and the radiator outlet hoses (item 5).
11. Remove the outlet hoses (item 4 & 5). Plug the outlet hoses to stop any excess coolant from draining.
12. Remove the bolt and washers securing the deaeration tank to the bracket (item2).
13. Remove the deaeration tank from the bracket.
14. Install the deaeration tank by reversing the steps.
15. Fill engine coolant *(refer to service/lubrication procedure).*

Radiator
- Removal Installation

1. Position the sweeper on a level surface,
2. Place the shifter in the Park (P) position, setting the parking brake.
3. Stop the engine.

WARNING

To prevent burn in ury, allow the engine to completely cool down before working on or around the Radiator.

4. Working from the rear of the sweeper, swingout the radiator.
5. When the engine is cool, remove the deaeration radiator cap.
6. When the engine is cool, open the radiator valve to drain the coolant.

   NOTE: Provide a container to drain the coolant from the radiator.

7. Unlatch and swing out the radiator to gain access to the radiator hoses.
8. On the left side of the radiator, loosen the upper hose clamp securing the small radiator coolant hose (item 4) coming from the deaerationtank.
9. Loosen the upper hose clamp securing the large radiator hose (item 15) coming from the engine outlet.
10. Remove the two upper hoses. Plug the two upper hoses to stop excess coolant from draining.
11. Loosen the lower hose clamp securing the large radiator hose (item 16) going to the engine waterpump.
12. Remove the lower hose. Plug the lower hose to stop excess coolant from draining.
13. Remove the nuts, bolts and washers securing the radiator shroud (item 12) to the radiator support frame (item 13). Remove the radiator shroud.
14. Remove the bolts and washers securing the radiator (item 7) to the radiator support frame (item 13).
15. Remove the radiator.
16. Install the radiator by reversing the steps.
17. Fill the engine coolant *(refer to the service/lubrication procedure).*

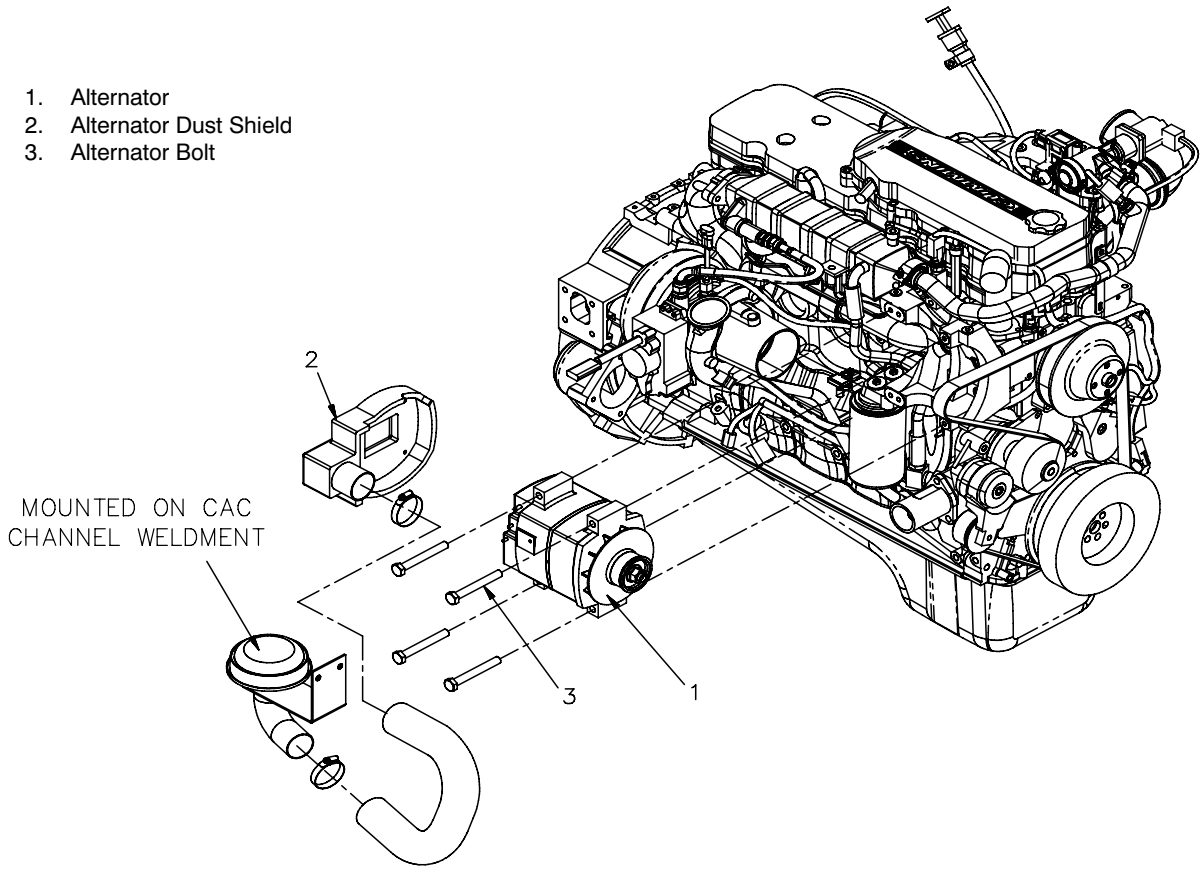


Fig: 5.37 A *The Alternator is located on the engine. Remove the air conditioner belt before removing alternator belt from the fan pulley.*

Alternator –***Removal/Installation***

1. Position the sweeper on a level surface.
2. Place the shifter in the *Park (P)* position, setting the parking brake.
3. Raise the hopper and install the props.
4. Stop the engine.
5. Working from the rear of the sweeper, swing out the radiator to gain access to the alternator.
6. Disconnect the negative battery cable *(black)* from each battery. Move the cables away from the terminals.
7. Disconnect the positive battery cables *(red)* from each battery. Move the cables away from the terminals.

CAUTION

When disconnecting cables from the batteries, ensure that cables are moved away from the terminals.

8. Identify and tag the electrical leads connected to the alternator.

NOTE: *A plug with yellow and white/red wires connects to the side of the alternator. A single black/white striped wire connects to the side of the alternator. A single red wire is bolted to the positive terminal on the back of the alternator. A white wire and the ground cable is bolted to the negative terminal on the back of the alternator.*

The ground cable comes from the engine. All other wires come from the wire harness.

9. Move tension pulley away from belt and relieve the tension on the large groove–belt.
10. Remove the groove–belt from the alternator pulley.

NOTE: *If the belt needs replacing, first remove the air conditioner belt from the fan pulley (refer to the following procedure). Next remove the alternator belt from the fan pulley*.

11. Remove the ground wire at the alternator body.
12. Remove hose clamp to the alternator dust shield.
13. Remove bottom bracket bolt and washer.
14. While supporting the alternator, remove the nut, washers and bolt securing the alternator to the engine bracket.
15. Remove the rear cover and then remove the electrical cable.
16. Remove the alternator
17. Install the alternator by reversing the steps.
18. Use the following procedure to adjust the groove–belt tension.

a. Tighten the alternator bracket nuts.
b. Place the groove belt around all the various pulleys except the tension pulley.
c. Move the tension pulley away from the belt relieving tension. Tighten the adjusting bolt.

NOTE: *The properly–adjusted tension on the groove–belt is controlled by the spring loaded tension pulley.*

d. Place the groove–belt over the tension pulley. Release the tension pulley.

BATTERY GROUP

The battery provides a source of energy for cranking the engine and acts a voltage stabilizer for the electrical system.

Batteries are factory sealed. Water never needs to be added. A small amount of electrolyte may leak from the top of the battery if it is tipped at more than 45 degree angle. Evidence of electrolyte leakage on top of the battery does not necessarily mean that the battery is defective.

Battery - *Warning*

WARNING

EXPLOSIVE GASES. Always shield eyes and face when working on or around batteries. Cigarettes, flames or sparks could cause the battery to explode.

Batteries contain poisonous sulfuric acid which can cause severe burns. Avoid contact with skin, eyes and clothing. In the event of accident flush with water and call a physician immediately.

Antidote-External:
Flush thoroughly with water.

Antidote-Internal:
Drink large quantities of water or milk. Follow with milk of magnesia, a beaten egg or vegetable oil.

Antidote-Eyes:
Flush eyes with water for 15 minutes.Accidental shorting across the battery terminals may result in lead splatter which can cause bodily injury and/or fire.

CAUTION

Do not tip the battery more than 45 degree angle when carrying or installing it.

NOTE: *Keeping the batteries in a charged condition should protect it against freezing.*

Batteries - *Replacement Precautions*

When handling a battery, the following precautions should be observed:

1. Hydrogen gas is produced by the battery. A flame or spark near the battery may cause the gas to ignite.
2. Inspect the battery for physical damage and replace as required.
3. Battery fluid is highly acidic. Avoid spilling on clothing or other fabric. Any spilled should be flushed with water immediately.
4. To disconnect, remove negative cable from the negative terminal and positive cable from the positive terminal.
5. To connect or install make sure positive cable is connected to the positive terminal and negative cable is connected to the negative terminal.

WARNING

Do not charge or use booster cables or adjust post connections without proper instructions and training.

Batteries
- *Removal/Installation*

1. Position the sweeper on a level surface.
2. Place the shifter in the *Park (P)* position, setting the parking brake.
3. Stop the engine.
4. Open RH fender cover to gain access to the batteries.
5. Remove plastic terminal cover. Disconnect the negative battery cable *(black)* from each battery negative terminal. Move the cables away from the terminals.
6. Disconnect the positive battery cable *(red)* from each battery positive terminal. Move the cables away from the terminals.
7. Remove the nuts and washers from the hold down assemblies.
8. Remove the hold down assemblies
9. Remove the batteries.

CAUTION

Batteries are extremely heavy. To prevent injury, always lift with your leg and arm muscles, not your back.

10. Install the batteries by reversing the steps.

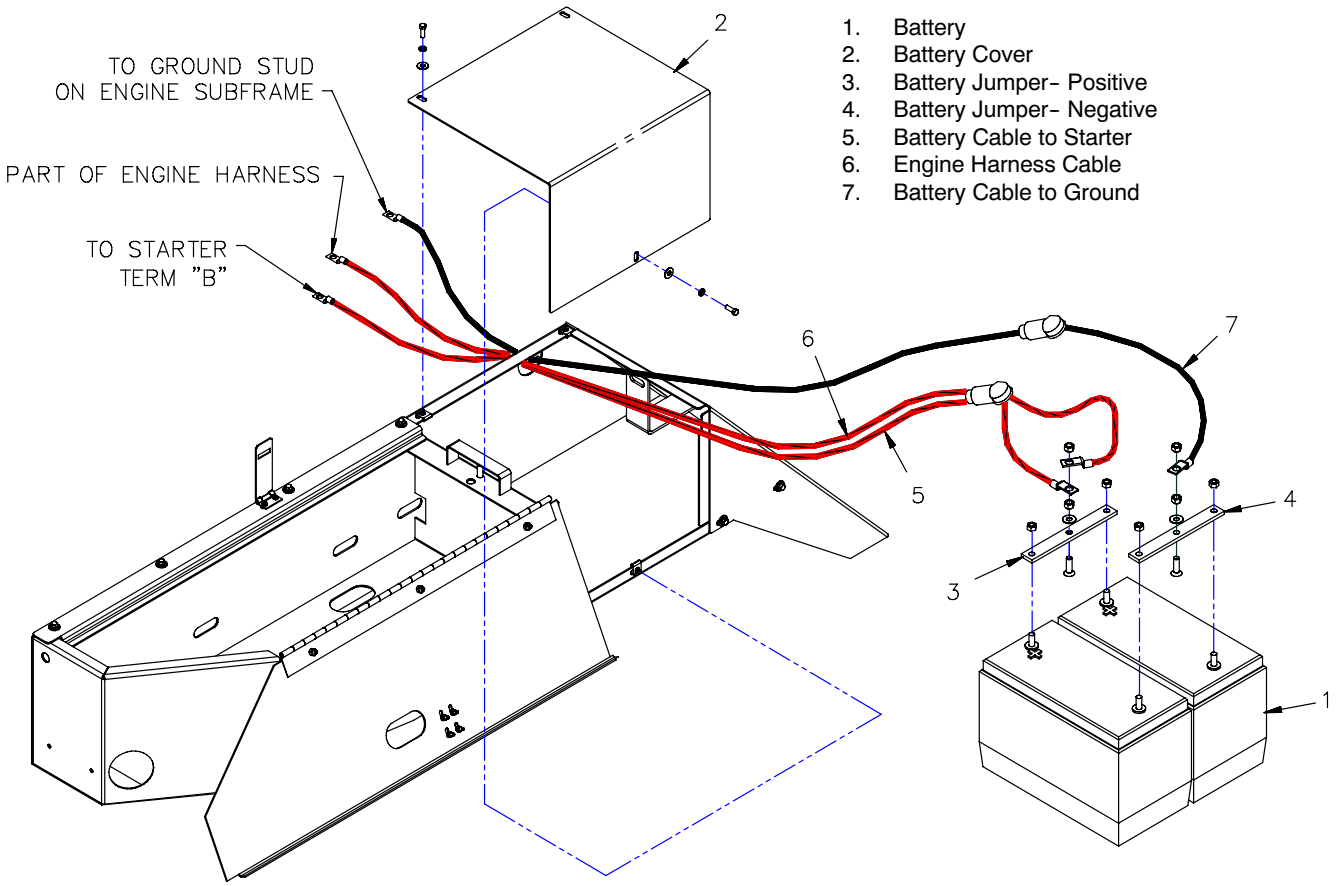


Fig: 5.39 A *The batteries are located in the RH fender. Remove the cover to gain access to the batteries.*

HOPPER GROUP

The removal and installation of the hopper requires a lifting equipment designed to lift the hopper safely as an assembly without causing personal injury or damage to the equipment.

Hopper
- *Removal/Installation*

1. Position the sweeper on a level surface.
2. Place the shifter in the *Park (P)* position, setting the parking brake.
3. Raise hopper to access Mtg. bolts on bottom, install safety props
4. Stop the engine.
5. Provide a chain sling and hoist capable of lifting the hopper. Attach the sling to the lifting eye at each corner of the hopper, with a center pull crane (or hoist) configuration.
6. Disconnect the hydraulic lines, and the hopper full sensor.
7. Remove hopper mounting bolts at bottom of hopper corners

WARNING

Do Not remove the lower lift cylinder pins from the frame.

8. Raise the crane (or hoist) to lift the hopper from the sweeper.
9. Install the hopper by reversing the steps.

Raising the Hopper Without Engine Power

In order to raise the hopper without engine power, a remote hydraulic pump is required to actuate pressure necessary to lift the cylinder.

1. Position the sweeper on a level surface.
2. Place the shifter in the *Park (P)* position, setting the parking brake.
3. Remove remote high pressure and low pressure caps from auxiliary hopper lift ports.
4. Attach remote hydraulic hoses and a remote hydraulic pump to the ports.

   ***NOTE:** The **male port (pressure**) comes directly from the auxiliary pump. The **female port (return)** should dump into a hydraulic oil container or pump reservoir.*

5. Start the remote hydraulic pump and raise the hopper.

   ***NOTE:** Pressure necesssary to lift the cylinder will depend on the amount of debris inside the hopper.*

Safety Under the Hopper

Before attempting to do any inspections or repairs under a raised hopper, make sure that BOTH Safety Props are in place

6. Remove the remote pump and related connections.
7. Replace the auxiliary port caps.
8. Check the hydraulic fluid level.

CHAPTER **6**

Hydraulic Components

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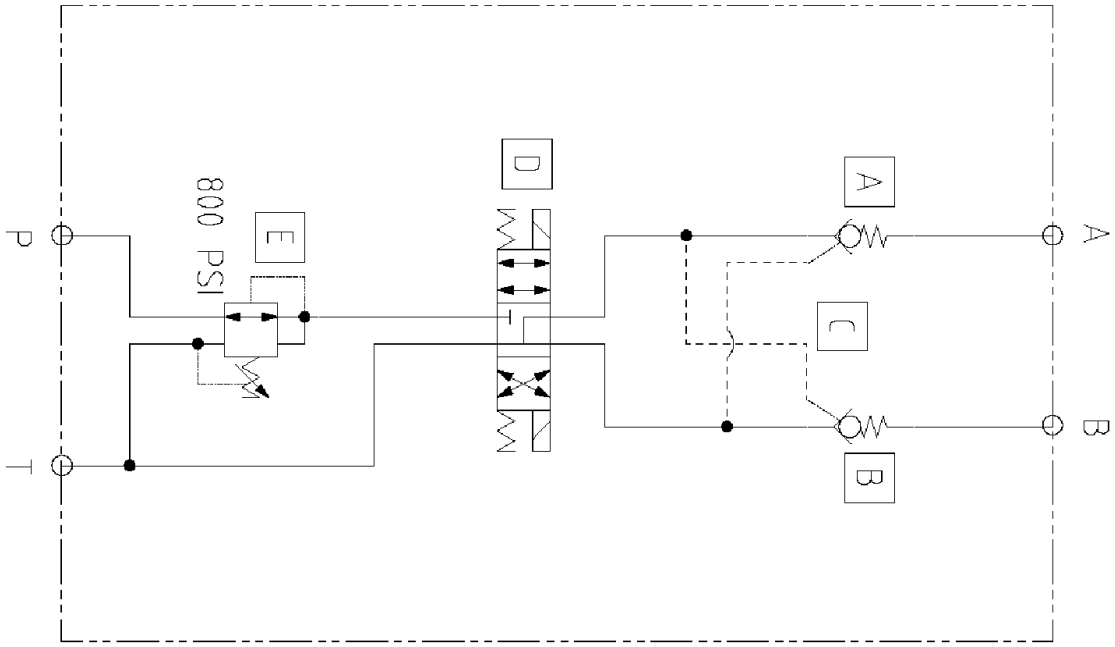
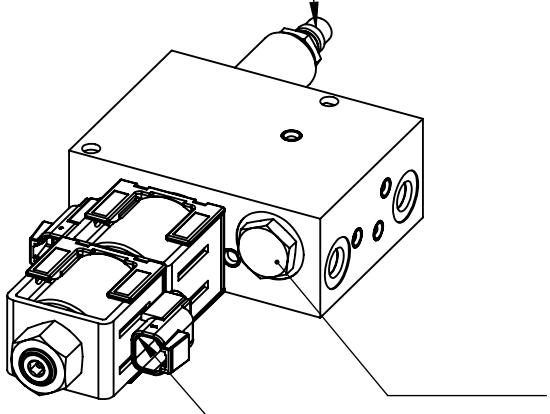


NOTE:
PART#331223 & 331224 ARE BUILT INSIDE AND ARE NOT SHOWN.

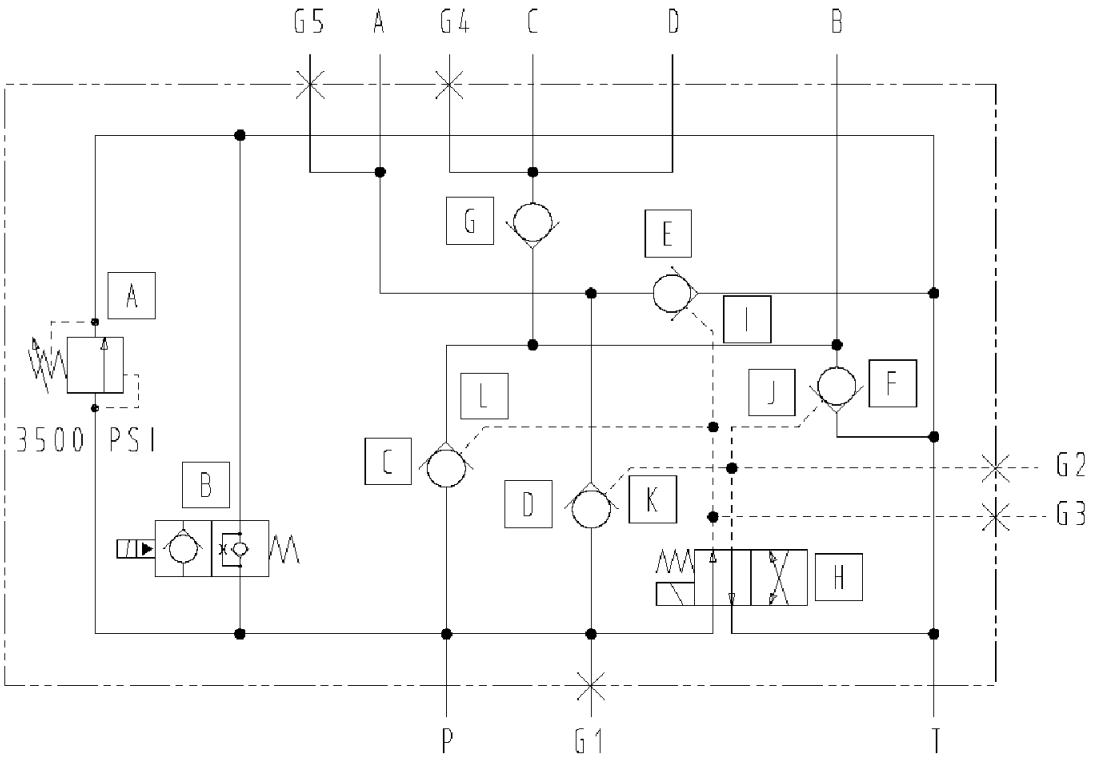
REDUCING/ RELIEVING CARTRIDGE (800PSI)
PART # (331227)



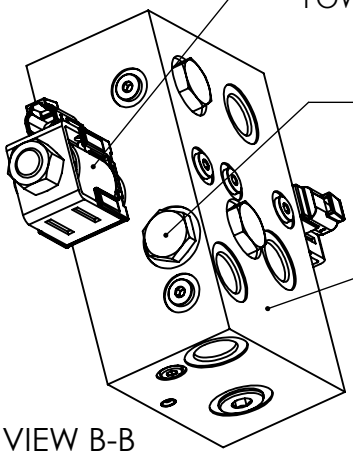
CHECK VALVE
PART# (331222)

SOLENOID VALVE & COIL
PART# (331225)

PART	DESCRIPTION
248020	G.B EXTENDED
331227	REDUCING/ RELIEVING CARTRIDGE (800PSI).
331288	SEAL KIT
331225	SOLENOID VALVE & COIL
331289	CARTRIDGE ONLY
331214	COIL
331290	SEAL KIT
331222	CHECK VALVE
331291	SEAL KIT



NOTE:
BACK UP RINGS AND PISTONS ARE BUILT INSIDE MANIFOLD AND ARE NOT SHOWN IN DRAWING.

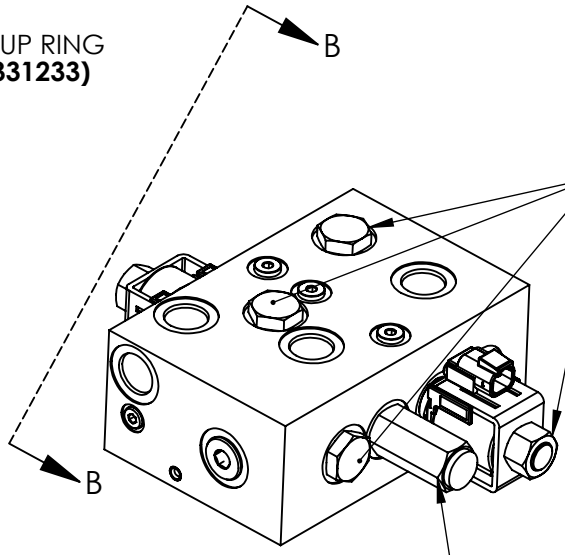


SOLENOID VALVE & COIL.
FOWARD/ REVERSE (4-WAY) VALVE.
PART# (307839)

CHECK VALVE CARTRIDGE.
PART# (382709)

12X BACKUP RING
PART# (331233)

VIEW B-B

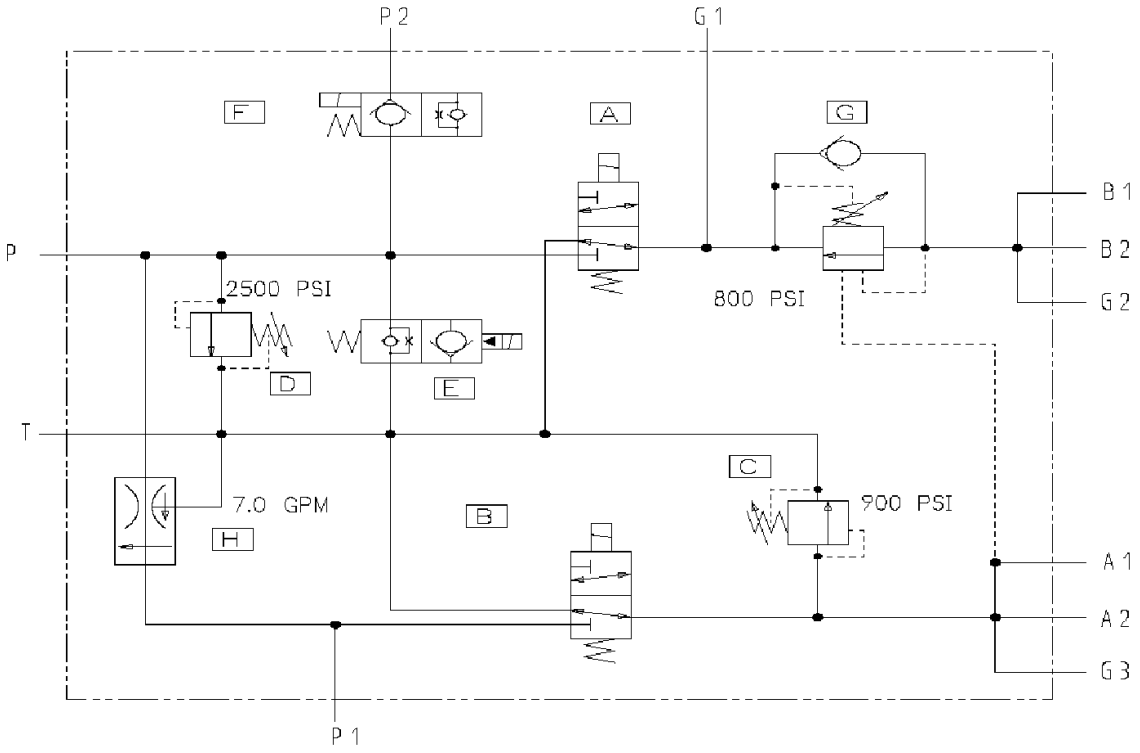


4X CHECK VALVE.
PART# (382708)
4X PISTON.
PART# (381212)

SOLENOID VALVE & COIL.
BY-PASS (2-WAY) VALVE.
(PART# 382707)

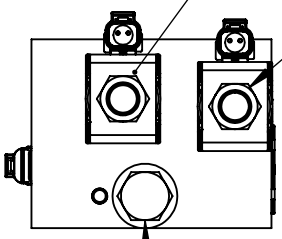
RELIEF VALVE CARTRIDGE, (3500 PSI).
PART# (381209)

PART	DESCRIPTION
319872	ELEV./ PICK UP BROOM
	382708 CHECK VALVE **381258** SEAL KIT
	382707 BY-PASS (2-WAY) VALVE **382723** CARTRIDGE **382724** COIL **331276** SEAL KIT
	307839 FORWARD/ REVERSE (4-WAY) VALVE **331280** CARTRIDGE **382724** COIL **331283** SEAL KIT
	331236 RELIEF VALVE (3500PSI). **381258** SEAL KIT
	382709 CHECK VALVE **381258** SEAL KIT
	331284 BACK UP RING FOR PILOT PISTON



2X CARTRIDGE & COIL
HOPPER UP.
PART# (331247)

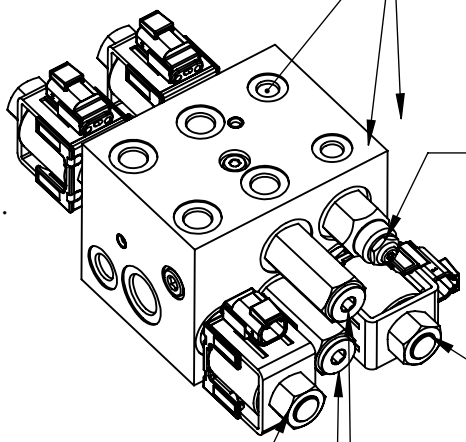
2X CARTRIDGE & COIL
HOPPER DOWN.
PART# (331247)



FLOW CONTROL CARTIDGE(7GPM).
PART# (381202)

NOTE:
PART NUMBER (381223) &
(381224) NOT SHOWN.

