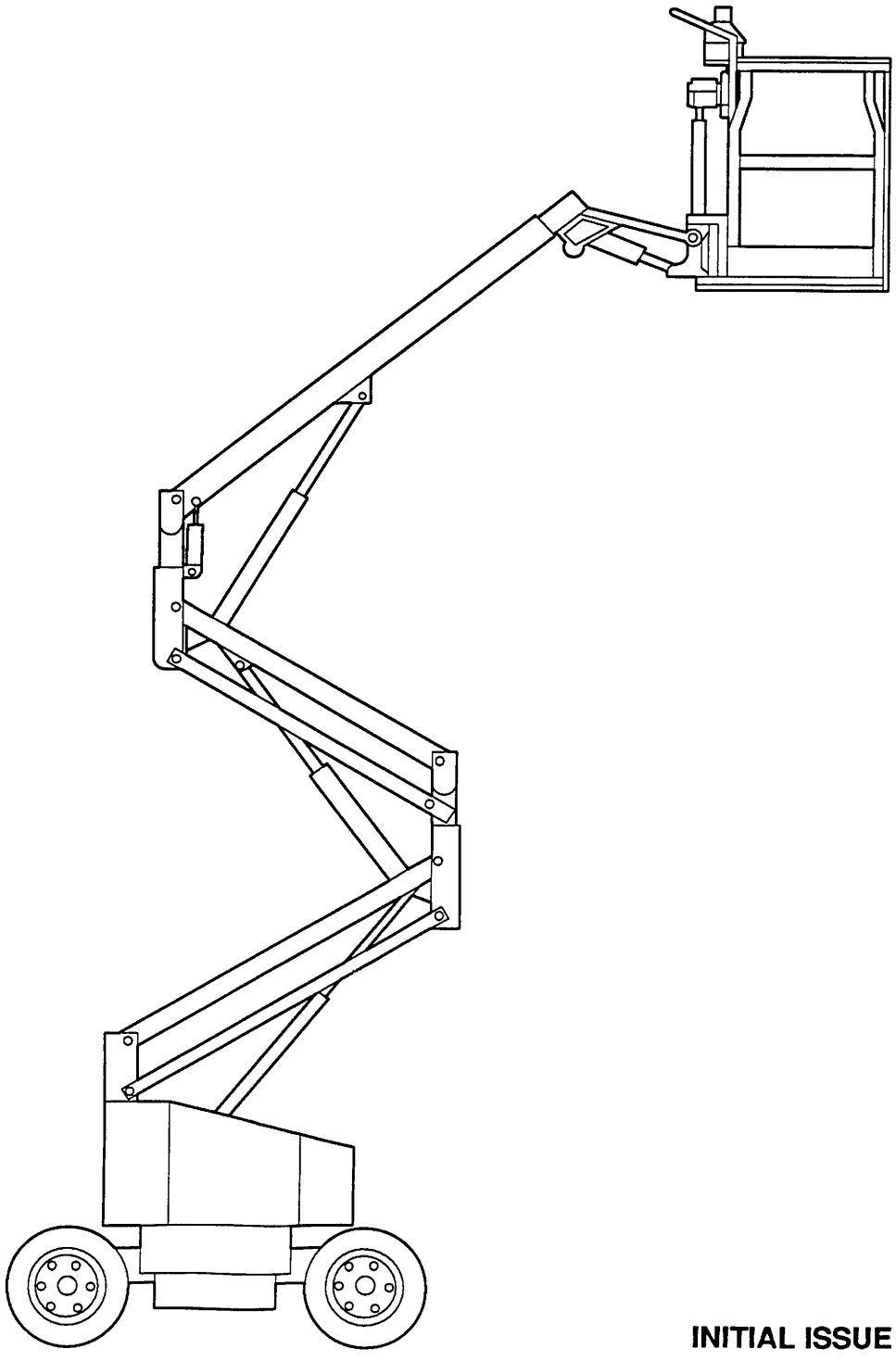
SIMON AERIALS INC.
10600 W. Brown Deer Road
Milwaukee, Wisconsin 53224
Phone (414) 355-0802
TWX: 910-262-3310
FAX: (414) 355-0832
Cable: SIMON MIL

SIMON

SERVICE MANUAL

MODEL
SILVER EAGLE SERIES ELECTRIC

32/21
41/24



PART NO. 89-410717

INITIAL ISSUE

TABLE OF CONTENTS

INTRODUCTION 5

MACHINE SPECIFICATIONS 6

COMPONENT LOCATORS 8

LUBRICATION DIAGRAM/ CHART 12

EMERGENCY PROCEDURES 15

HYDRAULIC FLUID

- HANDLING PRECAUTIONS 17
- FLUID RECOMMENDATIONS 17
- FLUID CONTAMINATION CHECKS 17
- SYSTEM FLUSHING PROCEDURE 18

HYDRAULIC SYSTEM

- HYDRAULIC MOTOR PUMP 20
- MANIFOLDS 20
- RELIEF VALVES 21
- HYDRAULIC FLUID RESERVOIR 22
- EMERGENCY HAND PUMP 22
- BOOM LIFT SYSTEM 23
- BOOM EXTEND SYSTEM 24
- SWING SYSTEM 25
- PLATFORM LEVELING SYSTEM 26
- PLATFORM ROTATE SYSTEM 27
- STEER SYSTEM 28

TABLE OF CONTENTS (CONTINUED)

DRIVE SYSTEM

DRIVE MOTOR 29

DRIVE LINE BRAKE 29

SPEED REDUCER 30

DRIVE SHAFT AND COUPLING 30

REAR (DRIVE) AXLE 31

AXLE BRAKES 31

DRIVE SYSTEM TROUBLESHOOTING 31

ELECTRICAL SYSTEM

ELECTRICAL CIRCUIT 32

BATTERIES 32

BATTERY CHARGER 34

DRIVE MOTOR CONTROLLER 42

EMERGENCY STOP BUTTONS 51

FOOT PEDAL SWITCH 51

MOVEMENT ALARM 51

TILT ALARM 52

RELAYS 53

FUSES 53

DC CONTACTORS 53

AUTOMATIC WARNING BEACON 53

TABLE OF CONTENTS (CONTINUED)

MECHANICAL COMPONENTS

TIRES 54

WHEELS AND LUG NUTS 54

SUPERSTRUCTURE 54

HOSES AND CABLES 54

LIFT PUMP MOTOR ASSEMBLY 54

TOWING PACKAGE 54

MISCELLANEOUS EQUIPMENT 54

CYLINDER PIVOT PINS AND PIN BUSHINGS 54

PIN REPLACEMENT 55

BOOM LIFT CYLINDERS 56

BOOM EXTEND (TELESCOPE) CYLINDER 57

WEAR PADS 58

PLATFORM LEVEL CYLINDERS 59

SAFETY AND INSTRUCTIONAL LABELS 60

TROUBLESHOOTING 62

MAINTENANCE SCHEDULE 65

ROUTINE SERVICING 66

OPERATIONAL CHECKLISTS 70

MAINTENANCE CHART 76

INTRODUCTION

This Service Manual is designed to provide you with the instructions needed to properly maintain the SIMON AERIALS SILVER EAGLE Self-Propelled Aerial Work Platform. When used in conjunction with the Operators, Parts and Component Repair manuals (provided separately) this Service Manual will assist you in making all necessary adjustments or repairs.

Simon Aerial Mobile Platforms are designed and built to provide many years of safe, dependable service. To obtain full benefits from your SILVER-EAGLE, always follow the proper operating and maintenance procedures. Only trained, authorized personnel should be allowed to operate or service this machine. Service personnel should read and study the Operators, Service, Parts and Component Repair Manuals in order to gain a thorough understanding of the unit prior to making any repairs.

Service personnel and machine operators must understand and comply with all warnings and instructional decals on the body of the machine, and at the ground and platform control stations.

MODIFICATIONS OF THIS MACHINE FROM THE ORIGINAL DESIGN ARE STRICTLY FORBIDDEN WITHOUT WRITTEN PERMISSION FROM SIMON AERIALS INC., AND WILL VOID ANY REMAINING WARRANTY.

SIMON AERIALS INC. reserves the right to change, improve, modify or expand features of its equipment. Therefore, specifications, models or equipment are subject to change without notice, and without incurring obligations.

All SIMON AERIALS INC. manuals are periodically updated to reflect changes that occur in the equipment. Please contact the factory for information regarding changes which may affect your machine.

MACHINE SPECIFICATIONS
ELECTRIC POWERED
SILVER EAGLE

	32/21	41/24
WORKING HEIGHT	38 FT (11.58 M)	47 FT (14.33 M)
PLATFORM HEIGHT	32 FT (9.75 M)	41 FT (12.50 M)
HORIZONTAL OUTREACH	21 FT (6.40 M)	24 FT (7.32 M)
SUPERSTRUCTURE ROTATION, STOP TO STOP	360°	360°
PLATFORM CAPACITY (UNRESTRICTED)	500 LBS (227 KG)	500 LBS (227 KG)
PLATFORM DIMENSIONS	30 IN. (0.76 M) x 60 IN. (1.52 M)	30 IN. (0.76 M) x 60 IN. (1.52 M)
PLATFORM ROTATION	170 DEGREES	170 DEGREES
STOWED LENGTH	15 FT 7 IN. (4.75 M)	16 FT 2 IN. (4.93 M)
STOWED HEIGHT	6 FT 7 IN. (2.01 M)	6 FT 7 IN. (2.01 M)
WIDTH	5 FT 11 IN. (1.80 M)	5 FT 11 IN. (1.80 M)
WHEELBASE	6 FT 3 IN. (1.91 M)	6 FT 3 IN. (1.91 M)
GROUND CLEARANCE	8 IN. (0.20 M)	8 IN. (0.20 M)
GROSS WEIGHT	9,500 LBS (4309 KG)	13,000 LBS (5897 KG)
OUTSIDE TURNING RADIUS	13 FT 6 IN. (4.12 M)	13 FT 6 IN. (4.12 M)
INSIDE TURNING RADIUS	6 FT 1 IN. (1.85 M)	6 FT 1 IN. (1.85 M)
GRADEABILITY (ON HARD SURFACE)	14 DEGREES (25%)	12 DEGREES (21%)
TRAVEL SPEED-BOOMS STOWED	3.1 MPH (5 KPH)	3.1 MPH (5 KPH)
BOOMS ELEVATED	0.5 MPH (0.8 KPH)	0.5 MPH (0.8 KPH)
POWER SOURCE	48 VOLT DC (EIGHT 6 VOLT, 105 AMP/HR. LEAD-ACID BATTERIES CONNECTED IN SERIES.)	48 VOLT DC (EIGHT 6 VOLT, 105 AMP/HR. LEAD-ACID BATTERIES CONNECTED IN SERIES.)

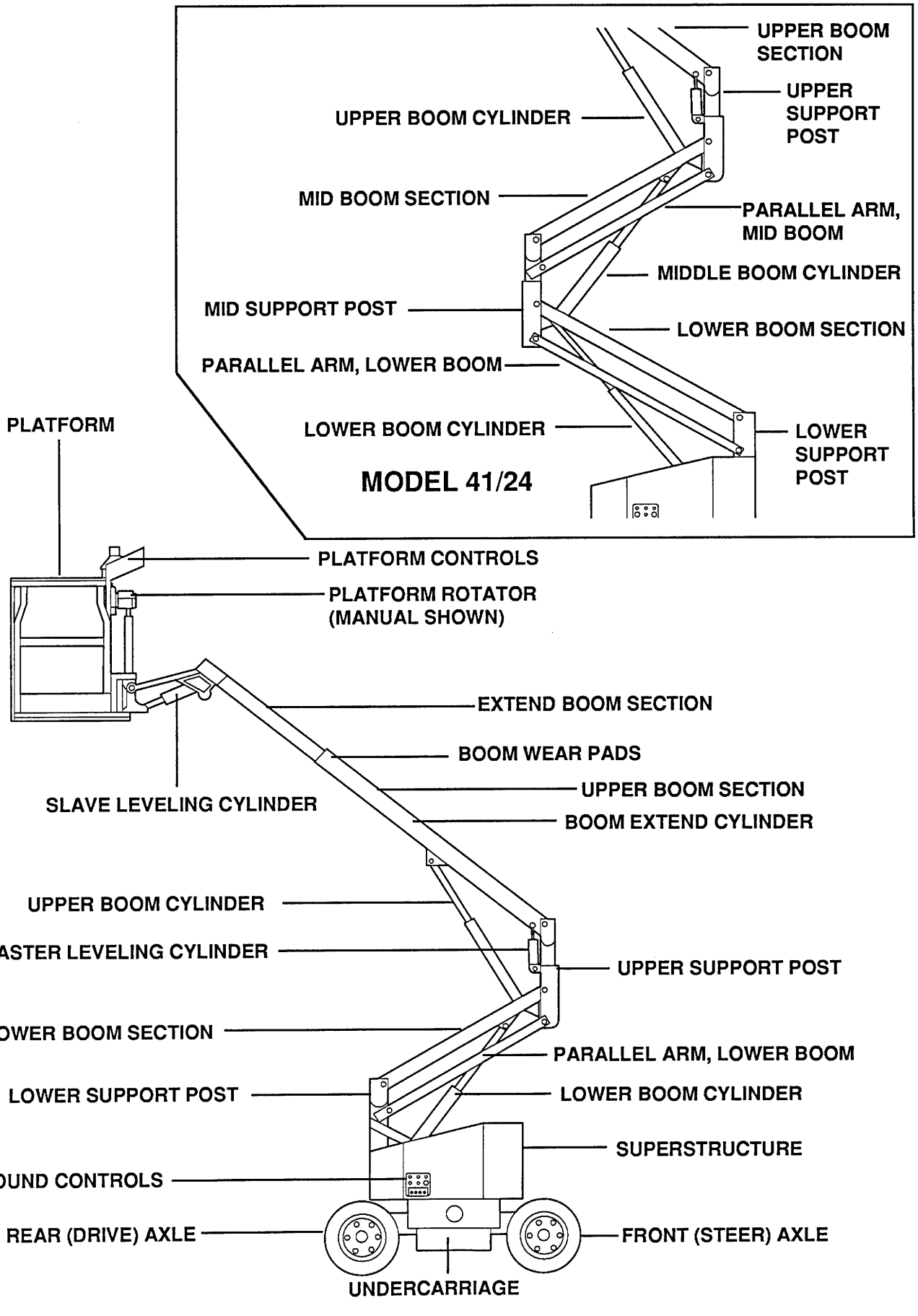
MACHINE SPECIFICATIONS (CONTINUED)

PUMP MOTOR (48 VOLT)	5 H.P. (3.7 KW)
HYDRAULIC PUMP/ PUMP MOTOR FLOW RATE	2.6 GPM (9.8 LPM)
PUMP PRESSURE	2200 PSI (152 BARS)
STEERING CROSS PORT RELIEF VALVE SETTING	3000 PSI (207 BARS)
MAXIMUM LIFT SYSTEM PRESSURE (MODEL 32/21)	2200 PSI (152 BARS)
LIFT FUNCTION AND STEERING RELIEF VALVE SETTING	2500 PSI (178 BARS)
SYSTEM MANIFOLD BLOCK RELIEF VALVE SETTING	2200 PSI (152 BARS)
PLATFORM RELIEF VALVE SETTING	2200 PSI (152 BARS)
HYDRAULIC FLUID CAPACITY (TANK)	6.6 GAL. (25 L)
(SYSTEM, MODEL 32/21) (APPROX.)	13 GAL. (49 L)
(SYSTEM, MODEL 41/24) (APPROX.)	19 GAL. (72 L)
TIRES	8.75-16.5 LT, 8 PLY
TIRE PRESSURE (STANDARD LIQUID BALLASTED TIRES)	65 PSI
WHEEL LUG NUT TORQUE (FRONT)	150 FT LBS (203 NM)
(REAR)	90 FT LBS (122 NM)
AXLE MOUNTING BLOCK BOLT TORQUE	285 FT LBS (386 NM)
SWING BEARING BOLT TORQUE	85 FT LBS (115 NM)
SWING DRIVE MOUNTING BOLT TORQUE	80 FT LBS (108 NM)
FUSE CONNECTOR NUT TORQUE	20 IN. LBS (23 CM KG)
BATTERY CHARGER TRANSFORMER CAPACITOR COIL RATING	6 Mfd, 660 V AC
VOLTAGE	88 V AC

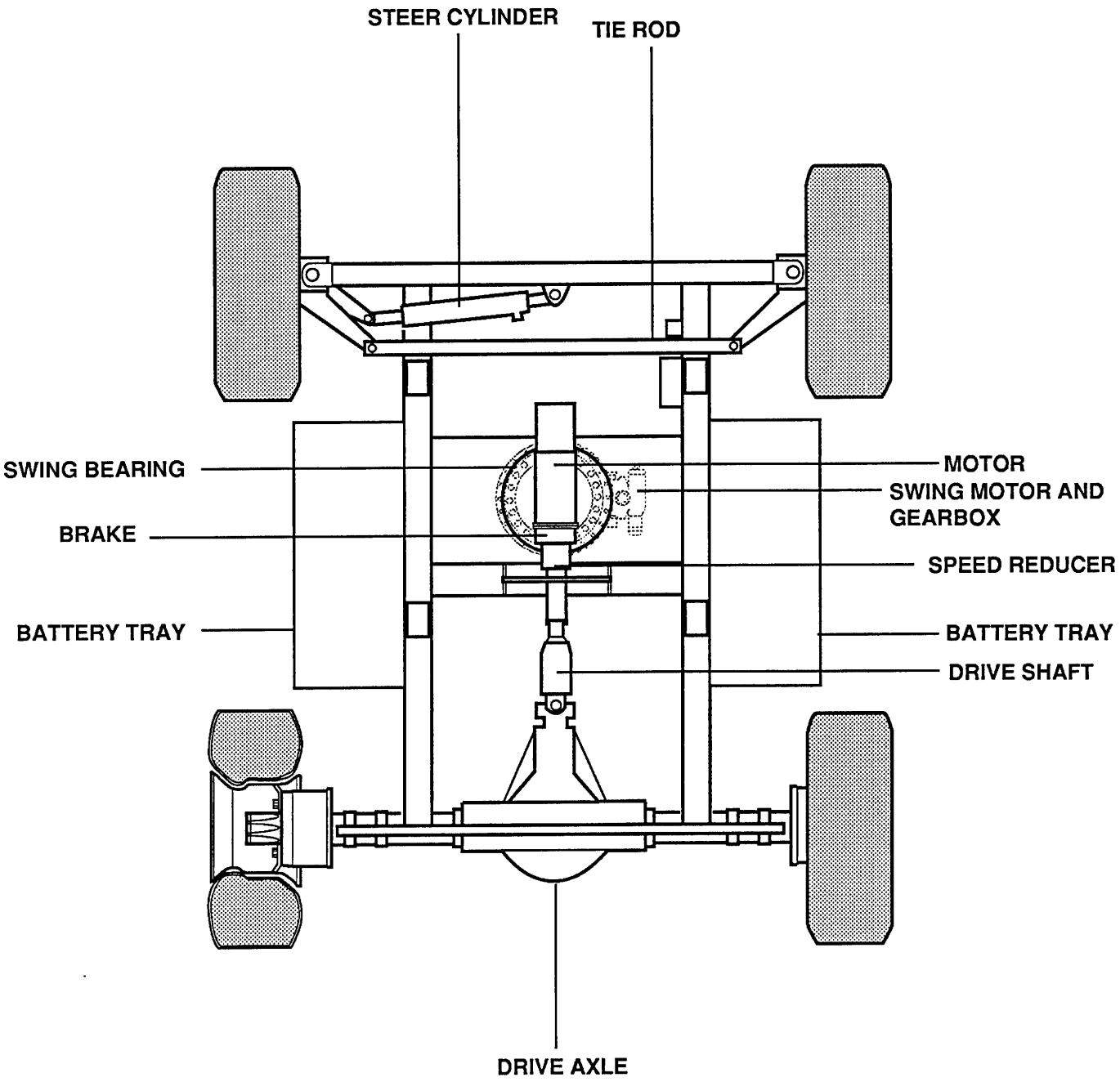
CONTROLLER SPECIFICATIONS (HDI SERIES 1205):

MODEL NUMBER	1205-201
MOTOR TYPE	SE/PM
NOMINAL SUPPLY VOLTAGE	48 VOLTS
NOMINAL OUTPUT CURRENT	350 AMPS
KEY SWITCH INPUT VOLTAGE	48 VOLTS
CONTROL POTENTIOMETER REQUIREMENTS	2-WIRE, 0-5K OHM
SIZE	8.75" (222 mm) x 5.75" (146 mm) x 2.80" (71 mm)
WEIGHT	5.75 LBS (2.6 KG)

