Service and Maintenance Manual

Model
60H
70H

3120630
January 15, 1995

ANSI

A. GENERAL.

1. This section contains the general safety precautions which must be observed during maintenance of the aerial platform. It is of utmost importance that maintenance personnel pay strict attention to these warnings and precautions to avoid possible injury to themselves or others, or damage to the equipment. A maintenance program must be followed to ensure that the machine is safe to operate.

⚠ WARNING

MODIFICATION OF THE MACHINE WITHOUT CERTIFICATION BY A RESPONSIBLE AUTHORITY THAT THE MACHINE IS AT LEAST AS SAFE AS ORIGINALLY MANUFACTURED, IS A SAFETY VIOLATION.

2. The specific precautions to be observed during maintenance are inserted at the appropriate point in the manual. These precautions are, for the most part, those that apply when servicing hydraulic and larger machine component parts.

3. 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.

⚠ WARNING

SINCE THE MACHINE MANUFACTURER HAS NO DIRECT CONTROL OVER THE FIELD INSPECTION AND MAINTENANCE, SAFETY IN THIS AREA RESPONSIBILITY OF THE OWNER/OPERATOR.

B. HYDRAULIC SYSTEM SAFETY.

1. It should be noted that the machines hydraulic systems operate at extremely high potentially dangerous pressures. Every effort should be made to relieve any system pressure prior to disconnecting or removing any portion of the system.

2. Relieve system pressure by cycling the applicable control several times with the engine stopped and ignition on, to direct any line pressure back into the reservoir. Pressure feed lines to system components can then be disconnected with minimal fluid loss.

C. MAINTENANCE.

⚠ WARNING

FAILURE TO COMPLY WITH SAFETY PRECAUTIONS LISTED IN THIS SECTION MAY RESULT IN MACHINE DAMAGE, PERSONNEL INJURY OR DEATH AND IS A SAFETY VIOLATION.

'NO SMOKING' IS MANDATORY. NEVER REFUEL DURING ELECTRICAL STORMS. ENSURE THAT FUEL CAP IS CLOSED AND SECURE AT ALL OTHER TIMES.

REMOVE ALL RINGS, WATCHES AND JEWELRY WHEN PERFORMING ANY MAINTENANCE.

DO NOT WEAR LONG HAIR UNRESTRAINED, OR LOOSE-FITTING CLOTHING AND NECKTIES WHICH ARE APT TO BECOME CAUGHT ON OR ENTANGLED IN EQUIPMENT.

OBSERVE AND OBEY ALL WARNINGS AND CAUTIONS ON MACHINE AND IN SERVICE MANUAL.

KEEP OIL, GREASE, WATER, ETC. WIPED FROM STANDING SURFACES AND HAND HOLDS.

USE CAUTION WHEN CHECKING A HOT, PRESSURIZED COOLANT SYSTEM.

NEVER WORK UNDER AN ELEVATED BOOM UNTIL BOOM HAS BEEN SAFELY RESTRAINED FROM ANY MOVEMENT BY BLOCKING OR OVERHEAD SLING, OR BOOM SAFETY PROP HAS BEEN ENGAGED.

BEFORE MAKING ADJUSTMENTS, LUBRICATING OR PERFORMING ANY OTHER MAINTENANCE, SHUT OFF ALL POWER CONTROLS.

BATTERY SHOULD ALWAYS BE DISCONNECTED DURING REPLACEMENT OF ELECTRICAL COMPONENTS.

KEEP ALL SUPPORT EQUIPMENT AND ATTACHMENTS STOWED IN THEIR PROPER PLACE. USE ONLY APPROVED, NONFLAMMABLE CLEANING SOLVENTS.

SUBJECT - SECTION, PARAGRAPH **PAGE NO.**

1-1. CAPACITIES.

- Fuel Tank - 26 U.S. Gallons (98.41 L).
- Hydraulic Oil Tank - 55 U.S. Gallons (208.18 L).
- Hyraulic System (Including Tank) - 70 U.S. Gallons (264.95 L).
- Torque Hub, Drive - 44 oz. (1.32 L).
- Torque Hub, Swing - 17 oz. (.51 L).

Note

Torque Hubs should be one-half full of lubricant. (EPGL-90)

- Engine Crankcase (Ford LSG423) w/Filter - 5 quarts (4.73 L).
- Engine Crankcase (Deutz F3L912) w/Filter - 9.5 quarts (8.99 L).
- Engine Crankcase (Wisconsin V465D) w/Filter - 7 quarts (6.62 L).

Note

Tolerance on all engine rpm settings is plus or minus 10%.

1-2. COMPONENT DATA.

■ **Engine - Ford LSG423.**

- Oil Capacity - 5 quarts (4.73 L) w/Filter, 4 quarts (3.79 L) w/o Filter.
- Cooling System - 16 quarts (15.14 L).
- Low RPM - 1000, no load
- Mid RPM - 1800, no load.
- High RPM - 3000, no load.
- Alternator - 40 Amp, belt drive.
- Battery - 1000 cold cranking Amps, 210 minutes reserve capacity, 12 VDC.
- Fuel Consumption Low RPM - 2.03 GPH (7.68 LPH).
- Fuel Consumption High RPM - 2.73 GPH (10.33 LPH).
- Horsepower - 63 @ 2800 RPM, no load.

■ **Engine - Deutz F3L912.**

- Oil Capacity - 9.5 quarts (8.99 L) w/Filter, 8.5 quarts (8.04 L) w/o Filter.
- Low RPM 1800.
- High RPM 2400.
- Alternator - 85 Amp, belt drive.
- Battery - 1000 cold cranking Amps, 210 minutes reserve capacity, 12 VDC.
- Fuel Consumption Low RPM - 2.03 GPH (7.68 LPH).
- Fuel Consumption High RPM - 2.73 GPH (10.33 LPH).
- Horsepower - 47 @ 2800 RPM, no load.

■ **Engine - Wisconsin V465D.**

- Oil Capacity - 7 quarts (6.62 L) w/Filter, 6 quarts (5.68 L) w/o Filter.
- Low RPM 1800, no load.
- High RPM 2400, no load.
- Alternator - 37 Amp, belt drive.
- Battery - 1000 cold cranking Amps, 210 minutes reserve capacity, 12 VDC.
- Fuel Consumption Low RPM - 2.46 GPH (9.31 LPH).
- Fuel Consumption High RPM - 3.59 GPH (13.59 LPH).
- Horsepower - 60 @ 2400 RPM, no load.

■ **Drive System.**

- Tires - 14 x 17.5, 10 ply rating, 85 PSI. (6 Bar) (Only on 60H Model).
- Tires - 14 x 17.5, 10 ply rating foam filled (Only on 60H Model).
- Tires - 15 x 19.5 NHS, 12 ply rating, 65 PSI. (4.5 Bar).
- Tires - 15 x 19.5 NHS, 14 ply rating, 70 PSI (5 Bar).
- Tires - 15 x 19.5, 14 ply rating, 95 PSI (6.5 Bar).
- Tires - 15 x 19.5, 14 ply rating, foam filled (Only on 70H Model).

- **Drive Motor Displacement Machines Built Prior to Jan. 1992.**
  - Cessna - 5.04 in.^{3}/rev. (4WD Same)
  - Vickers - 2.5/.98 in.^{3}/rev. (4WD Same)
  - 2 Speed Cessna - 2.48/1.10^3/rev.
  - Gear Reducer - Vickers Drive Motors only - 3.6:1.
- **Drive Motor Displacement Machines Built from Jan. 1992 to Present.**
  - Rexroth - 2.8 in.^{3}/rev. (4WD Same)
- **Drive Hub Ratio Machines Built Prior to Jan. 1992.**
  - - 60H with Cessna Single Speed Drive Motors - 30:1 (4WD Same)
  - - 70H with Cessna Single Speed Drive Motors - 43:1 (4WD Same)
  - - 60H with Vickers Single Speed Drive Motors - 18.75:1 with 3.6:1 Reducer Total Reduction 67.5:1
  - - 70H with Vickers Single Speed Drive Motors - 24:1 with 3.6:1 Reducer Total Reduction 86.4:1
  - - 60H (4WD) with Vickers Single Speed Drive Motors - 53.58:1
  - - 70H (4WD) with Vickers Single Speed Drive Motors - 54:1
  - - 60H (2 Speed) with Cessna Drive Motors - 53.58:1
  - - 70H (2 Speed) with Cessna Drive Motors - 53.58:1
- **Drive Hub Ratio Machines Built from Jan. 1992 to Present.**
  - - 60H/70H with Fairfield Drive Motors - 73:1 (4WD Same).

- Drive Brake - Automatic spring applied, hydraulically released disc brakes (4WD same).

- **Steer System.**
  - Toe-in, adjust for 1/4 in. (6.35 mm) overall.
- **Swing System.**
  - Swing Motor - Displacement - 4.5 cu. in/Rev.
  - Swing Hub - Ratio - 69.50:1.
  - Swing Brake - Automatic spring applied, hydraulically released disc brakes.
- **Hydraulic Pump.**

- Ford LSG423, Deutz F3L912, Wisconsin V465D with Racine Valves (Single Speed Drive Motors).
  - First Section to Proportional Valve-Drive, Lift, Swing - 24 GPM (90.84 LPM).
  - Second Section to High Drive - 24 GPM (90.84 LPM).
  - Third Section to Bang-Bang ValveLevel, Telescope, Steer, Rotate - 9.5 GPM (35.96 LPM).
  - Clockwise Rotation.

- Ford LSG423, Deutz F3L912, Wisconsin V465D with Racine Valves (2 Speed Drive Motors).
  - First Section to Proportional Valve-Drive, Lift, Swing - 19 GPM (71.92 LPM).
  - Second Section to High Drive - 19 GPM (71.92 LPM).
  - Third Section to Bang-Bang ValveLevel, Telescope, Steer, Rotate - 9.5 GPM (35.96 LPM).
  - Clockwise Rotation.

- Ford LSG423, Deutz F3L912, Wisconsin V465D with Vickers Valves.
  - First Section to Proportional Valve-Drive, Lift, Swing - 15 GPM (56.78 LPM).
  - Second Section to High Drive - 9 GPM (34.10 LPM).
  - Third Section to Bang-Bang ValveLevel, Telescope, Steer, Rotate - 9 GPM (34.10 LPM).
  - Clockwise Rotation.

- **Auxiliary Power Pump .**
  - Two section, 3.75 GPM (14.19 lpm) each section, 12 VDC motor, clockwise rotation.
- **Hydraulic Filter - Tank.**
  - Return - Bypass Type.
  - 10 Microns Nominal.
- **Hydraulic Filter - Inline (Racine Valve Only).**
  - Return - Non-Bypass Type.
  - 10 Microns Nominal.

1-3. PERFORMANCE DATA.

- **Travel Speed.**
  - Model 60H/60H+6.
    - 2WD- 4.0 MPH (6.4 KM/HR).
    - 4WD - 3.5 MPH (5.6 KM/HR).
  - Model 70H.
    - 2WD- 3.5 MPH (5.6 KM/HR).
    - 4WD - 3.0 MPH (4.8 KM/HR).
- **Gradeability.**
  - Model 60H/60H+6/70H.
    - 2WD- 25% or 14°slope, hard surface.
    - 4WD - 35% or 19°slope, hard surface.
- **Turning Radius.**
  - Model 60H/60H+6.
    - 2WS/2WD- 18 ft. 0 in. (5.49 m).
    - 2WS/4WD - 18 ft. 0 in. (5.49 m).
    - 4WS/2WD- 11 ft. 9 in. (3.58 m).
    - 4WS/4WD - 11 ft. 9 in. (3.58 m).
  - Model 70H.
    - 2WS/2WD- 18 ft. 4 in. (5.59 m).
    - 2WS/4WD - 18 ft. 4 in. (5.59 m).
- **Boom Speed.**
  - Extend 50-80 Seconds; Retract 40-60 Seconds.
  - Lift Up 25-40 Seconds; Lift Down 20-30 Seconds.
- **Swing Speed 360° - 61-92 Seconds.**
- **Boom Elevation.**
  - Model 60H/70H.
    75° (above horizontal)
    -21° (below horizontal)
  - Model 60H+6.
    75° +15° ART. (above horizontal)
    -21° -80° ART. (below horizontal)
- **Machine Weight.**
  - Model 60H (2WD) - 23,000 LBS. (10,442 KG.)
  - Model 60H (4WD) - 23,500 LBS. (10,669 KG.)
  - Model 60H+6 - 26,250 LBS. (11,907 KG.)
  - Model 70H (2WD) - 28,600 LBS. (12,984 KG.)
  - Model 70H (4WD) - 29,100 LBS. (13,211 KG.)
- **Machine Stowed Height.**
  - Model 60H (2WD) - 9 ft., 2 in. (2.82 M)
  - Model 60H (4WD) - 9 ft., 4 in. (2.84 M)
  - Model 70H (2WD) - 9 ft., 2 in. (2.82 M)
  - Model 70H (4WD) - 9 ft., 2 in. (2.82 M)
- **Machine Stowed Length.**
  - Model 60H (2WD/4WD) - 25 ft.,11 in. (7.90 M)
  - Model 60H+6 (4WD) - 28 ft., 6 in. (8.69 M)
  - Model 70H (2WD/4WD) - 30 ft., 7 in. (9.32 M)
- **Machine Width.**
  - Model 60H/60H+6/70H (2WD/4WD) - 8 ft.,0 in. (2.44 M)
- **Wheelbase.**
  - Model 60H/60H+6/70H (2WD/4WD) - 102 in. (2.59 M)

1-4. TORQUE REQUIREMENTS.

Description	Torque Value (Dry)	Interval Hours
A. Bearing To Chassis	110 lbs. (149 Nm)	*200/500
B. Bearing To Turntable	220 lbs. (298 Nm)	*200/500
C. Wheel Lugs	300 lbs. (407 Nm)	100
D. Drive Hub	150 lbs. (204 Nm)	*200/500
E. Swing Hub	110 lbs. (149 Nm)	*200/500

*Retorque after first 200 hours of operation and every 500 hours thereafter.

Note

See Procedure Section for tightening sequence of turntable bearing bolts.

Note

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

1-5. LUBRICATION.

- **Ford LSG423 Engine.**

  - Single Viscosity Oils (SF, SF-SE, SF-CC, SF-CD).

When Outside Temp is Consistently	Use SAE Viscosity Number
-10° F - +60° F.	*10W
+10° F - + 90° F.	20W-20
Above +32° F.	30
Above + 50° F.	40

  - Multi-Viscosity Oils (SF, SF-SE, SF-CC, SF-CD).

When Outside Temp is Consistently	Use SAE Viscosity Number
Below +10° F.	*5W-20
Below +60° F.	5W-30
-10° F - +90° F.	10W-30
Above -10° F.	10W-40 or 10W-50
Above +20° F.	20W-40 or 20W-50

* Not recommended for severe service - including high RPM operation.

- **Deutz F3L912 Engine.**

  - Single Viscosity Oils (CD-SE, CD-SF).

When Outside Temp is Consistently	Use SAE Viscosity Number
-20° F - +25° F.	*10W
+15° F - + 50° F.	20W-20
+40° F - + 85° F.	30
Above 75° F.	40

  - Multi-Viscosity Oils (CD-SE, CD-SF).

When Outside Temp is Consistently	Use SAE Viscosity Number
-40° F - +75° F.	*5W-20 (Synthetic)
-5° F - +70° F.	10W-30
-5° F - +85° F.	10W-40
+15° F - +75° F.	15W-30
Above +15° F.	15W-40

* This viscosity can be used at colder temperatures only with engine oil preheating.

- **Wisconsin V465D Engine.**

  - Single Viscosity Oils (MS, SD, SE).

When Outside Temp is Consistently	Use SAE Viscosity Number
+15° F - 0° F.	*10W
+40° F - + 15° F.	20-20W
+120° F - + 40° F.	30

  - Multi-Viscosity Oils (MS, SD, SE).

When Outside Temp is Consistently	Use SAE Viscosity Number
Below Zero.	*5W-20

Note

Crankcase oil should meet one of the following API classification grades: SE/CC, SE/CD, SF/CC, SF/CD.

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

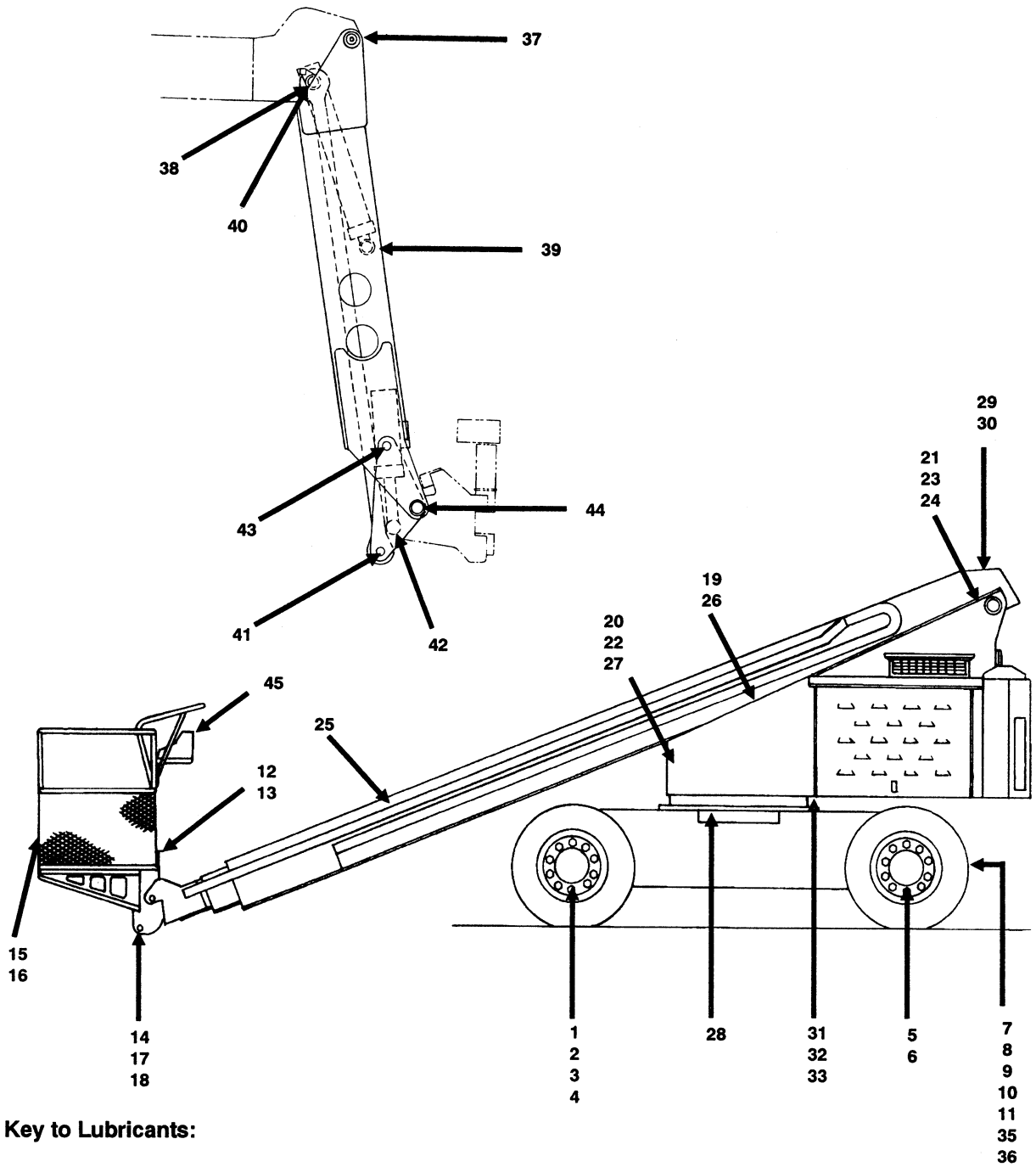
SIZE	THD	BOLT DIA. (IN)	TENSILE STRESS AREA (SQ. IN.)	SAE GRADE 5 BOLTS & SAE GRADE 2 NUTS				SAE GRADE 8 BOLTS & SAE GRADE 8 NUTS				RECOMMENDED TORQUE WRENCH SIZE		
				CLAMP LOAD (LB.)	TORQUE (DRY) LB. IN.	TORQUE (LUB.) LB. IN.	TORQUE (LOCTITE) LB. IN.	CLAMP LOAD (LB.)	TORQUE (DRY) LB. IN.	TORQUE (LUB.) LB. IN.	TORQUE (LOCTITE) LB. IN.	IN. OZS.	IN. LBS.	FT. LBS.
4	40	0.1120	0.00604	380	8	6	—	540	12	9	—	160	10	—
	48		0.00661	420	9	7	—	600	13	10	—	160	10	—
6	32	0.1380	0.00909	580	16	12	—	820	23	17	—	—	25	—
	40		0.01015	610	18	13	—	920	25	19	—	—	25	—
8	32	0.1640	0.01400	900	30	22	—	1260	41	31	—	—	25	—
	36		0.01474	940	31	23	—	1320	43	32	—	—	25	—
10	24	0.1900	0.01750	1120	43	32	—	1580	60	45	—	—	50	—
	32		0.02000	1285	49	36	—	1800	68	51	—	—	50	—
1/4	20	0.2500	0.0318	2020	96	75	105	2860	144	108	160	—	100	—
	28		0.0364	2320	120	86	135	3280	168	120	185	—	200	—
					LB. FT.	LB. FT.	LB. FT.		LB. FT.	LB. FT.	LB. FT.			
5/16	18	0.3125	0.0524	3340	17	13	19	4720	25	18	30	—	200	—
	24		0.0580	3700	19	14	21	5220	25	20	30	—	200	—
3/8	16	0.3750	0.0775	4940	30	23	35	7000	45	35	50	—	300	25
	24		0.0878	5600	35	25	40	7900	50	35	55	—	300	50
7/16	14	0.4375	0.1063	6800	50	35	55	9550	70	55	80	—	600	50
	20		0.1187	7550	55	40	60	10700	80	60	90	—	600	50
1/2	13	0.5000	0.1419	9050	75	55	85	12750	110	80	120	—	1200	100
	20		0.1599	10700	90	65	100	14400	120	90	135	—	1200	100
9/16	12	0.5625	0.1820	11600	110	80	120	16400	150	110	165	—	1200	100
	18		0.2030	12950	120	90	135	18250	170	130	190	—	1200	100
5/8	11	0.6250	0.2260	14400	150	110	165	20350	220	170	240	—	1800	150
	18		0.2560	16300	170	130	190	23000	240	180	265	—	1800	150
3/4	10	0.7500	0.3340	21300	260	200	285	30100	380	280	420	—	2400	200
	16		0.3730	23800	300	220	330	33600	420	320	465	—	2400	200
7/8	9	0.8750	0.4620	29400	430	320	475	41600	600	460	660	—	3600	300
	14		0.5090	32400	470	350	520	45800	660	500	725	—	3600	300
1	8	1.000	0.6060	38600	640	480	675	51500	900	680	990	—	7200	600
	12		0.6630	42200	700	530	735	59700	1000	740	1100	—	7200	600
1-1/8	7	1.1250	0.7630	42300	800	600	840	68700	1280	960	1400	—	7200	600
	12		0.8560	47500	880	660	925	77000	1440	1080	1575	—	7200	600
1-1/4	7	1.2500	0.9690	53800	1120	840	1175	87200	1820	1360	2000	—	—	Multi*
	12		1.0730	59600	1240	920	1300	96600	2000	1500	2200	—	—	Multi*
1-3/8	6	1.3750	1.1550	64100	1460	1100	1525	104000	2380	1780	2625	—	—	—
	12		1.3150	73000	1680	1260	1750	118100	2720	2040	3000	—	—	—
1-1/2	6	1.500	1.4050	78000	1940	1460	2025	126500	3160	2360	3475	—	—	Multi*
	12		1.5800	87700	2200	1640	2300	142200	3560	2660	3925	—	—	Multi*

Figure 1-1. Torque Chart.

NOTE: Tensile strength for bolt size 4 to 1 - 120,000 (min. psi), size 1-1/8 to 1-1/2 - 105,000 (min. psi).
*Torque multiplier.
Torque specifications are usually given in foot-pounds; lower ranges in inch-pounds or inch-ounces.


SAE Grade 5


SAE Grade 8



Key to Lubricants:

EO - Engine
EPGL - Exterme Pressure Gear Lube
HO - Hydraulic Oil - Kendall Hyken 052, BP Energol SHS46 or approved Equivalent
MPG - Multi-Purpose Grease

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

INDEX NO.	COMPONENT	NUMBER/TYPE LUBE POINTS	LUBE & METHOD	INTERVAL (HOURS)
1	Wheel Drive Hub	Fill Plug - 1/2 Full	EPGL - SAE 90	***50/2000
2	Steer Spindles - 4WS	2 Grease Fittings	MPG - Pressure Gun	100
3	Steer Cylinder - 4WS	2 Grease Fittings	MPG - Pressure Gun	100
4	Tie Rod - 4WS	2 Grease Fittings	MPG - Pressure Gun	100
5	Wheel Bearings	N/A	MPG - Repack	500
6	Wheel Drive Hubs - 4WD	Fill Plug - 1/2 Full	EPGL - SAE 90	***50/2000
7	Steer Spindles	2 Grease Fittings	MPG - Pressure Gun	100
8	Steer Cylinder	2 Grease Fittings	MPG - Pressure Gun	100
9	Tie Rod	2 Grease Fittings	MPG - Pressure Gun	100
10	Oscillating Axle Pivot Pin (If Equipped)	1 Grease Fitting	MPG - Pressure Gun	****100
11	Lockout Cylinders (If Equipped)	4 Grease Fittings	MPG - Pressure Gun	100
12	Rotary Platform Control Stand (If Equipped)	1 Grease Fitting	MPG - Pressure Gun	100
13	Platform Rotary Worm Gear (If Equipped)	1 Grease Fitting	MPG - Pressure Gun	100
14	Platform Pivot Pin	2 Grease Fittings	MPG - Pressure Gun	100
15	Platform Hinges	2 Grease Fittings	MPG - Pressure Gun	100
16	Platform Latch	N/A	SAE 10 - Oil Can	100
17	Slave Level Cylinder - Barrel End	1 Grease Fitting	MPG - Pressure Gun	100
18	Slave Level Cylinder - Rod End	1 Grease Fitting	MPG - Pressure Gun	100
19	Lift Cylinder - Rod End	1 Grease Fitting	MPG - Pressure Gun	100
20	Lift Cylinder - Barrel End (Remote Access)	1 Grease Fitting	MPG - Pressure Gun	100
21	Master Cylinder - Rod End	1 Grease Fitting	MPG - Pressure Gun	100
22	Master Cylinder - Barrel End (Remote Access)	1 Grease Fitting	MPG - Pressure Gun	100
23	Boom Pivot Bushings	2 Grease Fittings	MPG - Pressure Gun	100
24	Boom Chain Retract Sheave	1 Grease Fitting	MPG - Pressure Gun	100
25	Boom Chain Extension Sheave	1 Grease Fitting	MPG - Pressure Gun	100
26	Swing Drive Hub	Fill Plug	EPGL - SAE 90	***50/2000
27	Swing Bearing (Remote Access)	2 Grease Fittings	MPG - Pressure Gun	100
28	Swing Bearing and Pivot Gear Teeth	N/A	MPG - Brush	100
29	Engine Oil Crankcase	Fill Cap/Drain Plug	EO (Refer to Engine Manual)	*10/250
30	Engine Oil Filter	N/A	Replacement Element	*250
31	Hydraulic Oil Reservoir	Fill Cap/Drain Plug	N/A	**10/2000
32	Hydraulic Oil Return Filter	N/A	Replacement Element	*****40/250
33	Hydraulic Oil Reservoir Suction Filter	N/A	Replacement Element	*****40/250
34	Door and Access Panel Hinges	N/A	SAE 10 - Oil Can	A/R
35	Tie Rods - Tow Hitch (If Equipped)	4 Grease Fittings	MPG - Pressure Gun	100
36	Tow Hitch (If Equipped)	1 Grease Fitting	MPG - Pressure Gun	100
37	Extend-A-Reach Pivot (If Equipped)	2 Grease Fittings	MPG - Pressure Gun	100
38	Extend-A-Reach Lift Cylinder - Barrel End (If Equipped)	1 Grease Fitting	MPG - Pressure Gun	100
39	Extend-A-Reach Lift Cylinder - Rod End (If Equipped)	1 Grease Fitting	MPG - Pressure Gun	100
40	Extend-A-Reach Link - Boom End (If Equipped)	2 Grease Fittings	MPG - Pressure Gun	100
41	Extend-A-Reach Link - Platform End (If Equipped)	1 Grease Fitting	MPG - Pressure Gun	100
42	Extend-A-Reach Slave Cylinder - Rod End (If Equipped)	1 Grease Fitting	MPG - Pressure Gun	100
43	Extend-A-Reach Slave Cylinder - Pivot Point (If Equipped)	2 Grease Fittings	MPG - Pressure Gun	100
44	Extend-A-Reach Platform Pivot (If Equipped)	1 Grease Fitting	MPG - Pressure Gun	100
45	P.Q. Control Handles	N/A	SAE 10 - Oil Can	100

Note:

***Check oil level after 10 hours of operation. Change oil after every 250 hours of operation.**
****Check oil level after every 10 hours of operation. Change oil after every 2000 hours of operation.**
*****Check oil level after every 50 hours of operation. Change oil after every 2000 hours of operation.**
******It will be necessary to swing the boom overthe side of the frame and remove the frame shield to gain access to the grease fitting.**
*******Replace filter element after first 40 hours of operation, then after every 250 hours of operation thereafter.**

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

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 Kendall Hyken 052 hydraulic oil, which has an SAE viscosity of 10W-20 and viscosity index of 152.

When temperatures remain consistently below 20 degrees F. (-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 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 degrees F. 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, SAE 10W-20, Viscosity Index 152, e.g. Kendall Hyken 052.
EO	Engine (crankcase) Oil. Gas - API SF/SG class, MIL-L-2104. Diesel - API CC/CD class, MIL-L-2104B/MIL-L-2104C.

Note

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

1-6. PRESSURE SETTINGS.

Note

All pressure are given in pounds per square inch (psi), with the metric equivalent, Bar, in parentheses.

- **Racine Proportional Valve.**
  - Racine.
    - Main Relief - 2750 psi. (189.61 Bar).
    - Drive - 2750 psi. (189.61 Bar).
    - Lift Up - 2750 psi. (189.61 Bar).
    - Lift Down - 1100 psi. (75.85 Bar).
    - Swing - 1200 psi. (82.74 Bar).
- **Vickers - Proportional Valve w/o Tele.**
  - Vickers.
    - Drive - 3100 psi. (213.75 Bar).
    - Lift Up - 2500 psi. (172.38 Bar).
    - Lift Down - 1500 psi. (103.43 Bar).
    - Swing - 1200 psi. (82.74 Bar).
  - Accessory.
    - Main Relief - 3200 psi. (220.64 Bar).
    - Sequence Cartridge - 450 psi. (31.03 Bar).
    - Pressure Reducing - 550 psi. (37.92 Bar).
  - 4 Stack Racine Bang-Bang Valve.
    - Main Relief - 3100 psi. (213.75 Bar).
    - Telescope In - 3000 psi. (206.85 Bar).
    - Telescope Out - 1500 psi (103.43 Bar).
    - Steer - Model 60H/60H+6 - 1500 psi. (103.43 Bar). Model 70H - 2000 psi. (137.9 Bar).
    - 4WD/2WS, 4WD/4WS Steer Pressure - 2000 psi. (137.9 Bar).

- **Vickers Proportional Valve.**
  - Vickers.
    - Drive - 3100 psi.(213.75 Bar).
    - Lift Up - 2500 psi.(172.38 Bar).
    - Lift Down - 1500 psi. (103.43 Bar).
    - Telescope In - 3000 psi. (206.85 Bar).
    - Telescope Out - 1500 psi. (103.43 Bar).
    - Swing - 1200 psi. (82.74 Bar).
    - Main Relief - 3200 psi (220.64 Bar).
    - Sequence Cartridge - 450 psi. (31.03 Bar).
    - Pressure Reducing - 550 psi. (37.92 Bar).
  - 3 Stack Racine Bang-Bang Valve.
    - Main Relief - 3100 psi. (213.75 Bar).
    - Steer - 1500 psi. (103.43 Bar).
    - 4WD/2WS, 4WD/4WS Steer Pressure - 2000 psi. (137.9 Bar).
  - Extend-A-Reach Racine Valve.
    - Extend Up - 2500 psi. (172.38 Bar).
    - Extend Down - 800 psi. (55.16 Bar).

Note

Refer to Section 2 for pressure setting procedures.

1-7. CYLINDER SPECIFICATIONS.

Table 1-3. CYLINDER SPECIFICATIONS.

DESCRIPTION	BORE	STROKE	ROD DIA.
Master Level	2.50	15.25	1.25
Slave Level	2.50	15.21	1.25
Lift	8.00	30.75	3.50
Lockout (Oscillating Axle)	4.00	4.88	1.25
Lockout (4WD)	4.00	4.25	1.25
Telescope 60H	3.00	179.75	2.00
70H	3.00	217.19	2.00
Steer (2WD)	3.00	8.06	1.25
Steer (4WD)	3.00	9.81	1.50
Extend-A-Reach			
Lift	3.00	12.687	2.00
Slave	3.50	7.25	1.75

1-8. BOOM TAPE.

- **Model 60H (American Standard).**
  - Red - 42.25 in. (107.32 cm).
  - Yellow - 27.00 in. (68.58 cm).
  - Blue - 119.00 in. (302.26cm).
- **Model 70H (American Standard).**
  - Red - 45.43 in. (115.39 cm).
  - Yellow - 33.50 in. (85.09 cm).
  - Blue - 147.25 in. (347.02cm).
- **Model 60H (Canadian Standard).**
  - Red - 46.75 in. (118.75 cm).
  - Yellow - 33.50 in. (85.09 cm).
  - Blue - 108 in. (274.32 cm).
- **Model 70H (Canadian Standard).**
  - Red - 52.18 in. (132.54 cm).
  - Yellow - 37.00 in. (93.98 cm).
  - Blue - 137.00 in. (347.98cm).

1-9. MAJOR COMPONENTS WEIGHTS.

TABLE 1-4. COMPONENT WEIGHTS.

	MODEL60H		MODEL 60H+6		MODEL 70H	
	LBS.	KG	LBS.	KG	LBS.	KG
Platform - 36" x 60" (91.4 cm x 152 cm) w/Control Box.	185	84	185	84	185	84
Platform - 36" x 72" (91.4 cm x 182.88 cm) w/Control Box.	200	90	200	90	200	90
Platform - 36" x 96" (91.4 cm x 243.84 cm) w/Control Box.	240	109	N/A	N/A	240	109
Boom (Includes Boom Lift Cylinder, Rotator and Support).	3,590	1628	3,590	1628	4,450	2038
Turntable Complete.	7,638	3465	7,638	3465	9,905	4493
Frame Complete (Includes Pneumatic Tires and Wheels). (2WD)	10,008	4540	11,483	5209	12,983	5889
Frame Complete (Includes Pneumatic Tires and Wheels). (4WD)	10,008	4540	11,683	5299	12,983	5889
Complete Machine - 2WD.	23,000	10,442	26,250	11,907	28,600	12,984
Complete Machine - 4WD.	23,500	10,669	26,750	12,134	29,100	13,211

1-10. CRITICAL STABILITY WEIGHTS.

TABLE 1-5. CRITICAL STABILITY WEIGHTS.

			MODEL 60H		MODEL 60H+6		MODEL 70H	
			LBS.	KG	LBS.	KG	LBS.	KG
Counterweight (If Removeable)		1.5:1	2500	1134	4200	1905	4450	2019
		2:1	3950	1791	4200	1905	5260	2386
Tires (Ballasted Only)		Size	14-17.5		14-17.5		15-19.5	
		Weight	415	188.2	415	188.2	500	226.8
Engine		Ford	525	238.1	525	238.1	525	238.1
		Deutz	600	272.2	600	272.2	600	272.2
		Wisconsin	- - -	- - -	- - -	- - -	530	240.4
Platform	Size	4'	N/A	N/A	150	68	N/A	N/A
		5'	165	75	165	75	165	75
		6'	180	82	180	82	180	82
		8'	220	100	220	100	220	100

1-11. RELAY/CIRCUIT BREAKERS.

(See Figure 1-3.)

- **Main Terminal Box.**
  - 3740049 - Relay SPDT, Robert Bosch 0332204174, Potter Brumfield VF455F11-S02.
  - 3740016 - Relay Potter Brumfield Kup 14D15, 12 Volt Deutz.
  - 3740059 - Relay, Ford E4JL-11450-AA, Deutz.
  - 3740077 - Relay, SPDT, 6 Volt, Robert Bosch 0332204001.
  - 4360212 - Circuit Breaker, 3 Amp, Heineman KD1-3, Deutz.
  - 4360186 - Circuit Breaker, 35 Amp, Potter Brumfield W58XB1A6A35.
  - 4360069 - Circuit Breaker, 10 Amp, Wood Co. W58XB1A4A-10.

- **Console Box.**

  - 3740049 - Relay SPDT, Robert Bosch 0332204174, Potter Brumfield VF455F11-S02.

  - 4360209 - Circuit Breaker, 15 Volt 20 Amp,Self - resetting.

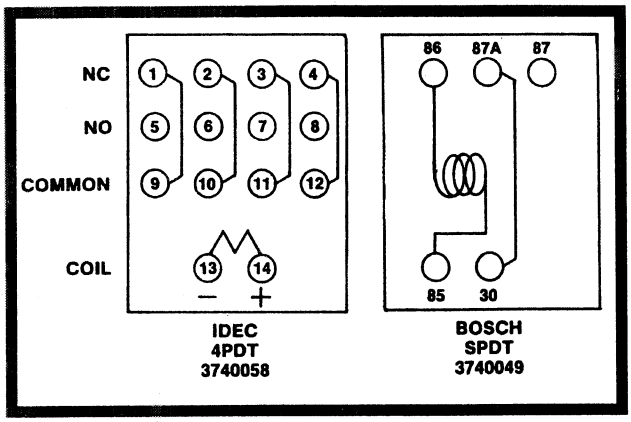


Figure 1-3. Relay Wiring.

1-12. Serial Number Location. (See Figure 1-4.)

A serial number plate is affixed to the left rear front of the turntable. If the serial number plate is damaged or missing, the machine serial number is stamped on the left side of the frame between front and rear wheels, below turntable bearing. In addition, the last five digits of the serial number are stamped on top of the fly, mid and base end of the boom and on the left side of the turntable.

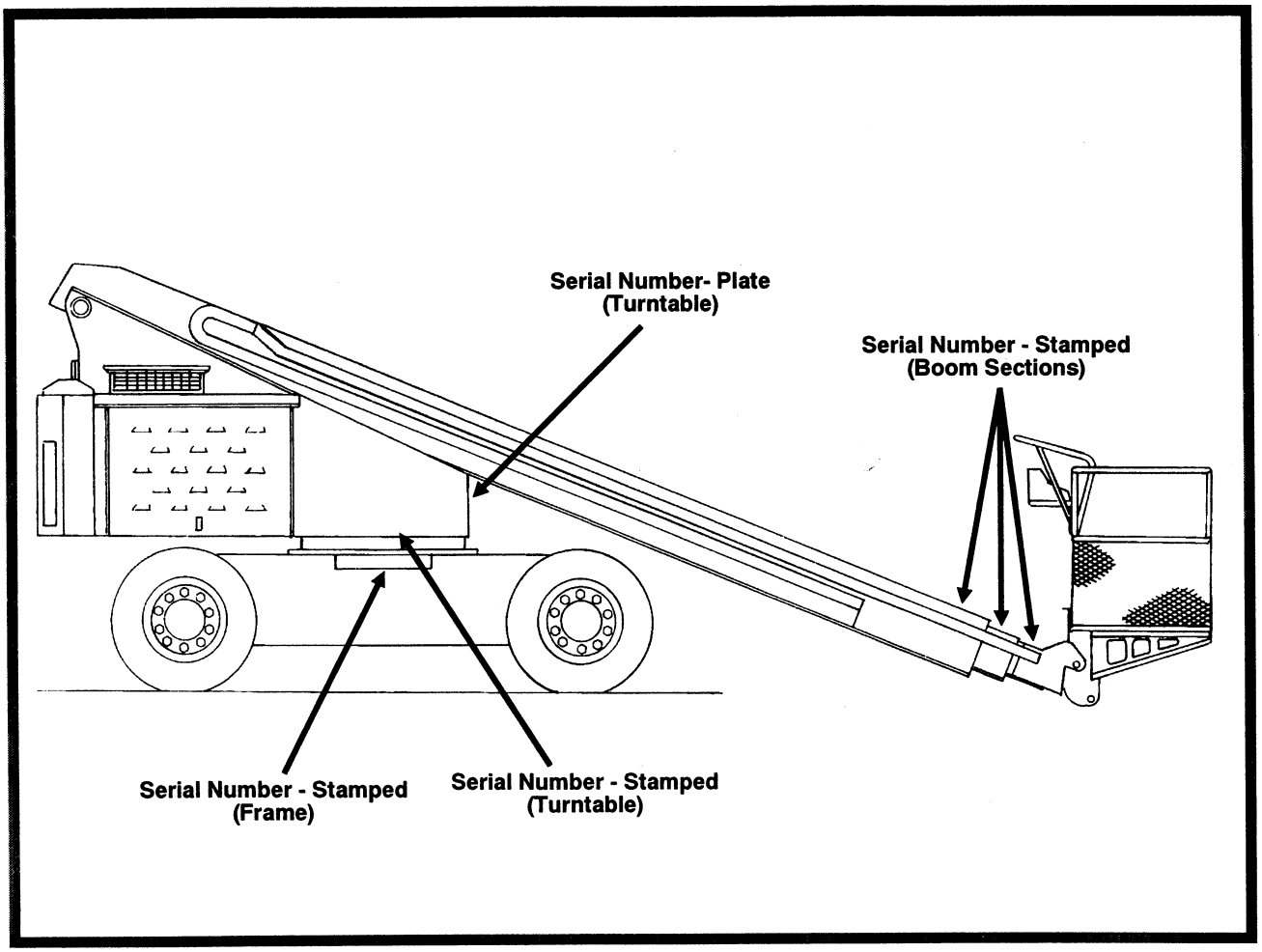


Figure 1-4. Serial Number Locations.

2-1. GENERAL.

a. 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.

b. 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.

a. General.

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

b. 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.

c. 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 air, fuel, and oil supplies clean; however, these items must be maintained on a scheduled basis in order to function properly.

(2). At any time when air, fuel, or 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.

d. Components 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 interferring.

e. 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.

f. Presssure-Fit Parts.

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

g. 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 install.

(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.

h. 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.

i. 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.)

j. 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.

k. 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 non-flammable cleaning solvent. Lubricate components, as required, to aid assembly.

l. Lubrication.

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

m. Battery.

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

n. Lubrication and Servicing.

Components and assemblies requiring lubrication and servicing are shown in Figures 1-2.

2-3. LUBRICATION INFORMATION.

a. Hydraulic System.

(1). The primary enemy of a hydraulic system is contamination. Contaminants enter the system by various means, e.g., using 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 or leaks in the pump supply (suction) lines.

(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 as necessary, 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.

b. Hydraulic Oil.

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

(2). JLG recommends Kendall Hyken 052 hydraulic oil, which has an SAE viscosity of 10W-20 and a viscosity index of 152, or BP Energol SHS46.

Note

Start-up of hydraulic system with oil temperatures below -15° 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° F.

(3). The only exception to the above is to drain and fill the system with Mobil DTE 11 oil or its equivalent. This will allow start up at temperatures down to -20°F. However, use of this oil will give poor performance at temperatures above 120° F. Systems using DTE 11 oil should not be operated at temperatures above 200°F. under any condition.

c. Changing Hydraulic Oil.

(1). Use of any of the recommended crankcase or hydraulic oils eliminates the need for changing the oil on a regular basis. However, filter elements must be changed after the first 40 hours of operation and every 250 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 annually.

(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.

d. 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 grease 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.

a. Systems Incorporating Double Acting Cylinders:

Cylinders are of the double-acting type. Systems incorporating double-acting cylinders are as follows: Lift, Telescope, Platform Leveling, Steer and Lockout. 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 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.

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

2-5. VALVES - THEORY OF OPERATION.

a. Solenoid Control Valves (Bang-Bang).

Control valves used are four-way three-position solenoid valves of the sliding spool design. When a circuit is activated and the control valve solenoid energizes, the spool is shifted and the corresponding work port opens to permit oil flow to the component in the selected circuit with the opposite work port opening to reservoir. Once the circuit is deactivated (control returned to neutral) the valve spool returns to neutral (center) and oil flow is then directed through the valve body and returns to reservoir. A typical control valve consist of the valve body, sliding spool, and two solenoid assemblies. The spool is machine fitted in the bore of the valve body. Lands on the spool divide the bore into various chambers, which when the spool is shifted, align with corresponding ports in the valve body open to common flow. At the same time other ports would be blocked to flow. The spool is spring loaded to center position, therefore when the control is released, the spool automatically returns to neutral, prohibiting any flow through the circuit.

b. Proportional Control Valve - Vickers.

CMX series valves provide a power output matching that reqired by the load. A small line connected to a load-sensing port feeds load pressure back to the pump. The pump senses the difference between the load and pump outlet pressures, and varies the pump displacement to keep the difference constant. This differential pressure is applied accross the valves meter-in spool, with the effect that pump flow is determined by the degree of spool opening, independent of load pressure. Return lines are connected together simplifying routing of return flow and to help reduce cavitation. Load sensing lines connect through shuttle valves to feed the highest load signal back to the pump. Integral actuator port relief valves, anticavitation check valves, and load check valves are standard. The load drop check prevents any drop of a suspended load before upward movement.

c. Relief Valves.