3X FITTING, DIAGNOSTIC, 7/16.
PART# (381223)
3X DUST CAP.
PART# (381224)



COUNTERBALANCE VALVE(800 PSI).
PART# (331238)

CARTRIDGE & COIL
BYPASS VALVE.
PART# (382707)

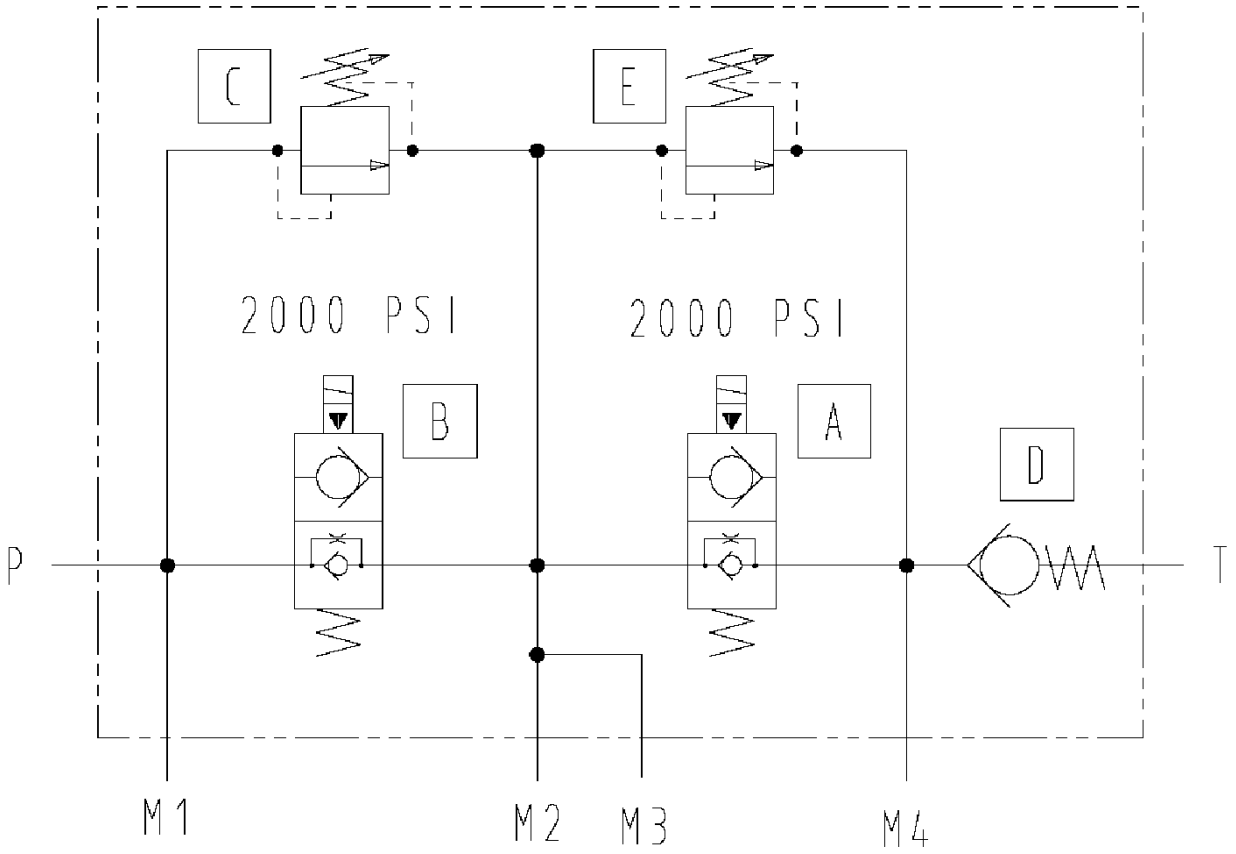
RELIEF VALVE CARTRIDGE (900 PSI).
PART# (331240)

CARTRIDGE & COIL
G.B. RUN VALVE.
PART# (382706)

RELIEF VALVE CARTRIDGE (2500 PSI).
PART# (331239)

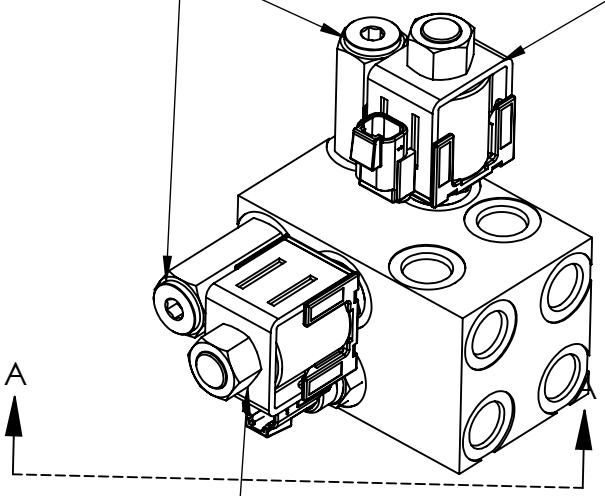
PART	DESCRIPTION
319870	HOPPER, UP/DOWN
331238	COUNTERBALANCE VALVE (800 PSI)
331277	SEAL KIT
331239	RELIEF VALVE (2500 PSI)
381258	SEAL KIT
331240	RELIEF VALVE (900 PSI)
381258	SEAL KIT
381202	FLOW CONTROL (7GPM)
331278	SEAL KIT
382707	BYPASS VALVE
382723	CARTRIDGE
382724	COIL
331276	SEAL KIT
331247	HOPPER UP/DOWN VALVE
331280	CARTRIDGE
382724	COIL
331281	SEAL KIT
382706	G.B. RUN VALVE
331282	CARTRIDGE
382724	COIL
331276	SEAL KIT

BLUE MANIFOLD- GUTTERBROOM DRIVE.
PART# (319871)



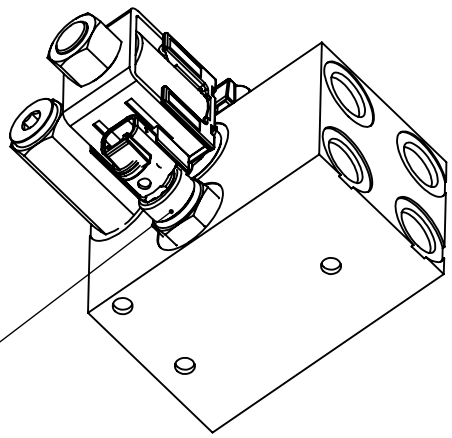
RELIEF VALVE CARTRIDGE (2000 PSI).
PART# (331256)

SOLENOID VALVE & COIL.
LH G/B RUN VALVE.
PART# (382707)



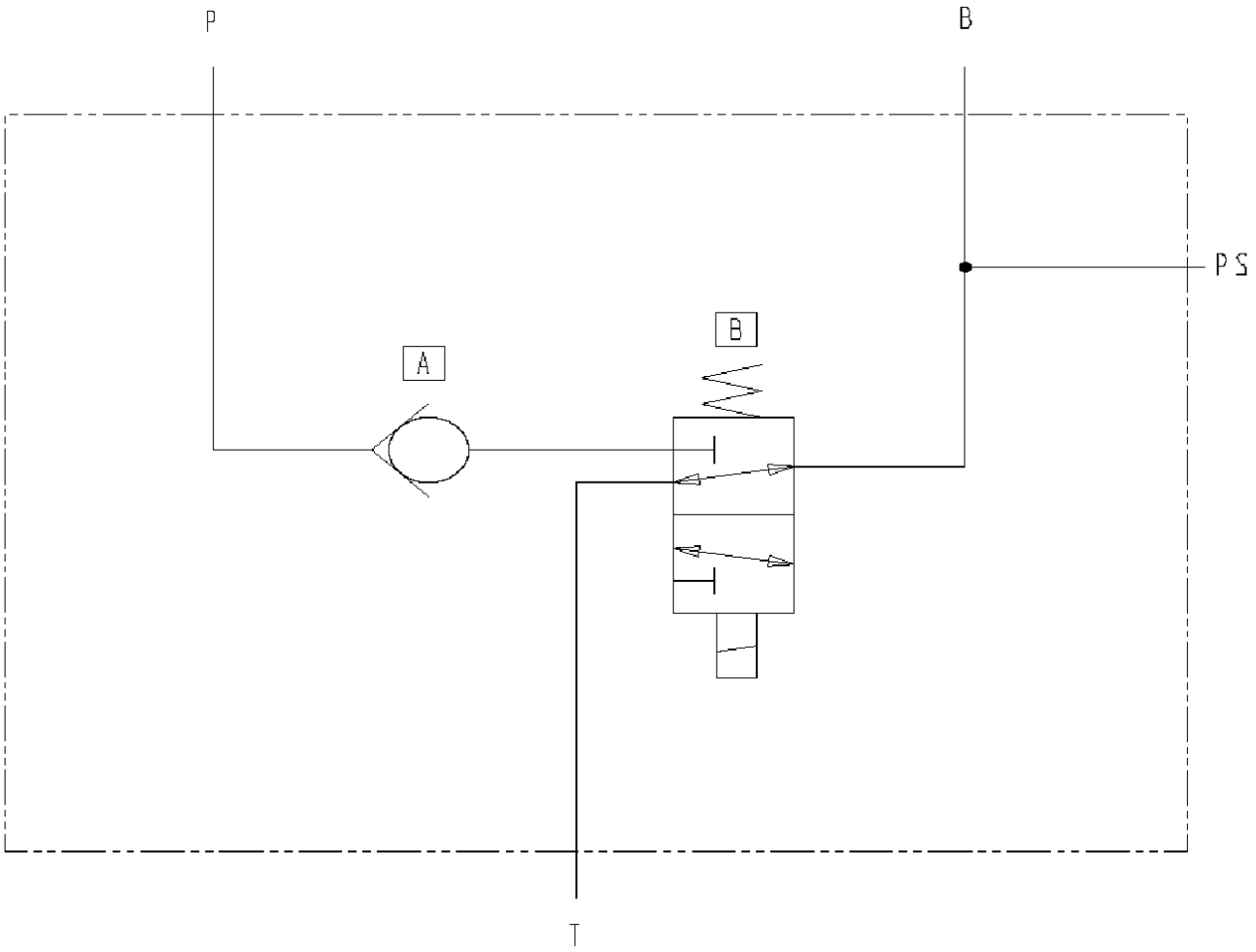
SOLENOID VALVE & COIL.
RH G/B VALVE.
PART# (382707)

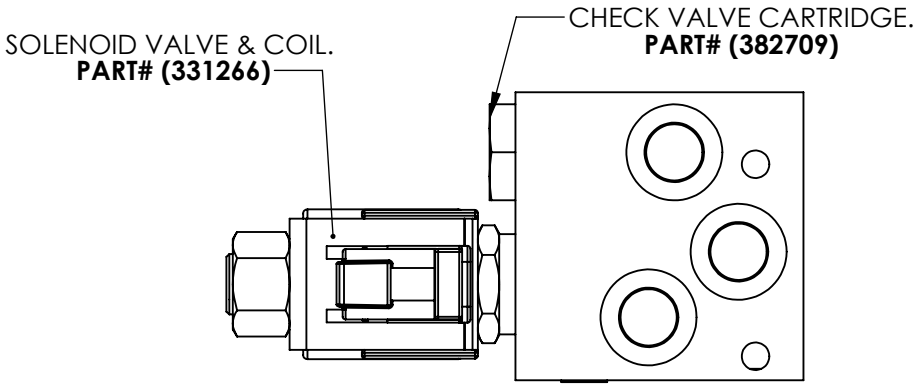
CHECK VALVE.
PART# (382709)



VIEW A-A
SCALE 1 : 3

PART	DESCRIPTION
319871	GUTTER BROOM DRIVE
	331256 RELIEF VALVE (2000 PSI) 381258 SEAL KIT
	382707 SOLENOID VALVE & COIL 382723 CARTRIDGE 382724 COIL 331276 SEAL KIT
	382709 CHECK VALVE 381258 SEAL KIT

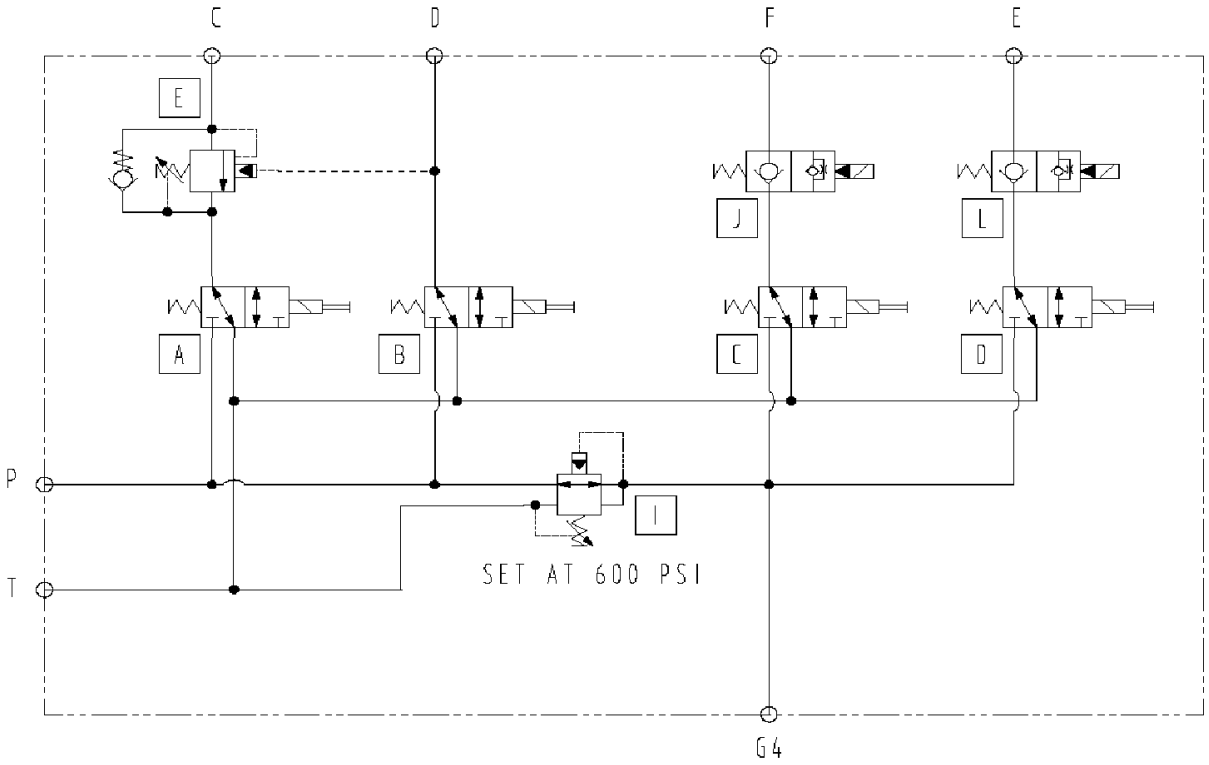

P
B
PS
A
B
T

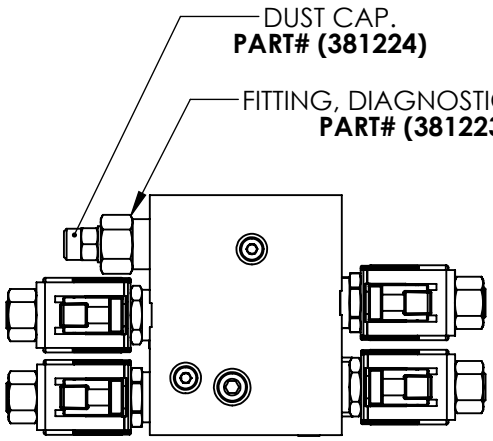

SOLENOID VALVE & COIL.
PART# (331266)
CHECK VALVE CARTRIDGE.
PART# (382709)

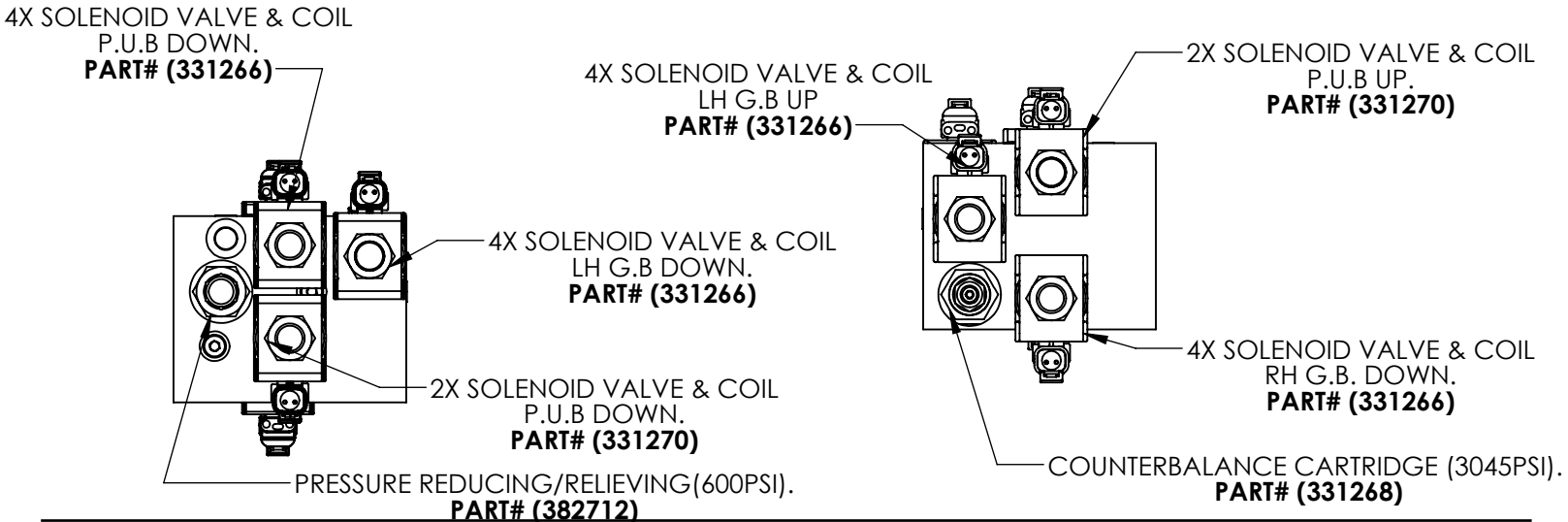
PART	DESCRIPTION
319874	**PARK BRAKE**

331266 SOLENOID VALVE & COIL
331280 CARTRIDGE
382724 COIL
331281 SEAL KIT

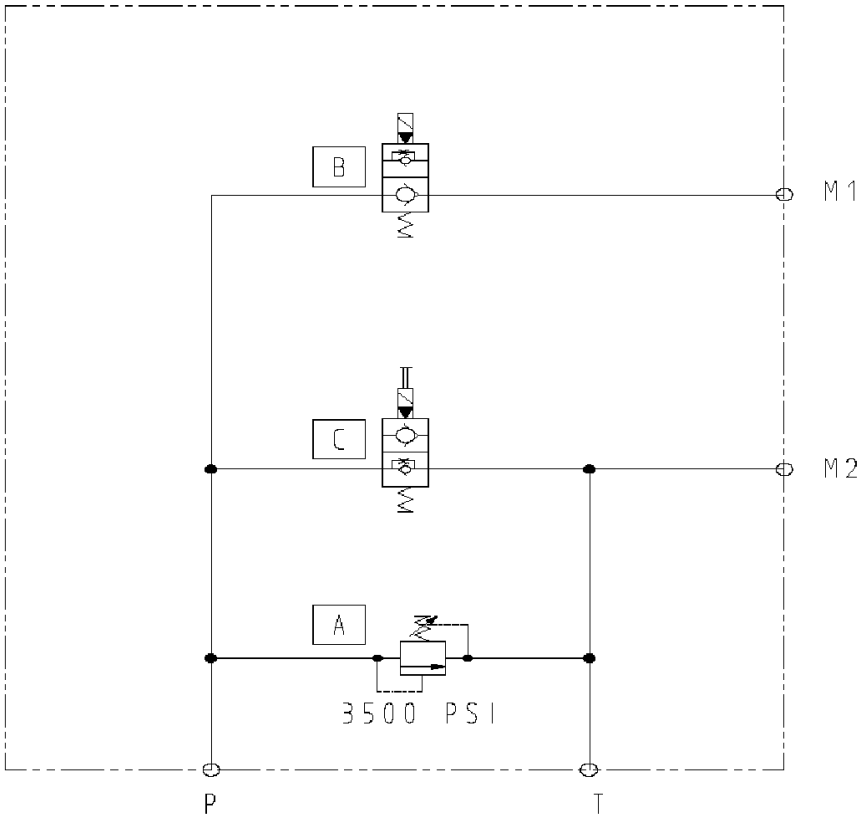
382709 CHECK VALVE
381258 SEAL KIT

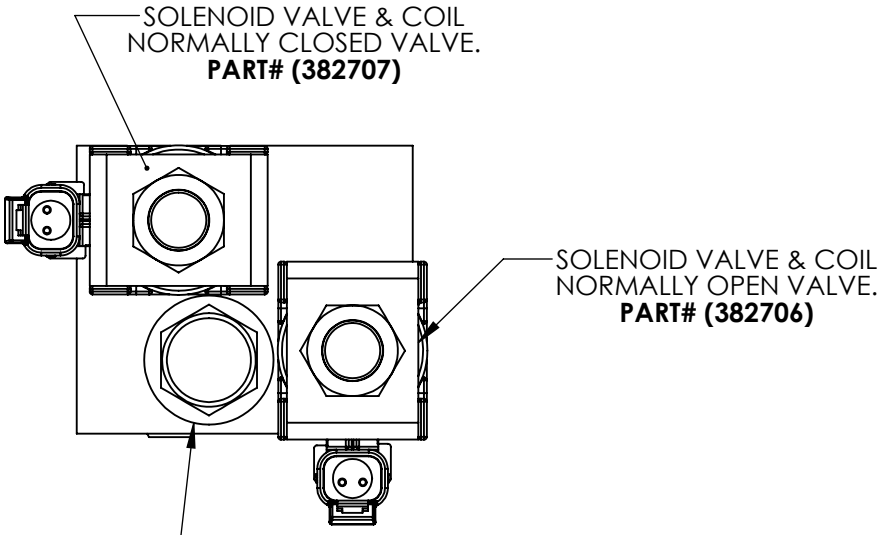

C
D
F
E
E
J
L
A
B
C
D
P
T
I
SET AT 600 PSI
G4


DUST CAP.
PART# (381224)
FITTING, DIAGNOSTIC, 7/16.
PART# (381223)


4X SOLENOID VALVE & COIL
P.U.B DOWN.
PART# (331266)
4X SOLENOID VALVE & COIL
LH G.B DOWN.
PART# (331266)
2X SOLENOID VALVE & COIL
P.U.B DOWN.
PART# (331270)
PRESSURE REDUCING/RELIEVING(600PSI).
PART# (382712)
4X SOLENOID VALVE & COIL
LH G.B UP
PART# (331266)
2X SOLENOID VALVE & COIL
P.U.B UP.
PART# (331270)
4X SOLENOID VALVE & COIL
RH G.B. DOWN.
PART# (331266)
COUNTERBALANCE CARTRIDGE (3045PSI).
PART# (331268)

