Ask your supervisor to explain any operation, maintenance, or safety information that you do not fully understand.

**WARNING**

Untrained personnel can cause death or severe injury. Do not operate or perform maintenance on a forklift until you have read and understand:

- The Operation and Safety Manual for the forklift.
- Chapter 2 of this Service Manual.
- The safety labels affixed to the forklift.
- Your employer’s applicable work rules regarding the safety, operation, and maintenance of the forklift.
- Applicable federal, state, or local government regulations.

**WARNING**

Untrained personnel can cause death or severe injury. Do not operate or work on a forklift until you have been trained in the safe operation and maintenance of the forklift.

**– REPLACEMENT OF MANUALS –**

Contact Xtreme Manufacturing, LLC, to obtain replacement Operation and Safety Manuals, Owner’s Service Manuals, Service Manuals, or Illustrated Parts Catalogs.

Xtreme Manufacturing, LLC
8350 Eastgate Road
Henderson, NV 89015
(702) 851-3750
xmfg.com

**IMPORTANT**

Read and understand this manual before operating or performing maintenance on these forklifts.
The following Service Bulletins have been incorporated in this manual:

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Comments</th>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
## Table of Contents

<table>
<thead>
<tr>
<th>PARA.</th>
<th>TITLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Service Bulletins ................................</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Table of Contents ................................</td>
<td>i</td>
</tr>
<tr>
<td>SECTION 1</td>
<td>– GENERAL INFORMATION</td>
<td>1-1</td>
</tr>
<tr>
<td>1-1</td>
<td>LUBRICANTS AND FLUIDS</td>
<td>1-1</td>
</tr>
<tr>
<td>1-2</td>
<td>TORQUE WRENCH USE</td>
<td>1-3</td>
</tr>
<tr>
<td>1-3</td>
<td>CAP SCREW TORQUE VALUES</td>
<td>1-3</td>
</tr>
<tr>
<td>SECTION 2</td>
<td>– MAINTENANCE</td>
<td>2-1</td>
</tr>
<tr>
<td>2-1</td>
<td>PERIODIC MAINTENANCE</td>
<td>2-1</td>
</tr>
<tr>
<td>2-2</td>
<td>GREASE POINTS</td>
<td>2-2</td>
</tr>
<tr>
<td>SECTION 3</td>
<td>– TIRES &amp; WHEELS</td>
<td>3-1</td>
</tr>
<tr>
<td>3-1</td>
<td>CHECK WHEEL LUG NUT TORQUE</td>
<td>3-1</td>
</tr>
<tr>
<td>3-2</td>
<td>INSPECT WHEEL/TIRE ASSEMBLY</td>
<td>3-3</td>
</tr>
<tr>
<td>3-3</td>
<td>REPLACE WHEEL/TIRE ASSEMBLY</td>
<td>3-4</td>
</tr>
<tr>
<td>PARA.</td>
<td>TITLE</td>
<td>PAGE</td>
</tr>
<tr>
<td>-------</td>
<td>-------</td>
<td>------</td>
</tr>
<tr>
<td><strong>SECTION 4 – HYDRAULIC SYSTEM</strong></td>
<td></td>
<td>4-1</td>
</tr>
<tr>
<td>4-1</td>
<td>GENERAL MAINTENANCE SAFETY</td>
<td>4-1</td>
</tr>
<tr>
<td>4-2</td>
<td>HYDRAULICS MAINTENANCE SAFETY AND PRECAUTIONS</td>
<td>4-1</td>
</tr>
<tr>
<td>4-3</td>
<td>HANDLING HYDRAULIC FLUID</td>
<td>4-2</td>
</tr>
<tr>
<td>4-4</td>
<td>MAKING LEAK-FREE CONNECTIONS</td>
<td>4-2</td>
</tr>
<tr>
<td>4-5</td>
<td>HOSE AND TUBING INSTALLATION PRACTICES</td>
<td>4-2</td>
</tr>
<tr>
<td>4-6</td>
<td>OPERATING CONDITIONS</td>
<td>4-2</td>
</tr>
<tr>
<td>4-7</td>
<td>MAINTENANCE PRACTICES</td>
<td>4-3</td>
</tr>
<tr>
<td>4-8</td>
<td>KEEPING THE HYDRAULIC SYSTEM CLEAN</td>
<td>4-4</td>
</tr>
<tr>
<td>4-9</td>
<td>CHECK HYDRAULIC FLUID LEVEL</td>
<td>4-6</td>
</tr>
<tr>
<td>4-10</td>
<td>CHANGE HYDRAULIC FLUID</td>
<td>4-8</td>
</tr>
<tr>
<td>4-11</td>
<td>REPLACE SUCTION STRAINER</td>
<td>4-10</td>
</tr>
<tr>
<td>4-12</td>
<td>CLEAN HYDRAULIC RESERVOIR STRAINER</td>
<td>4-12</td>
</tr>
<tr>
<td>4-13</td>
<td>REPLACE AIR BREATHER</td>
<td>4-14</td>
</tr>
<tr>
<td>4-14</td>
<td>REPLACE HIGH-PRESSURE FILTER</td>
<td>4-16</td>
</tr>
<tr>
<td>4-15</td>
<td>REPLACE RETURN LINE FILTER</td>
<td>4-19</td>
</tr>
<tr>
<td>4-16</td>
<td>TAKING HYDRAULIC FLUID SAMPLE</td>
<td>4-21</td>
</tr>
<tr>
<td>4-17</td>
<td>REPLACING A HOSE</td>
<td>4-24</td>
</tr>
<tr>
<td>1-18</td>
<td>TIGHTENING LOOSE FITTINGS</td>
<td>4-27</td>
</tr>
<tr>
<td>4-19</td>
<td>REPLACE CARTRIDGE VALVE SOLENOID</td>
<td>4-30</td>
</tr>
<tr>
<td>4-19-1</td>
<td>LOCATION OF HYDRAULIC COMPONENTS</td>
<td>4-27</td>
</tr>
<tr>
<td>4-19-2</td>
<td>DISTRIBUTION MANIFOLD HOSE CONNECTIONS</td>
<td>4-30</td>
</tr>
<tr>
<td>4-20</td>
<td>MAINTENANCE REQUIREMENTS FOR FAILED PUMP</td>
<td>4-41</td>
</tr>
</tbody>
</table>

<p>| <strong>SECTION 5 – ELECTRICAL SYSTEM</strong> | | 5-1 |
| 5-1  | GENERAL MAINTENANCE SAFETY | 5-1 |
| 5-2  | BATTERY DESCRIPTION | 5-3 |
| 5-3  | BATTERY CABLE DESCRIPTION | 5-3 |
| 5-4  | CHECK CONDITION OF BATTERY AND CABLES | 5-3 |
| 5-5  | REPLACE BATTERY | 5-4 |
| 5-6  | INSPECT AND CLEAN BATTERY | 5-7 |
| 5-7  | INSTALL AUXILIARY BATTERY | 5-9 |
| 5-8  | ELECTRICAL CENTER ASSEMBLY | 5-11 |
| 5-9  | REPLACE A FUSE | 5-15 |</p>
<table>
<thead>
<tr>
<th>PARA.</th>
<th>TITLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-1</td>
<td>GENERAL MAINTENANCE SAFETY</td>
<td>6-1</td>
</tr>
<tr>
<td>6-2</td>
<td>USING A GREASE GUN</td>
<td>6-1</td>
</tr>
<tr>
<td>6-3</td>
<td>BOOM AND ATTACHMENT LUBRICATION</td>
<td>6-2</td>
</tr>
<tr>
<td>6-4</td>
<td>LUBRICATE BOOM EXTEND CHAIN</td>
<td>6-6</td>
</tr>
<tr>
<td>6-5</td>
<td>INSPECT BOOM CHAINS</td>
<td>6-7</td>
</tr>
<tr>
<td>6-5-1</td>
<td>CHAIN NOMENCLATURE</td>
<td>6-8</td>
</tr>
<tr>
<td>6-5-2</td>
<td>VISUALLY INSPECT CHAIN</td>
<td>6-8</td>
</tr>
<tr>
<td>6-5-3</td>
<td>MEASURE CHAIN EDGE WEAR</td>
<td>6-11</td>
</tr>
<tr>
<td>6-5-4</td>
<td>MEASURE CHAIN ELONGATION</td>
<td>6-13</td>
</tr>
<tr>
<td>6-6</td>
<td>CHECK AND ADJUST BOOM CHAIN TENSION</td>
<td>6-15</td>
</tr>
<tr>
<td>6-7</td>
<td>SLIDE BLOCKS</td>
<td>6-16</td>
</tr>
<tr>
<td>6-8</td>
<td>INSPECT SLIDE BLOCKS</td>
<td>6-16</td>
</tr>
<tr>
<td>6-9</td>
<td>REPLACE SLIDE BLOCKS</td>
<td>6-20</td>
</tr>
<tr>
<td>6-10</td>
<td>INSPECT BOOM ROLLERS</td>
<td>6-21</td>
</tr>
<tr>
<td>6-11</td>
<td>FORK NOMENCLATURE</td>
<td>6-24</td>
</tr>
<tr>
<td>6-12</td>
<td>MEASURE FORK FLANK WEAR</td>
<td>6-26</td>
</tr>
<tr>
<td>6-13</td>
<td>FORK INSPECTION</td>
<td>6-28</td>
</tr>
<tr>
<td>6-14</td>
<td>MANUALLY RETRACT AND LOWER BOOM</td>
<td>6-29</td>
</tr>
<tr>
<td>7-1</td>
<td>CHECK OPERATION OF REAR AXLE STABILIZATION SYSTEM</td>
<td>7-1</td>
</tr>
<tr>
<td>8-1</td>
<td>GENERAL MAINTENANCE SAFETY</td>
<td>8-1</td>
</tr>
<tr>
<td>8-2</td>
<td>PREPARING ENGINE FOR LONG-TERM STORAGE</td>
<td>8-1</td>
</tr>
<tr>
<td>8-3</td>
<td>PREPARING FORKLIFT FOR LONG-TERM STORAGE</td>
<td>8-4</td>
</tr>
<tr>
<td>8-4</td>
<td>TRANSPORTING FORKLIFT</td>
<td>8-5</td>
</tr>
</tbody>
</table>
# Table of Contents – Cont.

<table>
<thead>
<tr>
<th>PARA.</th>
<th>TITLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SECTION 9 – ENGINE</strong></td>
<td></td>
<td>9-1</td>
</tr>
<tr>
<td>9-1</td>
<td>GENERAL MAINTENANCE SAFETY</td>
<td>9-1</td>
</tr>
<tr>
<td>9-2</td>
<td>CHECK ENGINE OIL LEVEL</td>
<td>9-2</td>
</tr>
<tr>
<td>9-3</td>
<td>CHECK ENGINE COOLANT LEVEL</td>
<td>9-3</td>
</tr>
<tr>
<td>9-4</td>
<td>CHECK FOR OIL AND COOLANT LEAKS</td>
<td>9-5</td>
</tr>
<tr>
<td>9-5</td>
<td>CHECK FOR WATER IN FUEL-WATER SEPARATOR</td>
<td>9-6</td>
</tr>
<tr>
<td>9-6</td>
<td>EMPTY AIR FILTER DUST CUP</td>
<td>9-8</td>
</tr>
<tr>
<td>9-7</td>
<td>CHECK CONDITION AND TENSION OF DRIVE BELTS</td>
<td>9-10</td>
</tr>
<tr>
<td>9-8</td>
<td>CHANGE ENGINE OIL</td>
<td>9-10</td>
</tr>
<tr>
<td>9-9</td>
<td>REPLACE OIL FILTERS</td>
<td>9-13</td>
</tr>
<tr>
<td>9-10</td>
<td>REPLACE FUEL FILTER</td>
<td>9-16</td>
</tr>
<tr>
<td>9-11</td>
<td>CHECK SPECIFIC GRAVITY OF COOLANT</td>
<td>9-18</td>
</tr>
<tr>
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<td>DRAIN AND FLUSH COOLING SYSTEM</td>
<td>9-20</td>
</tr>
<tr>
<td>9-13</td>
<td>REPLACE AIR FILTERS</td>
<td>9-22</td>
</tr>
<tr>
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<td>CHECK AND ADJUST VALVE TIP CLEARANCES</td>
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</tr>
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<td>9-29</td>
</tr>
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<td>CHECK RADIATOR HOSES AND CONNECTIONS</td>
<td>9-30</td>
</tr>
<tr>
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<td>CHECK ENGINE WIRING AND CONNECTIONS</td>
<td>9-31</td>
</tr>
<tr>
<td>9-20</td>
<td>CHECK FOR OIL, COOLANT, AND FUEL LEAKS</td>
<td>9-32</td>
</tr>
<tr>
<td><strong>SECTION 10 – TRANSMISSION, AXLES, AND DRIVESHAFTS</strong></td>
<td></td>
<td>10-1</td>
</tr>
<tr>
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<td>GENERAL MAINTENANCE SAFETY</td>
<td>10-1</td>
</tr>
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<td>10-1</td>
</tr>
<tr>
<td>10-3</td>
<td>LUBRICATE AXLE GREASE FITTINGS</td>
<td>10-2</td>
</tr>
<tr>
<td>10-4</td>
<td>LUBRICATE DRIVESHAFTS</td>
<td>10-4</td>
</tr>
<tr>
<td>10-5</td>
<td>REPLACE TRANSMISSION FILTERS AND FLUID</td>
<td>10-6</td>
</tr>
<tr>
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<td>10-8</td>
</tr>
<tr>
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<td>10-11</td>
</tr>
<tr>
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<td>DRAIN AND FILL AXLE WHEEL-END</td>
<td>10-13</td>
</tr>
</tbody>
</table>
## Table of Contents – Cont.

<table>
<thead>
<tr>
<th>PARA.</th>
<th>TITLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPENDIX – MAINTENANCE FORMS AND SAFETY TAGS</td>
<td></td>
<td>A-1</td>
</tr>
<tr>
<td>A-1</td>
<td>Preventive Maintenance and History Logs</td>
<td>A-1</td>
</tr>
<tr>
<td>A-2</td>
<td>Pre-Operation Checklist</td>
<td>A-1</td>
</tr>
<tr>
<td>A-3</td>
<td>Safety Tags</td>
<td>A-1</td>
</tr>
<tr>
<td></td>
<td>Maintenance Schedule</td>
<td>A-2</td>
</tr>
<tr>
<td></td>
<td>Maintenance History Log</td>
<td>A-8</td>
</tr>
<tr>
<td></td>
<td>Fork Inspection Log</td>
<td>A-11</td>
</tr>
<tr>
<td></td>
<td>Pre-Operation Checklist</td>
<td>A-13</td>
</tr>
<tr>
<td></td>
<td>Grease Fittings List</td>
<td>A-15</td>
</tr>
<tr>
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<td>Danger Tags</td>
<td>A-16</td>
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<td>A-17</td>
</tr>
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<td>Notes</td>
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1-1 LUBRICANTS AND FLUIDS

The lubricants and fluids listed in Table 1-1 are required for forklift lubrication and servicing.

Table 1-1. Lubricants and Fluids

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<tr>
<th>Item</th>
<th>Specification</th>
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<tr>
<td>Fuel</td>
<td>ASTM #2 diesel fuel with minimum Cetane rating of 40 for better fuel economy and performance under most operating conditions. Use standard #2 diesel fuel for operating at temperatures above 32°F. Use a blend of #1 and #2 diesel fuel (&quot;winterized&quot; #2 diesel) for operating at temperatures below 32°F. Fuels with Cetane ratings higher than 40 may be required in higher altitudes or an extremely low temperature climate to prevent misfiring and excessive smoke.</td>
</tr>
<tr>
<td>Engine oil</td>
<td>15W-40 API CJ-4</td>
</tr>
<tr>
<td>Engine coolant</td>
<td>DefendAL™ Heavy Duty Pre-Charged Antifreeze/Coolant</td>
</tr>
<tr>
<td>Transmission fluid</td>
<td>Dexron III</td>
</tr>
<tr>
<td>Axle oil</td>
<td>XR842) TRACTELF SF3; XR1045 One axle requires SAE 80W-90 EP API GL4 Oil; the other axle requires SAE 80W-90 EP API GL5 Oil.</td>
</tr>
<tr>
<td>Service brake fluid (842)</td>
<td>Dexron III</td>
</tr>
<tr>
<td>Hydraulic fluid</td>
<td>Dexron III (AW46 for older units with clear fluid)</td>
</tr>
<tr>
<td>Grease</td>
<td>Extreme pressure NLGI #2 or better</td>
</tr>
<tr>
<td>Chain lubricants</td>
<td>Zep 45 Penetrating Lubricant</td>
</tr>
<tr>
<td></td>
<td>LPS 3® Heavy-Duty Inhibitor</td>
</tr>
<tr>
<td></td>
<td>Lubriplate Chain &amp; Cable Fluid</td>
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### Table 1-1. Specifications

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<tr>
<td><strong>Performance</strong></td>
<td></td>
</tr>
<tr>
<td>Lift capacity</td>
<td>XR842: 8,000 lbs / XR1045: 10,000 lbs</td>
</tr>
<tr>
<td>Lift height</td>
<td>XR842: 41' 5&quot; / XR1045: 44'8&quot;</td>
</tr>
<tr>
<td>Forward reach</td>
<td>XR842: 28' 10&quot; / XR1045: 30' 4&quot;</td>
</tr>
<tr>
<td>Frame leveling</td>
<td>11° left, 11° right</td>
</tr>
<tr>
<td>Operating weight</td>
<td>XR842: 26,850 lbs / XR1045: 30,800 lbs</td>
</tr>
<tr>
<td><strong>Power Train</strong></td>
<td></td>
</tr>
<tr>
<td>Engine</td>
<td>Perkins diesel</td>
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<tr>
<td>Horsepower</td>
<td>74</td>
</tr>
<tr>
<td>Fuel capacity</td>
<td>48 gallons</td>
</tr>
<tr>
<td>Transmission</td>
<td>Dana</td>
</tr>
<tr>
<td>Speeds</td>
<td>3</td>
</tr>
<tr>
<td>Axle</td>
<td>ZF</td>
</tr>
<tr>
<td>Service brakes</td>
<td>Inboard, wet disk</td>
</tr>
<tr>
<td>Parking brake</td>
<td>Spring-actuated, hydraulically-released</td>
</tr>
<tr>
<td>Tires</td>
<td>Foam filled, 13.0 x 24 E3 / G2</td>
</tr>
<tr>
<td><strong>Hydraulic System</strong></td>
<td></td>
</tr>
<tr>
<td>Pump</td>
<td>Kawasaki K3VL80</td>
</tr>
<tr>
<td>Maximum flow rate at rated engine speed</td>
<td>XR842: 39 GPM / XR1045: 49 GPM</td>
</tr>
<tr>
<td>Maximum pressure</td>
<td>3,500 psi</td>
</tr>
<tr>
<td>Hydraulic reservoir capacity</td>
<td>45 gallons</td>
</tr>
<tr>
<td><strong>Dimensions</strong></td>
<td></td>
</tr>
<tr>
<td>Length to fork face</td>
<td>XR842: 20' 11&quot; / XR1045: 21' 9&quot;</td>
</tr>
<tr>
<td>Wheel base</td>
<td>10'</td>
</tr>
<tr>
<td>Width</td>
<td>XR842: 8' 5&quot; / XR1045: 8' 5&quot;</td>
</tr>
<tr>
<td>Ground clearance</td>
<td>16.5&quot;</td>
</tr>
<tr>
<td>Height</td>
<td>XR842: 7' 11&quot; / XR1045: 7' 11&quot;</td>
</tr>
<tr>
<td>Turning radius</td>
<td>12' (inside)</td>
</tr>
</tbody>
</table>
1-2 TORQUE WRENCH USE
Numerous forklift components require that the attaching hardware be torqued to a specific value during component installation. A torque wrench is required to tighten bolts, nuts, and screws. Listed below are standard procedures and precautions to observe when using a torque wrench:

- Ensure that the torque wrench has been calibrated.
- Always work with clean fastener threads that are free of corrosion.
- If an installation procedure specifies a thread lubricant, use it.
- Observe the torque sequence instructions provided in installation procedures.
- Pull the torque wrench in a clockwise direction, using a steady, smooth motion. A fast or jerky tightening motion will result in an improperly torqued fastener.
- Avoid over-tightening a fastener with a conventional wrench or impact wrench before applying a torque wrench to the fastener.
- Do not use the torque wrench to apply greater amounts of torque than its rated capacity.
- Never use a torque wrench as a hammer or to pry apart parts.
- Never use a torque wrench as a conventional wrench.
- Do not apply a torque wrench to a nut that has been tightened. Back off the nut one turn with a conventional wrench and retighten it to the correct torque with a torque wrench.
- Do not use the torque wrench to break loose bolts that have been previously tightened.
- Avoid dropping a torque wrench. If a wrench is dropped, check its accuracy on a torque tester.
- When using a torque wrench, do not over-torque the fastener by applying torque past the release point. Learn the feel of the torque wrench release rather than relying on the sound the wrench makes.
- When not in use, set the torque wrench to its lowest torque value. But DO NOT set the wrench to a value below the lowest torque value.

When the torque wrench is in frequent or continuous use, periodically check the wrench’s calibration accuracy.

