Service and Maintenance Manual

Model
1532E
1932E
2033E
2046E
2646E
2658E

3120725
March 1, 1998

ANSI
A. GENERAL.

1. This section contains the general safety precautions which must be observed during maintenance of the aerial platform. It is of utmost importance that maintenance personnel pay strict attention to these warnings and precautions to avoid possible injury to themselves or others or damage to the equipment. A maintenance program must be 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. WIRED 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.
NOTE: This manual is split from the combined Operators and Safety, Service and Maintenance, and Illustrated Parts Manual 3123000

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Original Issue - April 1997

⚠️ 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, 1-1, 1-8, 2-22, 2-28, 2-29, 3-2, 3-3, 3-4

Change 2 - August 1997
pages b, 2-15, 2-16, 2-17

Change 3 - March 1998

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JLG Sizzor
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1-1. CAPACITIES.

• Hydraulic Oil Tank.

1532E/1932E.
3.7 gallons (14.0 liters) at full mark on tank.
3.2 gallons (12.1 liters) at add mark on tank.
2033E/2046E/2646E/2658E.
5.4 gallons (20.4 liters) at full mark on tank.
4.2 gallons (15.9 liters) at add mark on tank.

• Hydraulic System. (Including Tank)

1532E/1932E - Approximately 4.4 gallons (16.8 liters).
2033E/2046E/2646E/2658E - Approximately 6.5 gallons (24.6 liters).

1-2. COMPONENT DATA.

• Hydraulic Pump/Electric Motor Assembly.
(All Models)

24 Volts DC motor.
2 section gear pump - 3.1 gpm (11.7 lpm) output each section.

• Battery Charger.

Single Voltage
110 Volts AC - 60 Hz input.
24 Volts DC - 25 Amp output w/auto timer.

Dual Voltage.
240 Volts/120 Volts AC - 50 Hz input.
24 Volts DC - 20 Amp output w/auto timer.

120 Volts AC - 50/60 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 - 12.5 in.³ (205 cm³) displacement.
2033E - 14.2 in.³ (233 cm³) displacement.
2046E/2646E/2658E - 15.9 in.³ (261 cm³) displacement.

• Hydraulic Filter - Inline.

Return - Bypass Type.
10 Microns Nominal.

• Platform Size.

1532E/1932E - 30 in. x 64 in. (0.8 m x 1.6 m).
2033E - 30 in. x 94 in. (0.8 m x 2.4 m).
2046E/2646E - 42 in. x 94 in. (1.1 m x 2.4 m).
2658E - 54 in. x 94 in. (1.4 m x 2.4 m).

1-3. PERFORMANCE DATA.

• Travel Speed.

1532E/1932E.
Low Speed - 1.3 mph (2.1 km/h).
Elevated Speed - 0.7 mph (1.1 km/h).
Maximum Speed - 2.4 mph (3.9 km/h).

2033E.
Low Speed - 1.3 mph (2.1 km/h).
Elevated Speed - 0.7 mph (1.1 km/h).
Maximum Speed - 2.75 mph (4.4 km/h).

2046E.
Low Speed - 1.3 mph (2.1 km/h).
Elevated Speed - 0.7 mph (1.1 km/h).
Maximum Speed - 2.25 mph (3.6 km/h).

2646E/2658E.
Low Speed - 1.2 mph (1.9 km/h).
Elevated Speed - 0.7 mph (1.1 km/h).
Maximum Speed - 2.25 mph (3.6 km/h).
**Gradeability.**

All Models - 25%

**Inside Turning Radius.**

1532E/1932E/2033E - 3 in. (7.6 cm).
2046E/2646E/2658E - 16 in. (40.6 cm).

**Inside Turning Angle.**

1532E/1932E/2033E - 87 degrees.
2046E/2646E/2658E - 80 degrees.

**Lift. (No Load In Platform)**

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 effectiveness 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 - 600 lb. (272 kg).
1932E - 500 lb. (227 kg).
2033E/2646E - Standard - 750 lb. (340 kg).
2033E/2646E - Optional - 1,000 lb. (454 kg).
2046E/2658E - 1,000 lb. (454 kg).

If machine is equipped with optional pipe racks, maximum load on pipe racks is 100 lb. (45 kg).
Maximum total capacity of pipe racks and platform combined is as follows:
2033E/2646E - 650 lb. (295 kg).
2046E/2658E - 900 lb. (408 kg).

**Manual Platform Extension Capacity.**

All Models - 250 lb. (113 kg) - 1 person.

**Powered Deck Extension Capacity.**

(Models 2033E, 2046E, 2646E, 2658E Only)

4 Foot (1.2 m) Extension.
750 lb. (340 kg) - 2 persons.
6 Foot (1.8 m) Extension.
350 lb. (159 kg) - 1 person.

**WARNING**

FOR MODELS 2033E, 2046E, 2646E, AND 2658E EQUIPPED WITH EITHER THE 4 FT. (1.2 M) OR 6 FT. (1.8 M) POWERED DECK EXTENSION, THE MAXIMUM TOTAL PLATFORM CAPACITY WITH THE EXTENSION, EXTENDED OR RETRACTED, IS 750 LB. (340 KG) - 2 PERSONS.

**Machine Weight.**

1532E - approx. 2400 lb. (1089 kg).
1932E - approx. 2520 lb. (1143 kg).
2033E - approx. 3870 lb. (1756 kg).
2046E - approx. 3620 lb. (1642 kg).
2646E - approx. 4100 lb. (1860 kg).
2658E - approx. 4230 lb. (1919 kg).

**Wheelbase**

1532E/1932E - 50.0 in. (1.3 m).
2033E/2046E/2646E/2658E - 73.0 in. (1.9 m).
- Machine Height (Platform Fully Elevated).
  - 1532E - 15 feet (4.6 m).
  - 1932E - 19 feet (5.8 m).
  - 2033E/2046E - 20 feet (6.1 m).
  - 2646E/2658E - 26 feet (7.9 m).

