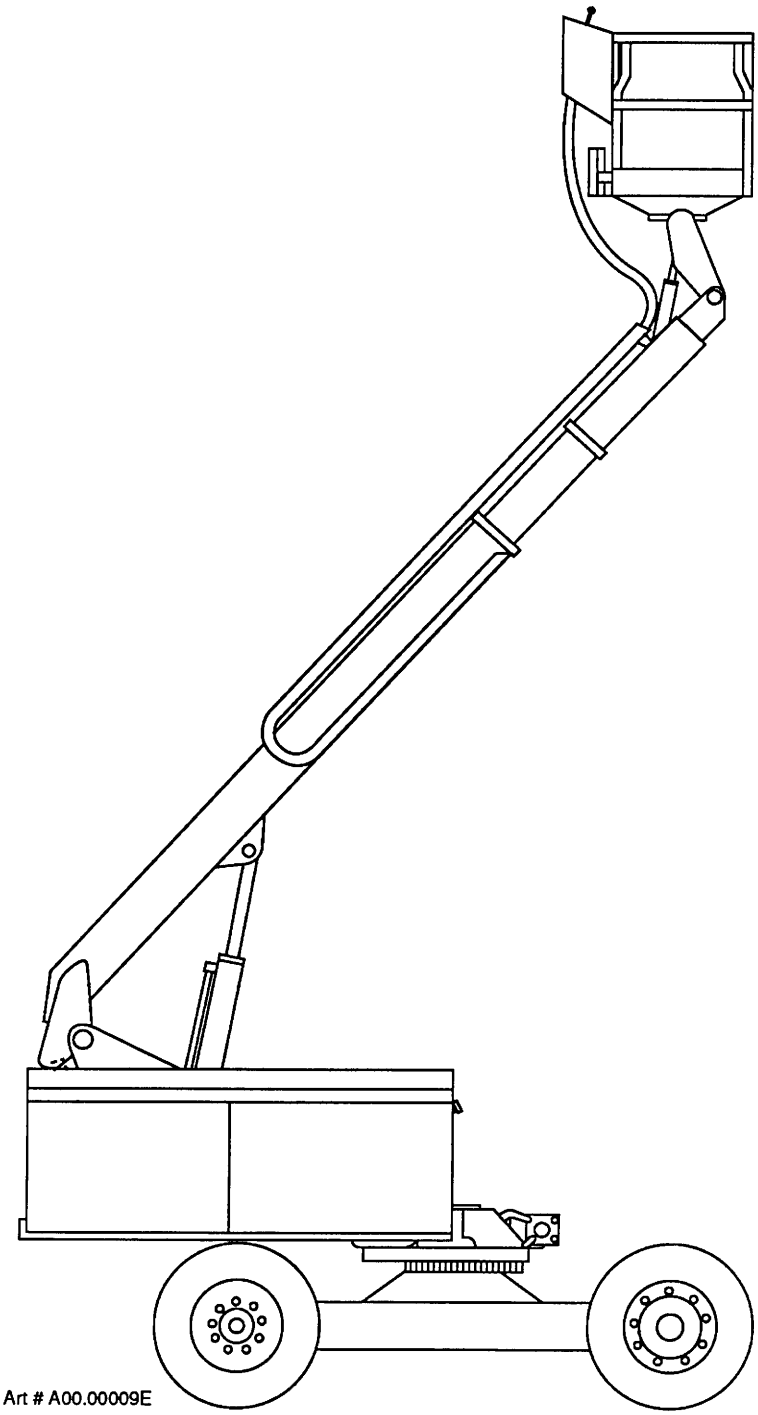
SIMON AERIALS INC.
10600 W. Brown Deer Road
Milwaukee, Wisconsin 53224
Phone (414) 355-0802
TWX: 910-262-3310
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Cable: SIMON MIL

SIMON

SERVICE MANUAL

MODEL
MP

ELECTRO-PROPORTIONAL



Art # A00.00009E

PART NO. 89-100307

Introduction

THIS MANUAL CONTAINS INSTRUCTIONS FOR THE SERVICE, ADJUSTMENTS AND MAINTENANCE OF THE MP SERIES SIMON AERIAL BOOM LIFT.

IT IS INTENDED TO BE USED IN CONJUNCTION WITH AND AS A SUPPLEMENT TO THE OPERATORS, PARTS AND COMPONENT REPAIR MANUALS WHICH ARE PROVIDED SEPARETELY.

THE MP SERIES MOBILE PLATFORM HAS BEEN DESIGNED AND BUILT TO PROVIDE THE CUSTOMER WITH MANY YEARS OF DEPENDABLE SERVICE. THE FULL BENEFITS PROVIDED BY THIS MACHINE CAN BE DERIVED ONLY BY FOLLOWING THE PROPER OPERATING AND MAINTENANCE PROCEDURES. ONLY TRAINED AND AUTHORIZED PERSONNEL SHOULD OPERATE AND SERVICE THIS EQUIPMENT. OPERATORS AND SERVICE PERSONNEL SHOULD STUDY THESE MANUALS TO ASSURE THAT THEY HAVE A THOROUGH UNDERSTANDING OF THE CONTENTS WHICH PERTAIN TO THEIR PARTICULAR RESPONSIBILITIES.

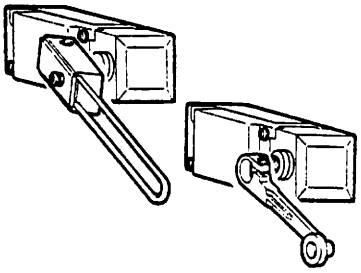
OPERATORS MUST ALSO UNDERSTAND ALL WARNINGS AND INSTRUCTIONS ON THE BODY OF THE MACHINE AND CONTROL CONSOLES.

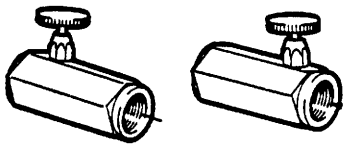
MODIFICATIONS FROM THE ORIGINAL DESIGN OF THIS EQUIPMENT ARE STRICTLY FORBIDDEN WITHOUT WRITTEN PERMISSION FROM SIMON AERIALS, INC.

SIMON AERIALS, INC. RESERVES THE RIGHT TO IMPROVE AND EXPAND PRODUCT FEATURES ON ITS EQUIPMENT. THEREFORE, SPECIFICATIONS AND/OR EQUIPMENT IS SUBJECT TO CHANGE WITHOUT PRIOR NOTICE. THESE MANUALS ARE PERIODICALLY UPDATED TO REFLECT ANY CHANGES THAT OCCURED BETWEEN PRINTINGS. IT IS THEREFORE RECOMMENDED THAT USERS CONTACT SIMON AERIALS, INC. FOR LATEST INFORMATION REGARDING THIS EQUIPMENT.

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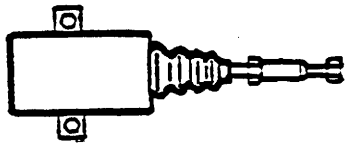


ADJUSTMENTS

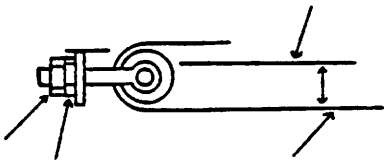
Two Speed Drive Limit Switches - are located at the front end of the base boom. Adjust the limit switch lever arms for proper operation. Refer to the Drive System section for specifications.

Unit Speed - is adjusted by two adjustable flow control valves located at the directional control valve. By loosening the lock nut, speeds can be increased or decreased as needed by turning the knurled knob.

Brakes - are set at the factory for shipment of the unit only! They should be reset for ground operation upon receipt of the unit. Proper ground operation setting should be approx. 1½ turns from the closed position.



Solenoid Actuators - MUST be bottomed out for full throw of the linkage. When bottomed out, the rod activates a hold coil relieving the high amperage pull coil. If the pull coil does not disengage, the solenoid will burn out.

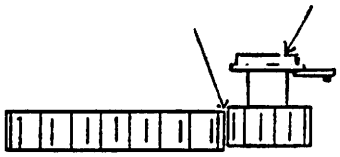


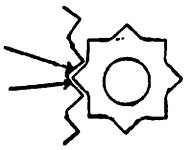
Boom Extend Chain Adjustment - should be as follows: one inch of droop or chain sag for every ten feet of the unit. Example: 6" = 60' Adjustment is accomplished by tightening or loosening the chain anchor adjusting bolts located on the mid boom section.

IMPORTANT!!! MAINTAIN EQUAL TENSION ON BOTH CHAINS WHEN ADJUSTING.

Swing Gear & Pinion Shaft Backlash - should be set with ZERO BACKLASH! Also note, NO PRE-LOAD of the pinion shaft to the swing bearing is allowed! To adjust, loosen the gear box side lock bolts and adjust the front lock bolts until the proper backlash is attained. After proper adjustment has been made, retighten the side lock bolts and re-torque the foot mount plate bolts.

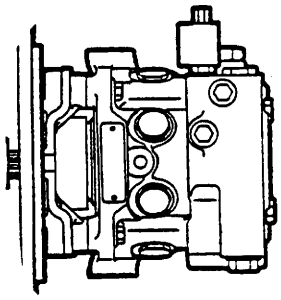
Vertical Swing Reducer Adjustment -





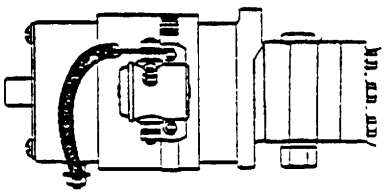
When adjusting the vertical swing reducer assembly, the essentric bushing located under the reducer must be turned. To accomplish this, remove the locking "T" plate which locks the essentric bushing in place. This is located on the superstructure in front of the swing reducer. Loosen the foot mount plate bolts and turn the essentric bushing by means of a screwdriver or any flat object. NOTE: NO BACKLASH OR PINION PRE-LOAD IS ALLOWED IN ADJUSTMENTS!!!!!! After adjustment has been completed, replace the locking "T" plate and retorque the foot plate bolts.

Main Pump Adjustment: John Deere Pump -

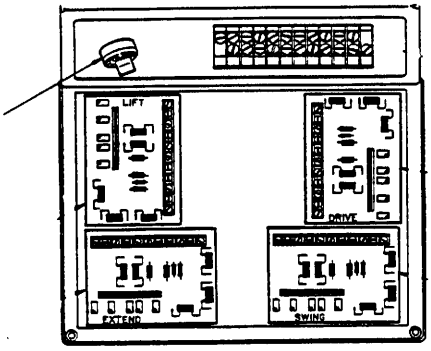


To adjust the system pressure, locate the adjusting screw on the side of the main pump adapter plate. Loosen the lock nut and while viewing the pressure guage, set system pressure to setting specified on the unit serial number tag. After system pressure has been attained, lock the adjustment screw in place. Again re-stroke the pump and check setting on the pressure gauge.

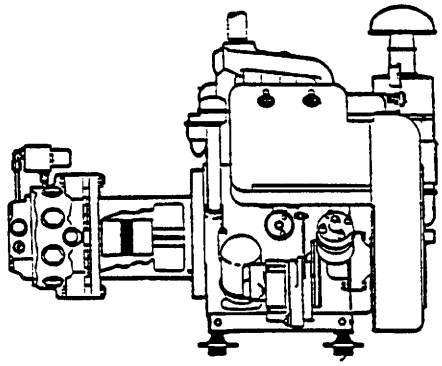
Emergency Pump System Pressure Adjustment -



System pressure is adjusted on the emergency pump by removing the cap over the adjustment screw and turning the screw in or out to increase or decrease pressure accordingly. NOTE: SYSTEM PRESSURE MUST NOT BE ADJUSTED WITHOUT THE USE OF A PRESSURE GUAGE!!!!!!!



Low Speed Drive - is adjusted by means of a potentiometer wired thru the H-1 circuit to the Drive Circuit Board. When raised and telescoped, adjust pot. to designated speed on Speeds Chart. This chart is located in the Service Manual. Low speed drive should be approximately .5 MPH while high speed drive is approx. 3 MPH.



Engine RPM's -------

Wisconsin V465 65HP ---------- 2500 RPM

VH4D 30HP ---------- 2500 RPM

W4-1770 35HP ---------- 2600 RPM

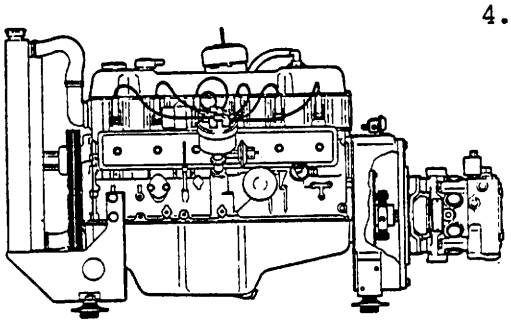
Duetz Diesel ---------- Idle 1800 RPM

---------- High 2500 RPM

Ford ---------- Idle RPM

2.3 Litre 4 Cylinder &----- High 2750 RPM

4.9 Litre 6 Cylinder



Bolt Torque Specification For Current Production Models

Model	Upper Bearing & Lower Bearing
MPN 30	9/16-12 Grade 8 bolt w/hardened flatwasher torque to 120 ft/lbs.
MPN 40 MP 40 MP 50 MPN 55	5/8-11 Grade 8 bolts w/hardened flatwasher torque to 170 ft/lbs
MP 60 MPH 60 MP 70 MP 80 MP 80N	3/4-16 Grade 8 bolts w/hardened flatwasher torque to 340 ft/lbs

Wheel Torque

Model	Front Wheel	Rear Wheel
MPN 30	9/16-18 Grade 5 stud w/lug nut and flatwasher. Torque to 95 ft/lbs	1/2-13 Grade 8 bolt w/ lockwasher,torque to 85 ft/lbs.
MPN 40 MP 40 MP 50	9/16-18 Grade 5 stud w/ lug nut & flatwasher Torque to 95 ft/lbs	1/2-20 Grade 5 stud w/ lug nut and flatwasher Torque to 70 ft/lbs
MPN 55 MP 60 MPL 60 MP 70 MP 80	3/4-16 Grade 5 stud w/ lug nut. Torque to 200 ft/lbs.	3/4-16 Grade 5 stud w/ lug nut. Torque to 200 ft/lbs

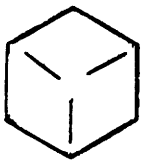
NOTE: ALL BOLT TORQUES ARE CALCULATED USING A LUBRICATED TORQUE SPEC. LUBRICATE ALL BOLTS BEFORE INSTALLATION.

Model	Drive Hub Torque
MPN 30	5/8-11 Grade 5 bolts w/lockwasher torque to 120 ft/lbs
MPN 40 MP 40 MP 50	1/2-13 Grade 8 bolts w/lockwasher torque to 85 ft/lbs
MPN 55 MP 60 MPL 60 MP 70 MP 80 MP 80N	5/8-11 Grade 5 bolts w/lockwasher torque to 120 ft/lbs

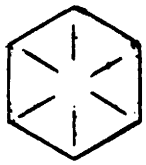
TORQUE IN (LBS.—FT.)

BOLTS, CAPSCREWS, STUDS AND NUTS

Grade 5 Identification, 3 Radial Dashes 120° Apart on Head of Bolt



Grade 8 Identification, 6 Radial Dashes 60° Apart on Head of Bolt



	Grade 5		Grade 8	
COARSE THREADS	Dry	▼ Lubricated or Plated	Dry	▼ Lubricated or Plated
3/8 — 16	31 — 34	23 — 25	44 — 48	33 — 36
7/16 — 14	49 — 54	37 — 41	70 — 77	52 — 57
1/2 — 13	75 — 83	57 — 63	106 — 117	80 — 88
9/16 — 12	109 — 120	82 — 90	153 — 168	115 — 127
5/8 — 11	150 — 165	113 — 124	212 — 233	159 — 175
3/4 — 10	266 — 293	200 — 220	376 — 414	282 — 310
7/8 — 9	394 — 433	296 — 326	606 — 667	455 — 501
1 — 8	591 — 649	443 — 489	909 — 1000	682 — 750
1 1/8 — 7	794 — 873	596 — 656	1288 — 1417	966 — 1063
1 1/4 — 7	1120 — 1232	840 — 924	1817 — 1999	1360 — 1496
FINE THREADS	Dry	▼ Lubricated or Plated	Dry	▼ Lubricated or Plated
3/8 — 24	35 — 39	26 — 29	49 — 54	37 — 41
7/16 — 20	55 — 61	41 — 45	78 — 86	58 — 64
1/2 — 20	85 — 94	64 — 70	120 — 132	90 — 99
9/16 — 18	121 — 133	91 — 100	171 — 188	128 — 141
5/8 — 18	170 — 187	128 — 141	240 — 264	180 — 198
3/4 — 16	297 — 327	223 — 245	420 — 462	315 — 347
7/8 — 14	434 — 477	326 — 359	668 — 735	501 — 550
1 — 12	646 — 711	485 — 534	995 — 1096	746 — 821
1 1/8 — 12	891 — 980	668 — 735	1445 — 1590	1083 — 1191
1 1/4 — 12	1240 — 1364	931 — 1024	2012 — 2213	1509 - 1660

APPROVED BY AXLE ENGINEERING

REVISED JANUARY 8th, 1962

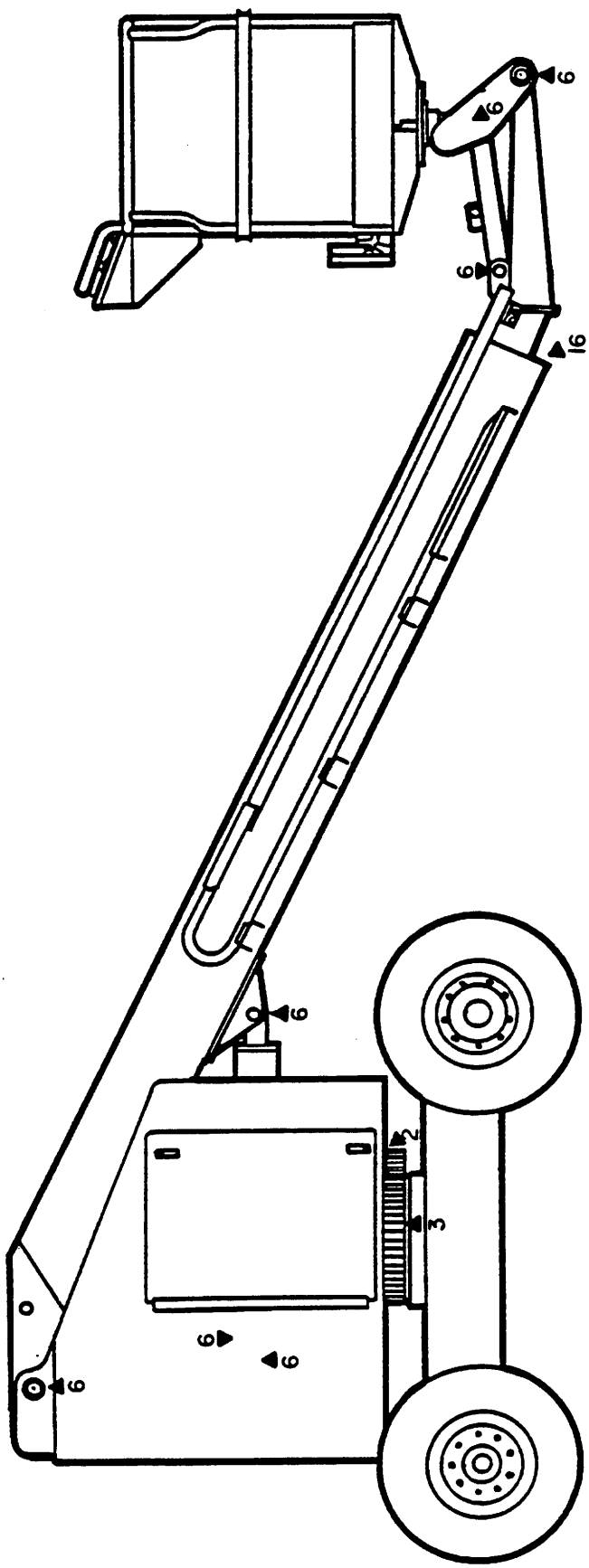
MP SERIES - Unit Speeds In Seconds

FUNCTION	MP40	MPN40	MP60	MPL60	MP80
High speed Drive- 5 Revolutions	10-13	10-13	12-15	18-21	12-15
Low speed Drive- 5 Revolutions	60-75	60-75	75-100	90-110	75-100
Boom Up Function	36-40	36-40	75-80	65-70	90-95
Boom Down Function	47-53	47-53	82-89	72-82	105-110
Boom Extend	32-35	32-35	45-50	38-47	60-65
Boom Retract	53-57	53-57	45-50	56-72	60-65
Swing - 90 Degrees Right & Left Within 6%	30-33	30-33	40-45	40-45	60-65

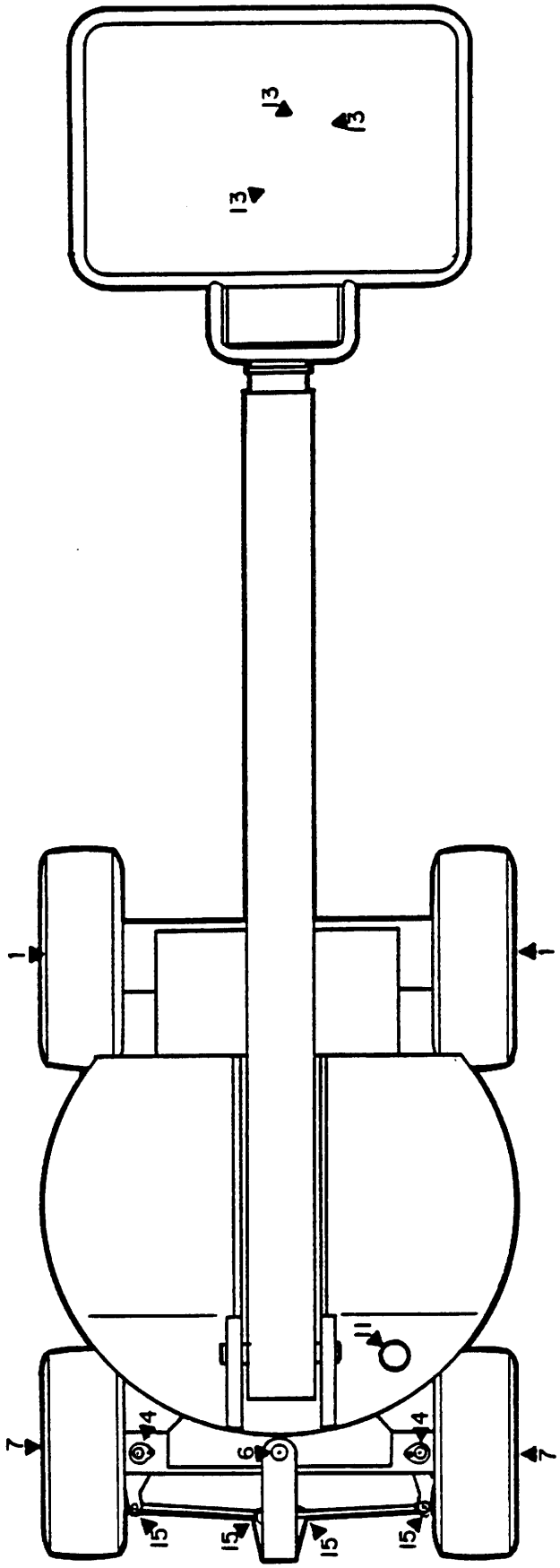
Note: These speeds may vary per unit due to special construction applications. The speeds listed above are for current standard production models manufactured from current Simon specification data sheets.