Main relief valves are installed at various points with the hydraulic system to protect associated systems and components against excessive pressure. Excessive pressure can be developed when a cylinder reaches its limit of travel and the flow of pressurized fluid continues from the system control. The relief valve provides an alternate path for the continuing flow from the pump, thus preventing rupture of the cylinder, hydraulic line or fitting. Complete failure of the system pump is also avoided by relieving circuit pressure. The relief valve is installed in the circuit between the pump outlet (pressure line) and the cylinder of the circuit, generally as an integral part of the system valve bank. Relief pressures are set slightly higher than the load requirement, with the valve diverting excess pump delivery back to the reservoir when operating pressure of the component is reached.

d. Relief Valves.

Crossover relief valves are used in circuits where the actuator requires an operating pressure lower than that supplied to the system. When the circuit is activated and the required pressure at the actuator is developed, the crossover relief diverts excess pump flow to the reservoir, individaul, integral reliefs are provided for each side of the circuits.

2-6. BOOM CHAINS. (See Figure 2-1)

a. Adjusting Procedures.

⚠ WARNING

ENSURE MACHINE IS ON A FIRM AND LEVEL SURFACE.

(1). Fully retract boom in the horizontal position.

(2). Torque fly boom retract chains, adjust to 40 ft. lbs. (2.76 Bar).

(3). Torque fly boom extend chains, adjust to 40 ft. lbs. (2.76 Bar).

(4). Cycle boom (extend at least three feet and return to the fully retracted position).

(5). Recheck fly boom retract chains (40 ft. lbs. (2.76 Bar) required).

(6). Recheck fly boom extend chains (40 ft. lbs. (2.76 Bar) required).

(7). Repeat steps #2, #3 and #4 if necessary.

(8). Check for proper operation of boom.

JLG Industries, Inc. requires a complete boom disassembly, per instructions outlined in the 2-12 boom disassembly, every two years. All boom chains and related components (i.e., sheaves, pins, sprockets, wear pads, etc.) must also be inspected and replaced (as necessary) during this disassembly.

An immediate disassembly of the boom assembly and inspection of the boom chains and related components is required if any of the following conditions occur:

1. After machine is exposed to hostile environments or conditions (i.e. extreme cold, dust, sand, blasting grit, salt, chemicals, etc.), which could adversely affect boom operation.
2. Erratic boom operation or unusual noise exists. See trouble-shooting section in Service Manual.
3. Chain adjustment is required more often than specified in Service Manual or links need to be removed (chain shortened) to make adjustment.
4. Machine is idle for an extended period (6 months or longer.)
5. Boom is overloaded or sustained a shock load.

⚠ WARNING

FAILURE TO DISASSEMBLE THE BOOM ASSEMBLY AND PROPERLY INSPECT AND/OR REPLACE THE BOOM CHAINS AND RELATED COMPONENTS (I.E., SHEAVES, PINS, SPROCKETS, WEAR PADS, ETC.) COULD RESULT IN THE DAMAGE AND/OR BREAKAGE OF THE BOOM CHAINS AND/OR RELATED COMPONENTS. DAMAGE AND/OR BREAKAGE OF THESE ITEMS COULD RESULT IN UNCONTROLLED EXTENSION OR RETRACTION OF THE BOOM ASSEMBLY AND COULD CAUSE SERIOUS INJURY OR DEATH TO PERSONNEL OPERATING THE JLG BOOM LIFT.

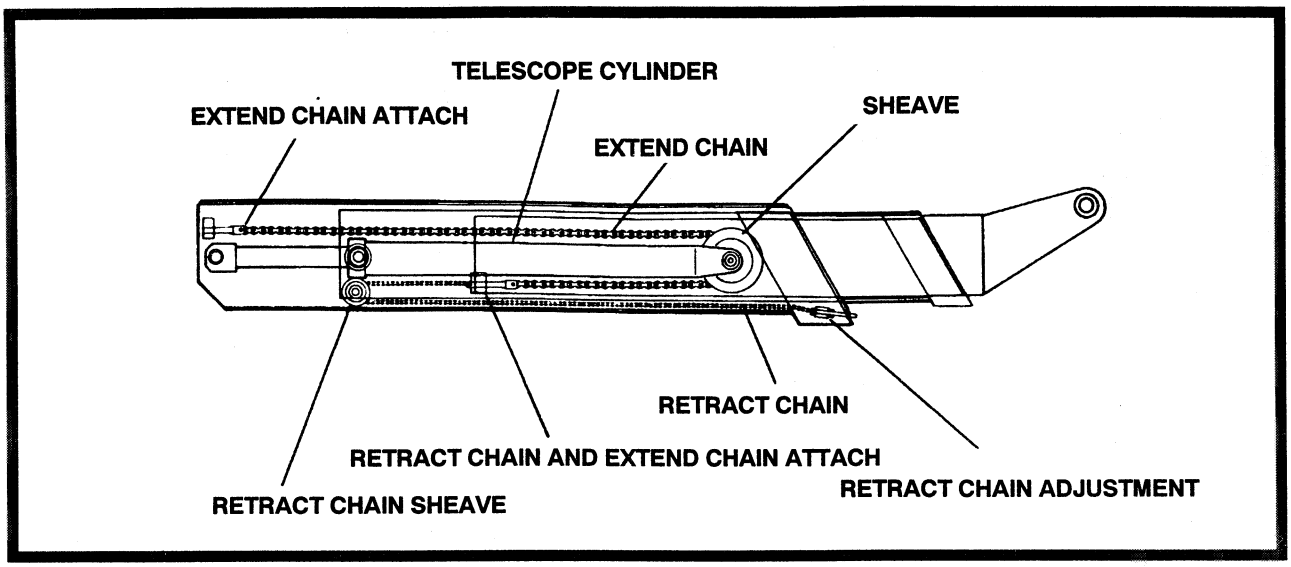
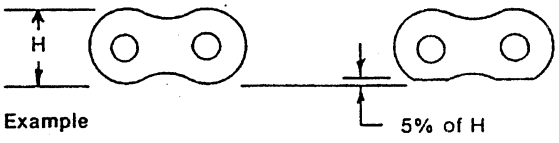


Figure 2-1. Typical Three Section Boom Assembly.

b. Inspection Procedures.

(1). Inspect boom chains for the following condition:

(a). **Wear:** Always inspect that segment of chain that operates over a sheave. As the chain flexes over the extend/retract sheaves, joints and plate edges very gradually wear. Chain "stretch" can be measured using a manufacturers wear scale or steel tape. When chains have elongated 3% they must be removed and replaced. Refer to Table 1 for proper chain specifications and allowable stretch tolerances. Peening and wear of chain plate edges are caused by sliding over a chain worn contact face of a sheave, or unusually heavy loads. All of the above require replacement of the chain and correction of the cause. Chain side wear, noticeable when pin heads and outside plates show a definite wear pattern, is caused by misalignment of the sheave/chain anchors and must be corrected promptly. Do not repair chains; if a section of chain is damaged, replace the entire chain set.



Example

H for a 1" chain	= .950"
Maximum wear	= 5% of .950" = .047"
Minimum plate depth	= .950" - .047" = .903"

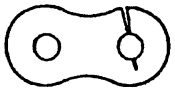
(b). **Lubrication:** One of the most important but often overlooked factors is adequate lubrication. In addition to reducing internal friction, maintaining a film of oil on all chain surfaces will inhibit rusting and corrosion. This is important as corrosion of highly stressed, hardened steel chain components can cause a major reduction in the load capacity of leaf chain and result in link plate cracking.

Note

The need for lubrication can be determined by the presence of rust on the exposed portions of chain.

(c). **Rust and Corrosion:** Rust and corrosion will cause a major reduction in the load carrying capacity of the chain, because these are primary reasons for side plate cracking. The initial lubrication at the factory is applied in a hot dip tank to assure full penetration into the joint. Do not steam clean or degrease this lubricant on chains. A grade of SAE 30 or 40 weight, nondetergent motor oil should be used as a supplemental lubricant and a film of this oil should be constantly maintained on the surfaces and internal joints. At time of chain installation, factory lube must be supplemented by a maintenance program to provide a film of oil on the chains at all times. If chains are corroded, they must be inspected, especially the outside plates, for cracks in-line with the pins. If cracks are found, replace the chain; if no cracks are discovered, lubricate the chains by dipping in heated oil, and reinstall on the machine. Keep chains lubricated.

(d). **Fatigue Cracks:** Fatigue is a phenomenon that affects most metals, and is the most common cause of chain plate failures. Fatigue cracks are found through the link holes, perpendicular (90 degrees) from the pin in-line position. Inspect chains carefully after long time use and heavy loading for this type of crack. If any cracks are discovered, replace all chains, as seemingly sound plates are on the verge of cracking. Fatigue and ultimate strength failures on JLG Lifts are incurred as a result of severe abuse as design specs are well within the rated lifting capacity of these chains.

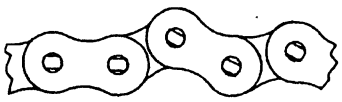


(e). **Tight Joints:** All joints in the roller chain should flex freely. On roller chain, tight joints are usually caused by rust/corrosion, or the inside plates "walking" off the bushing. Limber up rusty/corroded chains (after inspecting care fully) with a heavy application of oil (preferably a hot oil dip). Tap inside "walking" plates inward; if "walking" persists, replace the chain. This type of problem is accelerated by poor lubrication maintenance practice, and most tight joint chains have been operated with little or no lubrication. Tight joints on leaf chain are generally caused by:

1. Bent pins or plates.
2. Rusty joints.
3. Peened plate edges.

Oil rusty chains, and replace chains with bent or peened chain components. Keep chains lubricated.

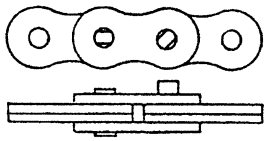
TIGHT JOINTS



(f). **Protruding or Turned Pins:** Chains operating with inadequate lube generate tremendous friction between the pin and plates (pin and bushing on roller chain). In extreme cases, this frictional torque can actually turn the pins in the outside press-fit plates. Inspect for turned pins, which can be easily spotted as the "V" flats on the pin heads are no longer in line. Replace all chains showing evidence of turned or protruding pins. Keep chains lubricated.

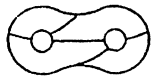
(g). **Stress Corrosion Cracking:** The outside link plates, which are heavily press-fitted to the pins, are particularly susceptible to stress corrosion cracking. Like fatigue cracks, these initiate at the point of highest stress (aperture) but tend to extend in an arc-like path, often parallel to the rolling grain of the material.

ABNORMAL PROTRUSION OR TURNED PINS



Also, more then one crack can often appear on a link plate. In addition to rusting, this condition can be caused by exposure to an acidic or caustic medium or atmosphere. Stress corrosion is an environmentally assisted failure. Two conditions must be present — corrosive agent and static stress. In the chain, static stress is present at the aperture due to the

ARC-LIKE CRACKED PLATES (STRESS CORROSION)



press fit pin. No cycle motion is required and the plates can crack during idle periods. The reactions of many chemical agents (such as battery acid fumes) with hardened metals liberate hydrogen which attacks and weakens the metal grain structure.

(h). **Chain Anchors, Sheaves and Pins:** An inspection of the chain must include a close examination of chain anchors, sheaves and pins. Check chain anchors for wear breakage and misalignment. Anchors with worn or broken fingers should be replaced. They should also be adjusted to eliminate twisting the chain for an even load distribution.

Sheaves should be inspected for worn flanges, which would indicate misalignment, and wear on the outside diameter of the sheave. A worn sheave can mean several problems, as follows:

1. Chains too tight.
2. Sheave bearings/pin bad.
3. Bent/misaligned chains.

Table 2-1 Chain Stretch Tolerances.

Chain Size	Pin To Pin Measurement	Allowable Stretch
0.50 in. (1.27 cm) pitch	14 in. (36 cm) or 28 pitches	0.42 in. (1.07 cm)
0.625 in. (1.59 cm) pitch	15 in. (38 cm) or 24 pitches	0.45 in. (1.14 cm)
0.75 in. (1.91 cm) pitch	15 in. (38 cm) or 20 pitches	0.45 in. (1.14 cm)
1 in. (2.54 cm) pitch	14 in. (36 cm) or 14 pitches	0.42 in. (1.07 cm)
1.25 in. (3.18 cm) pitch	15 in. (38 cm) or 12 pitches	0.45 in. (1.14 cm)
1.75 in. (4.45 cm) pitch	14 in. (36 cm) or 8 pitches	0.42 in. (1.07 cm)
2 in. (5.08 cm) pitch	14 in. (36 cm) or 7 pitches	0.42 in. (1.07 cm)

2-7. WEAR PADS.

(1). Shim up wear pads within 1/16 in. (1.59 mm) tolerance between wear pad and adjacent surface.

(2). Replace wear pads when worn within 1/8 in. (3.18 mm) of threaded insert.

2-8. CYLINDER CHECKING PROCEDURE.

Note

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

a. Cylinders Without Counterbalance Valves. Steer Cylinder and Master Cylinder.

(1). Using all applicable safety precautions, activate engine and fully extend cylinder to be checked. Shut down engine.

(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 the initial discharge there should be no further leakage from the retract port.

(3). Activate engine and extend cylinder.

(4). If cylinder retract port leakage is less than 6-8 drops per minute, carefully reconnect hose to 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 engine and carefully disconnect hydraulic hose from cylinder extend port.

(6). Activate engine and retract cylinder. 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.

b. Cylinders With Single Counterbalance Valve.

- Lift Cylinder, Telescope Cylinder and Extend-A-Reach Lift Cylinder.

⚠ IMPORTANT

OPERATE ALL FUNCTIONS FROM GROUND CONTROLS.

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

⚠ WARNING

WHEN WORKING ON THE LIFT CYLINDER, RAISE THE BOOM TO HORIZONTAL AND PLACE A BOOM PROP APPROXIMATELY 1 INCH (2.50 CM) BELOW THE BOOM. DO NOT WORK ON THE CYLINDER WITHOUT A SUITABLE PROP IN PLACE. REFER TO FIGURE 2-2.

(2). After completing the above, shut down hydraulic system and allow machine to sit for 10-15 minutes. Turn IGNITION SWITCH to ON, move control switch or lever for applicable cylinder in each direction, then turn IGNITION SWITCH to OFF. 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 seals are defective and must be replaced. If the extend port is leaking, the counterbalance valve is defective and must be replaced.

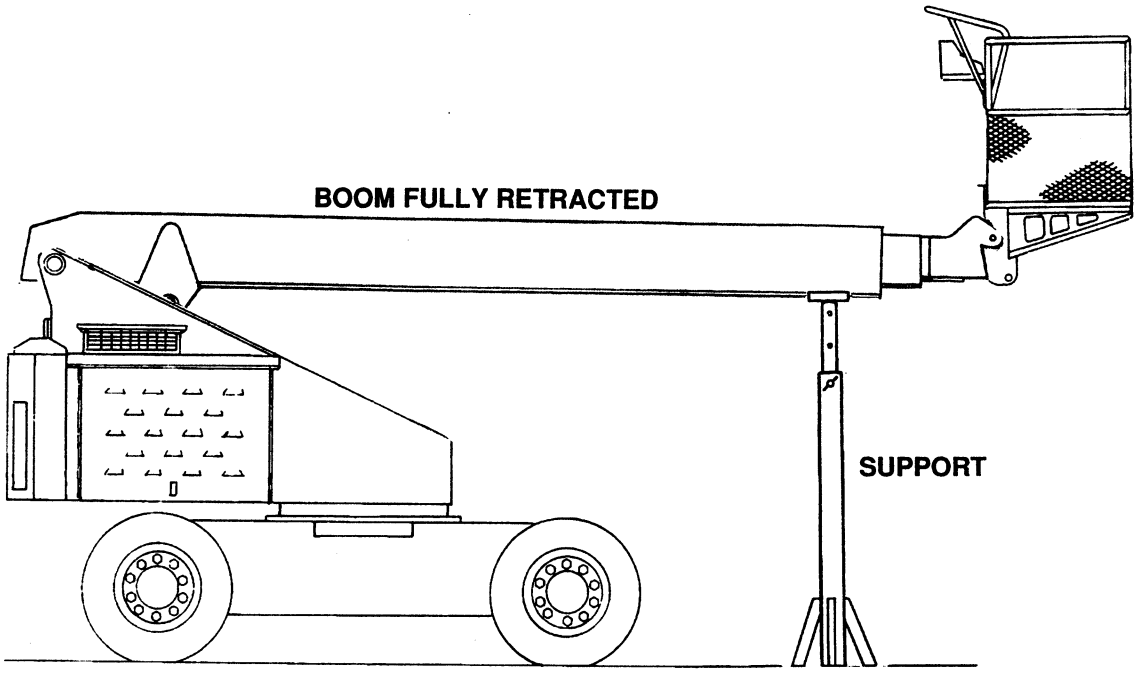


Figure 2-2. Boom Positioning and Support, Cylinder Repair.

(4). If no repairs are necessary or when repairs have been made, carefully reconnect hydraulic hoses to the appropriate ports.

(5). If used, remove boom prop from beneath boom, activate hydraulic system and run cylinder through one complete cycle to check for leaks.

c. Cylinders With Dual Counterbalance Valves.

- Platform Slave Level Cylinder, Lockout Cylinder and Extend-A-Reach Level Cylinder.

⚠ IMPORTANT

OPERATE ALL FUNCTIONS FROM GROUND CONTROL STATION ONLY.

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

(2). When working on the platform slave level cylinder, stroke platform slave level cylinder forward until platform sits at a 45° angle.

(3). Shut down hydraulic system and allow machine to sit for 10-15 minutes. If machine is equipped with a bang-bang or proportional control valves, turn IGNITION SWITCH to ON, move control switch or lever for applicable cylinder in each direction, then turn IGNITION SWITCH to OFF. If machine is equipped with hydraulic control valves, move control lever for applicable cylinder in each direction. 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 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, replace counterbalance valve and carefully connect hydraulic hoses to cylinder port block.

(7). If used, remove lifting device from upright or remove prop from below boom, activate hydraulic system and run cylinder through one complete cycle to check for leaks.

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.

a. 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.

⚠ WARNING

CYLINDERS WITH DOUBLE HOLDING VALVES. BEFORE REMOVING HOLDING VALVES CRACK BLEEDERS TO RELEASE PRESSURE.

(3). If applicable, remove the cartridge-type holding valve and fittings from the cylinder port block. Discard o-rings.

Note

Procedure step (4) applies only to the Model 70H Telescope Cylinder.

(4). Remove the nuts which attach each cylinder rod support block pull rod and withdraw the rods from the forward end of the telescope cylinder.

(5). Place the cylinder barrel into a suitable holding fixture. Tap around outside of cylinder head retainer with a suitable hammer to shatter loctite.

(6). Using a suitable spanner wrench, loosen the cylinder head retainer, if applicable, and/or cylinder head gland, and remove from cylinder barrel.

(7). 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.

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

(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 to the rod, and remove the piston. Discard self-locking set screws.

(11). Remove the piston rings.

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

(13). Remove the set screw, if applicable, piston spacer, and wear ring, if applicable, from the rod.

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

b. Cleaning and Inspection.

(1). Clean all parts thoroughly in an approved cleaning 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 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 piston surface 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 inside diameter for scoring or other damage and for ovality and tapering. Replace as necessary.

(9). Inspect seal and o-ring grooves in head for burrs and sharp edges. Dress applicable surfaces as necessary.

(10). If applicable, inspect cylinder head retainer or end cap for surface or thread damage. Repair or replace as necessary.

(11). Inspect cylinder head outside diameter for scoring or other damage and ovality and tapering. Replace as necessary.

(12). If applicable, inspect thread ring for scoring or other damage. Dress threads or applicable surfaces as necessary.

(13). If applicable, inspect seal grooves in thread ring for burrs and sharp edges. Dress applicable surfaces as necessary.

(14). If applicable, inspect rod and barrel bushings for signs of correct lubrication and excessive wear. Replace as necessary.

(15). Inspect travel limiting collar or spacer for burrs and sharp edges. If necessary, dress inside diameter surface with Scotch Brite or equivalent.

(16). If applicable, inspect port block fittings and holding valve. Replace as necessary.

Note

Procedure step (17) applies only to the Model 70H Telescope Cylinder.

(17). On the telescope cylinder only, inspect the cylinder rod support block and wear ring inside diameter for scoring or other damage. Repair or replace as necessary.

(18). Inspect the oil ports for blockage or the presence of dirt or other foreign material. Repair as necessary.

(19). If applicable, inspect piston rings for cracks or other damage. Replace as necessary.

Note

Steps (20) through (23) apply to the Telescope Cylinder only.

(20). Inspect chain sheave bushings for scoring, tapering, ovality and for excessive wear and evidence of correct lubrication. Replace bushing as necessary.

(21). Inspect sheave chain groove for damage. Replace sheave assembly as necessary.

(22). Inspect sheave attach pin for scoring or other damage and for evidence of correct lubrication. Dress pin surface with Scotch Brite or equivalent or replace pin as necessary.

(23). Inspect sheave pin lubrication drilling and fitting for blockage or the presence of dirt or other foreign material. Repair as necessary.

c. Assembly.

Note

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.

⚠ IMPORTANT

WHEN INSTALLING 'POLY-PAK' PISTON SEALS, ENSURE SEALS ARE INSTALLED PROPERLY. REFER TO FIGURE 2-3 FOR CORRECT SEAL ORIENTATION. IMPROPER SEAL INSTALLATION COULD RESULT IN CYLINDER LEAKAGE AND IMPROPER CYLINDER OPERATION.

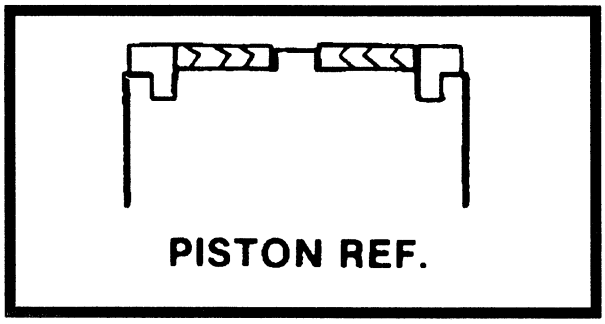


Figure 2-3. Poly-Pak Seal Installation.

Note

Step (1) applies only to the Model 70H Telescope Cylinder.

(1). For the telescope cylinder only, support the cylinder rod and install the assembled rod support on the rod shaft. Push the support along the rod to the port block end.

(2). Place a new wiper seal and rod seal into the applicable cylinder head gland grooves.

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

(4). Carefully slide the piston spacer on the rod. If applicable, align the oil holes in the rod and the spacer. Secure the spacer, if applicable.

(5). If applicable, correctly place a new o-ring and back-up rings in the inner piston diameter groove.

(6). Carefully place the piston on the cylinder rod, ensuring that the o-ring and back-up rings are not damaged or dislodged.

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

(8). Push the piston onto the rod until it abuts the spacer end and install the attaching nut.

⚠ WARNING

WHEN REBUILDING THE LIFT, SLAVE LEVEL, TELESCOPE, STEER (SINGLE ROD), AND EXTEND-A-REACH SLAVE AND LIFT CYLINDERS, APPLY LOCTITE #242 TO PISTON NUT, THEN TIGHTEN BOTH SECURELY. (SEE TABLE 2-2 FOR TORQUE SPECIFICATIONS).

Notes

These cylinders use self-locking knurled cup point setscrews which should be discarded and replaced whenever they are removed.

After torquing piston nut spot drill cylinder rod for setscrews.

(9). If applicable, install the setscrew (s) which secure the piston attaching nut to the diameter groove. (See Table 2-2 for Torque Specifications).

(10). Remove the cylinder rod from the holding fixture.

(11). Place new o-rings and seals in the applicable outside diameter grooves of both the piston and the cylinder head.

(12). 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.

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

Note

Step (14) applies only to the Model 70H Telescope Cylinder.

(14). Place the support rods in the tubes provided on the barrel assembly. The rods will bottom out on the attached stops. Thread the rods through the rod support block and, using loctite, tighten the rod nuts down on the support.

⚠ IMPORTANT

THE SUPPORT RODS MUST BE INSTALLED SO THAT THEY BOTTOM OUT SIMULTANEOUSLY ON THE STOPS.

(15). 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 threads engage the threads of the barrel.

(16). If applicable, secure the cylinder head gland using a suitable spanner type wrench in the holes provided.

(17). If applicable, secure the cylinder head retainer using a suitable spanner type wrench in the holes provided.

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

(19). 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.

Note

Steps (20) through (23) apply to the Boom Telescope Cylinders.

(20). Elevate the barrel end of the cylinder to a work bench or other suitable device.

(21). Plug the retract port and supply hydraulic power to the extend port.

(22). Open the bleeder port plug (TP) venting all trapped air to atmosphere. Retighten the bleeder port plug. Disconnect the hydraulic power source and remove plug from retract port.

(23). An alternative to steps (20) through (23) is to position the barrel horizontally in a suitable holding device, attach a hydraulic power source to both extend and retract ports, while supporting the cylinder rod, cycle the cylinder a minimum of 5 times with the bleeder port unplugged venting all trapped air to atmosphere. A suitable hose may be attached to the bleeder port with the end in a container suitable to contain the hydraulic fluid. After all air is vented remove all attached hoses, and install the bleeder port plug. Also plug the extend and retract ports until cylinder is installed in boom.

Table 2-2. Cylinder Piston Nut Torque Specifications.

Description	Nut Torque Value (Wet)	Setscrew Torque Value (Dry)
Lift Cylinder	600 ft. lbs. (814 Nm)	200 in. lbs. (23 Nm)
Slave Cylinder	80 ft. lbs. (109 Nm)	100 in. lbs. (12 Nm)
Master Cylinder	80 ft. lbs. (109 Nm)	100 in. lbs. (12 Nm)
Steer Cylinder	80 ft. lbs. (109 Nm)	100 in. lbs. (12 Nm)
Lockout Cylinder	80 ft. lbs. (109 Nm)	100 in. lbs. (12 Nm)
Telescope Cylinder	600 ft. lbs. (814 Nm)	200 in. lbs. (23 Nm)
Extend-A-Reach		
Lift Cylinder	200 ft. lbs. (271 Nm)	100 in. lbs. (12 Nm)
Slave Cylinder	200 ft. lbs. (271 Nm)	100 in. lbs. (12 Nm)

Note

After torquing piston nut spot drill cylinder rod for setscrews.

Table 2-3. 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.

a. Telescope Cylinder Removal.

(1). Be sure boom is fully retracted and in a horizontal position.

(2). Shut down engine. Support boom basket end with a prop. (See Figure 2-2.)

(3). Remove boom end-cover.

⚠ CAUTION

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

(4). Tag and disconnect hydraulic lines to telescope cylinder. Use suitable container to retain any residual hydraulic fluid. Cap hydraulic lines and ports.

(5). Remove the two setscrews that retain the telescope cylinder pin to the base boom.

(6). Using a suitable brass drift, carefully drive the telescope cylinder pin from the base boom.

(7). Remove the telescope cylinder trunnion pin covers from each side of the base boom.

(8). Remove the capscrews securing the trunnion pins from each side of the boom.

(9). Using a suitable slide hammer, remove the trunnion pins attaching the telescope cylinder to the mid boom.

(10). Attach a suitable sling to the telescope cylinder. Support with an overhead crane or other suitable lifting device.

(11). Remove the two (2) extension chain adjusting nuts from the eyebolt through the chain adjust assembly.

(12). Remove the four (4) bolts and lock washers attaching the chain attach block to the base boom section and remove block.

(13). Attach a suitable lifting device to the extension chain adjusting eyebolt above the cylinder rod.

Note

The extension chain will come out of the boom twice as far as the telescope cylinder.

(14). Using both lifting devices, carefully pull the cylinder from the boom assembly.

(15). As the cylinder is removed from the boom, lay the extension chain on top of the base boom.

(16). Using another lifting device, support the sheave wheel end of the cylinder and remove the cylinder from the boom assembly.

(17). Carefully lift the cylinder clear of the boom assembly and lower to the ground or suitably supported work area.

b. Telescope Cylinder Installation.

(1). Using suitable lifting equipment, carefully lower the cylinder to the boom assembly.

(2). Using another lifting device, support the sheave wheel, or rod end, of the cylinder and install the cylinder into the boom assembly.

(3). Slide the cylinder into boom, sliding the extension chain in place as the cylinder is moving in.

(4). Attach a suitable lifting device to the extension chain adjusting eyebolt.

(5). Install chain adjust block with four (4) lockwasher and bolts to base boom section.

(6). Install the two (2) extension chain adjusting nuts that attach the eyebolt to the chain adjust block.

(7). Remove the lifting device from the telescope cylinder.

(8). Using a suitable brass drift install the trunnion pins attaching the telescope cylinder to the mid boom section.

(9). Install the capscrews securing the trunnion pins to each side of the boom. Note that loctite 242 is required on the capscrew threads.

(10). Install trunnion pin covers on each side of boom.

(11). Carefully install the telescope cylinder barrel attach pin into base boom.

(12). Install the setscrews that retain the telescope cylinder pin to the base boom.

(13). Remove applicable hydraulic line and port caps and correctly connect the hydraulic lines to the telescope cylinder. Ensure all hoses are correctly routed.

(14). Install boom end cover.

(15). Activate hydraulic system.

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

(17). Cycle (extend/retract) boom several times, then torque boom chains to 40 ft. lbs. (2.76 Bar). See Section 2-6 Boom Chains for correct torquing procedure.

(18). Check fluid level of hydraulic tank and adjust as necessary.

c. Boom Lift Cylinder Removal.

(1). Place the machine on a flat and level surface. Start the engine and place the boom in a horizontal position. Shut down the engine and prop the boom. (See Figure 2-2.)

(2). Remove the hardware retaining the cylinder rod attach pin to the boom. Using a suitable brass drift, drive out the cylinder rod attach pin.

(3). Using auxiliary power, retract the lift cylinder rod completely.

(4). Disconnect, cap and tag the boom lift cylinder hydraulic lines and ports.

(5). Remove barrel end attach pin retaining hardware. Using a suitable brass drift drive out the barrel end attach pin from the turntable upright.

(6). Remove the cylinder from the boom and place in a suitable work area.

d. Boom Lift Cylinder Installation.

(1). Install lift cylinder in place using suitable slings or supports, aligning attach pin mounting holes on the turntable upright.

(2). Using a suitable drift, drive the barrel end attach pin through the mounting holes in the lift cylinder and the turntable upright. Secure in place with the pin retaining hardware.

(3). Remove cylinder port plugs and hydraulic line caps and correctly attach lines to cylinder ports.

(4). Using auxiliary power extend the cylinder rod until the attach pin hole aligns with those in the boom. Using a suitable drift drive the cylinder rod attach pin through the aligned holes, taking care to align the grooved pin holes. Secure the pin in place with attaching hardware.

(5). Remove boom prop and overhead crane. Activate hydraulic system.

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

(7). Check fluid level of hydraulic tank and adjust as necessary.

2-11. TELESCOPE CYLINDER ECCENTRIC BUSHING.

⚠ IMPORTANT

RELOCATE ALTERNATE SETSCREW HOLE ONLY WHEN REPLACING ECCENTRIC BUSHING.

When replacing eccentric bushings, drill 5/16" dia. x 3/4" deep, tap 3/8-16NC x 9/16" deep for new setscrew (bushing to boom) either above or below original holes. Allow enough room between holes for strength while staying on the thick side of bushing. (See Figure 2-4)

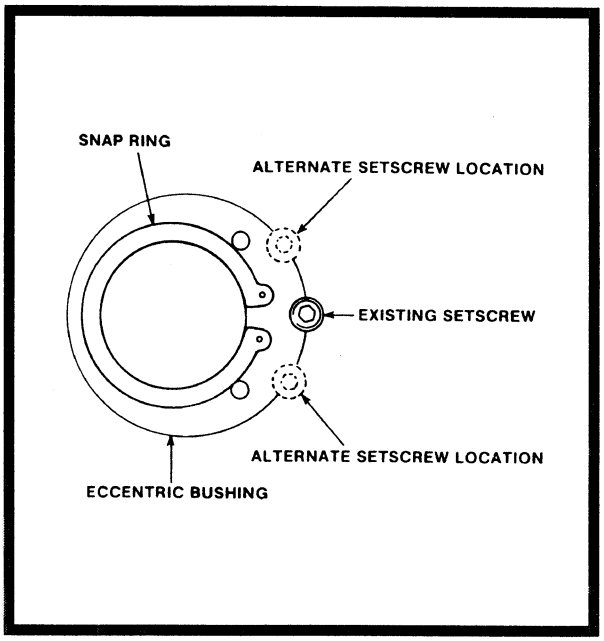


Figure 2-4. Telescope Cylinder Eccentric Bushing.

2-12. BOOM MAINTENANCE.

a. Removal.

(1). Remove the platform from boom assembly.

(2). Remove the slave leveling cylinder from boom assembly.

Note

Boom Assembly weighs approximately 3,590 lbs. (1628 kg) Model 60H, 4,450 lbs. (2038 kg) Model 70H.

(3). Using suitable lifting equipment, adequately support boom weight along entire length of retracted boom.

⚠ CAUTION

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

(4). Tag and disconnect hydraulic lines that run along the side of the boom.

(5). Remove hardware attaching upper lift cylinder attach pin to boom.

(6). Using a slide hammer or similar tool, and taking care not to damage pin, remove pin from boom.

(7). Using all applicable safety precautions, and only if necessary, operate crane and fully retract lift cylinder.

(8). Shut down machine systems.

(9). Tag and disconnect all wiring to ground control box.

(10). Loosen and remove hardware securing boom pivot pin.

(11). Ensuring that boom is adequately supported and using a suitable slide hammer, carefully remove pivot pin from boom and turntable structure. Ensure that boom and turntable structure are not damaged.

(12). Carefully lift boom assembly clear of turntable and lower to ground or suitably supported work surface.

b. Disassembly.

⚠ CAUTION

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

(1). Remove hydraulic lines, electrical cables, carrier tube, power track from right side of boom assembly.

(2). Remove the telescope cylinder, extension chain assembly

(3). Remove control console from the platform.

(4). Remove platform from fly boom assembly.

(5). Remove carrier tube and power track from right side of the boom assembly.

(6). Removal and disassemble of the extension chain attachment and adjustment assembly (mounted at aft of boom base section) as follows:

a. Remove jam nut and nut which secures the chain attachment clevis bolt to the chain adjustment block.

b. Remove the bolts and washer which secure the extension chain attachment, assembly to the base boom section; remove chain attachment assembly from the base boom section mounting point.

c. Remove the cotter pins from the clevis pins. Remove clevis pins and washers from the chain attachment clevis bolt; remove the chain attachment clevis from the chain.

(7). Removal and disassemble of the retraction chain attachment and adjustment assembly as follows:

a. Remove nuts and washers from the chain attachment shield, and remove shield from the boom base section.

b. Remove the jam nut and nut from the threaded end of the tension-adjusting clevis bolt. Remove the entire tension-adjusting assembly from the boom-mounted bracket.

c. Remove the cotter pins from the clevis pins which secure the retraction chains, to the clevis bolt assembly.

d. Remove cotter pins, nuts and bolts securing chain attach blocks to clevis bolt assembly. Remove attach blocks.

e. Separate top and bottom clevis bolt assembly plates. Remove clevis bolt from bottom plate.

(8). Remove the snap rings from the pin which attaches the telescope cylinder rod end to the boom base section; use a brass drift to remove the pin.

Note

Note and record the number and thickness of any wear pad shims during wear pad removal.

(9). Remove bolts which secure the wear pads to the inner forward surfaces of the boom base section. Remove the wear pads from the top, sides and bottom of the boom base section.

(10). Using suitable lifting equipment, carefully slide the assembled mid and fly sections from the base section. Place the mid and fly sections on a suitable trestle.

(11). Remove the setscrew which secures the sheave pin at the aft end of the midsection. Use a suitable brass drift to remove pin. Remove sheave assembly.

(12). Remove the bolts, washers and bar from the trunnion pins which secure the cylinder base to the boom mid section; use a suitable slide hammer to remove the pins.

⚠ CAUTION

WHEN REMOVING THE TELESCOPE CYLINDER FROM THE BOOM, IT MAY BE NECESSARY AT SOME POINT TO TURN THE CYLINDER SLIGHTLY IN ORDER TO CLEAR ASSEMBLIES MOUNTED WITHIN THE BOOM CARE MUST BE TAKEN TO MOVE THE CYLINDER SLOWLY FROM THE BOOM, DAMAGE TO COMPONENTS MAY RESULT FROM FORCIBLE IMPACT WITH THESE ASSEMBLIES.

(13). Pull the cylinder partially from the rear of the boom mid section; secure the cylinder with a suitable sling and lifting device at approximately the center of gravity.

(14). Carefully remove the telescope cylinder and sheave assembly. Place the cylinder on a suitable trestle.

(15). Remove bolts and washers from the sheave pin; remove the pin and the sheave assembly.

Note

Note and record the number and thickness of any wear pad shims during wear pad removal.

(16). Remove the bolts which secure the wear pads to the inner surfaces of the boom mid section; remove the wear pads from the top, sides and bottom of the mid section.

(17). Remove bolts and lockwashers which secure the chain block weldment to the aft end of the fly section. Remove the cotter pins from the clevis pins which secure the extension chain and retraction chains to the block; remove the clevis pin, washers and chains from the block.

(18). Using suitable lifting equipment, remove the fly section from the mid section; place the fly section on a suitable trestle.

(19). Remove the bolts which secure the wear pads to the aft ends of the fly and mid sections; remove the wear pads from the boom sections.

c. Inspection.

(1). Inspect all sheaves (extend chains, retract chains and telescope cylinder) for excessive groove wear, burrs or other damage. Replace sheaves as necessary.

(2). Inspect extend chain and retract chain sheave bearings for wear, scoring, or other damage, and for ovality. Replace bearings as necessary, ensuring they are installed flush with sheave surface.

(3). Inspect extend chain and retract chain sheave pins for scoring, tapering, ovality and evidence of correct lubrication. Replace pins as necessary.

(4). Inspect telescope cylinder sheave pin for tapering, scoring, ovality and evidence of correct lubrication. Replace pin as necessary.

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

(6). Inspect upper lift cylinder attach pin for tapering, ovality, scoring, wear, or other damage. Ensure pin surfaces are protected prior to installation. Replace pin as necessary.

(7). Inspect telescope cylinder trunnion attach pin for tapering, ovality, scoring, wear, or other damage. Replace pin as necessary.

(8). Inspect extend chain attach clevis pins for wear, scoring, or other damage. Replace pins as necessary.

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

(10). Inspect inner diameter of boom pivot bushing for scoring, distortion, wear, or other damage. Replace bushing as necessary.

(11). Inspect all wear pads for excessive wear or damage. Replace pads when worn to within 1/8 inch (3.2 mm) of insert.

(12). Inspect extend and retract chains and chain attach components for cracks, stretching, distortion, or other damage. Replace components as necessary.

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

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

d. Assembly.

Note

When installing fly section wear pads, install same number and thickness of shims as were removed during disassembly.

(1). Measure the inside dimensions of the base and mid sections to determine the number of shims required for proper lift.

(2). Install side wear pads to the aft end of the fly section; shim evenly to the measurements of the inside of the mid section.

(3). Install the side wear pads to the aft end of the mid section; shim evenly to the measurement of the inside of the base section.

(4). Shim the insides of the boom sections for a total of 1/16 inch (.062) clearance (if the action is centered, there will be 1/32 clearance on each side).

(5). Slide fly section into the mid section a distance of approximately one foot; measurement of the inside of the mid section top wear pad clearance and fabricate shim packs.

(6). Remove the fly section from the mid section and install two top wear pads and a shim pack. Shim the top of the fly section for a total of 1/16 inch (.062) clearance.

(7). Slide the mid section into the base section a distance of approximately one foot; measurement top wear pad clearance and fabricate shim packs.

(8). Remove the mid section from the base section and install two top wear pads and a shim pack. Shim the top of the mid section for a total of 1/16 inch (.062) clearance.

(9). Attach the extension chain to the appropriate clevised attachment point of the chain block weldment by installing the clevis pin and washer through the attach holes;secure the clevis pin with a new cotter pin. Place the chain block weldment in position at the aft end of the fly section; secure the weldment by installing the bolts and washers.

⚠ CAUTION

WHEN ASSEMBLING BOOM SECTIONS, ENSURE THAT THE BOOM SLIDING TRAJECTORIES HAVE BEEN CLEARED OF CHAINS, TOOLS, AND OTHER OBSTRUCTIONS.

(10). Slide the fly section into the mid section. Shim boom, if necessary, for a total of 1/16 inch (.062) clearance.

(11). Install wear pads into the forward portion of the mid section. Shim boom, if necessary, for a total of 2/10 inch (.20) clearance.

(12). Align the attach points of the retraction chains with those of the chain attachment block, located at the aft end of the fly section. Install the clevis pins and washers through the attaching holes of the chains and block; secure the clevis pins by installing new cotter pins.

(13). Properly position the retraction chain sheave assemblies at the aft end of the mid section; ensure all sheave-to-mounting block attachment holes align. Install the sheave pin and secure by installing the s setscrews. Position the retraction chains onto the sheaves.

(14). Align the telescope cylinder base-to-sheave attachment points. Install the sheave pin through the cylinder base and sheave assembly; secure the pin with bolt and washer.

(15). 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, IT MAY BE NECESSARY AT SOME POINT TO TURN THE CYLINDER SLIGHTLY IN ORDER TO CLEAR ASSEMBLIES MOUNTED WITHIN THE BOOM. CARE MUST BE TAKEN TO MOVE THE CYLINDER SLOWLY INTO POSITION: DAMAGE TO COMPONENTS MAY RESULT FROM FORCIBLE IMPACT WITH THESE ASSEMBLIES.

(16). Position the free end of the extension chain around and over the sheave; slowly slide the cylinder into the boom while maintaining tension on the chain. (This will keep the chain properly seated in the sheave groove throughout installation).

(17). Align the cylinder base-end attachment holes with the boom mid section attachment holes; install the trunnion pins and secure the pins by installing bars, washers and bolts.

(18). Slide the mid section into the base section. Allow the retraction chains to trail between the bottom surfaces of boom sections; ensure that no twists exist in chains. Shim the top of the mid section for a total of 1/16 inch (.062) clearance.

(19). Install wear pads into the forward portion of the base section. Shim boom, if necessary, for a total of 2/10 inch (.20) clearance.

(20). Assemble the extension chain attachment and adjustment assembly (mounted at aft of boom base section) as follows:

a. Align the attaching holes of the chain attachment clevis bolt with those of the extension chain end; install the clevis pin through the attaching holes. Install the washer and cotter pin which secures the clevis pin through the chain attachment assembly.

(21). Align the cylinder rod-end attachment point with those of the boom base section. If necessary, use an auxiliary hydraulic power source to extend and retract the cylinder rod for alignment. Install the cross pin through the base boom section and cylinder rod. Install snap rings onto cross pin.

(22). Align the chain attachment assembly holes with the threaded mounting holes at the aft end of the boom by installing the bolts and washers.

(23). Insert the threaded end of the chain attachment clevis bolt through the large hole of the chain attachment weldment. Loosely install the jam nut and nut onto the threaded end of clevis bolt.

(24). Assemble and install the retraction chain attachment and adjustment assembly as follows:

a. Place clevis bolt on bottom plate and place top plate onto clevis assembly. Secure clevis bolt with clevis pins, washers and new cotter pins.

b. Insert chain attach blocks between clevis plates ensuring attachment points are properly aligned. Secure block in position with bolts, nuts and new cotter pins.

c. Align retraction chains with clevis attach blocks; secure chains with clevis pins, washers and new cotter pins.

d. Position the bolt end of the extension-adjustment clevis into the boom mounted bracket. Secure the chain-adjusting assembly by installing the jam nut and nut.

e. Position the chain adjustment shield over the chain adjustment assembly; secure the shield by installing the bolts and washers.

(25). Adjust retract and extend chains to the proper torque. (See step a. adjusting procedures of paragraph 2-6).

(26). Install the hydraulic hoses, electrical cables, and the harnessing powertrack components as follows:

a. Properly position the fly section carrier tube with carrier tube-bracket installed at the side of the boom. Align the attachment holes the forward end of the carrier tube with those of the fly section mounting plate. Secure the carrier tube by installing the bolts, washers , lock washers and nuts. Align the support bracket with attachment holes in the mid boom and secure with bolts and washers.

b. Properly position the assembled hoses, electrical cable, and the harnessing powertrack onto the base section carrier tube. Carefully feed the proper hose and cable ends through the fly section carrier tube and into the hole in the boom fly section. Properly align the powertrack end with the attachment point of the fly section carrier tube; install the bolts, washers, lock washers and nuts which secure the powertrack to the carrier tube.

c. Carefully feed the remaining hose and cable ends aft through the base section carrier tube. Properly align the remaining powertrack end with the attachment point of the base section carrier tube; install the bolts, washers, lockwashers and nuts which secure the powertrack to carrier tube.

d. Ensure all hoses and cables are properly routed through the carrier tube and powertrack. Tighten or install all clamping or securing apparatus to the hoses or cables, as necessary.

e. Installation.

(1). Using suitable lifting equipment, position assembled boom on turntable so that boom pivot holes in both boom and turntable are aligned.

(2). Insert boom pivot pin, ensuring that locating slots in pin are aligned with setscrew locating holes in pin bushings.

(3). If necessary, gently tap pin into position with a soft headed mallet. Secure pin with setscrews.

(4). Connect all wiring to ground control box.

(5). Using all applicable safety precautions, operate lifting equipment in order to position boom lift cylinder so that holes in cylinder rod end and boom structure are aligned. Insert lift cylinder pin.

(6). If necessary, gently tap pin into position with a soft headed mallet, ensuring that pin plate holes are aligned with attach holes in boom structure. Install pin attaching bolts, washers and lockwashers.

(7). Shut down machine systems.

(8). Connect hydraulic lines running along side of boom.