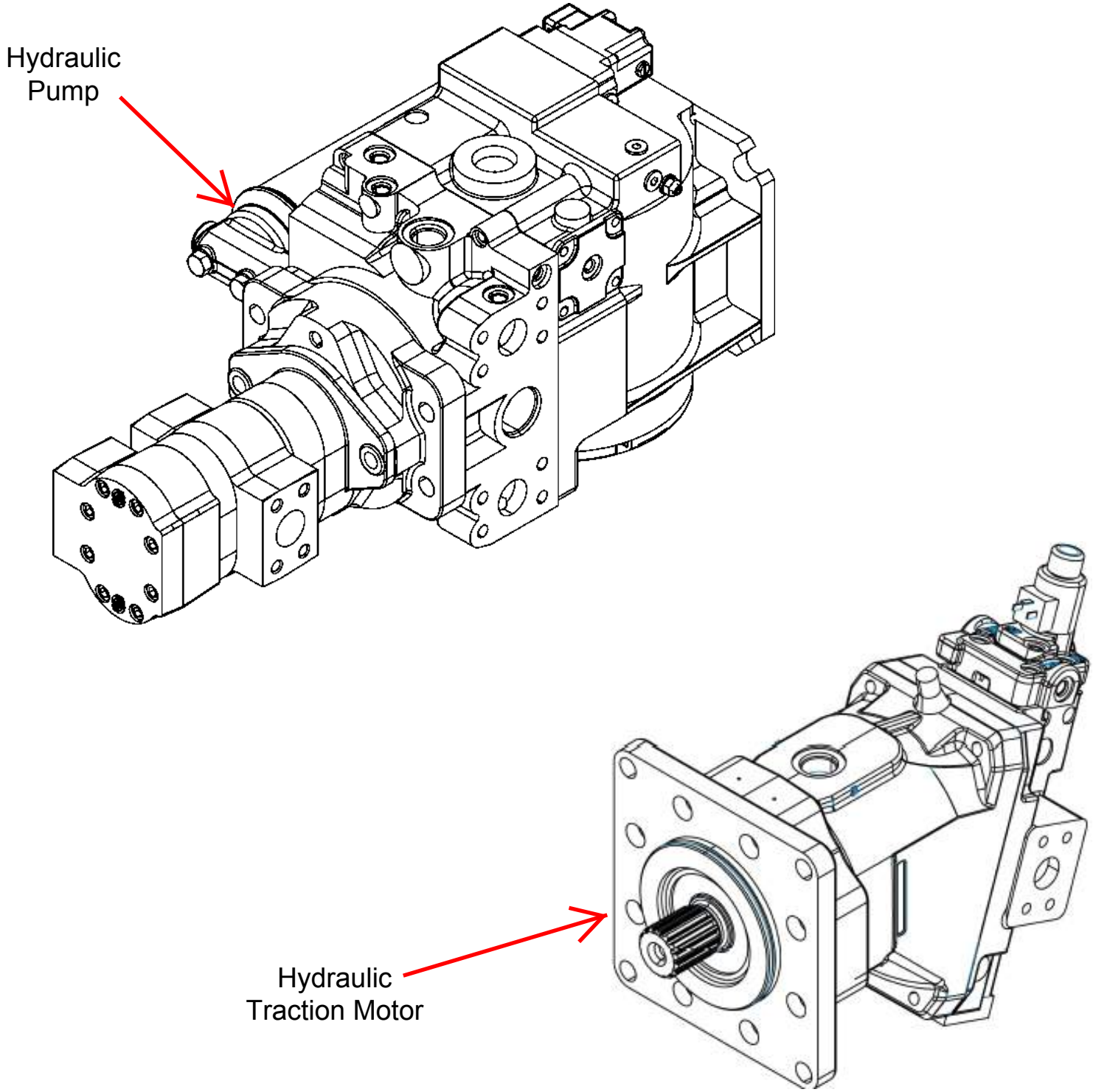
PART	DESCRIPTION
319875	**BROOM LIFT**
331268	COUNTERBALANCE VALVE (3045PSI)
331277	SEAL KIT
382712	PRESSURE REDUCER VALVE (600PSI)
331285	SEAL KIT
331266	P.U.B DOWN
331280	CARTRIDGE
382724	COIL
331281	SEAL KIT
331270	P.U.B UP
331282	CARTRIDGE
382724	COIL
331276	SEAL KIT

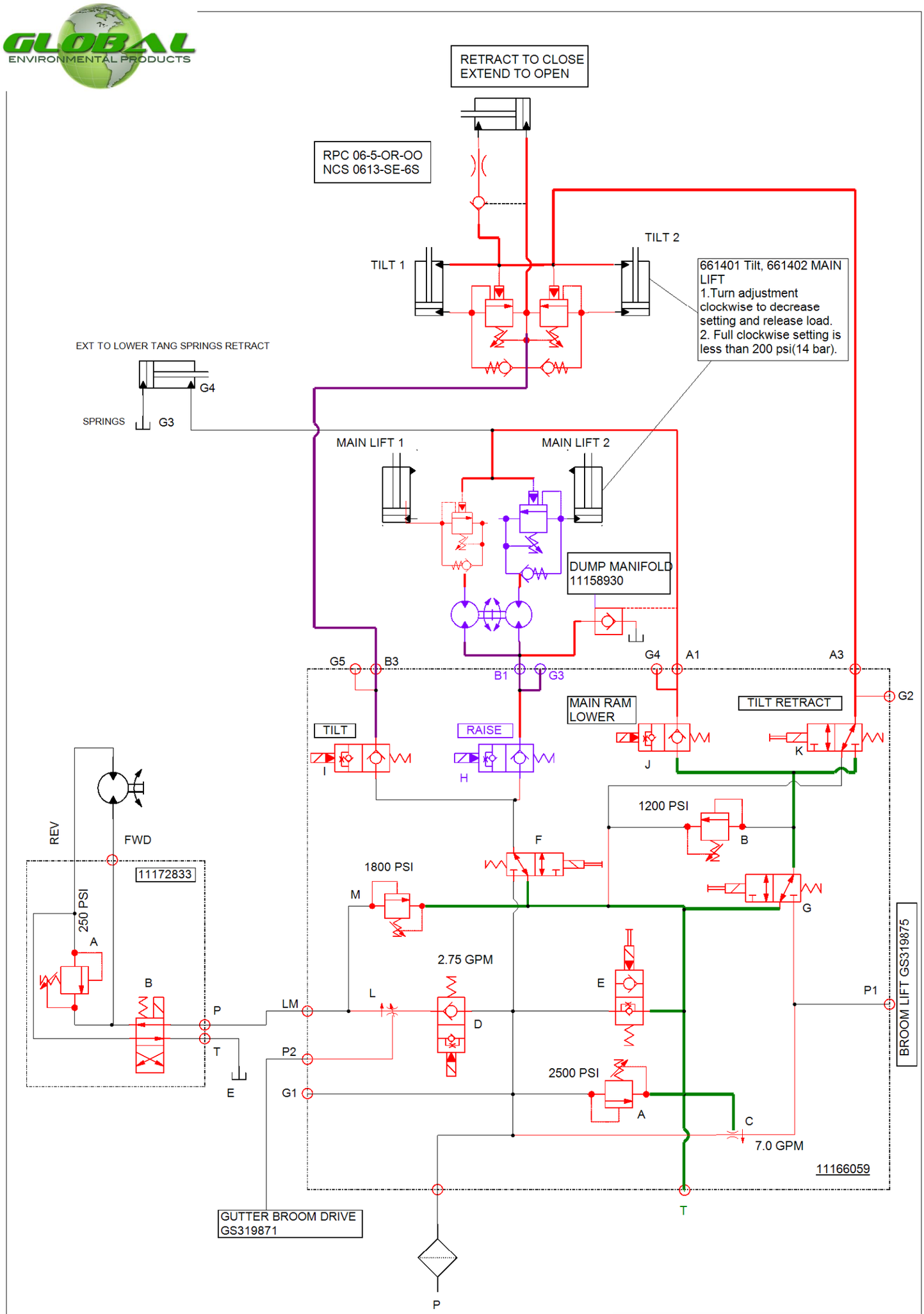

B
M1
C
M2
A
3500 PSI
P
T


SOLENOID VALVE & COIL
NORMALLY CLOSED VALVE.
PART# (382707)
SOLENOID VALVE & COIL
NORMALLY OPEN VALVE.
PART# (382706)
RELIEF VALVE CARTRIDGE (3500PSI).
PART# (381209)

PART	DESCRIPTION
319876	P.U.B DRIVE
382707	NORMALLY CLOSED VALVE
382723	CARTRIDGE
382724	COIL **331276**
	SEAL KIT
382706	NORMALLY OPEN VALVE
331282	CARTRIDGE
382724	COIL
331276	SEAL KIT
381209	RELIEF VALVE (3500PSI)
381258	SEAL KIT

Hydraulic Traction Pump & Motor





E.R. : 29507 NEXT ASSY: 660900	DWG NO.	333131
	HSD HOPPER HYD SCH	
GEP	Rev: 2 By: G ODGERS Date: 3/17/2016 4:44:20	

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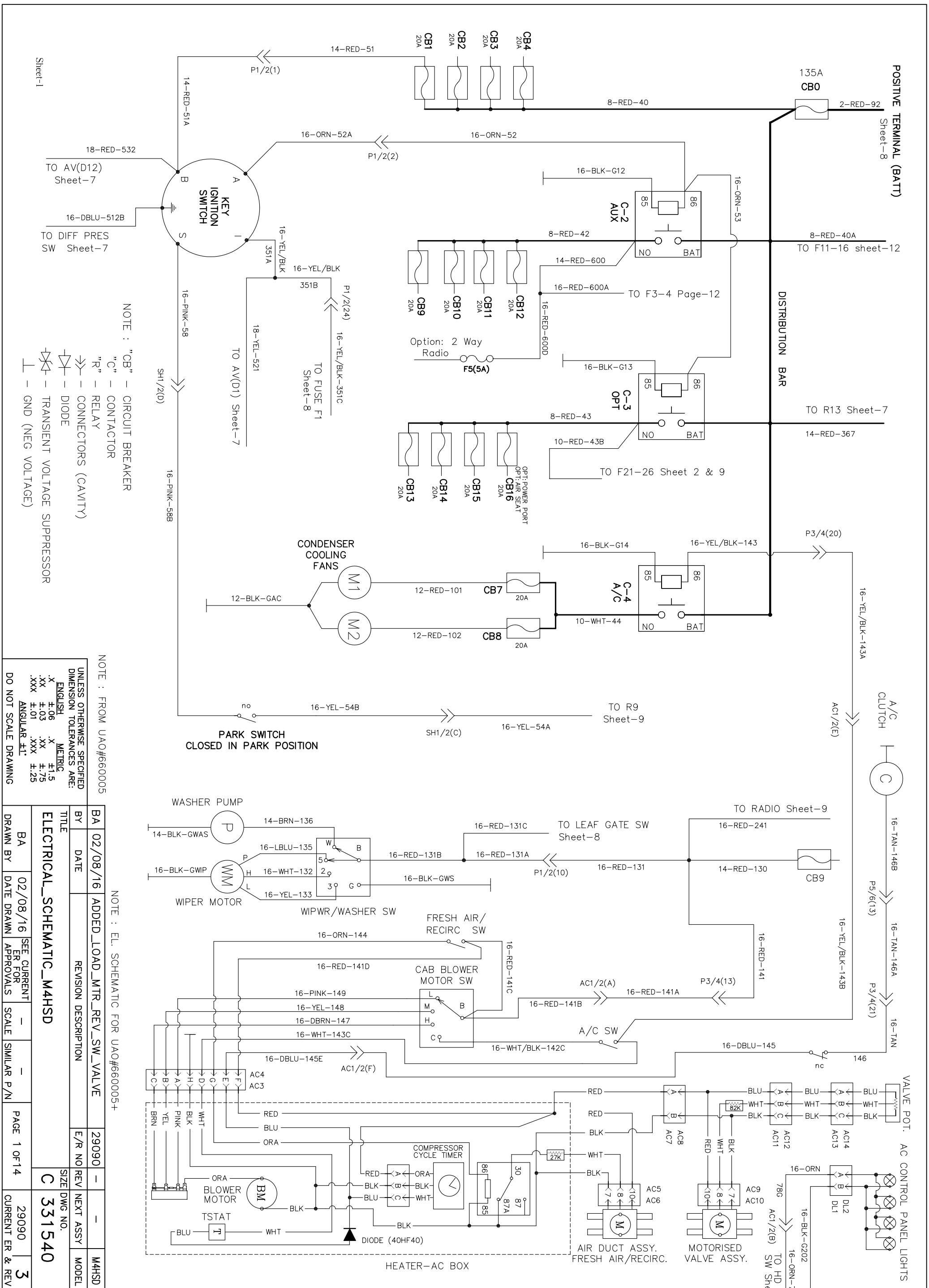
CHAPTER 7

Troubleshoot



UNLESS OTHERWISE SPECIFIED DIMENSION TOLERANCES ARE:

ENGLISH		METRIC	
.X	±.06	.X	±1.5
.XX	±.03	.XX	±.75
.XXX	±.01	.XXX	±.25

ANGULAR ±1°

DO NOT SCALE DRAWING

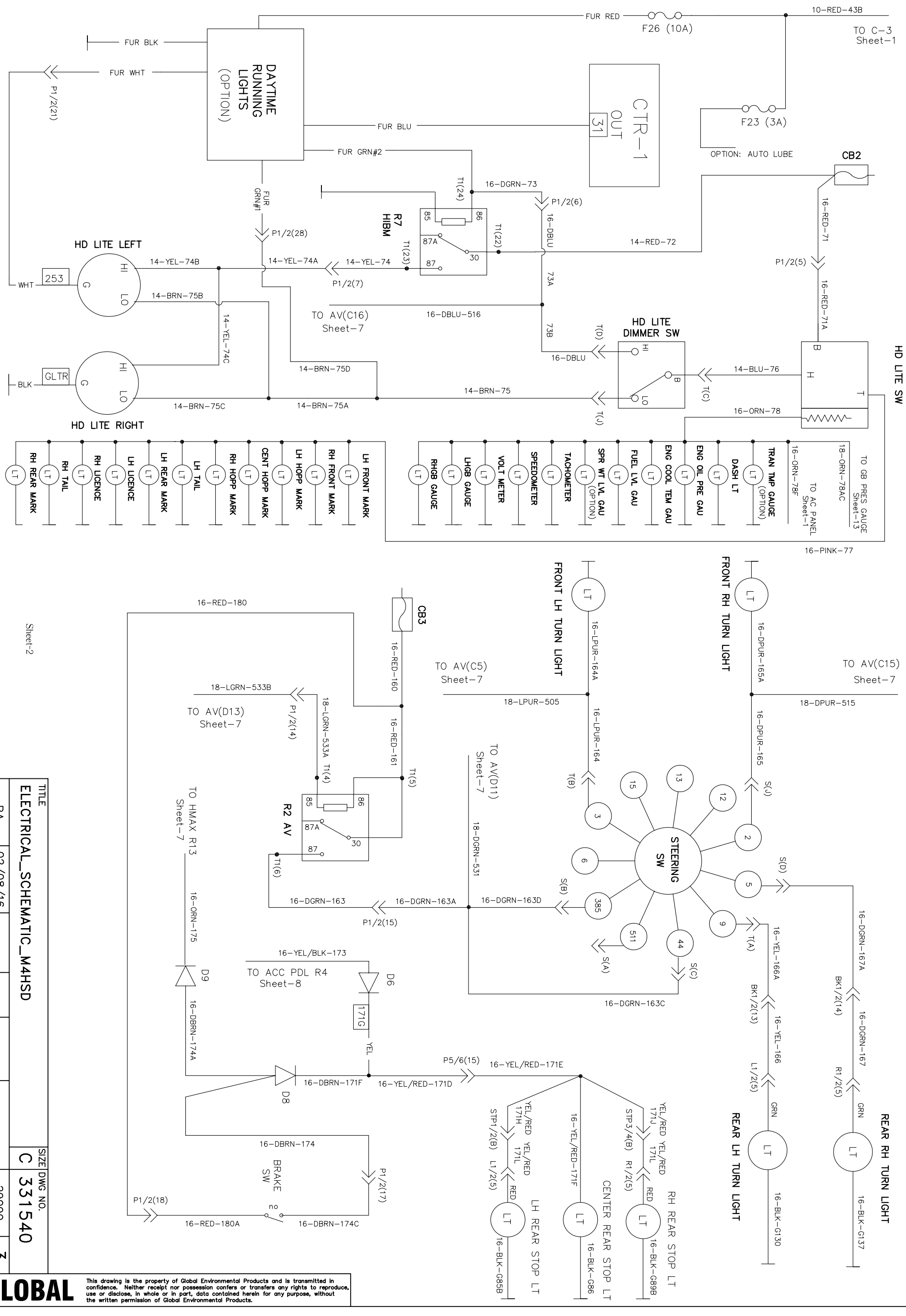
BY	DATE	REVISION DESCRIPTION	E/R NO	NEXT ASSY	MODEL
BA	02/08/16	ADDED_LOAD_MTR_REV_SW_VALVE	29090	–	M4HSD

TITLE

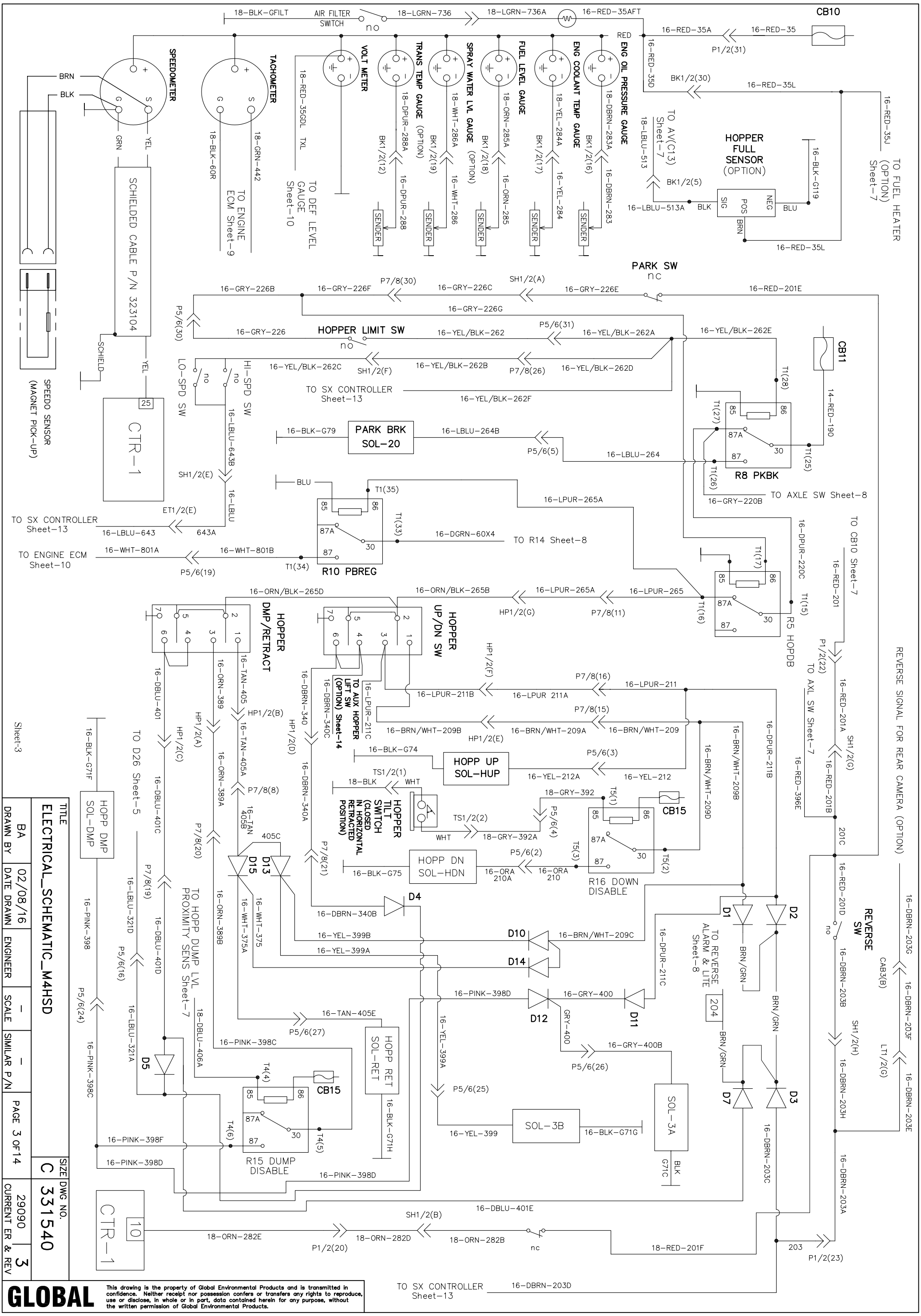
ELECTRICAL_SCHEMATIC_M4HSD

SIZE C | DWG NO. 331540

DRAWN BY	DATE DRAWN	SEE CURRENT ER FOR APPROVALS	SCALE	SIMILAR P/N	PAGE	CURRENT ER & REV
BA	02/08/16	–	–	–	1 OF 14	29090 3



TITLE	ELECTRICAL_SCHEMATIC_M4HSD		
BA	02/08/16		
DRAWN BY	DATE DRAWN		
ENGINEER	SCALE –	SIMILAR P/N –	PAGE 2 OF14
		SIZE C	DWG NO. 331540
		29090 CURRENT ER & REV	3



TITLE	ELECTRICAL_SCHEMATIC_M4HSD
DRAWN BY	BA
DATE DRAWN	02/08/16
ENGINEER	–
SCALE	–
SIMILAR P/N	
PAGE	3 OF 14
SIZE	C
DWG NO.	331540
CURRENT ER & REV	29090 3

GLOBAL

CAN TO ENG ECM AND CTR-2
Sheet-5 and Sheet-10

CB10

18-DBRN-658B — TO R6, REVERSE Sheet-3

TO AXLE SHIFT SW Sheet-8 — 18-DPUR-222C — P7/8(22) — 18-DPUR-222F

TO AXLE SHIFT SW Sheet-8 — 18-TAN-221C — P7/8(23) — 18-TAN-221F

18-RED-765K

VS2 (Voltage Suppressor)

ELEV FWD/REV SW — RHGB ROT SW — RHGB UP/DN SW — ERGO SW — LHGB ROT SW — LHGB UP/DN SW

18-DGRN-328 — P3/4(24) — 18-DGRN-328A

18-ORN-318 — P3/4(8) — 18-ORN-318A

18-YEL-331 — P3/4(26) — 18-YEL-331A

18-PINK-332 — P3/4(27)

18-DBLU-303 — P3/4(2)

18-GRY-325 — P3/4(28)

18-LBLU-327 — P3/4(11)

18-DBRN-314 — P3/4(6) — 18-DBRN-314A

18-GRY-324 — P3/4(25) — 18-GRY-324A

18-PINK-333 — P3/4(10) — 18-PINK-333A

TO R3 Sheet-9

TO HI-SPEED SW Sheet-3 — 282D — ORA

P1/2(20)

ORA — 282E

1	POWER GND (−)	IN	26
2	POWER SUPPLY (+)	IN	27
3	CAN0 (+)	IN	28
4	CAN0 (−)	IN	29
5	AIN/CAN0 SHIELD	IN	30
6	IN	OUT	31
7	IN	OUT	32
8	5 VDC SENSOR PWR (+)	OUT	33
9		OUT	34
10	IN	OUT	35
11	IN	OUT	36
12	IN	OUT	37
13	IN	OUT	38
14	IN	OUT	39
15	IN	OUT	40
16	IN	OUT	41
17	IN	OUT	42
18	IN	OUT	43
19	IN	OUT	44
20	CAN1 (+)	OUT	45
21	CAN1 (−)	OUT	46
22	AIN/CAN1 SHIELD	POWER SUPPLAY (+)	47
23	IN	POWER SUPPLAY (+)	48
24	IN	POWER SUPPLAY (+)	49
25	IN	POWER SUPPLAY (+)	50

CTR-1

T2(14) T2(13) — ORN — 776 — 5 VDC SENSOR PWR (+)

T2(12) T2(11) — DGRN — GCON

18-LBLU-303A

18-PINK-332A

TO LEAF GATE SW Sheet-8 — 18-PINK-686B — 18-PINK-686 — P3/4(15)

18-GRY-325A

18-ORN-351D

ES1/2 — ELEVATOR STALL PROXIMITY SENSOR (OPTION)

BLK — B — WHT — T2(3)
BRN — A — RED — T2(1)
BLU — C — BLK — T2(2)

WHT — BLK

18-RED-339C — TO R4 Sheet-8

YEL — SCHIELDED CABLE P/N 323104 — SCHIELD — YEL — GRN — TO SPEEDOMETER Sheet-3

18-ORN-351G — TO F7 Sheet-8 — P3/4(5)

BLK

18-LBLU-777 — T2(11) T2(13) T2(15) — SHL BLK RED WHT — BLK WHT RED — CW — LHGB GROUND PRESS SET

18-DBLU-778 — T2(11) T2(13) T2(16) — SHL BLK RED WHT — BLK WHT RED — CW — PRESS SET RHGB GROUND

18-LGRN-779 — T2(12) T2(14) T2(17) — SHL BLK RED WHT — BLK RED WHT — 1 2 3 — BLK RED WHT — LST1/2 — TRANSDUCER LHGB PRESSURE

18-DGRN-780 — T2(12) T2(14) T2(18) — SHL BLK RED WHT — BLK RED WHT — 1 2 3 — BLK RED WHT — RST1/2 — TRANSDUCER RHGB PRESSURE

FUR BLU — TO DRL (OPTION) Sheet-2

18-PINK-892 — T2(4) — PINK — VS4 — 18-PINK-892A — ENG COOLER FAN REVERSE — BLK

18-DPUR-307 — P3/4(4) — 18-DPUR-307A — 18-DPUR-307B — WH1/2(C) — LT — BLK — LOW WATER LEVEL LAMP

18-DBRN-534 — P1/2(11) — 18-DBRN-534A — TO AV100(D14). RH HYD OIL LEVEL LAMP Seet-7

18-ORN-536 — P1/2(12) — 18-ORN-536A — TO AV100(D16). LH HYD OIL LEVEL LAMP Seet-7

18-TAN-946 — P1/2(29) — 18-TAN-946A — POWER FOR PUB ODOMETER/HOURMETER (OPTION)

18-TAN-893 — T2(7) — TAN — VS5 — 18-TAN-893A — ENG COOLER FAN PROPORT. — BLK

18-LBLU-764 — P7/8(12) — 18-LBLU-764A — LT BUZZ — BLK — "MOTOR OVERSPEED" IN-CAB LED LIGHT & BUZZER

18-PINK-504 — P7/8(4) — 18-PINK-504A — TO AV100(C4) Sheet-7

18-ORN-501 — P7/8(3) — 18-PINK-501A — TO AV100(C1) Sheet-7

GB PANEL ILLUMINATION LAMP — BLK — LT — 18-ORN-78M

18-DGRN-653B — TO R4 Sheet-8

18-ORN-78C — TO LINE 78 Sheet-2

18-ORN-78M — HY1/2(B)

18-GRY-514 — P1/2(4) — 18-GRY-514A — TO AV100(C14). ELEV STALL (OPTION) Sheet-7
IF NO OPTION USED. PULL OUT WIRE GRY 514 FROM (44) AND CONNECT THIS WIRE TO THE GROUND.