1-3 CAP SCREW TORQUE VALUES
Refer to Table 1-3 for a listing of recommended assembly torque values for Society of Automotive Engineers (SAE) Grade 5 and Grade 8 cap screws. The following criteria apply to the determination of torque values:

- All torque values are based on the use of through-hardened flat washers under the bolt head and nut or only under the bolt head in a tapped hole application. This provides a uniform, hard, smooth bearing surface.
- Torque values are calculated at 75% of proof load. This calculation method provides a safety factor.
- All dry torque values are given for the as received condition, such as plated hex head cap screws.

Ensure that damaged cap screws are replaced with SAE grade 8 cap screws from a reputable manufacturer/vendor. Refer to Figure 1-1 for a diagram depicting the cap screw head markings of a grade 8 cap screw or bolt.
<table>
<thead>
<tr>
<th>Nominal Diameter (Inches) and Threads-Per-Inch</th>
<th>Tightening Torque (Ft-Lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SAE Grade 5 Cap Screws</td>
</tr>
<tr>
<td>1/4 20</td>
<td>8 (96) a</td>
</tr>
<tr>
<td>1/4 28</td>
<td>10 (120) a</td>
</tr>
<tr>
<td>5/16 18</td>
<td>17 (205) a</td>
</tr>
<tr>
<td>5/16 24</td>
<td>19 (230) a</td>
</tr>
<tr>
<td>3/8 16</td>
<td>31 (370) a</td>
</tr>
<tr>
<td>3/8 24</td>
<td>35 (420) a</td>
</tr>
<tr>
<td>7/16 14</td>
<td>49 (590) a</td>
</tr>
<tr>
<td>7/16 20</td>
<td>56 (670) a</td>
</tr>
<tr>
<td>1/2 13</td>
<td>76</td>
</tr>
<tr>
<td>1/2 20</td>
<td>86</td>
</tr>
<tr>
<td>9/16 12</td>
<td>110</td>
</tr>
<tr>
<td>9/16 18</td>
<td>122</td>
</tr>
<tr>
<td>5/8 11</td>
<td>150</td>
</tr>
<tr>
<td>5/8 18</td>
<td>170</td>
</tr>
<tr>
<td>3/4 10</td>
<td>265</td>
</tr>
<tr>
<td>3/4 16</td>
<td>295</td>
</tr>
<tr>
<td>7/8 9</td>
<td>430</td>
</tr>
<tr>
<td>7/8 14</td>
<td>475</td>
</tr>
<tr>
<td>1 8</td>
<td>645</td>
</tr>
<tr>
<td>1 14</td>
<td>723</td>
</tr>
<tr>
<td>1-1/8 7</td>
<td>794</td>
</tr>
<tr>
<td>1-1/8 12</td>
<td>890</td>
</tr>
<tr>
<td>1-1/4 7</td>
<td>1120</td>
</tr>
<tr>
<td>1-1/4 12</td>
<td>1241</td>
</tr>
<tr>
<td>1-3/8 6</td>
<td>1469</td>
</tr>
<tr>
<td>1-3/8 12</td>
<td>1672</td>
</tr>
</tbody>
</table>
Table 1-4. Tightening Torque Values – Cap Screws

<table>
<thead>
<tr>
<th>Nominal Diameter (Inches) and Threads-Per-Inch</th>
<th>Tightening Torque (Ft-Lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SAE Grade 5 Cap Screws</td>
</tr>
<tr>
<td>1-1/2</td>
<td>1949</td>
</tr>
<tr>
<td>1-1/2</td>
<td>2194</td>
</tr>
</tbody>
</table>

*Installation with an inch-pound torque wrench is recommended. The inch-pound torque value is listed in parentheses.

SAE GRADE 8
BOLT MARKINGS

Figure 1-1. SAE Grade 8 Bolt Markings
## Section 2
### Maintenance

#### 2-1 XR842/XR1045 Periodic Maintenance

<table>
<thead>
<tr>
<th>Component</th>
<th>Part Number</th>
<th>Daily</th>
<th>50-100 Hours</th>
<th>250 Hours</th>
<th>500 Hours</th>
<th>1000 Hours</th>
<th>2000 Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine Oil</td>
<td>13952-009</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CES 20881/API</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CJ-4/ACEA E9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engine Oil Filter</td>
<td>14362-010</td>
<td>I</td>
<td>I</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary Air Filter</td>
<td>14362-011</td>
<td>I</td>
<td>I</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary Air Filter</td>
<td>14362-008</td>
<td>D</td>
<td>R</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary Fuel Filter</td>
<td>13952-008</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary Fuel Filter</td>
<td></td>
<td>R</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankcase Breather</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engine Belts</td>
<td></td>
<td>I</td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coolant Level</td>
<td></td>
<td>I</td>
<td>T</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replace Filter</td>
<td>14105-010</td>
<td></td>
<td>R</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transmission Oil (Hygard)</td>
<td></td>
<td>I</td>
<td>I</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change Differential Oil</td>
<td></td>
<td>I</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Hygard)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change Planetary Oil</td>
<td></td>
<td>I</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Hygard)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Return Filter</td>
<td>14361-000</td>
<td>R</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Pressure Filter</td>
<td>14360-000</td>
<td>R</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tank Breather</td>
<td></td>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suction Filter</td>
<td>14365-000</td>
<td>R</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydraulic Oil (Dexron III)</td>
<td>14362-011</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Legend:**
- I = Inspect
- D = Drain
- R = Replace
- T = Test
2-2  Grease Points

XR842
XR1045

Lube Chart

Slide Pads

Slide Pads

NOTE: Orange arrow indicates lubrication first 50 hours, then every 250 hours.

NOTE: use extreme pressure NLGI #2 or better.
Section 3
Wheels & Tires

3-1 CHECK WHEEL LUG NUT TORQUE

Perform the following procedure to check the torque applied to the wheel lug nuts:

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Torque wrench</td>
</tr>
<tr>
<td></td>
<td>30 mm socket</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2)</td>
</tr>
</tbody>
</table>

INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key. Refer to para. 2-5, for lockout-tagout procedure.

CHECK LUG NUT TORQUE

1. Set torque wrench to 400 ft-lbs.
2. Attach 30 mm socket to torque wrench.

   **NOTE:** If a lug nut is found to be very loose, first tighten lug nut with a wrench or impact driver until moderately tight. Then use the torque wrench for precise tightening.

3. See Figure 7-1. Place socket on lug nut No. 1 and check torque. With very little clockwise (tightening) pressure, torque wrench should make an audible click sound. This click sound indicates that lug nut is properly torqued to 400 ft-lbs.

4. In the sequence shown in Figure 7-1, check torque on remainder of wheel lug nuts.

5. Check wheel lug nut torque on three remaining wheels.

![Figure 3-1. Lug Nut Torque Check Sequence](image)
3-2 INSPECT WHEEL/TIRE ASSEMBLY

Perform the following procedure to inspect the wheel/tire assembly:

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2)</td>
</tr>
</tbody>
</table>

INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key. Refer to para. 2-5, for lockout-tagout procedure.

INSPECTION

1. Inspect wheels (Figure 3-2) for following defects:
   - Loose or missing lug nuts.
   - Corroded or damaged lug nuts.
   - Cracks, corrosion, or other damage to the rim.
2. Inspect tires (Figure 3-2) for the following defects:
   - Pneumatic (air-filled) tires installed instead of foam filled tires.
   - Excessive tire wear.
   - Mismatched tires.
   - Tears, cracks, or cuts in the tire casing.
3-3 REPLACE WHEEL/TIRE ASSEMBLY

Perform the following procedure to replace the wheel/tire assembly:

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td></td>
<td>Torque wrench</td>
</tr>
<tr>
<td></td>
<td>Lift, or Hydraulic jack(s), and jack-stand(s)</td>
</tr>
<tr>
<td></td>
<td>Tire dolly</td>
</tr>
<tr>
<td></td>
<td>Wire brush</td>
</tr>
<tr>
<td></td>
<td>30 mm socket</td>
</tr>
<tr>
<td></td>
<td>Impact tool</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2)</td>
</tr>
<tr>
<td></td>
<td>Wheel with foam-filled tire</td>
</tr>
</tbody>
</table>
Support the weight of the forklift using a suitable lift, or jack(s) and jack stands with the appropriate load capacity. Forklift operating weights are listed below.

Table 3-1. Forklift Operating Weights

<table>
<thead>
<tr>
<th>Forklift Model</th>
<th>Operating Weight (Lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>XR842</td>
<td>26,850</td>
</tr>
<tr>
<td>XR1045</td>
<td>30,800</td>
</tr>
</tbody>
</table>

INITIAL SET-UP
1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key. Refer to your company's approved lockout-tagout procedure.

REMOVAL
1. Raise forklift on lift or with jack(s) and support weight with jack stands.
2. Remove lug nuts with impact wrench with 30mm socket.
3. Remove wheel/tire assembly from wheel-end.

INSTALLATION
1. Clean wheel-end studs if dirty or corroded.
2. Clean area around wheel bolt holes if dirty or corroded.
3. Place wheel/tire assembly on wheel-end.
4. To prevent cross-threading lug nuts, thread nuts on wheel-end studs by hand.
5. Using impact wrench and 30mm socket, tighten lug nuts. DO NOT over tighten nuts.
6. Torque lug nuts in accordance with instructions provided on Figure 3-3.
7. Lower forklift.
Figure 3-3. Wheel Lug Nut Tightening Sequence

**STEP 1**
Hand-tighten nuts.

**STEP 2**
In sequence, use wrench to tighten nuts until snug.

**STEP 3**
In sequence, use torque wrench to torque nuts to 300 ft-lbs.

**STEP 4**
In sequence, use torque wrench to torque nuts to 350 ft-lbs. Then torque nuts to 400 ft-lbs.
Section 4
Hydraulic System

4-1 GENERAL MAINTENANCE SAFETY

**WARNING**

Use caution when performing maintenance on the forklift. Wear personal protective equipment when appropriate and use danger tags. Carefully follow the maintenance procedures provided in this chapter. Read the Material Safety Data Sheets (MSDS) for solvents, cleaners, etc. Read and fully understand the safety information before performing maintenance on the forklift.

4-2 HYDRAULICS MAINTENANCE SAFETY AND PRECAUTIONS

**WARNING**

- Escaping hydraulic fluid under pressure can penetrate the skin, causing death or extremely serious injury. Amputation of hands and arms is often necessary to prevent death. Relieve hydraulic pressure before removing and installing any hydraulic system component.

- **DO NOT** use your hand or any part of your body to check for hydraulic leaks. When checking for hydraulic leaks, wear safety glasses and gloves to help provide protection from spraying hydraulic fluid. Use a piece of cardboard or paper to search for leaks.

- Hot hydraulic fluid can cause severe burns. Wait for hydraulic fluid to cool before performing maintenance on any hydraulic component.
Hydraulic System

- Spilled hydraulic fluid is a combustible and slip hazard material that requires immediate containment and cleaning. Failure to identify the spill, alert nearby personnel, and clean the spilled fluid may result in death or serious personal injury, and damage to equipment and facilities.

**CAUTION**

Very minute foreign particles, as small as 10 microns, can adversely affect operation of the hydraulic systems. (One micron equals one millionth of a meter.) Use extreme caution to prevent dirt, debris, and other contaminants from entering the hydraulic system.

4-3 HANDLING HYDRAULIC FLUID

The following general precautions must be observed when handling hydraulic fluid:

- NEVER allow different categories of hydraulic fluids to become mixed. Chemical reactions may occur; fire resistant fluids may lose their fire resistance; and seals may be damaged.
- NEVER, under any circumstances, service the forklift with a fluid other than Dexron III (AW46 for older units with clear fluid).
- ENSURE that hydraulic fluid and fluid containers are protected from contamination of any kind. Dirt particles may cause hydraulic components to become inoperative, cause seal damage, etc. If there is any question regarding the cleanliness of the fluid, DO NOT use it. Containers for hydraulic fluid must never be left open to air longer than necessary.
- DO NOT expose hydraulic fluid to high temperature or open flames. Mineral-based fluids, such as Dexron III, are highly flammable.

4-4 MAKING LEAK-FREE CONNECTIONS

Some leakage in a hydraulic system is unavoidable. An example of this type of leakage would be the slight amount of fluid found on cylinder rods. However, any leakage reduces efficiency and causes power loss. Factors that contribute to leakage are:

- Hose and tubing installation practices.
- Operating conditions.
- Maintenance practices.

4-5 HOSE AND TUBING INSTALLATION PRACTICES

Installing hoses and tubing according to Xtreme Manufacturing maintenance instructions (Figure 8-1) will promote long life of external seals. Vibration or stresses that result from improper installation can shake loose connections. Avoid pinching, cocking, or incorrectly installing seals during hydraulic component installation.

4-6 OPERATING CONDITIONS

To ensure correct seal life, the operating conditions of the forklift must be controlled. A shaft seal or piston-rod seal exposed to moisture, salt, dirt, or any other abrasive contaminant will adversely affect a seal. Also, operators should always try to keep their loads within the recommended limits to prevent leakage caused by excessive pressures.
4-7 MAINTENANCE PRACTICES

Regular filter and hydraulic fluid changes, using high-quality Dexron III hydraulic fluid, adds to seal life. Using an inferior fluid will cause wear on seals and interfere with desirable hydraulic fluid properties. Proper maintenance prevents introduction of contaminants that can damage seals. Never use additives without approval from Xtreme Manufacturing. Manufacturers recommend soaking seals overnight in hydraulic fluid before installation. Do not install seals dry. Before installation, always coat seals with clean hydraulic fluid.

**NOTE**

A LEAKING CONNECTION THAT PRODUCES ONE DROP EVERY 10 SECONDS WILL WASTE 40 GALLONS OF HYDRAULIC FLUID EACH YEAR.

**IMPORTANT!** - ENSURE THAT:

- FITTINGS ARE CLEAN.
- FITTINGS ARE NOT DAMAGED.
- HOSE IS NOT DAMAGED.
- HOSE IS CONNECTED TO THE CORRECT FITTING.
- HOSE IS PROPERLY ROUTED WITH NO TWISTS AND SHARP BENDS.
- HOSE HAS SUFFICIENT SLACK.

**Figure 4-1. Making Leak-Free Connections**
4-8 KEEPING THE HYDRAULIC SYSTEM CLEAN

The hydraulic system has been carefully designed to keep the hydraulic fluid free of contaminants. See Figure 8-2 for a schematic diagram of the hydraulic filtration system. The filtration system is comprised of the following components:

- Air breather (10 µM absolute).
- Suction strainer (200 µM).
- High-pressure filter (10 µM absolute).
- Return line filter (10 µM absolute).

Note that one micron (1 µM) is equal to one-millionth of a meter. Regardless of how thoroughly the system filters the fluid, it can easily be defeated by poor maintenance practices. To keep the hydraulic system free of contamination, it is essential that the following maintenance practices be followed:

- Clean exterior surfaces of dust, dirt, hydraulic fluid, etc. before removing covers.
- Ensure that new parts are clean before installation.
- Keep parts protected prior to assembly or installation.
- Protect system openings. Use covers, tape, plastic wrap, etc. to cover the openings.
- Keep fluid transfer containers, funnels, nozzles, etc. clean.
Figure 4-2. Hydraulic Filtration System
4-9 CHECK HYDRAULIC FLUID LEVEL

Perform the following procedure to check the hydraulic fluid level and add fluid if required:

CHECK FLUID LEVEL
Check sight gauge on side of hydraulic reservoir (Figure 8-3). Fluid level should be at mid-point on gauge. If fluid level is low, refer to ADD FLUID procedure below.

ADD FLUID

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
</table>
| Special tools and equipment | Safety glasses  
Hex key wrench, 3/4"  
Funnel |
| Parts and consumable materials | Danger tags  
Hydraulic fluid, Dexron III  
(AW46 for older units with clear fluid)  
Safety solvent  
Brush  
Lint-free wiping cloths or clean cloth |

INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key. Refer to para. 2-5, for lockout-tagout procedure.
7. Relieve hydraulic system pressure as follows:
   a. Remove air breather from reservoir. Be careful to prevent contamination of air breather or reservoir fittings.
   b. Depress pressure relief valve in center of reservoir air breather fitting.
Contaminated hydraulic fluid can severely damage hydraulic system components and degrade performance. Ensure that filler cap and pipe are clean to prevent contaminants from entering reservoir when fluid is added to tank.

NOTE: Some early forklift models have lockable, filler caps used for adding hydraulic fluid. Late model forklifts have a plug installed in the filler/breather plate.

1. Inspect filler cap (Figure 4-4) and surrounding area for dirt and debris. Clean as required.
2. Unlock filler cap and lift cap.
3. Add fluid to reservoir until fluid level reaches midpoint on sight gauge.
4. Close and lock filler cap.

ADD FLUID – PLUG

1. Inspect plug (Figure 4-4) and surrounding area for dirt and debris. Clean as required.
2. Remove plug with adjustable wrench or 3/4" hex key wrench. Remove O-ring.
3. Add fluid to reservoir until fluid level reaches midpoint on sight gauge.
4. Install O-ring and plug in filler/breather plate and tighten.
4-10 CHANGE HYDRAULIC FLUID

Perform the following procedure to change the hydraulic fluid:

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td></td>
<td>Funnel</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2)</td>
</tr>
<tr>
<td></td>
<td>Hydraulic fluid, Dexron III</td>
</tr>
<tr>
<td></td>
<td>(AW46 for older units with clear fluid)</td>
</tr>
<tr>
<td></td>
<td>Safety solvent</td>
</tr>
<tr>
<td></td>
<td>Brush</td>
</tr>
<tr>
<td></td>
<td>Lint-free wiping cloths or clean cloth</td>
</tr>
</tbody>
</table>

NOTE: The strainer should be replaced or cleaned when the hydraulic fluid is changed.
INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key. Refer to your company's lockout-tagout procedure.
7. Relieve hydraulic system pressure as follows:
   a. Remove air breather from reservoir. Be careful to prevent contamination of air breather or reservoir fittings.
   b. Depress pressure relief valve in center of reservoir air breather fitting.

DRAIN AND FILL RESERVOIR

1. Place container under each drain plug (Figure 4-5).
2. Clean area around fill plug (Figure 4-4) on filler/breather plate.
3. Remove fill plug.
4. Clean area around each drain plug.
5. Remove both drain plugs from reservoir and allow hydraulic fluid to fill containers. When containers are full almost full, reinstall drain plugs.
6. Dispose of hydraulic fluid in accordance with state and/or local laws.
7. Repeat Steps 5 and 6 until reservoir and hydraulic system are fully drained.
8. Install both reservoir drain plugs and tighten.
9. Use clean funnel to add new hydraulic fluid to reservoir through fill port on filler/breather plate. Add fluid until fluid level reaches mid point on reservoir sight gauge (Figure 4-3).
10. Install fill cap on filler/breather plate and tighten.
11. Install air breather on filler/breather plate and tighten hand tight.
12. Start engine and check for leaks at both drain plugs, fill plug, and air breather.

   NOTE: It is necessary to operate all hydraulic subsystems to expel any air bubbles entrained in the hydraulic fluid.

13. Use boom control to raise and extend boom. Then retract and lower boom.
14. Use sway control to tilt forklift to left, right, and back to level orientation.
15. Recheck reservoir fluid level sight gauge. Add more fluid as required using above procedure.
4-11  REPLACE SUCTION STRAINER
Perform the following procedure to replace the suction strainer

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and test equipment</td>
<td>2-3/4&quot; open end wrench</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags</td>
</tr>
<tr>
<td></td>
<td>Suction strainer</td>
</tr>
<tr>
<td></td>
<td>Xtreme P/N 14365-000</td>
</tr>
<tr>
<td></td>
<td>Hydraulic fluid, Dexron III</td>
</tr>
<tr>
<td></td>
<td>(AW46 for older units with clear fluid)</td>
</tr>
<tr>
<td></td>
<td>Safety solvent</td>
</tr>
<tr>
<td></td>
<td>Brush</td>
</tr>
<tr>
<td></td>
<td>Lint-free wiping cloths or clean cloth</td>
</tr>
<tr>
<td></td>
<td>Marker</td>
</tr>
</tbody>
</table>

Figure 4-5. Hydraulic Reservoir
INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key. Refer to your local lockout-tagout procedure.
7. Relieve hydraulic system pressure as follows:
   a. Remove air breather from reservoir. Be careful to prevent contamination of air breather or reservoir fittings.
   b. Depress pressure relief valve in center of reservoir air breather fitting.

REMOVAL

1. Drain reservoir.
2. To prevent contamination of reservoir, clean top of filler/breather plate (Figure 4-6) and adjacent area around reservoir opening.
3. Use marker to make orientation marks on filler/breather plate and top of reservoir.
4. Remove six screws and six flat washers from filler/breather plate.
5. Remove filler/breather plate from reservoir and place on clean, contaminant-free surface.
6. Use 2-3/4” open-end wrench to loosen strainer.
7. Remove strainer from reservoir.