(9). Using all applicable safety precautions, operate machine systems and raise and extend boom fully, noting the performance of the extension cycle. If chattering is apparent, extend chain system requires adjustment.

(10). Retract and lower boom, noting performance of retraction cycle. If chattering is apparent, retract chain system requires adjustment.

(11). Shut down machine systems.

(12). Adjust extend and retract chain systems as required and secure adjustment locknuts.

(13). As necessary, lubricate all points requiring lubrication.

2-13. TILT ALARM SWITCH.

Note

There are two methods of adjustment, a manual adjustment and an adjustment using a voltmeter.

⚠ CAUTION

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

a. Manual Adjustment.

(1). Park the machine on a flat, level surface. Ensure machine is level and tires are filled to rated pressure.

Note

Ensure switch mounting bracket is level and securely attached.

(2). Level the base of the indicator by tightening the three flange nuts through approximately one half of its spring travel. DO NOT ADJUST THE "X" NUT DURING THE REMAINDER OF THE PROCEDURE.

(3). With the electrical connections complete, slowly tighten one of the "Y" nuts until the circuit is closed and the light on the Platform Control Console illuminates.

(4). Slowly back off the nut, counting the number of turns, until the circuit is again closed and the light again illuminates.

(5). Divide the number of turns determined in step d. in half. Tighten the nut this many turns. The line determined by this nut and the "X" nut is now parallel to the ground.

(6). Repeat steps 3. through 5. for the remaining "Y" nut. The switch is now level.

(7). Individually push down on one corner at a time; there should be enough travel to cause the switch to trip. If the switch does not trip in all three tests, the flange nuts have been tightened too far. Loosen the "X" nut and repeat steps (3). through (7).

b. Voltmeter Adjustment.

(1). Park machine on a flat, level surface. Ensure machine is level and tires are filled to rated pressure.

(2). If engine is not running, turn ignition switch to ON.

(3). Connect black lead of voltmeter to ground and red lead to yellow wire protruding from pot on bottom of sensor.

(4). Adjust leveling nuts to obtain the highest possible voltage reading.

(5). Check Voltage at trip point in all four directions. If voltage reading is not symmetrical, repeat step (4) above.

2-14. HORIZONTAL HIGH SPEED CUTOUT SWITCH ADJUSTMENT PROCEDURE .

Adjust switch to trip when boom reaches 0 degrees +0 degrees /-3 degrees.

2-15. GOVERNOR CHECKS AND ADECO ADJUSTMENT, LSG423.

a. Checks. (Refer to Figure 2-5)

(1). Check governor drive belt tension. A belt in operation for 10 minutes or more should be set at 100 ft. lbs. (135 Nm).

(2). Check length of spring spreader adjustment from centerline of eye to centerline of eye. Dimension should be 1 5/8 inch.

(3). Manually move the governor throttle lever to maximum high speed position. (The Adeco actuator must be disconnected to accomplish this.) The carburetor throttle lever should have 1/32 to 1/16 inch travel remaining to stop. The governor high speed stop screw was removed at the factory.

Note

All governor adjustments must be made with Adeco throttle actuator disconnected.

b. Adjustments. (Refer to Figure 2-6 and 2-7)

(1). With the throttle rod and Adeco actuator disconnected from governor, advance governor arm to high speed position. This should advance governor throttle lever to maximum wide open position. Verify wide open position of lever by checking governor spring for tension. Reconnect throttle rod.

(2). From ground control, start engine. Allow engine to come up to normal operating temperature. Advance governor arm to wide open position. Set high engine speed at 3000 RPM (2500 RPM for machines with piston pump) by making adjustments at throttle rod. Return engine to low speed.

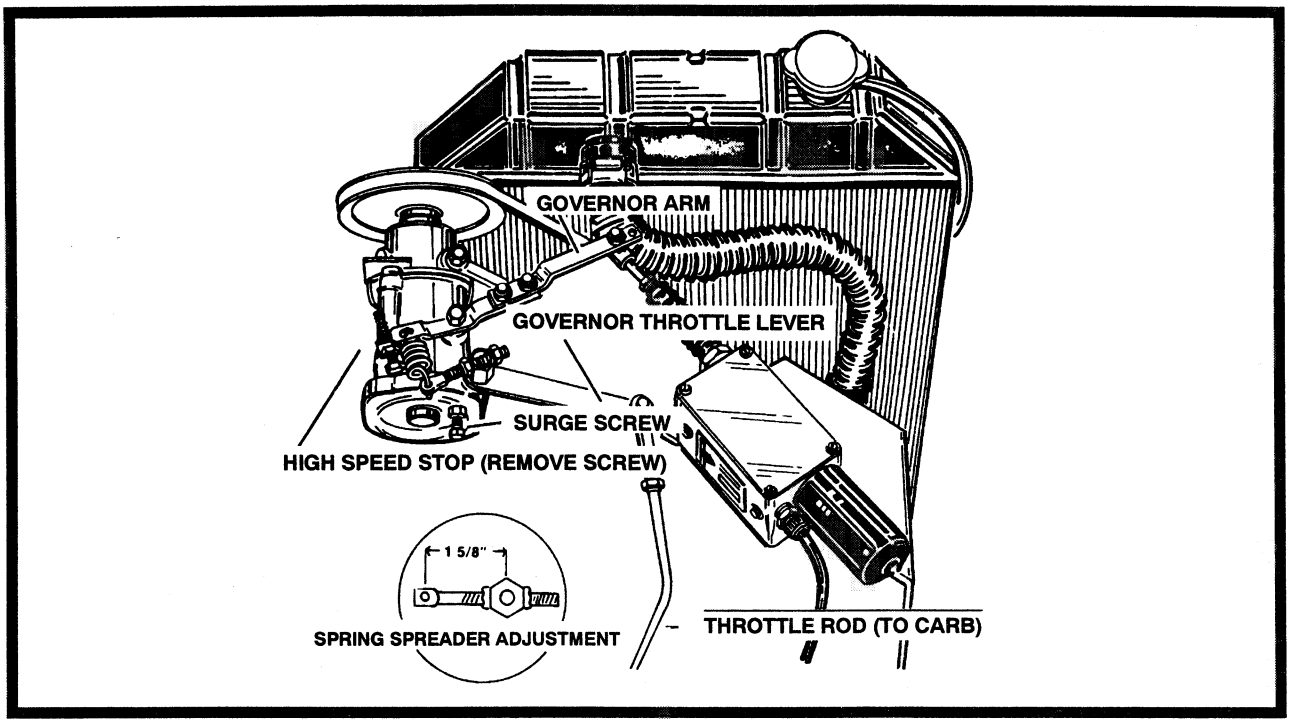


Figure 2-5. Governor Adjustment, LSG-423 with Adeco.

(3). If the engine hunts or surges in the maximum speed no load condition, decrease engine speed until surging stops. Increase speed slowly to 2925 RPM (2425 RPM for machines with piston pump). Slowly turn governor surge screw clockwise until no load engine speed increases to 3000 RPM (2500 RPM for machines with piston pump). Lock surge screw in position. Shut off engine.

Note

Do not turn surge screw in any further than necessary or governor performance will be affected.

(4). From basket (for idle) start engine and allow engine to come up to operating temperature. Set idle speed at 1000 RPM using idle adjustment screw on carburetor. Shut off engine.

(5). Remove cover on Adeco actuator. With no function activated, actuator should be fully extended. Hold governor arm in idle position. Adjust slide pin (1) to contact idle limit switch at output rod end of actuator. Adjust actuator rod until you can hook up to governor arm.

(6). With the aid of an assistant, start engine from basket and allow to come to operating temperature. Disconnect proportional dump valve wire. Activate footswitch. Turn high engine switch on. Hold drive controller in full drive position. Adjust slide pin (2) to contact high engine limit switch at 3000 RPM (2500 RPM for machines with piston pump). Shut off all switches and controllers. Reconnect proportional dump valve wire.

(7). With the aid of a assistant, start engine from basket and allow to come to operating temperature. Disconnect bang-bang dump valve wire. Activate footswitch. Operate a bang-bang function switch to increase RPM to low engine. Using a small screwdriver set low engine at 1800 RPM at the Adeco electronic module.

Note

Early machines are at idle until a function is activated. Later machines are at idle only at platform without footswitch activated. Therefore when setting low engine speed on later machines it will not be necessary to disconnect bang-bang dump valve wire or operate a bang-bang function. Just activate footswitch to get low engine.

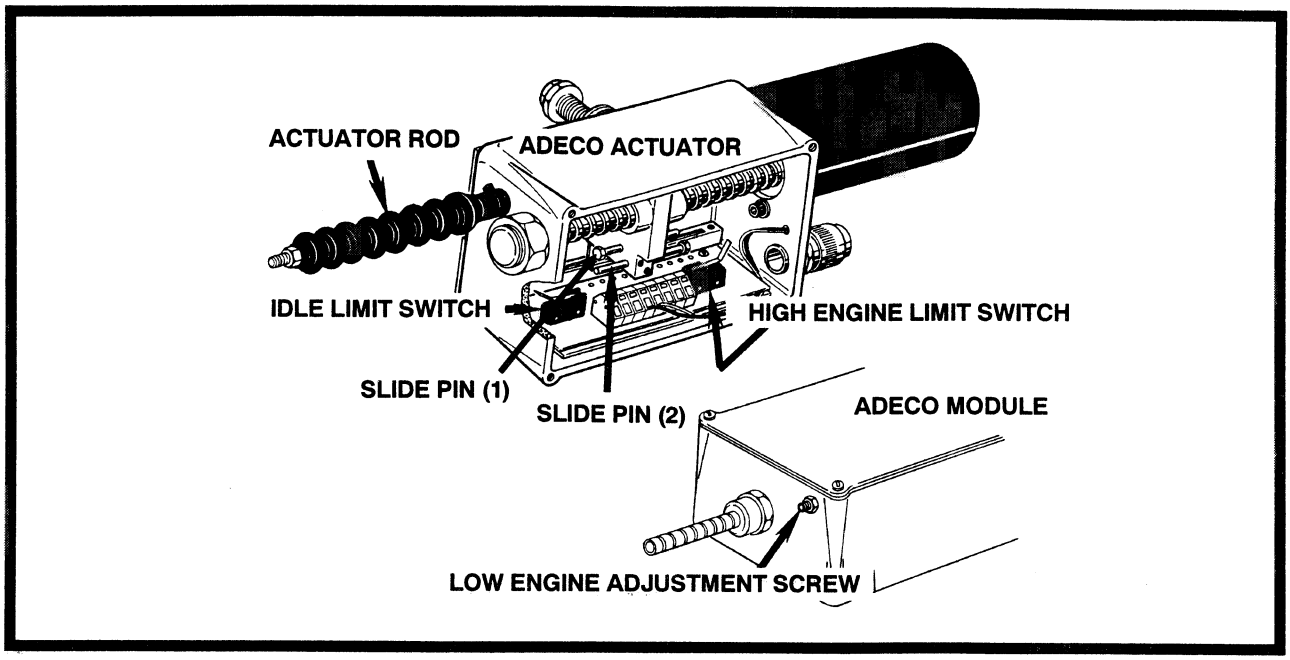


Figure 2-6. Adeco Adjustment, LGS-423.

2-16. THROTTLE CHECKS AND PRECISION GOVERNOR ADJUSTMENTS, LSG-423. (See Figure 2-7.)

Note

Never run 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 Deutz Instruction Manual for procedure.

a. Checks.

(1). Check that anti-dieseling solenoid is operating. If solenoid is operating, an audible click at the carburetor should be heard when ignition is switched on.

(2). Check throttle linkage for smooth operation by rotating throttle lever by hand to full throttle position then slowly back to idle position feeling closely for sticking or binding. To accomplish this the throttle rod must first be disconnected.

b. Choke Adjustments.

Note

Automatic choke and vacuum pulloff adjustment procedure to be made only on a cold engine.

(1). Make sure choke body and mounting bracket are positioned so that choke rod moves freely with no binding anywhere through its stroke.

(2). The choke spring should hold the choke plate firmly closed but require only slight finger pressure to open at 70 degrees F. (21.28 degrees C.)

(3). Retract pulloff shaft until it bottoms (as if under engine vacuum). Bend pulloff rod until a 3/8" (9.53mm) rod just fits between choke plate and carburetor body.

(4). The above procedure outlines the correct choke system adjustment for most conditions. Some environments such as high altitude, very warm or very cold temperatures may require that the choke cover be set richer or leaner, or the amount of putoff may need to be varied somewhat.

c. Carburetor amd Governor Adjustment.

(1). With the aid of an assistant, start the engine at the platform console and allow it to come up to operating temperature with air cleaner installed. Adjust carburetor idle screw until engine idles at 1000 RPM. Shut down engine.

Note

Steps (2) and (3) are preliminary settings.

(2). On controller (in ground control box) turn 'high engine' (P1) adjusting screw 25-30 turns CCW, then 10 turns CW.

(3). On controller (in ground control box) turn 'gain' (P2) adjusting screw CCW to the stop, then CW until screw slot is vertical (approximately 1/4 turn).

(4). On controller (in ground control box) turn 'droop' (P3) adjusting screw CCW to the stop, then CW until screw slot is vertical (approximately 1/4 turn). No further adjustment should be necessary to 'droop' (P3).

(5). With the aid of an assistant at platform console start the engine and allow to come up to operating temperature. Then have assistant depress footswitch and place engine speed switch to HIGH ENGINE.

(6). If engine surging occurs at this point, turn 'gain' (P2) adjusting screw CCW until surging ceases. Turn 'high engine' (P1) adjusting screw until engine runs at 3000 RPM (2500 RPM for machines with piston pump). Turning the screw CW increases RPM. Turning the screw CCW decreases RPM.

(7). While your assistant continues to depress the footswitch, have him place engine speed switch to LOW ENGINE. Turn 'low (mid) engine' adjusting screw until engine runs at 1800 RPM. Turning the screw CW increases RPM. Turning the screw CCW decreases RPM. Shut down engine. Seal all trim pots when finished with finger nail polish.

Note

If engine surges under no load, on HIGH ENGINE and you cannot get enough response from adjusting 'gain' (P2), try adjusting surge screw on actuator. Loosen surge screw locknut. Disconnect throttle linkage. Turn surge screw CW until linkage arm moves. Manually stroke the linkage fully and allow to return slowly until it stops. Try to move linkage towards return position. If linkage moves, turn surge screw CCW 1/2 turn. Again stroke linkage and allow to return slowly until it stops. Try to move linkage towards return position. If linkage moves, turn surge screw CCW 1/2 turn. Repeat this procedure until linkage does not move after stroking. Do not turn any more. This will set buffer spring tension properly. Reconnect throttle linkage.

(9). With engine speed switch set to LOW ENGINE, when footswitch is depressed engine should immediately respond, if response time lags, turn 'gain' (P2) adjusting screw CW to improve response time. Turn adjusting screw in small increments only until response time is correct. Turning adjusting screw too far CW can cause surging. (See 7 above)

2-17. THROTTLE CHECKS AND ADJUSTMENTS - DEUTZ ENGINE. (See Figure 2-8.)

Note

Never run 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 Deutz Instruction Manual for procedure.

a. Disconnect actuator cable from throttle lever. With the aid of an assistant, start the engine and allow it to come up to operating temperature. Adjust throttle lever stop until engine runs at 2000 RPM. Shut down engine. Reattach actuator cable to throttle lever making sure that low engine setting remains the same. If necessary, adjust slide pin to contact low engine limit switch at 2000 RPM. Shut down engine.

b. With the aid of an assistant, start engine from basket and allow to come up to operating temperature. Disconnect proportional dump valve wire. Activate footswitch. Turn on HIGH ENGINE switch. Hold drive controller in full drive position. Adjust slide pin to contact high engine limit switch at 3000 RPM. Shut off all switches and controllers. Reconnect proportional dump valve wire.

Note

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

Note

Early machines are at idle until a function is activated. Later machines are at idle only at platform without footswitch activated. Therefore when setting low engine speed on later machines it will not be necessary to disconnect bang-bang dump valve wire or operate a bang-bang function. Just activate footswitch to get low engine.

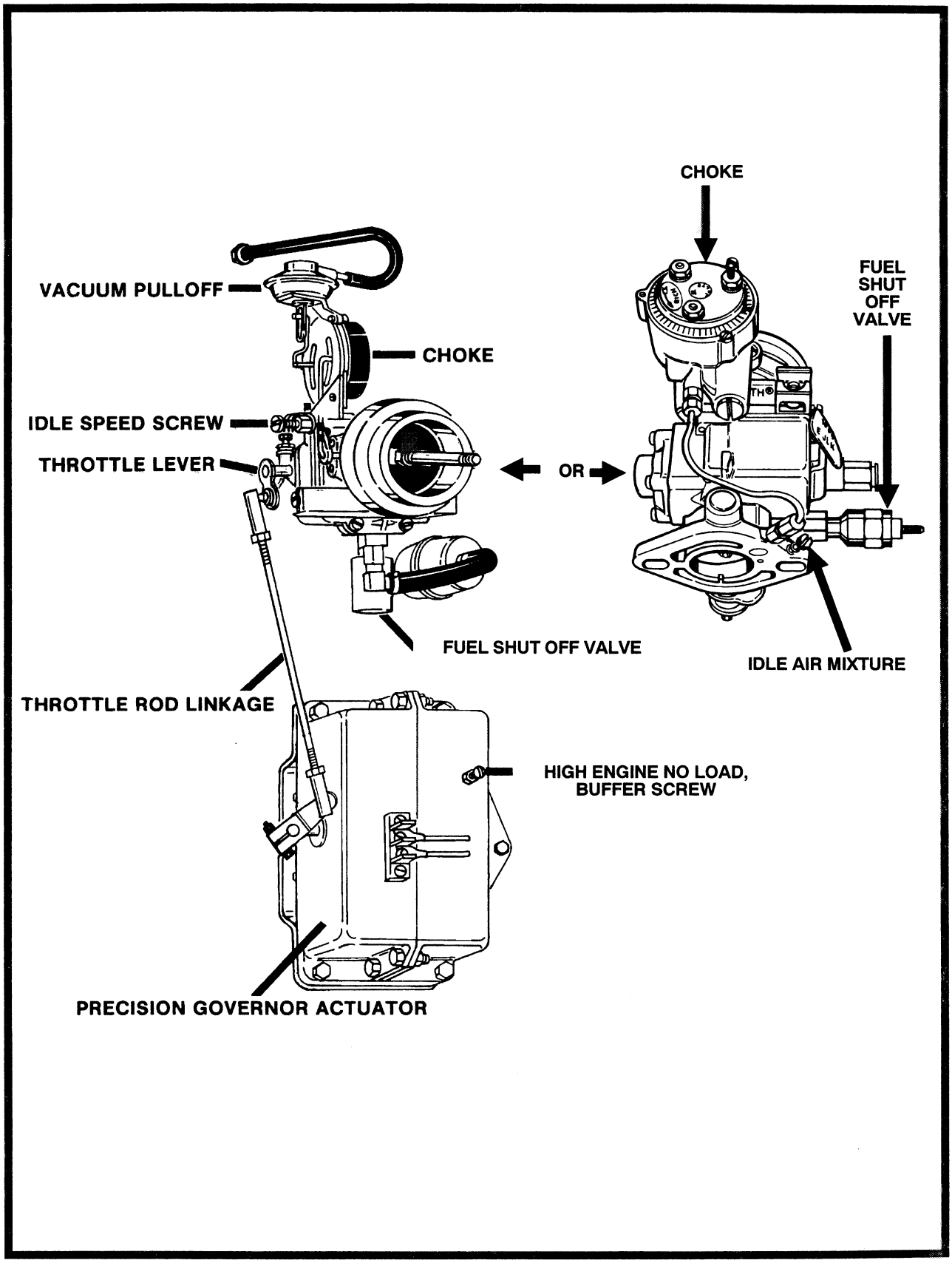
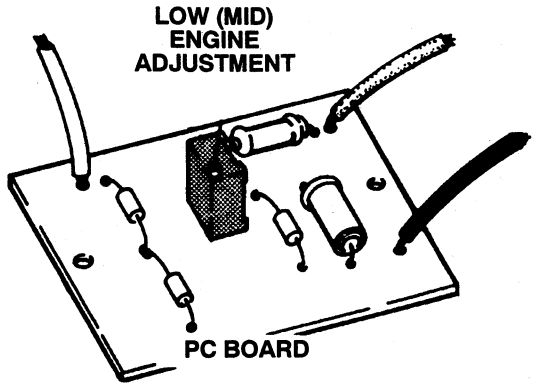
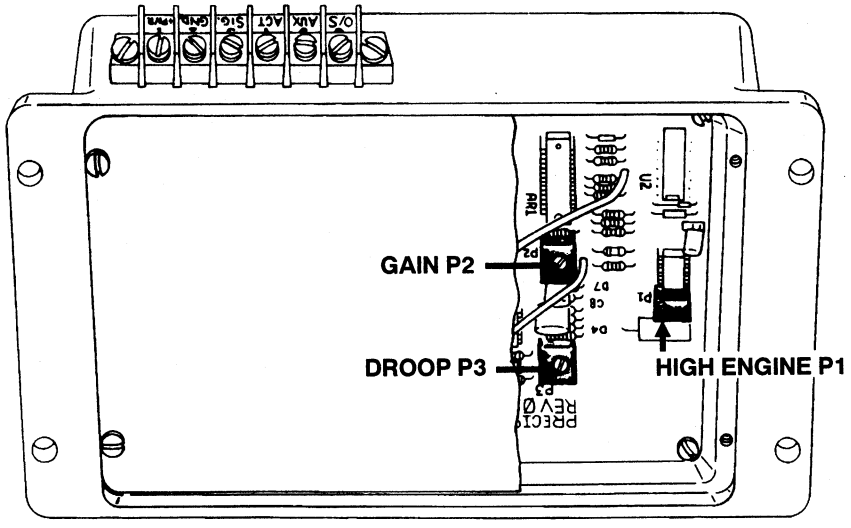


Figure 2-7. Precision Governor Adjustment, LSG-423 (Sheet 1 of 2).



Note

All pots should be sealed with finger nail polish, after all adjustment are completed.



PRECISION GOVERNOR CONTROLLER

Figure 2-7. Precision Governor Adjustment, LSG-423 (Sheet 2 of 2).

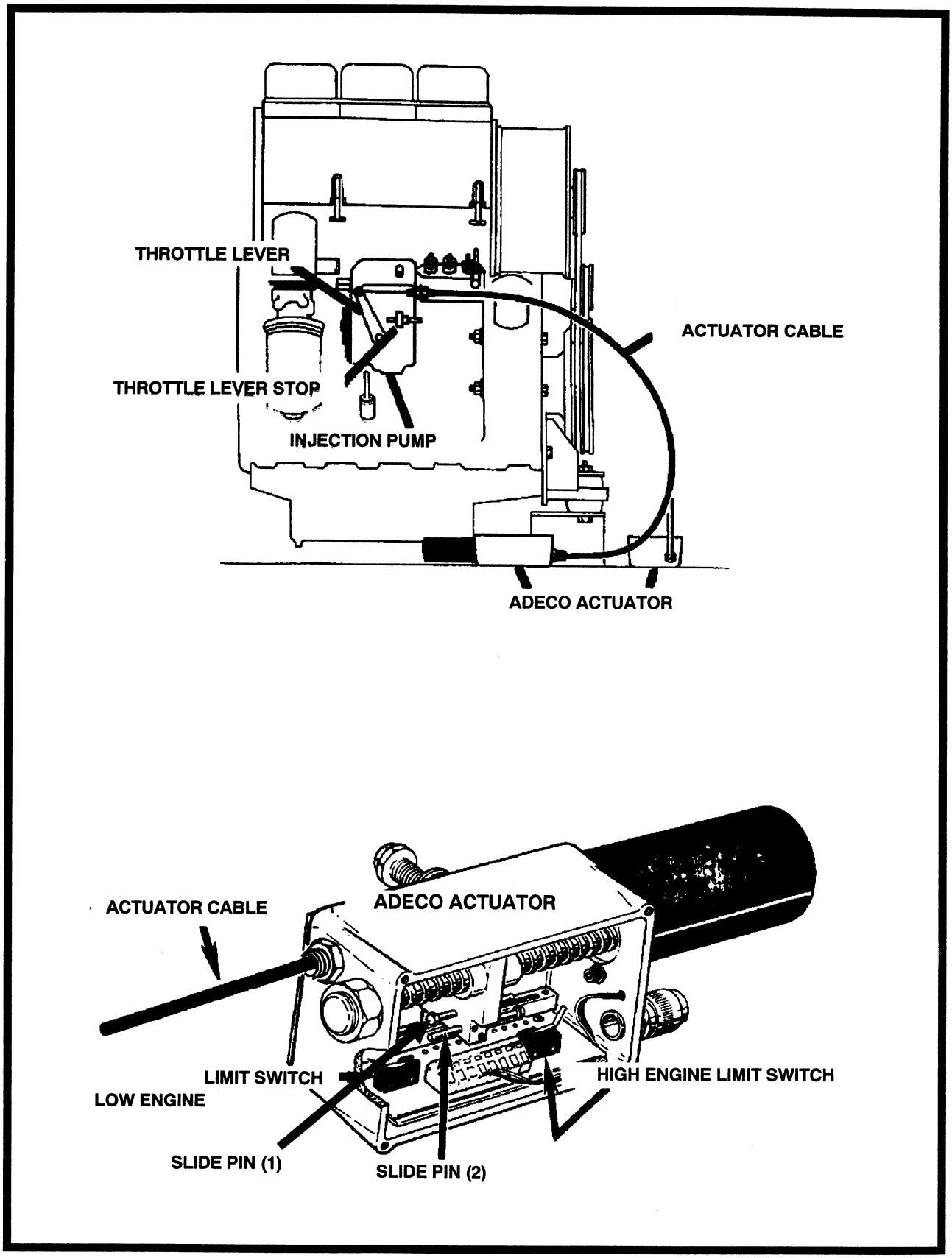


Figure 2-8. Adeco Actuator Adjustments, F3L912.

2-18. PRESSURE SETTING PROCEDURES.

a. Racine Proportional Valve Pressure Setting, Machines Built Prior To Mid 1987 are shown in Figure 2-9.

b. Vickers Proportional Valve Pressure Setting, Machines Built Prior To 1989 With Accessory Valve are shown in Figure 2-10.

c. Solenoid Valve Pressure Settings Machines Built Prior To May 1992 With Steer Wheel are shown in Figure 2-11.

d. Pressure And Flow Settings Machines Built Prior To May 1992 With Steering Wheel are shown in Figure 2-12.

e. Vickers Proportional Valve Pressure Setting, Machines Built To Present are shown in Figure 2-13.

f. Vickers All Hydraulic Pressure Setting are shown in Figure 2-14.

g. Solenoid Valve Pressure Settings Machines Built To Present are shown in Figure 2-15.

h. Solenoid Valve Pressure Settings 4 W/S are shown in Figure 2-16.

i. Extend - A - Reach Valve Pressure and Speed Settings Model 60H+6 are shown in Figure 2-17.

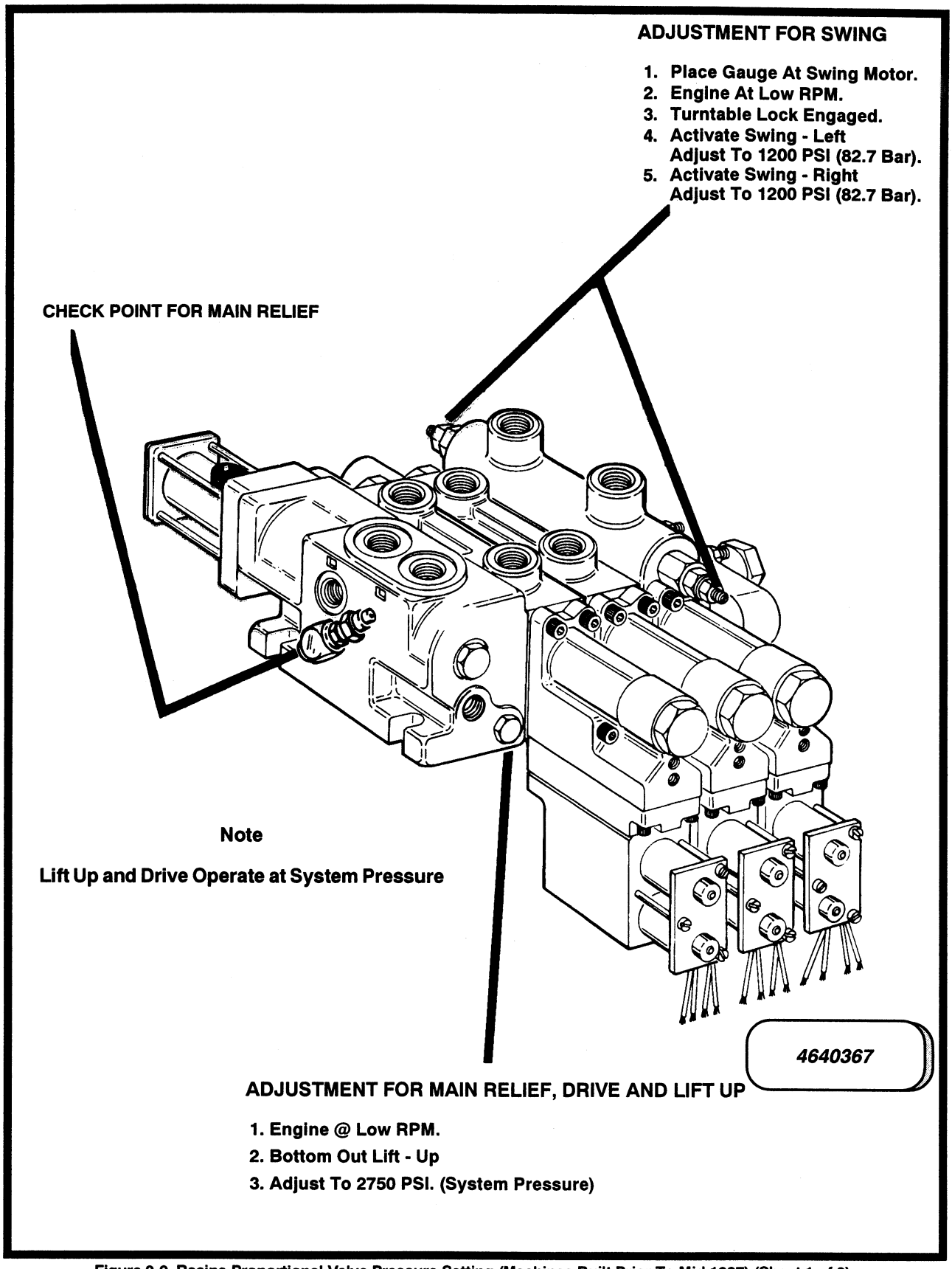


Figure 2-9. Racine Proportional Valve Pressure Setting (Machines Built Prior To Mid 1987) (Sheet 1 of 2).

ADJUSTMENT FOR PILOT PRESSURE

1. Engine @ low RPM.
2. Connect 12 volt jumper wire to dump valve solenoid.
3. Pressure gauge should read between 250 - 400 PSI (17.2 - 31 Bar).
4. Shut down system, remove cap plug and shim up spring to increase pressure, shorten spring to decrease pressure.
5. Install cap plug and repeat steps 1 thru 3.

⚠ IMPORTANT

Take pilot pressure reading before attempting to make adjustment. Do not adjust if pilot pressure is between 250 - 400 PSI (17.2 - 31 Bar).

Note

The pilot pressure is factory set and normally should not require adjusting. Adjust only if you notice poor or sluggish response to proportional functions or loss of auxiliary power.

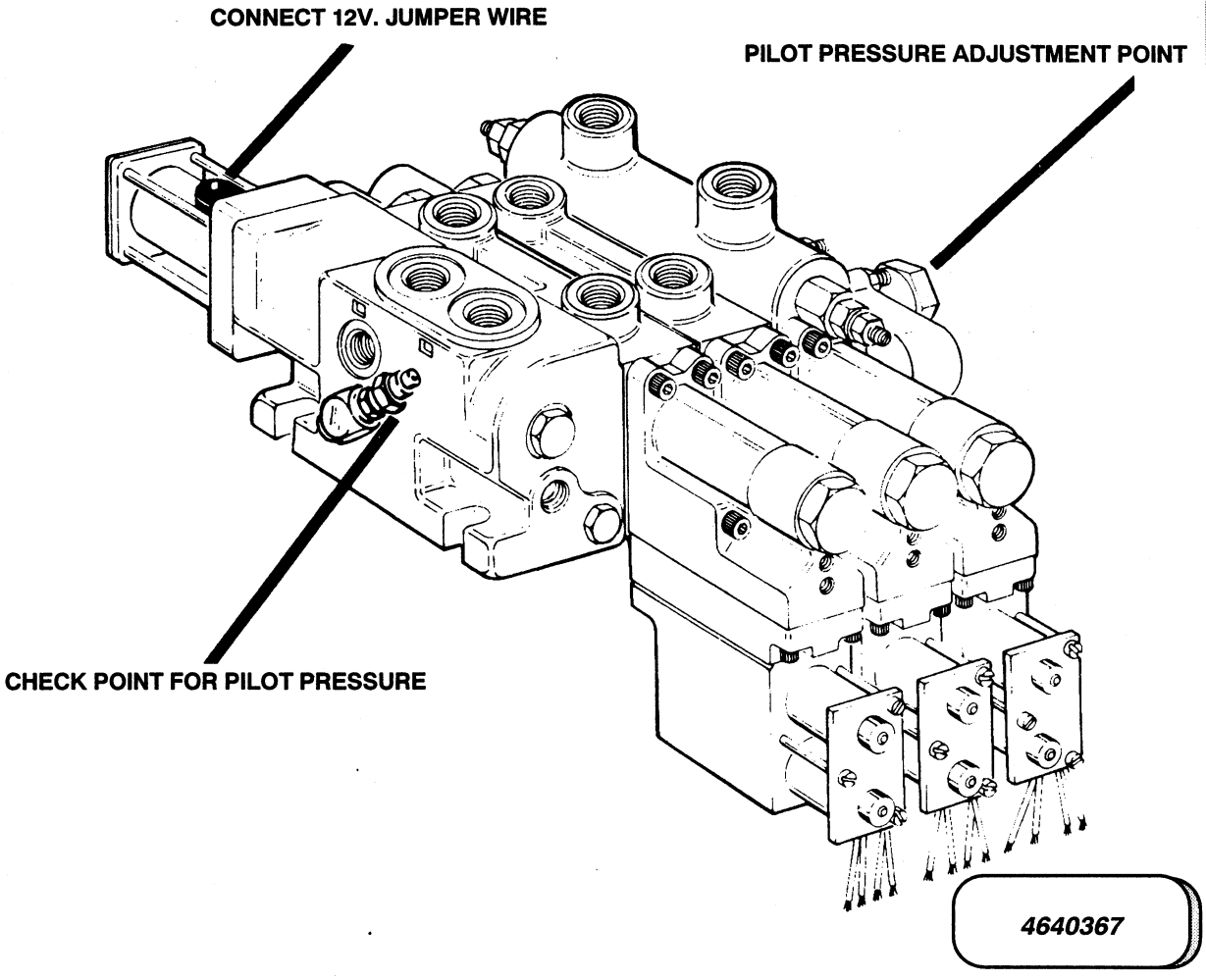
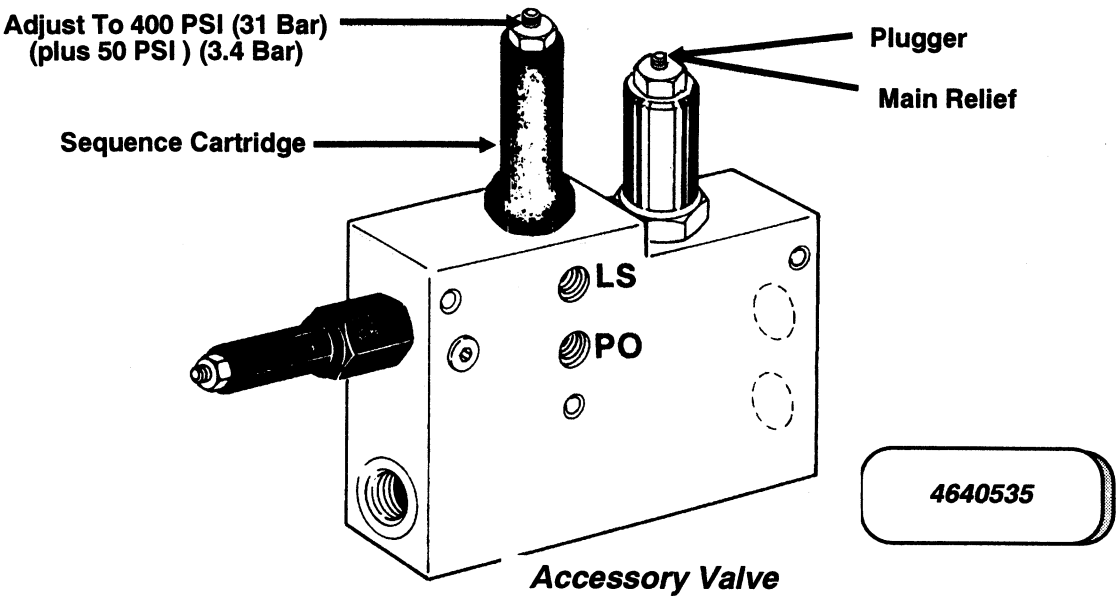


Figure 2-9. Racine Proportional Valve Pressure Setting (Machines Built Prior To Mid 1987) (Sheet 1 of 2).

To Be Performed In Sequence, Step 1, Step 2, ect.



Accessory Valve

STEP 1

To Set Sequence Pressure

1. **Plug pressure gauge into quick-disconnect on Vickers Valve.**
2. **Loosen nut at main relief and depress plugger.**
3. **Monitor pressure gauge while making adjustments at sequence cartridge to 400 PSI (31 Bar) (plus or minus 50 PSI) (3.4 Bar).**
4. **Release plugger and tighten nut at main relief.**
5. **Remove pressure gauge.**

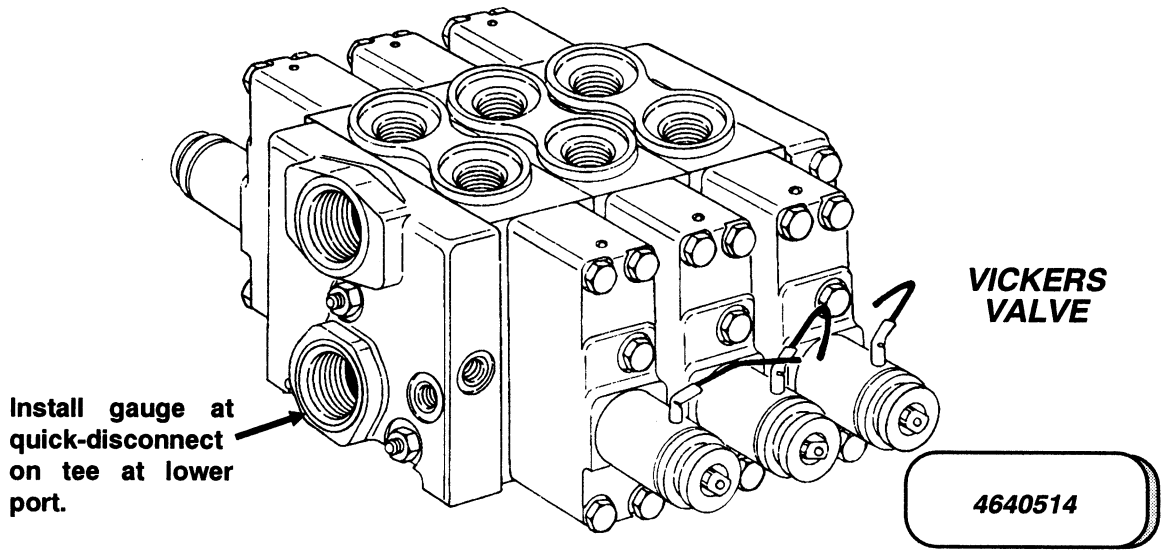
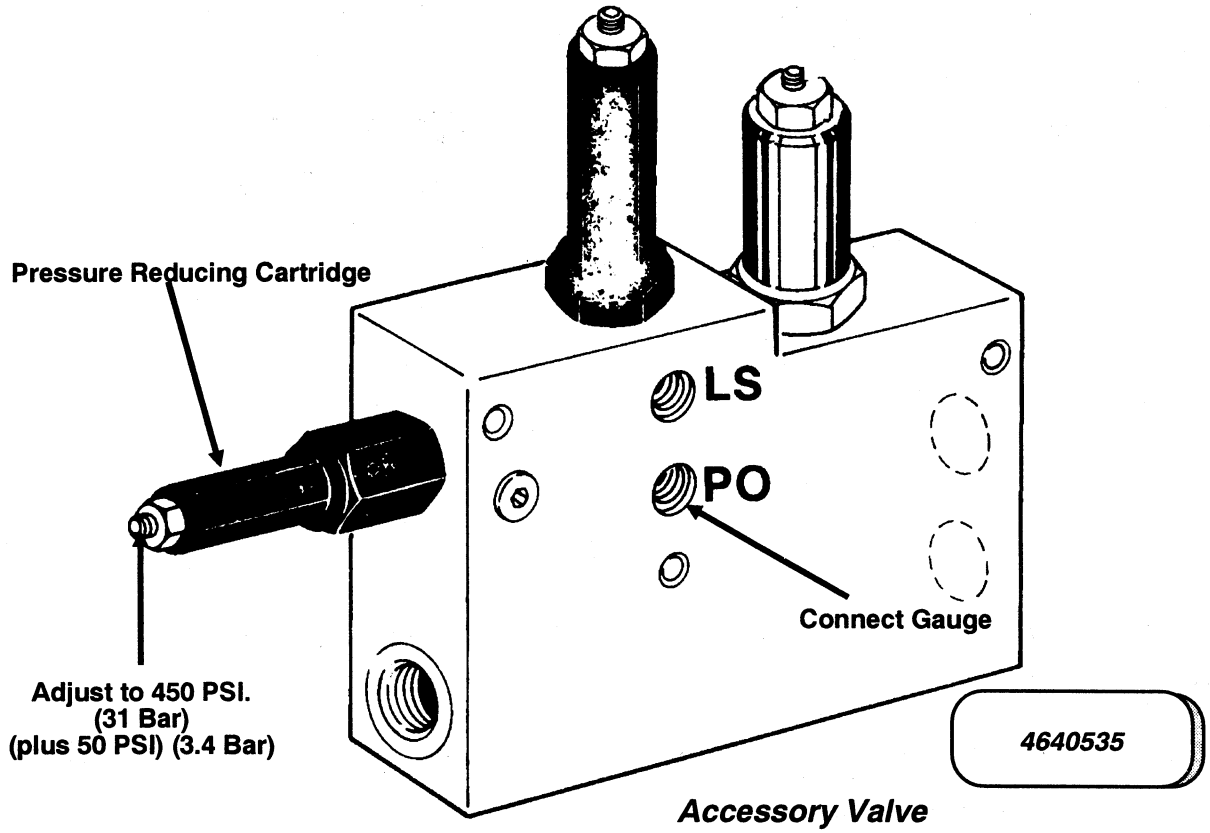


Figure 2-10. Vickers Proportional Valve Pressure Setting, Machines Built Prior To 1989 With Accessory Valve (Sheet 1 of 4).

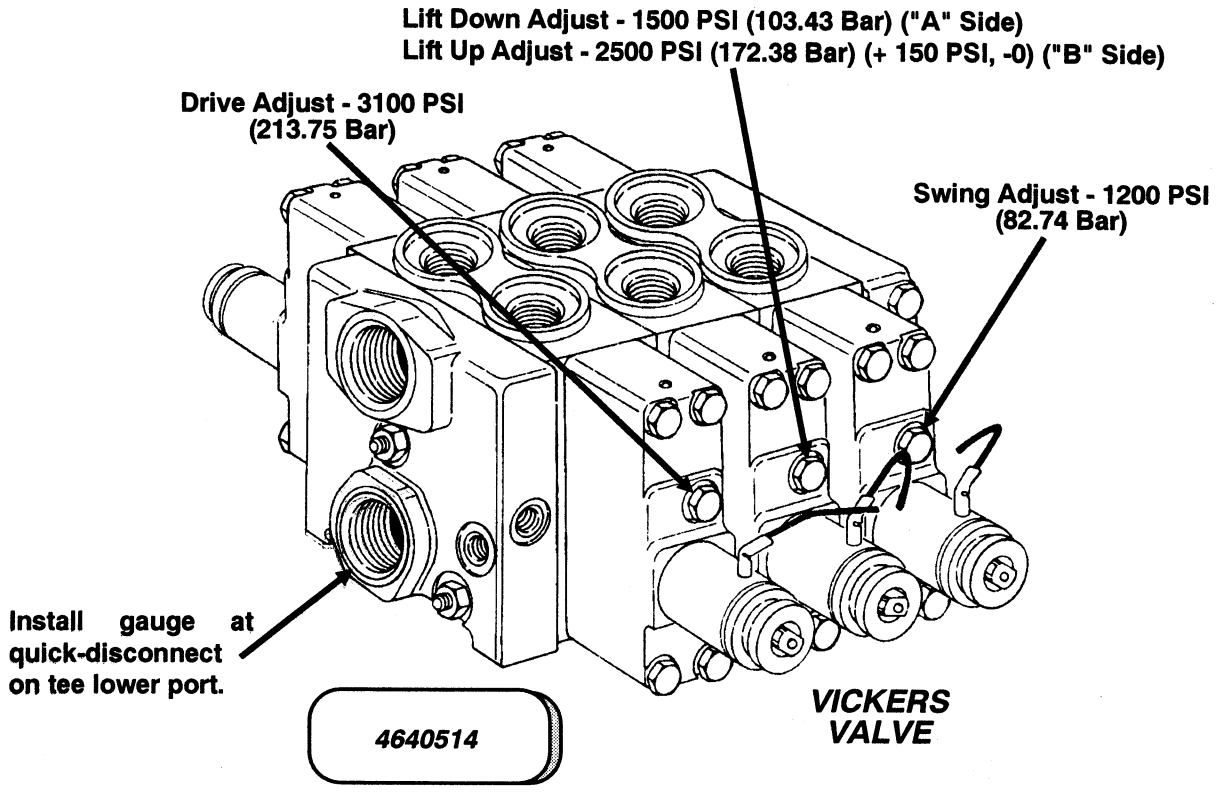


STEP 2

To Set Pilot Pressure

1. Plug pressure gauge into quick-disconnect on Accessory Valve.
2. Activate Lift Down.
3. While monitoring pressure gauge, adjust reducing cartridge to 450 PSI (31 Bar) (plus 50 PSI) (3.4 Bar).
4. Remove pressure gauge.