18-ORN-78AC — RHGB GROUND PRESSURE GAUGE

18-DGRN-795 — TO R14 Sheet-8

18-RED-301AC

LGRN — 781 — F E — FILTER — B D C — 782 — LBLU

18-ORN-320 — P3/4(9) — 18-ORN-320A

18-DBRN-316 — P3/4(7) — 18-DBRN-316A — LHGB GROUND PRESSURE GAUGE

16-RED-301 — P3/4(1) — 18-RED-301A — TO CB13 Sheet-7

18-RED-301C

TO GB LIT SW Sheet-6

GLOBAL

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ELECTRICAL_SCHEMATIC_M4HSD	C	331540

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HOPPER MOTOR LOAD SENSOR

TO CAB BLOWER MOTOR SW Sheet-1

16-RED-141C

LOAD MOTOR REVERSE SW

HM1/2(3) RED

HM1/2(2) WHT

HM1/2(1) BLK

18-BLK-GSD5

CAN TO ENG ECM AND CTR-1 Sheet-4 and Sheet-10

G Y Y G G Y

A Y G B

120 OHM BR-2

CB14 RED

RED

BLK

BLK RED

VS25 (Voltage Suppressor)

1	POWER GND (-)	IN	26
2	POWER SUPPLY (+)	IN	27
3	CANO (+)	IN	28
4	CANO (-)	IN	29
5	AIN/CANO SHIELD	IN	30
6	IN	OUT	31
7	IN	OUT	32
8	5 VDC SENSOR PWR (+)	OUT	33
9	SENSOR PWR GND (-)	OUT	34
10	IN	OUT	35
11	IN	OUT	36
12	IN	OUT	37
13	IN	OUT	38
14	IN	OUT	39
15	IN	OUT	40
16	IN	OUT	41
17	IN	OUT	42
18	IN	OUT	43
19	IN	OUT	44
20	CAN1 (+)	OUT	45
21	CAN1 (-)	OUT	46
22	AIN/CAN1 SHIELD	POWER SUPPLAY (+)	47
23	IN	POWER SUPPLAY (+)	48
24	IN	POWER SUPPLAY (+)	49
25	IN	POWER SUPPLAY (+)	50

CTR-2

18-GRY-409

18-RED-5953

18-YEL-391A

18-DBRN-968

18-YEL-969

18-ORN-970

18-WHT-309C

18-DBRN-305C

18-GRY-972A

P5/6(29)

P5/6(9)

18-WHT-309B

18-DBRN-305B

TO SPRAY WATER HI/LO SW Seet-6

TO SPRAY WATER HI/LO SW Seet-6

BK1/2(24)

18-YEL-391

OPEN IF TANK EMPTY

LOW LVL WAT SW

BLK

CLOSED IF TANK EMPTY

BLK

LH HYD OIL LEVEL SW

CLOSED IF TANK EMPTY

BLK

RH HYD OIL LEVEL SW

LOAD MOTOR REVERSE VLV

BLK

18-RED-35RC

TO LINE 35 Seet-3

18-GRY-972

BK1/2(27)

SPRAY WATER RECIRCULATION SW (OPTION)

TS1/2

18-WHT-763A

18-WHT-763

TRMO(B)

TRMO(A)

TRMO(C)

WHT

RED

BLK

TRACTION MOTOR SPEED SENSOR

TO LINE 59 Sheet-7

18-RED-59D

18-RED-59D1

18-RED-59S1

18-BLK-GMSEN

18-RED-59S3

18-RED-59S2

TO HOPPER LEVEL PROXIMITY SENSOR Sheet-7

Sheet-5

LBLU 321D TO D4/D5 Sheet-3

D26

LBLU 952B MAIN BY-PASS SOL-10 BLK

18-DBRN-282 — 18-DBRN-282A — TRACTION MOT LOW SHIFT — BLK

DBRN VS11

18-LBLU-952 — 18-LBLU-952A

LBLU VS12

18-DPUR-953 — 18-DPUR-953A — GB BY-PASS SOL-18 — BLK

DPUR VS13

18-DBLU-954 — 18-DBLU-954A — LHGB ROTATE SOL-13 — BLK

DBLU VS14

18-DGRN-955 — 18-DGRN-955A — RHGB ROTATE SOL-12 — BLK

DGRN VS15

18-ORN-956 — 18-ORN-956A — PUB UP SOL-4A — BLK

ORA VS16

18-DPUR-958 — 18-DPUR-958A — PUB DN SOL-4B — BLK

DPUR VS17

18-PINK-959 — 18-PINK-959A — ELEV REV SOL-7B — BLK

PINK VS18

LT BUZZ BLK

HOPPER LOAD MOTOR STALL

CB13

18-DBRN-960

86 30 85 87A 87

R20 ELV FWD

18-YEL-967

18-YEL-967B — ELEV FWD SOL-7A — BLK

18-YEL-967C — ELEV FWD SOL-7D (OPTION) — BLK

18-YEL-967D — ELEV FWD SOL-7E (OPTION) — BLK

18-YEL-961 — 18-YEL-961A — RHGB UP SOL-5A — BLK

YEL VS19

18-DBRN-962 — 18-DBRN-962A — RHGB DN SOL-5B — BLK

DBRN VS20

18-GRY-963 — 18-GRY-963A — LHGB UP SOL-6A — BLK

GRY VS21

18-YEL-964 — 18-YEL-964A — LHGB DN SOL-6B — BLK

YEL VS22

18-DPUR-965 — 18-DPUR-965A — TO C-6 Sheet-6

DPUR VS23

18-WHT-966 — 18-WHT-966A — TO C-8 Sheet-6

WHT VS24

GLOBAL

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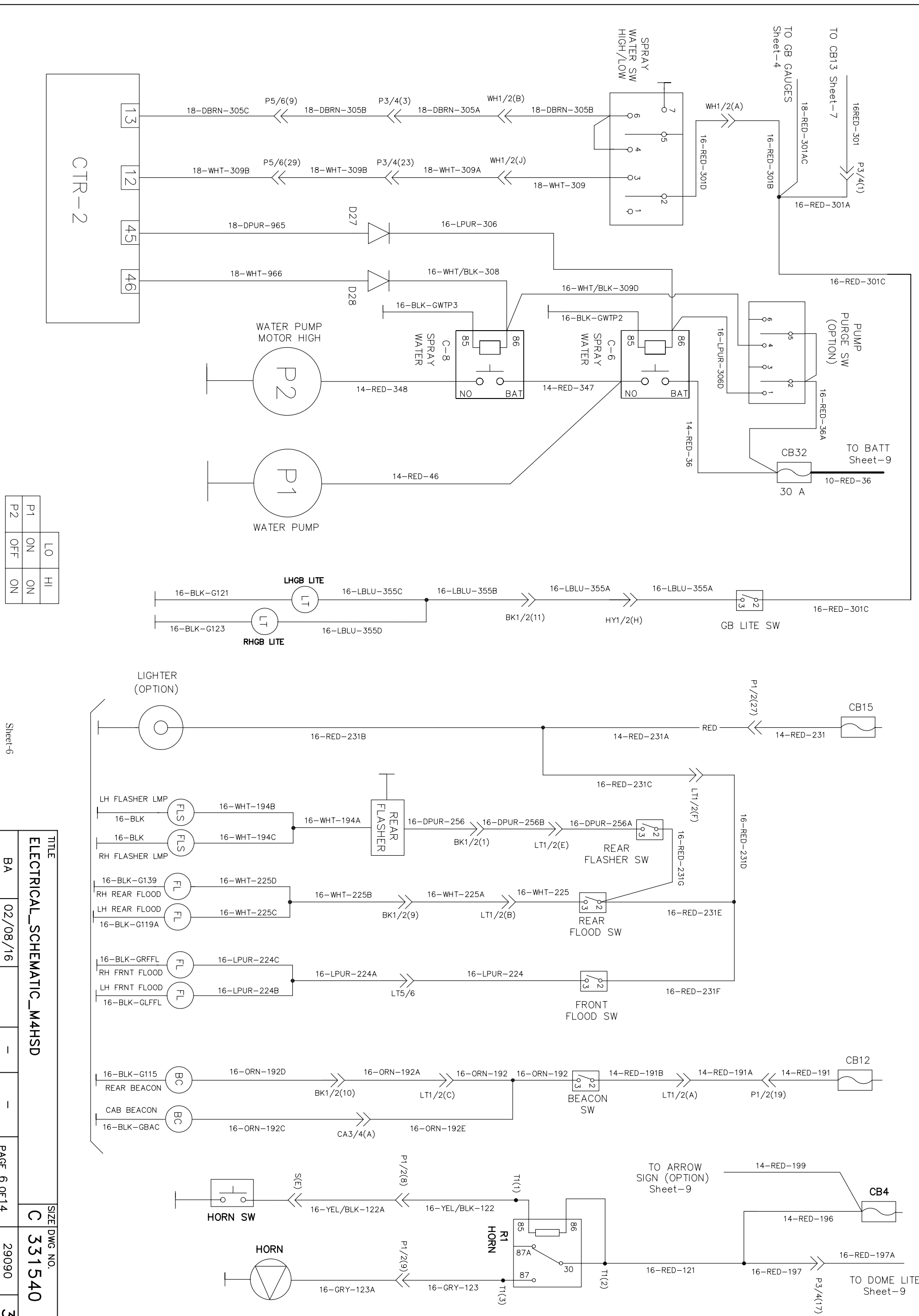

Sheet-6

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HOPPER DUMP LEVEL PROXIMITY SENSOR

BRN - A
BLK - B
BLU - C
HDL1/2

16-BLK-GSD3

TO HOPPER LOAD MOTOR SENSOR Sheet-5

16-RED-59S3

16-RED-59S2

16-RED-59S1

16-RED-59D

P5/6(21)

16-RED-59

16-RED-59D1

TO TRACTION MOTOR SPEED SENSOR Sheet-5

TO WAT SPRAY SW Sheet-6

16-RED-301

CB13

16-RED-300

16-DBLU-512B

TO IGN MOMENTARY GND Sheet-1

BRAKE DIFF SWITCH

16-DBLU-512

TO R15 Sheet-3

16-DBLU-606A

16-DBLU-606

P5/6(22)

16-RED-302

TO R4 Sheet-8

16-RED-339B

FLOW SW
(NO FLOW SW CLOSED)

16-DGRN-502D

P7/8(7)

18-DGRN-502B

18-DGRN-502A

18-DGRN-502

18-RED-339

TO DIODE D9 Sheet-2

16-ORN-175

16-ORN-175A

T3(6)

T3(8)

T3(3)

T3(5)

TO LINE 351 Sheet-8

16-YEL/BLK-351S

D16

16-ORN-175B

85

86

87A

30

87

T3(7)

T3(4)

BMP

BRAKE MOTOR PUMP

12-BLK-G-HM

12-RED-366

R13 HMAX

R12 BRKF

14-RED-367

SOCKET FUR.

TO C3(BAT) Sheet-1

18-DGRN-502F

P7/8(3)

TO CTR-1 (40) Sheet-4

16-ORN-501

18-ORN-501A

P7/8(14)

18-DGRN-502E

TO IGNITION SW (I) Sheet-1

18-YEL-521

PARK BRK PRESS SW

18-YEL-503B

16-YEL-503

BK1/2(2)

no

c

nc

Sheet-7

FUEL FILTER/WATER SEPARATOR
IN-FILTER HEATER
With an internal
automatic thermostat

(OPTION)

KYSOR
AV1000
SYSTEM

D1 C1
D2 C2
D3 C3
D4 C4
D5 C5
D6 C6
D7 C7
D8 C8
D9 C9
D10 C10
D11 C11
D12 C12
D13 C13
D14 C14
D15 C15
D16 C16

18-PINK-504C

16-PINK-504

P7/8(4)

TO CTR-1 (39) Sheet-4

18-LPUR-505

TO STEERING SW (3) Sheet-2

NO

BAT

CB33
20 A

C-7
FUEL
HEATER

18-BLK-GF37

TO BATT
(POS)

COOLANT LVL SENS
HIGH RESITANSE IF TANK IS EMPTY

BK1/2(4)

18-WHT-511A

16-WHT-511

TO STEERING SW (44) Sheet-2

18-DGRN-531

18-DBLU-512

TO STARTER SW (B) Sheet-1

18-RED-532

TO AV RELAY-2 (85) Sheet-2

18-LGRN-533B

18-LBLU-513A

TO HOPPER FULL SENSOR Sheet-3

TO CTR-1 (34) Sheet-4

16-DBRN-534

18-DBRN-534A

P1/2(11)

RH HYD
OIL LVL
LAMP

18-GRY-514A

18-GRY-514

BK1/2(2)

TO CTR-1 (44) Sheet-4 (OPTION)

18-DPUR-515

TO STEERING SW (2) Sheet-2

TO CTR-1 (35) Sheet-4

16-ORN-536

18-ORN-536A

P1/2(12)

LH HYD
OIL LVL
LAMP

18-DBLU-516

TO HD LITE DIMM SW (HI) Sheet-2

16-RED-35J

TO HOPPER FULL SENSOR Sheet-3

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16-BLK-G90 — LT — YEL — 16-BRN/ORN-204F — R1/2(4) — 16-BRN/ORN-204D — STP3/4(A)

RH REVERSE LITE

16-BLK-G88 — LT — YEL — 16-BRN/ORN-204E — L1/2(4) — 16-BRN/ORN-204C — STP1/2(A)

LH REVERSE LITE

16-BLK-G87 — 16-BRN/ORN-204B

REVERSE ALARM

16-BRN/ORN-204A — P5/6(1) — 16-BRN/GRN-204 — TO D3 Sheet-3

TO CTR-1 (18) Sheet-4 — P3/4(15) — 18-PINK-686 — 18-PINK-686B — HY1/2(C) — 18-PINK-686A

BLK — LEAF GATE UP VALVE — 16-LGRN-685 — BK1/2(22) — 16-LGRN-685A

BLK — LEAF GATE DN VALVE — 16-YEL-684 — BK1/2(21) — 16-YEL-684A

LEAF GATE UP/DN SW

16-RED-131E

16-RED-131C — TO WIPER/WASHER SW Sheet-1

18-RED-131F — LG3/4(1) — GRN — LED LEAF GATE UP — BLK — LG3/4(2) — 18-ORN-743A — BK1/2(6) — 18-ORN-743 — BLK — LEAF GATE UP SWITCH

18-RED-131G — LG3/4(3) — GRN — LED LEAF GATE DN — BLK — LG3/4(4) — 18-LBLU-744A — BK1/2(7) — 18-LBLU-744 — BLK — LEAF GATE DN SWITCH

CB16 — BLK FUR.

18-DGRN-795 — T4(2) — TO CTR-1 Sheet-4

86 85 87A 30 87 — T4(3) — T4(1)

18-DPUR-659C — CE1/2(1) — 18-DPUR-659 — P5/6(12) — 18-DPUR-659A

R14 AXRAT

18-DGRN-60X3 — 18-DGRN-60X4 — TO R10 Sheet-3

18-DGRN-60X2 — P5/6(20) — 18-DGRN-60Y — TO LINE 60 Sheet-11

TO R8 Sheet-3 — P7/8(17) — 16-GRY-220B — AX1/2(B) — 16-GRY-220A — 16-GRY-220

TO CONT-1 Sheet-4 — AX3/4(A) — 18-DPUR-222C — BK1/2(28) — 16-DPUR-222D — 16-DPUR-222E — HI

16-BLK-G138 — M — AXLE SHIFT MOTOR

LO — 16-TAN-221D — 16-TAN-221E — BK1/2(15) — 18-TAN-221C — AX3/4(C) — TO CONT-1 Sheet-4

AX1/2(A) — 16-DPUR-222A — 16-DPUR-222 — AX1/2(C) — 16-TAN-221A — 16-TAN-221

TO LINE 201 Sheet-3

16-RED-396E — TO SWEEP/TRAVEL SV Sheet-10 — 16-RED-396A

AXLE SHIFT SW

TO R42 Sheet-10 — 18-ORN-990A — P7/8(29) — 16-ORN-990 — F8(5A) — 16-YEL/BLK-351F8 — 16-YEL/BLK-351S — TO D16 Sheet-7

TO DEF TANK LVL SENSOR Sheet-10 & 11 — 18-YEL-989A — P7/8(28) — 18-YEL-989 — F7(2A) — 16-YEL/BLK-351F7

F2(5A) — 16-YEL/BLK-351H — 16-ORN/BLK-424B — TO LINE 424 Sheet-10 — 16-ORN/BLK-424A

TO SWITCHES Sheet-4 — 18-ORN-351D — P3/4(5) — 18-ORN-351G

TO SX CONTROLLER Sheet-13 — 16-RED-641A — P7/8(18) — 16-RED-641 — F6(4A) — 16-YEL/BLK-351D — 18-ORN-351R — P7/8(10)

TRANSIENT VOLTAGE SUPPRESSOR P/N 354300 — VS — 16-PINK-336A — 16-PINK-336 — F1(5A) — 16-YEL/BLK-351 — 16-YEL/BLK-351C — P1/2(24) — 16-YEL/BLK-351B — TO IGNITION SWITCH (I) Sheet-1

16-ORN-423C — P7/8(9) — 16-ORN-423B — TO RAD DOOR SW #1 Sheet-10

TO CTR-1 (42) Sheet-4 — 16-DGRN-653B — T2(11)

85 86 87A 30 87 — T1(12) — T2(13)

TO DIODE D6 Sheet-2 — 16-YEL/BLK-173

R4 ACCELERATOR PEDAL SWITCH

16-RED-339B — TO CB13 Sheet-7

16-RED-339C — TO ELEVATOR STALL PROXIMITY SENSOR Sheet-4 (OPTION)

TO OCM 96 PIN CONNECTOR PIN 70

Sheet-8

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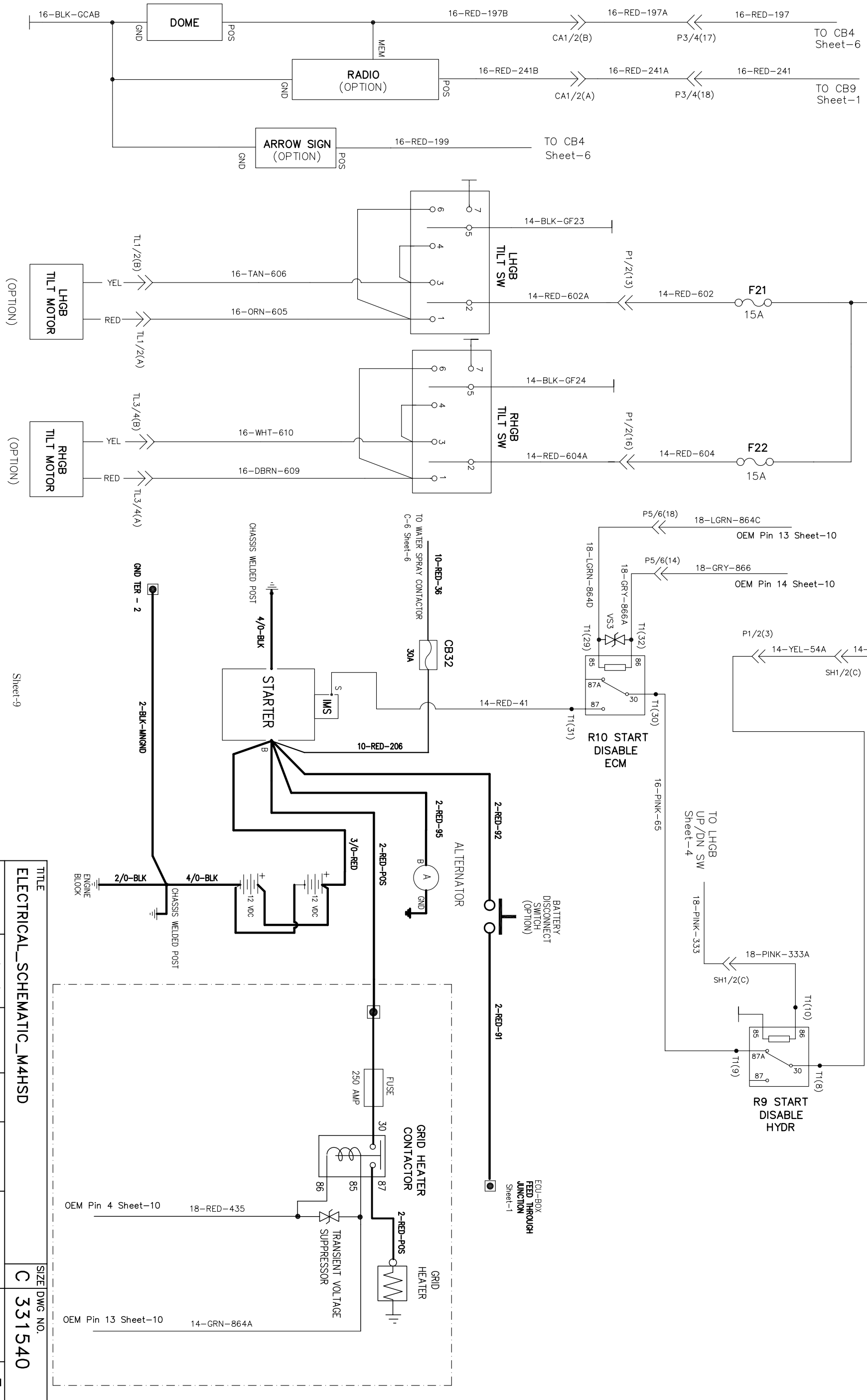

Sheet-9

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CUMMINS WIRING

ENGINE ECM

OEM CONNECTOR 96 PIN

30 9 10 33 8 64 32 35 90 12 19 91 2 71 72 96 23 95 5 61 48 20 44 62 22 46 65 75 76 83 60 59

TACHOMETER — S — 18-GRN-442 — CX1/2(31) — 18-GRN-442A — EX1/2(31) — 20-GRN-442B; G — 18-BLK

ACCELERATOR SENSOR

RED	C	+5 VOLTS	18-RED	CX1/2(30) 18-RED	EX1/2(30)	20-RED
BLK	B	SIGNAL-1	18-WHT	CX1/2(18) 18-WHT	EX1/2(18)	20-WHT
WHT	A	RETURN	18-BLK	CX1/2(17) 18-BLK	EX1/2(17)	20-BLK
GRN	C	+5 VOLTS	18-RED	CX1/2(7) 18-RED	EX1/2(7)	20-RED
ORN	A	SIGNAL-2	18-GRN	CX1/2(19) 18-GRN	EX1/2(19)	20-GRN
BLU	B	RETURN	18-BLK	CX1/2(26) 18-BLK	EX1/2(26)	20-BLK

20-RED, 20-BLK

TO SUPPLY MODULE Sheet-12 18-RED-850

COOLANT LEVEL SENSOR — CL1/2(A) 20-RED; CL1/2(C) 20-BLK; CL1/2(B) 20-BLU-741

SWEEP/TRAVEL SWITCH — TO GROUND 16-BLK; 16-RED-396B; 16-GRY-762 TO SX CONTROLLER Sheet-14; 18-BLK-60R

SWEEP/TRAVEL	18-GRY-413	CS1/2(G) 18-GRY-413	CX1/2(8) 18-GRY-413A	EX1/2(8) 20-GRY-413B
RPM SET (SLOW)	18-GRY-FS4	CS1/2(J) 18-GRY-412	CX1/2(15) 18-GRY-412A	EX1/2(15) 20-GRY-412B
RPM RES (FAST)	18-GRY-FS6	CS1/2(B) 18-GRY-411	CX1/2(6) 18-GRY-411A	EX1/2(6) 20-GRY-411B
PARTICULATE FILTER REGENERATION / DIAGNOSTIC SW	18-GRY-60N	CS1/2(C)	14-BLK-60P CX1/2(23)	14-BLK-60M EX1/2(23)
	18-GRY-414C	CS1/2(A) 18-GRY-414	CX1/2(9) 18-GRY-414A	EX1/2(9) 20-GRY-414B

RPM FAST/SLOW SWITCH — 16-BLK; 16-RED-396C; 18-BLK-60P

TO AXLE SHIFT SW Sheet-8 16-RED-396A

(EXHAUS FLUID)	18-GRY-820	CX1/2(5)	18-GRY-820A	EX1/2(5) 20-GRY-820B
(STOP ENGINE)	18-GRY-418	CX1/2(20)	18-GRY-418A	EX1/2(20) 18-GRY-418B
(CHECK ENGINE)	18-GRY-420	CX1/2(3)	18-GRY-420A	EX1/2(3) 20-GRY-420B
(GRID HEATER)	18-GRY-421	CX1/2(4)	18-GRY-421A	EX1/2(4) 20-GRY-421B
(REGEN NEED)	18-GRY-410	CX1/2(12)	18-GRY-410A	EX1/2(12) 20-GRY-410B
(EXH HI TEMP)	18-ORN-HEST RTN	CX1/2(13)	18-ORN-HEST RTN	EX1/2(13) 20-ORN-HEST RTN
(MIL)	18-GRY-982	CX1/2(25)	18-GRY-982A	EX1/2(25) 20-GRY-982B

18-BLK-60A; TO SUPPLY MODULE Sheet-12 18-BLK-849

TO OEM 14 PIN CONNECTOR Sheet-12

20-BLK; 20-RED; 20-GRY-983

FUEL LEVEL SENSOR

20-982B TXL

TO R10 Sheet-3 PARK BRAKE

BRK1/2(A) 20-WHT-801; BRK2/2(C) 20-GRY-822; BRK/2(B) 18-BLK-60W

16-WHT-801A; 16-WHT-801B; P5/6(19)