INSTALLATION

1. Carefully mount strainer on fitting inside reservoir.
2. Tighten strainer slightly more than hand-tight with 2-3/4” open-end wrench.
3. Fill reservoir with hydraulic fluid.
4. Position filler/breather plate and O-ring on reservoir opening and align orientation marks.
5. Attach filler/breather plate to reservoir with six screws and six flat washers.
7. Check all hydraulic systems for proper operation.
8. Shut-off engine.
4-12 CLEAN HYDRAULIC RESERVOIR STRAINER

Perform the following procedure to clean the hydraulic reservoir strainer:

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td></td>
<td>2-3/4&quot; open-end wrench</td>
</tr>
<tr>
<td></td>
<td>Container</td>
</tr>
<tr>
<td></td>
<td>Gloves</td>
</tr>
<tr>
<td></td>
<td>Brush</td>
</tr>
</tbody>
</table>
Hydraulic System

<table>
<thead>
<tr>
<th>Parts and consumable materials</th>
<th>Danger tags (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydraulic fluid, Dexron III</td>
<td></td>
</tr>
<tr>
<td>(AW46 for older units with clear fluid)</td>
<td></td>
</tr>
<tr>
<td>Safety solvent</td>
<td></td>
</tr>
<tr>
<td>Solvent</td>
<td></td>
</tr>
<tr>
<td>Lint-free wiping cloths or clean cloth</td>
<td></td>
</tr>
<tr>
<td>Marker</td>
<td></td>
</tr>
</tbody>
</table>

INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key. Refer to your company's lockout-tagout procedure.
7. Relieve hydraulic system pressure as follows:
   a. Remove air breather from reservoir. Be careful to prevent contamination of air breather or reservoir fittings.
   b. Depress pressure relief valve in center of reservoir air breather fitting.

REMOVAL

1. Drain reservoir.
2. To prevent contamination of reservoir, clean top of filler/breather (Figure 4-6) and adjacent area around reservoir opening.
3. Use marker to make orientation marks on filler/breather plate and top of reservoir.
4. Remove six screws and six flat washers from filler/breather plate.
5. Remove filler/breather plate from reservoir and place on clean, contaminant-free surface.
6. Use 2-3/4" open-end wrench to loosen strainer.
7. Remove strainer from reservoir.

CAUTION

Be very careful to prevent dirt and other contaminants from entering the inside of the strainer.

DO NOT use compressed air to clean the strainer. Compressed air may damage filter media and force contaminants into the filter media.
Hydraulic System

CLEANING

1. Inspect strainer for damage to threads. Inspect filter media for breaks and tears. Replace strainer if damaged.
2. Fill suitable, very clean, container, with fresh solvent.
3. Place strainer in solvent and clean with a clean, soft, bristle brush until all sludge, dirt, and residue have been removed from filter.
4. Remove strainer from solvent and rinse with hot soapy water until thoroughly clean. Then rinse with clean water.
5. Allow strainer to air dry.

INSTALLATION

1. Carefully mount strainer on fitting inside reservoir.
2. Tighten strainer slightly more than hand-tight with 2-3/4" open-end wrench.
3. Fill reservoir with hydraulic fluid.
4. Position filler/breather plate and O-ring on reservoir opening and align orientation marks.
5. Attach filler/breather plate to reservoir with six screws and six flat washers.
7. Check all hydraulic systems for proper operation.
8. Shut-off engine.

4-13 REPLACE AIR BREATER

Perform the following procedure to replace the air breather:

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and test equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td></td>
<td>Strap wrench</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Air breather</td>
</tr>
<tr>
<td></td>
<td>Xtreme P/N 14366-010</td>
</tr>
<tr>
<td></td>
<td>Safety solvent</td>
</tr>
<tr>
<td></td>
<td>Lint-free wiping cloths or clean cloth</td>
</tr>
<tr>
<td></td>
<td>Brush</td>
</tr>
</tbody>
</table>
Hydraulic System

INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.

REPLACE AIR BREATHER

1. Carefully clean area around air breather fitting (Figure 4-7) to prevent contamination of reservoir.
2. Remove air breather from reservoir. If air breather cannot be removed by hand, loosen with a strap wrench.
3. Install new air breather on fitting and hand tighten. DO NOT use strap wrench to tighten filter.
4. Start engine and check for leaks at air breather.
5. Check operation of hydraulic system.

Figure 4-7. Air Breather
4-14 REPLACE HIGH-PRESSURE FILTER

Perform the following procedure to replace the high-pressure filter:

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
</table>
| Special tools and equipment | Safety glasses  
Wheel chocks (4)  
O-ring removal/installation tool  
Container |
| Parts and consumable materials | Danger tags (2)  
High-pressure filter element  
P/N 14360-000  
O-ring seal kit, Xtreme  
P/N 14359-000  
Chip indicator, Xtreme  
P/N 14359-010  
Hydraulic fluid, Dexron III  
(AW46 for older units with clear fluid)  
Safety solvent  
Lint-free cloths or clean cloth  
Brush |

INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key. Refer to your company's lockout-tagout procedure.
7. Place wheel chocks in front of front tires and behind rear tires.

WARNING

DO NOT relieve hydraulic system pressure by loosening plugs located at top and bottom of high-pressure filter. See Figure 4-9 for location of plugs.
8. Relieve hydraulic system pressure as follows:
   a. Remove air breather from reservoir. Be careful to prevent contamination of air breather or reservoir fittings.
   b. Depress pressure relief valve in center of reservoir air breather fitting.

REPLACE FILTER

1. Open front cover to gain access to high-pressure filter (Figure 4-8).
2. Inspect chip indicator (Figure 4-9) if installed. Replace as required.
3. Place container beneath filter.

Figure 4-8. Location of Hydraulic Filters

⚠️ CAUTION

Filter bowl may be full of hot hydraulic fluid.
4. Use wrench to remove filter bowl from filter body. Allow hydraulic fluid to drain into container.
5. Remove filter element from filter bowl and dispose of properly.
6. Coat new filter bowl O-ring with hydraulic fluid and install in filter bowl.
7. Coat new filter head seal with hydraulic fluid and install in filter head.
8. Insert new filter element inside filter bowl.

**CAUTION**

Special care is required when screwing filter bowl into filter to prevent cross threading. DO NOT torque the filter bowl. Hand tighten only.

9. Screw filter bowl onto filter head until O-ring contacts sealing surface, then tighten 3/4 turn.
10. Start engine and run until warm.
11. Check for leaks at filter. Hand tighten filter further if necessary.

---

**Figure 4-9. High-Pressure Filter**

*NOTE: SOME EARLY MODELS MAY HAVE CHIP INDICATOR INSTALLED.*
4-15 REPLACE RETURN LINE FILTER

Perform the following procedure to replace the return line filter:

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
</table>
| Special tools and equipment | Safety glasses  
Wheel chocks (4)  
Filter wrench or strap wrench  
O-ring removal/installation tool  
Container |
| Parts and consumable materials | Danger tags (2)  
Return line filter  
Xtreme P/N 14361-000  
O-ring  
Seal  
Hydraulic fluid, Dexron III  
(AW46 for older units with clear fluid)  
Safety solvent  
Lint-free cloths or clean cloth  
Brush |

INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key. Refer to your lockout-tagout procedure.
7. Place wheel chocks in front of front tires and behind rear tires.
8. Relieve hydraulic system pressure as follows:
   a. Remove air breather from reservoir. Be careful to prevent contamination of air breather or reservoir fittings.
   b. Depress pressure relief valve in center of reservoir air breather fitting.
REPLACE FILTER

1. Open front cover to gain access to return line filter (Figure 4-8).
2. Place container beneath return line filter.
3. Clean area around filter to prevent contaminants from entering system.

⚠️ WARNING

Filter may be full of hot hydraulic fluid.

4. Use strap wrench or filter wrench to remove filter from distribution manifold (Figure 4-10). Allow hydraulic fluid to drain into container.
5. Dispose of fluid and filter properly.

⚠️ CAUTION

DO NOT torque the filter. Hand tighten only.

7. Screw filter on to distribution manifold and hand tighten until O-ring contacts sealing surface, then tighten 3/4 turn.
8. Start engine and run until warm.
9. Check for leaks at filter. Hand tighten filter further if necessary.

Figure 4-10. Return Line Filter
**4-16 TAKING HYDRAULIC FLUID SAMPLE**

Perform the following procedure to take a hydraulic fluid sample.

---

**– TASK REQUIREMENTS –**

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
</table>
| Special tools and equipment | Safety glasses  
 | Rubber gloves      | Soft bristle brush  
 | HYDAC Micro Bore Flexible Hose |
| Parts and consumable materials | Danger tags (2)  
 | Safety solvent (aerosol)  
 | Lint-free cloth  
 | Fluid analysis kit |

---

**INITIAL SET-UP**

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Operate engine at idle speed.
6. Attach DANGER – DO NOT OPERATE tag to steering wheel. Also attach a tag by tape or cord around the boom control, attachment tilt, and frame sway joysticks. Operating any one of these joysticks can raise the pressure at the distribution manifold test port from 500 psi to 3,500 psi.

**TAKING SAMPLE**

1. Put on safety glasses and rubber gloves.
2. Open front cover to gain access to distribution manifold.
3. On back side of distribution manifold (Figure 4-11), remove cap from test port GLS.
4. Thoroughly clean area around test port GLS with clean brush, safety solvent, and clean, lint-free cloth.

---

**CAUTION**

Be very careful to keep the test hose and the fluid sample bottle clean during this procedure. Very minute foreign particles can contaminate the sample and adversely affect the test results.

5. Check test hose and fluid sample bottle to ensure that they are very clean.
Hydraulic fluid under pressure can penetrate the skin, causing death or extremely serious injury. Amputation of hands and arms is often necessary to prevent death.

If this procedure is followed correctly, the maximum pressure available at test port GLS is 500 psi. The pressure will be much less simply by connecting the test hose to the port slowly until sufficient flow is obtained to fill the fluid sample bottle.

**DO NOT** operate the boom control, attachment tilt, or frame sway joysticks during this procedure. If any of these joysticks are operated, the pressure at test port GLS can increase to 3,500 psi thereby creating an extremely hazardous situation.

6. In one hand, hold fluid sample bottle upright with one end of test hose secured at opening of bottle with thumb and forefinger.
7. With other hand’s thumb and forefinger, very slowly screw other end of test hose into test port GLS until fluid begins to flow into fluid sample bottle.
8. Fluid flow rate is controlled by how far hose connector is screwed on to test port GLS. Unscrew hose connector from test port when bottle is almost full.
9. Place cap on fluid sample bottle and tighten.
10. Remove test hose from test port GLS and reconnect cap.
11. Clean any spilled hydraulic fluid.
12. Close front cover.
Figure 4-11. Taking Hydraulic Fluid Sample
4-17 REPLACING A HOSE

Perform the following procedure to replace a hydraulic hose:

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
</table>
| Special tools and equipment | Safety glasses  
Torque wrench  
O-ring removal/installation tool  
Brush  
Container |
| Parts and consumable materials | Danger tags (2)  
Protective caps, plugs  
Safety solvent  
Lint-free cloth |

**WARNING**

NEVER replace a hydraulic hose with a hose not specifically designed for this forklift and subsystem. An underrated hose may explode resulting in death or serious injury and damage to the forklift and property. Always use genuine Xtreme Manufacturing replacement hoses for best performance and safety.

**INITIAL SET-UP**

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key. Refer to your lockout-tagout procedure.
7. Relieve hydraulic system pressure as follows:
   a. Remove air breather from reservoir. Be careful to prevent contamination of air breather or reservoir fittings.
   b. Depress pressure relief valve in center of reservoir air breather fitting.

**REMOVAL**

1. Open front cover.
2. To prevent contamination of hydraulic system, ensure that hose and component fittings and adjacent area are clean. Clean as required with safety solvent, brush, and lint-free cloths.
3. Place suitable container beneath hose and component fitting to catch oil that drains from hose and component.
4. Disconnect hose from hydraulic component fitting.
5. Drain hydraulic fluid from hose end into container.
6. If hose is not to be immediately replaced, place protective cap on component fitting.
7. Repeat Step 3 through Step 7 for connector at opposite end of hose.
8. Remove hose from forklift.

INSTALLATION

1. Verify that replacement hose part number is same as part number on defective hose.
2. Remove protective caps from replacement hose fittings. Inspect fittings for damage and cleanliness.
3. Inspect replacement hose for nicks, cuts, or other damage.
4. If replacement hose interior and/or fittings are dirty, clean by flushing with hydraulic fluid.
5. Carefully inspect component fittings for damage and cleanliness. Fittings can be reused if clean and serviceable.
6. Replace component fitting O-rings using O-ring removal/installation tool. DO NOT reuse O-rings.
7. Carefully connect hose connector to one component fitting and hand-tighten. Ensure hose connector is not cross-threaded.
8. Route hose in same location/path as removed hose. See Figure 4-12 for hose installation guidelines.
9. Verify that hose has sufficient slack and bend radius. Verify that hose is not twisted and that it will not interfere with any moving forklift parts.
10. Carefully connect opposite end hose connector to other component fitting. Tighten connector.
11. Torque both hose connectors. Refer to Table 4-1 for hose connector torque values.
12. Re-install and/or tighten any hose clamps that were removed or loosened during hose removal.

WARNING

Before starting the engine, verify that all hydraulic connections are properly tightened. Escaping hydraulic fluid under pressure can penetrate the skin, causing death or extremely serious injury.

13. Start engine and check for leaks and operation of affected system.
14. Check hydraulic fluid level. Add fluid as required.
Figure 4-12. Hose Installation Guidelines

- **Correct**
  - Hose may change in length under pressure. Always provide some slack to allow for this shortening.
  - If hose is twisted when connected, operating pressure will try to force it straight. This may loosen fitting nut, cause hose separation, or cause hose to burst at strain point.
  - At bends, provide adequate hose length so that hose bend radius is correct. A tight bend may cause the hose to kink. This may restrict or stop fluid flow.

- **Incorrect**
Table 4-1. Hose Connector Torque Values

<table>
<thead>
<tr>
<th>Dash Size</th>
<th>Thread Size (Inches)</th>
<th>Swivel Nut Torque (Ft-Lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>–04</td>
<td>9/16 -18</td>
<td>10-12</td>
</tr>
<tr>
<td>–06</td>
<td>11/16 -16</td>
<td>18-20</td>
</tr>
<tr>
<td>–08</td>
<td>13/16 -16</td>
<td>32-35</td>
</tr>
<tr>
<td>–10</td>
<td>1-14</td>
<td>46-50</td>
</tr>
<tr>
<td>–12</td>
<td>13/16 -12</td>
<td>65-70</td>
</tr>
<tr>
<td>–16</td>
<td>17/16 -12</td>
<td>92-100</td>
</tr>
<tr>
<td>–20</td>
<td>111/16 -12</td>
<td>125-140</td>
</tr>
<tr>
<td>–24</td>
<td>2-12</td>
<td>150-165</td>
</tr>
</tbody>
</table>

4-18 TIGHTENING LOOSE FITTINGS

⚠️ WARNING ⚠️

If a hydraulic connection is leaking, DO NOT tighten the fitting while the engine is operating and the hydraulic system is pressurized. Death or extremely serious injury may result if a fitting, tube, hose, or component ruptures while pressurized.

4-18 REPLACE CARTRIDGE VALVE

Perform the following procedure to replace a cartridge valve:

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td></td>
<td>Rubber gloves</td>
</tr>
<tr>
<td></td>
<td>Torque wrench</td>
</tr>
<tr>
<td></td>
<td>Thread chaser</td>
</tr>
<tr>
<td></td>
<td>Clean container</td>
</tr>
</tbody>
</table>
Hydraulic System

<table>
<thead>
<tr>
<th>Parts and consumable materials</th>
<th>Danger tags (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cartridge valve</td>
<td></td>
</tr>
<tr>
<td>Hydraulic fluid, Dexron III</td>
<td>Safety solvent</td>
</tr>
<tr>
<td>(AW46 for older units with clear fluid)</td>
<td>Brush</td>
</tr>
<tr>
<td>Safety solvent</td>
<td>Clean shop rags</td>
</tr>
<tr>
<td>Brush</td>
<td>Lint-free wiping cloths</td>
</tr>
</tbody>
</table>

INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key. Refer to para. 2-5, for lockout-tagout procedure.
7. Relieve hydraulic system pressure as follows:
   a. Remove air breather from reservoir. Be careful to prevent contamination of air breather or reservoir fittings.
   b. Depress pressure relief valve in center of reservoir air breather fitting.
   c. If cartridge valve is installed in a boom lift cylinder, turn manual lowering valve adjustment screw fully counterclockwise (CCW) approximately five turns.
   d. If cartridge valve is installed in the boom extend cylinder, turn manual lowering valve adjustment screw fully counterclockwise (CCW) approximately five turns.

REMOVAL

1. Gain access to cartridge valve.
2. If valve is solenoid-type, refer to para. 8-17 for solenoid removal instructions.
3. Use safety solvent, brush, and lint-free wipes to thoroughly clean cartridge valve and surrounding area.

⚠️ WARNING ⚠️

Rev 01 – 08/17
There may be residual pressure in the hydraulic system after performing steps 7a through 7d (Initial Set-up). Wear eye protection and gloves. Loosen the valve slowly and be ready for a momentary release of pressurized hydraulic fluid.

4. Wrap several shop rags around valve to absorb escaping, spraying oil and prevent injury to mechanic.

5. Very slowly loosen valve and remove from component.

6. If necessary, clean area around valve port again in the event area became re-contaminated during valve removal.

7. Carefully inspect port thread for burrs or other irregularities. Repair damaged threads with thread chaser.

INSTALLATION

**WARNING**

Installation of a cartridge valve in the incorrect manifold or cylinder block port can cause serious injury or death and damage to equipment.

Installation of an incorrect cartridge valve in a manifold or cylinder block can cause serious injury or death and damage to equipment.

When replacing a cartridge valve, check that the numbers and/or letters on the old cartridge valve exactly match the numbers and/or letters on the new cartridge valve. If there is a discrepancy in a single letter or number, DO NOT install the cartridge valve. Call the supplier/manufacturer for assistance.

The fact that a replacement cartridge valve fits into a manifold or valve block correctly is no indication that the cartridge valve is the correct model/part number. Hydraulic component manufacturers do not follow any standardized method of identifying (labeling) ports, etc. For example, do not assume that the number 1 always corresponds to the inlet port, etc.

1. Inspect exterior of new valve for dirt and contaminants.

2. Ensure that O-rings and back-up rings are intact and correctly positioned.

3. If valve is equipped with solenoid, refer to para. 4-18 for removal instructions.

4. Inspect valve cavity in manifold for burrs or other defects which could damage O-rings and back-up rings during installation.

5. If cavity threads are damaged, try cleaning the threads using a thread chaser. Ensure that the correct size thread chaser is used and that no metal particles are allowed to fall inside the manifold cavity.

6. Dip valve in clean oil.

7. Screw valve in by hand until top O-ring is met. Then tighten valve by torque wrench to the torque specification provided by the manufacturer.

8. If valve is equipped with a solenoid, refer to para. 4-18 for installation instructions.
9. If a boom lift or extend cylinder manual lowering valve was opened, close valve by turning the adjustment screw five turns clockwise (CW).

10. Start engine and check operation of applicable hydraulic subsystem.

⚠️ CAUTION

Counterbalance valves are factory set. DO NOT adjust.

4-19 REPLACE CARTRIDGE VALVE SOLENOID

Perform the following procedure to replace a cartridge valve solenoid:

--- TASK REQUIREMENTS ---

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2) Solenoid</td>
</tr>
</tbody>
</table>

INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key. Refer to your company's lockout-tagout procedure.
7. Relieve hydraulic system pressure as follows:
   a. Remove air breather from reservoir. Be careful to prevent contamination of air breather or reservoir fittings.
   b. Depress pressure relief valve in center of reservoir air breather fitting.

REPLACE SOLENOID

1. Disconnect solenoid connector (Figure 4-13) from chassis wiring harness connector.
2. Turn nut on top of solenoid counterclockwise (CCW) to loosen.
3. Remove nut from solenoid body.
4. Lift solenoid off of valve body.
5. Place new solenoid on valve body.
CAUTION

DO NOT over tighten nut. Damage to valve will result.

6. Install nut on solenoid body and turn clockwise (CW) to tighten. Torque nut to 3-4.5 ft-lbs.
7. Connect solenoid connector to chassis wiring harness connector.
8. Start engine and check operation of applicable hydraulic subsystem.

Figure 4-13. Cartridge Valve Solenoid
4-19-1 LOCATION OF HYDRAULIC COMPONENTS
The location of several major hydraulic components and close-up views are provided in Figure 4-14. The torque values for the valves depicted in Figure 8-14 are provided in Tables 4-2 through 4-5.

4-19-2 DISTRIBUTION MANIFOLD HOSE CONNECTIONS
See Figures 4-15 through 8-18 for diagrams depicting the distribution manifolds and the part numbers of hoses connected to the various manifold ports.
NOTE:
1. NUMBER IN PARENS: ( ) IS NUMBER STAMPED ON BLOCK.

