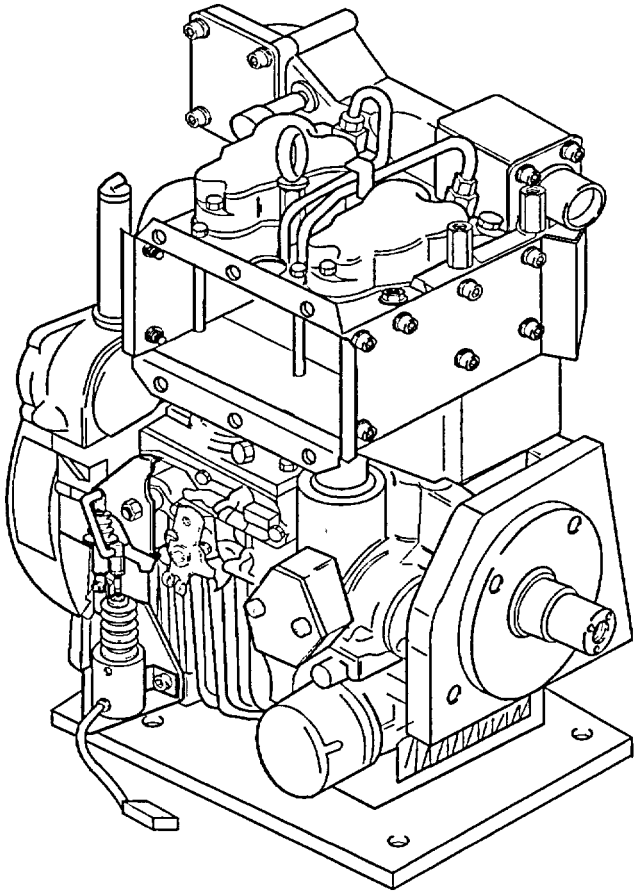
TECHNICAL MANUAL

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) EIC: AKA



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HEADQUARTERS, DEPARTMENT OF THE ARMY

SEPTEMBER 1998

FOR INFORMATION ON FIRST AID, REFER TO FM 21-11.

WARNING

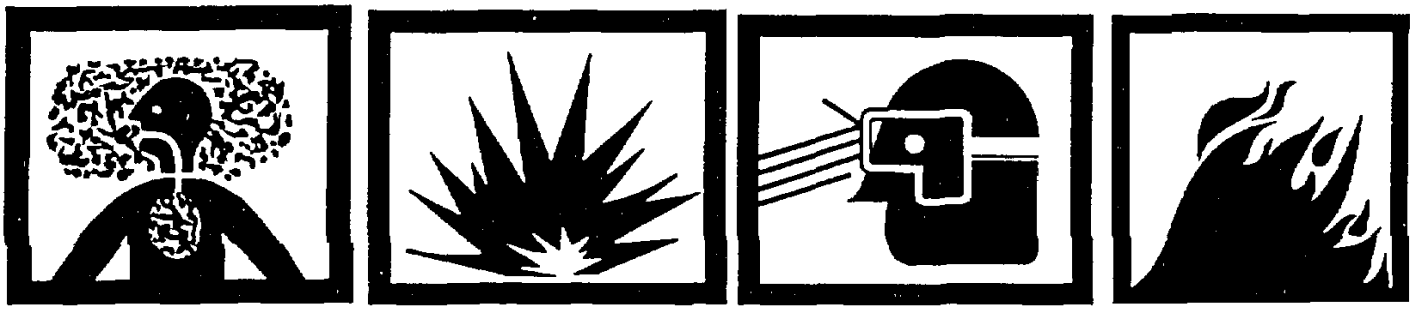
CARBON MONOXIDE

- **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 ortactical reasons. Do not operate the engine in an enclosed area without adequate ventilation.**

WARNING

DRYCLEANING SOLVENT



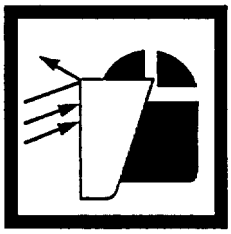
- **Drycleaning solvent (P-D680) is TOXIC and flammable. Wear protective goggles and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and DO NOT breathe vapors. Keep away from heat or flame. Never smoke when using drycleaning solvent. Failure to follow this warning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

TECHNICAL MANUAL
NO. 9-2815-250-24&P

HEADQUARTERS
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 EIC: AKA

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2, located in the back of this manual, directly to Commander, U.S. Army Tankautomotive and Armaments Command, ATTN: AMSTA-AC-NML, Rock Island, IL 61299-7630. A reply will be furnished to you.

You may also provide DA Form 2028-2 information to TACOM via datafax or e-mail:

- fax number: DSN 793-0726 or (309) 782-0726
- e-mail address: amsta-ac-nml ria-emh2.army.mil

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TABLE OF CONTENTS

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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.

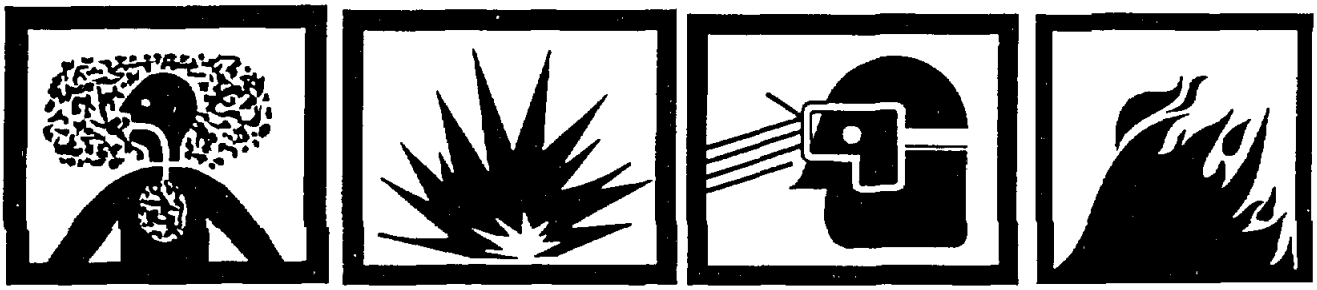
- Do not work on any item supported only by lift jacks or a hoist. Always use blocks or trestles to support the item prior to any work. Equipment may fall and cause injury or death to personnel.

- 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	technical manual
TMDE	test, measurement, and diagnostic equipment
TU	tube
U/M	unit of measure

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 corrosion problem be reported so it can be corrected and improvements can be made to prevent the problem in the future.

b. While corrosion 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 of materials may indicate 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 "corrosion," "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.

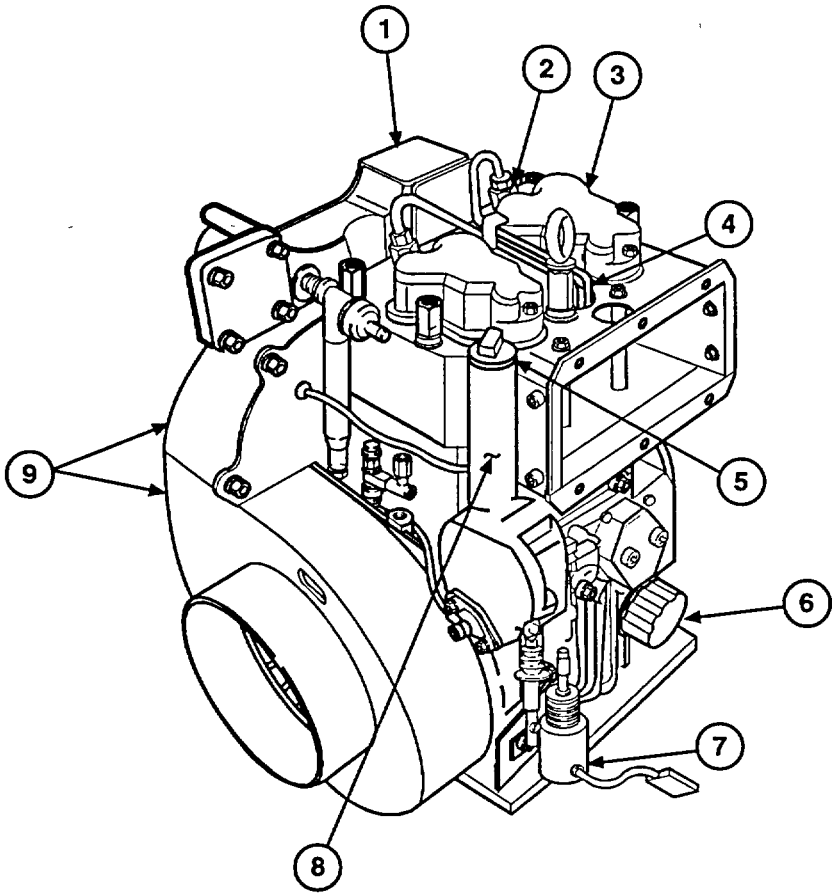
SECTION II. EQUIPMENT DESCRIPTION AND DATA

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.

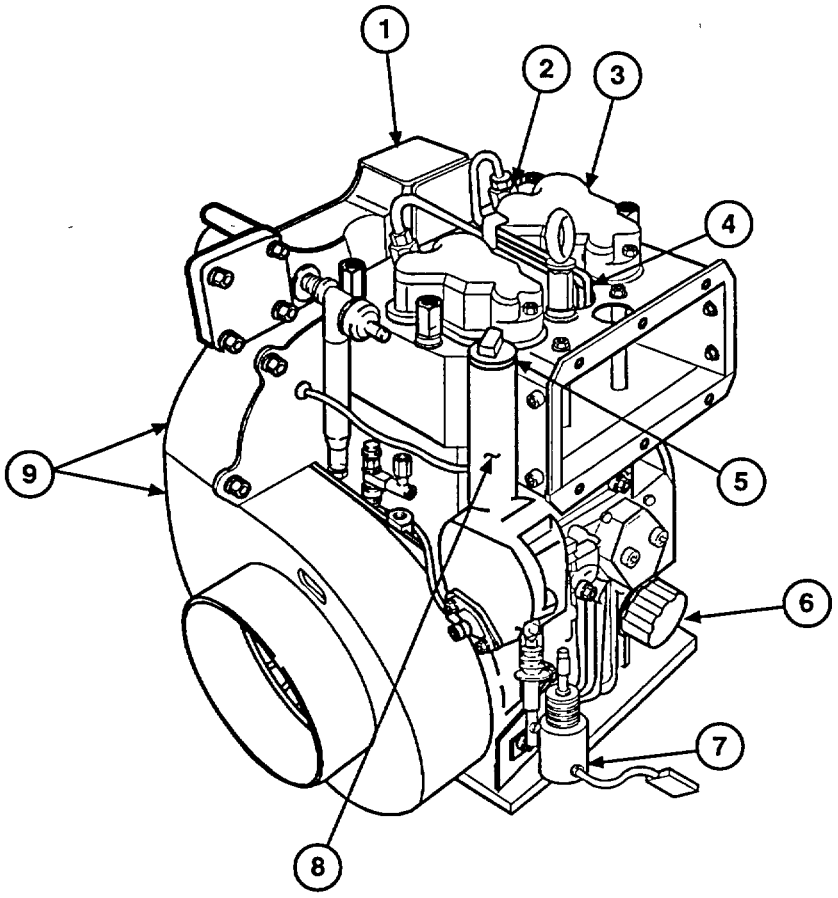
b. The engine is a lightweight, all-purpose industrial engine.

1-12. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS.



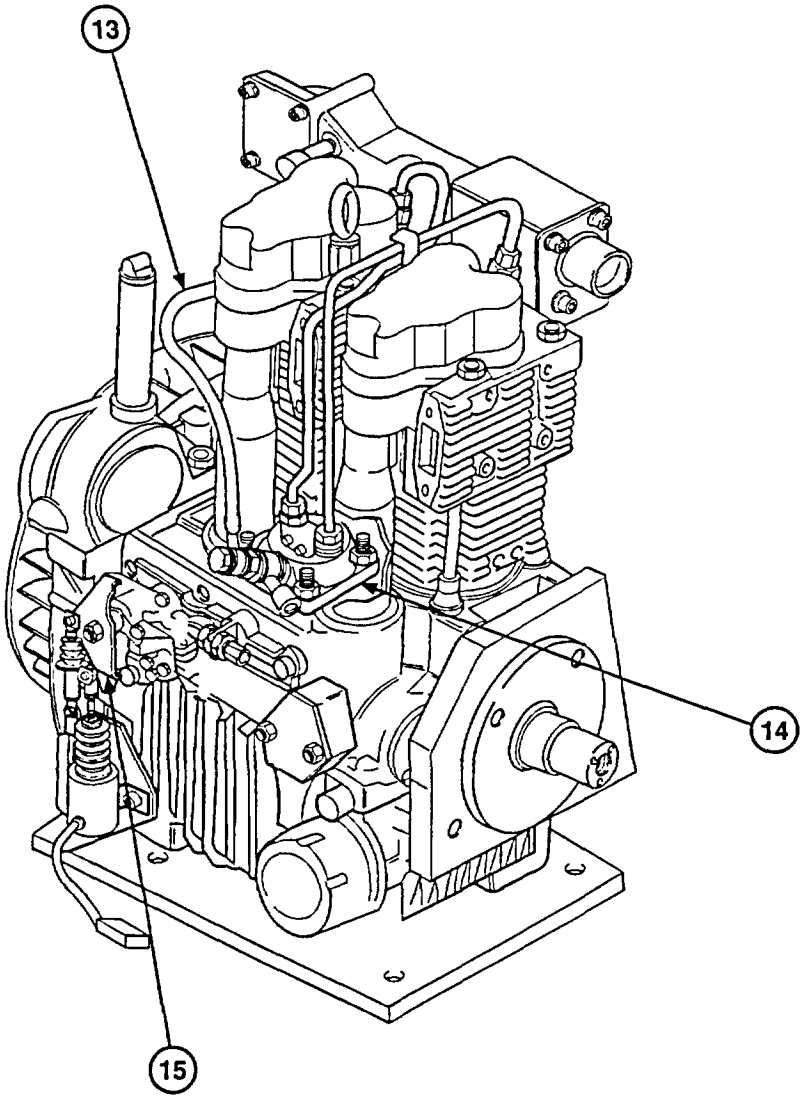
Key	Component	Description
1	Intake Manifold	Provides fresh air to cylinders for combustion.
2	Fuel Injectors (2)	Supply fuel to cylinders.
3	Rocker Arm Covers (2)	Protect rocker arm assemblies.
4	Fuel Pressure Pipes (2)	Provide fuel to fuel injectors.
5	Filler Cap	Allows access to filler neck.
6	Filter 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).



For purposes of clarity, airflow deflectors are not shown.

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/min (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	2200±50 rpm
Thermostatic Switch	Closes at 446°F±18F (230°C±10°C)
Horsepower	13.5 at 2000 rpm at 325-ft 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 (para 2-24, removal steps 1-3).

a. REMOVAL

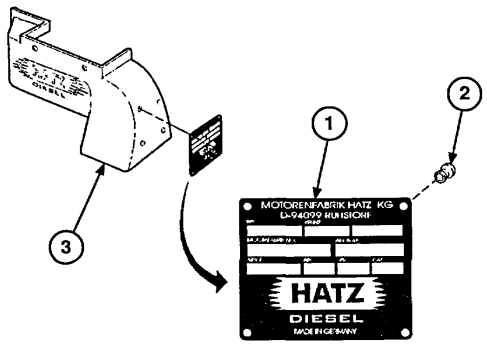
Remove four rivets (2) and identification plate (1) from airflow deflector (3).

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.

This Task Covers:

a. Removal

b. Installation

Initial Setup:

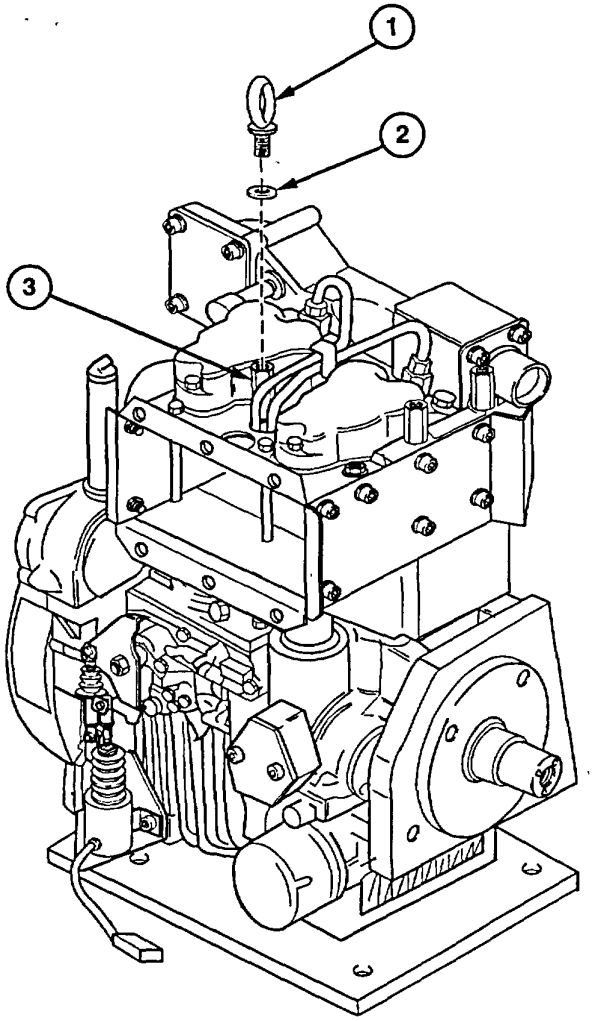
Tools/Test Equipment:
•General mechanic's tool kit (Item 14, Appendix G)

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

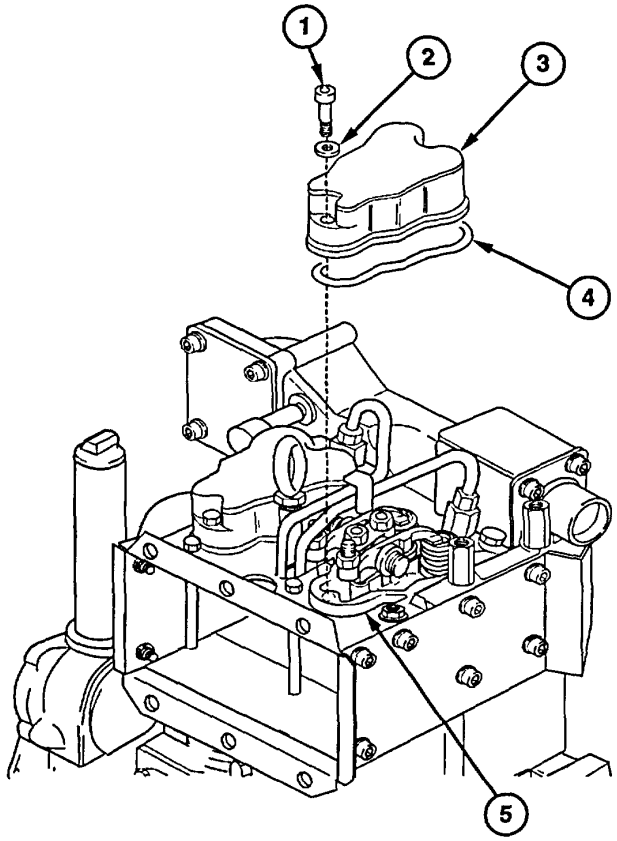
The Diesel Engine Assembly has two rocker arm covers. Use this procedure to remove either one.

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 rockerarm cover(3) and cylinder head (5).



FOLLOW-ON TASKS:
- None

2-18. FILLER OPENING CAP REPLACEMENT.

This Task Covers:

a. Removal

b. Installation

Initial Setup:

Tools/Test Equipment:

- General Mechanic's tool kit (Item 14, Appendix G)

Materials/Parts:

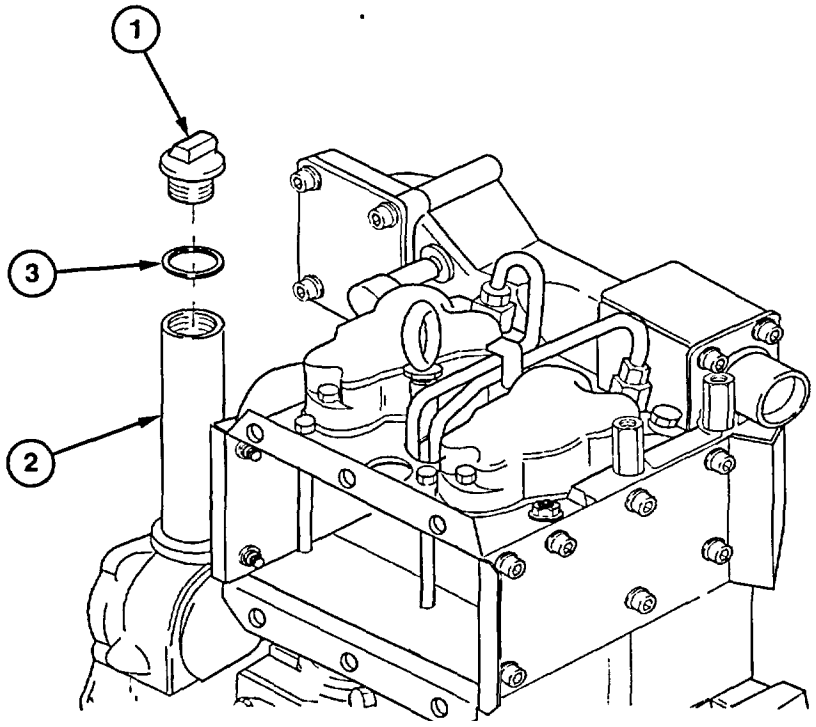
- Grease, automotive (Item 5, Appendix D)
- O-ring (Item 28, Appendix F)

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).

---

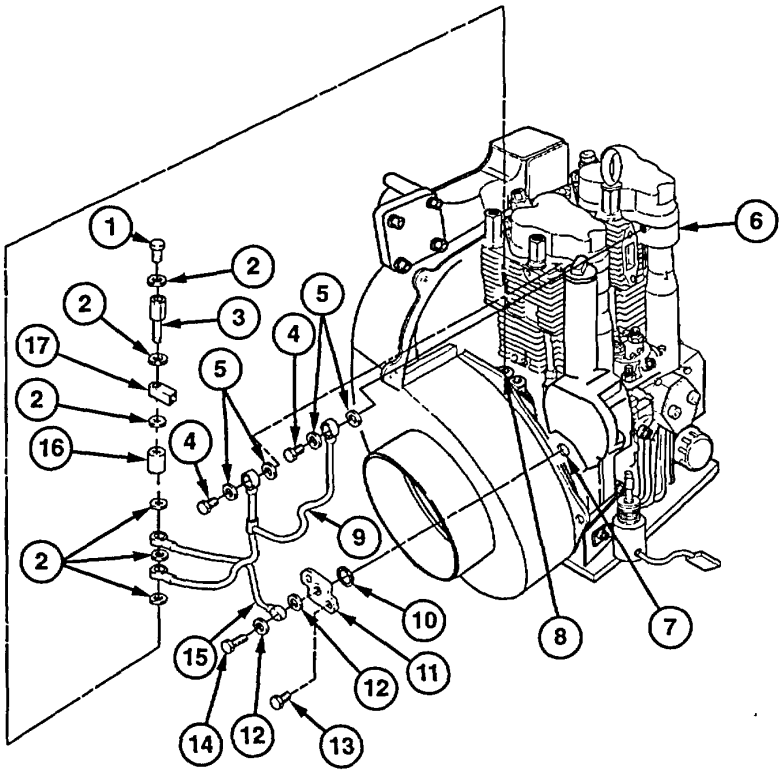
a. REMOVAL

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

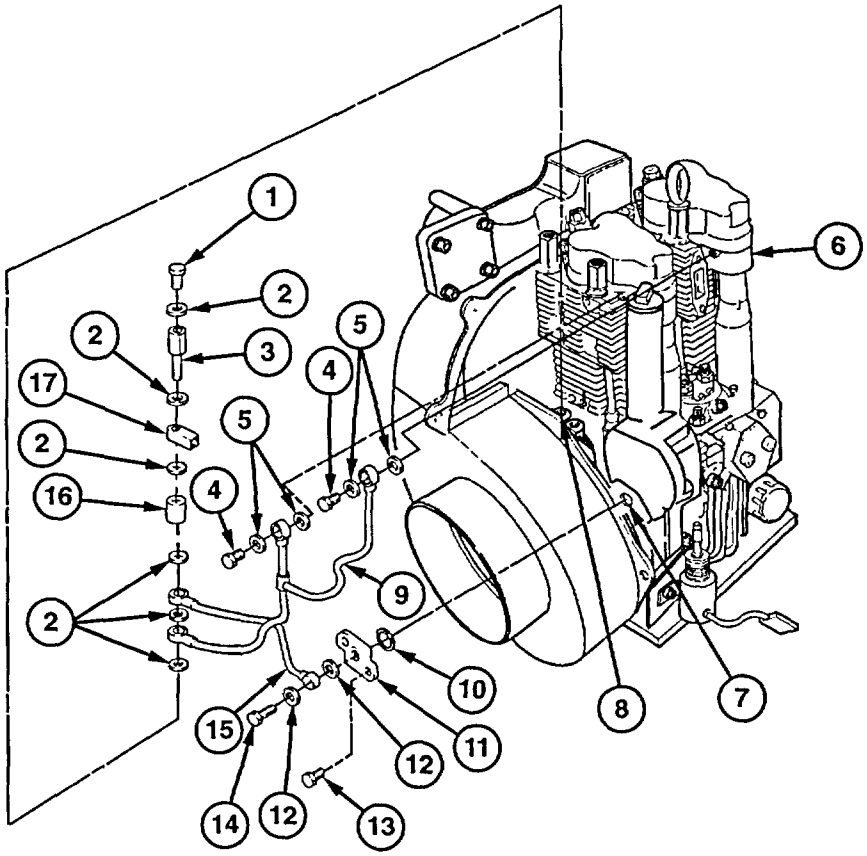
1. Install two oil tube assemblies (9 and 15), fluid passage bolt (3), connector (17), bushing (16), and six new washers (2) on crankcase (8). Loosely install screw (1) in fluid passage bolt (3).

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.

This Task Covers:

a. Removal
b. Cleaning
c. Installation

Initial Setup:

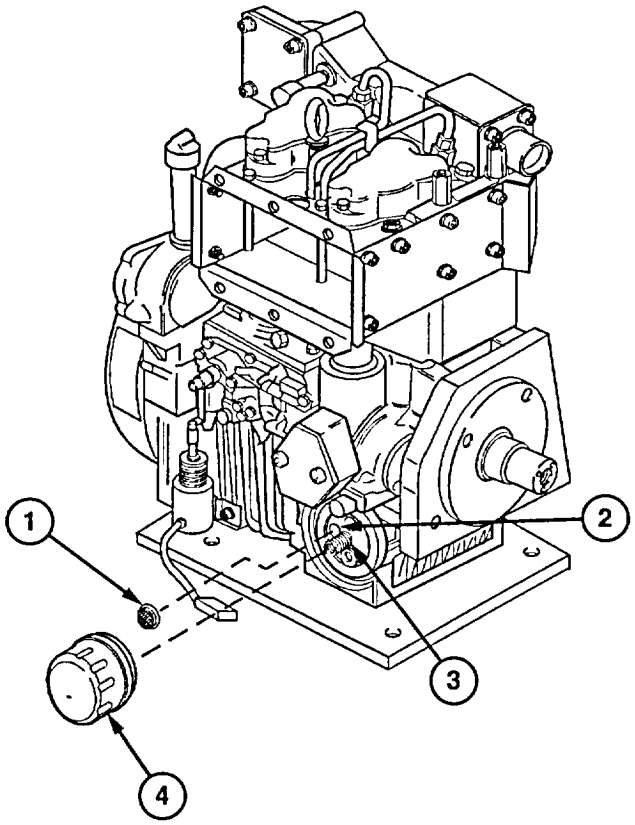
Tools/Test Equipment:
- General mechanic's tool kit, automotive (Item 15, Appendix G)
- Strap wrench (Item 29, Appendix G)
- Rag (Item 7, Appendix D)
- Filter element (Item 35, Appendix F)

Materials/Parts:
- Drycleaning solvent (Item 4, Appendix D)
- Lubricating oil (Item 6, Appendix D)

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 (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.

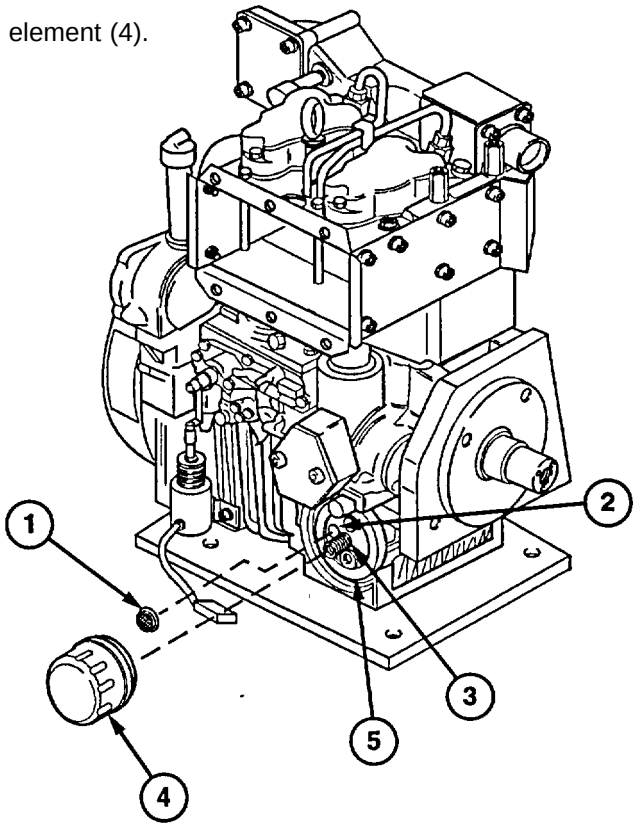
WARNING

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:

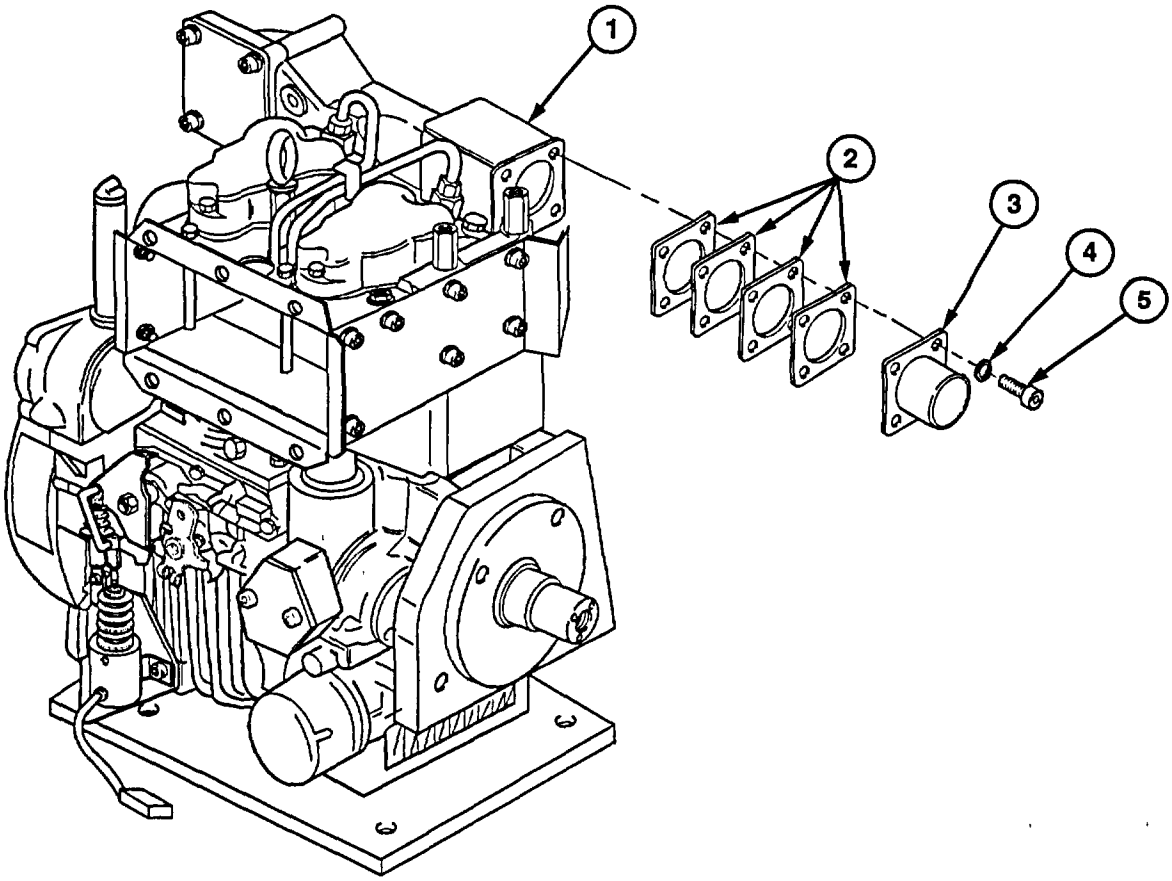
Tools/Test Equipment:
- General mechanic's tool kit, automotive (Item 15, Appendix G)
- Screwdriver attachment, 6 mm (Item 24, Appendix G)
- Socket wrench set, 3/8-inch drive (Item 27, Appendix G)

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).

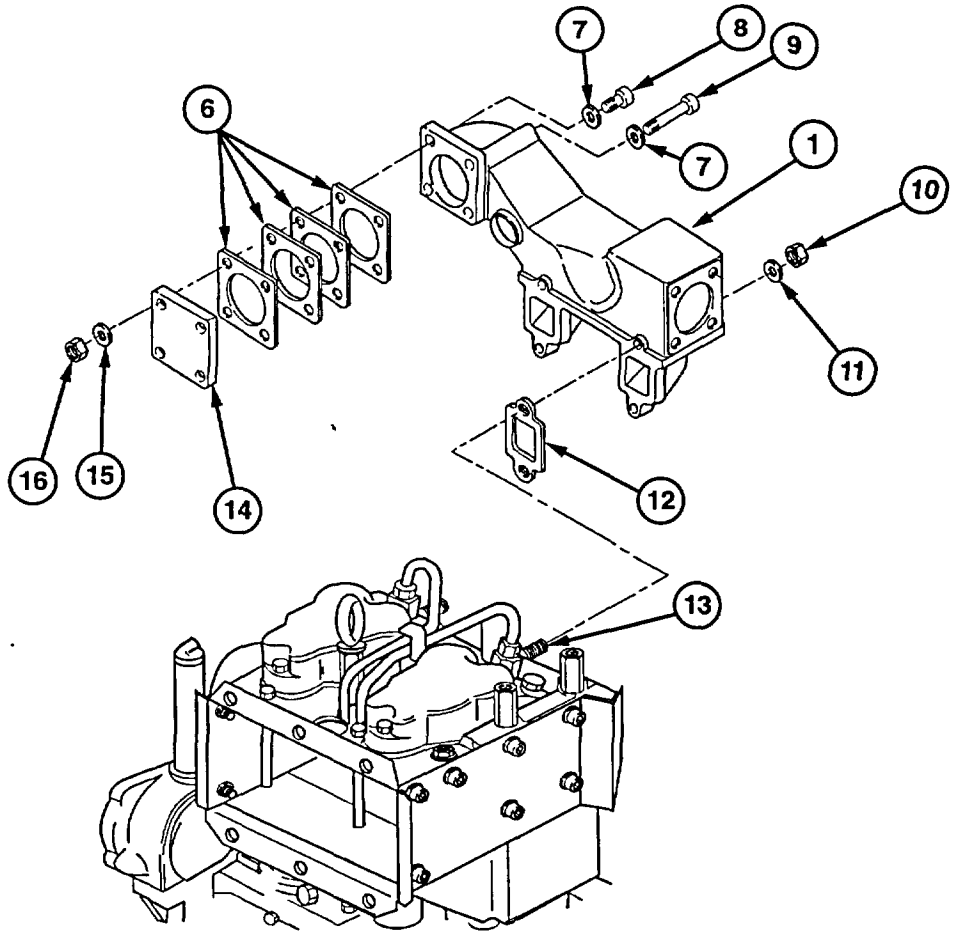
2. Remove two socket head screws (8) and socket head screws (9), four washers (7), spring tension washers (15), and nuts (16), access cover (14), and four-part gasket (6) from intake manifold (1). Discard spring tension washers and gasket.

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

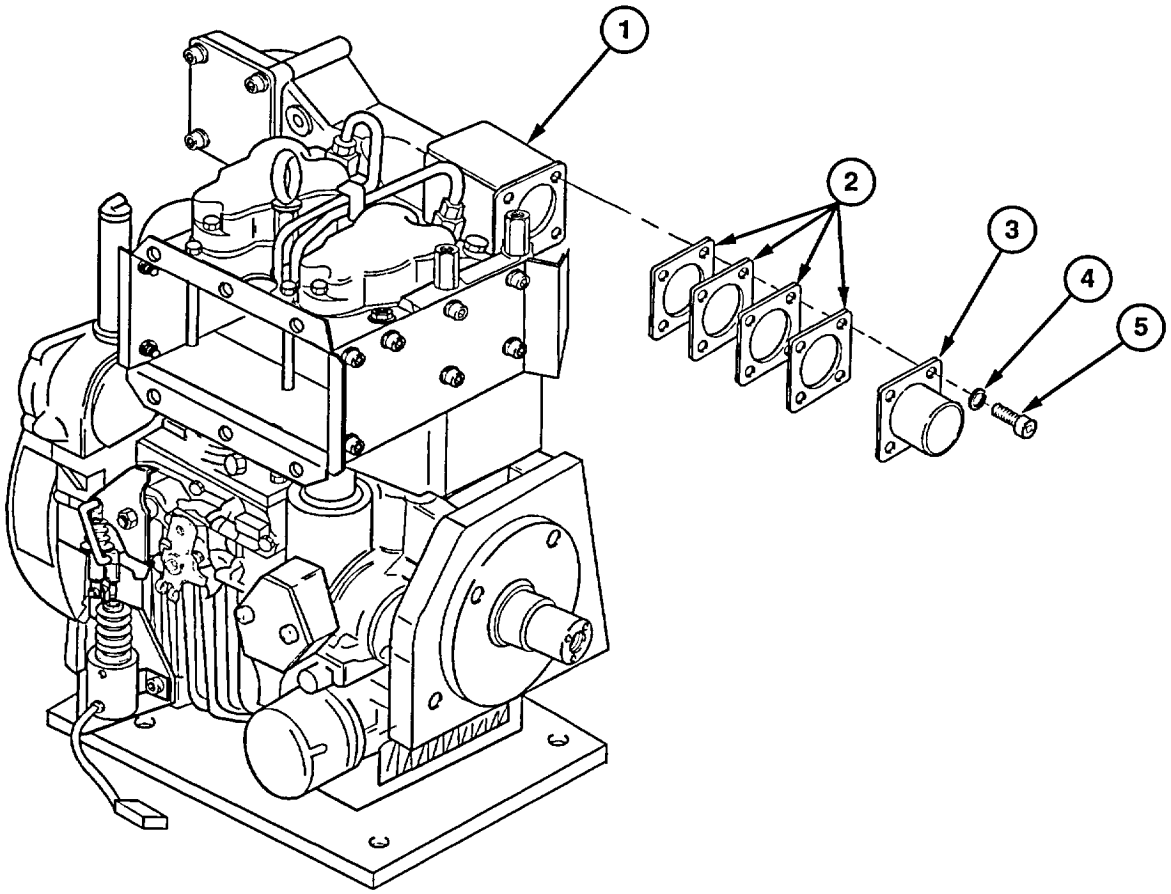
1. Install two new gaskets (12), intake manifold (1), and four new spring tension washers (11) and new self-locking nuts (10) on four studs (13).

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

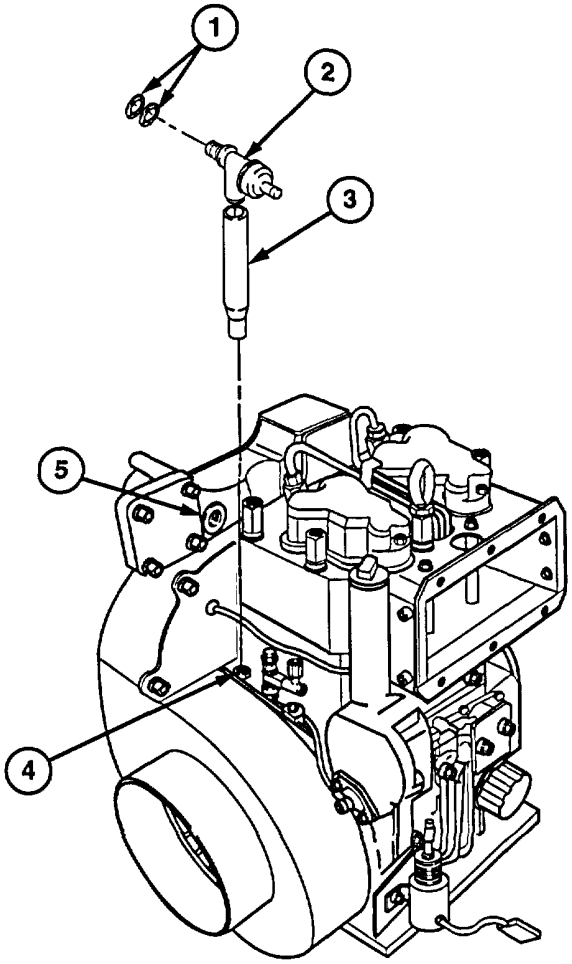
Initial Setup:

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

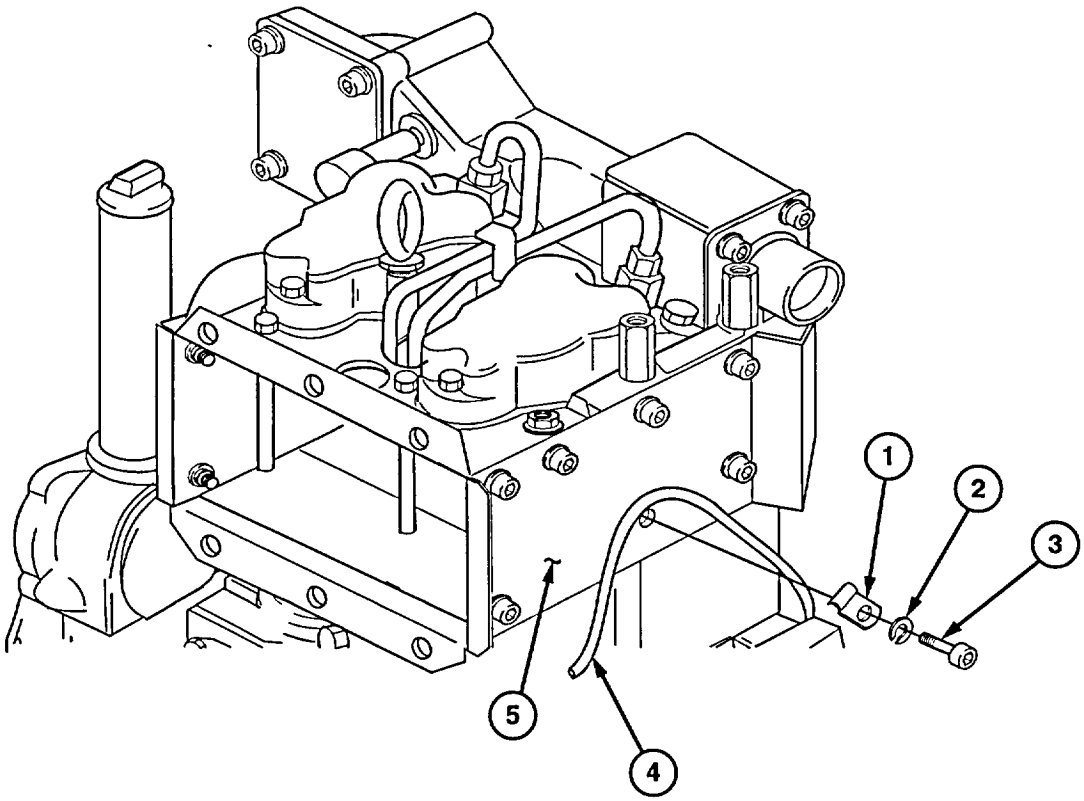
Initial Setup:

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

1. Remove screw (3), spring tension washer (2), and clamp (1) from return fuel hose (4) and air duct bracket (5). Discard spring tension washer.



NOTE

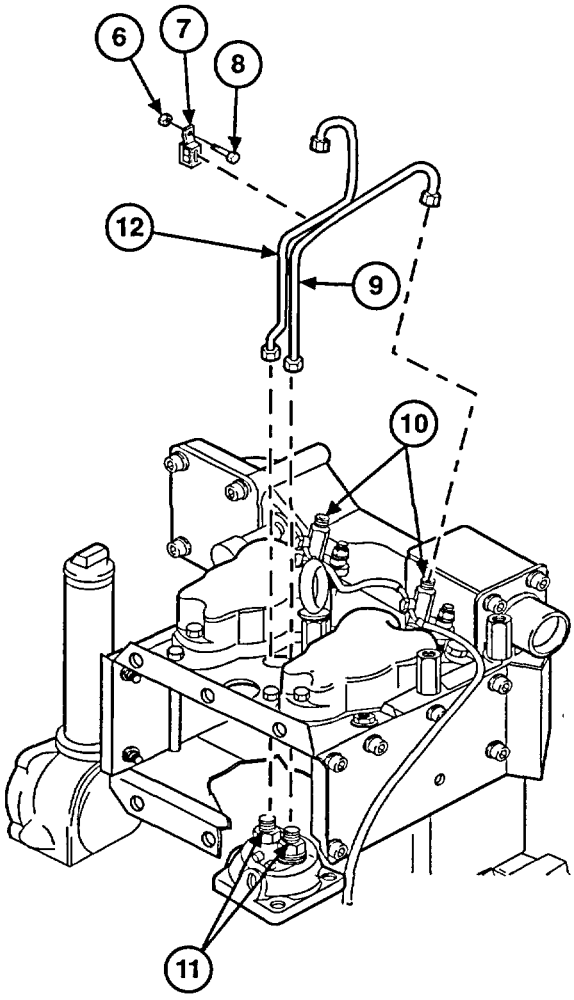
Fuel pressure pipe nuts will stay on fuel pressure pipe assemblies when they are removed.

2. Loosen two fuel pressure pipe nuts on each of two fuel pressure pipe assemblies (9 and 12).

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

3. Remove two fuel pressure pipe assemblies (9 and 12) and clamp (7) from two injection pump fittings (11) and fuel injector fittings (10).

