



## SERVICE & MAINTENANCE

### Models

1532E

1932E

2033E

2046E

2646E

2658E

3120846

August 1997



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**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 established by a qualified person and 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 machine 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 IS THE RESPONSIBILITY OF THE OWNER/OPERATOR.**

**B. HYDRAULIC SYSTEM SAFETY.**

1. It should be particularly noted that the machines hydraulic systems operate at extremely high and 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 return line to 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.**

- 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.
- NEVER WORK UNDER AN ELEVATED PLATFORM UNTIL SAFETY PROPS HAVE BEEN ENGAGED OR PLATFORM HAS BEEN SAFELY RESTRAINED FROM ANY MOVEMENT BY BLOCKING OR OVERHEAD SLING.
- 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.

**EFFECTIVITY PAGE**

**NOTE:** This manual is split from the combined Operators and Safety, Service and Maintenance, and Illustrated Parts Manual 3120838

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**▲ IMPORTANT**

**NOTE:** Machines through serial number 34920 are equipped with power LIFT DOWN. Machines beginning with serial number 34921 are equipped with gravity LIFT DOWN.

**Machines with the following serial numbers are also equipped with gravity LIFT DOWN:**

**33685 - 33687**

**33691 - 33693**

**33697 - 33699**

**33701 - 33707**

**34044**

**34049**

**34141 - 34143**

**34172 - 34174**

**Where differences in machine operation exist, applicable serial numbers will be referenced. Refer to the listing above for exceptions to the power lift down serial number block.**

Change 1 - June 1997

pages b, 2-22, 2-23, 2-28, 2-29, 3-2, 3-3, 3-4

Change 2 - August 1997

pages b, 2-15, 2-16, 2-17

Change 2

b

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**1-1. CAPACITIES.****• Hydraulic Oil Tank.**

1532E/1932E.

14.0 liters at full mark on tank.

12.1 liters at add mark on tank.

2033E/2046E/2646E/2658E.

20.4 liters at full mark on tank.

15.9 liters at add mark on tank.

**• Hydraulic System. (Including Tank)**

1532E/1932E - Approximately 16.8 liters.

2033E/2046E/2646E/2658E - Approximately 24.6 liters.

**1-2. COMPONENT DATA.****• Hydraulic Pump/Electric Motor Assembly. (All Models)**

24 Volts DC motor.

2 section gear pump - 11.7 lpm output each section.

**• Battery Charger.**

CE Specification - Single Voltage.

240 Volts AC - 50 Hz input.

24 Volts DC - 20 Amp output w/auto timer.

CE Specification - Dual Voltage.

240/120 Volts AC - 50 Hz input.

24 Volts DC - 20 Amp output w/auto timer.

Australian Specification - Single Voltage.

250 Volts AC - 50 Hz input.

24 Volts DC - 20 Amp output w/auto timer.

**• Batteries (4).**

1532E/1932E - 6 Volt, 235 Amp Hour.

2033E/2046E/2646E/2658E - 6 Volt, 245 Amp Hour.

**• Steer/Drive System.**

Tires - 1532E/1932E.

Standard - 4.50 x 14.00 - Solid, Rib.

Optional - 4.50 x 14.00 - Solid, Non-Marking, Rib.

Tires - 2033E/2046E/2646E/2658E.

Standard - 5.00 x 16.00 - Solid, Rib.

Optional - 5.00 x 16.00 - Solid, Non-Marking, Rib.

Optional (2046E/2646E/2658E) - 7.50 x 16.00 - Solid, Floatation Tread.

Parking Brake - All models - Single cylinder, spring applied, hydraulically released.

Drive Motors.

1532E/1932E - 205 cm<sup>3</sup> displacement.

2033E - 233 cm<sup>3</sup> displacement.

2046E/2646E/2658E - 261 cm<sup>3</sup> displacement.

**• Hydraulic Filter - Inline.**

Return - Bypass Type.

10 Microns Nominal.

**• Platform Size.**

1532E/1932E - 0.8 meters x 1.6 meters.

2033E - 0.8 meters x 2.4 meters.

2046E/2646E - 1.1 meters x 2.4 meters.

2658E - 1.4 meters x 2.4 meters.

**1-3. PERFORMANCE DATA.****• Travel Speed.**

1532E/1932E.

Low Speed - 2.1 kmh.

Elevated Speed - 1.1 kmh.

Maximum Speed - 3.9 kmh.

2033E.

Low Speed - 2.1 kmh.

Elevated Speed - 1.1 kmh.

Maximum Speed - 4.4 kmh.

2046E.

Low Speed - 2.1 kmh.

Elevated Speed - 1.1 kmh.

Maximum Speed - 3.6 kmh.

2646E/2658E.

Low Speed - 1.9 kmh.

Elevated Speed - 1.1 kmh.

Maximum Speed - 3.6 kmh.

- **Gradeability.**

All Models - 25%

- **Inside Turning Radius.**

1532E/1932E/2033E - 7.6 centimeters.

2046E/2646E/2658E - 40.6 centimeters.

- **Inside Turning Angle.**

1532E/1932E/2033E - 87 degrees.

2046E/2646E/2658E - 80 degrees.

- **Lift. (No Load in Platform)**

**Note**

E Scissor scissor lifts are equipped with either Power Lift Down or Gravity Lift Down. To identify Power Lift Down or Gravity Lift Down machines, refer to the effectivity page for serial number identification.

**Power Down Machines.**

1532E.

Up - 20-25 seconds.

Down - 18-28 seconds.

1932E.

Up - 20-25 seconds.

Down - 18-28 seconds.

2033E/2046E.

Up - 28-33 seconds.

Down - 29-35 seconds.

2646E/2658E.

Up - 40-45 seconds.

Down - 34-40 seconds.

**Gravity Down Machines.**

1532E.

Up - 18-23 seconds.

Down - 22-27 seconds.

1932E.

Up - 18-23 seconds.

Down - 23-28 seconds.

2033E/2046E.

Up - 28-33 seconds.

Down - 26-31 seconds.

2646E/2658E.

Up - 40-45 seconds.

Down - 37-42 seconds.

- **Platform Capacity.**

1532E - 270 kilograms.

1932E - 230 kilograms.

2033E/2646E - 340 kilograms.

2046E/2658E - 455 kilograms.

If machine is equipped with optional pipe racks, maximum load on pipe racks is 45 kilograms. Maximum total capacity of pipe racks and platform combined is as follows:

2033E/2646E - 295 kilograms.

2046E/2658E - 410 kilograms.

- **Manual Platform Extension Capacity.**

CE and French Specification.

All Models - 120 kilograms - 1 person.

Australian Specification.

All Models - 110 kilograms - 1 person.

- **Machine Weight.**

CE Specification.

1532E - approx. 1089 kilograms.

1932E - approx. 11439 kilograms.

2033E - Indoor - approx. 1756 kilograms.

2033E - Outdoor - approx. 2028 kilograms.

2046E - Indoor - approx. 1642 kilograms.

2046E - Outdoor - approx. 1642 kilograms.\*\*

2646E - Indoor - approx. 2076 kilograms.

2646E - Outdoor - approx. 2348 kilograms.

2658E - Indoor w/Arm Guards - approx. 2009 kilograms.

2658E - Outdoor w/Arm Guards - approx. 2009 kilograms.\*\*

\*\*Outdoor machine restricted to 1 person in the platform for Models 2046E and 2658E.

Australian Specification.

1532E - approx. 1089 kilograms.

1932E - approx. 1384 kilograms.

2033E - approx. 2028 kilograms.

2046E - approx. 1642 kilograms.

2646E - approx. 2076 kilograms.

2658E - approx. 1919 kilograms.



#### • Wheelbase

1532E/1932E - 1.3 meters.  
2033E/2046E/2646E/2658E - 1.9 meters.

#### • Machine Height (Platform Fully Elevated).

1532E - 4.6 meters.  
1932E - 5.8 meters.  
2033E/2046E - 6.1 meters.  
2646E/2658E - 7.9 meters.

#### • Machine Height (Platform Lowered).

1532E - 1.9 meters.  
1932E - 2.0 meters.  
2033E/2046E - 2.0 meters.  
2646E/2658E - 2.1 meters.

#### • Platform Railing Height.

CE Specification - Standard Handrails.  
1532E/1932E - 113.7 centimeters (1.14 meters).  
2033E/2046E/2646E/2658E - 110.5 centimeters (1.11 meters).  
CE Specification - Fold-Down Handrails.  
1532E/1932E/2033E - 100.3 centimeters (1.00 meters).  
2046E/2646E/2658E - 110.5 centimeters (1.11 meters).  
Australian Specification - Standard Handrails.  
All Models - 100.3 centimeters (1.00 meters).  
Australian Specification - Fold-Down Handrails.  
1532E/1932E/2033E - 100.3 centimeters (1.00 meters).  
2046E/2646E/2658E - 110.5 centimeters (1.11 meters).

#### • Machine Length.

1532E/1932E - 1.7 meters.  
2033E/2046E/2646E/2658E - 2.4 meters.

#### • Machine Width.

1532E/1932E w/standard tires - 0.8 meters.  
2033E w/standard tires - 0.8 meters.  
2046E/2646E w/standard tires - 1.2 meters.  
2658E w/standard tires - 1.5 meters.  
2046E/2646E/2658E w/optional floatation tires - 1.5 meters.

#### • Ground Clearance.

With Platform Lowered.  
All Models - 5.4 centimeters.  
With Platform Elevated.  
(Pothole Protection System Deployed)  
All Models - 1.9 centimeters.

#### • Maximum Tire Load.

CE Specification.  
1532E - 479 kilograms @ 4.6 bar.  
1932E - 492 kilograms @ 4.7 bar.  
2033E - Indoor - 662 kilograms @ 5.6 bar.  
2033E - Outdoor - 730 kilograms @ 6.1 bar.  
2046E - Indoor - 694 kilograms @ 5.9 bar.  
2046E - Outdoor - 694 kilograms @ 5.9 bar.\*\*  
2646E - Indoor - 771 kilograms @ 6.5 bar.  
2646E - Outdoor - 868 kilograms @ 7.0 bar.  
2658E - Indoor w/Arm Guards - 819 kilograms @ 6.6 bar.  
2658E - Outdoor w/Arm Guards - 819 kilograms @ 6.6 bar.\*\*

\*\*Outdoor machine restricted to 1 person in the platform for Models 2046E and 2658E.

Australian Specification.

1532E - 479 kilograms @ 4.6 bar.  
1932E - 552 kilograms @ 5.2 bar.  
2033E - 730 kilograms @ 6.1 bar.  
2046E - 694 kilograms @ 5.9 bar.  
2646E - 771 kilograms @ 6.5 bar.  
2658E - 796 kilograms @ 6.3 bar.

**1-4. TORQUE REQUIREMENTS.**

Table 1-1. Torque Requirements.

Description	Torque Value (Dry)	Interval Hours
A. Wheel Lugs	122 Nm	50
B. Wheel Hub To Drive Motor	169-203 Nm*	600
C. Lifting Bar Attach Bolts (2033E with Power Lift Down)	102 Nm (w/Loctite)	600
D. Motor Controller Battery Terminal Nuts	7 Nm	At Controller Replacement Only

\* Torque nut to 169-203 Nm (dry), then add extra torque to line up the slot with the hole in the shaft to install the cotter pin.

**Note**

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

**1-5. LUBRICATION.**

- Hydraulic Oil.

Table 1-2. Hydraulic Oil.

HYDRAULIC SYSTEM OPERATING TEMPERATURE RANGE	SAE VISCOSITY GRADE
-18° C to -5° C	10W
-18° C to +99° C	10W-20,10W-30
+10° C to +210° C	20W-20

**Notes**

Hydraulic oils must have anti-wear qualities at least to API Service Classification GL-3, and sufficient chemical stability for mobile hydraulic system service. JLG Industries recommends Mobilfluid 424 hydraulic oil, which has an SAE viscosity of 10W-30 and a viscosity index of 152 or, as an alternate, Kendall Hyken 052 hydraulic oil, which has an SAE viscosity of 10W-20 and a viscosity index of 152. Mobilfluid 424 and Kendall Hyken 052 are fully compatible, and can be mixed as necessary.

When temperatures remain consistently below -20° F (-7° 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.

**Note**

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

Some machines may be specially equipped with Mobil EAL224H biodegradable and non-toxic hydraulic oil. This oil is vegetable oil based and possesses the same anti-wear and rust protection characteristics as mineral oils, but will not adversely affect ground water or the environment when spilled or leaked in small amounts. Mobil EAL224H has a viscosity of 34 cSt at 40° C and a viscosity index of 213. The operating temperature range of this oil is -18° C to +83° C.

**⚠ IMPORTANT**

IT IS RECOMMENDED THAT MOBIL EAL224H HYDRAULIC OIL BE STORED ABOVE FREEZING (0° C), AS THE OIL MAY APPEAR CLOUDY AFTER EXPOSURE TO LOW TEMPERATURES FOR EXTENDED PERIODS OF TIME. THE CLOUDINESS WILL DISAPPEAR WHEN THE OIL IS WARMED TO AT LEAST 10° C AND AGITATED. **DO NOT** ATTEMPT TO "THIN" THE OIL WITH NO. 2 DIESEL FUEL. FOR BEST RESULTS, STORE THE OIL ABOVE FREEZING.

**Note**

Accidentally mixing Mobil EAL224H hydraulic oil with other mineral oils will cause no loss of performance characteristics. However, biodegradability may be reduced and the toxicity may be increased, depending on the oil and the level of contamination.

- Lubrication Specifications.

Table 1-3. Lubrication Specifications.

KEY	SPECIFICATIONS
MPG	Multipurpose Grease having a minimum dripping point of 178° C. Excellent water resistance and adhesive qualities, and being of extreme pressure type. (Timken OK 40 pounds minimum.)
EPGL	Extreme Pressure Gear Lube (oil) meeting API service classification GL-5 or MIL-Spec MIL-L-2105.
HO	Hydraulic Oil. API service classification GL-3, e.g. Mobilfluid 424, Kendall Hyken 052, or BP Energol Type SHS46. Mobil EAL224H is also acceptable.

**Note**

Refer to Figure 1-2 for specific lubrication procedures.

VALUES FOR ZINC PLATED BOLTS ONLY												UNPLATED CAP SCREWS			
SIZE	THD	BOLT DIA. (IN.)	THREAD STRESS AREA (SQ. IN.)	SAE GRADE 5 BOLTS & GRADE 2 NUTS				SAE GRADE 8 BOLTS & GRADE 8 NUTS				UNBRAKO 1960 SERIES SOCKET HEAD CAP SCREW WITH LOC-WEL PATCH			
				CLAMP LOAD (LB.)		TORQUE (LB.-IN.)		CLAMP LOAD (LB.)		TORQUE (LB.-IN.)		CLAMP LOAD (LB.)	TORQUE (as required) (LB.-FT.)		
				(DRY OR LOC. 283) LB. IN.	(LOCITE 252) LB. IN.	(DRY OR LOC. 283) LB. IN.	(LOCITE 252) LB. IN.	(DRY OR LOC. 283) LB. IN.	(LOCITE 252) LB. IN.	(DRY OR LOC. 283) LB. IN.	(LOCITE 252) LB. IN.	(DRY OR LOC. 283) LB. IN.	(LOCITE 252) LB. IN.	(DRY OR LOC. 283) LB. IN.	(LOCITE 252) LB. IN.
4	40	0.1120	0.00604	8	6	8	6	12	9	12	9	12	9	12	9
	48	0.00661	420	9	7	9	7	13	10	13	10	13	10	13	10
6	32	0.1380	0.00909	16	12	16	12	23	17	23	17	23	17	23	17
	40	0.01015	610	18	13	18	13	25	19	25	19	25	19	25	19
8	32	0.1640	0.01400	30	22	30	22	41	31	41	31	41	31	41	31
	36	0.01474	940	31	23	31	23	43	32	43	32	43	32	43	32
10	24	0.1900	0.01750	43	32	43	32	60	45	60	45	60	45	60	45
	32	0.02000	1285	49	36	49	36	68	51	68	51	68	51	68	51
1/4	20	0.0318	2020	96	75	96	75	144	108	144	108	144	108	144	108
	28	0.0364	2320	120	86	120	86	168	120	168	120	168	120	168	120
5/16	18	0.0524	3340	17	13	17	13	25	18	25	18	25	18	25	18
	24	0.0580	3700	19	14	19	14	25	20	25	20	25	20	25	20
3/8	16	0.0775	4940	30	23	30	23	45	35	45	35	45	35	45	35
	24	0.0878	5600	35	25	35	25	50	35	50	35	50	35	50	35
7/16	14	0.1063	6800	50	35	50	35	70	55	70	55	70	55	70	55
	20	0.1187	7550	55	40	55	40	80	60	80	60	80	60	80	60
1/2	13	0.1419	9050	75	55	75	55	110	80	110	80	110	80	110	80
	20	0.1599	10700	90	65	90	65	120	90	120	90	120	90	120	90
9/16	12	0.1820	11600	110	80	110	80	150	110	150	110	150	110	150	110
	18	0.2030	12950	120	90	120	90	170	130	170	130	170	130	170	130
5/8	11	0.2260	14400	150	110	150	110	220	170	220	170	220	170	220	170
	18	0.2560	16300	170	130	170	130	240	180	240	180	240	180	240	180
3/4	10	0.3340	21300	260	200	260	200	380	280	380	280	380	280	380	280
	16	0.3730	23800	300	220	300	220	420	320	420	320	420	320	420	320
7/8	9	0.4620	29400	430	320	430	320	600	460	600	460	600	460	600	460
	14	0.5090	32400	470	350	470	350	660	500	660	500	660	500	660	500
1	8	0.6060	38600	640	480	640	480	900	680	900	680	900	680	900	680
	12	0.6630	42200	700	530	700	530	1000	740	1000	740	1000	740	1000	740
1-1/8	7	0.7630	42300	800	600	800	600	1280	960	1280	960	1280	960	1280	960
	12	0.8560	47500	880	660	880	660	1440	1080	1440	1080	1440	1080	1440	1080
1-1/4	7	0.9690	53800	1120	840	1120	840	1820	1360	1820	1360	1820	1360	1820	1360
	12	1.0730	59600	1240	920	1240	920	2000	1500	2000	1500	2000	1500	2000	1500
1-1/2	6	1.1550	64100	1460	1100	1460	1100	2380	1780	2380	1780	2380	1780	2380	1780
	12	1.3150	73000	1680	1260	1680	1260	2720	2040	2720	2040	2720	2040	2720	2040
1-1/2	6	1.4050	78000	1940	1460	1940	1460	3160	2360	3160	2360	3160	2360	3160	2360
	12	1.5800	87700	2200	1640	2200	1640	3560	2660	3560	2660	3560	2660	3560	2660