Nomenclature	Specification and Level Fill	Interval	Fig. Item
Drive Wheel Power Hubs	SAE 90 SAE 85-140 ½ Full	Initial 100 HRS. then yearly or 1000 HRS, whichever comes first	1
Engine Oil	Summer SAE 10W40 Winter SAE 10W30 To Full mark on Dip Stick	Initial 50 HRS. then every 100 HRS. or sooner if the oil is dirty	8
Hydraulic Fluid	To Full mark on gauge with boom down and retracted Mobil DTE-13 Petro Prod. DTE-13 after Aug.1983	Analysis for serviceability 6 months, change every year	11
Boom Wear Pads	Spray Silicone	Every 6 months	16
Turntable Swing Bearing	Til new grease comes out at 45° intervals EP N.L.G.i. #2	Monthly or 100 HRS. whichever comes first	3
Cylinder Pins	Til new grease comes out EP N.L.G.i.#2	Monthly or 100 HRS. whichever comes first	6
Gasoline	Regular		9
Diesel Fuel	Type II		10
Steering Spindles	Til new grease comes out EP N.L.G.i. #2	Monthly or 100 HRS. whichever comes first	4
Wheel Bearings	Clean and repack EP N.L.G.i. #2	Yearly or 1000 HRS. whichever comes first	7

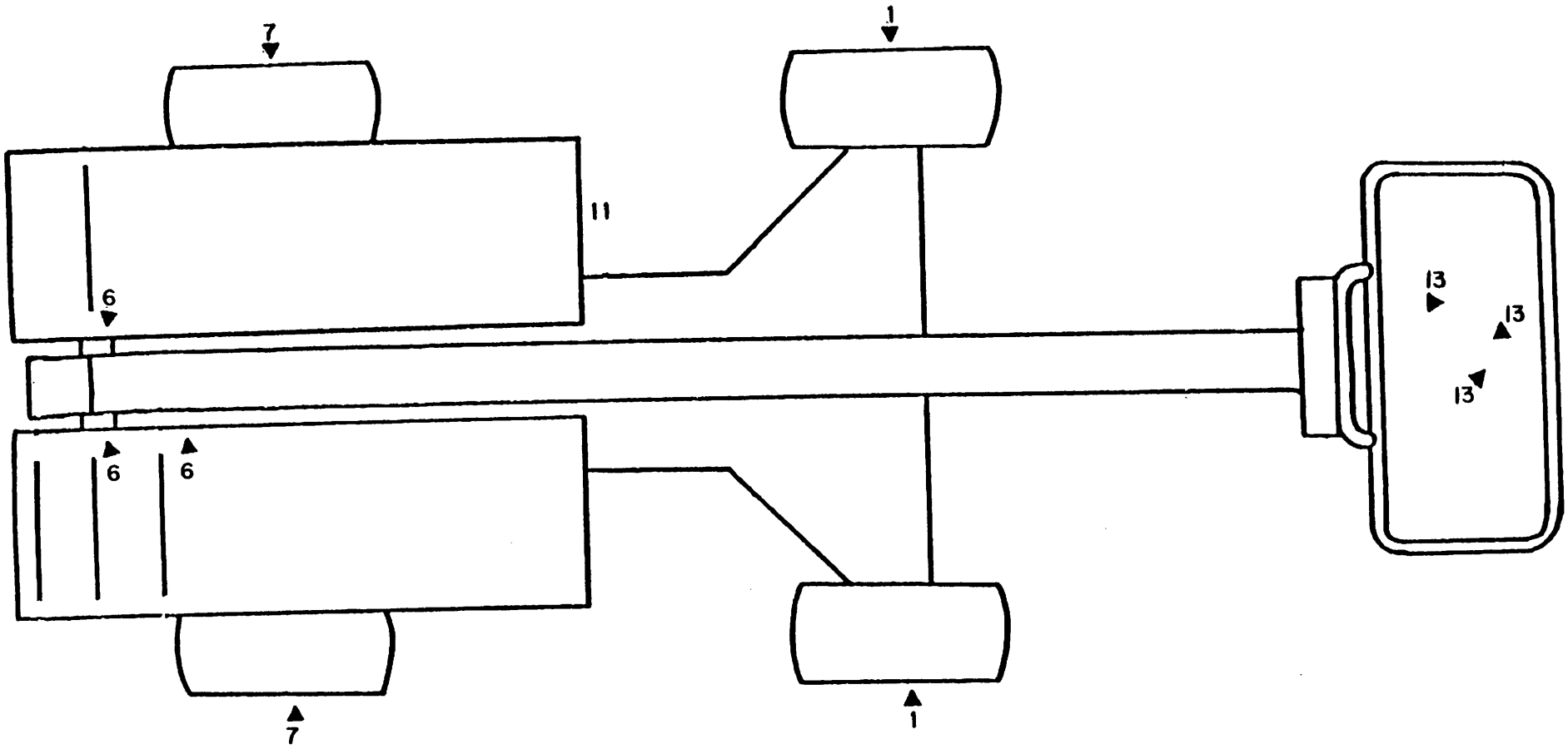
NOMENCLATURE	SPECIFICATION & FILL LEVEL	INTERVAL	
SWING REDUCER (SWING DRIVE)	OIL SAE 85-140 SAE 90W OR GREASE EP N.L.G.I. #1 WINTER EP N.G.L.I. #0	INITIAL 100 HRS. THEN EVERY YEAR OR 2000 HRS. WHICHEVER COMES FIRST	2
BOOM CHAIN SPROCKETS OF SHEAVES	EP N.G.L.I. #2 UNTILL NEW GREASE COMES OUT	MONTHLY OR 100 HRS. WHICHEVER COMES FIRST	5
BOOM CHAIN	WD 40 OR PENETRATING OIL	MONTHLY OR 100 HRS. WHICHEVER COMES FIRST	12
PLATFORM ROTATE MECHANISM	MULTI PURPOSE N.G.L.I. #2 UNTILL NEW GREASE COMES OUT	MONTHLY OR 100 HRS. WHICHEVER COMES FIRST	13
PLATFORM ROTATE TRUNNION (EARLY MODEL MACHINES)	MULTI PURPOSE N.G.L.I. #2 UNTILL NEW GREASE COMES OUT	MONTHLY OR 100 HRS. WHICHEVER COMES FIRST	14
STEERING TIE ROD ENDS	EP N.G.L.I. #2 UNTILL NEW GREASE COMES OUT	MONTHLY OR 100 HRS. WHICHEVER COMES FIRST	15



LUBRICATION DIAGRAM

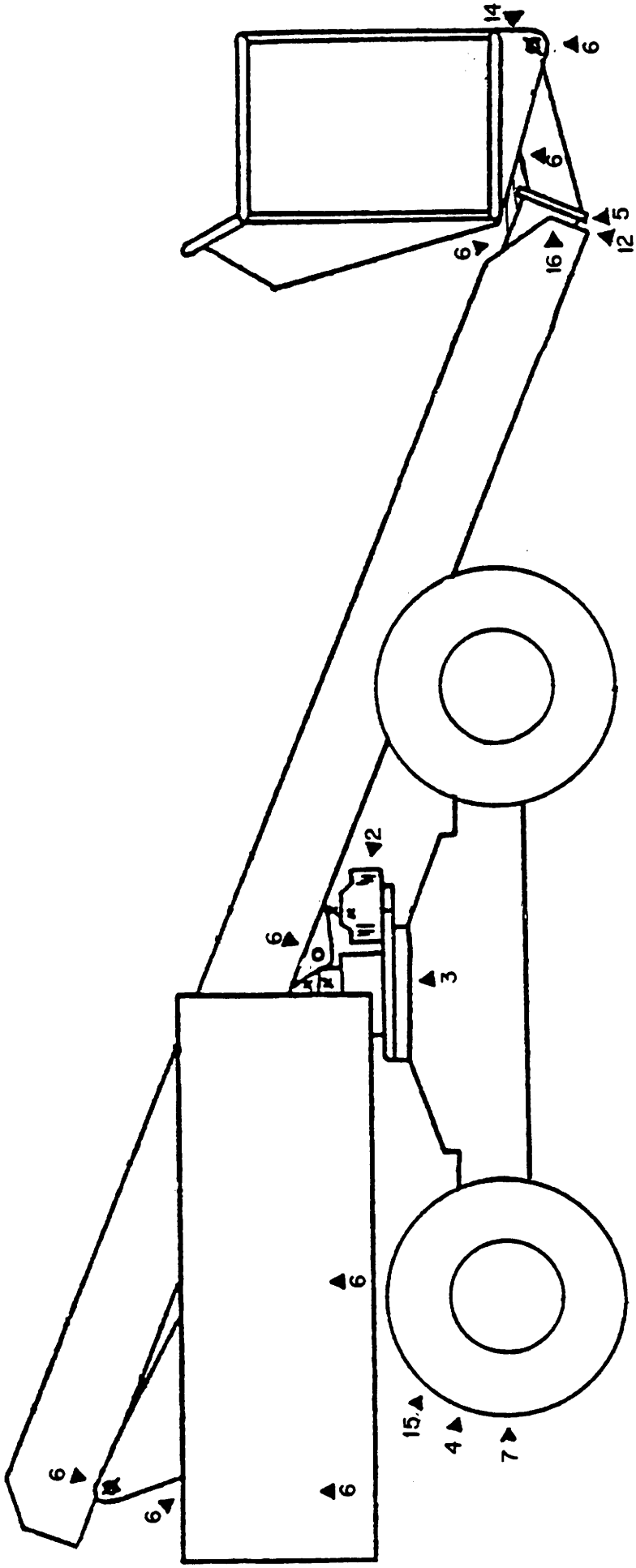


LUBRICATION DIAGRAM



LUBRICATION DIAGRAM

LUBRICATION DIAGRAM



Mobil D.T.E.® 10 Series

PREMIUM HYDRAULIC OILS

The Mobil D.T.E. 10 Series of hydraulic oils was developed specifically to meet the requirements of modern hydraulic systems that must operate at low ambient temperatures or under widely varying ambient temperature conditions. In the marine trade, hydraulically operated deck and cargo handling equipment may be required to operate under tropic conditions at one port and under arctic conditions at the next port within a short period of time. These conditions require that the fluid has sufficiently low viscosity to permit start up of the equipment at the subzero ambient temperatures encountered, yet has sufficiently high viscosity to maintain system efficiency and minimize internal leakage when the system is fully warmed up or high ambient temperatures are encountered. These requirements can be met only by fluids with viscosity indices considerably higher than those of normal petroleum oils, and the fluids must be formulated so that mechanical shearing in the pumps and hydraulic elements does not cause excessive loss of VI and viscosity in service. In addition, these fluids must have the antiwear characteristics required for modern, high pressure hydraulic systems, give long service life, prevent rusting, separate readily from water, and resist foaming in service.

PRODUCT DESCRIPTION

The Mobil D.T.E. 10 Series are very high VI oils with carefully controlled low temperature flow properties. They are manufactured from highly refined base oils combined with selected VI improvers. Antiwear agents, rust and oxidation inhibitors, and a defoamant are also included. All components are selected and balanced to maintain, as nearly as possible, the good air release and water separation properties of the base oils.

In the development of the Mobil D.T.E. 10 Series particular attention was paid to the requirements of systems that must operate under widely varying ambient temperature conditions. A survey was conducted with major builders of marine hydraulic equipment and, based on their requirements, the viscosities of the series were selected. The survey uncovered a requirement for fluids with low, controlled viscosities at subzero temperatures, and viscosities high enough at the maximum anticipated operating temperatures to maintain system efficiency and minimize internal leakage. These desired viscosity-temperature characteristics are obtained in the Mobil D.T.E. 10 Series by selection of base oils with excellent low temperature flow properties and high VI and by the addition of a shearstable VI improver to the base blends. The VI improver used is selected for high resistance to shearing and viscosity loss under the conditions encountered in hydraulic systems. This shear resistance is illustrated by the results of a severe Diesel Injector Shear Test in which no member of the series exceeded 10 to 15 percent loss in viscosity at 100 °F (38 °C) after 10 passes through the injector.

Characteristic	Mobil D.T.E. 11	Mobil D.T.E. 13	Mobil D.T.E. 15	Mobil D.T.E. 16	Mobil D.T.E. 18	Mobil D.T.E. 19
API Gravity	31.9	29.2	28.6	27.8	27.5	27.1
Specific Gravity	0.866	0.881	0.884	0.888	0.890	0.892
Flash Point, °C	165	165	165	165	165	165
°F	329	329	329	329	329	329
Pour Point, max, °C	-45	-45	-45	-45	-40	-40
°F	-50	-50	-50	-50	-40	-40
Viscosity						
cSt 40 °C	15.0/16.5	32/34	46/49	68/72	100/104	145/151
100 °C	4.12	6.37	8.36	10.87	12.87	17.23
cSt 100 °F (37.8 °C)	17.41	36.05	52.42	76.91	113.02	165.9
210 °F(98.9 °C)	4.20	6.51	8.56	11.14	13.22	17.78
Viscosity Index, min	145	145	145	135	120	120
Brookfield Viscosity						
cP @ 0 °F, max	500	1250	2500	4500	9500	20,000
@ 0 °F, typ	350	940	1730	3390	7790	18,770
@ -20 °F, max	1250	3650	6900	18,000	67,750	263,000
@ -20 °F, typ	1130	3300	6250	16,500	61,600	239,000
@ -30 °F, typ	3200	7680	13,500	43,800	220,000	—
@ -40 °F, typ	10,500	19,300	57,800	161,000	—	—
Low-Temperature Pumpability						
Delivery @ 0 °F(-18 °C), gpm	8.2	6.6	4.7	2.7	1.5	0.5
Efficiency @ 0 °F(-18 °C), %	99	88	63	36	20	7
Total Acid No., min	0.8	0.8	0.8	0.8	0.8	0.8
Zinc, % wt. min	0.06	0.06	0.06	0.06	0.06	0.06
Rust Test, ASTM D665, Synthetic Sea Water	Pass	Pass	Pass	Pass	Pass	Pass
Emulsion Test, ASTM D1401, min to 40-37-3	30	30	30	30	30	30
Foam Test, ASTM D892 Tendency, Stability, ml Seq. I, II, III	20/0	20/0	20/0	20/0	20/0	20/0

Contamination Checks:

A. Comply with a contamination analysis using the following as a guide in determining the requirement. By utilizing a hydraulic system check, the life of the Simon Aerial's lift will be enhanced.

1. Change the hydraulic fluid any time the engine driven pump is changed.

2. If fluid discoloration is evident in the reservoir sight glass, change hydraulic fluid and flush complete hydraulic system.

3. After the first 50 hours of operation the high pressure filter element indicates a plugged condition (Schroeder filter only). Remove and replace the element to again filter full fluid flow.

4. Change the hydraulic oil whenever the high pressure filter indicates a high metal content.

5. Change hydraulic oil if the valves in the main valve bank assembly have a continuous problem with the spools sticking. Note: Valve stack hold down bolts should be torqued to 15 ft/lbs.

6. Hydraulic fluid should be changed once a year under normal conditions.

7. Hydraulic fluid should be changed every 6 months under dirty or dusty conditions.

B. If the above schedule is followed, it will prevent premature system component wear to include cylinder seals, drive motors and early failure of the pump. It will also decrease unit down time.

C. A contamination anaysis should be accomplished by a qualified laboratory with the following information to insure a proper analysis and recommendations.

1. Type of oil (the type of oil at initial fill is Mobil DTE-13)
2. Serial number of the unit having the analysis and the type of unit, ie: mobile aerial platform.
3. Purpose of the analysis, ie: pump failure, discolored oil, etc
4. Type of analysis, ie: complete to show additive breakdown, acid build-up, viscosity, type and percent of contaminants, etc. There should also be a comparison to new oil data specs plus analysis recommendations.

D. If flushing and replacement of hydraulic fluid is recommended, refer to flushing procedures.

Hydraulic System Flushing Procedure

A. Drain, flush and refill the main hydraulic tank

If the hydraulic system is severely contaminated, several system flushings may be needed.

B. Remove the system return hose from the hydraulic oil tank. Cap the hydraulic tank fitting and put the open system return hose in an empty container to catch the contaminated system fluid.

NOTE: it is recommended to use a filter cart and external pumping in the following procedures. The main engine driven pump may be used but CAUTION should be used to insure that the pump does not cavitate. In either case, during flushing, the system pressure should be between 600 and 1000 PSI during flushing except for boom lift which you may need to increase to move the boom. The engine RPM's should also be set at 1650 RPM to reduce the GPM.

C. Remove the brake return hoses at the drive motors and allow 1 quart of fluid to drain from each hose with a fresh supply coming from the reservior. Reinstall brake return hoses.

NOTE: If a pumping unit is being used, connect the output to the engine pump pressure hose. Start the pump being used and run until gallons of fluid are drained.

CAUTION - MAKE SURE THAT THE MAIN HYDRAULIC PUMP KEEPS A PRIME!!!

D. While standing at the ground controls, activate the destroke toggle switch (main pump / aux. pump). This will bring the pump on line causing fluid flow.

NOTE: During the following steps, hydraulic fluid will be exiting from the open system return hose which MUST be in a suitable containing reservior. If this hose is not contained, hydraulic fluid will drain on the ground. Continuous monitoring of the reservior fluid level or fresh hydraulic oil supply MUST be maintained to prevent cavitation. Also, when servicing the hydraulic system from an external drum, keep the pickup tube at least one (1) inch above the bottom of the drum to keep from picking up drum contaminants.

ALL CYLINDERS MUST BE IN THEIR STOWED POSITIONS <u>BEFORE</u> STARTING THIS PROCEDURE.

E. Raise the boom 3 feet then lower it completely 3 times

Raise the boom to full extention

Lower the boom 3 feet then raise it back to the fully raised position twice.

F. Extend the boom for 5 seconds then retract it completely 2 times.

Extend boom fully.

Retract the boom for 5 seconds then extend it to the full out position twice.

G. Reconnect the system return hose to the pump, retract and lower the boom.

CAUTION: MONITOR THE RESERVIOR FLUID LEVEL WHEN LOWERING AND RETRACTING THE BOOM TO PREVENT THE RESERVIOR FROM OVER FILLING AS MORE HYDRAULIC FLUID ENTERS THE RESERVIOR THAN WHAT IS LEAVING.

H. Disconnect the system return hose as in step. B

I. Extend the boom until high speed drive disengages and raise the drive tires from the ground. Operate the drive until 5 gallons of oil pass through the return hose. Then reverse the drive for 5 more gallons to pass in the reverse mode of operation. Lower the unit to the ground.