Figure 2-10. Vickers Proportional Valve Pressure Setting, Machines Built Prior To 1989 With Accessory Valve (Sheet 2 of 4).



Note: All Pressure Plus or Minus 150 PSI (10.34 Bar), Except Where Noted.

STEP 3.

Swing Adjust - Right and Left - Monitor gauge at quick disconnect on relief valve. Lock turntable and activate Swing Right. Add shims to increase pressure, remove shims to decrease pressure. Same procedure applies to Swing Left.

Lift Adjust - Lift Down - Monitor gauge at quick disconnect on relief valve. Bottom out Lift Down. Add shims to increase pressure, remove shims to decrease pressure.

Lift Up - Bottom out Lift Up, add shims to increase pressure, remove shims to decrease pressure.

Drive Adjust - Disconnect and cap brake line at counterbalance valve, also plug port in valve. Have assistant activate Drive Forward. Monitor gauge at quick disconnect on relief valve. Add shims to increase pressure, remove shims to decrease pressure. Same procedure applies to Drive Reverse.

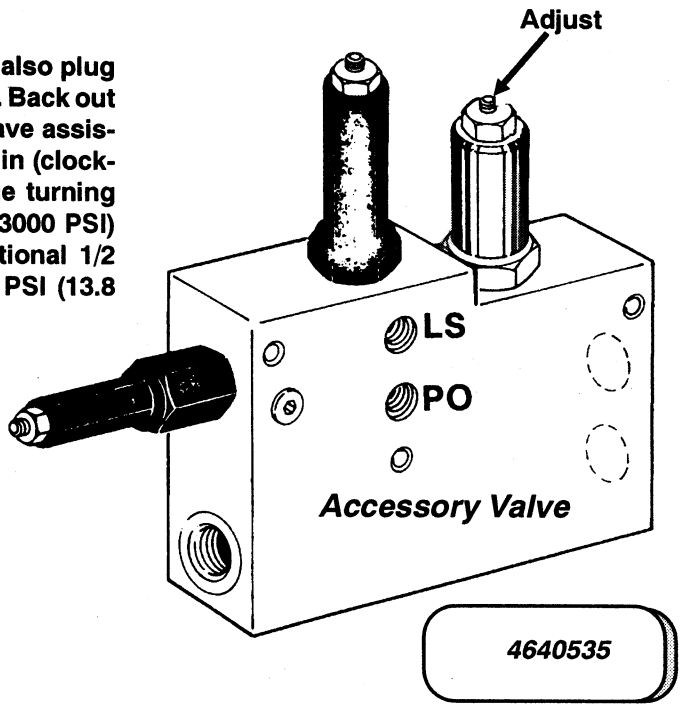
Figure 2-10. Vickers Proportional Valve Pressure Setting, Machines Built Prior To 1989 With Accessory Valve (Sheet 3 of 4).

STEP 4

To Set Main Relief (Proportional Functions).

Note: This adjustment to be made after all proportional functions are set.

Disconnect and cap hoses to drive motor, also plug ports on drive section of proportional valve. Back out adjustment 2 turns (counter-clockwise). Have assistant activate drive. Slowly turn adjustment in (clockwise) and watch pressure gauge. Continue turning until gauge stops moving (approximately 3000 PSI) (206.8 Bar). Turn adjustment in and additional 1/2 turn, this will result in approximately 200 PSI (13.8 Bar) higher than Drive relief setting.



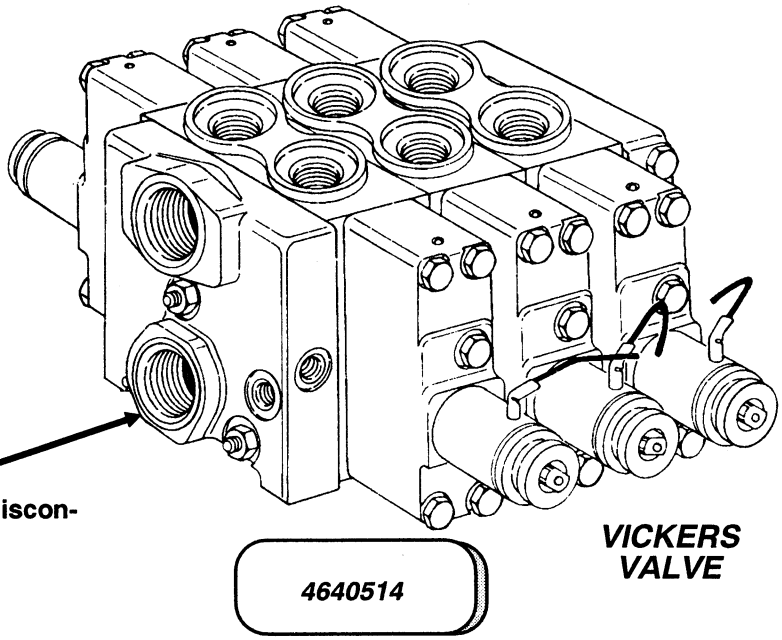


Figure 2-10. Vickers Proportional Valve Pressure Setting, Machines Built Prior To 1989 With Accessory Valve (Sheet 4 of 4).

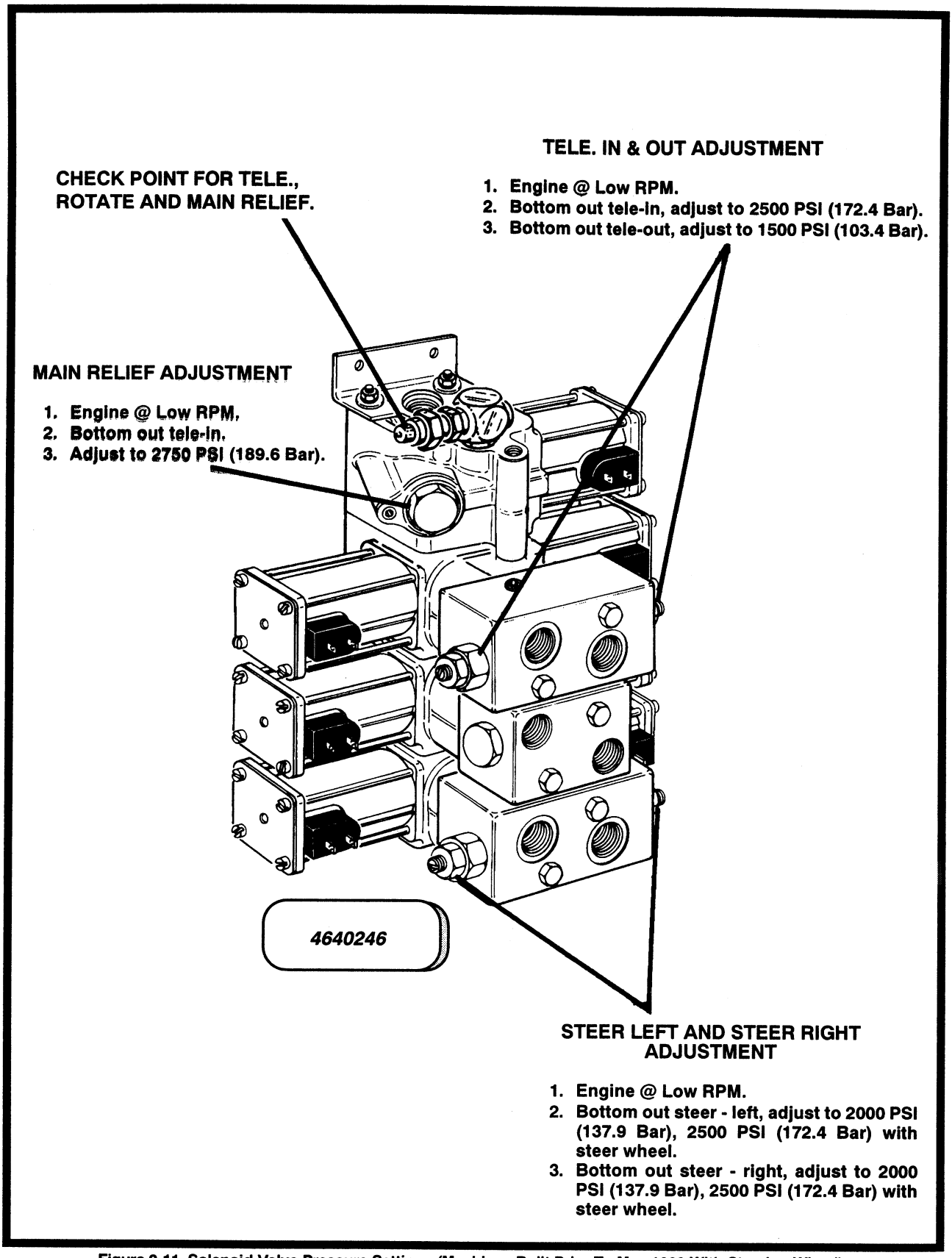
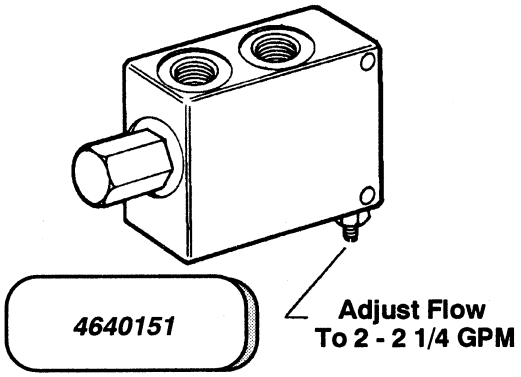
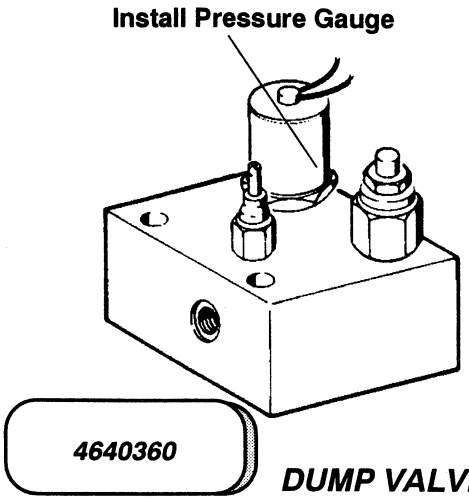


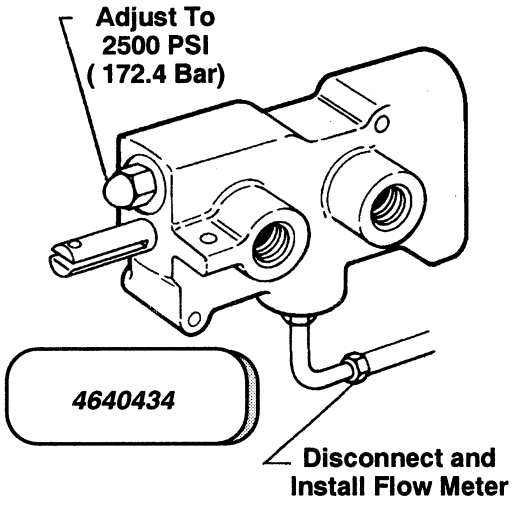
Figure 2-11. Solenoid Valve Pressure Settings (Machines Built Prior To May 1992 With Steering Wheel).



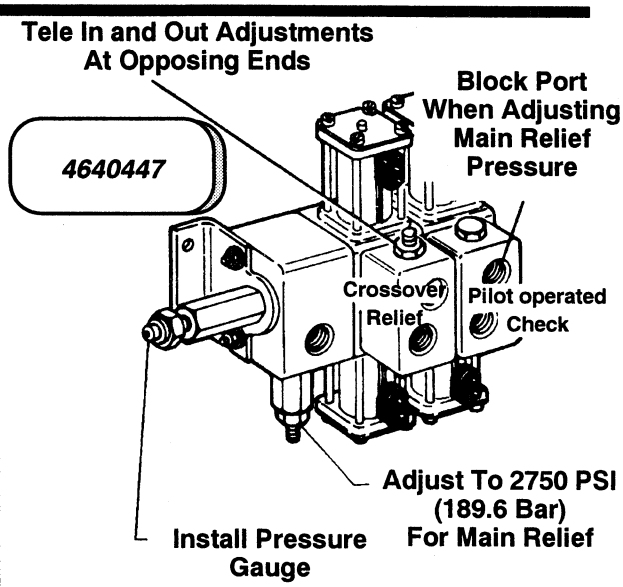
PRIORITY FLOW CONTROL VALVE



DUMP VALVE



ROTATOR VALVE



2 STACK VALVE

1. ROTATE AND STEERING

a. TO SET FLOW. Install a flow gauge inline at rotate valve. With the aid of an assistant, make adjustments at the priority flow control valve for 2 - 2 1/4 GPM.

b. TO SET PRESSURE. Install pressure gauge at quick disconnect on dump valve. With the aid of an assistant, make adjustments at rotator valve to 2500 PSI (172.4 Bar). Set with engine at low RPM and bottom out rotate left or right.

2. TELESCOPE AND MAIN RELIEF

a. TO SET MAIN RELIEF PRESSURE. Install pressure gauge at quick disconnect on 2 stack valve. Disconnect level hose, plug hose and block on valve. Make adjustments at 2 stack to 2750 PSI (189.6 Bar) with engine at low RPM, activate level function.

b. TO SET TELESCOPE PRESSURE. With a pressure gauge at quick disconnect, and engine at low RPM, bottom out tele-in and adjust to 2500 PSI (189.6 Bar). Then bottom out tele-out and adjust to 1500 PSI (103.4 Bar).

Figure 2-12. Pressure And Flow Settings (Machines Built Prior To May 1992 With Steering Wheel).

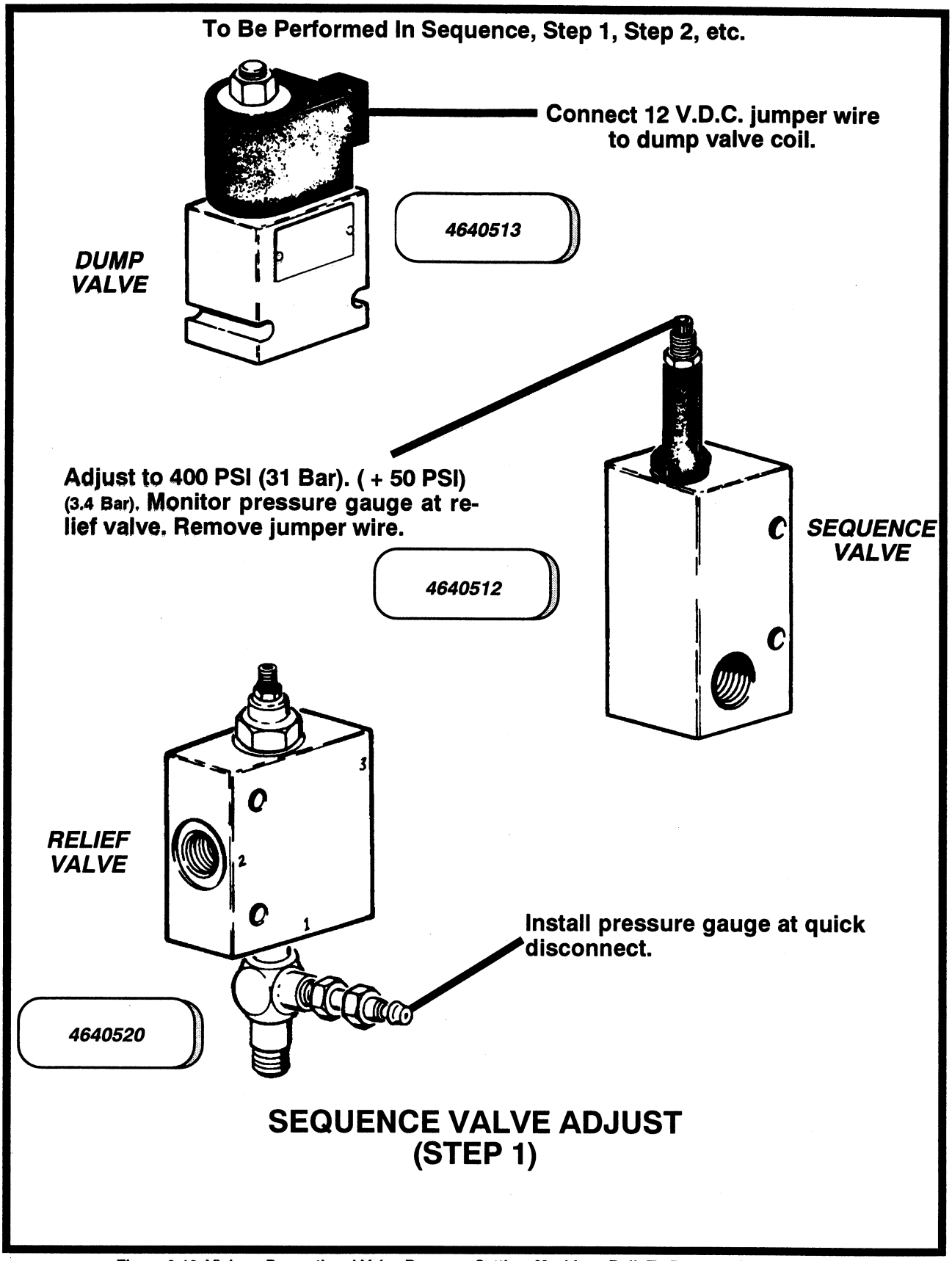
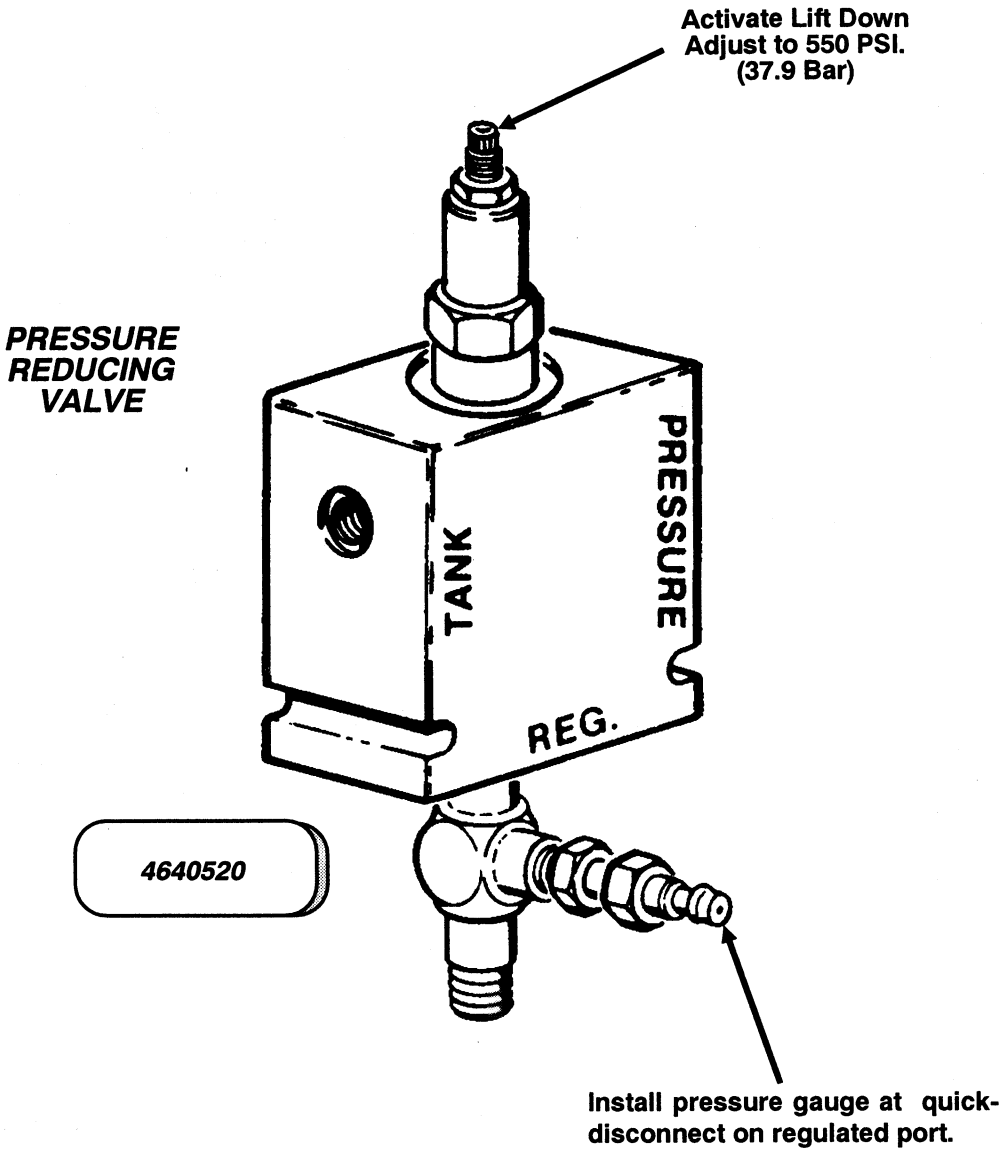
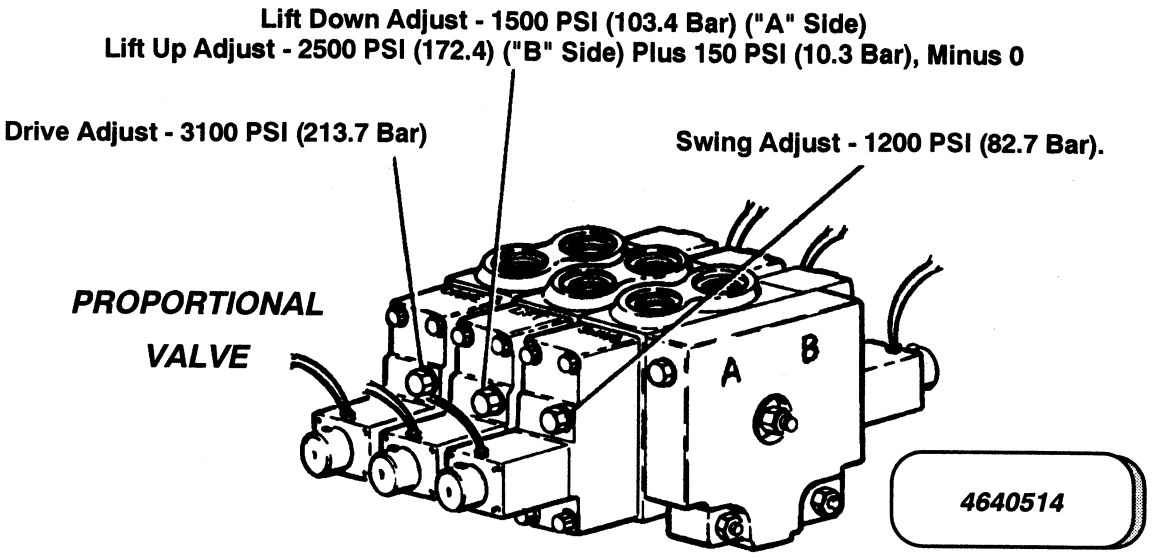


Figure 2-13. Vickers Proportional Valve Pressure Setting, Machines Built To Present (Sheet 1 of 4).



PILOT PRESSURE ADJUST (STEP 2)

Figure 2-13. Vickers Proportional Valve Pressure Setting, Machines Built To Present (Sheet 2 of 4).

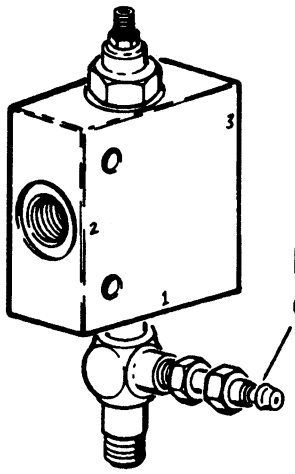


Swing Adjust - Right and Left - Monitor gauge at quick disconnect on relief valve. Lock turntable and activate Swing Right. Add shims to increase pressure, remove shims to decrease pressure. Same procedure applies to Swing Left.

Lift Adjust - Lift Down - Monitor gauge at quick disconnect on relief valve. Bottom out Lift Down. Add shims to increase pressure, remove shims to decrease pressure.

Lift Up - Bottom out Lift Up, add shims to increase pressure, remove shims to decrease pressure.

Drive Adjust - Disconnect and cap hose to brake line at counterbalance valve also plug port in valve. Have assistant activate Drive Forward. Monitor gauge at quick disconnect on relief valve. Add shims to increase pressure, remove shims to decrease pressure. Same procedure applies to Drive Reverse.



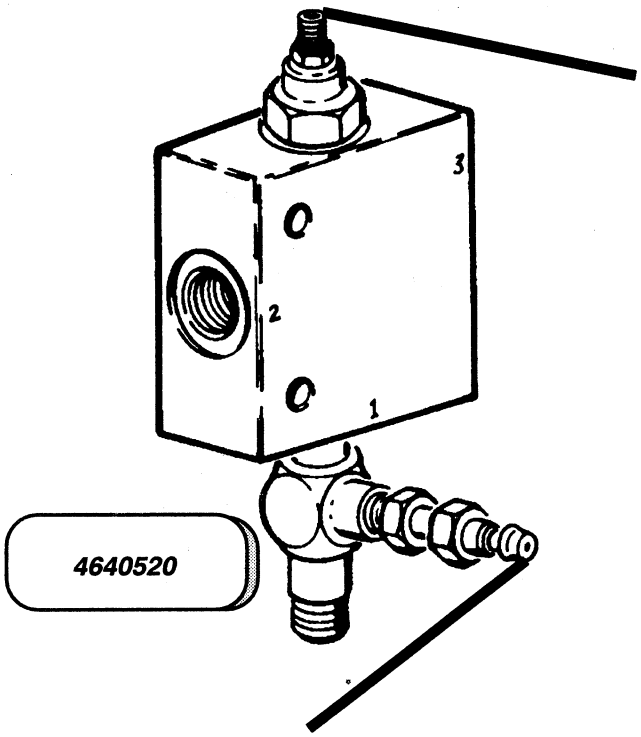
4640520

Install pressure gauge at quick disconnect.

PROPORTIONAL VALVE ADJUST (STEP 2)

Figure 2-13. Vickers Proportional Valve Pressure Setting, Machines Built To Present (Sheet 3 of 4).

RELIEF VALVE



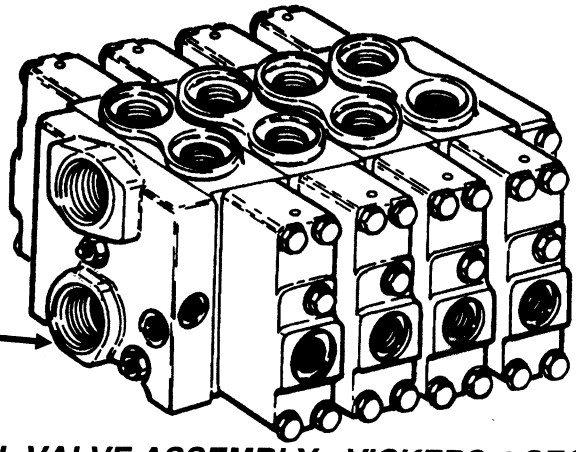
Install Pressure Gauge At Quick Disconnect.

Note: This adjustment to be made after all proportional functions are set.

Disconnect and cap hose to brake line at counterbalance valve also plug port in valve. Back out adjustment 2 turns (counter-clockwise). Have assistant activate drive. Slowly turn adjustment in (clockwise) and watch pressure gauge. Continue turning until gauge stops moving (approximately 3000 PSI) (206.8 Bar). Turn adjustment in an additional 1/2 turn, this will result in approximately 200 PSI (13.8 Bar) higher than Drive relief setting.

MAIN RELIEF ADJUST (PROPORTIONAL FUNCTIONS) (STEP 4)

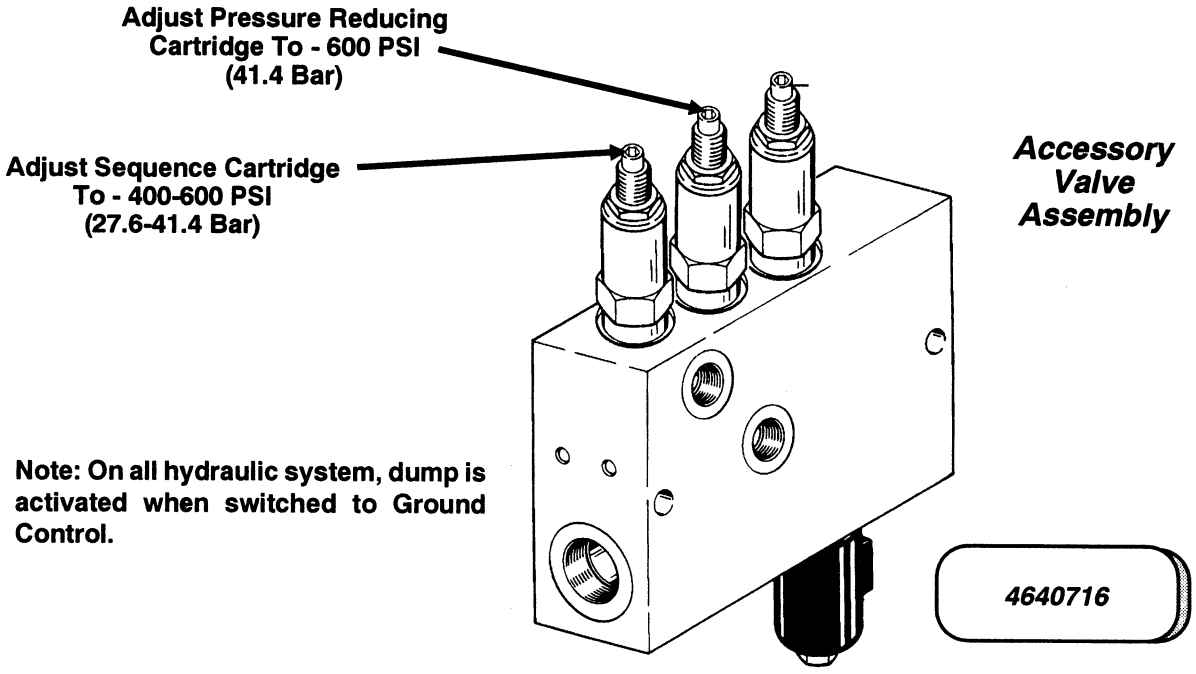
Figure 2-13. Vickers Proportional Valve Pressure Setting, Machines Built To Present (Sheet 4 of 4).



CONTROL VALVE ASSEMBLY - VICKERS 4 SECTION

STEP 1. SETTING SEQUENCE PRESSURE

1. Plug pressure gauge into quick disconnect on Vickers Valve.
2. Start engine from ground control, this will energize dump valve.
3. Monitor pressure gauge while making adjustment at sequence cartridge (400-600 PSI) (27.6-41.4 Bar).
4. Remove pressure gauge.

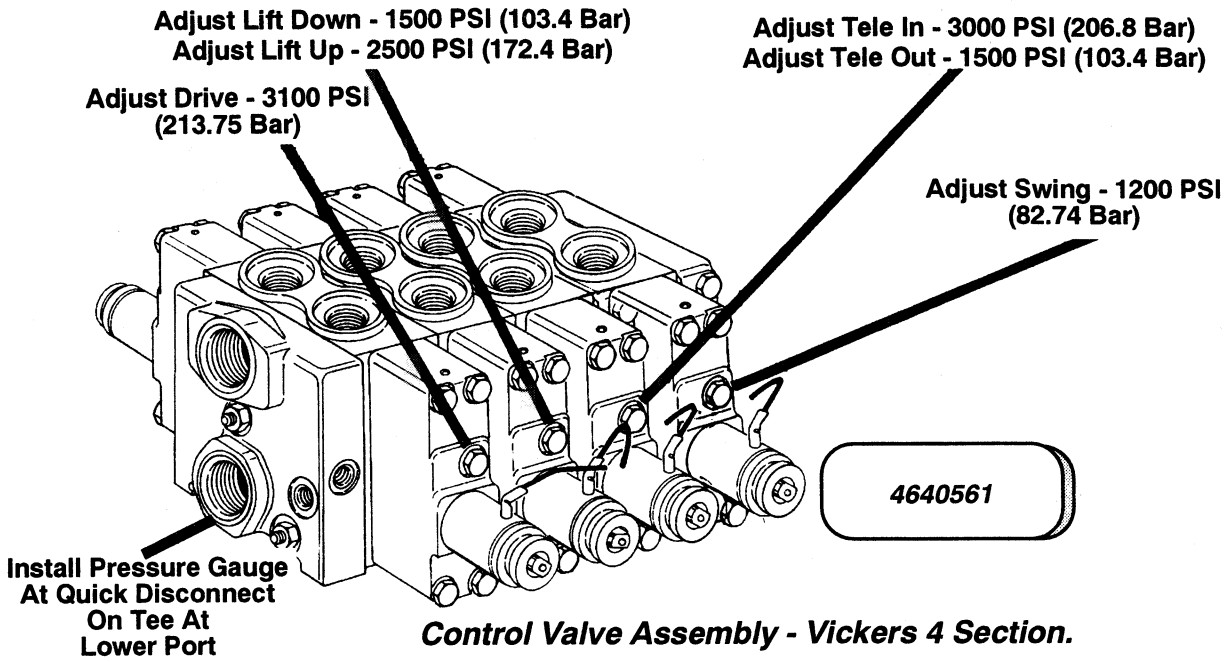


Note: On all hydraulic system, dump is activated when switched to Ground Control.

STEP 2. SETTING PILOT PRESSURE

1. Plug pressure gauge into quick disconnect on Accessory Valve.
2. Activate Lift Down.
3. While monitoring pressure gauge, adjust pressure reducing cartridge to 600 PS (41.4 Bar).
4. Remove pressure gauge.

Figure 2-14. Vickers All Hydraulic Machines Pressure Setting (Sheet 1 of 4).



Control Valve Assembly - Vickers 4 Section.

STEP 3. SETTING DRIVE, SWING, LIFT AND TELE ADJUSTMENTS.

⚠ CAUTION

AFTER BRAKE LINES ARE DISCONNECTED AND PRIOR TO MAKING ADJUSTMENTS, ACTIVATE DRIVE WITH NO PERSONNEL IN VICINITY OF TRAVEL PATH TO ENSURE BRAKES ARE HOLDING SECURELY.

Drive Adjust

1. Disconnect and cap brake line at counterbalance valve also plug port in valve.
2. Have assistant activate Drive Forward.
3. Monitor gauge. Add shims to increase pressure, remove shims to decrease.
4. Same procedure applies to Drive Reverse. Make note of pressures. Leave brake line capped, until all adjustments are complete.

Swing Adjust Right and Left

1. Lock turntable. Monitor gauge at quick disconnect.
2. Add shims to increase pressure, remove shims to decrease.
3. Activate Swing Right.
4. Same procedure applies to Swing Left.

Lift Adjust - Lift Down

1. Bottom out Lift Down.
2. Monitor gauge at quick disconnect.
3. Add shims to increase pressure, remove shims to decrease.

Lift Adjust - Lift Up

1. Bottom out Lift Up.
2. Monitor gauge at quick disconnect.
3. Add shims to increase pressure, remove shims to decrease.

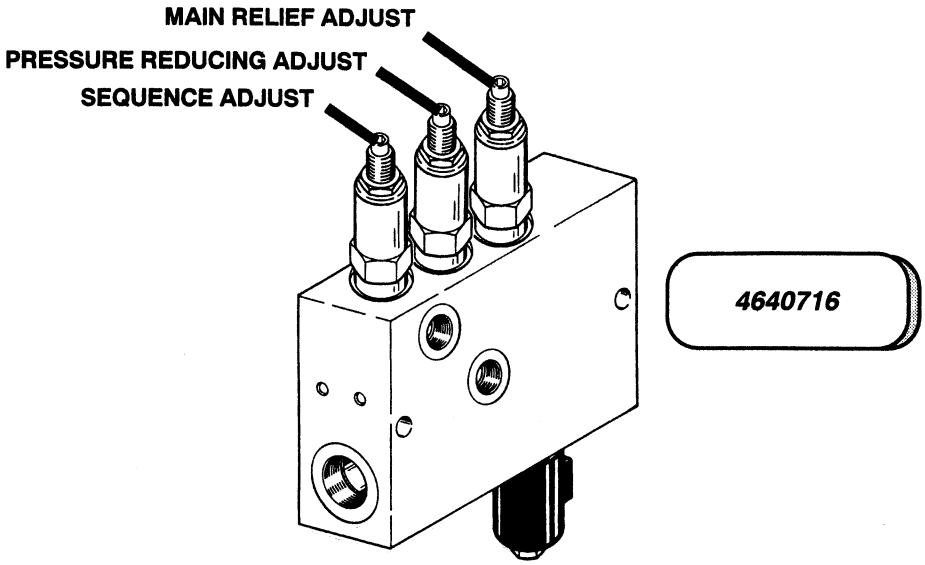
Tele Adjust - Tele In

1. Bottom out Tele In.
2. Monitor gauge at quick disconnect.
3. Add shims to increase pressure, remove shims to decrease.

Tele Adjust - Tele Out

1. Bottom out Tele Out.
2. Monitor gauge at quick disconnect.
3. Add shims to increase pressure, remove shims to decrease.

Figure 2-14. Vickers All Hydraulic Machines Pressure Setting (Sheet 2 of 4).

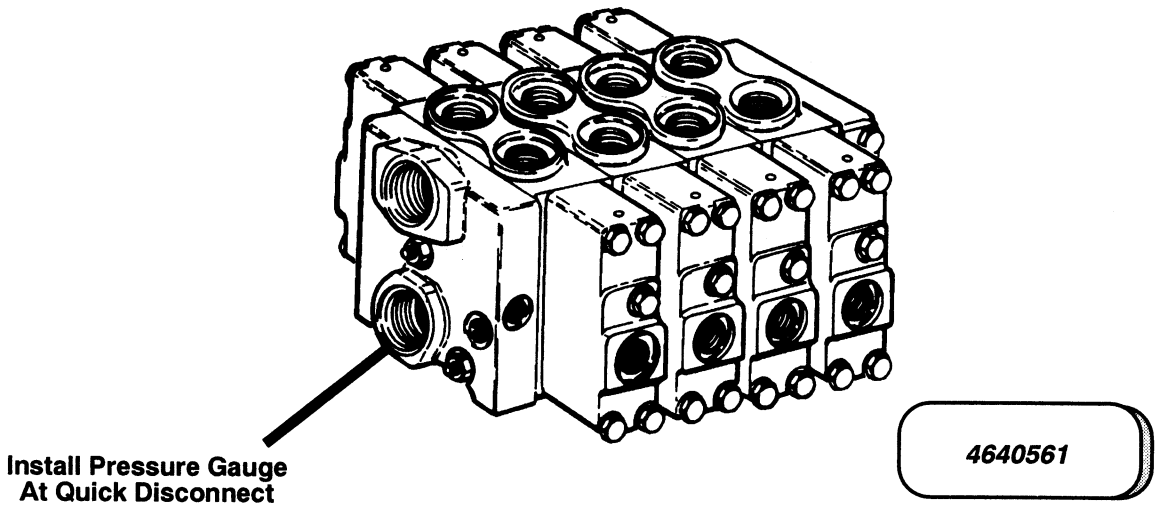


Accessory Valve Assembly

STEP 4. SETTING MAIN RELIEF (PROPORTIONAL FUNCTIONS)

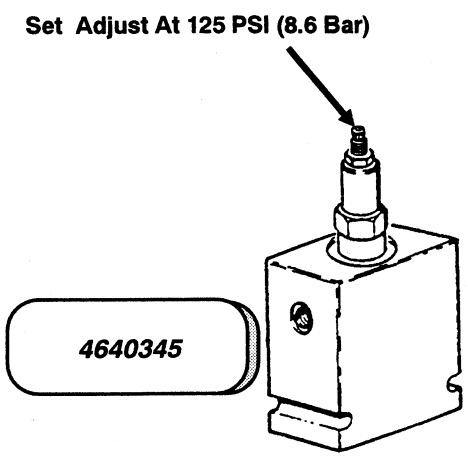
Note: This adjustment to be made after all proportional functions are set.

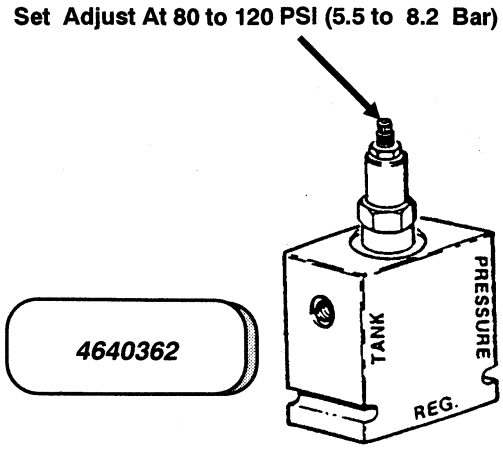
1. Disconnect and cap hoses to brakes and cap port at counterbalance valve.
2. Back out adjustment 2 turns (counterclockwise).
3. Have assistant activate drive.
4. Slowly turn adjustment in (clockwise) and watch pressure gauge. Continue turning until gauge stops moving (approximately 3000 PSI) (206.8 Bar).
5. Turn adjustment in an additional 1/2 turn, this will result in approximately 200 PSI (13.8 Bar) higher than the highest Drive relief setting.



Control Valve Assembly - Vickers 4 Section.

Figure 2-14. Vickers All Hydraulic Machines Pressure Setting (Sheet 3 of 4).

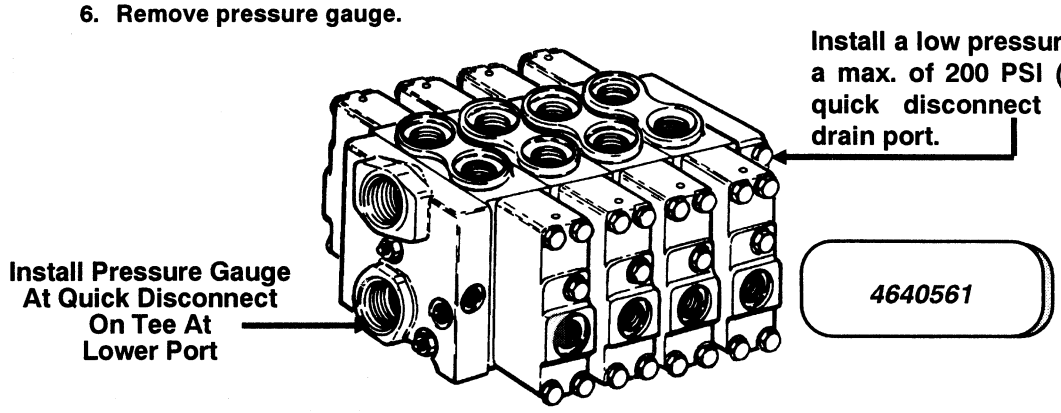




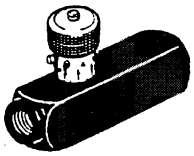
Relief Valve Assembly *Pressure Reducing Valve Assembly*

STEP 5. SETTING RELIEF AND PRESSURE REDUCING VALVES

1. Plug a low pressure gauge into quick disconnect on Vickers Valve Pressure drain port at end cap.
2. Adjust relief all the way in "temporary".
3. Set pressure reducing valve to 150 PSI (10.34 Bar) temporary.
4. Reset relief valve pressure to 140 PSI (9.6 Bar) and lock.
5. Reset pressure reducing valve to 80 to 120 PSI (5.5 to 8.2 Bar) and lock.
6. Remove pressure gauge.



Control Valve Assembly - Vickers 4 Section.



4640128 AND 4640216 COLOR FLOW VALVES

STEP 6. SETTING FLOW CONTROL VALVES

Adjust out - for faster start response to control. Adjust in - for slower start response to control.

Figure 2-14. Vickers All Hydraulic Machines Pressure Setting (Sheet 4 of 4).

