*TM 9-2815-200-35

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

DIRECT SUPPORT, GENERAL SUPPORT AND DEPOT MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOLS LISTS FOR

ENGINE, WITH CONTAINER: TURBOSUPERCHARGED, DIESEL, FUEL INJECTION, 90-DEGREE "V" TYPE, AIR-COOLED, 12-CYLINDER, ASSEMBLY; MODELS AVDS-1790-2M (2815-856-4996), AVDS-1790-2A AND AVDS-1790-2AM (2815-856-9005)

HEADQUARTERS, DEPARTMENT OF THE ARMY
15 OCTOBER 1970

ERRATA SHEET

TM 9-2815-200-35, 15 October 1970

To all account holders of DA Form 12-37, Direct and General Support Maintenance requirements for Tanks, M60, M60A1, M48A3; Combat Engineer Vehicle M728 and Launcher, M60A1 Tank Chassis Transporting:

You have received printed copies of TM 9-2815-200-34, TM 9-2815-200-35 and TM 9-2815-200-35P dated 15 October 1970. These three manuals are actually one manual and the correct number is TM 9-2815-200-35. Remove all covers and destroy covers designated TM 9-2815-200-34 and TM 9-2815-200-35P. Assemble manual in numerical order with cover for TM 9-2815-200-35 as the basic cover.

CAUTION/WARNING

Caution: The splined coupler halves are a matched set. Damage or wear to the sleeve or hub of either coupling half requires the replacement of a complete coupler assembly. (Figure 4-59)

Caution: Overtightening will damage tube ferrule causing fuel leaks. (Figure 4-86)

Caution: Do not run engine above idle and not longer than ten minutes without cooling fans. (Figure 4-87)

Warning: The valve cover is spring loaded. Exercise care when removing cover. (Figure 4-93)

Caution: Check to be certain the original seating gasket has been removed and discarded before installing a new gasket on the nozzle. The inadvertent installation of two seating gaskets would damage the nozzle retainer spring. (Figure 4-1 53)

Caution: Do not damage sealing surface on flange of intercylinder preformed hose as it will cause oil leaks and replacement of hose will be required. (Figure 4-157)

Warning: When only one cylinder is checked, there is the possibility of the engine firing on the other cylinders when compression check is being made. To prevent engine firing, remove all nozzles then check cylinder compression. Unless all nozzles are removed, the engine motoring rpm will be below desired cylinder checking rpm. (Paragraph 4-22a)

Caution: Make certain the improvised tool is properly secured before removing housing and that the fan drive housing is being lifted straight up off the studs. (Figure 5-124)

Caution: Use care in removing the flywheel from the dowel pins so as not to bind the flywheel on the pins. (Figure 5-162)

Warning: Particles blown by compressed air are hazardous. Make certain air stream is directed away from user and that other persons are not exposed. Protect eyes and face with appropriate shields. (Paragraph 6-2b(4))

Caution: Do not attempt to preheat by using welding torch. (Paragraph 6-4c(5))

CAUTION / WARNING— Continued

Warning: Use goggles, rubber gloves, and rubber apron when cleaning parts in carbon removing compound. Provide adequate ventilation. Avoid inhalation of fumes and skin contact. If compound is splashed on skin, flush with fresh water and wash with alcohol, Alcohol containing 2 to 3 percent camphor is preferable. (Paragraph 6-24a(1))

Warning: The valves and locks are under heavy spring tension. Exercise extreme care when removing locks, retainers, and springs. (Figure 6-48)

Caution: Do not use an arbor press to remove ball bearings from drive cluster gear. The gear is designed with a shoulder between the two bearings. (Figure 6-83)

Caution: The piston oil cooling valve is a spring loaded assembly. Exercise care when disassembling. (Figure 6-86)

Warning: The oil pressure regulator cover is spring loaded. Exercise care when removing cover. (Figure 6-103)

Caution: Do not attempt to remove the diaphragm drive coupler half from the shaft using a standard puller as shown in figure 6-163. This may distort the coupler and render it unserviceable. Use puller as shown. (Figure 6-165)

Caution: Use extreme care in this operation to prevent damage to vane cover on gearshaft. (Paragraph 6-42a(6) (c))

Warning: Cleaning solvents and solvent cleaning compounds are toxic and flammable and must be used only in a well ventilated room. Take adequate safe guards for fire prevention in work area. Use protective clothing and avoid contact of these solutions with the skin. (Paragraph 6-47c(3))

Caution: If lubricant is extended to face of washer nut, reliable retaining torque cannot be obtained. (Figure 7-13)

Caution: The fuel injector pump advance assembly must always be installed and secured before operating test stand. (Paragraph 6-42, d., (4), (g))

Caution: Do not operate the starter motor continuously for more than one minute. Allow a two-minute cool-off period before re-energizing the starter. (Paragraph 8-4c)

TECHNICAL MANUAL
No. 9-2815-200-35

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D. C. 20025, *15 October 1970*

DIRECT SUPPORT, GENERAL SUPPORT,

AND DEPOT MAINTENANCE MANUAL

INCLUDING REPAIR PARTS AND SPECIAL TOOLS LISTS
FOR

ENGINE, WITH CONTAINER: TURBOSUPERCHARGED, DIESEL, FUEL INJECTION, 90-DEGRE "V"TYPE, AIR COOLED, 12 CYLINDER, ASSEMBLY; MODELS AVDS-1790-2M (2815-856-4996), AVDS-1790-2A AND AVDS-1790-2AM (2815-856-9005)

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This manual supersedes TM 9-2815-200-34 dated February 1963, TM 9-2815-200-35 dated August 1960 and TM 9-2815-200-35P dated November 1962 and all published changes thereto.

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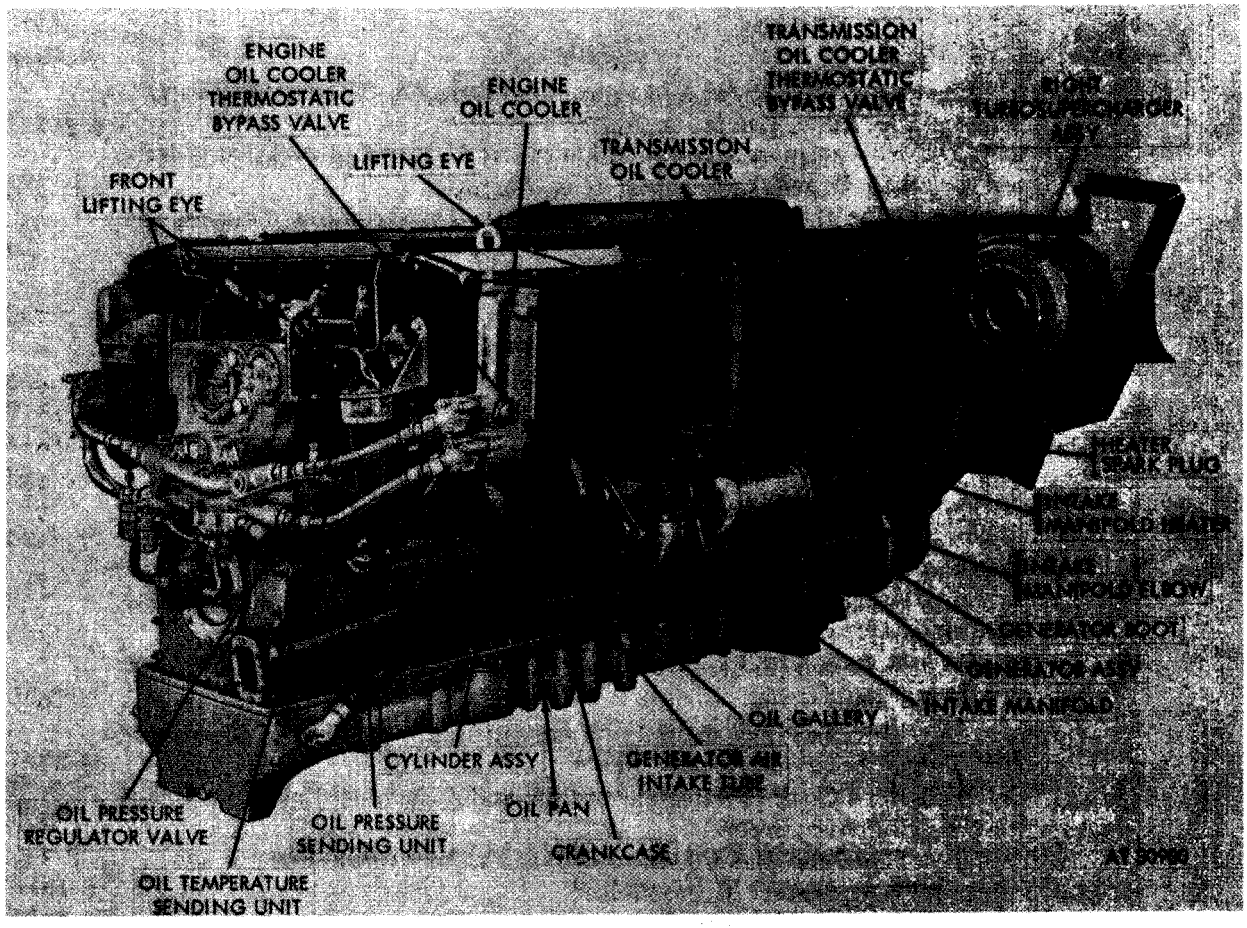


Figure 1-1. AVDS-1790-2-M, AVDS-1790-2-AM, and AVDS-1790-2A engine assembly without time totalizing meter-right front view.

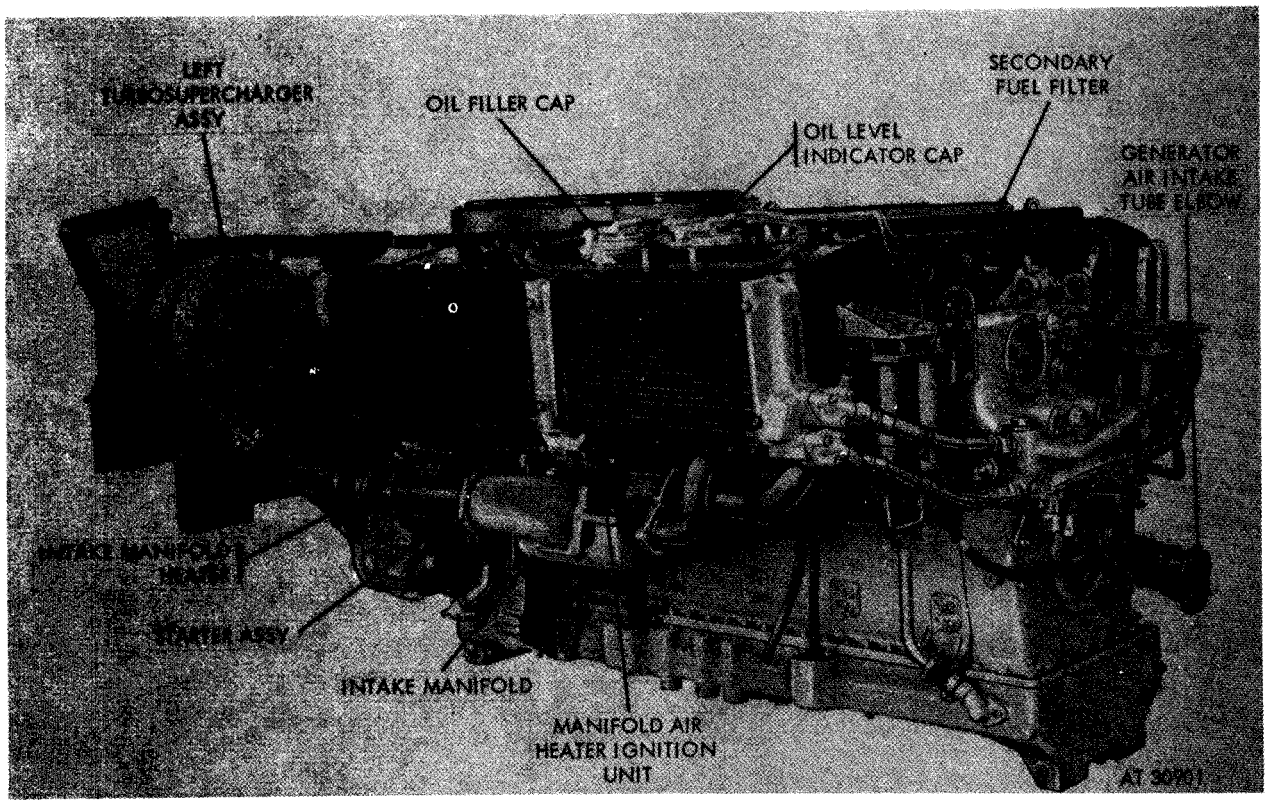


Figure 1-2. AVDS-1790-2-M, AVDS-1790-2-AM, and AVDS-1790-2A engine assembly with secondary fuel filter-left front view.

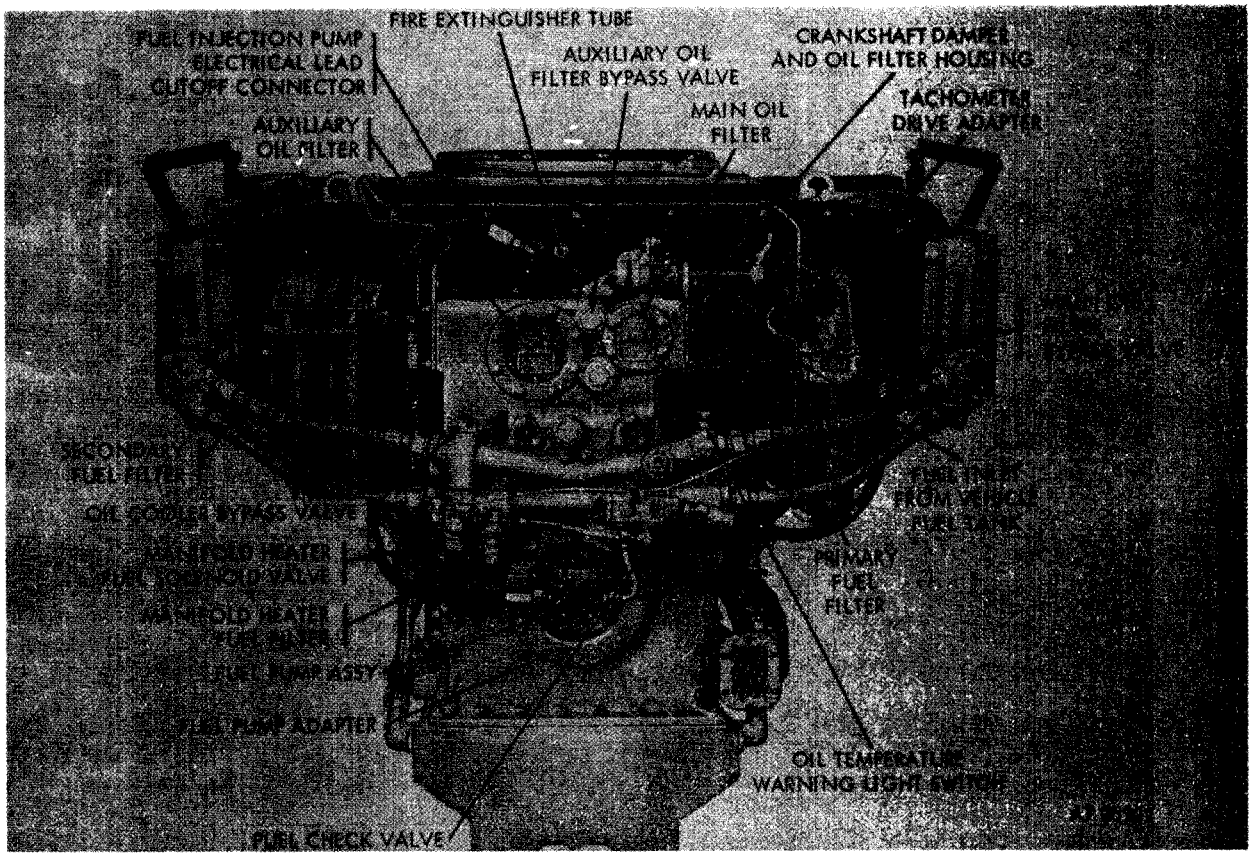


Figure 1-3. AVDS-1790-2-M, AVDS-1790-2-AM, and AVDS-1790-2A engine assembly with secondary fuel filter-front view.

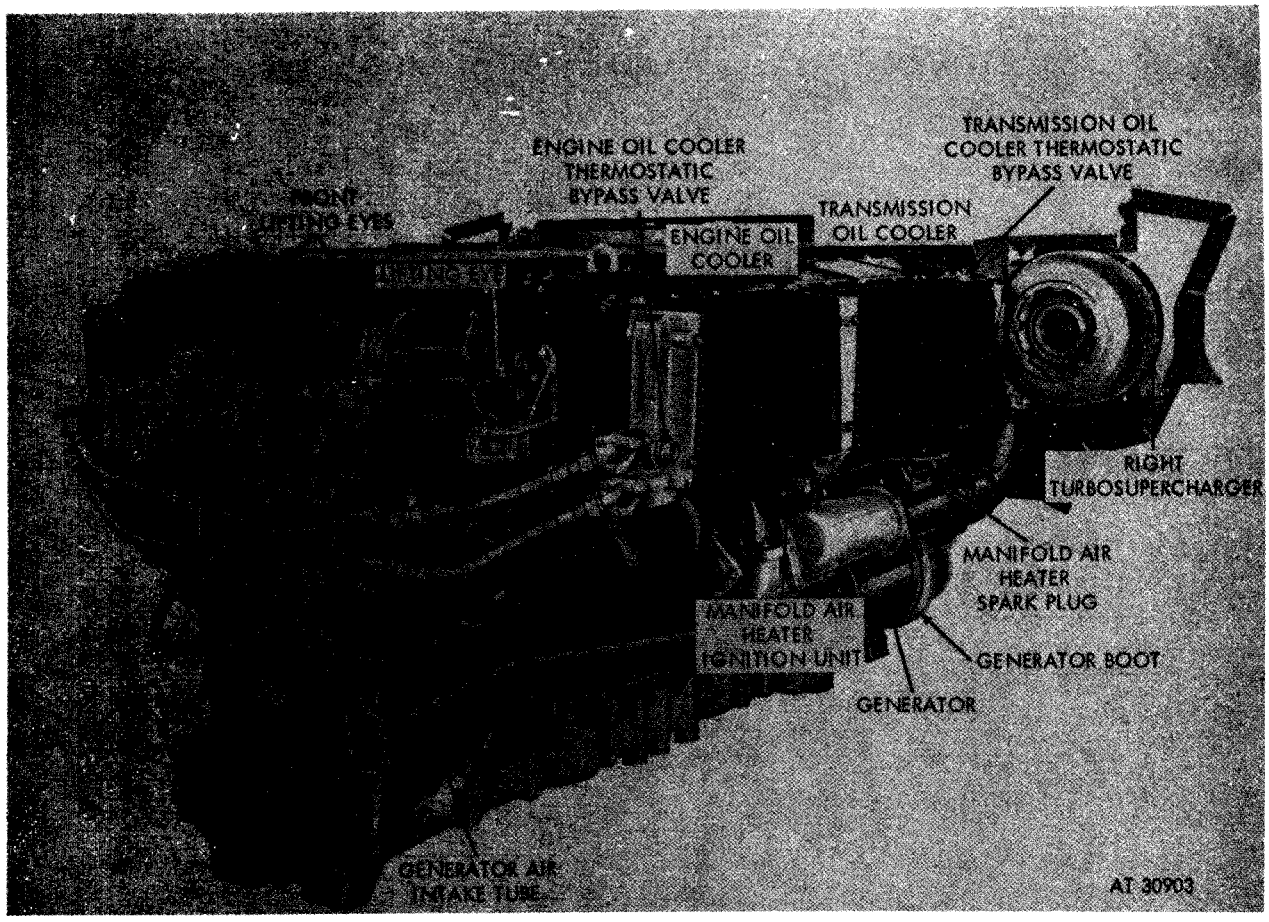


Figure 1-4. AVDS-1790-2A engine assembly with time totalizing meter-right front view.

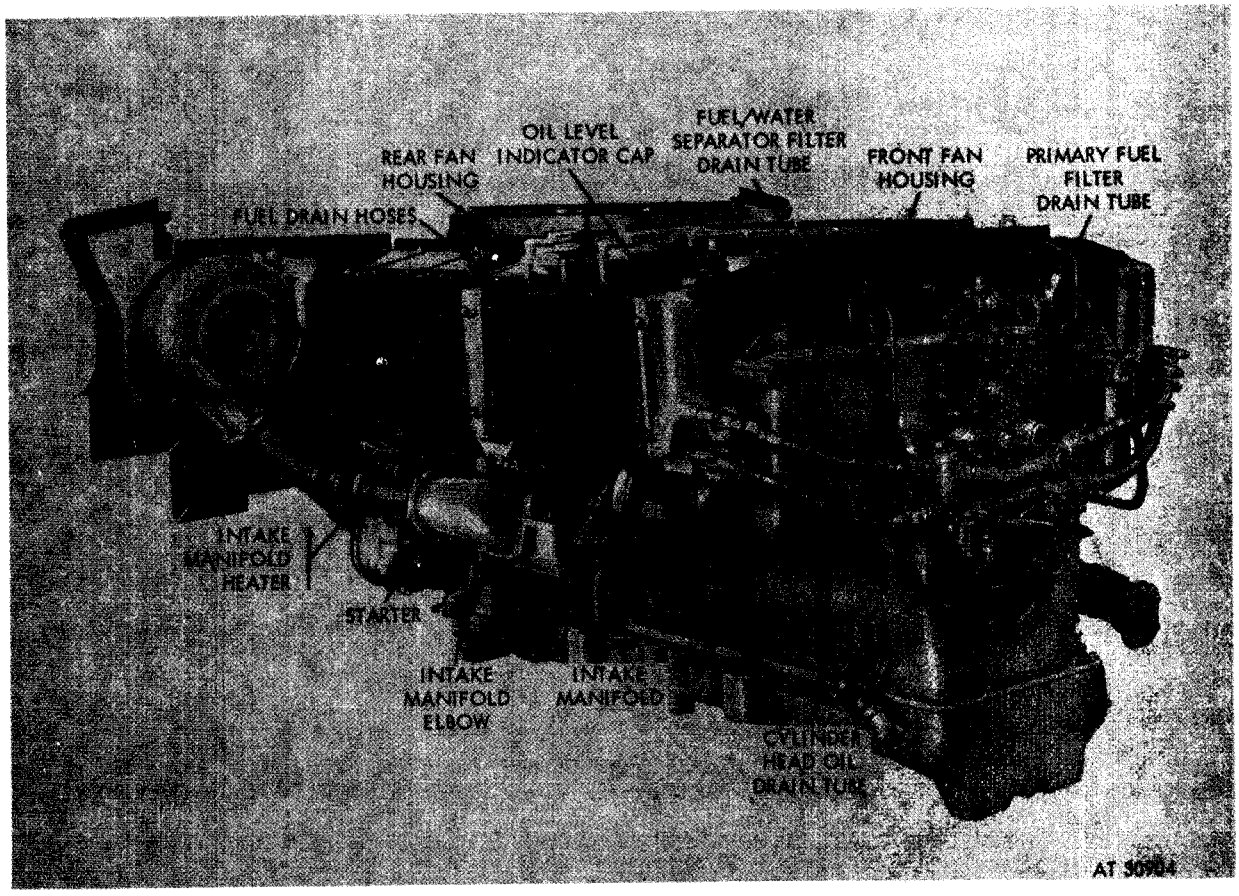


Figure 1-5. AVDS-1790-2A engine assembly with fuel / water separator filter-left front view.

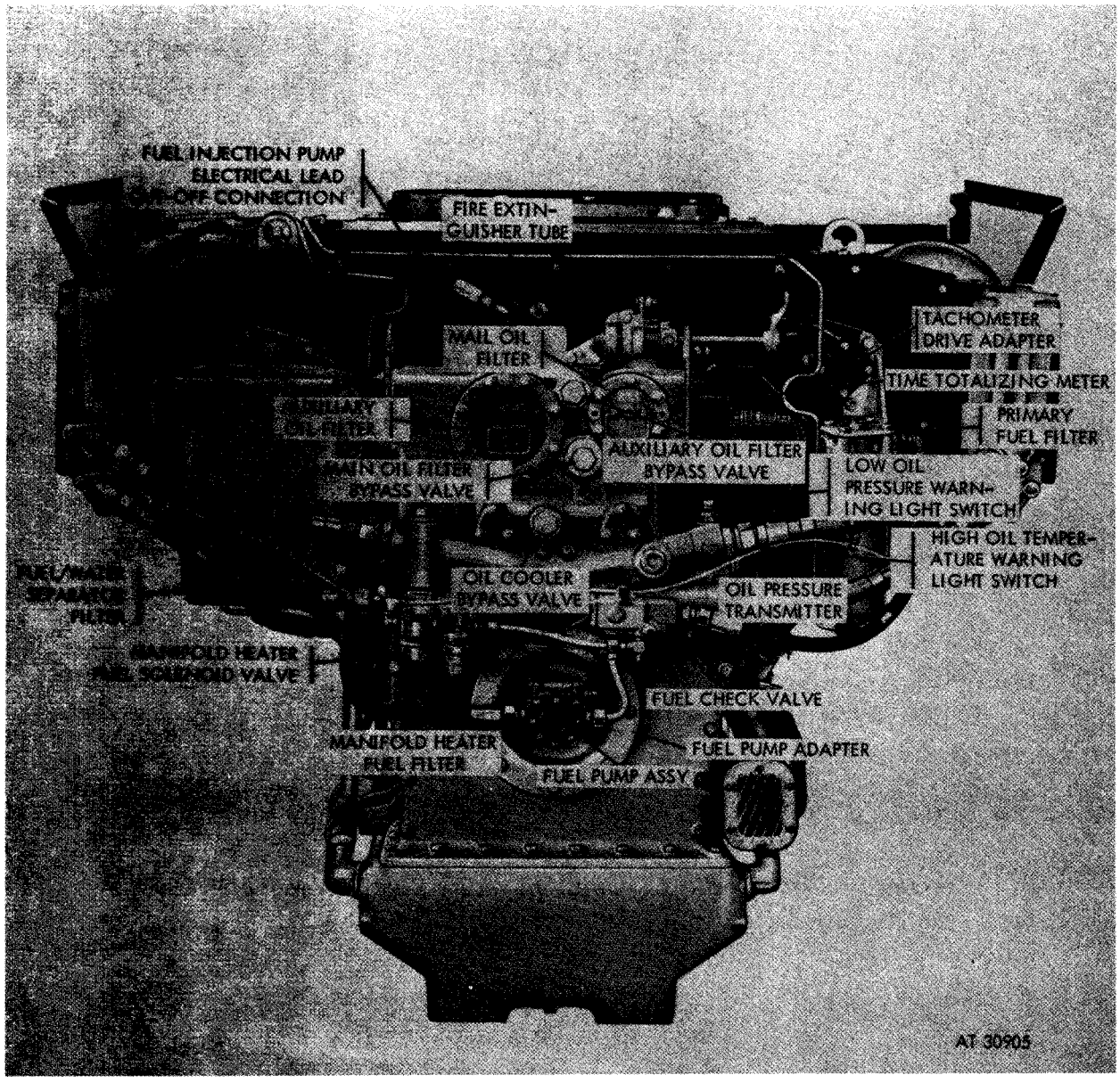


Figure 1-6. AVDS-1790-2A engine assembly with fuel/ water separator filter-front view.

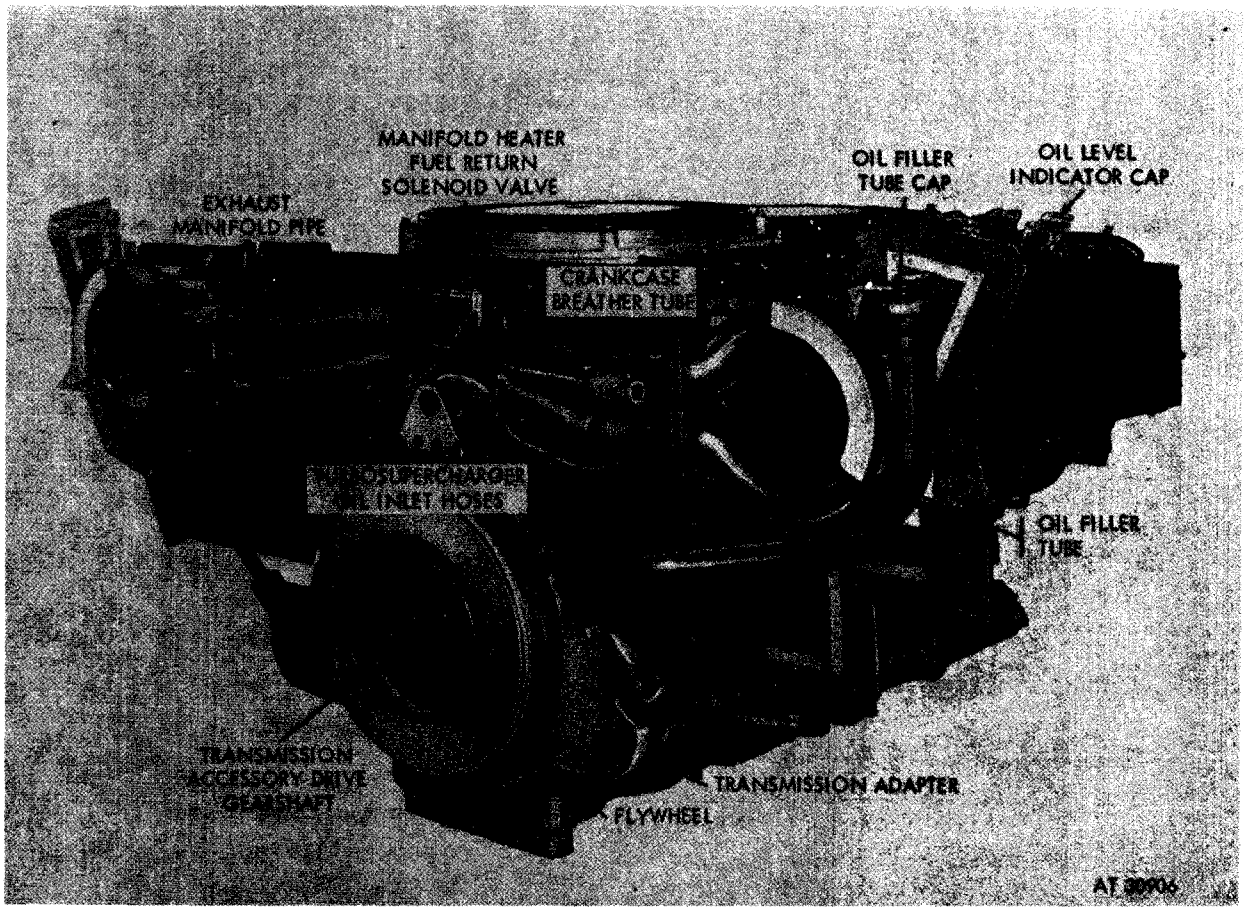


Figure 1-7. AVDS-1790-2A engine assembly with relocated oil filler tube-rear view.

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1-1. Scope

a. This technical manual contains instructions for direct support, general support and depot maintenance, and listings of repair parts and special tools for the 12-cylinder, Model AVDS-1790-2-M, AVDS-1790-2AM, and AVDS-1790-2A engines (figs. 1-1 through 1-3 and 1-7) and the AVDS-1790-2A engine (figs. 1-4 through 1-7). Included are descriptions of and procedures for, removal of engine accessories and components, troubleshooting, disassembly, inspection, including engine overhaul standards, repair, reassembly, and testing of the engines.

b. Appendix A contains a list of current references, including supply manuals, forms, technical manuals, and other available publications applicable to the materiel.

c. Appendix B contains an illustrated list of all parts and special tools with the estimated quantities of component parts and equipment authorized and stocked for Direct Support, General Support and Depot Maintenance of the engines.

d. Appendix B also contains illustrated parts on fold-out pages for rapid reference.

e. This edition of the manual supersedes Field Maintenance edition of TM 9-2815-200-34 (February 1963), Field and Depot Maintenance edition of TM 9-2815-200-35 (August 1960) with changes, and Field and Depot Maintenance Repair Parts and Special Tool List edition of TM 9-2815-200-35P (November 1962). Record any errors or omissions on DA Form 2028 (Recommended Changes for DA Publications), and forward it to: The Commanding General, U.S. Army Tank — Automotive Command, 28251 Van Dyke, Warren, Michigan 48090, Attn: AMSTRA-TP.

1-2. Reference to Other Manuals

a. TM 9-2350-214-10, TM 9-2350-215-10, TM 9-2350-222-10, TM 9-2350-224-10, TM 5-5420-202-10, and TM 9-2350-232-10 contain operating instructions for the materiel as well as instructions for performing operator / crew maintenance functions.

b. TM 9-2350-214-20, TM 9-2350-215-20, TM 9-2350-222-20, TM 9-2350-224-20, TM 5-5420-202-20, and TM 9-2350-232-20 contain pertinent Maintenance Allocation Charts (MAC) and instructions for the maintenance of the materiel within the scope of organizational maintenance.

c. L() 9-2350-214-12, LO 9-2350-215-12, LO 9-2350-222-12, LO 9-2350-224-10, LO 5-5420-202-20-1, LO 5-5420-202-20-1, and LO 9-2350-232-10 contain lubricating instructions for the materiel.

d. TM 9-2910-212-34 contains service information on the American Bosch fuel injection metering pump.

e. TM 9-2910-213-34 contains service information on the Viking vane type fuel pump.

f. TM 9-2920-224-35 contains service information on the Model G22-6 and G22-6F Lear Siegler (formerly Jack and Hientz) generators.

g. TM 9-2920-232-34 contains service information on the Delco-Remy starter.

h. TM 9-2990-200-34 contains service information on the Schwitzer turbosuperchargers.

1-3. Scope of Manual

a. Chapters 1 through 3. Chapter 1 provides general inform ation, description, and tabulated data. Chapter 2 contains a list of special tools and equipment required for field maintenance, illustrates three improvised tools, and includes a shop layout for engine rebuild. Chapter 3 covers engine troubleshooting and includes a chart to assist in location of troubles, and corrective action necessary.

b. Chapter 4. This chapter covers the direct support maintenance service operations supplementing the Organizational Maintenance Manuals in paragraph 1-2, above.

c. Chapters 5 and 6. Chapter 5 gives information on preparation of the engine for disassembly, removal of engine accessories, and

the disassembly of the engine into subassemblies. Chapter 6 gives information for cleaning, inspection, handling of parts and general repair procedures including overhaul standards, and the disassembly and assembly of the various engine subassemblies and components.

d. Chapter 7. This chapter covers the assembly of the engine from subassemblies, and provides pertinent assembly information peculiar to the engine, including installation of accessories.

e. Chapter 8. This chapter outlines the test and adjustment procedures required to insure that an engine has been properly repaired. Also included in this chapter is the information relating to the engine container. Complete instructions concerning the removal or installation of the engine, repair of the container and engine preservation and storage have been covered.

f. Appendixes and Indexes.

(1) Following Chapter 8 is an alphabetical index for maintenance services outlined in the manual. This index provides a rapid reference to a paragraph and figure in accordance with the subject operation.

(2) Appendix A provides a list of publications which are related to the materiel or its maintenance.

(3) Appendix B contains an introduction, a list of parts and special tools, and a Federal Stock Number index.

(4) At the back of Appendix B of the manual are fold-out illustrations which provide rapid reference for repair parts identification. These illustrations are numerically keyed to the items in the repair parts text, and also include alphabetical keys for points of measurement for the maintenance manual overhaul standards.

1-4. Organizational, Direct Support, General Support, and Depot Maintenance Allocation

Refer to the pertinent maintenance allocation chart in the Organizational Maintenance Manuals (para 1-2).

1-5. Forms, Records and Reports

For listings of all authorized forms, refer to the current issue of DA PAM 310-2. TM 38-750 contains instructions on the use of forms for records and reports. Authorized forms for units maintaining this materiel are listed in Appendix A.

Section II — DESCRIPTION

1-6. Differences Between Engine Models

a. Engineering improvements were developed on the AVDS-1790 series engines to improve engine performance and reliability.

b. The following engine models are available in the field :

(1) AVDS-1790-2-M. This original AVDS-1790 series engine developed for the M60 vehicle had engine oil pan, Part No. 10865039. In order to use the engine in other vehicles, the oil pan had to be redesigned. Because engine interchangeability was affected it was necessary to change the engine model when the new oil pan was installed on the engine. AVDS-1790-2-M engines with the new oil pan are identified as AVDS-1790-2-AM models.

(2) AVDS-1790-2-AM. This was an original AVDS-1790 series engine with a new engine oil pan, Part No. 10912261, which permitted the engine to be used as a replacement engine in certain gasoline engine powered vehicles. The oil pan change was the only difference between this engine model and the AVDS-1790-2-M model.

(3) AVDS-1790-2A. The AVDS-1790 series engines, having the new oil pan and numerous other changes to improve engine performance and reliability, is identified as the AVDS-1790-2A model. Basically all models of the engine are similar except for the oil pan, and other improvements which are as follows:

(a) Secondary fuel / water separator filter unit (fig. 1-6) replaced the conventional dual replaceable element type filter (fig. 1-3) in late production. All engines produced with secondary fuel filter shall be updated to water separator filter unit at time of engine overhaul.

(b) Relocated oil temperature and pressure transmitters and switches to the front of the engine for ease of maintenance.

(c) Optional splined or diaphragm type fuel injection pump drive coupling.

(d) Flexible fuel injector nozzle fuel return lines replaced rigid steel tubes to improve service life.

(e) Double lip oil seal in cooling fan drive for deep-water fording to prevent water from entering the engine.

(f) An improved fuel injection pump incorporating a filter at the fuel inlet to prevent foreign materials from entering the pump, thereby extending pump life.

(g) Simplified and improved cooling fan clutch, eliminating the hydraulic engagement feature.

(h) Oil filler tube has been relocated at left rear of left turbosupercharger to prevent oil spillage from plugging cylinder cooling fins and restricting air flow through the engine and transmission oil coolers. The relocation eliminated the need for the oil filler and indicator tube splash pan drain.

(i) Primary fuel filter screen type element has been replaced with a high capacity replaceable-type element.

(j) Wall thickness of cylinders has been increased to improve service life. Cylinders with increased wall thickness can be identified by machine groove around mounting base flange.

(k) Drain cocks and hoses on fuel filters were replaced with rigid lines and drain valves located on top of the engine.

(l) Additional clamps and supports have been added to fuel injection lines to reduce line breakage from vibration.

(m) Added numerous tube and hose clamps and rerouted lines to prevent line failures from chaffing and vibration.

(n) Added a preformed packing to starter drive bearing cage, and a flat gasket to the drive adapter to prevent oil leaks. Preformed packings cannot be used on engines which have bearing cages without the groove for the preformed packing.

(o) Time totalizing meter added to record total engine operating hours.

1-7. Location of Engine Components

a. In this manual the terms defined in b through e, below will be used to identify the location of parts and assemblies on the engines.

b. The ends of the engines will be called the "damper end" or "front" and the "flywheel end" or "rear".

c. As viewed from the front end toward the rear, the side to the right will be called the "right side" and the side to the left will be called the "left side". Beginning at the front, the right bank of cylinders is numbered lR through 6R and the left bank of cylinders is numbered IL through 6L.

d. Starting from the front, the main bearings are numbered 1 through 7.

e. The cylinders, pistons, connecting rods, and connecting rod bearings are numbered with their respective cylinder number locations.

1-8. General Description

a. The Model AVDS-1790-2-M, AVDS-1790-2-AM and the AVDS-1790-2A engines are 12-cylinder, 90 degree, V-type, 4-cycle, air-cooled, turbosupercharged, diesel engines. The cylinder assemblies are individually replaceable units, with overhead valves and valve rocker assemblies in the head. The cylinders are arranged in two banks of six cylinders each. Each bank of cylinders has an overhead camshaft arrangement to actuate the valves of each cylinder.

b. The engines feature a fuel injection system and a turbosupercharged air induction system which obtains optimum engine performance. The fuel injection system has a fuel injection metering pump which supplies metered fuel to individual cylinders through fuel injector nozzles. The fuel supply pump assembly (figs. 1-3 and 1-6) located at the front of the engine, draws fuel through the primary and secondary fuel systems from the vehicle fuel tanks and delivers it to the injection pump. A turbosupercharger assembly (figs. 1-1, 1-2, 1-4, and 1-5) is located on each side of the engine at the rear. The turbosuperchargers are exhaust-gas driven and increase the air flow pressure entering the air intake manifolds (figs. 1-1, 1-2, 1-4, and 1-5).

c. The engines are equipped with a 28 volt, 300 amp, dc generator (figs. 1-1 and 1-4) and a 24 volt solenoid operated starter (figs. 1-2 and 1-5).

d. The engines are lubricated by a forced feed system. The system consists of three circuits; i.e., the scavenge circuit, the main or pressure oil circuit, and the piston cooling circuit. These circuits are operated independently by one oil pump which consists of three separate sections.

e. The engines are equipped with two intake manifold heaters (figs. 1-1, 1-2, 1-4, and 1-5) which are installed in the air intake systems between the intake manifold elbows and the turbo superchargers. The heaters, when operated, preheat the air entering the cylinders to facilitate cold weather starting and cold weather idle operation.

f. The engine crankcase is vented by an enclosed crankcase breather system which is vented through the crankcase breather tube (fig. 1-7) at the left turbosupercharger exhaust pipe.

g. The engine primary and secondary fuel filters (fig. 1-3) have individual drain lines, with drain cocks, which provide a means of draining the filters to remove water which may be accumulated and to purge the fuel system. Late production AVDS-1790-2A engines have a filter / water separator type secondary filter and drain lines to remove entrained moisture from the fuel (fig. 1-6).

1-9. Accessories

Refer to paragraph 1-2 for information on engine accessories.

1-10. The crankcase (fig. l-l) is a one-piece aluminum casting with forged aluminum main bearing caps. The bearing caps function as an integral part of the crankcase. Each cap is secured on studs with four slotted nuts. Two through bolts clamp the main bearing cap in the tunnel slot of the crankcase. With this type of crankcase and bearing cap construction, uniform load distribution in the bearing area is obtained making possible uniform distribution of combustion forces over the entire crankcase.

1-11. Main Bearings

The seven replaceable main bearings are the steel-backed, split type, having copper-lead alloy bearing surfaces. The center main bearing is double-flanged with bearing material to control crankshaft end play and thrust.

Figure 1-8. Legend

A - Intake valve rocker arm assembly
B - Exhaust valve rocker arm assembly
C - Left camshaft assembly
D - Camshaft driven gear
E - Camshaft drive gearshaft
F - Camshaft drive shaft
G - Camshaft drive bevel gearshaft
H - Accessory drive gearshaft assembly
J - Fuel injector pump advance assembly
K - Right camshaft assembly
L - Transmission accessory drive gearshaft
M - Accessory drive gear
N - Flywheel
P - Generator drive gearshaft
Q - Generator idler gear
R - Oil pump driven gear
S - Piston cooling oil pump driven impeller
T - Pressure oil pump driven impeller
U - Scavenge oil pump driven impeller
V - Oil pump driven shaft
W - Scavenge oil pump drive impeller
X - Scavenge oil pump driven impeller shaft
Y - Pressure oil pump drive impeller
Z - Piston cooling oil pump drive impeller
AA - Oil pump drive gear
BB - Starter idler gear
CC - Starter driven gearshaft
DD - Starter drive gear
EE - Front fan drive shaft
FF - Fan drive bevel gearshaft
GG - Rear fan drive shaft
HH - Fan driven gearshaft
JJ - Fuel injector pump drive gear shaft
KK - Fuel injector pump driven shaft gear
LL - Fan drive clutch assembly
MM - Cooling fan adapter
NN - Rear cooling fan assembly
PP - Fan drive bevel gearshaft
QQ - Crankshaft assembly
RR - Fuel pump drive coupling
SS - Fuel pump drive adapter
TT - Crankshaft torsional vibration damper
UU - Connecting rod assembly
VV - Piston
WW - Front cooling fan assembly
XX - Exhaust valve
YY - Intake valve

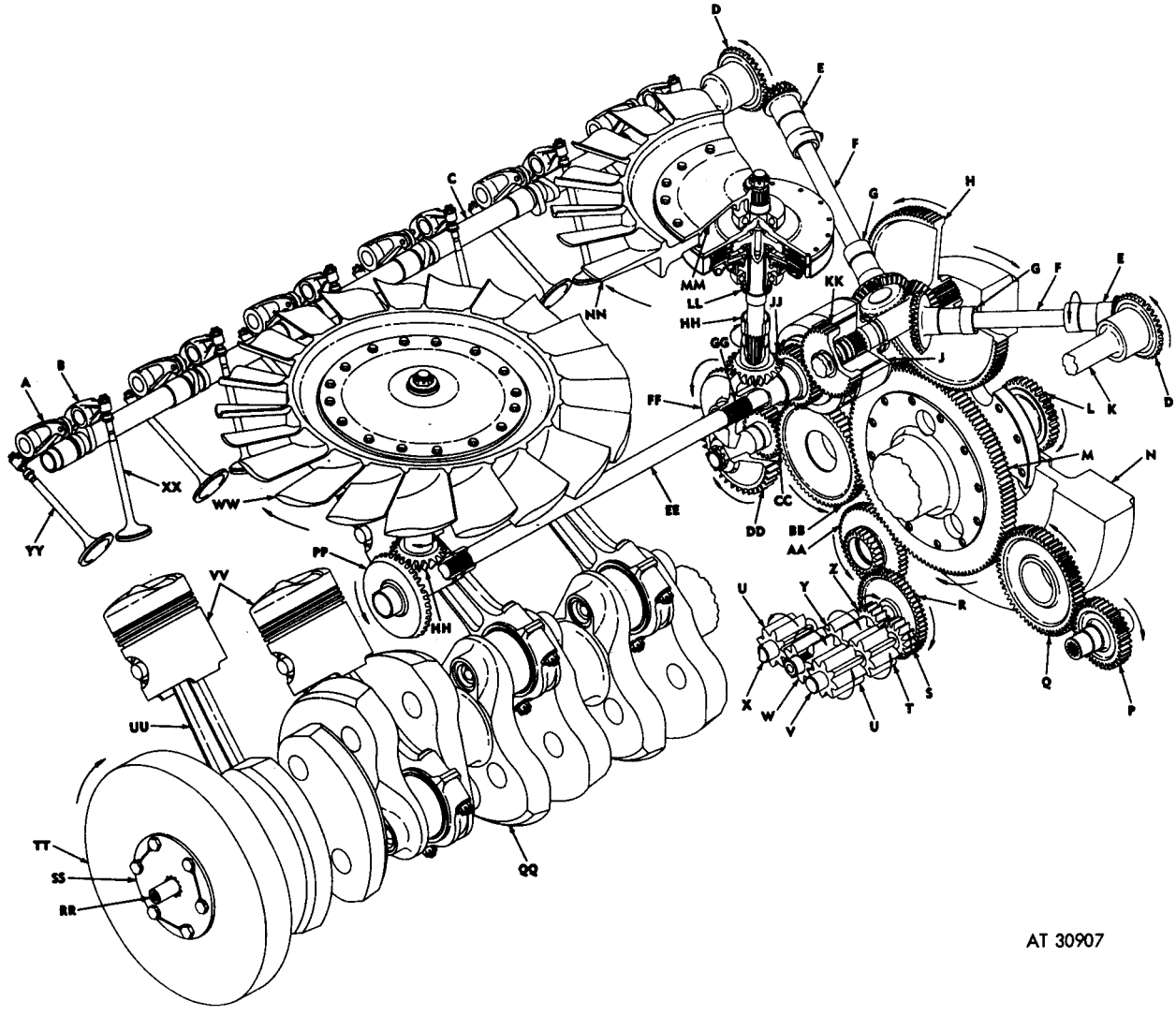


Figure 1-8. Engine major working parts

1-12. Crankshaft, Flywheel, and Damper

Note. The key letters shown below in parentheses refer to figure 1-8.

a. Crankshaft assembly (QQ) is a nitrided steel forging with seven main bearing journals and six crankpins. Each crankpin accommodates two opposing connecting rod assemblies (UU). Flanges are provided on the crankshaft for mounting the flywheel (N) on the rear end and a torsional vibration damper (TT) on the front end.

b. All crankpin and main bearing journals are hollow to reduce weight. Holes are drilled diagonally through each main bearing journal and extend through the crank cheek and crankpin to provide a direct passage for oil under pressure to the connecting rod and crankshaft main bearings as shown in figure 1-9.

c. The crankshaft and flywheel are statically and dynamically balanced.

d. The torsional vibration damper (TT) is a precision viscous type and is replaceable only as an assembly.

1-13. Connecting Rods and Bearings

The connecting rod assemblies (UU, fig. 1-8) are tapered, I-beam section steel forgings. A bronze-lined, steel-backed, split, bushing type bearing is pressed into the piston pin end of the rod. The replaceable precision connecting rod bearings are the steel-backed, split type having copper-lead alloy bearing surfaces.

1-14. Pistons, Pins and Rings

The pistons (VV, fig. 1-8) are aluminum forgings, cam ground and tapered to provide an accurate fit in the cylinders at operating tern. peratures. The piston dome is machined to the shape of a conical section (toridal shape) so that it tapers into the open type combustion chamber. Each piston is fitted with four rings. The upper three rings are compression rings and the bottom ring is an oil control ring. The heavy walled, tubular, steel piston pins are full-floating in the piston and the connecting rod. Domed aluminum plugs are inserted into each end of the piston pin to center it in the piston and prevent scoring of the cylinder wall.

1-15. Cylinders and Valves

Note. The key letters shown below in parentheses refer to figure 1-8 except where otherwise indicated.

a. Each cylinder assembly (fig. 1-1) is an individually replaceable unit that consists of a barrel, cooling fin muff, and a cylinder head. The cooling fin muff is cast directly on the steel barrel. The finned, cast aluminum cylinder head is threaded and shrunk on the barrel. Cooling fins, exhaust and intake ports, and a single rocker box are cast integrally with the cylinder head. Valve guides and seats are shrunk into place in the head, The cylinder barrel is "choked" at the head end to provide a straight bore under running conditions. A mounting flange is machined on the cylinder barrel near the base to provide an attachment of the cylinder to the crankcase. The cylinder assembly is secured to the crankcase with studs and nuts. An outer extension of the cylinder head encloses a recess or rocker box, which houses the valves, valve springs, and related parts. Rocker arm assemblies (A and B) are held in place by rocker shafts in the cylinder head valve rocker support cover.

b. A camshaft bearing surface is provided in each cylinder. The camshaft bearing is bored with the cylinder head valve rocker support cover in place. Therefore the covers are not interchangeable and each must remain as a part of a specific cylinder assembly. Identifying numbers are used on cylinder and covers to prevent mismatching. Counterbores in the rocker box. and rocker support covers accommodate the intercylinder rubber hoses and the steel flanges which enclose the camshaft between the cylinders.

c. The stem of the intake valve (YY) and exhaust valve (XX), for each cylinder, extends into the rocker box. Three nested springs, compressed between two retainers and secured to the valve stem by two cone-shaped locks, hold each valve to its seat. Each exhaust valve has a positive valve rotator which also serves as the lower spring retainer. Valve clearance adjusting screws with flat swivel pusher pads are mounted on one end of the valve rocker arms (A and B).

d. Forged steel valve rocker arms (A and B) with roller cam-followers are used. The rollers are hardened and honed to provide an extremely smooth and permanent contact surface. Hollow rocker arm shafts and drilled passages in the rocker arms convey oil to all moving parts.

1-16. Camshafts

Note. The key letters shown below in parentheses refer to figure 1-8.

a. The left and right camshaft assemblies (C and K) are mounted, one on each bank, on the cylinders and operate the valve mechanism. The camshafts are hollow to provide oil passages for pressure lubrication to the valve parts and to permit deflection when the cylinders fire, Tubular molded rubber hoses enclose the camshafts between cylinders.

b. Each camshaft is driven by the accessory drive gear (M), accessory drive gearshaft assembly (H), camshaft drive bevel gearshaft (G), camshaft drive gearshaft (E), and camshaft driven gear (D) through an inclined quill type camshaft drive shaft (F). The drive shafts can be rem oved to permit separate rotation of the camshafts for engine timing. When camshafts are correctly' positioned in relation to the crankshaft, the drive shafts have different number of splines on each end and this allows them to be inserted in the camshaft bevel gearshafts without disturbing relationship between camshafts and crankshaft.

1-17. Lubrication System (figs. 1-9 and 1-10)

a. *General*. The main pressure oil pump draws oil from the pressure oil pump compartment in the oil pan. This compartment is fed by the scavenge oil pump which picks up oil from both ends of the engine oil pan. The pressurized oil is forced through the engine oil coolers and main oil filter to the engine oil galleries and bearings. A pressure regulator valve, located on the right side of the crankshaft damper and oil filter housing, is influenced by the pressure in the main bearing oil gallery and returns the incoming excess unfiltered oil to the oil pan. A small portion of the pressure oil is diverted, after passing through the main oil filter, and passes through the auxiliary oil filter to provide the turbosuperchargers and the fuel injection pump with oil having a greater degree of filtration. The piston cooling oil pump picks up oil from the end compartment (rear) of the oil pan and delivers it to the piston oil sprayer nozzles. These nozzles are located in the crankcase, below each cylinder, and provide a continuous oil spray to the pistons and cylinder walls.

b. *Oil Pan*. The oil pan (figs. 1-1 and 1-4) is a one-piece, aluminum alloy casting divided into a pressure oil pump compartment, oil reserve compartment, and the end compartments at the front and rear of the pan. The oil pan is designed to maintain a constant oil level above the main pressure oil pump pickup tube in the pressure oil pump compartment during vehicle operation regardless of the angle at which the engine may be inclined.

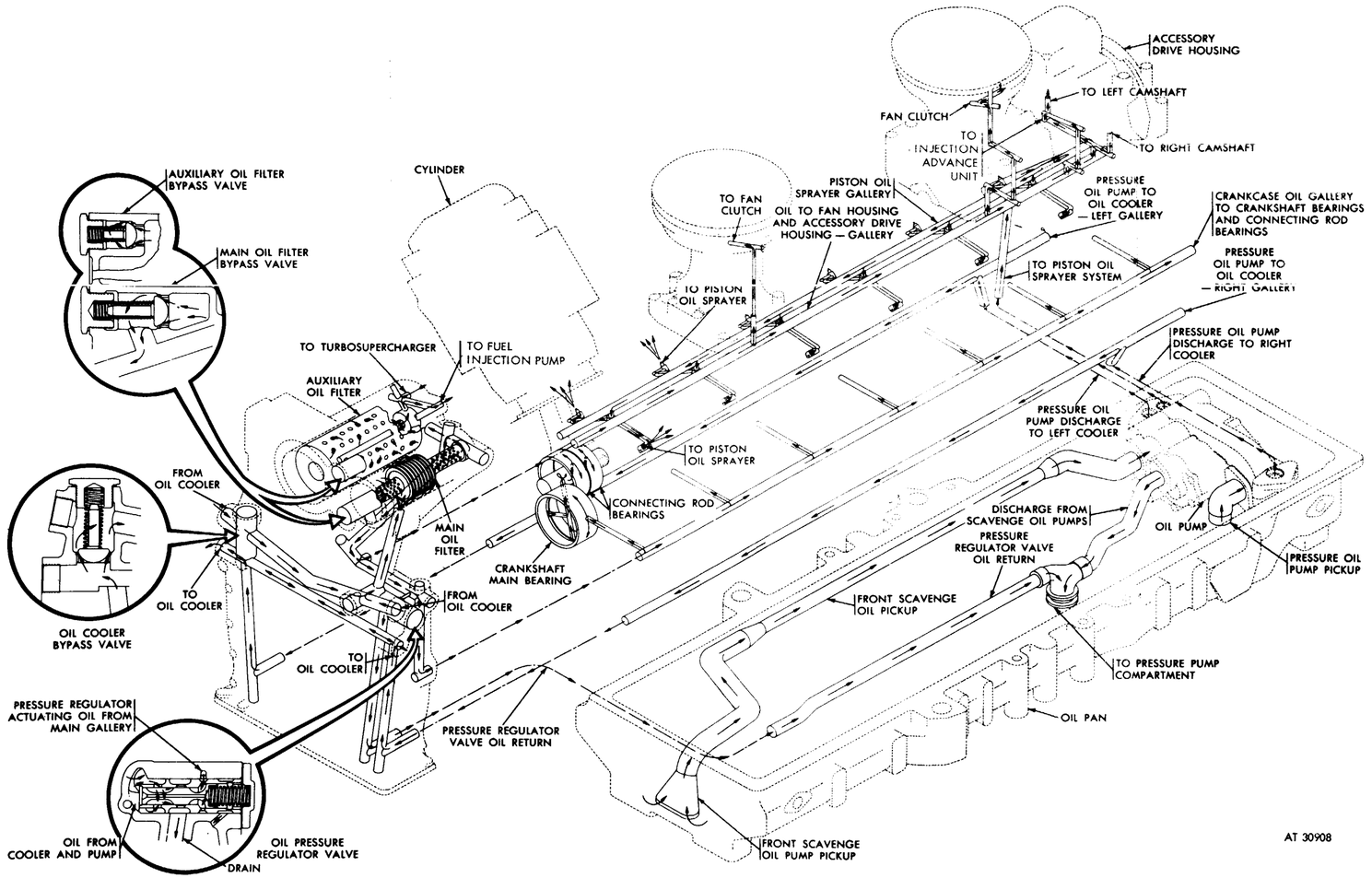


Figure 1-9. Engine lubrication) system.

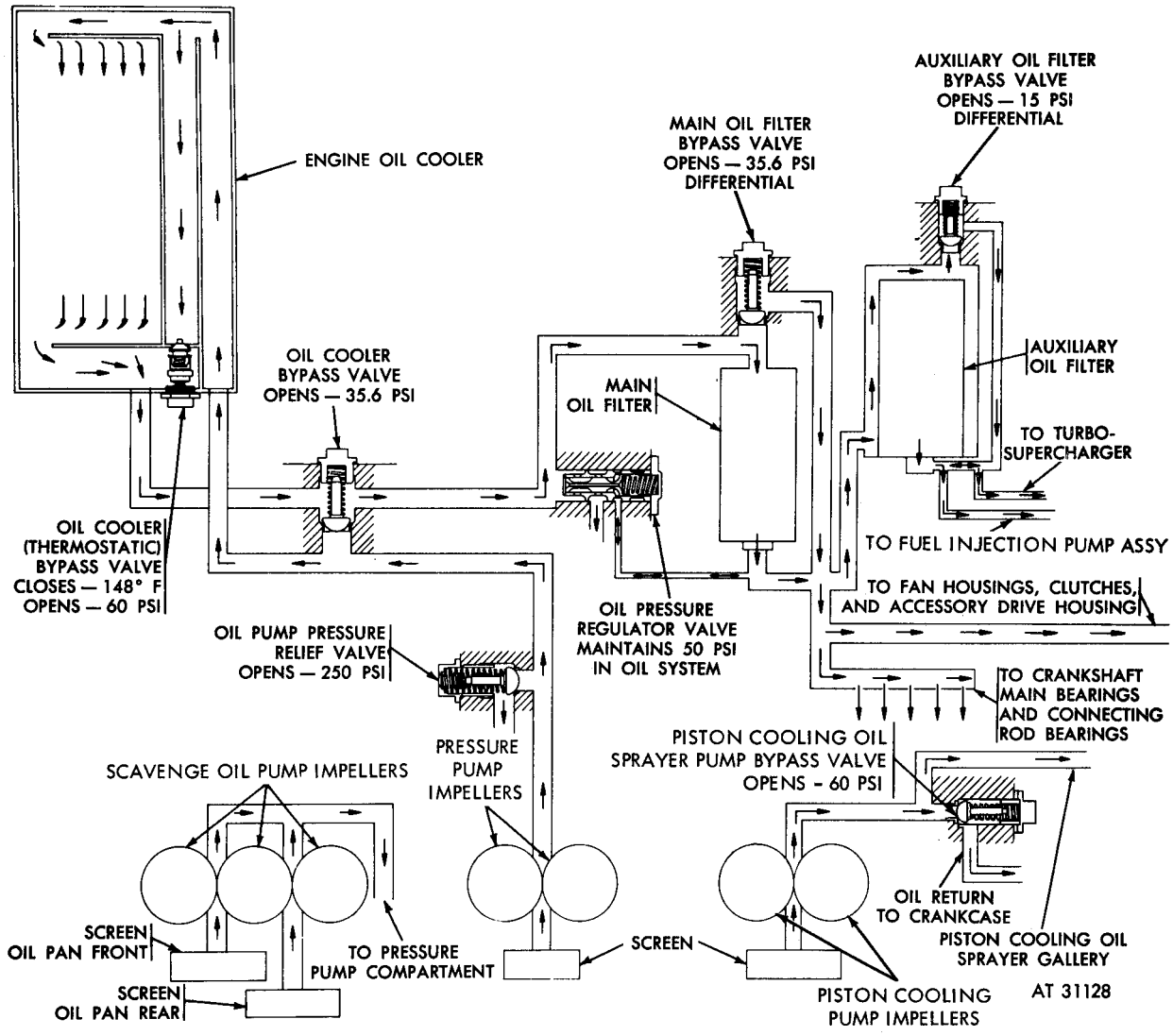


Figure 1-10. Engine oil flow control—schematic diagram.

c. Oil Pump. The oil pump assembly consists of three sections combined as a single unit. The twin scavenge oil pump section of the unit picks up oil from the front and rear compartments of the oil pan and delivers it to the main pressure pump oil compartment. The main pressure oil pump section picks up oil from its respective compartment and supplies oil to the engine oil galleries and bearings. The piston cooling oil pump section picks up oil from the rear sump section of the oil pan and supplies oil to the piston oil sprayer nozzles (a, above).

d. Oil Filters and Control Valves. The main and auxiliary oil filters (figs. 1-3 and 1-6) and the bypass valves are located in the crankshaft damper and oil filter housing at the front of the engine. All engine oil passes through a screen type main oil filter. Engine oil, which lubricates the fuel injection pump and the two turbosuperchargers (figs. 1-1, 1-2, and 1-4), is further filtered by a replaceable element type auxiliary oil filter. Two oil filter bypass valves are used, one for the main oil filter and one for the auxiliary oil filter. The main oil filter bypass valve opens at a differential pressure of 35.6 psi and the auxiliary oil filter bypass valve at a differential pressure of 15 psi. The bypass valves permit oil to bypass the filters in the event that they become clogged.

1-18. Fuel System

a. Fuel Supply Pump Assembly. The engine driven vane type fuel supply pump assembly (figs. 1-3 and 1-6) is used to supply fuel under pressure to the fuel injection pump. The fuel pump is crankshaft driven by the fuel pump drive adapter (SS, fig. 1-8) and the drive coupling (RR) located at the front of the engine.

b. Fuel Injection Metering Pump. The fuel injection metering pump is located in the "V" of the engine between the fan drive housings, and supplies fuel under high pressure to each cylinder. The pump is driven at engine speed from the fan drive housing located at the rear of the engine. A fuel injector pump advance assembly (J, fig. 1-8) is incorporated in the accessory drive housing to automatically provide a gradual degree advance of injection timing during the engine speed range from idle to 1800 rpm.

c. Fuel Injector Nozzles and Tubes. Twelve fuel injector nozzles (fig. 1-11), one per cylinder, are used to inject fuel into the combustion chambers, Twelve fuel injector tubes of equal length carry the fuel from the fuel injection pump to the nozzles. The nozzles on each cylinder bank are interconnected by fuel return lines to provide a path for the return of excess fuel.

d. Fuel Purge System. A manually operated purge pump is provided in the vehicle operator's compartment and is used to clear the engine main fuel system and flame heater system of air, and fill them with fuel. Purged air is forced through the main fuel tubes into the fuel return lines and on to the vehicle fuel tanks. The fuel filters contain drain lines, with manually operated valves, which are used to drain the water from the filters, and for purging the fuel system.

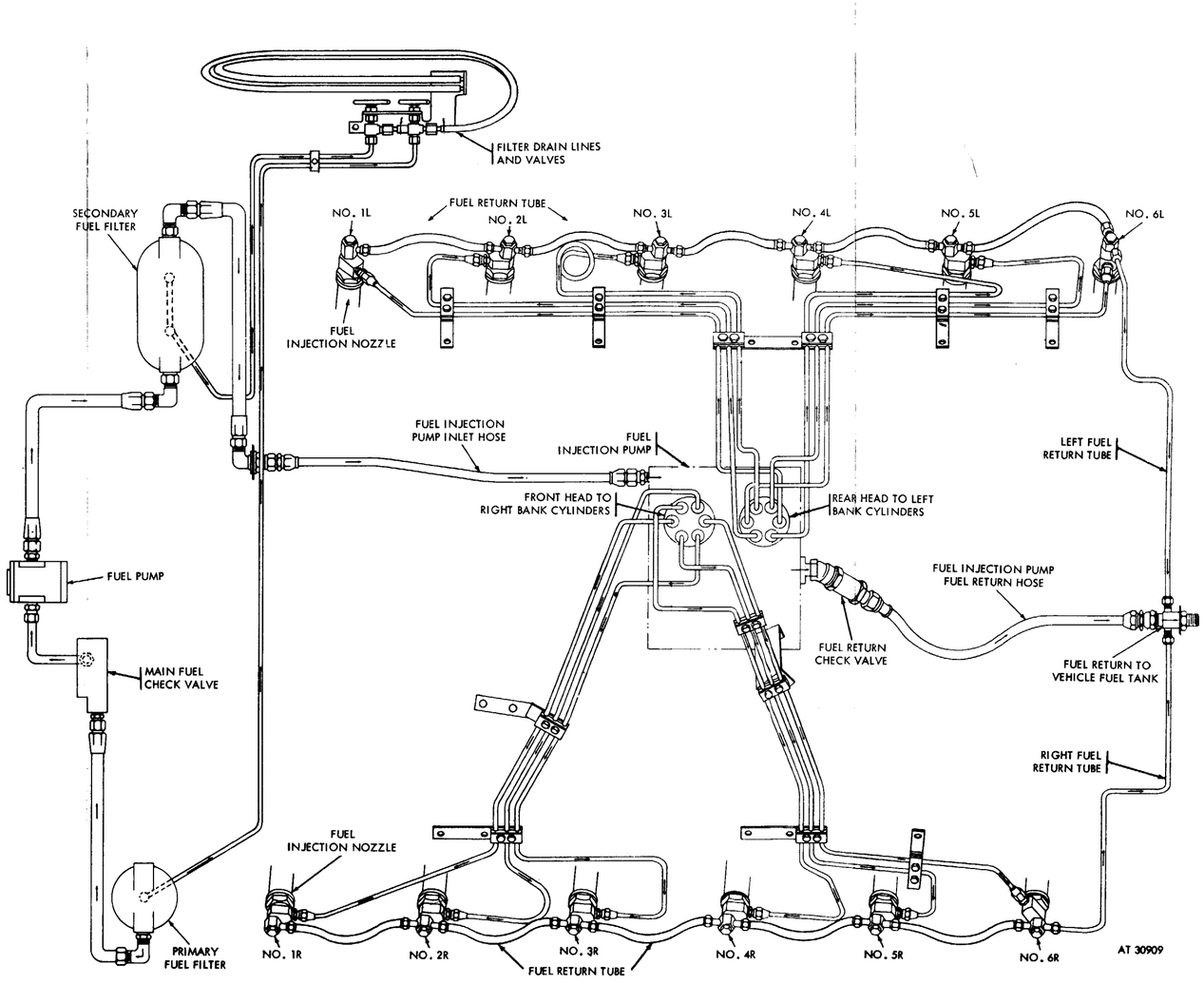


Figure 1-11. Main fuel system—schematic diagram.

e. Fuel Filters (figs. 1-3 and 1-6). The replaceable element type primary fuel filter is mounted on the right front of the engine and contains a fuel drain or purging line. The replaceable element type secondary fuel filter, or the water / separator type filter, is mounted on the left front of the engine. Each filter has a drain or purging line connected to separate drain cocks mounted on a common bracket on top of the engine. Each drain cock is fitted with a flexible hose for dumping drainage from the filters. Fuel from the vehicle fuel tank passes through the primary filter before entering the engine fuel pump. The pump delivers fuel to the secondary filter, or the fuel / water separator filter on late engines and on to the fuel injection pump. Excess fuel bypasses the fuel injection pump and is returned to the fuel tanks (fig. 1-11). The fuel/ water separator filter unit has three replaceable elements, and contains a chamber for collecting water. The unit provides moisture-free and uncontaminated fuel to the injection pump.

f. Fuel Cutoff Solenoid. An electrically operated fuel cutoff solenoid is mounted in the fuel injection pump. The solenoid is normally open. A switch in the vehicle driver's compartment actuates the ciruit to close the solenoid. Closing the solenoid cuts off fuel delivery from the fuel injection pump and stops the engine.

g. *Fuel Return Check Valve.* A fuel return check valve (fig. 1-11) is installed between the fuel injection pump fuel return outlet and the fuel return hose assembly. The valve prevents fuel flowing back to the injection pump when the fuel supply is closed.

1-19. Manifold Air Induction and Heater System

a. Turbosupercharger Assemblies. Exhaust gas driven turbosupercharger assemblies (figs. 1-1, 1-2, and 1-4), one for each bank of cylinders, are mounted on each side of the engine, at the rear. The turbosuperchargers increase the pressure of the intake air, thereby delivering a higher density air to the cylinders as compared with a non-supercharged engine. This higher density air, with a proper fuel flow, increases engine power.

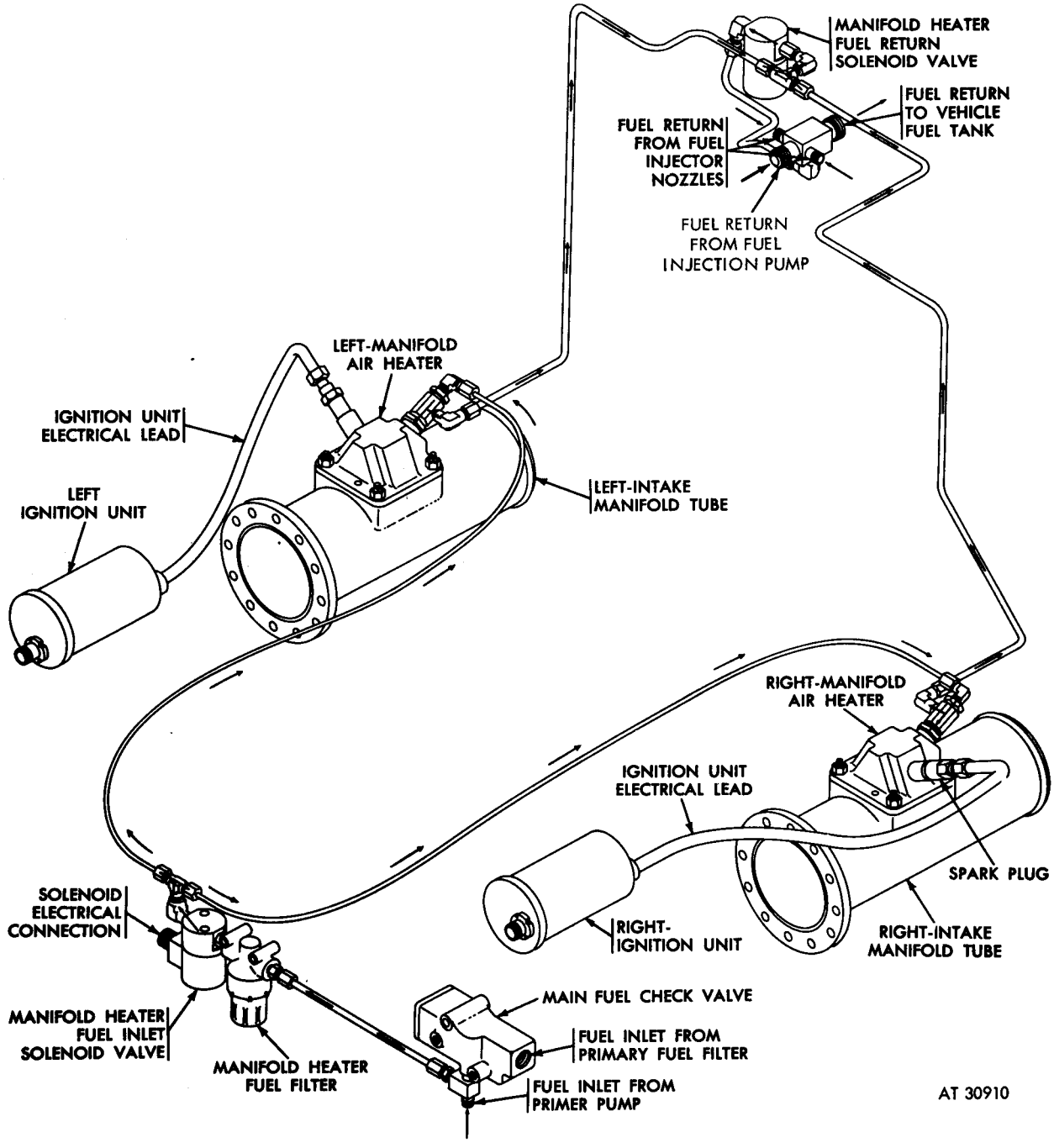


Figure 1-12. Manifold air induction heater system—schematic diagram.

b. Intake Manifold Heater (fig. 1-12).

(1) The intake manifold (figs. 1-1 and 1-5) which distributes induction air to each bank of cylinders is equipped with an electrically operated flame type intake manifold heater. The heater is provided as an aid for cold weather starting and cold weather operations. Operation of the heater switch (in the vehicle operator's compartment) energizes the manifold heater fuel solenoid valve, the heater ignition unit, and spark plug for each heater simultaneously. Fuel is hand pumped through the manifold heater fuel filter and fuel solenoid valve and sprayed into the intake manifold. The fuel is ignited by the spark plug and burns in the intake manifold as the engine is cranking, and the flame heats the incoming air. This flame-heated air and the products of combustion are fed directly into the cylinders with little heat loss. This results in an immediate engine response, and assures complete combustion at low engine rpm and at no-load operating conditions with low ambient temperature.

(2) The manifold heater fuel inlet solenoid valve prevents fuel pumped by the fuel pump assembly from entering the air intake manifold heater unless the heater system is energized. A manifold heater fuel return solenoid valve is located at the rear of the engine. The valve is also energized (opened) when the ignition unit and heater spark plugs are energized to permit excess fuel to be returned to the fuel tanks. The main fuel check valve prevents back flow of the fuel when the purge pump in the driver's compartment is actuated.