J. Cycle the steer cylinder to the full stroke position in both directions twice.

K. Cycle any remaining cylinders twice except platform rotate and platform level.

L. Reconnect all removed hoses to their respective positions.

M. Disconnect the return hose at the free flow end of the check valve under the platform control panel. Plug this line. Install another hose on the check valve and put the loose end in an empty container.

N. Cycle platform rotate two full times then cycle platform level for two more full cycles.

O. Disconnect the master leveling cylinder hoses at the master cylinder and operate the manual leveling valve in both directions until at least 1½ gallons of oil have passed through each disconnected hose. Reconnect the rod end hose and bleed air from the hose before tightening the hose fitting.

P. Raise the boom to its full up position catching the fluid passing out of the blind end port of the master leveling cylinder.

Q. Reconnect the blind end hose to the master leveling cylinder bleeding the air from the hose before tightening the hose fitting.

R. While lowering the boom, use the manual selector for platform leveling through 2 complete cycles of operation.

S. Restore unit to full operating capacity by reconnecting all hoses and resetting system pressure. Fill the hydraulic reservior to the full mark on the sight guage.

T. Operate all functions to their extreme positions and insure that the platform levels properly when booming up and down.

U. Check to make certain that reservior pressurization is operating by pressing the red button on the hydraulic reservior cap. Escaping air should be heard when the button is depressed.

V. If all the systems are operating properly, check for leaks and repair as needed.

1. Power trac cross braces breaking -

   A. Check for hose skiving in the power trac. If skiving is noted, proceed to step B.

   B. If system pressure is too high, it will cause the hoses to shrink more than normal. If pressure is normal, proceed to steo C.

   C. If the hydraulic system pressure is normal, the hoses are run to tight in the trac. To achieve proper hose tension, it may be necessary to adjust the hoses 3 or 4 times. NOTE: hoses too loose may be pinched under the power trac.

2. Power trac sagging -

   A. The lowest portion of a sagging power trac has the pin holes stretched usually caused by a damaged "I" beam support. If the unit is equipped with an over head guard, the trac could also get caught on a damaged guard which could also tear off the moving anchor.

   B. Lack of lubrication and/or cleaning.

3. Boom extent and retract rough in operation-(3 piece boom)

   A. Check boom chain tension, extend boom fully then retract approx. 6 inches. Check the lowest point of the chain to the bottom of the mid boom. The chain should sag 1 inch for every 10 feet of unit model. Example: MP-60 = 6" , MP-80 = 8". If to loose, the chain may be stretched and need to be replaced.

   B. Excessive sand and/or grit inside boom.

   C. Grease on boom collecting grit. The booms are dry running and should require NO GREASING! If lubrication is needed, use only silicone spray.

   D. The inside chain anchor block is worn and has sharp edges grabbing the lower base boom when retracting.

   E. The lower extend holding valve is out of adjustment. The flow control valves could be out of adjustment.

   F. The inner or outer chain has frozen or has stiff links. Clean and lubricate with a penatrating oil, it may be necessary to soak the chain overnight to remove the kinks and/or stiff links.

4. Platforms equipped with rack and pinion rotate actuator. If there is play in rotator, check -

   A. Check for loose mounting bolts for platform to pinion flange.

   B. Check for trapped air in hydraulic lines.

   C. Check for excessive play in mounting pins and hardware.

5. Boom drifts down when raised and telescoped out.

   A. Check holding valve cartridge to be seating properly

   B. Check that piston seals are good in cylinder. If not, repair as soon as possible.

6. Boom will not retract from the fully extended position.

   A. Hydraulic pressure filter dirty not allowing full system flow.

   B. System pressure set too low. Check system pressure.

   C. Excessive grit on boom sections. Check and lubricate if necessary.

7. Unit will not go into high speed drive when boom is retracted and lowered.

   High pressure filter clogged. Remove and replace filter element.

8. Unit will not drive utilizing the emergency pump.

   The low speed drive valve is inoperative. Check and repair if necessary.

9. Unit function is erratic operating the platform controller.

   A. Micro-switch in controller handle out of adjustment

   B. Possibility of potentiometer failure. Check wiper

   C. Possibility of controller body has wear in the handle stop trac area. If this is the problem, a new body must be installed to prevent over travel of the controller handle.

10. Valve operation(s) sticking in valve bank.

    A. Too much valve body torque on valve stck. Retorque nuts to 15 Ft/Lbs each. (Lower stack only!!!)

    B. Valve body facings not milled square causing uneven valve stack pressures resulting in a distorted valve body.

    C. Improper hydraulic oil in unit. Added hydraulic oils may not mix properly causing different additives to breakdown distributing varnishes on moving and non-moving parts. This will eventually lead to component failure.

    D. Contaminated hydraulic fluid will also cause this problem Samples should be taken on a yearly schedule (maximum) and measured against original specifications.

    E. On older model units, a flow control valve was used that incorporated a spring operated check ball. This spring can become dislodged from its proper location and travel into the valve causing the valve spool to jam.

11. Low speed drive valve inoperative in low speed drive only

    A. Valve spool sticking

    B. A low resistance in one of the high speed drive valve coils. Each coil should have a resistance of 4 ohms. If a high speed drive coil has less than 4 ohms. excessive voltage will feed across the coil to the opposite coil of the low speed drive valve which is being activated. (Lower stack only!!!!)

12. One tire leaves ground surface when the boom is extended over the corner of the unit.

    A. The unit is not on level ground.

    B. The units capacity has been exceeded. Remove excess weight------- IMMEDIATELY !!!!!

    C. Tires are under-serviced with calcium cloride. This condition could also rust out the tire rims internally as the normal liquid level is over the top of the rim to reduce oxygen concentration.

WHEEL DRIVE MOTOR FAILURE

CAUSE OF FAILURE

A) Contamination - If one motor failed, the internal loose pieces will eventually flow into the opposite motor causing that motor to fail.

B) Improper installation of needle bearings.

C) Excessive bearing loads caused by high speed braking with brakes set for full application.

D) Useful bearing life exceeded caused by braking loads.

E) System not flushed or protected properly after components failure within the drive circuit.

F) Use of poor quality oils or worn-out oil will decrease the life of any component.

G) Towing machine with hubs engaged.

H) Cavitation - Motor running faster than input is available causing ratcheting.

I) Motor stopping unit, i.e. brake adjustment closed too far, low speed flow valve has a malfunctioning check valve.

SWING GEAR PINION SHAFT, TOOTH AND/OR RING BEARING FAILURE

CAUSE OF FAILURE

Shock = excessive side loading of boom. Unit throttling not being used, causing instant on and off of the swing motion i.e. foot pedal being blocked to the on position, the foot pedal being operated before the controller or the hydra-port control not being maintained for throttle control. Lack of gear lube causing gears to bind. Pinion gear too tight (no backlash to ring gear). Gear box loose causing the load to be at the ends of the gears instead of being evenly distributed over the teeth of the pinion which will also cause ring gear teeth wear due to slippage. Foreign objects caught between the teeth forcing the pinion away from the ring gear.

HYDRAULIC PUMP COUPLING FAILURE

A. Hayes Coupling: Splined coupling not locked to splined shaft, causing coupling to move away from insert resulting in insert destruction and ensuing coupling failure.

B. Browning Coupling: The splined half will move on the spline, eventually working into the back of the pump and destroying the spline. A stop should be welded into the coupling to prevent it from moving into the pump.

EXCESSIVE HEAT Excessive heat will cause excessive wear on seals and metal parts due to lowered viscosity.

Symptoms = Pump case turns brown, darkens or hydraulic oil darkens. Premature pump failure.

Causes:
1. Excessive water content in the oil.
2. Improper oil viscosity.
3. Pump cam bearing failure.
4. Lack of lubrication, worn out oil, improper oil.
5. Stroke flow valve opened.
6. Foot pedal blocked closed.

Corrective Action:
1. Drain and flush system, rebuild pump as required.
2. Close pump stroke valve.

WATER IN FLUID

Symptoms = Pitting and etching of pump pistons with eventual pump piston cam wear causing heat build up and premature pump failure.

Corrective Action: Drain and flush system. Replace worn pump components. Check reservoir pressurization.

THE MOST COMMON CAUSES OF HYDRAULIC SYSTEM MALFUNCTIONS IN ORDER

1. Incompatible hydraulic oils mixed, destroying the additives and causing varnish build up resulting in the valves to stick.

2. Water in the oil due to a damp climate and reservoir pressurization inoperative.

3. Improper oil used; viscosity too high cold climates, viscosity too low warm climates. Note: Mobil DTE-13 is a multiple viscosity oil that is light enough for cold climates and resists thinning in warm climates.

4. Fuel in the oil, lowers the viscosity and lubricity of the oil.

VARNISH Varnish is the dark brownish residue left from oxidation of hydraulic fluids.

Symptoms = This residue will cause pistons and spools to stick and will hang up moving parts with close tolerances.

Causes:
1. Mixing incompatible oils or use of poor quality oils.
2. Excessive heating of the oil.

Corrective Action: Drain and flush system.

CAVITATION Cavitation is a gaseous condition within the fluid stream where the pressure is reduced to the vapor pressure of the fluid. The higher the system pressure the more violent the reaction will be.

Symptoms = Pitting and etching of pump pistons.

Causes:
1. Low reservoir fluid level.
2. Air leaks in suction line.
3. Oil viscosity too high, improper oil used.
4. Cold hydraulic fluid.
5. Pump speed too high.
6. Vaporization of water.

Corrective Action:
1. Warm up system before using full system pressure or adjust system as required.
2. Have fluid analyzed regularly and use proper hydraulic fluid.
3. Repair any suction hose leaks.
4. Insure reservoir pressurization is operating properly.

POOR LUBRICATION Parts break through lubricant causing metal to metal contact.

Symptoms = Heads of pump pistons worn to shape of cam. Excessive heat build up.

Causes:
1. Fluid viscosity too low.
2. Lack of anti wear additives in the oil.
3. Fluid contaminated with water or other low viscosity liquid.
4. Improper or poor grade oil used.

Corrective Action: Drain and flush system, install recommended hydraulic oil.

DEUTZ ENGINE

1. Starter stays engaged
   A. Start button sticking
   B. Relay sticking
2. Engine quits after seconds.
   A. Oil pressure switch stuck closed or no oil pressure.
   B. Wire # 20 is grounded energizing the second safety relay.
   C. Start button or plug-in relay sticking closed.
3. The rack (fuel shut off) will not shut the engine off.
   A. Injector fuel shut off shaft is clogged with dirt.
   B. Fuel shut off arm spring broken.
   C. The bolt holding the rack solenoid bell crank is too tight and/or needs cleaning.
   D. The rack solenoid is adjusted improperly, causing the shaft to bind, or adjusted to not allow the linkage to go to the off position.
4. Rack solenoid failure.
   A. See items A - C and D above.
   B. If the solenoid is not adjusted to be bottomed out with the rack linkage in the full open position, the holding coil will not engange and the pulling coil will not disengage (The pulling coil will not take a continuous amp load without destruction of the coil very quickly). Also, if you allow the linkage to bottom out completely, when engaged, destruction of the linkage could occur.
5. Excessive engine vibration at idle.
   A. All Deutz engines have a high quivering (vibration) point, that usually occurs between 700 rpm and 1300 rpm. By setting the idle rpm above this point, excessive destructive vibration will be eliminated.

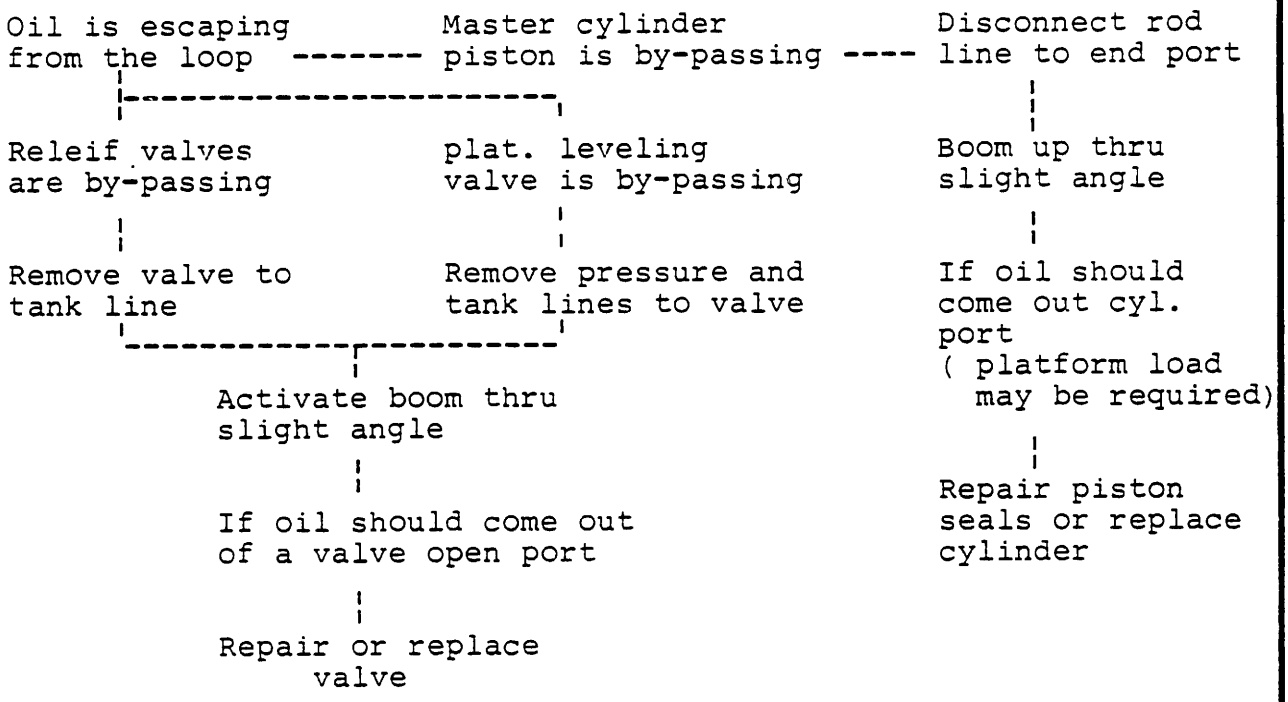
V 465 WISCONSIN ENGINE

1. Engine floods when starting unit.
   A. Choke operator piston sticking.
   B. Choke set too rich.
   C. Starting engine on high throttle, (engine should be started on low rpm or vacuum loss will not allow choke piston to operate).
   D. Throttle linkage binding or out of adjustment not allowing carburator to go into idle, or idle rpm set too high causing an intake vaccum loss.
   E. An electric solenoid operated choke is available to eliminate this condition.

Platform Ratchets or Does Not Level Properly

Platform does not stay level while booming up or down.

1. Check for platform drifting
2. Check for damaged parts such as bent pins or elongated pin holes



Platform Drifting

With engine off, platform does not stay level

Oil is escaping from the slave cylinder ---- Internal leak ---- **Disconnect lines to cylinder (place load in platform if needed to create drifting)**

External Leak

Tighten or replace part

No oil leakage. Platform only drifts a short distance.

Repair piston seals or replace cylinder

Oil comes out retract port	Oil comes out extend port
Tighten, repair or replace holding valve.	Repair piston seals or replace cylinder. Also, repair and/or replace holding valve.

This pump has 8 inlet and 8 discharge valves. It also has 8 pistons and 8 piston springs, a cam, crankcase control valve, crankcase pressure control orfice as well as a pressure compensator. It is obvious that as the shaft turns, the pistons move upward and downward.

On the downward piston stroke, fluid is drawn into the piston chamber from the reservoir through the inlet valve. On the upward stroke the fluid is exhausted through the outlet valve and into the units hydraulic system.

On this pump, the displacement is varied by reducing the piston travel. The pump pistons are forced down toward the imput shaft or cam by the piston springs. Crankcase pressure holds these pistons off the cam while the pump is in a null state. Hydraulic pump flow is controled by increasing or decreasing the crankcase pressure thus allowing the pistons to move downward to follow the cam. This will then increase fluid volume in the piston chambers.

Crankcase pressure is increased or decreased by the pressure compensator. A hollow poppet type valve, with a spring holding the poppet on its seat has system pressure exerted on it. The poppet is preloaded against its seat by a spring. The poppet will only move away from the seat when system pressure is greater than the spring force. As the poppet moves away from the seat area, a flow path is opened to the crankcase from the discharge side of the pump. The fluid that is exiting the crankcase is restricted by a crankcase orfice resulting in a increase in crankcase pressure as the fluid passes from the crankcase orfice and back to the pump inlet.

Throttle control is maintained through this passage and its flow of oil. A sequence valve is used in conjunction with the destroke solenoid which controls the flow needed to maintain function speed. The sequence valve allows a load sensing pressure to be transmitted through itself at a 200 PSI pressure setting. This load sensing pressure is then channeled to the HPI directional control valve manifold and is split to each individual control valve to sense load. This is called an ISO circuit. As the pilot spool is shifted, the internal pilot or load sensing pressure shifts the main control spool thus changing the load sensing pressure and the related crankcase pressure in the pump. Since the crankcase pressure is decreasing, the pump output is increased to try and maintain the differential flow change. After the pump matches the differential change, crankcase pressure again maintains a null state causing the pump to maintain its required flow rate.

P-Q Controls, Inc.

MODEL 505-02,-03,-05 VALVE DRIVE BOARD

I DESCRIPTION

The Model 505 Valve Drive Boards are an electronic interface between a command source and an electrically modulated valve or transmission stroker. The boards provide a "ramp" function or accel/decel causing a smoothed output to the valve regardless of abrupt command source.

The Models 505-02 and -03 have outputs to drive dual or "grounded" coil valves. Output is provided either to the "A" or "B" coil, depending on the command signal. The Model 505-03 also has auxiliary outputs (Aux A, Aux B) which supply up to 1.0 amp output at supply voltage simultaneously with output of "A" or "B". If only one auxiliary output common to both directions is required, the "Aux A" and "Aux B" can be paralleled.

The Model 505-05 has output to drive single or "floating" coil valves. Output current is provided with "A" terminal positive and "B" terminal ground for "A" command signal, and with "B" terminal positive and "A" terminal ground for "B" command signal.

The command source can be a potentiometer, switch, or inductively coupled joystick control.

The output is pulse width modulated at a frequency compatible with the specific valve for which it has been ordered. If the output of the valve or transmission "pulses", the frequency may need to be increased. Should the output of the driven function exhibit excessive hysteresis, the frequency may need to be decreased. Contact P-Q for instructions and assistance.

II GENERAL SPECIFICATIONS

Supply Voltage: 10VDC to 30VDC

Load Impedance: 4 Ohms to 60 Ohms

Max Output Current: 2.0 Amps at 12VDC

Accel/Decel Ramp Length:

Standard: 5 Seconds from Off to Hi and
5 Seconds from Hi to Off

Other ramp durations are available upon request.

Note: Ramp Length is adjustable from Zero to Full Ramp.

Model 505 - XX - XX - XX - XX

- Special Features:
  - 00 None
  - 01 Unidirectional Command Interface
  - 02 Bidirectional Command Interface
  - 10 Independent "HiA" & "HiB" Adjustment
- Max Ramp Duration X.X Seconds:
  - 00 No Ramp Capability
  - 05 5 Seconds (Standard)
  - 10 10 Seconds
- Valve Code: Consult P-Q for Valve Code
- Type of Output:
  - -02 Grounded Coil (Dual Coil)
  - -03 Grounded Coil with Auxiliary Switched Output
  - -05 Floating Coil (Single Coil)

Note: Be sure to specify the valve or stroker being used and the system voltage.

IV CALIBRATION PROCEDURE

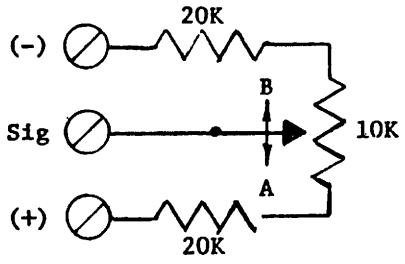
As received, the board should be calibrated for the valve you are using. If the output does not suit your requirements, or the adjustments have been altered and need to be reset, the following procedure should be followed:

A. Turn the following pots counterclockwise twenty (20) turns, or until a "click" is heard: Hi, HiA, Lo, Ramp.

B. Connect supply voltage (+10 to 30VDC) to "V_S" terminal and ground to "GND" terminal.

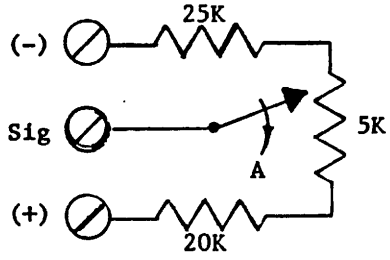
C. Connect a command source to (+), Sig and (-) terminals as shown in one of the diagrams which follow:

1. Bidirectional Potentiometer Command Connection



Note: A 10K pot is recommended. A 500 ohm to 10K ohm pot is permissible; limiting resistors must be 2X the pot value.

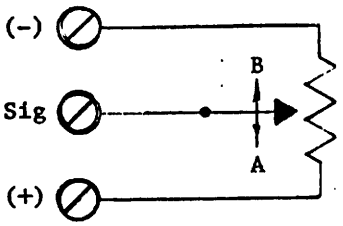
2. Unidirectional Potentiometer Command Connection



Note: A 5K pot is recommended. A 250 ohm to 5K ohm pot is permissible; limiting resistors must be 4X and 5X the pot value respectively.