4. Remove screw (8) and nut (6) from clamp (7). Remove clamp (7) from two fuel pressure pipe assemblies (9 and 12).

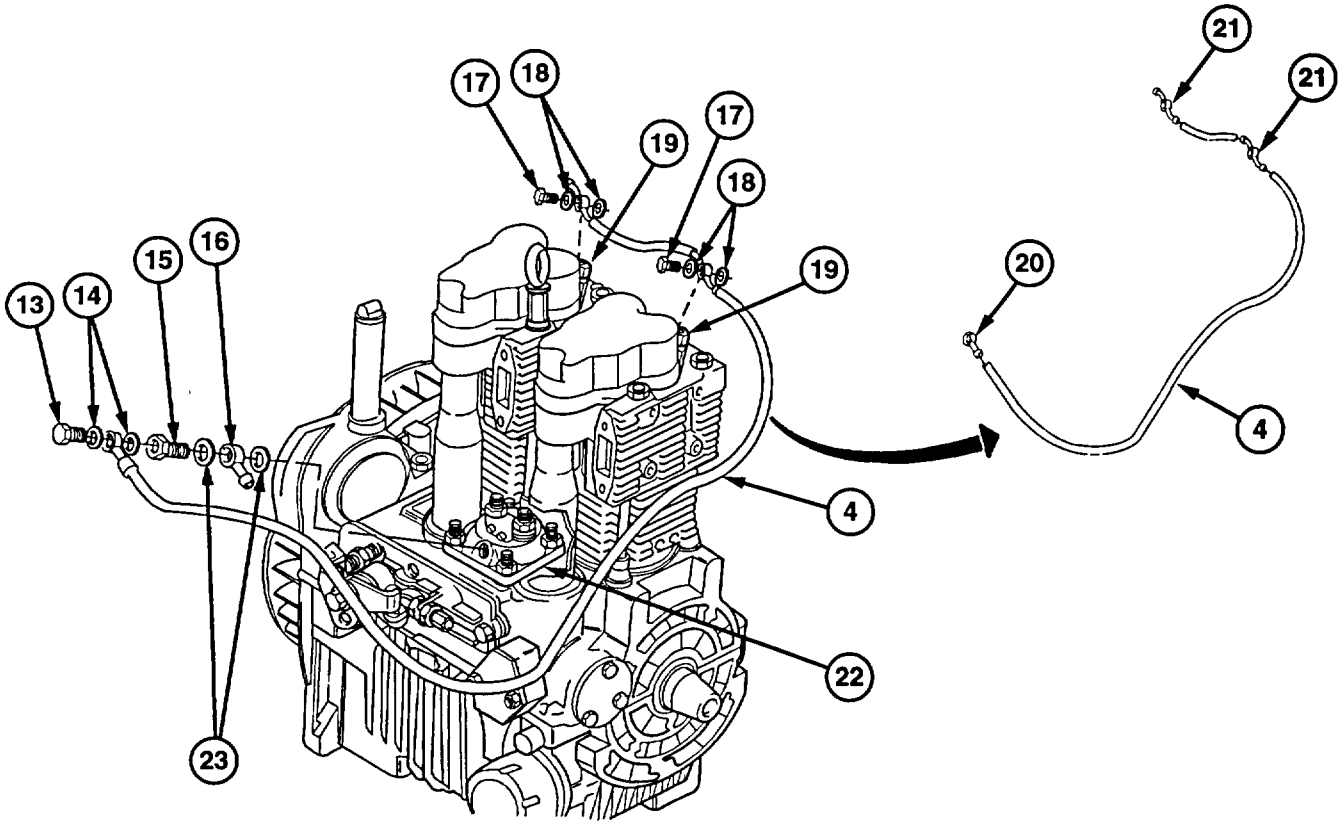


2-23. FUEL PRESSURE PIPE ASSEMBLIES AND RETURN FUEL HOSE REPLACEMENT (continued).

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

6. Remove two fluid passage bolts (17), four gaskets (18), and return fuel hose (4) from two fuel injectors (19). Discard gaskets.

7. Remove two hose nipples (21) and fitting (20) from return fuel hose (4).



FOR PURPOSES OF CLARITY, AIRFLOW DEFLECTORS ARE NOT SHOWN.

b. INSTALLATION

1. Install two hose nipples (21) and fitting (20) on return fuel hose (4).

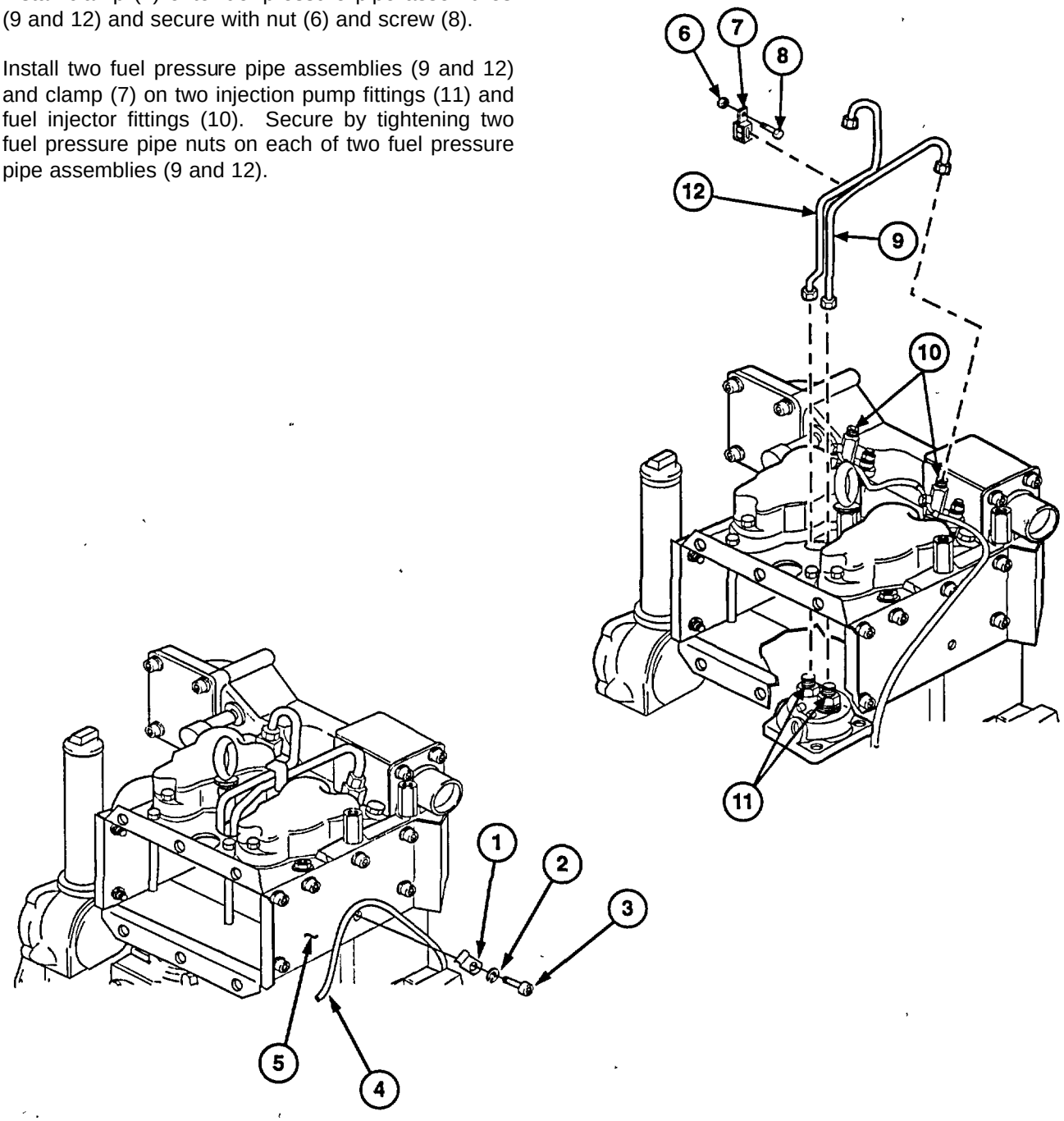
2. Install return fuel hose (4) on two fuel injectors (19) and secure with two fluid passage bolts (17) and four new gaskets (18).

3. Install two new gaskets (23), fitting (16), adapter (15), two new washers (14), return fuel hose (4), and fluid passage bolt (13) on injection pump (22). Torque adapter to 26 ft-lb (35 Nom). Torque fluid passage bolt to 18.5 ft-lb (25 Nom).

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).



6. Install clamp (1), new spring tension washer (2), and screw (3) on return fuel hose (4) and air duct bracket (5).

FOLLOW-ON TASKS:

- None

2-24. AIRFLOW DEFLECTORS REPLACEMENT.

This Task Covers:

a. Removal

b. Installation

Initial Setup:

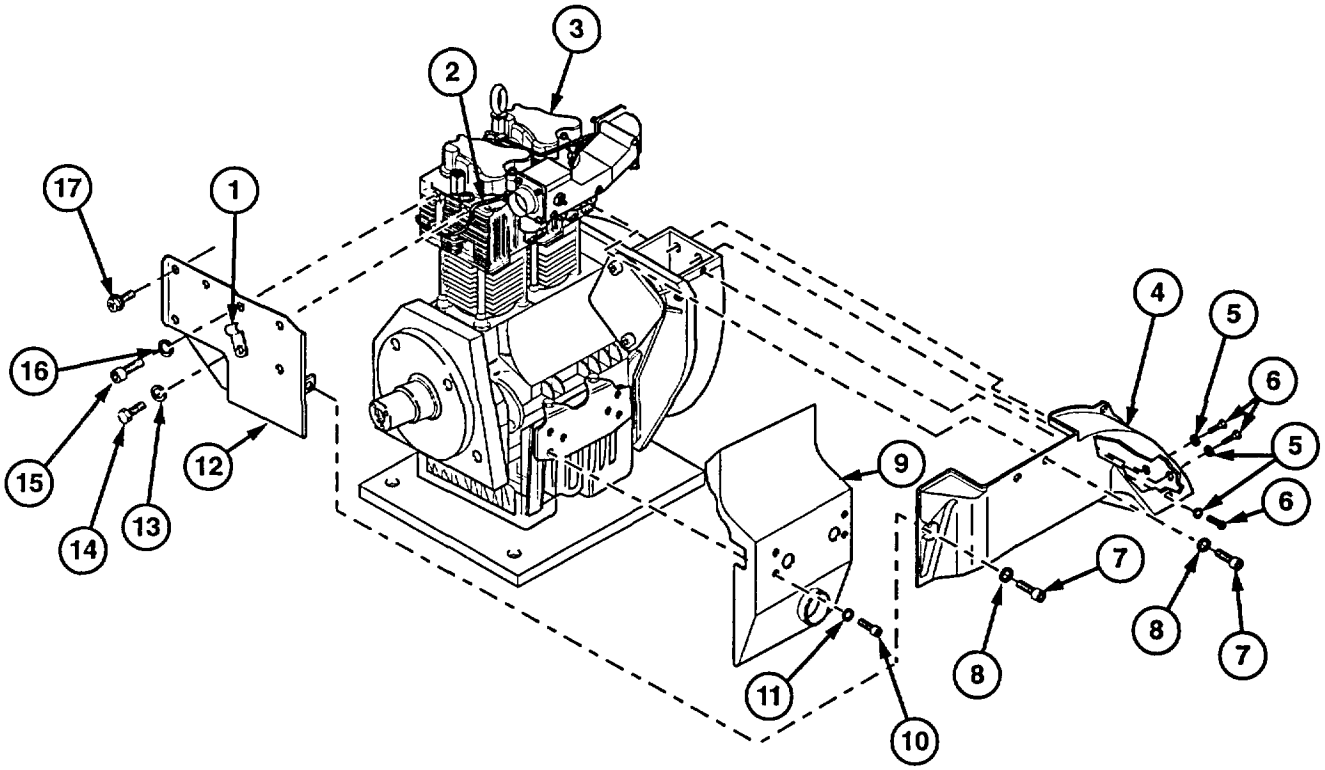
Tools/Test Equipment:
- General mechanic's tool kit, automotive (Item 15, Appendix G)

Materials/Parts:
- 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 (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 washers.

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).

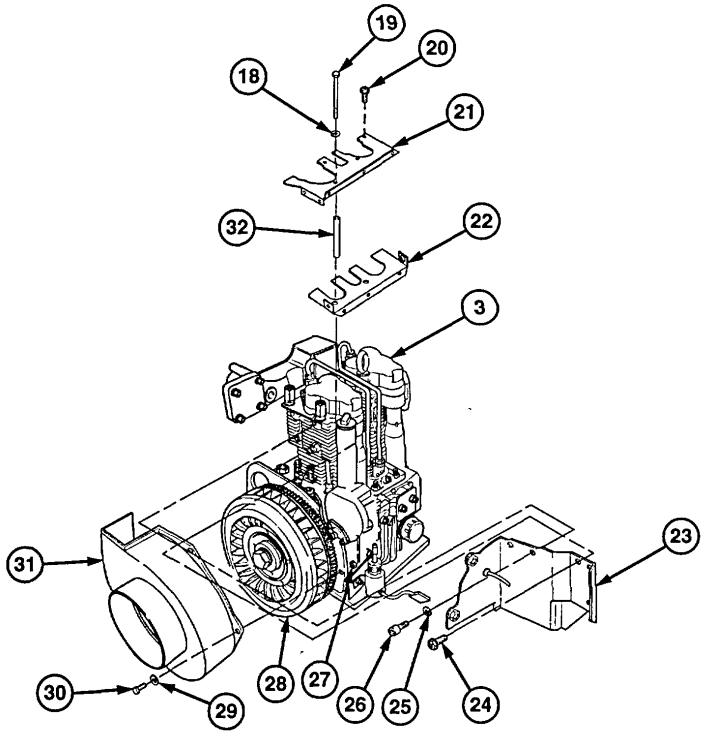
9. Remove two screws (26) and spring tension washers (25) from air duct bracket (23). Discard spring tension washers.

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).



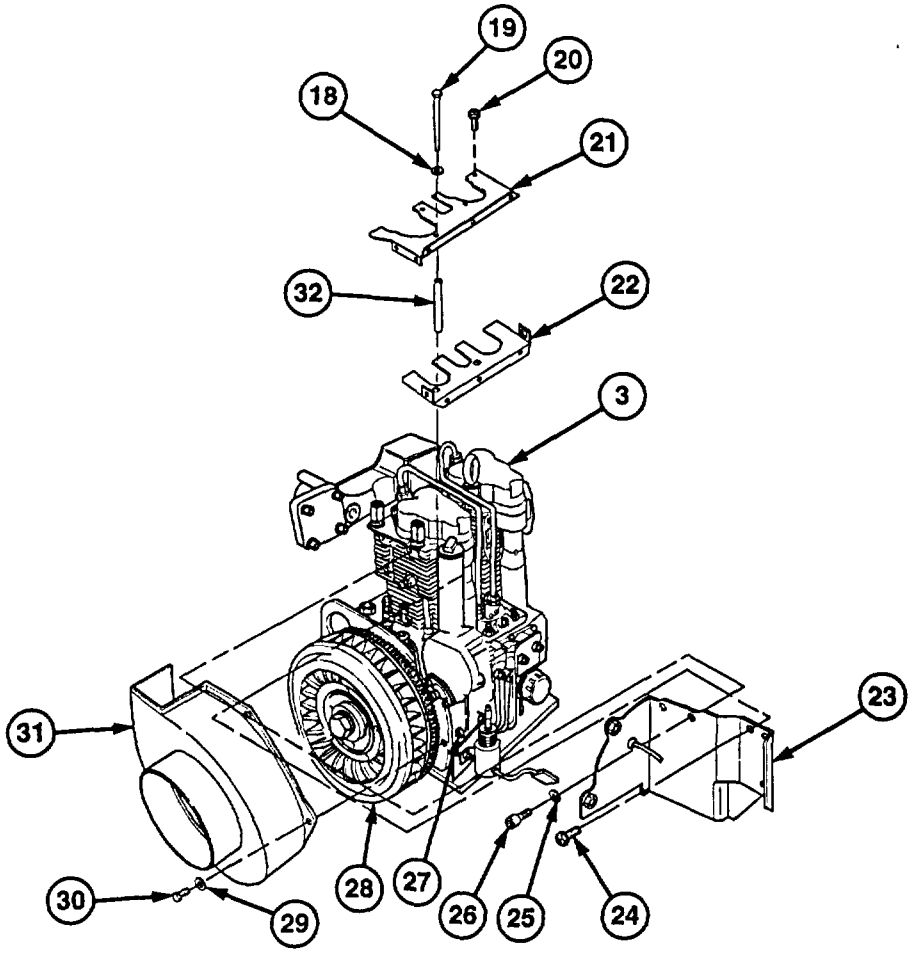
2-24. AIRFLOW DEFLECTORS REPLACEMENT (continued).

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 (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).

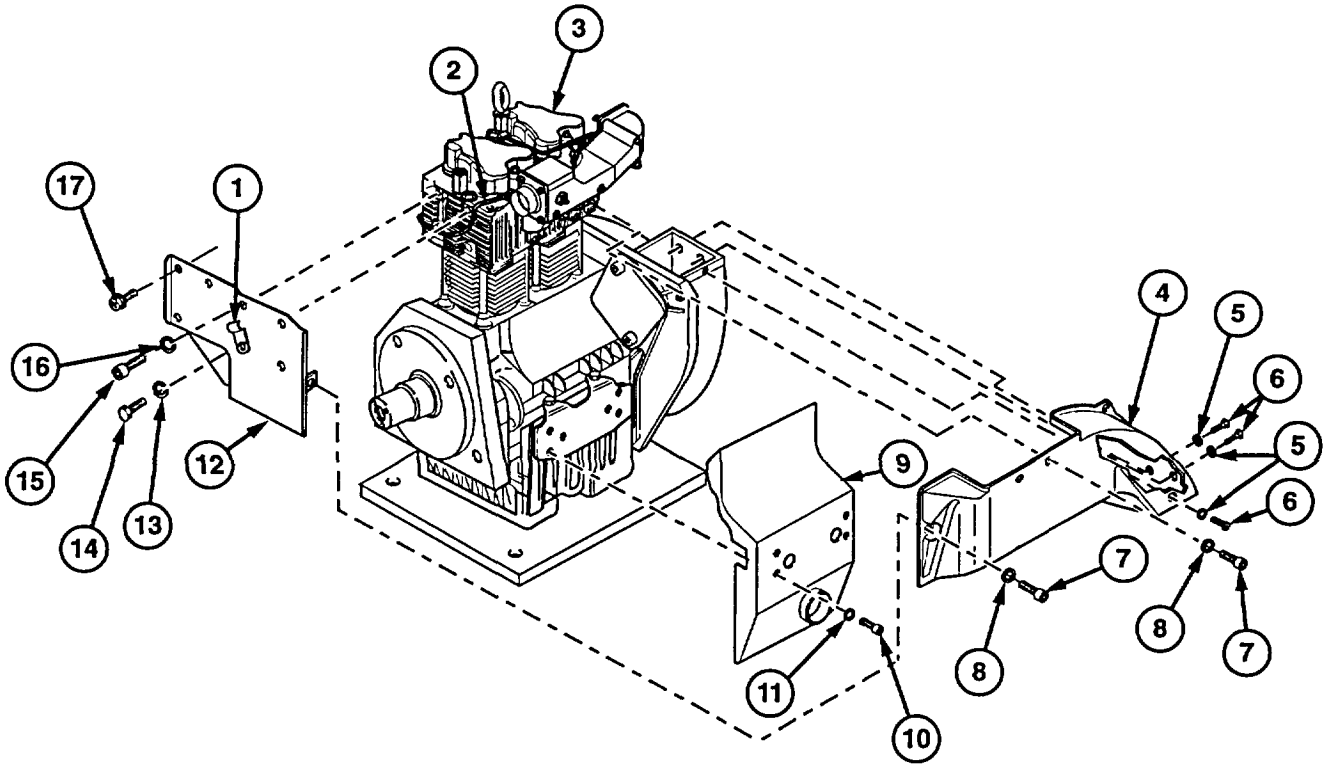
9. Install three screws (17) on air duct bracket (12).

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 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:
- Antiseize compound (Item 2, Appendix D)

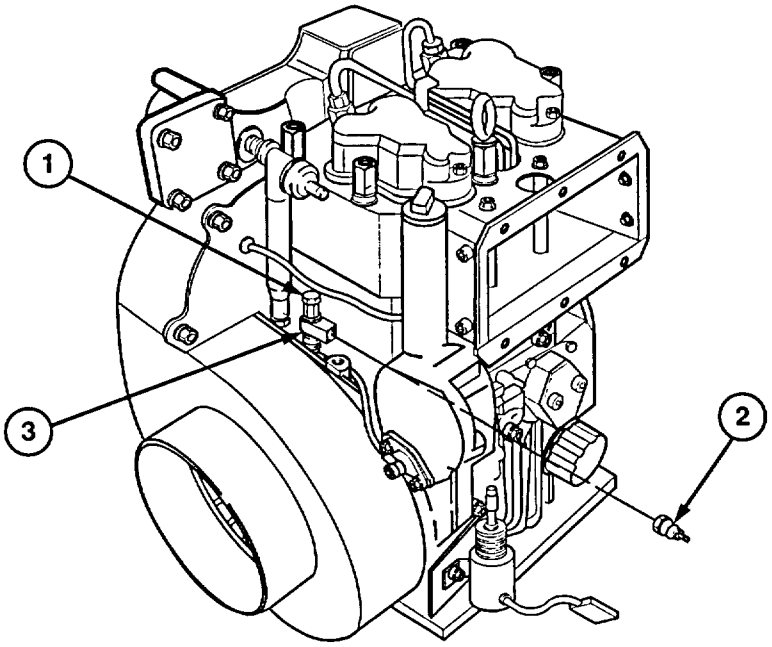
a. REMOVAL

NOTE

For easy access to oil switch, it may be necessary to loosen the screw (1) to turn manifold. Remove oil switch (2) from adapter (3).

b. INSTALLATION

Coat threads of oil switch (2) with antiseize compound. Install switch (2) on adapter (3).



FOLLOW-ON TASKS:
- None

2-26. THERMOSTATIC SWITCH REPLACEMENT.

This Task Covers:

a. Removal

b. Installation

Initial Setup:

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

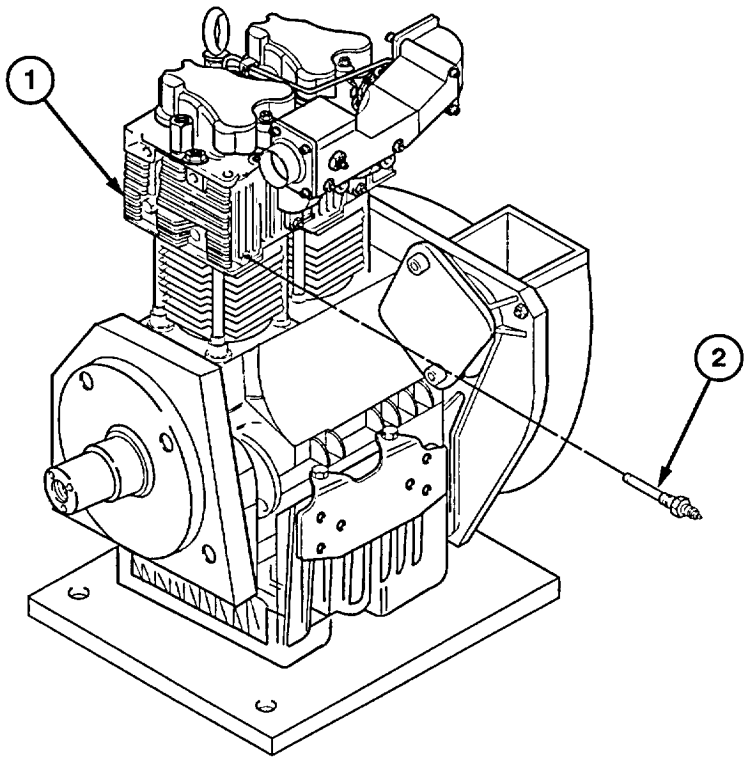
Equipment Conditions:
- Airflow deflectors removed as needed (para 2-24).

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.

2-27. SOLENOID REPLACEMENT AND ADJUSTMENT.

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)

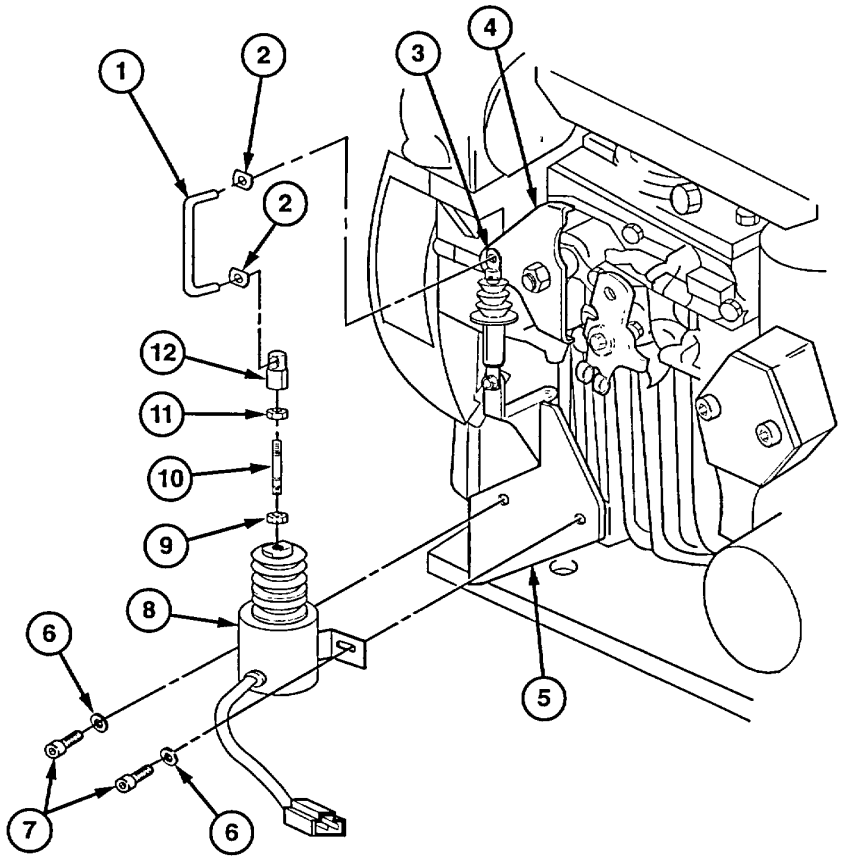
Materials/Parts:
- O-ring (Item 32, Appendix F)

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).

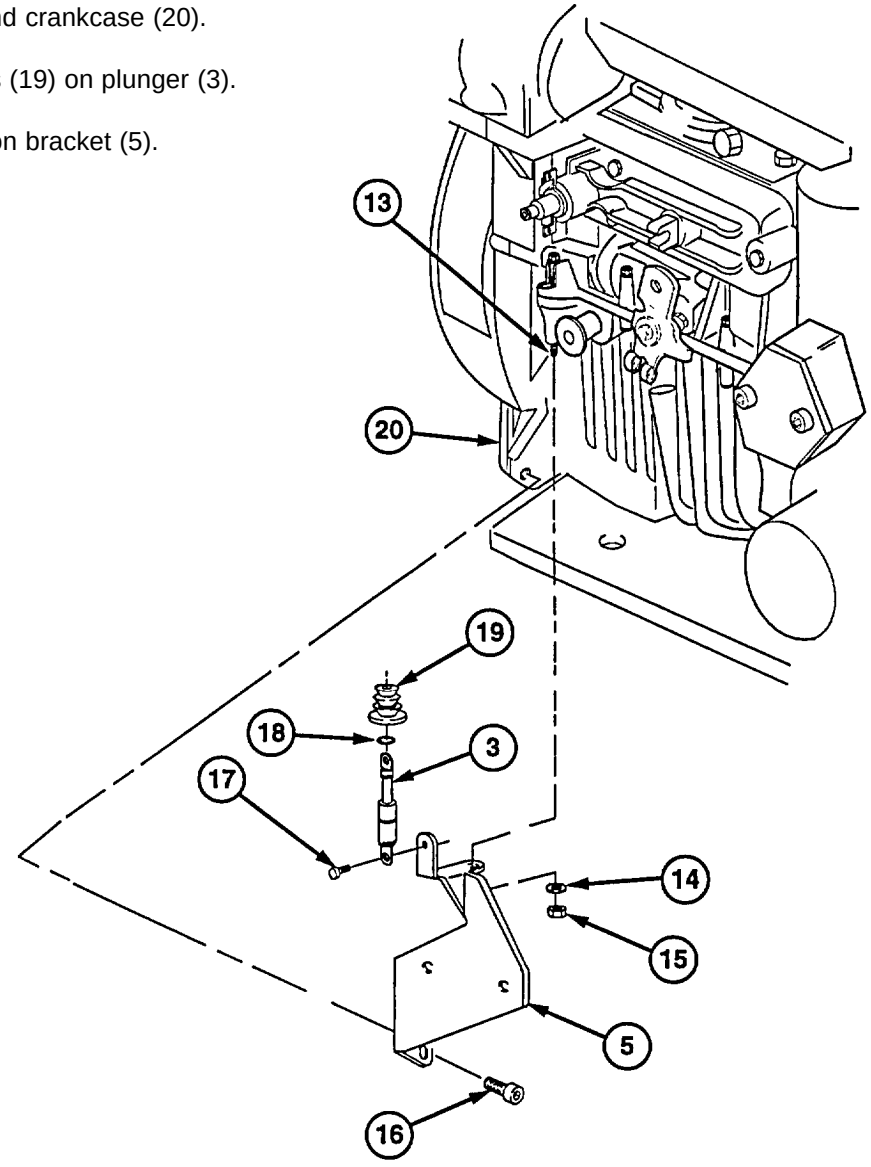


2-27. SOLENOID REPLACEMENT AND ADJUSTMENT (continued).

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).

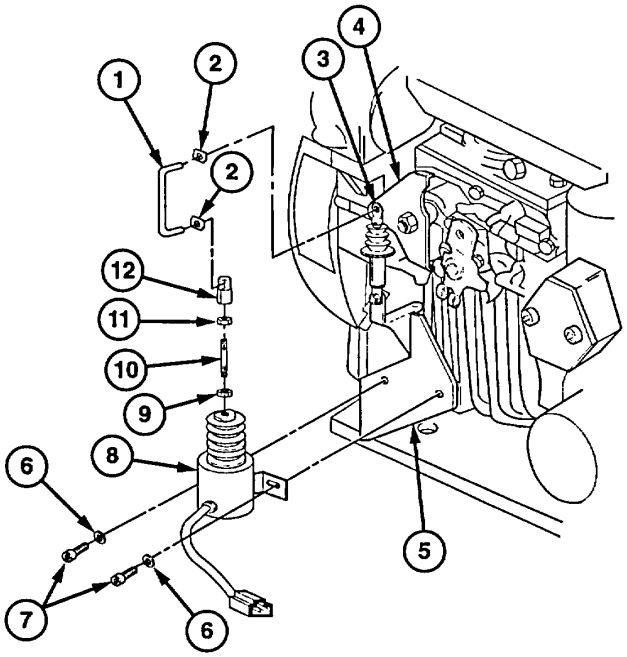


2-27. SOLENOID REPLACEMENT AND ADJUSTMENT (continued).

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).

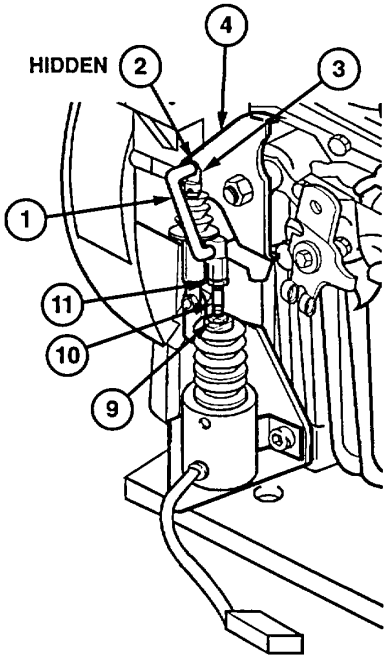
2. Remove top clip (2) from connecting link (1). Remove connecting link (1) from governor lever (4) and plunger (3).

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.

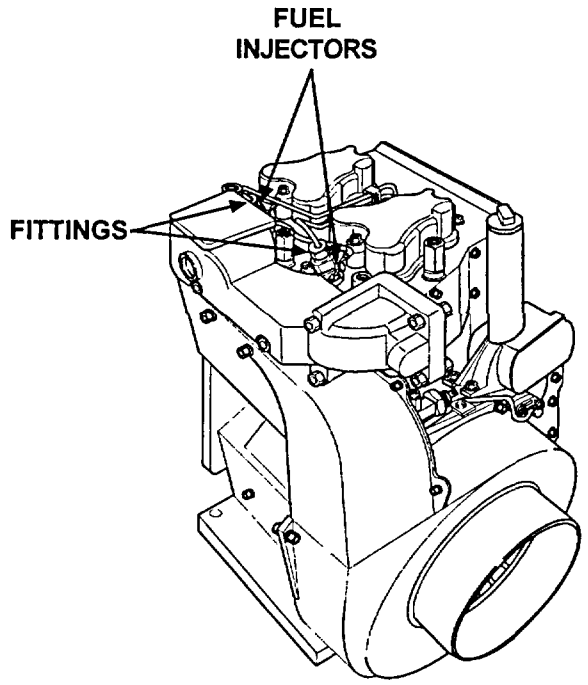
C. Perform injection pump test (para 3-20).

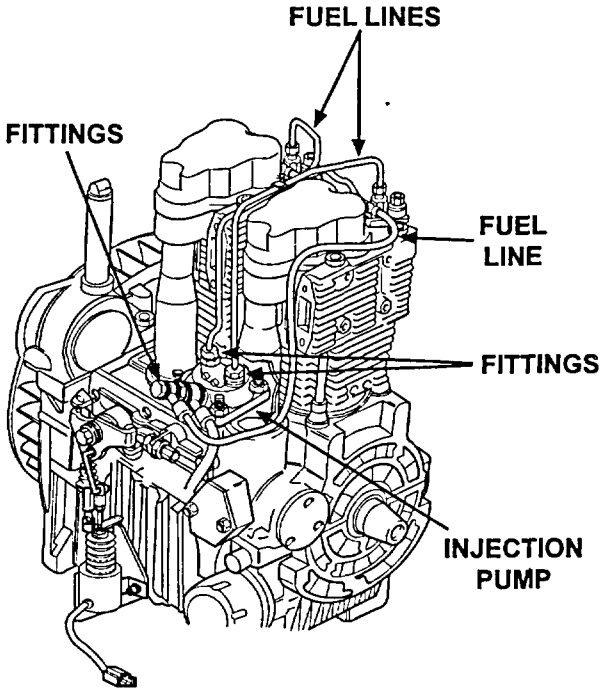
Does injection pump pass test?

NO — YES

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

GO TO STEP D

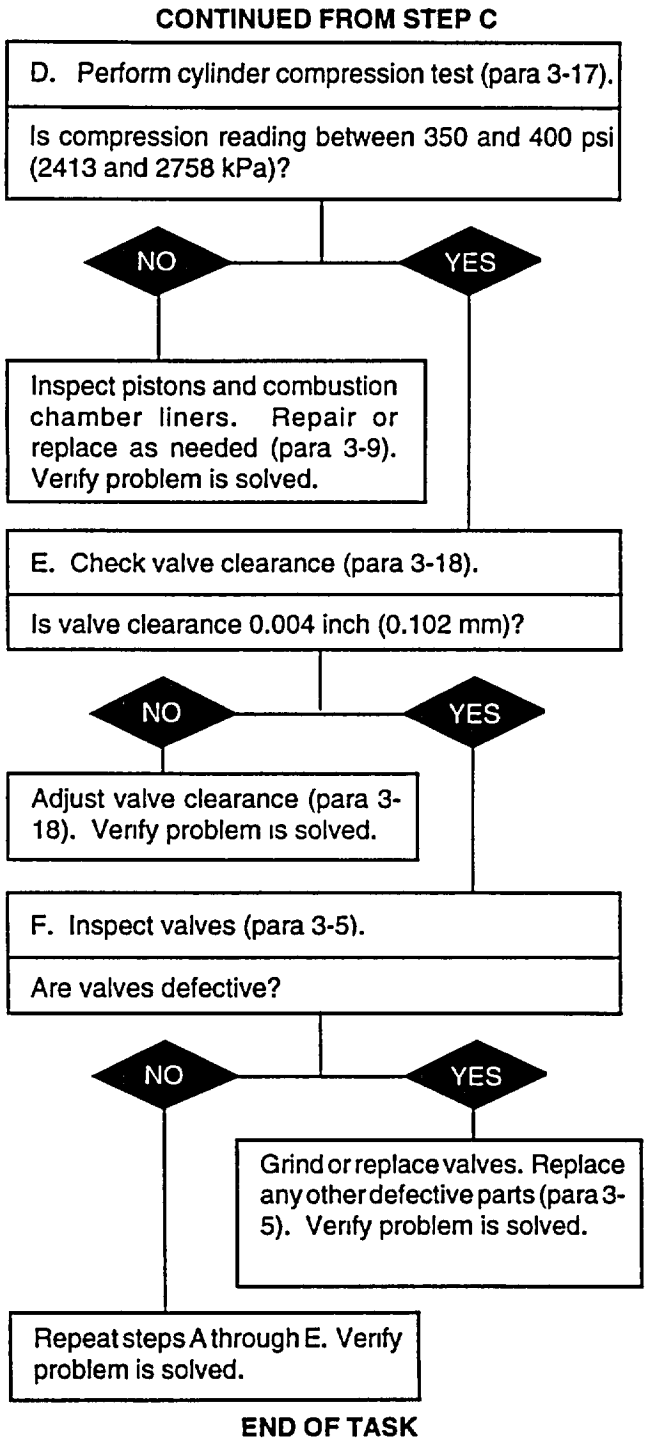




FOR PURPOSES OF CLARITY, AIRFLOW DEFLECTORS AND INTAKE MANIFOLD ARE NOT SHOWN.

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.

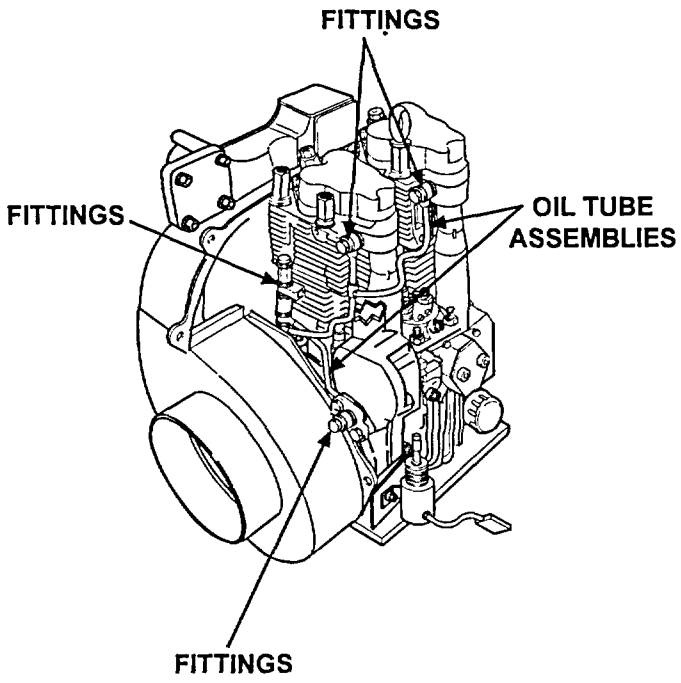
C. Check thermostatic switch for continuity by placing red lead of multimeter on connector of switch and grounding black lead.

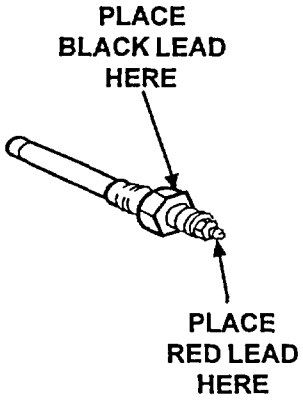
Is there continuity?

NO — YES

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

GO TO STEP D



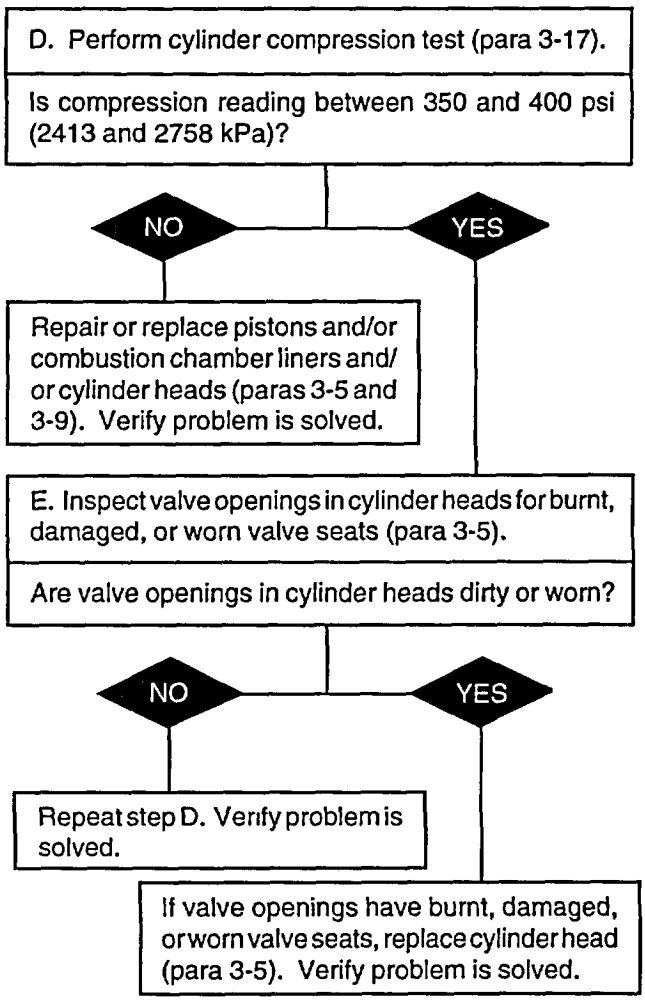


3-3. TROUBLESHOOTING CHART (continued).

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

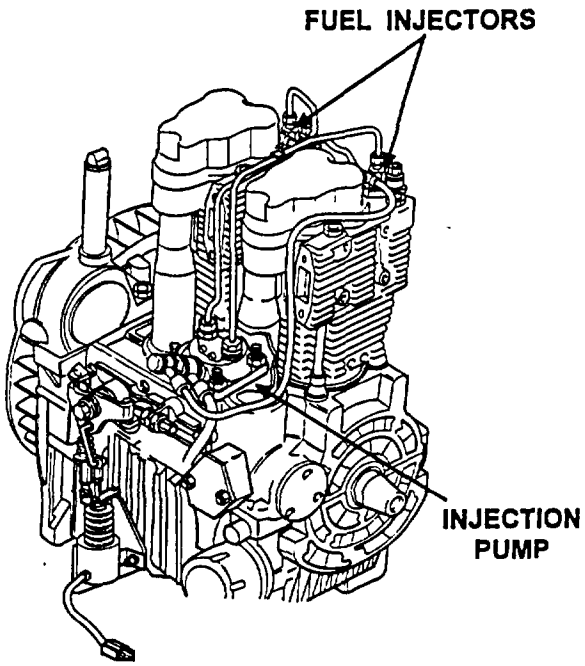
D. Inspect valves and valve seats (para 3-5).

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).

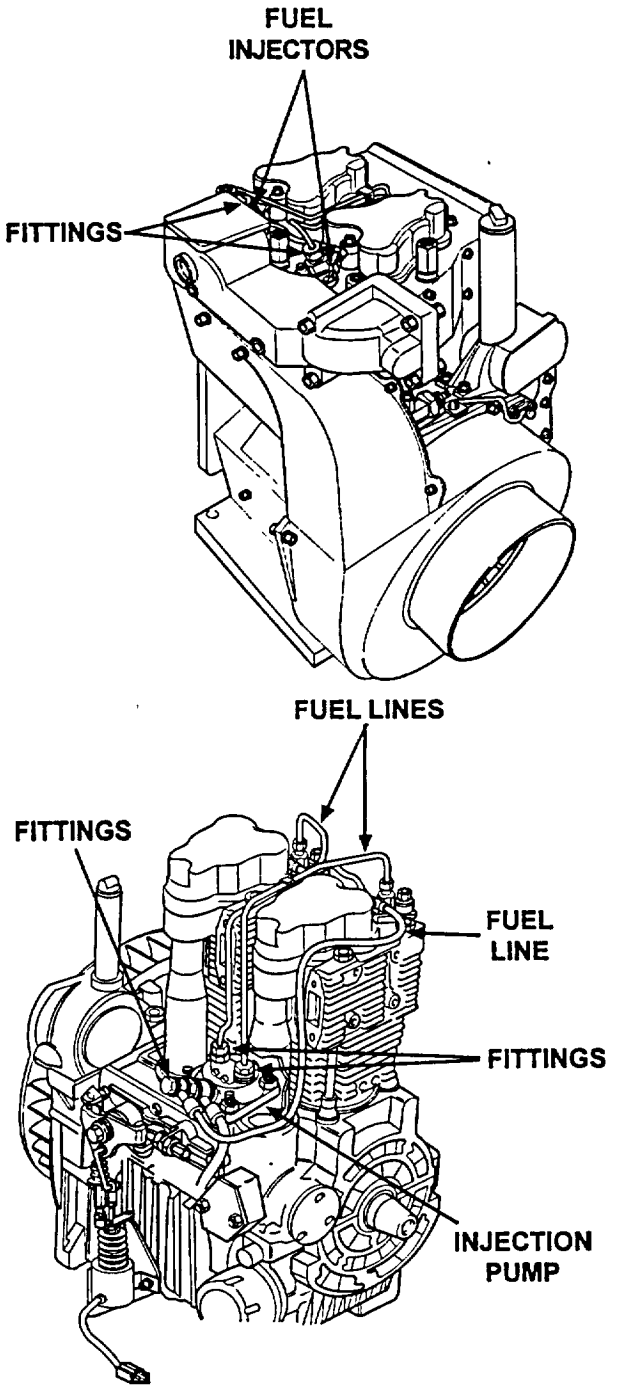
Is compression reading between 350 and 400 psi (2413 and 2758 kPa)?

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).