1-20. Exhaust System and Turbosupercharger

a. The exhaust system consists of four manifolds, one for each group of three adjacent cylinders. The two exhaust manifolds on each cylinder bank are connected to the turbosupercharger on their respective side of the engine.

b. Exhaust gases from each side of the engine enter a turbosupercharger and are forced around a turbine housing, radially inward, and through a nozzle ring, toward the turbine wheel. The exhaust gases drive the turbine wheel which in turn, drives the compressor wheel since both wheels are on a common shaft. Intake manifold air enters at the center of the compressor wheel and flows radially outward through a diffuser section into the compressor housing. The air at increased velocity then leaves through a tangential outlet on the outside of the compressor housing, and enters the intake manifold.

c. The exhaust gases are expelled from the turbosuperchargers into the vehicle exhaust system.

1-21. Cooling System

Note. The key letters shown below in parentheses refer to figure 1-8.

a. Fans. The top of the engine is shrouded to house two cooling fans (WW and NN) which draw cool air from the underside of the engine, through the cylinder fins, and discharge the hot air vertically from the top shroud. The fans are attached to adapters (MM) and are mounted on shafts which are driven through a fan drive clutch assembly (LL). The rear fan clutch is driven by the rear fan drive shaft (GG), fan drive bevel gearshaft (FF), and fan driven gearshaft (HH). The front fan clutch is driven by the front fan drive shaft (EE) and another fan driven gearshaft (HH).

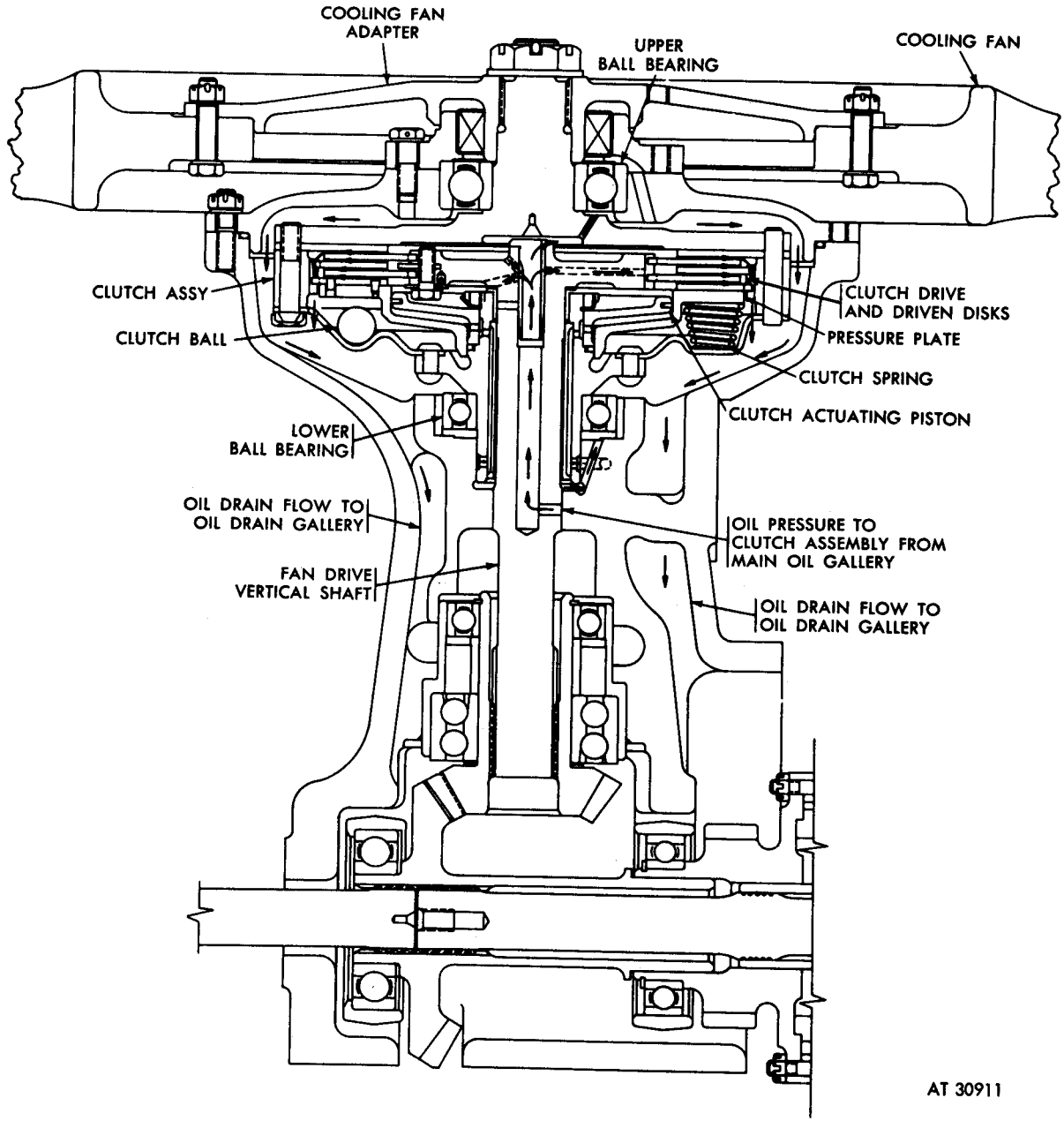


Figure 1-13. Piston actuated cooling fan clutch—sectional view.

b. Fan Drive and Clutch (figs. 1-13 and 1-14). The fan clutch is oil cooled. The fan clutch drive and driven disks are loaded by the centrifugal action of clutch balls and springs housed in the clutch assembly. The balls and springs are in the driven member and apply upward force to the clutch disks. The clutch oil enters the fan drive vertical shaft from the fan drive housing through an annular groove in the shaft. The oil flows through a central hole in the shaft to a distributor where it is dispersed to the ball bearings and to the clutch disks. The oil moves between the clutch disks by centrifugal action and drains back through the fan drive housing into the engine oil pan. Early cooling fan clutches had a hydraulic disengagement feature, The clutch actuating piston (fig. 1-13) for this hydraulic disengagement feature was eliminated on late engines, and the clutch has been greatly simplified and improved (fig. 1-14).

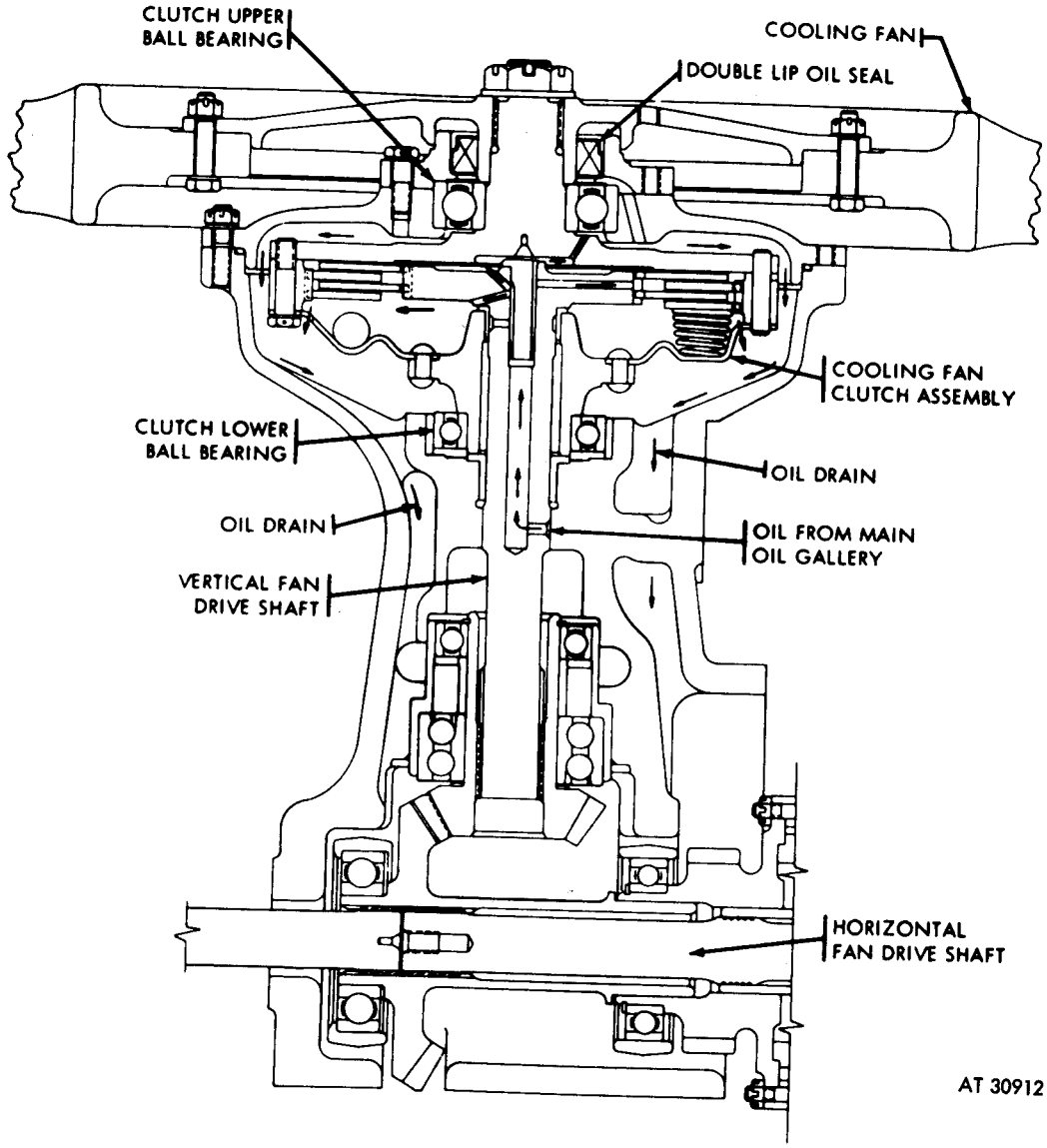


Figure 1-14. Mechanical cooling fan clutch—sectional view.

c. Engine and Transmission Oil Coolers (figs. 1-1 and 1-4). All transmission and engine oil cooling is accomplished by external oil coolers. The oil coolers are located on the sides of the engine, above the cylinders. Air is drawn through the oil coolers by the cooling fans. A thermostatic control valve in each oil cooler controls the temperature of the oil from the cooler by permitting cold oil to bypass the coolers. This valve also permits oil to bypass the cooler in the event that the cooler becomes clogged.

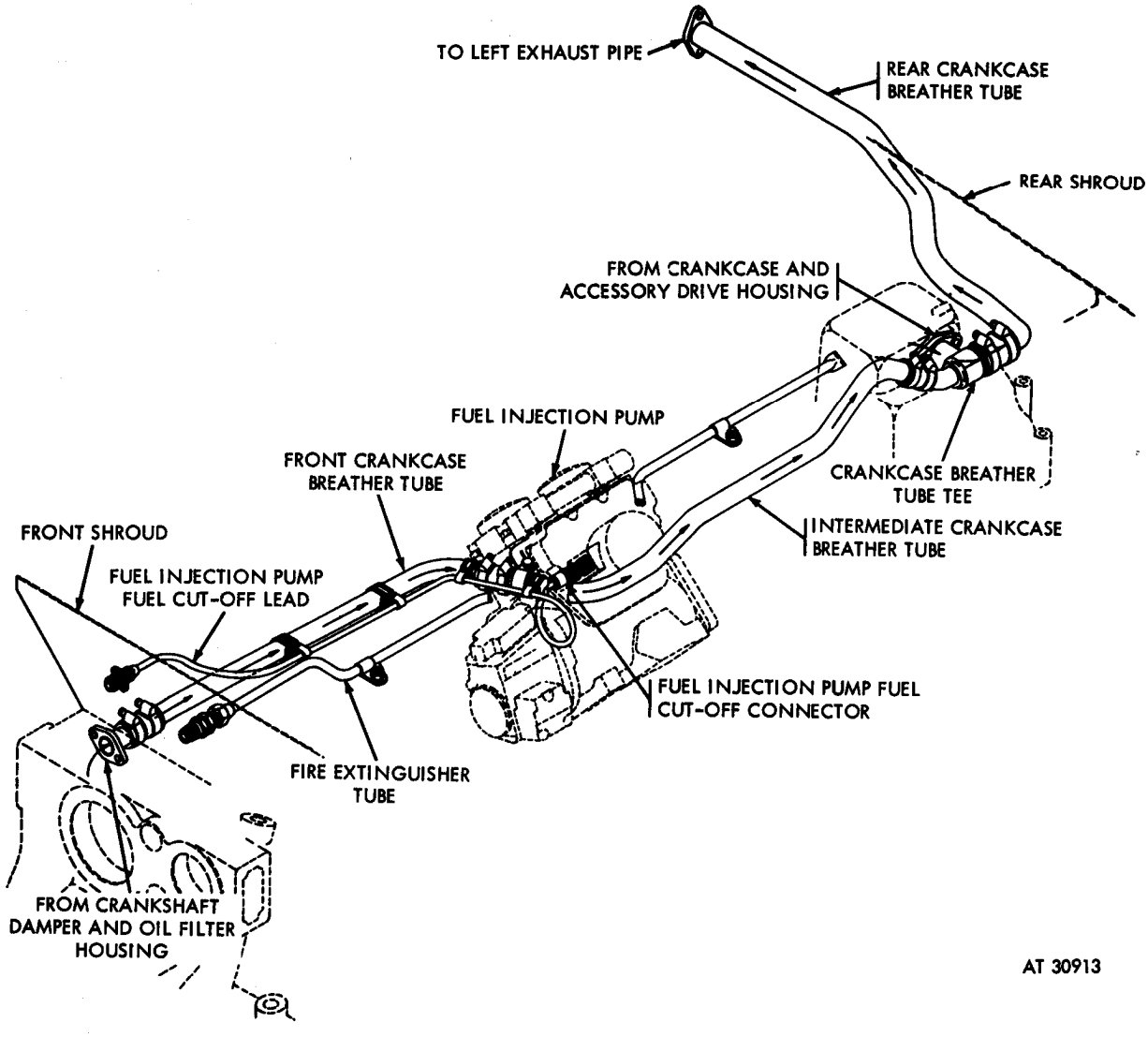


Figure 1-15. Early crankcase breather and fire extinguisher system.

1-22. Crankcase Breather and Fire Extinguisher Systems (figs. 1-15 and 1-16)

a. Crankcase Breather System. The engine crankcase breather system is completely enclosed which allows the engine to be submerged without entrance of water and permits the crankcase to be vented. The breather system is vented through the left turbosupercharger exhaust outlet into the vehicle exhaust system.

b. Fire Extinguisher System. The engine is equipped with a fire extinguisher tube located in the "V". This tube is connected to the engine compartment fire extinguisher system. The tube has small holes drilled along the entire length to direct the carbon dioxide (CO_2) fire extinguisher fluid in predetermined directions around cylinders, fuel injection pump, and intercylinder components in case of fire.

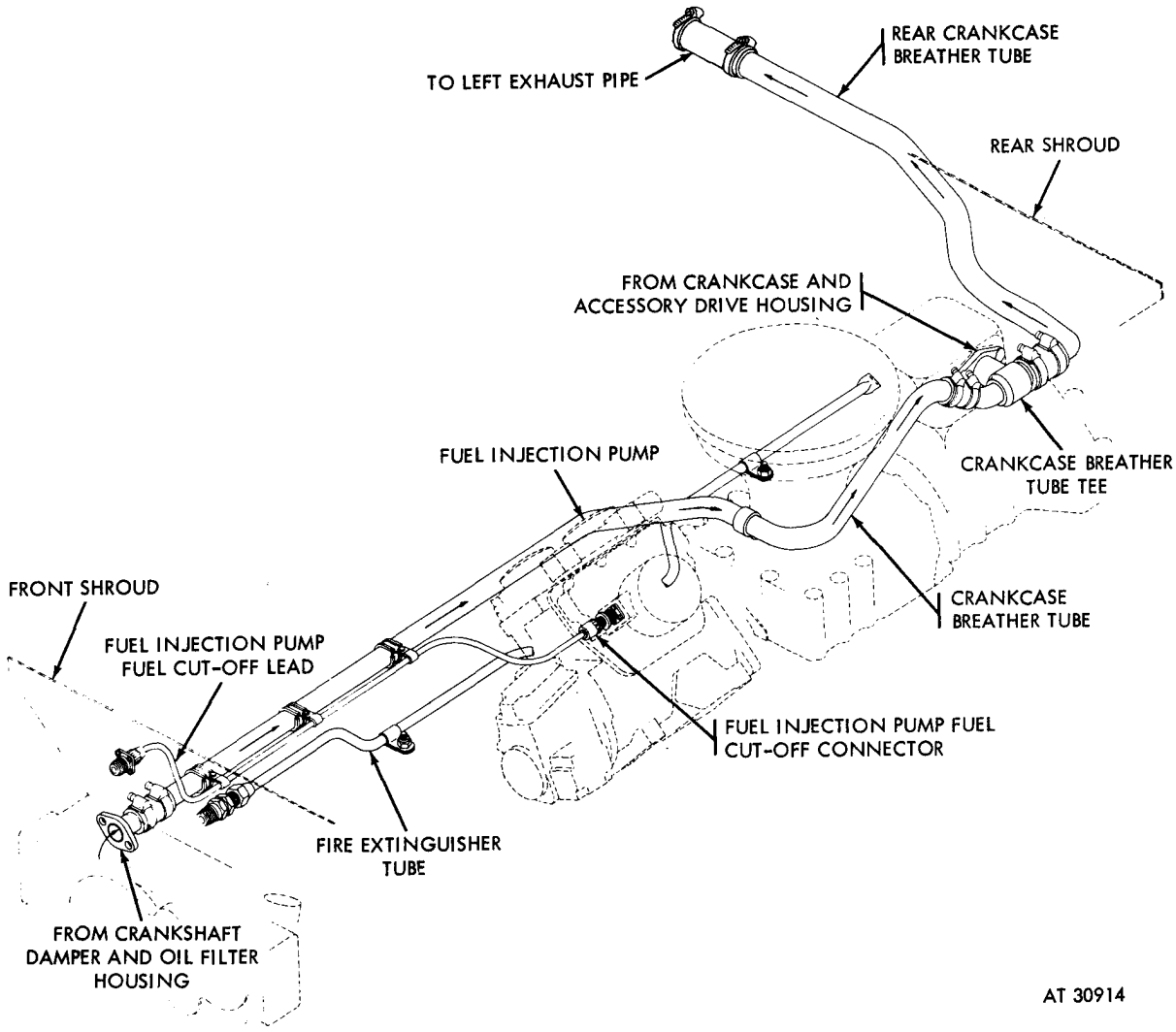


Figure 1-16. Late crankcase breather and fire extinguisher system.

1-23. Sending Units and Switches

a. Oil Pressure Sending Unit (fig. 1-1). The electrical oil pressure gage sending unit on early engines was located at the right rear of the right side of the crankcase in the main oil gallery line. On late engines, for ease of maintenance, the sending unit is relocated to the front of the crankcase at the opening in the gallery line at No. 1 right cylinder. This sealed sending unit consists of a threaded plate to which a diaphragm, a radially notched spring, and an overload guard plate are crimped. Electrical resistance in the sending unit varies directly as the oil pressure varies. The resulting variation in the current is transmitted to the electrical oil gage on the vehicle instrument panel.

b. Low Oil Pressure Warning Light Switch. The low oil pressure warning light switch is furnished with the engine and it is located at the right rear of the right side of the engine crankcase in the main oil gallery line near No. 5 right cylinder. The electrical contact points in this switch close when the oil pressure in the main oil gallery falls to 1132 psi. The completion of the electrical circuit lights the low pressure warning lamp on the vehicle instrument panel.

c. Oil Temperature Sending Unit (figs. 1-1). The oil temperature sending unit is located at the

upper right side of the crankshaft damper and oil filter housing,

d. High Engine Oil Temperature Warning Light Switch (fig. 1-6). The oil temperature warning light switch is located in the oil passage immediately above the oil temperature sending unit in the upper right side of the crankshaft damper and oil filter housing. The warning light sending switch thermostatically controlled electrical contact points close when oil temperature in the engine main oil passage reaches 245 ±5 degrees. The completion of the electrical circuit lights the oil high temperature warning lam p on the vehicle instrument panel.

Section III. ENGINE SPECIFICATIONS

1-24. Tabulated Data

a. General. Refer to pertinent Organizational Maintenance Manuals (para 1-2) for the tabulated data pertaining to the general characteristics and performance of the engine,

b. Accessories.

Accessory	Manufacturer	Model	Part No.
Generator	Lear Siegler	G22-6F	10889713
Starter	Delco-Remy	1109972	8712242
Fuel Injection Metering Pump	American Bosch	PSB-12BT	10912447
Fuel Supply Pump	Viking	FV492	10882763
Turbosupercharger	Schwitzer	D6S	10912477 and 10912478
Fuel Filter (primary)	Fram or Purolator	2949 or 664479	8395476
Fuel Filter (secondary)	Fram	FBM1126	8764641
Fuel/Water Separator Filter	Keene Corp. Filtration Div.	11602063	
Manifold Heater Fuel Filter	Military Standard		96906-51085-1
Oil Filter (Main)	Air Maze (Ord design)		7025886
Oil Filter (Auxiliary)	Continental Motors (Ord design)		8761542
Oil Pressure Sending Unit	Military Standard		96906-24539-1
Oil Temperature Sending Unit	Military Standard		96906-24537-1
High Oil Temperature Warning Light Switch	Military Standard		MIL-S-12285/1-5
Low Oil Pressure Warning Light Switch	Military Standard		96906-90530-2
Ignition Unit, Manifold Heater	Bendix Corp.		7062198

c. Engine.

Make	Continental Motors Corp.
Type	Diesel, air-cooled, V-12
Models	AVDS-1790-2-M, AVDS-1790-2-AM, and AVDS-1790-2A
Dimensions, including shroud;	
Length (to transmission adapter)	70.60 in.
Width (overall, shrouds installed)	88.37 in.
Height	45.97 in.
Displacement	1790 cu in.
Weight, dry (with accessories)	4685 lb.
Speed:	
Governed, full load	2400 rpm
Governed, no load	2640 rpm
Idle	700 rpm

Horsepower, gross	750 bhp at 2400 rpm
Horsepower, net	642 bhp at 2400 rpm
Torque, gross	1720 lb-ft at 1800 rpm
Torque, net	1585 lb-ft at 1800 rpm
Cylinders:	
Number	12
Arrangement	90 degrees upright "V"
Numbering (from front):	
Left side	1L, 2L, 3L, 4L, 5L, 6L
Right side	1R, 2R, 3R, 4R, 5R, 6R
Firing Order	1R, 2L, 5R, 4L, 3R, 1L, 6R, 5L, 2R, 3L, 4R, 6L
Bore	5.750 in.
Pistons:	
Stroke	5.750 in.
Compression ratio	16:1
Displacement	149.1 cu in. per cyl
Cooling:	
Type	air cooled by two enginedriven fans
Air flow	20,000 cfm at 2400 rpm
Drive (from crankshaft)	direct
Crankshaft rotation (viewed from front)	clockwise
Camshafts:	
Number	2
Rotation (viewed from front)	counterclockwise
Ignition	compression
Fuel system:	
Induction	supercharged
Air flow (at rated power and speed)	2000 cfm
Fuel:	
Type	diesel
Grande	40 cetane min
Specification	VV-F-800, Grade DF-2
Supply pressure (at injection pump inlet)	40 psi
Consumption at 750 hp and 2400 rpm	296 lbs per hr
Valve timing:	
Intake opens	25 deg before top center (BTC)
Intake closes	55 deg after bottom center (ABC)
Intake remains open	260 deg
Exhaust opens	45 deg before bottom center (BBC)
Exhaust closes	20 deg after top center (ATC)
Exhaust remains open	245 deg
Setting (0.100 in. clearance)	intake closes 32 deg after bottom center (ABC)
Valves:	
Lift	0.460 in.
Clearance (cold engine):	
Exhaust	0.025 in.
Intake	0.010 in.
Fuel injection metering pump timing:	
Static setting with injection advance in full retarded position	26 deg BTC
Lubrication:	
Oil specifications:	
Above 60° F	OE 50 MIL-L-45199 Alternate MIL-L-2104B
+32 to 90° F	OE 30 MIL-L-45199 Alternate MIL-L-2104B
-10 to +40° F	OE 10 MIL-L-45199 Alternate MIL-L-2104B
-65 to 0° F	OES MIL-L-10295

Normal oil temperature	180 F at 60° F ambient
Maximum oil temperature (out of cooler)	250 F
Oil pressure (crankcase main oil gallery):	
750 rpm	20 psi (OE 30 oil at 180° F)
2400 rpm (full load)	40 to 70 psi (OE 30 oil at 180 F)
Oil pump output (OE 30 oil at 180° F at 2800 rpm of pump):	
Pressure pump	35 gpm
Scavenge pump	65 gpm
Piston oil sprayer pump	7.5 gpm
Oil capacity (approximate):	
Dry engine	18 gallons
Oil change	13 gallons
Manifold heater (cold weather starting and idle operation in cold weather):	
Type	flame type, spark ignition
Spark plug (ignition) gap	0.094 in. to 0.114 in.
Pump (hand operated from driver's compartment)	90 psi
Spray nozzle flow	1.5 to 2.2 lbs / hr
Fuel (type)	same as engine fuel

1-25. Drive Ratios and Rotation (From Front)

Camshafts	0.500:1 counterclockwise
Cooling fans	2.000:1 clockwise
Generator	3.200:1 clockwise
Starter	11.846:1 clockwise
Fuel injection metering pump	1.000:1 clockwise
Fuel supply pump	1.000:1 clockwise
Oil pump	1.327:1 clockwise
Tachometer	0.500:1 counterclockwise

CHAPTER 2
PARTS, SPECIAL TOOLS AND EQUIPMENT, IMPROVISED TOOLS AND SHOP LAYOUT

Section I. REPAIR AND REPLACEMENT PARTS

2-1. General

Authorized repair parts for the engine are listed in Appendix B, which is the authority for requisitioning replacement parts.

2-2. Repair Parts

a. Repair parts required for the maintenance of the engines are issued to supporting maintenance personnel for the replacement of parts which have been worn, broken or are otherwise unserviceable, and for parts which have been salvaged and stocked for future use on repairable engines.

b. Repair parts for engine installation or replacement (attaching or associated external parts) are listed in Organizational repair parts manuals.

c. Repair parts for engine accessories are listed in the following technical manuals:

(1) TM 9-2910-212-34, Pump, Metering, Fuel Injection, Assembly

(2) TM 9-2910-213-34, Pump, Fuel, Engine, Assembly

(3) TM 9-2920-224-35, Generator, Engine, Assembly

(4) TM 9-2920-232-34, Starter, Engine, Electrical, Assembly

(5) TM 9-2990-200-34, Turbosupercharger, Engine, Assembly

2-3. Mandatory Replacement Parts

To expedite repair and rebuild of the engines, it is economically advantageous to replace certain parts rather than perform the required cleaning and inspection necessary to assure that the parts are suitable for continued use. Gaskets, packings, oil seals, and other similar parts are always replaced at engine rebuild. Refer to Appendix B for 100 percent replacement items.

Section II. SPECIAL TOO LS AND EQUIPMENT FOR DIRECT SUPPORT, GENERAL SUPPORT AND DEPOT MAINTENANCE

2-4. Common Tools and Equipment

Standard and commonly used tools and equipment having general application to the engines are authorized by tables of allowance (TA) and tables of organization and equipment (TOE).

2-5. Special Tools and Equipment

The special tools and equipment illustrated in figures B-29 through B-31 and listed in Table 2-1 are necessary to perform the field maintenance repair, and overhaul operations described in this manual. Refer to Appendix B which is the authority for requisitioning special tools, kits, and equipment.

2-6. Improvised Tools and Equipment

The improvised tools illustrated in figures 2-1 and 2-2 apply only to direct support, general support and depot maintenance shops. Principal dimensions are shown to enable maintenance personnel to fabricate tools locally, if desired. These tools are of chief value to maintenance organizations engaged in overhauling a large number of identical components. However, these improvised tools are not available for issue. One of the improvised tools illustrated in figure 2-1 is used for lifting the front fan drive housing and clutch assembly and the other is used for compressing the advance unit cover internal retaining ring. The puller for removing the fuel injection pump diaphragm type coupling is illustrated in figure 2-2. The improvised tool illustrated in figure 2-3 is used to remove the oil pressure regulating valve sleeve.

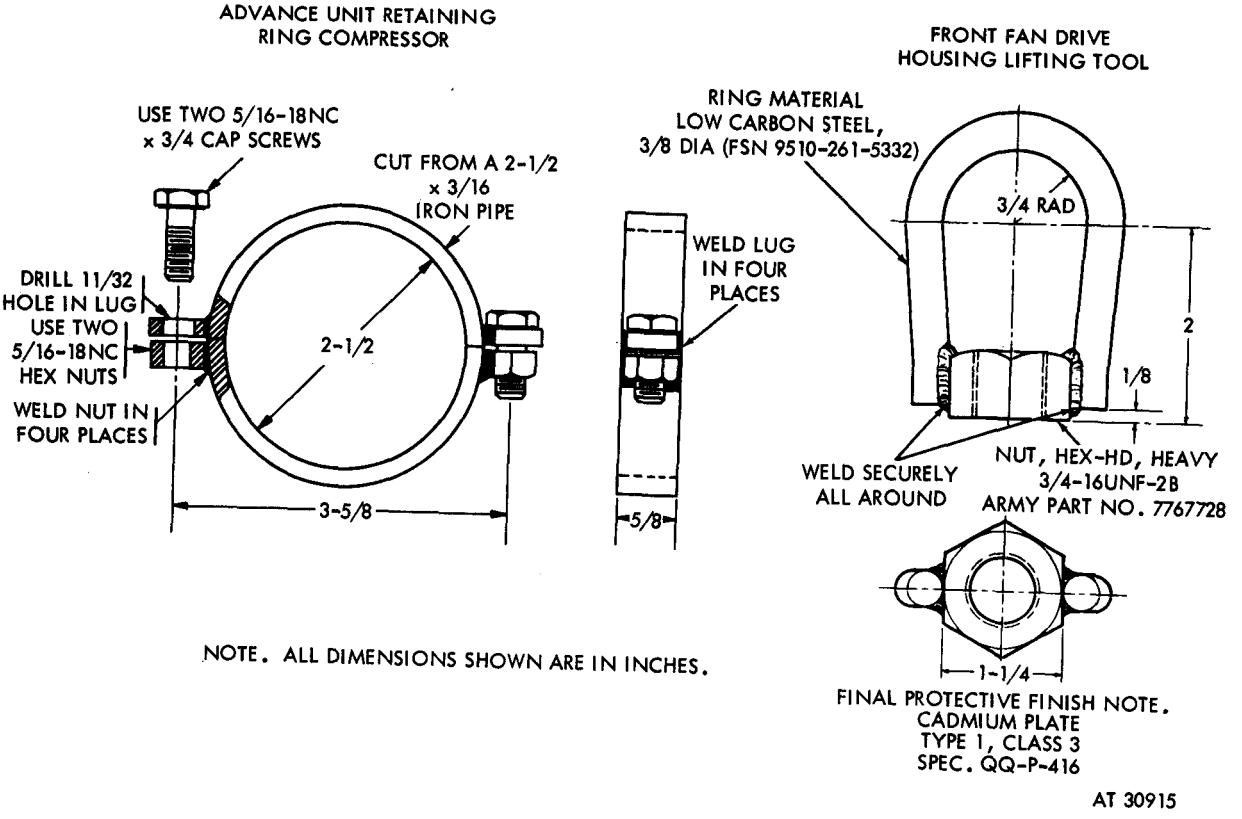
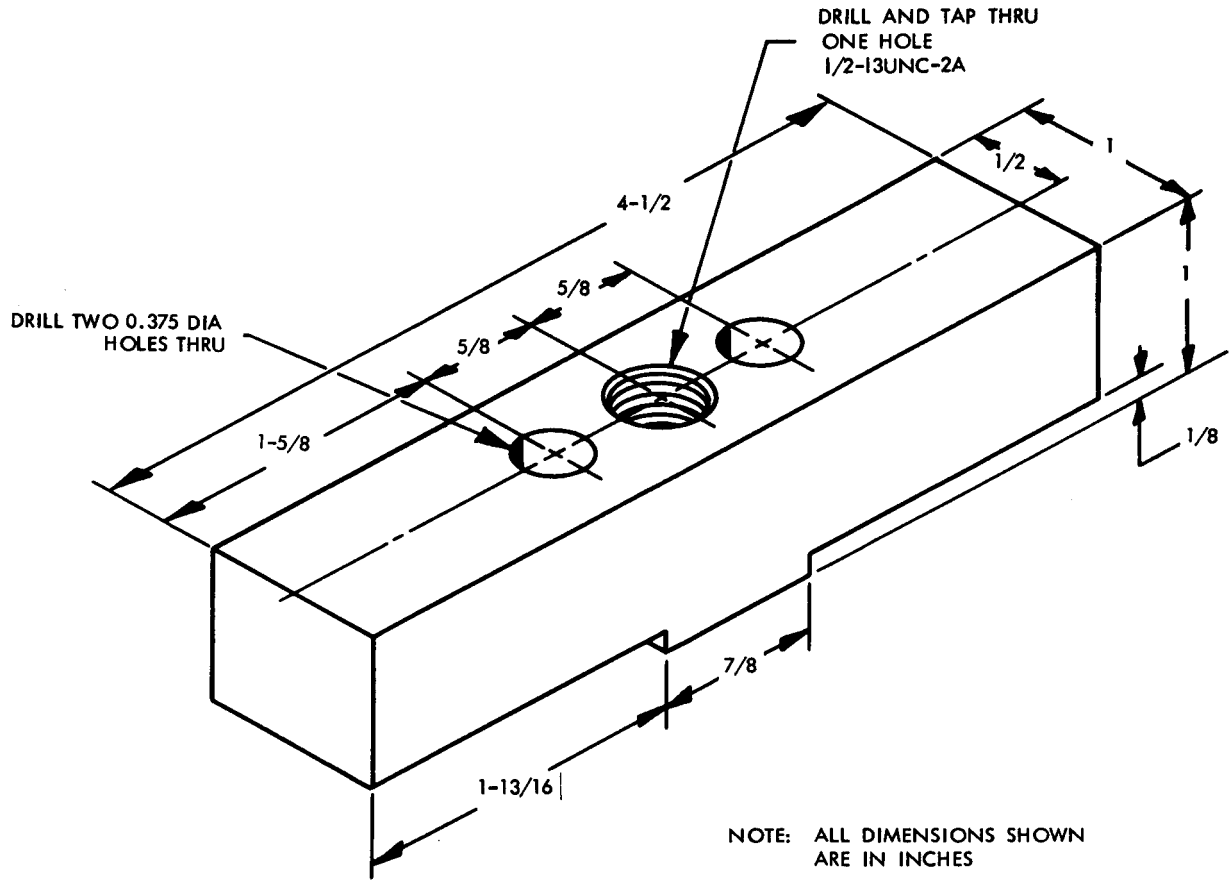


Figure 2-1. Improvised tools—ring compressor, and lifting tool



MATERIAL:
4-1/2 x 1 x 1 CARBON TOOL STEEL - 9510-596-6293
ONE 1/2-13UNC-2A x 2, HEX-HD CAP SCREW - 96906-35307-115
TWO 5/16-13UNF-2A x 2-1/2 HEX-HD CAP SCREW - 96906-35308-42

AT 30916

Figure 2-2. Improvised tool—coupling puller

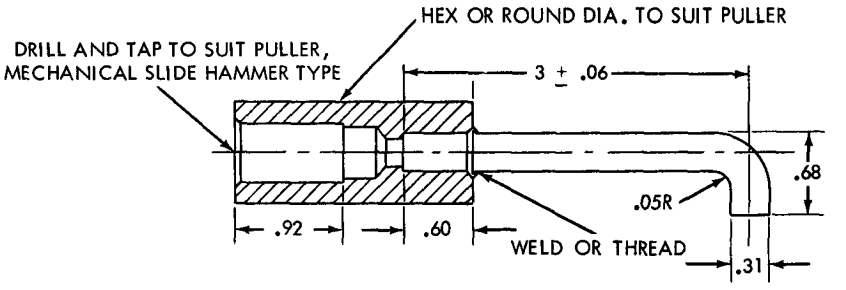


Figure 2-3. Improvised tool—valve sleeve remover.

Table 2-1. Special Tools and Equipment for Direct Support, General Support and Depot Maintenance

Item	Identifying No.	Reference Fig.	Reference Par.	Use
ADAPTER, COMPRESSION: Compression Test	4910-795-7961 (8743025)	4-185	4-22	Used with GAGE — 4910-870-6283 to check cylinder compression
ADAPTER, MECHANICAL: ½-20NF-2 to ½-13NC x 1-7/8 in. long	5120-837-5091 (8375091)	5-174 5-182	5-15 5-15	Used with PULLER — 5120-310-4668 to remove starter and generator idler gearshaft and with SPREADING TOOL — 5120-575-7767 to remove main bearing caps
BLADE, THICKNESS GAGE: (0.010) (Intake Valve Clearance)	5210-793-7898 (10882615)	4-189	4-23	Intake valve tappet adjusting 0.010 gap
BLADE, THICKNESS GAGE: (0.025) (Exhaust Valve Clearance)	5210-793-7899 (10882616)	4-188 7-23	4-23 7-10	Exhaust valve tappet adjusting 0.025 gap
BLADE, THICKNESS GAGE: (0.100) (Intake Valve Timing Clearance)	5210-793-7897 (10882617)	4-197 7-22	4-24 7-10	Valve tappet adjusting 0.100 gap
BOLT, EYE: 1⅜ id x 2½ od x 4-23/32 in. long, ⅝-11 Thread	5306-017-6143 (MS51937-7)	4-173 5-161 5-162 7-8	4-20 5-14 5-14 7-6	Lifting flywheel
BUSHING, REAMER: (Exhaust Valve)	4910-795-7957 (10882891)	6-61	6-33	Used with REAMER — 5110-708-3696 and 5110-708-3967 to ream exhaust valve guide hole
BUSHING, REAMER: (Intake Valve)	4910-795-7950 (10882892)	6-61 6-62	6-33 6-33	Used with REAMERS—5110-708-3699 and 5110-708-3698 to ream intake valve guide hole
COMPRESSOR AND GAGE: Piston Ring	4910-795-7956 (10882888)	7-12	7-8	Installing pistons and rings in cylinders
CROWFOOT, ATTACHMENT:	5120-078-3809 (10935497)			Tighten fuel injector tube nuts at pump head
CROWFOOT ATTACHMENT: (Fuel Injector Nozzle Holder)	5120-871-7198 (11610167)	4-152 4-165 4-153	4-15 4-14 4-14	Removing or installing fuel injector nozzle holders
CUTTER, CARBON, NOZZLE: (Nozzle Seat)	4910-795-7958 (10882949)	6-50	6-30	Cleaning carbon from fuel injector nozzle holder seat in cylinder head
EXTRACTOR, SCREW THREAD:	5120-723-6833 (MIL-T-21309A, Table VIII Type V, Size 2)			Removing threaded inserts
EXTRACTOR, SCREW THREAD: (7/16 to 1 in.)	5120-251-1527 (7751056)	6-2	6-5	Removing threaded inserts
GAGE ASSEMBLY: (Compression Testing)	4910-870-6283 (10899180)	4-185	4-22	Used with ADAPTER — 4910-795-7961 to check cylinder compression
GAGE, RING, PLAIN: (Piston Ring Gap)	5220-988-8774 (10912589)			Checking piston ring gap

Table 2-1. Special Tools and Equipment for Direct Support, General Support and Depot Maintenance — Continued

Item	Identifying No.	Reference Fig.	Reference Par.	Use
INSERTER, SCREW THREAD: (5/16-24 thread)	5120-797-2405 (91767-73552-5)	6-3	6-5	Installing threaded inserts
INSERTER, SCREW THREAD: (⅜-24 Thread)	5120-710-7437 (8375324)			Installing threaded inserts
INSERTER, SCREW THREAD: (7/16-20 Thread)	5120-797-2407 (91767-73552-7)	6-3	6-5	Installing threaded inserts
INSERTER, SCREW THREAD: (½-20 Thread)	5120-672-8897 (8761582)			Installing threaded inserts
LIFTER ASSEMBLY, VALVE: (Valve Springs)	5120-678-5285 (8761535)	6-47 6-48 6-65	6-29 6-34	Used with STAND — 4910-554-1317 for removing and installing valves and valve springs
PLIERS, RETAINING RING:	5120-752-9755 (GGG-P-480A-Type 2, Class 3, Style B, Size 22)	5-119	5-11	Removing or installing inner fan drive shaft retaining ring
PROTECTOR, CRANKCASE: (Cylinder Mounting Pads)	4910-795-7951 (10882790)	5-145 5-147	5-12	Protecting crankcase at cylinder removal
PULLER, MECHANICAL:	5120-873-6943 (11610150)	4-152	4-15	Removing fuel injector nozzles
PULLER, MECHANICAL: "T" Handle, ¾-16UNF-2A, 6½ in. long	5120-678-5282 (8761297)	4-200 5-113 5-114 7-25 7-26	4-24 5-11 5-11 7-10	Removing and installing camshaft drive shaft and upper gear oil transfer plug
PULLER, MECHANICAL: Slide Hammer, 10¾ in. long with ½-20UNF-2A thread	5120-310-4668 (8708712)	5-174 5-182	5-15 5-15	Used with ADAPTER — 5120-837-5091 to remove starter and generator drive idler gearshaft and with SPREADING TOOL — 5120-575-7767 to remove main bearing caps
PULLER, MECHANICAL: (Exhaust Valve Guide)	5120-448-0401 (10882954)	6-58	6-33	Removing exhaust valve guides
PULLER, MECHANICAL: (Intake Valve Guide)	5120-448-0400 (10882953)	6-58	6-33	Removing intake valve guides
PULLER, MECHANICAL: Threaded, 5/16-18UNC-2, 8½ in. long, 2¾ in. Handle (3 req'd per operation)	5120-473-7222 (5739997)	5-152	5-13	Removing fan drive oil seal retainer, vibration damper, and crankshaft oil seal housing
REAMER, HAND: Roughing Exhaust Valve Stem Hole. Diameter tapers from 0.550 to 0.560 in., 13¾ in. long	5110-708-3696 (7083696)	6-61	6-33	Used with BUSHING — 4910-795-7957 for rough reaming exhaust valve guide hole
REAMER, HAND: Finishing Exhaust Valve Stem Hole. Diameter tapers from 0.557 in. to 0.562 in., 13¾ in. long	5110-708-3697 (7083697)	6-61 6-62	6-33	Used with BUSHING — 4910-795-7957 for finish reaming exhaust valve guide holes
REAMER, HAND: Roughing Intake Valve Stem Hole. Diameter tapers from 0.488 in. to 0.498 in., 13¾ in. long	5110-708-3698 (7083698)	6-61 6-62	6-33 6-33	Used with BUSHING — 4910-795-7950 for rough reaming intake valve guide holes
REAMER, HAND: Finishing Intake Valve Stem Hole. Diameter tapers from 0.495 in. to 0.500 in., 13¾ in. long	5110-708-3699 (7083699)	6-61 6-62	6-33	Used with BUSHING — 4910-795-7950 for finish reaming intake valve guide hole
REMOVER AND REPLACER: Plier Type	5120-795-0177 (7950177)	6-44	6-23	Removing and installing piston rings
REPLACER, VALVE GUIDE: Intake Valve	5120-448-0402 (10883052)	6-59	6-33	Installing intake valve guide

Table 2-1. Special Tools and Equipment for Direct Support.
General Support and Depot Maintenance
— Continued

Item	Identifying No.	Reference Fig.	Reference Par.	Use
REPLACER, VALVE GUIDE: Exhaust Valve	5120-448-7993 (10883053)	6-59	6-33	Installing exhaust valve guide
RESET DEVICE,HOUR METER:	6645-179-2712 (11641917)	6-256	6-70	Resetting time totalizing meter
SLING, CRANKSHAFT AND CONNECTING ROD:	4910-795-7955 (10882958)	5-176 5-177 5-178	5-15 5-15 5-15	Removing and installing engine crankshaft
SLING, FAN DRIVE AND ADVANCE UNIT HOUSING:	4910-795-7954 (10882945)	5-131 7-17	5-11 7-9	Removing and installing rear fan and advance unit housing
SLING, MULTIPLE LEG: Engine Lifting	4910-919-2884 (10952220)	5-1	5-2	Engine lifting
SOCKET WRENCH: Fuel Injector Nozzle Holder, 1⅜ in. nom. hex socket, ¾ in. sq. drive, 2 in. long	5120-875-9556 (11610171)	4-152	4-15	Removing fuel injector nozzle holders
SOCKET WRENCH, FACE:	5120-793-7896 (10882653)	6-141	6-40	Removing and installing fan drive clutch piston to clutch ball retainer plate
SPACER, FAN ROTOR HUB SLEEVE:	4910-795-7952 (10882651)	4-87	4-4 8-2	Retains fan clutch oil seal during fuel injection pump leak test
SPREADING TOOL, CRANKCASE:	5120-575-7767 (8708361)	5-174 7-2	5-15 7-5	Used with PULLER — 5120-310-4668 and ADAPTER — 5120-837-5091 to remove main bearing caps
STAND, MAINTENANCE AND OVERHAUL:	4910-856-4137 (10912260)	5-6	5-5	Engine overhaul
STAND, VALVE REMOVING AND INSERTING:	4910-554-1317 (8708419)	6-47 6-49 6-65	6-29 6-29 6-34	Cylinder stand for removing and installing valves, used with LIFTER — 5120-678-5285
TEST STAND:	4910-986-9873 (10898928)	6-199	6-42	Test fuel injection pump advance unit
TESTER, CYLINDER BARREL:	4910-937-4261 (10935532)	6-52 6-54 thru 6-57	6-32	Check for cracks in cylinder barrel
TUBE, ATTACHING, NOZZLE: Connector	4910-795-7953 (10882963)	4-168	4-17	Check fuel injector nozzles
WRENCH, BOX: Generator Mounting Nuts Offset, 9/16 in. open end, 9/16 in. hex socket end, 6 in. long	5120-789-4881 (10935476)	4-14	4-4	Removing or installing generator mounting nuts
WRENCH, BOX: Torquing Cylinder hold down nuts, ½ in. drive, ¾ in. double hex, 19-7/8 in. long, 4-15/32 in. offset	5120-678-5287 (8761561)	5-143	5-12	Torquing cylinder hold down nuts
WRENCH, OPEN END: Starter mounting nuts, 15/16 in. opening, offset handle, 10 in. long	5120-678-5288 (8761568)	4-7	4-4	Removing or installing starter mounting nuts
WRENCH, OPEN END: Turbosupercharger oil line, offset, 11/16 in. opening, 10 in. long	5120-448-0404 (10883075)	4-22	4-4	Disconnecting or connecting turbosupercharger oil inlet hose at nipple
WRENCH, OPEN END, FIXED: Fuel injector nozzle holder, ½ in. drive with 1⅜ in. opening	5120-678-5286 (8761560)			Removing or installing fuel injector nozzle holders
WRENCH, SPLINED: Engine turning, ¾ in. drive with external spline, 2½ in. long	5120-793-7895 (10882747)	4-51 5-91 7-21	5-9 7-10	Turning engine at transmission drive gearshaft

Section III. SHOP LAYOUT

2-7. General

This section discusses the purpose and maintenance policy pertaining to depot maintenance prescribed in this manual for production-line overhaul or rebuild of the engine.

2-8. Shop Layout

a. The layout (fig. 2-4) shows a typical station-by-station production line setup for overhaul or rebuild of the engine. The engine is steam cleaned and engine oil is drained. The engine accessories are removed and routed to their respective rebuild stations. The basic engine moves along the assembly line through the various stages of disassembly into subassemblies. The subassemblies are then routed to the various overhaul stations for disassembly, cleaning, inspection, repair and reassembly. The overhauled assemblies are returned to the main assembly line for basic engine assembly. Overhauled accessories are installed on the basic engine, and the engine is subjected to a dynamometer acceptance test.

b. In actual practice, specific shop layouts will vary according to the physical facilities available and the quantity of engines to be overhauled. Planning for a depot overhaul program must he sufficiently flexible to allow for variations in the condition of the materiel received for processing.

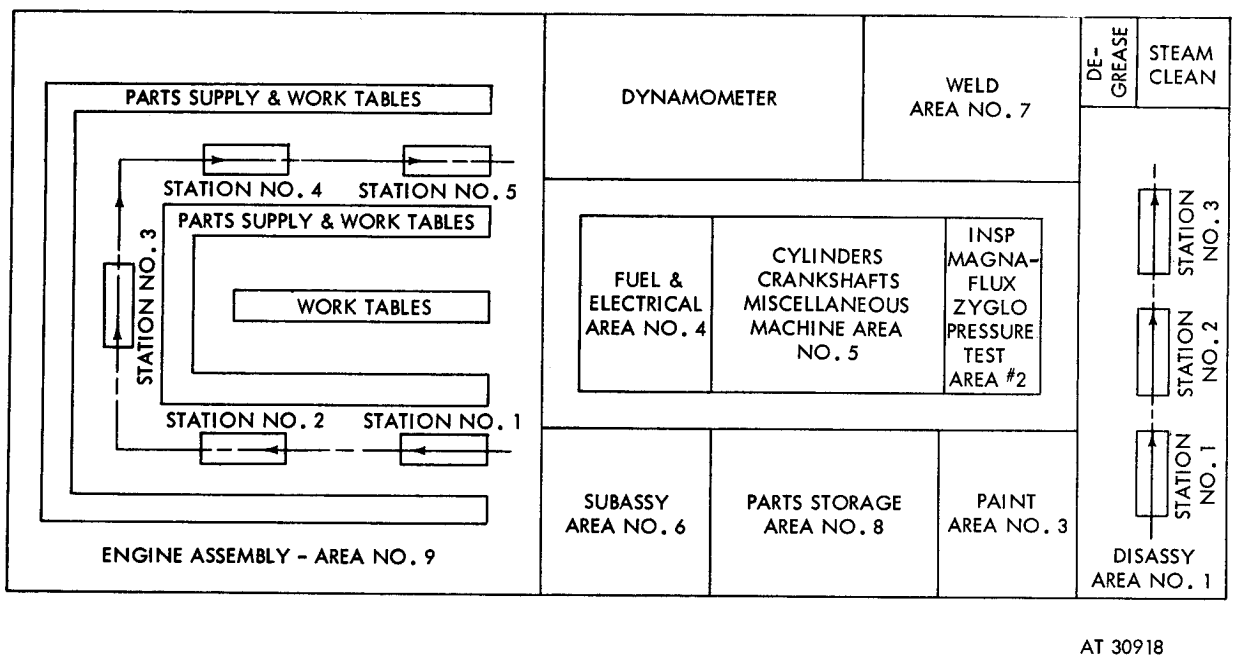


Figure 2-4. Typical shop layout.

CHAPTER 3
TROUBLESHOOTING

Section I. GENERAL

3-1. Purpose of Troubleshooting

Note. Information in this chapter is for use of Direct Support and General Support maintenance personnel in conjunction with and as a supplement to the troubleshooting section in the pertinent organizational manual (refer to Appendix A). It provides the instructions where a remedy in the organizational maintenance manual refers to supporting maintenance personnel for corrective action.

a. Prevent Damage. Operation of a deadlined vehicle without a preliminary examination can cause further damage to the engine and possible injury to personnel. By careful inspection and troubleshooting, such damage and injury can be avoided. In addition, the cause of faulty operation can often be determined without extensive disassembly.

b. Precautions by Inspection. Most of the inspections are visual inspection and are to be perform ed before attempting to operate the vehicle. These inspections are mainly to determine the condition and to take precautions to prevent further damage.

c. *Troubleshooting While Mounted.* The troubleshooting performed while the engine is mounted in the vehicle is that which is beyond the normal scope of the using organization. Check the troubleshooting section of the pertinent organizational manual, then proceed as outlined in this chapter.

d. Troubleshooting Engine only. If the engine only is received, inspection should be performed to verify the diagnosis made while the engine was installed in the vehicle. This inspection, to uncover further defects or to determine malfunction, is important as it is the only means for determining the trouble without completely disassembling the engine.

3-2. General Instructions

Note. This chapter contains inspection and troubleshooting procedures to be performed while a malfunctioning engine is still mounted in the vehicle and after it has been removed.

a. Visual inspections made while the engine is mounted in the vehicle are performed before attempting to operate the vehicle to avoid damage or injury as well as to determine the cause of the malfunctioning engine.

b. Troubleshooting performed while the engine is installed in the vehicle beyond the scope of the using organization, is performed to determine if the malfunction can be remedied without removing the engine from the vehicle, and, when subsequent removal is necessary, to indicate when repair can be made without complete engine disassembly.

c. Troubleshooting a malfunctioning engine after it has been removed from the vehicle consists of subjecting it to tests on a dynamometer. This chapter discusses those symptoms which can be diagnosed by using testing equipment, interprets results in terms of probable causes, and recommends appropriate corrective action.

d. Tests and adjustments prescribed for an engine after assembly (para 8-5) may be applied to the engine in which the malfunction is suspected. Particular attention should be given to proper oil level, fuel pressures and proper adjustments when operating the engine to determine appropriate corrective action to be taken for the malfunction.

Section II. TROUBLESHOOTING PROCEDURES

3-3. General

Most engine troubles are actually engine accessory troubles. The troubleshooting portion of pertinent organizational maintenance manuals, normally, will cover troubleshooting of all engine accessories while mounted on the engine. For complete coverage of accessories, refer to pertinent manuals listed in paragraph 1-24. The procedures for troubleshooting the engine assembly and the accessory systems are listed in paragraphs 3-4 through 3-11. Engine malfunctions are referenced to the appropriate accessory system for corrective action, when applicable.

3-4. Troubleshooting Engine Assembly

Malfunction	Probable Cause	Corrective Action
1. Engine will not crank:	a. Electrical switch or starter solenoid not properly adjusted.	a. Adjust electrical switch and starter solenoid switch (refer to TM 9-2920-232-34).
	b. Failed starter.	b. Remove starter (Table 4-1). Refer to TM 9-2920-232-34 and overhaul starter. Install starter and install cradle and support (Table 4-1).
	c. Failed starter drive gear.	c. Remove starter (Table 4-1). Remove starter drive adapter and driven gear (para 5-13). Remove flywheel (para 5-14). Remove crankshaft oil seal cap and housing (para 5-14). Remove starter driven gearshaft bearing cage (para 5-15). Replace drive gear (para 6-11b). Install starter driven gearshaft bearing cage (para 7-5a(1). Install starter idler gear (para 7-5a(2)). Install crankshaft oil seal cap and housing (para 7-6b). Install flywheel (para 7-6f). Install starter driven gear (para 7-7b). Install starter, cradle and support (para 7-17c).
	d. Hydrostatic lock.	d. Remove upper covers (figs. 4-126 through 4-135). Remove fuel return tubes and disconnect injector tubes at nozzle and holder assemblies (fig. 4-150). Remove fuel injector nozzle and holder assemblies (figs. 4-152 and 4-153). Using wrench — 5120-793-7985 (fig. 4-51), turn engine over several times by hand to displace liquid from cylinders through the injector nozzle openings. Then blow fuel from openings by turning engine with starter. If the engine can be turned freely by hand, after all liquid has been displaced, install the nozzle and holder assemblies (figs. 4-153 and 4-165) and connect injector tubes and fuel return tubes (fig. 4-150). Turn engine by hand to be sure cylinders are free of liquid. Start engine. If engine cannot be turned freely by hand, internal parts of engine have been damaged. Disassemble engine (chapter 5), replace damaged parts (chapter 6). Assemble engine (chapter 7).
	e. Seized internal engine parts.	e. Disassemble engine (chapter 5). Replace damaged parts (chapter 6) and assemble engine (chapter 7)
2. Engine cranks but will not start:	a. Low ambient temperature.	a. Use intake manifold heater.
	b. Insufficient cranking speed.	b. Check starter and electrical system. Refer to TM 9-2920-232-34. Check for partially seized bearings in engine by turning engine using wrench —5120-793-7895. (fig. 4-51).
	c. Air in fuel system.	c. Open vent on secondary fuel filter. Actuate hand purge pump until all air is removed.
	d. Fuel check valve not operating, preventing effective purging of fuel system.	d. Remove fuel check valve (fig. 4-1) and replace with new fuel check valve (fig. 5-25). Install new check valve (figs. 5-25, 4-1).
	e. Faulty fuel filter, tubes and hoses, or defective fuel pump.	e. Replace fuel filter elements. Refer to pertinent vehicle Technical Manual, Appendix A.

Malfunction	Probable Cause	Corrective Action
	f. Fuel injection pump not properly timed. (Initial engine starting.)	f. Time fuel injection pump (para 4-4). Also refer to TM 9-2910-212-34.
	g. Failed fuel injection pump.	g. Remove fuel injection pump (para 4-4). Install new fuel injection pump (para 4-4).
	h. Fuel injection pump fails to turn when engine is cranking or turned by hand.	h. Disassemble engine (chapter 5) and replace defective parts. Assemble engine (chapter 7).
	i. Low cylinder compression.	i. Check valve clearance (para 4-23) and make cylinder compression check (para 4-22) and take appropriate corrective action as noted below:
		1. *Worn piston rings* Remove cylinders (para 5-1 2) and replace worn piston rings (para 6-23 through 6-27). Install pistons and cylinders (para 7-8a).
		2. *Leaking valves* Remove cylinders (para 5-1 2) and repair leaking valves (para 6-33a). Install pistons and cylinders (para 7-8a).
3. Engine runs rough, one or more cylinders not fiiing:	a. Engine operating at below normal temperature.	a. Check oil cooler thermostat (para 6-47d(2)). Operate engine at higher rpm.
	b. Water in fuel, dirty fuel, or restricted fuel filters.	b. Check fuel filters for water, dirt, and ob structions. Refer to pertinent vehicle Technical Manual, Appendix A. If clean, replace fuel pump (para 4-4).
	c. Leaking or failed fuel injector tubes.	c. Tighten or remove leaking fuel injector tubes (Table 5-5). Install fuel injector tubes (Table 5-5).
	d. Improper valve adjustment.	d. Check and reset valve clearance (para 4-23).
	e. Fuel injector nozzles dribbling or not functioning properly.	e. Check and clean fuel filter elements. Refer to pertinent vehicle Technical Manual, Appendix A. Remove fuel injector nozzle and overhaul nozzle and holder assembly (Table 4-7).
	f. Fuel injection pump not functioning properly.	f. Remove fuel injection pump (Table 4-1). Install fuel injection pump (Table 4-1). Inspect fuel filters for dirt and service if necessary. Refer to b, above.
	g. Low compression on one or more cylinders.	g. Refer to item 2j, above, for corrective action.
4. Engine low on power, stall speed below normal of 1850 to 1950 rpm:	a. Improper fuel being used or inadequate fuel delivery to engine.	a. Drain fuel tanks and fill with proper specification fuel. Refer to pertinent vehicle Technical Manual, Appendix A for proper fuel. Refer to fuel system troubleshooting, paragraph 3-8.
	b. Restricted fuel filters or lines.	b. Clean filters and fuel lines and remove restrictions. Refer to pertinent vehicle Technical Manual, Appendix A.
	c. Faulty fuel pump assembly.	c. Replace fuel pump assembly (para 4-4).
	d. Engine overheated.	d. Refer to cooling system troubleshooting, paragraph 3-10.

Malfunction	Probable Cause	Corrective Action
	e. Improper fuel injection pump operating lever travel or engine linkage adjustment.	e. Adjust fuel injection pump linkage to get complete travel. Refer to TM 9-2910-212-34 for procedures on adjusting pump and figures 4-84 and 4-85 for adjustment of linkage.
	f. One or more cylinders not firing. Fuel injector nozzles not functioning properly.	f. Refer to item 3, above, for corrective action.
	g. Fuel injection pump not properly timed.	g. Time fuel injection pump (para 4-4). Also refer to TM 9-2910-212-34.
	h. Low cylinder compression. (Worn piston rings or burned valves.)	h. Check valve clearance (para 4-23). Check cylinder compression (para 4-22) and take appropriate corrective action tabulated in item 2h, above.
	j. Failed turbosupercharger. (in checking for a failed turbosupercharger, a quick check should be made to see that turbosupercharger vanes turn freely. Vanes which have excessive drag will have low output.)	j. Remove turbosupercharger (Table 5-1). Overhaul turbosupercharger, refer to TM 9-2990-200-34. Install serviceable turbosupercharger (para 7-17b).
	k. Leaking engine exhauet system causing reduced pressure to turbosuperchargers.	k. Repair exhaust system. Refer to pertinent vehicle Technical Manual, Appendix A. Remove engine exhaust manifold (table 5-5). Repair exhaust manifolds. Install exhaust manifolds (table 7-9).
	l. Fuel injection pump advance unit not functioning properly.	l. Remove rear fan and accessory drive housing assembly (table 5-8). Rebuild fuel injection pump advance unit (table 6-29). Install rear fan and accessory drive housing assembly (table 7-5).
5. Excess engine power:	a. Cooling fans not operating.	a. Refer to paragraph 3-10 for corrective action.
	b. Improper fuel injection pump high idle screw or bridge setting.	b. Adjust fuel injection pump high idle screw. Refer to TM 9-2910-212-34 for procedures.
	c. Improper fuel injection pump timing.	c. Time fuel injection pump (para 4-4). Also refer to TM 9-2910-212-34.
6. Engine overspeeds beyond 2640 rpm at on load:	Fuel injection pump governor not properly adjusted.	Adjust fuel injection pump governor. Refer to TM 9-2910-212-34 for procedures.
7. Engine will not idle, but runs well under load.	a. Some cylinders not firing (low ambient temperatures).	a. Operate engine at part load to increase cylinder head temperature or use intake manifold heater.
	b. Improper adjustment of engine idle screw or linkage sticking.	b. Reset idle screw and check for sticking linkage.
	c. Fuel injector nozzles not functioning properly.	c. Remove fuel injector nozzles. Refer to table 4-7 for references on removing, repairing, checking, and installing nozzle and holder assembly.
	d. Fuel injection pump governor not properly adjusted.	d. Adjust fuel injection pump governor. Refer to TM 9-2910-212-34 for procedures.
	e. Fuel injection pump not functioning properly.	e. Remove fuel injection pump (table 4-1). Overhaul fuel injection pump. Refer to TM 9-2910-212-34 for instructions. Install injection pump (table 4-1).
8. Engine smokes: (a) White or grey smoke indicating unburned fuel.	a. Engine cylinders and intake air too cold for efficient combustion.	a. Operate engine under load to increase cylinder head temperatures. Increase idle speed, use manifold heater.

Malfunction	Probable Cause	Corrective Action
	b. Defective fuel injector nozzle gaskets.	b. Replace fuel injector nozzle gaskets (para 7-11a). Refer to item 7c, above, for other corrective action.
	c. Water in fuel.	c. Service fuel filters and drain fuel tanks. Refer to 4a, above.
	d. Low compression.	d. Check cylinder compression, refer to 2j, above. Replace defective parts.
(b) Blue smoke indicating presence of engine oil in combustion chamber.	a. One or more cylinders not firing.	a. Refer to 3, above, for corrective action. (Replace engine.)
	b. Worn or stuck piston rings or worn cylinder.	b. Remove cylinders and pistons and replace rings and worn parts. Refer to 2h, above.
	c. Worn valve guides.	c. Remove cylinder and replace valve guides.
	d. Worn turboeupercharger oil seals.	d. Remove turbosupercharger (Table 5-1). Overhaul turbosupercharger refer to TM 9-2990-200-34 for procedures. Install turbosupercharger (para 7-17b).
(c) Black smoke indicating a rich fuel mixture. Note: Black smoke during acceleration is normal.	a. Restriction in air supply system.	a. Refer to para 3-7.
	b. Failed turbosupercharger (excessive smoke for afflicted engine bank).	b. Remove turbosupercharger (Table 5-1). Overhaul turbosupercharger refer to TM 9-2990-200-34 for procedures. Install turbosupercharger (para 7-17b).
	c. Fuel injector nozzles not functioning, dripping, or retaining	c. Overhaul fuel injector nozzle and holder assemblies. Refer to 7c, above, for corrective action. Replace springs.
	d. Operating with improper fuel.	d. Check fuel. Refer to 4a, above.
	e. Fuel injection pump improperly adjusted.	e. Adiust fuel iniection pump. Refer to TM 9-2910-212-34 for adjustment procedures.
	f. Fuel injection pump not properly timed.	f. Time fuel injection pump (para 4-4). Also refer to TM 9-2910-212-34.
	g. Fuel injection pump advance unit not functioning properly.	g. Refer to 41, above, for corrective action.
9. Engine noise. (a) Abnormal knocking noise.	a. Loose piston pin or pins or broken piston rings.	a. Remove cylinders and pistons (table 5-9). Rebuild pistons, rings, and pins (table 6-12). Install pistons and cylinders (table 7-4).
	b. Worn engine bearings.	b. Disassemble engine (chapter 5). Rebuild crankshaft, connecting rod assemblies, and bearings (table 6-8). Assemble engine (chapter 7).
	c. Scored piston or cylinder.	c. Remove cylinder and piston (table 5-9). Overhaul cylinder (table 6-14). Install piston and cylinder (table 7-4).
(b) Tapping noise.	a. Excessive valve clearances.	a. Adjust valve clearances (para 4-23).
	b. Worn or damaged valve rocker arm	b. Remove valve rocker arm covers. (Refer to table 4-6.) Disassemble rocker arm covers. Replace valve rocker arm assemblies. Assemble rocker arm covers. Install valve rocker arm covers.
(c) Grinding or squeaking noise.	a. Accessories damaged. 1. Fuel injection pump.	a. Replace damaged engine accessories. 1. Remove fuel injection pump (table 4-1). Refer to TM 9-2910-212-34 and overhaul fuel injection pump. Install injection pump (table 4-1).
	2. Generator.	2. Remove generator (table 4-1). Refer to TM 9-2920-224-35 and overhaul generator. Install generator (table 4-1).

Malfunction	Probable Cause	Corrective Action
	3. Turbosupercharger.	3. Remove turboeupercharger (table 4-1). Refer to TM 9-2990-200-34 and overhaul turbosupercharger. Install turbosupercharger (table 4-1).
	4. Fuel pump	4. Remove fuel pump (table 4-1). Refer to TM 9-2910-213-34 and overhaul pump. Install fuel pump (table 4-1).
	b. Failed engine bearings or gears.	b. Use wrench - 5120-793-7895 and turn engine over by hand. If engine turns hard and grinding or squealing noiee persists, disassemble engine (chapter 5) and inspect. Replace damaged parta. Assemble engine (chapter 7).
	c. Dry valve rocker arm shafts and rocker arm bushing-type bearings.	c. New or dry engine must be run at fast idle to get oil up to rocker arm bushing-type bearings.
	d. Cooling fans rubbing housing.	d. Adjust cooling fan clearance (fig. 4-88).
10. Rough or poor idling.	a. Some cylinders not firing.	a. Refer to 7, above for corrective action.
	b. Nozzles not functioning properly.	b. Refer to 7c, above, for corrective action.
	c. Air leak in intake manifold system.	c. Refer to para 3-7 for corrective action.
	d. Fuel injection pump not properly timed.	d. Time fuel injection pump (para 4-4). Also refer to TM 9-2910-212-34.
11. Engine surges at all speeds.	a. Fuel injection pump governor improperly adjusted.	a. Adjust fuel injection pump governor. Refer to TM 9-2910-212-34 for procedure.
	b. Injection pump linkage sticking or binding.	b. Clean linkage and inspect for binding or sticking condition. Refer to pertinent vehicle Technical Manual, Appendix A. Lubricate linkage.
12. Poor fuel economy.	a. Engine operating at below normal temperature.	a. Refer to 7 and 8, above, for corrective action. Increase engine operating temperature.
	b. Operating with improper fuel.	b. Drain fuel tanks and refill with proper fuel. Refer to pertinent vehicle Technical Manual, Appendix A, for proper fuel.
	c. Air intake system restricted.	c. Refer to para 3-7 for corrective action.
	d. Exhaust system restricted.	d. Repair exhaust system. Refer to pertinent vehicle Technical Manual, Appendix A. Remove engine exhaust manifold (table 5-5). Repair exhaust manifolds. Install exhaust manifolds (table 7-9).
	e. Loss of power or low power.	e. Refer to 4, above, for corrective action.
13. Engine stops suddenly.	a. Plugged or damaged fuel supply system or fuel pump fails to operate properly.	a. Refer to para 3-8 for corrective action.
	b. Failed fuel injection pump coupling.	b. Replace coupling. Refer to table 4-1 for replacement instructions.
	c. Fuel injection pump fails to operate properly.	c. Refer to 2g, above, for corrective action.
	d. Seizure of internal engine components.	d. Disassemble engine (chapter 5) and inspect. Replace damaged parts. Assemble engine (chapter 7).
14. Engine will not stop when shut off.	a. Fuel cutoff in fuel injection pump inoperative.	a. Check electrical lead. Refer to 2g, above, for corrective action.
	b. Binding fuel injection pump control linkage.	b. Refer to 2g, above, for corrective action.

3-5. Troubleshooting Starting System

Malfunction	Probable Cause	Corrective Action
1. Starter will not operate.	a. Improper starting procedure being used.	a. Refer to pertinent vehicle Technical Manual, Appendix A for proper starting procedures.
	b. Starter not receiving electrical current.	b. Refer to pertinent vehicle Technical Manual, Appendix A for procedures covering troubleshooting vehicle electrical system.
	c. Failed starter.	c. Refer to 1b, para 3-4.
	d. Failed starter relay.	d. Refer to 1b, para 3-7.
2. Starter runs but will not crank engine.	a. Failed starter drive gear.	a. Refer to 1c, para 3-4.
	b. Failed starter drive clutch.	b. Refer to 1b, para 3-4.
3. Starter operates but fails to crank engine at proper cranking speed.	a. Improper grade engine oil.	a. Drain and refill with proper grade oil for prevailing temperature.
	b. Defective starter.	b. Refer to 1b, para 3-4.
	c. Partially seized engine caused by tight engine bearings.	c. Turn engine manually. If engine does not turn freely, disassemble engine and replace or repair damaged parts.

3-6. Troubleshooting Generating System

1. Generator runs but will not produce electrical current.	a. Generator regulator not operating.	a. Refer to pertinent vehicle Technical Manual, Appendix A for troubleshooting generator regulator.
	b. Improperly connected generator cables.	b. Refer to pertinent vehicle Technical Manual, Appendix A for correct cable connections and procedures.
	c. Generator not producing electrical current.	c. Remove generator (table 4-1). Refer to TM 9-2920-224-35 and overhaul generator. Install generator (table 4-1).
2. Generator does not turn or operate.	a. Failed generator shaft.	a. Replace generator, Refer to 1c, above.
	b. Generator drive gear failed.	b. Remove generator (table 4-1). Remove generator drive adapter and drive gearshaft (table 5-10). Rebuild adapters and drive gearshaft (table 6-1). Check generator idler gears in crankcase for damaged teeth. If damaged, disassemble engine and remove idler gear. Install new gear (table 7-1) and assemble engine. Install generator (table 4-1).

3-7. Troubleshooting Air Intake System

1. Restricted air to turbosuperchargers (engine will not develop full power).	a. Plugged air cleaner.	a. Service air cleaner. Refer to pertinent vehicle Technical Manual, Appendix A for procedures.
	b. Collapsed air induction hose.	b. Repair or replace air induction hose. Refer to pertinent vehicle Technical Manual, Appendix A for procedures.
	c. Turbosuperchargers worn or fail to operate.	c. Remove turbosuperchargers (table 4-1). Refer to TM 9-2990-200-34 for overhaul instructions. Install turbosuperchargers (table 4-1).
	d. Restrictions in air intake manifolds.	d. Remove intake manifolds (table 4-4). Remove restrictions. Install intake manifolds (table 4-4).

Malfunction	Probable Cause	Corrective Action
2. Loss of engine power.	a. Air leak in intake manifold.	a. Remove turbosuperchargers (table 4-1). Remove intake manifolds (table 4-4). Repair air leak. Install intake manifolds (table 4-4) and install turbosuperchargers (table 4-1).
	b. Turbosuperchargers worn, plugged, or failed.	b. Refer to 1c, above for corrective action.
	c. Leak in exhaust pipes or manifolds.	c. Repair or replace exhaust pipes and manifolds (table 5-5).

3-8. Troubleshooting Fuel System

1. No fuel being delivered from fuel injector nozzles.	a. Plugged primary fuel filter, secondary fuel filter, or fuel/water separator filter or fuel system not free of air.	a. Service primary fuel filter, secondary fuel filter, or fuel/water separator filter. Refer to pertinent vehicle Technical Manual, Appendix A for procedures.
	b. Defect in vehicle fuel system.	b. Troubleshoot vehicle fuel system. Refer to pertinent vehicle Technical Manual, Appendix A for procedures.
	c. Damaged fuel hoses (fuel pump to filter or filter to fuel injection pump).	c. Remove damaged fuel hoses (table 4-1). Install new fuel hoses (table 4-1).
	d. Defective fuel pump	d. Troubleshoot fuel pump. Refer to TM 9-2910-213-34 for procedures. If trouble cannot be corrected remove pump (table 4-1). Refer to TM 9-2910-213-34 for overhaul. Install pump (table 4-1).
	a. Failed fuel injection pump.	e. Remove fuel injection pump (table 4-1). Refer to TM 9-2910-212-34 and overhaul pump. Install injection pump (table 4-1).
	f. Failed fuel injection pump coupling.	f. Remove fuel injection pump (table 4-1). Replace coupling (tables 6-29 or 6-45). Install injection pump (table 4-1).
2. Fuel being delivered at nozzles but engine will not stare run, or runs rough on one or more cylinders.	a. Operating with contaminated fuel or partially plugged fuel filters, refer to 1a, above.	a. Drain fuel tank and refill with proper fuel. Refer to pertinent vehicle Technical Manual, Appendix A, for proper fuel.
	b. Flame heater not operating (low ambient temperature).	b. Refer to para 3-4 (2 and 3) for corrective action.
	c. Fuel injector nozzle and holder not functioning properly.	c. Remove fuel injector nozzle and holders (table. 4-7). Rebuild nozzle and holders (table 4-7). Install nozzle and holder (table 4-7).
	d. Fuel injection pump not timed properly.	d. Time fuel injection pump (para 4-4). Also refer to TM 9-2910-212-34.
	e. Fuel injection pump not functioning properly.	e. Remove fuel injection pump (table 4-1). Refer to TM 9-2910-212-34 for overhaul procedures. Install pump (table 4-1).
3. Engine runs hot, misfires, or runs rough.	a. Restricted induction air supply.	a. Service air cleaner. Refer to pertinent vehicle Technical Manual, Appendix A, for proper fuel.
	b. Low fuel pressure from fuel supply pump or leaking hoses and connections.	b. Remove fuel supply pump (table 4-1). Refer to TM 9-2910-213-34 for overhaul procedures. Install pump (para 7-17a). Tighten all connections and replace damaged hoses.
	c. Fan clutch slipping.	c. Remove engine fan (table 4-3).
	d. Leaking fuel tubes at nozzle and holder assemblies.	d. Tighten connections. Remove fuel injector tubes (table 4-1). Replace damaged tubes. Install injector tubes (table 4-1).