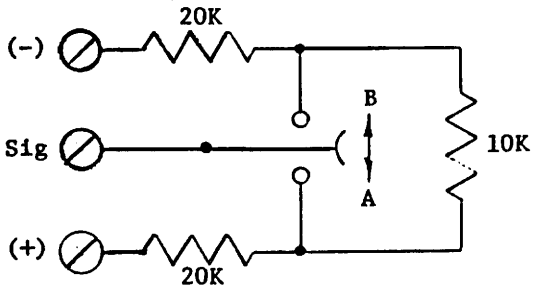
IV CALIBRATION PROCEDURE (continued)

3. Joystick Command Connection

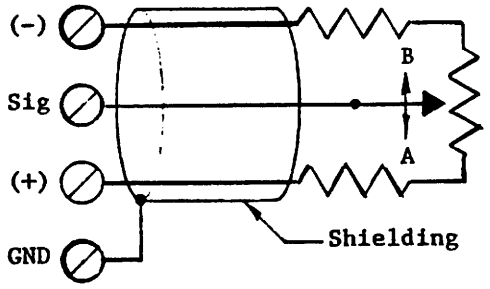


Note: With joystick, wiper does not traverse full range of pot. If another style is used where it does, limiting resistors must be used as in Figure 1.

4. Switch Command Connection



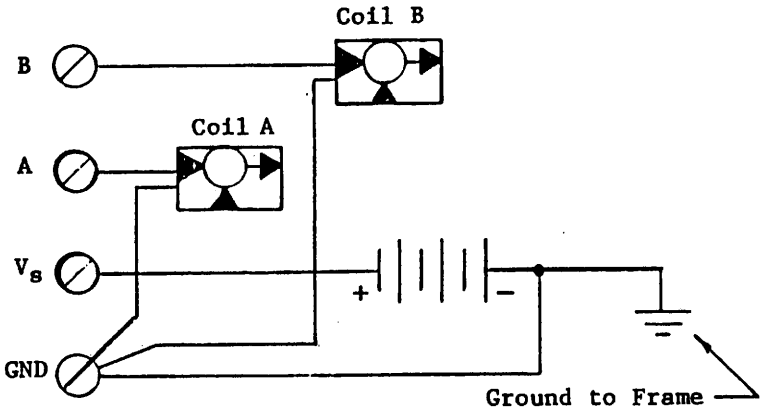
In cases where the length of the leads from the command source to the board is long (over 10 feet), or where the leads are run parallel to the valve coil leads or AC leads, the leads should be shielded. The shielding should be grounded to the "GND" terminal on the board as shown below:



Note: Command wires should be 22 gauge or larger.

D. Connect the valve coil(s) to the board as shown below:

1. Grounded Coil Connection to Model 505-02 or 505-03



V TROUBLESHOOTING PROCEDURE

1. Equipment Required:

   a. 10-30VDC Supply Source, 2 amps
   b. Volt/Ohmmeter with 0-10VDC range (minimum)
   c. Trim pot adjusting screwdriver
   d. Command source (or 10K potentiometer with two 20K resistors)

2. Power Up Board:

   Connect supply source to V_S and GND terminals, observing polarity (+ to V_S, - to GND).

3. Check V Reg:

   Measure voltage from (+) to (-) terminals. The regulated supply here should be 6 volts ±.4VDC.

4. Check Signal Swing:

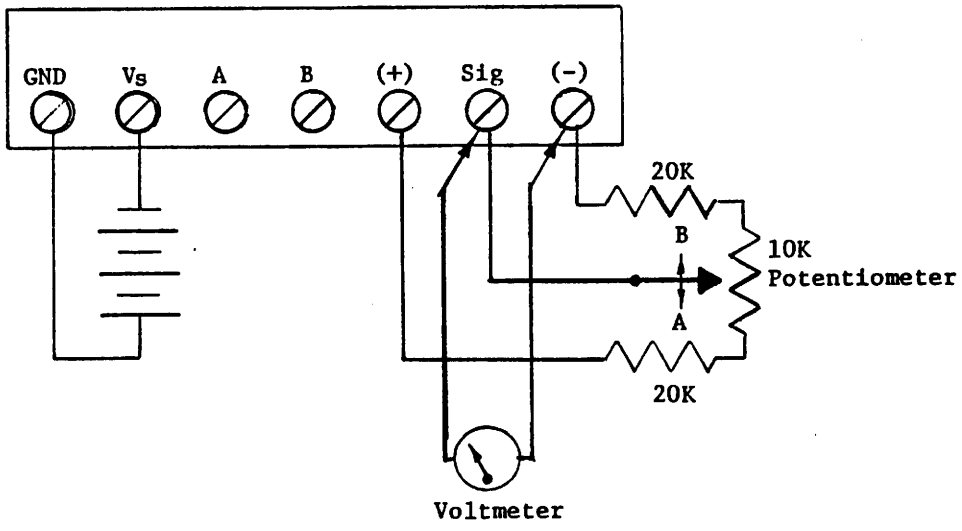
   a. Measure voltage from (-) to Sig. It should read one-half the difference from (+) to (-), or 3 volts ±.2VDC.

   b. Connect command source. With command source in neutral, Sig voltage reading should not change.

   c. If you do not have a command source, use a potentiometer with resistance of .5 to 10K with a fixed value resistor connected from each end of the pot to the (+) and (-) signals. Fixed resistor value should be 2X pot resistance. Connect Sig to pot wiper. With pot one-half way through swing of pot, Sig voltage should be one-half differential from (+) to (-) as in "a." above.

   d. Swing command source in the (+) direction. The voltage at Sig should increase from 3.0VDC to 3.6VDC.

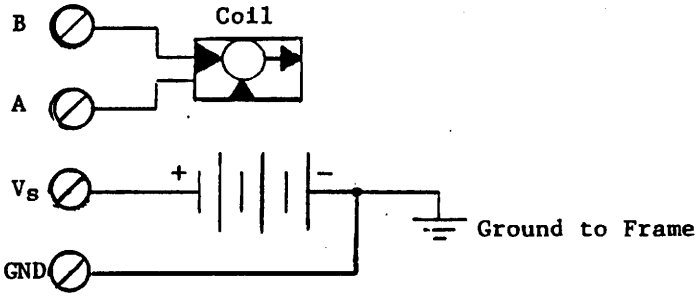
   e. Swing command source in the (-) direction. The voltage at Sig should decrease from 3.0VDC to 2.4VDC.



EXAMPLE of TEST CONNECTIONS

IV CALIBRATION PROCEDURE (continued)

2. Floating Coil Connection to Model 505-05



We strongly recommend a single point grounding scheme be used in the wiring. Power and Ground should be brought directly to the board from the battery or power supply. The valve coils should be grounded to a single wire that is brought back to the Ground of the board. After that connection, the system can be grounded between the power supply and board to the common ground frame if required.

E. Apply command hard on "B" direction and adjust Lo trim pot clockwise to the desired level for the valve you are driving.

F. Continue to apply command hard on "B" and adjust Hi trim pot clockwise to desired max output.

G. Return command to "just on" (10% of travel) and adjust "Lo" to the desired value as required.

H. Recheck "Hi" setting and adjust as required; follow by rechecking "Lo", since one adjustment may affect the other.

I. Apply hard "A" command and adjust "HiA" to desired output (clockwise to increase) through "A" valve coil.

J. Adjust "DEL" pot to the desired delay. Clockwise increases the ramp length for accel and decel. Counterclockwise decreases ramp length or delay. The normally supplied range of ramp is 0-5 seconds.

Note: Since the circuitry has delay for both accelerating and decelerating a load, it is important to note that the only means for stopping the output quickly will be with a power switch which interrupts power to the circuit.

Should an emergency-off condition be necessary, an emergency-off switch should be put in series with the power supply to the board.

V TROUBLESHOOTING PROCEDURE (continued)

5. Check Coil Continuity:

   a. Disconnect wires from terminals A and B on board; check continuity of coil(s) and wiring by connecting an ohmmeter between Coil A and Ground & Coil B and Ground for grounded coil valves. Connect between the two coil wires for floating coil valves. The resistance should be no greater than the load itself.

   b. Reconnect valve coil(s) to the board as shown in calibration procedure, Paragraph "D." If you don't have a valve coil to connect to the board, a resistor of value close to that of the valve coil can be used as a test load.

6. Check Range of Output:

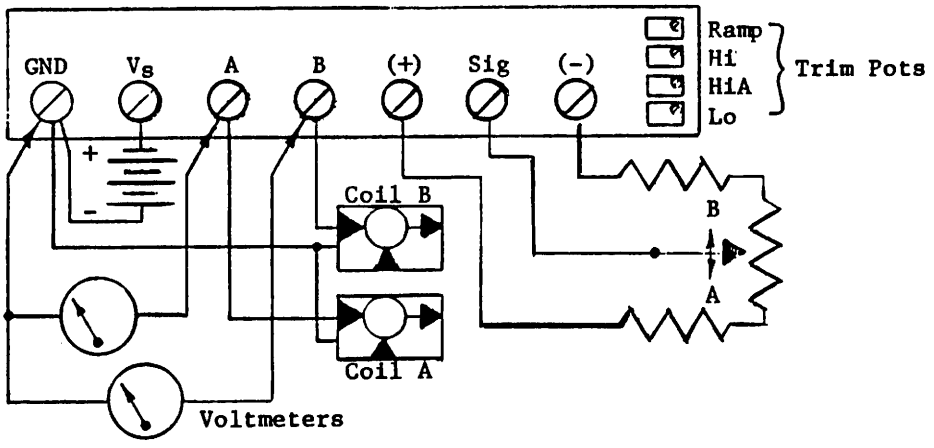
   a. With command source connected and voltmeter reading from terminal B to GND, swing command source toward B (decreasing signal voltage) until meter at B just shows "turn-on."

   b. If output voltage is too low, turn Lo adjustment clockwise. To decrease voltage, turn counterclockwise.

   c. Increase command to max, approximately 2.4 volts at signal with respect to (-). If voltage drop across load is too low, turn Hi clockwise to increase. If it does not increase, turn counterclockwise until meter just starts to drop; this is the max output you will get with this supply voltage and load with a Model 505.

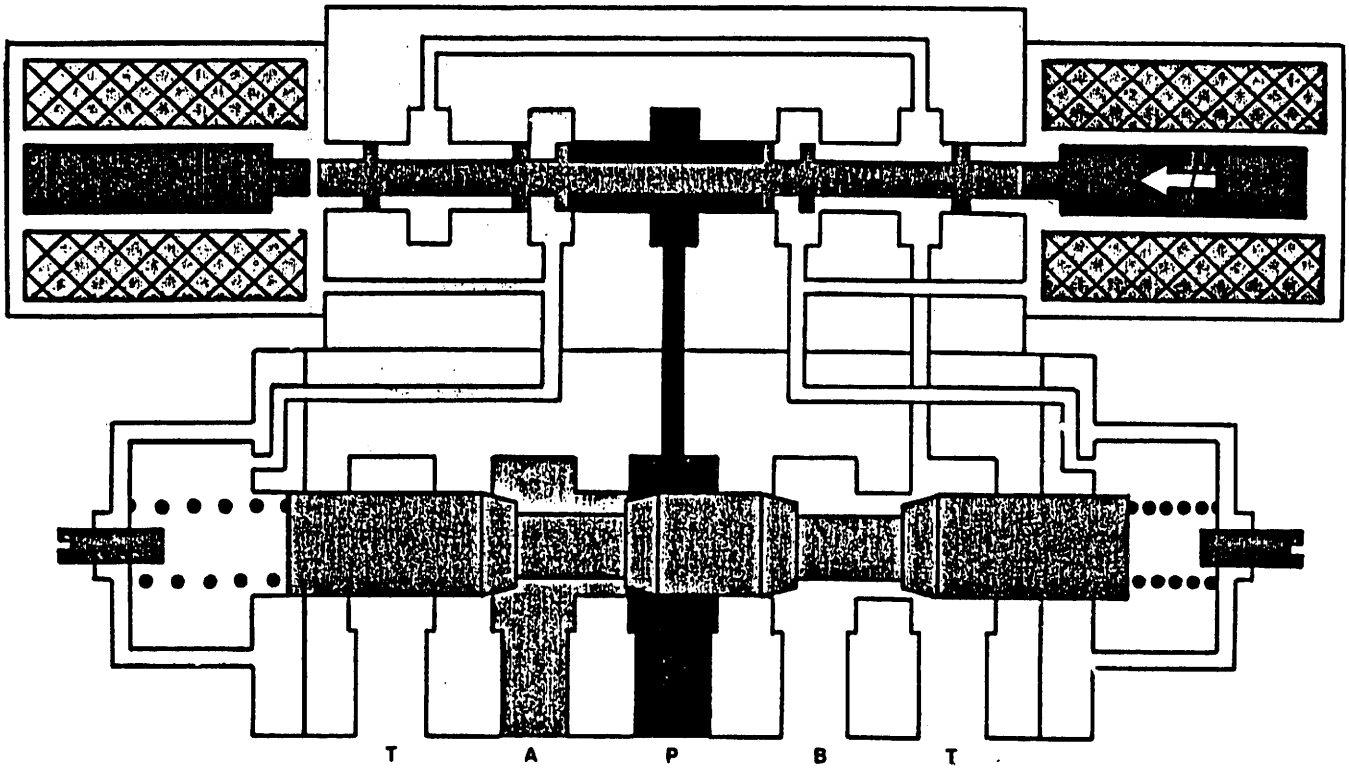
   d. If satisfied with setting obtained in "c." above, return command source to Lo and check Lo setting, as the Hi and Lo trim pots may interact with each other. Readjust and recheck Hi if necessary.

   e. Check max A output by moving command source to cause a 3.6VDC signal at Sig. Adjust A as required for more or less output. LoA will be the product of HiA, Hi and LoB. If HiA equals Hi, LoA will equal LoB. If HiA is 50% higher than Hi, LoA will be 50% higher than LoB.



VI REPAIRS

Field repairs are limited to replacement of defective trim pots. If the outputs do not respond to trim pot adjustment and the signal swings check out properly, the trim pot may be removed and replaced with an equivalent model. If difficulties continue, the board should be returned to P-Q for evaluation and repair.



The electro-proportional MP Series units utilize a series of four (4) individually mounted directional control valves. Each individual valve operates a single function, both in one direction then the other. These valves are mounted on a single manifold block which incorporates a series of load sensing shuttle valves and compensators. This allows for each individual function to be operated proportionally while being devoid of any interaction from another function. This unique system allows for exceptionally smooth operation. The proportional directional control valves are mounted to control Swing, Hoist (Lift), Extend and Drive in that order.

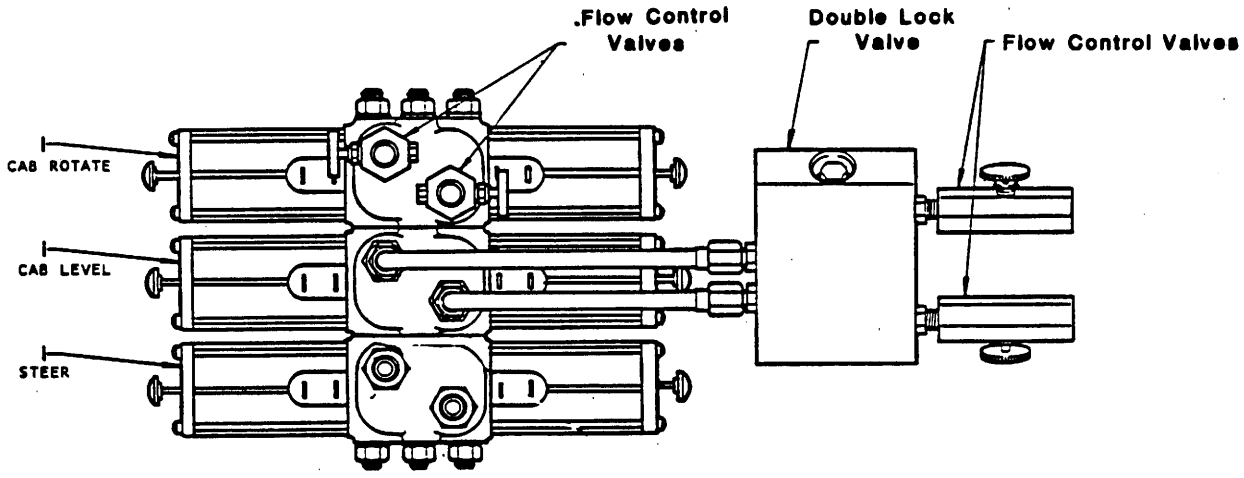
A single proportional valve is made up of two (2) individual valve spool blocks. The top is the pilot spool, which when activated, controls hydraulically the movements of the lower spool which is the main directional spool. The main directional spool is the spool that controls the main work ports of the valve assembly. In a " Null " state, a hydraulic pilot pressure of approximately 200 to 300 PSI is exerted equally on both sides of the pilot spool.

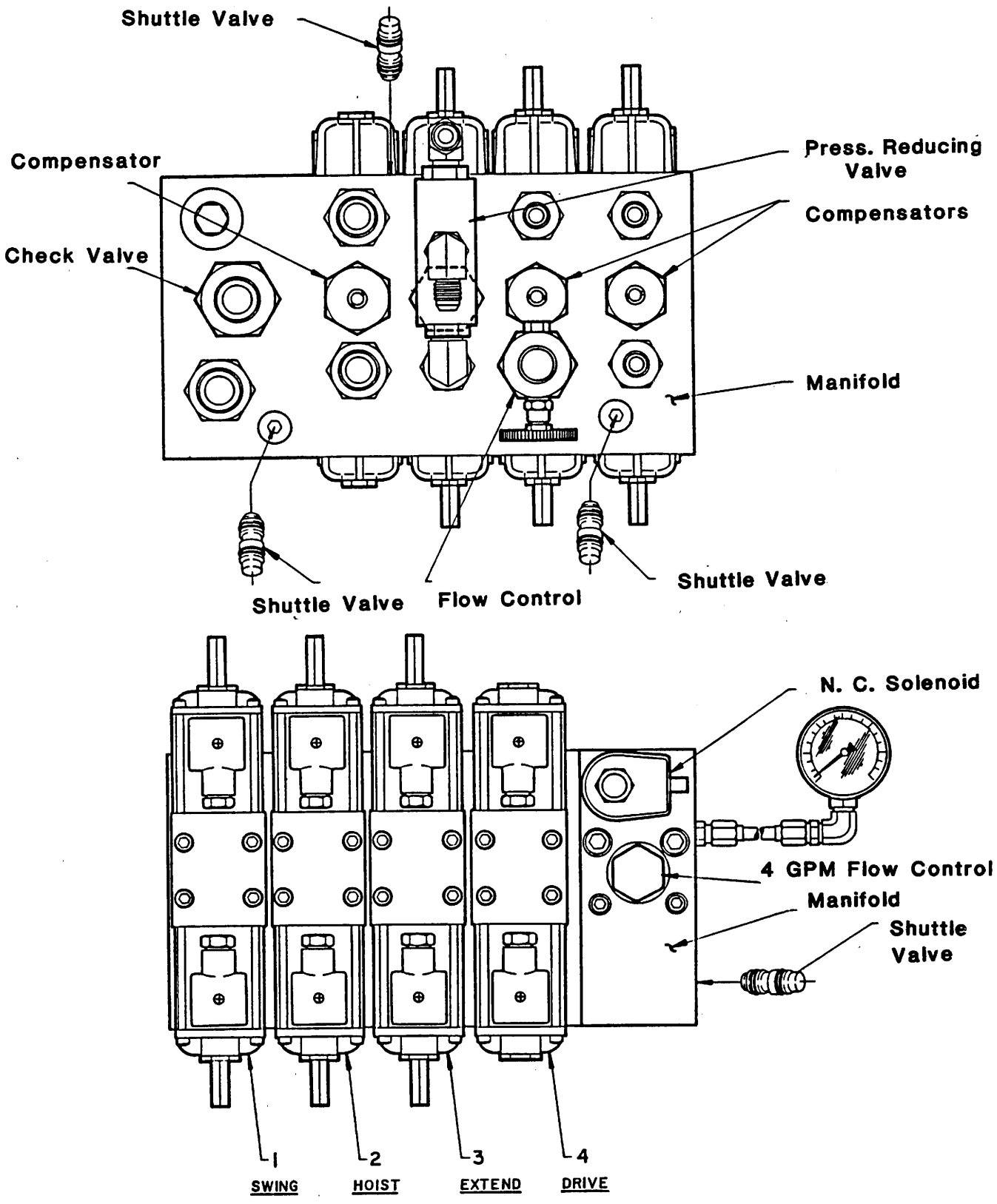
When a control is energized, a signal is generated by the control circuitry and sent to the respective pilot valve. As this coil is energized, it mechanically shifts the pilot spool in the desired direction causing an inverse effect hydraulically. As this pressure changes and is no longer equal, the pressure in the end caps at the main directional control spool shifts the spool.