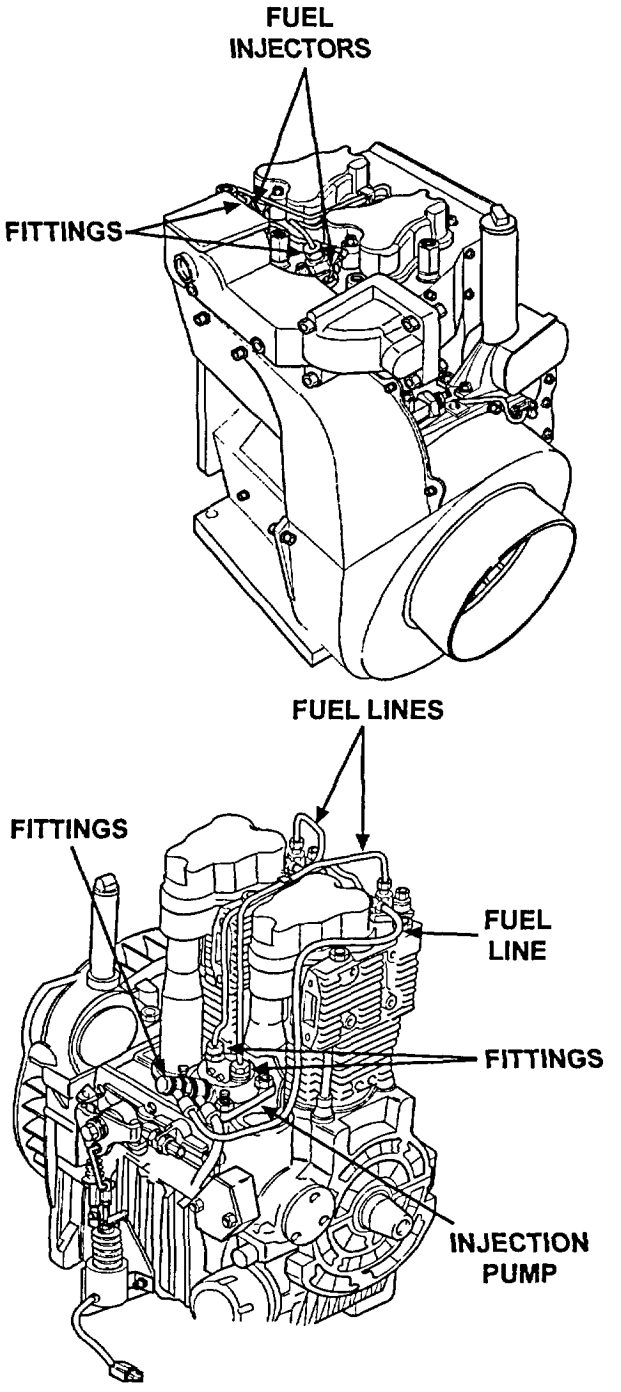
Does injection pump pass test?

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.

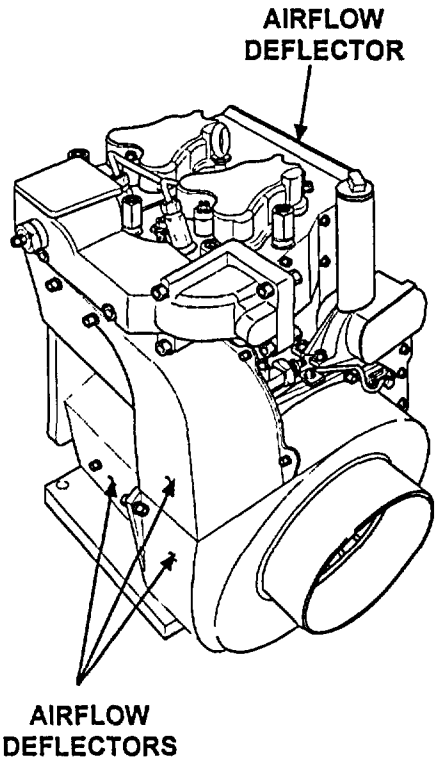
Is knocking sound coming from crankcase?

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).

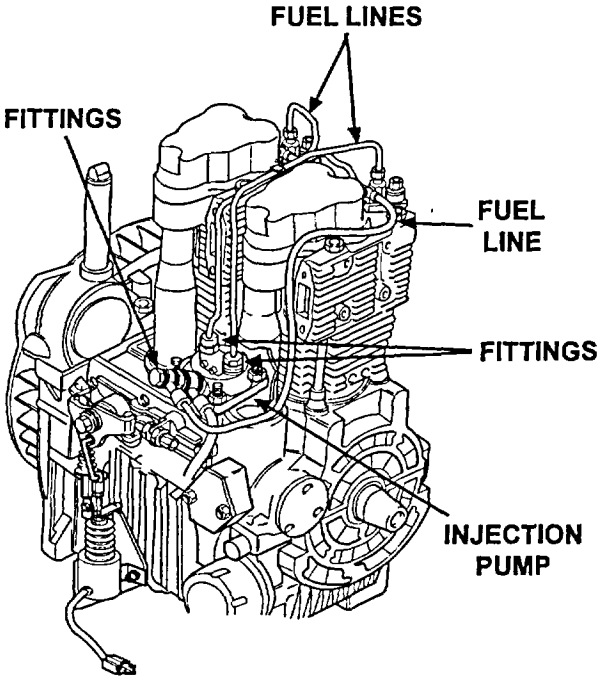
Is governor speed 2200±50 rpm?

NO — YES

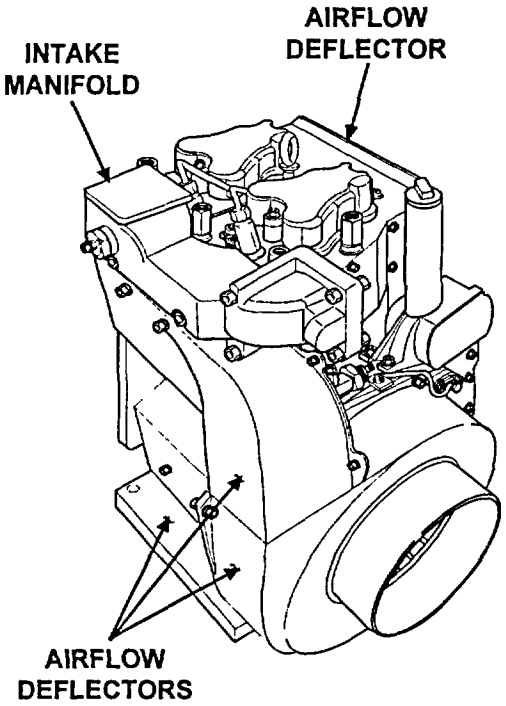
Adjust governor speed (para 3-22). Verify problem is solved.

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)

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.

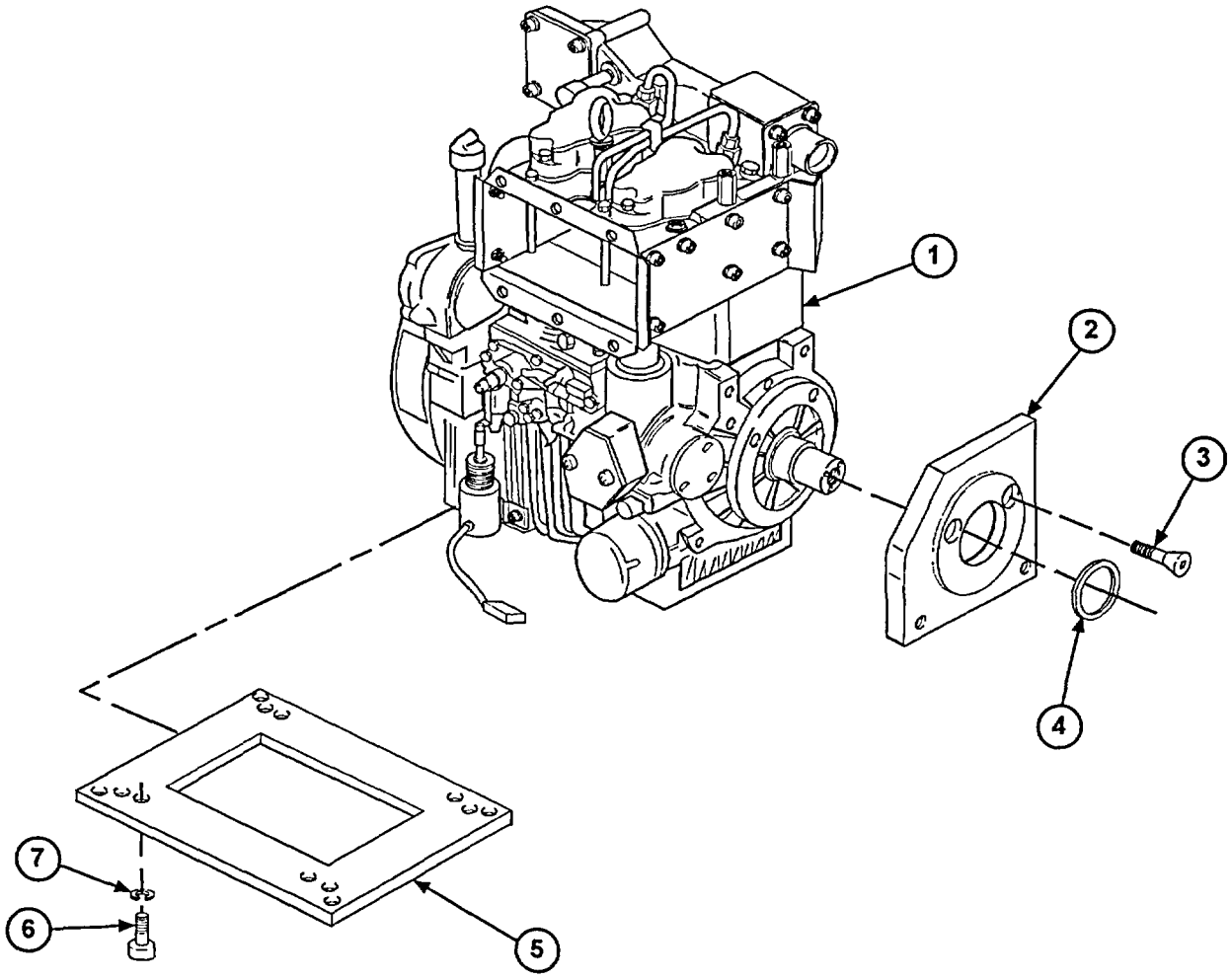
3-4. MOUNTING PLATES REPLACEMENT (continued).

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 lip facing inward.

2. Apply sealing compound (Item 10, Appendix D) to inside surface of mounting plate (2) that will come in contact with crankcase (1).

CAUTION

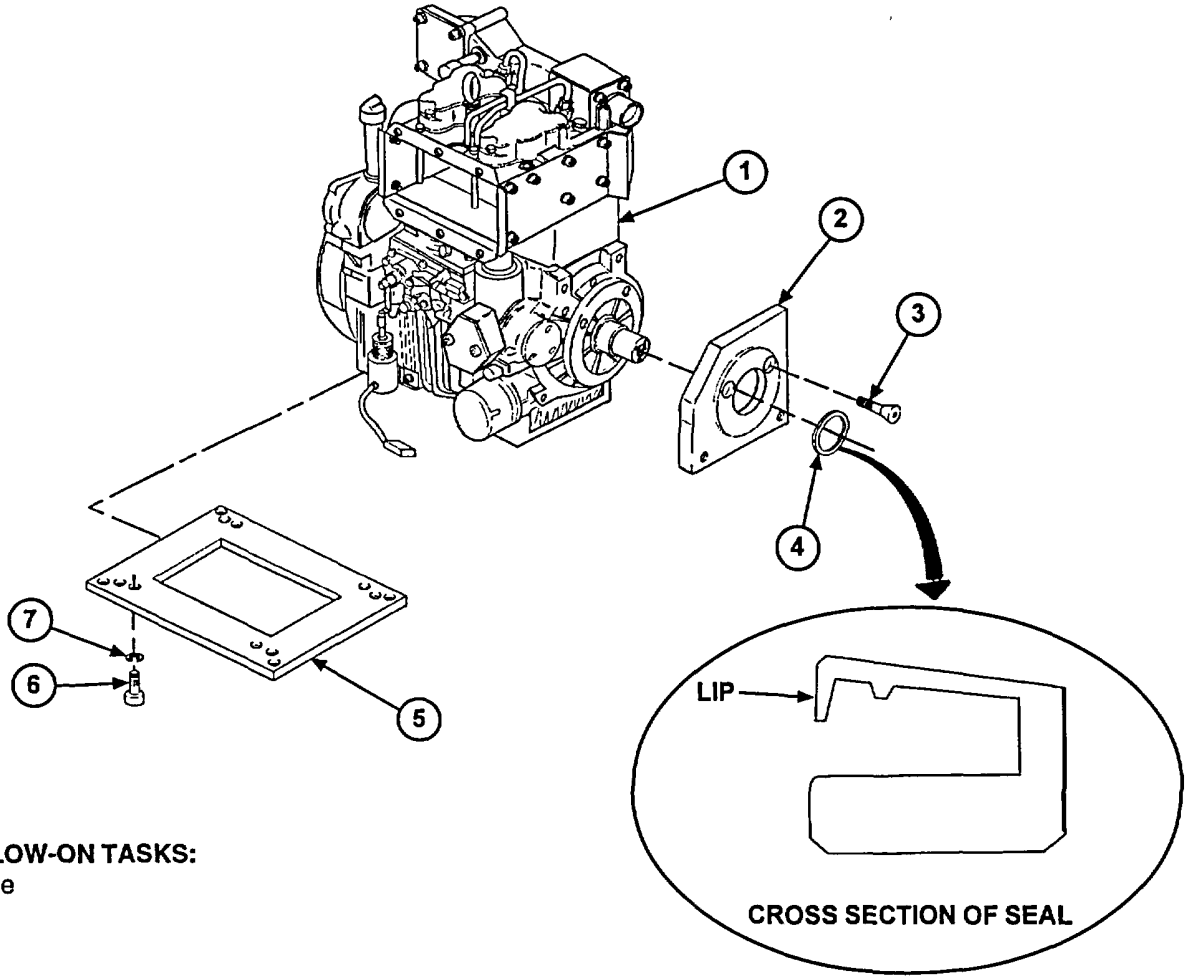
Use extreme caution not to damage new seal when installing mounting plate on crankcase.

3. Install mounting plate (2) on crankcase (1) and secure with four screws (3).

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).



FOLLOW-ON TASKS:
• None

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)

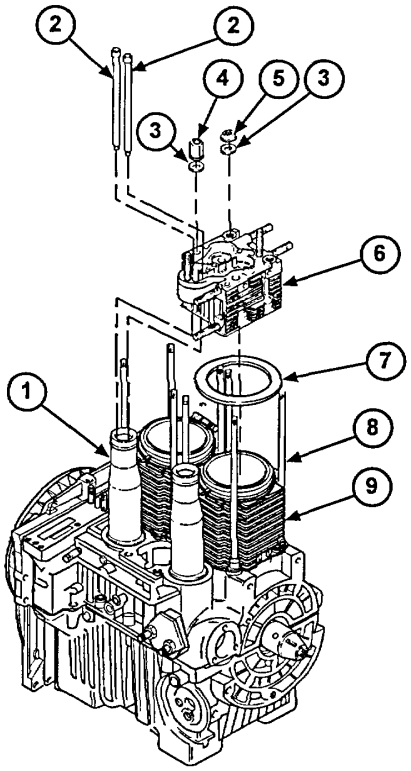
Equipment Conditions:
- Eyebolt removed (para 2-16).
- Rocker arm assemblies removed (para 3-10).
- Airflow deflectors removed (para 2-24).
- Intake manifold removed (para 2-21).
- Fuel injectors removed (para 3-14).
- Oil tube assemblies removed (para 2-19).
- Thermostatic switch removed (para 2-26).

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).

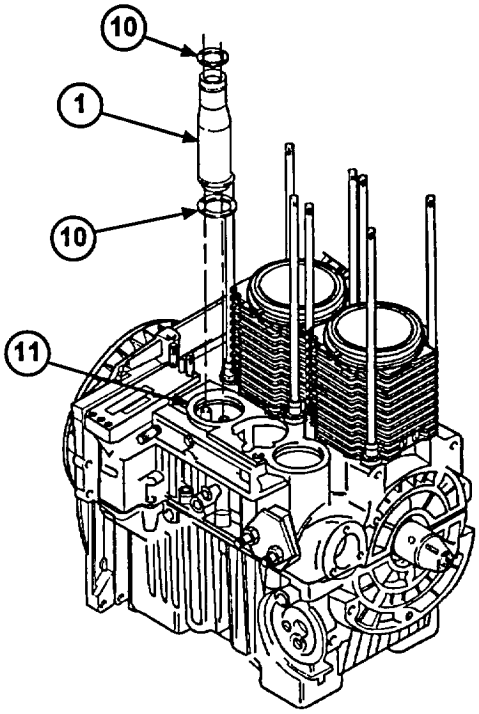
3. Remove two cylinder heads (6) and gaskets (7) from two combustion chamber liners (9). Discard gaskets.



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

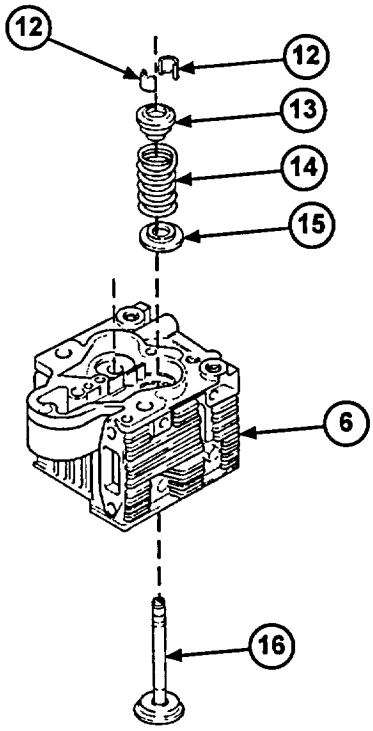
1. Inspect four push rods for bends or wear on four sockets at ends of push rods. Replace any push rods if bent or if sockets are worn.

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

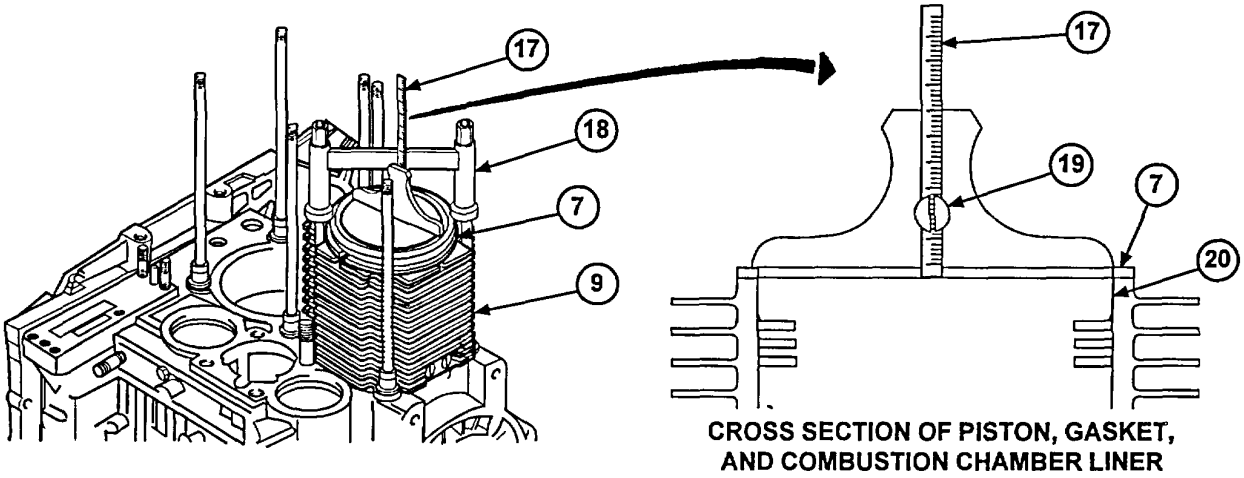
If, after removing the cylinder head, you have replaced the combustion chamber liner, piston, connecting rod, or crankshaft, the valve-to-piston clearance must be checked.

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).

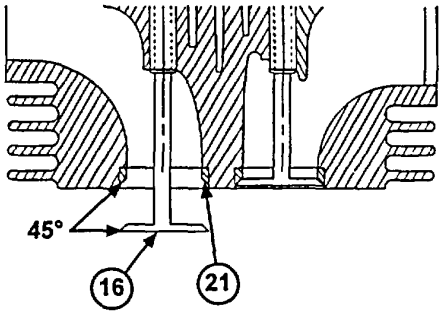
3. If clearance is incorrect, repeat steps 1 and 2 using a gasket with a different thickness.

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

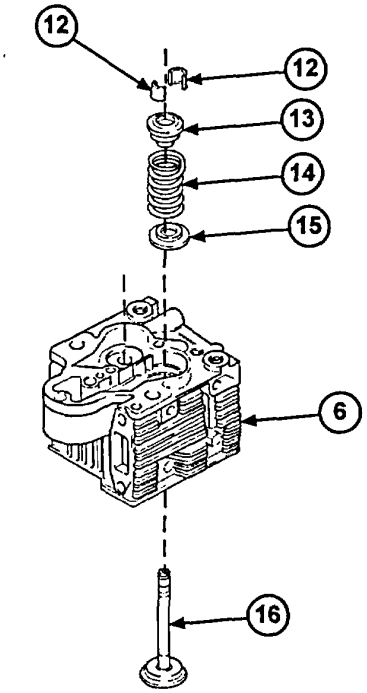
- **There are two valves, intake and exhaust, in each of two cylinder heads. Follow steps 1 and 2 for each of them.**
- **Part numbers are different for the intake and exhaust valves, but the valves are installed the same way. This procedure describes the installation of an exhaust valve.**

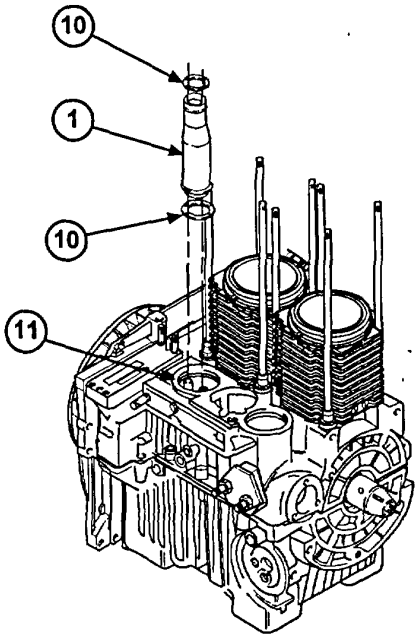
1. Install exhaust valve (16) in cylinder head (6). Place base spring washer (15) over exhaust valve (16). Install valve spring (14) over exhaust valve (16) so it is seated on base spring washer (15). Place valve spring retainer washer (13) on valve spring (14).

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).

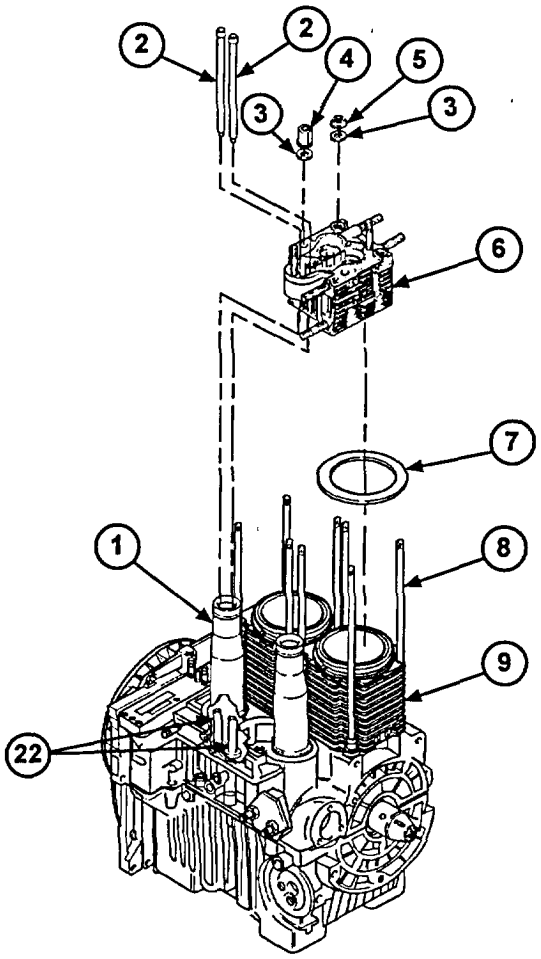




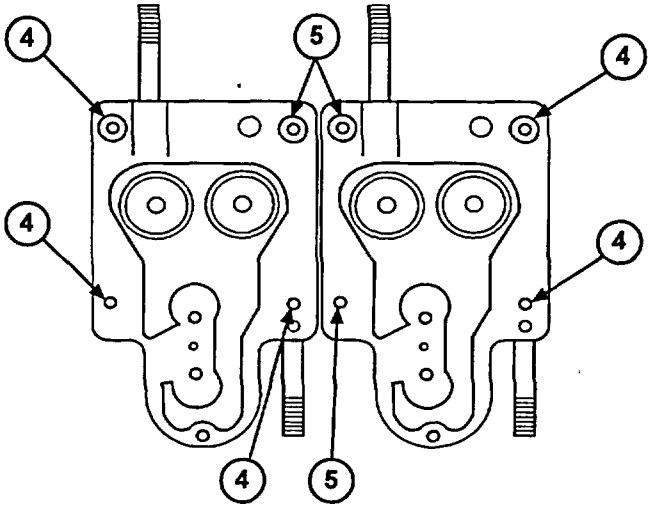
3-5. CYLINDER HEADS REPAIR (continued).

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 oil tube assemblies (para 2-19).
- Install fuel injectors (para 3-14).
- Install intake manifold (para 2-21).
- Install airflow deflectors(para 2-24).
- Install rocker arm assemblies (para 3-10).
- Install eyebolt (para 2-16).

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)

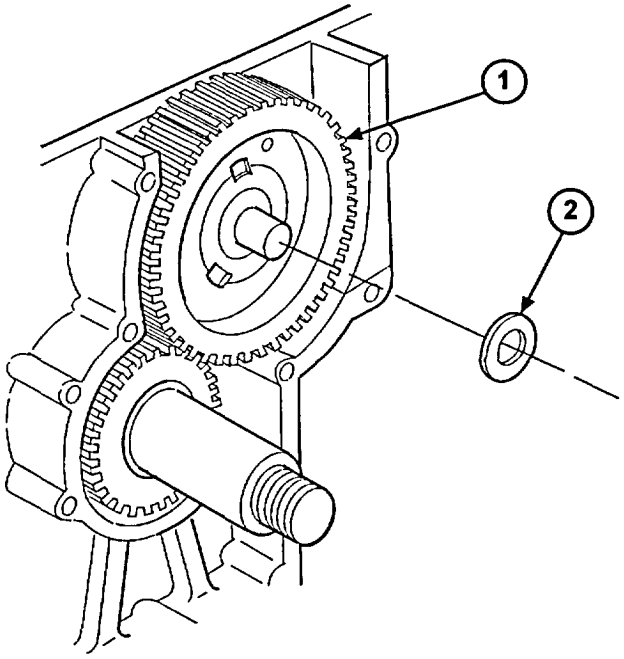
Materials/Parts:
- Grease, automotive (Item 5, Appendix D)
- Lubricating oil (Item 6, Appendix D)
- Sealing compound (Item 10, Appendix D)
- Crankcase gasket set (Item 1, Appendix F)
- Shim (Item 5 or 6, Appendix F)
- Spring tension washer (2) (Item 31, Appendix F)

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.

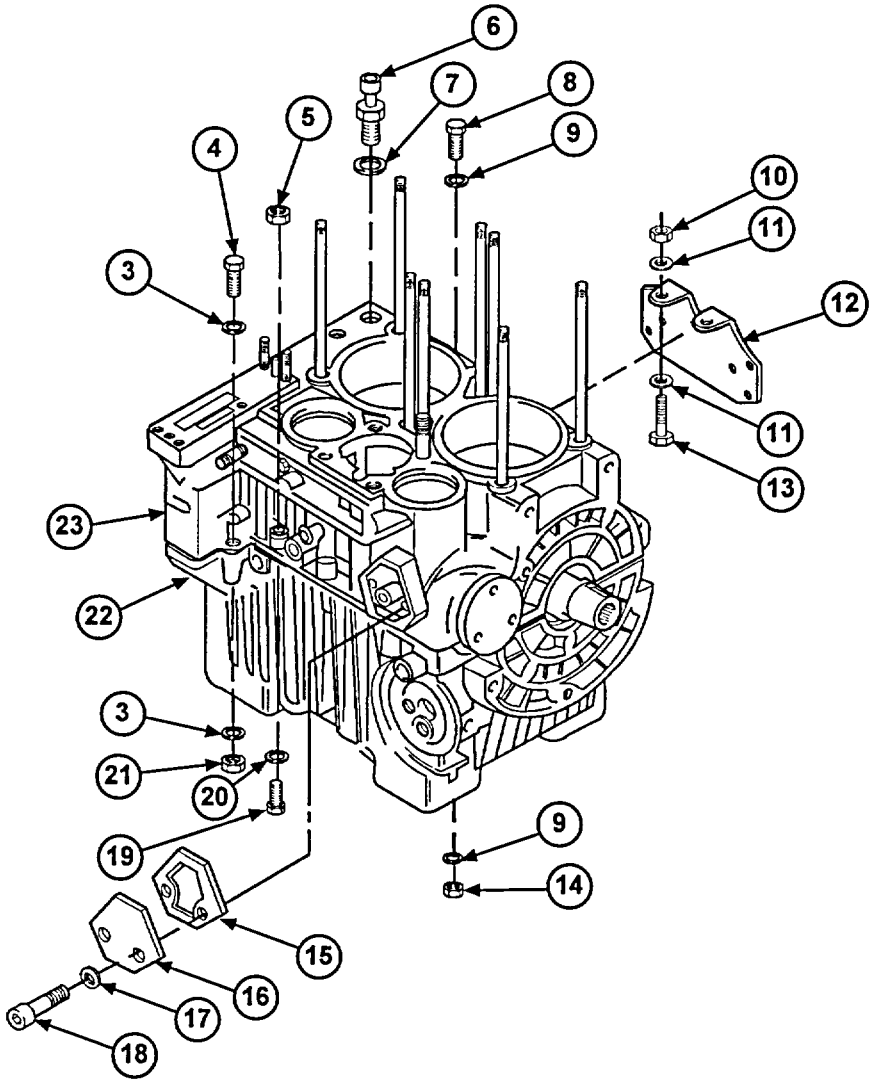
3-6. CRANKCASE REPAIR (continued).

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).



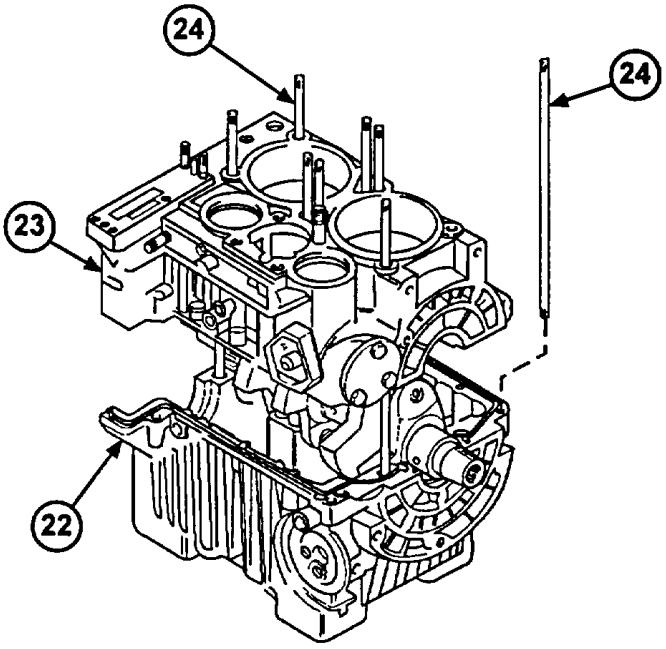
3-6. CRANKCASE REPAIR (continued).

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.

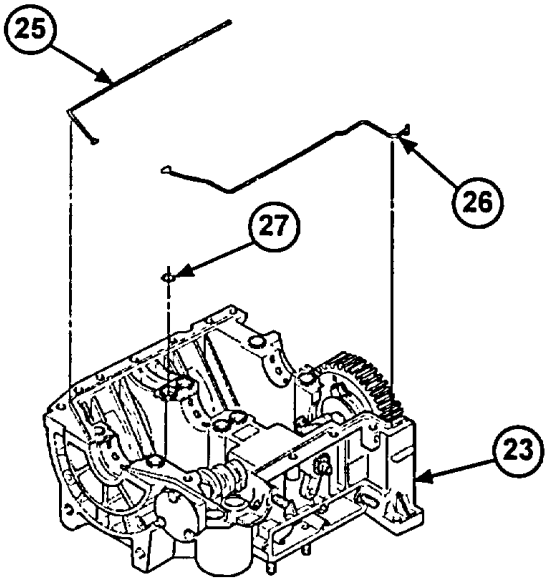
11. Remove eight O-rings (27) from eight grooves in upper crankcase (23). Discard O-rings.

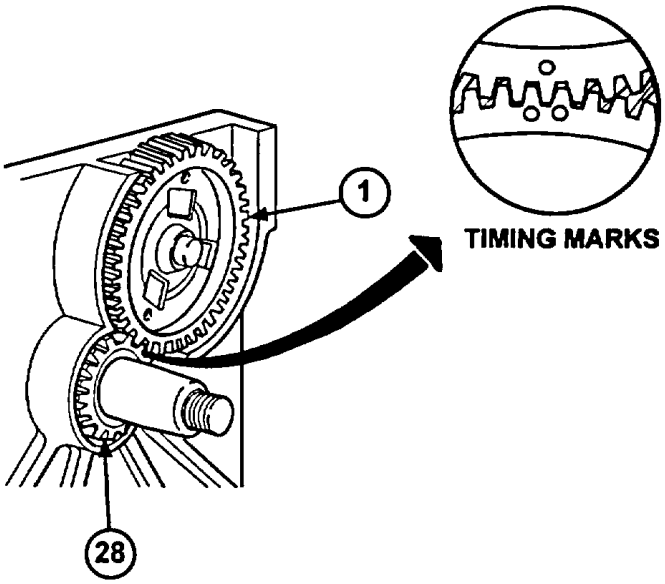


b. ASSEMBLY

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. 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.

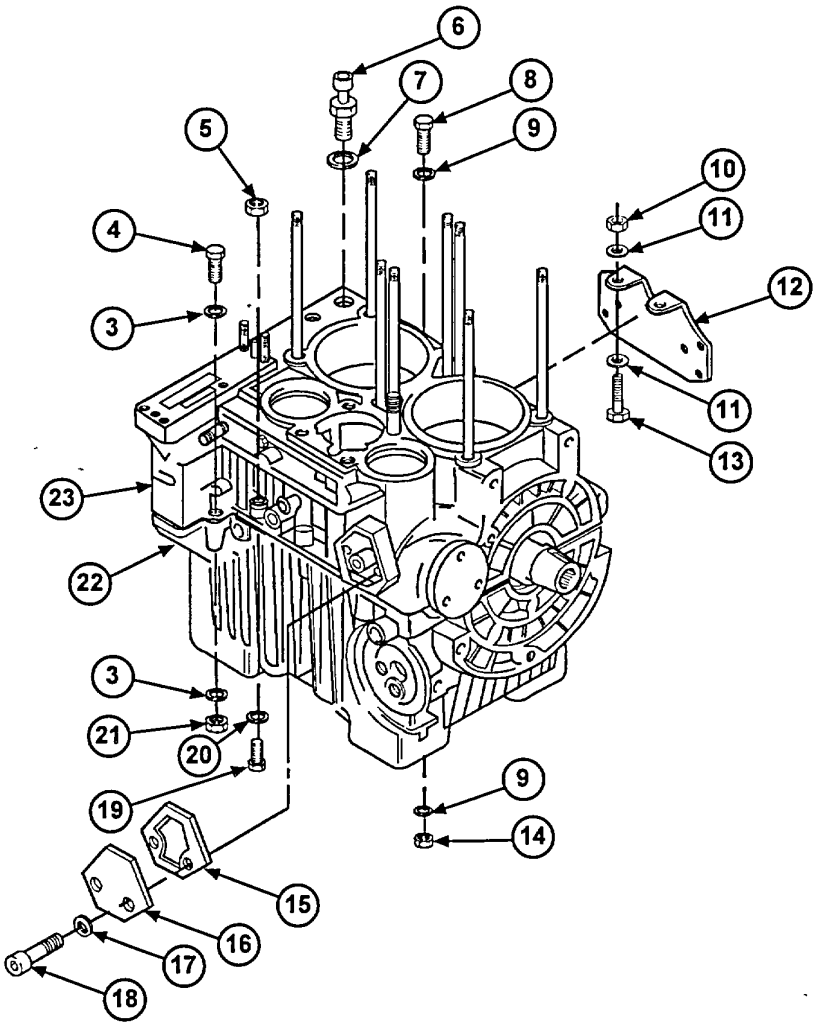
7. Install three screws (19), washers (20), and nuts (5) loosely securing upper crankcase (23) to lower crankcase (22) on injection-pump side of engine.

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).



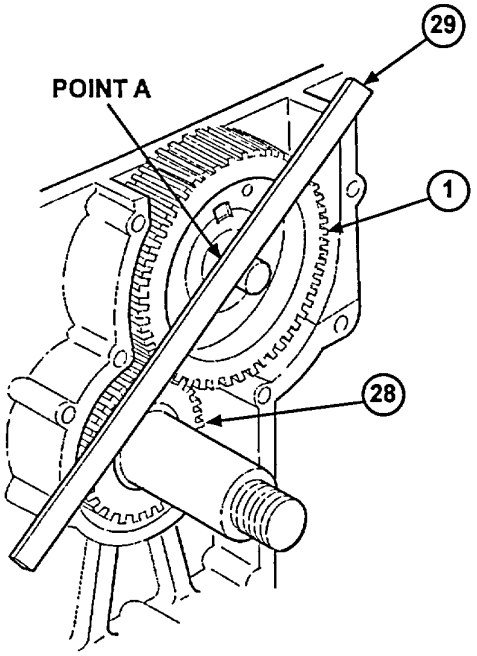
3-6. CRANKCASE REPAIR (continued).

c. TEST

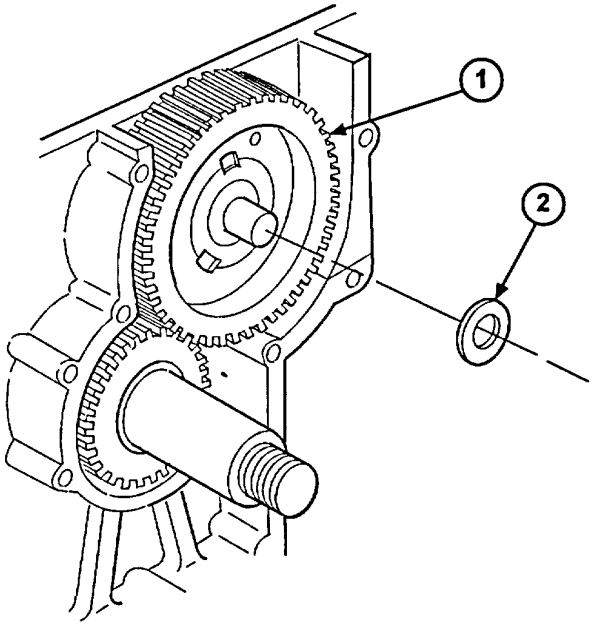
NOTE

- **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.

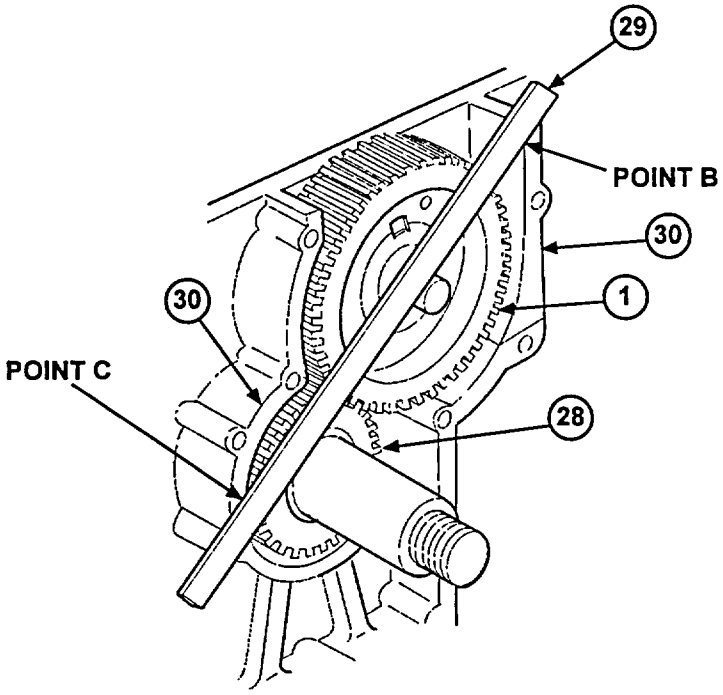


3-6. CRANKCASE REPAIR (continued).

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.

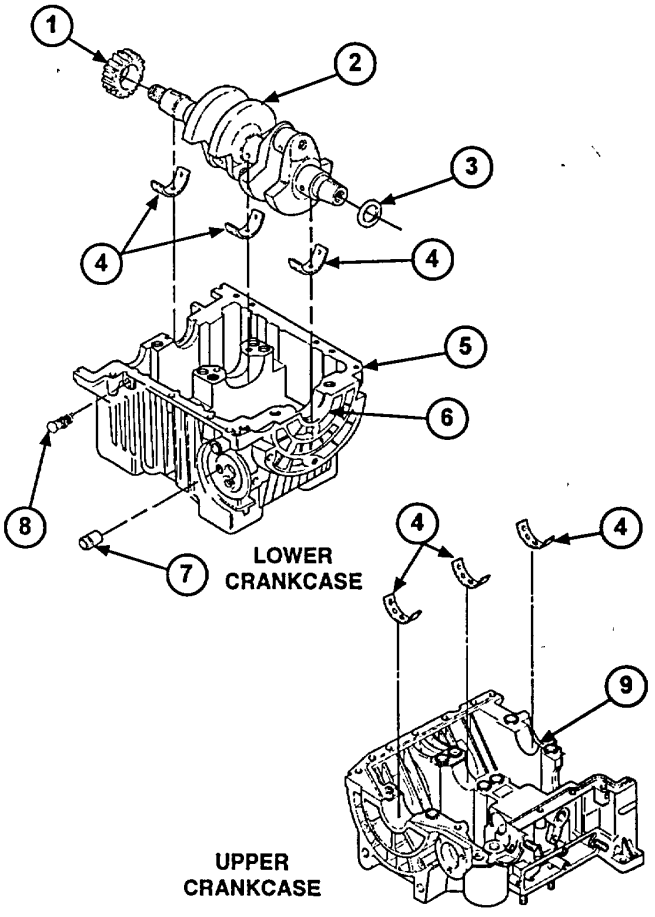
2. Remove crankshaft (2) from lower crankcase (5).

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).



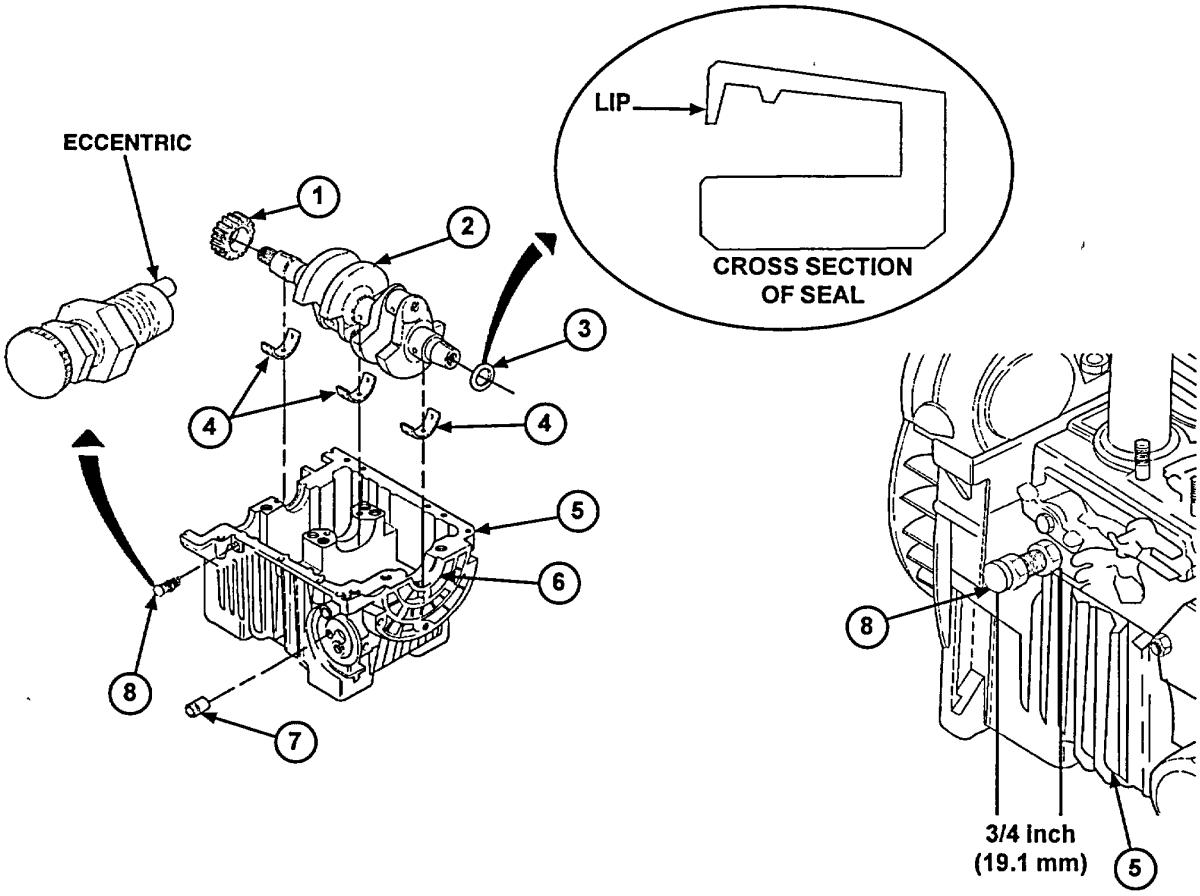
3-7. CRANKSHAFT AND BEARINGS REPAIR (continued).

b. INSPECTION

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

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).
3. Apply sealing compound 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. 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, AUXILIARY DRIVE HARDWARE, AND FLYWHEEL HOUSING REPLACEMENT.

This Task Covers:

a. Removal

b. Installation

Initial Setup:

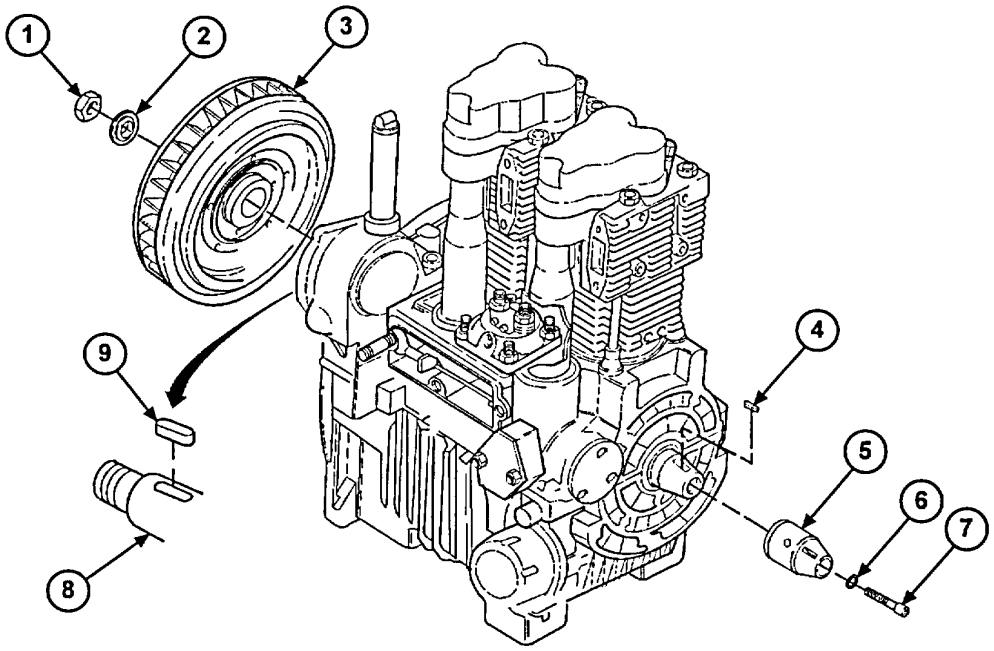
Tools/Test Equipment:
- General mechanic's tool kit, automotive (Item 15, Appendix G)
- Mechanical gear and bearing puller kit (Item 17, Appendix G)
- Torque wrench, 1/2-inch drive (Item 31, Appendix G)

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 (para 2-24).