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

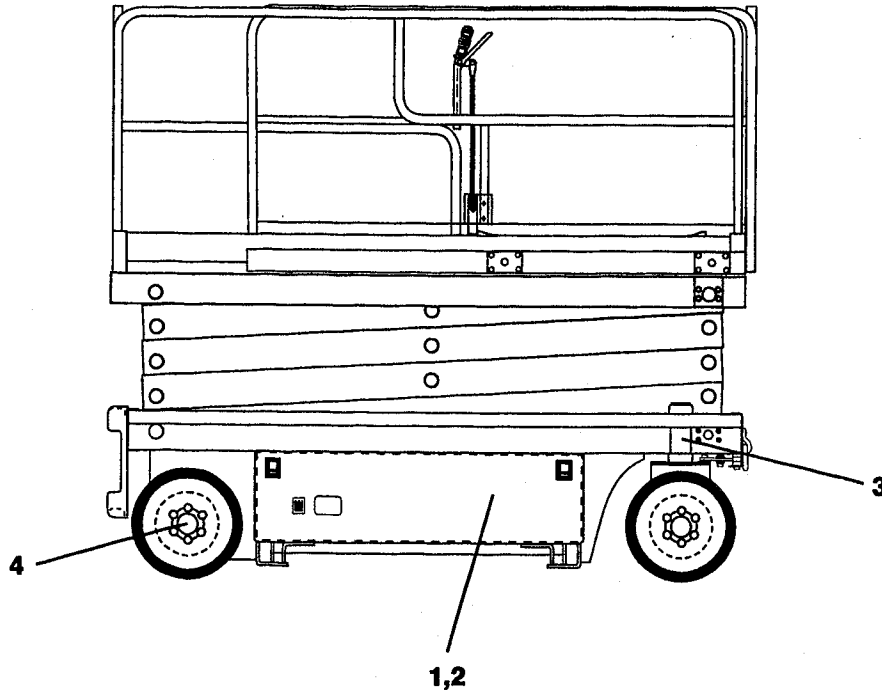


SAE GRADE 8



SAE GRADE 5

Figure 1-1. Torque Chart.



INDEX NUMBER	COMPONENT	NO/TYPE LUBE POINTS	LUBE/METHOD	INTERVAL HOURS	COMMENTS
1	Hydraulic Oil	Fill Cap/Drain Plug	HO - Check HO Level HO - Change HO	10/1200	Check oil every 10 hrs. Change oil every 1200 hrs.
2	Hydraulic Filter Element	N/A	N/A	50/300	Change filter after first 50 hours of operation, then every 300 hours thereafter.
3	Kingpin Housing	2 Grease Fittings (1 each housing)	MPG - Pressure Gun	600	N/A
4	Wheel Bearings	2 - Rear Wheels	MPG - Repack	1200	N/A

**Key To Lubricants:**

MPG - Multi-Purpose Grease

HO - Hydraulic Oil - Mobilfluid 424, Kendall Hyken 052, BP Energol Type SHS46, or Mobil EAL224H

**⚠ WARNING**

**TO AVOID PERSONAL INJURY, USE SAFETY PROP FOR ALL MAINTENANCE REQUIRING PLATFORM TO BE ELEVATED.**

**Notes:**

1. Be sure to lubricate like items on each side of machine.
2. Recommended lubricating intervals are based on machine operations under normal conditions. For machines used in multi-shift operations and/or exposed to hostile environments or conditions, lubrication frequencies must be increased accordingly.
3. Lubricating intervals are calculated on 10 hours of machine operation per week.

Figure 1-2. Lubrication Chart - 1532E/1932E/2033E/2046E/2646E/2658E.

**1-6. CYLINDER SPECIFICATIONS.****Note**

All dimensions are given in centimeters (cm).

Table 1-4. Cylinder Specifications.

DESCRIPTION	BORE	STROKE	ROD DIA.
Lift Cylinder (1532E/1932E) (Power Lift Down)	7.6	77.8	5.1
Lift Cylinder (1532E/1932E) (Gravity Lift Down)	7.6	77.2	5.1
Lift Cylinder (2033E/2046E) (Power Lift Down)	8.9	101.0	5.1
Lift Cylinder (2033E/2046E) (Gravity Lift Down)	8.9	101.0	5.1
Lift Cylinder (2646E/2658E) (Power Lift Down))	10.2	101.0	6.4
Lift Cylinder (2646E/2658E) (Gravity Lift Down))	10.2	101.0	6.4
Steer Cylinder - All Models	3.8	15.9	1.9
Parking Brake Cylinder - All Models (Gravity Lift Down)	4.4	4.4	2.9
Parking Brake Cylinder - All Models (Power Lift Down)	5.1	4.4	2.5

**1-7. PRESSURE SETTINGS.****Note**

E Scissor scissor lifts are equipped with either Power Lift Down or Gravity Lift Down. To identify Power Lift Down or Gravity Lift Down machines, refer to the effectivity page for serial number identification.

• **Machines with Power Lift Down.**

- Main Relief - 207 bar.
- Steer Relief - 117 bar.
- Lift Up Relief - 145 bar.
- Lift Down Relief - 55 bar.
- High Drive Pressure Switch - 76 bar.

• **Machines with Gravity Lift Down.**

- Main Relief - 220 bar.
- Steer Relief - 117 bar.
- Lift Up Relief.
  - 1532E - 114 bar.
  - 1932E - 141 bar.
  - 2033E - 117 bar.
  - 2046E - 141 bar.
  - 2646E - 138 bar.
  - 2658E - 159 bar.

**1-8. SERIAL NUMBER LOCATIONS.**

(See Figure 1-3.)

For machine identification, a serial number plate is affixed to the machine. On all machines with Power Lift Down, the plate is located one of two places, depending on the date of manufacture: on the rear center of the machine frame, just below the top step of the ladder, or on the rear platform kickplate. Check your machine for the specific location. On all machines with Gravity Lift Down, the serial number plate is located on the left rear side of the machine frame, just above the left rear tire and wheel assembly. In addition, if the serial number plate is damaged or missing, the machine serial number is stamped on the right front of the frame.

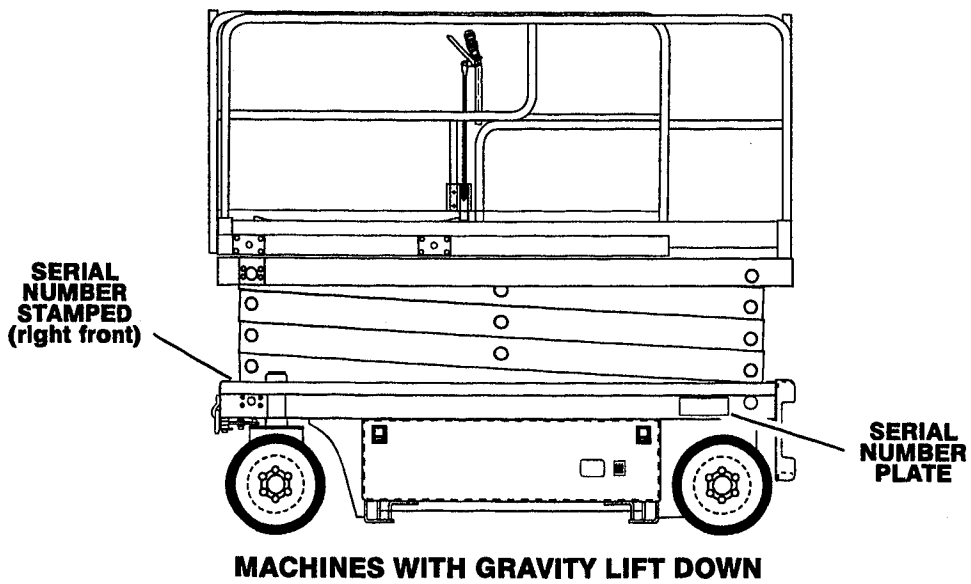
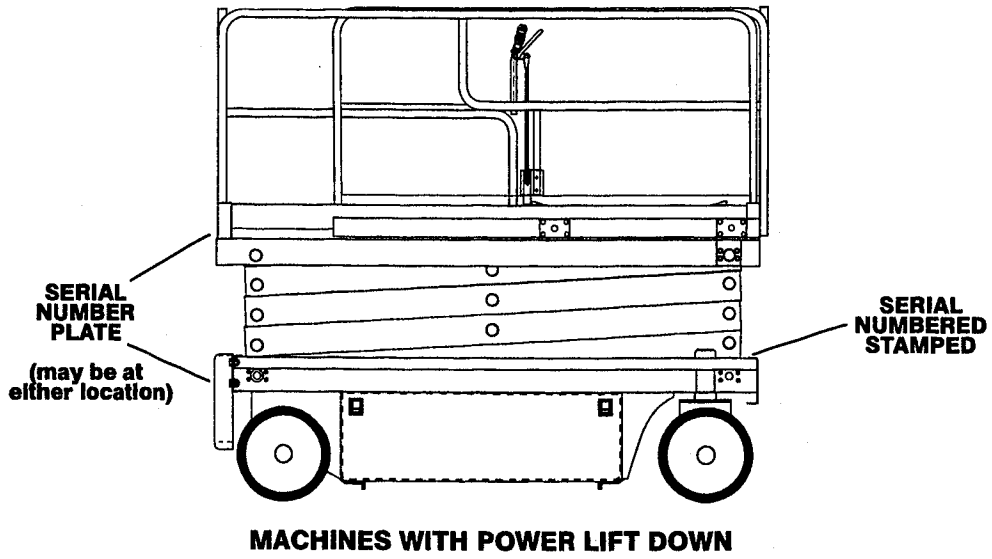


Figure 1-3. Serial Number Locations - 1532E/1932E/2033E/2046E/2646E/2658E.

**1-9. LIMIT SWITCHES.**

The machines are equipped with the following limit switches:

Tilt Switch - 2 degrees (CE Specification) - Illuminates a light on the platform control panel when the machine is 2 degrees out of level in any direction. If the machine is elevated and tilted, the platform alarm is sounded continuously.

Tilt Switch - 2 degrees (Australian Specification) - Illuminates a light on the platform control panel when the machine is 2 degrees out of level in any direction. If the machine is elevated and tilted, the platform alarm is sounded continuously and the LIFT UP and DRIVE functions are cut out.

High Drive Cut-Out - High drive speed is cut out when the platform is raised above the stowed position.

Drive Cut-Out - For the specified models, the Drive function is cut out when the platform is raised above the specified height.

Model 1532E - 4 meters

Model 1932E - 4.25 meters

Model 2646E - 7 meters

Temperature Switch (equipped on machines after and including serial number 0200037715)- This switch prevents the high drive function from engaging when the oil temperature is very cold. The machine will remain in low drive until the oil has warmed and will then automatically move up to high drive.

Deck Interlock (French and Italian Specification) - When the manual platform extension is extended, this limit switch cuts out the LIFT DOWN function until the platform extension is completely retracted. If the operator tries to activate the LIFT DOWN function with the platform extension extended, the platform alarm is sounded for one second on, one second off, one second on, three seconds off while the operator tries to activate the function.

**1-10. MAJOR COMPONENT WEIGHTS.****Table 1-5. Major Component Weights.**

COMPONENT	KG
Platform (0.8 m x 1.6 m) - 1532E/1932E	89
Platform (0.8 m x 2.4 m) - 2033E	143
Platform (1.1 m x 2.4 m) - 2046E/2646E	164
Platform (1.1 m x 2.4 m) - 2658E	173
Manual Platform Extension - 1532E/1932E	50
Manual Platform Extension - 2033E	80
Manual Platform Extension - 2046E/2646E	92
Manual Platform Extension - 2658E	100
Arm Assembly - 1532E (Includes Lift Cylinder)	234
Arm Assembly - 1932E (Includes Lift Cylinder)	283
Arm Assembly - 2033E/2046E (Includes Lift Cylinder)	527
Arm Assembly - 2646E/2658E (Includes Lift Cylinder)	734
Chassis - 1532E/1932E w/Solid Tires	466
Chassis - 2033E w/Solid Tires (Includes 211 kg Counterweight)	901
Chassis - 2046E/2646E w/Solid Tires	778
Chassis - 2658E w/Solid Tires	819

**1-11. CRITICAL STABILITY WEIGHTS.**

**⚠ WARNING**

**DO NOT REPLACE ITEMS CRITICAL TO STABILITY, SUCH AS BATTERIES OR SOLID TIRES, WITH ITEMS OF DIFFERENT WEIGHT OR SPECIFICATION. DO NOT MODIFY UNIT IN ANY WAY TO AFFECT STABILITY.**

**Table 1-6. Critical Stability Weights.**

Component	1532E	1932E	2033E	2046E	2646E	2658E
Tires-Solid (each)	11 kg	11 kg	14 kg	14 kg	14 kg	14 kg
Tires-Solid-Non-Marking (each)	11 kg	11 kg	14 kg	14 kg	14 kg	14 kg
Tires-Solid-Floatation (each)	n/a	n/a	n/a	23 kg	23 kg	23 kg
Motor/Pump Assembly	20 kg	20 kg	20 kg	20 kg	20 kg	20 kg
Batteries - Std. - Each	35 kg	35 kg	35 kg	35 kg	35 kg	35 kg
Batteries - Standard - Combined	140 kg	140 kg	140 kg	140 kg	140 kg	140 kg
Counterweight	n/a	n/a	211 kg	n/a	n/a	n/a



## 2-1. GENERAL.

This section provides information necessary to perform maintenance on the scissor lift. 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.

### Note

Maintenance procedures provided in this section apply to all six scissor lift models covered in this manual. Procedures that apply to a specific model will be so noted.

### ⚠ CAUTION

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

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

## 2-2. SERVICING AND MAINTENANCE GUIDELINES.

### • General.

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

### • Safety and Workmanship.

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

### • Cleanliness.

1. The most important single item in preserving the long service life of a machine is to keep dirt and foreign materials out of the vital

components. Precautions have been taken to safeguard against this. Shields, covers, seals, and filters are provided to keep 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.

### • 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 interfering.

### • Component Disassembly and Reassembly.

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

### • Pressure-Fit Parts.

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

### • Bearings.

1. When a bearing is removed, cover it to keep out dirt and abrasives. Clean bearings in nonflammable cleaning solvent and allow to drip dry. Compressed air can be used but do not spin the bearing.
2. Discard bearings if the races and balls (or rollers) are pitted, scored, or burned.
3. If a 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.

### • Gaskets.

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

### • Bolt Usage and Torque Application.

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

### • Hydraulic Lines and Electrical Wiring.

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

### • Hydraulic System.

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

### • Lubrication.

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

### • Batteries.

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

### • Lubrication and Servicing.

Components and assemblies requiring lubrication and servicing are shown in Section 1.

## 2-3. LUBRICATION INFORMATION.

### • Hydraulic System.

1. The primary enemy of a hydraulic system is contamination. Contaminants enter the system by various means, e.g., 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 Section 1. 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, except as recommended, as they may not contain the same required additives or be of comparable viscosities. Good grade mineral oils, with viscosities suited to the ambient temperatures in which the machine is operating, are recommended for use.

**Note**

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

• **Hydraulic Oil.**

1. Refer to Table 1-1 for recommendations for viscosity ranges.
2. JLG recommends Mobilfluid 424, which has an SAE viscosity of 10W-30 and a viscosity index of 152 or, as an alternate, Kendall Hyken 052 hydraulic oil, which has an SAE viscosity of 10W-20 and a viscosity index of 152. Mobilfluid 424 and Kendall Hyken 052 are fully compatible, and can be mixed as necessary. BP Energol Type SHS46 is also an acceptable substitute.

**Note**

Start-up of hydraulic system with oil temperatures below -26 degrees C 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 -26 degrees C.

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 tem-

peratures down to -29 degrees C. However, use of this oil will give poor performance at temperatures above 49 degrees C. Systems using DTE 11 oil should not be operated at temperatures above 94 degrees C under any condition.

4. Some machines may be equipped with Mobil EAL 224H biodegradable and non-toxic hydraulic oil. This oil is vegetable oil based and possesses the same anti-wear and rust protection characteristics as mineral oils, but will not adversely affect ground water or the environment when spilled or leaked in small amounts. Mobil EAL 224H has a viscosity of 34 cSt at 40° C and a viscosity index of 213. The operating temperature range of this oil is -18° C to +83° C.

**▲ IMPORTANT**

**IT IS RECOMMENDED THAT MOBIL EAL 224H HYDRAULIC OIL BE STORED ABOVE FREEZING (0° C), AS THE OIL MAY APPEAR CLOUDY AFTER EXPOSURE TO LOW TEMPERATURES FOR EXTENDED PERIODS OF TIME. THE CLOUDINESS WILL DISAPPEAR WHEN THE OIL IS WARMED TO AT LEAST 10° C AND AGITATED. DO NOT ATTEMPT TO "THIN" THE OIL WITH NO. 2 DIESEL FUEL. FOR BEST RESULTS, STORE THE OIL ABOVE FREEZING.**

**Note**

Accidentally mixing Mobil EAL 224H hydraulic oil with other mineral oils will cause no loss of performance characteristics. However, biodegradability may be reduced and toxicity may be increased, depending on the oil and the level of contamination.

