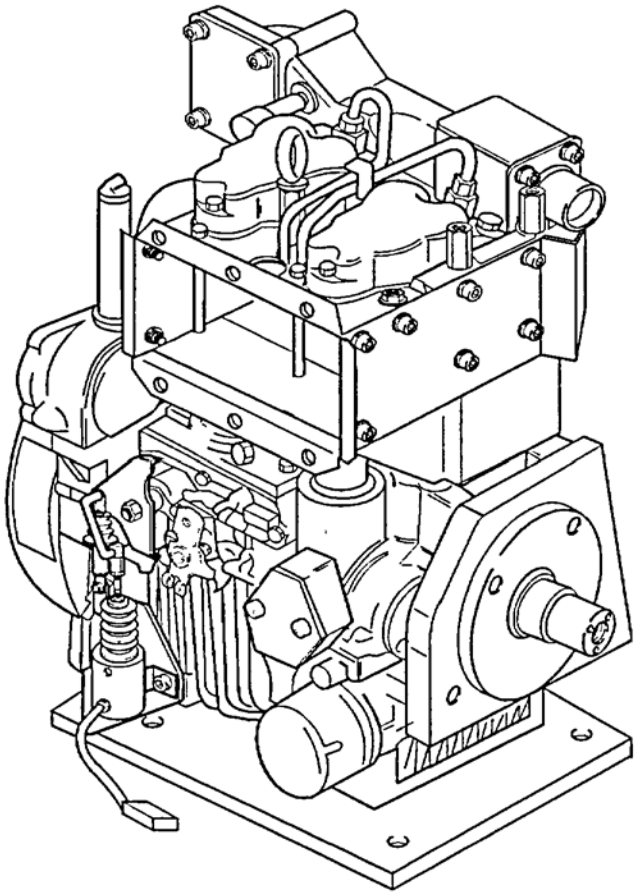
# TECHNICAL MANUAL

# UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST FOR ENGINE ASSEMBLY, DIESEL HATZ 2G 40 (NSN 2815-01-446-3500) (NSN 2815-01-465-4321)







**HEADQUARTERS, DEPARTMENT OF THE ARMY**

**SEPTEMBER 1998**

FOR INFORMATION ON FIRST AID, REFER TO FM 4-25.11.

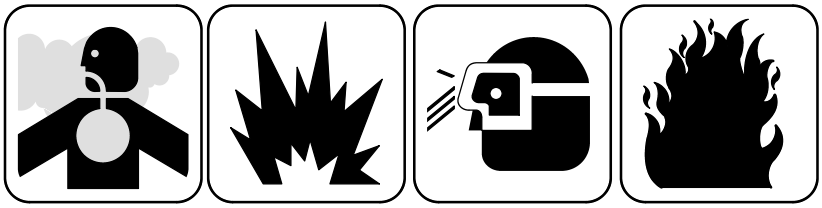
**WARNING**

## CARBON MONOXIDE

- **Carbon monoxide is a colorless, odorless, deadly poisonous gas that, when breathed, deprives the body of oxygen and causes suffocation. Exposure to carbon monoxide can cause headache, dizziness, loss of muscle control, drowsiness, and coma. Permanent brain damage or death can result from serious exposure.**
- **Carbon monoxide is present in the exhaust fumes of diesel engines; inadequate ventilation causes dangerous concentrations of this gas. Precautions must be observed to ensure the safety of personnel whenever the diesel engine is operated for maintenance or tactical reasons. Do not operate the engine in an enclosed area without adequate ventilation.**

**WARNING**

## DRYCLEANING SOLVENT



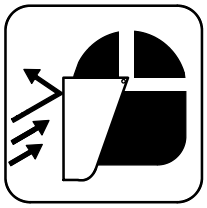
- **Drycleaning solvent (P-D680) is TOXIC and flammable. Wear protective goggles and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and DO NOT breathe vapors. Keep away from heat or flame. Never smoke when using drycleaning solvent. Failure to follow this warning may result in injury or death to personnel.**

- **If personnel become dizzy while using drycleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush them with water and get immediate medical attention.**

- **When drycleaning solvent is used, notify the local medical authority (preventive medicine) and environmental coordinator concerning medical surveillance, respiratory protection, and disposal requirements.**

**WARNING**

## COMPRESSED AIR



**Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Wear protective clothing (gloves, etc.) and use caution, particularly when drying or cleaning metal parts, to avoid injury to personnel. It is particularly important to wear eye protection (goggles or a face shield) to protect eyes from blowing particles and prevent serious eye injury.**

**WARNING**

## LIFTING

**Use extreme caution when handling heavy parts. The diesel engine weighs about 200 pounds (90 kg). Use a suitable lifting device to place the engine on the stand. Failure to follow this warning may result in serious injury or death to personnel.**

TM 9-2815-250-24&P
C1
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CHANGE DEPARTMENT OF THE ARMY
NO. 1 WASHINGTON, D.C. 31 December 2005

# TECHNICAL MANUAL
# UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST) FOR ENGINE ASSEMBLY, DIESEL HATZ 2G 40 (NSN 2815-01-446-3500) (NSN 2815-01-465-4321)

TM 9-2815-250-24&P, September 1998, is changed as follows:

1. The purpose of this change is to update TM 9-2815-250-24&P.
2. New or changed material is indicated by a vertical bar in the outside margin of text changes and by a hand symbol beside illustration changes.
3. Remove the old page and insert the new page as indicated below:

| Remove Pages | Insert Pages |
|---|---|
| a and b | a and b |
| A and B | A and B |
| i and ii | i and ii |
| 1-3 and 1-4 | 1-3 and 1-4 |
| 1-7 and 1-8 | 1-7 and 1-8 |
| 2-7 thru 2-10 | 2-7 thru 2-10 |
| 2-13 and 2-14 | 2-13 and 2-14 |
| 2-19 thru 2-32 | 2-19 thru 2-32 |
| 3-11 thru 3-14 | 3-11 thru 3-14.1/3-14.2 blank |
| 3-15 and 3-16 | 3-15 and 3-16 |
| 3-19 thru 3-22 | 3-19 thru 3-22 |
| 3-27 thru 3-32 | 3-27 thru 3-32 |
| 3-37 thru 3-40 | 3-37 thru 3-40 |
| 3-45 and 3-46 | 3-45 and 3-46 |
| 3-47 thru 3-56 | 3-47/3-48 blank thru 3-56 |
| 3-59 and 3-60 | 3-59 and 3-60 |
| 3-63 thru 3-70 | 3-63 thru 3-70 |
| A-1 and A-2 | A-1 and A-2 |
| C-5 and C-6 | C-5 and C-6 |
| C-7 thru 17-1 | C-7 thru 17-1/17-2 blank |
| I-1 thru I-9 | I-1 thru I-6 |
| D-1 and D-2 | D-1 thru D-3/D-4 blank |
| F-3/F-4 blank | F-3 and F-4 |
| Index-1 thru Index-4 | Index-1 thru Index-4 |
| Cover/Blank | Cover/Pin |

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4. File this change in front of the publication.

By Order of the Secretary of the Army:

PETER J. SCHOOMAKER
*General, United States Army*
*Chief of Staff*

Official:

SANDRA R. RILEY
*Administrative Assistant to the*
*Secretary of the Army*
0524301

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DESTROY SUPERSEDED PAGES

# LIST OF EFFECTIVE PAGES

Note: The portion of the text affected by the changes is indicated by a vertical line in the outer margin of the page. Changes to illustrations are indicated by miniature pointing hands. Changes to wiring diagrams are indicated by shaded areas.

Date of issue for original and changed pages are:

Original ..... 0 ..... 11 September 1998
Change ..... 1 .....31 December 2005

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 232, CONSISTING OF THE FOLLOWING:

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| a | 1 | 2-20 | 1 | 3-24 | 0 |
| b | 0 | 2-21 | 1 | 3-25 | 0 |
| i | 1 | 2-22 | 1 | 3-26 | 0 |
| ii | 0 | 2-23 | 1 | 3-27 | 1 |
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| 2-8 | 1 | 3-14 | 1 | 3-48.2 (added) | 1 |
| 2-9 | 0 | 3-14.1 | 1 | 3-48.3 (added) | 1 |
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| 2-14 | 1 | 3-18 | 0 | 3-52 | 1 |
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| Figure 8 | 1 |
| 8-1 | 1 |
| Figure 9 | 1 |
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| Figure 13 (SH 2 of 2) (added) | 1 |
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TECHNICAL MANUAL
NO. 9-2815-250-24&P

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DEPARTMENT OF THE ARMY
WASHINGTON, D.C. 11 September 1998

# UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST) FOR ENGINE ASSEMBLY, DIESEL HATZ 2 G 40 NSN 2815-01-446-3500 NSN 2815-01-465-4321

**REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS**

You can help improve this publication. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Submit your DA Form 2028 (Recommended Changes to Equipment Technical Publications), through the Internet, on the Army Electronic Product Support (AEPS) website. The Internet address is https://aeps.ria.army.mil. The DA Form 2028 is located under the Public Applications section in the AEPS Public Home Page. Fill out the form and click on SUBMIT. Using this form on the AEPS will enable us to respond quicker to your comments and better manage the DA Form 2028 program. You may also mail, fax or E-mail your letter or DA Form 2028 direct to: AMSTA-LC-LMIT / TECH PUBS, TACOM-RI, 1 Rock Island Arsenal, Rock Island, IL 61299-7630. The email address is TACOM-TECH-PUBS@ria.army.mil. The fax number is DSN 793-0726 or Commercial (309) 782-0726.

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TABLE OF CONTENTS

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*Table of Contents (continued)*

## HOW TO USE THIS MANUAL

### SCOPE.

This technical manual contains Unit, Direct Support, and General Support maintenance procedures for the Diesel Engine Assembly, Hatz 2 G 40. Chapter 1 contains general information; Chapter 2 describes and illustrates Unit troubleshooting and maintenance procedures; and Chapter 3 describes and illustrates Direct Support and General Support troubleshooting and maintenance procedures. Seven appendixes and a subject index are also included in this manual.

### INDEXING.

Four Indexing procedures are used to help you locate information quickly:

- Cover index. Lists chapter titles and important parts of this manual, with corresponding page numbers. Each chapter or part listed is boxed in, with a black outer edge that is in line with the first page of that chapter or part.
- Table of contents. The table of contents follows the summary of warnings. The table of contents lists all chapters and sections numerically, with corresponding page numbers.
- Section indexes. Each section starts with a numerical listing of all paragraphs in that section.
- Alphabetical index. The alphabetically arranged subject index starts on page Index 1.

### TEXT AND ILLUSTRATIONS.

1. Each chapter is divided into sections; each section begins with a numencal listing of all paragraphs.

2. Each paragraph in the maintenance chapters (2 and 3) contains the following information, as appropriate:

   - The common or special tools and test equipment required to perform the procedures are listed under the heading 'Tools/Test Equipment." Information (e.g., part numbers and national stock numbers) for all common and special tools is given in Appendix G.
   - Materials and mandatory replacement parts that will be discarded during performance of the procedure are listed under the heading "Materials/Parts." A materials/parts list does not contain items that may be replaced If found defective during inspection. Also, the list does not contain the item cited in the paragraph title. Information on the materials is In Appendix D, and information on the mandatory replacement parts is in Appendix F.
   - If more than one person is required to perform the procedure, the number is specified under the heading "Personnel Required."
   - Procedures that must be followed prior to performing the engine maintenance procedure are listed under the heading "Equipment Conditions."

**TEXT AND ILLUSTRATIONS (continued).**

3. Maintenance procedures are to be performed in the sequence given in the text and illustrations.

4. Illustrations are numbered clockwise, beginning at the 11 o'clock position. Because an illustration is keyed to the text, parts that are removed sequentially may not have sequential numbers. For example:

Remove screw (4), lockwasher (6), washer (7), and bracket (5) from crankcase (2).

5. Be sure to read the entire paragraph before beginning a maintenance procedure. Also, read the general information in Chapter 1 before beginning a procedure

**WARNINGS, CAUTIONS, AND NOTES.**

1. Throughout this manual you will see WARNING, CAUTION, and NOTE headings. There are good reasons for every one of these notices.

**WARNING**

**A warning is used to alert the user to hazardous operating and maintenance procedures, practices, or conditions that could result in injury or death. Warnings must be strictly observed.**

**CAUTION**

**A caution is used to alert the user to hazardous operating and maintenance procedures, practices, or conditions that could result in damage to, or destruction of, equipment or mission effectiveness. Cautions must be strictly observed.**

**NOTE**

**A note highlights an essential operating or maintenance procedure, condition, or statement.**

2. Warnings and cautions appear immediately preceding the step to which they pertain. It is important to read and thoroughly understand the warnings and/or cautions before beginning maintenance.

3. Notes may precede or follow the steps to which they pertain, depending on what makes the most sense.

## SAFETY SUMMARY

This safety summary contains general safety precautions and hazardous materials warnings that must be understood and applied during maintenance to protect personnel and U.S. Department of Defense property. Portions of this summary may be repeated elsewhere for emphasis.

WARNING and CAUTION statements appear throughout this manual prior to procedures, practices, or conditions that may endanger personnel (WARNING) or cause equipment and property damage (CAUTION). A warning or caution will apply each time the related step is repeated. Before starting any task, review and understand the warnings and cautions included in the text for that task.

This manual contains procedures that may require using chemicals, solvents, paints, or other commercially available material that may pose a health or safety hazard. Refer to the "Materials/Parts" list at the beginning of a task to see which materials will be used during the task. Obtain material safety data sheets (Occupational Safety and Health Act [OSHA] Form 20 or equivalent) from the manufacturer or supplier of the material to be used. Become completely familiar with the information and manufacturer/supplier procedures, recommendations, warnings, and cautions for the safe use, handling, storage, and disposal of these materials.

Following the "General Safety Precautions" list is a list of "Hazardous Materials Warnings." These warnings are designed to warn personnel of dangers associated with hazardous materials. For each hazardous material used, a material safety data sheet is required to be provided and available for review by personnel. Consult your local safety and health staff concerning questions on hazardous chemicals, personnel protective equipment requirements, and appropriate handling and emergency procedures.

## GENERAL SAFETY PRECAUTIONS

- Always use the same fastener part number (or equivalent) when replacing fasteners. Do not risk using a fastener of less quality; do not mix metric and inch (customary) fasteners. Mismatched or incorrect fasteners can result in damage, malfunction, or injury.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.
- Make sure equipment will not move while repairing or inspecting it. For powered equipment, block or chock wheels or tracks and red-tag the starter. Prevent a quick fix from becoming a quick injury.
- When adjustment or service requires a running engine, two people are needed, one at the controls and one at the service point. This helps prevent accidental movement of controls.
- Sharp edges can cut hands. Use rags or a brush to lubricate parts.
- Do not use equipment for other than its intended use, unless authorized by the National Inventory Control Point/commodity command.
- Remove rings, bracelets, wristwatches, and neck chains before working on the engine. Jewelry can catch on equipment and result in injury.

## GENERAL SAFETY PRECAUTIONS (continued)

- Keep clear of equipment when it is being raised or lowered. Equipment may fall and cause serious injury or death to personnel.

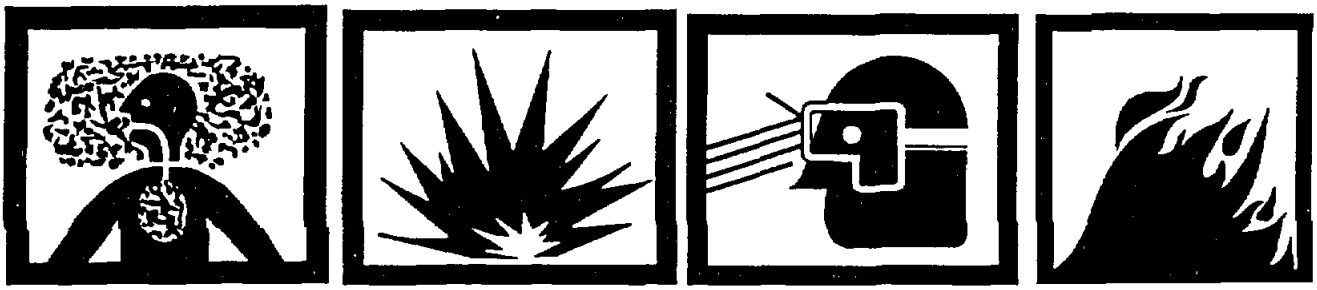
- Do not work on any item supported only by lift jacks or a hoist. Always use blocks or trestles to support the item prior to any work. Equipment may fall and cause injury or death to personnel.

- Do not allow heavy components to swing while hanging from a lifting device. Equipment may strike personnel and cause injury or death.

- Exercise extreme caution when working near a cable or chain under tension. A snapped cable or a swinging or shifting load may result in injury or death to personnel.

- When working on a running engine, provide shielding for exposed rotating parts. Tools, clothing, or hands can get caught and cause serious injury to personnel.

## HAZARDOUS MATERIALS WARNINGS



- Adhesive causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in a wellventilated area. If adhesive gets in your eyes, try to keep them open; flush with water for 15 minutes and get immediate medical attention.

- Adhesive sealant MIL-S-46163 (Loctite) can damage your eyes. Wear safety goggles/glasses when using sealant, and avoid contact with eyes. If sealant contacts your eyes, flush them with water and get immediate medical attention.

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Keep away from heat or flame. Never smoke when using drycleaning solvent. Failure to follow this warning may result in injury or death to personnel.

- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush with water and get immediate medical attention.

# CHAPTER 1
# INTRODUCTION

## Section I. GENERAL INFORMATION



### 1-1. SCOPE.

This technical manual describes Unit, Direct Support, and General Support maintenance for the Diesel Engine Assembly, Hatz 2 G 40. The manual also contains the repair parts and special tools list (RPSTL) for the engine assembly.

### 1-2. MAINTENANCE FORMS, RECORDS, AND REPORTS.

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA Pam 738-750.

### 1-3. DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE.

Refer to TM 750-244-6 for procedures on the destruction of military vehicles to prevent enemy use.

### 1-4. PREPARATION FOR STORAGE OR SHIPMENT.

Refer to TM 743-200-1 for information on preparing the Diesel Engine Assembly, Hatz 2 G 40, for storage or shipment.

### 1-5. QUALITY ASSURANCE.

a. No specific quality assurance manual pertains to the Diesel Engine Assembly, Hatz 2 G 40.

## 1-5. QUALITY ASSURANCE (continued).

b. Defective material received through the supply system should be reported on SF Form 368. Instructions for preparing the reports are provided in AR 702-7. Mail your completed form directly to:

Commander
U.S. Army Tank-automotive and Armaments Command
ATTN: AMSTA-TR-E/MPA/267
Warren, MI 48397-5000

## 1-6. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS.

If your Diesel Engine Assembly, Hatz 2 G 40, needs improvement, let us know. Send us an equipment improvement recommendation (EIR). You, the user, are the only one who can tell us what you do not like about the equipment. Let us know why you don't like the design or performance. Put it on an SF Form 368 and mail it to:

Commander
U.S. Army Tank-automotive and Armaments Command
ATTN: AMSTA-TR-E/MPA/267
Warren, Ml 48397-5000

## 1-7. LIST OF ABBREVIATIONS AND ACRONYMS.

| | |
|---|---|
| approx. | approximately |
| APU | auxiliary power unit |
| AR | Army regulation |
| ATTN | attention |
| BT | bottle |
| BX | box |
| C | Celsius |
| CAGEC | commercial and government entity code |
| cc | cubic centimeter |
| cm | centimeter |
| CN | can |
| CPC | corrosion prevention and control |
| cu in | cubic inch |
| DA | Department of the Army |
| DD Form | Department of Defense Form |
| DOD | Department of Defense |
| DSN | defense switching network |
| EIR | equipment improvement recommendation |
| F | Fahrenheit |
| ft | foot |
| ft-lb | foot-pound |
| GL | gallon |
| in. | inch |
| kg | kilogram |
| km | kilometer |
| kPa | kilopascal |
| L | liter |

## 1-7. LIST OF ABBREVIATIONS AND ACRONYMS (continued).

| | |
|---|---|
| lb, LB | pound |
| MAC | maintenance allocation chart |
| min | minimum, minute |
| mm | millimeter |
| MTOE | Modified Table of Organization and Equipment |
| NIIN | national item identification number |
| N•m | newton meter |
| NSN | national stock number |
| OZ | ounce |
| p. | page |
| Pam | pamphlet |
| para | paragraph |
| psi | pounds per square inch |
| qt, QT | quart |
| rpm | revolutions per minute |
| RPSTL | repair parts and special tools list |
| SF | standard form |
| SMR | source, maintenance, and recoverability |
| TC | technical circular |
| TM | technial manual |
| TMDE | test, measurement, and diagnostic equipment |
| TU | tube |
| U/M | unit of measure |
| UOC | usable on code |

## 1-8. WARRANTY INFORMATION.

The Diesel Engine Assembly, Hatz 2 G 40, is not covered by a warranty.

## 1-9. SAFETY, CARE, AND HANDLING.

For information on general safety precautions and regulations, review the warning summary and the safety summary at the beginning of this manual. In addition, observe all warnings and cautions that appear in the maintenance procedures.

## 1-10. CORROSION PREVENTION AND CONTROL.

a. Corrosion prevention and control (CPC) of Army materiel is a continuing concern. It is important that any corrion problem be reported so it can be corrected and improvements can be made to prevent the problem in the future.

b. While corrision is typically associated with the rusting of metals, it can also include deterioration of other materials, such as rubber and plastic. Unusual cracking, softening, swelling, or breaking or materials may indicat a corrosion problem.

c. If a corrosion problem is identified, it can be reported using an SF Form 368. The use of key words, such as “corrision,” “rust,” “deterioration,” or “cracking,” will ensure that the information is identified as a CPC problem. The form should be submitted to the address specified in DA Pam 738-750.

## SECTION II. EQUIPMENT DESCRIPTION AND DATA



### 1-11. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES.

a. The Diesel Engine Assembly, Hatz 2 G 40, is an air-cooled four-stroke diesel engine with vertical cylinders and direct fuel injection.

b. The engine is a lightweight, all-purpose industrial engine.

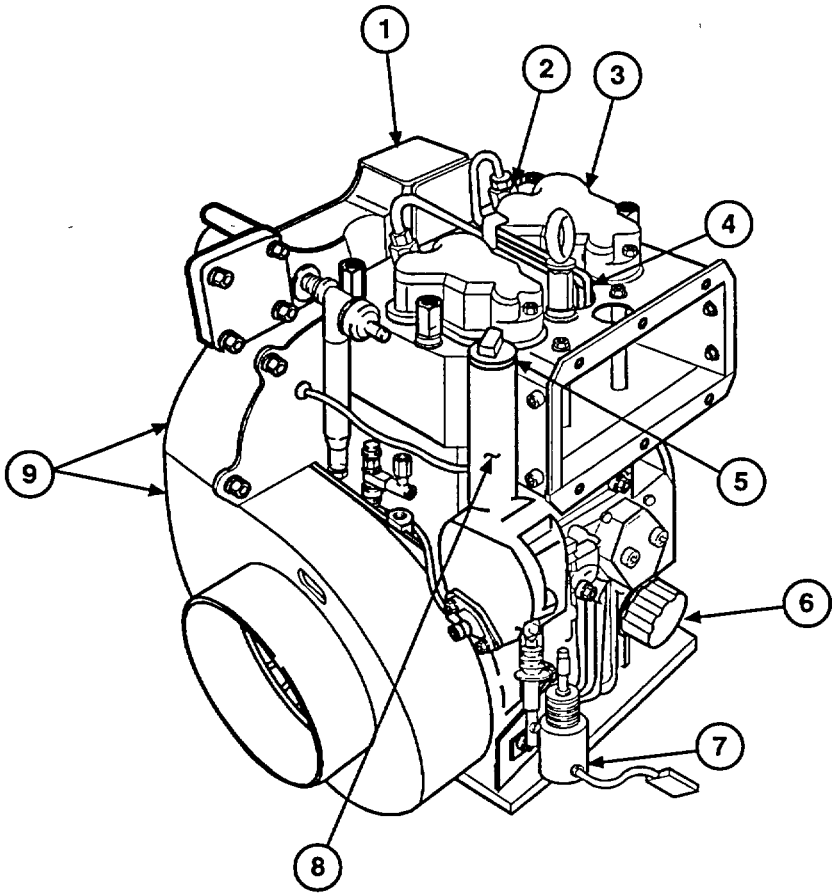
c. Later models of Hatz 2 G 40 come EPA version 1 compliant. Differences in configuration affect fuel control on these engines. Examine the serial number on the ID plate to determine which style you have. Also look for statement “EPA compliant” at bottom of tag.

EXAMPLE: 091 XX 02028520

MODEL 2G40

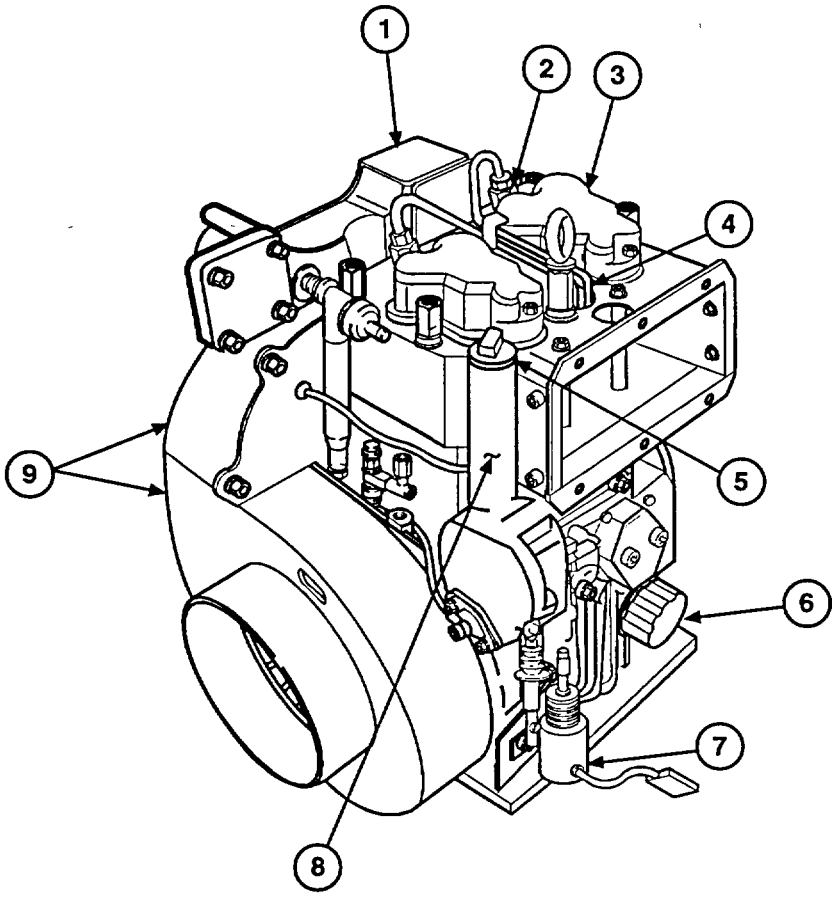
00 to 13 are non EPA
14 and above are EPA compliant

## 1-12. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS.



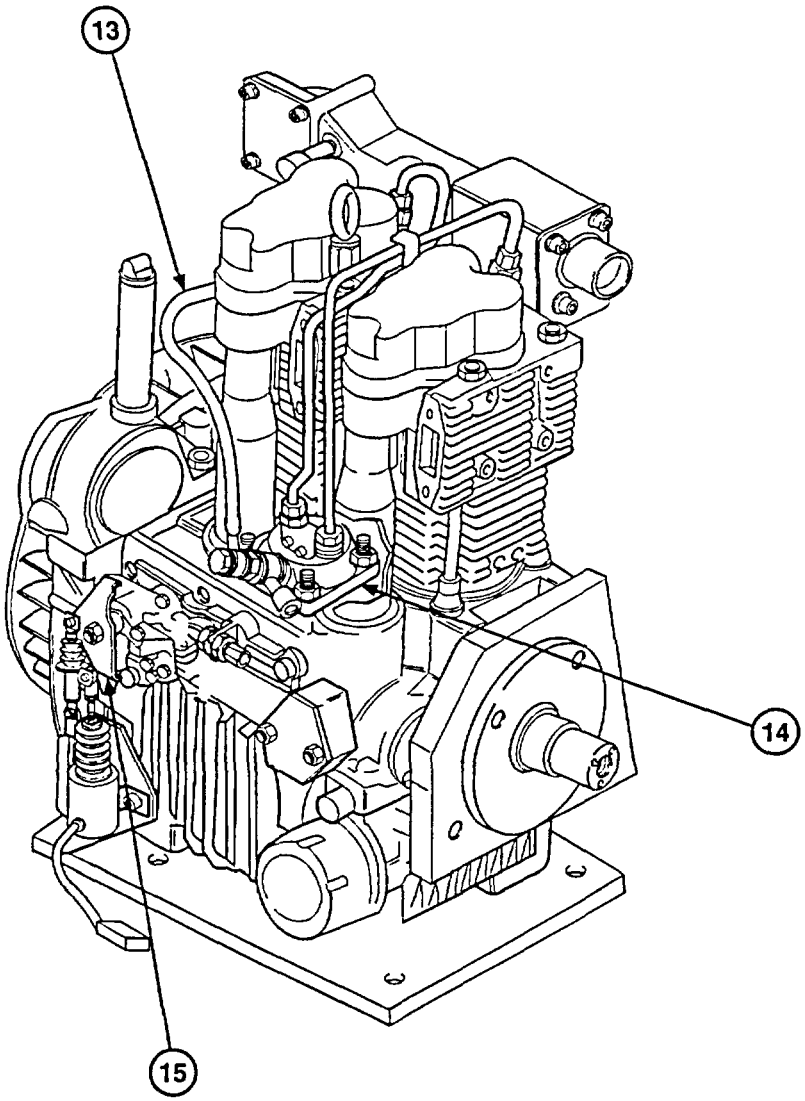

| Key | Component | Description |
|---|---|---|
| 1 | Intake Manifold | Provides fresh air to cylinders for combustion. |
| 2 | Fuel Injectors (2) | Supply fuel to cylinders. |
| 3 | Rocker Arm Covers (2) | Protect rocker arm assemblies. |
| 4 | Fuel Pressure Pipes (2) | Provide fuel to fuel injectors. |
| 5 | Filler Cap | Allows access to filler neck. |
| 6 | Filter Element | Removes impurities from lubrication system. |
| 7 | Solenoid | Opens and closes fuel supply. |
| 8 | Filler Neck | Allows oil to be added to lubrication system. |
| 9 | Airflow Deflectors (6) | Provide and direct cooling air. |

## 1-12. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS (continued).




| Key | Component | Description |
|---|---|---|
| 10 | Oil Tube Assemblies (2) | Supply oil to various parts of engine. |
| 11 | Oil Switch | Shuts off engine if oil pressure is not high enough. |
| 12 | Engine Mounts (2) | Secure engine to auxiliary power unit (APU). |

## 1-12. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS (continued).




| Key | Component | Description |
|---|---|---|
| 13 | Fuel Hose | Removes excess fuel from engine. |
| 14 | Injection Pump | Pumps fuel to injectors. |
| 15 | Governor Control Assembly | Controls engine speed. |

## 1-13. EQUIPMENT DATA.

### GENERAL SPECIFICATIONS

| | |
|---|---|
| Model | 2 G 40 |
| Manufacturer | Hatz Diesel of America |
| Mode of Operation | 4 cycle |
| Combustion | Method direct injection |
| Number of Cylinders | 2 |
| Bore/Stroke | 3.622/2.935 in. (92/75 mm) |
| Cubic Capacity | 60.79 cu in (997 cc) |
| Compression Ratio | 18:1 |
| Ignition Sequence (Cylinder 1-Flywheel Side)‘ | 1-2 |
| Direction of Rotation | Crankshaft power takeoff rotation is counterclockwise when facing power takeoff shaft |
| Net Weight | approx. 196 lb (90 kg) |
| Cooling air Required at 3000 rpm | 4.13 in/min (10.5 cm/min) |
| Combustion Air Required at 3000 rpm | 0.56 in/mim (1.42 cm/min) |
| Oil Capacity (Including Filter Replacement) | approx. 2.65 qt (2.5 L) |
| Oil Pressure | min 14.5 psi/900 rpm (min 1 bar/900 rpm) |
| Injection Pressure | 3625-3741 psi (250-258 bar) |
| Tappet Clearance | 0.004 in. (0.10 mm) |
| Governor Speed | 2200U$\pm$50 rpm |
| Thermostatic Switch | Closes at 446° F$\pm$18F (230° C$\pm$10° C) |
| Horsepower (UOC APP) | 13.3 hp at 2000 rpm at 328-ft elevation at 77° F (25° C) ambient temperature |
| Horsepower (UOC APJ) | 17.5 hp at 2650 rpm at 328 foot elevation at 77° F (25° C) ambient temperature |

## Section III. PRINCIPLES OF OPERATION

### 1-14. PRINCIPLES OF OPERATION.

The Diesel Engine Assembly, Hatz 2 G 40, is an internal combustion power unit that converts heat energy to work energy inside the cylinders. This particular engine has a four-stroke cycle. A four-stroke engine completes one cycle every other time the piston goes up and down (up being one stroke, down being the return stroke).

- The first stroke is intake; the piston goes down in the cylinder and the intake valve opens, allowing air to flow into the cylinder.
- The second stroke is compression; the piston comes up and both valves close, so the air in the cylinder is compressed. While the air is compressed, the fuel injector releases a spray of fuel into the cylinder.
- The compression heats the air enough to ignite the fuel.
- The third stroke is power; the fuel burns, forcing the piston down.
- The fourth stroke is exhaust; the piston comes up in the cylinder and the exhaust valve opens, allowing exhaust gas to escape.

# CHAPTER 2
# UNIT MAINTENANCE

## Section I. REPAIR PARTS; TOOLS; SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT



### 2-1. GENERAL.

This chapter describes the Unit maintenance tasks to be performed on the Diesel Engine Assembly, Hatz 2 G 40.

### 2-2. COMMON TOOLS AND EQUIPMENT.

Common tools and equipment are issued to Unit maintenance personnel for maintaining the Diesel Engine Assembly, Hatz 2 G 40. Common tools and equipment should not be used for purposes other than those prescribed and should be properly stored when not in use. For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE), CTA 50-970, or CTA 8-100, as applicable to your unit.

### 2-3. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT.

Special tools are listed and illustrated in Appendix C of this manual.

### 2-4. REPAIR PARTS.

Repair parts are listed and illustrated in Appendix C of this manual.

## Section II. SERVICE UPON RECEIPT



### 2-5. GENERAL.

When a new, used, or reconditioned Diesel Engine Assembly, Hatz 2 G 40, is received, determine whether it has been properly prepared for service and is capable of accomplishing its mission by performing the inspection instructions in paragraph 2-6.

### 2-6. INSPECTION INSTRUCTIONS.

a. Refer to DD Form 1397 for procedures on unpacking the Diesel Engine Assembly, Hatz 2 G 40.l

b. Remove all straps, plywood, tape, seals, and wrappings.

**WARNING**

**Drycleaning solvent P-D-680 is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat.**

c. Remove rust-preventive compound from coated exterior parts of the engine using drycleaning solvent (Item 4, Appendix D) and rags (Item 7, Appendix D).

d. Inspect engine for damage incurred during shipment.

## Section III. GENERAL MAINTENANCE PROCEDURES



### 2-7. GENERAL.

a. These general maintenance procedures and instructions contain general shop practices and specific methods you must be familiar with to properly maintain your Diesel Engine Assembly, Hatz 2 G 40. You should read and understand these practices and methods before performing any maintenance task.

b. Before beginning a task find out how much repair, modification, or replacement is needed to fix the equipment as described in this manual. Sometimes the reason for equipment failure can be seen right away and complete tear down is not necessary. Disassemble equipment only as far as necessary to repair or replace damaged or broken parts.

c. The following applies to the "Initial Setup" section contained in all the maintenance-task paragraphs.

(1) Materials, parts, and tools are not listed unless they apply to the procedure.

(2) Personnel are listed under "Personnel Required" only if more than one technician is needed in order to complete the task. If "Personnel Required" is not listed, it means that one technician can perform the task.

d. Check all tags and forms attached to the Diesel Engine Assembly for any information about the reason it was removed from service. Modification work orders and technical bulletins must also be checked for equipment changes and updates.

e. In some cases, a part may be damaged by removal. If the part appears to be good and other parts behind it are not defective, leave it on and continue with the procedure. Here are a few simple rules:

(1) Do not remove dowel pins or studs unless loose, bent, broken, or otherwise damaged.

(2) Do not remove bearings or bushings unless damaged. If you need to remove them to access parts, pull out bearings and bushings carefully.

(3) Replace all gaskets, seals, lockwashers, cotter pins, preformed packings, and other locking hardware.

## 2-8. WORK SAFETY.

a. Observe all WARNINGs and CAUTIONs. Always use power tools carefully.

b. Protect yourself against injury. Wear protective gear, such as safety goggles or lenses, safety shoes, a rubber apron, and gloves.

c. When lifting heavy parts, have someone help you. Make sure lifting and jacking equipment is working properly, is suitable for the assigned task, and is secure against slipping.

## 2-9. CLEANING INSTRUCTIONS.

**WARNING**

**Improper cleaning methods and the use of unauthorized cleaning liquids or solvents can injure personnel and damage equipment. To prevent this, refer to TM 9-247 for further instructions.**

a. **General.** Cleaning instructions will be the same for a majority of the parts and components that make up the Diesel Engine Assembly, Hatz 2 G 40. The following should apply to all cleaning, inspection, repair, and assembly operations:

(1) Clean all parts before inspection, after repair, and before assembly.

(2) Keep hands free of grease, which can collect dust, dirt, and grit.

(3) After cleaning, cover or wrap all parts to protect them from dust and dirt. Parts that are subject to rust should be lightly oiled.

b. **Steam-Cleaning**.

(1) Before steam-cleaning exterior of engine, protect all electrical equipment that could be damaged by steam or moisture.

(2) Place disassembled parts in a suitable container to steam-clean. Parts that are subject to rust should be dried and lightly oiled after cleaning.

c. **Castings, Forgings, and Machined Metal Parts**.

**WARNING**

**Drycleaning solvent P-D-680 is toxic and flammable. Always wear protective goggles and gloves and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat.**

(1) Clean inner and outer surfaces with drycleaning solvent (Item 4, Appendix D) and rag (Item 7, Appendix D).

(2) Remove grease and accumulated deposits with a stiff-bristled brush.

## 2-9. CLEANING INSTRUCTIONS (continued).

**WARNING**

**Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Wear protective clothing (goggles/shield, gloves, etc.) and use caution to avoid injury to personnel.**

(3) Clear out all threaded holes with compressed air to remove dirt and cleaning fluids.

**CAUTION**

**Do not wash oil seals, electrical cables, and flexible hoses with drycleaning solvent or mineral spirits. Serious damage or destruction of material would result.**

d. Oil Seals, Electrical Cables, and Flexible Hoses. Wash electrical cables and flexible hoses with a solution of water and dishwashing soap, and wipe dry.

e. Bearings. Clean bearings in accordance with TM 9-214.

## 2-10. INSPECTION INSTRUCTIONS.

**NOTE**
**All damaged areas should be marked for repair or replacement.**

a. All components and parts must be checked carefully to determine if they are serviceable for reuse, can be repaired, or must be scrapped.

b. Inspect drilled and tapped (threaded) holes for the following:

(1) In or around holes-wear, distortion (stretching), cracks, and any other damage.

(2) Threaded areas-wear, distortion (stretching), and evidence of cross-threading.

c. Inspect metal lines (tubes), flexible lines (hoses), and metal fittings and connectors for the following:

(1) Metal lines-sharp kinks, cracks, bad bends, and dents.

(2) Flexible lines-fraying, evidence of leakage, and loose metal fittings or connectors.

(3) Metal fittings and connectors-thread damage and worn or rounded hex heads.

d. Inspect castings, forgings, and machined metal parts for the following:

(1) Machined surfaces-nicks, burrs, raised metal, wear, and other damage.

(2) Inner and outer surfaces-breaks and cracks.

e. Inspect bearings in accordance with TM 9-214.

## 2-11. REPAIR INSTRUCTIONS.

a. Any repair procedure peculiar to a specific part or component is covered in the section or paragraph relating to that item. After repair, clean all parts thoroughly to prevent dirt, metal chips, or other foreign material from entering any working parts.

b. Repair castings, forgings, and machined parts using the following instructions:

(1) Refer to TC 9-237 for instructions on repairing minor cracked castings or forgings.

**WARNING**

**Drycleaning solvent P-D-680 is toxic and flammable. Always wear protective goggles and gloves and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat.**

(2) Repair minor damage to machined surfaces with a fine mill file or abrasive cloth dipped in drycleaning solvent (Item 4, Appendix D).

(3) Replace any deeply nicked machined surface that could affect the operation of the Diesel Engine Assembly.

(4) Repair minor damage to a threaded capscrew hole with thread tap of same size, to prevent cutting the hole too large.

## 2-12. HOSE AND TUBE TAGGING.

a. As soon as the first hose or tube is disconnected, write the number "1" on two tags. Secure one tag to the hose or tube and the other tag to the nipple or fitting. After disconnecting the second hose or tube, write the number "2" on two tags. Secure one tag to the hose or tube and the other tag to the nipple or fitting. Do the same for all hoses and tubes.

b. Note which numbers you used, in pencil, on the art in this manual. This will help you retag properly when you remove tags from some parts to perform cleaning and maintenance work.

c. Remove all tags when finished.

## 2-13. LUBRICATION INSTRUCTIONS.

To prevent corrosion, apply a light coat of lubricating oil to metal parts after they are cleaned and before they are assembled.

## 2-14. TORQUE VALUES.

Follow the torque values given in the maintenance procedures, which apply to unlubricated threads. If no torque value is given, refer to Appendix E.

## SECTION IV. UNIT MAINTENANCE PROCEDURES



## 2-15. IDENTIFICATION PLATE REPLACEMENT.

*This Task Covers:*

a. Removal

b. Installation

*Initial Setup:*

**Tools/Test Equipment:**
- Blind hand riveter (Item 2, Appendix G)
- Cable assembly (Item 3, Appendix G)
- Drill set (Item 10, Appendix G)
- Electric drill (Item 11, Appendix G)
- General mechanic's tool kit, automotive (Item 15, Appendix G)

**Materials/Parts:**
- Blind rivet (4) (Item 12, Appendix F)

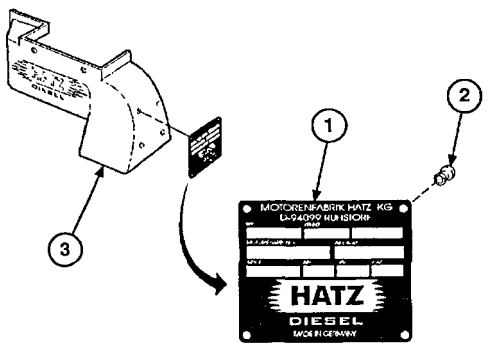
**Equipment Conditions:**
- Airflow deflector removed from engine (UOC: APP) (para 2-24, removal steps 1-3).
- Airflow deflector removed from engine (UOC: APJ) (TM 9-2350-292-20-2).

### a. REMOVAL

Remove four rivets (2) and identification plate (1) from airflow deflector (3).

### b. INSTALLATION

Install identification plate (1) on airflow deflector (3) and secure with four rivets (2).




**FOLLOW-ON TASKS:**

- Install airflow deflector on engine (para 2-24, installation steps 11-13).

## 2-16. EYEBOLT REPLACEMENT (UOC: APP)

*This Task Covers:*

a. Removal

b. Installation

*Initial Setup:*

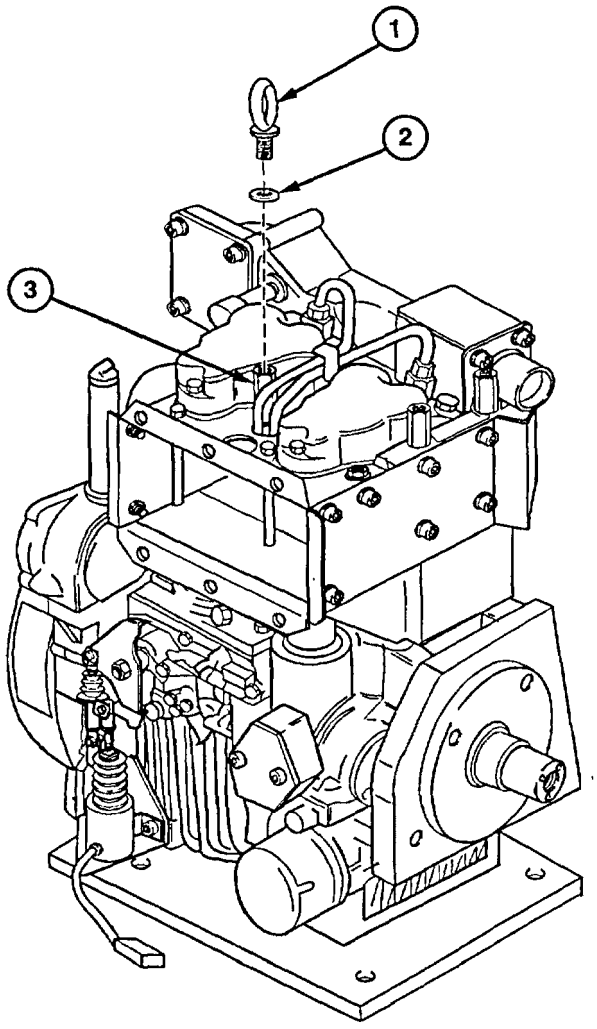
**Tools/Test Equipment:**
- General mechanic's tool kit, automotive (Item 14, Appendix G)

### a. REMOVAL

Remove eyebolt (1) and shim (2) from collar nut (3).

### b. INSTALLATION

Install shim (2) and eyebolt (1) in collar nut (3).




**FOLLOW-ON TASKS:**
- None

## 2-17. ROCKER ARM COVER AND O-RING REPLACEMENT.

*This Task Covers:*

a. Removal

b. Installation

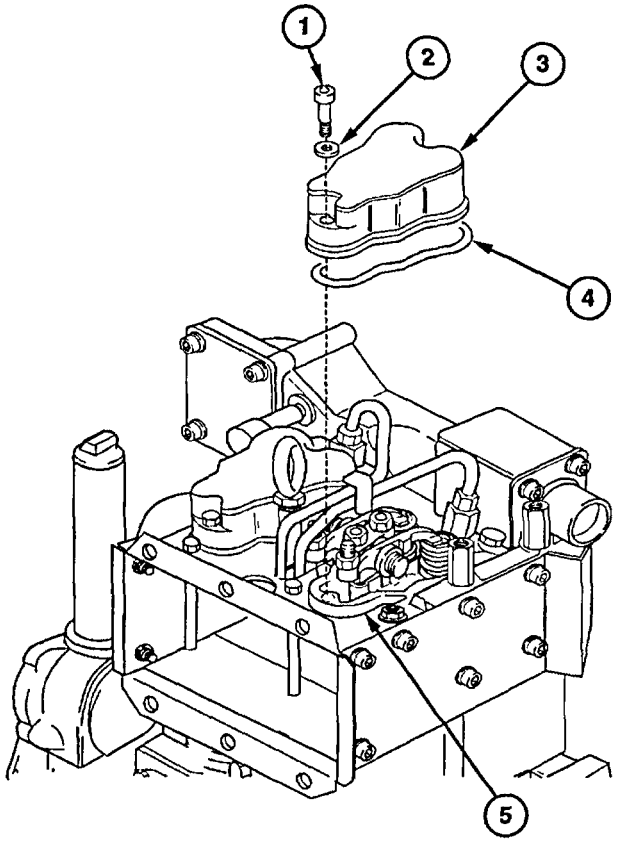
*Initial Setup:*

**Tools/Test Equipment:**
- General mechanic's tool kit, automotive (Item 15, Appendix G)

**Materials/Parts:**
- Grease, automotive (Item 5, Appendix D)
- O-ring (Item 33, Appendix F)
- Washer (2) (Item 29, Appendix F)

**NOTE**

**The Diesel Engine Assembly has two rocker arm covers. Use this procedure to remove either one.**




**a. REMOVAL**

1. Remove two screws (1) and washers (2) from rocker arm cover (3) and cylinder head (5). Discard washers.
2. Remove rocker arm cover (3) from cylinder head (5).
3. Remove O-ring (4) from groove in rocker arm cover (3). Discard O-ring.

**b. INSTALLATION**

1. Lightly coat new O-ring (4) with grease and install in groove in rocker arm cover (3).
2. Install rocker arm cover (3) on cylinder head (5).
3. Install two screws (1) and new washers (2) on rocker arm cover (3) and cylinder head (5).

**FOLLOW-ON TASKS:**

- None

## 2-18. FILLER OPENING CAP REPLACEMENT (UOC: APP).

*This Task Covers:*

a. Removal

b. Installation

*Initial Setup:*

**Tools/Test Equipment:**
- General mechanic's tool kit, (Item 14, Appendix G)

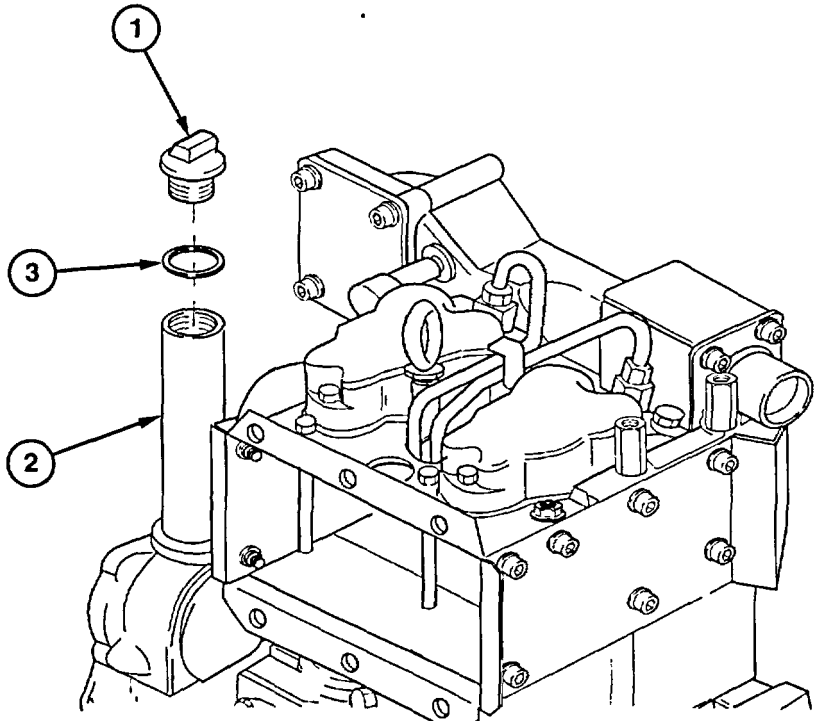
**Materials/Parts:**
- Grease, automotive (Item 5, Appendix D)
- O-ring (Item 28, Appendix F)

### a. REMOVAL

1. Remove filler opening cap (1) and O-ring (3) from filler neck (2).
2. Remove O-ring (3) from cap (1). Discard O-ring.

### b. INSTALLATION

1. Lightly coat new O-ring (3) with grease. Install O-ring (3) on cap (1).
2. Install cap (1) on filler neck (2).




**FOLLOW-ON TASKS:**

- None

## 2-19. OIL TUBE ASSEMBLIES REPLACEMENT.

*This Task Covers:*

a. Removal

b. Installation

---

*Initial Setup:*

**Tools/Test Equipment:**
- General mechanic's tool kit, automotive (Item 15, Appendix G)
- Oil switch removed (para 2-25).

**Materials/Parts:**
- O-ring (Item 46, Appendix F)
- Washer (12) (Item 18, Appendix F)

**Equipment Conditions:**
- Airflow deflectors removed (only as many as needed to allow access to oil tubes) (para 2-24).
- Fuel pressure pipe assemblies removed (para 2-23).

---

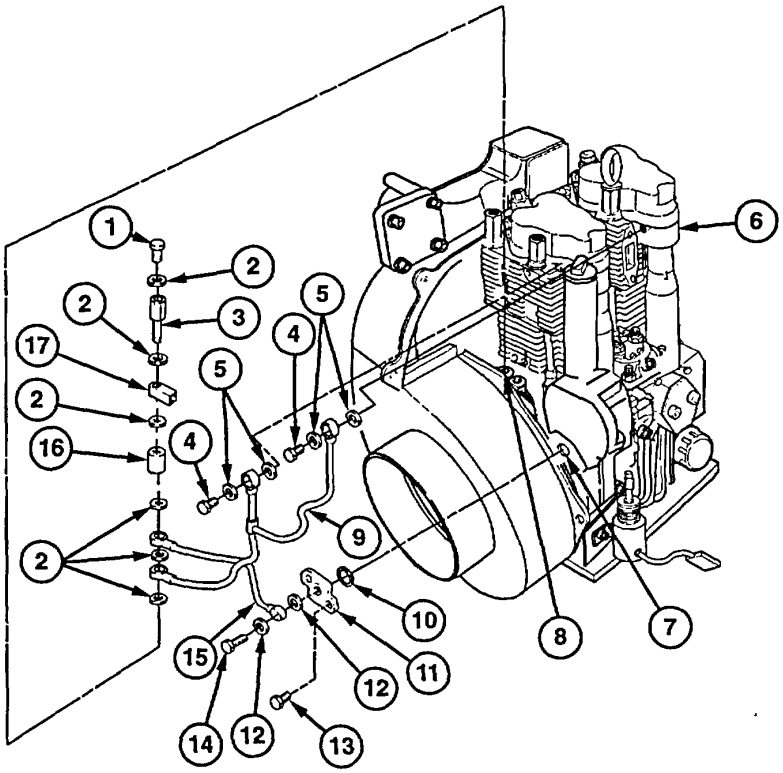
### a. REMOVAL

1. Remove fluid passage bolt (14) and two washers (12) from plate (11) and oil tube assembly (15). Discard washers.

2. Remove two screws (13) and plate (11) from timing cover (7). Remove O-ring (10)from plate (11). Discard O-ring.

3. Remove two fluid passage bolts (4) and four washers (5) from two cylinder heads (6) and oil tube assembly (9). Discard washers.

4. Remove screw (1), fluid passage bolt (3), connector (17), bushing (16), six washers (2), and two oil tube assemblies (9 and 15) from crankcase (8). Discard washers.



## 2-19. OIL TUBE ASSEMBLIES REPLACEMENT (continued).

### b. INSTALLATION

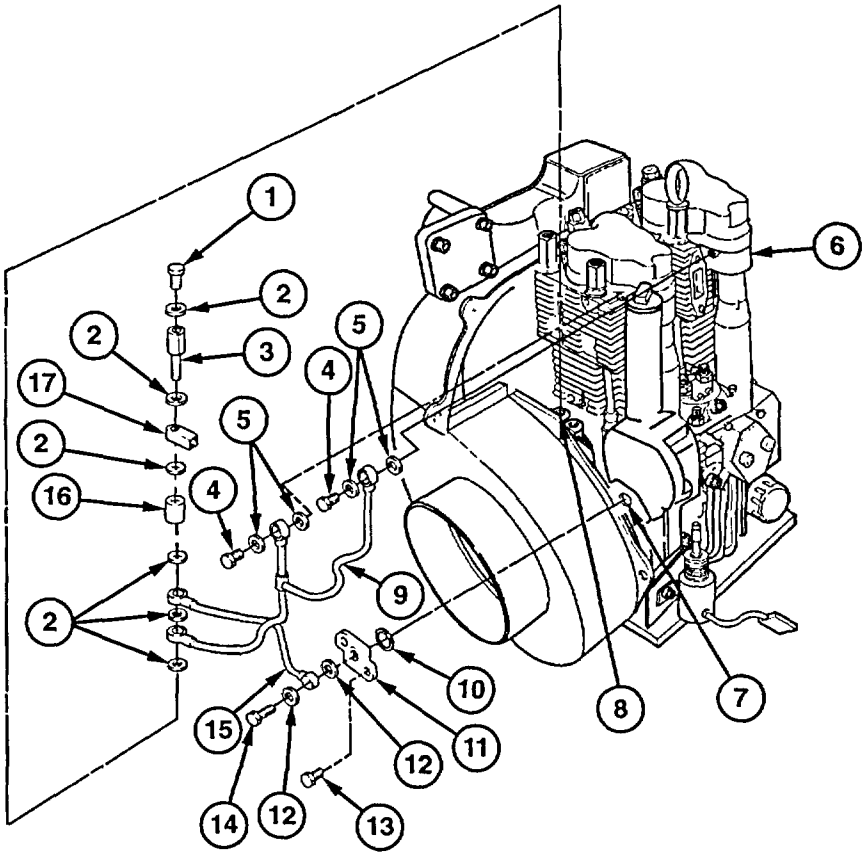
1. Install two oil tube assemblies (9 and 15), fluid passage bolt (3), connector (17), bushing (16), and six new washers (2) on crankcase (8). Loosely install screw (1) in fluid passage bolt (3).

2. Install four new washers (5) on two cylinder heads (6) and oil tube assembly (15) and secure loosely with two fluid passage bolts (4).

3. Install new O-ring (10) on plate (11). Install plate (11) and two screws (13) on timing cover (7).

4. Install two new washers (12) and fluid passage bolt (14) on plate (11) and oil tube assembly (15).

5. Tighten screw (1) and two fluid passage bolts (4).




**FOLLOW-ON TASKS:**

- Install fuel pressure pipe assemblies (para 2-23).
- Install oil switch (para 2-25).
- Install airflow deflectors (para 2-24), if any were removed.

## 2-20. FILTER ELEMENT REPLACEMENT (UOC: APP).

*This Task Covers:*

a. Removal

b. Cleaning

c. Installation

*Initial Setup:*

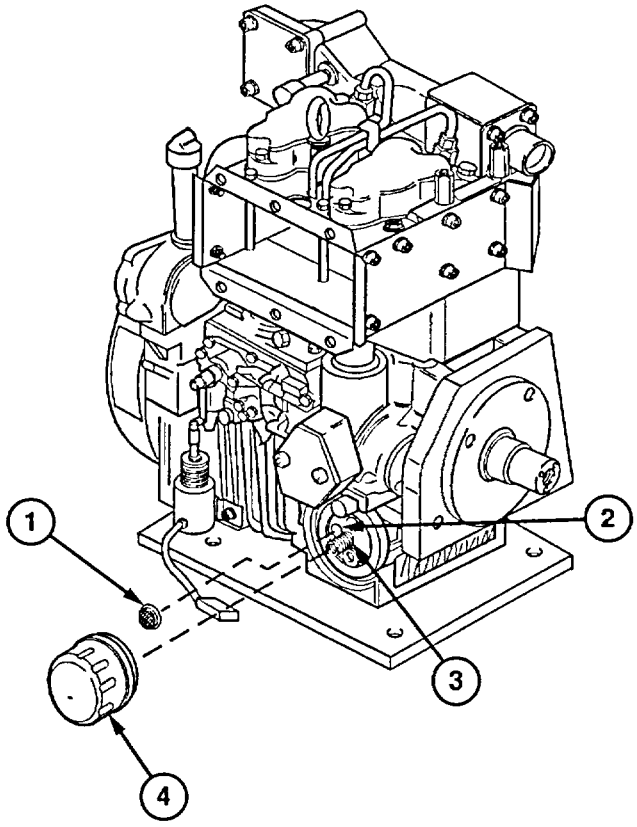
**Tools/Test Equipment:**
- General mechanic's tool kit, automotive (Item 15, Appendix G)
- Strap wrench (Item 29, Appendix G)

**Materials/Parts:**
- Drycleaning solvent (Item 4, Appendix D)
- Lubricating oil (Item 6, Appendix D)
- Rag (Item 7, Appendix D)
- Filter element (Item 35, Appendix F)

### a. REMOVAL

1. Remove filter element (4) from filter mount (3). Discard filter element).

2. Remove strainer element (1) from safety relief valve (2).



## 2-20. FILTER ELEMENT REPLACEMENT (UOC: APP) (continued).

**b. CLEANING**

**WARNING**

**Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Wear protective clothing (goggles/shield, gloves, etc.) and use caution to avoid injury to personnel.**

1. Clean strainer element (1) with compressed air.

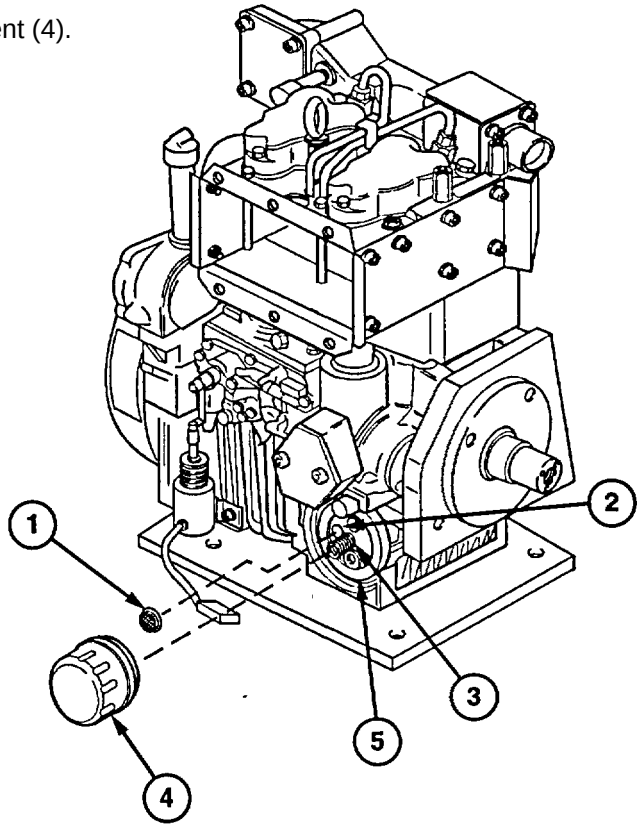
**WARNING**

**Drycleaning solvent P-D-680 is toxic and flammable. Always wear protective goggles and gloves and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat.**

2. Clean sealing surface (5) with drycleaning solvent and rag.

**c. INSTALLATION**

1. Install strainer element (1) on safety relief valve (2).
2. Apply light coat of oil to sealing ring of new filter element (4).
3. Install filter element (4) on filter mount (3).




**FOLLOW-ON TASKS:**

- None

## 2-21. INTAKE MANIFOLD REPLACEMENT.

*This Task Covers:*

a. Removal

b. Installation

*Initial Setup:*

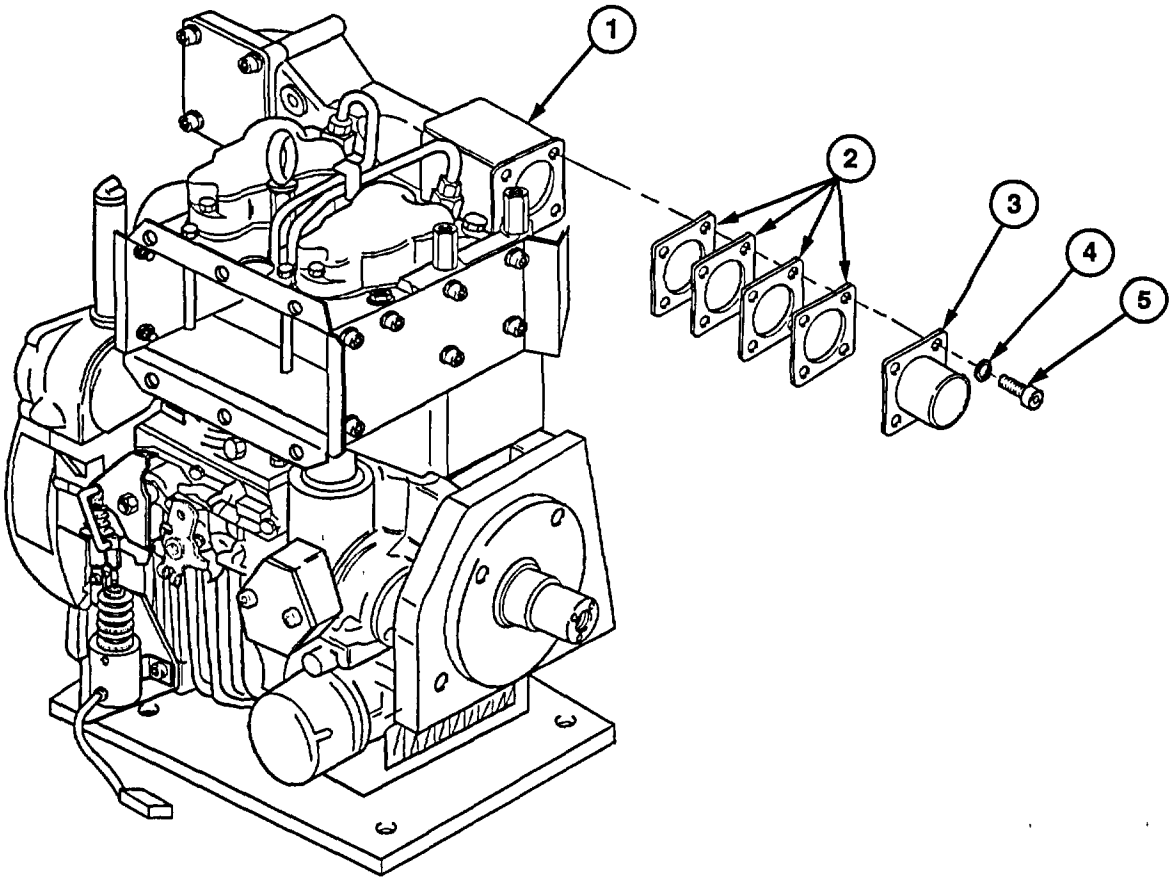
**Tools/Test Equipment:**
- General mechanic's tool kit, automotive (Item 15, Appendix G)
- Screwdriver attachment, 6 mm (Item 24, Appendix G)
- Socket wrench set, 3/8-inch drive (Item 27, Appendix G)

**Materials/Parts:**
- Gasket set (2) (Item 4, Appendix F)
- Gasket (2) (Item 8, Appendix F)
- Self-locking nut (4) (Item 15, Appendix F)
- Spring tension washer (4) (Item 25, Appendix F)
- Spring tension washer (8) (Item 31, Appendix F)

**Equipment Conditions:**
- Valve vent removed (para 2-22).
- Airflow deflectors removed as needed to permit replacement of air intake manifold (para 2-24).

### a. REMOVAL

1. Remove four socket head screws (5) and spring tension washers (4), adapter (3), and four-part gasket (2) from Intake manifold (1). Discard spring tension washers and gasket.



**2-21. INTAKE MANIFOLD REPLACEMENT (continued).**

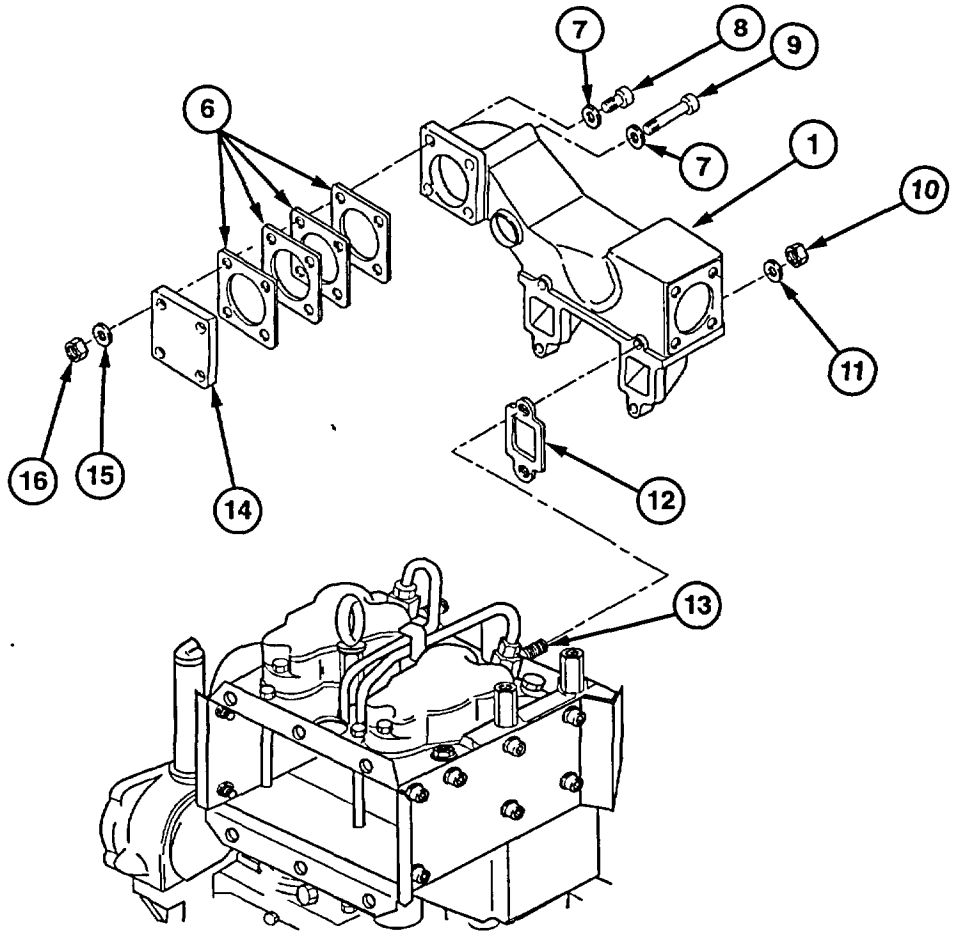
2. Remove two socket head screws (8) and socket head screws (9), four washers (7), spring tension washers (15), and nuts (16), access cover (14), and four-part gasket (6) from intake manifold (1). Discard spring tension washers and gasket.

3. Remove four self-locking nuts (10) and spring tension washers (11), intake manifold (1), and two gaskets (12) from four studs (13). Discard self-locking nuts, spring tension washers, and gaskets.

**b. INSTALLATION**

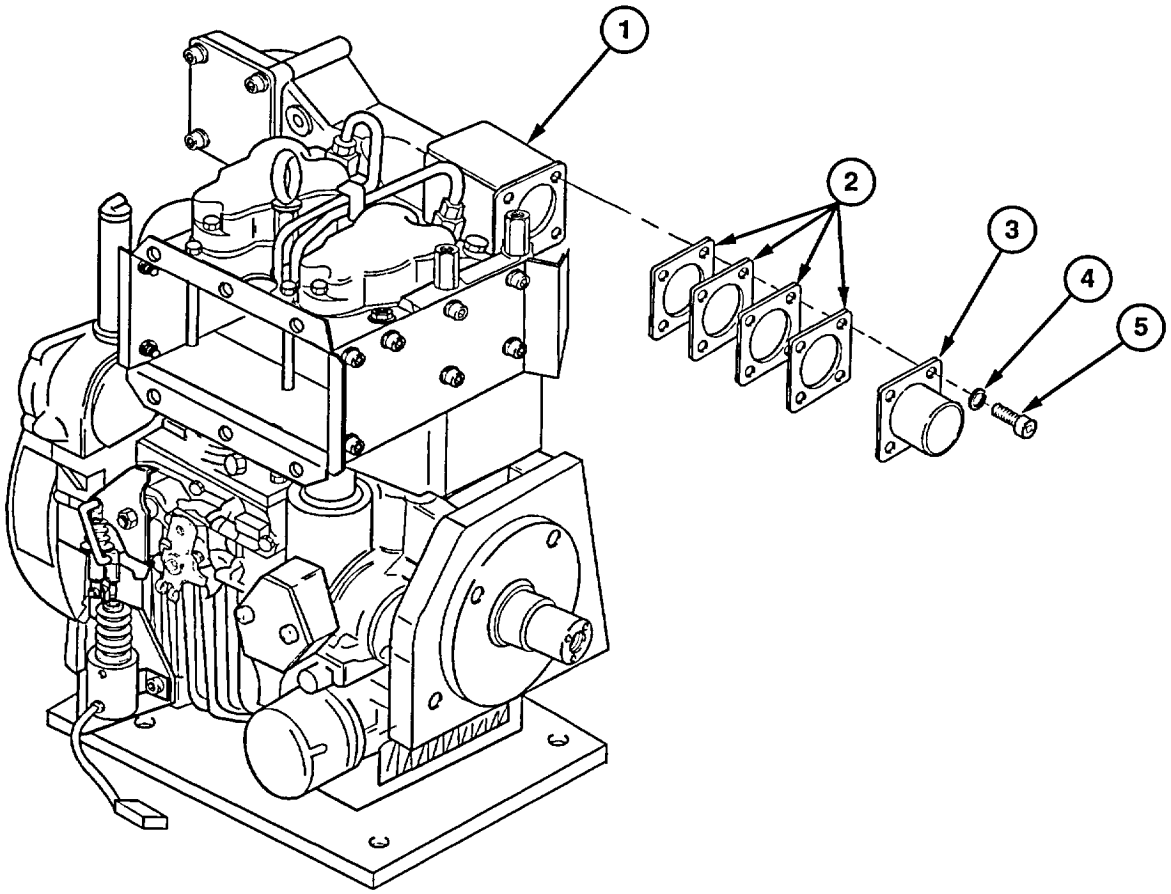
1. Install two new gaskets (12), intake manifold (1), and four new spring tension washers (11) and new self-locking nuts (10) on four studs (13).

