REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2, located in the back of this manual direct to: Commander, U.S. Army Troop Support Command, ATTN: DRSTR-MPS, 4300 Goodfellow Blvd., St. Louis, MO 63120. A reply will be furnished directly to you.

TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter 3</td>
<td></td>
</tr>
<tr>
<td>Section V</td>
<td></td>
</tr>
<tr>
<td>Section VI</td>
<td></td>
</tr>
<tr>
<td>Appendix A</td>
<td>REFERENCES A-1</td>
</tr>
<tr>
<td>Appendix B</td>
<td>MAINTENANCE ALLOCATION CHART B-1</td>
</tr>
<tr>
<td>Index</td>
<td>INDEX-1</td>
</tr>
</tbody>
</table>
3-171. PISTONS, CONNECTING RODS, AND CYLINDER LINERS.

The following is an index to the piston connecting rods and cylinder liner maintenance instructions:

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>PARAGRAPH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piston</td>
<td>3-171.1</td>
</tr>
<tr>
<td>Connecting Rods</td>
<td>3-171.2</td>
</tr>
<tr>
<td>Connecting Rod Bearings</td>
<td>3-171.3</td>
</tr>
<tr>
<td>Cylinder Liner</td>
<td>3-171.4</td>
</tr>
</tbody>
</table>

3-171.1. PISTON - MAINTENANCE INSTRUCTIONS.

a. The trunk-type malleable iron piston is plated with a protective coating of tin which permits close fitting, reduces scuffing and prolongs piston life. The top of the piston forms the combustion chamber bowl and is designed to compress the air into close proximity to the fuel spray.

b. Each piston is internally braced with fin-shaped ribs and circular struts, scientifically designed to draw heat rapidly from the piston crown and transfer it to the lubricating oil spray to ensure better control of piston ring temperature.

3-2875
c. The piston is cooled by a spray of lubricating oil directed at the underside of the piston head from a nozzle in the top of the connecting rod, by fresh air from the blower to the top of the piston and indirectly by the water jacket around the cylinder.

d. Each piston is balanced to close limits by machining a balancing rib, provided on the inside at the bottom of the piston skirt.

e. Two bushings, with helical grooved oil passages, are pressed into the piston to provide a bearing for the hardened, floating piston pin. After the piston pin has been installed, the hole in the piston at each end of the pin is sealed with a steel retainer. Thus, lubricating oil returning from the sprayed underside of the piston head and working it way through the grooves in the piston pin bushings, is prevented from reaching the cylinder walls.

f. Each piston is fitted with compression rings and oil control rings. Eight equally spaced drilled holes just below each oil control ring groove permit excess oil, scraped from the cylinder walls, to return to the crankcase.
9. When an engine is hard to start, runs rough or lacks power, worn or sticking compression rings may be the cause. Replacing the rings will aid in restoring the engine to normal.

h. The compression rings may be inspected through the ports in the cylinder liners after the air box covers have been removed. If the rings are free and are not worn to the extent that the plating or grooves are gone, compression should be within operating specifications.

i. Excessively worn or scored pistons, rings or cylinder liners may be an indication of abnormal maintenance or operating conditions which should be corrected to avoid a recurrence of the failure. The use of the correct types and proper maintenance of the lubricating oil filters and air cleaners will reduce to a minimum the amount of abrasive dust and foreign material introduced into the cylinders and will reduce the rate of wear.

j. Long periods of operation at idle speed and the use of improper lubricating oil or fuel must be avoided, otherwise a heavy formation of carbon may result and cause the rings to stick.

k. Keep the lubricating oil and engine coolant at the proper levels to prevent overheating of the engine.
3-171.1. PISTON - MAINTENANCE INSTRUCTIONS (Cont).

This task covers:

a. Pre-Inspection
b. Removal
c. Disassembly
d. Cleaning
e. Inspection
f. Reassembly
g. Installation

INITIAL SETUP:

Test Equipment

Feeler gage

None

References

Special Tools

Equipment Condition Condition Description Paragraph

Assembly tool piston ring J8128 3-163 Oil Pan Removal
Pump, hand Pump, hand 3-164 Cylinder Head Removal
NSN 4930-00-263-9886 3-169 Lube Oil Pump Removal
Installer and remover piston and connecting rod bushings-J1513-02 3-170 Oil Inlet Pipe Removal
(part J7032 and J7632

Material/Parts

Cylinder kit Do not drain oil into bilges.
P/N 5149265 Use the oil/water separation and recovery system to collect drained oil.

Personnel Required

2 Observe WARNING in procedure.

3-2878
### 3-171.1. PISTON - MAINTENANCE INSTRUCTIONS (Cont).

