SERVICE & MAINTENANCE

Models
40ic
45ic

3120734
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FOREWORD

The purpose of this manual is to provide users with the operating procedures essential for the promotion of proper machine operation for its intended purpose. It is important to over-stress proper machine usage. All information in this manual should be **READ** and **UNDERSTOOD** before any attempt is made to operate the machine. **YOUR OPERATING MANUAL IS YOUR MOST IMPORTANT TOOL** - Keep it with the machine. **REMEMBER ANY EQUIPMENT IS ONLY AS SAFE AS THE OPERATOR.**

BECAUSE THE MANUFACTURER HAS NO DIRECT CONTROL OVER MACHINE APPLICATION AND OPERATION, PROPER SAFETY PRACTICES ARE THE RESPONSIBILITY OF THE USER AND HIS OPERATING PERSONNEL.

ALL INSTRUCTIONS IN THIS MANUAL ARE BASED ON THE USE OF THE MACHINE UNDER PROPER OPERATING CONDITIONS, WITH NO DEVIATIONS FROM THE ORIGINAL DESIGN. ALTERATION AND/OR MODIFICATION OF THE MACHINE IS STRICTLY FORBIDDEN, WITHOUT WRITTEN APPROVAL FROM JLG INDUSTRIES, PER OSHA REGULATIONS.

THIS "SAFETY ALERT SYMBOL" IS USED TO CALL ATTENTION TO POTENTIAL HAZARDS WHICH MAY LEAD TO SERIOUS INJURY OR DEATH IF IGNORED.

Safety of personnel and proper use of the machine are of primary concern, DANGER, WARNING, CAUTION, IMPORTANT, INSTRUCTIONS and **NOTE** are inserted throughout this manual to emphasize these areas. They are defined as follows:

⚠ DANGER

DANGER INDICATES AN IMMINENTLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED WILL RESULT IN SERIOUS INJURY OR DEATH.

⚠ WARNING

WARNING INDICATES A POTENTIALLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED COULD RESULT IN SERIOUS INJURY OR DEATH.

⚠ CAUTION

CAUTION INDICATES A POTENTIALLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, MAY RESULT IN MINOR OR MODERATE INJURY. IT MAY ALSO BE USED TO ALERT AGAINST UNSAFE PRACTICES.

⚠ IMPORTANT

IMPORTANT OR INSTRUCTIONS INDICATES A PROCEDURES ESSENTIAL FOR SAFE OPERATION AND WHICH, IF NOT FOLLOWED, MAY RESULT IN A MALFUNCTION OR DAMAGE TO THE MACHINE.

In this Manual "Notes" are used to provide information of special interest.

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1-1. CAPACITIES.

• Fuel Tank.

8.0 gallons (30.28 liters). max. capacity.

7.8 gallons (29.5 liters) w/10% air space.

• Hydraulic Oil Tank.

14.0 gallons (53 liters).

• Hydraulic System. (Including Tank)

Approximately 16.8 gallons (63.59 liters).

• Torque Hub, Drive.

17 ounces (0.5 liters).

1-2. COMPONENT DATA.

• Engine - Diesel. (Water Cooled)

Manufacturer/Model - Yanmar 3TNE68.

Oil Capacity.

2.5 Quarts (2.4 liters) w/Filter.

Idle RPM - 1500

Low RPM - 2000

High RPM - 3050

Alternator - 40 AMP w/Regulator.

Battery - 85 Amphour, 550 Cold Cranking Amps, 12 VDC.

Horsepower - 17.5 @ 3,200 rpm.

Cooling System.

? Quarts (? liters) radiator.

1.0 Quarts (0.9 liters) engine.

• Engine - Gas. (Water Cooled)

Manufacturer/Model - Vanguard DM700G.

Oil Capacity.

3.0 Quarts (3.2 liters) w/Filter.

Idle RPM - 1500.

Low RPM - 2000

High RPM - 3200

Alternator - 14 AMP w/Regulator.

Battery - 85 Amphour, 550 Cold Cranking Amps, 12 VDC.

Horsepower - 21.5 HP @ 3,200 RPM.

Cooling System.

? Quarts (? liters) radiator.

1.9 Quarts (1.8 liters) engine.

• Drive System.

Drive Motor Displacement.

Standard - 2.48 cu in/rev (40.64 cm^3)

Drive Hub Ratio.

Standard - 19:1

Drive Brake - Automatic spring applied, hydraulically released disc brakes.

Tires - 40ic.

Tires - G78-15, Load Range E, 10 Ply Rating, 80 psi (5.5 Bar).

Tires - G78-15, Load Range E, 10 Ply Rating, Foam Filled. (Optional)

Solid Tires - 22 x 6.5 x 16 Lug Tread Non marking Compound. (Optional)

Tires - 45ic.

Tires - LT215 85R16, Load Range E, 10 Ply Rating, 90 psi (6.2 Bar).

Tires - LT215 85R16, Load Range E, 10 Ply Rating, Foam Filled. (Optional)

Solid Tires - 22 x 6.5 x 16 Lug Tread Non marking Compound. (Optional)

- **Steer System.**

Toe-in, adjust for 1/4" (6.35 mm) overall.

- **Hydraulic Gear Pump. 3600257**

2.84 GPM (10.7 lpm).

Pump Displacement.
0.188 in rev (3.08 cm^3 rev).

Clockwise Rotation.

- **Hydraulic Main Pump. 3600256**

Output.
2.0 GPM (7.57 lpm).

Pump Displacement.
1.16 cu in (19 cm^3).

Clockwise Rotation.

- **Auxiliary Power Pump.**

1.05 GPM (3.97 lpm).

Pump Displacement.
0.073 cu in (1.196 cm^3).

DC Motor.

Clockwise Rotation.

- **Hydraulic Filter - In-line.**

Return - Bypass Type.
Return, 10 Microns Absolute.

Charge.
Return, 10 Microns Absolute.

Hydraulic Strainers (In Tank).
30 Microns.

1-3. PERFORMANCE DATA.

- **Travel Speed.**

3.5 mph (5.63 kph).

- **Gradeability.**

25%.

- **Turning Radius (Inside).**

6 ft. 1 in. (1.85 m.).

- **Turning Radius (Outside).**

13 ft. 3 in. (4.04 m.).

- **Main Boom Speed.**

Lift Up - 32 - 45 seconds.
Lift Down - 25 - 35 seconds.

- **Telescope Speed.**

Tele In - 33 - 43 seconds.
Tele Out - 23 - 33 seconds.

- **Lower Boom Speed.**

40ic - Lift Up - 18 - 33 seconds.
40ic - Lift Down - 25 - 35 seconds.
45ic - Lift Up - 48 - 60 seconds.
45ic - Lift Down - 25 - 35 seconds.

- **Rotate Speed - 180 Degrees.**

Left - 33 - 39 seconds.
Right - 23 - 27 seconds.

- **Swing Speed - 360 Degrees.**

Left and Right - 59 - 69 seconds.

- **Drive Speed - 200 ft.**

Forward - 30 - 48 seconds.
Reverse - 30 - 48 seconds.

- **Machine Weight.**

40ic - 10,700 lb. (4,853 kg).
45ic - 11,800 lb. (5,352 kg).

- **Machine Height (stowed).**

40ic - 6 ft. 7 in. (2.0 m.).
45ic - 6 ft. 7 in. (2.0 m.).

• Machine Length (stowed).

40ic - 17 ft. 7 in. (5.36 m.).

45ic - 18 ft. 8 in. (5.69 m.).

• Machine Width.

40ic - 5 ft. 9 in. (1.75 m.).

45ic - 5 ft. 9 in. (1.75 m.).

• Wheel base.

40ic - 6 ft. 7.25 in. (2.01 m.).

45ic - 6 ft. 7.25 in. (2.01 m.).

1-4. TORQUE SPECIFICATIONS.

Description	Torque Value (Dry)	Interval Hours
A. Bearing To Chassis	See Note	50/600*
B. Bearing To Turntable	See Note	50/600*
C. Torque Hub	75 ft. lb. (102 Nm)	500
D. Wheel Bolts	90 ft. lb. (122 Nm)	150
E. Swing Motor to Rotation Box	120 ft. lb. (163 Nm)	500
F. Counterweight	260 ft. lb. (358 Nm)	500

Note

***Check swing bearing bolts for security after first 50 hours of operation and every 600 hours thereafter. (See paragraph 2-14. Swing Bearing.)**

Note

When maintenance becomes necessary or a fastener has loosened, refer to the Torque Chart, Figure 1-1, to determine proper torque value.

1-5. LUBRICATION.

• Yanmar 3TNE68 Engine.

Single Viscosity Oils (CC-CD)

When Outside Temperature is Consistently	Use SAE Viscosity Number
-22° F to +68° F (-30° C to +20° C)	5W-20
+14° F to +104° F (-10° C to +40° C)	20W-40
-4° F to +86° F (-20° C to +30° C)	10W-30
-4° F to +32° F (-20° C to +0° C)	10W
+14° F to +50° F (-10° C to +10° C)	20W
+32° F to +68° F (0° C to +20° C)	20W-20
+50° F to +86° F (+10° C to +30° C)	20W-30
68° F to +104° F (+20° C to +40° C)	20W-40

• Vanguard Gas Engine.

Single Viscosity Oils (CC-CD)

When Outside Temperature is Consistently	Use SAE Viscosity Number
-22° F to +68° F (-30° C to +20° C)	5W-20
+14° F to +104° F (-10° C to +40° C)	20W-40
-4° F to +86° F (-20° C to +30° C)	10W-30
-4° F to +32° F (-20° C to +0° C)	10W
+14° F to +50° F (-10° C to +10° C)	20W
+32° F to +68° F (0° C to +20° C)	20W-20
+50° F to +86° F (+10° C to +30° C)	20W-30
68° F to +104° F (+20° C to +40° C)	20W-40

• Hydraulic Oil.

Table 1-1. Hydraulic Oil.

HYDRAULIC SYSTEM OPERATING TEMPERATURE RANGE	SAE VISCOSITY GRADE
0° F to 23° F (-18° C to -5° C)	10W
0° F to 210° F (-18° C to +99° C)	10W-20,10W-30
50° F to 210° F (+10° C to +99° C)	20W-20

Notes

Hydraulic oils must have anti-wear qualities at least to API Service Classification GL-3, and sufficient chemical stability for mobile hydraulic system service. JLG Industries recommends Mobilfluid 424 hydraulic oil, which has an SAE viscosity index of 152 or Kendall Hyken 052 hydraulic oil, which has an SAE viscosity of 10W-20 and a viscosity index of 152.

When temperatures remain consistently below 20 degrees (-7 degrees C), an amount of no. 2 diesel fuel, not to exceed 20% of system capacity, may be added to the hydraulic oil reservoir. This diesel fuel will "thin" the hydraulic oil for easier cold weather operation, and will almost completely dissipate from the hydraulic system over a several month period of time. When cold weather is past, it may be necessary to drain and refill the hydraulic system to rid the system of any remaining diesel fuel.

Aside from JLG recommendations, it is not advisable to mix oils of different brands or types, as they may not contain the same required additives or be of comparable viscosities. If use of hydraulic oil other than Mobilfluid 424 or Kendall Hyken 052 is desired, contact JLG Industries for proper recommendations.

• Lubrication Specifications

Table 1-2. Lubrication Specifications.

KEY	SPECIFICATIONS
MPG	Multipurpose Grease having a minimum dripping point of 350° F (178° C). Excellent water resistance and adhesive qualities, and being of extreme pressure type. (Timken OK 40 pounds minimum.)
EPGL	Extreme Pressure Gear Lube (oil) meeting API service classification GL-5 or MIL-Spec MIL-L-2105.
HO	Hydraulic Oil. API service classification GL-3, e.g. Mobilfluid 424 or Kendall Hyken 052.
OG*	Open Gear Lube - Tribol Molub-Alloy 936 Open Gear Compound. (JLG Part No. 3020027)
BG*	Bearing Grease (JLG Part No. 3020029) Mobilith SHA 460.
LL	Synthetic Lithium Lubricant, Gredag 741 Grease. (JLG Part No. 3020022)

***MPG may be substituted for these lubricants, if necessary, but service intervals will be reduced.**

Note

Refer to Lubrication Chart, Figure 1-2, for specific lubrication procedures.

1-6. PRESSURE SETTINGS.

Hydro-Air Valve 4640797.

Upper Lift Down Relief - 650 psi (44.82 bar).

Mid/Lower Lift Down Relief - 1700 psi (117.21 bar).

Swing Relief - 1000 psi (68.95 bar).

Telescope In Relief - 2150 psi (148.25 bar).

Platform Level Up Relief - 2500 psi (172.37 bar).

Platform Level Down Relief - 1200 psi (82.74 bar).

Hydro-Air Valve 4640969.

Steer Relief - 1500 psi (103.42 bar).

Main Relief at Pump - 3200 psi (220.64 bar).

1-7. CYLINDER SPECIFICATIONS.

Note

All dimensions are given in inches (in.), with the metric equivalent, millimeters (mm), given in parentheses.

Table 1-3. Cylinder Specifications. 40ic

DESCRIPTION	BORE	STROKE	ROD DIA.
Upper Lift Cylinder	3.00 (76.2)	28.3125 (719.1)	1.50 (38.1)
Mid Lift Cylinder	3.00 (76.2)	21.25 (539.7)	1.50 (38.1)
Lower Lift Cylinder	3.50 (88.9)	23.1875 (589.0)	2.00 (50.8)
Telescope Cylinder	2.00 (50.8)	79 (2006.6)	1.25 (31.8)
Master Cylinder	2.00 (50.8)	9.375 (238.1)	1.00 (25.4)
Slave Cylinder	2.00 (50.8)	9.375 (238.1)	1.00 (25.4)
Rotator Cylinder	1.875 (47.6)	15.250 (387.3)	1.00 (25.4)
Steer Cylinder (Double Rod)	2.00 (50.8)	3.00 (76.2) each direction	1.25 (31.8) each rod

Table 1-4. Cylinder Specifications. 45ic

DESCRIPTION	BORE	STROKE	ROD DIA.
Upper Lift Cylinder	3.00 (76.2)	28.3125 (719.1)	1.50 (38.1)
Mid Lift Cylinder	3.00 (76.2)	21.25 (539.7)	1.50 (38.1)
Lower Lift Cylinder	4.00 (101.6)	23.25 (590.5)	2.25 (57.1)
Telescope Cylinder	2.00 (50.8)	92 (2337)	1.25 (31.8)
Master Cylinder	2.00 (50.8)	9.375 (238.1)	1.00 (25.4)
Slave Cylinder	2.00 (50.8)	9.375 (238.1)	1.00 (25.4)
Rotator Cylinder	1.875 (47.6)	15.250 (387.3)	1.00 (25.4)
Steer Cylinder (Double Rod)	2.00 (50.8)	3.00 (76.2) each direction	1.25 (31.8) each rod

1-8. MAJOR COMPONENT WEIGHTS.

Table 1-5. MAJOR COMPONENT WEIGHTS.

	40lc		45lc	
	LB.	KG.	LB.	KG.
Platform & Support	215	97.5	215	97.5
Upper Boom Complete	615	279	810	367.4
Mid Boom Complete	440	199.6	550	249
Lower Boom Complete	440	199.6	550	249
Upper Lift Cylinder	89	40.4	89	40.4
Mid Lift Cylinder	75	34	95	43
	104	47.2	110	50
Telescope Cylinder	55	24.9	85	38.5
Upper Upright	225	102	225	102
Lower Upright	97	44	97	44
Turntable	948	430	948	430
Chassis 5 ft. 9 in. (Includes Pneumatic Tires)	3646	1653	4995	2266
Chassis 5 ft. 9 in. (Includes Foam Filled Tires)	4,045	1835	4,695	2130
Counterweight	3850	1746	3850	1746
Machine Complete 5 ft. 9 in. (GVW)	10,850	4922	12,600	5715

⚠ WARNING

SELECT LIFTING EQUIPMENT WITH CAPACITY CAPABLE OF SAFELY SUPPORTING WEIGHT.

1-9. CRITICAL STABILITY WEIGHTS.

Table 1-6. CRITICAL STABILITY WEIGHTS.

			40lc		45lc	
			LB.	KG.	LB.	KG.
Counterweight (If Removable)		Tail	3850	1746	3850	1746
Tire & Wheel (Ballasted Only)		Poly Filled	160	72	165	74.8
Platform	Size	4 ft. (1.22M)	90	41	90	41
		5 ft. (1.52M)	100	45	100	45

⚠ WARNING

DO NOT REPLACE ITEMS CRITICAL TO STABILITY WITH ITEMS OF DIFFERENT WEIGHT OR SPECIFICATION (FOR EXAMPLE: FILLED TIRES, PLATFORM) DO NOT MODIFY UNIT IN ANY WAY TO AFFECT STABILITY.

SIZE	THD	BOLT DIA. (IN.)	THREAD STRESS AREA (SQ. IN.)	VALUES FOR ZINC PLATED BOLTS ONLY										UNPLATED CAP SCREWS	
				SAE GRADE 5 BOLTS & GRADE 2 NUTS					SAE GRADE 8 BOLTS & GRADE 8 NUTS					UNBRAKO 1960 SERIES SOCKET HEAD CAP SCREW WITH LOC-WEL PATCH	
				CLAMP LOAD (LB.)	TORQUE (DRY OR LOC. 263)	TORQUE (LUB.)	TORQUE (LOCTITE 262)	TORQUE (LOCTITE 242 OR 271)	CLAMP LOAD (LB.)	TORQUE (DRY OR LOC. 263)	TORQUE (LUB.)	TORQUE (LOCTITE 262)	TORQUE (LOCTITE 242 OR 271)	CLAMP LOAD (LB.)	TORQUE (as received)
					LB. IN.	LB. IN.	LB. IN.	LB. IN.		LB. IN.	LB. IN.	LB. IN.	LB. IN.		LB. FT.
4	40	0.1120	0.00604	380	8	6	—	—	540	12	9	—	—	—	—
	48		0.00661	420	9	7	—	—	600	13	10	—	—	—	—
6	32	0.1380	0.00909	580	16	12	—	—	820	23	17	—	—	—	—
	40		0.01015	610	18	13	—	—	920	25	19	—	—	—	—
8	32	0.1640	0.01400	900	30	22	—	—	1260	41	31	—	—	—	—
	36		0.01474	940	31	23	—	—	1320	43	32	—	—	—	—
10	24	0.1900	0.01750	1120	43	32	—	—	1580	60	45	—	—	—	—
	32		0.02000	1285	49	36	—	—	1800	68	51	—	—	—	—
1/4	20	0.2500	0.0318	2020	96	75	—	105	2860	144	108	—	160	3180	13
	28		0.0364	2320	120	86	—	135	3280	168	120	—	185	3640	14
					LB. FT.	LB. FT.	LB. FT.	LB. FT.		LB. FT.	LB. FT.	LB. FT.	LB. FT.		
5/16	18	0.3125	0.0524	3340	17	13	16	19	4720	25	18	22	30	5240	25
	24		0.0580	3700	19	14	17	21	5220	25	20	25	30	5800	27
3/8	16	0.3750	0.0775	4940	30	23	28	35	7000	45	35	40	50	7750	45
	24		0.0878	5600	35	25	32	40	7900	50	35	45	55	8780	50
7/16	14	0.4375	0.1063	6800	50	35	45	55	9550	70	55	63	80	10630	70
	20		0.1187	7550	55	40	50	60	10700	80	60	70	90	11870	75
1/2	13	0.5000	0.1419	9050	75	55	68	85	12750	110	80	96	120	14190	110
	20		0.1599	10700	90	65	80	100	14400	120	90	108	135	15990	115
9/16	12	0.5625	0.1820	11600	110	80	98	120	16400	150	110	139	165	18200	155
	18		0.2030	12950	120	90	109	135	18250	170	130	154	190	20300	165
5/8	11	0.6250	0.2260	14400	150	110	135	165	20350	220	170	180	240	22600	210
	18		0.2560	16300	170	130	153	190	23000	240	180	204	265	25600	220
3/4	10	0.7500	0.3340	21300	260	200	240	285	30100	380	280	301	420	33400	365
	16		0.3730	23800	300	220	268	330	33600	420	320	336	465	37300	400
7/8	9	0.8750	0.4620	29400	430	320	386	475	41600	600	460	485	660	46200	585
	14		0.5090	32400	470	350	425	520	45800	660	500	534	725	50900	635
1	8	1.000	0.6060	38600	640	480	579	675	51500	900	680	687	990	60600	865
	12		0.6630	42200	700	530	633	735	59700	1000	740	796	1100	66300	915
1-1/8	7	1.1250	0.7630	42300	800	600	714	840	68700	1280	960	1030	1400	76300	1240
	12		0.8560	47500	880	660	802	925	77000	1440	1080	1155	1575	85600	1380
1-1/4	7	1.2500	0.9690	53800	1120	840	1009	1175	87200	1820	1360	1453	2000	96900	1750
	12		1.0730	59600	1240	920	1118	1300	96600	2000	1500	1610	2200	107300	1880
1-1/2	6	1.500	1.1550	64100	1460	1100	1322	1525	104000	2380	1780	1907	2625	115500	2320
	12		1.3150	73000	1680	1260	1506	1750	118100	2720	2040	2165	3000	131500	2440
1-1/2	6	1.500	1.4050	78000	1940	1460	1755	2025	126500	3160	2360	2530	3475	140500	3040
	12		1.5800	87700	2200	1640	1974	2300	142200	3560	2660	2844	3925	158000	3270

Note: These torque values do not apply to cadium plated fasteners.

SAE GRADE 5

SAE GRADE 8

Figure 1-1. Torque Chart.

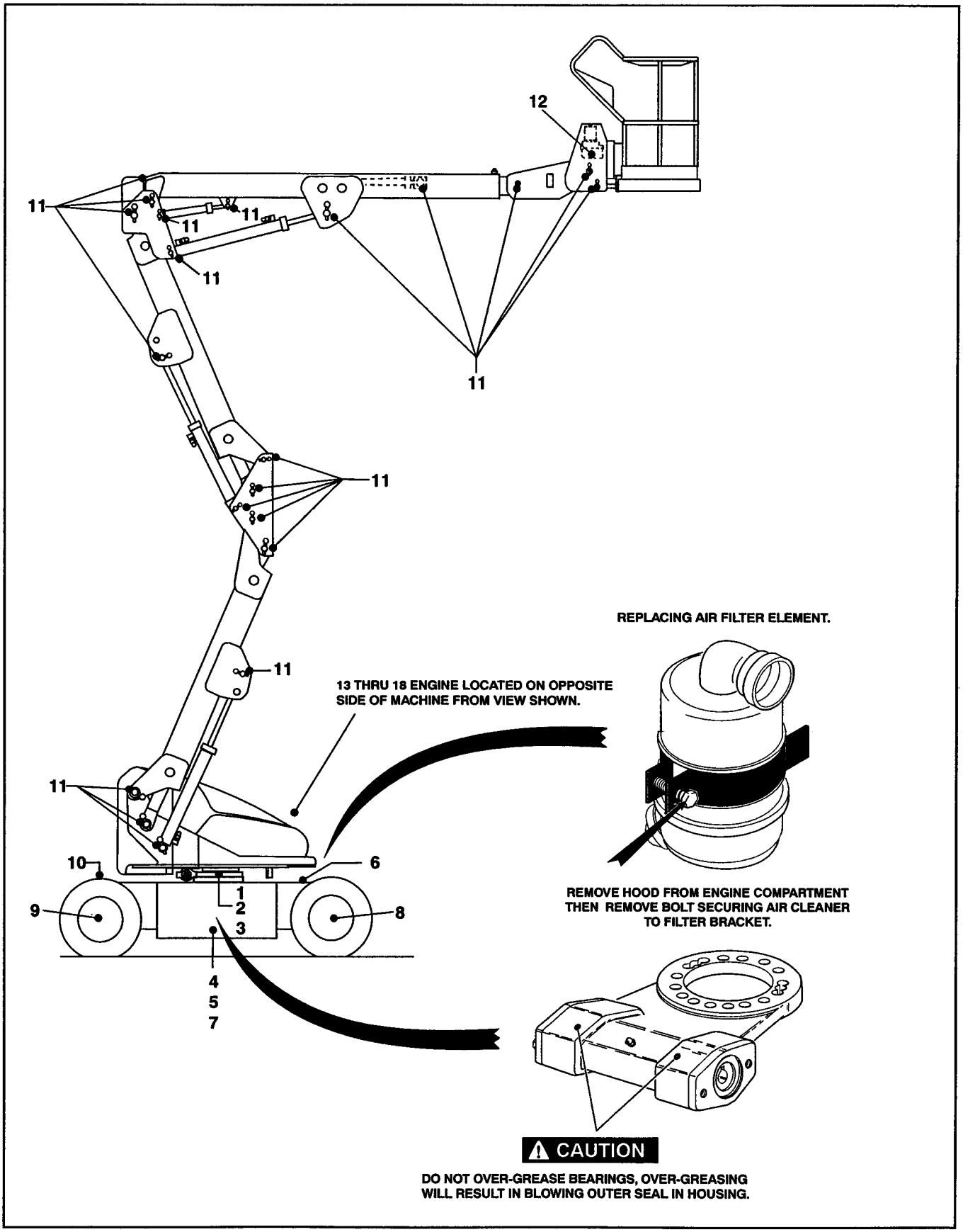


Figure 1-2. Lubrication Chart. (Sheet 1 of 2)

	COMPONENTS	NUMBER/TYPE LUBE POINTS	CAPACITY	LUBE	INTERVAL 3 MONTHS 150 HRS	INTERVAL 6 MONTHS 300 HRS	HOURS 1 YEAR 600 HRS	HOURS 2 YEAR 1200 HRS	COMMENTS
LUBRICATION									
1	Swing Bearing - Gear - Teeth *	1 Grease Fitting	A/R	OG/MPG	✓				OG will have a longer service interval than MPG.
2	Swing Bearing	1 Grease Fitting	A/R	BG/MPG	✓				BG will have a longer service interval than MPG.
3	Swing Worm Gear - Bearing **	Plug	A/R	BG/MPG				✓	BG will have a longer service interval than MPG.
4	Hydraulic Fluid (Oil)	Fill Cap	14.0 Gallons Tank 16.8 Gallons System	HO				✓	Check level daily/change 1200 hrs.
5	Hydraulic Return Filter	N/A	N/A	N/A		✓			Change after first 50 hrs. and every 300 hrs. thereafter or as indicated by Condition Indicator.
6	Hydraulic Charge Filter	N/A	N/A	N/A		✓			Change after first 50 hrs. and every 300 hrs. thereafter or as indicated by Condition Indicator.
7	Suction Strainers (In Tank)	1	N/A	N/A				✓	Remove and clean at time of hydraulic oil change.
8	Wheel Drive Hub	Level/Fill Plug	17 oz. (1/2 Full)	EPGL	✓				Check level every 150 hrs/change 1200 hrs.
9	Wheel Bearings	Repack	A/R	MPG				✓	
10	Steer Spindle/Bushings	N/A	A/R	LL	At spindle/bushing replacement.				Coat I.D. of bushings prior to installing pins.
11	Boom Pivot Pins/Bushings	N/A	A/R	LL	At boom pivot pin/bushing replacement.				Coat I.D. of bushings prior to installing king pins.
12	Hydraulic Fluid (Oil)	Fill Cap	1 Quart	HO				✓	Check level daily/change 1200 hrs.
ENGINES									
13	Oil Change w/Filter - Yanmar	Fill Cap/Spin-on Element	2.5 Quarts	EO	✓				Check level dailychange after first 50 hrs. and every 150 hrs. thereafter.
14	Oil Change w/Filter - Vanguard	Fill Cap/Spin-on Element	3.0 Quarts	EO		✓			Check level dailychange after first 50 hrs. and every 300 hrs. thereafter.
15	Fuel Filter - Yanmar	Replaceable Element	N/A	N/A			✓		
16	Fuel Filter - Vanguard	Replaceable Element	N/A	N/A			✓		
17	Air Filter - Yanmar	Replaceable Element	N/A	N/A		✓			Industy conditions, clean air cleaner after 50 hrs. of operation and 100 hrs. In normal conditions. In dusty conditions, change air clearner after 300 hrs. In normal conditions 600 hrs.
18	Air Filter - Vanguard	Replaceable Element	N/A	N/A		✓			Change after 50 hrs. and every 150 hrs. thereafter.

NOTE:

Lubrication intervals are based on machine operation under normal conditions. For machines used in multi shift operations and/or exposed to hostile environments or conditions, lubrication frequencies must be increased accordingly.

* Note: Hostile Environment, steam washing or weather exposure may necessitate more frequent lubrication. Lube bearing teeth anytime tightness or jerky operation is noticed.

** If necessary install grease fittings into worm gear housing and grease bearings. Read CAUTION on diagram before greasing.

KEY TO LUBRICANTS

EO - Engine Oil
EPGL - Extreme Pressure Gear Lube
HO - Hydraulic Fluid (Kendall Hyken 052, Mobile #424 or equal)
MPG - Multi-Purpose Grease
LL - Synthetic Lithium Lubricant (Gredag 741 Grease)
OG - Open Gear Lube (Tribol Molub-Alloy 93
BG - Mobilith SHC 460 Bearing Grease

Figure 1-2. Lubrication Chart. (Sheet 1 of 2)

1-10. SERIAL NUMBER LOCATIONS. (See Figure 1-3.)

For machine identification, a serial number plate is affixed to the left rear of frame, in front of left rear wheel. If the serial number plate is damaged or missing, the machine serial number is stamped on the top left side of the frame and the top left side of the turntable. In addition, the serial number is stamped on top of the end of the upper boom, mid boom, and lower boom at the left rear of the booms.

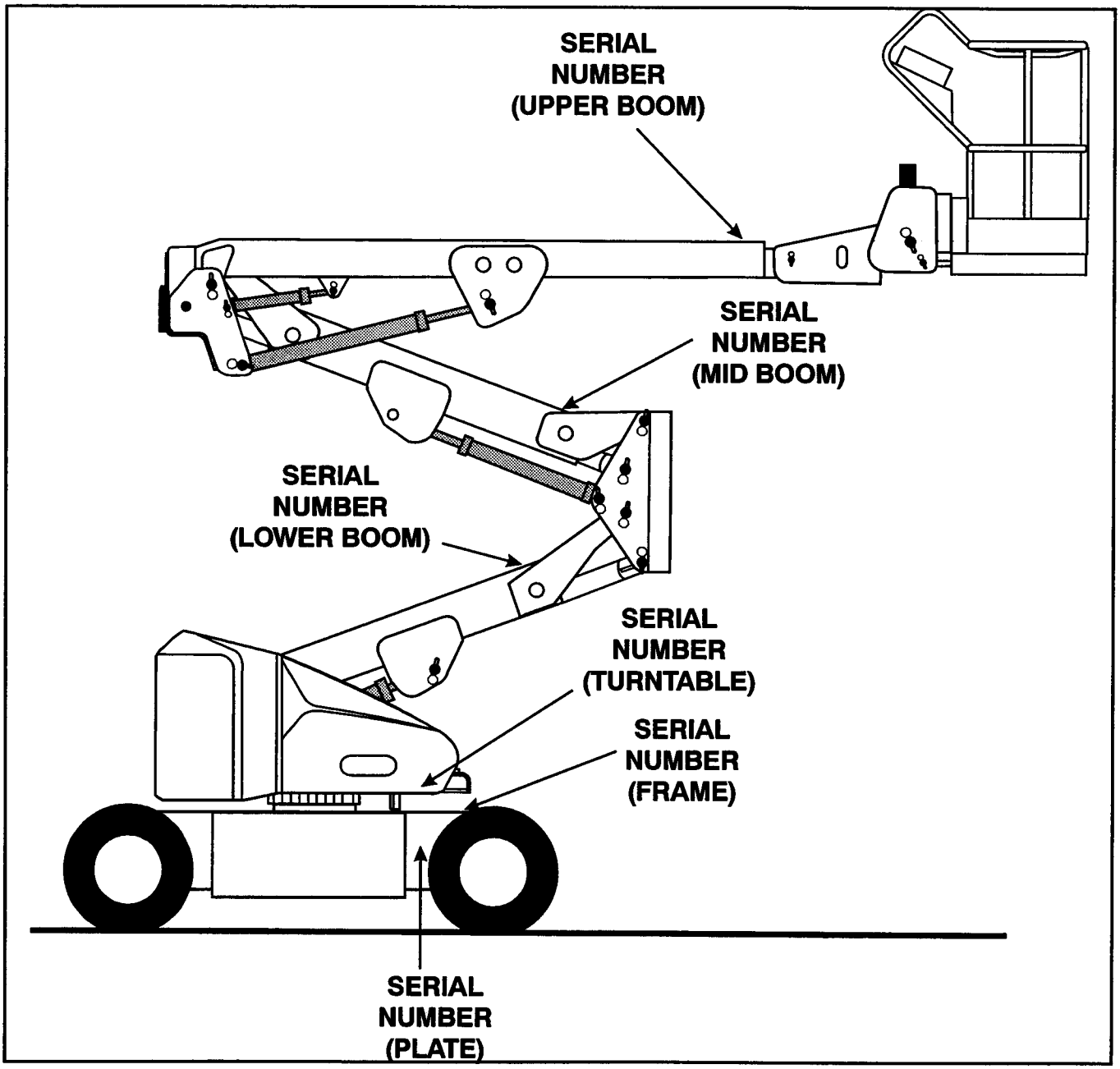


Figure 1-3. Serial Number Locations.