• **Changing Hydraulic Oil.**

1. Use of any of the recommended hydraulic oils increase JLG's recommended oil change interval to 1200 hours. However, filter elements must be changed after the first 50 hours of operation and every 300 hours thereafter. When changing 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 your local supplier for assistance in selecting the proper equivalent. Avoid mixing petroleum and synthetic base oils.
2. Use every precaution to keep the hydraulic oil clean. If the oil must be poured from the original container into another, be sure to clean all possible contaminants from the

service container. Always clean the mesh element of the filter and replace the cartridge any time the system oil is changed.

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

#### • **Lubrication Specifications.**

Specified lubricants, as recommended by the component manufacturers, are always the best choice, however, multi-purpose greases usually have the qualities which meet a variety of single purpose grease requirements. Should any question arise regarding the use of greases in maintenance stock, consult your local supplier for evaluation. Refer to Table 1-3 for an explanation of the lubricant key designations appearing in the Lubrication Chart.

### 2-4. CYLINDERS - THEORY OF OPERATION.

Cylinders are of the double acting type. The Lift and Steer systems incorporate double acting cylinders. A double acting cylinder is one that requires oil flow to operate the cylinder rod in both directions. Directing oil (by actuating the corresponding control valve to the piston side of the cylinder) forces the piston to travel toward the rod end of the barrel, extending the cylinder rod (piston attached to rod). When the oil flow is stopped, movement of the rod will stop. By directing oil to the rod side of the cylinder, the piston will be forced in the opposite direction and the cylinder rod will retract.

A holding valve is used in the Lift circuit 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.

#### • **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 (cen-

ter) and oil flow is then directed through the valve body and returns to reservoir. A typical control valve consists 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.

#### • **Proportional Control Valves.**

The proportional control valves provide a power output matching that required by the load. A small line connected to a load sensing port feeds load pressure back to a sequence valve. The sequence valve senses the difference between the load and pump outlet pressure, and varies the pump displacement to keep the difference constant. This differential pressure is applied across the valve's 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 sequence valve. Integral actuator port relief valves, anti-cavitation check valves, and load check valves are standard.

#### • **Relief Valves.**

Main relief valves are installed at various points within 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.

### • Crossover 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. Individual, integral reliefs are provided for each side of the circuit.

## 2-6. COMPONENT FUNCTIONAL DESCRIPTION.

### • Hydraulic Pump.

The main hydraulic pump is an integral part of the electric motor/pump assembly, located at the rear of the battery and ground control tray on the frame of the machine. The pump is a two-section pump that provides an output of 11.8 lpm from each pump section.

### • Lift Cylinder Counterbalance/Manual Descent Valve.

The lift cylinder counterbalance/manual descent valve is located on top of the lift cylinder. The counterbalance valve is used to hold the platform in place when raised. A cable is connected to the valve which, when pulled, manually opens the LIFT DOWN port and allows the platform to be lowered in the event hydraulic power is lost.

### • Positive Traction Valve.

The positive traction solenoid valve is located on the main control valve and is activated by a switch on the platform control box. When activated, it equally divides the flow of hydraulic oil in the drive circuit to send an equal amount of oil to each drive motor.

## 2-7. WEAR PADS.

### • Sliding Pads.

The original thickness of the sliding pads is 51 mm. Replace sliding pads when worn to 48 mm.

## 2-8. CYLINDER CHECKING PROCEDURES.

### Note

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

### • Cylinder w/o Counterbalance Valves - Brake Cylinder and Steer Cylinder.

### ⚠ IMPORTANT

OPERATE FUNCTIONS FROM GROUND CONTROL STATION ONLY.

### ⚠ WARNING

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

1. Using all applicable safety precautions, activate motor and fully extend cylinder to be checked. Shut down motor.
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 motor and activate cylinder extend function. Check retract port for leakage.
4. If cylinder leakage is 6-8 drops per minute or more, piston seals are defective and must be replaced. If cylinder retract port leakage is less than 6-8 drops per minute, carefully reconnect hose to retract port and retract cylinder.
5. With cylinder fully retracted, shut down motor and carefully disconnect hydraulic hose from cylinder extend port.
6. Activate motor and activate cylinder retract function. Check extend port for leakage.
7. If cylinder leakage is 6-8 drops per minute or more, piston seals are defective and must be replaced. 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.

- **Cylinders w/Single Counterbalance Valves - Lift Cylinder.**

**⚠ IMPORTANT**

**OPERATE ALL FUNCTIONS FROM GROUND CONTROL STATION ONLY.**

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

**⚠ WARNING**

**WHEN WORKING ON THE LIFT CYLINDER, RAISE THE PLATFORM COMPLETELY AND SUPPORT THE PLATFORM USING A SUITABLE OVERHEAD LIFTING DEVICE.**

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

2. Raise platform completely then retract cylinder slightly to avoid trapping pressure. Place a suitable overhead lifting device approximately 1 inch (2.5 cm) below the platform.
3. Shut down hydraulic system and allow machine to sit for 10-15 minutes. Carefully remove hydraulic hoses from 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. If no repairs are necessary or when repairs have been made, carefully reconnect hydraulic hoses to the appropriate ports.
6. Remove lifting device from platform, activate hydraulic system and run cylinder through one complete cycle to check for leaks.

**2-9. LIFT CYLINDER REMOVAL AND INSTALLATION.**

- **Lift Cylinder Removal.**

1. Place the machine on a flat and level surface. Start the motor and raise the platform. Shut down the engine and attach a suitable lifting device to the platform.
2. Remove the bolt and locknut securing the cylinder rod attach pin to the upper inner arm assembly. Using a suitable brass drift, drive out the rod end attach pin from the arm assembly.
3. Retract the lift cylinder rod completely.
4. Tag and disconnect the hydraulic lines, then cap the lift cylinder hydraulic lines and ports.
5. Remove the bolt and locknut securing the barrel end attach pin to the lower arm assembly. Using a suitable brass drift, drive out the barrel end attach pin from the arm assembly.
6. Carefully remove the cylinder from the scissor lift and place in a suitable work area.

- **Lift Cylinder Installation.**

1. Install lift cylinder in place using suitable slings, aligning barrel end attach pin mounting holes on lower arm assembly.
2. Using a suitable drift, drive the barrel end attach pin through the mounting holes in the lift cylinder and the lower arm assembly. Secure in place with the bolt and locknut.
3. Remove cylinder port plugs and hydraulic line caps and correctly attach lines to cylinder ports.
4. Extend the cylinder rod until the attach pin hole aligns with those in the upper arm assembly. Using a suitable drift, drive the cylinder rod attach pin through the aligned holes, taking care to align the pin retaining hole with the hole in arm assembly. Secure the pin in place with the bolt and locknut.
5. Lower platform to stowed position and shut down motor. Check hydraulic fluid level and adjust accordingly.

## 2-10. LIFT CYLINDER REPAIR. (Machines manufactured prior to August, 1996.)

### Note

The following procedures apply to the lift cylinder. Repair procedures for the brake and steer cylinders are found in paragraphs 2-12 and 2-13.

### • Disassembly.

#### ⚠ IMPORTANT

**DISASSEMBLY OF THE CYLINDER SHOULD BE PERFORMED ON A CLEAN WORK SURFACE IN A DIRT FREE WORK AREA. BE SURE TO CLEAN ALL DIRT OR OTHER FOREIGN SUBSTANCES FROM CYLINDER OPENINGS - PARTICULARLY AT THE HEAD.**

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

#### ⚠ WARNING

**DO NOT FULLY EXTEND CYLINDER TO 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 necessary.
3. If applicable, remove the cartridge-type holding valve and fittings from the cylinder port block. Discard o-rings.

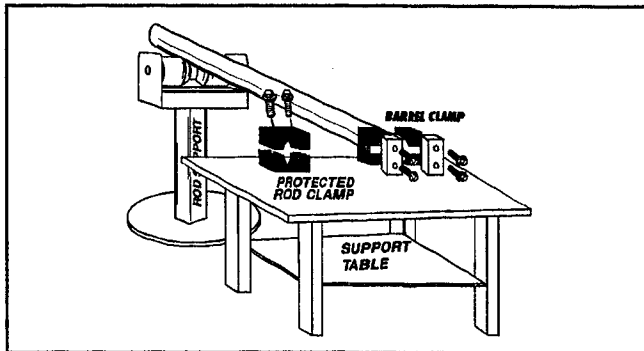


Figure 2-1. Barrel Support.

4. Place the cylinder barrel into a suitable holding fixture.
5. To aid in realignment, mark cylinder head and barrel with a center punch. Using an allen wrench, loosen the eight (8) cylinder head retainer cap screws and remove cap screws from cylinder barrel.

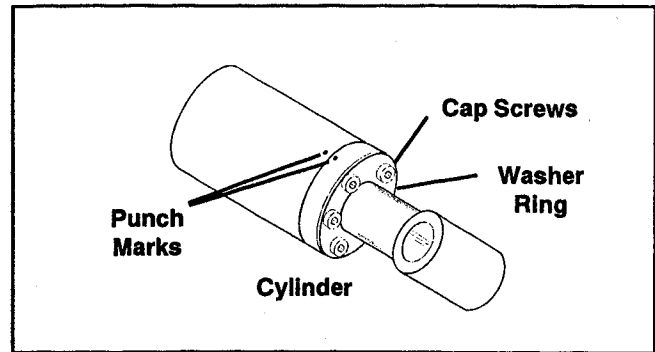


Figure 2-2. Cylinder Head Retainer Cap Screw Removal.

6. If applicable, using a suitable spanner wrench, loosen the spanner nut retainer and remove the spanner nut from the cylinder barrel.
7. Attach a suitable pulling device to the cylinder rod port block 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.

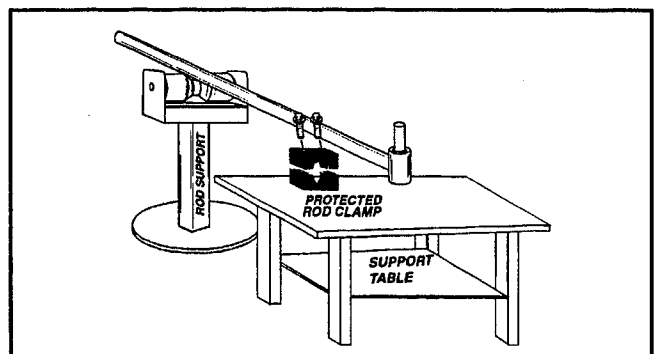


Figure 2-3. Rod Support.

9. Using suitable protection, clamp the cylinder rod in a vise or similar holding fixture as close to the piston as possible.
10. If applicable, loosen and remove the nut which attaches the piston to the rod, then remove the piston from the rod.

11. If applicable, loosen and remove the cap screw(s) securing the tapered bushing to the piston.
12. Insert the capscrew(s) in the threaded holes in the outer piece of the tapered bushing. Progressively tighten the cap screw(s) until the bushing is loose on the piston, then remove the bushing from the piston.

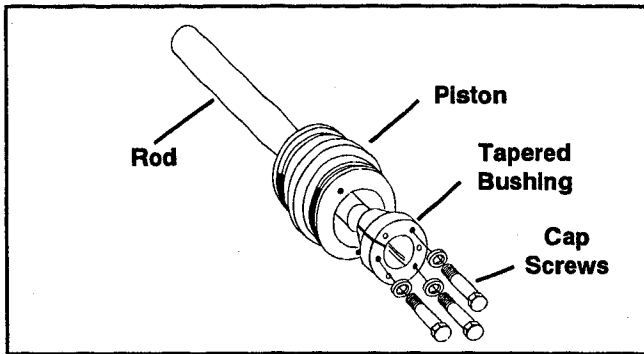


Figure 2-4. Tapered Bushing Removal.

13. Screw the piston counter-clockwise, by hand, and remove the piston from the cylinder rod.
14. Remove and discard the piston o-rings, back-up rings, guidelock rings and hydrolock seals.
15. If applicable, remove the piston spacer from the rod.
16. Remove the rod from the holding fixture. Remove the cylinder head and retainer plate from the rod.

#### • 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 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 threaded portion of piston for damage. Dress threads as necessary.
8. Inspect seal and o-ring grooves in piston for burrs and sharp edges. Dress applicable surfaces as necessary.
9. Inspect cylinder head inside diameter for scoring or other damage and for ovality and tapering. Replace as necessary.
10. Inspect threaded portion of head for damage. Dress threads as necessary.
11. Inspect seal and o-ring grooves in head for burrs and sharp edges. Dress applicable surfaces as necessary.
12. Inspect cylinder head outside diameter for scoring or other damage and ovality and tapering. Replace as necessary.
13. If applicable, inspect rod and barrel bearings for signs of correct lubrication and excessive wear. If necessary, replace bearings as follows:
  - a. Thoroughly clean steel bushing hole of burrs, dirt, etc. to facilitate bearing installation.
  - b. Inspect steel bushing for wear or other damage. If steel bushing is worn or damaged, rod or barrel (as applicable) must be replaced.
  - c. Lubricate *inside of steel bushing* with WD-40 prior to bearing installation.
  - d. Using arbor of the correct size, carefully press the bearing into the steel bushing.

#### Note

Install the cylinder pin into the Gar-Max bearing dry. Lubrication is not required with chrome pins and bearings.

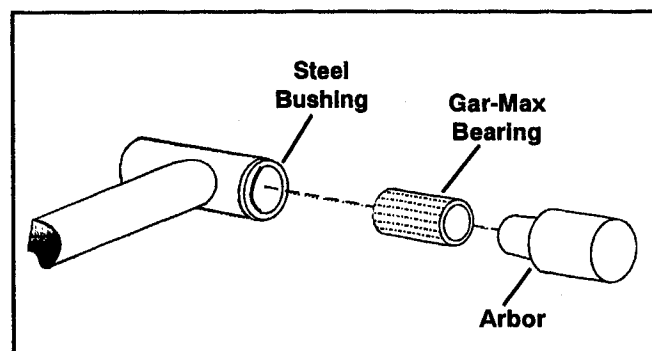


Figure 2-5. Gar-Max Bearing Installation.



14. Inspect travel limiting collar or spacer for burrs and sharp edges. If necessary, dress inside diameter surface with Scotch Brite or equivalent.
15. If applicable, inspect port block fittings and holding valve. Replace as necessary.
16. Inspect the oil ports for blockage or the presence of dirt or other foreign material. Repair as necessary.
17. If applicable, inspect piston rings for cracks or other damage. Replace as necessary.

**• Assembly.**

**Notes**

Prior to cylinder assembly, ensure that the proper cylinder seal kit is used. Refer to Section 11 of this manual.

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

1. Using a special tool, pictured in the following illustration, install a new rod seal into the applicable cylinder head gland groove. Refer to the following illustration for the proper tool size.

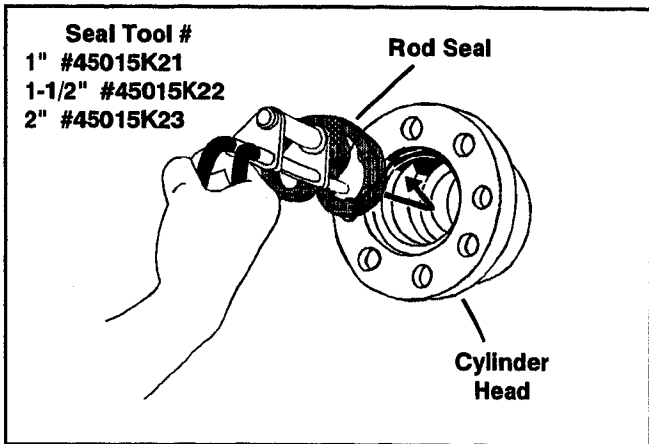


Figure 2-6. Rod Seal Installation.

**⚠ IMPORTANT**

WHEN INSTALLING NEW "POLY-PAK" TYPE PISTON SEALS, ENSURE SEALS ARE INSTALLED PROPERLY. REFER TO FIGURE 2-7 FOR CORRECT SEAL ORIENTATION. IMPROPER SEAL INSTALLATION COULD RESULT IN CYLINDER LEAKAGE AND IMPROPER CYLINDER OPERATION.

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

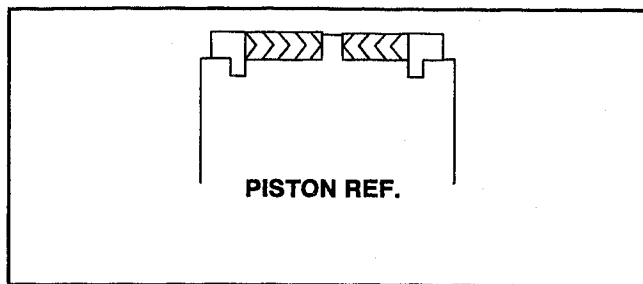


Figure 2-7. Poly-Pak Seal Installation.

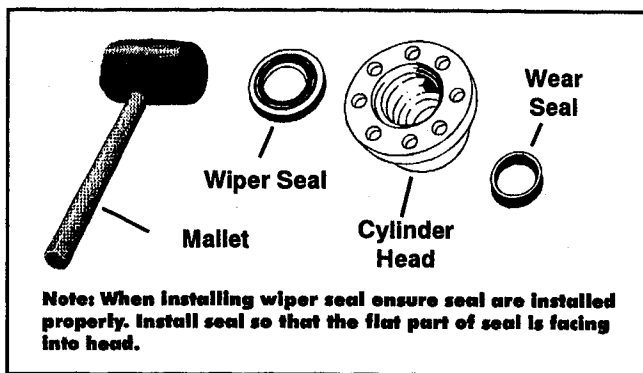


Figure 2-8. Wiper Seal Installation.