NOTE: THE DIRECTIONAL CONTROL SPOOL SHIFTS IN THE OPPOSITE DIRECTION OF THE PILOT SPOOL IN OPERATION.

When the main directional spool is shifted, work will begin on the desired function.

Along with the proportional valve bank, a stack of solenoid operated control valves is also mounted. These solenoid operated directional control valves operate the secondary functions of Steer, Platform Level and Platform Rotate. These valves are fed hydraulically by a 4 GPM flow control valve located on the proportional manifold. This flow control valve is fed hydraulically by a normally closed cartridge valve that, when activated, opens to allow a designated flow of 4 GPM to pass through the flow control valve to the solenoid operated control valves. This oil flow then is shifted to the work ports for the desired function.




Shuttle Valve
Compensator
Check Valve
Press. Reducing Valve
Compensators
Manifold
Shuttle Valve
Shuttle Valve
Flow Control
Shuttle Valve
N. C. Solenoid
4 GPM Flow Control
Manifold
Shuttle Valve
1
SWING
2
HOIST
3
EXTEND
4
DRIVE

Ref #

1. Directional Control Valve -

   This valve is a proportional electro-hydraulic control valve which is controlled by a pilot valve. This valve also may utilize a manual hand lever which is directly attached to the main valve spool. This is used for ground control functions only. When electrically activated, the pilot spool shifts allowing internal hydraulic pressures to shift the main valve spool. Hydraulic flow then travels to the work ports. This directional control valve selects the lift function both up and down.

2. Holding Valve -

   This valve prevents unintentional boom down movement. It allows free fluid flow into the blind side of the lift cylinder. It will not let fluid out of the blind end of the cylinder until pressure in the rod end overcomes a pilot spring force opening a pilot spool thus letting the cylinder retract and lowering the boom.

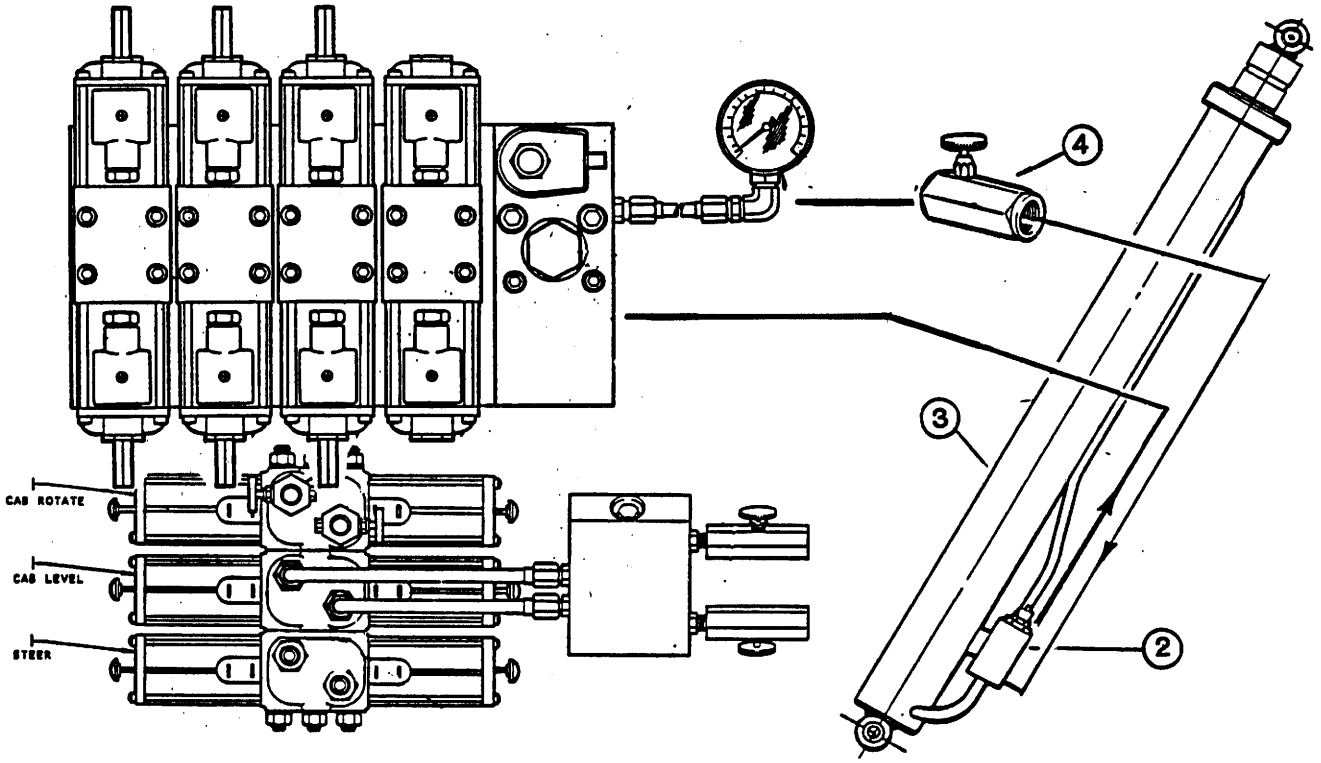
3. Lift Cylinder -

   A double acting cylinder powers the boom up and down movements plus supporting the boom.

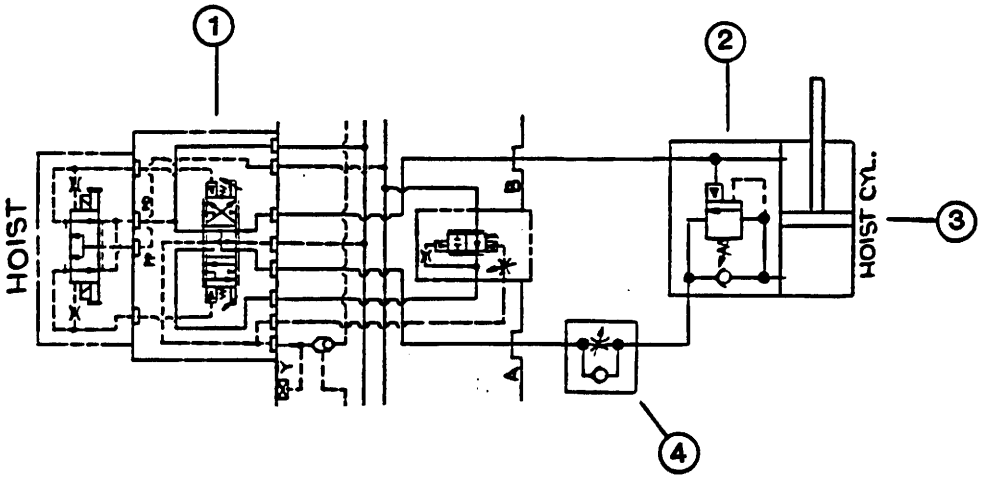
4. Flow Control Valve -

   This valve controls the boom down speed and prevents the holding valve from bouncing and squealing.

ITEM	TROUBLE SHOOTING	ADJUSTMENTS	REPAIR	MISC.	PARTS
1 Selector Valve	M6.2 M6.2 M5				D13
2 Holding Valve		M1.3			D9
3 Lift Cylinder					D9
4 Flow Control Valve		M1.3			D9



Diagram



Schematic

Ref #

1. Directional Control Valve -

This valve is a proportional electro-hydraulic control valve which is controlled by a pilot valve. This valve may also utilize a manual hand lever which is directly attached to the main valve spool. This is used for ground control functions only. When electrically activated, the pilot spool shifts allowing internal hydraulic pressures to shift the main valve spool. Hydraulic flow then travels to the work ports. This directional control valve selects boom extention and retract.

2. Holding Valve -

Two load holding valves are utilized in the extend/retract circuits. This is done to prevent unintentional boom movement.

3. Pressure Reducing Valve -

The pressure reducing valve is used on all new style models. This valve allows only a predetermined pressure to the extend side of the telescope cylinder. This pressure is stamped on the valve body and can only be checked by placing a pressure gauge downstream of the reducing valve.

4. Extend Cylinder -

A double acting cylinder powers the boom through the telescope cylinder function. Oil is passed through the telescope cylinder rod which is through drilled. This type of cylinder has NO external transfer tube on trunion mountings. With regards to normal cylinder mountings, a transfer tube is utilized.

Mechanical Extend Function -

On three piece booms, the third section is chain or cable driven depending on model.

The second section of the boom is cylinder driven as the cylinder is connected between the first and second boom sections. This is called a trunion mounted cylinder application.

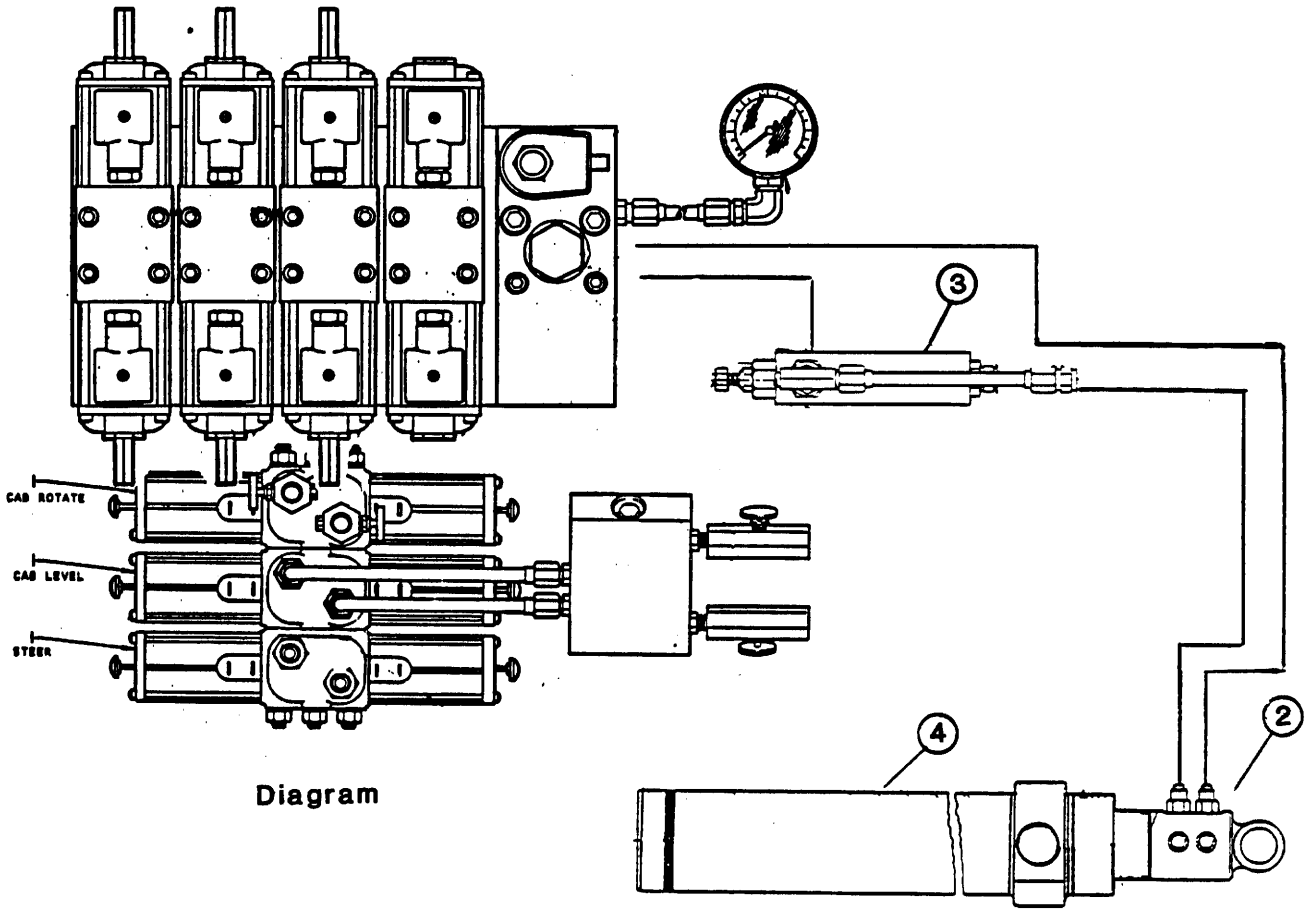
The first boom section is the base boom. This section holds the second and third sections and allows them to extend and retract.

NOTE: ALL BOOM TUBE SECTIONS SLIDE ON NYLON PADS.

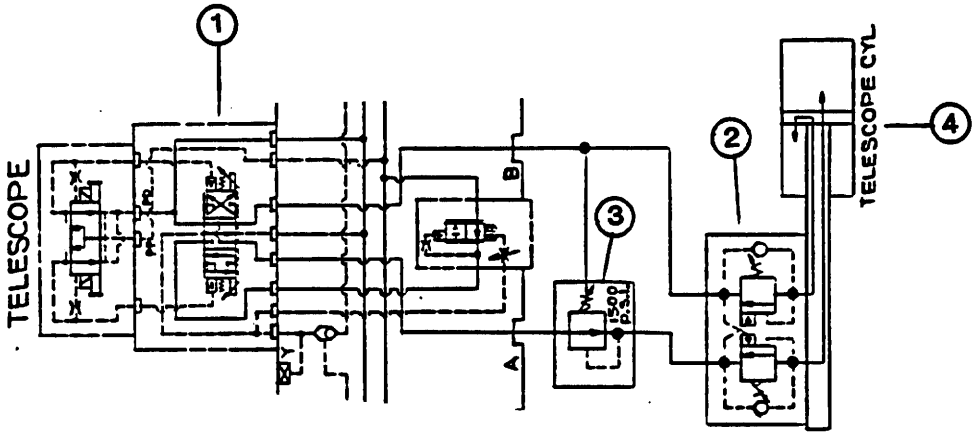
The chains are in two sections. Both sections connect together at the anchor blocks allowing a continuous loop around the second section of boom tube. The chains are anchored first at the inside end of the tip section and secondly at the end of the base boom near the anchor adjustment bolts.

On all Simon Aerial three section booms, there are two (2) extend chains or cables while there is only one (1) retract chain. All the weight placed in the platform is suspended by the two (2) extend chains or cables.

ITEM	TROUBLE SHOOTING	ADJUSTMENTS	REPAIR	MISC.	PARTS
1 Selector Valve	M5 M6.2				D13
2 Holding Valve					
3 Reducing Valve					
4 Extend Cylinder					D19



Diagram



Schematic

Ref #

5 Wire Rope Replacement (for MPH-80, MP-95, or MP-110 with Three-Piece or Four-Piece CABLE Operated Boom)

Disassembly Procedure

NOTE: BOOM SECTIONS MUST BE FULLY RETRACTED BEFORE PERFORMING THE FOLLOWING PROCEDURE.

Remove mid and tip booms (as one unit) from the base boom assembly. This will require disconnecting:

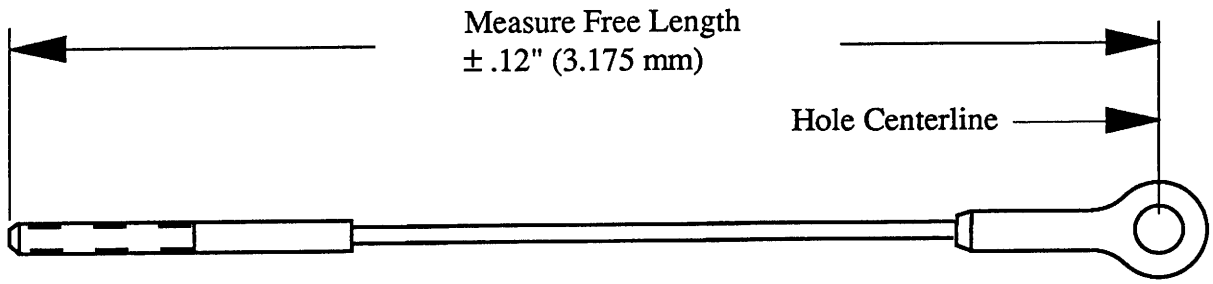
- the hoses to the rod end of the telescope (extend) cylinder,
- the telescope cylinder rod end pin,
- the EXTEND ropes to the front (lower) end of the BASE BOOM section,
- the bottom boom slide (wear) pad and tapped block from the front (lower) end of the MID BOOM section (or sections, for models with 4-piece boom),
- all wear pads from the upper (rear) end of the BASE BOOM section, and
- the bolted block anchoring the RETRACT ropes to the top of the BASE BOOM section upper (rear) end.

Remove the bolted bracket anchoring the ends of the retract and extend ropes on the lower (front) end of the TIP BOOM section. Remove the split half trunnion brackets which attach the telescope cylinder housing (case) to the MID BOOM section (LOWER MID BOOM section on models with 4-piece booms). Lift and slide the telescope cylinder out the lower end of the MID BOOM section.

Remove all of the rope guides on the boom sections, and on the housing of the telescope cylinder, to allow the removal of the extend and retract wire ropes from the boom.

Disassembly Procedure (Continued)

Stretch out the new replacement ropes, and measure the free length of each rope (see chart and illustration below).



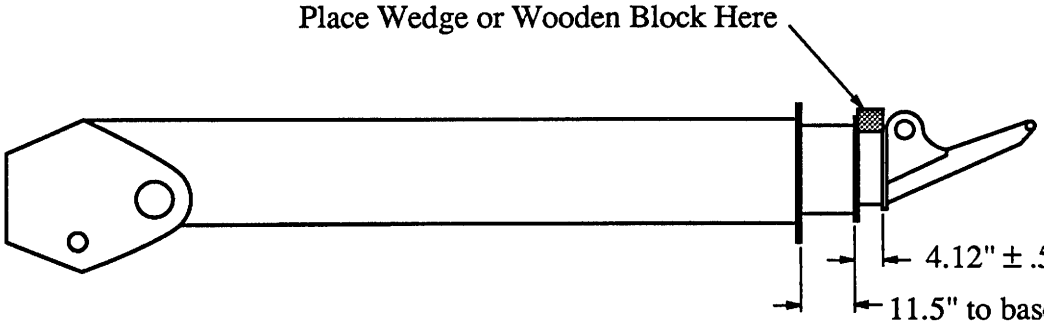
MODEL	EXTEND ROPE		RETRACT ROPE	
	DIA.	LENGTH	DIA.	LENGTH
MPH-80 (MP80-1)	5/8" (16mm)	585.00" (14.859 M)	3/8" (10mm)	343.00" (8.712 M)
MP-95	5/8" (16mm)	705.00" (17.907 M)	3/8" (10mm)	411.00" (10.439 M)
MP-110 Tip Boom	1/2" (12.7mm)	385.63" (9.795 M)	3/8" (10mm)	391.38" (9.941 M)
Upper (Rear) Mid Boom	1/2" (12.7mm)	378.63" (9.617 M)	3/8" (10mm)	378.63" (9.617 M)

Re-assembly Procedure

Re-assemble the boom by reversing the procedures outlined in the previous steps. TAKE CARE TO PREVENT CROSSING THE WIRE ROPES AS THEY ARE RE-INSTALLED IN THE BOOM.

Wire Rope Adjustment

Attach the extend and retract ropes to the BASE BOOM, and tighten the adjusting nuts to remove all visible slack from the ropes. With the telescope cylinder fully retracted, the boom sections should be positioned relative to each other as shown below.



Note: Boom shown with telescope cylinder fully retracted.

The position of the tip boom section RELATIVE TO THE MID BOOM is dependent on the adustment of the extend and retract ropes. To extend the tip boom, tighten the extend ropes. To retract the tip boom, tighten the retract ropes.

NOTE: DO NOT ALLOW THE ENDS OF THE WIRE ROPES TO TWIST WHILE MAKING THESE INITIAL ADJUSTMENTS.

Extend the tip boom approximately 2" (50mm), which will cause increased slack in the retract ropes. Using a wedge or block of wood as shown in the above illustration, lock the tip boom in this slightly extended position. Tighten the retract ropes EQUALLY to remove any slack in the ropes.

With the tip boom section still blocked, try to retract the boom. This will cause increased slack in the extend ropes. Re-tighten the extend ropes EQUALLY to remove any slack in the ropes.

Remove the wedge or wood block, and retract the boom. The tip boom section should be positioned relative to the mid boom section as shown in the illustration above. If not, repeat the above wire rope adjustment procedure.

Fully extend the boom, then retract about 2" (50mm) and stop. Look inside the boom to determine the amount of slack in the EXTEND ropes. With the boom in this position, the extend ropes should be tight enough so they do not lay loosely on the bottom inside surface of the boom. If the extend ropes have too much slack, tighten the adjusting nuts as necessary to insure both extend ropes are tensioned EQUALLY.

REF #

1. Directional Control Valve -

   This valve is a proportional electro-hydraulic control valve which is controlled by a pilot valve. This valve also may utilize a manual hand lever which is directly attached to the main valve spool. This is used for ground control functions only. When electrically activated, the pilot spool shifts allowing internal hydraulic pressures to shift the main valve spool. Hydraulic flow then travels to the work ports. This directional control valve selects the swing function both clockwise and counterclockwise.

   Since an intregal brake is installed in the swing reducer assembly, a motoring spool is used to allow hydraulic flow to relief to tank thus releasing pressure to the brake.