2-1. GENERAL.

This section provides information necessary to perform maintenance on the aerial platform. Descriptions, techniques and specific procedures are designed to provide the safest and most efficient maintenance for use by personnel responsible for ensuring the correct installation and operation of machine components and systems.

⚠ CAUTION

WHEN AN ABNORMAL CONDITION IS NOTED AND PROCEDURES CONTAINED HEREIN DO NOT SPECIFICALLY RELATE TO THE NOTED IRREGULARITY, WORK SHOULD BE STOPPED AND TECHNICALLY QUALIFIED GUIDANCE OBTAINED BEFORE WORK IS RESUMED.

The maintenance procedures included consist of servicing and component removal and installation, disassembly, and assembly, inspection, lubrication and cleaning. Information on any special tools or test equipment is also provided where applicable.

2-2. SERVICING AND MAINTENANCE GUIDELINES.

• General.

The following information is provided to assist you in the use and application of servicing and maintenance procedures contained in this chapter.

• Safety and Workmanship.

Your safety and that of others is the first consideration when engaging in the maintenance of equipment. Always be conscious of weight. Never attempt to move heavy parts without the aid of a mechanical device. Do not allow heavy objects to rest in an unstable position. When raising a portion of the equipment, ensure that adequate support is provided.

• Cleanliness.

1. The most important single item in preserving the long service life of a machine is to keep dirt and foreign materials out of the vital components. Precautions have been taken to safeguard against this. Shields, covers, seals and filters are provided to keep oil supplies clean; however, these items must be maintained on a scheduled basis in order to function properly.
2. At any time when hydraulic oil lines are disconnected, clear adjacent areas as well as the openings and fittings themselves. As soon as a line or component is disconnected, cap or cover all openings to prevent entry of foreign matter.
3. Clean and inspect all parts during servicing or maintenance, and assure that all passages and openings are unobstructed. Cover all parts to keep them clean. Be sure all parts are clean before they are installed. New parts should remain in their containers until they are ready to be used.

• Component Removal and Installation.

1. Use adjustable lifting devices, whenever possible, if mechanical assistance is required. All slings (chains, cables, etc.) should be parallel to each other and as near perpendicular as possible to top of part being lifted.
2. Should it be necessary to remove a component on an angle, keep in mind that the capacity of an eyebolt or similar bracket lessens, as the angle between the supporting structure and the component becomes less than 90 degrees.
3. If a part resists removal, check to see whether all nuts, bolts, cables, brackets, wiring, etc. have been removed and that no adjacent parts are interfering.

• Component Disassembly and Reassembly.

When disassembling or reassembling a component, complete the procedural steps in sequence. Do not partially disassemble or assemble one part, then start on another. Always recheck your work to assure that nothing has been overlooked. Do not make any adjustments, other than those recommended, without obtaining proper approval.

• Pressure Fit Parts.

When assembling pressure fit parts, use an "anti-seize" or molybdenum disulfide base compound to lubricate the mating surface.

• Bearings.

1. When a bearing is removed, cover it to keep out dirt and abrasives. Clean bearings in nonflammable cleaning solvent and allow to drip dry. Compressed air can be used but do not spin the bearing.
2. Discard bearings if the races and balls (or rollers) are pitted, scored or burned.
3. If bearing is found to be serviceable, apply a light coat of oil and wrap it in clean (waxed) paper. Do not unwrap reusable or new bearings until they are ready to be installed.
4. Lubricate new or used serviceable bearings before installation. When pressing a bearing into a retainer or bore, apply pressure to the outer race. If the bearing is to be installed on a shaft, apply pressure to the inner race.

• Gaskets.

Check that holes in gaskets align with openings in the mating parts. If it becomes necessary to hand fabricate a gasket, use gasket material or stock of equivalent material and thickness. Be sure to cut holes in the right location as blank gaskets can cause serious system damage.

• Bolt Usage and Torque Application.

1. Use bolts of proper length. A bolt which is too long will bottom before the head is tight against its related part. If a bolt is too short, there will not be enough thread area to engage and hold the part properly. When replacing bolts, use only those having the same specifications of the original, or one which is equivalent.
2. Unless specific torque requirements are given within the text, standard torque values should be used on heat treated bolts, studs and steel nuts, in accordance with recommended shop practices (See Figure 1-1).

• Hydraulic Lines and Electrical Wiring.

Clearly mark or tag hydraulic lines and electrical wiring, as well as their receptacles, when disconnecting or removing them from the unit. This will assure that they are correctly reinstalled.

• Hydraulic System.

1. Keep the system clean. If evidence of metal or rubber particles are found in the hydraulic system, drain and flush the entire system.
2. Disassemble and reassemble parts on clean work surface. Clean all metal parts with nonflammable cleaning solvent. Lubricate components, as required, to aid assembly.

• Lubrication.

Service applicable components with the amount, type, and grade of lubricant recommended in this manual, at the specified interval. When recommended lubricants are not available, consult your local supplier for an equivalent that meets or exceeds the specifications listed.

• Batteries.

Clean batteries using a non-metallic brush and a solution of baking soda and water. Rinse with clean water. After cleaning, thoroughly dry batteries and coat terminals with an anti-corrosion compound.

• Lubrication and Servicing.

Components and assemblies requiring lubrication and servicing are shown in Lubrication Chart.

2-3. LUBRICATION INFORMATION.

• Hydraulic System.

1. The primary enemy of a hydraulic system is contamination. Contaminants enter the system by various means, e.g.; inadequate hydraulic oil, allowing moisture, grease, filings, sealing components, sand, etc. to enter when performing maintenance, or by permitting the pump to cavitate due to insufficient system warm-up.
2. The design and manufacturing tolerances of the component working parts are very close, therefore, even the smallest amount of dirt or foreign matter entering a system can cause wear or damage to the components and generally results in faulty operation. Every precaution must be taken to keep hydraulic oil clean, including reserve oil in storage. Hydraulic system filters should be

checked, cleaned, and/or replaced at the specified intervals required in Figure 1-2. Always examine filters for evidence of metal particles.

3. Cloudy oils indicate a high moisture content which permits organic growth, resulting in oxidation or corrosion. If this condition occurs, the system must be drained, flushed, and refilled with clean oil.

4. It is not advisable to mix oils of different brands or types, as they may not contain the same required additives or be of comparable viscosities. Good grade mineral oils, with viscosities suited to the ambient temperatures in which the machine is operating, are recommended for use.

Note

Metal particles may appear in the oil or filters of new machines due to the wear-in of meshing components.

• Hydraulic Oil.

1. Refer to Table 1-1 for recommendations for viscosity ranges.

2. JLG recommends Mobilfluid 424 hydraulic oil, which has an SAE viscosity of 10W-30 and a viscosity index of 152 or Kendall Hyken 052 hydraulic oil, which has an SAE viscosity of 10W-20 and a viscosity index of 152.

Note

Start-up of hydraulic system with oil temperatures below -15 degrees F. is not recommended. If it is necessary to start the system in a sub-zero environment, it will be necessary to heat the oil with a low density 100VAC heater to a minimum temperature of -15 degrees F.

3. The only exception to the above is to drain and fill the system with Mobil DTE11 oil or its equivalent. This will allow start up at temperatures down to -20 degrees F. However, use of this oil will give poor performance at temperatures above 120 degrees F. Systems using DTE11 oil should not be operated at temperatures above 200 degrees F. under any condition.

• Changing Hydraulic Oil.

1. Use of any of the recommended hydraulic oils eliminates the need for changing the oil on a regular basis. However, filter elements must be changed after the first 50 hours of operation and every 300 hours thereafter. If it is necessary to change the oil, use only those oils meeting or exceeding the specifications appearing in this manual. If unable to obtain the same type of oil supplied with the machine, consult local supplier for assistance in selecting the proper equivalent. Avoid mixing petroleum and synthetic base oils. JLG Industries recommends changing the hydraulic oil every two years.

2. Use every precaution to keep the hydraulic oil clean. If the oil must be poured from the original container into another, be sure to clean all possible contaminants from the service container. Always clean the mesh element of the filter and replace the cartridge any time the system oil is changed.

3. While the unit is shut down, a good preventive maintenance measure is to make a thorough inspection of all hydraulic components, lines, fittings, etc., as well as a functional check of each system, before placing the machine back in service.

• Lubrication Specifications

Specified lubricants, as recommended by the component manufacturers, are always the best choice, however, multi-purpose greases usually have the qualities which meet a variety of single purpose requirements. Should any question arise regarding the use of greases in maintenance stock, consult your local supplier for evaluation. Refer to Table 1-2 for an explanation of the lubricant key designations appearing in the Lubrication Chart.

2-4. CYLINDERS - THEORY OF OPERATION.

• Systems Incorporating Double Acting Cylinders.

Upper Boom Lift, Mid Boom Lift, Lower Boom Lift, Telescope, Slave, Master, Rotator, and Steer.

A double acting cylinder is one that requires oil flow to operate the cylinder rod in both directions. Directing oil (by actuating the corresponding control valve to the piston side of the cylinder) forces the piston to travel toward the rod end of the barrel, extending the cylinder rod (piston attached to rod). When the oil flow is stopped, movement of the rod will stop. By directing oil to the rod side of the cylinder, the piston will be

forced in the opposite direction and the cylinder rod will retract.

Holding valves are used in the Lift circuits to prevent retraction of the cylinder rod should a hydraulic line rupture or leak develop between the cylinder and its related control valve.

2-5. VALVES - THEORY OF OPERATION.

• Control Valves.

Control Valve 4640797 this valve controls Platform, Telescope, Swing, Lower Lift, and Upper Lift.

It consists of cartridge type valves in an anodized aluminum manifold. The cartridge valves provide for control of flow, volume of flow and pressure in the hydraulic system.

The directional control valves are solenoid operated, three position, 4-way sliding spool type valves. One valve is provided for each of the three functions. Energizing one of the electrical coils on a valve will divert the supply of hydraulic oil to provide motion of that function in one direction. Energizing the other coil will divert the oil for motion in the other direction. When neither coil is energized, the supply of hydraulic oil is blocked.

Flow control valves in the lift circuits provide for control of the rate of flow when the oil is flowing out of the cap ends of the cylinders (the load is being lowered). An adjusting screw on each cartridge flow control valve allows the rate of flow (speed) to be adjusted. When oil is flowing into the cap end of the lift cylinders, an internal check valve feature allows unrestricted flow.

Pressure relief valves limit the pressure in the swing circuit and the rod end of each lift cylinder. When the pressure in one of those circuits reaches the set point of the valve, the valve opens, allowing enough flow to return to the reservoir so that the set pressure is not exceeded. An adjusting screw on each cartridge relief valve allows the set pressure to be adjusted.

The aluminum manifold provides the passages through which the hydraulic oil is diverted to provide the desired movement of the actuators. No moving parts of the valves slide against the manifold and so it is not subject to wear.

• Steer Valve 4640969.

This valve controls the STEER function. It consists of screw-in cartridge type valves in an anodized aluminum manifold. The cartridge valves provide for control of direction of flow and pressure in the STEER hydraulic circuit.

The directional control valve is a solenoid operated, three position, 4-way sliding spool type valve. Energizing one of the electrical coils on the valve will divert the supply of hydraulic oil to provide steering in one direction. Energizing the other coil will divert the oil for steering in the other direction. When neither coil is energized, the supply of hydraulic oil is blocked.

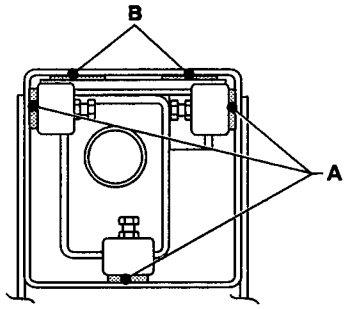
A pressure relief valve limits the pressure in the steer circuit. When the pressure reaches the set point of the valve, the valve opens, allowing enough flow to return to the reservoir so that pressure is not exceeded. An adjusting screw on the cartridge relief valve allows the set pressure to be adjusted.

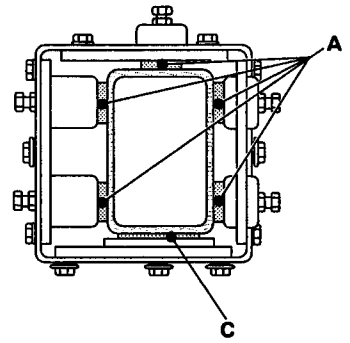
The aluminum manifold provides the passages through which hydraulic oil is diverted to provide the desired movement of the steer cylinder. No moving parts of the valves slide against the manifold and so it is not subject to any wear.

2-6. WEAR PADS.

• Main Boom.

1. Shim up wear pads until snug to adjacent surface.
2. Replace wear pads when worn to thickness shown in Figure 2-1.
3. Adjust wear pads as follows:
   a. Loosen jam nut on adjustment bolt, turn bolt CW until wear pad is snug to adjacent surface.
   b. After adjustments have been made, tighten the jam nuts on wear pad bolts.





WEAR PADS NEW		
PAD NUMBER	THICKNESS OF NEW PAD	REPLACE WHEN WORN TO:
A	0.75"	0.375"
B	0.50"	0.3125"
C	0.50"	0.3125"

Figure 2-1. Location and Thickness Of Wear Pads.

2-7. BOOM MAINTENANCE.

• Removal.

1. Remove the platform/support as follows:

   a. Disconnect electrical cable from control console.

   b. Using an overhead crane or suitable lifting device, strap support the platform/support.

   c. Remove hardware from pin #1. Using a suitable brass drift and hammer, remove pin #1 from the platform support.

   d. Supporting the platform/support, remove the hardware from pin #2. Using a suitable brass drift and hammer, remove pin #2 from the fly boom and remove the rotator.

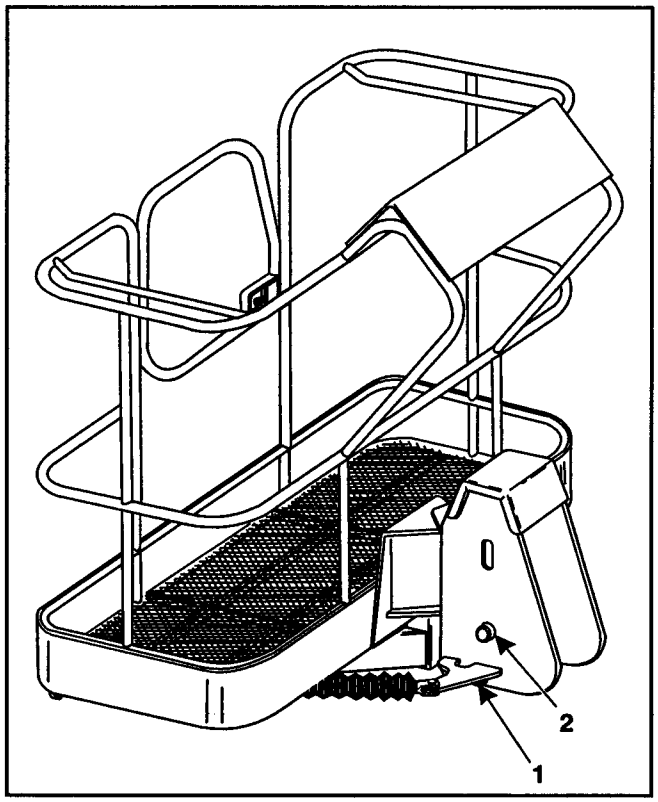


Figure 2-2. Location Of Components - Platform Support.

   e. Supporting the slave cylinder, remove the hardware from pin #3. Using a suitable brass drift and hammer, remove pin #3 from the fly boom.

   f. Tag and disconnect hydraulic lines to the slave leveling cylinder. Use a suitable container to retain any residual hydraulic fluid. Cap hydraulic lines and ports. Remove the slave cylinder.

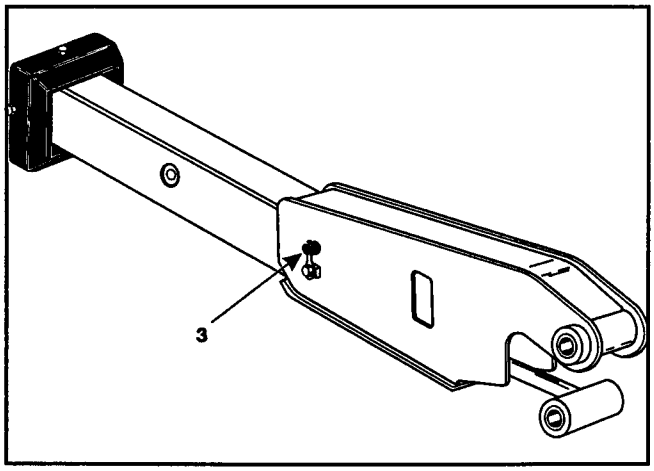


Figure 2-3. Location Of Components - Slave Leveling Cylinder.

2. Remove the boom from upright as follows:

   a. Remove hardware securing the cover plate on the side of the base boom section and remove hose clamps. Disconnect wiring harness from ground control harness connector.

⚠ CAUTION

HYDRAULIC LINES AND PORTS SHOULD BE CAPPED IMMEDIATELY AFTER DISCONNECTING LINES TO AVOID ENTRY OF CONTAMINANTS INTO SYSTEM.

   b. Tag and disconnect hydraulic lines from boom to control valve. Use a suitable container to retain any residual hydraulic fluid. Cap hydraulic lines and ports.

   c. Using a suitable lifting equipment, adequately support boom weight along entire length.

   d. Remove hardware securing the lift cylinder pin #1. Using a suitable brass drift and hammer, remove pin #1 from the base boom.

   e. Remove hardware securing the master cylinder pin #2. Using a suitable brass drift and hammer, remove pin #2 from the base boom.

   f. Remove hardware securing the base boom pin #3. Using a suitable brass drift and hammer, remove pin #3 from the upright.

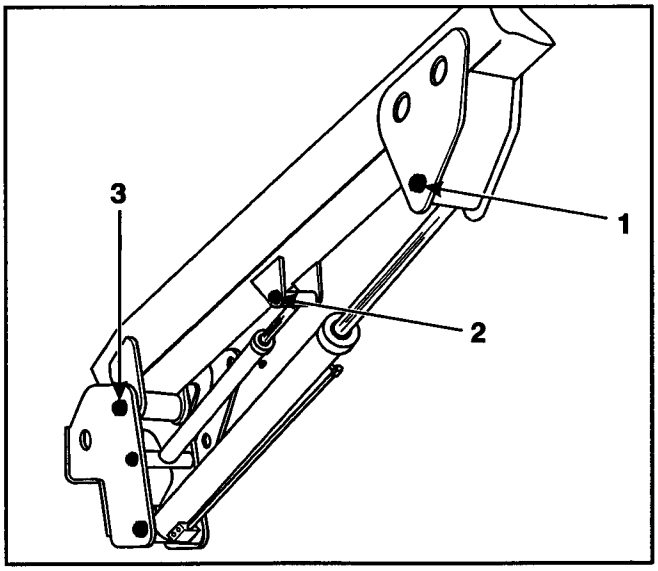


Figure 2-4. Location Of Components - Removal of Base Boom.

   g. Using all applicable safety precautions, carefully lift boom assembly clear of upright and lower to ground or suitable supported work surface.

• Disassembly Boom Sections.

1. Loosen jam nuts on aft end of fly boom wear pad adjustment and loosen adjustments.

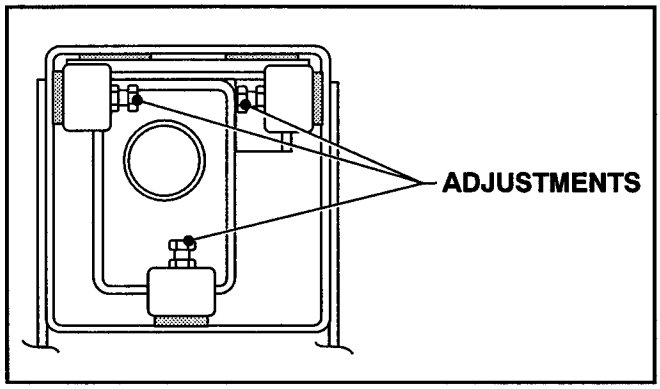


Figure 2-5. Location Of Components - Aft End Fly Boom Wear Pad Adjustments.

2. Using a portable power source, attach hose to telescope cylinder port block. Using all applicable safety precautions, activate hydraulic system and extend cylinder to gain access to cylinder rod pin #1. Shut down hydraulic system.

3. Carefully disconnect hydraulic hose from retract port of cylinder. There will be initial weeping of hydraulic fluid which can be caught in a suitable container. After initial discharge, there should be no further leakage from the retract port.

4. Remove hardware securing telescope cylinder #1 to the fly boom section, then remove pin from fly.

5. Remove hardware securing telescope cylinder to the base boom section.

⚠ CAUTION

WHEN REMOVING TELESCOPE CYLINDER FROM BOOM SECTIONS. CARE SHOULD BE TAKEN NOT TO LEAVE CYLINDER REST ON POWERTRACK WHICH COULD CAUSE DAMAGE TO POWERTRACK.

6. Using a suitable lifting device, remove telescope cylinder from boom sections.

7. Using a piece of tape, mark the length of hoses and wires from front of fly boom and bottom of base boom for reassembly.

8. Remove hardware securing the front cover on base boom section.

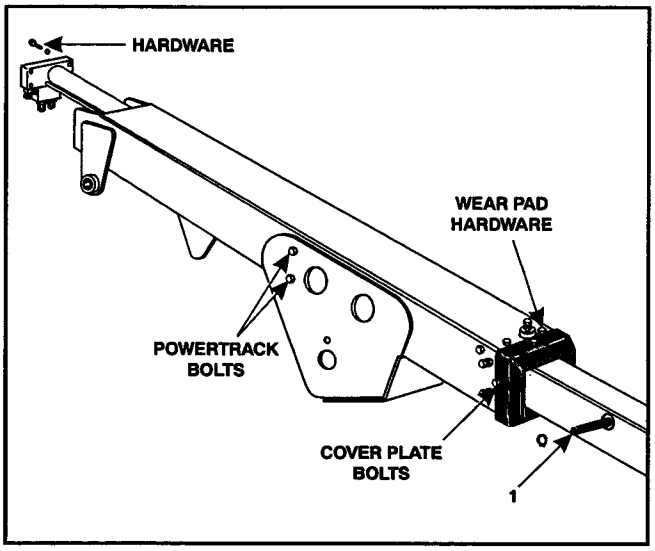


Figure 2-6. Location Of Components - Removal of Telescope Cylinder.

9. Loosen jam nuts on front wear pad adjustments and loosen adjustments.

10. Remove hardware securing the front wear pads on base boom section, remove wear pads.

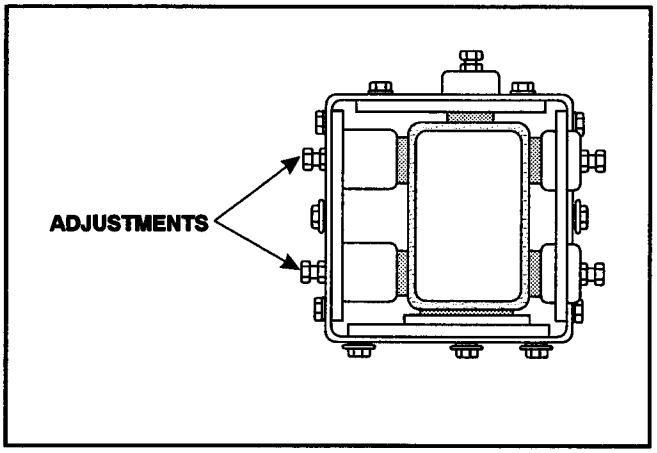


Figure 2-7. Location Of Components - Front Base Boom Wear pad Adjustments.

11. Remove wire clamp on the inside of the fly nose.

12. Manually push the fly boom section into base boom section to gain access to the powertrack attachment bolts on the right side of the base boom section.

13. Remove hardware securing the powertrack to the aft end of the fly boom section.

14. Using a suitable lifting device, remove fly boom from boom section.

15. Remove hydraulic lines and electrical cables from powertrack.

16. Remove hardware securing powertrack to the base boom section. Remove powertrack.

• Inspection.

1. Inspect boom pivot pin for wear, scoring or other damage, and for tapering or ovality. Replace pin as necessary.

2. Inspect lift and master cylinder pins for wear, scoring or other damage, and for tapering or ovality. Ensure pin surfaces are protected prior to installation. Replace pins as necessary.

3. Inspect telescope cylinder rod attach pin for wear, scoring or other damage. Replace pin as necessary.

4. Inspect inner diameter of boom pivot bushings for scoring, distortion, wear or other damage. Replace bushings as necessary.

5. Inspect wear pads for wear as shown in paragraph 2-6, Wear Pads.

6. Inspect all threaded components for damage such as stretching, thread deformation, or twisting. Replace as necessary.

7. Inspect structural units of boom assembly for bending, cracking, separation of welds, or other damage. Replace boom sections as necessary.

• Assembly.

1. Install power track to the attach point on the inside of the base boom section. Secure power track with hardware.

2. Install hydraulic lines and electrical cables into the power track.

3. Install wear pads to the aft end of the fly section.
4. Using suitable lifting equipment, slide fly section into the base section until power track attach point aligns with holes in side of base section.
5. Attach the power track to the aft end of fly boom section. Secure power track with hardware.
6. Using suitable lifting equipment, slide fly boom section out to gain access to telescope cylinder attach pin hole.
7. Measure the distance between the telescope cylinder port block attach point on base boom section and the attach point on fly boom section.
8. Connect a suitable auxiliary hydraulic power source to the telescope cylinder port block.
9. Extend the telescope cylinder the distance of the two attach points.
10. Secure the sling and lifting device at the telescope cylinder's approximate center of gravity, and lift the cylinder to the aft end of the boom assembly.

⚠ CAUTION

WHEN INSERTING THE TELESCOPE CYLINDER INTO THE BOOM, CARE MUST BE TAKEN NOT TO DAMAGE THE POWER TRACK ASSEMBLY.

11. Slowly slide the telescope cylinder into boom assembly, align rod end with attach point in fly section. Insert pin and secure with retaining ring.
12. Align bolt holes at aft end of base boom section with telescope cylinder port block. Secure telescope cylinder with hardware.
13. Install wear pads at end of base boom section. Adjust the adjustable wear pads to zero clearance. Adjust pads alternately side to side, so that fly boom section is centered in base boom section.
14. Retract boom section fully. Adjust wear pads at aft end of boom section to zero clearance. Adjust pads alternately side to side, so that fly boom section is centered in base boom section.
15. Disconnect auxiliary power source from telescope cylinder.

- **Installation.**

1. Using suitable lifting equipment, position boom assembly on upright so that boom pivot holes in both boom and upright are aligned.
2. Install boom pivot pin, ensuring that location of the hole in pivot pin aligns with attach point on upright.
3. Using all applicable safety precautions, operate lifting equipment in order to position boom lift and master cylinders so that holes in cylinder rod ends and boom structure are aligned. Insert cylinder pins.
4. If necessary, gently tap pins into position with a soft headed mallet, ensuring that attach holes in pins are aligned with attach holes in boom structure. Secure with hardware.
5. Connect all hosing and wiring.
6. Install the slave leveling cylinder to the boom assembly.
7. Install the platform to the boom assembly.
8. Connect all hosing and wiring at platform control station.
9. Using all safety precautions, operate machine systems and extend and retract boom for four or five cycles.
10. Shut down machine systems and check for leakage.

2-8. CYLINDER CHECKING PROCEDURES.

Note

Cylinder checks must be performed any time a cylinder component is replaced or when improper system operation is suspected.

• Cylinder Without Counterbalance Valves.

Steer, Master, and Rotate.

1. Using all applicable safety precautions, activate hydraulic system and fully extend cylinder to be checked. Shut down hydraulic system.
2. Carefully disconnect hydraulic hose from retract port of cylinder. There will be initial weeping of hydraulic fluid which can be caught in a suitable container. After initial discharge, there should be no further leakage from the retract port.
3. Activate hydraulic system, and activate cylinder extend function.
4. If cylinder retract port leakage is less than 6-8 drops per minute, carefully reconnect hose to retract port and retract cylinder. If leakage continues at a rate of 6-8 drops per minute or more, cylinder repairs must be made.
5. With cylinder fully retracted, shut down motor and carefully disconnect hydraulic hose from cylinder extend port.
6. Activate hydraulic system and activate cylinder retract function. Check extend port for leakage.
7. If extend port leakage is less than 6-8 drops per minute, carefully reconnect hose to extend port, then activate cylinder through one complete cycle and check for leaks. If leakage continues at a rate of 6-8 drops per minute or more, cylinder repairs must be made.

• Cylinders With Single Counterbalance Valve.

Upper Lift Cylinder.

⚠ IMPORTANT

OPERATE ALL FUNCTIONS FROM GROUND CONTROL STATION ONLY.

1. Using all applicable safety precautions, activate hydraulic system.

⚠ WARNING

WHEN WORKING ON THE UPPER BOOM LIFT CYLINDER, RAISE THE UPPER BOOM TO HORIZONTAL AND PLACE A BOOM PROP APPROXIMATELY 1 INCH (2.54 CM) BELOW THE MAIN BOOM. REFER TO FIG. 2-8, BOOM PROP CONFIGURATIONS. IF WORKING ON LOWER BOOM LIFT CYLINDER, RAISE LOWER BOOM HALFWAY, FULLY ELEVATE UPPER BOOM AND ATTACH OVERHEAD CRANE TO THE UPRIGHT FOR SUPPORT, LEAVING APPROXIMATELY 1 INCH (2.54 CM) OF SLACK IN CHAIN OR SLING FOR TEST PURPOSES.

2. After completing the above, shut down hydraulic system and allow machine to sit for 10-15 minutes. This is done to relieve pressure in the hydraulic lines. Carefully remove hydraulic hoses from appropriate cylinder port block.
3. There will be initial weeping of hydraulic fluid, which can be caught in a suitable container. After the initial discharge, there should not be any further leakage from the ports. If leakage continues at a rate of 6-8 drops per minute or more, the following cylinder repairs must be made. If the retract port is leaking, the piston is leaking, the piston seals are defective and must be replaced. If the extend port is leaking, the counterbalance valve is defective and must be replaced.
4. If no repairs are necessary or when repairs have been made, carefully reconnect hydraulic hoses to the appropriate ports.
5. Remove boom prop/overhead crane, activate hydraulic system and run cylinder through complete cycle to check for leaks and operation.