BOOM ISOLATION MANIFOLD

Figure 4-14. Location of Hydraulic Components  (Sheet 2 of 5)
NOTE:

1. NUMBER IN PARENS ( ) IS NUMBER STAMPED ON BLOCK.

REAR AXLE CYLINDER LOCK MANIFOLD

Figure 4-14. Location of Hydraulic Components (Sheet 3 of 5)
Figure 4-14. Location of Hydraulic Components  (Sheet 4 of 5)

NOTES:

1. RETURN LINE FILTER NOT SHOWN.
2. NUMBER IN PARENS. ( ) IS NUMBER STAMPED ON BLOCK.
Hydraulic System

Figure 4-14. Location of Hydraulic Components  (Sheet 5 of 5)

NOTES:

1. RETURN LINE FILTER NOT SHOWN.
2. NUMBER IN PARENTS. ( ) IS NUMBER STAMPED ON BLOCK.
Figure 4-15. Distribution Manifold Hose Connections – Model RT045/XR1045 (Sheet 1 of 2)
Figure 4-15. Distribution Manifold Hose Connections – Model RT045/XR1045 (Sheet 2 of 2)
### Table 4-2. Boom Isolation Manifold Valve Torque Values

<table>
<thead>
<tr>
<th>Component</th>
<th>Component No.</th>
<th>Torque Value (ft-lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilot-to-open check valve</td>
<td>2.1</td>
<td>25-30</td>
</tr>
<tr>
<td>Pilot-to-open check valve</td>
<td>2.2</td>
<td>25-30</td>
</tr>
<tr>
<td>Pressure reducing/relieving valve</td>
<td>5</td>
<td>29-37</td>
</tr>
<tr>
<td>Needle valve</td>
<td>1</td>
<td>29-37</td>
</tr>
<tr>
<td>Check valve</td>
<td>7</td>
<td>59-66</td>
</tr>
<tr>
<td>Pressure relief valve</td>
<td>6</td>
<td>19-22</td>
</tr>
<tr>
<td>Diverter valve</td>
<td>4</td>
<td>37</td>
</tr>
<tr>
<td>Shuttle valve</td>
<td>3</td>
<td>11-13</td>
</tr>
</tbody>
</table>

### Table 4-3. Rear Axle Cylinder Valve Torque Values

<table>
<thead>
<tr>
<th>Component</th>
<th>Component No.</th>
<th>Torque Value (ft-lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bypass valve</td>
<td>1</td>
<td>67-74</td>
</tr>
<tr>
<td>Float valve</td>
<td>4</td>
<td>18.5-22</td>
</tr>
</tbody>
</table>

### Table 4-4. Distribution Manifold Torque Values (RT042/XR1045)

<table>
<thead>
<tr>
<th>Component</th>
<th>Component No.</th>
<th>Torque Value (ft-lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Park brake release pressure reducing valve</td>
<td>8</td>
<td>18.5-22</td>
</tr>
<tr>
<td>Rear lock system pressure reducing valve</td>
<td>9</td>
<td>18.5-22</td>
</tr>
<tr>
<td>Steering mode valve</td>
<td>1</td>
<td>28-33</td>
</tr>
<tr>
<td>Left frame lockout valve</td>
<td>10.1</td>
<td>18.5-22</td>
</tr>
<tr>
<td>Main frame level lockout valve</td>
<td>4</td>
<td>18.5-22</td>
</tr>
<tr>
<td>Load sense dump valve</td>
<td>12</td>
<td>18.5-22</td>
</tr>
<tr>
<td>Right frame level lockout valve</td>
<td>10.2</td>
<td>18.5-22</td>
</tr>
<tr>
<td>Steering mode valve</td>
<td>1</td>
<td>28-33</td>
</tr>
<tr>
<td>Park brake release valve</td>
<td>7</td>
<td>18.5-22</td>
</tr>
</tbody>
</table>
4-20 MAINTENANCE REQUIREMENTS FOR FAILED PUMP

If the hydraulic pump should fail, the hydraulic fluid will very likely be contaminated with metal particles and other types of contaminants. In addition to replacing the pump, the following maintenance actions should be taken:

- Drain the reservoir.
- Clean or replace the hydraulic reservoir strainer.
- Fill the reservoir with clean, filtered hydraulic fluid.
- Replace the high-pressure filter.
- Replace the return line filter.
- Operate all hydraulic systems through ten cycles of operation.
- If any subsystem fails or has degraded performance, the components of that system should be removed from the forklift, disassembled, and thoroughly cleaned.
- Remove the return line filter. Inspect the filter and hydraulic fluid for contamination.

If the hydraulic fluid is still contaminated, perform the following maintenance actions:

- Drain the reservoir.
- Clean or replace the hydraulic reservoir strainer.
- Fill the reservoir with clean, filtered hydraulic fluid.
- Replace the high-pressure filter.
- Replace the return line filter.
- Operate all hydraulic systems through ten cycles of operation.
- If any subsystem fails or has degraded performance, the components of that system should be removed from the forklift, disassembled, and thoroughly cleaned.
- Take a sample of the hydraulic fluid and have it analyzed. Perform additional maintenance per recommendations provided in the hydraulic fluid analysis report.
5-1 GENERAL MAINTENANCE SAFETY

**WARNING**

Use caution when performing maintenance on the forklift. Wear personal protective equipment when appropriate and use danger tags. Carefully follow the maintenance procedures provided in this chapter. Read the Material Safety Data Sheets (MSDS) for solvents, cleaners, etc. Read and fully understand the safety information before performing maintenance on the forklift.

- If contact with battery acid occurs, administer the following first aid treatment to self or others:
  - External contact – Flush with water.
  - Eyes – Flush with water for at least 15 minutes. Get medical attention immediately.
  - Internal contact – Drink large quantities of water. Follow with Milk of Magnesia, beaten egg, or vegetable oil. Get medical attention immediately.
  - IMPORTANT – In case of internal contact, DO NOT give fluids that induce vomiting.

- Disconnect the battery terminals before a repair is made to the electrical system.
• Lead-acid batteries produce flammable and potentially explosive gases. To avoid injury or death when checking, testing, or charging batteries:
  – DO NOT use smoking materials near batteries.
  – Keep arcs, sparks, and open flames away from batteries.
  – Provide ventilation for flammable vapors.
  – Wear proper personal protective equipment, including safety glasses.
• Fluid in electric storage batteries contains sulfuric acid which is a poison that can cause severe chemical burns. Avoid all contact of fluid with eyes, skin, or clothing. Use protective gear when handling batteries.
• DO NOT tip a battery beyond a 45° angle in any direction.
• Wear eye protection when starting a vehicle with jump start cables. Improper jump start procedures can cause the battery to explode.
• Do not allow sparks or fire near the batteries (especially when the batteries are on charge) because the gases from the electrolyte are highly flammable. The battery fluid is dangerous to the skin and especially to the eyes.
• NEVER jump start a frozen battery, as it can explode. Let the battery thaw out before charging.
• NEVER jump start the forklift directly at the starter solenoid. This could cause the vehicle to lurch forward or backward, resulting in injury or death.
• To avoid injury or death when jump starting with another vehicle, ensure the two vehicles are not touching.
• DO NOT allow jump start cable ends to contact each other near the battery.
• Connect charged battery positive (+) to stalled battery positive (+).
• Connect charged battery negative (–) to stalled vehicle ground. Make the connection to the stalled vehicle ground LAST.
• Connect jump start cable to stalled vehicle ground a safe distance from the battery to PREVENT sparks near the battery.
• Jump start only with a power source with the same voltage as the stalled forklift.
• Jump start power source must have a negative-ground electrical system.
• Electrolyte is an acid and cause injury if it contacts the skin or eyes.

CALIFORNIA PROPOSITION 65

Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. WASH HANDS IMMEDIATELY AFTER HANDLING BATTERY.
5-2 BATTERY DESCRIPTION

The forklift's initial source of electricity is the 12-volt battery. The primary function of the battery is to start the engine. Once the engine is running, the alternator takes over to supply the forklift's electrical requirements and to charge the battery.

The battery consists of layers of positively and negatively charged lead plates that, together with their insulated separators, make up each of six, two-volt cells. The cells are filled with an electricity-conducting liquid (electrolyte). The electrolyte contains approximately two-thirds distilled water and one-third sulfuric acid. Spaces between the immersed plates provide the most exposure to the electrolyte. The interaction of the plates and the electrolyte produces chemical energy that becomes electricity when a circuit is formed between the negative and positive battery terminals.

5-3 BATTERY CABLE DESCRIPTION

The battery cables connect the battery to the starting and charging circuits. Because of the heavy current flow through the cables, the cables are fabricated from size 1 AWG cable. The red cable is connected to the positive terminal of the battery and the black lead is connected to the negative terminal.

Because of the cable's close proximity to the battery it is extremely important to periodically inspect and clean the cables, clamps, and battery posts. Vapors from battery acid causes corrosion to form on the lead surfaces and copper wiring associated with the battery wires. A loose or corroded connection will cause a significant voltage drop. This voltage drop will cause the starter motor to turn slowly or not at all.

5-4 CHECK CONDITION OF BATTERY AND CABLES

Perform the following procedure to check the condition of the battery and cables:

- TASK REQUIREMENTS -

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td></td>
<td>Rubber gloves</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>None</td>
</tr>
</tbody>
</table>

INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.

CHECK BATTERY AND CABLES

1. Pull back on both battery cover T-handles until they release from holders (Figure 1-2).
2. Lower battery compartment cover.
3. Check battery condition indicator by looking straight down at indicator. Indicator will appear green if battery is fully charged. If battery charge is depleted, indicator will appear black. If indicator appears black, charge or replace battery. If indicator appears white, replace the battery. DO NOT attempt to test or charge the battery.
4. Check battery cables and terminal for tightness and corrosion. Tighten and clean as required
5. Close battery compartment cover.

![Diagram of battery and cables](image)

**Figure 9-1. Battery and Cables**

### 5-5 REPLACE BATTERY

Perform the following procedure to replace the battery:

**– TASK REQUIREMENTS –**

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td></td>
<td>Rubber gloves</td>
</tr>
<tr>
<td></td>
<td>Rubber apron</td>
</tr>
<tr>
<td></td>
<td>Battery post/terminal cleaning tool</td>
</tr>
</tbody>
</table>
Electrical System

<table>
<thead>
<tr>
<th>Parts and consumable materials</th>
<th>Danger tags (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Battery</td>
</tr>
<tr>
<td></td>
<td>Paper towels</td>
</tr>
<tr>
<td></td>
<td>Battery post/terminal grease</td>
</tr>
</tbody>
</table>

**WARNING**

DO NOT begin this maintenance procedure without first reading and understanding para. 5-2, *Battery Safety*.

**INITIAL SET-UP**

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key.

**REMOVAL**

1. Pull back on both battery cover T-handles until they release from holders.
2. Lower battery cover.
3. Disconnect positive (red) battery cable terminal (Figure 5-1) from positive post (+) of battery.
4. Disconnect negative (black) battery cable terminal from negative (-) post of battery.
5. Loosen wing nuts on both j-bolts (Figure 5-2) until they can be removed from slots in recessed battery mount.
6. Remove battery from forklift.

**INSTALLATION**

1. Place new battery in mount.
2. Insert curved end of J-bolts in mount holes.
3. Position battery hold-down on top of battery and over J-bolts and attach with wing nuts.
4. Inspect cable terminals for cleanliness and corrosion. Clean as required with a battery post/terminal cleaning tool.
5. Apply battery terminal grease to both battery posts.
6. Connect positive (red) battery cable terminal to positive post (+) of battery.
7. Connect negative (black) battery cable terminal to negative (-) post of battery.
8. Apply battery terminal grease to both battery cable terminals.
10. Verify Volts indicator on front control panel displays approximately 14 volts.
11. Close and secure battery compartment cover.

Figure 5-2. Battery Installation
5-6 INSPECT AND CLEAN BATTERY
Perform the following procedure to inspect and clean the battery:

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td></td>
<td>Rubber gloves</td>
</tr>
<tr>
<td></td>
<td>Stiff bristle brush</td>
</tr>
<tr>
<td></td>
<td>Container</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Baking soda (1 tabs)</td>
</tr>
<tr>
<td></td>
<td>Warm water (8 oz)</td>
</tr>
<tr>
<td></td>
<td>Spray detergent</td>
</tr>
<tr>
<td></td>
<td>Spay solvent</td>
</tr>
<tr>
<td></td>
<td>Paper towels</td>
</tr>
</tbody>
</table>

**WARNING**

DO NOT begin this maintenance procedure without first reading and understanding para. 5-2, *Battery Safety*.

INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key.

**NOTE:** Some forklifts have an auxiliary battery installed in the battery compartment. Both batteries should be inspected and cleaned.

INSPECT BATTERY

1. Pull back on both battery cover T-handles until they release from holders.
2. Lower battery cover.
3. Check battery condition indicator (Figure 5-1). Green indicates that battery capacity is normal. Black indicates that battery capacity is low. If capacity is low, charge or replace battery.
4. Check battery cover and case for dirt and grease.
5. Check battery case for cracks, loose terminal posts, and other signs of physical damage.
6. Check all cables for broken or corroded wires, damaged insulation, or loose or damaged terminal connectors. Clean and/or replace as required.
7. Check battery posts for corrosion damage or buildup.
8. Check battery mount for corrosion.
9. Check battery hold-down, J-bolts, and wing nuts for corrosion (Figure 5-2). Clean and/or replace as required.

CLEAN BATTERY

**WARNING**

Before removing battery connectors or the battery itself, always neutralize any accumulated corrosion on the terminals, posts, J-bolts, wing nuts, etc.

Be very careful not to splash the corrosion (acid) onto your hands and face.

**CAUTION**

Be very careful not splash the corrosion (acid) onto the forklift's paint, metal, or rubber parts.

Ensure that no baking soda/water solution is allowed to enter any battery fill caps or the condition indicator lens.

1. Mix 1 tbs. baking soda with 8 oz. warm water.
2. Remove battery from forklift if corrosion is heavy or if corrosion is present in mounting area.
3. Remove corrosion from battery with baking soda/water solution and a stiff bristle brush.
4. Remove dirt and grease from battery with paper towels and a spray detergent or solvent.
5. Rinse battery with clean water. Dry battery with clean rag or paper towels and allow to air dry.
6. Remove terminal connectors from battery cables. Place in baking soda/water solution and then rinse in clean water. Dry connectors with clean rag or paper towels and allow to air dry.
5-7 INSTALL AUXILIARY BATTERY

Perform the following procedure to install an auxiliary battery:

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td></td>
<td>Rubber gloves</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>24V Shut-off switch (1)</td>
</tr>
<tr>
<td></td>
<td>Auxiliary 12-volt battery</td>
</tr>
<tr>
<td></td>
<td>Auxiliary battery cable (positive)</td>
</tr>
<tr>
<td></td>
<td>Auxiliary battery cable (negative)</td>
</tr>
<tr>
<td></td>
<td>Battery hold-down</td>
</tr>
<tr>
<td></td>
<td>J-bolt (2)</td>
</tr>
<tr>
<td></td>
<td>Wing nut (2)</td>
</tr>
</tbody>
</table>

**WARNING**

DO NOT begin this maintenance procedure without first reading and understanding para. 9-2, Battery Safety.

INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key.

INSTALLATION

1. Place battery in auxiliary battery mount (Figure 9-3).
2. Insert curved end of J-bolts in mount holes.
3. Position battery hold-down on top of battery and over J-bolts and attach with wing nuts.
4. Inspect battery posts. Clean as required with battery post/terminal cleaning tool.
5. Apply battery terminal grease to both battery posts.
6. Inspect cable terminals for cleanliness and corrosion. Clean as required with a battery post/terminal cleaning tool.
7. Connect negative and positive auxiliary battery cables as shown in Figure 5-4.
8. Apply battery terminal grease to both battery cable terminals.
10. Verify VOLTS indicator on front control panel displays approximately 14 volts.
11. Close and secure battery compartment cover.
The electrical center (Figure 5-6) consists of numerous plug-in relays and fuses.

5-8 ELECTRICAL CENTER ASSEMBLY

The electrical center assembly (Figure 9-5) contains most of the forklift's electrical circuits. Located on a drop-down panel in the operator control console, the electrical center contains the following electrical components:

- Three terminal strips.
- Solenoid.
- Fuse block.
- 25-amp circuit breaker.
- Electrical center.
LEGEND:

1. PARKING BRAKE SWITCH
2. PARKING BRAKE INDICATOR
3. LOAD CAPACITY CHART HOLDER
4. DIGITAL TOUCHSCREEN DISPLAY
5. IGNITION SWITCH
6. STEERING SELECT SWITCH
7. WORKLIGHT SWITCH

Figure 5-5. Front Control Panel, T4F
Figure 5-6. Electrical Center Relays and Fuses, T4i
**INITIAL SET-UP**

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key. Refer to your lockout-tagout procedure.

**REPLACE RELAY**

1. Open battery compartment cover.
2. Set Battery Disconnect switch (Figure 5-8) to OFF.
3. Remove three screws and washers from hinged console access panel (Figure 5-5).
4. Gently lower console access panel to gain access to electrical center.
5. Refer to Table 5-1 and Figure 5-5 for description and location of relays.
6. Locate relay to be removed.
7. Gently rock relay back and while applying upward pressure until relay releases from socket.
8. Install new relay in socket.
9. Reconnect black battery cable to negative (-) battery terminal.
10. Start engine and check out systems and subsystems controlled by relay.
11. Set Ignition switch to OFF.
12. Raise console access panel and secure with three screws and washers.
13. Close battery compartment cover.
### Table 9-1. Electrical Center Relays

<table>
<thead>
<tr>
<th>Relay</th>
<th>Function</th>
<th>Relay</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>–</td>
<td>(Position is vacant)</td>
<td>H</td>
<td>Rear axle fast float switching</td>
</tr>
<tr>
<td>B</td>
<td>Horn switching</td>
<td>J</td>
<td>Frame sway override switching</td>
</tr>
<tr>
<td>C</td>
<td>Brake on – drive lockout switching</td>
<td>K</td>
<td>Engine start enable switching</td>
</tr>
<tr>
<td>D</td>
<td>Left frame sway lockout switching</td>
<td>L</td>
<td>Disable forward drive switching</td>
</tr>
<tr>
<td>E</td>
<td>Right frame sway lockout switching</td>
<td>M</td>
<td>Disable reverse drive switching</td>
</tr>
<tr>
<td>F</td>
<td>Primary rear axle control switching</td>
<td>N</td>
<td>Elevated drive/sway override switching</td>
</tr>
<tr>
<td>G</td>
<td>Rear axle slow float switching</td>
<td>P</td>
<td>Outrigger drive lockout switching (Model XR1245/1254/1267/1270/2045/2450 forklifts only)</td>
</tr>
</tbody>
</table>

Note: See Figure 9-5, View B for location of relays.

### Table 9-2. Electrical Center Fuses and Circuit Breaker

<table>
<thead>
<tr>
<th>Fuse/Breaker</th>
<th>Protected Circuit</th>
<th>Amperage</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>Fuel control</td>
<td>5.0</td>
<td>Mini</td>
</tr>
<tr>
<td>F2</td>
<td>Transmission</td>
<td>7.5</td>
<td>Mini</td>
</tr>
<tr>
<td>F3</td>
<td>Gauges and indicator lights</td>
<td>5.0</td>
<td>Mini</td>
</tr>
<tr>
<td>F4</td>
<td>Park brake</td>
<td>10.0</td>
<td>Mini</td>
</tr>
<tr>
<td>F6</td>
<td>Sway right – elevated</td>
<td>7.5</td>
<td>Mini</td>
</tr>
<tr>
<td>F7</td>
<td>Axle float – forward/reverse</td>
<td>10.0</td>
<td>Mini</td>
</tr>
<tr>
<td>F9</td>
<td>Sway right – elevated</td>
<td>7.5</td>
<td>Mini</td>
</tr>
<tr>
<td>F10</td>
<td>Outrigger (Model XR1245/1254/1267/1270/2045/2450 only)</td>
<td>10.0</td>
<td>Mini</td>
</tr>
<tr>
<td>F12</td>
<td>Interlocks</td>
<td>10.0</td>
<td>Mini</td>
</tr>
<tr>
<td>CB1</td>
<td>Main circuit breaker (located on solenoid bracket)</td>
<td>25.0</td>
<td>–</td>
</tr>
</tbody>
</table>

Note: See Figure 9-5, View C for location of fuses, and View E for location of circuit breaker.
Table 9-3. Fuse Block Fuses

<table>
<thead>
<tr>
<th>Fuse</th>
<th>Protected Circuit</th>
<th>Amperage</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>FB1</td>
<td>Fuel pump</td>
<td>7.5</td>
<td>ATO</td>
</tr>
<tr>
<td>FB2</td>
<td>Horn</td>
<td>10.0</td>
<td>ATO</td>
</tr>
<tr>
<td>FB3</td>
<td>Lights</td>
<td>10.0</td>
<td>ATO</td>
</tr>
<tr>
<td>FB4</td>
<td>Power outlet</td>
<td>10.0</td>
<td>ATO</td>
</tr>
</tbody>
</table>

Note: See Figure 9-5, View D for location of fuses.

9-10 ENGINE RELAY ASSEMBLY

The engine relay assembly (Figure 9-6) is comprised of the starter and glow plug relays and the 50-amp glow plug fuse. The assembly is located adjacent to the engine air cleaner assembly. Refer to Table 9-4 for a description of the engine relay assembly relays and fuse.

Table 9-4. Engine Relay Assembly Relays and Fuse

<table>
<thead>
<tr>
<th>Relay / Fuse</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glow plug relay</td>
<td>Energizes to provide 12 VDC to the four engine glow plugs. The glow plugs warm the combustion chambers allowing for faster engine starts.</td>
</tr>
<tr>
<td>Starter relay</td>
<td>Energizes to provide 12 VDC to the starter solenoid.</td>
</tr>
<tr>
<td>Glow plug fuse F1A</td>
<td>50-amp over-current protection for engine glow plugs and associated circuitry.</td>
</tr>
</tbody>
</table>
Figure 9-6. Engine Relay Assembly
9-11 REPLACE A RELAY
Perform the following procedure to replace a defective relay.