2. Shuttle Valve - (used with brake equipped units only)

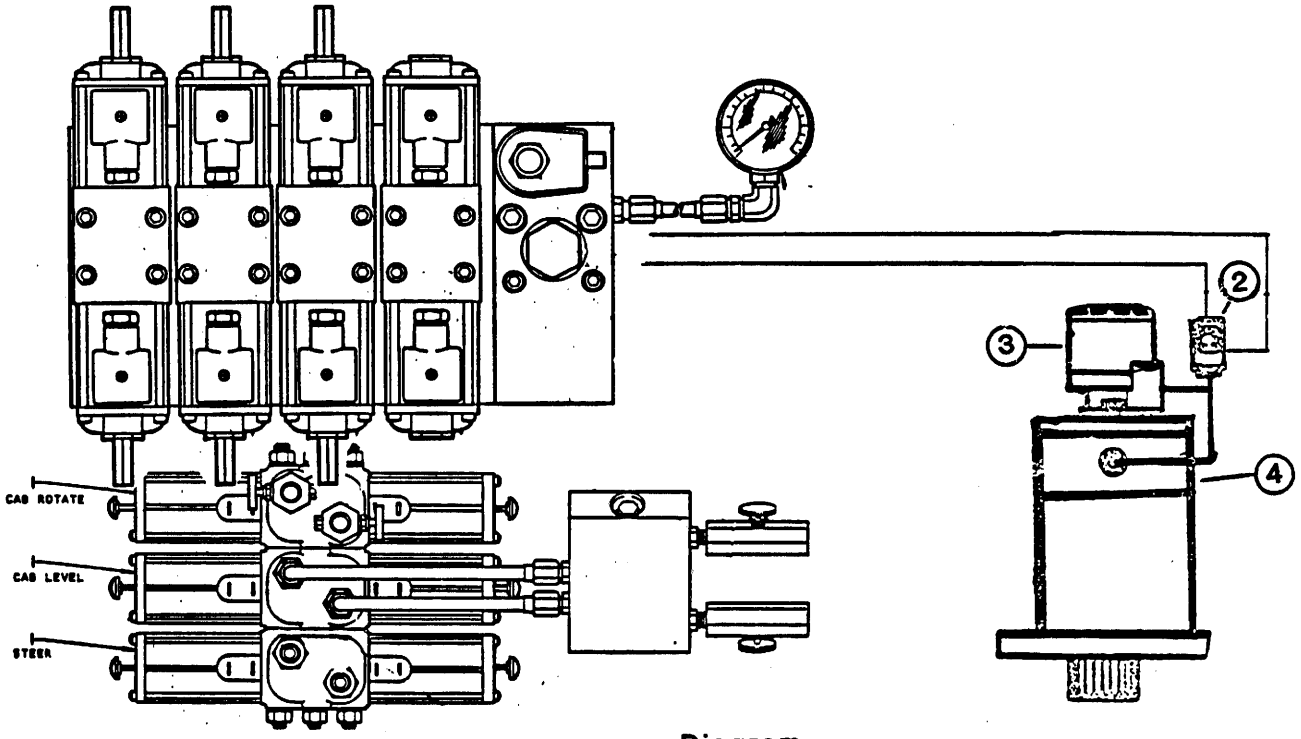
   This valve selects either clockwise or counter-clockwise pressure to be routed to the intregal brake assembly.

3. Swing Motor -

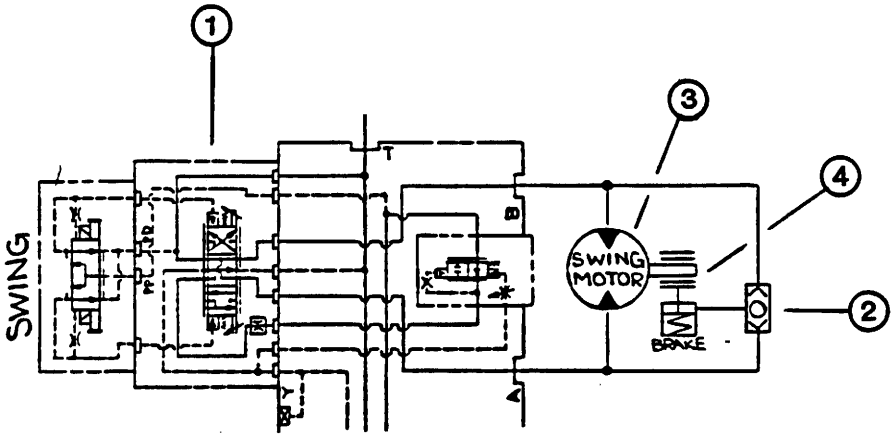
   This motor is rotor driven which is keyed to a shaft. This in turn powers the gear reducer assembly.

4. Swing Brake -

   The brake is a multiple disc type which is part of the swing reducer. This brake prevents the pinion shaft from taking the full load during quick stops by allowing the pinion to slip during overloads.



Diagram



Schematic

Ref #

1 Motion Control Valve -

The motion control valve found in the drive system has a two fold purpose. It shuttles hydraulic oil flow to the intregal brake assemblies plus it produces a back pressure in the drive system so that unit run a way is impossible. This is accomplished by two (2) counter balance valves located in the motion control valve. Proper brake valve adjustment - open 1½ turn

2 Flow Divider Combiner -

The flow divider combiner provides a differential action for the drive motors. In a turning situation, hydraulic fluid will force the internal spools to channel fluid to the driving wheel. It also has a great impact on driving characteristics when one wheel becomes lite.

3 Globe Valve -

The Globe valve has one function. It allows hydraulic fluid to pass from one drive wheel to the other when unit is in a turn situation. It can be adjusted as to the amount of oil requested to pass but the correct setting should be approximately one and one half turn open from the closed position. In this position, the engine will load slightly and allow a metered amount of hydraulic fluid to pass to the driving wheel.

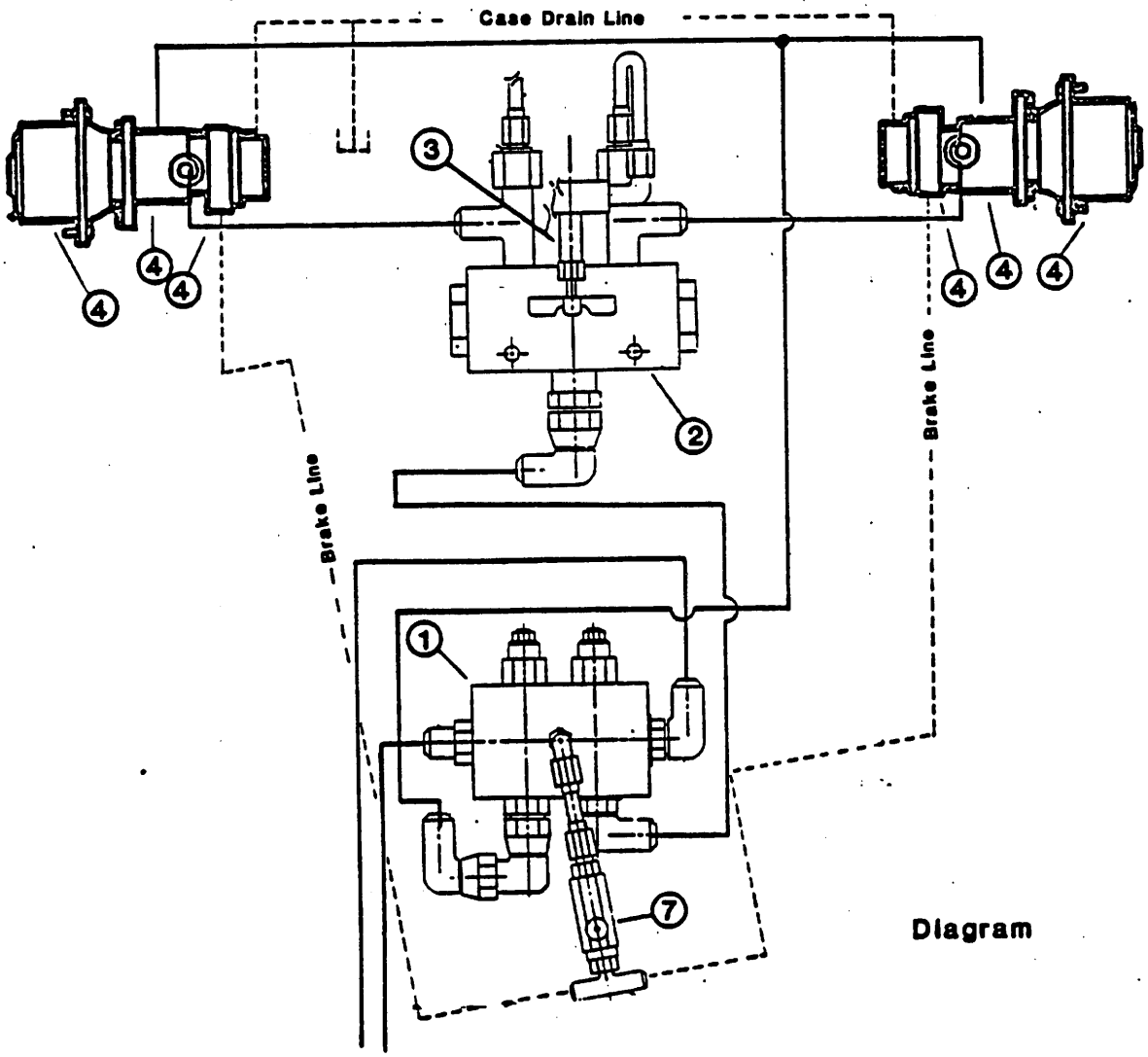
4 Drive Motors and Brake Assembly -

The brake assembly used on the Simon boom lift is a rool seal type brake. It is a wetted disc which is spring applied with hydraulic release. The drive motor rotor is keyed to a shaft which in turn is splined on both ends. One end of the splined shaft is used for the roll seal brake while the other is inserted into the gear reducer assembly.

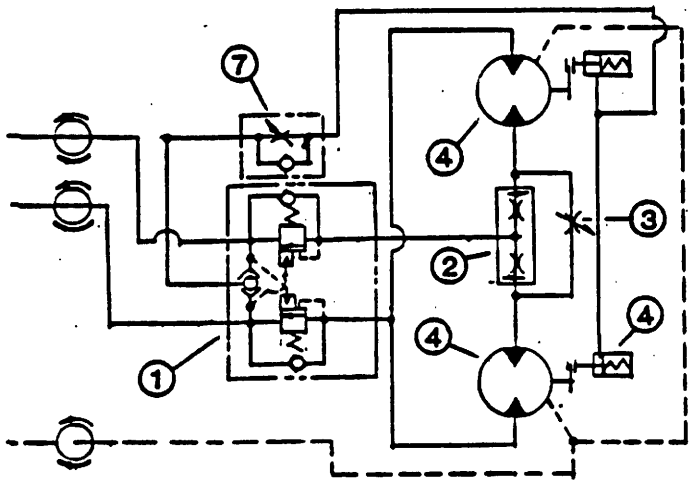
Note: Motor internal leakage passed through the brake disc's and back to the main hydraulic reservoir thereby cooling the brake and preventing excessive brake disc wear.

There is also two (2) case drain lines which return directly to the main hydraulic reservoir to reduce motor back pressure.

Drive Circuit (Cont.)



Diagram



Schematic

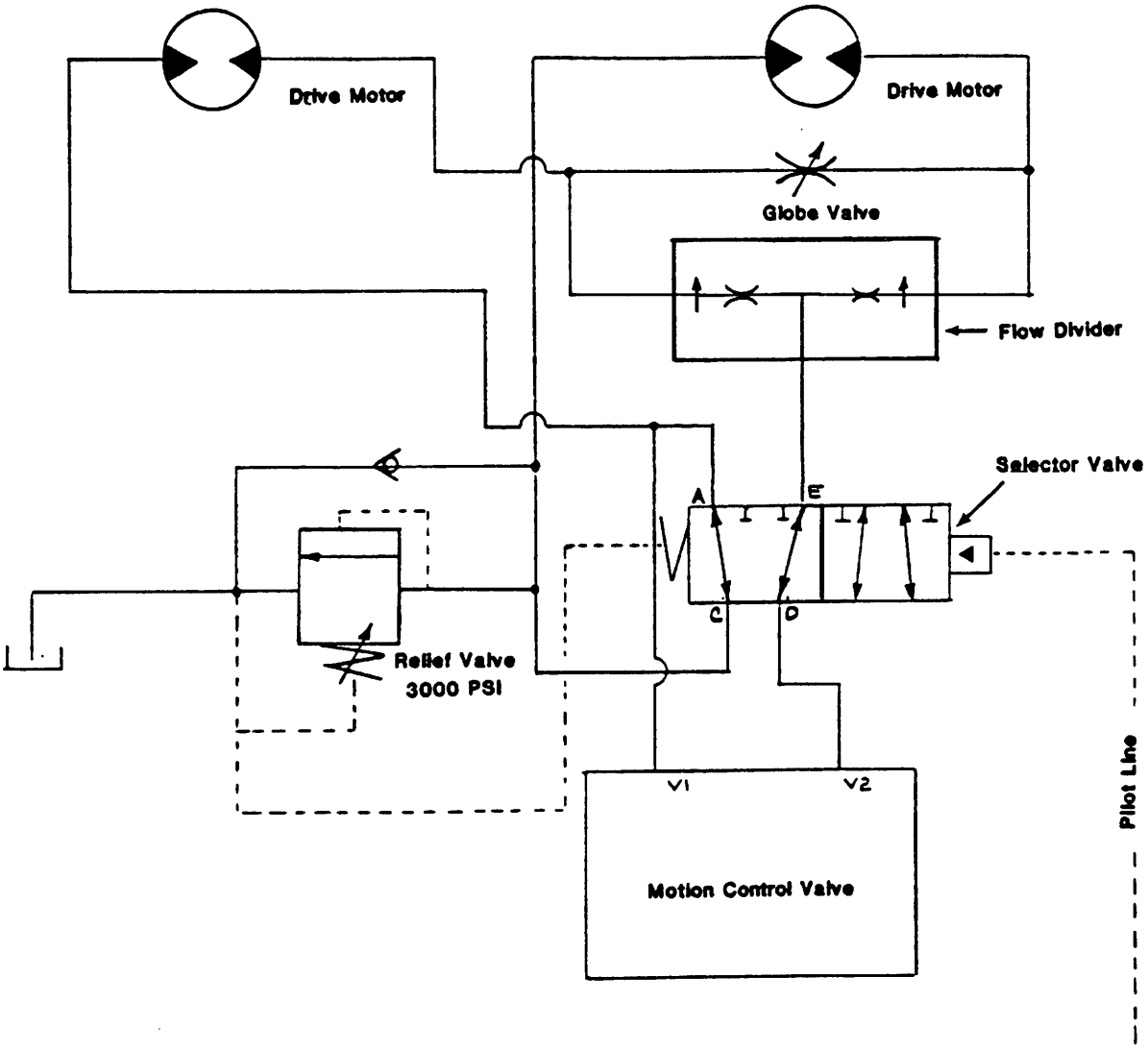
Ref #

5 Selector Valve - (Series / Parallel)

The selector valve used in the Simon drive system allows for a pilot pressure to shift the directional control spool changing the drive system flow from series flow to parallel flow.

6 Relief Valve -

The relief valve utilized in this drive system is set at 3,000 P.S.I. and adds assurance that the drive system will see only this pressure during the drive mode.



Ref #

1. Directional Control Valve -

   This valve is a 3 position, 4 port valve. It is normally closed and equipped with a manual override for manual operation. This valve selects hydraulic fluid pressure to the steering circuit.

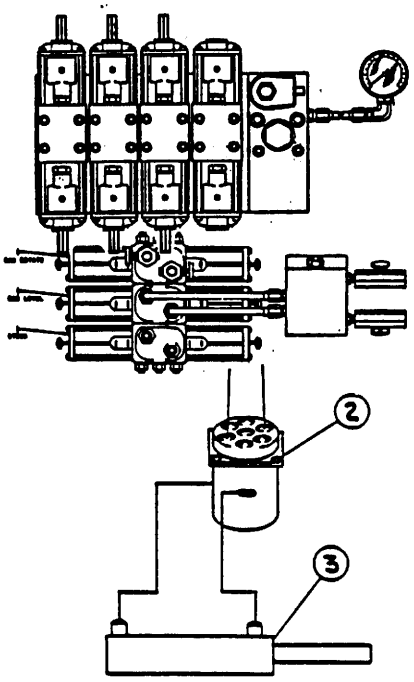
2. Hydraulic Swivel -

   The swivel allows passage of pressure and return fluid between the upper and lower assemblies of the unit. This also allows for 360 degrees of continous rotation.

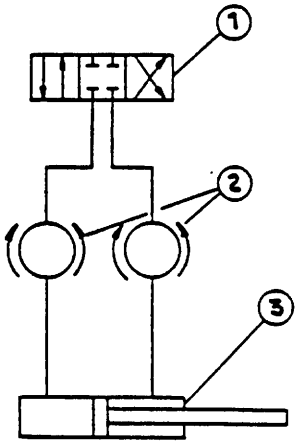
3. Steer Cylinder -

   The cylinder is double acting and is directly connected to the steering linkage assembly. This cylinder powers all steering movements.

ITEM	TROUBLE SHOOTING	ADJUSTMENTS	REPAIR	MISC.	PARTS
1 Selector Valve	M5 M6.2.				D-13
2 Swivel					D-2
3 Steer Cylinder					D-1



STEERING



Ref #

1. Flow Valve -

This adjustable control valve varies the volume of hydraulic fluid entering the rotate and platform leveling circuits. By decreasing the flow to these circuits, this prevents the destruction of the rotating hardware.

2. Leveling Selector Valve -

This is a 3 position, 4 port electrically operated solenoid valve. It is normally closed and selects fluid flow to rotate the platform.

3. Slave Leveling Cylinder -

The cylinder is a 2 port double acting cylinder connected between the tip boom and the platform. This cylinder controls the position of the platform relative to the tip boom.

4. Master Leveling Cylinder -

This cylinder is also a 2 port double acting cylinder with the same displacement as the slave cylinder. This cylinder is located between the upper frame and the boom or boom lift cylinder. Whenever the boom is raised or lowered, the master cylinder is forced to move. The fluid displacement from the master cylinder is in turn sent up the boom to the slave cylinder. This forces the slave cylinder to move the same distance as the master cylinder.

5. Leveling System Holding Valves -

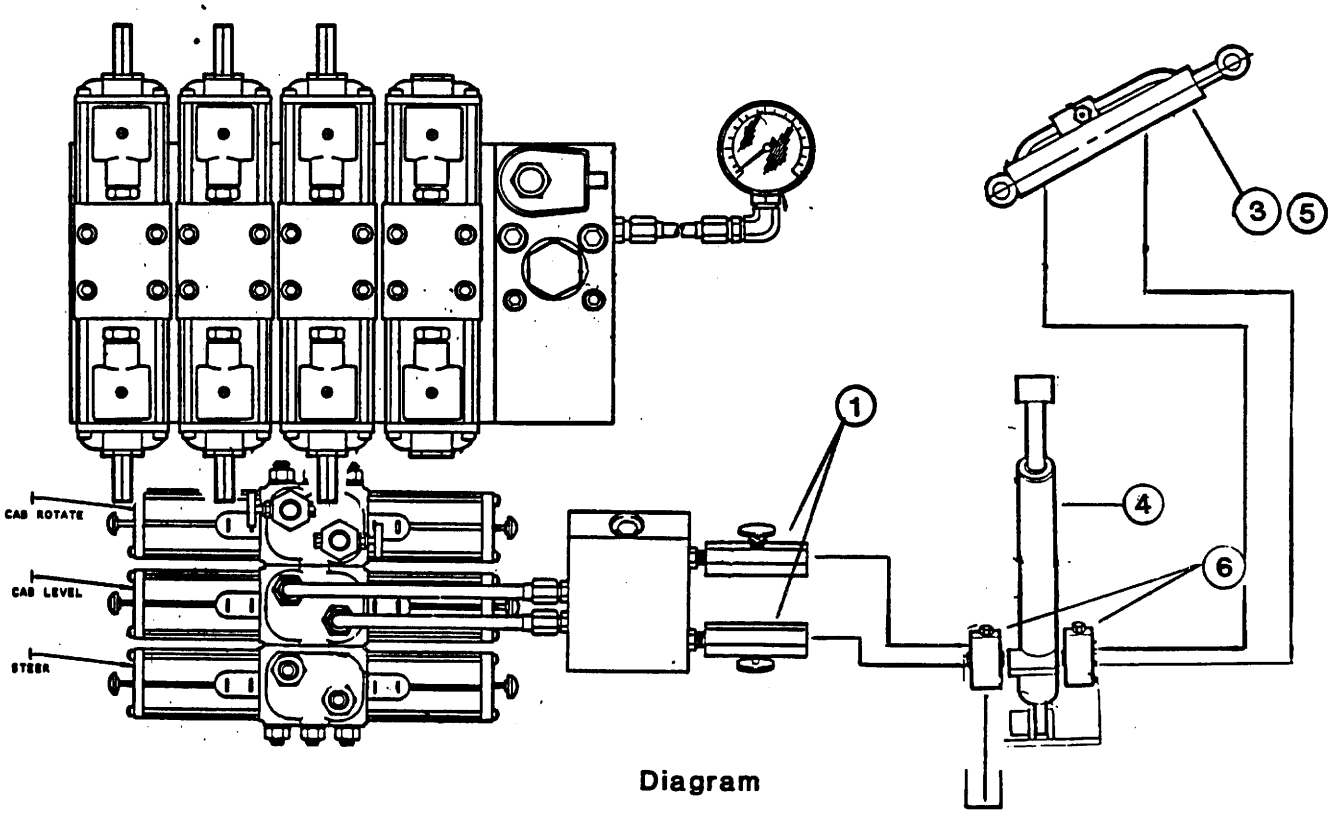
These are pilot adjustable and prevent platform movement. In the event of hose failure, the holding valve does not allow fluid to leave the slave cylinder unless imput pressure allows the pilot valve to open.