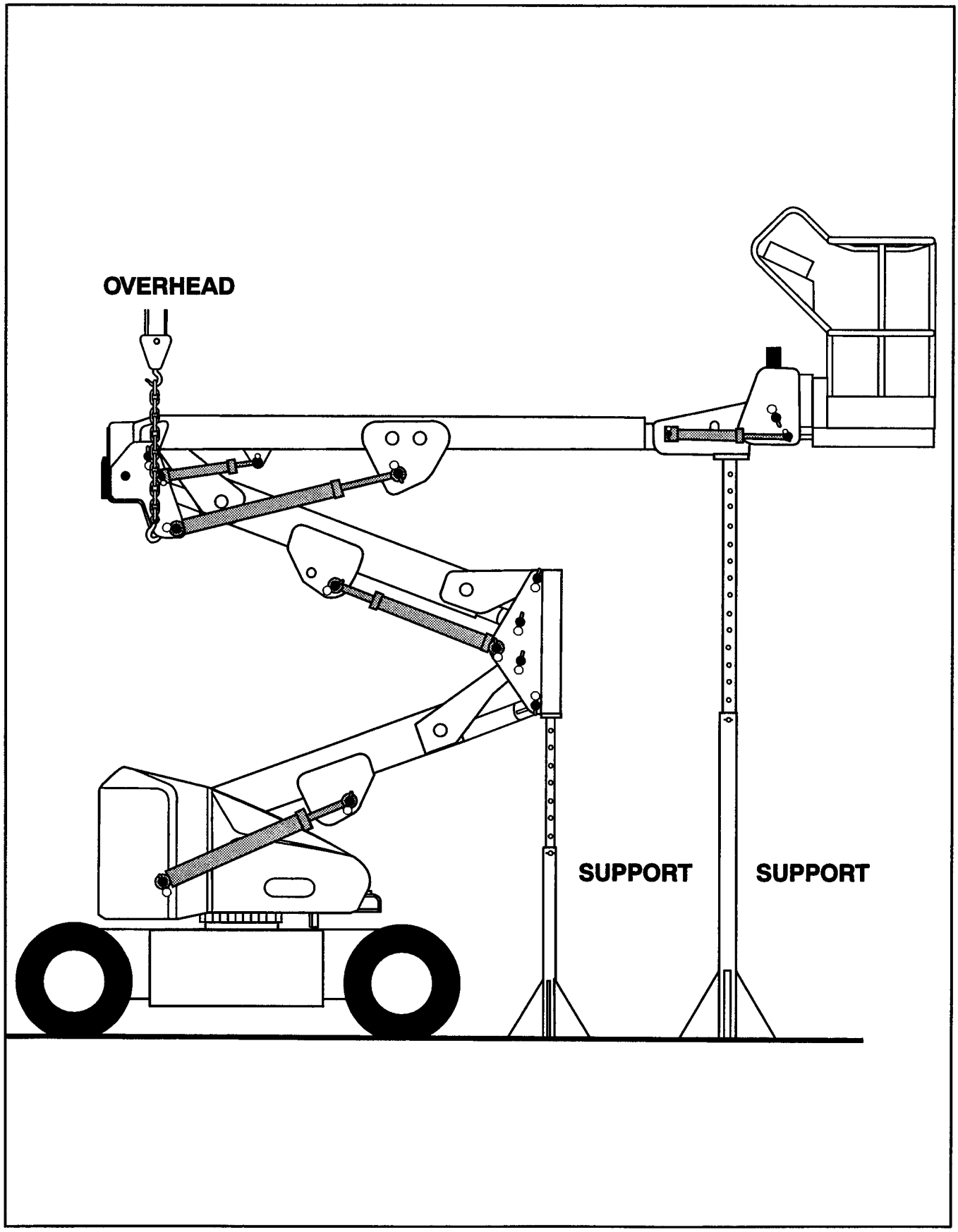


Figure 2-8. Boom Prop Configurations.

• Cylinders With Dual Counterbalance Valve.

Lower Lift, Mid Lift, Telescope, and Slave Cylinders.

⚠ IMPORTANT

OPERATE ALL FUNCTIONS FROM GROUND CONTROL STATION ONLY.

1. Using all applicable safety precautions, activate hydraulic system.

⚠ WARNING

WHEN WORKING ON THE UPPER BOOM LIFT CYLINDER, RAISE THE UPPER BOOM TO HORIZONTAL AND PLACE A BOOM PROP APPROXIMATELY 1 INCH (2.54 CM) BELOW THE MAIN BOOM. REFER TO FIG. 2-8, BOOM PROP CONFIGURATIONS. IF WORKING ON LOWER BOOM LIFT CYLINDER, RAISE LOWER BOOM HALFWAY, FULLY ELEVATE UPPER BOOM AND ATTACH OVERHEAD CRANE TO THE UPRIGHT FOR SUPPORT, LEAVING APPROXIMATELY 1 INCH (2.54 CM) OF SLACK IN CHAIN OR SLING FOR TEST PURPOSES.

2. When working on the platform slave cylinder, stroke platform slave level cylinder forward until platform sits at a 45 degree angle.
3. After completing the above, shut down hydraulic system and allow machine to sit for 10-15 minutes. This is done to relieve pressure in the hydraulic lines. Carefully remove hydraulic hoses from appropriate cylinder port block.
4. There will be initial weeping of hydraulic fluid, which can be caught in a suitable container. After the initial discharge, there should not be any further leakage from the ports. If leakage continues at a rate of 6-8 drops per minute or more, the following cylinder repairs must be made. If the retract port is leaking, the piston is leaking, the piston seals are defective and must be replaced. If the extend port is leaking, the counterbalance valve is defective and must be replaced.
5. To check piston seals, carefully remove the counterbalance valve from the retract port. After initial discharge, there should not be any further leakage from the ports. If leakage occurs at a rate of 6-8 drops per minute or more, the piston seals are defective and must be replaced.
6. If no repairs are necessary or when repairs have been made, carefully reconnect hydraulic hoses to the appropriate ports.
7. Remove boom prop/overhead crane, activate hydraulic system and run cylinder through complete cycle to check for leaks and operation.

2-9. CYLINDER REPAIR.

Note

The following are general procedures that apply to all of the cylinders on this machine. Procedures that apply to a specific cylinder will be so noted.

• Disassembly.

⚠ IMPORTANT

DISASSEMBLY OF THE CYLINDER SHOULD BE PERFORMED ON A CLEAN WORK SURFACE IN A DIRT FREE WORK AREA.

1. Connect a suitable auxiliary hydraulic power source to the cylinder port block fitting.

⚠ WARNING

DO NOT FULLY EXTEND CYLINDER TO THE END OF STROKE. RETRACT CYLINDER SLIGHTLY TO AVOID TRAPPING PRESSURE.

2. Operate the hydraulic power source and extend the cylinder. Shut down and disconnect the power source. Adequately support the cylinder rod, if applicable.
3. If applicable, remove the cartridge type holding valve, manual descent valve, and fittings from the port block. Discard o-rings.
4. Place the cylinder barrel into a suitable holding fixture. Tap around outside of cylinder head retainer with a suitable hammer to shatter loctite.

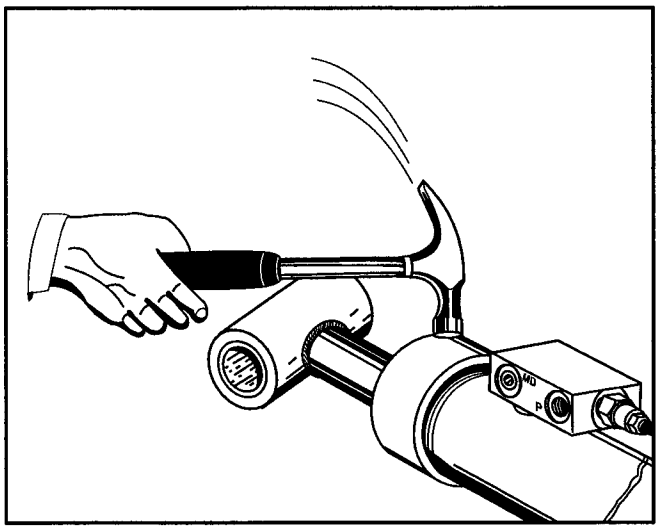


Figure 2-9. Removal of Cylinder Retainer.

5. Using a suitable chain wrench, loosen the cylinder head retainer, if applicable, and/or cylinder head gland, and remove from cylinder barrel.

Note

Steer cylinder has cylinder head retainer at both ends. Remove both retainers.

6. Attach a suitable pulling device to the cylinder rod port block end or cylinder rod end, as applicable.

⚠ IMPORTANT

EXTREME CARE SHOULD BE TAKEN WHEN REMOVING THE CYLINDER ROD, HEAD AND PISTON. AVOID PULLING THE ROD OFF CENTER, WHICH COULD CAUSE DAMAGE TO THE PISTON AND CYLINDER BARREL SURFACES.

7. With the barrel clamped securely, apply pressure to the rod pulling device and carefully withdraw the complete rod assembly from the cylinder barrel.

⚠ CAUTION

ONCE THE HEAD GLAND HAS CLEARED THE CYLINDER CASE MOUTH, THE ROD MUST BE SUPPORTED CLOSE TO THE CYLINDER CASE PRIOR TO THE PISTON BEING PULLED PAST THE CYLINDER CASE THREADS, AND/OR THE PISTON AND PISTON SEALS.

Note

Step (8) applies to the steer cylinder.

8. Remove the remaining head gland from the barrel if you have not already done so.

9. Using suitable protection, clamp the cylinder rod in a vise or similar holding fixture as close to the piston as possible.

10. Remove the set screw(s) if applicable, and nut which attach the piston and spacer(s), if applicable, to the rod, and remove piston and spacers. Discard self locking set screws.

11. Remove the set screw and nut which attach the piston and spacer to the rod. Using a suitable nylon strap wrench, loosen piston and remove piston and spacers. Discard self locking set screws

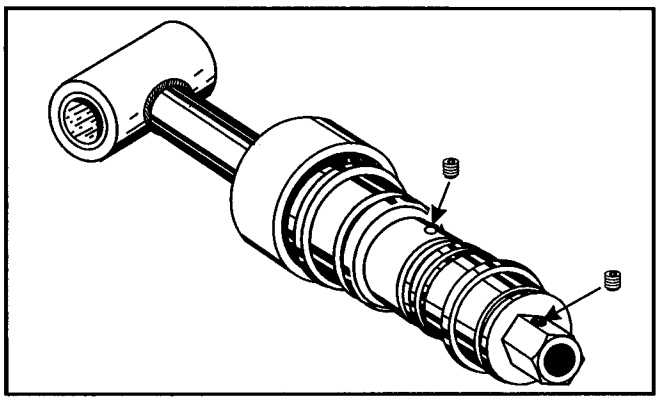


Figure 2-10. Removal of Set Screws.

12. Remove and discard the o-rings, seal rings and backup rings.

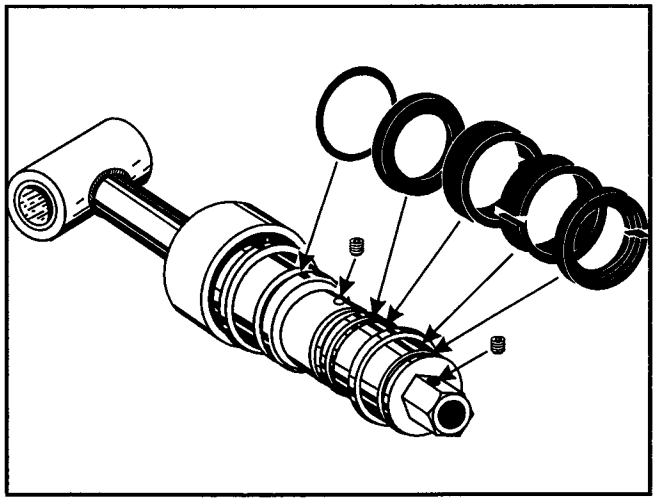


Figure 2-11. Removal of Seals and O-Rings.

13. Remove the rod from the holding fixture. Remove the cylinder head gland, if applicable. Discard the o-rings, back-up rings, rod seals, and wiper seals.

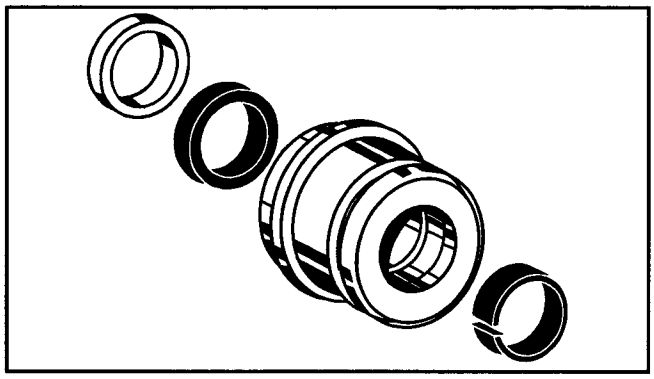


Figure 2-12. Removal of Piston Seals.

• Cleaning and Inspection.

1. Clean all parts thoroughly in approved solvent.
2. Inspect the cylinder rod for scoring, tapering, ovality, or other damage. If necessary, dress rod with Scotch-Brite or equivalent. Replace rod if necessary.
3. Inspect threaded portion of rod, if applicable, for excessive damage. Dress threads as necessary.
4. Inspect inner surface of cylinder barrel tube for scoring or other damage. Check inside diameter for tapering or ovality. Replace if necessary.
5. Inspect threaded portion of barrel for damage. Dress threads as necessary.
6. Inspect piston surface for damage and scoring and for distortion. Dress or replace piston as necessary.
7. Inspect seal and o-ring grooves in piston for burrs and sharp edges. Dress applicable surfaces as necessary.
8. Inspect cylinder head(s) inside diameter for scoring or other damage and ovality and tapering. Replace as necessary.
9. Inspect seal and o-ring grooves in head(s) for burrs and sharp edges. Dress applicable surfaces as necessary.
10. If applicable, inspect cylinder head retainer(s) or end cap(s) for surface or thread damage. Repair or replace as necessary.
11. Inspect cylinder head(s) outside diameter for scoring or other damage and ovality and tapering. Replace as necessary.
12. If applicable, inspect rod and barrel bushing for signs of correct lubrication and excessive wear. Replace as necessary.
13. Inspect travel limiting collar or spacer(s) for burrs and sharp edges. If necessary, dress inside diameter surface with Scotch Brite or equivalent.
14. If applicable, inspect port block fittings and holding valve. Replace as necessary.
15. Inspect the oil ports for blockage or presence of dirt or other foreign material. Clean or repair as necessary.

• Assembly.

Notes

Prior to cylinder assembly, ensure that the proper cylinder seal kit is used. See your JLG Parts Manual.

Apply a light film of hydraulic oil to all components prior to assembly.

1. A special tool is used to install a new rod seal into the applicable cylinder head gland groove.

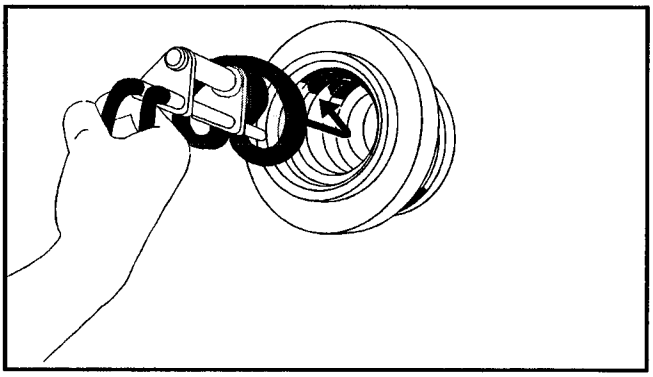
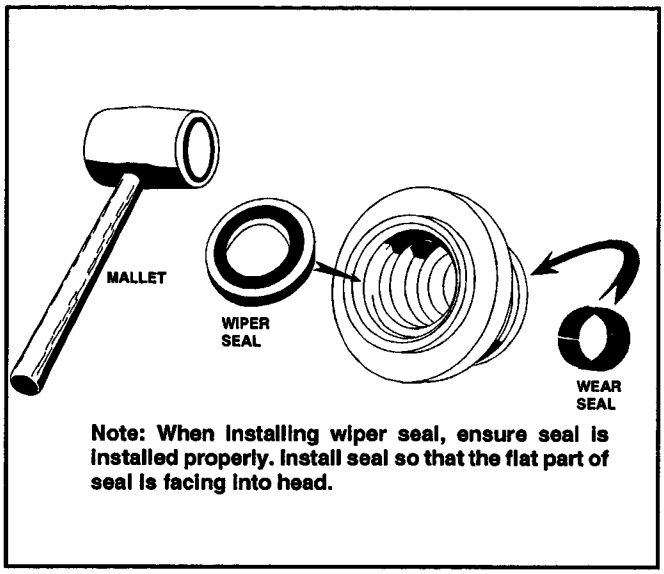


Figure 2-13. Rod Seal Installation.

2. Using a soft mallet, tap a new wiper seal into the applicable cylinder head gland grooves. Install a new wear ring into applicable cylinder head gland groove



Note: When installing wiper seal, ensure seal is installed properly. Install seal so that the flat part of seal is facing into head.

Figure 2-14. Wiper Seal Installation.

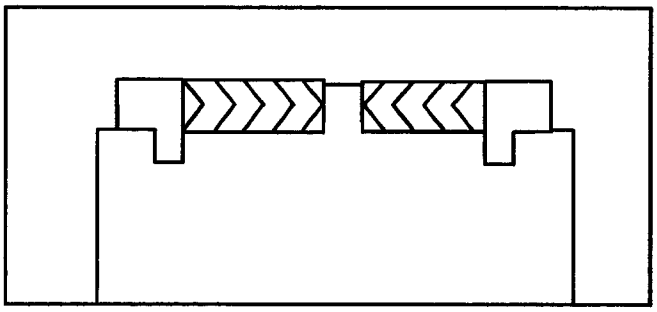


Figure 2-15. Poly-Pak Piston Seal Installation.

3. Place a new "o"-ring in the applicable outside diameter groove of the cylinder head.

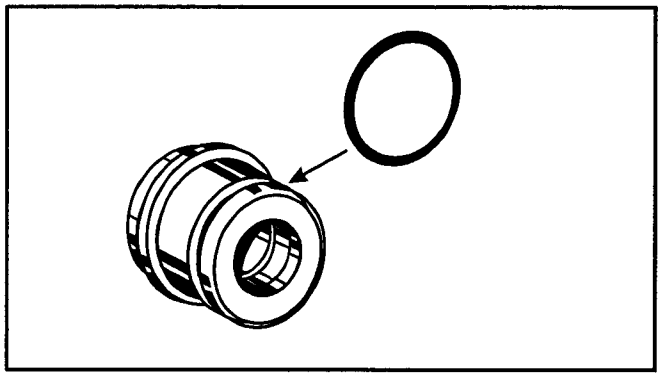


Figure 2-16. "O"-Ring Installation.

4. Install retainer or retainer ring onto the rod.

5. Carefully install the head gland on the rod, ensuring that the wiper and rod seal are not damaged or dislodged. Push the head along the rod to the rod end as applicable.

6. Carefully slide the piston spacer and washer, if applicable, on the rod. If applicable, align the oil holes in the rod and spacer. Secure the spacer, if applicable, with set screw.

7. If applicable, correctly place new o-ring in the inner piston diameter groove.

8. If applicable, correctly place a new seals and guide lock rings in the outer piston diameter groove.

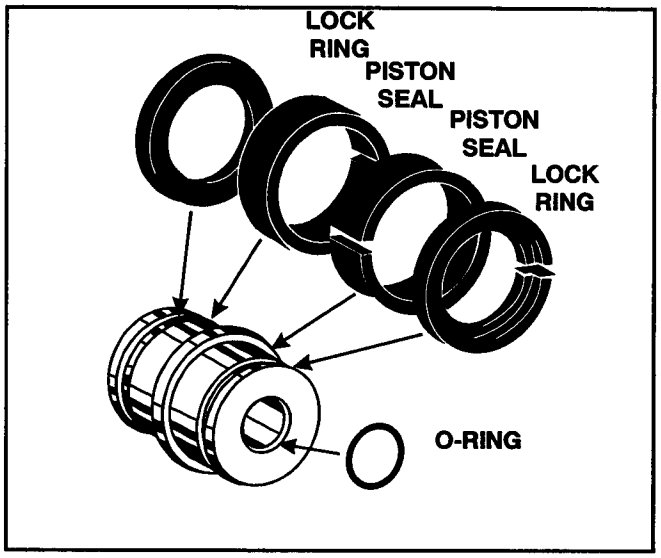


Figure 2-17. Piston Seal Kit Installation.

9. Carefully place the piston on the cylinder rod, ensuring that the o-ring is not damaged or dislodged.

10. Using suitable protection, clamp the cylinder rod in a vise or similar holding fixture as close to the piston as possible.

Note

Step (11) applies to Upper, Mid, Lower Lift, and Master Cylinders.

11. Push the piston onto the rod until it abuts the spacer end and install the attaching nut. Spot drill cylinder rod for set screw, then install set screw. (See Table 2-1.)

Note

Step (12) applies to Steer Cylinder.

12. Push the piston onto the rod until it straddles the o-ring in the center groove and abuts the retaining ring. Install the other retaining ring and spacer.

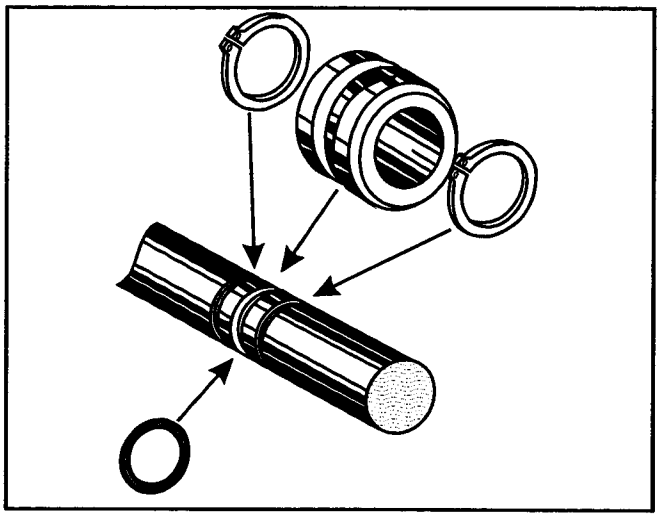


Figure 2-18. Steer Cylinder Piston Installation.

Note

Step (13) applies to Slave Leveling Cylinder.

13. Install piston onto rod by hand, tighten the piston hand tight and install the attaching nut. Spot drill cylinder rod for set screw then install set screw. (See Table 2-1.).

Note

Step (14) applies to Telescope Cylinder.

14. Push the piston onto the rod until it abuts the spacer end and install the attaching locknut. (See Table 2-1.)

15. Remove cylinder rod from the holding valve.

16. Position the cylinder barrel in a suitable holding fixture.

⚠ IMPORTANT

EXTREME CARE SHOULD BE TAKEN WHEN INSTALLING THE CYLINDER ROD, HEAD AND PISTON. AVOID PULLING THE ROD OFF-CENTER, WHICH COULD CAUSE DAMAGE TO THE PISTON AND CYLINDER BARREL SURFACES.

17. With barrel clamped securely, and while adequately supporting the rod, insert the piston end into the cylinder barrel. Ensure that the piston loading o-ring and seal ring are not damaged or dislodged.

18. Continue pushing the rod into the barrel until the cylinder head gland can be inserted into the barrel cylinder or if applicable until the cylinder head threads engage the barrel threads.

19. If applicable, apply loctite #222 and secure the cylinder head retainer using a suitable chain wrench.

Note

Step (20) applies to the Telescope Cylinder.

20. Secure the cylinder head with retainer ring.

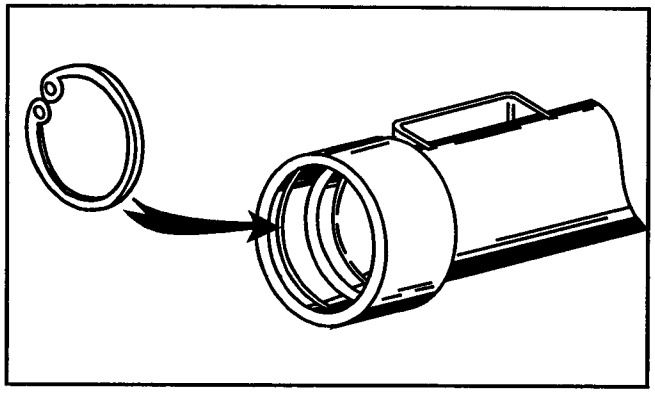


Figure 2-19. Retaining Ring On Telescope Cylinder Barrel.

Note

Step (21) applies to the Steer Cylinder.

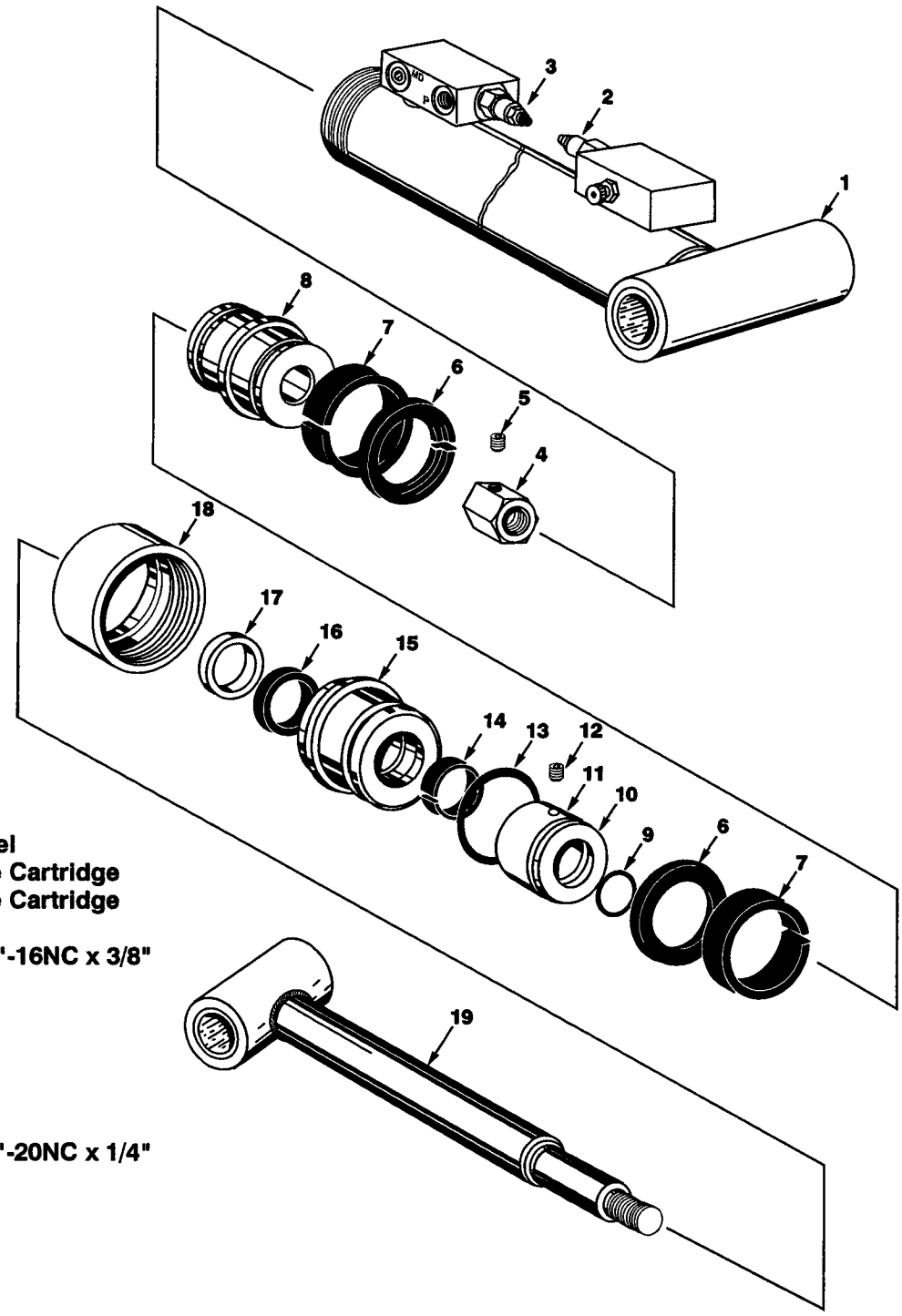
21. Insert the other cylinder head gland into the barrel cylinder. Secure the cylinder head retainer using a suitable chain wrench.

22. After the cylinder has been reassembled, the rod should be pushed all the way in (fully retracted) prior to the reinstallation of any holding valves.

23. If applicable, install the cartridge type holding valve and fittings in the rod port block using new o-rings as applicable. (See Table 2-2, Holding Valve Torque Specifications)

⚠ CAUTION

IF THE CYLINDER IS TO BE TESTED PRIOR TO INSTALLATION ON THE MACHINE, EXTREME CARE SHOULD BE USED TO INSURE THAT THE OUTER END OF THE ROD IS SUPPORTED. USE EITHER A TRAVELING OVERHEAD HOIST, FORKLIFT, OR OTHER MEANS TO SUPPORT THE OVERHANGING WEIGHT OF THE EXTENDING ROD.



1. Cylinder Barrel
2. Holding Valve Cartridge
3. Holding Valve Cartridge
4. Nut, Hex
5. Set screw 3/8"-16NC x 3/8"
6. Ring, Lock
7. Seal, Piston
8. Piston
9. O-Ring
10. Washer
11. Spacer
12. Set screw 1/4"-20NC x 1/4"
13. O-Ring
14. Ring, Wear
15. Head
16. Seal, Rod
17. Wiper, Rod
18. Retainer
19. Cylinder Rod

Figure 2-20. Lift Cylinder Assembly.

⚠ WARNING

WHEN REBUILDING THE LIFT CYLINDERS, APPLY LOCTITE 242 TO PISTON NUT AND SET SCREWS.

Table 2-1. Cylinder Piston Nut Torque Specifications.

Description	Nut Torque Valve (Wet)	Setscrew Torque Value (Dry)
Model 40ic		
Upper Lift Cylinder	200 ft. lbs. (271 Nm)	100 in. lbs. (12 Nm)
Mid Lift Cylinder	200 ft. lbs. (271 Nm)	100 in. lbs. (12 Nm)
Lower Lift Cylinder	400 ft. lbs. (542 Nm)	100 in. lbs. (12 Nm)
Slave Cylinder	80 ft. lbs. (109 Nm)	100 in. lbs. (12 Nm)
Master Cylinder	50 ft. lbs. (68 Nm)	100 in. lbs. (12 Nm)
Rotator Cylinder	N/A	N/A
Steer Cylinder	N/A	N/A

Telescope Cylinder Piston Nut Torque Specifications. (Models 40/45)

Description	Locknut Torque Value (Dry)
Tele Cylinder	150 ft. lbs. (203 Nm)

Table 2-1. Cylinder Piston Nut Torque Specifications.

Description	Nut Torque Value (Wet)	Set screw Torque Value (Dry)
Model 45ic		
Upper Lift Cylinder	200 ft. lbs. (271 Nm)	100 in. lbs. (12 Nm)
Mid Lift Cylinder	400 ft. lbs. (542 Nm)	100 in. lbs. (12 Nm)
Lower Lift Cylinder	400 ft. lbs. (542 Nm)	100 in. lbs. (12 Nm)
Slave Cylinder	80 ft. lbs. (109 Nm)	100 in. lbs. (12 Nm)
Master Cylinder	50 ft. lbs. (68 Nm)	100 in. lbs. (12 Nm)
Rotator Cylinder	N/A	N/A
Steer Cylinder	N/A	N/A

Table 2-2. Holding Valve Torque Specifications.

Description	Torque Value
SUN - 7/8 HEX M20 X 1.5 THDS.	30-35 ft. lbs. (41-48 Nm)
SUN - 1 1/8 HEX 1 -14 UNS THDS.	45-50 ft. lbs. (61-68 Nm)
SUN - 1 1/4 HEX M36 X 2 THDS.	150-160 ft. lbs. (204-217 Nm)
RACINE - 1 1/8 HEX 1 1/16 - 12 THDS.	50-55 ft. lbs. (68-75 Nm)
RACINE - 1 3/8 HEX 1 3/16 - 12 THDS.	75-80 ft. lbs. (102-109 Nm)
RACINE - 1 7/8 HEX 1 5/8 - 12 THDS.	100-110 ft. lbs. (136-149 Nm)

2-10. CYLINDER REMOVAL AND INSTALLATION. (See Figure 8-8)

• Upper (Main) Boom Lift Cylinder Removal. (See Figure 2-21.)

1. Place the machine on a flat and level surface. Place the Upper Boom in a horizontal position. Place Lower and Mid Booms 5 degrees above horizontal. Shut down machine and prop boom.
2. Tag, disconnect and cap the upper boom lift cylinder hydraulic lines and ports.
3. Remove the hardware securing the cylinder rod attach pin #1 to the boom. Using a suitable brass drift, drive out the cylinder rod attach pin #1.
4. Secure the cylinder with suitable slings or supports as required. Remove the hardware securing the barrel end attach pin #2. Using a suitable brass drift, drive out the barrel end attach pin #2.
5. Remove the cylinder from the boom and place in a suitable work area.

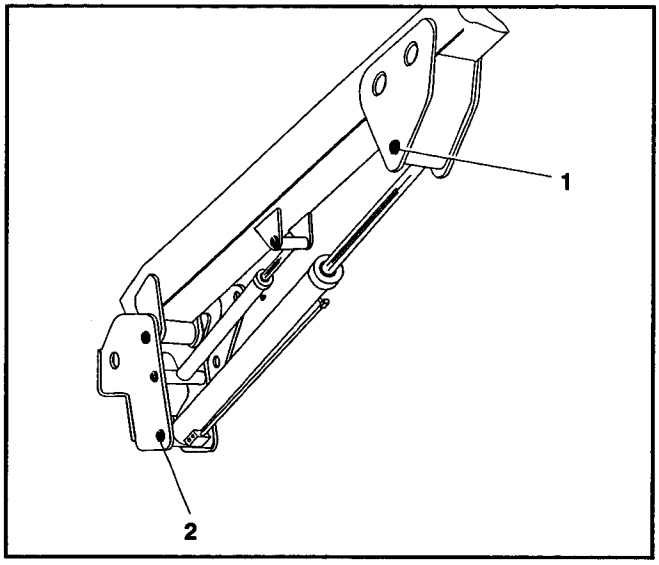


Figure 2-21. Upper Boom Lift Cylinder Removal.