MACHINE COMPONENT LOCATOR

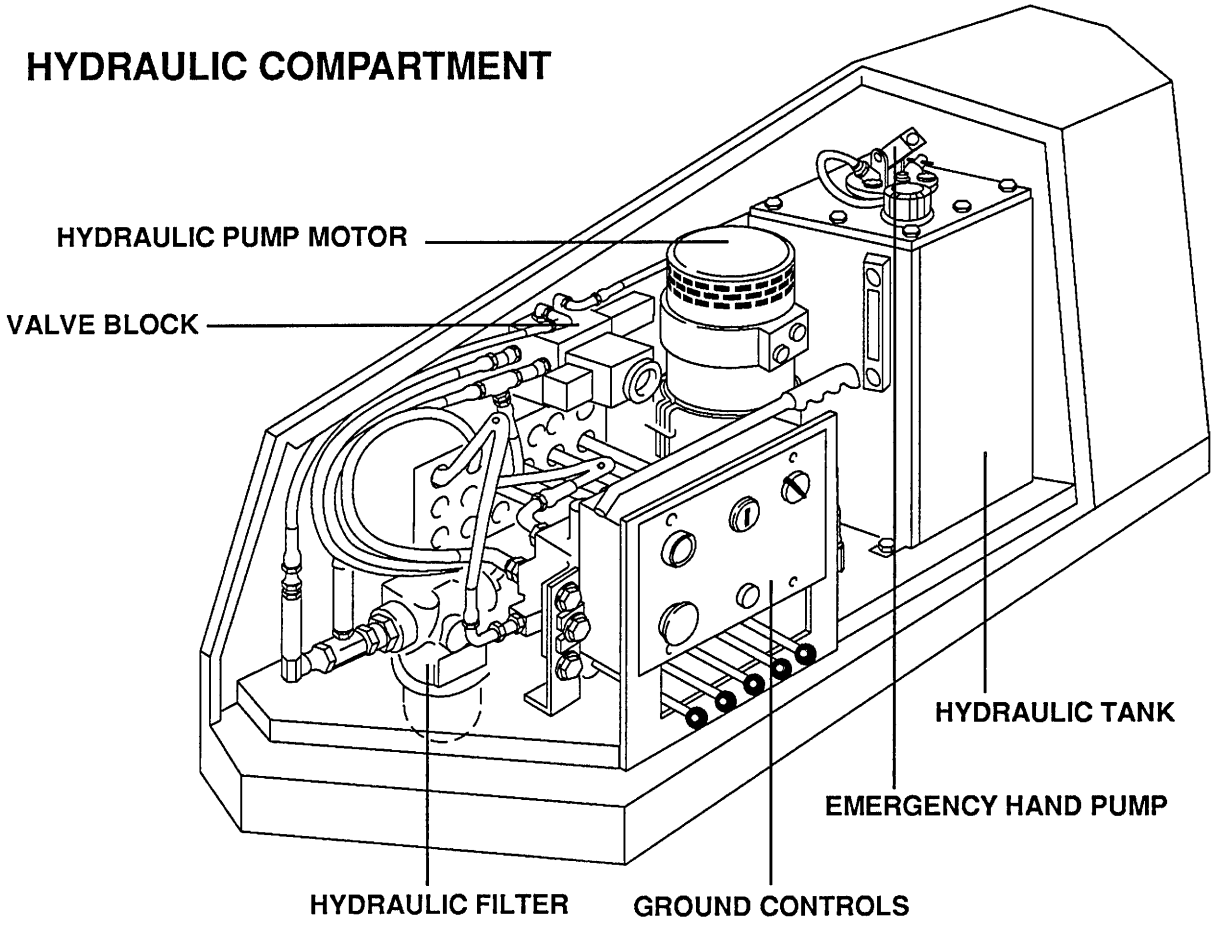


UNDERCARRIAGE COMPONENT LOCATOR

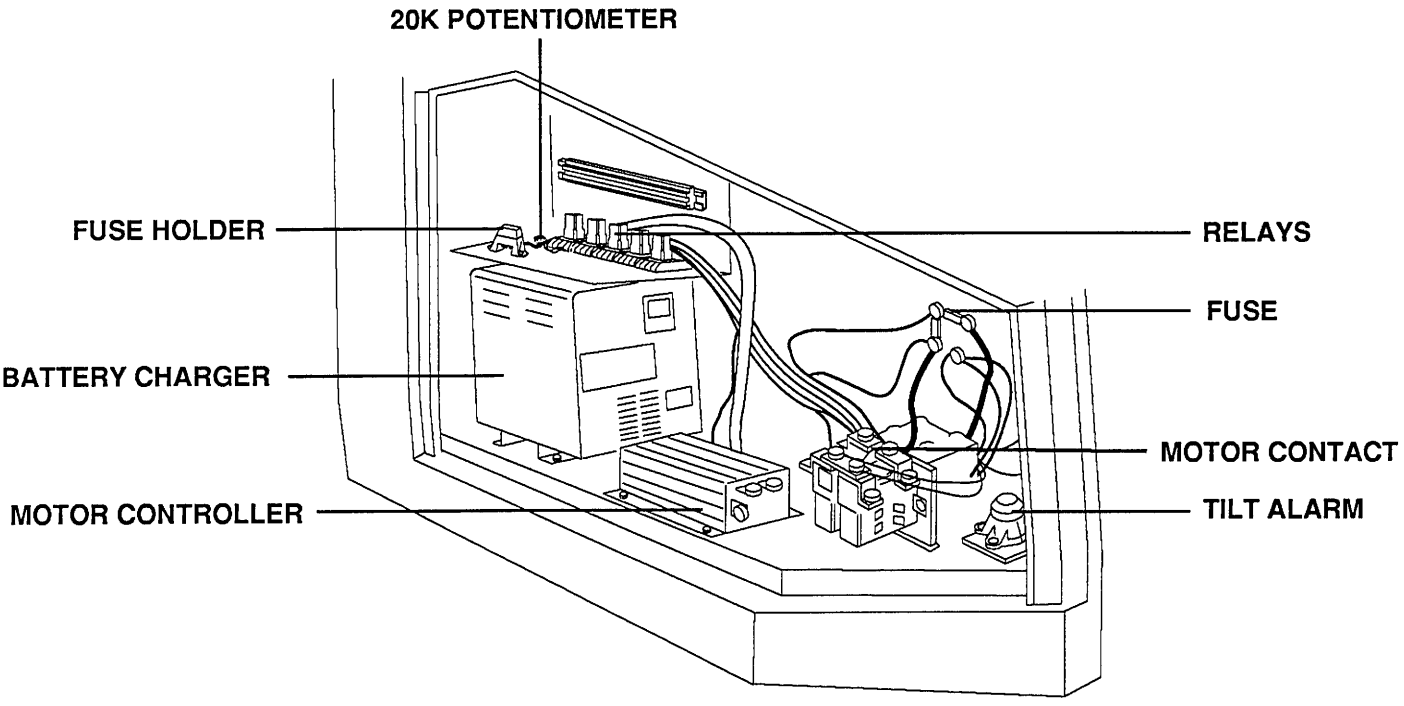


SUPERSTRUCTURE COMPONENT LOCATOR

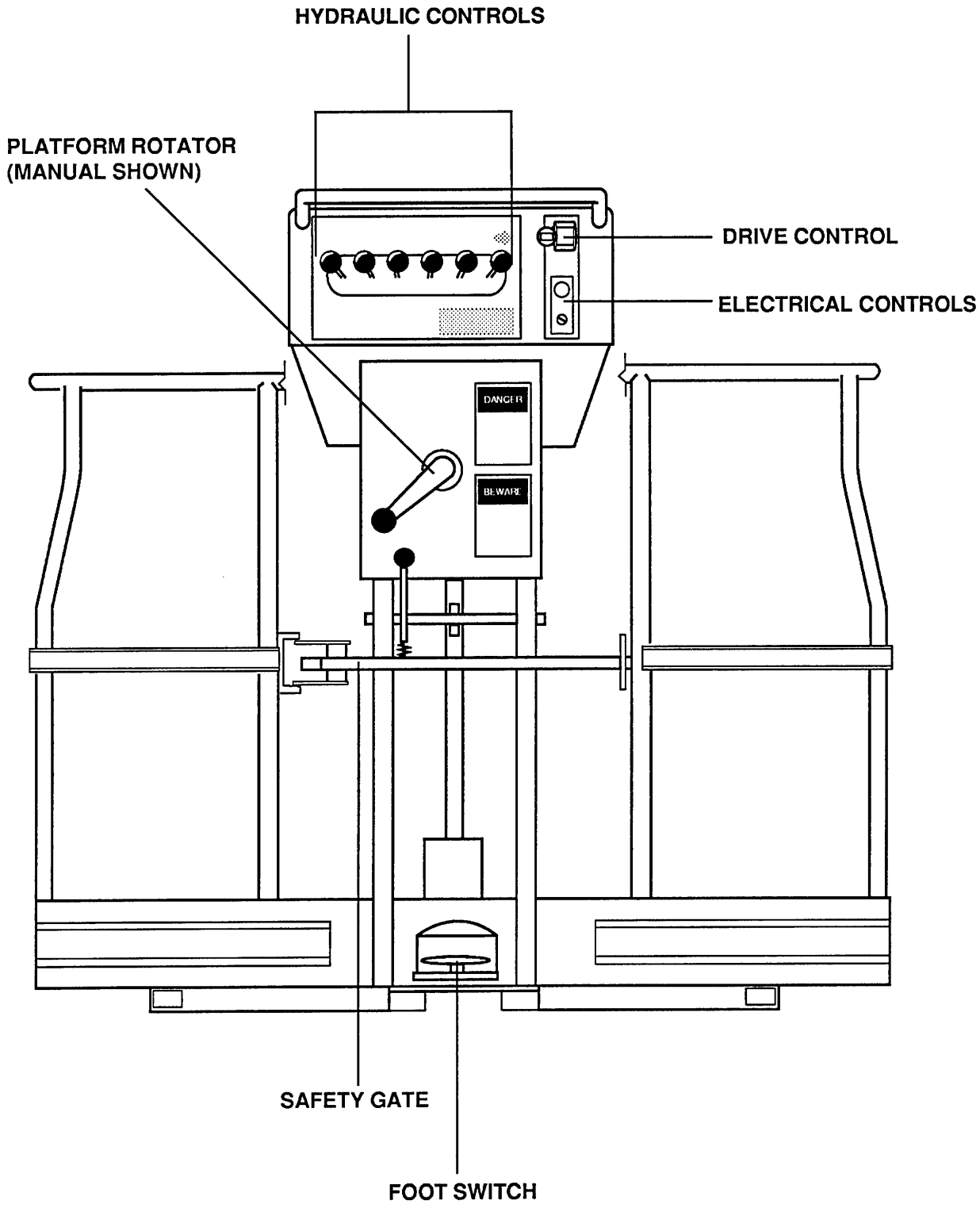
HYDRAULIC COMPARTMENT



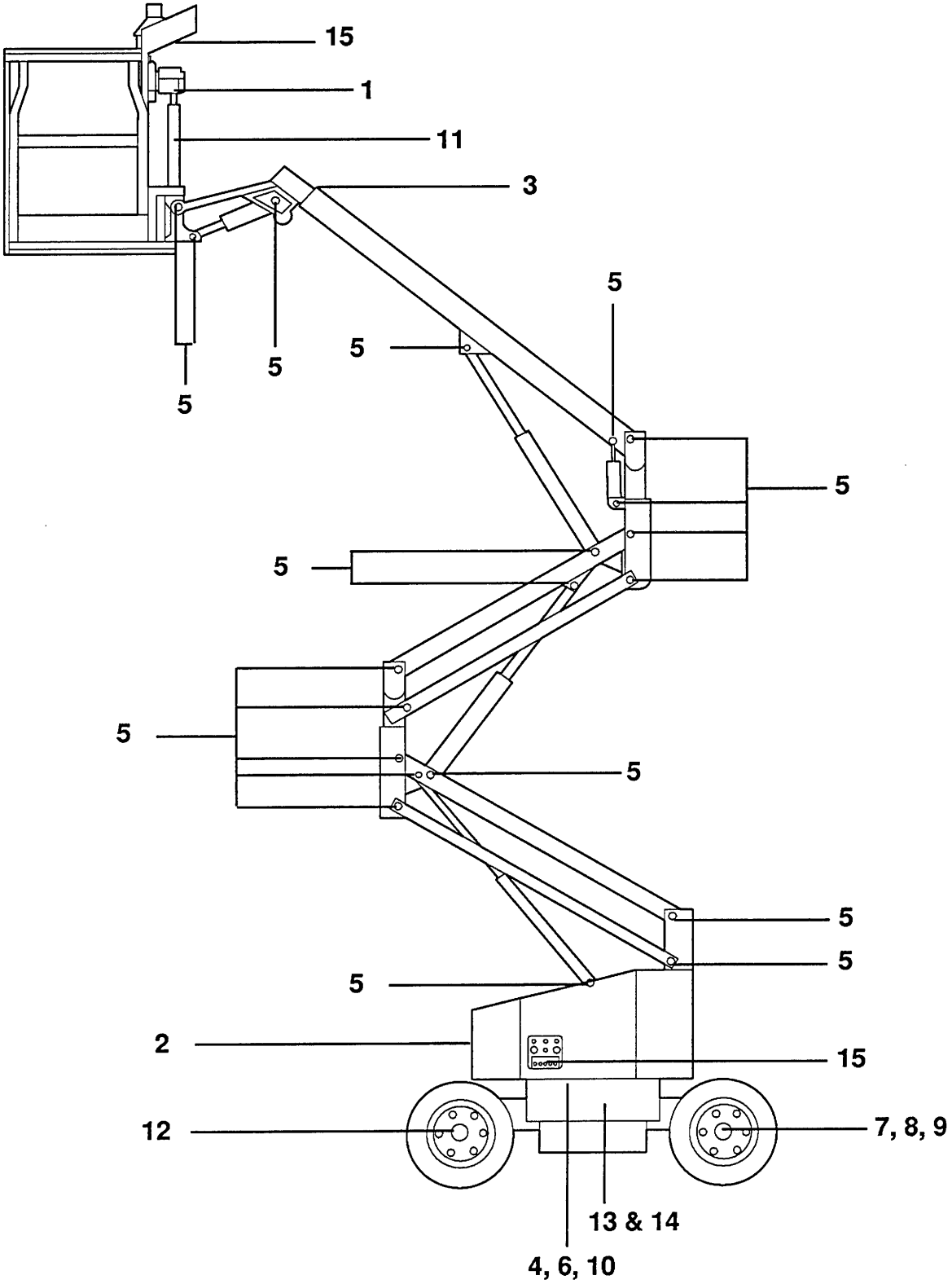
ELECTRICAL COMPARTMENT



PLATFORM COMPONENT LOCATOR
(MODEL 41/24 SHOWN)



LUBRICATION DIAGRAM



LUBRICATION CHART

ITEM NO.	DESCRIPTION	SPECIFICATION (QUANTITY)	FREQUENCY OF LUBRICATION
1	PLATFORM ROTATOR GEAR BOX	EP - 90W (HALF FULL).	CHECK MONTHLY OR EVERY 100 HRS. *, CHANGE YEARLY OR EVERY 1,000 HRS.*
2	HYDRAULIC RESERVOIR	MOBIL DTE-15 TO FULL MARK W/ ALL CYLINDERS RETRACTED.	CHECK DAILY, ANALYZE EVERY 6 MONTHS, CHANGE YEARLY.
3	BOOM SLIDE	DRY SILICONE LUBRICANT	MONTHLY OR EVERY 100 HRS.*
4	SWING BEARING	LUBRIPLATE #630-2 (PURGE OLD GREASE)	MONTHLY OR EVERY 100 HRS.*
5	PIVOT PINS	EP N.L.G.I. #2 (PURGE OLD GREASE)	MONTHLY OR EVERY 100 HRS.*
6	SWING BEARING GEAR TEETH	DRI-LUBE (MOLYKOTE 321R OR EQUIVALENT)	EVERY 6 MONTHS OR 500 HRS.*
7	STEERING SPINDLES	EP N.L.G.I. #2 (PURGE OLD GREASE)	MONTHLY OR EVERY 100 HRS.*
8	STEERING HUB BEARINGS	LUBRIPLATE #630-2 (CLEAN AND REPACK)	YEARLY OR EVERY 1,000 HRS.*
9	STEERING LINKAGE	EP N.L.G.I. #2 (PURGE OLD GREASE)	MONTHLY OR EVERY 100 HRS.*
10	SWING DRIVE GEAR BOX TOP BEARING (41/24)	EP-90W (TO FILL PLUG) EP N.L.G.I.	CHECK MONTHLY OR EVERY 100 HRS.*, CHANGE EVERY 12 MONTHS
11	PLATFORM ROTATOR SHAFT	EP N.L.G.I. #2 (PURGE OLD GREASE)	MONTHLY OR EVERY 100 HRS.*
12	DIFFERENTIAL	EP-90W (TO FILL PLUG)	CHECK MONTHLY, CHANGE EVERY 6 MONTHS
13	SPEED REDUCER	EP-90W (TO FILL PLUG)	CHECK MONTHLY, CHANGE EVERY 6 MONTHS
14	BRAKE	MOBIL DTE-15 (OUTER SECTIONS - TO FILL PLUG)	CHECK M0NTHLY, CHANGE EVERY 6 MONTHS
15	CONTROL VALVE HANDLE PIVOT PINS	WD40 OR SILICONE SPRAY	MONTHLY OR EVERY 100 HRS*

* WHICHEVER OCCURS FIRST.

EMERGENCY PROCEDURES

⚠ WARNING

IF THE POWER FAILS WHILE THE OPERATOR'S PLATFORM IS RAISED OR EXTENDED, DO NOT ATTEMPT TO CLIMB DOWN THE BOOM ASSEMBLY. SERIOUS INJURY MAY RESULT.

EMERGENCY HAND PUMP

Each SILVER-EAGLE has an emergency hand pump which can be operated from the ground control station. The pump is located in the side compartment containing the hydraulic controls, mounted on top of the hydraulic tank.

To safely return the platform to the ground position, attach the handle (stored on top of the control panel) to the emergency pump. Close the release valve on top of the pump, pump the handle and operate the boom control levers to lower and retract the boom sections.

Always use caution in selecting the correct valve lever to bring the operator to safety.

EMERGENCY MOVEMENT

The emergency pump will not provide control or operation of the drive or steering functions. Should it be necessary to move or steer the unit, you must do the following:

NOTE

Unit must be blocked or attached to the tow vehicle prior to the following steps.

WITHOUT OPTIONAL TOWING PACKAGE:

Remove drive shaft from rear (drive) axle. Remove steering cylinder rod end pin from steering linkage, allowing steering wheels to track tow vehicle.

WITH OPTIONAL TOWING PACKAGE:

Pull lever provided to disengage rear (drive) axle and pull control valve to allow steering wheels to track tow vehicle.

EMERGENCY LOWERING

SITUATION: Platform elevated, operator not incapacitated, but unit will not respond to platform controls.

⚠ WARNING

DO NOT TRY TO CLIMB DOWN THE BOOM.

HAVE AN EXPERIENCED OPERATOR USE THE EMERGENCY PUMP TO SAFELY LOWER THE PLATFORM.

POSSIBLE CONDITION:

- One or more functions not operating correctly.
- Unit movement from unselected control lever.
- Unit function will not stop unless power is switched off.

CORRECTIVE ACTION:

1. Remove foot from foot pedal.
2. Evaluate the nature of the failure. Return to the ground if possible. If the condition will not allow you to return to the ground, contact an experienced operator to lower the machine using the emergency hand pump and lowering procedure.
3. **Report the incident to your supervisor immediately.**

SITUATION: Unit elevated with operator incapacitated at platform controls.

⚠ WARNING

DANGER!!! DO NOT TOUCH UNIT!!! DETERMINE THE CAUSE OF THE PROBLEM BEFORE YOU TOUCH THE MACHINE.

CORRECTIVE ACTION:

1. Have someone summon first aid or rescue squad.
2. Attempt to talk to operator before taking any rescue measures.
3. **Check to see if operator is in a pinned position before attempting emergency lowering procedure.**
4. After establishing that the machine is not in contact with live power lines, lower the platform using the emergency lowering procedure .
5. Render first aid to the operator.

SITUATION: Platform in contact with live power lines, operator incapacitated.

⚠ WARNING

DANGER!!! DO NOT TOUCH UNIT!!!!

CORRECTIVE ACTION:

1. Contact authorized personnel to disconnect power supply touching unit.
2. Have someone summon first aid or rescue squad.
3. If operator is unconscious, check to see if he is in a pinned position.
4. AFTER POWER IS CUT, use the emergency lowering procedure to bring platform with operator to a safe location to render first aid.

NOTE

Any incident involving personal injury must be immediately reported to the local Simon Aerials Distributorship as well as to Simon Aerials, Inc.

HYDRAULIC FLUID

HANDLING PRECAUTIONS

⚠ WARNING

PERSONS IN REGULAR CONTACT WITH MINERAL OILS NEED TO BE AWARE OF THE IMPORTANCE OF THOROUGH HYGIENE, AND THE PROPER METHODS FOR HANDLING MINERAL OILS IN ORDER TO AVOID POTENTIAL HAZARDS TO HEALTH.

If mineral-based hydraulic fluid is SPLASHED INTO THE EYES, it must be WASHED OUT THOROUGHLY using abundant quantities of water. If irritation persists, medical advice should be sought.

Mineral oils act as solvents on the natural oils in the skin. FREQUENT AND PROLONGED SKIN CONTACT CAN CAUSE DERMATITIS OR SEVERE IRRITATION. Mineral-based hydraulic fluids normally present no health hazard when used intelligently. Protective clothing and proper washing facilities should be provided or be accessible.

⚠ WARNING

HYDRAULIC FLUID UNDER PRESSURE CAN PENETRATE AND BURN THE SKIN, DAMAGE EYES, AND MAY CAUSE SERIOUS INJURY, BLINDNESS, AND EVEN DEATH.

FLUID LEAKS UNDER PRESSURE MAY NOT ALWAYS BE VISIBLE.

IF MINERAL-BASED HYDRAULIC FLUID HAS PENETRATED THE SKIN, IT MUST BE SURGICALLY REMOVED, BY A DOCTOR FAMILIAR WITH THIS TYPE OF INJURY, WITHIN A FEW HOURS.

FLUID RECOMMENDATIONS

We strongly recommend the use of MOBIL DTE-15 HYDRAULIC FLUID. An EXACT substitute can be used if absolutely necessary. Mineral-based hydraulic fluids produced by different companies will USUALLY mix with each other satisfactorily, but this IS NOT RECOMMENDED. When in doubt, consult your supplier.

MOBIL DTE-15 has proven to be suitable for use in all climates. For continued operation in temperatures below 32° F (0° C), the use of MOBIL DTE-13 or DTE-11 FLUID may prove satisfactory.

For operation in tropical climates, the use of MOBIL DTE-16 is allowable.

FLUID CONTAMINATION CHECKS

Use the following as a guide to determine when analysis of the hydraulic fluid is necessary.

- Any time the motor driven hydraulic pump is replaced.
- If fluid discoloration is noticed in the hydraulic reservoir sight tube.
- If, after the first 50 hours of operation, the hydraulic filter elements are plugged.
- Any time the hydraulic filter elements show signs of metal content.
- If valve spools at either operator's station have continuous sticking problems which are not corrected by lubrication.
- Once a year, under normal operating conditions.
- Every 6 months, in extremely dusty or dirty operating conditions.

The hydraulic fluid analysis must be done by a qualified laboratory. To insure that you receive accurate recommendations about the fluid being analyzed, always provide the following information with the test sample.

- Type of hydraulic fluid. (See lubrication chart)
- Model and serial number of unit from which sample was taken.
- Purpose of analysis: i.e. pump failure, discoloration, etc.
- Type of analysis: i.e. complete to show additive breakdown, acid buildup, viscosity, type and percent of contaminants. Comparison to new fluid and recommendations.

Comply with contamination analysis and recommendations to achieve a clean, contamination free hydraulic system.

Following the above guide will prevent premature failure of pumps, cylinder seals and drive motors, and will prevent unnecessary down time.

If system flushing and replacement of fluid is recommended, refer to the following flushing procedure.

SYSTEM FLUSHING PROCEDURE

With BOOMS DOWN AND FULLY RETRACTED (in stowed position), drain hydraulic fluid from main hydraulic tank into a clean, empty container. This can be done with an oil filter cart so the fluid may be reused if analysis is good.

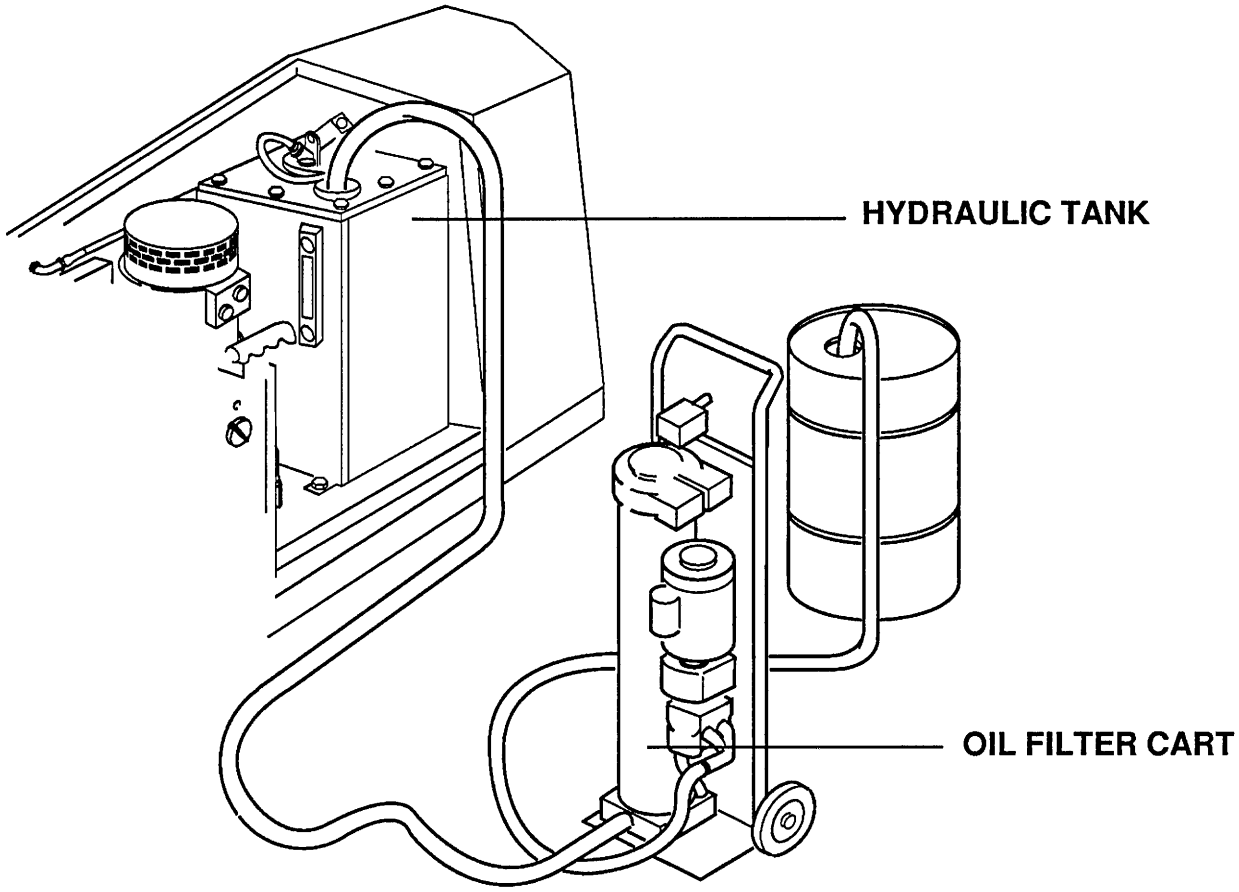
When the hydraulic tank is empty, remove suction hoses between tank and pump. Remove hoses between pump and main valve bank. Flush the hoses. Remove hydraulic fluid filter, and flush the filter body and attaching hoses. Discard old filter element and replace.

With hoses removed from the hydraulic tank, open tank bottom drain and flush out the tank. When this is completed, all the hoses removed in the previous steps should be properly reinstalled except the system return line to tank. This hose should be lengthened to drain into the container used for the reservoir fluid.

If the hydraulic fluid removed from the reservoir is good, it can now be pumped (through a filter cart) back into the tank. If fluid is not usable, fill hydraulic tank with filtered, fresh hydraulic fluid (refer to Lubrication Chart).

Make sure the suction line valves are opened to allow fluid to flow to the hydraulic pump. Loosen hose fittings at pump to allow pump to flood with hydraulic fluid, then tighten pump fittings.

Turn main power key switch "ON". Press "Power" button to engage pump. Use care when doing this as hydraulic fluid is now being returned to container provided above. This will remove old fluid from the rest of the hydraulic system as each function is cycled to its maximum limits.



Filling Hydraulic Tank.

⚠ CAUTION

Monitor the hydraulic reservoir fluid level when cycling the unit functions, adding fluid as necessary to replace that being discharged to container at system return line. This fluid may be returned to the reservoir through a filter cart, if good.

Three cycles of ALL hydraulic cylinder functions should remove enough old hydraulic fluid from the system.

When the above procedures have been completed, re-connect all hoses including system return hose to tank. Fill the hydraulic reservoir to full mark on sight gauge.

Operate all functions to their full extreme positions to insure proper operation.

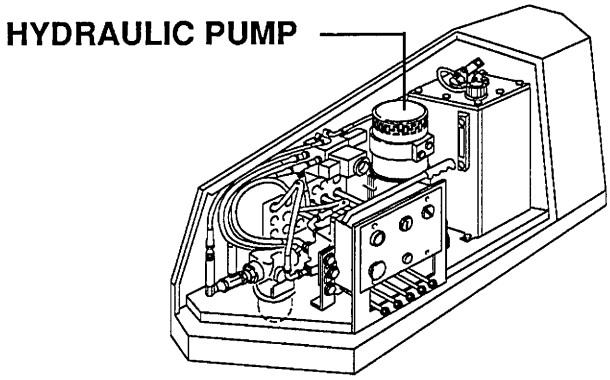
Check for leaks and correct as necessary. Unit is now ready to be placed back in operation.

HYDRAULIC SYSTEM

Following is a description of the major components of the SILVER-EAGLE hydraulic system.

HYDRAULIC MOTOR PUMP

A 48 volt DC motor, started by a heavy duty contactor, drives the hydraulic pump. The pump provides hydraulic fluid flow to the system manifold block to operate the functions as called for by the operator when either the ground control power switch or platform foot switch are activated.



Hydraulic Pump Location.

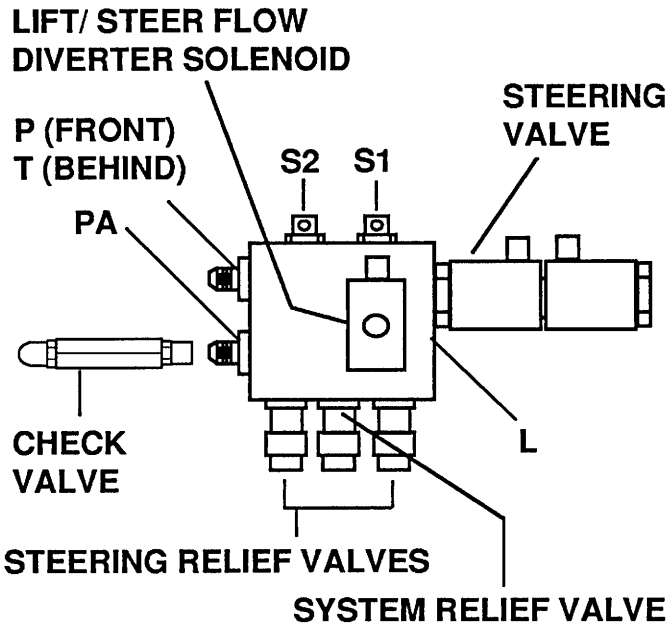
MANIFOLDS

The hydraulic system manifold block, located on the superstructure base, controls hydraulic fluid flow to operate the lift, drive and brake functions of the machine.

The return manifold block collects and returns the hydraulic fluid to the tank.

Hydraulic fluid flow from the pump is directed to the manifolds, and dispersed to the valves controlling machine functions thru ports identified by letters or numbers stamped into the blocks. Refer to "Machine Specifications" for system pressures.

Port marked "P". Hydraulic fluid from the pump enters at this port and flows to the **lift/ steer flow diverter valve** (on the front of the manifold). When the "DRIVE" function is selected, the lift/steer diverter sends fluid to the 4-way, 3-position directional solenoid **steering valve**.



Hydraulic System Manifold Block.

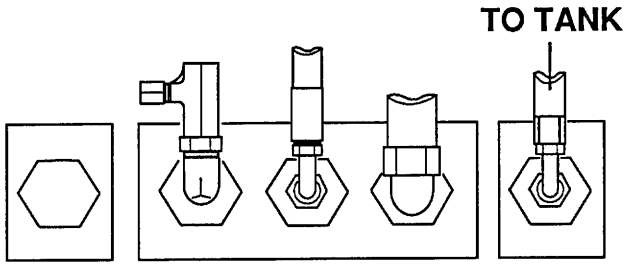
When steering is initiated, this valve opens to direct fluid flow through **port "S1"** or **"S2"** to the double-acting steer cylinder end ports to steer the wheels left or right. When the "Lift" function is selected, the lift/steer diverter switches, sending fluid out through **port "L",** to the ground or platform valve banks, to control the lift functions.

Port marked "PA". Fluid leaves the manifold through this port and travels to the **brake control solenoid valve**. When the drive control lever is activated, the brake valve allows fluid to flow to the hydraulic drive line brake, releasing it and allowing the machine to move. When the drive control lever returns to the center (neutral) position, fluid flow to the brake is cut, and the brake engages.

There is an **adjustable needle valve** in the brake line, on the undercarriage near the accumulator, which allows a free flow of fluid to release the brake and controls flow when the brake is engaged to prevent sudden stops.

Port marked "T". This port directs fluid flow through the return manifold, and back to the hydraulic tank.

There are three relief valve ports located on the bottom of the hydraulic system manifold block. The front (center) port holds the **system relief valve**, and the other two hold the **steering cross port relief valves**.



Return Manifold Block.

The return manifold block contains four ports. It collects and returns the hydraulic fluid to the tank. One port receives fluid from the brake, one port from the steering system and one from the lift valve bank. The end port returns the fluid to the tank.

MANIFOLD MAINTENANCE

Operate the motor, and check the manifold block and solenoid securing bolts for tightness. Check the security and condition of hoses, cables and wire connections.

RELIEF VALVES

NOTE

Refer to "Machine Specifications" to determine maximum system pressure for your SILVER-EAGLE.

SYSTEM RELIEF VALVE

To check system relief valve setting, connect pressure gauge to pressure test fitting, located at the pump input port of the ground control valve bank. Select "GROUND" at the platform/ ground selector switch. Turn the main power switch "ON". With the BOOM FULLY RETRACTED, operate the telescope lever "IN". In this situation, fluid will be directed through the system relief valve. Note pressure reading.

To adjust system relief valve, turn adjusting bolt on the end of the valve CLOCKWISE TO INCREASE PRESSURE, and COUNTER-CLOCKWISE TO DECREASE PRESSURE.

WITH BOOM FULLY RETRACTED, continue to operate the telescope lever "IN" , while turning adjusting bolt until proper reading is achieved. Lock the adjusting bolt.

STEERING CROSS PORT RELIEF VALVES

Select "PLATFORM" at the platform/ground selector switch. Turn the lift/ drive selector to "DRIVE" and operate "Steer Left" on the drive control lever (the pump should operate and the wheels should steer to the left). TURN THE IGNITION KEY SWITCH "OFF".

Connect a pressure gauge to the high pressure test point on the accumulator block, located beneath the chassis. TURN THE IGNITION KEY SWITCH "ON", and operate "Steer Left" until wheels have reached full left position.

Note pressure reading (should be equal to pump pressure. Refer to "Machine Specifications").

NOTE

If the pressure is too low, adjust the appropriate cross port relief valve (the two valves behind the system relief valve) on the hydraulic system manifold block.

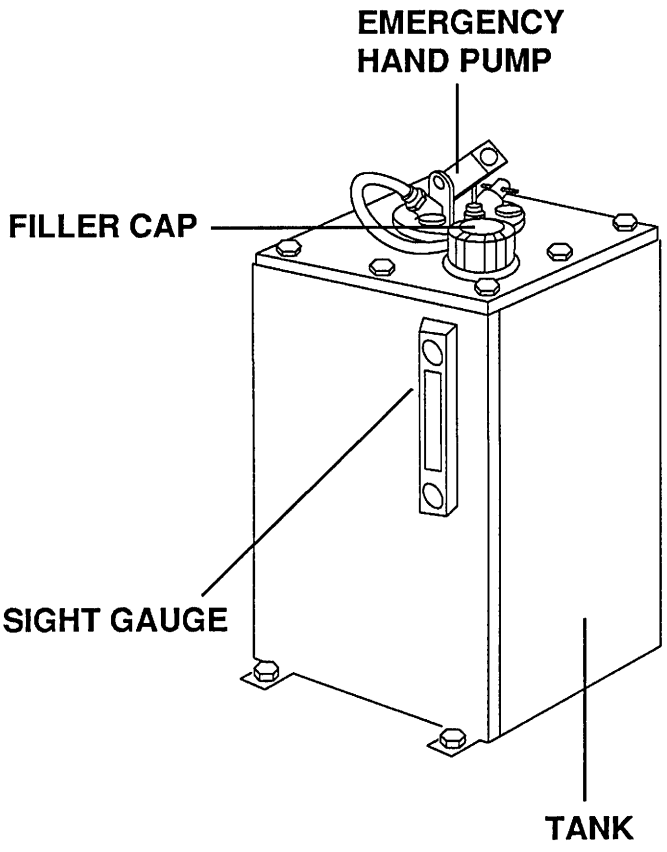
Repeat the procedure for "Steer Right" by adjusting the remaining cross port relief valve.

HYDRAULIC FLUID RESERVOIR

The hydraulic fluid reservoir consists of the tank, a filler cap with strainer, a return line defuser, and a suction filter. An emergency hand pump is also included as a permanent part of the hydraulic circuit, for emergency use.

HYDRAULIC RESERVOIR MAINTENANCE

Check tank for signs of leakage. Inspect tank securing bolts for tightness. Check hand pump operation by closing the release valve, engaging one of the machine function levers and operating the pump handle.



Hydraulic Tank.