- Machine Height (Platform Lowered).
  - 1532E - 75.75 in. (1.9 m).
  - 1932E - 79.75 in. (2.0 m).
  - 2033E/2046E - 79.0 in. (2.0 m).
  - 2646E/2658E - 84.25 in. (2.1 m).

- Platform Railing Height.
  Standard Handrails.
  - All Models - 39.5 in. (1.0 m).
  Fold-Down Handrails.
  - 1532E/1932E/2033E - 39.5 in. (1.0 m).
  - 2046E/2646E/2658E - 43.5 in. (1.1 m).

- Machine Length.
  - 1532E/1932E - 68.0 in. (1.7 m).
  - 2033E/2046E/2646E/2658E - 96.0 in. (2.4 m).

- Machine Width.
  - 1532E/1932E w/standard tires - 32.5 in. (0.8 m).
  - 2033E w/standard tires - 33.0 in. (0.8 m).
  - 2046E/2646E w/standard tires - 46.0 in. (1.2 m).
  - 2658E w/standard tires - 58.0 in. (1.5 m).
  - 2046E/2646E/2658E w/optimal floatation tires - 60.0 in. (1.5 m).

- Ground Clearance.
  With Platform Lowered.
  - All Models - 2.13 in. (5.4 cm).
  With Platform Elevated.
  (Pothole Protection System Deployed)
  - All Models - 0.75 in. (1.9 cm).

- Maximum Tire Load.
  - 1532E - 1,055 lb. (479 kg) @ 66 psi (4.6 bar).
  - 1932E - 1,085 lb. (492 kg) @ 68 psi (4.7 bar).
  - 2033E - 1,460 lb. (662 kg) @ 81 psi (5.6 bar).
  - 2046E - 1,530 lb. (694 kg) @ 85 psi (5.9 bar).
  - 2646E - 1,645 lb. (746 kg) @ 91 psi (6.3 bar).
  - 2658E - 1,755 lb. (796 kg) @ 92 psi (6.3 bar).

1-4. TORQUE REQUIREMENTS.

Table 1-1. Torque Requirements.

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<th>Description</th>
<th>Torque Value (Dry)</th>
<th>Interval Hours</th>
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<tr>
<td>A. Wheel Lugs</td>
<td>90 ft lb</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>(122 Nm)</td>
<td></td>
</tr>
<tr>
<td>B. Wheel Hub To Drive Motor</td>
<td>125-150 ft lb*</td>
<td>600</td>
</tr>
<tr>
<td></td>
<td>(169-203 Nm)</td>
<td></td>
</tr>
<tr>
<td>C. Lifting Bar Attach Bolts (2033E</td>
<td>900 in lb</td>
<td>600</td>
</tr>
<tr>
<td>w/Power Lift Down)</td>
<td>(102 Nm)</td>
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<tr>
<td></td>
<td>(w/Loctite)</td>
<td></td>
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<tr>
<td>D. Motor Controller Battery Terminal Nuts</td>
<td>60 in lb</td>
<td>At Controller Replacement Only</td>
</tr>
<tr>
<td></td>
<td>(7 Nm)</td>
<td></td>
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* Torque nut to 125-150 ft lbs (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.

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<tr>
<td>0°F to +23°F (-18°C to -5°C)</td>
<td>10W</td>
</tr>
<tr>
<td>0°F to +210°F (-18°C to +99°C)</td>
<td>10W-20,10W-30</td>
</tr>
<tr>
<td>50°F to 210°F (+10°C to +210°C)</td>
<td>20W-20</td>
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### VALUES FOR ZINC PLATED BOLTS ONLY

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<th>SIZE</th>
<th>THD</th>
<th>BOLT DIA. (IN.)</th>
<th>THREAD STRESS AREA (SQ. IN.)</th>
<th>SAE GRADE 5 BOLTS &amp; GRADE 2 NUTS</th>
<th>SAE GRADE 8 BOLTS &amp; GRADE 8 NUTS</th>
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<td></td>
<td></td>
<td></td>
<td>CLAMP LOAD (L.B.)</td>
<td>TORQUE (FT-LB)</td>
<td>CLAMP LOAD (L.B.)</td>
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<td></td>
<td></td>
<td>(DIN OR LOC 283)</td>
<td>(LB-IN.)</td>
<td>(LOCITE 262)</td>
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<td>48</td>
<td>0.1120</td>
<td>0.00604 380 8 6</td>
<td>540 12 9</td>
<td>820 23 17</td>
</tr>
<tr>
<td>6</td>
<td>32</td>
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<td>0.00909 580 16 12</td>
<td>820 23 17</td>
<td>1260 41 31</td>
</tr>
<tr>
<td>8</td>
<td>32</td>
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<td>0.01015 610 18 13</td>
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<td>1580 60 45</td>
</tr>
<tr>
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<td>24</td>
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<td>0.01570 1120 43 32</td>
<td>1580 60 45</td>
<td>1800 68 51</td>
</tr>
<tr>
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<td>0.2500</td>
<td>0.0318 2020 96 75</td>
<td>105 12 9</td>
<td>160 23 17</td>
</tr>
<tr>
<td>5/16</td>
<td>18</td>
<td>0.3125</td>
<td>0.0364 2320 120 86</td>
<td>540 12 9</td>
<td>105 12 9</td>
</tr>
<tr>
<td>3/8</td>
<td>16</td>
<td>0.3750</td>
<td>0.0524 3340 17 13</td>
<td>5200 25 18</td>
<td>5200 25 18</td>
</tr>
<tr>
<td>7/16</td>
<td>14</td>
<td>0.4375</td>
<td>0.0600 4000 19 14</td>
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<td>5200 25 18</td>
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<tr>
<td>1/2</td>
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<td>0.0650 4600 15 10</td>
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<td>5200 25 18</td>
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<td>5200 25 18</td>
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<tr>
<td>1-1/8</td>
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<td>5200 25 18</td>
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<tr>
<td>1-1/4</td>
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<tr>
<td>1-1/2</td>
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<td>1.5000</td>
<td>0.0850 7000 12 9</td>
<td>5200 25 18</td>
<td>5200 25 18</td>
</tr>
</tbody>
</table>