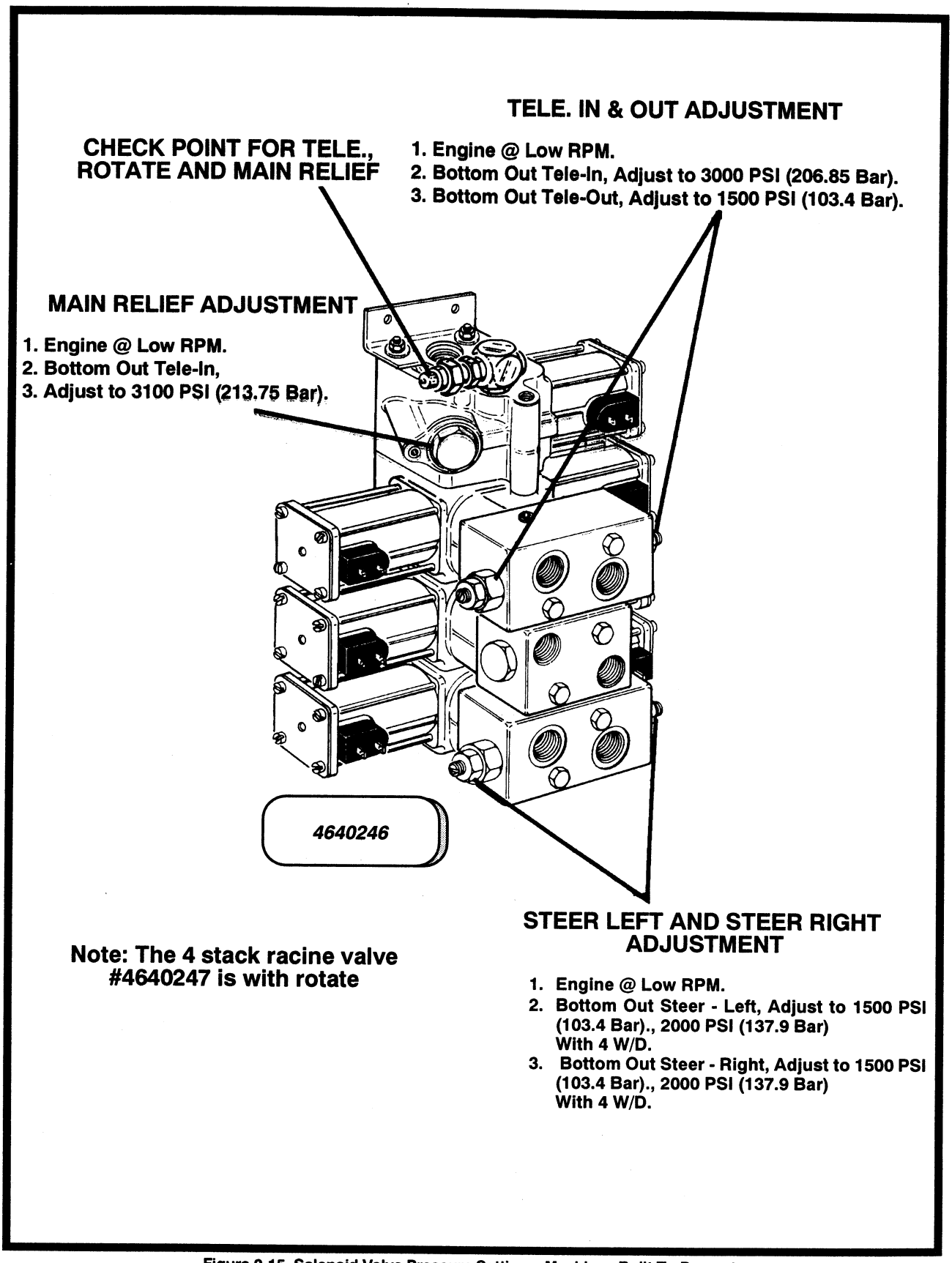


Figure 2-15. Solenoid Valve Pressure Settings, Machines Built To Present.

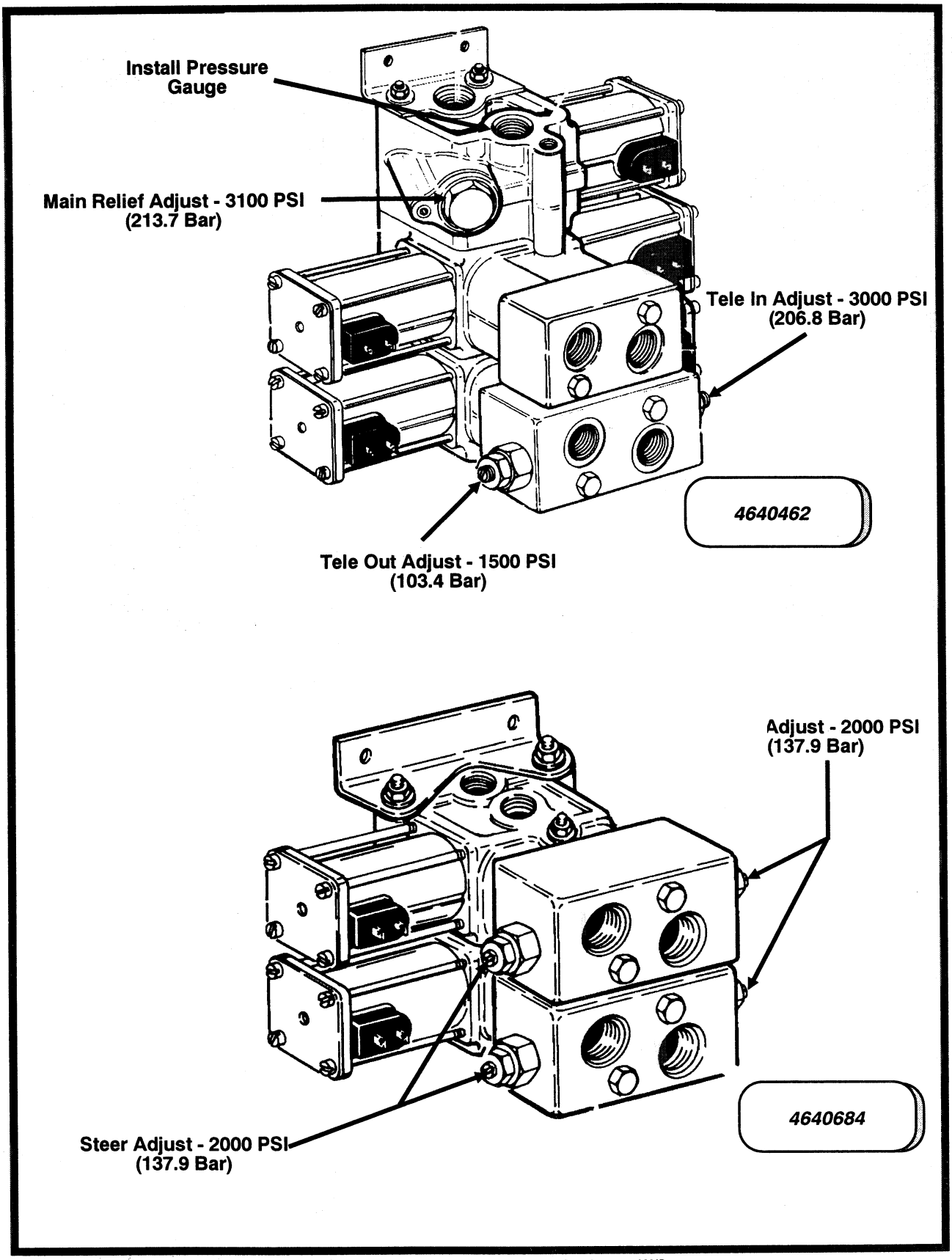


Figure 2-16. Solenoid Valve Pressure Settings 4 W/S.

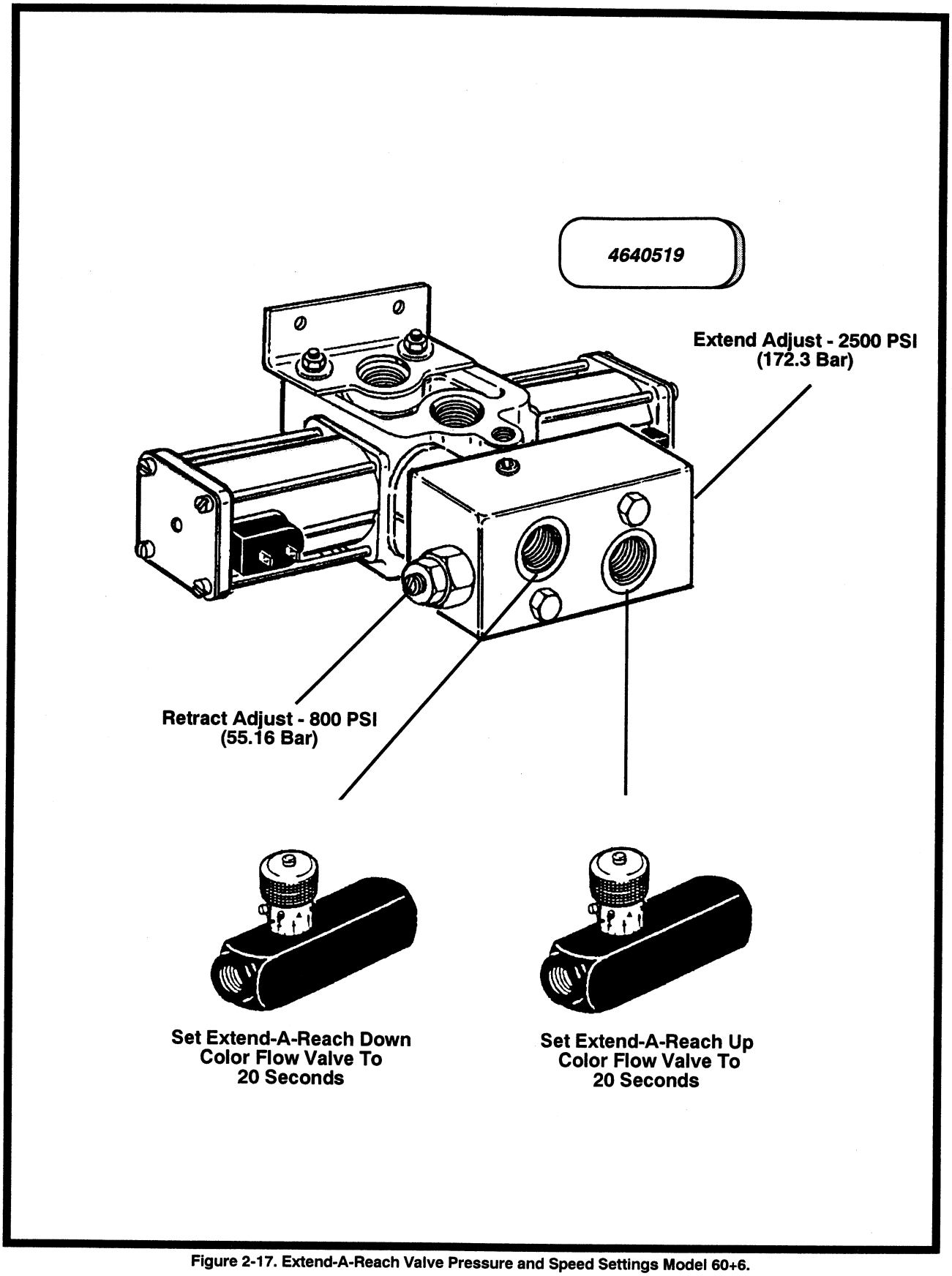


Figure 2-17. Extend-A-Reach Valve Pressure and Speed Settings Model 60+6.

2-19. Racine Proportional Air Gap Adjustment.

Note

The assembly in Figure 2-18 includes select fit parts in order to maintain a proper air gap. These parts must remain as an assembly or if disassembled, controlled to insure that these component parts are not intermixed with similar parts.

Note

In the event that parts do become exchanged or you suspect the air gap to be incorrect (Too much air gap will result in loss of auxiliary power operation and less than full spool shift; too little air will result in erratic operation.), it may be checked and adjusted using the procedure below.

a. *With all parts assembled as shown in Figure 2-18, use a depth mike or other measuring instrument to determine the distance from the end of the guide tube to the exposed end of the plunger. Record this dimension.

b. Remove plunger and poppet. With poppet removed, install plunger and check distance from the end of the guide tube to the exposed end of the plunger.

c. Subtract the first dimension from the second dimension, this will be the amount of air gap.

d. Correct air gap is .018"-.020" with .018" preferred. If air gap is excessive, it may be reduced by using a brass drift and hammer. Lightly tap end of plunger with all parts assembled. Recheck air gap.

e. If air gap is less than recommended, replace nose cone assembly.

* All parts must be clean and properly assembled before making these checks.

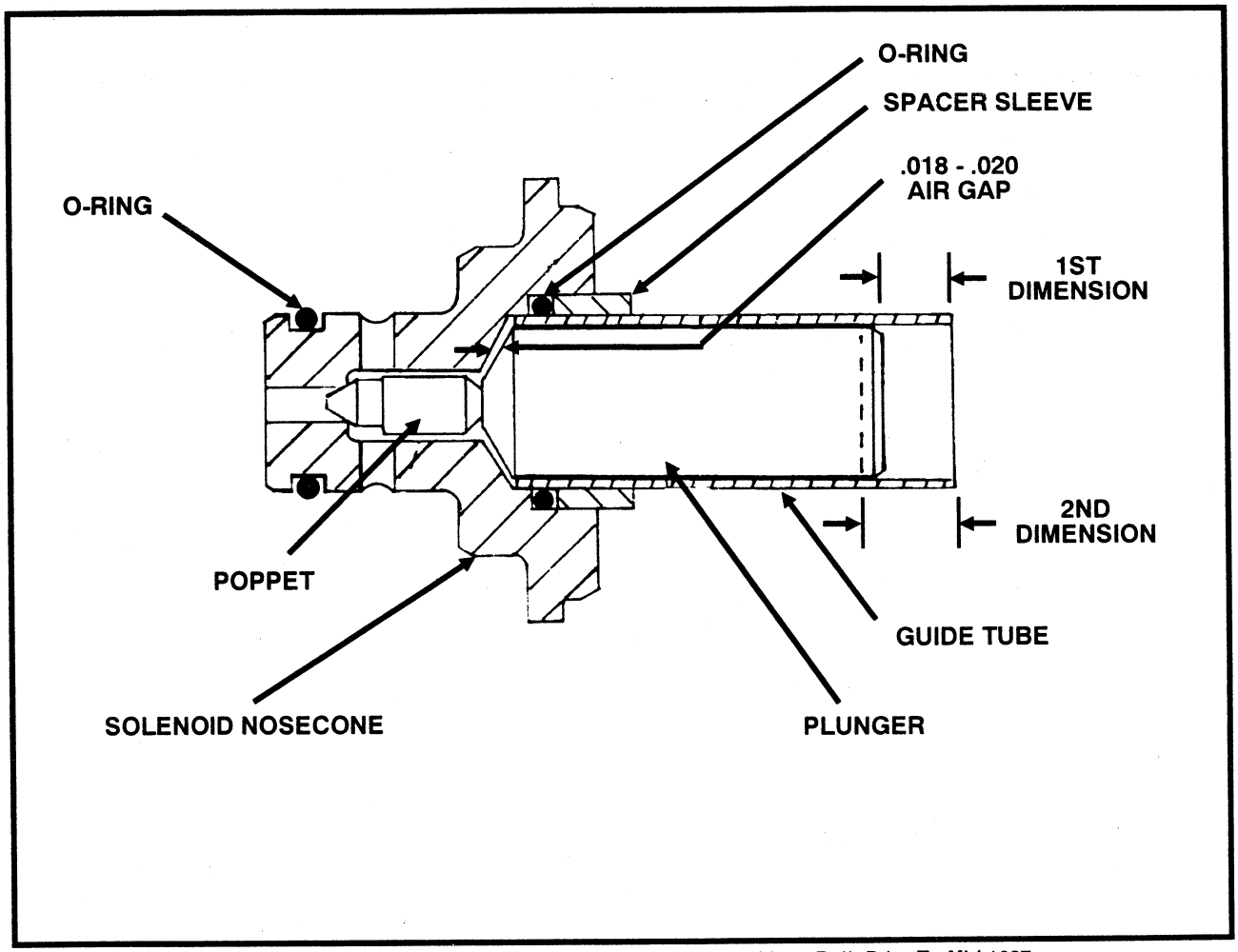


Figure 2-18. Racine Proportional Air Gap Adjustment, Machines Built Prior To Mid 1987.

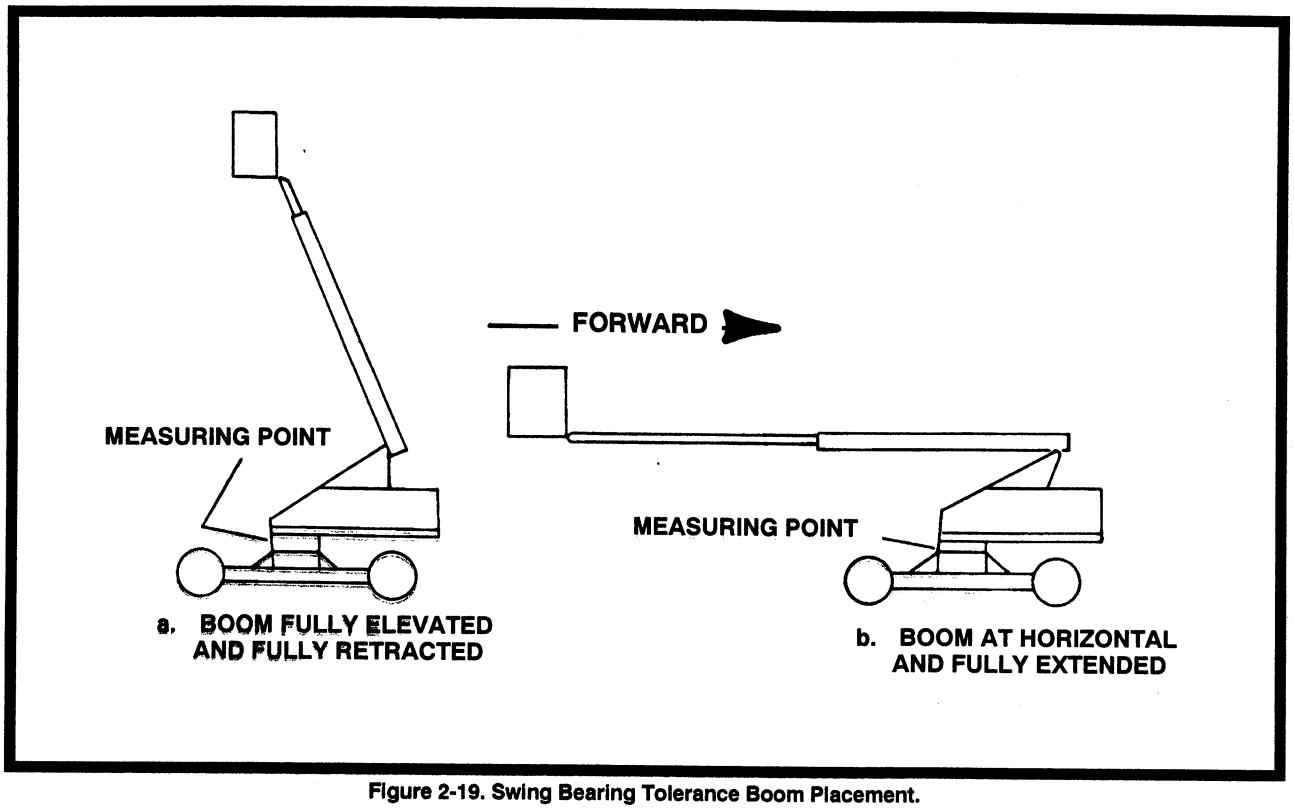


Figure 2-19. Swing Bearing Tolerance Boom Placement.

2-20. SWING BEARING.

a. Wear Tolerance.

(1). From the underside of the machine, at rear center, with the boom fully elevated and fully retracted (See Figure 2-19a.), using a magnetic base dial indicator, measure and record the distance between the swing bearing and frame. (See figure 2-19.)

(2). At the same point, with the boom at horizontal and fully extended (See Figure 2-19b.), using a magnetic base dial indicator, measure and record the distance between the swing bearing and frame. (See Figure 2-19.)

(3). If a difference greater than .057" (1.45 mm) is determined, the swing bearing should be replaced.

(4). If a difference less than .057" (1.45 mm) is determined, and any of the following conditions exist, the bearing should be removed, disassembled, and inspected for the following:

(a). Metal particles in the grease.

(b). Increased drive power required.

(c). Noise.

(d). Rough rotation.

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

⚠ IMPORTANT

THE SWING BEARING IS ONE OF THE MOST CRITICAL POINTS ON AN AERIAL LIFT. IT IS HERE THAT THE STRESSES OF LIFTING ARE CONCENTRATED, AT THE CENTER OF ROTATION. BECAUSE OF THIS, PROPER MAINTENANCE OF THE SWING BEARING BOLTS IS A MUST FOR SAFE OPERATION.

b. Replacement and Devcon Application Procedures on Machines Built Prior to Mid of 1991.

(1). Removal.

(a). From Ground Control station, operate the boom adequately to provide access to frame opening or, if equipped, to rotary coupling.

⚠ WARNING

NEVER WORK BENEATH THE BOOM WITHOUT FIRST ENGAGING BOOM SAFETY PROP OR PROVIDING ADEQUATE OVERHEAD SLING SUPPORT AND/OR BLOCKING.

(b). Attach an adequate support sling to the boom and draw all slack from sling. Prop or block the boom if feasible.

(c). From underside of the machine frame, remove bolts and lockwashers which attach the retaining yoke of the rotary coupling to the coupling housing.

⚠ IMPORTANT

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

(d). Tag and disconnect the hydraulic lines from the fittings on the top and sides of the rotary coupling. Use a suitable container to retain any residual hydraulic fluid. Immediately cap lines and ports.

(e). If machine is not equipped with a rotary coupling, tag and disconnect hydraulic lines running through center of turntable and frame. Use a suitable container to retain any residual hydraulic fluid. Immediately cap lines and ports.

(f). Attach suitable overhead lifting equipment to the base of the turntable weldment.

(g). 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 the bolts, nuts and washers which attach the turntable to the bearing inner race. Discard the nuts and bolts.

(h). 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.

(i). Carefully place the turntable on a suitably supported trestle.

(j). 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 from the frame, move the bearing to a clean, suitably supported work area.

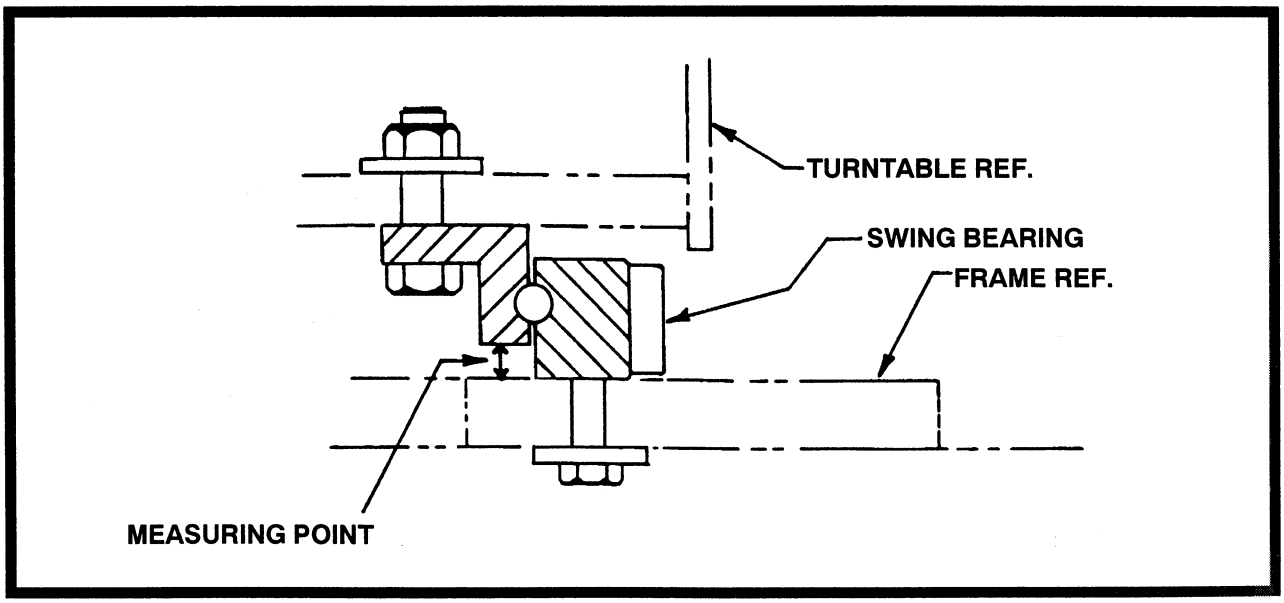


Figure 2-20. Swing Bearing Tolerance Measuring Point.

(2). Installation.

Note

A thru M only apply to machines built prior to mid of 1991.

Note

Manufacturing tolerances of frames and turntables are inspected prior to the factory installation of swing bearings to determine the need for use of Devcon filler. When servicing machine swing bearing, apply Devcon filler only to those machines having Devcon previously applied at the factory. If new turntable or frame is being installed, contact manufacturer for procedures to determine the need for Devcon application.

(a). Use suitable standard tools and equipment to carefully remove any hardened epoxy residue from the bearing mounting area of frame and turntable.

(b). Apply a layer of Devcon (or equivalent) filler approximately 0.125 inches (0.318 cm) thick on the bearing mounting plate on the frame.

(c). Use suitable lifting equipment to carefully lower the swing bearing into position on the frame. Ensure that the scribed line of the outer race of the bearing aligns with the scribed mark on the frame. 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 frame.

(d). Ensure that all frame and bearing attachment holes are aligned, and install four diametrically opposed bolts or clamps to secure the bearing to the frame. Tighten the bolts or clamps evenly in a diametrically opposed pattern to a torque of 20 ft. lbs. (2.77 kgm).

(e). Allow Devcon filler to cure at room temperature (approximately 70 degrees F., 21 degrees C.) for 10 to 16 hours.

(f). After the appropriate interval, release the clamps or remove the bolts. Use a suitable lifting device to carefully remove the bearing from the frame.

(g). Carefully remove any excess filler from the frame mounting area, from the bearing attachment holes, and from between the gear teeth.

⚠ WARNING

ENSURE THAT TURNTABLE IS ADEQUATELY SUPPORTED WHILE APPLYING DEVCON AND WHILE INSTALLING THE BEARING. EXTREME CARE MUST BE TAKEN DURING THE FOLLOWING STEPS TO AVOID SERIOUS OR FATAL INJURY TO PERSONNEL.

(h). Apply a layer of Devcon (or equivalent) filler approximately 0.125 inches (0.318 cm) thick to the underside of the bearing mounting area of the turntable base plate.

(i.) Use suitable hydraulic jacks to carefully raise the swing bearing to the underside of the turntable mounting plate. 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).

(j). Ensure that all turntable and bearing attachment holes are aligned, and install four diametrically opposed clamps or bolts and nuts to secure the bearing to the turntable. Tighten the nuts and bolts or clamp evenly in a diametrical pattern to a torque of 20 ft. lbs. (2.78 kgm).

(k). Allow Devcon filler to cure at room temperature (approximately 70 degrees F., 21 degrees C.) for 10 to 16 hours.

(l). After the appropriate time interval, place a suitable hydraulic jack under the bearing and release the clamps or remove the nuts and bolts, use the hydraulic jack to carefully remove the bearing from the turntable.

(m). Carefully remove excess filler from the turntable mounting area, from the bearing attachment holes and from between gear teeth.

(n). Position the bearing on the machine frame in the same position as noted in step (c) above.

⚠ CAUTION

JLG INDUSTRIES RECOMMENDS THAT ALL REMOVED 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.

(o). Spray a light coat of Safety Solvent 13 to the new bearing bolts. Then 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.

(p). Following the Torque Sequence diagram shown in Figure 2-21, tighten the bolts an torque bolts to 80 ft. lbs. (109 NM) wet.

(q). Remove the lifting equipment from the bearing.

(r). Use suitable lifting equipment to carefully position the turntable assembly above the machine frame.

(s). Carefully lower the turntable onto the swing bearing, ensuring that the turntable and bearing align as noted in step (i) above.

⚠ 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.

(t). Spray a light coat of Safety Solvent 13 to the new bearing bolts. Then apply a light coating of Loctite #271 to the new bearing bolts, and install the bolts, washers and nuts through the turntable and inner race of the bearing.

(u). Following the Torque Sequence diagram shown in Figure 2-21, tighten the bolts an torque bolts to 170 ft. lbs. (231NM) wet.

(v). Remove the lifting equipment.

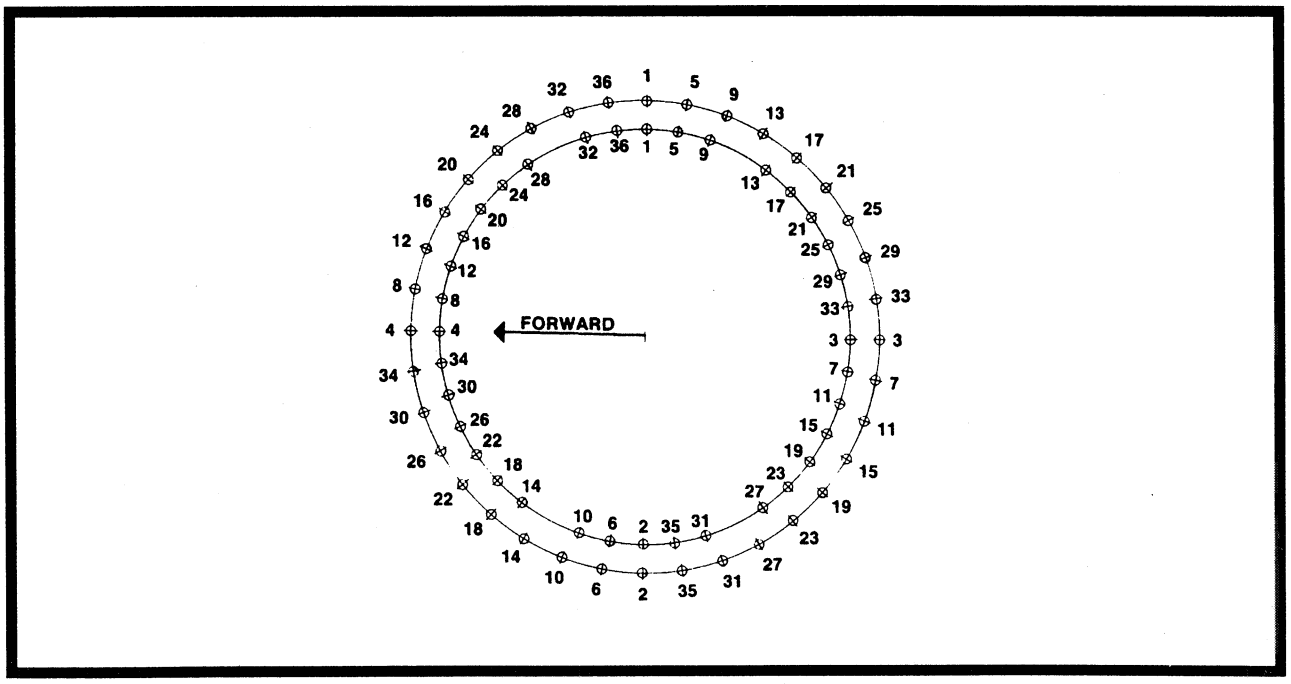


Figure 2-21. Swing Bearing Torquing Sequence.

(w). Install the rotary coupling retaining yoke, apply a light coating of Loctite Sealant #TL277-41 to the attaching bolts and secure the yoke to the rotary coupling with the bolts and lockwasher.

(x). Connect the hydraulic lines to the rotary coupling as tagged prior to removal.

(y). At ground control station, use boom lift control to lower boom to stowed position.

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

c. Swing Bearing Torque Values.

(1). Outer Race - 80 ft. lbs. (109 NM) wet, 110 ft. lbs. (149 NM) dry.

(2). Inner Race - 170 ft. lbs. (231 NM) wet, 220 ft. lbs. (298 NM) dry.

(3). Swing Bearing Torquing Sequence, see Figure 2-21.

⚠ WARNING

RETORQUE THE INNER AND OUTER SWING BEARING BOLTS AFTER FIRST 200 HOURS OF OPERATION, AND EVERY 500 HOURS THEREAFTER.

2-21. TORQUE HUB, MACHINES BUILT PRIOR TO MID 1991. (SEE FIGURE 2-22.)

a. Disassembly.

(1). Position hub over suitable container and remove drain plugs (10) from unit. Allow oil to completely drain, then replace drain plugs.

(2). Remove eight bolts (41) and four shoulder bolts (42) securing cover assembly to hub (7). Remove cover assembly and discard o-ring seal (22).

(3). Lift carrier assembly and top thrust washer (39) from hub. Thrust washer may stick inside cover.

(4). Pry ring gear (21) loose from hub and remove it. Remove o-ring seal (22) from hub counterbore and discard it.

(5). Remove input gear (37) and thrustwashers (36,38) from input shaft assembly and remove input shaft assembly from hub.

(6). Lift internal gear (12) and thrustwasher (39) from hub. Thrust washer may stick to bottom of carrier.

(7). Remove retaining ring (9) from spindle (1) and lift hub from spindle.

⚠ CAUTION

EYE PROTECTION SHOULD BE WORN DURING RETAINING RING REMOVAL.

(8). Remove inside bearing cone (6) and bearing shim (8).

(9). If necessary, pry seal (2) out of hub using screwdriver or pry bar. With seal removed, outside bearing cone (4) can be removed.

(10). If necessary, remove inner and outer bearing cones (3,5) using a suitable slide hammer puller.

⚠ IMPORTANT

WHEN REBUILDING TORQUE HUB, REMOVE AND REPLACE ALL O-RINGS AND RETAINING RINGS.

b. Cleaning and Inspection.

(1). Thoroughly clean all parts in an approved cleaning solvent.

(2). Inspect bearing cups and cones for damage, pitting, corrosion, or excessive wear. If necessary, replace bearings as a complete set ensuring that they remain covered until use.

(3). Inspect bearing mounting surfaces on spindle, hub, input shaft and carrier. Replace components as necessary.

(4). Inspect all geared components for chipped or broken teeth and for excessive or uneven wear patterns.

(5). Inspect carrier for damage, especially in anti-roll pin and planet shaft hole areas.

(6). Inspect all planet shafts for scoring or other damage.

(7). Inspect all threaded components for damage including stretching, thread deformation, or twisting.

(8). Inspect seal mounting area in hub for burrs or sharp edges. Dress applicable surfaces or replace components as necessary.

(9). Inspect cover for cracks or other damage, and o-ring sealing area for burrs or sharp edges. Dress applicable surfaces or replace cover as necessary.

c. Repair.

(1). Cover Assembly.

(a). Remove two bolts (25) securing disconnect cap (26) to cover (23) and remove cap.

(b). Remove two bolts (25) securing cover cap (24) to cover and remove cap.

(c). Remove disconnect rod (27) from cap and remove o-rings (28,29) from cover cap. Discard o-rings.

(d). If necessary, remove pipe plug (30) from cover.

(e). Clean and inspect parts in accordance with paragraph b. Replace parts as necessary.

(f). If removed, screw pipe into cover.

(g). Slip o-ring (29) over cover cap and against face.

(h). Place o-ring (28) into cover cap internal groove. Disconnect rod may be used to push o-ring into groove.

(i). Place cover cap into cover with large hole located over pipe plug. Secure cover cap to cover with two bolts. Torque bolts to 70-80 in. lbs. (7.9-9.0 NM).

(j). Place disconnect cap over cover cap with nipple facing out and secure with two bolts. Torque bolts to 70-80 in. lbs. (7.9-9.0 NM).

(k). Turn cover over and push disconnect rod into cover cap. Rod will be held in place by friction from o-ring.

(2). Carrier Assembly.

(a). Drive anti-roll pin (19) into planet (17) using a suitable punch.

(b). Using a suitable press, press planet shaft from carrier (13). After planet shaft is removed, drive anti-roll pin from shaft.

(c). Remove cluster gear (18) and thrust washers (20,14) from carriers.

(d). Remove sixteen needle rollers (15) from cluster gear bore.

(e). Remove spacer (16) from cluster gear bore and remove second set of sixteen needle rollers (15).

(f). Repeat steps (a) through (e) for remaining two cluster gears.

(g). Clean and inspect all parts in accordance with paragraph b. Replace parts as necessary.

(h). Apply a coat of grease or petroleum jelly to cluster gear bore.

(i). Place sixteen needle rollers into cluster gear bore.

(j). Place spacer into opposite side of cluster gear and against needle rollers.

(k). Place second set of sixteen needle rollers into cluster gear.

(l). Apply grease or petroleum jelly to tang side of two thrust washers. Place thrust washers against bosses in carrier with washer tang fitting into slot in carrier outside diameter.

(m). While keeping thrust washers in place, slide cluster gear into carrier with larger gear on side with small pin hole.

(n). Line up cluster gear and thrust washers with hole in carrier and slide planet shaft through. Ensure chamfered side of hole in planet shaft is lined up with pin hole in carrier.

(o). Drive anti-roll pin flush into carrier hole, locking planet shaft into place.

(p). Repeat steps (h) through (o) for remaining two cluster gears.

(3). Input Shaft Assembly.

⚠ CAUTION

EYE PROTECTION SHOULD BE WORN DURING RETAINING RING REMOVAL AND INSTALLATION.

(a). Carefully remove retaining ring (34) from input shaft (35) and discard retaining ring.

(b). Remove two spacers (31) and spring (32) from input shaft.

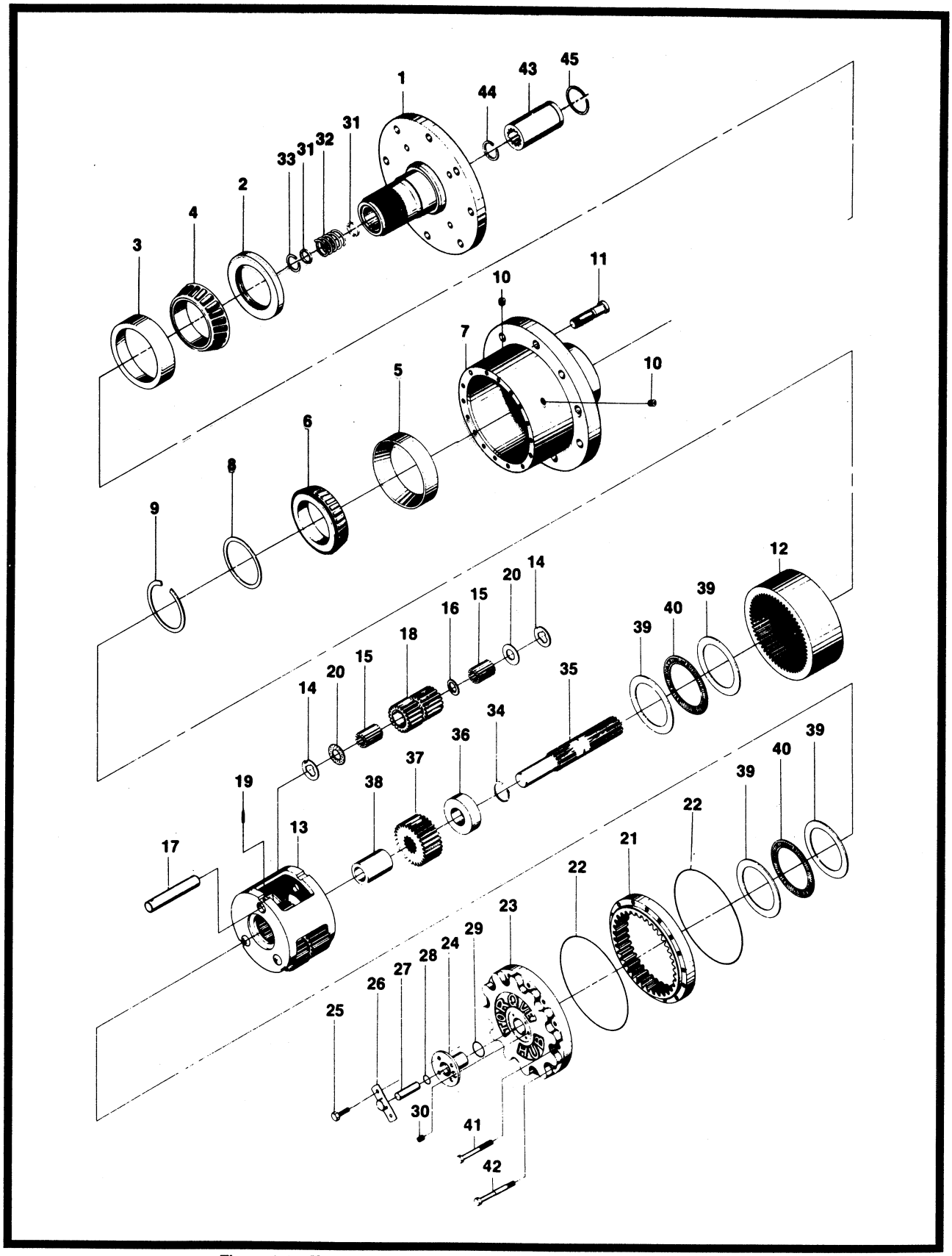


Figure 2-22. Torque Hub Assembly, Machines Built Prior To Mid 1991.

(c). Clean and inspect all parts in accordance with paragraph b. Replace parts as necessary.

(d). Place washer (31), spring (32), and washer (31), in that order, onto input shaft.

(e). Install retaining ring into input shaft groove to secure spacers and spring to shaft.

d. Assembly.

(1). Using a suitable press, press new bearing cups (3,5), with large inside diameters facing out, into hub (7) counterbores.

(2). Place bearing cone (4) into bearing cup (3) in small end of hub.

(3). Press new seal (2) into hub counterbore with flat metal side facing in. Use a flat object to ensure that seal is pressed evenly and is flush with hub face.

(4). Lower hub onto spindle (1) with large open end up.

(5). Place bearing cone (6) over end of spindle and into bearing cup (5).

(6). Place bearing shim (8) over end of spindle and against bearing cone.

⚠ CAUTION

EYE PROTECTION SHOULD BE WORN DURING RETAINING RING INSTALLATION.

(7). Install new retaining ring (9) completely into spindle groove and against bearing shim. Ensure retaining ring is entirely in groove.

(8). Place internal gear (12) onto end of spindle.

(9). Place input shaft assembly into spindle bore with unsplined end facing out.

(10). Place narrow thrust washer (36) over input shaft (35) with counterbore side facing spindle.

(11). Place o-ring (22) into hub counterbore. Use petroleum or grease to hold o-ring in place. Slight stretching of o-ring may be necessary to insure proper seating.

(12). Place carrier assembly on a flat surface with large gears up and positioned as shown in Figure 2-24. Find punch marked tooth on each large gear and locate at 12 o'clock (straight up) from each planet pin. Marked tooth will be located just under carrier on upper two gears.

(13). With shoulder side of ring gear (21) facing down, place ring gear over (into mesh with) large gears. Ensure punch marks remain in correct location during ring gear installation.

(14). Install input gear (37) into carrier, meshing with small diameter cluster gears (18). Counterbore in bore of input gear must be to outside of carrier assembly.

(15). Turn over carrier assembly and ring gear while keeping gears in mesh. Place thrust washer (39) into carrier counterbore. Use petroleum jelly or grease to hold washer in place.

(16). While holding ring gear, input gear, and cluster gears in mesh, place small side of cluster gears into mesh with internal gear. On ring gear, locate hole marked 'X' over one of counterbored holes in hub. Mark counterbored holes on outside diameter for later use.

Note

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

(17). Slide thrust spacer (38) over end of input shaft.

(18). Place thrust washer (39) into carrier counterbore.

(19). Place o-ring (22) into cover assembly counterbore. Use petroleum jelly or grease to hold o-ring in place.

(20). Place cover assembly over ring gear with oil level check plug in cover located approximately 90 degrees from oil fill plug in hub.

(21). Locate four shoulder bolts (42) 90 degrees apart into counterbored holes in hub marked in step (16). Torque shoulder bolts to 23-27 ft. lbs. (31-36 NM).

(22). Install bolts (41) in remaining holes. Torque bolts to 23-27 ft. lbs. (31-36 NM).

(23). Place coupling (43) into spindle and onto input shaft.

(24). Fill hub one-half full of EPGL 90 lubricant before operation.

2-22. TORQUE HUB 2WD/4WD. (SEE FIGURE 2-23.)

a. Disassembly.

(1). Position hub over suitable container and remove drain plugs (10) from unit. Allow oil to completely drain, then replace drain plugs.

(2). Remove eight bolts (41) and four shoulder bolts (42) securing cover assembly to hub (7). Remove cover assembly and discard o-ring seal (22).

(3). Lift carrier assembly and top thrust washer (39) from hub. Thrust washer may stick inside cover.

(4). Pry ring gear (21) loose from hub and remove it. Remove o-ring seal (22) from hub counterbore and discard it.

(5). Remove input gear (37) and thrustwashers (38) from input shaft assembly and remove input shaft assembly from hub.

(6). Lift internal gear (12) and thrustwasher (39) from hub. Thrust washer may stick to bottom of carrier.

(7). Remove retaining ring (9) from spindle (1) and lift hub from spindle.

⚠ CAUTION

EYE PROTECTION SHOULD BE WORN DURING RETAINING RING REMOVAL.

(8). Remove inside bearing cone (6) and bearing shim (8).

(9). If necessary, pry seal (2) out of hub using screwdriver or pry bar. With seal removed, outside bearing cone (4) can be removed.

(10). If necessary, remove inner and outer bearing cones (3,5) using a suitable slide hammer puller.

⚠ IMPORTANT

WHEN REBUILDING TORQUE HUB, REMOVE AND REPLACE ALL O-RINGS AND RETAINING RINGS.

b. Cleaning and Inspection.

(1). Thoroughly clean all parts in an approved cleaning solvent.

(2). Inspect bearing cups and cones for damage, pitting, corrosion, or excessive wear. If necessary, replace bearings as a complete set ensuring that they remain covered until use.

(3). Inspect bearing mounting surfaces on spindle, hub, input shaft and carrier. Replace components as necessary.

(4). Inspect all geared components for chipped or broken teeth and for excessive or uneven wear patterns.

(5). Inspect carrier for damage, especially in anti-roll pin and planet shaft hole areas.

(6). Inspect all planet shafts for scoring or other damage.

(7). Inspect all threaded components for damage including stretching, thread deformation, or twisting.

(8). Inspect seal mounting area in hub for burrs or sharp edges. Dress applicable surfaces or replace components as necessary.