Malfunction	Probable Cause	Corrective Action
	e. Improperly adjusted fuel injection pump.	e. Adjust fuel injection pump. Refer to TM 9-2910-212-34 for procedures.
	f. Fuel bleeder valve in injection pump not functioning properly.	f. Remove fuel injection pump (table 4-1). Refer to TM 9-2910-212-34 for overhaul procedures. Install fuel injection pump (table 4-1).
4. Excessive exhaust smoke.	a. Fuel injection pump improperly adjusted causing excessive fuel delivery.	a. Adjust fuel injection pump. Refer to TM 9-2910-212-34 for procedures.
	b. Fuel injector nozzle and holder assemblies not functioning properly. Nozzles dripping or nozzle holder spring broken.	b. Refer to item 2c, above, for corrective action.
	c. Turbosupercharger failed or restricted induction system.	c. Refer to para 3-7, above, for troubleshooting procedures.
	d. Fuel injection pump not properly timed.	d. Time fuel injection pump (table 4-1). Also refer to TM 9-2910-212-34.
	e. Worn or scored pistons, cylinder, or rings.	e. Remove cylinders and pistons (table 5-9) and replace defective parts (tables 6-12 and 6-14). Install pistons and cylinders (table 5-9).

3-9. Troubleshooting Lubricating System

1. Low engine oil pressure.	a. Improper grade oil for prevailing temperature.	a. Drain oil pan and refill with proper grade oil for prevailing temperature. Refer to pertinent vehicle Technical Manual, Appendix A.
	b. Engine idle speed too low.	b. Check engine idle speed and reset to 700 to 750 rpm.
	c. Insufficient oil in oil pan.	c. Fill oil pan to proper level. Refer to pertinent vehicle Technical Manual, Appendix A.
	d. Engine oil pressure sending unit not functioning properly.	d. Remove oil pressure sending unit (table 5-10). Install new unit (table 5-10).
	e. High engine oil temperature or diluted oil.	e. Refer to 4, below, for corrective action.
	f. Oil pressure regulator valve not operating properly.	f. Remove oil pressure regulator valve (table 4-2). Replace damaged parts (para 6-38d). Install oil pressure regulator valve (table 4-2).
	g. Oil filters partially obstructed.	g. Refer to pertinent vehicle Technical Manual, Appendix A for service procedures.
	h. Crankcase oil passages obstructed.	h. Disassemble engine (chapter 5). Clean oil passages (para 6-9c). Assemble engine (chapter 7).
	j. Oil pump pickup tube screen obstructed.	j. Remove oil pan (table 4-5). Clean obstructions from pickup tube screen. Install oil pan, (table 4-5).
	k. Oil pump not functioning properly.	k. Remove oil pan (table 4-5). Remove oil pump (table 5-10). Rebuild oil pump (table 6-17). Install oil pan (table 4-5).
	l. Engine bearings worn.	l. Disassemble engine (chapter 5). Replace worn bearings and necessary parts. Assemble engine (chapter 7).
2. High engine oil pressure.	a. Oil pressure sending unit not functioning properly.	a. Refer to 1d, above, for corrective action.
	b. Oil pressure regulator valve not functioning properly.	b. Refer to 1f, above, for corrective action.

Malfunction	Probable Cause	Corrective Action
	c. Improper grade of oil for prevailing ambient temperatures.	c. Drain crankcase oil and fill with proper grade oil. Refer to pertinent vehicle Technical Manual, Appendix A.
	d. Obstructed crankcase oil passages.	d. Refer to 1h, above, for corrective action.
3. No engine oil pressure.	a. Low oil level.	a. Fill oil pan to proper level Refer to pertinent vehicle Technical Manual, Appendix A for proper grade oil for prevailing temperature.
	b. Oil pressure sending unit not functioning properly.	b. Refer to 1 d, above, for corrective action.
	c. Obstructed crankcase oil passages.	c. Refer to 1 h, above, for corrective action.
	d. Oil pressure regulator valve not functioning properly.	d. Refer to 1 f, above, for corrective action.
	e. Oil pump or drive gears failed.	e. Refer to 1 k, above, for corrective action.
4. High engine oil temperature.	a. Restricted air flow through oil coolers.	a. Remove oil cooler air restrictions or replace damaged screens, deflectors, and baffles (tables 5-2 and 5-7).
	b. Oil temperature sending unit not functioning properly.	b. Replace aending unit (tables 5-10 and 7-3).
	c. High oil temperature warning light sending switch not functioning properly).	c. Replace switch (tables 5-10 and 7-3).
	d. Oil cooler thermostatic bypass valve not functioning properly.	d. Replace valve (para 6-38).
	e. Restricted engine oil cooler.	e. Remove engine oil cooler (table 5-2). Clean and repair oil cooler (table 6-3 7). Install oil cooler (table 7-1 2).
	f. Cooling fan clutch slipping or inoperative. Engine runs hot.	f. Refer to para 3-10 for corrective action.
	g. Excessive fuel, engine runs hot.	g. Refer to fuel system troubleshooting, para 3-8, for corrective action.
	h. Defective pieton cooling nozzles.	h. Remove oil pan (table 4-5). Inspect pump and nozzle. Replace defective parts. Install oil pan (table 4-5).
5. Excessive oil consumption.	a. High oil temperature or oil leaks.	a. Refer to 4, above, for corrective action. Repair oil leaks.
	b. Improper grade oil for prevailing ‘ temperature.	b. Refer to pertinent vehicle Technical Manual, Appendix A, for proper grade for prevailing temperature.
	c. Restricted crankcase breather system.	c. Remove (table 5-5), clean (para 6-2) and install (para 7-9) breather tubes
	d. Worn or scored pistons, cylinders, or rings.	d. Refer to para 3-8, 4e.
	e. Worn valve stems or valve guides.	e. Remove cylinders and replace defective parts. Assemble cylinders.
	f. Worn or leaking turbosupercharger oil scale.	f. Refer to para 3-7, 1c for corrective action.

3-10. Troubleshooting Cooling System

1. Cooling fans not operating.	a. Fan drive clutch slipping or inoperative.	a. Rebuild front fan drive clutch (table 6-24). Rebuild rear fan drive clutch (table 6-24).
	b. Fan drive gear train not functioning.	b. Disassemble engine (chapter 5). Replace damaged parts. Assemble engine (chapter 7).
2, Cooling fam operate but engine does not cool.	a. Oil cooler thermostatic bypass valve not functioning properly.	a. Refer to 4d, above.
	b. Defective oil cooler bypass valve.	b. Replace valve (table 6-37).

Malfunction	Probable Cause	Corrective Action
	c. Obstructed oil cooler core passages.	c. Remove oil coolers (table 5-2) and remove obstructions from oil cooler core passages (table 6-37). Install oil coolers (table 7-12).
	d. Low engine oil pressure.	d. Refer to para 3-9, above, for corrective action.
	e. Damaged baffles or deflectors.	e. Refer to para 3-9, 4a.
	f. Plugged baffles and air deflectors.	f. Remove engine (chapter 5) and clean thoroughly. Replace engine (chapter 7).
3. Engine fails to reach normal operating temperature.	a. Engine warm-up rpm too low for prevailing temperature.	a. Increase engine warm-up speed from 1100 rpm to 1400 rpm.
	b. Damaged baffles or deflectors.	b. Refer to 2e, above, for corrective action.
3-11. Troubleshooting Intake Manifold Flame Heater Fuel System		
1. No fuel to intake manifold flame heater.	a. Purge pump inoperative.	a. Refer to pertinent vehicle Technical Manual, Appendix A, for corrective action.
	b. Flame heater fuel filter plugged.	b. Remove filter and clean or replace element (table 6-44).
	c. Fuel inlet solenoid valve not operating due to electrical or mechanical failure.	c. Remove fuel inlet solenoid valve (table 5-3). Replace damaged or inoperative valve. Install solenoid valve (table 7-11).
	d. Manifold heater spray nozzle restricted or plugged.	d. Remove, overhaul, and install manifold heater (table 6-40).
	e. Restricted or plugged fuel supply tubes.	e. Clean tubes.
	f. Fuel check valve inoperative.	f. Remove fuel check valve.
2. Fuel to intake manifold, but flame heater will not ignite fuel.	a. Insufficient air for combustion in chamber.	a. Always crank engine as heater is operated.
	b. No electrical current to ignition unit.	b. Refer to pertinent vehicle Technical Manual, Appendix A, for corrective action.
	c. Spark plug not operating.	c. Replace spark plug (table 6-40).
	d. Electrical lead to ignition unit damaged.	d. Remove electrical lead and install new electrical lead (table 6-44).
	e. Improper heater spray nozzle pattern.	e. Replace heater spray nozzle (table 6-40).
3. Intake manifold heater on one side of engine fails to operate.	a. Electrical lead to ignition unit damaged, unit defective or spark plug not operating.	a. Remove electrical lead or unit and install new lead or unit (table 6-44).
	b. Spray nozzle line plugged or damaged.	b. Remove and replace line (table 6-40).
	c. Spray nozzle plugged.	c. Remove and replace nozzle (table 6-40).

CHAPTER 4
REPLACEMENT OF ENGINE ACCESSORIES, COMPONENTS AND RELATED SERVICE OPERATIONS

Section I. GENERAL

4-1. Purpose

a. This chapter of the manual covers replacement of engine accessories, and removal and replacement of components related to inspection, adjustment and service operations allocated to Direct Support maintenance personnel. Some accessories, engine components or service operations can be accomplished while engine is installed in vehicle, but is dependent upon how accessible the item is. Engines which have been removed from the vehicle for accessory replacement should be thoroughly cleaned before replacement of accessory is attempted. Refer to pertinent technical manuals for instructions on the removal or installation of the power plant and separation of the transmission from the engine.

4-2. Removal and Installation Instructions

a. Illustrations. The illustration sequences provided in the following subparagraphs depict the procedure for removal or installation of a particular item or an adjustment and service operation. When necessary, illustrations covering variations between engine models are included to clarify any differences in disassembly or assembly procedures.

b. Tables. This chapter has been grouped into sections. Each section has a contents table for easy reference for removing, cleaning, testing, installing and adjustment procedures required for a given operation and are listed by figure number under an appropriate heading in the table.

c. *Instructions.* The step-by-step procedure to be followed for removal, installation, adjustment, or service operation is listed immediately following each illustration.

d. Parts Identification. Callouts will be used to point out related parts involved in the removal operation being performed. Callouts not mentioned in the instructions are related to subsequent installation procedures or are used as reference to other pertinent operations performed in this technical manual.

Note. Parts mentioned in the instructions that accompany the operational sequence letters will be called out separately on the illustration only when required to further clarify the instructions,

e. Special Instructions.

(1) *"Notes and Cautions".* Instructional "Notes" or "Cautions" accompany some of the illustrations and are used to further define the instructions, eliminate procedures that might result in the equipment being damaged, or injury to personnel.

(2) *Cleanliness.* Extreme care must be exercised to insure that dust and dirt, even in minute quantities, does not enter the engine. Plug or cover all fuel and oil line connections to prevent entry of dirt. Clean parts thoroughly and coat all surfaces of bearings, shafts and contact surfaces with engine oil (OE). Surface must be protected from dirt after oiling.

(3) *Gaskets.* Always use new gaskets and preformed packings when reinstalling engine components.

(4) *Torque tightening attaching hardware.* All hardware must be torque tightened to specified limits. When a torque value is not specified in the text or on an illustration, refer to Standard Torque Values, para 6-7. Special torque values are specified in the text and / or illustrations. Refer also to Special Torque Values, para 6-7.

Note. Do not vary from torque specified. Under-torquing will result in premature failure of studs and bolts. Over-torquing can result in yielding of bolts and studs.

(5) *Safety devices.* All bolts and nuts must be secured with lock washers, lock nuts, tab washers, locking wire or cotter pins, as specified.

Section II. REMOVAL OR INSTALLATION OF ENGINE ACCESSORIES

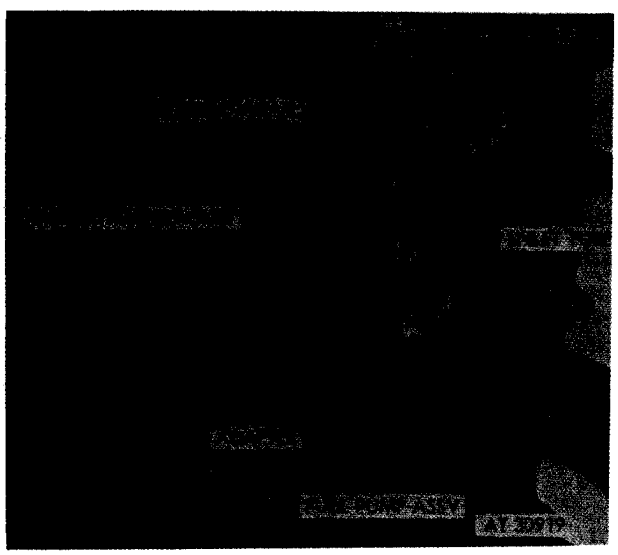
4-3. General

This section covers the replacement of the engine accessories. Proper procedures and instructions for the removal and installation of any one of the engine accessories can easily be determined by referring to Table 4-1. This table lists the illustrations applicable for removing or installing an Engine Accessory Reference figures are listed under the appropriate heading in the table.

Table 4-1. Engine Accessories

Accessory	Removal	Installation
Fuel Pump	**4-1 through 4-3**	**4-3 through 4-1**
Starter	**4-4 through 4-8**	**4-8, 4-7, 4-9, 4-4**
Generator	**4-10 through 4-16**	**4-16 through 4-13, 4-17, 4-11, 4-10**
Turbosupercharger	**4-18 through 4-33**	**4-33 through 4-18**
Fuel Injection Pump	**4-34 through 4-62**	**4-63 through 4-77, 4-55, 4-56, 4-78 through 4-82, 4-50 through 4-45, 4-86, 4-87, 4-42, 4-41, 4-83 through 4-85, 4-40 through 4-36, 4-88, 4-35, 4-34**

4-4. Removal or Installation Instructions



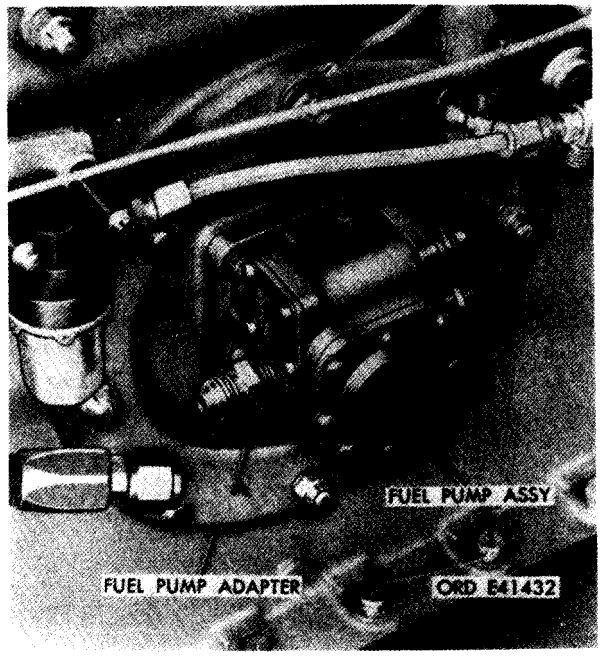
Disconnect

1. Disconnect fuel hose (A) from fuel pump outlet adapter. Collect fuel in a suitable container and discard.
2. Disconnect fuel pump inlet tube nuts (B).
3. Remove two screws (C), lock washers, one flat washer, and one clip. Pull check valve away from mounting bracket as necessary, and remove fuel inlet tube.

Connect

1. Position fuel inlet tube on check valve and fuel pump. Loosely install two cap screws (C), lock washers, one flat washer, and one clip securing check valve to mounting bracket.
2. Connect fuel inlet tube nuts (B).
3. Tighten cap screws (C).
4. Connect fuel hose (A) to fuel pump outlet adapter.

Figure 4-1. Disconnecting or connecting fuel hose at fuel pump outlet adapter and fuel pump inlet tube at fuel pump.



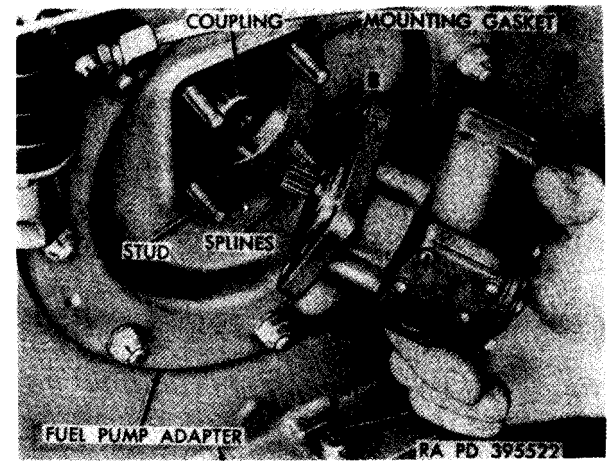
Disconnect

1. Remove adapter (A) from pump outlet.
2. Remove connector (B) from pump inlet.
3. Remove four self-locking nuts (C) and flat washers securing fuel pump to adapter.

Connect

1. Install four self-locking nuts (C) and flat washers securing fuel pump to adapter.
2. Install connector (B) in pump inlet.
3. Install adapter (A) in pump outlet.

Figure 4-2. Disconnecting or connecting fuel pump.



Remove

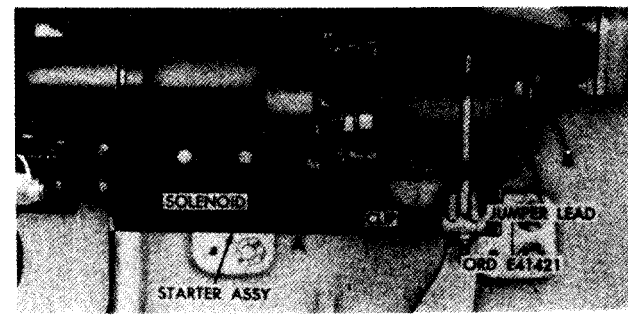
1. Remove fuel pump (A) from pump adapter.
2. Remove and discard mounting gasket (B).

Install

1. Position new mounting gasket (B) on studs.
2. Position fuel pump (A) on pump adapter.

Note. When installing fuel pump make sure fuel pump shaft splines are properly alined with drive coupling before securing pump to adapter.

Figure 4-3. Removing or installing fuel pump.



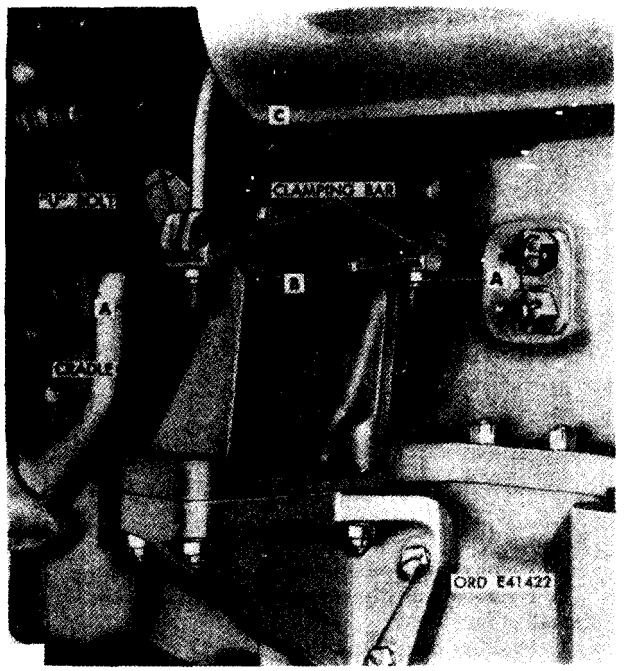
Remove

1. Remove hexagon head cap screw (A) and clip securing starter jumper lead to solenoid.
2. Remove large starter jumper lead clip from terminal (B).

Install

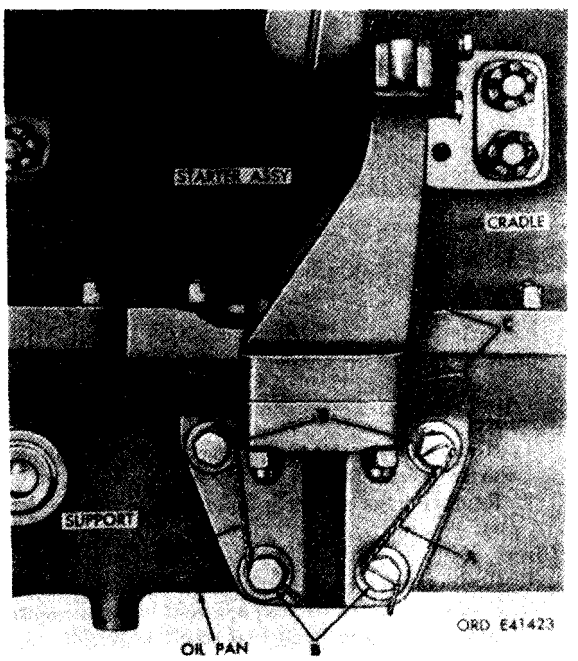
1. Position large starter jumper lead clip on terminal (B).
2. Position jumper lead on solenoid lug and secure with clip and hexagon head cap screw (A).

Figure 4-4. Removing or installing starter solenoid jumper lead.



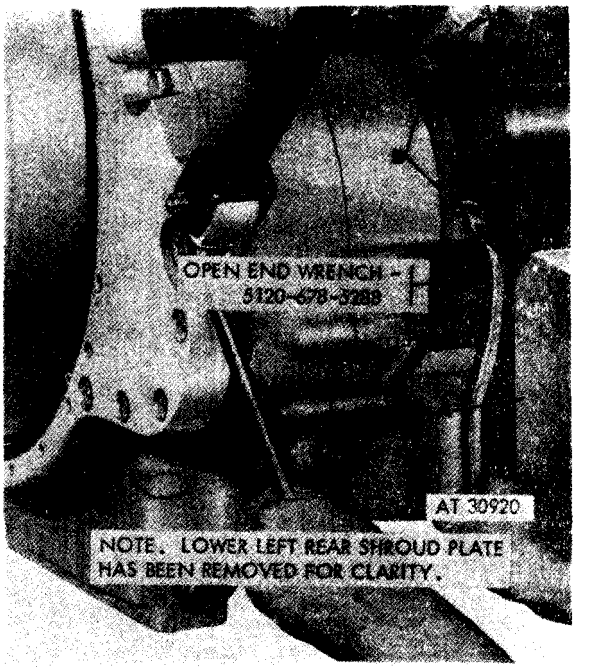
1. Remove two self-locking nuts (A).
2. Remove two clamping bars (B).
3. Remove starter retaining "U" bolt (C).

Figure 4-5. Removing starter retaining "U" bolt.



1. Cut and remove locking wire (A).
2. Remove four bolts (B) and flat washers securing starter support to oil pan.
3. Remove starter support and starter cradle as an assembly (C).

Figure 4-6. Removing starter retaining and cradle.



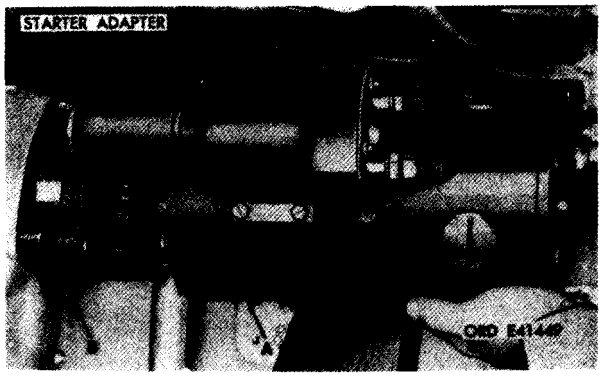
Remove

1. Install suitable blocks (A) under starter assembly for support.
2. Remove two self-locking nuts (B) from bolts and one self-locking nut from stud (behind starter) using open end wrench 5120-678-5288.

Install

1. Install two self-locking nuts (B) on two bolts and one self-locking nut on stud (behind starter) using open end wrench - 5120-678-5288.
2. Remove supporting blocks (A) under starter.

Figure 4-7. Removing or installing starter mounting nuts using open end wrench-5120-678-5288.



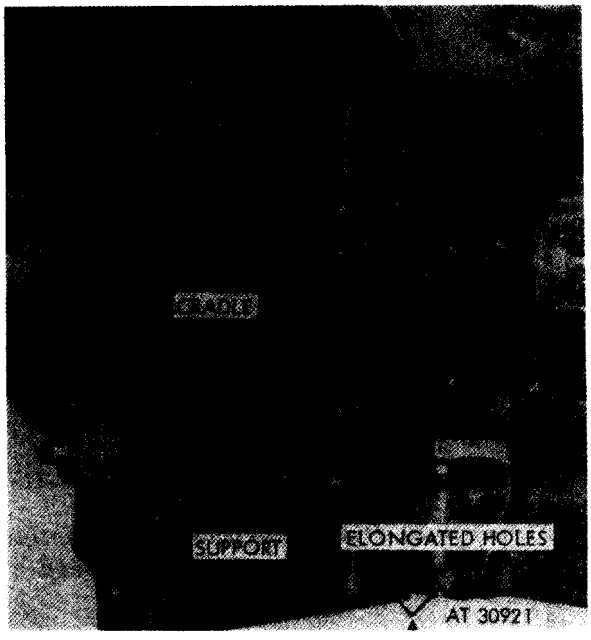
Remove

1. Remove starter assembly (A) from starter adapter.
2. Remove and discard mounting gasket (B).

Install

1. Position new mounting gasket (B) on starter adapter.
2. Position starter assembly (A) on starter adapter.
3. Position suitable blocks (A, fig. 4-7) under starter assembly for support.

Figure 4-8. Removing or installing starter assembly.



Note. It is of utmost importance that the starter support, cradle, and "U" bolt be installed in a manner that will not disturb starter mounting alinement and still furnish adequate support to minimize vibration. Misalignment of 0.010-in. in any direction is sufficient to cause a leak (pressure loss) between the starter mounting flange and the starter housing. Refer to paragraph 8-2 for procedure to determine if there is a pressure loss.

1. Position the assembled support and cradle on oil pan and install four hexagon head bolts (A) and plain washers. Tighten only until bolt heads engage the washers (finger-tight).
2. Loosen four self-locking nuts (B) securing cradle to support allowing cradle studs to move freely in elongated holes in support.
3. Position the "U" bolt over the starter and secure to cradle with two clamping bars and self-locking nuts (C). Torque tighten nuts evenly.
4. Torque tighten the four self-locking nuts (B) securing cradle to support, then torque tighten the four hexagon head bolts (A) securing support to oil pan. Secure oil pan bolts with locking wire (A, fig. 4-6).

Figure 4-9. Installing starter support, cradle, and "U" bolt.

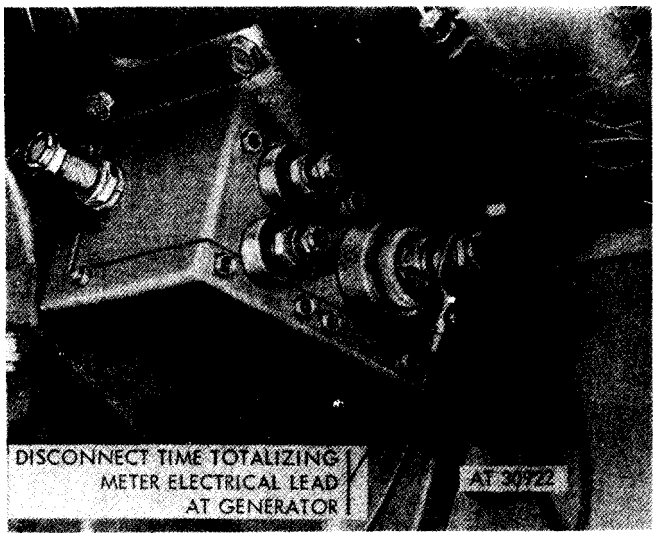
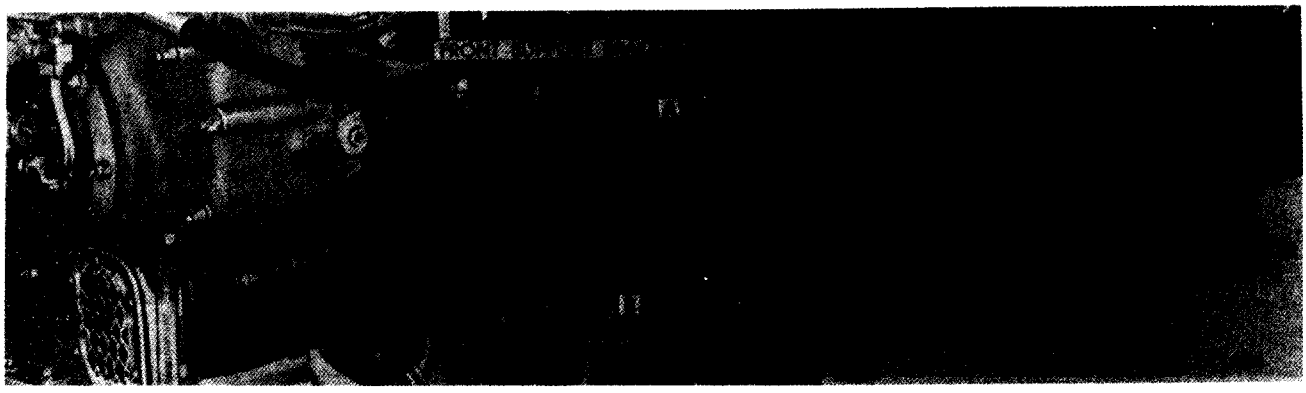


Figure 4-10. Disconnecting or connecting time-totalizing meter electrical lead at generator.



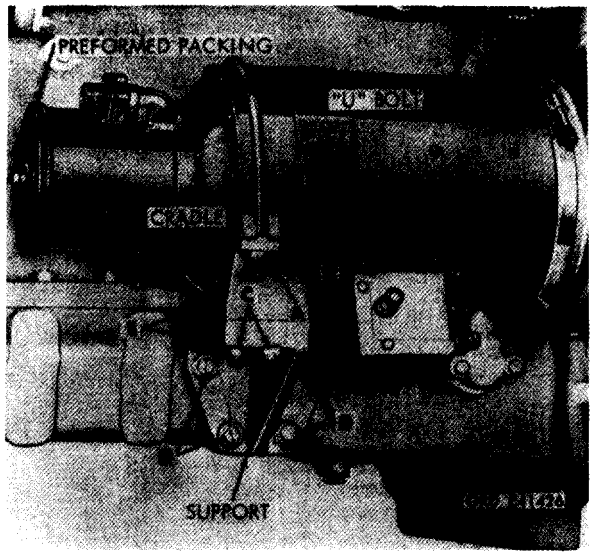
Remove

1. Remove two cap screws (A), lock washers, and flat washers securing generator air intake tube to front and rear support brackets.
2. Remove generator air intake tube (B) from generator blower motor housing.

Install

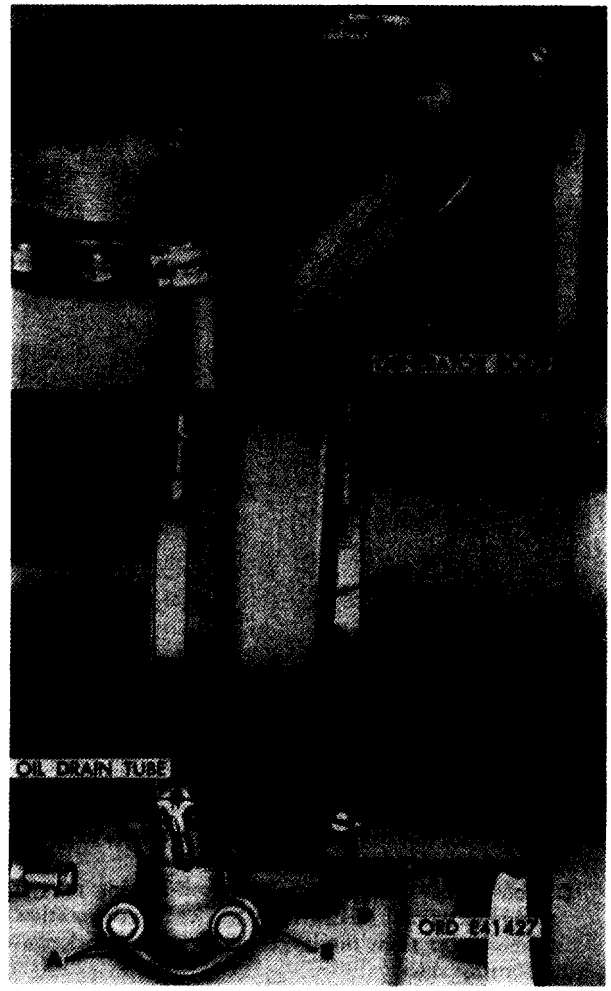
1. Position generator air intake tube (B) on generator blower motor housing.
2. Install two cap screws (A), lock washers, and flat washers securing generator air intake tube to front and rear support brackets.

Figure 4-11. Removing or installing generator air intake tube.



1. Remove one self-locking nut (A).
2. Remove clamping bar (B).
3. Loosen two self-locking nuts (C).
4. Cut locking wire and remove four bolts (D) and flat washers.
5. Remove generator support and cradle (E) and "U" bolt as an assembly.

Figure 4-12. Removing generator support, cradle, and "U" bolt.



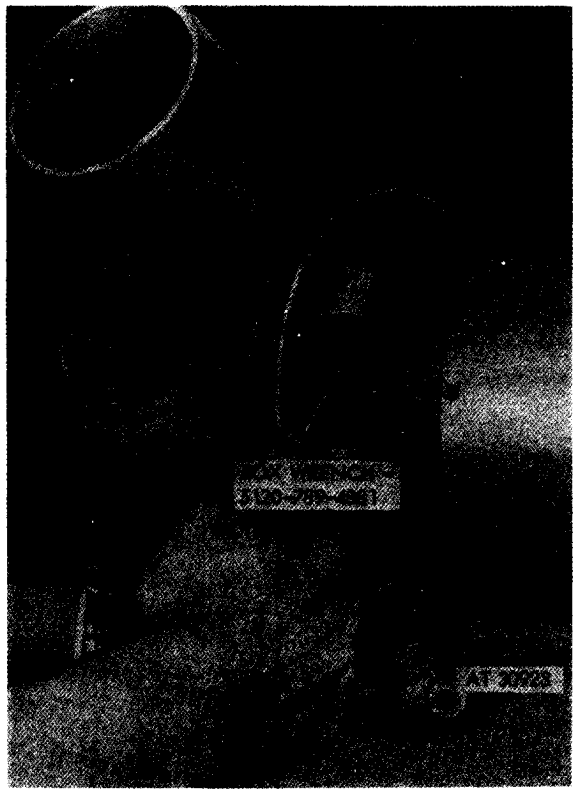
Disconnect

1. Remove two bolts (A) and lock washers.
2. Remove and discard oil drain tube gasket (B).
3. Loosen generator boot to exhaust tube hose clamp (C).
4. Remove two generator boot hose clamps (D).
5. Rotate generator boot (E) to position shown in figure 4-14, then remove hose clamp (C).

Connect

1. Position generator boot (E) to install exhaust tube hose clamp (C) on boot and rotate boot to position shown.
2. Install two generator boot hose clamps (D).
3. Tighten hose clamp (C).
4. Position new oil drain tube gasket (B) on oil drain tube.
5. Install two bolts (A) and lock washers securing oil drain tube to oil pan.

Figure 4-13. Disconnecting or connecting cylinder head right rear oil drain tube and generator boot hose clamps.



Loosen

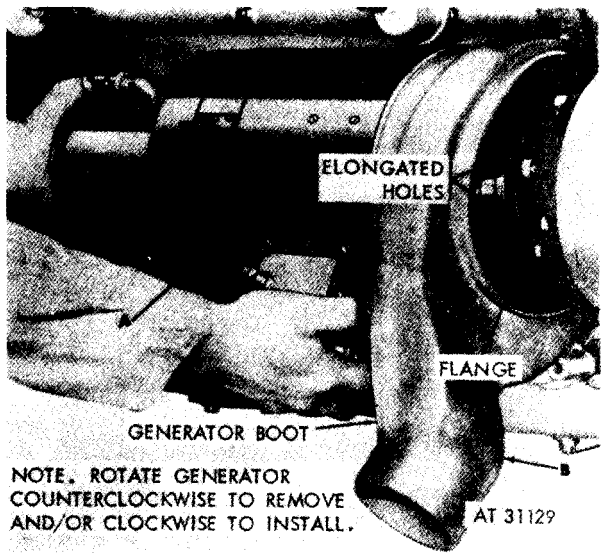
1. Slide boot back on generator far enough to expose the mounting nut access openings (A).
2. Loosen, but do not remove, six self-locking nuts (B), using box wrench -5120-789-4881 to permit rotation of generator to align the large openings in the elongated mounting slots.

Note. In cases where boot is rigid, it may be necessary to slide one side of boot back and loosen three mounting nuts, then repeat the procedure for the other three nuts. Do not cut or otherwise mutilate boot.

Tighten

1. Position boot on generator just far enough so that the mounting nut access openings (A) are exposed.
2. Tighten six self-locking nuts (B) using box wrench-5120-789-4881.

Figure 4-14. Loosening or tightening generator mounting nuts using box wrench-5120-789-4881.



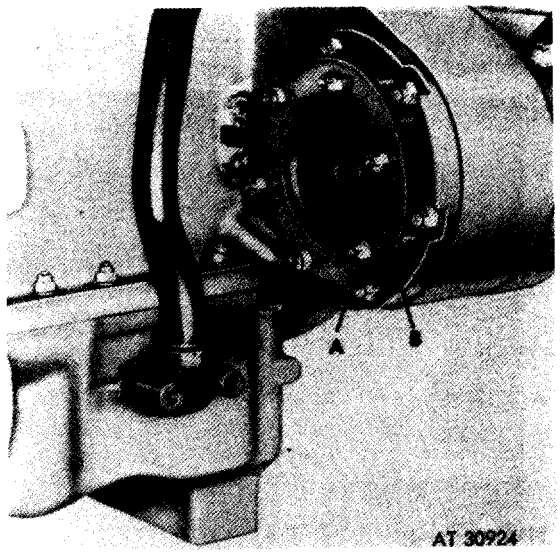
Remove

1. Rotate generator (A) counterclockwise until large elongated openings in flange are alined with mounting nuts, and remove generator and boot.
2. Remove boot (B) from generator.

Install

1. Position boot (B) on generator.
2. Position generator (A) so that large elongated openings in flange are alined with mounting nuts, and install generator and boot.

Figure 4-15. Removing or installing generator and boot.



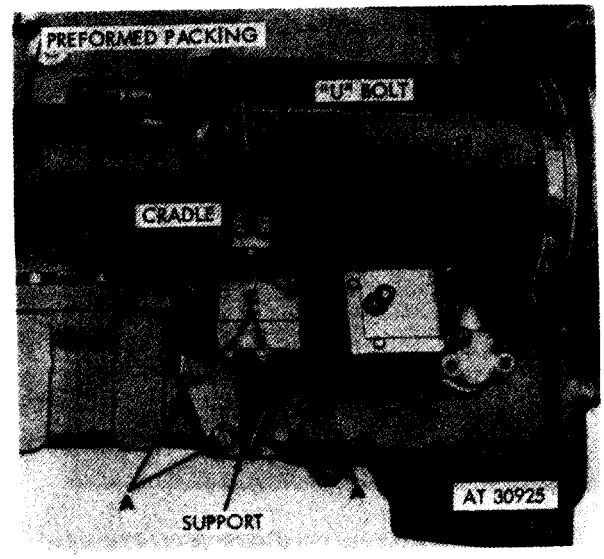
Remove

1. Remove six self-locking nuts (A).
2. Remove and discard generator mounting gasket (B).

Install

1. Position new generator mounting gasket (B) on studs.
2. Install, but do not tighten, six self-locking nuts (A).

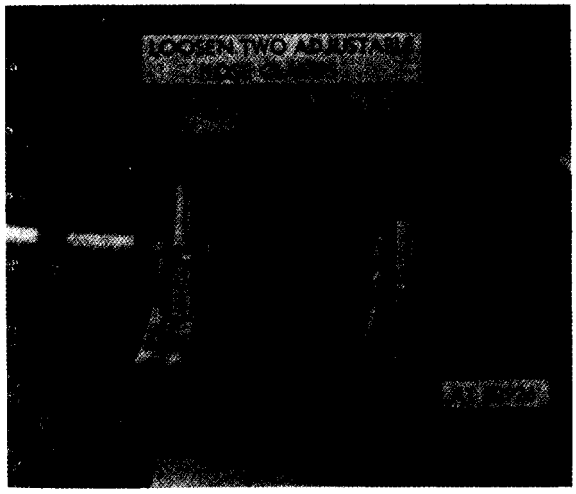
Figure 4-16. Removing or installing generator gasket.



Note. It is important that the generator cradle, support, and "U" bolt be installed in a manner that will not disturb generator alinement and still furnish adequate support to minimize vibration.

1. Position the assembled generator cradle, support, and "U" bolt and install four bolts (A) and flat washers. Tighten bolts only until bolt heads engage washers (finger-tight).
2. Install "U" bolt over generator and secure with one clamping bar and self-locking nut (B) and torque tighten. Torque tighten two self-locking nuts (C).
3. Torque tighten four bolts (A) and secure with locking wire as shown in figure 4-12.

Figure 4-17. Installing generator support, cradle, and "U" bolt.



Note. Similar procedures are required to remove the left and right turbosupercharges. For instructional purposes, removal of the left turbo supercharger is described. Removal procedures for the right turbosupercharger are the same, except for the relocated oil filler tube installation and the generator air exhaust tube and cap.

Figure 4-18. Loosening or tightening oil filler upper and lower tube hose connection (relocated oil filler tube installation).



Remove

1. Remove one bolt (A) attaching upper oil filler tube support bracket to turbosupercharger tie rod.
2. Remove one bolt (B) and lock washer attaching upper oil filler tube support clamp to tie rod.
3. Remove one bolt (C) and self-locking nut attaching upper oil filler tube support clamp to support bracket.
4. Remove upper oil filler tube (D) from lower left rear shroud plate.

Install

1. Position upper oil filler tube (D) through aperture in lower left rear shroud plate. Make cure lower end of tube enters hose connection (fig. 4-18).
2. Install one bolt (C) and self-locking nut securing upper oil filler tube support clamp to support bracket.
3. Install one bolt (B) and lock washer securing upper oil filler tube support clamp to turbosupercharger tie rod.
4. Install one bolt (A) securing upper oil filler tube support bracket to tie rod.

Figure 4-19. Removing or installing upper oil filler tube (relocated oil filler tube installation).



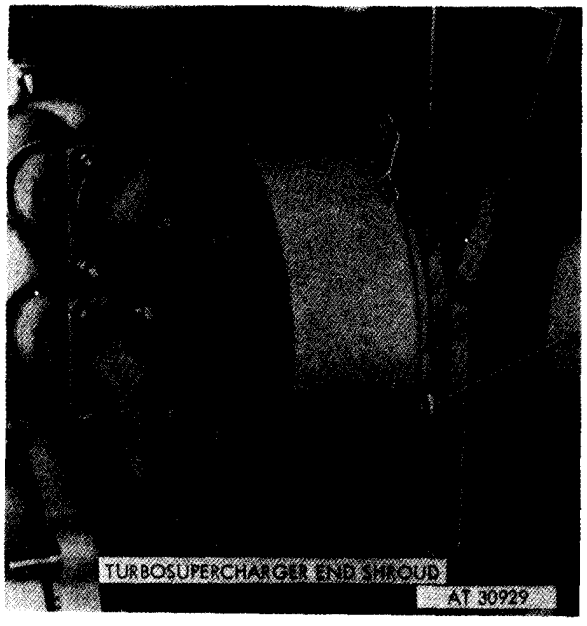
Remove

1. Loosen hose clamp (A) and remove breather tube and clamp.
2. Remove one self-locking nut and bolt (B).
3. Remove eight bolts (C) and remove lower left rear shroud plate.

Install

1. Position lower left rear shroud plate on lower left rear side of engine and install eight bolts (C).
2. Install one self-locking nut and bolt (B).
3. Position breather tube and hose clamp (A) and tighten clamp.

Figure 4-20. Removing or installing crankcase rear breather tube and lower left rear shroud plate.



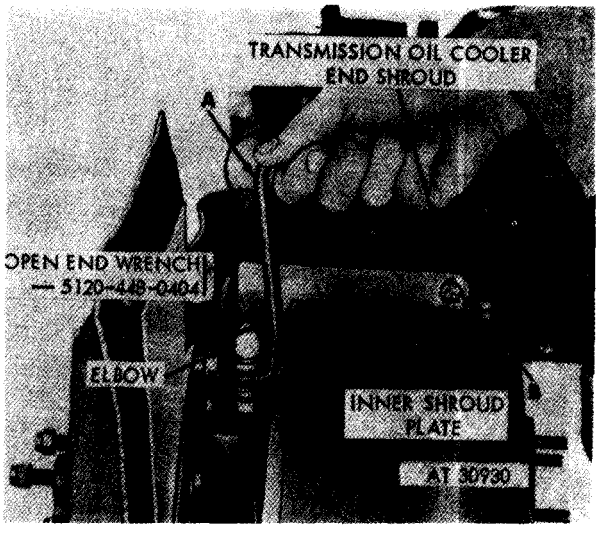
Remove

1. Remove two self-locking nuts and bolts (A).
2. Remove upper oil filler tube support bracket (B) from bolt (relocated oil filler tube installation only).
3. Remove turbosupercharger end shroud (C).

Install

1. Position turbosupercharger end shroud (C) over turbosupercharger.
2. Position upper oil filler tube support bracket (B) on one bolt (A) relocated oil filler tube installation only).
3. Install two bolts (A) and self-locking nuts securing end shroud. Bolt with support bracket must be installed at top of shroud.

Figure 4-21. Removing or installing upper oil filler tube support bracket and turbosupercharger end shroud.



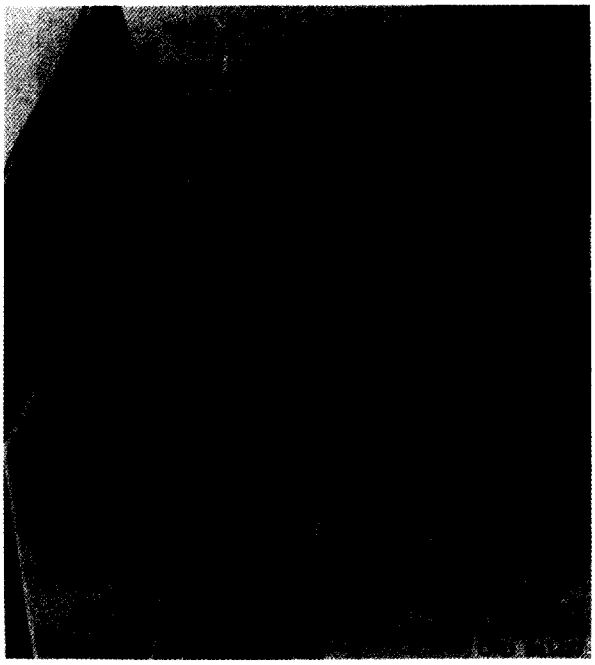
Disconnect

1. Disconnect turbosupercharger oil inlet hose elbow from nipple using open end wrench - 5120-448-0404 (A).
2. Remove self-locking nut and bolt (B) attaching inner shroud plate to transmission oil cooler end shroud.

Connect

1. Install self-locking nut and bolt (B) securing inner shroud plate to transmission oil cooler end shroud.
2. Connect turbosupercharger oil inlet hose elbow to nipple using open end wrench - 5120-448-0404 (A).

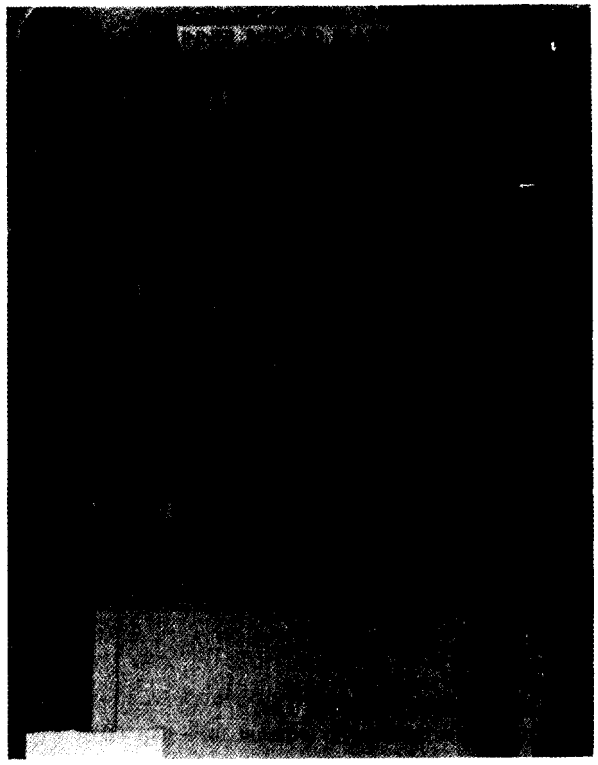
Figure 4-22. Disconnecting or connecting turbosupercharger oil inlet hose elbow from nipple using open end wrench- 5120-448-0404.



Remove
1. Remove two bolts (A) attaching outer shroud plate.
2. Remove outer shroud plate (B).

Install
1. Position outer shroud plate (B) on turbosupercharger.
2. Install two bolts (A) securing outer shroud plate.

Figure 4-23. Removing or installing turbo supercharger outer shroud plate.



Remove
1. Remove grommet (A) from inner shroud plate.
2. Remove elbow (B) from oil inlet hose.
3. Pull oil inlet hose (C) through grommet hole opening in inner shroud plate.
4. Remove nipple (D).

Install
1. Install nipple (D) in turbosupercharger.
2. Push oil inlet hose (C) through grommet hole opening in inner shroud plate.
3. Install elbow (B) in oil inlet hose.
4. Install grommet (A) in inner shroud plate.

Figure 4-24. Removing or installing oil inlet hose, elbow, and nipple.



Remove

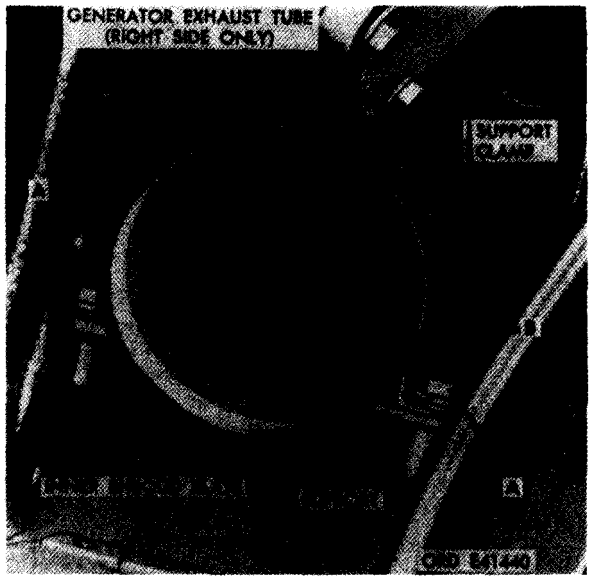
1. Remove hose clamp (A).
2. Remove generator exhaust tube cap (B).

Install

. Position hose clamp (A) on generator exhaust tube cap (B) and then position cap on generator exhaust tube.

2. Tighten hose clamp (A) securing cap on exhaust tube.

Figure 4-25. Removing or installing generator exhaust tube cap (right side only).

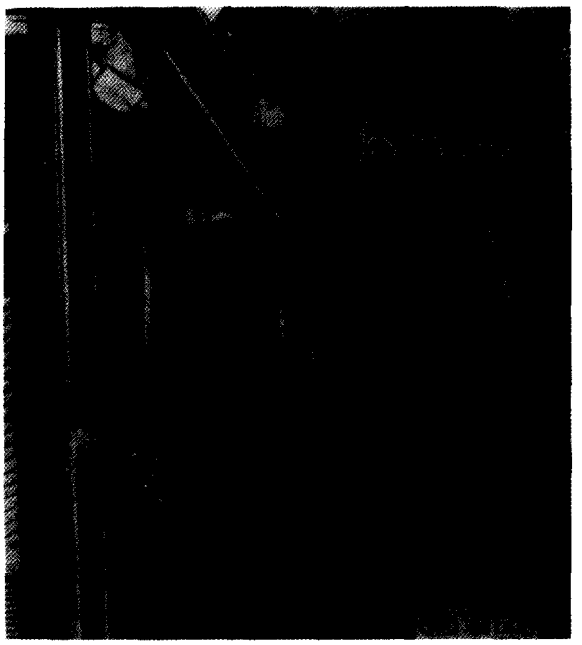


Remove

1. Remove two bolts (A), lock washers, and flat washers securing generator exhaust tube.

1. Position support clamp (B) and support around generator exhaust tube.
2. Install two bolts (A), lock washers, and flat washers securing clamp and support to inner shroud plate.

Figure 4-26. Removing or installing generator exhaust tube support clamp (right side only).



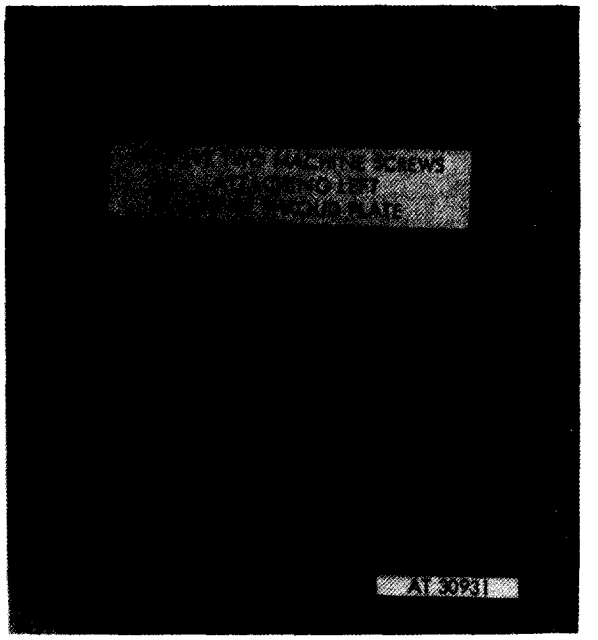
Remove

1. Remove two cap screws (A), lock washers, and plain washers securing generator exhaust tube to turbosupercharger tie rod.
2. Remove exhaust tube (B) through bottom of right inner shroud.

Install

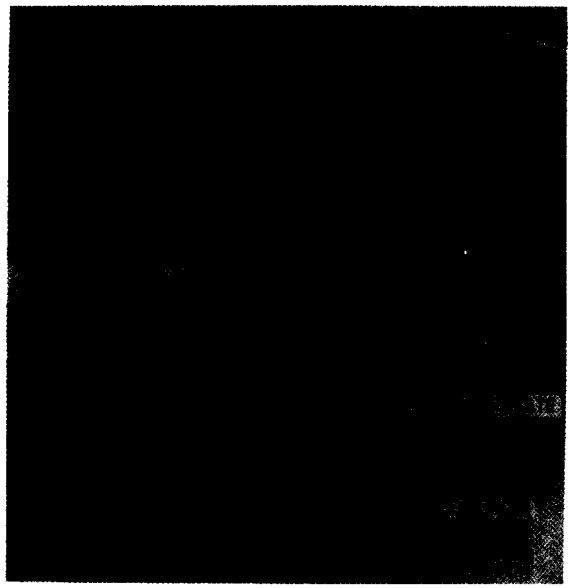
1. Position generator exhaust tube (B) through bottom of right inner shroud.
2. Install two cap screws (A), lock washers, and plain washers securing exhaust tube to turbosupercharger tie rod.

Figure 4-27. Removing or installing generator exhaust tube (right side only).



Note. Do not remove inner shroud plate until transmission oil cooler end shroud is removed (fig. 4-29).

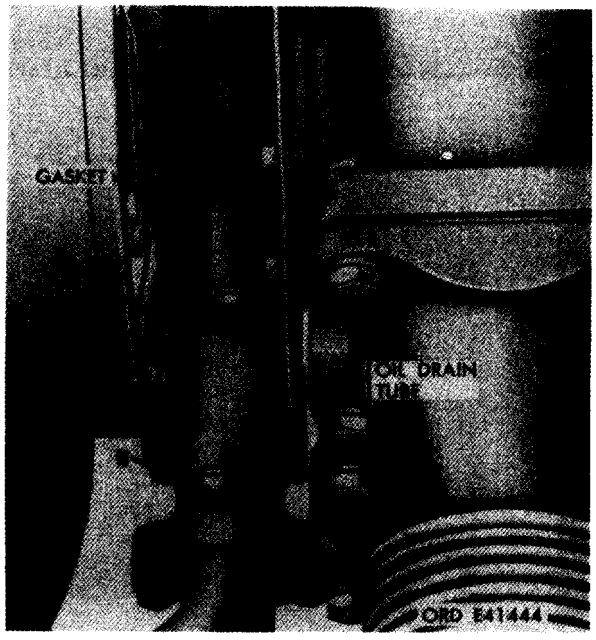
Figure 4-28. Disconnecting or connecting inner shroud plate (rear view).



Remove
1. Remove two bolts (A) attaching the transmission oil cooler end shroud.
2. Remove end shroud and inner shroud plate (B).

Install
1. Position inner shroud plate and transmission oil cooler end shroud (B) on engine.
2. Install two bolts (A) securing end shroud.

Figure 4-29. Removing or installing transmission oil cooler end shroud and inner shroud plate.



Disconnect
1. Remove short cap screw (A) and lock washer.
2. Remove long bolt (B) and lock washer.
3. Separate oil drain tube (C) from turbosupercharger. Remove and discard gasket.

Connect
1. Position new gasket between turbosupercharger and oil drain tube (C).
2. Install long bolt (B) and lock washer.
3. Install short cap screw (A) and lock washer.

Figure 4-30. Disconnecting or connecting turbosupercharger oil drain tube at turbosupercharger.



Disconnect
1. Loosen hose clamps (A) on air outlet elbow hose.
2. Remove six self-locking nuts (B) attaching elbow to turbosupercharger compressor housing and remove elbow.
3. Remove and discard elbow gasket (C).
4. Remove outer self-locking nut (D) and flat washer attaching turbosupercharger to mounting base.
5. Loosen hose clamps (E) and remove oil drain tube.

Connect
1. Position oil drain tube and tighten hose clamps (E).
2. Install outer self-locking nut (D) and flat washer securing turbosupercharger to mounting base.
3. Position new elbow gasket (C) on studs.
4. Position air outlet elbow on turbosupercharger compressor housing and install six self-locking nuts (B) securing elbow to housing.
5. Tighten hose clamps (A) on air outlet elbow.

Figure 4-31. Disconnecting or connecting turbosupercharger air outlet elbow.

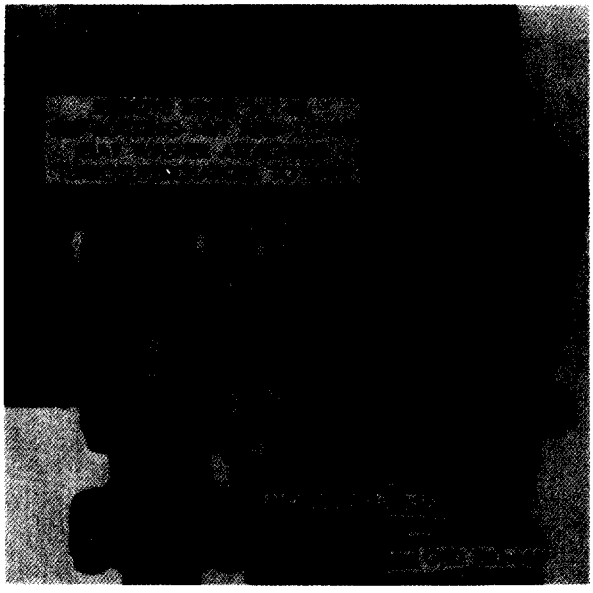
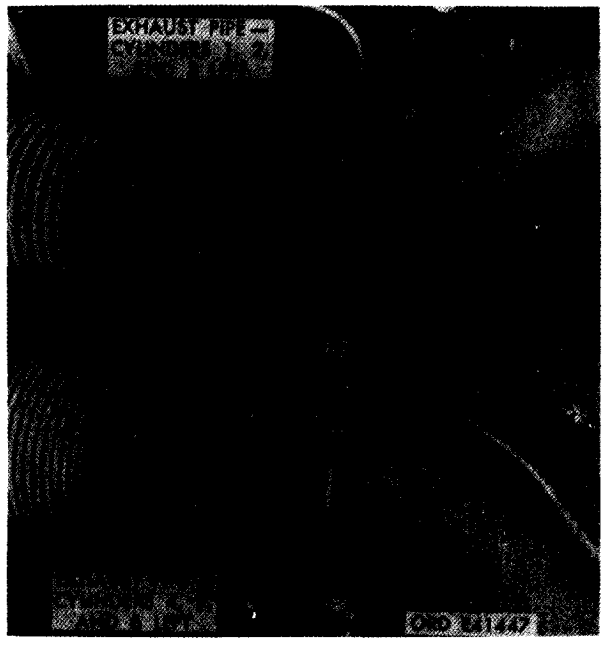


Figure 4-32. Disconnecting or connecting turbosupercharger at mounting base.



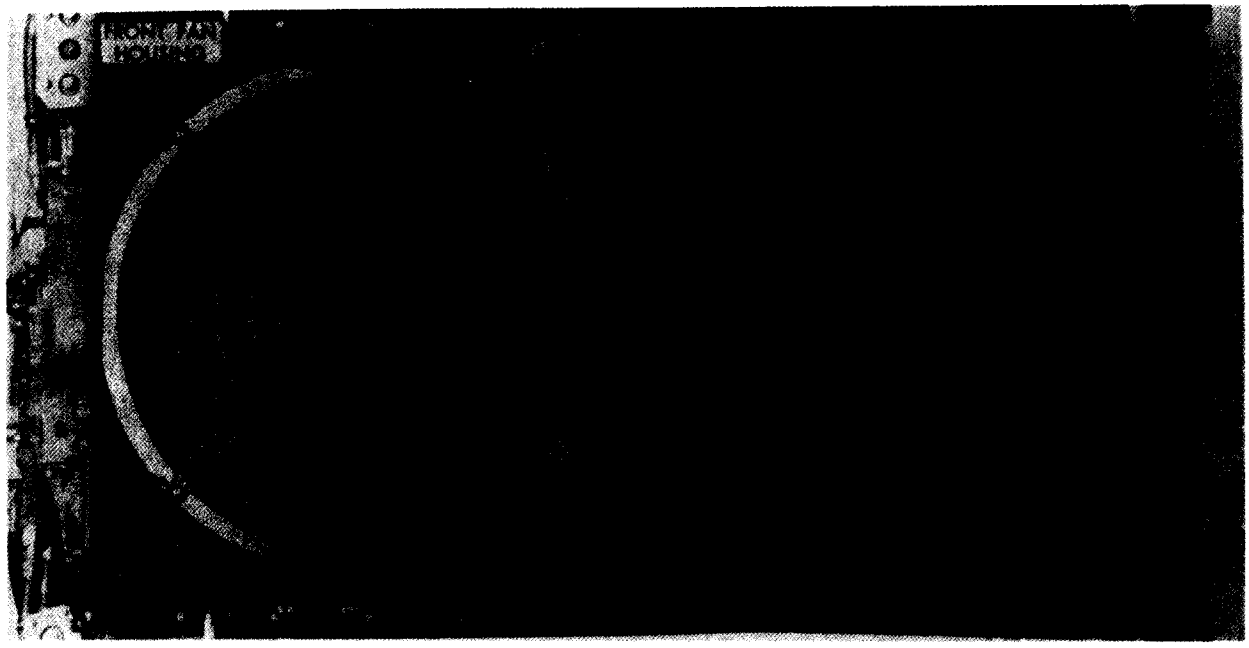
Disconnect and remove

1. Remove eight self-locking nuts (A), flat washers, and cap screws attaching exhaust pipes to turbine housing.
2. Separate exhaust pipes from turbine housing and remove and discard two gaskets (B).
3. Remote turbosupercharger assembly (C) from mounting base.

Connect and install

1. Position turbosupercharger assembly (C) on mounting base.
2. Position new gaskets (B) between exhaust pipes and turbine housing.
3. Install eight cap screws, flat washers, and self-locking nuts (A) securing exhaust pipes to housing.

Figure 4-33. Disconnecting or connecting exhaust pipes at turbine housing and removing or installing turbosupercharger.



Remove

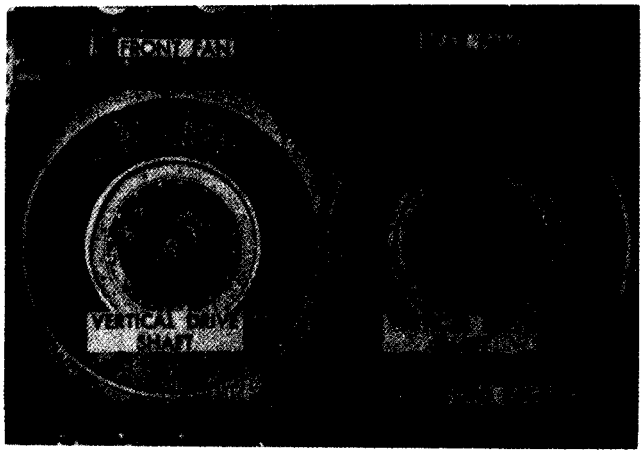
1. Remove two bolts (A) and lock washers.
2. Remove two cap screws (B) and lock washers and remove cooling fan vane from front fan housing.
3. Remove two bolts (C) and lock washers.
4. Remove two cap screws (D) and lock washers and remove cooling fan vane from rear fan housing.

Install

Note. When installing the cooling fan vanes, it is important that the proper cooling fan vane is installed on the correct fan housing. The rear fan housing (flywheel end) mounts noticeably higher than the front fan housing and takes the wide lip cooling fan vane (item 3, fig. B-25). The front fan housing mounts lower into the cooling fan shroud and takes the narrow lip cooling fan vane. Be sure the wide lip *is not* installed on the front fan housing as this will interfere with the fan and cause damage to both fan and vane housing.

1. Position cooling fan vane in rear fan housing and install two cap screws (D) and lock washers.
2. Install two bolts (C) and lock washers.
3. Position cooling fan vane in front fan housing and install two cap screws (B) and lock washers.
4. Install two bolts (A) and lock washers.

Figure 4-34. Removing or installing cooling fan vanes.



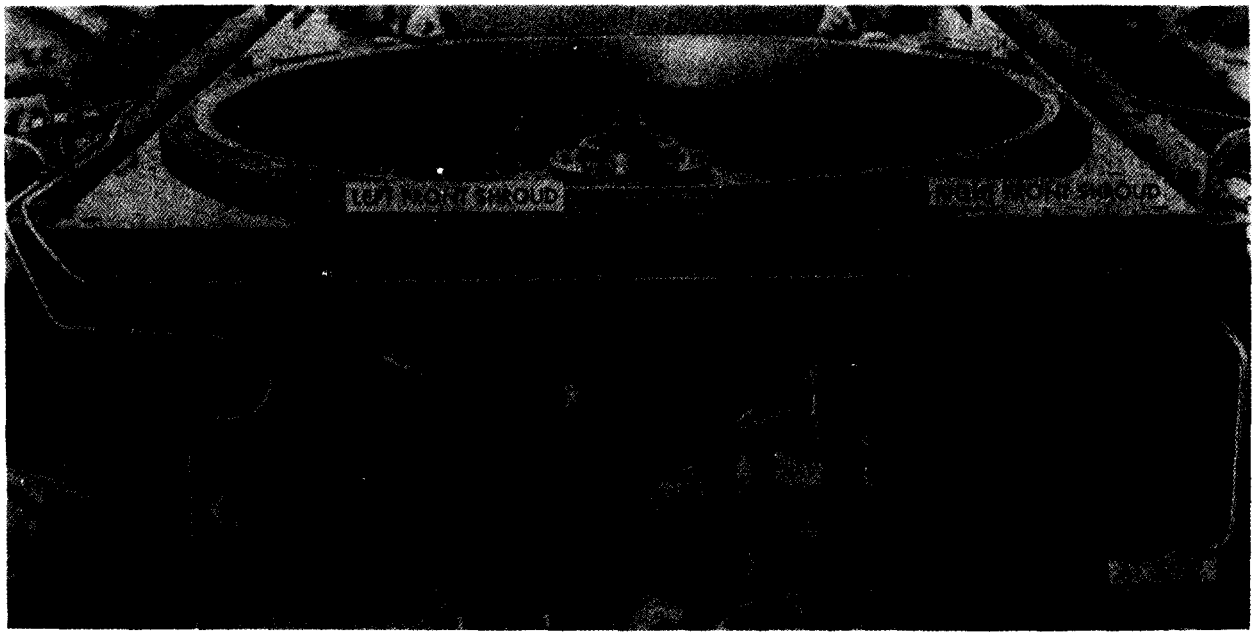
Remove

1. Remove cotter pin, slotted nut (A), and flat washer. Discard cotter pin.
2. Remove front cooling fan and hub assembly (B) from vertical drive shaft.
3. Remove rear cooling fan and hub assembly (C) in the same manner.

Install

1. Position front cooling fan and hub assembly (B) on vertical drive shaft.
2. Install flat washer, slotted nut (A), and new cotter pin securing fan and hub assembly.
3. Install rear cooling fan and hub assembly (C) in the same manner.

Figure 4-35. Removing or installing cooling fans.



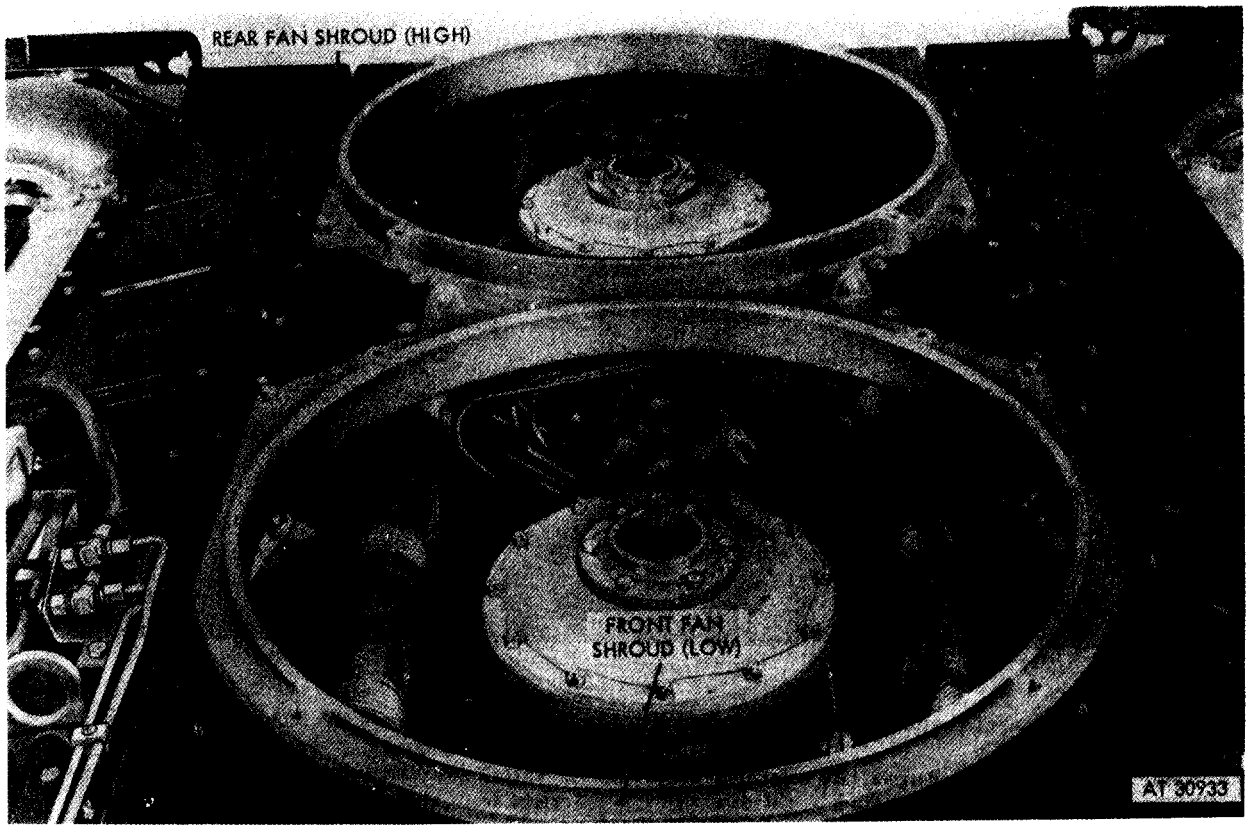
Disconnect

1. Remove three screws (A) attaching cooling fan shroud to right front shroud.
2. Remove remaining two screws (B) attaching cooling fan shroud to left front shroud.

Connect

1. Install two screws (B) securing cooling fan shroud to left front shroud.
2. Install three screws (A) securing cooling fan shroud to right front shroud.

Figure 4-36. Disconnecting or connecting front end of cooling fan shroud.



Disconnect

1. Remove six self-locking nuts (A) attaching right side of cooling fan shroud to top frame.
2. Remove six self-locking nuts (B) attaching left side of shroud to top frame.

Connect

1. Install six self-locking nuts (B) securing left side of cooling fan shroud to top frame.
2. Install six self-locking nuts (A) securing right side of shroud tn frame.

Figure 4-37. Disconnecting or connecting cooling fan shroud on top frame.