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2)</td>
</tr>
<tr>
<td></td>
<td>Relay</td>
</tr>
</tbody>
</table>

**WARNING**

Be very careful when installing electrical center relays B through G, P/N 12068567. These five relays can easily be installed "upside-down" and will be inoperative if installed incorrectly. Proper operation of each of these relays is essential for safe forklift operation. Refer to Figure 9-7 to ensure that the correct part number relay is installed in the correct socket and that the orientation of the relay is correct.

Figure 9-7. Correct Installation of Relays B through G, P/N 12068567
5-9 REPLACE A FUSE
Perform the following procedure to replace a defective fuse.

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2)</td>
</tr>
<tr>
<td></td>
<td>Fuse</td>
</tr>
</tbody>
</table>

INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract and lower boom.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key.
REPLACE FUSE

1. Open battery compartment cover.
2. Set Battery Disconnect switch (Figure 9-8) to OFF.
3. Remove three screws and washers from hinged console access panel (see Figure 5-5).
4. Gently lower console access panel to gain access to electrical center.
5. Refer to Table 5-1 and Figure 5-5 for description and location of fuses.
6. Locate relay to be removed.
7. Gently rock fuse back and while applying upward pressure until fuse releases from socket.
8. Inspect fuse to determine if defective (Figure 5-9).
9. Install new fuse in socket.
10. Reconnect black battery cable to negative (-) battery terminal.
11. Start engine and check out system and or component protected by fuse.
12. Set Ignition switch to OFF.
13. Raise console access panel and secure with three screws and washers.
14. Close battery compartment cover.

![Figure 5-9. Determining Fuse Condition](image)
Section 6
Boom & Attachments

6-1 GENERAL MAINTENANCE SAFETY

Use caution when performing maintenance on the forklift. Wear personal protective equipment when appropriate and use danger tags. Carefully follow the maintenance procedures provided in this chapter. Read the Material Safety Data Sheets (MSDS) for solvents, cleaners, etc. Read and fully understand the safety information before performing maintenance on the forklift.

6-2 USING A GREASE GUN

The following is a general procedure to follow when lubricating boom and attachment grease fittings:

Use caution when loading grease into the gun to ensure that contaminants are not introduced into the grease. If using a cartridge, be careful when removing the metal lid to prevent metal slivers from being introduced into the grease.

1. Load grease gun with extreme pressure, NLGI #2 grease.

Dirt and other contaminants in the grease can cause premature failure of the bearing. Ensure that grease fitting and grease gun nozzle are clean.

2. Clean dispensing nozzle of grease gun with clean cloth.
3. Pump small amount of grease out of dispensing nozzle to ensure that fresh, clean grease will be used.
4. Clean grease fitting with clean cloth.
5. Inspect fitting for damage. Replace as necessary. Torque grease fitting to correct value.
6. Attach grease gun dispensing nozzle to grease fitting.

**CAUTION**

A high-pressure grease gun delivers pressure up to 15,000 psi. The maximum pressure rating for forklift grease seals is 500 psi. Excessive applied pressure can damage the seal and lead to early failure.

**NOTE:** If back pressure is felt immediately when attempting to pump grease into the grease fitting, the fitting may be defective or the grease port and/or path may be blocked.

7. Pump grease in boom and attachment grease fittings until back-pressure is felt at grease gun lever, then stop pumping.
8. Start engine and operate boom and attachments for several cycles. Shut-off engine, then re-grease fittings.
9. Clean excess grease off fitting with clean cloth.
10. After use, store grease gun (unpressurized) in a horizontal position to prevent leakage.

**6-3 BOOM AND ATTACHMENT LUBRICATION**

Perform the following procedure to lubricate the boom and attachments:

**– TASK REQUIREMENTS –**

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td></td>
<td>Grease gun</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2)</td>
</tr>
<tr>
<td></td>
<td>Grease, NLGI #2, extreme pressure</td>
</tr>
<tr>
<td></td>
<td>Clean cloth</td>
</tr>
</tbody>
</table>

**WARNING**

Be very careful when working in and around the boom cylinders and pivot points. There are numerous pinch points that may cause serious personal injury.
INITIAL SET-UP
1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract and level boom.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key. Refer to your lockout-tagout procedure.

LUBRICATION
1. See Figure 6-1, Sheets 1-4, for location of boom grease fittings.

![Boom & Attachment Lubrication Diagram]

**CAUTION**

Note that the lubrication interval for the boom pivot points is 50 hours. The lubrication interval for boom rollers and chain rollers grease fittings is 250 hours.

2. Lubricate boom and attachment grease fittings in accordance with para. 6-2. Left and right boom pivot point grease fittings should be lubricated every 50 hours. Boom rollers and chain rollers should be lubricated every 250 hours.
Figure 6-1. Boom and Attachment Lubrication (Sheet 2 of 4)
Figure 6-1. Boom and Attachment Lubrication (Sheet 3 of 4)

Figure 6-1. Boom and Attachment Lubrication (Sheet 4 of 4)
Perform the following procedure to lubricate the boom extend chain:

### TASK REQUIREMENTS

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td></td>
<td>Gloves (Viton)</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2)</td>
</tr>
<tr>
<td></td>
<td>Zep 45 penetrating lubricant or,</td>
</tr>
<tr>
<td></td>
<td>LPS 3® Heavy-Duty Inhibitor or,</td>
</tr>
<tr>
<td></td>
<td>Lubriplate Chain &amp; Cable Fluid</td>
</tr>
</tbody>
</table>

**WARNING**

Be very careful when working near moving boom parts and the chain. Serious injuries may result when fingers or loose clothing get caught in moving chain.

**INITIAL SET-UP**

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Raise boom to horizontal (level) position.
5. Fully extend boom until extend chain is taut.
6. Set Ignition switch to OFF.
7. Attach danger tags to steering wheel and ignition key. Refer to para. 2-5, for lockout-tagout procedure.

**LUBRICATE CHAINS**

1. Spray entire length of extend chain with lubricant. (See Figure 6-2.)
2. Clean spilled lubricant, dirt, etc. from painted surfaces of forklift.
Chain failure can be caused by worn pins, cracked links, corrosion, worn link plates, or chain elongation (stretching). Chain failure can result in:

- Erratic, uncontrolled boom movement and loss of load.
- Vehicle instability and tip over.
- Death, serious injury, and/or property damage.

The comprehensive chain inspection consists of the following tasks:

- A thorough visual inspection.
• Measuring the amount of wear on the edge of a chain link plate.
• Measuring the amount of elongation (stretch) of a 12-inch sample of chain.

**NOTE:** Because of boom construction, access to the retract chain is very limited. The chain must be inspected by a mechanic through a small inspection opening in the bottom of the boom while another mechanic very slowly extends and retracts the boom. Because of these limitations, it will not be possible to inspect for all the defects listed below. Note however, that the retract chain is very well protected from the environment and that it performs much less work than the extend chain.

### 6-5-1 CHAIN NOMENCLATURE

See Figure 6-3 for a description of chain terms.

![Figure 6-3. Chain Nomenclature](image)

### 6-5-2 VISUALLY INSPECT CHAIN

Perform the following procedure to inspect the boom extend chain:

**– TASK REQUIREMENTS –**

<table>
<thead>
<tr>
<th>Personnel</th>
<th>Two mechanics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2)</td>
</tr>
</tbody>
</table>
Be very careful when working near moving boom parts and the chain. Serious injuries may result when fingers or loose clothing get caught in moving chain.

INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Raise boom to horizontal (level) position.
5. Fully extend boom until extend chain is taut.
6. Set Ignition switch to OFF.
7. Attach danger tags to steering wheel and ignition key. Refer to para. 2-5, for lockout-tagout procedure.

INSPECT EXTEND CHAIN

1. See Figure 10-4. Inspect extend chain for following defects:
   a. Corrosion and contamination.
   b. Lack of lubrication.
   c. Cracks caused by fatigue.
   d. Cracks caused by stress corrosion.
   e. Broken links caused by extreme overload.
   f. Enlarged holes caused by extreme overload.
   g. Tight joints.
   h. Distorted or battered link plates.
   i. Rotated pin heads.
   j. Abnormal pin protrusion.
   k. "V" flats in incorrect alignment.
   l. Chain clevis ends for cracking or distortion.
   m. Chain sheaves for bearing wear and grooving from chain.
Figure 6-4. Chain Damage Inspection (Sheet 1 of 2)
6-5-3 MEASURE CHAIN EDGE WEAR

Perform the following procedure to measure chain edge wear:

- TASK REQUIREMENTS -

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td></td>
<td>Caliper</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2)</td>
</tr>
</tbody>
</table>

NOTE: A chain with a link that is worn beyond the 5% wear limit requires that the entire chain be replaced.
**NOTE:** Because of boom construction, access to the retract chain is very limited. The chain edge wear measurement can only be performed when the boom has been completely disassembled. Note however, that the retract chain is very well protected from the environment and that it performs much less work than the extend chain.

**INITIAL SET-UP**

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Raise boom to horizontal (level) position.
5. Fully extend boom until extend chain is taut.
6. Set Ignition switch to OFF.
7. Attach danger tags to steering wheel and ignition key. Refer to your lockout-tagout procedure.

**MEASURE CHAIN EDGE WEAR**

1. See Figure 10-5. The height of all link plates in a new chain is 1.185" from the top edge to the bottom edge. The maximum allowable wear limit is 5% (0.059") for chains in operation.
2. Select chain link for measurement that runs over chain sheave during normal operation. Chain links that run over chain sheaves are most likely to experience wear.
3. Measure height of link plate with caliper. If link plate height is 1.126" or less, the entire chain must be replaced.

![Figure 6-5. Chain Edge Wear Measurement](image_url)
6-5-4 MEASURE CHAIN ELONGATION

Perform the following procedure to measure chain elongation:

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2)</td>
</tr>
</tbody>
</table>

**NOTE:** A chain that is elongated beyond the 7/16-inch limit requires that the entire chain be replaced.

**NOTE:** Because of boom construction, access to the retract chain is very limited. The chain elongation measurement can only be performed when the boom has been completely disassembled. Note however, that the retract chain is very well protected from the environment and that it performs much less work than the extend chain.

**INITIAL SET-UP**

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Raise boom to horizontal (level) position.
5. Fully extend boom until extend chain is taut.
6. Set Ignition switch to OFF.
7. Attach danger tags to steering wheel and ignition key. Refer to your lockout-tagout procedure.

**CHAIN ELONGATION MEASUREMENT**

1. See Figure 10-6. The length of a chain sample that contains 13 pins, from a new chain, is 15” from the center of the far left pin to the center of the far right pin. The maximum allowable elongation limit is 7/16-inch for a chain in operation.
2. Select chain section for measurement that runs over chain sheave during normal operation. Chain links that run over chain sheaves are most likely to experience elongation.
3. Measure length of chain sample with tape measure. If the sample length is 15-7/16” or more, the entire chain must be replaced.
Figure 6-6. Chain Elongation Measurement

PITCH IS 1-1/8" BETWEEN EACH PIN. LENGTH IS 15" IN SAMPLE SHOWN IN "A" ABOVE. ELONGATION LIMIT IS 7/16".

MEASUREMENT TAKEN OF SAME SAMPLE, SHOWN IN "B" ABOVE, AT 3,000 HOURS IS 15-7/16". CHAIN MUST BE REPLACED.
6-6 CHECK AND ADJUST BOOM CHAIN TENSION

Perform the following procedure to check and adjust the boom chain tension:

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>Two mechanics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>None</td>
</tr>
</tbody>
</table>

![WARNING]

Be very careful when working near moving boom parts and the chain. Serious injuries may result when fingers or loose clothing get caught in moving chain.

**NOTE:** This procedure adjusts the tension of the extend and retract chains.

INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Lower both outriggers until left and right OUTRIGGER lights come on.

CHECK AND ADJUST CHAIN TENSION

1. Raise boom to horizontal (level) position.
2. Fully extend boom.
3. Position second mechanic where he/she can closely observe operation of extend chain.
4. Retract boom about 2 inches then abruptly stop movement of boom. Second mechanic should observe amount of slack there is in chain by noting how much chain bounced when boom was stopped. If chain bounced more than 1/2 " proceed to step 5.
5. See Figure 10-7. Turn chain tension adjustment nut approximately one turn clockwise.
6. Repeat steps 3 through 5 until extend chain has approximately 1/2" of slack. Some slack in chain is desirable. DO NOT OVER TIGHTEN CHAIN.

![Boom & Attachments](image)

**Figure 10-7. Boom Chain Tension Adjustment**

**6-7 SLIDE BLOCKS**

The boom utilizes slide blocks to guide the middle and inner boom sections as they are extended and retracted.

**6-8 INSPECT SLIDE BLOCKS**

Perform the following procedure to inspect the boom slide blocks:

---

**TASK REQUIREMENTS**

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2) Loctite Blue 242®</td>
</tr>
</tbody>
</table>
---

**EVERY 250 HOURS OF OPERATION**
Be very careful when working near moving boom parts and the chain. Serious injuries may result when fingers or loose clothing get caught in moving chain or boom components.

INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage to ground.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key. Refer to your lockout-tagout procedure.

INSPECTION

1. Inspect slide blocks (Figure 6-8, Sheet 2) for following defects:
   - Looseness.
   - Cracks or other damage.
   - Excessive wear.
   - Missing screws and washers.
   - Corrosion and dirt.
2. Correct any defects found during inspection. If a screw is loose, remove screw and clean threads. Apply Loctite Blue 242® to portion of screw threads that engage with slide block nut and re-install screw.
3. If any single slide block must be replaced, replace all the slide blocks at the location.
Figure 6-8. Boom Slide Blocks  (Sheet 1 of 2)
Figure 6-8. Boom Slide Blocks (Sheet 2 of 2)

NOTE:
3 SLIDE BLOCKS ON RIGHT SIDE ALSO.
6-9 REPLACE SLIDE BLOCKS
Perform the following procedure to replace boom slide blocks:

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2) Slide blocks Loctite Blue 242®</td>
</tr>
</tbody>
</table>

⚠️ WARNING ⚠️

Be very careful when working near moving boom parts and the chain. Serious injuries may result when fingers or loose clothing get caught in moving chain or boom components.

INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage to ground.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key. Refer to your lockout-tagout procedure.

**NOTE:** Loctite Blue 242® is designed for the locking and sealing of threaded fasteners which require normal disassembly with standard hand tools. The product cures when confined in the absence of air between close fitting metal surfaces and prevents loosening and leakage from shock and vibration.

**NOTE:** When it is necessary to replace a slide block at the base end or carriage end of a boom section, all the slide blocks at that location should be replaced at the same time.

REPLACE SLIDE BLOCK

1. Gain access to slide block (see Figure 6-8, Sheet 2).
2. Note order and number of shims and spacers used at slide block installation.

   **NOTE:** Not all slide blocks may have shims and spacers installed.

3. Remove two screws and two washers securing slide block to boom section.
4. Remove slide block, shims, and spacer from boom.
5. Apply Loctite Blue 242® to the two screws that will attach slide block to boom section. Apply to portion of screw threads that will engage with slide block nut.
6. Install new slide block and spacer with two screws and washers. Do not tighten screws if shims are to be inserted between slide block and spacer, otherwise tighten screws.
7. Insert shims between slide block and spacer.
8. Tighten screws.
9. Repeat steps 1-8 for remaining slide blocks at location.
10. Check operation of boom. Pay particular attention to binding caused by excessive friction between boom and new slide blocks for full length of boom stroke.

---

**6-10 INSPECT BOOM ROLLERS**

Perform the following procedure to inspect the boom rollers:

---

<table>
<thead>
<tr>
<th><strong>– TASK REQUIREMENTS –</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personnel</strong></td>
</tr>
<tr>
<td><strong>Special tools and equipment</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Parts and consumable materials</strong></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

---

**WARNING**

Be very careful when working near moving boom parts and the chain. Serious injuries may result when fingers or loose clothing get caught in moving chain or boom components.
INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Extend boom and lower carriage to ground so that boom weight is taken off bottom rollers on outer boom and mid boom.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key.

INSPECTION

1. See Figures 6-9 and 6-10. Inspect boom rollers for the following defects:
   - Uneven wear.
   - Hairline cracks.
   - Corrosion.
   - Looseness, worn bearings.
   - Loose mounting hardware. Tighten as required.
   - Lack of lubricant. Lubricate as required. (Refer to para. 6-2 for lubrication instructions.)
2. Replace defective rollers.
3. Thoroughly check operation of boom.

Figure 6-9. Boom Roller Inspection
Figure 6-10. Location of Boom Rollers
6-11 FORK NOMENCLATURE
See Figure 10-11 and refer to Table 10-1 for a description of fork terms.

Figure 6-11. Fork Nomenclature

Table 6-1. Fork Nomenclature

<table>
<thead>
<tr>
<th>Term</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blade</td>
<td>The horizontal portion of the fork upon which the load is supported.</td>
</tr>
<tr>
<td>Heel</td>
<td>The radiused portion of the fork connecting the blade to the shank.</td>
</tr>
<tr>
<td>Shank</td>
<td>The upright (vertical) portion of the fork.</td>
</tr>
</tbody>
</table>
### Table 6-1. Fork Nomenclature – Cont.

<table>
<thead>
<tr>
<th>Term</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tip</td>
<td>The free end of the blade.</td>
</tr>
<tr>
<td><strong>Fork Surfaces</strong></td>
<td></td>
</tr>
<tr>
<td>Blade – upper face</td>
<td>The uppermost surface of the blade on which the load is carried.</td>
</tr>
<tr>
<td>Bottom</td>
<td>The lower surfaces of the blade, including the tapers.</td>
</tr>
<tr>
<td>Shank – front face</td>
<td>The face of the shank which contacts the load and from which the load center distance is measured.</td>
</tr>
<tr>
<td>Flanks</td>
<td>The side faces of the blade and shank.</td>
</tr>
<tr>
<td>Hook retaining face</td>
<td>The inclined faces of the top and the bottom hooks.</td>
</tr>
<tr>
<td>Hook suspension face</td>
<td>The bottom horizontal face of the top hook in contact with the carriage or fork carrier.</td>
</tr>
<tr>
<td>Blade bevel</td>
<td>The surfaces of the tip of the blade which are tapered to facilitate insertion of the fork.</td>
</tr>
<tr>
<td>Tip flanks (toe flanks)</td>
<td>The tip of blade sides which are shaped to facilitate insertion of the fork. (The tip shapes may take various forms.)</td>
</tr>
<tr>
<td>Shank top</td>
<td>The upper surface of the vertical (or shank).</td>
</tr>
<tr>
<td>Shaft</td>
<td>The tube used for mounting forks onto shaft-type carriages.</td>
</tr>
<tr>
<td><strong>Fork Dimensions</strong></td>
<td></td>
</tr>
<tr>
<td>Thickness</td>
<td>The thickness of the parallel portion of the blade or shank closest to the heel.</td>
</tr>
<tr>
<td>Width</td>
<td>The width of the blade.</td>
</tr>
<tr>
<td>Back height</td>
<td>The distance from the bottom of the blade to the top of the shank.</td>
</tr>
<tr>
<td>Length</td>
<td>The length of the blade measured from the front of the shank to the extreme tip of the blade.</td>
</tr>
<tr>
<td>Cross section</td>
<td>The product of the width and thickness.</td>
</tr>
<tr>
<td>Angle</td>
<td>The angle from the upper face of the blade to the front face of the shank.</td>
</tr>
</tbody>
</table>
6-12 MEASURE FORK FLANK WEAR

Perform the following procedure to measure flank wear:

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses&lt;br&gt;Fork caliper</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2)</td>
</tr>
</tbody>
</table>

INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage until forks are about 36" above ground.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key. Refer to your lockout-tagout procedure.

**NOTE:** Fork calipers are calibrated by first measuring the fork shank thickness. On a new fork, the shank and the flank are the same thickness. The fork flank is subject to continuous wear during normal forklift operation. Therefore, comparing the thickness of the flank to the thickness of the shank is an accurate method for gauging flank wear.

**NOTE:** In accordance with ASME B56.1, forks must be removed from service if flank wear is equal to or greater than 10 percent. A 10 percent reduction in flank thickness reduces load-carrying capacity by 20 percent.

MEASURING FLANK WEAR

1. To calibrate calipers, measure shank (View A) thickness. Set top jaws of caliper by measuring the thickness of the shank. Ensure that the caliper is held square across the shank for an accurate reading. The caliper is now set to measure the fork blade.
2. To check flank thickness, position the bottom jaws of the caliper over the flanks of the fork.
3. If inside jaws of caliper hit fork (View B), the fork has less than 10% wear and can remain in service.
4. If inside jaws of caliper pass over the fork arm (View C), fork must be taken out of service.
Figure 6-12. Measuring Fork Flank Wear
6-13 FORK INSPECTION

The following information (in italics) is reprinted from ASME/ANSI B56.1-2000, Inspection and Repair of Forks in Service on Fork Lift Trucks.

6.13.1 INSPECTION AND REPAIR OF FORKS IN SERVICE ON FORK LIFT TRUCKS

(a) Forks in use shall be inspected at intervals of not more than 12 months (for single shift operations) or whenever any defect or permanent deformation is detected. Several applications will require more frequent inspection.

(b) Individual and Load Rating of Forks. When forks are used in pairs (the normal arrangement), the rated capacity of each fork shall be at least half of the manufacturer’s rated capacity of the truck, and at the rated load center distance shown on the lift truck nameplate.