(9). Inspect cover for cracks or other damage, and o-ring sealing area for burrs or sharp edges. Dress applicable surfaces or replace cover as necessary.

c. Repair.

(1). Cover Assembly.

(a). Remove two bolts (25) securing disconnect cap (26) to cover (23) and remove cap.

(b). Remove two bolts (25) securing cover cap (24) to cover and remove cap.

(c). Remove disconnect rod (27) from cap and remove o-rings (28,29) from cover cap. Discard o-rings.

(d). If necessary, remove pipe plug (30) from cover.

(e). Clean and inspect parts in accordance with paragraph b. Replace parts as necessary.

(f). If removed, screw pipe into cover.

(g). Slip o-ring (29) over cover cap and against face.

(h). Place o-ring (28) into cover cap internal groove. Disconnect rod may be used to push o-ring into groove.

(i). Place cover cap into cover with large hole located over pipe plug. Secure cover cap to cover with two bolts. Torque bolts to 70-80 in. lbs. (7.9-9.0 NM).

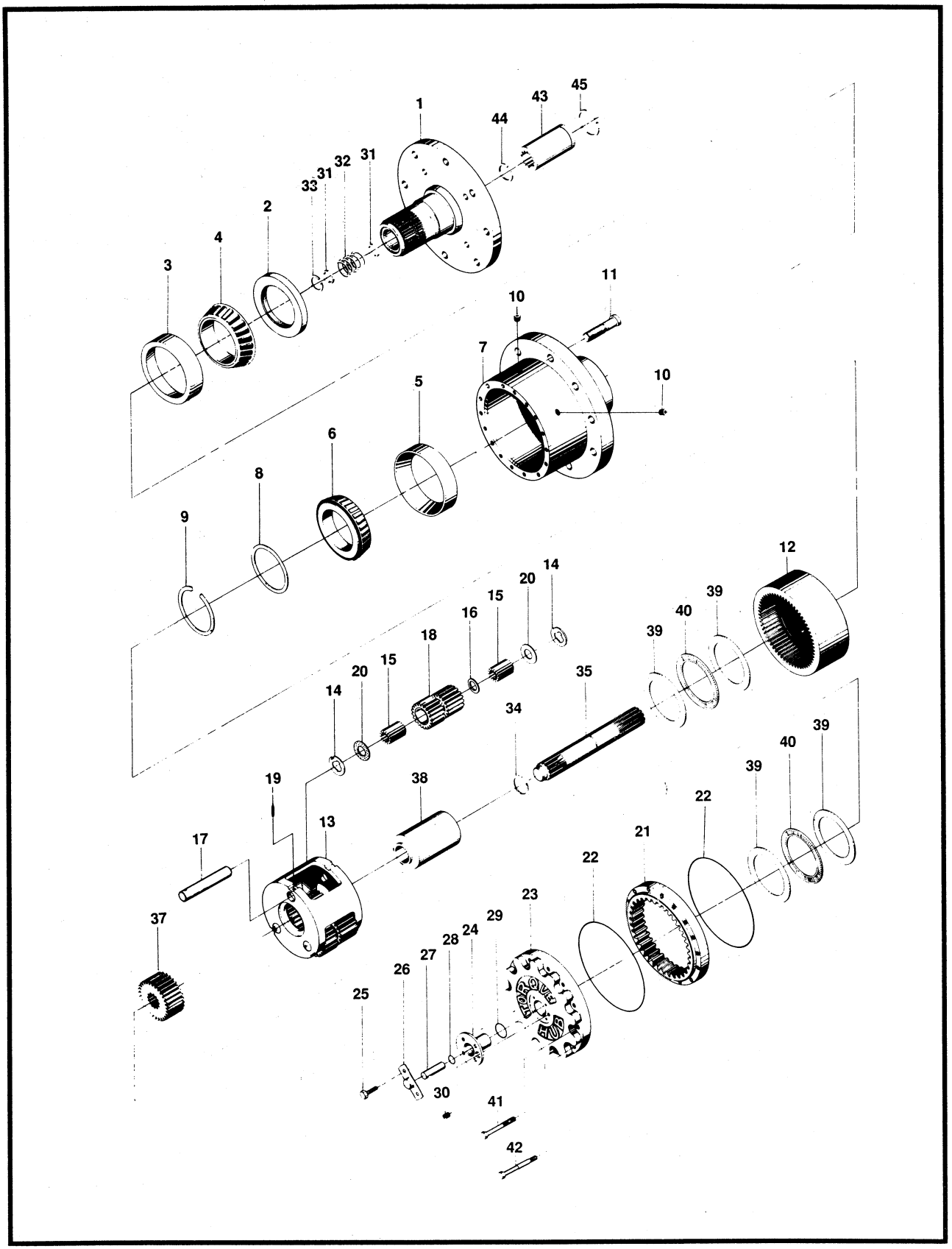


Figure 2-23. Torque Hub Assembly 2WD/4WD.

(j). Place disconnect cap over cover cap with nipple facing out and secure with two bolts. Torque bolts to 70-80 in. lbs. (7.9-9.0 NM).

(k). Turn cover over and push disconnect rod into cover cap. Rod will be held in place by friction from o-ring.

(2). Carrier Assembly.

(a). Drive anti-roll pin (19) into planet (17) using a suitable punch.

(b). Using a suitable press, press planet shaft from carrier (13). After planet shaft is removed, drive anti-roll pin from shaft.

(c). Remove cluster gear (18) and thrust washers (20,14) from carriers.

(d). Remove sixteen needle rollers (15) from cluster gear bore.

(e). Remove spacer (16) from cluster gear bore and remove second set of sixteen needle rollers (15).

(f). Repeat steps (a) through (e) for remaining two cluster gears.

(g). Clean and inspect all parts in accordance with paragraph b. Replace parts as necessary.

(h). Apply a coat of grease or petroleum jelly to cluster gear bore.

(i). Place sixteen needle rollers into cluster gear bore.

(j). Place spacer into opposite side of cluster gear and against needle rollers.

(k). Place second set of sixteen needle rollers into cluster gear.

(l). Apply grease or petroleum jelly to tang side of two thrust washers. Place thrust washers against bosses in carrier with washer tang fitting into slot in carrier outside diameter.

(m). While keeping thrust washers in place, slide cluster gear into carrier with larger gear on side with small pin hole.

(n). Line up cluster gear and thrust washers with hole in carrier and slide planet shaft through. Ensure chamfered side of hole in planet shaft is lined up with pin hole in carrier.

(o). Drive anti-roll pin flush into carrier hole, locking planet shaft into place.

(p). Repeat steps (h) through (o) for remaining two cluster gears.

(3). Input Shaft Assembly.

⚠ CAUTION

EYE PROTECTION SHOULD BE WORN DURING RETAINING RING REMOVAL AND INSTALLATION.

(a). Carefully remove retaining ring (34) from input shaft (35) and discard retaining ring.

(b). Remove two spacers (31) and spring (32) from input shaft.

(c). Clean and inspect all parts in accordance with paragraph b. Replace parts as necessary.

(d). Place washer (31), spring (32), and washer (31), in that order, onto input shaft.

(e). Install retaining ring into input shaft groove to secure spacers and spring to shaft.

d. Assembly.

(1). Using a suitable press, press new bearing cups (3,5), with large inside diameters facing out, into hub (7) counterbores.

(2). Place bearing cone (4) into bearing cup (3) in small end of hub.

(3). Press new seal (2) into hub counterbore with flat metal side facing in. Use a flat object to ensure that seal is pressed evenly and is flush with hub face.

(4). Lower hub onto spindle (1) with large open end up.

(5). Place bearing cone (6) over end of spindle and into bearing cup (5).

(6). Place bearing shim (8) over end of spindle and against bearing cone.

⚠ CAUTION

EYE PROTECTION SHOULD BE WORN DURING RETAINING RING INSTALLATION.

(7). Install new retaining ring (9) completely into spindle groove and against bearing shim. Ensure retaining ring is entirely in groove.

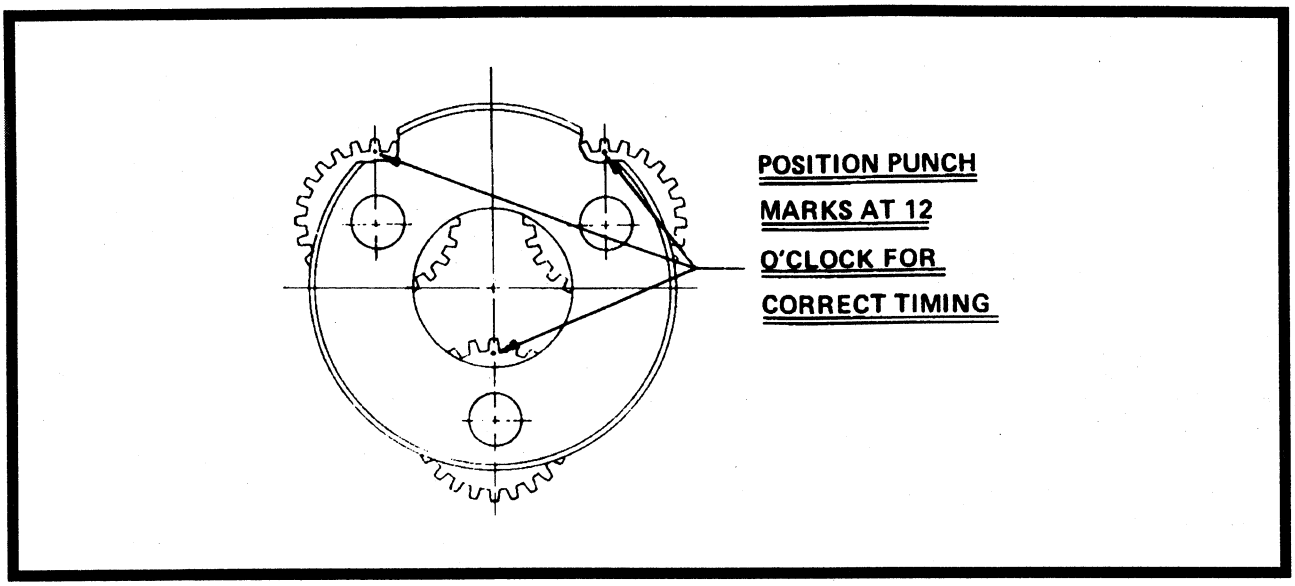


Figure 2-24. Torque Hub Carrier Timing.

(8). Place internal gear (12) onto end of spindle.

(9). Place input shaft assembly into spindle bore with unsplined end facing out.

(10). Place narrow thrust washer (38) over input shaft (35) with counterbore side facing spindle.

(11). Place o-ring (22) into hub counterbore. Use petroleum or grease to hold o-ring in place. Slight stretching of o-ring may be necessary to insure proper seating.

(12). Place carrier assembly on a flat surface with large gears up and positioned as shown in Figure 2-24. Find punch marked tooth on each large gear and locate at 12 o'clock (straight up) from each planet pin. Marked tooth will be located just under carrier on upper two gears.

(13). With shoulder side of ring gear (21) facing down, place ring gear over (into mesh with) large gears. Ensure punch marks remain in correct location during ring gear installation.

(14). While holding ring gear, input gear, and cluster gears in mesh, place small side of cluster gears into mesh with internal gear. On ring gear, locate hole marked 'X' over one of counterbored holes in hub. Mark counterbored holes on outside diameter for later use.

Note

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

(15). Install input gear (37) into carrier, meshing with small diameter cluster gears (18). Counterbore in bore of input gear must be to outside of carrier assembly.

(16). Turn over carrier assembly and ring gear while keeping gears in mesh. Place thrust washer (39) into carrier counterbore. Use petroleum jelly or grease to hold washer in place.

(17). Place thrust washer (39) into carrier counterbore.

(18). Place o-ring (22) into cover assembly counterbore. Use petroleum jelly or grease to hold o-ring in place.

(19). Place cover assembly over ring gear with oil level check plug in cover located approximately 90 degrees from oil fill plug in hub.

(20). Locate four shoulder bolts (42) 90 degrees apart into counterbored holes in hub marked in step (16). Torque shoulder bolts to 23-27 ft. lbs. (31-36 NM).

(21). Install bolts (41) in remaining holes. Torque bolts to 23-27 ft. lbs. (31-36 NM).

(22). Place coupling (43) into spindle and onto input shaft.

(23). Fill hub one-half full of EPGL 90 lubricant before operation.

2-23. Swing Drive Brake, Mico (Machines Built Prior To May 1992). (See Figure 2-25.)

a. Disassembly.

(1). Separate end cover (4) from housing (26) by removing capscrews (1) and lockwashers (2).

⚠ WARNING

END COVER IS UNDER SPRING TENSION OF APPROXIMATELY 1500 POUNDS (681 KG). THE FOUR CAPSCREWS SHOULD BE LOOSENED EVENLY TO RELIEVE THIS FORCE. IF A HYDRAULIC PRESS IS AVAILABLE (3000 LBS (1362 KG) MINIMUM), THE COVER CAN BE HELD IN POSITION WHILE REMOVING THE CAPSCREWS AND LOCKWASHERS.

(2). Tap cover with a soft mallet in order to dislodge bearing (7) from cover.

(3). Remove o-ring (6), square-ring (5), pipe plug (3), and bleeder screw (13), from end cover.

(4). Remove piston (10) from end cover by inserting two 1/4-20 UNC bolts into threaded holes in piston. By turning and pulling, piston can be removed from bore.

(5). Remove o-ring (8), and back-up ring (9), o-ring (11) and back-up ring (12) from piston.

(6). Remove separators (19) from housing (26).

(7). Remove shaft assembly, consisting of shaft (15), discs (16,20), and friction plates (18), springs (17), snap ring (14) and bearings (7,24) from housing by pressing or using a soft mallet on male end of shaft.

(8). Remove springs (17) from between tabs of discs (16,20).

(9). Remove bearing (7,24) from shaft (15) with appropriate bearing puller. The discs and friction discs will then slide off male end of shaft. Remove snap ring and shaft.

(10). Remove dowel pins (23), springs (21,22) and o-ring (25) from housing.

b. Cleaning and 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 found to be in good condition.

c. Assembly.

Note

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

(1). Insert new o-ring (25), dowel pins (23), and springs (21,22) in housing (26).

(2). Install new bearing (24) in housing and press until bearing bottoms on shoulder in housing.

(3). Position new large diameter disc (20) in housing with tabs guided by dowel pins (23) until disc rests on springs (21,22).

⚠ IMPORTANT

DISCS (16 & 20) AND FRICTION DISCS (18) SHOULD REMAIN DRY DURING INSTALLATION. NO OIL RESIDUE SHOULD BE ALLOWED TO CONTAMINATE DISC SURFACES.

(4). Place a new friction disc (18) on bottom disc (20) centering it as closely as possible. Insert one spring (17) on each dowel pin (23).

(5). Add additional new disc (16), and friction disc (18) and springs (17) as required for specific model.

(6). Install snap ring (14) on shaft (15). Insert shaft (15) thru friction discs (18) until shaft contacts bearing (24). Press shaft (15) until it shoulders on inner race of bearing (24). A small preload will exist on snap ring (14) at this point.

(7). Insert separators (19) over spiral pins in housing (26). Separators will contact top of bottom disc (20) when properly installed.

(8). Install new o-ring (8), new back-up ring (9), new o-ring (11) and new back-up ring (12) on piston (10). Insert piston (10) into end cover (4) being careful not to shear o-rings or back-up rings. Inserting 1/4-20UNC bolts in piston may simplify installation.

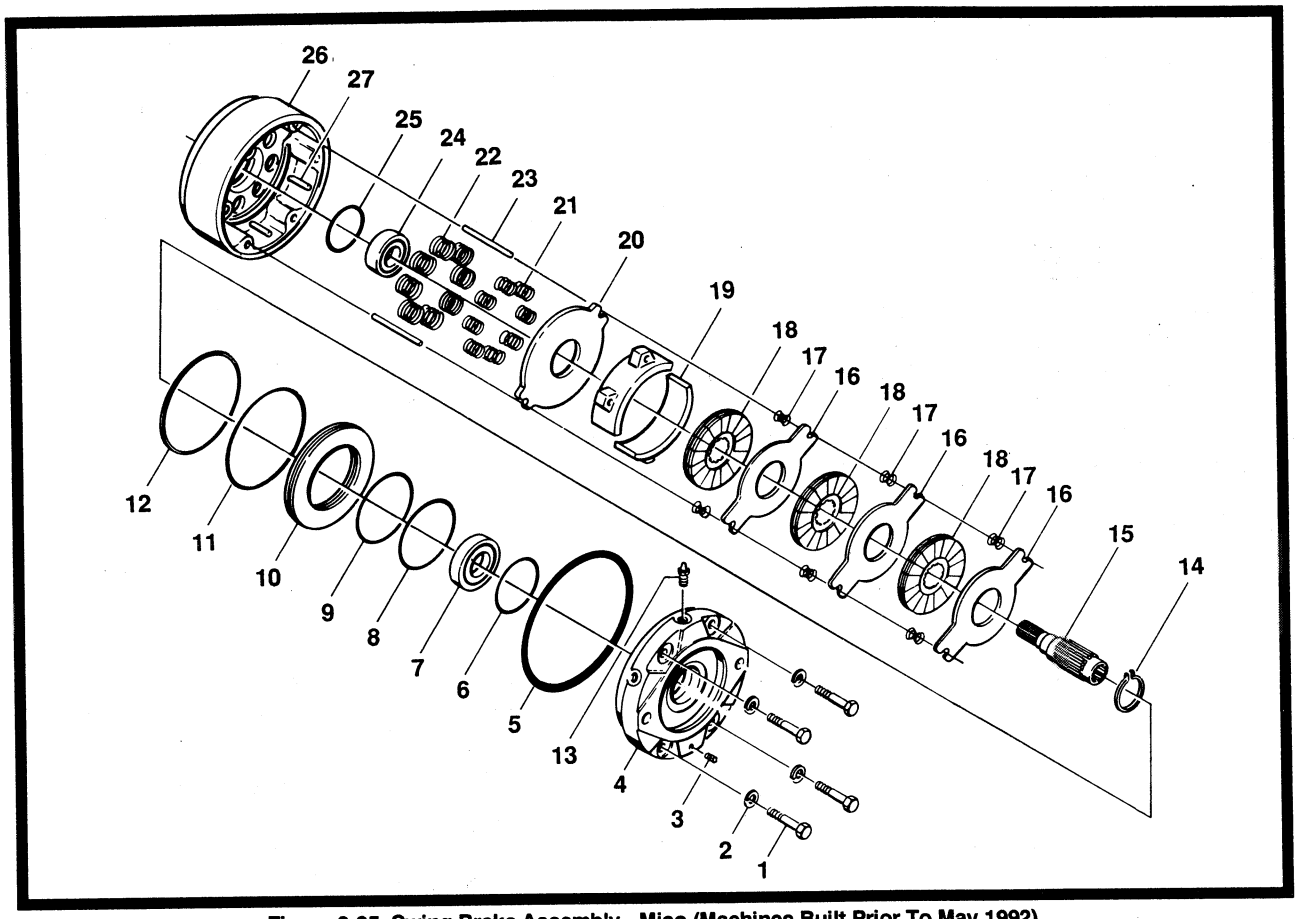


Figure 2-25. Swing Brake Assembly - Mico (Machines Built Prior To May 1992).

(9). Install new o-ring (6), new bearing (7), new square ring, pipe plug (3), and bleeder screw (13) in end cover.

(10). Position end cover (4) on housing, aligning dowel pins (23) with holes in end cover.

(11). Install capscrews (1) and lockwashers (2). Tighten evenly to draw end cover (4) to housing and bearing (7) onto shaft (15). Torque capscrews to 55 ft. lbs. (75 NM).

Note

If available, a hydraulic press will simplify installation of end cover on housing. Clamp cover in position while tightening capscrews.

(12). Press on inner ring of bearing (7) until it shoulders on shaft (15) to eliminate binding on bearings. Be certain to restrain opposite end of shaft to avoid excessive thrust loading on bearing (24).

⚠ IMPORTANT

PRESS FORCE SHOULD BE LIMITED TO 2000 LBS (907.2 KG) MAXIMUM TO AVOID POSSIBLE DAMAGE TO SNAP RING (14).

⚠ IMPORTANT

IF HYDROSTATIC BENCH TESTING IS PERFORMED ON THE BRAKE ASSEMBLY. RELEASE PRESSURE SHOULD NOT EXCEED 2000 PSI (137.9 BAR) UNLESS TWO ADDITIONAL BOLTS ARE USED FOR SUPPLEMENTAL CLAMPING.

d. Bleeding.

(1). Install brake and connect pressure lines.

(2). Bleed pressure release section of brake by pressurizing side inlet port and allowing air to escape from top port. Pressure should not exceed 100 psi (6.9 Bar) during bleeding.

(3). Apply sufficient pressure to release brake and check for proper operation.

2-24. DRIVE BRAKE, MICO (Machines Built Prior To May 1992). (SEE FIGURE 2-26.)

a. Disassembly.

(1). Remove end cover (4) from housing (25) by removing capscrews (1) and lockwashers (2).

⚠ WARNING

END COVER IS UNDER SPRING TENSION OF APPROXIMATELY 1500 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). Tap cover with a soft mallet in order to dislodge bearing (7) from cover.

(3). Remove o-ring (6), square ring (5), pipe plug (3) and bleederscrew (13) from end cover.

(4). Remove piston (10) from end cover by inserting two 1/4-20 UNC bolts into threaded holes in piston. By turning and pulling, piston can be removed from bore.

(5). Remove o-ring (8), back-up ring (9), o-ring (11) and back-up ring (12) from piston (24).

(6). Remove separators (18) from housing (25).

(7). Remove shaft assembly, consisting of shaft (14), discs (15,19), and friction discs (17), springs (16) and bearings (7,23), from housing by pressing or using a soft mallet on male end of shaft.

(8). Remove springs (16) from between tabs of discs (15,19).

(9). Remove bearings (7,23) from shaft using an appropriate bearing puller. The discs and friction discs will then slide off either end of shaft.

(10). Remove dowel pins (22), springs (20,21) and oil seal (24) from housing (25).

b. 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 re-used if, after thorough inspection, they are found to be in good condition.

c. Assembly.

Note

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

(1). Insert new oil seal (24), dowel pins (22) and springs (20,21) in housing (25).

(2). Install new bearing (23) on male end of shaft (14) and press until it shoulders on shaft.

(3). Insert shaft and bearing on housing (25) and press until bearing bottoms on shoulder in housing.

(4). Position large diameter disc (19) in housing, with tabs guided by dowel pins (22), until disc rests on springs (20,21).

⚠ IMPORTANT

DISC (15,19) AND FRICTION DISCS (17) SHOULD REMAIN DRY DURING INSTALLATION. NO OIL RESIDUE SHOULD BE ALLOWED TO CONTAMINATE DISC SURFACES.

(5). Place friction disc (17) on shaft until it contacts bottom disc (19). Insert one spring (16) on each dowel pin (22).

(6). Add additional discs (15), friction discs (17), and springs (16) as required to complete assembly. Alternate discs and friction discs during assembly.

(7). Insert separators (18) over spiral pins in housing. When properly installed, separators will contact top of bottom disc.

(8). Install o-ring (8), back-up ring (9), o-ring (11) and back-up ring (12) on piston (10). Insert piston into end cover (4), being careful not to shear o-rings or back-up rings. Inserting 1/4-20 UNC bolts in piston may simplify installation.

(9). Install o-ring (6), bearing (7), square ring (5), pipe plug (3) and bleeder screw (13) in end cover.

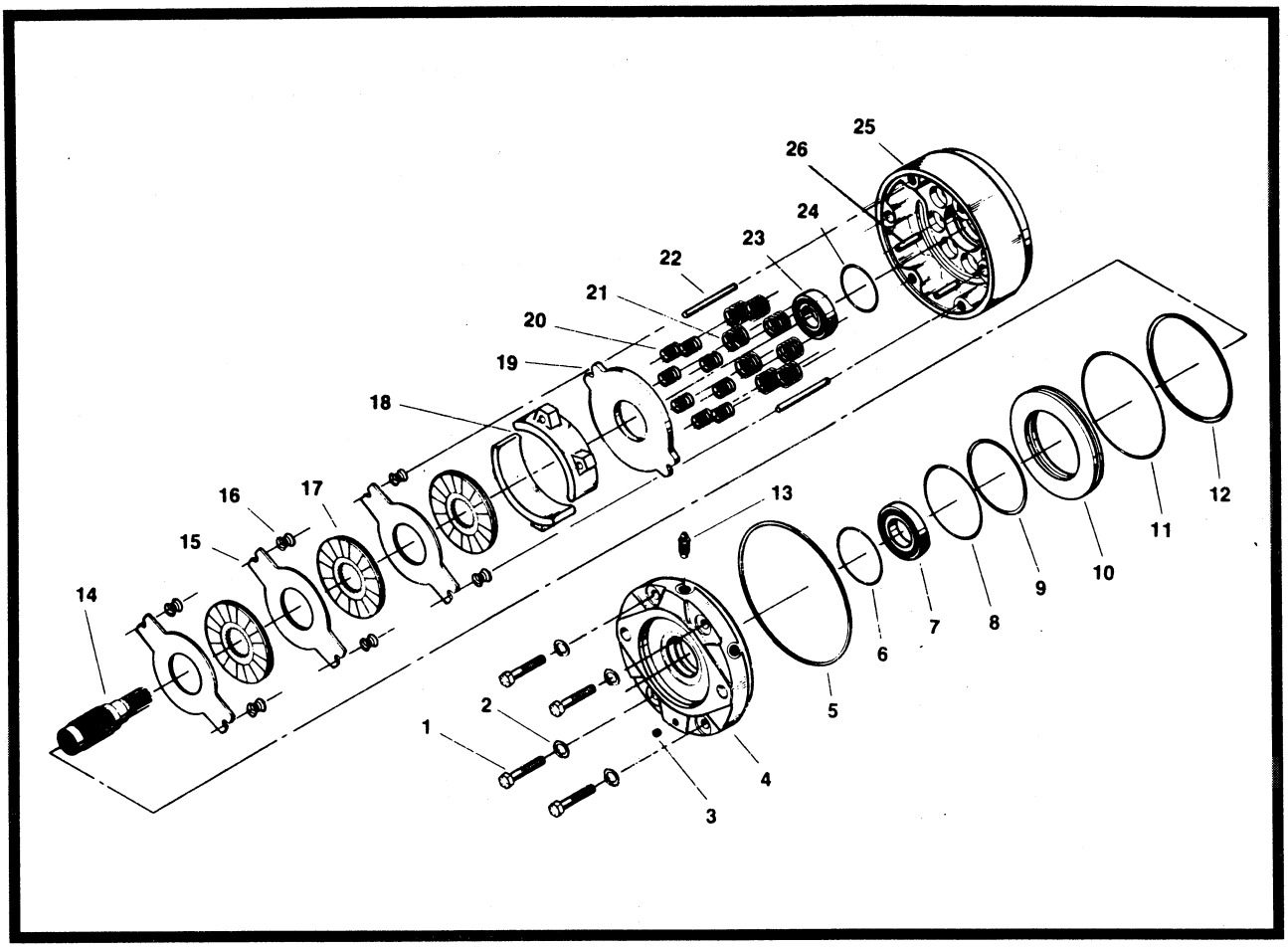


Figure 2-26. Drive Brake Assembly - Mico (Machines Built Prior To May 1992).

(10). Position end cover on housing, aligning dowel pins with holes in cover, and push end cover until top friction disc aligns with spline shaft.

(11). Install capscrew (1) and lockwashers (2). Tighten evenly to draw end cover to housing and bearing onto shaft. Torque capscrews to 55 ft. lbs. (75 NM).

Note

If available, a hydraulic press will simplify installation of end cover on housing. Clamp cover in position while tightening capscrews.

(12). To eliminate binding on bearings, press on inner ring of bearing (7) until it shoulders on shaft. Restrain opposite end of shaft to avoid excessive thrust loading of bearing (24).

⚠ IMPORTANT

IF HYDROSTATIC BENCH TESTING IS PERFORMED ON THE BRAKE ASSEMBLY. RELEASE PRESSURE SHOULD NOT EXCEED 2000 PSI (137.9 BAR) UNLESS TWO ADDITIONAL BOLTS ARE USED FOR SUPPLEMENTAL CLAMPING.

d. Bleeding

(1). Install brake and connect pressure lines.

(2). Bleed pressure release section of brake by pressurizing side inlet port and allowing air to escape from top port. Pressure should not exceed 100 psi (6.9 Bar) during bleeding.

(3). Apply sufficient pressure to release brake and check for proper operation.

2-25. Swing Drive Brake, AUSCO (Machines Built Prior To May 1992). (See Figure 2-27.)

a. Disassembly.

(1). With shaft protruding downward, remove bolts (22) alternately and evenly to reduce spring tension.

(2). Remove power plate (21) and gasket (2).

(3). Bearing (18) is pressed onto shaft (7) and must be removed before removal of rotating discs (11) and stationary discs (12).

(4). Further disassembly is not recommended unless necessary for the replacement of specific parts.

(5). If further disassembly is required, remove shaft (7) and stack sub-assembly from housing (1) by lightly tapping or pressing on the small external spline end of the shaft and removing the shaft, bearings and stack from housing.

(6). Remove bearing (18), stationary disc (12), rotating disc (11), springs (10) and primary disc (9).

(7). Remove bearing (3) from shaft using care not to damage seal (4). Remove seal (4).

(8). Remove springs (6) and spring retainer (5) from housing.

(9). Remove piston (13) from power plate by introducing low pressure air (15 PSI) into hydraulic inlet. Direct piston away from operator.

(10). Remove o-rings (15,17) and back-up rings (14,16) from piston O.D. and I.D. grooves. Back-up rings will be damaged and should not be removed if replacement is not planned.

(11). Pressure relief valve (23) can be removed and inspected to assure spring loaded ball moves freely and is contamination free.

b. Cleaning and 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 found to be in good condition.

c. Assembly.

Note

Lubricate all seals, o-rings, cylinder of the power plate and piston with clean hydraulic oil prior to assembly.

(1). Assemble piston (13) into power plate (21) using a shop press, being careful not to damage the o-rings or back-up rings. Visually align the center of the cutouts in piston (13) with torque pin (8) holes in power plate (21). Avoid pushing the piston all the way to the bottom of the cylinder in the power plate. Try to keep the top surface of the piston flush to 1/8"(0.32 cm) below the machined surface of the power plate.

(2). When pressing the bearing onto the shaft, press on the inner race of the bearing and support the shaft properly.

(3). Rotating discs must be clean and dry. Worn or heavily scored rotating discs must be replaced.

(4). Press bearings (3) into housing (1). Bearing must be seated against shoulder in housing.

(5). Using a shop press install seal (4) by pressing evenly around O.D. of seal. Use care to avoid cocking.

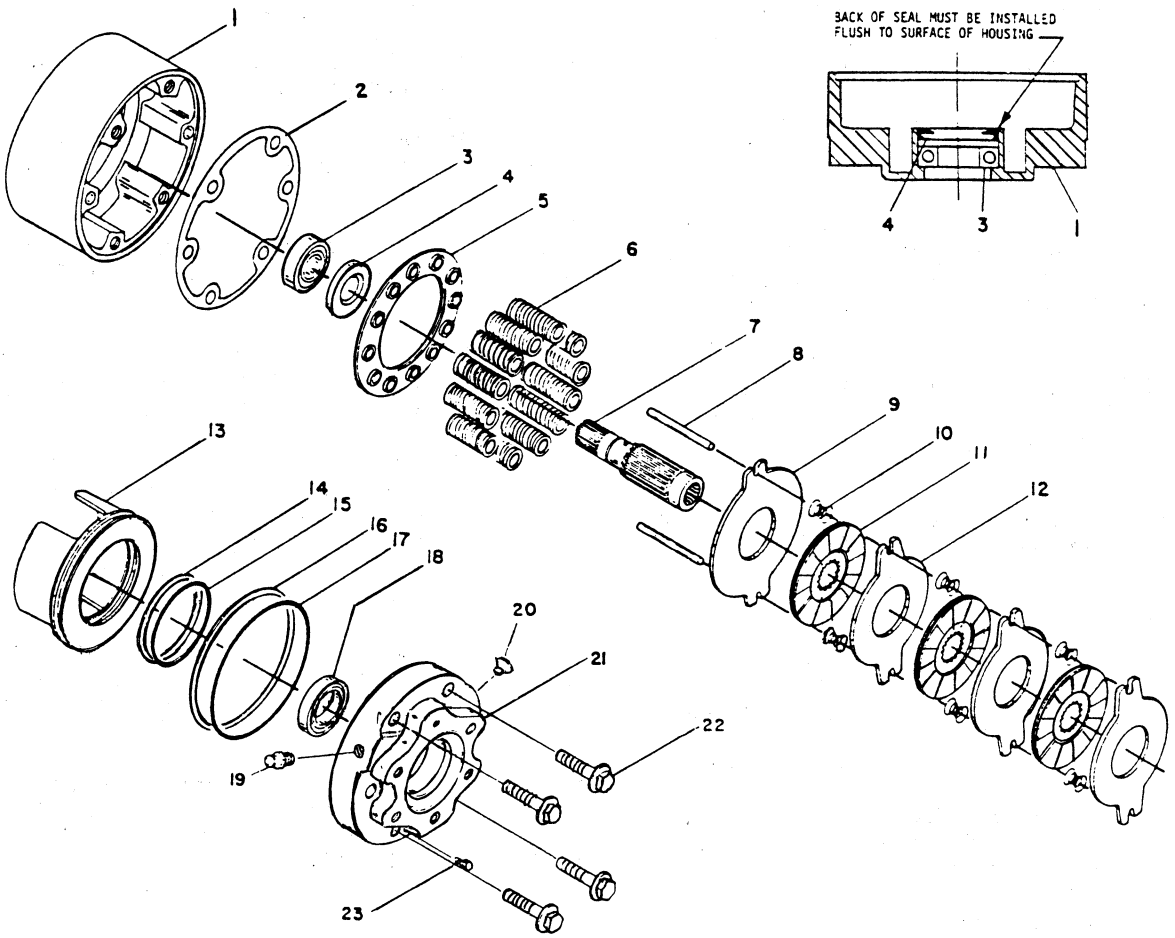
(6). Install shaft (7) into housing. Support the inner race of bearing (3) when pressing shaft into bearing.

(7). Install gasket (2). Align properly. After installing all the remaining internal components of the brake, install bearing (18). Properly support the shaft when pressing the bearing onto shaft.

(8). Install the power plate sub-assembly. Use a shop press to evenly lower plate into position. There should be no gap at the O.D. when the power plate is properly seated against housing. If a shop press is not available, use the assembly bolts (22). Tighten sequentially one turn at a time until the power plate is properly seated. Torque to 50-60 ft. lbs. (68-81 NM).

(9). If replacement of pressure relief valve is necessary, install 1/2 to 3/4 turns beyond finger tight.

(10). Bleed air from brake via bleeder screw.



1. Housing
2. Gasket
3. Bearing
4. Seal
5. Spring Retainer
6. Springs
7. Shaft
8. Torque Pin
9. Primary Disc
10. Springs
11. Rotating Discs
12. Stationary Discs
13. Piston
14. Back-Up Ring
15. O-Ring
16. Back-Up Ring
17. O-Ring
18. Bearing
19. Bleeder Screw
20. Plug
21. Power Plate
22. Bolts
23. Pressure Relief Valve

Figure 2-27. Swing Brake Assembly - Ausco (Machines Built Prior To May 1992).

2-26. DRIVE BRAKE, AUSCO. (Machines Built Prior To May 1992) (See Figure 2-28.)

a. Disassembly.

(1). When shaft protruding downward, remove bolts (23) alternately and evenly to reduce spring tension.

(2). Remove power plate (20), o-ring (5), stationary discs (13), springs (11), rotating discs (12), primary disc (10), pins (9), springs (6,7) and spring retainer (if so equipped).

(3). Further disassembly is not recommended unless necessary for the replacement of specific parts.

(4). If further disassembly is required, remove snap rings (1,2), then remove shaft (8) from bearing (3) by lightly tapping shaft with a plastic mallet.

(5). Remove bearing from housing.

(6). Remove piston (14) from the power plate (20) by introducing low pressure air (15 PSI) into hydraulic inlet. Make sure piston is directed away from operator. Remove o-rings (15,17) from the piston O.D. and I.D. grooves. Back-up rings will be damaged and should not be removed if replacement is not planned.

(7). Bleeder (19) can be removed and inspected to assure spring loaded ball moves freely and is free of contamination.

b. Cleaning and 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 found to be in good condition.

c. Assembly.

Note

Lubricate all seals, o-rings, cylinder of power plate and piston with clean hydraulic oil prior to assembly.

(1). Use the reverse of the disassembly procedure with the following notes and additions.

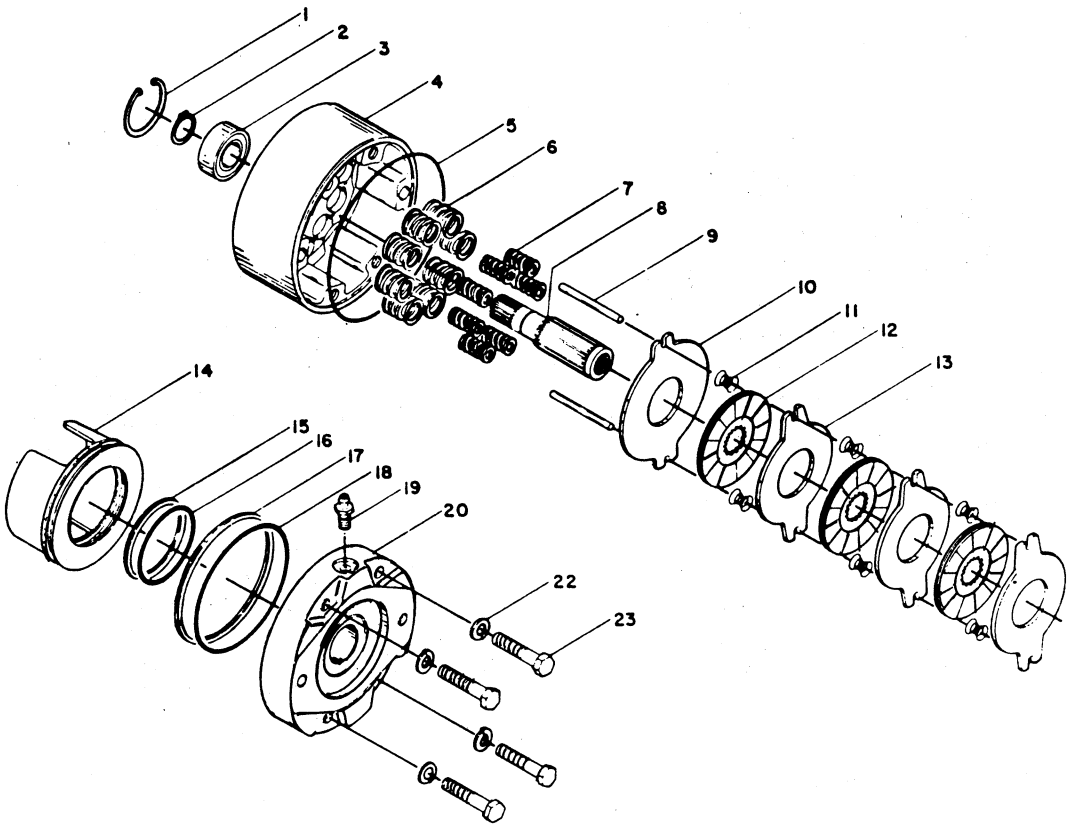
(2). Worn o-rings and damaged or worn teflon back-up rings must be replaced prior to assembly.

(3). If replacement of bleeder (19) is necessary, install 1/2 to 3/4 turns beyond finger tight.

(4). Assemble piston (14) into power plate (20) using a shop press, being careful not to damage the o-rings or teflon back-up rings. Visually align the center of the cut-outs in the piston with the torque pin (9) holes in the power plate.

(5). Rotating discs (12) must be clean and dry, with no presence of oil on any lining material or mating surface or the stationary discs (13).

(6). Install bolts (23). Tighten sequentially one turn at a time, until power plate (20) is properly seated. Torque to 50-60 ft. lbs. (68-81 NM).



1. Snap Rings
2. Snap Rings
3. Bearing
4. Housing
5. O-Ring
6. Spring
7. Spring
8. Shaft
9. Pins
10. Primary Disc
11. Springs
12. Rotating Discs
13. Stationary Discs
14. Piston
15. Back-Up Ring
16. O-Ring
17. Back-Up Ring
18. O-Ring
19. Bleeder
20. Power Plate
21. Not Used
22. Lockwasher
23. Bolts

Figure 2-28. Drive Brake, Ausco. (Machines Built Prior To May 1992).

2-27. DRIVE BRAKE, MICO. (Machines Built From May 1992 To Present) (See Figure 2-29.)

a. Disassembly.

(1). Remove end cover (2) from housing (21) by removing capscrews (1).

⚠ WARNING

END COVER IS UNDER SPRING TENSION OF APPROXIMATELY 2000 POUNDS (907 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.

(2). Remove case seal (4) from housing (21) then remove bleeder screw (3) from end cover (2).

(3). Remove piston (7) from end cover (2).

(4). Remove o-ring (5), back-up ring (6), o-ring (8) and back-up ring (9) from piston (7).

(5). Remove separators (13) from housing (21).

(6). Remove stack assembly, consisting of shaft (11), return plate (14), and friction discs (12), from housing (21).

(7). Remove dowel pins (20), springs (15,16) and spring retainer (17) from housing (21).

(8). Remove retaining ring (18) from housing (21).

(9). Remove shaft by pressing or using a soft mallet on male end of shaft (10).

(10). Remove retaining ring (22) and bearing (19) from shaft (10).

(11). Press rotary oil seal (23) from housing (21).

b. 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 re-used if, after thorough inspection, they are found to be in good condition.

c. Assembly.

Note

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

(1). Clean all parts thoroughly before assembly.

(2). Press new rotary oil seal (23) into housing (21). Note direction of seal.

(3). Install new bearing (19) and retaining ring (22) on shaft (10).

(4). Insert shaft assembly and retaining ring (18) in housing (21).

(5). Insert dowel pins (20), spring retainer (17) and springs (15,16) in housing (21).

(6). Position new large diameter return plate (14) in housing with tab guided by dowel pins (20) until disc rests on springs (15,16).

⚠ IMPORTANT

DISC (15,19) AND FRICTION DISCS (17) SHOULD REMAIN DRY DURING INSTALLATION. NO OIL RESIDUE SHOULD BE ALLOWED TO CONTAMINATE DISC SURFACES.

(7). Place a new friction disc (12) on shaft (10) until it contacts return plate (14).

(8). Add additional new discs (11) and new friction discs (12) as required to complete assembly.

(9). Insert separators (13) in holes of return plate (14).

(10). Install new o-ring (5), new back-up ring (6), new o-ring (8) and new back-up ring (9) on piston (7). Note order of o-rings and back-up rings. Insert piston (7) into end cover (2) being careful not to shear o-rings or back-up rings.

(11). Install new case seal (4) in housing (21) then install bleeder screw (3) in end cover (2).

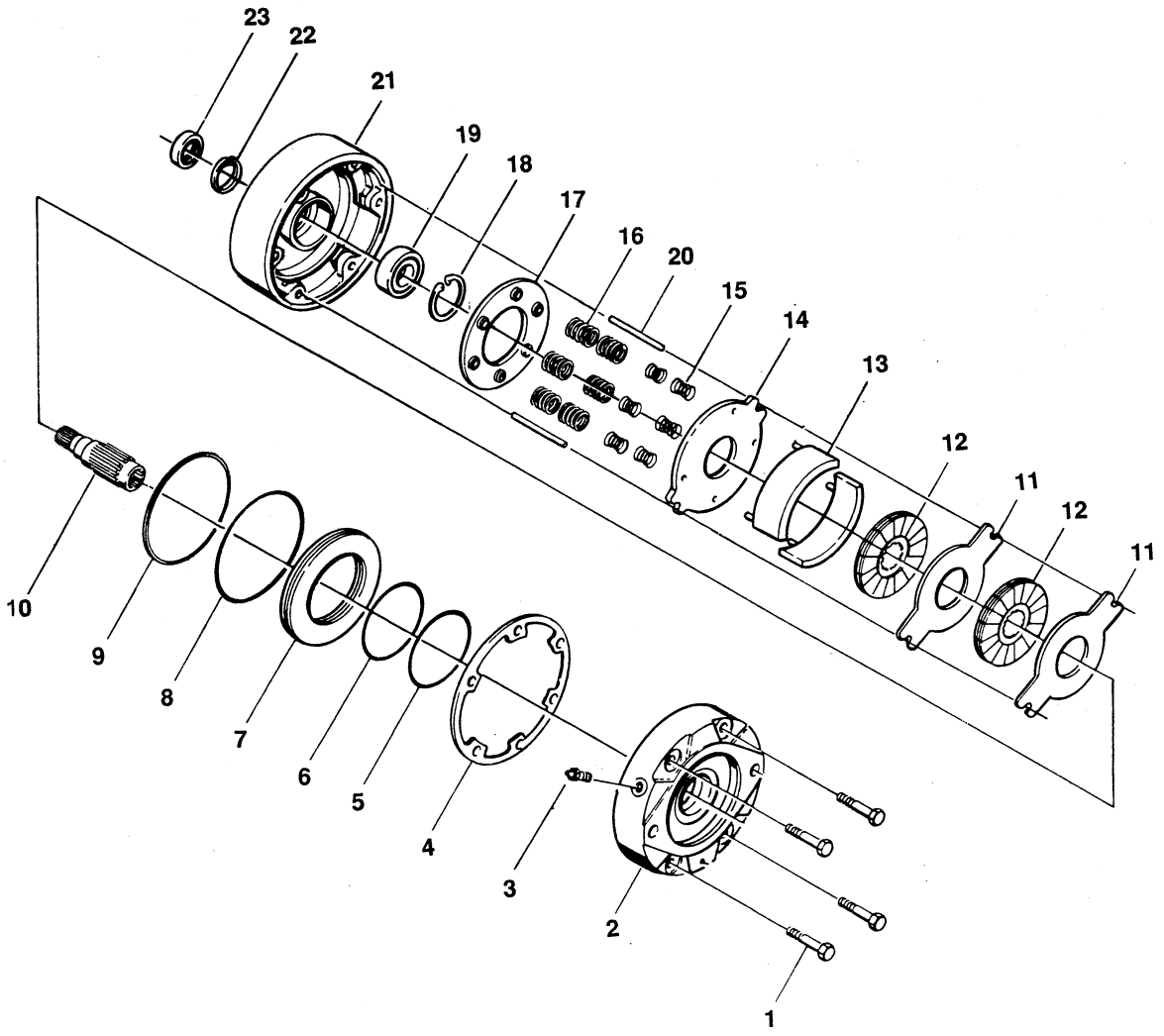
(12). Position end cover (2) on housing (21) aligning dowel pins (20) with holes in end cover.