EMERGENCY HAND PUMP

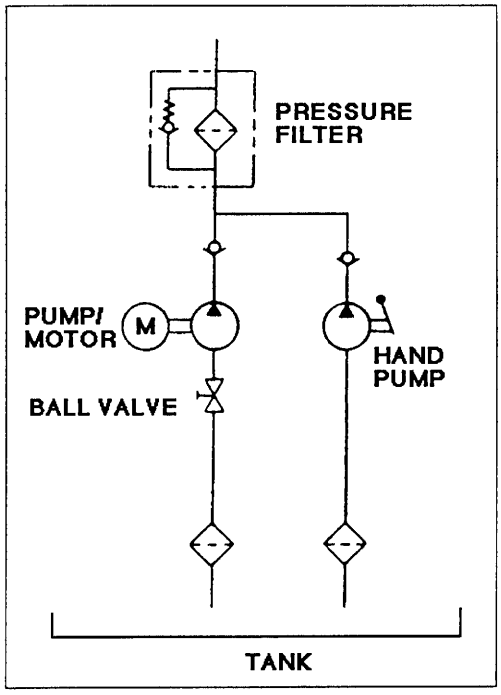
The emergency hand pump is located on top of the hydraulic tank. It is meant to be used only when the ground and platform controls are inoperative due to motor, pump or control system failure.

The pump handle is stored near the tank, and a release valve mounted on the pump must be closed before operating the hand pump.

There are also two check valves in the system. One prevents hydraulic fluid from entering the hand pump from the hydraulic pump. The other allows the fluid to flow from the hand pump to the filter, then to the manifold block and to the ground valve bank.

Check the operation of the emergency hand pump (see "Hydraulic reservoir maintenance").

Check for leaks around the pump gasket. If the hand pump will not operate, the internal filter may be clogged. Remove the filter and clean it by backwashing.



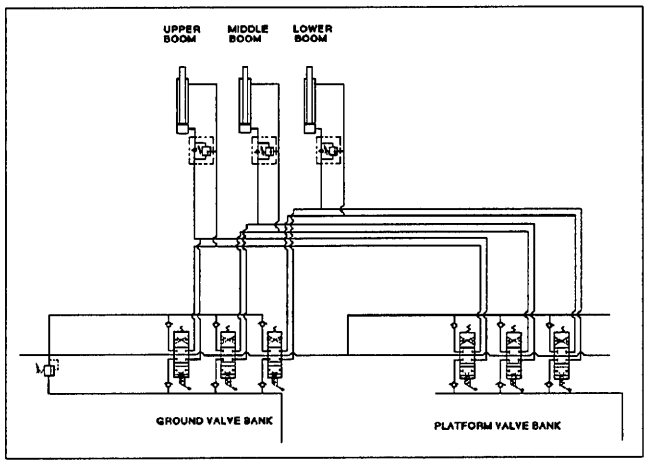
Emergency Pump Hydraulic Schematic.

BOOM LIFT SYSTEM

When the pump push button at the ground control station or the foot pedal on the platform floor is pressed and held, fluid is sent from the manifold block to the ground and platform hydraulic control valve banks.

All boom sections are then controlled by moving the proper control lever in the desired direction. THE SPEED OF BOOM MOVEMENT IS PROPORTIONAL TO THE AMOUNT OF CONTROL LEVER THROW.

Each boom function is controlled by a double acting cylinder. Each cylinder contains a counterbalance valve, which will prevent unintended movement of the cylinder should a hose or fitting develop a leak. When a boom section is lowered, fluid flows to the rod end cylinder port and to the counterbalance valve, opening this valve and allowing fluid in the base end of the cylinder to flow back to the tank.



Lift System Hydraulic Schematic.

BOOM LIFT SYSTEM TROUBLESHOOTING

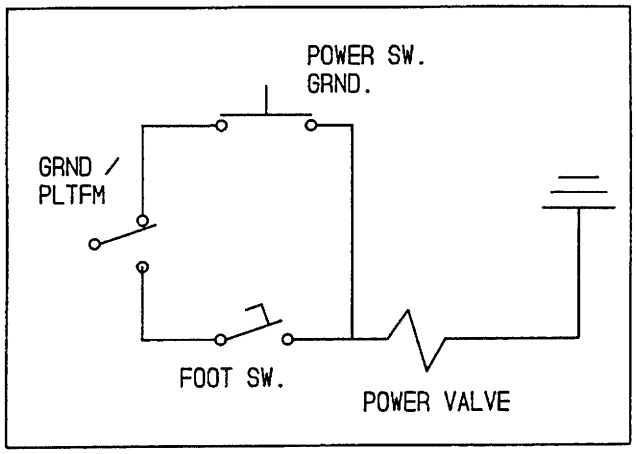
Problem: No boom functions operate from either ground or platform control stations.

Check boom functions from ground control station with motor off, using emergency hand pump.

IF ALL BOOM SECTIONS CAN BE RAISED AND LOWERED slightly with the hand pump, the ground control valve bank is good, and it will be necessary to investigate the hydraulic system, or electrical control system ahead of the control valve banks.

If any boom section FAILS TO OPERATE FROM THE GROUND CONTROL PANEL, using the hand pump, the problem may be in the ground control valve bank. Check the inoperative boom function with the platform control and the hand pump. If an assistant is not available for this procedure, the platform control lever can be tied into position.

If any boom function FAILS TO OPERATE FROM THE PLATFORM CONTROL PANEL using the hand pump, the problem may be a defective holding valve. Remove the holding valve to check for foreign material or internal damage. If faulty, the holding valve must be replaced.



Electrical Schematic.

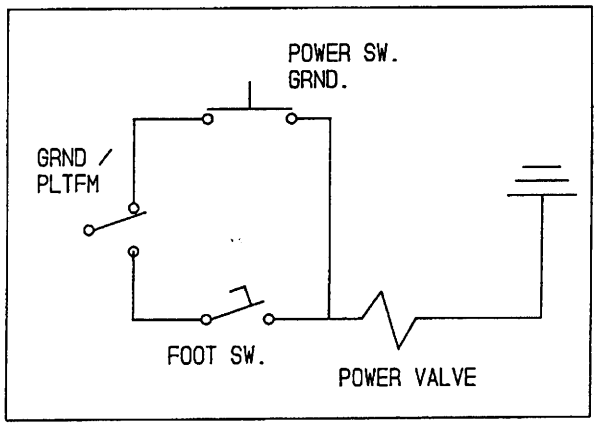
BOOM EXTEND SYSTEM

When the pump push button at the ground control station or the foot pedal on the platform floor is pressed and held, fluid is sent from the manifold block to both the ground and platform hydraulic control valve banks.

The boom extend (telescope) cylinder is then controlled by moving the telescope control lever in the desired direction. THE SPEED OF EXTEND OR RETRACT IS PROPORTIONAL TO THE AMOUNT OF CONTROL LEVER THROW.

The boom extend cylinder is a double acting cylinder, and contains a double acting check valve block located at its base. This check valve prevents the cylinder from moving in or out in the event of a hose or fitting failure. Cylinder movement should only occur when the control valve lever is moved to the "IN" or "OUT" position.

When extending the boom, fluid flows to the base end of the extend cylinder, with a pilot pressure in the base check valve going to open another check valve in the rod end. This allows the fluid displaced by the piston inside the cylinder to flow out of the rod end and back to the tank. When the boom is retracted, fluid flow to the rod end of the cylinder opens the base end check valve, allowing displaced fluid to return to the tank. This prevents the boom from extending or retracting unless called for by a control valve.



Electrical Schematic.

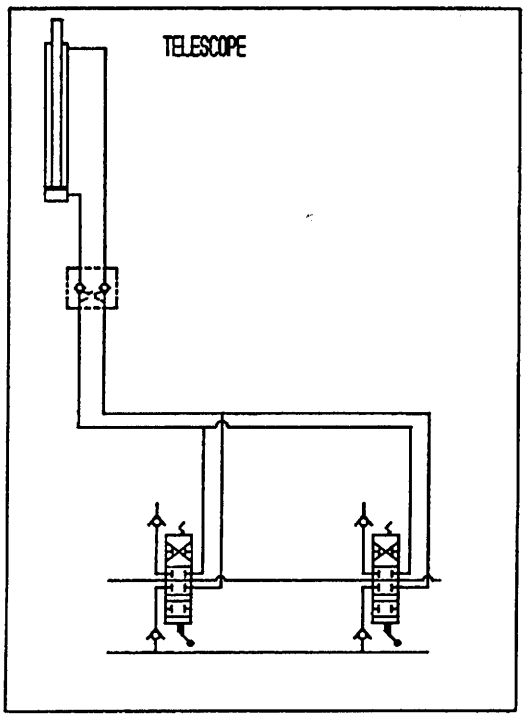
EXTEND SYSTEM TROUBLESHOOTING

Problem: Boom will not extend from either ground or platform control stations.

Check boom extend function from ground control station with motor off, using emergency hand pump. If boom CAN BE EXTENDED AND RETRACTED SLIGHTLY with the hand pump, the ground control valve bank is good, and it will be necessary to investigate the hydraulic system manifold, or electrical control system.

If boom FAILS TO EXTEND OR RETRACT FROM THE GROUND CONTROL PANEL using the hand pump, the problem may be in the ground control valve bank. Check with the platform "Boom Telescope" control and the hand pump.

If boom extend function FAILS TO OPERATE FROM THE PLATFORM CONTROL PANEL using the hand pump, the problem may be a defective double acting check valve, or bad cylinder rod packing. Disassemble check valve to check for foreign material or internal damage. If necessary, disassemble cylinder for inspection.



Extend System Hydraulic Schematic.

SWING SYSTEM

When the pump push button at the ground control station or the foot pedal on the platform floor is pressed and held, fluid is sent from the manifold block to the ground and platform hydraulic control valve banks.

Superstructure swing (rotation) is then controlled by moving the swing control lever in the desired direction, left (clockwise) or right (counterclockwise). SPEED OF SWING IS PROPORTIONAL TO THE AMOUNT OF CONTROL LEVER THROW. Pressure relief is provided by the system relief valve.

The hydraulic swing motor is a gear motor that drives through the swing gearbox to rotate the superstructure. The direction of the flow of hydraulic fluid through the motor will cause left or right swing.

The swing gearbox output pinion gear mates with teeth on the swing bearing mounted to the undercarriage.

The superstructure can swing 360 degrees (non-continuous). There is a mechanical stop to prevent overtravel.

SWING SYSTEM TROUBLESHOOTING

Problem: Swing motor will not run in either direction.

Check swing function from ground control station with motor off using emergency hand pump.

If swing FUNCTIONS with the hand pump, check lift power switch control solenoid valve at hydraulic system manifold block.

If swing DOES NOT FUNCTION with the hand pump, check for mechanical malfunctions.

The mechanical swing stop may be preventing rotation in one direction. Try to operate swing function in opposite direction.

The swing gearbox pinion shaft may be broken. Remove and disassemble worm drive swing gearbox and replace pinion shaft. Re-install gearbox. Be sure bolt heads are recessed in the motor mounting bracket. Check for proper gear adjustment.

The hydraulic swing motor shaft may be broken. Remove and replace swing motor.

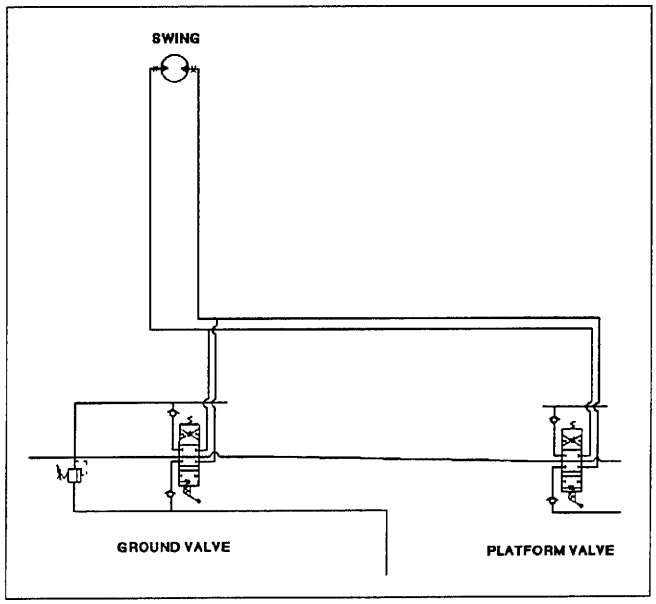
The swing motor pinion key to the gearbox may have sheared off. Remove and replace key.

SWING GEAR ADJUSTMENT

If the pinion gear teeth are not engaged properly to the teeth on the swing bearing, loosen the four mounting bolts holding the swing motor mounting bracket.

Turn the worm gear shaft (on the side of the motor housing) with a socket wrench until the pinion gear teeth mesh properly.

Tighten the adjusting screw to obtain .004 to .006" (.10 to .15 mm) gap at gear teeth. Check for minimal backlash and NO INTERFERENCE throughout entire range of swing gear travel. Tighten lock nut on adjusting screw. Tighten the mounting bolts to the recommended torque.

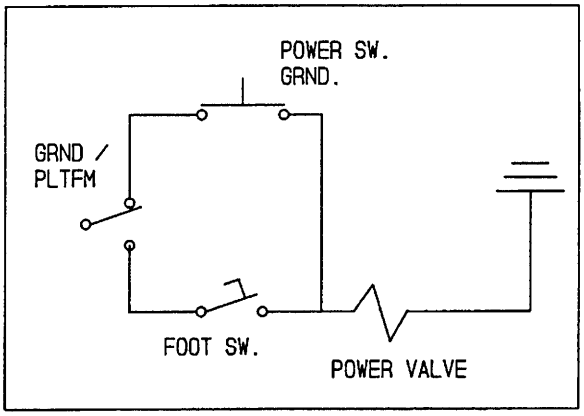


Swing System Hydraulic Schematic.

PLATFORM LEVELING SYSTEM

The platform leveling system automatically keeps the platform level, using a master/ slave cylinder arrangement. As the upper boom is raised or lowered, fluid is forced from one cylinder to the other in a closed loop, which keeps the platform parallel to the ground in any boom position. Due to slight internal leakage, fluid may at times need to be added to the leveling circuit through the platform leveling control valve.

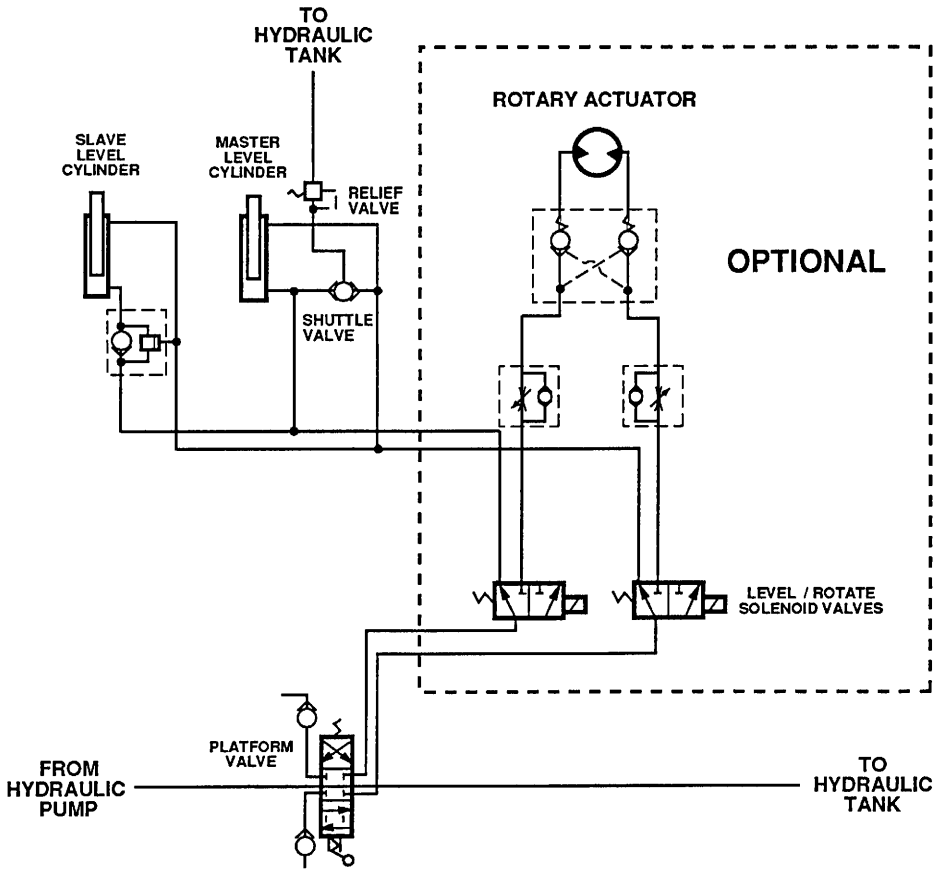
The platform level system is only controlled from the platform controls. The ground/ platform selector switch on the ground control panel must be in the "PLATFORM" position. The platform lift/ drive selector switch must be in the "LIFT" position. With the foot switch depressed, you can now level the platform by moving the platform level control lever in the direction desired. AMOUNT OF CONTROL LEVER THROW CONTROLS SPEED OF LEVEL.



Electrical Schematic.

A holding valve on the slave cylinder acts as a safety valve in case of a hose or fitting failure. The holding valve prevents unintended travel of the platform through the use of a counterbalance valve, which is opened only by pilot pressure from the control valve or master cylinder.

On models equipped with the optional hydraulic platform rotator, hydraulic fluid flows to the platform leveling circuit from the platform control valve through a pair of 3-way, 2-position control valves mounted behind the control console.



Platform Level Hydraulic Schematic.

PLATFORM LEVELING SYSTEM TROUBLESHOOTING

Problem: Platform will not react to platform level control lever movement (models with hydraulic rotator).

With foot pedal depressed, move control lever in both directions. If platform DOES NOT RESPOND at all, one or both solenoid activated control valves may not be shifting. If platform ATTEMPTS TO MOVE or LEAKS DOWN (slowly drifts out of position), the problem is at slave cylinder.

Check shuttle and relief valves at master cylinder.

Problem: Platform leaks down.

Remove line from slave cylinder holding valve to control valve.

If platform leaks down and hydraulic FLUID FLOWS from holding valve, remove holding valve and inspect it for damage or dirt. Clean or replace as necessary.

If cylinder leaks down, but NO FLUID FLOWS from holding valve, problem is in slave cylinder. Remove, inspect and repack the slave cylinder as needed.

PLATFORM ROTATE SYSTEM

A hydraulic platform rotator is an available option on the SILVER-EAGLE.

The optional hydraulic platform rotate circuit consists of a rotary actuator locked in position by a double acting pilot operated check valve. Rotation of the platform is controlled through the shared use of the platform leveling control valve, which is found only on the platform control panel.

The ground/ platform selector switch on the ground control panel must be in the "PLATFORM" position, and the level/ rotate selector switch must be in the "ROTATE" position. With the foot pedal depressed, you can now rotate the platform by moving the platform level/ rotate control lever in the direction desired. SPEED OF ROTATION IS PROPORTIONAL TO THE AMOUNT OF CONTROL LEVER THROW.

ROTATE SYSTEM TROUBLESHOOTING

Problem: Platform will not react to platform rotate control lever movement.

Adjust the flow controls (located between the control valves and the pilot operated check block) to see if that will allow the platform to rotate.

If that does not solve the problem, turn level/ rotate selector switch to the "LEVEL" position, and operate the platform level control. If the leveling circuit works, the problem is not in the manual control valve.

Turn level/ rotate selector switch to the "ROTATE" position, and operate the control in both directions.

If rotator does not operate IN EITHER DIRECTION, one or both of the solenoid activated control valves is not shifting.

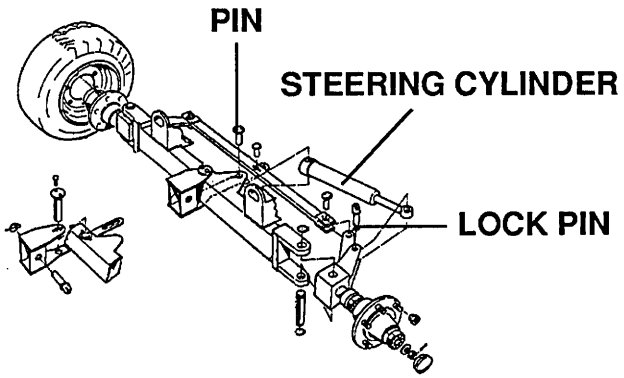
If rotator works IN ONE DIRECTION, look for physical constraints or foreign material restricting platform rotation.

Problem: Platform rotates faster in one direction than the other.

Re-adjust the flow controls (located between the control valves and the pilot operated check block) to allow smooth, even travel.

STEER SYSTEM

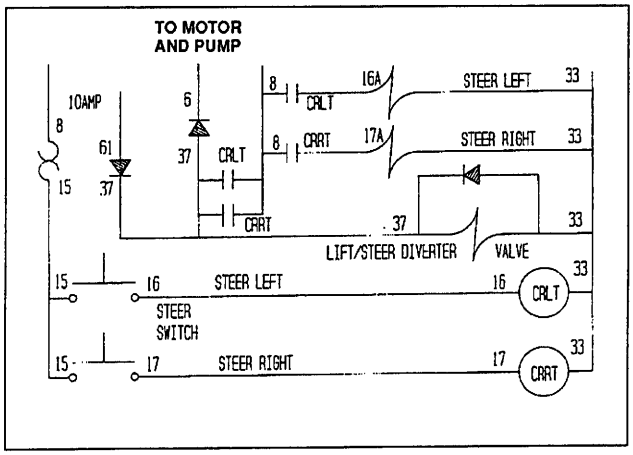
The steering circuit is controlled by a 4-way directional solenoid valve mounted in the hydraulic system manifold block. This valve is activated by a thumb button on top of the drive control lever. When the thumb button is pressed to steer "LEFT" or "RIGHT", the valve spool shifts to allow fluid flow to either the rod end or blank end of the steer cylinder. The blank end of the steer cylinder is attached to the undercarriage, while the rod end is connected to the steering axle linkage. There are two steering cross port relief valves in the hydraulic system manifold block.



Steering Assembly Component Location.

STEER SYSTEM MAINTENANCE

Check all pins on steering linkage for excessive play, and ensure that all clips are in place and secure. Lubricate linkage as necessary. Check steering cylinder pins for excessive play. Check cylinder and hoses for hydraulic fluid leakage and security.



Steer System Electrical Schematic.

STEER SYSTEM TROUBLESHOOTING

Problem: Unit will not steer; all other functions operate.

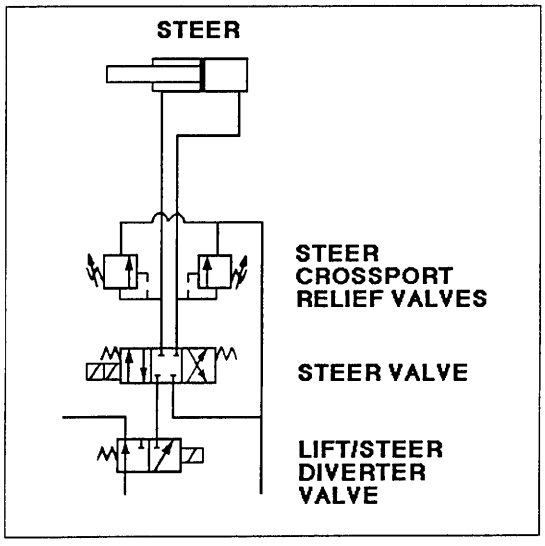
Steer cylinder may not be mechanically connected to steering linkage. Check for disconnected or damaged steering linkage.

The steering solenoid valve may not be shifting. The valve spool may be stuck, the solenoid may not be energizing, or there may be open wires in the steering circuit.

Locate steering valve on manifold. Check to see if the solenoids, located on this valve, are being energized. If power is reaching the solenoids, either one or both solenoids are defective or the valve spool is obstructed. Remove valve and inspect, clean, repair or replace as needed. If solenoids are not being energized, check for continuity in the wire harness to the steering control switch on the drive lever.

NOTE

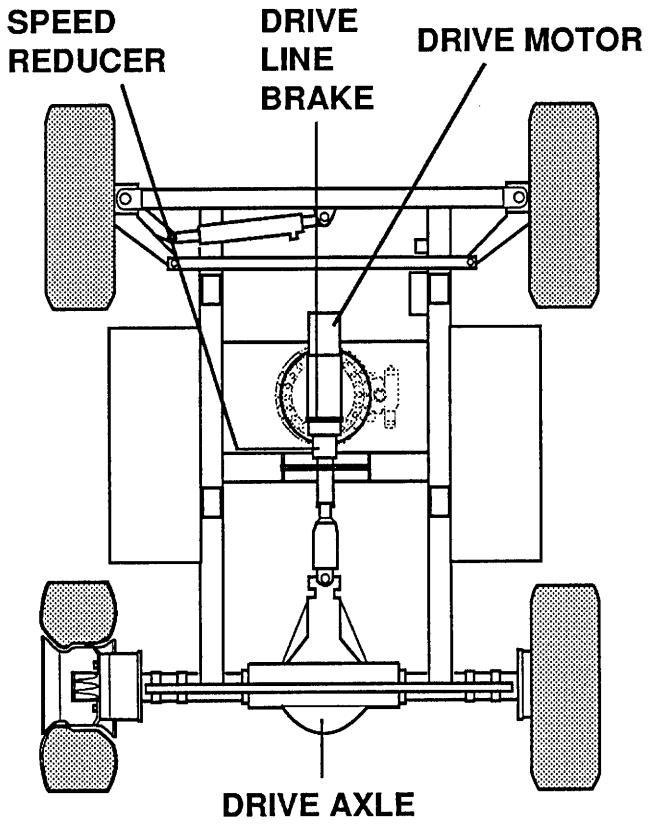
On units with the Tow Package option, check the steering tow release valve for proper position.



Steer System Hydraulic Schematic.

DRIVE SYSTEM

Following is a description of the major components of the SILVER-EAGLE drive system.



Drive System Components.

DRIVE MOTOR

The drive motor is a 48 volt series wound reversible motor, controlled by a motor controller.

DRIVE MOTOR MAINTENANCE

Check all securing bolts for tightness. Check all cables for security and signs of chafing. Apply grease to motor terminals to prevent corrosion.

When troubleshooting the electrical circuit; if the controller is good, test the motor.

Remove motor from the machine, but keep it wired to the electrical circuit. Apply current to the motor, using the drive control lever. If drive motor doesn't turn, the motor is bad and must be replaced.

DRIVE LINE BRAKE

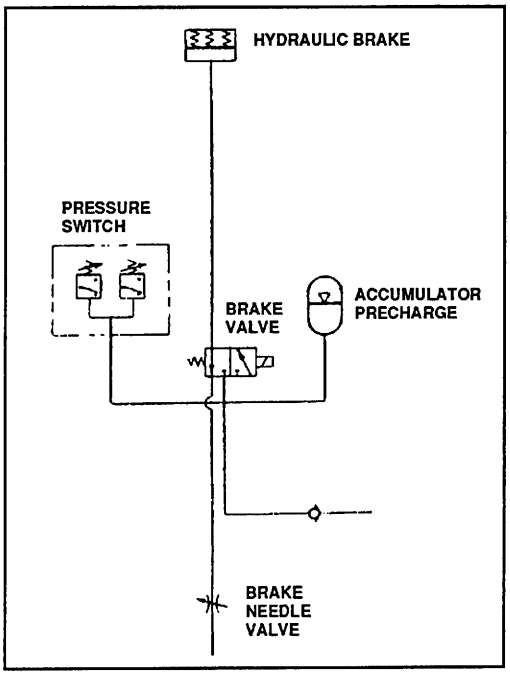
The spring applied, hydraulically released brake is mounted between the drive motor and the speed reducer. The brake is pressurized, causing it to release, whenever:

- the foot pedal on the platform is pressed and held, AND
- a "drive" function is called for, AND
- the drive controller is moved from its center (neutral) position.

If, at any time during normal operation, the operator moves the drive controller to "NEUTRAL", or releases the power switch or foot pedal, the brake will engage, causing the machine to stop traveling. Drive line brake engagement time is determined by the setting of the needle valve in the hydraulic system manifold block.

BRAKE MAINTENANCE

Check fluid level in two outer sections of brake. There is NO FLUID IN CENTER SECTION. Inspect gaskets for damage. Check for worn out discs or clogged breather plug.



Brake Hydraulic Schematic.

DRIVE LINE BRAKE REPLACEMENT

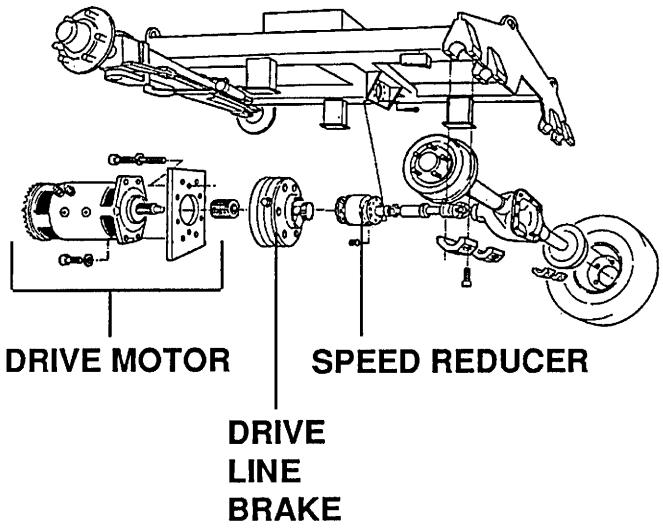
Remove brake line, and drain the hydraulic fluid from the line. Open the drain plug on the drive line brake, and drain the fluid. Remove the two bolts that hold the drive motor to the speed reducer, through the brake. Separate the brake from the motor and reducer.