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).
4. Remove screw (7), spring tension washer (6), adapter (5), and key (4) from auxiliary drive end of crankshaft (8). Discard spring tension washer.



3-8. FLYWHEEL, AUXILIARY DRIVE HARDWARE, AND FLYWHEEL HOUSING REPLACEMENT (continued).

5. 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.

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

NOTE

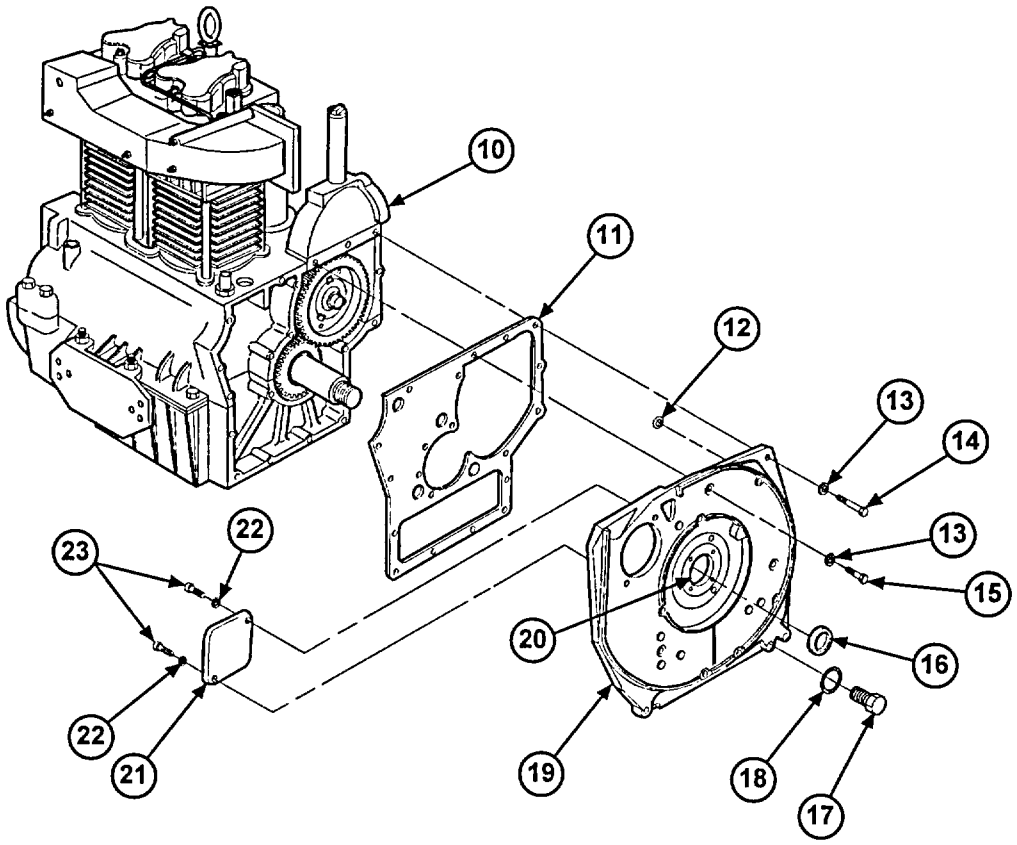
There may be one or two gaskets on flywheel housing. Remove all of them, and note how many gaskets are removed from flywheel housing.

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

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

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

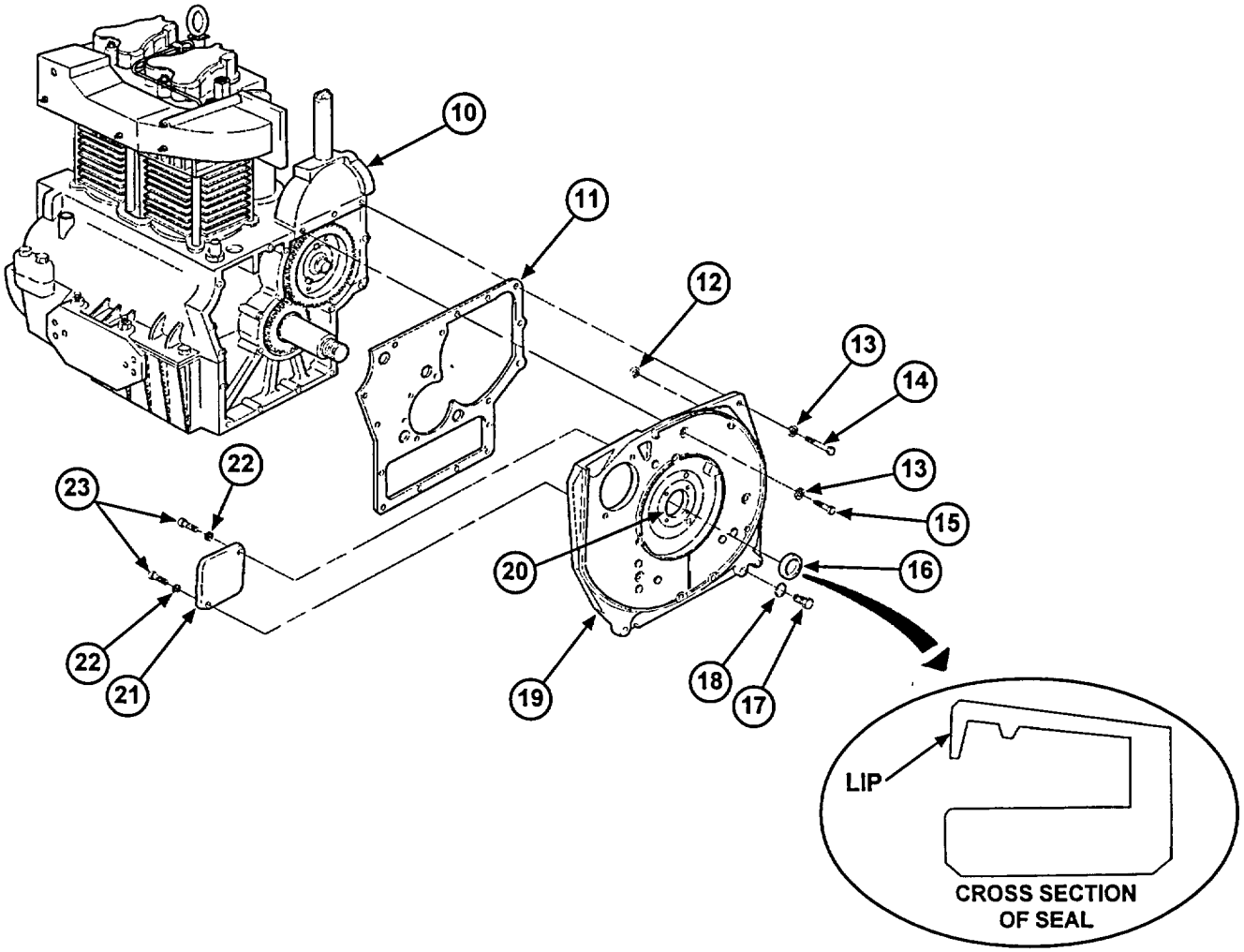
10. Remove two screws (23) and washers (22) and plate (21) from flywheel housing (19).



3-8. FLYWHEEL, AUXILIARY DRIVE HARDWARE, AND FLYWHEEL HOUSING REPLACEMENT (continued).

b. INSTALLATION

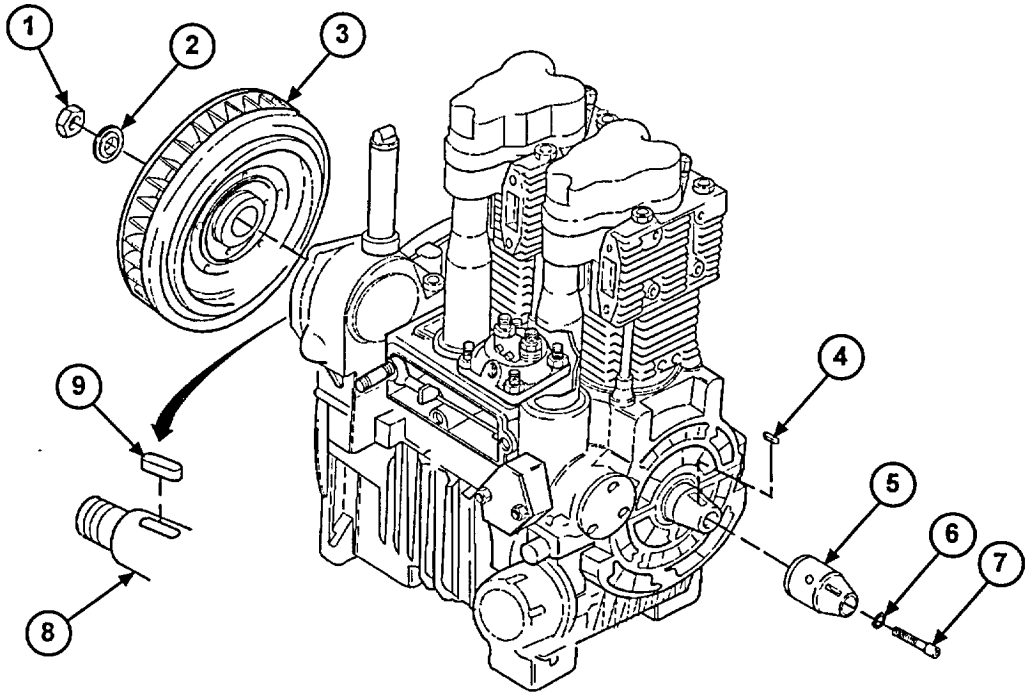
1. Install two screws (23) and washers (22) and plate (21) on flywheel housing (19).
2. Install new seal (16) in crankshaft opening (20), with lip of seal (16) facing inward.
3. Install new O-ring (12) on flywheel housing (19).
3. Depending on the number removed, install one or two new gaskets (11) on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



3-8. FLYWHEEL, AUXILIARY DRIVE HARDWARE, AND FLYWHEEL HOUSING REPLACEMENT (continued).

6. 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).

7. Install key (4), adapter (5), new spring tension washer (6), and screw (7) on auxiliary drive end of crankshaft (8). Torque screw to 37 ft-lb (50 N•m).



FOLLOW-ON TASKS:

- Install airflow deflectors (para 2-24).
- 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:

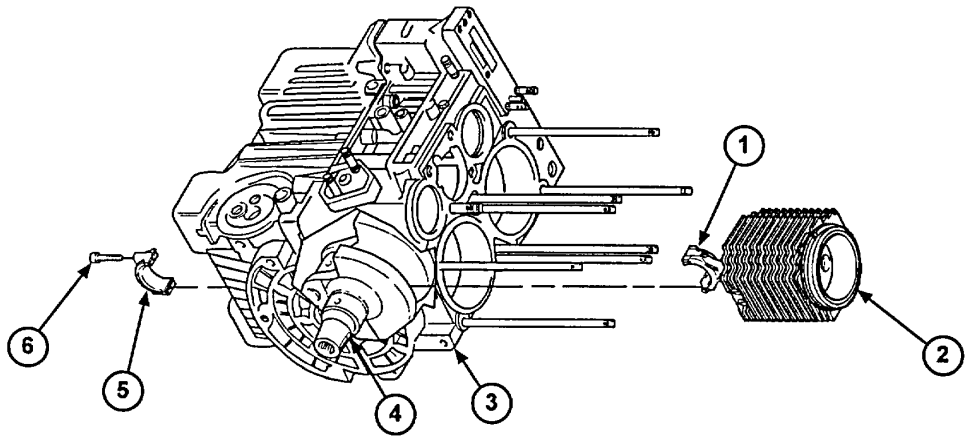
Equipment Conditions:
- Cylinder heads removed (para 3-5).
- Engine placed on side.
- Oil pan removed (para 3-13).

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

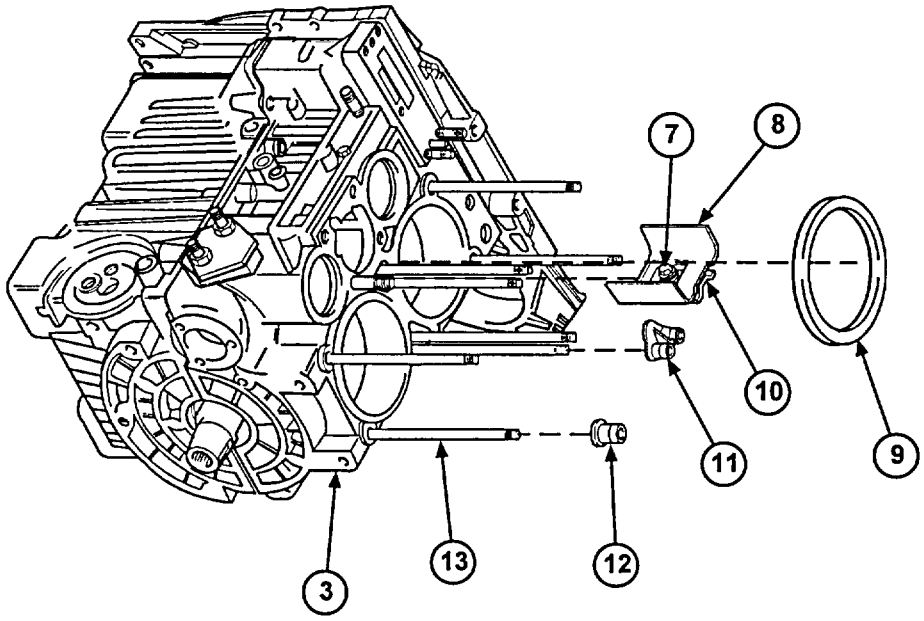
Each connecting rod and connecting rod cap is stamped with a number, and each also has a notch on one side. Each connecting rod cap must be installed on the connecting rod stamped with the same number and with the notches on the same side.

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).

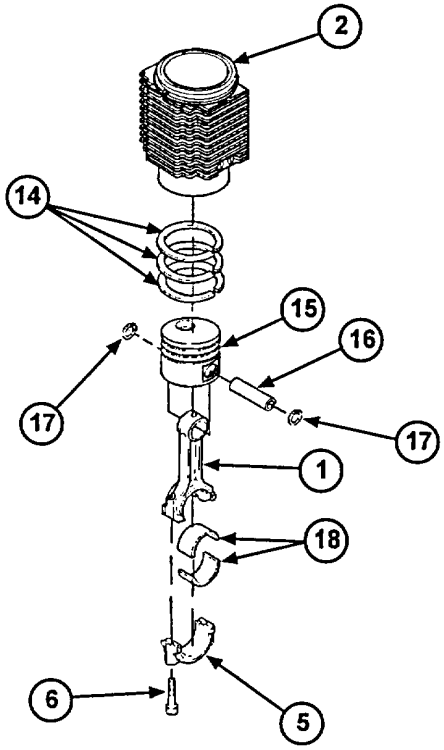
2. Remove three piston rings (14) from each of two pistons (15). Discard piston rings.

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.

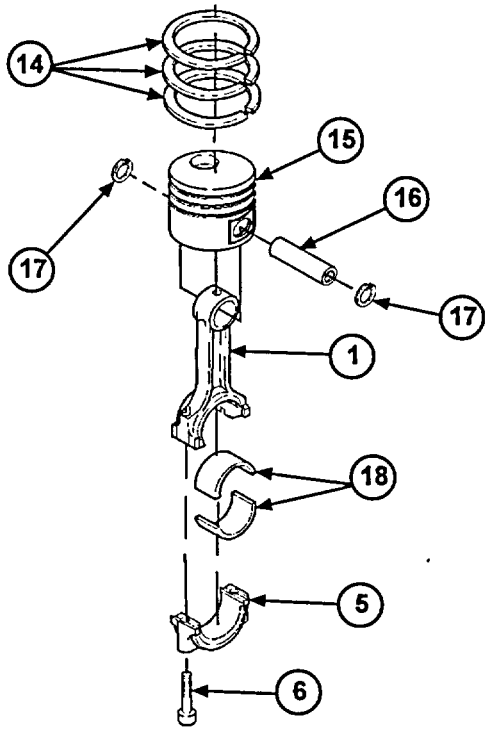
3-9. PISTON AND COMBUSTION CHAMBER LINER REPAIR (continued).

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.

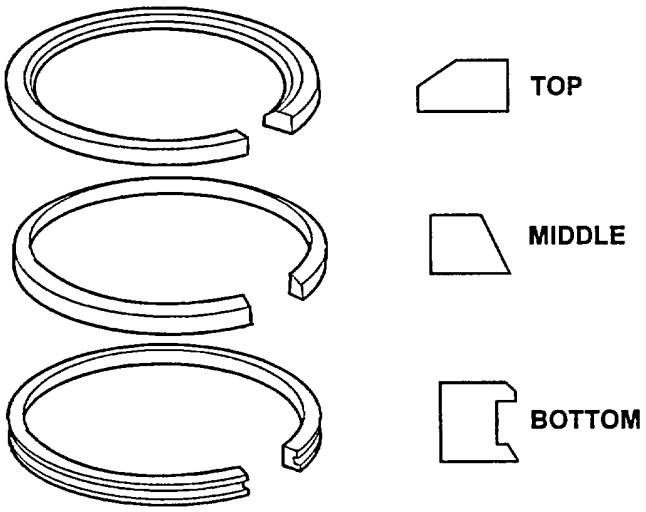
1. If piston (15) is being replaced, place piston (15) on connecting rod (1) with pocket in piston (15) facing the same direction as notches in connecting rod (1). Install piston pin (16) in piston (15) and connecting rod (1) and secure with two new retaining rings (17). Repeat for other piston, if necessary.



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.



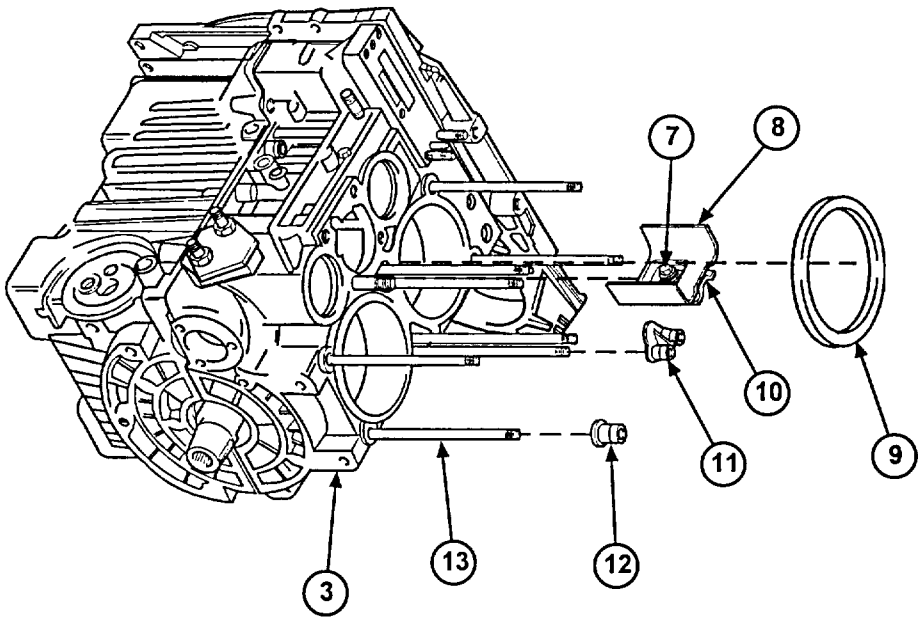
PLACEMENT OF PISTON RINGS

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.

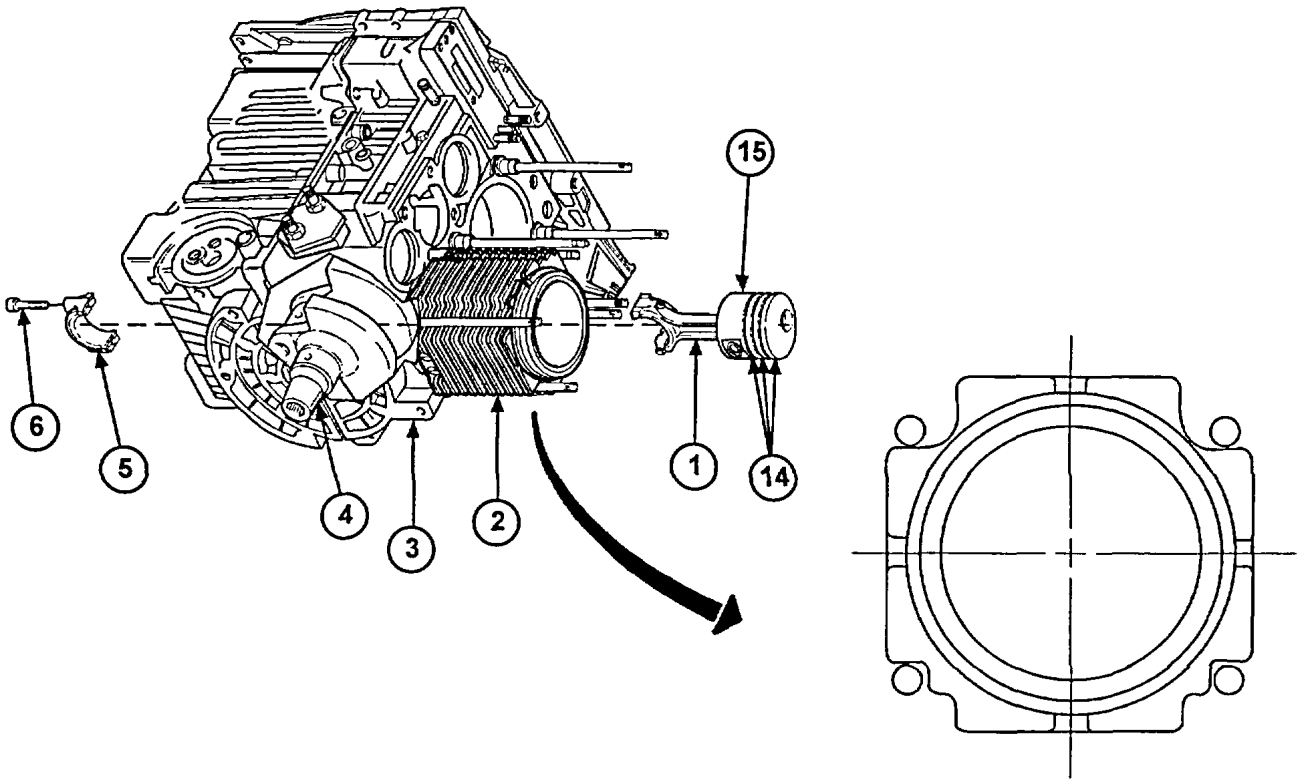


NOTE

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 Nom).

FOLLOW-ON TASKS:
- Install oil pan (para 3-13).
- 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)
- 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).

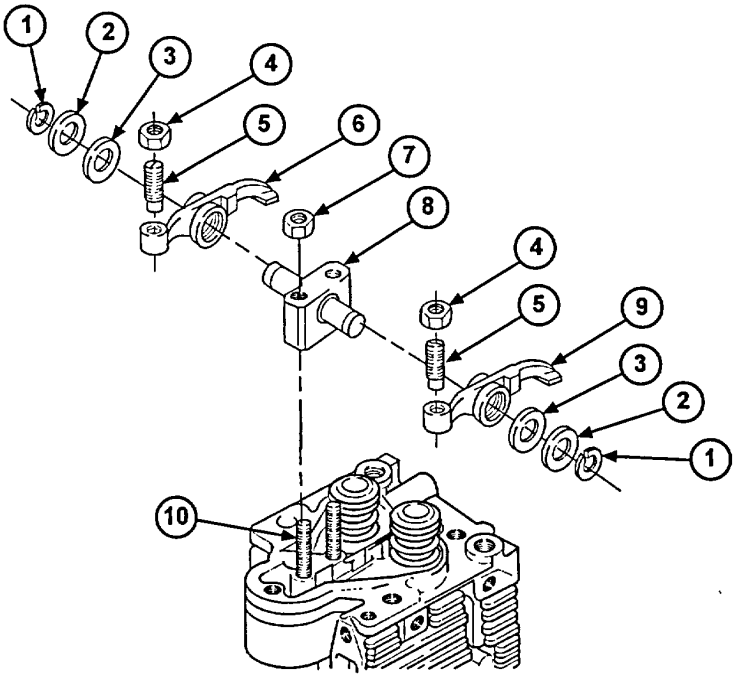
a. REMOVAL

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

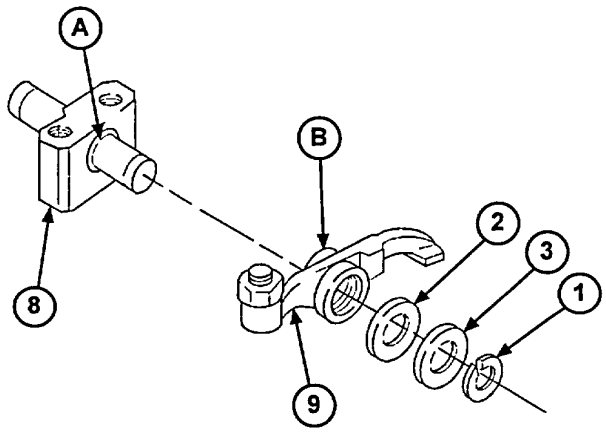
NOTE

- **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. 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:

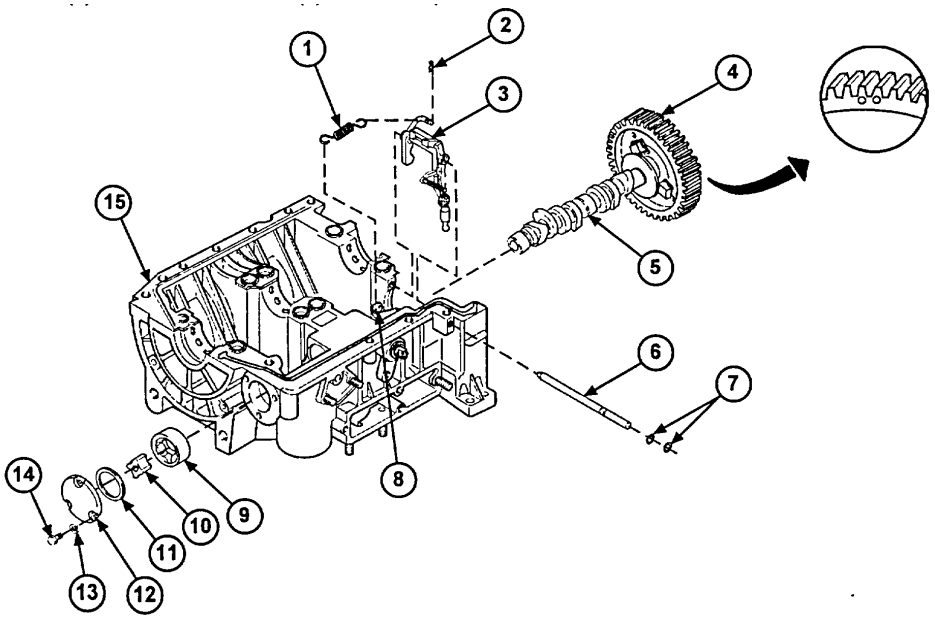
Tools/Test Equipment:
- Arbor press (Item 1, Appendix G)
- General mechanic's tool kit (Item 14, Appendix G)
- Snapring pliers (Item 26, Appendix G)

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.

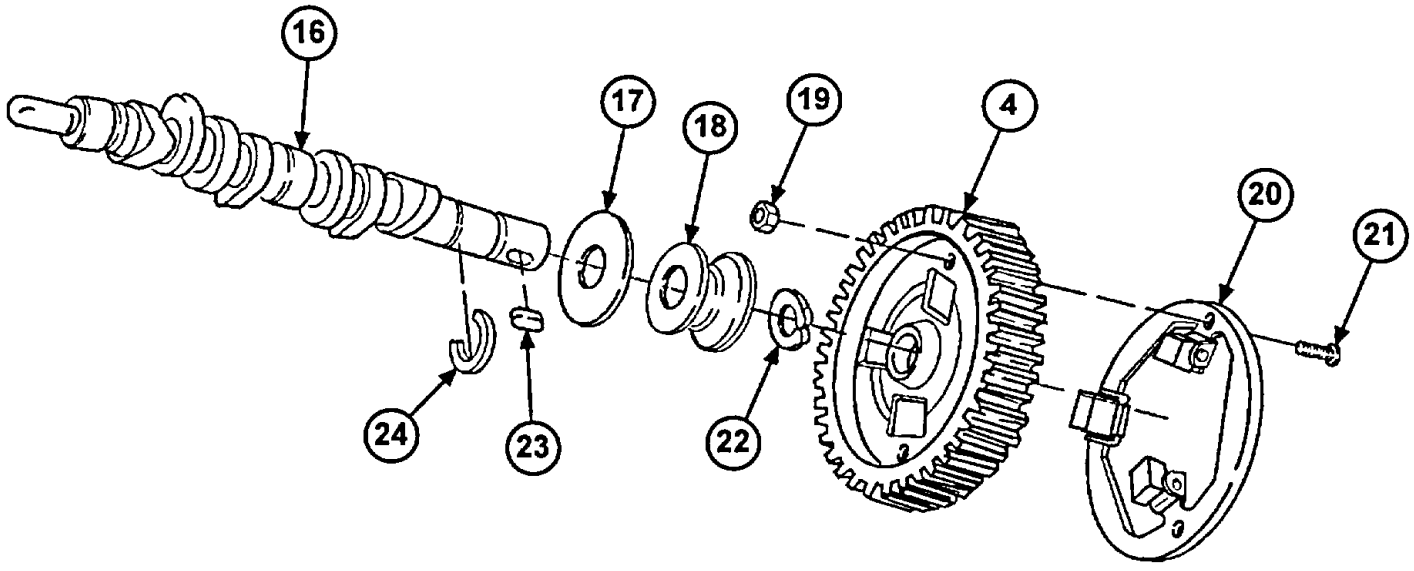
8. Remove three screws (21) and nuts (19) and mounting plate (20) from camshaft gear (4).

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).

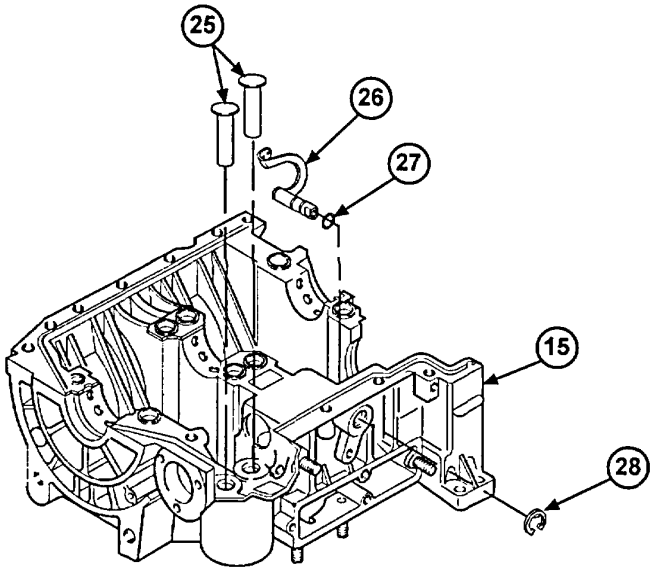


3-11. CAMSHAFT REPAIR (continued).

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

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

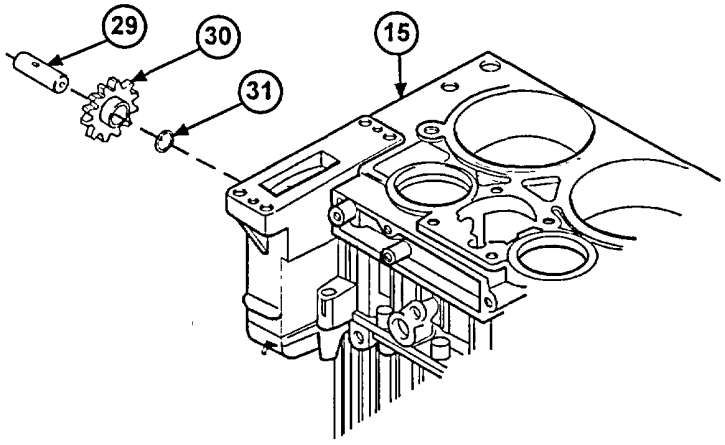
15. Remove acceleration lever(26) from upper crankcase (15). Remove O-ring (27) from acceleration lever (26). Discard O-ring.



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

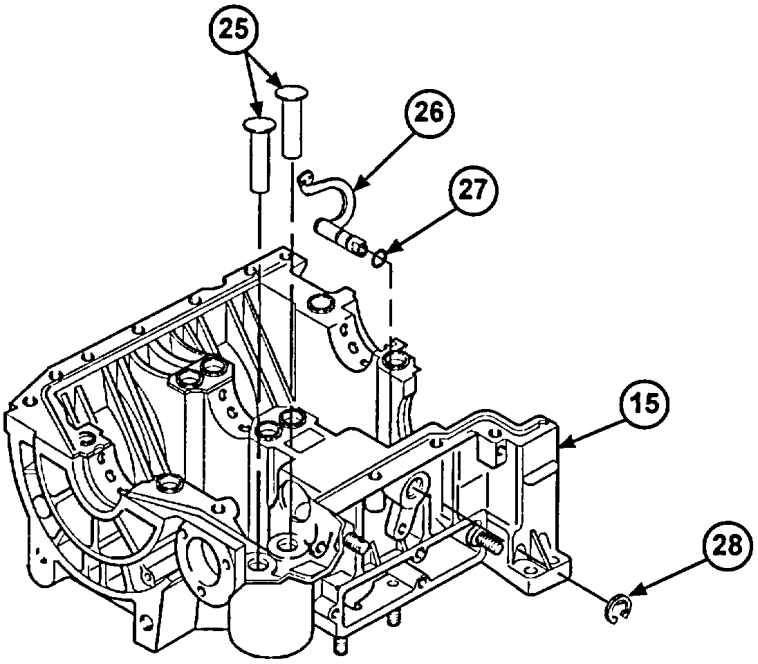
1. Install washer (31), pinion assembly (30), and pin (29) in upper crankcase (15).

3-11. CAMSHAFT REPAIR (continued).

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

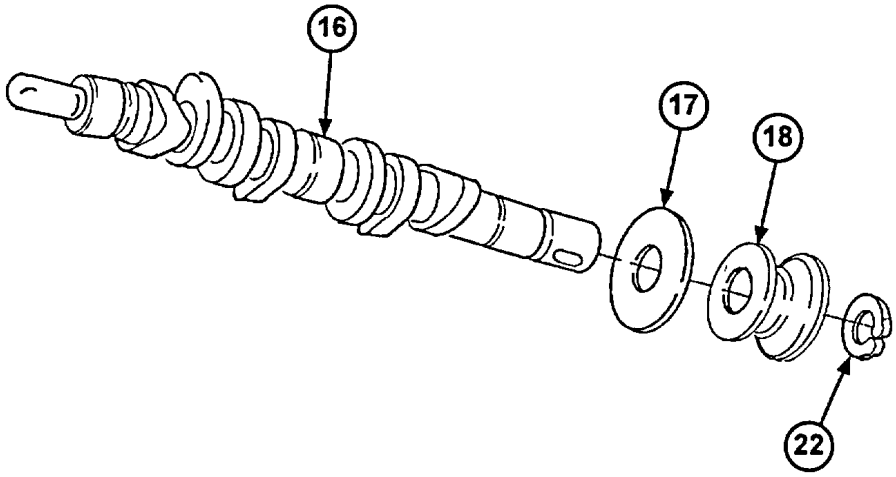
3. Install new retaining ring (28) on acceleration lever (26).

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).

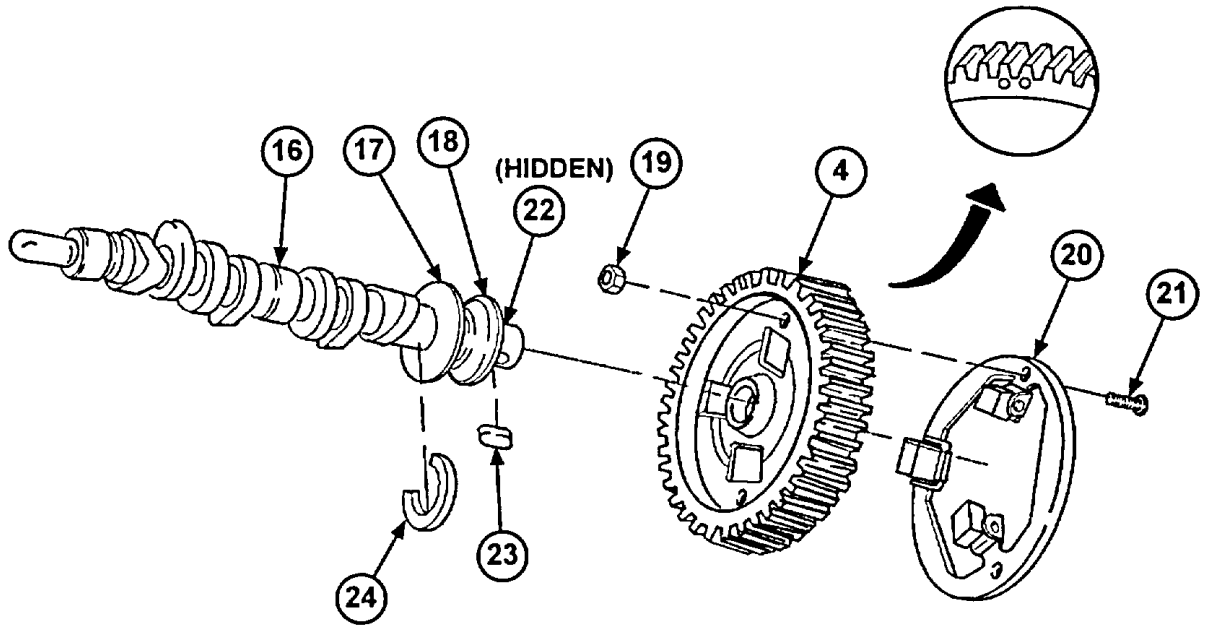


3-11. CAMSHAFT REPAIR (continued).

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).

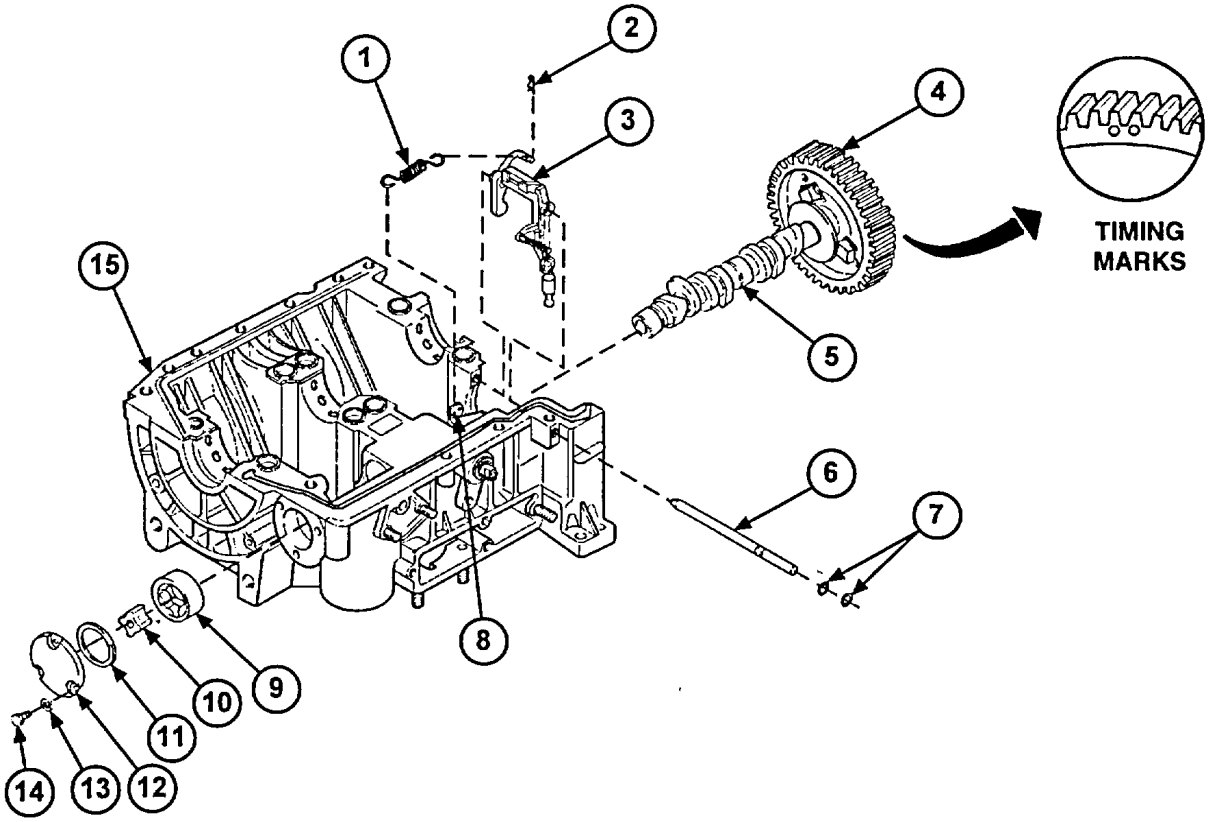
13. Install pin (6) on governor control lever assembly (3) and upper crankcase (15).

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(1 2) 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.

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)
- Sealing compound (Item 11, Appendix D)
- Crankcase gasket set (Item 1, Appendix F)

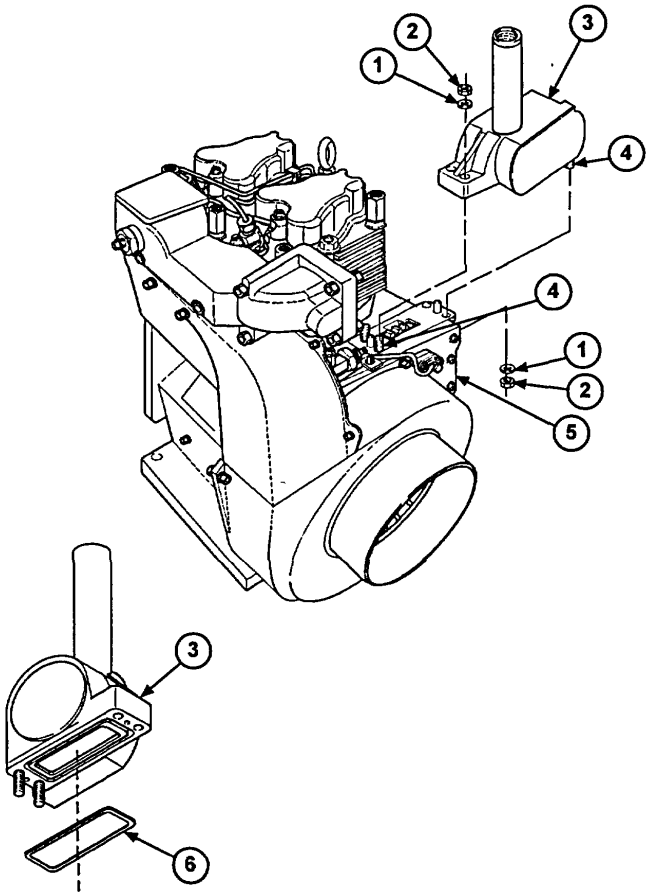
Equipment Conditions:
- Filler cap removed (para 2-18).
- Airflow deflectors removed as needed to allow access to oil filler assembly (para 2-24).

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 O-ring (6) in groove in filler neck (3).
2. Apply sealing compound 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.

This Task Covers:

a. Removal

b. Installation

Initial Setup:

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

Materials/Parts:
- Crankcase gasket set (Item 1, Appendix F)
- Lockwasher (10) (Item 24, Appendix F)

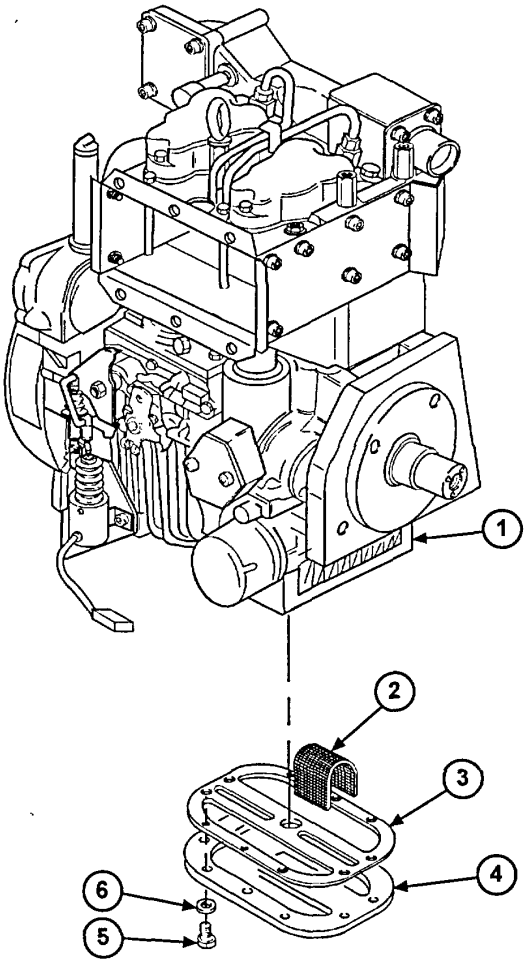
Equipment Conditions:
- Engine mounting plate removed (para 3-4).

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).

3-14. FUEL INJECTOR REPLACEMENT.

This Task Covers:

a. Removal
b. Cleaning
c. 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 gasket.