3. Place a new o-ring and back-up seal in the applicable outside diameter groove of the cylinder head as shown in the following illustration.

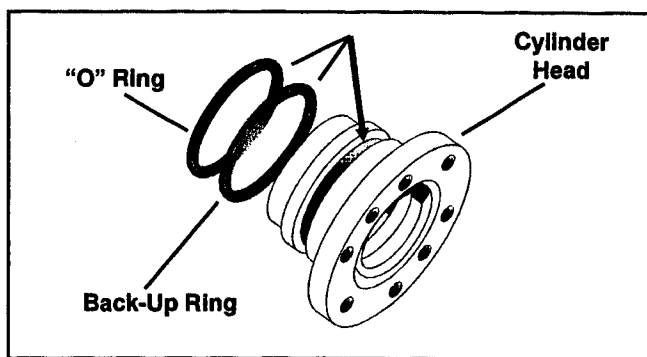


Figure 2-9. Head Seal Kit Installation.

4. Install a washer ring onto the rod, then 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.
5. Carefully slide the piston spacer onto the rod.
6. If applicable, correctly place a new o-ring and back-up rings in the inner piston diameter groove.

7. Using suitable protection, clamp the cylinder rod in a vise or similar holding fixture as close to the piston as possible.
8. Carefully thread the piston on the cylinder rod hand tight, ensuring that the o-ring and back-up rings are not damaged or dislodged.
9. Thread the piston onto the rod until it abuts the spacer end and install the tapered bushing.

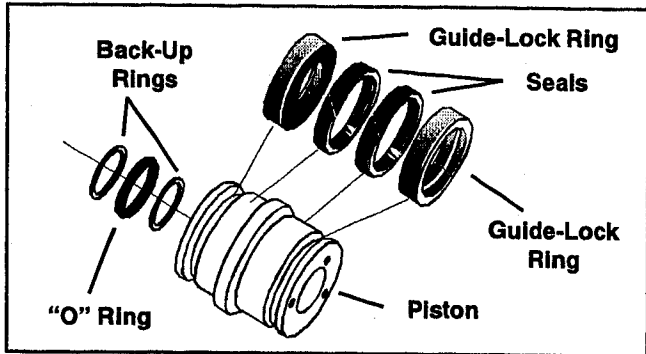


Figure 2-10. Piston Seal Kit Installation.

**Note**

When installing the tapered bushing, the piston and mating end of the rod must be free of oil.

**⚠ WARNING**

WHEN REBUILDING THE LIFT CYLINDER, APPLY LOCTITE #242 TO TAPERED BUSHING BOLTS, THEN TIGHTEN BOLTS SECURELY. REFER TO TABLE 8-1 FOR PROPER BOLT TORQUE VALUES.

10. Install the bolts into the bushing using Loctite #242. Refer to Table 2-1 for proper bolt torque values.

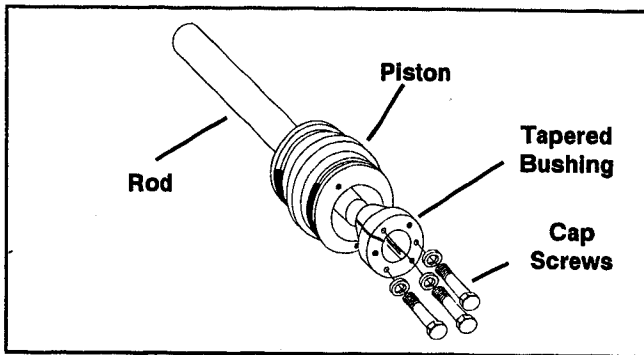


Figure 2-11. Tapered Bushing Installation.

11. Remove the cylinder rod from the holding fixture.

12. Place new guidelocks and hydrolock seals in the applicable outside diameter grooves of both the piston and the cylinder head. Refer to Figure 2-10.
13. 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.**

14. With the barrel clamped securely, and while adequately supporting the rod, insert the piston end into the cylinder barrel. Ensure that the piston loading o-ring and seal ring are not damaged or dislodged.
15. Continue pushing the rod into the barrel until the cylinder head gland can be inserted into the cylinder barrel.
16. Secure the cylinder head gland using the washer ring and socket head bolts. Refer to Table 2-1 for proper bolt torque specifications.

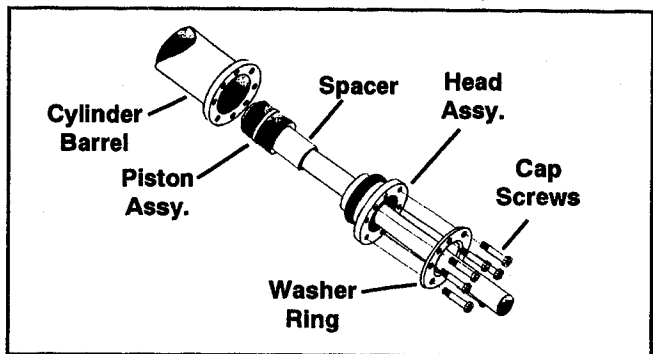


Figure 2-12. Rod Assembly Installation.

17. 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.
18. If applicable, install the cartridge-type holding valve and fittings in the port block using new o-rings as applicable. Refer to Table 2-2 for proper holding valve torque specifications.

Table 2-1. Cylinder Component Torque Specifications.

Component	Torque Value (w/Loctite)
Tapered Bushing Retaining Screws - Lift Cylinder	108 Nm
Head Retaining Screws - Lift Cylinder	12 Nm
Piston Nut - Lift Cylinder - 1532E/1932E (Machines built August 1996 to present)	508-610 Nm
Piston Nut - Lift Cylinder - 2033E/2046E (Machines built August 1996 to present)	1085-1356 Nm
Piston Nut - Lift Cylinder - 2646E/2658E (Machines built August 1996 to present)	1525-1864 Nm

Table 2-2. Holding Valve Torque Specifications.

Description	Torque Value
Sun - 7/8 hex M20 x 1.5 thds	41-48 Nm
Sun - 1-1/8 hex 1 - 14 UNS thds	61-68 Nm
Sun - 1-1/4 hex M36 x 2 thds	204-207 Nm
Racine - 1-1/8 hex 1-1/16 - 12 thds	68-75 Nm
Racine - 1-3/8 hex 1-3/16 - 12 thds	102-109 Nm
Racine - 1-7/8 hex 1-5/8 - 12 thds	136-149 Nm

## 2-11. LIFT CYLINDER REPAIR. (Machines manufactured August 1996 to present.)

### Note

This procedure may be used for lift cylinders on both power down and gravity down machines. Refer to the effectivity page for serial number identification.

### • Disassembly.

#### ⚠ IMPORTANT

DISASSEMBLY OF THE CYLINDER SHOULD BE PERFORMED ON A CLEAN WORK SURFACE IN A DIRT FREE WORK AREA. BE SURE TO CLEAN ALL DIRT OR OTHER FOREIGN SUBSTANCES FROM CYLINDER OPENINGS - PARTICULARLY AT THE HEAD.

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

#### ⚠ WARNING

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

2. Operate the hydraulic power source and extend the cylinder. Shut down and disconnect the power source. Adequately support the cylinder rod, if applicable.
3. Remove the cartridge-type holding valve and fittings from the cylinder port block. Discard o-rings.
4. Place the cylinder barrel into a suitable holding fixture.

#### ⚠ 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.

5. Using a suitable spanner wrench inserted in the holes provided, turn the cylinder head counter-clockwise to remove it from the cylinder barrel. If the head is difficult to turn or moves erratically, tap the tube adjacent to the head with a brass or plastic mallet while turning it.
6. Attach a suitable pulling device to the cylinder rod end.
7. With the barrel clamped securely, apply pressure to the rod pulling device and carefully withdraw the complete rod assembly from the cylinder barrel.
8. Using suitable protection, clamp the cylinder rod in a vise or similar holding fixture as close to the piston and head as possible.
9. Remove the lock nut which attaches the piston to the rod, and remove the piston.
10. Slide the head off the rod from the piston end.
11. Remove and discard the sealing o-ring, wiper, u-cup seal, static o-ring, static back-up ring and wear ring.
12. Remove the piston guidelock ring.
13. Remove and discard the piston o-ring and seals, then remove the piston spacer.
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.

### • **Cleaning and Inspection.**

1. Clean all parts thoroughly in an approved cleaning solvent.
2. Inspect the cylinder rod for scratches or pits deep enough to catch the fingernail. Pits that go to the base metal are unacceptable. Scratches that catch the fingernail but are not to the base metal, less than 12.7 mm long and primarily in the circumferential direction are acceptable provided they cannot cut the rod seal. Chrome should be present over the entire surface of the rod; the lack of chrome on the rod surface is unacceptable. If an unacceptable condition exists, repair or replace the rod.
3. Inspect the threaded portion of the rod for excessive damage. Dress the threads as necessary.
4. Inspect inner surface of cylinder barrel tube for scratches and pits. There should be no scratches or pits deep enough to catch the fingernail. Scratches that catch the fingernail but are less than 12.7 mm long and primarily in the circumferential direction are acceptable provided they cannot cut the piston seal. The roughness of the bore should be between 10 and 20  $\mu$ inches RMS. Significant variations (greater than 8  $\mu$ inches difference) are unacceptable. If an unacceptable condition exists, repair or replace the cylinder barrel tube.
5. Inspect the threaded portion of the barrel tube for damage. Dress the threads as necessary.
6. Inspect piston outside surface for scratches or polishing. Deep scratches are unacceptable. Polishing indicates uneven loading and when this occurs, the diameter should be checked for out-of-roundness. If out-of-roundness exceeds 0.178 mm, this is unacceptable. Check the condition of the seal and o-ring, looking particularly for metallic particles embedded in the seal and o-ring surfaces. Remove the seal and o-ring. Damage to the seal grooves, particularly on the sealing surfaces, is unacceptable. If an unacceptable condition exists, replace the piston.
7. Inspect the piston spacer for burrs and sharp edges. If necessary, dress inside diameter surface with Scotch Brite or equivalent.

8. Inspect the cylinder head inside bore for scratches or polishing. Deep scratches are unacceptable. Polishing indicates uneven loading and when this occurs, the bore should be checked for out-of-roundness. If out-of-roundness exceeds 0.178 mm, this is unacceptable. Check for the condition of the dynamic seals, looking particularly for metallic particles embedded in the seal surface. It is normal to cut the static seal on the retaining ring groove upon disassembly. Remove the rod seal, static o-ring, backup ring, and rod wiper. Damage to the seal grooves, particularly on the sealing surfaces, is unacceptable. If an unacceptable condition exists, replace the head.
9. Inspect the port block fittings and holding valve. Replace as necessary.
10. Inspect the oil ports for blockage or the presence of dirt or other foreign material. Repair as necessary.

### • **Assembly.**

#### Notes

Prior to cylinder assembly, ensure that the proper cylinder seal kit is used. Refer to the Illustrated Parts Manual. Apply a light film of hydraulic oil to all components prior to assembly.

#### **⚠ IMPORTANT**

**WHEN INSTALLING NEW "POLY-PAK" TYPE PISTON SEALS, ENSURE SEALS ARE INSTALLED PROPERLY. REFER TO FIGURE 2-7 FOR CORRECT SEAL ORIENTATION. IMPROPER SEAL INSTALLATION COULD RESULT IN CYLINDER LEAKAGE AND IMPROPER CYLINDER OPERATION.**

1. Using round-nose pliers or special installation tools, twist the loaded u-cup seal into a "C" shape and allow it to snap into the groove. Use a similar technique for installing the wiper.
2. Install a new static o-ring and back-up o-ring into the static seal groove, verifying that the back-up o-ring is closest to the threads. Install a new sealing o-ring into the groove between the threads and the flange lip. Install a new wear ring into the inside applicable head groove. If possible, the head/seal assembly should sit for at least one hour to allow the seals to elastically restore.
3. Carefully slide the head assembly onto the cylinder rod, ensuring that the wiper seal, o-ring and wear ring are not damaged or dislodged.

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. Place a new o-ring in the inner piston diameter groove.
6. Carefully place the piston on the cylinder rod, ensuring that the o-ring is 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**

APPLY "LOCQUIC PRIMER T" AND LOCTITE #242 TO PISTON NUT THREADS, THEN TIGHTEN NUT TO TORQUE SHOWN IN TABLE 2-1.

8. Torque the piston nut to the proper torque as outlined in Table 2-1.
9. Remove the cylinder rod from the holding fixture.
10. Install new seals and a new guidelock ring in the applicable outside diameter grooves of the piston.
11. 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.

12. With barrel clamped securely, and while adequately supporting the rod, insert the piston end of the rod into the cylinder barrel. Ensure that the piston seals are not damaged or dislodged.
13. Continue pushing the rod into the barrel until the cylinder head can be inserted into the cylinder barrel.
14. Slide the head into the barrel and engage the threads. Turn the head counterclockwise until the first thread just passes the engagement point (the head will move noticeably), then turn the head clockwise until it is hand-

tight or fully seated. Insert a spanner wrench into the holes provided and tighten 1/8 to 1/4 turn past fully seated.

15. 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.
16. If removed, install the cartridge-type holding valve and fittings in the port block using new o-rings as applicable. Torque the holding valve cartridge to 68-75 Nm.

**2-12. BRAKE CYLINDER REPAIR.**

(See Figure 2-13.)

• **Disassembly.**

**⚠ IMPORTANT**

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

1. Tag and disconnect the hoses from the cylinder ports.

**⚠ WARNING**

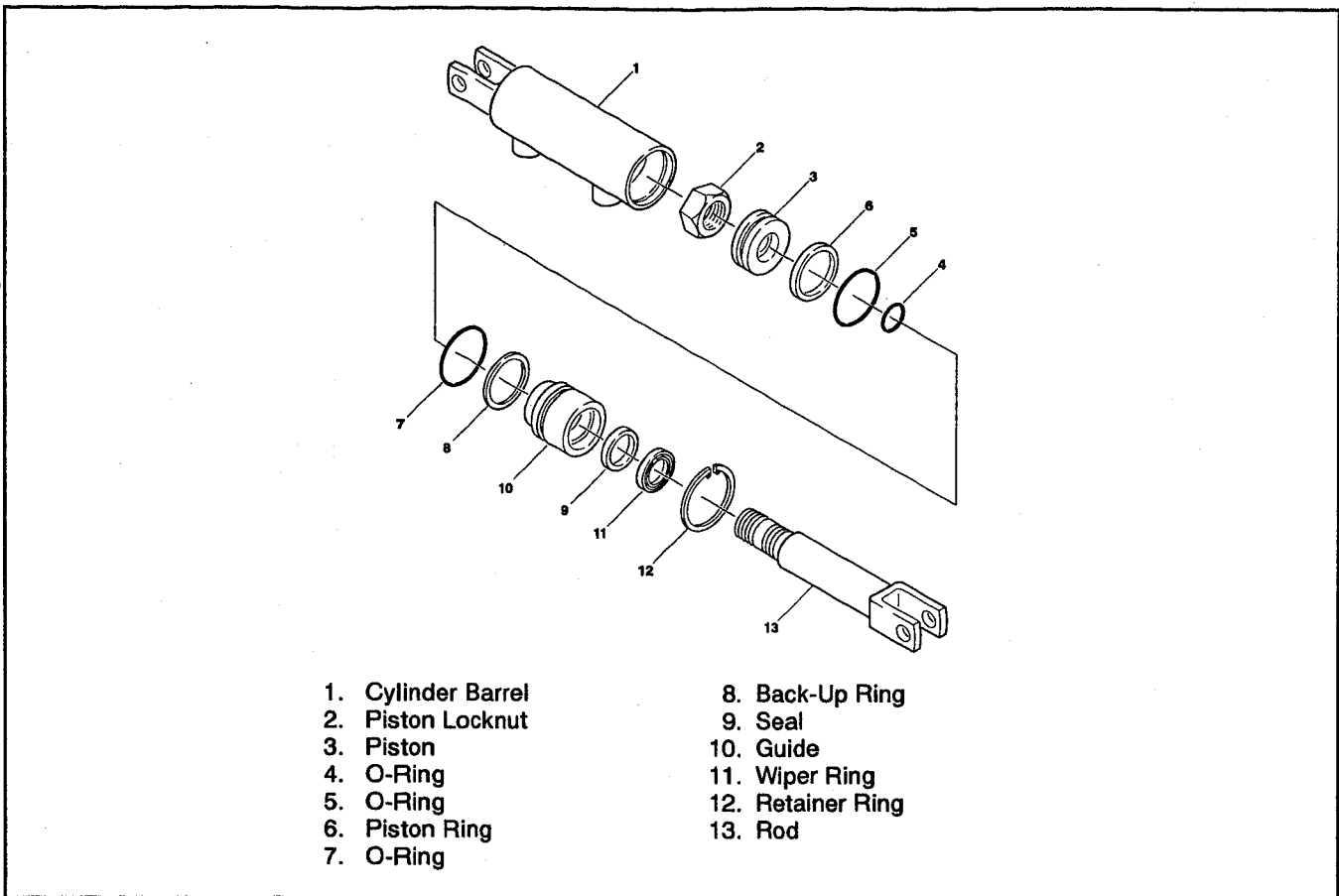
DO NOT FULLY EXTEND CYLINDER TO END OF STROKE. RETRACT CYLINDER SLIGHTLY TO AVOID TRAPPING PRESSURE.

2. Place the cylinder barrel (1) into a suitable holding fixture.
3. Using a suitable pair of snap ring pliers, carefully remove the retaining ring (12) from the cylinder barrel.
4. Attach a suitable pulling device to the cylinder rod end.