2. Install new four-part gasket (6), access cover (14), four nuts (16), new spring tension washers (15), and washers (7), and two socket head screws (8) and socket head screws (9) on intake manifold (1).



## 2-21. INTAKE MANIFOLD REPLACEMENT (continued).

3. Install new four-part gasket (2), adapter (3), and four new spring tension washers (4) and socket head screws (5) on intake manifold (1).




**FOLLOW-ON TASKS:**

- Install valve vent (para 2-22).
- Install airflow deflectors (para 2-24), if removed.

## 2-22. VALVE VENT REPAIR.

*This Task Covers:*

a. Removal
b. Disassembly
c. Assembly
d. Installation

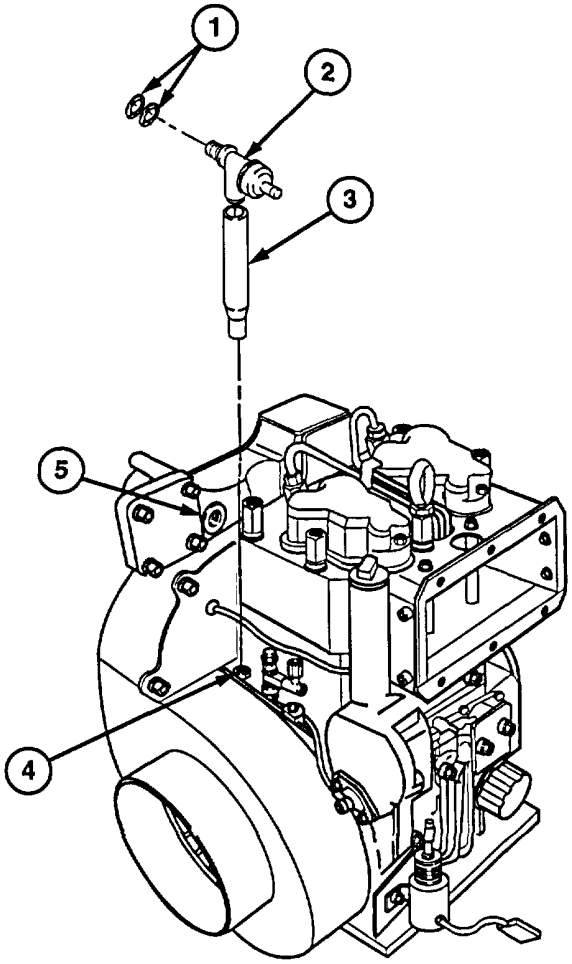
*Initial Setup:*

**Tools/Test Equipment:**
- General mechanic's tool kit, automotive (Item 15, Appendix G)

**Materials/Parts:**
- Grease, automotive (Item 5, Appendix D)
- O-ring (2) (Item 45, Appendix F)

### a. REMOVAL

1. Remove valve vent (2) from intake manifold (5).
2. Remove hose (3) from hose coupling (4).



## 2-22. VALVE VENT REPAIR (continued).

**b. DISASSEMBLY**

1. Remove two O-rings (1) from valve vent (2). Discard O-rings.
2. Remove hose (3) from valve vent (2).

**c. ASSEMBLY**

1. Install hose (3) on valve vent (2).
2. Apply light coat of grease on two new O-rings (1). Install two O-rings (1) on valve vent (2).

**d. INSTALLATION**

1. Install hose (3) on hose coupling (4).
2. Install valve vent (2) on intake manifold (5).

**FOLLOW-ON TASKS:**

- None

## 2-23. FUEL PRESSURE PIPE ASSEMBLIES AND RETURN FUEL HOSE REPLACEMENT.

*This Task Covers:*

a. Removal

b. Installation

*Initial Setup:*

**Tools/Test Equipment:**
- General mechanic's tool kit, (Item 14, Appendix G)
- Torque wrench, 1/2-inch drive (Item 31, Appendix G)
- Wrench (Item 36, Appendix G)

**Materials/Parts:**
- Gasket (2) (Item 19, Appendix F)
- Gasket (4) (Item 40, Appendix F)
- Spring tension washer (Item 31, Appendix F)
- Washer (2) (Item 18, Appendix F)

### a. REMOVAL

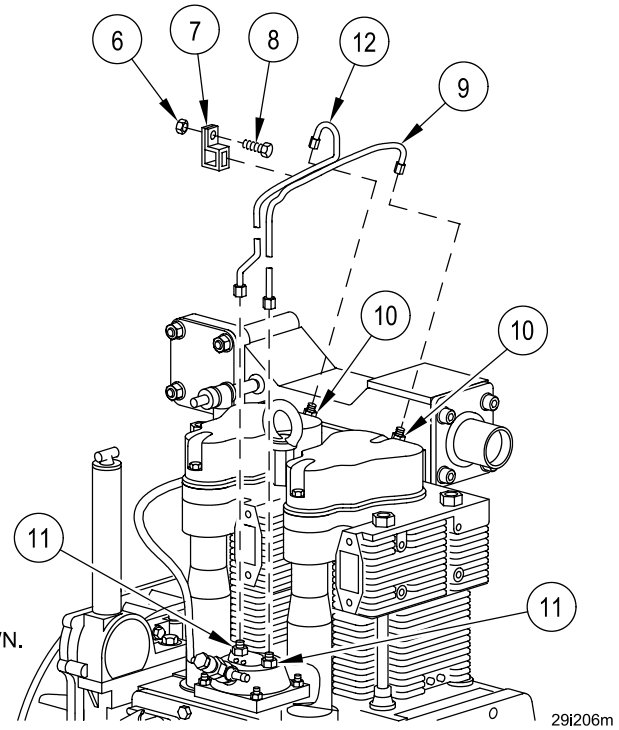
**NOTE**

**Fuel pressure pipe nuts will stay on fuel pressure pipe assemblies when they are removed.**

1. Loosen two fuel pressure pipe nuts on each of two fuel pressure pipe assemblies (9 and 12).
2. Remove two fuel pressure pipe assemblies (9 and 12) and clamp (7) from two injection pump fittings (11) and fuel injector fittings (10).
3. Remove screw (8) and nut (6) from clamp (7). Remove clamp (7) from two fuel pressure pipe assemblies (9 and 12).

NOTE: ITEMS 1 THROUGH 5 DELETED

NOTE: FOR PURPOSES OF CLARITY, AIRFOW DEFLECTORS ARE NOT SHOWN.



**2-23. FUEL PRESSURE PIPE ASSEMBLIES AND RETURN FUEL HOSE REPLACEMENT (continued).**

**NOTE**

**Steps 6-7 are done only if equipment has dual banjo fittings. Steps 8 and 9 are done only for single banjo fittings.**

4. Remove fluid passage bolt (13), two washers (14), strap clamp (14.1), return fuel hose (4), adapter (15), two gaskets (23), and fitting (16) and fitting (20) from injection pump (22). Discard washers and gaskets.

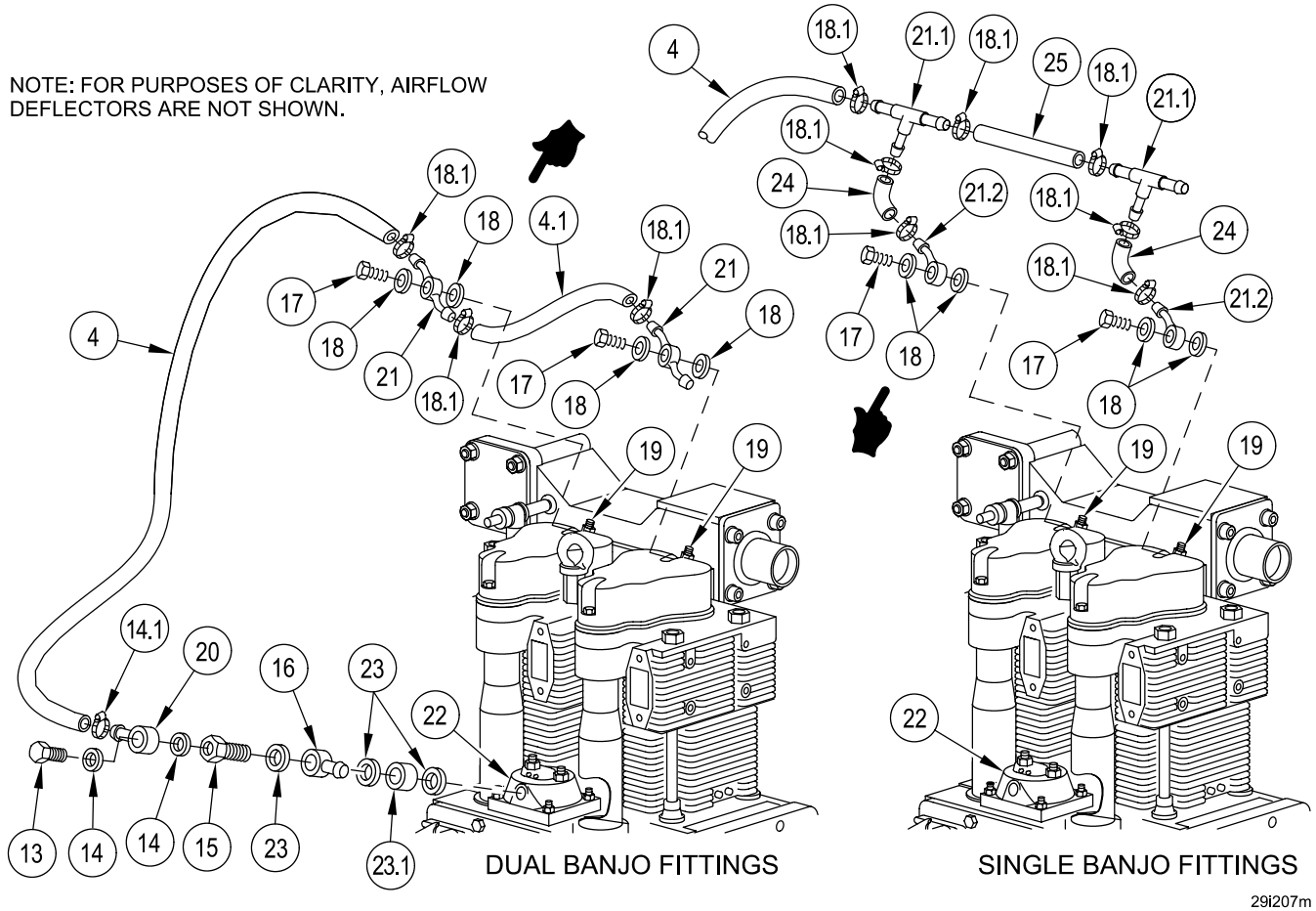
5. Remove strap clamp (18.1) and hose (4) from fitting (21) or tee (21.1).

6. Remove two fluid passage bolts (17), four gaskets (18), and fuel hose (4.1) from two fuel injectors (19). Discard gaskets.

7. Remove two hose nipples (21) and two strap clamps (18.1) from return fuel hose (4.1).

8. Remove two fluid passage bolts (17), four gaskets (18) and two single banjo fittings (21.2) from two fuel injectors (19). Discard gaskets.

9. Remove six strap clamps (18.1) securing fuel return hoses (24 and 25) to tees (21.1) and separate hoses (24 and 25) from tees (21.1) and single banjo fitting (21.2).



**2-23. FUEL PRESSURE PIPE ASSEMBLIES AND RETURN FUEL HOSE REPLACEMENT (continued).**

**NOTE**

**Steps 1 and 2 are done only if equipment has dual banjo fittings. Steps 3.2 and 3.3 are done only if equipment has single banjo fittings.**

**b. INSTALLATION**

1. Install two hose nipples (21) on return fuel hose (4.1) and secure with two strap clamps (18.1).

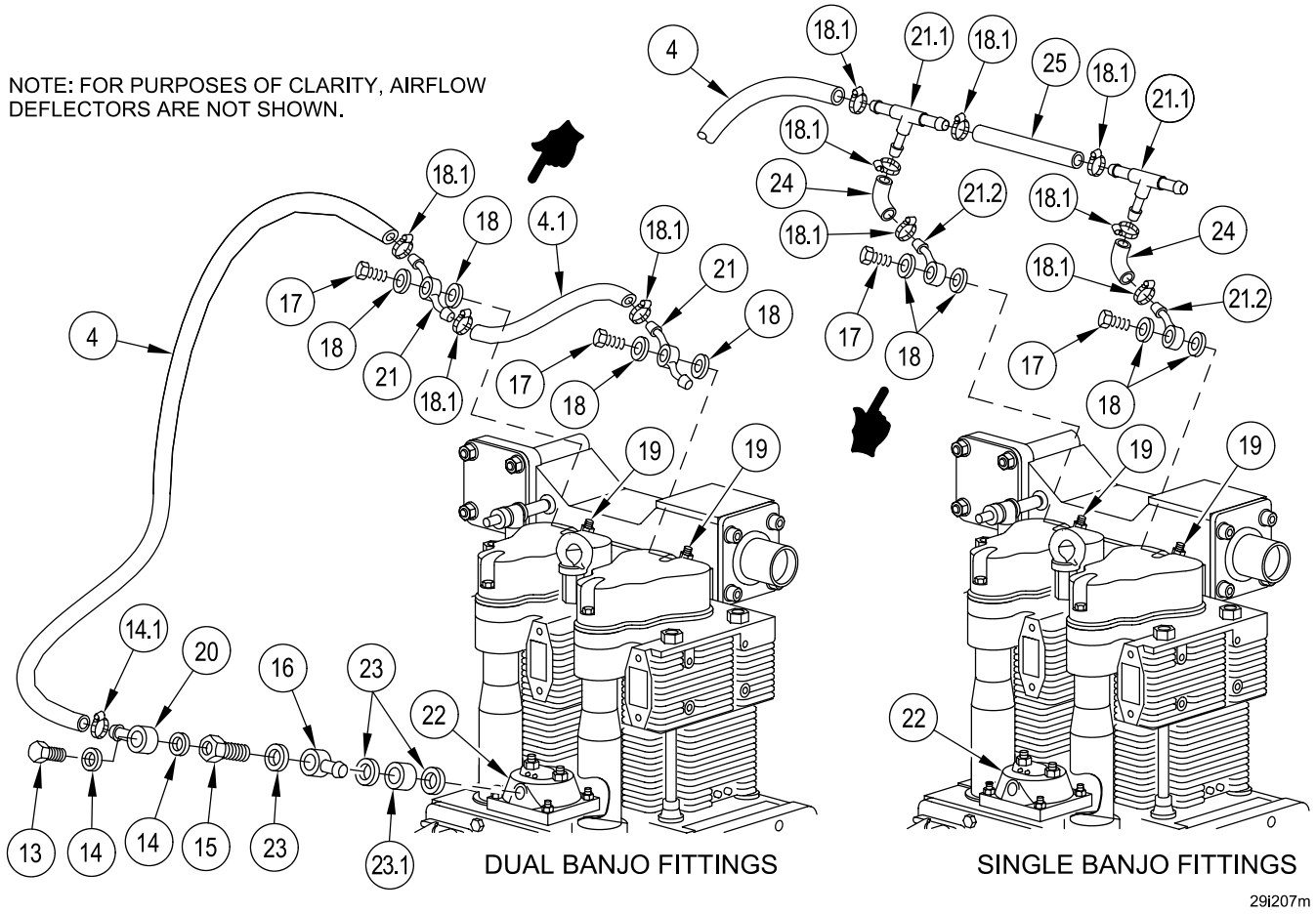
2. Install return fuel hose (4.1) and two fittings (21) on two fuel injectors (19) and secure with two fluid passage bolts (17) and four new gaskets (18).

3. Install two new gaskets (23), fitting (16), adapter (15), two new washers (14), return fuel hose (4) and fitting (20) and fluid passage bolt (13) on injection pump (22). Torque adapter to 26 ft-lb (35 N•m). Torque fluid passage bolt to 18.5 ft-lb (25 N•m). Secure return fuel hose (4) to fitting (20) with strap clamp (14.1).

3.1 Connect fuel hose (4) to fitting (21) or tee (21.1) and secure with strap clamps (18.1).

3.2 Install six strap clamps (18.1) to secure fuel return hoses (24 and 25) to tees (21.1) and single banjo (21.2).

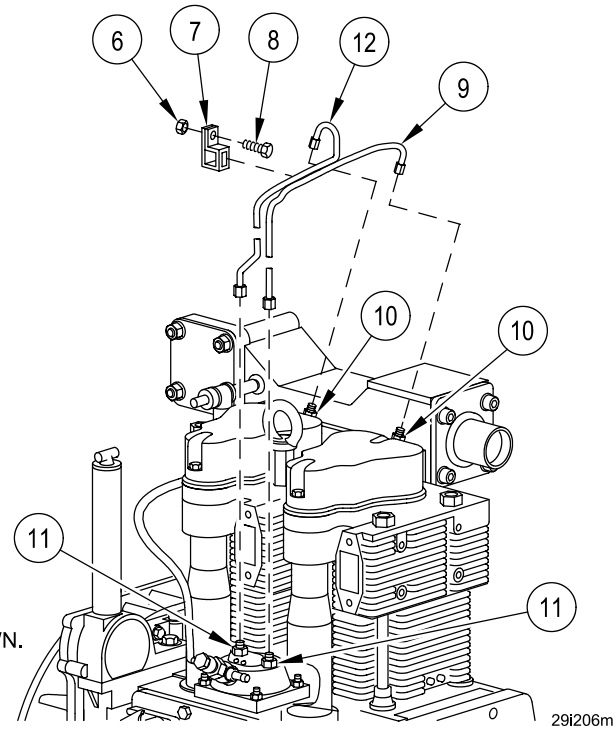
3.3 Install two fluid passage bolts (17), four gaskets (18), and single banjo fittings (21.2) to two fuel injectors (19).



**2-23. FUEL PRESSURE PIPE ASSEMBLIES AND RETURN FUEL HOSE REPLACEMENT (continued).**

4. Install clamp (7) onto fuel pressure pipe assemblies (9 and 12) and secure with nut (6) and screw (8).

5. Install two fuel pressure pipe assemblies (9 and 12) and clamp (7) on two injection pump fittings (11) and fuel injector fittings (10). Secure by tightening two fuel pressure pipe nuts on each of two fuel pressure pipe assemblies (9 and 12).




NOTE: ITEMS 1 THROUGH 5 DELETED

NOTE: FOR PURPOSES OF CLARITY, AIRFOW DEFLECTORS ARE NOT SHOWN.

## 2-24. AIRFLOW DEFLECTORS REPLACEMENT (UOC: APP).

*This Task Covers:*

a. Removal

b. Installation

*Initial Setup:*

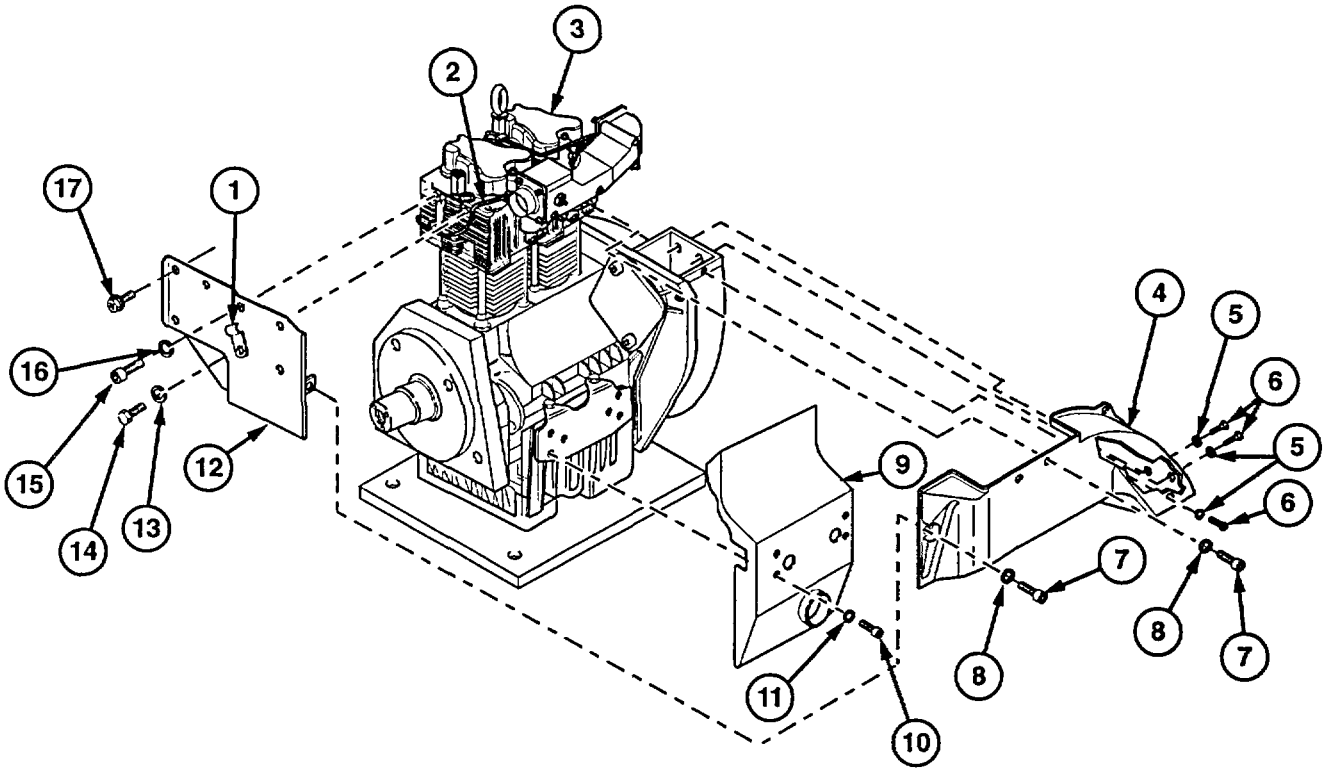
**Tools/Test Equipment:**
- General mechanic's tool kit, automotive (Item 15, Appendix G)

**Materials/Parts:**
- Split washer (3) (Item 41, Appendix F)
- Spring tension washer (6) (Item 30, Appendix F)
- Spring tension washer (2) (Item 31, Appendix F)

**Equipment Conditions:**
- Valve vent removed (para 2-22)

### a. REMOVAL

1. Remove five screws (7) and washers (8) from airflow deflector (4).
2. Remove three screws (6) and split washers (5) from airflow deflector (4). Discard split washers.
3. Remove airflow deflector (4) from engine (3).
4. Remove two screws (10) and spring tension washers (11) and airflow deflector (9) from engine (3). Discard spring tension washers.



**2-24. AIRFLOW DEFLECTORS REPLACEMENT (UOC: APP) (continued).**

5. Remove three screws (17) from air duct bracket (12).

6. Remove two screws (15) and spring tension washers (16) from air duct bracket (12). Discard spring tension

**CAUTION**

**Be careful not to damage fuel line when removing air duct.**

7. Remove two screws (14) and spring tension washers (13), clip (1), fuel hose (2), and air duct bracket (12) from engine (3). Discard spring tension washers.

8. Remove three screws (24) from air duct bracket (23).

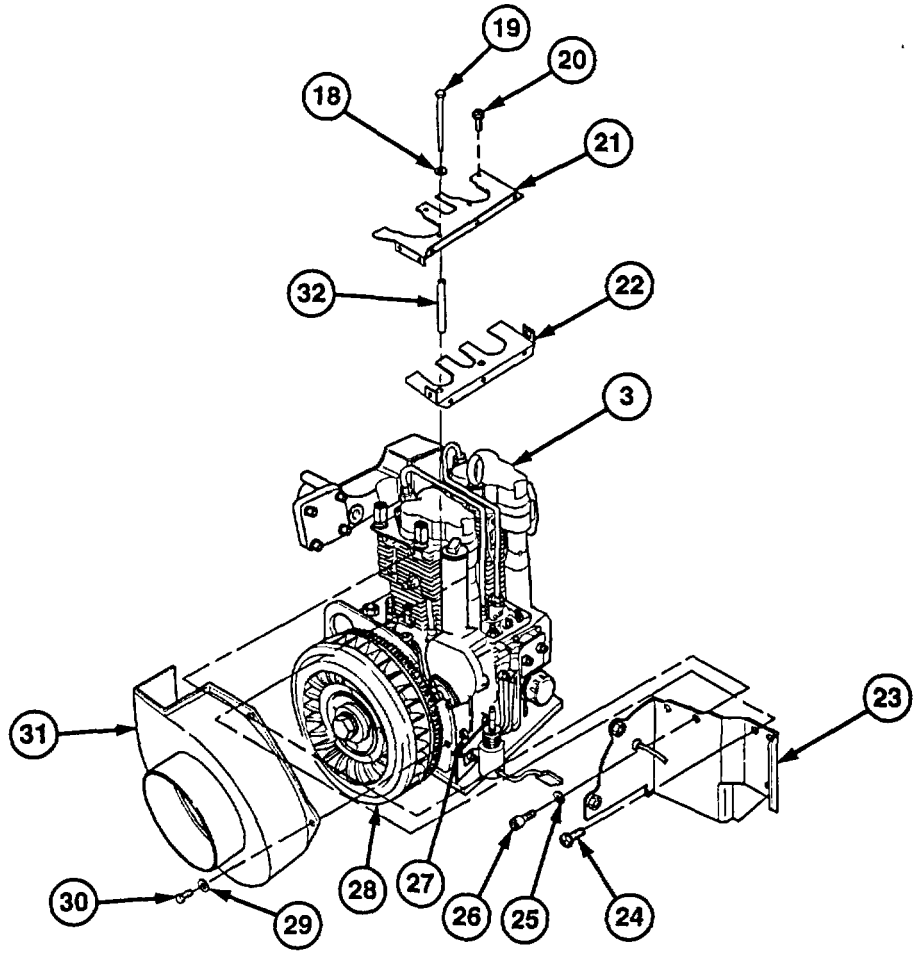
9. Remove two screws (26) and spring tension washers (25) from air duct bracket (23). Discard spring tension washers.

10. Remove two screws (19), washers (18), and spacers (32) and airflow deflector (22) from airflow deflector (21).

11. Remove two screws (20) and airflow deflector (21) from engine (3).

12. Remove air duct bracket (23) from engine (3).

13. Remove four screws (30), washers (29), and nuts (27) and airflow deflector (31) from flywheel (28).



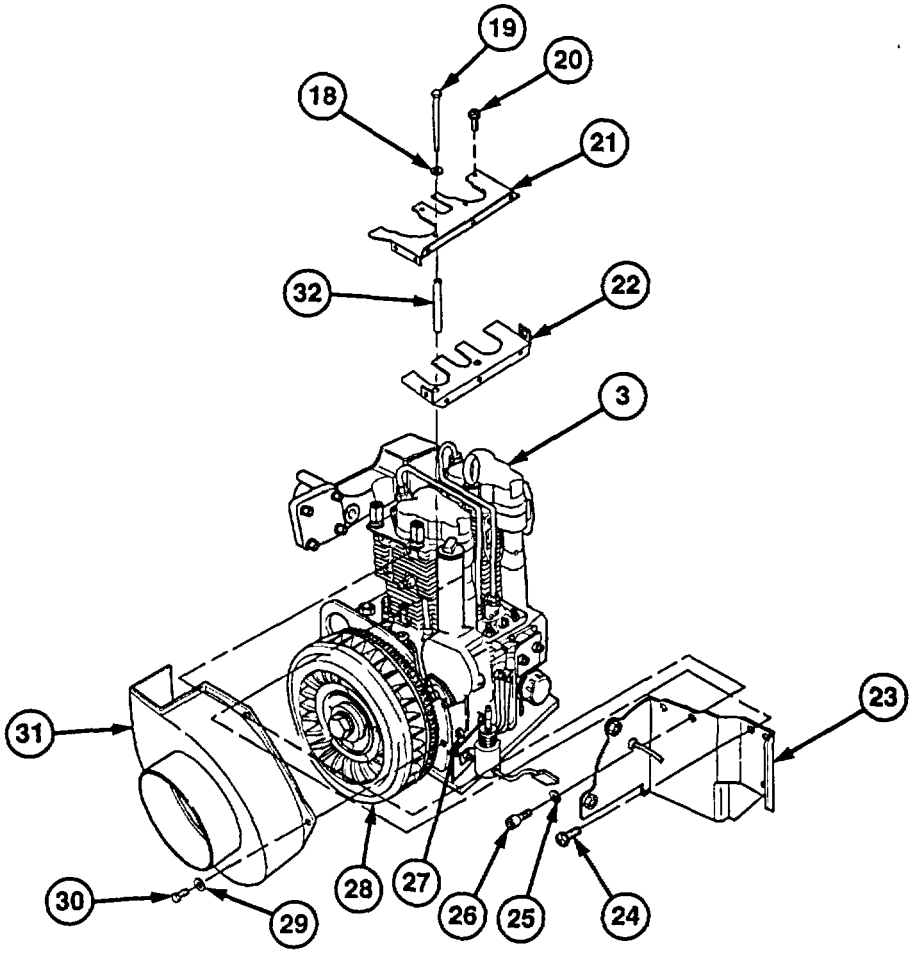
## 2-24. AIRFLOW DEFLECTORS REPLACEMENT (UOC: APP) (continued).

**b. INSTALLATION**

**NOTE**

**Install screws loosely, to allow some movement of air ducts brackets and airflow deflectors during installation procedure.**

1. Install four screws (30), washers (29), and nuts (27) and airflow deflector (31) on flywheel (28).
2. Install air duct bracket (23) on engine (3).
3. Install airflow deflector (21) and two screws (20) on engine (3).
4. Install two spacers (32), washers (18), and screws (19) and airflow deflector (22) on airflow deflector (21).



## 2-24. AIRFLOW DEFLECTORS REPLACEMENT (UOC: APP) (continued).

5. Install two new spring tension washers (25) and screws (26) on air duct bracket (23).

6. Install three screws (24) on air duct bracket (23).

**CAUTION**

**Be careful not to damage fuel line when installing air duct bracket on engine.**

7. Install air duct bracket (12) on engine (3) and secure with two new spring tension washers (16) and screws (15).

8. Position clip (1) and fuel hose (2) on air duct bracket (12). Install two new spring tension washers (13) and screws (14) on air duct bracket (12).

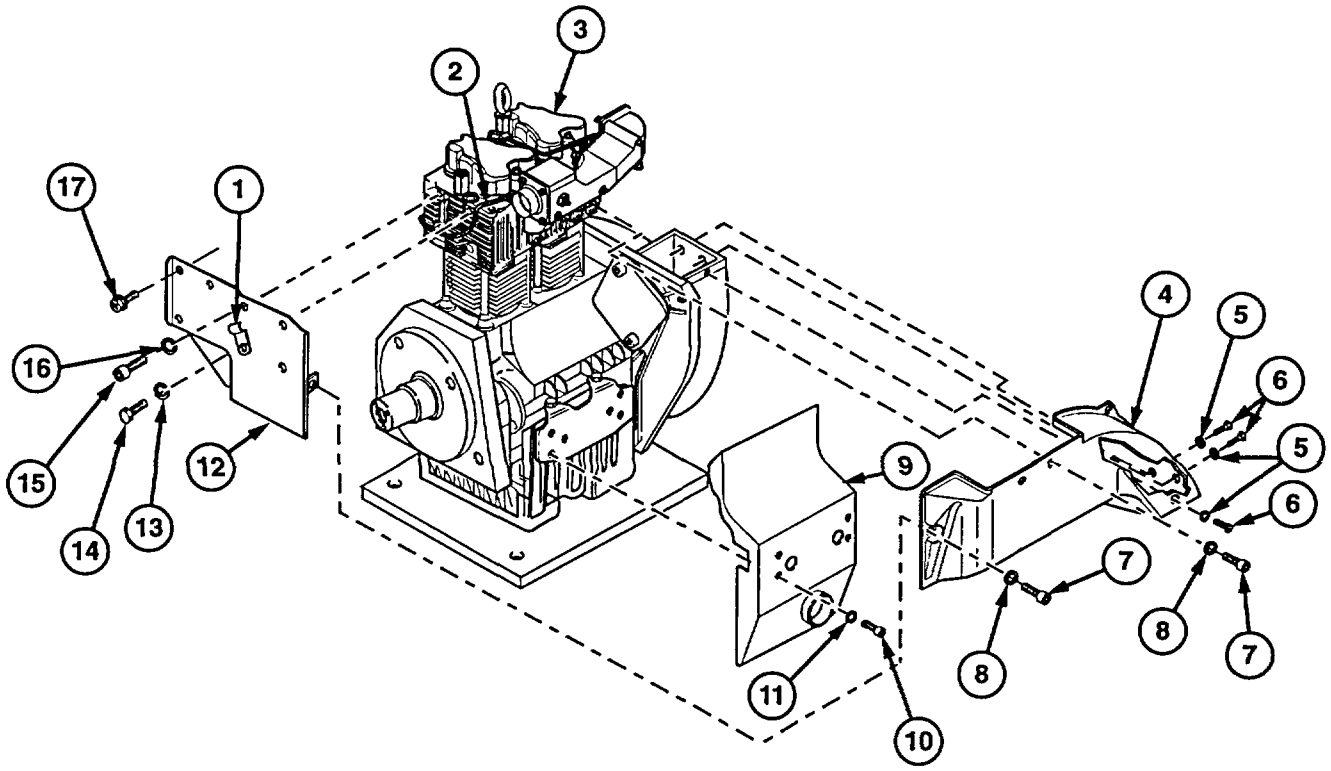
9. Install three screws (17) on air duct bracket (12).

10. Install airflow deflector (9) on engine (3) and secure with two new spring tension washers (11 ) and screws (10).

11. Install airflow deflector (4) on engine (3) and secure with five washers (8) and screws (7).

12. Install three new split washers (5) and screws (6) on airflow deflector (4).

13. Tighten all screws.




**FOLLOW-ON TASKS:**

- Install valve vent (para 2-22).

## 2-25. OIL PRESSURE SWITCH REPLACEMENT.

*This Task Covers:*

a. Removal

b. Installation

*Initial Setup:*

**Tools/Test Equipment:**
- General mechanic's tool kit, automotive (Item 15, Appendix G)

**Materials/Parts:**
- Sealing compound (Item 17, Appendix D)

### a. REMOVAL

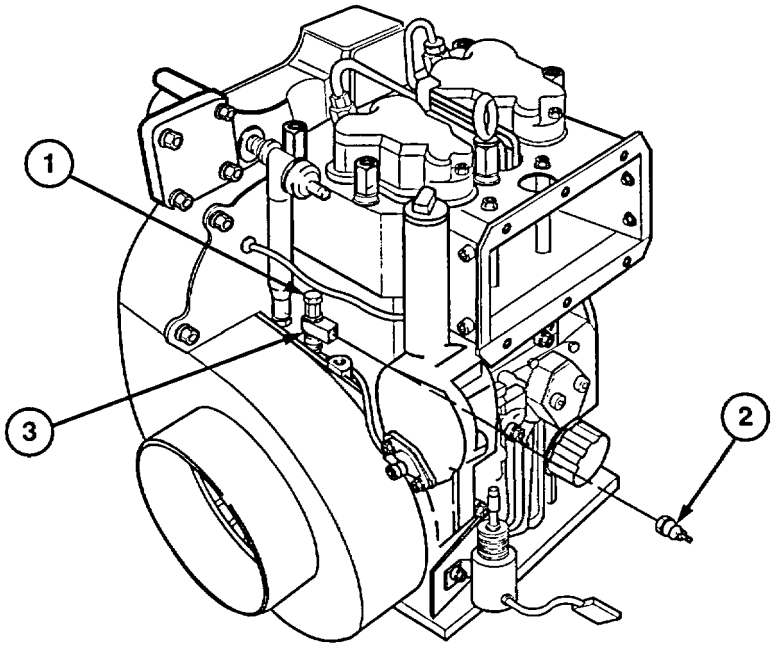
**NOTE**

**For easy access to oil switch, it may be necessary to loosen the screw (1) to turn manifold. (UOC: APP).**

Remove oil switch (2) from adapter (3).

### b. INSTALLATION

Coat threads of oil switch (2) with sealing compound (Item 17, Appendix D). Install switch (2) on adapter (3).




**FOLLOW-ON TASKS:**

- None

## 2-26. THERMOSTATIC SWITCH REPLACEMENT.

*This Task Covers:*

a. Removal

b. Cleaning

*Initial Setup:*

**Tools/Test Equipment:**
- General mechanic's tool kit, automotive (Item 15, Appendix G)

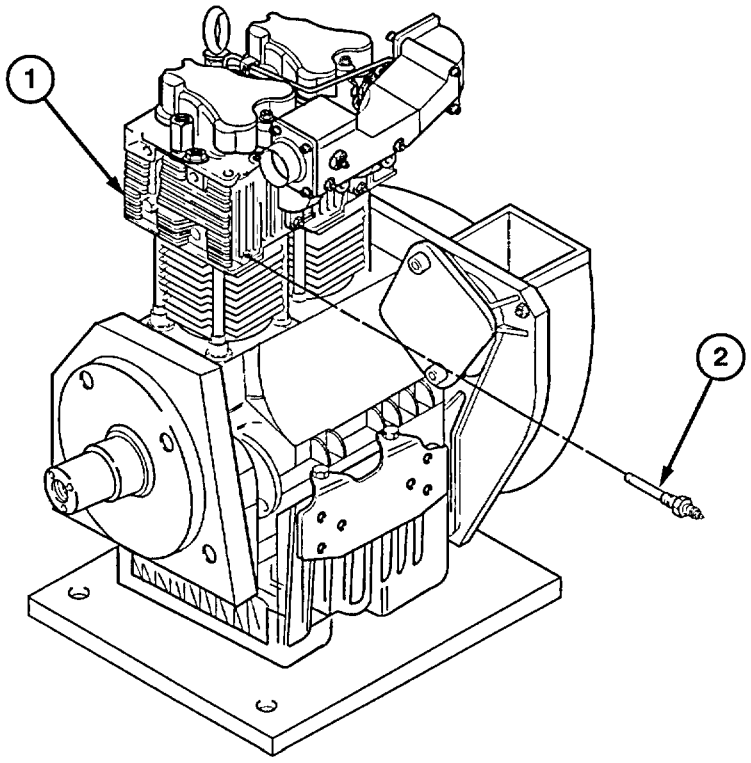
**Materials/Parts:**
- Airflow deflectors removed as needed (UOC: APP) (para 2-24).
- Airflow deflectors removed as needed (UOC: APJ) (TM 9-2350-292-20-2)

### a. REMOVAL

Remove thermostatic switch (2) from cylinder head (1) on auxiliary drive side of engine.

### b. INSTALLATION

Install thermostatic switch (2) in cylinder head (1) on auxiliary drive side of engine.




**FOLLOW-ON TASKS:**
- Install airflow deflectors (para 2-24), if any were removed (UOC:APP).
- Install airflow deflectors (TM 9-2350-292-20-2), if any were removed (UOC:APJ).

## 2-27. SOLENOID REPLACEMENT AND ADJUSTMENT (UOC:APP).

*This Task Covers:*

a. Removal
b. Installation
c. Adjustment

*Initial Setup:*

**Tools/Test Equipment:**
- General mechanic's tool kit, automotive (Item 15, Appendix G)
- Screwdriver attachment, 6 mm (Item 24, Appendix G)
- Socket wrench set, 3/8-inch drive (Item 27, Appendix G)

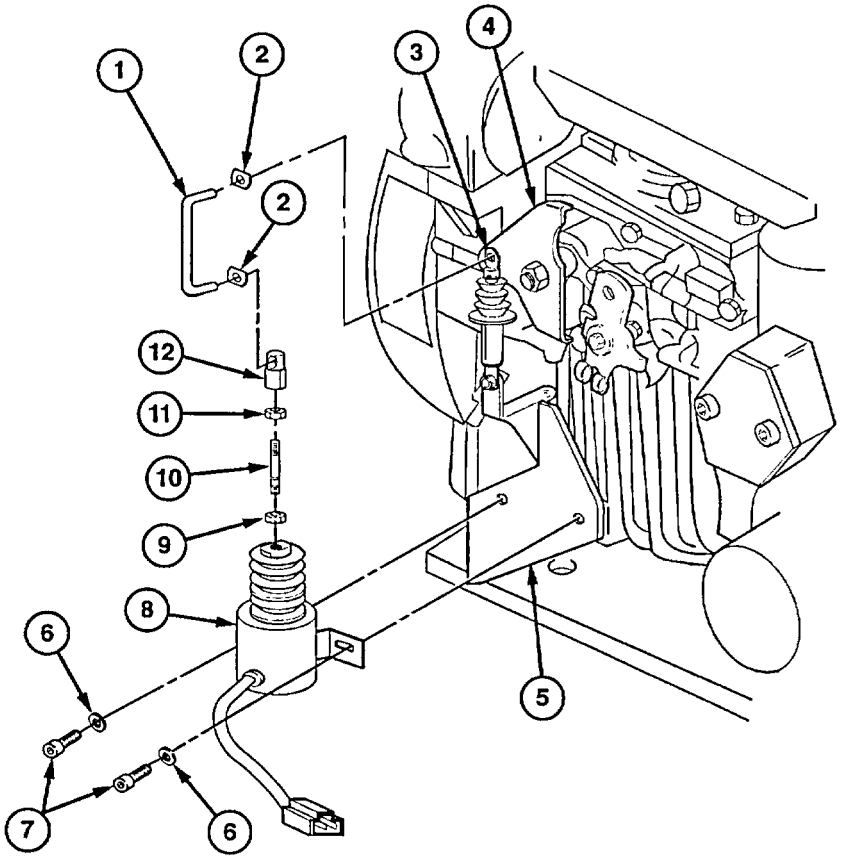
**Materials/Parts:**
- O-ring (Item 32, Appendix F)

### a. REMOVAL

1. Remove two clips (2) from connecting link (1). Remove connecting link (1) from governor lever (4), plunger (3), and solenoid (8).

2. Remove two screws (7) and washers (6) and solenoid (8) from bracket (5).

3. Remove stud (10) from solenoid (8). Remove connector (12) and two nuts (9 and 11) from stud (10).

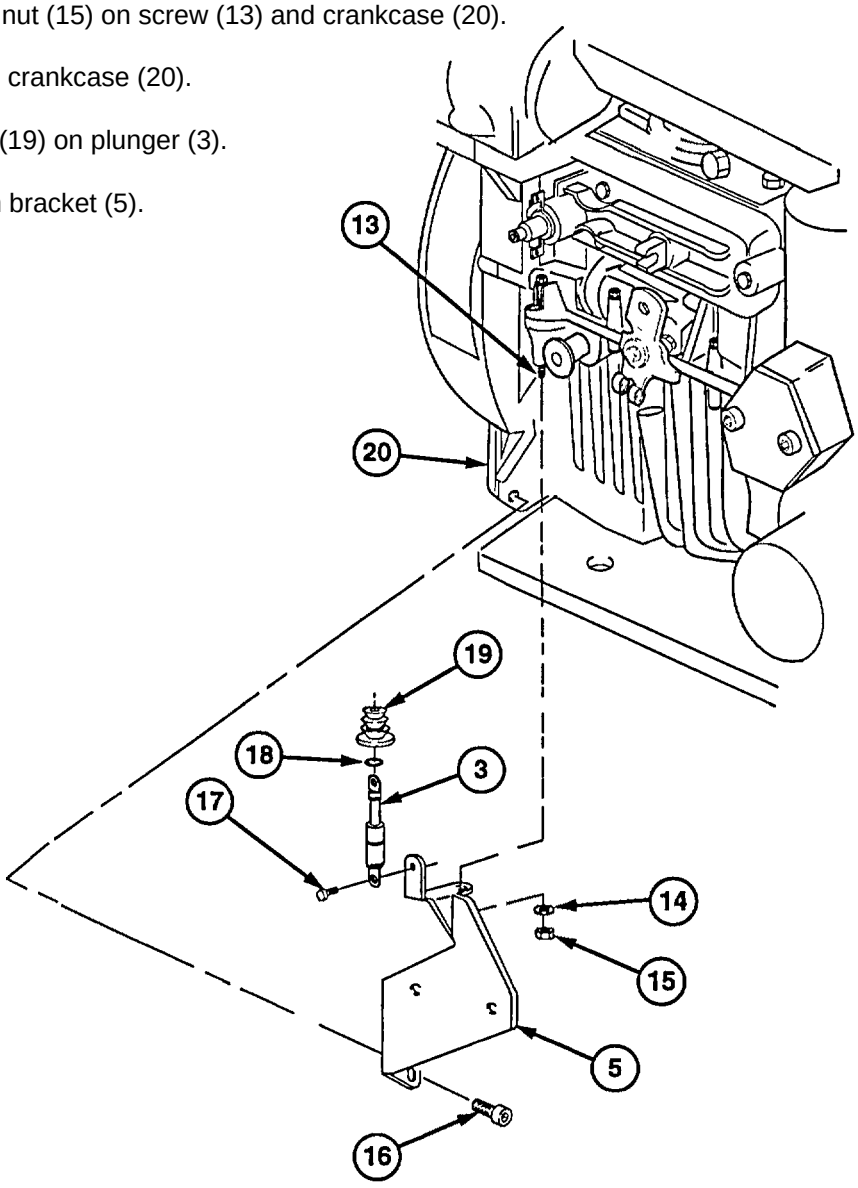


## 2-27. SOLENOID REPLACEMENT AND ADJUSTMENT (UOC:APP) (continued).

4. Remove screw (17) and plunger (3) from bracket (5).
5. Remove bellows (19) and O-ring (18) from plunger (3). Discard O-ring.
6. Remove screw (16) from bracket (5) and crankcase (20).
7. Remove nut (15), washer (14), and bracket (5) from screw (13) and crankcase (20).

**b. INSTALLATION**

1. Install bracket (5), washer (14), and nut (15) on screw (13) and crankcase (20).
2. Install screw (16) on bracket (5) and crankcase (20).
3. Install new O-ring (18) and bellows (19) on plunger (3).
4. Install plunger (3) and screw (17) on bracket (5).

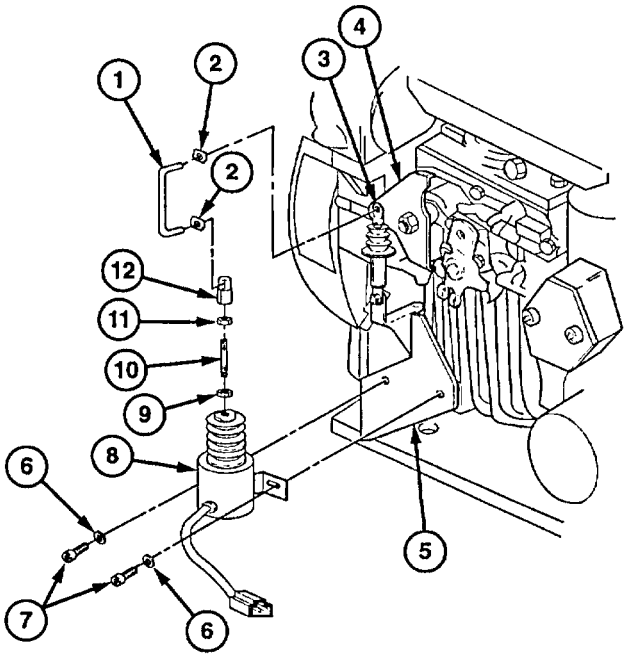


## 2-27. SOLENOID REPLACEMENT AND ADJUSTMENT (UOC:APP) (continued).

5. Install two nuts (9 and 11) and connector (12) on stud (10). Install stud (10) on solenoid (8).

6. Install solenoid (8) and two washers (6) and screws (7) on bracket (5).

7. Install connecting link (1) in plunger (3), governor lever (4), and solenoid (8). Secure connecting link (1) with two clips (2).




**c. ADJUSTMENT**

1. Loosen two nuts (9 and 11) on stud (10).

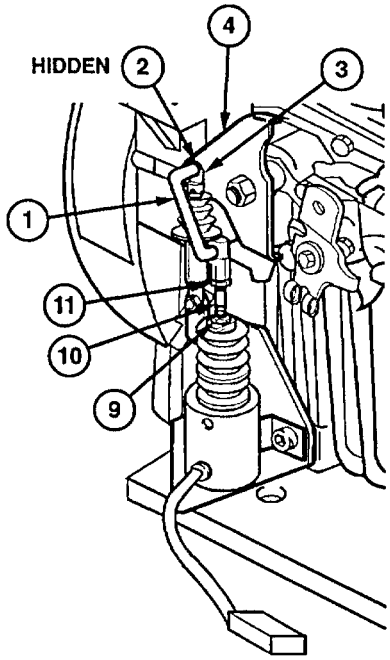
2. Remove top clip (2) from connecting link (1). Remove connecting link (1) from governor lever (4) and plunger (3).

3. Rotate governor lever (4) fully counterclockwise, to the off position, and push stud (10) all the way down.

4. Turn stud (10) until connecting link (1) reaches governor lever (4) while stud (10) remains pushed all the way down. Install connecting link (1) in governor lever (4) and plunger (3).

5. Tighten two nuts (9 and 11).

6. Install top clip (2) on connecting link (1).




**FOLLOW-ON TASKS:**

- None

# CHAPTER 3
# DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE

## Section I. DIRECT SUPPORT AND GENERAL SUPPORT TROUBLESHOOTING



### 3-1. GENERAL.

a. This section provides information for identifying and correcting malfunctions that may develop while operating or maintaining the Diesel Engine Assembly, Hatz 2 G 40.

b. The Quick Guide to Troubleshooting (para 3-2) lists common malfunctions of the diesel engine or its components and refers you to the appropriate paragraph in the Troubleshooting Chart (para 3-3). You should perform the tests/inspections and corrective actions in the order listed in the chart.

c. If you are unsure of the location of an item mentioned in troubleshooting, refer to paragraph 1-12 or to the maintenance task where the item is replaced.

d. Before performing troubleshooting, read and follow all safety instructions listed in the warning summary at the beginning of this manual.

e. This section cannot list all malfunctions that may occur, or all tests or inspections and corrective actions. If a malfunction is not listed or is not corrected by the corrective action listed, notify your supervisor.

f. When troubleshooting a malfunction:

- In the Quick Guide to Troubleshooting, locate the symptom or symptoms that best describe the malfunction.
- Turn to the subparagraph in the Troubleshooting Chart where the troubleshooting procedures for the malfunction in question are described.
- Perform each step in the order listed until the malfunction is corrected. DO NOT perform any maintenance task unless the troubleshooting procedure tells you to do so.

g. When troubleshooting any electrical system or component, exercise extreme care in order to prevent electric shock.

**WARNING**

- **To prevent injury due to electric shock throughout troubleshooting of the electrical system or electrical components, be certain MASTER switch is turned off between every step unless otherwise directed.**
- **To prevent injury due to electric shock, remove all jewelry and metal objects when working on the electrical system.**

h. The multimeter is used throughout troubleshooting of the electrical system. When using the multimeter, make sure it is used with a probe kit.

i. When performing a continuity check, connect the meter probes to both terminals of the circuit you are testing. Read the meter and interpret the results. If the needle swings to near 0 on the top scale, the circuit has continuity. If the needle does not move, the circuit is open. If the needle jumps or flickers, there is a loose connection.

## 3-2. QUICK GUIDE TO TROUBLESHOOTING.

| ITEM | SYMPTOM | PARAGRAPH |
|---|---|---|
| ENGINE | ENGINE CRANKS, BUT STARTS HARD OR FAILS TO START. | para 3-3a(i) |
| | OIL CONSUMPTION IS EXCESSIVE. | para 3-3a(2) |
| | FUEL CONSUMPTION IS EXCESSIVE, AND THERE IS BLACK EXHAUST SMOKE. | para 3-3a(3) |
| | ENGINE HAS LOW POWER OR MISFIRES. | para 3-3a(4) |
| | ENGINE MAKES A KNOCKING SOUND. | para 3-3a(5) |
| GOVERNOR | ENGINE SPEED IS ERRATIC. | para 3-3b |

## 3-3. TROUBLESHOOTING CHART.

| a. ENGINE | (1) ENGINE CRANKS, BUT STARTS HARD OR FAILS TO START. |
|---|---|

A. Inspect fuel lines and fittings for leaks.

Are there leaks?

NO — YES

Replace defective fuel lines and fittings (para 2-23). Verify problem is solved.

B. Perform fuel injector test (para 3-21).

Do fuel injectors pass test?

NO — YES

Replace fuel injector(s) (para 3-14). Verify problem is solved.

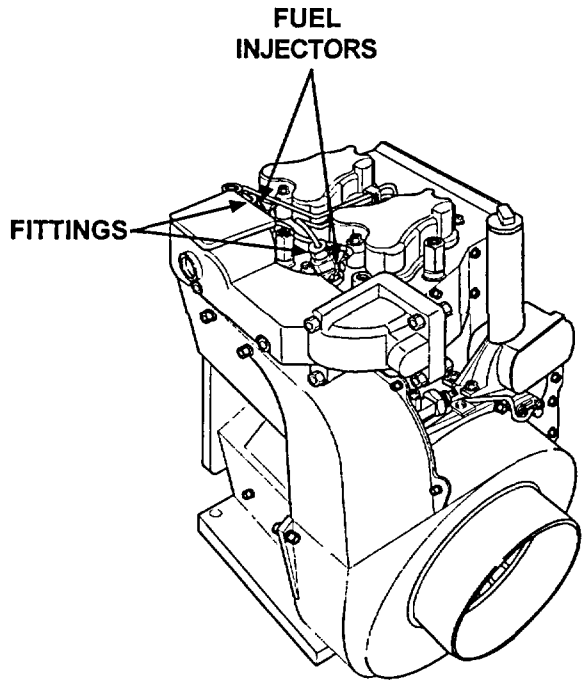
C. Perform injection pump test (para 3-20).

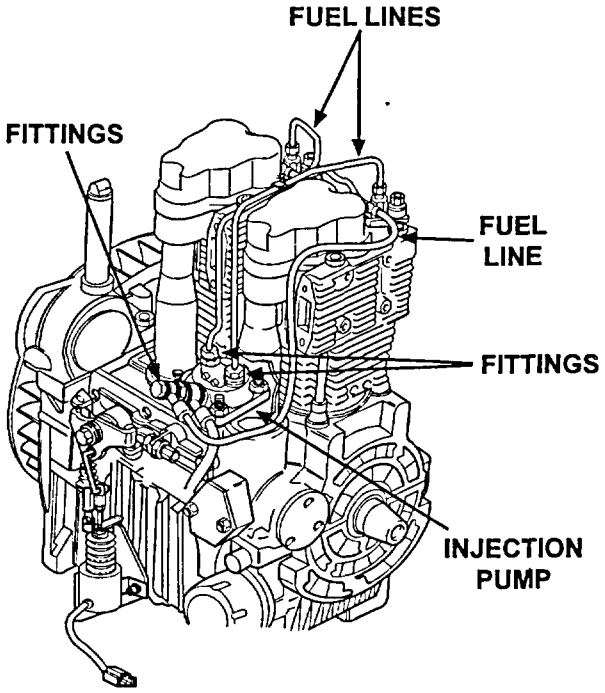
Does injection pump pass test?

NO — YES

Replace injection pump (para 3-15). Verify problem is solved.

GO TO STEP D

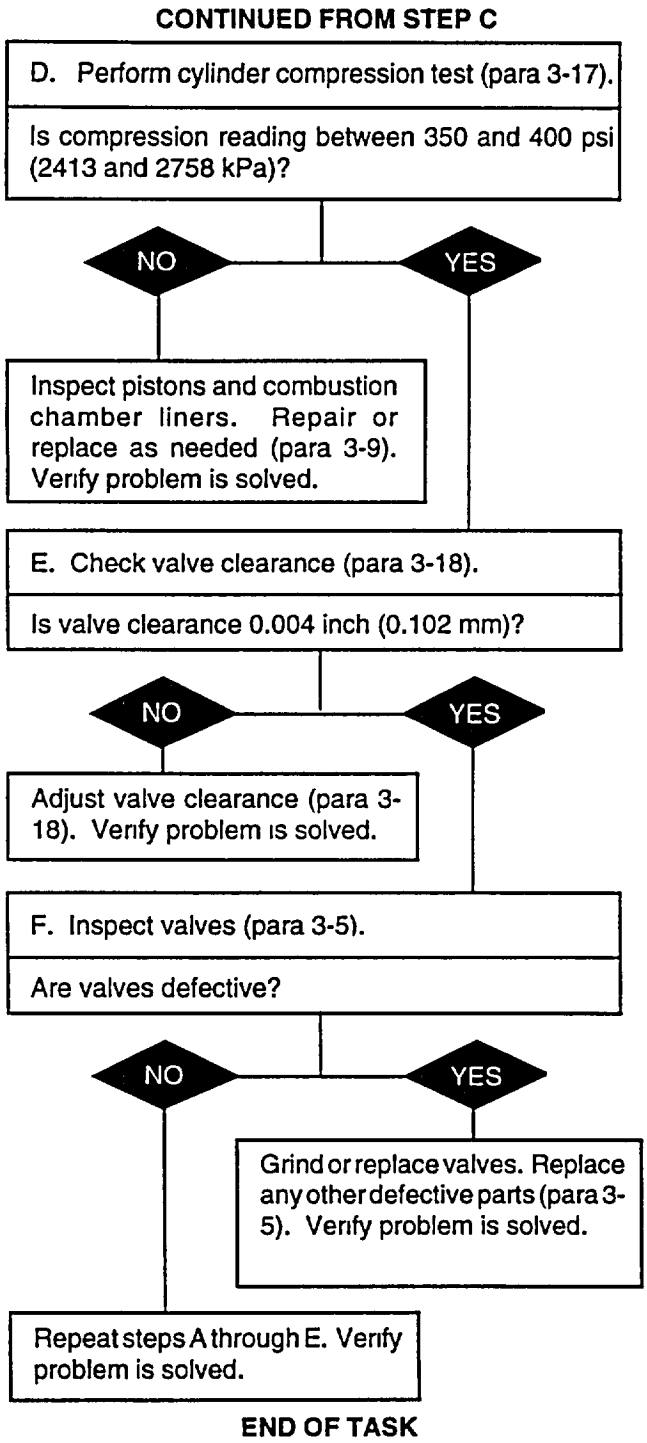



FOR PURPOSES OF CLARITY, AIRFLOW DEFLECTORS AND INTAKE MANIFOLD ARE NOT SHOWN.

**3-3. TROUBLESHOOTING CHART (continued).**

| | |
|---|---|
| a. ENGINE | (1) ENGINE CRANKS, BUT STARTS HARD OR FAILS TO START (continued). |



## 3-3. TROUBLESHOOTING CHART (continued).

a. ENGINE

(2) OIL CONSUMPTION IS EXCESSIVE.

A. Check oil tube assemblies and fittings for leaks.

Are there any leaks?

NO — YES

Replace any defective oil tube assemblies and fittings (para 2-19). Verify problem is solved.

B. Check two oil seals on crankshaft, oil pan gasket, and O-rings on filler neck and oil pump cover for leaks.

Are there any leaks?

NO — YES

Replace any defective oil seals, O-rings, or gasket (paras 3-6, 3-12, and 3-13). Verify problem is solved.

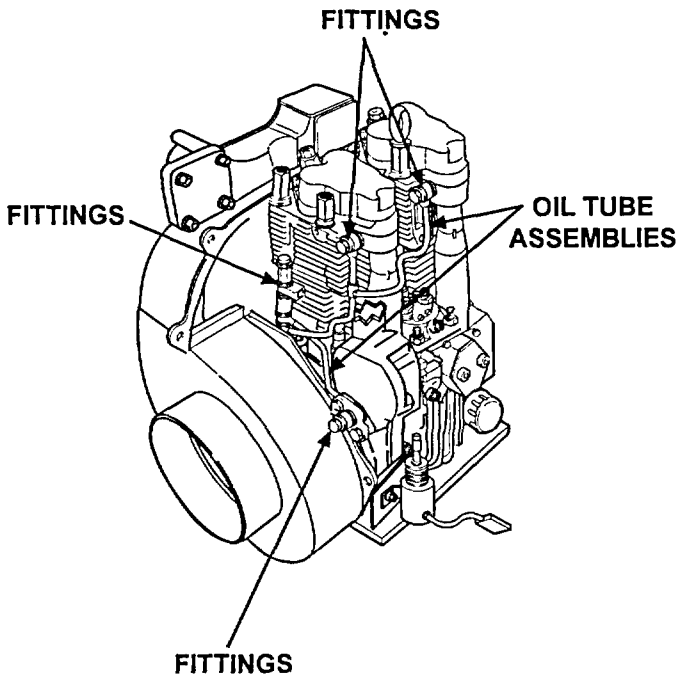
C. Check thermostatic switch for continuity by placing red lead of multimeter on connector of switch and grounding black lead.

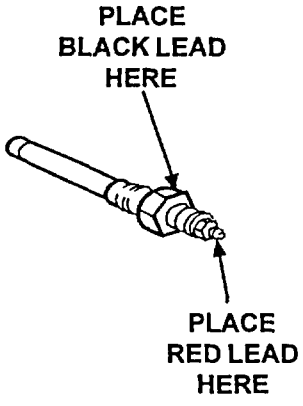
Is there continuity?

NO — YES

Replace thermostatic switch (para 2-26). Verify problem is solved.

**GO TO STEP D**



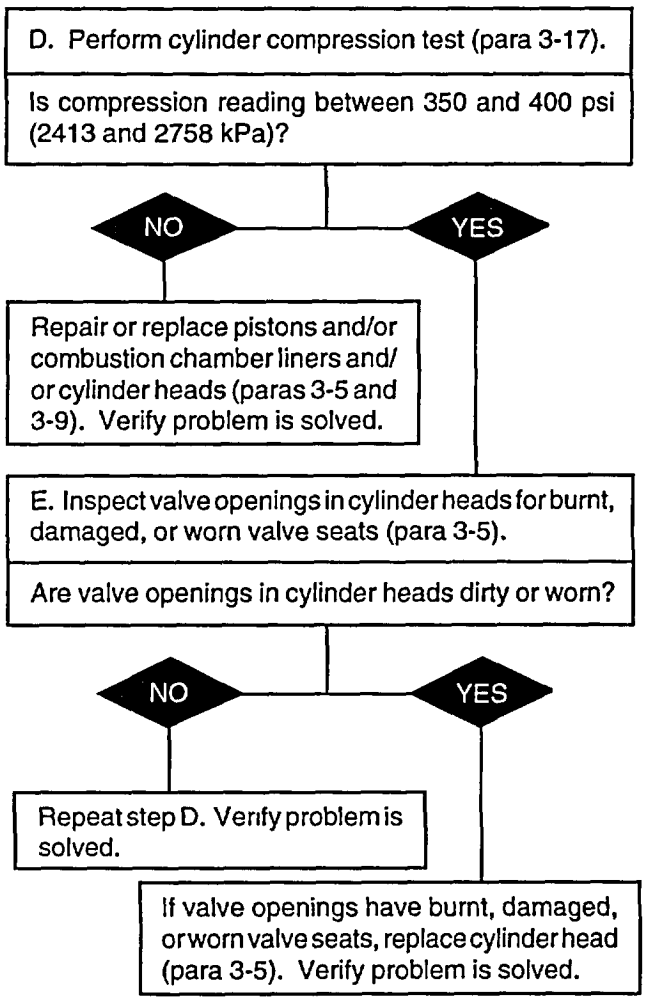



**3-3. TROUBLESHOOTING CHART (continued).**

a. ENGINE

(2) OIL CONSUMPTION IS EXCESSIVE (continued).

**CONTINUED FROM STEP C**




**END OF TASK**

**3-3. TROUBLESHOOTING CHART (continued).**

| | | | |
|---|---|---|---|
| a. | ENGINE | (3) | FUEL CONSUMPTION IS EXCESSIVE, AND THERE IS BLACK EXHAUST SMOKE. |

A. Perform fuel injector test (para 3-21).

Do fuel injectors pass test?

NO — Replace fuel injector(s) (para 3-14). Verify problem is solved.

YES

B. Perform injection pump test (para 3-20).

Does injection pump pass test?

NO — Replace injection pump (para 3-15). Verify problem is solved.

YES

C. Perform cylinder compression test (para 3-17).

Is compression reading between 350 and 400 psi (2413 and 2758 kPa)?

NO — Repair or replace pistons and/or combustion chamber liners (para 3-9). Verify problem is solved.

YES

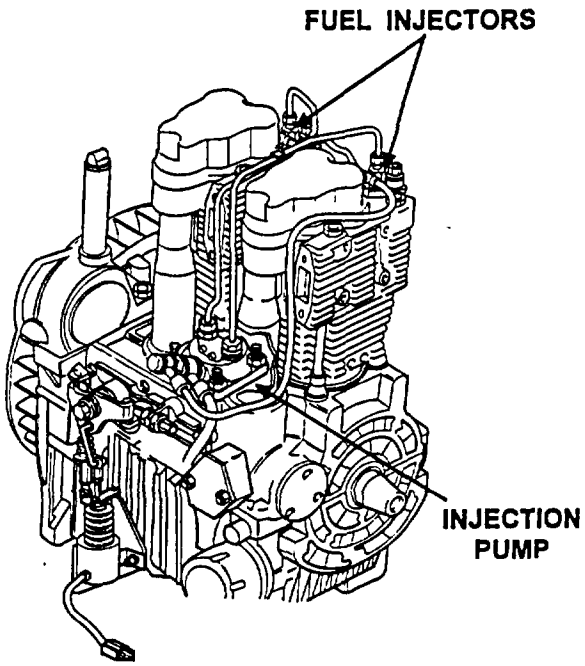
D. Inspect valves and valve seats (para 3-5).

Are valves and/or valve seats burnt, bent, or worn?

NO — Repeat steps A through C. Verify problem is solved.

YES — Replace or grind valves and valve seats (para 3-5). Verify problem is solved.

**END OF TASK**



**3-3. TROUBLESHOOTING CHART (continued).**

a. ENGINE

(4) ENGINE HAS LOW POWER OR MISFIRES.

A. Inspect fuel lines and fittings for leaks.

Are there leaks?

NO / YES

Replace any defective fuel lines and fittings (para 2-23). Verify problem is solved.

B. Perform fuel injector test (para 3-21).

Do fuel injectors pass test?

NO / YES

Replace fuel injector(s) (para 3-14). Verify problem is solved.

C. Perform injection pump test (para 3-20).

Does injection pump pass test?

NO / YES

Replace injection pump (para 3-15). Verify problem is solved.

D. Perform cylinder compression test (para 3-17).

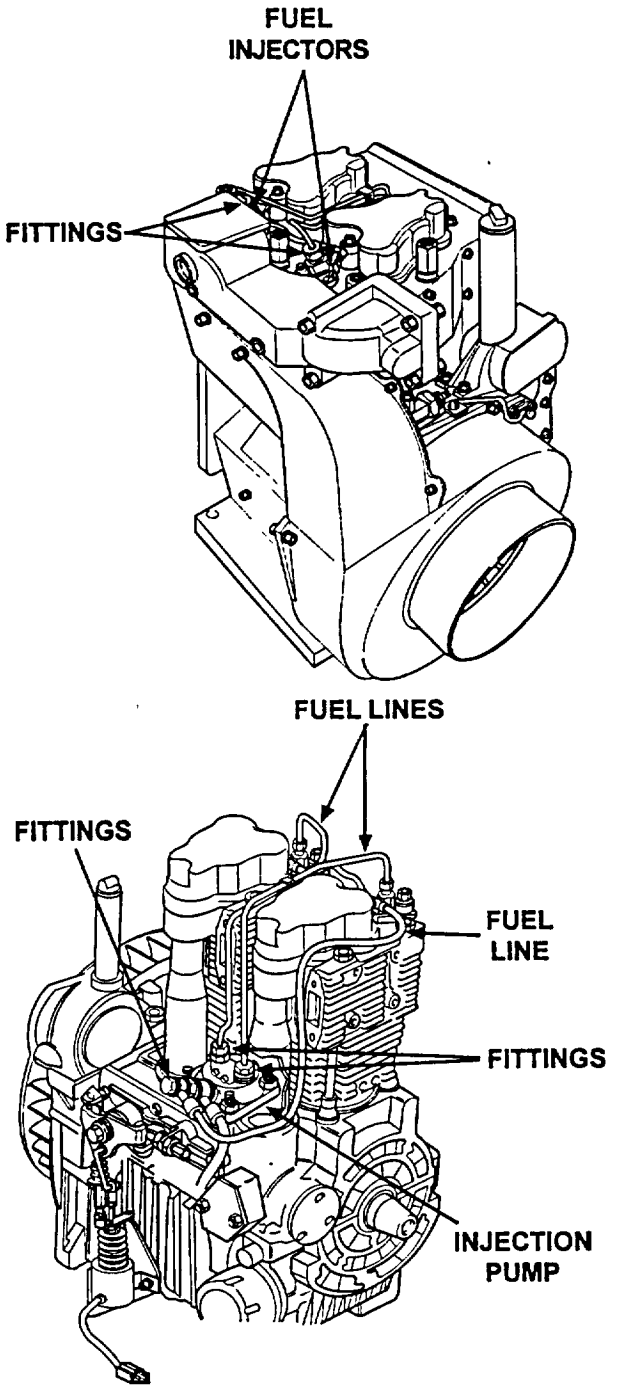
Is compression reading between 350 and 400 psi (2413 and 2758 kPa)?

NO / YES

Repair or replace pistons and/or combustion chamber liners (para 3-9). Verify problem is solved.

Repeat steps B through D. Verify problem is solved.

**END OF TASK**




**FOR PURPOSES OF CLARITY, AIRFLOW DEFLECTORS AND INTAKE MANIFOLD ARE NOT SHOWN.**

**3-3. TROUBLESHOOTING CHART (continued).**

a. ENGINE

(5) ENGINE MAKES A KNOCKING SOUND.

A. Inspect fuel lines and fittings for leaks.

Are there leaks?

NO

YES

Replace defective fuel lines and fittings (para 2-23). Verify problem is solved.

B. Perform fuel injector test (para 3-21).

Do fuel injectors pass test?

NO

YES

Replace fuel injector(s) (para 3-14). Verify problem is solved.