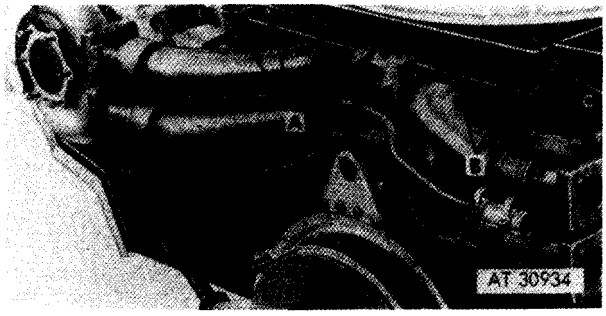


Figure 4-38. Disconnecting or connecting rear end of cooling fan shroud and removing or installing cooling fan shroud and fan housings.

Disconnect and remove

1. Remove four screws (A) attaching right rear shroud and right rear center shroud to cooling fan shroud.
2. Remove three screws (B) attaching left rear shroud and left rear center shroud to cooling fan shroud.
3. Remove cooling fan shroud (C) and fan housings from engine.

Connect and install

1. Position cooling fan shroud (C) and fan housings on engine. Be sure raised fan housing is to the rear of the engine.
2. Install three screws (B) securing left rear shroud and left rear center shroud to cooling fan shroud.
3. Install four screws (A) securing right rear shroud and right rear center shroud to cooling fan shroud.

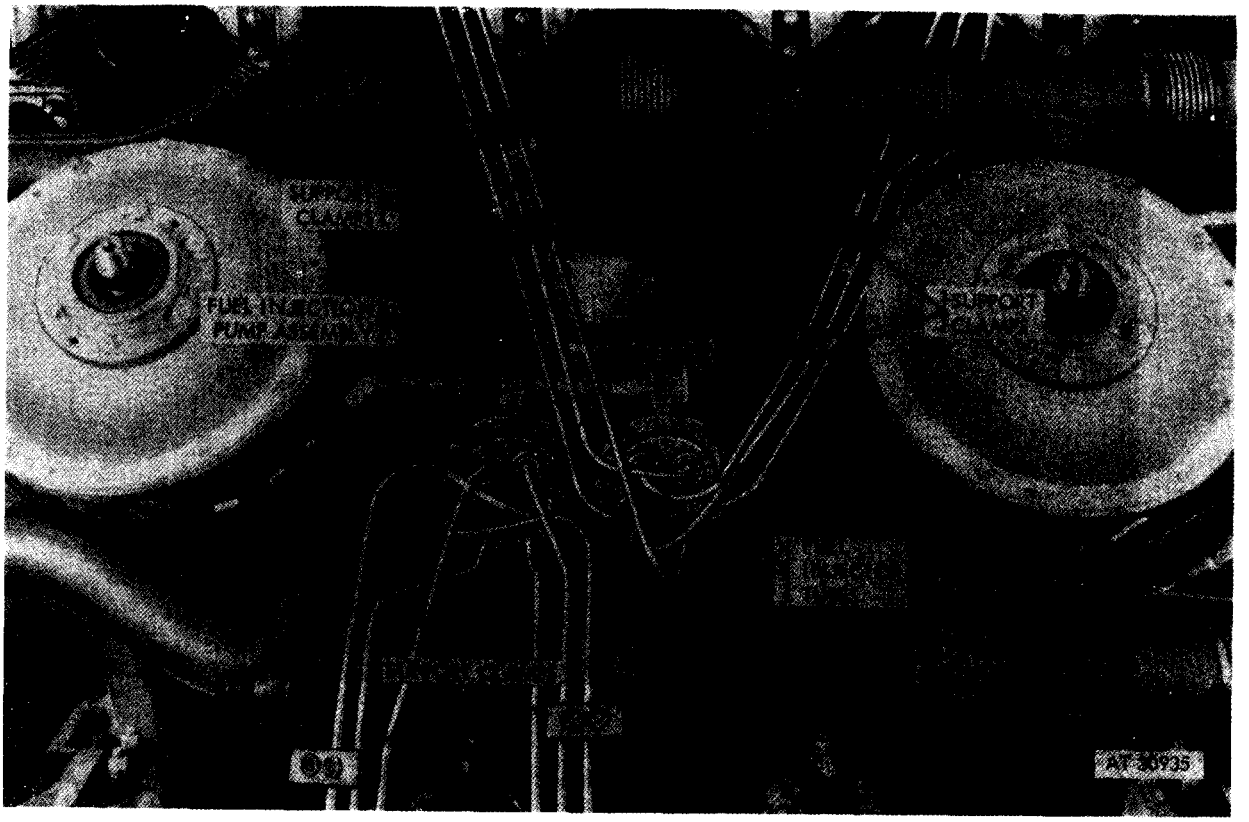
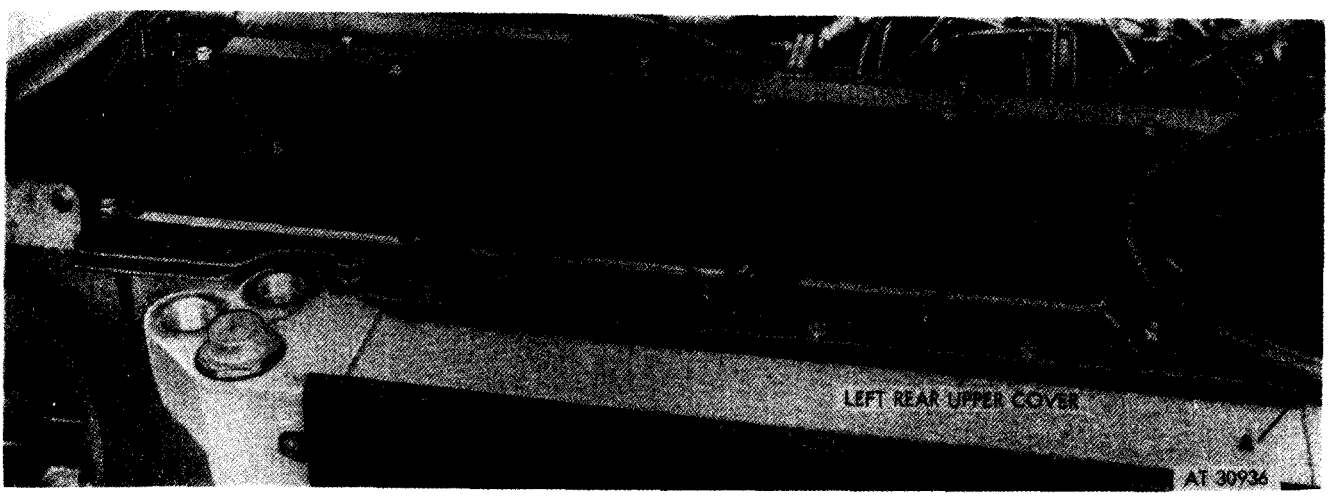


Figure 4-39. Fuel injection pump—installed view.



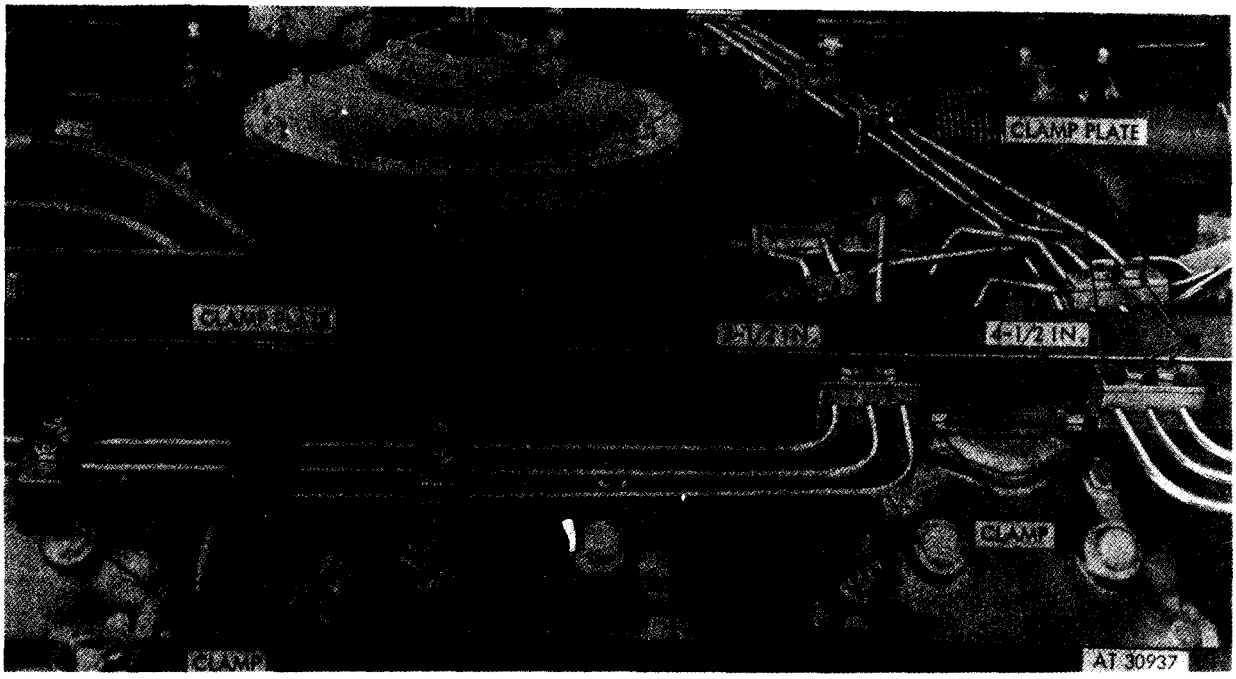
Remove

1. Remove fuel filter drain hose (A) from bracket.
2. Remove 11 bolts (B) attaching left rear upper cover and fuel filter drain hose bracket to beam.
3. Remove upper cover and hose bracket (C).

Install

1. Position left rear upper cover and fuel filter drain hose bracket on beam.
2. Install 11 bolts (B) securing upper cover and hose bracket to beam.
3. Position fuel filter drain hose (A) around bracket.

Figure 4-40. Removing or installing left rear upper cover.



Remove

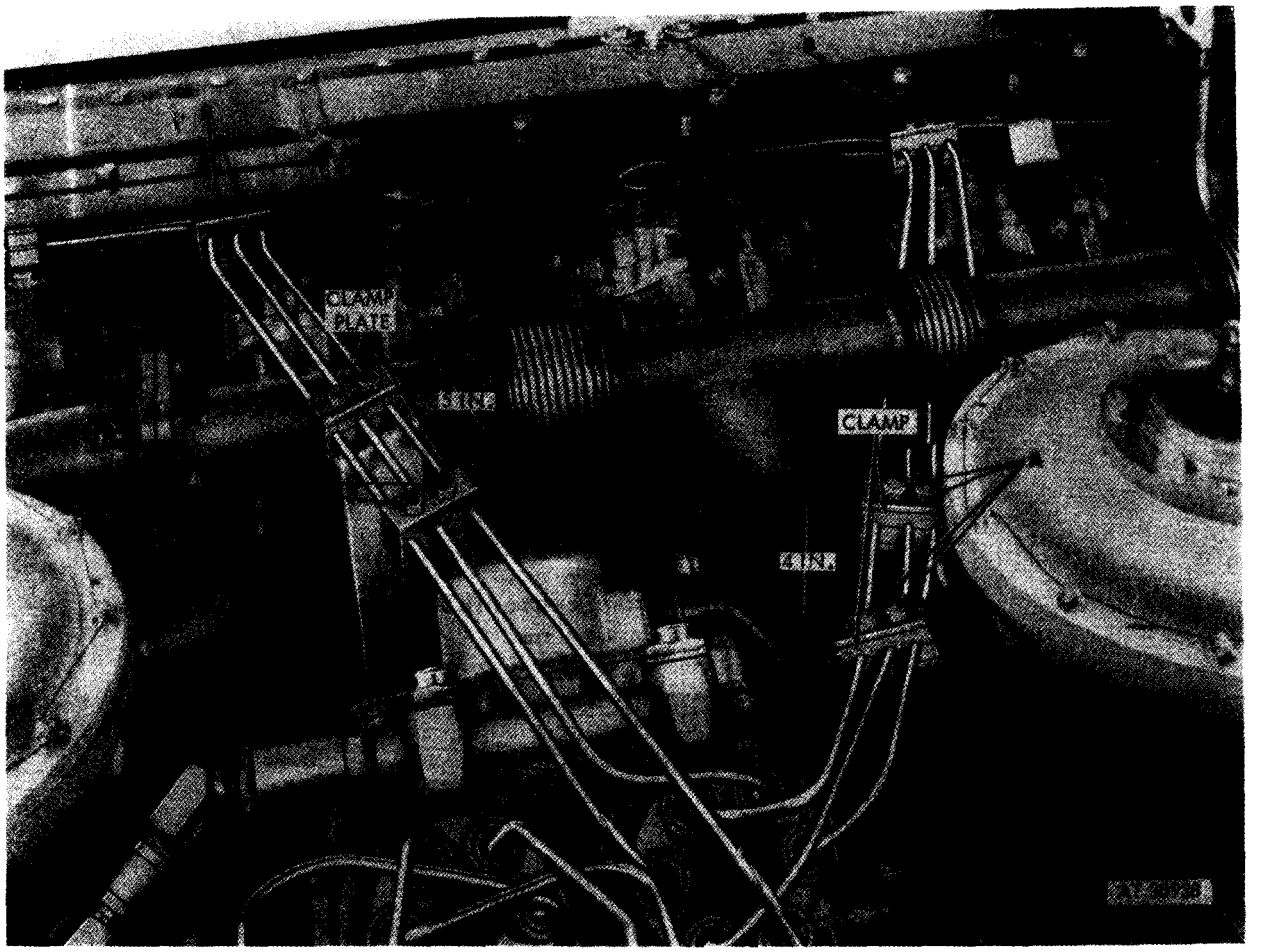
1. Loosen two bolts (A) attaching fuel injector tube supports to valve adjusting screw cover plates to gain clearance for bolt removal.
2. Remove 12 self-locking nuts (B), bolts, and clamps from the left bank injector tubes.

Install

Note. Space floating clamps, as shown.

1. Install 12 clamps, bolts, and self-locking nuts (B) on the left bank injector tubes.
2. Tighten two bolts (A) securing fuel injector tube supports to valve adjusting screw cover plates.

Figure 4-41. Removing or installing fuel injector left tube clamps.



Remove

1. Remove eight self-locking nuts (A), bolts, and clamps from the right bank injector tubes.
2. Loosen but do not remove the four bolts (B) attaching injector tube clamps to supports.

Install

Note. Space floating clamps, as shown.

1. Tighten the four bolts (B) securing injector tube clamps to supports.
2. Install eight clamps, bolts, and self-locking nuts (A) on the right bank injector tubes.

Figure 4-42. Removing or installing fuel injector right tube clamps.

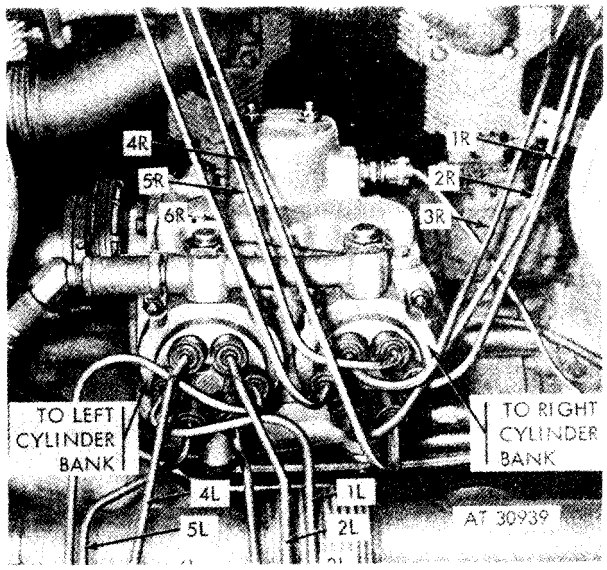
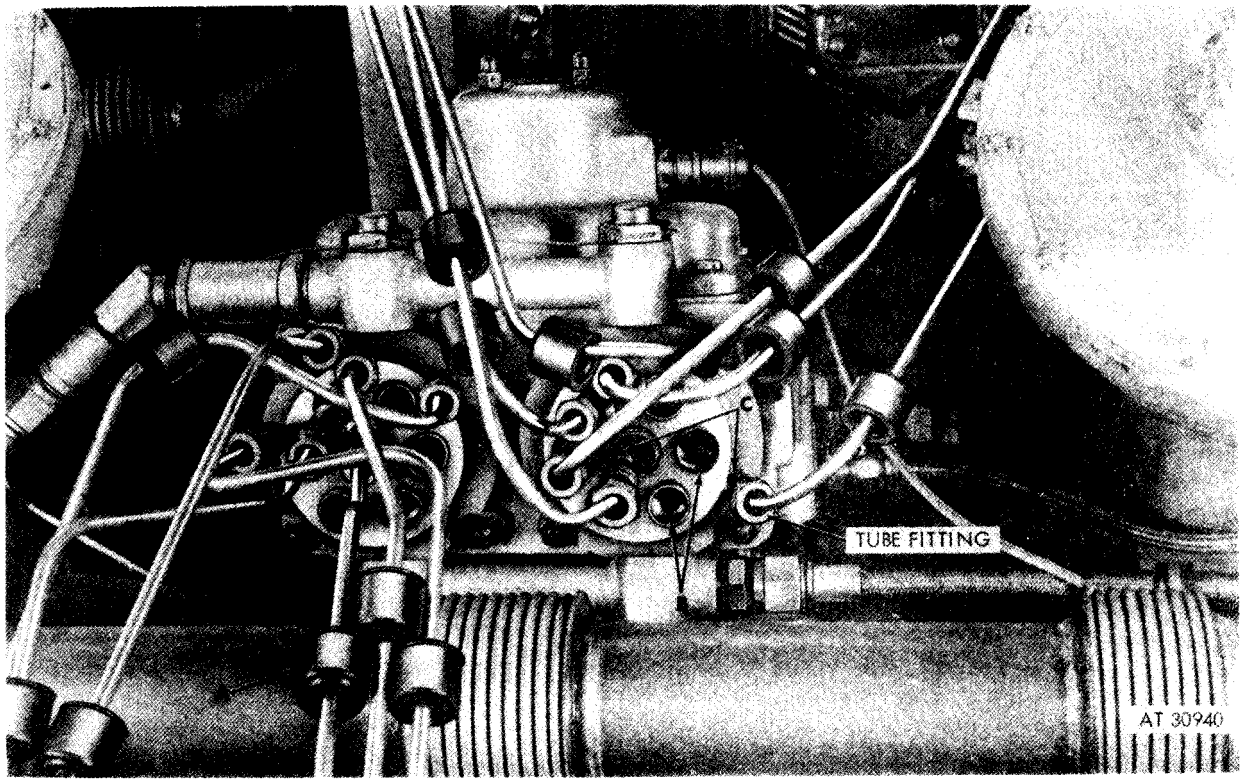


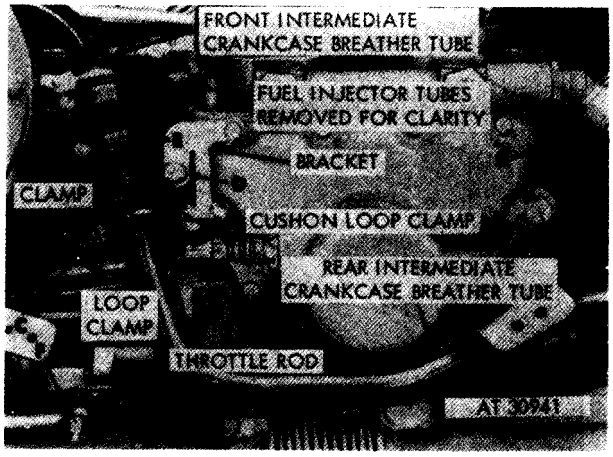
Figure 4-43. Fuel injector tubes-installed view.



1. Slip 12 dust caps (A) from fuel tube fittings and disconnect tubes from fuel injection pump,

2. Cap or plug tube openings (B) in fuel injection pump and tubes (C).

Figure 4-44. Disconnecting fued injector tubes from fuel injection pump.



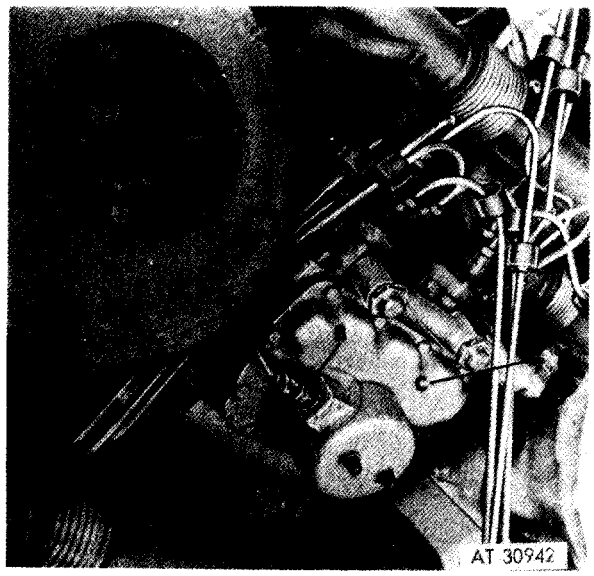
Disconnect

1. Disconnect electrical lead (A).
2. Disconnect fuel return hose (B).
3. Remove nut and screw attaching clamp (C) to cushioned loop clam p.
4. Remove self-locking nut and bolt (D) attaching loop clamp to bracket.
5. Loosen hoee clamps (E), separate crankcase breather tubes, and remove hose and clamps.
6. Remove cotter pin, nut (F), flat washer, and bolt. Discard cotter pin. Disconnect throttle rod from injection pump.

Connect

1. Connect throttle control rod to fuel injection pump operating lever with bolt, flat washer, nut (F), and new cotter pin.
2. Connect crankcase breather tubes with hose and install hose clamps (E). Tighten clamps.
3. Install self-locking nut and bolt (D) securing loop clamp to bracket
4. Install nut and screw securing clamp (C) to cushioned loop clamp.
5. Connect fuel return hose (B).
6. Connect electrical lead (A).

Figure 4-45. Disconnecting or connecting crankcase breather tube, electrical lead, throttle control, and fuel return hose-engines prior to relocated crankcase breather tube.



Disconnect

1. Remove cotter pin, nut (A), flat washer, and bolt. Discard cotter pin. Disconnect throttle rod from injection pump.
2. Disconnect electrical lead (B).
3. Disconnect fuel return hose (C).

Connect

1. Connect fuel return hose (C).
2. Connect electrical lead [If).
3. Connect throttle control rod to fuel injection pump operating lever with bolt, flat washer, nut (A), and new cotter pin.

Figure 4-46. Disconnecting or connecting throttle control, fuel return hose, and electrical lead-engines with relocated crankcase breather tube.

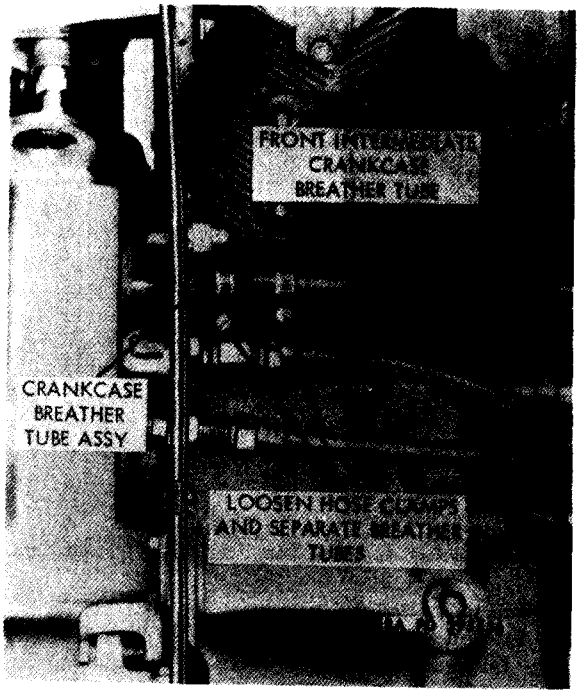
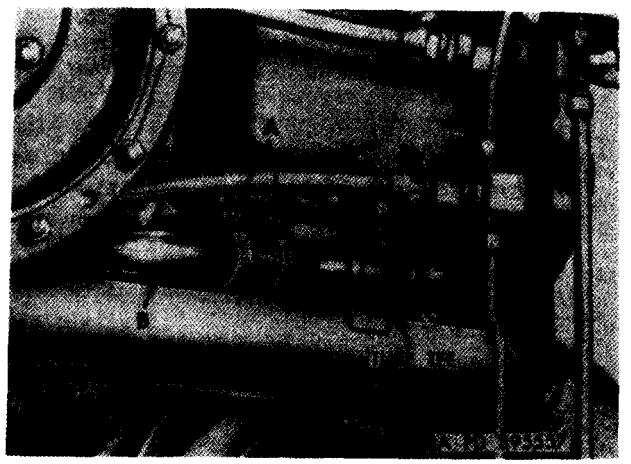


Figure 4-47. Disconnecting or connecting crankcase breather tube at front of engine.



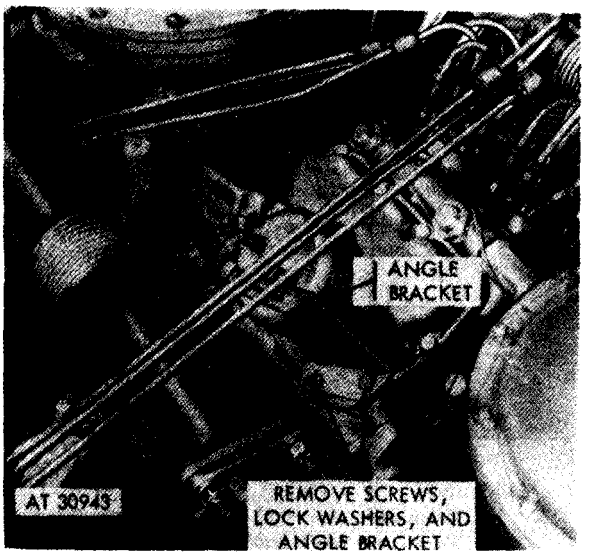
Disconnect

1. Loosen hose clamps (A) and separate rear intermediate crankcase breather tube (B) from breather tube tee.
2. Move breather tube (B) aside so fuel injection angle bracket can be removed.

Connect

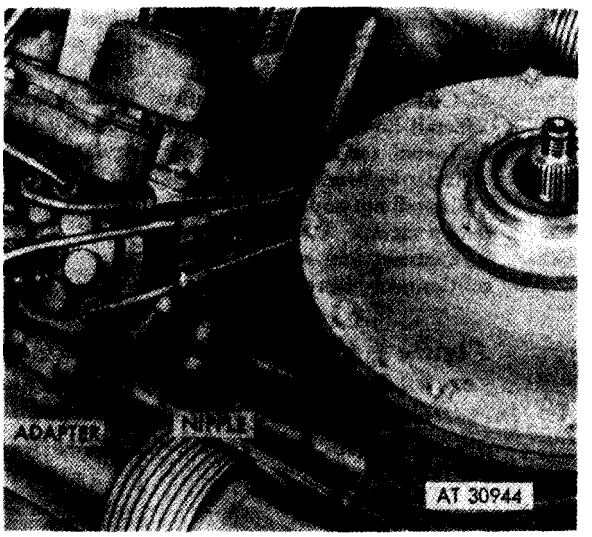
1. Connect rear intermediate crankcase breather tube (B) to breather tube tee.
2. Tighten hose clamps (A).

Figure 4-48. Disconnecting or connecting rear intermediate crankcase breather tube at tube tee-engines prior to relocated crankcase breather tube.



Note. Screws and lock washers are part of injection pump assembly and must be re-installed after the angle bracket has been removed.

Figure 4-49. Removing or installing angle bracket from fuel injection pump.



Disconnect

1. Disconnect fuel inlet hose (A) from adapter.
2. Disconnect oil inlet hose (B) from nipple.

Connect

1. Connect oil inlet hose (B) to nipple.
2. Connect fuel inlet hose (A) to adapter.

Figure 4-50. Disconnecting or connecting fuel injection pump oil and fuel inlet hoses.

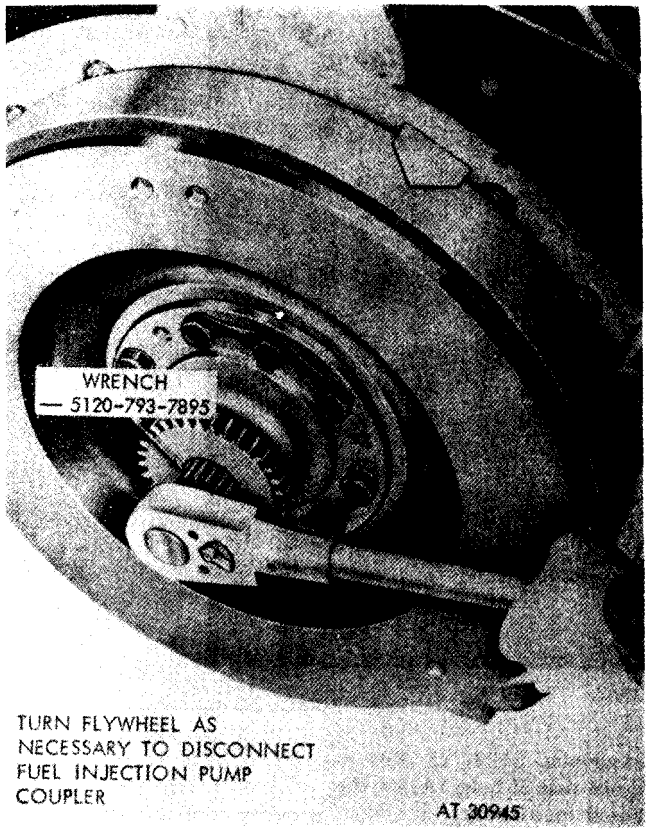
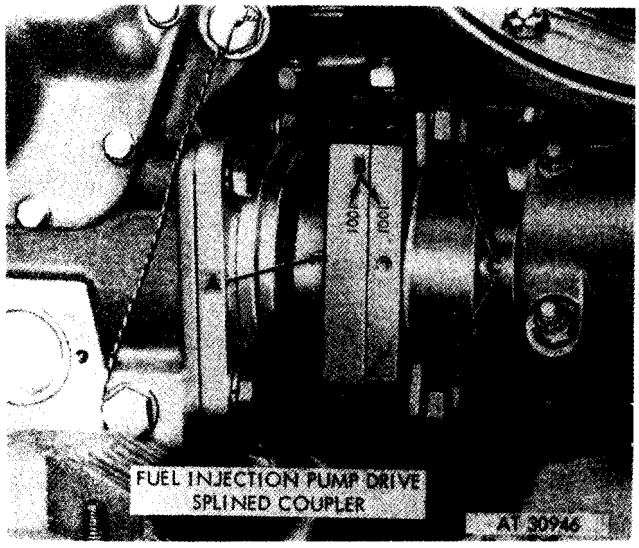


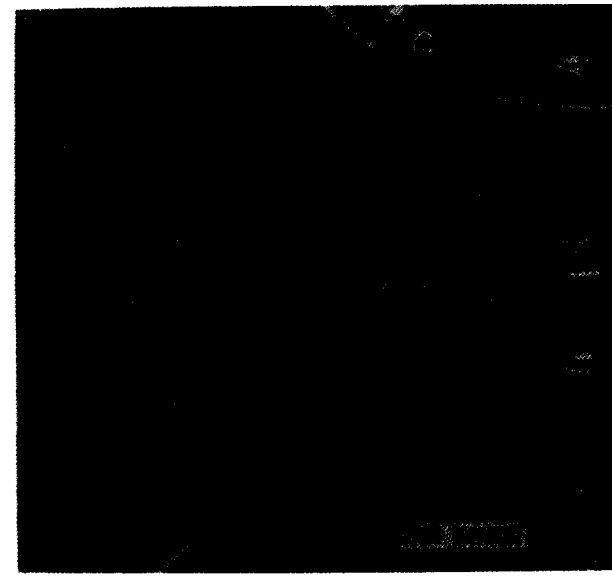
Figure 4-51. Positioning fuel injection pump coupler by turning flywheel using splined wrench -5l2O-793-7895.



1. Torn engine using splined wrench -5120-793-7895 as shown in figure 4-51, until fuel injection pump coupler bolts are accessible.
2. Stamp identification marks (B) on both injection coupler sleeves.
3. Remove four bolts (C), lock washers, and lock plates.

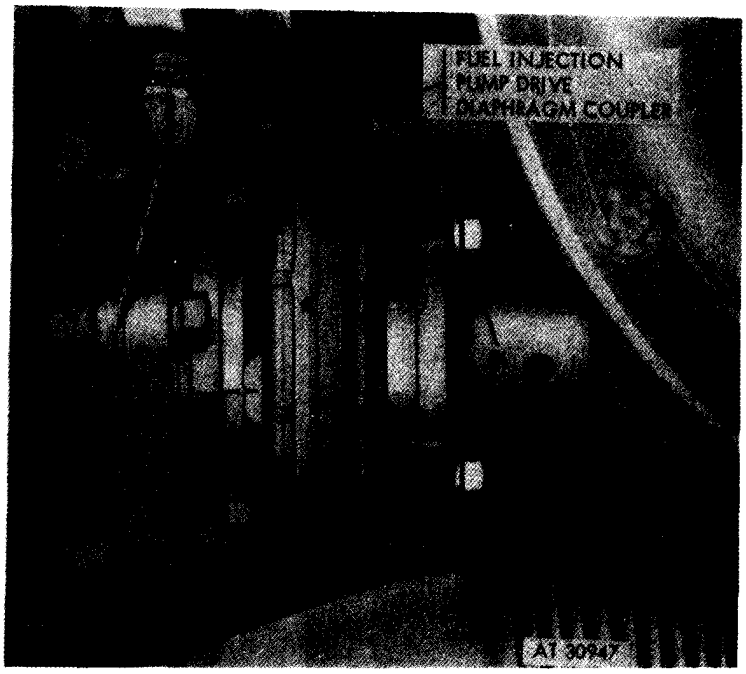
Note. **The fuel injection pump splined coupler sleeves and hubs must be identified with identical marks to prevent mismating of parts. The sleeves and hubs are matched for each assembly and must not be interchanged between assemblies.**

Figure 4-52. Removing fuel injection pump splined coupler bolts.



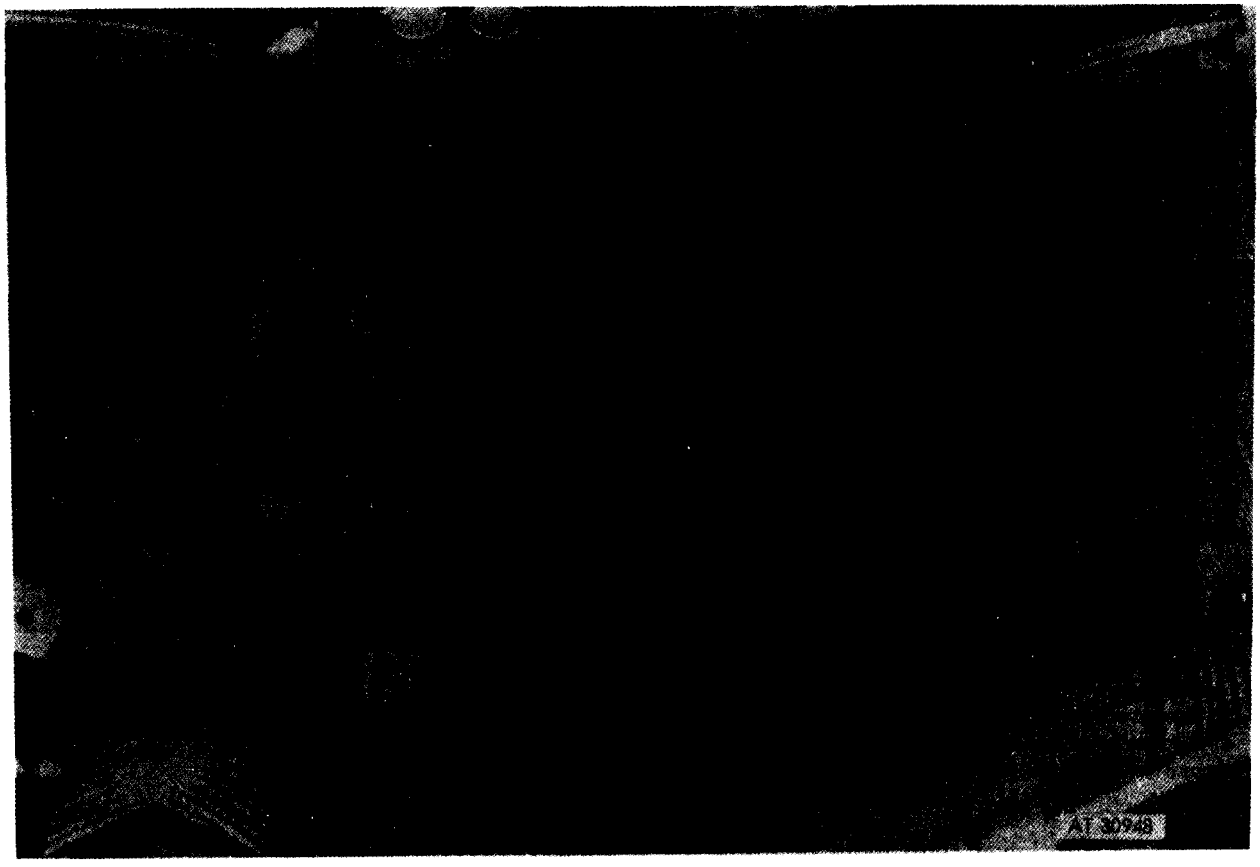
1. Separate coupler sleeves (.4).
2. Remove and discard preformed packing (B) from fuel injection pump coupler sleeve.

Figure 4-53. Separating fuel injection pump coupler sleeves.



1. Turn engine using splined wrench -5120-793-7895 as shown in figure 4-51 until one pair of bolts (A) on the diaphragm coupler is exposed for removal.
2. Remove two bolts and lock washers. Turn engine until remaining pair of bolts are accessible and remove them.

Figure 4-54. Removing fuel injection pump diaphragm coupler bolts.



Remove

1. Cut lockingwire and remove two screws (A) attaching breather tube bracket to pump. Remove bracket. Install the two screws in the pump (early pump only).
2. Cut locking wire and remove two bolts (B) and washers.
3. Remove bolt (C) and washer.
4. Loosen bolt (D) until threads are free. Bolt cannot be removed until after fuel injection pump is removed from engine.

Install

Note. Be sure lower right hand fuel injection pump long mounting bolt (D) and washer are inserted in injection pump before pump is seated on mounting base. It cannot be installed with pump in position.

1. Tighten bolt (D).
2. Install long bolt (C) and washer.
3. Install two short bolts (B) and washers. Install locking wire on bolts (B and C) and on bolts (B and D).
4. Remove two screws (A) from pump (early pump only). Position breather tube bracket on pump and install two screws (A). Install locking wire.

Figure 4-55. Removing or installing fuel injection pump mounting bolts and breather tube bracket-engines with breather tube routed around injection pump.



Remove

1. Separate fuel injection pump diaphragm coupler halves (A).
2. Cut locking wire and remove two bolts (B) and washers.
3. Remove bolt (C) and washer.
4. Loosen bolt (D) until threads are free. Bolt cannot be removed until after fuel injection pump is removed from engine.

Install

Note. Be sure lower right hand fuel injection pump long mounting bolt (D) and washer are inserted in injection pump before pump is seated on mounting base. It cannot be installed with pump in position.

1. Tighten bolt (D).
2. Install long bolt (C) and washer.
3. Install two short bolts (B) and washers. Install locking wire on bolts (B and C) and on bolts (B and D).

Figure 4-56. Separating fuel injection pump diaphragm coupler and removing or installing fuel injection pump mounting bolts.



1. Remove fuel injection pump (A) from mounting base.
2. Remove and discard preformed packing (B) from mounting base.
3. Remove bolt (C) and washer.

Note. Plug or cap fuel and oil openings in pump.

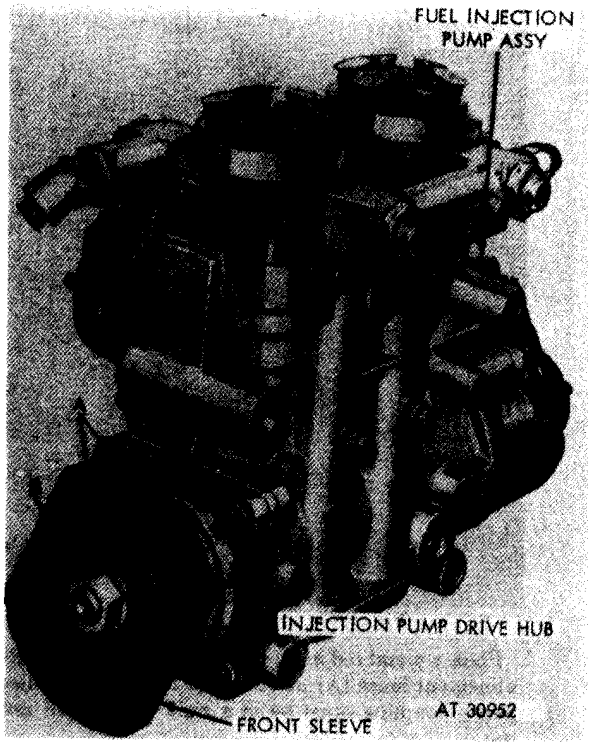
Figure 4-57. Removing fuel injection pump and preformed packing-splined coupler.



1. Remove fuel injection pump (A) from mounting base.
2. Remove and discard preformed packing (B) from mounting base.
3. Remove bolt (C) and washer.

Note. Plug or cap fuel and oil openings in pump.

Figure 4-58. Removing fuel injection pump and preformed packing-diaphragm coupler.



1. Place a metal rod in one of the sleeve alinement holes (A) as shown in figure 4-63. Coupler sleeve must be in rigid position to remove nut.
2. Remove plain nut (B) and lock washer.

Note. The nut, lock washer, and key are part of the pump assembly and must be installed on pump after hub is removed.

Caution: The splined coupler halves are a matched set. Damage or wear to the sleeve or hub of either coupling half requires the replacement of a complete coupler assembly.

Figure 4-59. Removing fuel injection pump front splined coupler sleeve nut and lock washer.



1. Place a metal rod in one of the injection pump coupler alinement holes (A) as shown in figure 4-64. Injection pump coupling must be in a rigid position to remove nut.
2. Remove plain nut (B) and lock washer.

Note. The nut, lock washer, and key are part of the pump assembly and must be installed on the pump after the coupler sleeve is removed.

Figure 4-60. Removing fuel injection pump diaphragm coupler nut and lock washer.

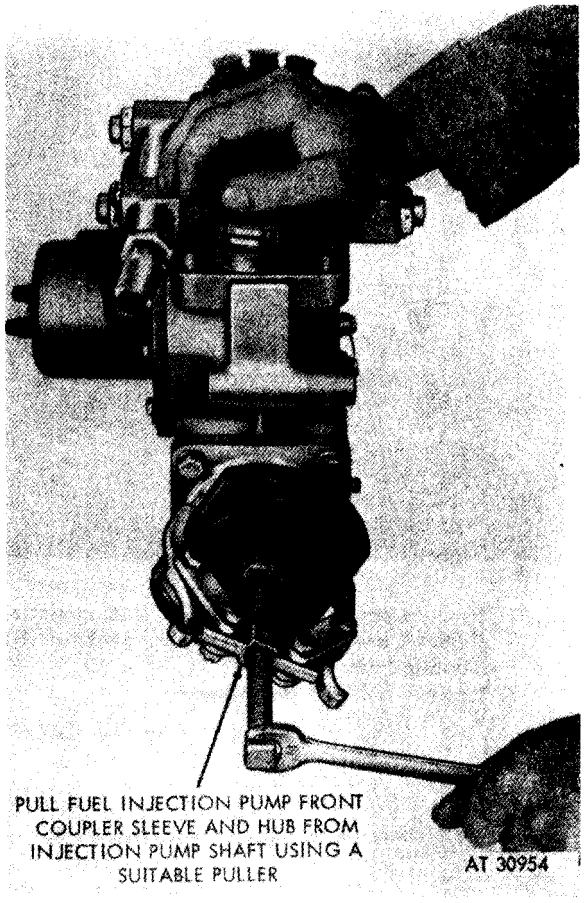
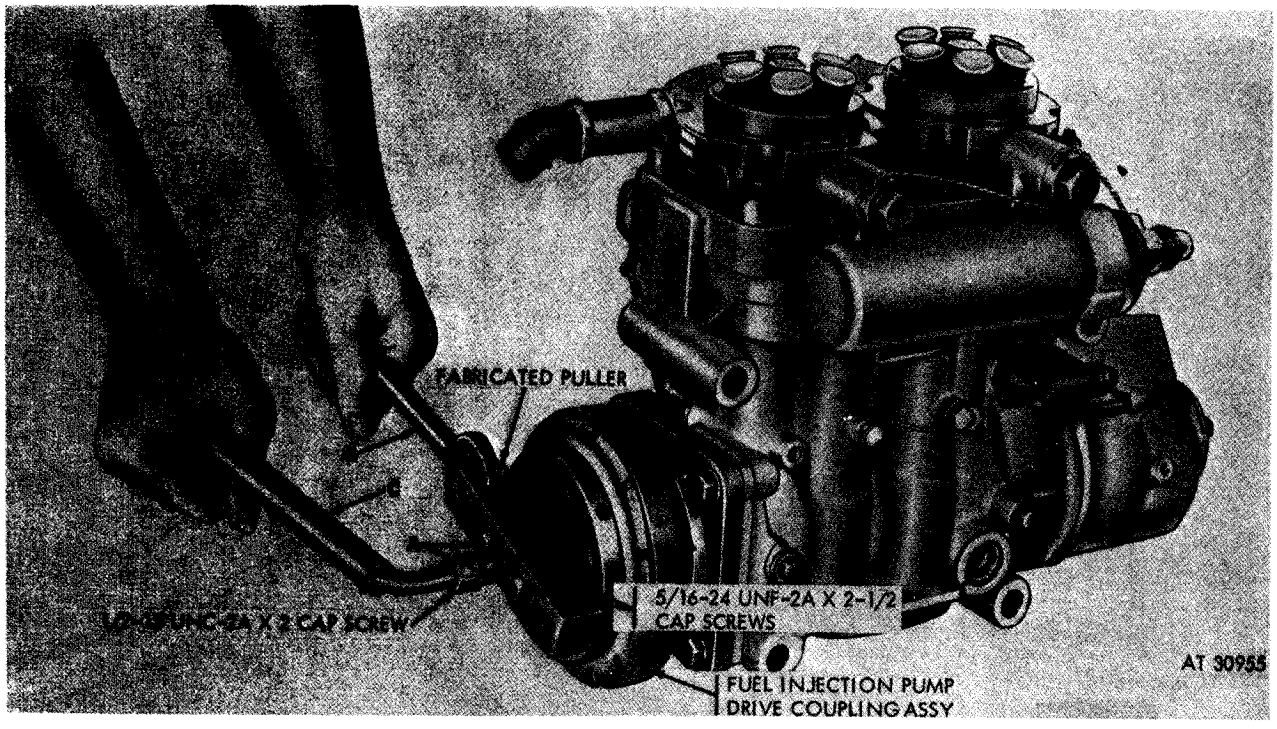


Figure 4-61. Removing fuel injection pump splined coupler sleeve and hub.



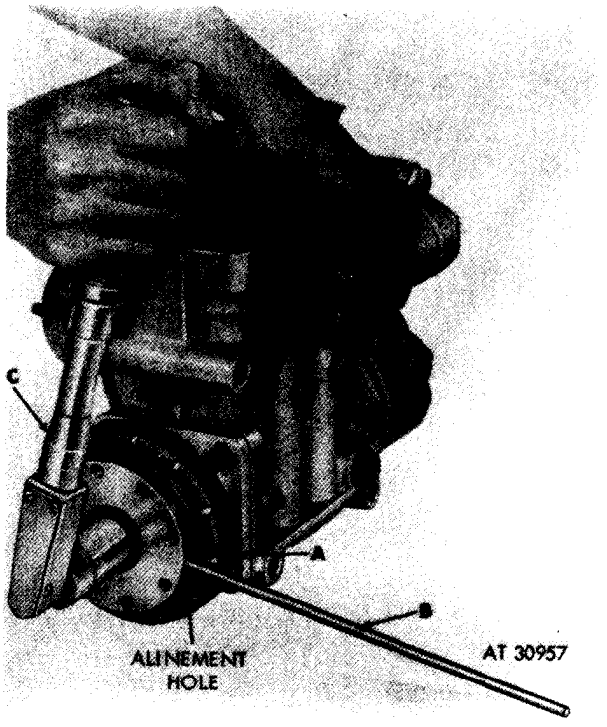
1. Position improvised puller (fig. 2-2) on diaphragm coupler and install two 5 / 16-24 UNF-2A x 2-1 / 2 in. hex head cap screws (A) into puller screw holes provided in the diaphragm coupler.
2. Hold improvised puller with a 1 in. open end wrench (B).
3. Tighten 1 / 2-13 UNC-2A x 2 in. hex head cap screw (C) to remove diaphragm coupler from injection pump tapered shaft.

Figure 4-62. Removing fuel injection pump diaphragm coupler.



1. Install new preformed packing (A) in groove in face of coupler sleeve. Use a light coating of grease to hold preformed packing in position.
2. Position Woodruff key and injection pump coupler half (B) on pump shaft and install lock washer and plain nut (B, fig. 4-59).
3. Insert a metal rod (C) in one of the alinement holes in the injection pump coupler.
4. Tighten plain nut to 900 pound-inches using a torque wrench (D).

Figure 4-63. Installing coupler half and torque tightening fuel injection pump splined coupler nut.



1. Position Woodruff key and injection pump coupler half (A) on pump shaft and install lock washer and plain nut (B, fig. 4-60).
2. Insert a metal rod (B) in one of the alinement holes in the injection pump coupler.
3. Tighten plain nut to 900 pound-inches using a torque wrench (C).

Figure 4-64. Installing coupler half and torque tightening fuel injection pump diaphragm coupler nut.

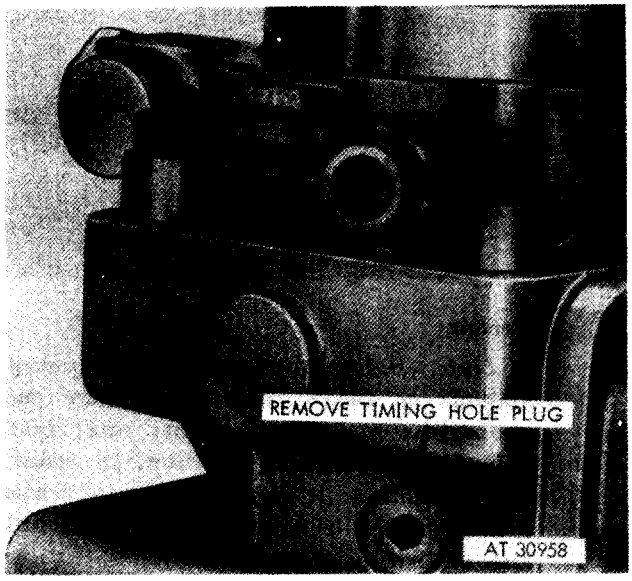


Figure 4-65. Removing or installing fuel injection pump timing hole plug.

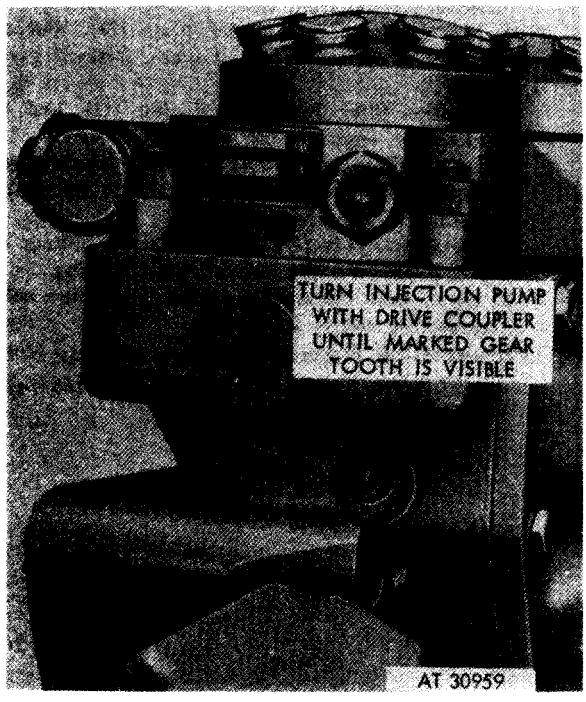


Figure 4-66. Fuel injection pump timing hole cover removed showing marked gear tooth in timed position.



Note. It is possible to have timing marks on both splined coupler and diaphragm coupler alined with mark on injection pump and not have the marked gear tooth visible in timing hole. Make sure marked tooth (fig. 4-66) is visible when timing marks are alined. If the marked tooth is not visible, rotate the coupler 360 degrees, in either direction. Aline the timing marks and the marked tooth will be visible. Install timing plug.

Figure 4-67. Timing marks on fuel injection bearing retaining plate and splined coupler hub alined.

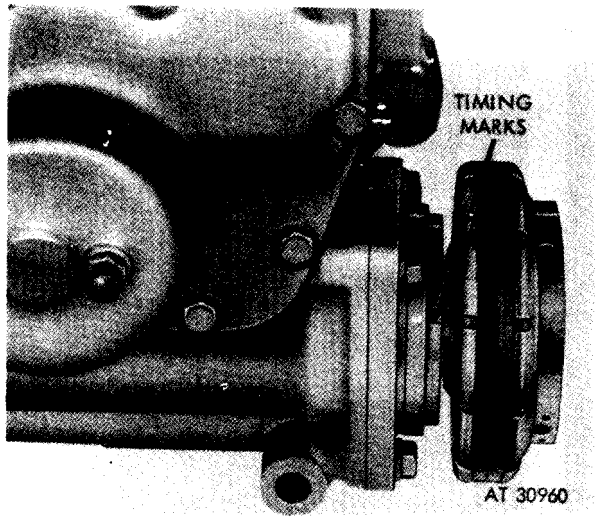


Figure 4-68. Timing marks on fuel injection pump bearing retaining plate and diaphragm coupler hub alined.

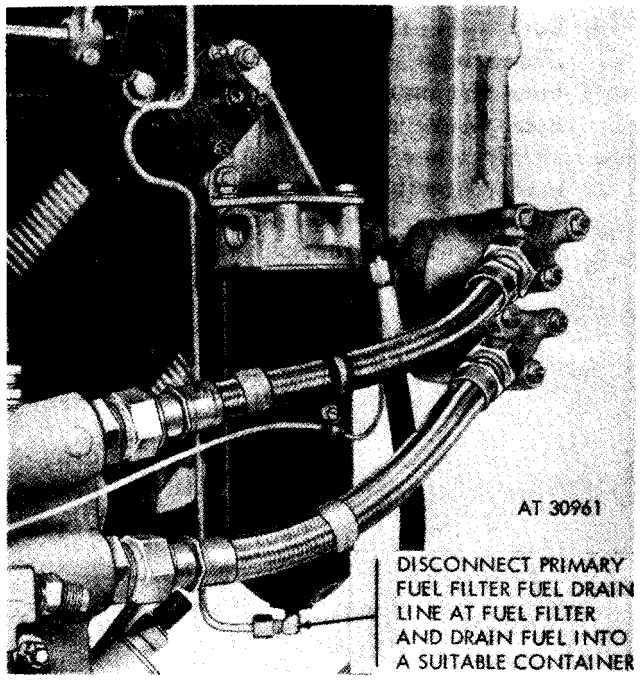
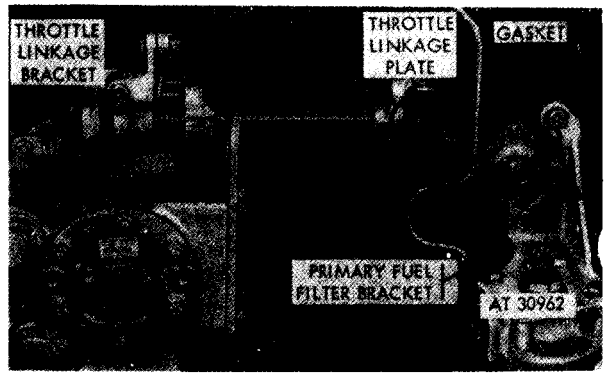


Figure 4-69. Disconnecting or connecting primary fuel filter drain line.



Remove

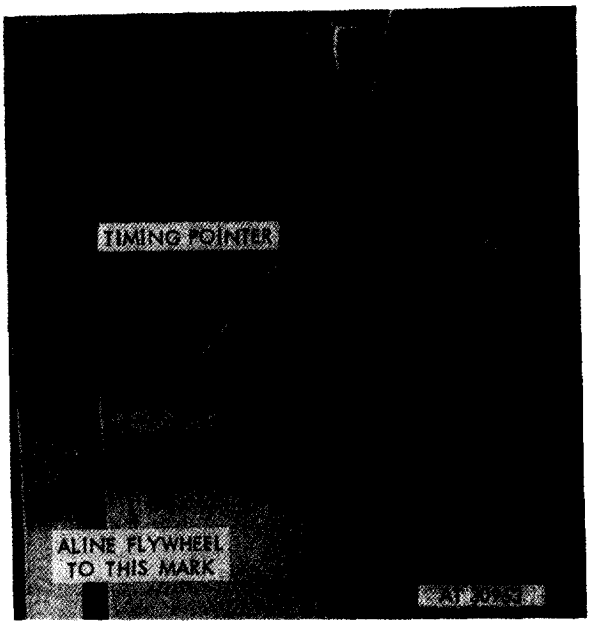
Note. Before the fuel injection pump is installed on the engine, the engine must be properly timed with number one right bank cylinder in the firing position. In order to set engine timing, it is necessary to remove the primary fuel filter bracket and throttle linkage to check position of camshaft. lobes (fig. 4-73).

1. Remove three screws (A) and lock washers attaching primary fuel filter bracket and throttle linkage plate to number 1R cylinder assembly.
2. Remove two bolts (B) attaching throttle linkage bracket to crankshaft damper and oil fiber housing.
3. Remove cotter pin, nut (C), flat washer, and bolt and disconnect rod from lever. Discard cotter pin.
4. Move filter, bracket and plate (D), and throttle linkage to expose camshaft lobes. Discard gasket.

Install

1. Position filter, bracket and plate (D), and throttle linkage on engine using new gasket.
2. Install three screws (A) and lock washers securing primary fuel filter bracket and throttle linkage plate to number 1R cylinder assembly.
3. Install two bolts (B) securing throttle linkage bracket to camshaft damper and oil filter housing.
4. Install bolt, flat washer, nut (C), and new cotter pin connecting rod to lever.

Figure 4-70. Removing or installing primary fuel filter bracket and throttle linkage.



1. Turn flywheel (A) using splined wrench - 5120-793-7895 (fig. 4-51).
2. A line 1R INJ PORT CLOSE timing mark on flywheel with timing pointer (B).

Caution: Be sure pointer alines with correct timing mark on flywheel. Refer to figure 6-40 to check timing mark location.

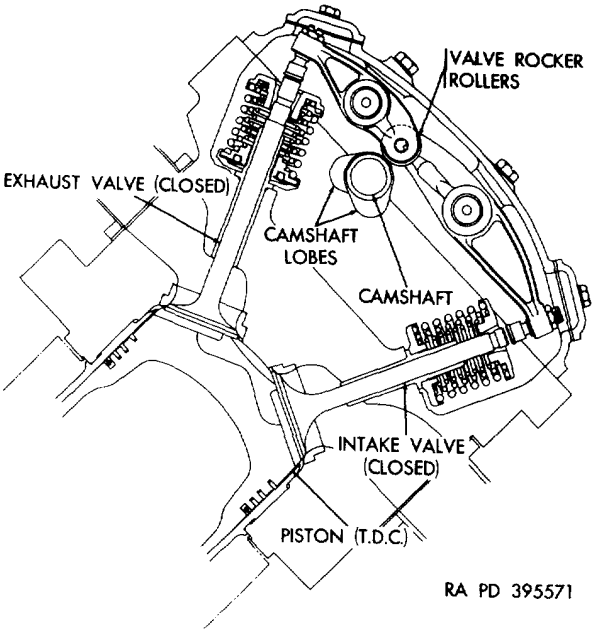
Figure 4-71. Flywheel in position for fuel injection pump timing (Models AVDS-1790-2-M and AVDS-1790-2-AM only).



1. Turn flywheel (A) using splined wrench -5120-793-7895 (fig. 4-51).
2. Aline 1R INJ PORT CLOSE modified timing mark on flywheel with timing pointer (B).

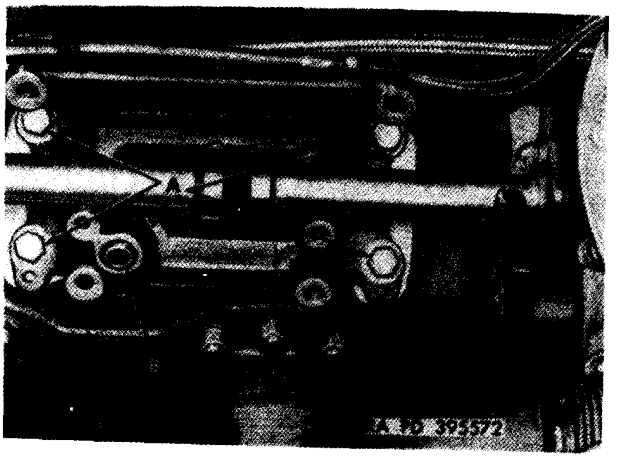
Caution: Be sure pointer alines with correct timing mark location on flywheel. Refer to figure 6-41 to check timing mark location.

Figure 4-72. Flywheel in position for fuel injection pump timing (Model AVDS-1790-2A only).



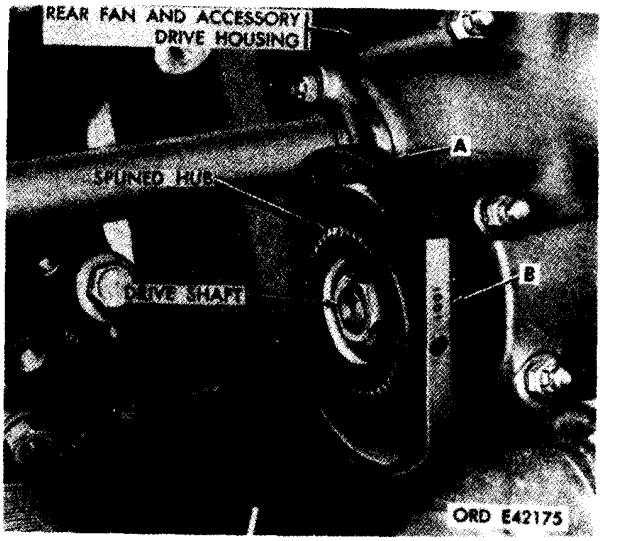
Note. Camshaft lobes must be in position Shown for proper injection pump timing.

Figure 4-73. Position of camshaft lobes for injection pump timing.



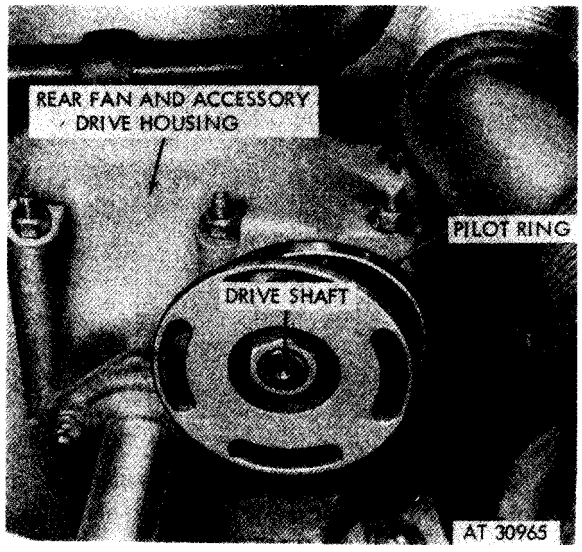
1. Check length of bolts (A) securing fuel injection pump mounting base to crankcase. Discard bolts that are 1-7 / 32 in. long and replace with the correct 1-3 / 8 in. long bolts (5305-725-0154) and lock washers (5310-584-5272). Torque tighten bolts to 720 to 780 pounds-inch.
2. Position new preformed packing (B) on mounting base oil transfer tube.

Figure 4-74. Installing preformed packing on fuel injection pump mounting base oil transfer tube.



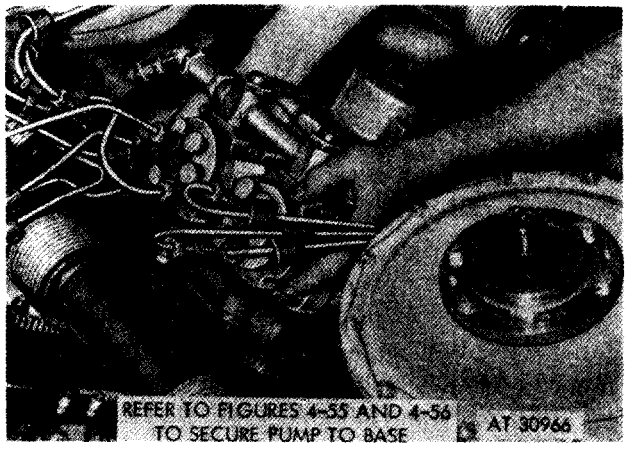
1. Push drive coupler sleeve (A) toward rear fan and accessory drive housing, until sleeve clears splined hub.
2. Rotate coupler sleeve (B) until identification numbers approximate the correct position to mate with fuel injection pump drive coupler sleeve identification numbers.

Figure 4-75. Correct position of fuel injection pump drive coupler on hub before pump installation.



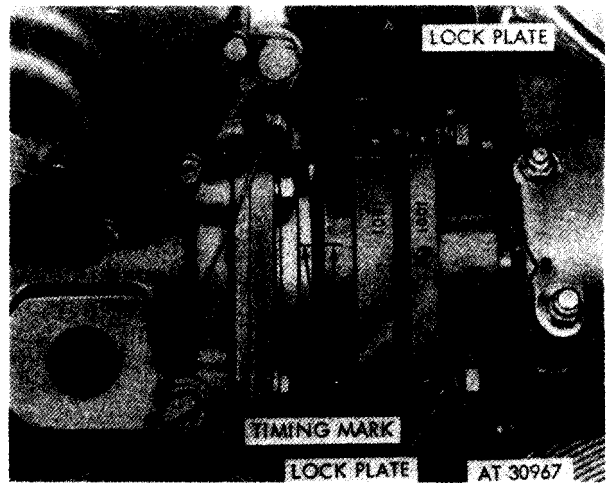
Note. The fuel injection pump diaphragm coupler parts are not matched sets, and parts are interchangeable between assemblies. The coupler hub and pilot ring on the drive shaft need not be removed or replaced unless they are damaged. Check torque tightness of nut securing coupler to drive shaft (900 lb-in.).

Figure 4-76. Fuel injection pump diaphragm coupling and pilot ring on hub before pump installation.



Note. Be sure lower right fuel injection pump mounting bolt is inserted in injection pump before pump is seated on mounting base. It cannot be installed with pump in position. Refer to figures 4-55 and 4-56 to secure pump to base.

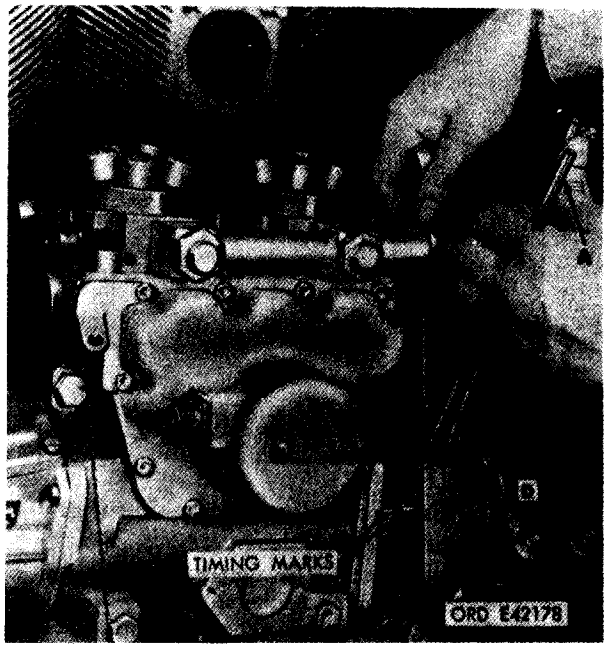
Figure 4-77. Installing fuel injection pump assembly on engine.



Note. Be sure preformed packing (fig. 4-63) is installed in coupler sleeve.

1. Postion fuel injection pump coupler sleeves (A) making sure timing marks on bearing retaining plate and coupler hub remain alined as shown. These marks must be alined before attempting to assemble the coupler.
2. Loosely position four lock plates, lock washers, and bolts (B) in drive shaft coupler sleeves. These bolts will not be tightened until gear backlash has been removed, with timing marks on pump alined as instructed in figure 4-79.

Figure 4-78. Positioning fuel injection pump coupler sleeve s-splined coupler.

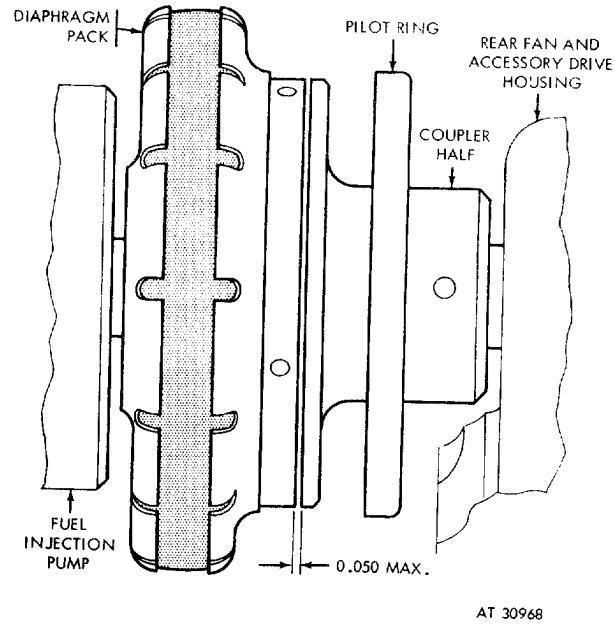


1. Using two 5 / 16-in. steel rods (A), hold fuel injection pump drive coupler sleeve (nearest the pump) stationary and rotate the other drive coupler sleeve counterclockwise to remove backlash from the pump drive shaft.
2. When backlash is removed and flat sides of drive coupler mate, tighten four drive coupler bolts (B) securely.
3. When flat sides of drive coupler sleeves (C) do not mate when backlash is removed, the coupler sleeves must be separated and reset. Separate coupler and push sleeve of drive coupler on rear fan and accessory drive housing (fig. 4-75) shaft toward drive shaft and from hub splines. Adjust sleeve on splines so flat sides of coupler half are alined. Torque tighten coupler bolts. Lubricate drive coupler (fig. 4-80).

Figure 4-79. Removing fuel injection pump drive gear train backlash and setting advanced unit retard position-splined coupler.

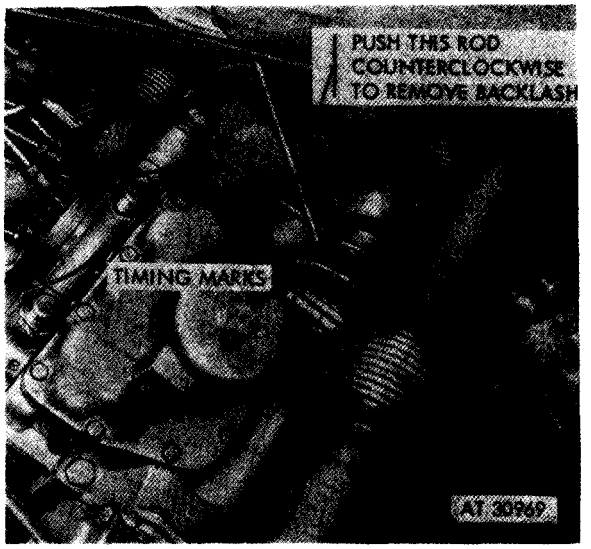


Figure 4-80. Fuel injection pump splined drive coupler with lubrication fitting installed.



Note. For proper assembly of coupler half to diaphragm pack, place a pry bar between rear fan and accessory drive housing and coupler half and apply pressure to take up the end thrust of drive gear. Measure clearance between coupler half and diaphragm pack. This clearance cannot exceed 0.050-inch or it will put undue stress on the diaphragm pack causing early failure. If the 0.050-inch dimension cannot be achieved, it will be necessary to remove fuel injection pump and replace coupler hall or complete coupling assembly. Torque coupler half retaining nut to 900 inch-pounds when installing new coupler half.

Figure 4-81. Checking diaphragm coupler assembly clearance.



1. Using two 5 / 16-in. steel rods (A) hold fuel injection pump drive coupling flange (nearest the pump) stationary and rotate the other coupling half counterclockwise to remove backlash from the pump drive shaft.
2. Making certain timing marks (B) are a lined and backlash is removed, position pilot ring (C) on coupler half and install four lock washers and bolts.

Figure 4-82. Removing fuel injection pump drive gear train backlash and setting advance unit retard position-diaphragm coupler.