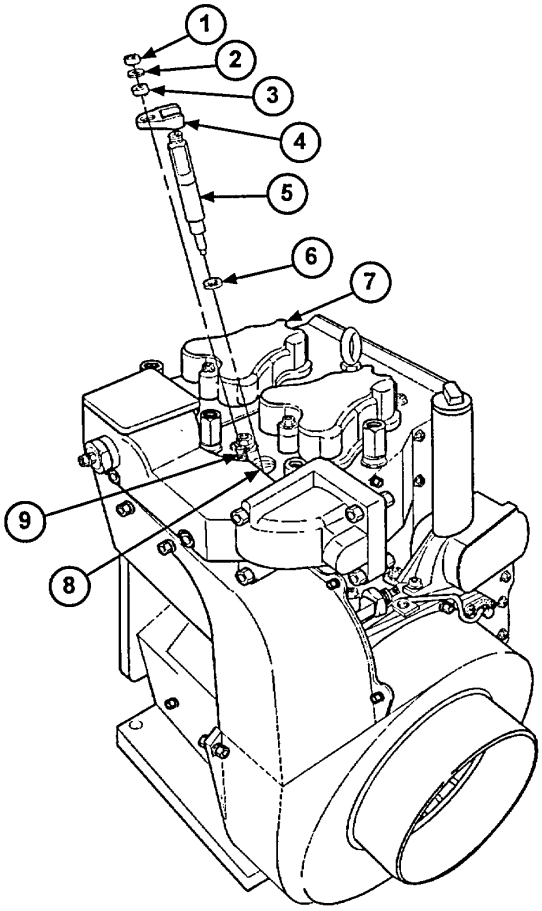
b. CLEANING

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.

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

3-14. FUEL INJECTOR REPLACEMENT (continued).



c. 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. J

This Task Covers:

a. Removal
b. Cleaning and Inspection
c. Installation

Initial Setup:

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

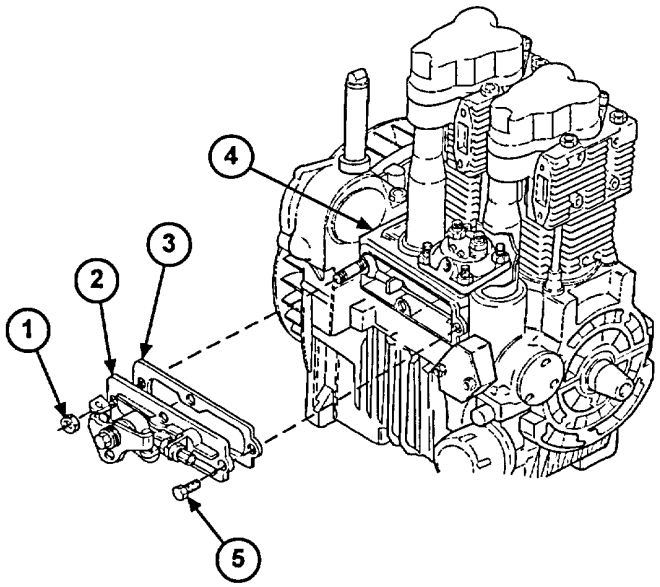
Materials/Parts:
- Drycleaning solvent (Item 4, Appendix D)
- Rag (Item 7, Appendix D)
- Cotter pin (Item 22, Appendix F)
- Crankcase gasket set (Item 1, Appendix F)
- Head gasket set (Item 3, Appendix F)

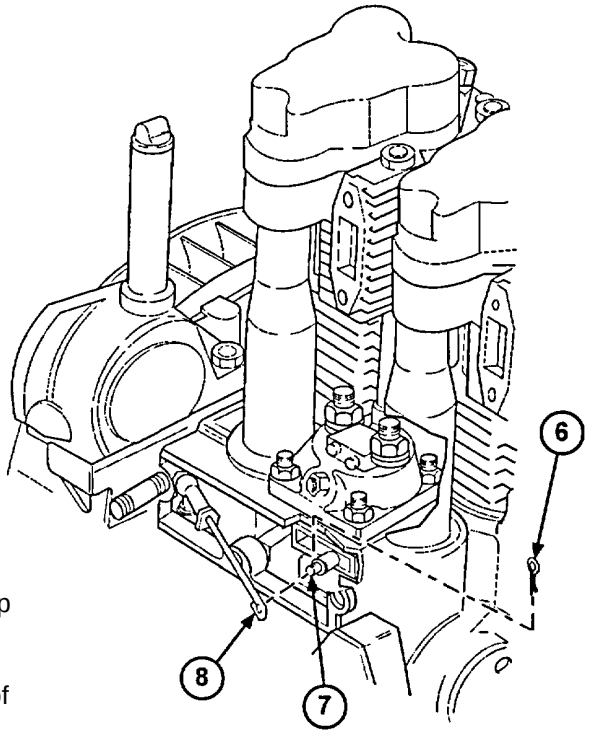
Equipment Conditions:
- Airflow deflectors removed (para 2-24).
- Fuel pressure pipe assemblies and return fuel hose removed (para 2-23).

a. REMOVAL

1. Remove three screws (5), nut (1), and governor plate (2) from crankcase (4).

2. Remove gasket (3) from governor plate (2). Discard gasket.





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).

3-15. INJECTION PUMP REPLACEMENT (continued).

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 subparagraph c.**

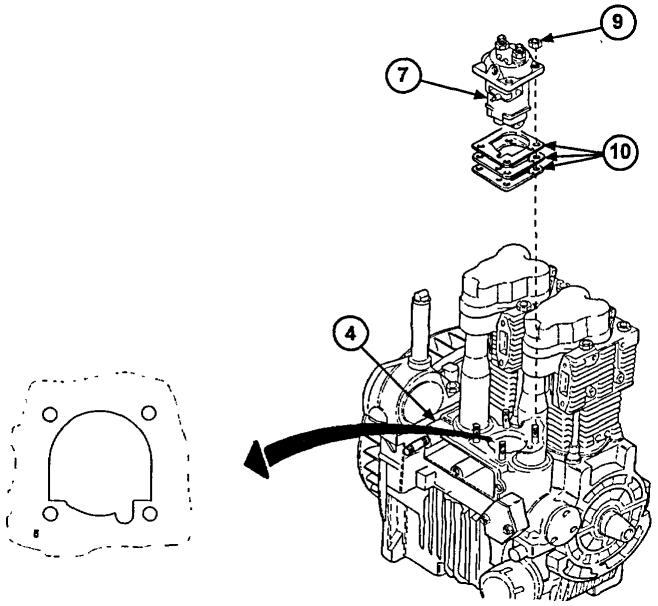
6. Position control rack of injection pump (7) under cutout in crankcase (4), and remove injection pump (7) and gaskets (10) from crankcase (4). Discard gaskets.

b. CLEANING AND INSPECTION

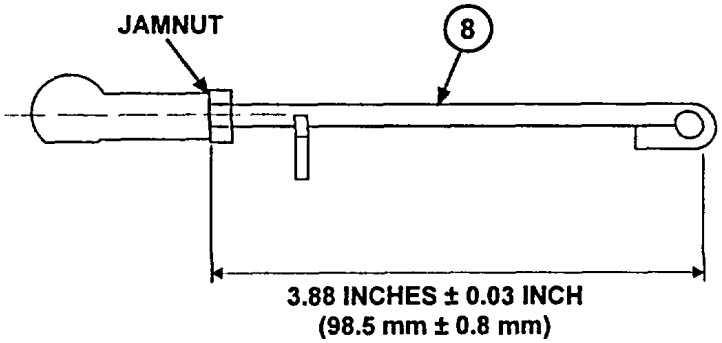
WARNING

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.

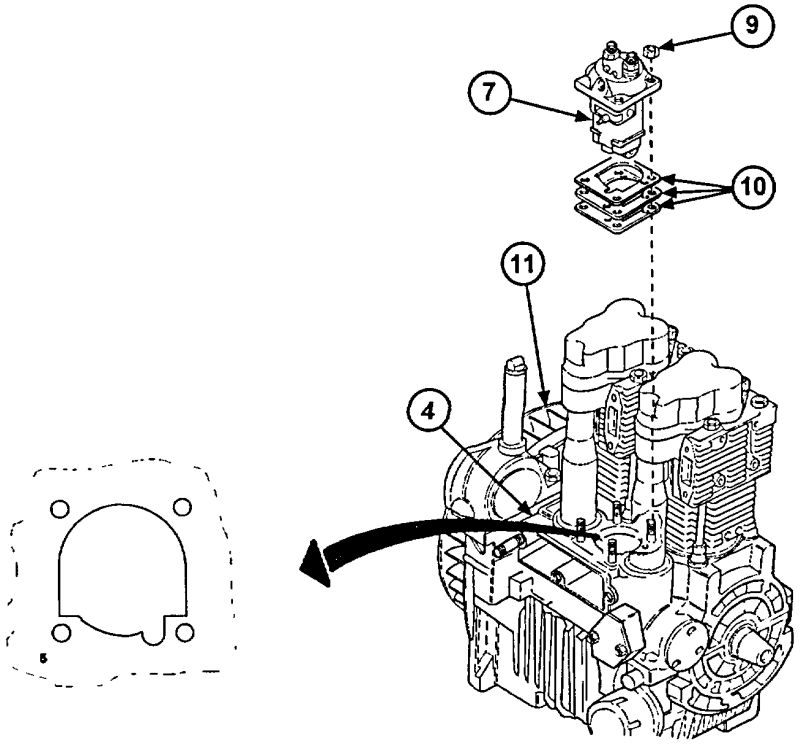
1. Install enough new gaskets (10) on crankcase (4) to reach the thickness indicated by the number stamped on crankcase (4).

NOTE

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

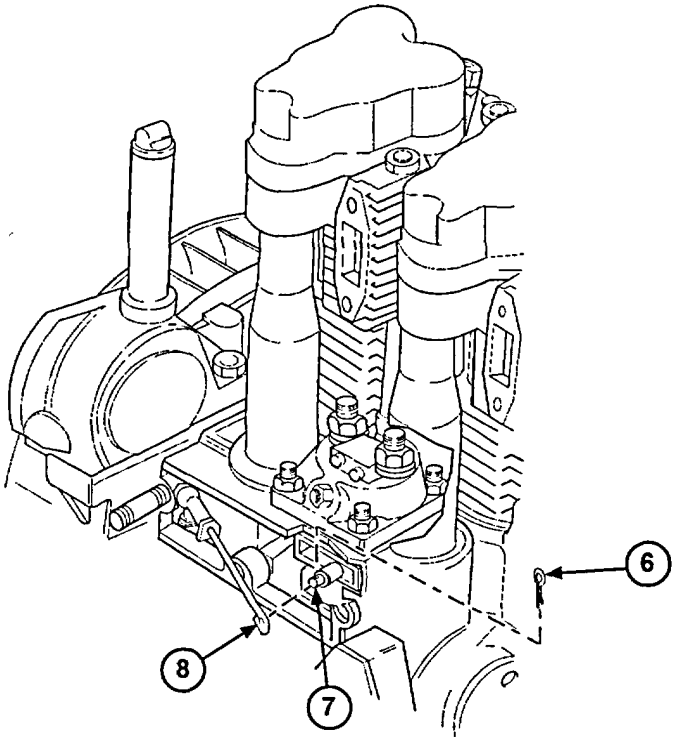
2. Position control rack of injection pump (7) over cutout, and install injection pump (7) on crankcase (4). Turn flywheel (11) to allow injection pump (7) to sit all the way down in the opening.

3. Install four nuts (9) on injection pump (7).



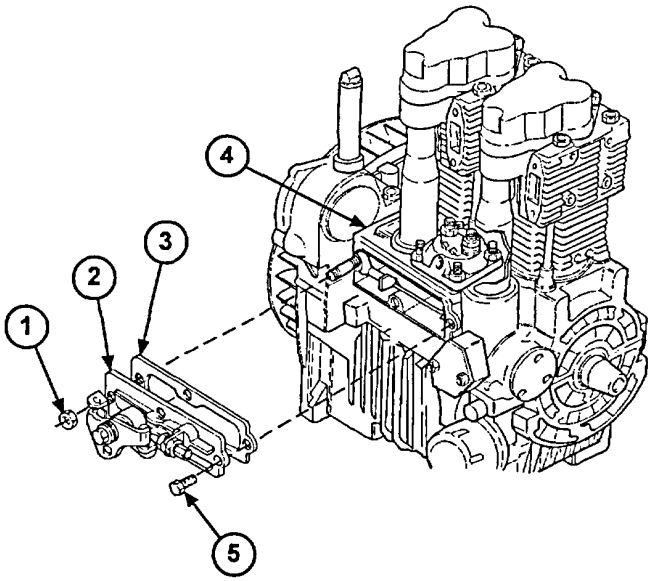
3-15. INJECTION PUMP REPLACEMENT (continued).

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) 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. Installation

Initial Setup:

Tools/Test Equipment:
- General mechanic's tool kit, automotive (Item 15, Appendix G)
- Snapring pliers (Item 26, Appendix G)

Materials/Parts:
- Lockwasher (Item 26, Appendix F)
- O-ring (Item 37, Appendix F)
- Seal (Item 13, Appendix F)
- Spring tension washer (Item 30, Appendix F)
- Wire mesh (Item 14, Appendix F)

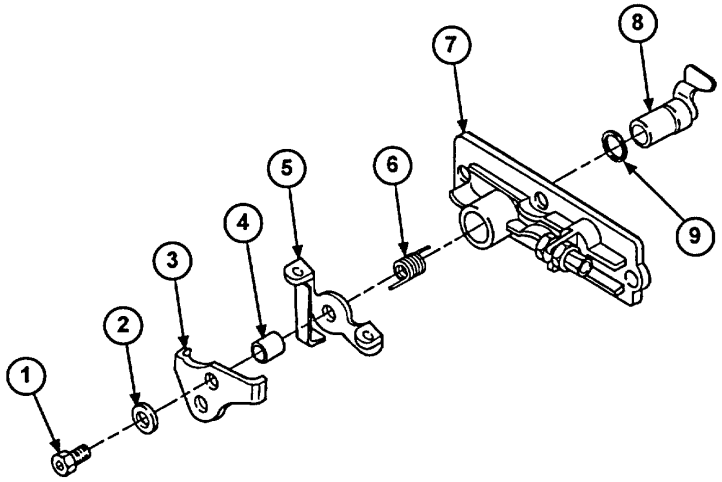
Equipment Conditions:
- Injection pump removed (para 3-15).

a. REMOVAL

1. Remove screw (1), spring tension washer (2), two levers (3 and 5), and bushing (4) from mounting plate (7). Discard spring tension washer.

2. Remove stop lever (8) and spring (6) from mounting plate (7).

3. Remove O-ring (9) from stop lever (8). Discard O-ring.



4. Remove screw (10), lockwasher (11), washer (12), lever (13), and spring (21) from speed control lever (18). Discard lockwasher.

5. Remove seal (14) and wire mesh (15) from speed control lever (18). Discard seal and wire mesh.

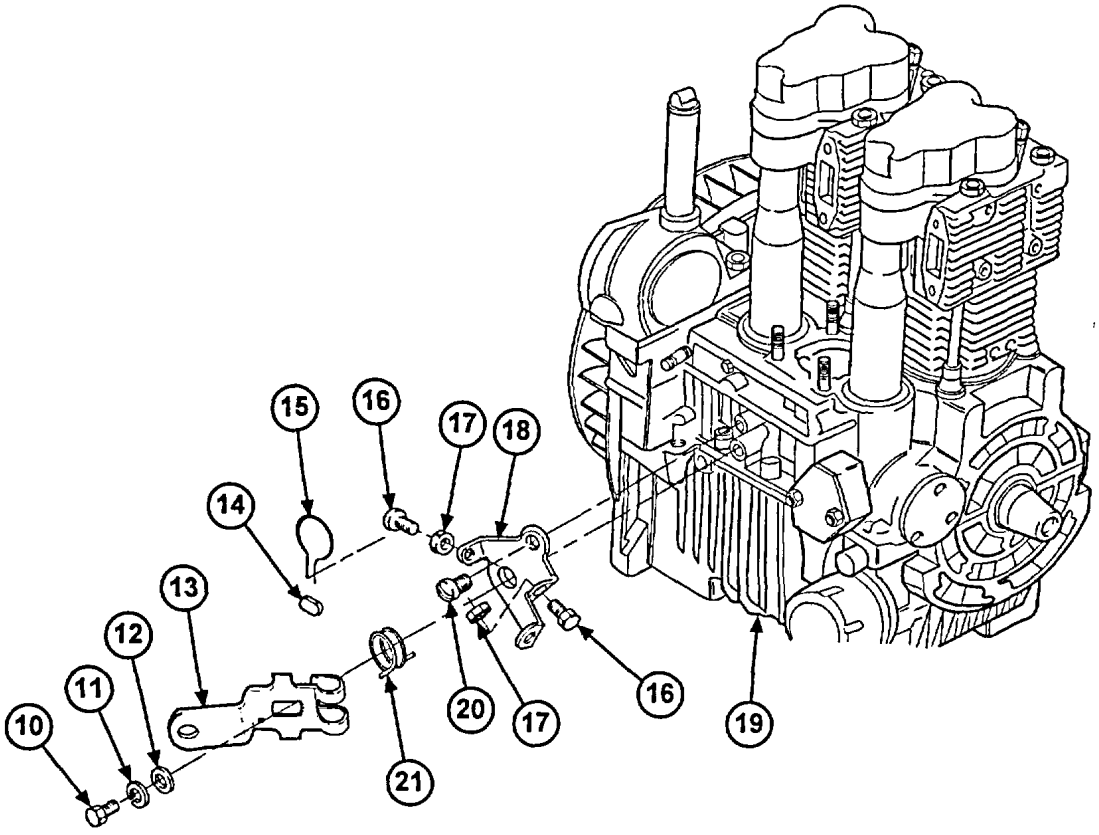
6. Remove screw (20) and speed control lever (18) from crankcase (19).

7. Remove two nuts (17) and screws (16) from speed control lever (18).

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

b. INSTALLATION

1. Install two screws (16) and nuts (17) on speed control lever (18).
2. Install screw (20) and speed control lever (18) on crankcase (19).
3. Install spring (21), lever (13), washer (12), new lockwasher (11), and screw (10) on speed control lever (18).
4. Install new O-ring (9) on stop lever (8).
5. Install stop lever (8) and spring (6) on mounting plate (7).
6. Install two levers (5 and 3), bushing (4), new spring tension washer (2), and screw (1) on mounting plate (7).



7. Install injection pump (para 3-15).
8. Adjust engine speed (para 3-22).
9. Install new wire mesh (15) and new seal (14) on speed control lever (18).

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).

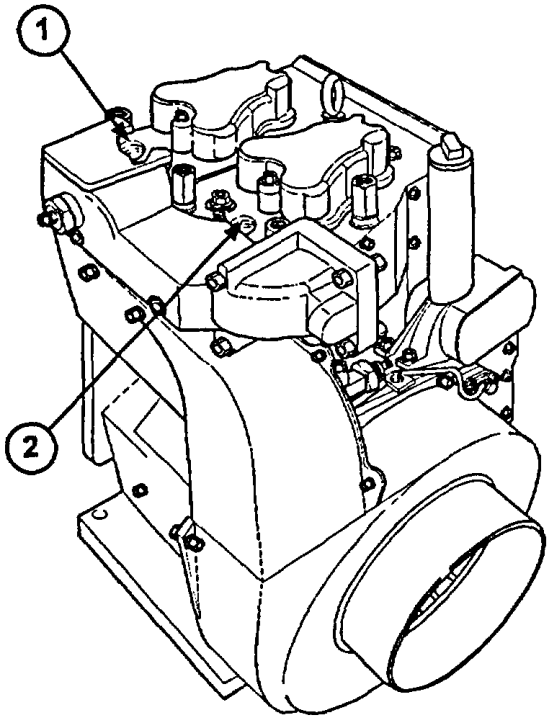
NOTE

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)

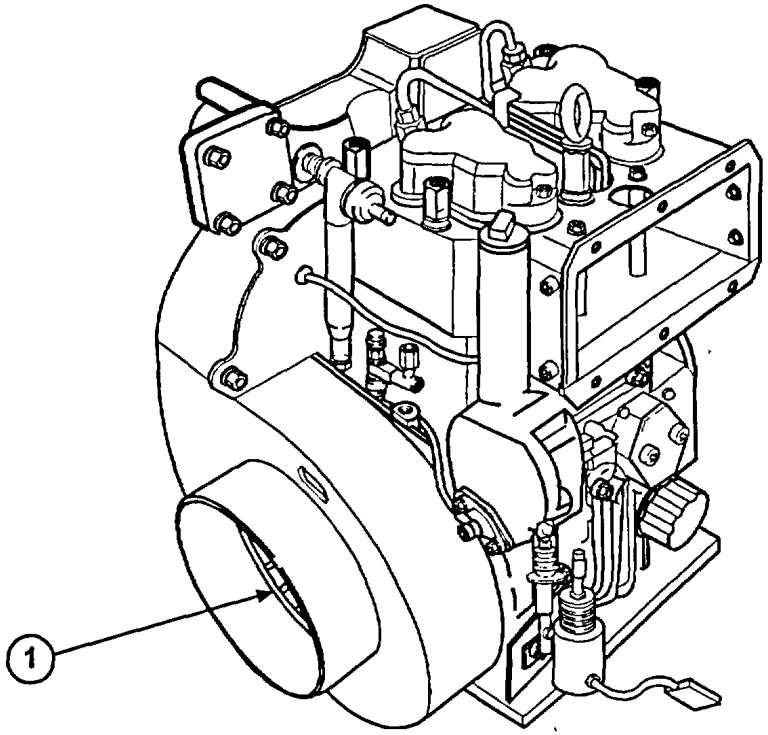
Equipment Conditions:
- Rocker arm cover removed (para 2-17).

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.

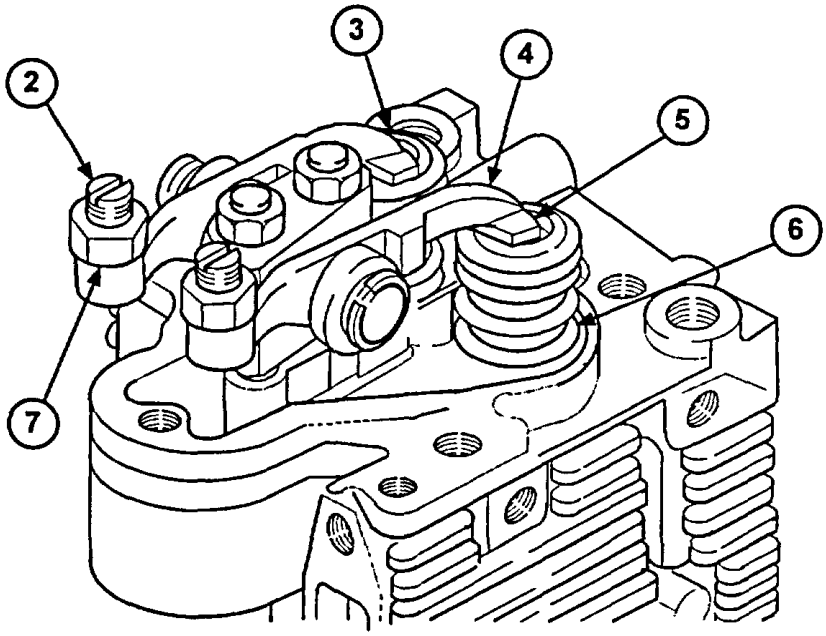


3-18. VALVE ADJUSTMENT (continued).

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 (para 2-24).
- Fuel pressure pipes removed (para 2-23).
- Vehicle fuel supply connected to injection pump (refer to TM 9-2350-293-20).

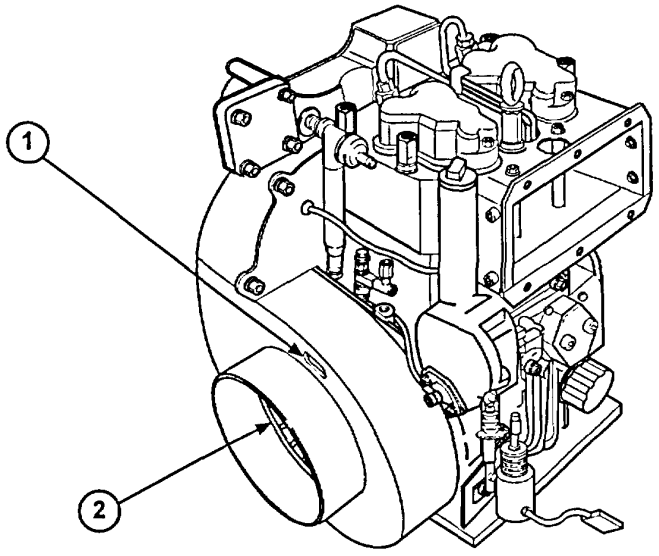
ADJUSTMENT

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.**

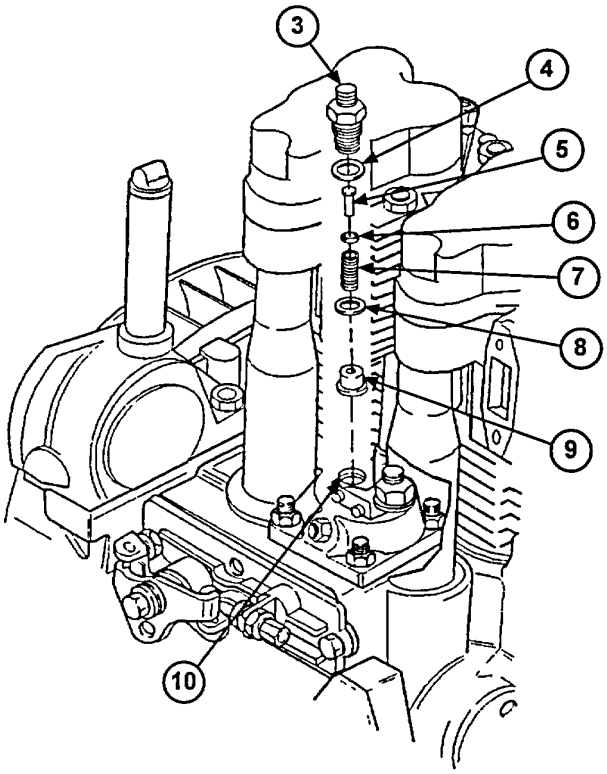
- **The fuel quantity injected is determined by the travel of the pump plunger between start and end of delivery. This dimension is specified in millimeters on the engine data plate located on the flywheel air duct.**

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



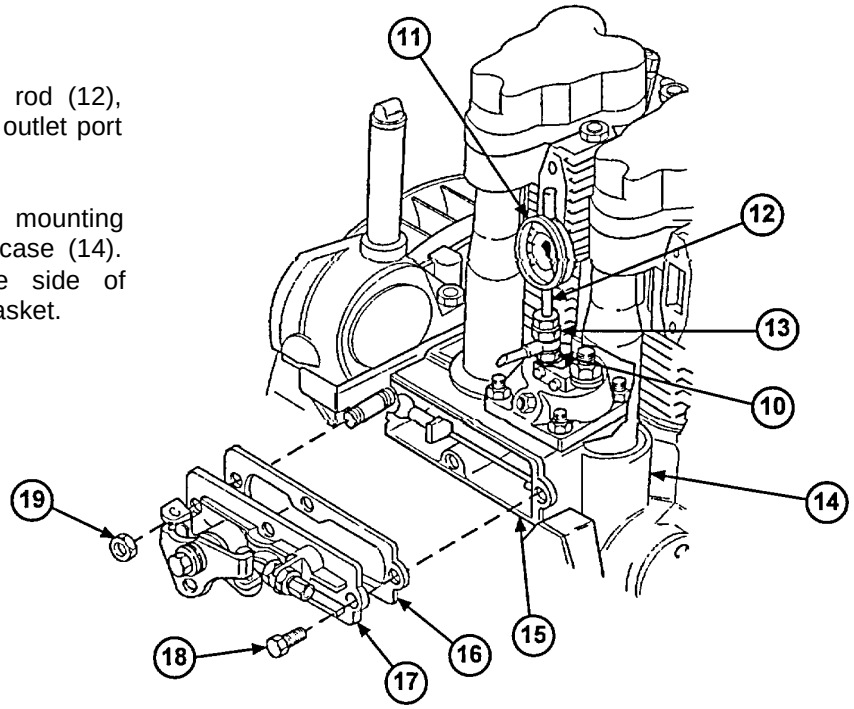
3-19. FLOW CONTROL VALVE ADJUSTMENT (continued).

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.

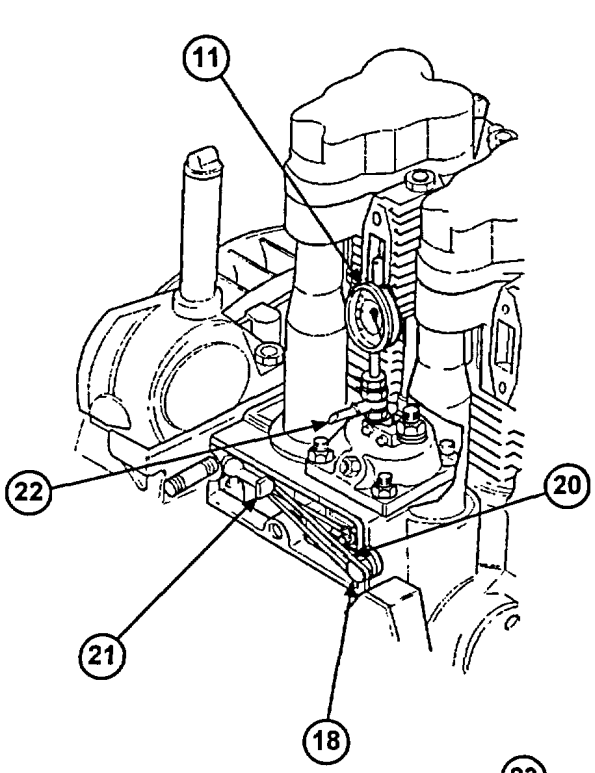


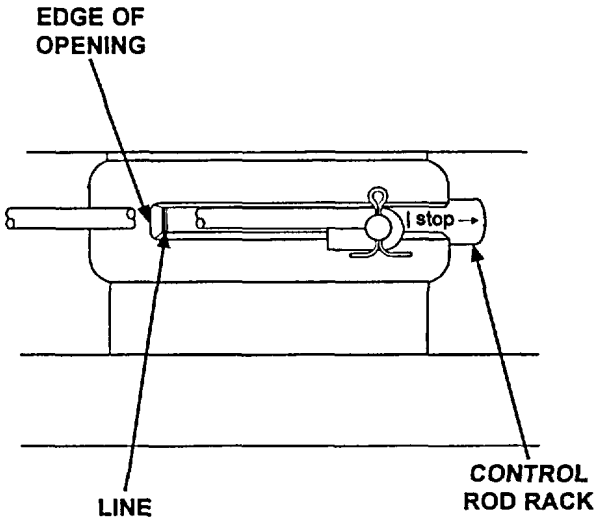
3-19. FLOW CONTROL VALVE ADJUSTMENT (continued).

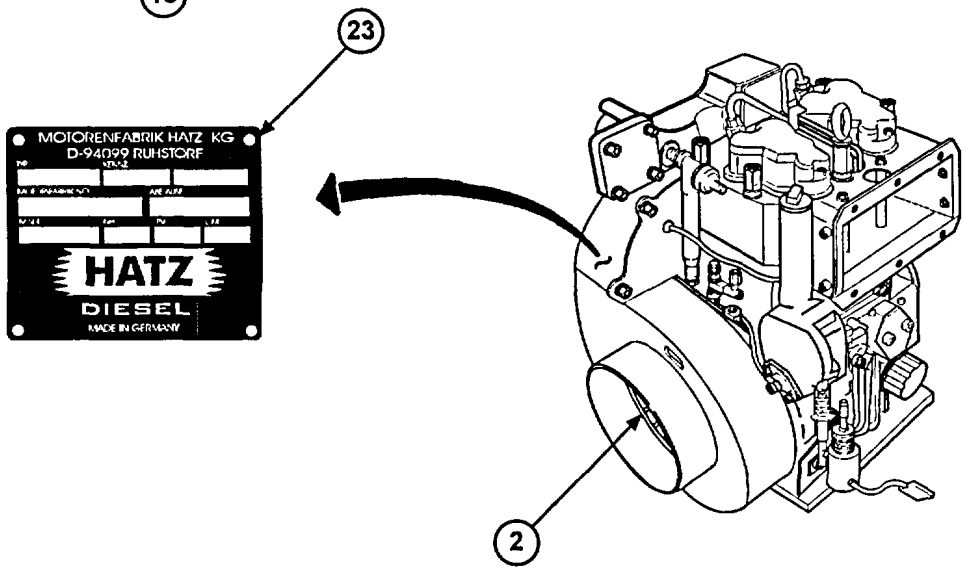
e. Place rubber band (20) around governor lever pad (21) and screw (18), to position line on control rod rack at edge of opening.

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.







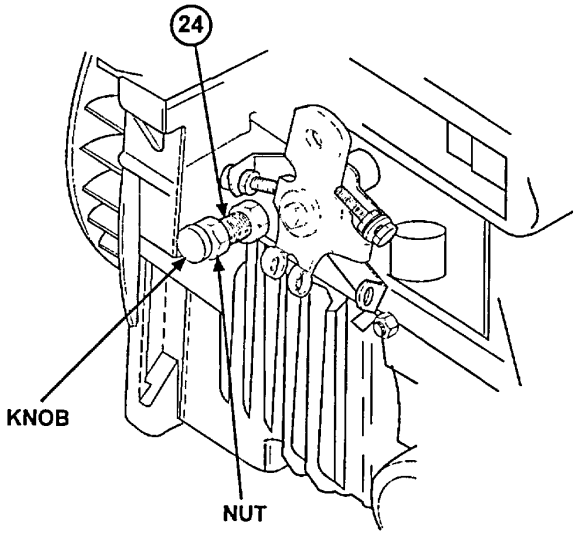
3-19. FLOW CONTROL VALVE ADJUSTMENT (continued).

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.

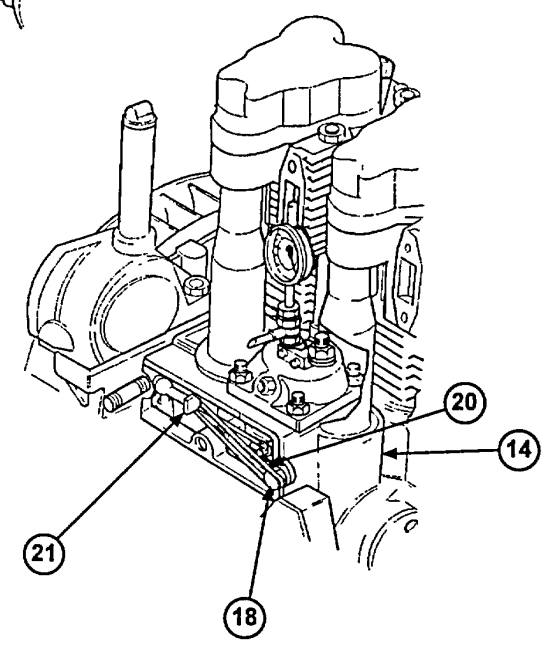
h. If fuel quantity is incorrect, loosen nut on flow control valve (24). Turn knob to the right to increase fuel quantity or to the left to decrease fuel quantity.

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).

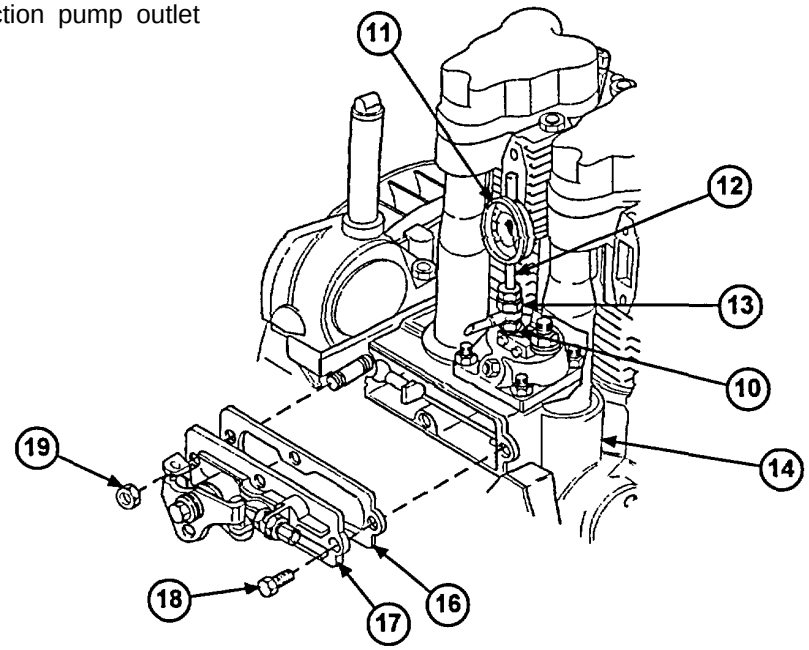
k. Remove rubber band (20) from governor lever pad (21) and screw (18). Remove screw (18) from crankcase (14).



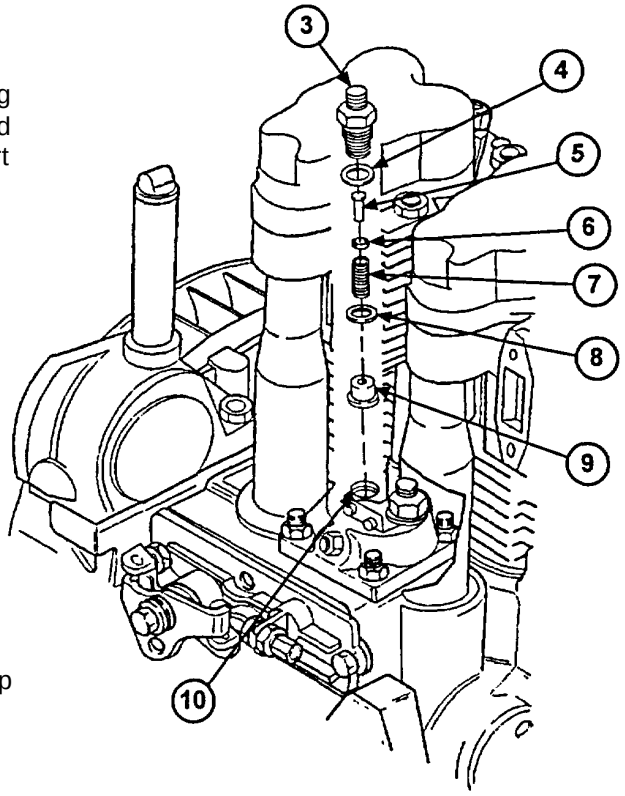
3-19. FLOW CONTROL VALVE ADJUSTMENT (continued).

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 (refer to TM 9-2350-293-20).
- Install fuel pressure pipes (para 2-23).
- Install airflow deflectors (para 2-24).

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 (para 2-24).

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.

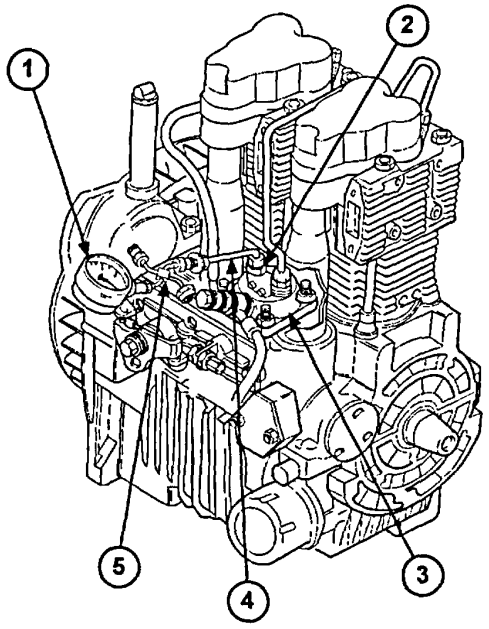
d. Crank engine and observe indicator dial (1). Reading should be between 250 and 258 bars. If reading is incorrect, replace injection pump (para 3-15).

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 (para 2-24).

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 (para 2-24).
- Injection pump test performed (para 3-20).

TEST

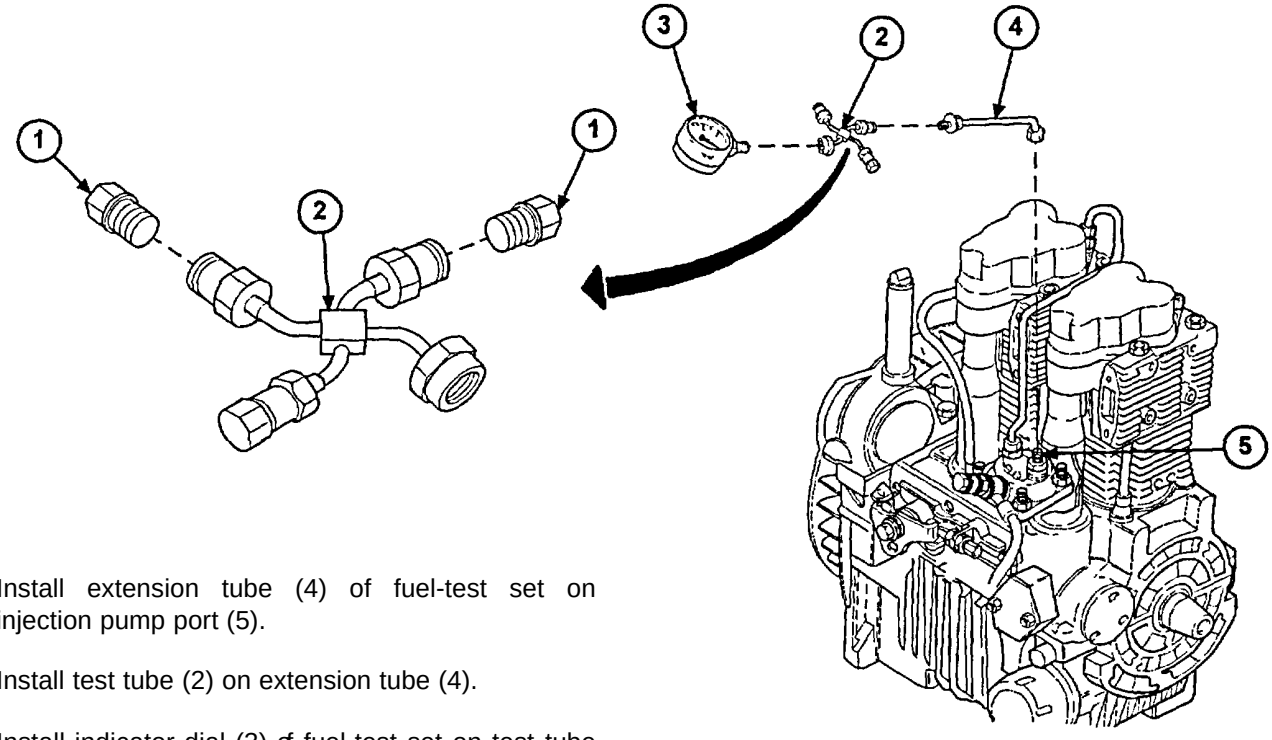
NOTE

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.

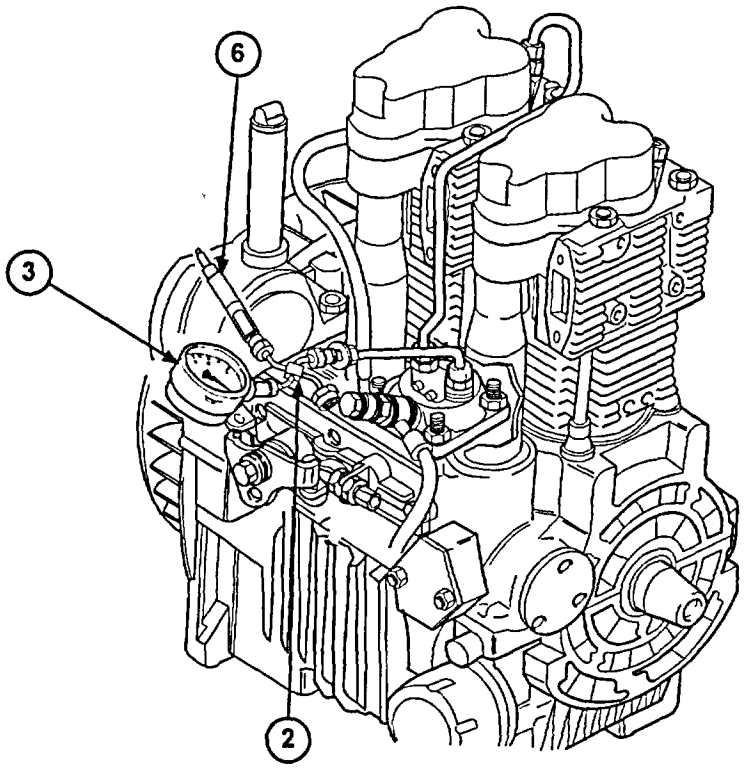
i. Check pressure reading at indicator dial (3). Correct pressure is 250 to 258 bar.

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).

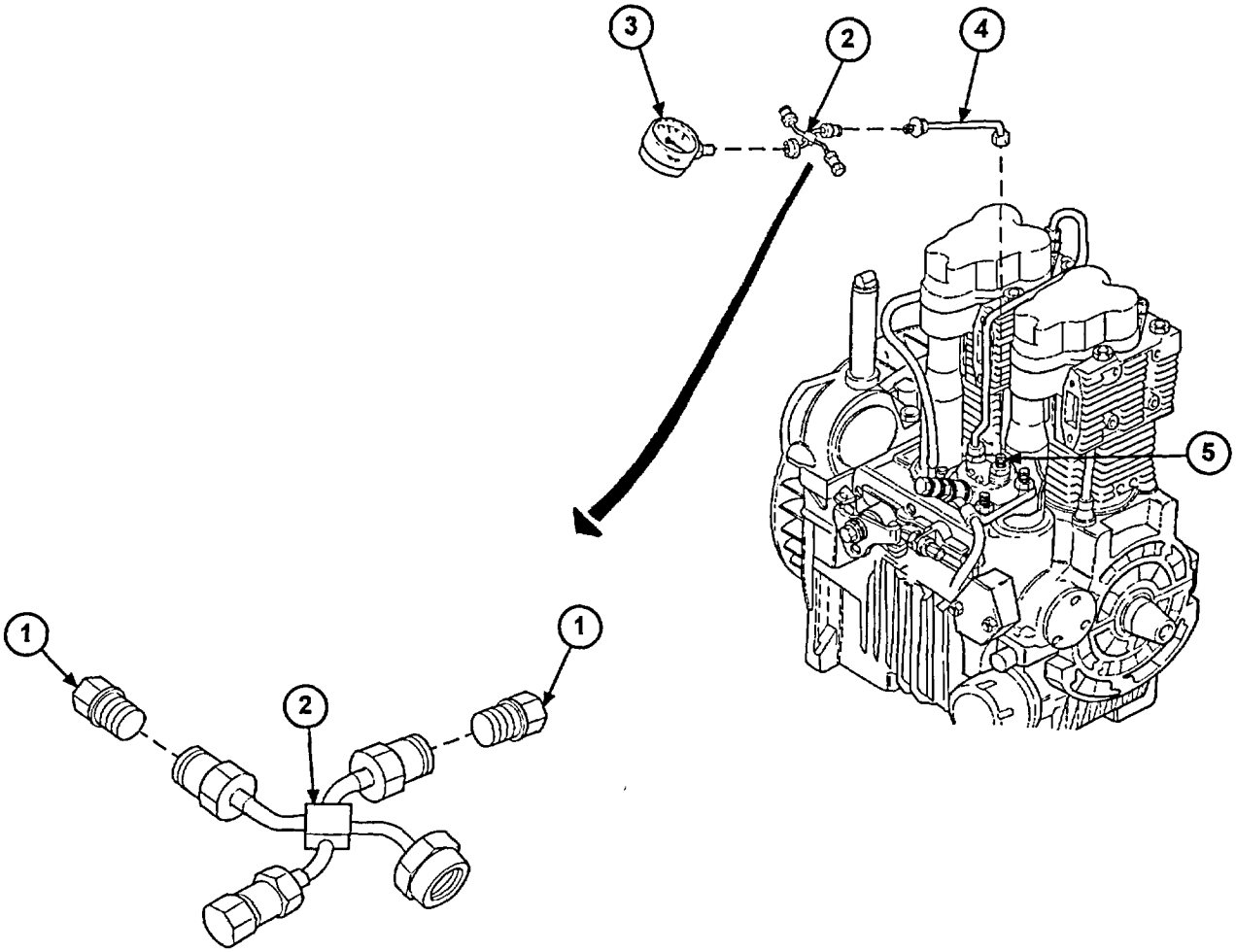


3-21. FUEL INJECTOR TEST (continued).