C. Perform injection pump test (para 3-20).

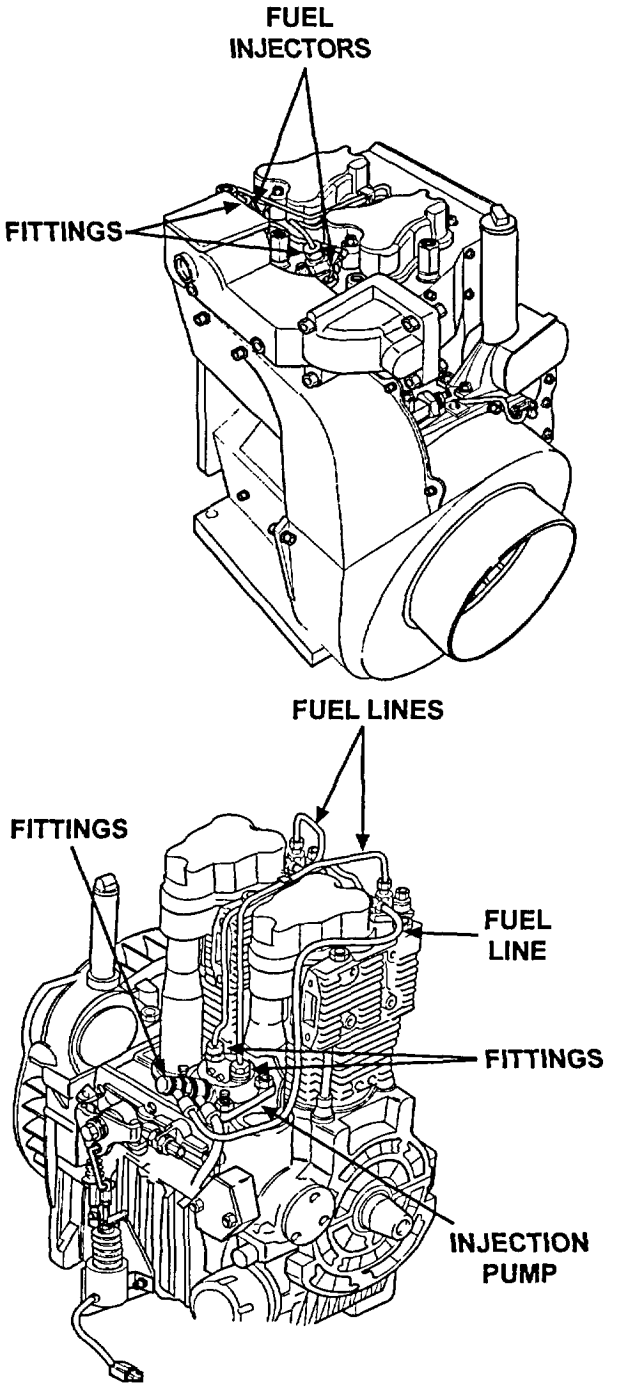
Does injection pump pass test?

NO

YES

Replace injection pump (para 3-15). Verify problem is solved.

GO TO STEP D




FOR PURPOSES OF CLARITY, AIRFLOW DEFLECTORS AND INTAKE MANIFOLD ARE NOT SHOWN.

**3-3. TROUBLESHOOTING CHART (continued).**

a. ENGINE

(5) ENGINE MAKES A KNOCKING SOUND (continued).

**CONTINUED FROM C**

D. Check for engine overheating.

Does engine overheat?

NO / YES

Remove airflow deflectors and clean any obstructions. Replace airflow deflectors (para 2-24). Verify problem is solved.

E. Check to see if knocking sound is coming from crankcase.

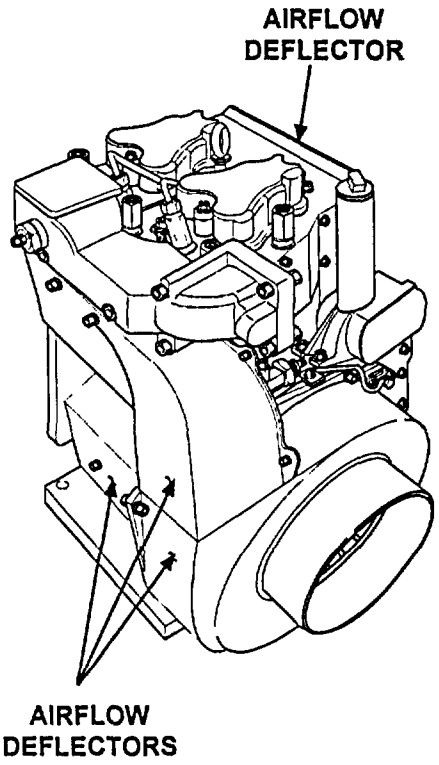
Is knocking sound coming from crankcase?

NO / YES

Inspect piston assemblies and combustion chamber liners. Replace any defective or worn parts. Tighten any loose screws on connecting rod caps. Replace worn retaining rings (para 3-9). Verify problem is solved.

Inspect camshaft, valves, and cylinder heads. Replace any defective or worn parts (paras 3-5 and 3-11). Verify problem is solved.

**END OF TASK**



## 3-3. TROUBLESHOOTING CHART (continued).

b. GOVERNOR — ENGINE SPEED IS ERRATIC.

A. Inspect fuel lines and fittings for leaks.

Are there leaks?

NO — YES

Replace any defective fuel lines and fittings (para 2-23). Verify problem is solved.

B. Check for air restrictions in the intake manifold or airflow deflectors.

Are there any restrictions?

NO — YES

Clear out restrictions. Verify problem is solved.

C. Check engine governor speed (para 3-22).

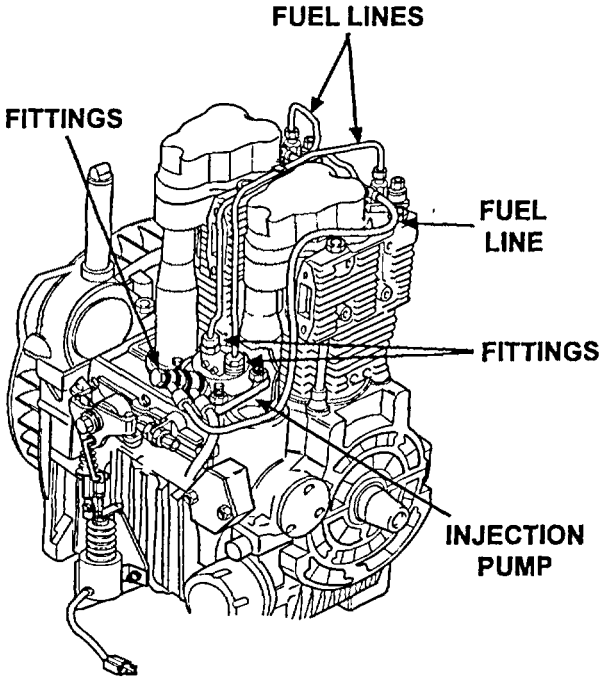
Is governor speed within limits specified (para 3-22)?

NO — YES

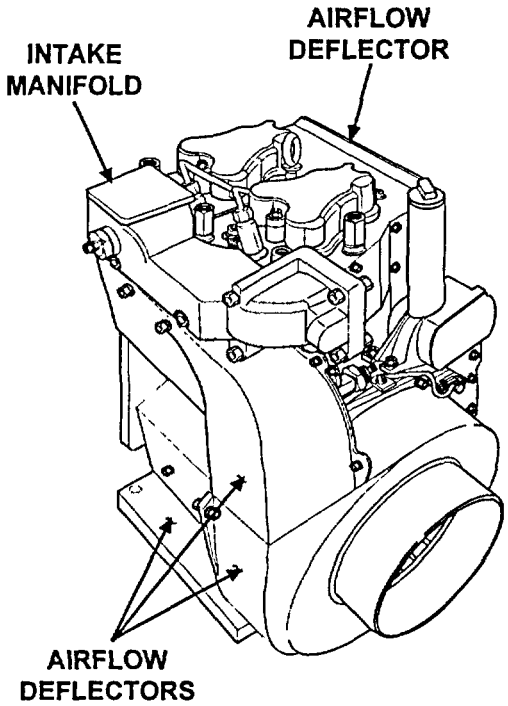
Adjust governor speed (para 3-22). Verify problem is solved.

Repair or replace governor control assembly (para 3-16). Verify problem is solved.

**END OF TASK**




**FOR PURPOSES OF CLARITY, AIRFLOW DEFLECTORS AND INTAKE MANIFOLD ARE NOT SHOWN.**



## SECTION II. DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE PROCEDURES



### 3-4. MOUNTING PLATES REPLACEMENT.

*This Task Covers:*

a. Removal
b. Cleaning
c. Installation

*Initial Setup:*

**Tools/Test Equipment:**
- General mechanic's tool kit, automotive (Item 15, Appendix G)
- Screwdriver attachment, 6 mm (Item 24, Appendix G)
- Socket wrench set, 3/8-inch drive (Item 27, Appendix G)

**Materials/Parts:**
- Drycleaning solvent (Item 4, Appendix D)
- Grease, automotive (Item 5, Appendix D)
- Rag (Item 7, Appendix D)
- Sealing compound (Item 10, Appendix D)
- Sealing compound (Item 12, Appendix D)
- Lockwasher (8) (Item 23, Appendix F)
- Seal (Item 48, Appendix F)

**Equipment Conditions**
- Auxiliary Drive Adapter Removed (para 3-4.1)

#### a. REMOVAL

**NOTE**

**Mark position of engine mounting plate on crankcase before removing mounting plate from crankcase.**

1. Remove eight screws (6) and lockwashers (7) and engine mounting plate (5) from crankcase (1). Discard lockwashers.
2. Remove four screws (3) and mounting plate (2) from crankcase (1).
3. Remove seal (4) from mounting plate (2). Discard seal.

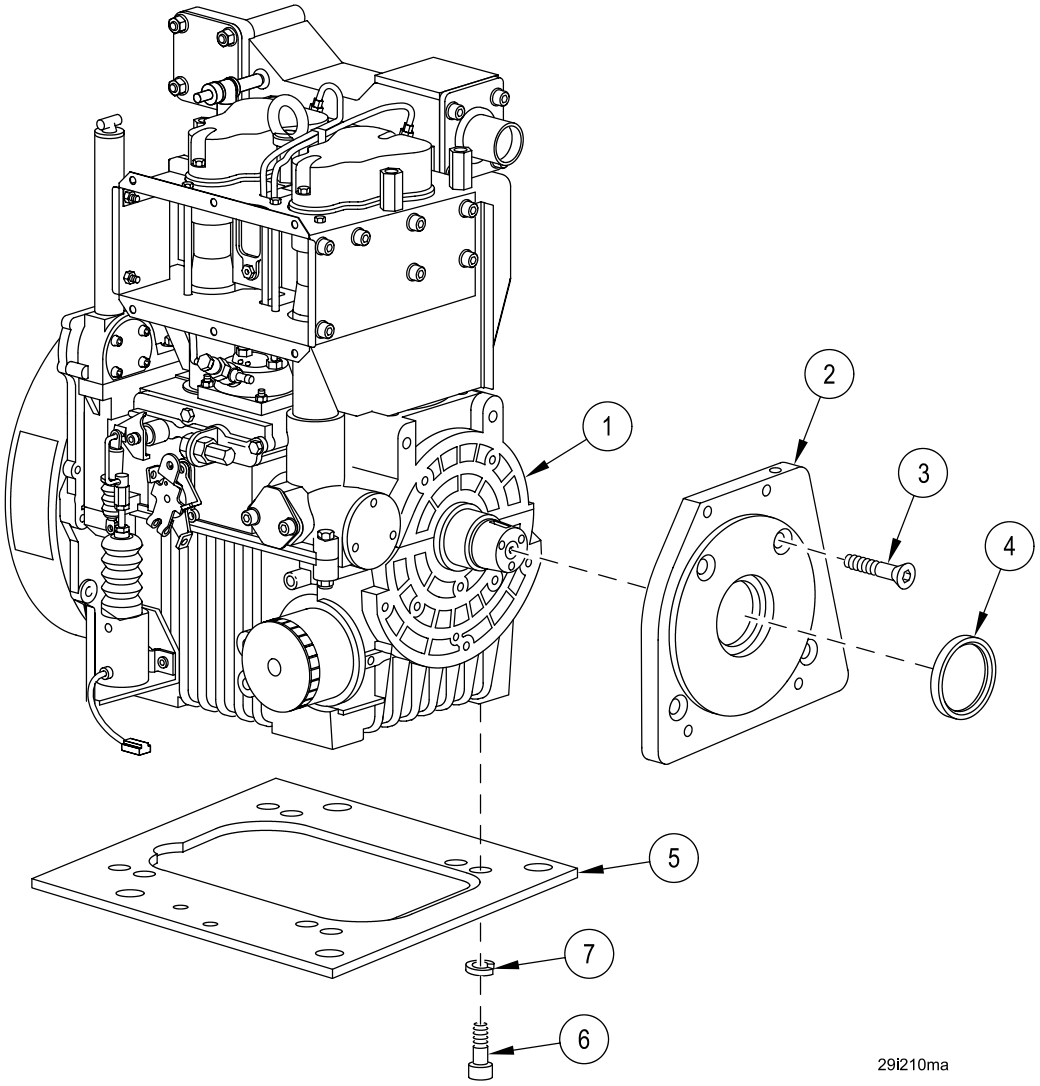
**3-4. MOUNTING PLATES REPLACEMENT (continued).**

**b. CLEANING**

**WARNING**

**Drycleaning solvent P-D-680 is toxic and flammable. Always wear protective goggles and gloves and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat.**

Using drycleaning solvent and a rag, clean sealing compound from both mounting plates.



**3-4. MOUNTING PLATES REPLACEMENT (continued).**

**c. INSTALLATION**

1. Apply light coat of grease to new seal (4). Install seal (4) on mounting plate (2) with secondary sealing lip facing inboard and primary sealing lip facing outboard.

2. Apply sealing compound (Item 10, Appendix D) under four screws (3) and designated surface of crankcase (1) that will come in contact with mounting plate (2).

2.1 Apply loctite 242 (Item 13, Appendix D) to threads of screws (3).

**CAUTION**

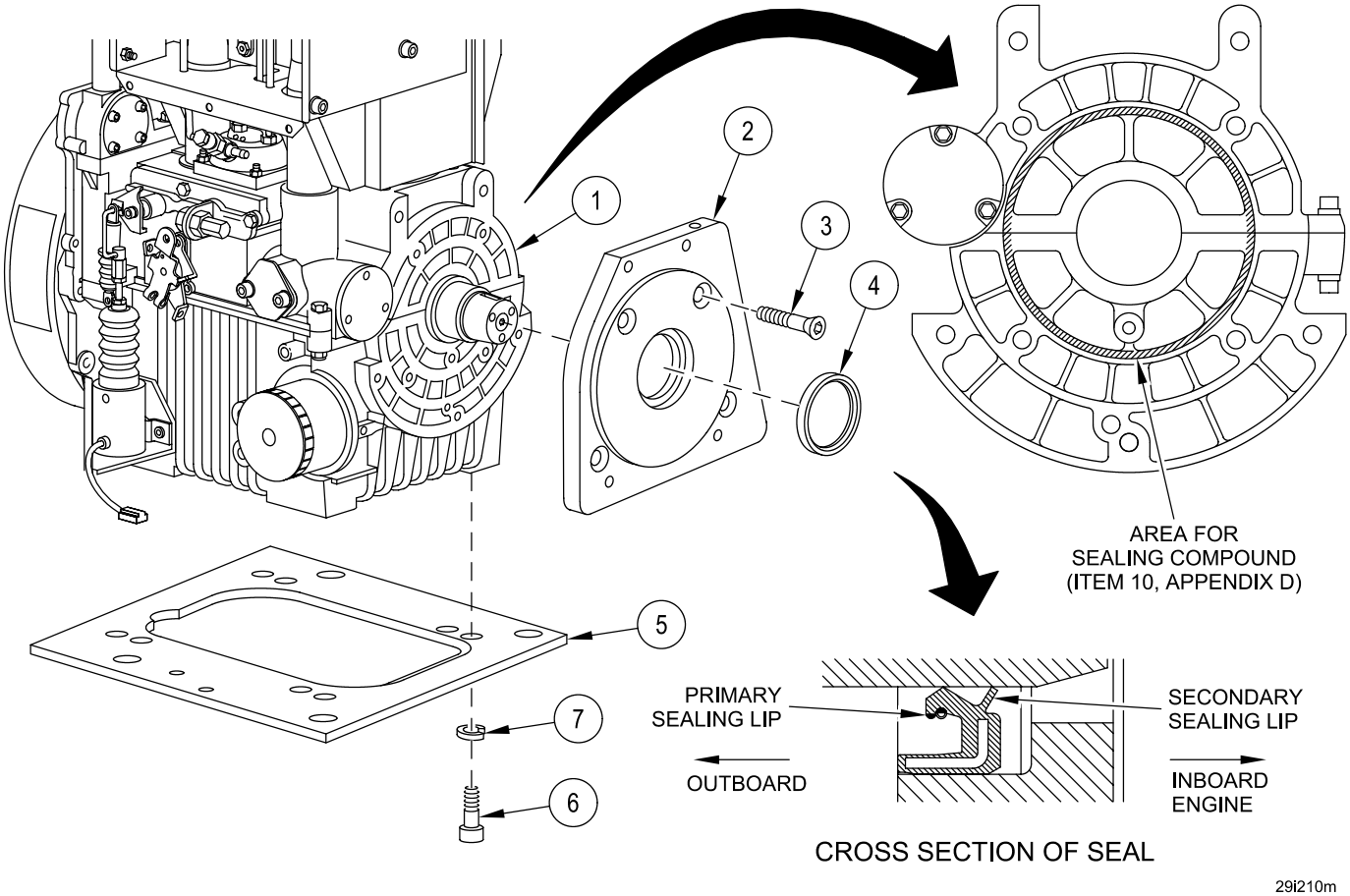
**Use extreme caution not to damage new seal when installing mounting plate on crankcase.**

3. Install mounting plate (2) on crankcase (1) and secure with four screws (3). Torque screws (35-38 ft-lbs (47-52 N•m).

**NOTE**

**Use marks made during removal to install engine mounting plate correctly.**

4. Apply sealing compound (Item 12, Appendix D) to eight screws (6). Install engine mounting plate (5) on crankcase (1) and secure with eight new lockwashers (7) and screws (6). Torque screws (35-38 ft-lbs (47-52 N•m).




**FOLLOW-ON TASKS:**

- install drive adapter (para 3-4.1)

## 3-4.1 AUXILIARY DRIVE ADAPTER REPLACEMENT

*This Task Covers:*

a. Removal

b. Installation

*Initial Setup:*

**Tools/Test Equipment:**
- General mechanic's tool kit, automotive (Item 15, Appendix G)

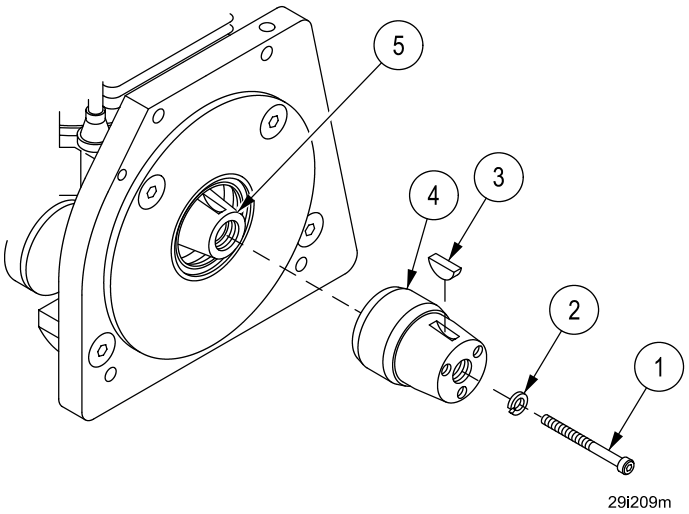
**Materials/Parts:**
- Sealing compound (Item 13, Appendix D)

### a. REMOVAL

Remove socket screw (1), lockwasher (2), woodruff key (3) and drive adapter (4) from crankshaft (5).

### b. INSTALLATION

1. Install drive adapter (4) with woodruff key (3) onto crankshaft (5).
2. Apply sealing compound (Item 13, Appendix D) to threads of socket screw (1).
3. Install socket screw (1), lockwasher (2) into crankshaft (5). Torque screw to 37 ft-lb (50 N•m).



## 3-5. CYLINDER HEADS REPAIR

*This Task Covers:*

a. Removal
b. Cleaning and Inspection
c. Adjustment
d. Machining
e. Installation.

*Initial Setup:*

**Tools/Test Equipment:**

- Cylinder alignment bracket (Item 6, Appendix G)
- Depth gage rule (Item 9, Appendix G)
- General mechanic's tool kit, automotive (Item 15, Appendix G)
- Torque wrench, 1/2-inch drive (Item 31, Appendix G
- Valve face grinding machine (Item 33, Appendix G)
- Valve seat grinding kit (Item 34, Appendix G)
- Valve spring lifter (Item 35, Appendix G)

**Materials/Parts:**

- Carbon-removing compound (Item 3, Appendix D)
- Drycleaning solvent (Item 4, Appendix D)
- Rag (Item 7, Appendix D)
- Head gasket set (Item 3, Appendix F)

**Equipment Conditions:**

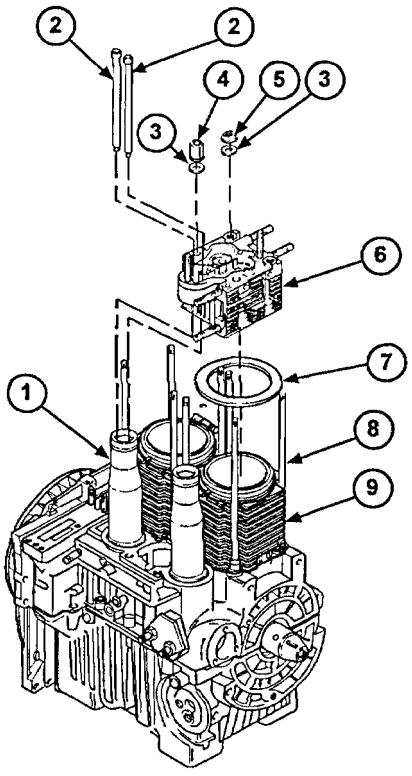
- Eyebolt removed (UOC: APP) (para 2-16).
- Lifting bracket removed (UOC: APJ) (TM 9-2350-292-20-2)
- Rocker arm assemblies removed (para 3-10).
- Airflow deflectors removed (UOC: APP) (para 2-24).
- Air flow deflectors removed (UOC: APJ) (TM 9-2350-292-20-2)
- Intake manifold removed (para 2-21).
- Fuel injectors removed (para 3-14).
- Oil tube assemblies removed (para 2-19).
- Exhaust manifold removed (UOC: APJ)
- Thermostatic switch removed (para 2-26).

### a. REMOVAL

1. Remove two push rods (2) from each of two guides (1).

2. Remove five extended plain nuts (4), three plain nuts (5), and eight washers (3) from eight studs (8).

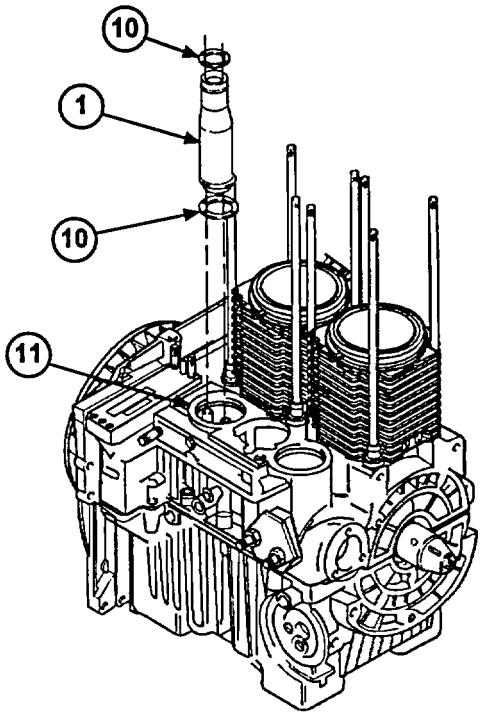
3. Remove two cylinder heads (6) and gaskets (7) from two combustion chamber liners (9). Discard gaskets.



**3-5. CYLINDER HEADS REPAIR (continued).**

4. Remove two guides (1) from two recesses in crankcase (11).

5. Remove two O-rings (10) from two grooves in each of two guides (1). Discard O-rings.

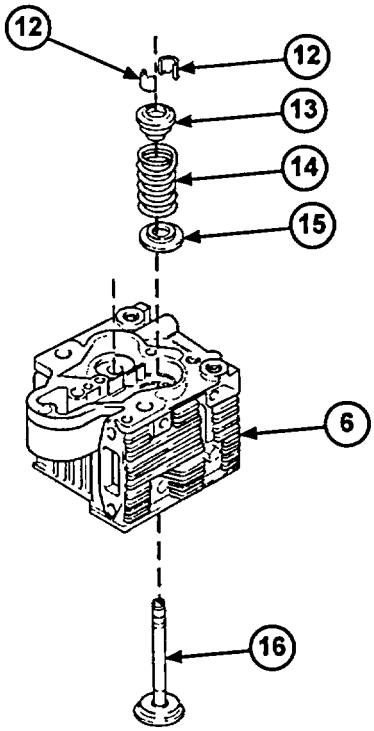



**NOTE**

- **There are two valves, intake and exhaust, in each of two cylinder heads. Follow steps 6 and 7 for each of them.**
- **Part numbers are different for the intake and exhaust valves, but the valves are removed the same way. This procedure describes the removal of an exhaust valve.**

6. Using a valve spring lifter, compress valve spring (14) and remove two valve spring retainer locks (12) from valve spring (14) and exhaust valve (16).

7. Remove valve spring retainer washer (13), valve spring (14), and base spring washer(15) from exhaust valve (16). Remove exhaust valve (16) from bottom of cylinder head (6).




**b. CLEANING AND INSPECTION**

1. Inspect four push rods for bends or wear on four sockets at ends of push rods. Replace any push rods if bent or if sockets are worn.

2. Clean valves and valve seats with carbon removing compound.

**WARNING**

**Drycleaning solvent P-D-680 is toxic and flammable. Always wear protective goggles and gloves and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat.**

3. Using drycleaning solvent and rag, clean valves, springs, washers, locks, and valve seat.

**3-5. CYLINDER HEADS REPAIR (continued).**

4. Inspect valves and valve seats for cracks, burns, or bends. Replace any cracked, burned, or bent valves. If valve seats are cracked or burned, replace cylinder head.

**c. ADJUSTMENT**

**CAUTION**

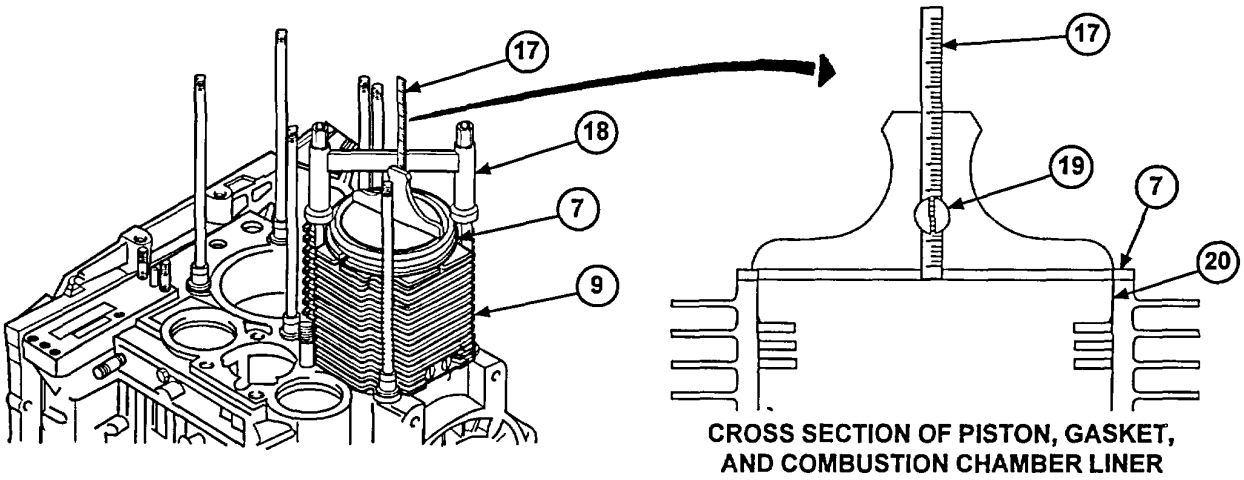
**If, after removing the cylinder head, you have replaced the combustion chamber liner, piston, connecting rod, or crankshaft, the valve-to-piston clearance must be checked.**

**Too little clearance will result in damage to pistons, cylinder heads, and valves. Too much clearance will cause the engine to lose power and be difficult to start.**

**NOTE**

- **There are two pistons on the engine. Follow steps 1 through 4 to adjust the valve-to-piston clearance on each of them.**
- **Gaskets come in various thicknesses. It may be necessary to try several different gaskets to achieve the desired valve-to-piston clearance. Use only one gasket on each combustion chamber liner.**

1. Install new gasket (7), with a thickness of 0.60 mm, and cylinder alignment bracket (18) on combustion chamber liner (9).




**CROSS SECTION OF PISTON, GASKET, AND COMBUSTION CHAMBER LINER**

**NOTE**

**Make sure piston is as high as possible in the combustion chamber.**

2. Place bottom of depth gage rule (17) across piston (20) and gasket (7). Loosen screw (19) and slide depth gage rule (17) down to crown of piston (20). Be sure to measure highest part of piston (20). Tighten screw (19) and read measurement. Clearance should be no less than 0.024 inch (0.61 mm) and no greater than 0.026 inch (0.66 mm).

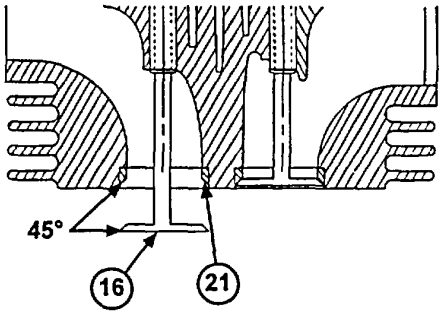
3. If clearance is incorrect, repeat steps 1 and 2 using a gasket with a different thickness.

4. When clearance is correct, remove cylinder alignment bracket (18) from combustion chamber liner (9), leaving gasket (7) in place.

## 3-5. CYLINDER HEADS REPAIR (continued).

### d. MACHINING

Grind exhaust valve (16) and valve seat (21) to a 45-degree angle. If necessary, repeat for other valves.




### e. INSTALLATION

**NOTE**

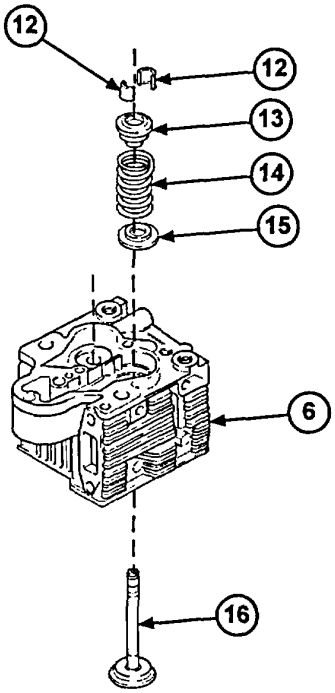
- **There are two valves, intake and exhaust, in each of two cylinder heads. Follow steps 1 and 2 for each of them.**
- **Part numbers are different for the intake and exhaust valves, but the valves are installed the same way. This procedure describes the installation of an exhaust valve.**

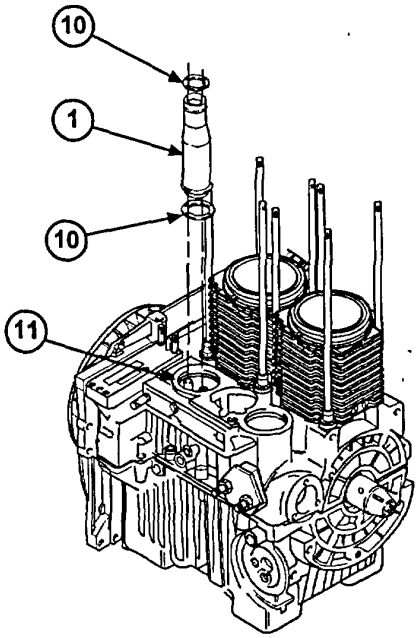
1. Install exhaust valve (16) in cylinder head (6). Place base spring washer (15) over exhaust valve (16). Install valve spring (14) over exhaust valve (16) so it is seated on base spring washer (15). Place valve spring retainer washer (13) on valve spring (14).

2. Using a valve spring lifter, compress valve spring (14) and install two valve spring retainer locks (12) in valve spring retainer washer (13).

3. Install two new O-rings (10) in two grooves on each of two guides (1).

4. Install two guides (1) in two recesses in crankcase (11).

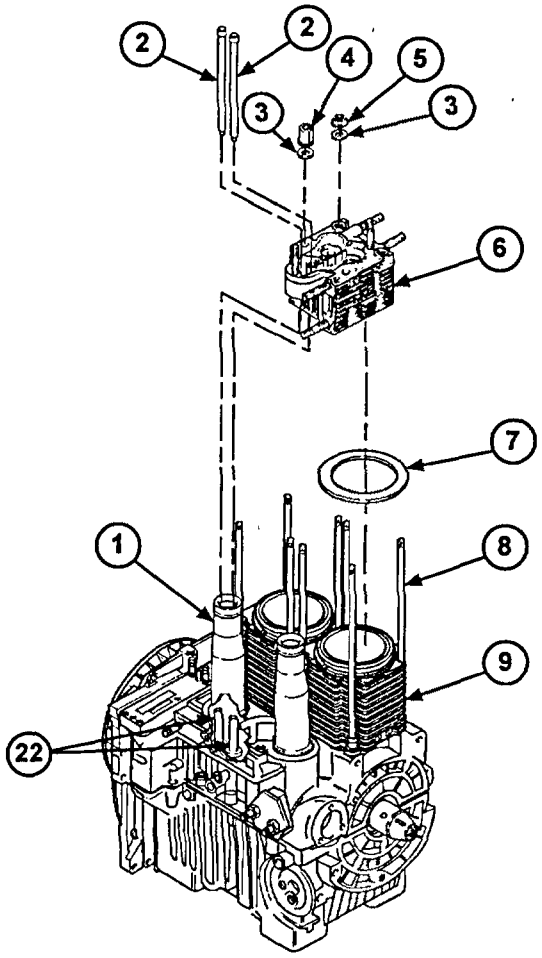


## 3-5. CYLINDER HEADS REPAIR (continued).

5. Install two push rods (2) in two guides (1). Make sure each push rod (2) rests on a tappet (22).

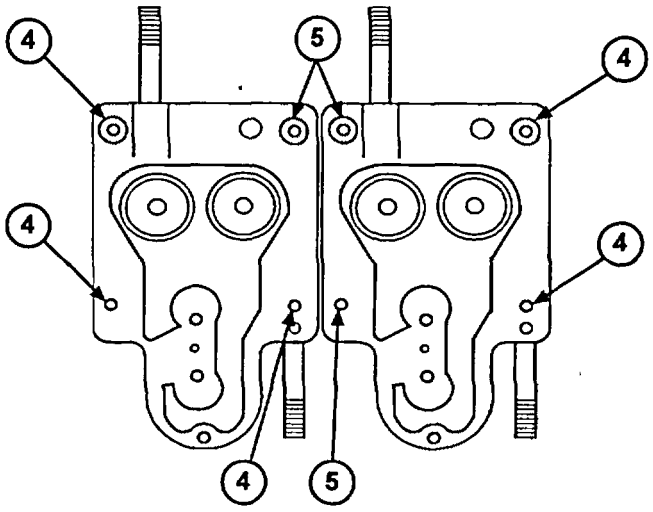
6. Place two cylinderheads (6) on two combustion chamber liners (9), making sure two gaskets (7) are in place.




7. Install eight washers (3), five extended plain nuts (4), and three plain nuts (5) on eight studs (8). Torque nuts to 40 ft-lb (55 Nom). See diagram below for correct placement of extended plain nuts (4) and plain nuts (5).

**FOLLOW-ON TASKS:**

- Install thermostatic switch (para 2-26).
- Install exhaust manifold (UOC: APJ) (TM 9-2350-292-20-2)
- Install oil tube assemblies (para 2-19).
- Install fuel injectors (para 3-14).
- Install intake manifold (para 2-21).
- Install airflow deflectors (UOC: APP) (para 2-24).
- Install airflow deflectors (UOC: APJ) (TM 9-2350-292-20-2)
- Install rocker arm assemblies (para 3-10).
- Install eyebolt (UOC: APP) (para 2-16).
- Install lifting bracket (UOC: APJ) (TM 9-2350-292-20-2)



## 3-6. CRANKCASE REPAIR

*This Task Covers:*

a. Disassembly
b. Assembly
c. Test

*Initial Setup:*

**Tools/Test Equipment:**
- General mechanic's tool kit, automotive (Item 15, Appendix G)
- Steel rule (Item 28, Appendix G)

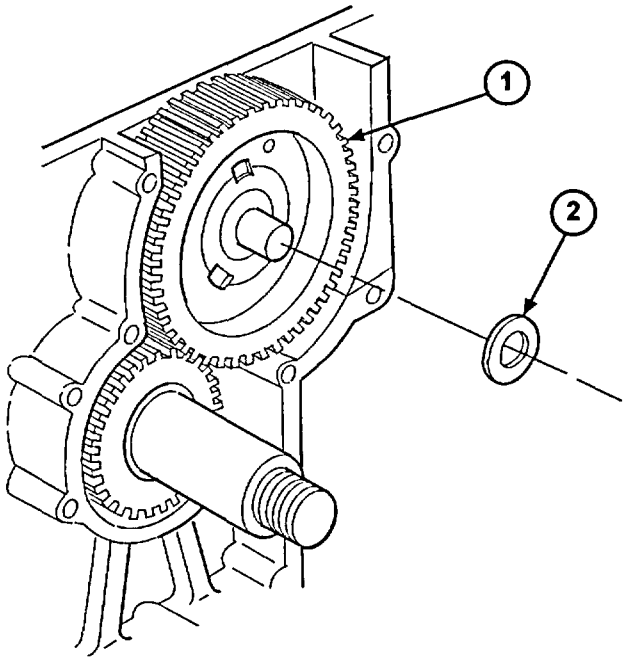
**Materials/Parts:**
- Grease, automotive (Item 5, Appendix D)
- Lubricating oil (Item 6, Appendix D)
- Sealing compound (Item 10, Appendix D)
- Crankcase gasket set (Item 1, Appendix F)
- Shim (Item 5 or 6, Appendix F)
- Spring tension washer (2) (Item 31, Appendix F)

**Personnel Required:** Two

**Equipment Conditions:**
- Pistons and combustion chamber liners removed (para 3-9)
- Flywheel, auxiliary drive hardware, and flywheel housing removed (para 3-8)
- Solenoid removed (para 2-27)
- Governor control assembly removed (para 3-16)

### a. DISASSEMBLY

1. Remove shim (2) from camshaft gear (1).




2. Remove hose coupling (6) and gasket (7) from upper crankcase (23). Discard gasket.

3. Remove two screws (18) and spring tension washers (17), access cover (16), and gasket (15) from upper crankcase (23). Discard gasket and spring tension washers.

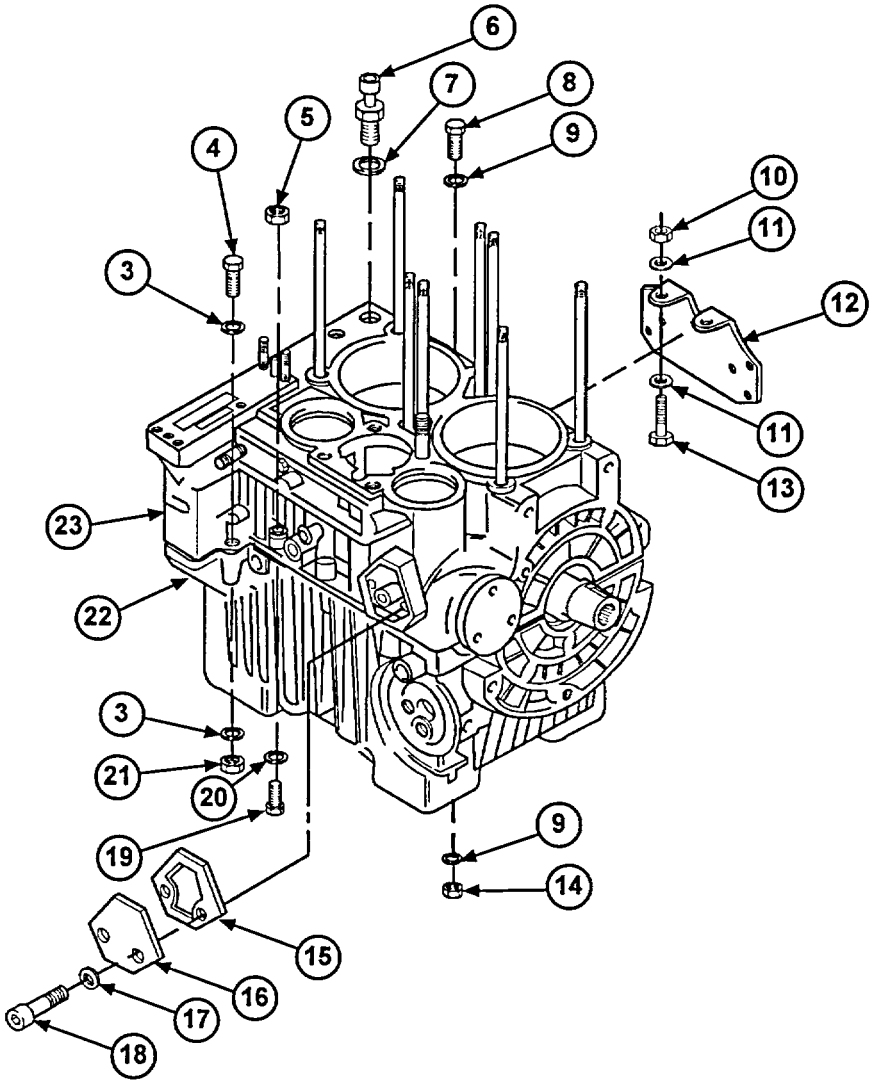
**3-6. CRANKCASE REPAIR (continued).**

4. Remove nut (21), two washers (3), and screw (4) from upper crankcase (23) and lower crankcase (22) on injection-pump side of engine.

5. Remove three nuts (5), washers (20), and screws (19) from upper crankcase (23) and lower crankcase (22) on injection-pump side of engine.

6. Remove three nuts (14), six washers (9), and three screws (8) from upper crankcase (23) and lower crankcase (22) on starter side of engine.

7. Remove two nuts (10), four washers (11), two screws (13), and air duct bracket (12) from upper crankcase (23) and lower crankcase (22).



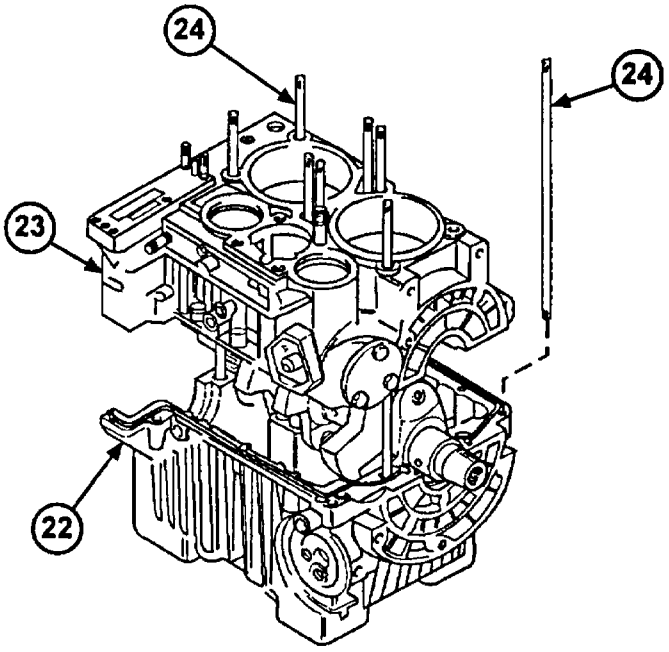
**3-6. CRANKCASE REPAIR (continued).**

8. Remove upper crankcase (23) from eight studs (24) on lower crankcase (22). Set upper crankcase (23) top down on work surface.

9. Inspect eight studs (24) and remove any bent or damaged studs from lower crankcase (22). Discard removed studs.

10. Remove two gaskets (25 and 26) from upper crankcase (23). Discard gaskets.

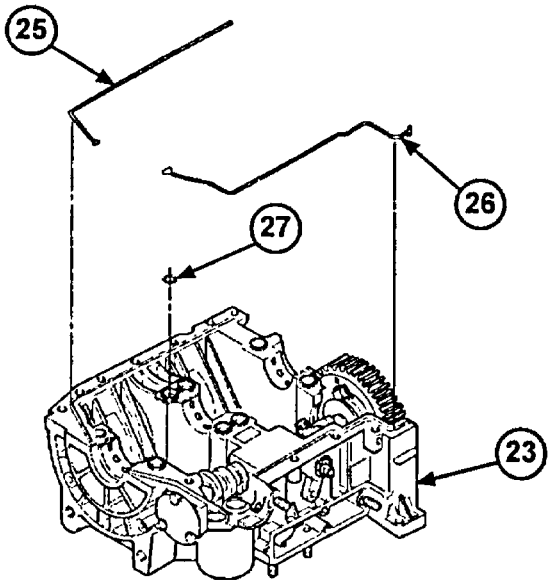
11. Remove eight O-rings (27) from eight grooves in upper crankcase (23). Discard O-rings.

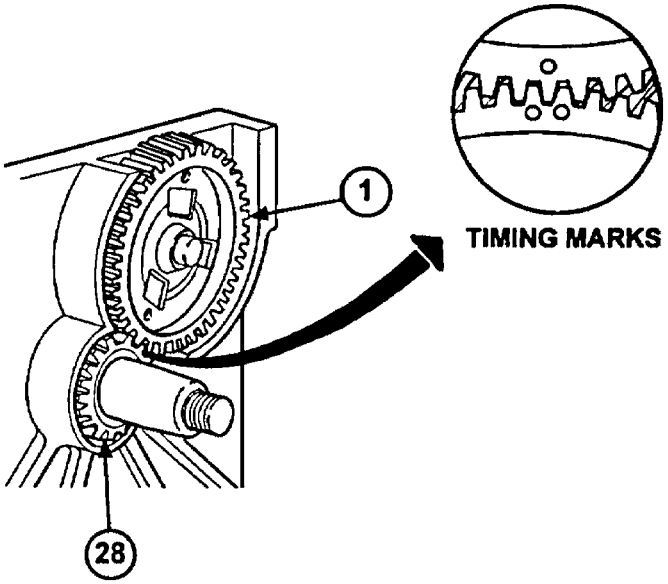



**b. ASSEMBLY**

1. Apply grease to eight new 0-rings (27). Install eight O-rings (27) on eight grooves in upper crankcase (23).

2. Apply sealing compound to ends of two new gaskets (25 and 26). Lightly coat the rest of each gasket (25 and 26) with lubricating oil. Install two gaskets (25 and 26) on upper crankcase (23).




3. Apply GAA (Item 5, Appendix D) to threads of studs (24). Install eight new studs (24), if removed.

**CAUTION**

**During installation of upper crankcase, rotate crank gear so timing mark on crank gear is between two timing marks on camshaft gear. Failure to align timing marks correctly may cause damage to the engine.**

4. With the aid of an assistant, install upper crankcase (23) on eight studs (24) and lower crankcase (22). Make sure timing marks on crankshaft gear (28) and camshaft gear (1) are aligned and that two gaskets (25 and 26) and eight O-rings (27) stay in place.

**3-6. CRANKCASE REPAIR (continued).**

5. Install air duct bracket (12) on upper crankcase (23) and lower crankcase (22). Secure loosely with two screws (13), four washers (11), and two nuts (10)

6. Install three screws (8), six washers (9), and three nuts (14) loosely securing upper crankcase (23) to lower crankcase (22) on starter side of engine.

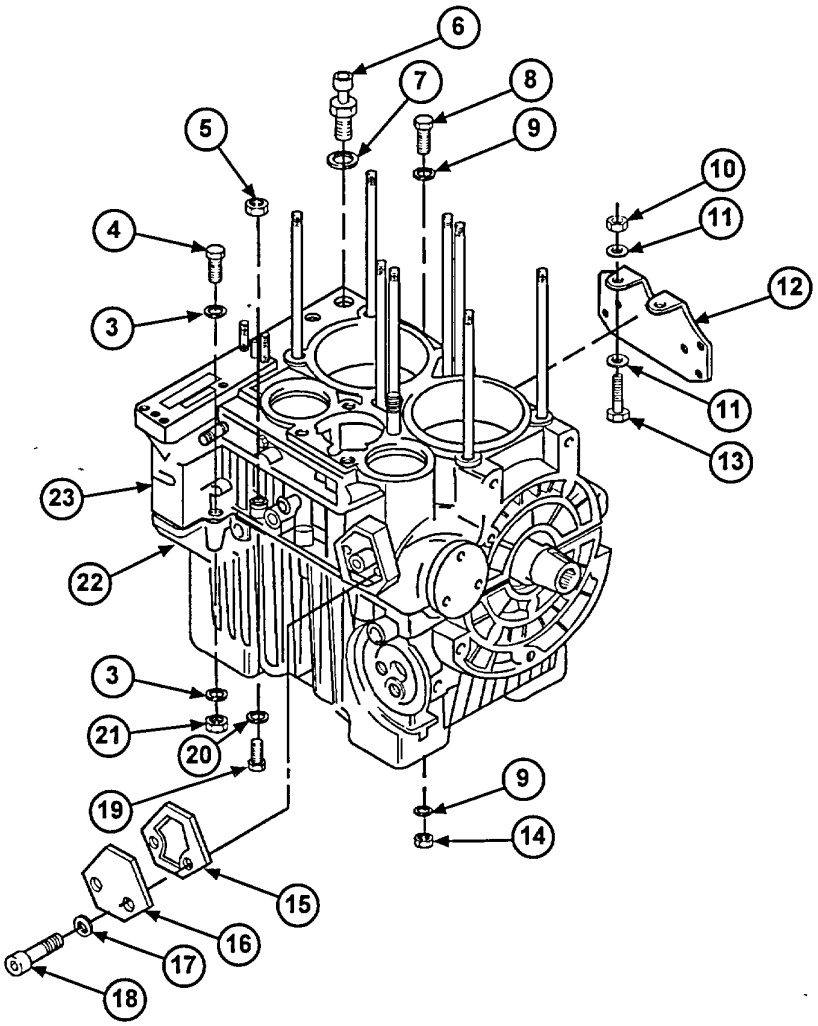
7. Install three screws (19), washers (20), and nuts (5) loosely securing upper crankcase (23) to lower crankcase (22) on injection-pump side of engine.

8. Install screw (4), two washers (3), and nut (21) loosely securing upper crankcase (23) to lower crankcase (22) on injection-pump side of engine.

9. Tighten nine screws (13, 8, 19, and 4), starting with the center front and back of the engine.

10. Install new gasket (15), access cover (16), and two new spring tension washers (17) and screws (18) on upper crankcase (23).

11. Install new gasket (7) and hose coupling (6) on upper crankcase (23).



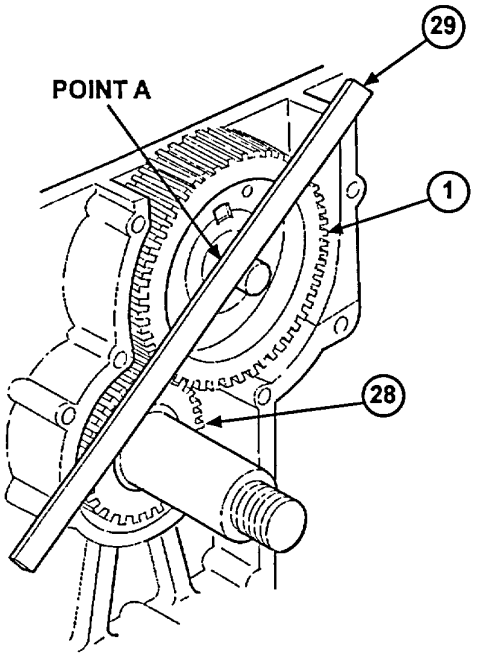
**3-6. CRANKCASE REPAIR (continued).**

**c. TEST**

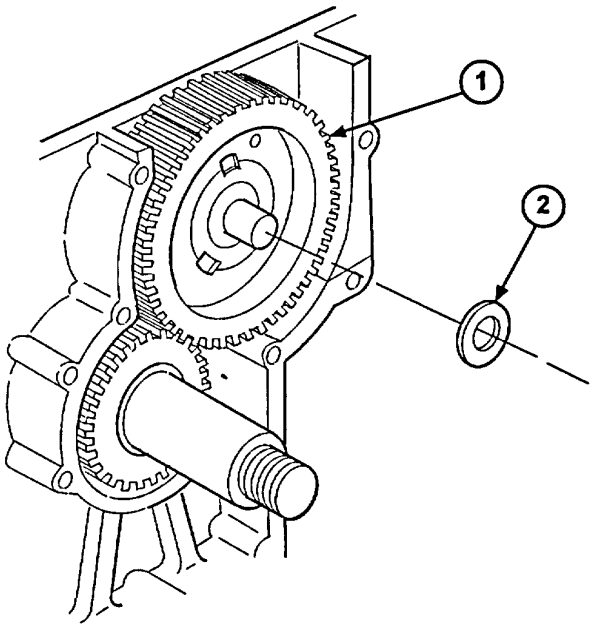
**NOTE**

- **This test procedure determines the offset between the camshaft gear and the crankshaft gear and gives instruction about how to correct the offset, if necessary.**
- **Perform this test only if the camshaft, camshaft gear, crankshaft, or crankshaft gear has been replaced.**

1. Place steel rule (29) across crankshaft gear (28) and camshaft gear (1). Using feeler gage, measure any distance at point A between steel rule (29) and camshaft gear (1). There should be 0.00-inch gap.




2. On camshaft gear (1), install shim(s) (2) of appropriate thickness to completely fill any distance measured in step 1.

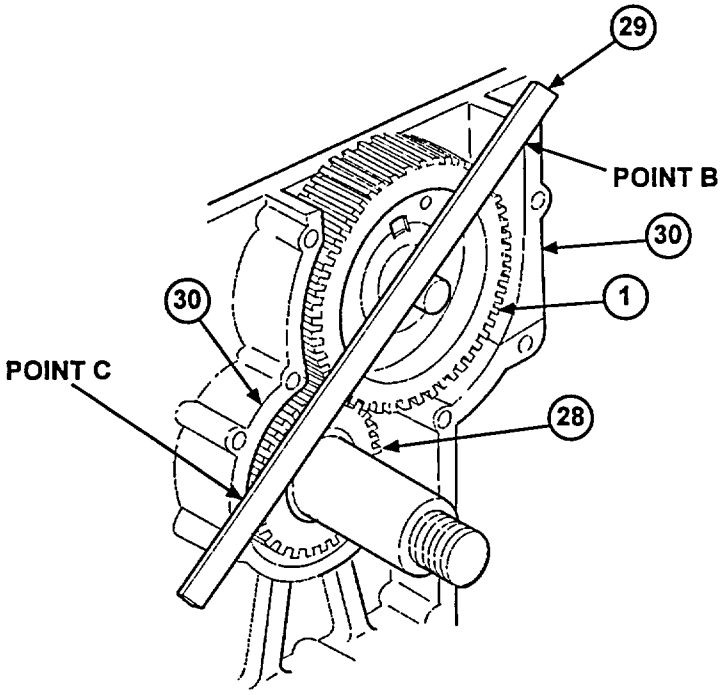


**3-6. CRANKCASE REPAIR (continued).**

**NOTE**

**When correct size and number of shim(s) are used, steel rule will be in contact with both crankshaft gear and top shim on camshaft gear.**

3. Place steel rule (29) across crankshaft gear (28) and camshaft gear (1). Measure the distance at point B and point C between crankcase sealing surfaces (30) and steel rule (29). If measurement is between 0.00 inch and 0.0039 inch (0.00 mm and 0.10 mm), install gasket on flywheel housing (para 3-8). If measurement is between 0.0043 inch and 1.18 inches (0.11 and 0.30 mm), install two gaskets on flywheel housing (para 3-8).




**FOLLOW-ON TASKS:**

- Install governor control assembly (para 3-16).
- Install solenoid (para 2-27).
- Install flywheel, auxiliary drive hardware, and flywheel housing (para 3-8).
- Install pistons and combustion chamber liners (para 3-9).

## 3-7. CRANKSHAFT AND BEARINGS REPAIR.

*This Task Covers:*

a. Removal
b. Inspection
c. Installation

*Initial Setup:*

**Tools/Test Equipment:**
- Crank gear driver (Item 4, Appendix G)
- Crank gear puller (Item 5, Appendix G)
- General mechanic's tool kit (Item 14, Appendix G)
- Relief valve puller (Item 23, Appendix G)
- Screwdriver attachment, 8 mm (Item 25, Appendix G)
- Socket wrench set, 3/8-inch drive (Item 27, Appendix G)

**Materials/Parts:**
- Lubricating oil (Item 6, Appendix D)
- Sealing compound (Item 12, Appendix D)
- Crankcase gasket set (Item 1, Appendix F)
- Sleeve bearing (3) (Item 34, Appendix F)

**Equipment Conditions:**
- Crankcase disassembled (para 3-6).
- Camshaft removed (para 3-11).

### a. REMOVAL

1. Remove seal (3) from auxiliary drive end of crankshaft (2). Discard seal.

**CAUTION**

**To prevent warping, crankshaft must be placed standing up in flywheel.**

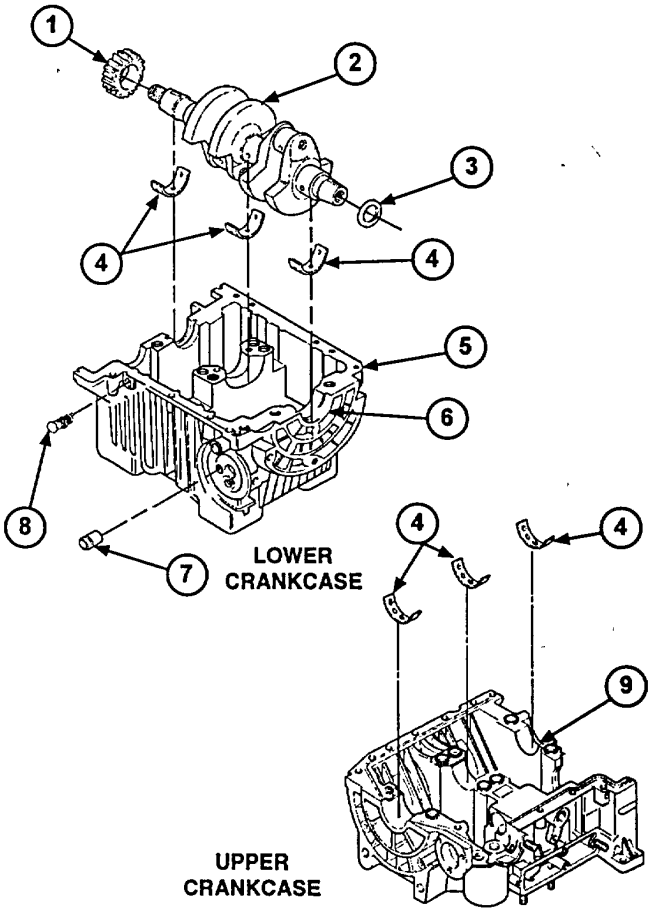
2. Remove crankshaft (2) from lower crankcase (5).

3. Remove three sleeve bearing halves (4) from three upper crank supports (9) (upper crankcase), and remove three sleeve bearing halves (4) from three lower crank supports (6) (lower crankcase). Discard sleeve bearing halves.

4. Remove flow control valve (8) from lower crankcase (5).

5. Using crank gear puller, remove crank gear (1) from crankshaft (2).

6. Using relief valve puller, remove relief valve (7) from lower crankcase (5).



## 3-7. CRANKSHAFT AND BEARINGS REPAIR (continued).

### b. INSPECTION

Inspect crankshaft for scoring, nicks, and excessive wear. Replace if necessary.

Inspect bushing (2.1) internal threads for damage. Bushing (2.1) should not be removed unless damaged.

### c. INSTALLATION

1. Install relief valve (7) in lower crankcase (5) with grooved side facing auxiliary drive side of engine.

2. Install crank gear (1) on crankshaft (2). Make sure timing mark is facing end of crankshaft (2).

2.1 If installing bushing (2.1), apply primer (Item 19, Appendix D) to threads of bushing.

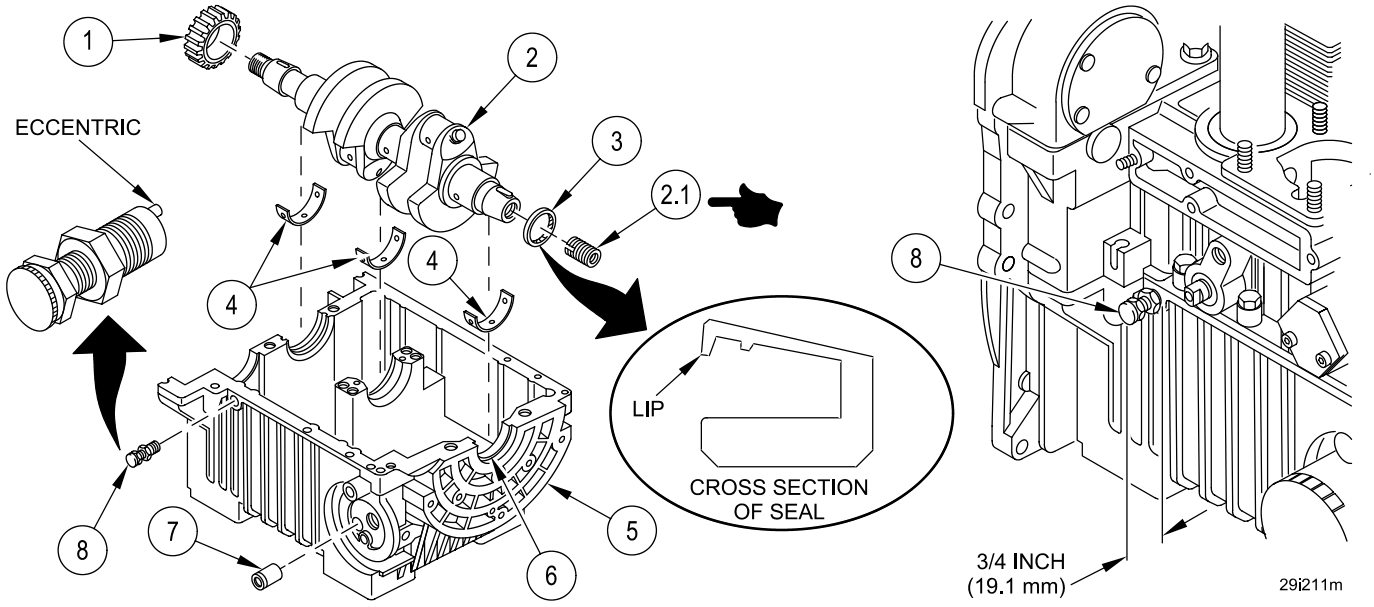
2.2 Apply loctite 271 (Item 20, Appendix D) to threads of bushing (2.1). Torque to 20 lb-ft (27 N•m). Allow to cure for 6 hours before assembly.

3. Apply sealing compound (Item 10, Appendix D) to new seal (3). Install seal (3) on crankshaft (2) with lip facing inward.

4. Install flow control valve (8) in lower crankcase (5) with eccentric at approximately the 11 o'clock position. Tighten flow control valve (8) into lower crankcase (5) until it projects 3/4 inch (1 9.1 mm) from lower crankcase (5).

5. Apply sealing compound (Item 21, Appendix D) to sleeve bearing halves (4) and bearing surfaces. Install three new sleeve bearing halves (4) in three upper crank supports (9), and install three sleeve bearing halves (4) in three lower crank supports (6). Keep matching bearings together.

6. Apply light coat of lubricating oil to crankshaft (2). Install crankshaft (2) in lower crankcase (5).




**FOLLOW-ON TASKS:**

- Install camshaft (para 3-11).
- Assemble crankcase (para 3-6).
- Adjust engine speed (para 3-18).

## 3-8. FLYWHEEL AND HOUSING REPLACEMENT.

*This Task Covers:*

a. Removal

b. Installation

*Initial Setup:*

**Tools/Test Equipment:**

- General mechanic's tool kit automotive (Item 15, Appendix G)
- Mechanical gear and bearing puller kit (Item 17, Appendix G)
- Torque wrench, 1/2-inch drive (Item 31, Appendix G)

**Materials/Parts:**

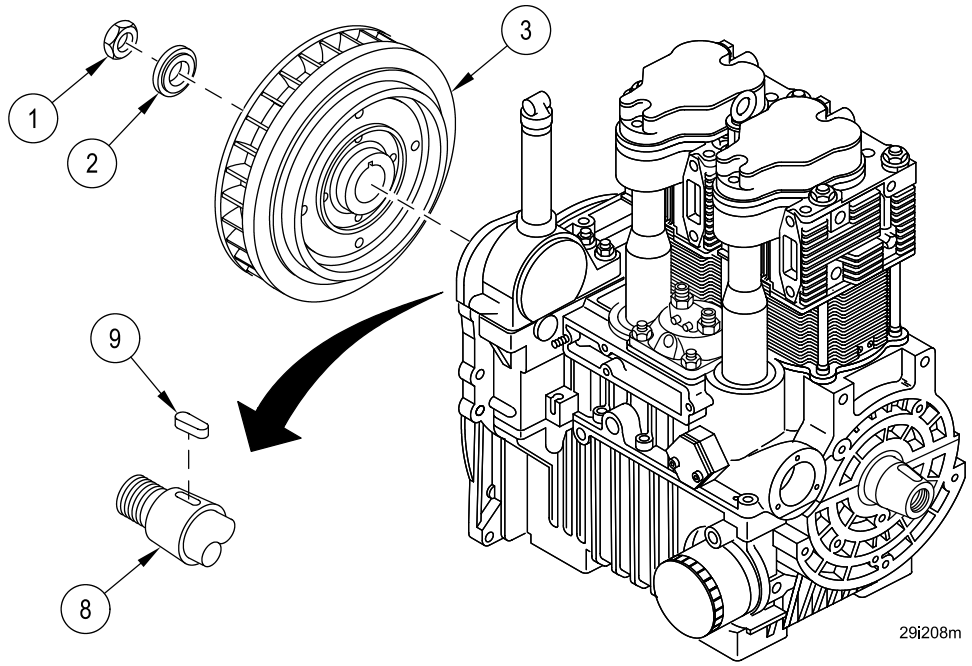
- Crankcase gasket set (Item 1, Appendix F)
- O-ring (item 44, Appendix F)
- Spring tension washer (Item 27, Appendix F)

**Equipment Conditions:**

- **Oil tube assemblies removed (para 2-19).**
- Airflow deflectors removed (UOC:APP) (para 2-24).
- Airflow deflectors removed (UOC:APJ) (TM 9-2350-292-20-2).

**a. REMOVAL**

1. Remove nut (1) and washer (2) from crankshaft (8).
2. Using mechanical gear puller, remove flywheel (3) from crankshaft (8).
3. Remove key (9) from crankshaft (8).



**3-8. FLYWHEEL AND HOUSING REPLACEMENT (continued).**

4. Remove oil drain plug (17) and gasket (18) from flywheel housing (19). Discard gasket.

**NOTE**

**Pin for intermediate gear may come off with flywheel housing.**

5. Remove screw (14), 18 screws (15), 19 washers (13), and flywheel housing (19) from crankcase (10).

**NOTE**

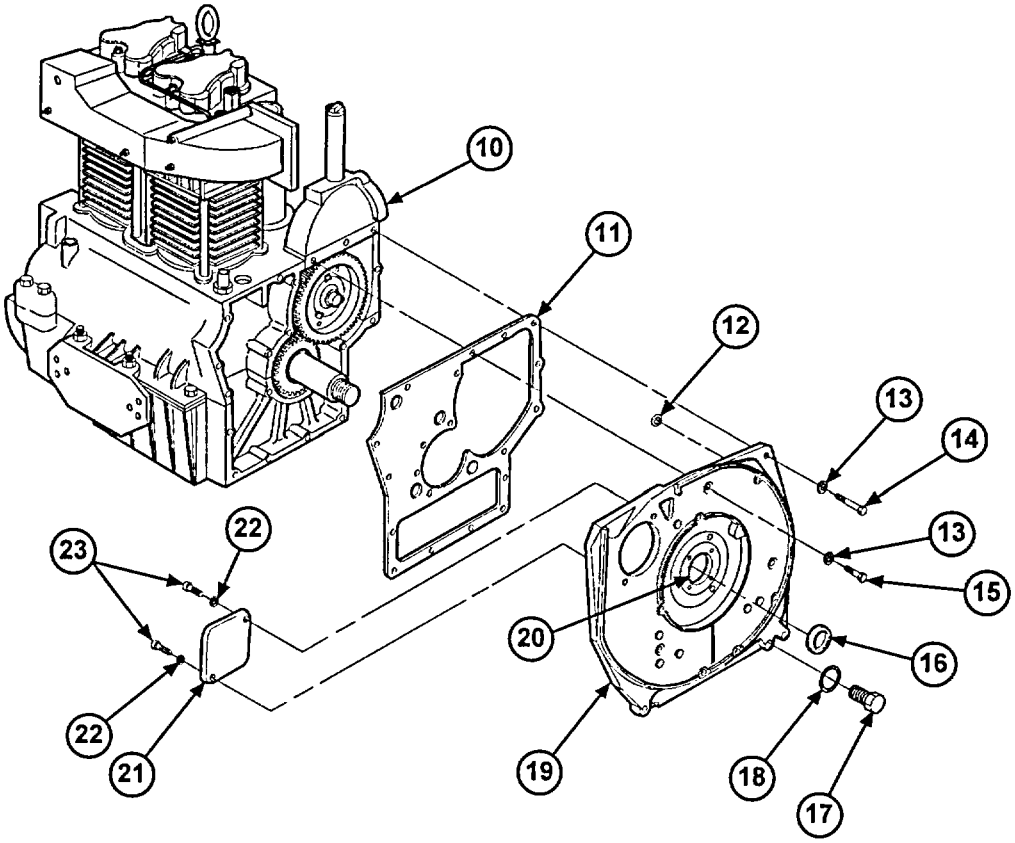
**There may be one or two gaskets on flywheel housing. Remove all of them, and note how many gaskets are removed from flywheel housing.**

6. Remove one or two gaskets (11) from flywheel housing (19). Discard gasket(s).

7. Remove O-ring (12) from flywheel housing (19). Discard O-ring.

8. Remove seal (16) from crankshaft opening (20). Discard seal.

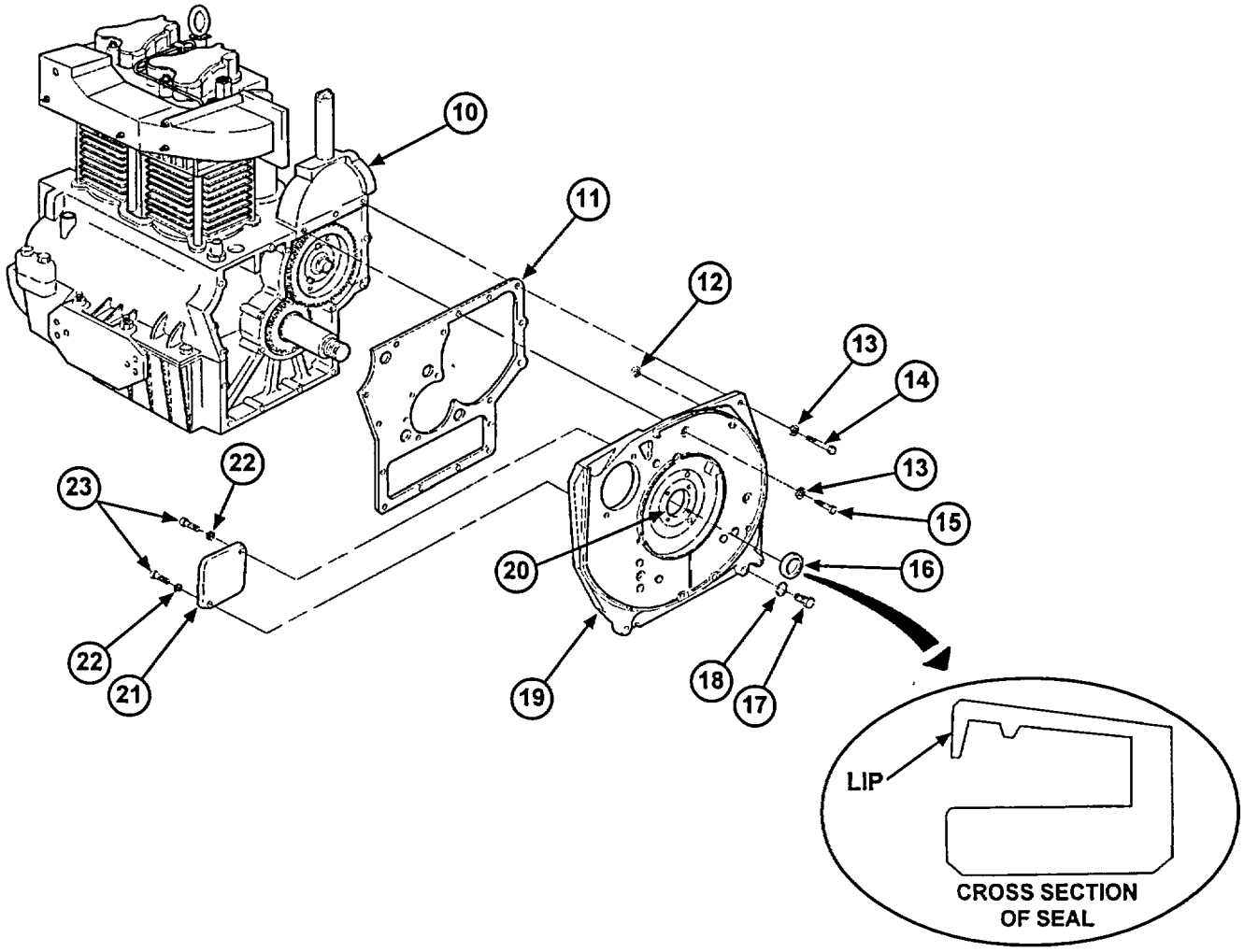
9. Remove two screws (23) and washers (22) and plate (21) from flywheel housing (19).