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

### UNPLATED CAP SCREWS

**UNBRAX 1960 SERIES**
**SOCKET HEAD CAP SCREW**
**WITH LOC-VEL PATCH**

<table>
<thead>
<tr>
<th>SIZE</th>
<th>THD</th>
<th>BOLT DIA. (IN.)</th>
<th>THREAD STRESS AREA (SQ. IN.)</th>
<th>SAE GRADE 5 BOLTS &amp; GRADE 2 NUTS</th>
<th>SAE GRADE 8 BOLTS &amp; GRADE 8 NUTS</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>CLAMP LOAD (L.B.)</td>
<td>TORQUE (FT-LB)</td>
<td>CLAMP LOAD (L.B.)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>(DIN OR LOC 283)</td>
<td>(LB-IN.)</td>
<td>(LOCITE 262)</td>
</tr>
<tr>
<td>4</td>
<td>48</td>
<td>0.1120</td>
<td>0.00604 380 8 6</td>
<td>540 12 9</td>
<td>820 23 17</td>
</tr>
<tr>
<td>6</td>
<td>32</td>
<td>0.1380</td>
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<td>0.1900</td>
<td>0.01570 1120 43 32</td>
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<td>1/4</td>
<td>20</td>
<td>0.2500</td>
<td>0.0318 2020 96 75</td>
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<tr>
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<td>18</td>
<td>0.3125</td>
<td>0.0364 2320 120 86</td>
<td>540 12 9</td>
<td>105 12 9</td>
</tr>
<tr>
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<td>0.0524 3340 17 13</td>
<td>5200 25 18</td>
<td>5200 25 18</td>
</tr>
<tr>
<td>7/16</td>
<td>14</td>
<td>0.4375</td>
<td>0.0600 4000 19 14</td>
<td>5200 25 18</td>
<td>5200 25 18</td>
</tr>
<tr>
<td>1/2</td>
<td>12</td>
<td>0.5000</td>
<td>0.0650 4600 15 10</td>
<td>5200 25 18</td>
<td>5200 25 18</td>
</tr>
<tr>
<td>9/16</td>
<td>10</td>
<td>0.5625</td>
<td>0.0600 3680 12 9</td>
<td>5200 25 18</td>
<td>5200 25 18</td>
</tr>
<tr>
<td>5/8</td>
<td>12</td>
<td>0.6250</td>
<td>0.0600 4000 19 14</td>
<td>5200 25 18</td>
<td>5200 25 18</td>
</tr>
<tr>
<td>3/4</td>
<td>10</td>
<td>0.7500</td>
<td>0.0650 4600 15 10</td>
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<td>5200 25 18</td>
</tr>
<tr>
<td>7/8</td>
<td>8</td>
<td>0.8750</td>
<td>0.0700 5200 12 9</td>
<td>5200 25 18</td>
<td>5200 25 18</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>1.0000</td>
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<td>5200 25 18</td>
</tr>
<tr>
<td>1-1/8</td>
<td>4</td>
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<td>5200 25 18</td>
<td>5200 25 18</td>
</tr>
<tr>
<td>1-1/4</td>
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<td>1.5000</td>
<td>0.0800 6400 12 9</td>
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<td>5200 25 18</td>
</tr>
<tr>
<td>1-1/2</td>
<td>2</td>
<td>1.5000</td>
<td>0.0850 7000 12 9</td>
<td>5200 25 18</td>
<td>5200 25 18</td>
</tr>
</tbody>
</table>

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

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

- Lubrication Specifications.

Table 1-3. Lubrication Specifications.

<table>
<thead>
<tr>
<th>KEY</th>
<th>SPECIFICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPG</td>
<td>Multipurpose Grease having a minimum dripping point of 350° F. Excellent water resistance and adhesive qualities, and being of extreme pressure type. (Timken OK 40 pounds minimum.)</td>
</tr>
<tr>
<td>EPGL</td>
<td>Extreme Pressure Gear Lube (oil) meeting API service classification GL-5 or MIL-Spec MIL-L-2105.</td>
</tr>
<tr>
<td>HO</td>
<td>Hydraulic Oil. API service classification GL-3, e.g. Mobilfluid 424 or Kendall Hyken 052.</td>
</tr>
</tbody>
</table>

Note
Refer to Figure 1-2 for specific lubrication procedures.

1-6. 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 Power 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.


Note
All dimensions are given in inches (in), with the metric equivalent, centimeters (cm), given in parentheses.

Table 1-4. Cylinder Specifications.