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 (para 2-24).

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

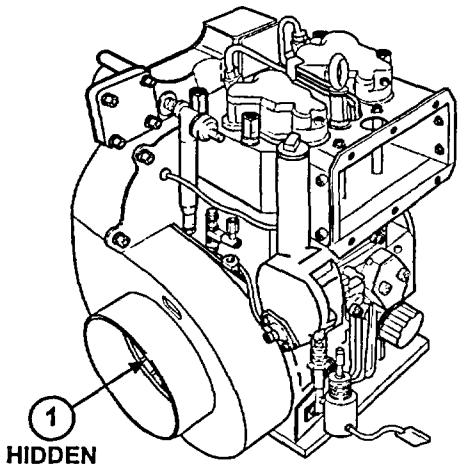
Engine speed is measured in revolutions per minute (rpm).

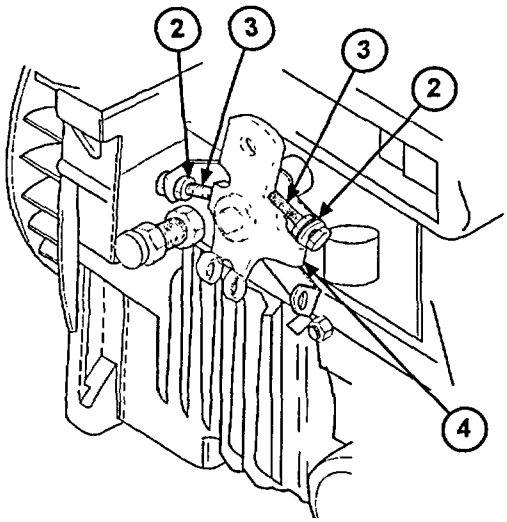
a. Start engine and let it run until warm.

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. 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:

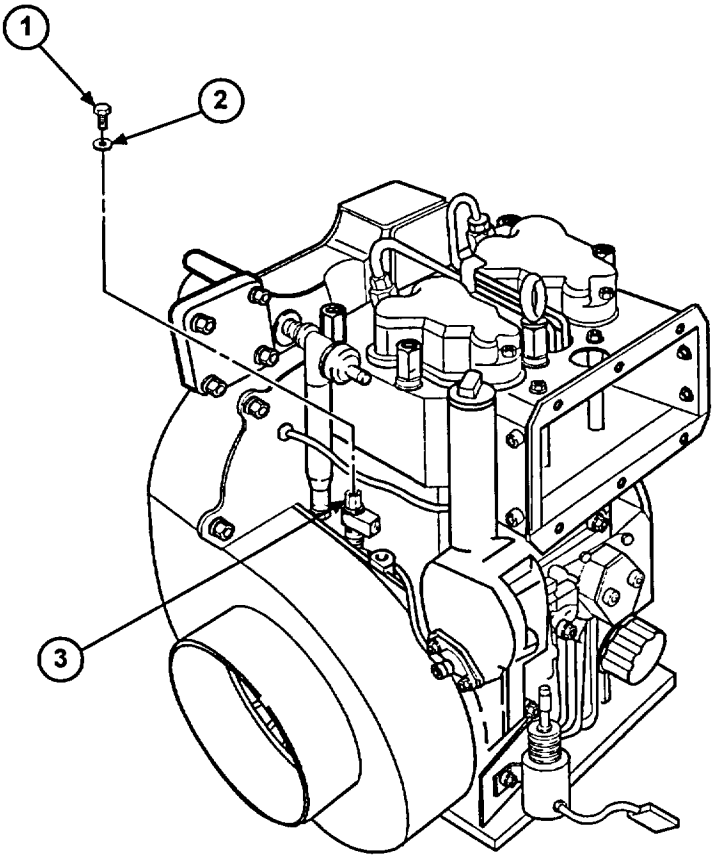
Test

Initial Setup:

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

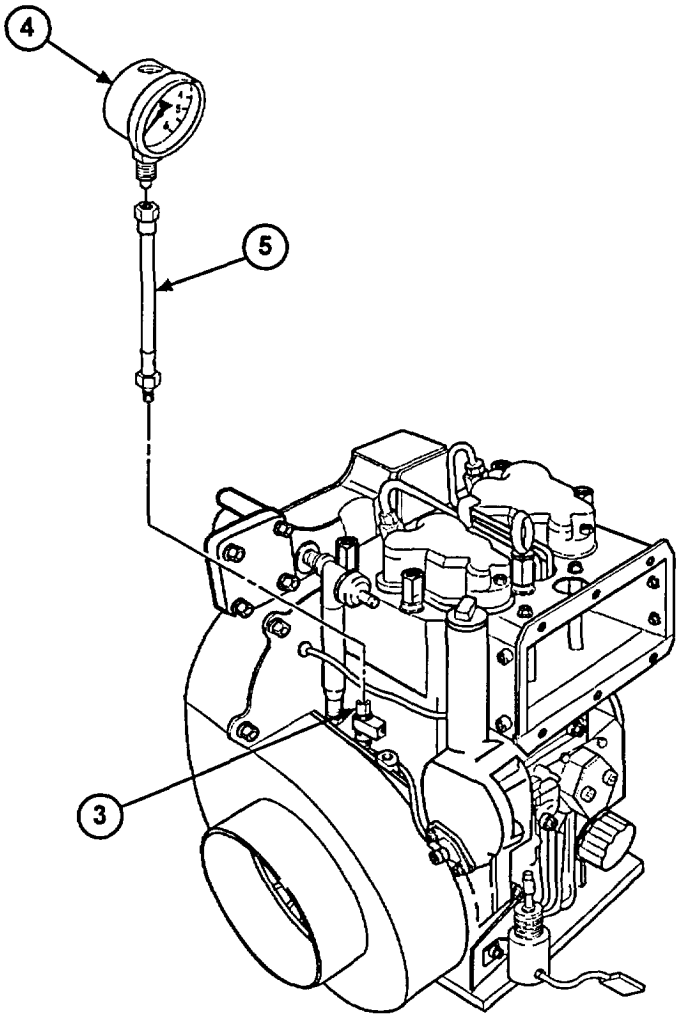
TEST

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, manuals, 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 ..... FM 21-11
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-4. PAMPHLETS AND CIRCULARS.

Consolidated Index of Army Publications and Blank Forms.....DA Pam 25-30
Functional Users 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 Replace		2.0 5.0			2, 5 3, 8	
2952	Engine Cowling, Deflectors, Air Ducts, and Shrouds	Replace	1.0				3	
2960	Sending Units	Test Replace	0.5 1.0				5 2	
2968	Switches, Circuit Breakers, and Fuses							
	Fuel Shutoff Solonoid	Adjust Replace	1.0 0.5				2, 5, 8 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.

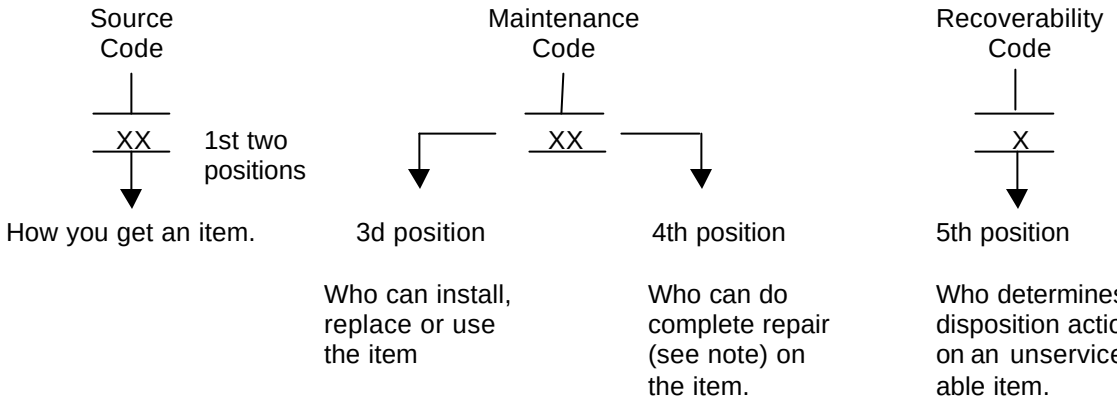
b. **Section III. Special Tools List.** A list of special tools, special TMDE, and other special support equipment authorized by this RPSTL for the performance of maintenance.

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 PB PC PD PE PF 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. ***Items coded PC are subject to deterioration.*
KD KF 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 *MF - Made at DS/AVUM Level* *MH - Made at GS Level* *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 *AF - Assembled by DS/AVUM Level* *AH - Assembled by GS Level* *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. 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. Depot is the lowest level that can do complete repair of the item.
D	Nonrepairable. No repair is authorized.
Z 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 (SECTIONS II AND III) (continued).

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.

(4) Spare/repair parts that make up an assembled item are listed immediately following the assembled item line entry.

(5) Part numbers for bulk materials are referenced in this column in the line item entry for the item to be manufactured/fabricated.

(6) 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.

(9) 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., NSN 5305-01-674-1467). When using this column to locate an item, ignore the first four digits NIIN 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 IIII.

(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 O 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, etc., 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.** Not applicable.

b. **Fabrication Instructions.** Not applicable.

c. **Assembly Instructions.** Not applicable.

d. **Kits.** Not applicable.

e. **Index Numbers.** Not applicable.

C-5. SPECIAL INFORMATION (continued).

f. **Associated Publications.**

Operators Manual, Unit Maintenance Manual, Direct Support and	TM 9-2350-293-10
General Support Maintenance Manual, and Repair Parts and Special	TM 9-2350-293-20-1 and -2
Tools List For Carrier, Ammunition, Tracked M992A2	TM 9-2350-293-34
(NSN 2350-01-368-9500)	TM 9-2350-293-24P

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 the 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.

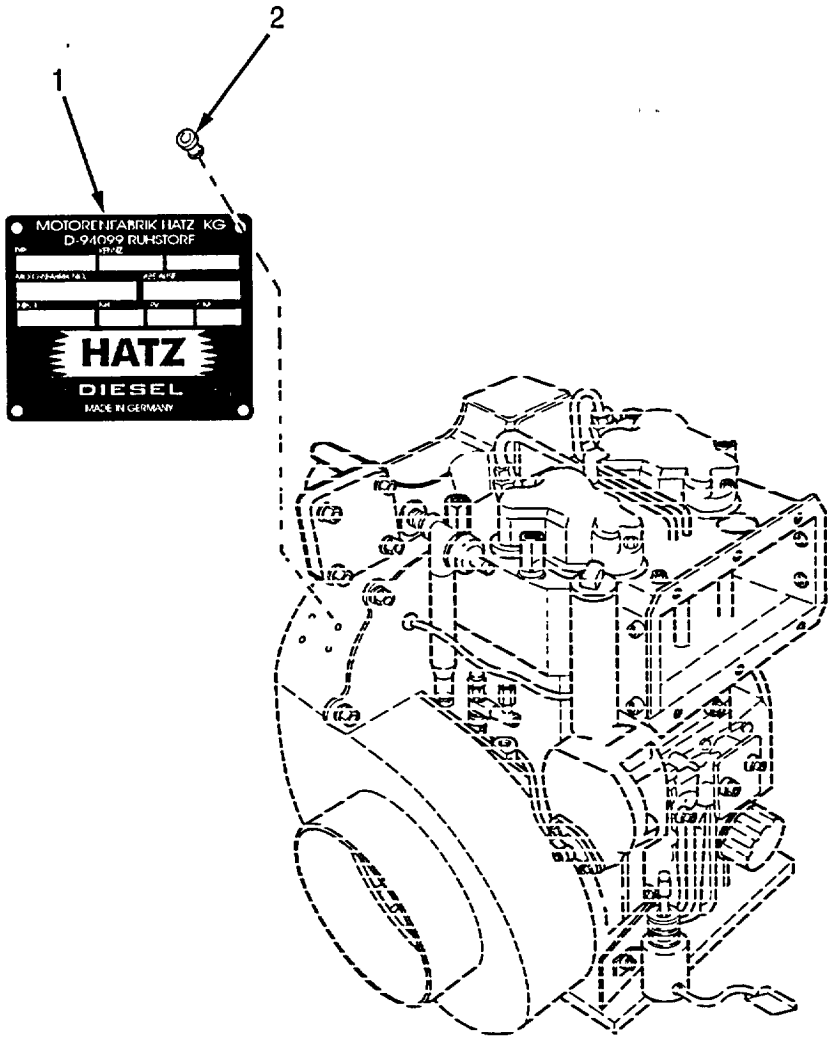


Figure 1. Engine Identification Plate

(1) ITEM NO	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
					GROUP 22 BODY, CHASSIS, AND HULL ACCESSORY ITEMS	
					GROUP 2210 DATA PLATES AND INSTRUCTION HOLDERS	
					FIG. 1 ENGINE IDENTIFICATION PLATE	
1	PAOZZ		61080	03225504	PLATE, IDENTIFICATIO.....	1
2	PAOZZ	5315010705656	61080	40002500	RIVET, BLIND.....	4
					END OF FIGURE	

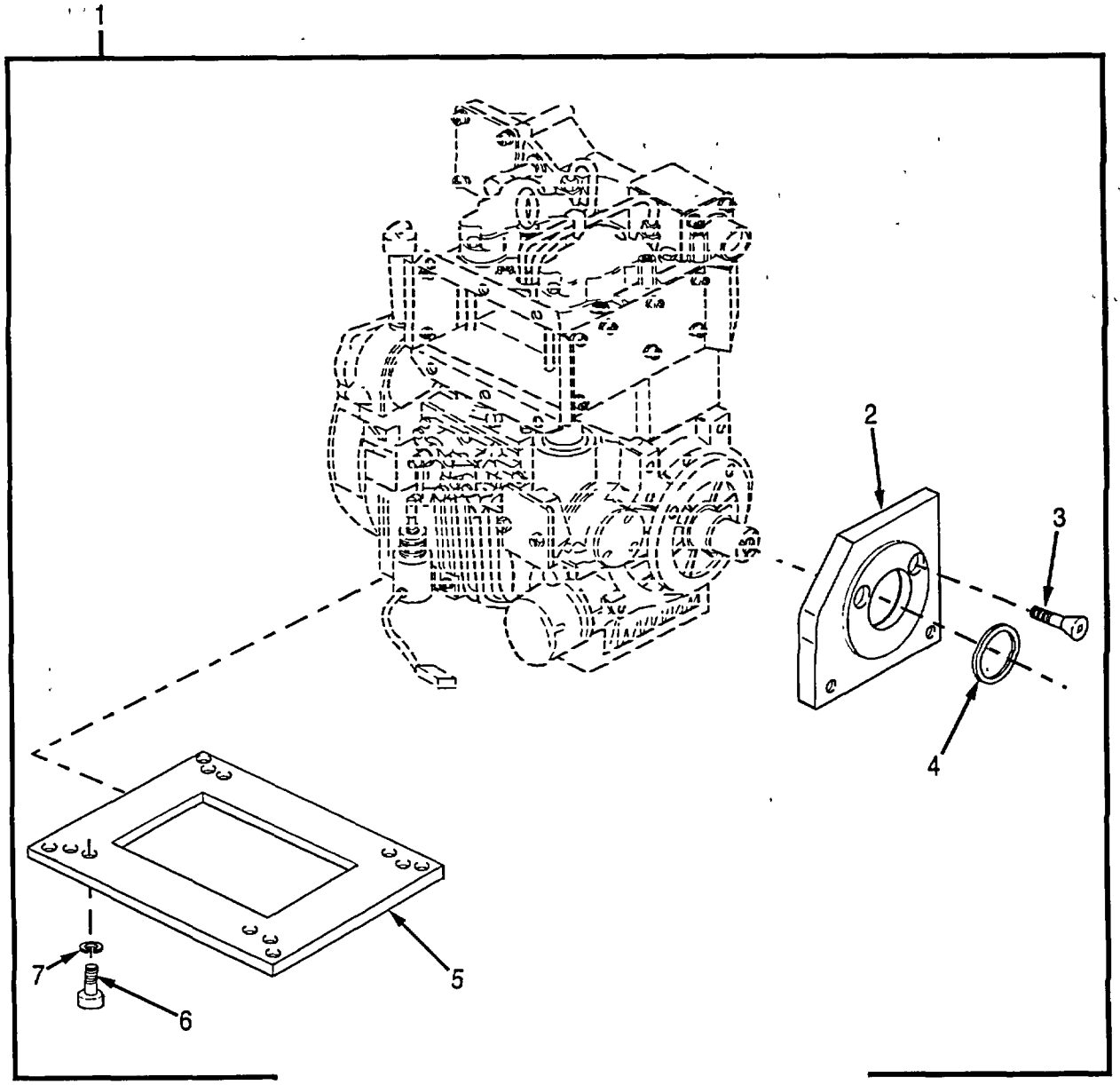


Figure 2. Engine, Diesel

(1) ITEM NO	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
					GROUP 29 AUXILIARY GENERATOR AND ENGINE, AND CONTROLS	
					GROUP 2910 ENGINE ASSEMBLY	
					FIG. 2 ENGINE, DIESEL	
1	PAOFD	2815014463500	19207	12463204	ENGINE ASSY DIESEL.....	1
2	PFFZZ	5340014548631	61080	99400639	.PLATE, MOUNTING.....	1
3	PAFZZ	5305014552207	61080	99400642	.SCREW, CAP, SOCKET HE	4
4	PAFZZ	5330014557822	61080	99400641	.SEAL, PLAIN ENCASED.....	1
5	PFFZZ	2990014548843	61080	99400640	.PLATE, MOUNTING, ENG.....	1
6	PAFZZ	5305014552206	61080	50054300	.SCREW, CAP, SOCKET HE	8
7	PAFZZ	5310012744387	61080	50061700	.WASHER, LOCK	8
					END OF FIGURE	

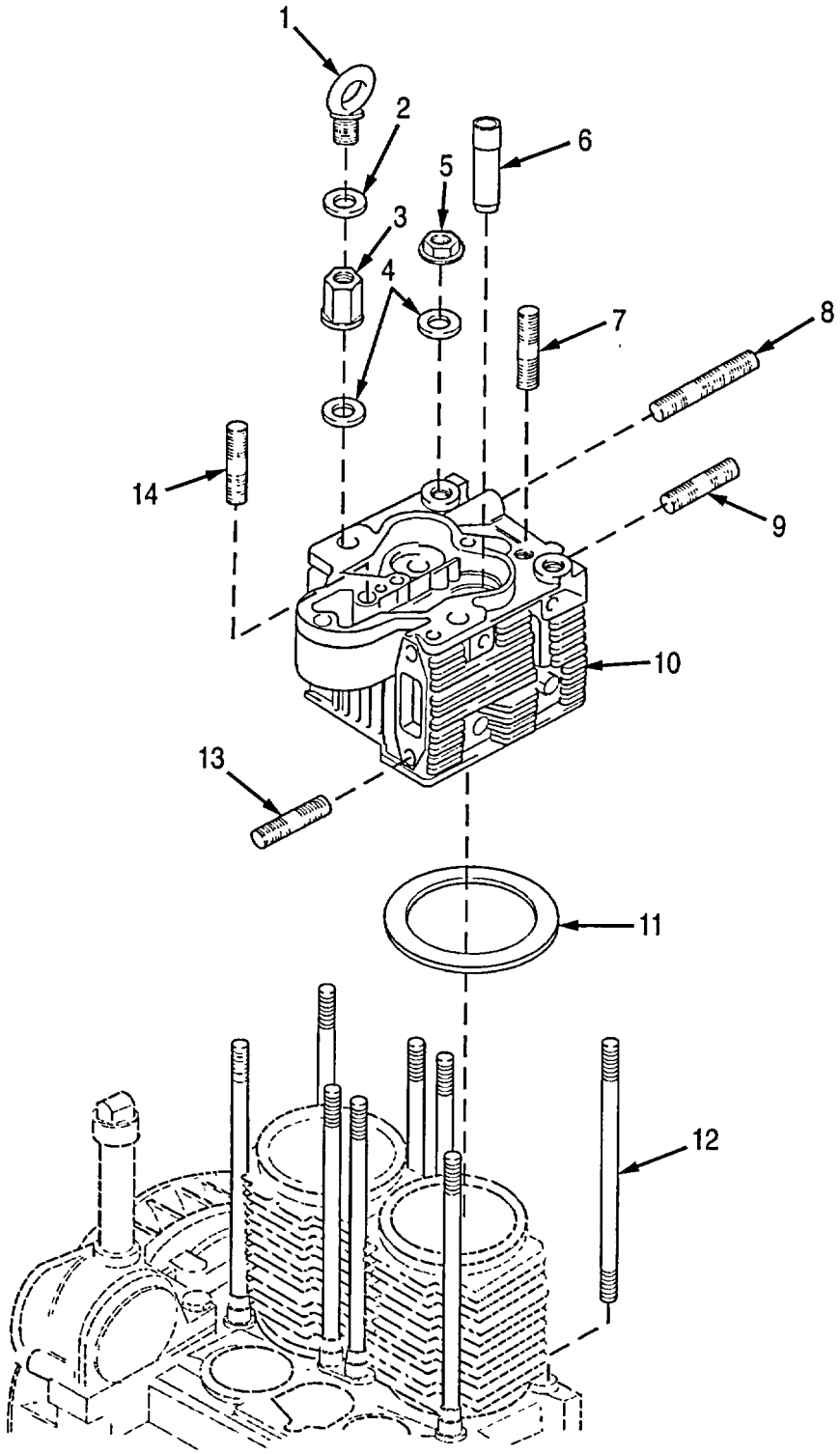


Figure 3. Cylinder Head

(1) ITEM NO	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
					GROUP 2911 CRANKCASE, CYLINDER SLEEVE, AND CYLINDER HEAD	
					FIG. 3 CYLINDER HEAD	
1	PAOZZ	5306014552212	61080	50315500	BOLT, EYE LIFT	1
2	PAOZZ	5365013995013	61080	03787300	SHIM PART OF KIT P/N 01247700	1
3	PAFZZ	5310014558479	61080	03784501	NUT, PLAIN, EXTENDED	5
4	PAFZZ	5310013998358	61080	03791400	WASHER FLAT	8
5	PAFZZ	5310013997312	61080	03171800	NUT PLAIN, HEXAGON	3
6	PAFZZ	2815014550056	61080	03785200	GUIDE, VALVE STEM	4
7	PAFZZ	5307014059899	61080	50038400	STUD, PLAIN	2
8	PAFZZ	5307014065443	61080	50065100	STUD, PLAIN	2
9	PAFZZ	5307014059997	61080	50128100	STUD, PLAIN	2
10	PAFZZ	2815014550371	61080	01247200	CYLINDER HEAD, DIESEL	2
11	KFFZZ		61080	03792800	GASKET 0.60mm PART OF KIT P/N 01247700	V
11	KFFZZ		61080	03971200	GASKET 0.65mm PART OF KIT P/N 01247700	V
11	KFFZZ		61080	03792900	GASKET 0.70mm PART OF KIT P/N 01247700	V
11	KFFZZ		61080	03971300	GASKET 0.75mm PART OF SIT P/N 01247700	V
11	KFFZZ		61080	03793000	GASKET 0.80mm PART OF KIT P/N 01247700	V
11	KFFZZ		61080	04090600	GASKET 0.85mm PART OF KIT P/N 01247700	V
11	KFFZZ		61080	03793100	GASKET 0.90mm PART OF KIT P/N 01247700	V
11	KFFZZ		61080	04090700	GASKET 0.95mm PART OF KIT P/N 01247700	V
11	KFFZZ		61080	03793200	GASKET 1.00mm PART OF KIT P/N 01247700	V
11	KFFZZ		61080	03793300	GASKET 1.10mm PART OF KIT P/N 01247700	V
11	KFFZZ		61080	03793400	GASKET 1.20mm PART OF KIT P/N 01247700	V
12	PAFZZ	5307014552210	61080	03781000	STUD, PLAIN	8
13	PAFZZ	5307014059907	61080	50231900	STUD, PLAIN	4
14	PAFZZ	5307014059909	61080	50279200	STUD, PLAIN	4
					END OF FIGURE	

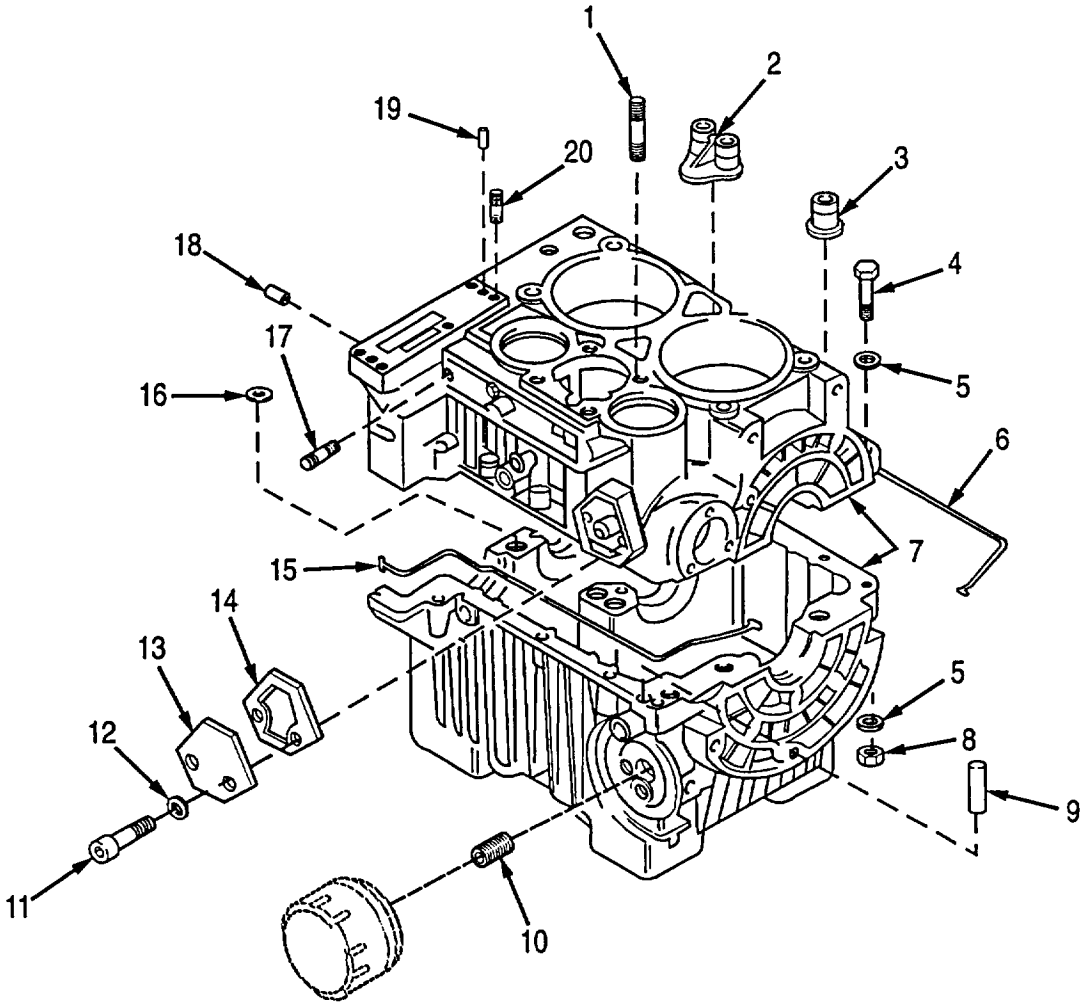
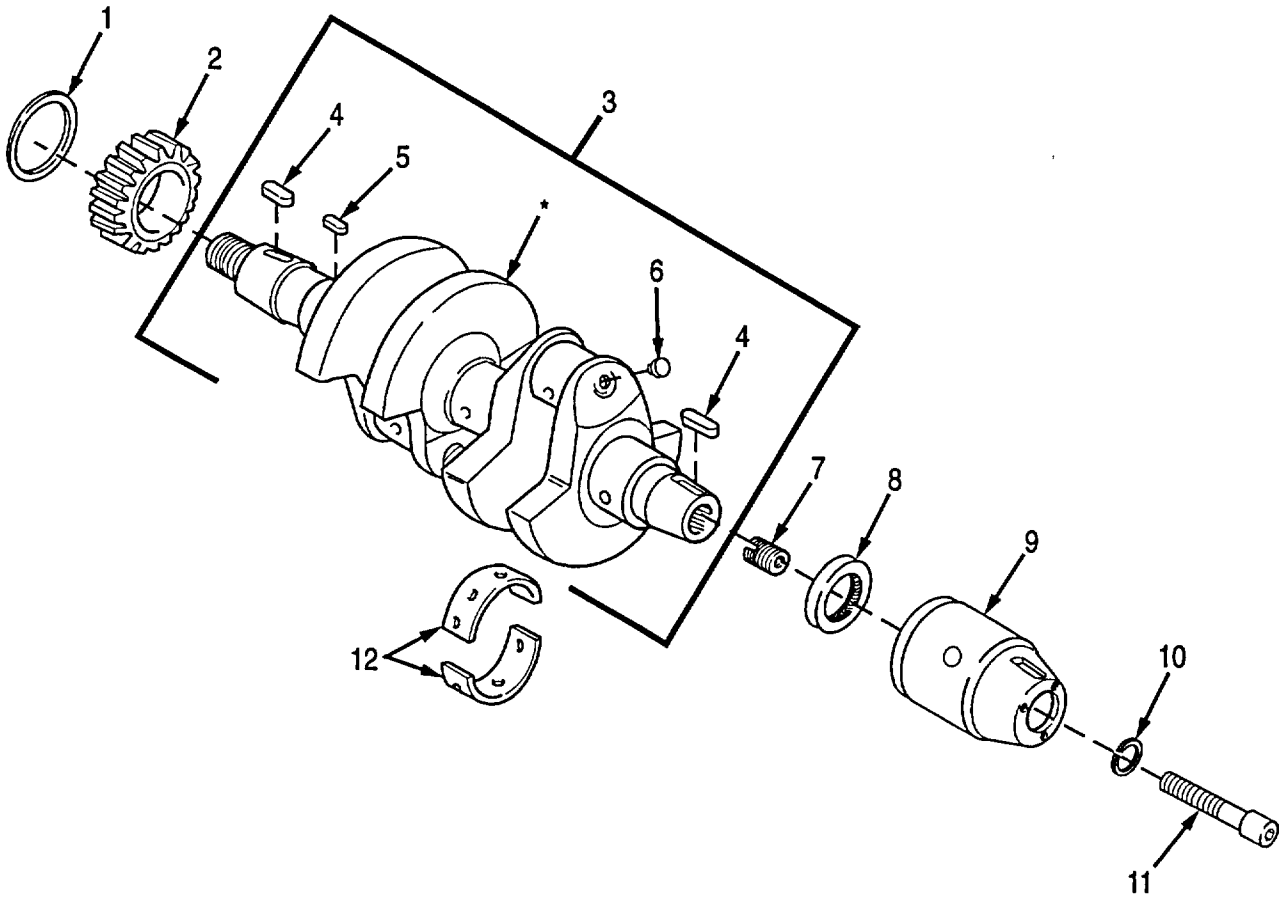


Figure 4. Crankcase Assembly

(1) ITEM NO	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
					GROUP 2911 CRANKCASE, CYLINDER SLEEVE, AND CYLINDER HEAD	
					FIG. 4 CRANKCASE ASSEMBLY	
1	PAFZZ	5307014059905	61080	50098300	STUD, PLAIN	4
2	PAFZZ	5340014549272	61080	04038200	CAP-PLUG, PROTECTIVE	2
3	PAFZZ	5340014549273	61080	04039100	CAP-PLUG, PROTECTIVE	4
4	PAFZZ	5305014060014	61080	50137000	SCREW, MACHINE	7
5	PAFZZ	5310121494353	61080	50144500	WASHER, FLAT	11
6	KFFZZ		61080	50301200	GASKET PART OF KIT P/N 01228000	1
7	XAOZZ		61080	01227410	CRANKCASE ASSY	1
8	PAFZZ	5310014059890	61080	50144400	NUT PLAIN, HEXAGON	10
9	PAFZZ	5315014000444	61080	50300700	PIN, STRAIGHT, HEADLE	2
10	PAFZZ	4730014547542	61080	50302700	NIPPLE, PIPE	1
11	PAFZZ	5305014551615	61080	50052100	SCREW, CAP, SOCKET HE	2
12	PAFZZ	5310013997303	61080	50208500	WASHER, SPRING TENSI	2
13	PAFZZ	5340014552343	61080	99400645	COVER, ACCESS	1
14	KFFZZ		61080	50291400	GASKET PART OF KIT P/N 01228000	1
15	KFFZZ		61080	50301100	GASKET PART OF KIT P/N 01228000	1
16	KFFZZ		61080	50275000	O-RING PART OF KIT P/N 01228000	8
17	PAFZZ	5307014552205	61080	50307000	STUD, PLAIN	1
18	PAFZZ	5315013996106	61080	50301000	PIN, SPRING	1
19	PAFZZ	5315013996105	61080	50290500	PIN, STRAIGHT, HEADLE	2
20	PAFZZ	5307014059997	61080	50128100	STUD, PLAIN	2
					END OF FIGURE	



* Part of Item 3

Figure 5. Crankshaft Assembly

(1) ITEM NO	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
					GROUP 2912 CRANKSHAFT ASSEMBLY FIG. 5 CRANKSHAFT ASSEMBLY	
1	KFFZZ		61080	50347500	SHIM 0.2mm PART OF KIT P/N 01228000	1
1	KFFZZ		61080	50347600	SHIM 0.3nmm PART OF KIT P/N 01228000	1
2	PAFZZ		61080	50304400	GEAR, HELICAL	1
3	PAFFF	2815014550423	61080	01262700	CRANKSHAFT, ENGINE	1
4	PAFZZ	5315011031522	61080	50011200	.KEY	2
5	PAFZZ	5315014000441	61080	50304300	.KEY, MACHINE	1
6	PAFZZ	5340014550010	61080	50304100	.PLUG, MACHINE THREAD	4
7	PAFZZ	5365014064171	61080	50333900	INSERT	1
8	PAFZZ	5330014005773	61080	50304500	SEAL, PLAIN PART OF KIT P/N 01228000 .	1
9	PAFZZ		61080	99400638	HUB, BODY	1
10	PAFZZ	5310014002138	61080	50146000	WASHER, SPRING TENSI	1
11	PAFZZ	5305014551245	61080	50055100	SCREW, CAP, SOCKET HE	1
12	PAFZZ	3120014163105	61080	50302100	BEARING, SLEEVE	3
					END OF FIGURE	

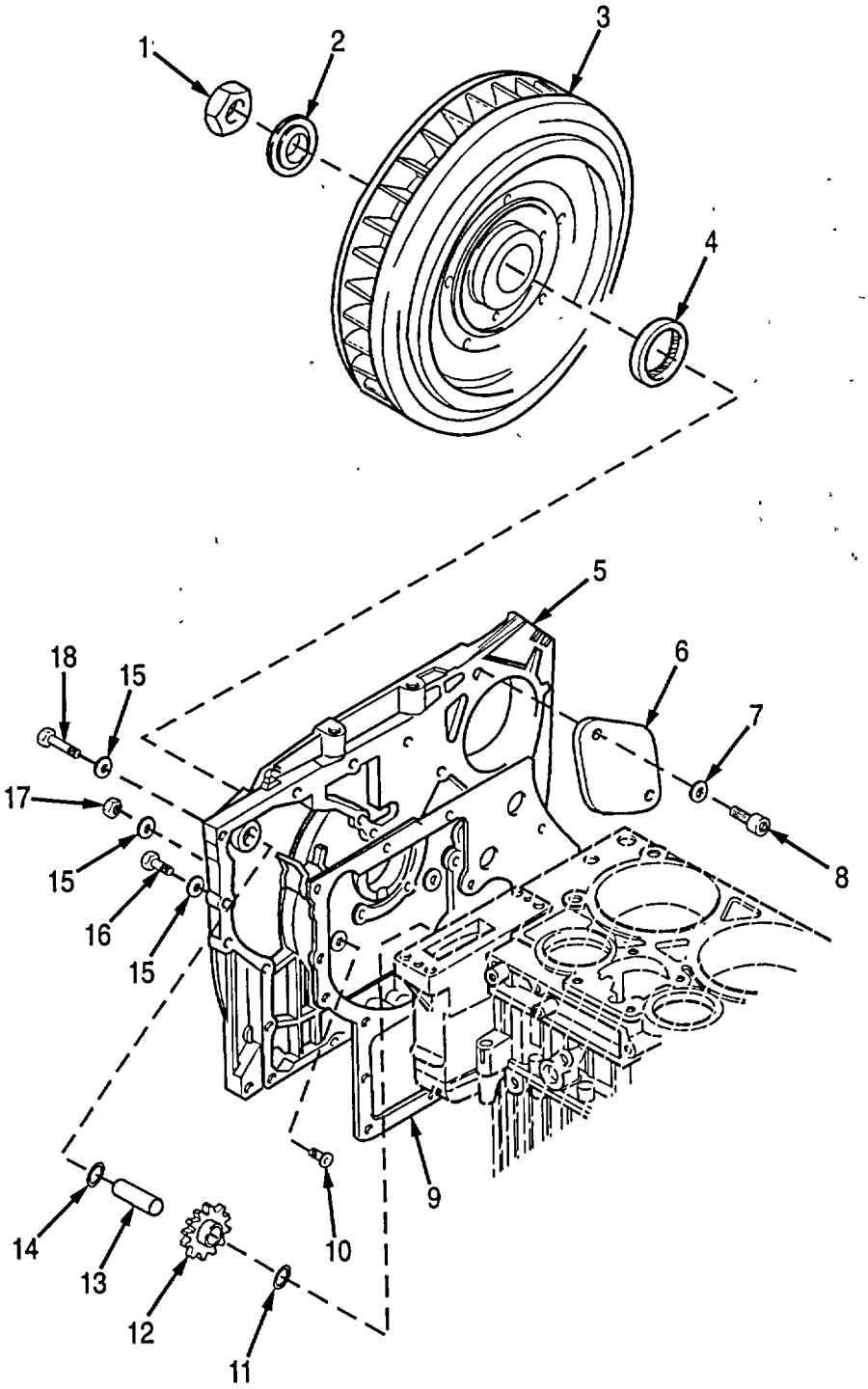
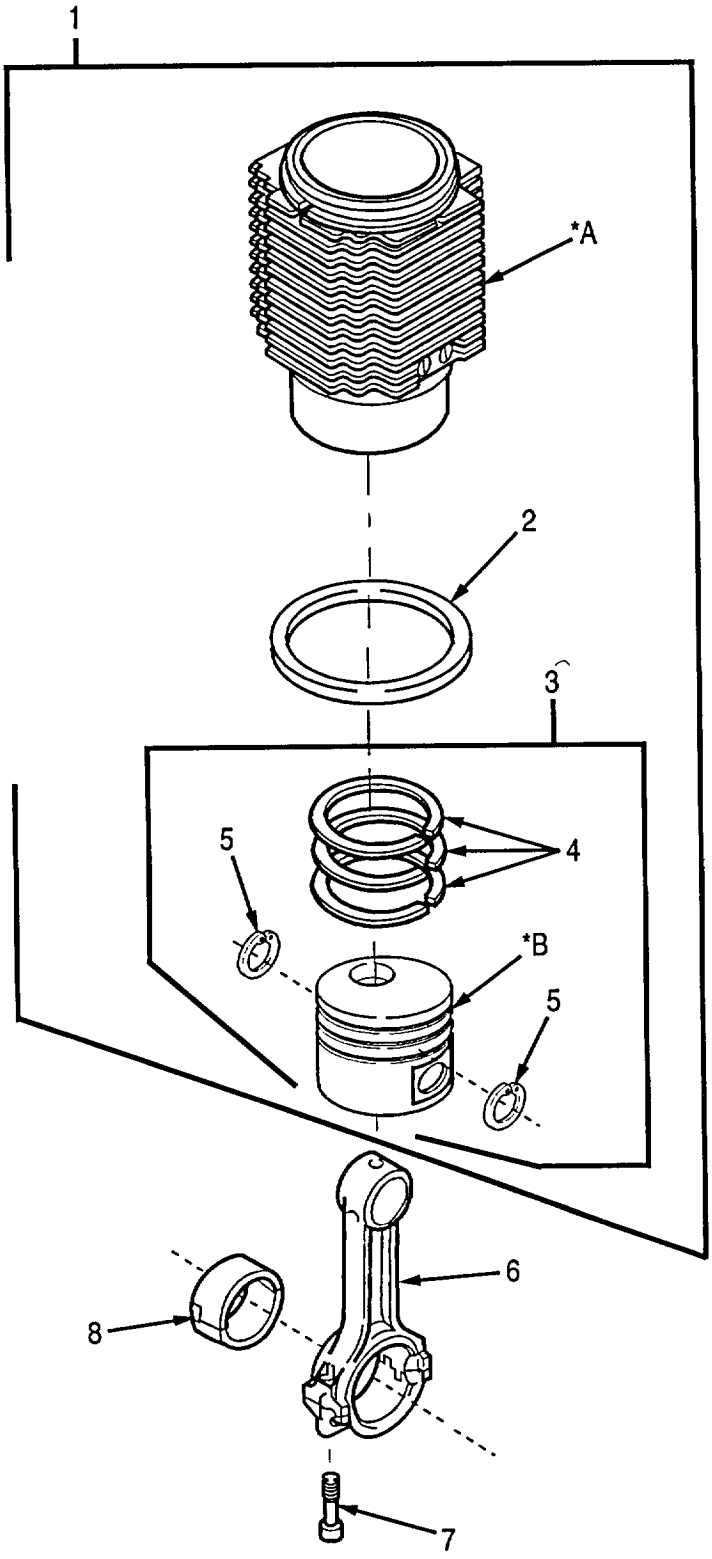


Figure 6. Flywheel and Related Components

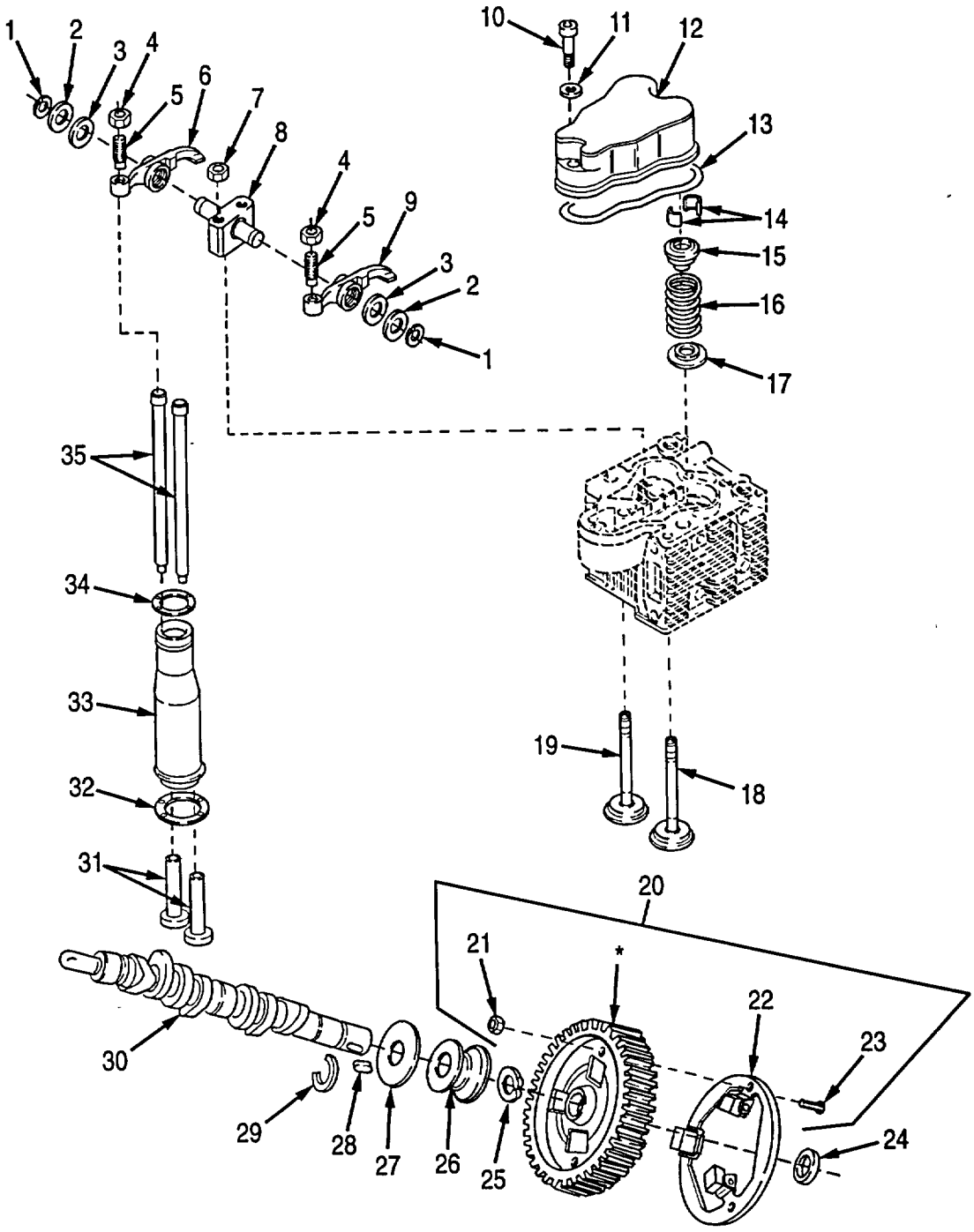
(1) ITEM NO	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
					GROUP 2913 FLYWHEEL ASSEMBLY FIG. 6 FLYWHEEL AND RELATED COMPONENTS	
1	PAFZZ	5310014002140	61080	04031300	NUT PLAIN, HEXAGON	1
2	PAFZZ	5310014002141	61080	03975300	WASHER FLAT	1
3	PAFZZ	2815014550376	61080	03792100	FLYWHEEL, ENGINE	1
4	KFFZZ		61080	50311200	O-RING PART OF KIT P/N 01228000	1
5	PAFZZ	2815014549103	61080	50310810	HOUSING, FLYWHEEL	1
6	PAOZZ		61080	99400646	COVER, ACCESS	1
7	PAOZZ	5310014059911	61080	50145900	WASHER, FLAT	2
8	PAOZZ	5305014060005	61080	50093400	SCREW, MACHINE	2
9	KFFZZ		61080	50311500	GASKET PART OF KIT P/N 01228000	1
10	PAFZZ	5305014059908	61080	50310900	SCREW, MACHINE	3
11	PAFZZ	5310014001002	61080	50195800	WASHER FLAT	1
12	PAFZZ		61080	01239901	PINION ASSEMBLY	1
13	PAFZZ	5315014558935	61080	50303610	PIN, STRAIGHT, HEADLE	1
14	PAFZZ	5330013998357	61080	50336200	O-RING	1
15	PAFZZ	5310121494353	61080	50144500	WASHER, FLAT	22
16	PAFZZ	5305014060000	61080	50092100	SCREW, MACHINE	18
17	PAFZZ	5310014059890	61080	50144400	NUT PLAIN, HEXAGON	3
18	PAFZZ		61080	50026400	SCREW, MACHINE	1
					END OF FIGURE	