## 3-8. FLYWHEEL AND HOUSING REPLACEMENT (continued).

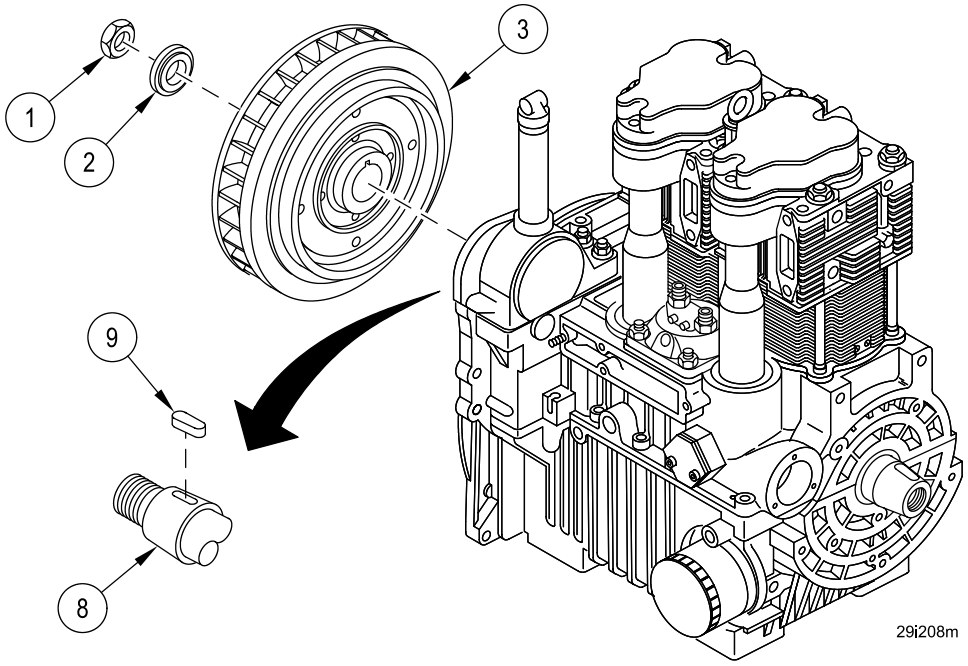
**b. INSTALLATION**

1. Install two screws (23) and washers (22) and plate (21) on flywheel housing (19).
2. Install new seal (16) in crankshaft opening (20), with lip of seal (16) facing inward.
3. Install new O-ring (12) on flywheel housing (19).
4. Apply sealing compound (Item 17, Appendix D) to surfaces of gasket(s) (11). Depending on the number removed, install one or two new gaskets (11) on flywheel housing (19).
5. Install flywheel housing (19) on crankcase (10) and secure with screw (14),18 screws (15), and 19 washers (13).
6. Install oil drain plug (17) and new gasket (18) in flywheel housing (19) and crankcase (10).



**3-8. FLYWHEEL AND HOUSING REPLACEMENT (continued).**

7. Install key (9) in crankshaft (8). Install flywheel (3), washer (2), and nut (1) on crankshaft (8). Torque nut to 148 ft-lb (200 N·m).




**FOLLOW-ON TASKS:**

- Install airflow deflectors (UOC:APP) (para 2-24).
- Install airflow deflectors (UOC:APJ) (TM 9-2350-292-20-2).
- Install oil tube assemblies (para 2-19).

## 3-9. PISTON AND COMBUSTION CHAMBER LINER REPAIR.

*This Task Covers:*

a. Removal
b. Disassembly
c. Cleaning
d. Assembly
e. Installation

*Initial Setup:*

**Tools/Test Equipment:**

- Cylinder ridge reamer (Item 8, Appendix G)
- General mechanic's tool kit, automotive (Item 15, Appendix G)
- Piston ring compressor (Item 21, Appendix G)
- Piston ring expander (Item 22, Appendix G)
- Screwdriver attachment, 6 mm (Item 24, Appendix G)
- Snapring pliers (Item 26, Appendix G)
- Socket wrench set, 3/8-inch drive (Item 27, Appendix G).
- Torque wrench, 3/8-inch drive (Item 30, Appendix G)

**Materials/Parts:**

- Carbon-removing compound (Item 3, Appendix D)
- Drycleaning solvent (Item 4, Appendix D)
- Lubricating oil (Item 6, Appendix D)
- Rag (Item 7, Appendix D)
- Cap-plug (2) (Item 10, Appendix F)
- Cap-plug (4) (Item 11, Appendix F)
- Piston ring set (2) (Item 2, Appendix F)
- Retaining ring (4) (Item 47, Appendix F)
- Shim (2) (Item 9, Appendix F)
- Sleeve bearing (2) (Item 7, Appendix F)

**Personnel Required:**

**Equipment Conditions:**

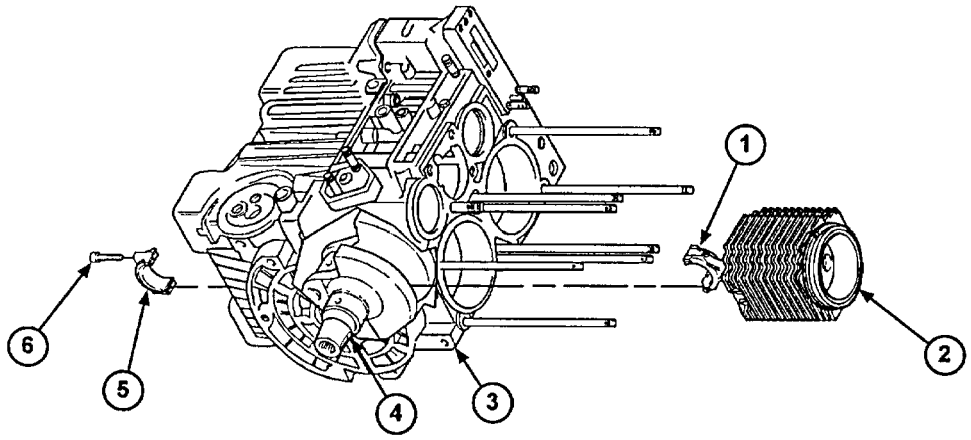
- Cylinder heads removed (para 3-5).
- Engine placed on side.
- Oil pan removed (UOC: APP) (para 3-13).
- Oil pan removed (UOC: APJ) (para 3-13.1).

### a. REMOVAL

**NOTE**

**There are two connecting rod caps on the engine. Repeat steps 1 and 2 to remove each of them.**

1. Turn crankshaft (4) so crankshaft journal for connecting rod cap (5) to be removed is in its lowest position.
2. Remove two connecting rod screws (6) and connecting rod cap (5) from connecting rod (1).
3. Remove two combustion chamber liners (2), with two pistons inside, from crankcase (3).



## 3-9. PISTON AND COMBUSTION CHAMBER LINER REPAIR (continued).

**CAUTION**

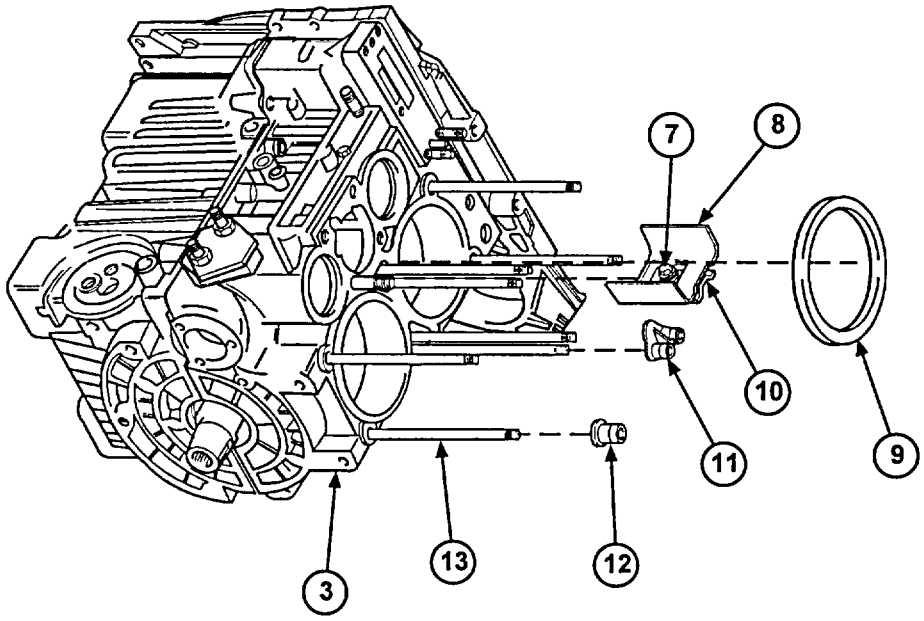
**Each connecting rod and connecting rod cap is stamped with a number, and each also has a notch on one side. Each connecting rod cap must be installed on the connecting rod stamped with the same number and with the notches on the same side.**

4. Using the numbers stamped on the two connecting rods (1) and connecting rod caps (5), loosely install connecting rod cap (5) and two screws (6) on each connecting rod (1), making sure the notches are on the same side.

5. Loosen screw (7) on bracket (8) and clamping sheet (10). Remove bracket (8) and clamping sheet (10) by lifting them straight up until they are free of two studs (13).

6. Remove two cap-plugs (11) and four cap-plugs (12) from eight studs (13). Discard cap-plugs.

7. Remove two shims (9) from crankcase (3). Discard shims.



**3-9. PISTON AND COMBUSTION CHAMBER LINER REPAIR (continued).**

8. Remove two pistons (15) and connecting rods (1) from two combustion chamber liners (2)

**b. DISASSEMBLY**

1. Remove two connecting rod caps (5) and four screws (6) from two connecting rods (1). Remove two sleeve bearing halves (18) from each of two connecting rods (1) and connecting rod caps (5). Discard bearing halves. Loosely install two connecting rod caps (5) and four screws (6) on two connecting rods (1).

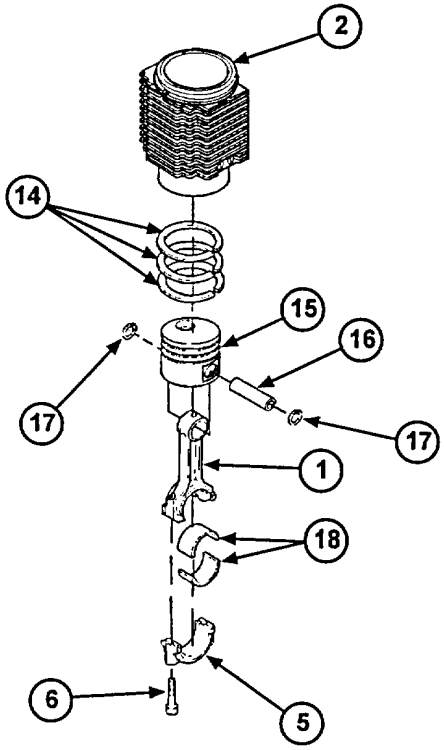
2. Remove three piston rings (14) from each of two pistons (15). Discard piston rings.

**NOTE**

**If any pistons, piston pins, retaining rings, or connecting rods are damaged and need to be replaced, do steps 3 and 4. Otherwise, go to step 3 in subparagraph d.**

3. Remove two retaining rings (17) and piston pin (16) from piston (15) and connecting rod (1). Discard retaining rings.

4. Remove piston (15) from connecting rod (1). Replace piston, piston pin, and/or connecting rod if damaged. Repeat for other piston, if necessary.




**c. CLEANING**

**WARNING**

**Drycleaning solvent P-D-680 is toxic and flammable. Always wear protective goggles and gloves and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat.**

1. Remove carbon from pistons, piston ring grooves, and combustion chamber liners with carbon-removing compound. Clean all parts with drycleaning solvent and rag.

2. Using cylinder ridge reamer, remove ridge from top of combustion chamber liner.

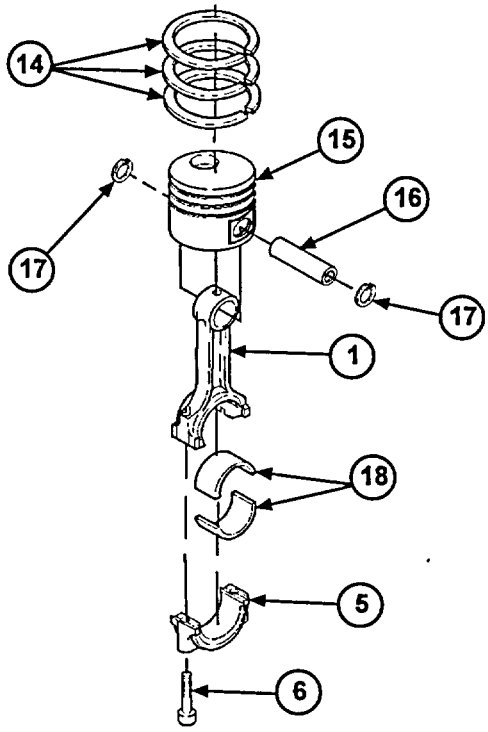
## 3-9. PISTON AND COMBUSTION CHAMBER LINER REPAIR (continued).

### d. ASSEMBLY

**NOTE**

**Piston head must be installed so the pocket is on the same side of the piston assembly as the notches in the connecting rod and connecting rod cap.**

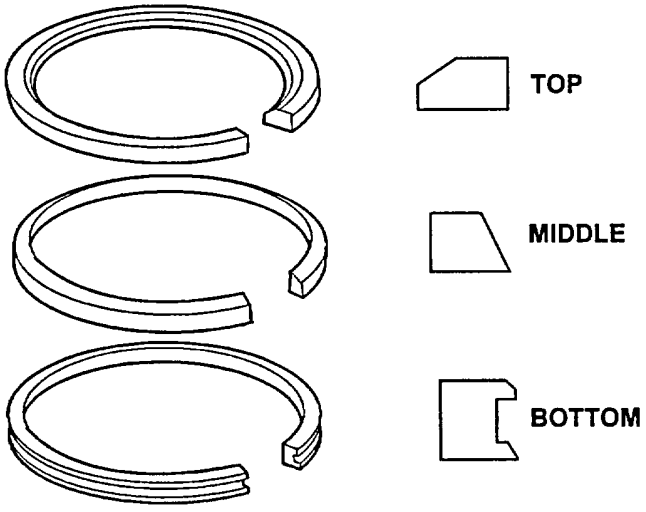
1. If piston (15) is being replaced, place piston (15) on connecting rod (1) with pocket in piston (15) facing the same direction as notches in connecting rod (1). Install piston pin (16) in piston (15) and connecting rod (1) and secure with two new retaining rings (17). Repeat for other piston, if necessary.




**NOTE**

**There are two pistons on the engine. Repeat steps 2 and 3 for each of them.**

2. Install three piston rings (14) on piston (15). See diagram for correct location and orientation of piston rings. Stagger three ring gaps so they are 120 degrees apart and no ring gap is over piston pin (16) or directly above or below other ring gaps.



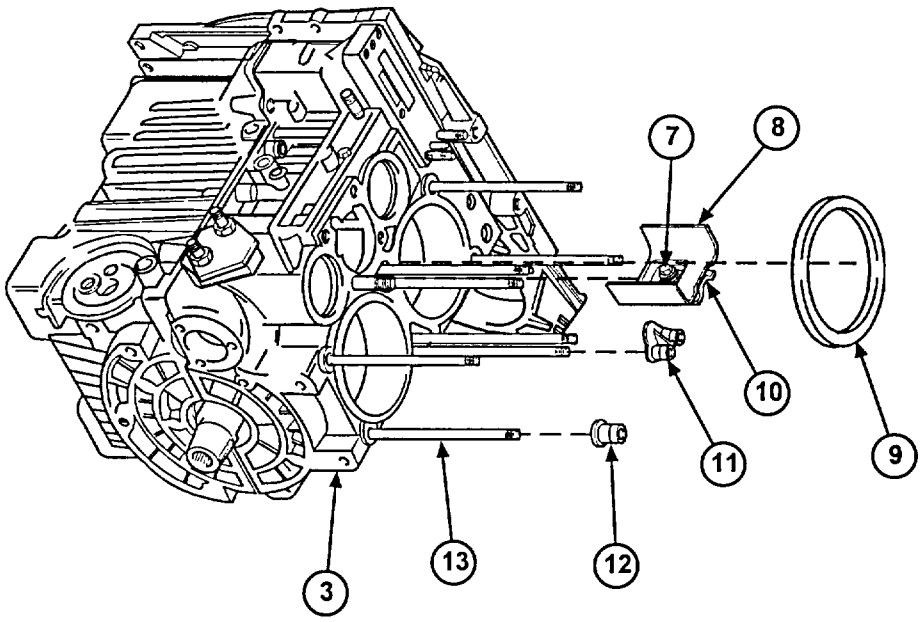

**PLACEMENT OF PISTON RINGS**

3. Remove two screws (6) and connecting rod cap (5) from connecting rod (1). Place two new sleeve bearing halves (18) in connecting rod (1) and connecting rod cap (5).

## 3-9. PISTON AND COMBUSTION CHAMBER LINER REPAIR (continued).

### e. INSTALLATION

1. Install two new shims (9) on crankcase (3).
2. Install two new cap-plugs (11) and four new cap-plugs (12) on eight studs (13).
3. Install bracket (8) and clamping sheet (10) on two studs (13). Tighten screw (7) to secure.

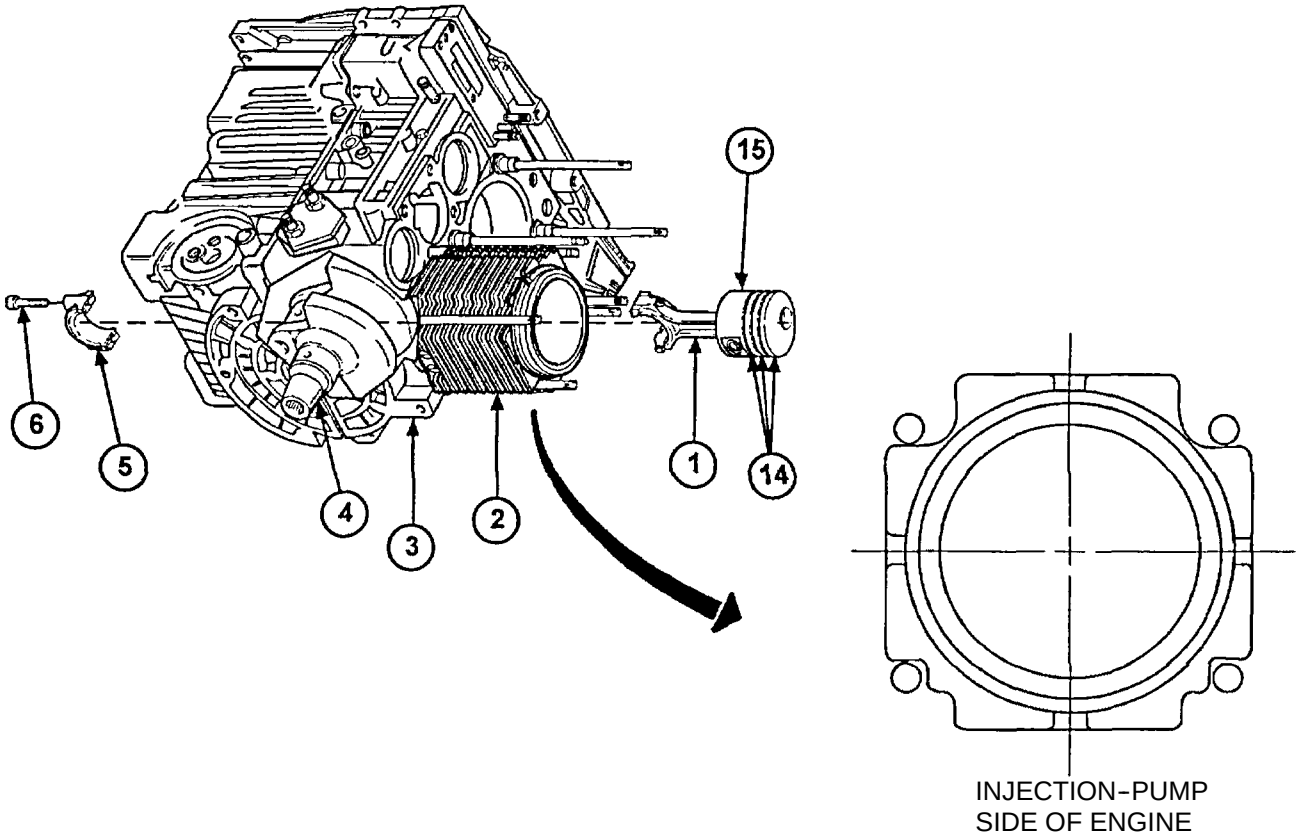



**NOTE**

**There are two pistons and combustion chamber liners on the engine. Follow steps 4 through 9 for each of them.**

4. Apply light coat of lubricating oil to three piston rings (14) and piston (15). Clamp piston ring compressor over piston rings (14). Tighten piston ring compressor.
5. Install combustion chamber liner (2) in crankcase (3). Make sure notched corners on combustion chamber liner (2) are facing injection-pump side of engine.
6. Turn crankshaft (4) so crankshaft journal for piston to be installed is at the bottom of crankcase (3).

## 3-9. PISTON AND COMBUSTION CHAMBER LINER REPAIR (continued).




**CAUTION**

**Pocket in piston and notches in connecting rod must face starter access plate side of engine.**

7. Slide piston (15) into combustion chamber liner (2). Make sure pocket in piston (15) is facing toward starter access plate side of engine.

8. Tap piston (15) into combustion chamber liner (2) with hammer handle. Make sure connecting rod (1) is aligned with crankshaft journal.

**CAUTION**

**Each connecting rod and connecting rod cap is stamped with a number and also has a notch on one side. Each connecting rod cap must be installed on the connecting rod stamped with the same number and with the notches on the same side.**

9. Install two connecting rod caps (5) on two connecting rods (1) and secure loosely with two screws (6). Torque screws to 30 ft-lb (40 N•m).

**FOLLOW-ON TASKS:**

- Install oil pan (UOC: APP) (para 3-13).
- Install oil pan (UOC: APJ) (para 3-13.1).
- Turn engine upright.
- Install cylinder heads (para 3-5).

## 3-10. ROCKER ARM ASSEMBLIES REPAIR.

*This Task Covers:*

a. Removal

b. Installation

*Initial Setup:*

**Tools/Test Equipment:**
- General mechanic's tool kit, automotive (Item 15, Appendix G)
- Snapring pliers (Item 26, Appendix G)
- Torque wrench, 1/2-inch drive (Item 31, Appendix G)

**Materials/Parts:**
- Retaining ring (4) (Item 20, Appendix F)
- Sealing compound (Item 16, Appendix D)
- Self-locking nut (4) (Item 15, Appendix F)
- Shim (1 or 2) (Item 42 or 43, Appendix F)

**Equipment Conditions:**
- Rocker arm covers and gaskets removed (para 2-17).

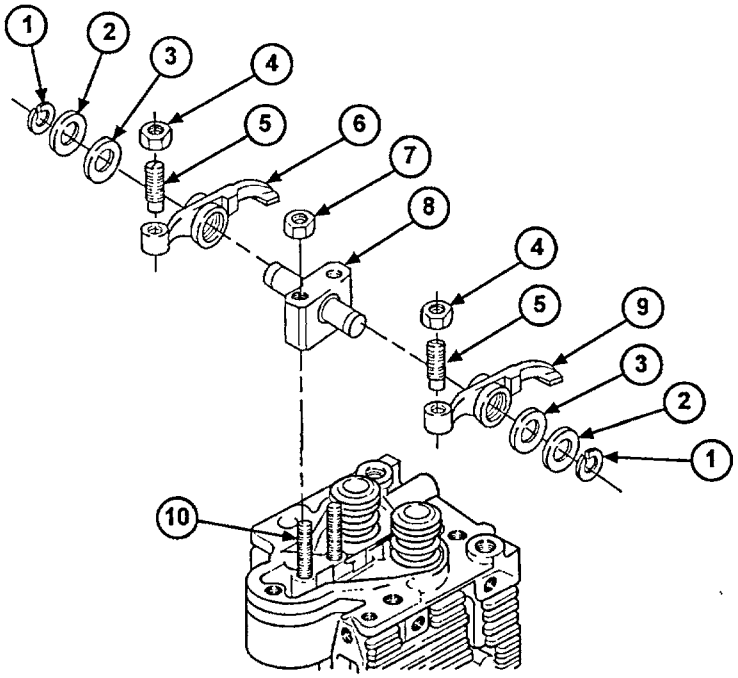
### a. REMOVAL

**NOTE**

**There are two rocker arm assemblies on the engine, each containing two rocker arms. Repeat steps 1 through 4 to remove both assemblies.**

1. Remove two self-locking nuts (7) and rocker arm bracket (8) from two studs (10). Discard self-locking nuts.

2. Remove two retaining rings (1) and any shims (2 or 3) from rocker arm bracket (8). Discard retaining rings and shims.



**3-10. ROCKER ARM ASSEMBLIES REPAIR (continued).**

3. Remove two rocker arms (6 and 9) from rocker arm bracket (8).

**NOTE**

**Remove nuts and adjusting screws only if damaged.**

4. Remove two nuts (4) and adjusting screws (5) from two rocker arms (6 and 9). If damaged, discard nuts and adjusting screws.

**b. INSTALLATION**

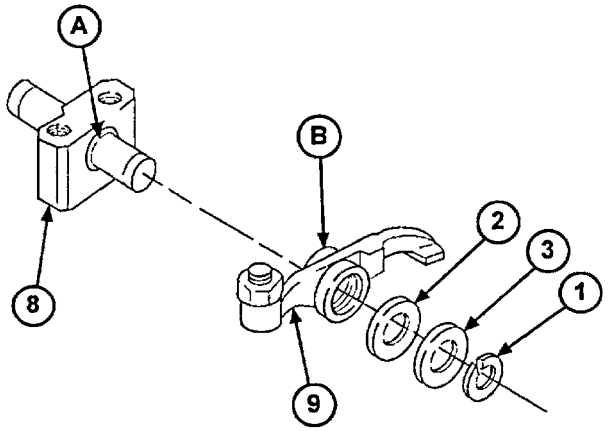
**NOTE**

- **There are two rocker arm assemblies on the engine. Repeat steps 1 through 4 to install both of them.**
- **If nuts or adjusting screws need to be replaced, do step 1. If not, go to step 2.**

1. Install two new nuts (4) on two new adjusting screws (5). Install two adjusting screws (5) on two rocker arms (6 and 9).

2. Place two rocker arms (6 and 9) on rocker arm bracket (8) and secure with two new retaining rings (1).

3. To determine if shims (2 or 3) are needed, use a feeler gage to measure play between rocker arm bracket (8) (point A) and inside edge of rocker arm (6 or 9) (point B). This measurement should be between 0.004 and 0.008 inch (0.1 mm and 0.2 mm). Remove two retaining rings (1) from rocker arm bracket (8), and install shims (2 or 3) as needed to achieve this distance. Reinstall retaining rings (1) in rocker arm bracket (8).




**CAUTION**

**To ensure adequate lubrication, rocker arm bracket must be installed with the oil hole on the bottom.**

4. Apply sealing compound (Item 16, Appendix D) to threads of studs (10). Install rocker arm bracket (8) on two studs (10) and secure with two new self-locking nuts (7). Torque nuts to 17 ft-lb (23 N·m).

**FOLLOW-ON TASKS:**

- Adjust valves (para 3-18).
- Install rocker arm covers and gaskets (para 2-17).

## 3-11. CAMSHAFT REPAIR

*This Task Covers:*

a. Removal

b. Installation

*Initial Setup:*

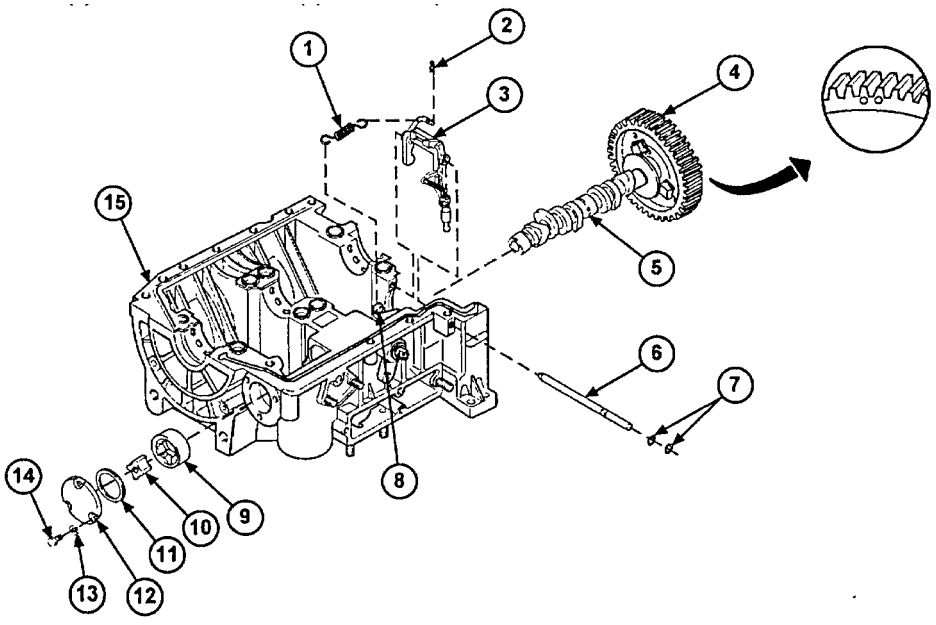
**Tools/Test Equipment:**
- Arbor press (Item 1, Appendix G)
- General mechanic's tool kit (Item 14, Appendix G)
- Snapring pliers (Item 26, Appendix G)

**Materials/Parts:**
- Clip (Item 38, Appendix F)
- Crankcase gasket set (Item 1, Appendix F)
- Retaining ring (Item 21, Appendix F)
- Retaining ring (Item 36, Appendix F)
- Retaining ring (Item 39, Appendix F)

**Equipment Conditions:**
- Crankcase disassembled (para 3-6):

### a. REMOVAL

1. Remove three screws (14) and washers (13) and oil pump cover (12) from upper crankcase (15).
2. Remove O-ring (11) from oil pump cover (12). Discard O-ring.
3. Remove rotor (9) and oil pump gear (10) from upper crankcase (15).
4. Remove clip (2) from governor spring (1). Remove governor spring (1) from governor control lever assembly (3) and accelerator lever (8). Discard clip.



**3-11. CAMSHAFT REPAIR (continued).**

5. Remove governor control lever assembly pin (6) and governor control lever assembly (3) from upper crankcase (15).

6. Remove two O-rings (7) from pin (6). Discard O-rings.

7. Remove camshaft assembly (5) from upper crankcase (15): Position the timing marks on camshaft gear (4) at the 10 o'clock position. Pull camshaft assembly (5) toward you until it stops. Turn camshaft gear (4) until timing marks are in the 12 o'clock position. Pull camshaft assembly (5) the rest of the way out of upper crankcase (15).

**CAUTION**

**Do not lay camshaft flat on table while it is attached to camshaft gear. Stand camshaft and camshaft gear assembly on camshaft gear, to prevent warping.**

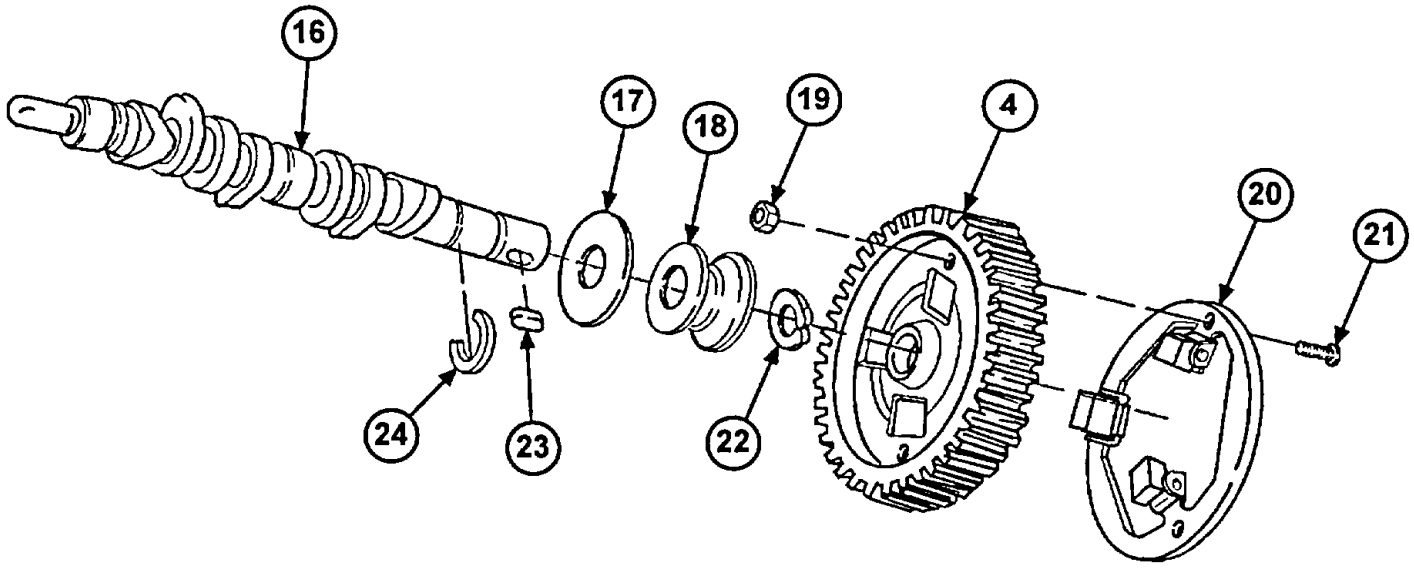
8. Remove three screws (21) and nuts (19) and mounting plate (20) from camshaft gear (4).

9. Remove retaining ring (24) from groove on camshaft (16), and slide spacer (18) and washer (17) away from camshaft gear (4). Discard retaining ring.

10. Remove camshaft gear (4) and key (23) from camshaft (16).

11. Remove retaining ring (22) from groove on camshaft (16). Discard retaining ring.

12. Remove spacer (18) and washer (17) from camshaft (16).

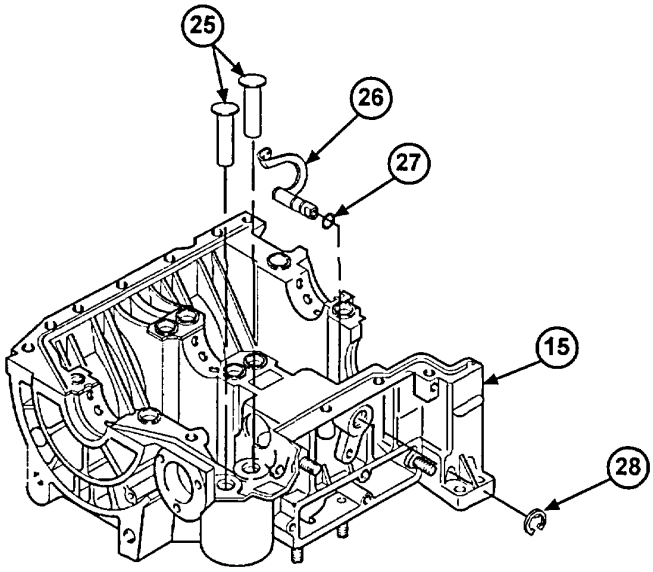


**3-11. CAMSHAFT REPAIR (continued).**

13. Remove four tappets (25) from upper crankcase (15).

14. Remove retaining ring (28) from acceleration lever (26). Discard retaining ring.

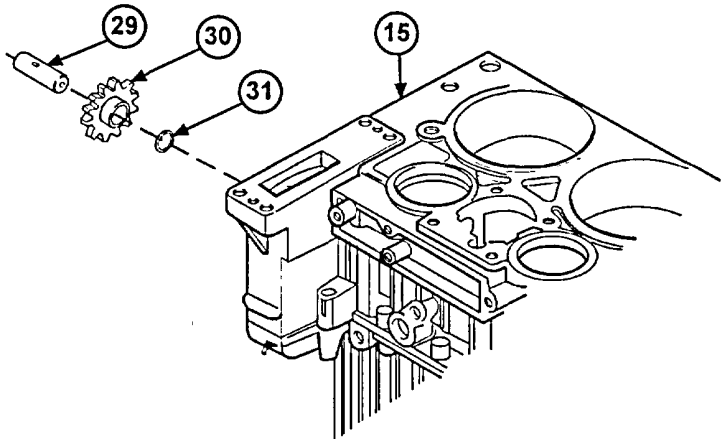
15. Remove acceleration lever(26) from upper crankcase (15). Remove O-ring (27) from acceleration lever (26). Discard O-ring.




**NOTE**

**Pin for pinion assembly may have come off with flywheel housing (para 3-8).**

16. Remove pin (29), pinion assembly (30), and washer (31) from upper crankcase (15).




**b. INSTALLATION**

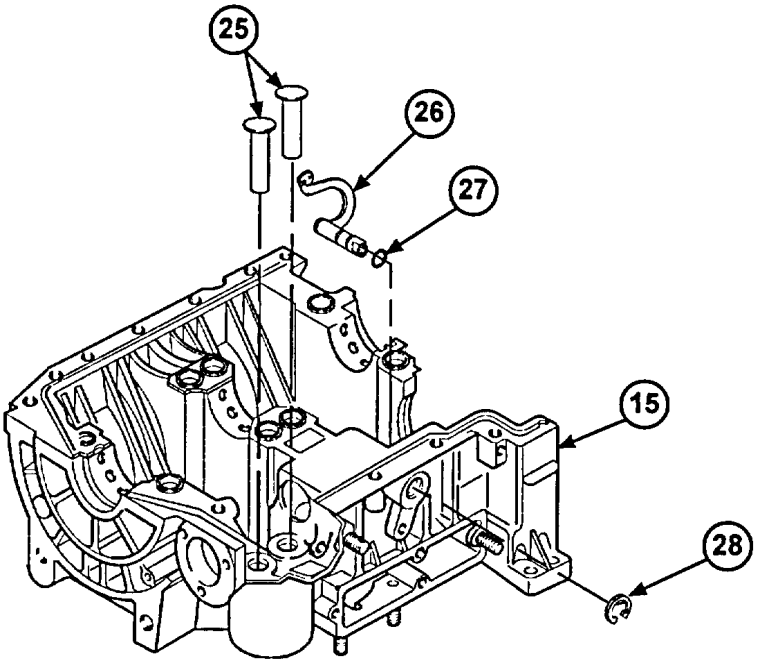
1. Install washer (31), pinion assembly (30), and pin (29) in upper crankcase (15).

**3-11. CAMSHAFT REPAIR (continued).**

2. Install new O-ring (27) on acceleration lever (26). Install acceleration lever (26) on upper crankcase (15).

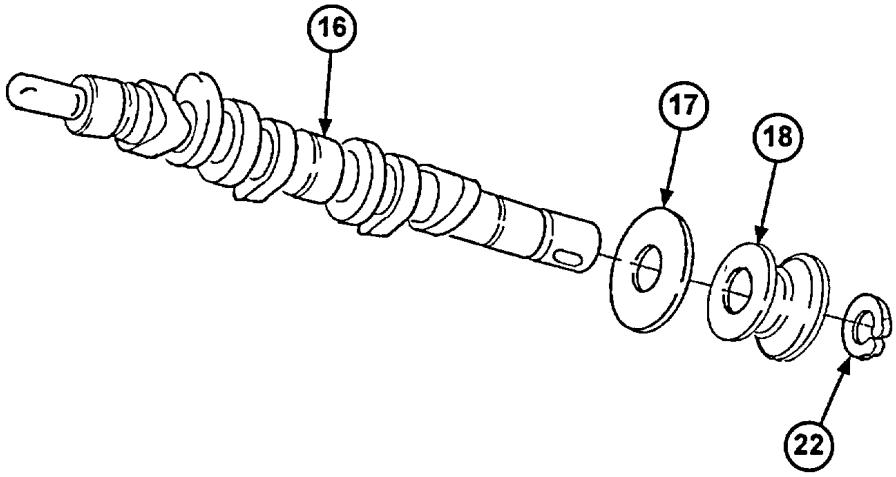
3. Install new retaining ring (28) on acceleration lever (26).

4. Install four tappets (25) in upper crankcase (15).




5. Install washer (17) and spacer (18) on camshaft (16). Make sure tapered end of spacer (18) is facing away from washer (17).

6. Install new retaining ring (22) in groove on camshaft (16).

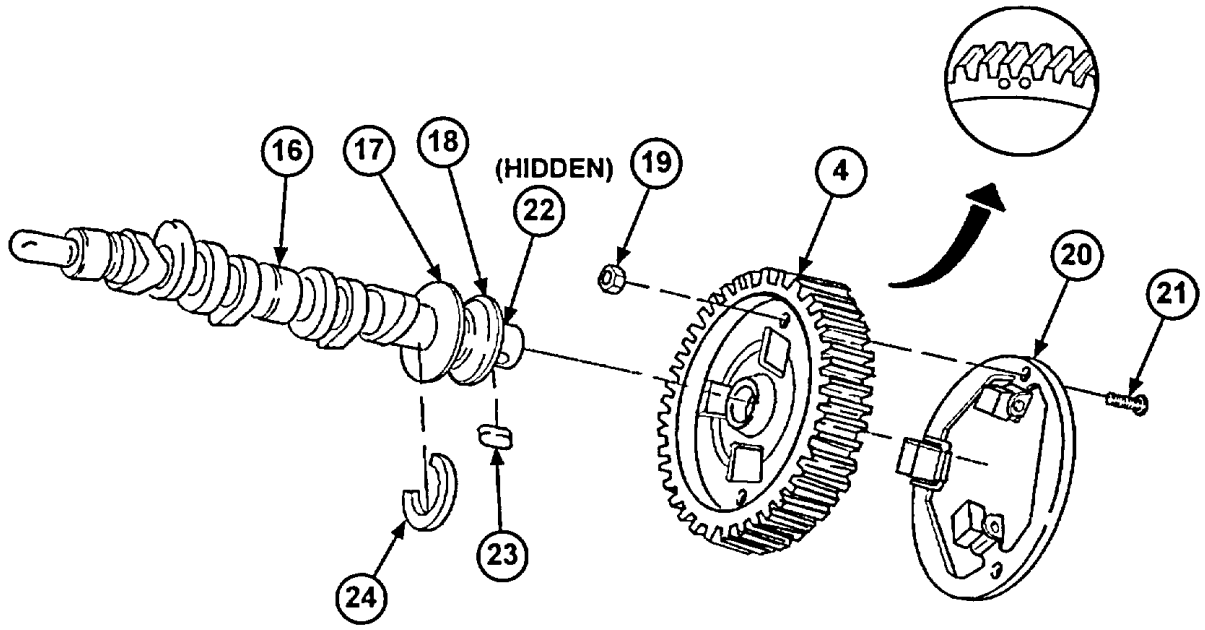


**3-11. CAMSHAFT REPAIR (continued).**

7. Install key (23) on camshaft (16). Using arbor press, install camshaft gear (4) on camshaft (16), making sure timing marks on camshaft gear (4) are facing toward near end of camshaft (16). Press camshaft gear(4) onto camshaft (16) until camshaft gear (4) seats against retaining ring (22).

8. Slide spacer (18) and washer (17) toward camshaft gear (4). Install new retaining ring (24) in groove on camshaft (16).

9. Install mounting plate (20) on camshaft gear (4) and secure with three screws (21) and nuts (19).




10. Set upper crankcase (15) on end on work surface with opening for camshaft (16) facing up. Install camshaft assembly (5) in upper crankcase (15): Position the timing marks on camshaft gear (4) in the 12 o'clock position, and insert camshaft assembly (5) into bearing bore. When the first cam lobe drops down behind bearing bore, turn camshaft gear (4) counterclockwise until timing marks are in the 10 o'clock position; insert camshaft assembly (5) the rest of the way.

11. Lay upper crankcase (15) on work surface. Install two new O-rings (7) on governor control lever assembly pin (6).

12. Position governor control lever assembly (3) in upper crankcase (15).

**3-11. CAMSHAFT REPAIR (continued).**

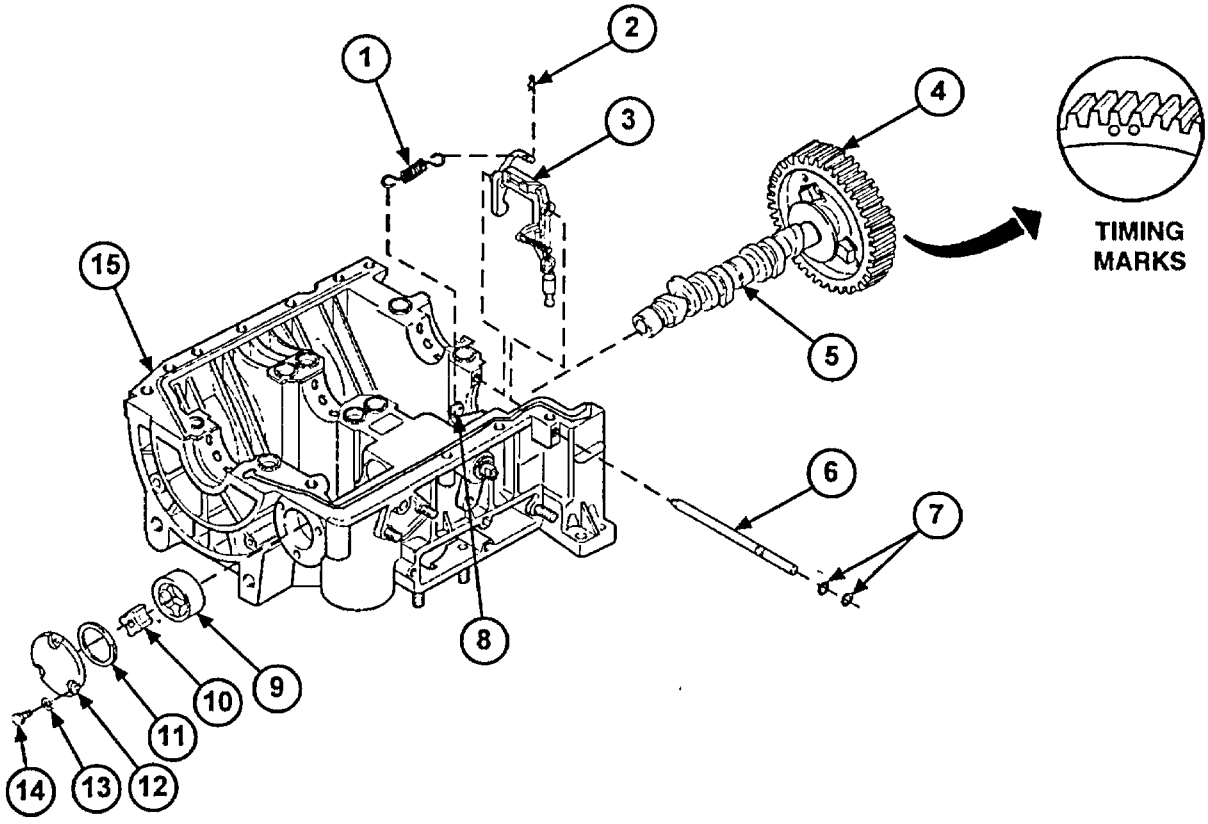
13. Install pin (6) on governor control lever assembly (3) and upper crankcase (15).

14. Install governor spring (1) on governor control lever assembly (3) and accelerator lever (8). Secure governor spring (1) with new clip (2).

15. Place oil pump gear (10) and rotor (9) in upper crankcase (15). Make sure beveled edge of rotor (9) is facing toward inside of upper crankcase (15).

16. Install new O-ring (11) in oil pump cover (12).

17. Install oil pump cover (12) on upper crankcase (15) and secure with three screws (14) and washers (13). Turn camshaft gear (4) to be sure camshaft assembly (5) turns freely.




**FOLLOW-ON TASKS:**

- Assemble crankcase (para 3-6).

## 3-12. FILLER NECK REPLACEMENT (UOC: APP).

*This Task Covers:*

a. Removal

b. Installation

*Initial Setup:*

**Tools/Test Equipment:**

- General mechanic's tool kit automotive (item 15, Appendix G)

**Materials/Parts:**

- Grease compound (Item 5, Appendix D)
- Sealing compound (Item 13, Appendix D)
- Crankcase gasket set (Item 1, Appendix F)

**Equipment Conditions:**

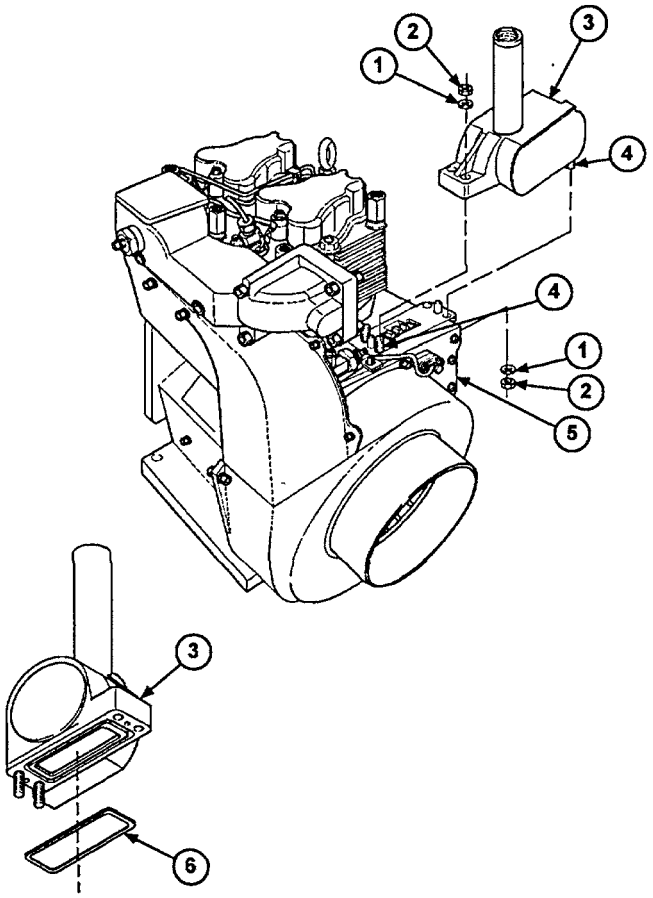
- Filler cap removed (para 2-18).
- Airflow deflectors removed as needed to allow access to oil filler assembly (para 2-24).

**a. REMOVAL**

1. Remove four nuts (2) and washers (1) from four studs (4).
2. Remove filler neck (3) from crankcase (5).
3. Remove O-ring (6) from groove of filler neck (3). Discard O-ring.

**b. INSTALLATION**

1. Lightly coat new O-ring (6) with grease. Install Oring (6) in groove in filler neck (3).
2. Apply sealing compound (Item 13, Appendix D) to four studs (4).
3. Install filler neck (3) on crankcase (5).
4. Install four washers (1) and nuts (2) on four studs (4).




**FOLLOW-ON TASKS:**

- Install airflow deflectors (para 2-24).
- Install filler cap (para 2-18).

## 3-13. OIL PAN AND GASKET REPLACEMENT (UOC: APP).

*This Task Covers:*

a. Removal

b. Installation

*Initial Setup:*

**Tools/Test Equipment:**

- General mechanic's tool kit, automotive (item 15, Appendix G)

**Equipment Conditions:**

- Engine mounting plate removed (para 3-4)

**Materials/Parts:**

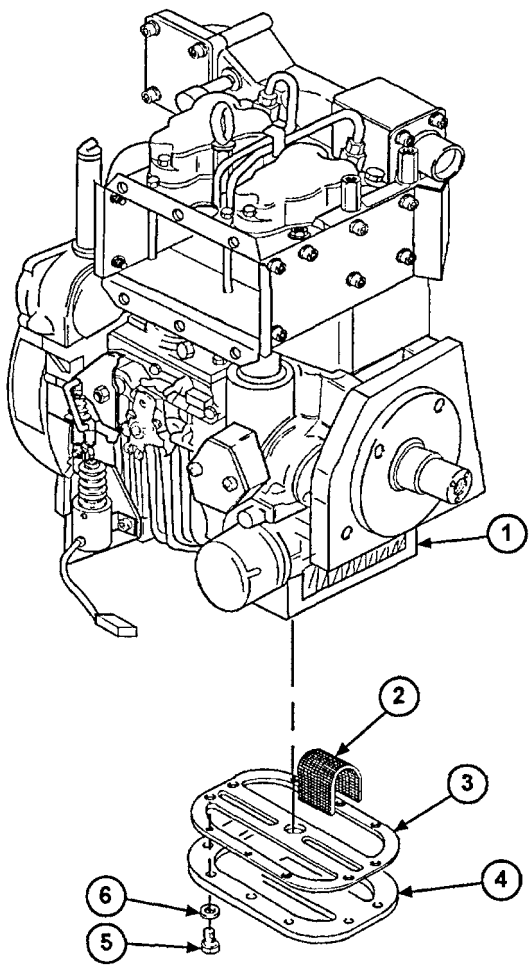
- Crankcase gasket set (item 1, Appendix F)
- Lockwasher (10) (Item 24, Appendix F)

**a. REMOVAL**

1. Remove 10 screws (5) and lockwashers (6) and oil pan (4) from crankcase (1). Discard lockwashers.
2. Remove strainer element (2) from crankcase (1).
3. Remove gasket (3) from oil pan (4). Discard gasket.

**b. INSTALLATION**

1. Install strainer element (2) in crankcase (1).
2. Install new gasket (3) on oil pan (4).
3. Install oil pan (4) on crankcase (1) and secure with 10 new lockwashers (6) and screws (5).




**FOLLOW-ON TASKS:**

- Install engine mounting plate (para 3-4).

## 3-13.1. DEEP OIL PAN AND GASKET REPLACEMENT (UOC: APJ).

*This Task Covers:*

a. Removal

b. Installation

*Initial Setup:*

**Tools/Test Equipment:**

- General mechanic's tool kit, automotive (item 14, Appendix G)

**Equipment Conditions:**

- Engine mounting plate removed (para 3-4)

**Materials/Parts:**

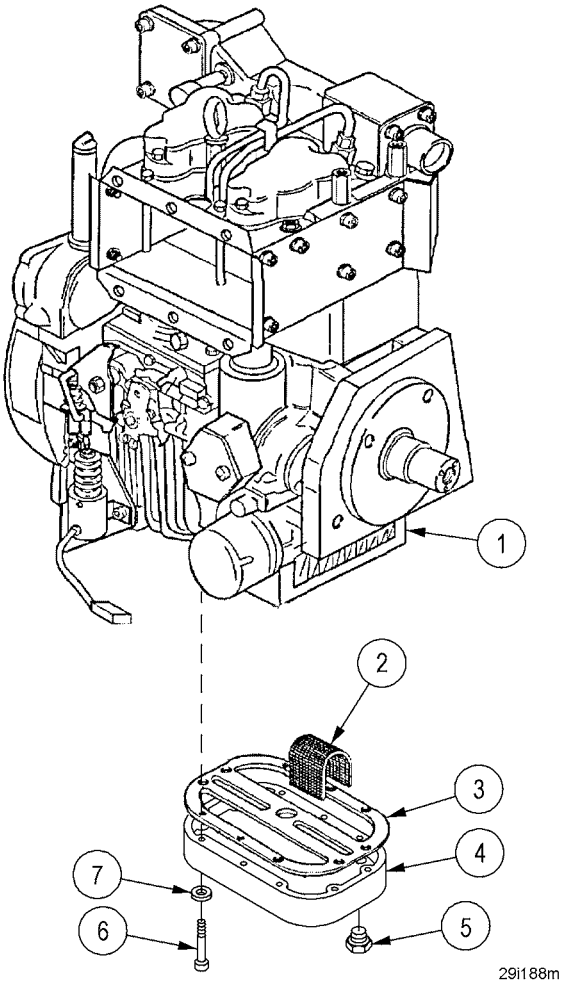
- Crankcase gasket set (item 1, Appendix F)

**a. REMOVAL**

1. Place a suitable container under drain plug (5) to catch oil then remove drain plug (5) from deep oil pan (4).
2. Remove 10 screws (6) and flat washers (7) and oil pan (4) from crankcase (1). Discard lockwashers.
3. Remove strainer element (2) from crankcase (1).
4. Remove gasket (3) from deep oil pan (4). Discard gasket.

**b. INSTALLATION**

1. Install strainer element (2) in crankcase (1).
2. Install new gasket (3) on deep oil pan (4).
3. Install deep oil pan (4) on crankcase (1) and secure with two new flat washers (7) and screws (6).
4. Install drain plug (5).




**FOLLOW-ON TASKS:**

- Install engine mounting plate (para 3-4).
- Refill with oil (TM 9-2350-292-20-2).

## 3-14. FUEL INJECTOR REPLACEMENT.

*This Task Covers:*

a. Removal
b. Cleaning
c. Inspection
d. Installation

*Initial Setup:*

**Tools/Test Equipment:**

- General mechanic's tool kit (item 14, Appendix G)
- Socket wrench set, 3/8-inch drive (Item 27, Appendix G)
- Torque wrench, 3/8-inch drive (Item 30, Appendix G)

**Materials/Parts:**

- Drycleaning solvent (Item 4, Appendix D)
- Rag (Item 7, Appendix D)
- Head gasket set (Item 3, Appendix F)
- Spring tension washer (2) (Item 31, Appendix F)

**Equipment Conditions:**

- Fuel pressure pipe assemblies and return fuel hose removed (para 2-23).

**NOTE**

**There are two fuel injectors on the engine. Use this procedure to replace either one. The injector on the flywheel side of the engine is shown.**

### a. REMOVAL

1. Remove nut (1), spring tension washer (2), spacer (3), and hose clamp (4) from fuel injector (5) and stud (9). Discard spring tension washer.

2. Remove fuel injector (5) from bore in cylinder head (8).

**NOTE**

**Gasket may stay in bore in cylinder head. check bore if gasket is not on the end of the fuel injector.**

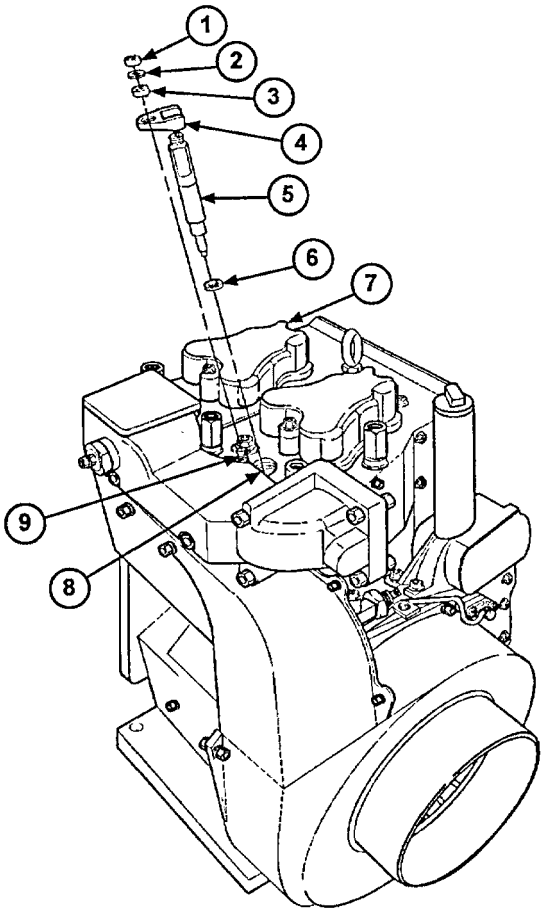
3. Remove gasket (6) from fuel injector (5) or bore in cylinder head (8). Discard gaset.

### b. CLEANING

**Drycleaning solvent P-D-680 is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes and do not breathe vapors. Do not use near open flame or excessive heat.**

1. Clean bore in cylinder head (8) with drycleaning solvent and rag.

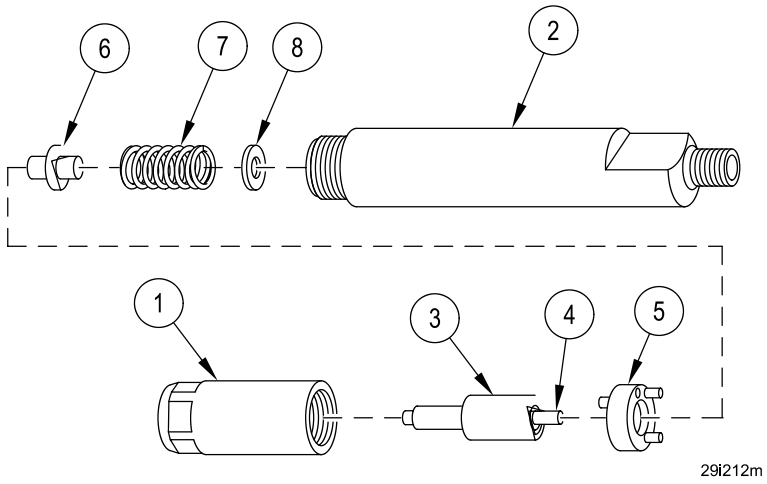
**3-14. FUEL INJECTOR REPLACEMENT (continued).**



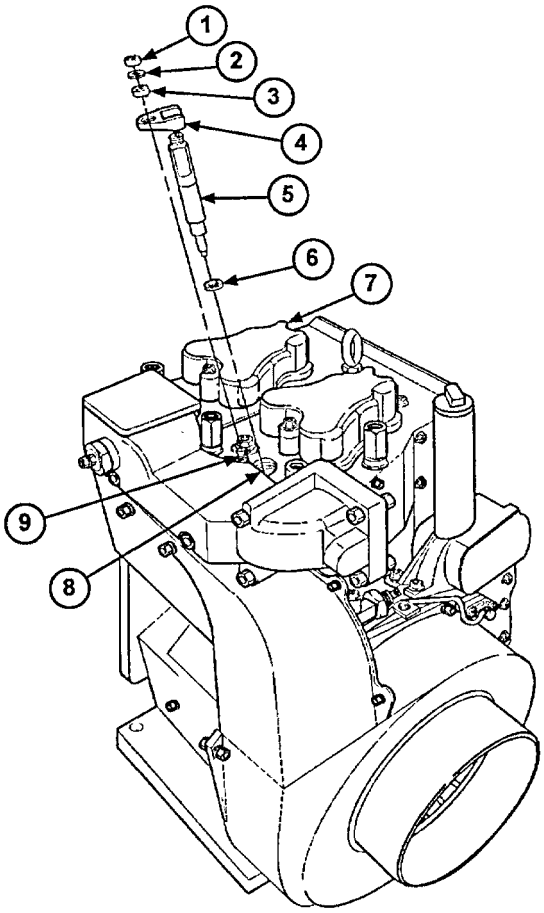
## 3-14. FUEL INJECTOR REPLACEMENT (continued).

**c. INSPECTION**

1. Remove the nozzle retaining nut (1) from the fuel injector body (2).
2. Check the nozzle body (3) and nozzle needle (4) for overheating damage, scoring and coked-up spray holes.
3. Immerse the nozzle needle (4) in clean fuel. The nozzle needle (4) must slide down under its own weight into the seat of nozzle body (3).
4. Replace the nozzle needle (4) and the nozzle body (3) as an assembly if defective. If other parts are defective, replace entire fuel injector.
5. Assemble fuel injector parts (1) through (8) together as shown. Torque nozzle retaining nut (1) to 44 ft-lb (60 N•m).
6. Test fuel injector spray pattern (para 3-21).



**3-14. FUEL INJECTOR REPLACEMENT (continued).**




**d. INSTALLATION**

**NOTE**

**Make sure that the soft, graphite-coated surface of the gasket is facing fuel injector.**

1. Install new gasket (6) on fuel injector (5).
2. Install fuel injector (5) in bore in cylinder head (8). Make sure opening for screw faces rocker arm cover (7).

**NOTE**

**Make sure tapered side of spacer is toward hose clamp and that tapered side of hose clamp is facing up.**

3. Install hose clamp (4), spacer (3), new spring tension washer (2), and nut (1) on stud (9) and fuel injector (5). Torque nut to 17 ft-lb (23 N•m).

**FOLLOW-ON TASKS:**

- Install fuel pressure pipe assemblies and return fuel hose (para 2-23).

## 3-15. INJECTION PUMP REPLACEMENT.

*This Task Covers:*

a. Removal
b. Cleaning and Inspection
c. Installation

*Initial Setup:*

**Tools/Test Equipment:**

- General mechanic's tool kit, automotive (item 14, Appendix G)

**Materials/Parts:**

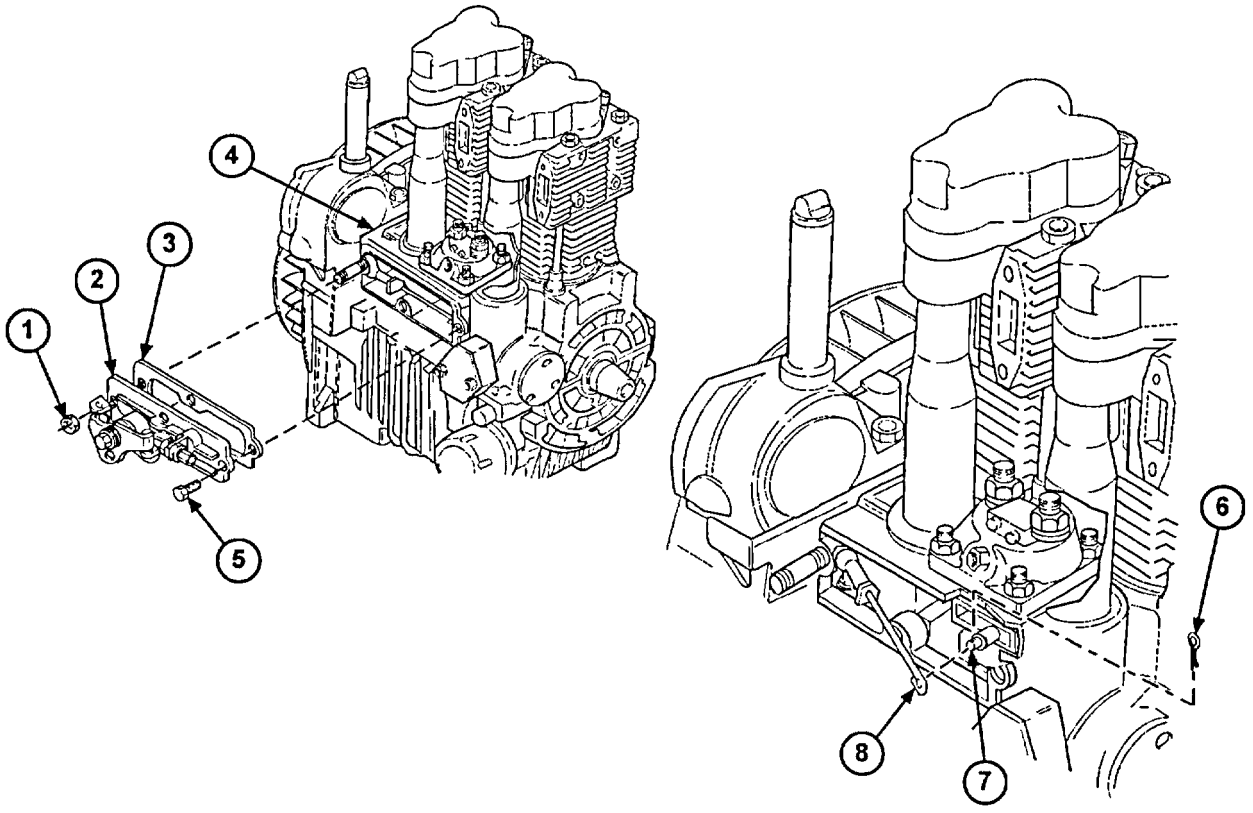
- Drycleaning solvent (Item 4, Appendix D)
- Rag (Item 7, Appendix D)
- Cotter pin (Item 22, Appendix F)
- Sealing compound (Item 17, Appendix D)
- Crankcase gasket set (Item 1, Appendix F)
- Head gasket set (Item 3, Appendix F)

**Equipment Conditions:**

- Airflow deflectors removed (UOC:APP) (para 2-24).
- Airflow deflectors removed (UOC:APJ) (TM 9-2350-292-20-2).
- Fuel pressure pipe assemblies and return fuel hose removed (para 2-23).

### a. REMOVAL

1. Remove three screws (5), nut (1), and governor plate (2) shown or extra fuel device, if equipped, from crankcase (4).
2. Remove gasket (3) from governor plate (2). Discard gasket.



**3-15. INJECTION PUMP REPLACEMENT (continued).**

3. Remove cotter pin (6) from control rack of injection pump (7). Discard cotter pin.

4. Remove end of governor lever (8) from control rack of injection pump (7).

5. Remove four nuts (9) from injection pump (7).

**NOTE**

- **To remove injection pump from crankcase, control rack of injection pump must be positioned under cutout in crankcase.**
- **The number of gaskets to be removed will vary. Refer to the first note in sub-paragraph c.**

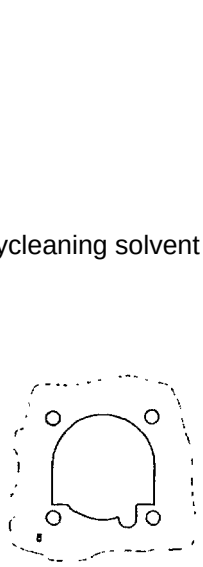
6. Position control rack of injection pump (7) under cutout in crankcase (4), and remove injection pump (7) and gaskets (10) from crankcase (4). Discard gaskets.