**⚠ IMPORTANT**

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

5. With the barrel clamped securely, apply pressure to the rod pulling device and carefully withdraw the complete rod assembly from the cylinder barrel.
6. Using suitable protection, clamp the cylinder rod (13) in a vise or similar holding fixture.



**Figure 2-13. Brake Cylinder Assembly.**

7. Carefully remove the piston locknut (2) and piston (3) from the cylinder rod. Remove and discard the piston ring (6) and o-rings (4 and 5).
8. Carefully remove the guide (10) from the cylinder rod. Remove and discard the o-ring (7), back-up ring (8), rod seal (9), and wiper ring (11).
9. Remove the cylinder rod from the holding fixture.

#### • **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 piston surface for damage and scoring and for distortion. Dress piston surface or replace piston as necessary.
6. Inspect seal and o-ring grooves in piston for burrs and sharp edges. Dress applicable surfaces as necessary.
7. Inspect cylinder guide inside diameter for scoring or other damage and for ovality and tapering. Replace as necessary.
8. Inspect seal and o-ring grooves in guide for burrs and sharp edges. Dress applicable surfaces as necessary.
9. Inspect cylinder guide outside diameter for scoring or other damage and ovality and tapering. Replace as necessary.

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

#### • Assembly.

#### Notes

Prior to cylinder assembly, ensure that the proper cylinder seal kit is used. Refer to the Illustrated Parts manual.

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

- Using suitable protection, clamp the cylinder rod in a vise or similar holding fixture.
- Place a new wiper ring (11), rod seal (9), o-ring (7), and back-up ring (8) into the applicable cylinder guide (10) grooves.
- Carefully install the guide on the rod, ensuring that the wiper ring and rod seal are not damaged or dislodged. Push the guide onto the rod.
- Place a new piston ring (6) and o-rings (4 and 5) on the piston.
- Carefully place the piston on the threaded end of the cylinder rod, ensuring that the o-ring is not damaged or dislodged. Push the piston onto the rod as far as it will go.
- Install the piston locknut (2) on the threaded end of the cylinder rod and torque to 136-163 Nm.
- Remove the cylinder rod from the holding fixture.
- Position the cylinder barrel in a suitable holding fixture.

#### ⚠ DANGER

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

- With the barrel clamped securely, and while adequately supporting the cylinder rod, insert the piston end of the rod into the cylinder barrel. Ensure that the piston ring and o-ring are not damaged or dislodged.
- Continue pushing the rod into the barrel until the cylinder guide can be inserted into the cylinder barrel.
- Using all applicable safety precautions, secure the cylinder rod assembly with a new retaining ring (12).

- Reconnect the hydraulic hoses to the applicable cylinder ports.

#### 2-13. STEER CYLINDER REPAIR.

(See Figure 2-14.)

#### • Disassembly.

#### ⚠ IMPORTANT

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

- Tag and disconnect the hoses from the cylinder ports.

#### ⚠ WARNING

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

- Place the cylinder barrel (6) into a suitable holding fixture.
- Using a suitable hammer, tap around the outside of the cylinder barrel and guide (2) to shatter the Loctite.
- Using a suitable spanner wrench, carefully remove the guide from the rod clevis end of the cylinder barrel.
- Attach a suitable pulling device to the clevis end of cylinder rod section one (7).

#### ⚠ IMPORTANT

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

- With the barrel clamped securely, apply pressure to the rod pulling device and carefully withdraw the complete rod assembly from the cylinder barrel.
- Using a suitable hammer, tap around the outside of the cylinder barrel and guide (2) to shatter the Loctite.
- Using a suitable spanner wrench, carefully remove the remaining guide (2) from the cylinder barrel. Remove and discard the wiper ring (1), rod seal (3), back-up ring (4) and o-ring (5).
- Using suitable protection, clamp cylinder rod section two (7a) in a vise or similar holding fixture.

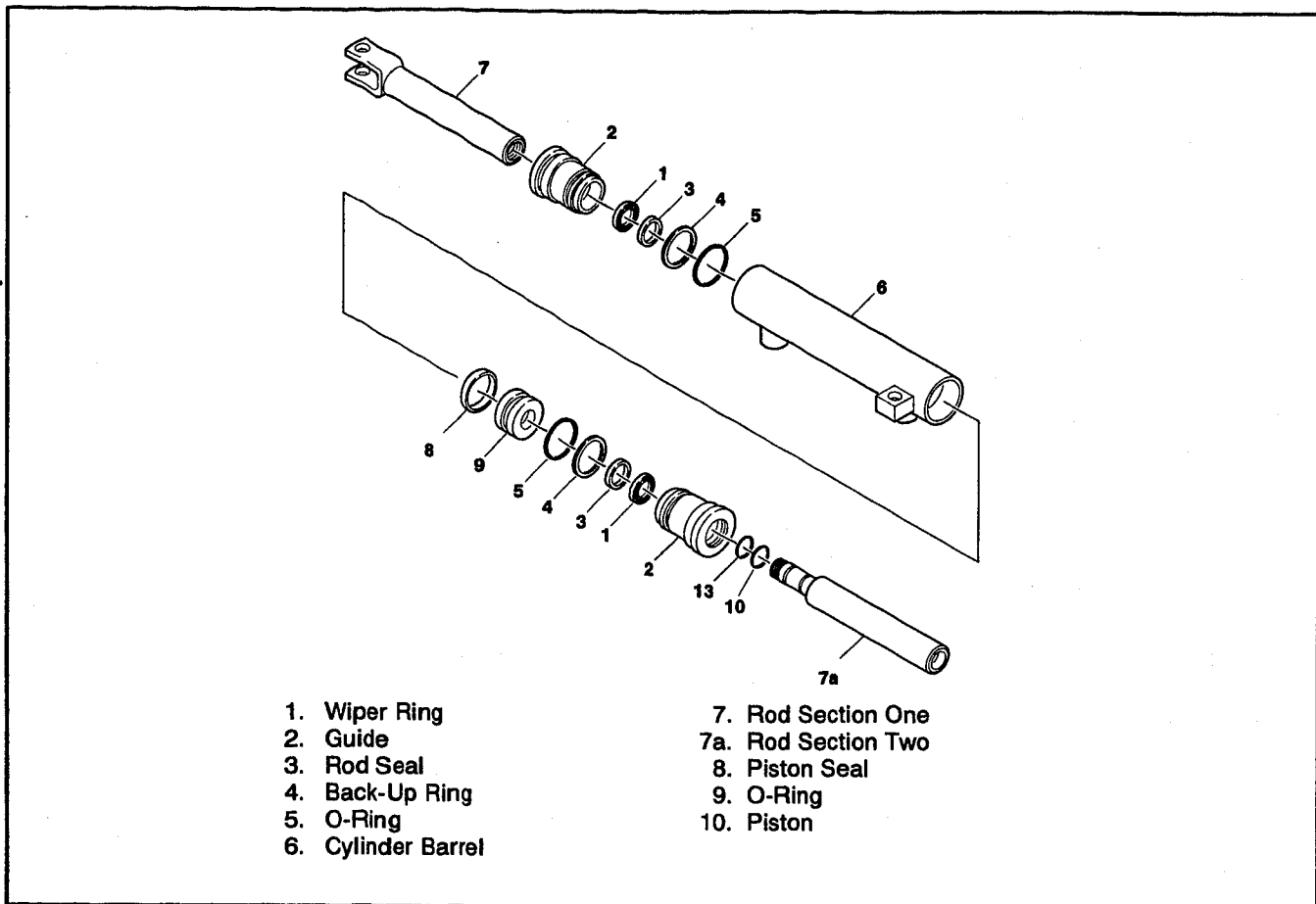


Figure 2-14. Steer Cylinder Assembly.

10. Carefully remove cylinder rod section one (7) from cylinder rod section two (7a) and carefully remove the piston (10) from the cylinder rod. Remove and discard the piston seal (8) and o-ring (9).
11. Carefully remove the guide (2) from cylinder rod section one. Remove and discard the o-ring (5), back-up ring (4), rod seal (3), and wiper ring (1).
12. Remove the cylinder rod from the holding fixture.

#### • 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 piston surface for damage and scoring and for distortion. Dress piston surface or replace piston as necessary.
6. Inspect seal and o-ring grooves in piston for burrs and sharp edges. Dress applicable surfaces as necessary.
7. Inspect cylinder guide inside diameter for scoring or other damage and for ovality and tapering. Replace as necessary.
8. Inspect seal and o-ring grooves in guide for burrs and sharp edges. Dress applicable surfaces as necessary.
9. Inspect cylinder guide outside diameter for scoring or other damage and ovality and tapering. Replace as necessary.



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

### • Assembly

#### Notes

Prior to cylinder assembly, ensure that the proper cylinder seal kit is used. Refer to the Illustrated Parts Manual.

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

1. Using suitable protection, clamp the cylinder rod section one (7) in a vise or similar holding fixture.
2. Place a new wiper ring (1), rod seal (3), o-ring (5), and back-up ring (4) into the cylinder rod guide (2) grooves.
3. Carefully install the cylinder rod guide on rod section one, ensuring that the wiper ring and rod seal are not damaged or dislodged. Push the guide onto the rod section.
4. Place a new piston ring (8) on the piston (10) and a new o-ring (9) on the threaded end of cylinder rod section two (7a).
5. Carefully place the piston on the threaded end of cylinder rod section two, ensuring that the o-ring is not damaged or dislodged. Push the piston onto the rod as far as it will go.
6. Attach cylinder rod section one to the threaded end of cylinder rod section two and assemble.
7. Remove the cylinder rod assembly from the holding fixture.
8. Position the cylinder barrel in a suitable holding fixture.

#### ⚠ IMPORTANT

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

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

10. Continue pushing the rod into the barrel until the cylinder rod guide can be inserted into the end of the cylinder barrel.
11. Coat the threads of the cylinder rod guide with Loctite #242 then secure the cylinder rod guide to the cylinder barrel using a suitable spanner wrench.
12. On the remaining cylinder rod guide (2), place a new wiper ring (1), rod seal (3), o-ring (5), and back-up ring (4) into the cylinder rod guide grooves.
13. Carefully install the cylinder rod guide onto rod section two and slide the guide into the end of the cylinder barrel.
14. Coat the threads of the cylinder rod guide with Loctite #242 then secure the cylinder rod guide to the cylinder barrel using a suitable spanner wrench.
15. Reconnect the hydraulic hoses to the applicable cylinder ports.

### 2-14. TILT SWITCH ADJUSTMENT.

#### Note

The machine is equipped with a tilt switch (sensor), factory set to activate when the machine is out of level in any direction at 2 degrees. The switch may illuminate a light, sound an alarm, or cut out a function, depending on the machine specification. Refer to Section 1 for tilt switch function specifications. Consult factory for tilt sensor adjustment. The only field adjustment necessary is leveling the switch on the spring loaded studs. 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.**

### • Manual Adjustment. (See Figure 2-15.)

1. Park the machine on a flat, level surface and ensure the machine is level.

#### Note

Ensure switch mounting bracket is level and securely attached.

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

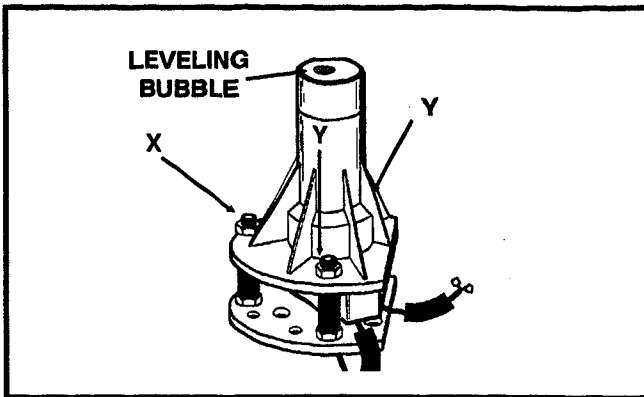


Figure 2-15. Tilt Switch Leveling - Manual Adjustment.

3. With the electrical connections complete, slowly tighten one of the "Y" nuts until the circuit is closed (the light on the Platform Control Console illuminates, the tilt alarm sounds).
4. Slowly back off the nut, counting the number of turns, until the circuit is closed again.

5. Divide the number of turns determined in step 4 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.

• **Voltmeter Adjustment. (See Figure 2-16.)**

1. Park the machine on a flat, level surface and ensure the machine is level.
2. If the motor is not running, turn the ignition switch to ON.
3. Connect the black lead of the voltmeter to ground and the red lead to the yellow wire protruding from the pot on the bottom of the sensor.

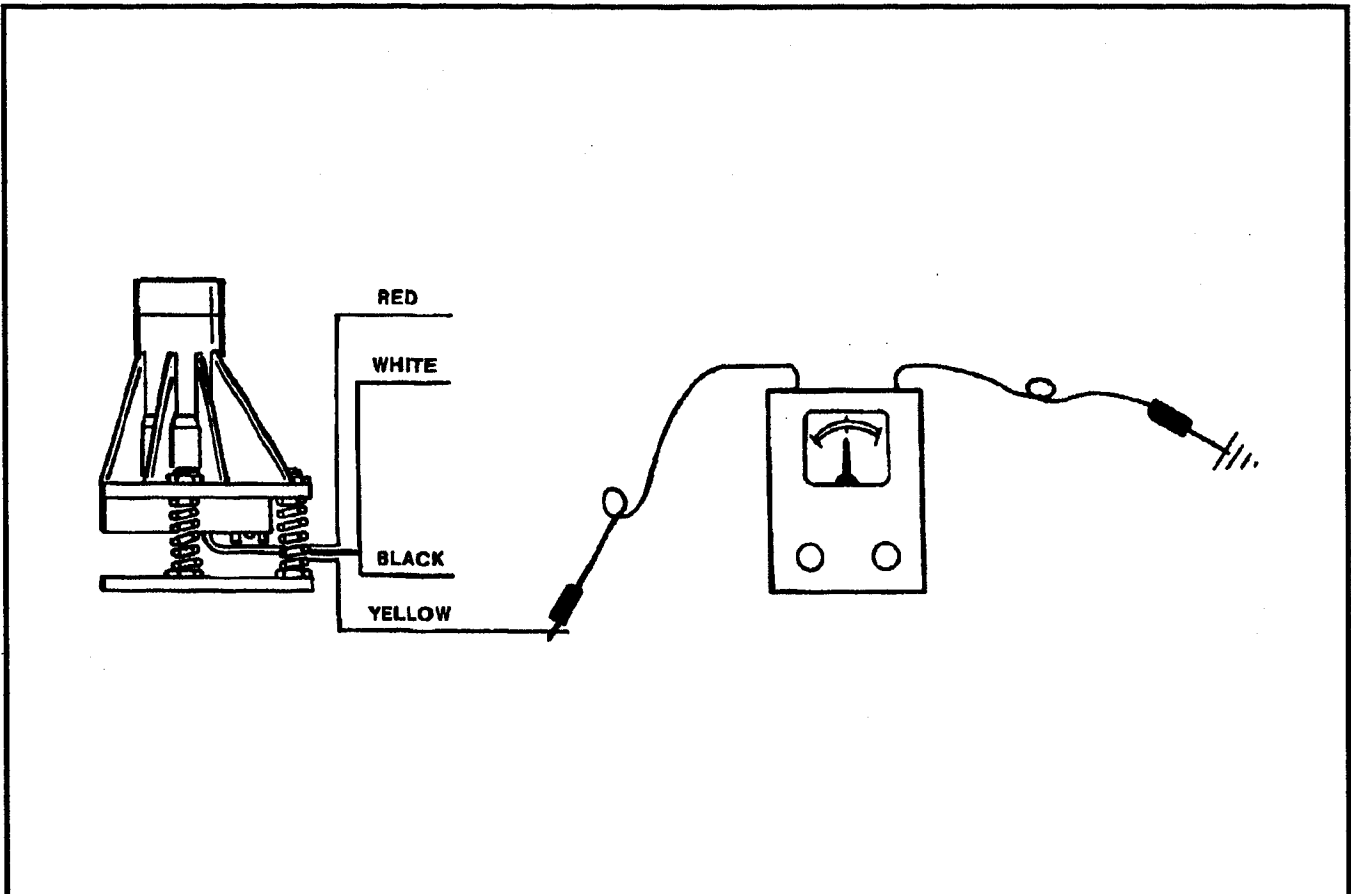


Figure 2-16. Tilt Switch Leveling - Voltmeter Adjustment.

4. Adjust the leveling nuts to obtain the highest possible voltage reading.
5. Check the voltage at the trip point in all four directions. If the voltage reading is not symmetrical, repeat step 4 above.

## 2-15. LIMIT SWITCH ADJUSTMENT.

### • Platform Limit Switch.

The platform limit switch is located on the left side of the frame of the machine. When activated, the switch cuts out the High Drive function. Adjust the switch to activate when the platform is raised above the stowed position.

### • Deck Interlock Switch. (French and Italian Specification.)

The deck interlock switch is located on the right front of the machine platform. When activated, the switch cuts out the LIFT DOWN function and activates the platform alarm when the operator tries to activate the function. Adjust the switch to activate when the manual deck extension is extended and to de-activate when the platform extension is retracted.

### • Drive Cut-Out Switch. (Models 1532E, 1932E and 2646E Only.)

The drive cut-out switch is located on the right front of the machine frame at the right front scissor arm. When activated, the switch cuts out the DRIVE function when the platform is raised to the specified height. Adjust the switch to activate at the following platform heights:

Model 1532E - 4 meters

Model 1932E - 4.25 meters

Model 2646E - 7 meters

## 2-16. PRESSURE SETTING PROCEDURES.

(See Figure 2-17.)

### Notes

Make all pressure adjustments with motor operating and hydraulic oil at normal operating temperature. In addition, all functions must be operated from the platform control station in order to achieve full pump speed. It may be necessary to use an assistant to adjust the pressure settings while operating the functions from the platform control station.