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>BORE</th>
<th>STROKE</th>
<th>ROD DIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lift Cylinder (1532E/1932E) (Power Lift Down)</td>
<td>3.00 (7.6)</td>
<td>30.625 (77.8)</td>
<td>2.00 (5.1)</td>
</tr>
<tr>
<td>Lift Cylinder (1532E/1932E) (Gravity Lift Down)</td>
<td>3.00 (7.6)</td>
<td>30.38 (77.2)</td>
<td>2.00 (5.1)</td>
</tr>
<tr>
<td>Lift Cylinder (2033E/2046E) (Power Lift Down)</td>
<td>3.50 (8.9)</td>
<td>39.75 (101.0)</td>
<td>2.00 (5.1)</td>
</tr>
<tr>
<td>Lift Cylinder (2033E/2046E) (Gravity Lift Down)</td>
<td>3.50 (8.9)</td>
<td>39.75 (101.0)</td>
<td>2.00 (5.1)</td>
</tr>
<tr>
<td>Lift Cylinder (2646E/2656E) (Power Lift Down)</td>
<td>4.00 (10.2)</td>
<td>39.75 (101.0)</td>
<td>2.50 (6.4)</td>
</tr>
<tr>
<td>Lift Cylinder (2646E/2658E) (Gravity Lift Down)</td>
<td>4.00 (10.2)</td>
<td>39.75 (101.0)</td>
<td>2.50 (6.4)</td>
</tr>
<tr>
<td>Steer Cylinder - All Models</td>
<td>1.50 (3.8)</td>
<td>6.25 (15.9)</td>
<td>0.75 (1.9)</td>
</tr>
<tr>
<td>Parking Brake Cylinder - All Models (Power Lift Down)</td>
<td>1.75 (4.4)</td>
<td>1.75 (4.4)</td>
<td>1.125 (2.9)</td>
</tr>
<tr>
<td>Parking Brake Cylinder - All Models (Gravity Lift Down)</td>
<td>2.00 (5.1)</td>
<td>1.75 (4.4)</td>
<td>1.00 (2.5)</td>
</tr>
<tr>
<td>INDEX NUMBER</td>
<td>COMPONENT</td>
<td>NO/TYPE LUBE POINTS</td>
<td>LUBE/METHOD</td>
</tr>
<tr>
<td>--------------</td>
<td>------------------------</td>
<td>---------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>1</td>
<td>Hydraulic Oil</td>
<td>Fill Cap/Drain Plug</td>
<td>HO - Check HO Level</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>HO - Change HO</td>
</tr>
<tr>
<td>2</td>
<td>Hydraulic Filter Element</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>3</td>
<td>Kingpin Housing</td>
<td>2 Grease Fittings</td>
<td>MPG - Pressure Gun</td>
</tr>
<tr>
<td>(1 each housing)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Wheel Bearings</td>
<td>2 - Rear Wheels</td>
<td>MPG - Repack</td>
</tr>
</tbody>
</table>

**Key To Lubricants:**

MPG - Multi-Purpose Grease  
HO - Hydraulic Oil - Mobilfluid 424 or Kendall Hyken 052

**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.
Figure 1-3. Serial Number Locations - 1532E/1932E/2033E/2046E/2646E/2658E.
1-8. 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 effectiveness page for serial number identification.

- Machines with Power Lift Down.
  
  Main Relief - 3000 psi (207 bar).
  Steer Relief - 1700 psi (117 bar).
  Lift Up Relief - 2100 psi + / - 100 psi (145 bar + / - 7 bar).
  Lift Down Relief - 800 psi (55 bar).
  High Drive Pressure Switch - 1100 psi (76 bar).
  Powered Deck Extension Relief (If Equipped) - 3000 psi (207 bar).

- Machines with Gravity Lift Down.
  
  Main Relief - 3200 psi + 50 / - 0 psi (220 bar + 3.4 / - 0 bar).
  Steer Relief - 1700 psi (117 bar).
  Lift Up Relief:
    1532E - 1650 psi (114 bar).
    1932E - 2050 psi (141 bar).
    2033E - 1700 psi (117 bar).
    2046E - 2050 psi (141 bar).
    2646E - 2000 psi (138 bar).
    2658E - 2300 psi (159 bar).
  Powered Deck Extension Relief (If Equipped) 3000 psi (207 bar).

1-9. LIMIT SWITCHES.

The machines are equipped with the following limit switches:

- Tilt Alarm (optional) - 5 degrees - Illuminates a light on the platform and sounds an alarm when the machine is 5 degrees out of level in any direction.
- High Drive Cut-Out - High drive speed is cut out when the platform is raised above the stowed position.
- 1,000 Pound Capacity Cut-Out (Optional on Models 2033E and 2646E) - When Models 2033E and 2646E are equipped for the optional 1,000 pounds (454 kg) platform capacity, this limit switch cuts out drive at the following platform heights:
  
  2033E - 17 feet (5.2 m)
  2646E - 19 feet (5.8 m)

- Drive Cut-Out (Models 2033E, 2046E, 2646E, and 2658E with Powered Deck Extension) - On these machines, the Drive function is cut out when the powered deck extension is extended with the platform raised above the stowed position.

- Temperature Switch (equipped on machines after and including serial number 020037715) - 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.

- Overload Protection (Japanese Specification Only) - When the platform is loaded to 120% of its rated capacity, the LIFT UP and DRIVE functions are cut out and the platform alarm (if equipped) is sounded for two seconds on, two seconds off while the operator tries to activate either LIFT UP or DRIVE. Remove weight from the platform to restore LIFT UP and DRIVE functions operation and to silence the alarm (if equipped).
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.

Note
Start-up of hydraulic system with oil temperatures below -15 degrees F (-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 -15 degrees F (-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 temperatures down to -20 degrees F (-29 de-

- Changing Hydraulic Oil.

1. Use of any of the recommended crankcase or hydraulic oils increases 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 you are 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 1-2 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 (center) 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 3.13 gpm (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 2.0 inches (51 mm). Replace sliding pads when worn to 1.875 inches (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 - Platform Extension Cylinder (if Equipped), Brake Cylinder and Steer Cylinder.

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.

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

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 attach 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.

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.

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.

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

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

10. 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 cap screw(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.

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.

--- JLG Sizzor ---

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

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.](image)

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.](image)

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.](image)

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 2-8. Wiper Seal Installation.](image)
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.

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.