Ref #

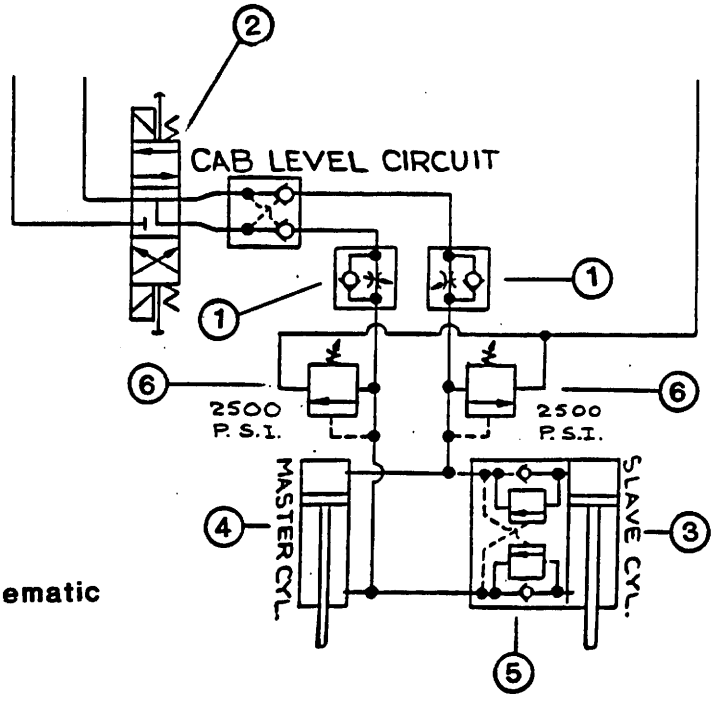
6 Relief Valve -

This valve is adjustable and prevents high pressure spikes in the leveling circuit that could result in component damage. The pressure spikes occur when the slave cylinder is serviced manually by the selector valve and is not leveled which will cause the cylinder to bottom out before the master cylinder stops moving as the boom is lowered.

ITEM	TROUBLE SHOOTING	ADJUSTMENTS	REPAIR	MISC.	PARTS
Flow Valve		M1.1		M6.2	B4
Selector Valve	m5.4				D14
Slave Cylinder					D21
Holding Valves					D21
Master Cylinder					D10
Relief Valves	m5.1 &5.2	M1.1			



Diagram



Schematic

Ref #

1. Flow Valve -

This adjustable control valve varies the volume of hydraulic fluid entering the platform rotate and leveling circuits. By decreasing the flow to these circuits, this prevents the destruction of the rotating hardware.

2. Rotating Selector Valve -

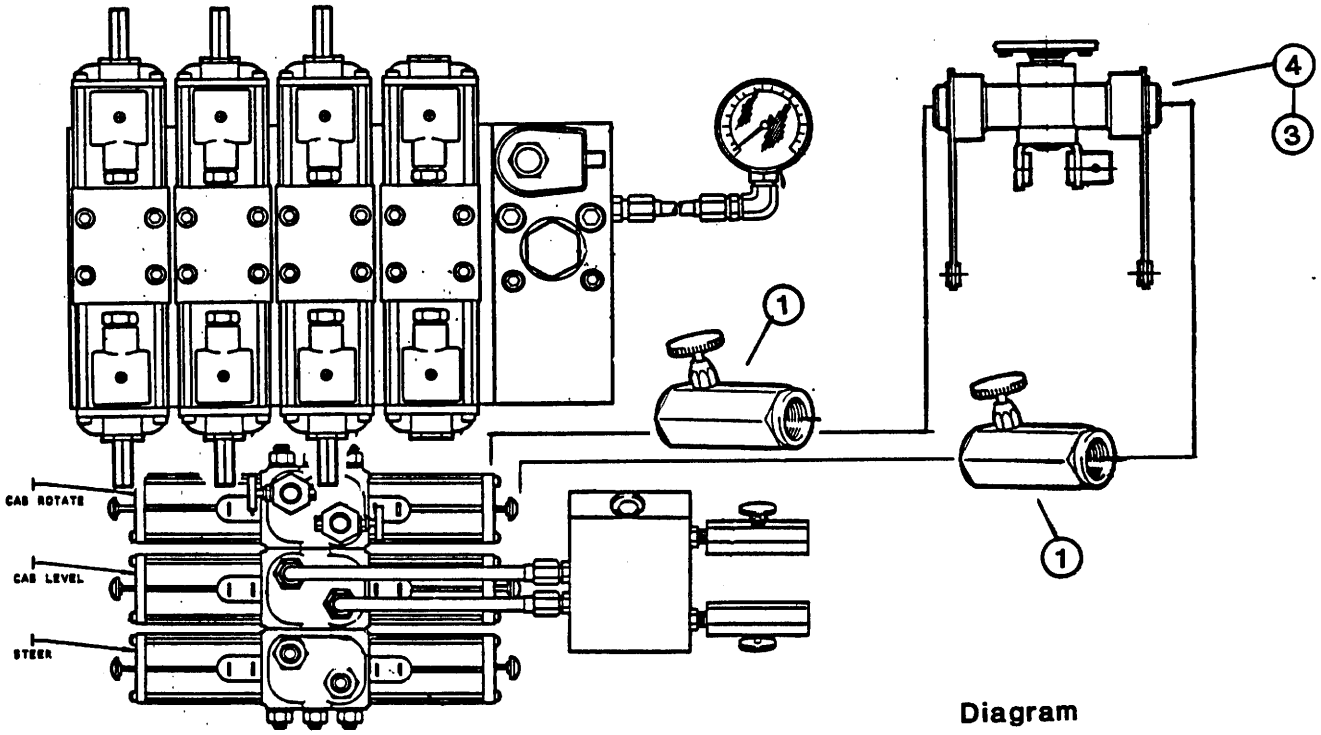
This is a 3 position, 4 port electrically operated solenoid valve. It is normally closed and selects fluid flow to rotate the platform

3. Rotary Actuator -

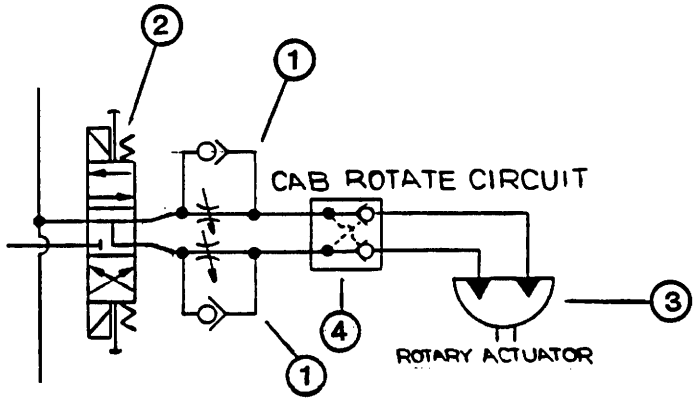
The rotary actuator utilized in the Simon boom lift is of the rack and pinion type. Hydraulic fluid enters the actuator from either side, depending on the desired rotation, and powers the rack in the opposite direction causing the pinion shaft to rotate.

4. Double Pilot Operated Check Valve -

The double pilot operated check valve used with the rotary actuator is mounted as an intregal part of the actuator. Its purpose is to act as the locking componet so the actuator does not rotate while not in use. When the rotate circuit is powered by hydraulic fluid, partial fluid flow is piloted over to the return side to unseat the check ball.



Diagram



Schematic

Ref #

1 Main Hydraulic Pump -

The main pump is engine driven and is of a radial piston type. This pump delivers hydraulic fluid, under pressure, through the high pressure filter to the main hydraulic distribution manifold. This manifold is located in the center of the main valve bank.

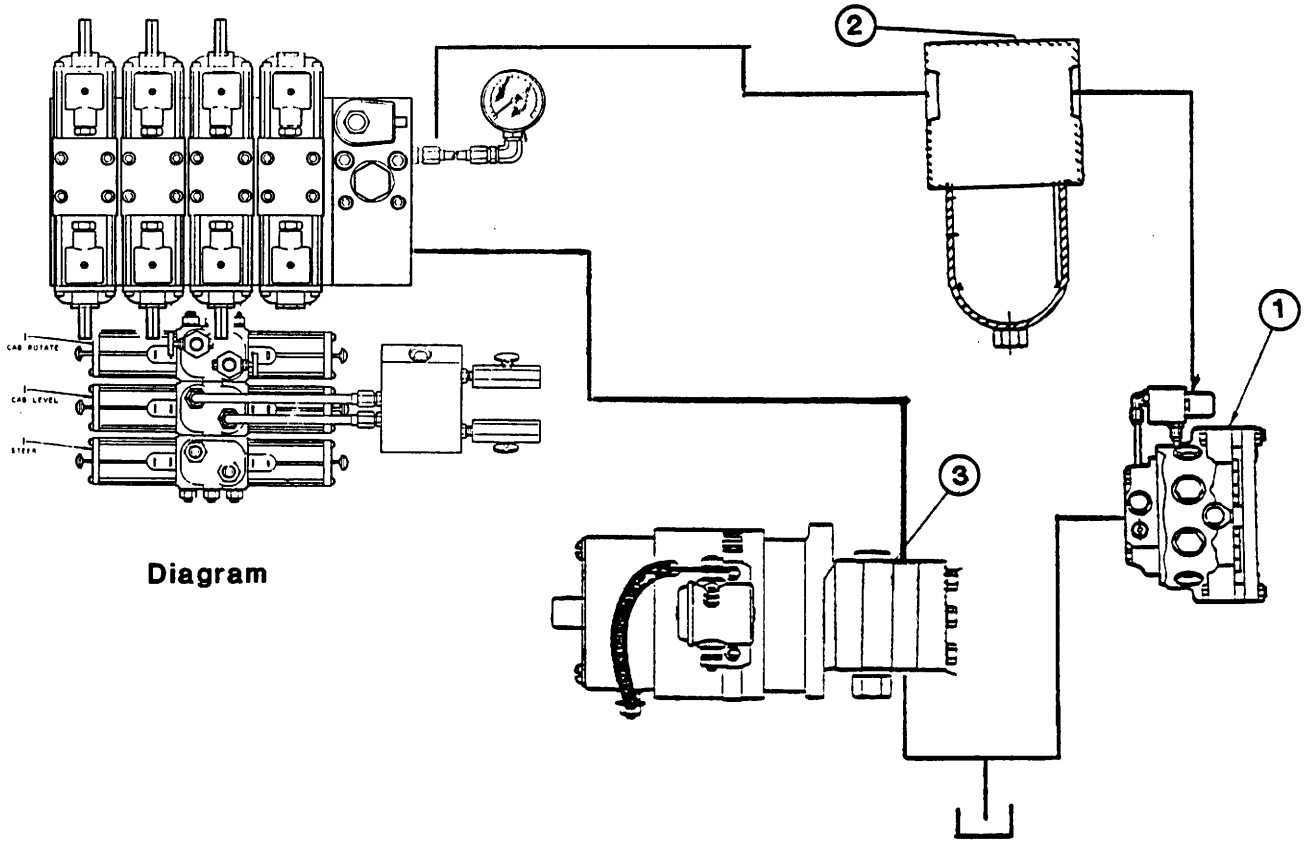
2 High Pressure Filter -

The high pressure filter, filters the hydraulic fluid before it reaches the main hydraulic distribution manifold. The high pressure filter utilized on current production models is a non by-passing type. The filter element used is rated at 10 microns. This type of hydraulic filter does incorporate a differential pressure shut off valve that will stop fluid flow when the filter becomes dirty. However; this valve allows enough fluid to pass as not to crush the element from back pressure.

Note: Older type Simon booms utilized a high pressure filter with a by-pass circuit. This type of filter is identified by a metal 2 micron filter element located internally in the filter body. This filter housing also has a red indicator pin which, when the element is dirty, pops out of the filter head indicating a by-passing situation.

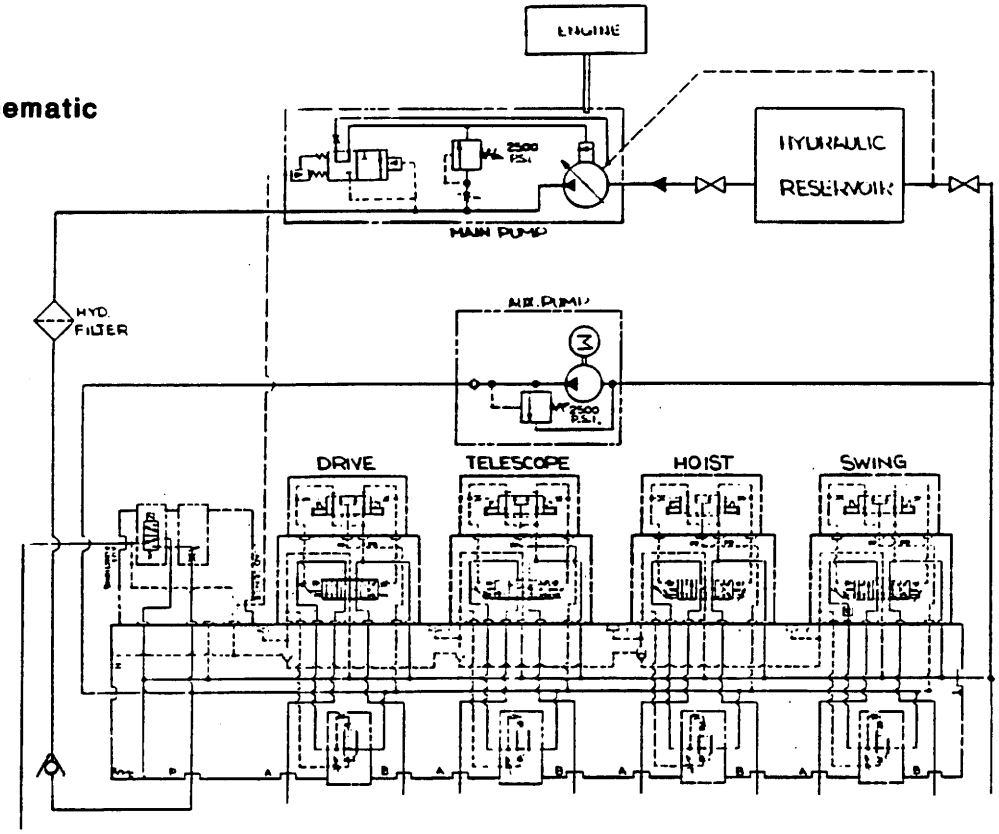
3 Emergency Pump -

The emergency pump is driven by an electric DC motor. This pump delivers hydraulic fluid, under pressure, to the main hydraulic distribution manifold. This pump should only be used in emergency situations! The electric motor is of a non-continuous type and will fail if used excessively.



Diagram

Schematic



The emergency descent package incorporates three (3) manually operated control valves.

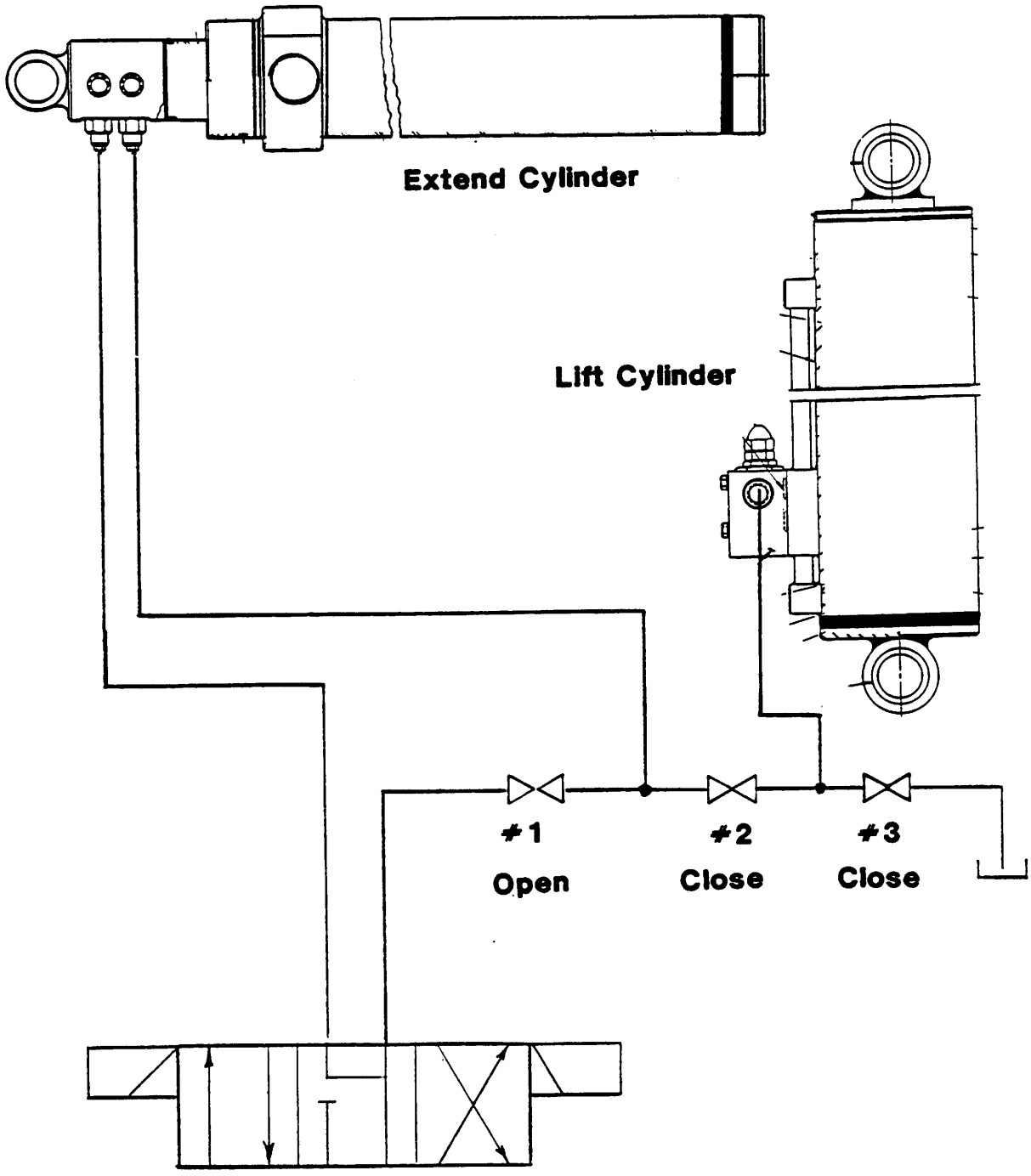
During normal operation, these valves allow hydraulic fluid to pass to various function cylinders as directed. In normal operation, the #1 control valve is in the " OPEN " mode while #2 and #3 control valves are to be in the " Closed " mode. This will allow hydraulic fluid to pass through the #1 control valve to the extend cylinder while hydraulic flow is stopped from entering the lift cylinder and the main hydraulic reservoir through the #2 and #3 control valves.

However; if the main hydraulic power source becomes inoperative and/or the auxilary power source also fails, the emergency descent package can be used. This can be accomplished by " CLOSING " the #1 control valve while " OPENING " the #2 control valve. This will allow hydraulic fluid, under pressure from the raised boom, to flow freely thru the #2 control valve to the extend cylinder causing the extend cylinder to retract.

After the boom has stopped lowering and retracting under its own weight, to continue to lower the boom " OPEN " #3 control valve. This will allow excess hydraulic fluid to pass freely to the main hydraulic reservoir.

NOTE: #3 control valve should only be " OPENED " AFTER the extend cylinder has fully retracted or the boom no longer descends under its own weight.

The emergency retract application for the extend cylinder will only operate when the boom is above horizontal.