Steer and Lift functions are governed by M1. Drive is governed by M2.

### ⚠ IMPORTANT

E SERIES SCISSOR LIFTS ARE EQUIPPED WITH EITHER POWER LIFT DOWN, WHICH REQUIRES A LIFT DOWN RELIEF ADJUSTMENT, OR GRAVITY LIFT DOWN, WHICH DOES NOT. TO IDENTIFY POWER LIFT DOWN AND GRAVITY LIFT DOWN MACHINES, REFER TO THE EFFECTIVITY PAGE FOR MACHINE SERIAL NUMBER IDENTIFICATION.

### • Lift Relief Adjustments.

1. Install a pressure gauge at gauge port M1, located at the bottom rear of the valve body. The port is identified by a stamping on the valve body.
2. Disconnect the hose from valve port 3, then plug the hose and the valve port.
3. From the platform control station, activate the Lift Up function by pressing the LIFT switch and activating the controller to the full forward position.

4. While monitoring the pressure gauge at M1, adjust the Lift Up relief as follows:

Power Lift Down Machines - All - 145 bar + / - 7 bar.

Gravity Lift Down Machines.

1532E - 114 bar.

1932E - 141 bar.

2033E - 117 bar.

2046E - 141 bar.

2646E - 138 bar.

2658E - 159 bar.

### Note

Steps 5 through 7 apply only to those machines equipped with Power Lift Down. Machines equipped with Gravity Lift Down have no adjustment.

5. Remove the plugs from valve port 3 and the applicable hose, then reconnect the hose to valve port 3.
6. From the platform control station, activate the Lift Down function by pressing the LIFT switch and activating the controller to the full rearward position, bottoming out the LIFT DOWN function.
7. Adjust the Lift Down relief to 55 bar.
8. If adjusting the steer pressure, proceed to **Steer Adjustment**; if not, remove the pressure gauge from gauge port M1.

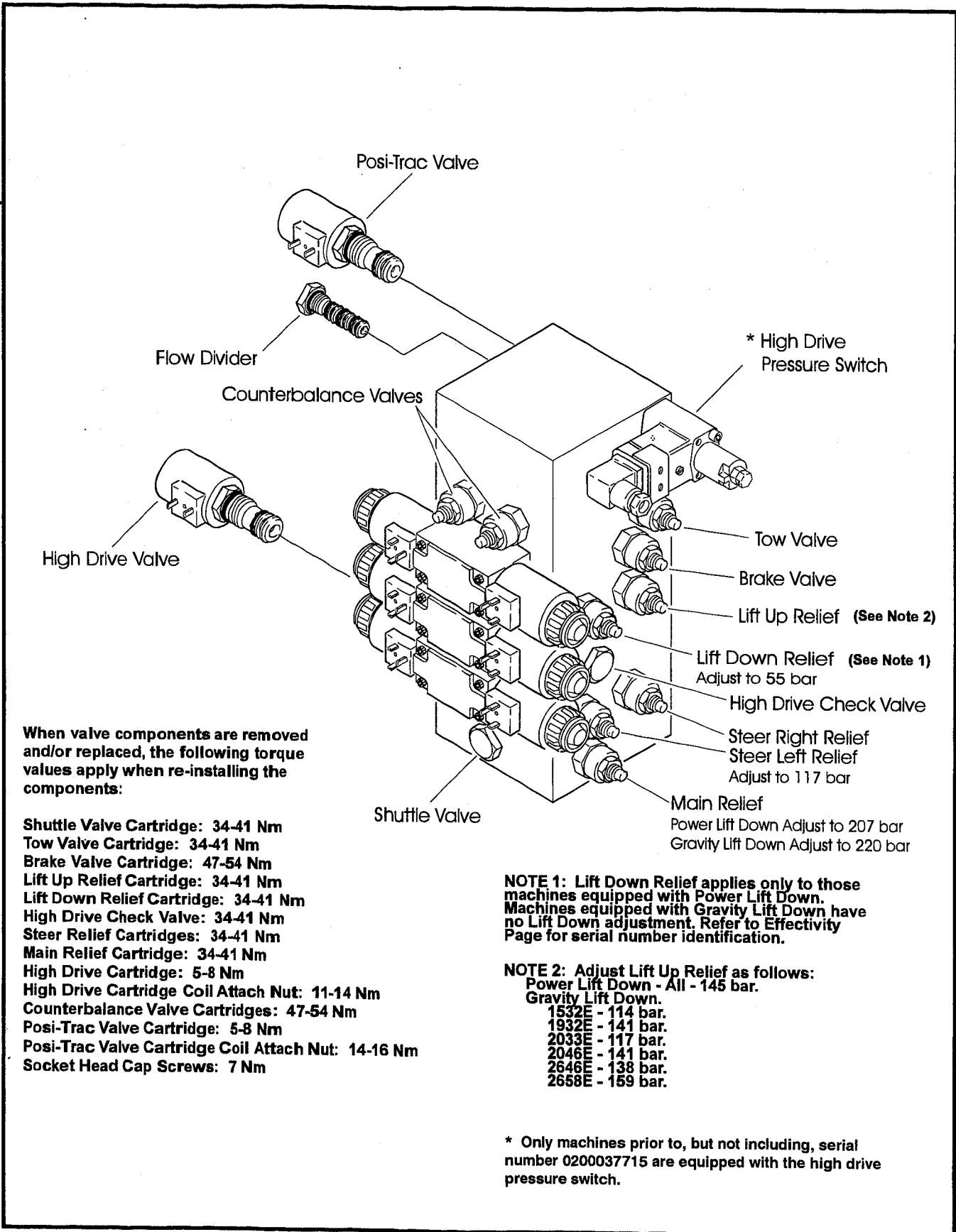


Figure 2-17. Pressure Setting Adjustments

### • Steer Adjustment.

1. If necessary, connect a pressure gauge to gauge port M1, then open the Steer/Tow valve.
2. Activate drive by pressing the DRIVE switch and activating the controller to the full forward position. While holding the controller, activate Steer Right and check Steer Right pressure. If necessary, adjust Steer Right pressure to 117 bar.
3. Activate drive by pressing the DRIVE switch and activating the controller to the full forward position. While holding the controller, activate Steer Left and check Steer Left pressure. If necessary, adjust Steer Left pressure to 117 bar.
4. Close the Steer/Tow valve.

### • Main Relief and High Drive Pressure Switch Adjustment.

1. Install a pressure gauge at gauge port M2, located at the bottom front of the valve body. The port is identified by a stamping on the valve body.
2. Disconnect the drive hose from port 8 on the valve body, then plug the hose and the valve port.
3. Remove the wires from the high drive pressure switch and perform a continuity check using a voltmeter.
4. Activate drive by pressing the DRIVE switch and activating the controller to the full forward position.
5. Monitor the voltmeter to ensure the pressure switch is activated when the hydraulic pressure reaches 76 bar. Adjust the pressure switch as necessary.
6. From the platform control station, activate Drive by pressing the DRIVE switch and activating the controller to the full forward position.
7. While monitoring the pressure gauge at M2, adjust P2 to 220 bar + 3.4 / - 0 bar.
8. Remove the plugs from the drive hose and port 8, then reconnect the drive hose to port 8.

### 2-17. Pothole Protection System Limit Switch Adjustment.

#### Note

To identify power Lift Down and gravity Lift Down machines, refer to the effectivity page for serial number identification.

### • Machines with Power Lift Down. (See Figure 2-18.)

1. With the pothole protection system in the down position as shown and the limit switch installed, loosen the switch arm adjusting bolt to permit the arm to move freely.
2. Rotate the arm until it contacts the pivot bar, then slide the arm in the adjusting slot until a 6.35 cm radius is obtained as shown in Figure 2-18.
3. Tighten the bolt to lock the arm in this position.
4. Repeat the adjustment procedure for the limit switch on the opposite side of the machine.

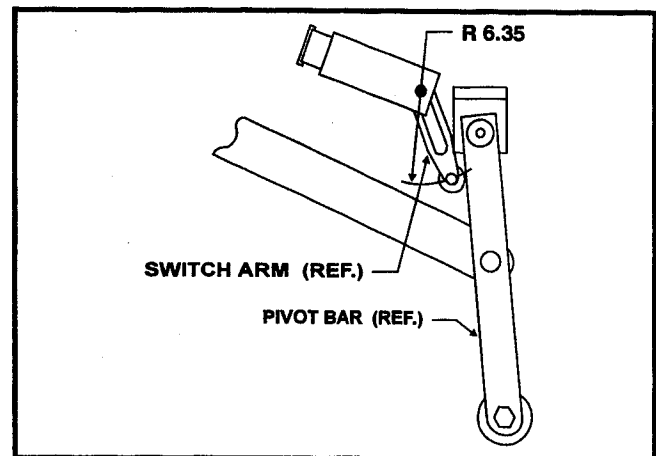


Figure 2-18. Pothole Protection System Limit Switch Adjustment. (Power Lift Down)

• **Machines with Gravity Lift Down.**  
 (See Figure 2-19.)

1. With the pothole protection system in the fully down position, mount the limit switch as shown in Figure 2-19.
2. Adjust the switch to provide for 1.6 mm maximum clearance between the roller and the cam.
3. Tighten the switch mounting hardware.
4. Repeat the adjustment procedure for the limit switch on the opposite side of the machine.

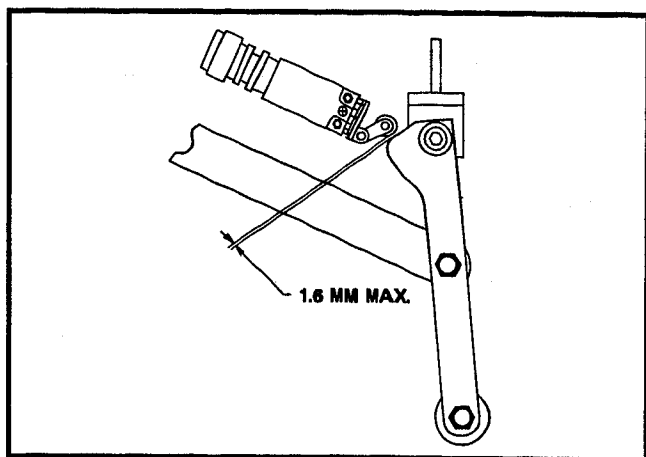


Figure 2-19. Pothole Protection System Limit Switch Adjustment. (Gravity Lift Down)

**2-18. JLG SMART SYSTEM™.**

The JLG SMART System™ uses a 24 Volt multiplex motor control unit, working in conjunction with a joystick controller and several switches, to operate all machine functions.

The SMART System™ has a built-in LED to indicate any faults which occur during operation of the machine. The system also stores the last ten trouble faults for use in troubleshooting the machine. Each fault is indicated by a first sequence of flashes, then a short pause, followed by a second sequence, then a long pause before everything repeats.

When a fault occurs in normal operation, the flash fault repeats while the fault is present; as far as possible normal operation continues. If there is more than one fault present, the 'most important two' will be indicated alternately. Faults are grouped according to the first digit; the second digit provides an extra diagnostic indication. Refer to Table 2-3 for flash fault codes.

In addition, the control unit may be programmed for any future options that are added to the machine. The SMART System™ may be adjusted using a custom designed calibrator or special system software installed on a personal computer (PC), preferably a laptop, operating under DOS or Windows. Both the analyzer (JLG kit no. 2901443) and the computer software (JLG kit no. 2900874) are available from JLG and include a connecting cable and SMART System™ adjustment procedures. Refer to Section 3 for SMART System™ troubleshooting procedures.

**⚠ IMPORTANT**

**WHEN INSTALLING A NEW SMART SYSTEM CONTROLLER ON THE MACHINE, IT WILL BE NECESSARY TO PROGRAM THE CONTROLLER FOR THE PROPER MACHINE CONFIGURATION, INCLUDING OPTIONS. REFER TO ANALYZER KIT NO. 2901443 OR COMPUTER SOFTWARE KIT NO. 2900874 FOR PROGRAMMING INSTRUCTIONS. MACHINES EQUIPPED WITH GRAVITY LIFT DOWN (SEE EFFECTIVITY PAGE) MUST BE PROGRAMMED FOR GRAVITY LIFT DOWN AT CONTROLLER REPLACEMENT.**

**⚠ IMPORTANT**

**WHEN INSTALLING A NEW SMART SYSTEM CONTROLLER ON THE MACHINE, ELECTRICAL SILICONE GREASE, JLG PART NUMBER 0100076 OR 7016397, MUST BE APPLIED TO THE BACK OF THE CONTROLLER.**

Table 2-3. JLG SMART System™ Flash Fault Codes.

Code	Fault
1-1	Idle time-out
2-1	EMS inputs (both together, or neither)
2-2	Platform (digital) inputs (includes high drive for > 10 seconds)
2-3	Ground (digital) inputs
2-4	Steering (digital) inputs
2-5	Cut-out input (not a fault but an indication)
2-7	Accelerator (analog) input
3-1	Line contactor open circuit or welded
3-3	Line contactor (or other) driver short circuit (or tripped)
4-2	Temperature cut back
4-4	Battery supply voltage out of range
9-1	Watchdog reset
9-2	EEPROM Fault
9-3	Mux stream not being updated
9-6	Point A short circuit
9-7	Point A open circuit
9-8	Motor open circuit
9-9	power circuit failure (driver short circuit, bat/cap < 15V)

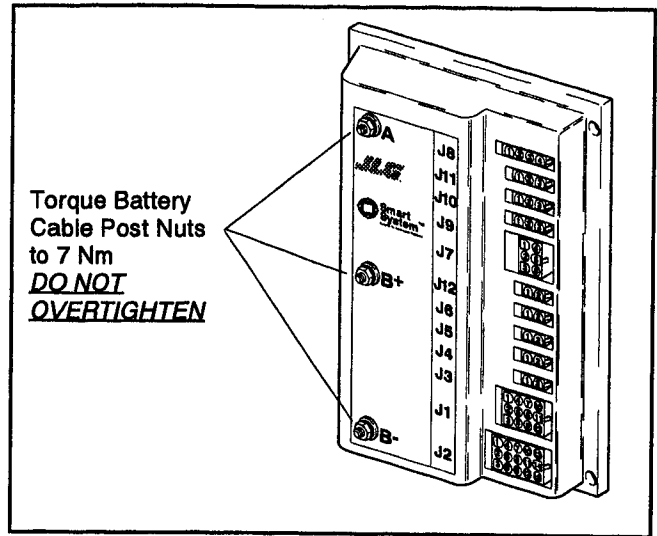


Figure 2-20. JLG SMART System™ Controller.

**⚠ IMPORTANT**

IT IS A GOOD PRACTICE TO AVOID PRESSURE-WASHING ELECTRICAL/ELECTRONIC COMPONENTS. SHOULD PRESSURE-WASHING BE UTILIZED TO WASH AREAS CONTAINING ELECTRICAL/ELECTRONIC COMPONENTS, JLG INDUSTRIES, INC. RECOMMENDS A MAXIMUM PRESSURE OF 52 BAR (750 PSI) AT A MINIMUM DISTANCE OF 30.5 CM (12 INCHES) AWAY FROM THESE COMPONENTS. IF ELECTRICAL/ELECTRONIC COMPONENTS ARE SPRAYED, SPRAYING MUST NOT BE DIRECT AND BE FOR BRIEF TIME PERIODS TO AVOID HEAVY SATURATION.

**2-19. PREVENTIVE MAINTENANCE AND INSPECTION SCHEDULE.**

The preventive maintenance and inspection checks are listed and defined in the following table. This table is divided into two basic parts, the "AREA" to be inspected and the "INTERVAL" at which the inspection is to take place. Under the "AREA" 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.

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

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

**Note**

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

The inspection and maintenance code numbers are as follows:

1. Check for proper and secure installation.
2. Check for visible damage and legibility.
3. Check for proper fluid level.
4. Check for any structural damage; cracked or broken welds; bent or warped surfaces.
5. Check for leakage.
6. Check for presence of excessive dirt or foreign material.
7. Check for proper operation and freedom of movement.
8. Check for excessive wear or damage.
9. Check for proper tightness and adjustment.
10. Drain, clean and refill.
11. Check for proper operation while pump/motor 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. Check Inspection Decal for current inspection stamp.



Table 2-4. Preventive Maintenance and Inspection Schedule.

PREVENTIVE MAINTENANCE AND INSPECTION SCHEDULE						
AREA	INTERVAL					
PLATFORM	DAILY	WEEKLY	MONTHLY	3 MONTH	6 MONTH	1 YEAR
1. Controller (If Equipped)	1,11					
2. Switches	1,11					
3. Placards and Decals	1,2					
4. Control Tags	1,2					
5. Hose and Cable		4,8				
6. Wear Pads			8			
7. Handrail and Chains	1,4					
<b>CHASSIS</b>						
1. Batteries	3	5				
2. Battery Charger	1					
3. Hydraulic Pump/Motor	1	5				
4. Valves	1	5				
5. Hydraulic Filter (See Lubrication Chart)		5			14	
6. Hydraulic Hoses and Tubing	1	5				
7. Hydraulic Oil Tank *	3	5	4			
8. Hydraulic Tank Breather		6				14
9. Lift Cylinder	1,12	5,6,13	4			
10. Limit Switch	1,7					
11. Placards and Decals	1,2					16
12. Wheel and Tire Assemblies	1	8,9				
13. Drive Motors		1,5,6				
14. Drive Brake		1,6	8			
15. Steer Cylinder	1	5,6,13	4			
16. Steer Components	1	4,6	8			12
17. Wheel Bearings			8			
18. Sizzor Arms	1,4					
19. Safety Prop	1,4					
20. Wear Pads			8			
21. Pivot Pins/Bolts	1,4		7,8			
22. Switches, Ground Control	1,11					
23. Control Tags	1,2					
24. Placards and Decals	1,2					
25. Hose and Cable	1	4,8				

\* Inspection and Maintenance Code 10 to be performed every two years (1200 hours).