<table>
<thead>
<tr>
<th>Component</th>
<th>Torque Value (w/Locitite)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tapered Bushing Retaining Screws</td>
<td>80 ft lb (108 Nm)</td>
</tr>
<tr>
<td>- Lift Cylinder</td>
<td></td>
</tr>
<tr>
<td>Head Retaining Screws</td>
<td>9 ft lb (12 Nm)</td>
</tr>
<tr>
<td>- Lift Cylinder</td>
<td></td>
</tr>
<tr>
<td>Piston Nut - Lift Cylinder - 1532E/1932E</td>
<td>375-450 ft lb (508-610 Nm)</td>
</tr>
<tr>
<td>Piston Nut - Lift Cylinder - 2033E/2046E</td>
<td>800-1000 ft lb (1085-1356 Nm)</td>
</tr>
<tr>
<td>Piston Nut - Lift Cylinder - 2646E/2656E</td>
<td>1125-1375 ft lb (1525-1864 Nm)</td>
</tr>
</tbody>
</table>

Table 2-2. Holding Valve Torque Specifications.

<table>
<thead>
<tr>
<th>Description</th>
<th>Torque Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun - 7/8 hex M20 x 1.5 thds</td>
<td>30-35 ft lb (41-48 Nm)</td>
</tr>
<tr>
<td>Sun - 1-1/8 hex 1-14 UNS thds</td>
<td>45-50 ft lb (61-68 Nm)</td>
</tr>
<tr>
<td>Sun - 1-1/4 hex M36 x 2 thds</td>
<td>150-160 ft lb (204-207 Nm)</td>
</tr>
<tr>
<td>Racine - 1-1/8 hex 1-1/16 - 12 thds</td>
<td>50-55 ft lb (68-75 Nm)</td>
</tr>
<tr>
<td>Racine - 1-3/8 hex 1-3/16 - 12 thds</td>
<td>75-80 ft lb (102-109 Nm)</td>
</tr>
<tr>
<td>Racine - 1-7/8 hex 1-5/8 - 12 thds</td>
<td>100-110 ft lb (136-149 Nm)</td>
</tr>
</tbody>
</table>

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 effectiveness 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 0.5 inch (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 0.5 inch (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 μinches RMS. Significant variations (greater than 8 μinches 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 0.007 inch (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 0.007 inch (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 50-55 ft lb (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.

---

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

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 suitable protection, clamp the cylinder rod in a vise or similar holding fixture.

2. Place a new wiper ring (11), rod seal (9), o-ring (7), and back-up ring (8) into the applicable cylinder guide (10) grooves.

3. 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.

4. Place a new piston ring (6) and o-rings (4 and 5) on the piston.

5. 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.

6. Install the piston locknut (2) on the threaded end of the cylinder rod and torque to 100-120 ft. lb. (136-163 Nm).

7. Remove the cylinder rod from the holding fixture.

8. 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.

9. 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.

10. Continue pushing the rod into the barrel until the cylinder guide can be inserted into the cylinder barrel.

11. Using all applicable safety precautions, secure the cylinder rod assembly with a new retaining ring (12).

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.

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 (6) into a suitable holding fixture.

3. Using a suitable hammer, tap around the outside of the cylinder barrel and guide (2) to shatter the Loctite.

4. Using a suitable spanner wrench, carefully remove the guide from the rod clevis end of the cylinder barrel.

5. 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.

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

7. Using a suitable hammer, tap around the outside of the cylinder barrel and guide (2) to shatter the Loctite.

8. 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).

9. Using suitable protection, clamp cylinder rod section two (7a) in a vise or similar holding fixture.
1. Wiper Ring
2. Guide
3. Rod Seal
4. Back-Up Ring
5. O-Ring
6. Cylinder Barrel
7. Rod Section One
7a. Rod Section Two
8. Piston Seal
9. O-Ring
10. Piston

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.

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.
(If Equipped)

Note
The machine may be equipped with a tilt switch (sensor), factory set to activate when the machine is out of level in any direction at 5 degrees and will cut out 2 speed drive. 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.
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 2-15. Tilt Switch Leveling - Manual Adjustment.

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

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.

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 - 2100 psi + / - 100 psi (145 bar + / - 7 bar).
   Gravity Lift Down Machines.
   1532E - 1650 psi (114 bar).
   1932E - 2050 psi (141 bar).
   2033E - 1700 psi (117 bar).
   2046E - 2050 psi (141 bar).
   2646E - 2000 psi (138 bar).
   2658E - 2300 psi (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 800 psi (55 bar).

8. If adjusting the steer pressure, proceed to Steer Adjustment; if not, remove the pressure gauge from gauge port M1.

- 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 1700 psi (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 1700 psi (117 bar).

When valve components are removed and/or replaced, the following torque values apply when re-installing the components:

Shuttle Valve Cartridge: 25-30 ft. lb. (34-41 Nm)
Tow Valve Cartridge: 25-30 ft. lb. (34-41 Nm)
Brake Valve Cartridge: 35-40 ft. lb. (47-54 Nm)
Lift Up Relief Cartridge: 25-30 ft. lb. (34-41 Nm)
Lift Down Relief Cartridge: 25-30 ft. lb. (34-41 Nm)
(Power Lift Down Machines Only)
High Drive Check Valve: 25-30 ft. lb. (34-41 Nm)
Steer Relief Cartridges: 25-30 ft. lb. (34-41 Nm)
Main Relief Cartridge: 25-30 ft. lb. (34-41 Nm)
High Drive Cartridge: 4-6 ft. lb. (5-8 Nm)
High Drive Cartridge Coil Attach Nut: 8-10 ft. lb. (11-14 Nm)
Counterbalance Valve Cartridges: 35-40 ft. lb. (47-54 Nm)
Posi-Trac Valve Cartridge: 4-8 ft. lb. (5-8 Nm)
Posi-Trac Valve Cartridge Coil Attach Nut: 10-12 ft. lb. (14-16 Nm)
Socket Head Cap Screws: 60 in. lb. (7 Nm)

NOTE 1: Lift Down Relief applies only to those machines equipped with Power Lift Down. Machines equipped with Gravity Lift Down have no Lift Down adjustment. Refer to Effectivity Page for serial number identification.