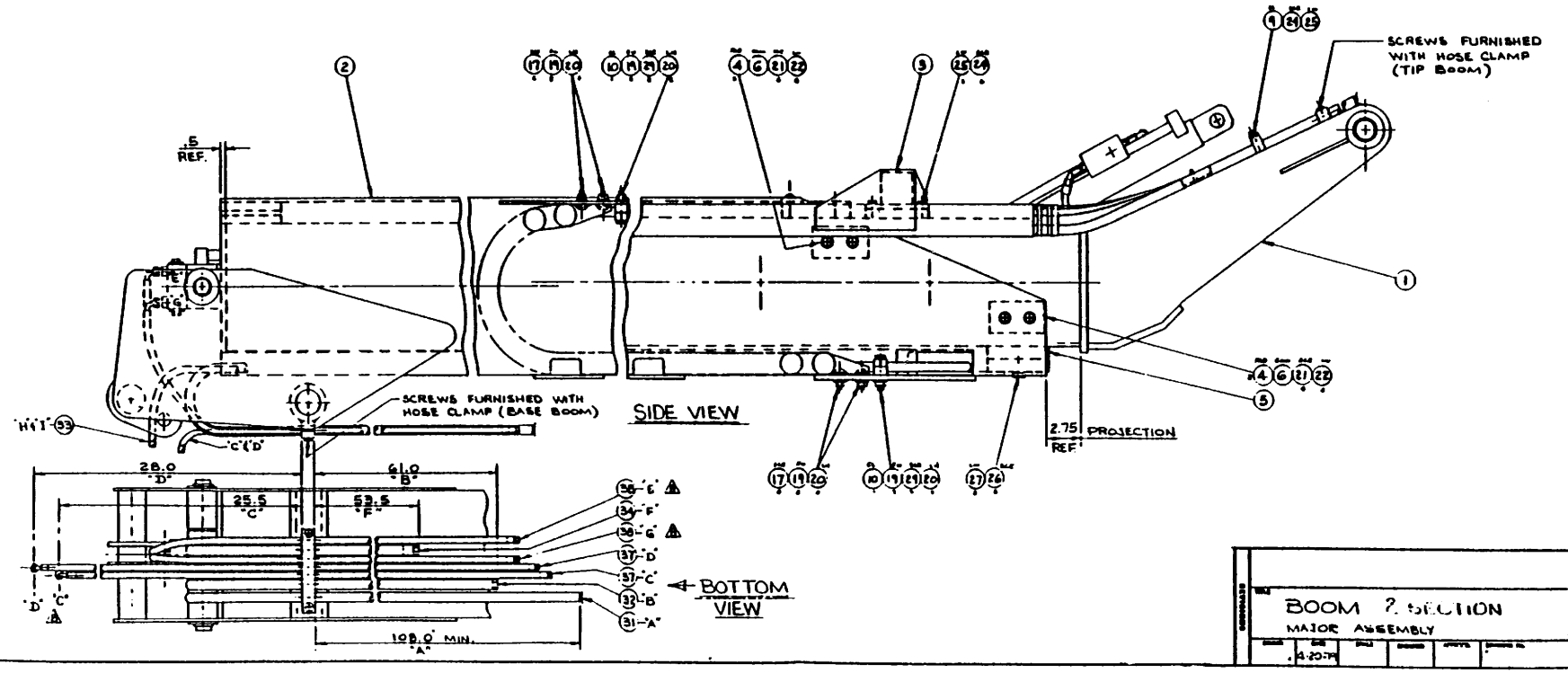
Manual Descent Package - Normal Operation

ITEM	QTY	PART NO.	DESCRIPTION	MATL	WT.
31	1	B670-911	CABLE 24C 7/8"	"A"	
32	1	05-34100	HOSE ASSY 3/8 I.D. x 574.5	"B"	
33	2	05-22800	HOSE ASSY 1/4 I.D. x 474.	HOT	
34	1	05-34200	HOSE ASSY 3/8 I.D. x 561.	"B"	
35	2	05-23800	HOSE ASSY 1/4 I.D. x 40.	-	
36	2	05-22100	HOSE ASSY 1/4 I.D. x 29.5	-	
37	2	05-21700	HOSE ASSY 1/4 I.D. x 109.	"C" "D"	
38	2	05-21800	HOSE ASSY 1/4 I.D. x 96"	"E" "G"	
39	AR	08-64000	TIE WRAPS		
40	1	A-440-906	RUBBER PAD		
41					
42					
43					
44					
45					

ITEM	QTY	PART NO	DESCRIPTION	MATL	WT.
16	2	08-40700	SNAP RING 1 1/4		80.
17	8	07-17005	SCR, BUT. HD. 1/4 NC x 1 GR 8		
18	2	07-62035	FLATWASHER 1 1/4 (HVY)		
19	20	07-62014	FLATWASHER 1/4 (HVY)		
20	12	07-50014	LOCKNUT 1/4 NC		
21	8	07-03084	SCR, H.H.C.S. 1/2 NC x 1 1/2 GR 8		
22	8	07-68018	LOCKWASHER 1/2		
23	3	07-17085	SCR, BUT. HD. 1/2 NC x 1 GR 8		
24	7	07-03045	SCR, H.H.C.S. 3/8 NC x 1 GR 8		
25	7	07-68016	LOCKWASHER 3/8		
26	2	07-03128	SCR, H.H.C.S. 5/8 NC x 1 3/4 GR 8		
27	2	07-68021	LOCKWASHER 5/8		
28	1	08-00700	HOSE TRACK		
29	4	07-03010	SCR, H.H.C.S. 1/4 NC x 2 1/2 GR 8		
30					

BILL OF MATERIAL

ITEM	QTY.	PART No.	DESCRIPTION	MATL.	WEIGHT
1	1	D440-307	POINT BOOM SUB-ASSY		
2	1	D440-206	BASE BOOM-WELDED		1,077
3	1	D440-201	TUBE - WELDED		87.
4	4	B440-301	SLIDER PAD		1.6
5	1	B440-302	SLIDER PAD		1.8
6	AS REQ	B440-901	SHIM - SLIDE PAD		.17
7	1	B440-910	SPACER		6.9
8	1	B440-904	PIN - TELESCOPE CYL		4.1
9	1	B450-924	CLAMP-BOOM POINT		.2
10	2	B440-210	CLAMP - HOSE TRACK		3.
11					
12					
13					
14					
15					



BOOM 2 SECTION

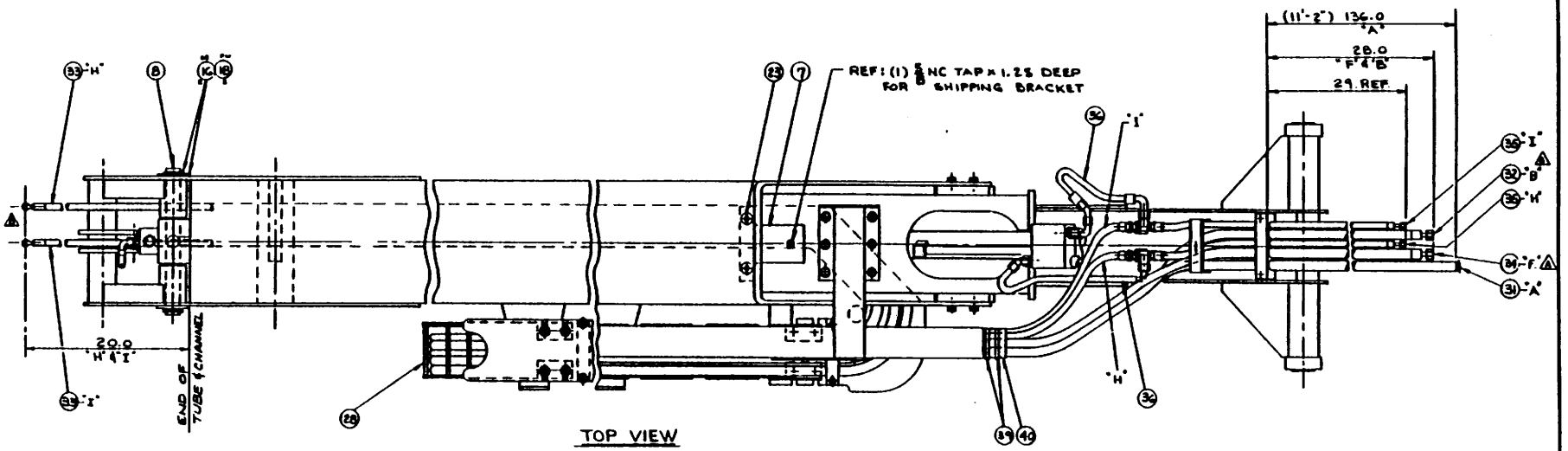
MAJOR ASSEMBLY

SH 1 OF 2

4-20-71

BILL OF MATERIAL

ITEM	QTY.	PART NO.	DESCRIPTION	UNIT	WEIGHT
			REFER TO SH. 1		

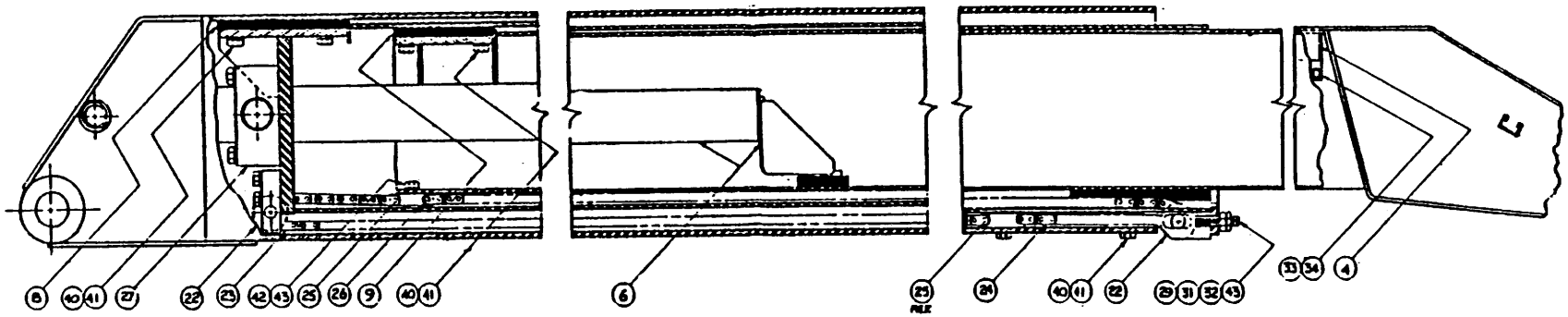


TOP VIEW

BOOM 2 SECTION
MAJOR ASSY.

SH. 2 OF 2

4-20-74



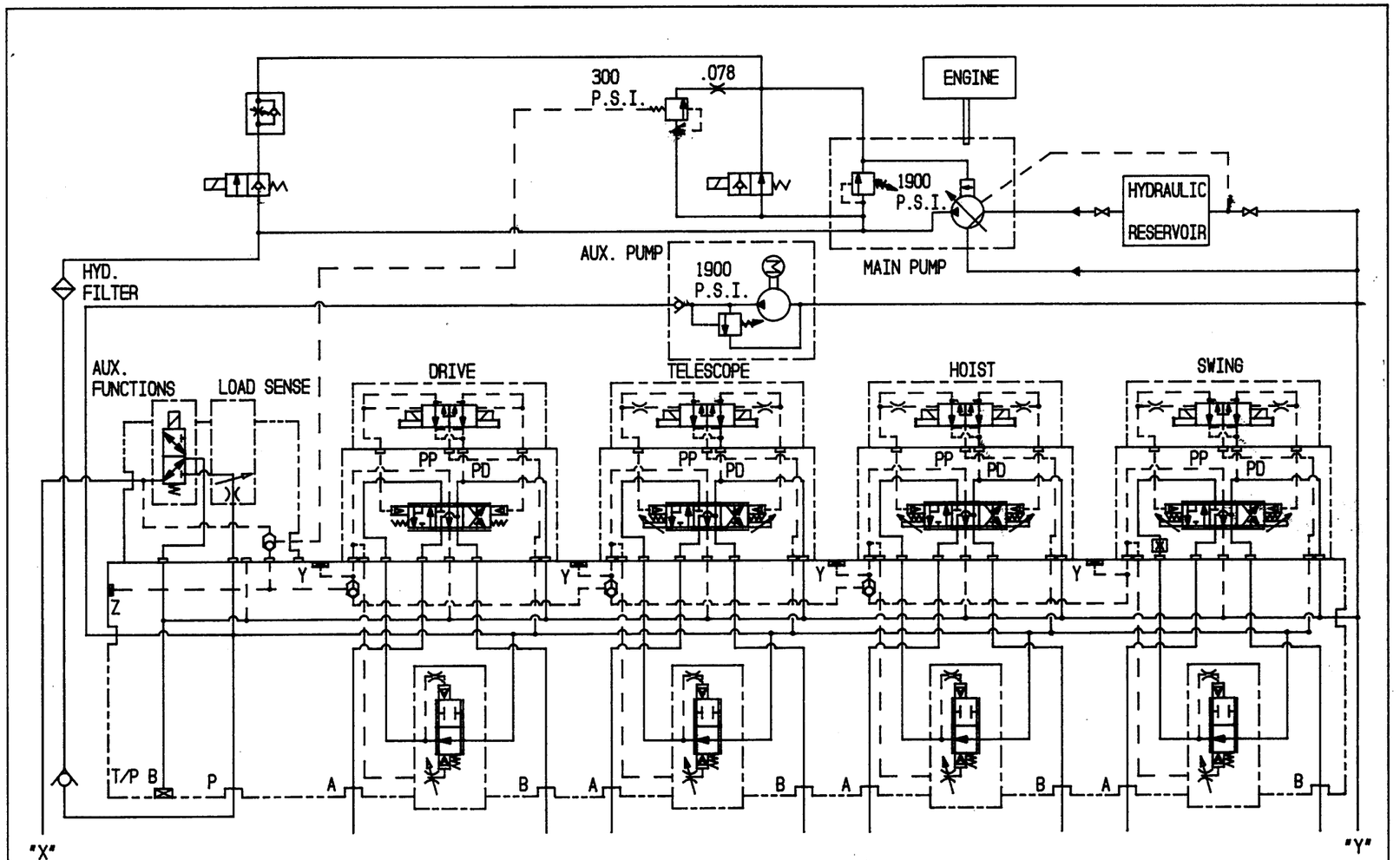
SIMON

MAJOR BOOM ASSEMBLY
SECTION

SCHEMATICS

MP Electro-Proportional Service Manual

1.	SCS-209033-5 Pg 1	Hydraulic Schematic, MP Type 1 Controls	8-1/2" x 11"
2.	SCS-209033-5 Pg 2	Hydraulic Schematic, MP Type 1 Controls	8-1/2" x 11"
3.	SDS-216664-0 Pg 1	Electrical Schematic, MP110 Type 1 Controls	11" x 17"
4.	SDS-216664-0 Pg 2	Electrical Schematic, MP110 Type 1 Controls	11" x 17"

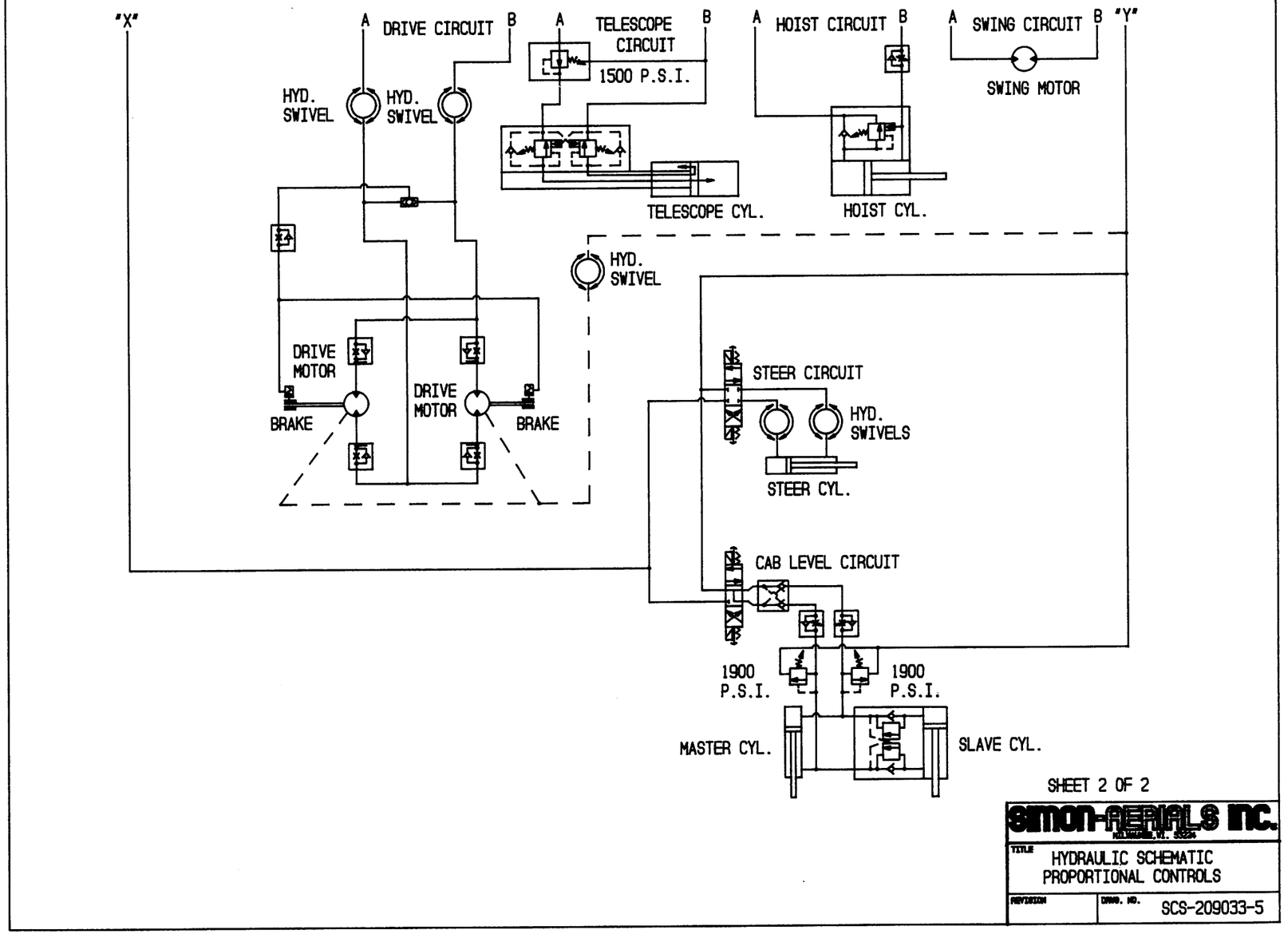


SHEET 1 OF 2

SIMON-GERRARDS INC.

TITLE: HYDRAULIC SCHEMATIC
PROPORTIONAL CONTROLS

REVISION | DWG. NO. SCS-209033-5



SHEET 2 OF 2

SIMON-AERIALS INC.

TITLE	
HYDRAULIC SCHEMATIC PROPORTIONAL CONTROLS	
REVISION	DRWG. NO. SCS-209033-5

ENG. START MOTOR BENDIX
ENERG. PUMP
TO TACH.
ALTERNATOR
THROTTLE
FUEL SOLENOID
ENG. START
ENG. SHUT DOWN ALARM
OIL PRESS. SWITCH
WATER TEMP. SWITCH
HORN
TILT ALARM
ENERG. PUMP
SOURCE RELAY
HOUR METER
STARTER SWITCH
THROTTLE
PUMP STROKE
CAB WORK LIGHTS
STEER
2 SPEED TRAVEL
CAB LEVEL
CAB ROTATE
12v BATTERY
PROX. SW. 7
PROX. SW. 9
PROX. SW. 13
CAB IGN.
KEY SWITCH
BATT. SPLITTER
SHEET 1 OF 2

SIMON-AERIALS INC.
MILWAUKEE, WI. 53224

TITLE: ELECTRIC SCHEMATIC MP-110
PROPORTIONAL CONTROLS

REVISION:

DRWG. NO.: SDS-216664-0

BOOM EXTEND
BOOM HOIST
BOOM LOWER
MOVEMENT ALARM
SOL. 10
SOL. 9
HOIST LIMIT SWITCH
EXTEND LIMIT SWITCH
SOL. 8
SOL. 7
SOL. 6
SOL. 5
SOL. 4
SOL. 3
25
3
LS6
LS5
LS4
LS3
LS2
LS12
LS11
LS14
LS13
CR13
CR9
CR7
CR1
19
14
15
9
8
7
6
12
13
A
B
G
H
HOIST
TELESCOPE
SWING
DRIVE
P
R
AUX. PUMP
STEER
11
10
1
5
35
50
6.2Ω
10Ω
10Ω
DEADMAN
TRAVEL
PENDENT

AUX	A	B	25	3	14	15		H	R	—	REF.	HI
AUX	B		GR.	VS	A	B	+	STG				

DRIVE

AUX	A	B	25	3	9	8		G	R
AUX	B		GR.	VS	A	B	+	STG	—

SWING

AUX	A	B	25	3	7	6		B	R
AUX	B		GR.	VS	A	B	+	STG	—

TELESCOPE

AUX	A	B	25	3	12	13	P	A	R
AUX	B		GR.	VS	A	B	+	STG	—

HOIST

SHEET 2 OF 2

SIMON-AERIALS INC.
MILWAUKEE, WI. 53224

TITLE: ELECTRIC SCHEMATIC MP-110
PROPORTIONAL CONTROLS

REVISION

DRWG. NO. SDS-216664-0