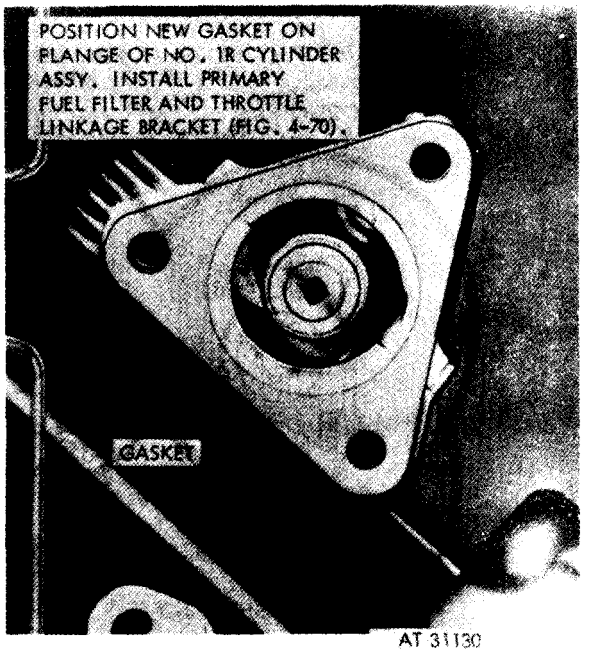
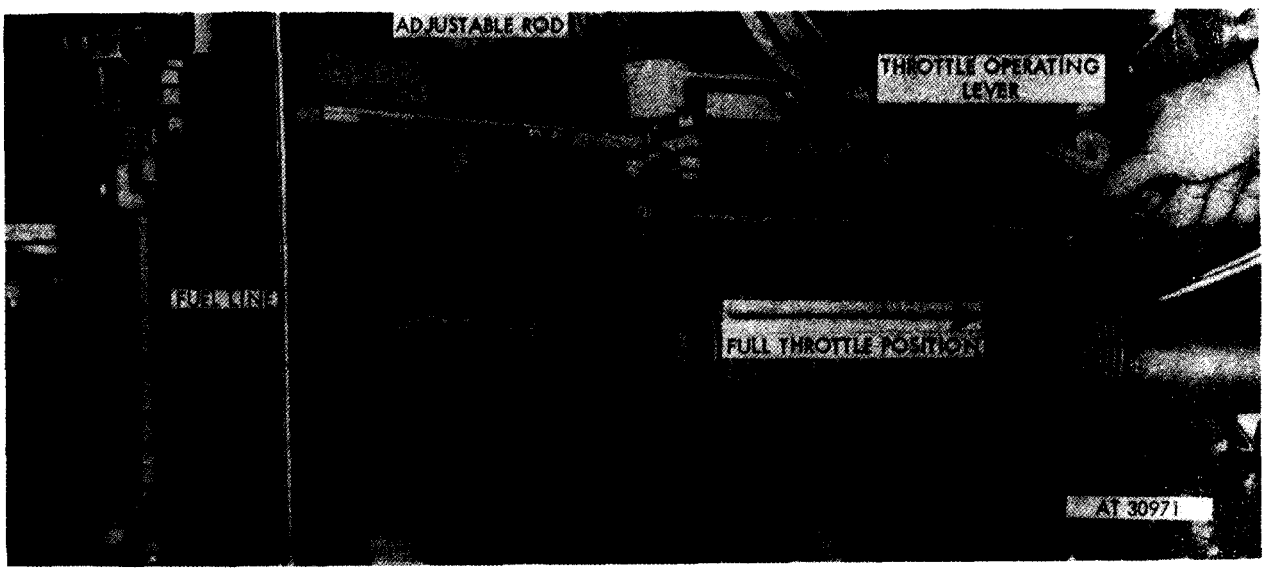
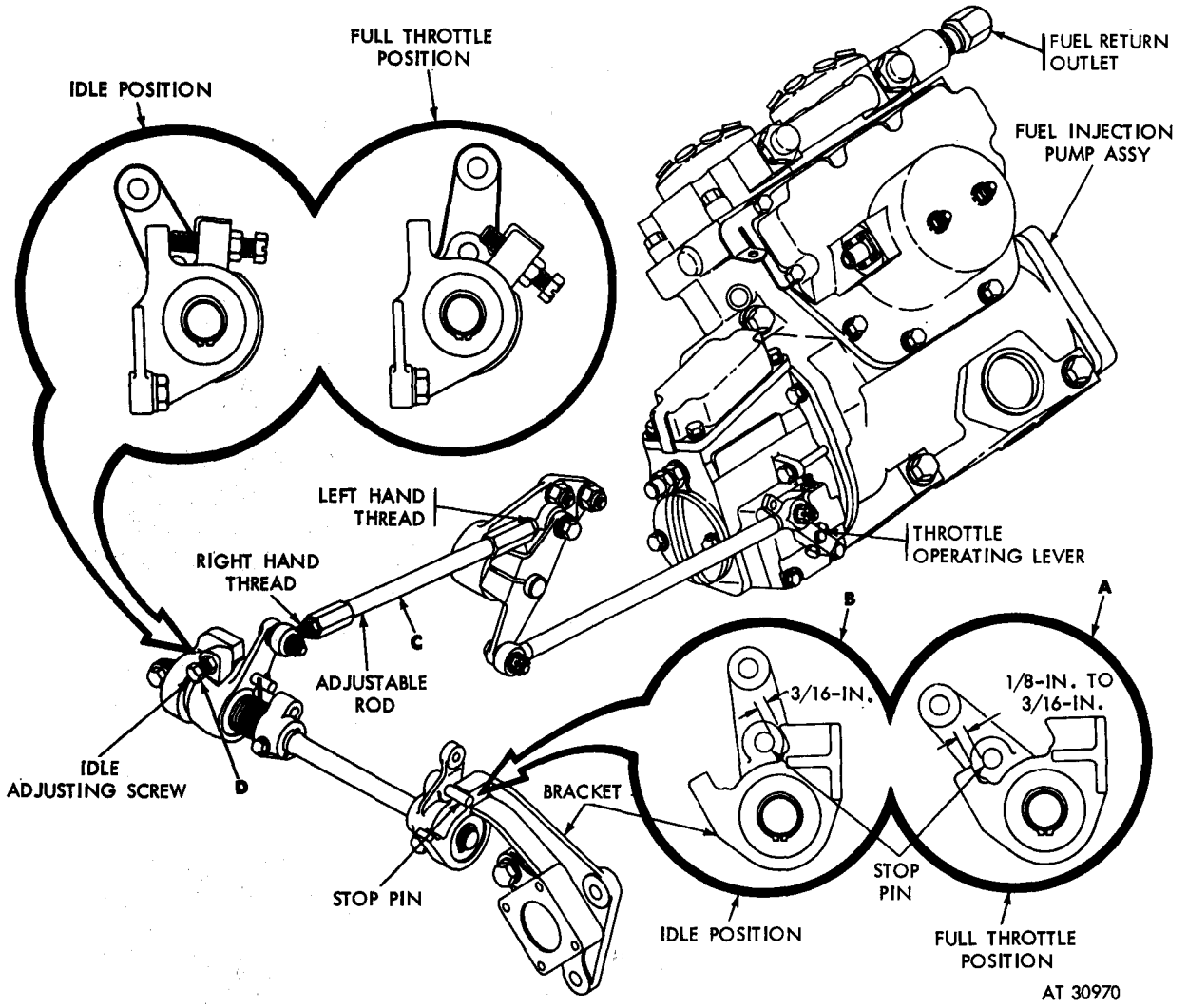


Figure 4-83. Installing gasket on cylinder 1R before installing primary fuel filter and throttle linkage.



1. Check throttle linkage (A) for free movement.
2. Check lever operation (B) and adjust linkage as shown on figure 4-85.

Figure 4-84. Checking throttle linkage for free movement.

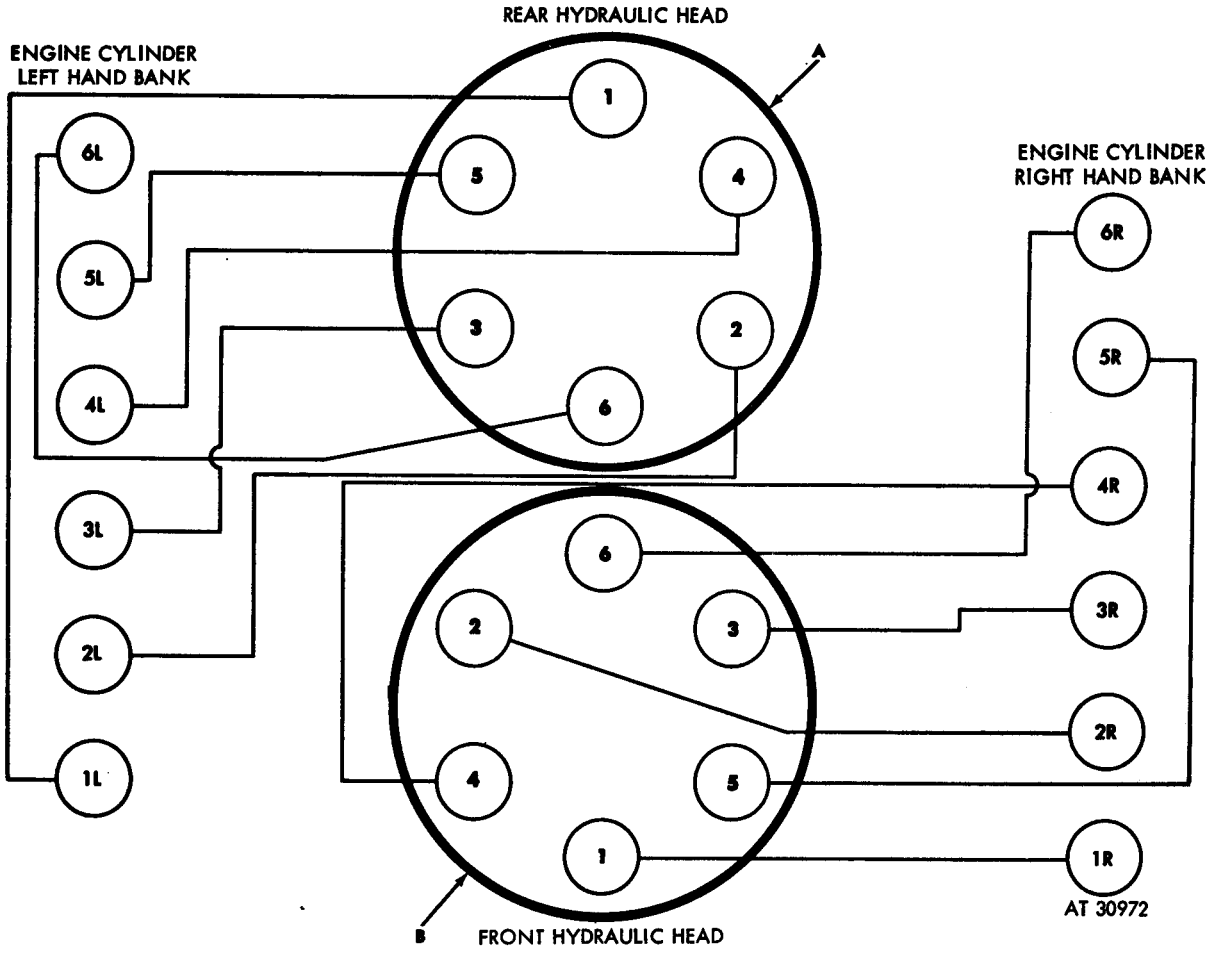


1. With throttle linkage in full throttle position (A), clearance between lever stop pin and stop on bracket must be 1/8 to 3 / 16 inch.
2. With throttle linkage in idle position (B), clearance between lever stop pin and stop on bracket must be 3 / 16 inch.
3. When the foregoing clearances are not met, loosen lock nuts on adjustable rod (C) and adjust rod as necessary to obtain required clearance. Tighten lock nuts after adjustment.
4. The idle adjusting screw (D) must not be set until engine is installed and tested.
5. Check the fuel supply as follows:

a. Connect the necessary fuel and oil hoses and electrical harnesses to the engine to permit slave operation from the vehicle to check for fuel and / or oil leaks. Activate the vehicle in-tank fuel pumps to make certain fuel is supplied to and through the fuel injection pump. Fuel should flow from the fuel return outlet (fig. 4-85).

b. Crank the engine with the starter until fuel flows from all outlet ports in the fuel injection pump hydraulic head.

Figure 4-85. Throttle linkage adjustment-schematic diagram.



Note. The hydraulic head outlet ports are numbered on late fuel injection pumps.

1. Connect the left bank fuel injector tubes to the rear injection pump hydraulic head (A) in the following order: No. 5, 3, 1, 6, 2, and 4.
2. Connect the right bank fuel injector tubes to the front injection pump hydraulic head (B) in the following order: No. 2, 4, 1, 6, 5, and 3.

Note. Tighten fuel injector tube fittings until a sharp increase in torque becomes apparent. This will indicate that the fitting sleeve is seated. When this point is reached, draw the nut up approximately 1 / 6 of a turn (minimum) but not more than 1 / 3 of a turn (maximum), to complete tightening operation.

Caution: Overtightening will damage tube ferrule causing fuel leaks.

Figure 4-86. Connecting fuel injector tubes-schematic diagram.

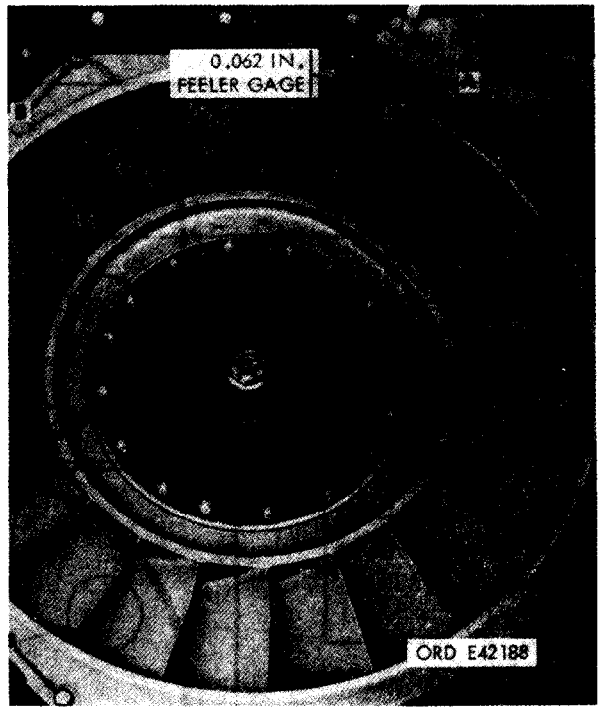


Note. The fuel injection pump, fuel tubes, and fuel tube connections must be checked for fuel leaks with the engine running before the cooling fans are installed.

Caution: Do not run engine above idle and not longer than ten minutes without cooling fans.

1. Install a fan rotor hub sleeve spacer -4910-795-7952 (A) on each fan drive vertical drive shaft to prevent oil seepage at fan drive oil seals while operating engine.
2. Secure the sleeve spacer (A) to each drive shaft with the same nut (B) used to secure the cooling fan. Start engine and check for fuel leaks. If leaks are evident loosen the tube fittings and retighten. Replace fuel injection tubes if leak persists.
3. Slide the 12 fuel injector tube dust caps (C) over tube fittings at fuel injection pump hydraulic head.

Figure 4-87. Front fan drive housing fan rotor hub sleeve spacer-4910-795-7952 installed for leakage test.



1. With cooling fan shroud and fan housing installed, check clearance between end of each cooling fan blade and rim of cooling fan housing with feeler gage (A). Clearance must be 0.062 inch minimum.
2. When clearance is not within limits loosen screws (B) and shift housing as necessary until clearance is obtained.

Figure 4-88. Checking cooling fan blade clearance.

Section III. REPLACEMENT OF MAIN AND AUXILIARY OIL FILTER BYPASS VALVE, OIL PRESSURE REGULATOR VALVE AND FUEL / WATER SEPARATOR FILTER

4-5. General

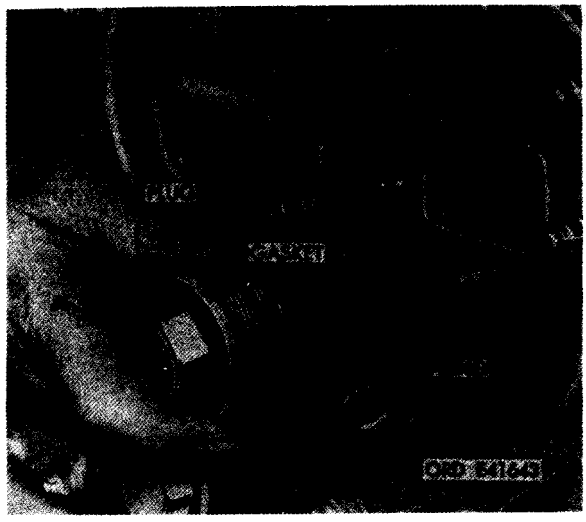
This section covers the replacement of the main and auxiliary oil filter bypass valves, the oil pressure regulating valve, and the fuel / water separator filter. The valves are not periodic maintenance items, and should only be removed for inspection or replaced in case of malfunction. The two outer elements in the fuel / water separator filter are periodic maintenance items and are allocated to the organizational maintenance personnel. These are coalescer elements designated to separate water from the fuel system. The center element is a final fuel filter

element and is replaced annually or at time of engine overhaul. Refer to Table 4-2 for replacement and service instructions. Reference figures are listed under appropriate headings in the table.

Table 4-2. Main and Auxiliary Oil Filter Bypass Valves, Oil Pressure Regulating Valve, and Fuel / Water Separator Filter Assembly

Component	Removal	Installation
Main Oil Filter Bypass Valve	4-89, 4-90	4-90, 4-89
Auxiliary Oil Filter Bypass Valve	4-91, 4-92	4-92, 4-91
Oil Pressure Regulating Valve	4-93	4-93
Fuel / Water Separator Filter Assembly	4-94 through 4-96	4-96 through 4-94
Fuel / Water Separator Filter Elements	4-94, 4-97, 4-98	4-98, 4-97, 4-94

4-6. Replacement Instructions



Remove
1. Remove main oil filter bypass valve plug (A).
2. Remove and discard plug gasket (B).
3. Remove bypass valve spring (C).

Install
1. Install bypass valve spring (C).
2. Install new gasket (B) on valve plug (A).
3. Install main oil filter bypass valve plug (A).

Figure 4-89. Removing or installing main oil filter bypass valve plug, gasket and spring.



Figure 4-90. Removing or installing main oil filter bypass valve.



Remove

1. Remove auxiliary oil filter bypass valve plug (A).
2. Remove and discard plug gasket (B).
3. Remove bypass valve spring (C).

Install

1. Install bypass valve spring (C).
2. Install new gasket (B) on valve plug (A).
3. Install auxiliary oil filter bypass valve plug (A).

Figure 4-91. Removing or installing auxiliary oil-filter bypass valve plug, gasket, and spring.

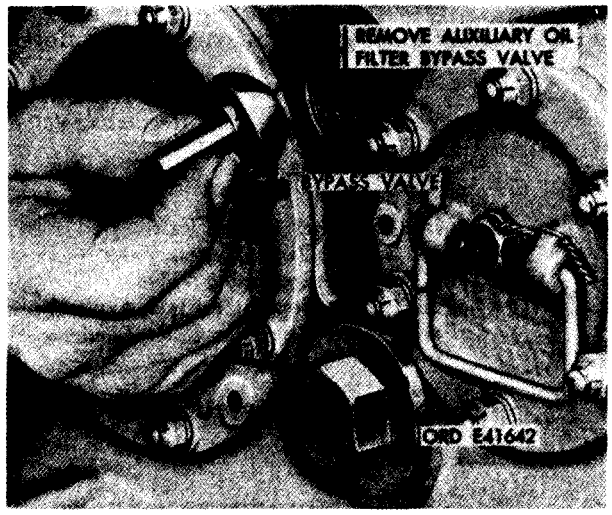
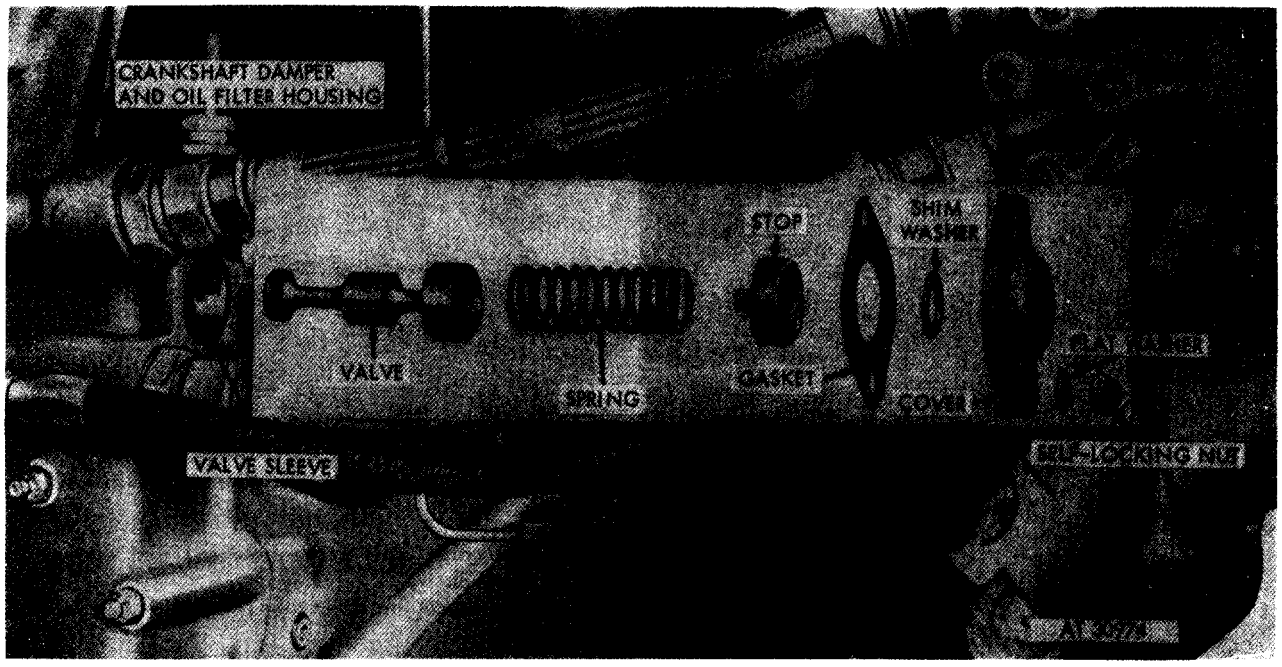


Figure 4-92. Removing or installing auxiliary oil filter bypass valve.



Warning: The valve cover is spring loaded. Excercise care when removing cover.

Remove

1. Remove two self-locking nuts and flat washers attaching cover to crankshaft damper and oil filter housing.
2. Remove cover shim washers, and gasket. Discard gasket.
3. Remove stop, spring, and valve.
4. Remove valve sleeve.

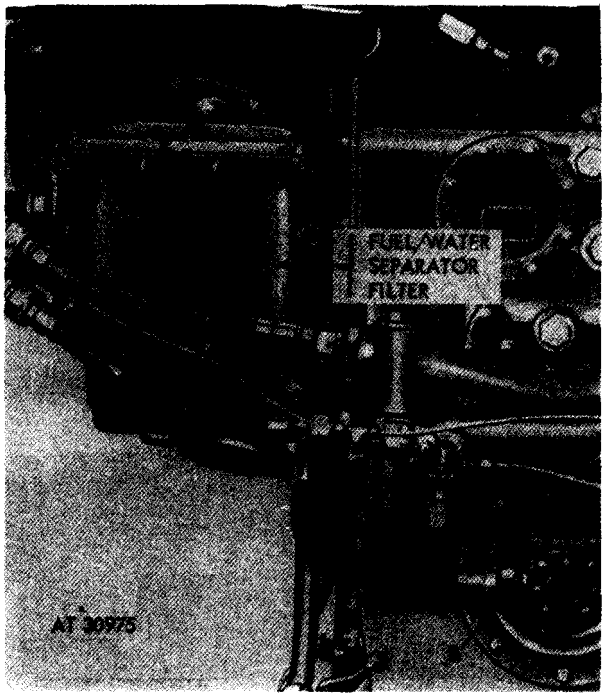
Note. The valve sleeve may be difficult to remove because of the presence of varnish from the oil. An improvised tool (fig. 2-3) used with mechanical puller-5120-310-4668 may be used to assist in removing valve sleeve. Insert hook end of tool into hole in sleeve and gently tap until sleeve is free.

Install

1. Install valve sleeve.
2. Install valve, spring, and stop.
3. Install new gasket, shim washers, and cover.
4. Install two self-locking nuts and flat washers securing cover to crankshaft damper and oil filter housing.

Note. To increase engine oil pressure, one or more shim washers can be installed between the cover and the spring. To decrease oil pressure remove shim washers. Refer to paragraph 1-24 for recommended oil pressures.

Figure 4-93. Removing or installing engine oil pressure regulating valve.



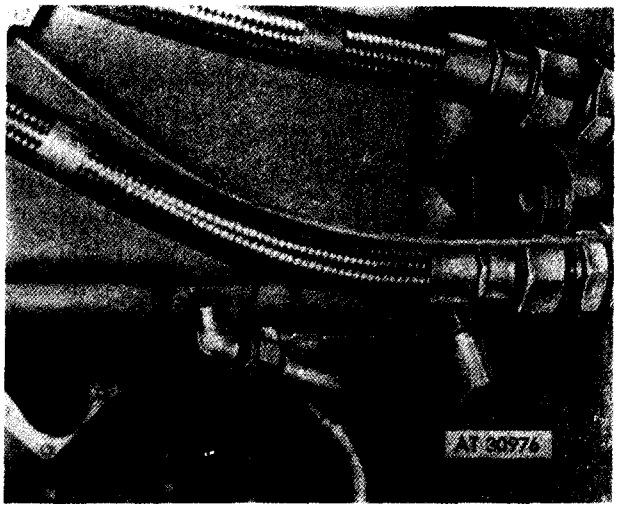
Disconnect

1. Remove vent plug (A) from fuel / water separator filter cover.
2. Disconnect fuel / water separator filter inlet hose (B) at fuel pump outlet and drain fuel into a suitable container.

Connect

1. Connect fuel / water separator filter inlet hose (B) to fuel pump outlet.
2. Instnll vent plug (A) in fuel / water separator filter cover.

Figure 4-94. Disconnecting or connecting fuel water separator filter inlet hose at fuel pump.



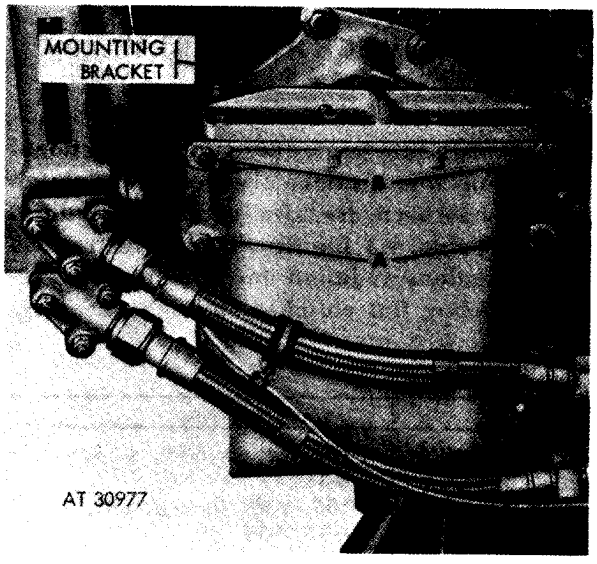
Disconnect

1. Disconnect fuel outlet hose (A) and remove fuel-outlet elbow.
2. Disconnect fuel drain tube (B) and remove fuel drain elbow.
3. Disconnect fuel inlet hose (C) and remove fuel inlet elbow.

Connect

1. Install fuel inlet elbow and connect fuel inlet hose (C).
2. Install fuel drain elbow and connect fuel drain tube (B).
3. Install fuel outlet elbow and connect fuel outlet hose (A).

Figure 4-95. Disconnecting or connecting fuel hoses and drain line at fuel / water separater filter.



Remove

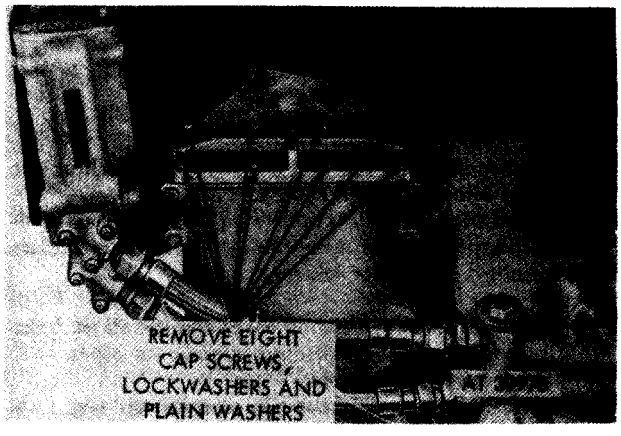
1. Remove lower two cap screws (A), lock washers, and plain washers.
2. Remove upper two cap screws (B) and lock washers and remove filter assembly from bracket.

Note. Fuel inlet, outlet, and drain elbows are not part of the filter assembly and must be installed in the replacement filter.

Install

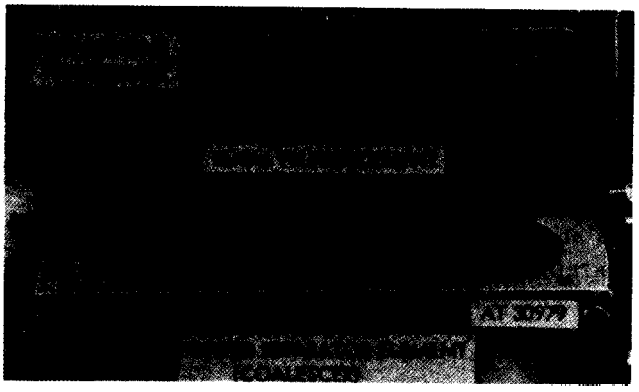
1. Position filter assembly on bracket and install upper two cap screws (B) and lock washers.
2. Install lower two cap screws (A), lock washers, and plain washers.

Figure 4-96. Removing or installing fuel / water separator filter assembly.



Note. Entire area around the fuel / water separator filter should be thoroughly cleaned to prevent the entry of dirt or other foreign objects before removing the cover.

Figure 4-97. Removing or installing fuel / water separator filter cover bolts.



Remove

1. Remove cover (A).
2. Remove and discard preformed packing (B).

Install

Note. Replacement coalescer elements and preformed packing are available in parts kit - 2910-801-1152. Purge fuel system, refer to pertinent operator's manual.

1. Install new preformed packing (B).
2. Install cover (A).

Figure 4-98 Removing or installing fuel / water separator filter cover.

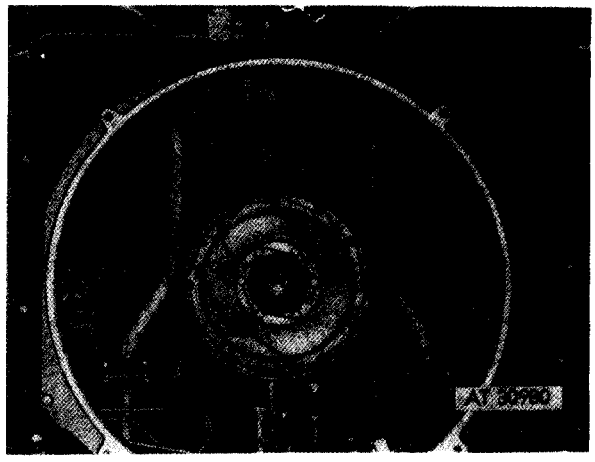
Section IV. REPLACEMENT OF COOLING FAN CLUTCH ASSEMBLY AND FAN DRIVE HOUSING OUTER FLANGE BEARING

4-7. General

This section covers the removal and installation of the cooling fan clutch assembly and the replacement of the outer flange bearing. The front and rear cooling fan clutch assemblies are interchangeable. Replace both clutch assemblies following the same procedure. For instructional purposes in this section, the rear fan clutch assembly has been used for typical procedure. Refer to Table 4-3 for applicable illustrations and instructions required for removing or installing cooling fan clutch and flange bearing.

Table 4-3. Cooling Fan Clutch Assembly

Component	Removal	Installation
Cooling Fan Clutch Assembly	4-34, 4-35, 4-99 through 4-101	4-101 through 4-99, 4-35, 4-34
Fan Drive Housing Outer Flange Bearing	4-34, 4-35, 4-99 through 4-101, 4-103, 4-104	4-105, 4-101 through 4-99, 4-35, 4-34



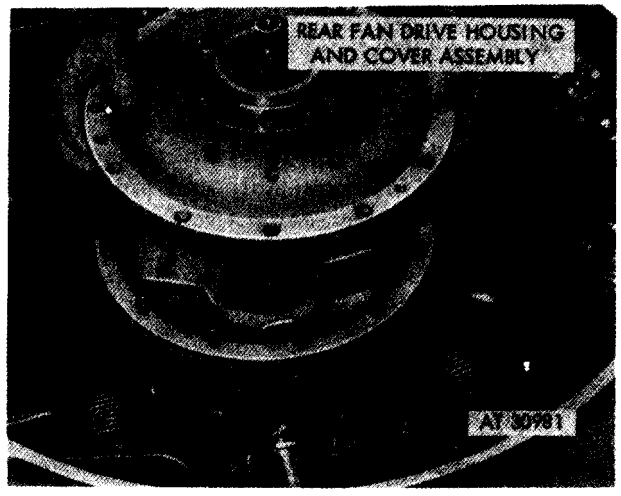
Remove

1. Cut locking wire (A).
2. Remove 12 slotted nuts (B).
3. Install jack screws (5 / 16-24NF thread) (C) into three threaded holes in the fan drive housing cover. Alternately tighten jack screws until fan drive housing and clutch assembly are separated from housing. Remove jack screws.

Install

1. Install 12 slotted nuts (B) securing fan drive housing and clutch assembly.
2. Install locking wire (A).

Figure 4-99. Removing or installing rear fan drive housing cover attaching parts.



Remove

1. Remove housing cover and clutch assembly (A).
2. Cut locking wire (B).
3. Remove six bolts (C) and flat washers attaching the oil seal housing to the cover.
4. Install two mechanical pullers -5120-473-7222 in oil seal housing puller screw holes (D). Turn pullers alternately to remove housing.

Install

1. Position oil seal housing on cover and install six bolts (C) and flat washers securing housing on cover.
2. Install locking wire (B).
3. Install housing cover and clutch assembly (A).

Figure 4-100. Removing or installing rear fan drive housing cover and clutch assembly.

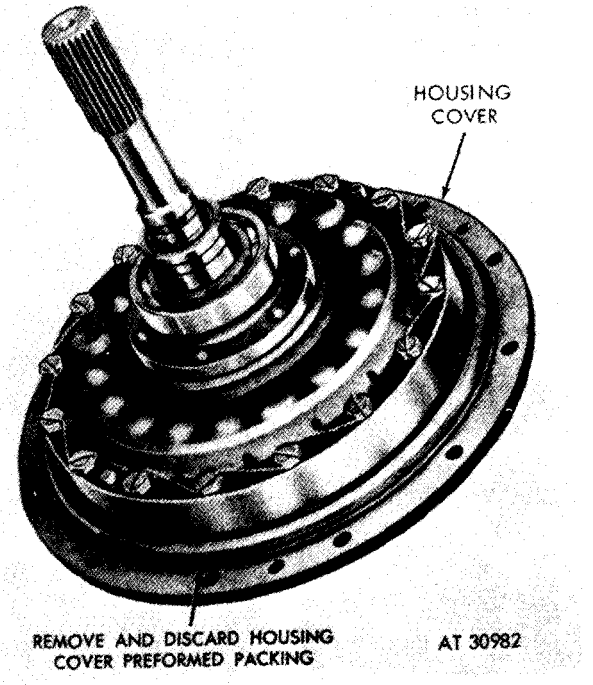


Figure 4-101. Removing or installing fan drive housing cover preformed packing.

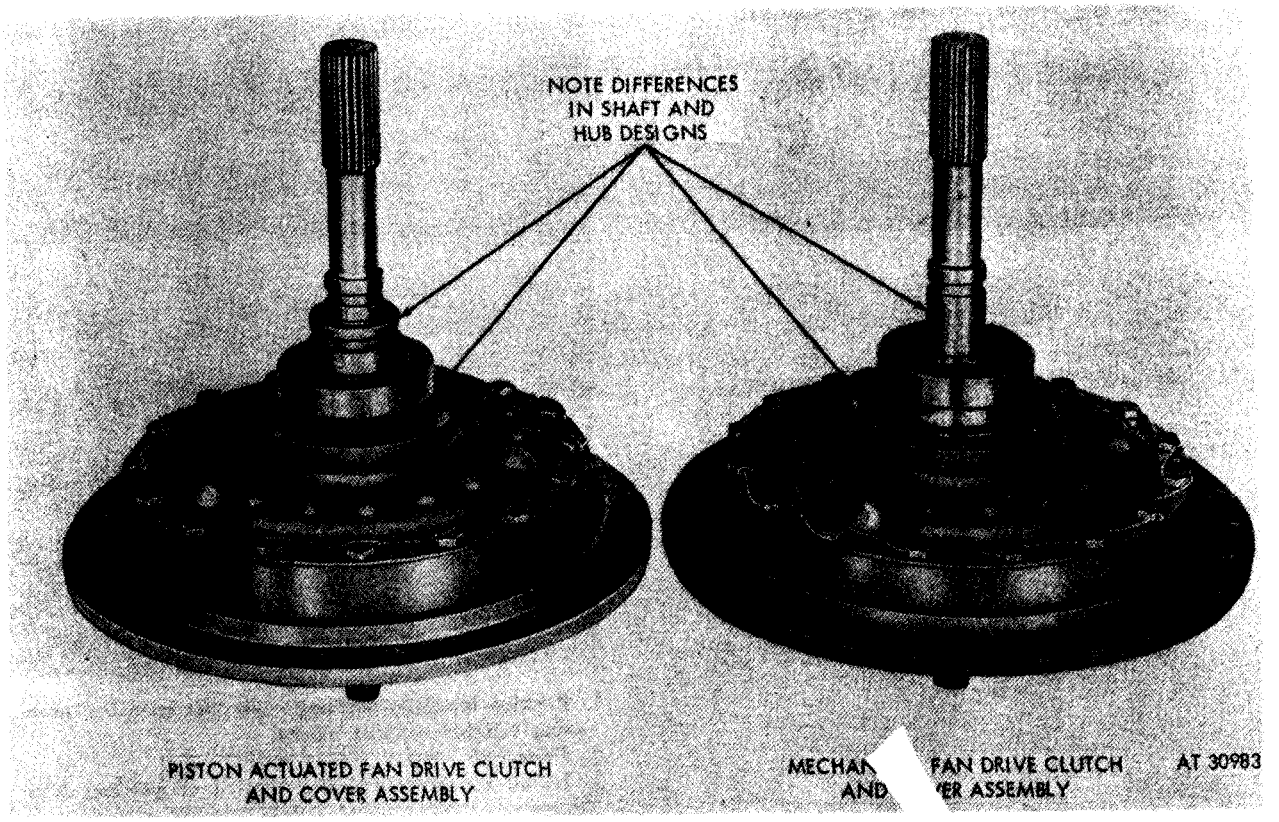


Figure 4-102. Comparison between piston actuated and mechanical fan drive housing and cover assemblies.

4-8. Difference Between Piston Actuated and Mechanical Fan Drive Clutch

The basic difference between the piston actuated and mechanical fan drive clutch is the redesign of the late clutch to eliminate the hydraulic disengagement feature. The mechanical design provides complete interchangeability between piston actuated and mechanical housing and cover assemblies. However, individual parts contained within the assemblies are not interchangeable.

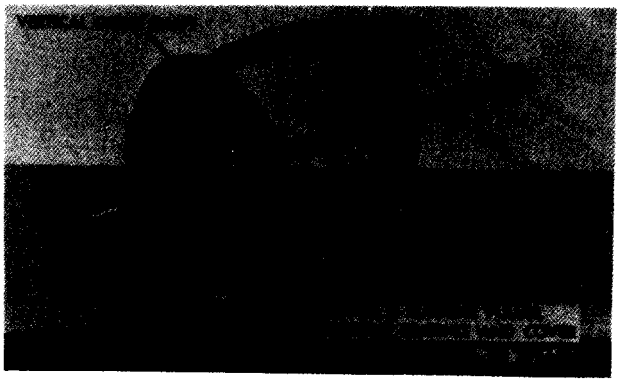


Figure 4-103. Removing housing cover and bearing from vertical drive shaft.

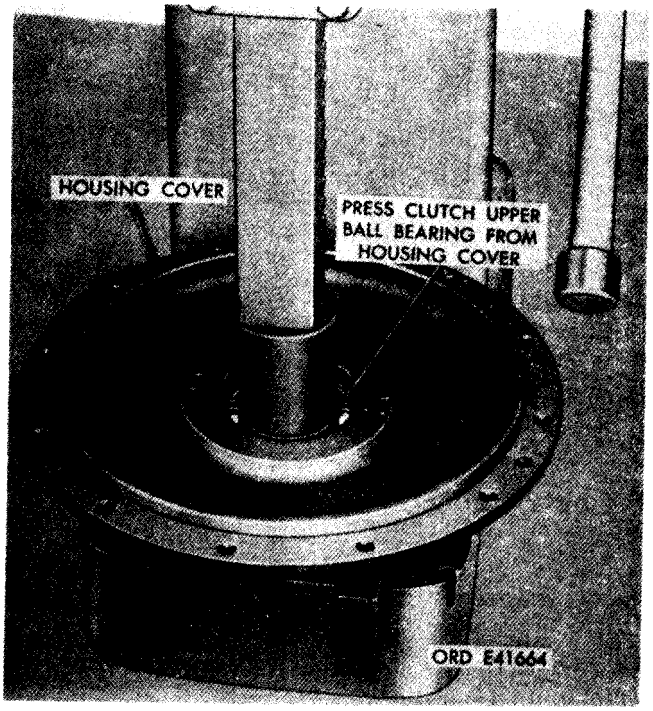
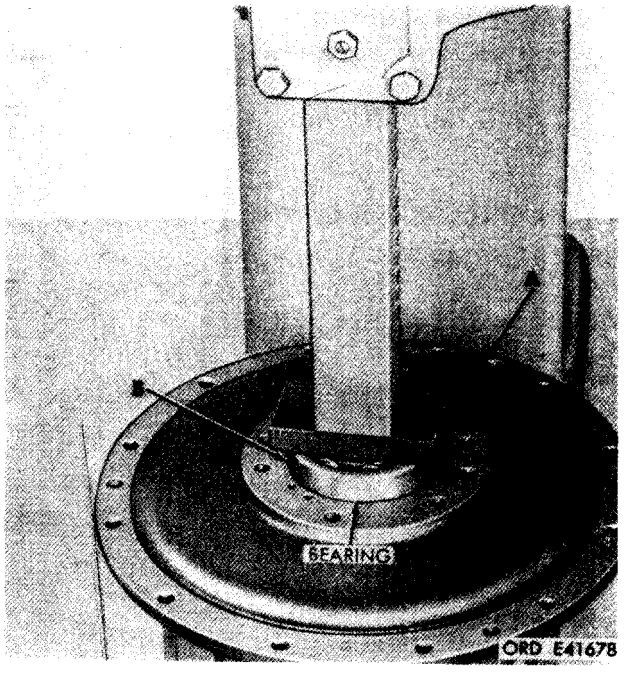


Figure 4-104. Removing fan drive clutch upper ball hearing from housing cover.



1. Position fan drive housing cover (A) on arbor press using suitable support blocks.
2. Press ball bearing (B) in cover.
3. Install housing cover and bearing on vertical drive shaft.

Figure 4-105. Pressing fan drive clutch upper ball bearing into housing cover.

Section V. REPLACEMENT OF INTAKE MANIFOLD TUBES AND INTAKE MANIFOLD ASSEMBLY

4-9. General

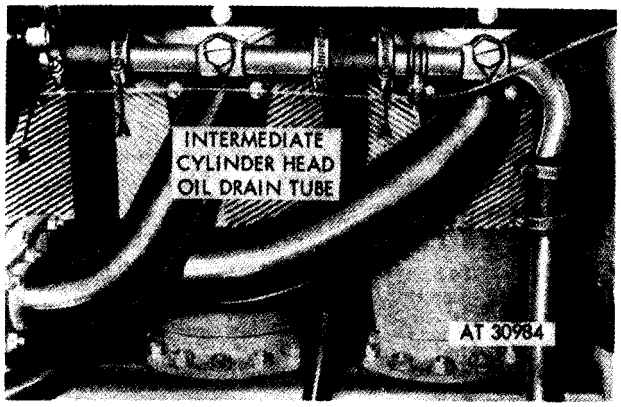
This section covers the replacement of intake manifold tubes and the intake manifold assembly. Intake manifold tubes for cylinder 1, 2, 5, and 6, on each side of the engine can be replaced without removing the complete intake manifold. Intake manifold tubes for cylinder 3 and 4 on each side of engine cannot be replaced unless the complete intake manifold system is removed from the engine. In order to remove any cylinder intake manifold tube, it is necessary to remove the oil drain tube on that cylinder. Refer to Table 4-4 for illustrations and instructions on removal and installation of the manifold tubes or manifold assemblies. Figure references are listed under appropriate headings in the table.

Table 4-4. Intake Manifold Tubes and Intake Manifold Assembly

Component	Removal	Installation
Intake Manifold Tubes	4-106 through 4-110	4-110 through 4-106
Intake Manifold Assembly	4-111 through 4-118, 4-110	4-110, 4-118 through 4-111

4-10. Intake Manifold Tubes

For instructional purposes replacement of intake manifold tube for cylinder 2L is described in this section. Tubes for cylinders lL, 5L, 6L, lR, 2R, 5R, and 6R are replaced in the same manner.



Disconnect

1. Loosen four hose clamps (A) and side hoses from intermediate cylinder head oil drain tube.
2. Remove screw and nut attaching flame heater fuel inlet line cushioned clamp (B) to loop clamp on cylinder head oil drain tube, if necessary.

Connect

1. Install screw and nut securing flame heater fuel inlet line cushioned clamp (B) to loop clamp on cylinder head oil drain tube.
2. Slide hoses on intermediate cylinder head OR drain tube and tighten four hose clamps (A).

Figure 4-106. Disconnecting or connecting cylinder head oil drain tube hoses-cylinders IL and 2L.

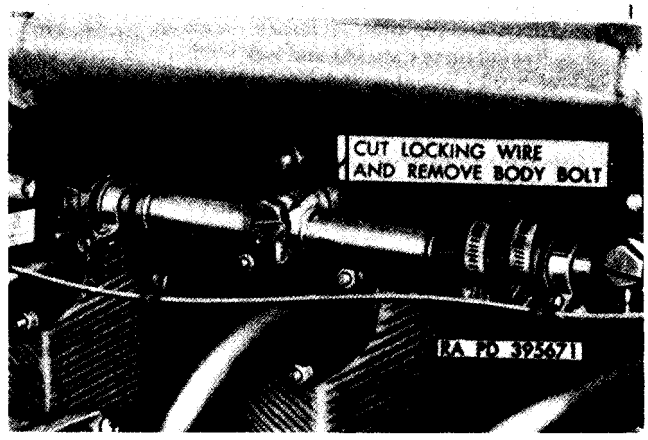


Figure 4-107. Disconnecting or connecting intermediate cylinder head oil drain tubes-cylinder 2L.

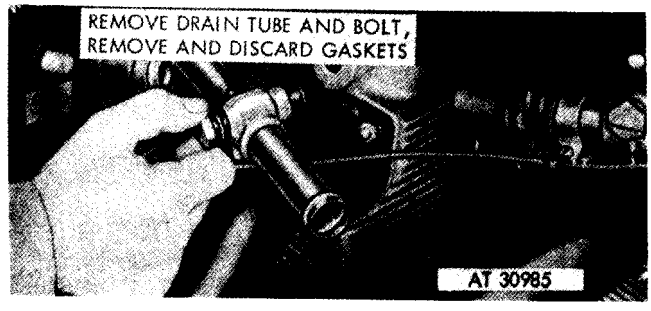
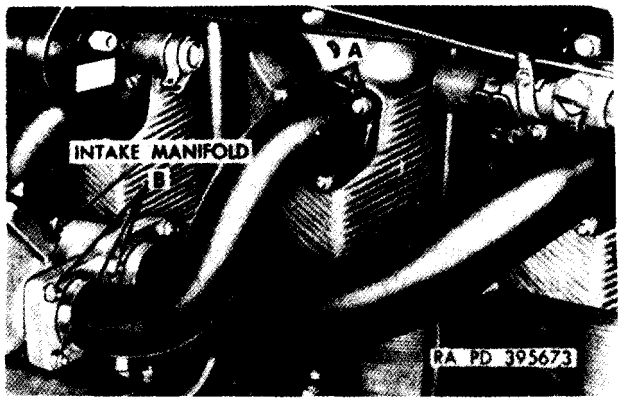


Figure 4-108. Removing or installing intermediate cylinder head oil drain tube-cylinder 2L.



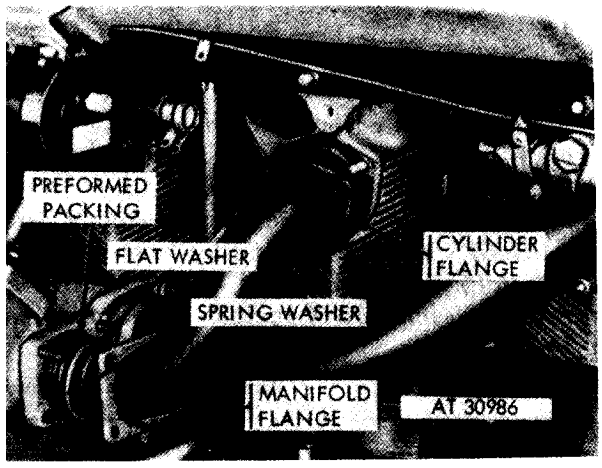
Disconnect

1. Remove three nuts (A) and lock washers attaching flange of intake manifold tube to cylinder.
2. Remove four self-locking nuts (B) attaching flange which secures tube to intake manifold.

Connect

1. Install four self-locking nuts (B) to attach flange which secures tube to intake manifold.
2. Install three nuts (A) and lock washers securing flange of intake manifold tube to cylinder.

Figure 4-109. Disconnecting or connecting intake manifold tube from intake manifold and cylinder 2L.



Remove

1. Separate manifold flange, spring washer, flat washer, and preformed packing from intake manifold.
2. Remove intake manifold tube from studs at cylinder. Remove and discard gasket.
3. Remove intake manifold tube from intake manifold and discard preformed packing.
4. Remove flat washer, spring washers, manifold flange, and cylinder flange in order listed and reinstall on replacement tube.

Note. Replacement tubes do not include flanges.

Install

1. With cylinder flange, manifold flange, spring washer, and flat washer installed on intake manifold tube, install new preformed packing against flat washer.
2. Install new gasket on studs at cylinder.
3. Install assembled intake manifold tube on intake manifold and studs at cylinder.

Figure 4-110. Removing or installing intake manifold tube-cylinder 2L.

4-11. Intake Manifold Assembly

For instructional purposes, replacement of the left intake manifold is described in this section. The right intake manifold assembly is replaced in the same manner.

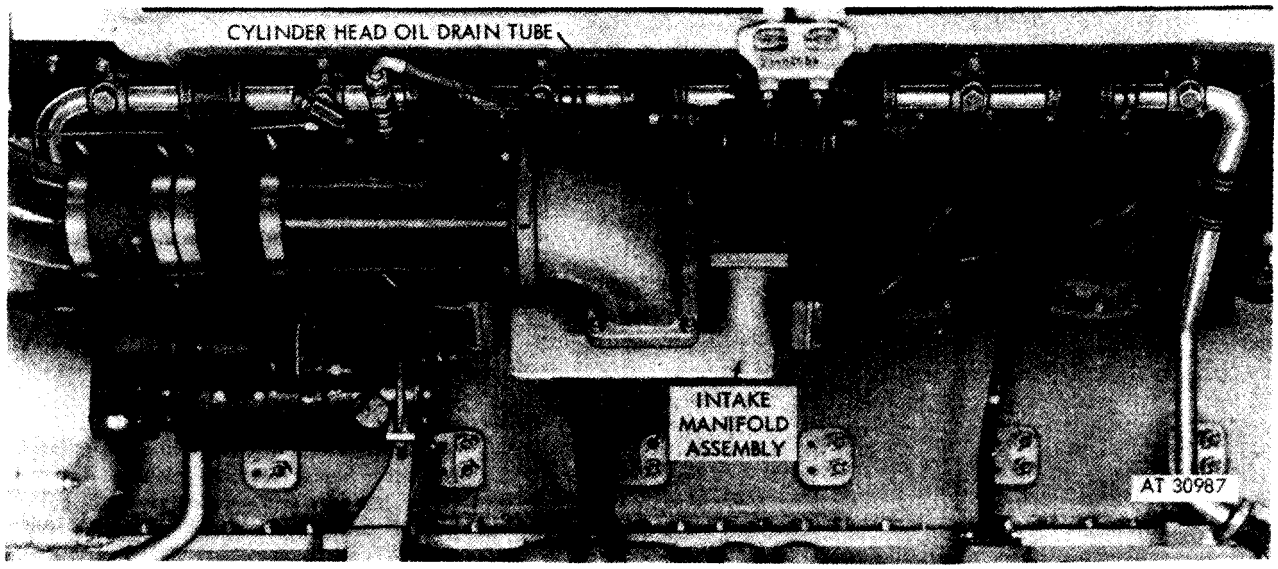
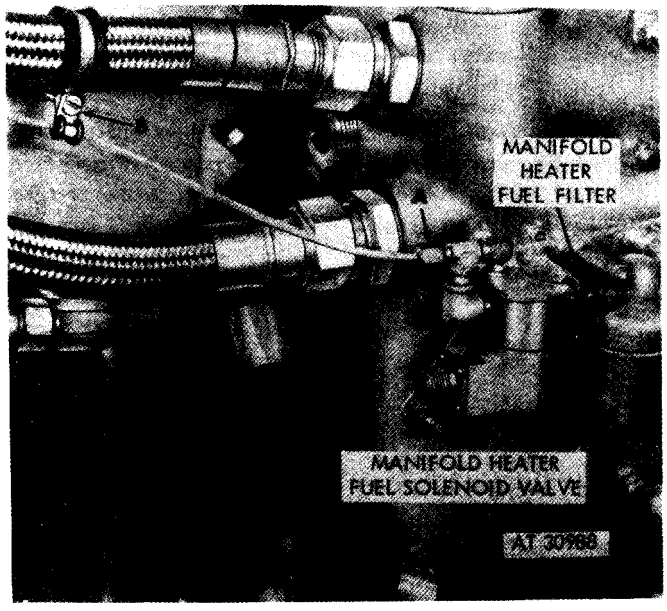


Figure 4-111. Left intake manifold—installed view.



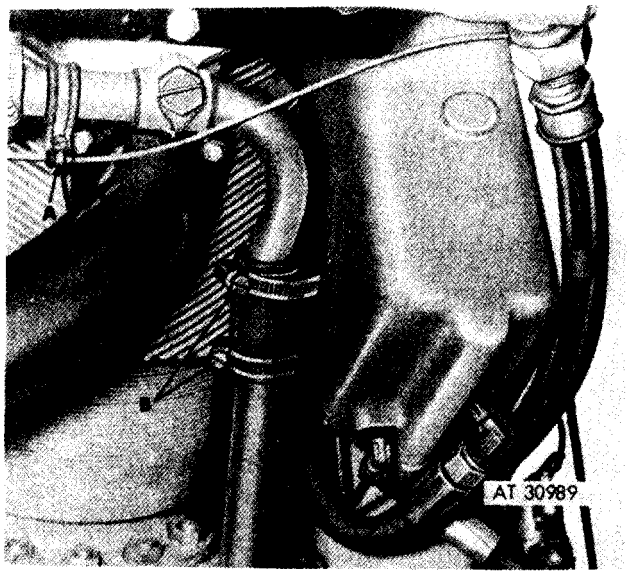
Disconnect

1. Disconnect manifold heater fuel inlet tube (A) from manifold heater fuel solenoid valve tee.
2. Remove self-locking nut and screw (B) attaching cushioned loop clamp to loop clamp on oil cooler outlet hose.

Connect

1. Install self-locking nut and screw (B) securing cushioned loop clamp to loop clamp on oil cooler outlet hose.
2. Connect manifold heater fuel inlet tube (A) to manifold heater fuel solenoid valve tee.

Figure 4-112. Disconnecting or connecting manifold heater fuel inlet tube.



Disconnect

1. Remove screw and nut attaching flame heater fuel inlet line cushioned clamp (A) to loop type clamp on cylinder head oil drain tube.
2. Loosen two hose clamps (B) and slide hose down on lower front drain tube.

Connect

1. Position hose between cylinder head oil drain tube and lower front drain tube and tighten two hose clamps (B).
2. Install screw and nut securing flame heater fuel inlet line cushioned clamp (A) to loop type clamp on cylinder head oil drain tube.

Figure 4-113. Disconnecting or connecting cylinder head oil drain tube-left front.

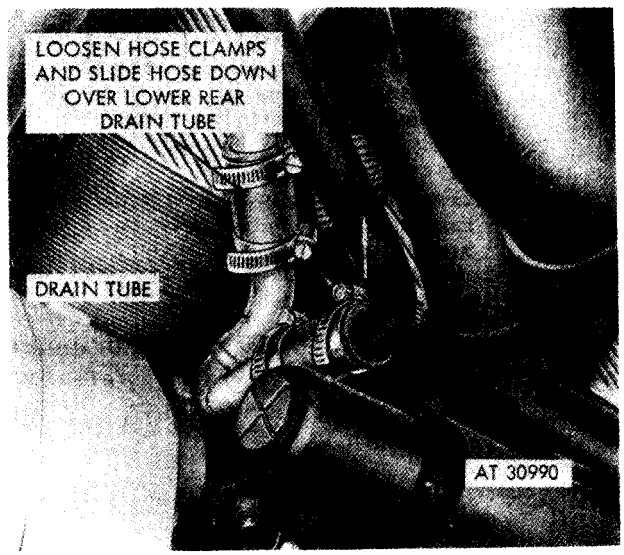
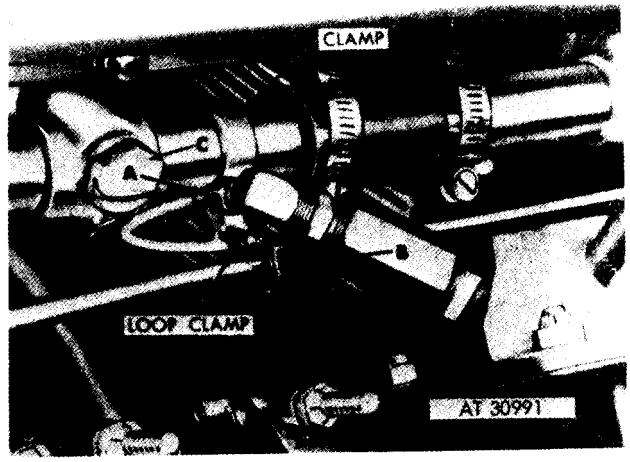


Figure 4-114. Disconnecting or connecting cylinder head oil drain tube-left rear.



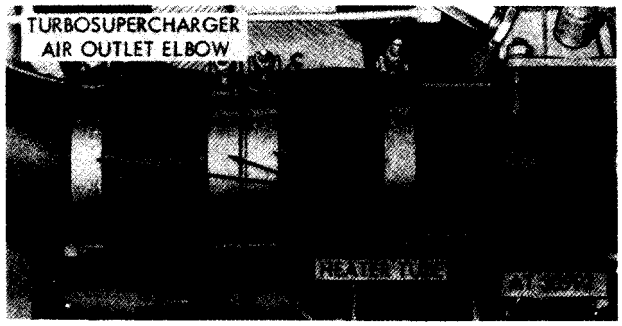
Disconnect

1. Disconnect manifold heater fuel inlet line (A).
2. Disconnect heater fuel outlet tube (B).
3. Cut locking wire and remove six body bolts (C) and remove oil drain tubes as an assembly. Remove and discard 12 gaskets.

Connect

1. Position oil drain tubes as an assembly on engine. Install new solid copper gaskets on six body bolts (C), insert bolts through oil drain tubes and install second new annular copper asbestos gasket on each bolt. Tighten bolts securing drain tube and install locking wire.
2. Connect heater fuel outlet tube (B).
3. Connect manifold heater fuel inlet line (A).

Figure 4-115. Disconnecting or connecting heater fuel inlet and outlet tubes from intake manifold heater.



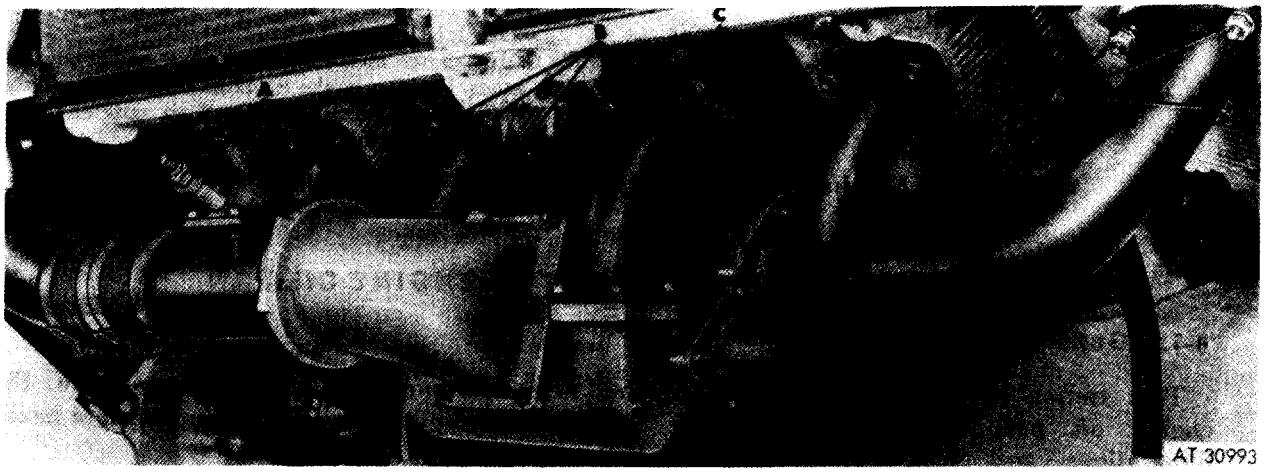
Disconnect

1. Loosen four hose clamps (A).
2. Separate hoses (B), sliding one hose on the heater tube and the other hose on the turbosupercharger air outlet elbow.
3. Remove turbosupercharger outlet elbow tube sleeve (C).

Connect

1. Position turbosupercharger outlet elbow tube sleeve (C) between elbow tube and heater tube.
2. Slide one hose (B) from elbow tube on sleeve (C). Slide second hose (B) from heater tube on sleeve (C).
3. Tighten four hose clamps (A).

Figure 4-116. Disconnecting or connecting turbosupercharger air outlet elbow and heater tube.



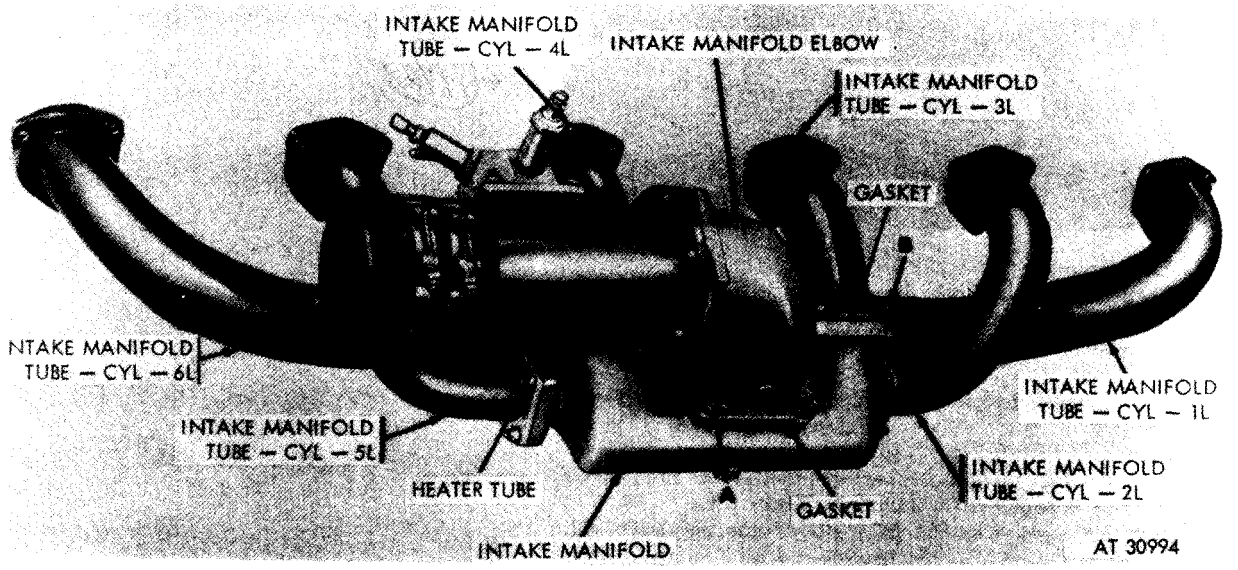
Remove

1. Remove 12 nuts (A) and lock washers attaching intake manifold tubes to cylinders 1L, 2L, 5L, and 6L.
2. Remove six nuts (B), lock washers, and flat washers attaching intake manifold tubes to cylinders 3L and 4L. Remove manifold assembly.
3. Remove and discard six intake manifold gaskets (C).

Install

1. Install six new intake manifold gaskets (C).
2. Position manifold assembly on cylinder studs. Install six nuts (B), lock washers, and flat washers securing intake manifold tubes to cylinders 3L and 4L.
3. Install 12 nuts (A) and lock washers securing intake manifold tubes to cylinders 1L, 2L, 5L, and 6L.

Figure 4-117. Removing or installing intake manifold assembly-left side.



Disassemble

1. Remove six nuts (A) and flat washers attaching intake manifold elbow to intake manifold. Remove elbow and heater tube as a unit. Remove and discard gasket.
2. Remove four nuts (B) attaching intake manifold tubes 3L and 4L to intake manifold and remove tubes, Remove and discard gaskets.
3. Remove intake manifold tubes for cylinders 1L, 2L, 5L, and 6L following instructions accompanying figure 4-110.

Assemble

1. Install intake manifold tubes for cylinders 1L, 2L, 5L, and 6L following instructions accompanying figure 4-110.
2. Install new gaskets on studs on intake manifold for cylinders 3L and 4L intake manifold tubes. Position tubes on manifold and install four nuts (B) securing each tube to manifold.
3. Install new intake manifold elbow gasket on manifold studs. Position intake manifold elbow and heater tube as a unit on manifold. Install six nuts (A) and flat washers securing elbow to manifold.

Figure 4-118. Disassembling or assembling intake manifold assembly.

Section VI. REPLACEMENT OF ENGINE OIL PAN

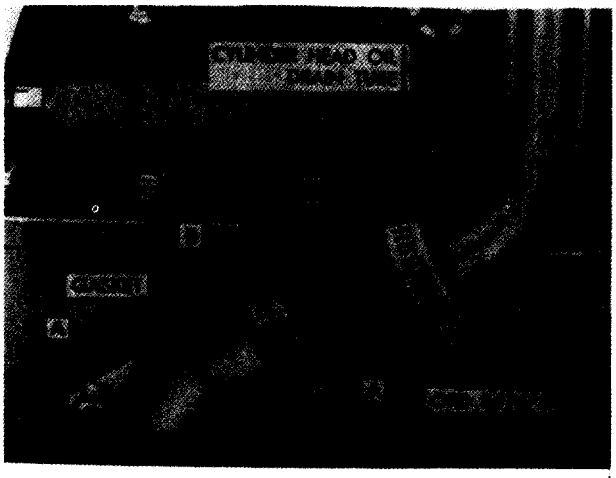
4-12. General

This section covers the replacement of the engine oil pan. Refer to Table 4-5 for illustrations and instructions covering the removal and installation of the oil pan. Figure references are listed under appropriate headings in the table.

Table 4-5. Engine Oil Pan

Component	Removal	Installation
Oil Pan	4-5, 4-6, 4-11 through 4-16, 4-119 through 4-125	4-125 through 4-119, 4-11, 4-16 through 4-13, 4-17, 4-11, 4-10

4-13. Replacement Instructions



Disconnect

Note. The left front drain tube may be disconnected in the same manner.

1. Remove two cap screws (A) and lock washers attaching right front cylinder head oil drain tube (B) to oil pan.
2. Separate drain tube from oil pan and remove and discard gasket.

Connect

Note. The left front drain tube may be connected in the same manner.

1. Install new gasket between right front cylinder head oil drain tube (B) and oil pan.
2. Install two cap screws (A) and lock washers securing drain tube to oil pan.

Figure 4-119. Disconnecting or connecting right front cylinder head oil drain tube.



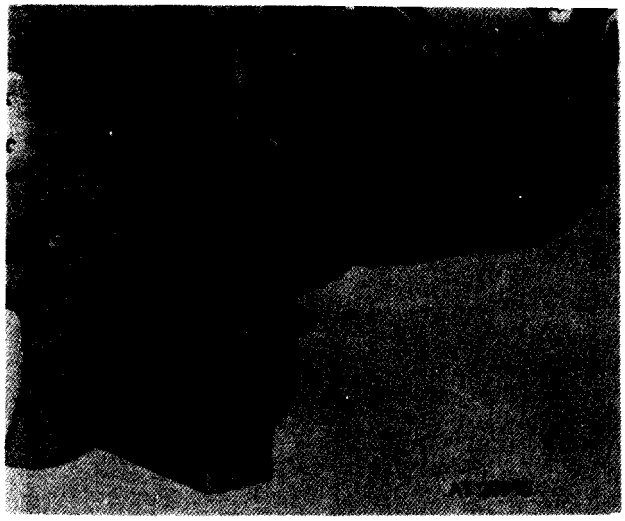
Disconnect

1. Remove two cap screws (A) and lock washers attaching left rear cylinder head oil drain tube to oil pan.
2. Separate drain tube front oil pan and remove and discard gasket (B).

Connect

1. Install new gasket (B) between left rear cylinder head oil drain tube and oil pan.
2. Install two cap screws (A) and lock washers securing drain tube to oil pan.

Figure 4-120. Disconnecting or connecting left rear cylinder head oil drain tube.



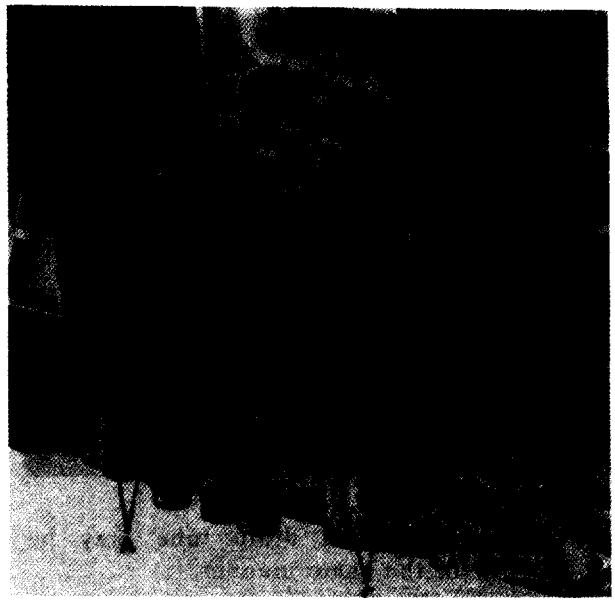
Disconnect

1. Remove two cap screws (A) and lock washers attaching right rear cylinder head oil drain tube to oil pan.
2. Separate drain tube from oil pan and remove and discard gasket (B).

Connect

1. Install new gasket (B) between right rear cylinder head oil drain tube and oil pan.
2. Install two cap screws (A) and lock washers securing drain tubes to oil pan.

Figure 4-121. Disconnecting or connecting right rear cylinder head oil drain tube.



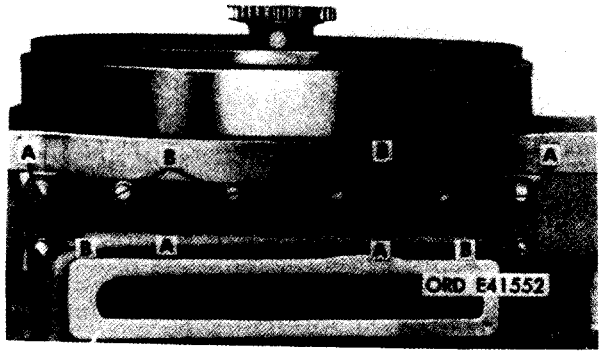
Disconnect

1. Remove three assembled washer screws (A) and seal washers attaching oil filler tube to oil pan. Discard seal washers.
2. Remove and discard filler tube gasket (B).
3. Remove three self-locking nuts (C) attaching oil level indicator tube to oil pan.
4. Remove and discard indicator tube gasket (D).

Connect

1. Position new oil filler indicator tube gasket (D) on oil pan.
2. Install three self-locking nuts (C) securing indicator tube to oil pan.
3. Position new oil filler tube gasket (B) on oil pan.
4. Assemble new seal washers on washer screws (A). Install assembled washer screws securing filler tube to oil pan.

Figure 4-122. Disconnecting or connecting oil-filler and oil level indicator tubes from oilpan.



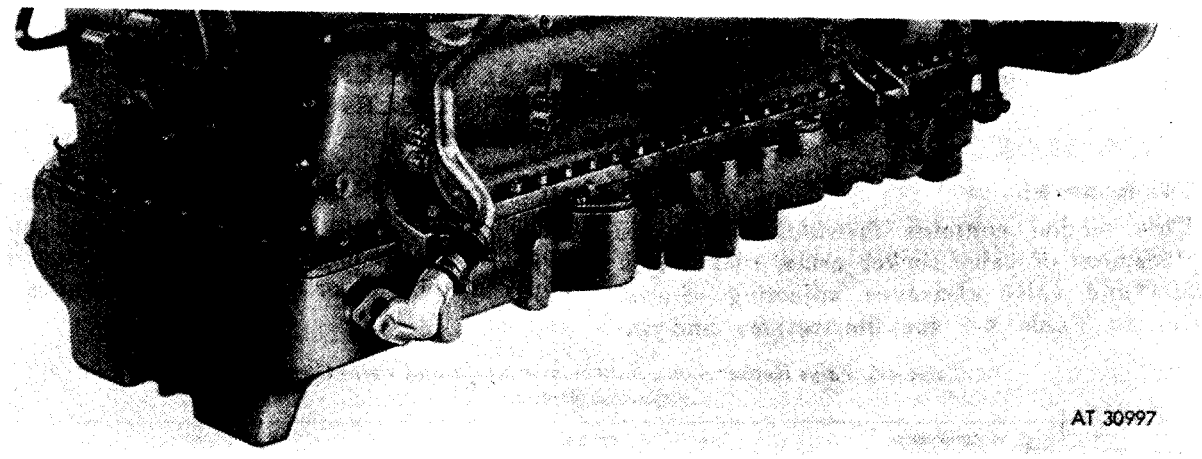
Remove

1. Cut locking wire (A) securing eight bolts.
2. Remove eight drilled head bolts (B) and flat washers.

Install

1. Install eight drilled head bolts (B) and flat washers.
2. Install locking wire (A) securing eight bolts.

Figure 4-123. Removing or installing oil pan rear bolts.