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>ITEM</th>
<th>ACTION</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PRE-INSPECTION</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Cylinder liners</td>
<td>Check that piston rings are free, and are not worn to the extent that plating or grooves are gone.</td>
<td></td>
</tr>
</tbody>
</table>

### REMOVAL

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>ITEM</th>
<th>ACTION</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Piston and connecting rod</td>
<td>a. Cooling system</td>
<td>Drain.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Oil pan</td>
<td>1. Remove oil.</td>
<td>Pump oil into a suitable container.</td>
</tr>
<tr>
<td></td>
<td>c. Oil inlet pipe</td>
<td>2. Remove pan.</td>
<td>Refer to paragraph 3-163.</td>
</tr>
<tr>
<td></td>
<td>d. Lube oil pump</td>
<td>Remove.</td>
<td>Refer to paragraph 3-170.</td>
</tr>
</tbody>
</table>

3-2879
### 3-171.1. PISTON - MAINTENANCE INSTRUCTIONS (Cont.)

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>ITEM</th>
<th>ACTION</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>REMOVAL (Cont)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Cylinder head</td>
<td>Remove.</td>
<td></td>
<td>Refer to paragraph 3-164.</td>
</tr>
<tr>
<td>f. Cylinder liner</td>
<td>1. Remove the carbon deposits from the upper inner surface of the cylinder liner.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Use a ridge cutter to remove any ridges in the cylinder liner at the top of the piston ring travel.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>NOTE</strong></td>
<td></td>
<td>Move the piston to the bottom of its travel and place a cloth over the top of the piston to collect the cuttings. After the ridge has been removed, turn the crankshaft to bring the piston to the top of its stroke and carefully remove the cloth with the cuttings.</td>
</tr>
<tr>
<td>g. Nut (1), bearing cap (2), and lower bearing shell (3)</td>
<td>Remove.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3-2880
### 3-171.1. PISTON - MAINTENANCE INSTRUCTIONS (Cont).

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>ITEM</th>
<th>ACTION</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>h. Piston and connecting rod assembly</td>
<td>Push the piston and rod assembly out thru the top of the cylinder block. The piston cannot be removed from the bottom of the cylinder block.</td>
</tr>
<tr>
<td></td>
<td>i. Lower bearing shell (3), bearing cap (2), and nuts (1)</td>
<td>Reassemble to connecting rod.</td>
<td></td>
</tr>
</tbody>
</table>
### 3-171.1. PISTON - MAINTENANCE INSTRUCTIONS (Cont).

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>ITEM</th>
<th>ACTION</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Piston and Connecting rod</td>
<td>a. Piston and connecting rod assembly</td>
<td>Place connecting rod in a vise with soft jaws.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d. Oil rings (6)</td>
<td>Remove.</td>
<td>Use tool J8128.</td>
</tr>
</tbody>
</table>
### 3-171.1. PISTON - MAINTENANCE INSTRUCTIONS (Cont).

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>ITEM</th>
<th>ACTION</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DISASSEMBLY (Cont)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e.</td>
<td>Piston pin retainer (9)</td>
<td>Punch a hole thru the center of one of the piston pin retainers with a narrow chisel or punch, and pry the retainer from the piston.</td>
<td>Be careful not to damage the piston or bushings.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f.</td>
<td>Piston pin (10)</td>
<td>Remove.</td>
<td></td>
</tr>
<tr>
<td>h.</td>
<td>Piston pin retainer (9)</td>
<td>Drive out remaining retainer.</td>
<td>Use a brass rod or a suitable tool.</td>
</tr>
</tbody>
</table>

![Diagram of piston assembly](image_url)

3-2883
Wear protective eye goggles when using compressed air.

4. **Piston components**
   a. Clean the piston components with fuel oil and dry them with compressed air. If fuel oil does not remove the carbon deposits, use a chemical solvent that will not harm the piston pin bushings or the tin-plate on the piston.
   b. The upper part of the piston, including the compression ring lands and grooves, is not tin-plated and may be wire-brushed to remove any hard carbon. However, use care to avoid damage to the tin-plating on the piston skirt. Clean the ring grooves with a suitable tool or a piece of an old compression ring that has been ground to a bevel edge.
   c. Clean the inside surfaces of the piston and the oil drain holes in the piston skirt. Exercise care to avoid enlarging the holes while cleaning them.
### 3-171.1. PISTON - MAINTENANCE INSTRUCTIONS (Cont.)

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>ITEM</th>
<th>ACTION</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INSPECTION</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Piston</td>
<td>a. If the tin-plate on the piston and the original grooves in the piston rings are intact, it is an indication of very little wear.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Examine the piston for score marks, cracks, damaged ring groove lands or indications of overheating. A piston cleaned up may be reused. Any piston with light score marks which can be that has been severely scored or over-heated must be replaced. Indications of overheating or burned spots on the piston may be the result of an obstruction in the connecting rod oil passage.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Replace the piston if cracks are found across the internal struts. Use the magnetic particle inspection method for locating cracks in the piston.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![Diagram of piston conditions](image-url)

- **This Piston Suitable for Installation as Is**
- **Slightly Scored. Use Only After Removing Score Marks by Polishing With Crocus Cloth or Hard India Stone**
- **Badly Scored. Unfit for Use**
3-171.1. PISTON - MAINTENANCE INSTRUCTIONS (Cont).