READY FOR FUTURE USE

BR-2 120 Ohm TERMINATION RESISTOR

DATA DIAG. PLUG-ENG

TO CONTROLLER-2 Sheet-5

20-BLK 60P

18-BLK-60W1 TO DEF LVL SENSOR Sheet-11

18-BLK-60X TO CONNECTOR CE1/2(2) Sheet-11

18-BLK-60C TO DEF TEMP SENSOR Sheet-11

18-BLK-60F1 TO WATER IN FUEL SENSOR Sheet-11

J1939+ J1939-

YEL GRN

18-BLK-60AT; 18-GRY-984; 18-RED-435

AMBIENT AIR TEMP SENSOR

TO GRID HEATER CONTACTOR Sheet-9

18-GRN-864; 18-GRN-864A; 18-GRN-864B; C24(A); 16-LGRN-864C

TO R9 START DISABLE ECM Sheet-9

18-GRY-865; CLOSED IF DOOR IS CLOSED; WHT; RADIATOR DOOR SWITCH #2; BLK; 16-GRY-866; P5/6(14); 16-GRY-866A

VSS1/2(A) 20-WHT-437; VSS1/2(B) 20-BLK-432; BRN; BLK; CABLE

VEHICLE SPEED SENSOR (MAGNET PICK UP)

CUMMINS WIRING

DATA DIAG. PLUG-CAB — A 12V(+); B; C YEL; D GRN; G; F; E

16-RED-50F; CX1/2(22); CX1/2(16); 16-RED-59A; CX1/2(27); EX1/2(22); 16-RED-59

TERMINATION RESISTOR 120 Ohm

TO CONTROLLER-1 Sheet-4

SPLICE UNDER FRONT CONSOLE

16-ORN/BLK-424; 16-ORN/BLK-424A

16-YEL/BLK-351H F2 (5A) 16-ORN/BLK-424B P7/8(10) TO IGNITION (I) LINE 351 Sheet-8

VS-1 16-PINK-336A TRANSIENT VOLTAGE SUPPRESSOR

DEF LEVEL GAUGE — DS1/2(1) YEL; DS1/2(2) GRN; 18-BLK-GDLG; 18-RED-35GDL TO LINE 35 Sheet-3

SPLICE UNDER FRONT CONSOLE

RADIATOR DOOR SWITCH #1 CLOSED IF DOOR IS CLOSED — C5(1) WHT; C5(2) BLK

TO IGNITION (I) Sheet-7 F1(5A) 16-PINK-336 16-ORN-423C P7/8(9) 16-ORN-423B 18-ORN-423B CX1/2(10) 18-ORN-423C EX1/2(10) 18-ORN-423D 18-ORN-443

F7(2A) 18-YEL-989 P7/8(28) 18-YEL-989A 18-YEL-989B CX1/2(28) 18-YEL-989C EX1/2(28) 18-YEL-989D TO DEF TANK LEVEL SENSOR Sheet-11

F8(5A) 18-ORN-990 P7/8(29) 18-ORN-990A 18-ORN-990B CX1/2(29) 18-ORN-990C EX1/2(29) 18-ORN-990D

SPLICE UNDER FRONT CONSOLE

R42 — 86; 85; 87A; 30; 87

16-ORN-986C TO OEM CONNECTOR 14 PIN PIN 6, Sheet-11

18-ORN-443; 14-BLK-G1

BATTERY (2) (+) (-)

8-RED-50

TO LINE 853 Sheet-12 12-BLK-853

4/0-BLK

CHASSIS WELDED POST

2/0-BLK

8-BLK-60G GROUNDING STUD ENGINE BLOCK

16-RED-50B F33 10A; 16-RED-50A F32 10A; 12-RED-50C F31 30A; 14-RED-50D F34 15A; 14-RED-50E F35 10A; 14-RED-50F F36 10A

12-RED-56; 14-RED-630; 14-ORN-824; 16-RED-R42

TO R41 Sheet-12

TO R25 Sheet-12

16-BLK-GR42; 16-RED-57; 16-BLK-G2; 14-BLK-G4; 14-BLK-G5; 14-BLK-G6; 14-BLK-G1; 16-RED-59

16-RED-56A 1; 16-RED-56B 25; 16-RED-56C 26; 16-RED-56D 27; 16-RED-56E 28

16-BLK-60D1 49; 16-BLK-60D2 50; 16-BLK-60D3 51; 16-BLK-60D4 52; 16-BLK-60D5 73

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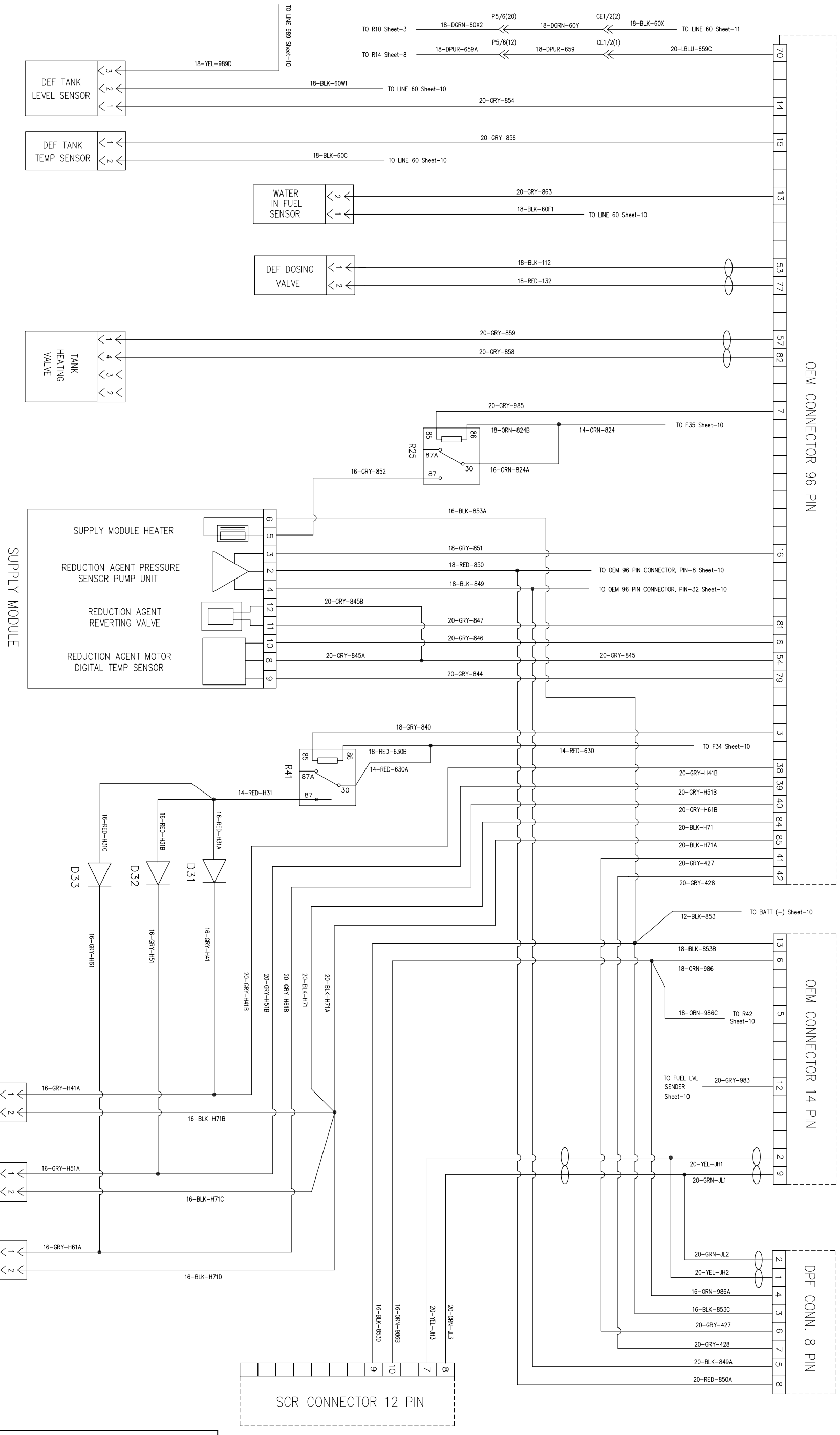

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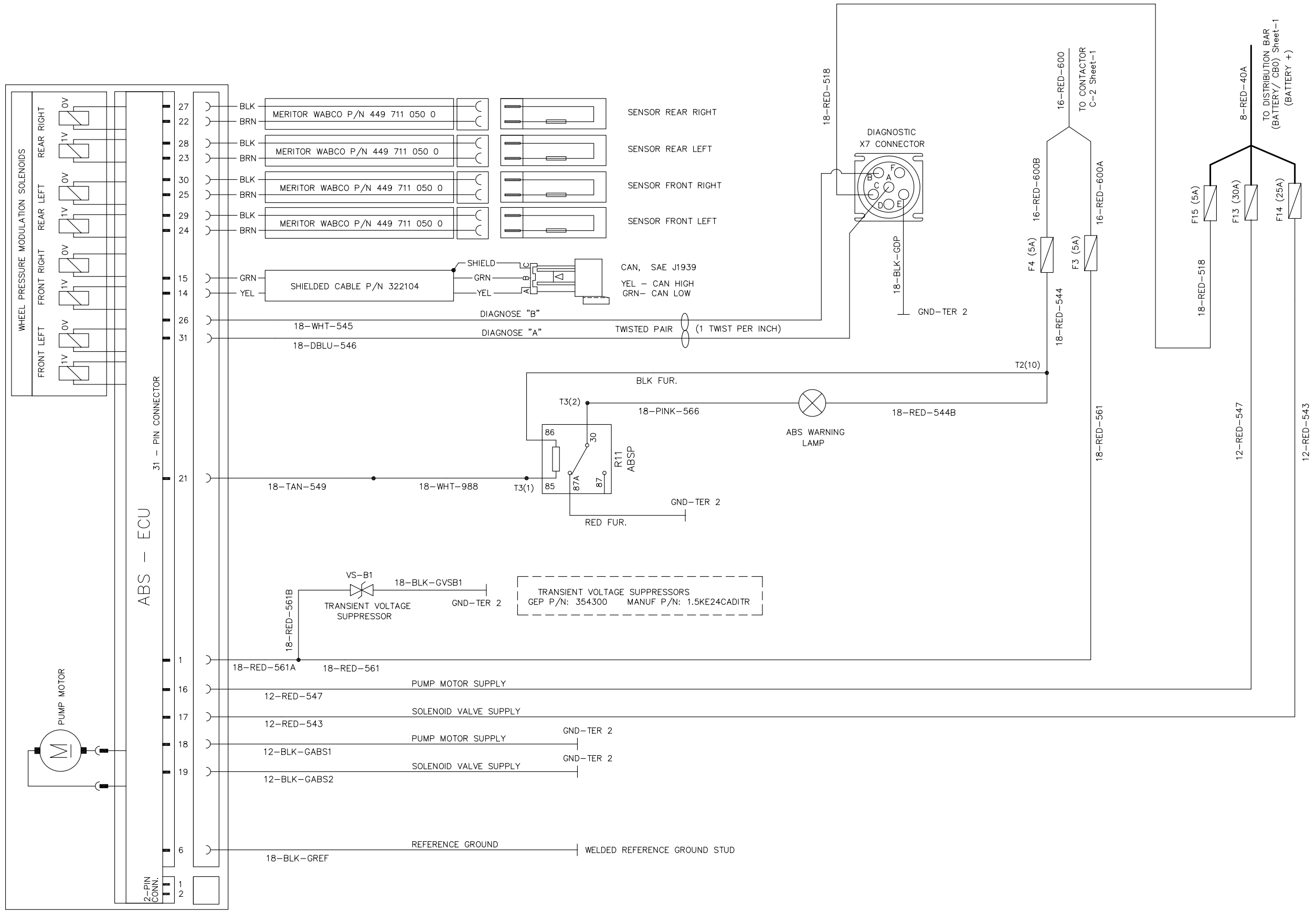

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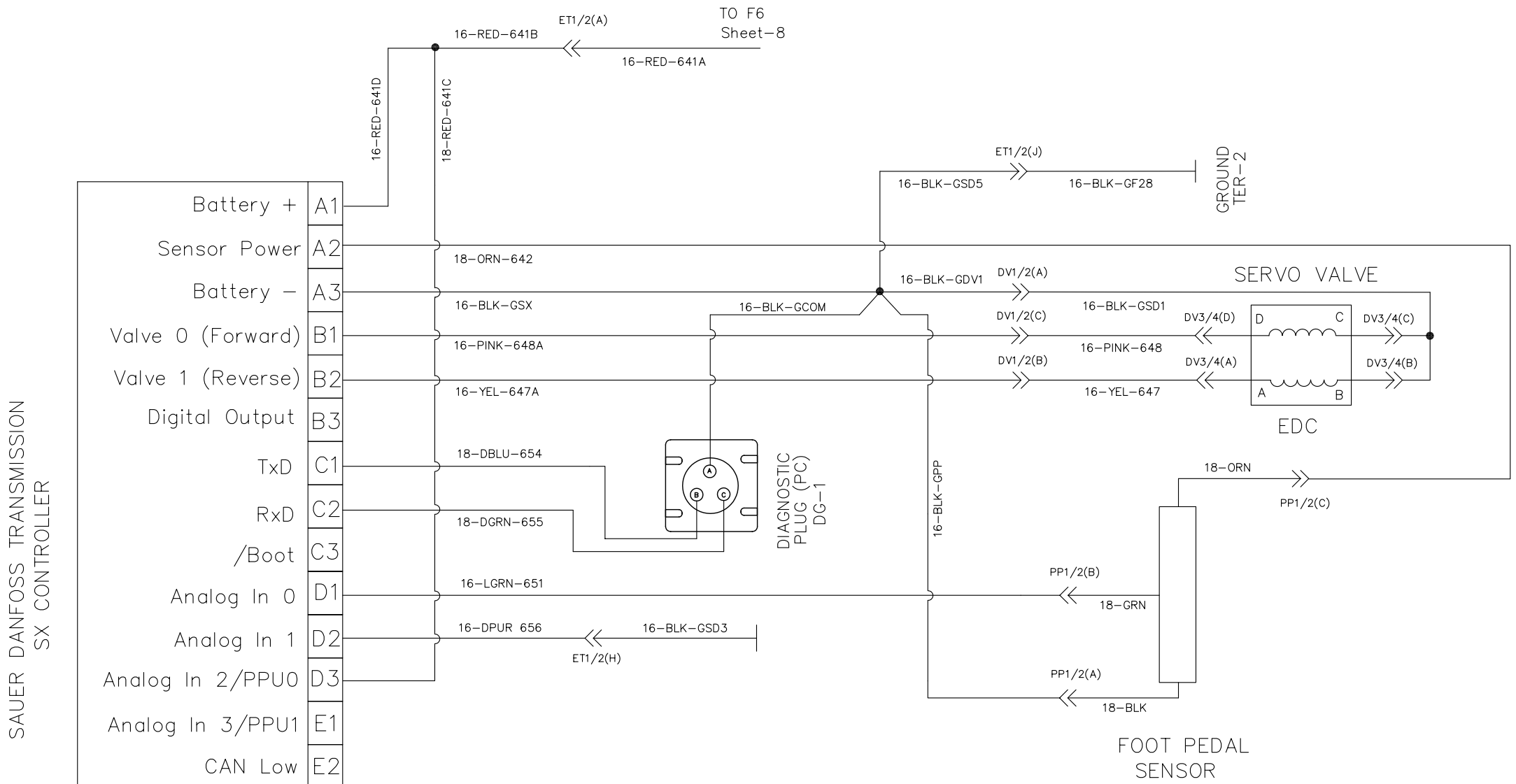

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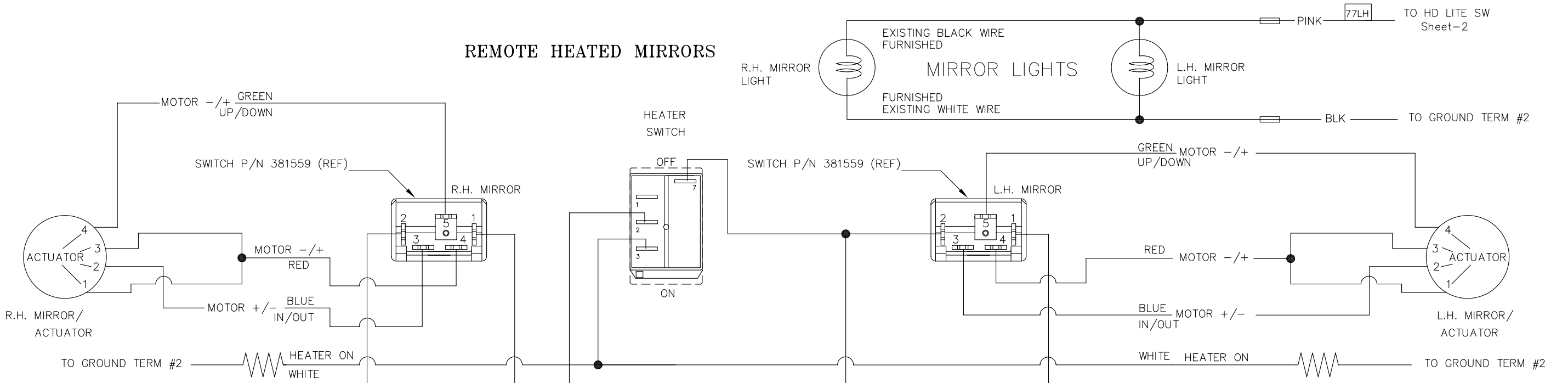
REMOTE HEATED MIRRORS



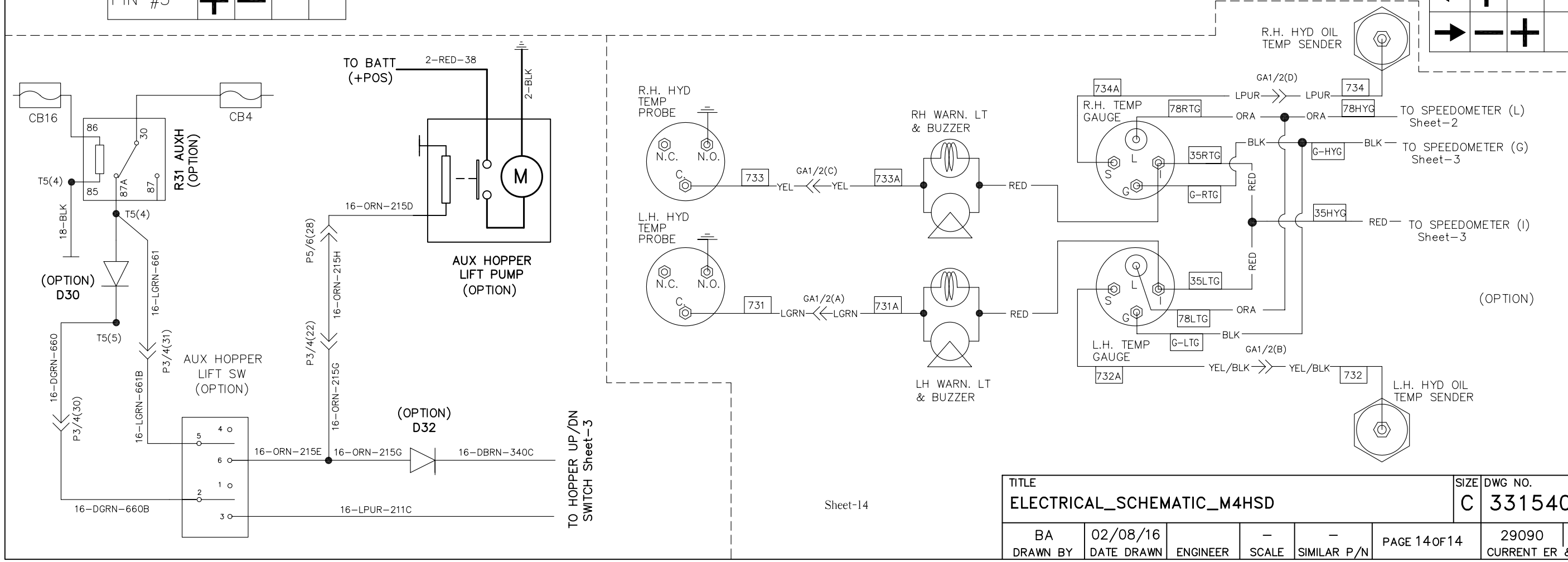
SW FUNCTIONS

PIN NO.	↑	↓	←	→
PIN #3			−	+
PIN #4	−	+	+	−
PIN #5	+	−		

ACTUATOR FUNCTIONS

	1	2	3	4
↑			−	+
↓			+	−
←	+	−		
→	−	+		

(OPTION)



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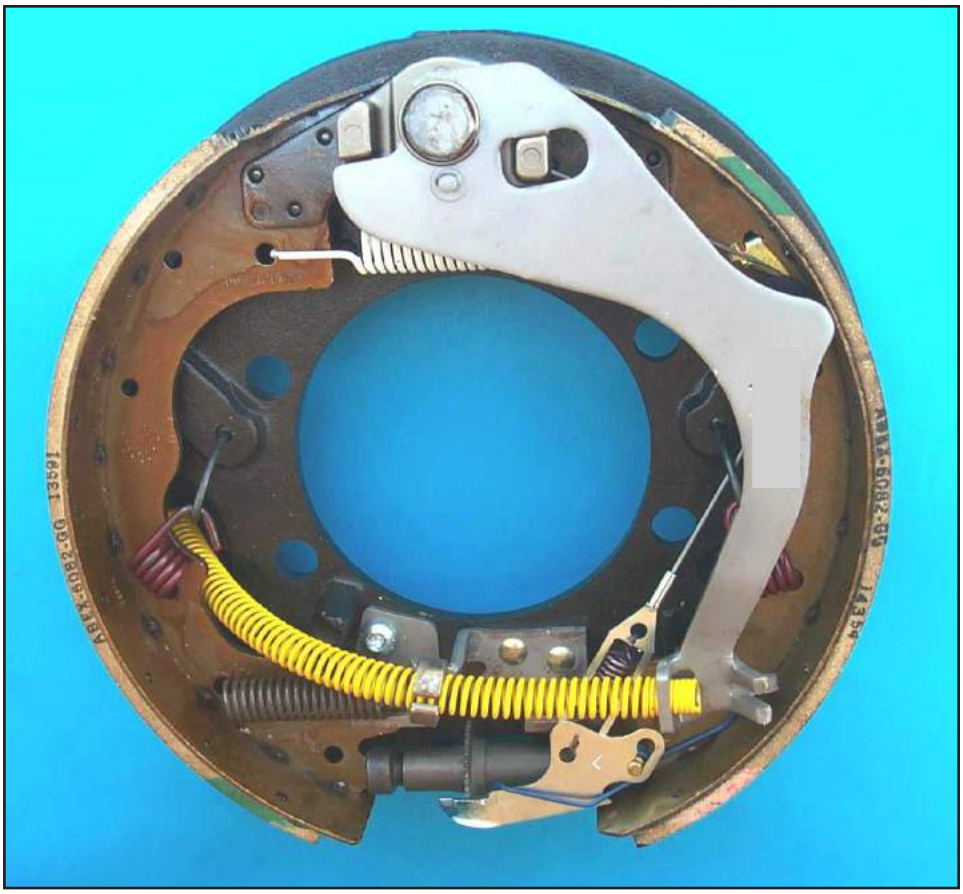
Brake systems for medium duty trucks

305x76 Park Brake



Service Manual
2nd Edition

Important Service Notes

The information in this publication was current at the time of printing. The information presented in this publication is subject to change without notice or liability.

The information contained in this publication is intended for use by properly trained and equipped professional technicians and is NOT for the “Do It Yourselfer.”

⚠WARNING

Failure to follow safety and vehicle repair procedures either contained in this manual, in the chassis and vehicle manufacturer’s repair manuals or in accordance with other accepted methods can result in personal injury, death, or damage to components, vehicles, or personal property.

2nd Edition
February 2006

Contents

305x76 mm Park Brake

EXPLODED VIEW
(Typical)

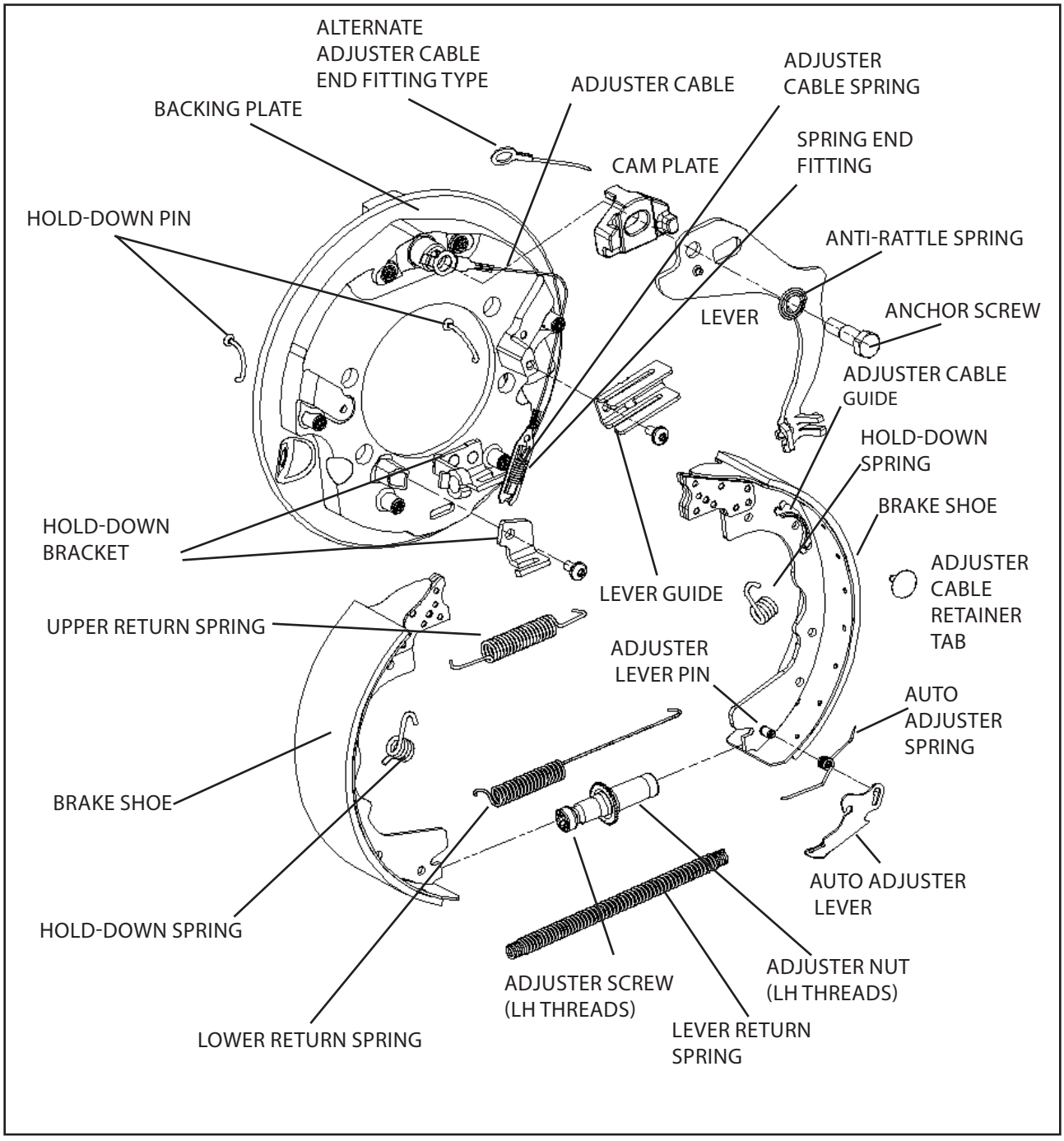


Figure 1.