Remove

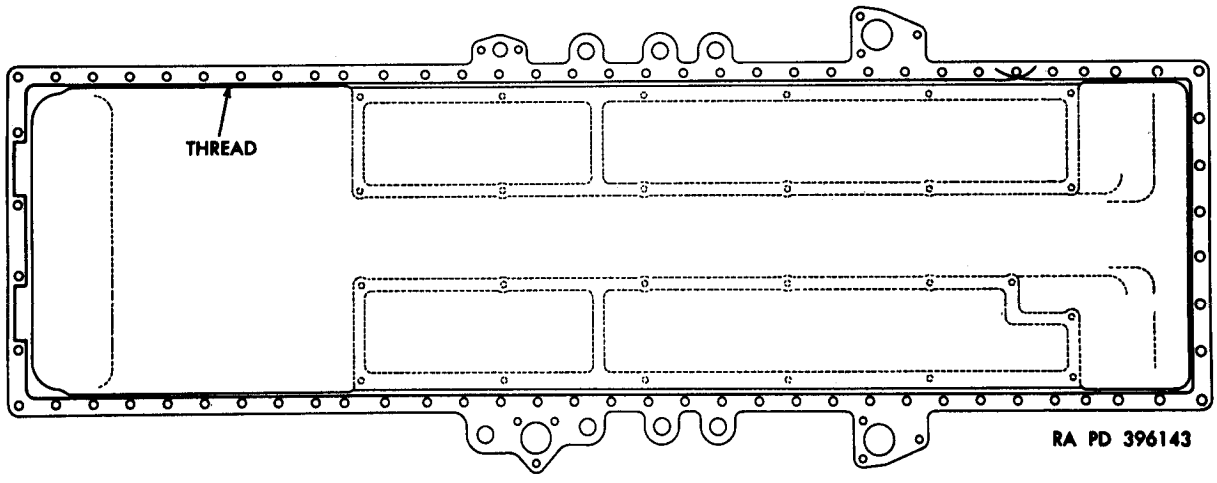
1. Cut locking wire and remove 12 drilled head bolts (A) and flat washers attaching the oil pan to crankshaft damper and oil filter housing.
2. Remove 27 of the 28 self-locking nuts (B) and flat washers attaching oil pan to each side of the crankcase assembly.

Note. One nut and washer are left installed on each side of the oil pan, near the center, to prevent oil pan from falling and being damaged. Support oil pan adequately before removing remaining two nuts and washers then remove oil pan.

Install

1. Install 28 self-locking nuts (B) and flat washers securing oil pan to each aide of the crankcase assembly.
2. Install 12 drilled head bolts (A) and flat washers securing oil pan to crankshaft damper and oil filter housing.

Figure 4-124. Removing or installing engine oilpan.



Remove

Remove oil pan sealing thread and clean oil pan mating surfaces thoroughly.

Install

Apply a thin coat of gasket cement, Specification MIL-C-10523 (ORD), on the oil pan flange and install sealing thread.

Figure 4-125. Removing or installing oil pan sealing thread.

Section VII. REPLACEMENT OF VALVE ROCKER ARMS, ROCKER ARMSHAFTS, AND VALVE CLEARANCE ADJUSTING SCREWS

4-14. General

This section contains instructions for the replacement of valve rocker arms, rocker arm shafts and valve clearance adjusting screws. Refer to Table 4-6 for illustrations and instructions on removal and installation procedures. Figure references are listed under appropriate headings in the table. Instructions apply to either left or right side of the engine.

Table 4-6. Valve Rocker Arms, Rocker Arm Shafts and Valve Clearance Adjusting Screws

Component	Removal	Installation
Valve Rocker Arms, Rocker Arm Shafts or Valve Clearance Adjusting Screws	4-34 through 4-38, 4-126 through 4-135, 4-141 through 4-160	4-161 through 4-158, 4-162 through 4-164, 4-157 through 4-153, 4-165, 4-151 through 4-126, 4-38 through 4-35, 4-88, 4-34

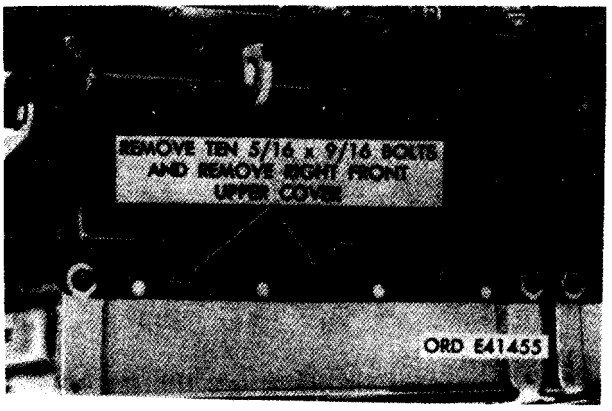


Figure 4-126. Removing or installing right front upper cover.

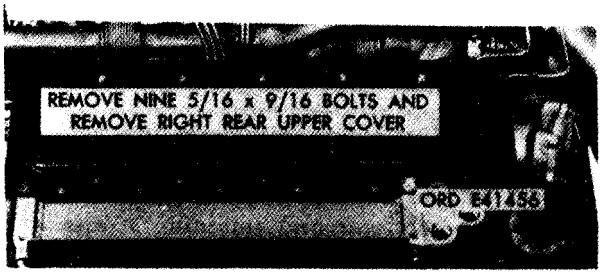


Figure 4-127. Removing or installing right rear upper cover.



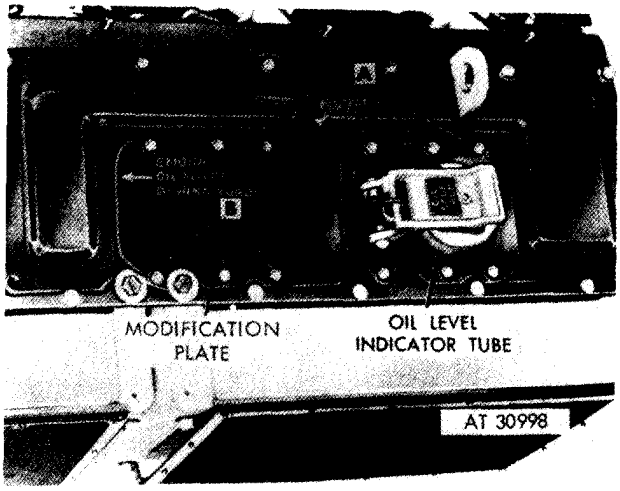
Remove

1. Remove six bolts (A) and remove oil filler tube shroud plate.
2. Remove six bolts (B) and remove oil level indicator tube shroud plate.

Install

1. Position oil level indicator tube shroud plate and install six bolts (B).
2. Position oil filler tube shroud plate and install six bolts (A).

Figure 4-128. Removing or installing oil filier and oil level indicator tube shroud plates-one piece type oil filler and indicator tubes installation.



Remove

1. Remove six bolts (A) and remove oil level indicator tube shroud plate.
2. Remove three bolts (B) attaching modification cover plate and upper cover to frame.

Note. Do not remove remaining three bolts attaching modification cover plate to upper cover. Maintain upper cover as an assembly.

Install

1. Install three bolts (B) securing modification cover plate and upper cover to frame.
2. Position oil level indicator tube shroud plate and install six bolts (A).

Figure 4-129. Removing or installing oil level indicator tube shroud plate-modified shroud plate installation.

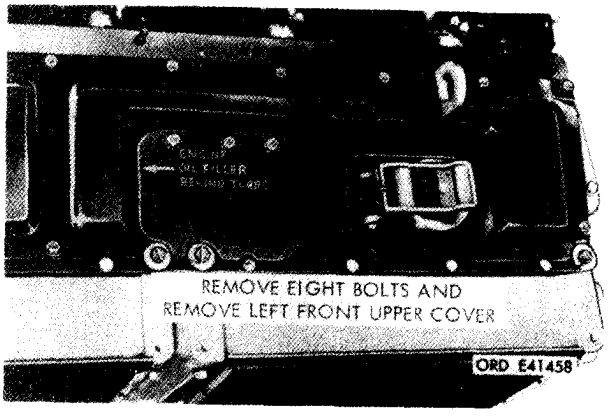
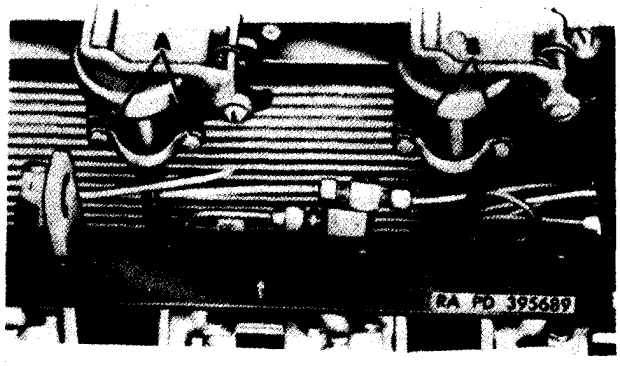


Figure 4-130. Removing or installing left front upper cover-modified upper-cover installation.



Disconnect

1. Remove two self-locking nuts (B), cap screws, and retaining straps attaching oil filler tube to frame.

Note. Some early engines used weld nuts in lieu of self-locking nuts,

2. Remove two self-locking nuts (A), cap screws, and retaining straps attaching oil level indicator tube to frame.

Connect

Note. On installations that have been modified, oil filler tube will be relocated behind turbosupercharger and retaining straps will be discarded.

1. Position retaining straps and install two self-locking nuts (A) and cap screws, securing straps and oil level indicator tube to frame.
2. Position retaining straps and install two self-locking nuts (B) and cap screws securing straps and oil level indicator tube to frame.

Figure 4-131. Disconnecting or connecting oil filler and oil level indicator tube retaining straps-one piece type oil filler and indicator tubes installation shown.

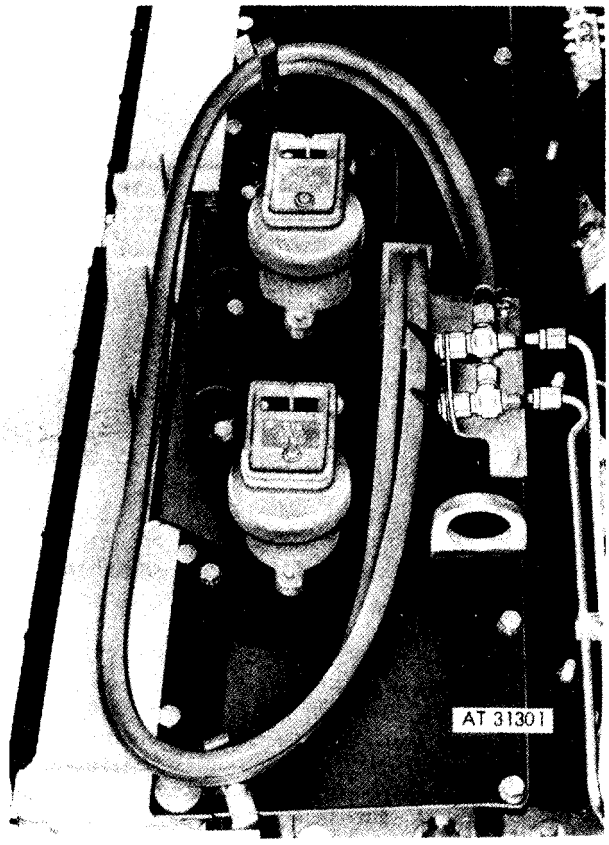
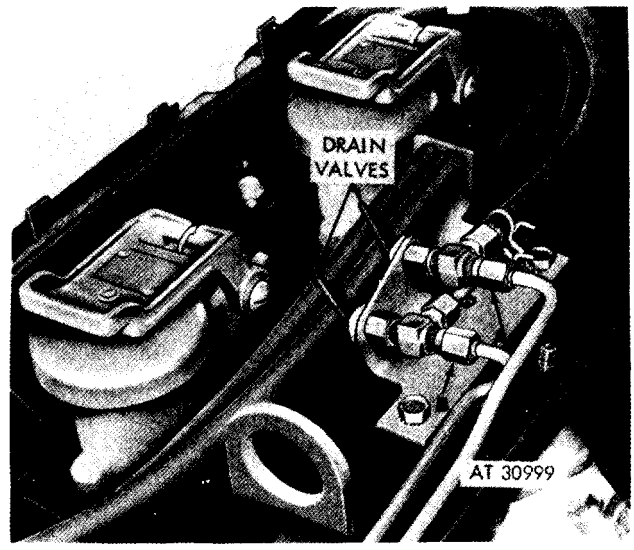


Figure 4-132. Oil level indicator and oil filler tube upper shroud-tubes with splash pan installation installed view.



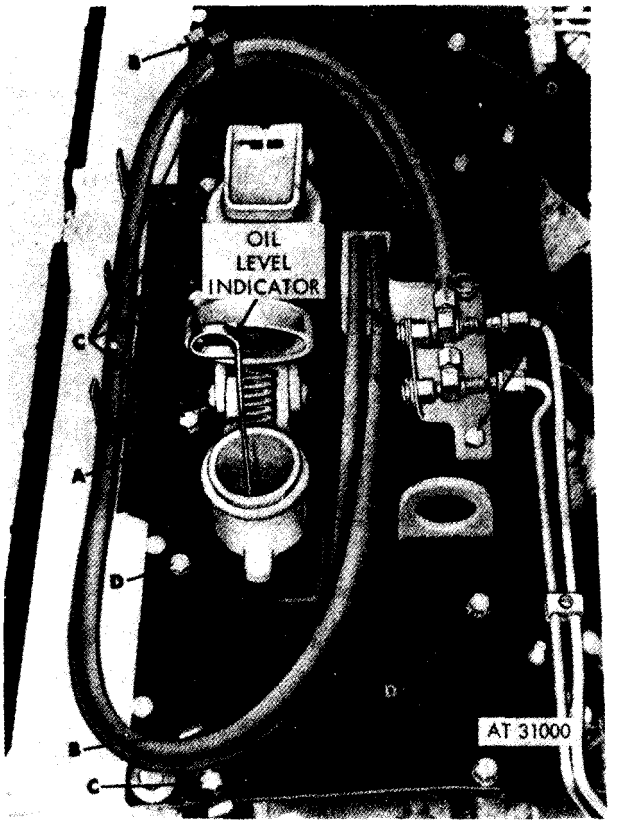
Disconnect

1. Disconnect primary fuel filter drain line (A) from drain valve.
2. Disconnect fuel / water separator filter drain line (B) from drain valve.

Connect

1. Connect fuel / water separator filter drain line (B) to drain valve.
2. Connect primary fuel filter drain line (A) to drain valve.

Figure 4-133 Disconnecting or connecting fuel drain tubes-tubes with splash pan installation.



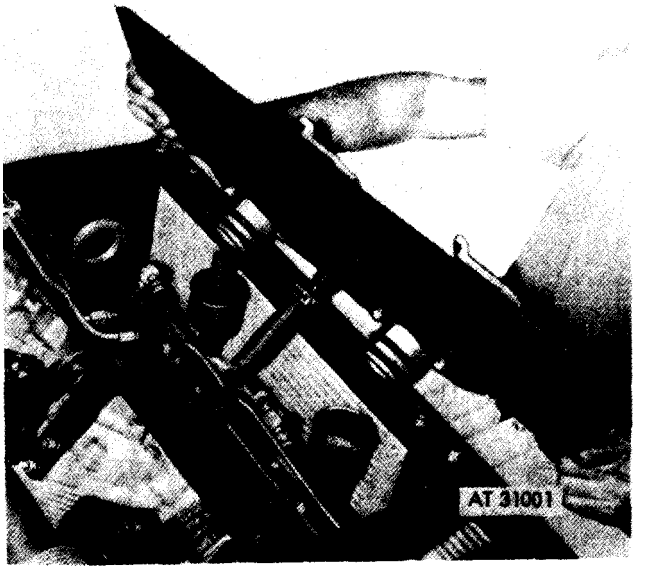
Remove

1. Lift cover and remove oil level indicator (A).
2. Remove drain hose (B) from retaining brackets.
3. Remove seven cap screws (C) attaching valve and hose brackets to shroud plate.
4. Remove five cap screws (D) attaching plate to frame.

Install

1. Install five cap screws (D) securing plate to frame.
2. Install seven cap screws (C) securing valve and hose brackets to shroud plate.
3. Install drain hose (B) on retaining brackets.
4. Install oil level indicator (A) and close cover.

Figure 4-134. Removing or installing oil level *indicator and oil filler and oil level indicator tube shroud plate bolts-tubes with splash pan installation.*



Remove

1. Raise cover plate (A) until oil drain hose clamp (B) is accessable.
2. Loosen hose clamp (B) and disconnect oil drain hose from cover plate.
3. Remove cover plate (A) and remove and discard four preformed packings (C).

Install

1. Install four new preformed packings (C) and position cover plate (A) on frame.
2. With cover plate partially raised, connect oil drain hose to cover plate and tighten hose clamp (B).
3. Position cover plate (A) on frame.

Figure 4-135. Removing or installing oil level indicator and oil filter tube upper cover-with splash pan installation.

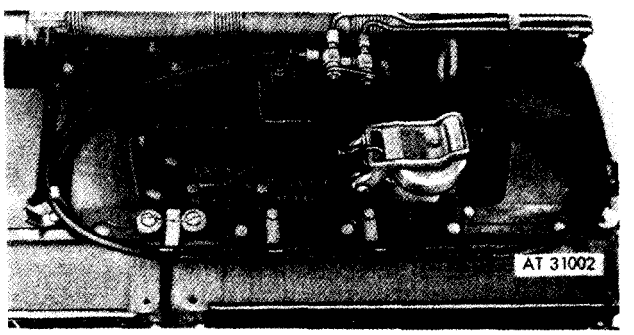


Figure 4-136. Oil level indicator tube upper cover plate-relocated oil filler tube modified installed view.

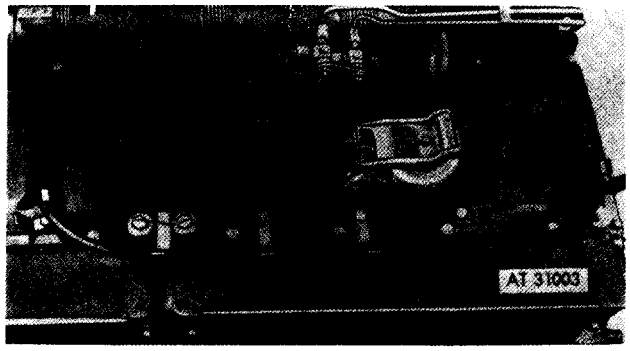
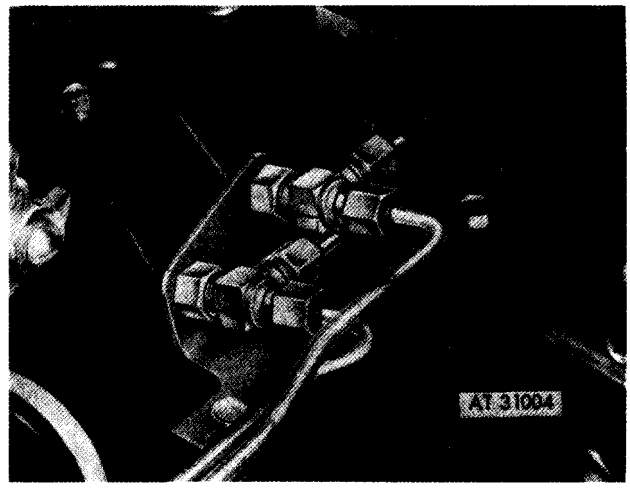


Figure 4-137. Oil level indicator tube upper cover plate-relocated oil filler tube installed view.



Disconnect

1. Disconnect primary fuel drain tube (A) from drain valve.
2. Disconnect fuel / water separator filter drain tube (B) from drain valve.

Connect

1. Connect Fuel / water separator filter drain tube (B) to drain valve.
2. Connect primary fuel filter drain tube (A) to drain valve.

Figure 4-138. Disconnecting or connecting fuel drain tubes-relocated oil filler tube installation.



Remove

1. Lift cover and remove oil level indicator (A).
2. Remove drain hose (B) from retaining brackets.
3. Remove seven cap screws (C) attaching valve and hose brackets to cover plate and frame.
4. Remove five cap screws (D) attaching cover plate to frame.

Install

1. Install five cap screws (D) securing cover plate to frame.
2. Install seven cap screws (C) securing valve and hose brackets to cover plate and frame.
3. Install drain hose (B) on retaining brackets.
4. Install oil level indicator (A) and close cover.

Figure 4-139. Removing or installing oil level indicator tube upper cover plate—relocated oil filler tube installation.

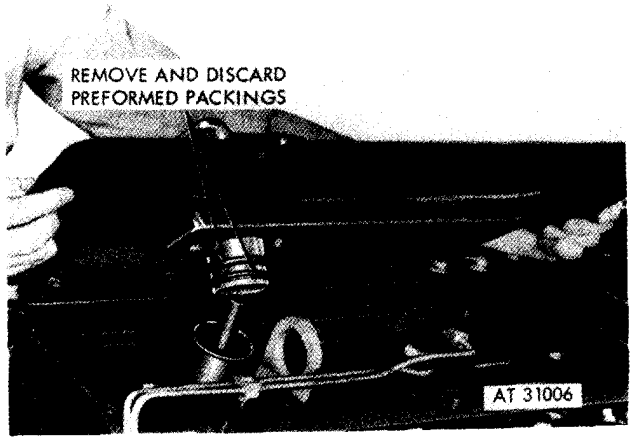


Figure 4-140. Removing or installing oil level indicator upper cover plate-relocated oil filler tube installation.

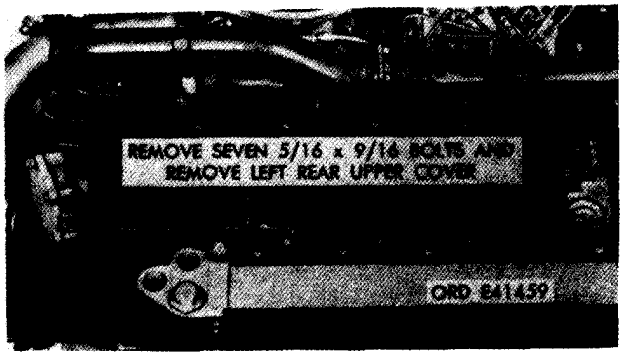
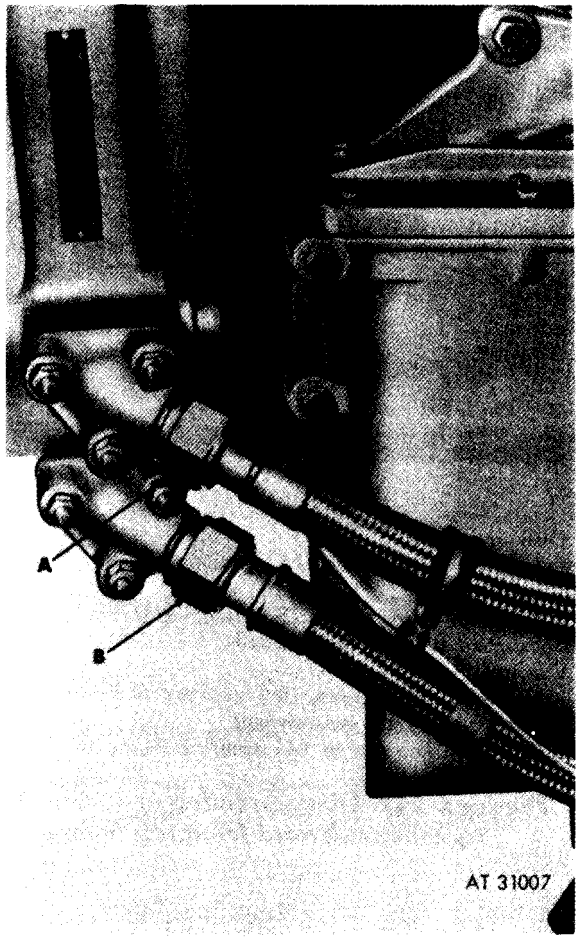


Figure 4-141. Removing or installing left rear upper cover.



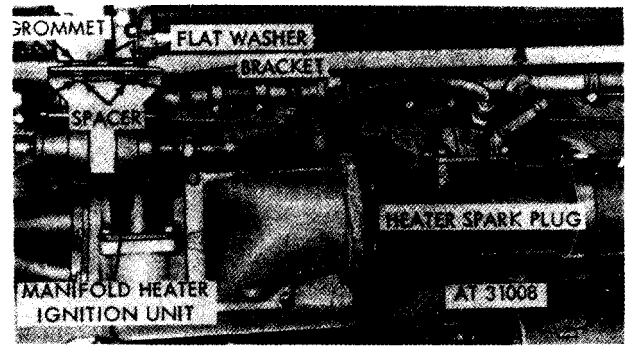
Disconnect

1. Disconnect oil cooler outlet hose (A) and drain oil into a suitable container.
2. Disconnect oil cooler inlet hose (B).

Connect

1. Connect oil cooler inlet hose (B).
2. Connect oil cooler outlet hose (A).

Figure 4-142. Disconnecting or connecting oil cooler hoses-left side.



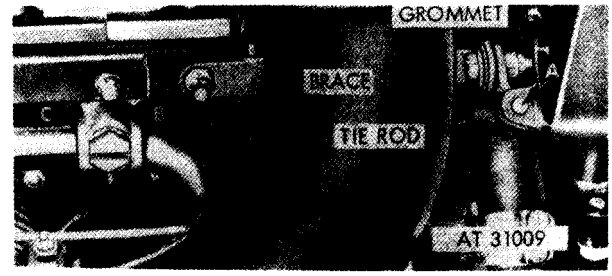
Remove

1. Disconnect manifold heater spark plug cable (A).
2. Remove two screws (B), spacers, and flat washers attaching ignition unit bracket to oil coolers. Remove ignition unit, bracket and cable.
3. Remove grommets (C) from brackets. Replace damaged grommets.

Install

1. Install grommets (C) in ignition unit bracket.
2. Position ignition unit, bracket, and cable on oil coolers and install two screws (B), spacers, and flat washers securing bracket to oil coolers.
3. Connect manifold heater spark plug cable (A).

Figure 4-143. Removing or installing manifold heater ignition unit-right side.



Disconnect

1. Loosen, but do not remove, bolt (A) and self-locking nut attaching brace to turbosupercharger tie rod.
2. Remove self-locking nut (B), flat washer, and cap screw attaching brace to support beam.
3. Remove six self-locking nuts (C) and flat washers attaching support beam to cylinders.

Note. The flat washers are located at cylinder Nos. 2, 4, and 5 on both banks.

Connect

1. Install six self-locking nuts (C) and flat washers securing support beam to cylinders.
2. Install self-locking nut (B), flat washer, and cap screw securing brace to support beam.
3. Tighten bolt (A) and self-locking nut attaching brace to turbosupercharger tie rod.

Figure 4-144. Disconnecting or connecting oil cooler support beam-right side.

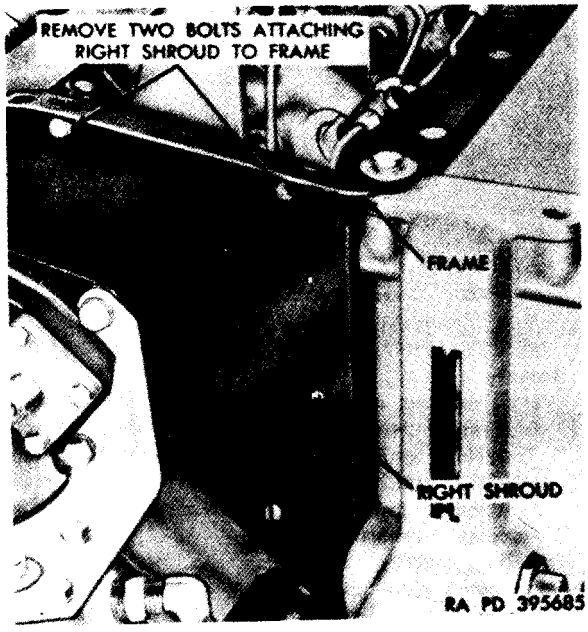
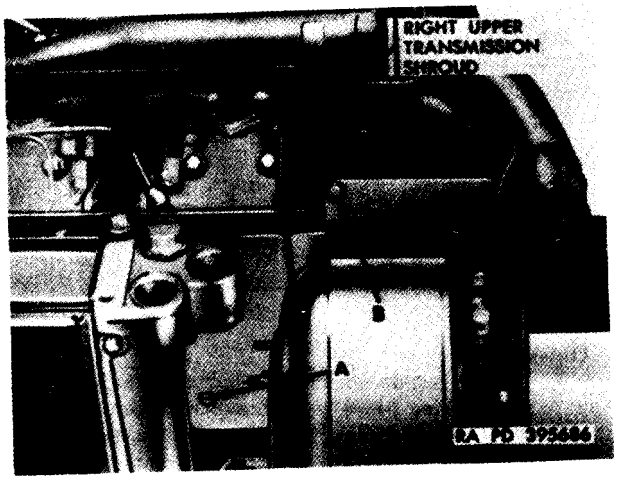


Figure 4-145. Disconnecting or connecting shroud from top frame-right front side.



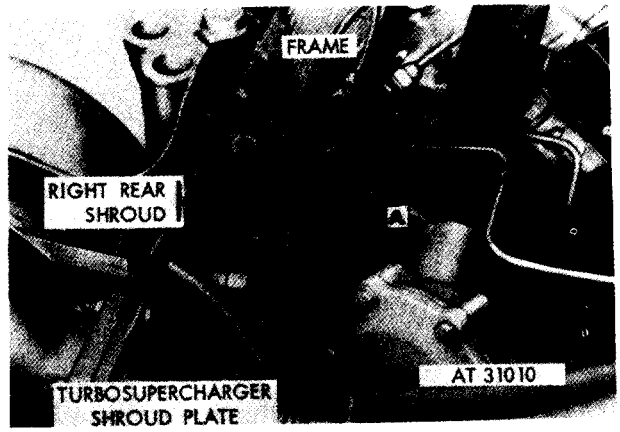
Disconnect

1. Remove one pan head screw (A) attaching right oil cooler end shroud.
2. Remove one self-locking nut and bolt (B) and remove right upper transmission shroud.

Connect

1. Position right upper transmission shroud and install one bolt (B) and self-locking nut.
2. Install one pan head screw (A) securing right oil cooler end shroud.

Figure 4-146. Disconnecting or connecting right oil cooler end shroud and upper transmission shroud.



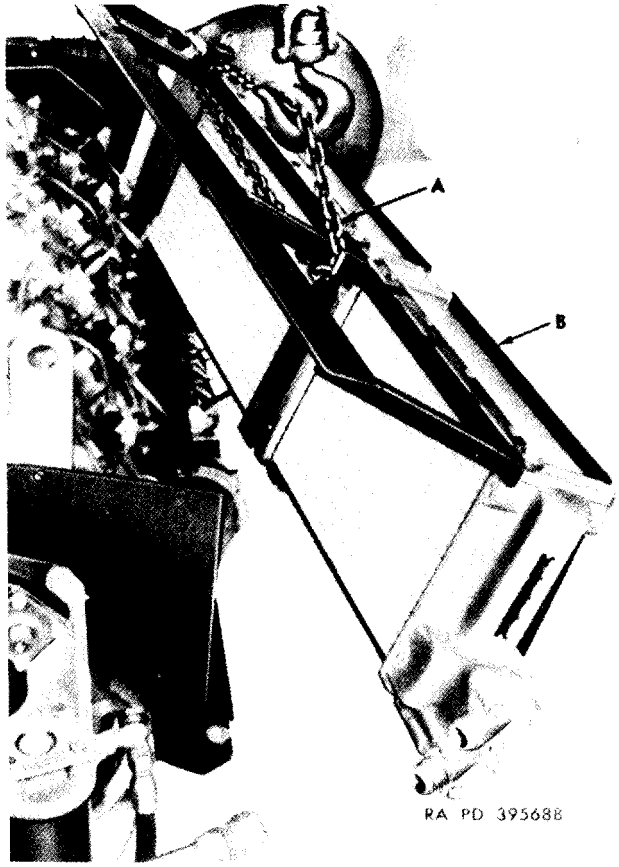
Disconnect

1. Remove two screws (A) attaching frame to right rear shroud.
2. Remove two screws (B) attaching turbosupercharger shroud to right rear shroud.

Connect

1. Install two screws (B) securing turbosupercharger shroud to right rear shroud.
2. Install two screws (A) securing frame to right rear shroud.

Figure 4-147. Disconnecting or connecting right rear shroud from top frame.



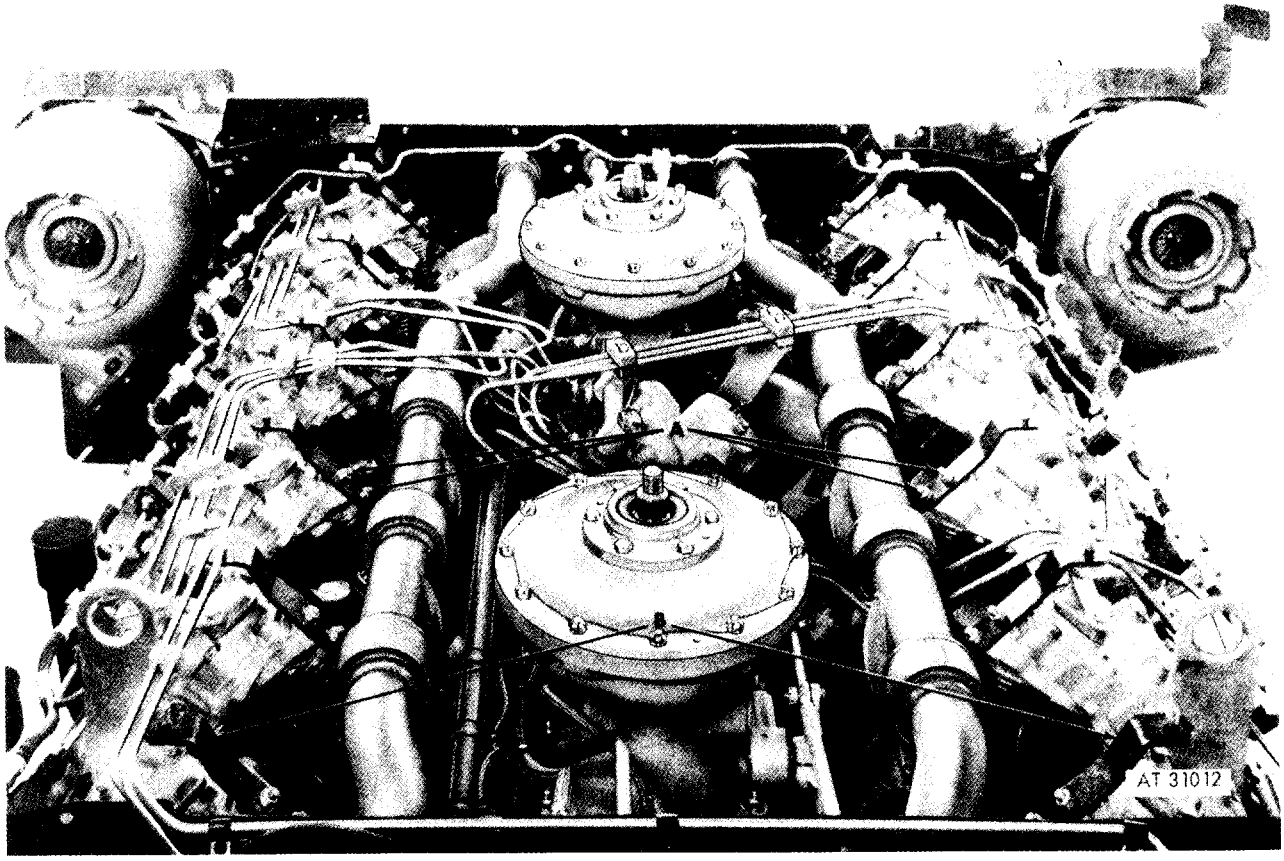
Remove

1. Attach a straight-link chain (A) around top frame.
2. Remove oil cooler and top frame (B) as an assembly.

Install

1. Attach a straight-link chain (A) around top frame and oil cooler assembly.
2. Position assembly on side of engine making sure six mounting holes in top frame are located on studs on top frame retaining brackets.

Figure 4-148. Removing or installing oil coolers and top frame as an assembly.



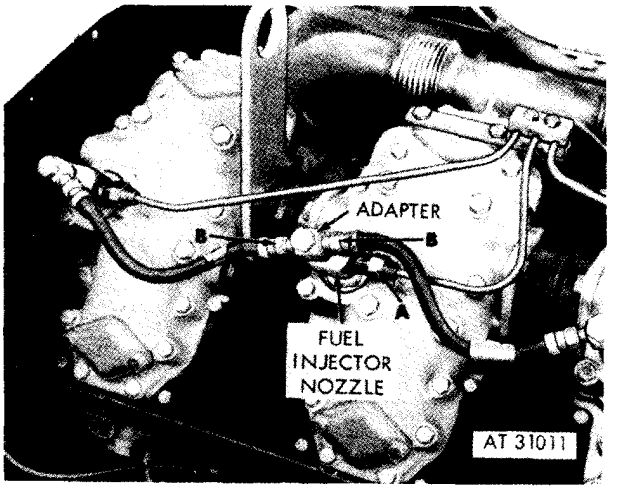
Remove

1. Remove 24 self-locking nuts (A).
2. Remove 12 top frame retaining brackets (B).

Install

1. Position 12 top frame retaining brackets (B) on cylinder mounting studs.
2. Install 24 self-locking nuts (A).

Figure 4-149. Removing or installing top frame retaining brackets.



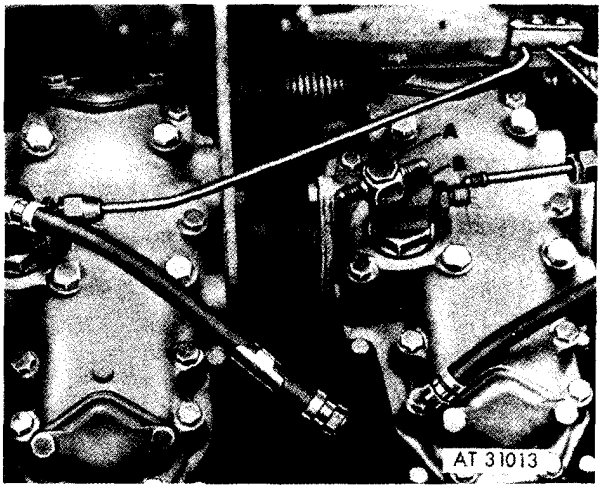
Disconnect

1. Disconnect fuel injector nozzle fuel inlet tube (A).
2. Disconnect fuel injector nozzle fuel return tubes (B) at nozzle adapter.

Connect

1. Connect fuel injector nozzle fuel return tubes (B) at nozzle adapter.
2. Connect fuel injector nozzle fuel inlet tube (A).

Figure 4-150. Disconnecting or connecting fuel injector nozzle holder fuel inlet and return tubes.



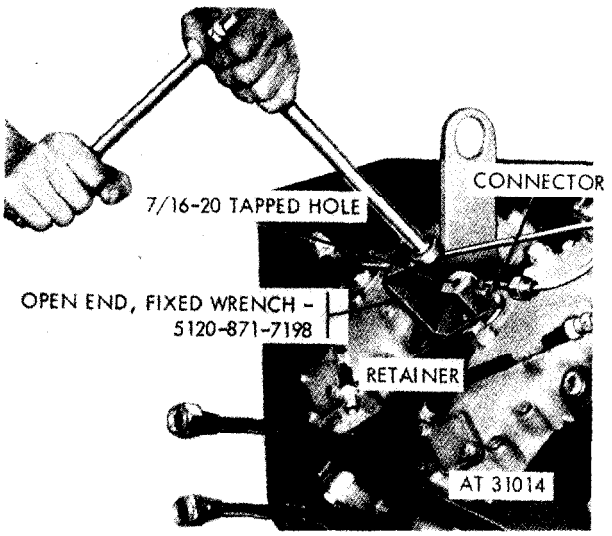
Remove

1. Remove nozzle adapter bolt (A).
2. Remove nozzle adapter and discard two gaskets (B).

Install

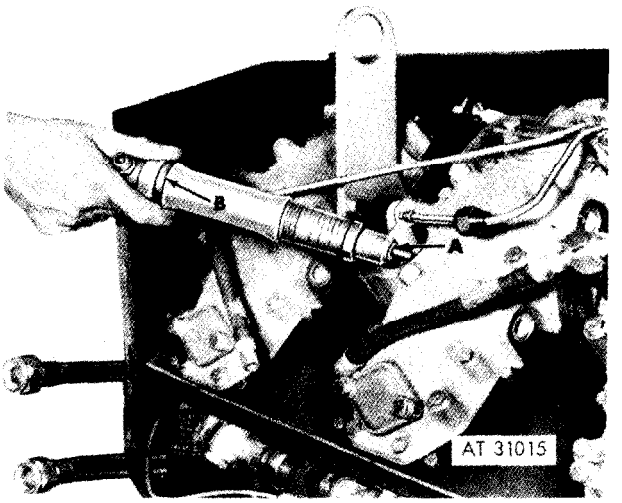
1. Install one gasket (B) on nozzle adapter bolt (A), install bolt through adapter, and install second gasket (B).
2. Install nozzle adapter and tighten bolt (A).

Figure 4-151. Removing or installing fuel injector nozzle fuel tube adapters.



Note. In stubborn cases, when the nozzle is frozen, it will be necessary to remove the fuel inlet connector from the nozzle and turn the nozzle using wrench socket - 5120-875-9556. When the nozzle is free of cylinder threads, install mechanical puller - 5120-873-6943 in the 7 / 16-20 tapped hole in the end of the nozzle holder. Remove nozzle and holder using puller.

Figure 4-152. Loosening fuel injector nozzle and holder retainer using wrench-5120-871-7198.



Remove

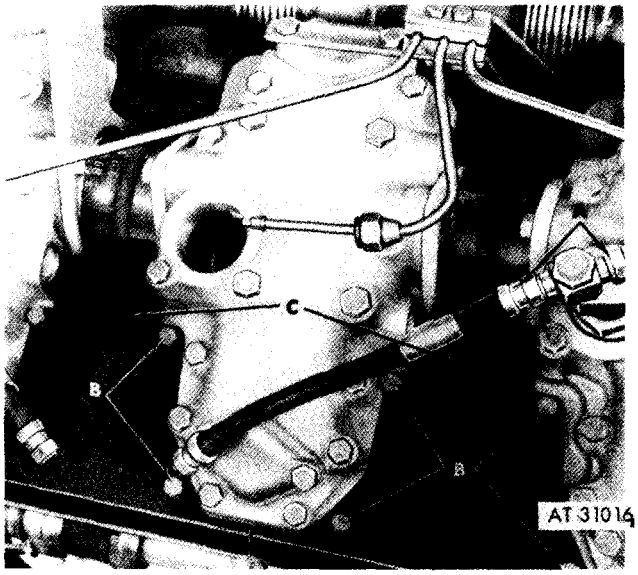
1. Remove fuel injector nozzle and holder assembly. Remove and discard gasket (A).
2. Remove and discard fuel injector nozzle holder preformed packing (B).

Install

Note. Use only the dead soft copper gasket - 5310-861-1406 for replacement seal whenever the fuel injector nozzle and holder assembly has been removed from the cylinder. The dead soft copper gasket conforms to the specific contours of the nozzle cylinder head seat in an individual installation. Because of this, it is the only approved gasket for this function and should never be reused. Before installing new gasket in cylinder nozzle seat, always check to be sure that original gasket has been removed as an inadvertent installation of two seating gaskets would damage the fuel injector nozzle retaining spring. Check to be sure cylinder nozzle seat is free from excessive carbon deposit and that the seat face is free from surface roughness. Remove carbon deposits and / or surface roughness using nozzle carbon cutter - 4910-795-7958.

1. Install new preformed packing (B) on fuel injector nozzle holder.
2. Install new gasket (A) and install fuel injector nozzle and holder assembly.

Figure 4-153. Removing or installing fuel injector nozzle and holder assembly.



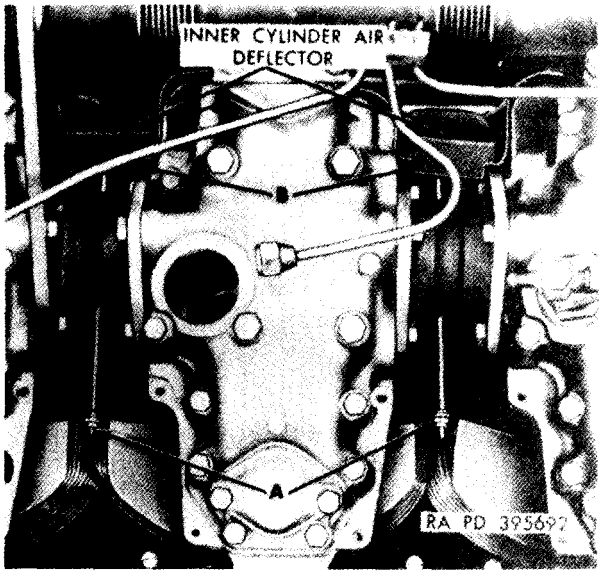
Remove

1. Remove fuel injector nozzle fuel return hose (A).
2. Remove four screws (B) and external tooth lock washers attaching each cylinder head shroud plate.
3. Remove two cylinder head plates (C).

Install

1. Position each cylinder head shroud plate (C) between cylinders.
2. Install four screws (B) and external tooth lock washers securing each plate.
3. Install fuel injector nozzle fuel return hose (A).

Figure 4-154. Removing or installing cylinder head shroud plate.



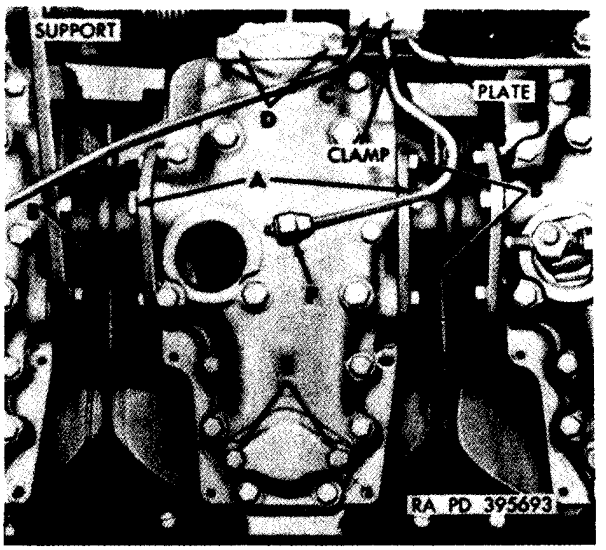
Disconnect

1. Remove self-locking nuts (A) from hooks attaching inner cylinder air deflectors.
2. Lift air deflector (B) from cylinder fins and rocker arm covers. It is not necessary to remove deflectors.

Connect

1. Position inner cylinder air deflectors (B) between cylinder fins and rocker arm covers
2. Install self-locking nuts (A) on hooks securing deflectors.

Figure 4-155. Disconnecting or connecting inner cylinder air deflector.



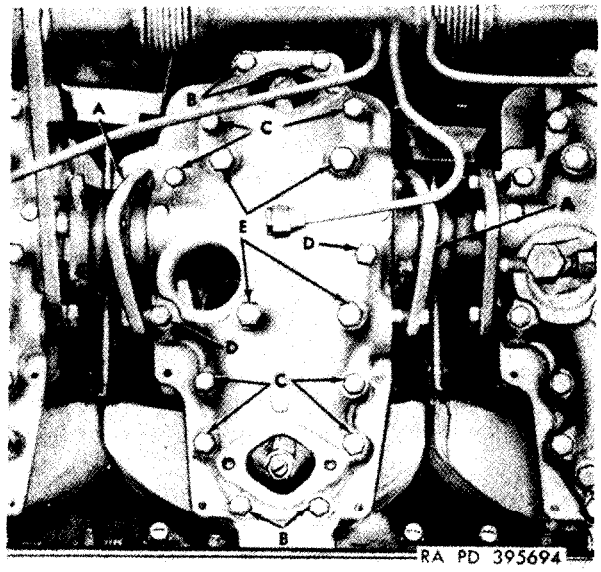
Disconnect

1. Remove the outer screw (A) attaching the intercylinder connector flanges to the rocker arm cover.
2. Loosen the inner two connector flange attaching screws (B).
3. Remove two self-locking nuts and screws (C) attaching plate and fuel tube clamps to the support.
4. Remove two bolts (D) attaching support and exhaust valve adjusting screw cover plate. Remove support cover plate and gasket. Discard gasket.
5. Remove two bolts (E) and flat washers. Remove the intake valve adjusting screw cover plate and gasket. Discard gasket.
6. Disconnect fuel tubes (F) from the two adjacent injector nozzles.

Connect

1. Connect fuel tubes (F) to the two adjacent injector nozzles.
2. Position new gasket on cylinder and install intake valve adjusting screw cover plate. Install two bolts (E) and flat washers.
3. Position new gasket on cylinder and install exhaust valve adjusting screw cover plate. Install two bolts (D).
4. Position plate and fuel tube clamp support. Install two self-locking nuts and screws (C).
5. Tighten the inner two connector flange attaching screws (B).
6. Install the outer screw (A) securing intercylinder connector flanges to the rocker arm cover.

Figure 4-156. Disconnecting or connecting intercylinder connector flange and valve adjusting screw covers.



Remove

Note. All valve rocker arm covers are removed in the same manner.

1. Separate intercylinder connector flanges (A) from valve rocker arm cover.

Note. Use a piece of shim stock to loosen flanges of intercylinder preformed hose.

Caution; Do not damage sealing surface on flange of intercylinder preformed hose as it will cause oil leaks and replacement of hose will be required.

2. Remove four bolts (B) and flat washers.
3. Remove seven bolts (C) and flat washers.
4. Remove two screws (D) and flat washers.

Note. Before removing rocker arm cover bolts (E), instruction 5, below, the tension on the valve rocker arms, caused by the valve springs. must be released. Turn engine, figure 4-51, until valve rocker arm rollers are on camshaft base circle, or until both valves are closed, to relieve spring tension before removing cover. Check rocker arms to see that they move up and down. If movement (clearance) cannot be felt, turn engine until clearance is evident. When clearance is obtained between both adjusting screw pads and valve stems, the rocker arm rollers are on the camshaft base circle, and the valves are completely closed.

5. Remove four bolts (E) and packings with retainer and remove valve rocker arm cover.

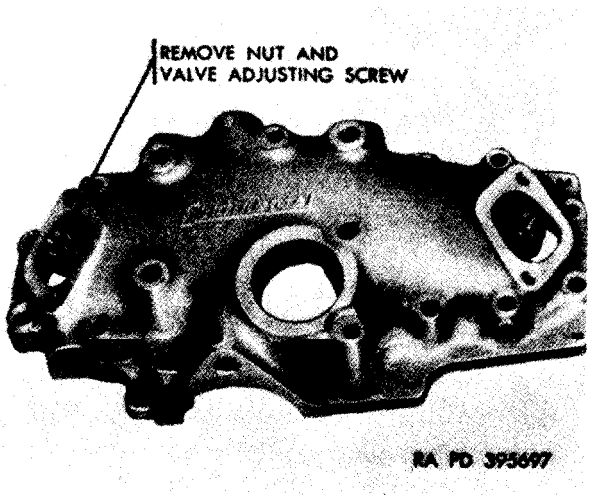
Install

Note. The cylinder and valve rocker arm cover are machined as an assembly. The number on the rocker cover must be kept with its mating number on cylinder to insure camshaft bearing alinement and running clearance.

Note. The bolts and screws securing valve rocker arm cover to cylinder must be torqued carefully to prevent stripping of heli-coil inserts.

1. Position valve rocker arm cover on cylinder and install four bolts (E) and packings with retainer and tighten to 275-325 pounds inch torque.
2. Install two screws (D) and flat washers and tighten to 100 pounds inch torque.
3. Install seven bolts (C) and flat washers and tighten to 100 pounds-inch torque.
4. Install four bolts (B) and flat washers and tighten to 100 pounds inch torque.
5. Position intercylinder connector flanges (A) on valve rocker arm cover.

Figure 4-157. Removing or installing valve rocker arm cover bolts and removing valve rocker arm cover.



Note. Valve rockers do not have to be removed to replace adjusting screws.

Figure 4-158. Removing or installing valve adjusting screw.

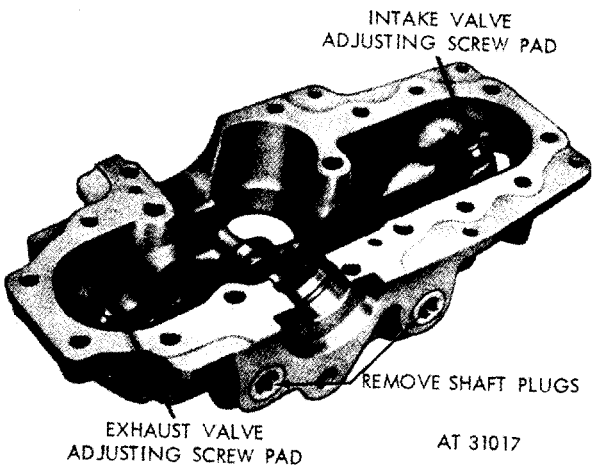


Figure 4-159. Removing or installing valve rocker arm shaft plugs.

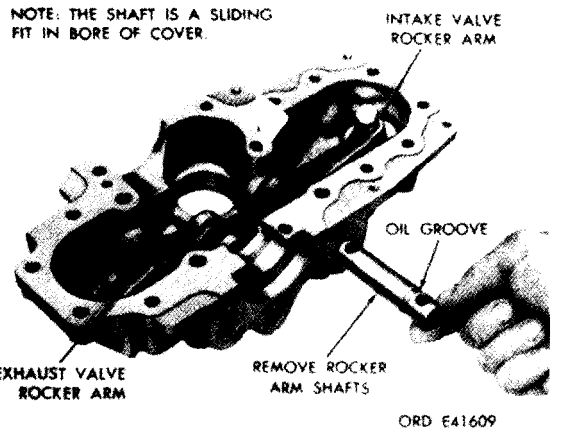
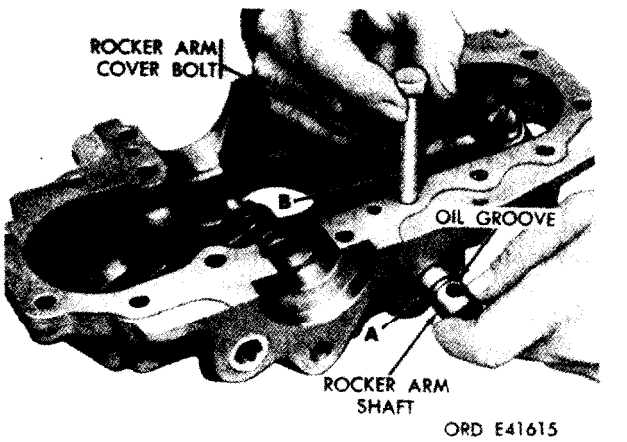


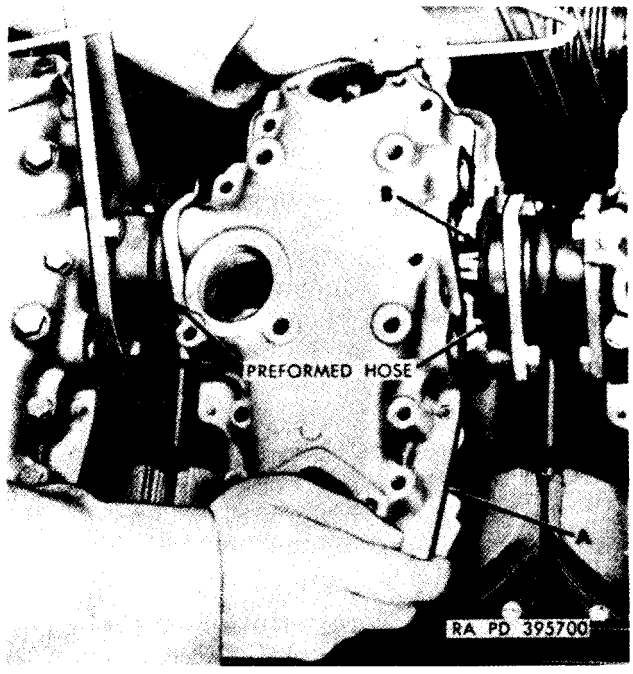
Figure 4-160. Removing valve rocker arm shafts and valve rocker arms.



1. Position valve rocker arms in reeker arm cover. Insert valve rocker arm shaft (A) through bore in rocker arm cover and rocker arm.
2. Use one rocker arm cover bolt (B) to a line hole in shaft with bolt hole in cover. Push shaft into position, without twisting, to retain alinement.

Note. Under normal circumstances, if rocker arm cover is damaged, the entire cylinder and cover must be replaced. In cases of emergency. the rocker arm covers can be changed hut it will require special attention to insure alinement of the two halves of the camshaft base.

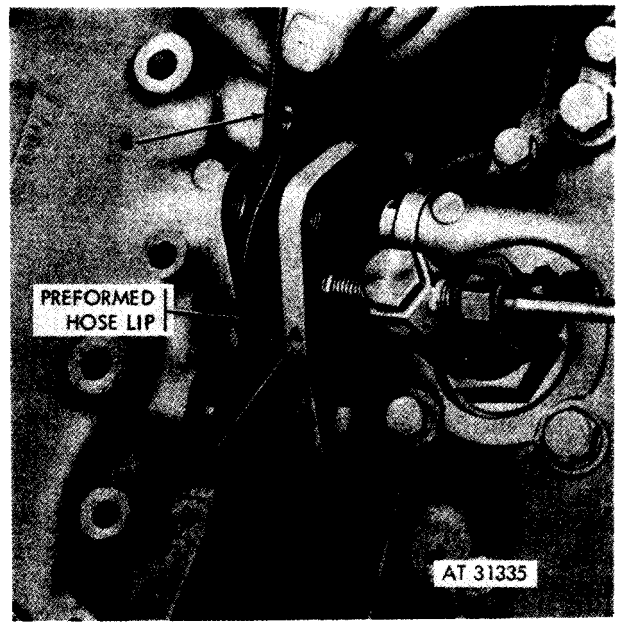
Figure 4-161. Installing valve rocker arms and valve rocker arm shafts.



Note. Be sure adjusting screws allow adequate clearance between the rocker arm roller and the camshaft lobe.

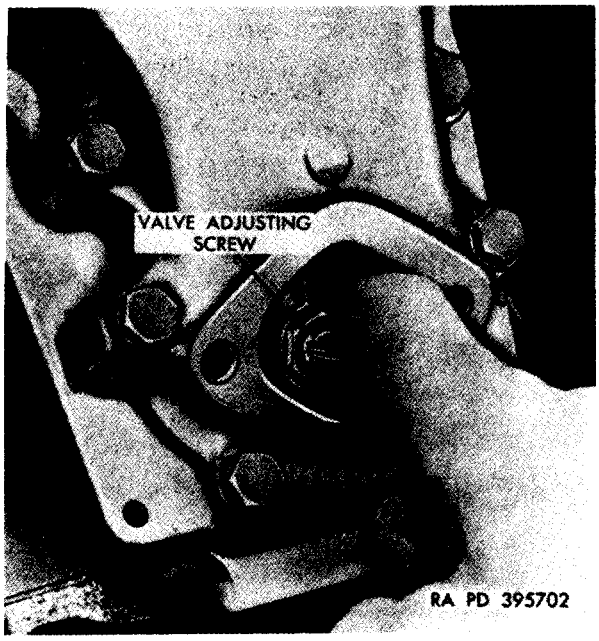
1. Coat face of valve rocker arm cover with sealer, MIL-C-10523 (ORD).
2. Install cover (A), being careful not to damage lip of intercylinder preformed hose (B) on each side of cylinder.

Figure 4-162. Installing valve rocker arm cover.



1. Tap valve rocker arm cover (A) gently into position on locating dowel pins being sure cover is flush with mating surface of cylinder.
2. Properly position lip of intercylinder preformed hose using shim stock (B).

Figure 4-163. Positioning lip of intercylinder preformed hose.



Note. Make certain adjusting screw pad is positioned squarely on end of valve stem. Refer to Section X, figures 4-188 and 4-189 for valve adjustment.

Figure 4-164. Positioning valve adjusting screw pad on end of valve stem.

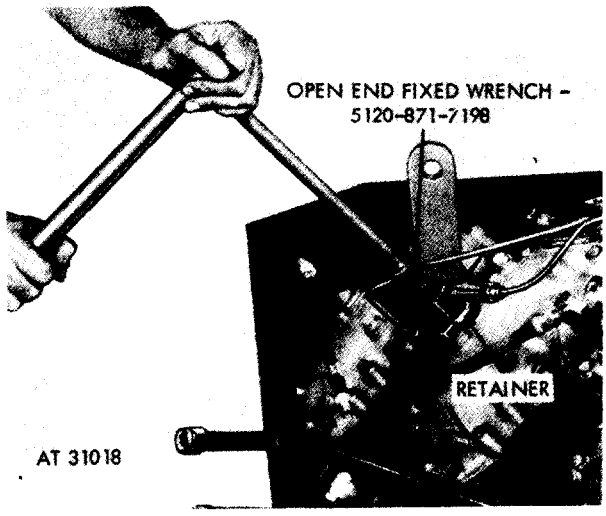


Figure 4-165. Torque tightening fuel injector nozzle.

Section VIII. OVER HAUL OF FUEL INJECTOR NOZZLE AND HOLDER ASSEMBLY

4-16. General

This section covers the overhaul of the fuel injector nozzle and holder assembly. Refer to Table 4-7 for illustrations and instructions on removal, testing, disassembly, cleaning, inspection, repair, assembly, and installation. Figure references are listed under appropriate headings in the table.

Note. Table 4-7 provides illustrations for removal and installation of all upper covers to gain access to the fuel injector nozzle and holder assemblies. It is not necessary to remove all covers unless all assemblies are to be rebuilt.

Table 4-7. Fuel Injector Nozzle and Holder Assembly

Removal and Testing	Disassembly	Cleaning and Inspection	Repair	Assembly and Test	Install
Para 4-17 Figs. 4-126 through 4-130, 4-133 through 4-135, 4-141, 4-150 through 4-153	Para 4-18a Figs. 4-167, 4-168	Para 4-18 b and c	Para 4-18d	Para 4-18e Figs. 4-166 through 4-168	Figs. 4-157 through 4-150, 4-135 through 4-133, 4-130 through 4-126

4-17. Removal and Testing

a. *General.* The fuel injector nozzle and holder assemblies are generally removed while troubleshooting the fuel system, particularly when a fuel injection pump has failed. The nozzles should be tested on a nozzle tester for opening pressure, spray pattern, leakage and nozzle chatter before reinstalling in engine. Check the nozzle retaining spring to dimensions shown in figure 4-166, as springs that have been installed over a period of time tend to take a permanent "set". The nozzles are to be replaced 100% at time of overhaul. Nozzle pressure adjusting shims are furnished in shim set FSN 5365-235-1941.

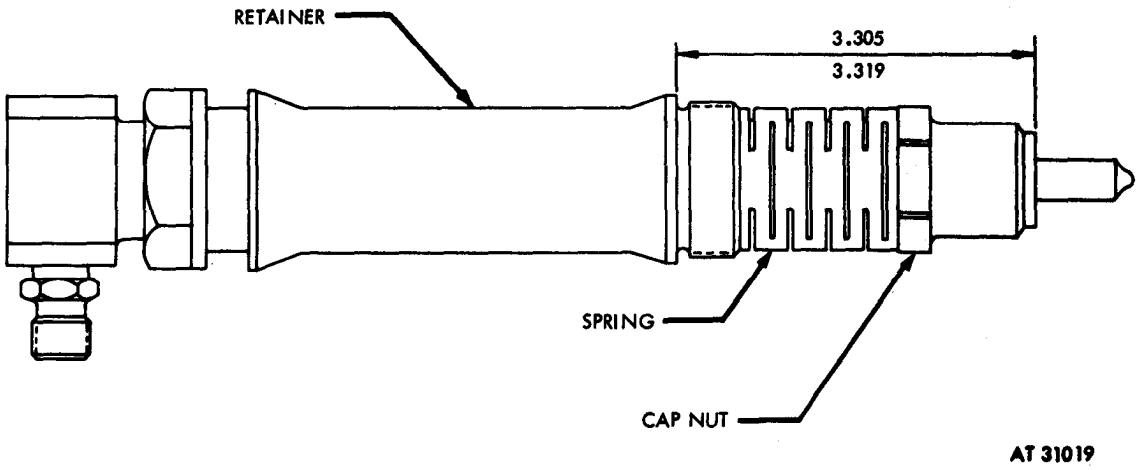


Figure 4-166. Fuel injector nozzle and holder assembly.

b. *Removal.* Refer to Table 4-7 for figure references and instructions pertinent to the removal of the fuel injector nozzle and holder assembly.

c. *Testing.*

Note. Before installing injector nozzle on nozzle tester, thoroughly clean external area to remove carbon and dirt. Do not allow dirt to enter nozzle fuel inlet opening. For nozzles that do not perform properly on nozzle tester refer to paragraph 4-18 for disassembly sequence and necessary procedures 'required to assure a properly functioning nozzle and holder assembly.

(1) *Nozzle installation.* Mount the fuel injector nozzle and holder assembly on the fuel injector nozzle tester using nozzle attaching tube -4910-795-7953. The tube should be connected to the lower connection on the injector nozzle tester. Close the pressure gage valve and actuate the pump handle rapidly (approximately 2S strokes per minute) to expel air from nozzle and holder and to settle spring and nozzle holding column.

(2) *Nozzle opening pressure.* Fill reservoir with sufficient fuel to perform test. Open pressure gage valve and actuate tester slowly to raise pressure. When nozzle opens, gage pressure must be between 3050 psi (minimum), 3150 psi (maximum). If this gage reading is not achieved, nozzle and holder assembly must be disassembled and spring adjusting spacers (fig. 4-167) added or removed to obtain the proper pressure reading.

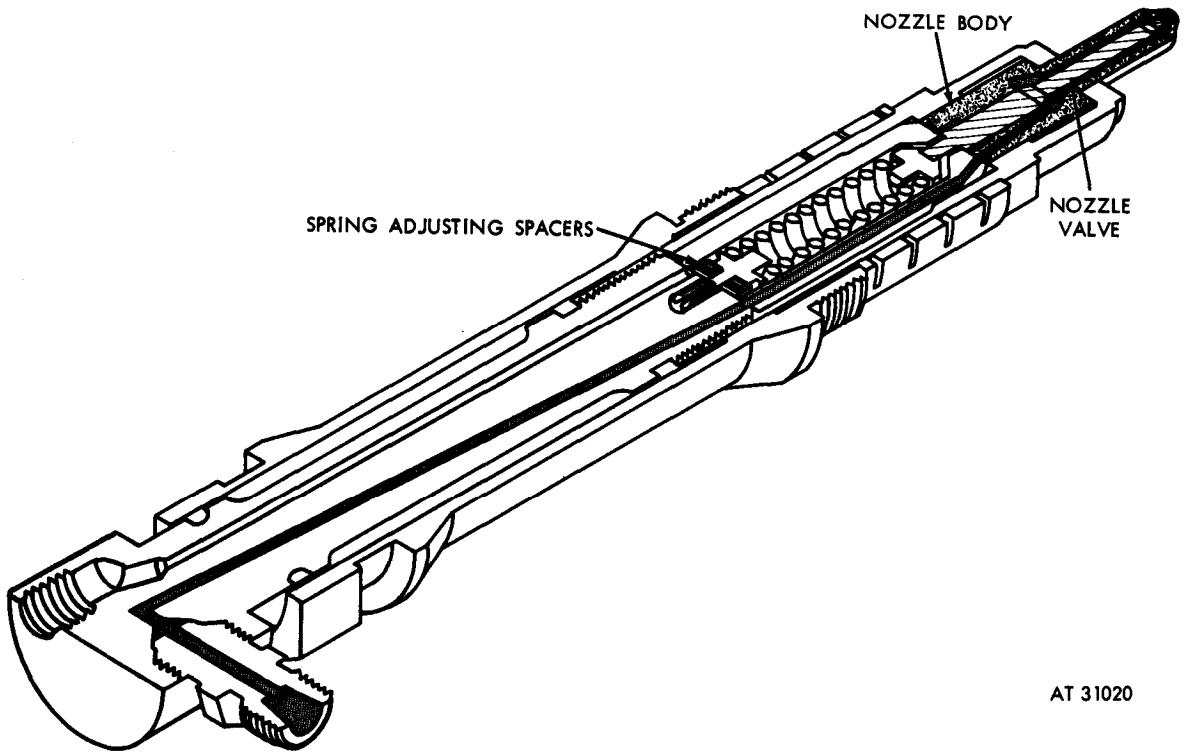


Figure 4-167. Fuel injector nozzle and holder assembly—sectional view.

(3) *Nozzle spray pattern.* Close pressure gage valve and operate tester at approximately 15 strokes per minute. The spray pattern should be sharp, with a rather solid pattern, and the angles formed by the eight individual spray openings should be uniform. If spray pattern is irregular and does not improve with continued operation of the tester, check opening pressure. If spray pattern is not acceptable, replace nozzle assembly.

(4) *Nozzle leakage.* Disconnect tube and nozzle from lower connector and move to upper connector (fig. 4-168). With pressure gage valve open, actuate tester slowly to build up pressure. As correct pressure is approached (3050 psi minimum to 3150 psi maximum) observe spray orifices. If drops of fuel form, or if fuel issues as a stream at pressures below 3050 psi, the nozzle is leaking and must be replaced.

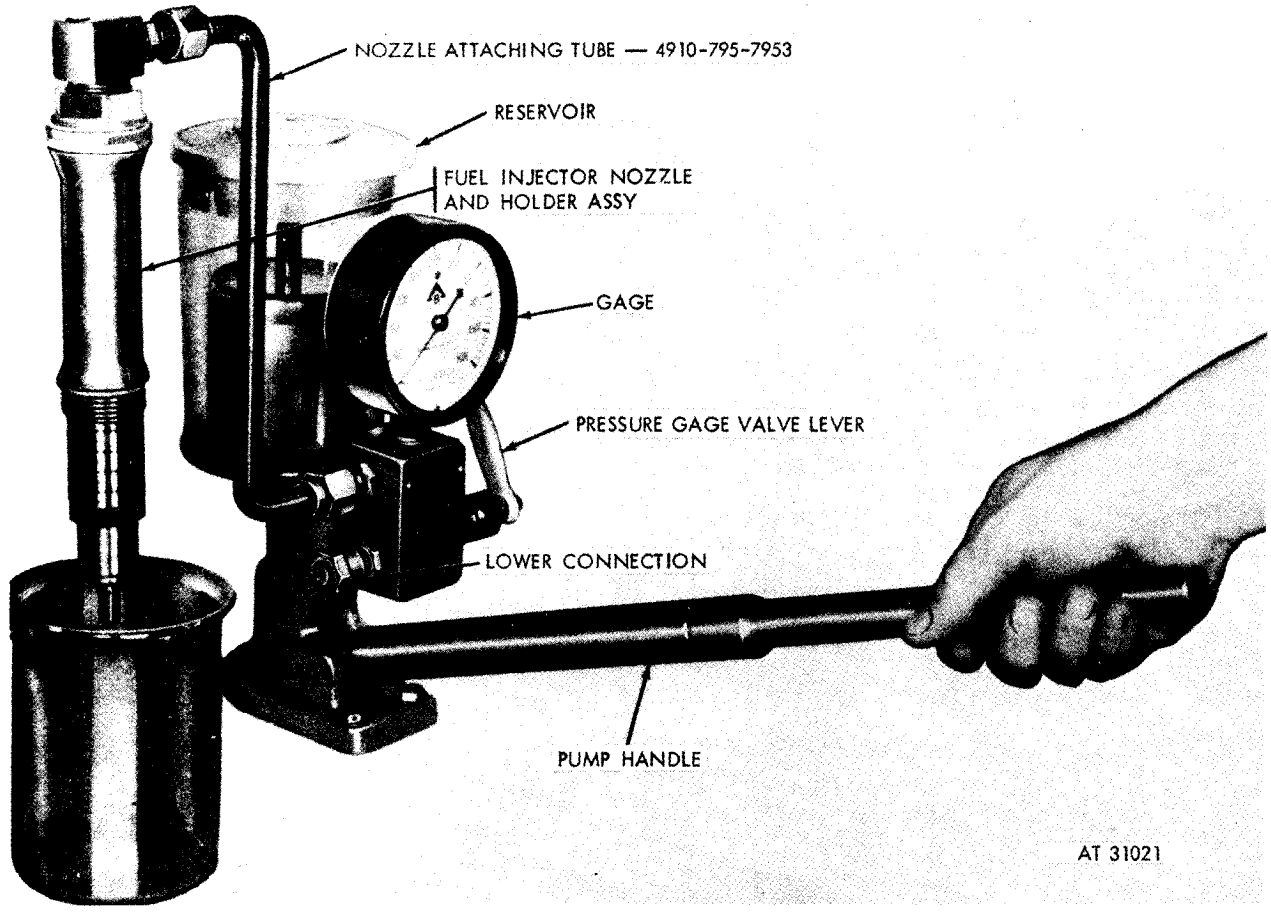


Figure 4-168. Testing fuel injector nozzle and holder assembly.

(5) *Nozzle chatter.* The chatter test requires that one stroke of the tester handle takes approximately two seconds, with pressure gage valve closed. Chatter must be distinct and regular. A sharp pitch sound is not mandatory, and an occasional skip or variation in chatter pitch is acceptable. When nozzle chatter is not satisfactory, and does not improve with continued operation of the tester, the nozzle must be replaced.

4-18. Overhaul of Fuel Injector Nozzle and Holder Assembly

a. Disassembly. Refer to figures 4-169 and 4-170 for disassembly of the fuel injector nozzle and holder assembly.