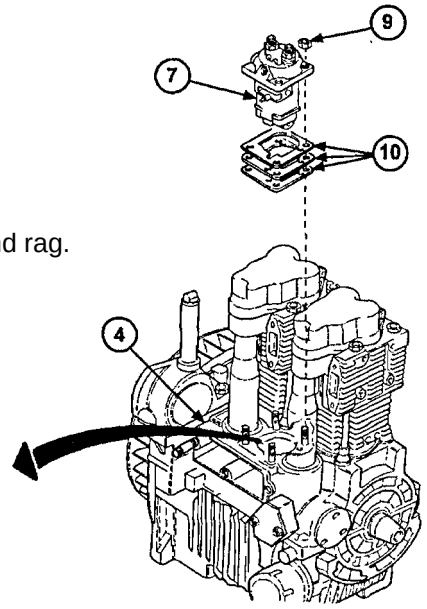
**b. CLEANING AND INSPECTION**

**WARNING**

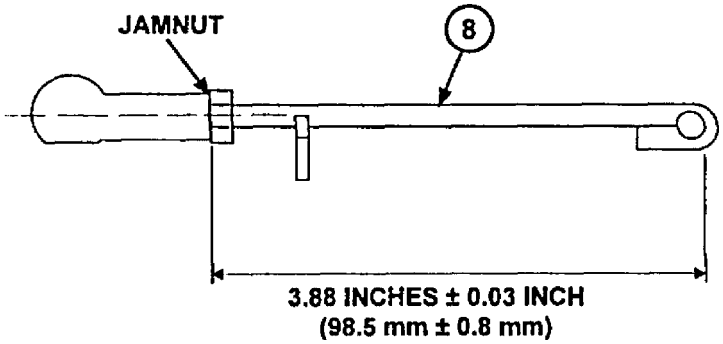
**Drycleaning solvent P-D-680 is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and do not breathe vapors. Do not use near open flame or excessive heat.**

1. Clean injection pump and cavity in crankcase with drycleaning solvent and rag.






2. Measure governor lever (8). It should measure 3.88 inches + 0.03 inch (98.5 mm = 0.8 mm). If measurement is not correct, adjust it by loosening jamnut and turning governor lever (8) in or out to shorten or lengthen it. Tighten jamnut when length is correct.



**3-15. INJECTION PUMP REPLACEMENT (continued).**

**c. INSTALLATION**

**NOTE**

**The thickness of the gasket(s) to be installed is determined by the number stamped on the side of the crankcase next to the injection pump. For example, if the number "6" is stamped on the crankcase, the total thickness of the gaskets should be 0.60 mm. Gaskets come in sets of three gaskets of varying thickness.**

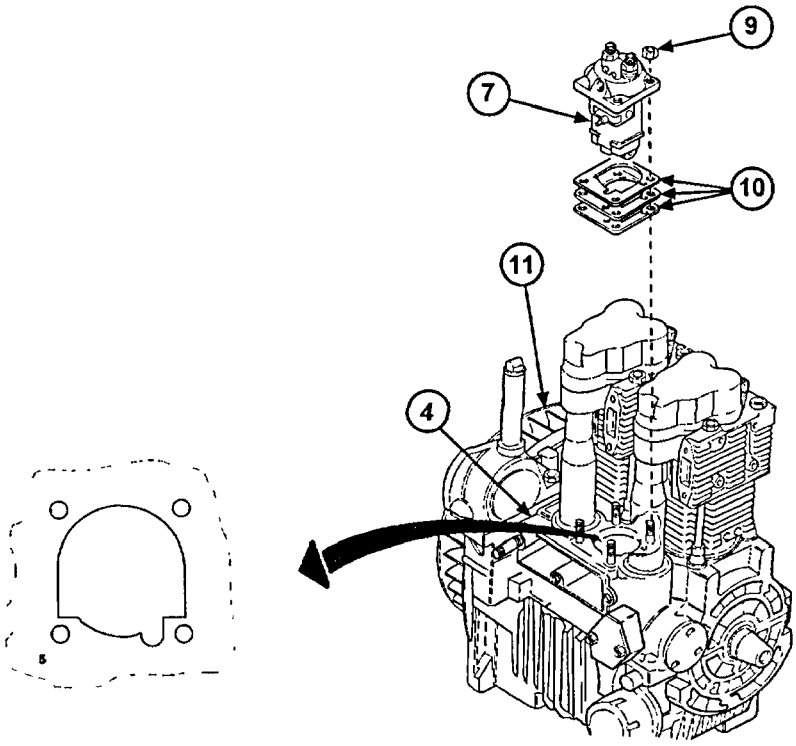
1. Install enough new gaskets (10) on crankcase (4) to reach the thickness indicated by the number stamped on crankcase (4).

**NOTE**

**To install injection pump in crankcase, control rack of injection pump must be positioned over cutout in crankcase.**

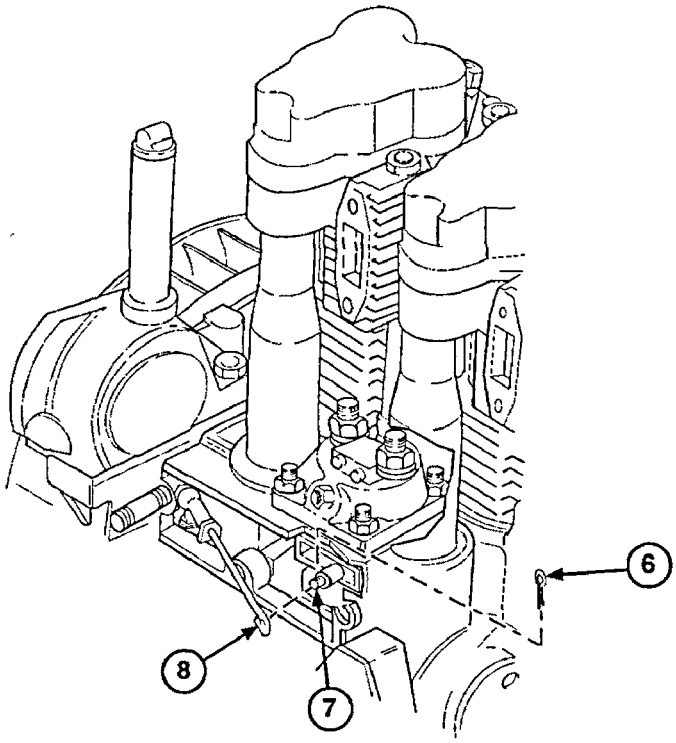
2. Position control rack of injection pump (7) over cutout, and install injection pump (7) on crankcase (4). Turn flywheel (11) to allow injection pump (7) to sit all the way down in the opening.

3. Apply sealing compound (Item 17, Appendix D) to threads of studs. Install four nuts (9) on injection pump (7).



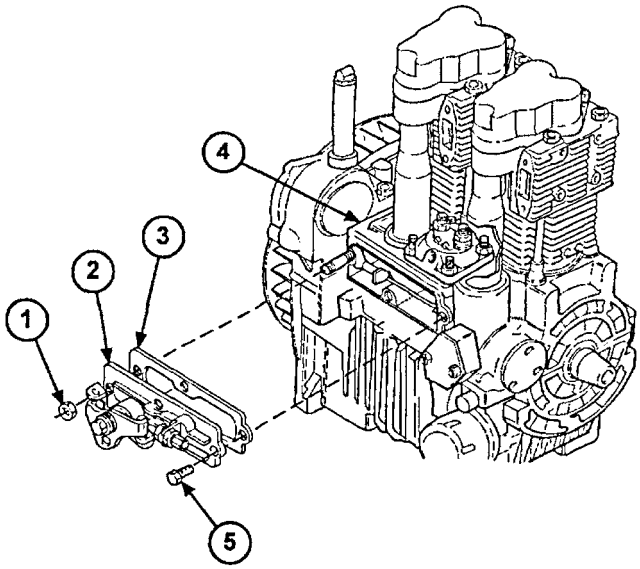
**3-15. INJECTION PUMP REPLACEMENT (continued).**

4. Install end of governor lever (8) on control rack of injection pump (7) and secure with new cotter pin (6).




5. Install new gasket (3) on governor plate (2).

6. Install governor plate (2) shown or extra fuel device if equipped on crankcase (4) and secure with nut (1) and three screws (5).




**FOLLOW-ON TASKS:**

- Install fuel pressure pipe assemblies and return fuel hose (para 2-23).
- Install airflow deflectors (para 2-24).

## 3-16. GOVERNOR CONTROL ASSEMBLY REPAIR

*This Task Covers:*

a. Removal
b. Disassembly
c. Assembly
d. Installation

*Initial Setup:*

**Tools/Test Equipment:**

- General mechanic's tool kit, automotive (item 15, Appendix G)
- Snapring pliers (Item 26, Appendix G)
- Seal (Item 13, Appendix F)
- Spring tension washer (Item 30, Appendix F)
- Wire mesh (Item 14, Appendix F)

**Materials/Parts:**

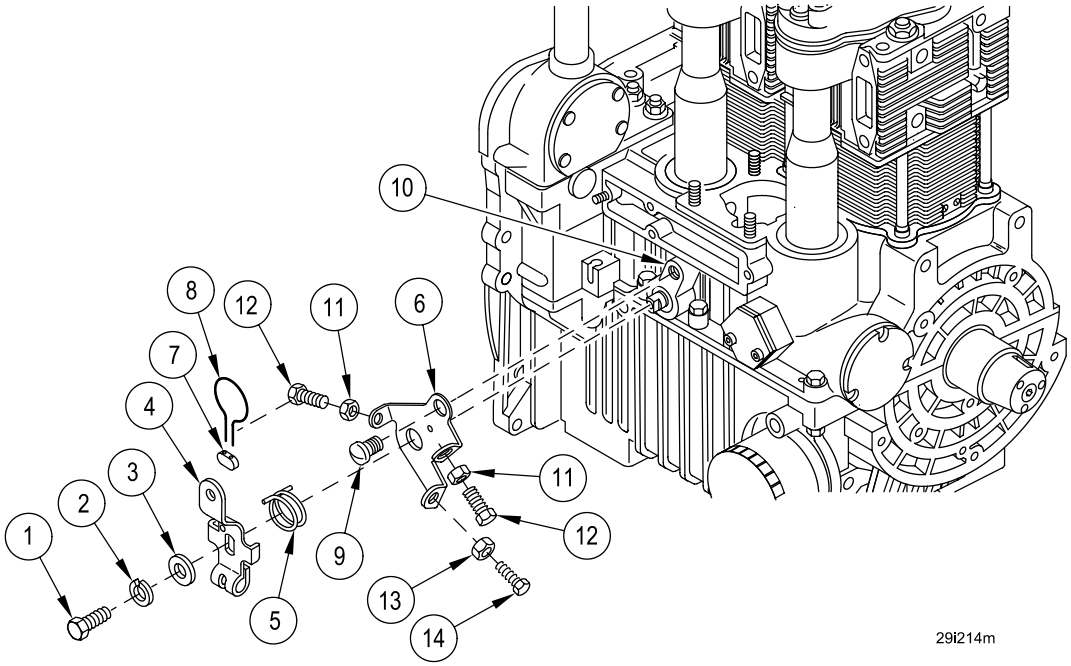
- Lockwasher (Item 26, Appendix F)
- O-ring (Item 37, Appendix F)

**References:**

- para 3-15
- para 3-22

### a. REMOVAL

1. Remove governor plate ((para 3-15).
2. Remove screw (1), lockwasher (2), washer (3), lever (4), and spring (5) from speed control lever (6). Discard lockwasher.
3. Remove seal (7) and wire mesh (8) from speed control lever (6). Discard seal and wire mesh.
4. Remove screw (9) and speed control lever (6) from crankcase (10).
5. Remove two nuts (11) and two screws (12) from speed control lever (6).
6. Remove nut (13) and screw (14) (UOC:APP).



## 3-16. GOVERNOR CONTROL ASSEMBLY REPAIR (continued).

**b. DISASSEMBLY**

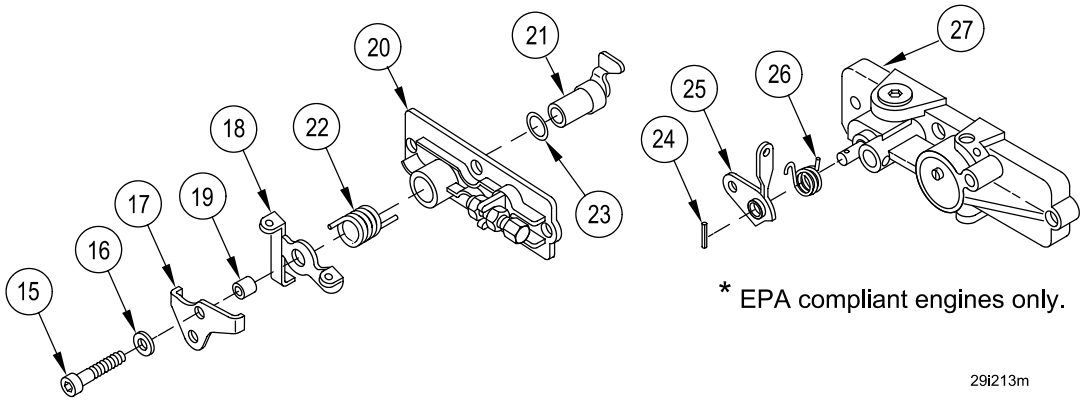
1. Remove screw (15), spring tension washer (16), two levers (17 and 18), and bushing (19) from mounting plate (20). Discard spring tension washer.
2. Remove stop lever (21) and spring (22) from mounting plate (20).
3. Remove O-ring (23) from stop lever (21). Discard O-ring.

*4. Remove spring pin (24), lever (25), and spring (26) from extra fuel device (27).

**c. ASSEMBLY**

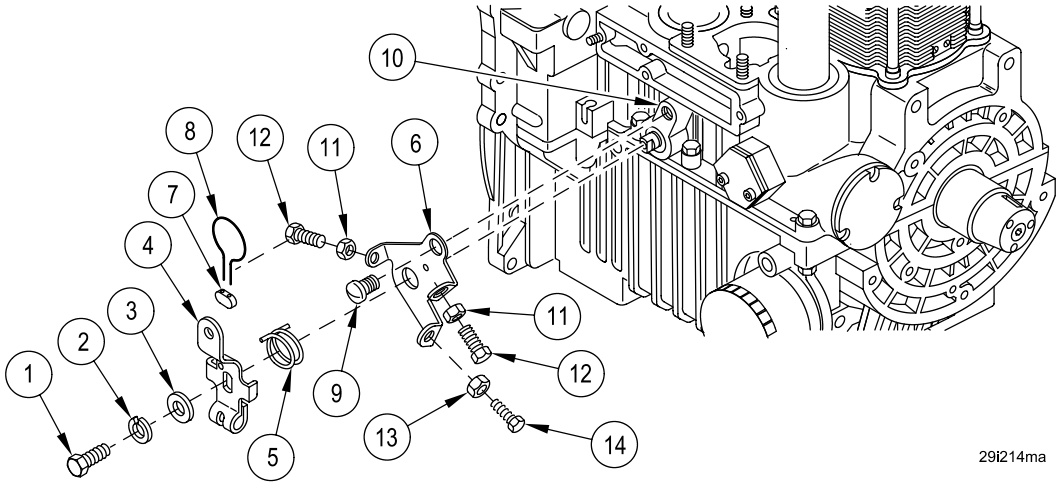
1. Install new O-ring (23) to stop lever (21).
2. Install stop lever (21) and spring (22) into mounting plate (20).
3. Install screw (15), new spring tension washer (16), two levers (17 and 18), and bushing (19) into mounting plate (20).

*4. Install spring (26), lever (25), and spring pin (24) to extra fuel device (27).




**d. INSTALLATION**

1. Install two screws (12) and two nuts (11) on speed control lever (6).
2. Install screw (14) and nut (13) (UOC:APP).
3. Install screw (9) and speed control lever (6) on crankcase (10).
4. Install spring (5), lever (4), washer (3), new lockwasher (2), and screw (1) on speed control lever (6).
5. Install governor plate (para 3-15).
6. Adjust engine speed (para 3-22).




7. Install new wire mesh (8) and new seal (7) on speed control lever (6).

**FOLLOW-ON TASKS:**

- None

## SECTION III. TESTS AND ADJUSTMENTS



### 3-17. CYLINDER COMPRESSION TEST.

*This Task Covers:*

Test

*Initial Setup:*

**Tools/Test Equipment:**
- Cylinder compression tester (Item 7, Appendix G)
- General mechanic's tool kit (Item 14, Appendix G)

**TEST**

**NOTE**

**The cylinder compression test is used to determine the condition of valves, pistons, piston rings, and cylinders. Any pressure difference between cylinders indicates a problem with one or more of these components.**

a. Run engine until thoroughly warm.

b. Remove fuel injectors (para 3-14).

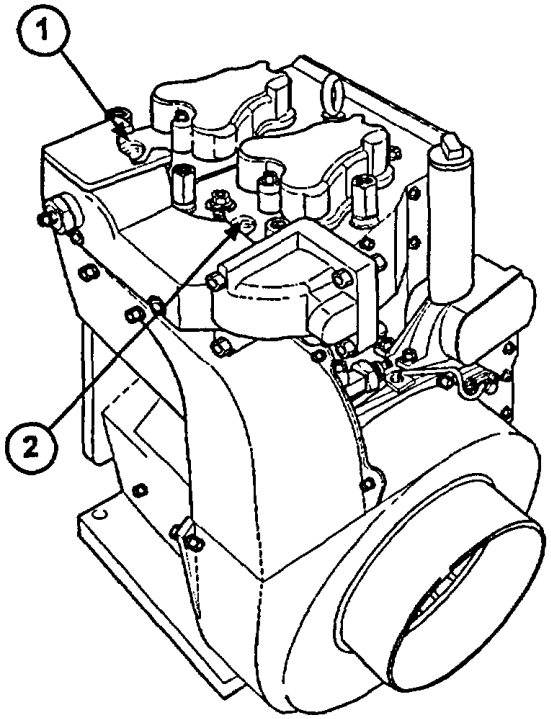
**NOTE**

**Compression tester gage reading for a new engine turning at about 300 rpm should be approximately 350 to 400 psi (2410 to 2758 kPa). If there is a pressure difference between cylinders, refer to paragraphs 3-5 and 3-9 for repair procedures for valves, pistons, piston rings, and cylinders.**

c. Insert compression tester into fuel injector bore near cylinder no. 1 (2) (on flywheel side of engine).

d. Crank engine and note compression reading on compression tester gage.

**3-17. CYLINDER COMPRESSION TEST (continued).**




e. Remove compression tester from fuel injector bore for cylinder no. 1 (2), and repeat steps c and d for fuel injector bore for cylinder no. 2 (1) (on auxiliary drive side of engine).

f. Remove compression tester from fuel injector bore for cylinder no. 2 (1).

g. Install fuel injectors (para 3-14).

**FOLLOW-ON TASKS:**
- None

## 3-18. VALVE ADJUSTMENT.

*This Task Covers:*

Adjustment

*Initial Setup:*

**Tools/Test Equipment:**
- General mechanic's tool kit, automotive (Item 15, Appendix G)

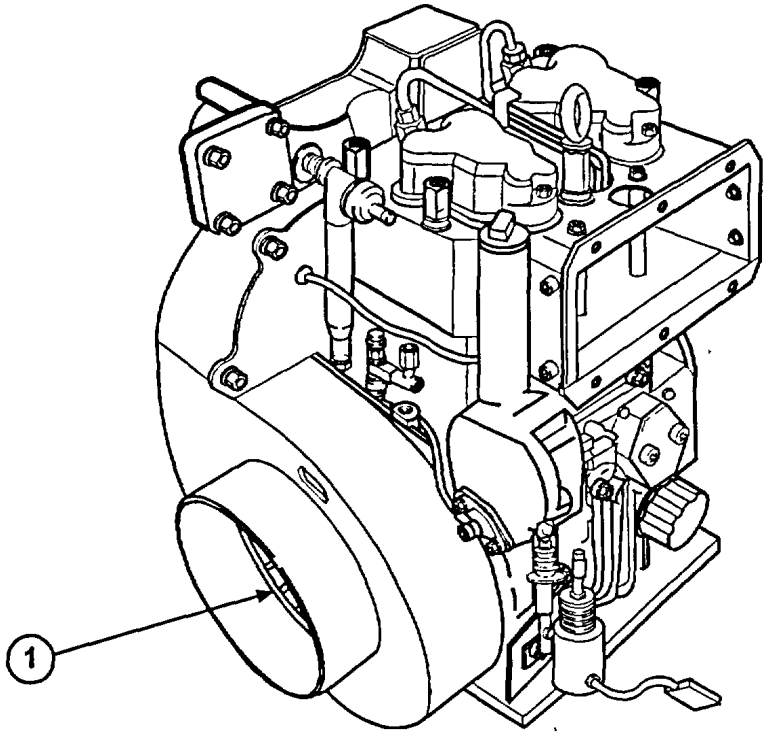
**Equipment Conditions:**
- Rocker arm cover removed (para 2-17).

**ADJUSTMENT**

**NOTE**

- **Cylinder no. 1 is on the flywheel side of the engine. Cylinder no. 2 is on the auxiliary drive side of the engine.**
- **Allow engine to cool to room temperature (approximately 75°F [24°C]) before adjusting the valves.**
- **Valves are in rocking position when the rocker arms are level and can be moved slightly.**

a. Turn flywheel (1) clockwise until valves in cylinder no. 2 are in rocking position, then turn flywheel 180 degrees further.

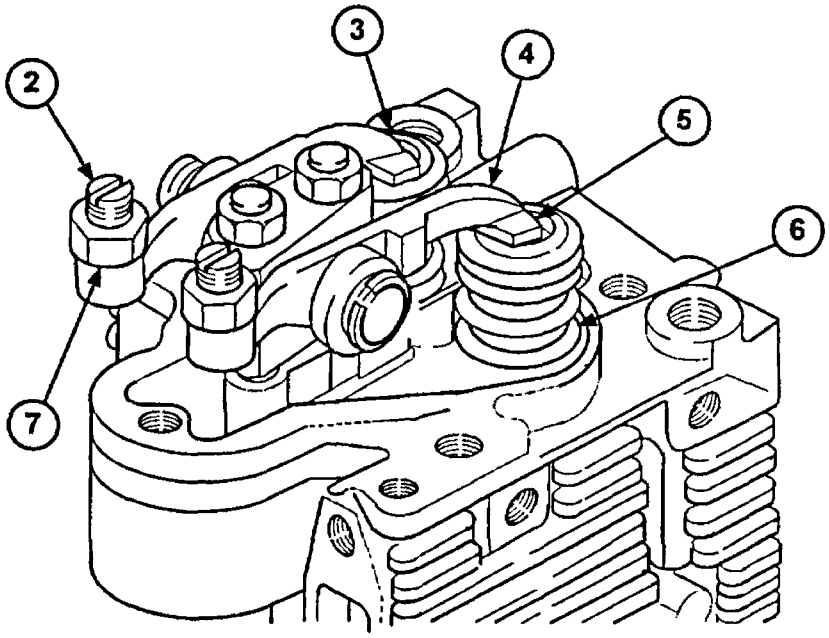


**3-18. VALVE ADJUSTMENT (continued).**

b. Using feeler gage, measure the clearance between rocker arm (4) and valve stem (5) on intake valve (3) and exhaust valve (6) of cylinder no. 1. Clearance should be 0.004 inch (0.102 mm).

c. To adjust clearance, loosen nut (7) and turn adjusting screw (2) so that, after tightening nut (7), clearance is correct.

d. Rotate flywheel (1) clockwise 180 degrees. Intake valve (3) and exhaust valve (6) of cylinder no. 2 will be fully closed. Repeat steps b and c for both valves (3 and 6) in cylinder no. 2.




**FOLLOW-ON TASKS:**

- Install rocker arm cover (para 2-17).

## 3-19. FLOW CONTROL VALVE ADJUSTMENT.

*This Task Covers:*

Adjustment

*Initial Setup:*

**Tools/Test Equipment:**

- Fuel-test set (Item 12, Appendix G)
- Fuel-testing device (Item 13, Appendix G)
- General mechanic's tool kit (Item 14, Appendix G)
- Indicator dial (Item 16, Appendix G)
- Wrench (Item 36, Appendix G)

**Materials/Parts:**

- Rubber band (Item 8, Appendix D)
- Crankcase gasket set (Item 1, Appendix F)
- Gasket (2) (Item 16, Appendix F)
- O-ring (2) (Item 17, Appendix F)

**Equipment Conditions:**

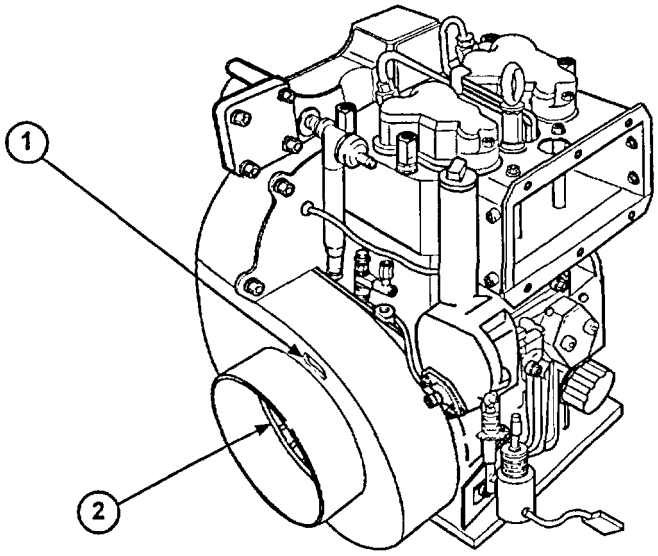
- Airflow deflectors removed as needed (UOC: APP) (para 2-24).
- Airflow deflectors removed as needed (UOC: APJ) (TM 9-2350-292-20-2)
- Fuel pressure pipes removed (para 2-23).
- Vehicle fuel supply connected to injection pump (refer to TM 9-2350-293-20) (UOC: APP).
- Vehicle fuel supply connected to injection pump (UOC: APJ) (TM 9-2350-292-20-2)

**ADJUSTMENT**

**NOTE**

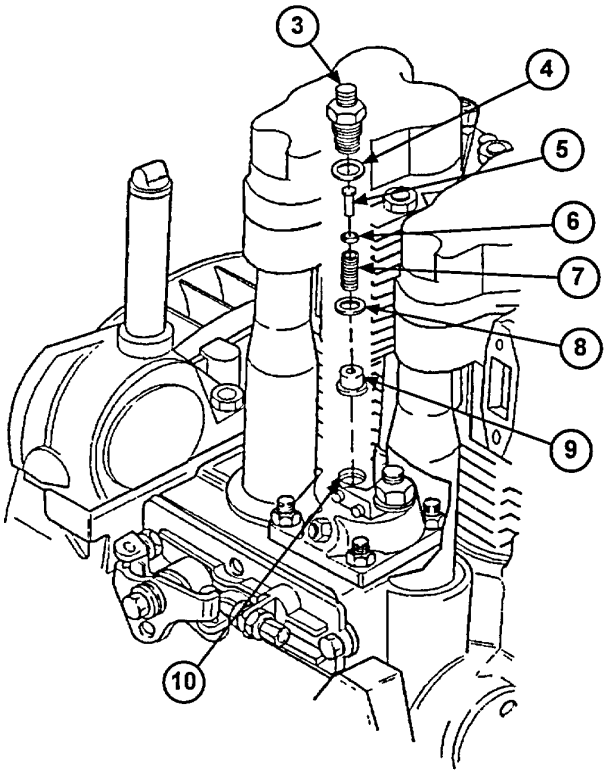
- **The flow control valve should be adjusted only if any of the following conditions exist: The flow control valve has been replaced; the engine lacks power; or the engine emits smoke after start-up, during operation.**
- **The fuel quantity injected is determined by the travel of the pump plunger between start and end of delivery. This dimension is specified in millimeters on the engine data plate located on the flywheel air duct.**

a. Turn flywheel (2) clockwise until 26-degree mark on flywheel (2) is aligned with "PM" mark on flywheel airflow deflector (1).



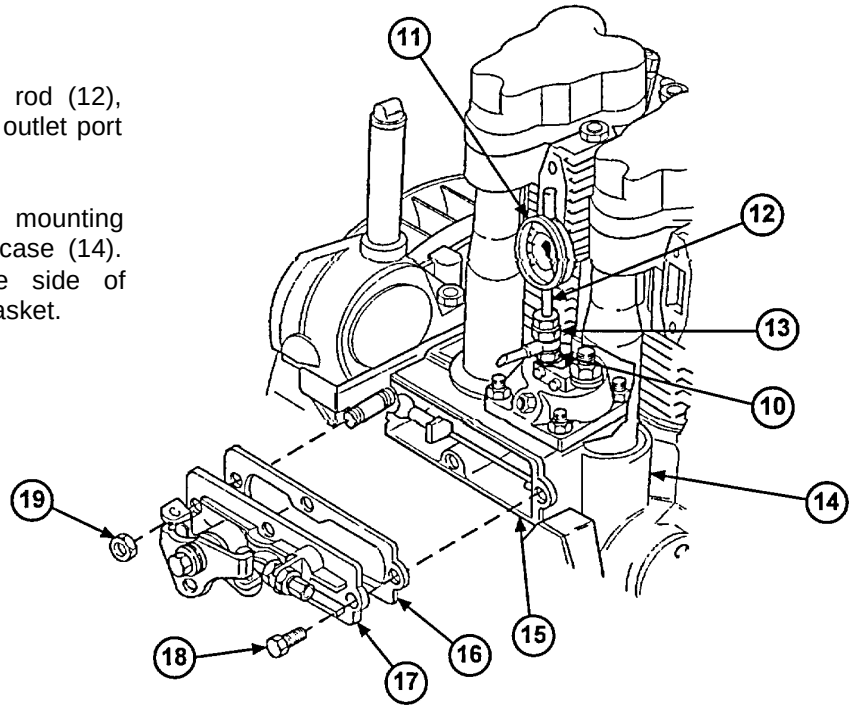
**3-19. FLOW CONTROL VALVE ADJUSTMENT (continued).**

b. Remove injector line fitting (3), O-ring (4), spring guide (5), shim (6), spring (7), gasket (8), and delivery valve (9) from injection pump outlet port (10). Discard O-ring and gasket.




c. Install fuel-testing device (13), adapter rod (12), and indicator dial (11) in injection pump outlet port (10).

d. Remove three screws (18), nut (19), mounting plate (17), and gasket (16) from crankcase (14). Install screw (18) on auxiliary drive side of mounting plate opening (15). Discard gasket.

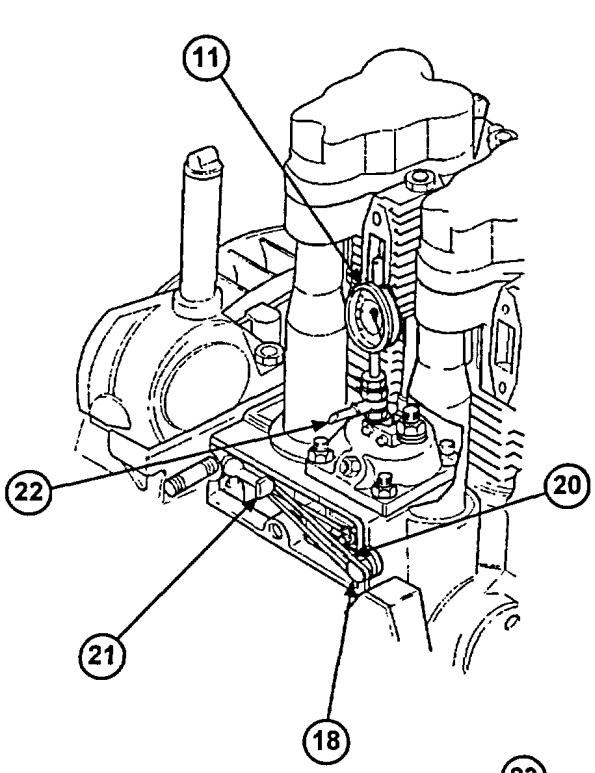


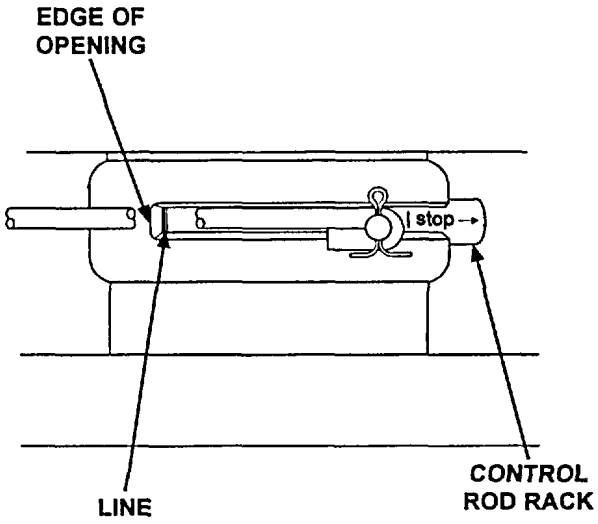
**3-19. FLOW CONTROL VALVE ADJUSTMENT (continued).**

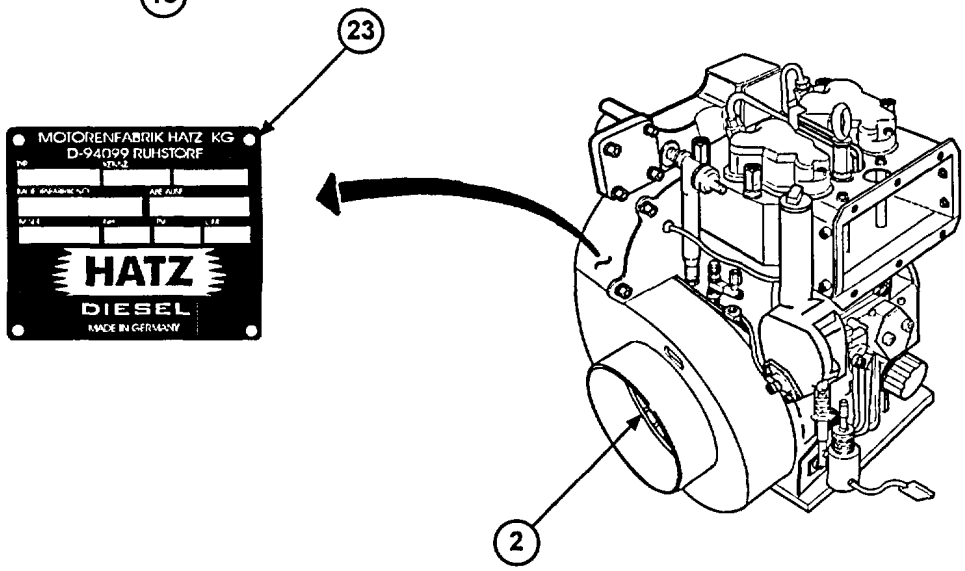
e. Place rubber band (20) around governor lever pad (21) and screw (18), to position line on control rod rack at edge of opening.

f. Open fuel shutoff valve (refer to technical manual for vehicle).

g. Set indicator dial (11) at "0." Turn flywheel (2) clockwise until the dimension specified on engine data plate (23) is reached. In this position, fuel should come out of spill device outlet (22) at the rate of approximately one drop every five seconds.



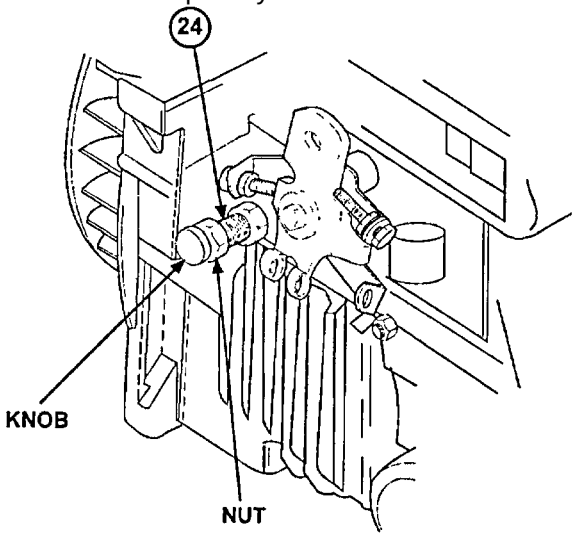
**3-19. FLOW CONTROL VALVE ADJUSTMENT (continued).**

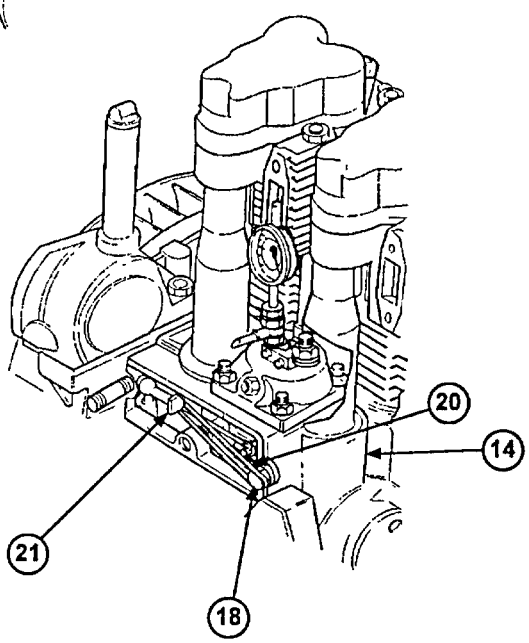
**NOTE**

**If fuel comes out of spill device outlet before the dimension specified on engine data plate is reached, fuel quantity is set too low. If no fuel comes out of the spill device outlet at the specified dimension, fuel quantity is set too high.**

h. If fuel quantity is incorrect, loosen nut on flow control valve (24). Turn knob to the right to increase fuel quantity or to the left to decrease fuel quantity.

i. Tighten nut and repeat steps g and h until fuel quantity is correct.



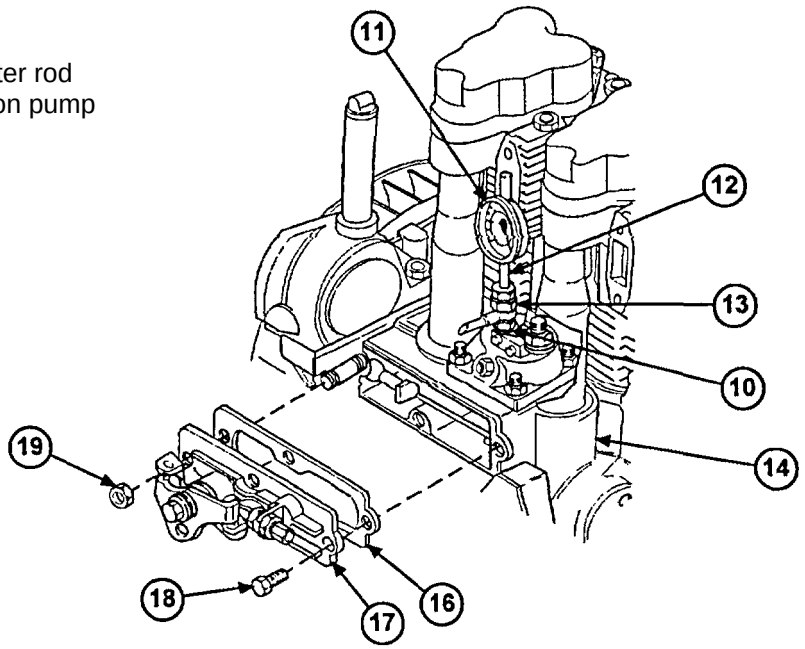

j. Close fuel shutoff valve (refer to technical manual for vehicle).

k. Remove rubber band (20) from governor lever pad (21) and screw (18). Remove screw (18) from crankcase (14).

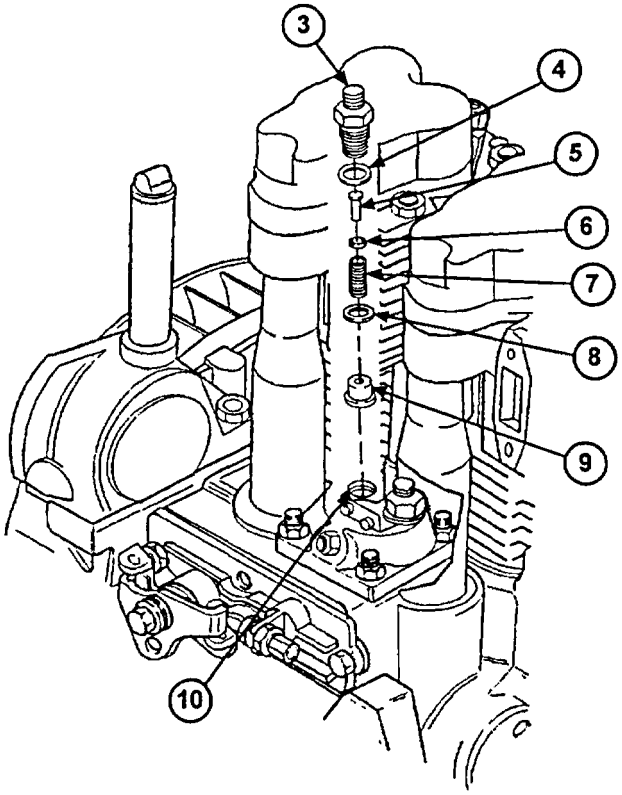
**3-19. FLOW CONTROL VALVE ADJUSTMENT (continued).**

l. Install mounting plate (17) and new gasket (16) on crankcase (14). Secure with three screws (18) and nut (19).

m. Remove fuel-testing device (13), adapter rod (12), and indicator dial (11) from injection pump outlet port (10).




n. Install delivery valve (9), new gasket (8), spring (7), shim (6), spring guide (5), new O-ring (4), and injector line fitting (3) on injection pump outlet port (10).




**FOLLOW-ON TASKS:**

- Disconnect vehicle fuel supply from injection pump (UOC: APP) (refer to TM 9-2350-293-20).
- Disconnect vehicle fuel supply from injection pump (UOC: APJ) (TM 9-2350-292-20-2)
- Install fuel pressure pipes (para 2-23).
- Install airflow deflectors (UOC: APP) (para 2-24).
- Install airflow deflectors (UOC: APJ) (TM 9-2350-292-20-2).

## 3-20. INJECTION PUMP TEST.

*This Task Covers:*

Test

*Initial Setup:*

**Tools/Test Equipment:**

- Fuel-test set (Item 12, Appendix G)
- General mechanic's tool kit, automotive (Item 15, Appendix G)
- Wrench (Item 36, Appendix G)

**Equipment Conditions:**

- Airflow deflectors removed as needed (UOC: APP) (para 2-24).
- Air flow deflectors removed as needed (UOC: APJ) (TM 9-2350-292-20-2).

**TEST**

a. Remove fuel pressure pipe clamp and fuel pressure pipe assembly from fuel injector on flywheel side of engine (para 2-23).

b. Remove fuel injector from flywheel side of engine (para 3-14).

c. Install extension tube (4), tube assembly (5), and indicator dial (1) from fuel-test set on flywheel-side port (2) of injection pump (3).

**WARNING**

**Fuel spray on hot components is an extreme fire hazard. Control leakage immediately, to prevent serious injury to personnel.**

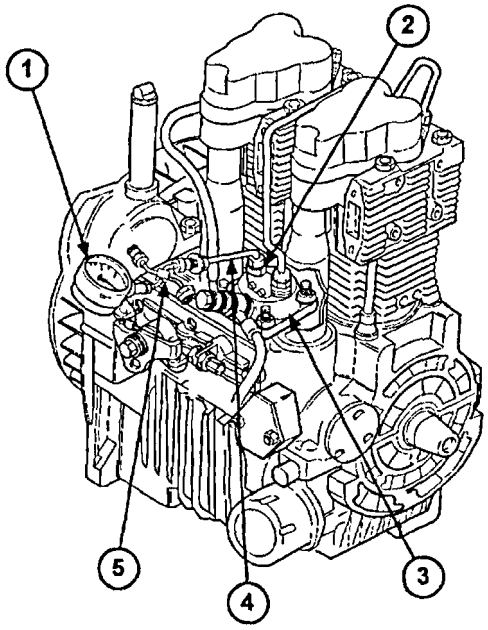
d. Crank engine and observe indicator dial (1). Reading should be between 250 and 258 bars. If reading is incorrect, replace injection pump (para 3-15).

e. Remove indicator dial (1), tube assembly (5), and extension tube (4) from flywheel side port (2) of injection pump (3).

f. Install fuel injector on engine (para 3-14).

g. Install fuel pressure pipe assembly and fuel pressure pipe clamp (para 2-23).

h. Repeat steps a through g for port on auxiliary drive side of injection pump.




**FOLLOW-ON TASKS:**

- Install airflow deflectors (UOC:APP) (para 2-24).
- Install airflow deflectors (UOC:APJ) (TM 9-2350-292-20-2).

## 3-21. FUEL INJECTOR TEST.

*This Task Covers:*

Test

*Initial Setup:*

**Tools/Test Equipment:**

- Fuel-test set (Item 12, Appendix G)
- General mechanic's tool kit, automotive (Item 15, Appendix G)

**Equipment Conditions:**

- Airflow deflectors removed as needed (UOC: APP) (para 2-24).
- Air flow deflectors removed as needed (UOC: APJ) (TM 9-2350-292-20-2)
- Injection pump test performed (para 3-20).

**TEST**

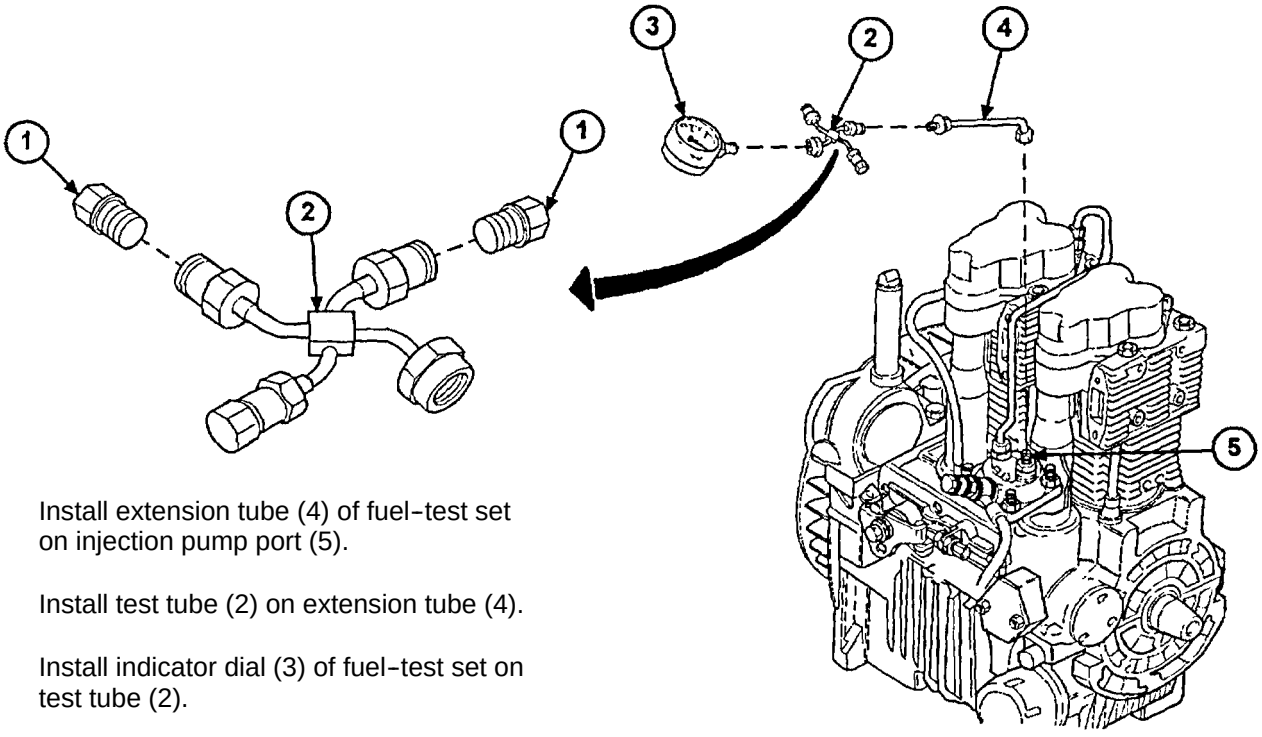
**NOTE**

**There are two fuel injectors on the engine. Use this procedure to test either one.**

a. Remove fuel pressure pipe clamp and fuel pressure pipe assembly from fuel injector to be tested (para 2-23).

b. Remove fuel injector to be tested (para 3-14).

c. Remove two blank plugs (1) from test tube (2).




d. Install extension tube (4) of fuel-test set on injection pump port (5).

e. Install test tube (2) on extension tube (4).

f. Install indicator dial (3) of fuel-test set on test tube (2).

**3-21. FUEL INJECTOR TEST (continued).**

g. Install fuel injector (6) on test tube (2).

**WARNING**

- **Fuel spray on hot components is an extreme fire hazard. Control leakage immediately, to prevent serious injury to personnel.**
- **Keep hands away from fuel injector after installing it on test tube. Fuel spray can penetrate the skin, causing blood poisoning. Failure to follow this warning may result In serious injury or death.**

h. Crank engine.

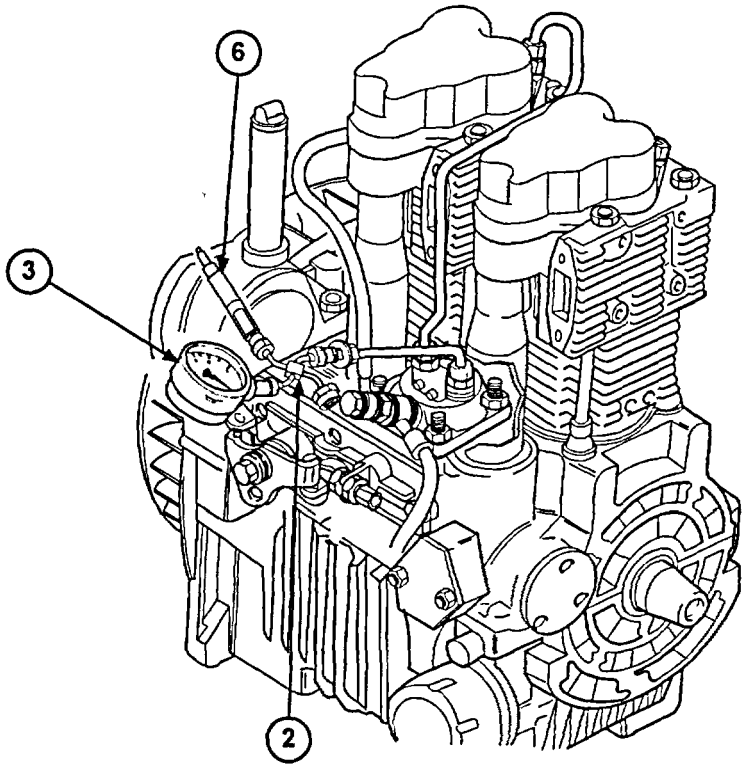
i. Check pressure reading at indicator dial (3). Correct pressure is 250 to 258 bar.

j. If pressure is not correct, replace fuel injector (para 3-14).

k. Check spray pattern. Fuel should spray evenly, in a diffuse pattern, rather than in a stream or dripping.

l. If spray pattern is not correct, replace fuel injector (6) (para 3-14).

m. Remove fuel injector (6) from test tube (2).

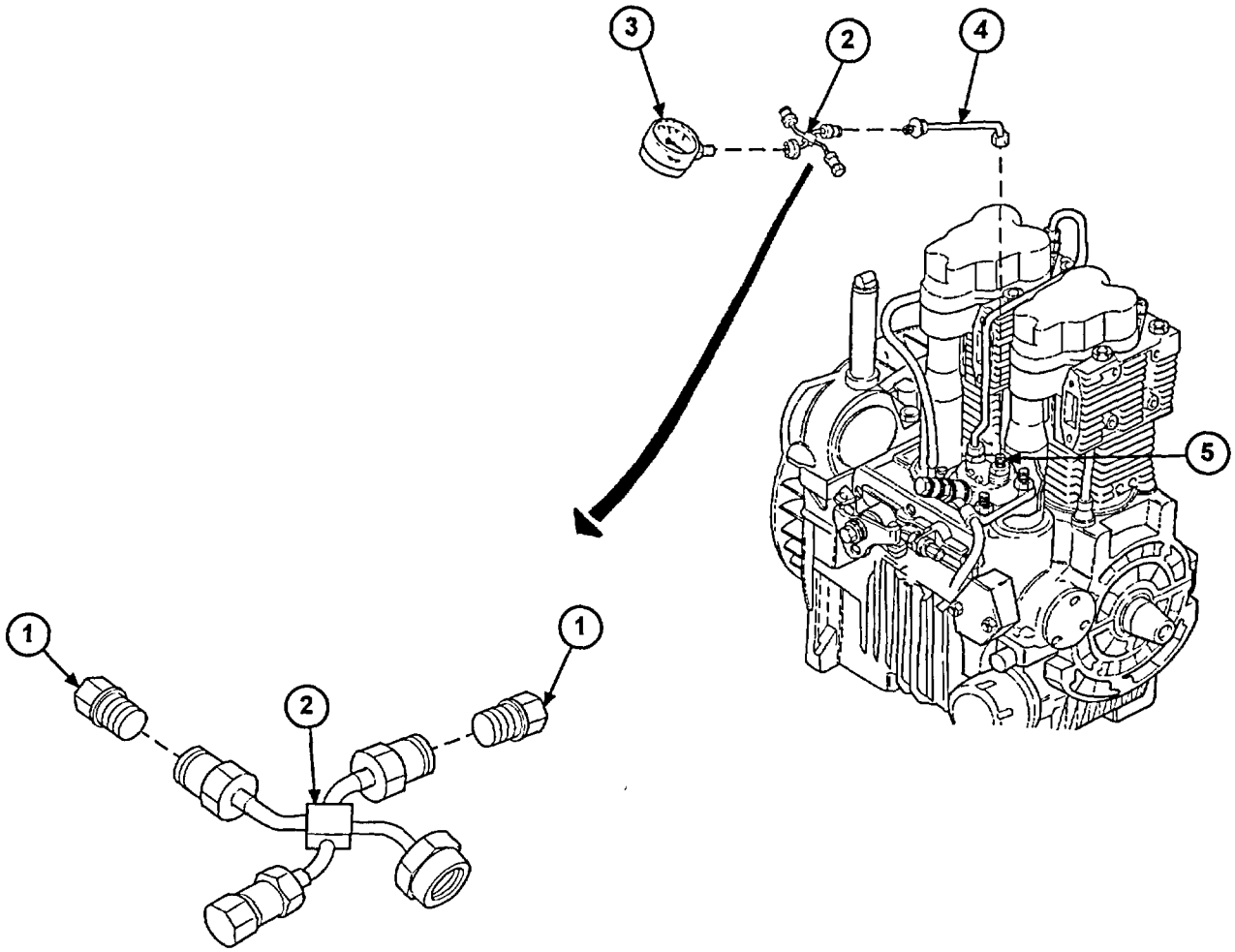


**3-21. FUEL INJECTOR TEST (continued).**

n. Remove indicator dial (3) from test tube (2).

o. Remove test tube (2) from extension tube (4)

p. Remove extension tube (4) from injection pump port (5).




q. Install blank two plugs (1) on test tube (2).

r. Install fuel injector (para 3-14).

s. Install fuel pressure pipe assembly and fuel pressure pipe clamp (para 2-23).

**FOLLOW-ON TASKS:**

- Install airflow deflectors (UOC: APP) (para 2-24).
- Install airflow deflectors (UOC: APJ) (TM 9-2350-292-20-2).

## 3-22. ENGINE SPEED ADJUSTMENT.

*This Task Covers:*

Adjustment

*Initial Setup:*

**Tools/Test Equipment:**

- General mechanic's tool kit, automotive (Item 15, Appendix G)
- Mechanical hand-held tachometer (Item 18, Appendix G)

**Personnel Required:**

- Two

**ADJUSTMENT**

**NOTE**

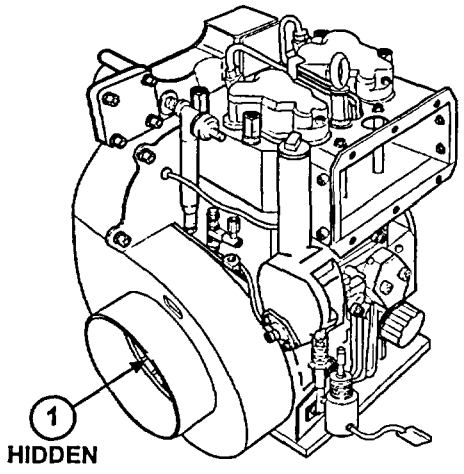
**Engine speed is measured in revolutions per minute (rpm).**

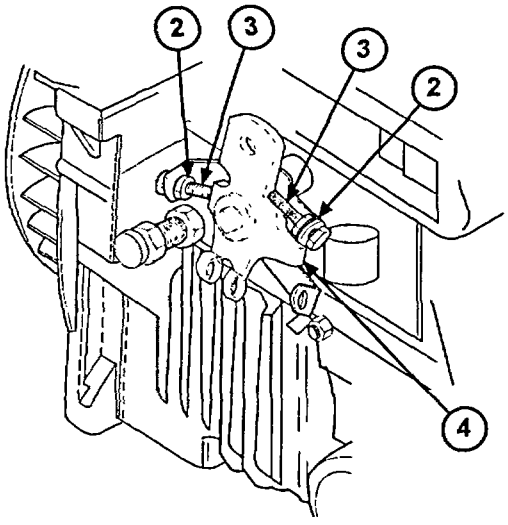
a. Start engine and let it run until warm.

b. Have an assistant hold a hand-held mechanical tachometer on end of crankshaft (1) on flywheel side of engine.

c. The rpm reading on tachometer should be 2200±50 rpm (UOC: APP) or 2650 ±50 rpm (UOC: APJ). If it is not, loosen two nuts (2) and turn two adjusting screws (3) to move speed control lever (4), while assistant watches tachometer gage, until correct rpm reading is reached. Moving speed control lever (4) to the left will decrease engine speed; moving speed control lever (4) to the right will increase engine speed.

d. Hold two adjusting screws (3) in place and tighten two nuts (2).




e. Recheck engine speed by repeating steps b through d.

**FOLLOW-ON TASKS:**

- None

## 3-23. OIL PRESSURE TEST.

*This Task Covers:*

Test

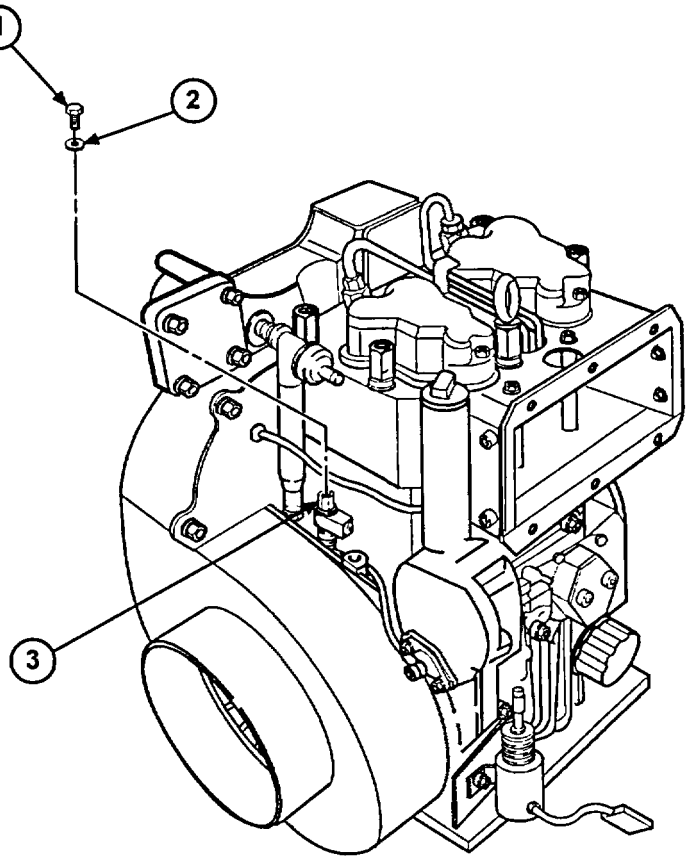
*Initial Setup:*

**Tools/Test Equipment:**

- General mechanic's tool kit, automotive (Item 15, Appendix G)
- Oil pressure test set (Item 20, Appendix G)

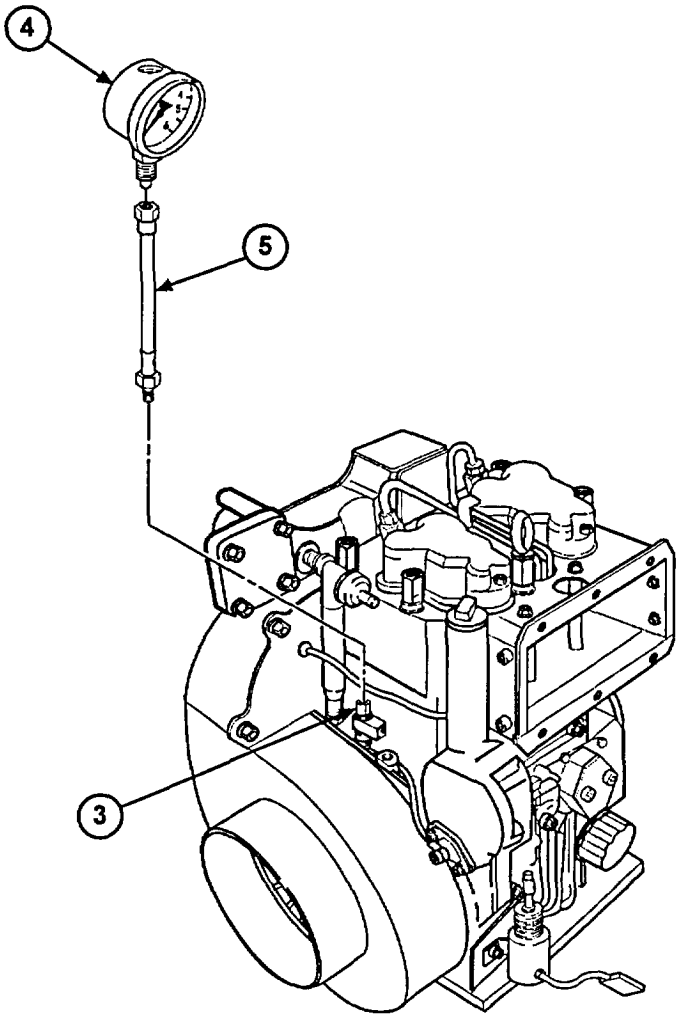
**TEST**

a. Remove screw (1) and washer (2) from fluid passage bolt (3).



**3-23. OIL PRESSURE TEST (continued).**

b. Install oil pressure gage (4) on flexible connector (5), and install flexible connector (5) on fluid passage bolt (3).




c. Start the engine and allow it to warm up. Run the engine at the speeds indicated in Table 3-1, and check the oil pressure gage.

*Table 3-1. Oil Pressure*

| Speed in rpm | Normal Oil Pressure | Minimum Oil Pressure |
|---|---|---|
| 900 | 1.2 to 2.5 bar (17.4 to 36.3 psi) | 0.4 bar (5.8 psi) |
| 1500 | 1.8 to 3.5 bar (26.1 to 50.8 psi) | 1.0 bar (14.5 psi) |
| 2300 | 2.5 to 4.5 bar (36.3 to 65.3 psi) | 1.8 bar (26.1 psi) |
| 3000 | 3.5 to 5.0 bar (50.8 to 72.5 psi) | 2.5 bar (36.3 psi) |

**FOLLOW-ON TASKS:**

- None

# APPENDIX A
# REFERENCES



## A-1. GENERAL.

This appendix lists all forms, pamphlets, and regulations that are referenced in this technical manual. DA Pam 25-30 should be consulted frequently for the latest changes or revisions and for new publications relevant to material covered in this manual.

## A-2. FORMS.

Refer to DA Pam 738-750 for instructions on the use of maintenance forms.

Recommended Changes to Publications and Blank Forms . . . . . DA Form 2028

Recommended Changes to Equipment Technical Publications . . . . . DA Form 2028-2

Processing and Deprocessing Record for Shipment, Storage and Issue of Vehicles and Spare Engines . . . . . DD Form 1397

Product Quality Deficiency Report . . . . . SF Form 368

## A-3. MANUALS.

First Aid for Soldiers
Army . . . . . FM 4-25.11
Marine Corps . . . . . MCRP 3-02G

Inspection, Care and Maintenance of Antifriction Bearings . . . . . TM 9-214

Materials Used for Cleaning, Preserving, Abrading and Cementing Ordnance Materiel and Related Materials Including Chemicals . . . . . TM 9-247

Operator's Manual for Carrier, Ammunition, Tracked, M992A2 (NSN 2350-01-368-9500) . . . . . TM 9-2350-293-10

Unit Maintenance Manual for Carrier, Ammunition, Tracked, M992A2 (NSN 2350-01-368-9500) . . . . . TM 9-2350-293-20-1 and -2

Unit, Direct Support and General Support Maintenance Repair Parts and Special Tools List for Carrier, Ammunition, Tracked, M992A2 (2350-01-368-9500) . . . . . TM 9-2350-293-24P

Direct Support and General Support Maintenance Manual: for Carrier, Ammunition, Tracked, M992A2 (NSN 2350-01-368-9500) . . . . . TM 9-2350-293-34

Storage and Materials Handling . . . . . TM 743-200-1

Procedures for Destruction of Tank-Automotive Equipment to Prevent Enemy Use . . . . . TM 750-244-6

## A-3. MANUALS (CONTINUED)

Operator's Manual: Recovery Vehicle, Heavy, Full-Tracked: M88A2 . . . . . TM 9-2350-292-10
Unit Maintenance Manual: Recovery Vehicle, Heavy, Full-Tracked: M88A2 . . . . . TM 9-2350-292-20
Direct and General Support Maintenance Manual: Recovery Vehicle, Full-Tracked, Heavy: M88A2 (NSN 2350-01-390-4683) . . . . . TM 9-2350-292-34
Unit, Direct Support and General Support Maintenance Repair Parts and Special Tools List for Recovery Vehicle, Heavy, Full-Tracked: M88A2 . . . . . TM 9-2350-292-24P

## A-4. PAMPHLETS AND CIRCULARS.

Consolidated Index of Army Publications and Blank Forms . . . . . DA Pam 25-30
Functional User's Manual for The Army Maintenance Management System (TAMMS) . . . . . DA Pam 738-750
Operator's Circular Welding Theory and Application . . . . . TC 9-237

## A-5. REGULATIONS.

Product Quality Deficiency Report Program . . . . . AR 702-7
Army Medical Department Expendable/Durable Items . . . . . CTA 8-100
Expendable/Durable Items (Except: Medical, Class V, Repair Parts and Heraldic Items) . . . . . CTA 50-970
Abbreviations for Use on Drawings, Specifications, Standards, and in Technical Documents . . . . . MIL-STD-12

# APPENDIX B
# MAINTENANCE ALLOCATION CHART

## Section I. INTRODUCTION



### B-1. GENERAL.

Appendix B consists of three sections:

a. Section I provides a general explanation of all maintenance and repair functions authorized at the various maintenance levels.

b. Section II, the maintenance allocation chart (MAC), designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component will be consistent with the capacities and capabilities of the designated maintenance levels.

c. Section III lists the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from Section II.

### B-2. MAINTENANCE FUNCTIONS.

Maintenance functions are limited to and defined as follows:

a. **Inspect.** To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination (e.g., by sight, sound, or feel).

b. **Test.** To verify serviceability by measuring the mechanical, pneumatic, hydraulic, or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. **Service.** To keep an item in proper operating condition by periodically cleaning (including decontaminating, when required), preserving, draining, painting, or replenishing fuel, lubricants, chemical fluids, or gases.

d. **Adjust.** To maintain or regulate, within prescribed limits, by bringing into proper or exact position or by setting the operating characteristics to specified parameters.

e. **Align.** To adjust specified variable elements of an item to bring about optimum or desired performance.

## B-2. MAINTENANCE FUNCTIONS (continued).

f. **Calibrate.** To determine the accuracy of and cause corrections or adjustments to be made on instruments or test, measuring, and diagnostic equipment (TMDE) used in precision measurement. Calibration consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy In the accuracy of the instrument being compared.

g. **Remove/Install.** To remove and Install the same item when required to perform service or other maintenance functions. "Install" may be the act of emplacing, seating, or fixing into position a spare, repair part, or module (component or assembly) in a manner to allow the proper functioning of an end Item or system.

h. **Replace.** To remove an unserviceable item and install a serviceable counterpart in its place. "Replace" is authorized by the MAC and is shown as the third position of the source, maintenance, and recoverability (SMR) code.

i. **Repair.** To apply maintenance services-including fault location/troubleshooting, removal/installation, and disassembly/assembly procedures-and maintenance actions to identify troubles and restore serviceability to an item by correcting any specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end Item, or system.

j. **Overhaul.** To perform that maintenance effort (service/action) required to restore an item to a completely serviceable/operational condition as required by maintenance standards in an appropriate technical publication (e.g., depot maintenance work requirement). Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like-new condition.

k. **Rebuild.** To perform those services/actions necessary for the restoration of unserviceable equipment to a like-new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (e.g., hours, miles) considered In classifying Army equipment/components.

## B-3. EXPLANATION OF COLUMNS IN SECTION II, MAINTENANCE ALLOCATION CHART FOR ENGINE ASSEMBLY, DIESEL, HATZ 2 G 40.

a. **(1) Group Number.** Column 1 lists functional group code numbers, whose purpose is to identify maintenance-significant components, assemblies, subassembies, and modules with the next higher assembly. The end Item group number is "00."

b. **(2) Component/Assembly.** Column 2 contains the names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. **(3) Maintenance Function.** Column 3 lists the functions to be performed on the item listed in Column 2. (For a detailed explanation of these functions, refer to para B-2.)

d. (**4) Maintenance Level.** Column 4 specifies, by the listing of a work-time figure in the appropriate subcolumn(s), the level of maintenance authorized to perform the function listed in Column 3. This figure represents the active time required to perform that maintenance function at the indicated level of maintenance. If the number or complexity of the tasks within the listed maintenance function varies at different maintenance levels, appropriate work-time figures will be shown for each level. The work-time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This time includes preparation time (including any necessary disassembly/assembly

## B-3. EXPLANATION OF COLUMNS IN SECTION II, MAINTENANCE ALLOCATION CHART FOR ENGINE ASSEMBLY, DIESEL, HATZ 2 G 40 (continued).

troubleshooting/fault location time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the MAC. The symbol designations for the various maintenance levels are as follows:

C.....Operator/Crew
O.....Unit
F.....Direct Support
H.....General Support
D.....Depot

e. **(5) Tools and Test Equipment Reference Code.** Column 5 specifies, by code, those common tool sets (not individual tools), common TMDE, special tools, special TMDE, and special support equipment required to perform the designated maintenance function. Codes are keyed to tools and test equipment listed in Section III.

f. **(6) Remarks.** When applicable, this column contains a lettercode, in alphabetical order, which is keyed to remarks contained in Section IV. If there is nothing in the Remarks column, there is no Section IV.

## B-4. EXPLANATION OF COLUMNS IN SECTION III, TOOLS AND TEST EQUIPMENT REQUIREMENTS.

a. **Column 1, Tools and Test Equipment Reference Code.** This code correlates with the code used in Section II, Column 5.

b. **Column 2, Maintenance Level.** The symbol designation shown indicates the lowest level of maintenance authorized to use the tool or test equipment.

c. **Column 3, Nomenclature.** This is the name or identification of the tool or test equipment.

d. **Column 4, National Stock Number.** This is the national stock number of the tool or test equipment.

e. **Column 5, Tool Number.** This is the manufacturer's part number.