• Upper (Main) Boom Lift Cylinder Installation.

Note

Coat I.D. of bushings with specified lubricant prior to installing pins.

1. Install Lift Cylinder in place using suitable slings or supports, aligning attach pin mounting holes on upright.
2. Using a suitable drift, drive the barrel end attach pin #2 through the mounting holes in the lift cylinder and upright. Secure in place with pin retaining hardware.
3. Remove cylinder port plugs and hydraulic line caps and correctly attach lines to cylinder ports.
4. With function speed switch at its slowest setting, extend the cylinder rod until attach pin hole aligns with those in boom. Using a suitable drift, drive the cylinder rod attach pin #1 through the aligned holes. Secure the pin in place with pin retaining hardware.
5. Cycle cylinder completely to check for proper functioning. Place boom in stowed position. Check hydraulic fluid level and adjust accordingly.

• Mid Boom Lift Cylinder Removal. (See Figure 2-22.)

1. Place machine on flat and level surface. Place the Upper Boom in a horizontal position. Place the Mid Boom in a 10 degree elevated position. Support Upper Boom with a prop. Support upright with an overhead crane.
2. Using slings, restrain the lower lift cylinder.
3. Remove the hardware securing the cylinder rod attach pin #3 to the boom. Using an appropriate brass drift, drive out the cylinder rod attach pin #3.
4. Tag, disconnect and cap the lift cylinder hydraulic lines and ports.
5. Remove the hardware securing the barrel end attach pin #4 to the boom. Using an appropriate brass drift, drive out the cylinder barrel pin #4.
6. Carefully remove cylinder from boom. Place in a suitable work area.

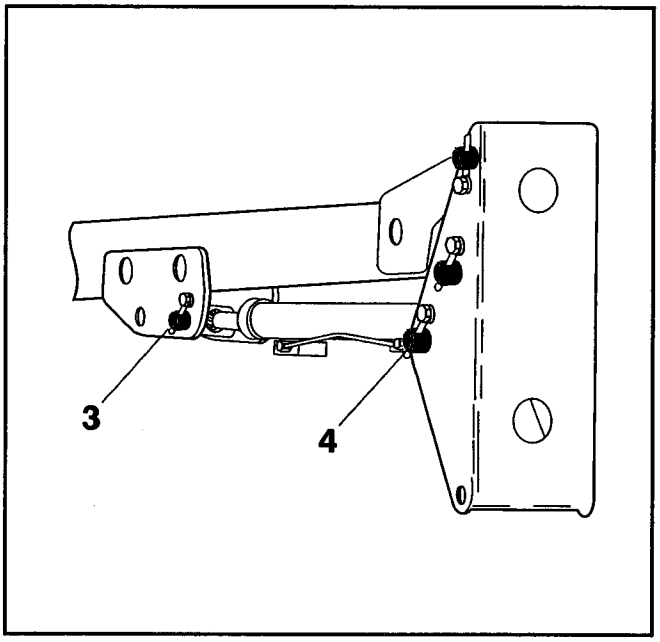


Figure 2-22. Mid Boom Lift Cylinder Removal.

• Mid Boom Lift Cylinder Installation.

Note

Coat I.D. of bushings with specified lubricant prior to installing pins.

1. With the booms positioned and supported as in Figure 2-8. Boom Prop Configurations, place cylinder in position and secure in place using slings.
2. Install the cylinder barrel pin #4, being sure to align the hole in the cylinder barrel pin with the retaining pin screw hole. When holes align, install hardware.
3. Correctly install hydraulic lines to cylinder as previously tagged. Extend cylinder rod slowly until attach pin hole aligns with those in boom.
4. Using a suitable brass drift, drive the cylinder rod attach pin #3 through the aligned holes. Secure the pin in place using retaining hardware.
5. Remove boom prop and overhead crane. Take the lift cylinder through one complete cycle to assure correct functioning. Place boom in stowed position. Check hydraulic fluid and adjust accordingly.

• Lower Boom Lift Cylinder Removal. (See Figure 2-23.)

1. Place machine on flat and level surface. Place the Upper Boom in a horizontal position. Place the Mid and Lower Booms in a 10 degree elevated position. See Figure 2-8, Boom Prop Configurations. Support Upper Boom with a prop. Support upright with an overhead crane.
2. Using slings, restrain the lower lift cylinder.
3. Remove the hardware securing the cylinder rod attach pin #5 to the boom. Using an appropriate brass drift, drive out the cylinder rod attach pin #5.
4. Tag, disconnect and cap the lift cylinder hydraulic lines and ports.
5. Remove the hardware securing the barrel end attach pin #6 to the boom. Using an appropriate brass drift, drive out the cylinder barrel pin #6.
6. Carefully remove cylinder from boom. Place in a suitable work area.

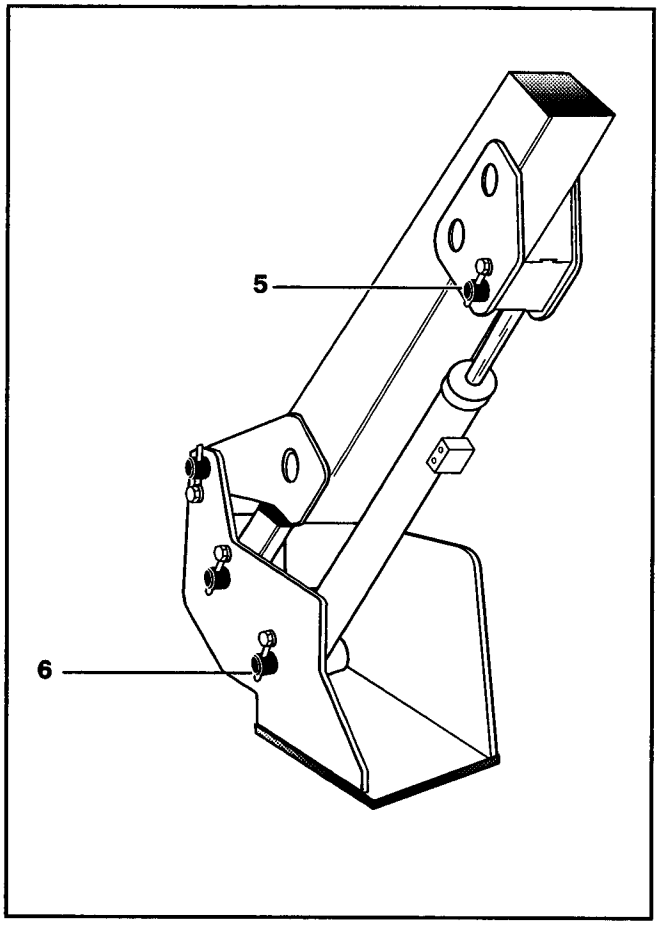


Figure 2-23. Lower Boom Lift Cylinder Removal.

• Lower Boom Lift Cylinder Installation.

Note

Coat I.D. of bushings with specified lubricant prior to installing pins.

1. With the booms positioned and supported as in Figure 2-8, Boom Prop Configurations, place cylinder in position and secure in place using slings.
2. Install the cylinder barrel pin #6, being sure to align the hole in the cylinder barrel pin with the retaining pin screw hole. When holes align, install hardware.
3. Correctly install hydraulic lines to cylinder as previously tagged. Extend cylinder rod slowly until attach pin hole aligns with those in boom.

4. Using a suitable brass drift, drive the cylinder rod attach pin #5 through the aligned holes. Secure the pin in place using retaining hardware.
5. Remove boom prop and overhead crane. Take the lift cylinder through one complete cycle to assure correct functioning. Place boom in stowed position. Check hydraulic fluid and adjust accordingly.

• Upper Boom Telescope Cylinder Removal. (See Figure 2-24.)

1. Place machine on flat and level surface, with Upper Boom in the horizontal position. Extend Upper Boom until fly attach pin #1 is accessible on fly.
2. Support Upper Boom basket end with a prop. Support Upper Upright end with an overhead crane (See Figure 2-8, Boom Prop Configurations).
3. Tag, disconnect hydraulic lines to telescope cylinder. Use suitable container to retain any residual hydraulic fluid. Cap hydraulic lines and ports.
4. Remove the retaining rings that retain the telescope cylinder rod to the fly boom.
5. Using a suitable brass drift, carefully drive the telescope cylinder rod pin #1 from the fly boom.
6. Remove the four (4) bolts securing the telescope cylinder barrel end to the base boom.

Note

Care should be taken when removing the telescope cylinder. Do not leave cylinder rest on powertrack which could cause damage to powertrack.

7. Using a suitable brass drift, carefully drive the telescope cylinder pin from the base boom.
8. Attach a suitable sling to the telescope cylinder. Using a suitable lifting device attached to the sling, carefully pull the telescope cylinder from the boom assembly.
9. Using another lifting device, support the rod end of the cylinder and remove the cylinder from the boom assembly.
10. Carefully lift the cylinder clear of the boom assembly and lower to the ground or suitably supported work area.

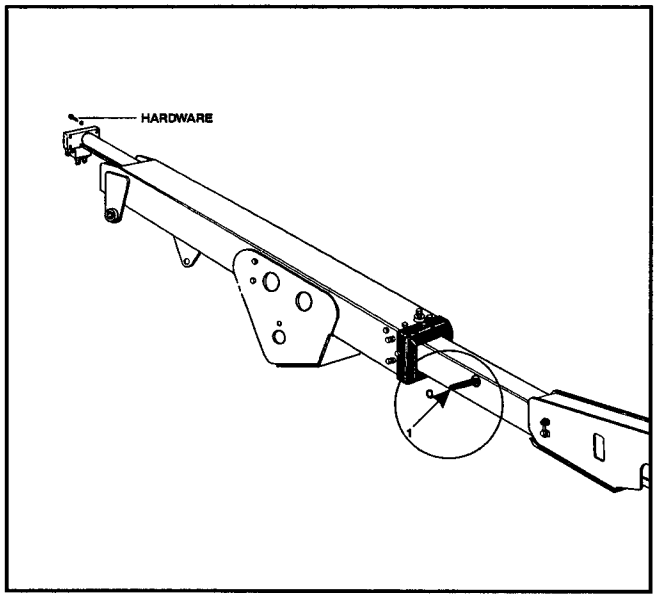


Figure 2-24. Upper Telescope Cylinder Removal.

• Upper Boom Telescope Cylinder Installation.

1. Attach a hydraulic power supply to the telescope cylinder ports. Using suitable supports or lifting devices at each end of the cylinder, extend the rod so that the cylinder pin attach holes are the same distance apart as the boom pin attach holes.
2. Using suitable lifting equipment, carefully lower the cylinder to the boom assembly.
3. Using another lifting device, support the rod end of the cylinder and install the cylinder into the boom assembly.
4. Remove lifting devices from the telescope cylinder.
5. Carefully install the telescope cylinder rod pin #1 through the fly boom and secure it with the retaining rings.
6. Carefully install the telescope cylinder barrel end to base, securing cylinder to the base boom with four (4) bolts and hardware.
7. Remove applicable hydraulic line and port caps and correctly connect the hydraulic lines to the telescope cylinder. Ensure all hoses are correctly routed.
8. Remove boom prop and overhead crane. Activate hydraulic system.

9. Using all applicable safety precautions, operate the boom functions. Check for correct operation and hydraulic leaks. Secure as necessary.

10. Check fluid level of hydraulic tank and add oil as necessary.

2-11. TILT INDICATOR SWITCH LEVELING PROCEDURE. (If Equipped.)

⚠ CAUTION

PERFORM TILT ALARM SWITCH LEVELING PROCEDURE A MINIMUM OF EVERY SIX MONTHS TO ENSURE PROPER OPERATION AND ADJUSTMENT OF SWITCH.

• Manual Adjustment.

1. Park the machine on a flat level surface. Be sure it is as level as possible,with tires filled to rated pressure.

Note

Ensure switch mounting is level and securely attached.

2. Tighten the three flange nuts with a socket wrench. Each nut should be tightened approximately one-quarter of its spring's travel.

3. Using bubble level on top of indicator, Tighten or loosen the three flange nuts until indicator is level.

4. Individually push down on one corner at a time. There should be enough travel to cause the indicator to trip. If the indicator does not trip in all three tests, the flange nuts have been tightened too far.

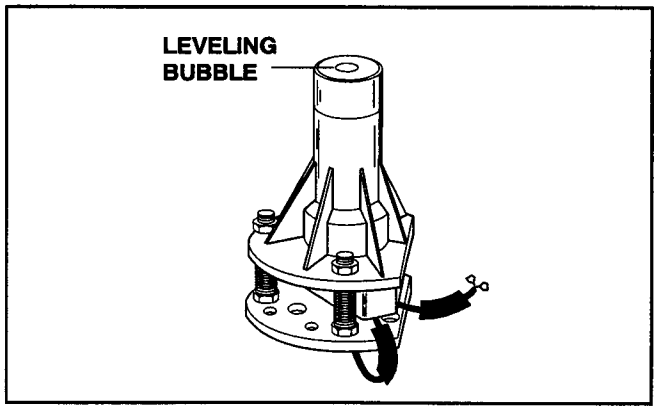


Figure 2-25. Tilt Switch.

2-12. BOOM LIMIT SWITCHES.

There are no adjustments to be made to the two Boom Limit Switches which bolt in place on the uprights.

2-13. PRESSURE SETTING PROCEDURES. (In Sequence) (See Figure 2-26)

• Main Relief at Pump.

1. Install pressure gauge at port "G" on 4640797 valve.

2. Activate and bottom out either Upper or Lower Lift Up. Adjust Main Relief to 3200 psi (220.64 bar).

• Upper Lift Down Relief.

1. With pressure gauge at "G" port on 4640797 valve, activate and bottom out Upper Lift Down.

2. Adjust Upper Lift Relief to 650 psi (44.82 bar).

• Mid/Lower Lift Down Relief.

1. With pressure gauge at "G" port on 4640797 valve, activate and bottom out Mid/Lower Lift Down.

2. Adjust Mid/Lower Lift Relief to 1700 psi (117.21 bar).

• Swing Relief.

1. With pressure gauge at "G" port on 4640797 valve, activate and bottom out Swing function in either direction.

2. Adjust Swing Relief to 1000 psi (68.95 bar).

• Telescope In Relief.

1. With pressure gauge at "G" port on 4640797 valve, activate and bottom out Telescope In.

2. Adjust Telescope In Relief to 2150 psi (148.25 bar).

• Platform Level Up Relief.

1. With pressure gauge at "G" port on 4640797 valve, activate and bottom out Platform Level Up.
2. Adjust Platform Level Up Relief to 2500 psi (172.37 bar).

• Platform Level Down Relief.

1. With pressure gauge at "G" port on 4640797 valve, activate and bottom out Platform Level Down.
2. Adjust Platform Level Down Relief to 1200 psi (82.74 bar).

• Steer Relief.

1. With pressure gauge at "G" port on 4640797 valve, activate and bottom out Steer Left or Right.
2. Adjust Steer Relief to 1500 psi (103.42 bar).
3. Shut down hydraulic system and remove pressure gauge.

2-14. SWING BEARING.

• Turntable Bearing Mounting Bolt Condition Check.

Note

This check is designed to replace the existing bearing bolt torque checks on JLG Lifts in service. This check must be performed after the first 50 hours of machine operation and every 600 hours of machine operation thereafter. If during this check any bolts are found to be missing or loose, replace missing or loose bolts with new bolts and torque to the value specified in the torque chart, after lubricating the bolt threads with loctite #271. After replacing and retorquing bolt or bolts recheck all existing bolts for looseness.

a. Check the frame to bearing. Attach bolts as follows:

1. Elevate the fully retracted boom to 70 degrees (full elevation).
2. At the positions indicated on Figure 2-26. try and insert the .0015" feeler gauge between the bolt head and hardened washer at the arrow indicated position.
3. Assure that the .0015" feeler gauge will not penetrate under the bolt head to the bolt shank.
4. Swing the turntable 90 degrees, and check some selected bolts at the new position.
5. Continue rotating the turntable at 90 degrees intervals until a sampling of bolts have been checked in all quadrants.

b. Check the turntable to bearing. Attach bolts as follows:

1. Elevate the fully retracted boom to 70 degrees (full elevation).
2. At the positions indicated on Figure 8-26. try and insert the .0015" feeler gauge between the bolt head and hardened washer at the arrow indicated position.
3. Lower the boom to horizontal and fully extend the boom.
4. At the position indicated on Figure 8-26. try and insert the .0015" feeler gauge between the bolt head and hardened washer at the arrow indicated position.

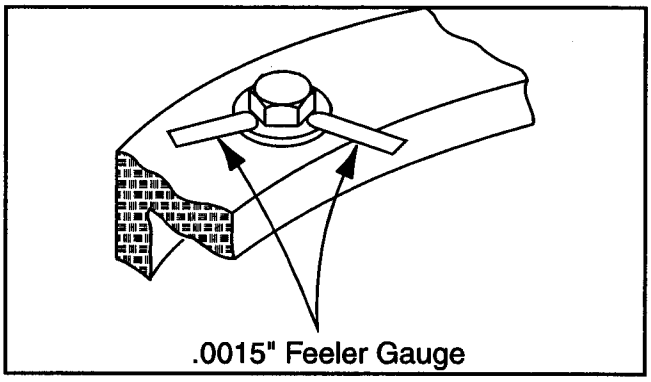


Figure 2-26. Swing Bearing Bolt Feeler Gauge Check.

• Wear Tolerance.

1. With the boom positioned over the side of the machine, the Upper Boom horizontal with telescope fully extended and Mid/Lower Boom stowed, (See Figure 2-28 a.), using a magnetic base dial indicator, measure and record the distance between the swing bearing and turntable. (See Figure 2-29.)

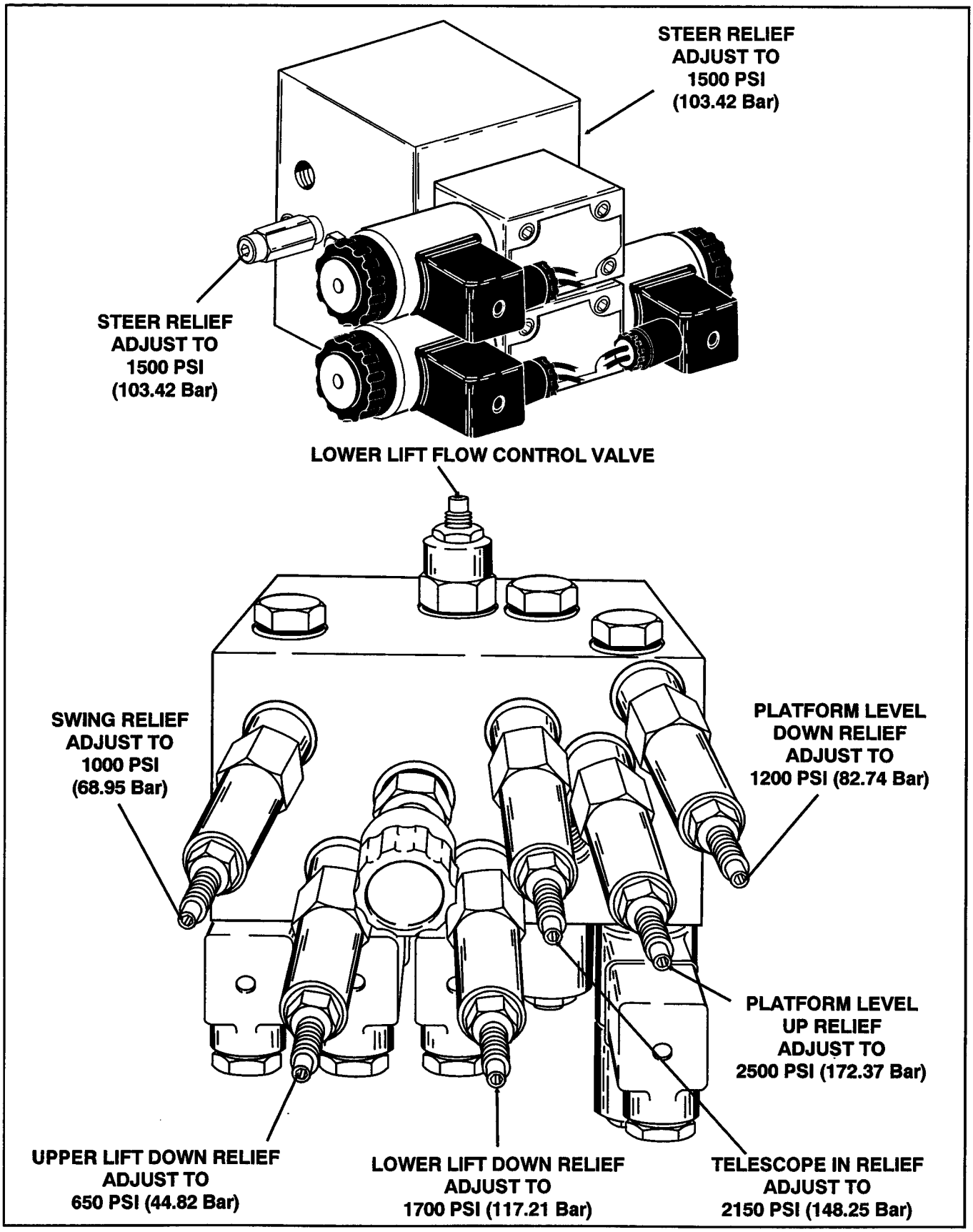


Figure 2-27. Pressure Setting Procedures.

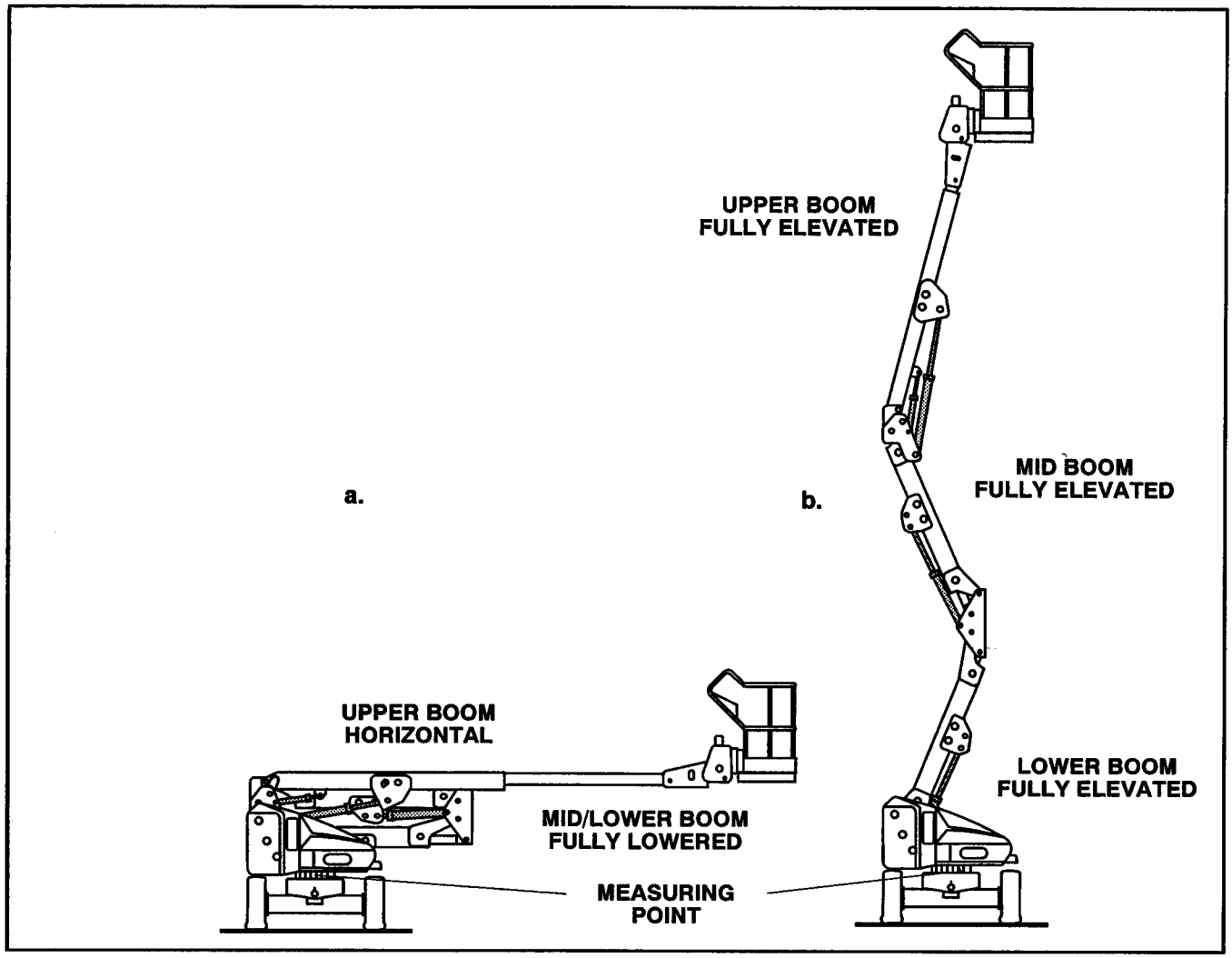


Figure 2-28. Swing Bearing Tolerance Boom Placement.

2. At the same point, with the boom positioned over the side of the machine, the Upper Boom fully elevated and the Mid/Lower Boom fully elevated, (See Figure 2-28b.) using a magnetic base dial indicator, measure and record the distance between the swing bearing and turntable (See Figure 2-29).

3. If a difference greater than 0.057 in. (1.40 mm) is determined, the swing bearing should be replaced.

4. If a difference less than 0.057 in. (1.40 mm) is determined, and any of the following conditions exist, the bearing should be removed.

   a. Metal particles in the grease.
   b. Increased drive power.
   c. Noise.
   d. Rough rotation.

5. If bearing inspection shows no defects, reassemble bearing and return to service.

• Replacement of Swing Bearing.

1. Removal.

   a. Attach an adequate support sling to the boom and draw all slack from sling. Prop or block the boom if feasible.
   b. Tag and disconnect hydraulic lines running through center of turntable and frame. Use a suitable container to retain any residual hydraulic fluid. Cap lines and ports.
   c. Attach suitable overhead lifting equipment to the base of turntable weldment.

d. Use a suitable tool to scribe a line on the inner race of the swing bearing and on the underside of the turntable. This will aid in aligning the bearing upon installation. Remove bolts, nuts and washers which attach the turntable to the bearing inner race. Discard nuts and bolts.

e. Use the lifting equipment to carefully lift the complete turntable assembly from the bearing. Ensure that no damage occurs to the turntable, bearing or frame mounted components.

f. Carefully place the turntable on a suitably supported trestle.

g. Use a suitable tool to scribe a line on the outer race of the swing bearing and the frame. This line will aid in aligning the bearing upon installation. Remove the bolts and washers which attach the outer race of the bearing to the frame. Discard the bolts. Use suitable lifting equipment to remove the bearing and rotation box assembly from the frame; move to a clean, suitably supported work area.

h. Remove the two capscrews securing the bearing to the rotation box to separate the two for inspection.

2. Installation.

a. Install bearing to rotation box with two capscrews, so that fill plug of bearing is as close to gear as bolt pattern will allow. Do not tighten capscrews.

b. Line up high spot (blue) of bearing with center tooth of worm gear. Set backlash to 0.008 - 0.010 inch (0.20 - 0.25 mm). Tighten capscrews as shown in Figure 2-30.

c. Apply Tribol Molub-Alloy 936 Open Gear Compound to bearing and worm gear teeth.

d. Grease bearing with Mobilith SHC Bearing Grease. Grease fitting is on inside wall of inner race of bearing.

Note

If Tribol Molub-Alloy 936 Open Gear Compound or Mobilith SHC Bearing Grease are not available, Multi-Purpose Grease (MPG) can be substituted, however the service interval will be shorter.

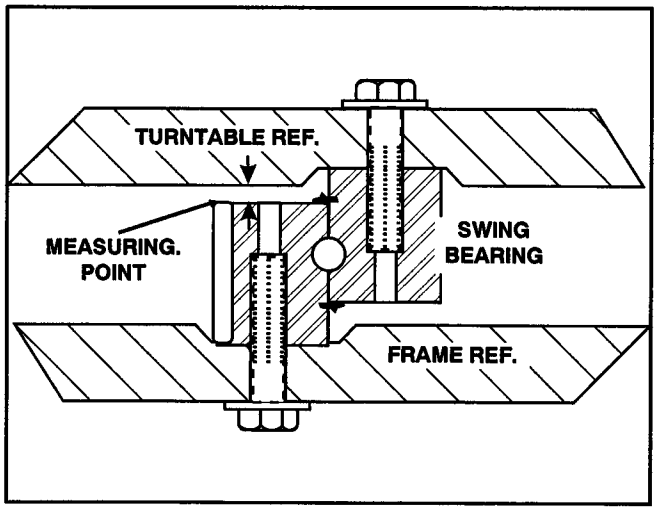


Figure 2-29. Swing Bearing Tolerance Measuring Point.

e. Using suitable lifting equipment, install bearing/rotation box assembly to frame with soft spot (red) 90 degrees relative to load axis. If using old bearing, ensure that scribed line of outer race of the bearing aligns with the scribed mark on the frame.

⚠ CAUTION

JLG INDUSTRIES RECOMMENDS THAT ALL REMOVED GRADE 8 BEARING NUTS AND BOLTS BE DISCARDED AND REPLACED WITH NEW NUTS AND BOLTS. SINCE THE SWING BEARING IS THE ONLY STRUCTURAL LINK BETWEEN THE FRAME AND TURNTABLE, IT IS IMPERATIVE THAT SUCH REPLACEMENT HARDWARE MEETS JLG SPECIFICATIONS. USE OF GENUINE JLG HARDWARE IS HIGHLY RECOMMENDED.

f. Apply a light coating of Loctite 271 to the new bearing bolts and loosely install the bolts and washers through the frame and outer race of bearing.

⚠ CAUTION

IF COMPRESSED AIR OR ELECTRICALLY OPERATED IMPACT WRENCH IS USED FOR TIGHTENING THE BEARING ATTACHMENT BOLTS, THE TORQUE SETTING ACCURACY OF THE TOOL SHOULD BE CHECKED PRIOR TO USE.

g. Following the torque sequence diagram shown in Figure 2-30, tighten the bolts to an initial torque of 175 ft. lbs. (237 Nm). Then, following the same sequence, tighten the bolts to a final torque of 240 ft. lbs. (326 Nm).

h. Remove lifting equipment from bearing.

i. Use suitable lifting equipment to carefully position the turntable assembly above the machine frame.

j. Carefully lower the turntable onto the swing bearing. Ensure that the scribed line of the inner race of the bearing aligns with the scribed mark on the turntable. If a new swing bearing is used, ensure that the filler plug fitting is at 90 degrees from the fore and aft centerline of the turntable.

k. Apply a light coating of Loctite 271 to the new bearing bolts and install through the turntable and inner race of bearing.

l. Following the torque sequence shown in Figure 2-30, tighten the bolts to an initial torque of 175 ft. lbs. (237 Nm). Then following the same sequence, tighten the bolts to 240 ft. lbs (326 Nm).

m. Remove the lifting equipment.

n. Route hydraulic lines through center of turntable and frame and connect as tagged prior to removal.

o. Using all applicable safety precautions, activate the hydraulic system and functionally check swing system for proper and safe operation.

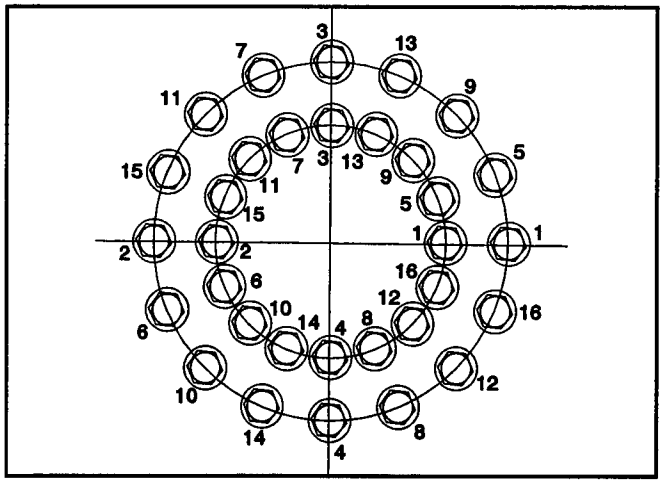


Figure 2-30. Swing Bearing Torquing Sequence.