Position the new brake between the drive motor and speed reducer. Align all three items, and install the two bolts that hold the motor and brake to the reducer. Tighten the bolts.

Attach the brake line. BE SURE THE BRAKE DRAIN PLUG IS CORRECTLY INSTALLED. Add hydraulic fluid.

⚠ WARNING

AFTER BRAKE SERVICING OR REPLACEMENT, TEST THE BRAKE TO ENSURE NO AIR IS TRAPPED IN THE BRAKE LINE, AND BLEED THE LINE IF NECESSARY.



Drive Line Brake Removal and Installation.

SPEED REDUCER

Located between the brake and drive shaft is a single stage speed reducer, consisting of a sun gear and a set of planet (or satellite) gears mounted to a carrier. The speed reducer is in the drive train to reduce the drive motor RPM's, and develop the torque required to move the machine.

SPEED REDUCER MAINTENANCE

Check all securing bolts for tightness. Check for oil leaks. Check the speed reducer oil level, and top off if necessary.

DRIVE SHAFT AND COUPLING

DRIVE SHAFT MAINTENANCE

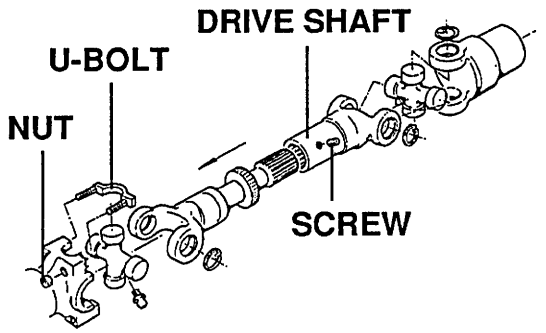
Check the drive shaft securing bolts (at axle end) for tightness. Check the weld at gearbox end for cracks. Check the coupling for cracks and damage.

Drive Shaft Removal.

Remove four nuts and two U-bolts from axle end of shaft. Disconnect bolts connecting drive shaft to gear reducer, and remove drive shaft. Remove retaining screw on drive shaft slip yoke, if necessary, to slide drive shaft apart.

Drive Shaft Installation.

Position the drive shaft, and bolt shaft to gear reducer. Line up U-joint to the axle yoke, and install U-bolts and nuts.



Drive Shaft Removal and Installation.

REAR (DRIVE) AXLE

The rear (drive) axle assembly is a standard Ford light truck axle, with a hypoid gear set consisting of a ring gear and an overhung drive pinion supported by two opposed tapered roller bearings.

Pinion bearing preload is maintained by a pinion nut and selective shims, assuring seating of the inner and outer bearings. The axle housing assembly consists of a cast center section with two steel tube assemblies and a stamped center cover.

If center cover is removed, replace gasket or use RTV sealant (see Parts Catalog).

If removal or adjustment of the internal gears is required, it is recommended that Ford Truck Shop Manual FPS-12107-88A be obtained.

REAR AXLE MAINTENANCE

Check all securing bolts for tightness. Check for oil leaks. Check the differential housing oil level and top off if necessary.

AXLE BRAKES

In addition to the drive line brake found on all SILVER-EAGLES, a pair of drum brakes mounted to the rear axle at each wheel are an available option. Whenever the main power key switch is turned "ON", a valve directs hydraulic fluid pressure from the accumulator to the wheel cylinders, engaging the brakes. The brakes disengage whenever:

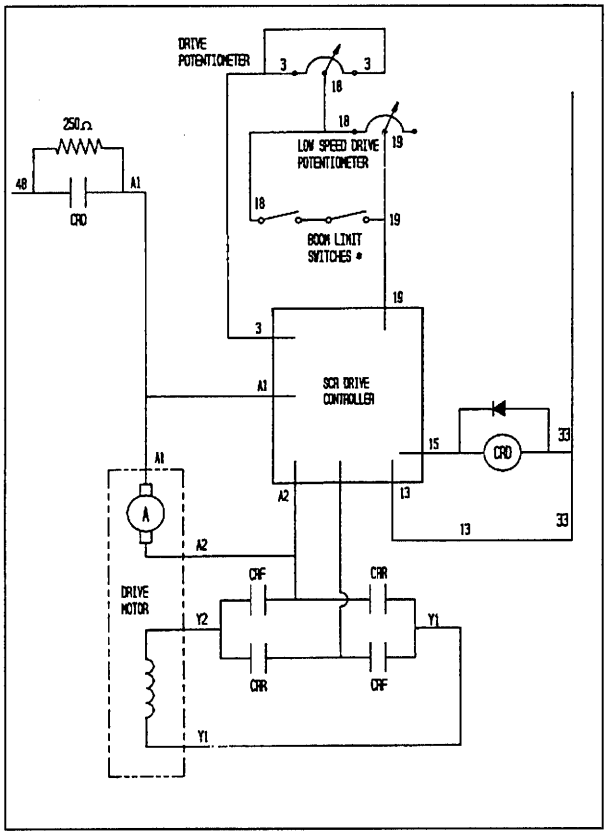
- the lift/ drive selector is turned to "DRIVE", AND
- the foot pedal power switch is pressed, AND
- the drive controller is moved to "FORWARD" or "REVERSE".

If, at any time during normal operation, the operator moves the drive controller to "NEUTRAL", releases the foot pedal, or activates one of the "Emergency Stop" buttons, the axle brakes will engage, causing machine travel to stop. When the main power key switch is turned "OFF", pressure to the axle brakes is relieved as the fluid is allowed to flow back to the tank. The drive line brake acts as a "parking brake".

DRIVE SYSTEM TROUBLESHOOTING

Problem: Unit will not drive either direction.

Brakes may not be releasing due to brake valve not shifting.



Drive System Electrical Schematic.

ELECTRICAL SYSTEM

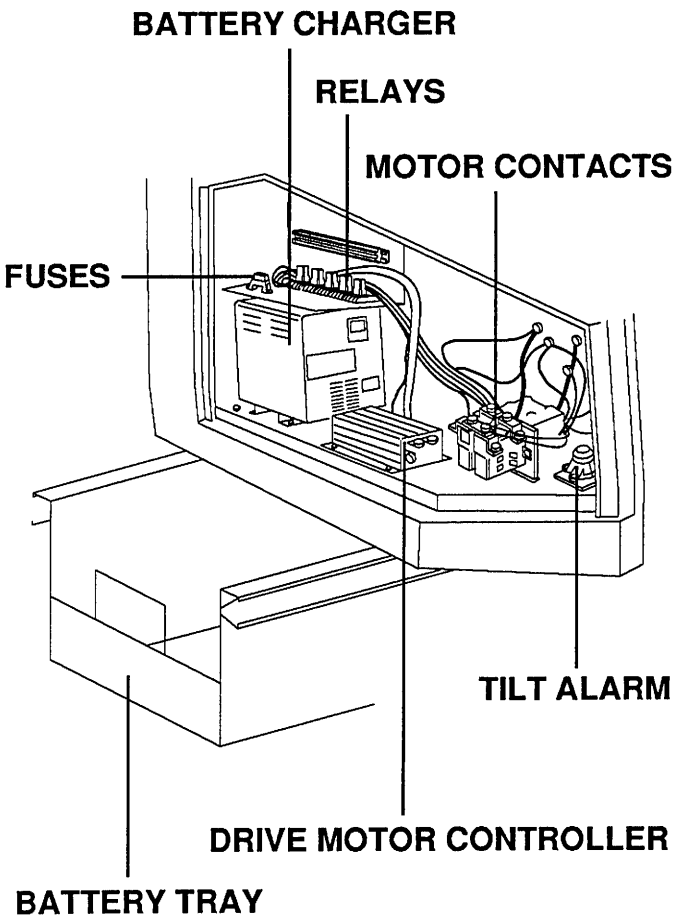
Following is a description of the major components of the SILVER-EAGLE electrical system.

ELECTRICAL CIRCUIT

The main electrical components of the unit are in the electrical cabinet, located on the superstructure. The electrical circuit consists of two distinct parts: the lift circuit and the drive circuit.

The lift circuit consists of two duplicate circuits, controlling lift, telescope, swing and steering functions from either the ground or platform control panel, and selected by a switch on the ground control panel.

The drive circuit controls the drive motor through the motor controller and directional circuitry.



Electrical System Components.

BATTERIES

Eight 6 volt lead-acid batteries are connected in series to provide a 48 volt DC power supply to operate all functions on the electric powered SILVER-EAGLES.

BATTERY MAINTENANCE (IN STORAGE)

Follow these procedures for maintenance of stored batteries:

Keep batteries clean. Electrolyte of "wet" batteries should be checked regularly, and kept at proper levels.

Never stack one battery directly on top of another, as post or container damage can result. If batteries are stored individually, place supporting boards between layers. Do not stack more than three high, and rotate stock so that the oldest batteries are used first.

"Wet" batteries should be kept fully charged. A "wet" battery, while in storage, should be recharged to full charge at the following intervals:

IF STORED AT:	RECHARGE:
Below 40° F (4° C)	None required
40° to 60° F (4° to 15° C)	Every 2 months
Above 60° F (15° C)	Every month

BATTERY MAINTENANCE (IN USE)

Check batteries and mounting frame for signs of damage or corrosion.

Check battery terminals for:

- **Corrosion**. Regularly clean connections and apply a non-metallic grease or protective spray to retard corrosion.
- **Loose connections.** Be sure all cable connections are tight, and that good contact is made to terminals.

- **Broken or frayed cables.** Be sure all cable connections are good, and that no loose or broken wires are exposed. Replace as needed.

Check battery electrolyte level. Replenish the electrolyte, if necessary. Remove vent caps before filling, and USE ONLY DISTILLED WATER. Fill all cells to the proper level. Do not overfill. Fill to level indicator (or 1/2 inch over the top of the separators if there is no level indicator). Fill after charging to prevent overflow of acid due to expansion. Do not use a hose to add water to batteries.

Allowing the electrolyte level to drop below the top of the separators will lead to shortened battery life. Excessive water usage can indicate that a battery has been overcharged, has been subjected to excessively high temperatures, or is nearing the end of its service life.

Keep batteries clean. Wash the tops of the batteries, making sure all vent caps are in place. Do not allow cleaning water or other foreign matter to enter the cells. Use a solution of bicarbonate of soda and water to wash the batteries if there is an accumulation of acid.

BATTERY TROUBLESHOOTING:

Once a week, after the batteries have been charged, spot check the specific gravity of two or more cells. A fully charged battery should indicate between 1.25 and 1.28. If low readings are noted, check the following:

- Check battery charger to insure that a proper charge is being returned to the batteries.
- Check terminals for corrosion, loose connections and broken or frayed cables.
- Check all cells with a hydrometer for variation in specific gravity. A variation of 0.03 points or more between cells is cause for concern. Mark the low cells.

Recheck specific gravity of all cells after recharging.

BATTERY REPLACEMENT

To remove the batteries, follow these procedures:

⚠ WARNING

BEFORE REMOVING BATTERIES FROM THE UNIT, TURN OFF THE IGNITION SWITCH. THERE SHOULD BE NO POWER TO THE MACHINE.

Be sure all power is shut off to the machine. Slide the battery tray out. Disconnect the battery cables.

⚠ CAUTION

ALWAYS DISCONNECT THE NEGATIVE BATTERY CABLE FIRST.

Release the battery retaining strap, and carefully remove the battery from the tray. LEAD-ACID BATTERIES ARE HEAVY. DO NOT DROP.

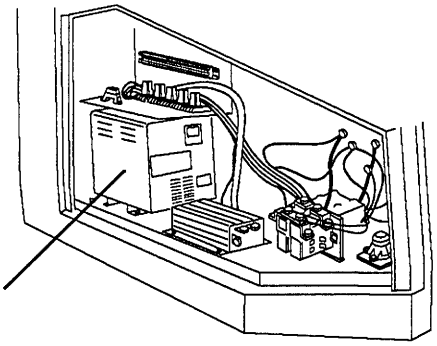
To install, carefully lower the battery into the tray. Connect the battery retaining strap, and the battery cables.

⚠ CAUTION

ALWAYS CONNECT THE POSITIVE BATTERY CABLE FIRST.

BATTERY CHARGER

The battery charger supplied with the SILVER-EAGLE is designed to recharge deep-cycle, lead-acid batteries. It is a highly reliable unit with a minimum of moving parts. A patented electronic timer determines full battery charge by measuring the rate of battery voltage increase during charge. When the voltage stops rising, the battery is fully charged and the charger automatically turns off.



Battery Charger Location.

To operate, connect the power supply cord to a 115 volt, 60 hertz outlet. The charger DC output cord should remain connected to the batteries.

⚠ WARNING

CONNECT ONLY TO A PROPERLY GROUNDED THREE-PRONG, SINGLE PHASE OUTLET.

⚠ WARNING

TO AVOID ELECTRIC SHOCK, DO NOT TOUCH UNINSULATED PARTS OF THE CHARGER DC OUTPUT CONNECTOR, BATTERY CONNECTOR OR TERMINALS.

BE SURE CHARGER IS IN GOOD CONDITION, AND THAT BATTERY CONNECTORS MAKE ADEQUATE ELECTRICAL CONTACT AND ARE NOT CRACKED OR CORRODED. OVERHEATING AND PROPERTY DAMAGE MAY RESULT.

Monitor the ammeter for the correct charge rate, which should vary from 20 to 29 amps, depending upon the condition and depth of discharge of the batteries.

⚠ CAUTION

TO PREVENT DAMAGE FROM OVERHEATING, DO NOT ALLOW THE CHARGER TO OPERATE FOR MORE THAN THIRTY MINUTES WITH AN AMMETER READING OF 30 AMPS OR MORE.

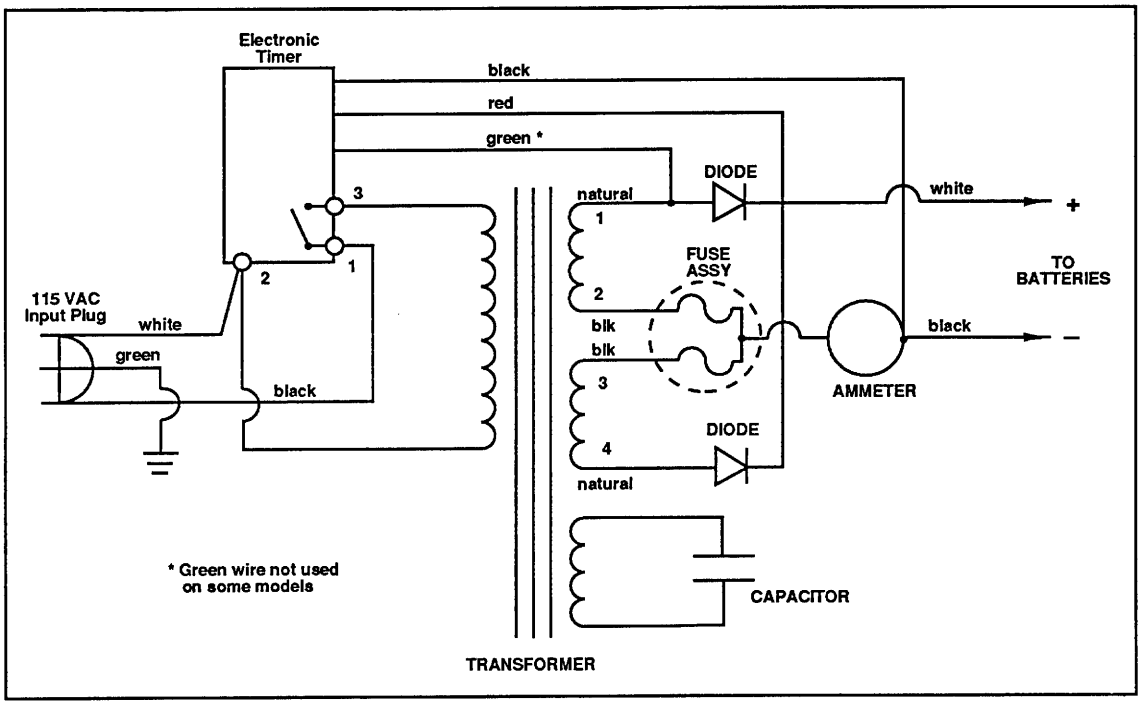
Required charge time varies with depth of discharge.

⚠ WARNING

LEAD-ACID BATTERIES GENERATE EXPLOSIVE GASES. NO SMOKING! KEEP SPARKS AND FLAME AWAY FROM BATTERIES.

NEVER DISCONNECT THE DC OUTPUT CONNECTOR FROM THE BATTERIES WHILE THE CHARGER IS OPERATING.

IF THE CHARGE CYCLE MUST BE INTERRUPTED, DISCONNECT THE POWER SUPPLY CORD FROM ITS OUTLET; DO NOT DISCONNECT THE DC OUTPUT CONNECTOR FROM THE BATTERY CONNECTOR.



Battery Charger Schematic.

BATTERY CHARGER TROUBLESHOOTING

CAUTION

ALWAYS UNPLUG THE ELECTRICAL CORDS FROM THE AC OUTLET AND THE BATTERIES BEFORE ATTEMPTING ANY REPAIRS TO THE CHARGER.

WARNING

HIGH VOLTAGE! WITH THE CHARGER ON, THE INTERNAL CHARGER CAPACITOR VOLTAGE IS APPROXIMATELY 650 VOLTS.

NOTE

Modifying the charger for use other than that for which it was specifically intended, repairs by unqualified persons or use of other than original equipment replacement parts will void the warranty.

If the charger malfunctions, identify the symptoms and refer to the following procedures.

Problem: Charger does not turn on.

The charger DC output cord normally remains connected to the batteries. When the charger is turned on, a time delay of two to five seconds is provided before the charger switches on. After this time delay, the POWER RELAY CLOSES WITH AN AUDIBLE " CLICK", and AC power is supplied to the transformer.

When operating properly, the TRANSFORMER HUMS and the AMMETER INDICATES THE CHARGE RATE. If the charger does not turn on properly, one of three situations will exist:

1. Relay DOES NOT CLOSE, Transformer DOES NOT HUM, and Ammeter DOES NOT REGISTER.

2. Relay CLOSES, but Transformer DOES NOT HUM, and Ammeter DOES NOT REGISTER.

3. Relay CLOSES and Transformer HUMS, but Ammeter DOES NOT REGISTER.

Following are the procedures to be used in each of the above circumstances.

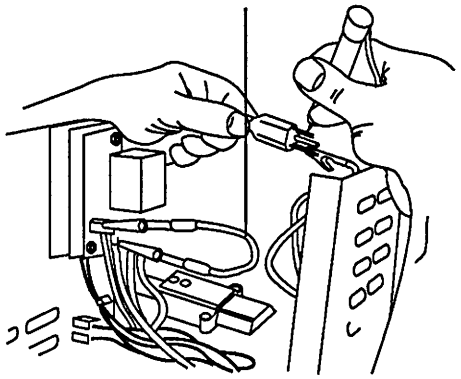
1. If Relay DOES NOT CLOSE, Transformer DOES NOT HUM, and Ammeter DOES NOT REGISTER:

Check that both the power supply cord and DC output connector are securely connected. If so, disconnect the power supply cord from the power outlet. Measure the voltage at the battery connector using a suitable DC voltmeter.

The voltage reading SHOULD BE THE SAME as the battery terminal voltage (between 20 and 50 volts DC). If the DC voltage is within these limits, remove the charger cover and check the wiring against the wiring diagram. If correct, a malfunction in the electronic timer has probably occurred.

To verify a malfunction in the electronic timer, bypass the timer, then check for transformer hum and normal charging current.

JUMPER WIRE



Bypassing Electronic Timer.

To bypass the timer, disconnect the charger power supply cord from the outlet, and the DC output connector from the battery connector. Place a jumper wire between terminals "1" and "3". The transformer should hum when the power supply cord is reconnected to the outlet.

If the transformer HUMS, disconnect the power cord. Reconnect the DC output connector to the battery connector. Reconnect the cord. If ammeter shows normal charging current , the timer is defective and must be replaced.

⚠ CAUTION

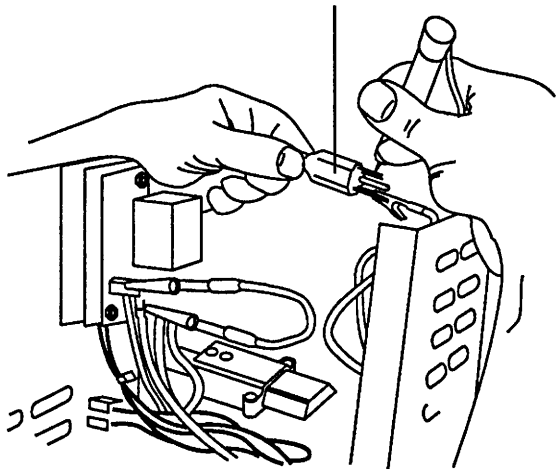
DO NOT CHARGE BATTERIES WITH THE TIMER BYPASSED. THE CHARGER WILL REMAIN ON AS LONG AS THE POWER SUPPLY CORD IS CONNECTED TO A POWER SOURCE, AND SEVERE DAMAGE TO BATTERIES WILL RESULT.

If the transformer DOES NOT HUM and the ammeter does not register with the timer bypassed, check the continuity of the charger AC circuit. disconnect the power cord from the outlet, and the DC output connector from the battery connector. With a suitable Continuity Tester, check the circuit across the power cord prongs. If the circuit is not complete, check the continuity of the power supply cord, primary transformer coil and all connections.

2. If Relay CLOSES, but Transformer DOES NOT HUM, and Ammeter DOES NOT REGISTER:

Check to be sure the power supply cord is securely connected to a live outlet.

POWER SUPPLY CORD PRONGS



Charger AC Circuit Continuity Test.

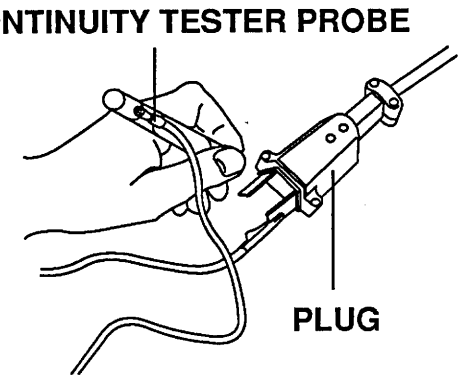
Disconnect the cord from the outlet, and the DC output connector from the battery connector. Bypass the electronic timer (refer to situation #1, on previous page), and with a suitable Continuity Tester, check the circuit across the power

cord prongs. If the circuit is complete, check the relay wiring and all connections. If the circuit is not complete, check the wiring of the power supply cord, transformer primary coil leads and the electronic timer.

Remove the charger cover, and check the wiring against the diagram. If correct, individually check the continuity of the power supply cord, transformer primary coil and relay.

3. If Relay CLOSES and Transformer HUMS, but Ammeter DOES NOT REGISTER:

In this situation, the charger AC circuit and electronic timer are functioning properly, and a fault in the charger DC circuit exists. A continuity check must be performed.



Charger DC Circuit Continuity Test.

Disconnect the power cord from the outlet and the DC output connector from the battery connector. Check the charger fuse. If a fuse link is blown, further testing is required (see "Charger Fuse Blows", later in this section). If the fuse is good, use a low voltage Continuity Tester to perform the following tests:

3A. Connect the Tester leads to the charger DC output connector and note the reading. Reverse the Tester leads and check the reading again. The circuit should be complete IN ONLY ONE DIRECTION.

If the circuit DOES NOT CONDUCT IN EITHER DIRECTION and the fuse is good, check the continuity of the DC output cord, ammeter, diodes and all connections.

If the circuit CONDUCTS IN BOTH DIRECTIONS, a short exists in the charger DC circuit. Check the DC output cord. Check if one or both diodes have shorted (see "Charger Fuse Blows").

3B. Check the capacitor. Disconnect the power cord from the outlet and the DC output connector from the battery connector. Disconnect both transformer coil leads from the capacitor terminals, taking care that the wires do not break. Connect an Ohmmeter (with the scale set to R x 10K ohms) to the capacitor terminals, and test the capacitor.

If, when the Ohmmeter leads are connected to the capacitor terminals:

the meter needle JUMPS TO MID-SCALE and RAPIDLY MOVES TO HIGH RESISTANCE, the capacitor is GOOD.

the meter needle DOES NOT MOVE, and instead stays at high resistance, the capacitor is OPEN. A bulge in the top of the capacitor may be visible.

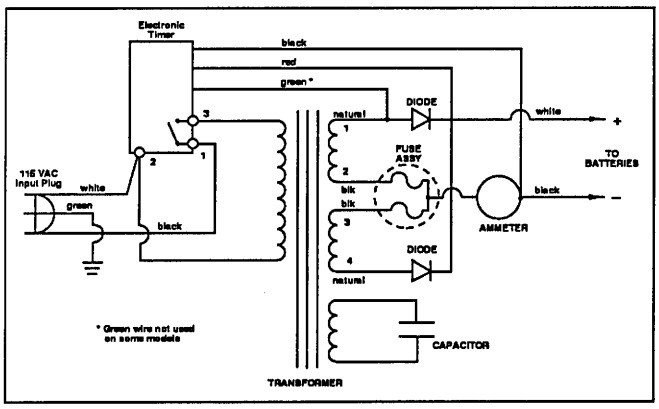
the meter needle JUMPS IMMEDIATELY TO ZERO OHMS and remains there, the capacitor is SHORTED.

If the capacitor is "open" or "shorted", it must be replaced.

⚠ CAUTION

USE ONLY A "6 MFD, 660 VOLT AC" RATED CAPACITOR FOR REPLACEMENT. THE USE OF A CAPACITOR OF A DIFFERENT VALUE MAY RESULT IN IMPROPER CHARGING, CAPACITOR FAILURE, TRANSFORMER BURNOUT OR BATTERY DAMAGE.

3C. If the charger DC circuit and capacitor are good, test the transformer (see "Transformer Short or Burn-Out", later in this section).



Battery Charger Schematic.

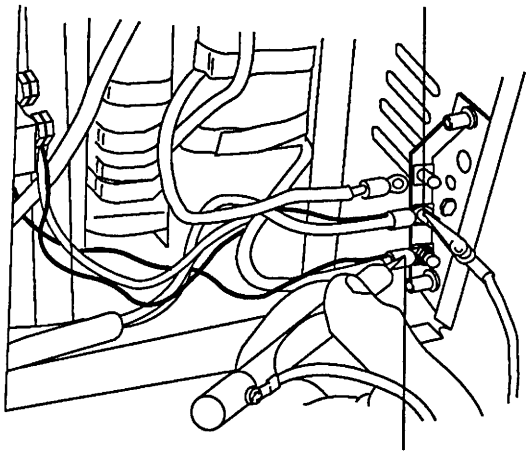
Problem: Charger fuse blows.

The charger fuse consists of two fusible links mounted as a single assembly on the charger front panel. Each link is connected in series with one diode to provide protection for the transformer in the event of diode failure. Visually check the fuse to determine if one or both links are blown.

⚠ CAUTION

Replace the complete fuse assembly if blown. DO NOT ATTEMPT TO REPAIR THE FUSIBLE LINK, as inadequate charger protection may result.

DIODE MOUNTING PLATE



DIODE TERMINAL

Diode Continuity Test.

If a SINGLE FUSIBLE LINK BLOWS, the cause is normally a short circuit failure of one diode. The link will blow when the charger DC output connector is connected to the battery connector, whether or not the power cord is connected.

To check the diodes, disconnect the power cord and the DC output connector. Disconnect one transformer secondary coil lead from the diode terminal. Using a low voltage Continuity Tester, connect one Tester lead to the diode mounting plate and the other to a diode terminal. Note the reading and then reverse the Tester leads and check each diode again. If a diode CONDUCTS CURRENT IN BOTH DIRECTIONS, it is SHORTED. The complete heat sink assembly with diodes must be replaced.

Occasionally, a single fusible link may melt due to excessive heat caused by a loose internal fuse connection. Check that all three fuse connections inside the charger are clean and tight. Tighten the fuse connector nuts to the proper torque (see "Machine Specifications").

If BOTH FUSE LINKS BLOW, the cause is normally a reverse polarity connection between the charger DC output connector and the battery connector. Check the battery pack and connections. Check the voltage and polarity at the battery connector with a DC voltmeter.

Check the charger DC output connector for correct polarity. The white wire should be connected to the positive (+) blade, and the black wire to the negative (-) blade. If polarity is reversed between the charger and batteries, BOTH FUSIBLE LINKS WILL BLOW whether or not the power supply cord is connected to an outlet.

BOTH FUSIBLE LINKS MAY ALSO BLOW due to a short circuit failure of both diodes. A lightning strike at the charging location can be a cause. Excessive heat due to a loose connection may also cause both fusible links to melt.

Problem: Ammeter reads 30 amps for more than 30 minutes.

If the charger is connected to a battery system of less than 48 volts, the charge rate may not go below 30 amps within 30 minutes. Check that all batteries are correctly wired, and also check the battery pack voltage at the battery connector using a DC Voltmeter. For a 48 volt battery system, the charging voltage should be 45 to 51 volts DC.

This condition could also result if there is a shorted cell in one of the batteries.

⚠ CAUTION

Do not connect the charger to battery systems of other than 48 volts. Overheating and transformer burnout will result.

Problem: Charger output is low.

Low charger output is normally caused by a single fusible link blowing as the result of a short circuit failure of one diode (refer to "Charger Fuse Blows", in this section), or the transformer coils (refer to "Transformer Short or Burnout", in this section).

⚠ CAUTION

Do not use the charger if the output is low. Batteries will not reach full charge, and the possibility of a harmful deep discharge exists in subsequent usage.