## Section II. MAINTENANCE ALLOCATION CHART FOR ENGINE ASSEMBLY, DIESEL, HATZ 2 G 40

| (1) Group No. | (2) Component/ Assembly | (3) Maintenance Function | (4) Maintenance Level | | | | (5) Tools and Equipment | (6) Remarks |
|---|---|---|---|---|---|---|---|---|
| | | | O | F | H | D | | |
| **22** | BODY, CHASSIS AND HULL ACCESSORY ITEMS | | | | | | | |
| **2210** | Engine Identification Plate | Replace | 0.5 | | | | 1, 2, 7 | |
| **29** | AUXILIARY GENERATOR AND ENGINE, AND CONTROLS | | | | | | | |
| **2910** | Engine Assembly | Inspect | 0.1 | | | | | |
| | | Service | 0.5 | | | | 2 | |
| | | Test | 1.0 | 3.0 | | | 3, 9 | |
| | | Adjust | 1.0 | 3.0 | | | 2, 6,10, 15,16 | |
| | | Repair | 2.0 | 16 | | | 2, 6, 10 15, 16 | |
| **2911** | Crankcase, Cylinder Sleeve, Cylinder Head, and Block | Replace | | 8.0 | | | 2, 5, 7, 8 | |
| | | Repair | | 2.0 | | | 2, 4, 6,11 | |
| **2912** | Crankshaft | Replace | | 1.0 | | | 3, 5, 8, 12, 14 | |
| **2913** | Flywheel Assembly | Replace | | 1.0 | | | 2, 5 | |
| **2914** | Pistons and Connecting Rods | Replace | | 2.0 | | | 2, 7 | |
| | | Repair | | 2.0 | | | 2, 5, 6, 8 | |
| **2915** | Valves, Camshaft, and Timing System | Adjust | | 1.0 | | | 2 | |
| | | Replace | | 3.0 | | | 2 | |
| | | Repair | | 2.0 | | | 2, 5, 8 | |
| **2916** | Engine Lubrication System | Test | | 0.5 | | | 2, 17 | |
| | | Replace | 0.5 | 2.0 | | | 2, 5, 13 | |
| | Oil Filter | Replace | 0.2 | | | | 2, 7 | |
| **2918** | Manifolds | Replace | 1.0 | | | | 2, 5 | |
| **2932** | Injector Pump, Nozzles, and Fuel Lines | Adjust | | 2.0 | | | 2, 3, 10, 16 | |
| | | Replace | 1.0 | 3.0 | | | 2, 5,10 | |

## Section II. MAINTENANCE ALLOCATION CHART FOR ENGINE ASSEMBLY, DIESEL, HATZ 2 G 40 (continued)

| (1) Group No. | (2) Component/ Assembly | (3) Maintenance Function | (4) Maintenance Level | | | | (5) Tools and Equipment | (6) Remarks |
|---|---|---|---|---|---|---|---|---|
| | | | O | F | H | D | | |
| **2936** | Engine Speed Governor and Controls | Adjust<br>Replace | | 2.0<br>5.0 | | | 2, 5<br>3, 8 | |
| **2952** | Engine Cowling, Deflectors, Air Ducts, and Shrouds | Replace | 1.0 | | | | 3 | |
| **2960** | Sending Units | Test<br>Replace | 0.5<br>1.0 | | | | 5<br>2 | |
| **2968** | Switches, Circuit Breakers, and Fuses | | | | | | | |
| | Fuel Shutoff Solonoid | Adjust<br>Replace | 1.0<br>0.5 | | | | 2, 5, 8<br>2, 5, 8 | |

## Section III. TOOLS AND TEST EQUIPMENT REQUIREMENTS

| (1) Tools and Test Equipment Reference Code | (2) Maintenance Level | (3) Nomenclature | (4) National Stock Number | (5) Tool Number |
|---|---|---|---|---|
| 1 | O | Shop Equipment, Automotive Maintenance and Repair Organizational Maintenance, Common No. 2, Less Power | 4910-00-754-0650 | SC 4910-95-CL-A72 |
| 2 | O, F | Tool Kit, General Mechanic's: Automotive | 5180-00-177-7033 | SC 5180-90-N26 |
| 3 | F | Tool Kit, General Mechanic's | 5180-00-699-5273 | SC 5180-90-CL-N05 |
| 4 | F | Shop Equipment, Machine Shop: Field Maintenance, Basic | 3470-00-754-0708 | SC 3470-95-A02 |
| 5 | F | Shop Equipment, Automotive Maintenance and Repair: Field Maintenance Basic, Less Power | 4910-00-754-0705 | SC 4910-95-A31 |
| 6 | F | Shop Equipment, Automotive Maintenance and Repair: Field Maintenance Supplemental No. 2 | 4910-00-754-0707 | SC 4910-95-CL-A63 |
| 7 | O | Shop Equipment, Automotive Maintenance and Repair Organizational Maintenance, Common No. 1 | 4910-00-754-0654 | SC4910-95-A74 |
| 8 | F | Tool Kit, Automotive Fuel and Electrical Systems Repair | 5180-00-754-0655 | SC5180-95-B08 |
| 9 | F | Tester, Cylinder Compression | 4910-00-808-4300 | SC 4940-95-B02 |
| 10 | F | Wrench | | 61372800 |
| 11 | F | Bracket, Cylinder Alignment | | 62574200 |
| 12 | F | Puller, Crank Gear | | 62574801 |
| 13 | F | Puller, Relief Valve | | 62569902 |
| 14 | F | Driver, Crank Gear | | 62574700 |
| 15 | F | Testing Device, Fuel | | 66503091 |
| 16 | F | Test Set, Fuel | | 60462890 |
| 17 | F | Test Set, Oil Pressure | | 62092692 |

# APPENDIX C
# REPAIR PARTS AND SPECIAL TOOLS LIST

## Section I. INTRODUCTION



### C-1. SCOPE.

This repair parts and special tools list (RPSTL) lists and authorizes spares and repair parts; special tools; special test, measurement, and diagnostic equipment (TMDE); and other special support equipment required for the performance of Unit, Direct Support, and General Support maintenance of the Diesel Engine Assembly, Hatz 2 G 40. This RPSTL authorizes the requisitioning, issue, and disposition of spares, repair parts, and special tools as indicated by the source, maintenance, and recoverability (SMR) code.

### C-2. GENERAL.

In addition to Section I, this RPSTL is divided into the following sections:

a **Section II. Repair Parts List.** A list of spares and repair parts authorized by this RPSTL for use in the performance of maintenance. The list also includes parts that must be removed for replacement of the authorized parts. Parts lists are composed of functional groups In ascending alphanumeric sequence, with the parts in each group listed in ascending figure and item number sequence Bulk materials are listed in item name sequence. Repair parts kits are listed separately In their own functional group within Section II.

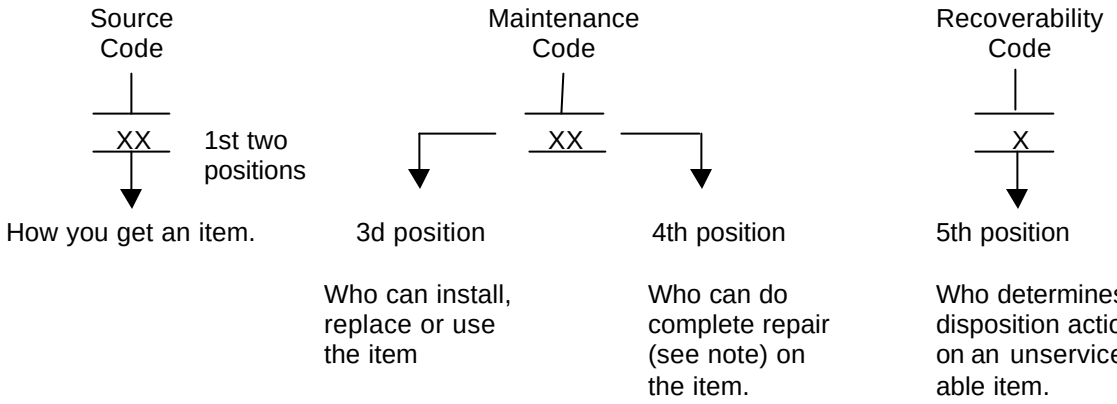
b. **Section III. Special Tools List.** A list of special tools, special TMDE, and other special support equipment authorized by this RPSTL for the performance of maintenance.

c. **Section IV. Cross-reference Indexes.** There are two indexes The first is a list, in national item identification number (NIIN) sequence, of all national stock numbered items appearing in the listings; the second is a list, in alphanumeric sequence, of all part numbers appearing in the listings National stock numbers (NSNs) and part numbers are cross-referenced to each illustration/figure and item number appearance.

## C-3. EXPLANATION OF COLUMNS (SECTIONS II AND III).

a. **ITEM NO. [Column (1)].** Indicates the number used to identify items called out in the illustration.

b. **SMR CODE [Column (2)].** The SMR code is a five-position code containing supply/requisitioning information, maintenance category authorization criteria, and disposition instruction, as shown in the following breakout:




* *Complete Repair.* Maintenance capacity, capability, and authority to perform all corrective maintenance tasks of the Repair function in a use/user environment in order to restore serviceability to a failed item.

(1) **Source Code**. The source code tells you how to get an item needed for maintenance, repair, or overhaul of an end item/equipment. Explanations of source codes follow:

| *Code* | *Application/Explanation* |
|---|---|
| PA<br>PB<br>PC<br>PD<br>PE<br>PF<br>PG | Stocked Items; use the applicable NSN to request/requisition items with these source codes. They are authorized to the category indicated by the code entered in the third position of the SMR code.<br><br>***Items coded PC are subject to deterioration.* |
| KD<br>KF<br>KB | Items with these codes are not to be requested/requisitioned individually. They are part of a kit that is authorized to the maintenance category indicated in the third position of the SMR code. The complete kit must be requisitioned and applied. |
| *MO - Made at UNIT/AVUM Level*<br>*MF - Made at DS/AVUM Level*<br>*MH - Made at GS Level*<br>*MD - Made at Depot* | Items with these codes are not to be requested/requisitioned individually. They must be made from bulk material that is identified by the part number in the DESCRIPTION AND USABLE ON CODE (UOC) column and listed in the bulk material group of the repair parts list in this RPSTL. If the item is authorized to you by the third-position code of the SMR code, but the source code indicates it is made at a higher level, order the item from the higher level of maintenance. |
| *AO - Assembled by UNIT/A VUM Level*<br>*AF - Assembled by DS/AVUM Level*<br>*AH - Assembled by GS Level*<br>*AD - Assembled at Depot* | Items with these codes are not to be requested/requisitioned individually. The parts that make up the assembled item must be requisitioned or fabricated and assembled at the level of maintenance indicated by the source code. If the third-position code of the SMR code authorizes you to replace the item, but the source code indicates that the item is assembled at a higher level, order the item from the higher level of maintenance. |

**C-3. EXPLANATION OF COLUMNS (SECTIONS II AND III) (continued).**

**NOTE**

**Cannibalization or controlled exchange, when authorized, may be used as a source of supply for items with the preceding source codes, except for those source-coded "XA".**

XA - DO NOT requisition an "XA"-coded item. Order its next higher assembly.

XB - If an "XB" item is not available from salvage, order it using the CAGEC and part number given.

XC - Installation drawing, diagram, instruction sheet, or field service drawing that is identified by manufacturer's part number.

XD - Item is not stocked. Order an "XD"-coded item through normal supply channels using the CAGEC and part number given if no NSN is available.

(2) **Maintenance Code.** Maintenance codes tell you the level(s) of maintenance authorized to use and repair support items. The maintenance codes are entered in the third and fourth positions of the SMR code as follows:

(a) The maintenance code entered in the third position tells you the lowest maintenance level authorized to remove, replace, and use an item. The maintenance code entered in the third position will indicate authorization to one of the following levels of maintenance:

| *Code* | *Application/Explanation* |
|---|---|
| C | Crew or Operator maintenance done within Unit maintenance or Aviation Unit maintenance. |
| O | Unit maintenance or Aviation Unit can remove, replace, and use the item. |
| F | Direct Support or Aviation Intermediate level can remove, replace, and use the item. |
| H | General Support level can remove, replace, and use the item.<br>Specialized repair activity (SRA) can remove, replace, and use the item. |
| L | Depot level can remove, replace, and use the item. |
| D | |

**NOTE**

**If authorized by the maintenance allocation chart (MAC) and SMR codes, some limited repair may be done on an item at a lower level of maintenance.**

(b) The maintenance code entered in the fourth position tells whether the item is to be repaired and identifies the lowest maintenance level with the capability to do complete repair (i.e., perform all authorized "Repair" functions). This position will contain one of the following maintenance codes:

**C-3. EXPLANATION OF COLUMNS (SECTIONS II AND III) (continued).**

| *Code* | *Application/Explanation* |
|---|---|
| O | Unit maintenance or Aviation Unit is the lowest level that can do complete repair of the item. |
| F | Direct Support or Aviation Intermediate is the lowest level than can do complete repair of the item. |
| H | General Support is the lowest level that can do complete repair of the item. |
| L | SRA is the lowest level that can do complete repair of the Item.<br>Depot is the lowest level that can do complete repair of the item. |
| D | Nonrepairable. No repair is authorized. |
| Z<br>B | No repair is authorized. (No parts or special tools are authorized for the maintenance of a "B"-coded item.) However, the item may be reconditioned by adjusting, lubricating, and so on, at the user level. |

(3) **Recoverability Code.** Recoverability codes are assigned to Items to indicate the disposition action on unserviceable items. The recoverability code is entered in the fifth position of the SMR code as follows:

| *Code* | *Application/Explanation* |
|---|---|
| Z | Nonrepairable item. When unserviceable, condemn and dispose of the item at the level of maintenance shown In the third position of the SMR code. |
| O | Repairable item. When uneconomically repairable, condemn and dispose of the item at Unit maintenance or Aviation Unit level. |
| F | Repairable item. When uneconomically repairable, condemn and dispose of the item at the Direct Support or Aviation Intermediate level. |
| H | Repairable item. When uneconomically repairable, condemn and dispose of the item at the General Support level. |
| D | Repairable Item. When beyond lower-level repair capability, return to Depot. Condemnation and disposal of the item is not authorized below Depot level. |
| L | Repairable item. Condemnation and disposal of the Item is not authorized below SRA. |
| A | Item requires special handling or condemnation procedures for specific reasons (e.g., precious metal content, high dollar value, critical material, or hazardous material). Refer to appropriate manuals/directives for specific instructions. |

c. **NSN [Column (3)]**. The NSNs for the Items are listed in this column.

## C-3. EXPLANATION OF COLUMNS

d. **CAGEC [Column (4)].** The commercial and government entity code (CAGEC) is a five-digit alphanumeric code used to identify the manufacturer, distributor, or Government agency, etc., that supplies the item.

**NOTE**

**When you use an NSN to requisition an item, the item you receive may have a part number different from the part ordered.**

e. **PART NUMBER [COLUMN (5)].** Indicates the primary number used by the manufacturer (individual, company, firm, corporation, of Government activity), which controls the design and characteristics of the item by means of its engineering drawings, specifications standards, and inspection requirements, to identify an item or range of items.

f. **DESCRIPTION AND USABLE-ON CODE (UOC) [Column (6)].** This column includes the following information:

(1) The Federal item name and, when required, a minimum description to identify the item.

(2) Physical security classification. Not applicable (3) Items that are included in kits and sets are listed below the name of the kit or set on Figure KIT.

(3) Spare/repair parts that make up an assembled item are listed immediately following the assembled item line entry.

(4) Part numbers for bulk materials are referenced in this column in the line item entry for the item to be manufactured/fabricated.

(5) When the item is not used with all serial numbers of the same model, the effective serial numbers are shown on the last line(s) of the description (before the UOC) (7) The UOC, when applicable (see para C-5, Special Information) (8) In the Special Tools List section, the Basis of Issue (BOI) appears as the last line(s) in the entry for each special tool, special TMDE, and other special support equipment. when density of equipments supported exceeds density spread indicated in the BOI, the total authorization is increased proportionately.

(6) The statement “END OF FIGURE” appears just below the last item description in Column 5 for a given figure in both Section II and Section III.

g. **QTY [Column (7)].** The QTY (quantity per figure) column indicates the quantity of the item used in the breakout shown on the illustration/figure, which is prepared for a functional group, subfunctional group, or an assembly. A “V” appearing in this column in lieu of a quantity indicates that the quantity is variable and may vary from application to application.

## C-4. EXPLANATION OF COLUMNS (SECTION IV).

a. **National Stock Number (NSN) Index.**

(1) **STOCK NUMBER Column.** This column lists the NSN by NIN sequence. The NUN consists of the last nine digits of the NSN (i.e., 5305-01-674-1467). When using this column to locate an item, ignore the first four digits of the NSN. However, the complete NSN should be used when ordering items by stock number.

(2) **FIG. Column.** This column lists the number of the figure where the item is identified/located. The figures are in numerical order in Section II and Section III.

(3) **ITEM Column.** The item number identifies the item associated with the figure listed in the adjacent FIG. column. This item is also identified by the NSN listed on the same line.

b. **Part Number Index.** Part numbers in this index are listed by part number in ascending alphanumeric sequence (i.e., vertical arrangement of letter and number combination that places the first letter or digit of each group in order a through Z, followed by the numbers 0 through 9 and each following letter or digit in like order).

(1) **CAGEC Column.** The CAGEC is a five-digit alphanumeric code used to identify the manufacturer, distributor, or Government agency, tc., that supplies the item.

(2) **PART NUMBER Column.** Indicates the primary number used by the manufacturer (individual, firm, corporation, or Government activity), which controls the design and characteristics of the item by means of its engineering drawings, specifications standards, and inspection requirements, to identify an item or range of items.

(3) **STOCK NUMBER Column.** This column lists the NSN for the associated part number and manufacturer identified in the PART NUMBER and CAGEC columns to the left.

(4) **FIG. Column.** This column lists the number of the figure where the item is identified/located in Section II and Section III.

(5) **ITEM Column.** The item number is that number assigned to the item as it appears in the figure referenced in the adjacent figure number column.

## C-5. SPECIAL INFORMATION.

a. **Usable-on Code.** Uncoded items are applicable to all models. usable on code for the M88A2 HERCULES items is APJ. Usable on code for all other applications is APP.

b. **Fabrication Instructions.** Not applicable.

c. **Assembly Instructions.** Not applicable.

d. **Kits.** Not applicable.

e. **Index Numbers.** Not applicable.

## C-5. SPECIAL INFORMATION (continued).

b. **Fabrication Instructions.** Not applicable.

c. **Assembly Instructions.** Not applicable.

d. **Kits.** Not applicable.

e. **Index Numbers.** Not applicable.

f. **Associated Publications.**

| | |
|---|---|
| Operator's Manual, Unit Maintenance Manual, Direct Support and General Support Maintenance Manual, and Repair Parts and Special Tools List For Carrier, Ammunition, Tracked M992A2 (NSN 2350-01-368-9500) | TM 9-2350-293-10<br>TM 9-2350-293-20-1 and -2<br>TM 9-2350-293-34<br>TM 9-2350-293-24P |
| Operator's Manual, Unit Maintenance Manual, Direct Support and General Support Maintenance Manual, and Repair Parts and Special Tools List For Recovery Vehicle, Full Tracked: Heavy M88A2 (NSN 2350-01-390-4683) | TM 9-2350-292-10<br>TM 9-2350-292-20-1 and -2<br>TM 9-2350-292-34<br>TM 9-2350-292-24P |

## C-6. HOW TO LOCATE REPAIR PARTS.

a. When the NSN or part number is not known, you can locate a repair part by following these steps:

(1) **First.** Using the Table of Contents, determine the assembly group or subassembly group to which the item belongs. This is necessary because figures are prepared for assembly groups and subassembly groups, and listings are divided into the same groups.

(2) **Second.** Find the figure covering the assembly group or subassembly group to which the item belongs.

(3) **Third.** Identify the item on the figure and note the item number of the item.

(4) **Fourth.** Refer to the Repair parts List for the figure to find the line item entry for the item number noted on the figure.

b. When the NSN or part number is known, you can locate a repair part by following these steps.

(1) **First.** Using the National Stock Number Index or the Part Number Index, find the pertinent NSN or part number. the National Stock Number Index is in NIIN sequence. The part numbers in the Part Number Index are listed in ascending alphanumeric sequence. Both indexes cross-reference you to the figure number and item number of the item you are looking for.

(2) **Second.** After finding the figure and item numbers, verify that the item is the one you're looking for; then locate the item number in the Repair Parts List for the figure.

## C-7. ABBREVIATIONS.

For standard abbreviations see MIL-STD-12, Military Standard Abbreviations for Use on Drawings, Specifications, Standards, and in Technical Documents.

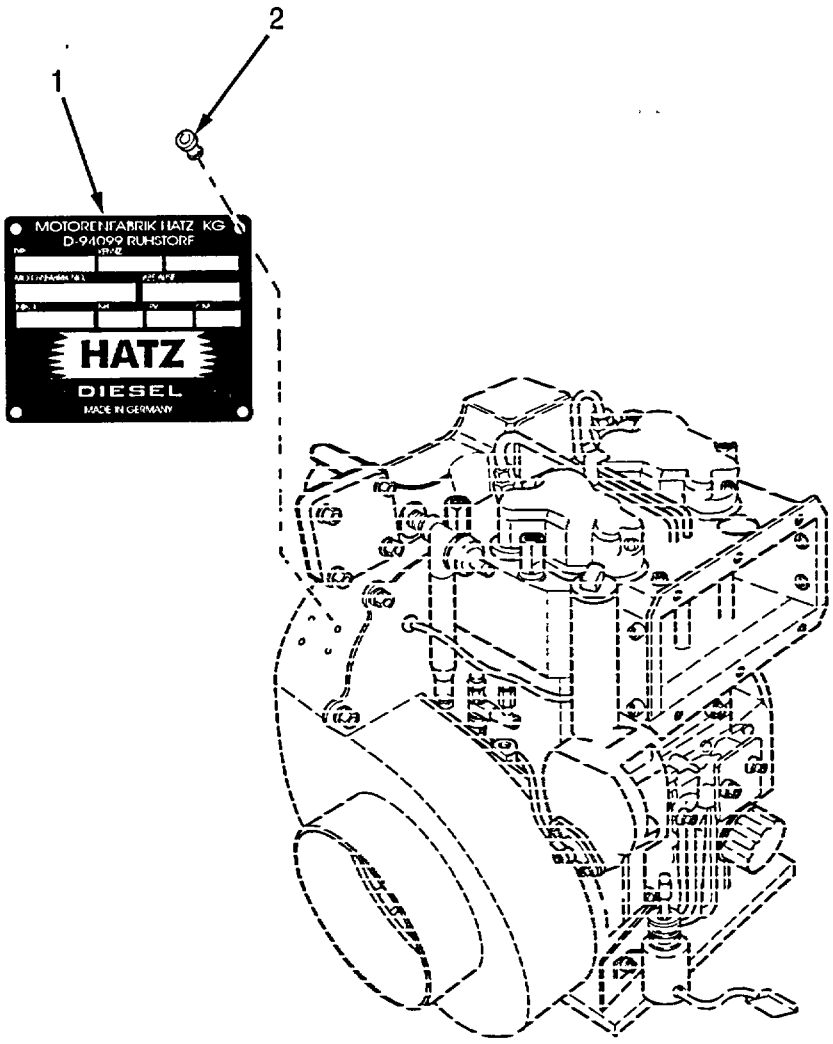



*Figure 1. Engine Identification Plate*

| (1) ITEM NO | (2) SMR | (3) NSN | (4) CAGE | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| | | | | | GROUP 22 BODY, CHASSIS, AND HULL ACCESSORY ITEMS | |
| | | | | | GROUP 2210 DATA PLATES AND INSTRUCTION HOLDERS | |
| | | | | | FIGURE 1 ENGINE IDENTIFICATION PLATE | |
| 1 | PAOZZ | 9905-01-456-3828 | 61080 | 03225504 | PLATE,IDENTIFICATIO..... | 1 |
| 2 | PAOZZ | 5315-01-070-5656 | 61080 | 40002500 | PIN,GROOVED,HEADED..... | 4 |

END OF FIGURE

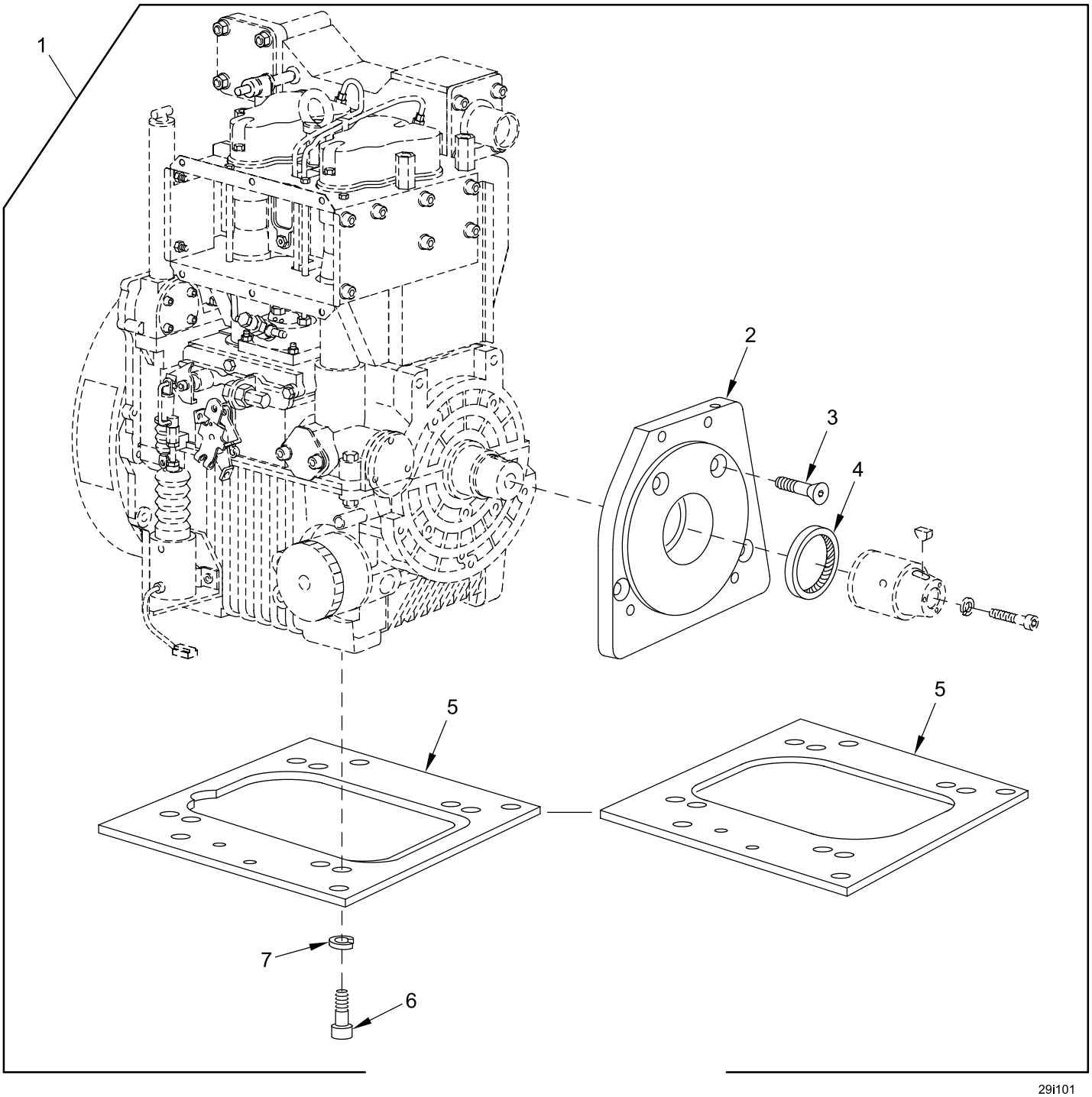



*Figure 2. Engine, Diesel*

| | (1) ITEM NO | (2) SMR | (3) NSN | (4) CAGE | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|---|
| | | | | | | GROUP 29 AUXILIARY GENERATOR AND ENGINE, AND CONTROLS | |
| | | | | | | GROUP 2910 ENGINE ASSEMBLY | |
| | | | | | | FIGURE 2 ENGINE, DIESEL | |
| * | 1 | PAFFD | 2815-01-465-4321 | 19207 | 12367094 | ASSEMBLY,ENGINE,APU..... UOC:APJ, | 1 |
| | 1 | PAOFD | 2815-01-446-3500 | 19207 | 12463204 | ENGINE,DIESEL..... UOC:APP, | |
| * | 2 | PAFZZ | 5935-01-480-9543 | 19207 | 12367105 | .SPACER,SPECIAL SHAP..... UOC:APJ, | 1 |
| | 2 | PFFZZ | 5340-01-454-8631 | 61080 | 99400639 | .PLATE,MOUNTING..... UOC:APP, | 1 |
| | 3 | PAFZZ | 5305-01-455-2207 | 61080 | 99400642 | .SCREW,CAP,SOCKET HE..... | 4 |
| | 4 | PAFZZ | 5330-01-455-7822 | 61080 | 99400641 | .SEAL,PLAIN ENCASED..... | 1 |
| * | 5 | PAFZZ | | 19207 | 12478240 | PLATE,MOUNTING..... UOC:APJ, | 1 |
| | 5 | PFFZZ | 2990-01-454-8843 | 61080 | 99400640 | .PLATE,MOUNTING,ENGI..... UOC:APP, | 1 |
| * | 6 | PAFZZ | 5305-12-146-1760 | 4B948 | DIN7984-M10X30-10.9-A3P | .SCREW,LOW HEAD CAP..... UOC:APJ, | 8 |
| | 6 | PAFZZ | 5305-01-455-2206 | 61080 | 50054300 | .SCREW,CAP,SOCKET HE..... UOC:APP, | 8 |
| | 7 | PAFZZ | 5310-01-274-4387 | 61080 | 50061700 | .WASHER,SPRING TENSI..... UOC:APP, | 8 |
| * | 7 | PAFZZ | 5310-12-130-4938 | D8286 | DIN7980-10-FST | .WASHER,LOCK..... UOC:APJ, | 8 |

END OF FIGURE

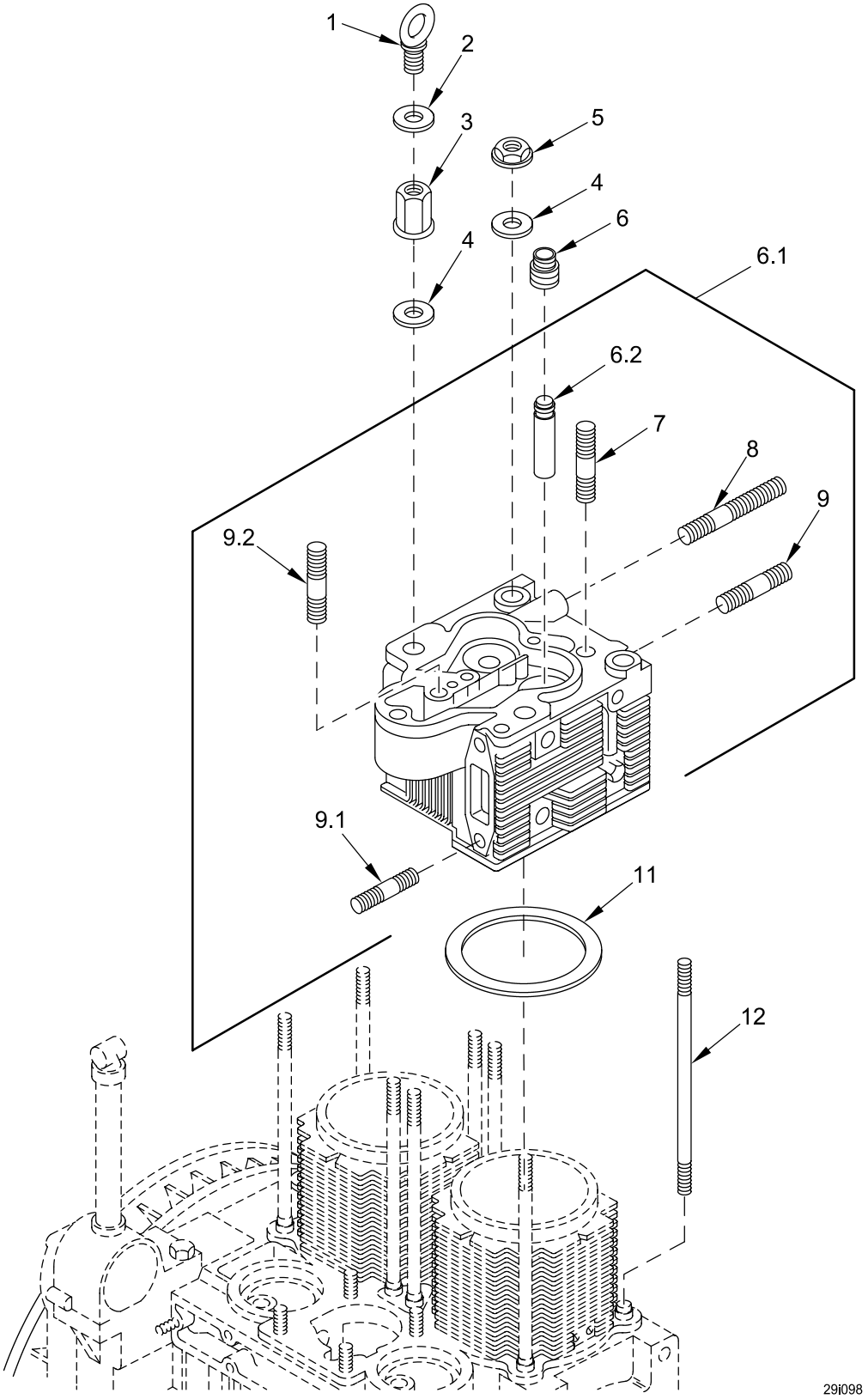



*Figure 3. Cylinder Head*

| (1) ITEM NO | (2) SMR | (3) NSN | (4) CAGE | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| | | | | | GROUP 2911 CRANKCASE, CYLINDER SLEEVE, AND CYLINDER HEAD | |
| | | | | | FIGURE 3 CYLINDER HEAD | |
| ** 1 | PAOZZ | 5306-01-455-2212 | 61080 | 50315500 | BOLT,EYE..... UOC:APP, | 1 |
| ** 2 | PAOZZ | 5365-01-399-5013 | 61080 | 03787300 | SHIM..... UOC:APP, | 1 |
| 3 | PAFZZ | 5310-01-455-8479 | 61080 | 03784501 | NUT,PLAIN,EXTENDED..... | 5 |
| 4 | PAFZZ | 5310-01-399-8358 | 61080 | 03791400 | WASHER,FLAT..... | 8 |
| 5 | PAFZZ | 5310-01-399-7312 | 61080 | 03171800 | NUT,PLAIN,HEXAGON..... | 3 |
| * 6 | PAFZZ | | 61080 | 50405200 | SEAL CAP,VALVE STEM..... | 4 |
| 6.1 | PAFFF | 2815-01-455-0371 | 61080 | 01247200 | CYLINDER HEAD,DIESE..... | 2 |
| ***6.1 | PAFFF | | 61080 | 01247210 | CYLINDER HEAD,DIESE..... | 2 |
| * 6.2 | PAFZZ | 2815-01-455-0056 | 61080 | 03785201 | .GUIDE,VALVE STEM..... | 4 |
| 7 | PAFZZ | 5307-01-405-9899 | 61080 | 50038400 | .STUD,PLAIN..... | 2 |
| 8 | PAFZZ | 5307-01-406-5443 | 61080 | 50065100 | .STUD,PLAIN..... | 2 |
| 9 | PAFZZ | 5307-01-405-9997 | 61080 | 50128100 | .STUD,PLAIN..... | 2 |
| 9.1 | PAFZZ | 5307-01-405-9907 | 61080 | 50231900 | .STUD,PLAIN..... | 4 |
| 9.2 | PAFZZ | 5307-01-405-9909 | 61080 | 50279200 | .STUD,PLAIN..... | 4 |
| 11 | KFFZZ | | 61080 | 03792800 | GASKET,0.60 MM PART OF KIT P/N 01247702..... | 1 |
| 11 | KFFZZ | | 61080 | 03792900 | GASKET,0.70 MM PART OF KIT P/N 01247702..... | 1 |
| 11 | PAFZZ | | 61080 | 03793000 | GASKET,0.80 MM..... | V |
| 11 | PAFZZ | | 61080 | 03793100 | GASKET,0.90 MM..... | V |
| 11 | PAFZZ | | 61080 | 03793200 | GASKET,1.00 MM..... | V |
| 11 | PAFZZ | | 61080 | 03793300 | GASKET,1.10 MM..... | V |
| 11 | PAFZZ | | 61080 | 03793400 | GASKET,1.20 MM..... | V |
| 11 | PAFZZ | | 61080 | 03971200 | GASKET,0.65 MM..... | V |
| 11 | PAFZZ | | 61080 | 03971300 | GASKET,0.75 MM..... | V |
| 11 | PAFZZ | | 61080 | 04090600 | GASKET,0.85 MM..... | V |
| 11 | PAFZZ | | 61080 | 04090700 | GASKET,0.95 MM..... | V |
| *** 11 | PAFZZ | | 61080 | 04110800 | GASKET,0.50 MM..... | V |
| *** 11 | PAFZZ | | 61080 | 04110900 | GASKET,0.55 MM..... | V |
| 12 | PAFZZ | 5307-01-455-2210 | 61080 | 03781000 | STUD,PLAIN..... | 8 |

END OF FIGURE

** Refer to TM 9-2350-292-24P and TM 9-2350-292-20-2 for UOC: APJ Item.
*** EPA Version 1 Compliant Only

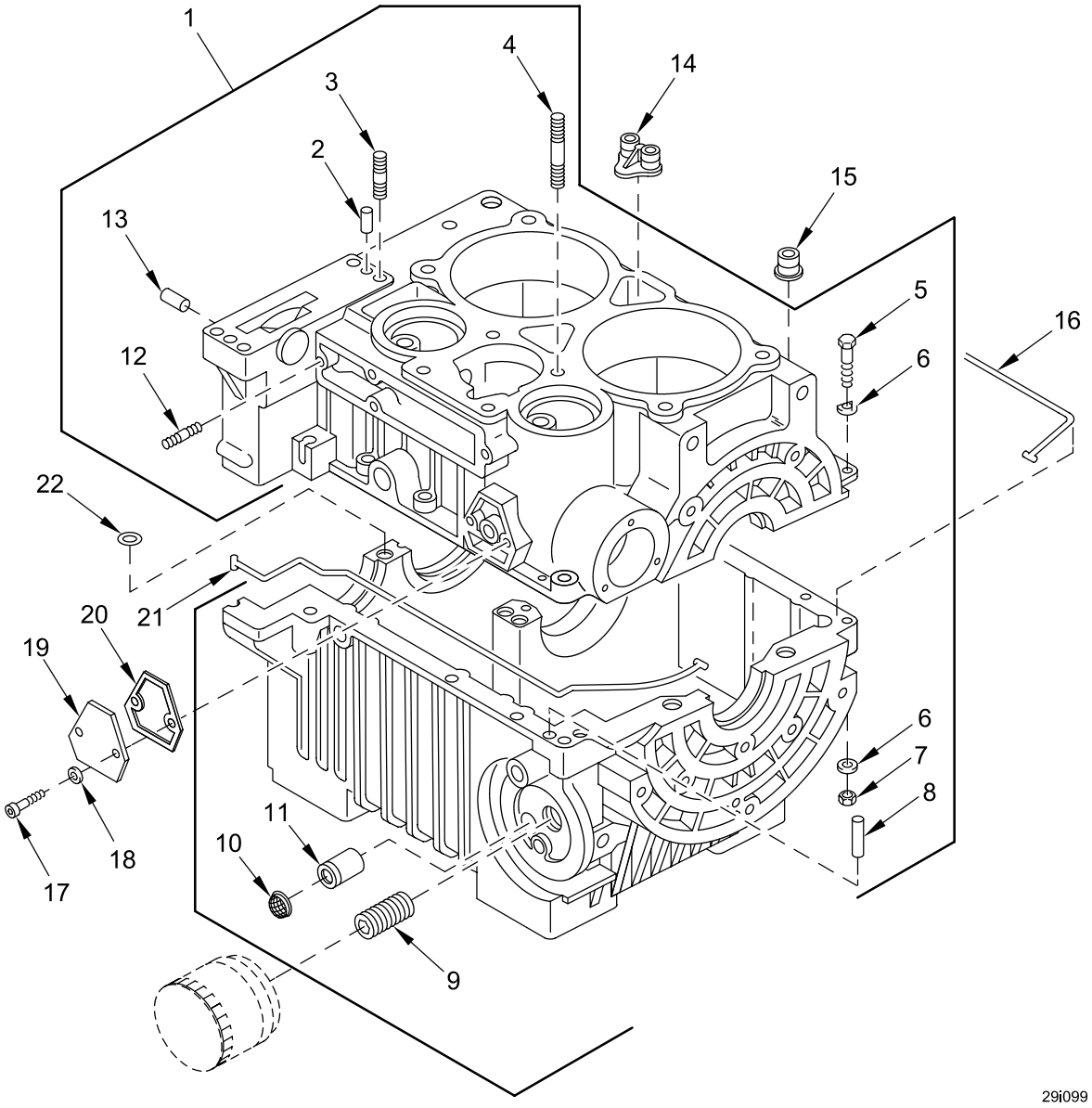



*Figure 4. Crankcase Assembly*

| (1) ITEM NO | (2) SMR | (3) NSN | (4) CAGE | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| | | | | | GROUP 2911 CRANKCASE, CYLINDER SLEEVE, AND CYLINDER HEAD | |
| | | | | | FIGURE 4 CRANKCASE ASSEMBLY | |
| * 1 | PAFFF | | 61080 | 01227410 | CRANKCASE ASSEMBLY 2G40.13, 2G40.14, 2G40.15..... | 1 |
| * 1 | PAFFF | | 61080 | 01227420 | CRANKCASE ASSEMBLY 2G40.16, 2G40.17, 2G40.18..... | 1 |
| 2 | PAFZZ | 5315-01-399-6105 | 61080 | 50290500 | .PIN,STRAIGHT,HEADLE..... | 2 |
| 3 | PAFZZ | 5307-01-405-9997 | 61080 | 50128100 | .STUD,PLAIN..... | 2 |
| 4 | PAFZZ | 5307-01-405-9905 | 61080 | 50098300 | .STUD,PLAIN..... | 4 |
| 5 | PAFZZ | 5305-01-406-0014 | 61080 | 50137000 | .SCREW,MACHINE..... | 10 |
| 6 | PAOZZ | 5310-12-149-4353 | 61080 | 50144500 | .WASHER,FLAT..... | 21 |
| 7 | PAFZZ | 5310-01-405-9890 | 61080 | 50144400 | .NUT,PLAIN,HEXAGON..... | 10 |
| 8 | PAFZZ | 5315-01-400-0444 | 61080 | 50300700 | .PIN,STRAIGHT,HEADLE..... | 2 |
| 9 | PAFZZ | 4730-01-454-7542 | 61080 | 50302700 | .NIPPLE,PIPE..... | 1 |
| * 10 | PAOZZ | 4730-01-454-7545 | 61080 | 05034900 | .STRAINER ELEMENT,SE..... | 1 |
| * 11 | PAFZZ | 4820-01-455-5017 | 61080 | 01221803 | .VALVE,SAFETY RELIEF..... | 1 |
| *** 12 | PAFZZ | | 61080 | 50139201 | .STUD,M6 X 16..... | 1 |
| 12 | PAFZZ | 5307-01-455-2205 | 61080 | 50307000 | .STUD,PLAIN..... | 1 |
| 13 | PAFZZ | 5315-01-399-6106 | 61080 | 50301000 | .PIN,SPRING..... | 1 |
| 14 | PAFZZ | 5340-01-454-9272 | 61080 | 04038200 | CAP-PLUG,PROTECTIVE..... | 2 |
| 15 | PAFZZ | 5340-01-454-9273 | 61080 | 04039100 | CAP-PLUG,PROTECTIVE..... | 4 |
| 16 | KFFZZ | | 61080 | 50301200 | GASKET PART OF KIT P/N 01228002..... | 1 |
| ** 17 | PAFZZ | 5305-01-455-1615 | 61080 | 50052100 | SCREW,CAP,SOCKET HE..... UOC:APP, | 2 |
| 18 | PAOZZ | 5310-01-399-7303 | 61080 | 50208500 | WASHER,SPRING TENSI..... | 2 |
| ** 19 | PAFZZ | 5340-01-455-2343 | 61080 | 99400645 | COVER,ACCESS..... UOC:APP, | 1 |
| 20 | PAFZZ | 5330-01-400-5766 | 61080 | 50291400 | GASKET..... | 1 |
| 21 | KFFZZ | | 61080 | 50301100 | GASKET PART OF KIT P/N 01228002..... | 1 |
| 22 | KFFZZ | | 61080 | 50275000 | O-RING PART OF KIT P/N 01228002..... | 8 |

END OF FIGURE

** Refer to TM 9-2350-292-24P and TM 9-2350-292-20-2 for UOC: APJ Item.
*** EPA Version 1 Compliant Only

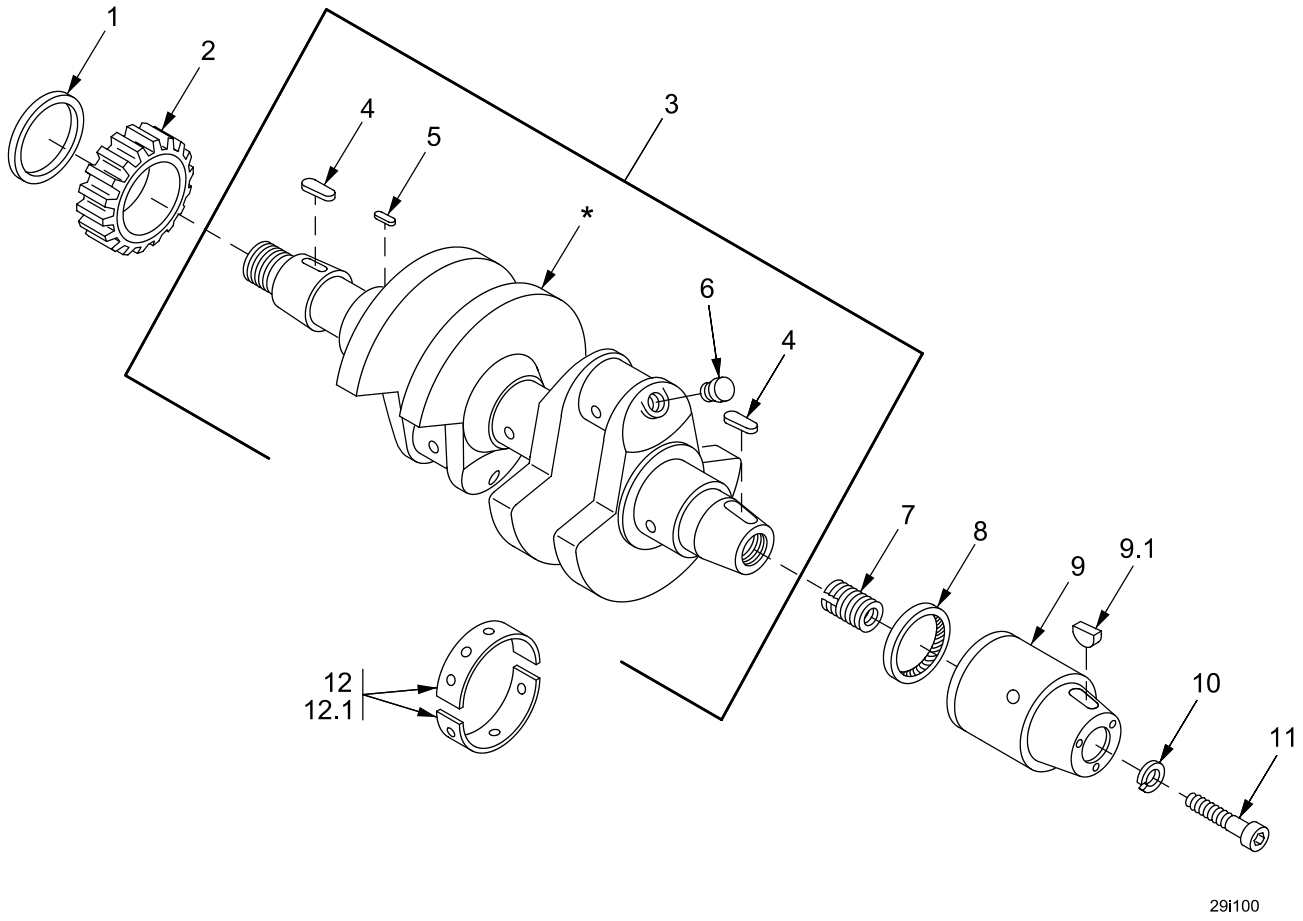



*Figure 5. Crankshaft Assembly*

| | (1) ITEM NO | (2) SMR | (3) NSN | (4) CAGE | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|---|
| | | | | | | GROUP 2912 CRANKCHSAFT ASSEMBLY | |
| | | | | | | FIGURE 5 CRANKSHAFT ASSEMBLY | |
| | 1 | PAFZZ | | 61080 | 50347500 | SHIM..... | 1 |
| | 1 | PAFZZ | | 61080 | 50347600 | SHIM..... | 1 |
| | 2 | PAFZZ | 3020-01-455-2798 | 61080 | 50304400 | GEAR,HELICAL..... | 1 |
| * | 3 | PAFFF | 2815-01-455-0423 | 61080 | 01262701 | CRANKSHAFT,ENGINE..... | 1 |
| | 4 | PAFZZ | 5315-01-103-1522 | 61080 | 50011200 | .KEY..... | 2 |
| | 5 | PAFZZ | 5315-01-400-0441 | 61080 | 50304300 | .KEY,MACHINE..... | 1 |
| | 6 | PAFZZ | 5340-01-455-0010 | 61080 | 50304100 | .PLUG,MACHINE THREAD..... | 4 |
| | 7 | PAFZZ | 5365-01-406-4171 | 61080 | 50333900 | BUSHING,MACHINE THR..... | 1 |
| | 8 | PAFZZ | 5330-01-400-5773 | 61080 | 50304500 | SEAL,PLAIN PART OF KIT P/N 01228002. | 1 |
| | 9 | XDFZZ | | 61080 | 99400638 | HUB,BODY..... | 1 |
| * | 9.1 | PAFZZ | 5315-00-616-5530 | 96906 | MS35756-15 | KEY,WOODRUFF..... | 1 |
| | 10 | PAFZZ | 5310-01-400-2138 | 61080 | 50146000 | WASHER,SPRING TENSI..... | 1 |
| * | 11 | PAFZZ | 5305-01-101-4830 | 21969 | M10X55DIN912-8.8 | SCREW,CAP,SOCKET HE..... UOC:APJ, | 1 |
| | 11 | PAFZZ | 5305-01-455-1245 | 61080 | 50055100 | SCREW,CAP,SOCKET HE..... UOC:APP, | 1 |
| | 12 | XDFZZ | | 61080 | 50302100 | BEARING,SLEEVE..... | 3 |
| * | 12.1 | XDFZZ | | 61080 | 50324200 | BEARING,SLEEVE..... | 3 |

END OF FIGURE

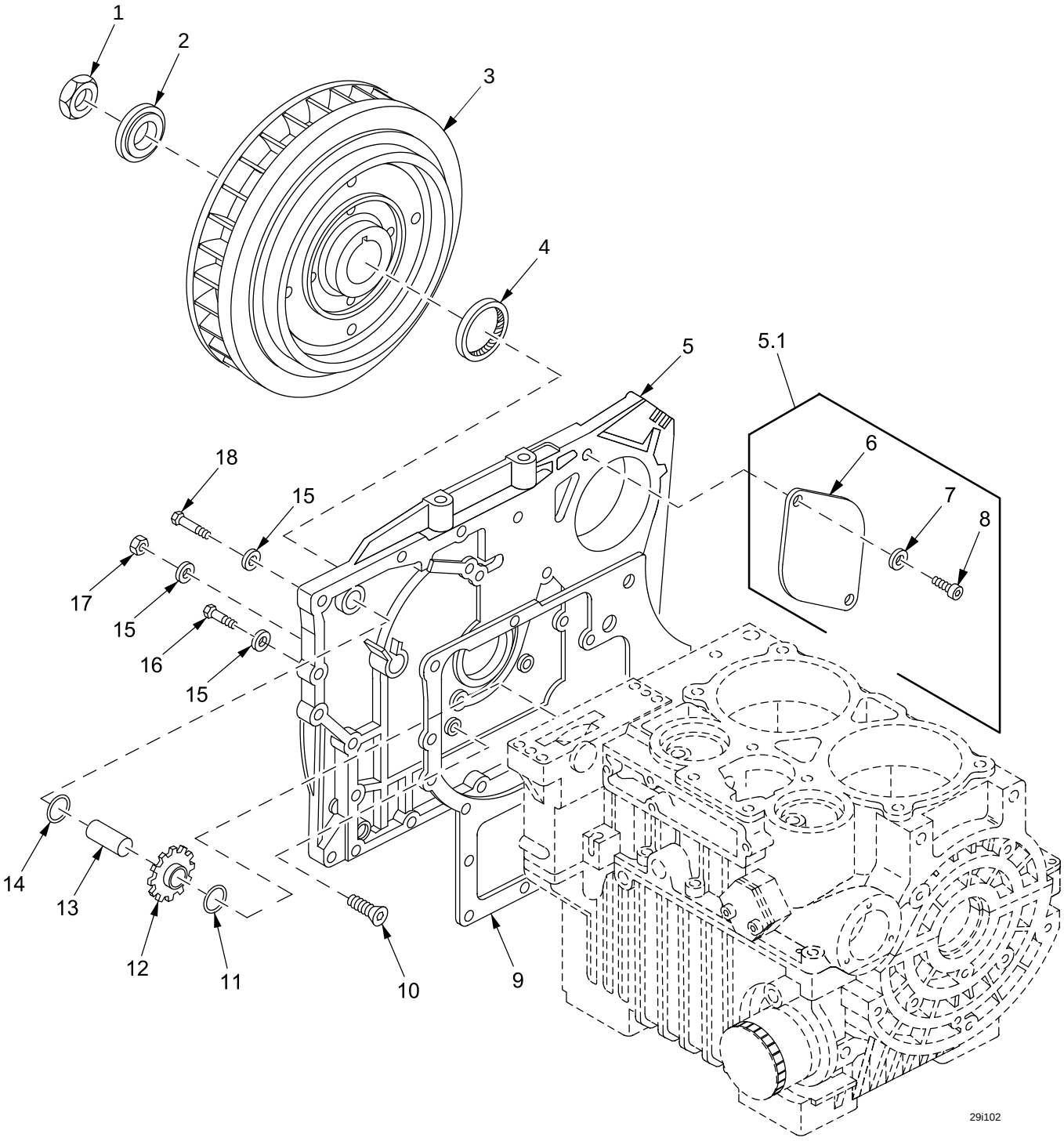



*Figure 6. Flywheel and Related Components*

| (1) ITEM NO | (2) SMR | (3) NSN | (4) CAGE | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| | | | | | GROUP 2913 FLYWHEEL ASSEMBLY | |
| | | | | | FIGURE 6 FLYWHEEL AND RELATED COMPONENTS | |
| 1 | PAFZZ | 5310-01-400-2140 | 61080 | 04031300 | NUT,PLAIN,HEXAGON..... | 1 |
| 2 | PAFZZ | 5310-01-400-2141 | 61080 | 03975300 | WASHER,FLAT..... | 1 |
| 3 | PAFZZ | 2815-01-455-0376 | 61080 | 03792100 | FLYWHEEL,ENGINE..... | 1 |
| 4 | KFFZZ | | 61080 | 50311200 | O-RING PART OF KIT P/N 01228002..... | 1 |
| 5 | PAFZZ | 2815-01-454-9103 | 61080 | 50310810 | HOUSING,FLYWHEEL..... | 1 |
| * 5.1 | PAFFF | 5340-01-494-6423 | 61080 | 99400644 | COVER,ACCESS..... | 1 |
| 6 | PAOZZ | 5340-01-454-9940 | 61080 | 99400646 | .COVER,ACCESS..... | 1 |
| 7 | PAFZZ | 5310-01-405-9911 | 61080 | 50145900 | .WASHER,FLAT..... | 2 |
| 8 | PAOZZ | 5305-01-406-0005 | 61080 | 50093400 | .SCREW,MACHINE..... | 2 |
| 9 | KFFZZ | | 61080 | 50311500 | GASKET PART OF KIT P/N 01228002..... | 2 |
| 10 | PAFZZ | 5305-01-405-9908 | 61080 | 50310900 | SCREW,MACHINE..... | 3 |
| 11 | PAFZZ | 5310-01-400-1002 | 61080 | 50195800 | WASHER,FLAT..... | 1 |
| 12 | XDFZZ | | 61080 | 01239901 | ROD,PINION..... | 1 |
| 13 | PAFZZ | 5315-01-455-8935 | 61080 | 50303610 | PIN,STRAIGHT,HEADLE..... | 1 |
| 14 | XDFZZ | | 61080 | 50336200 | O-RING..... | 1 |
| 15 | PAOZZ | 5310-12-149-4353 | 61080 | 50144500 | WASHER,FLAT..... | 22 |
| 16 | PAFZZ | 5305-01-406-0000 | 61080 | 50092100 | SCREW,MACHINE..... | 18 |
| 17 | PAFZZ | 5310-01-405-9890 | 61080 | 50144400 | NUT,PLAIN,HEXAGON..... | 3 |
| 18 | PAFZZ | 5305-01-463-1028 | 61080 | 50026400 | SCREW,MACHINE..... | 1 |

END OF FIGURE

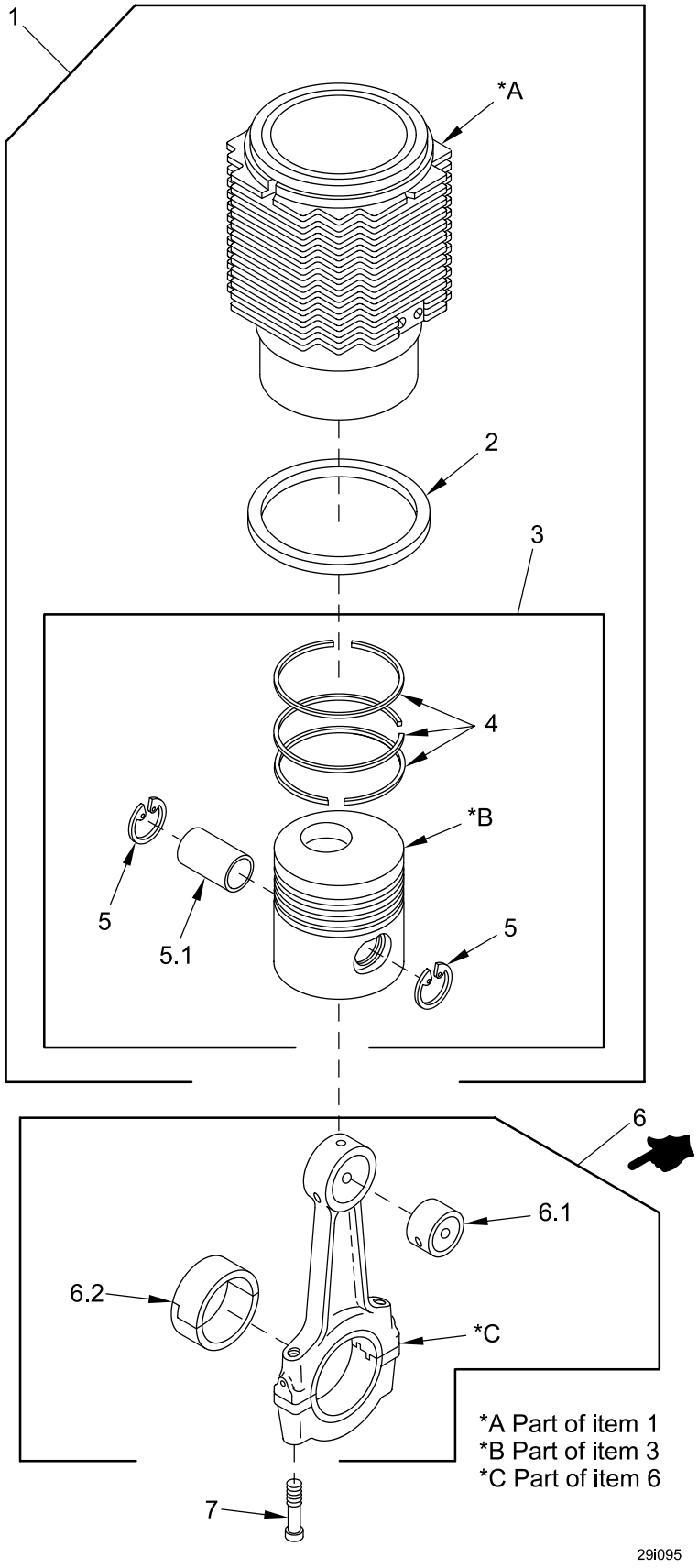



*Figure 7. Pistons and Connecting Rods*

| (1) ITEM NO | (2) SMR | (3) NSN | (4) CAGE | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| | | | | | GROUP 2914 PISTONS AND CONNECTING RODS | |
| | | | | | FIGURE 7 PISTONS AND CONNECTING RODS | |
| 1 | PAFFF | 2835-01-414-8480 | 61080 | 01247100 | LINER,COMBUSTION CH..... | 2 |
| *** 1 | PAFFF | | 61080 | 01247110 | LINER,COMBUSTION CH..... | 2 |
| 2 | PAFZZ | 5365-01-455-0011 | 61080 | 03958000 | .SHIM..... | 1 |
| * 3 | PAFFF | | 61080 | 01240203 | .PISTON,INTERNAL COM..... | 1 |
| *** 3 | PAFFF | | 61080 | 01240211 | .PISTON,INTERNAL COM..... | 1 |
| * 3 | PAFFF | | 61080 | 01248303 | .PISTON,INTERNAL COM OVERSIZE 0.5 MM..... | 1 |
| *** 3 | PAFFF | | 61080 | 01248311 | .PISTON,INTERNAL COM OVERSIZE 0.5 MM..... | 1 |
| * 4 | PAFZZ | 2815-01-455-0428 | 61080 | 01240301 | ..RING SET,PISTON..... | 1 |
| * 4 | PAFZZ | | 61080 | 01248701 | ..RING SET,PISTON OVERSIZE 0.5 MM.. | 1 |
| 5 | PAFZZ | 5325-01-455-8936 | 61080 | 50359110 | ..RING,RETAINING..... | 2 |
| * 5.1 | PAFZZ | | 61080 | 50359000 | ..PIN,PISTON 2G40.10..... | 1 |
| * 5.1 | PAFZZ | | 61080 | 50359010 | ..PIN,PISTON..... | 1 |
| 6 | PAFFF | 2815-01-414-1273 | 61080 | 01262200 | CONNECTING ROD,PIST..... | 2 |
| * 6.1 | PAFZZ | | 61080 | 03785300 | .BEARING,SLEEVE..... | 1 |
| * 6.2 | XDFZZ | | 61080 | 03781300 | .BEARING,SLEEVE..... | 1 |
| * 6.2 | XDFZZ | | 61080 | 03785600 | .BEARING,SLEEVE OVERSIZE 0.5 MM.... | 1 |
| 7 | PAFZZ | 5305-01-406-0001 | 61080 | 03781100 | SCREW,MACHINE..... | 4 |

END OF FIGURE

*** EPA Version 1 Compliant Only

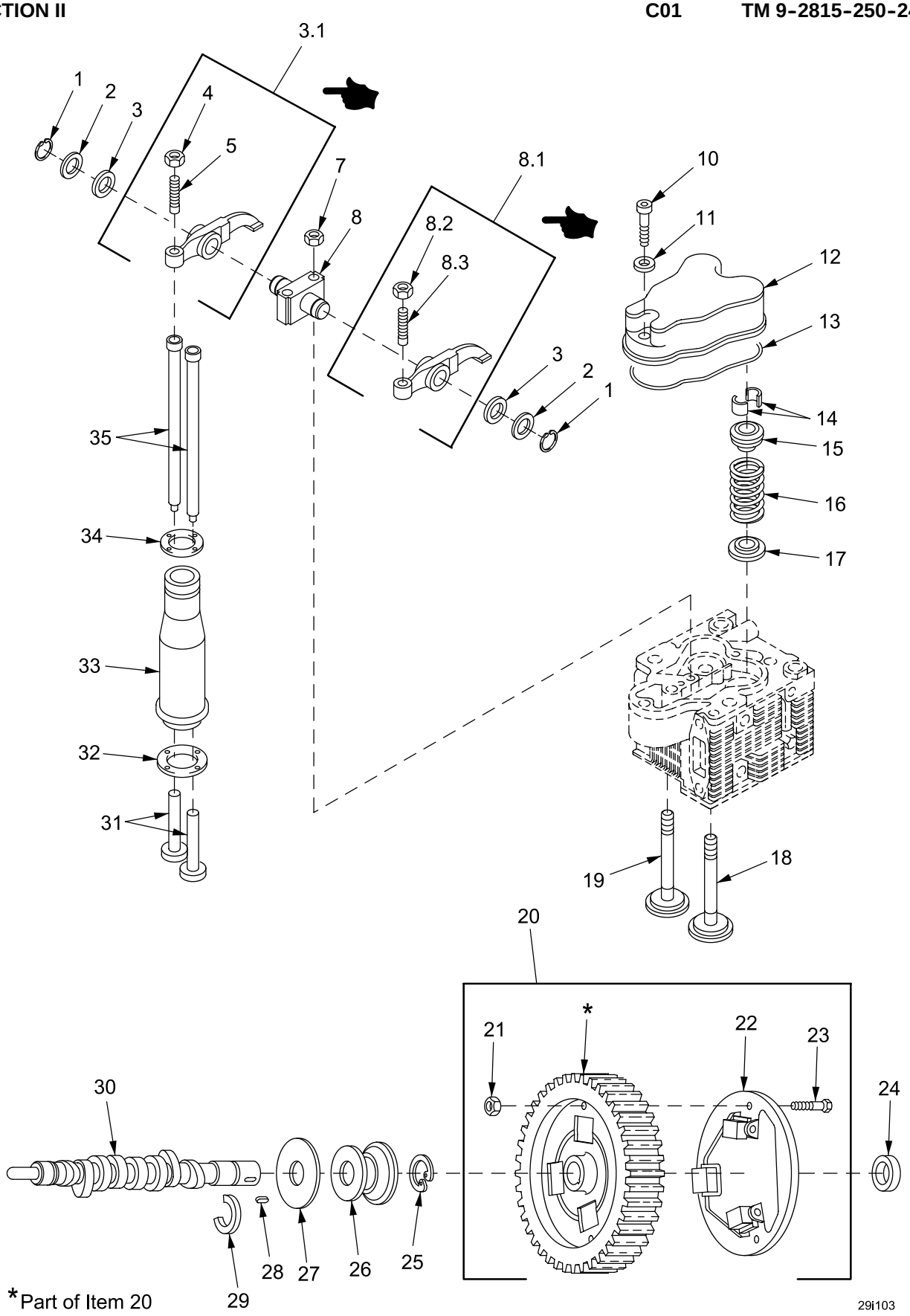



*Figure 8. Camshaft and Valves*

| (1) ITEM NO | (2) SMR | (3) NSN | (4) CAGE | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| | | | | | GROUP 2915 VALVES, CAMSHAFT, AND TIMING SYSTEM | |
| | | | | | FIGURE 8 CAMSHAFT AND VALVES | |
| 1 | PAFZZ | 5325-01-399-4615 | 61080 | 50019800 | RING,RETAINING..... | 4 |
| 2 | PAFZZ | 5365-01-399-5011 | 61080 | 50315900 | SHIM..... | V |
| 3 | PAFZZ | 5365-01-455-0012 | 61080 | 50316000 | SHIM..... | V |
| 3.1 | PAFFF | 2815-01-455-0054 | 61080 | 01224400 | ROCKER ARM,ENGINE P..... | 2 |
| 4 | PAFZZ | 5310-01-078-8066 | 61080 | 03173100 | .NUT,PLAIN,HEXAGON PART OF KIT P/N 01228202..... | 1 |
| 5 | PAFZZ | 5305-01-405-9904 | 61080 | 03783000 | .SCREW,MACHINE..... | 1 |
| 7 | PAFZZ | 5310-01-101-2028 | 61080 | 40028400 | NUT,SELF-LOCKING,HE..... | 4 |
| 8 | PAFZZ | 2815-01-455-0046 | 61080 | 01224600 | BRACKET,ROCKER ARM..... | 2 |
| 8.1 | PAFFF | 2815-01-455-0043 | 61080 | 01224500 | ROCKER ARM,ENGINE P..... | 2 |
| * 8.2 | PAFZZ | 5310-01-078-8066 | 61080 | 03173100 | .NUT,PLAIN,HEXAGON PART OF KIT P/N 01228202..... | 1 |
| * 8.3 | PAFZZ | 5305-01-405-9904 | 61080 | 03783000 | .SCREW,MACHINE..... | 1 |
| 10 | PAOZZ | 5305-01-405-9903 | 61080 | 50177500 | SCREW,MACHINE..... | 4 |
| 11 | PAOZZ | 5310-01-415-2649 | 61080 | 50162900 | WASHER,FLAT PART OF KIT P/N 01228202 , 01247702..... | 4 |
| 12 | PAOZZ | 2815-01-454-8841 | 61080 | 03783800 | COVER,ENGINE POPPET..... | 2 |
| 13 | PAOZZ | 5330-01-400-5772 | 61080 | 50290200 | O-RING PART OF KIT P/N 01228202, 01247702..... | 2 |
| 14 | PAFZZ | 2815-01-455-0364 | 61080 | 03786300 | LOCK,VALVE SPRING R..... | 4 |
| 15 | PAFZZ | 5310-01-456-2275 | 61080 | 03783600 | WASHER,SPRING TENSI..... | 4 |
| 16 | PAFZZ | 5360-01-414-8475 | 61080 | 03783500 | SPRING,HELICAL,COMP..... | 4 |
| 17 | PAFZZ | 5310-01-399-7311 | 61080 | 03783401 | WASHER,SPRING TENSI..... | 4 |
| * 18 | PAFZZ | 4820-01-407-0705 | 61080 | 03783300 | VALVE,EXHAUST CONTR..... | 2 |
| *** 18 | PAFZZ | | 61080 | 03783301 | VALVE,EXHAUST CONTR..... | 2 |
| * 19 | PAFZZ | 2805-01-407-0706 | 61080 | 03783200 | VALVE,POPPET,ENGINE..... | 2 |
| *** 19 | PAFZZ | | 61080 | 03783210 | VALVE,POPPET,ENGINE..... | 2 |
| 20 | PAFFF | 3010-01-455-2856 | 61080 | 01222100 | GEAR ASSY,CAMSHAFT..... | 1 |
| 21 | PAFZZ | 5310-01-400-3721 | 61080 | 50305400 | .NUT,PLAIN,HEXAGON..... | 3 |
| 22 | PAFZZ | 5340-01-400-1000 | 61080 | 01244800 | .PLATE,MOUNTING..... | 1 |
| 23 | PAFZZ | 5305-01-406-0013 | 61080 | 50305300 | .SCREW,MACHINE..... | 3 |
| 24 | PAFZZ | 5365-01-100-5415 | 61080 | 03233200 | SHIM..... | 1 |
| 24 | PAFZZ | 5365-01-100-5416 | 61080 | 03233300 | SHIM..... | 1 |
| 25 | PAFZZ | 5325-01-245-3517 | 61080 | 50020000 | RING,RETAINING..... | 1 |
| 26 | PAFZZ | 5365-01-400-3717 | 61080 | 50305700 | SPACER,SLEEVE..... | 1 |
| 27 | PAFZZ | 5310-01-399-6981 | 61080 | 50306001 | WASHER,FLAT..... | 1 |
| 28 | PAFZZ | 5315-01-102-7922 | 61080 | 50010500 | KEY..... | 1 |
| 29 | PAFZZ | 5325-01-399-4618 | 61080 | 50305000 | RING,RETAINING..... | 1 |
| * 30 | PAFZZ | 2815-01-454-8842 | 61080 | 04092800 | CAMSHAFT,ENGINE..... | 1 |
| *** 30 | PAFZZ | | 61080 | 04092810 | CAMSHAFT,ENGINE..... | 1 |
| * 30 | PAFZZ | | 61080 | 50304900 | CAMSHAFT,ENGINE 2G40.10, 2G40.11... | 1 |
| 31 | PAFZZ | 2815-01-455-0085 | 61080 | 50302000 | TAPPET,ENGINE POPPE..... | 4 |
| 32 | KFFZZ | | 61080 | 50290100 | O-RING PART OF KIT P/N 01247702..... | 2 |
| 33 | PAFZZ | 2815-01-454-8839 | 61080 | 03781800 | GUIDE,ENGINE POPPET..... | 2 |
| 34 | KFFZZ | | 61080 | 50208400 | O-RING PART OF KIT P/N 01247702..... | 2 |
| 35 | PAFZZ | 2815-12-330-5421 | 61080 | 01224001 | PUSH ROD,ENGINE POP..... | 4 |