Introduction

The 305 x 76 mm park brake is a lever actuated, duo-servo, single-anchor drum brake. The brake is designed for driveline mounted applications typically on the rear axle differential carrier housing. Its self-adjusting feature enables the brake to maintain a consistent functional clearance between the brake shoes and the drum as the shoe linings wear.

There are three (3) releases of this brake in service. Release 1 was the original release and manufactured prior to April 2002. The Release 2 design has a brake manufacture date after April 2002 and up to December 2005. The Release 3 design has a manufacture date after December 2005. Figure 2 shows the Release 1 brake, highlights the differences between the Release 1 and Release 2 brakes. Figure 3 shows the Release 2 brake and highlights the differences between Release 1 and Release 2 brakes. Figure 4 shows the Release 3 brake and highlights the differences between Release 2 and Release 3.

Basic Major Components

The foundation of the brake is a ductile iron backing plate. Major actuating components are a cam and a lever, which are fastened to the backing plate by an anchor screw. An anti-rattle spring under the head of this screw reduces clatter. Brakes with hex socket anchor screw (Release 1) will also have two flat washers immediately under the head of the screw. The anchor point for brake actuation and shoe abutment is located at the 12 o'clock position when the assembly is properly mounted. See Figures 1, 2, 3 and 4.

Service Component Interchangeability

Only use Release 1 brake components on Release 1 brakes.
Only use Release 2 brake components on Release 2 brakes.
Release 3 brake components can be used on Release 2 brakes.

305 x 76 mm Park Brake

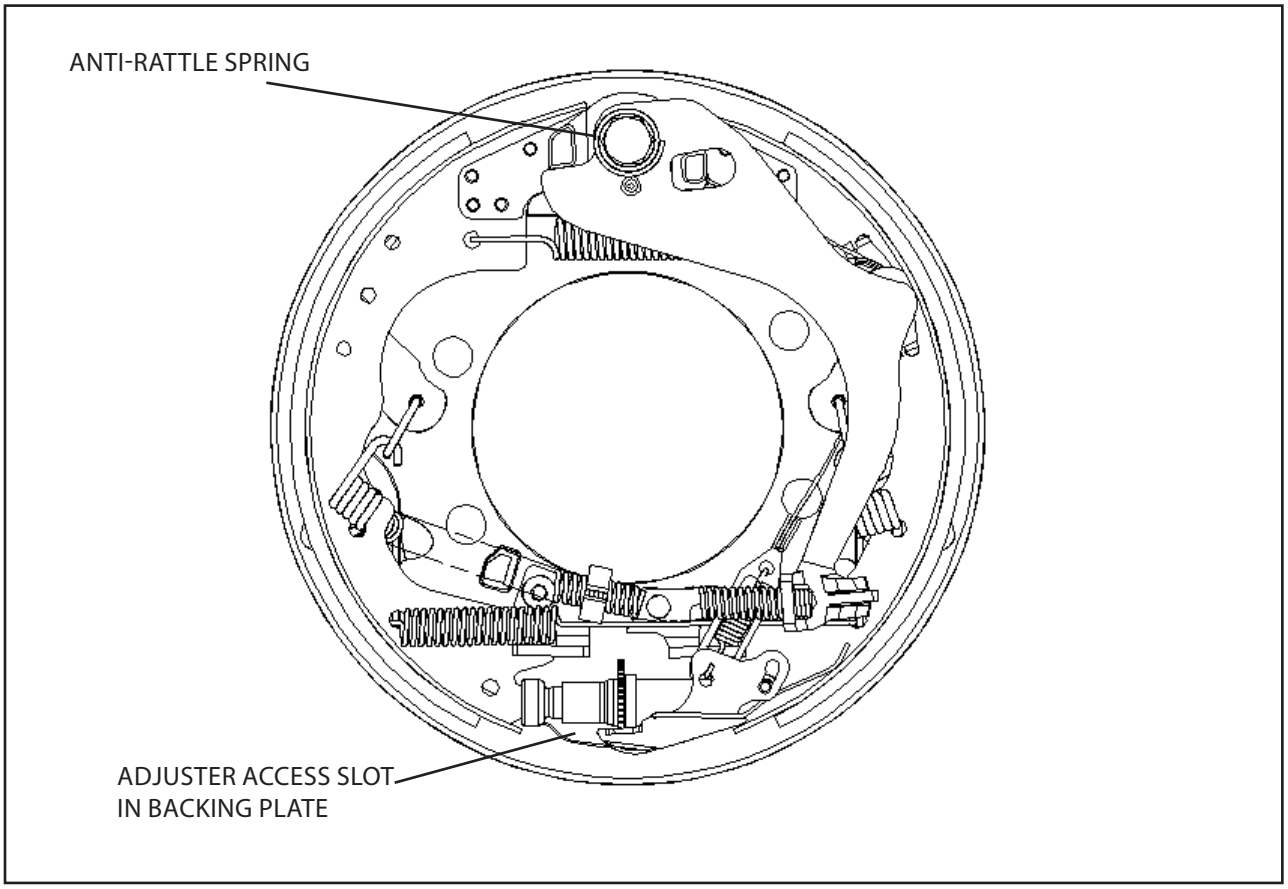


Figure 4. 305x76 Park Brake Major Components
(Release 3 Shown)

Release 3 - Manufactured beginning December 2005.

Features:
- No apply lever guide
- Revised anti-rattle spring
- Adjuster access slot size increased

Includes features from Release 2:
- Apply lever with bump stop
- External hex head style anchor screw with M12 thread
- Abex-6082-GG lining codes
- Revised adjuster cable anchor end fitting
- Adjuster cable retainer tab

Shoes and Related Components

Brake shoes are attached to the backing plate by hold-down springs and pins, shown in Figure 5. Both shoes seat against the backing plate anchor post at the top and are connected by the adjuster nut and screw assembly at the bottom. Shoe hold-down brackets are permanently mounted to the backing plate to assist in guiding the shoes. The shoes are pulled toward each other by two low-tension shoe return springs. Proper orientation of the various springs, including their hook ends, must be maintained for proper function. The starwheel used for adjusting the shoe clearance to the drum is on the adjuster nut.

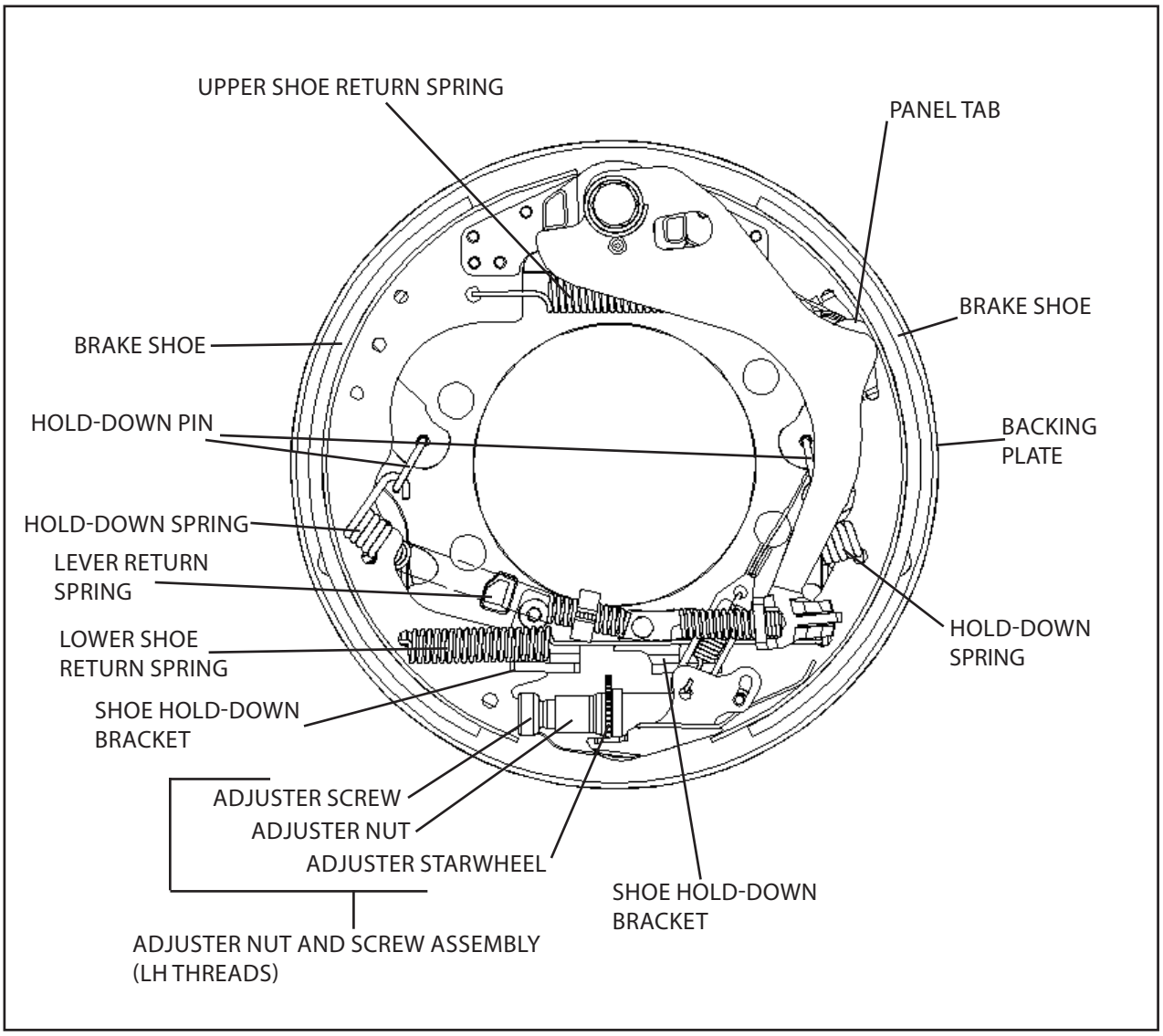


Figure 5. Brake Shoes and Related Components (Release 3 shown)

Shoe Cage Adjusting Components

The clearance between the shoe linings and the inside drum surface is adjusted in response to excessive movement of a given shoe when the brake is actuated. This excessive movement is typically due to normal wear of the lining during use. (See SHOE REPLACEMENT and SHOE CAGE ADJUSTMENT procedures for details.) The adjuster cable is anchored on top of the anchor post, under the cam, by the anchor screw, routed along the side of the shoe by a cable guide, and attached to the auto adjuster lever via a spring (assembled on the cable end-fitting) at the bottom of the brake. A push in panel tab retains the cable in the cable guide. The adjuster lever seats against the starwheel on the adjuster nut. The adjuster screw and adjuster nut/starwheel assembly use left hand threads to expand the shoes to compensate for lining wear.

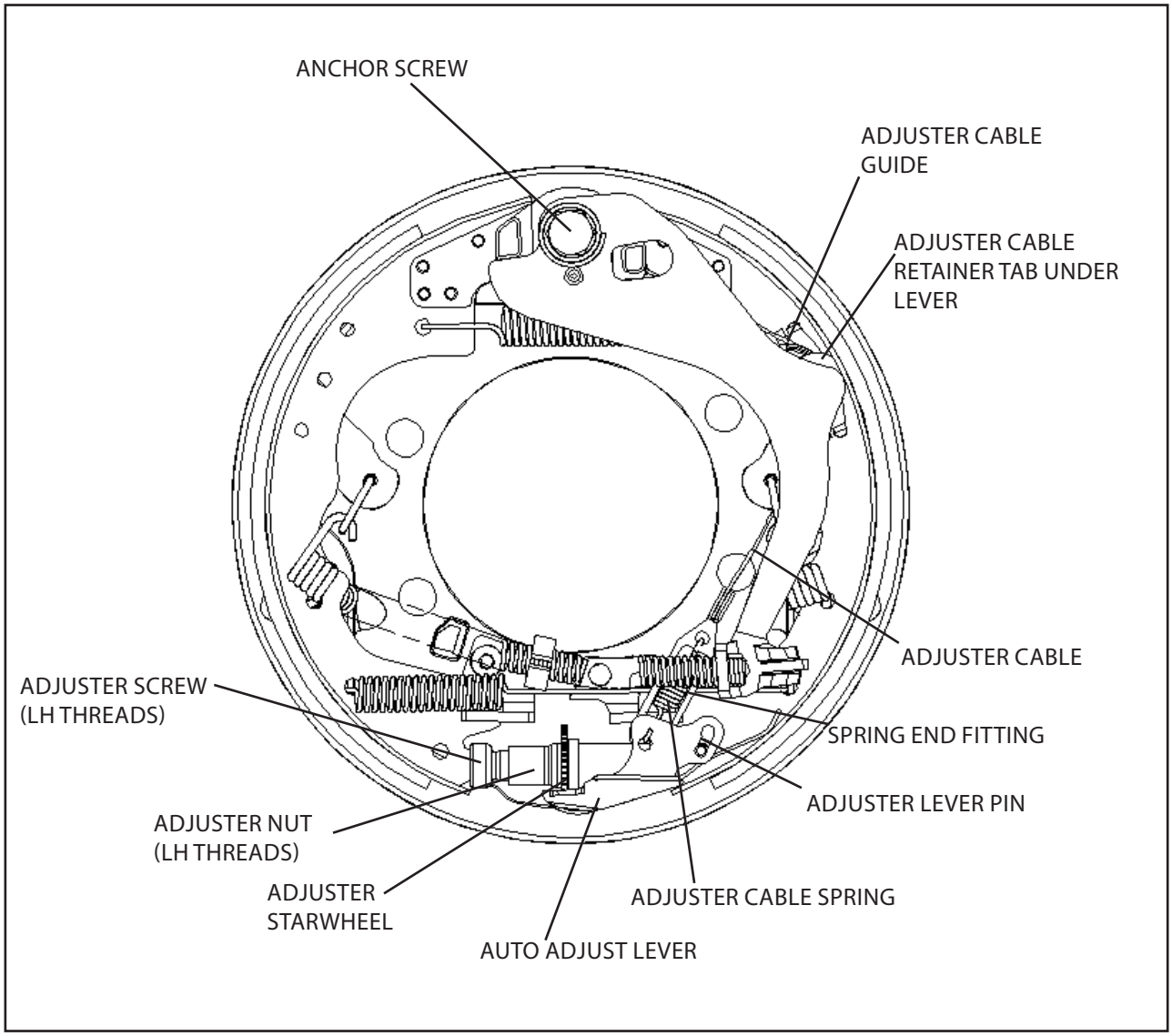


Figure 6. Shoe Cage Adjusting Components (Release 3 shown)

Before Servicing Brakes...

Information in this manual is not intended to replace the vehicle manufacturer's service manual. Always refer to the latest vehicle manufacturer's service information. Information contained in this manual is subject to change without notice.

Always verify proper operation of the park brake prior to returning vehicle to service.

⚠WARNING

Always wear eye protection. Keep fingers, hands and other body parts away from the brake when verifying operation. Do not stand by or under a vehicle at this time.

⚠WARNING

Always block vehicle to prevent vehicle movement, such as with suitable wheel chocks. Failure to do this could result in personal injury or property damage.

⚠WARNING

Do not work under or around a vehicle supported by a mechanical or hydraulic jack. Vehicle must be supported by suitable floor stands. Failure to do so can result in personal injury or propery

⚠CAUTION

Keep grease and other foreign materials away from the shoe lining and drum surfaces. Contamination of shoe linings or drum surface may result in degradation of brake holding capability, possibly resulting in personal injury or property damage.

⚠WARNING

Use only original equipment parts, available through the vehicle manufacturer's Service department.

Failure to do so may result in reduced brake performance, possibly resulting in personal injury or property damage.

Inspection

Note: It is not necessary to raise vehicle for "inspection" in most cases. However, if required, follow steps 1 through 3 in SHOE REPLACEMENT section.

Anytime service is required, it is recommended that a complete visual inspection be performed on all components in the park brake assembly. This includes:

1. Follow manufacturer's recommended procedures to ready the vehicle for servicing. Pay attention to all WARNING and CAUTION notes throughout this booklet.

2. Remove the drum. See vehicle manufacturer's service manual for details.

3. Clean the individual brake components, removing dust and grease.

4. Visually inspect the brake shoes (Figure 5). Shoes should be replaced if there is uneven lining wear or when the remaining lining reaches 0.76 mm (0.030" or approximately 1/32") thickness or less above the shoe. If grease, automotive fluids, or other foreign material that would compromise operation is found on, soaked into or embedded in the linings, the shoes should be replaced. Also, if cracks, excessive deformation, or wear on either end is found, the shoes should be replaced. See section on SHOE REPLACEMENT for service details.

5. Visually inspect the brake lever and cam (Figure 1). If cracks, excessive wear, or abnormal deformation is found in either part, they should be replaced. Light wear, which typically shows up as polishing is acceptable. If unsure, replace brake lever, cam plate and anchor screw. See section on ANCHOR SCREW, LEVER, AND CAM REPLACEMENT for service details.

6. Inspect various springs and hold down pins (Figure 5) for excessive wear, heat discoloration, heavy corrosion or other damage and replace as necessary. See section on SHOE REPLACEMENT for service

⚠WARNING

Whenever possible, work on brakes in a separate area away from other operations. Always wear a respirator approved by NIOSH or MSHA during all brake service procedures. NEVER use compressed air or dry brushing to clean brake parts or assemblies. OSHA recommends that you use cylinders that enclose the brake. These cylinders have vacuums with high efficiency HEPA filters and worker's arm access sleeves. But, if such equipment is not available, carefully clean parts and assemblies in the open air.

Clean brake parts and assemblies in the open air. During disassembly, carefully handle all parts to avoid getting dust in the air. Use an industrial vacuum cleaner with a HEPA filter system to clean dust from the brake drums, backing plates and other brake parts. After using the vacuum, remove any remaining dust with a rag soaked in water and wrung until nearly dry.

Inspection (continued)

7. Inspect adjuster cable assembly for damage or wear (Figure 5). Replace as necessary. See section on SHOE REPLACEMENT for service details.

8. Inspect adjuster nut and screw (Figure 5) for any damage or corrosion to the threads or burrs, chips, corrosion or other damage to the teeth on the adjuster nut starwheel. Damaged teeth or threads may prevent proper function of the brake self-adjusting function. Replace as necessary. See section SHOE REPLACEMENT for service details.

9. Clean-out all dust or grease present on the inside of drum. Use a 12 inch caliper or an inside diameter micrometer to measure the manufacturer's recommended inside diameter of the drum. Replace drum if it exceeds maximum inside diameter (which typically is stamped on the inside of the drum near the mounting holes), is worn unevenly, has deep grooves, heavy corrosion or excessive runout. See vehicle manufacturer's service manual for details.

10. Inspect the parking brake lever-apply cable for excessive wear or damage, and replace as necessary. See vehicle manufacturer's service manual for details.

11. Inspect the axle pinion oil seal for leakage that can contaminate the park brake system parts and repair as necessary. See vehicle manufacturer's service manual for details.

12. After a thorough inspection, if the brake and its components are found to be in good working condition, check parking brake for proper shoe cage adjustment. See Shoe Cage Adjustment Procedures section for details.

Shoe Replacement

Removing the Shoes

1. Block the front wheels to keep the vehicle from moving.
2. With the engine off and battery disconnected, place the transmission in gear and release the parking brake.
3. If recommended in vehicle manufacturer's service manual, raise the rear of the vehicle so the wheels clear the floor and install safety stands to support.
4. Remove the drum. See vehicle manufacturer's service manual for details, if necessary.

⚠CAUTION

Do not use a drum puller or a torch to remove a brake drum. Drum distortion may result.

Note: If the drum proves difficult to remove, insert a thin flat bladed screwdriver through the brake adjusting hole in the backing plate and disengage the adjuster lever from the adjuster nut teeth. With the adjuster lever disengaged as shown in Figures 14 and 15, insert a brake adjusting tool (or flat bladed screw driver) through the adjusting hole to engage the adjusting nut teeth. Move the teeth upward enough times to retract the brake shoes to clear the drum. If the drum is rusted to the axle input flange yoke pilot, tap the center of the brake drum with a nonmetallic mallet to loosen.

5. Inspect the brake per the INSPECTION PROCEDURE in this service manual.

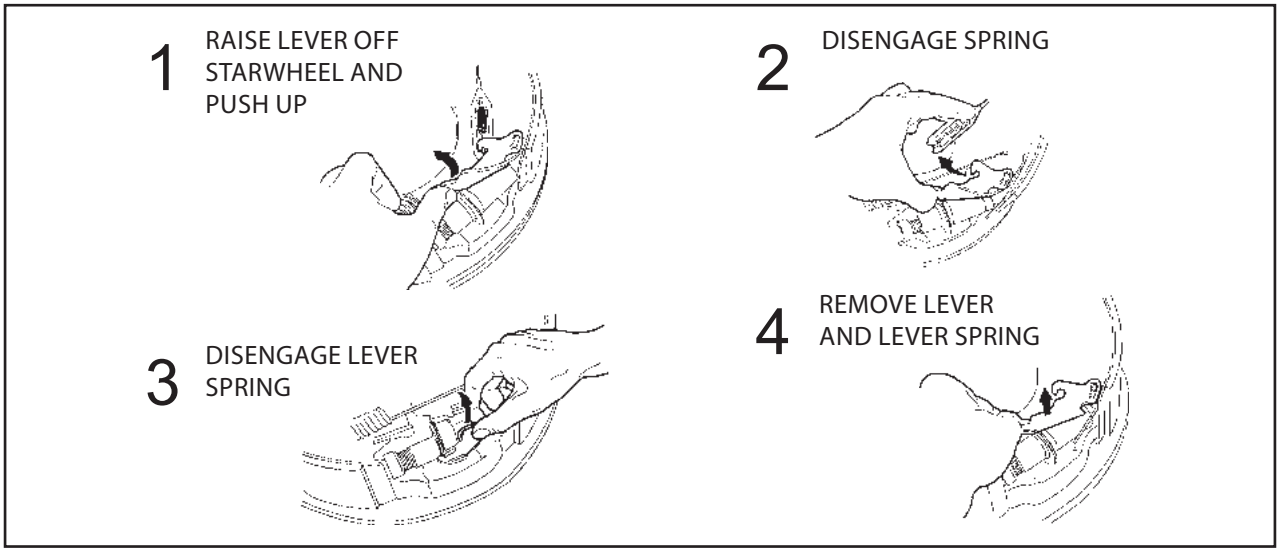


Figure 7. Adjuster Lever and Adjuster Spring Removal

Removing the Shoes (continued)

6. Detach adjuster cable from adjuster lever, slide cable off of adjuster cable guide, and remove the cable retaining tab if so equipped. See Figure 7.

7. Remove the adjuster lever and the adjuster spring. (These parts will need to be placed on the new replacement shoe, along with the adjuster lever mounting pin, in the opposite order removed.) See Figure 7.

8. Remove both shoe-return springs. Use pliers, vice-grips, or a heavy duty brake spring tool as shown in Figure 8.

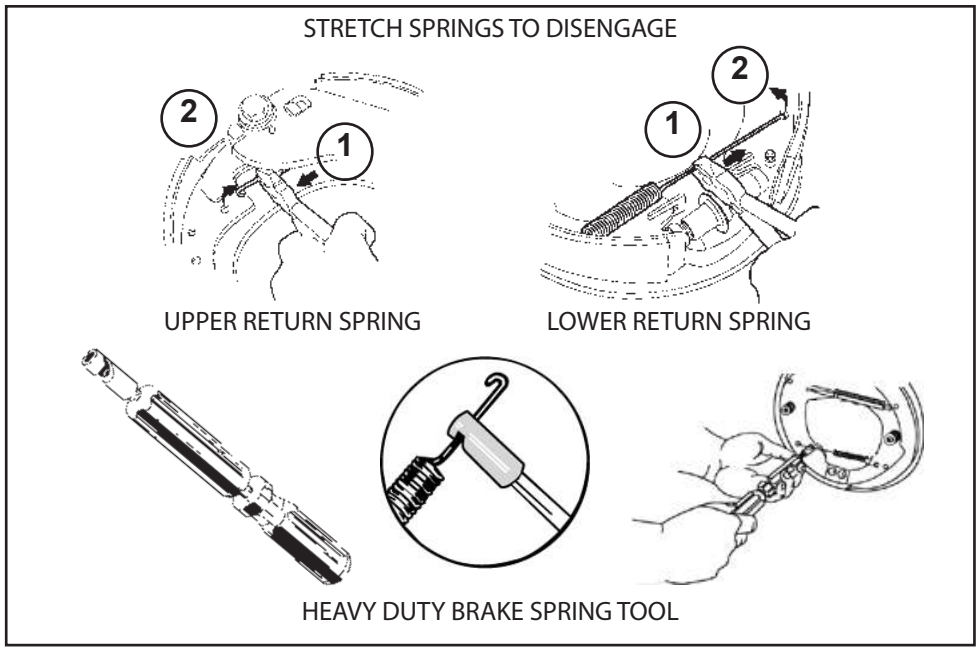


Figure 8. Shoe Return Spring Removal

9. Remove both shoe hold-down springs. Use a brake shoe spring tool as shown in Figure 9.

TIP: Detach the parking brake apply cable and lever return spring from the end of the lever to allow easier access to the spring on the lever side.