Problem: Charger does not turn off.

The electronic timer turns the charger on and off. Proper charge time is determined by many factors, but larger, severely discharged batteries require more time to reach full charge than do smaller, lightly discharged batteries. Charge time should not exceed 18 hours.

If the charger remains on longer than that, verify that the green wire from the electronic timer and the secondary transformer coil lead are securely connected to the diode lead. The charger will not turn off if this wire is loose or disconnected. If the green wire is secure, the timer has malfunctioned and must be replaced (see "Electronic Timer needs replacement", later in this section).

Problem: Electronic timer needs replacement.

The electronic timer kit should always be replaced as a complete assembly. Tools required are a Phillips Head Screwdriver, Pliers, a 3/8" Wrench, and an 11/32" Wrench. To replace the timer kit, follow the procedures listed below:

Disconnect the charger power cord from the outlet, and the DC output connector from the battery connector. Remove the charger cover.

Disconnect the green, black and red wires of the timer kit. Remove the black and white leads of the power cord and both primary transformer coil leads from the timer kit terminals. Remove the three mounting screws on the charger front panel, and the entire timer kit. Save all hardware for reassembly.

Install the replacement timer kit by reversing the above steps. When reconnecting the wires to the timer terminals, YOU SHOULD SUPPORT THE TERMINAL BOARD TO PREVENT DAMAGE TO THE ELECTRONIC CIRCUIT BOARD.

Connect one transformer primary lead to terminal "2", and the remaining lead to terminal "3".

Connect the black lead of the power supply cord to terminal "1" on the timer kit, and the white lead to terminal "2".

Connect the red wire of the timer kit and the white lead of the DC output cord to the heat sink assembly.

Connect the black wire of the timer kit and the black lead of the DC output cord to the ammeter post. DO NOT ALLOW THE POST TO TURN WHEN TIGHTENING THE NUT.

Connect the green wire of the timer kit and the transformer secondary lead to the diode lead terminal.

⚠ CAUTION

Be sure all connections are clean and tight. Insure that all wires and terminals are positioned so they do not short to the charger case or each other.

Replace the charger cover and check the timer kit for proper operation as follows:

With the DC output connector disconnected from the battery connector, plug the power cord into a suitable outlet. A DC Voltmeter connected across the DC output connector should indicate zero volts.

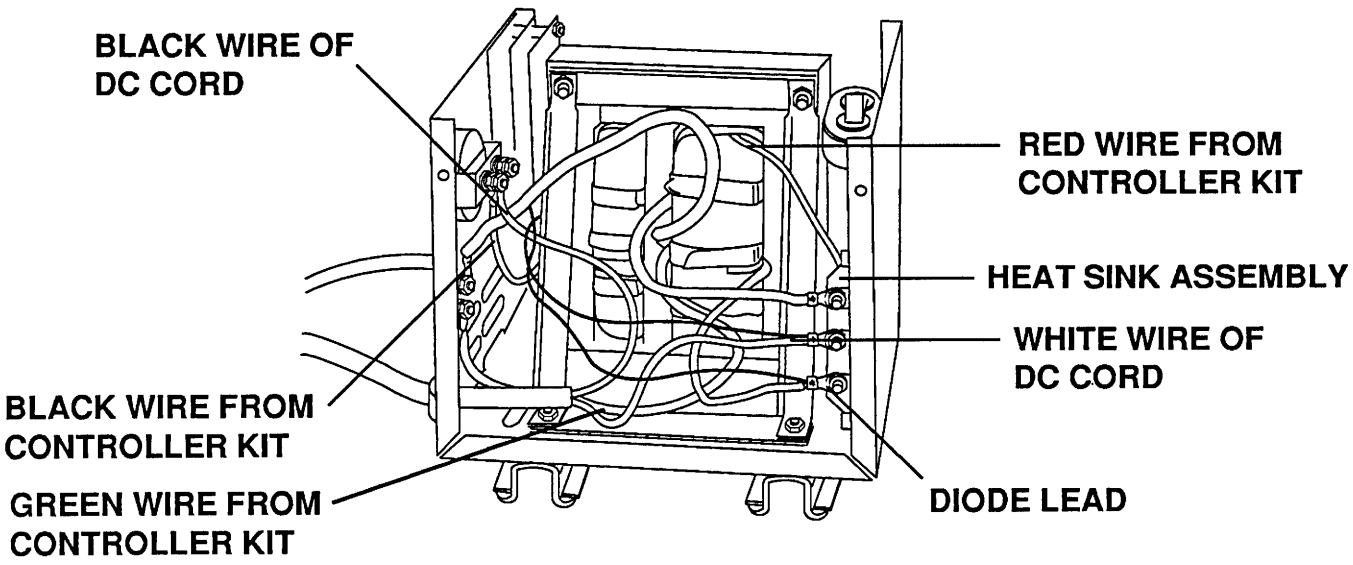
Disconnect the power cord from the outlet, and connect the DC output connector to the battery connector. The relay on the timer kit should close with an audible click after a two to five second delay.

If the timer does not operate as indicated in above, refer to the wiring diagram to insure the charger is wired correctly. If the timer operates properly, the charger is ready for use. Monitor the first charge cycle to verify that the charger turns off properly.

Problem: AC fuse or circuit breaker blows.

If this occurs when the charger is connected to an AC power source, but not to the batteries, the power cord may be shorted. Disconnect the cord from the outlet and the DC output connector from the battery connector. Check that the electronic timer kit has not been bypassed.

With a suitable Continuity Tester, check the circuit across the power cord prongs. The circuit should be open. If the circuit is complete, check the relay contacts to be sure they are open, and have not welded closed. If the relay



Electronic Timer Kit Wiring.

contacts are open, the power cord is shorted and must be replaced.

If the power cord is good, the transformer coils may be shorted.

Problem: Transformer shorted or burned out.

Transformer failure may be caused by natural aging, or shorting of adjacent coil turns. A low or complete lack of output will be observed on the ammeter, while the transformer may hum. The AC line fuse or circuit breaker may blow when the charger is turned on.

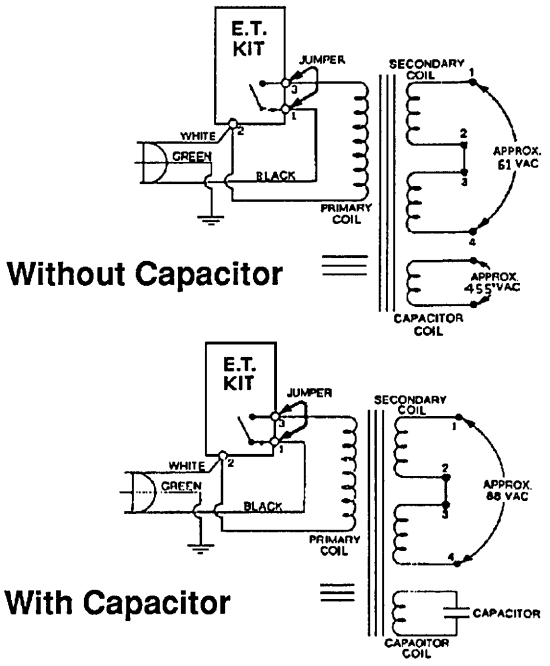
To test the transformer, disconnect the power cord from its outlet and the DC output connector from the battery connector. Disconnect transformer secondary coil leads "1" and "4" from the diode terminals, and the transformer capacitor coil leads from the capacitor terminals. When disconnecting capacitor leads, use care to avoid breaking wires .

⚠ WARNING

HIGH VOLTAGE!

WITH THE CHARGER ON, THE INTERNAL CHARGER CAPACITOR VOLTAGE IS APPROXIMATELY 650 VOLTS. USE EXTREME CAUTION WHEN WORKING NEAR CAPACITOR TERMINALS.

In order to apply AC power directly to the transformer primary coil, the timer must be bypassed. With the timer bypassed, and TAKING CARE FOR PERSONAL SAFETY, connect the power cord to a proper outlet. If the AC line fuse or circuit breaker blows, the transformer is shorted internally and must be replaced. If the fuse or breaker does not blow, check the transformer secondary and capacitor coil voltages using a suitable AC voltmeter. If the measured voltages are substantially lower than those shown, the transformer is shorted internally and must be replaced.



Transformer Coil Voltage Test.

If the transformer output voltages are good, disconnect the power cord from the outlet. Check the capacitor rating (should be 6 Mfd, 660 volts AC), then carefully reconnect the capacitor coil leads to the capacitor terminals. Then, TAKING CARE FOR PERSONAL SAFETY, reconnect the power cord to the outlet and again measure the transformer secondary and capacitor coil voltages.

If both read 88 volts AC, the transformer and capacitor are good (see DC Circuit Test Procedures under "Charger does not turn on"). If the secondary coil voltage reading is 61 V AC, and capacitor coil 455 V AC, the capacitor may be defective (see Capacitor Test Procedures under "Charger does not turn on", earlier in this section) or the capacitor coil leads may not be making proper electrical contact .

If replacement of a transformer lead terminal is required, the new terminal MUST be crimped and soldered.

NOTE

Some transformer lead wires may be aluminum, and a solder intended for aluminum MUST be used.

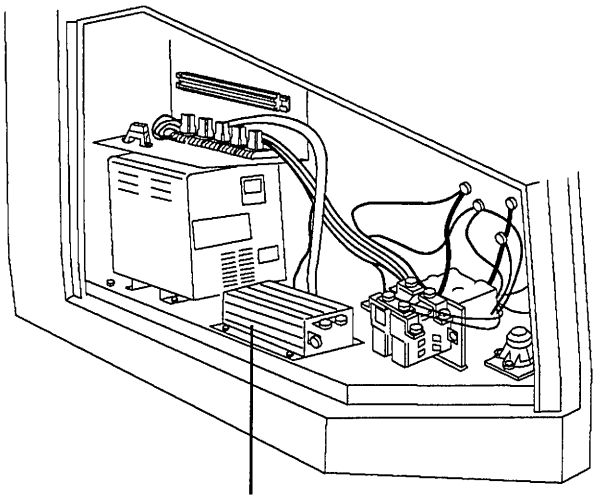
DRIVE MOTOR CONTROLLER

The drive motor controller used on electric operated SILVER-EAGLES is silent in normal operation. However, during "plug braking" (reversing the motor while the unit is moving), a slight "whistle" may be noticed while the controller regulates the motor to a smooth stop. This is normal, and will cease when the machine reverses.

The SILVER-EAGLE is wired so the following conditions must be met before the controller receives power to drive the machine:

- The key switch must be "ON",
- the ground/ platform switch must be in the "PLATFORM" position,
- the lift/ drive switch must be in the "DRIVE" position, and
- the foot pedal switch must be depressed.

When the drive controller lever on the platform control console is moved from its center (neutral) position under the above conditions, the vehicle will respond by moving forward or back.



DRIVE MOTOR CONTROLLER

Drive Motor Controller Location.

Sudden application of "full power" to the lever may switch off controller output. This feature is designed to protect the controller, and returning the lever to its center (neutral) position will reset the circuit. If the controller cuts out during normal lever movement, the lever potentiometer is out of adjustment, and should be corrected.

The drive motor controller is a sealed unit, and no servicing of internal components is possible. Normal maintenance consists of occasional checking of the controller mounting and all electrical connections for tightness, and removing dirt and corrosion from the terminals and surrounding areas.

⚠ WARNING

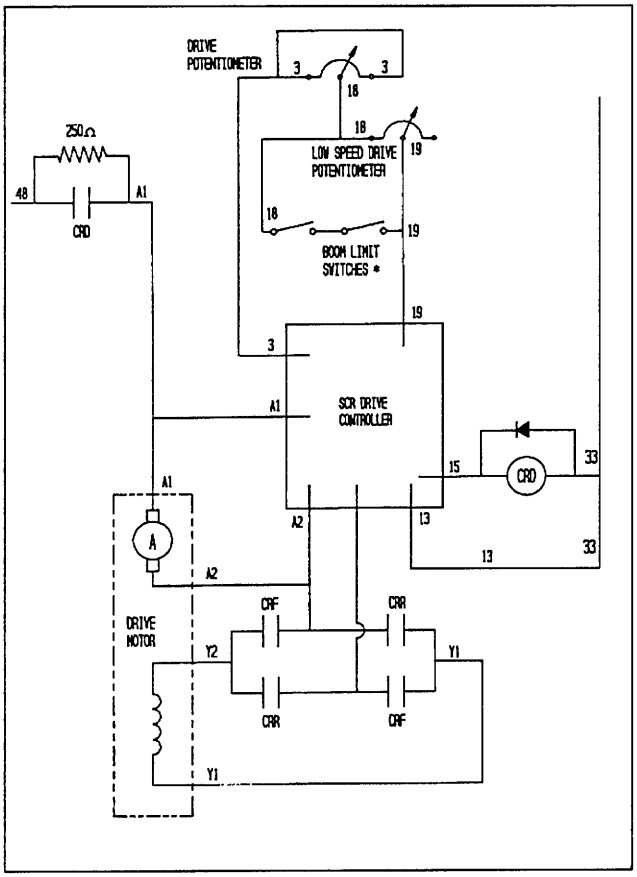
DISCONNECT THE BATTERIES BEFORE WORKING ON MOTOR CONTROL CIRCUITRY. USE INSULATED TOOLS TO PREVENT ACCIDENTAL SHORT CIRCUITS, AND ALWAYS WEAR SAFETY GLASSES.

When tightening the controller bus bar connections, AVOID STRESSING THE BARS, which could crack the surrounding seals. The controller may be hosed off, or wiped with a damp rag. Do not reconnect the batteries until the terminal area is completely dry.

DRIVE MOTOR CONTROLLER TROUBLESHOOTING

The following procedures are intended to help diagnose problems in the drive motor controller. Since the controller is sealed, and not field serviceable, the intent is to determine if trouble lies in the controller, or in some other part of the motor control circuitry.

Two controller troubleshooting sections follow. The first deals with tests that can be made to controllers while they are mounted on the machine. The second section covers "bench testing" of the controller. To avoid reaching



Drive System Electrical Schematic.

invalid conclusions, it is important that the tests be done in the order written.

The controller has built-in features to protect against damage caused by low voltage. The power to the motor is reduced whenever the battery voltage falls below approximately 25 volts. The controller is also protected against damage due to overheating, which can be caused by machine overloading. Power to the motor is reduced if the internal temperature exceeds 165° F (73° C). Power output is reduced for as long as the overheating condition exists. Full power is restored when the unit cools.

These procedures are for diagnosing machines that DO NOT RUN. If the problem is a motor that RUNS AT FULL SPEED without drive control lever input, look for incorrect wiring or short circuits, especially those which would connect the "M-" cable (A2) to the "B-" cable (#13). If wiring is correct, the controller is bad and must be replaced.

DRIVE MOTOR CONTROLLER TESTS (ON MACHINE)

These tests require the use of a general purpose Volt-Ohmmeter.

⚠ WARNING

BEFORE PERFORMING TEST PROCEDURES ON MOTOR CONTROL CIRCUITRY, THE MACHINE MUST BE JACKED UP, WITH THE DRIVE WHEELS OFF THE GROUND. SOME FAULT CONDITIONS CAN CAUSE THE MACHINE TO RUN UNCONTROLLABLY!

BATTERIES OF ELECTRIC MACHINES CAN SUPPLY VERY HIGH POWER FOR SHORT PERIODS. IF BATTERIES ARE ACCIDENTALLY SHORT CIRCUITED, ARCING CAN OCCUR. ALWAYS DISCONNECT BATTERIES BEFORE WORKING ON MOTOR CONTROL CIRCUITRY. USE INSULATED TOOLS AND WEAR SAFETY GLASSES!

CHARGING OR DISCHARGING OF LEAD ACID BATTERIES WILL GENERATE EXPLOSIVE HYDROGEN GAS. ALWAYS FOLLOW THE BATTERY MANUFACTURER'S RECOMMENDATIONS WHEN WORKING AROUND BATTERIES. ALWAYS WEAR SAFETY GLASSES.

As a first step, check the wiring of the controller for correctness against the wiring diagram. Check the security of all connections.

Check for power to the controller.

Leave the key switch "OFF" for these tests.

Verify that the battery (-) terminal connects to the "B-" terminal of the controller, and connect Voltmeter (-) lead to that point. Connect Voltmeter (+) lead to the battery side of the contactor. Check for full battery voltage. If low, the trouble is in the battery pack, cable plugs or cables.

Connect the Voltmeter (+) lead to the controller "B+" terminal. A reading of 1 to 5 volts LESS than the full battery voltage should be obtained.

If FULL BATTERY VOLTAGE is read, the contactor points have welded, and must be replaced.

If the reading is ZERO or NEAR ZERO, the trouble is either a bad controller, a failed 250 Ohm resistor across the contactor, or a fault in the cable between the contactor and the controller. Trace the cable to insure it is hooked up properly. Remove and test the 250 Ohm resistor with the Ohmmeter. If these check out, the controller is malfunctioning, and must be replaced.

Check for contactor operation and key switch input.

Turn the key switch "ON", and move the drive lever FORWARD or REVERSE. The main contactor should operate with an audible click. Connect the Voltmeter across the contactor coil terminals. Meter should show FULL BATTERY VOLTAGE.

Connect the Voltmeter (-) lead to the "B-" terminal on the controller, and the (+) lead to the key switch input (top push on) terminal. The meter should again show FULL BATTERY VOLTAGE.

If the contactor coil and key switch input terminal ARE getting voltage, connect the Voltmeter across the large terminals of the contactor to insure that the contactor is really working. There should be NO MEASURABLE VOLTAGE DROP. If any drop is shown, the contactor is bad.

If the contactor coil and key switch input terminal ARE NOT getting voltage, use the Voltmeter to find the open point. Connect the Voltmeter (-) lead to the controller "B-" terminal. Check the following points with the Voltmeter (+) lead (in the sequence shown) to trace the flow, isolate the problem and correct it.

1. Check both sides of the control wiring fuse,

2. Check both sides of the key switch,

3. Check both sides of the foot pedal microswitch,

4. Check the contactor coil and controller key switch input terminal.

Check platform drive controller circuitry.

The following applies to the STANDARD drive control lever input configuration, which has a nominal 5000 Ohm potentiometer connected as a two-wire rheostat (0 Ohms = full on/ 5000 Ohms = full off).

The booms must be fully down and retracted (in the stowed position) for this test.

With the key switch "OFF", disconnect the two lower "push-on" connectors going to the control lever inputs of the controller. Connect an Ohmmeter to the two wires (#3 and #19) going to the drive control lever, and observe the resistance as you operate the lever. The resistance in the center ("neutral") position can be between 4.91 and 5000 Ohms. In full "FORWARD" or "REVERSE", the meter should indicate 0 Ohms.

If these readings are not obtained, the drive control lever itself may be faulty, or the lever and its linkage may be out of adjustment. Remove the drive controller from the platform console, and operate the lever to verify proper movement in either direction. If the mechanical operation looks correct, the drive controller is defective, and must be replaced.

While the drive control lever wires are off the controller, use an Ohmmeter to check for short circuits between the wires and the machine frame. A resistance of AT LEAST ONE MEGOHM should be observed. If a lower reading is seen, inspect the wiring for damaged insulation or evidence of contact with battery acid. If necessary, replace the drive controller.

Reattach one wire (#3 or #19) to each terminal of the controller. Inspect the terminal area of the controller closely for a buildup of dirt or acid residue. A conducting layer may cause electrical leakage between the lever input terminals and the controller "B-" or "M-" terminals, leading to faulty operation.

To check for electrical leakage, measure the voltage at each of the controller potentiometer terminals (#3 and #19). Connect Voltmeter (-) lead to controller "B-" terminal. The key switch must be "ON", for this test. The readings at either potentiometer terminal should be 0 Volts with the drive lever in NEUTRAL, and 9.9 Volts with lever full "FORWARD" or "REVERSE".

NOTE

These voltages apply only to controllers with standard input configuration.

If the readings obtained vary by more than a few tenths of a volt, the problem may be contamination on the terminal face of the drive motor controller. Carefully clean off the terminal area of the controller with a cotton swab or clean rag moistened with water, and dry thoroughly. Test the controller for proper operation. Take steps to prevent a reoccurrence by keeping dirt and water from the controller terminal area.

Check Controller input and output.

NOTE

THE MACHINE DRIVE WHEELS MUST STILL BE OFF THE GROUND. The "emergency stop" buttons must be released, and the foot pedal power switch on the platform floor must be pressed prior to performing the following tests.

Connect the Voltmeter (-) lead to the controller "B-" terminal, and touch the (+) lead to the top "push-on" terminal. Turn the key switch "ON". Full battery voltage (48 volts) should be observed.

Touch the (+) lead to the middle "push-on" terminal. With the drive control lever full "FORWARD" or "REVERSE", a reading of at least 10 volts should be obtained.

Touch the (+) lead to the lower "push-on" terminal. With the drive control lever in the center ("neutral") position, you should observe a reading of 4.0 to 4.5 volts. With the drive control lever full "FORWARD" or "REVERSE", a reading of at least 10 volts should be obtained.

Connect the Voltmeter leads between the controller "B+" and "M-" terminals. The meter reading will vary as the drive control lever is moved from "neutral" to full "FORWARD" or "REVERSE".

If all the above readings are as shown, the drive motor controller and the platform drive controller are good. If the machine still does not drive, the drive motor may be bad, or the drive line brake may not be releasing.

Next, measure the current in the "M-" lead. THE MACHINE DRIVE WHEELS MUST STILL BE OFF THE GROUND. This is a high DC current, and is measured with a Shunt/Meter setup or a clamp-on DC Ammeter. Turn the key switch "ON", depress the foot pedal, and watch the Ammeter (which is being held against the "M-" lead) while moving the drive lever "FORWARD" or "REVERSE".

If NO CURRENT flows in the "M-" lead, there is an open circuit in the motor, or in the wiring between the motor and controller. Check for proper operation of the forward (CRF) and reverse (CRR) contacts in relation to the drive control lever. If okay, but the motor fails to run, check for a loose wire on the motor or contactor. Check the motor armature and field coils for an open circuit.

If a HIGH CURRENT FLOW is observed in the "M-" lead, but the motor does not turn, the problem is either a short in the motor circuit or the motor itself, or a short in the controller's internal plug diode. The drive line brake may also not be releasing.

Test the plug diode as follows:

Cut the power to the machine by disconnecting the battery connectors. Use an Ohmmeter to check for short circuits between motor leads and to ground. Check motor field and armature for open circuit.

Remove the cable from the controller "A2" terminal. Use the Ohmmeter to check the resistance between the controller "A2" and "B+" terminals. Note the Meter reading, then swap the leads and take another reading. A LOW RESISTANCE one way, and a MUCH HIGHER RESISTANCE the other way indicates a good diode. If your Ohmmeter has a "Diode Test" function, use that. If the diode is shorted, the controller is bad, and must be replaced.

Reconnect the "A2" cable to the controller, and reconnect the batteries. Turn the key switch "ON". Check to ensure that the "Emergency Stop" buttons are released, and switch the ground/ platform selector to "PLATFORM".

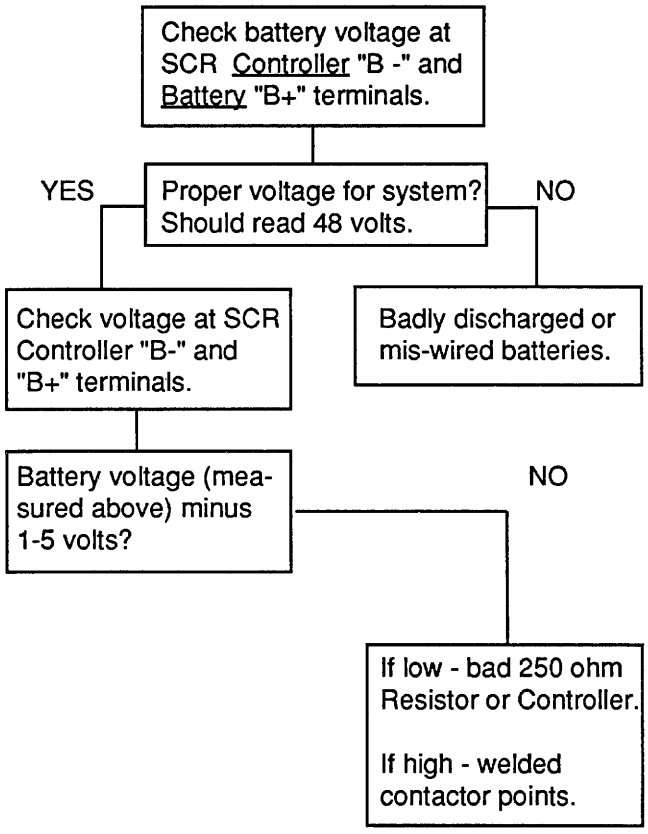
Locate the brake valve on the undercarriage. Use a voltmeter to check the brake solenoid coil, while an assistant presses the platform foot pedal switch and moves the drive control lever "FORWARD" or "REVERSE". A reading of 48 volts should be obtained.

If voltage is present at the brake coil, the brake should operate. Confirm brake operation by observing the hose leading from the brake valve to the brake assembly when the brake valve is activated. Stiffening of the hose will indicate hydraulic fluid flow.

TROUBLESHOOTING CHART

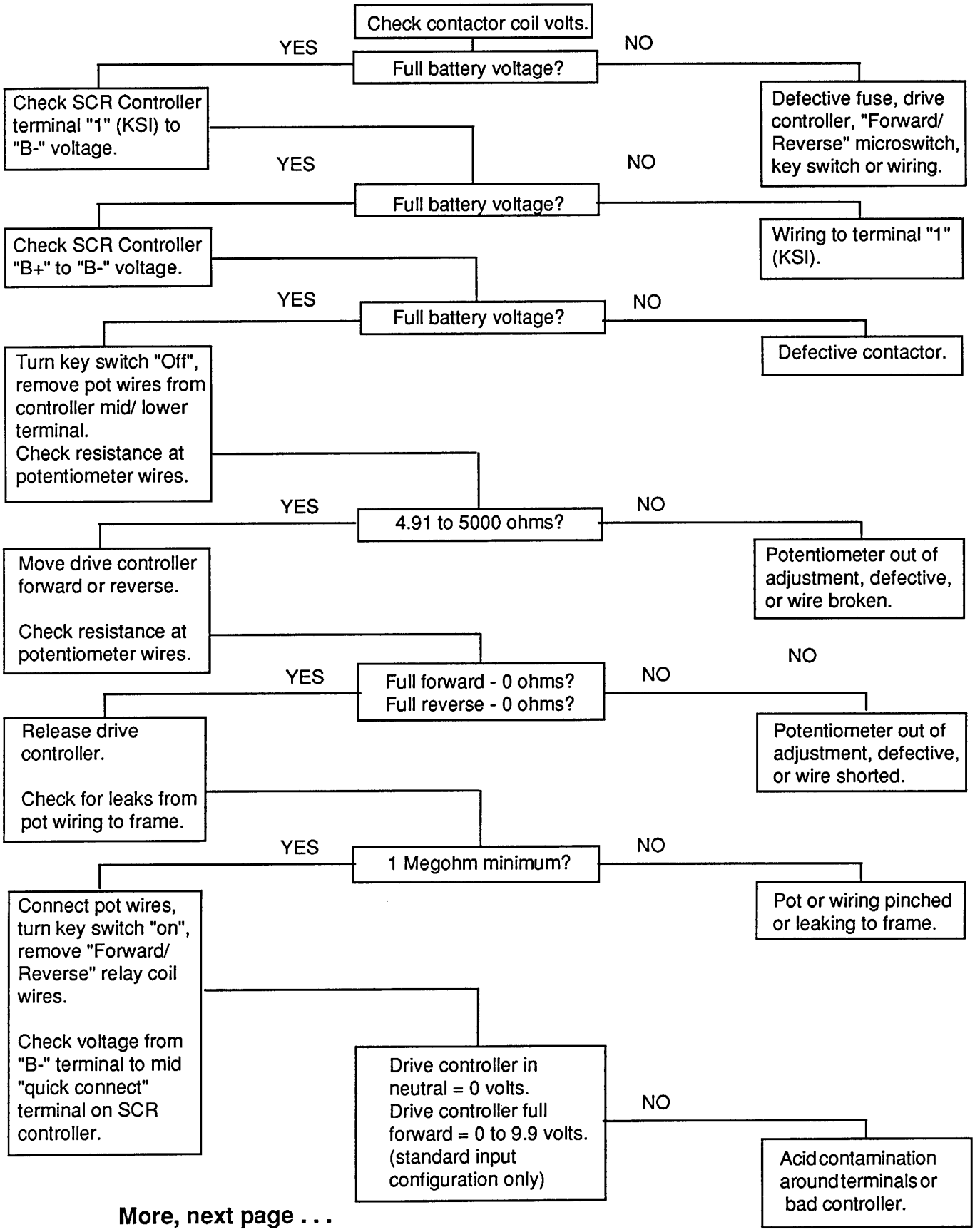
These Charts briefly outline the "On-Machine" tests contained in the previous section.

Testing battery circuit. Key switch "Off".