6.13.1.1 INSPECTION

Fork inspections shall be carried out carefully by trained personnel with the aim of detecting any damage, failure, deformation, etc., which might impair safe use. Any fork which shows such a defect shall be withdrawn from service, and shall not be returned to service unless it has been satisfactorily repaired in accordance with Para. 6.13.1.2.

(a) Surface Cracks. The fork shall be thoroughly examined visually for cracks and if considered necessary, subjected to a non-destructive crack detection process, special attention being paid to the heel and welds attaching all mounting components to the fork blank. This inspection for cracks must also include any special mounting mechanisms of the fork blank to the fork carrier including bolt type mountings and forged upper mounting arrangements for hook or shaft type carriages. The forks shall not be returned to service if surface cracks are detected.

(b) Straightness of Blade and Shank. The straightness of the upper face of the blade and the front face of the shank shall be checked. If the deviation from straightness exceeds 0.5% of the length of the blade and/or the height of the shank, respectively, the fork shall not be returned to service until it has been repaired in accordance with Para. 6.13.1.2.

(c) Fork Angle (Upper Face of Blade to Load of the Shank). Any fork that has a deviation of greater than 3 deg. from the original specification shall not be returned to service. The rejected fork shall be reset and tested in accordance with Para. 6.13.1.2.

(d) Difference in Height of Fork Tips. The difference in height of one set of forks when mounted on the fork carrier shall be checked. If the difference in tip heights exceeds 3% of the length of the blade, the set of forks shall not be returned to service until repaired in accordance with Para. 6.13.1.2.

(e) Positioning Lock (Where Originally Provided). It shall be confirmed that the positioning lock is in good repair and correct working order. If any fault is found, the fork shall be withdrawn from service until satisfactory repair has been effected.
6.13.1.2 

REPAIR AND TESTING

(a) Repair: Only the manufacturer of the fork or an expert of equal competence shall decide if a fork may be repaired for continual use, and the repairs shall only be carried out by such parties. It is not recommended that surface cracks or wear be repaired by welding. When repairs necessitating resetting are required, the fork shall subsequently be subjected to an appropriate heat treatment, as necessary.

6-14 MANUALLY RETRACT AND LOWER BOOM

A hydraulic system or engine malfunction may make retracting and lowering the boom impossible. In this situation, the boom can be retracted and lowered by opening manual lowering valves located on the extend cylinder valve block and the left and right boom lift cylinder valve blocks (Figure 6-13). Note that the boom must be above horizontal to accomplish retraction and lowering. Gravity supplies the power required to retract and lower the boom.

Perform the following procedure to manually retract and lower the boom:

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2)</td>
</tr>
</tbody>
</table>

WARNING

DO NOT get under a raised boom unless the boom is blocked up.
RETRACT BOOM

1. Remove four screws and washers from boom access panel (Figure 6-13, Sheet 1).
2. Remove boom access panel.
3. Loosen locknut on extend cylinder manual lowering valve (Figure 6-13, Sheet 2).
4. Turn extend cylinder manual lowering valve adjustment screw counter-clockwise (CCW) until boom starts to retract. Continue turning adjustment screw until a safe retraction speed is achieved.

   **CAUTION**

   Failure to turn the manual lowering valve adjustment screw clockwise and tightening the locknut may cause the boom to bleed out.

5. After boom has retracted, turn extend cylinder manual lowering valve adjustment screw fully clockwise (CW) and tighten locknut.
6. Attach boom access panel to boom with four screws and washers.

LOWER BOOM

**CAUTION**

A possible left or right cylinder failure may cause the boom to lower unexpectedly when the manual lowering valve adjustment screw is turned fully counter-clockwise.

1. Turn manual lowering valve adjustment screw on left boom lift cylinder fully counterclockwise (approximately five turns).
2. Turn the manual lowering valve adjustment screw on right boom lift cylinder counterclockwise until boom starts to lower. The speed at which boom lowers can be controlled by turning adjustment screw clockwise or counterclockwise.
3. After boom has been lowered, close left and right manual lowering valves by turning adjustment screws in fully clockwise. (With valves closed, boom will operate normally when original hydraulic system or engine malfunction has been repaired.)
Figure 6-13. Boom Lift and Extend Cylinder Manual Lowering Valves  (Sheet 1 of 2)

NOTE:
Both left and right lift cylinder manual lowering valves must be opened to lower boom.
Figure 6-13. Boom Lift and Extend Cylinder Manual Lowering Valves (Sheet 2 of 2)
Section 7
Check-Out Procedures

7-1 CHECK OPERATION OF REAR AXLE STABILIZATION SYSTEM
Perform the following procedure to check the operation of the Rear Axle Stabilization System (RAS):

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One operator and one observer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>8&quot; X 8&quot; wood block</td>
</tr>
<tr>
<td></td>
<td>Head protection</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>None</td>
</tr>
</tbody>
</table>

The test area must be cleared of personnel and objects which may pose a hazard in case the forklift rolls over during the test.

If the forklift starts to roll over, DO NOT attempt to get out of the cab. Stay in the seat. The cab is designed to provide protection to the operator in the event that the forklift rolls over. Leaving the cab may result in serious injury or death.

PRELIMINARY SET-UP

1. Post an observer to observe procedure and to render immediate aid if necessary.
2. Remove any attachments from carriage adapter.
3. Verify Boom Angle indicator (Figure 7-1) swings freely without drag.
4. Place 8" X 8" wood block in front of left front wheel.
5. Enter cab and adjust seat.
6. Fasten and adjust seat belt.
7. Start engine. Note that all tests are conducted at idle speed (approximately 1,000 rpm).
8. Park forklift on level surface.
9. Retract boom.
10. Raise boom and then lower until boom is horizontal (level) to ground. Verify Boom Angle indicator reads 0 degrees.
11. Retract outriggers (if equipped).
12. Use Frame Sway control to level frame.
13. Verify Rear Axle Locked indicator is OFF.
14. Use Frame Sway control to sway frame full left. Verify Frame Level (slope) indicator (Figure 7-2) displays 11 degrees left.
15. Use Frame Sway control to sway frame full right. Verify Frame Level (slope) indicator displays 11 degrees right.
16. Use Frame Sway control to level forklift. Verify Frame Level (slope) indicator displays 0 degrees.
17. Drive forklift up on 8” X 8” wood block located in front of left front wheel and depress service brake pedal.
18. Set Travel Select lever to NEUTRAL (N).
19. Raise boom to 40 degrees. The Rear Axle Locked light must come ON and remain on.

   NOTE: In the following step, observe and record the actual boom angle at which the Rear Axle Locked light comes on.

20. With Service Brake pedal depressed and Parking Brake switch set to OFF, set Travel Select lever to NEUTRAL (N) and raise the boom to 40 degrees.
NOTE: The following tests should be conducted at one time and in sequence.

**TEST NO. 1**

The test verifies that the Service Brake activates the RAS (Locked Mode).

**TEST SETUP**
1. Set Parking Brake switch to OFF.
2. Depress Service Brake pedal just enough to keep Rear Axle Locked indicator ON.
3. Set Travel Select lever to Reverse (R) and 1st gear.
4. Slowly depress Throttle to drive through service brakes sufficient distance to back off block where front left wheel is off ground.

**RESULTS**
The rear axle remains locked with no oscillation and the left front tire remains airborne.

**TEST NO. 2**

This test verifies that setting the travel select lever to N activates RAS (Locked Mode).

1. Keep Service Brake depressed and Parking Brake switch set to OFF.
2. Set Travel Select to NEUTRAL (N).
RESULTS
The rear axle must remain locked with no oscillation and the left front tire must remain airborne.

TEST NO. 3
This test verifies that the parking brake activates RAS (Locked Mode).

TEST SETUP
1. Keep Travel Select lever set to NEUTRAL (N).
2. Set Parking Brake switch to ON.
3. Move Travel Select lever to F and select 3rd gear.

RESULTS
The rear axle remains locked with no oscillation and the left front tire remains airborne.

TEST NO. 4
This test verifies frame sway maintains a four-point stance while operating in Slaved Mode.

TEST SETUP
1. Move Travel Select lever to NEUTRAL (N).
2. Set Parking Brake switch to ON.
3. Verify frame sway will not function unless Interlock button is depressed, then activate button and frame sway left about 5 degrees pause then right about 5 degrees beyond the start point.
4. During test verify, frame must sway in Reduced Speed Mode both directions, the Rear Axle Locked light remains ON and the front tire remains off the ground.

RESULTS
Although the tire's height off the ground may change slightly due to the changes in lateral weight distribution, the front to rear axle oscillation relationship is retained.

TEST NO. 5
This test verifies that release of the service brake deactivates the RAS system.

SETUP
1. Depress Service Brake pedal until Rear Axle Locked light comes ON.
2. Set Parking Brake switch to OFF.
3. Set Travel Select lever to REVERSE (R).
4. Select 4th gear.
5. Release Service Brake pedal slowly to deactivate RAS system.

RESULTS
1. The Rear Axle Locked light should go OFF.
2. The left front tire must return to the ground.
3. The forklift may travel in reverse during this test. Allow the forklift to equalize weight on all four tires without depressing service brake.

NOTE: The operator can toggle the RAS between Locked Mode and Restricted Float Mode simply by depressing or releasing the Service Brake pedal. The Rear Axle Locked light must come on and go out consistent with the mode change.

TEST NO. 6

This test verifies frame sway and RAS operation in Restricted Float Mode (Travel Mode).

TEST SETUP
1. Position forklift on level surface.
2. Use the Frame Sway control to level the frame.
3. Depress Service Brake pedal.
4. Raise boom above 45 degrees.
5. The Rear Axle Locked indicator light comes ON.
6. Move range selector to 3rd and Travel Select lever to FORWARD (F) or REVERSE (R).
7. Release Service Brake pedal to deactivate Rear Axle Locked Mode. The Rear Axle Locked light must come on and go out consistent with mode change.
8. Press Frame Sway override button and sway frame no more than 7 degrees left while holding Sway Control lever full stroke. (Operator controls frame sway travel and is responsible for maintaining corresponding forklift stability.)
9. Repeat frame sway towards right under same conditions and verify comparable performance.

RESULTS
The frame should sway in the Fast Mode and the front wheel may rise slightly but should return to the ground when frame swaying is stopped.
Section 8
Storage & Transportation

8-1 GENERAL MAINTENANCE SAFETY

Use caution when performing maintenance on the forklift. Wear personal protective equipment when appropriate and use danger tags. Carefully follow the maintenance procedures provided in this chapter. Read the Material Safety Data Sheets (MSDS) for solvents, cleaners, etc. Read and fully understand the safety information before performing maintenance on the forklift.

8-2 PREPARING ENGINE FOR LONG-TERM STORAGE

Perform the following procedure to prepare the engine for long-term storage (30 days or longer):

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2)</td>
</tr>
<tr>
<td></td>
<td>Ethylene glycol coolant</td>
</tr>
<tr>
<td></td>
<td>Oil, 15W-40 API CG4</td>
</tr>
<tr>
<td></td>
<td>Oil filters</td>
</tr>
<tr>
<td></td>
<td>Diesel Fuel Preservative</td>
</tr>
<tr>
<td></td>
<td>POWERPART Lay-Up 1 Protectant</td>
</tr>
<tr>
<td></td>
<td>POWERPART Lay-Up 2 Protectant</td>
</tr>
<tr>
<td></td>
<td>POWERPART Lay-Up 3 Protectant</td>
</tr>
<tr>
<td></td>
<td>Waterproof tape</td>
</tr>
<tr>
<td></td>
<td>Absorbent cotton</td>
</tr>
</tbody>
</table>
Storage & Transportation

NOTE: Several chemicals, lubricants, etc., are required to prepare the engine for storage. Carefully read the instructions printed on the containers prior to using the product.

NOTE: Record all steps done to prepare forklift for long-term storage.

INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key. Refer your lockout-tagout procedure.
7. Completely clean outside of engine.

FUEL SYSTEM

CAUTION

Fuel that has been stored in the tank and in the fuel system should not be used at the end of the storage period. The fuel should be drained, properly disposed of, and replaced with fresh fuel. The fuel filter must also be replaced. However, the fuel and filter can be prepared for storage and later used safely at the end of the storage period if a preservative is added to it.

1. If preservative fuel is used, drain fuel system and then fill with preservative fuel.
2. If normal fuel is to be retained, add POWERPART Lay-Up 1, Fuel Preservative to fuel tank.
3. Circulate fuel through fuel system by operating engine until it reaches normal operating temperature.

LUBRICATION SYSTEM

CAUTION

If the engine will not be started for several weeks, the lubricating oil will drain from the cylinder walls and from the piston rings. Rust can form on the cylinder walls and cause increased engine wear and reduce service life.

1. Stop engine and drain oil from oil pan. Dispose of oil properly.
2. Replace oil filters. Dispose of oil filters properly.
3. Fill oil pan to full mark on dipstick with new, clean lubricating oil.
4. Add POWERPART Lay-Up 2 to oil in order to protect engine against corrosion.
5. If POWERPART Lay-Up 2 is not available, use a preservative of the correct specification instead of lubricating oil. If a preservative is used, this must be drained completely at end of the storage period and oil pan must be refilled to correct level with normal lubricating oil.

6. Operate engine for short period of time to circulate oil. Check for leaks.

COOLING SYSTEM

**WARNING**

*Do not drain coolant while engine is still hot and the system is under pressure because dangerous hot coolant can be discharged.*

1. Remove filler cap of cooling system.
2. Remove drain plug from the side of cylinder block in order to drain engine. Ensure that drain hole is not restricted.
3. Place container beneath radiator drain plug.
4. Open radiator drain plug to drain radiator.
5. Flush cooling system with clean water.
6. Re-install drain plugs and filler cap.
7. Close radiator drain plug.
8. Fill cooling system with 50% ethylene glycol / 50% water mixture. Note that this mixture provides protection against corrosion.
9. Operate engine for short period in order to circulate coolant in engine.

BATTERY

1. Check battery condition indicator. Battery should be fully charged before being placed in storage.
2. Disconnect cables from battery.
3. Clean battery terminals and coat with POWERPART Lay-Up 3.
4. Put battery into safe storage.

FUEL INJECTION SYSTEM

1. Clean engine breather pipe and seal end of pipe with waterproof tape.
2. Remove fuel injector nozzles and spray POWERPART Lay-Up 2 for one or two seconds into each cylinder bore with piston at bottom dead center.
3. Slowly turn crankshaft for one complete revolution and then re-install fuel injector nozzles.

AIR INDUCTION SYSTEM

1. Remove air filter assembly.
2. If necessary, remove pipes that are installed between air filter assembly and turbocharger.
3. Spray POWERPART Lay-Up 2 Protectant into turbocharger. The duration of the spray time should be 50% longer than the time indicated on the container label.

4. Seal turbocharger with waterproof tape.

**EXHAUST SYSTEM**

1. Remove exhaust pipe.
2. Spray POWERPART Lay-Up 2 Protectant into turbocharger. Duration of spray time should be 50% longer than time indicated on container label.
3. Seal the turbocharger with waterproof tape.

**GENERAL ENGINE**

1. Remove valve cover filler cap.
2. Spray POWERPART Lay-Up 2 Protectant around rocker shaft assembly.
3. Re-install filler cap.
4. Seal fuel filler cap with waterproof tape.
5. Remove drive belts and put into storage.
6. In order to prevent corrosion, spray engine with POWERPART Lay-Up 3 Protectant. Be careful not to spray area inside alternator cooling fan.
7. Seal off engine openings with absorbent cotton to keep moisture out.

**8-3 PREPARING FORKLIFT FOR LONG-TERM STORAGE**

Perform the following procedure to prepare a forklift for long-term storage:

### – TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Grease gun</td>
</tr>
<tr>
<td></td>
<td>Tarp</td>
</tr>
</tbody>
</table>

| Parts and consumable materials | Danger tags (2) |
|  | Grease, extreme pressure NLGI #2 |
|  | Transmission fluid, Dexron III |
|  | Oil, SAE 80W-90 EP API GL5 |
|  | Rust inhibiting lubricant |
|  | Protectant, vinyl & rubber |
|  | Waterproof tape |

1. Lubricate all grease fittings.
2. Top off transmission fluid.
Storage & Transportation

3. Top off front and rear axle oil.
4. Wash and wax the exterior finish.
5. Apply rust-inhibiting lubricant to all exposed cylinder rods.
6. Apply protectant to tires.
7. Apply protectant to operator seat.
8. Seal tail pipe with waterproof tape to prevent entry in exhaust system by rodents, etc.
9. If the forklift will be in storage for a year or more, support it on jack stands or blocks. This will take the weight off of the wheel bearings.
10. Remove wheels and tires and store them flat and out of the sunlight.
11. If possible, store forklift indoors where it will be protected from adverse weather.
12. If forklift is to be stored outside, park it on concrete or asphalt, or wood planks laid out over dirt. Cover forklift with a tarp.

8-4 TRANSPORTING FORKLIFT

Refer to Table 8-1 for forklift operating weights and see Figure 8-1 for the location of forklift tie-down points.

WARNING

Xtreme Manufacturing is not responsible for any aspect of forklift transportation. The owner/operator assumes full responsibility for:

- Choosing the proper method of transportation.
- Choosing the proper tie-down devices.
- Ensuring the equipment used is capable of supporting the weight of the forklift being transported.
- Ensuring that Department of Transportation and other federal or state laws and regulations are followed.
- Ensuring that all safety rules of their employer are followed.
- Ensuring that all manufacturer's instructions and warnings are followed.
Table 8-1. Forklift Operating Weights

<table>
<thead>
<tr>
<th>Forklift Model</th>
<th>Operating Weight (Lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>XR1045</td>
<td>RT-045</td>
</tr>
</tbody>
</table>

Figure 8-1. Tie-Down Point Locations
9-1 GENERAL MAINTENANCE SAFETY

**WARNING**

Use caution when performing maintenance on the forklift. Wear personal protective equipment when appropriate and use danger tags. Carefully follow the maintenance procedures provided in this chapter. Read the Material Safety Data Sheets (MSDS) for solvents, cleaners, etc. Read and fully understand the safety information provided in the *Operation Manual*, before performing maintenance on the forklift.

9-2 CHECK ENGINE OIL LEVEL

Perform the following procedure to check the engine oil level and add oil if required:

**– TASK REQUIREMENTS –**

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td></td>
<td>Funnel</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2)</td>
</tr>
<tr>
<td></td>
<td>Clean cloth</td>
</tr>
<tr>
<td></td>
<td>Oil, 15W-40 API CG4</td>
</tr>
</tbody>
</table>

**INITIAL SET-UP**

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key.

**CHECK OIL LEVEL**

1. Open engine cover.
2. Pull dipstick (Figure 9-1) from engine and wipe with clean cloth.
3. Re-insert dipstick in engine and remove to check amount of oil in crankcase. If oil level is below upper notch on dipstick, add oil to crankcase.

**ADD OIL**

1. Remove engine oil fill cap from valve cover (Figure 9-1).
2. Using clean funnel, pour oil into valve cover opening.
3. Use dipstick to recheck oil level.
4. Repeat Steps 2 and 3 until oil level reaches second notch on dipstick.
5. Install oil fill cap in valve cover.
6. Close engine cover.

![Figure 9-1. General Location of Engine Oil Fill Cap and Dipstick](image)
9-3 CHECK ENGINE COOLANT LEVEL

The engine coolant level can easily be checked by looking at the opening in engine cover. The coolant level in the overflow tank (behind the opening) should be at mid level. If the coolant level is low, perform the following procedure to add coolant to the cooling system:

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td></td>
<td>Funnel</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2)</td>
</tr>
<tr>
<td></td>
<td>Coolant, 50%/50% mixture of ethylene glycol and water (normal). Maximum amount of ethylene glycol in mixture must not exceed 70%</td>
</tr>
</tbody>
</table>

WARNING

DO NOT leave coolant out where children or pets can get to it. Coolant has a sweet smell but is very toxic.

NOTE: If the overflow tank contains some coolant, coolant can be added directly to the tank to achieve the proper amount of coolant in the cooling system. If the overflow tank is empty, then coolant must be added to BOTH the radiator and the overflow tank.

INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key. Refer to para. 2-5, for lockout-tagout procedure.

ADD COOLANT TO OVERFLOW TANK

1. Open engine cover.
2. Remove cap from overflow tank (Figure 9-3).
3. Using clean funnel, pour coolant into overflow tank until tank is approximately half full.

**ADD COOLANT TO RADIATOR AND OVERFLOW TANK**

NEVER open a radiator cap on a hot engine. The radiator is pressurized and the coolant could spurt out and scald you

1. Let engine cool down completely.
2. Cover vent (Figure 9-3A) with cloth. Turn vent to counter-clockwise (CCW) to release any pressure stored in radiator.
3. Remove radiator cap.
4. Using clean funnel, pour coolant into radiator until radiator core is completely covered.
5. Remove cloth from vent and turn clockwise (CW) until closed. Replace radiator cap.
6. Open overflow tank cap.
7. Using clean funnel, pour coolant into overflow tank until tank is approximately half full. Close cap.
8. Start engine and operate until engine reaches normal operating temperature.
9. Check coolant level in overflow tank. Add coolant as required.
10. Close engine cover.

**Figure 9-2. Coolant Level Indicator**

NOTE: BOOM AND CAB NOT SHOWN FOR CLARITY
Perform the following procedure to check the engine for oil and coolant leaks:

**– TASK REQUIREMENTS –**

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2)</td>
</tr>
<tr>
<td></td>
<td>Clean cloth</td>
</tr>
</tbody>
</table>

**INITIAL SET-UP**

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key.