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>ITEM</th>
<th>ACTION</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>INSPECTION (Cont)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Cylinder</td>
<td>Check the cylinder liner</td>
<td>Refer to paragraph 3-171.4.</td>
<td></td>
</tr>
<tr>
<td>liner and block</td>
<td>and bore for excessive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bore</td>
<td>out-of-round, taper, or</td>
<td></td>
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<tr>
<td></td>
<td>high spots which could</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>cause failure of the piston.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Connecting</td>
<td>Inspect.</td>
<td>Refer to paragraph 3-171.2.</td>
<td></td>
</tr>
<tr>
<td>rod, and piston</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pin</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>8. Piston pin</td>
<td>Inspect and measure the</td>
<td></td>
<td></td>
</tr>
<tr>
<td>bushings.</td>
<td>piston pin-bushing clearance</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>with new parts is</td>
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<td></td>
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<tr>
<td></td>
<td>.0025 to .0034 inch</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>(0.0064 to 0.0086 cm). A</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>maximum clearance of .010</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>inch (0.025 cm) is</td>
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<td></td>
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<tr>
<td></td>
<td>allowable with worn parts.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The piston pin bushings in</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>the connecting rod are</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>covered in paragraph 3-171.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Other</td>
<td>Other factors that may</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>contribute to piston failure</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>include oil leakage into</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>the air box, oil pull-over</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>from the air cleaner,</td>
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<tr>
<td></td>
<td>dribbling injectors,</td>
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<tr>
<td></td>
<td>combustion blow-by, and</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>low oil pressure (dilution</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>of the lubricating oil).</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

REASSEMBLY

CAUTION

Do not remove the bushings from the piston. They are not serviced separately.

10. Piston             1. Measure the piston skirt diameter lengthwise and crosswise of the piston pin bore. Measurements should be taken at a room temperature of 70°F (21°C). The taper and out-of-round must not exceed .005 inch (.0013 cm).
### 3-171.1. PISTON - MAINTENANCE INSTRUCTIONS (Cont).

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>ITEM</th>
<th>ACTION</th>
<th>REMARKS</th>
</tr>
</thead>
</table>

**REASSEMBLY (Cont.)**

Refer to the Table for piston diameter specifications.

<table>
<thead>
<tr>
<th>ENGINE PARTS (Standard Size, New)</th>
<th>MINIMUM (inches) (cm)</th>
<th>MAXIMUM (inches) (cm)</th>
<th>LIMITS (inches) (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piston:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height (centerline of bushing to top)</td>
<td>3.5430 8.9992</td>
<td>3.5480 9.0119</td>
<td></td>
</tr>
<tr>
<td>Diameter (above compression rings)</td>
<td>4.2225 10.7252</td>
<td>4.2255 10.7328</td>
<td></td>
</tr>
<tr>
<td>Diameter (at skirt)</td>
<td>4.2428 10.7767</td>
<td>4.2450 10.7823</td>
<td></td>
</tr>
<tr>
<td>Clearance—piston skirt—</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>to-liner</td>
<td>.0045 .0114</td>
<td>.0083 .0211</td>
<td>.0120 .0305</td>
</tr>
<tr>
<td>Out-of-round</td>
<td>.0005 .0013</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taper</td>
<td>.0005 .0013</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compression rings:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gap (top-fire ring)</td>
<td>.0230 .0584</td>
<td>.0380 .0965</td>
<td>.0600 .1524</td>
</tr>
<tr>
<td>Gap (No. 2, 3 and 4)</td>
<td>.0180 .0457</td>
<td>.0430 .1092</td>
<td>.0600 .1524</td>
</tr>
<tr>
<td>Clearance—ring-to-groove:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. 1 (top-fire ring)</td>
<td>.0040 .0102</td>
<td>.0070 .0178</td>
<td>.0180 .0457</td>
</tr>
<tr>
<td>No. 2</td>
<td>.0100 .0254</td>
<td>.0130 .0330</td>
<td>.0220 .0559</td>
</tr>
<tr>
<td>No. 3 and 4</td>
<td>.0040 .0102</td>
<td>.0070 .0178</td>
<td>.0130 .0330</td>
</tr>
<tr>
<td>Oil control rings:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gap</td>
<td>.0080 .0203</td>
<td>.0230 .0584</td>
<td>.0430 .1092</td>
</tr>
<tr>
<td>Clearance</td>
<td>.0015 .0038</td>
<td>.0055 .0140</td>
<td>.0080 .0203</td>
</tr>
</tbody>
</table>

2. A new cylinder liner has an inside diameter of 4.2495 to 4.2511 inch (10.7937-10.7978 cm). Piston-to-liner clearance, with new parts, will vary with the particular piston diameter. A maximum clearance of .012 inch (0.030 cm) is allowed with used parts.

3-2887