NOTE 2: Adjust Lift Up Relief as follows:
Power Lift Down - ALL - 2100 psi (48 bar).
Gravity Lift Down:
1532E - 1550 psi (114 bar).
1932E - 2050 psi (141 bar).
2033E - 1700 psi (117 bar).
2046E - 2050 psi (141 bar).
2646E - 2000 psi (138 bar).
2658E - 2300 psi (165 bar).

* Only machines prior to, but not including, serial number 0200037715 are equipped with the high drive pressure switch.

Figure 2-17. Pressure Setting Adjustments

Updated 6/98
2-20
- 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 1100 psi (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 3200 psi, + 50 / - 0 psi (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 2-1/2 inch radius is obtained as shown in Figure 2-18.

3. Tighten the bolt to lock the arm in this position.

Figure 2-17. Pressure Setting Adjustments - 1532E/1932E/2033E/2048E/2646E/2658E.
Figure 2-18. Pothole Protection System Limit Switch

4. Repeat the adjustment procedure for the limit switch on the opposite side of the machine.

- 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 1/16 inch 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. (Power 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](image)

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](image)

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.

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

![IMPORTANT](image)

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 750 PSI (52 BAR) AT A MINIMUM DISTANCE OF 12 INCHES (30.5 CM) 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.
Figure 2-20. JLG SMART System™ Controller.
2-19. DRIVE MOTOR REPAIR (EATON)

- Disassembly.

1. Cleanliness is extremely important when repairing hydraulic motors. Work in a clean area. Before disconnecting the hydraulic motor thoroughly clean the exterior. Remove motor from the machine before disassembly; drain the oil from the motor.

2. Remove the 7 cap screws and disassemble the motor as shown.
3. Remove retaining ring from front of housing.

4. Remove bearing and retaining ring with special tool; insert tool cone end first and drive these two parts out from back side of housing. Seal will be damaged when tool is inserted and must be replaced upon reassembly.

5. Remove retaining ring, washer, backup washer and pressure seal from housing.

6. Check all mating surfaces. To reduce the chance of leakage, replace any parts that have scratches or burrs. Wash all metal parts in clean solvent. Blow them dry with pressurized air. Do not wipe parts dry with paper towels or cloth. Lint in a hydraulic system will cause damage.

7. Place housing on a smooth clean surface, lubricate pressure seal with petroleum jelly and insert in the housing, seal lip in the down position. Use a socket as a seal driver.

8. Place backup washer, washer, and retaining ring on top of the pressure seal. Make sure the retaining ring is fully engaged in groove in housing.
NOTE
WHEN HANDLING MOTOR ASSEMBLY WITHOUT BEARING INSTALLED, EXTRA CARE SHOULD BE TAKEN TO MAKE SURE THAT THE BACK END OF THE OUTPUT SHAFT ALWAYS STAYS FLUSH WITH THE BACK END OF HOUSING SURFACE. IF OUTPUT SHAFT MOVES, IN EITHER DIRECTION MORE THAN 0.79MM (1/32 IN.), OUTPUT SHAFT SHOULD BE REMOVED FROM THE HOUSING SO THAT THE SEAL MAY BE INSPECTED FOR CUTS. IF NECESSARY, REPLACE SEAL PER STEPS 7 AND 8, AND THEN REINSTALL OUTPUT SHAFT PER STEP 9.

9. Place seal bullet over shaft. With bullet and shaft seal lubricated with petroleum jelly, place shaft on a clean smooth hard surface, output end of shaft up. Position housing over shaft and carefully lower housing over bullet and shaft.

10. Remove bullet from shaft end and place retaining ring and bearing on shaft, along with bearing driver tool. Press these parts into housing.

11. Install retaining ring, making sure retaining ring is fully engaged in ring groove in housing.

12. Reposition housing shaft end down. The illustrations have been created from the master parts drawing and are for part reference only.
NOTE
IF THE SHAFT IS NOT FLUSH OR SLIGHTLY BELOW GEROLER MOUNTING SURFACE, PLACE DRIVE IN OPEN END OF THE SHAFT AND THROUGH SPLINE. STRIKE DRIVE WITH A SOFT HAMMER, SHAFT END SHOULD BE IN A HOLE ON A BENCH SO IT IS FREE TO MOVE FORWARD, THE HOUSING ONLY SHOULD BE SUPPORTED.

13. Install seal in seal groove housing.

14. Place drive in shaft, engage spline. Mark drive using mark on shaft as a reference point. Timing procedure is shown below.

15. Place Geroler over drive seal groove up, star point or star valley aligned with mark on drive per your rotation preference.

16. Align bolt holes on Geroler with housing holes, and install seal in seal groove of Geroler.

17. Place end cap on Geroler, insert seven cap screws and pretorque in a criss-cross pattern to a 28-34 Nm (250-300 in-lb). Final torque in a criss-cross pattern to a 51-62 Nm (450-550 in-lb).

18. Install new o-ring on case drain plug. This plug would be present only when case drain option is not being used. Torque plug to 7-9 Nm (64-84 inlb).

2-20. 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.

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

* Inspection and Maintenance Code 10 to be performed every two years (1200 hours).
Figure 2-23. Electrical Schematic - Gravity Lift Down Machines. (Sheet 1 of 2)
Figure 2-23. Electrical Schematic - Gravity Lift Down Machines. (Sheet 2 of 2)
Figure 2-24. Hydraulic Diagram - Standard - Power Lift Down Machines.
Figure 2-25. Hydraulic Diagram - Gravity Lift Down Machines.