END OF FIGURE

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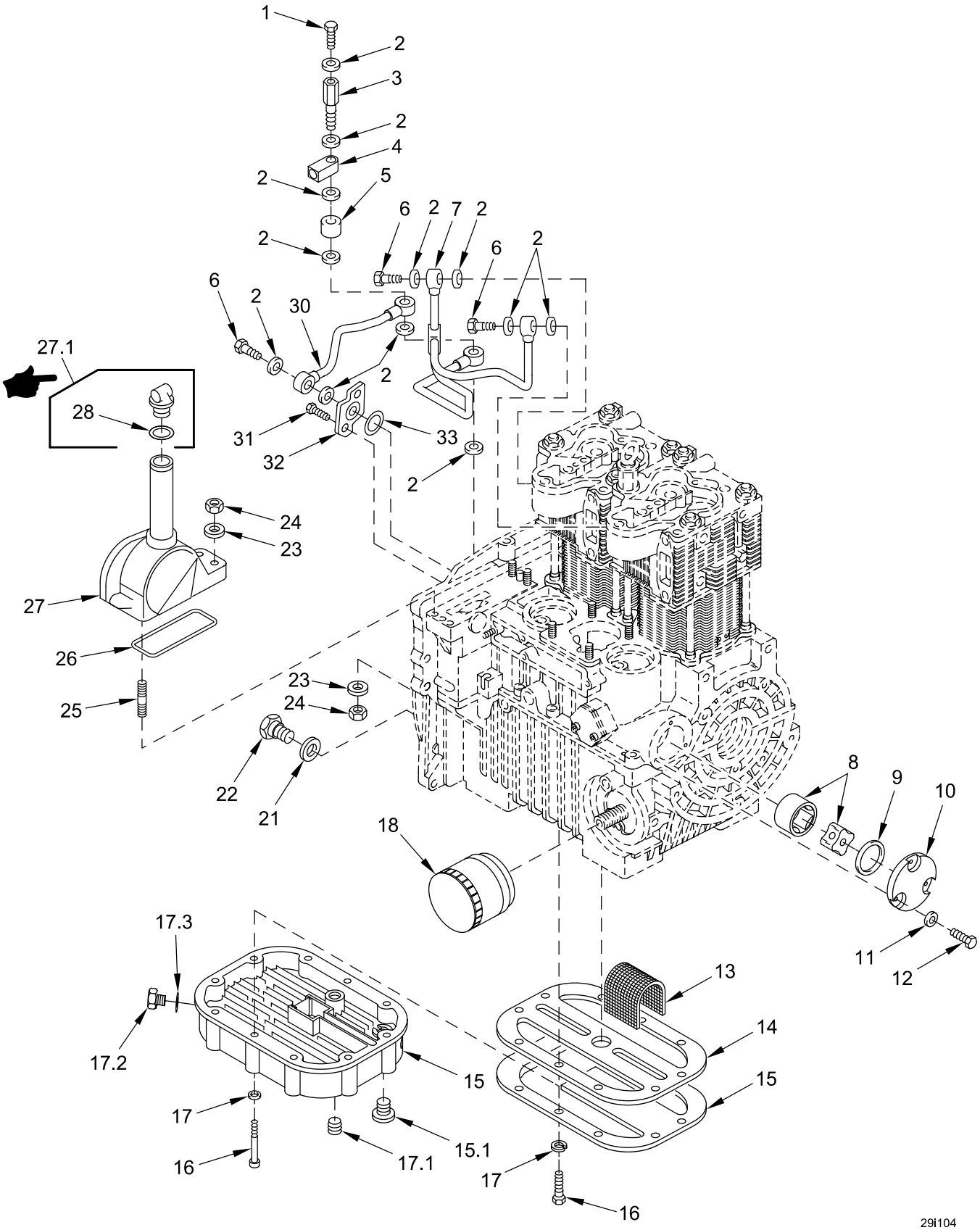


*Figure 9. Engine Lubrication System*

| (1) ITEM NO | (2) SMR | (3) NSN | (4) CAGE | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| | | | | | GROUP 2916 ENGINE LUBRICATION SYSTEM | |
| | | | | | FIGURE 9 ENGINE LUBRICATION SYSTEM | |
| 1 | PAOZZ | 5305-01-405-9906 | 61080 | 50033300 | SCREW,MACHINE..... | 1 |
| 2 | PAOZZ | 5310-01-090-0938 | 61080 | 50000900 | WASHER,FLAT PART OF KIT P/N 01247702 | 12 |
| 3 | PAOZZ | 4730-01-454-7549 | 61080 | 03790001 | BOLT,FLUID PASSAGE..... | 1 |
| 4 | PAOZZ | 4730-01-454-7692 | 61080 | 03932100 | CONNECTOR,MULTIPLE..... | 1 |
| 5 | PAOZZ | 4730-01-454-7693 | 61080 | 03790100 | BUSHING,BOSS..... | 1 |
| 6 | PAOZZ | 4730-01-103-3202 | 61080 | 50006100 | BOLT,FLUID PASSAGE..... | 3 |
| 7 | PAOZZ | 4710-01-454-7687 | 61080 | 01224900 | TUBE ASSEMBLY,METAL..... | 1 |
| * 8 | PAFZZ | 2805-01-488-7755 | 61080 | 01227910 | OIL PUMP ASSEMBLY,E..... | 1 |
| 9 | KFFZZ | | 61080 | 50310500 | O-RING PART OF KIT P/N 01228002..... | 1 |
| 10 | PAFZZ | 5340-01-454-9280 | 61080 | 50310400 | COVER,ACCESS..... | 1 |
| 11 | PAFZZ | 5310-01-400-2139 | 61080 | 50216300 | WASHER,FLAT..... | 3 |
| 12 | PAFZZ | 5305-01-406-0004 | 61080 | 50025200 | SCREW,MACHINE..... | 3 |
| 13 | PAFZZ | 4730-01-454-7461 | 61080 | 50301400 | STRAINER ELEMENT,SE..... | 1 |
| 14 | KFFZZ | | 61080 | 50301500 | GASKET PART OF KIT P/N 01228002..... | 1 |
| * 15 | PAFZZ | | 61080 | 03938610 | SUMP,OIL DEEP..... UOC:APJ, | 1 |
| 15 | PAFZZ | 2815-01-455-0042 | 61080 | 50301601 | OIL PAN..... UOC:APP, | 1 |
| * 15.1 | PAOZZ | | 61080 | 50341900 | PLUG..... UOC:APJ, | 1 |
| 16 | PAFZZ | 5305-01-455-1243 | 61080 | 50207900 | SCREW,MACHINE..... UOC:APP, | 10 |
| * 16 | PAFZZ | 5305-01-492-8775 | 61080 | 50342000 | SCREW,MACHINE..... UOC:APJ, | 10 |
| 17 | PAFZZ | 5310-01-239-2390 | 61080 | 500 812 00 | WASHER,LOCK..... UOC:APP, | 10 |
| * 17 | PAFZZ | 5310-12-149-4353 | 61080 | 50144500 | WASHER,FLAT..... UOC:APJ, | 1 |
| * 17.1 | PAOZZ | | 61080 | 50043800 | PLUG,RECESS..... UOC:APJ, | 1 |
| * 17.2 | PAOZZ | | 61080 | 50548200 | PLUG..... UOC:APJ, | 2 |
| * 17.3 | PAOZZ | | 61080 | 50448100 | WASHER..... UOC:APJ, | 2 |
| ** 18 | PAOZZ | 2940-01-383-9739 | 61080 | 50302800 | FILTER ELEMENT,FLUI PART OF KIT P/N 01228202..... UOC:APP, | 1 |
| 21 | PAOZZ | 5330-01-101-8076 | 61080 | 50001200 | GASKET PART OF KIT P/N 01228202..... | 1 |
| 22 | PAOZZ | 4820-01-406-0343 | 61080 | 50311000 | COCK,POPPET DRAIN PART OF KIT P/N 01228202..... | 1 |
| 23 | PAFZZ | 5310-01-399-8386 | 61080 | 03788800 | WASHER,FLAT..... | 4 |
| ** 24 | PAFZZ | 5310-01-400-3719 | 61080 | 50335300 | NUT,PLAIN,HEXAGON..... UOC:APP, | 4 |
| ** 25 | PAFZZ | | 61080 | 50321900 | STUD,PLAIN..... UOC:APP, | 2 |
| ** 26 | KFFZZ | 5331-01-400-5778 | 61080 | 50323500 | O-RING PART OF KIT P/N 01228002..... UOC:APP, | 1 |
| ** 27 | PAFZZ | 2590-01-454-8941 | 61080 | 03908201 | FILLER NECK,VEHICUL..... UOC:APP, | 1 |
| **27.1 | PAOFF | | 61080 | 01613100 | CAP,FILLER OPENING PART OF KIT P/N 01228202..... UOC:APP, | 1 |
| ** 28 | PAOZZ | | 61080 | 04125000 | .O-RING PART OF KIT P/N 01228002.... UOC:APP, | 1 |
| 30 | PAOZZ | 4710-01-454-7688 | 61080 | 50336300 | TUBE ASSEMBLY,METAL..... | 1 |
| 31 | PAOZZ | 5305-01-405-9998 | 61080 | 50274500 | SCREW,MACHINE..... | 2 |
| 32 | PAOZZ | 5340-01-454-9281 | 61080 | 50336400 | COVER,ACCESS..... | 1 |
| 33 | PAOZZ | 5330-01-399-6976 | 61080 | 50336500 | O-RING..... | 1 |

END OF FIGURE
9-1

** Refer to TM 9-2350-292-24P and TM 9-2350-292-20-2 for UOC: APJ Item.

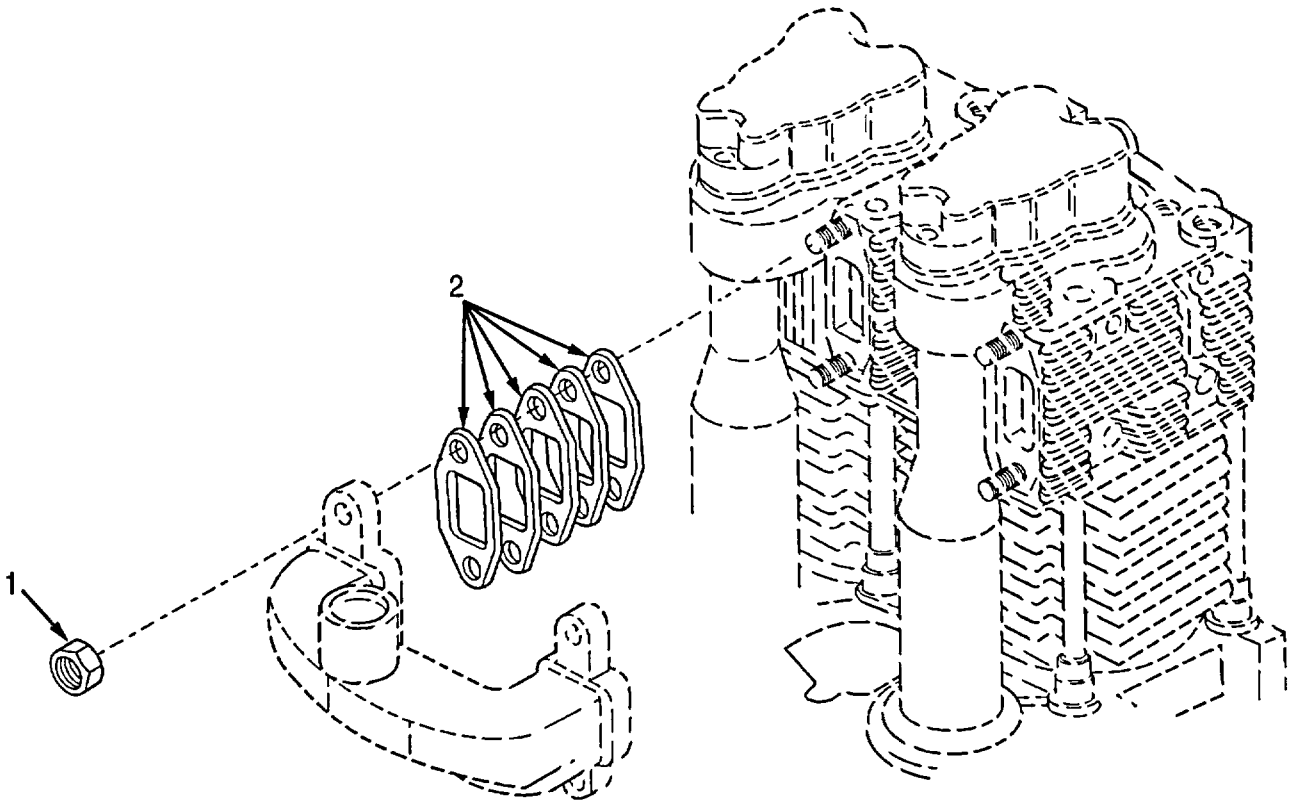


*Figure 10. Exhaust Manifold Mounting Hardware*

| (1) ITEM NO | (2) SMR | (3) NSN | (4) CAGE | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| | | | | | GROUP 2918 MANIFOLDS<br>FIGURE 10 EXHAUST MANIFOLD MOUNTING HARDWARE | |
| 1 | PAOZZ | 5310-01-101-2028 | 61080 | 40028400 | NUT,SELF-LOCKING,HE..... | 4 |
| 2 | PAOZZ | 5330-01-455-7566 | 61080 | 01285500 | GASKET SET PART OF KIT P/N 01247702. | 2 |

END OF FIGURE

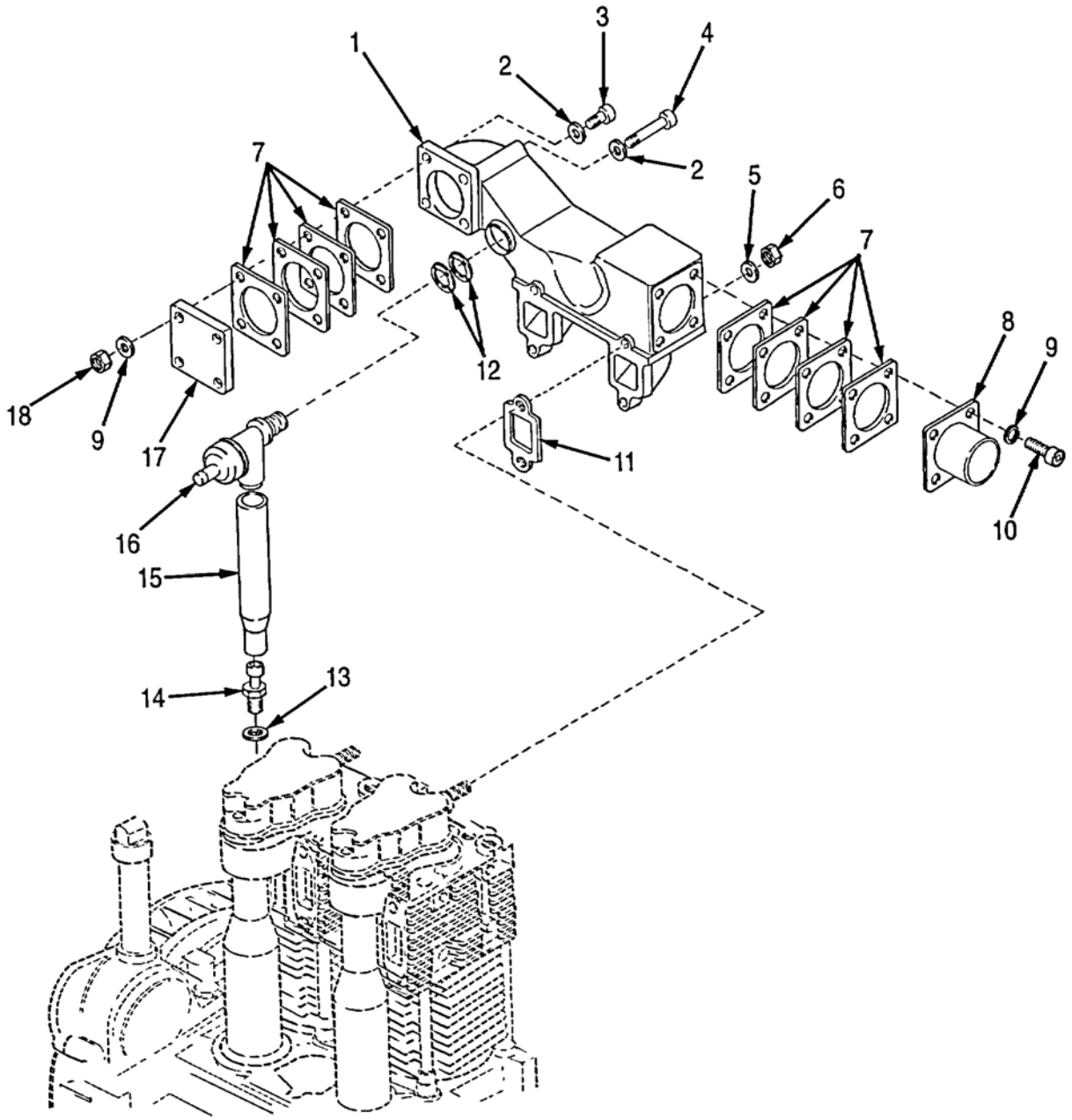


*Figure 11. Intake Manifold and Related Components*

| (1) ITEM NO | (2) SMR | (3) NSN | (4) CAGE | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| | | | | | GROUP 2918 MANIFOLDS<br>FIGURE 11 INTAKE MANIFOLD AND RELATED COMPONENTS | |
| 1 | PAOZZ | 2815-01-455-0041 | 61080 | 03787402 | MANIFOLD,INTAKE..... | 1 |
| 2 | PAOZZ | 5310-01-455-8480 | 61080 | 50148100 | WASHER,FLAT..... | 4 |
| 3 | PAOZZ | 5305-01-455-1242 | 61080 | 50175900 | SCREW,CAP,SOCKET HE..... | 2 |
| 4 | PAOZZ | 5305-01-455-1247 | 61080 | 50183100 | SCREW,CAP,SOCKET HE..... | 2 |
| 5 | PAOZZ | 5310-01-399-7305 | 61080 | 50095100 | WASHER,SPRING TENSI..... | 4 |
| 6 | PAOZZ | 5310-01-101-2028 | 61080 | 40028400 | NUT,SELF-LOCKING,HE..... | 4 |
| 7 | PAOZZ | 5330-01-455-7823 | 61080 | 01285600 | GASKET..... | 2 |
| ** 8 | PAOZZ | 2815-01-454-8626 | 61080 | 01198900 | ADAPTER,INTAKE MANI.....<br>UOC:APP, | 1 |
| 9 | PAOZZ | 5310-01-399-7303 | 61080 | 50208500 | WASHER,SPRING TENSI..... | 8 |
| 10 | PAOZZ | 5305-01-455-1613 | 61080 | 50206300 | SCREW,CAP,SOCKET HE..... | 4 |
| 11 | PAOZZ | 5330-01-455-7819 | 61080 | 03783902 | GASKET PART OF KIT P/N 01247702..... | 2 |
| 12 | PAOZZ | | 61080 | 50326200 | O-RING..... | 2 |
| 13 | PAOZZ | 5330-01-080-1776 | 61080 | 50001100 | GASKET PART OF KIT P/N 01228002..... | 1 |
| 14 | PAOZZ | 4730-01-399-6267 | 61080 | 50303000 | COUPLING,HOSE..... | 1 |
| * 15 | PAOZZ | | 61080 | 03784001 | HOSE,PREFORMED.....<br>UOC:APJ, | 1 |
| 16 | PAOZZ | 4820-01-399-5579 | 61080 | 01225610 | VALVE,VENT..... | 1 |
| 17 | PAOZZ | 5340-01-454-9271 | 61080 | 03939700 | COVER,ACCESS..... | 1 |
| * 18 | PAFZZ | 5310-01-400-3720 | 61080 | 50148000 | NUT,PLAIN,HEXAGON..... | 4 |

END OF FIGURE

** Refer to TM 9-2350-292-24P and TM 9-2350-292-20-2 for UOC: APJ Item.

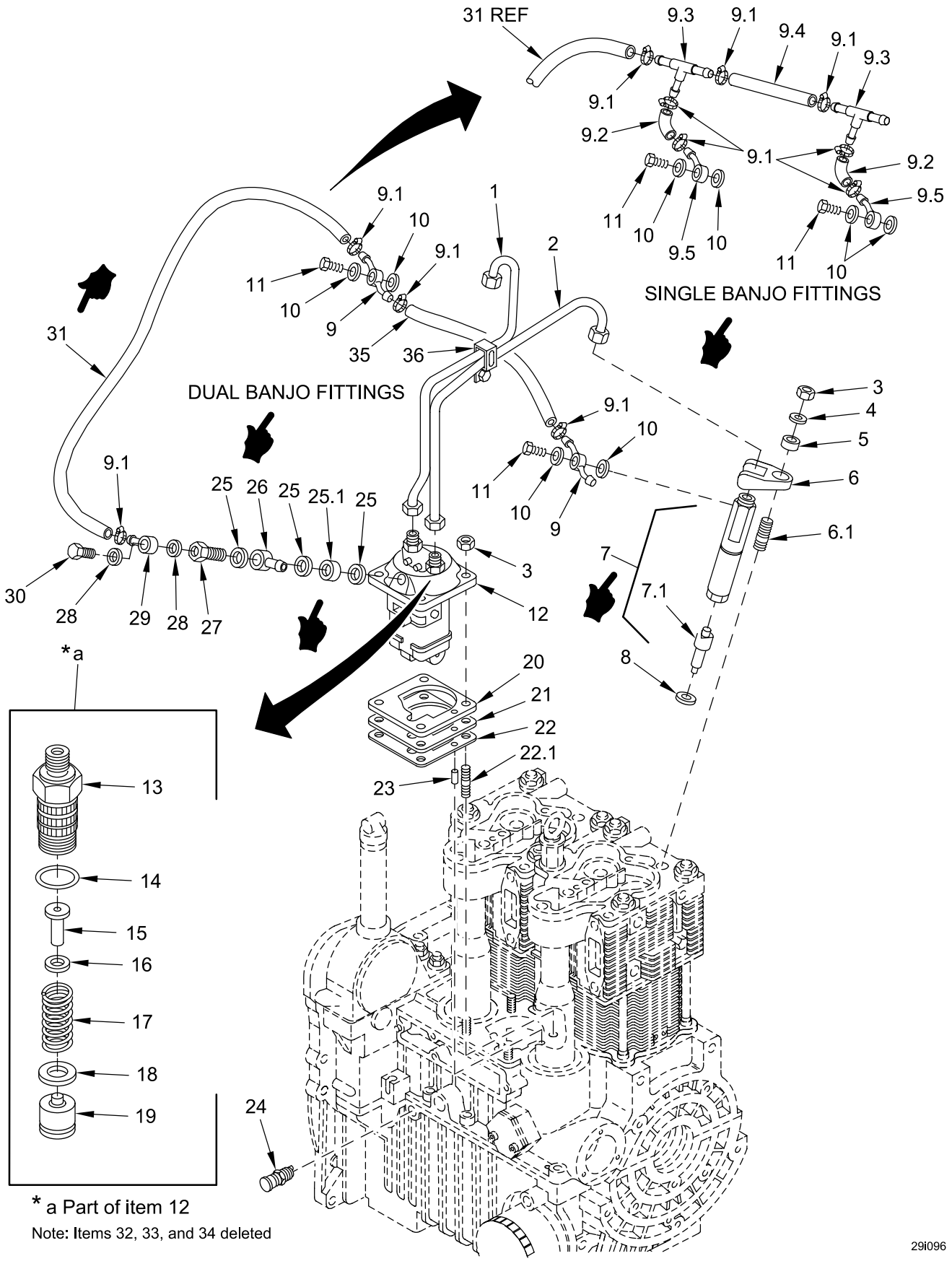


*Figure 12. Injection Pump, Nozzles, and Fuel Lines*

| (1) ITEM NO | (2) SMR | (3) NSN | (4) CAGE | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| | | | | | GROUP 2932 ENGINE FUEL SYSTEM<br>FIGURE 12 INJECTION PUMP, NOZZLES AND FUEL LINES | |
| 1 | PAOZZ | 4710-01-399-7358 | 61080 | 01240900 | PIPE ASSEMBLY,METAL..... | 1 |
| *** 1 | PAOZZ | 4710-01-518-8127 | 61080 | 01240910 | TUBE ASSEMBLY,METAL..... | 1 |
| 2 | PAOZZ | 4710-01-399-7359 | 61080 | 01241000 | PIPE ASSEMBLY,METAL..... | 1 |
| *** 2 | PAOZZ | 4710-01-518-8125 | 61080 | 01241010 | TUBE ASSEMBLY,METAL..... | 1 |
| 3 | PAFZZ | 5310-01-400-3720 | 61080 | 50148000 | NUT,PLAIN,HEXAGON..... | 6 |
| 4 | PAFZZ | 5310-01-399-7303 | 61080 | 50208500 | WASHER,SPRING TENSI..... | 2 |
| 5 | PAFZZ | 5310-01-400-0995 | 61080 | 04035700 | WASHER,FLAT..... | 2 |
| 6 | PAFZZ | 4730-01-399-4252 | 61080 | 03792400 | CLAMP,HOSE..... | 2 |
| * 6.1 | PAFZZ | 5307-01-405-9899 | 61080 | 50038400 | STUD,PLAIN..... | 2 |
| * 7 | PAFFF | 2910-12-337-7727 | 61080 | 50355500 | INJECTOR ASSEMBLY,F..... | 2 |
| *** 7 | PAFFF | | 61080 | 50493300 | INJECTOR ASSEMBLY..... | 2 |
| * 7.1 | PAFZZ | | 61080 | 50355600 | .NOZZLE..... | 1 |
| ***7.1 | PAFZZ | | 61080 | 50493400 | .NOZZLE..... | 1 |
| *** 8 | PAFZZ | | 61080 | 04025800 | .JOINT PART OF KIT P/N 01247702..... | 2 |
| 8 | PAFZZ | | 61080 | 04085001 | .JOINT PART OF KIT P/N 01247702..... | 2 |
| 8 | KFFZZ | | 61080 | 40085001 | GASKET PART OF KIT P/N 01247702..... | 2 |
| 9 | PAOZZ | 4730-01-399-4253 | 61080 | 03780800 | NIPPLE,HOSE..... | 2 |
| * 9.1 | PAOZZ | | 81343 | J1508-M-04 | CLAMP,HOSE..... | 8 |
| ***9.2 | MOOZZ | | 19207 | 12478232-4 | HOSE, 2.2□ MAKE FROM HOSE P/N 12478232..... | 2 |
| ***9.3 | PAOZZ | | 61080 | 50157800 | NIPPLE,HOSE..... | 2 |
| ***9.4 | MOOZZ | | 19207 | 12478232-3 | HOSE,4.0□ MAKE FROM HOSE, P/N 12478232..... | 1 |
| ***9.5 | PAOZZ | | 61080 | 50333400 | NIPPLE,HOSE..... | 2 |
| 10 | PAOZZ | 5330-01-405-9900 | 61080 | 50313100 | GASKET PART OF KIT P/N 01247702..... | 4 |
| 11 | PAOZZ | 4730-01-399-4254 | 61080 | 50313000 | BOLT,FLUID PASSAGE..... | 2 |
| 12 | PAFFF | 2910-12-338-8683 | 61080 | 50355400 | PUMP,FUEL,METERING..... | 1 |
| *** 12 | PAFFF | | 61080 | 50493200 | PUMP,FUEL,METERING..... | 1 |
| 13 | PAFZZ | 4820-01-406-6143 | 61080 | 49061200 | .BODY,VALVE..... | 2 |
| 14 | PAFZA | 5331-01-101-8063 | 61080 | 49004700 | .O-RING..... | 2 |
| 15 | PAFZZ | 5340-01-100-4991 | 61080 | 49003900 | .PLUG,VENT..... | 2 |
| 16 | PAFZZ | 5365-01-101-5938 | 61080 | 49004300 | .SHIM..... | 2 |
| 17 | PAFZZ | 5360-01-458-0666 | 61080 | 49003500 | .SPRING,HELICAL,COMP..... | 2 |
| 18 | PAFZA | 5330-01-101-7264 | 61080 | 49004400 | .GASKET..... | 2 |
| 19 | PAFZZ | 4820-01-407-1908 | 53867 | 3418502037 | .VALVE,PRESSURE EQUA..... | 2 |
| 20 | PAFZZ | | 61080 | 50312500 | GASKET,0.30 MM..... | V |
| *** 21 | KFFZZ | | 61080 | 50312400 | GASKET,0.20 MM PART OF KIT P/N 01228002..... | 1 |
| 21 | PAFZZ | | 61080 | 50552200 | GASKET,0.30 MM 2G40.17, 2G40.18 PART OF KIT P/N 01228002..... | 1 |
| 22 | KFFZZ | | 61080 | 50312300 | GASKET,0.10 MM PART OF KIT P/N 01228002..... | 2 |
| * 22.1 | PAFZZ | 5307-01-405-9905 | 61080 | 50098300 | STUD,PLAIN..... | 4 |
| 23 | PAFZZ | 5315-01-400-0445 | 61080 | 50312200 | PIN,STRAIGHT,HEADLE..... | 1 |
| 24 | PAFZZ | 4820-01-455-5018 | 61080 | 01231501 | VALVE,FLOW CONTROL..... | 1 |
| 25 | PAOZZ | 5330-01-080-1776 | 61080 | 50001100 | GASKET PART OF KIT P/N 01228002..... UOC:APP, | 2 |
| 25 | PAOZZ | 5330-01-080-1776 | 61080 | 50001100 | GASKET PART OF KIT P/N 01228002..... UOC:APJ, | 3 |
| * 25.1 | PAOZZ | 5310-01-494-3769 | 61080 | 03966300 | WASHER,FLAT..... UOC:APJ, | 1 |
| 26 | PAOZZ | 4730-01-454-7573 | 61080 | 40092600 | FITTING,RING PIECE..... UOC:APP, | 1 |
| 26 | PAOZZ | 4730-01-494-7219 | 61080 | 50015800 | CONNECTOR,MULTIPLE,..... UOC:APJ, | 1 |
| 27 | PAOZZ | 4730-01-454-7560 | 61080 | 01223200 | ADAPTER,STRAIGHT,TU..... | 1 |
| 28 | PAOZZ | 5310-01-090-0938 | 61080 | 50000900 | WASHER,FLAT PART OF KIT P/N 01247702 | 2 |
| 29 | PAOZZ | 4730-01-454-7567 | 61080 | 50015700 | FITTING,RING PIECE..... | 1 |
| 30 | PAOZZ | 4730-01-454-7569 | 61080 | 50311700 | BOLT,FLUID PASSAGE..... UOC:APP, | 1 |
| * 31 | MOOZZ | | 19207 | 12478232-2 | HOSE ASSEMBLY,NONME MAKE FROM HOSE, P/N 12478232..... | 1 |
| * 35 | MOOZZ | | 19207 | 12478232-5 | HOSE ASSEMBLY,NONME MAKE FROM HOSE, P/N 12478232..... | 1 |
| 36 | PAOZZ | 5340-01-406-1646 | 61080 | 50314100 | CLAMP,LOOP..... | 1 |

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12-1/12-2 blank

*** EPA Version 1 Compliant Only

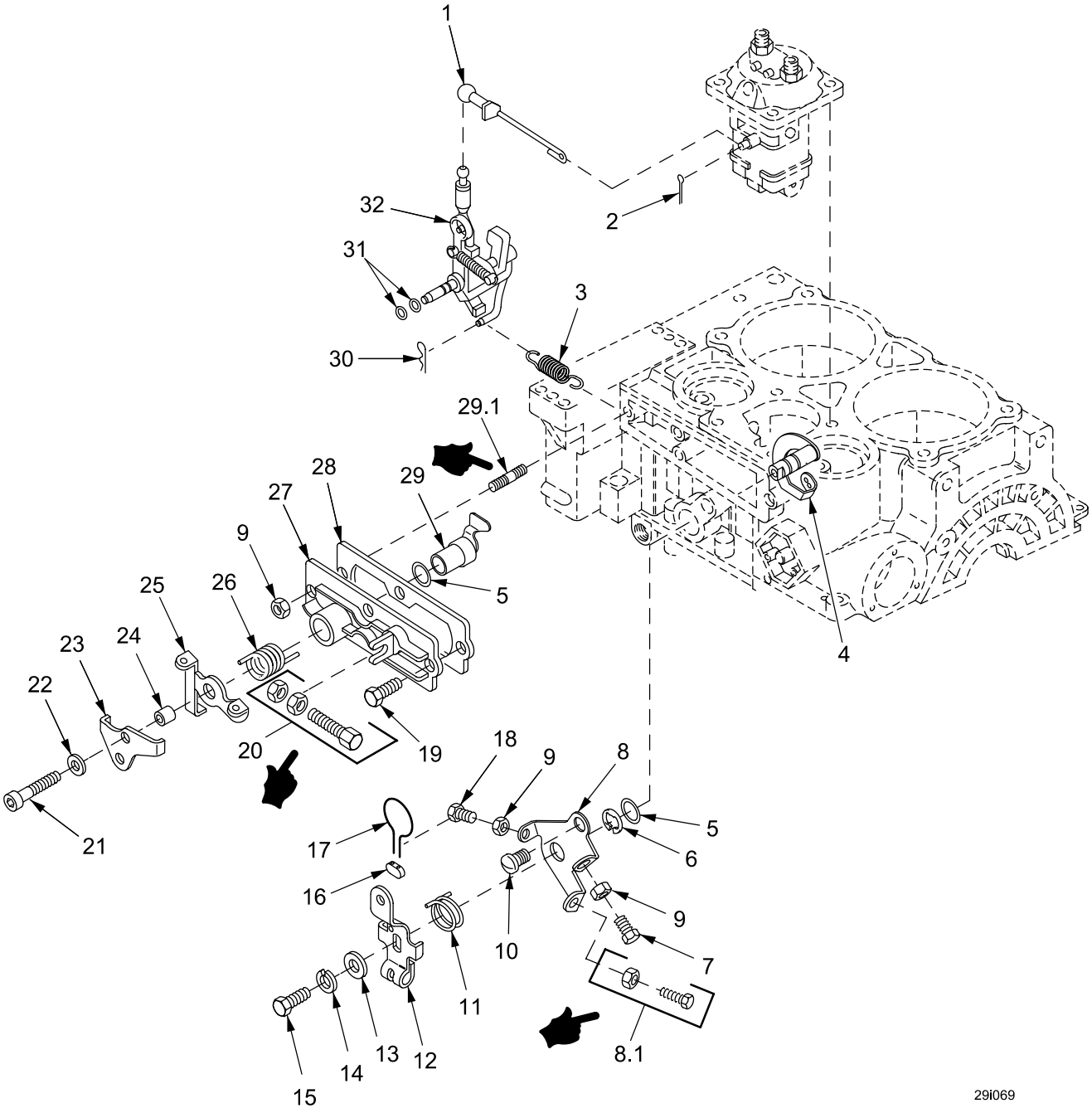


*Figure 13. Governor and Controls (SH 1 of 2)*

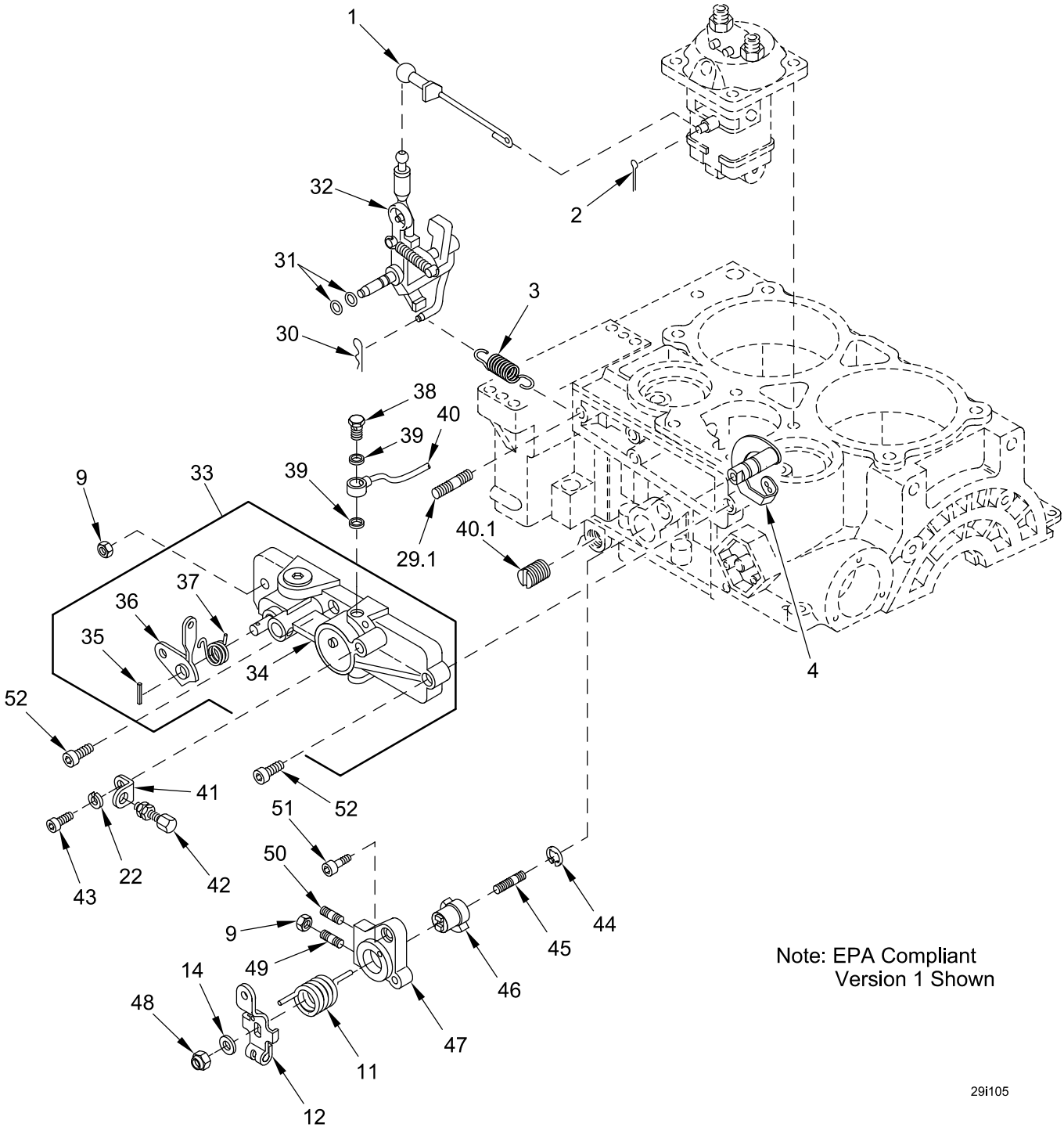


*Figure 13. Governor and Controls (SH 2 of 2)*

| (1) ITEM NO | (2) SMR | (3) NSN | (4) CAGE | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| | | | | | GROUP 2936 ENGINE SPEED GOVERNOR AND CONTROLS | |
| | | | | | FIGURE 13 GOVERNOR AND CONTROLS | |
| 1 | PAFZZ | 2990-01-454-7609 | 61080 | 01222400 | LEVER ASSEMBLY,POWE..... | 1 |
| 2 | PAFZZ | 5315-01-399-6107 | 61080 | 50036000 | PIN,COTTER..... | 1 |
| 3 | PAFZZ | 5360-01-399-5014 | 61080 | 04020200 | SPRING,HELICAL,COMP..... UOC:APP, | 1 |
| * 3 | PAFZZ | | 61080 | 04086300 | SPRING,HELICAL,COMP..... UOC:APJ, | 1 |
| 4 | PAFZZ | 2990-01-454-8630 | 61080 | 04088300 | LEVER,THROTTLE..... | 1 |
| 5 | PAFZZ | 5331-01-399-6978 | 61080 | 50306500 | O-RING PART OF KIT P/N 01228002..... | 2 |
| 6 | PAFZZ | 5325-01-400-0999 | 61080 | 50308800 | RING,RETAINING..... | 1 |
| 7 | PAFZZ | 5305-01-406-0000 | 61080 | 50092100 | SCREW,MACHINE..... | 1 |
| 8 | PAFZZ | 2990-01-454-9173 | 61080 | 50308901 | LEVER,SPEED CONTROL..... | 1 |
| * 8.1 | PAFZZ | 5305-01-406-0009 | 61080 | 50309100 | SCREW,MACHINE UOC:APP..... | 1 |
| 9 | PAFZZ | 5310-01-405-9890 | 61080 | 50144400 | NUT,PLAIN,HEXAGON..... | 3 |
| 10 | PAFZZ | 5305-01-455-1246 | 61080 | 50309200 | SCREW,MACHINE..... | 1 |
| 11 | PAFZZ | 5360-01-399-5016 | 61080 | 50309300 | SPRING,HELICAL,COMP..... | 1 |
| 12 | PAFZZ | 2990-01-454-9177 | 61080 | 50309400 | LEVER,SPEED CONTROL..... | 1 |
| 13 | PAFZZ | 5310-01-405-9912 | 61080 | 50309500 | WASHER,FLAT..... | 1 |
| 14 | PAFZZ | 5310-01-455-8481 | 61080 | 50114300 | WASHER,LOCK..... | 2 |
| 15 | PAFZZ | 5305-01-274-1064 | 61080 | 500-254-00 | SCREW,MACHINE..... | 1 |
| 16 | PAFZZ | 5330-01-120-2966 | 61080 | 40021400 | SEAL..... | 1 |
| 17 | PAFZZ | 5999-01-116-8286 | 61080 | 40021500 | WIRE MESH,KNITTED..... | 1 |
| 18 | PAFZZ | 5305-01-406-0011 | 61080 | 03791600 | SCREW,MACHINE..... UOC:APP, | 1 |
| * 18 | PAFZZ | 5305-01-406-0010 | 61080 | 50344900 | SCREW,MACHINE..... UOC:APJ, | 1 |
| 19 | PAFZZ | 5305-01-406-0006 | 61080 | 50146300 | SCREW,MACHINE..... | 3 |
| 20 | PAFZZ | 5305-01-406-0007 | 61080 | 50306900 | SCREW,MACHINE..... | 1 |
| 21 | PAFZZ | 5305-01-455-1248 | 61080 | 50170800 | SCREW,CAP,SOCKET HE..... | 1 |
| 22 | PAFZZ | 5310-01-399-7301 | 61080 | 50170900 | WASHER,SPRING TENSI..... | 1 |
| 23 | PAFZZ | 2990-01-454-9202 | 61080 | 05063900 | LEVER,GOVERNOR..... | 1 |
| 24 | PAFZZ | 5365-01-455-0004 | 61080 | 03125800 | SPACER,STRAIGHT..... | 1 |
| 25 | PAFZZ | 2990-01-454-9214 | 61080 | 01266500 | LEVER,GOVERNOR..... | 1 |
| 26 | PAFZZ | 5360-01-399-5017 | 61080 | 50306600 | SPRING,HELICAL,COMP..... | 1 |
| 27 | PAFZZ | 5340-01-454-9278 | 61080 | 50306200 | PLATE,MOUNTING..... | 1 |
| 28 | KFFZZ | | 61080 | 50307100 | GASKET PART OF KIT P/N 01247702..... | 1 |
| 29 | PAFZZ | 2990-01-454-8635 | 61080 | 01222300 | STOP LEVER,GOVERNOR..... | 1 |
| 29.1 | PAFZZ | | 61080 | 50139201 | STUD,M6 X 16..... | 1 |
| 30 | PAFZZ | 5340-01-406-1645 | 61080 | 50308500 | CLIP,SPRING TENSION..... | 1 |
| 31 | KFFZZ | | 61080 | 50308100 | O-RING PART OF KIT P/N 01228002..... | 2 |
| 32 | PAFZZ | 2990-01-455-0084 | 61080 | 01222510 | LEVER ASSEMBLY,POWE..... | 1 |
| *** 33 | PAFFF | | 61080 | 01665610 | EXTRA FUEL DEVICE A..... | 1 |
| *** 34 | PAFZZ | | 61080 | 01665600 | .EXTRA FUEL DEVICE A..... SSEMBLY, 2G40.14 | 1 |
| 35 | PAFZZ | 5315-01-081-4488 | 61080 | 50034100 | .PIN,SPRING..... | 1 |
| 36 | PAFZZ | | 61080 | 01665000 | .LEVER..... | 1 |
| 37 | PAFZZ | | 61080 | 04021800 | .SPRING..... | 1 |
| 38 | PAFZZ | 4730-01-103-3202 | 61080 | 50006100 | BOLT,FLUID PASSAGE..... | 1 |
| 39 | PAFZZ | 5310-01-090-0938 | 61080 | 50000900 | WASHER,FLAT..... | 2 |
| 40 | PAFZZ | | 61080 | 01670100 | PIPE,OIL..... | 1 |
| 40.1 | PAFZZ | | 61080 | 05184200 | SCREW,CLOS..... | 1 |
| 41 | PAFZZ | | 61080 | 05186900 | SUPPORT..... | 1 |
| 42 | PAFZZ | 5305-01-406-0007 | 61080 | 50306900 | SCREW,MACHINE..... | 1 |
| 43 | PAFZZ | 5305-01-455-1250 | 61080 | 50149100 | SCREW,CAP,SOCKET HE..... | 1 |
| *** 44 | PAFZZ | 5340-01-526-2574 | 61080 | 50500800 | CLIP,RETAINING..... | 1 |
| *** 45 | PAFZZ | | 61080 | 50511000 | STUD,M6 X 30..... | 1 |
| *** 46 | PAFZZ | | 61080 | 05185400 | STOP..... | 1 |
| *** 47 | PAFZZ | | 61080 | 05184800 | BRACKET..... | 1 |
| *** 48 | PAFZZ | 5310-01-525-7457 | 61080 | 50328300 | NUT,PLAIN,HEXAGON..... | 1 |
| *** 49 | PAFZZ | | 61080 | 50507800 | SCREW,GRUB..... | 1 |
| *** 50 | PAFZZ | | 61080 | 50286300 | SCREW,GRUB..... | 1 |
| *** 51 | PAFZZ | 5305-01-264-6247 | 61080 | 50052000 | SCREW,ALLEN..... | 1 |
| 52 | PAFZZ | | 61080 | 50323800 | SCREW,SOCKET HEAD..... | 3 |



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END OF FIGURE

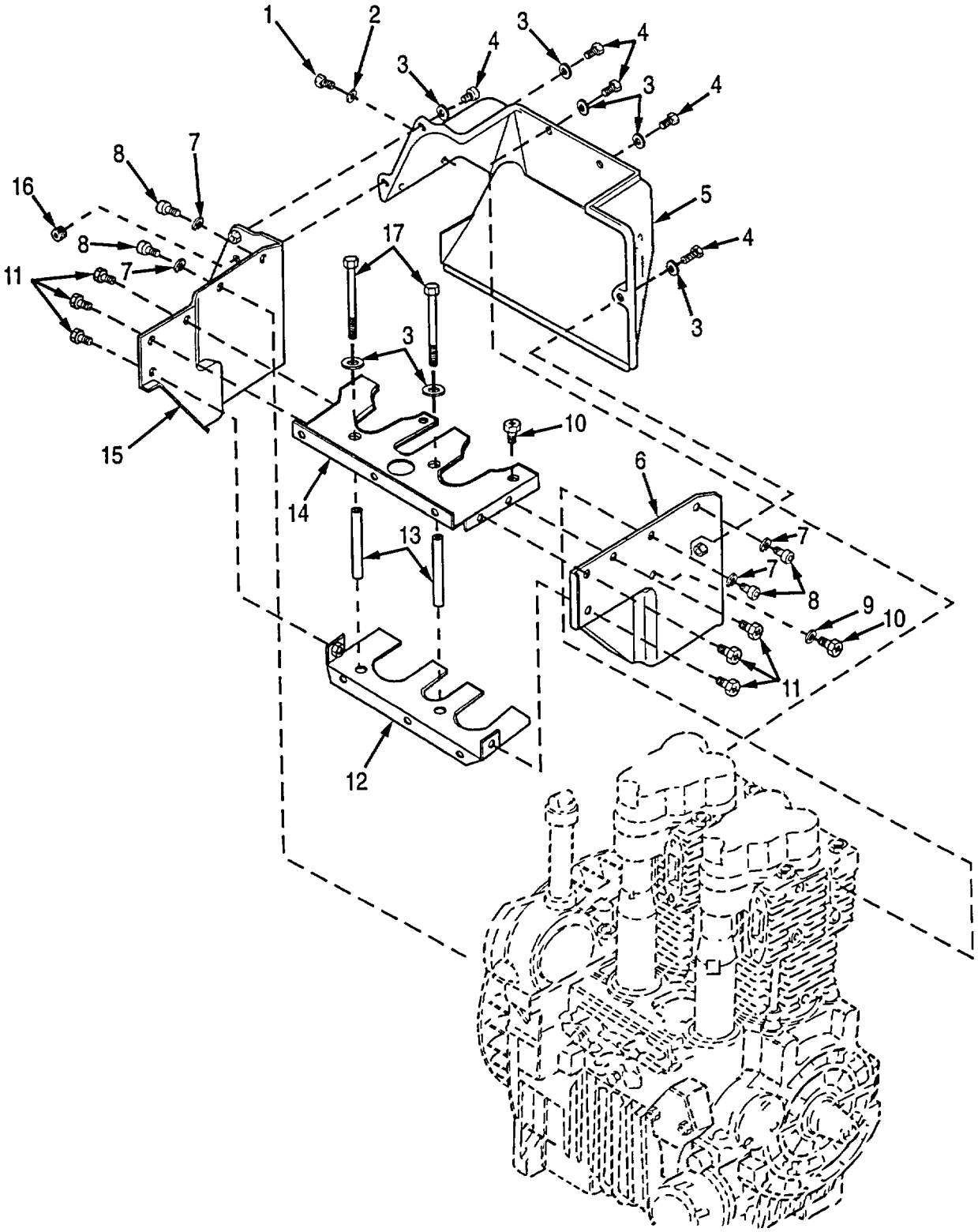


*Figure 14. Engine Cowling, Ducts, and Shroud (SH 1 of 2)*

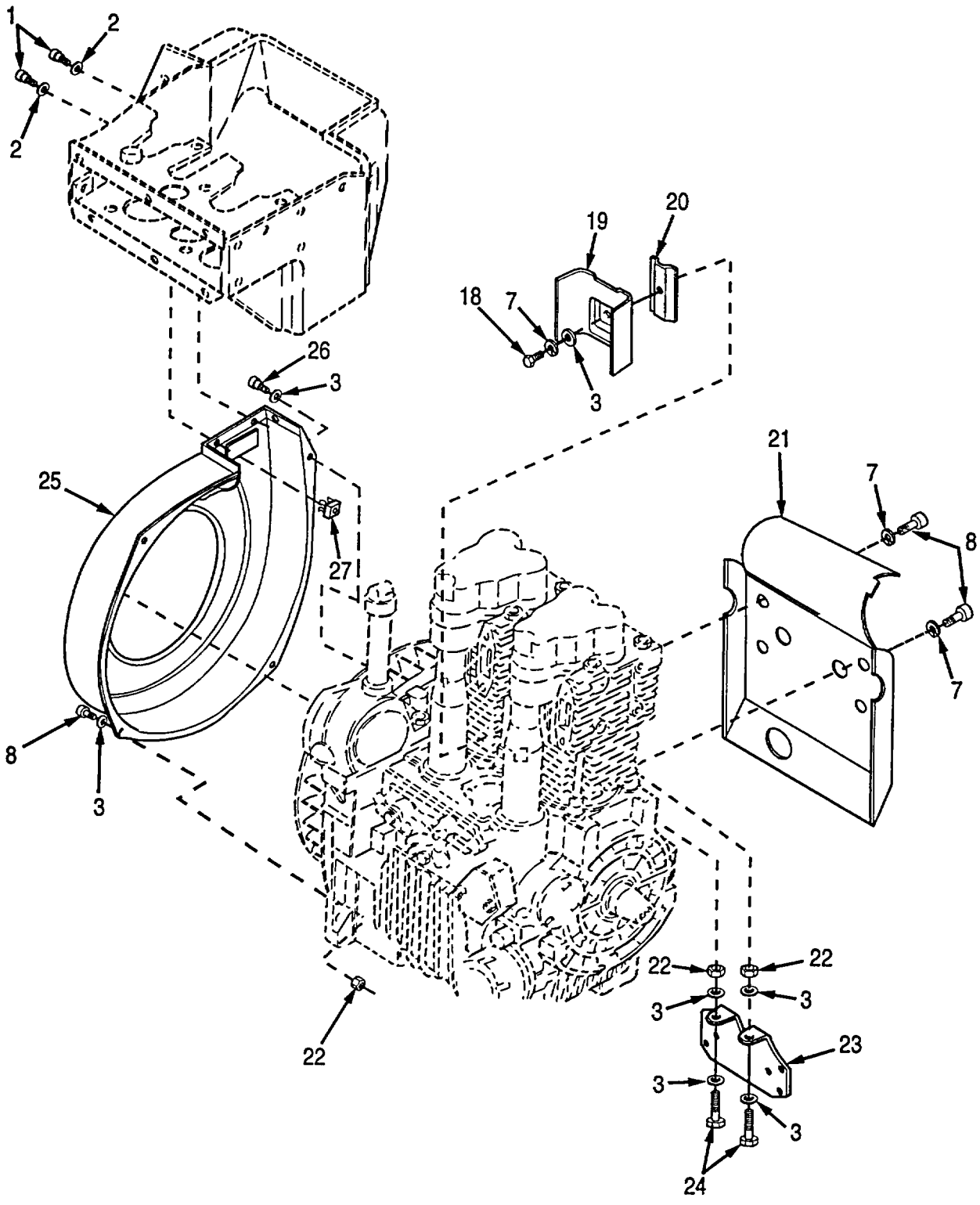


*Figure 14. Engine Cowling, Ducts, and Shroud (SH 2 of 2)*

| (1) ITEM NO | (2) SMR | (3) NSN | (4) CAGE | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| | | | | | GROUP 2952 ENGINE COWLING<br>FIGURE 14 ENGINE COWLING, DUCTS, AND SHROUD | |
| 1 | PAOZZ | 5305-01-405-9895 | 61080 | 50334600 | SCREW,MACHINE..... | 3 |
| 2 | PAOZZ | 5310-01-400-3715 | 61080 | 50315400 | WASHER,SPLIT..... | 3 |
| 3 | PAOZZ | 5310-12-149-4353 | 61080 | 50144500 | WASHER,FLAT..... | 15 |
| 4 | PAOZZ | 5305-01-405-9894 | 61080 | 50333800 | SCREW,MACHINE..... | 5 |
| ** 5 | PAOZZ | 2815-01-455-0040 | 61080 | 03784400 | DEFLECTOR,AIRFLOW.....<br>UOC:APP, | 1 |
| ** 6 | PAOZZ | 5340-01-459-1403 | 61080 | 01133200 | BRACKET,AIR DUCT.....<br>UOC:APP, | 1 |
| 7 | PAOZZ | 5310-01-399-7301 | 61080 | 50170900 | WASHER,SPRING TENSI..... | 10 |
| 8 | PAOZZ | 5305-01-405-9897 | 61080 | 50170700 | SCREW,MACHINE..... | 10 |
| 9 | PAOZZ | 5310-01-399-7303 | 61080 | 50208500 | WASHER,SPRING TENSI..... | 2 |
| 10 | PAOZZ | 5305-01-405-9901 | 61080 | 50098500 | SCREW,MACHINE..... | 2 |
| 11 | PAOZZ | 5305-01-455-1622 | 61080 | 50289200 | SCREW,MACHINE..... | 8 |
| ** 12 | PAOZZ | 2815-01-454-9237 | 61080 | 01129900 | DEFLECTOR,AIRFLOW.....<br>UOC:APP, | 1 |
| ** 13 | PAOZZ | 3120-01-455-7311 | 61080 | 03920100 | SPACER,SLEEVE.....<br>UOC:APP, | 2 |
| ** 14 | PAOZZ | 2815-01-454-9210 | 61080 | 99400648 | DEFLECTOR,AIRFLOW.....<br>UOC:APP, | 1 |
| ** 15 | PAOZZ | 5340-01-458-8159 | 61080 | 01133300 | BRACKET,AIR DUCT.....<br>UOC:APP, | 1 |
| 16 | PAOZZ | 4720-01-399-5578 | 61080 | 50334800 | SLEEVE,REINFORCING,..... | 1 |
| ** 17 | PAOZZ | 5305-01-455-1619 | 61080 | 50317800 | SCREW,CAP,HEXAGON H.....<br>UOC:APP, | 2 |
| 18 | PAOZZ | 5305-01-405-9892 | 61080 | 50165500 | SCREW,CAP,HEXAGON H..... | 1 |
| 19 | PAOZZ | 5340-01-454-9270 | 61080 | 03784300 | BRACKET,AIR DUCT..... | 1 |
| 20 | PAOZZ | 4730-01-415-7923 | 61080 | 01226100 | SHEET,CLAMPING..... | 1 |
| ** 21 | PAOZZ | 2815-01-454-9344 | 61080 | 01445200 | DEFLECTOR,AIRFLOW.....<br>UOC:APP, | 1 |
| ** 22 | PAOZZ | 5310-01-405-9890 | 61080 | 50144400 | NUT,PLAIN,HEXAGON.....<br>UOC:APP, | 6 |
| 23 | PAOZZ | 2815-01-439-3916 | 61080 | 03958100 | CONSOLE,REGULATOR..... | 1 |
| 24 | PAOZZ | 5305-01-406-0003 | 61080 | 50293200 | SCREW,MACHINE..... | 2 |
| 25 | PAOZZ | 2815-01-455-0039 | 61080 | 50405600 | DEFLECTOR,AIRFLOW..... | 1 |
| 26 | PAOZZ | 5305-01-405-9898 | 61080 | 50170600 | SCREW,MACHINE..... | 1 |
| 27 | PAOZZ | 5310-01-455-8482 | 61080 | 50408500 | NUT,PLAIN,CLINCH..... | 3 |

END OF FIGURE

** Refer to TM 9-2350-292-24P and TM 9-2350-292-20-2 for UOC: APJ Item.

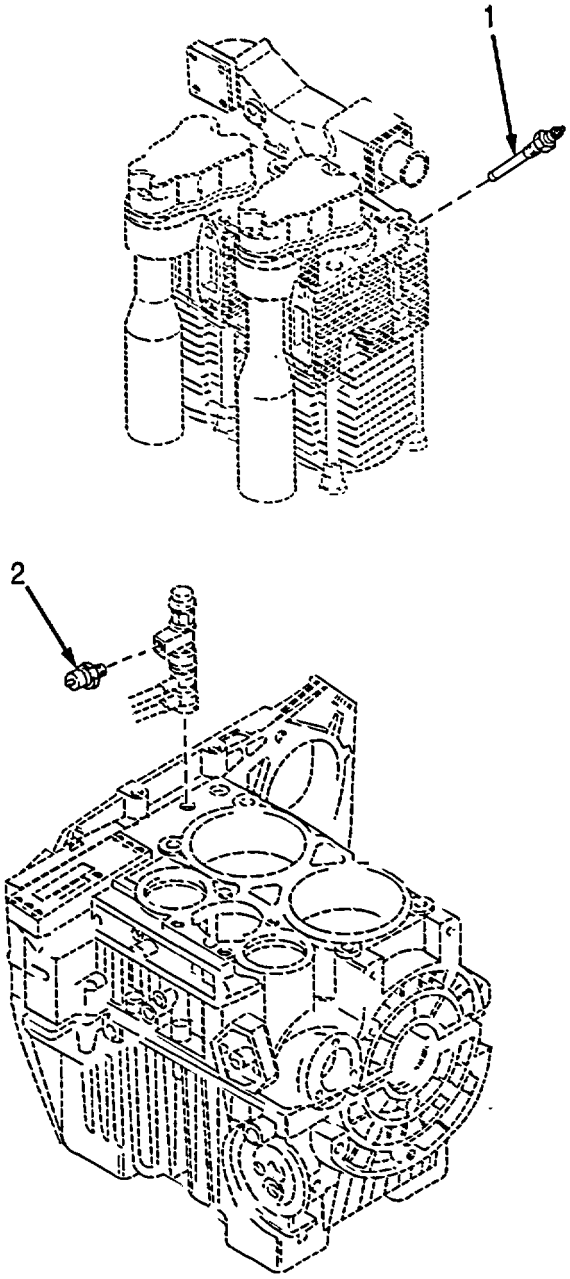


*Figure 15. Sending Units*

| | (1) ITEM NO | (2) SMR | (3) NSN | (4) CAGE | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|---|
| | | | | | | GROUP 2960 SENDING UNITS<br>FIGURE 15 SENDING UNITS | |
| | 1 | PAOZZ | 2990-01-497-9561 | 61080 | 01160500 | SWITCH,ENGINE TEMPE.....<br>UOC:APJ, | 1 |
| * | 1 | PAOZZ | 5930-01-348-9797 | 61080 | 50268600 | SWITCH,THERMOSTATIC.....<br>UOC:APP, | 1 |
| | 2 | PAOZZ | 5930-01-441-0097 | 61080 | 50293810 | SWITCH,PRESSURE..... | 1 |

END OF FIGURE

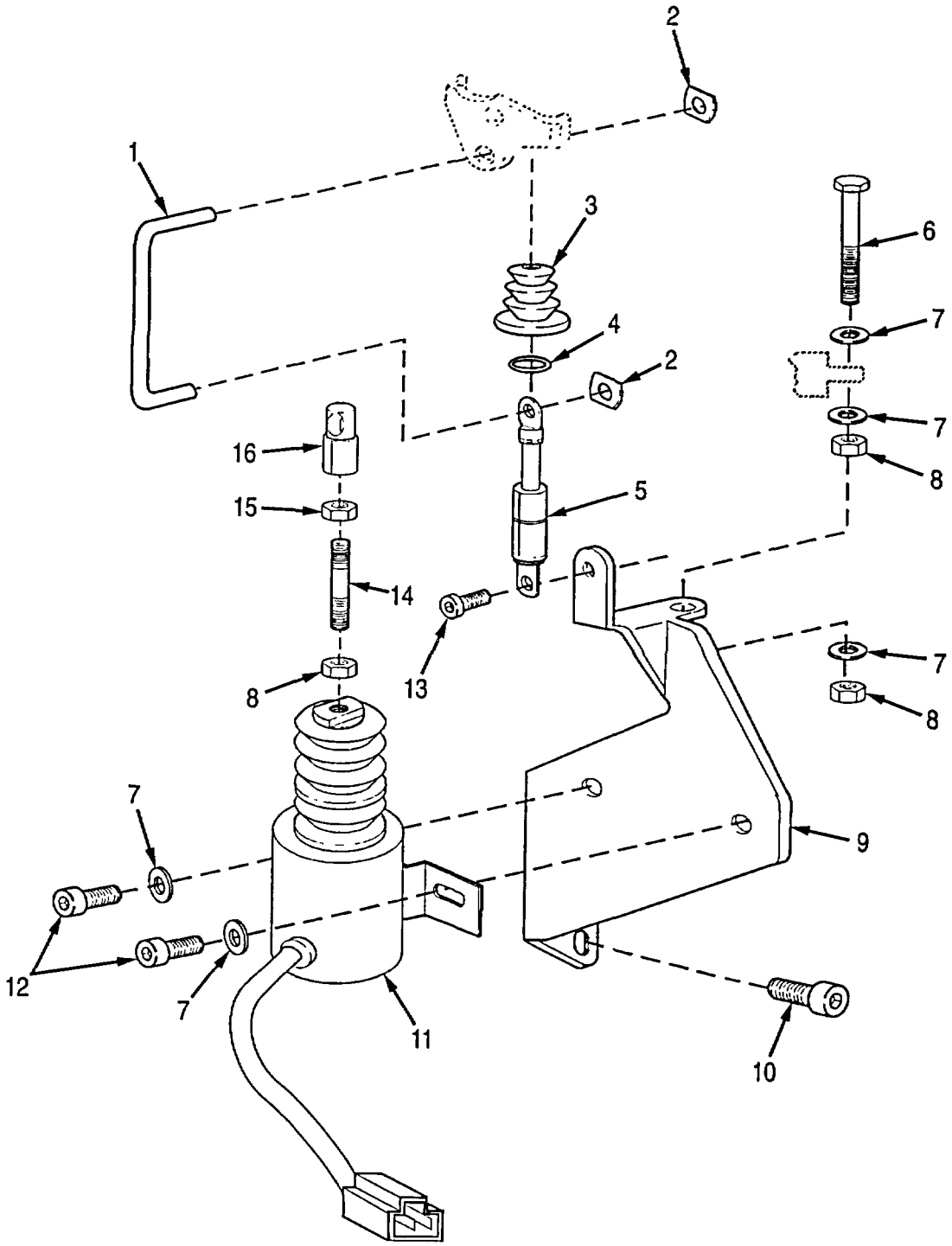


*Figure 16. Fuel-Shutoff Solenoid*

| (1) ITEM NO | (2) SMR | (3) NSN | (4) CAGE | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| | | | | | GROUP 2968 SWITCHES, CIRCUIT BREAKERS AND FUSES | |
| | | | | | FIGURE 16 FUEL-SHUTOFF SOLENOID | |
| ** 1 | PAOZZ | 3040-01-455-2816 | 61080 | 05063800 | CONNECTING LINK,RIG..... UOC:APP, | 1 |
| 2 | PAOZZ | 5340-01-454-9284 | 61080 | 50365600 | CLIP,RETAINING..... | 2 |
| 3 | PAOZZ | 5340-01-454-9277 | 61080 | 50180400 | BELLOWS,PROTECTION..... | 1 |
| 4 | PAOZZ | 5331-01-457-3350 | 61080 | 50225501 | O-RING..... | 1 |
| 5 | PAOZZ | 5945-01-454-8223 | 61080 | 50431300 | PLUNGER,SOLENOID..... | 1 |
| ** 6 | PAOZZ | 5305-01-401-3694 | 61080 | 50328500 | SCREW,MACHINE..... UOC:APP, | 4 |
| 7 | PAOZZ | 5310-12-149-4353 | 61080 | 50144500 | WASHER,FLAT..... | 5 |
| ** 8 | PAOZZ | 5310-01-405-9890 | 61080 | 50144400 | NUT,PLAIN,HEXAGON..... UOC:APP, | 3 |
| ** 9 | PAOZZ | 5945-01-454-8230 | 61080 | 01516900 | BRACKET,SOLENOID..... UOC:APP, | 1 |
| ** 10 | PAOZZ | 5305-01-455-1251 | 61080 | 50290300 | SCREW,CAP,SOCKET HE..... UOC:APP, | 1 |
| ** 11 | PAOZZ | 5945-01-454-8238 | 61080 | 01509110 | SOLENOID,ELECTRICAL..... UOC:APP, | 1 |
| ** 12 | PAOZZ | 5305-01-455-1250 | 61080 | 50149100 | SCREW,CAP,SOCKET HE..... UOC:APP, | 2 |
| ** 13 | PAOZZ | 5305-01-274-1064 | 61080 | 500-254-00 | SCREW,MACHINE..... UOC:APP, | 1 |
| ** 14 | PAOZZ | 5307-01-455-1249 | 61080 | 05094600 | STUD,PLAIN..... UOC:APP, | 1 |
| ** 15 | PAOZZ | 5310-01-456-0736 | 61080 | 50446700 | NUT,PLAIN,HEXAGON..... UOC:APP, | 1 |
| ** 16 | PAOZZ | 5340-01-454-9275 | 61080 | 05064010 | CONNECTOR,ROD END..... UOC:APP, | 1 |

END OF FIGURE

** Refer to TM 9-2350-292-24P and TM 9-2350-292-20-2 for UOC: APJ Item.

| (1) ITEM NO | (2) SMR | (3) NSN | (4) CAGE | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | | | (7) QTY |
|---|---|---|---|---|---|---|---|---|
| | | | | | GROUP 94 REPAIR KITS | | | |
| | | | | | GROUP 9401 REPAIR KITS | | | |
| | | | | | FIGURE KITS REPAIR KITS | | | |
| * 1 | PAFZZ | 5330-01-415-6721 | 61080 | 01247702 | GASKET SET..... | | | 1 |
| | | | | | GASKET,0.70 MM | ( 1) | 3-11 | |
| | | | | | GASKET,0.60 MM | ( 1) | 3-11 | |
| | | | | | WASHER,FLAT | ( 4) | 8-11 | |
| | | | | | O-RING | ( 2) | 8-13 | |
| | | | | | O-RING | ( 2) | 8-32 | |
| | | | | | O-RING | ( 2) | 8-34 | |
| | | | | | WASHER,FLAT | ( 2) | 9-2 | |
| | | | | | GASKET SET | ( 2) | 10-2 | |
| | | | | | GASKET | ( 2) | 11-11 | |
| | | | | | GASKET | ( 2) | 12-8 | |
| | | | | | JOINT | ( 2) | 12-8 | |
| | | | | | JOINT | ( 2) | 12-8 | |
| | | | | | GASKET | ( 4) | 12-10 | |
| | | | | | GASKET | ( 1) | 13-28 | |
| | | | | | GASKET | ( 1) | 13A-20 | |
| * 2 | PAFZZ | | 61080 | 01228002 | GASKET SET..... | | | 1 |
| | | | | | GASKET | ( 1) | 4-15 | |
| | | | | | O-RING | ( 8) | 4-16 | |
| | | | | | GASKET | ( 1) | 4-15.1 | |
| | | | | | SEAL,PLAIN | ( 1) | 5-8 | |
| | | | | | O-RING | ( 1) | 6-4 | |
| | | | | | GASKET | ( 2) | 6-9 | |
| | | | | | O-RING | ( 1) | 9-9 | |
| | | | | | GASKET | ( 1) | 9-14 | |
| | | | | | O-RING | ( 1) | 9-26 | |
| | | | | | O-RING | ( 1) | 9-28 | |
| | | | | | GASKET | ( 1) | 11-13 | |
| | | | | | GASKET,0.20 MM | ( 1) | 12-21 | |
| | | | | | GASKET,0.30 MM | ( 1) | 12-21 | |
| | | | | | GASKET,0.10 MM | ( 2) | 12-22 | |
| | | | | | GASKET | ( 2) | 12-25 | |
| | | | | | GASKET | ( 3) | 12-25 | |
| | | | | | O-RING | ( 2) | 13-5 | |
| | | | | | O-RING | ( 2) | 13-31 | |
| | | | | | O-RING | ( 1) | 13A-7 | |
| * 3 | PAFZZ | | 61080 | 01228202 | MAINTENANCE KIT..... | | | 1 |
| | | | | | NUT,PLAIN,HEXAGON | ( 1) | 8-4 | |
| | | | | | WASHER,FLAT | ( 4) | 8-11 | |
| | | | | | O-RING | ( 2) | 8-13 | |
| | | | | | NUT,PLAIN,HEXAGON | ( 1) | 8-8.2 | |
| | | | | | FILTER ELEMENT,FLUI | ( 1) | 9-18 | |
| | | | | | GASKET | ( 1) | 9-21 | |
| | | | | | COCK,POPPET DRAIN | ( 1) | 9-22 | |
| | | | | | CAP,FILLER OPENING | ( 1) | 9-27.1 | |