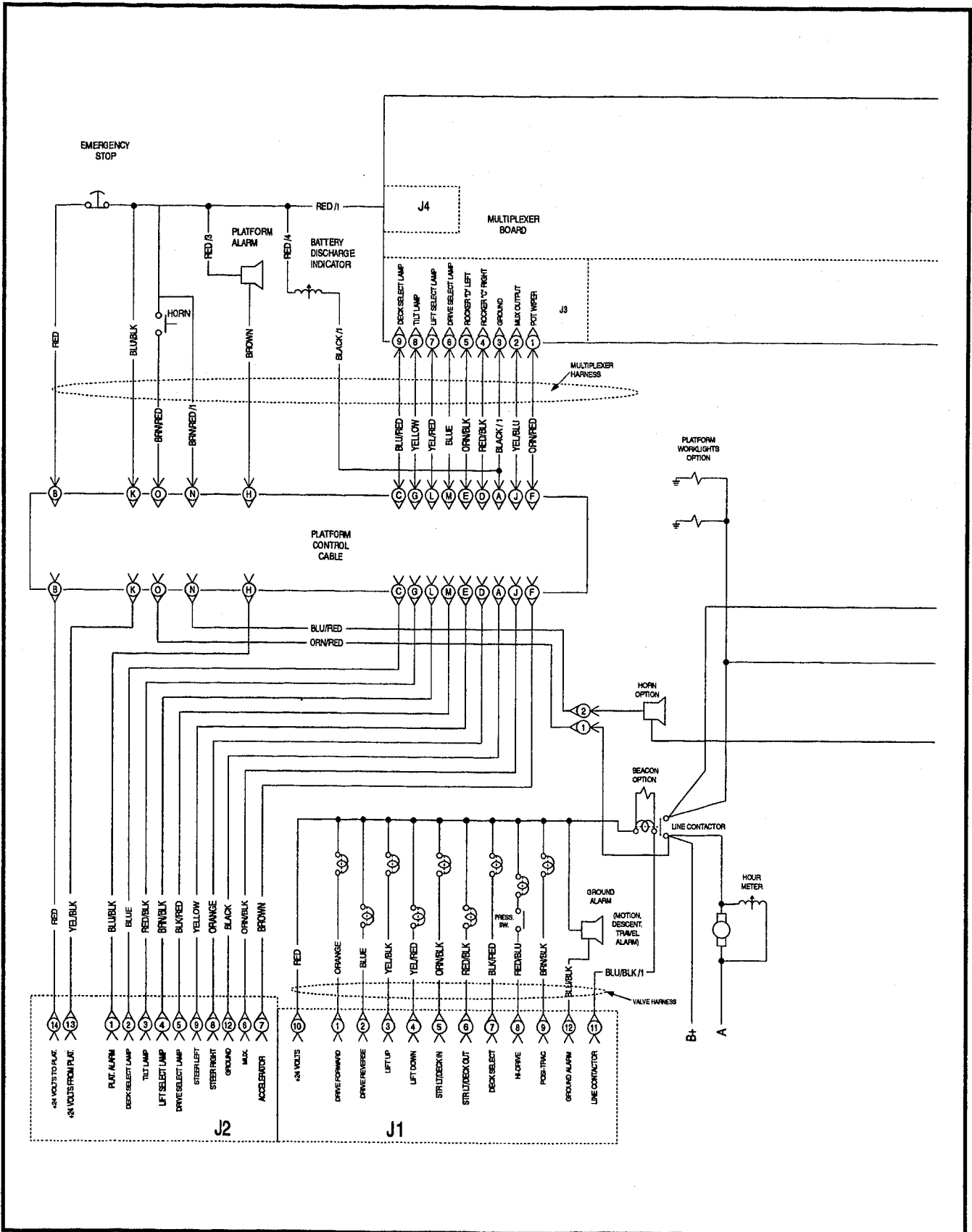


Figure 2-21. Electrical Schematic - Power Lift Down Machines. (Sheet 1 of 2)

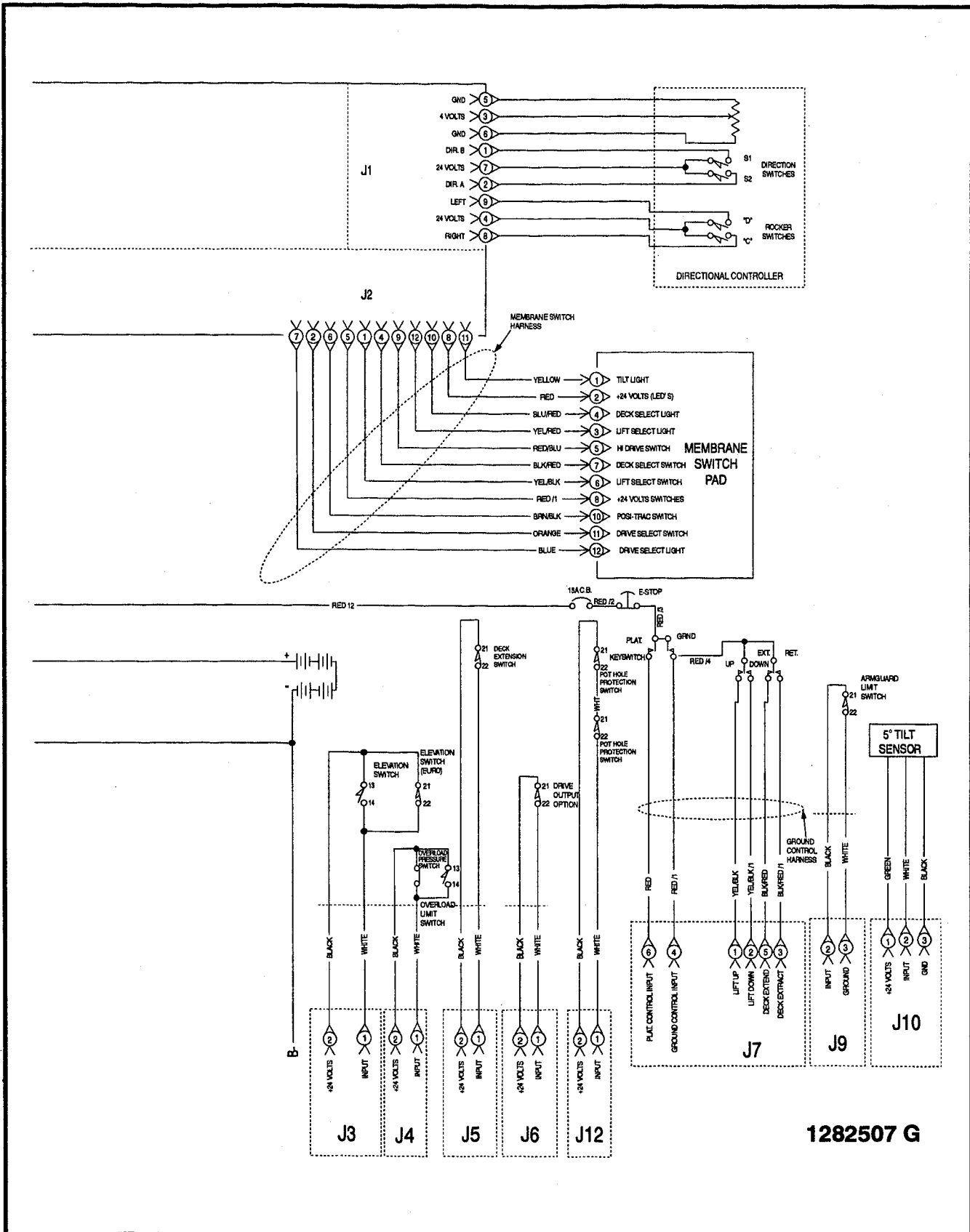


Figure 2-21. Electrical Schematic - Power Lift Down Machines. (Sheet 2 of 2)

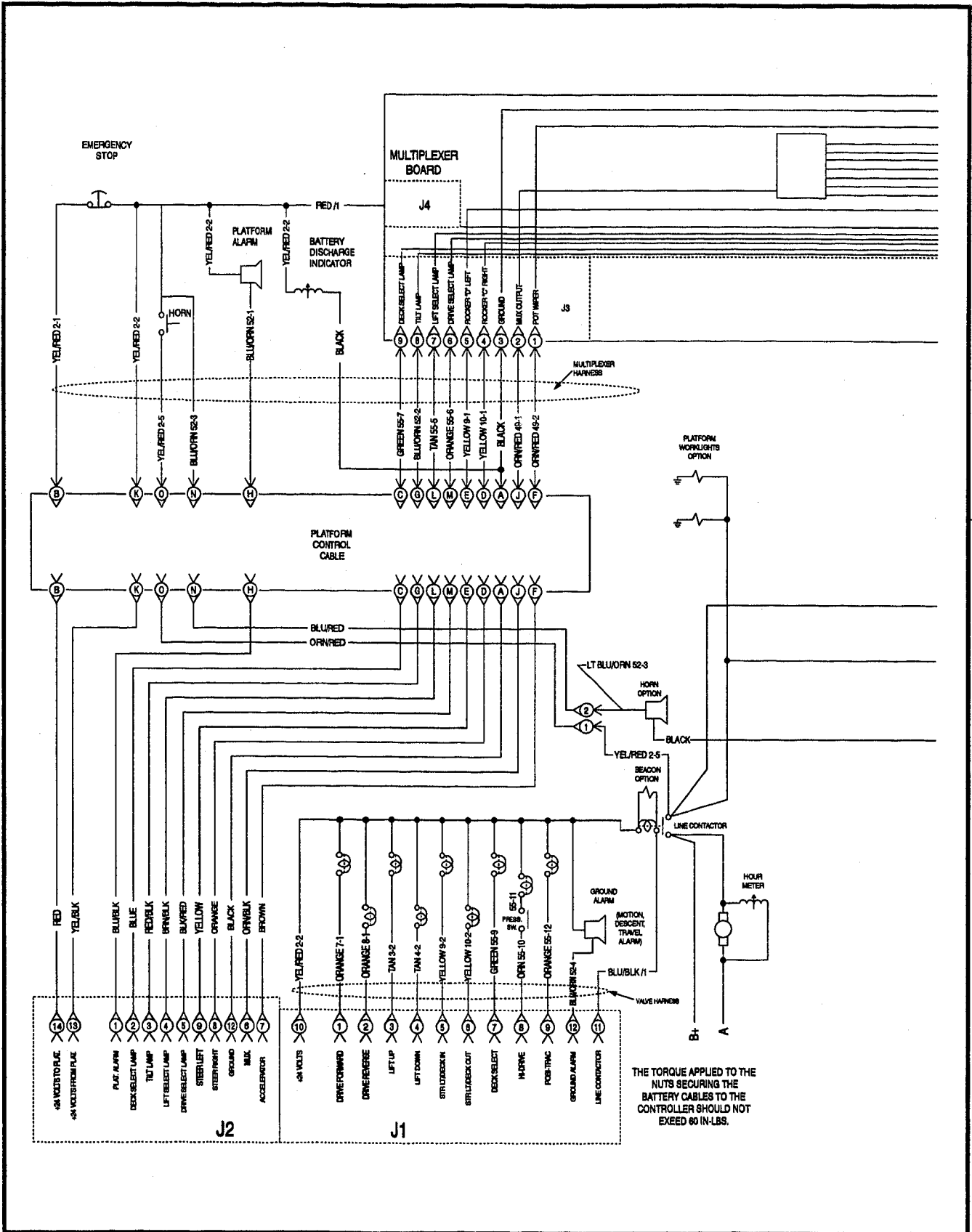


Figure 2-22. Electrical Schematic - Gravity Lift Down Machines. (Sheet 1 of 2)

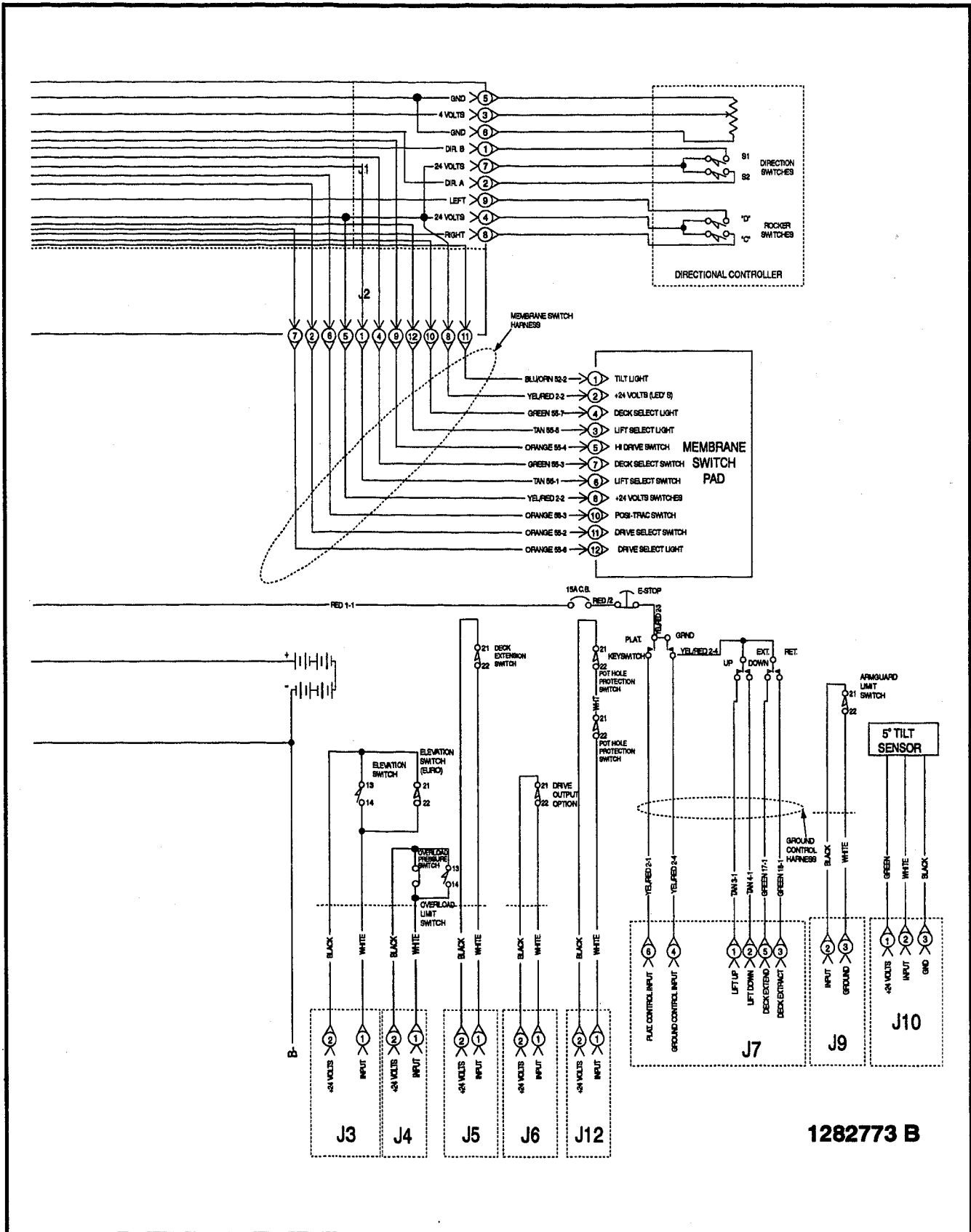


Figure 2-22. Electrical Schematic - Gravity Lift Down Machines. (Sheet 2 of 2)

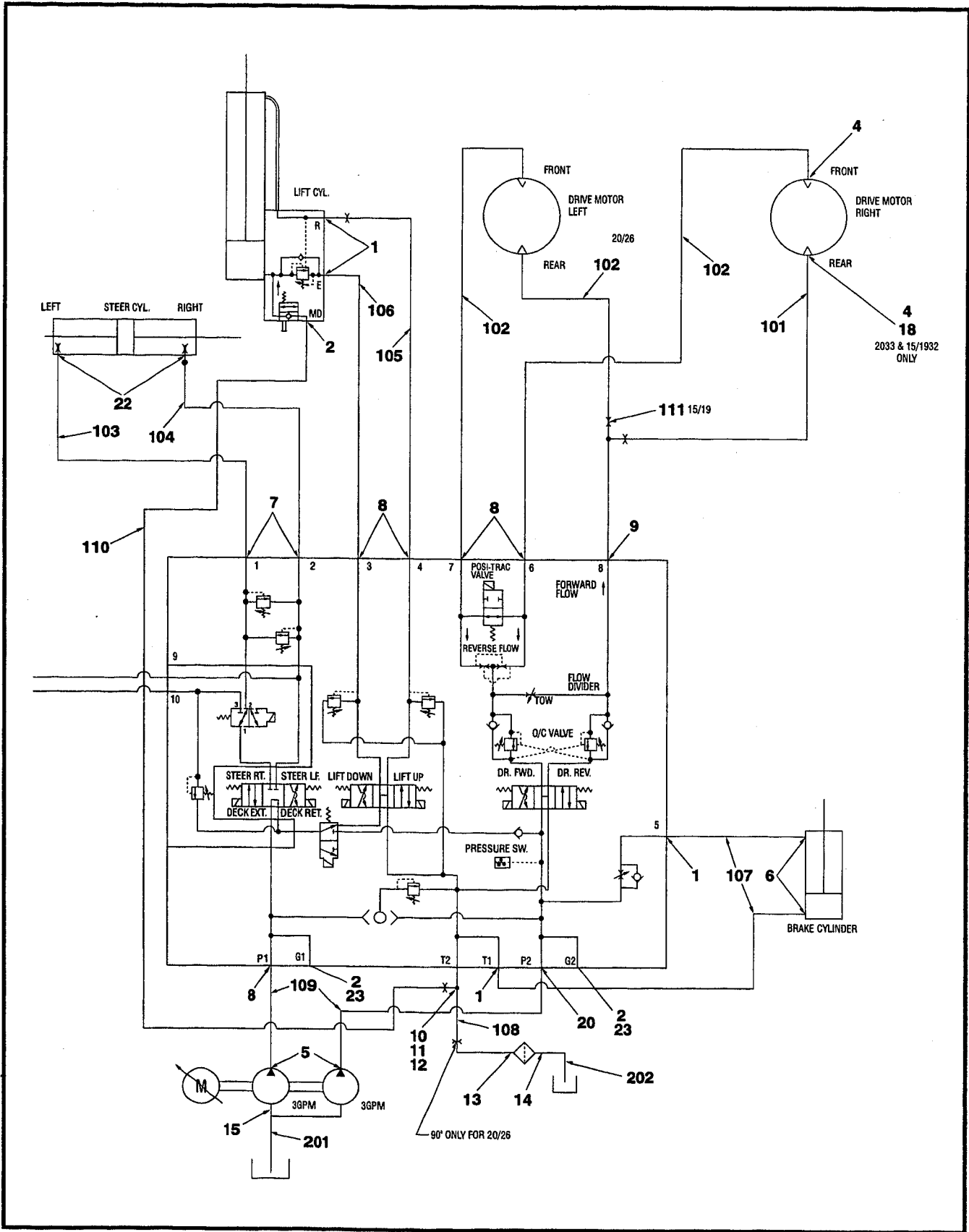


Figure 2-23. Hydraulic Diagram - Standard - Power Lift Down Machines.