- JLG Sizzor -

2-35/2-36 Blank
Updated 10/98
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 9-1 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.

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

![JLG SMART System™ Controller.](image)

Figure 3-1. JLG SMART System™ Controller.

⚠️ 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.

⚠️ 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 750 PSI (52 BAR) AT A MINIMUM DISTANCE OF 12 INCHES (30.5 CM) 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>
<thead>
<tr>
<th>TROUBLE</th>
<th>PROBABLE CAUSE</th>
<th>REMEDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>All machine functions do not operate.</td>
<td>Emergency Stop switch not activated.</td>
<td>Activate Emergency Stop switch and wait for flash of LED's.</td>
</tr>
<tr>
<td></td>
<td>Joystick not in neutral position. (flash code 2-7)</td>
<td>Release joystick, then select function.</td>
</tr>
<tr>
<td></td>
<td>Joystick potentiometer not centered.</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>Idle time-out. (flash code 1-1)</td>
<td>Select function again.</td>
</tr>
<tr>
<td></td>
<td>Mux stream not being updated. (flash code 9-3)</td>
<td>Use voltmeter to verify power on J4 of the multiplexer board.</td>
</tr>
<tr>
<td></td>
<td>• No power to the multiplexer card in the platform.</td>
<td>Re-connect cable to platform box or J2.</td>
</tr>
<tr>
<td></td>
<td>• Platform cable not connected to platform box or SMART System™ at base (J2).</td>
<td>Replace multiplexer card. (JLG part no. 0810123)</td>
</tr>
<tr>
<td></td>
<td>• Faulty multiplexer card.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Battery voltage out of range. (flash code 4-4)</td>
<td>Check voltage with VOM. Unplug battery charger.</td>
</tr>
<tr>
<td></td>
<td>• If battery charger is plugged in, voltage of batteries may be above 31 Volts.</td>
<td>Check voltage with VOM. Plug in battery charger.</td>
</tr>
<tr>
<td></td>
<td>• Battery voltage too low.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Line contactor open circuit. (flash code 3-1)</td>
<td>Check wire terminations on line contactor and harness connection at J1. Tighten connections as necessary.</td>
</tr>
<tr>
<td></td>
<td>• Loose wiring connections on line contactor or at harness connection J1.</td>
<td>Clean corrosion from line contactor.</td>
</tr>
<tr>
<td></td>
<td>• Open coil on line contactor.</td>
<td>Replace line contactor. (JLG part no. 3740117)</td>
</tr>
<tr>
<td></td>
<td>• Faulty wiring at J1.</td>
<td>Repair or replace wiring as necessary.</td>
</tr>
<tr>
<td>TROUBLE</td>
<td>PROBABLE CAUSE</td>
<td>REMEDY</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Machine Functions. (cont.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All machine functions do not operate. (cont.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Line contactor welded. (flash code 3-1)</td>
<td>Replace line contactor. (JLG part no. 3740117)</td>
<td></td>
</tr>
<tr>
<td>Line contactor or other driver short circuit or tripped. (flash code 3-3)</td>
<td>Disconnect valve harness at J1. Using an ohmmeter, 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. 1600258)</td>
<td></td>
</tr>
<tr>
<td>Point A short circuit. (flash code 9-6)</td>
<td>Check motor lead connections. Tighten connections as necessary.</td>
<td></td>
</tr>
<tr>
<td>• Motor lead connections loose.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Faulty controller.</td>
<td>Replace controller. (JLG part no. 1600258)</td>
<td></td>
</tr>
<tr>
<td>Point A open circuit. (flash code 9-7)</td>
<td>Replace controller. (JLG part no. 1600258)</td>
<td></td>
</tr>
<tr>
<td>• Faulty controller.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Motor stalled.</td>
<td>Determine cause. Repair or replace motor (JLG part no. 3600266) as necessary.</td>
<td></td>
</tr>
<tr>
<td>Motor open circuit. (flash code 9-8)</td>
<td>Replace motor. (JLG part no. 3600266)</td>
<td></td>
</tr>
<tr>
<td>• Faulty motor.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No drive function when platform fully lowered. Lift function okay.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cutout input. (flash code 2-5)</td>
<td>Use analyzer to verify limit switch inputs. Drive cutout and Elevation cutout should be HI. Adjust or repair malfunctioning limit switch.</td>
<td></td>
</tr>
<tr>
<td>• Malfunctioning limit switch.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No drive function when platform elevated. Lift function okay.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cutout input. (flash code 2-5)</td>
<td>Use analyzer to verify limit switch inputs. Pothole should be HI. Adjust or repair malfunctioning limit switch.</td>
<td></td>
</tr>
<tr>
<td>• Malfunctioning limit switch.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Platform above drive cutout height.</td>
<td>Lower platform below drive cutout height.</td>
<td></td>
</tr>
<tr>
<td>Machine cannot lift down. Lift up function okay.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cutout input. (flash code 2-5)</td>
<td>Use analyzer to verify limit switch inputs. Extension limit should be HI. Retract deck extension.</td>
<td></td>
</tr>
<tr>
<td>• Deck extension extended.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TROUBLE</td>
<td>PROBABLE CAUSE</td>
<td>REMEDY</td>
</tr>
<tr>
<td>---------</td>
<td>---------------</td>
<td>--------</td>
</tr>
<tr>
<td><strong>Hydraulic System - General.</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hydraulic pump noisy.</strong></td>
<td>Air bubbles in oil. (Reservoir too low.) Oil filter dirty.</td>
<td>Replenish oil as necessary. Clean and/or replace filter as necessary.</td>
</tr>
<tr>
<td><strong>Pump cavitating. (Vacuum in pump due to oil starvation.)</strong></td>
<td>Oil in reservoir low. Restricted reservoir air vent. Oil viscosity too high.</td>
<td>Replenish oil as necessary. Clean vent. Drain system and replace with recommended oil. Refer to Table 1-1, Hydraulic Oil.</td>
</tr>
<tr>
<td><strong>System overheating.</strong></td>
<td>Oil viscosity too high. Main relief valve set too high. Hydraulic system oil low.</td>
<td>Drain system and replace with recommended oil. Refer to Table 1-1, Hydraulic Oil. Adjust relief valve to proper pressure. Replenish oil as necessary.</td>
</tr>
<tr>
<td><strong>Pump not delivering oil.</strong></td>
<td>Defective pump on motor.</td>
<td>Repair or replace motor.</td>
</tr>
<tr>
<td><strong>System pressure too low.</strong></td>
<td>Main relief valve set too low. Hydraulic pump not functioning properly. Leak in component, line or fitting. Scored valve spool; scored cylinder.</td>
<td>Reset valve as required. Repair or replace pump. Repair or replace component, line or fitting. Replace valve; replace cylinder.</td>
</tr>
<tr>
<td><strong>System(s) operate erratically.</strong></td>
<td>Sticking or binding valve cartridge, piston rod, etc. Hydraulic oil not at operating temperature.</td>
<td>Clean, repair or replace components as necessary. Allow oil sufficient time to warm up.</td>
</tr>
</tbody>
</table>
# JLG Worldwide Locations