Note: If the brake is a Release 2 level design with a lever guide present, it will need to be removed to provide access to the spring underneath with the tool shown in Figure 9. Upon removal of the hold down springs, the shoes, and the adjuster nut screw assembly will fall if not secured by hand.

10. Remove brake shoes from backing plate.

11. Disassemble the adjuster nut and screw assembly for cleaning and inspection of the threads.

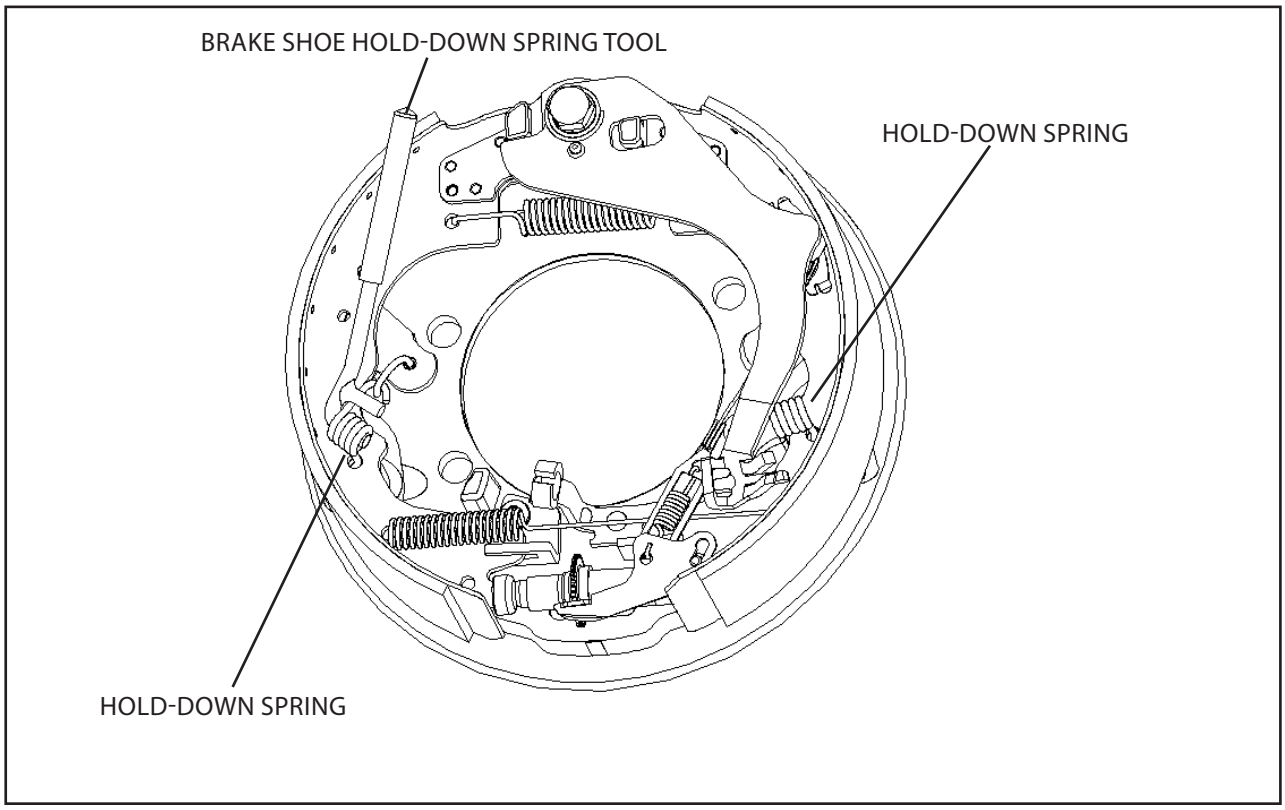


Figure 9. Shoe Hold-Down Spring Removal

Installing the Shoes

⚠WARNING

Failure to correctly assemble the Adjuster Cable may result in reduced brake performance that could cause personal injury or property damage.

⚠WARNING

Torque all fasteners to the manufacturer's recommended torque using a torque wrench. Failure to do so could possibly result in personal injury or property damage.

Installing the Shoes (continued)

1. Clean backing plate and adjuster screw assembly. Remove old grease from shoe contact points and adjuster threads as well as debris and corrosion that could contaminate linings or interfere with proper brake operation.
2. Apply a light film of Wolfrakote paste ledge grease to the six (6) backing plate shoe ledges and one (1) anchor post as shown in Figure 10.
3. Apply Chevron RPM heavy duty, lithium complex, molybdenum disulfide, extreme pressure grease, or equivalent, to the cam plate lugs where they contact the shoe ends, the end of the shoes that contact the cam lugs, and the brake lever.

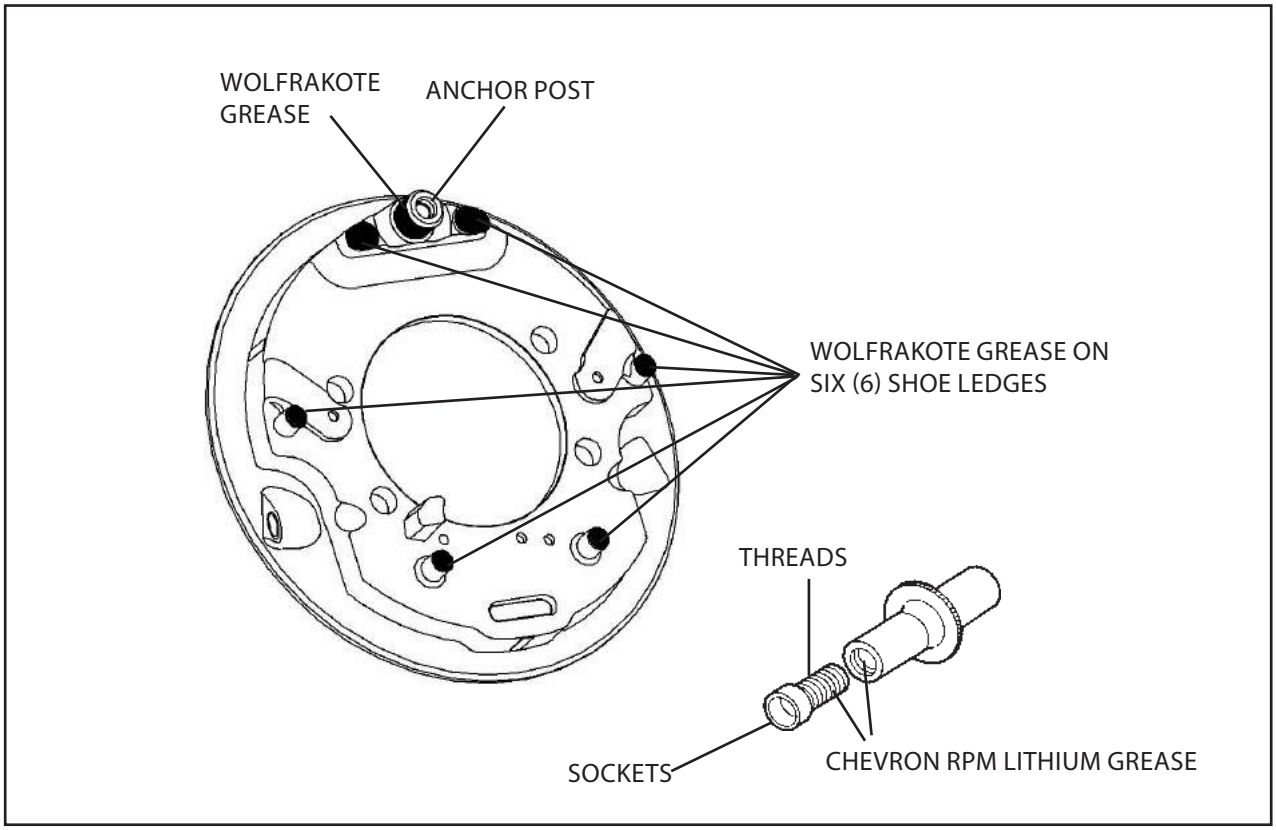


Figure 10. Application of Wolfrakote Paste Grease to Wear Points and Chevron RPM Lithium Shoe Grease to Adjuster Screw

Installing the Shoes (continued)

4. Apply Chevron RPM heavy duty, lithium complex, molybdenum disulfide, extreme pressure grease to the threads of the adjuster screw, adjuster nut, and the socket ends of the adjuster nut and install the screw fully into the adjuster nut. Insure the screw moves in and out freely. If any damage to the threads prohibits free movement, or if the starwheel is damaged, replace adjuster assembly. See Figure 10.

Note: Only use the approved lubricants as specified. Do not substitute.

Note: When installing new shoes, make sure the shoe with the adjuster cable guide and adjuster lever pin is installed on the correct side of the shoe. See Figure 11.

5. Place one shoe into the installed position. Reattach shoe hold-down spring and pin. See Figures 9 and 11.

⚠CAUTION

For Steps 5 through 10, proper orientation of the various springs, including their hook-ends must be maintained, as shown in Figure 11, for proper brake function.

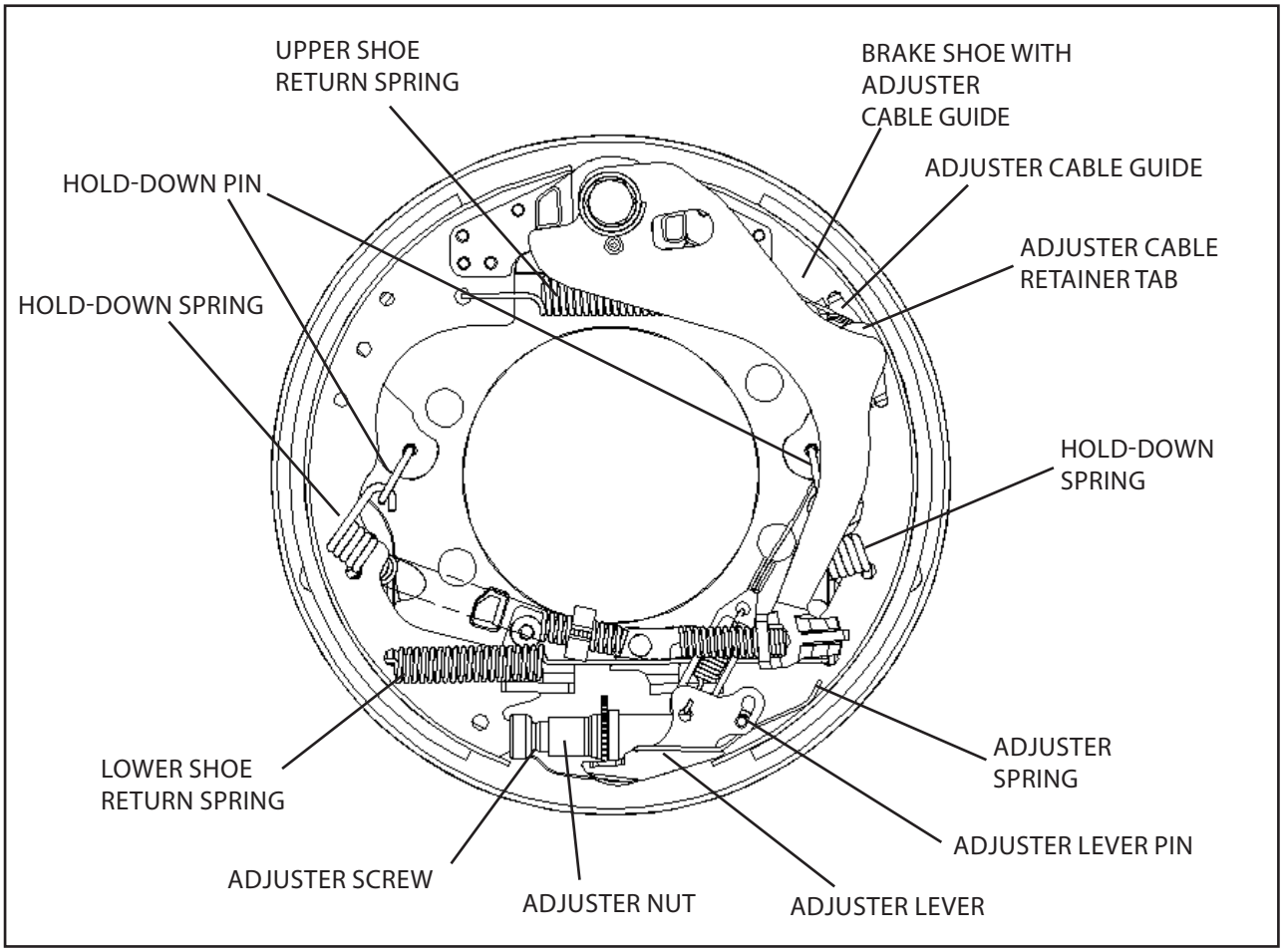


Figure 11. Brake Shoe Installation

Installing the Shoes (continued)

6. Position the second shoe and the adjuster nut and screw assembly as shown in Figure 11. The adjuster nut (internally threaded) should be seated against the shoe with the adjuster cable guide and pin. Reattach shoe hold-down spring to shoe hold-down pin using the brake spring tool as shown in Figure 9.

7. Install both shoe-return springs as shown in Figure 11.

8. Install the adjuster spring and the adjuster lever. Ensure that the adjuster lever is properly seated against the starwheel as shown in Figure 11.

9. If the lever has been removed, reinstall lever and associated components per the ANCHOR SCREW, LEVER, AND CAM REPLACEMENT section in the manual.

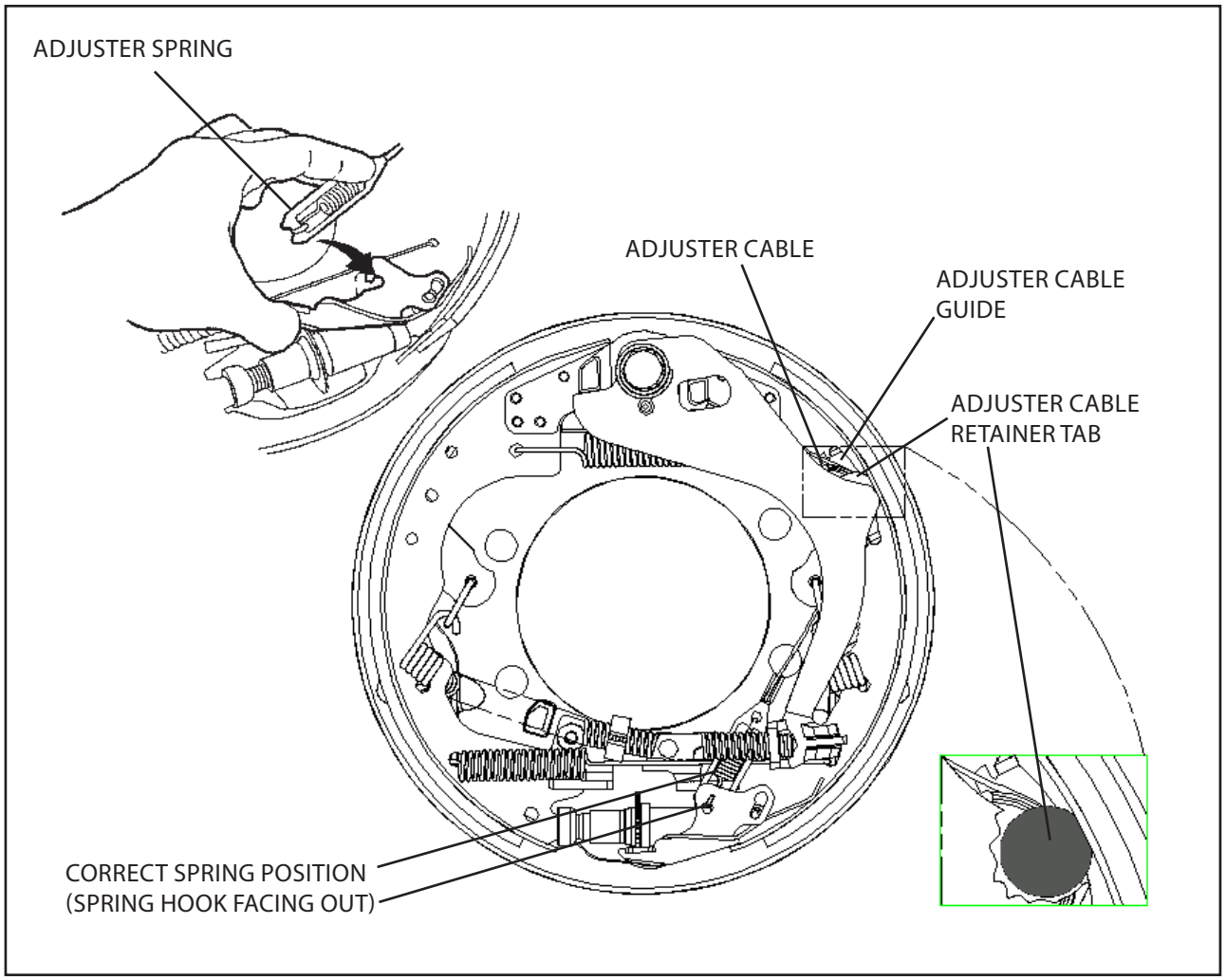


Figure 12. Adjuster Cable Installation

Installing the Shoes (continued)

10. Route the adjuster cable around the adjuster cable guide, under the shoe hold down spring, and attach to the adjuster lever as shown in Figure 12. Install adjuster cable retaining tab if so equipped.

Note: Correctly assembled, the adjuster cable end-fitting is behind the adjuster lever, with the spring hook facing out as shown in Figure 12.

11. The shoe cage should be adjusted now per the SHOE CAGE ADJUSTMENT PRIMARY procedure or after the drum has been reinstalled per the SHOE CAGE ADJUSTMENT ALTERNATE procedure in this service manual.

12. Make a final inspection of the shoe linings and the inside of the drum to ensure that no grease or other contamination was accidentally applied.

⚠WARNING

Keep grease and other foreign materials away from the shoe lining and drum surfaces. Contamination of shoe linings or drum surface may result in degradation of brake holding capability, possibly resulting in personal injury or property damage.

13. Inspect, service and reinstall drum per the vehicle manufacturer's service manual.

14. Lower the vehicle and test the brake for proper function before returning the vehicle for service use. If necessary, make adjustments per the vehicle manufacturer's service manual.

Shoe Cage Adjustment Procedures

Adjustment with Drum Off - Primary Procedure

1. Use a 12 inch caliper, or inside micrometer, to measure the inside diameter of the drum. Subtract 0.025 inches from the drum inside diameter measurement. Set the measurement caliper to this value, and lock the set screw.

2. Rotate the axle input flange yoke as necessary to provide clearance for the measurement caliper.

3. Place the pre-adjusted caliper over the shoes at the center of the shoes.

Adjustment with Drum Off - Primary Procedure (continued)

4. To adjust brake, rotate the starwheel until the shoes touch the measurement caliper jaws. It is necessary to disengage the adjuster lever away from the starwheel. See Figure 13.

Note: During adjustment the calipers should be moved up and down around the shoe center points to ensure adjustment at the highest points across the width of the shoes.

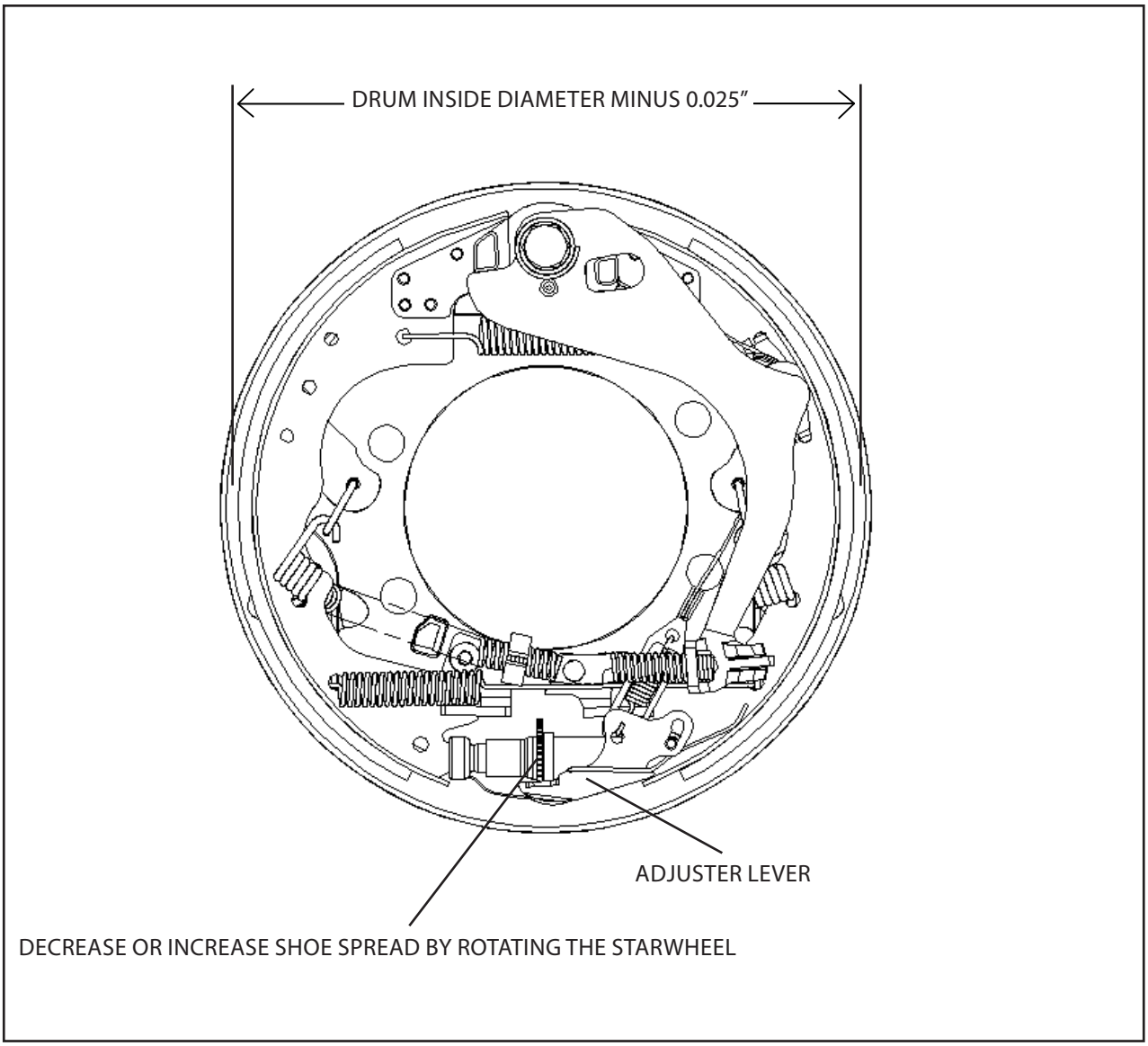


Figure 13. Initial Brake Shoe Adjustment

Adjustment with Drum Installed - Alternate Procedure

1. With the engine off, the battery disconnected, and the tires blocked to prevent vehicle movement, place transmission in neutral and fully release the parking brake. Check to see if the drum can be rotated back and forth by hand. If the drum cannot rotate, it will be necessary to raise the rear wheels off the ground, in order to allow rotation of the drum. Support the vehicle with suitable floor stands.

Note: Some vehicles may not have enough clearance behind the park brake to have direct access through the access slot to the adjuster lever. In these cases, an adjuster lever tool can be made from 3/32" diameter welding filler rod. See Figure 16.

2. Insert the adjuster lever tool or a thin flat bladed screw driver through the adjusting slot in the backplate and push on the adjuster lever to disengage it from the adjuster starwheel. Insert a brake adjusting tool (or flathead screwdriver) through the adjusting slot and move the starwheel teeth downward to expand the brake shoes outward. See Figures 14 and 15. Continue expanding the shoes until the drum can not be rotated by hand.

3. Now adjust the starwheel teeth upward to retract the shoes until the drum just begins to rotate freely by hand (without drag from the shoes). See Figures 14 and 15.

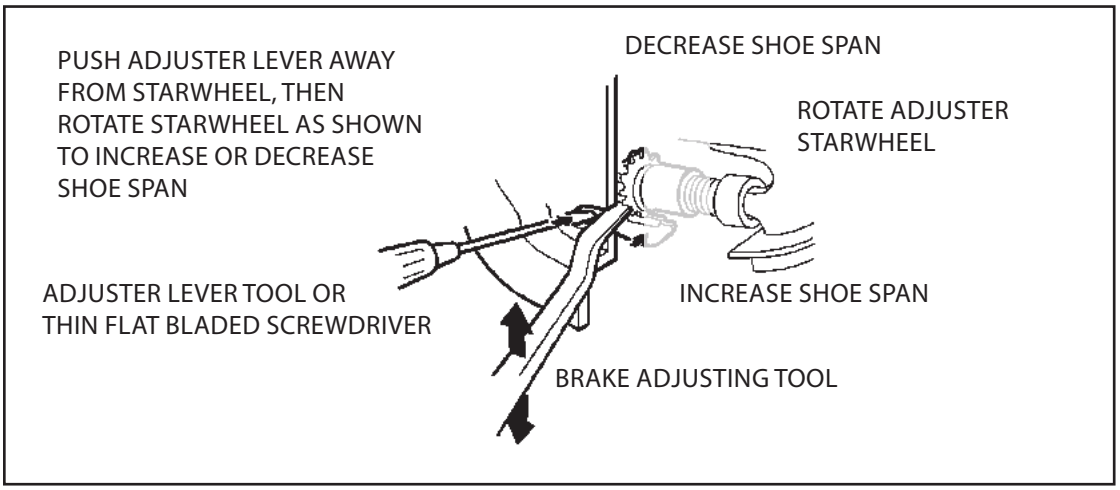


Figure 14. Brake Adjustment With Drum In Place (cut away view)

Disengaging Adjuster Lever from Adjuster Starwheel to Allow Retracting the Brake shoes (Loosen Brake)

Note: Some vehicles may not have enough clearance behind the park brake to have direct access through the access slot to the adjuster lever. In these cases, an adjuster lever tool can be made from 3/32" diameter welding filler rod. See Figure 16.