END OF FIGURE

| (1) ITEM NO | (2) SMR | (3) NSN | (4) CAGE | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| | | | | | GROUP 95 GENERAL USE STANDARDIZED PARTS | |
| | | | | | GROUP 9501 BULK MATERIAL | |
| | | | | | FIGURE BULK MATERIAL | |
| * 1 | PAFZZ | | 19207 | 12478232 | HOSE,NONMETALLIC..... | 1 |

END OF FIGURE

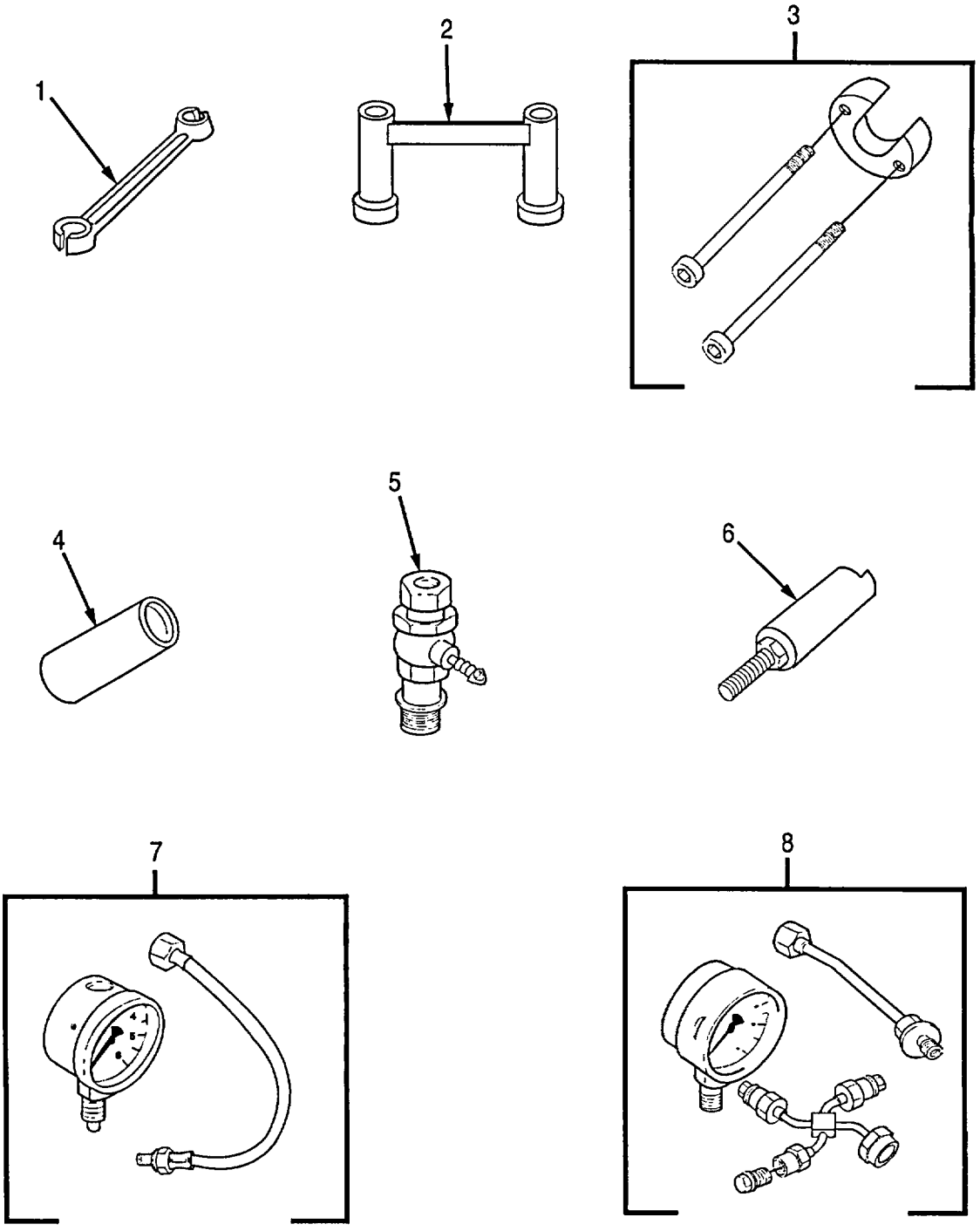


*Figure 17. Special Tools*

| (1) ITEM NO | (2) SMR | (3) NSN | (4) CAGE | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| | | | | | GROUP 26 TOOLS AND TEST EQUIPMENT | |
| | | | | | GROUP 2604 SPECIAL TOOLS | |
| | | | | | FIGURE 17 SPECIAL TOOLS | |
| * 1 | PEOZZ | 5120-01-428-5525 | 1CV05 | 3715M | WRENCH,OPEN END BOX..... | 1 |
| * 2 | PEFZZ | 5120-01-454-5887 | 61080 | 62574200 | BRACKET,CYL,ALINE..... | 1 |
| * 3 | PEFZZ | 5120-01-454-5888 | 61080 | 62574801 | PULLER,CRANK GEAR..... | 1 |
| * 4 | PEFZZ | 5120-01-454-5885 | 61080 | 62574700 | DRIVER,CRANK GEAR..... | 1 |
| * 5 | PEFZZ | 5120-01-458-3944 | 61080 | 66503091 | TESTING DEVICE,FUEL..... | 1 |
| * 6 | PEFZZ | 5120-01-454-5886 | 61080 | 62568902 | PULLER,RELIEF VALVE..... | 1 |
| * 7 | PEFZZ | 5120-01-454-5890 | 19207 | 57K3263 | TEST SET,OIL PRESSU..... | 1 |
| * 8 | PEFZZ | 4910-01-454-5889 | 19207 | 57K3264 | TESTER,FUEL INJETOR..... | 1 |

END OF FIGURE

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| STOCK NUMBER | FIGURE NO | ITEM NO | STOCK NUMBER | FIGURE NO | ITEM NO |
|---|---|---|---|---|---|
| 5315-00-616-5530 | 5 | 9.1 | 4710-01-399-7358 | 12 | 1 |
| 5315-01-070-5656 | 1 | 2 | 4710-01-399-7359 | 12 | 2 |
| 5310-01-078-8066 | 8 | 4 | 5310-01-399-8358 | 3 | 4 |
| | 8 | 8.2 | 5310-01-399-8386 | 9 | 23 |
| 5330-01-080-1776 | 11 | 13 | 5315-01-400-0441 | 5 | 5 |
| | 12 | 25 | 5315-01-400-0444 | 4 | 8 |
| 5315-01-081-4488 | 13 | 35 | 5315-01-400-0445 | 12 | 23 |
| 5310-01-090-0938 | 9 | 2 | 5310-01-400-0995 | 12 | 5 |
| | 12 | 28 | 5325-01-400-0999 | 13 | 6 |
| | 13 | 39 | 5340-01-400-1000 | 8 | 22 |
| 5340-01-100-4991 | 12 | 15 | 5310-01-400-1002 | 6 | 11 |
| 5365-01-100-5415 | 8 | 24 | 5310-01-400-2138 | 5 | 10 |
| 5365-01-100-5416 | 8 | 24 | 5310-01-400-2139 | 9 | 11 |
| 5310-01-101-2028 | 8 | 7 | 5310-01-400-2140 | 6 | 1 |
| | 10 | 1 | 5310-01-400-2141 | 6 | 2 |
| | 11 | 6 | 5310-01-400-3715 | 14 | 2 |
| 5305-01-101-4830 | 5 | 11 | 5365-01-400-3717 | 8 | 26 |
| 5365-01-101-5938 | 12 | 16 | 5310-01-400-3719 | 9 | 24 |
| 5330-01-101-7264 | 12 | 18 | 5310-01-400-3720 | 11 | 18 |
| 5331-01-101-8063 | 12 | 14 | | 12 | 3 |
| 5330-01-101-8076 | 9 | 21 | 5310-01-400-3721 | 8 | 21 |
| 5315-01-102-7922 | 8 | 28 | 5330-01-400-5766 | 4 | 20 |
| 5315-01-103-1522 | 5 | 4 | 5330-01-400-5772 | 8 | 13 |
| 4730-01-103-3202 | 9 | 6 | 5330-01-400-5773 | 5 | 8 |
| | 13 | 38 | 5331-01-400-5778 | 9 | 26 |
| 5999-01-116-8286 | 13 | 17 | 5305-01-401-3694 | 16 | 6 |
| 5330-01-120-2966 | 13 | 16 | 5310-01-405-9890 | 4 | 7 |
| 5310-01-239-2390 | 9 | 17 | | 6 | 17 |
| 5325-01-245-3517 | 8 | 25 | | 13 | 9 |
| 5305-01-264-6247 | 13 | 51 | | 14 | 22 |
| 5305-01-274-1064 | 13 | 15 | | 16 | 8 |
| | 16 | 13 | 5305-01-405-9892 | 14 | 18 |
| 5310-01-274-4387 | 2 | 7 | 5305-01-405-9894 | 14 | 4 |
| 5930-01-348-9797 | 15 | 1 | 5305-01-405-9895 | 14 | 1 |
| 2940-01-383-9739 | 9 | 18 | 5305-01-405-9897 | 14 | 8 |
| 4730-01-399-4252 | 12 | 6 | 5305-01-405-9898 | 14 | 26 |
| 4730-01-399-4253 | 12 | 9 | 5307-01-405-9899 | 3 | 7 |
| 4730-01-399-4254 | 12 | 11 | | 12 | 6.1 |
| 5325-01-399-4615 | 8 | 1 | 5330-01-405-9900 | 12 | 10 |
| 5325-01-399-4618 | 8 | 29 | 5305-01-405-9901 | 14 | 10 |
| 5365-01-399-5011 | 8 | 2 | 5305-01-405-9903 | 8 | 10 |
| 5365-01-399-5013 | 3 | 2 | 5305-01-405-9904 | 8 | 5 |
| 5360-01-399-5014 | 13 | 3 | | 8 | 8.3 |
| 5360-01-399-5016 | 13 | 11 | 5307-01-405-9905 | 4 | 4 |
| 5360-01-399-5017 | 13 | 26 | | 12 | 22.1 |
| 4720-01-399-5578 | 14 | 16 | 5305-01-405-9906 | 9 | 1 |
| 4820-01-399-5579 | 11 | 16 | 5307-01-405-9907 | 3 | 9.1 |
| 5315-01-399-6105 | 4 | 2 | 5305-01-405-9908 | 6 | 10 |
| 5315-01-399-6106 | 4 | 13 | 5307-01-405-9909 | 3 | 9.2 |
| 5315-01-399-6107 | 13 | 2 | 5310-01-405-9911 | 6 | 7 |
| 4730-01-399-6267 | 11 | 14 | 5310-01-405-9912 | 13 | 13 |
| 5330-01-399-6976 | 9 | 33 | 5307-01-405-9997 | 3 | 9 |
| 5331-01-399-6978 | 13 | 5 | | 4 | 3 |
| 5310-01-399-6981 | 8 | 27 | 5305-01-405-9998 | 9 | 31 |
| 5310-01-399-7301 | 13 | 22 | 5305-01-406-0000 | 6 | 16 |
| | 14 | 7 | | 13 | 7 |
| 5310-01-399-7303 | 4 | 18 | 5305-01-406-0001 | 7 | 7 |
| | 11 | 9 | 5305-01-406-0003 | 14 | 24 |
| | 12 | 4 | 5305-01-406-0004 | 9 | 12 |
| | 14 | 9 | 5305-01-406-0005 | 6 | 8 |
| 5310-01-399-7305 | 11 | 5 | 5305-01-406-0006 | 13 | 19 |
| 5310-01-399-7311 | 8 | 17 | 5305-01-406-0007 | 13 | 20 |
| 5310-01-399-7312 | 3 | 5 | | 13 | 42 |

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| 5305-01-406-0009 | 13 | 8.1 | 5340-01-454-9271 | 11 | 17 |
| 5305-01-406-0010 | 13 | 18 | 5340-01-454-9272 | 4 | 14 |
| 5305-01-406-0011 | 13 | 18 | 5340-01-454-9273 | 4 | 15 |
| 5305-01-406-0013 | 8 | 23 | 5340-01-454-9275 | 16 | 16 |
| 5305-01-406-0014 | 4 | 5 | 5340-01-454-9277 | 16 | 3 |
| 4820-01-406-0343 | 9 | 22 | 5340-01-454-9278 | 13 | 27 |
| 5340-01-406-1645 | 13 | 30 | 5340-01-454-9280 | 9 | 10 |
| 5340-01-406-1646 | 12 | 36 | 5340-01-454-9281 | 9 | 32 |
| 5365-01-406-4171 | 5 | 7 | 5340-01-454-9284 | 16 | 2 |
| 5307-01-406-5443 | 3 | 8 | 2815-01-454-9344 | 14 | 21 |
| 4820-01-406-6143 | 12 | 13 | 5340-01-454-9940 | 6 | 6 |
| 4820-01-407-0705 | 8 | 18 | 5365-01-455-0004 | 13 | 24 |
| 2805-01-407-0706 | 8 | 19 | 5340-01-455-0010 | 5 | 6 |
| 4820-01-407-1908 | 12 | 19 | 5365-01-455-0011 | 7 | 2 |
| 2815-01-414-1273 | 7 | 6 | 5365-01-455-0012 | 8 | 3 |
| 5360-01-414-8475 | 8 | 16 | 2815-01-455-0039 | 14 | 25 |
| 2835-01-414-8480 | 7 | 1 | 2815-01-455-0040 | 14 | 5 |
| 5310-01-415-2649 | 8 | 11 | 2815-01-455-0041 | 11 | 1 |
| 5330-01-415-6721 | KITS | 1 | 2815-01-455-0042 | 9 | 15 |
| 4730-01-415-7923 | 14 | 20 | 2815-01-455-0043 | 8 | 8.1 |
| 5120-01-428-5525 | 17 | 1 | 2815-01-455-0046 | 8 | 8 |
| 2815-01-439-3916 | 14 | 23 | 2815-01-455-0054 | 8 | 3.1 |
| 5930-01-441-0097 | 15 | 2 | 2815-01-455-0056 | 3 | 6.2 |
| 2815-01-446-3500 | 2 | 1 | 2990-01-455-0084 | 13 | 32 |
| 5120-01-454-5885 | 17 | 4 | 2815-01-455-0085 | 8 | 31 |
| 5120-01-454-5886 | 17 | 6 | 2815-01-455-0364 | 8 | 14 |
| 5120-01-454-5887 | 17 | 2 | 2815-01-455-0371 | 3 | 6.1 |
| 5120-01-454-5888 | 17 | 3 | 2815-01-455-0376 | 6 | 3 |
| 4910-01-454-5889 | 17 | 8 | 2815-01-455-0423 | 5 | 3 |
| 5120-01-454-5890 | 17 | 7 | 2815-01-455-0428 | 7 | 4 |
| 4730-01-454-7461 | 9 | 13 | 5305-01-455-1242 | 11 | 3 |
| 4730-01-454-7542 | 4 | 9 | 5305-01-455-1243 | 9 | 16 |
| 4730-01-454-7545 | 4 | 10 | 5305-01-455-1245 | 5 | 11 |
| 4730-01-454-7549 | 9 | 3 | 5305-01-455-1246 | 13 | 10 |
| 4730-01-454-7560 | 12 | 27 | 5305-01-455-1247 | 11 | 4 |
| 4730-01-454-7567 | 12 | 29 | 5305-01-455-1248 | 13 | 21 |
| 4730-01-454-7569 | 12 | 30 | 5307-01-455-1249 | 16 | 14 |
| 4730-01-454-7573 | 12 | 26 | 5305-01-455-1250 | 13 | 43 |
| 2990-01-454-7609 | 13 | 1 |  | 16 | 12 |
| 4710-01-454-7687 | 9 | 7 | 5305-01-455-1251 | 16 | 10 |
| 4710-01-454-7688 | 9 | 30 | 5305-01-455-1613 | 11 | 10 |
| 4730-01-454-7692 | 9 | 4 | 5305-01-455-1615 | 4 | 17 |
| 4730-01-454-7693 | 9 | 5 | 5305-01-455-1619 | 14 | 17 |
| 5945-01-454-8223 | 16 | 5 | 5305-01-455-1622 | 14 | 11 |
| 5945-01-454-8230 | 16 | 9 | 5307-01-455-2205 | 4 | 12 |
| 5945-01-454-8238 | 16 | 11 | 5305-01-455-2206 | 2 | 6 |
| 2815-01-454-8626 | 11 | 8 | 5305-01-455-2207 | 2 | 3 |
| 2990-01-454-8630 | 13 | 4 | 5307-01-455-2210 | 3 | 12 |
| 5340-01-454-8631 | 2 | 2 | 5306-01-455-2212 | 3 | 1 |
| 2990-01-454-8635 | 13 | 29 | 5340-01-455-2343 | 4 | 19 |
| 2815-01-454-8839 | 8 | 33 | 3020-01-455-2798 | 5 | 2 |
| 2815-01-454-8841 | 8 | 12 | 3040-01-455-2816 | 16 | 1 |
| 2815-01-454-8842 | 8 | 30 | 3010-01-455-2856 | 8 | 20 |
| 2990-01-454-8843 | 2 | 5 | 4820-01-455-5017 | 4 | 11 |
| 2590-01-454-8941 | 9 | 27 | 4820-01-455-5018 | 12 | 24 |
| 2815-01-454-9103 | 6 | 5 | 3120-01-455-7311 | 14 | 13 |
| 2990-01-454-9173 | 13 | 8 | 5330-01-455-7566 | 10 | 2 |
| 2990-01-454-9177 | 13 | 12 | 5330-01-455-7819 | 11 | 11 |
| 2990-01-454-9202 | 13 | 23 | 5330-01-455-7822 | 2 | 4 |
| 2815-01-454-9210 | 14 | 14 | 5330-01-455-7823 | 11 | 7 |
| 2990-01-454-9214 | 13 | 25 | 5310-01-455-8479 | 3 | 3 |
| 2815-01-454-9237 | 14 | 12 | 5310-01-455-8480 | 11 | 2 |
| 5340-01-454-9270 | 14 | 19 | 5310-01-455-8481 | 13 | 14 |

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| 5315-01-455-8935 | 6 | 13 | 4730-01-494-7219 | 12 | 26 |
| 5325-01-455-8936 | 7 | 5 | 2990-01-497-9561 | 15 | 1 |
| 5310-01-456-0736 | 16 | 15 | 4710-01-518-8125 | 12 | 2 |
| 5310-01-456-2275 | 8 | 15 | 4710-01-518-8127 | 12 | 1 |
| 9905-01-456-3828 | 1 | 1 | 5310-01-525-7457 | 13 | 48 |
| 5331-01-457-3350 | 16 | 4 | 5340-01-526-2574 | 13 | 44 |
| 5360-01-458-0666 | 12 | 17 | 5310-12-130-4938 | 2 | 7 |
| 5120-01-458-3944 | 17 | 5 | 5305-12-146-1760 | 2 | 6 |
| 5340-01-458-8159 | 14 | 15 | 5310-12-149-4353 | 4 | 6 |
| 5340-01-459-1403 | 14 | 6 | | 6 | 15 |
| 5305-01-463-1028 | 6 | 18 | | 9 | 17 |
| 2815-01-465-4321 | 2 | 1 | | 14 | 3 |
| 5935-01-480-9543 | 2 | 2 | | 16 | 7 |
| 2805-01-488-7755 | 9 | 8 | 2815-12-330-5421 | 8 | 35 |
| 5305-01-492-8775 | 9 | 16 | 2910-12-337-7727 | 12 | 7 |
| 5310-01-494-3769 | 12 | 25.1 | 2910-12-338-8683 | 12 | 12 |

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|---|---|---|---|---|---|
| 01129900 | 14 | 12 | 03781800 | 8 | 33 |
| 01133200 | 14 | 6 | 03783000 | 8 | 5 |
| 01133300 | 14 | 15 | | 8 | 8.3 |
| 01160500 | 15 | 1 | 03783200 | 8 | 19 |
| 01198900 | 11 | 8 | 03783210 | 8 | 19 |
| 01221803 | 4 | 11 | 03783300 | 8 | 18 |
| 01222100 | 8 | 20 | 03783301 | 8 | 18 |
| 01222300 | 13 | 29 | 03783401 | 8 | 17 |
| 01222400 | 13 | 1 | 03783500 | 8 | 16 |
| 01222510 | 13 | 32 | 03783600 | 8 | 15 |
| 01223200 | 12 | 27 | 03783800 | 8 | 12 |
| 01224001 | 8 | 35 | 03783902 | 11 | 11 |
| 01224400 | 8 | 3.1 | 03784001 | 11 | 15 |
| 01224500 | 8 | 8.1 | 03784300 | 14 | 19 |
| 01224600 | 8 | 8 | 03784400 | 14 | 5 |
| 01224900 | 9 | 7 | 03784501 | 3 | 3 |
| 01225610 | 11 | 16 | 03785201 | 3 | 6.2 |
| 01226100 | 14 | 20 | 03785300 | 7 | 6.1 |
| 01227410 | 4 | 1 | 03785600 | 7 | 6.2 |
| 01227420 | 4 | 1 | 03786300 | 8 | 14 |
| 01227910 | 9 | 8 | 03787300 | 3 | 2 |
| 01228002 | KITS | 2 | 03787402 | 11 | 1 |
| 01228202 | KITS | 3 | 03788800 | 9 | 23 |
| 01231501 | 12 | 24 | 03790001 | 9 | 3 |
| 01239901 | 6 | 12 | 03790100 | 9 | 5 |
| 01240203 | 7 | 3 | 03791400 | 3 | 4 |
| 01240211 | 7 | 3 | 03791600 | 13 | 18 |
| 01240301 | 7 | 4 | 03792100 | 6 | 3 |
| 01240900 | 12 | 1 | 03792400 | 12 | 6 |
| 01240910 | 12 | 1 | 03792800 | 3 | 11 |
| 01241000 | 12 | 2 | 03792900 | 3 | 11 |
| 01241010 | 12 | 2 | 03793000 | 3 | 11 |
| 01244800 | 8 | 22 | 03793100 | 3 | 11 |
| 01247100 | 7 | 1 | 03793200 | 3 | 11 |
| 01247110 | 7 | 1 | 03793300 | 3 | 11 |
| 01247200 | 3 | 6.1 | 03793400 | 3 | 11 |
| 01247210 | 3 | 6.1 | 03908201 | 9 | 27 |
| 01247702 | KITS | 1 | 03920100 | 14 | 13 |
| 01248303 | 7 | 3 | 03932100 | 9 | 4 |
| 01248311 | 7 | 3 | 03938610 | 9 | 15 |
| 01248701 | 7 | 4 | 03939700 | 11 | 17 |
| 01262200 | 7 | 6 | 03958000 | 7 | 2 |
| 01262701 | 5 | 3 | 03958100 | 14 | 23 |
| 01266500 | 13 | 25 | 03966300 | 12 | 25.1 |
| 01285500 | 10 | 2 | 03971200 | 3 | 11 |
| 01285600 | 11 | 7 | 03971300 | 3 | 11 |
| 01445200 | 14 | 21 | 03975300 | 6 | 2 |
| 01509110 | 16 | 11 | 04020200 | 13 | 3 |
| 01516900 | 16 | 9 | 04021800 | 13 | 37 |
| 01613100 | 9 | 27.1 | 04025800 | 12 | 8 |
| 01665000 | 13 | 36 | 04031300 | 6 | 1 |
| 01665600 | 13 | 34 | 04035700 | 12 | 5 |
| 01665610 | 13 | 33 | 04038200 | 4 | 14 |
| 01670100 | 13 | 40 | 04039100 | 4 | 15 |
| 03125800 | 13 | 24 | 04085001 | 12 | 8 |
| 03171800 | 3 | 5 | 04086300 | 13 | 3 |
| 03173100 | 8 | 4 | 04088300 | 13 | 4 |
| | 8 | 8.2 | 04090600 | 3 | 11 |
| 03225504 | 1 | 1 | 04090700 | 3 | 11 |
| 03233200 | 8 | 24 | 04092800 | 8 | 30 |
| 03233300 | 8 | 24 | 04092810 | 8 | 30 |
| 03780800 | 12 | 9 | 04110800 | 3 | 11 |
| 03781000 | 3 | 12 | 04110900 | 3 | 11 |
| 03781100 | 7 | 7 | 04125000 | 9 | 28 |
| 03781300 | 7 | 6.2 | 05034900 | 4 | 10 |

## CROSS REFERENCE INDEXES

### PART NUMBER INDEX

| PART NUMBER | FIG. | ITEM | PART NUMBER | FIG. | ITEM |
|---|---|---|---|---|---|
| 05063800 | 16 | 1 | | 13 | 7 |
| 05063900 | 13 | 23 | 50093400 | 6 | 8 |
| 05064010 | 16 | 16 | 50095100 | 11 | 5 |
| 05094600 | 16 | 14 | 50098300 | 4 | 4 |
| 05184200 | 13 | 40.1 | | 12 | 22.1 |
| 05184800 | 13 | 47 | 50098500 | 14 | 10 |
| 05185400 | 13 | 46 | 50114300 | 13 | 14 |
| 05186900 | 13 | 41 | 50128100 | 3 | 9 |
| 12367094 | 2 | 1 | | 4 | 3 |
| 12367105 | 2 | 2 | 50137000 | 4 | 5 |
| 12463204 | 2 | 1 | 50139201 | 4 | 12 |
| 12478232 | BULK | 1 | | 13 | 29.1 |
| 12478232-2 | 12 | 31 | 50144400 | 4 | 7 |
| 12478232-3 | 12 | 9.4 | | 6 | 17 |
| 12478232-4 | 12 | 9.2 | | 13 | 9 |
| 12478232-5 | 12 | 35 | | 14 | 22 |
| 12478240 | 2 | 5 | | 16 | 8 |
| 3418502037 | 12 | 19 | 50144500 | 4 | 6 |
| 3715M | 17 | 1 | | 6 | 15 |
| 40002500 | 1 | 2 | | 9 | 17 |
| 40021400 | 13 | 16 | | 14 | 3 |
| 40021500 | 13 | 17 | | 16 | 7 |
| 40028400 | 8 | 7 | 50145900 | 6 | 7 |
| | 10 | 1 | 50146000 | 5 | 10 |
| | 11 | 6 | 50146300 | 13 | 19 |
| 40085001 | 12 | 8 | 50148000 | 11 | 18 |
| 40092600 | 12 | 26 | | 12 | 3 |
| 49003500 | 12 | 17 | 50148100 | 11 | 2 |
| 49003900 | 12 | 15 | 50149100 | 13 | 43 |
| 49004300 | 12 | 16 | | 16 | 12 |
| 49004400 | 12 | 18 | 50157800 | 12 | 9.3 |
| 49004700 | 12 | 14 | 50162900 | 8 | 11 |
| 49061200 | 12 | 13 | 50165500 | 14 | 18 |
| 500 812 00 | 9 | 17 | 50170600 | 14 | 26 |
| 500-254-00 | 13 | 15 | 50170700 | 14 | 8 |
| | 16 | 13 | 50170800 | 13 | 21 |
| 50000900 | 9 | 2 | 50170900 | 13 | 22 |
| | 12 | 28 | | 14 | 7 |
| | 13 | 39 | 50175900 | 11 | 3 |
| 50001100 | 11 | 13 | 50177500 | 8 | 10 |
| | 12 | 25 | 50180400 | 16 | 3 |
| 50001200 | 9 | 21 | 50183100 | 11 | 4 |
| 50006100 | 9 | 6 | 50195800 | 6 | 11 |
| | 13 | 38 | 50206300 | 11 | 10 |
| 50010500 | 8 | 28 | 50207900 | 9 | 16 |
| 50011200 | 5 | 4 | 50208400 | 8 | 34 |
| 50015700 | 12 | 29 | 50208500 | 4 | 18 |
| 50015800 | 12 | 26 | | 11 | 9 |
| 50019800 | 8 | 1 | | 12 | 4 |
| 50020000 | 8 | 25 | | 14 | 9 |
| 50025200 | 9 | 12 | 50216300 | 9 | 11 |
| 50026400 | 6 | 18 | 50225501 | 16 | 4 |
| 50033300 | 9 | 1 | 50231900 | 3 | 9.1 |
| 50034100 | 13 | 35 | 50268600 | 15 | 1 |
| 50036000 | 13 | 2 | 50274500 | 9 | 31 |
| 50038400 | 3 | 7 | 50275000 | 4 | 22 |
| | 12 | 6.1 | 50279200 | 3 | 9.2 |
| 50043800 | 9 | 17.1 | 50286300 | 13 | 50 |
| 50052000 | 13 | 51 | 50289200 | 14 | 11 |
| 50052100 | 4 | 17 | 50290100 | 8 | 32 |
| 50054300 | 2 | 6 | 50290200 | 8 | 13 |
| 50055100 | 5 | 11 | 50290300 | 16 | 10 |
| 50061700 | 2 | 7 | 50290500 | 4 | 2 |
| 50065100 | 3 | 8 | 50291400 | 4 | 20 |
| 50092100 | 6 | 16 | 50293200 | 14 | 24 |

## CROSS REFERENCE INDEXES

### PART NUMBER INDEX

| PART NUMBER | FIG. | ITEM |
|---|---|---|
| 50293810 | 15 | 2 |
| 50300700 | 4 | 8 |
| 50301000 | 4 | 13 |
| 50301100 | 4 | 21 |
| 50301200 | 4 | 16 |
| 50301400 | 9 | 13 |
| 50301500 | 9 | 14 |
| 50301601 | 9 | 15 |
| 50302000 | 8 | 31 |
| 50302100 | 5 | 12 |
| 50302700 | 4 | 9 |
| 50302800 | 9 | 18 |
| 50303000 | 11 | 14 |
| 50303610 | 6 | 13 |
| 50304100 | 5 | 6 |
| 50304300 | 5 | 5 |
| 50304400 | 5 | 2 |
| 50304500 | 5 | 8 |
| 50304900 | 8 | 30 |
| 50305000 | 8 | 29 |
| 50305300 | 8 | 23 |
| 50305400 | 8 | 21 |
| 50305700 | 8 | 26 |
| 50306001 | 8 | 27 |
| 50306200 | 13 | 27 |
| 50306500 | 13 | 5 |
| 50306600 | 13 | 26 |
| 50306900 | 13 | 20 |
| | 13 | 42 |
| 50307000 | 4 | 12 |
| 50307100 | 13 | 28 |
| 50308100 | 13 | 31 |
| 50308500 | 13 | 30 |
| 50308800 | 13 | 6 |
| 50308901 | 13 | 8 |
| 50309100 | 13 | 8.1 |
| 50309200 | 13 | 10 |
| 50309300 | 13 | 11 |
| 50309400 | 13 | 12 |
| 50309500 | 13 | 13 |
| 50310400 | 9 | 10 |
| 50310500 | 9 | 9 |
| 50310810 | 6 | 5 |
| 50310900 | 6 | 10 |
| 50311000 | 9 | 22 |
| 50311200 | 6 | 4 |
| 50311500 | 6 | 9 |
| 50311700 | 12 | 30 |
| 50312200 | 12 | 23 |
| 50312300 | 12 | 22 |
| 50312400 | 12 | 21 |
| 50312500 | 12 | 20 |
| 50313000 | 12 | 11 |
| 50313100 | 12 | 10 |
| 50314100 | 12 | 36 |
| 50315400 | 14 | 2 |
| 50315500 | 3 | 1 |
| 50315900 | 8 | 2 |
| 50316000 | 8 | 3 |
| 50317800 | 14 | 17 |
| 50321900 | 9 | 25 |
| 50323500 | 9 | 26 |
| 50323800 | 13 | 52 |
| 50324200 | 5 | 12.1 |
| 50326200 | 11 | 12 |
| 50328300 | 13 | 48 |
| 50328500 | 16 | 6 |
| 50333400 | 12 | 9.5 |
| 50333800 | 14 | 4 |
| 50333900 | 5 | 7 |
| 50334600 | 14 | 1 |
| 50334800 | 14 | 16 |
| 50335300 | 9 | 24 |
| 50336200 | 6 | 14 |
| 50336300 | 9 | 30 |
| 50336400 | 9 | 32 |
| 50336500 | 9 | 33 |
| 50341900 | 9 | 15.1 |
| 50342000 | 9 | 16 |
| 50344900 | 13 | 18 |
| 50347500 | 5 | 1 |
| 50347600 | 5 | 1 |
| 50355400 | 12 | 12 |
| 50355500 | 12 | 7 |
| 50355600 | 12 | 7.1 |
| 50359000 | 7 | 5.1 |
| 50359010 | 7 | 5.1 |
| 50359110 | 7 | 5 |
| 50365600 | 16 | 2 |
| 50405200 | 3 | 6 |
| 50405600 | 14 | 25 |
| 50408500 | 14 | 27 |
| 50431300 | 16 | 5 |
| 50446700 | 16 | 15 |
| 50448100 | 9 | 17.3 |
| 50493200 | 12 | 12 |
| 50493300 | 12 | 7 |
| 50493400 | 12 | 7.1 |
| 50500800 | 13 | 44 |
| 50507800 | 13 | 49 |
| 50511000 | 13 | 45 |
| 50548200 | 9 | 17.2 |
| 50552200 | 12 | 21 |
| 57K3263 | 17 | 7 |
| 57K3264 | 17 | 8 |
| 62568902 | 17 | 6 |
| 62574200 | 17 | 2 |
| 62574700 | 17 | 4 |
| 62574801 | 17 | 3 |
| 66503091 | 17 | 5 |
| 99400638 | 5 | 9 |
| 99400639 | 2 | 2 |
| 99400640 | 2 | 5 |
| 99400641 | 2 | 4 |
| 99400642 | 2 | 3 |
| 99400644 | 6 | 5.1 |
| 99400645 | 4 | 19 |
| 99400646 | 6 | 6 |
| 99400648 | 14 | 14 |
| DIN7980-10-FST | 2 | 7 |
| DIN7984-M10X30-1 0.9-A3P | 2 | 6 |
| J1508-M-04 | 12 | 9.1 |
| M10X55DIN912-8.8 | 5 | 11 |
| MS35756-15 | 5 | 9.1 |

# APPENDIX D
# EXPENDABLE AND DURABLE ITEMS LIST

## Section I. INTRODUCTION



### D-1. SCOPE.

This appendix lists expendable/durable supplies and materials you will need to operate and maintain the Diesel Engine Assembly, Hatz G 2 40. This listing is for informational purposes only nd is not authority to requisition the listed items. These items are authorized to you by CTA 50-970 or CTA 8-100.

### D-2. EXPLANATION OF COLUMNS.

There are five columns in Section II, Expendable and Durable Items List:

**(1) Item Number.** This number is assigned to the entry in the listing and is referenced in the "Initial Setup" of maintenance paragraphs or narrative instructions to identify the material needed (e.g., Drycleaning Solvent, Item 4, Appendix D).

**(2) Level.** This column identifies the lowest level of maintenance that requires the listed item.

C - Operator/Crew
O - Unit
F - Direct Support
H - General Support

**(3) National Stock Number.** This is the national stock number assigned to the item; use it to request or requisition the item.

**(4) Description (CAGEC).** This column contains the Federal item name and, if required, a description to identify the item. The last line for each item indicates the commercial and government entity code (CAGEC) in parentheses followed by the part number, if applicable.

**(5) U/M (Unit of Measure).** Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation: BT (bottle), BX (box), CN (can), GL (gallon), LB (pound), OZ (ounce), PT (pint), QT (quart), and TU (tube). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

*Section II. EXPENDABLE AND DURABLE ITEMS LIST*

| (1) Item Number | (2) Level | (3) National Stock Number | (4) Description (CAGEC) | (5) (U/M) |
|---|---|---|---|---|
| 1 | F | 8040-00-833-9563 | Adhesive Kit<br>(71984) RTV 732 | BT |
| 2 | O | 8030-00-597-5367 | Antiseize Compound, 2.5-Pound Can<br>(73165) 51008 | LB |
| 3 | F | 6850-01-085-1423 | Carbon-Removing Compound, 13-Ounce Aerosol Can<br>(01326) 7450 | OZ |
| 4 | O | 6850-00-281-1985 | Drycleaning Solvent, 1-Gallon Can<br>(58536) A-A-59601 | GL |
| 5 | F | 9150-01-197-7690 | Grease, Automotive, 1.75-Pound Can (81349)<br>M-10924-C | CN |
| 6 | O | 9150-00-186-6681 | Lubricating Oil, 1-Quart Can<br>(15958) ALLIEDC030 | QT |
| 7 | O | 7920-00-205-1711 | Rag, Wiping, 50-Pound Bale<br>(80244) 7920-00-205-1711 | LB |
| 8 | F | 7510-00-243-3437 | Rubber Band, 1/4-Pound Box<br>(88001) 0385B | BX |
| 9 | F | 1015-01-255-4144 | Sealant, Pipe, Teflon, 50-Milliliter Tube<br>(19207) 12297953 | TU |
| 10 | F | 8030-00-252-3391 | Sealing Compound, 11-Ounce Tube<br>(80064) 1756371 | TU |
| 11 | F | 8030-00-081-2335 | Sealing Compound, 10 Cubic Centimeter bottle<br>(05970) 85-14 | BT |
| 12 | O | 8030-00-275-8115 | Sealing Compound, 1-Pint Can<br>(81349) MIL-S-46163 | PT |
| 13 | O | 8040-01-250-3969 | Sealing Compound<br>(05972) 242 | ML |
| 14 | F | | Primer, Grade N, 500 ML<br>(05972) 50223001 | ML |
| 15 | F | 8030-01-060-0015 | Sealing Compound<br>(05972) 573 | ML |
| 16 | F | 8030-01-231-7156 | Sealing Compound<br>(05972) 601 | ML |
| 17 | F | | Sealing Compound<br>(05972) 221 | ML |
| 18 | F | 8030-01-475-2445 | Sealing Compound<br>(05972) 648 | ML |
| 19 | F | 8030-01-388-5604 | Sealing Compound<br>(05972) T7471 | ML |

*Section II. EXPENDABLE AND DURABLE ITEMS LIST (continued)*

| (1) Item Number | (2) Level | (3) National Stock Number | (4) Description (CAGEC) | (5) (U/M) |
|---|---|---|---|---|
| 20 | F | 8030-00-148-9833 | Sealing Compound (05972) 27121 | ML |
| 21 | F | 5330-01-399-7318 | Silicon Sealer (61080) 50282501 | ML |

# APPENDIX E
# TORQUE VALUES FOR THREADED FASTENERS



## E-1. GENERAL.

This section provides general torque limits for screws used on the Diesel Engine Assembly, Hatz 2 G 40. Special torque limits are indicated in the maintenance procedures for applicable components. The general torque limits given in this appendix shall be used when specific torque limits are not indicated in the maintenance procedure. These general torque limits cannot be applied to screws that retain rubber components. The rubber components will be damaged before the correct torque limit is reached. If a special torque limit is not given in the maintenance instructions, tighten the screw or nut until it touches the metal bracket, then tighten it one more turn.

## E-2. TORQUE LIMITS.

Table E-1 (p. E-2) lists dry torque limits. Dry torque limits are used on screws that do not have lubricants applied to threads. Table E-2 (p. E-3) lists wet torque limits. Wet torque limits are used on screws that have high-pressure lubricants applied to threads.

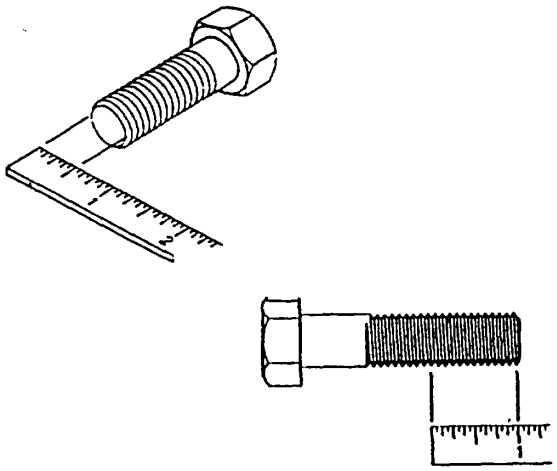
## E-3. HOW TO USE TORQUE TABLE.

1. Measure the diameter of the screw to be installed.

2. Count the number of threads per inch or use a pitch gage.

3. Under the heading SIZE (Tables E-1 and E-2), look down the left-hand column until the diameter of the screw to be installed is found (there will usually be two lines beginning with the same size).

4. In the second column under SIZE, find the number of threads per inch that matches the number of threads counted in step 2.

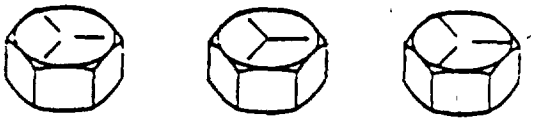


## E-3. HOW TO USE TORQUE TABLE (continued).

5. To find the grade of the screw that is to be installed, match the markings on the head to the correct picture of CAPSCREW HEAD MARKINGS on the table.

CAPSCREW HEAD MARKINGS

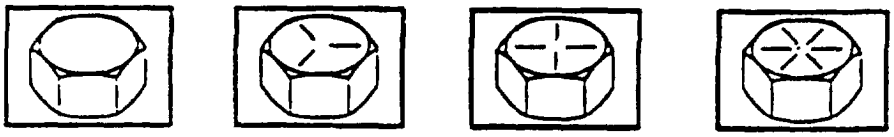
Manufacturer's marks may vary.
These are all SAE Grade No. 5 (3 lines).



6. Look down the column under the picture found in step 5 until the torque limit in foot-pounds for the diameter and threads per inch of the screw being Installed is found.

*Table E-1. Torque Limits for Dry Fasteners*

**SAE CAPSCREW HEAD MARKINGS**

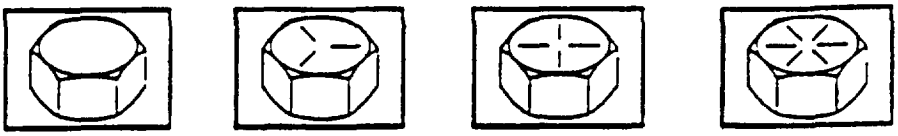


| SIZE | | | TORQUE | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | SAE GRADE No. 1 or 2 | | SAE GRADE No. 5 | | SAE GRADE No. 6 or 7 | | SAE GRADE No. 8 | |
| DIA. (IN.) | THREADS PER INCH | MM | FOOT POUNDS | N•m | FOOT-POUNDS | N•m | FOOT-POUNDS | N•m | FOOT-POUNDS | N•m |
| 1/4 | 20 | 6.35 | 5 | 6.78 | 8.0 | 10.85 | 10 | 13.56 | 12.0 | 16.27 |
| 1/4 | 28 | 6.35 | 6 | 8.14 | 10.0 | 13.56 | — | — | 14.0 | 18.98 |
| 5/16 | 18 | 7.94 | 11 | 14.92 | 17.0 | 23.05 | 19 | 25.76 | 24.0 | 32.52 |
| 5/16 | 24 | 7.94 | 13 | 17.63 | 19.0 | 25.76 | — | — | 27.0 | 36 61 |
| 3/8 | 16 | 9.53 | 18 | 24.41 | 31.0 | 42.04 | 34 | 46.10 | 44.0 | 59.66 |
| 3/8 | 24 | 9.53 | 20 | 27.12 | 35.0 | 47.46 | — | — | 49.0 | 66.44 |
| 7/16 | 14 | 11.11 | 28 | 37.97 | 49.0 | 66.44 | 55 | 74.58 | 70.0 | 94.92 |
| 7/16 | 20 | — | 30 | 40.68 | 55.0 | 74.58 | — | — | 78.0 | 105.77 |
| 1/2 | 13 | 12.70 | 39 | 52.88 | 75.0 | 101.70 | 85 | 115.26 | 105.0 | 142.38 |
| 1/2 | 20 | — | 41 | 55.60 | 85.0 | 115.26 | — | — | 120.0 | 162.78 |
| 9/16 | 12 | 14.28 | 51 | 69.16 | 110.0 | 149.16 | 120 | 162.72 | 155.0 | 210.18 |
| 9/16 | 18 | — | 55 | 74.58 | 120.0 | 162.72 | — | — | 170.0 | 230.52 |
| 5/8 | 11 | 15.88 | 63 | 85.43 | 150.0 | 203.40 | 167 | 226.45 | 210.0 | 284.76 |
| 5/8 | 18 | — | 95 | 128.82 | 170.0 | 230.52 | — | — | 240.0 | 325.44 |
| 3/4 | 10 | 19.05 | 105 | 142.38 | 270.0 | 356.12 | 280 | 379.68 | 375.0 | 506.50 |
| 3/4 | 16 | — | 115 | 155.94 | 295.0 | 400.02 | — | — | 420.0 | 596.52 |
| 7/8 | 9 | 22.23 | 160 | 216.96 | 375.0 | 536.62 | 440 | 596.64 | 605.0 | 820.38 |
| 7/8 | 14 | — | 175 | 237.30 | 435.0 | 599.85 | — | — | 675.0 | 915.30 |
| 1 | 8 | 25.40 | 235 | 318.66 | 590.0 | 800.04 | 660 | 694.96 | 910.0 | 1233.96 |
| 1 | 14 | — | 250 | 338.00 | 660.0 | 894.96 | — | — | 990.0 | 1342.44 |
| 1 1/8 | — | 25.58 | — | — | 800.0 | 1064.80 | — | — | 1280.0 | 1735.70 |
| | | | | | 880.0 | 1193.30 | | | 1444.0 | 1952.80 |
| 1 1/4 | — | 31.75 | — | — | — | — | — | — | 1820.0 | 2467.90 |
| | | | | | | | | | 2000.0 | 2712.00 |
| 1 3/8 | — | 34.93 | — | — | 1460.0 | 1979.80 | — | — | 2300.0 | 3227.30 |
| | | | | | 1680.0 | 2278.10 | | | 2720.0 | 3688.30 |
| 1 1/2 | — | 38.10 | — | — | 1940.0 | 2630.60 | — | — | 3160.0 | 4285.00 |
| | | | | | 2200.0 | 2963.20 | | | 3560.0 | 4827.40 |

## E-3. HOW TO USE TORQUE TABLE (continued).

*Table E-2. Torque Limits for Wet Fasteners*

**SAE CAPSCREW HEAD MARKINGS**



| SIZE | | | TORQUE | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | SAE GRADE No. 1 or 2 | | SAE GRADE No. 5 | | SAE GRADE No. 6 or 7 | | SAE GRADE No. 8 | |
| DIA. (IN.) | THREADS PER INCH | MM | FOOT POUNDS | N•m | FOOT-POUNDS | N•m | FOOT-POUNDS | N•m | FOOT-POUNDS | N•m |
| 1/4 | 20 | 6.35 | 4.9 | 6.10 | 7.2 | 9.76 | 9.0 | 12.00 | 10.8 | 14.64 |
| 1/4 | 28 | 6.35 | 5.4 | 7.33 | 9.0 | 12.20 | — | — | 12.6 | 17.08 |
| 5/16 | 18 | 7.94 | 9.9 | 13.34 | 15.3 | 22.54 | 17.1 | 23.18 | 21.6 | 29.27 |
| 5/16 | 24 | 7.94 | 11.7 | 15.87 | 17.1 | 23.18 | — | — | 24.3 | 32.95 |
| 3/8 | 16 | 9.53 | 16.2 | 21.97 | 27.9 | 37.84 | 30.6 | 41.49 | 39.6 | 53.69 |
| 3/8 | 24 | 9.53 | 18.0 | 24.41 | 31.5 | 42.71 | — | — | 44.1 | 59.80 |
| 7/16 | 14 | 11.11 | 25.2 | 34.17 | 44.1 | 59.80 | 49.5 | 67.12 | 63.0 | 85.42 |
| 7/16 | 20 | — | 27.0 | 36.61 | 49.5 | 67.12 | — | — | 70.2 | 95.19 |
| 1/2 | 13 | 12.70 | 35.1 | 47.58 | 67.5 | 91.53 | 76.5 | 103.73 | 94.5 | 128.14 |
| 1/2 | 20 | — | 36.9 | 50.04 | 76.5 | 103.73 | — | — | 106.0 | 146.50 |
| 9/16 | 12 | 14.29 | 45.9 | 62.24 | 99.0 | 134.24 | 108.0 | 146.45 | 139.5 | 189.16 |
| 9/16 | 18 | — | 45.5 | 67.12 | 106.0 | 146.45 | — | — | 153.0 | 207.47 |
| 5/8 | 11 | 15.88 | 56.7 | 76.89 | 135.0 | 183.06 | 150.3 | 203.80 | 189.0 | 256.28 |
| 5/8 | 18 | — | 85.5 | 115.94 | 153.0 | 207.47 | — | — | 216.0 | 296.90 |
| 3/4 | 10 | 19.05 | 94.5 | 128.14 | 243.0 | 329.51 | 252.0 | 341.71 | 337.5 | 457.65 |
| 3/4 | 16 | — | 103.5 | 140.35 | 265.5 | 360.20 | — | — | 378.0 | 536.87 |
| 7/8 | 9 | 22.23 | 144.0 | 195.26 | 355.5 | 482.06 | 396.0 | 536.98 | 544.5 | 738.34 |
| 7/8 | 14 | — | 157.5 | 213.57 | 391.5 | 530.87 | — | — | 607.5 | 823.77 |
| 1 | 8 | 25.40 | 211.5 | 286.79 | 531.0 | 720.04 | 594.0 | 805.46 | 819.0 | 1110.56 |
| 1 | 14 | — | 225.0 | 305.10 | 594.0 | 805.46 | — | — | 891.0 | 1208.20 |
| 1-1/8 | — | 25.58 | — | — | 720.0 | 976.32 | — | — | 1152.0 | 1562.13 |
| | | | | | 792.0 | 1073.97 | | | 1296.0 | 1757.52 |
| 1-1/4 | — | 31.75 | — | — | — | — | — | — | 1638.0 | 2221.11 |
| | | | | | | | | | 1800.0 | 2440.80 |
| 14-3/8 | — | 34.93 | — | — | 1314.0 | 1781.82 | — | — | 2142.0 | 2904.57 |
| | | | | | 1512.0 | 2050.29 | | | 2448.0 | 3319.47 |
| 1-1/2 | — | 38.10 | — | — | 1746.0 | 2367.54 | — | — | 2844.0 | 3856.50 |
| | | | | | 1980.0 | 2684.88 | | | 3204.0 | 4344.66 |

## E-4. TIGHTENING METAL FASTENERS.

When torquing a fastener, select a torque wrench whose range (Table E-3, p. E-4) fits the required torque value. A torque wrench is most accurate from 25 percent to 75 percent of its stated range. A torque wrench with a stated range of 0 to 100 will be most accurate from 25 to 75 foot-pounds. The accuracy of readings will decrease as you approach 0 foot-pounds or 100 foot-pounds. The ranges in Table E-3 are based on this principle.

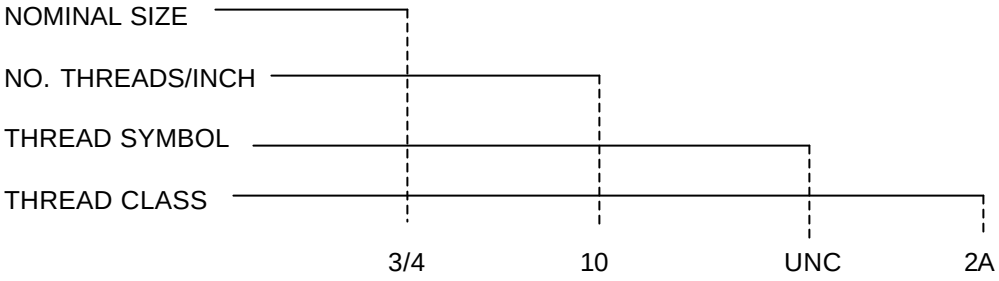
## E-4. TIGHTENING METAL FASTENERS (continued).

| *Table E-3. Torque Ranges* | |
|---|---|
| STATED RANGE | MOST EFFECTIVE RANGE |
| 0-600 ft-lb | 150-450 ft-lb |
| 0-170 ft-lb | 44-131 ft-lb |
| 15-75 ft-lb | 30-60 ft-lb |

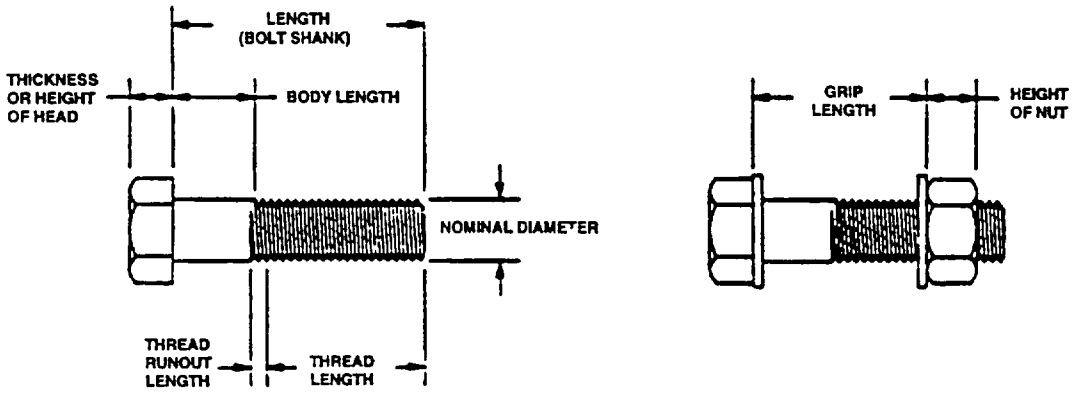
## E-5. FASTENER SIZE AND THREAD PATTERN.

Threaded fasteners are categorized according to diameter of the fastener shank. Thread styles are divided into broad groups, the two most common being coarse (Unified Coarse-UNC) and fine (Unified Fine-UNF). These groups are defined by the number of threads per inch on the bolt shanks. In addition, threads are categorized by thread class (Table E-4), which is a measure of the degree between threads of bolt or screw (external threads) and threads of the attaching nut or tapped hole (internal threads of the attaching nut or tapped hole) (internal threads). The most common thread class for bolts and screws is Class 2.

| *Table E-4. Thread Classes and Description* | | |
|---|---|---|
| EXTERNAL | INTERNAL | INTERNAL |
| 1A | 1B | LOOSE FIT |
| 2A | 2B | MEDIUM FIT |
| 3A | 3B | CLOSE FIT |




NOTE: Unless followed with -LH (e.g., 314-10 UNC-2A-LH), threads are right-hand.



## E-6. FASTENER GRADE.

In addition to being classified by thread type, thread fasteners are also classified by material. The most familiar fastener classification system is the SAE grading system (Table E-5).

*Table E-5. SAE Screw and Bolt Markings*

| SCREWS | BOLTS |
|---|---|
| SAE GRADE 2<br>NO MARKING | SAE GRADE 6<br>4 RADIAL DASHES<br>90° APART |
| SAE GRADE 3<br>2 RADIAL DASHES<br>180° APART | SAE GRADE 7<br>5 RADIAL DASHES<br>72° APART |
| SAE GRADE 5<br>3 RADIAL DASHES<br>120° APART | SAE GRADE 8<br>6 RADIAL DASHES<br>60° APART |

**Markings on Hex Locknuts**

GRADE A - No Marks
GRADE B - 3 Marks
GRADE C - 6 Marks

GRADE A - No Marks
GRADE B - Letter B
GRADE C - Letter C

GRADE A - No Notches
GRADE B - 1 Notch
GRADE C - 2 Notches

# APPENDIX F
# MANDATORY REPLACEMENT PARTS



## F-1. GENERAL.

This appendix is a cross-reference of item numbers to part numbers and is included for that purpose only.

## F-2. EXPLANATION OF COLUMNS .

There are five columns in Table F-1, Mandatory Replacement Parts List (p. F-2):

**(1) Item Number.** This number is assigned to the entry in Table F-1 for cross-referencing to the part number. The item number appears in the Materials/Parts listing of a maintenance procedure.

**(2) Part Number.** This is the primary number used by the manufacturer, which controls the design and characteristics of the item by means of its engineering drawings, specifications, standards, and inspection requirements to identify an item or a range of items.

**(3) National Stock Number.** When available, the national stock number is listed for each part.

**(4) Item Name.** This is the name given each item in the Materials/Parts listing of a maintenance procedure.

**(5) Reference.** This is the Repair Parts and Special Tools List (RPSTL) appendix in which the referenced replacement part can be found. The RPSTL is the authorization for requisitioning replacement parts.

*Table F-1. MANDATORY REPLACEMENT PARTS LIST*

| (1) Item Number | (2) National Part Number | (3) Stock Number | (4) Item Name | (5) Reference |
|---|---|---|---|---|
| 1 | 01228000 | 5330-01-415-6723 | Crankcase Gasket Set | Appendix C |
| 2 | 01240300 | 2815-01-455-0428 | Piston Ring Set | Appendix C |
| 3 | 01247700 | 5330-01-415-6721 | Head Gasket Set | Appendix C |
| 4 | 01285600 | | Gasket Set | Appendix C |
| 5 | 03233200 | 5365-01-100-5416 | Shim, 0.2 mm | Appendix C |
| 6 | 03233300 | 5365-01-100-5417 | Shim, 0.3 mm | Appendix C |
| 7 | 03781300 | 3120-01-416-3110 | Sleeve Bearing | Appendix C |
| 8 | 03783902 | | Gasket | Appendix C |
| 9 | 03958000 | 5365-01-455-0011 | Shim, 0.3 mm | Appendix C |
| 10 | 04038200 | 5340-01-454-9272 | Cap-Plug | Appendix C |
| 11 | 04039100 | 5340-01-454-9273 | Cap-Plug | Appendix C |
| 12 | 40002500 | | Blind Rivet | Appendix C |
| 13 | 40021400 | 5330-01-120-2966 | Seal | Appendix C |
| 14 | 40021500 | 5999-01-116-8286 | Wire Mesh | Appendix C |
| 15 | 40028400 | 5310-01-101-2028 | Self-Locking Nut | Appendix C |
| 16 | 49004400 | 5330-01-101-7264 | Gasket | |
| 17 | 49004700 | | O-Ring | |
| 18 | 50000900 | 5310-01-090-0938 | Washer | Appendix C |
| 19 | 50001100 | 5330-01-080-1776 | Gasket | Appendix C |
| 20 | 50019800 | 5360-01-399-4615 | Retaining Ring | Appendix C |
| 21 | 50020000 | 5365-01-245-3517 | Retaining Ring | Appendix C |
| 22 | 50036000 | 5315-01-399-6107 | Cotter Pin | Appendix C |
| 23 | 50061700 | 5310-01-274-4387 | Lockwasher | Appendix C |
| 24 | 50081200 | 5130-01-274-3165 | Lockwasher | Appendix C |
| 25 | 50095100 | 5310-01-399-7305 | Spring Tension Washer | Appendix C |
| 26 | 50114300 | | Lockwasher | Appendix C |
| 27 | 50146000 | 5310-01-400-2138 | Spring Tension Washer | Appendix C |

*Table F-1. MANDATORY REPLACEMENT PARTS LIST (continued)*

| (1) Item Number | (2) Part Number | (3) National Stock Number | (4) Item Name | (5) Reference |
|---|---|---|---|---|
| 28 | 50153800 | 5330-01-070-7136 | O-Ring | Appendix C |
| 29 | 50162900 | 5301-01-415-2649 | Washer | Appendix C |
| 30 | 50170900 | 5310-01-399-7301 | Spring Tension Washer | Appendix C |
| 31 | 50208500 | 5310-01-399-7307 | Spring Tension Washer | Appendix C |
| 32 | 50225501 | | O-Ring | Appendix C |
| 33 | 50290200 | 5330-01-400-5772 | O-Ring | Appendix C |
| 34 | 50302100 | 3120-01-4161-3105 | Sleeve Bearing | Appendix C |
| 35 | 50302800 | 2940-01-383-9739 | Filter Element | Appendix C |
| 36 | 50305000 | 5365-01-399-4618 | Retaining Ring | Appendix C |
| 37 | 50306500 | | O-Ring | Appendix C |
| 38 | 50308500 | 5340-01-406-1645 | Clip | Appendix C |
| 39 | 50308800 | 5365-01-400-0999 | Retaining Ring | Appendix C |
| 40 | 50313100 | | Gasket | Appendix C |
| 41 | 50315400 | 5310-01-400-3715 | Split Washer | Appendix C |
| 42 | 50315900 | 5365-01-399-5011 | Shim, 0.2 mm | Appendix C |
| 43 | 50316000 | 5365-01-455-0012 | Shim, 0.3 mm | Appendix C |
| 44 | 50326200 | 5330-01-399-8354 | O-Ring | Appendix C |
| 45 | 50336200 | 5330-01-399-8357 | O-Ring | Appendix C |
| 46 | 50336500 | 5330-01-399-6979 | O-Ring | Appendix C |
| 47 | 50359110 | | Retaining Ring | Appendix C |
| 48 | 99400641 | | Seal | Appendix C |
| 49 | 05185802 | | Spring, Return | Appendix C |
| 50 | 50153900 | | O-Ring | Appendix C |
| 51 | 50224200 | | CIRCLIP, 16x1 | Appendix C |
| 52 | 50195800 | 5310-01-400-1002 | Shim | Appendix C |

*Table F-1. MANDATORY REPLACEMENT PARTS LIST (continued)*

| (1) Item Number | (2) Part Number | (3) National Stock Number | (4) Item Name | (5) Reference |
|---|---|---|---|---|
| 53 | 50499900 | | Spring, Pressure | Appendix C |
| 54 | 50499800 | | O-Ring | Appendix C |
| 55 | 50500000 | | Spring, Pressure | Appendix C |
| 56 | 50034100 | 5315-01-081-4488 | Pin, Spring | Appendix C |
| 57 | 04021800 | | Spring | Appendix C |
| 58 | 50519800 | | O-Ring | Appendix C |

# APPENDIX G
# TOOL IDENTIFICATION LIST

## Section I. INTRODUCTION



### G-1. GENERAL.

This appendix lists all of the common and special tools required to maintain the Diesel Engine Assembly, Hatz 2 G 40. This appendix is for reference only. To requisition special tools, refer to Appendix C, Repair Parts and Special Tools List (RPSTL).

### G-2. EXPLANATION OF COLUMNS IN SECTION II.

a. Column (1) - Item Number. This number is assigned to the entry in the listing and is referenced in the initial setup in each maintenance procedure to identify the item (e.g., General mechanic's tool kit, Item 11, Appendix G).

b. Column (2) Item Name. This column lists the item by nomenclature and other descriptive features, such as measurement.

c. Column (3) National Stock Number. This is the national stock number assigned to the item; use it to requisition or request an item.

d. Column (4) Part Number. This indicates the primary number used by the manufacturer who controls the design and characteristics of the item by means of engineering drawings, specification, standards, and inspection requirements.

e. Column (5) Reference. This column identifies the authorizing supply catalog (SC) or RPSTL for items listed in this appendix.

*Section II. TOOL IDENTIFICATION LIST*

| (1) Item Number | (2) National Part Number | (3) Stock Number | (4) Item Name | (5) Reference |
|---|---|---|---|---|
| 1 | Arbor press | 3444-00-449-7295 | A-A-51194 | SC- 4910-95-A31 |
| 2 | Blind hand riveter | 5120-00-017-2849 | 98 | SC 4910-95-CL-A74 |
| 3 | Cable assembly | 6150-00-682-3460 | 11647741 | SC 4910-95-CL-A74 |
| 4 | Crank gear driver | | 62574700 | TM 9-2815-250-24&P |
| 5 | Crank gear puller | | 62574801 | TM 9-2815-250-24&P |
| 6 | Cylinder alignment bracket | | 62574200 | NA |
| 7 | Cylinder compression tester | 4910-00-808-4300 | MIL-G-5353, Type 2 | SC-4940-95-B02 |
| 8 | Cylinder ridge reamer | 5110-00-237-8598 | MIL-C-82069 | SC-4910-95-A63 |
| 9 | Depth gage rule | 5210-00-221-1902 | MC103A | SC-3470-95-A02 |
| 10 | Drill set | 5133-00-293-0983 | DB129B | SC 4910-95-CL-A72 |
| 11 | Electric drill | 5130-00-889-9004 | WD00661 | SC 4910-95-CL-A74 |
| 12 | Fuel-test set | | 60462890 | TM 9-2815-250-24&P |
| 13 | Fuel-testing device | | 66503191 | TM 9-2815-250-24&P |
| 14 | General mechanic's tool kit | 5180-00-699-5273 | SC-5180-90-CL-N05 | SC-5180-90-CL-N05 |
| 15 | General mechanic's tool kit, automotive | 5180-00-177-7033 | SC-5180-90-CL-N26 | SC-5180-90-CL-N26 |
| 16 | Indicator dial | 5210-00-277-8840 | 196A | SC-4910-95-A63 |
| 17 | Mechanical gear and bearing puller kit | 5180-00-423-1569 | GGG P 781 | SC-4910 95 A31 |
| 18 | Mechanical hand-held tachometer | 6680-00-171-4584 | 4800 | SC-4910 95 A31 |
| 19 | Multimeter | 6625-01-139-2512 | T00377 | SC-4910 95 A31 |
| 20 | Oil pressure test set | | 62092692 | TM 9-2815-250-24&P |

**Section II. TOOL IDENTIFICATION LIST (continued)**

| (1) Item Number | (2) National Part Number | (3) Stock Number | (4) Item Name | (5) Reference |
|---|---|---|---|---|
| 21 | Piston ring compressor | 5120-00-223-8848 | J3272-03 | SC-4910-95-A63 |
| 22 | Piston ring expander | 5120-00-857-3190 | PRS 8 | SC-4910 95 A31 |
| 23 | Relief valve puller | | 62568902 | TM 9-2815-250-24&P |
| 24 | Screwdriver attachment, 6 mm | 5120-01-102-1670 | J3516-A | SC-4910-95-A31 |
| 25 | Screwdriver attachment, 8 mm | 5120-01-101-1943 | GIT-17595 | SC-4910 95 A31 |
| 26 | Snapring pliers | 5120-00-789-0492 | 4440R | SC-5180-95-B08 |
| 27 | Socket wrench set, 3/8-inch drive | 5120-00-322-6231 | 512000 17510 | SC-5181-95-B08 |
| 28 | Steel rule, 12-inch | 5210-00-234-5224 | GGG-R-791 | SC-3470-95-A02 |
| 29 | Strap wrench | 5120-00-020-2947 | A91C | SC-4910-95-A74 |
| 30 | Torque wrench, 3/8-inch drive | 5120-00-554-7292 | GGG-W-00686 | SC-4910-95-A74 |
| 31 | Torque wrench, 1/2-inch drive | 5120-00-640-6364 | 1753 LDF | SC-4910 95 A31 |
| *32 | Torque wrench, 3/8-inch drive | 5120-01-112-9531 | TESI60 | SC-4910 95 A31 |
| 33 | Valve face grinding machine | 44910-00-540-4679 | K403CM | SC-4910-95-A63 |
| 34 | Valve seat grinding kit | 4910-00-060-9983 | WG690 | SC-4910-95-A63 |
| 35 | Valve spring lifter | 5120-00-239-8686 | GGG-L-350 | SC-4910-95-A63 |
| 36 | Wrench | 51230-01-309-2048 | 3715M | TM 9-2815-250-24&P |

*This torque wrench may be used instead of Item 30 if a metric torque reading is preferred.

# INDEX

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**V**



**W**

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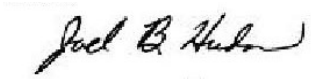

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# THE METRIC SYSTEM AND EQUIVALENTS

### LINEAR MEASURE

1 Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
1 Kilometer = 1000 Meters = 0.621 Miles

### WEIGHTS

1 Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
1 Kilogram = 1000 Grams = 2.2 Lb.
1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

### LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

### SQUARE MEASURE

1 Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inches
1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet
1 Sq. Kilometer = 1,000 Sq. Meters = 0.386 Sq. Miles

### CUBIC MEASURE

1 Cu. Centimeter = 1000 Cu. Millimeters = 0.06 Cu. Inches
1 Cu. Meter = 1,000,000 Cu. Centimeters = 35.31 Cu. Feet

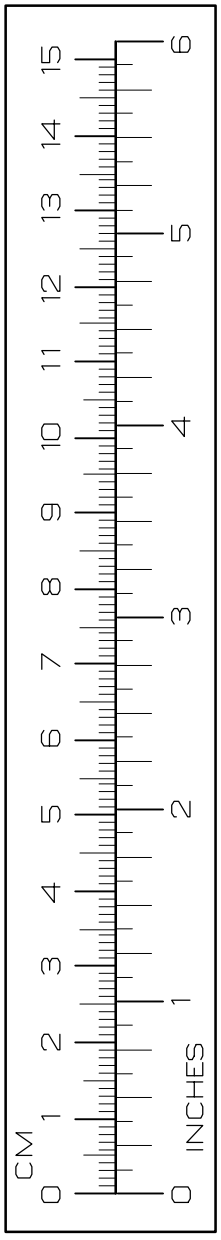
### TEMPERATURE

5/9 (°F – 32) = °C
212° Fahrenheit is equivalent to 100° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
32° Fahrenheit is equivalent to 0° Celsius
(9/5 x °C) + 32 = °F

## APPROXIMATE CONVERSION FACTORS

| TO CHANGE | TO | MULTIPLY BY |
|---|---|---|
| Inches | Centimeters | 2.540 |
| Feet | Meters | 0.305 |
| Yards | Meters | 0.914 |
| Miles | Kilometers | 1.609 |
| Square Inches | Square Centimeters | 6.451 |
| Square Feet | Square Meters | 0.093 |
| Square Yards | Square Meters | 0.836 |
| Square Miles | Square Kilometers | 2.590 |
| Acres | Square Hectometers | 0.405 |
| Cubic Feet | Cubic Meters | 0.028 |
| Cubic Yards | Cubic Meters | 0.765 |
| Fluid Ounces | Millimeters | 29.573 |
| Pints | Liters | 0.473 |
| Quarts | Liters | 0.946 |
| Gallons | Liters | 3.785 |
| Ounces | Grams | 28.349 |
| Pounds | Kilograms | 0.454 |
| Short Tons | Metric Tons | 0.907 |
| Pound–Feet | Newton–Meters | 1.356 |
| Pounds per Square Inch | Kilopascals | 6.895 |
| Miles per Gallon | Kilometers per Liter | 0.425 |
| Miles per Hour | Kilometers per Hour | 1.609 |

| TO CHANGE | TO | MULTIPLY BY |
|---|---|---|
| Centimeters | Inches | 0.394 |
| Meters | Feet | 3.280 |
| Meters | Yards | 1.094 |
| Kilometers | Miles | 0.621 |
| Square Centimeters | Square Inches | 0.155 |
| Square Meters | Square Feet | 10.764 |
| Square Meters | Square Yards | 1.196 |
| Square Kilometers | Square Miles | 0.386 |
| Square Hectometers | Acres | 2.471 |
| Cubic Meters | Cubic Feet | 35.315 |
| Cubic Meters | Cubic Yards | 1.308 |
| Milliliters | Fluid Ounces | 0.034 |
| Liters | Pints | 2.113 |
| Liters | Quarts | 1.057 |
| Liters | Gallons | 0.264 |
| Grams | Ounces | 0.035 |
| Kilograms | Pounds | 2.205 |
| Metric Tons | Short Tons | 1.102 |
| Newton–Meters | Pound–Feet | 0.738 |
| Kilopascals | Pounds per Square Inch | 0.145 |
| Kilometers per Liter | Miles per Gallon | 2.354 |
| Kilometers per Hour | Miles per Hour | 0.621 |



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