*A Part of Item 1
*B Part of Item 3

Figure 7. Pistons and Connecting Rods

(1) ITEM NO	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
					GROUP 2914 PISTONS AND CONNECTING RODS FIG. 7 PISTONS AND CONNECTING RODS	
1	PAFFF	2835014148480	61080	01247100	LINER,COMBUSTION CH	2
2	PAFZZ	5365014550011	61080	03958000	.SHIM 0.3mm	1
3	PAFFF	2815014550057	61080	01240202	.PISTON,INTERNAL CO	1
4	PAFZZ	2815014550428	61080	01240300	.RING SET,PISTON.....	1
5	PAFZZ	5325014558936	61080	50359110	.RING,RETAINING.....	2
6	PAFZZ	2815014141273	61080	01262200	CONNECTING ROD,PIST	2
7	PAFZZ	5305014060001	61080	03781100	SCREW,MACHINE	4
8	PAFZZ	3120014163110	61080	03781300	BEARING,SLEEVE.....	2
					END OF FIGURE	



* Part of Item 20

Figure 8. Camshaft and Valves

(1) ITEM NO	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
					GROUP 2915 VALVES, CAMSHAFT, AND TIMING SYSTEM	
					FIG. 8 CAMSHAFT AND VALVES	
1	PAFZZ	5325013994615	61080	50019800	RING, RETAINING	4
2	PAFZZ	5365013995011	61080	50315900	SHIM 0.2MM	1
3	PAFZZ	5365014550012	61080	50316000	SHIM 0.3MM	1
4	PAFZZ	5310010788066	61080	03173100	NUT PLAIN, HEXAGON	4
5	PAFZZ	5305014059904	61080	03783000	SCREW, MACHINE	4
6	PAFZZ	2815014550054	61080	01224400	ROCKER ARM, ENGINE P	2
7	PAFZZ	5310011012028	61080	40028400	NUT SELF-LOCKING, HE	4
8	PAFZZ	2815014550046	61080	01224600	BRACKET, ROCKER ARM	2
9	PAFZZ	2815014550043	61080	01224500	ROCKER ARM, ENGINE P	2
10	PAOZZ	5305014059903	61080	50177500	SCREW, MACHINE	4
11	PAOZZ	5310014152649	61080	50162900	WASHER FLAT PART OF KIT P/N 01247700	4
12	PAOZZ	2815014548841	61080	03783800	COVER, ENGINE POPPET	2
13	PAOZZ	5330014005772	61080	50290200	O-RING PART OF KIT P/N 01247700	2
14	PAFZZ	2815014550364	61080	03786300	LOCK, VALVE SPRING R	4
15	PAFZZ		61080	03783600	WASHER, SPRING TENSI	4
16	PAFZZ	5360014148475	61080	03783500	SPRING HELICAL, COMP	4
17	PAFZZ	5310013997311	61080	03783401	WASHER SPRING TENSI	4
18	PAFZZ	4820014070705	61080	03783300	VALVE EXHAUST CONTR	2
19	PAFZZ	2805014070706	61080	03783200	VALVE POPET, ENGINE	2
20	PAFZZ	3010014552856	61080	01222100	GEAR ASSY, CAMSHAFT	1
21	PAFZZ	5310014003721	61080	50305400	.NUT PLAIN, HEXAGON	3
22	PAFZZ	5340014001000	61080	01244800	.PLATE, MOUNTING	1
23	PAFZZ	5305014060013	61080	50305300	.SCREW, MACHINE	3
24	PAFZZ	5365011005415	61080	03233200	SHIM 0.2MM	1
24	PAFZZ	5365011005416	61080	03233300	SHIM 0.3MM	1
25	PAFZZ	5325012453517	61080	50020000	RING, RETAINING	1
26	PAFZZ	5365014003717	61080	50305700	SPACER, SLEEVE	1
27	PAFZZ	5310013996981	61080	50306001	WASHER FLAT	1
28	PAFZZ	5315011027922	61080	50010500	KEY	1
29	PAFZZ	5325013994618	61080	50305000	RING, RETAINING	1
30	PAFZZ	2815014548842	61080	04092800	CAMSHAFT, ENGINE	1
31	PAFZZ	2815014550085	61080	50302000	TAPPET, ENGINE POPPE	4
32	KFFZZ		61080	50290100	O-RING PART OF KIT P/N 01247700	2
33	PAFZZ	2815014548839	61080	03781800	GUIDE, ENGINE POPPET	2
34	KFFZZ		61080	50208400	O-RING PART OF KIT P/N 01247700	2
35	PAFZZ	2815123305421	61080	01224001	ROD, PUSH	4
					END OF FIGURE	

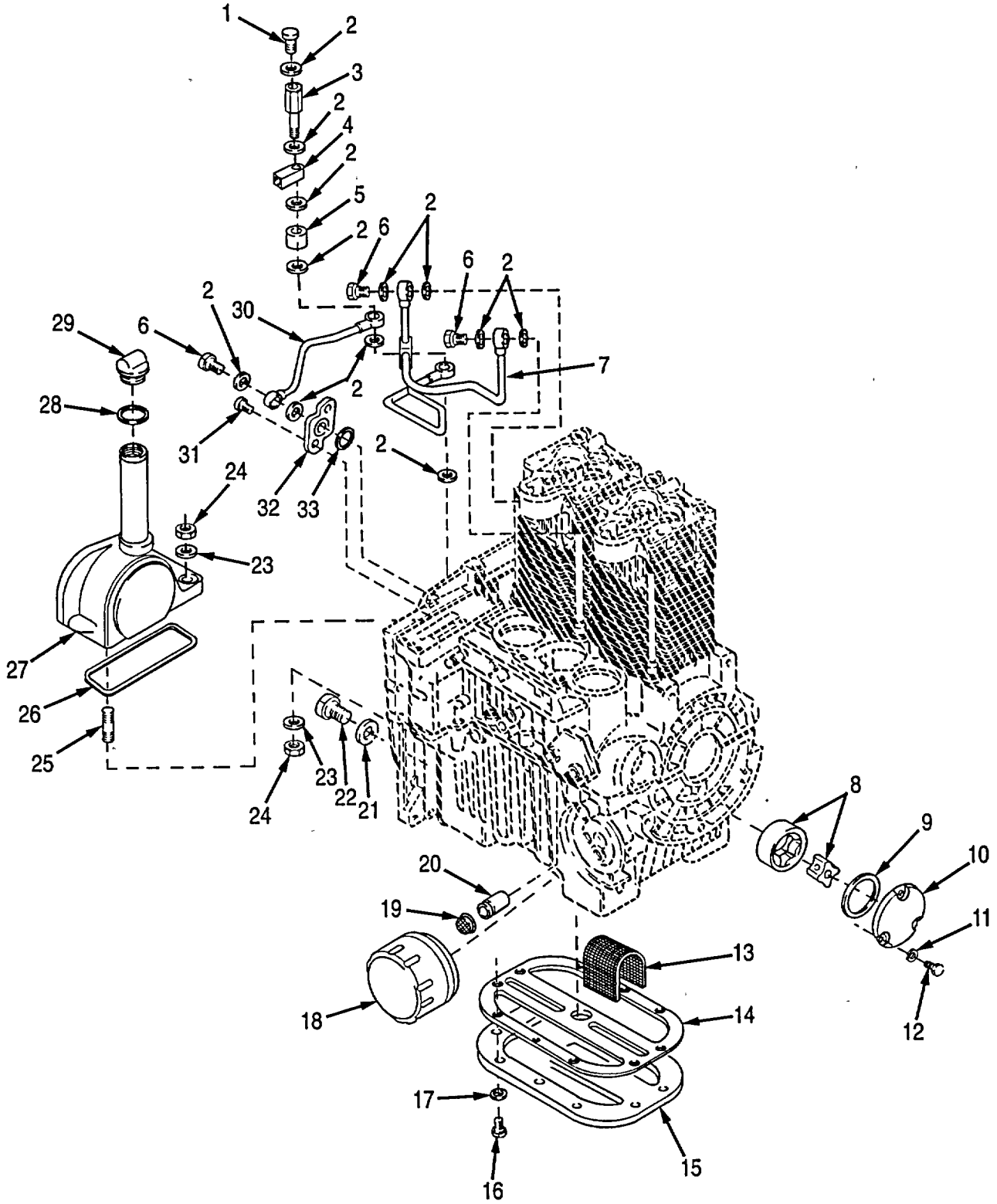


Figure 9. Engine Lubrication System

(1) ITEM NO	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
					GROUP 2916 ENGINE LUBRICATION SYSTEM FIG. 9 ENGINE LUBRICATION SYSTEM	
1	PAOZZ	5305014059906	61080	50033300	SCREW, MACHINE	1
2	PAOZZ	5310010900938	61080	50000900	WASHER FLAT PART OF KIT P/N 01247700 .	12
3	PAOZZ	4730014547549	61080	03790001	BOLT, FLUID PASSAGE	1
4	PAOZZ	4730014547692	61080	03932100	CONNECTOR, MULTIPLE	1
5	PAOZZ	4730014547693	61080	03790100	BUSHING, BOSS	1
6	PAOZZ	4730011033202	61080	50006100	BOLT, FLUID PASSAGE	3
7	PAOZZ	4710014547687	61080	01224900	TUBE ASSEMBLY, METAL	1
8	PAFZZ	2815014550432	61080	01227900	OIL PUMP ASSEMBLY	1
9	KFFZZ		61080	50310500	O-RING PART OF KIT P/N 01228000	1
10	PAFZZ	5340014549280	61080	50310400	COVER, ACCESS	1
11	PAFZZ	5310014002139	61080	50216300	WASHER, FLAT	3
12	PAFZZ	5305014060004	61080	50025200	SCREW, MACHINE	3
13	PAFZZ	4730014547461	61080	50301400	STRAINER ELEMENT, SE	1
14	KFFZZ		61080	50301500	GASKET PART OF KIT P/N 01228000	1
15	PAFZZ	2815014550042	61080	50301601	OIL PAN	1
16	PAFZZ	5305014551243	61080	50207900	SCREW, MACHINE	10
17	PAFZZ	5310012392390	61080	500-812-00	WASHER LOCK	10
18	PAOZZ	2940013839739	61080	50302800	FILTER ELEMENT, FLUI OIL	1
19	PAOZZ	4730014547545	61080	05034900	STRAINER ELEMENT, SE	1
20	PAFZZ	4820014555017	61080	01221803	VALVE, SAFETY RELIEF	1
21	PAOZZ	5330011018076	61080	50001200	GASKET PART OF KIT P/N 01228000	1
22	PAOZZ	4820014060343	61080	50311000	COCK, POPPET DRAIN	1
23	PAFZZ	5310013998386	61080	03788800	WASHER FLAT	4
24	PAFZZ	5310014003719	61080	50335300	NUT PLAIN, HEXAGON	4
25	PAFZZ	5307014059907	61080	50321900	STUD, PLAIN	2
26	KFFZZ		61080	50323500	O-RING PART OF KIT P/N 01228000	1
27	PAFZZ	2590014548941	61080	03908201	FILLER NECK, VEHICUL	1
28	PAOZZ	5331010707136	61080	50153800	O-RING PART OF KIT P/N 01228000	1
29	PAOZZ	2590012825087	61080	00632101	CAP, FILLER OPENING	1
30	PAOZZ	4710014547688	61080	50336300	TUBE ASSEMBLY, METAL	1
31	PAOZZ	5305014059998	61080	50274500	SCREW, MACHINE	2
32	PAOZZ	5340014549281	61080	50336400	COVER, ACCESS	1
33	PAOZZ	5330013996976	61080	50336500	O-RING PART OF KIT P/N 01228000	1
					END OF FIGURE	

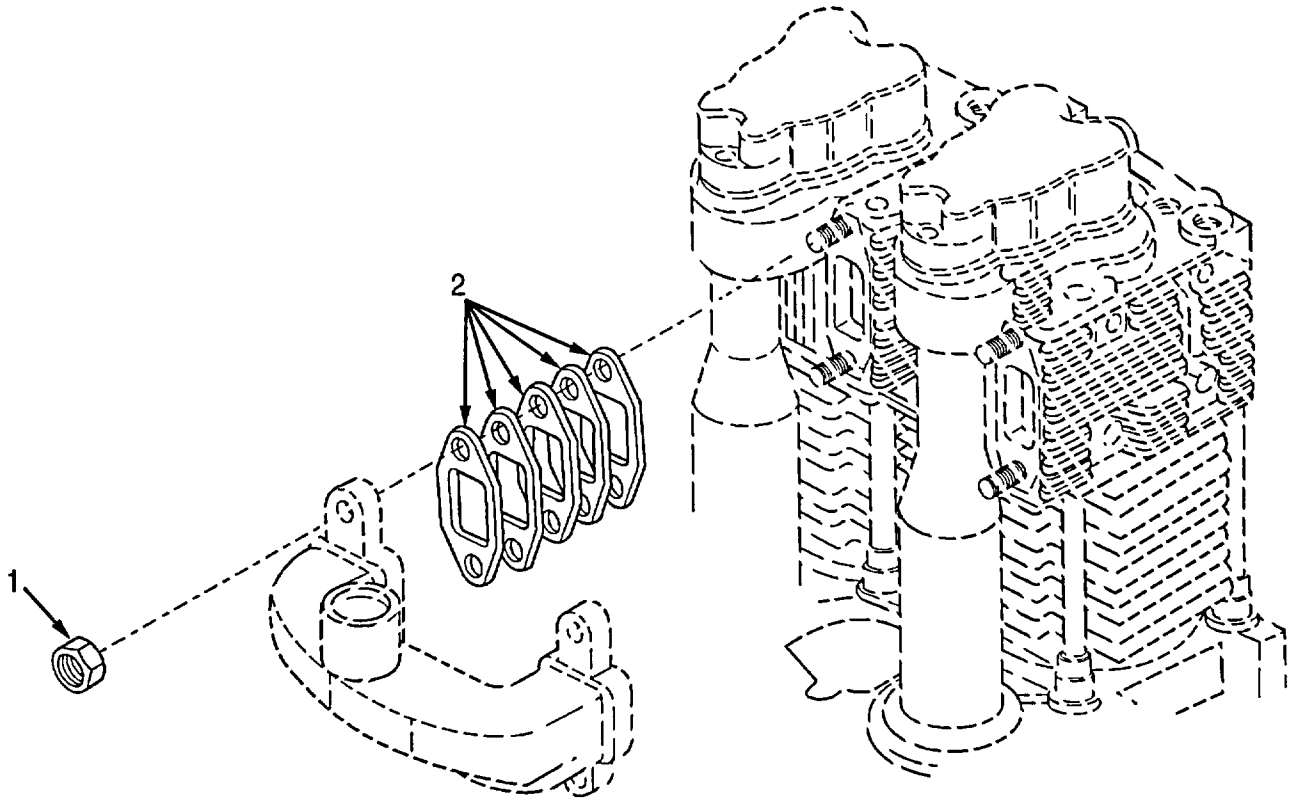


Figure 10. Exhaust Manifold Mounting Hardware

(1) ITEM NO	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
					GROUP 2918 MANIFOLDS FIG. 10 EXHAUST MANIFOLD MOUNTING HARDWARE	
1	PAOZZ	5310011012028	61080	40028400	NUT SELF-LOCKING,HE	4
2	PAOZZ	5330014557566	61080	01285500	GASKET SET	2
					END OF FIGURE	

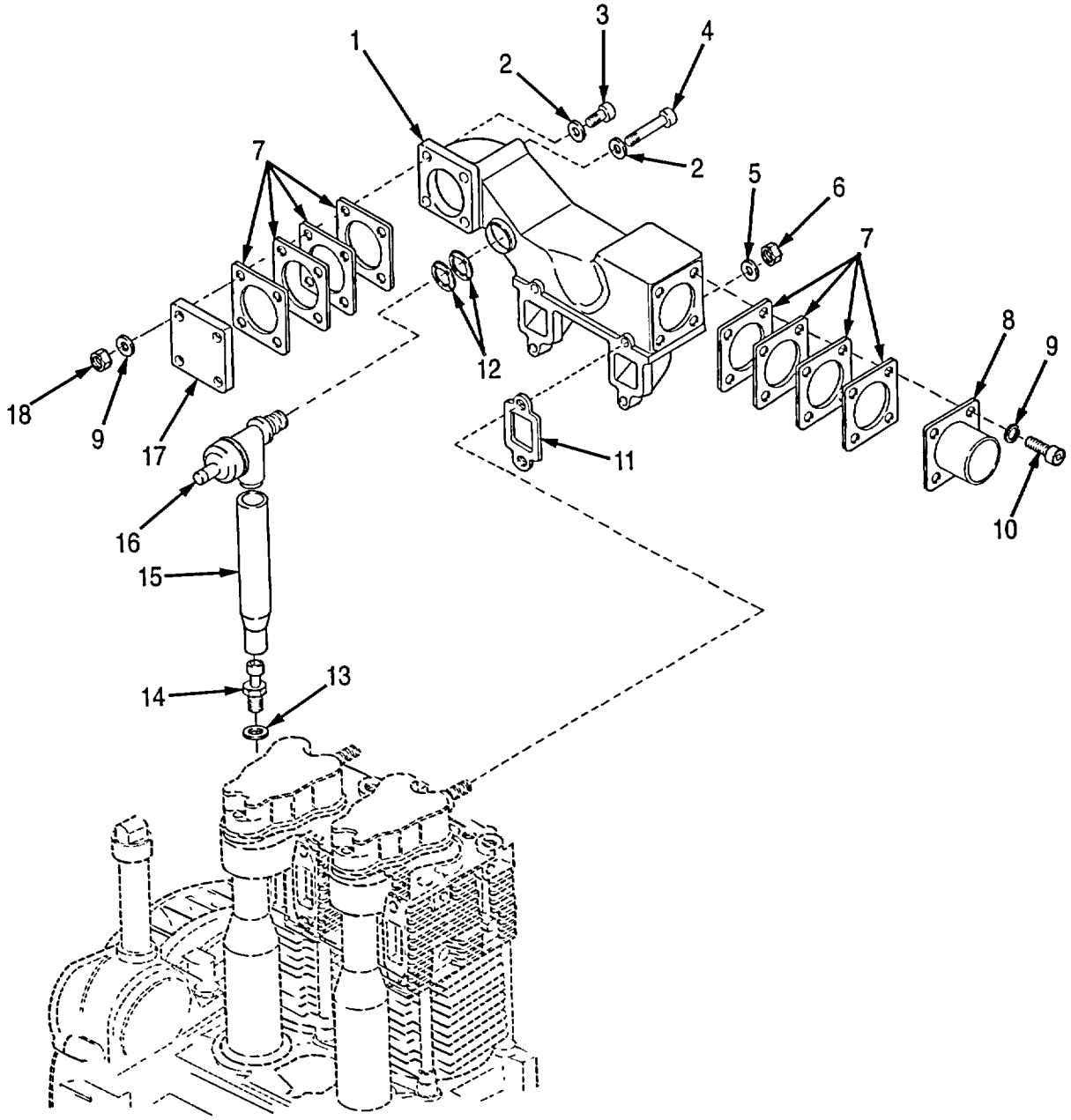
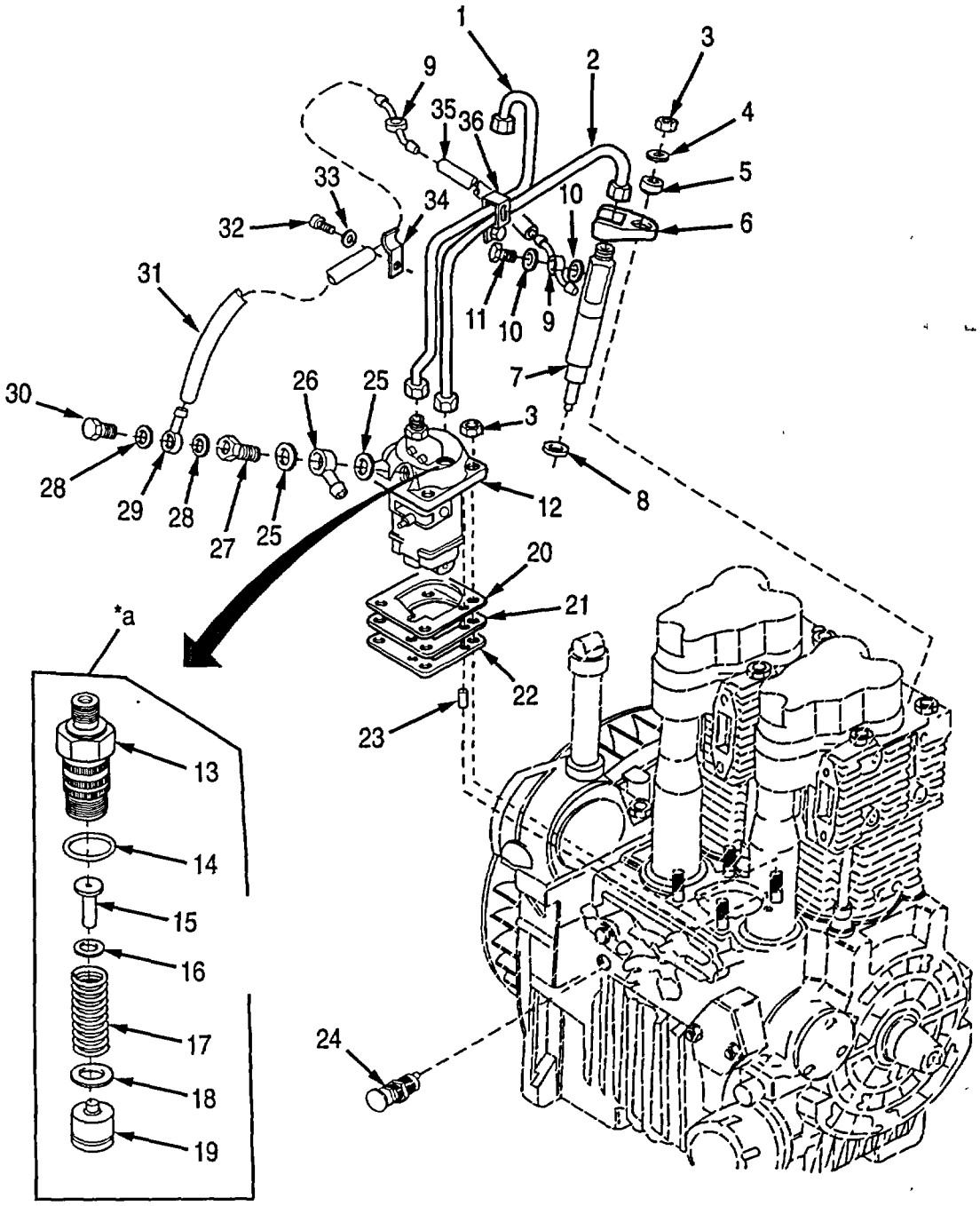


Figure 11. Intake Manifold and Related Components

(1) ITEM NO	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
					GROUP 2918 MANIFOLDS FIG. 11 INTAKE MANIFOLD AND RELATED COMPONENTS	
1	PAOZZ	2815014550041	61080	03787402	MANIFOLD, INTAKE	1
2	PAOZZ	5310014558480	61080	50148100	WASHER, FLAT	4
3	PAOZZ	5305014551242	61080	50175900	SCREW, CAP, SOCKET HE	2
4	PAOZZ	5305014551247	61080	50183100	SCREW, CAP, SOCKET HE	2
5	PAOZZ	5310013997305	61080	50095100	WASHER SPRING TENSI	4
6	PAOZZ	5310011012028	61080	40028400	NUT SELF-LOCKING, HE	4
7	PAOZZ	5330014557823	61080	01285600	GASKET SET	2
8	PAOZZ	2815014548626	61080	01198900	ADAPTER, INTAKE MANI	1
9	PAOZZ	5310013997303	61080	50208500	WASHER, SPRING TENSI	8
10	PAOZZ	5305014551613	61080	50206300	SCREW, CAP, SOCKET HE	4
11	PAOZZ	5330014557819	61080	03783902	GASKET PART OF KIT P/N 01247700	2
12	PAOZZ	5330013998354	61080	50326200	O-RING	2
13	PAOZZ	5330010801776	61080	50001100	GASKET PART OF KIT P/N 01228000	1
14	PAOZZ	4730013996267	61080	50303000	COUPLING, HOSE	1
15	PAOZZ	4720013996266	61080	03784000	HOSE, PREFORMED	1
16	PAOZZ	4820013995579	61080	01225610	VALVE VENT	1
17	PAOZZ	5340014549271	61080	03939700	COVER, ACCESS	1
18	PAOZZ	5310014003720	61080	50148000	NUT PLAIN, HEXAGON	4
					END OF FIGURE	



*a Part of Item 12

Figure 12. Injection Pump, Nozzles, and Fuel Lines

(1) ITEM NO	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
					GROUP 2932 ENGINE FUEL SYSTEM	
					FIG. 12 INJECTION PUMP, NOZZLES, AND FUEL LINES	
1	PAOZZ	4710013997358	61080	01240900	PIPE ASSEMBLY, METAL	1
2	PAOZZ	4710013997359	61080	01241000	PIPE ASSEMBLY, METAL	1
3	PAFZZ	5310014003720	61080	50148000	NUT PLAIN, HEXAGON	6
4	PAFZZ	5310013997303	61080	50208500	WASHER, SPRING TENSI	2
5	PAFZZ	5310014000995	61080	04035700	WASHER, FLAT	2
6	PAFZZ	4730013994252	61080	03792400	CLAMP, HOSE	2
7	PAFZZ	2910123377727	61080	50355500	INJECTOR, FUEL	2
8	KFFZZ		61080	40085001	GASKET PART OF KIT P/N 01247700	2
9	PAOZZ	4730013994253	61080	03780800	NIPPLE, HOSE	2
10	PAOZZ	5310014059900	61080	50313100	GASKET PART OF KIT P/N 01247700	4
11	PAOZZ	4730013994254	61080	50313000	BOLT, FLUID PASSAGE	2
12	PAFZZ	2910123388683	61080	50355400	PUMP, INJECTION	1
13	PAFZZ		61080	49061200	.BODY, VALVE	2
14	PAFZZ	5330011018063	61080	49004700	.O-RING	2
15	PAFZZ	5340011004991	61080	49003900	.PLUG, VENT	2
16	PAFZZ	5365011015938	61080	49004300	.SHIM	2
17	PAFZZ		61080	49003500	.SPRING, RELICAL, COMP	2
18	PAFZZ	5330011017264	61080	49004400	.GASKET	2
19	PAFZZ	4820014071908	61080	3418502037	.VALVE, PRESSURE EQUA	2
20	KFFZZ		61080	50312500	GASKET 0.3mm PART OF KIT P/N 01228000.	1
21	KFFZZ		61080	50312400	GASKET 0.2mm PART OF KIT P/N 01228000 .	1
22	KFFZZ		61080	50312300	GASKET 0.1mm PART OF KIT P/N 01228000 .	1
23	PAFZZ	5315014000445	61080	50312200	PIN, STRAIGHT, HEADLE	1
24	PAFZZ	4820014555018	61080	01231501	VALVE, FLOW CONTROL	1
25	PAOZZ	5330010801776	61080	50001100	GASKET PART OF KIT P/N 01228000	2
26	PAOZZ	4730014547573	61080	40092600	FITTING, RING PIECE	1
27	PAOZZ	4730014547560	61080	01223200	ADAPTER, STRAIGHT, TU	1
28	PAOZZ	5310010900938	61080	50000900	WASHER FLAT PART OF KIT P/N 01228000 .	2
29	PAOZZ	4730014547567	61080	50015700	FITTING, RING PIECE	1
30	PAOZZ	4730014547569	61080	50311700	BOLT, FLUID PASSAGE	1
31	MOOZZ		61080	03902000-18	HOSE, NONMETALLIC MAKE FROM NONMETALLIC HOSE, P/N 0390200, 18 IN.	1
32	PAOZZ	5305014059901	61080	50098500	SCREW, MACHINE	1
33	PAOZZ	5310013997303	61080	50208500	WASHER, SPRING TENSI	1
34	PAOZZ	5340013997969	61080	03174700	CLAMP LOOP	1
35	MOOZZ		61080	03902000-6	HOSE, NONMETALLIC MAKE FROM NONMETALLIC HOSE, P/N 03902000, 6 IN	1
36	PAOZZ	5340014061646	61080	50314100	CLAMP LOOP	1
					END OF FIGURE	

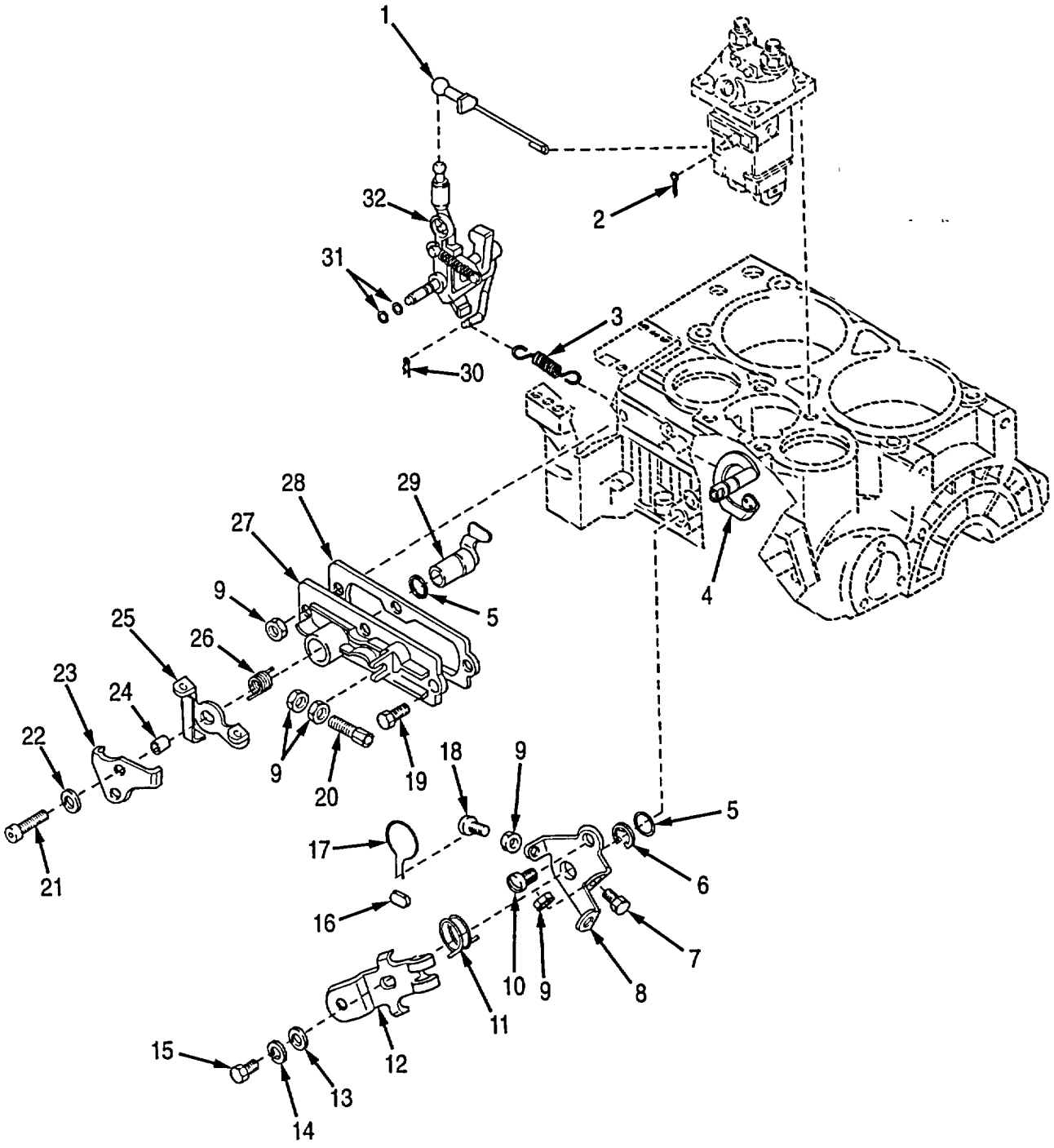


Figure 13. Governor and Controls

(1) ITEM NO	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
					GROUP 2936 ENGINE SPEED GOVERNOR AND CONTROLS FIG. 13 GOVERNOR AND CONTROLS	
1	PAFZZ		61080	01222400	LEVER, GOVERNOR	1
2	PAFZZ	5315013996107	61080	50036000	PIN, COTTER	1
3	PAFZZ	5360013995014	61080	04020200	SPRING HELICAL, COMP	1
4	PAFZZ	2990014548630	61080	04088300	LEVER, THROTTLE	1
5	PAFZZ	5331013996978	61080	50306500	O-RING PART OF KIT P/N 01228000	2
6	PAFZZ	5325014000999	61080	50308800	RING, RETAINING	1
7	PAFZZ	5305014060000	61080	50092100	SCREW, MACHINE	1
8	PAFZZ	2990014549173	61080	50308901	LEVER, SPEED CONTROL	1
9	PAFZZ	5310014059890	61080	50144400	NUT PLAIN, HEXAGON	5
10	PAFZZ	5305014551246	61080	50309200	SCREW, MACHINE	1
11	PAFZZ	5360013995016	61080	50309300	SPRING HELICAL, COMP	1
12	PAFZZ	2990014549177	61080	50309400	LEVER, SPEED CONTROL	1
13	PAFZZ	5310014059912	61080	50309500	WASHER, FLAT	1
14	PAFZZ	5310014558481	61080	50114300	WASHER LOCK	1
15	PAFZZ	5305012741064	61080	500-254-00	SCREW, MACHINE	1
16	PAFZZ	5330011202966	61080	40021400	SEAL	1
17	PAFZZ	5999011168286	61080	40021500	WIRE MESH, KNITTED	1
18	PAFZZ	5305014060011	61080	03791600	SCREW, MACHINE	1
19	PAFZZ	5305014060006	61080	50146300	SCREW, MACHINE	3
20	PAFZZ	5305014060007	61080	50306900	SCREW, MACHINE	1
21	PAFZZ	5305014551248	61080	50170800	SCREW, CAP, SOCKET HE	1
22	PAFZZ	5310013997301	61080	50170900	WASHER, SPRING TENSI	1
23	PAFZZ	2990014549202	61080	05063900	LEVER, GOVERNOR	1
24	PAFZZ	5365014550004	61080	03125800	SPACER, STRAIGHT	1
25	PAFZZ	2990014549214	61080	01266500	LEVER, GOVERNOR	1
26	PAFZZ	5360013995017	61080	50306600	SPRING HELICAL, COMP	1
27	PAFZZ	5340014549278	61080	50306200	PLATE, MOUNTING	1
28	KFFZZ		61080	50307100	GASKET PART OF KIT P/N 01247700	1
29	PAFZZ	2990014548635	61080	01222300	STOP LEVER, GOVERNOR	1
30	PAFZZ	5340014061645	61080	50308500	CLIP, SPRING TENSION	1
31	KFFZZ		61080	50308100	O-RING PART OF KIT P/N 01228000	2
32	PAFZZ	2990014550084	61080	01222510	LEVER ASSEMBLY, POWE	1
					END OF FIGURE	

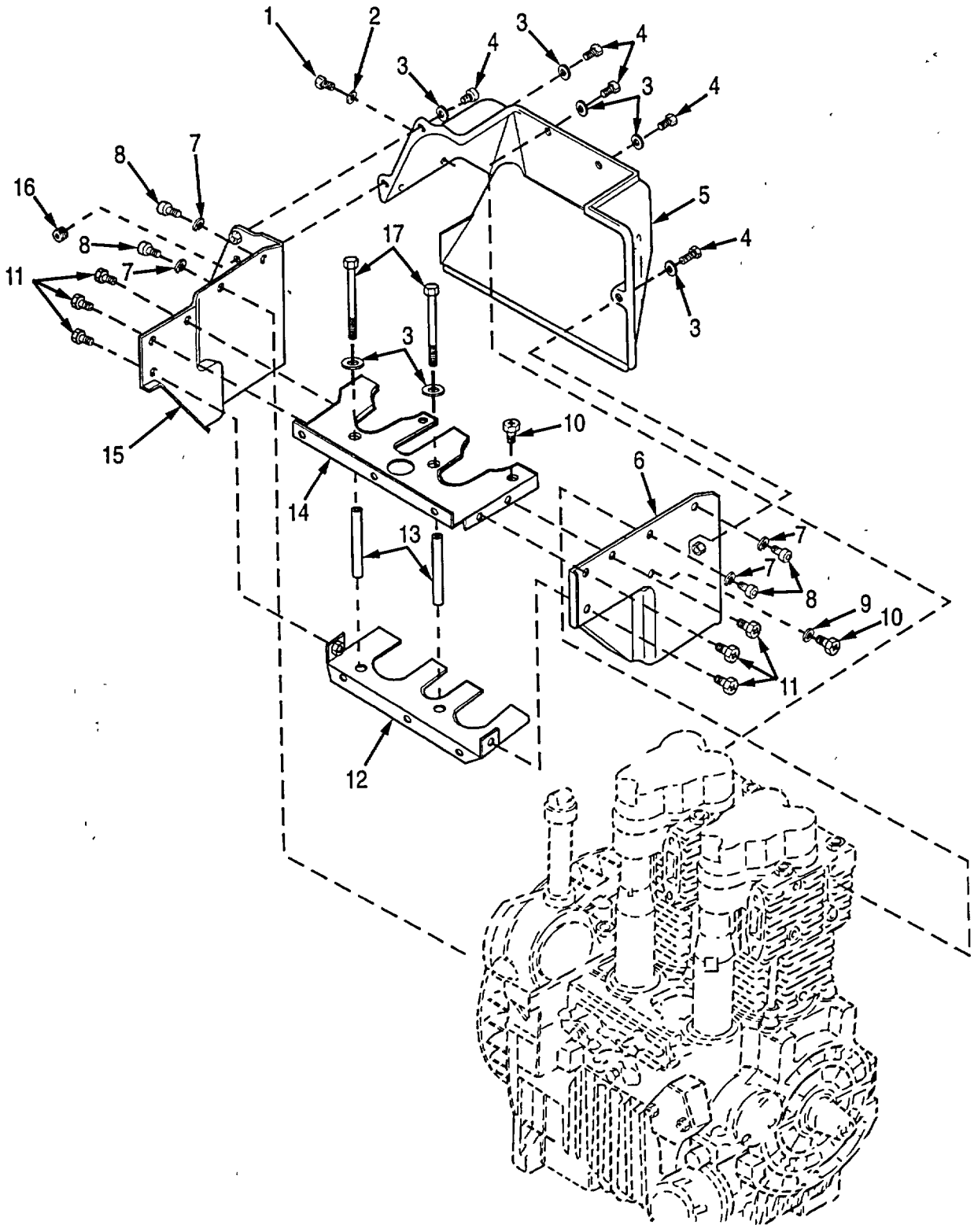


Figure 14. Engine Cowling, Ducts, and Shroud (sheet 1 of 2)

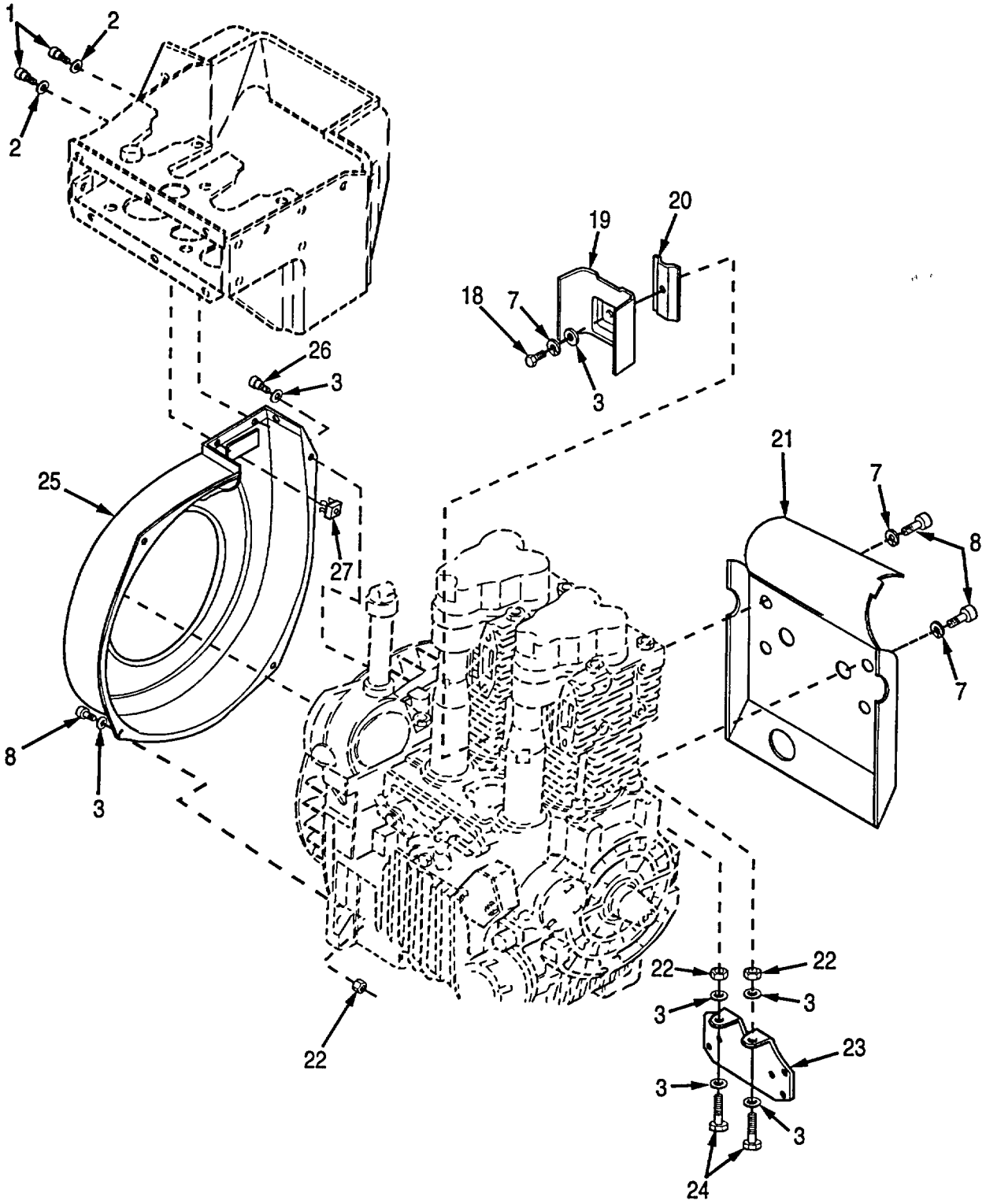


Figure 14. Engine Cowling, Ducts, and Shroud (sheet 2 of 2)

(1) ITEM NO	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
					GROUP 2952 ENGINE COWLING DEFLECTORS, AIR DUCTS, AND SHROUDS	
					FIG. 14 ENGINE COWLING,DUCTS, AND SHROUD	
1	PAOZZ	5305014059895	61080	50334600	SCREW, MACHINE	3
2	PAOZZ	5310014003715	61080	50315400	WASHER, SPLIT	3
3	PAOZZ	5310121494353	61080	50144500	WASHER, FLAT	15
4	PAOZZ	5305014059894	61080	50333800	SCREW, MACHINE	5
5	PAOZZ	2815014550040	61080	03784400	DEFLECTOR, AIRFLOW	1
6	PAOZZ		61080	01133200	BRACKET, AIR DUCT	1
7	PAOZZ	5310013997301	61080	50170900	WASHER, SPRING TENSI	10
8	PAOZZ	5305014059897	61080	50170700	SCREW, MACHINE.	10
9	PAOZZ	5310013997303	61080	50208500	WASHER, SPRING TENSI	2
10	PAOZZ	5305014059901	61080	50098500	SCREW, MACHINE	2
11	PAOZZ	5305014551622	61080	50289200	SCREW, MACHINE	8
12	PAOZZ	2815014549237	61080	01129900	DEFLECTOR, AIRFLOW	1
13	PAOZZ	3120014557311	61080	03920100	SPACER, SLEEVE	2
14	PAOZZ	2815014549210	61080	99400648	DEFLECTOR, AIRFLOW	1
15	PAOZZ		61080	01133300	BRACKET, AIR DUCT	1
16	PAOZZ	4720013995578	61080	50334800	SLEEVE, REINFORCING	1
17	PAOZZ	5305014551619	61080	50317800	SCREW, CAP, HEXAGON H	2
18	PAOZZ	5305014059892	61080	50165500	SCREW, CAP, HEXAGON H	1
19	PAOZZ	5340014549270	61080	03784300	BRACKET, AIR DUCT	1
20	PAOZZ	4730014157923	61080	01226100	SHEET, CLAMPING	1
21	PAOZZ	2815014549344	61080	01445200	DEFLECTOR, AIRFLOW	1
22	PAOZZ	5310014059890	61080	50144400	NUT PLAIN, HEXAGON	6
23	PAOZZ	2815014393916	61080	03958100	CONSOLE, REGULATOR	1
24	PAOZZ	5305014060003	61080	50293200	SCREW, MACHINE	2
25	PAOZZ	2815014550039	61080	50405600	DEFLECTOR, AIRFLOW	1
26	PAOZZ	5305014059898	61080	50170600	SCREW, MACHINE	1
27	PAOZZ	5310014558482	61080	50408500	NUT, PLAIN, CLINCH	3
					END OF FIGURE	