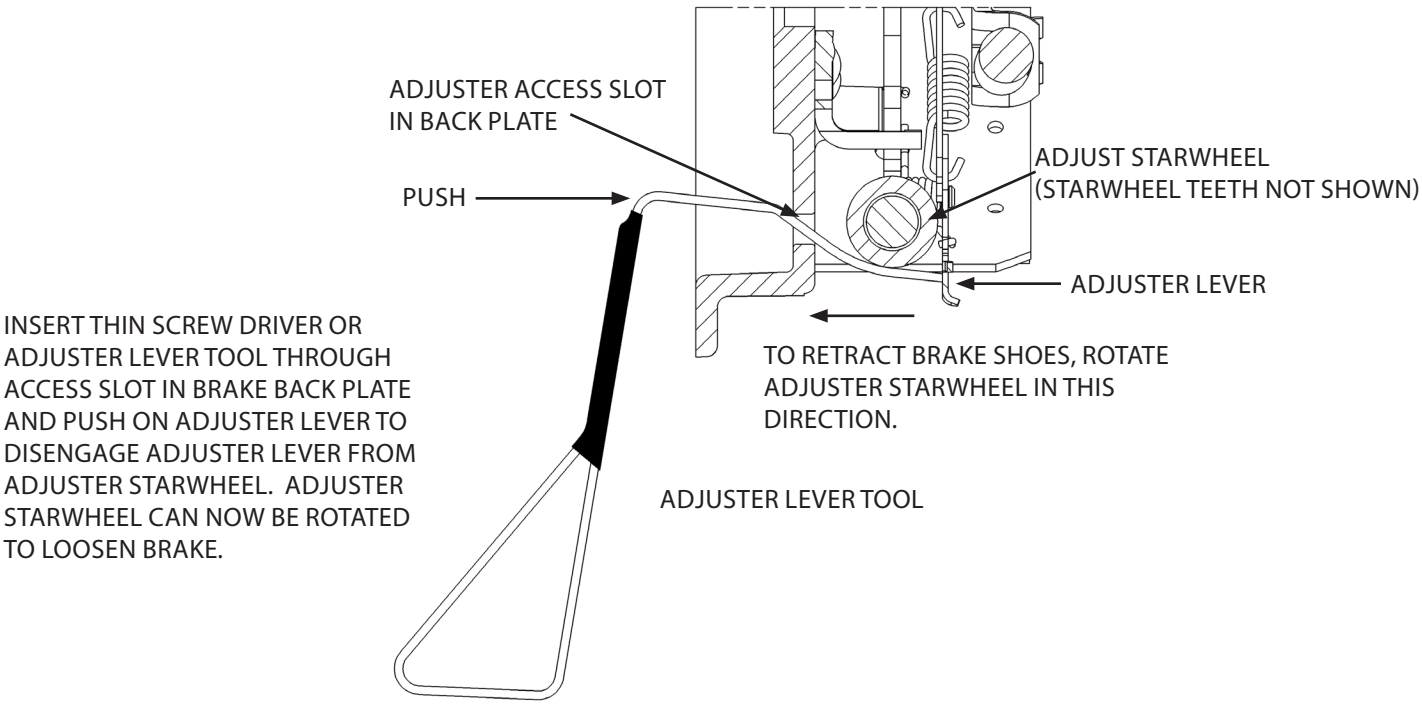


Figure 15. Disengaging Adjuster Lever from Adjuster Starwheel to Allow Retracting the Brake Shoes (Loosen Brake)

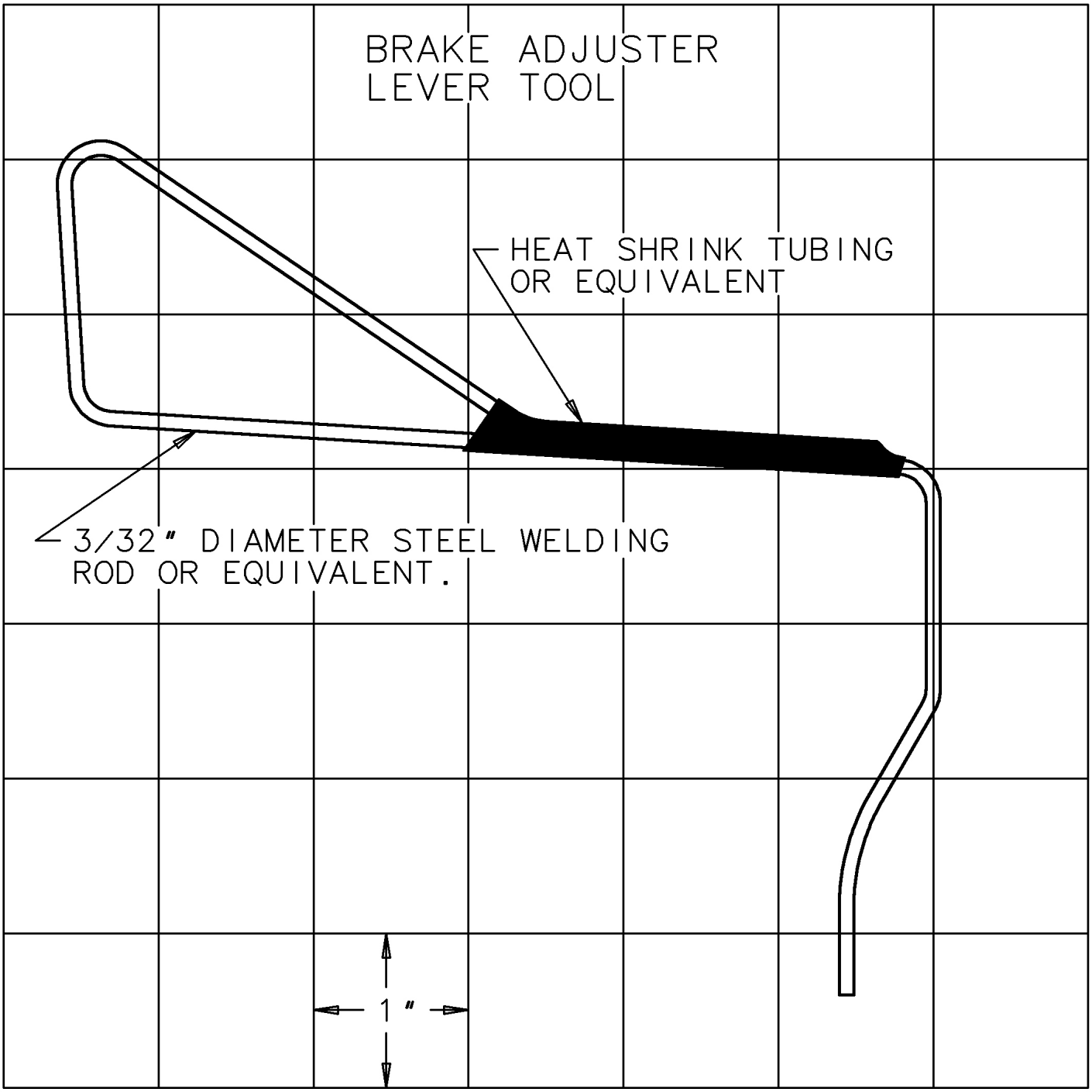


Figure 16. Brake Adjuster Lever Tool

Anchor Screw, Lever, and Cam Replacement

Removing Components

Note: The anchor screw, lever, and cam should all be replaced at the same time. Do not replace just one or two of the three parts at any time. Inspection of these parts is recommended at 250,000 miles or 5 years for typical use, or more often under severe operating conditions.

1. Block the front wheels to keep the vehicle from moving.

2. With the engine off and battery disconnected, place the transmission in gear and fully release the parking brake.

3. If recommended in vehicle manufacturer's service manual, raise the rear of the vehicle so the wheels clear the floor and install safety stands to support.

4. Remove the drum. See vehicle manufacturer's service manual for details, if necessary.

⚠CAUTION

Do not use a drum puller or a torch to remove a brake drum. Drum distortion may result.

Note: If the drum proves difficult to remove, insert a narrow screwdriver through the brake adjusting hole in the backing plate and disengage the adjuster lever from the adjuster nut starwheel teeth. With adjuster lever disengaged as shown in Figures 14 and 15, insert a brake adjusting tool (or screw driver) through the adjusting hole to engage the adjusting nut teeth. Move the teeth upward enough times to retract the brake shoes to clear the drum. If the drum is rusted to the axle input flange yoke pilot, tap the center of the brake drum with a non-metallic mallet to loosen.

5. Inspect the brake per the INSPECTION procedure in this service manual.

6. Detach the parking brake apply cable and lever return spring from end of brake lever. Remove the apply lever guide (on Release 2 brakes).

7. Detach adjuster cable from the adjuster lever and slide adjuster cable off the adjuster cable guide, remove retaining tab if so equipped. See Figure 7.

8. Remove the anchor screw. See Figure 17.

Removing Components (continued)

Note: On Release 1 brakes with a hex socket anchor screw, the use of a thread-locking compound may prevent removal of the anchor screw with a hex key and torque in excess of 55 Nm (40 ft.-lbs.) May break or deform a 6mm hex key. If necessary, use a pipe wrench, vice grips, or similar tool on the knurling of the head to loosen the anchor screw. Replace screw if removed, regardless of condition.

9. Remove the flat washers (if installed on your application for Release 1 level brake), anti-rattle spring, lever, cam, and adjuster cable. See Figures 2 and 17.

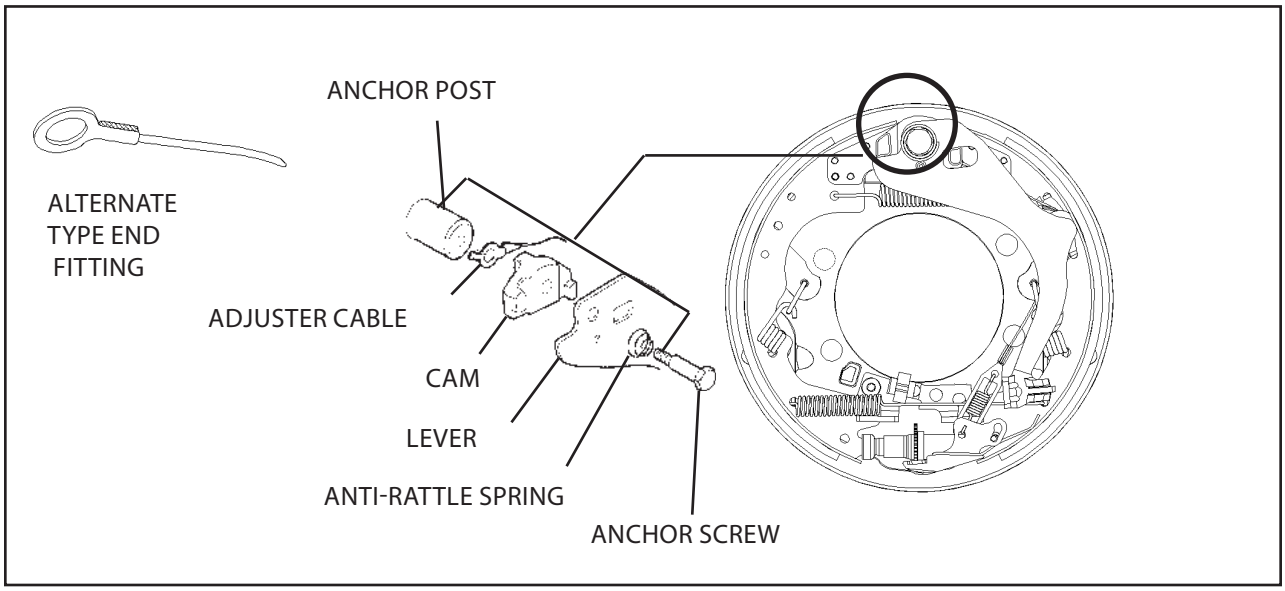


Figure 17. Spring, Lever, Cam, and Adjuster Cable Removal
(Release 3 Brake Shown)

Installing Components

Note: If for any reason the cam, lever, and anchor screw is removed, a complete new set is recommended for service.

1. Remove the cured thread-locking compound from the anchor post hole threads. Run the appropriate size tap completely into the anchor post and back out to clean the threads. Remove loose debris from anchor post hole.

Note: For brakes with a hex socket head anchor screw, use an M10 x 1.5 tap (brakes manufactured prior to April 2002). For brakes with an external hex head anchor screw, use and M12 x 1.75 tap (brakes manufactured after April 2002).

2. Apply Chevron heavy duty lithium complex extreme pressure grease, or equivalent, to the cam plate lugs where they contact the shoes and the apply lever, to the cam plate slotted hole and top and bottom faces. Apply grease to the brake lever pivot hole and the contact surfaces with the cam plate lugs. Apply grease to the non-threaded portion of the anchor screw. ***Do not get grease on anchor screw threads or in anchor post threaded hole.***

3. Reinstall the adjuster cable, new cam plate, new lever, anti-rattle spring (small coil end toward screw head for Release 2), flat washers (if previously installed on your application), and new anchor screw as shown in Figure 18. Make sure the adjuster cable end fitting is installed to allow the cam plate to sit flat on the fitting and anchor post.
   - Stepped type end fitting - the step faces towards the backplate. See Figure 18.
   - Alternate "eyelet" type fitting - cable crimp portion faces towards the backplate. See Figure 18.

⚠CAUTION

Only thread anchor screw into the anchor post 1 to 2 turns to temporarily hold assembly together. Do not thread in completely until ready to tighten to specification (step 4).

A faulty installation will result if the thread-locking compound is activated and begins to cure prior to tightening the screw.

⚠CAUTION

When installing the hex socket head anchor screw, careful attention should be taken during reassembly to ensure that the adjuster cable-end fitting is not clamped underneath the shoulder of the anchor screw during reassembly.

Clamping the adjuster cable may prevent proper functioning of the brake self-adjust feature.

Installing Components (continued)

4. Tighten the anchor screw per the appropriate specification:
   For the internal hex socket anchor screw tighten to 50 ± 3 Nm (37 ± 2 ft-lbs.)
   For the external hex head anchor screw tighten to 100 ± 10 Nm (74 ± 7 ft-lbs.)

⚠CAUTION

To tighten the anchor screw, only use a recently calibrated, known good, "clicker" type torque wrench set to the correct torque specification. Do not use add on devices such as universal joints, swivels, crows feet or other devices as these can cause inaccurate tightening results. Do not attempt this repair if a recently calibrated, known good "clicker" type torque wrench is not available. Failure to do so could result in personal injury or property damage.

Note: Remove excess grease that could contaminate brake drum or linings while the brake is in service.

5. Reinstall the lever return spring and parking brake cable to the end of the brake lever.

6. Route the adjuster cable around the adjuster cable guide, under the shoe hold-down spring, and attach to the adjuster lever as shown in Figure 12. Install adjuster cable retainer tab if equipped.

Note: When correctly assembled, the adjuster cable end-fitting is behind the adjuster lever with the spring hook facing out as shown in Figures 12 and 18. Failure to do so may result in reduced brake operation.

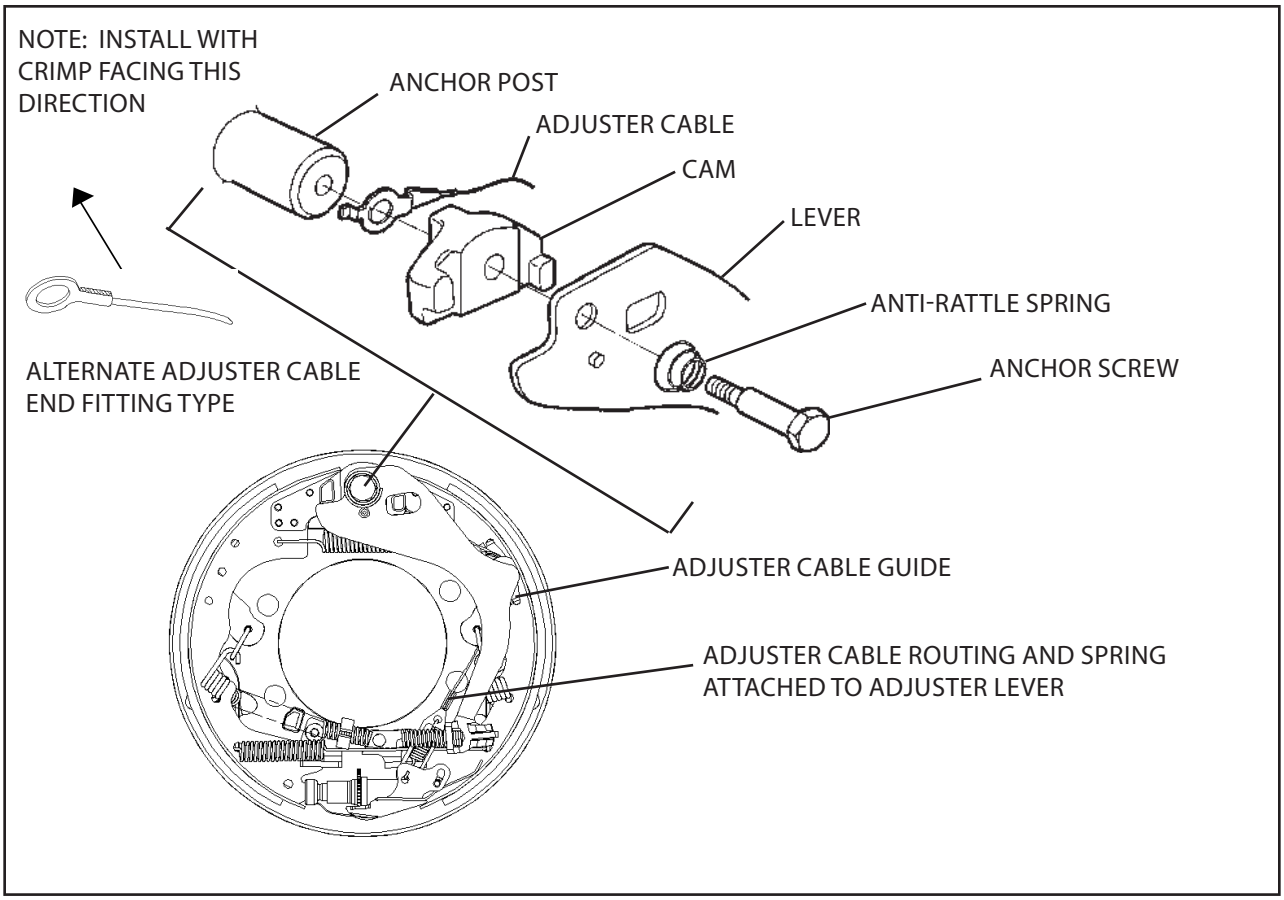


Figure 18. Install Adjuster Cable, Cam Lever, Anti-rattle Spring and Anchor Screw

7. The shoe cage should now be adjusted per the SHOE CAGE ADJUSTMENT PRIMARY procedure or after the drum has been reinstalled, per the SHOE CAGE ADJUSTMENT ALTERNATE procedure in this service manual.

8. Make a final inspection of the shoe linings and the inside of the drum to ensure that no grease or other contamination is present.

⚠CAUTION

Keep grease and other foreign materials away from the shoe lining and drum surfaces. Contamination of shoe linings or drum surface may result in degradation of brake holding capability, possibly resulting in personal injury or property damage.

9. Inspect, service, then reinstall drum per the vehicle manufacturer's service manual.

10. Lower vehicle and remove the blocks or wheel chocks from the front wheels.

11. Test the brake for proper function before returning the vehicle for service use. If necessary, make adjustments per the vehicle manufacturer's service manual.

Trouble Shooting

Condition	Cause	Remedy
Light force or lack of resistance when applying brake lever (on manual apply systems)	Shoe cage under-adjusted[1]	Adjust shoes per shoe cage adjustment procedure
	Worn or deformed actuation components (lever, cam lugs shoe ends)	Inspect and replace per Anchor Screw, Lever, and Cam Replacement procedure or Shoe Replacement procedure
	Apply system not operating properly	Repair per manufacturer's recommended procedure
Heavy force or excessive resistance when applying brake lever (on manual apply system)	Over adjusted brake	Adjust brake cage clearance diameter
	Apply system over adjusted	Adjust or repair per manufacturer's recommended procedures
Brake does not release	Internal damage to brake	Inspect and replace damaged components
	Apply cable bound up	Check cable for corrosion, binding, kinks, or damage. Repair per vehicle manufacturer's recommended procedures
	Apply system not operating properly	Repair per vehicle manufacturer's recommended procedure
Brake does not hold vehicle on hill	Grease, oil or other foreign material on or embedded in shoe linings	Replace shoes and clean drum[2]
	Damaged or incorrect shoes	Replace with correct shoes
	Worn out lining (metal shoe rim contacting drum)	Replace shoes and resurface or replace drum as necessary
	Excessive drum runout	Resurface or replace drum per manufacturer's recommended procedure
	Shoe cage under-adjusted	Adjust shoes per primary (or alternate) Shoe Cage Adjustment procedure
	Worn or deformed actuation components (lever, cam lugs, shoe)	Inspect and replace per Anchor Screw, Lever, and Cam Replacement procedure

[1] Inspect adjuster components to see if any are damaged or jammed.
[2] Inspect the rear pinion seal for leakage that can contaminate the park brake system parts. Repair as necessary.

Component Specifications

Item		Specifications
Shoe Lining:	thickness, new (above shoe)	7mm (0.277 inch) (at center)
	thickness, replace (above shoe)	0.76mm (0.030 inch)
	width	76mm (3.00 inch)
Drum (typical):	inside diameter	304.8mm (12.000 inch)
	max inside diameter	305.7mm (12.035 inch)
	thickness	8 mm (0.315 inch)
	surface finish	3.2 micro m (125 micro in) or less

Fastener Torque Specifications

Fastener Type	Size	Torque	Brake Manufacture Date
Anchor Screw, hex socket head	M10 x 1.5	50±Nm (37 ± 2 ft-lbs)	Before April 2002
Anchor Screw, external hex head	M12 x 1.75	100±1 Nm (74 ± 7 ft-lbs)	After April 2002

Special Tools

These tools aid in servicing the parking brake:

- Heavy duty brake spring tool such as those available from, Lisle (#44800), Matco Tools (#BST 4480), Snap-On Tools (#BT19A) and others.
- Brake shoe retaining spring tool is available from Matco Tools (#RST10), Vim Tools - Durston Manufacturing (#B10) and others.

Lubrication

- Wolfrakote top paste (#89003-198)
  Manufacturer: Kluber Lubrication, 32 Industrical Dr., Londonberry, NH 03053, www.kluber.com, phone 603-647-4101
- Chevron RPM heavy duty LC EP NLGI 2 grease
  Distributor: Brenntag Southeast, 4200 Azelea Dr., Charleston, SC 29405, phone 843-744-7421

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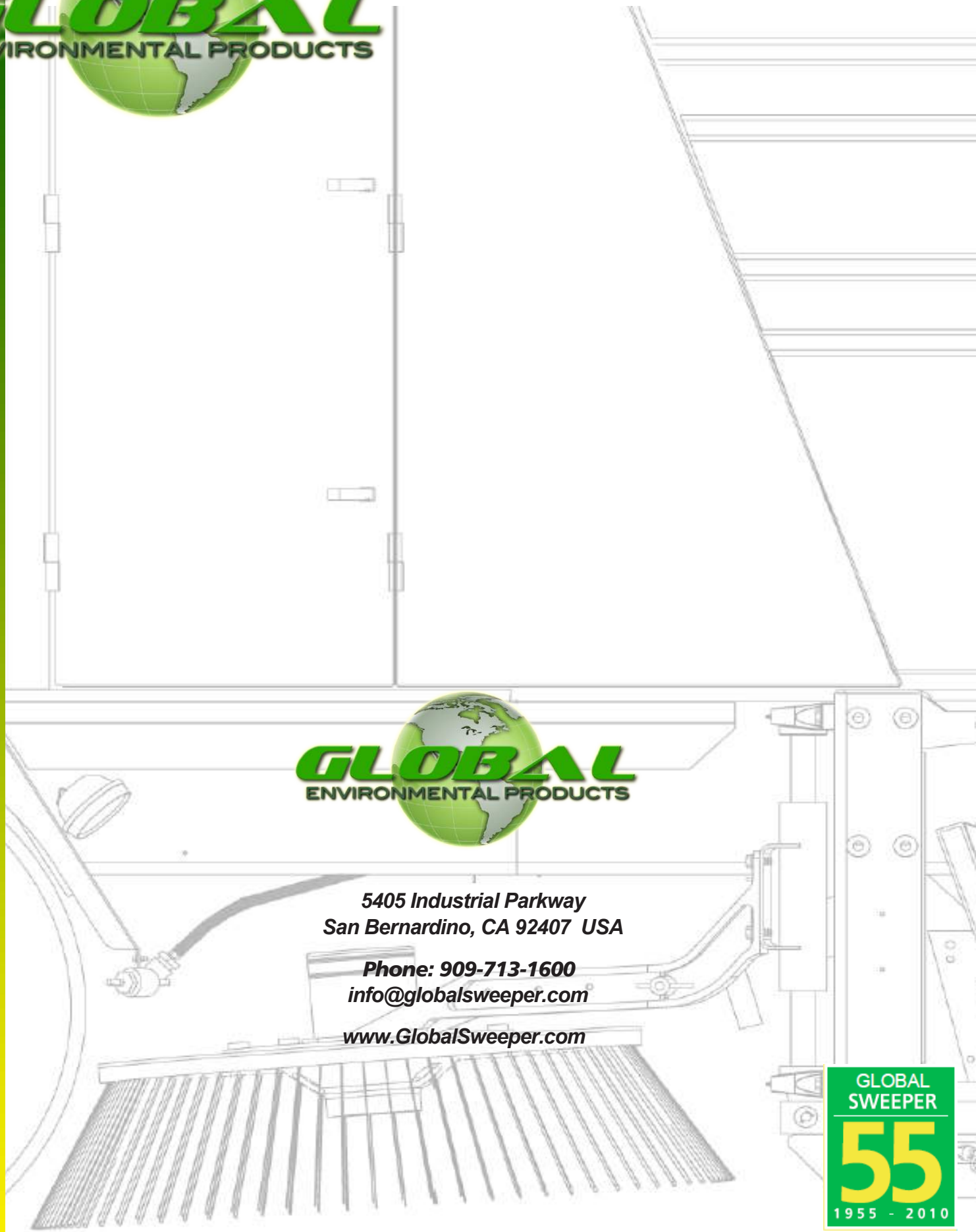

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