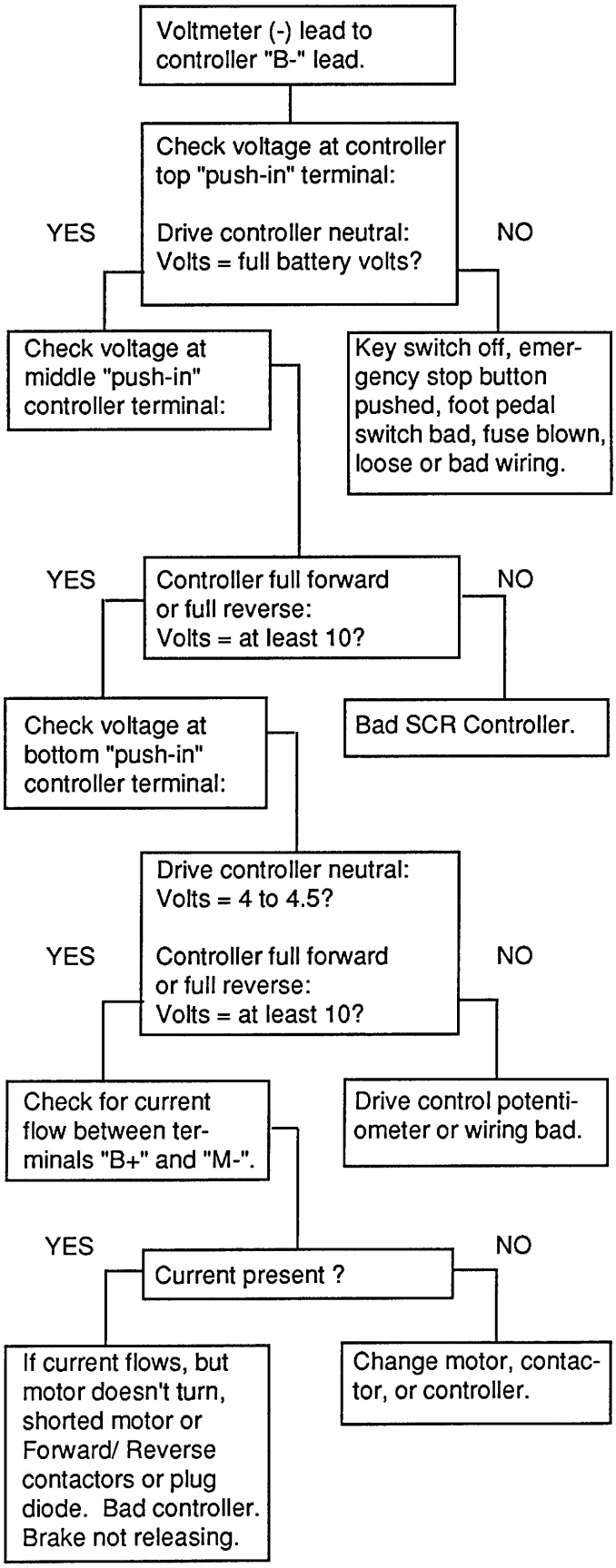
More, next page . . .

Testing control wiring. Key switch "On", drive wheels off ground, move drive controller until "Forward/ Reverse" microswitch clicks.



More, next page . . .

Testing controller input/ output. Key switch "On", drive wheels off ground, foot pedal depressed.



DRIVE MOTOR CONTROLLER BENCH TESTS

To "Bench-Test" the controller, the following equipment is needed:

1. A regulated, line operated power supply, or a string of batteries having voltage equal to the controller rating. Since only low power tests will be performed, A 10 AMP FUSE SHOULD BE WIRED IN SERIES WITH A BATTERY STRING to protect both operator and controller against accidental short circuits. A BATTERY CHARGER ALONE SHOULD NOT BE USED AS A POWER SUPPLY since, without a battery load, its output voltage may exceed the rating of the controller.

2. A control input source. For a controller with the standard input configuration (a 5000 Ohm potentiometer wired as a 2-terminal rheostat), any 5000 Ohm potentiometer will work fine. For controllers with other input options, use a similar type of drive controller to that on the machine.

3. A contactor with a 250 Ohm, 5 Watt resistor across its contacts, and an "ON/ OFF" toggle switch.

4. A test board consisting of incandescent light bulbs having the same voltage as the test setup. Series wired 12-Volt light bulbs can be used to obtain the required voltage: e.g., for 48 Volts, use four (4) 12-Volt lamps wired in series.

5. A general purpose or digital Volt-Ohmmeter.

CONTROLLER BENCH TESTS

First, pick up the controller and shake it. If anything rattles around inside, the unit is defective, and must be replaced.

Connect the controller to the power supply as shown on the diagram below. Connect the Voltmeter leads to the controller "B+" and "B-" terminals.

Turn on the power supply (NOT THE CONTACTOR), and watch the Voltmeter. The reading should BUILD UP SLOWLY over several seconds to the full battery voltage. If it does not, the controller is bad.

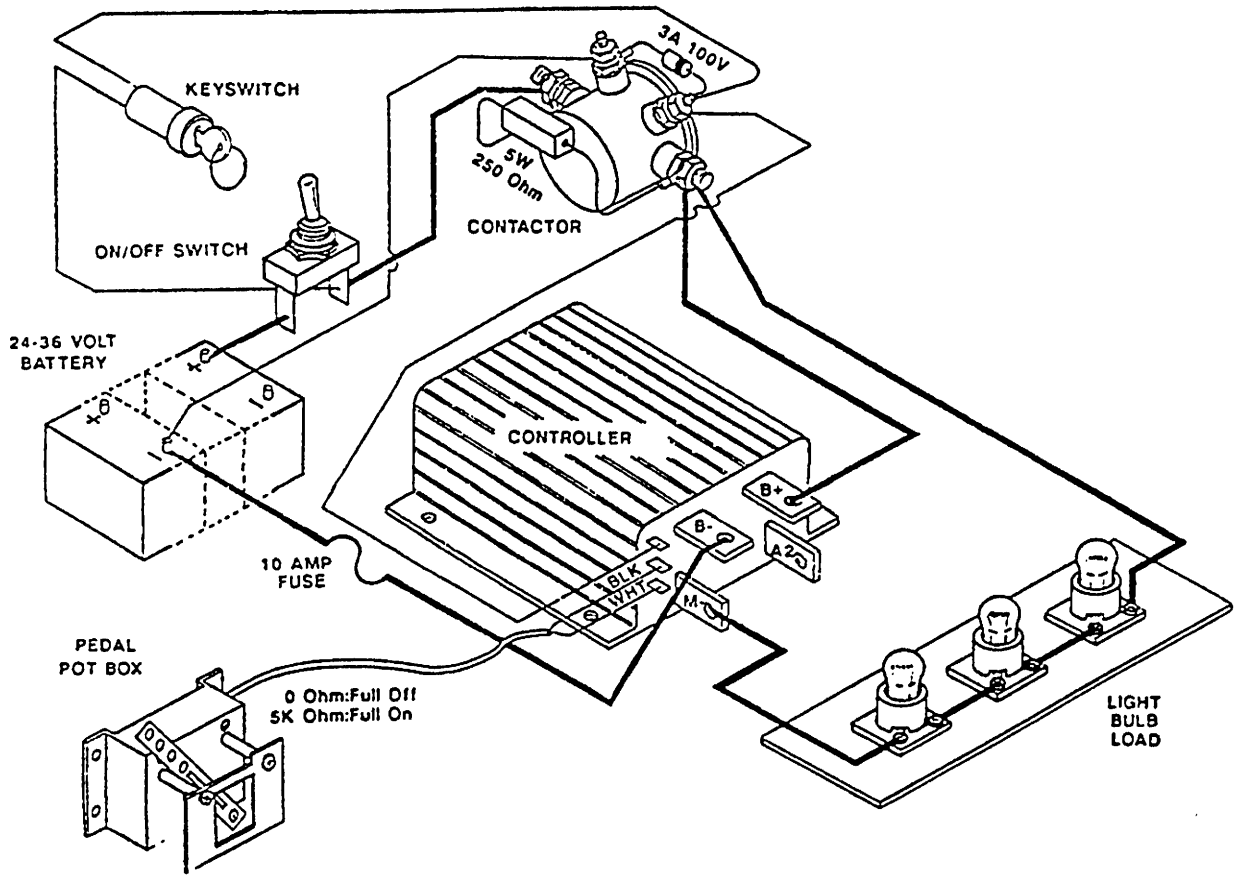
The test lamp SHOULD NOT COME ON at this point. If it does, the controller is bad.

Turn on the switch operating the contactor, and the toggle switch input to the controller. Move the control input source, and watch the lamp brightness. The test lamp should go smoothly from FULL OFF to FULL ON with control operation.

Test the controller's "high speed disable" function (if applicable). Turn the contactor operating switch off. Move the control input to "full on", then turn the switch back on. The test lamp SHOULD NOT COME ON until the control is turned nearly ALL THE WAY DOWN and then turned back UP.

Test the controller's "fault" function by pulling off one of the control potentiometer connections. The test lamp SHOULD NOT COME ON when the Drive Controller is moved to FORWARD or REVERSE.

Remove the controller from the test setup, and check the internal plug diode as described in the troubleshooting section.



Bench Test Set-Up.

EMERGENCY STOP BUTTONS

Two emergency stop buttons (one on the ground control panel, and one on the platform control panel) act as power "on/ off" switches. Both switches must be "ON" to operate the machine. When either of the emergency stop buttons is depressed, all functions stop immediately and the drive line brake is automatically applied. IF SO EQUIPPED, the axle brakes will also engage.

When troubleshooting the electrical circuit; if there is a problem with the emergency stop button, check the wiring to the button. If the wiring is correct, replace the emergency stop button.

FOOT PEDAL SWITCH

The foot pedal is a double pole, double throw switch which must be fully depressed before any machine function can be operated from the platform. When the foot pedal switch is released, power to the hydraulic pump, and to the lift and drive function solenoid valves is terminated, and all machine functions stop. The foot pedal switch is located on the floor of the platform.

When troubleshooting the electrical and hydraulic circuits to the platform, ensure that the foot pedal switch is depressed. Check the wiring to the foot pedal switch. If the wiring is correct, but there is a problem with the foot pedal circuit, replace the entire switch.

MOVEMENT ALARM

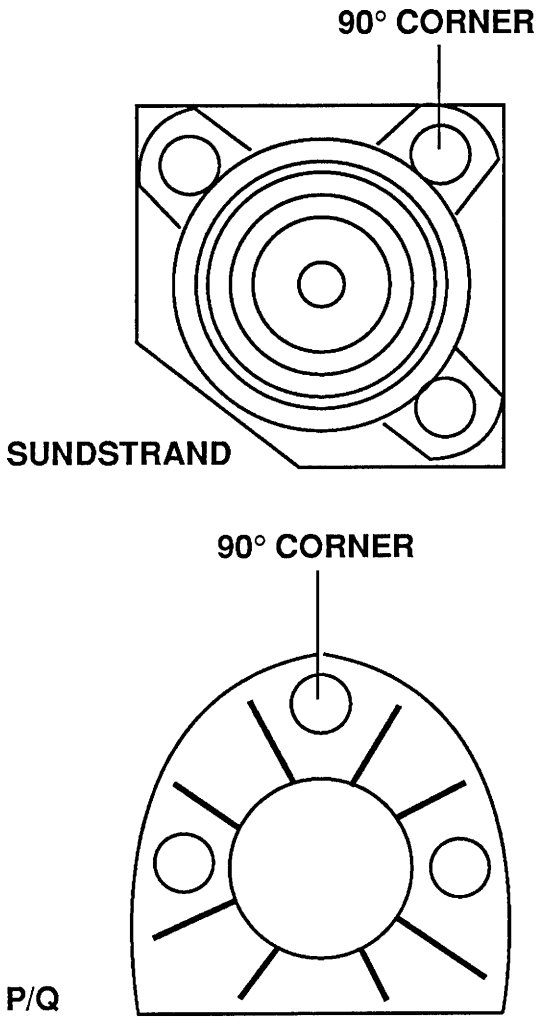
The movement alarm is activated as soon as the machine's drive controller is moved off the center "Neutral" position.

If the movement alarm does not function, check the wiring. If wiring is correct, replace the alarm.

TILT ALARM

The tilt alarm gives an audible warning when the machine is five degrees or more out of level. The alarm can be tested by manually tipping the alarm sensor (see test procedure, below). If the tilt alarm does not function, check the horn, then check the output relay.

Check the wiring. If wiring is correct, replace the alarm.



Tilt Alarm 90 Degree Corner.

TILT ALARM ADJUSTMENT

The tilt alarm can be adjusted. Before attempting to adjust the alarm, park the machine on a flat, level surface. Fill the tires to the proper pressure (liquid ballasted tires only).

Level the base of the alarm by tightening each of the three flange nuts to take up approximately one half of its spring's travel. During the remainder of the adjustment procedure, DO NOT ADJUST THE NUT ON THE 90° CORNER.

Check to be sure the electrical connections are correct. Slowly tighten the nut on one of the two corners ADJACENT to the 90° corner until the light-emitting diode (LED) just turns on, indicating that the circuit is closed. Note the position of the nut.

Loosen the nut (LED will go out), carefully counting the number and fraction of turns until the LED lights up again. Divide that number by two, and tighten the nut by this number of turns.

Adjust the nut on the OTHER corner adjacent to the 90° corner in the same manner. The alarm is now level, to the degree of accuracy determined by the nut adjustments and the surface on which the machine is sitting. Test the tilt alarm for proper function.

TILT ALARM TEST

Individually push down on each of the three fastened corners of the tilt alarm. There should be enough travel to cause the alarm to sound as each corner is pressed. If not, the flange nuts have been tightened too far. Loosen the nut on the 90° corner, and repeat the adjustment procedure above. This "Push-to-Test" feature enables the tilt alarm to be tested without losing its adjustment.

RELAYS

Six relays are associated with machine functions (refer to Electrical Schematic at the back of this manual). They are:

1. Tilt alarm and warning horn(CRT)
2. Forward / Reverse (CRFR)
3. Low pressure switch (CRL)
4. High pressure switch (CRH)
5. Left turn (CRLT)
6. Right turn (CRRT)

FUSES

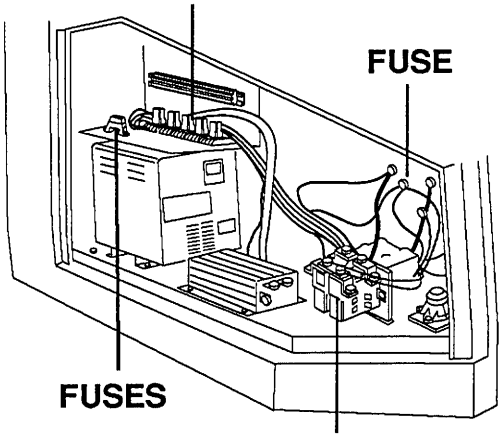
Four fuses are found on the machine, but only three are associated with machine functions:

Fuse #1 (5 amp) - Alarm circuit (24 volt)
Fuse #2 (10 amp) - Main system
Fuse #3 (10 amp) - Drive/Steer
Fuse #4 (5 amp) - Not used

Check for blown fuses. Be sure to REPLACE BLOWN FUSES WITH FUSES OF THE CORRECT SIZE.

DC CONTACTORS

The "Forward/ Reverse" contactor is a paired single pole, double throw contactor. The "Traction and Pump" isolating contactors are single pole, single throw (On/Off) contactors.



Electrical Compartment.

All three contactors have silver cadmium oxide contacts. These contacts have been designed to operate with a minimum of bounce and are extremely long wearing. The coils use 6 mm spade connectors. Power dissipation at 50% is 15 to 25 watts, and 7 to 12 watts at 100%.

CONTACTOR MAINTENANCE

The contactors should be inspected for contamination and spark damage. It is important to ensure that NO FERROUS METAL HAS BEEN ATTRACTED TO THE MAGNETS, and periodic cleaning with the aid of a pressurized air line is recommended.

NOTE

These contactors are fitted with life extending magnetic "blow-outs". It is important to ensure that NO FERROUS METAL HAS BEEN ATTRACTED TO THE MAGNETS, and periodic cleaning with the aid of a pressurized air line is recommended.

AUTOMATIC WARNING BEACON

There are two types of optional automatic warning beacons available. One is a "strobe" type, with no moving parts, that gives an intense light. The other has a rotating reflector with a less intense light. The beacon activates whenever the ignition is on.

MECHANICAL COMPONENTS

Following is a description of the major mechanical components of the SILVER-EAGLE.

TIRES

Pneumatic, liquid ballasted 8.75 - 16.5 LT, 8 ply tires are standard. Check tires for correct pressure, and inspect for cuts, sidewall damage or abnormal wear. Any tire faults MUST BE CORRECTED before further machine operation. Consult your tire dealer if ballast is needed.

Foam filled tires are an available option . Check for any significant sidewall or other damage.

CHANGING TIRES

⚠ CAUTION

LIQUID BALLASTED AND FOAM FILLED TIRES ARE EXTREMELY HEAVY. CARE MUST BE TAKEN TO AVOID PERSONAL INJURY.

When a tire change is necessary, ALWAYS BLOCK THE WHEELS before you raise the machine. Loosen and remove lug nuts, and pull off the wheel. Replace the tire, and reinstall. Fasten lug nuts, and tighten to proper torque. Lower the machine and remove the blocks.

WHEELS AND LUG NUTS

Front and rear wheels are different, and ARE NOT INTERCHANGEABLE. Check the security of the wheel lug nuts and examine the wheel rims for damage.

SUPERSTRUCTURE

Steam clean the superstructure, and inspect all welds and brackets. Check for cylinder pivot pins that turn in their mountings, which can indicate sheared pin lock bolts.

HOSES AND CABLES

Inspect all hoses and electrical cables for security and damage. Check for leaks at fittings. ANY DAMAGED HOSES OR CABLES SHOULD BE REPLACED.

Cables and hoses should be examined for rubbing and chafing, especially in the swing bearing area.

LIFT PUMP MOTOR ASSEMBLY

Operate the motor, and check all securing bolts for tightness. Check cables and hoses for security and leaks.

TOWING PACKAGE

A towing package is an available option on all SILVER-EAGLE models. IF SO EQUIPPED, the machine can be towed behind another vehicle, at speeds not to exceed four miles per hour.

Connect the machine to the tow vehicle. Pull lever provided to disengage the rear (drive) axle, and pull control valve to allow front (steering) wheels to track the towing vehicle.

MISCELLANEOUS EQUIPMENT

Check all miscellaneous equipment mounted on the machine for secure attachment. Check for evidence of oil or hydraulic fluid leakage. Check all cables and hoses for security and damage.

CYLINDER PIVOT PINS AND PIN BUSHINGS

Check all cylinder pivot pins and pin bushings for wear. Elevate the booms and check each pin individually for rotation or movement. If pins rotate, check if pin locking bolts have sheared. If wear is detected, the pin or bushing may need to be replaced.

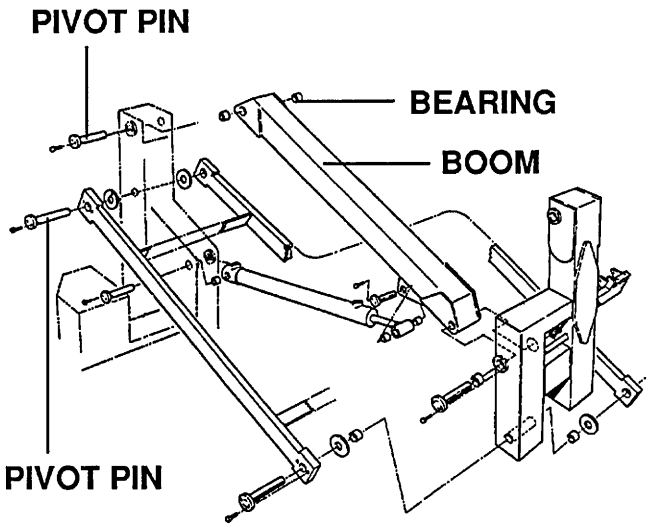
PIN REPLACEMENT

BOOM PIVOT PIN REPLACEMENT

⚠ CAUTION

It is IMPORTANT TO MAINTAIN CORRECT ALIGNMENT between the boom and side plates during this operation. Any relative movement will make fitting of the pins more difficult.

Support the boom and upper structure securely. Remove the pin locking bolts, and drive out the pivot pin, taking care not to damage the inner bore.



Boom Pivot Pin Replacement.

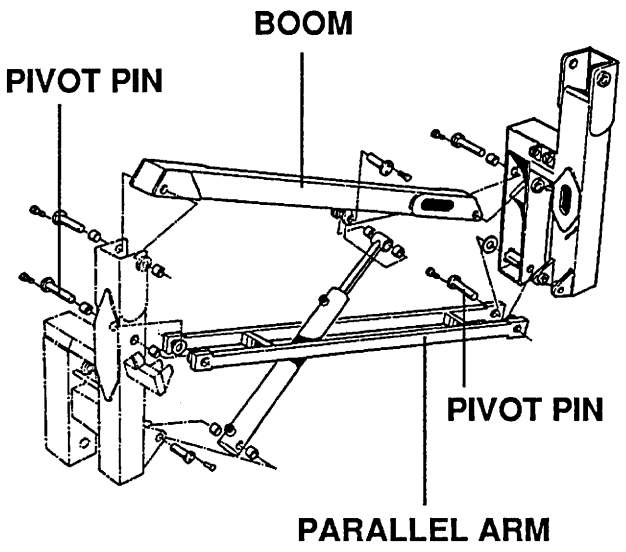
Install new pin and locking bolts (lubricate bolts before installation). Apply grease to pin.

PARALLEL ARM PIVOT PIN REPLACEMENT

SUPPORT THE BOOM SECURELY. Remove the pin locking bolts, and drive out the pivot pin.

⚠ CAUTION

Upon removal of the pin, the parallel arm WILL DROP if not held. The arm is relatively light, and can be held manually in position while the new pin is installed.



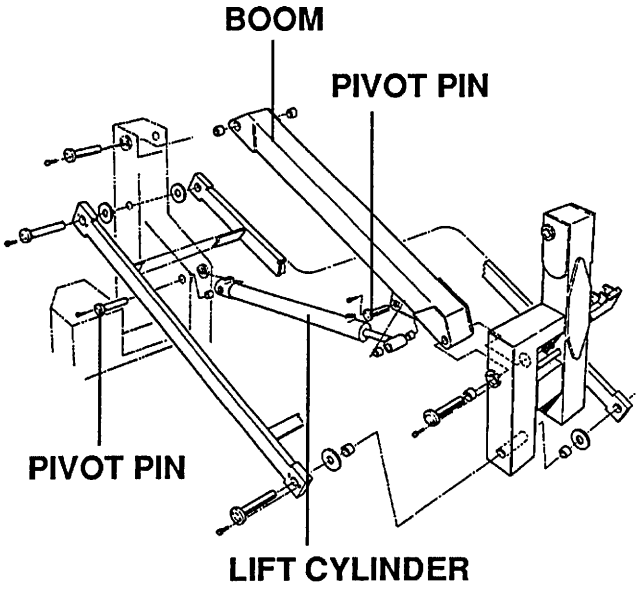
Parallel Arm Pivot Pin Replacement.

Install new pin and locking bolts (lubricate bolts before installation). Apply grease to pin.

LIFT CYLINDER PIVOT PIN REPLACEMENT

SUPPORT THE BOOM. Operate the proper boom lift control to release hydraulic pressure and remove any load on the lift cylinder. Remove the pin locking bolts, SUPPORT THE LIFT CYLINDER and remove the pin.

Install new pin and locking bolts (lubricate bolts before installation). Apply grease to pin.

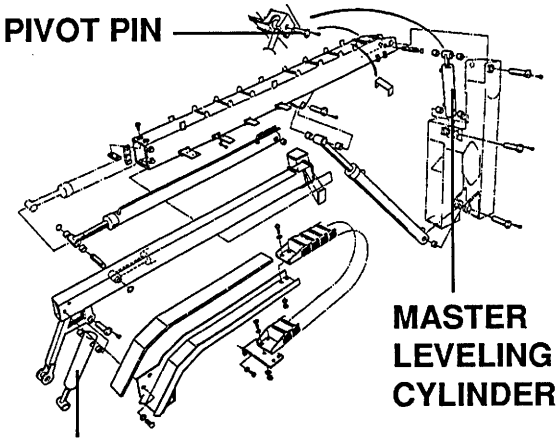


Lift Cylinder Pivot Pin Replacement.

PLATFORM LEVEL CYLINDER PIVOT PIN REPLACEMENT

SUPPORT THE PLATFORM to remove the load on both master and slave leveling cylinders. Remove the pin locking bolts, and remove the pin.

Install new pin and locking bolts (lubricate bolts before installation). Apply grease to pin.



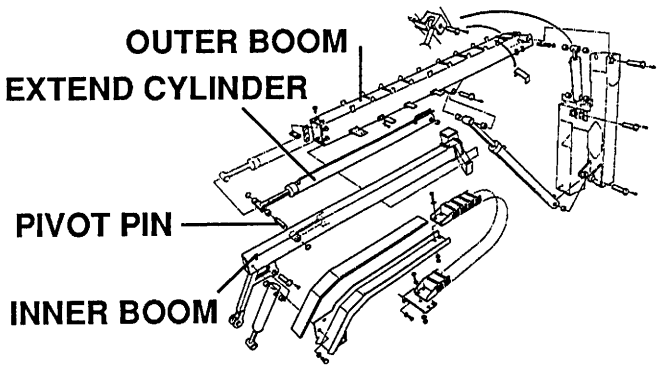
Level Cylinder Pivot Pin Replacement.

EXTEND (TELESCOPE) BOOM CYLINDER PIVOT PIN REPLACEMENT

Remove the pin locking bolts, SUPPORT THE CYLINDER and remove the pin. When changing the rod end pivot pin, it may be necessary to extend the boom out to expose the pin.

NOTE

If the extend boom has been greased, the pin recess may be filled and not readily visible. We recommend using only dry silicone lubricant on the boom.



Extend Cylinder Pivot Pin Replacement.

BOOM LIFT CYLINDERS

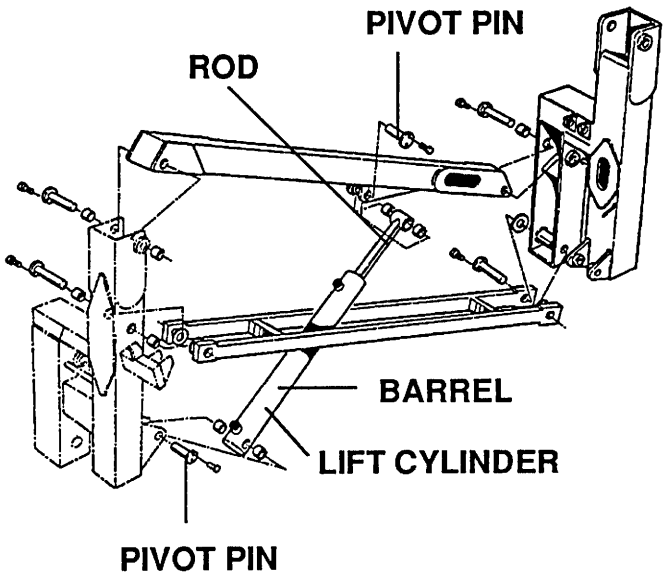
The boom lift cylinders are of the double acting type. During operation, the cylinders should not leak, but a slight dampness at the rod seal is acceptable. The pivot pins should be checked for wear. Check the pivot pin locking bolts for tightness. The cylinder and holding valve should be inspected for fluid leakage, damage and security.

LIFT CYLINDER SEAL REPLACEMENT (ON MACHINE)

SUPPORT THE BOOM. Operate the proper boom lift control to release hydraulic pressure and remove any load in the lift cylinder circuit. Clean the end of the cylinder, and loosen the cylinder end cap by several turns.

Remove the rod end pivot pin, and support the cylinder barrel. Loosen the end cap completely, and withdraw it carefully over the piston rod. TAKE CARE NOT TO DAMAGE THE ROD SURFACE, AND GUARD AGAINST DIRT ENTERING THE SYSTEM.

Replace the seals in the end cap, and reassemble the lift cylinder, again AVOIDING DIRT AND ROD DAMAGE.



Lift Cylinder Seal Replacement.

BENCH REPLACEMENT OF LIFT CYLINDER SEALS

The lift cylinder can also be removed from the machine for seal replacement.

Extend the cylinder, and examine the protruding rod for score marks and damage. Clean the holding valve, and examine for signs of leakage. BLEED THE SYSTEM after reinstalling the cylinder.

BOOM EXTEND (TELESCOPE) CYLINDER

The boom extend (telescope) cylinder is a double acting cylinder. It must be removed from the machine before a thorough inspection can be carried out.

EXTEND CYLINDER REMOVAL

Elevate the upper boom to the horizontal position. Extend the boom just enough to expose the upper cylinder pivot pin on the inner boom. Disconnect the hydraulic hoses from the cylinder. Remove the pivot pins from the inner and outer boom, and withdraw the cylinder from the boom.

⚠ CAUTION

With the extend cylinder disconnected, CARE MUST BE TAKEN TO PREVENT THE INNER BOOM FROM SLIDING OUT OF THE OUTER BOOM. Secure the inner boom in the fully retracted position.

EXTEND CYLINDER SEAL REPLACEMENT

Remove the end cap from the cylinder. Pull the cap and rod straight out of the cylinder barrel. Remove the split pin and nut from the end of the rod. Slip off the collar. Examine the rod and seals for signs of damage or wear.

Remove the old seals, and install a new set.

EXTEND CYLINDER INSTALLATION

WITH THE UPPER BOOM IN THE HORIZONTAL POSITION, slide the extend cylinder into the boom. Install the pivot pins and hoses.