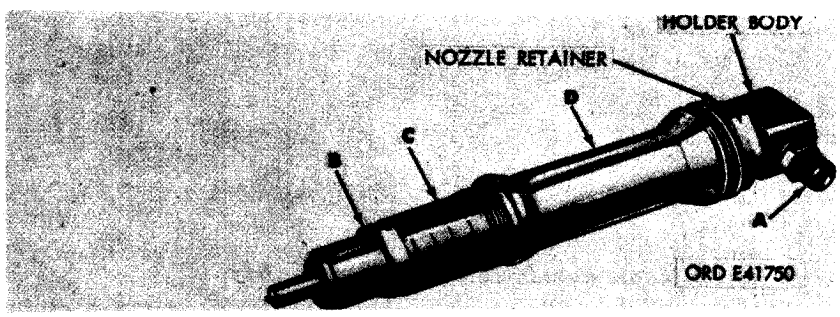
Disassemble

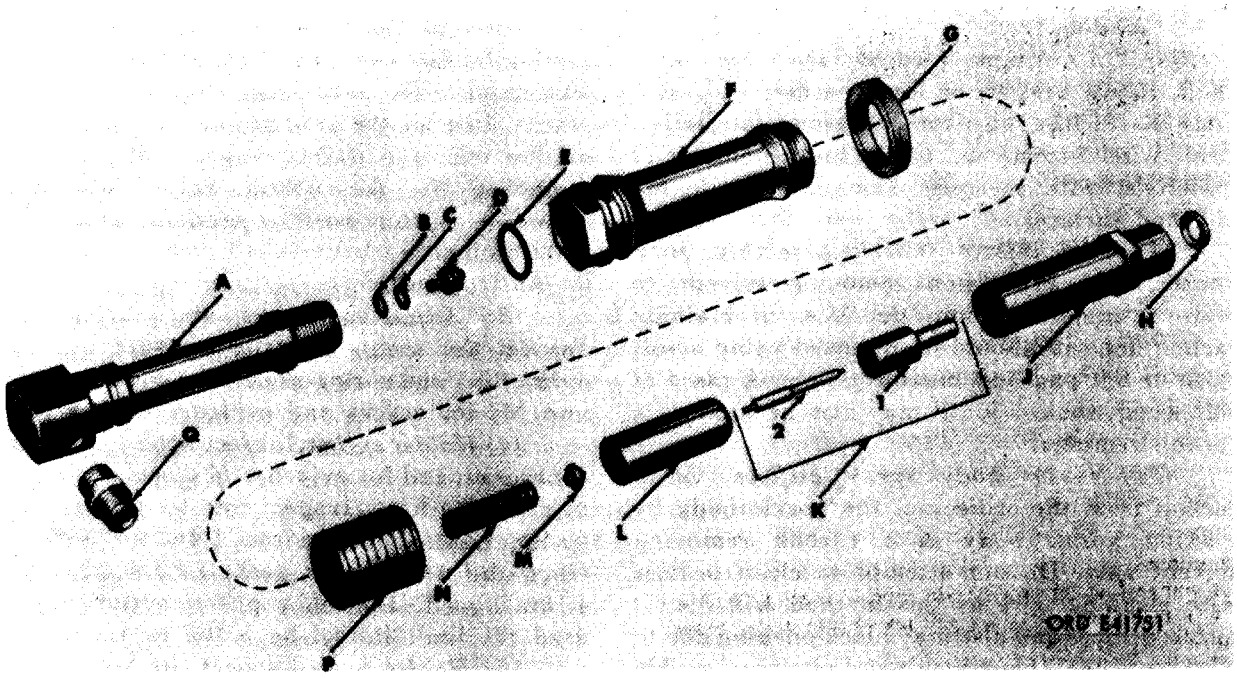
1. **Remove fuel injector nozzle tube connector (A).**
2. **Clamp holder body in a soft jawed vise and remove nozzle cap nut (B).**
3. **Remove holder spring (C).**
4. **Remove nozzle retainer (D).**

Assemble

1. **Assemble nozzle retainer (D).**
2. **Assemble holder spring (C).**
3. **Clamp holder body in a soft jawed vise and assemble nozzle cap nut (B) torquing to 65 pound feet. Be sure nozzle body is centered in opening of cap nut.**
4. **Install fuel injector nozzle tube connector (A).**

Figure 4-169. Partial disassembly or assembling fuel injector nozzle and holder assembly.





Disassemble

1. Remove fuel injector nozzle assembly (K), with nozzle body (K-1) and nozzle valve (K-2) from valve stop spacer (L).
2. Remove valve stop spacer (L) and nozzle opening pressure adjusting spring (N) with spring upper and lower seats (D and M) from holder body (A). Do not remove the spring adjusting upper and lower spacers (B and C) from spring upper seat (D) unless ajustment of the nozzle opening pressure is necessary during testing of the fuel injector nozzle and holder assembly (para 4-17).
3. Remove and discard preformed packing (E) from holder body (A).
4. Disassemble fuel injector nozzle assembly (K) by removing nozzle body (K-1). It may be necessary to soak the nozzle assembly in carbon removing solvent to aid in disassembly. It may be necessary to tap nozzle body downward on the edge of a wooden bench or other similarly soft surface to remove valve.

Note. The nozzle body and nozzle valve are fitted individually during manufacture to form a mated assembly. Individual parts are not interchangeable. Therefore, extreme care must be taken during the cleaning, inspection, and repair operations to keep these parts mated.

Assemble

Note. During assembly, the addition or removal of spring adjusting spacers to obtain the correct gage pressure reading on the nozzle tester may require various combinations of spacers available in shim set -5365-235-1941. Although each nozzle assembly pressure reading may vary, experience will indicate the approximate spacer thickness or combination of spacer thickness required to make up pressure differences. The nozzle assembly must be completely assembled, torque tightened and checked again on the nozzle tester to assure proper spacer combination and pressure reading. This procedure may have to be repeated several times before achieving a satisfactory reading.

1. Assemble nozzle valve (K-2) in nozzle body (K-1) to form fuel injector nozzle assembly.
2. Install a new preformed packing (E) in holder body (A).
3. Install spring upper seat (D), with spring adjusting upper and lower spacers (D and M) in end of nozzle opening pressure adjusting spring (N). Install spring lower seat (M) in opposite end of spring (N) and install assembled spring and valve stop spacer (L) in holder body (A).
4. Install fuel injector nozzle assembly (K-1 and K-2) in valve stop spacer (L).

Figure 4-170. Disassembling or assembling fuel injector nozzle components.

b. Cleaning.

Note. Do not remove carbon from the valve, (K-2, figure 4-170), or inner surface of nozzle body (K-1)with a sharp tool, abrasive material, or steel wire brush, as these implements and materials will severely damage the highly polished surfaces.

(1) Fuel injector nozzle assembly. Soak nozzle body in carbon removing solvent to remove major carbon deposits. Remaining carbon deposits should be removed using a soft cloth or felt pad and mutton tallow. A piece of soft wood, soaked in oil may also be used as a carbon remover.

(2) Nozzle body spray orifices. Clean carbon from the orifices of the nozzle body by soaking nozzle body in a carbon removing solvent only. Do not attempt to clean orifices with cleaning wire as this method will distort nozzle orifices and also may block opening due to wire breakage. It is difficult and often impossible to remove broken pieces of wire.

(3) Fuel injector holder and associated parts. Clean all parts thoroughly. Be sure hands are kept free from accumulation of grease which will cause collection of dust and grit on parts. Cover or wrap all parts after cleaning to protect them from dirt accumulation.

c. Inspection.

(1) Nozzle body and valve. Inspect seat of nozzle valve (K-2. fig. 4-170) for evidence of wear, distortion of the valve seat due to pounding, discoloration due to overheating, and pitting. Inspect the valve stem between seal and shoulder for scratches and discoloration. Check fit of valve in nozzle body by lifting the valve about one-third of its length out of the body. The valve should slide back to its seat without aid when the assembly is held at a 45 degree angle. Mark sticking assemblies for repair. Inspect the eight spray orifices in the nozzle body tip and the drilled passage in the body for freedom of obstructions, Inspect lapped sealing surface of valve body for scratches, discoloration, and cracks. Inspect nozzle body valve seat, using a strong light and a magnifying glass (5 to 7 power magnification minimum) for scratches, discoloration, wear, pitting, and evidence of pounding.

Note. An otoscope, such as used by physicians for examination of the inner ear, is well suited for this purpose.

(2) Valve stop spacers. Inspect the lapped sealing surfaces on the ends of the valve stop spacer (L) for scratches, discoloration, and cracks. Inspect the area around the center hole on the nozzle end for evidence of wear and pounding by the nozzle valve. Maximum allowable depth of wear or pounding at this area is 0.003-inch. Inspect drilled passages in spacer for obstructions.

(3) Adjusting spring and spring seats. Inspect the nozzle opening pressure adjusting spring (N) and spring upper and lower seats (D and M) for cracks and evidence of wear.

(4) Holder spring. Inspect holder spring (P) for cracks, and for evidence of discoloration due to excessive heat. Inspect free length of holder spring. Limit should be from 1.403 to 1.409-inch when the new copper gasket, FSN 5310-861-1406, is used. If the old copper-asbestos gasket is used the limit should be 1.407 to 1.409-inch.

(5) Holder body. Inspect the holder body (A) for cracks, burs, nicks, and raised metal. Inspect lapped sealing surface for scratches and discoloration. Inspect the threaded area and tapped openings for stripped or damaged threads.

(6) Nozzle cap nut. Inspect the nozzle cap nut (J) for nicks, burs, raised metal surfaces, and for cracks due to overheating. Inspect threaded area inside nut for stripped or damaged threads. Inspect the gasket area on end of nut for deep scratches.

(7) Nozzle retainer. Inspect the nozzle retainer (F) for cracks, nicks, burs, and raised metal, and for rounding of the hexagon nut area. Inspect threaded area for stripped or damaged threads,

(8) Fuel injector tube connector. Inspect the fuel injector tube connector(Q) for cracks and for stripped or damaged threads.

d. Repair.

(1) Nozzle body and valve.

(a) Replace nozzle body (K-1, figure 4-170) and nozzle valve (K-2) when body seat or valve seat is badly worn, pounded, or pitted, or when nozzle does not conform to spray pattern limits specified in paragraph 4-17c(3). Minor discoloration or imperfections of body and valve seat can be cleaned up by lapping the valve into the body. Clamp valve by its stem in jaws of rotating chuck. Place a very minute quantity of fine lapping compound on tip of valve. Slide

nozzle body over valve and lap valve to seat with a very light pressure for 15 to 20 seconds at 500 to 600 rpm chuck speed. Wash body and valve very thoroughly in clean fuel before assembly.

(b) A sticking valve can, in some instances, be made to slide freely by cleaning the valve stem with tallow and a felt pad with valve clamped in rotating chuck. If the valve cannot be made to slide freely, the fuel injector nozzle assembly must be replaced.

(c) Replace nozzle body and valve assembly when any of the spray holes or the drilled fuel passage cannot be cleaned so that they are free from obstructions.

(d) Replace nozzle body and valve assembly when lapped sealing surface of body is badly nicked, scratched, or cracked. Remove minor scratches from sealing surface by lapping with fine lapping compound on a smooth lapping plate. The nozzle body must be held flat on the lapping plate during this operation or the sealing surface will become rounded on the edges.

(2) Valve stop spacer.

(a) Replace valve stop spacer (L) when lapped sealing surfaces on either end are cracked, deeply scratched, pitted, or when the area around the center hole at nozzle end is worn or pounded beyond 0.003-inch depth.

(b) Remove minor scratches and imperfections from lapped sealing areas on ends of spacer by lapping with fine lapping compound on a smooth lapping plate. The spacer must be held flat against the lapping plate during this operation or the sealing surface will become rounded on edges.

(c) Replace valve stop spacer when drilled fuel passages cannot be cleaned so that they are completely free from obstructions.

(3) Adjusting spring and spring seats. Replace nozzle opening pressure adjusting spring (N) and spring upper and lower seats (D and M) when cracked or worn, or when nozzle opening pressure does not meet the limits specified in paragraph 4-17c(2).

(4) Holder spring. Replace holder spring (P) when cracked, broken, or when inspection revealed discoloration due to overheating. Replace the holder spring when it does not conform to the dimensions detailed in para. 4-18c(4).

(5) Holder body.

(a) Replace holder body (A) when cracked, burred, nicked, or when threads are stripped or damaged.

(b) Remove minor scratches and imperfections in lapped sealing surface of holder body by lapping with fine lapping compound on a smooth lapping plate. The holder and plate must be held 90 degrees to each other. There should be no rocking motion during lapping.

(6) Nozzle cap nut. Replace nozzle cap nut (J) when badly nicked, burred, or when cracks are evident due to overheating. Replace cap nut when threads are stripped or damaged, and when gasket area is scratched, nicked, or burred.

(7) Nozzle retainer. Replace nozzle retainer (F) when cracked, badly nicked or burred or when hexagon nut area is damaged, Replace retainer when threads are stripped or damaged.

(8) *Fuel injector tube connector.* Replace fuel injector tube connector (Q) when cracked or threads are stripped or damaged.

e. Assemble and Test.

(1) Assemble. Refer to figures 4-169 and 4-170.

(2) Test. Refer to paragraph 4-17c. The fuel injector nozzle and holder assembly should be tested whenever nozzle has been disassembled.

Section IX. REPLACEMENT OF FLY WHEEL AND CRANKSHAFT OIL SEAL

4-19. General

This section covers the replacement of the flywheel and crankshaft oil seal. Refer to Table 4-8 for illustrations and instructions for removal and installation of the flywheel and crankshaft oil seal. Figure references are listed under appropriate headings in the table.

Table 4-8. Flywheel and Crankshaft Oil Seal

Component	Removal	Installation
Flywheel	4-171 through 4-174	4-174, 4-183, 4-171
Crankshaft Oil Seal	4-171 through 4-180	4-181, 4-182, 4-179, 4-178, 4-176 through 4-174, 4-183, 4-171

4-20. Replacement Instructions



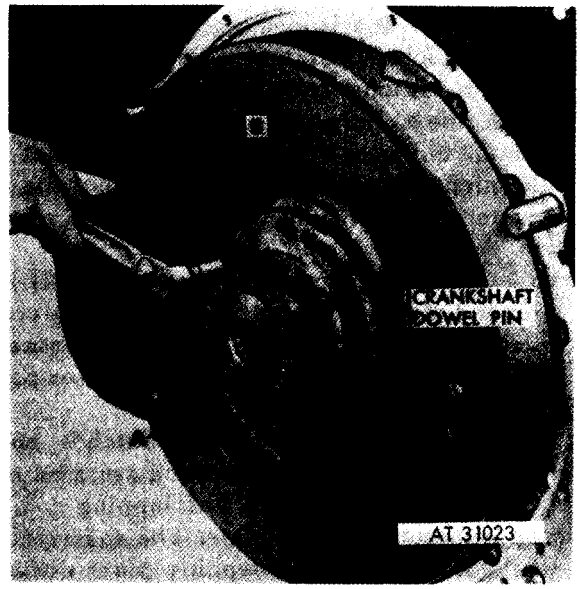
Remove

1. Using splined wrench - 5120-793-7895, as shown in figure 4-51, position flywheel so that lifting eye bolt hole (A) is located on top of flywheel.
2. Straighten tabs of lock plates (B) securing nine bolts.
3. Remove nine bolts (C) and three lock plates attaching transmission drive gear shaft and flywheel to crankshaft. Discard lock plates.

Install

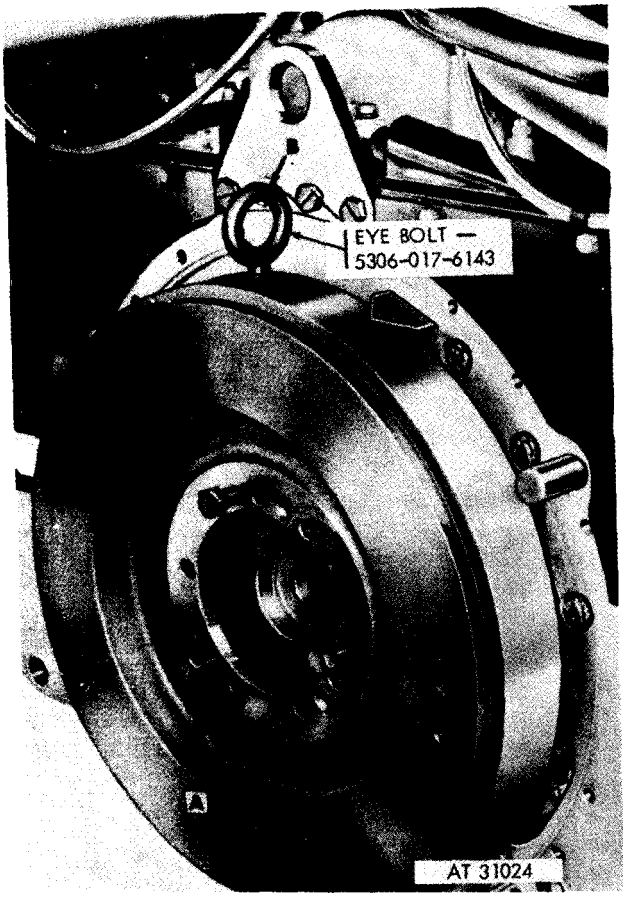
1. Install three lock plates (B) and nine bolts (C) securing transmission drive gear shaft and flywheel to crankshaft. Tighten bolts to 1000 pounds-inch torque.
2. Bend tabs of lock plates (B) securing nine bolts.

Figure 4-171. Removing or installing transmission drive gearshaft and flywheel mounting bolts.



1. Install three bolts (A) from transmission drive gearshaft and flywheel into puller screw holes provided.
2. Pull transmission drive gearshaft from crankshaft dowel pins by alternately tightening the three bolts (B).

Figure 4-172. Removing transmission drive gearshaft using bolts as ***puller screws.***



1. Install three bolts (A) from transmission drive gearshaft and flywheel into puller screw holes provided. Alternately tighten bolts until flywheel is far enough from crankshaft dowel pins to permit installation of lifting eye bolt.
2. Install eye bolt -5306-017-6143 (B).

Figure 4-173. Installing eye bolt— 5306-017-6143.

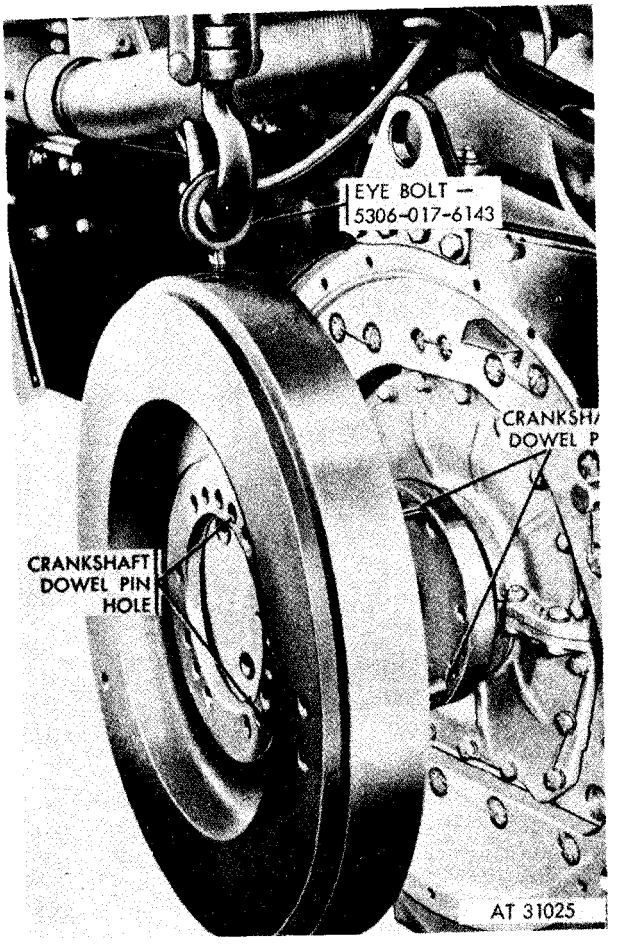
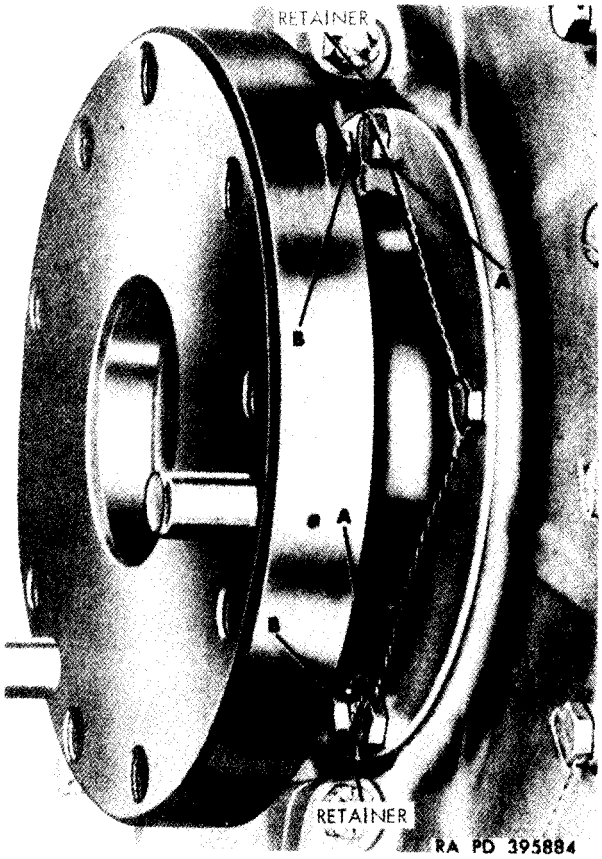


Figure 4-174. Removing or installing flywheel.



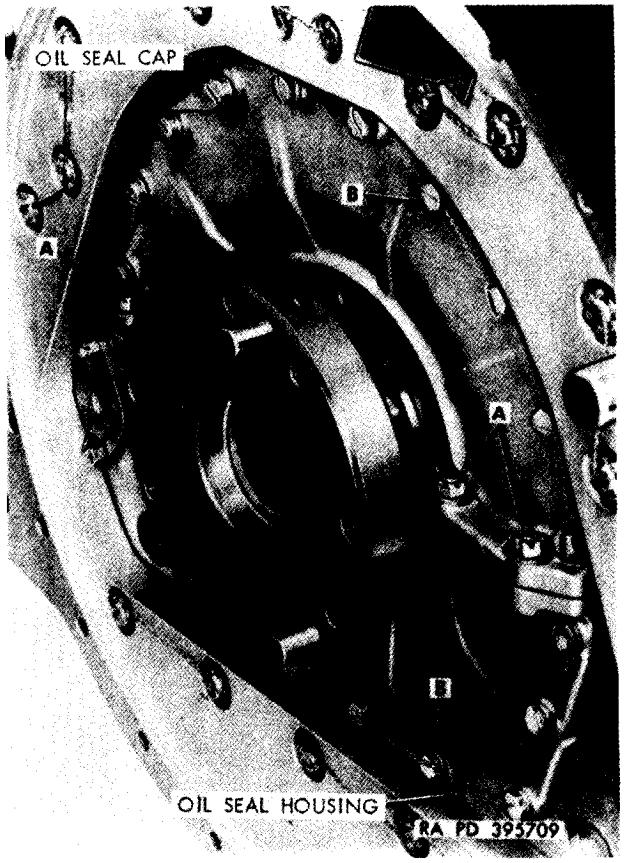
Remove

1. Cut locking wire and remove three bolts (A I attaching oil seal retainer to oil seal cap.
2. Cut locking wire and remove three bolts (B) attaching oil seal retainer to oil seal housing.

Install

1. Install three bolts (B) securing oil seal retainer to oil seal housing. Install locking wire.
2. Install three bolts (A) securing oil seal retainer to oil seal cap. Install locking wire.

Figure 4-175. Removing or installing crankshaft oil seal retainer.



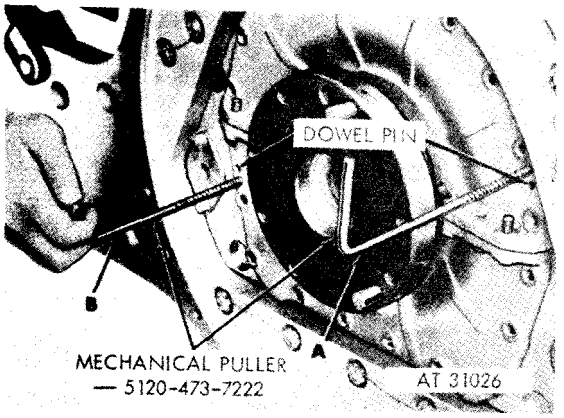
Remove

1. Cut locking wire and remove four nuts (A) and flat washers attaching oil seal cap to oil seal housing.
2. Cut locking wire and remove 20 bolts (B) and flat washers attaching oil seal cap and housing to crankcase.

Install

1. Install 20 bolts (B) and flat washers securing oil seal cap and housing to crankcase. Install locking wire.
2. Install four nuts (A) and flat washers securing oil seal cap to oil seal housing. Install locking wire.

Figure 4-176. Removing or installing oil seal cap and oil seal housing mounting bolts.



1. Install two mechanical pullers - 5120-473-7222 (A) into oil seal cap and housing puller *screw* holes.
2. Pull cap and housing free of dowel pins.

Figure 4-177. Removing oil seal housing using mechanical pullers—5120-473-7222.

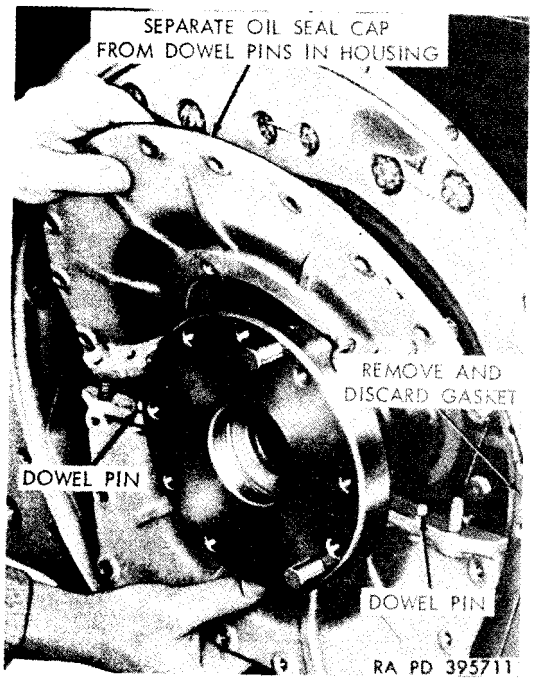
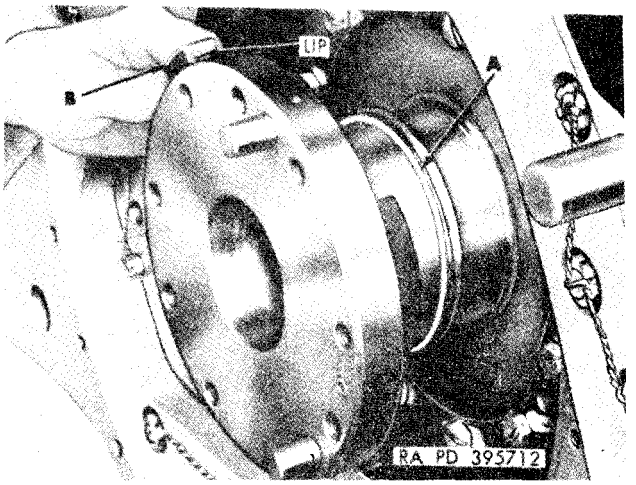


Figure 4-178. Removing or installing oil seal housing cap and housing.



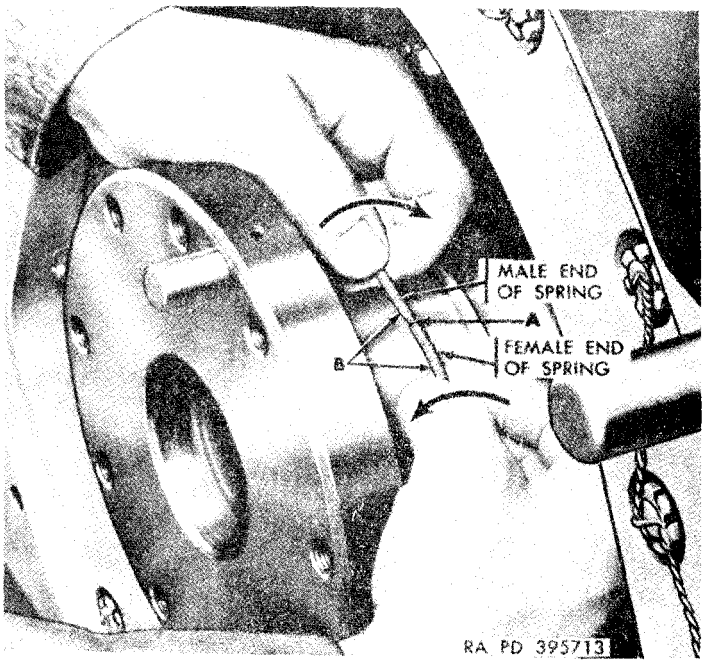
Remove

1. Remove spring (A) from lip in crankshaft oil seal.
2. Remove the split oil seal (B) from crankshaft.

Install

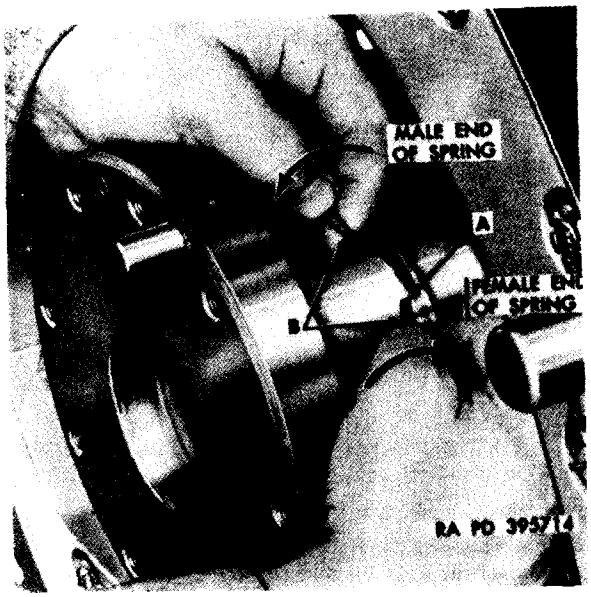
1. Install split oil seal (B) in crankshaft.
2. Install spring (A) in lip in crankshaft seal.

Figure 4-179. Removing or installing crankshaft oil seal.



1. Position oil seal spring (A) (male and female) to facilitate removal.
2. Twist male end clockwise and female end (B) counterclockwise, and remove crankshaft oil seal spring.

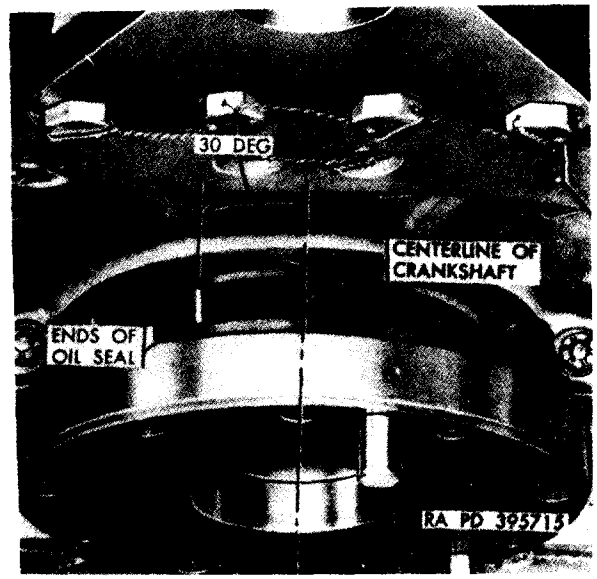
Figure 4-180. Removing crankshaft oil seal spring.



1. Position oil seal spring (A) around crankshaft and interlock ends (B).
2. Twist female end of spring clockwise and male end counterclock wise to secure spring.

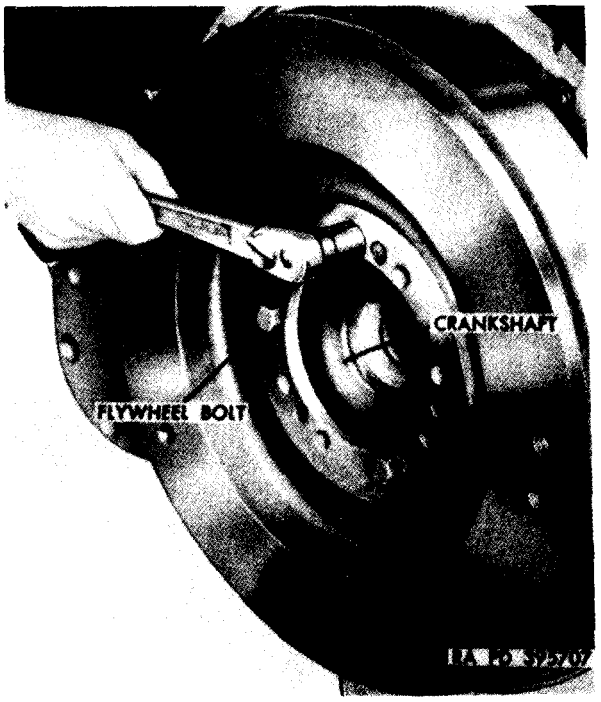
Note. Makes sure spring seats around lip of oil seal and that lip is toward crankcase. Apply a coating of lubricant around lip and outer surface of seal.

Figure 4-181. Installing crankshaft oil seal spring.



Note. Crankshaft oil seal must be rotated on crankshaft until ends of oil seal join 30 degrees from centerline of crank shaft looking at the rear of engine as shown. This is important in controlling oil seepage past the split line of oil seal.

Figure 4-182. Correct position for crankshaft oil seal sp!it line before installing seal retainer.



Note. Draw flywheel to crankshaft by installing three transmission drive shaftgear and flywheel bolts and alternately tighten about one turn at a time to draw flywheel into dowel pins without binding. Remove bolts and install transmission drive gearshaft following the above procedure until both flywheel and transmission drive gearshaft are properly alined on dowel pins.

Figure 4-183. Installing flywheel, using bolts to draw flywheel against crankshaft.

Section X. SERVICE OPERATIONS

4-21. General

This section covers service operations allocated to the Direct Support Maintenance Organization. Procedures outlined in this section are for service operations requiring a minimum of engine disassembly to perform. Refer to Table 4-9 for illustrations and instructions on service operations covered in this section. Figure and paragraph references will be listed under appropriate headings in the table.

Table 4-9. Service Operations

Service Operation	Removal	Service Procedure	Installation
Checking cylinder compression	4-126 through 4-135, 4-141, 4-153	4-184, 4-185 Para 4-22	4-154, 4-141, 4-135 through 4-126
Adjusting Intake and Exhaust Valve Clearance	4-34 through 4-38, 4-126 through 4-135, 4-141 through 4-149, 4-186, 4-187	4-188, 4-189 Para 4-23	4-187, 4-186, 4-149 through 4-126, 4-38 through 4-34
Checking Intake and Exhaust Valve Timing	4-191 through 4-194, 4-198	4-195 through 4-197, 4-200, 4-201, 4-189 Para 4-24	

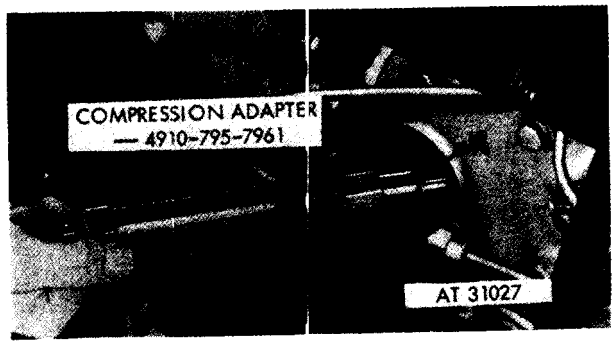
4-22. Checking Cylinder Compression

a. General. For instructional purposes in this section all fuel injector nozzle and holder assemblies will be removed and a compression test will be made on all cylinders. If troubleshooting indicates that only one cylinder requires a compression check, it may be done by rem oving the nozzle from the questionable cylinder.

Warning; When only one cylinder is checked, there is the possibility of the engine firing on the other cylinders when compression check is being made. To prevent engine firing, remove all nozzles then check cylinder compression. Unless all nozzles are removed, the engine motoring rpm will be below desired cylinder checking rpm.

b. Starting Engine. Check the vehicle batteries to assure full charge and replace if necessary. Refer to the pertinent operator's manual for engine starting procedures. Start engine and allow engine to reach normal operating temperature and then stop engine. Cut off fuel supply so engine will not deliver fuel while performing compression test.

c. Compression Test. Remove the fuel injector nozzle and holder assemblies from each cylinder (para 4-17). Install the compression checking adapter and compression gage (figs. 4-184 and 4-185) and motor engine with the starter motor. Crank engine several seconds, or until compression gage reaches maximum reading. Cylinder compression pressure should be between 330 and 480 psi. High cylinder pressures are caused by combustion of lubricating oil in the engine combustion chamber. If this occurs, allow combustion gases to escape prior to taking compression reading.



Install

1. Position new fuel injectc r nozzle gasket (A) on end of compression adapter - 4!'10-795-7961. Apply a light coating of grease *on* gasket so it adheres to adapter when installed in cylinder.

Note. Be sure gasket is installed with open face toward adapter.

2. Install adapter (B) into fuel injector nozzle holder opening and tighten securely using fixed open end wrench - 5120-871-7198

Remove

1. Remove adapter (B) frc m fuel injector nozzle holder opening using fixed open end wrench -5120-871-7198 as shown in figure 4-16$.
2. Remove and discard gasket (A).

Figure 4-184. Installing or removing compression adapter—4910-795-7961 (cylinder compress:ion test).



1. Install gage assembly -4910-870-6283 (A) on adapter - 4910-795-7961 and tighten securely.
2. Crank engine using starter motor and check cylinder compression. It must be within 330 to 480 psi at engine cranking speed.
3. Depress gage vent valve (B) to release pressure and reset gage to zero after compression reading is taken. Recheck reading. Test compression on all cylinders in the same manner.

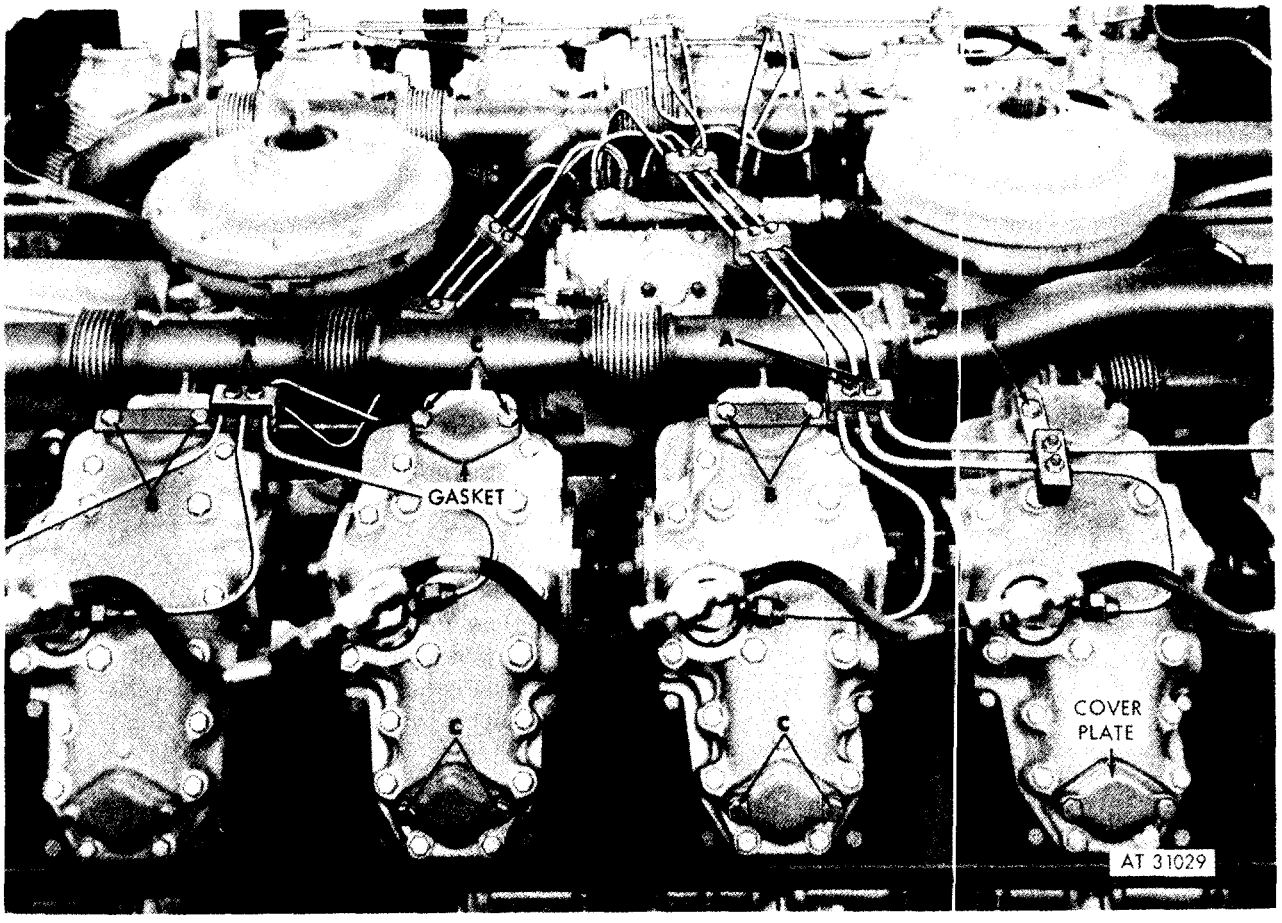
Figure 4-185. Checking cylinder compression using gage assembly-4910-870-6283 and compression adapter-4910-795-7961.

d. Compression Variation. After all 12 cylinders are checked, determine the pressure difference between high and low cylinder readings. This variation should not exceed 70 psi.

e. Engine Motoring RPM. If compression data exceeds the above specifications. the engine motoring rpm should be checked to be sure that it is 140 to 180 rpm. Compression should be checked again to confirm the previous readings before submitting an engine for overhaul.

4-23. Adjusting Intake and Exhaust Valve Clearance

When checking and / or adjusting valve clearance, it is necessary to first remov e the cooling fan vanes, fans, fan shroud, top covers, and oil coolers to gain access to valve adjusting screw cover plates. Refer to Table 4-9 for instructions pertinent to the removal of the above items, and the procedures involved in the adjustment of the intake and exhaust valve clearances.



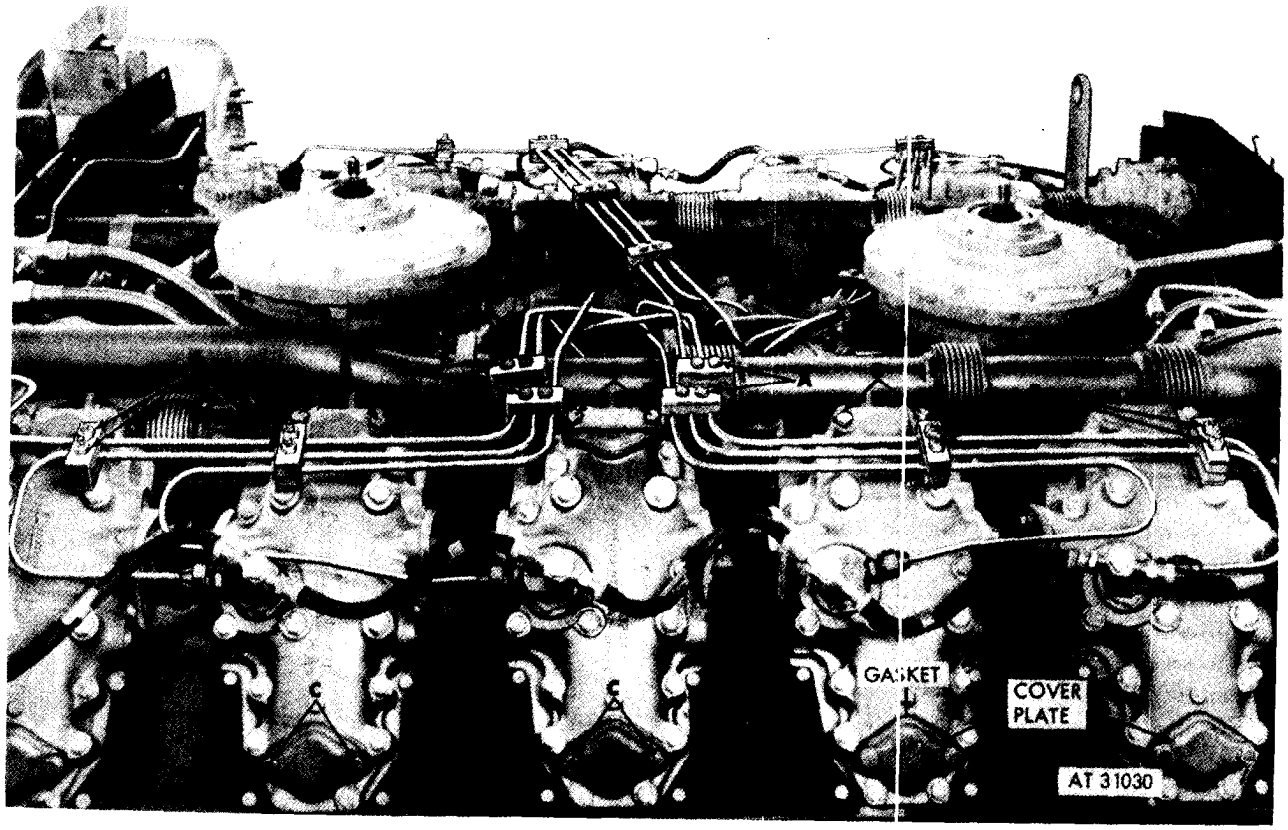
Remove

1. Remove two nuts (A), bolts, one plate, and two clamps attaching fuel tubes to support.
2. Remove two bolts (B) attaching support to valve adjusting screw cover plate. Remove supports and cover plates. Remove and discard gaskets.
3. Remove two bolts (C) and flat washers attaching each of the remaining valve adjusting screw cover plates and remove the plates. Remove and discard gaskets.

Install

1. Position new gaskets on exhaust valve openings. Install valve adjusting screw cover plates and supports and install two bolts (B) securing supporta and covers to cylinders.
2. Install two clamps, one plate, two bolts, and nuts (A) securing fuel tubes to support.

Figure 4-186. Removing or installing valve adjusting screw cover plates-right side.



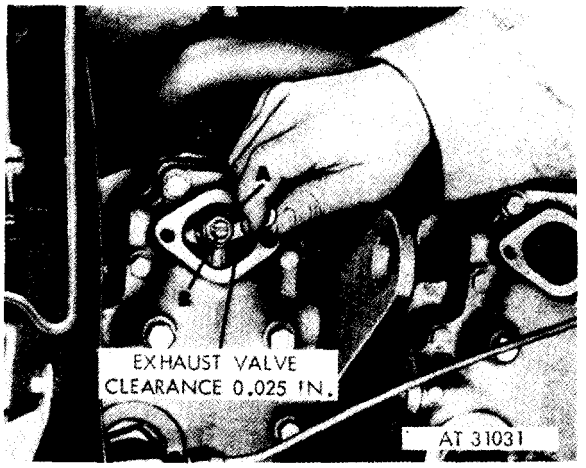
Remove

1. Remove two nuts (A), bolts, one plate, and two clamps attaching fuel tubes to supports.
2. Remove two bolts (B) attaching support to valve adjusting screw cover plate. Remove supporta and cover plates. Remove and discard gaskets.
3. Remove two bolts (C) and flat washers attaching the remaining valve adjusting screw cover plates, and rem ove the plates. Remove and discard gaskets.

Install

1. Position new gaskets on exhaust valve openings. Install valve adjtusting screw cover plates and supports and install two bolts (B) securing supports and covers to cylinders.
2. Position new gaskets on remaining valve openings on cylinders. Install valve adjusting screw cover plates and install two bolts C) and flat washers securing each plate.
3. Install two clamps, one plate, two bolts, and nuts (A) securing fuel tubes to support.

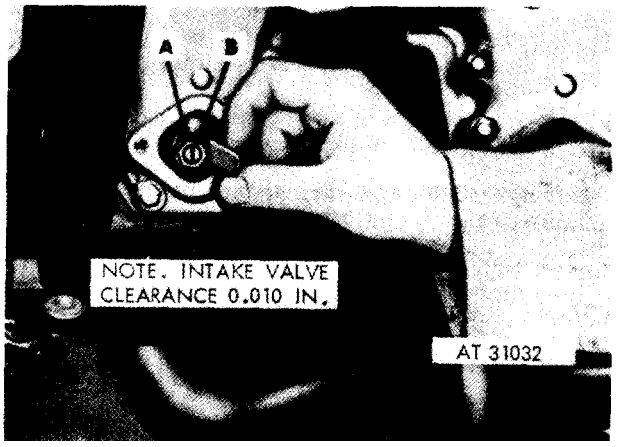
Figure 4-187. Removing or installing valve adjusting screw cover plates-left side.



Note. Before checking or adjusting exhaust valve clearance (fig. 4-188) and intake valve clearance (fig. 4-189), make sure both valves are closed on cylinder being checked. Turn engine as shown in figure 4-51 until valves are closed and camshaft lobes are in position shown in figure 4-73.

1. Loosen exhaust valve adjusting screw lock nut (A).
2. Turn valve adjusting screw (B) until clearance between screw pad and valve stem is 0.025 inch. Torque lock nut to 175 pounds inch after correct adjustment is made. Make certain setting has not changed after tightening lock nut.

Figure 4-188. Setting exhaust valve clearance using thickness gage blade-5210-793-7899.



1. Loosen intake valve adjusting screw lock nut (A).
2. Turn valve adjusting screw (B) until clearance between screw pad and valve stem is 0.010 inch. Torque lock nut to 175 pounds inch after correct adjustment is made.

Figure 4-189. Setting intake valve clearance using thickness gage blade-5210-793-7898.

4-24. Checking Intake and Exhaust Valve Timing

a. *General.* Valve timing is checked with cylinder No. 6R and 6L intake valve clearance set at 0.100 inch. The flywheel is stamped (fig. 4-190) with timing marks "6R INT CLOSE 0.100 CLR" for timing the right camshaft with the crankshaft, and is also marked with timing marks "6L INT CLOSE 0.100 CLR" for timing left. For instructional purposes the timing of the right camshaft is described. Right and left camshaft timing is identical. Refer to Table 4-9 for instructions pertinent to this operation.

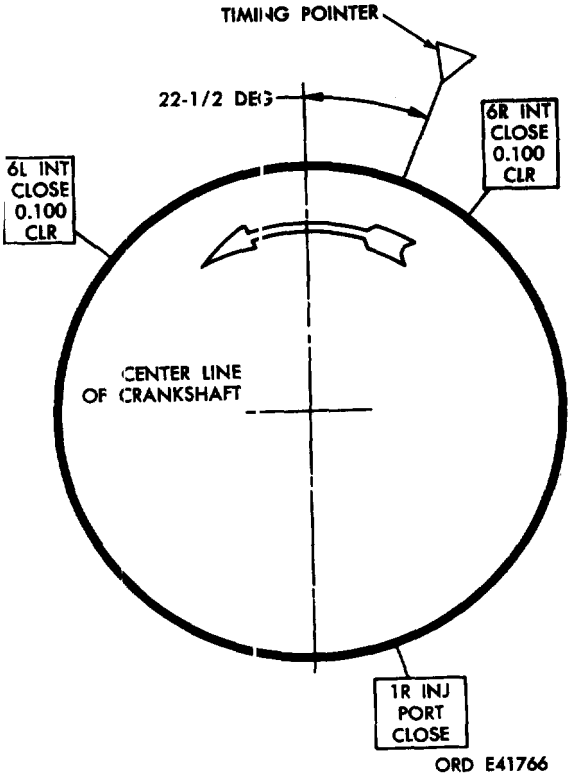


Figure 4-190. Flywheel timing mark locations.

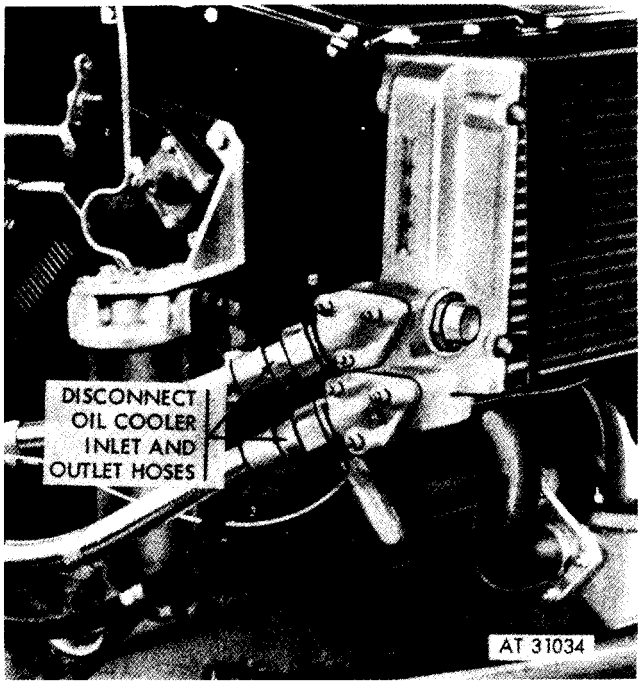
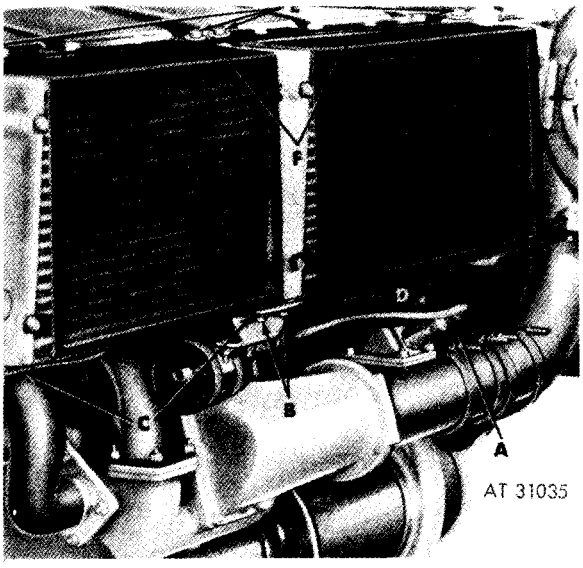


Figure 4-191. Disconnecting or connecting oil cooler inlet and outlet hoses.



Note. It is necessary to remove engine oil cooler before the transmission oil cooler can be removed.

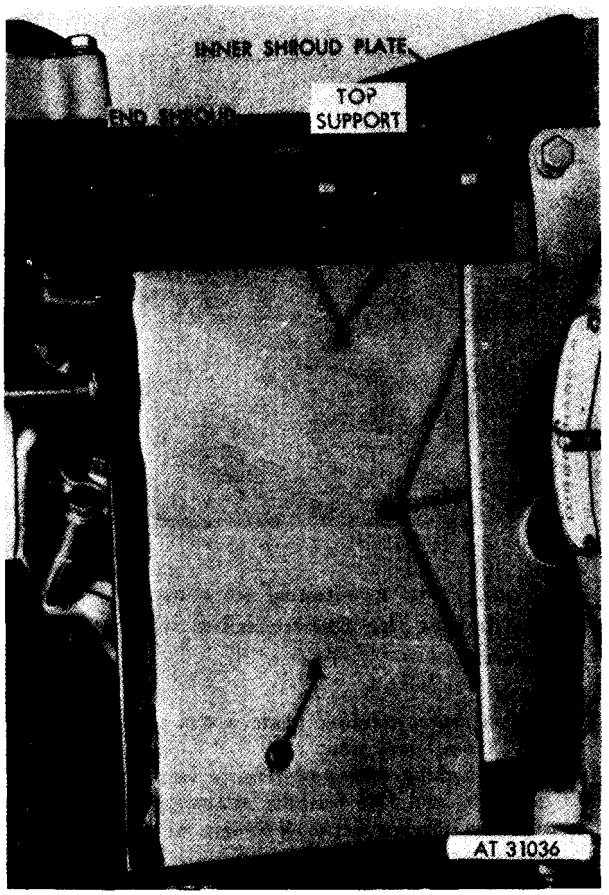
Remove

1. Disconnect manifold heater spark plug electrical lead (A) from spark plug.
2. Cut locking wire and remove two cap screws (B), spacers, and flat washer-a attaching manifold heater ignition unit bracket to oil coolers. Remove ignition unit with bracket and lead.
3. Cut locking wire and remove two bolts (C) and fiat washers attaching engine oil cooler to beam.
4. Cut locking wire and remove two bolts (D) and flat washers attaching transmission oil cooler to beam.
5. Cut locking wire and remove four bolts (E) and flat washers attaching oil coolers to top frame and remove coolers.
6. Remove nine fasteners (F) and remove oil cooler retainer and oil coolers.

Install

1. Position engine and transmission oil coolers on side of engine and install four bolts (E) and flat washers securing oil coolers to top frame. Install locking wire.
2. Install two bolts (D) and flat washers securing transmission oil cooler to beam. Install locking wire.
3. Install two bolts (C) and flat washers securing engine oil cooler to beam. Install locking wire.
4. Position oil cooler retainer on top of coolers and install nine fasteners (F) securing retainer to upper cover frame.
5. Position manifold heater ignition unit bracket, with ignition unit and lead, between oil coolers and install two cap screws (B), spacers, and flat washers securing brarket to coolers. Install locking wire.
6. Connect manifold heater spark plug electrical lead to spark plug (A).

Figure 4-192. Removing or installing engine and transmission oil coolers.



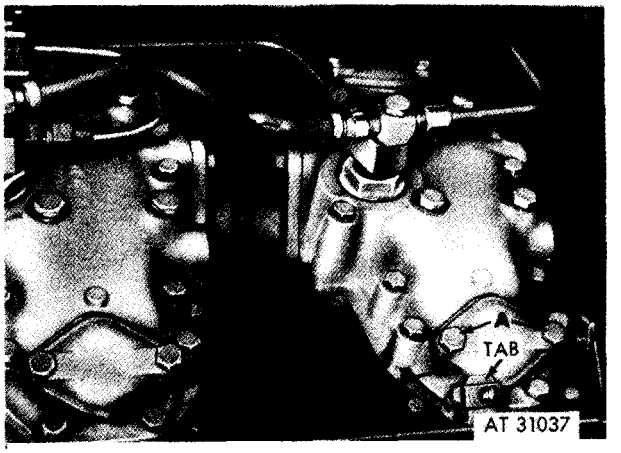
Remove

1. Remove three screws (AI attaching end shroud to top support and to tab on cylinder head.
2. Refer to figure 4-147 for removal of three screws (B) attaching shroud to inner shroud plate. Remove shroud.

Iustall

1. Position end shroud with inner shroud plate and refer to figure 4-147 for installation of three screws (B) securing shroud to shroud plate.
2. Install three screws (A) attaching shroud to top support and to tab on cylinder head.

Figure 4-193. Removing or installing oil cooler end shroud.



Remove

1. Remove two bolts (A) and flat washers attaching intake valve adjusting screw cover plate.
2. Remove cover plate and gasket (B). Discard gasket.

Install

1. Position new gasket (B) on cylinder and install intake valve adjusting screw cover plate.
2. Install two bolts (A) and flat washers securing cover plate.

Figure 4-194. Removing or installing intake valve cover plate.

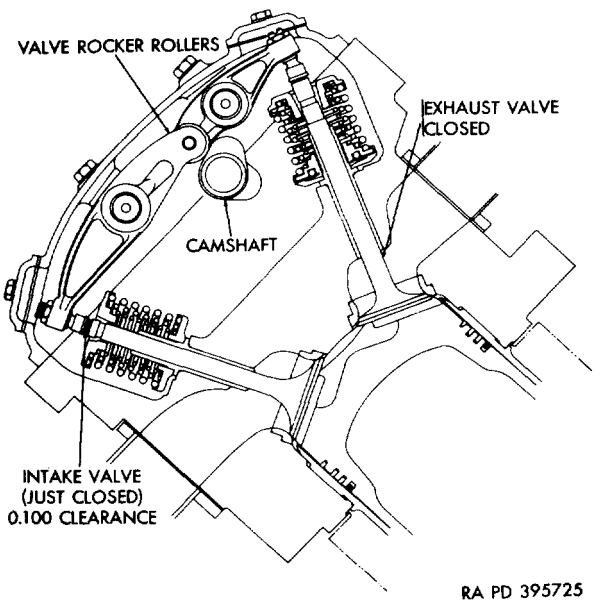


Figure 4-195. Cross section of cylinder 6R showing position of camshaft lobes for valve timing.

b. Positioning Camshaft. Turn engine using splined wrench - 5120-793-7895 until valve rocker arm roller is on base circle of camshaft as shown in figure 4-73. Set number 6R and 6L intake valve clearance to 0.100 inch (fig. 4-197).

c. Checking Valve Timing. Turn flywheel counterclockwise, viewed from rear, until pad on valve adjusting screw is just free of the valve stem (intake valve has just closed) (fig. 4-195). In this position the fly-wheel mark "6R INT CLOSE 0.100 CLR" should be alined with pointer (fig. 4-196). If flywheel marks are not alined with pointer within ¼ inch at the time the adjusting screw pad becomes free of valve stem it will be necessary to remove camshaft drive shaft and reset valve timing. Valve timing may be reset following the instructions that accompany figures 4-198 through 4-201.

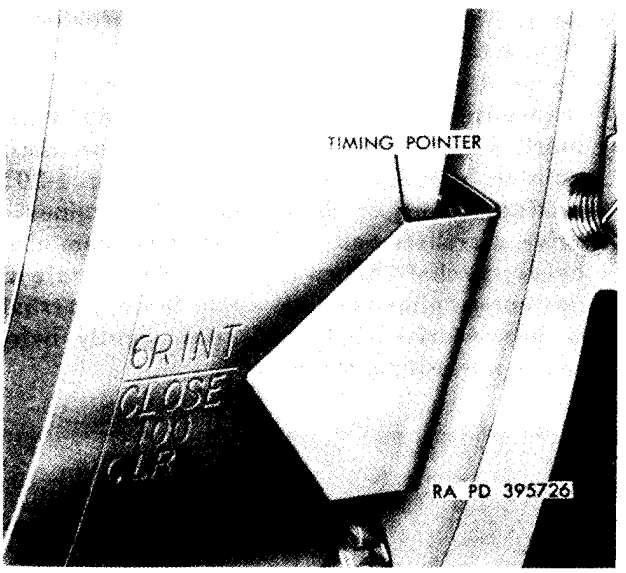
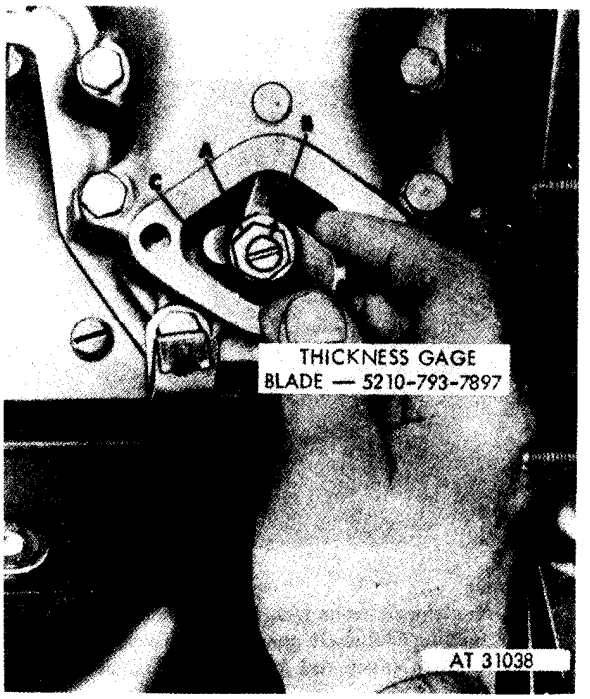
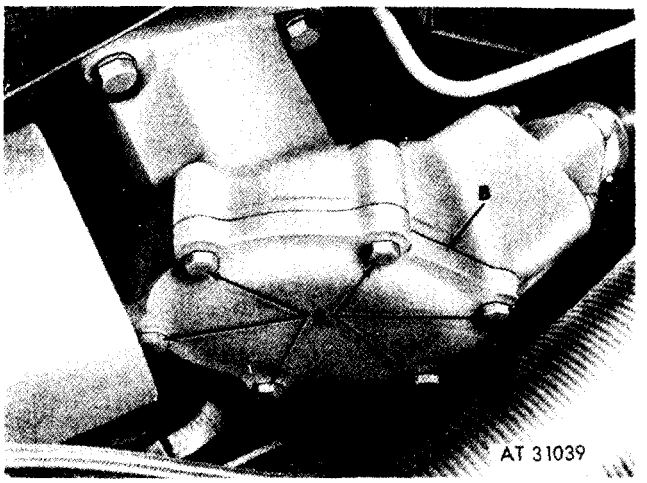


Figure 4-196. Flywheel timing marks a lined with pointer for valve timing-right bank of cylinders.



1. Loosen timing adjusting screw lock nut (A).
2. Turn valve adjusting screw (B) and set valve clearance to 0.100 inch.
3. Gage (C) must move through clearance with a slight drag. Tighten lock nut after setting clearance. Check clearance to make certain setting has not changed.

Figure 4-197. Setting intake valve clearance for cylinder 6R using thickness gage blade-5120-793-7897.



Remove

1. Remove six bolts (A), lock washers, and flat washers attaching camshaft gear housing cover.
2. Remove cover and gasket (B). Discard gasket.

Install

1. Position new gasket (B) on camshaft gear housing. Install camshaft gear housing *cover*.
2. Install six bolts (A), lock washers, and flat washers securing cover.

Figure 4-198. Removing or installing camshaft gear housing cover.

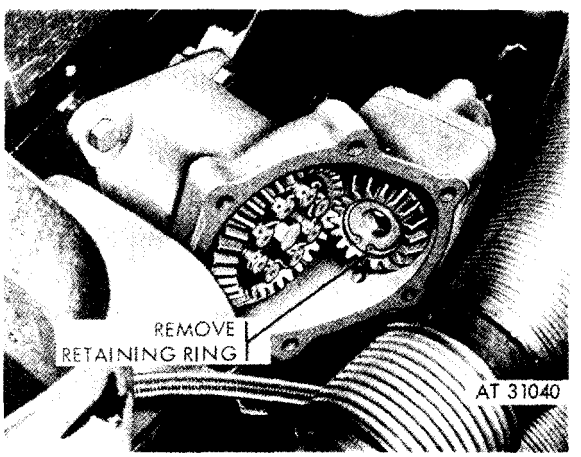


Figure 4-199. Removing or installing camshaft drive gearshaft plug retaining ring.



Figure 4-200. Removing or installing camshaft drive gearshaft plug using mechanical puller-5120-678-5282.

d. Special Timing Instructions. With cylinder 6R intake valve set at the just closing point (fig. 4-195) turn flywheel approximately 1/8 of a turn (or 45 degrees) clockwise (viewed at flywheel end) to remove backlash in g-ear train ; then turn flywheel counterclockwise until timing mark (fig. 4-196) is alined with the timing pointer. Install camshaft drive shaft (fig. 4-201), mating splines of drive shaft with splines on drive gearshaft and with splines on cam drive bevel gearshaft. When splines of drive shaft will not enter splines of cam drive bevel gearshaft, withdraw drive shaft and turn slightly before again attempting insertion.

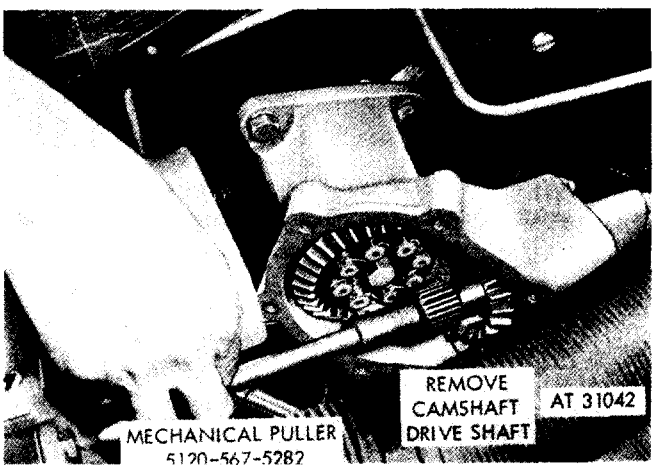


Figure 4-201. Removing or installing camshaft drive shaft using mechanical puller-5120-678-5282.

Note. It may be necessary to repeat this operation several times before mating splines are found.

Note. Do not force the drive shaft. The drive shaft is machined with a 24 tooth spline on the inner end and a 28 tooth spline on the outer end. This difference in number of splines makes it possible to index the drive shaft so it will engage the splines of the drive gearshaft and splines of cam drive bevel gearshaft simultaneously without changing the relationship of the camshaft and crankshaft. An accurate setting is then provided.

Note. Refer to figure 4-189 and reset cylinder No. 6 intake valve clearance of 0.010 inch.

CHAPTER 5
DISASSEMBLY OF ENGINE

Section I. PREPARATION OF ENGINE FOR DISASSEMBLY

5-1. General

This section covers the preparation of the engine for disassembly. Refer to the pertinent TM's covering the removal of powerplant from the vehicle and separation of the transmission from the engine. Prior to disassembly, engines must be thoroughly drained, cleaned, and stripped of external accessories before proceeding with disassembly. Refer to Table 5-1 for illustrations and instructions required for draining engine oil and removing accessories.

Table 5-1. Draining Engine Oil and Removing Engine Accessories

Component	Figure Reference
Engine and Sling	5-1
Oil Pan Drain Plugs	5-2, 5-3
Fuel Pump	4-1 through 4-3
Starter	4-4 through 4-8
Time Totalizing Meter	5-4, 5-5
Generator and Associated Parts	4-11 through 4-16
Turbosupercharger and Lower Shroud Plates	4-20 through 4-33

5-2. Drain Engine Oil

The engine oil must be drained from the engine before engine is disassembled. Lift engine using multiple leg sling -4910-919-2884 (fig. 5-1) and place engine on suitable blocks. Drain engine oil following instructions that accompany figures 5-2 and 5-3.

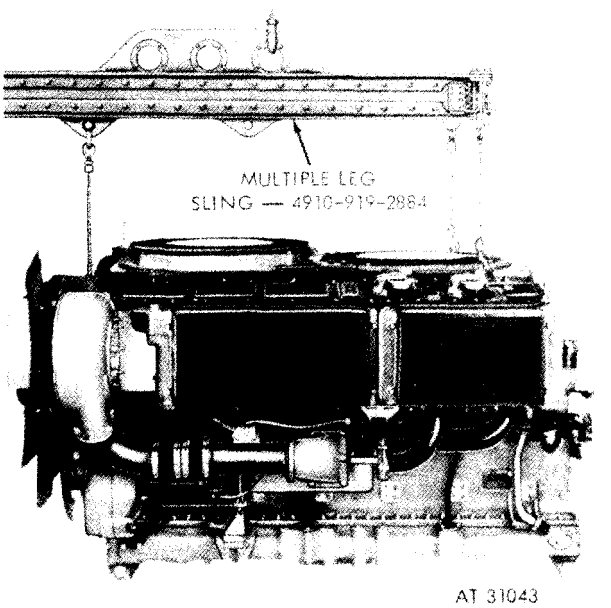
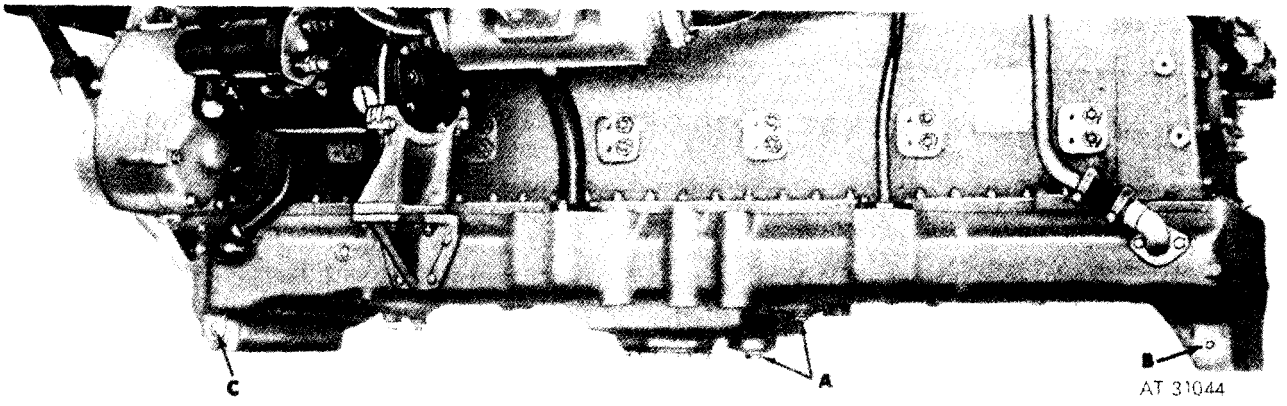


Figure 5-1. Lifting engine using multiple leg sling-4910-919-2884.



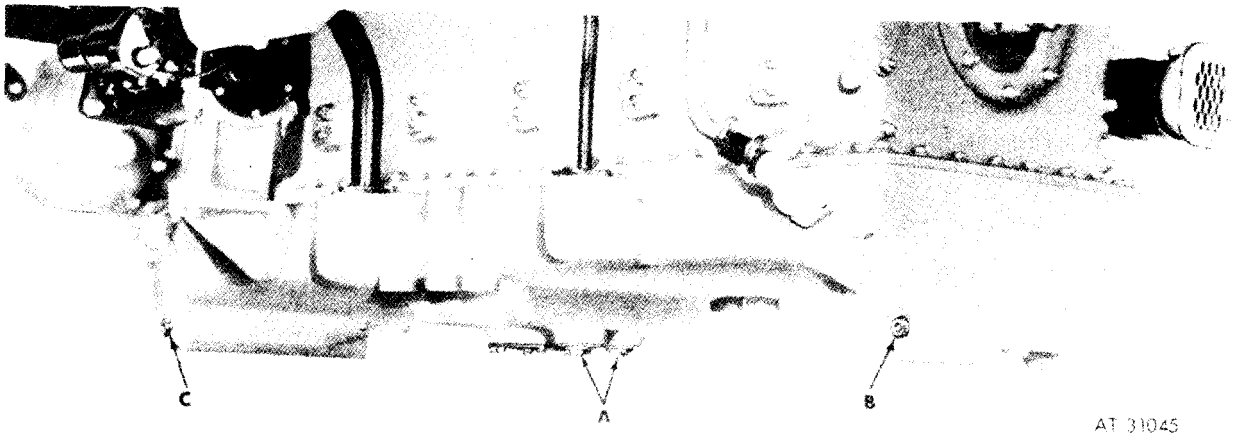
Remove

1. Cut locking wire and remove two plugs (A). Drain oil into a suitable container.
2. Remove pipe plug (B) and drain oil from front compartment.
3. Remove pipe plug (C) and drain oil from rear compartment

Install

1. Install pipe plug (C) in rear compartment of oil pan.
2. Install pipe plug (B) in front compartment of oil pan.
3. Install two plugs (A) in center of oil pan and install locking wire securing plugs.