(13). Install capscrews (1) and tighten evenly to draw end cover (2) to housing (21). Torque capscrews to 55 ft. lbs. (75 NM).

Note

If available a hydraulic press will simplify installation of end cover on housing. Clamp cover in position while tightening the capscrews.

(14). If hydrostatic bench testing is performed on the brake assembly, release pressure should not exceed 2000 psi (137 Bar) unless two additional bolts are used for supplemental clamping.



1. Bolts
2. Cover
3. Bleeder
4. Seal Case
5. O-Ring
6. Back-Up Ring
7. Piston
8. O-Ring
9. Back-Up Ring
10. Shaft
11. Stator
12 Rotor
13. Separator
14. Return Plate
15. Springs
16. Springs
17. Spring Guide
18. Retainer Ring
19. Bearing
20. Plug
21. Housing
22. Retainer Ring
23. Seal

Figure 2-29. Drive Brake, Mico. (Machines Built From May 1992 To Present)

2-28. SWING Brake, MICO. (Machines Built From May 1992 To Present) (See Figure 2-30.)

a. Disassembly.

(1). Remove end cover (2) from housing (21) by removing capscrews (1).

⚠ WARNING

END COVER IS UNDER SPRING TENSION OF APPROXIMATELY 2000 POUNDS (907 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.

(2). Remove case seal (4) from housing (21) then remove bleeder screw (3) from end cover (2).

(3). Remove piston (7) from end cover (2).

(4). Remove o-ring (5), back-up ring (6), o-ring (8) and back-up ring (9) from piston (7).

(5). Remove separators (13) from housing (21).

(6). Remove stack assembly, consisting of shaft (11), return plate (14), and friction discs (12), from housing (21).

(7). Remove dowel pins (20), springs (15,16) and spring retainer (17) from housing (21).

(8). Remove retaining ring (18) from housing (21).

(9). Remove shaft by pressing or using a soft mallet on male end of shaft (10).

(10). Remove retaining ring (22) and bearing (19) from shaft (10).

(11). Press rotary oil seal (23) from housing (21).

b. 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 re-used if, after thorough inspection, they are found to be in good condition.

c. Assembly.

Note

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

(1). Clean all parts thoroughly before assembly.

(2). Press new rotary oil seal (23) into housing (21). Note direction of seal.

(3). Install new bearing (19) and retaining ring (22) on shaft (10).

(4). Insert shaft assembly and retaining ring (18) in housing (21).

(5). Insert dowel pins (20), spring retainer (17) and springs (15,16) in housing (21).

(6). Position new large diameter return plate (14) in housing with tab guided by dowel pins (20) until disc rests on springs (15,16).

⚠ IMPORTANT

DISC (15,19) AND FRICTION DISCS (17) SHOULD REMAIN DRY DURING INSTALLATION. NO OIL RESIDUE SHOULD BE ALLOWED TO CONTAMINATE DISC SURFACES.

(7). Place a new friction disc (12) on shaft (10) until it contacts return plate (14).

(8). Add additional new discs (11) and new friction discs (12) as required to complete assembly.

(9). Insert separators (13) in holes of return plate (14).

(10). Install new o-ring (5), new back-up ring (6), new o-ring (8) and new back-up ring (9) on piston (7). Note order of o-rings and back-up rings. Insert piston (7) into end cover (2) being careful not to shear o-rings or back-up rings.

(11). Install new case seal (4) in housing (21) then install bleeder screw (3) in end cover (2).

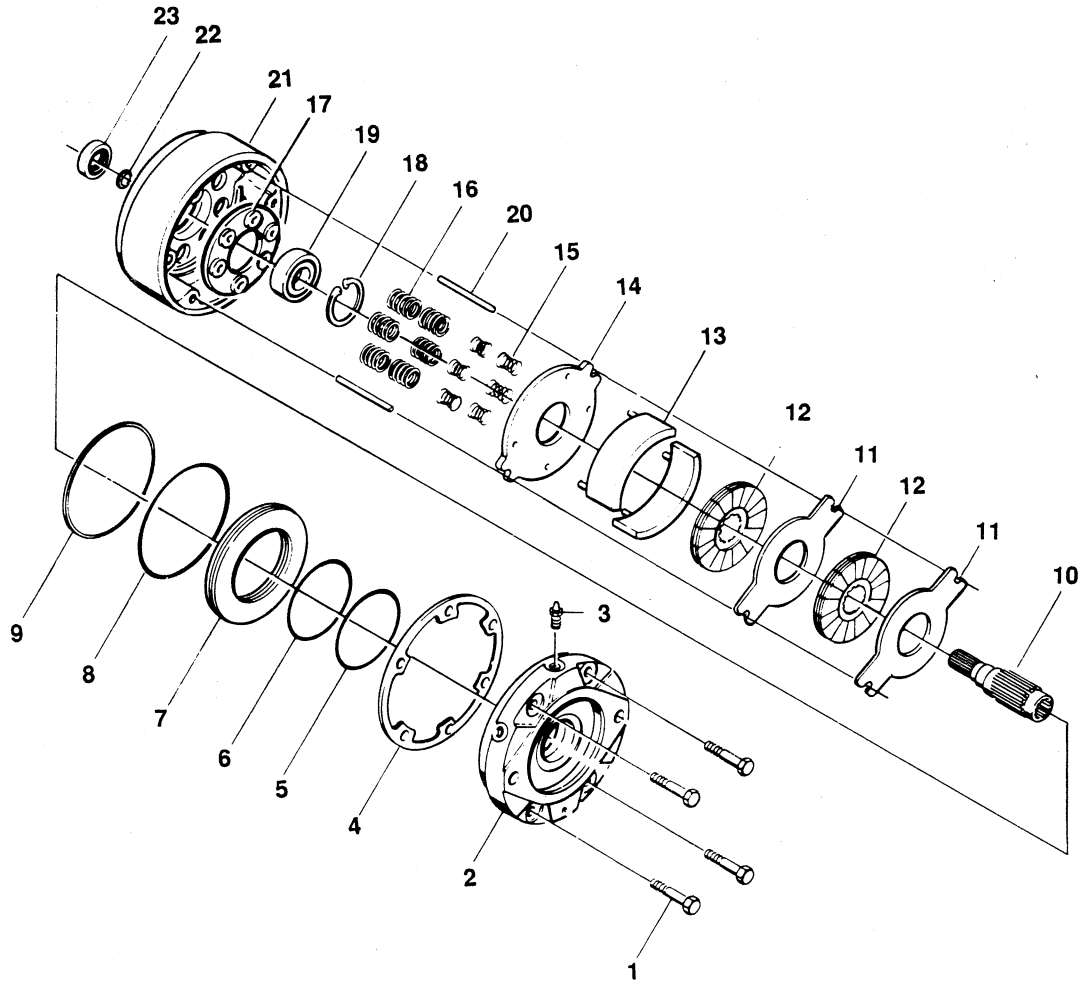
(12). Position end cover (2) on housing (21) aligning dowel pins (20) with holes in end cover.

(13). Install capscrews (1) and tighten evenly to draw end cover (2) to housing (21). Torque capscrews to 55 ft. lbs. (75 NM).

Note

If available a hydraulic press will simplify installation of end cover on housing. Clamp cover in position while tightening the capscrews.

(14). If hydrostatic bench testing is performed on the brake assembly, release pressure should not exceed 2000 psi (137 Bar) unless two additional bolts are used for supplemental clamping.



1. Bolts
2. Cover
3. Bleeder
4. Seal Case
5. O-Ring
6. Back-Up Ring
7. Piston
8. O-Ring
9. Back-Up Ring
10. Shaft
11. Stator
12 Rotor
13. Separator
14. Return Plate
15. Springs
16. Springs
17. Spring Guide
18. Retainer Ring
19. Bearing
20. Plug
21. Housing
22. Retainer Ring
23. Seal

Figure 2-30. Swing Brake, Mico. (Machines Built From May 1992 To Present)

2-29. CONTROLLERS

a. PQ.

Refer to separate publication (3120351) for complete troubleshooting, wiring and replacement parts.

b. OEM.

Refer to separate publication (3120344) for description troubleshooting, wiring and replacement parts.

c. VICKERS (All Hydraulic).

Refer to separate publication (3120335) for complete troubleshooting, wiring and replacement parts.

2-30. OSCILLATING AXLE BLEEDING PROCEDURE.

a. Lockout Cylinder Bleeding (Without Holding Valves).

(1). Make a hydraulic hose using approximately 6 feet of 1/4 in. wire braid hose with quick connect fitting on one end and a 1/4 in. JIC female fitting on the other.

(2). Swing the boom over the front of the machine and engage the turntable lock. Using ground control raise the boom out of the way.

(3). Remove the cover between frame slabs through which the cam valve wheel protrudes.

(4). Remove cap from fitting on cam valve and connect your hose (see 1 above) at this point.

(5). Attach the other end of the hose to the quick connect on the swing brake.

(6). Using a floor jack (or overhead crane) raise one front wheel approximately 6 inches (15.2 cm) off the ground.

(7). Use a bar as a lever to press down on the cam valve plunger which will allow the axle to fully oscillate against the stop.

(8). With the aid of an assistant, start the engine from ground control.

WARNING

ENSURE TURNTABLE LOCK IS ENGAGED.

(9). While your assistant activates swing from ground control, depress plunger on cam valve and open both bleeders on the lockout cylinder of the elevated wheel purging any air.

(10). Remove the jack from the elevated wheel and using the bar again press down on the cam valve plunger allowing the axle to center.

(11). Next raise the other front wheel as you did in step 6 and repeat steps 7 thru 10.

(12). Shut down the engine, remove the hose, and replace the cap on the cam valve fitting. Install frame cover over cam valve and disengage turntable lock.

(13). The boom can now be returned to its normal position.

b. Lockout Cylinder Bleeding (With Holding Valves).

⚠ IMPORTANT

ENSURE PLATFORM IS FULLY LOWERED AND BOOM IS CENTERED OVER REAR AXLE PRIOR TO BEGINNING BLEEDING PROCEDURE.

MAKING SURE MACHINE IS ON A LEVEL SURFACE AND REAR WHEELS ARE BLOCKED, DISENGAGE DRIVE HUBS. OPTIONAL 4WD ALL HUBS MUST BE DISENGAGED.

(1). Making sure machine is on a level surface and rear wheels are blocked, disengage drive hubs. **Optional 4WD** all hubs must be disengaged.

(2). Make up an adapter with an air regulator, remove filler cap on hydraulic tank and install regulator.

(3). Attach air supply to the regulator and set regulator to 2 - 5 psi (0.14-0.34 Bar).

⚠ CAUTION

DO NOT EXCEED 5 PSI (0.34 BAR) INTO HYDRAULIC TANK. MORE THAN 5 PSI (0.34 BAR) WILL CAUSE DAMAGE TO THE HYDRAULIC TANK.

(4). Activate machine hydraulic system from platform control station.

(5). Place LOW ENGINE, HIGH DRIVE SPEED and HIGH WHEEL MOTOR SPEED control switches to their respective HIGH positions.

(6). Depress footswitch and activate DRIVE CONTROLLER to "FORWARD" position.

(7). Using a suitable lifting equipment lift front of machine and place a 6 in. (15.2 cm) high block under right front wheel.

(8). Lower machine so both of the lockout cylinders are oscillated; one extended, the other retracted.

(9). Use suitable containers to retain any residual hydraulic fluid, place containers under each lockout cylinder.

(10). With DRIVE CONTROLLER activated and engine at idle, open all four bleeder screws (two on each lockout cylinder), one at a time, then close bleeder screws when all air is dissipated (bled).

(11). Using a suitable lifting equipment lift front of machine and remove the 6 in. (15.2 cm) high block.

(12). Transfer the 6 in. (15.2 cm) high block to the left front wheel and repeat steps 2 thru 7, substituting the word "right" for "left" in step 5.

(13). Perform oscillating axle lockout test.

2-31. OSCILLATING AXLE LOCKOUT TEST.

⚠ IMPORTANT

LOCKOUT SYSTEM TEST MUST BE PERFORMED QUARTERLY, ANY TIME A SYSTEM COMPONENT IS REPLACED, OR WHEN IMPROPER SYSTEM OPERATION IS SUSPECTED.

Note

Ensure boom is fully retracted, lowered, and centered between drive wheels prior to beginning lockout cylinder test.

(1). Place a 6 in. (15.2 cm) high block with ascension ramp in front of left front wheel.

(2). From platform control station, activate machine hydraulic system.

(3). Place HIGH ENGINE, DRIVE SPEED and WHEEL MOTOR SPEED control switches to their respective LOW positions.

(4). Place DRIVE control lever to FORWARD position and carefully drive machine up ascension ramp until left front wheel is on top of block.

(5). Carefully activate SWING control lever and position boom over right side of machine.

(6). With boom over right side of machine, place DRIVE control lever to REVERSE and drive machine off of block and ramp.

(7). Have an assistant check to see that left front wheel remains locked in position off of ground.

(8). Carefully activate SWING control lever and return boom to stowed position (centered between drive wheels). After boom reaches stowed position, activate DRIVE and lockout cylinders should release and allow wheel to rest on ground.

(9). Place the 6 in. (15.2 cm) high block with ascension ramp in front of right front wheel.

(10). Place DRIVE control lever to FORWARD and carefully drive machine up ascension ramp until right front wheel is on top of block.

(11). Carefully activate SWING control lever and position boom over left side of machine.

(12). With boom over left side of machine, place DRIVE control lever to REVERSE and drive machine off of block and ramp.

(13). Have an assistant check to see that right front wheel remains locked in position off of ground.

(14). Carefully activate SWING control lever and return boom to stowed position (centered between drive wheels). After boom reaches stowed position, activate DRIVE and lockout cylinders should release and allow wheel to rest on ground.

(15). If lockout cylinders do not function properly, have qualified personnel correct the malfunction prior to any further operation.

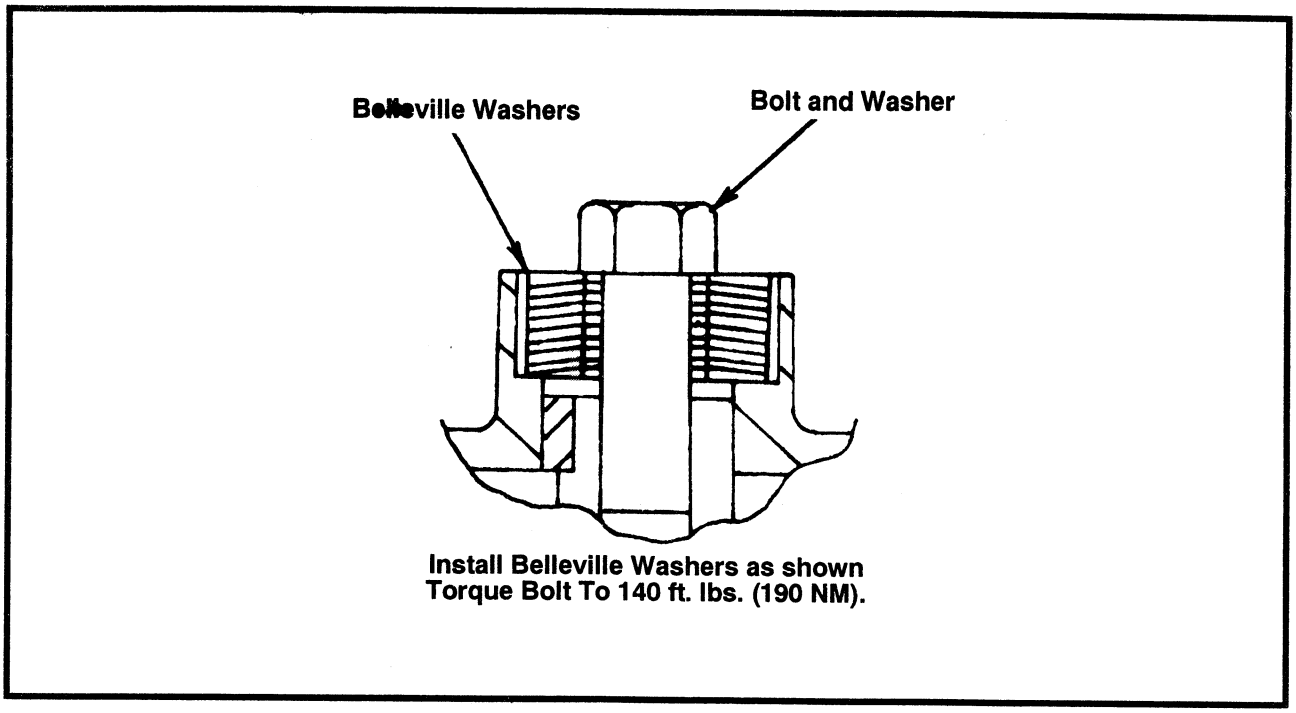


Figure 2-31. Basket Rotator Brake.

2-32. BASKET ROTATOR BRAKE. (SEE FIGURE 2-31.)

Torque belleville washers (4160026) to 140 ft. lbs. (190 NM).

2-33. FREE WHEELING OPTION.

a. To Disengage Drive Motors and Brakes (Free Wheel) for Towing, etc.

(1). Chock wheels securely if not on flat level surface.

(2). Disconnect both drive hubs by inverting disconnect caps in center of hubs.

(3). If equipped, move steer/tow selector valve to float (tow) position by pulling valve knob out.

b. To Engage Drive Motors and Brakes (Normal Operation).

(1). If equipped, move steer/tow valve to steer position by pushing valve knob in.

(2). Connect both drive hubs by inverting disconnect cap in center of hub.

(3). Remove chocks from wheels as required.

2-34. SPARK ARRESTOR MUFFLERS.

The multiple discs on these mufflers will require frequent cleaning if used with oily or sooty exhaust (diesel), or on malfunctioning engines (as evidenced by visible exhaust.

2-35. FOOTSWITCH ADJUSTMENT.

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

2-36. HYDRAULIC PUMP W/HAYES PUMP DRIVE COUPLING LUBRICATION.

a. 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)** coupling grease prior to assembly.

2-37. 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.

a. 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.

⚠ CAUTION

BE SURE ALL GASOLINE IS EXHAUSTED BEFORE SWITCHING TO LP GAS.

(3). While the engine is operating, place the three position LP/Gasoline switch at the ground control station to the center "off" position. Allow the engine to operate, without load, until the engine begins to "stumble" from lack of gasoline.

(4). As the engine begins to "stumble" place the switch to the "LPG" position, allowing the LP fuel to be sent to the fuel regulator.

b. Changing from LP Gas to Gasoline.

(1). With engine operating on LP under no load condition, throw the "LP/Gasoline" switch at the ground control station across to the "Gasoline" position.

(2). If engine "stumbles" because of lack of gasoline, place the switch to the "LPG" position until engine regains smoothness, then return the switch to the "Gasoline" position. Repeat as necessary until engine runs smoothly on gasoline.

(3). Close the hand valve on the LP gas supply tank by turning clockwise.

2-38. PREVENTIVE MAINTENANCE AND INSPECTION SCHEDULE.

a. 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' portion of the table, the various systems along with the components that make up that system are listed. The "INTERVAL" portion of the table is divided into five 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.

b. 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.

c. 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. Form 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.

d. 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.

PREVENTIVE MAINTENANCE AND INSPECTION SCHEDULE

AREA / BOOM	INTERVAL (10 HRS) DAILY	(50 HRS) WEEKLY	(200 HRS) MONTHLY	(500 HRS) 3 MONTH	(1000 HRS) 6 MONTH
1. Basket Door	1,4	12			
2. Basket	1,4				
3. Basket rotator	12	5,11	8		
4. Footswitch	1,11				
5. Controllers	1,11				
6. Switches	1,11				
7. Capacity Indicator	2,7				
8. Placards and Decals	1,2				
9. Control Tags	1,2				
10. Steering Wheel	1,11	5	8		
11. Valves		5,6			
12. Carrier (Hose and Tubing)	1	4,8			
13. Hydraulic Hoses and Tubing	1	5			
14. Pins		12	8		
15. Bushings		12	8		
16. Wear Pads			8		
17. Chains			8	12	
18. Chain Adjusters			9		
19. Sheaves		12	8		
20. Cylinders	12	1,5,6,13			
TURNTABLE					
1. Engine Oil (Refer to mfg. manual for detailed maint. schedule)	3	5			
2. Battery	3	5			
3. Radiator		3,5			
4. Air Cleaner	1	14			
5. Exhaust System	1		1,5		
6. Engine Mounts			1		
7. Gauges/Ground Controls	1,2,11				
8. Main Hydraulic Pump	1	5			
9. Auxiliary Power Pump	1	5			
10. Valves	1	5			
11. Hydraulic Filters	14	5			
12. Hydraulic Hoses and Tubing	1	5			
13. Hydraulic Oil Tank *	3	5	4		16
14. Breather Hydraulic Tank		6,14			
15. Fuel Tank	3,5		4		
16. Cylinders	12	1,5,6,13	4		
17. Shields	1				
18. Turntable Locking Pin.	1,7		4		
19. Horizontal Limit Switch	1,7				
20. Oil Coupling		5			
21. Placards and Decals	1,2				
22. Swing Bearing		1,12		9	
23. Swing Torque Hub		1,3,5,6		10	
24. Swing Brake		1,5,6	8		
CHASSIS					
1. Wheel and Tire Assembly	1	8,15,9			
2. Drive Motors		1,5.6			
3. Drive Torque Hub		1,3,5,6		10	
4. Drive Brakes		1,5,6	8		
5. Steer Cylinder	1	5,6,12,13			
6. Steer Components	1	4,6,12	8		
7. Lockout Cylinders	1	5,12,13			
8. Front Axle Pin	1	12	8		
9. Hydraulic Hoses	1	5			
10. Placards and Decals	1,2				
11. Shields	1				
12. Wheel Bearings			8	12	
13. Swing Bearing/Pinion Gear				9,12	

*** Inspection and Maintenance Code 10 to be performed annually.**

3-1. GENERAL.

a. This section contains troubleshooting information to be used for locating and correcting most of the operating problems which may develop in the aerial platform. 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.

b. Troubleshooting and maintenance information pertaining to the prime mover (engine) that are not contained in this manual are contained in the applicable engine maintenance manual.

3-2. TROUBLESHOOTING INFORMATION.

a. The troubleshooting procedures are listed and defined in Table 3-1 through 3-6. As an aid to table use, the aerial platform is divided into six major groups, each covered separately within this section. These groups are as follows: platform assembly, boom assembly, turntable assembly, chassis assembly, hydraulic system and electrical system.

b. 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 order listed in the tables.

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

d. It should also 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 of which have more than 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.

e. The first rule for troubleshooting and circuit that is hydraulically operated and electrically controlled is to determine if the circuit is lacking hydraulic oil or 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 first 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 control 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.

Table 3-1. Platform Assembly Troubleshooting.

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 lift cylinder.	Clean, repair, or replace line or fitting.
	Spit valve(s) leaking.	Clean, repair, or replace spit valve(s).
	Worn seal(s) in slave level or lift cylinder.	Replace seal(s).
	Counterbalance valves in slave cylinder defective.	Replace counterbalance valve.
	Slave level or 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 lift cylinder.	Replace seal(s).
	Damaged slave level or lift cylinder.	Repair or replace cylinder.
No response to platform leveling controls.	Level control inoperative.	Repair or replace control valve.
	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.

TROUBLE	PROBABLE CAUSE	REMEDY
Boom Elevation System.		
No response to control.	Lift control inoperative.	Repair or replace control lever.
	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.
Boom will not raise.	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 wiring diagram.
	Restricted or broken supply line on 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.

TROUBLE	PROBABLE CAUSE	REMEDY
Boom raises and lowers erratically.	Hydraulic system oil low.	Replenish oil as necessary.
	Restricted or broken supply line on 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 seal(s) in lift cylinder.	Replace seal(s).
	Cylinder not functioning properly.	Repair or replace cylinder.
Boom drifts down.	Worn seal(s) in lift cylinder.	Replace seal(s).
	Manual lowering valve not functioning properly.	Repair or replace valve.
	Holding valve on cylinder not functioning properly.	Repair or replace valve.
Pump Volume, Wheel Motor Speed, High Engine dose 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 switch.	Replace switch, repair or replace holder.
	Defective relay, main terminal box.	Replace relay.
	Defective platform switch.	Replace switch.
Telescope System.		
No response to control.	Telescope control inoperative.	Repair or replace control valve.
	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.

TROUBLE	PROBABLE CAUSE	REMEDY
Boom will not extend.	Control valve not functioning properly.	Repair or replace control valve.
	Damaged wiring on control switch or solenoid valve.	Repair or replace wiring.
	Restricted or broken supply line on fitting.	Clean, repair, or replace line or fitting.
	Pressure setting incorrect.	Check pressure/readjust 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 supply line on fitting.	Clean, repair, or replace line or fitting.
	Control valve not functioning properly.	Repair or replace valve.
	Worn seal(s) in telescope cylinder.	Replace seal(s).
	Cylinder not functioning properly.	Repair or replace cylinder.
	Distorted boom section (s).	Replace distorted section (s).
	Counterbalance valve not functioning properly.	Replace counterbalance valve.
Boom Swing System.		
No response to control.	Hydraulic system oil low.	Replenish oil as necessary.
	Swing control lever not functioning.	Repair or replace swing control lever.
	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.
	Swing brake not releasing.	Repair or replace brake.
	Restrictor valve(s) plugged.	Clean or replace restrictor valve.
	Foreign objects wedged between swing motor pinion and swing gear.	Remove objects, check for damage, and repair or replace component (s) as required.
	Sheared shaft on swing motor/brake.	Repair or replace motor/brake.
	Pressure reducing valve in swing circuit malfunctioning.	Repair or replace pressure reducing valve.
	No electric power to valve.	See proper wiring diagram.

TROUBLE	PROBABLE CAUSE	REMEDY
Boom will swing in only one direction.	Restricted or broken hydraulic line on fitting.	Clean, repair, or replace line or fitting.
	Control valve not functioning properly.	Repair or replace valve.
	Foreign objects wedged between swing motor pinion and swing gear.	Remove objects, check for damage, and repair or replace component (s) as required.
	Swing control lever not functioning.	Repair or replace swing control lever.
	Brake shuttle valve defective.	Replace shuttle valve.
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 lever.
	Worn or broken teeth on swing gear or swing motor pinion.	Replace gear(s) as required.
	Swing brake not functioning properly.	Repair or replace swing brake.
	Restrictor valves plugged.	Clean or replace restrictor valve.

Table 3-3. Turntable Assembly Troubleshooting.

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).
Engine will not start. (Ignition O.K.)	No fuel.	Replenish fuel as necessary.
	Clogged fuel filter.	Replace fuel filter.
	Restricted or broken fuel line.	Clean or replace fuel line.
	Automatic choke out of adjustment.	Adjust choke.
	Battery discharged.	Charge battery, replace if defective.
	Fuel pump not working.	Replace fuel pump.
Engine will not accelerate above low speed.	Damaged wiring on speed control switch or high engine solenoid.	Repair, replace wiring.
	Speed control switch not functioning properly.	Replace switch.
	High engine solenoid not functioning properly.	Repair or replace solenoid.
	High engine circuit breaker not functioning properly.	Replace circuit breaker.
	Switch not functioning properly or improperly adjusted.	Adjust, repair, or replace horizontal limit switch.
	Excessive load on engine.	Reduce load.
	Engine worn badly.	Rebuild engine.
	Engine improperly timed.	Time engine.
	Dirty fuel filter (diesel).	Replace filter.
	Fuel line pinched (diesel).	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.

TROUBLE	PROBABLE CAUSE	REMEDY
Control Valves.		
Valve spool sticking.	Dirt in oil causing excessive temperature build-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 repair valve as necessary.
	Valve spool scored.	Repair or replace valve.
	Excessive back pressure caused by restricted return line to reservoir.	Remove line and clean obstruction or replace line as necessary.
	Damaged valve seal(s).	Repair or replace valve as necessary.
Fuel System.		
Strong fuel odor during machine operation.	Fuel tank overfilled.	Check fuel tank and immediately wipe up any 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.
	Filter or carburetor fuel leak.	Determine cause of leak and make appropriate repairs.
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.
	Hub attachment nut loose or missing.	Secure or replace hub attachment nut and cotter pin as necessary.
Oscillating Axle will not hold properly.	Air in oscillating axle hydraulic system.	See bleeding procedure in section 2.
	Cam Valve Stuck or leaking.	Repair or replace cam valve.
	Lockout cylinder leaking.	Repair or replace cylinder.

TROUBLE	PROBABLE CAUSE	REMEDY
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 Caution Placard on platform for specfied grades and sideslopes.
	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.
	Counterbalance valve defective.	Replace counterbalance valve.
	Accessory valve not adjusted properly.	Correctly adjust accessory valve.
	Low amperage on controller.	Correctly adjust controller.
Drive System.		
No response to control.	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 or rotary coupling.	Clean, repair or replace line.
	Drive hub(s) disconnected.	Reconnect disconnect cap on hub.
	Rotary coupling leaking internally. (Seal(s) worn.)	Repair or replace coupling.
	Drive motor(s) not functioning properly.	Repair or replace motor(s).
	Air in wheel brake circuit.	Bleed circuit. determine and correct cause.
	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.

TROUBLE	PROBABLE CAUSE	REMEDY
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.
	No power to wheel motor speed switch.	See proper wiring diagram.
	Two speed valve sticking.	Repair or replace valve.
	Counterbalance valve sticking on return side.	Adjust return counterbalance out 3 turns - cycle drive - return to original position.
Machine overspeeds when descending a grade.	Counterbalance valve improperly adjusted or defective.	Adjust or replace valve.
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.
Motor turns slowly at maximum command.	Valve spool is not traveling far enough due to:	
	Worn, leaking drive motor(s).	Repair or replace drive motor(s).
	Engine speed too low.	Properly adjust engine speed.
	Low control pressure supply.	Replace pressure regulator if necessary.
	Function speed switch malfunction.	Replace switch.
	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 cap.
	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.

TROUBLE	PROBABLE CAUSE	REMEDY
Steering System.		
No response to control.	Circuit breaker open.	Determine and correct cause; reset circuit breaker.
	If equipped, steer/tow selector in "tow" position.	Actuate control to "steer" position. (Valve knob "in".)
	Hydraulic system oil low.	Repenish 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.	Clean,repair or replace line.
	Swivel coupling leaking internally. (Seal(s) defective.)	Repair or replace coupling.
	Control valve not functioning properly.	Repair or replace valve.
	Steer cylinder not functioning properly.	Repair or replace cylinder.
Machine hard to steer or steering is erratic.	Hydraulic system oil low.	Repenish oil as necessary.
	Restricted hydraulic line or fitting.	Clean,repair or replace line or fitting.
	Lack of lubrication.	Lubricate as required. (Refer to Lubrication Chart.)
	Restricted crossover relief valve.	Clean or replace valve.
	Steer system pressure low.	Adjust pressure.
	Bent linkage (tie rod(s) or steering hitch.)	Repair or replace linkage as required.
	Hydraulic pump not functioning properly.	Repair or replace pump.
	Steer cylinder not functioning properly.	Repair or replace cylinder.
	Spindle pins tight or need lubrication.	Repair or lubricate spindles.

TROUBLE	PROBABLE CAUSE	REMEDY
Steering inoperative.	Circuit breaker open.	Determine and correct cause; reset circuit breaker.
	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.
	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.
	Coil in solenoid is 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 valves as required.
	Steer linkages loose/spindle bushings worn.	Tighten linkage/replace bushing.
	Steer wheel toe-in not set properly.	Adjust toe-in for 1/4 in. (6.35 mm) overall.
	Swivel coupling leaking.	Repair or replace swivel coupling.

Table 3-5. Hydraulic Assembly Troubleshooting.

TROUBLE	PROBABLE CAUSE	REMEDY
Hydraulic System - General.		
Hydraulic pump noisy.	Air entering system through broken line or fitting. (Suction side.)	Repair or replace line or fitting.
	Air bubbles in oil. (Reservoir oil level too low.)	Replenish oil as necessary.
	Suction filter dirty.	Clean or replace filter.
	Oil filter dirty.	Replace hydraulic filter.
	Restricted suction line.	Clean, repair or replace line.
Pump cavitating. (Vacuum in pump due to oil starvation.)	Restricted suction line.	Clean, repair or replace line.
	Restricted reservoir air vent.	Clean or replace air vent.
	Oil viscosity too high.	Drain system and replace with recommended oil. (Refer to Hydraulic Oils.)
	Air leak on suction side of tank.	Repair leak.
	Suction filter dirty.	Clean or replace filter.
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 high. (Racine)	Reset valve as required.
	Main relief valve set too low. (Vickers)	Reset valve as required.
	Hydraulic system oil low.	Replenish oil as necessary.
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.
	Splines worn in drive disc.	Replace drive disc.

TROUBLE	PROBABLE CAUSE	REMEDY
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.
	Low voltage in electrical system.	Correct low voltage problem.
System(s) operate erratically.	Sticking or binding valve spool, pistons, rods, etc.	Clean, repair, or replace components as required.
Auxiliary Hydraulic System.		
Auxiliary hydraulic pump inoperable.	Circuit breaker open.	Determine and correct cause; reset circuit breaker.
	Check valve in system leaking.	Repair or replace 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.
	Low pilot pressure.	Reset valve as required.

Table 3-6. Electrical Assembly Troubleshooting.

TROUBLE	PROBABLE CAUSE	REMEDY
Platform Controls.		
No power to platform controls.	Self-reset circuit breaker open.	Check footswitch to ensure that both switches are making contact when pedal is depressed. Repair or replace footswitch as required.
	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 termimals 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 starter lockout system.	See correct wiring diagram.
	Faulty starter 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 starter switch.	Replace switch.

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 vacuum switch.	Replace vacuum 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.	Re-adjust tilt alarm.
	Defective bulb in tilt light.	Replace bulb.
Wheel motor speed circuit.	Switch damaged or inoperative.	Replace switch.
	Damaged or disconnected wiring circuit.	See proper wiring diagram.
	Plugged orifice in shifter valve.	Clean orifice.
	Faulty shifter valve.	Repair or replace valve.
High engine speed will not function.	Boom above horizontal.	Lower boom.
	Horizontal limit switch out of adjustment.	Adjust limit switch to activate (close) with boom at horizontal and below.
	High engine solenoid malfunctioning.	Repair or replace solenoid valve.
	Drive pressure switch malfunctioning.	Replace pressure switch.
	Electrical malfunctioning.	See proper wiring diagram.
	Defective engine governor.	Repair or replace governor.
High pump volume will not function.	Boom above horizontal.	Lower boom.
	Horizontal limit switch out of adjustment.	Adjust limit switch to activate (close) with boom at horizontal and below.
	Defective pump section.	Repair or replace pump section.
	Oil by-passing in step valve.	Repair or replace step valve.
	Electrical malfunction.	See proper wiring diagram.

TROUBLE	PROBABLE CAUSE	REMEDY
High wheel motor speed will not function.	Boom above horizontal.	Lower boom.
	Horizontal limit switch out of adjustment.	Adjust limit switch to activate (close) with boom at horizontal and below.
	Two speed drive solenoid valve malfunctioning.	Repair or replace solenoid valve.
	Dirve pressure switch malfunctioning.	Replace pressure switch.
	Valve orifice plugged.	Unplug valve orifice.
	Defective drive motor.	Repair or replace motor.
	Grade too steep.	Check gradeability of machine.

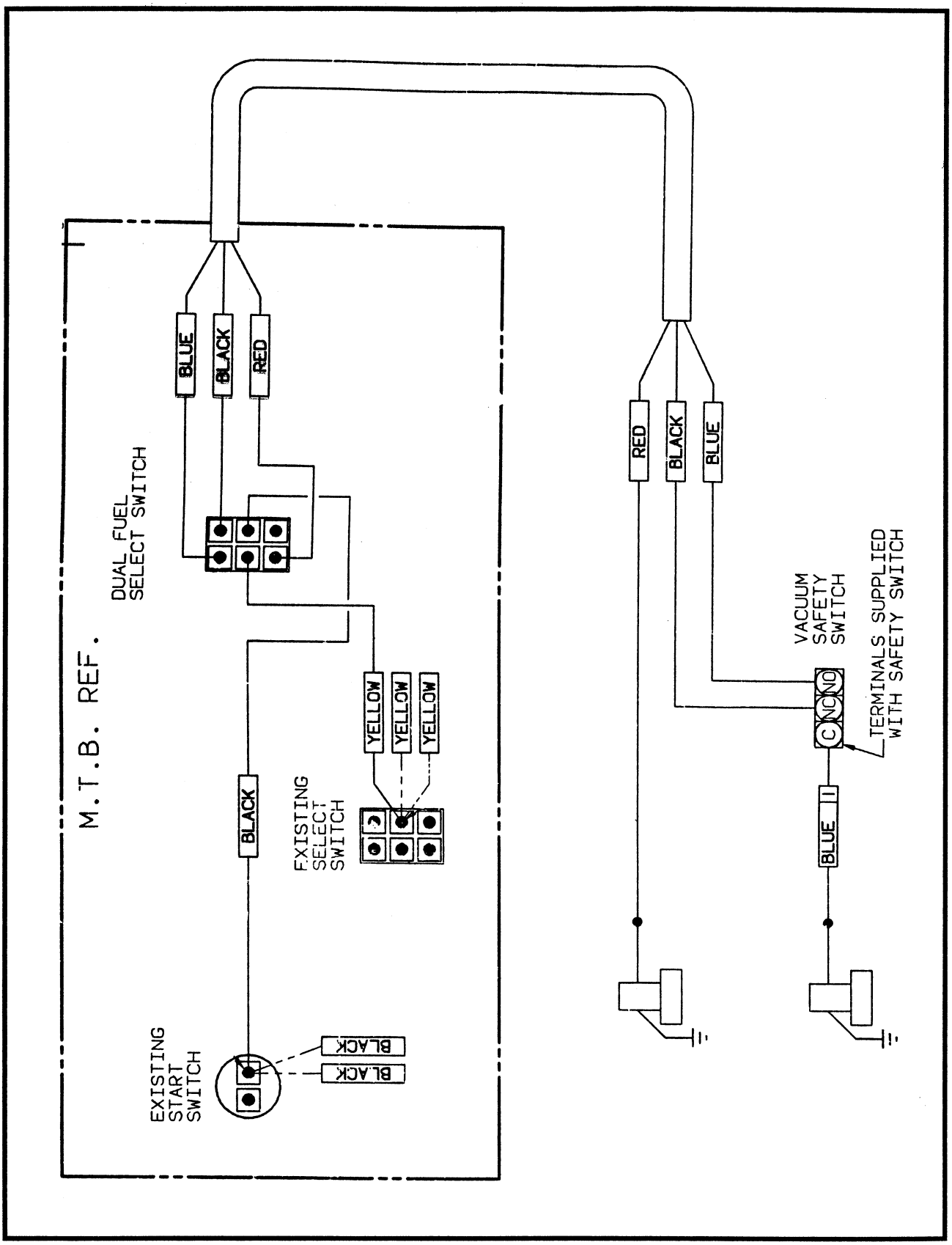


Figure 3-1. Wiring Diagram - Dual Fuel (Ford or Wisconsin).

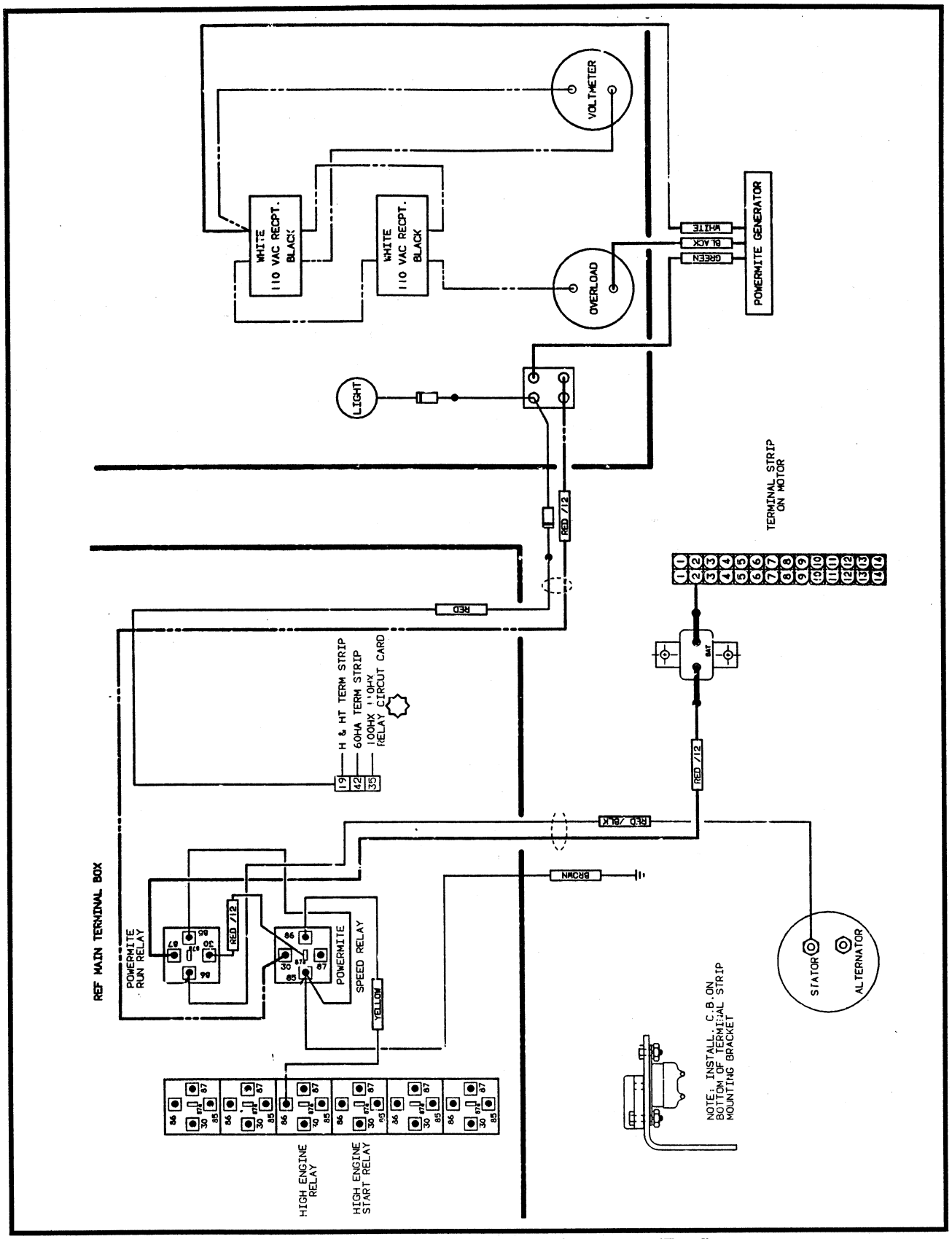


Figure 3-2. Wiring Diagram - 110V Generator (Ford).