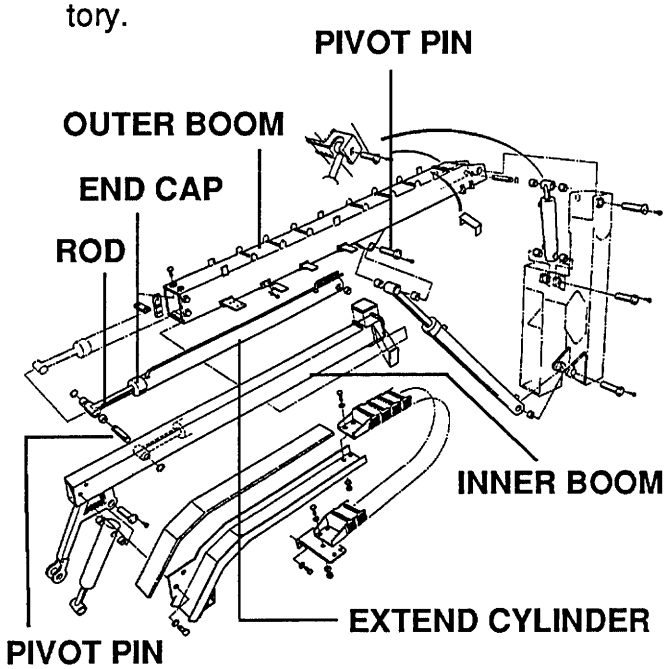
CHECKING HOLDING VALVES

Clean the end of the cylinder, and loosen the cylinder end cap.

Stop the motor, and activate the appropriate control lever several times to dissipate residual pressure. If the cylinder subsequently begins to move, the valve is faulty and the cartridge should be replaced.

NOTE

The holding valve is pre-set at the factory.



Extend Cylinder Service.

WEAR PADS

The nylon wear pads should be checked for wear approximately every six months. Fully retract the upper extend boom, and check the gap between the upper wear pad and the outer boom section, at the lower end of the boom. Inspect the side and lower pads as well.

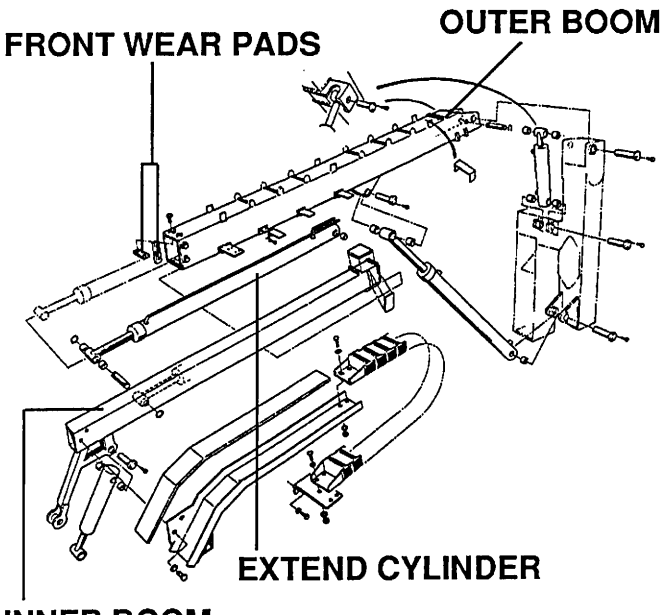
Then, extend the boom out, and check the gap between the lower wear pad and the inner boom section, at the upper end of the outer boom section. Inspect the side and upper pads as well.

⚠ CAUTION

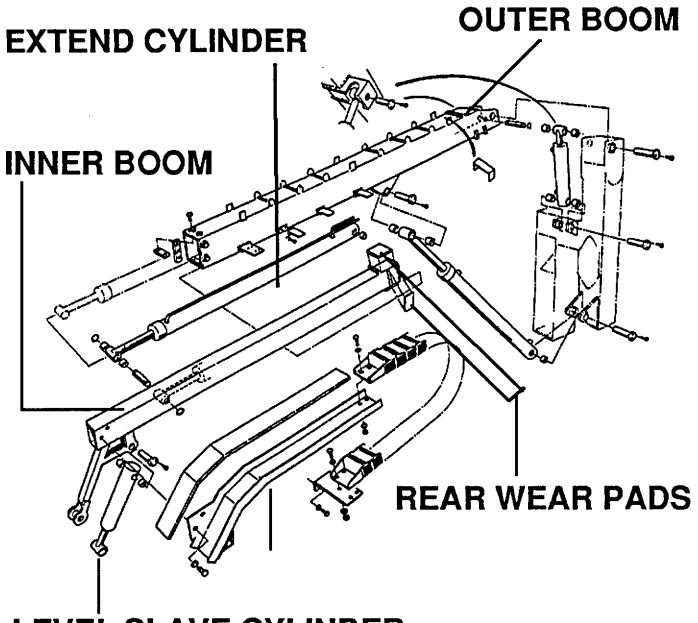
If a pad wears to approximately 3/8" (9.5 mm) thick, it should be replaced or shimmed. Generally, only the bottom pad at the upper end, and the top pad at the lower end of the boom will show wear.

FRONT (UPPER END) WEAR PAD REPLACEMENT

Remove the bolts holding the lower pad, and remove the pad (the boom may need to be extended out a short distance). Install replacement pad by hammering gently into place, then securing pad with mounting bolts. Repeat this procedure for the side and top pads if required.



Front (Upper End) Wear Pad Replacement.



Rear (Lower End) Wear Pad Replacement.

REAR (LOWER END) WEAR PAD REPLACEMENT

With the booms in stored position, extend the upper boom until the platform rests on the ground. Remove the platform pivot pin and the platform leveling slave cylinder upper pin. Remove the three bolts holding the upper end of the moving anchor to the extend boom section, and set it down. Be careful not to damage the catrac or hoses.

Retract the extend boom until the upper (front) extend cylinder pivot pin approaches the outer boom section. Remove the pin and the front wear pads, then raise the upper boom to clear the platform. Carefully slide the inner boom out of the outer boom section, supporting the boom as it is removed. The rear pads are merely trapped in the space between the inner and outer boom sections. Replace the rear pads, trimming as necessary for proper fit.

Reassemble the boom, making sure the pads are aligned properly as the inner boom section is inserted into the outer boom.

PLATFORM LEVEL CYLINDERS

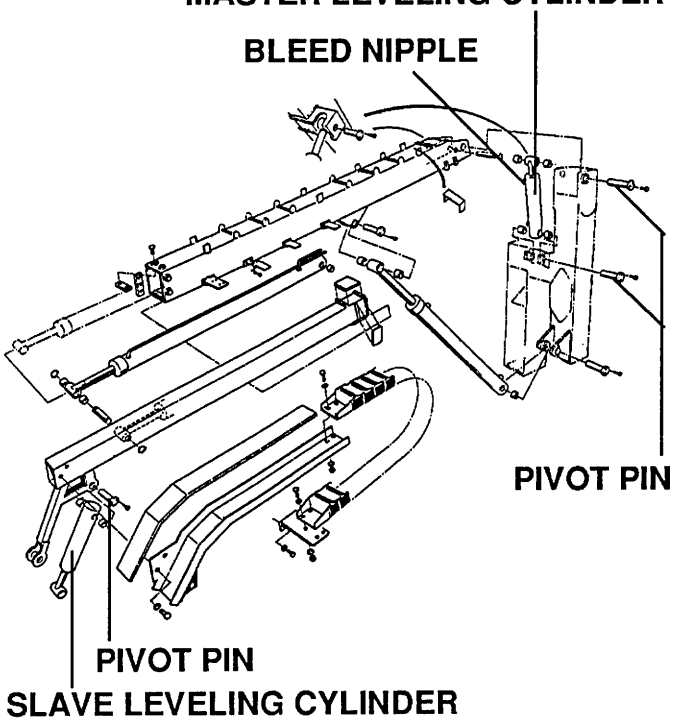
The platform level cylinders are of the double acting type. The pivot pins should be checked for wear. Check the pivot pin locking bolts for tightness. The cylinders should be inspected for fluid leakage, damage and security. The seals should be replaced whenever the cylinder is serviced.

LEVEL CYLINDER SEAL REPLACEMENT

Lower the upper boom. SUPPORT THE PLATFORM to remove the load on both master and slave leveling cylinders. Remove the pin locking bolts, and remove the pin.

Clean the end of the cylinder, and pull the cap and rod straight out of the cylinder barrel. TAKE CARE NOT TO DAMAGE THE ROD SURFACE, AND GUARD AGAINST DIRT ENTERING THE SYSTEM. Remove the split pin and nut from the end of the rod. Slip off the collar. Examine the rod and seals for signs of damage or wear.

Remove the old seals, and install a new seal kit.



Level Cylinders.

PLATFORM LEVELING PROCEDURE

After a platform level cylinder has been repaired or replaced, or if the platform does not remain level with the raising and lowering of the boom, the Platform Leveling Circuit may need to be bled.

NOTE

Assistance is required in order to perform the bleeding procedure. One person is needed to operate the platform level control, while the second person bleeds the system.

With all booms retracted, check the hydraulic fluid level in the tank. Slightly loosen the bleed nipple at the base of the leveling cylinder.

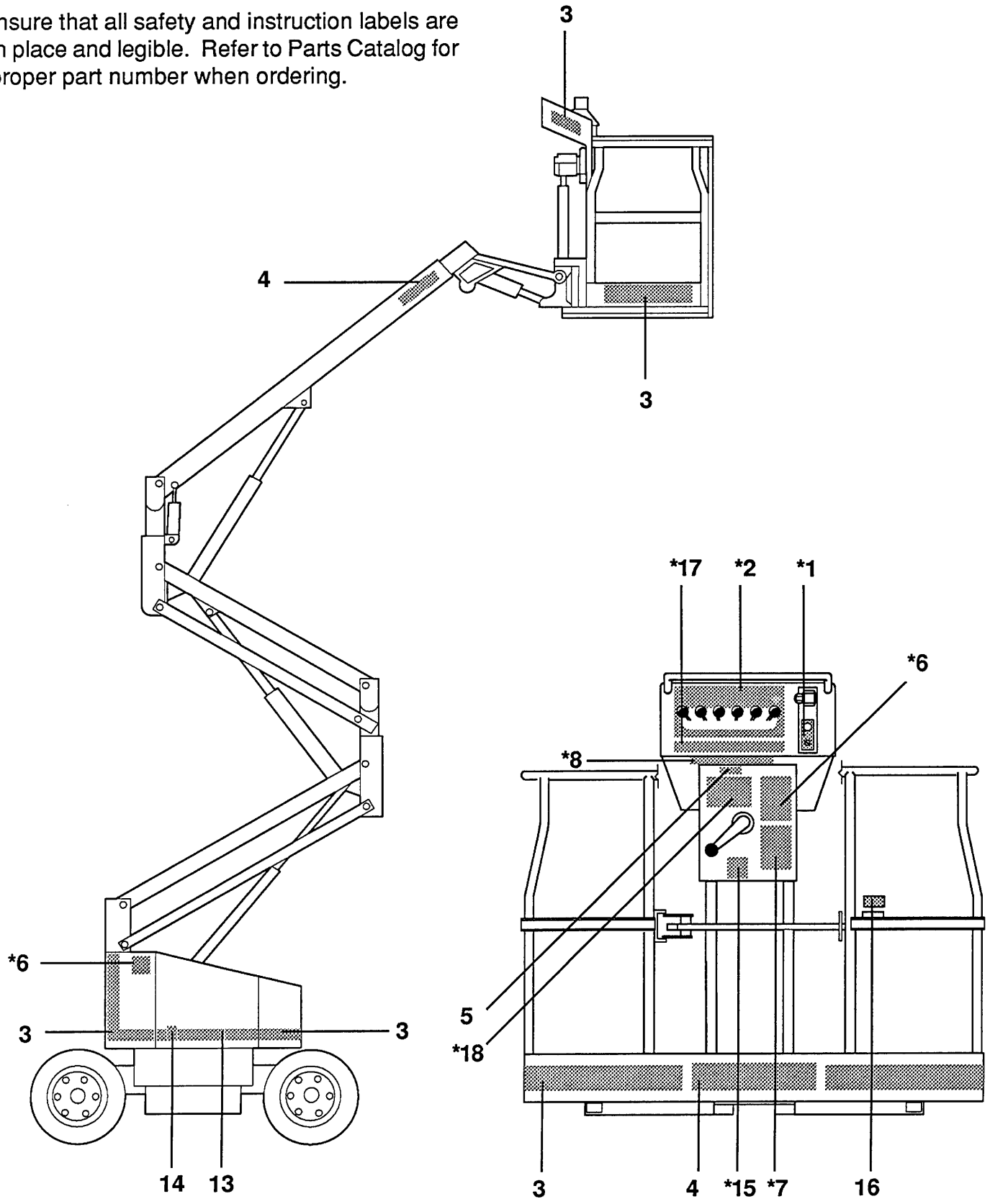
⚠ WARNING

HYDRAULIC FLUID WILL BE FORCIBLY EJECTED FROM THE BLEED NIPPLE. LOOSEN NIPPLE SLOWLY.

Operate the platform level control to move the platform fully backward and forward, repeating as necessary in order to expel any air from the system. Tighten the bleed nipple, and top off the hydraulic tank. Repeat the procedure as required until all air is expelled.

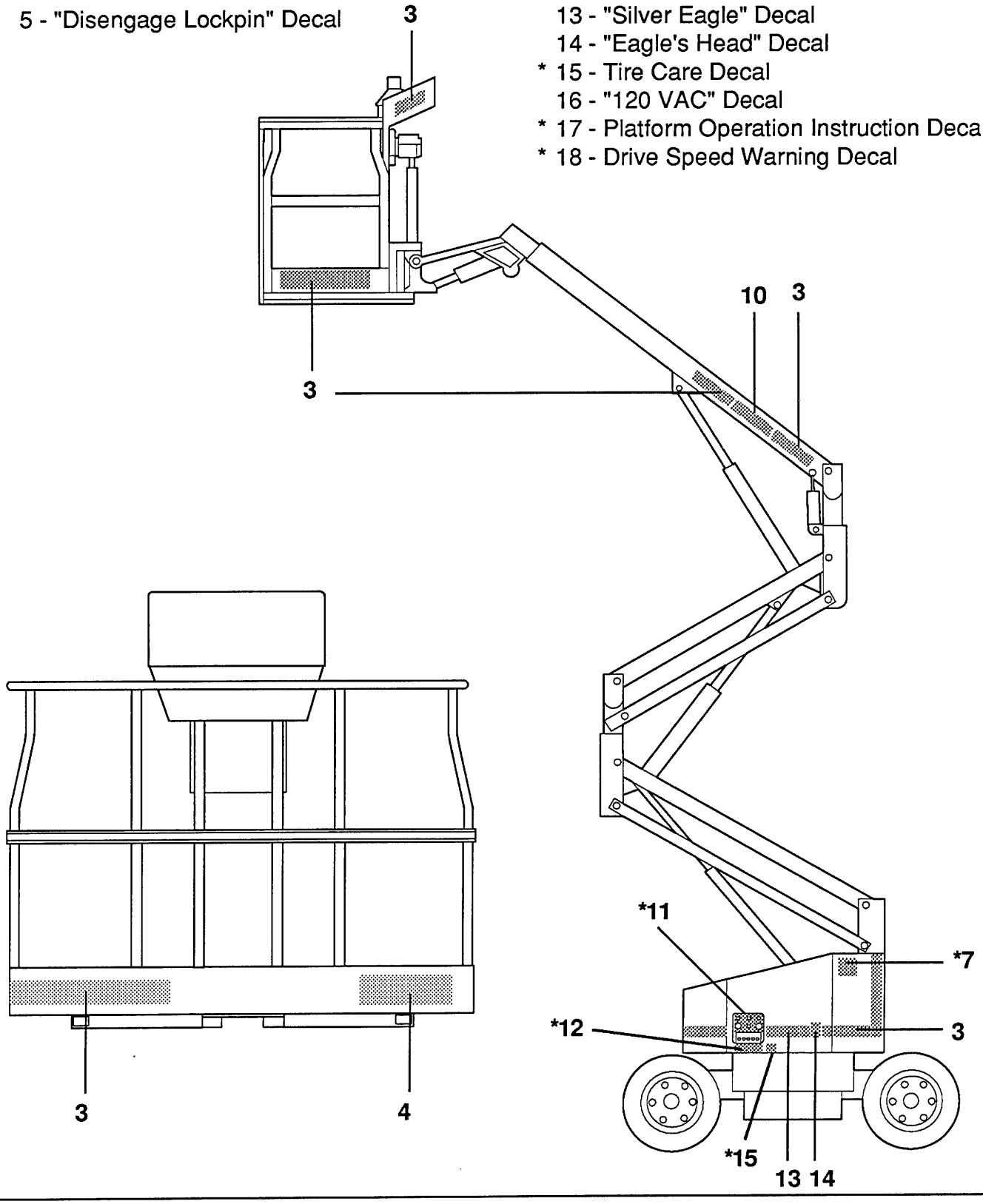
SAFETY AND INSTRUCTIONAL LABELS

Insure that all safety and instruction labels are in place and legible. Refer to Parts Catalog for proper part number when ordering.



Index for decal location.
NOTE: asterisk indicates safety-related item:

* 1 - Platform Control Panel Decal
* 2 - Platform Control Lever Decal
  3 - Stripe
  4 - "Simon" Decal
  5 - "Disengage Lockpin" Decal
* 6 - "Beware, Potential Hazard" Decal
* 7 - "Danger, Electrocution Hazard" Decal
* 8 - '500 Lb Payload Capacity" Decal
  9 - "Caution For Hydraulic Fluid Use" Decal
  10 - Model Designation Decal
* 11 - Ground Electrical Box Decal
* 12 - Ground Control Lever Decal
  13 - "Silver Eagle" Decal
  14 - "Eagle's Head" Decal
* 15 - Tire Care Decal
  16 - "120 VAC" Decal
* 17 - Platform Operation Instruction Decal
* 18 - Drive Speed Warning Decal



TROUBLESHOOTING

Before investigating a malfunction, check the following items:

- The ignition switch should be in the "ON" position.
- The emergency stop buttons on both the ground and platform control panels should be released (turn clockwise to reset).
- The ground/ platform selector switch on the ground control panel should be at the correct setting. The lift/ drive selector switch on the platform control panel must also be set to the correct function.
- When attempting to operate any function from the ground control panel, the "Pump" push button must be depressed.
- When attempting to operate any function from the platform, the foot pedal on the platform floor must be depressed.
- Check that battery connections are secure, and batteries have sufficient charge.
- Hydraulic fluid should be at the correct level.

Problem: Pump motor will not operate.

Operate pump and check voltage at batteries.

Check voltage at pump.

Examine electrical circuit for loose connections.

Check the contactor for proper operation.

Inspect pump motor brushes.

Check pump for mechanical defect

Problem: Pump motor operates, but does not generate hydraulic pressure.

Check for hydraulic fluid leaks.

Examine pump assembly for mechanical defect.

Check pressure relief valve for correct pressure setting.

Check 3-way, 2 position lift/ steer valve on hydraulic system manifold block for correct operation (refer to "MANIFOLDS" section under "HYDRAULIC SYSTEM").

Problem: Pump motor is slow in operation.

Check that the safe working load has not been exceeded.

Check pressure relief valve for correct pressure setting.

Verify that the correct grade of hydraulic fluid is being used.

Check for sufficient battery output.

Check electrical circuit for bad or loose connections.

Problem: Pump motor will not stop when machine is switched to DRIVE.

Check pressure switch and relays for correct operation.

Check operation of diverter valve.

Check diverter valve diode.

Check that the DC contactor contacts have not welded.

⚠ CAUTION

DO NOT ATTEMPT TO CLEAN CONTACTS WITH ABRASIVE MATERIAL. REPLACE CONTACTOR.

Problem: Booms will not raise or lower.

Check for sufficient battery output.

Check for hydraulic fluid leaks.

Check holding valves for sticking or damage.

Problem: Extend boom does not operate.

Check pressure relief valve for correct pressure setting.

Inspect boom assembly for damage, or for obstruction between the inner and outer boom sections.

Check boom sliding surfaces for proper lubrication. Lubricate as necessary with silicone spray.

Problem: Swing function does not operate.

Check for obstruction at the swing gearbox or swing bearing gear surfaces.

Inspect hydraulic swing motor and gearbox for proper operation.

The mechanical swing stop may be preventing rotation in one direction.

Problem: Drive motor will not operate.

Check contactors for proper operation.

Check drive motor electrical circuit for broken or loose connections.

Problem: Machine steers sluggishly, or not at all.

Check cross port relief valves for correct pressure settings.

Check 4-way, 3 position directional solenoid valve for correct operation.

Inspect steer cylinder seals for leaks.

Check for loose or damaged steering linkage.

Examine electrical connections on steering control switch (thumb button located on drive control lever).

Problem: Machine only operates in LOW SPEED mode.

Inspect boom limit switches for proper adjustment.

Verify that the brake is releasing.

Check that booms are in stowed position.

Problem: HIGH SPEED mode is available with booms elevated.

Check drive control lever for correct operation.

Inspect boom limit switches for proper adjustment.

Check settings of low speed drive potentiometer.

Problem: "EMERGENCY STOP" function does not work.

Check that the "Emergency Stop" button is operating correctly.

Problem: Drive motor controller does not operate.

See troubleshooting, test procedures and charts under "Drive Motor Controller".

Problem: Battery charger does not operate.

See troubleshooting section under "Battery Charger".

MAINTENANCE SCHEDULE

The Simon SILVER-EAGLE is designed to require a minimum amount of maintenance. However, it is essential that the specified services be performed at the indicated intervals, and that the instructions contained in this manual are followed to ensure safety and reliability.

The hydraulic pump, electric motor, cylinders and pressure valves are self-lubricating.

NOTE

As with any new machine, minor fluid leaks may occur until the various hydraulic components and pipe fittings are fully seated. It is particularly important that, for the first three months of operation, all hydraulic components, hoses and pipe fittings be checked regularly for leaks and tightness, and corrective action taken as required. Correction of minor fluid leaks and general tightening of machine components during this initial period are not considered as reimbursible expenses under the Simon Limited Warranty.

Pivot Pins and Bearings

All pivot pins are treated with a high oil absorption, corrosion resistant coating.

All pivot pin bearings use special steel backed bushings.

In tropical climates or other adverse conditions, pins and bearings may require more frequent lubrication.

General Maintenance Tips

Never leave components or hoses open. They must be protected from contamination (including rain) at all times.

Never open a hydraulic system when there are contaminants in the air.

Use only recommended lubricants. Improper lubricants or incompatible lubricants may be as harmful as no lubrication.

ALWAYS clean the surrounding area before attempting to open hydraulic or engine systems.

Watch for makeshift "fixes", which can jeapordize safety as well as lead to more costly repairs.

Any work platform found not to be in safe operating condition should be removed from service until repaired. All repairs should be made by authorized personnel in conformance with the manufacturer's operating, maintenance, and repair manuals.

ROUTINE SERVICING

NOTE

The following recommendations are based on the advice of suppliers, and the requirements of various safety regulations. They should be followed with discretion based on factors such as amount and type of machine usage, environmental conditions, and local safety regulations.

DAILY SERVICE

Hydraulic System

Before checking the hydraulic fluid level, ensure that the machine booms are stowed in the traveling position, and the machine is standing on level ground. Fluid level must be to full mark on sight gauge, located on the side of the tank. If the reservoir requires additional fluid, refer to the Lubrication Chart for the correct grade.

After checking the fluid level, ensure that the filler cap is secure to prevent entry of water or other impurities into the tank.

Tire Condition

Check that the machine tires are in good condition. Check tire pressure.

Platform Safety Gate

Check the security of the platform safety gate and latching mechanism.

WEEKLY SERVICE

Control Valves

Platform and ground control valves must be checked for correct operation. Check that all control valve handles automatically return to the center (neutral) position.

Hydraulic System

Pressurize the hydraulic circuit and inspect the system for any signs of leakage, particularly at flexible hoses, connections and hydraulic components.

Steering

Check the steering cylinder for fluid leakage. Inspect steering linkage for signs of wear.

Batteries

Check the electrolyte level in battery cells. Replenish with distilled water, if necessary.

Pivot Pins

Examine all pivot pins on booms, cylinders and leveling system to ensure that they are positively secured in position.

MONTHLY SERVICE

Hydraulic System

Allow the machine to stand overnight, or for at least eight hours, without operating the pump. This will allow water and any other impurities to separate out of the hydraulic fluid and settle to the bottom of the tank.

Disconnect the 3/4 inch pipe fitting from the pump side of the ball valve at the bottom of the tank, and block off to prevent fluid leakage from the system.

Open the ball valve just enough to allow a gradual trickle of fluid. Drain fluid from the tank into a transparent container, until clean hydraulic fluid flows. Under normal operating conditions, a maximum of one-half pint is usually sufficient to remove all impurities.

Check fluid color. If the hydraulic fluid does not flow clear amber, but has a cloudy appearance, it is usually an indication that water is present. A dark brown color, accompanied by a strong "burnt" smell, indicates that the fluid has overheated. If either condition occurs, a complete hydraulic fluid and filter change will be necessary.

The cause of hydraulic fluid deterioration should be investigated and rectified. Have fluid analyzed by a qualified laboratory.

Check for hydraulic system leaks.

Chassis Bolts

Check all bolts for signs of looseness.

Swing Bearing

Remove any dirt from between the swing bearing gear teeth, and lubricate.

NOTE

If solvents or a high-pressure washer are used for cleaning the machine, relubricate the swing bearing teeth (see Lubrication Chart).

Grease the swing bearing while rotating the superstructure as necessary to insure proper lubrication.

Check swing gearbox oil level. Top off as required.

The filler plug is located at the top, and the drain plug at the bottom of the gearbox housing. With the machine on level ground, the oil level should reach the filler plug hole. Low oil level is usually due to seal failure on the wormshaft.

On Model 41/24, the swing gearbox top bearing should be lubricated with a quality bearing grease. Add grease through the fitting on the top center of the gearbox until grease comes out the purge port on top of the box.

Lubrication

Lubricate all small pivots (but not the main pin pivots) throughout the machine with any good quality medium grade oil. Special attention should be given to the platform control lever pivots.

Pivot Pins

Examine all pivot pins on booms, cylinders and leveling system to ensure that they are positively secured in position.

Drive Gearbox

Check drive gearbox oil level. Top off as necessary.

Drive Line Brake

Check fluid level in drive line brake.

SEMI-ANNUAL SERVICE

Platform Leveling

Examine both platform leveling cylinders, particularly at the pivot points, for any sign of wear or damage. Ensure that the end fittings are secure.

Check cylinders and hose fittings for leaks.

Platform Pivots

The main pivots on the booms, cylinders and leveling system are fitted with corrosion resistant pins, and pre-lubricated bearings. Check the bearings with the pivot pins removed.

The bearings use special steel backed bushings. If the bearings should show any defect, they must be replaced with the correct type.

Boom Cylinders

Fully retract, then extend each boom lift cylinder, and the upper boom extend cylinder. At each extreme position, check that there is no movement between cylinder rod and bearing housing, or between cylinder cap and tube.

Check all cylinders for hydraulic fluid leakage.

Rear (Drive) Axle

Check axle differential housing oil level. Top off as required.

Hydraulic Line Filters

Change the return line filter element.

Change the suction line filter element.

In severe use applications, more frequent filter changes will be necessary.

Test All Machine Systems

Test the operation of the drive assembly, including drive shaft, axle, couplings, drive motor and gearbox.

Test the operation of the swing bearing, motor and gearbox.

Test the operation of the platform rotator.

Test the operation of all machine boom functions.

ANNUAL SERVICE

Swing Gearbox

Rotate the superstructure for a short period to warm the oil in the swing gearbox. This will allow the oil to flow more freely, and hold any impurities in suspension. Remove the drain and filler plugs from the gearbox housing, and drain the oil. Replace drain plug.

Fill swing gearbox. Replace filler plug.

Flexible Hoses

Inspect all hoses over their complete length. Replace any hoses showing looseness or corrosion at the end fittings. Replace hoses exhibiting cracking, blistering or excessive wear of outer protective covering.

Hydraulic Fluid

If the hydraulic system has been properly maintained, the fluid should only need to be changed once each year. This, of course, will depend on machine application, amount of use, temperature, atmospheric conditions and other factors.

Hydraulic Fluid Tank

Carefully check the condition of the fluid inside the tank to ensure that it flows easily and is of clear, amber color. In cases of gross contamination, it will be necessary to completely drain and refill the entire hydraulic system.

Place a suitable waste oil container under the drain tap, or attach a suitable hose from the drain tap to the container.

Open the drain tap, and completely drain the fluid from the tank. Remove the tank top plate for internal inspection and cleaning.

Clean or replace the suction hose, and close the drain tap. Reinstall the tank top plate, replacing the gasket if necessary, and refill the tank to the correct level.

Drive Line Brake

Check condition of fluid and top off.

Structural Examination

A thorough examination of the machine should be carried out for signs of corrosion, misalignment, material fractures, and other damage. Particular attention should be given to the condition of welded joints.

Platform Mounting

Check that platform mounting bolts are secure. Check that platform frame members are in good condition.

FOUR YEAR INTERVAL SERVICE

Pivot Pins and Bearings

Remove the pivot pins for examination. Check the pivot pin bearings with the pivot pins removed. Replace bearings as necessary. Pivot pins are treated with an oil absorbing, corrosion resistant coating. The bearings are steel backed, and copolymer lined. Replace with the correct type of pins and bearings.

DAILY OPERATIONAL CHECKLIST

All checks must be completed before operation of the Silver-Eagle.

MODEL NUMBER _____ **INSPECTED BY** _____

SERIAL NUMBER _____ **DATE** _____

- Keep inspection records up-to-date.
- Record and report all discrepancies to your supervisor.
- A dirty machine cannot be properly inspected.
  Keep your SIMON SILVER-EAGLE clean!!

THIS CHECKLIST MUST BE USED DAILY. FAILURE TO DO SO COULD ENDANGER THE LIFE OF THE OPERATOR. ALWAYS REMEMBER, A LITTLE PREVENTIVE MAINTENANCE CAN SAVE MUCH MORE THAN IT COSTS.