• Swing Bearing Torque Values.

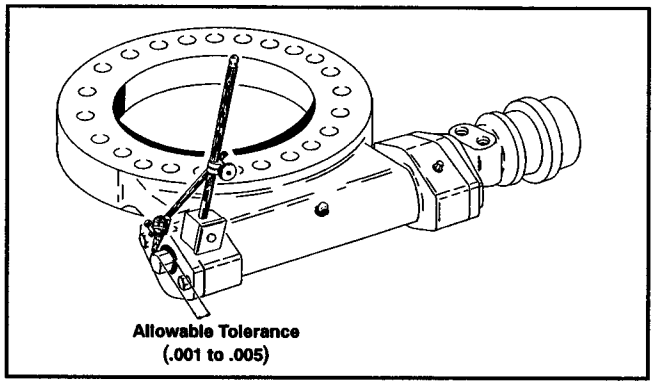
1. Dry - 220 ft. lbs. (298 Nm).
2. Loctite - 240 ft. lbs. (326 Nm).

• Checking Worm Gear End Play.

Note

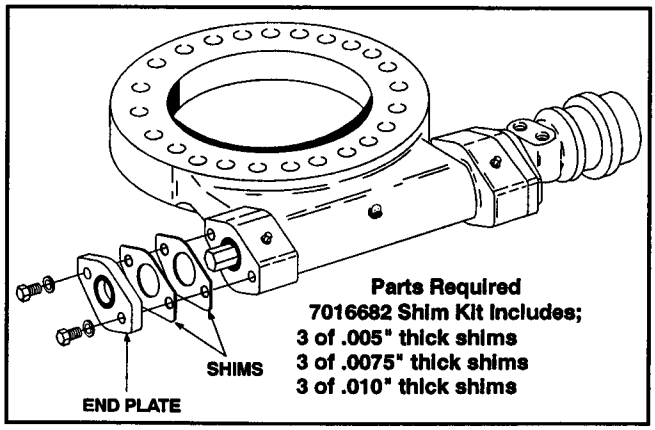
JLG Industries recommends that worm gear end play be check annual.

1. Using a dial indicator, measure end play of worm gear, by applying side to side movement by hand at platform.
2. If tolerance exceeds .010", reduce end play to less than .005". Refer to Adjusting End Play.



• Adjusting End Play.

1. Remove end plate.
2. Measure and record total thickness of existing shim pack.
3. Determine thichness of shim pack required to obtain .001" - .005" end play.
4. Adjust shim pack thickness as required to obtain proper end play. Reduce end play by removing thicker shims and replacing with thinner shims, included in kit.
5. Replace end plate and torque bolts to 90 ft. lbs. (122 Nm).
6. Recheck end play.



2-15. DRIVE TORQUE HUB. (See Figure 2-31)

• Disassembly.

1. Loosen all cover bolts (28 and 29) and drain oil from unit.
2. Remove the cover bolts (28 and 29) and lift off cover (23). Remove and discard o-ring (22) from counterbore of cover (23).
3. Remove input gear (24) and thrust washer (26).
4. Lift out the carrier assembly (14) and top thrust washer (27).
5. Remove input thrust spacer (25).
6. Lift out internal gear (13) and thrust washer (27).

Note

Eye protection should be worn during retaining ring (9) removal.

7. Remove the retaining ring (9) from the spindle (1) and discard.
8. Remove thrust washer (8) from the spindle (1).
9. The spindle (1) may now be pressed out of the housing (7).
10. The bearing cups (3 and 5) will remain in housing (7) as will bearing cone (6). Bearing cone (4) will remain on the spindle (1). The seal (2) will be automatically removed during this procedure.

Note

If bearing replacement is necessary, the bearing cups can be removed with a slide hammer puller or driven out with a punch.

11. To remove the cluster gears (19) from the carrier (14), drive the roll pin (20) into the planet shaft (18). The planet shaft may now be tapped out of the carrier. After planet shaft has been removed, the roll pin (20) can be driven out.
12. The cluster gear (19) can now be removed from the carrier (14). The tanged thrust washer (15) will be removed from the cluster gear.
13. The needle bearings (16) and thrust spacer (17) are now removed from cluster gear (19).

Note

When rebuilding or repairing the unit, the retaining ring (9), o-rings (22), and lip seal (2) should always be replaced.

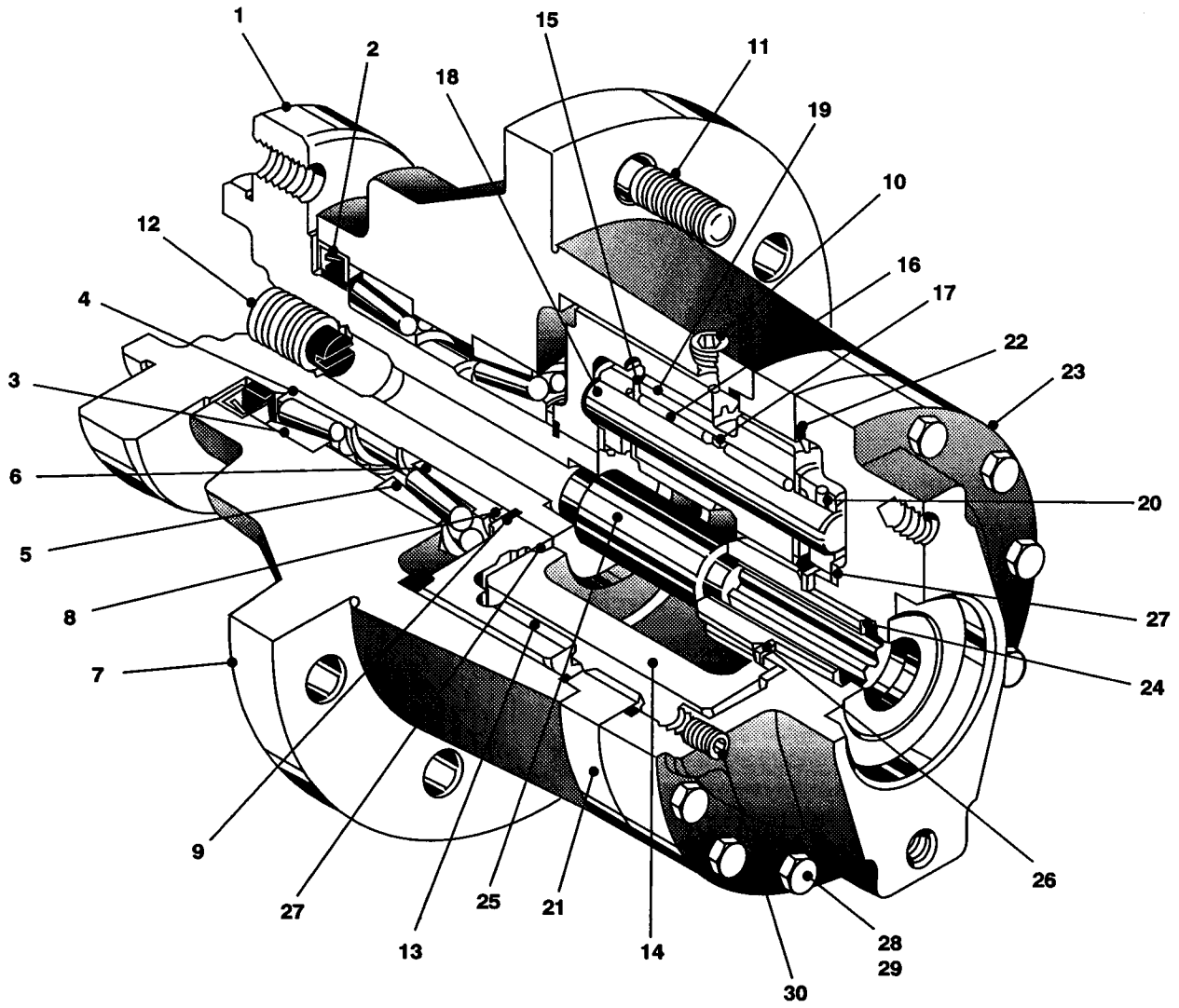
• Assembly.

1. With the hub shaft sub-assembly resting on the spindle (1), install internal gear (13). The spline of the internal gear (13) bore will mesh with the spline of the output shaft (1).
2. Install thrust washer (27) on the face of the spindle (1). Sufficient grease or petroleum jelly should be used to hold thrust washer (27) in place.
3. Place o-ring (22) into hub counterbore. Use petroleum jelly to hold in place. Locate and mark the four counter beamed holes in the face of the housing (7). This is for identification later in the assembly.
4. Install thrust spacer (25) into the bore of the spindle (1). This should be a slip fit and the thrust spacer should rotate in this location.
5. Place carrier assembly (14) on a flat surface with the cluster gears (19) up. Find the punch marked tooth on each large gear and locate at 12 o'clock (straight up) from each planet pin.
6. With shoulder side of ring gear (21) facing down, place ring gear over (into mesh with) large gears. Be sure that punch marks remain in correct location during installation. The side of the ring gear with an "X" stamped on it should be up.
7. While holding ring gear (21) and cluster gears (19) in mesh, place small side of cluster gears into mesh with the internal gear (13) and input gear (24). On the ring gear, locate the hole marked "X" over one of the marked counter bored holes in assembly (7).

Note

If gears do not mesh easily or carrier assembly does not rotate freely, then remove the carrier and ring gear and check the cluster gear timing.

8. Install input gear (24) meshing with the teeth of the large diameter cluster gear (19). The counterbore on the input gear (24) locates on the shoulder of the input spacer (25). This is to be a slip fit and should operate freely.
9. Install thrust washer (26) onto the input gear (24) and should locate on the gear teeth shoulder.
10. Install thrust washer (27) into the counterbore of the carrier.
11. Place o-ring (22) into input cover (23) counterbore. Use petroleum jelly to hold o-ring in place.



1. Spindle
2. Lip Seal
3. Outer Bearing Cup
4. Outer Bearing Cone
5. Inner Bearing Cup
6. Inner Bearing Cone
7. Housing
8. Thrust Washer
9. Retaining Ring
10. Pipe Plug
11. Wheel Stud
12. Pipe Plug
13. Internal Gear
14. Carrier Assembly
15. Tanged Thrust Washer
16. Needle Bearing
17. Thrust Spacer
18. Planet Shaft
19. Cluster Gear
20. Rollpin
21. Ring Gear
22. O-Ring
23. Input Cover
24. Input Gear
25. Input Spacer
26. Thrust Washer
27. Thrust Washer
28. Hex Bolt
29. Shoulder Bolt
30. Pipe Plug

Figure 2-31. Drive Torque Hub Assembly.

12. Install the input cover (23) on this assembly. Taking care to correctly align pipe plug hole (30) with those in the housing (7), usually 90 degrees to one another, locate the four counterbore holes in housing (7), marked in step (3) and install four shoulder bolts (29). A tap with a hammer may be necessary to align shoulder bolt with hub counterbore.
13. Install bolts (28) into remaining holes.
14. Pipe plugs (30) are to be installed into input cover (23) using a lubricant seal.
15. Torque bolts (28 and 29) to 23 - 27 ft. lbs. (31- 36 Nm).
16. Fill unit one-half full with EP90 lubricant.

2-16. DRIVE BRAKE - MICO.

(See Figure 2-32.)

• Disassembly.

1. With shaft protrusion downward, remove end cover (13) by removing capscrews (12).

⚠ CAUTION

END COVER IS UNDER SPRING TENSION OF APPROXIMATELY 2000 POUNDS (681 KG). THE FOUR CAPSCREWS SHOULD BE LOOSENED EVENLY TO RELIEVE THIS FORCE. IF A HYDRAULIC PRESS IS AVAILABLE (3000 LBS (1362 KG) MAXIMUM), THE COVER CAN BE HELD IN POSITION WHILE REMOVING THE CAPSCREWS AND LOCKWASHERS.

2. Remove case seal (11) from housing (7) then remove bleeder screw (14) from end cover (13).
3. Remove piston (24) from end cover (13).
4. Remove o-ring (19), back-up ring (18), o-ring (21) and back-up ring (20) from piston (24).
5. Remove separators (10) from housing (7).
6. Remove stack assembly, consisting of discs (23), return plate (8) and friction discs (22) from housing (7).
7. Remove dowel pins (17), springs (5 & 6) from housing (7).
8. Remove retaining ring (3) from housing (7).
9. Remove shaft by pressing or using a soft mallet on male end of shaft (4).
10. Remove retaining ring (15) and bearing (2) from shaft (4).
11. Press rotary seal (1) from housing (7).

• Inspection.

1. Clean all parts thoroughly.
2. Closely inspect all parts for excessive wear, cracks and chips. Replace parts as necessary.
3. Discard seals and o-rings.
4. Closely inspect bearings and bearing contact surfaces. Replace as necessary.

Note

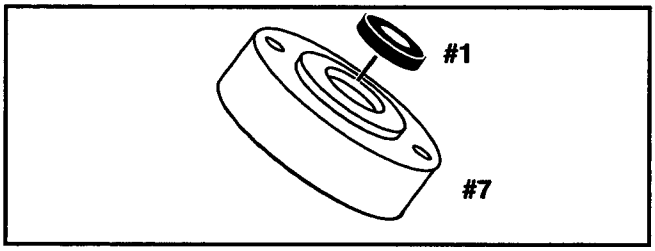
Bearings may be reused if, after thorough inspection, they are inspection, they are found to be in good condition.

• Assembly.

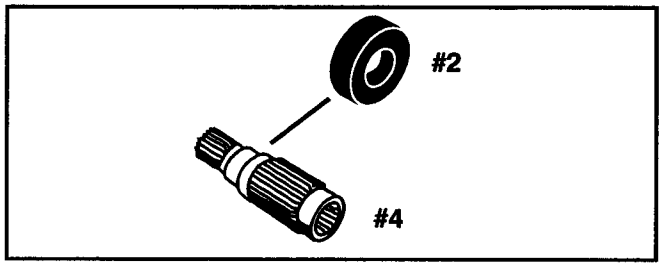
Note

Lubricate all seals and o-rings with clean hydraulic oil prior to assembly.

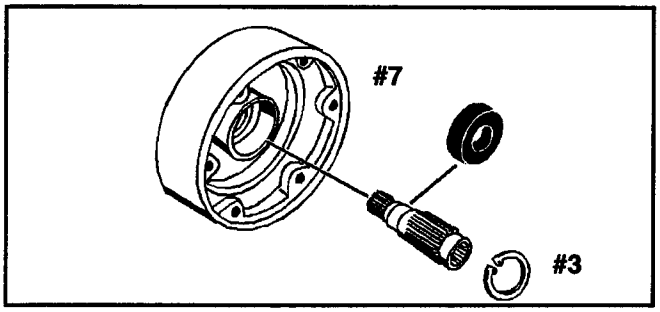
1. Press new rotary seal (1) into housing (7). Note the direction of seal.



2. Install new bearing (2) on shaft (4).



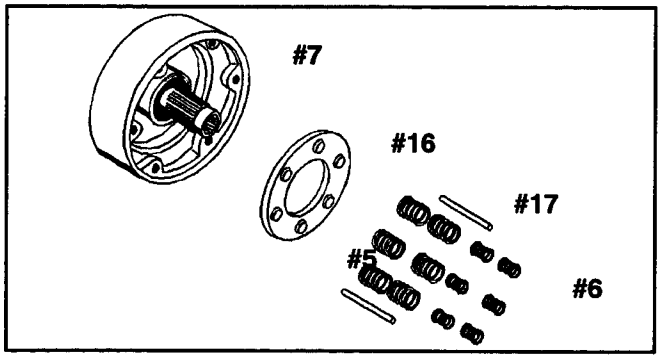
3. Install shaft assembly and retaining ring (3) into housing (7).



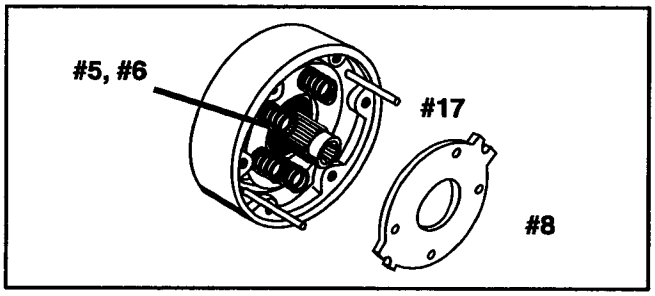
4. Install dowel pins (17), spring retainer (16), and springs (5 & 6) into housing (7).

Note

Be sure to use the same number of springs and spring pattern as recorded during disassembly.



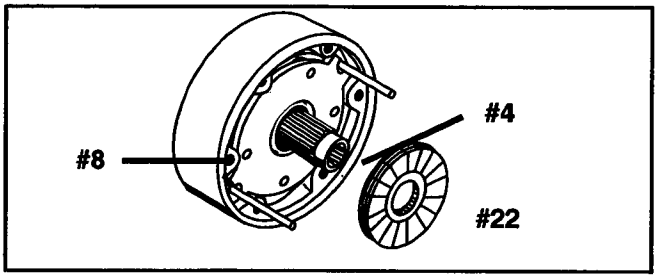
5. Position new large diameter return plate (8) in housing with tabs guided by dowel pins (17) until disc rests on springs (5 & 6).



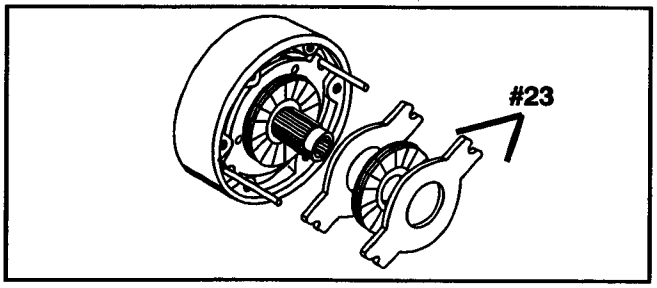
Note

Discs (8 & 23) and friction discs (22) should remain dry during installation. No oil should contaminate disc surfaces.

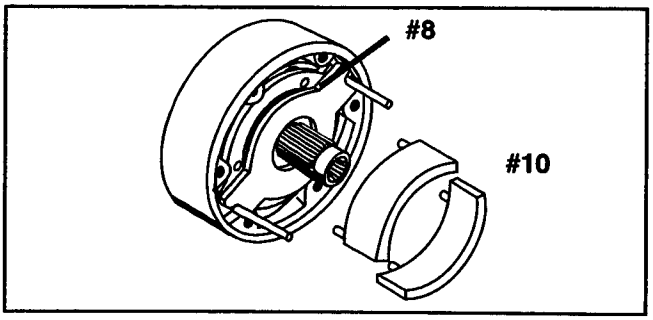
6. Place new disc (22) on shaft (4) until it contacts return plate (8).



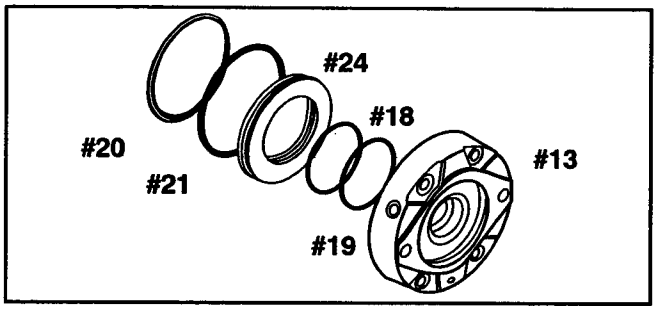
7. Add additional discs (23) as required to complete assembly.



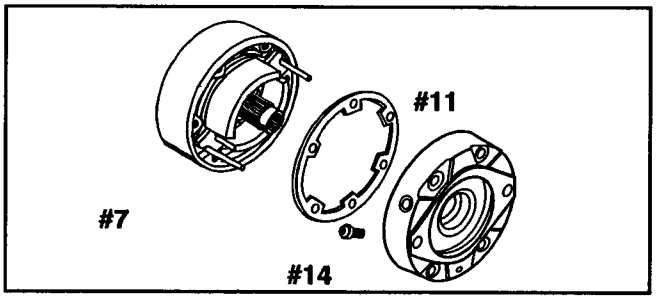
8. Insert separators (10) in holes of return plate (8).



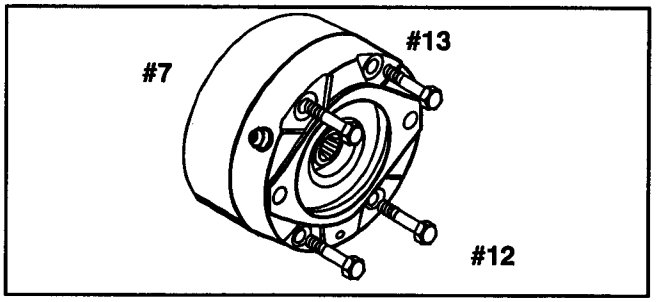
9. Install new o-ring (19), new back-up ring (18), new o-ring (20) and new back-up ring (21) on piston (24). Insert piston (24) into end cover (13), being careful not to shear o-rings or back-up rings.



10. Install new case seal (11) in housing (7) then install bleeder screw (14) in end cover.



11. Position end cover (13) on housing (7) aligning dowel pins (17) with holes in end cover.



12. Insert capscrews (12) and tighten evenly to draw end cover (13) to housing (7). Torque capscrews to 55 ft. lbs. (75 Nm).

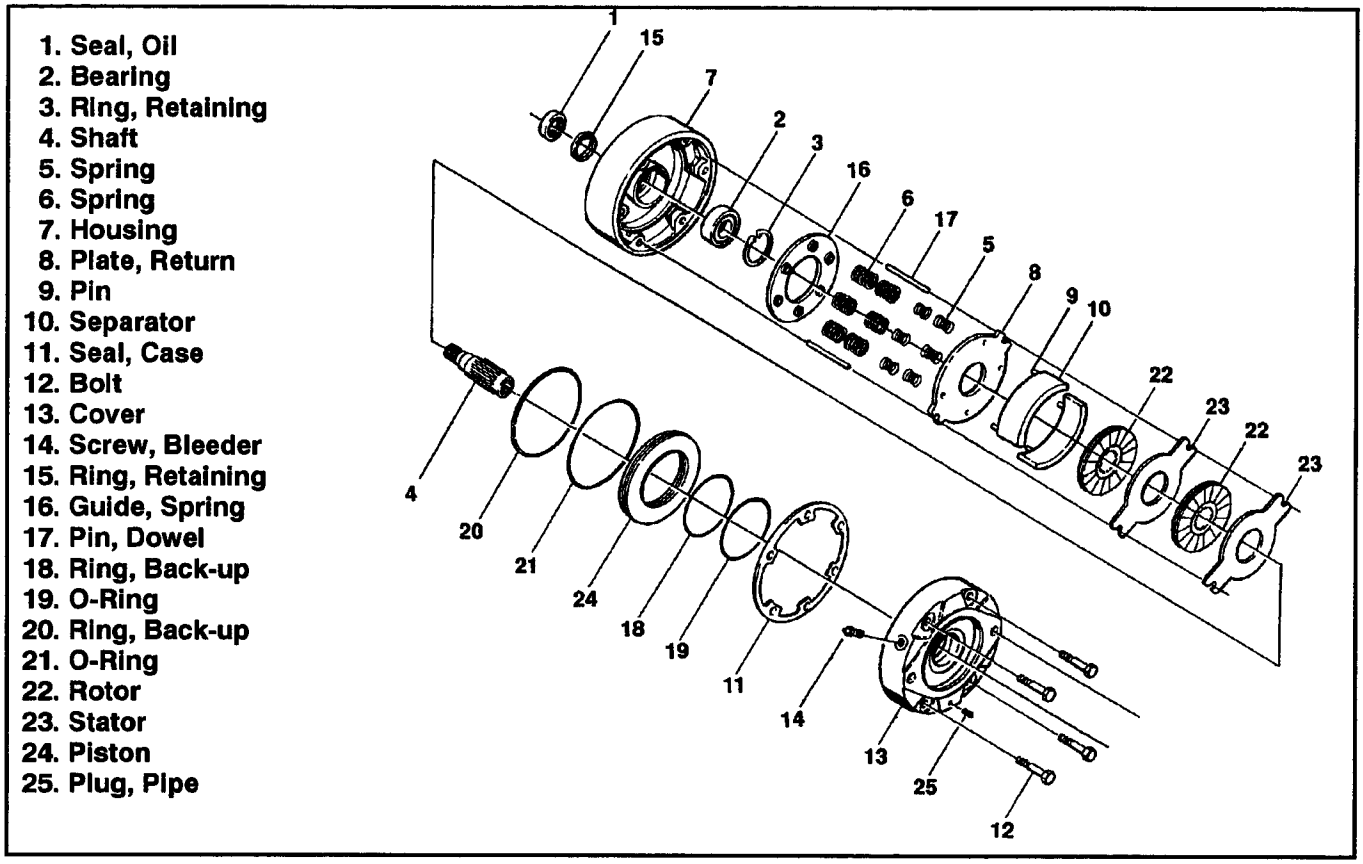


Figure 2-32. Drive Brake Assembly. (Mico)

2-17. MID AND LOWER LIFT CYLINDER BLEEDING PROCEDURE.

Note

Bleeding procedure should only be necessary if rebuilding or replacing lift cylinder.

1. Check oil level in the hydraulic oil tank (all booms must be retracted). See Figure 2-33 for location of bleeder fitting in pilot port "P" at rod end of mid cylinder.
2. Lay an oil drip pan under the rod end port block (Mid Cylinder) and crack bleeder open from the fitting in the port block.
3. From the platform, turn the speed control knob to the slow position.
4. Lift up very slowly. This will force any air out of the circuit. If the lower boom is not extending, turn the speed control up very slowly until the lower boom starts to move.
5. Raise the lower boom approx. 1 foot (30.48mm), then close bleeder while the boom is still moving.
6. Lift down all the way.
7. Repeat this procedure until all air has been purged from the circuit. Re-check the hydraulic oil level.
8. To test, cycle the lower lift function 3-4 times to see if both cylinders stop at the same time when fully extended.

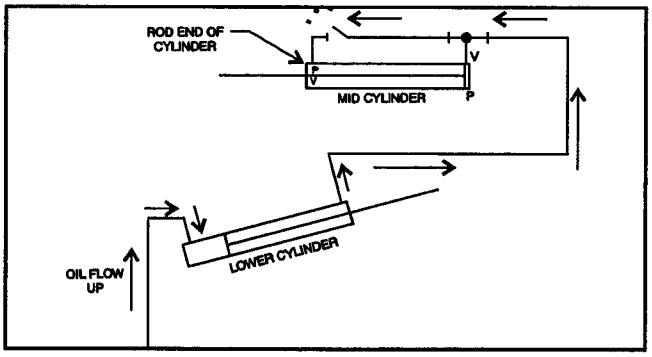


Figure 2-33. Port "P" Location.

2-18. BOOM SYNCHRONIZING PROCEDURE.

Note

If the Lower Boom assembly does not fully lower:

1. Remove all personnel from the platform.
2. Pull the red knob located under the main control valve.
3. From Ground Control, activate the lift control switch, raise Lower Boom 6 feet (1.83m).
4. After raising Lower Boom, release the red knob.
5. Activate Lower Boom Down, fully lower boom.
6. Repeat steps 1 thru 5 if necessary.

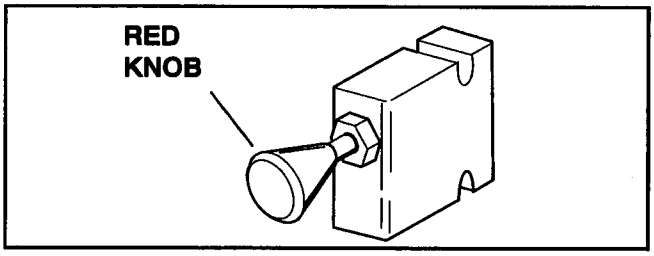


Figure 2-34. Synchronizing Valve.

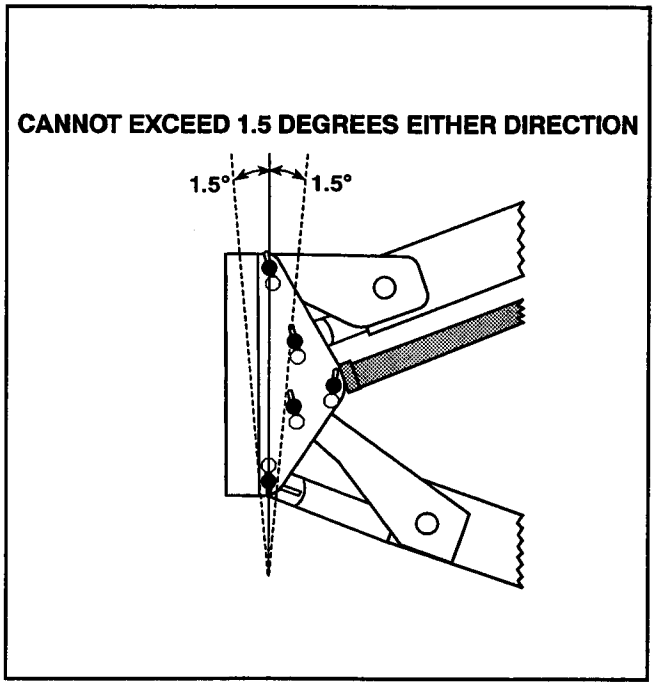


Figure 2-35. Upright Leveling.

2-19. FREE WHEELING PROCEDURE.

Use the following procedures ONLY for emergency movement to a suitable maintenance area. (See Figure 2-36.)

1. Chock wheels securely.
2. Locate brake release valve knob on the left side of frame behind drive wheel. Turn knob CCW to open.
3. Located beside brake release knob is a pop valve, push pop valve in.
4. After pushing pop valve in, pump the manual descent pump to release brakes.
5. Connect suitable equipment, remove chocks, and move machine.

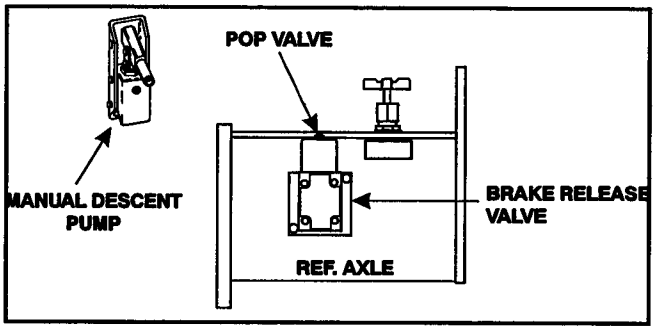


Figure 2-36. Brake Release.

2-20. CONTROL CARD SETUP PROCEDURES.

Note

Before starting this adjustment procedures all hydraulic relief pressure settings and engine Rpm's should be set, and the engine should be warmed-up to a normal operating temperature.

• Flow Card.

A. Set the valve card outputs for the given values at the control knob input points.

SETUP:

- EMS on at Ground Control.
- Selector at Ground Control set for Platform.
- EMS on at Platform.
- Do not start engine, make these settings with the engine off.
- Depress Footswitch. This will Enable the control box for 7 seconds. To continue to work for longer periods of time, hold a function switch on, such as Tele IN.

B. Set the minimum output first:

- Adjust the MIN A pot #4 for 0.8 amps with the control knob at the creep position. Measure current at terminal #11 BRN/BLK wire.
- Adjust the MAX A pot #3 for 1.4 amps with the control knob at the Maximum clockwise position.
- Adjust the RAMP UP pot #1 for 3.0 seconds from off to MAX output.

C. The minimum speed setting will affect the SWING function the most.

- With the engine running, check the operation of the swing function. Adjust the RAMP UP pot #1 for a smooth start of motion. Clockwise increases ramp time. If the function does not move at creep increase the MIN A pot #4. Clockwise increases current, increases speed.

Note

The other functions should just be moving very slowly at this low setting. Changing the MIN pot affects the MAX setting. If changes have to be made, check/reset the MAX pot.

D. Check/verify the function times against the MACHINE FUNCTION SPEED SPECIFICATIONS first. If the MAX A setting is "good" the speed will be slightly slower, and no further adjustments will be required. If turning the control knob back from fully clockwise does not reduce the function speed, then MAX A needs to be adjusted counter-clockwise to reduce the output current/speed. Check the speeds again to verify.