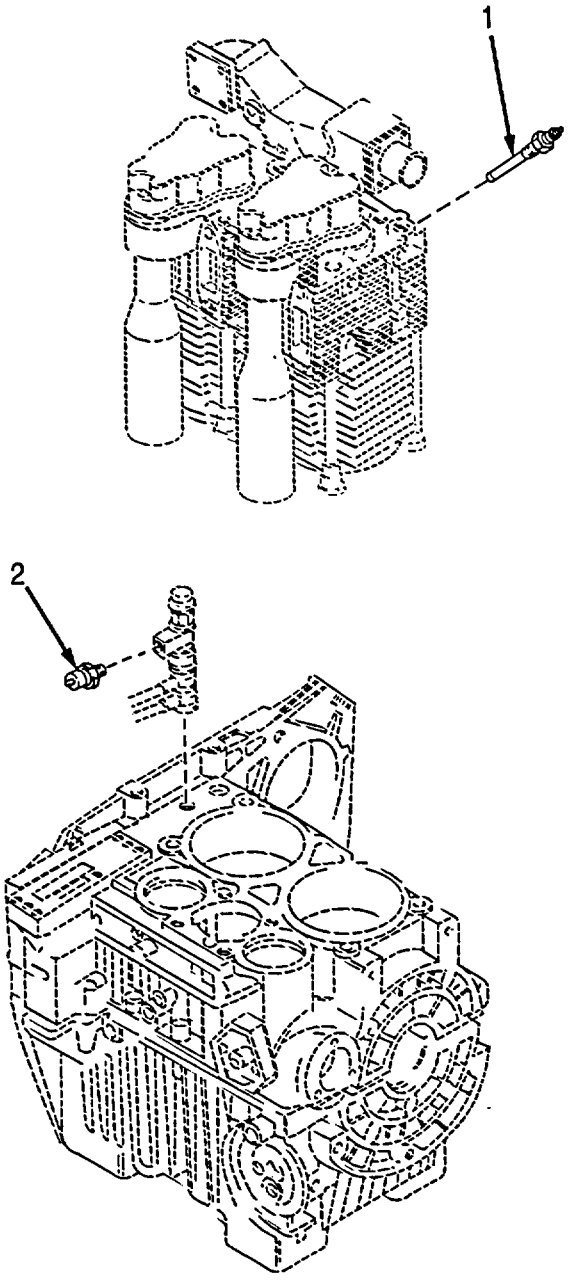


Figure 15. Sending Units

(1) ITEM NO	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
					GROUP 2960 SENDING UNITS FIG. 15 SENDING UNITS	
1	PAOZZ	5930014160352	61080	50344500	SWITCH, THERMOSTATIC	1
2	PAOZZ	5930014410097	61080	50293810	SWITCH, PRESSURE	1
					END OF FIGURE	

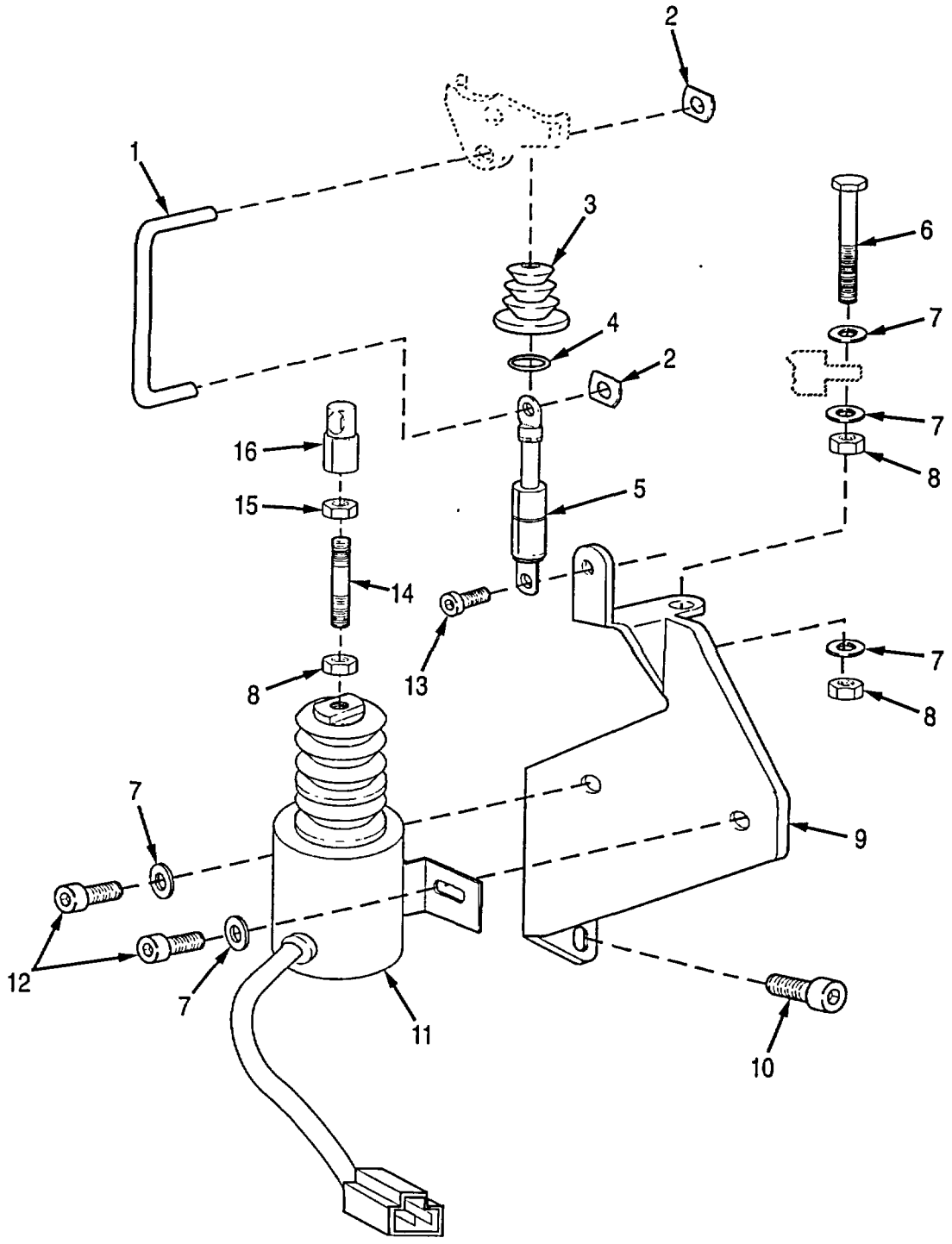


Figure 16. Fuel-Shutoff Solenoid

(1) ITEM NO	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
					GROUP 2968 SWITCHES,CIRCUIT BREAKERS AND FUSES	
					FIG. 16 FUEL-SHUTOFF SOLENOID	
1	PAOZZ		61080	05063800	CONNECTING LINK, RIG	1
2	PAOZZ	5340014549284	61080	50365600	CLIP	2
3	PAOZZ	5340014549277	61080	50180400	BELLOWS, PROTECTION	1
4	PAOZZ		61080	50225501	O-RING	1
5	PAOZZ	5945014548223	61080	50431300	PLUNGER, SOLENOID	1
6	PAOZZ	5305014013694	61080	50328500	SCREW MACHINE	4
7	PAOZZ	5310121494353	61080	50144500	WASHER, FLAT	5
8	PAOZZ	5310014059890	61080	50144400	NUT PLAIN, HEXAGON	3
9	PAOZZ	5945014548230	61080	01516900	BRACKET, SOLENOID	1
10	PAOZZ	5305014551251	61080	50290300	SCREW, CAP, SOCKET HE	1
11	PAOZZ	5945014548238	61080	01509110	SOLENOID, ELECTRICAL	1
12	PAOZZ	5305014551250	61080	50149100	SCREW, CAP, SOCKET HE	2
13	PAOZZ	5305012741064	61080	500-254-00	SCREW, MACHINE	1
14	PAOZZ	5307014551249	61080	05094600	STUD, PLAIN	1
15	PAOZZ	5310014560736	61080	50446700	NUT, PLAIN HEXAGON H	1
16	PAOZZ	5340014549275	61080	05064010	CONNECTOR, ROD END	1
					END OF FIGURE	

(1) ITEM NO	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
					GROUP 94 REPAIR KITS GROUP 9401 REPAIR KITS FIG. KITS REPAIR KITS	
1	PAFZZ	5330014156721	61080	01247700	GASKET SET CYLINDER HEAD.....	1
					GASKET (V) 3-11	
					GASKET (V) 3-11	
					GASKET (V) 3-11	
					GASKET (V) 3-11	
					GASKET (V) 3-11	
					GASKET (V) 3-11	
					GASKET (V) 3-11	
					GASKET (V) 3-11	
					GASKET (V) 3-11	
					GASKET (V) 3-11	
					GASKET (V) 3-11	
					GASKET (2) 11-11	
					GASKET (2) 12-8	
					GASKET (1) 13-28	
					NUT,PLAIN,HEXAGON (4) 12-10	
					O-RING (2) 8-13	
					O-RING (2) 8-32	
					O-RING (2) 8-34	
					SHIM (1) 3-2	
					WASHER,FLAT (4) 8-11	
					WASHER, FLAT (12) 9-2	
2	PAFZZ	5330014156723	61080	01228000	GASKET SET CRANKCASE.....	1
					GASKET (1) 4-6	
					GASKET (1) 4-14	
					GASKET (1) 4-15	
					GASKET (1) 6-9	
					GASKET (1) 9-14	
					GASKET (1) 9-21	
					GASKET (1) 11-13	
					GASKET (1) 12-20	
					GASKET (1) 12-21	
					GASKET (1) 12-22	
					GASKET (2) 12-25	
					O-RING (8) 4-16	
					O-RING (1) 6-4	
					O-RING (1) 9-28	
					O-RING (1) 9-26	
					O-RING (1) 9-9	
					O-RING (1) 9-33	
					O-RING (2) 13-5	
					O-RING (2) 13-31	
					SEAL,PLAIN (1) 5-8	
					SHIM (1) 5-1	
					SHIM (1) 5-1	
					WASHER,FLAT (2) 12-28	
					END OF FIGURE	

(1) ITEM NO	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
					GROUP 95 GENERAL USE STANDARDIZED PARTS GROUP 9501 BULK MATERIAL FIG. BULK BULK MATERIAL	
1	PAFZZ	4720014547571	61080	03902000	HOSE, NONMETALLIC.....	1
					END OF FIGURE	

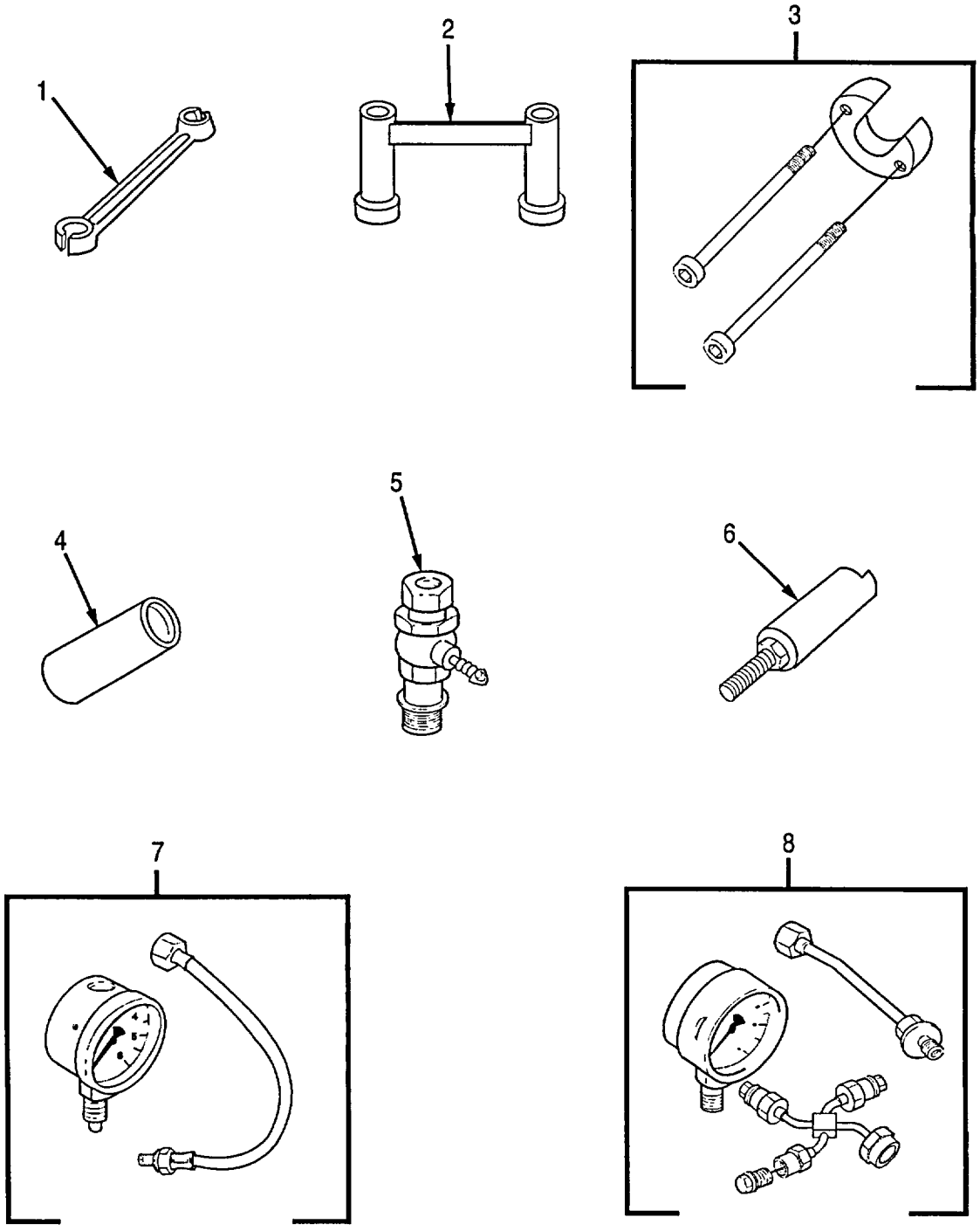


Figure 17. Special Tools

(1) ITEM NO	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODES (UOC)	(7) QTY
					GROUP 26 TOOLS AND TEST EQUIPMENT GROUP 2604 SPECIAL TOOLS FIG. 17 SPECIAL TOOLS	
1	PEOZZ	5120013092048	93389	3715M	WRENCH, OPEN END BOX	1
2	PEFZZ	5120014545887	61080	62574200	BRACKET, CYL, ALINE	1
3	PEFZZ	5120014545888	61080	62574801	PULLER, CRANK GEAR	1
4	PEFZZ	5120014545885	61080	62574700	DRIVER, CRANK GEAR	1
5	PEFZZ		61080	66503091	TESTING DEVICE, FUEL	1
6	PEFZZ	5120014545886	61080	62568902	PULLER, RELIEF VALVE	1
7	PEFZZ	5120014545890	61080	62092692	TEST SET, OIL PRESSU	1
8	PEFZZ	5120014545889	61080	60462890	TEST SET, FUEL	1
					END OF FIGURE	

CROSS-REFERENCE INDEXES

NATIONAL STOCK NUMBER INDEX

STOCK NUMBER	FIG.	ITEM	STOCK NUMBER	FIG.	ITEM
5315-01-070-5656	1	2	5310-01-399-7301	13	22
5331-01-070-7136	9	28		14	7
5310-01-078-8066	8	4	5310-01-399-7303	4	12
5330-01-080-1776	11	13		11	9
	12	25		12	4
5310-01-090-0938	9	2		12	33
	12	28		14	9
5340-01-100-4991	12	15	5310-01-399-7305	11	5
5365-01-100-5415	8	24	5310-01-399-7311	8	17
5365-01-100-5416	8	24	5310-01-399-7312	3	5
5310-01-101-2028	8	7	4710-01-399-7358	12	1
	10	1	4710-01-399-7359	12	2
	11	6	5340-01-399-7969	12	34
5365-01-101-5938	12	16	5330-01-399-8354	11	12
5330-01-101-7264	12	18	5330-01-399-8357	6	14
5331-01-101-8063	12	14	5310-01-399-8358	3	4
5330-01-101-8076	9	21	5310-01-399-8386	9	23
5315-01-102-7922	8	28	5315-01-400-0441	5	5
5315-01-103-1522	5	4	5315-01-400-0444	4	9
4730-01-103-3202	9	6	5315-01-400-0445	12	23
5999-01-116-8286	13	17	5310-01-400-0995	12	5
5330-01-120-2966	13	16	5325-01-400-0999	13	6
5310-01-239-2390	9	17	5340-01-400-1000	8	22
5325-01-245-3517	8	25	5310-01-400-1002	6	11
5305-01-274-1064	13	15	5310-01-400-2138	5	10
	16	13	5310-01-400-2139	9	11
5310-01-274-4387	2	7	5310-01-400-2140	6	1
2590-01-282-5087	9	29	5310-01-400-2141	6	2
5120-01-309-2048	17	1	5310-01-400-3715	14	2
2940-01-383-9739	9	18	5365-01-400-3717	8	26
4730-01-399-4252	12	6	5310-01-400-3719	9	24
4730-01-399-4253	12	9	5310-01-400-3720	11	18
4730-01-399-4254	12	11		12	3
5325-01-399-4615	8	1	5310-01-400-3721	8	21
5325-01-399-4618	8	29	5330-01-400-5772	8	13
5365-01-399-5011	8	2	5330-01-400-5773	5	8
5365-01-399-5013	3	2	5305-01-401-3694	16	6
5360-01-399-5014	13	3	5310-01-405-9890	4	8
5360-01-399-5016	13	11		6	17
5360-01-399-5017	13	26		13	9
4720-01-399-5578	14	16		14	22
4820-01-399-5579	11	16		16	8
5315-01-399-6105	4	19	5305-01-405-9892	14	18
5315-01-399-6106	4	18	5305-01-405-9894	14	4
5315-01-399-6107	13	2	5305-01-405-9895	14	1
4720-01-399-6266	11	15	5305-01-405-9897	14	8
4730-01-399-6267	11	14	5305-01-405-9898	14	26
5330-01-399-6976	9	33	5307-01-405-9899	3	7
5331-01-399-6978	13	5	5310-01-405-9900	12	10
5310-01-399-6981	8	27	5305-01-405-9901	12	32

CROSS-REFERENCE INDEXES

NATIONAL STOCK NUMBER INDEX

STOCK NUMBER	FIG.	ITEM	STOCK NUMBER	FIG.	ITEM
5305-01-405-9901	14	10	5120-01-454-5888	17	3
5305-01-405-9903	8	10	5120-01-454-5889	17	8
5305-01-405-9904	8	5	5120-01-454-5890	17	7
5307-01-405-9905	4	1	4730-01-454-7461	9	13
5305-01-405-9906	9	1	4730-01-454-7542	4	10
5307-01-405-9907	3	13	4730-01-454-7545	9	19
	9	25	4730-01-454-7549	9	3
5305-01-405-9908	6	10	4730-01-454-7560	12	27
5307-01-405-9909	3	14	4730-01-454-7567	12	29
5310-01-405-9911	6	7	4730-01-454-7569	12	30
5310-01-405-9912	13	13	4720-01-454-7571	BULK	1
5307-01-405-9997	3	9	4730-01-454-7573	12	26
	4	20	4710-01-454-7687	9	7
5305-01-405-9998	9	31	4710-01-454-7688	9	30
5305-01-406-0000	6	16	4730-01-454-7692	9	4
	13	7	4730-01-454-7693	9	5
5305-01-406-0001	7	7	5945-01-454-8223	16	5
5305-01-406-0003	14	24	5945-01-454-8230	16	9
5305-01-406-0004	9	12	5945-01-454-8238	16	11
5305-01-406-0005	6	8	2815-01-454-8626	11	8
5305-01-406-0006	13	19	2990-01-454-8630	13	4
5305-01-406-0007	13	20	5340-01-454-8631	2	2
5305-01-406-0011	13	18	2990-01-454-8635	13	29
5305-01-406-0013	8	23	2815-01-454-8839	8	33
5305-01-406-0014	4	4	2815-01-454-8841	8	12
4820-01-406-0343	9	22	2815-01-454-8842	8	30
5340-01-406-1645	13	30	2990-01-454-8843	2	5
5340-01-406-1646	12	36	2590-01-454-8941	9	27
5365-01-406-4171	5	7	2815-01-454-9103	6	5
5307-01-406-5443	3	8	2990-01-454-9173	13	8
4820-01-406-6143	12	13	2990-01-454-9177	13	12
4820-01-407-0705	8	18	2990-01-454-9202	13	23
2805-01-407-0706	8	19	2815-01-454-9210	14	14
4820-01-407-1908	12	19	2990-01-454-9214	13	25
2815-01-414-1273	7	6	2815-01-454-9237	14	12
5360-01-414-8475	8	16	5340-01-454-9270	14	19
2835-01-414-8480	7	1	5340-01-454-9271	11	17
5310-01-415-2649	8	11	5340-01-454-9272	4	2
5330-01-415-6721	KITS	1	5340-01-454-9273	4	3
5330-01-415-6723	KITS	2	5340-01-454-9275	16	16
4730-01-415-7923	14	20	5340-01-454-9277	16	3
5930-01-416-0352	15	1	5340-01-454-9278	13	27
3120-01-416-3105	5	12	5340-01-454-9280	9	10
3120-01-416-3110	7	8	5340-01-454-9281	9	32
2815-01-439-3916	14	23	5340-01-454-9284	16	2
5930-01-441-0097	15	2	2815-01-454-9344	14	21
2815-01-446-3500	2	1	5365-01-455-0004	13	24
5120-01-454-5885	17	4	5340-01-455-0010	5	6
5120-01-454-5886	17	6	5365-01-455-0011	7	2
5120-01-454-5887	17	2	5365-01-455-0012	8	3

CROSS-REFERENCE INDEXES

NATIONAL STOCK NUMBER INDEX

STOCK NUMBER	FIG.	ITEM
2815-01-455-0039	14	25
2815-01-455-0040	14	5
2815-01-455-0041	11	1
2815-01-455-0042	9	15
2815-01-455-0043	8	9
2815-01-455-0046	8	8
2815-01-455-0054	8	6
2815-01-455-0056	3	6
2815-01-455-0057	7	3
2990-01-455-0084	13	32
2815-01-455-0085	8	31
2815-01-455-0364	8	14
2815-01-455-0371	3	10
2815-01-455-0376	6	3
2815-01-455-0423	5	3
2815-01-455-0428	7	4
2815-01-455-0432	9	8
5305-01-455-1242	11	3
5305-01-455-1243	9	16
5305-01-455-1245	5	11
5305-01-455-1246	13	10
5305-01-455-1247	11	4
5305-01-455-1248	13	21
5307-01-455-1249	16	14
5305-01-455-1250	16	12
5305-01-455-1251	16	10
5305-01-455-1613	11	10
5305-01-455-1615	4	11
5305-01-455-1619	14	17
5305-01-455-1622	14	11
5307-01-455-2205	4	17
5305-01-455-2206	2	6
5305-01-455-2207	2	3
5307-01-455-2210	3	12
5306-01-455-2212	3	1
5340-01-455-2343	4	13
3010-01-455-2856	8	20
4820-01-455-5017	9	20
4820-01-455-5018	12	24
3120-01-455-7311	14	13
5330-01-455-7566	10	2
5330-01-455-7819	11	11
5330-01-455-7822	2	4
5330-01-455-7823	11	7
5310-01-455-8479	3	3
5310-01-455-8480	11	2
5310-01-455-8481	13	14
5310-01-455-8482	14	27
5315-01-455-8935	6	13
5325-01-455-8936	7	5
5310-01-456-0736	16	15
5310-12-149-4353	4	5
	6	15
	14	3
	16	7
2815-12-330-5421	8	35
2910-12-337-7727	12	7
2910-12-338-8683	12	12

CROSS-REFERENCE INDEXES

PART NUMBER INDEX

CAGEC	PART NUMBER	STOCK NUMBER	FIG.	ITEM
61080	00632101	2590-01-282-5087	9	29
61080	01129900	2815-01-454-9237	14	12
61080	01133200		14	6
61080	01133300		14	15
61080	01198900	2815-01-454-8626	11	8
61080	01221803	4820-01-455-5017	9	20
61080	01222100	3010-01-455-2856	8	20
61080	01222300	2990-01-454-8635	13	29
61080	01222400		13	1
61080	01222510	2990-01-455-0084	13	32
61080	01223200	4730-01-454-7560	12	27
61080	01224001	2815-12-330-5421	8	35
61080	01224400	2815-01-455-0054	8	6
61080	01224500	2815-01-455-0043	8	9
61080	01224600	2815-01-455-0046	8	8
61080	01224900	4710-01-454-7687	9	7
61080	01225610	4820-01-399-5579	11	16
61080	01226100	4730-01-415-7923	14	20
61080	01227410		4	7
61080	01227900	2815-01-455-0432	9	8
61080	01228000	5330-01-415-6723	KITS	2
61080	01231501	4820-01-455-5018	12	24
61080	01239901		6	12
61080	01240202	2815-01-455-0057	7	3
61080	01240300	2815-01-455-0428	7	4
61080	01240900	4710-01-399-7358	12	1
61080	01241000	4710-01-399-7359	12	2
61080	01244800	5340-01-400-1000	8	22
61080	01247100	2835-01-414-8480	7	1
61080	01247200	2815-01-455-0371	3	10
61080	01247700	5330-01-415-6721	KITS	1
61080	01262200	2815-01-414-1273	7	6
61080	01262700	2815-01-455-0423	5	3
61080	01266500	2990-01-454-9214	13	25
61080	01285500	5330-01-455-7566	10	2
61080	01285600	5330-01-455-7823	11	7
61080	01445200	2815-01-454-9344	14	21
61080	01509110	5945-01-454-8238	16	11
61080	01516900	5945-01-454-8230	16	9
61080	03125800	5365-01-455-0004	13	24
61080	03171800	5310-01-399-7312	3	5
61080	03173100	5310-01-078-8066	8	4
61080	03174700	5340-01-399-7969	12	34
61080	03225504		1	1
61080	03233200	5365-01-100-5415	8	24
61080	03233300	5365-01-100-5416	8	24
61080	03780800	4730-01-399-4253	12	9
61080	03781000	5307-01-455-2210	3	12
61080	03781100	5305-01-406-0001	7	7
61080	03781300	3120-01-416-3110	7	8
61080	03781800	2815-01-454-8839	8	33

CROSS-REFERENCE INDEXES

PART NUMBER INDEX

CAGEC	PART NUMBER	STOCK NUMBER	FIG.	ITEM
61080	03783000	5305-01-405-9904	8	5
61080	03783200	2805-01-407-0706	8	19
61080	03783300	4820-01-407-0705	8	18
61080	03783401	5310-01-399-7311	8	17
61080	03783500	5360-01-414-8475	8	16
61080	03783600		8	15
61080	03783800	2815-01-454-8841	8	12
61080	03783902	5330-01-455-7819	11	11
61080	03784000	4720-01-399-6266	11	15
61080	03784300	5340-01-454-9270	14	19
61080	03784400	2815-01-455-0040	14	5
61080	03784501	5310-01-455-8479	3	3
61080	03785200	2815-01-455-0056	3	6
61080	03786300	2815-01-455-0364	8	14
61080	03787300	5365-01-399-5013	3	2
61080	03787402	2815-01-455-0041	11	1
61080	03788800	5310-01-399-8386	9	23
61080	03790001	4730-01-454-7549	9	3
61080	03790100	4730-01-454-7693	9	5
61080	03791400	5310-01-399-8358	3	4
61080	03791600	5305-01-406-0011	13	18
61080	03792100	2815-01-455-0376	6	3
61080	03792400	4730-01-399-4252	12	6
61080	03792800		3	11
61080	03792900		3	11
61080	03793000		3	11
61080	03793100		3	11
61080	03793200		3	11
61080	03793300		3	11
61080	03793400		3	11
61080	03902000	4720-01-454-7571	BULK	1
61080	03902000-18		12	31
61080	03902000-6		12	35
61080	03908201	2590-01-454-8941	9	27
61080	03920100	3120-01-455-7311	14	13
61080	03932100	4730-01-454-7692	9	4
61080	03939700	5340-01-454-9271	11	17
61080	03958000	5365-01-455-0011	7	2
61080	03958100	2815-01-439-3916	14	23
61080	03971200		3	11
61080	03971300		3	11
61080	03975300	5310-01-400-2141	6	2
61080	04020200	5360-01-399-5014	13	3
61080	04031300	5310-01-400-2140	6	1
61080	04035700	5310-01-400-0995	12	5
61080	04038200	5340-01-454-9272	4	2
61080	04039100	5340-01-454-9273	4	3
61080	04088300	2990-01-454-8630	13	4
61080	04090600		3	11
61080	04090700		3	11
61080	04092800	2815-01-454-8842	8	30

CROSS-REFERENCE INDEXES

PART NUMBER INDEX

CAGEC	PART NUMBER	STOCK NUMBER	FIG.	ITEM
61080	05034900	4730-01-454-7545	9	19
61080	05063800		16	1
61080	05063900	2990-01-454-9202	13	23
61080	05064010	5340-01-454-9275	16	16
61080	05094600	5307-01-455-1249	16	14
19207	12463204	2815-01-446-3500	2	1
53867	3418502037	4820-01-407-1908	12	19
93389	3715M	5120-01-309-2048	17	1
61080	40002500	5315-01-070-5656	1	2
61080	40021400	5330-01-120-2966	13	16
61080	40021500	5999-01-116-8286	13	17
61080	40028400	5310-01-101-2028	8	7
			10	1
			11	6
61080	40085001		12	8
61080	40092600	4730-01-454-7573	12	26
61080	49003500		12	17
61080	49003900	5340-01-100-4991	12	15
61080	49004300	5365-01-101-5938	12	16
61080	49004400	5330-01-101-7264	12	18
61080	49004700	5331-01-101-8063	12	14
61080	49061200	4820-01-406-6143	12	13
61080	500 812 00	5310-01-239-2390	9	17
61080	500-254-00	5305-01-274-1064	13	15
			16	13
61080	50000900	5310-01-090-0938	9	2
			12	28
61080	50001100	5330-01-080-1776	11	13
			12	25
61080	50001200	5330-01-101-8076	9	21
61080	50006100	4730-01-103-3202	9	6
61080	50010500	5315-01-102-7922	8	28
61080	50011200	5315-01-103-1522	5	4
61080	50015700	4730-01-454-7567	12	29
61080	50019800	5325-01-399-4615	8	1
61080	50020000	5325-01-245-3517	8	25
61080	50025200	5305-01-406-0004	9	12
61080	50026400		6	18
61080	50033300	5305-01-405-9906	9	1
61080	50036000	5315-01-399-6107	13	2
61080	50038400	5307-01-405-9899	3	7
61080	50052100	5305-01-455-1615	4	11
61080	50054300	5305-01-455-2206	2	6
61080	50055100	5305-01-455-1245	5	11
61080	50061700	5310-01-274-4387	2	7
61080	50065100	5307-01-406-5443	3	8
61080	50092100	5305-01-406-0000	6	16
			13	7
61080	50093400	5305-01-406-0005	6	8
61080	50095100	5310-01-399-7305	11	5
61080	50098300	5307-01-405-9905	4	1

CROSS-REFERENCE INDEXES

PART NUMBER INDEX

CAGEC	PART NUMBER	STOCK NUMBER	FIG.	ITEM
61080	50098500	5305-01-405-9901	12	32
			14	10
61080	50114300	5310-01-455-8481	13	14
61080	50128100	5307-01-405-9997	3	9
			4	20
61080	50137000	5305-01-406-0014	4	4
61080	50144400	5310-01-405-9890	4	8
			6	17
			13	9
			14	22
			16	8
61080	50144500	5310-12-149-4353	4	5
			6	15
			14	3
			16	7
61080	50145900	5310-01-405-9911	6	7
61080	50146000	5310-01-400-2138	5	10
61080	50146300	5305-01-406-0006	13	19
61080	50148000	5310-01-400-3720	11	18
			12	3
61080	50148100	5310-01-455-8480	11	2
61080	50149100	5305-01-455-1250	16	12
61080	50153800	5331-01-070-7136	9	28
61080	50162900	5310-01-415-2649	8	11
61080	50165500	5305-01-405-9892	14	18
61080	50170600	5305-01-405-9898	14	26
61080	50170700	5305-01-405-9897	14	8
61080	50170800	5305-01-455-1248	13	21
61080	50170900	5310-01-399-7301	13	22
			14	7
61080	50175900	5305-01-455-1242	11	3
61080	50177500	5305-01-405-9903	8	10
61080	50180400	5340-01-454-9277	16	3
61080	50183100	5305-01-455-1247	11	4
61080	50195800	5310-01-400-1002	6	11
61080	50206300	5305-01-455-1613	11	10
61080	50207900	5305-01-455-1243	9	16
61080	50208400		8	34
61080	50208500	5310-01-399-7303	4	12
			11	9
			12	4
			12	33
			14	9
61080	50216300	5310-01-400-2139	9	11
61080	50225501		16	4
61080	50231900	5307-01-405-9907	3	13
			9	25
61080	50274500	5305-01-405-9998	9	31
61080	50275000		4	16
61080	50279200	5307-01-405-9909	3	14
61080	50289200	5305-01-455-1622	14	11

CROSS-REFERENCE INDEXES

PART NUMBER INDEX

CAGEC	PART NUMBER	STOCK NUMBER	FIG.	ITEM
61080	50290100		8	32
61080	50290200	5330-01-400-5772	8	13
61080	50290300	5305-01-455-1251	16	10
61080	50290500	5315-01-399-6105	4	19
61080	50291400		4	14
61080	50293200	5305-01-406-0003	14	24
61080	50293810	5930-01-441-0097	15	2
61080	50300700	5315-01-400-0444	4	9
61080	50301000	5315-01-399-6106	4	18
61080	50301100		4	15
61080	50301200		4	6
61080	50301400	4730-01-454-7461	9	13
61080	50301500		9	14
61080	50301601	2815-01-455-0042	9	15
61080	50302000	2815-01-455-0085	8	31
61080	50302100	3120-01-416-3105	5	12
61080	50302700	4730-01-454-7542	4	10
61080	50302800	2940-01-383-9739	9	18
61080	50303000	4730-01-399-6267	11	14
61080	50303610	5315-01-455-8935	6	13
61080	50304100	5340-01-455-0010	5	6
61080	50304300	5315-01-400-0441	5	5
61080	50304400		5	2
61080	50304500	5330-01-400-5773	5	8
61080	50305000	5325-01-399-4618	8	29
61080	50305300	5305-01-406-0013	8	23
61080	50305400	5310-01-400-3721	8	21
61080	50305700	5365-01-400-3717	8	26
61080	50306001	5310-01-399-6981	8	27
61080	50306200	5340-01-454-9278	13	27
61080	50306500	5331-01-399-6978	13	5
61080	50306600	5360-01-399-5017	13	26
61080	50306900	5305-01-406-0007	13	20
61080	50307000	5307-01-455-2205	4	17
61080	50307100		13	28
61080	50308100		13	31
61080	50308500	5340-01-406-1645	13	30
61080	50308800	5325-01-400-0999	13	6
61080	50308901	2990-01-454-9173	13	8
61080	50309200	5305-01-455-1246	13	10
61080	50309300	5360-01-399-5016	13	11
61080	50309400	2990-01-454-9177	13	12
61080	50309500	5310-01-405-9912	13	13
61080	50310400	5340-01-454-9280	9	10
61080	50310500		9	9
61080	50310810	2815-01-454-9103	6	5
61080	50310900	5305-01-405-9908	6	10
61080	50311000	4820-01-406-0343	9	22
61080	50311200		6	4
61080	50311500		6	9
61080	50311700	4730-01-454-7569	12	30

CROSS-REFERENCE INDEXES

PART NUMBER INDEX

CAGEC	PART NUMBER	STOCK NUMBER	FIG.	ITEM
61080	50312200	5315-01-400-0445	12	23
61080	50312300		12	22
61080	50312400		12	21
61080	50312500		12	20
61080	50313000	4730-01-399-4254	12	11
61080	50313100	5310-01-405-9900	12	10
61080	50314100	5340-01-406-1646	12	36
61080	50315400	5310-01-400-3715	14	2
61080	50315500	5306-01-455-2212	3	1
61080	50315900	5365-01-399-5011	8	2
61080	50316000	5365-01-455-0012	8	3
61080	50317800	5305-01-455-1619	14	17
61080	50323500		9	26
61080	50326200	5330-01-399-8354	11	12
61080	50328500	5305-01-401-3694	16	6
61080	50333800	5305-01-405-9894	14	4
61080	50333900	5365-01-406-4171	5	7
61080	50334600	5305-01-405-9895	14	1
61080	50334800	4720-01-399-5578	14	16
61080	50335300	5310-01-400-3719	9	24
61080	50336200	5330-01-399-8357	6	14
61080	50336300	4710-01-454-7688	9	30
61080	50336400	5340-01-454-9281	9	32
61080	50336500	5330-01-399-6976	9	33
61080	50344500	5930-01-416-0352	15	1
61080	50347500		5	1
61080	50347600		5	1
61080	50355400	2910-12-338-8683	12	12
61080	50355500	2910-12-337-7727	12	7
61080	50359110	5325-01-455-8936	7	5
61080	50365600	5340-01-454-9284	16	2
61080	50405600	2815-01-455-0039	14	25
61080	50408500	5310-01-455-8482	14	27
61080	50431300	5945-01-454-8223	16	5
61080	50446700	5310-01-456-0736	16	15
61080	60462890	5120-01-454-5889	17	8
61080	62092692	5120-01-454-5890	17	7
61080	62568902	5120-01-454-5886	17	6
61080	62574200	5120-01-454-5887	17	2
61080	62574700	5120-01-454-5885	17	4
61080	62574801	5120-01-454-5888	17	3
61080	66503091		17	5
61080	99400638		5	9
61080	99400639	5340-01-454-8631	2	2
61080	99400640	2990-01-454-8843	2	5
61080	99400641	5330-01-455-7822	2	4
61080	99400642	5305-01-455-2207	2	3
61080	99400645	5340-01-455-2343	4	13
61080	99400646		6	6
61080	99400648	2815-01-454-9210	14	14

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 and 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 (71984) DC 732 RTV	BT
2	O	8030-00-597-5367	Antiseize Compound, 2.5-Pound Can (73165) 51008	LB
3	F	6850-01-085-1423	Carbon-Removing Compound, 13-Ounce Aerosol Can (01326) 7450	OZ
4	O	6850-00-281-1985	Drycleaning Solvent, 1-Gallon Can (81346) ASTM D 235 TY1	GL
5	F	9150-01-197-7690	Grease, Automotive, 1.75-Pound Can (81349) M-10924-3-F	CN
6	O	9150-00-186-6681	Lubricating Oil, 1-Quart Can (15958) ALLIEDCO30	QT
7	O	7920-00-205-1711	Rag, Wiping, 50-Pound Bale (64067) 7920-00-205-1711	LB
8	F	7510-00-243-3437	Rubber Band, 1/4-Pound Box (88001) 0385B	BX
9	F	1015-01-255-4144	Sealant, Pipe, Teflon, 50-Milliliter Tube (19207)12297953	TU
10	F	8030-00-252-3391	Sealing Compound, 11-Ounce Tube (80064) 1756371	TU
11	F	8030-00-081-2335	Sealing Compound, 10 Cubic Centimeter Bottle (05970) 85-12	BT
12	O	8030-00-275-8115	Sealing Compound, 1-Pint Can (81349) MIL-S-46163	PT

APPENDIX E
TORQUE VALUES FOR THREADED FASTENERS

E-1. GENERAL.

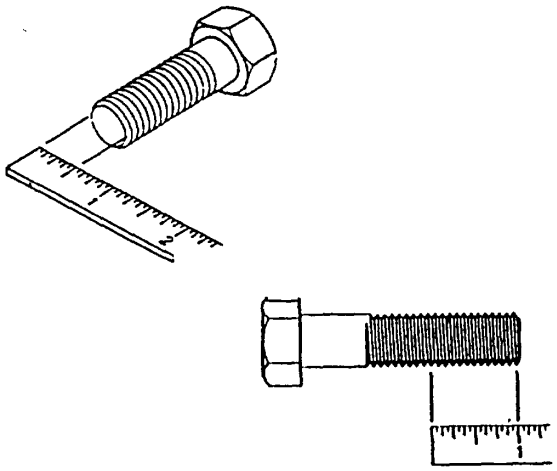
This section provides general torque limits for screws used on the Diesel Engine Assembly, Hatz 2 G 40. Special torque limits are indicated in the maintenance procedures for applicable components. The general torque limits given in this appendix shall be used when specific torque limits are not indicated 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.

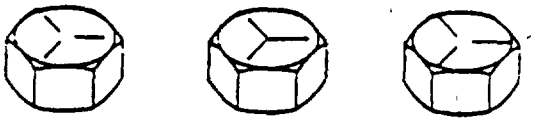


E-3. HOW TO USE TORQUE TABLE (continued).

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

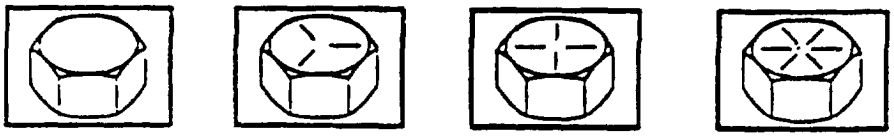
Manufacturer's marks may vary.
These are all SAE Grade No. 5 (3 lines).



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

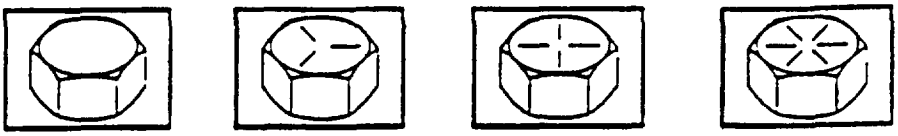


SIZE			TORQUE							
			SAE GRADE No. 1 or 2		SAE GRADE No. 5		SAE GRADE No. 6 or 7		SAE GRADE No. 8	
DIA. (IN.)	THREADS PER INCH	MM	FOOT POUNDS	N•m	FOOT-POUNDS	N•m	FOOT-POUNDS	N•m	FOOT-POUNDS	N•m
1/4	20	6.35	5	6.78	8.0	10.85	10	13.56	12.0	16.27
1/4	28	6.35	6	8.14	10.0	13.56	—	—	14.0	18.98
5/16	18	7.94	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.

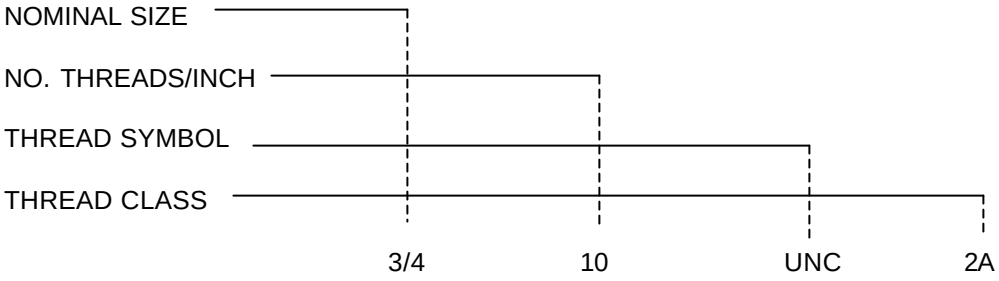
E-4. TIGHTENING METAL FASTENERS (continued).

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

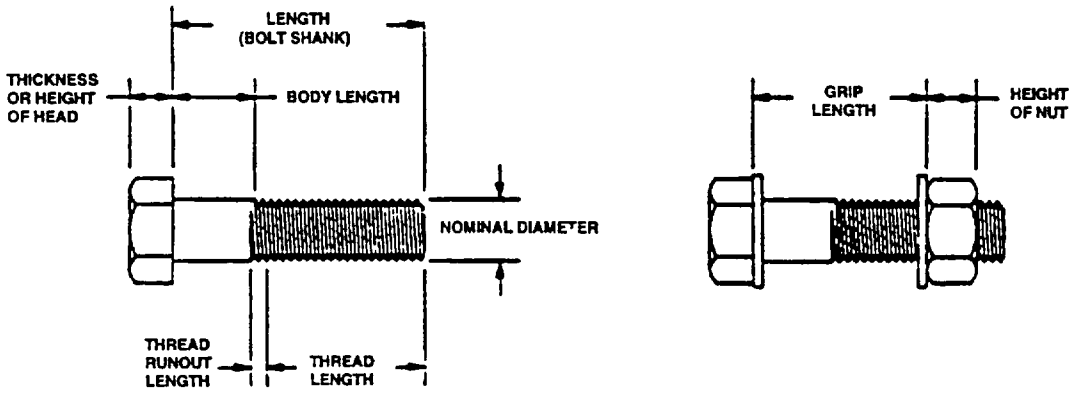
E-5. FASTENER SIZE AND THREAD PATTERN.

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 NO MARKING	SAE GRADE 6 4 RADIAL DASHES 90° APART
SAE GRADE 3 2 RADIAL DASHES 180° APART	SAE GRADE 7 5 RADIAL DASHES 72° APART
SAE GRADE 5 3 RADIAL DASHES 120° APART	SAE GRADE 8 6 RADIAL DASHES 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) National Part Number	(3) 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	3120-01-416-3105	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

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.

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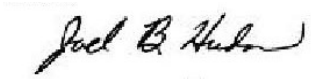
V

W

By Order of the Secretary of the Army:

DENNIS J. REIMER
General, United States Army
Chief of Staff

Official:



JOEL B. HUDSON
Administrative Assistant to the
Secretary of the Army
05170

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TM X-XXXX-XXX-XX	Date of TM	Title of TM

BE EXACT. PIN-POINT WHERE IT IS				IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO	
3		1-2		Item 10. Change illustration. Reason: Tube end shown assembled on wrong side of lever cam.
109		3-51		Item 3. The NSN and P/N are not listed on the AMDF nor the MCRL. Request correct NSN and P/N be furnished.
2-8			2-1	Preventive Maintenance Checks and Services. Item 7 under "Items to be inspected" should be changed to read as follows: Firing linkage and firing mechanism pawl.
12	1-6a			Since there are both 20- and 30- round magazines for this rifle, data on both should be listed.

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER

SIGN HERE:

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REVERSE OF DA FORM 2028-2

SAMPLE

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TEAR ALONG PERFORATED LINE

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

THEN...JOT DOWN THE DOPE ABOUT IT ON THIS FORM, CAREFULLY TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL.

SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 9-2815-250-24&P		ENGINE ASSEMBLY, DIESEL, HATZ 2 G 40

BE EXACT. PIN-POINT WHERE IT IS

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER

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REVERSE OF DA FORM 2023-2 AMSMC OP 103-85

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Director
Armament and Chemical Acquisition
and Logistics Activity
ATTN: AMSTA-AC-NML
Rock Island, IL 61201-9948

TEAR ALONG PERFORATED LINE

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
320 Fahrenheit is equivalent to 0° Celsius

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 = 1,000,000 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

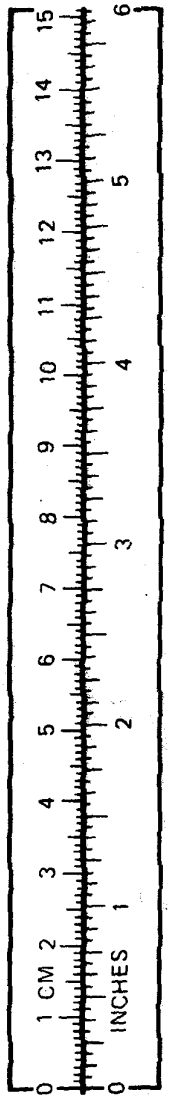
TEMPERATURE

s/s (°F - 32) = °C
212° Fahrenheit is equivalent to 100° Celsius
90° Fahrenheit is equivalent to 32 2° Celsius
s/s (°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 Milliliters	29.573
Pints	Liters	0.473
Quarts	Liters	0.946
Quarts	Liters	0.946
Gallons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.45
Short Tons	Metric Tons	0.0907
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
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0 155
Square Meters	Square Feet .	10.764
Square Meters	Square Yards	1.195
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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