<table>
<thead>
<tr>
<th>JLG Industries (Australia)</th>
<th>JLG Industries (UK)</th>
<th>JLG Deutschland GmbH</th>
<th>JLG Industries (Italia)</th>
<th>JLG Industries (Europe)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.O. Box 5119</td>
<td>Unit 12, Southside</td>
<td>Max Planck Strasse 21</td>
<td>Via Po. 22</td>
<td></td>
</tr>
<tr>
<td>11 Bolwarra Road</td>
<td>Bredbury Park Industrial Estate</td>
<td>D-27721 Ritterhude/Ihlpohl</td>
<td>20010 Pregnana Milanese - MI</td>
<td></td>
</tr>
<tr>
<td>Port Macquarie</td>
<td>Bredbury</td>
<td>Bei Bremen</td>
<td>Italy</td>
<td></td>
</tr>
<tr>
<td>N.S.W. 2444</td>
<td>Stockport</td>
<td>Germany</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>SK6 2sP</td>
<td>Phone: (49) 421 693 500</td>
<td>Phone: (39) 02 9359 5210</td>
<td></td>
</tr>
<tr>
<td>Phone: (61) 2 65 811111</td>
<td>England</td>
<td>Fax: (49) 421 693 5035</td>
<td>Fax: (39) 02 9359 5845</td>
<td></td>
</tr>
<tr>
<td>Fax: (61) 2 65 810122</td>
<td>Phone: (44) 870 200 7700</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fax: (44) 870 200 7711</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>JLG Latino Americana Ltda.</th>
<th>JLG Europe B.V.</th>
<th>JLG Industries (Norge AS)</th>
<th>JLG Polska</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rua Eng. Carlos Stevenson,</td>
<td>Jupiterstraat 234</td>
<td>Sofeimyrveien 12</td>
<td>Ul. Krolewski</td>
</tr>
<tr>
<td>80-Suite 71</td>
<td>2132 HJ Poofddorp</td>
<td>N-1412 Sofienyr</td>
<td>00-060 Warsawa</td>
</tr>
<tr>
<td>13092-310 Campinas-SP</td>
<td>The Netherlands</td>
<td>Norway</td>
<td>Poland</td>
</tr>
<tr>
<td>Brazil</td>
<td>Phone: (31) 23 565 5665</td>
<td>Phone: (47) 6682 2000</td>
<td>Phone: (48) 91 4320 245</td>
</tr>
<tr>
<td>Phone: (55) 19 3295 0407</td>
<td>Fax: (31) 23 557 2493</td>
<td>Fax: (47) 6682 2001</td>
<td>Fax: (48) 91 4358 200</td>
</tr>
<tr>
<td>Fax: (55) 19 3295 1025</td>
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<td></td>
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<table>
<thead>
<tr>
<th>JLG Industries (Europe)</th>
<th>JLG Industries (Pty) Ltd.</th>
<th>Plataformas Elevadoras</th>
<th>JLG Industries (Sweden)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kilmartin Place,</td>
<td>Unit 1, 24 Industrial Complex</td>
<td>JLG Iberica, S.L.</td>
<td>Enkopingsvagen 150</td>
</tr>
<tr>
<td>Tannochside Park</td>
<td>Herman Street</td>
<td>Trapadella, 2</td>
<td>Box 704</td>
</tr>
<tr>
<td>Uddington G71 5PH</td>
<td>Meadowdale</td>
<td>P.I. Castellbisbal Sur</td>
<td>SE - 175 27 Jarfalla</td>
</tr>
<tr>
<td>Scotland</td>
<td>Germiston</td>
<td>08755Castellbisbal</td>
<td>Sweden</td>
</tr>
<tr>
<td>Phone: (44) 1 698 811005</td>
<td>South Africa</td>
<td>Spain</td>
<td>Phone: (46) 8 506 59500</td>
</tr>
<tr>
<td>Fax: (44) 1 698 811055</td>
<td>Phone: (27) 11 453 1334</td>
<td>Phone: (34) 93 77 24700</td>
<td>Fax: (46) 8 506 59534</td>
</tr>
<tr>
<td></td>
<td>Fax: (27) 11 453 1342</td>
<td>Fax: (34) 93 77 11762</td>
<td></td>
</tr>
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</table>