Figure 9-2B. Radiator Overflow Tank, Perkins 854 T4F

Figure 9-3A. Radiator Overflow Tank, Perkins T4-i
CHECK FOR OIL AND COOLANT LEAKS

1. Open engine and radiator covers.
2. Check ground beneath engine for evidence of oil and coolant leaks.
3. Check top, sides, and underside of engine for evidence of oil and coolant leaks.
4. Check all hoses and tubing for evidence of leaks.
5. Close engine and radiator covers.

9-5 CHECK FOR WATER IN FUEL-WATER SEPARATOR

Perform the following procedure to check for water in the fuel-water separator:

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses Container</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2)</td>
</tr>
</tbody>
</table>

INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key.

DRAIN WATER

1. Open engine cover.
2. Place container beneath fuel-water separator.
3. Open drain valve (Figure 9-4).
4. If water does not drain, loosen fill valve.
5. When water has completely drained, close drain valve.
6. Hand tighten fill valve. DO NOT over tighten.
7. Close engine cover.
Figure 9-4. Fuel-Water Separator
Perform the following procedure to empty the air filter dust cup:

### TASK REQUIREMENTS

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2) Clean, disposable cloth</td>
</tr>
</tbody>
</table>

### INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key.

### EMPTY DUST CUP

1. Open engine cover.
2. Loosen thumb screw (Figure 9-5) on dust cup clamp.
3. Remove clamp.
4. Remove dust cup.
5. Clean out dust cup with clean, disposable cloth. Dampen cloth if necessary.

Use caution when replacing the air filters. The engine is highly vulnerable to abrasive dust contaminants during the servicing process when the filters are removed from the housing.

**NOTE:** The least efficient time in the life of an air filter element is when it is new. Filter elements increase in efficiency as dust builds up on the media. The filters should only be changed when the dust build-up is beginning to restrict engine air intake.

6. Remove main filter and safety filter and inspect. Replace if dirty. (Refer to para. 9-13.)
7. Position dust cup on air filter assembly body.
8. Attach dust cup to air filter assembly body with clamp. Tighten thumb screw.

Figure 9-5. Engine Air Filter Assembly
Perform the following procedure to check the condition and tension of the engine drive belts:

**– TASK REQUIREMENTS –**

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td></td>
<td>Tensiometer</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2)</td>
</tr>
</tbody>
</table>

**INITIAL SET-UP**

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach DANGER – DO NOT OPERATE tags to steering wheel and ignition key.

**CHECK CONDITION AND TENSION OF BELTS**

1. Open engine cover.
2. Locate midpoint of belt between engine and alternator.
3. Alternately push and pull on belts to roughly measure belt tension. Belts should have approximately ½" total slack. Refer to para. 9-15 for belt tension adjustment procedure.

**9-8 CHANGE ENGINE OIL**

Perform the following procedure to change the engine oil:

**– TASK REQUIREMENTS –**

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
</table>
Engine

<table>
<thead>
<tr>
<th>Special tools and equipment</th>
<th>Safety glasses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Torque wrench</td>
</tr>
<tr>
<td></td>
<td>Funnel</td>
</tr>
<tr>
<td></td>
<td>Container</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2)</td>
</tr>
<tr>
<td></td>
<td>Oil, 15W-40 API CG4 (8 qts)</td>
</tr>
<tr>
<td></td>
<td>(See Figure 9-7 for additional info.)</td>
</tr>
</tbody>
</table>

INITIAL SET-UP

1. Park forklift on level surface. This will help ensure an accurate reading on dipstick.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Operate engine until warm.
6. Set ignition switch to OFF.
7. Attach danger tags to steering wheel and ignition key.

**WARNING**

Do not exceed the correct level of engine oil. An excess of engine oil could enter the breather valve. This could cause the engine speed to increase rapidly without control.

**CAUTION**

Discard the used engine oil in a safe place and in accordance with local regulations.

DRAIN AND FILL CRANKCASE

1. Open engine cover.
2. Place container below engine oil pan.
3. See Figure 9-6. Remove oil pan drain plug (1) and O-ring.
4. Drain engine oil into container.
5. Ensure O-ring is not damaged. Install drain plug and O-ring. Torque drain plug to 25 ft-lbs.
6. Add approximately 8 quarts of oil to crankcase until oil level reaches fill line on dipstick (2).
7. Remove container and properly dispose of engine oil.
8. Start engine and check for oil leaks.
Figure 9-6. Oil Drain Plug and Dipstick

Figure 9-7. Recommended Engine Oil Viscosity Grades
9-9 REPLACE OIL FILTERS

NOTE: The engine is equipped with two oil filters, an element-type oil filter and a cartridge-type oil filter. If only the engine oil is to be changed, refer to para. 9-8 for oil change procedures.

Perform the following procedures to replace the element-type and canister-type oil filters:

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td></td>
<td>Torque wrench</td>
</tr>
<tr>
<td></td>
<td>Funnel</td>
</tr>
<tr>
<td></td>
<td>Container</td>
</tr>
<tr>
<td></td>
<td>Strap wrench</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2)</td>
</tr>
<tr>
<td></td>
<td>Element-type oil filter</td>
</tr>
<tr>
<td></td>
<td>Canister-type oil filter</td>
</tr>
</tbody>
</table>

**CAUTION**

- Discard the used engine oil and filters in a safe place and in accordance with local regulations.
- It is important that only Xtreme Manufacturing or Perkins oil filters are used. The use of other filters may damage the engine and void the warranty.

**INITIAL SET-UP**

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Operate engine until warm.
6. Set Ignition switch to OFF.
7. Attach danger tags to steering wheel and ignition key.
DRAIN OIL FROM CRANKCASE

1. Open engine cover.
2. Position suitable container below engine oil pan.
3. See Figure 5-6. Remove oil pan drain plug (1) and O-ring.
4. Drain engine oil into container.

REPLACE ELEMENT-TYPE OIL FILTER

1. See Figure 9-8. Put suitable container below oil filter (A4).
2. Remove plug (A2) and drain oil from filter.
3. Install ½” square drive ratchet into recess (A1) and remove casing (A3).
5. Clean filter casing and replace seal (B2).
6. Install new filter element (B1) into casing and rotate element to locate it into position.
7. Install new seal on drain plug (A2).
8. Torque plug to 9 ft-lbs.
9. Lubricate seal (B2) with clean engine oil.
10. Fill casing with clean engine oil.
11. Install filter (B1) into casing.
12. Torque casing (A3) to 18 ft-lbs.
13. Remove container and properly dispose of engine oil.

Figure 9-8. Element-Type Oil Filter
REPLACE CANISTER-TYPE OIL FILTER

**NOTE:** The canister contains a valve and a special tube to ensure that engine oil does not drain from the filter when the oil is changed.

1. See Figure 9-9. Position container below oil filter canister (2).
2. Remove filter canister (2) with strap wrench. Ensure adapter is secure in filter head.
3. Discard canister (2).
4. Clean filter head (3).
5. Fill canister with new oil.
6. Lubricate top of new canister seal (1) with clean oil.
7. Install new canister (2) and tighten by hand. DO NOT use strap wrench.
8. Remove container and properly dispose of engine oil.

![Figure 9-9. Canister-Type Oil Filter](image)

FILL CRANKCASE WITH OIL

1. Ensure O-ring is not damaged. Install drain plug and O-ring. Torque plug to 25 ft-lbs.
2. Add engine oil to crankcase until oil level reaches fill line on dipstick (2).
LEAK CHECK

1. Start engine
2. Check for leaks at crankcase drain plug and both filters.
3. When engine has cooled, check oil level on dipstick and add oil as needed.

9-10 REPLACE FUEL FILTER

Perform the following procedure to replace the fuel filter:

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td></td>
<td>Container</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2)</td>
</tr>
<tr>
<td></td>
<td>Fuel filter element</td>
</tr>
<tr>
<td></td>
<td>Xtreme P/N 13952-008</td>
</tr>
</tbody>
</table>

**CAUTION**

- The combustible material of some components of the engine (certain seals, for example) can become extremely dangerous if it is burned. Never allow this burnt material to come into contact with the skin or eyes.
- Discard the used element and fuel in a safe place and in accordance with local regulations.
- Ensure the starter switch is in the off position before servicing or repairs are made to the fuel system, because fuel will be released if the lift pump has power.
- All fuel line valves must be closed before maintenance or repairs are made to the fuel system. If this is not done, the fuel system may drain.

**CAUTION**

- It is important that only genuine Xtreme parts are used. The use of parts that are not genuine Xtreme parts may damage the fuel pump and void the warranty.
- The pre-filter canister and main filter elements must be replaced at the same time.
- Do not allow dirt to enter the fuel system.
INITIAL SET-UP
1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key.

REPLACE FILTER
1. Open engine cover.
2. See Figure 9-10. Place container below fuel filter assembly to catch any fuel spillage.
3. Thoroughly clean outside surfaces of fuel filter assembly. Open drain tap (A1) at bottom of filter casing (B4) to drain fuel from filter.
4. Loosen and remove filter casing (B4) and element (B1) from fuel filter head.
5. Remove filter element (B1) from casing (B4). Press down on filter element (B1), against spring pressure, and rotate it counter-clockwise (CCW) to release it from filter casing (B4).
6. Put new filter element (B1) inside casing (B4) and press it down against spring pressure. Rotate it clockwise (CW) to lock it into casing (B4).
7. Lightly lubricate new seal (B3) with clean fuel and install in casing (B4).
8. Check that thread (B2) on inside of element is not damaged.
9. Install filter assembly on fuel filter head and tighten by hand until it contacts filter head. Tighten assembly ¼ of turn further by hand. DO NOT over tighten.
10. Close drain tap (A1) and remove container.
11. Before starter motor is engaged, operate lift pump for one minute to eliminate air from filter.
12. Start engine and check for fuel leaks.

Figure 9-10. Fuel Filter Element
9-11 CHECK SPECIFIC GRAVITY OF COOLANT

Perform the following procedure to check the specific gravity of the coolant.

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td></td>
<td>Coolant hydrometer (with thermometer)</td>
</tr>
<tr>
<td></td>
<td>Container</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parts and consumable materials</th>
<th>Danger tags (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coolant, 50%/50% mixture of ethylene glycol and water (normal). Maximum amount of ethylene glycol in mixture must not exceed 70%</td>
<td></td>
</tr>
</tbody>
</table>

⚠️ WARNING ⚠️

DO NOT leave coolant out where children or pets can get to it. It has a sweet smell but is very toxic.

INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Attach danger tags to steering wheel and ignition key.

CHECK SPECIFIC GRAVITY OF COOLANT

1. Open engine cover.
2. Start engine and operate until warm enough to open thermostat. Continue to run engine until coolant has circulated through cooling system.
3. Stop engine and allow to cool until temperature of coolant is below 140°F.
**WARNING**

DO NOT drain the coolant while the engine is still hot and the system is under pressure. Dangerous hot coolant can be discharged.

4. See Figure 9-11. Open cap of coolant recovery tank.
5. Remove radiator cap.
6. Position container beneath radiator drain.
7. Open radiator drain to drain small amount of coolant into container.
8. Draw coolant from container into hydrometer and read hydrometer scale (refer to chart on Figure 9-12).
9. Add water or coolant to recovery tank to adjust strength of mixture as required.
10. Close radiator drain.
11. Install radiator cap.
12. Close coolant recovery tank cap.
13. Close engine cover.

Figure 9-11. Coolant Recovery Tank and Radiator Drain
DRAIN AND Flush COOLING SYSTEM

Perform the following procedure to drain and flush the cooling system:

- **TASK REQUIREMENTS** -

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td></td>
<td>Containers (2)</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2)</td>
</tr>
<tr>
<td></td>
<td>Coolant, 50%/50% mixture of ethylene glycol and water (normal). Maximum amount of ethylene glycol in mixture must not exceed 70%</td>
</tr>
</tbody>
</table>

**Figure 9-12. Specific Gravity Chart**
ENGINE

**WARNING**

DO NOT leave coolant out where children or pets can get to it. It has a sweet smell but is very toxic.

**INITIAL SET-UP**

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key.

**WARNING**

DO NOT drain the coolant while the engine is still hot and the system is under pressure. Dangerous hot coolant can be discharged.

**DRAIN**

1. Open engine and radiator covers.
2. Place cloth over radiator vent valve. Open vent.
3. Remove radiator cap.
4. Remove coolant recovery tank cap.
5. Place container beneath radiator pet cock (Figure 9-11).
6. Open radiator pet cock and allow coolant to drain into container.
7. Place container beneath cylinder block drain plug (Figure 9-12).
8. Remove cylinder block drain plug. Ensure that drain hole is not restricted. Allow coolant to drain into container.
9. After radiator and engine block have drained, properly dispose of coolant.
10. Flush system with clean water.
11. Re-install cylinder block drain plug and torque to 30 ft-lbs.
FILL

1. Fill radiator with coolant until core is covered.
2. Fill coolant recovery tank with coolant until one-half full.
3. Install radiator cap and close radiator vent valve.
4. Install coolant recovery tank cap.
5. Start engine and operate until engine reaches normal operating temperature.
6. Recheck coolant level in coolant recovery tank. If necessary, add coolant until tank is one-half full.
7. Close engine and radiator covers.

![Image of cylinder block drain plug]

Figure 9-13. Cylinder Block Drain Plug

9-13 REPLACE AIR FILTERS

Perform the following procedure to replace the air filters:

— TASK REQUIREMENTS —

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
</tbody>
</table>
Use caution when replacing the air filters. The engine is highly vulnerable to abrasive dust contaminants during the servicing process when the filters are removed from the housing.

**NOTE:** The least efficient time in the life of an air filter element is when it is new. Filter elements increase in efficiency as dust builds up on the media. The filters should only be changed when the dust build-up is beginning to restrict engine air intake.

**INITIAL SET-UP**

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key.

**REPLACE AIR FILTER**

1. Open engine cover.
2. See Figure 9-5. Loosen thumb screw on dust cup clamp.
3. Remove clamp.
4. Remove dust cup.
5. Inspect dust cup for cleanliness. If dirty, clean with clean, disposable cloth. Dampen cloth if necessary.
6. Replace main and safety air filter elements.
7. Position dust cup on air filter assembly body.
8. Attach dust cup to air filter assembly body with clamp. Tighten thumb screw.
9-14 CHECK AIR FILTER

NOTE: The air filter should be checked after every 8 hours of operation only during extremely dusty conditions. Normal inspection interval is 250 hours.

Perform the following procedure to check the engine air filter:

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2)</td>
</tr>
</tbody>
</table>

⚠️ CAUTION ⚠️

Use caution when replacing the air filters. The engine is highly vulnerable to abrasive dust contaminants during the servicing process when the filters are removed from the housing.

NOTE: The least efficient time in the life of an air filter element is when it is new. Filter elements increase in efficiency as dust builds up on the media. The filters should only be changed when the dust build-up is beginning to restrict engine air intake.

INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key.

INSPECT FILTER

1. Open engine cover.
2. Loosen thumb screw on clamp (Figure 9-5).
3. Remove dust cup from air filter body.
4. Remove main and safety filter elements from filter body.
Perform the following procedure to inspect and adjust the tension of the engine drive belts:

**– TASK REQUIREMENTS –**

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
</table>
| Special tools and equipment | Belt tensiometer  
Safety glasses |
| Parts and consumable materials | Danger tags (2) |

**INITIAL SET-UP**

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key.

**CHECK CONDITION OF DRIVE BELTS**

1. Open engine cover.
2. Check belts for following defects:
   - Cuts, cracks, or damage.
   - Excessive wear.
   - Dryness (loss of flexibility).
   - Contamination with oil or coolant.
   - Looseness.
3. If belts are defective, replace as a set. If belts are loose, refer to procedure below.

**CHECK AND ADJUST BELT TENSION**

1. Place belt tensiometer (Figure 9-14, A1) at center of longest free length and check tension. Correct tension is 120 ft-lbs.
2. Loosen pivot fastener (Figure 9-14, B1) of alternator and adjustment link fasteners (Figure 9-14, B2 and C1).
3. Change position of alternator to increase or decrease tension on belt. Torque alternator retaining bolt (Figure 9-14, B1) and tension adjusting bolts (Figure 9-14, B2, C1) to 16 ft-lbs.

4. Check belt tension again to ensure that it is still correct. If new belts are installed, belt tension must be checked again after 20 hours of operation.

Figure 9-14. Checking Drive Belt Tension

NOTE: ON ENGINES EQUIPPED WITH SERPENTINE BELTS (FIG. 9-14 D), THIS OPERATION IS ACCOMPLISHED CONTINUOUSLY BY THE SERPENTINE BELT TENSIONER
9-16 CHECK AND ADJUST VALVE TIP CLEARANCES

Perform the following procedure to check and adjust the valve tip clearances.

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Feeler gauge  Safety glasses</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2)</td>
</tr>
</tbody>
</table>

INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key.

CHECK AND ADJUST VALVE CLEARANCE

1. Open engine cover.

   **NOTE:** The valve clearances are checked between the top of the valve stem and the rocker lever (Figure 9-15, A), while the engine is engine cold. The correct clearance for the inlet valves is 0.008” and 0.018” for the exhaust valves. The valve positions are shown in (B). Refer to Table 9-1 for valve and cylinder numbers.

   **NOTE:** The number 1 cylinder is the furthest from the flywheel end of the engine.

2. Rotate crankshaft in normal direction until inlet valve (B7) of number 4 cylinder has just opened and exhaust valve (B8) of same cylinder has not closed completely. Check clearances of valves (B1/B2) and (B2) of number 1 cylinder and adjust them, if necessary.
3. Set valves (B3/B4) of number 2 cylinder as indicated above for number 4 cylinder. Check clearances of valves (B5/B6) of number 3 cylinder. Adjust valve clearance as required.
4. Set valves (B1/B2) of number 1 cylinder. Check clearances of valves (B7/B8) of number 4 cylinder. Adjust valve clearance as required.
5. Set valves (B5/B6) of number 3 cylinder. Check clearances of valves (B3/B4) of number 2 cylinder. Adjust valve clearance as required.
Table 9-1. Cylinder and Valve Numbers

<table>
<thead>
<tr>
<th>CYLINDER NO.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>VALVE NO. / TYPE</td>
<td>I</td>
<td>E</td>
<td>I</td>
<td>E</td>
</tr>
<tr>
<td>(I = INLET – E = EXHAUST)</td>
<td>I</td>
<td>E</td>
<td>I</td>
<td>E</td>
</tr>
</tbody>
</table>

Figure 9-15. Checking and Adjusting Engine Valve Clearances
Perform the following procedure to check the engine hoses, tubing, and connections for leaks, damage, and tightness:

### TASK REQUIREMENTS

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td></td>
<td>Drop light</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2)</td>
</tr>
</tbody>
</table>

### INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key.

### INSPECTION

1. Open engine cover.
2. Inspect engine hoses, tubing, and connections for the following defects:
   - Evidence of leakage.
   - Loose or corroded clamps.
   - Bulges.
   - Cracks.
   - Cuts.
   - Soft or mushy spots.
   - Hard spots.
3. Replace any defective hoses, tubing, or clamps.
4. Check system for leaks.
Perform the following procedure to check the radiator hoses and connections for leaks, damage, and tightness:

- **TASK REQUIREMENTS** -

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses  Drop light</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2)</td>
</tr>
</tbody>
</table>

**INITIAL SET-UP**

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key.

**INSPECTION**

1. Open engine cover.
2. See Figure 5-16. Inspect hoses connected to radiator for the following defects:
   - Signs of leakage.
   - Loose or corroded clamps.
   - Bulges.
   - Cracks.
   - Cuts.
   - Soft or mushy spots.
   - Hard spots.
3. Replace any defective hoses or clamps.
4. Check system for leaks.
Perform the following procedure to check the engine wiring and connections for damage and tightness:

**– TASK REQUIREMENTS –**

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td></td>
<td>Drop light</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2)</td>
</tr>
</tbody>
</table>
INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key.

INSPECTION

1. Open engine cover.
2. Inspect engine wiring and connections for the following defects:
   - Loose connections.
   - Damaged connectors.
   - Dirty or contaminated connectors.
   - Loose or missing clamps and hardware.
   - Misrouted wires and cables.
   - Damaged or missing cable jacket.
   - Loose or corroded ground connections.
3. Repair or replace any defective wiring and connections.
4. Check system for proper operation.

9-20 CHECK FOR OIL, COOLANT, AND FUEL LEAKS

Perform the following procedure to check the engine for oil, coolant, and fuel leaks:

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
</table>
| Special tools and equipment | Safety glasses  
                      | Drop light        
                      | Creeper           |
| Parts and consumable materials | Danger tags (2) |
INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key.

INSPECTION

1. Open engine cover.
2. Inspect the following components and areas for evidence of oil, coolant, and fuel leaks:

   CAUTION

   Some leaks can be repaired simply by tightening a loose screw or screws. However, note that the proper method for tightening the screws of a component, such as the oil pan, is with a torque wrench. Also note that the screws should be tightened in a specific sequence to prevent warping the component. All leaks should be troubleshot and repaired by a qualified mechanic.