INITIAL	DESCRIPTION
_____	1. Check unit for any prior-shift or transportation damage, i.e. missing parts, torn or loose hoses, hydraulic fluid leaks, torn or disconnected wires, flat or damaged tires, etc. The doors on both sides can be opened to inspect components inside.
_____	2. Check hydraulic fluid level with all cylinders retracted. Fluid level should be to full mark on sight gauge.
_____	3. Check that hydraulic pressure is as stated on the Data Plate.
_____	4. Check that wheel lug nuts are tightened to proper torque.
_____	5. Check tires for damage and proper inflation pressure.
_____	6. Check for bent or sagging hose track.
_____	7. Check platform and gate for damage.
_____	8. Check safety belt connection.
_____	9. Check battery terminals for cleanliness and tight connections.
_____	10. Check emergency hand pump for proper operation and hydraulic pressure as stated on Data Plate.
_____	11. Check pressure gauge on filter assembly. Replace filter element if gauge reads 20 PSI or higher. We recommend replacing both suction and return filter elements at the same time.

DAILY OPERATIONAL CHECKLIST (CONTINUED)

INITIAL	DESCRIPTION
_____	12. Check that drive interlock system has not been tampered with.
_____	13. Check warning and operating instruction decals for legibility.
_____	14. After pre-inspection checks have been completed, check ground control station for proper operation. (Refer to "Ground Operation and Checks" in Operators Manual).
_____	15. Check platform controls for proper operation. (Refer to "Platform Operation and Checks" in Operators Manual).
_____	16. With platform raised, check for smooth operation of low speed drive.
_____	18. Check "Emergency Stop" function at both ground and platform.

ADDITIONAL MAINTENANCE REQUIREMENTS FOR SEVERE USAGE APPLICATIONS

INITIAL	DESCRIPTION
	DAILY
_____	1. Inspect pylon boots, cylinder boots, controller boots, etc., for cuts or other damage after every eight hours of service. Repair or replace if necessary.
_____	2. Check hydraulic system for leakage after every eight hours of operation.
	WEEKLY
_____	1. Inspect condition of hydraulic fluid. Fluid should have a clear, amber color.
_____	2. Lubricate all grease fittings.
_____	3. Check all decals for legibility.
_____	4. Apply dry lubricant to swing drive pinion gear.

MONTHLY OPERATIONAL CHECKLIST

MODEL NUMBER _____ **INSPECTED BY** _____

SERIAL NUMBER _____ **DATE** _____

- Keep inspection records up-to-date.
- Record and report all discrepancies to your supervisor.
- A dirty machine cannot be properly inspected.
  Keep your SIMON SILVER-EAGLE clean!!

THIS CHECKLIST MUST BE USED AT MONTHLY INTERVALS . FAILURE TO DO SO COULD ENDANGER THE LIFE OF THE OPERATOR. ALWAYS REMEMBER, A LITTLE PREVENTIVE MAINTENANCE CAN SAVE MUCH MORE THAN IT COSTS.

INITIAL	DESCRIPTION OF CHECKS
_____	1. Perform all checks listed on Daily Operational Checklist.
_____	2. Lubricate all grease fittings (including those on drive shaft).
_____	3. Inspect condition of hydraulic fluid in the reservoir. Fluid should be a clear, amber color.
_____	4. Check hydraulic system for leaks. Examine hoses for signs of excessive wear, chafing or twisting. Replace worn hoses if necessary.
_____	5. Inspect the work platform and boom structure for damage and condition of welds.
_____	6. Check the low speed drive to ensure it is within specified limits.
_____	7. Check emergency descent system.
_____	8. Check all decals for legibility.
_____	9. Clean and lubricate all valve controls so they do not stick.
_____	10. Check joints and linkage pins for security.
_____	11. Check tires for cracks and other damage.
_____	12. Check for unit damage, broken welds, improper or quick fixes, (i.e. wired parts, improper parts).

MONTHLY OPERATIONAL CHECKLIST (CONTINUED)

INITIAL	DESCRIPTION
_____	13. Torque eight bolts on axle mounting blocks.
_____	14. Check rubber wrap around hoses at moving anchor and extend boom.
_____	15. Check boom hose track for sag and other damage. If damaged, repair, and correct the cause of damage, i.e. hoses too tight, breaking cross braces and worn, cracked or abraded hoses.
_____	16. Check torque of swing bearing bolts.
_____	17. Check adjustment and security of swing drive. There should be a slight amount of backlash between the superstructure and undercarriage when properly adjusted.
_____	18. Check oil level in swing drive. It should be half filled. **On Model 41/24,** grease top bearing.
_____	19. Check oil level in rear axle. (Refer to Lubrication Chart)
_____	20. Check snap rings on cylinder and other pins.

ADDITIONAL MAINTENANCE REQUIREMENTS FOR SEVERE USAGE APPLICATIONS

INITIAL	DESCRIPTION
	EVERY 90 DAYS
_____	1. Change suction and return filter elements.

SEMI-ANNUAL OPERATIONAL CHECKLIST

MODEL NUMBER _____ **INSPECTED BY** _____

SERIAL NUMBER _____ **DATE** _____

- Keep inspection records up-to-date.
- Record and report all discrepancies to your supervisor.
- A dirty machine cannot be properly inspected.
  Keep your SIMON SILVER-EAGLE clean!!

THIS CHECKLIST MUST BE USED AT 6 MONTH INTERVALS. FAILURE TO DO SO COULD ENDANGER THE LIFE OF THE OPERATOR. ALWAYS REMEMBER, A LITTLE PREVENTIVE MAINTENANCE CAN SAVE MUCH MORE THAN IT COSTS.

INITIAL	DESCRIPTION
_____	1. Perform all checks listed on Daily and Monthly Operational Checklists.
_____	2. Have hydraulic fluid sample analyzed at a test laboratory. Follow the recommendations of test results. If hydraulic fluid has been regularly maintained, it should only require changing once every year, depending on maintenance, temperature, application, duty cycle and atmospheric conditions.
_____	3. Inspect the entire machine for signs of damage and broken welds.
_____	4. Check operating speeds to ensure they are within specified limits.
_____	5. Check operation of emergency power system.
_____	6. Check all decals for legibility.
_____	7. Clean and lubricate all push button switches with an electrical contact cleaner and ensure that the switches operate freely in all positions.
_____	8. Check all electrical mounting and hardware connections for security.
_____	9. Replace both suction and return filter elements.
_____	10. Check tightness of upper frame, swing bearing and swing drive mounting bolts.
_____	11. Drain and replace lubricant from swing drive and rear axle. If badly contaminated, it may be necessary to disassemble and inspect components.

SEMI-ANNUAL OPERATIONAL CHECKLIST (CONTINUED)

INITIAL	DESCRIPTION
_____	12. Inspect entire machine for worn or damaged components. Replace as necessary.
_____	13. Lubricate all hydraulic valve spool linkages.
_____	14. Lubricate swing bearing and drive pinion gear.

MAINTENANCE CHART

NOTE

This Maintenance Chart is only to be used as a reminder of the detailed instructions given in this manual. All detailed servicing instructions must be implemented.

Maintenance Item	Daily	Weekly	Monthly	Semi-Annual	Annual	4 Year
Check machine structure	X					
Check platform structure	X					
Check boom structure	X					
Check unit for broken welds	X					
Check tire condition	X					
Check tire pressure	X					
Check wheel lug nuts	X					
Check hose track	X					
Check platform door latch	X					
Check pivot pin security	X					
Check battery terminals	X					
Check pressure gauge on filter assembly	X					
Check hydraulic fluid level	X					
Check hydraulic pressure	X					
Inspect hydraulic system	X					
Check low speed drive	X					
Check platform leveling	X					
Check emergency pump operation	X					
Test all machine systems	X					
Check battery electrolyte		X				
Check control valves		X				
Check steering system		X				
Check for tangled hoses			X			

MAINTENANCE CHART

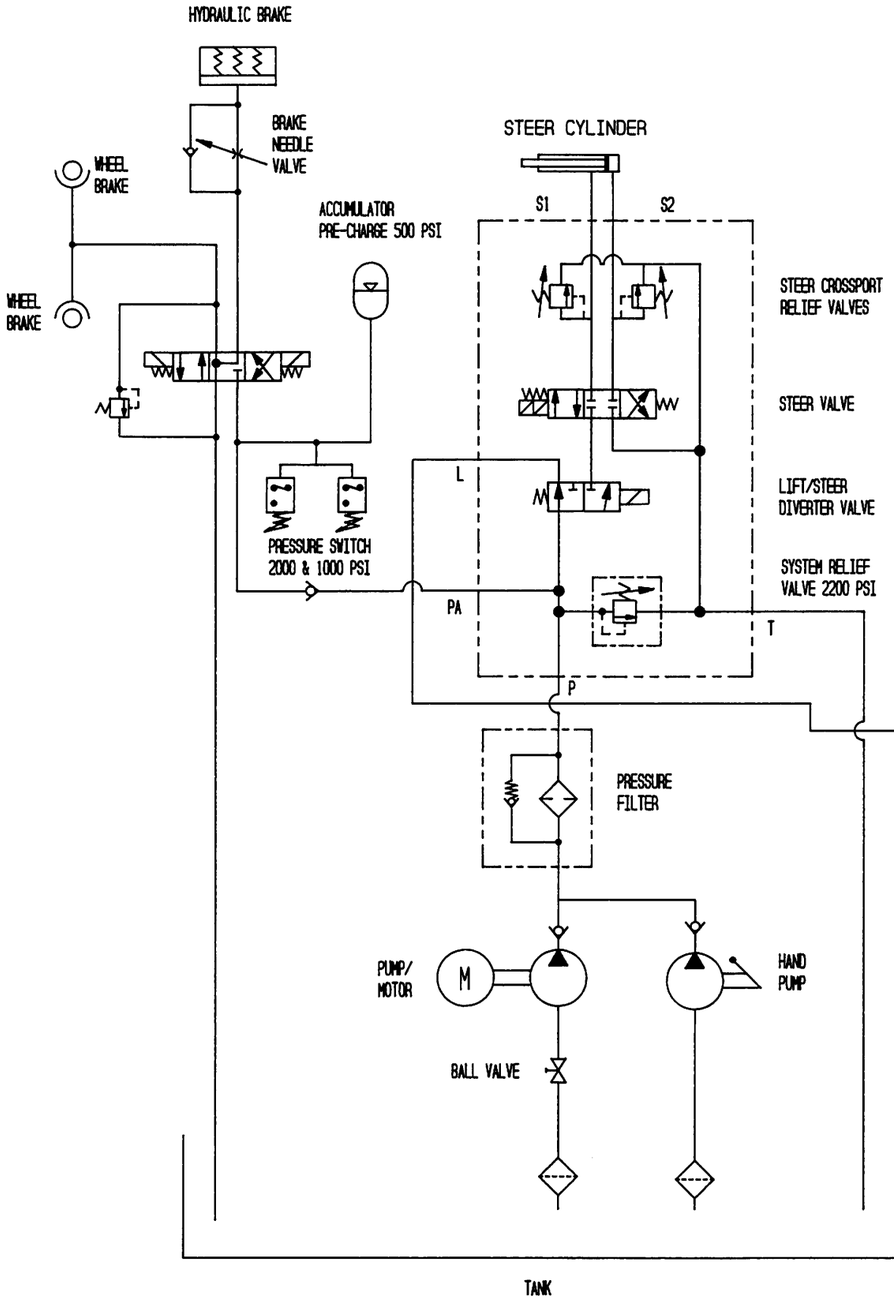
Maintenance Item	Daily	Weekly	Monthly	Semi-Annual	Annual	4 Year
Check chassis bolts			X			
Check moving anchor			X			
Check boom/cylinder pins			X			
Check torque on swing bearing bolts			X			
Torque bolts on axle mounting blocks			X			
Check drive gearbox oil			X			
Check swing gearbox oil level			X			
Check rear (drive) axle oil level			X			
Check hydraulic fluid contamination			X			
Lubricate all grease fittings			X			
Clean & lubricate valve controls			X			
Lubricate swing gear teeth			X			
Lubricate pivot pins			X			
Check platform mountings				X		
Check boom cylinder gland nuts				X		
Check swing drive mounting bolts				X		
Check electrical system				X		
Check operating speeds				X		
Replace swing drive and axles fluid				X		
Replace suction and return filter elements				X		
Clean and lubricate push button switches				X		

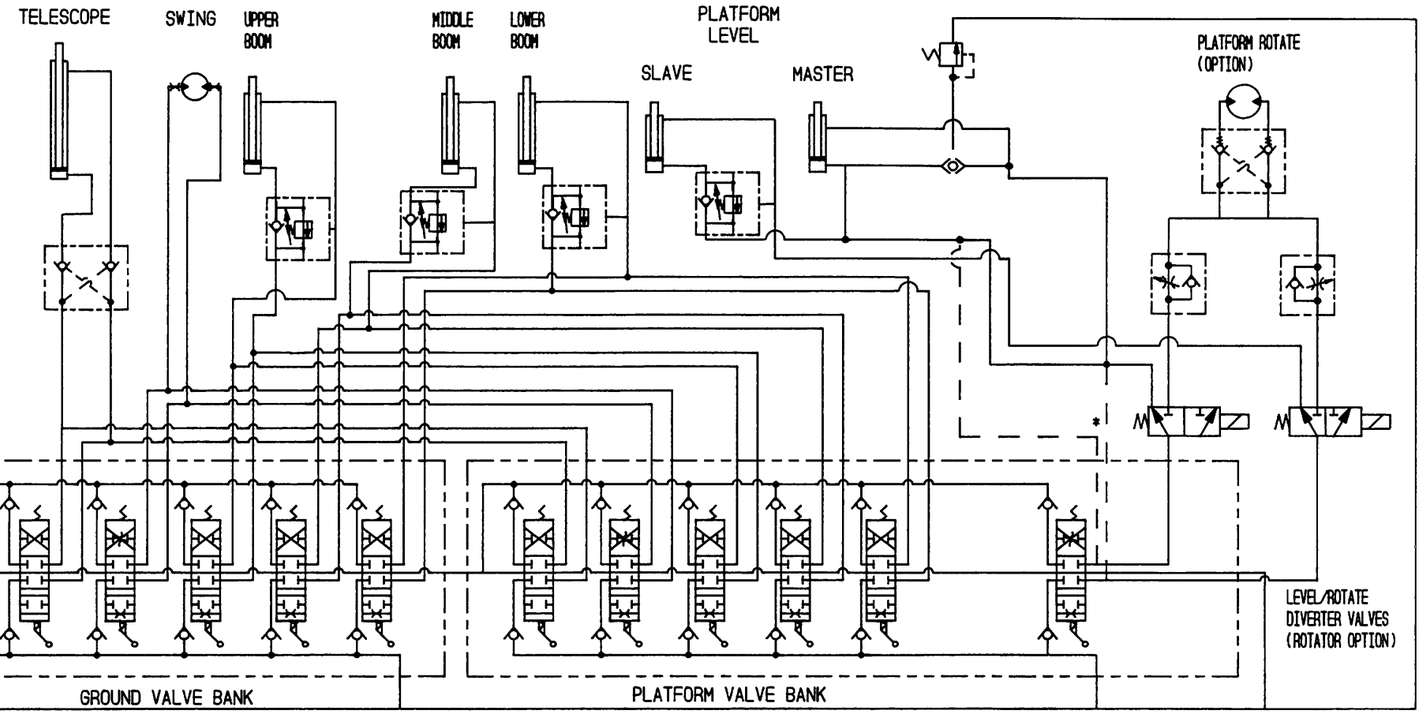
MAINTENANCE CHART

Maintenance Item	Daily	Weekly	Monthly	Semi-Annual	Annual	4 Year
Lubricate hydraulic valve control linkages				X		
Analyze hydraulic fluid				X		
Check pivots for wear					X	
Check hoses for wear					X	
Change hydraulic fluid					X	
Grease swing bearing					X	
Examine pivot pins						X
Examine pin bearings						X

ENGINEERING DRAWING SEQUENCE:
Silver Eagle Electric

1.	SDS-214015-0	Electric Schematic, Silver Eagle (Electric)	11" x 17"
2.	SDS-214173-0	Hydraulic Schematic, Silver Eagle 41/24 (Electric)	11" x 17"
3.	SDS-217067-0	Hydraulic Schematic, Silver Eagle 41/24 (Electric)	11" x 17"





NOTE: SCHEMATIC WAS DRAWN AS A 41/24 MACHINE. THE 32/21 IS THE SAME WITH THE EXCEPTION THAT IT HAS NO MIDDLE BOOM & THEREFORE NO MIDDLE BOOM CONTROL VALVES.

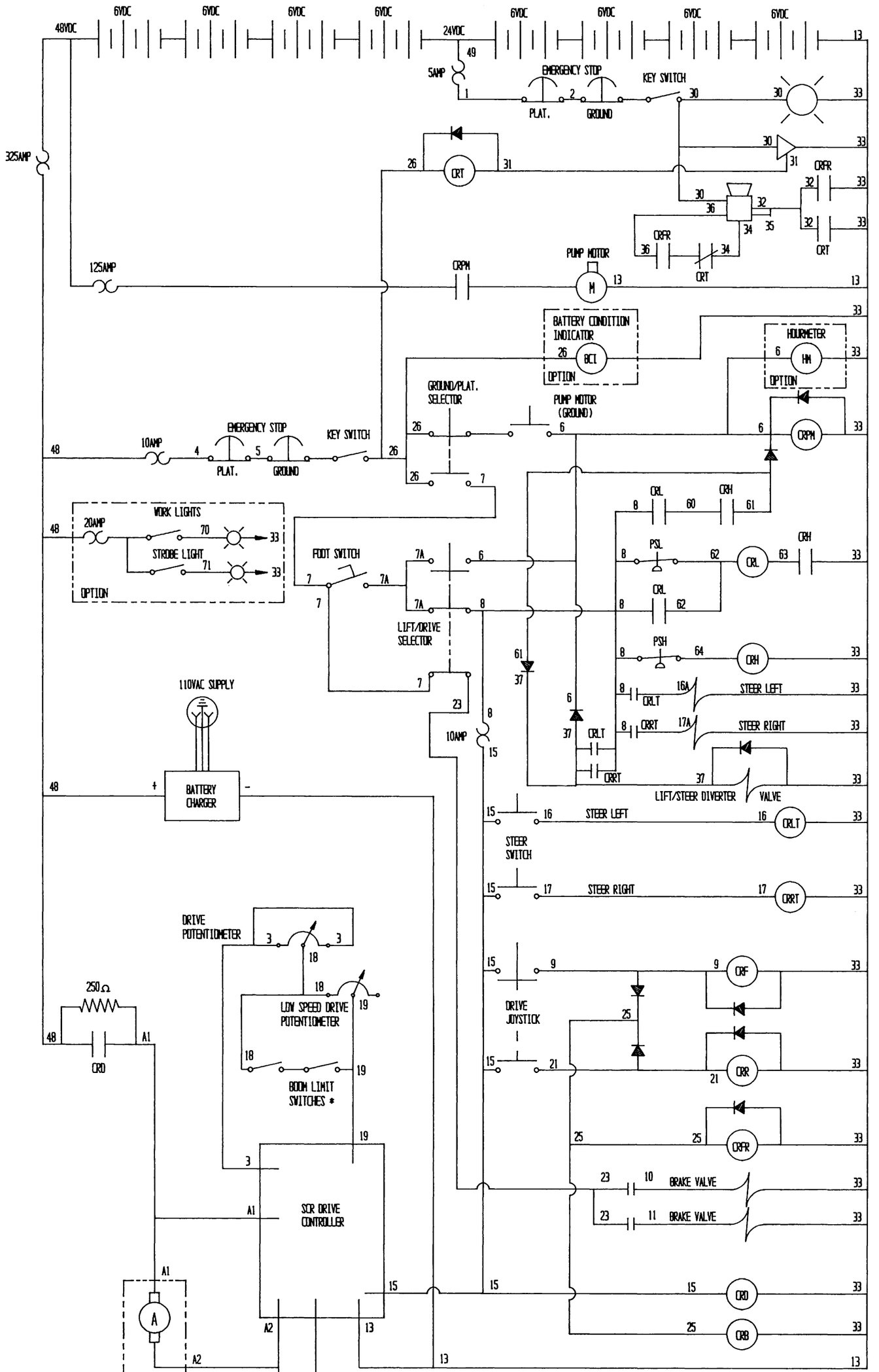
* FOR MACHINES NOT EQUIPED WITH THE HYDRAULIC PLATFORM ROTATE OPTION-THE LINES GOING TO THE LEVEL/ROTATE DIVERTER VALVES WOULD GO DIRECTLY FROM THE CONTROL VALVE TO THE PLATFORM LEVEL CIRCUIT.

SIMON-AERIALS INC.
MILWAUKEE, WI. 53224

TITLE
HYDRAULIC SCHEMATIC 41/24

REVISION

DRWG. NO.
SDS-217067-0



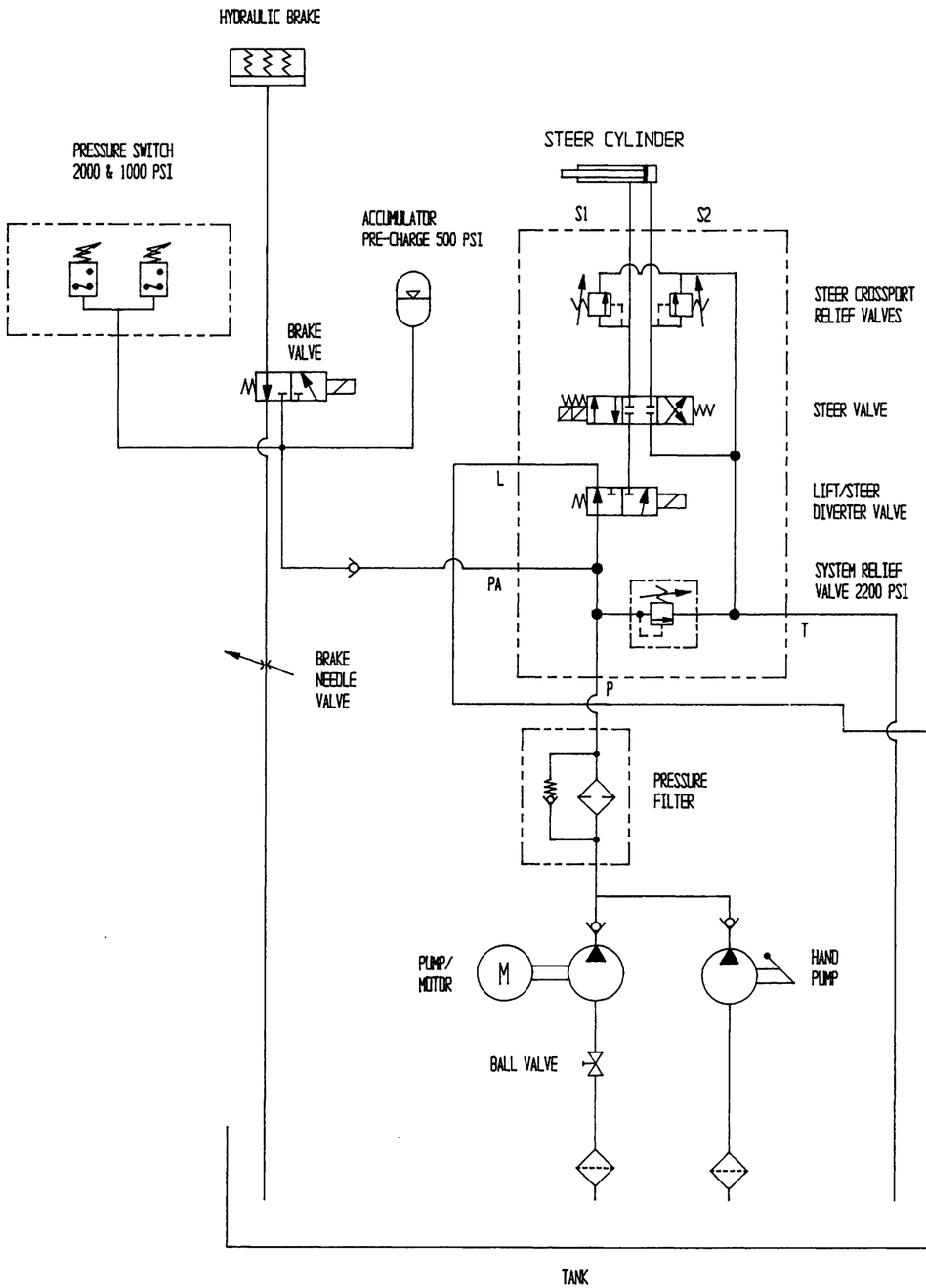
NOTES:
- WIRE NUMBERS 13&33 ARE BOTH BATTERY NEGATIVE- #13 DENOTES CABLE, #33 DENOTES WIRE.
- * BOOM LIMIT SWITCHES ARE DRAWN FOR 41/24. THE 32/21 MODEL HAS ONLY ONE BOOM LIMIT SWITCH
- GROUND/PLATFORM SELECTOR SWITCH SHOWN IN GROUND POSITION.
- LIFT/DRIVE SELECTOR SWITCH SHOWN IN DRIVE POSITION.

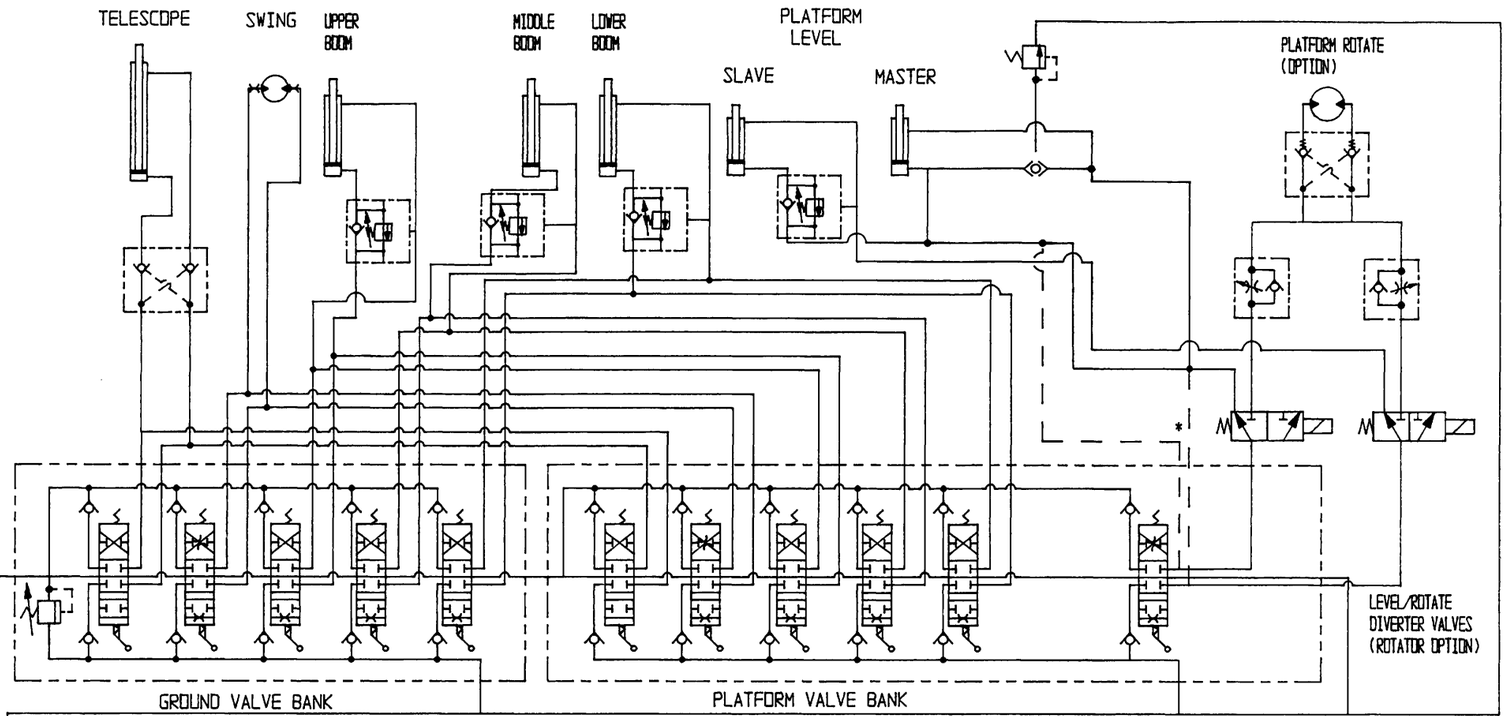
SIMON-AERIALS INC.
MILWAUKEE, WI. 53224

TITLE: ELECTRICAL SCHEMATIC
SILVER EAGLE
(ELECTRIC 41/24 & 32/21)

REVISION: B/ 10/17/88

DRWG. NO. SDS-214015-0





NOTE: SCHEMATIC WAS DRAWN AS A 41/24 MACHINE. THE 32/21 IS THE SAME WITH THE EXCEPTION THAT IT HAS NO MIDDLE BOOM & THEREFORE NO MIDDLE BOOM CONTROL VALVES.

* FOR MACHINES NOT EQUIPED WITH THE HYDRAULIC PLATFORM ROTATE OPTION-THE LINES GOING TO THE LEVEL/ROTATE DIVERTER VALVES WOULD GO DIRECTLY FROM THE CONTROL VALVE TO THE PLATFORM LEVEL CIRCUIT.

SIMON-AERIALS INC.
MILWAUKEE, WI. 53224

TITLE
HYDRAULIC SCHEMATIC 41/24

REVISION	DRWG. NO.
9/6/89	SDS-214173-0