Note

The pressure settings and engine Rpm's will effect the speed of the boom functions they should be set prior to these adjustments.

• Initialize the Drive Card.

A. Bypass the Horsepower card.

- Disconnect the HP card and connect the Bypass plug. This supplies +5vdc for the drive pot from pin #8 of the valve card.

SETUP:

- EMS on at Ground Control.
- Selector at Ground Control set for Platform.
- EMS on at Platform.
- Do not start engine, make these settings with the engine off.
- Depress Footswitch. This will Enable the control box for 7 seconds. To continue to work for longer periods of time, hold a function switch on, such as Steer.

B. Set the drive valve card outputs for the given values at the various controller input points.

- LED's #1 and #2 should be lit, indicating 100% output - boom below horizontal and the creep switch **not** activated.
- Set the forward direction first:
- Adjust the MIN A pot #4 for .37 amps with the controller at a "JUST ON" point forward. Measure current at terminal #21 BRN/BLU wire.
- Adjust the MAX A pot #3 for 1.05 amps with the controller at the Maximum forward point.
- Adjust the RAMP UP pot #1 for 4.0 seconds/20 turns CW from off to MAX output.
- Adjust the RAMP DOWN pot #2 for 2.0 seconds/15 turns CW from MAX to off.

- Repeat for the reverse direction:
- Adjust the MIN B pot #8 for .37 amps with the controller at a "JUST ON" point reverse. Measure current at terminal #16 BRN/RED wire.
- Adjust the MAX B pot #7 for 1.05 amps with the controller at the Maximum reverse point.
- Adjust the RAMP UP pot #1 for 4.0 seconds/20 turns CW from off to MAX output.
- Adjust the RAMP DOWN pot #2 for 2.0 seconds/15 turns CW from MAX to off.

• Verify the Drive Card.

A. Reconnect the horsepower card.

B. With the engine running, check the operation of the drive function with the HP card connected.

- If necessary adjust MIN A and MIN B, pot #4 and #8 for a smooth drive start in both directions.

Note

Changing the MIN pots affects the MAX settings. If changes have to made check/reset the MAX pots. With the HP card the MAX output current will be 1.2 Amps not just 1.05 Amps.

C. Full speed on level ground will be affected by the MAX pot settings.

- Check/verify the drive speed against the MACHINE FUNCTION SPEED SPECIFICATIONS first. Then check the drive speed with the controller fully on again with the controller turned back some. If the MAX settings are "good" the speed will be slightly slower, and no further adjustments will be required. If turning the controller down fully on does not reduce the function speed, then MAX A needs to be adjusted counterclockwise to reduce the output current/speed. Check the speeds again to verify. Repeat for both directions - the adjustments are independent.

Note

After all final adjustments have been made, seal all pots on control cards with finger nail polish.

• Horsepower Card.

A. Check the voltage output of the HP card by connecting a volt meter's red lead on the "L" terminal and the black lead on the "MO" terminal. With the engine idling the voltage will be about -3.8vdc. When the engine is brought up to HIGH the voltage should be +2vdc. If not the HP card is not set properly or is defective. Have the settings checked or replace as deemed necessary.

Note

Do not adjust horsepower card, this card is factory set.

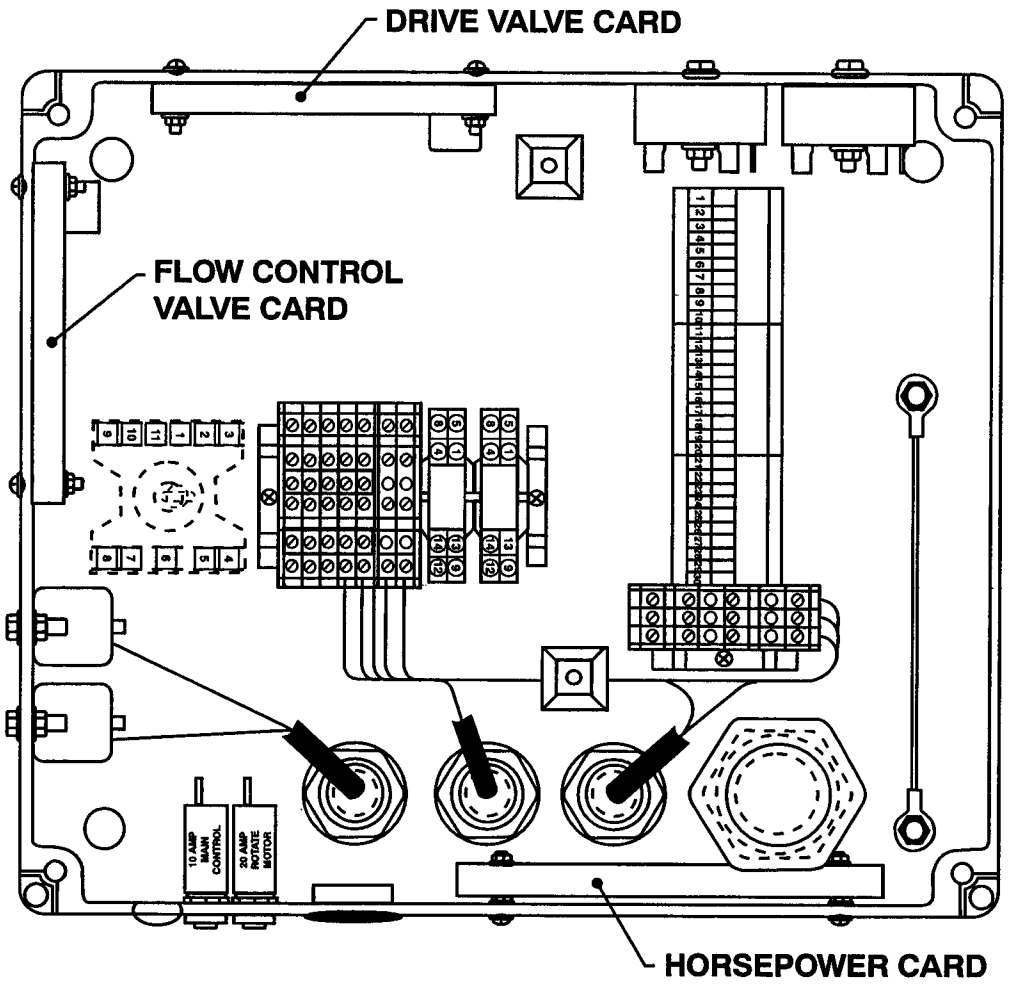
2-21. CHECK THE OPERATION OF THE UNIT.

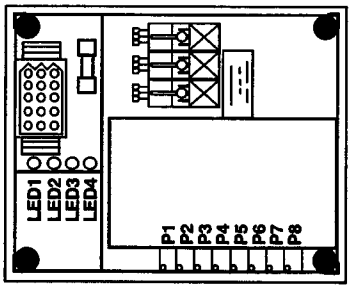
• Drive Function.

THINGS TO CHECK FOR:	IF NOT SATISFACTORY ADJUST DRIVE CARD:
Level ground operation:	
Smooth starts and stops.	MIN and RAMP pots.
Full speed.	MAX pots.
Ramping:	
From driving slowly to full speed.	RAMP UP pots.
From full speed to a stop.	RAMP DOWN pots.
Several transitions need to be checked:	
From level ground to various grades.	HP card.
From various grades to level ground.	HP card.
The engine should not stall.	HP card.
The unit should be able to climb grades up to 25%.	HP card.
The engine Rpm should not oscillate more than 2 or 3 times when making the transitions.	HP card.

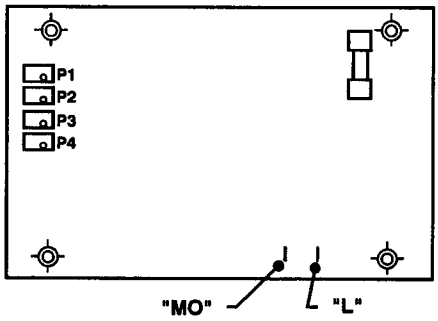
• Flow Control Functions.

THINGS TO CHECK FOR:	IF NOT SATISFACTORY ADJUST FLOW CARD:
Level ground operation:	
Smooth starts and stops.	MIN and RAMP pots.
Full speed. Refer to: MACHINE FUNCTION SPEED SPECIFICATIONS	MAX pot.
Ramping:	
Chattering when a function is activated.	RAMP UP pot.
Excessive delay to full speed.	RAMP UP pot.
Excessive delay from full speed.	RAMP DOWN pot.





DRIVE VALVE CARD
AND
FLOW CONTROL VALVE CARD



HORSEPOWER CARD

Figure 2-37. Control Box Layout.

2-22. ELECTRICAL CIRCUITS.

• Throttle Position Control.

The throttle position is controlled by an Addco 5 position ERC controller and Actuator. The engines are used at two throttle settings, MID (approximately 2000 RPM) and HIGH (3050 RPM Diesel and 3200 RPM Gas/DF). The ground controls run at MID only, whenever the ground controls are selected, MID engine is enabled. From the platform, the engine will idle until the footswitch is depressed, then MID engine is activated. Drive is the only function that activates HIGH engine, and only when the unit is in the travel position (boom below horizontal).

Note

During start from the ground controls, MID engine is locked-out to aid starting.

• Drive Speed.

The drive speed of the unit is automatically shifted into high (100%) when in the travel position (Boom below horizontal) and within 9 degrees from level. This can be over-ridden by the creep/snail switch for better maneuverability if desired. When the boom is above horizontal, the maximum drive speed is limited to 45%. There are options for drive interlocks when above horizontal, and above horizontal and tilted. See the attached charts for details.

STANDARD DRIVE SPEED CHARTS			
Conditions	PIN #2	PIN #3	OUTPUT
Below Elevation	+12VDC	+12VDC	100%
Below and In Creep or Over 9 degrees	+12VDC	0VDC	45%
Above Elevation	+12VDC	0VDC	45%

OPTIONAL ABOVE ELEVATION & TILTED DRIVE CUTOUT CHARTS			
Conditions	PIN #2	PIN #3	OUTPUT
Below Elevation	+12VDC	+12VDC	100%
Below and In Creep or Over 9 degrees	+12VDC	0VDC	45%
Above and Level	+12VDC	0VDC	45%
Above & Tilted (3 or 5 degrees)	0VDC	0VDC	0%

OPTIONAL ABOVE ELEVATION DRIVE CUTOUT CHARTS			
Conditions	PIN #2	PIN #3	OUTPUT
Below Elevation	+12VDC	+12VDC	100%
Below and In Creep or Over 9 degrees	+12VDC	0VDC	45%
Above Elevation	0VDC	0VDC	0%

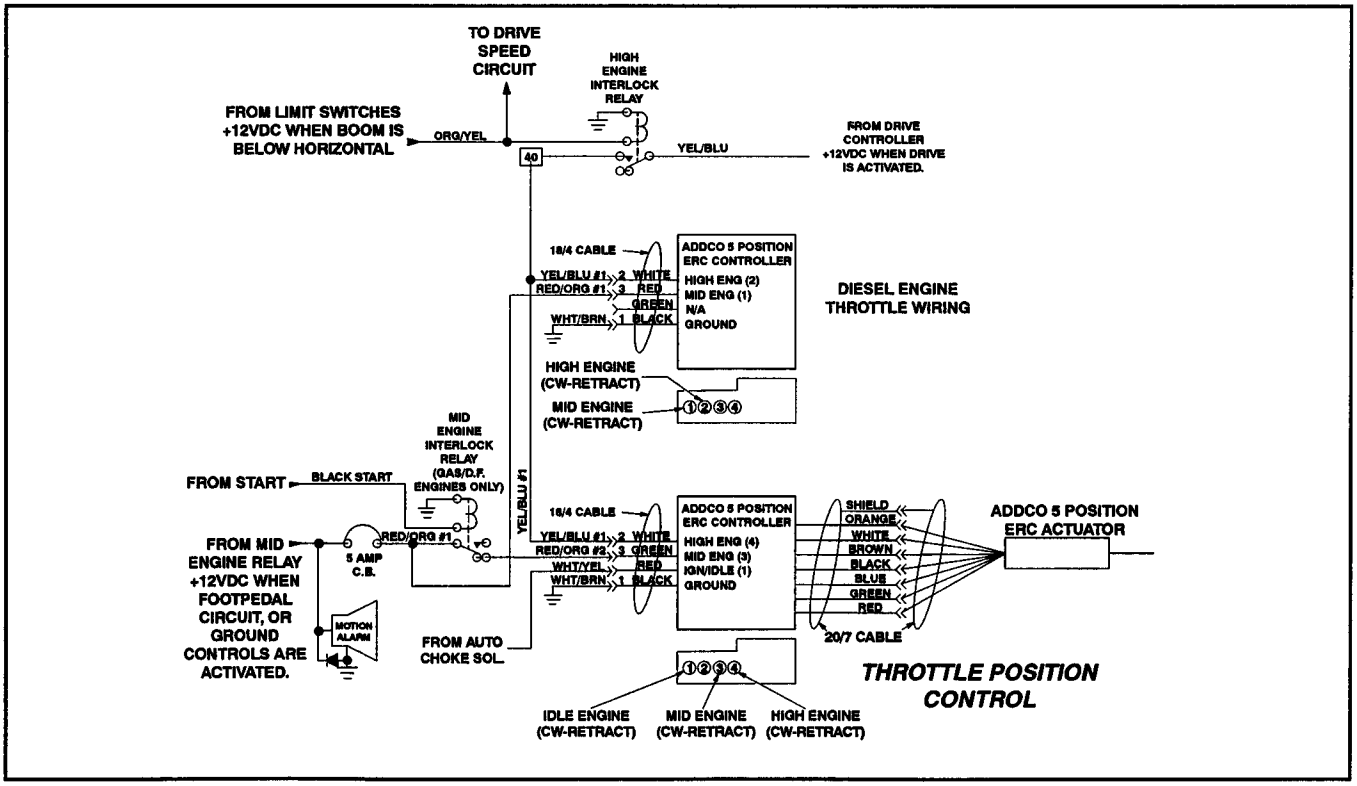


Figure 2-38. Throttle Electrical Circuit.

• Tilt Sensor Circuit.

There are two trip points in the sensor for these units. The first trip point is 5 degrees. This trip point lights a red light on the platform control console when in the travel position (Boom below horizontal). This trip point is direct, without any time delay, so it indicates the level of the unit instantly. However, it will also indicate any acceleration forces such as driving over rough terrain. An optional above horizontal tilt alarm is available.

The drive speed of the unit is automatically controlled by the high trip point which is 9 degrees, If the unit is driven on a grade over 15 % the drive is shifted down to 45% instantly. After the unit is returned to a grade less than 15% there is a time delay of four seconds to prevent having the unit jump in and out of high drive.

• Horsepower Control.

The drive system consists of a closed loop control that is intended to keep the engine from stalling as the unit is driven over different grades. The system monitors the RPM of the engine and the drive controller input, and will control the output to the drive valves. When the unit is driven up a grade the engine will become loaded and the RPM will drop. The horsepower control module will lower the voltage output to the drive controller, which will lower the given input to the drive control module, which will lower the output to the drive valves, which in turn will decrease the load that the engine sees.

The attached curves show the output of the horsepower control module compared to engine RPM. The output starts to limit at approximately 2800 RPM and does not allow the engine to go much below 2400 RPM. While driving on the grade the pressure in the hydraulic system will increase compared to level ground. The output to the drive valves will become limited and reduce the flow from the drive pump, reducing the load on the engine.

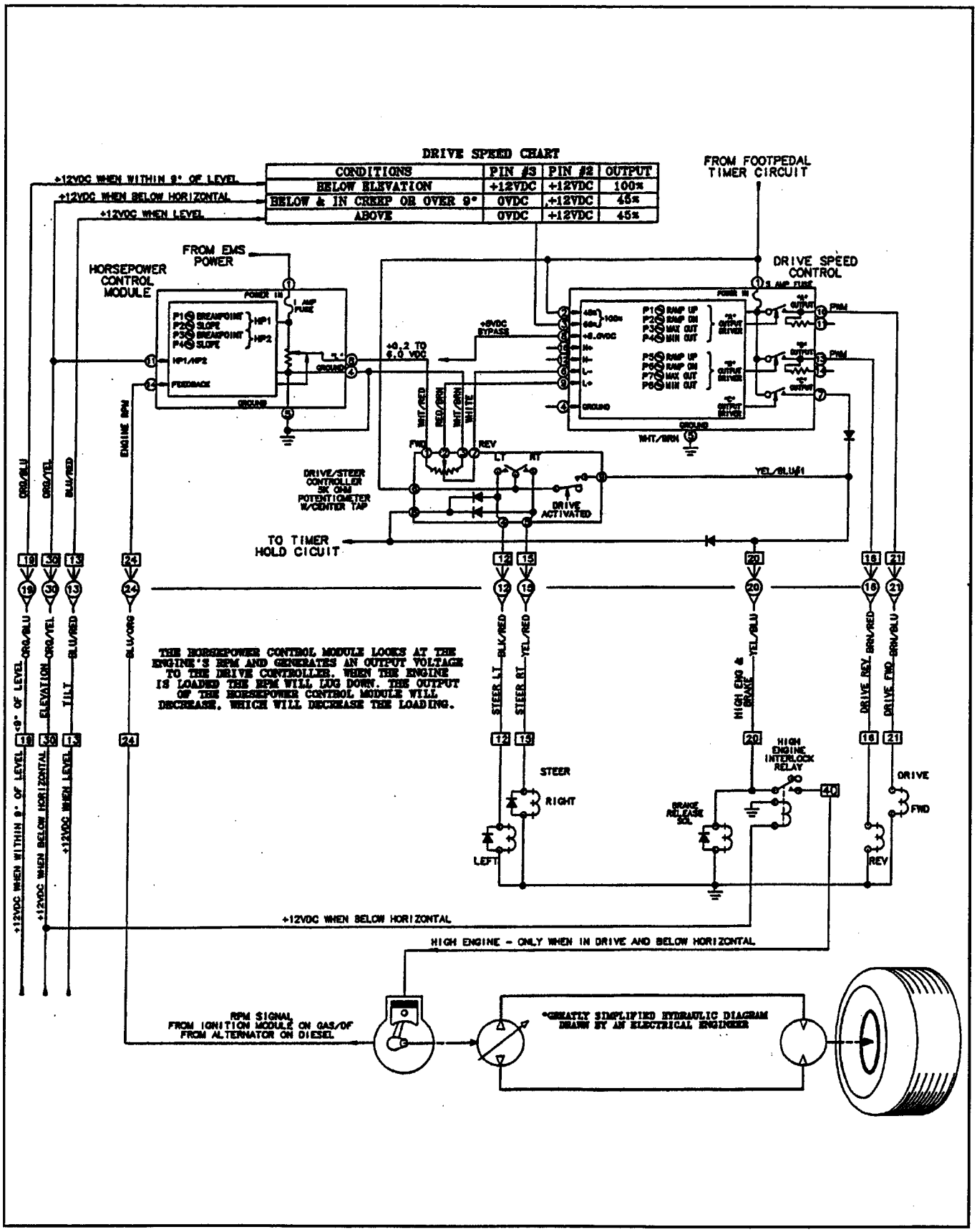
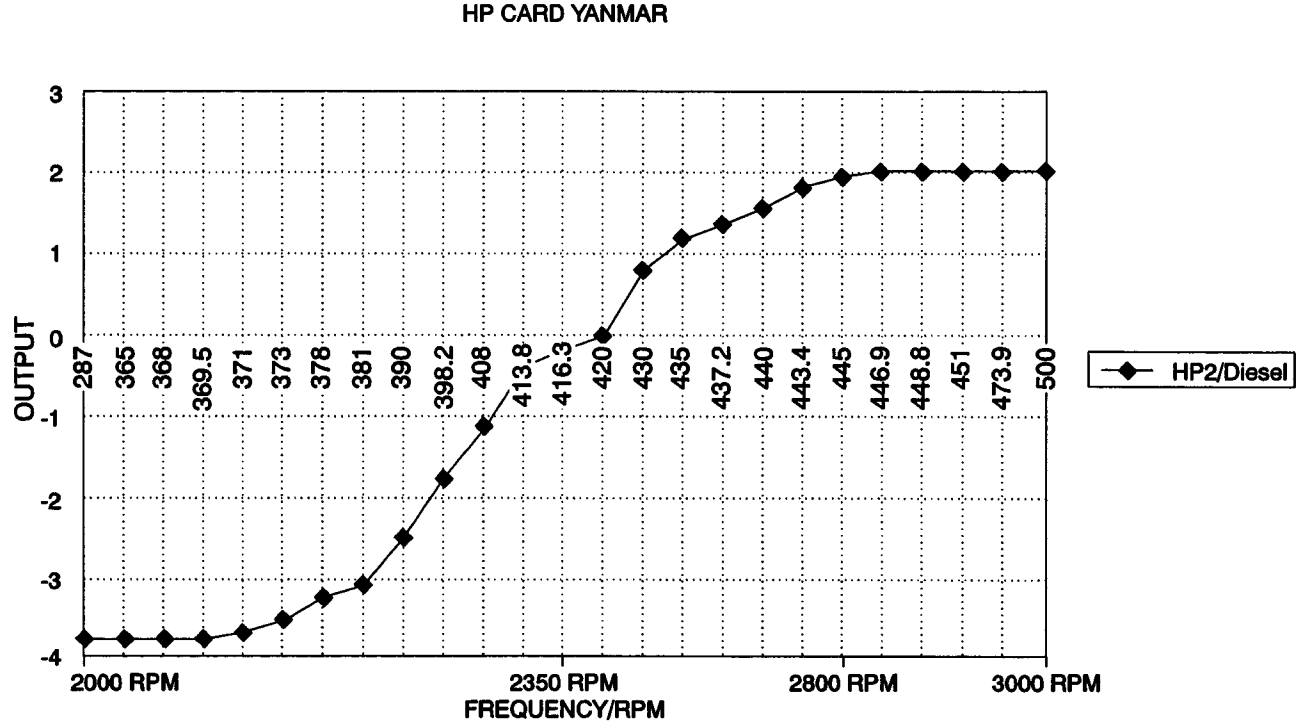


Figure 2-39. Drive System Control Circuit With Horsepower Control.



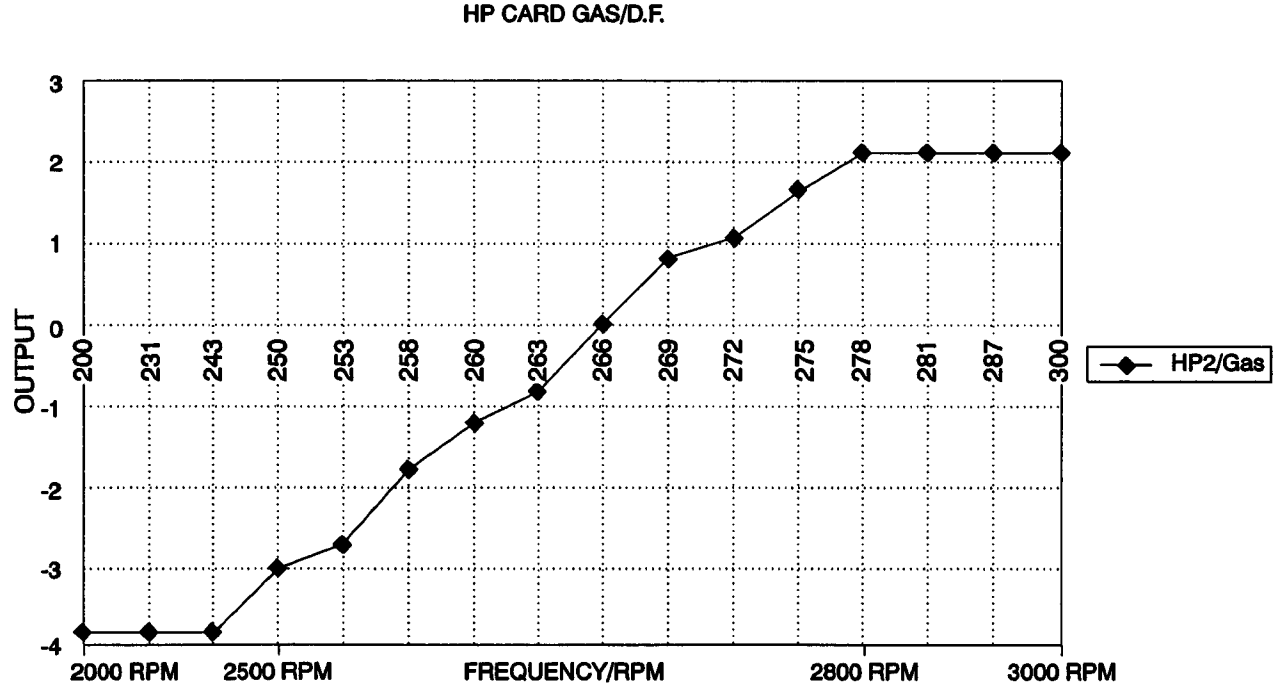


Figure 2-40. Horsepower Control Module Compared To Engine RPM.

• Anti-Restart Circuit.

The machines are equipped with an Anti-Restart Circuit. It is intended to prevent the starter from being activated while the engine is running. This circuit uses the alternators lamp line to indicate whether the engine is running or not. When the lamp line is low (0-2vdc), the alternator is not being turned/not charging. The starter can be activated in this condition. When the engine is running, the lamp line will be high (+12vdc), and the starter can not be activated. To prevent the starter from chattering when the alternator is being "spun" during start, an interlock relay has been incorporated. This circuit feature will aid cold weather starting.

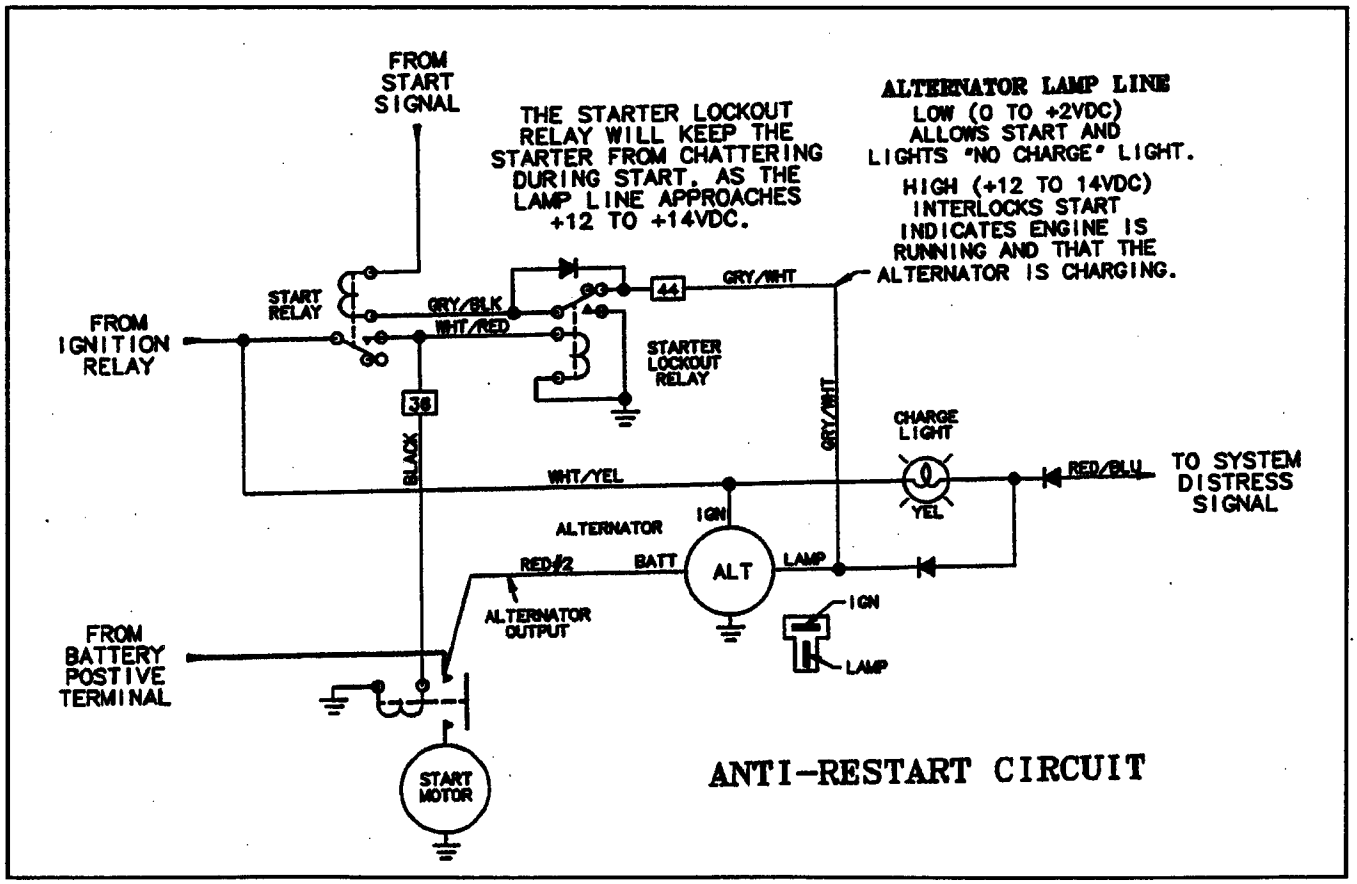


Figure 2-41. Anti-Restart Electrical Circuit.

• GAS/LP Select Circuit.

The gas engine is available with LP, and the circuit shown below is intended to clarify the how that option works along with the other engine wiring. The LP switch is located in the platform control console and energizes a relay at the engine when selected. An oil pressure switch controls the activation of the LP solenoid or the gas fuel pump and carburetor, depending on which is selected. The LP solenoid or gas fuel pump and carburetor are not powered on initial ignition, but when started. When the engine starts, the oil pressure comes, up the circuit switches to ignition. If the oil pressure should drop, the selected fuel would be shut off protecting the engine.

• Anti-Backfire Circuit.

To avoid backfire, the power to the selected fuel is shut off immediately with the Platform EMS, or the Platform/Ground control selector switch at the ground control. The ignition module and coils are powered on initial ignition, through the normally closed circuit of the oil pressure switch. When the engine starts and the oil pressure comes up, the circuit switches to power from the lower EMS switch. The power remains on to the ignition module and coils until the oil pressure drops. This happens after all the fuel in the manifold is spent.

2-23. FOOTSWITCH ADJUSTMENT.

Adjust switch so that functions will operate when pedal is at center of travel. If switch operates within last 1/4 inch (6.35 mm) of travel, top or bottom, it should be adjusted.

2-24. DUAL FUEL SYSTEM.

⚠ CAUTION

IT IS POSSIBLE TO SWITCH FROM ONE FUEL SOURCE TO THE OTHER WITHOUT ALLOWING THE ENGINE TO STOP. EXTREME CARE MUST BE TAKEN AND THE FOLLOWING INSTRUCTIONS MUST BE FOLLOWED.

• Changing from Gasoline to LP Gas.

1. Start the engine from the Ground Control Station.
2. Open the hand valve on the LP gas supply tank by turning counterclockwise.
3. While the engine is operating on GASOLINE under a no-load condition, place FUEL SELECT switch at Platform Control Station to LP position.

• Changing from LP Gas to Gasoline.

1. With engine operating on LP under a no load condition, position FUEL SELECT switch at the Platform Control Station to "Gasoline" position.