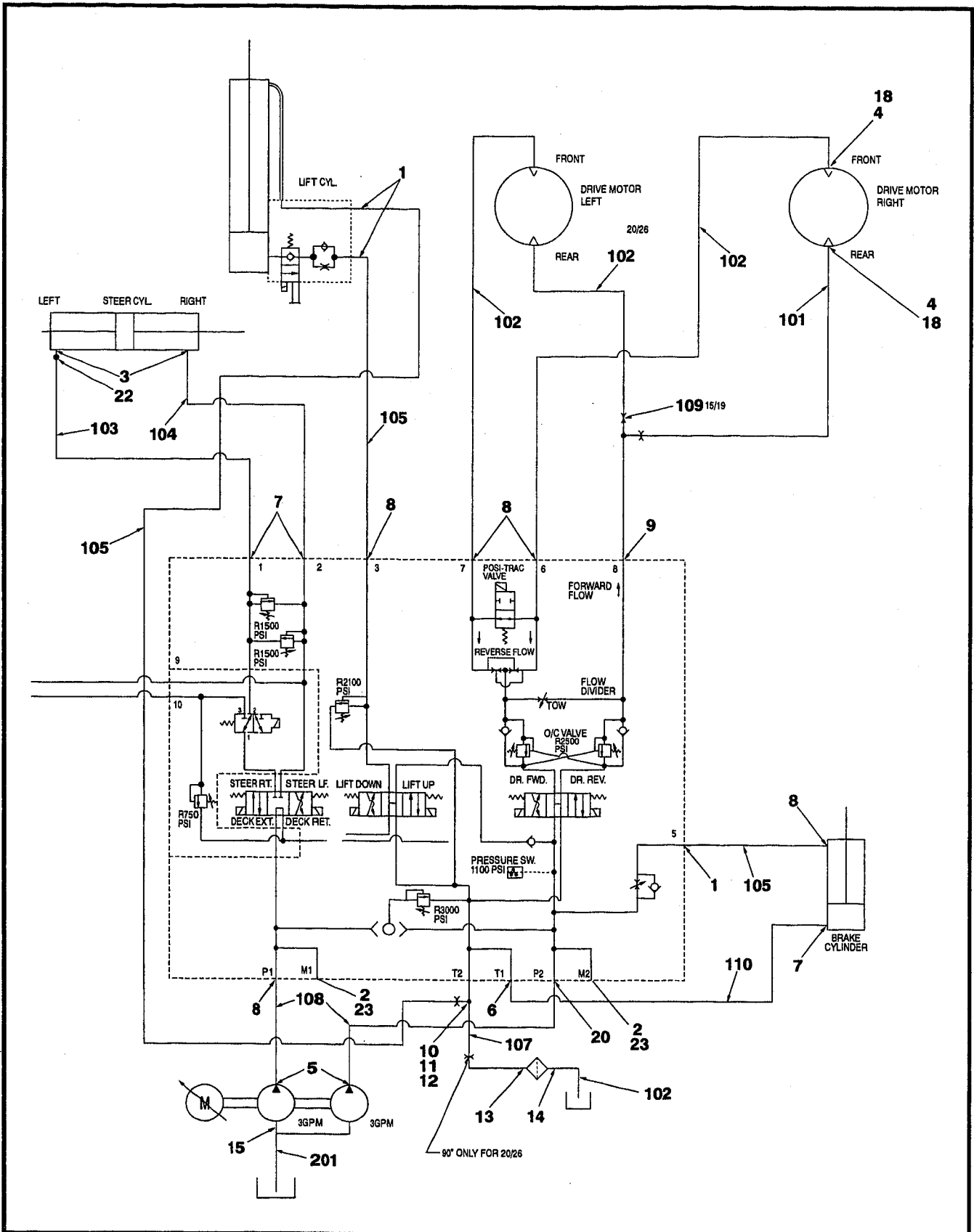


Figure 2-24. Hydraulic Diagram - Standard - Gravity Lift Down Machines.





### 3-1. GENERAL.

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.

### 3-2. TROUBLESHOOTING INFORMATION.

The troubleshooting procedures applicable to the aerial platform are listed and defined in Table 3-2, JLG SMART System™ Troubleshooting, and Table 3-3, Hydraulic System Troubleshooting.

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

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

It should be recognized that the majority of the problems arising in the machine will be centered in the hydraulic and electrical systems. For this reason, every effort has been made to ensure that all likely problems in these areas are given the fullest possible treatment. In the remaining machine groups, only those problems which are symptomatic of greater problems which have more 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.

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

### 3-3. HYDRAULIC CIRCUIT CHECKS.

The 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 check of the circuit components, beginning with the control, would follow. For aid in troubleshooting, refer to the Illustrated Parts Manual for hydraulic diagrams of the various circuits.

### 3-4. JLG SMART SYSTEM™.

The JLG SMART System™ uses a 24 Volt multiplex motor control unit, working in conjunction with a joystick controller and several switches, to operate all machine functions.

The SMART System™ has a built-in LED to indicate any faults which occur during operation of the machine. The system also stores the last ten trouble faults for use in troubleshooting the machine. Each fault is indicated by a first sequence of flashes, then a short pause, followed by a second sequence, then a long pause before everything repeats.

When a fault occurs in normal operation, the flash fault repeats while the fault is present; as far as possible normal operation continues. If there is more than one fault present, the 'most important two' will be indicated alternately. Faults are grouped according to the first digit; the second digit provides an extra diagnostic indication. Refer to Table 3-1 for flash fault codes.

In addition, the control unit may be programmed for any future options that are added to the machine. The SMART System™ may be adjusted using a custom designed analyzer or special system software installed on a personal computer (PC) or a laptop computer, operating under DOS or Windows. Both the analyzer (JLG kit no. 2901443) and the computer software (JLG kit no. 2900874) are available from JLG and include a connecting cable and SMART System™ adjustment procedures.

#### IMPORTANT

**WHEN INSTALLING A NEW SMART SYSTEM CONTROLLER ON THE MACHINE, IT WILL BE NECESSARY TO PROGRAM THE CONTROLLER FOR THE PROPER MACHINE CONFIGURATION, INCLUDING OPTIONS. REFER TO ANALYZER KIT NO. 2901443 OR COMPUTER SOFTWARE KIT NO. 2900874 FOR PROGRAMMING INSTRUCTIONS. MACHINES EQUIPPED WITH GRAVITY LIFT DOWN (SEE EFFECTIVITY PAGE) MUST BE PROGRAMMED FOR GRAVITY LIFT DOWN AT CONTROLLER REPLACEMENT.**

Table 3-1. JLG SMART System™ Flash Fault Codes.

Code	Fault
1-1	Idle time-out
2-1	EMS inputs (both together, or neither)
2-2	Platform (digital) inputs (includes high drive for > 10 seconds)
2-3	Ground (digital) inputs
2-4	Steering (digital) inputs
2-5	Cut-out input (not a fault but an indication)
2-7	Accelerator (analog) input
2-8	Arm guard or platform descent delay system cut-out (European [CE Specification] Machines Only)
3-1	Line contactor open circuit or welded
3-3	Line contactor (or other) driver short circuit (or tripped)
4-2	Temperature cut back
4-4	Battery supply voltage out of range
9-1	Watchdog reset
9-2	EEprom Fault
9-3	Mux stream not being updated
9-6	Point A short circuit
9-7	Point A open circuit
9-8	Motor open circuit
9-9	Power circuit failure (driver short circuit, bat/cap < 15V)

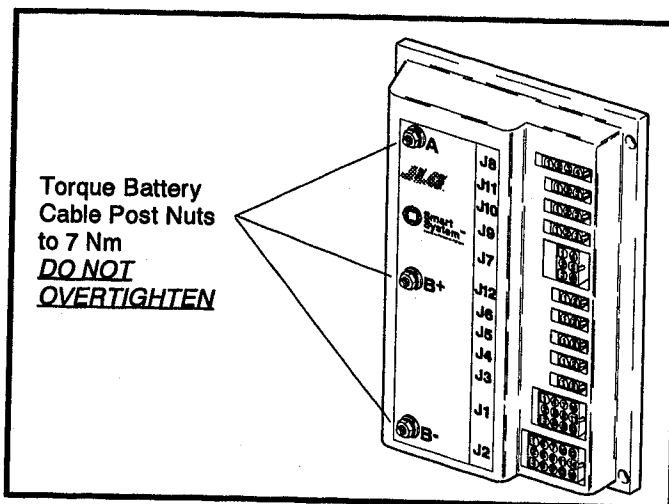


Figure 3-1. JLG SMART System™ Controller.

**⚠ IMPORTANT**

WHEN INSTALLING A NEW SMART SYSTEM CONTROLLER ON THE MACHINE, SILICONE GREASE, JLG PART NUMBER 0100076 OR 7016397, MUST BE APPLIED TO THE BACK OF THE CONTROLLER.

**⚠ IMPORTANT**

IT IS A GOOD PRACTICE TO AVOID PRESSURE-WASHING ELECTRICAL/ELECTRONIC COMPONENTS. SHOULD PRESSURE-WASHING BE UTILIZED TO WASH AREAS CONTAINING ELECTRICAL/ELECTRONIC COMPONENTS, JLG INDUSTRIES, INC. RECOMMENDS A MAXIMUM PRESSURE OF 52 BAR (750 PSI) AT A MINIMUM DISTANCE OF 30.5 CM (12 INCHES) AWAY FROM THESE COMPONENTS. IF ELECTRICAL/ELECTRONIC COMPONENTS ARE SPRAYED, SPRAYING MUST NOT BE DIRECT AND BE FOR BRIEF TIME PERIODS TO AVOID HEAVY SATURATION.

Table 3-2. JLG SMART System™ Troubleshooting.

TROUBLESHOOTING CHART		
TROUBLE	PROBABLE CAUSE	REMEDY
<b>Machine Functions.</b>		
<b>All machine functions do not operate.</b>		
	<p>Emergency Stop switch not activated.</p> <p>Joystick not in neutral position. (flash code 2-7)</p> <p>Joystick potentiometer not centered.</p> <p>Idle time-out. (flash code 1-1)</p> <p>Mux stream not being updated. (flash code 9-3)</p> <ul style="list-style-type: none"> <li>No power to the multiplexer card in the platform.</li> <li>Platform cable not connected to platform box or SMART System™ at base (J2).</li> <li>Faulty multiplexer card.</li> </ul> <p>Battery voltage out of range. (flash code 4-4)</p> <ul style="list-style-type: none"> <li>If battery charger is plugged in, voltage of batteries may be above 31 Volts.</li> <li>Battery voltage too low.</li> </ul> <p>Line contactor open circuit. (flash code 3-1)</p> <ul style="list-style-type: none"> <li>Loose wiring connections on line contactor or at harness connection J1.</li> <li>Open coil on line contactor.</li> <li>Faulty wiring at J1.</li> </ul>	<p>Activate Emergency Stop switch and wait for flash of LED's.</p> <p>Release joystick, then select function.</p> <p>Use analyzer to verify potentiometer is centered. (Accel should be 0) Replace joystick (JLG part no. 1600257 thru June 1997 or 1600266 after June 1997) if not 0.</p> <p>Select function again.</p> <p>Use voltmeter to verify power on J4 of the multiplexer board.</p> <p>Re-connect cable to platform box or J2.</p> <p>Replace multiplexer card. (JLG part no. 0610123)</p> <p>Check voltage with VOM. Unplug battery charger.</p> <p>Check voltage with VOM. Plug in battery charger.</p> <p>Check wire terminations on line contactor and harness connection at J1. Tighten connections as necessary.</p> <p>Clean corrosion from line contactor.</p> <p>Replace line contactor. (JLG part no. 3740117)</p> <p>Repair or replace wiring as necessary.</p>

**Table 3-2. JLG SMART System™ Troubleshooting.**

<b>Table 3-2. JLG SMART System™ Troubleshooting.</b>		
<b>TROUBLE</b>	<b>TROUBLESHOOTING CHART PROBABLE CAUSE</b>	<b>REMEDY</b>
<b>Machine Functions. (cont.)</b>		
<b>All machine functions do not operate. (cont.)</b>		
	<p>Line contactor welded. (flash code 3-1)</p> <p>Line contactor or other driver short circuit or tripped. (flash code 3-3)</p> <p>Point A short circuit. (flash code 9-6)</p> <ul style="list-style-type: none"> <li>• Motor lead connections loose.</li> <li>• Faulty controller.</li> </ul> <p>Point A open circuit. (flash code 9-7)</p> <ul style="list-style-type: none"> <li>• Faulty controller.</li> <li>• Motor stalled.</li> </ul> <p>Motor open circuit. (flash code 9-8)</p> <ul style="list-style-type: none"> <li>• Faulty motor.</li> </ul>	<p>Replace line contactor. (JLG part no. 3740117)</p> <p>Disconnect valve harness at J1. Using an ohm meter, measure resistance between B - and each pin of the connector, except pin 10. Each reading should be 1 - 12 megohms. If any reading is less, replace controller. (JLG part no. 1600233)</p> <p>Check motor lead connections. Tighten connections as necessary.</p> <p>Replace controller. (JLG part no. 1600233)</p> <p>Replace controller. (JLG part no. 1600233)</p> <p>Determine cause. Repair or replace motor (JLG part no. 3600266) as necessary.</p> <p>Replace motor. (JLG part no. 3600266)</p>
<b>No drive function when platform fully lowered. Lift function okay.</b>		
	<p>Cutout input. (flash code 2-5)</p> <ul style="list-style-type: none"> <li>• Malfunctioning limit switch.</li> </ul>	<p>Use analyzer to verify limit switch inputs. Drive cutout and Elevation cutout should be HI. Adjust or repair malfunctioning limit switch.</p>
<b>No drive function when platform elevated. Lift function okay.</b>		
	<p>Cutout input. (flash code 2-5)</p> <ul style="list-style-type: none"> <li>• Malfunctioning limit switch.</li> <li>• Platform above drive cutout height.</li> </ul>	<p>Use analyzer to verify limit switch inputs. Pothole should be HI. Adjust or repair malfunctioning limit switch.</p> <p>Lower platform below drive cutout height.</p>
<b>Machine cannot lift down. Lift up function okay.</b>		
	<p>Cutout input. (flash code 2-5)</p> <ul style="list-style-type: none"> <li>• Deck extension extended.</li> </ul>	<p>Use analyzer to verify limit switch inputs. Extension limit should be HI. Retract deck extension.</p>

Table 3-3. Hydraulic System Troubleshooting.

TROUBLESHOOTING CHART		
TROUBLE	PROBABLE CAUSE	REMEDY
<b>Hydraulic System - General.</b>		
<b>Hydraulic pump noisy.</b>		
	Air bubbles in oil. (Reservoir too low.)	Replenish oil as necessary.
	Oil filter dirty.	Clean and/or replace filter as necessary.
<b>Pump cavitating. (Vacuum in pump due to oil starvation.)</b>		
	Oil in reservoir low.	Replenish oil as necessary.
	Restricted reservoir air vent.	Clean vent.
	Oil viscosity too high.	Drain system and replace with recommended oil. Refer to Table 7-1, Hydraulic Oil.
<b>System overheating.</b>		
	Oil viscosity too high.	Drain system and replace with recommended oil. Refer to Table 7-1, Hydraulic Oil.
	Main relief valve set too high.	Adjust relief valve to proper pressure.
	Hydraulic system oil low.	Replenish oil as necessary.
<b>Pump not delivering oil.</b>		
	Defective pump on motor.	Repair or replace motor.
<b>System pressure too low.</b>		
	Main relief valve set too low.	Reset valve as required.
	Hydraulic pump not functioning properly.	Repair or replace pump.
	Leak in component, line or fitting.	Repair or replace component, line or fitting.
	Scored valve spool; scored cylinder.	Replace valve; replace cylinder.
<b>System(s) operate erratically.</b>		
	Sticking or binding valve cartridge, piston rod, etc.	Clean, repair or replace components as necessary.
	Hydraulic oil not at operating temperature.	Allow oil sufficient time to warm up.







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