   • Engine valve cover.
   • Engine head.
   • Engine oil pan.
   • Water pump.
   • Thermostat.
   • Turbocharger.
   • Fuel pump.
Section 10
Transmission, Axles, & Driveshafts

10-1 GENERAL MAINTENANCE SAFETY

WARNING

Use caution when performing maintenance on the forklift. Wear personal protective equipment when appropriate and use danger tags. Carefully follow the maintenance procedures provided in this chapter. Read the Material Safety Data Sheets (MSDS) for solvents, cleaners, etc. Read and fully understand the safety information before performing maintenance on the forklift.

10-2 USING A GREASE GUN

The following is a general procedure to follow when lubricating grease fittings:

CAUTION

Use caution when loading grease into the gun to ensure that contaminants are not introduced into the grease. If using a cartridge, be careful when removing the metal lid to prevent metal slivers from being introduced into the grease.

1. Load grease gun with extreme pressure, NLGI #2 grease.

CAUTION

Dirt and other contaminants in the grease can cause premature failure of the bearing. Ensure that grease fitting and grease gun nozzle are clean.

2. Clean dispensing nozzle of grease gun with clean cloth.
3. Pump small amount of grease out of dispensing nozzle to ensure that fresh, clean grease will be used.
4. Clean grease fitting with clean cloth.
5. Inspect fitting for damage. Replace as necessary. Torque grease fitting to correct value.

6. Attach grease gun dispensing nozzle to grease fitting.

### CAUTION

A high-pressure grease gun delivers pressure up to 15,000 psi. The maximum pressure rating for forklift grease seals is 500 psi. Excessive applied pressure can damage the seal and lead to early failure.

**NOTE:** If back pressure is felt immediately when attempting to pump grease into the grease fitting, the fitting may be defective or the grease port and/or path may be blocked.

7. Pump grease in front and rear axle fittings until back-pressure is felt at grease gun lever, then stop pumping.

8. Start engine and operate forklift system or subsystem for several minutes. Shut-off engine, then re-grease fittings.

9. Clean excess grease off fitting with clean cloth.

10. After use, store grease gun (unpressurized) in a horizontal position to prevent leakage.

### 10-3 LUBRICATE AXLE GREASE FITTINGS

Perform the following procedure to lubricate the front and rear axle grease fittings:

#### TASK REQUIREMENTS

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td></td>
<td>Grease gun</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2)</td>
</tr>
<tr>
<td></td>
<td>Grease, extreme pressure, NLGI #2</td>
</tr>
</tbody>
</table>

#### INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key.
LUBRICATE FITTINGS

1. See Figure 10-1 for location of axle grease fittings. Each axle has six grease fittings.

2. Lubricate front and rear axle grease fittings in accordance with para. 10-3.

NOTE:
EACH AXLE HAS SIX GREASE FITTINGS.

Figure 10-1. Axle Grease Fittings
10-4 LUBRICATE DRIVESHAFTS

Perform the following procedure to lubricate the front and rear driveshafts:

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td></td>
<td>Wheel chocks (4)</td>
</tr>
<tr>
<td></td>
<td>Creeper</td>
</tr>
<tr>
<td></td>
<td>Grease gun</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2)</td>
</tr>
<tr>
<td></td>
<td>Grease, extreme pressure, NLGI #2</td>
</tr>
</tbody>
</table>

INITIAL SET-UP
1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key.
7. Place wheel chocks in front of front tires and behind rear tires.

LUBRICATE DRIVESHAFTS
1. See Figure 10-1 for location of driveshaft grease fittings. Each driveshaft has three grease fittings.
2. Gain access to underside of forklift chassis.
3. Lubricate front and rear driveshaft grease fittings in accordance with para. 10-4.
Figure 10-2. Driveshaft Grease Fittings
10-5 REPLACE TRANSMISSION FILTERS AND FLUID

Perform the following procedure to replace the transmission filters and fluid:

– TASK REQUIREMENTS –

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
</table>
| Special tools and equipment | Safety glasses  
Torque wrench  
Container |
| Parts and consumable materials | Danger tags (2)  
Transmission fluid, Dexron III  
XR842 (13.5 qts)  
XR1045 (17 qts)  
Oil filter  
XR842 P/N 14106-010  
XR1045 P/N 14108-010 |

INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key.

DRAIN

1. Remove drain plug (Figure 10-4) and drain oil from the transmission into a suitable container.
2. Remove oil filter and dispose of in accordance with local regulations.
3. Clean drain plug and mating surface with a clean rag or shop towel.
FILL

1. Install drain plug and torque to 44 ft-lbs.
2. Apply a thin film of oil on delivery filter seal. Install delivery filter on transmission and tighten hand-tight.
3. Remove dipstick (DANA) or fill plug (CARRARO).
4. Refill transmission with Dexron III transmission fluid (as noted in chart on page 6-6).
5. Replace dipstick (DANA) or fill plug (CARRARO). Hand tighten fill plug, then tighten 1/2 turn further (CARRARO).
6. Start engine and run until engine is warm.
7. Set Travel Select lever to F (Forward). Alternately set Gear Select switch to 1st, 2nd, 3rd, and 4th gears.
8. Set Travel Select lever to R (Reverse). Alternately set Gear Select switch to 1st, 2nd, 3rd, and 4th gears.
9. Re-check transmission fluid level. Add fluid as required.

Figure 10-3. Transmission Plugs and Filters
10-6 CHECK AXLE OIL LEVEL

Perform the following procedure to check axle oil levels and add oil as required:

- TASK REQUIREMENTS -

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special tools and equipment</td>
<td>Safety glasses</td>
</tr>
<tr>
<td></td>
<td>Torque wrench</td>
</tr>
<tr>
<td>Parts and consumable materials</td>
<td>Danger tags (2)</td>
</tr>
<tr>
<td></td>
<td>Safety solvent</td>
</tr>
<tr>
<td></td>
<td>Oil, SAE 80W-90 EP API GL4</td>
</tr>
<tr>
<td></td>
<td>Oil, SAE 80W-90 EP API GL5</td>
</tr>
</tbody>
</table>

CAUTION

There are two different axles that may be installed on Model XR1045 forklifts. These axles have different lubrication requirements. One axle requires SAE 80W-90 EP API GL4 Oil; the other axle requires SAE 80W-90 EP API GL5 Oil. Always check the axle data plate to determine the correct lubricant and quantity required.

INITIAL SET-UP

1. Park forklift on level surface.
2. Set Travel Select lever to NEUTRAL (N).
3. Set Parking Brake switch to ON.
4. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
5. Set Ignition switch to OFF.
6. Attach danger tags to steering wheel and ignition key.

CLEAN OIL BREATHER

1. Remove oil breather (Figure 10-4, View A).
   
   NOTE: Breather requires cleaning to prevent internal pressure build-up.

   2. Clean breather with safety solvent.
   3. Install breather and torque to 7 ft-lbs.
CHECK AND FILL DIFFERENTIAL

1. Remove drain plug (Figure 10-4, View B).
2. Check oil level. Oil level should be at bottom of drain plug hole. If oil level is low, proceed to Step 3. If oil level is OK, proceed to Step 4.
3. Use funnel with flexible spout to fill axle with oil.
4. Clean and install drain plug. Torque plug to 44 ft-lbs.

CHECK AND FILL AXLE

1. Remove fill plug (Figure 10-4, View C).
2. Check oil level. Oil level should be at bottom of fill plug hole. If oil level is low, proceed to Step 3. If oil level is OK, proceed to Step 4.
3. Use funnel with flexible spout to fill axle with oil.
4. Clean and install fill plug. Torque plug to 44 ft-lbs.
Figure 10-4. Axle Differential and Trumpet Fluid Levels
Perform the following procedure to check the wheel-end oil level and add oil if required:

**TASK REQUIREMENTS**

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
</table>
| Special tools and equipment | Torque wrench  
                           | Brush  
                           | Funnel with flexible spout  |
| Parts and consumable materials | Danger tags (2)  
                                  | O-ring  
                                  | Clean cloth  
                                  | Safety solvent  
                                  | Oil, SAE 80W-90 EP API GL4  
                                  | Oil, SAE 80W-90 EP API GL5 |

**CAUTION**

There are two different axles that may be installed on Model XR1045 forklifts. These axles have different lubrication requirements. One axle requires SAE 80W-90 EP API GL4 Oil, the other axle requires SAE 80W-90 EP API GL5 Oil. Always check the axle data plate to determine the correct lubricant and quantity required.

**INITIAL SET-UP**

1. Move forklift to a level surface.
2. Move forklift backward and/or forward until wheel-end drain plug is at 3 o’clock position (Figure 10-5).
3. Set Travel Select lever to NEUTRAL (N).
4. Set Parking Brake switch to ON.
5. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
6. Set Ignition switch to OFF.
7. Attach danger tags to steering wheel and ignition key.

**CHECK/FILL WHEEL-END**

1. Clean area around wheel-end fill/drain plug with brush, solvent, and clean cloth.
2. Slowly loosen fill/drain plug and remove from wheel-end.
3. Inspect fill/drain plug for dirt and damaged threads. Clean, repair, and replace as required.
4. Inspect fill/drain port threads for damage. Repair as required.
5. Check fluid level in wheel-end. Fluid should be at bottom of drain port hole.
6. If fluid level is low, proceed to Step 7. If fluid level is OK, proceed to Step 9.
7. Place spout of clean funnel in wheel-end fill/drain port. Recommend using funnel that has flexible spout.
8. Slowly pour oil into wheel-end fill/drain port through funnel until oil comes up to bottom of port hole.
9. Install fill/drain plug in port and tighten finger-tight.
10. Torque fill/drain plug to 44 ft-lbs.
11. Perform above procedure for three remaining axle wheel-ends.

Figure 10-5. Axle Wheel End
Perform the following procedure to drain and fill an axle wheel-end:

**– TASK REQUIREMENTS –**

<table>
<thead>
<tr>
<th>Personnel</th>
<th>One mechanic</th>
</tr>
</thead>
</table>
| Special tools and equipment | Torque wrench  
      Brush 
      Funnel with flexible spout |
| Parts and consumable materials | Danger tags (2)  
      O-ring 
      Clean cloth  
      Safety solvent  
      Oil, SAE 80W-90 EP API GL4  
      Oil, SAE 80W-90 EP API GL5 |

**CAUTION**

There are two different axles that may be installed on Model XR1045 forklifts. These axles have different lubrication requirements. One axle requires SAE 80W-90 EP API GL4 Oil, the other axle requires SAE 80W-90 EP API GL5 Oil. Always check the axle data plate to determine the correct lubricant and quantity required.

**INITIAL SET-UP**

1. Move forklift to a level surface.
2. Move forklift backward and/or forward until wheel-end drain plug is at 6 o’clock position (Figure 10-5).
3. Set Travel Select lever to NEUTRAL (N).
4. Set Parking Brake switch to ON.
5. Retract boom and lower carriage. Allow sufficient space to open forklift covers.
6. Set Ignition switch to OFF.
7. Attach danger tags to steering wheel and ignition key.

**CHECK/FILL WHEEL-END**

1. Clean area around wheel-end fill/drain plug with brush, solvent, and clean cloth.
2. Slowly loosen fill/drain plug and remove from wheel-end.
3. Inspect fill/drain plug for dirt and damaged threads. Clean, repair, and replace as required.
4. Inspect fill/drain port threads for damage. Repair as required.
5. Position container beneath fill/drain port.
6. Slowly loosen fill/drain plug and remove from wheel-end.
7. Allow oil to drain completely into container.
8. Move forklift until wheel-end drain plug is at 3 o’clock position.
9. Place spout of clean funnel in wheel-end fill/drain port. Recommend using funnel that has flexible spout.
10. Slowly pour oil into wheel-end fill/drain port through funnel until oil comes up to bottom of port hole.
11. Install fill/drain plug in port and tighten finger-tight.
12. Torque fill/drain plug to 44 ft-lbs.
13. Perform above procedure for three remaining axle wheel-ends.
Appendix

Maintenance Forms and Safety Tags

A-1 PREVENTIVE MAINTENANCE AND HISTORY LOGS
Scheduled maintenance is essential to forklift operational reliability and safety. The following documents are provided to assist new forklift owners in the implementation of a successful preventive maintenance program:

- Maintenance Schedule.
- Maintenance History Log.
- Fork Inspection Log.

A-2 PRE-OPERATION CHECKLIST
A Pre-Operation Checklist is provided to help the operator or mechanic verify that all forklift systems and subsystems are operating correctly.

A-3 SAFETY TAGS
Safety tags, consisting of danger and condition tags, are provided at the end of this Appendix. The danger tags should be attached to the ignition key and steering wheel as directed by the maintenance procedures contained within this manual.
# Maintenance Schedule

**EVERY DAY OR 8 HOURS OF OPERATION**

<table>
<thead>
<tr>
<th>REQUIREMENT</th>
<th>COMMENTS</th>
<th>CHECK-OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check engine oil level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check engine coolant level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check engine for oil and coolant leaks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check for water in fuel-water separator</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In extremely dusty conditions, empty air filter dust cup. Also, check air filter and replace if necessary.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check condition of battery and cables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check condition and tension (by hand) of engine drive belts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check transmission fluid level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check hydraulic fluid level</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### AFTER FIRST 50 HOURS OF OPERATION

<table>
<thead>
<tr>
<th>REQUIREMENT</th>
<th>COMMENTS</th>
<th>CHECK-OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change engine oil and filters</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check air filter. Replace if necessary.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replace fuel filter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check engine hoses and connections for leaks, damage, and tightness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check radiator hoses for leaks, damage, and tightness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check engine electrical cables, leads, and connections for damage and tightness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check for oil and coolant leaks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check condition and tension of drive belts. Use tensiometer to check belt tension.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lubricate front and rear driveshaft grease fittings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lubricate front and rear axle grease fittings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change differential oil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change wheel-end oil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check wheel lug nuts torqued to 380-420 ft-lbs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lubricate boom pivot point grease fittings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lubricate front and rear axle cylinder pivot point grease fittings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lubricate left and right outrigger pivot point (1245/1255/1267/1270/2045/2450) grease fittings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lubricate boom roller grease fittings and chains</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replace hydraulic return line filter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replace transmission filter and top off fluid</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### AFTER EVERY 50 HOURS OF OPERATION

<table>
<thead>
<tr>
<th>Requirement</th>
<th>50</th>
<th>100</th>
<th>150</th>
<th>200</th>
<th>250</th>
<th>300</th>
<th>350</th>
<th>400</th>
<th>450</th>
<th>500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lubricate boom pivot point grease fittings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lubricate front and rear axle cylinder pivot point</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lubricate left and right outrigger pivot point</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>grease fittings (1245/1254/1267/1270/2045/2450)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### AFTER EVERY 250 HOURS OF OPERATION

<table>
<thead>
<tr>
<th>Requirement</th>
<th>250</th>
<th>500</th>
<th>750</th>
<th>1000</th>
<th>1250</th>
<th>1500</th>
<th>1750</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comply with 50-Hour Maintenance Requirements</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change engine oil and filters</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check air filter. Replace if necessary.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check tension and condition of drive belts. Use</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>tensiometer to check belt tension.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lubricate front and rear driveshaft grease fittings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lubricate front and rear axle grease fittings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check differential oil level</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check wheel-end oil level</td>
<td></td>
<td></td>
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<tr>
<td>Check boom chain tension. Adjust if necessary.</td>
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<tr>
<td>Inspect boom rollers and slide blocks for condition</td>
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<tr>
<td>and tightness</td>
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<tr>
<td>Lubricate boom roller grease fittings and chains</td>
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### After Every 500 Hours of Operation

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<td>Replace air filter</td>
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<td>Empty air filter dust cup</td>
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<tr>
<td>Check engine hoses and connections for leaks, damage, and tightness</td>
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<td>Check radiator hoses for leaks, damage, and tightness</td>
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<td>Check engine electrical cables, leads, and connections for damage and tightness</td>
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<td>Check specific gravity of engine coolant</td>
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<tr>
<td>Replace transmission filter and top off fluid</td>
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<td>Replace hydraulic reservoir air breather</td>
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<tr>
<td>Replace hydraulic return line filter</td>
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<tr>
<td>Inspect wheel/tire assemblies</td>
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### AFTER EVERY 1,000 HOURS OF OPERATION

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<tr>
<td>Replace transmission fluid and filters</td>
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<tr>
<td>Change wheel-end oil</td>
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<td>Change differential oil</td>
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<td>Check valve tip clearance. Adjust if necessary.</td>
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<tr>
<td>Replace hydraulic high-pressure filter</td>
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AFTER EVERY 2,000 HOURS OF OPERATION

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<tr>
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<td>Comply with 250-Hour Maintenance Requirements</td>
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<td>Comply with 500-Hour Maintenance Requirements</td>
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<tr>
<td>Comply with 1,000-Hour Maintenance Requirements</td>
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<tr>
<td>Change hydraulic fluid</td>
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<td>☐</td>
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<tr>
<td>Clean or replace hydraulic reservoir strainer</td>
<td>☐</td>
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LONG-INTERVAL MAINTENANCE REQUIREMENTS

<table>
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<tr>
<th>REQUIREMENT</th>
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<th>12,000</th>
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<tbody>
<tr>
<td>Drain and flush cooling system – After every 4,000 hours of operation</td>
<td>☐</td>
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# Maintenance History Log

**FORKLIFT MODEL:** ________________________________  
**SERIAL NO.:** ________________________________

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<tr>
<th>DATE</th>
<th>MALFUNCTION</th>
<th>CORRECTIVE ACTION</th>
<th>COMMENTS</th>
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<td>FORKLIFT MODEL:</td>
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## Maintenance History Log

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<td>FORKLIFT MODEL:</td>
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<td>DATE</td>
<td>OBSERVATIONS/COMMENTS</td>
<td>CORRECTIVE ACTION</td>
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Fork Inspection Log

Maintenance Forms & Safety Tags

Rev 01 – 08/17
Pre-Operation Checklist

- Operate the BOOM CONTROL joystick forward and backward to raise and lower the boom.
- Operate the BOOM CONTROL joystick left and right to extend and retract the boom.
- Operate the ATTACHMENT TILT AND FRAME SWAY CONTROL joystick forward and backward to tilt the attachment up and down.
- Operate the ATTACHMENT TILT AND FRAME SWAY CONTROL joystick left and right to sway the frame left and right.
- Operate the AUXILIARY ATTACHMENT CONTROL lever (if a hydraulic attachment is being used).
- Test the left outrigger (1245/1255/1267/1270/2045/2450).
- Test the right outrigger (1245/1255/1267/1270/2045/2450).
- Turn the work lights off and on.
- Press the HORN button to sound the horn.
- Place the TRAVEL SELECT lever in reverse to sound the backup alarm.
- Operate the forklift in forward and reverse.
- Test the GEAR SELECT lever while operating the forklift in forward and reverse.
- Apply the SERVICE BRAKE pedal after the forklift begins to move. The forklift should stop immediately.
- Set the PARKING BRAKE switch to ON. The forklift should not move unless the PARKING BRAKE switch is set to OFF.
- Test each steering function. Operate the forklift in forward and reverse at low idle speed and turn the steering wheel approximately ¼ turn in each direction.
  - Align the wheels and set the STEERING switch to CRAB steering.
  - Align the wheels and set the STEERING switch to 2W (2-wheel) steering.
  - Align the wheels and set the STEERING switch to 4W (4-wheel) steering.
Pre-Operation Checklist – Cont.

☐ Check the operator control panel gauges after the engine warms to the proper operating range:
  ☐ Check the VOLTS gauge. The gauge should read between 11 to 15 volts.
  ☐ Check the COOLANT gauge. The gauge should read between 180 to 200°F.
  ☐ Check the OIL gauge. The gauge should read between 40 to 80 psi.
☐ Check the FUEL gauge and verify the gauge reads between 2/4 and 4/4. Fill the fuel tank if the gauge shows less than 2/4.
## Grease Fittings List

<table>
<thead>
<tr>
<th>Component</th>
<th>No. of Fittings</th>
<th>See Figure No.</th>
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<td>Rear axle cylinder</td>
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<tr>
<td>Front axle cylinder</td>
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<tr>
<td>Lift cylinder, left</td>
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<tr>
<td>Lift cylinder, right</td>
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</tr>
<tr>
<td>Master cylinder, left</td>
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<tr>
<td>Master cylinder, right</td>
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<tr>
<td>Fork tilt cylinder</td>
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<tr>
<td>Boom pivot point, left</td>
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<tr>
<td>Boom pivot point, right</td>
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<tr>
<td>Chain rollers</td>
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<tr>
<td>Boom rollers</td>
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</tr>
<tr>
<td>Swing carriage(^1)</td>
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<tr>
<td>Swing carriage post(^1)</td>
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<tr>
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<td>Drive shaft, front</td>
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<td>Drive shaft, rear</td>
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<td>Axle, front</td>
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<tr>
<td>Axle, rear</td>
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<td>6-1</td>
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<tr>
<td>Outriggers, left and right(^2)</td>
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**NOTES:**
1. APPLICABLE ONLY TO FORKLIFTS EQUIPPED WITH SWING CARRIAGE.
2. APPLICABLE TO MODEL XR1245, XR1255, XR1267, XR1270, XR2045, AND XR2450 FORKLIFTS.
Notes

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## Notes

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Contact

Xtreme Manufacturing, LLC
8350 Eastgate Road
Henderson, NV 89015
(702) 851-3750

www.xmfg.com

Sales  (702) 858-2404
Product Support  (702) 636-2969
Engineering  (702) 851-3750
(702) 646-2196 (fax)

MODEL NO. _________________

SERIAL NO. _________________