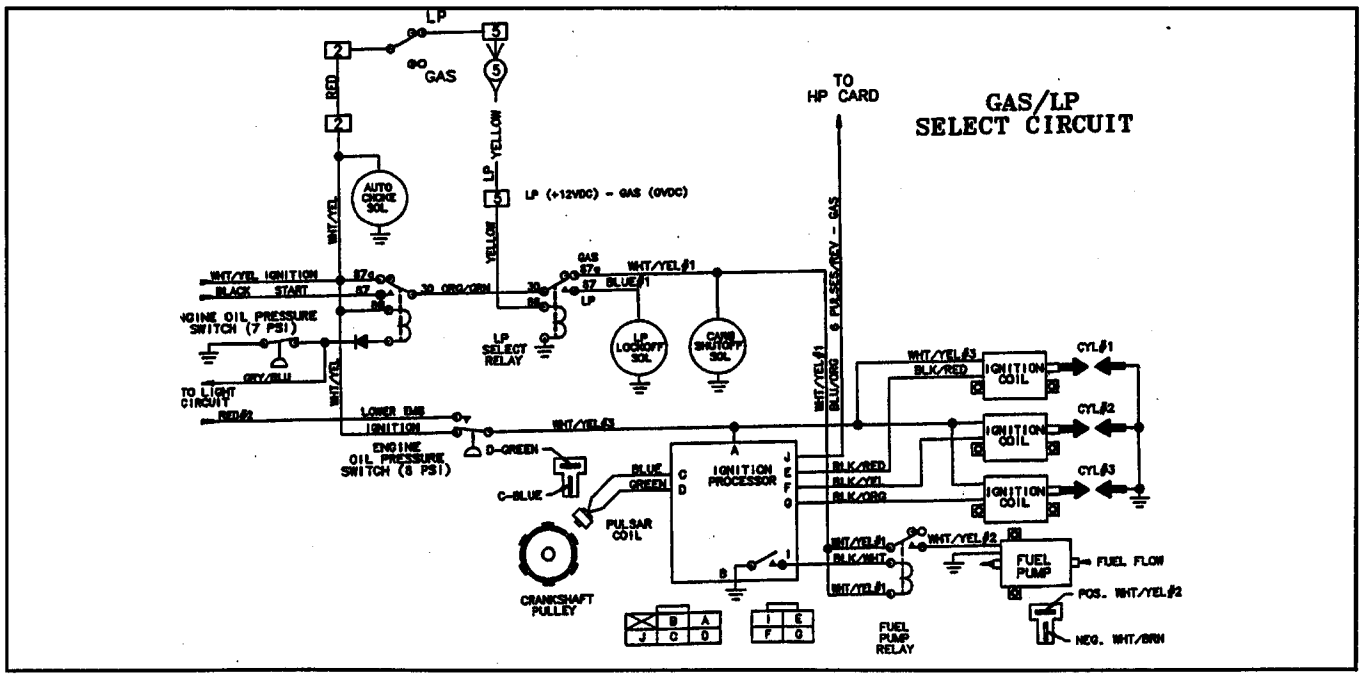


Figure 2-42. Gas/Lp Select Electrical Circuit.

2. Close the hand valve on the LP gas supply tank by turning clockwise.

2-25. THROTTLE CHECKS AND ADJUSTMENT. (SEE FIGURE 2-43.)

• Gas Engine

1. Remove engine hood to gain access to RPM adjustments.
2. Disconnect wire harness from ADDCO, install JLG wire harness kit #4921850 to the ADDCO and engine harness as shown in diagram below. Start the engine and allow it to come up to operating temperature. Adjust IDLE engine pot #1 on ADDCO CW, retract actuator (lower), or CCW, extend actuator (higher), until IDLE engine runs at 1500 RPM.
3. Position toggle switch to MID engine. Adjust MID #3 engine pot on ADDCO CW, retract actuator (lower), or CCW, extend actuator (higher), until MID engine runs at 2000 RPM.
4. Position toggle switch to HIGH engine. Adjust HIGH #4 engine pot on ADDCO CW, retract actuator (lower), or CCW, extend actuator (higher), until engine runs at 3200 RPM.

Note

Actuator cable travel must stop slightly before lever makes contact with throttle lever stop. Failure to do so will burn out actuator.

5. Remove adjustment harness and re-connect engine harness.

• Diesel Engine

Note

Never run the fuel tank dry. Diesel engines cannot be restarted after running out of fuel until fuel system has been air-vented or 'bled' of air. See Yanmar Instruction Manual for procedure.

1. Remove engine hood to gain access to RPM adjustments.
2. Disconnect wire harness from ADDCO, install JLG wire harness kit #4921850 to the ADDCO and engine harness as shown in diagram below. Start the engine and allow it to come up to operating temperature. Adjust IDLE screw CW (higher), or CCW (lower), until IDLE at 1500 RPM.
3. Position toggle switch to MID engine. Adjust MID #1 engine pot on ADDCO CCW, retract actuator (higher), or CW, extend actuator (lower), until MID engine runs at 2000 RPM.
4. Position toggle switch to HIGH engine. Adjust HIGH #2 engine pot on ADDCO CCW, retract actuator (higher), or CW, extend actuator (lower), until engine runs at 3050 RPM.

Note

Actuator cable travel must stop slightly before lever makes contact with throttle lever stop. Failure to do so will burn out actuator.

5. Remove adjustment harness and re-connect engine harness.

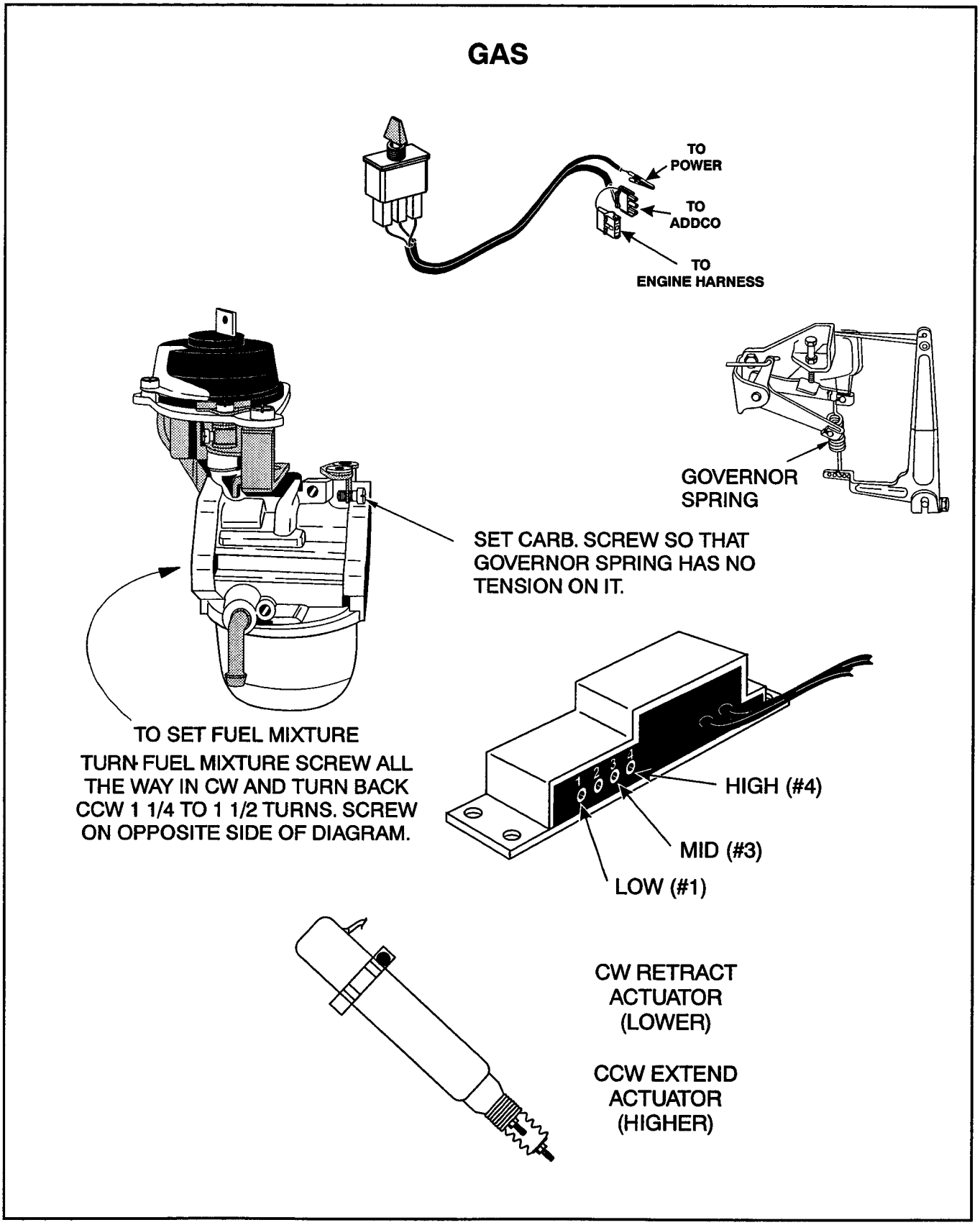
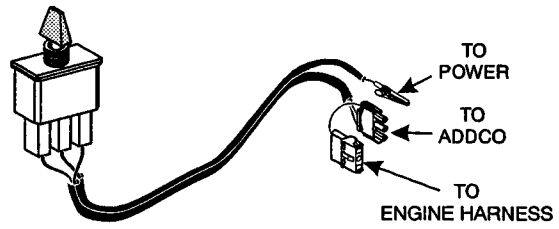
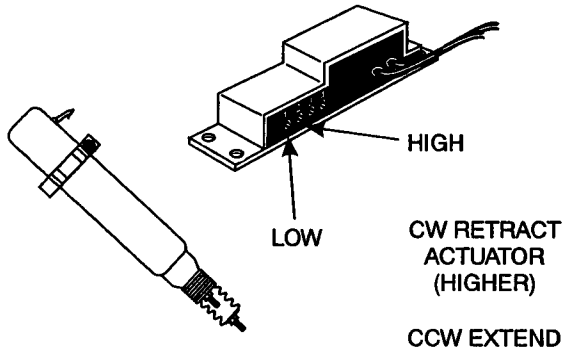


Figure 2-43. Addco Adjustments (Sheet 1 of 2).

DIESEL





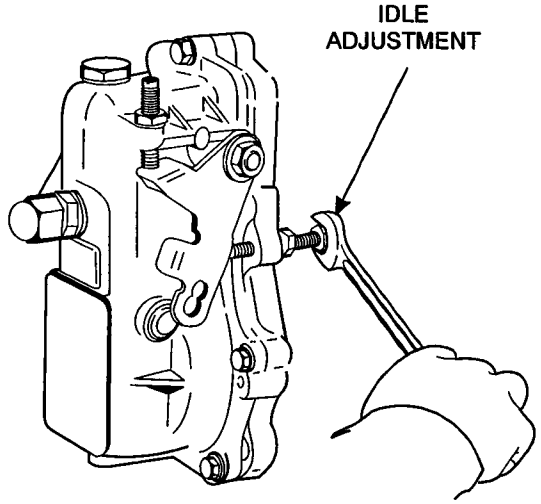
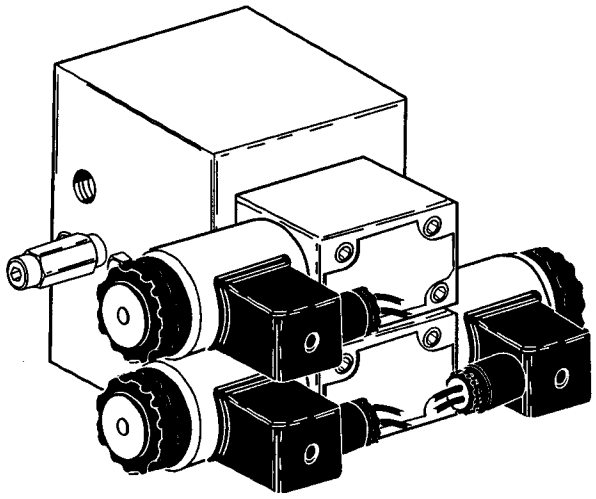
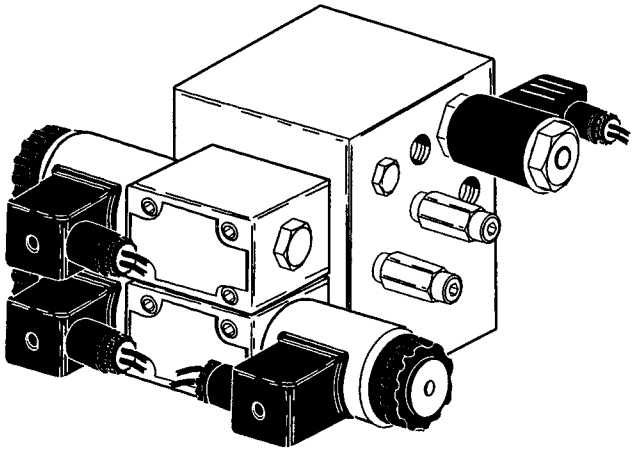


Figure 2-43. Addco Adjustments (Sheet 2 of 2).





1. Cartridge, Flow Control (Lower Lift Down)
2. Cartridge, Shuttle Valve. (Swing)
3. Cartridge, Check Valve. (Platform)
4. Cartridge, Relief Valve. (Platform Level)
5. Cartridge, Relief Valve. (Platform Level)
6. Cartridge, Solenoid Valve. (Platform Level)
7. Cartridge, Relief Valve. (Telescope)
8. Cartridge, Solenoid Valve. (Telescope)
9. Cartridge, Relief Valve. (Lower Lift Down)
10. Cartridge, Solenoid Valve. (Lift Down)
11. Cartridge, Valve. (Manual Descent)
12. Cartridge, Relief Valve. (Upper Lift Down)
13. Cartridge, Solenoid Valve. (Swing)
14. Cartridge, Relief Valve. (Swing)
15. Cartridge, Shuttle Valve. (Swing)

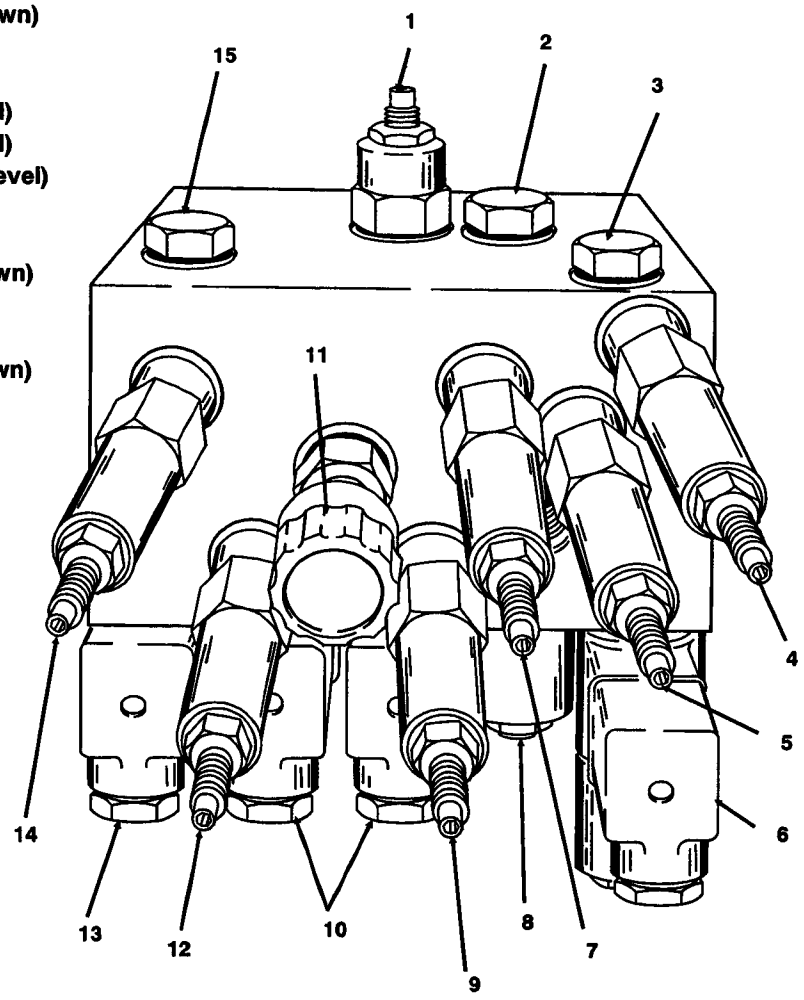


Figure 2-44. Cartridge Location.

2-26. PREVENTIVE MAINTENANCE AND INSPECTION SCHEDULE.

The preventive maintenance and inspection checks are listed and defined in the following table. This table is divided into two basic parts, the "AREA" to be inspected, and the "INTERVAL" at which the inspection is to take place. Under the "AREA" of the table, the various systems along with components that make up that system are listed. The "INTERVAL" portion of the table is divided into six columns representing the various inspection time periods. The numbers listed within the interval column represent the applicable inspection code for which that component is to be checked.

The checks and services listed in this schedule are not intended to replace any local or regional regulations that may pertain to this type of equipment nor should the lists be considered as all inclusive. Variances in interval times may occur due to climate and/or conditions and depending on the location and use of the machine.

JLG Industries requires that a complete annual inspection be performed in accordance with the "Annual Machine Inspection Report" form. Forms are supplied with each new machine and are also available from JLG Customer Service. Forms must be completed and returned to JLG Industries.

⚠ IMPORTANT

JLG INDUSTRIES REQUIRES THAT A COMPLETE ANNUAL INSPECTION BE PERFORMED IN ACCORDANCE WITH THE "ANNUAL MACHINE INSPECTION REPORT" FORM.

Note

This machine requires periodic safety and maintenance inspections by a JLG Dealer. A decal located on the turntable affords a place to record (stamp) inspection dates. Notify dealer if inspection is overdue.

The inspection and maintenance code numbers are as follows:

1. Check for proper and secure installation.
2. Check for visible damage and legibility.
3. Check for proper fluid level.
4. Check for any structural damage; cracked or broken welds; bent or warped surfaces.
5. Check for leakage.
6. Check for presence of excessive dirt or foreign material.
7. Check for proper operation and freedom of movement.
8. Check for excessive wear or damage.
9. Check for proper tightness and adjustment.
10. Drain, clean and refill.
11. Check for proper operation while engine is running.
12. Check for proper lubrication.
13. Check for evidence of scratches, nicks or rust and for straightness of rod.
14. Check for condition of element; replace as necessary.
15. Check for proper inflation.
16. Clean or replace suction screen.

Note

*** Inspection and Maintenance Code 10, 16 to be performed every two years.**

**** Inspection and Maintenance Code 10 to be performed every two years.**

***** Inspection and Maintenance Code 12 to be performed every two years.**

TABLE 8-3. PREVENTIVE MAINTENANCE AND INSPECTION SCHEDULE							
AREA		INTERVAL					
	BOOMS	DAILY	WEEKLY	MONTHLY	3 MONTH	6 MONTH	YEARLY
1.	Platform Gate	1, 4		12			
2.	Platform	1, 4					
3.	Platform Rotator	12	5, 11	8			
4.	Footswitch	1, 11					
5.	Controller	1, 11					
6.	Switches	1, 11					
7.	Placards and Decals	1, 2					
8.	Control Tags	1, 2					
9.	Hoses and Cables	1	4, 5, 8				
10.	Pins			8			
11.	Bushings			8			
12.	Wear Pads			8			
13.	Cylinders		1, 5, 6, 13				
	TURNTABLE						
1.	Gauges/Ground Controls	1, 2, 11					
2.	Valves	1, 11	5				
3.	Hydraulic Hoses	1	5				
4.	Shields	1					
5.	Limit Switches	1, 7					
6.	Placards and Decals	1, 2					
7.	Swing Bearing		1		9, 12		
8.	Swing Motor		1, 5, 6	8			
	CHASSIS						
1.	Engine Oil (See MFG. Manual)	3	5				
2.	Battery	3	5				
3.	Radiator	3	5				
4.	Air Cleaner	1	14				
5.	Exhaust System	1		1, 5			
6.	Engine Mount			1			
7.	Hydraulic Pump	1	5				
8.	Auxiliary Power Pump	1	5				
9.	Valves	1, 11	5				
10.	Hydraulic Filters	14	5				
11.	Hydraulic Hoses	1	5				
12.	Hydraulic Oil Tank*	3	5	4			
13.	Breather - Hydraulic Tank		6, 14				
14.	Fuel Tank	3, 5		4			
15.	Cylinders		1, 5, 6, 13	4			
16.	Hood Doors	1					
17.	Placards and Decals	1, 2					
18.	Swing Bearing/Worm Gear		1		9, 12		
19.	Wheel and Tire Assemblies	1	8, 9, 15				
20.	Drive Motors		1, 5, 6				
21.	Drive Torque Hubs **		1, 5, 6		3		
22.	Drive Brakes		1, 5, 6				
23.	Steer Components	1	4, 6	8			
24.	Front Axle Pin	1		8			
25.	Tilt Alarm Switch		1				
26.	Shields	1					
27.	Wheel Bearings ***			8			

3-1 GENERAL.

This section contains troubleshooting information to be used for locating and correcting most of the operating problems which may develop. If a problem should develop which is not presented in this section or which is not corrected by listed corrective actions, technically qualified guidance should be obtained before proceeding with any maintenance.

3-2 TROUBLESHOOTING INFORMATION.

The troubleshooting procedures applicable to the aerial platform are listed and defined in Tables 3-1 through 3-4. As an aid to table use, the aerial platform is divided into four major groups, each covered separately within this section. These groups are as follows: elevation system, chassis assembly, hydraulic system and electrical system.

Each malfunction within an individual group or system is followed by a listing of probable causes which will enable determination of the applicable remedial action. The probable causes and the remedial action should, where possible, be checked in the order listed in the tables.

It should be noted that there is no substitute for a thorough knowledge of the equipment and related systems.

It should be recognized that the majority of the problems arising in the machine will be centered in the hydraulic and electrical systems. For this reason, every effort has been made to ensure that all likely problems in these areas are given the fullest possible treatment. In the remaining machine groups, only those problems which are symptomatic of greater problems which have more that one probable cause and remedy are included. This means that problems for which the probable cause and remedy may be immediately obvious are not listed in this section.

The first rule for troubleshooting any circuit that is hydraulically operated and electrically controlled is to determine if the circuit is lacking hydraulic oil and electrical control power. This can be ascertained by overriding the bypass valve (mechanically or electrically) so that oil is available to the function valve, then overriding the function valve mechanically. If the function performs satisfactorily, the problem exists with the control circuit.

3-3 HYDRAULIC CIRCUIT CHECKS.

The reference for improper function of a hydraulic system, where the cause is not immediately apparent, should be the Troubleshooting Chart. The best place to begin the problem analysis is at the power source (pump). Once it is determined that the pump is serviceable, then a systematic check of the circuit components, beginning with the control, would follow. For aid in troubleshooting, refer to the Illustrated Parts Manual for hydraulic diagrams of the various circuits.

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Table 3-1.
PLATFORM ASSEMBLY - TROUBLESHOOTING

TROUBLESHOOTING CHART

TROUBLE	PROBABLE CAUSE	REMEDY
PLATFORM LEVELING SYSTEM.		
Automatic leveling inoperative.		
	Hydraulic system oil low.	Replenish oil as necessary.
	Dual check valves dirty/inoperative.	Clean or replace as necessary.
	Restricted or broken hydraulic line or fitting on slave cylinder or main lift cylinder.	Clean, repair, or replace line or fitting.
	Worn seal(s) in slave level or main lift cylinder.	Replace seal(s).
	Counterbalance valve in slave cylinder defective.	Replace counterbalance valve.
	Slave level or main lift cylinder not functioning properly.	Repair or replace cylinder.
Platform will not maintain level attitude.		
	Counterbalance valve on slave leveling cylinder improperly adjusted or not functioning properly.	Replace valve.
	Worn seal(s) in slave level or main lift cylinder.	Replace seal(s).
	Damaged slave level or main lift cylinder.	Repair or replace cylinder.
No response to platform leveling controls.		
	Level function not activated within 7 seconds after footswitch was depressed.	Recycle footswitch.
	Level control switch inoperative.	Repair or replace control switch lever.
	Hydraulic system oil low.	Replenish oil as necessary.
	System orifice plugged/dirty.	Clean orifice.
	Restricted or broken hydraulic line or fitting.	Clean, repair, or replace line or fitting.
	Control valve not functioning properly.	Repair or replace valve.
	No electric to dump or control valve.	See proper wiring diagram.
	Slave cylinder not functioning properly.	Repair or replace pump.
Platform will not adjust "up" to level.		
	Hydraulic pump not functioning properly.	Repair or replace pump.
	Restricted or broken hydraulic line or fitting.	Clean, repair, or replace line or fitting.
	Slave cylinder not functioning properly.	Repair or replace cylinder.
	Electrical failure.	See proper wiring diagram.
	Orifice plugged.	Clean orifice.
Platform will not adjust "down" to level.		
	See: Platform will not adjust "up" to level.	

Table 3-2.
BOOM ASSEMBLY - TROUBLESHOOTING

TROUBLESHOOTING CHART

TROUBLE	PROBABLE CAUSE	REMEDY
	CONTROL VALVES.	
Valve spool sticking.		
	Dirt in oil causing excessive temperature build-up.	Flush system and change oil using recommended viscosity
	Moisture in oil.	Flush system and change oil using recommended viscosity
	Incorrect valve mounting causing warping of the unit.	Loosen valve and check mounting. Repair as necessary.
	Valve spool scored.	Remove valve and repair or replace as necessary.
	Tie-bolts in valve over torqued.	Correctly torque bolts.
	Return spring weak or broken.	Remove valve and repair or replace as necessary.
	Relief valve malfunctioning causing excessive pressure within valve.	Check pressure delivery to and from valve and repair or replace as necessary.
Valve leaking.		
	Dirt or other foreign material under seal.	Remove and repair valve as necessary.
	Valve spool scored.	Remove valve and repair or replace as necessary.
	Excessive back pressure caused by restricted return line to reservoir.	Remove line and clear obstruction or replace line as necessary.
	Damaged valve seals.	Remove valve and repair or replace as necessary.
	BOOM ELEVATION SYSTEM.	
No response to lift control switch.		
	Lift function not activated within 7 seconds after footswitch was depressed.	Recycle footswitch.
	Lift control switch inoperative.	Repair or replace control switch.
	Lift cylinder holding valve inoperative.	Repair or replace holding valve.
	Dump valve (bypass) not operating.	Determine cause and repair or replace valve.
	Electrical malfunction.	See wiring diagram.
	Hydraulic system oil low.	Replenish oil as necessary.
	Restricted or broken supply line on valve bank or hydraulic pump.	Clean or replace line.
	Control valve not functioning properly.	Repair or replace valve.
	Lift cylinder not functioning properly.	Repair or replace cylinder.
	Hydraulic pump not functioning properly.	Repair or replace pump.

Table 3-2.
BOOM ASSEMBLY - TROUBLESHOOTING

TROUBLESHOOTING CHART

TROUBLE	PROBABLE CAUSE	REMEDY
BOOM ELEVATION SYSTEM (CONTINUED).		
Boom will not raise.		
	Lift function not activated within 7 seconds after footswitch was depressed.	Recycle footswitch.
	Load capacity exceeded (personnel or equipment on platform).	Reduce load.(Refer to capacity placard.)
	Hydraulic system oil low.	Replenish oil as necessary.
	Electrical failure to valves.	See proper wiring diagram.
	Restricted or broken hydraulic line or fitting.	Clean, repair, or replace line or fitting.
	Control valve not functioning properly.	Repair or replace valve.
	Pressure relief valve not functioning properly.	Re-adjust or replace valve.
	Bypass valve (dump) not functioning.	Repair or replace valve.
	Lift cylinder not functioning properly.	Repair or replace cylinder.
	Binding lift cylinder or boom pivot pin.	Repair or replace cylinder or pin.
Boom will not lower.		
	See: Boom will not raise.	
	Pressure relief valve not functioning properly.	Re-adjust or replace valve.
	Holding valve not functioning properly.	Re-adjust or replace valve.
Boom raises and lowers erratically.		
	Hydraulic system oil low.	Replenish oil as required.
	Restricted or broken hydraulic line or fitting.	Clean, repair, or replace line or fitting.
	Lack of lubricant on cylinder shafts and/or boom pivot.	Lubricate as required. (Refer to Lubrication Chart.)
	Counterbalance valve on lift cylinder improperly adjusted or not functioning properly.	Replace valve.
	Control valve not functioning properly.	Repair or replace valve.
	Worn seals in lift cylinder.	Replace seals.
	Cylinder not functioning properly.	Repair or replace cylinder.
Boom drifts down.		
	Worn seals in lift cylinder.	Replace seals.
Function Speed, Drive Speed and High Engine does not operate below horizontal.		
	Damaged wiring on level limit switch.	Repair or replace wiring.
	Solenoid failure.	Replace solenoid.
	Tripped circuit breaker.	Reset circuit breaker.
	Damaged level limit switch.	Replace switch, repair or replace holder.
	Defective relay, main terminal box.	Replace relay.
	Defective platform switch.	Replace switch.

Table 3-2.
BOOM ASSEMBLY - TROUBLESHOOTING

TROUBLESHOOTING CHART

TROUBLE	PROBABLE CAUSE	REMEDY
LOWER LIFT FUNCTION.		
If the lower boom assembly does not fully lower.		
	The Mid and Lower Booms are out of synchronization.	Refer to synchronize procedure.
MAIN TELESCOPE SYSTEM.		
No response to telescope control.		
	Telescope function not activated within 7 seconds after footswitch was depressed.	Recycle footswitch.
	Telescope control switch inoperative.	Repair or replace control switch.
	Hydraulic system oil low.	Replenish oil as necessary.
	Damaged wiring on control switch or solenoid valve.	Repair or replace wiring.
	Control valve not functioning properly.	Repair or replace valve.
	Restricted or broken supply line on valve bank or hydraulic pump.	Clean or replace line.
	Telescope cylinder not functioning properly.	Repair or replace cylinder.
	Hydraulic pump not functioning properly.	Repair or replace pump.
Boom will not extend.		
	Telescope function not activated within 7 seconds after footswitch was depressed.	Recycle footswitch.
	Control valve not functioning properly.	Repair or replace control valve.
	Restricted or broken hydraulic line or fitting.	Clean, repair, or replace line or fitting.
	Pressure setting incorrect.	Check pressure/re-adjust as necessary.
	Telescope cylinder not functioning properly.	Repair or replace cylinder.
Boom extends and retracts erratically.		
	Hydraulic system oil low.	Replenish oil as necessary.
	Wear pads worn.	Replace pads as required.
	Restricted or broken hydraulic line or fitting.	Clean, repair, or replace line or fitting.
	Control valve not functioning properly.	Repair or replace valve.
	Worn seals in telescope cylinder.	Replace seals.
	Cylinder not functioning properly.	Repair or replace cylinder.
	Distorted boom section(s).	Replace distorted section(s).
	Counterbalance valve not functioning properly.	Replace counterbalance valve.

Table 3-2.
BOOM ASSEMBLY - TROUBLESHOOTING

TROUBLESHOOTING CHART

TROUBLE	PROBABLE CAUSE	REMEDY
BOOM SWING SYSTEM.		
No response to swing control.		
	Swing function not activated within 7 seconds after footswitch was depressed.	Recycle footswitch.
	Hydraulic system oil low.	Replenish oil as necessary.
	Swing control switch not functioning.	Repair or replace swing control switch.
	Restricted or broken supply line on valve bank or hydraulic pump.	Clean or replace line.
	Control valve not functioning properly.	Repair or replace valve.
	Swing motor not functioning properly.	Repair or replace motor.
	Restrictor valve(s) plugged.	Clean or replace restrictor valve.
	Foreign objects(s) wedged between swing motor pinion and swing gear.	Remove objects, check for damage, and repair or replace component(s) as required.
	Pressure reducing valve in swing circuit malfunctioning.	Repair or replace pressure reducing valve.
	No electric power to valve.	See proper wiring diagram.
Boom will swing in only one direction.		
	Restricted or broken hydraulic line or fitting.	Clean, repair, or replace line or fitting.
	Control valve not functioning properly.	Repair or replace valve.
	Foreign object(s) wedged between swing motor pinion and swing gear.	Remove object(s), check for damage and repair or replace component(s) as required.
	Swing control switch not functioning properly.	Repair or replace swing control switch.
Boom swings erratically in either direction.		
	Hydraulic system oil low.	Replenish oil as necessary.
	Lack of lubricant on swing gear or speed reducer pinion.	Lubricate as required. (See Lubrication Chart.)
	Swing motor not functioning properly.	Repair or replace swing control switch.
	Worn or broken teeth on swing gear or swing motor pinion.	Replace gear(s) as required.
	Restrictor valves(s) plugged.	Clean or replace restrictor valve.

Table 3-3.
TURNTABLE ASSEMBLY - TROUBLESHOOTING

TROUBLESHOOTING CHART

TROUBLE	PROBABLE CAUSE	REMEDY
	CONTROL VALVE.	
Valve spool sticking.		
	Dirt in oil causing excessive temperature built-up.	Change oil using recommended viscosity and flush system.
	Incorrect valve mounting causing warping of the unit.	Loosen valve and check mounting. Repair as necessary.
	Valve spool scored.	Remove valve and repair or replace as necessary.
	Return spring weak or broken.	Remove valve and repair or replace as necessary.
	Relief valve malfunctioning causing excessive pressure within valve.	Check pressure delivery to and from valve and repair or replace as necessary.
Valve leaking.		
	Dirt or other foreign material under seal.	Remove and replace valve as necessary.
	Valve spool scored.	Repair or replace valve.
	Excessive back pressure caused by restricted return line to reservoir.	Remove line and clear obstruction or replace line as necessary.
	Damaged valve seals.	Repair or replace valve as necessary.