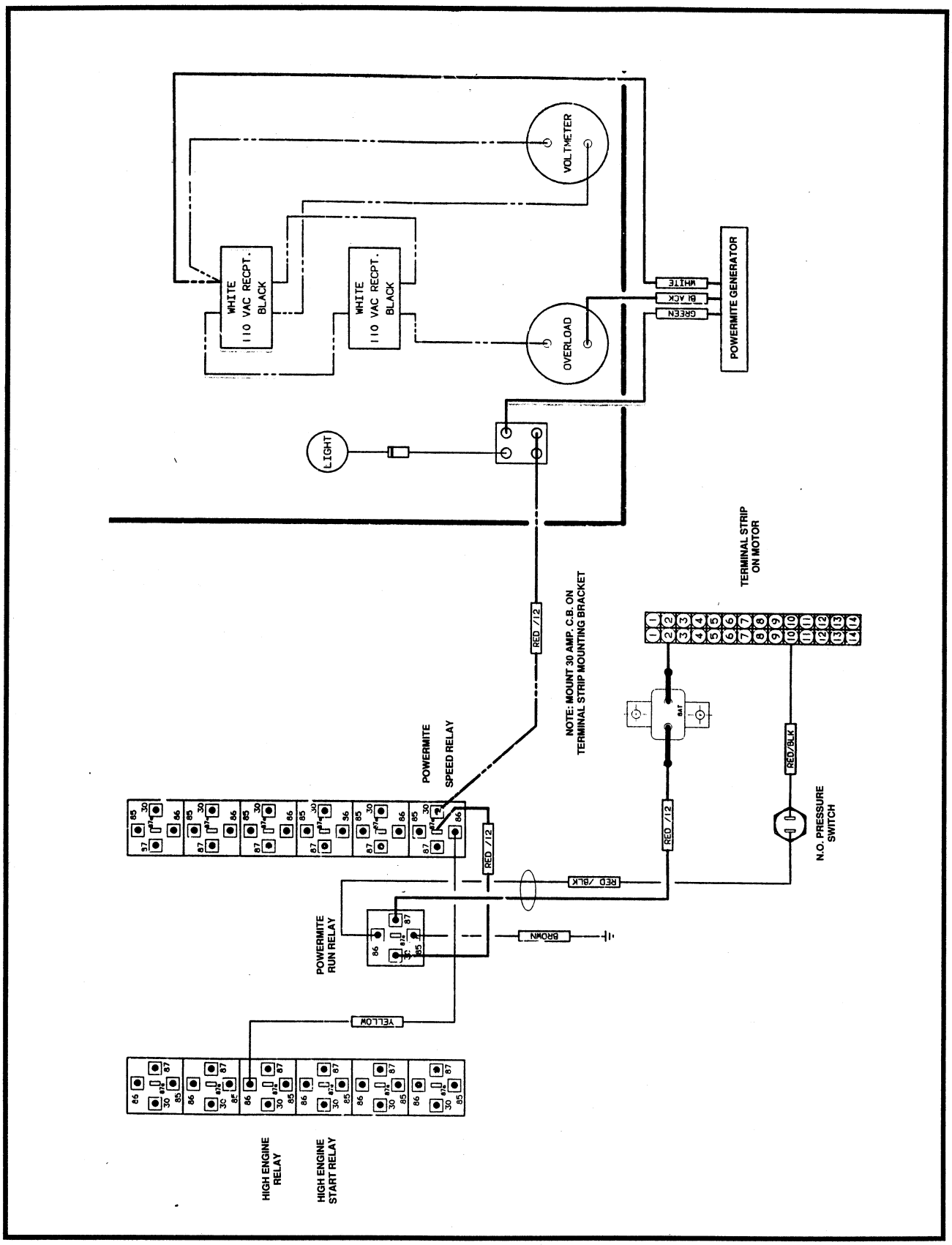


Figure 3-3. Wiring Diagram - 110V Generator (Deutz).

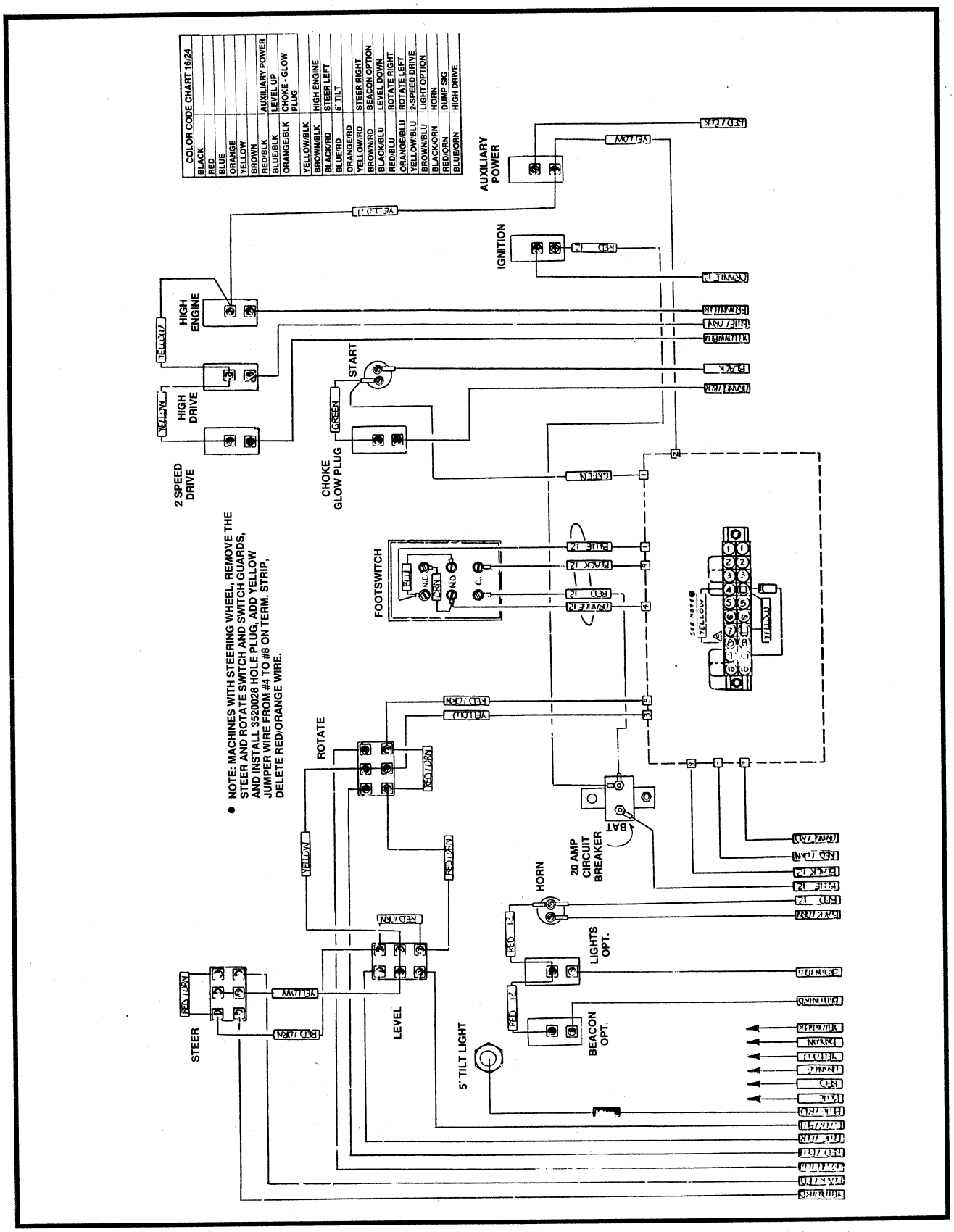


Figure 3-4. Wiring Diagram - Platform Console (W/All Hydraulic Controls).

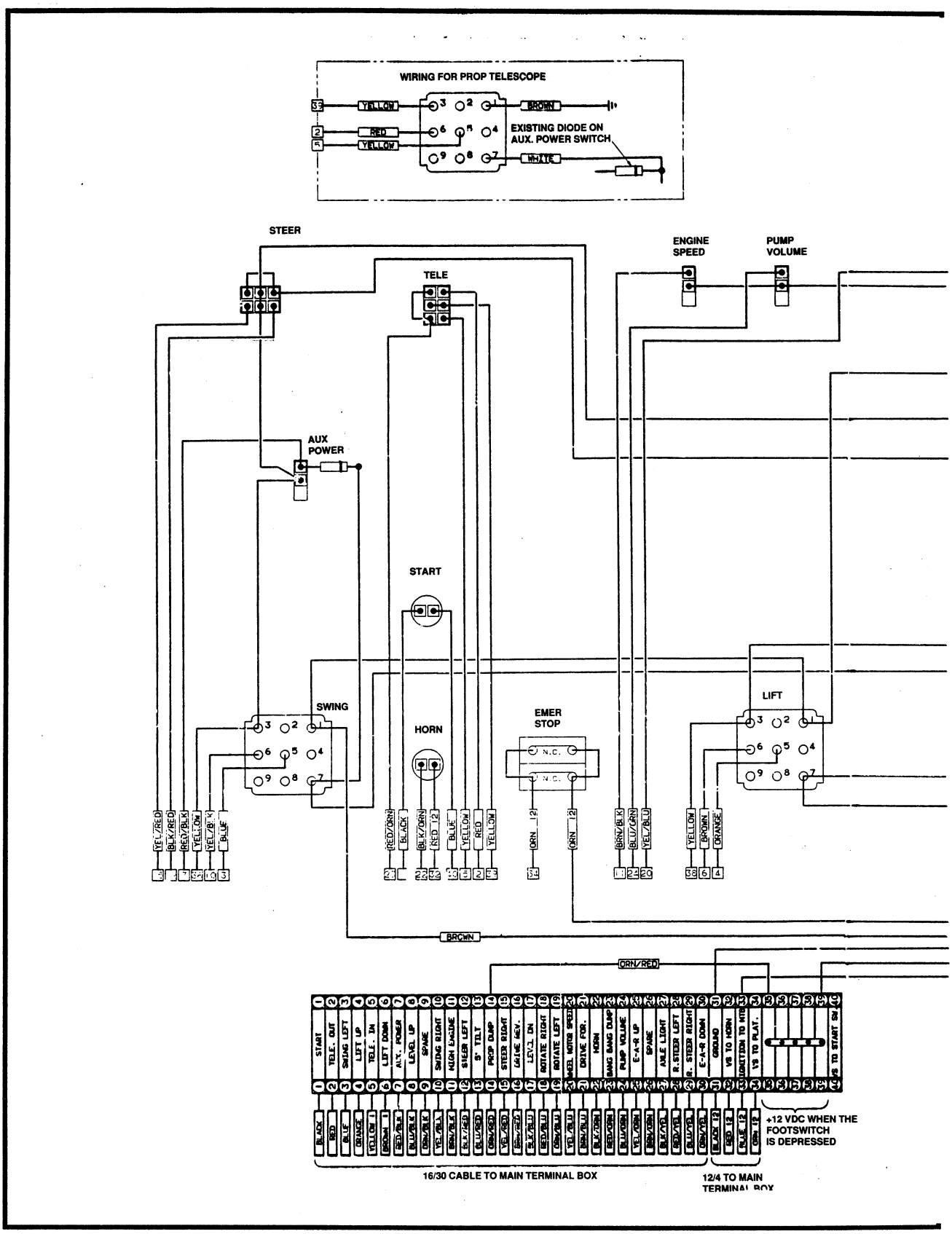


Figure 3-5. Wiring Diagram - Platform Console Standard (Sheet 1 of 2).

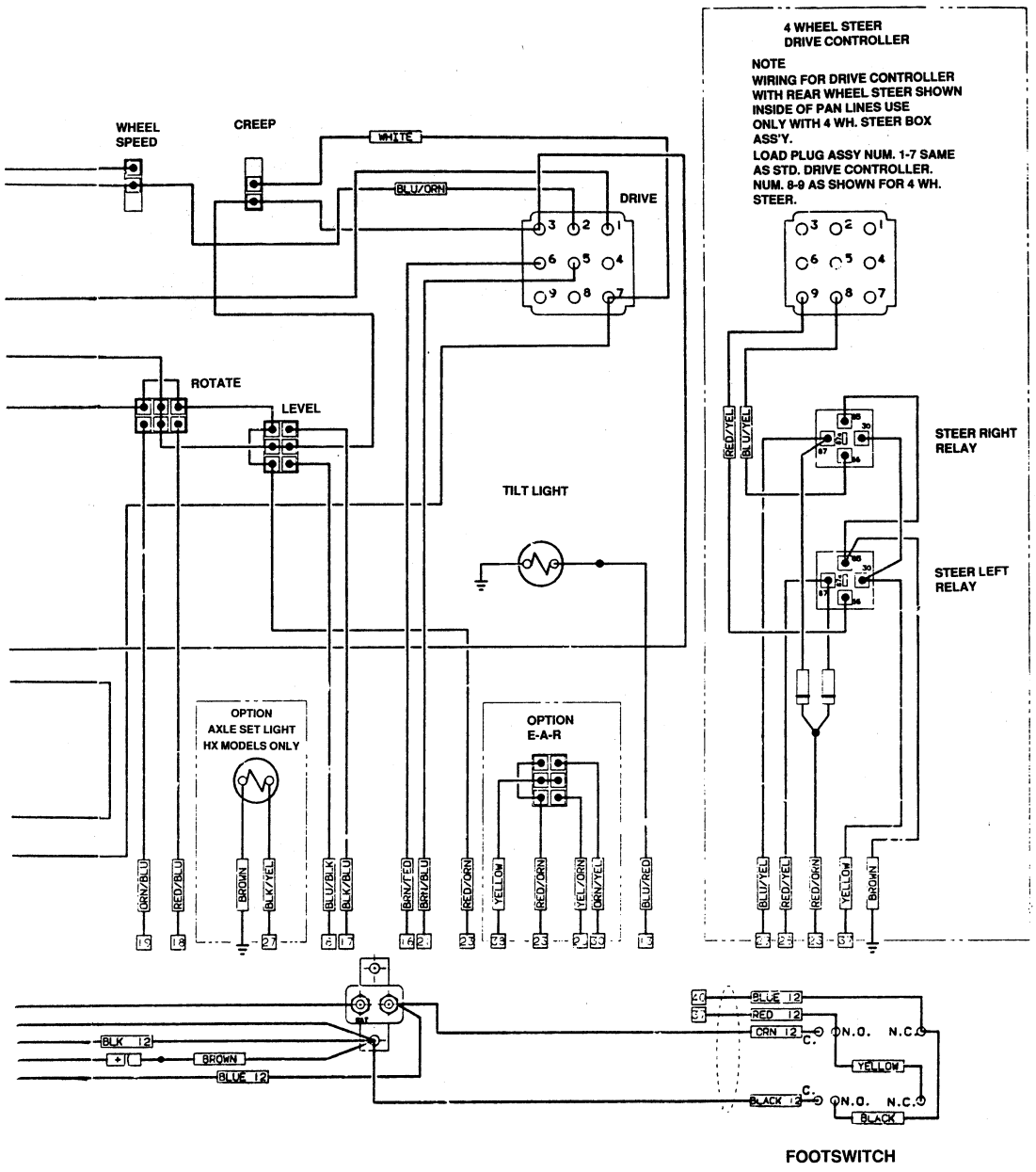
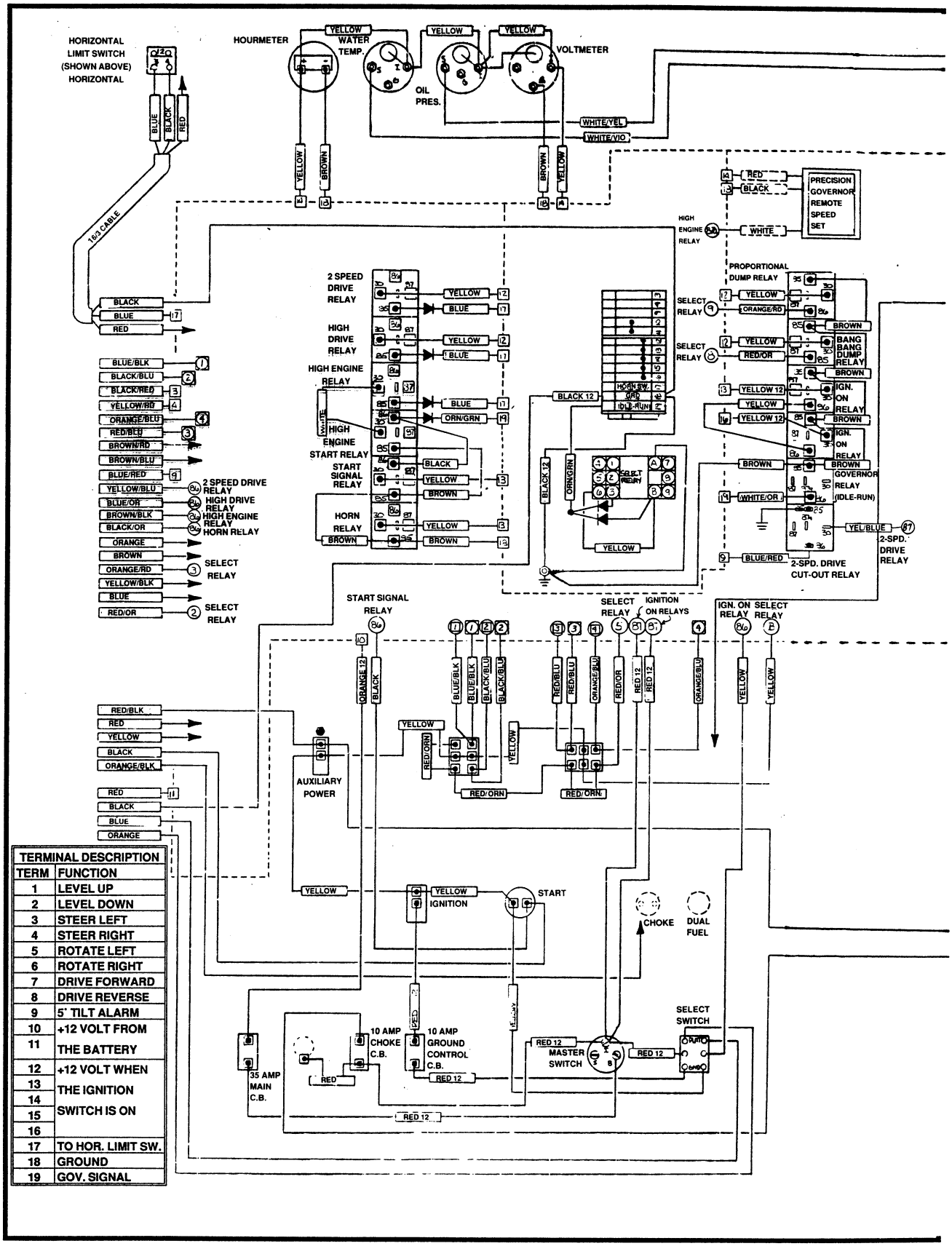


Figure 3-5. Wiring Diagram - Platform Console Standard (Sheet 2 of 2).



TERMINAL DESCRIPTION	
TERM	FUNCTION
1	LEVEL UP
2	LEVEL DOWN
3	STEER LEFT
4	STEER RIGHT
5	ROTATE LEFT
6	ROTATE RIGHT
7	DRIVE FORWARD
8	DRIVE REVERSE
9	5° TILT ALARM
10	+12 VOLT FROM
11	THE BATTERY
12	+12 VOLT WHEN
13	THE IGNITION
14	SWITCH IS ON
15	
16	
17	TO HOR. LIMIT SW.
18	GROUND
19	GOV. SIGNAL

Figure 3-6. Wiring Diagram - Precision Governor (Sheet 1 of 2).

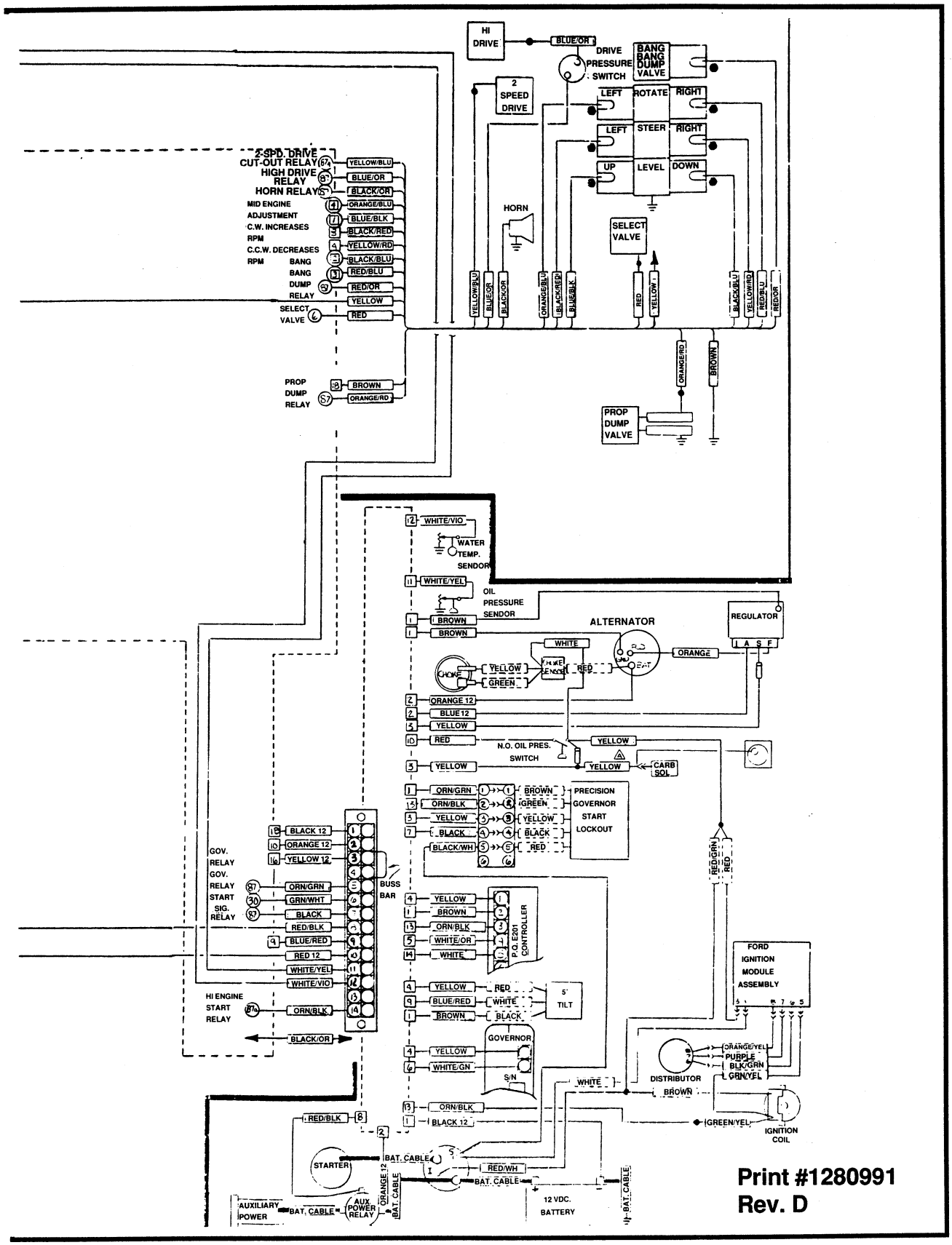
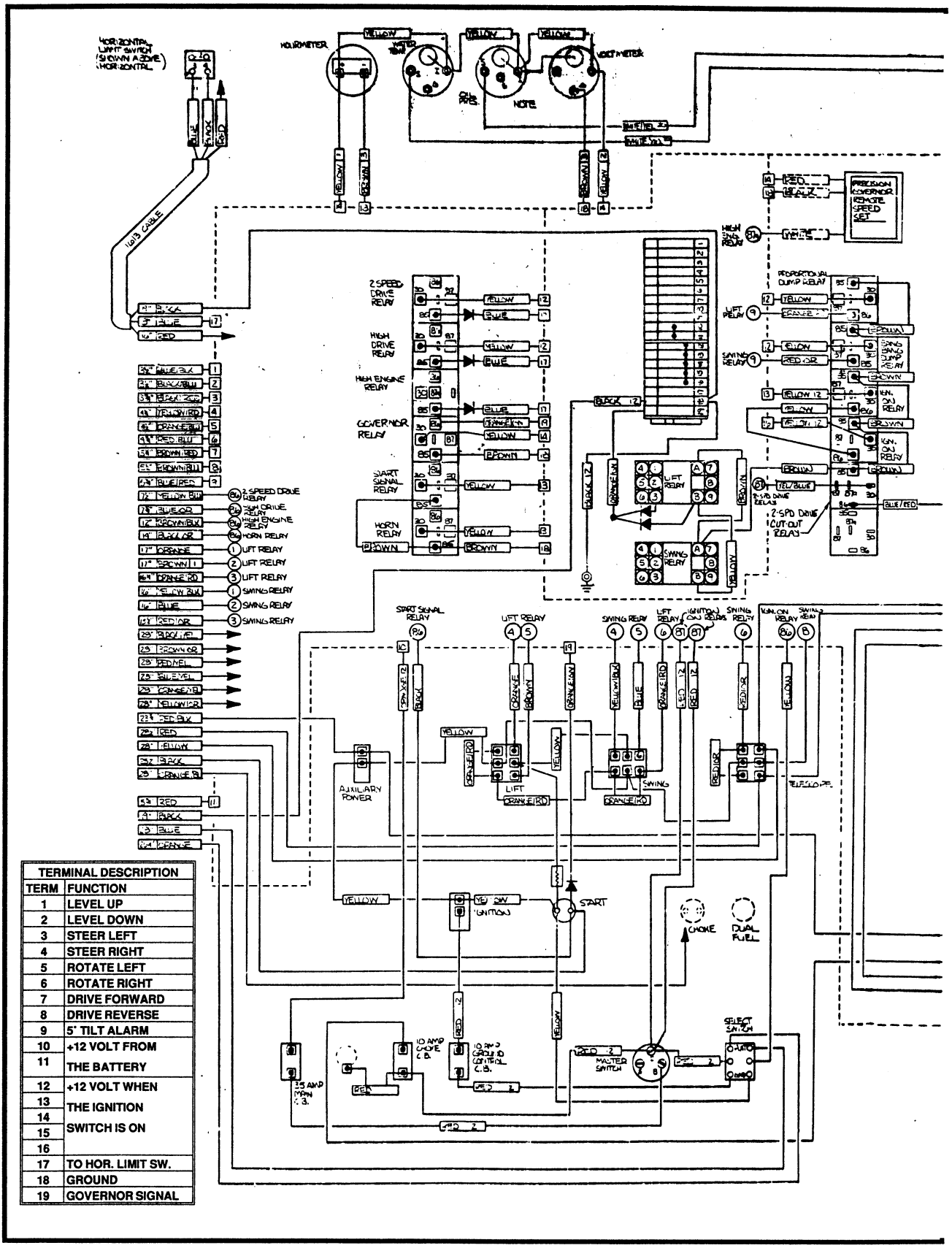


Figure 3-6. Wiring Diagram - Precision Governor (Sheet 2 of 2).



TERMINAL DESCRIPTION	
TERM	FUNCTION
1	LEVEL UP
2	LEVEL DOWN
3	STEER LEFT
4	STEER RIGHT
5	ROTATE LEFT
6	ROTATE RIGHT
7	DRIVE FORWARD
8	DRIVE REVERSE
9	5° TILT ALARM
10	+12 VOLT FROM
11	THE BATTERY
12	+12 VOLT WHEN
13	THE IGNITION
14	SWITCH IS ON
15	
16	
17	TO HOR. LIMIT SW.
18	GROUND
19	GOVERNOR SIGNAL

Figure 3-7. Wiring Diagram - Ford Engine (Sheet 1 of 2).

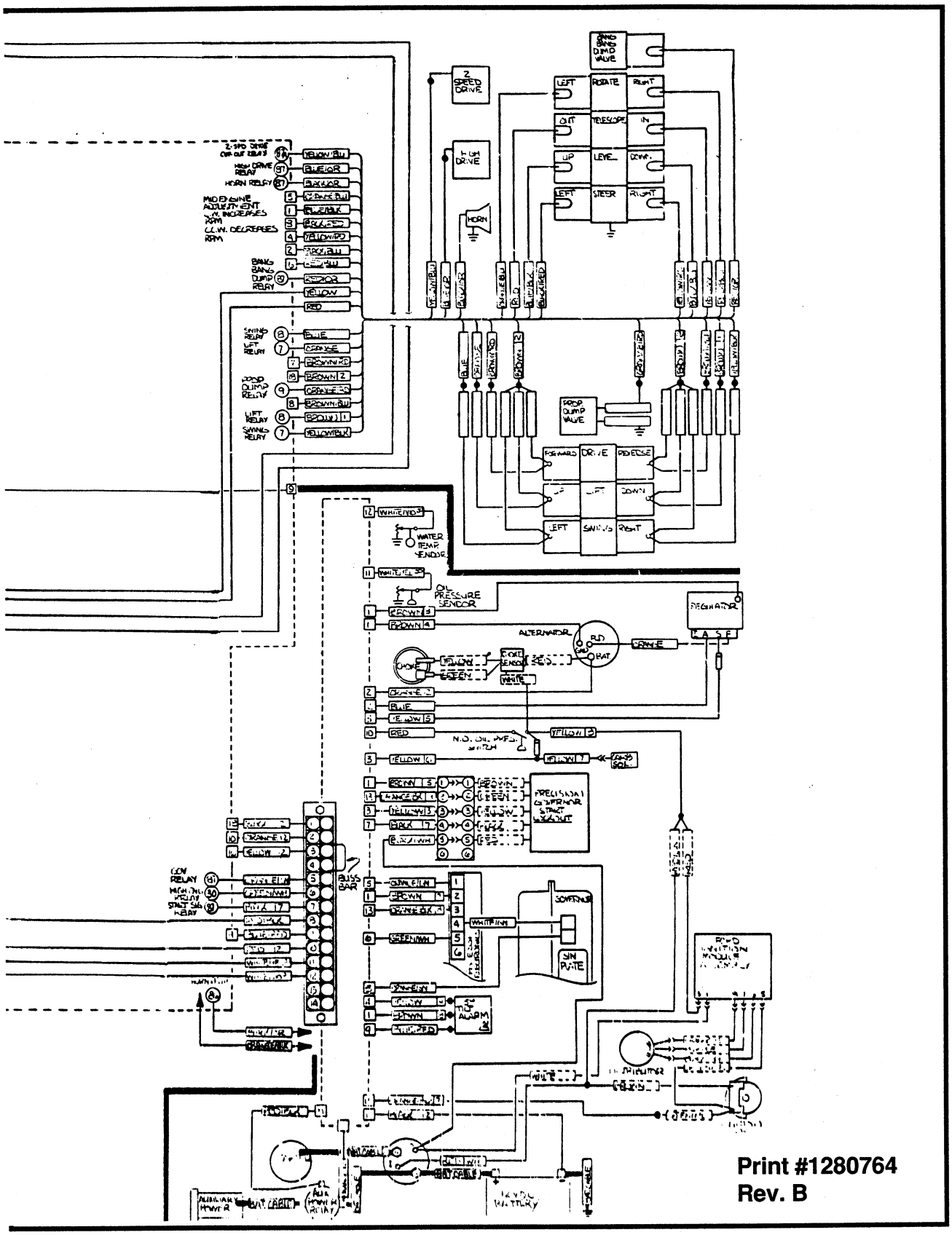
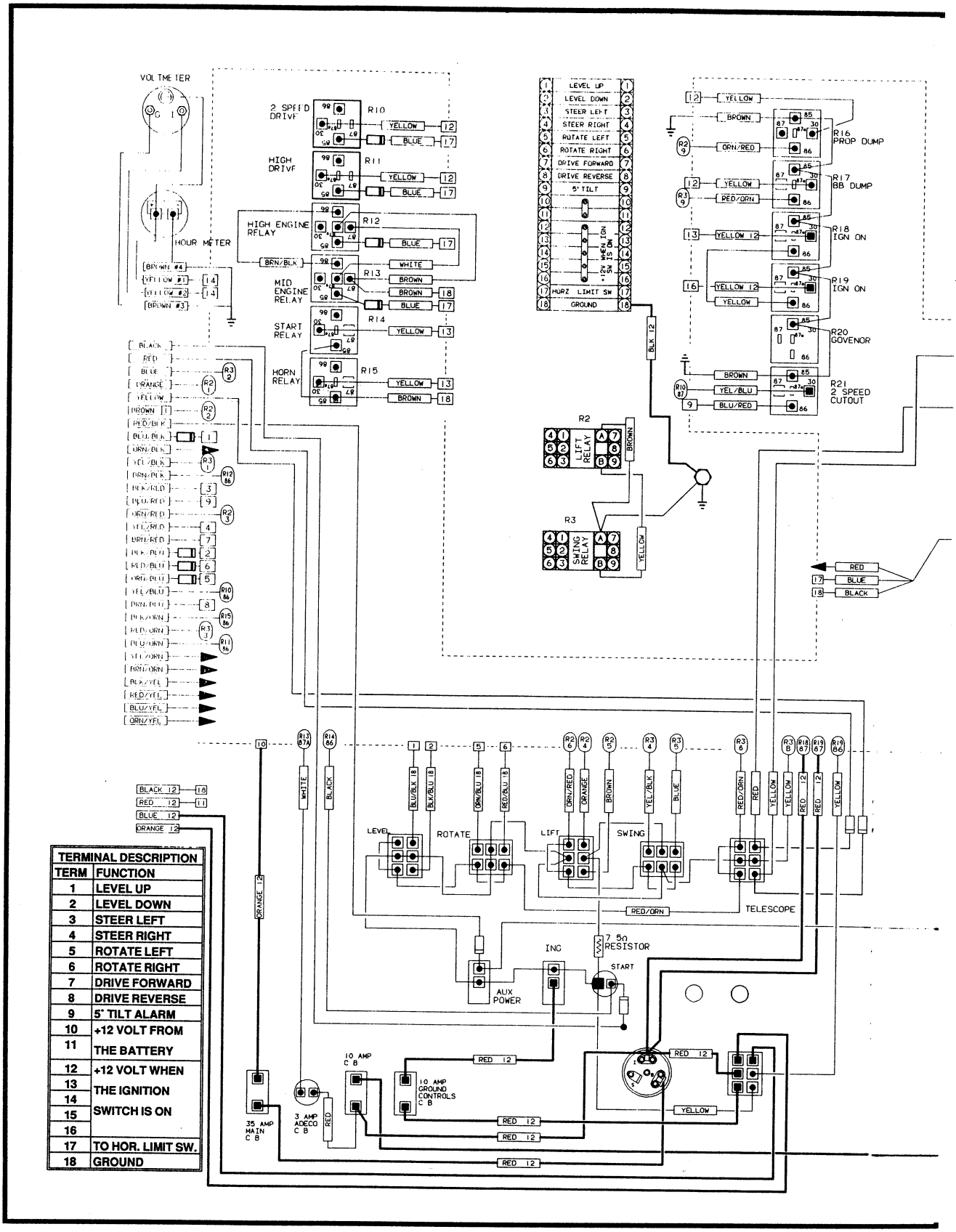


Figure 3-7. Wiring Diagram - Ford Engine (Sheet 2 of 2).



TERMINAL DESCRIPTION	
TERM	FUNCTION
1	LEVEL UP
2	LEVEL DOWN
3	STEER LEFT
4	STEER RIGHT
5	ROTATE LEFT
6	ROTATE RIGHT
7	DRIVE FORWARD
8	DRIVE REVERSE
9	5° TILT ALARM
10	+12 VOLT FROM
11	THE BATTERY
12	+12 VOLT WHEN
13	THE IGNITION
14	SWITCH IS ON
15	
16	
17	TO HOR. LIMIT SW.
18	GROUND

Figure 3-8. Wiring Diagram - Deutz, Wisconsin Engine (Sheet 1 of 2).

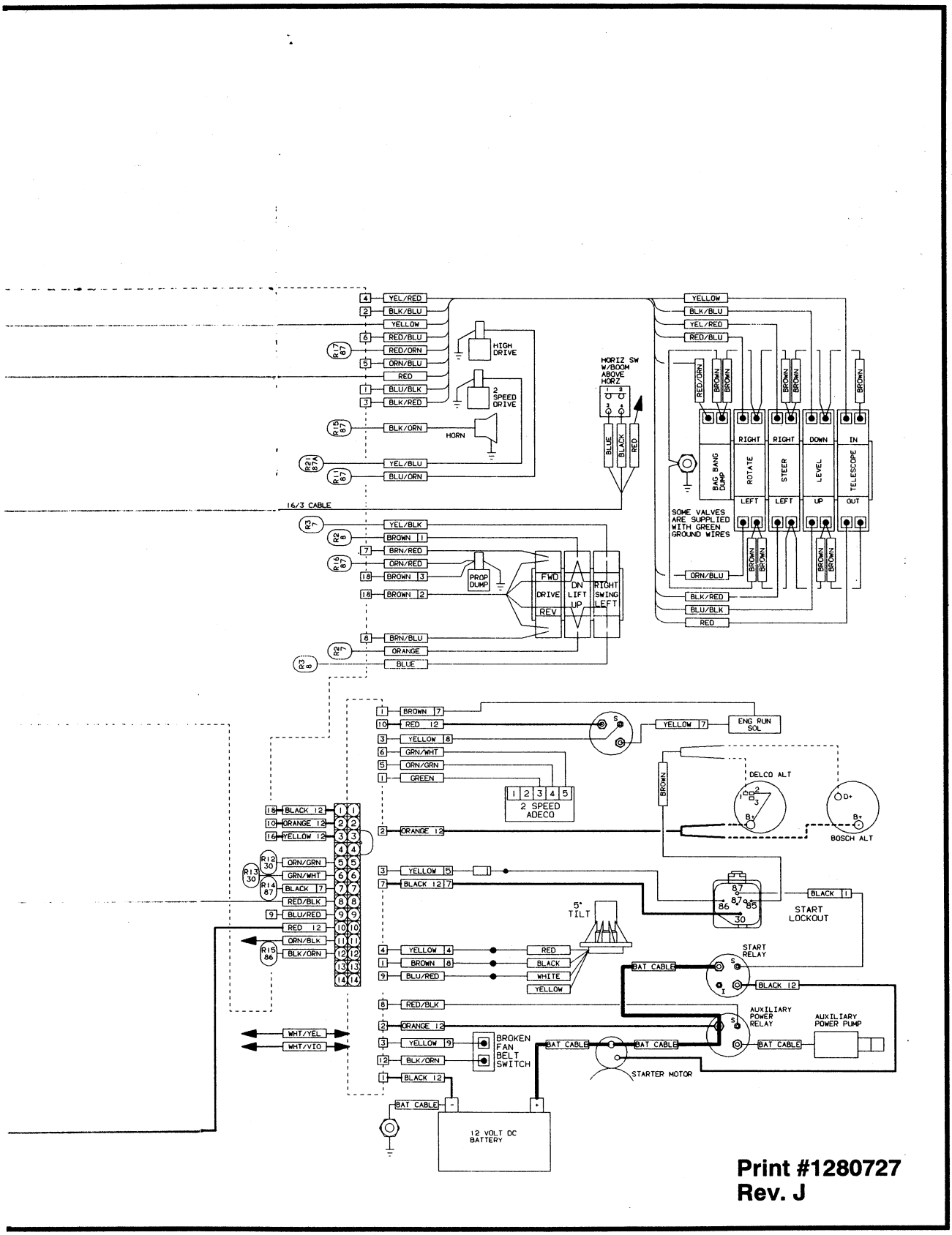
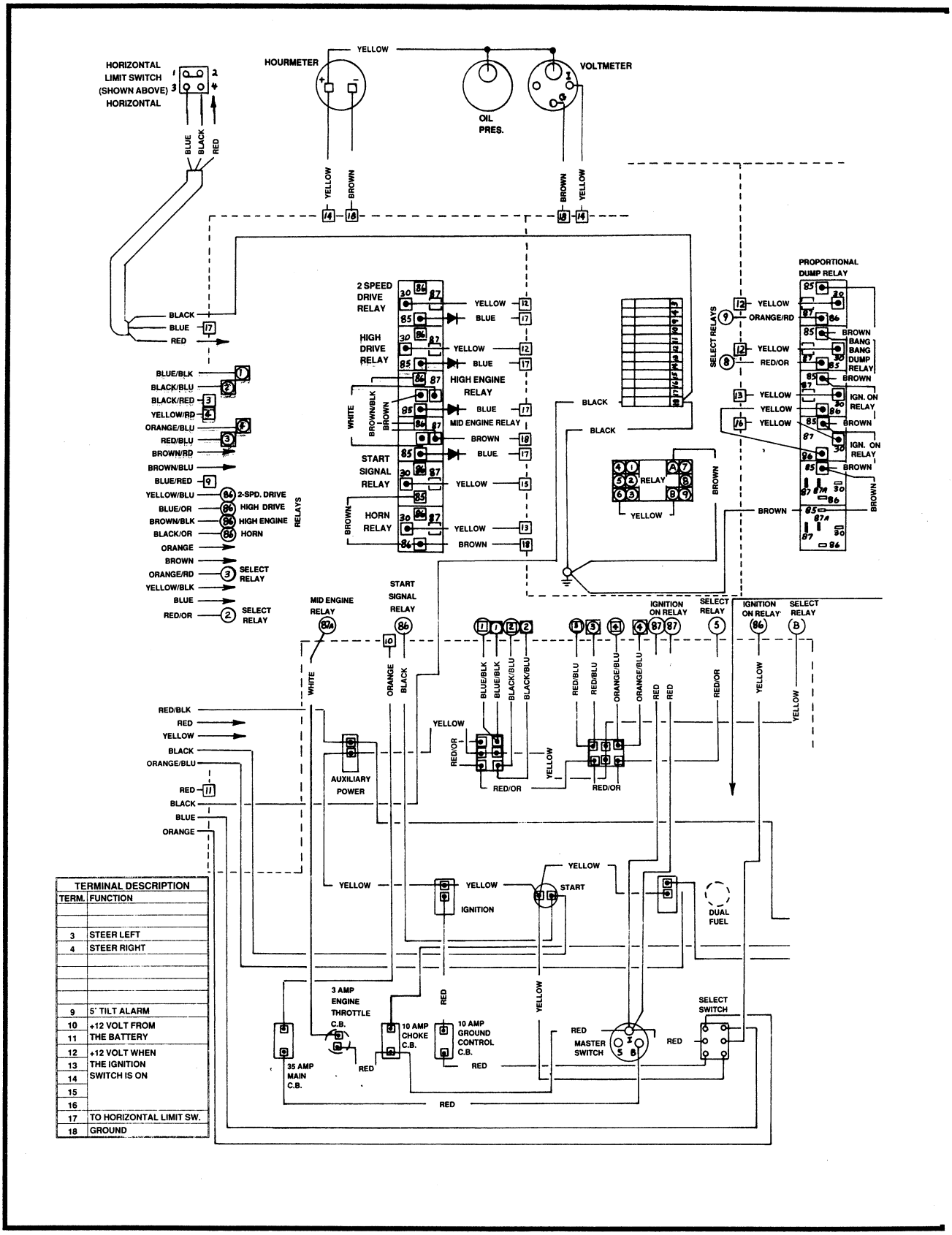


Figure 3-8. Wiring Diagram - Deutz, Wisconsin Engine (Sheet 2 of 2).



TERMINAL DESCRIPTION	
TERM.	FUNCTION
3	STEER LEFT
4	STEER RIGHT
9	5° TILT ALARM
10	+12 VOLT FROM
11	THE BATTERY
12	+12 VOLT WHEN
13	THE IGNITION
14	SWITCH IS ON
15	
16	
17	TO HORIZONTAL LIMIT SW.
18	GROUND

Figure 3-9. Wiring Diagram - Deutz Engine Hyd. Controls (Sheet 1 of 2).

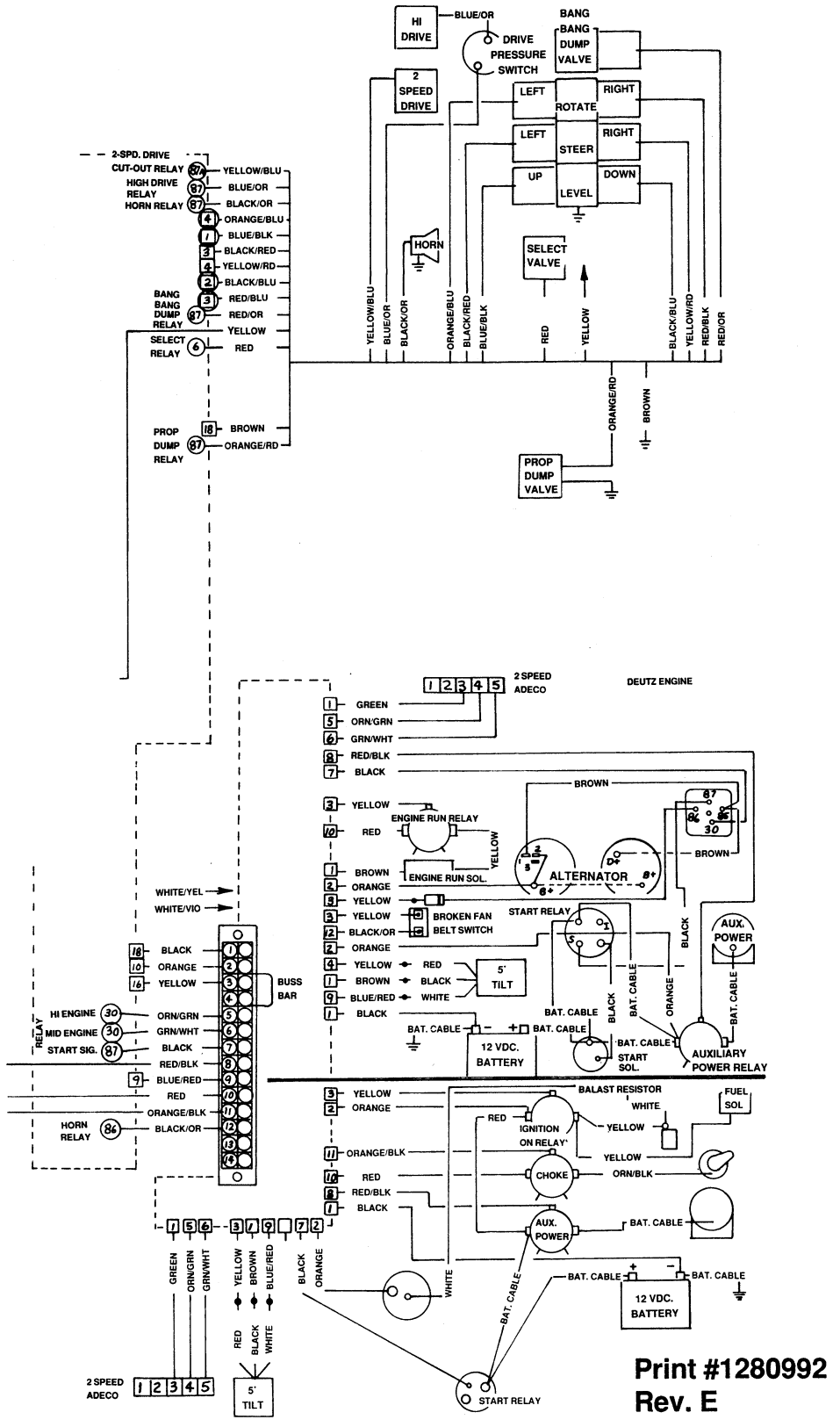


Figure 3-9. Wiring Diagram - Deutz Engine Hyd. Controls (Sheet 2 of 2).

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