Table 3-4.
CHASSIS ASSEMBLY - TROUBLESHOOTING

TROUBLESHOOTING CHART

TROUBLE	PROBABLE CAUSE	REMEDY
POWER PLANT.		
Engine will not start.		
	Station power selector switch not in required position.	Actuate switch as required.
	Circuit breaker open.	Determine and correct cause; reset circuit breaker.
	Defective starter motor.	Replace starter motor.
	Damaged wiring in ignition circuit (broken wire on starter).	Repair, replace wiring.
	Ignition switch not functioning properly.	Replace switch.
	Ignition relay not functioning properly.	Replace relay.
	Ignition circuit shorted to ground.	See proper wiring diagram.
	Battery cable(s) not making contact.	Clean and tighten cable(s).
	Start lockout not working.	See wiring diagram. Check relay.
Engine will not start. (Ignition O.K.)		
	No fuel.	Replenish fuel as necessary.
	Clogged fuel filter.	Replace fuel filter.
	Choke solenoid malfunction.	Replace choke solenoid.
	Restricted or broken fuel line.	Clean or replace fuel line.
	Fuel shut-off valve in carburetor stuck or frozen.	Repair or replace fuel shut-off. Check for electrical power.
	Battery discharged.	Charge battery, replace if defective.
	Fuel pump not working.	Replace fuel pump.
	Cam timing belt jumped time or broken.	Repair or replace timing belt.
	Ignition timing slipped.	Repair timing.
Engine will not accelerate above low.		
	Damaged wiring on speed control switch or high engine solenoid.	Repair or replace wiring.
	Drive controller not functioning properly.	Replace controller.
	Actuator not functioning properly.	Repair or replace solenoid.
	Excessive load on engine.	Reduce load.
	Engine worn badly.	Rebuild engine.
	Engine improperly timed.	Time engine.
	Engine overheating.	Determine cause of overheating and remedy.
	Dirty fuel filter.	Replace filter.
	Fuel line pinched.	Replace fuel line.
	Throttle governor not working properly.	Repair or replace governor.
Engine surges.		
	Governor not adjusted properly.	Correctly adjust governor.

Table 3-4.
CHASSIS ASSEMBLY - TROUBLESHOOTING

TROUBLESHOOTING CHART

TROUBLE	PROBABLE CAUSE	REMEDY
POWER PLANT. (CONTINUED)		
FUEL SYSTEM.		
Strong fuel odor during machine.		
	Fuel tank overfilled.	Check fuel tank and immediately wipe up spilled fuel.
	Fuel tank damaged.	Drain all fuel from tank and remove tank for replacement or repair.
	Fuel line from tank damaged.	Replace fuel line.
	Carburetor flooding.	Repair,replace or adjust carburetor.
Machine stalling out on a grade.		
	Horsepower card defective.	Replace horsepower card.
	Horsepower card disconnected.	Connect wire harness.

Table 3-4.
CHASSIS ASSEMBLY - TROUBLESHOOTING

TROUBLESHOOTING CHART

TROUBLE	PROBABLE CAUSE	REMEDY
FRONT FRAME AXLE AREA.		
One or both front wheels will not steer.		
	Steering link or tie rod broken or attaching hardware missing.	Replace steering link, tie rod or hardware as necessary.
One or both front wheels will not rotate or rotate erratically.		
	Wheel hub or bearings damaged or not lubricated.	Replace hub or bearings as necessary and repack bearings with approved grease.
REAR FRAME AXLE AREA.		
Difficulty encountered when moving machine.		
	Load capacity exceeded.	Reduce load. Apply loads only in accordance with load capacity indicator.
	Flow divider sticking.	Repair or replace flow divider.
	Machine being moved up too steep a grade.	Remove machine from grade and check that drive system operates correctly.
	Grade too steep.	See WARNING Placard on platform for specified grades and sideslopes.
	Horsepower card defective.	Replace horsepower card.
	Control cards not set properly.	Adjust control cards and seal pots.
	Towing valve not closed.	Close towing valve.
	Drive wheel tire treads worn smooth.	Replace tires as necessary and inflate to specified pressure.
	Drive brakes "dragging".	Re-adjust pressure.
	System pressure too low.	Re-adjust pressure.
	Drive hub(s) defective.	Repair or replace hub.
	Engine RPM's not set.	Correctly set engine RPM.
	Drive motors worn.	Repair or replace drive motors.
	Counterbalance valve defective.	Replace counterbalance valve.
	Low amperage on controller.	Correctly adjust controller.

Table 3-4.
CHASSIS ASSEMBLY - TROUBLESHOOTING

TROUBLESHOOTING CHART

TROUBLE	PROBABLE CAUSE	REMEDY
DRIVE SYSTEM.		
No response to drive control.		
	Drive function not activated within 7 seconds after footswitch was depressed.	Recycle footswitch.
	Hydraulic system oil low.	Replenish oil as necessary.
	Hydraulic pump not functioning properly.	Repair or replace pump.
	Restricted or broken pump supply line.	Clean, repair or replace line.
	Restricted or broken line on valve bank.	Clean, repair or replace line.
	Drive motor(s) not functioning properly.	Repair or replace motor(s).
	Air in wheel brake circuit.	Bleed circuit, determine and correct cause.
	Fuse is blow-out on control card.	Replace fuse.
	Damaged wiring on control switch.	Repair or replace wiring.
	Control switch not functioning properly.	Replace switch.
	Brake(s) not releasing.	Determine cause and repair or replace.
Machine will not travel in forward.		
	Hydraulic system oil low.	Replenish oil as necessary.
	Restricted or broken hydraulic line or fitting.	Clean, repair or replace line or fitting.
	Control valve not functioning properly.	Repair or replace valve.
	Drive motor(s) not functioning properly.	Repair or replace motor(s).
	Circuit breaker open.	Determine and correct cause; reset circuit breaker.
	Belt missing from alternator.	Replace belt.
	Counterbalance valve sticking on return side.	Adjust return counterbalance out 3 turns - cycle drive - return to original position.
Motor turns slowly in the direction of the last command.		
	Valve not returning to neutral.	Check neutral springs.
	Function speed switch malfunction.	Replace function switch.
	Sticking spool due to contamination.	Remove end cap and check spool freedom. Repair as necessary.
	Drive card adjustments not set properly.	Readjust drive card and seal pots.

Table 3-4.
CHASSIS ASSEMBLY - TROUBLESHOOTING

TROUBLESHOOTING CHART

TROUBLE	PROBABLE CAUSE	REMEDY
DRIVE SYSTEM (CONTINUED).		
Motor turns slowly at maximum command.		
	Valve spool is not traveling far enough due to:	Repair or replace drive motor(s).
	Worn, leaking drive motor(s).	Repair or replace drive motor(s).
	Engine Rpm's set too low.	Properly adjust engine Rpm's.
	Low control pressure supply.	Replace pressure regulator if necessary.
	Function speed switch malfunction.	Replace switch.
	Drive card adjustments not set properly.	Readjust drive card and seal pots.
	Amperage too low on controller.	Correctly adjust controller.
	Defective pump, low oil volume.	Repair or replace pump.
Poor response, function shuts off slowly when command is removed.		
	Low spool spring preload.	Check for correct spring and shims in end caps.
	Sticking spool due to contamination.	Remove end cap and check spool freedom.
	Ramp set too high in controller.	Adjust controller.
	Sticking control handle.	Repair or replace controller.
STEERING SYSTEM.		
No response to steer control.		
	Circuit breaker open.	Determine and correct cause; reset circuit breaker.
	Fuse is blown on control card.	Replace fuse.
	Hydraulic system oil low.	Replenish oil as necessary.
	Hydraulic system pressure too low.	Adjust pressure.
	Damaged wiring on control switch or solenoid valve.	See proper wiring diagram.
	Control switch not functioning properly.	Replace switch.
	Restricted or broken hydraulic line on valve bank, hydraulic pump or rotary coupling. (If equipped.)	Clean, repair or replace line.
	If equipped, swivel coupling leaking internally. (Seals defective.)	Repair or replace coupling.
	Steer control valve not functioning properly.	Repair or replace valve.
	Steer cylinder not functioning properly.	Repair or replace cylinder.

Table 3-4.
CHASSIS ASSEMBLY - TROUBLESHOOTING

TROUBLESHOOTING CHART

TROUBLE	PROBABLE CAUSE	REMEDY
STEERING SYSTEM (CONTINUED).		
Machine hard to steer or steering is erratic.		
	Hydraulic system oil low.	Replenish oil as necessary.
	Restricted hydraulic line or fitting.	Clean, repair or replace line or fitting.
	Restricted crossover relief valve.	Clean or replace valve.
	Steer system pressure low.	Adjust pressure.
	Bent linkage (tie rods).	Repair or replace linkage as required.
	Hydraulic pump not functioning properly.	Repair or replace pump.
	Steer cylinder not functioning properly.	Repair or replace cylinder.
Steering inoperative.		
	Damaged wiring on control switch or solenoid valve.	See proper wiring diagram.
	Solenoid valve not functioning properly.	Repair or replace valve.
	Control switch not functioning properly.	Replace switch.
	Relief valve improperly set or not functioning properly.	Reset, repair or replace valves as required.
	Fuse is blown on control card.	Replace fuse.
	Steer cylinder not functioning properly.	Repair or replace cylinder.
Machine will not steer left or to the right.		
	Wiring on control switch is damaged.	See proper wiring diagram.
	Wiring on solenoid valve damaged.	Repair or replace wiring.
	Fuse is blown on control card.	Replace fuse.
	Coil in solenoid damaged.	Replace coil.
	No oil flow or pressure to steer circuit.	Take pressure reading at steer valve and adjust as necessary.
	Bent cylinder rod.	Repair or replace cylinder.
	Damaged tie rod.	Replace tie rod.
	Crossover relief valve sticking.	Repair crossover relief valve.
	Cylinder packing defective.	Repair or replace cylinder.
Machine wanders; steering not firm.		
	Crossover relief valve set too low or not functioning properly.	Reset, repair or replace valve as required.
	Steer linkages loose.	Tighten linkage.
	Steer wheel toe-in not set properly.	Adjust toe-in for 1/4 inch overall.
	Spindle bushings badly worn.	Replace bushings.

Table 3-5.
HYDRAULIC SYSTEM - TROUBLESHOOTING

TROUBLESHOOTING CHART

TROUBLE	PROBABLE CAUSE	REMEDY
HYDRAULIC SYSTEMS - GENERAL.		
Hydraulic pump noisy.		
	Air entering system through broken line or fitting. (Suction Side.)	Repair or replace line or fitting.
	Suction screen dirty.	Clean suction screen.
	Air bubbles in oil. (Reservoir oil too low.)	Replenish oil as required.
	Suction hose squeezed shut.	Determine cause and repair.
	Oil filter dirty.	Replace hydraulic filter.
	Wrong type of hydraulic oil.	Replace hydraulic oil.
Pump cavitating. (Vacuum in pump due to oil starvation.)		
	Restricted suction line.	Clean, repair, or replace line.
	Restricted reservoir air vent.	Clean or replace vent.
	Oil viscosity too high.	Drain system and replace with recommended oil. (Refer to Hydraulic Oils.)
	Air leak in suction side of tank.	Repair leak.
	Restricted suction strainer.	Clean strainer.
System overheating.		
	Oil viscosity too high.	Drain system and replace with recommended oil. (Refer to Hydraulic Oils.)
	Bypass valve not operating properly.	Repair or replace valve.
	Main relief valve set too low.	Reset valve as required.
	Hydraulic system oil low.	Replenish oil as necessary.
	Port relief set too high.	Reset valve as required.
	Restricted or blocked return line.	Repair or replace line.
Pump not delivering oil.		
	Restricted suction line.	Clean, repair, or replace line.
	Air entering system through broken line or fitting.	Repair or replace line or fitting.
	Broken pump drive shaft/pump coupling.	Repair or replace pump/pump coupling. **Note: Any time pump or pump drive coupling is removed coat pump and drive coupling splines with Lithium Soap Base Grease (TEXACO CODE 1912 OR EQUIVALENT).**

Table 3-5.
HYDRAULIC SYSTEM - TROUBLESHOOTING

TROUBLESHOOTING CHART

TROUBLE	PROBABLE CAUSE	REMEDY
HYDRAULIC SYSTEMS - GENERAL. (CONTINUED)		
Function sluggish during operation. (System pressure too low.)		
	Main relief valve set too low.	Reset valve as required.
	Pump section not delivering sufficient oil.	Repair or replace pump section or pump.
	Main relief valve stuck in open position.	Clean, repair, or replace valve. (Check system oil for contamination.)
	Oil viscosity too low.	Drain system and replace with recommended oil. (Refer to Hydraulic Oils.)
	Leak in component, line or fitting.	Repair or replace component, line or fitting.
	Scored valve spool; scored cylinder.	Replace valve; replace cylinder.
	Amperage too low on controller.	Correctly adjust controller.
	Low sequence pressure.	Reset valve as required.
	Low pilot pressure.	Reset valve as required.
	Wrong/defective spool in drive section.	Repair or replace drive section.
	Shuttle balls leaking in proportional valve.	Repair or replace valve.
	Low voltage in electrical system.	Correct low voltage problem.
System(s) operate erratically.		
	Sticking or binding valve spools, pistons.	Clean, repair, or replace components as required.
AUXILIARY HYDRAULIC SYSTEM.		
Auxiliary hydraulic pump inoperable.		
	Circuit breaker open.	Determine and correct cause; reset circuit breaker.
	Engine is running.	Shut down engine.
	Check valve in system leaking.	Repair or replace check valve.
	Battery requires charging or will not hold a charge.	Charge or replace battery as required.
	Damaged wiring on control switch or auxiliary pump.	See proper wiring diagram.
	Control switch not functioning properly.	Replace switch.
	Restricted or broken hydraulic line or fitting.	Clean, repair or replace line or fitting.
	Pump motor solenoid not functioning properly.	Replace solenoid.
	Pump motor not functioning properly.	Repair or replace motor.

Table 3-6.
ELECTRICAL SYSTEM - TROUBLESHOOTING

TROUBLESHOOTING CHART

TROUBLE	PROBABLE CAUSE	REMEDY
PLATFORM CONTROLS.		
No power to platform controls.		
	15 Amp self-reset circuit breaker open.	Check footswitch to ensure that both switches are making contact when pedal is depressed. Repair or replace footswitch as necessary.
	Contact block in footswitch malfunctioning.	Repair, replace or adjust contact block as required.
	Faulty power circuit wiring.	Check wiring continuity. Refer to proper wiring diagram.
	Select switch in wrong position.	Place select switch to correct position.
ENGINE STARTER SYSTEM.		
Starter will not crank.		
	Discharged battery or loose battery terminals.	Check and charge battery or replace battery as necessary. Clean and secure battery terminals.
	Starter relay faulty or faulty relay connections.	Using a test meter, check relay coil terminals for presence of electrical power and for energization of relay coil. Also check relay terminals for correct switching of contacts. Replace relay as necessary.
	Malfunctioning starter solenoid or motor.	Replace solenoid or motor in accordance with applicable manufacturer's manual.
	Malfunctioning ignition switch.	Using a test meter, check ignition switch for correct switching of contacts. Replace switch as necessary.
	Faulty ignition and/or starter circuit wiring.	Check wiring continuity. See proper wiring diagram.
	Faulty start lockout system.	See correct wiring diagram.
	Faulty start switch.	Replace switch.
Engine continues to crank.		
	Faulty ignition and/or starter circuit wiring.	Check wiring continuity. See proper wiring diagram.
	Malfunctioning starter solenoid or motor.	Replace solenoid or motor in accordance with applicable manufacturer's manual.
	Faulty start switch.	Replace switch.

Table 3-6.
ELECTRICAL SYSTEM - TROUBLESHOOTING

TROUBLESHOOTING CHART

TROUBLE	PROBABLE CAUSE	REMEDY
INSTRUMENTS AND INDICATORS.		
Travel warning horn inoperative.		
	Circuit breaker open.	Determine and correct cause; reset circuit breaker.
	Damaged wiring in horn circuit.	Repair or replace wiring.
	Damaged horn.	Replace horn.
Hourmeter inoperative.		
	Damaged wiring in hourmeter circuit.	Repair or replace wiring.
	Defective pressure switch.	Replace pressure switch.
	Inoperative hourmeter.	Replace hourmeter.
Tilt alarm circuit.		
	Damaged wiring in tilt alarm circuit.	Repair or replace wiring. See proper wiring diagram.
	Tilt alarm inoperative.	Replace tilt alarm.
	Tilt alarm not adjusted properly.	Adjust tilt alarm.
	Defective bulb in tilt light.	Replace bulb.
High engine speed will not function.		
	Boom above horizontal.	Lower boom.
	Horizontal limit switch malfunctioning.	Repair or replace limit switch.
	Drive controller defective.	Replace controller.
	Fuse blow-out on control card.	Replace fuse.
	High engine solenoid malfunctioning.	Repair or replace solenoid valve.
	Drive pressure switch malfunctioning.	Replace pressure switch.
	Electrical malfunction.	See wiring diagram.
	Defective engine governor.	Repair or replace governor.
Function speed control will not function.		
	Boom above horizontal.	Lower boom.
	Horizontal limit switch malfunctioning.	Repair or replace limit switch.
	Defective pump section.	Repair or replace pump section.
	Electrical malfunction.	See correct wiring diagram.
	Fuse blow-out on control card.	Replace fuse.

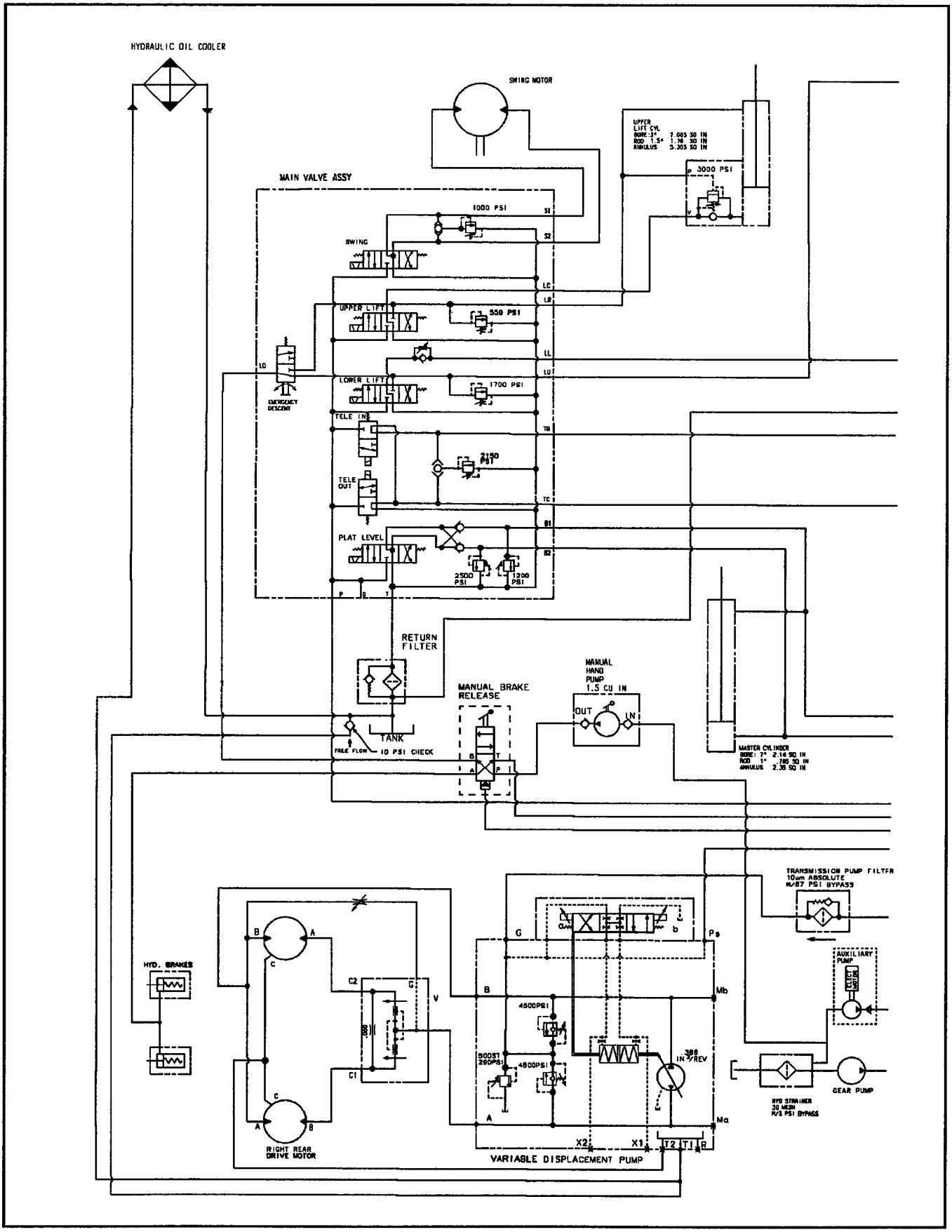

Figure 3-1. Hydraulic Schematic. (Sheet 1 of 2)

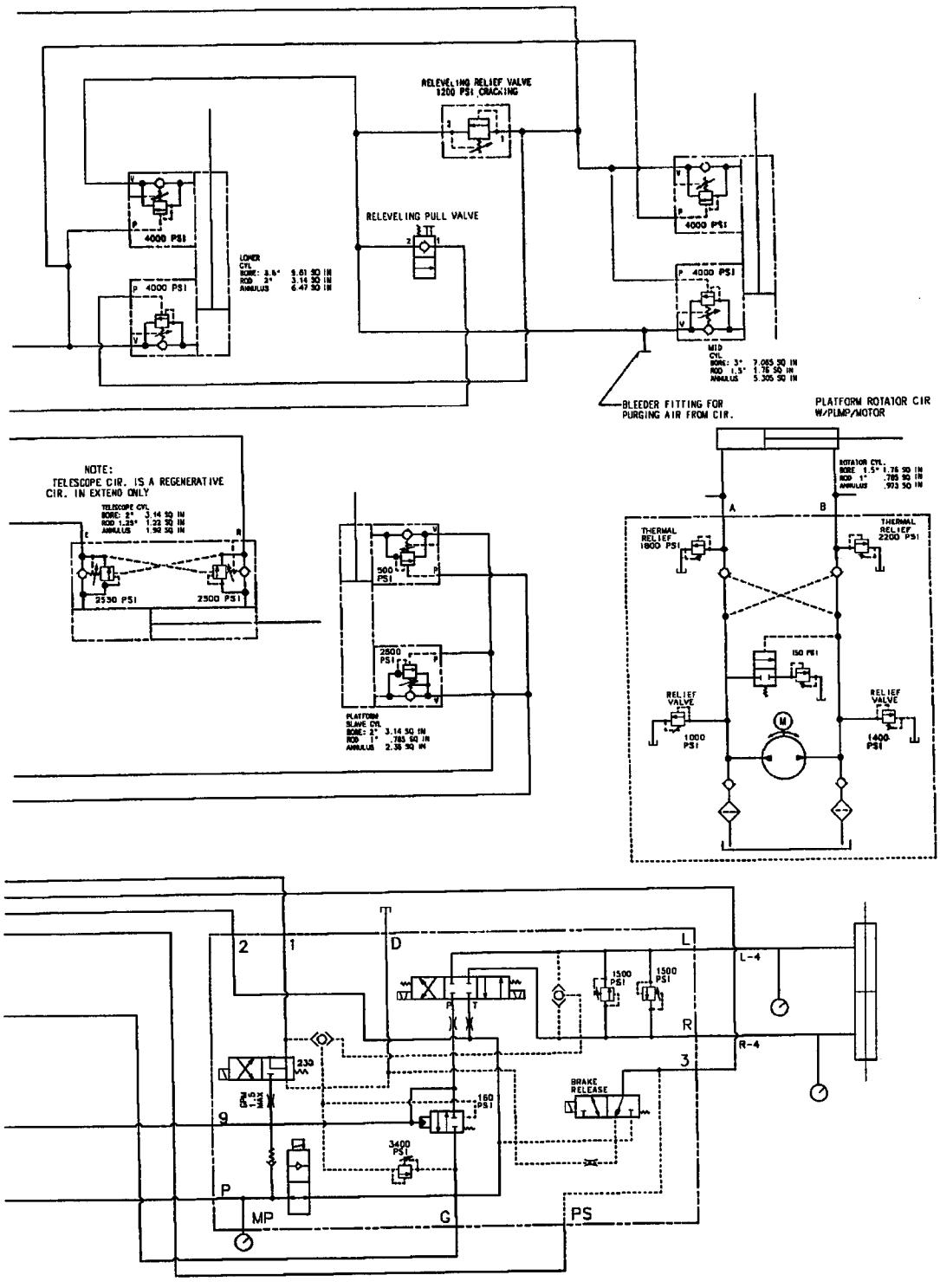

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Figure 3-1. Hydraulic Schematic. (Sheet 2 of 2)

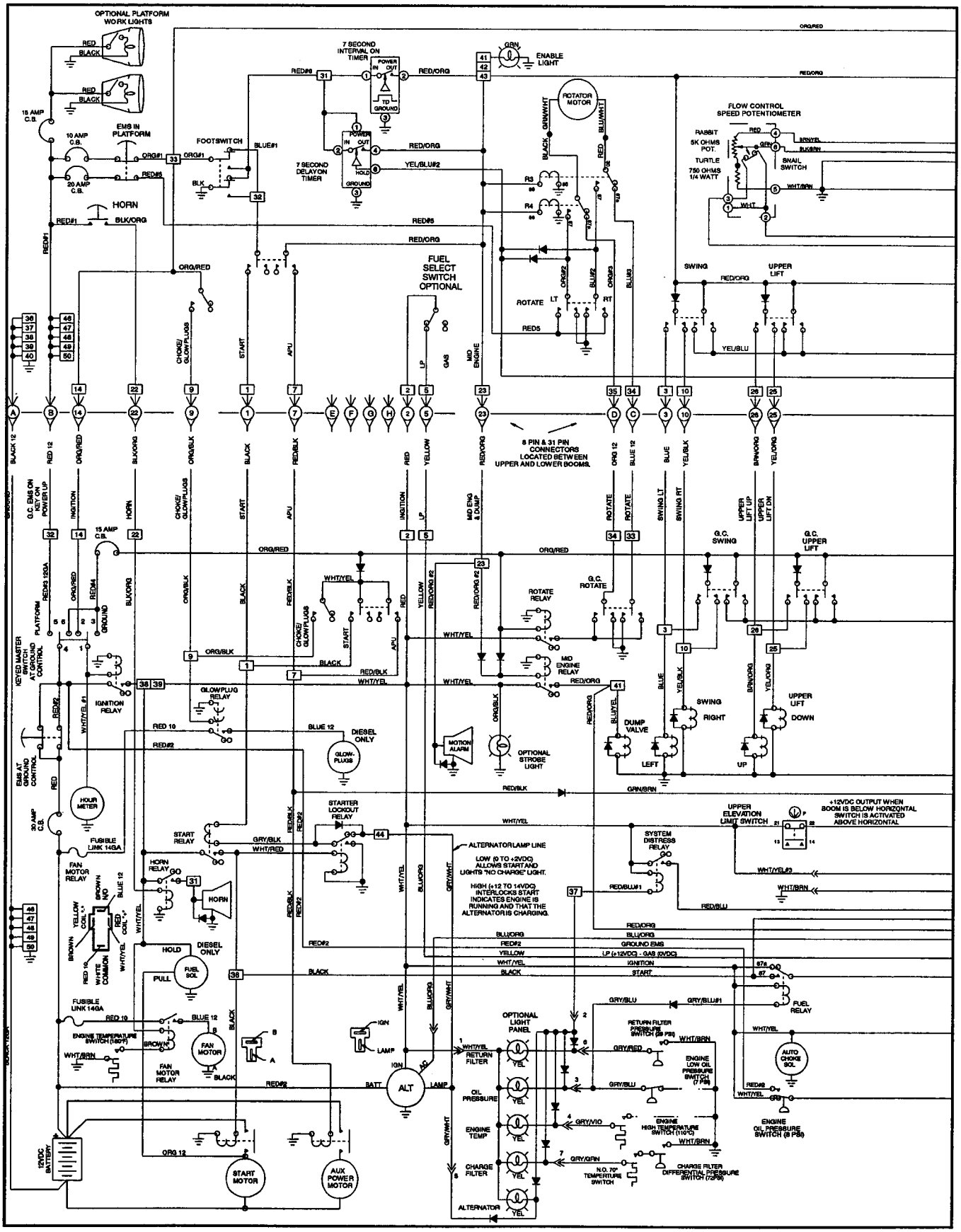
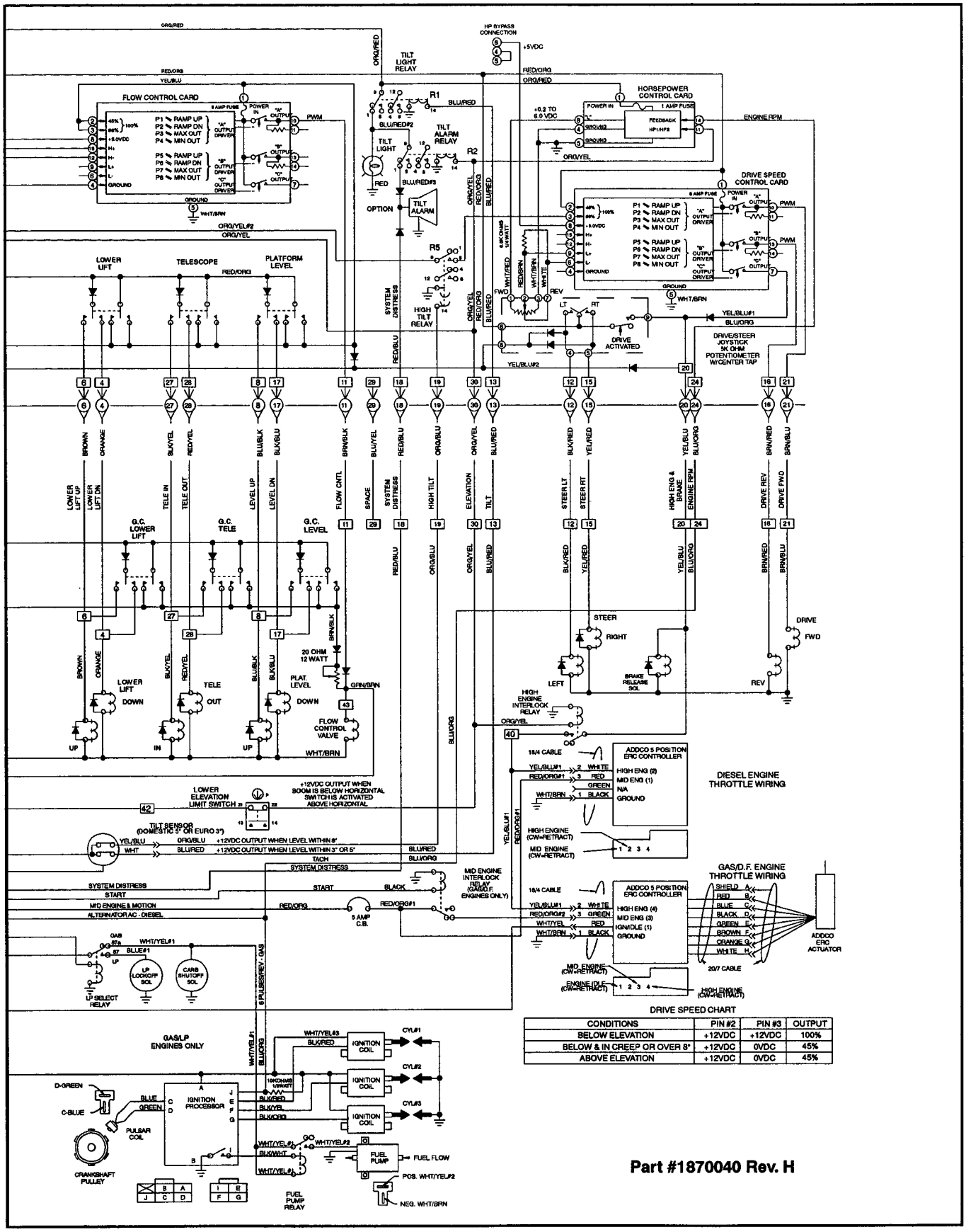


Figure 3-2. Electrical Schematic. (Sheet 1 of 2)



CONDITIONS	PIN #2	PIN #3	OUTPUT
BELOW ELEVATION	+12VDC	+12VDC	100%
BELOW & IN CREEP OR OVER 8°	+12VDC	0VDC	45%
ABOVE ELEVATION	+12VDC	0VDC	45%

Figure 3-2. Electrical Schematic. (Sheet 2 of 2)

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