Figure 5-2. Removing or installing oilpan drain plugs {Model AVDS-1790-2-M).



Remove

1. Cut locking wire and remove two drain plugs (AI. Drain oil into a suitable container.
2. Remove pipe plug (B) and drain oil from front compartment.
3. Remove pipe plug (C) and drain oil from rear compartment.

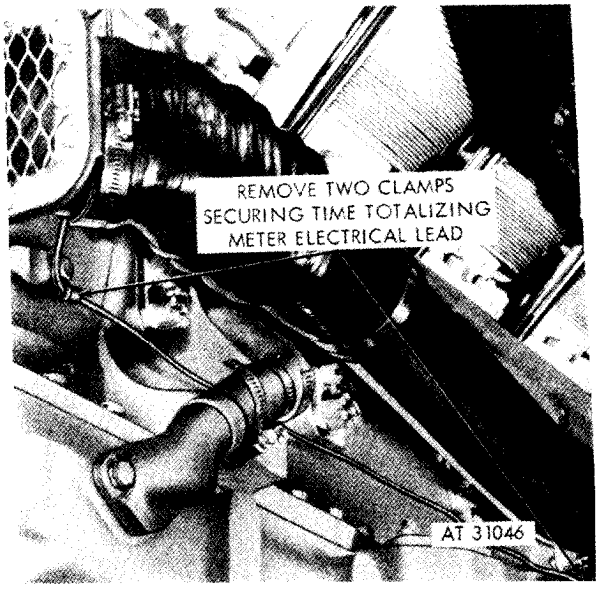
Install

1. Install pipe plug (C) in rear compartment of oil pan.
2. Install pipe plug (B) in front compartment of oil pan.
3. Install two pipe plugs (A) in center of oil pan and install locking wire securing plugs.

Figure 5-3. Removing or installing oil pan drain plugs (Models AVDS-1790-2AM and AFDS-1790-2A).

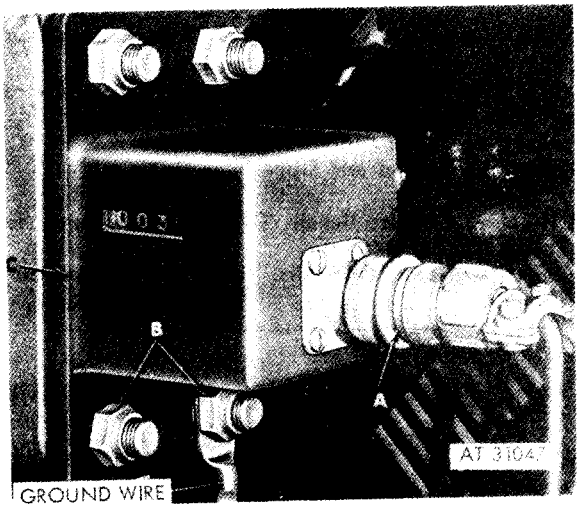
5-3. Remove Engine Accessories

The starter, cradle, and support, generator cradle support and air intake tube must be removed to allow the engine to be mounted on the overhaul stand. Remove the fuel pump, starter, generator, turbo supercharger, and associated components as outlined in Chapter 4 and remove the time totalizing meter. Appropriate figure references are listed in table 5-1.



Note. Two clamps are used to secure the time totalizing meter electrical lead on the basic engine. The clamps are installed to secure the electrical lead to prevent damage.

Figure 5-4. Disconnecting or connecting time totalizing meter electrical lead clamps.



Remove

1. Disconnect time totalizing meter electric lead (A).
2. Remove four self-locking nuts (B) and electrical lead ground wire.
3. Remove time totalizing meter (C) from crankshaft damper and oil filter housing.

Install

1. Position time totalizing meter (C) on crankshaft damper and oil filter housing.
2. Install four self-locking nuts (B) and electrical lead ground wire.
3. Connect time totalizing meter electrical lead (A).

Figure 5-5. Removing or installing time totalizing meter.

Section II. Installation OF ENGINE ON OVER HAUL STAND AND DISASSEMBLY INTO SUBASSEMBLIES

5-4. General

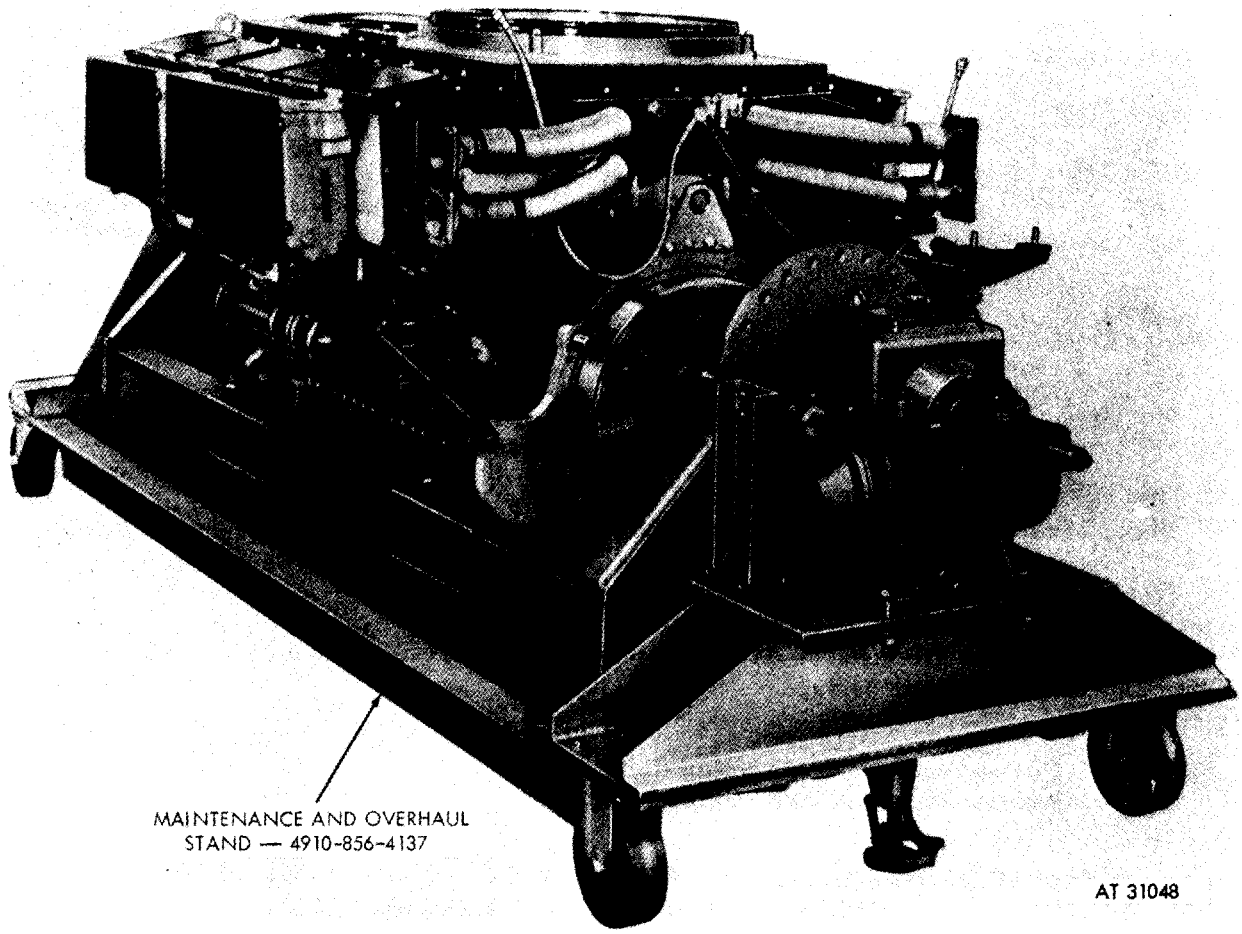
This section covers the installation of the engine on the overhaul stand and disassembly of the engine into subassemblies. Components are grouped together in proper disassembly order.

5-5. Shrouding, Cooling Fans, Oil Coolers, Beams, and Associated Parts

Refer to Table 5-2 for illustrations and disassembly instructions. Figure references are listed in the table.

Table 5-2. Shrouding, Cooling Fans, Oil Coolers, Beams, and Associated Parts

Component	Figure Reference
Engine on Overhaul Stand	5-6
Cooling Fan Vanes and Cooling Fans	4-34, 4-35
Cooling Fan Shroud and Upper Covers	4-36 through 4-38, 4-126 through 4-134, 5-7 through 5-9, 4-136 through 4-141
Oil Coders, Support Beams, Upper Cover Frame, and Frame Support Bracket	5-10 through 5-21
Turbosupercharger Oil Inlet Hose and Transmission Shrouds	5-17



Note. Secure engine to maintenance and overhaul stand -4910-856-4137 with four 5/8 x 1-1/2 inch hexagon head bolts and 5/8 inch flat washers furnished with stand.

Figure 5-6. Engine on maintenance and overhaul stand-4910-856-4137.

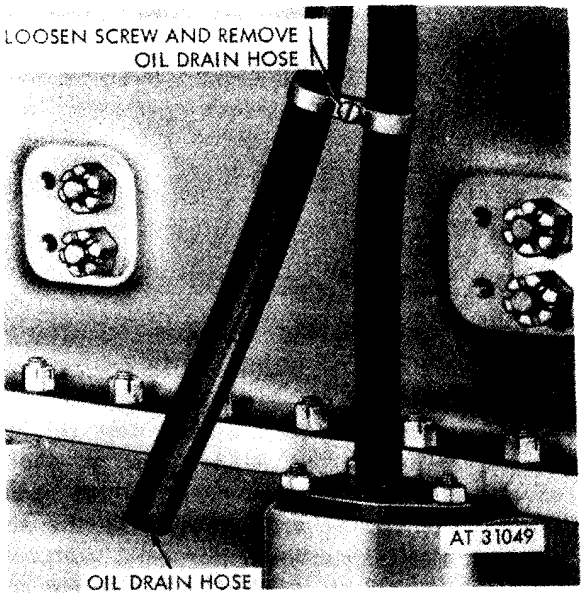
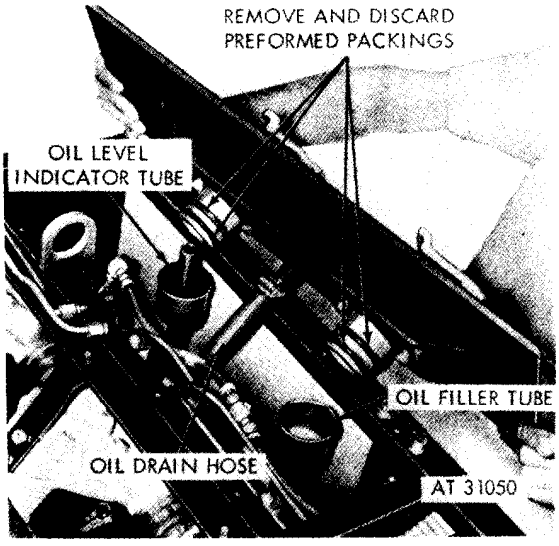


Figure 5-7. Removing or installing oil filler and oil level indicator tube shroud plate oil drain hose-engines with oil filler and indicator with splash pan drain.



Note. Be certain drain hose is inserted through grommet and that grommet is securely seated during reinstallation of shroud plate and drain hose.

Figure 5-8. Removing or installing oil filler and oil level indicator tube shroud plate and oil drain hose-engines with oil filler and indicator with splash pan drain.

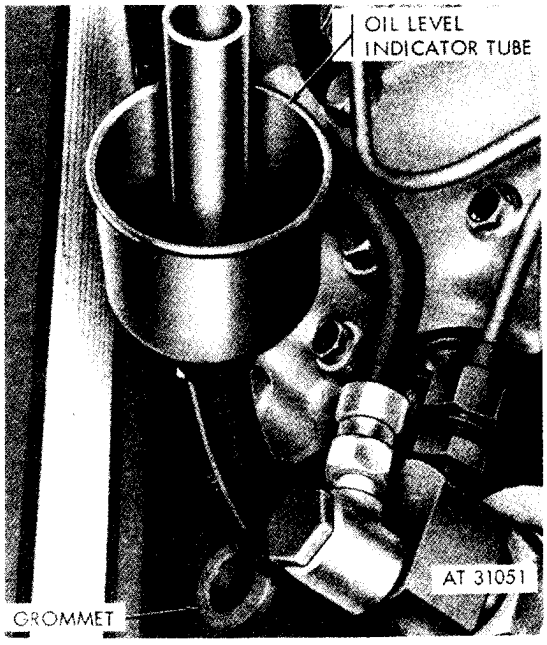
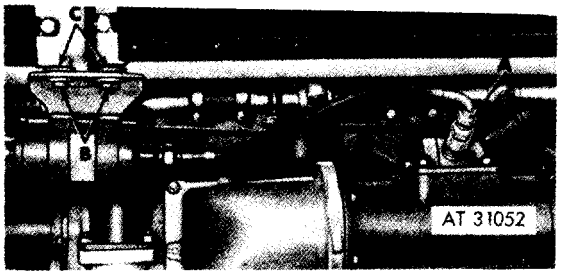


Figure 5-9. Oil filler and oil level indicator tube shroud plate oil drain hose grommet-installed view-engines with oil filler and indicator with splash pan drain.



Remove

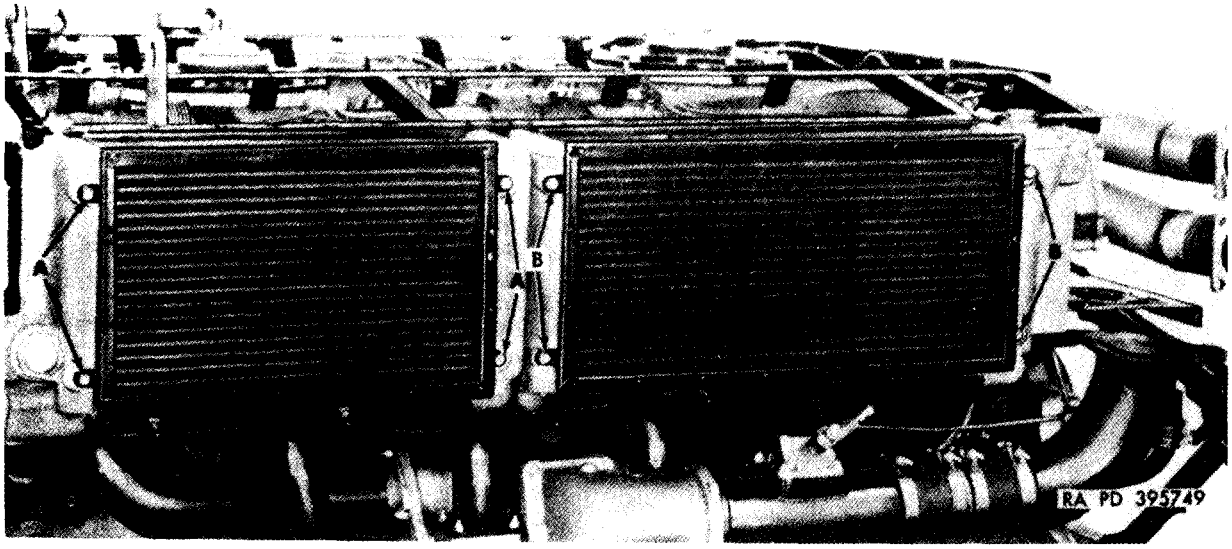
Note. With the exception of the early engine oil filler and oil level indicator tube retaining straps (A and B, fig. 4-131), the oil coolers, support beams, and upper cover frames on each side of the engine are removed in the same manner. For instructional purposes, removal of the right oil coolers, support beams, upper cover frames and frame support brackets are described in the following instructions.

1. Disconnect manifold heater spark plug cable (A).
2. Cut locking wire and remove two screws (B), spacers, and flat washers attaching ignition unit bracket to oil coolers. Remove ignition unit, bracket, and cable.
3. Remove grommets (C) from bracket- Replace damaged grommets.

Install

1. Position grommets (C) in bracket.
2. Position ignition unit, bracket, and cable on oil coolers. Install two screws (B), spacers, and flat washers securing ignition unit bracket to oil coolers. Lock wire screws securely.
3. Connect manifold heater spark plug cable (A) to spark plug.

Figure 5-10. Removing or installing manifold heater ignition unit-right side.



Remove

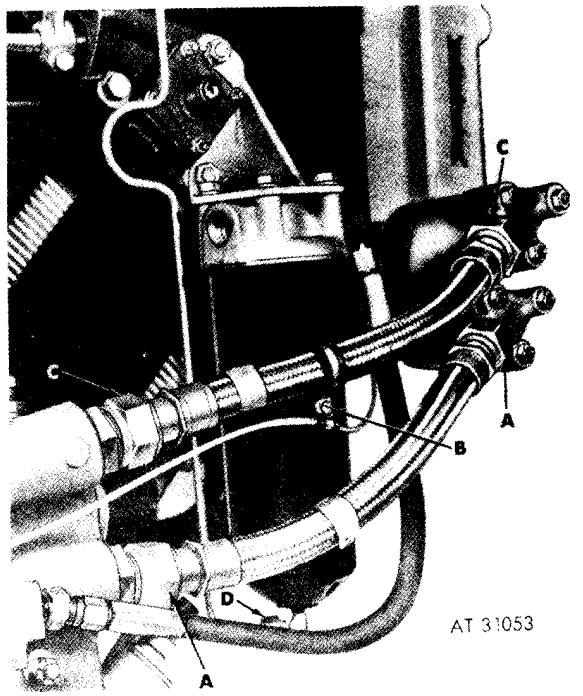
1. Remove four bolts (A) and remove engine oil cooler screen.
2. Remove four bolts (B) and remove transmission oil cooler screen.

Install

Note. When installing oil cooler screens, be sure the longer screen mounting flanges are attached to the lower mounting bosses on the oil coolers. This provides adequate clearance so that debris does not collect and hinder air circulation through the oil coolers.

1. Position transmission oil cooler screen on transmission oil cooler and install four bolts (B) securing screen to cooler.
2. Position engine oil cooler screen on engine oil cooler and install four bolts (A) securing screen to cooler.

Figure 5-11. Removing or installing right oil cooler screens.



Disconnect

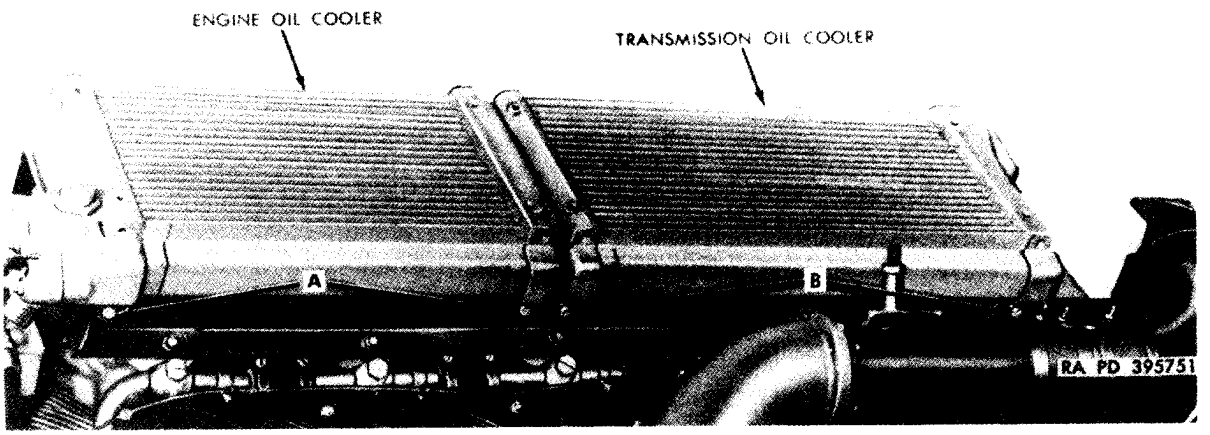
Note. Oil coolers will retain a certain amount of oil after engine has been drained. Position a suitable container to catch the excess oil prior to disconnecting the oil cooler inlet and outlet hoses.

1. Disconnect oil cooler oil inlet hose (A) and remove hose.
2. Remove screw (B) and nut attaching manifold heater fuel tube clamp to hose clamp and remove clamps.
3. Disconnect oil cooler outlet hose (C).
4. Disconnect primary fuel filter fuel drain tube (D) and drain fuel into suitable container.

Connect

1. Connect primary fuel filter fuel drain tube (D) to primary fuel filter.
2. Connect oil cooler oil outlet hose (C).
3. Position manifold heater fuel tube clamp on fuel tube and oil hose clamp on outlet hose. Install screw (B) and nut securing clamps in plate.
4. Connect oil cooler oil inlet hose (A).

Figure 5-12. Disconnecting or connecting right oil cooler hoses and primary fuel filter drain tubes.



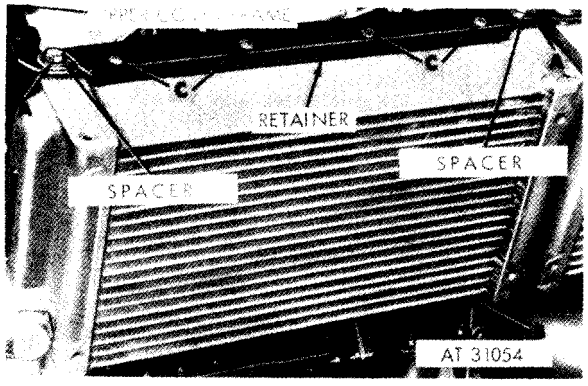
Remove

1. Cut locking wire and remove two bolts (A) and four spacers attaching engine oil cooler to support beam.
2. Cut locking wire and remove two bolts (B) and four spacers attaching transmission oil cooler to support beam.

Install

1. Install two bolts (B) and four spacers securing transmission oil cooler to support beam. Install locking wire securing bolts.
2. Install two bolts (A) and four spacers securing engine oil cooler to support beam. Install locking wire securing bolts.

Figure 5-13. Removing or installing oil cooler to support bolts.



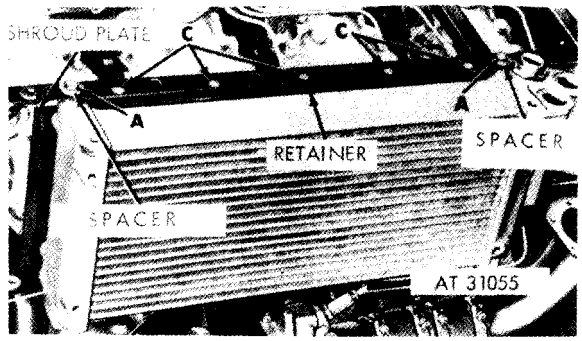
Remove

1. Cut locking wire and remove two bolts (A) and four spacers attaching engine oil cooler to upper cover frame.
2. Remove oil cooler (B).
3. Remove four fasteners (C) and remove retainer from upper cover frame.

Install

1. Position engine oil cooler (B) against upper cover frame.
2. Install two bolts (A) and four spacers securing oil cooler to frame.
3. Position retainer on upper cover frame and install four fasteners (C).
4. Tighten two bolts securing oil cooler to upper cover frame and lock wire securely.

Figure 5-14. Removing or installing right engine oil cooler.



Remove

1. Cut locking wire and remove two bolts (A) and four spacers attaching transmission oil cooler to upper cover frame.
2. Remove oil cooler (B) and shroud plate.
3. Remove five fasteners (C) and remove retainer frorn upper cover frame.

Install

1. Position transmission oil cooler (B) and shroud plate against upper cover frame.
2. Install two, bolts (A) and four spacers securing oil cooler to frame.
3. Position retainer on upper cover frame and install five fasteners (C).
4. Tighten two bolts securing oil cooler to upper cover frame and lock wire securely.

Figure 5-15. Removing or installing right transmission oil cooler.

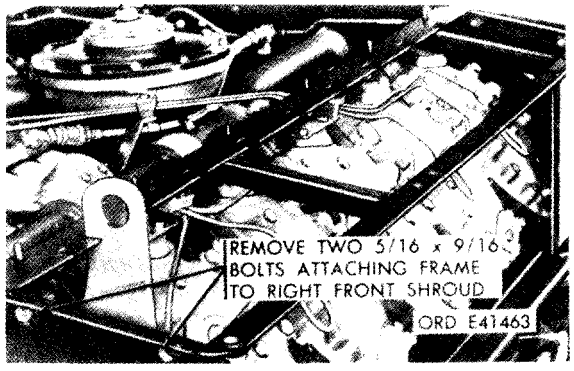
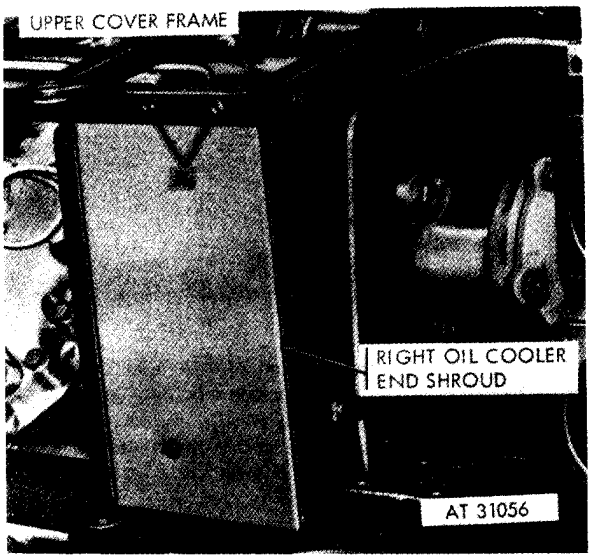


Figure 5-16. Disconnecting or connecting upper cover frame-right front view.



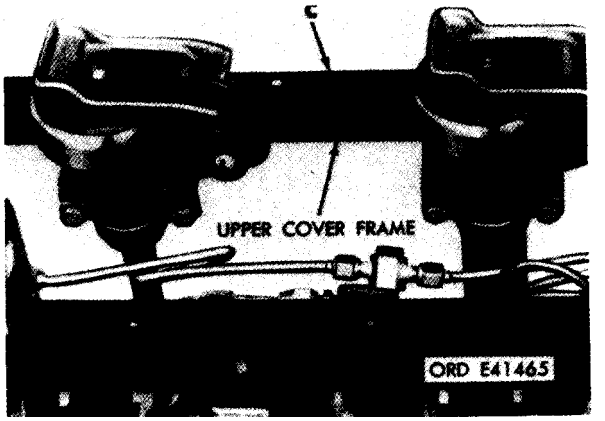
Disconnect

1. Remove two machine screws (A) attaching upper cover frame to right oil cooler end shroud.
2. Remove two bolts (B) attaching frame to right rear shroud.
3. Remove right upper cover frame.

Connect

1. Position right upper cover frame (C) on right side of engine.
2. Install two bolts (B) securing frame to right rear shroud.
3. Install two machine screws (A) securing upper cover frame to right oil cooler. end shroud.

Figure 5-17. Disconnecting or connecting upper cover fra me-right rear view.



Remove

1. Remove two self-locking nuts and bolts (A) attaching oil indicator tube retaining strap and remove strap.

Note. Some early engines used weld nuts in lieu of self-locking nuts.

2. Remove two self-locking nuts and bolts (B) attaching oil filler tube retaining strap and remove strap.
3. Remove left upper cover frame (C).

Install

Note. On installations that have been modified, oil filler tube will be relocated behind turbosupercharger and retaining straps will be discarded.

1. Position left upper cover frame (C) on left side of engine.
2. Position oil filler tube retaining strap around oil filler tube and install two self-locking nuts and bolts (B) securing strap.
3. Position oil indicator tube retaining strap around oil indicator tube and install two self-locking nuts and bolts (A) securing strap.

Figure 5-18. Removing or installing oil indicator and oil filler tube to upper frame retaining strap-left side engines without relocated oil filler tube.

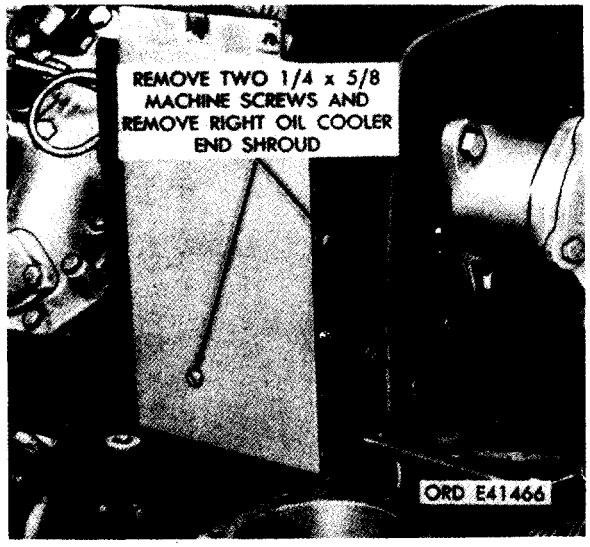
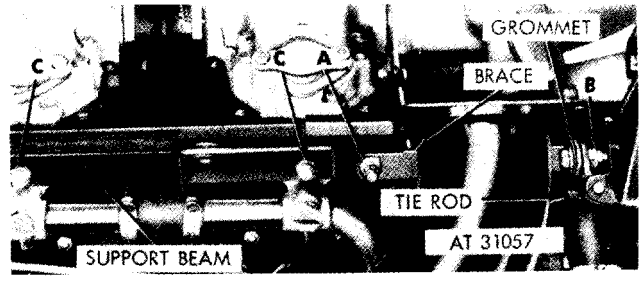


Figure 5-19. Removing or installing right oil cooler end shroud.



Remove

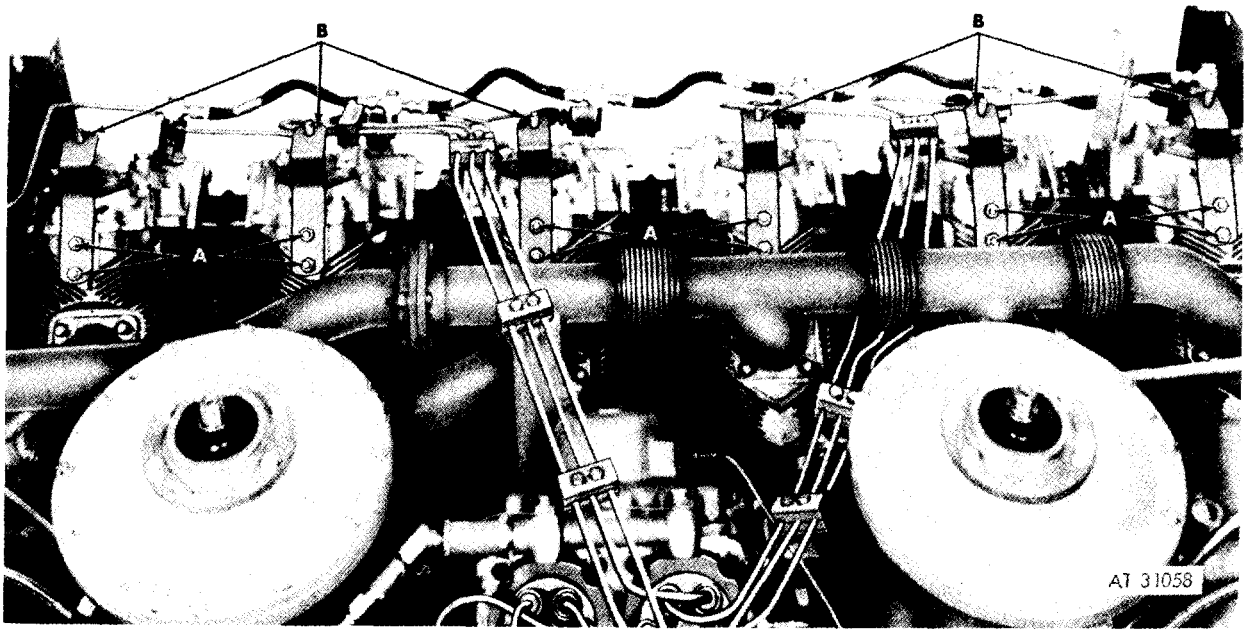
1. Remove self-locking nut (A), washer, and cap screw attaching brace to support beam.
2. Remove self-locking nut (B), two spacers, bolt, and grommet attaching brace to turbosupercharger tie rod.
3. Remove six self-locking nuts (C) and three flat washers attaching support beam to cylinders and rem ove beam.

Install

Note. The flat washers are located at cylinder Nos. 3, 4 and 5 on both cylinder banks.

1. Position support beam on engine and install six self-locking nuts (C) and three flat washers securing beam to cylinders.
2. Install self-locking nut (B), two spacers, bolt, and grommet securing brace to turbosupercharger tie rod.
3. Install self-locking nut (A), washer, and cap screw securing brace to support beam.

Figure 5-20. Removing or installing right oil cooler support beam.



Remove

1. Remove 12 self-locking nuts (A) attaching upper cover frame support brackets.
2. Remove six brackets (B).

Note. Upper cover frame support brackets on left side of engine are removed or installed in the same manner.

Install

1. Position six upper cover frame support brackets (B) on cylinder studs.
2. Install 12 self-locking nuts (A) securing brackets to cylinders.

Figure 5-21. Removing or installing upper cover frame support brackets-right side.

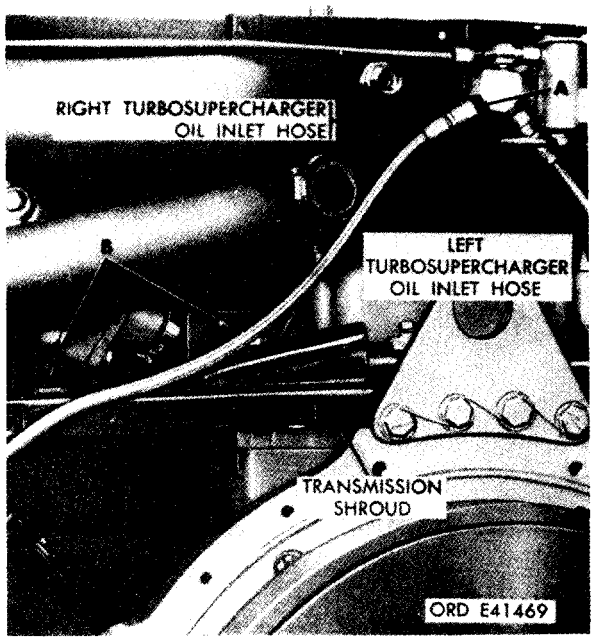


Figure 5-22. Removing or installing right turbosupercharger oil inlet hose and transmission shroud.

Remove

1. Disconnect turbosupercbarger oil inlet hose (A) from bulkhead adapter elbow and remove hose.
2. Remove two machine screws (B) attaching right transmission shroud and remove shroud.

Note. Left turbosupercharger oil inlet hose and transmission shroud are removed or installed in the same manner.

Install

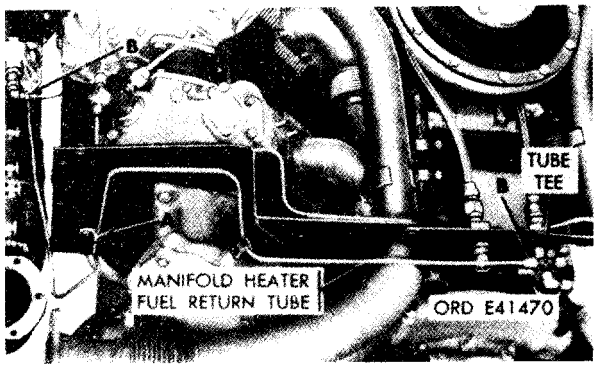
1. Position right transmission shroud on rear of engine and install two machine screws (B) securing shroud.
2. Connect oil inlet hose (A) to bulkhead adapter elbow.

5-6. Manifold Heater Tubes, Solenoids, and Filter, Cylinder Head Oil Drain Lines, and Intake Manifold Assemblies

Refer to Table 5-3 for illustrations and disassembly instructions. Figure references are listed in the table.

Table 5-3. Manifold Heater Tubes, Solenoids and Filter, Cylinder Head Oil Drain Lines, and Intake Manifold Assembly-

Component	Figure Reference
Manifold Heater Tubes, Hoses, Fuel Check Valve, Fuel Filter, Bracket. and Solenoid Valves	5-23 through 5-27
Cylinder Head Oil Drain Tubes	5-28 through 5-32
Intake Manifold, Manifold Heater, and Turbosupercharger Air Outlet Elbow	5-33



Remove

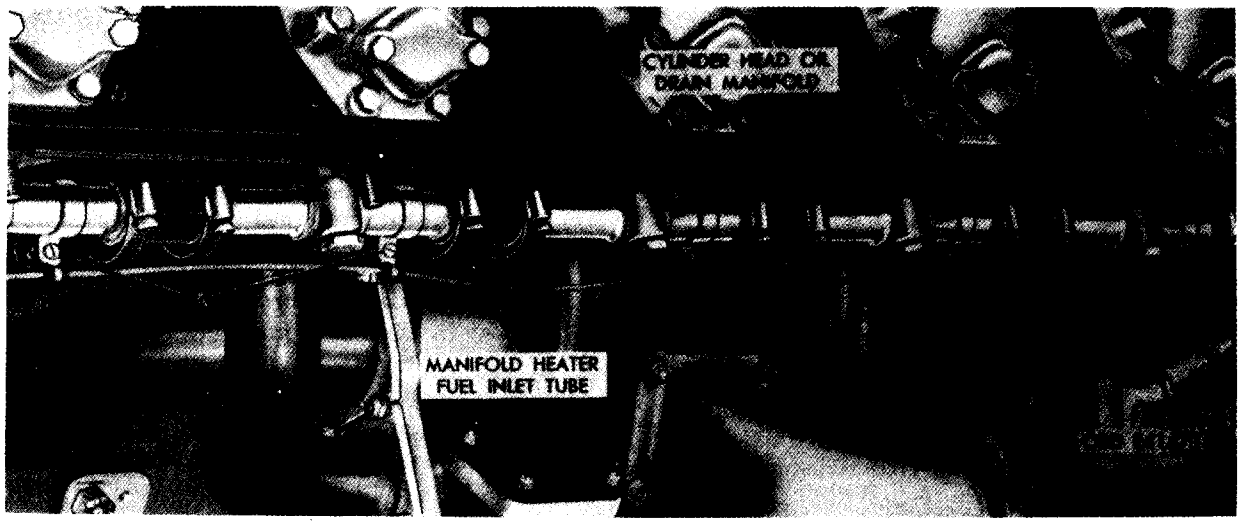
1. Remove machine screw (A) attaching right manifold beater fuel return tube clamp to right rear shroud.
2. Disconnect fuel return tube (B) from heater and tube tee. Remove tube.

Note. Left manifold heater fuel return tube is removed or installed in the same manner.

Install

1. Position right manifold heater fuel return tube (B) on right rear shroud and connect to heater and tube tee.
2. Install machine screw (A) securing fuel return tube clamp to right rear shroud.

Figure 5-23. Removing or installing right manifold heater fuel return tube.



Disconnect

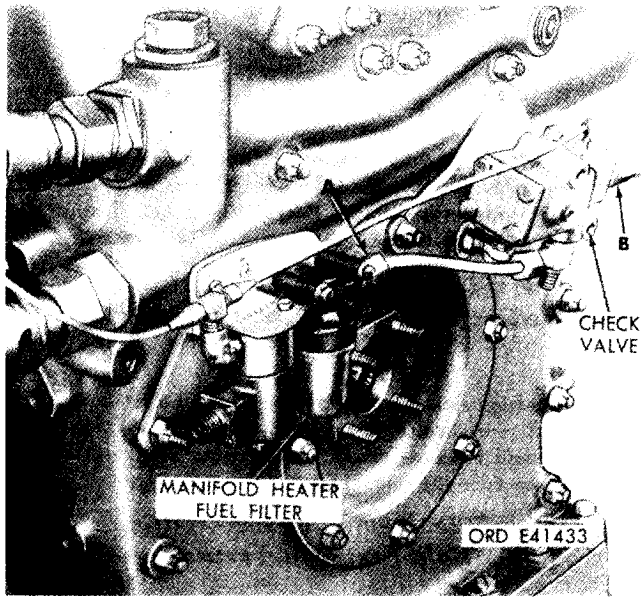
1. Remove nut and machine screw (A) from each of the four clamps attaching manifold heater fuel inlet tube to cylinder head oil drain manifold.
2. Disconnect fuel inlet tube (B) from manifold heater.

Note. Manifold heater inlet tube on the left side of the engine is disconnected or connected in the same manner.

Connect

1. Connect manifold heater fuel inlet tube (B) to manifold heater.
2. Install nut and machine screw (A) in each of the four clamps securing fuel inlet tube to cylinder head oil drain manifold.

F'igure 5-24. Disconnecting or connecting manifold heaterfuel inlet tube at manifold heater and cylinder head oil drain manifolds.



Remove

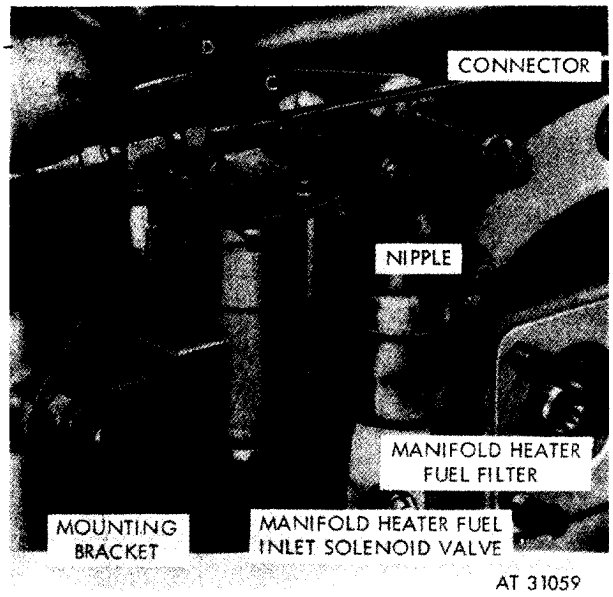
1. Disconnect fuel inlet line (A) from manifold heater fuel filter.
2. Disconnect fuel inlet hose (B) from check valve and remove check valve with attached fuel tube.

Note. The fuel check valve attaching screws were removed to facilitate removal of the fuel pump (fig. 4-l).

Install

1. Position check valve with attached fuel tube on front of engine and connect fuel inlet hose (B) on check valve.
2. Connect fuel inlet line (A) to manifold heater fuel filter connection.

Figure 5-25. Removing or installing fuel check valve.



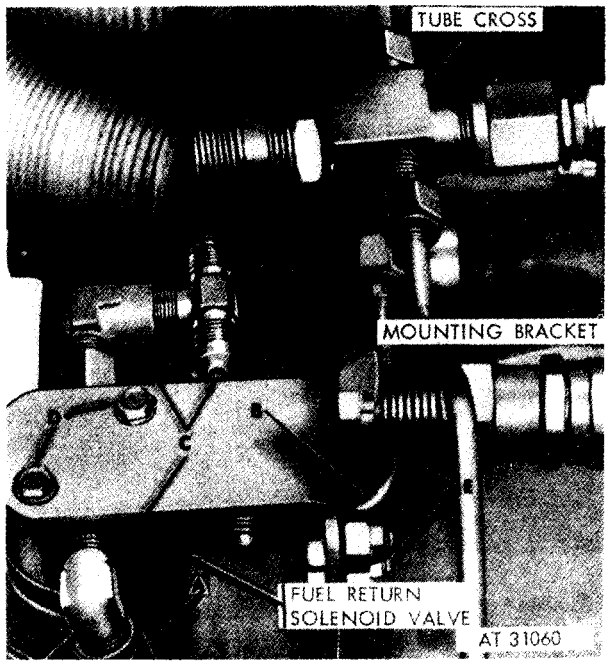
Remove

1. Disconnect manifold heater fuel inlet tubes (A) from tee in manifold heater fuel solenoid valve. Remove both fuel inlet tubes.
2. Remove tube tee and elbow (B).
3. Remove two assembled washer bolts (C J attaching solenoid valve to mounting bracket and two assembled washer bolts (D) and flat washers attaching solenoid mounting bracket to filter mounting bracket. Remove solenoid mounting bracket.
4. Remove two screws (E), lock washers, and flat washers attaching manifold heater fuel filter to mounting bracket. Remove fuel solenoid valve and filter as a unit.
5. Separate filter and solenoid valve. Remove connecting nipple and inlet tube connector.

Install

1. Install inlet tube connector in manifold heater fuel filter and install connecting ripple between fuel filter and manifold heater fuel solenoid valve.
2. Position fuel filter with solenoid valve on mounting bracket and install two screws (E), lock washers, and flat washers securing filter to bracket.
3. Position solenoid mounting bracket and install two assembled washer bolts (D) and flat washers securing solenoid bracket to filter mounting bracket. Install two assembled washer bolts (C) securing solenoid valve to mounting bracket.
4. Install elbow and tube tee (B) in solenoid valve.
5. Position both manifold heater fuel inlet tubes (A) and connect tubes to tee in fuel solenoid valve.

Figure 5-26. Removing or installing manifold heater fuel inlet solenoid valve and fuel filter.



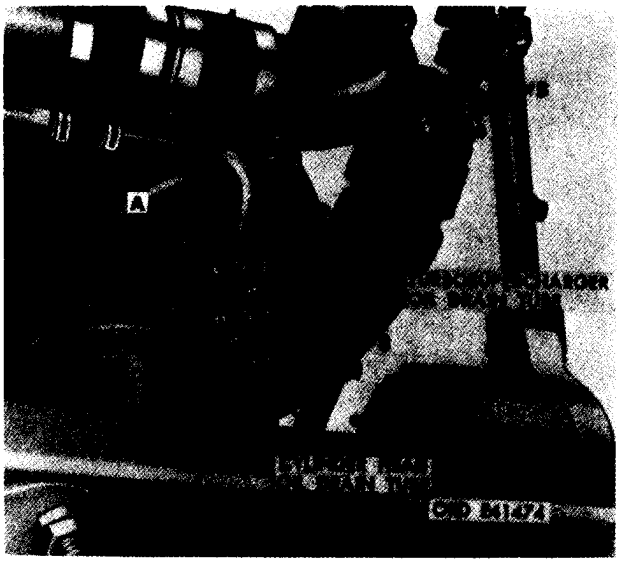
Remove

1. Disconnect manifold heater fuel return tube (A) from elbow in heater fuel return solenoid valve and from elbow in tube cross. Remove fuel return tube (B) and grommet.
2. Remove elbows (C) and tube tee from solenoid valve.
3. Remove two assembled washer bolts (D) and remove valve from mounting bracket.
4. Remove three self-locking nuts (E) and bolts attaching mounting bracket to left center shroud and remove bracket.

Install

1. Position mounting bracket on left center shroud and install three self-locking nuts (E) and bolts securing bracket to shroud.
2. Position heater fuel return solenoid valve on mounting bracket and install two assembled washer bolts (D) securing valve to bracket.
3. Install elbows (C) and tube tee in solenoid valve.
4. Position manifold heater fuel return tube (B) with grommet and connect tube to elbow (A) in tube cross and elbow (A) in solenoid valve.

Figure 5-27. Removing or installing manifold heater fuel return solenoid valve and bracket.

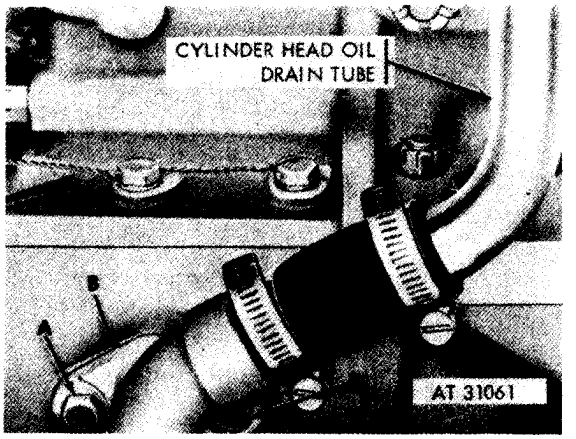


Remove
1. Loosen hose clamps (A).
2. Loosen hose clamps (B) and remove cylinder head oil drain tube, hoses, and turbosutpercharger oil drain tube.

Note. The right rear cylinder head oil drain tube was disconnected from the oil pan to facilitate removal of the generator (fig. 4-13).

Install
1. Position turbosupercharger oil drain tube, hoses, and cylinder head oil drain tube and tighten hose clamps (B).
2. Tighten hose clamps (A).

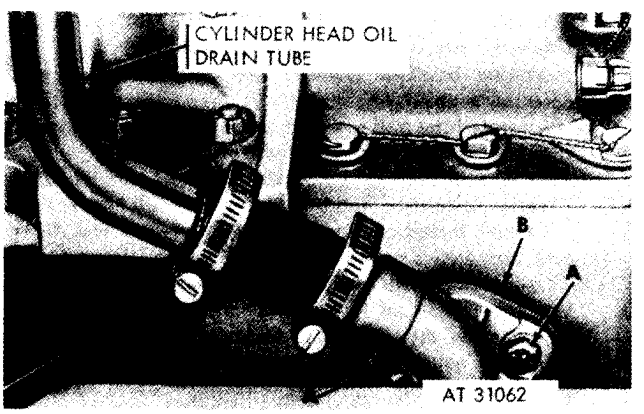
Figure 5-28. Removing or installing right rear cylinder head oil drain tube and turbosupercharger oil drain tube.



Disconnect
1. Remove two cap screws (A) and lock washers at taching right front cylinder head oil drain tube to oil pan.
2. Separate drain tube from pan and remove and discard drain tube gasket (B).

Connect
1. Install new drain tube gasket (B) and position right front cylinder head oil drain tube on oil pan.
2. Install two cap screws (A) and lock washers securing drain tube to oil pan.

Figure 5-29. Disconnecting or connecting right front cylinder head oil drain tube.



Disconnect
1. Remove two cap screws (A) and lock washers attaching left front cylinder head oil drain tube to oil pan.
2. Separate drain tube from pin and remove and discard drain tube gasket (B).

Connect
1. Install new drain tube gasket (B) and position left front cylinder head oil drain tube on oil pan.
2. Install two cap screws (A) and lock washers securing drain tube to oil pan.

Figure 5-30. Disconnecting or connecting left front cylinder head oil drain tube.

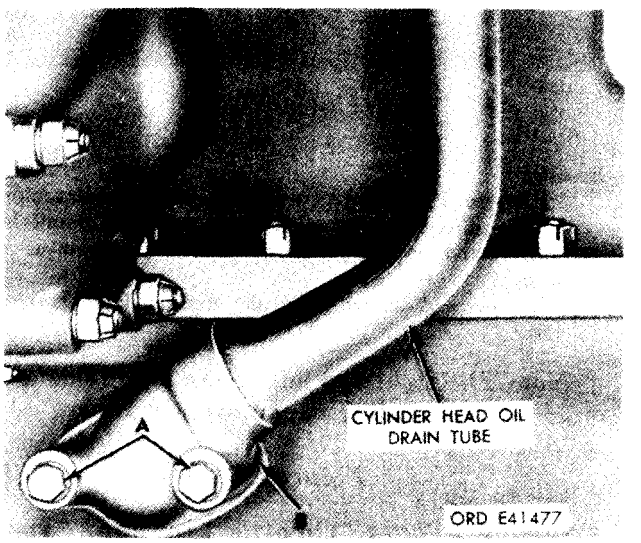
Disconnect

1. Remove two cap screws (A) and lock washers attaching left rear cylinder head oil drain tube to oil pan.
2. Separate drain tube from pan and remove and discard tube gasket (B).

Connect

1. Install new drain tube gasket (B) and position left rear cylinder head oil drain tube on oil pan.
2. Install two cap screws (A) and lock washers securing drain tube to oil pan.

Figure 5-31. Disconnecting or connecting left rear cylinder head oil drain tube.



Remove

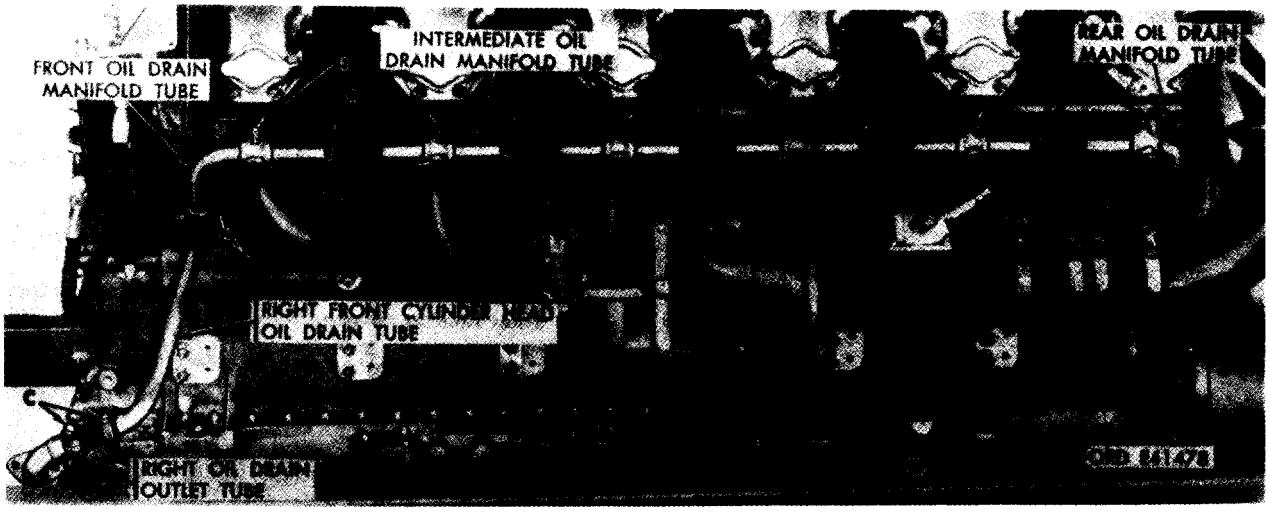
1. Cut locking wire and remove six externally relieved body bolts (A) and flat washers attaching six oil drain manifold tubes to cylinders. Remove oil drain manifold tubes, oil drain tube and outlet tube as a unit.
2. Remove and discard the six body bolt flat washers (B).
3. Loosen all hose clamps (C). Separate and remove right oil drain outlet tube, right front cylinder head oil drain tube, front oil drain manifold tube, four intermediate oil drain manifold tubes, rear oil drain manifold tube, and clamps. Remove and discard six manifold tube annular gaskets.

Note. The left cylinder head oil drain manifold tubes are removed or installed in the same manner.

Install

1. Install hose clamps (C) and connect rear oil drain manifold tube, four intermediate oil drain manifold tubes, front oil drain manifold tube, right front cylinder head oil drain tube, and right oil drain outlet tube.
2. Install six externally relieved body bolts (A) and flat washers (B) in manifold oil drain tubes. Install six new body bolt annular gaskets on ends of bolts.
3. Position outlet tube, oil drain tube, and manifold tubes as a unit on cylinders. Tighten six body bolts (A) securing tubes to cylinders and install locking wire securing bolts. Tighten all hose clamps.

Figure 5-32. Removing or installing right cylinder head oil drain manifold tubes.



Remove

1. Remove 18 nuts (A) and lock washers attaching intake tubes to cylinders. Remove manifold, manifold heater, and turbosupercharger air outlet elbow as a unit.
2. Remove and discard six intake manifold tube gaskets (B).

Note. The right and left intake manifolds are removed or installed in the same manner.

Install

1. Install six new intake manifold tube gaskets (B) on studs.
2. Position manifold, manifold heater, and turbosupercharger air outlet elbow as. a unit on cylinder studs. Install 18 nuts (A) and lock washers securing intake tubes to cylinders.

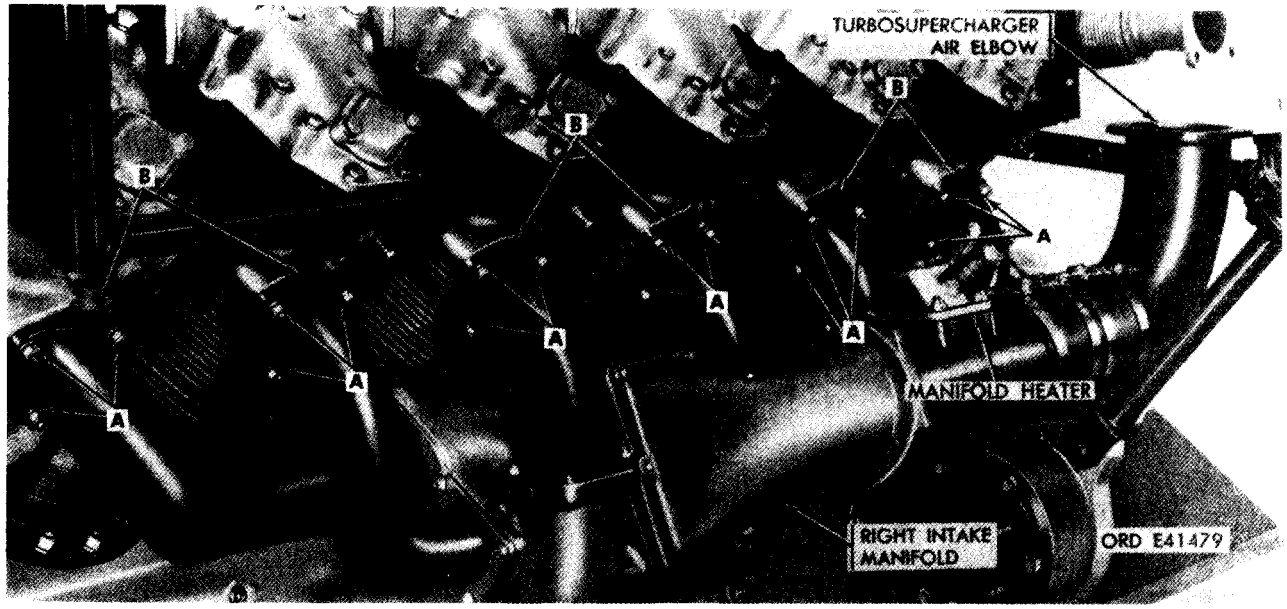
Figure 5-33. Removing or installing right intake manifold.

5-7. Fuel Filters, Throttle Linkage, Front and Rear Shrouds, and Oil Filler and Indicator Tubes

Refer to Table 5-4 for illustrations and disassembly instructions. Figure references are listed in the table.

Table 5-4. Fuel Filters, Throttle Linkage, Front and Rear Shrouds, and Oil Filler and Indicator Tubes

Component	Figure Reference
Primary Fuel Filter, Secondary Fuel Filter, Fuel/Water Separator, Fuel Drain Tubes, and Throttle Linkage	5-34 through 5-41
Front Shroud	5-42 through 5-47
Rear Shroud	5-48 through 5-50
Cylinder Head Plates, Oil Filler Tube, and Oil Level Indicator Tube	5-51 through 5-60



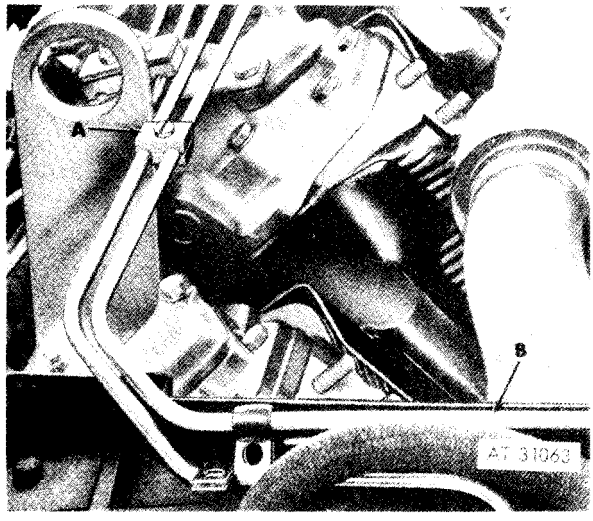
Remove

1. Remove one self-locking nut, pan head screw (A), and holder attaching primary and secondary fuel drain tubes together. Remove holder.
2. Remove primary fuel filter drain tube (B).

Install

1. Position primary fuel filter drain tube (B) on engine.
2. Position holder on tubes and install one self-locking nut and pan head screw (A) in holder to secure tubes.

Figure 5-34. Removing or installing primary fuel filter drain tube.



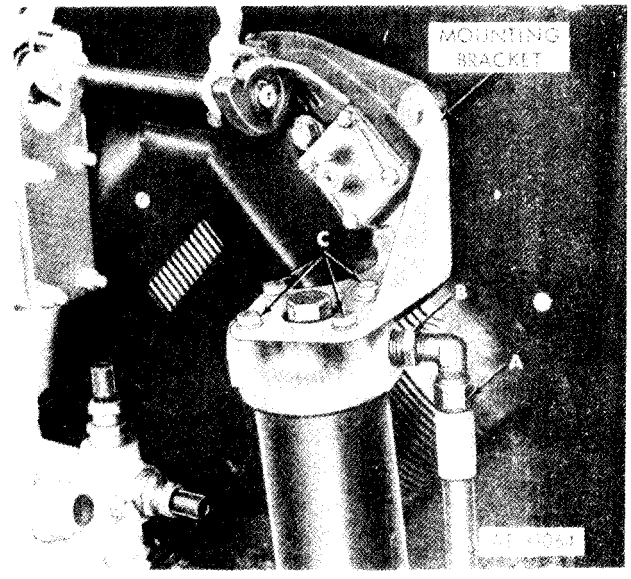
Remove

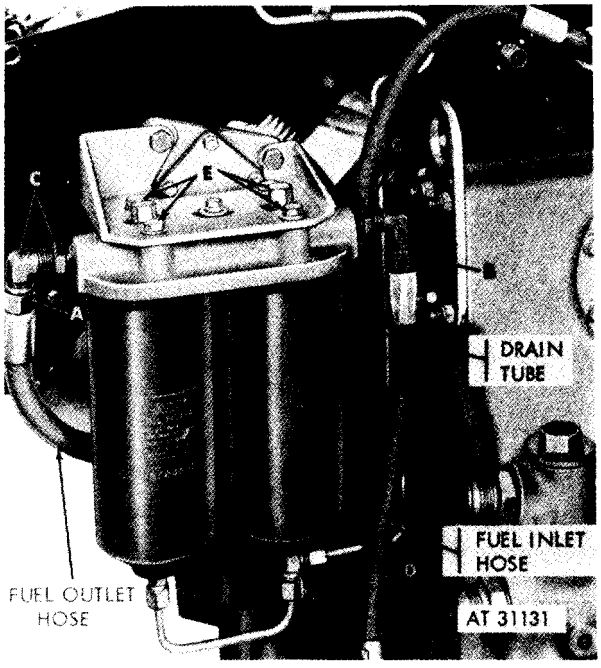
1. Disconnect fuel outlet hose (A) from elbow.
2. Remove elbow and pipe reducer (B) from position fuel filter outlet.
3. Remove four cap screws (C) and lock washers at taching primary fuel filter to mounting bracket and remove primary fuel filter.

Install

1. Position primary fuel filter against mounting bracket and install four cap screws (C) and lock washers securing filter to bracket.
2. Install elbow and pipe reducer (B) in filter outlet.
3. Connect fuel outlet hose (A) to elbow.

Figure 5-35. Removing or installing primary fuel filter.





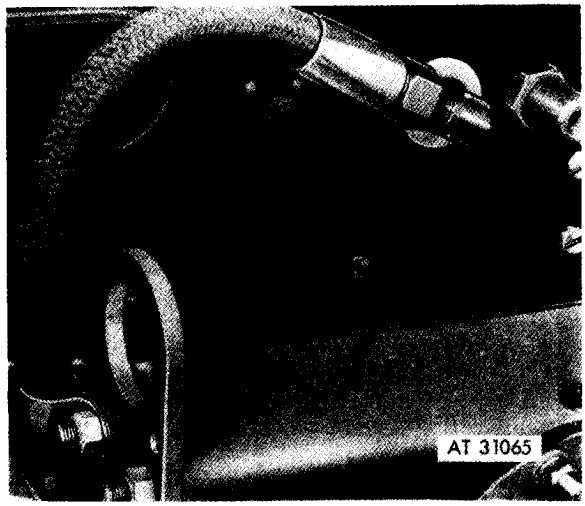
Remove

1. Disconnect fuel outlet hose (A) from elbow in secondary fuel filter and bulkhead elbow in left front shroud and remote hose.
2. Disconnect and remove fuel inlet hose (B).
3. Remove elbows and pipe reducers (C).
4. Disconnect and remove secondary fuel filter fuel drain tube (D).
5. Remove four cap screws (E) and lock washers attaching secondary fuel filter to mounting bracket. Remove filter.

Install

1. Position secondary fuel filter against mounting bracket and install four cap screws (E) and lock washers securing filter to bracket.
2. Position secondary fuel filter fuel drain tube (D) under filter and con nect tube to filter.
3. Install elbows and pipe reducers (C) in filter.
4. Connect fuel inlet hose (B) to filter.
5. Connect fuel outlet hose (A) to bulkhead elbow in left front shroud and elbow in filter.

Figure 5-36. Removing or installing secondary fuel filter.



Disconnect

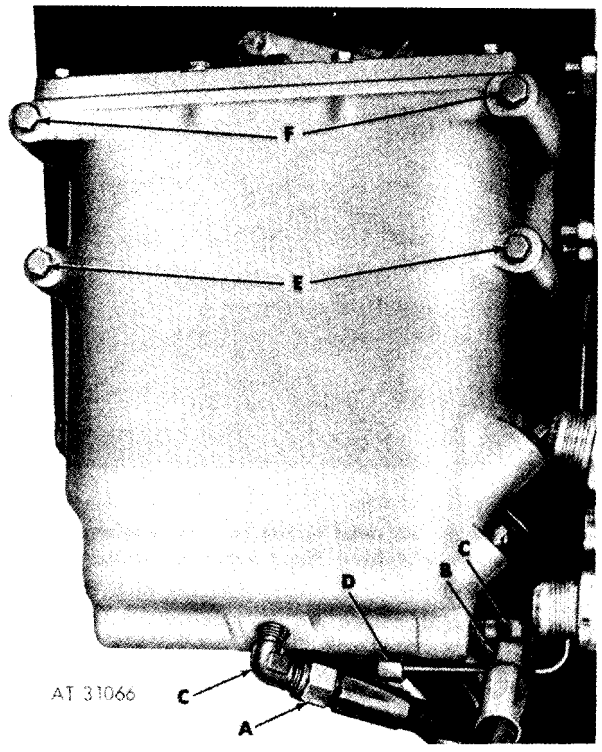
1. Disconnect fuel outlet hose (A) from bulkhead elbow.
2. Remove nut (B) attaching fuel outlet hose clamp to lifting eye stud.

Note. Re-install nut on lifting eye stud and tighten. Lifting eye will be used for oil filter and damper housing assembly removal.

Connect

1. Remove nut (B) from lifting eye stud. Install fuel outlet hose clamp on stud and re-install nut (B).
2. Connect fuel outlet hose (A) to bulkhead elbow.

Figure 5-37. Disconnecting or connecting fuel/ water separator fuel outlet hose from bulkhead elbow.



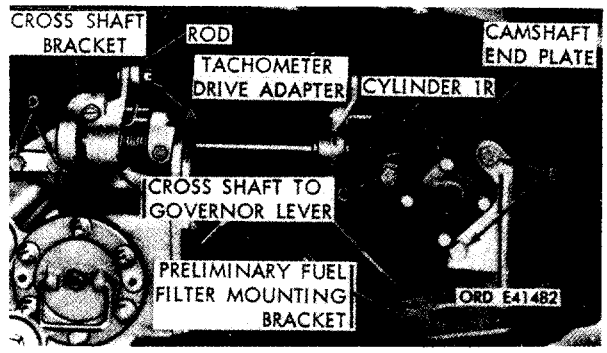
Remove

1. Disconnect fuel outlet hose (A) from elbow in fuel / water separator filter and remove hose.
2. Disconnect and remove fuel inlet hose (B).
3. Remove fuel inlet and outlet elbows and drain tube elbow (C) from filter.
4. Disconnect and remove fuel/ water separator filter fuel drain tube (D).
5. Remove lower two cap screws (E), lock washers, and plain washers.
6. Remove upper two cap screws (F), lock washers, and plain washers attaching fuel / water separator filter to mounting bracket. Remove filter.

Install

1. Position fuel/ water separator filter on mounting bracket and install upper two cap screws (F), lock washers, and plain washers securing filter to bracket.
2. Install lower two cap screws (E), lock washers, and plain washers.
3. Install fuel inlet and outlet elbows and drain tube elbow (C) in filter.
4. Position fuel/ water separator filter fuel drain tube (D) under filter and connect tube to filter.
5. Connect fuel inlet hose (B) to filter.
6. Connect fuel outlet hose (A) to elbow in filter.

Figure 5-38. Removing or installing fuel/ water separator filter.



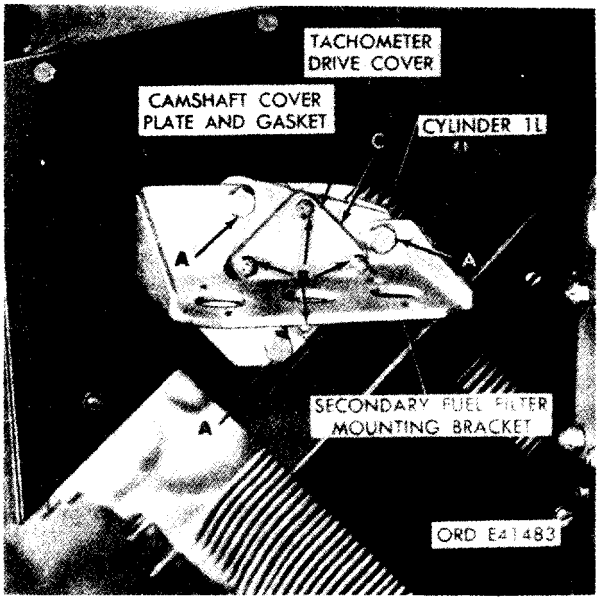
Remove

1. Remove cotter pin, slotted nut (A), flat washer, and bolt Separate adjustable control rod from cross shaft lever.
2. Remove two cap screws (B) and lock washers attaching primary fuel filter mounting bracket to cylinder No. 1 R. Remove mounting bracket.
3. Remove cap screw (C) and lock washers attaching camshaft end plate to cylinder No. 1R.
4. Remove two assembled washer bolts (D) attaching cross shaft bracket. Remove bracket, end plate with tachometer drive adapter, and throttle linkage cross shaft as a unit. Separate cross shaft from camshaft end plate. Remove and discard camshaft end plate gasket.

Install

1. Install new camshaft end plate gasket. Install throttle linkage cross shaft in camshaft end plate. Position cross shaft bracket, end plate with tachometer drive adapter, and cross shaft as a unit on right front shroud. Install two assembled washer bolts (D) securing cross shaft bracket.
2. Install cap screw (C) and lock washer securing camshaft end plate to cylinder No. 1 R.
3. Position primary fuel filter mounting bracket on cylinder No. 1 R and install two cap screws (B) and lock washers securing bracket to cylinder.
4. Position cross shaft lever and adjustable control rod and install bolt, flat washer, slotted nut (A) and cotter pin.

Figure 5-39. Removing or installing primary fuel filter bracket, throttle linkage cross shaft, and camshaft end plate.



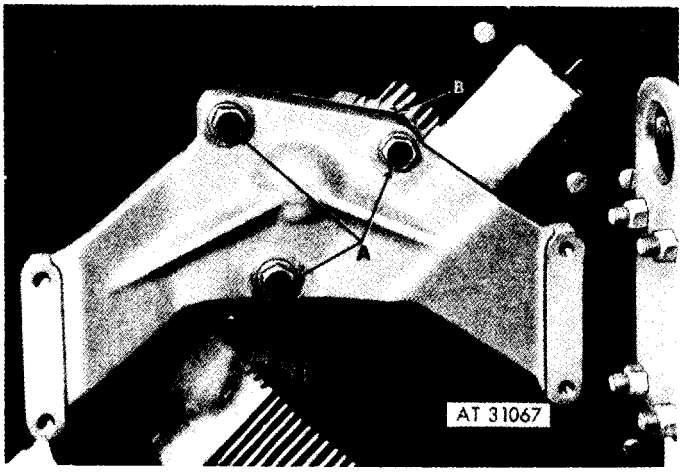
Remove

1. Remove three cap screws (A) and lock washers attaching secondary fuel filter mounting bracket and camshaft cover plate to cylinder No. 1L. Remove bracket and cover plate. Remove and discard cover plate gasket.
2. Remove four self-locking nuts (B) and flat washers attaching tachometer drive cover and remove cover.
3. Remove and discard tachometer drive cover gasket (C),

Install

1. Install a new tachometer drive cover gasket (C).
2. Position tachometer drive cover and install four self-locking nuts (B) and flat washers securing cover.
3. Install new camshaft cover plate gasket. Position camshaft cover plate and secondary fuel filter mounting bracket to cylinder No. 1 L and install three cap screws (A) securing plate and bracket to cylinder.

Figure 5-40. Removing or installing secondary fuel filter mounting bracket, camshaft cover plate, and tachometer drive cover.



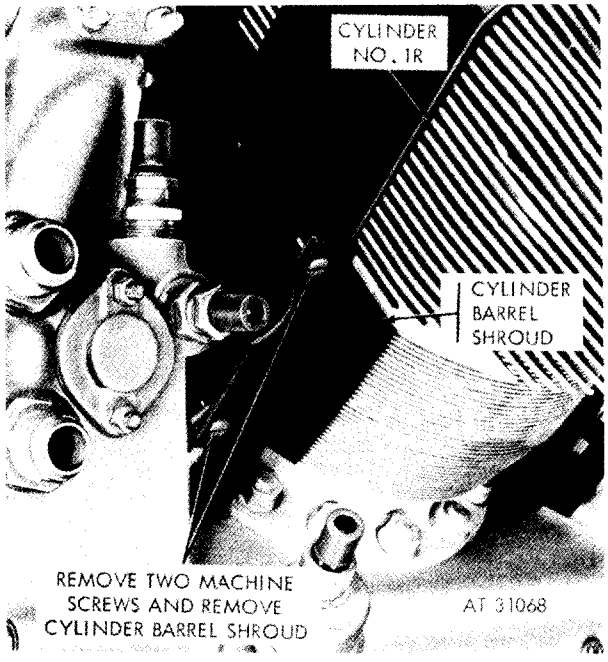
Remove

1. Remove three hex head screws (A), flat washers, and lock washers attaching fuel / water separator filter mounting bracket to cylinder No. 1L and remove bracket.
2. Remove and discard mounting bracket gasket (B).

Install

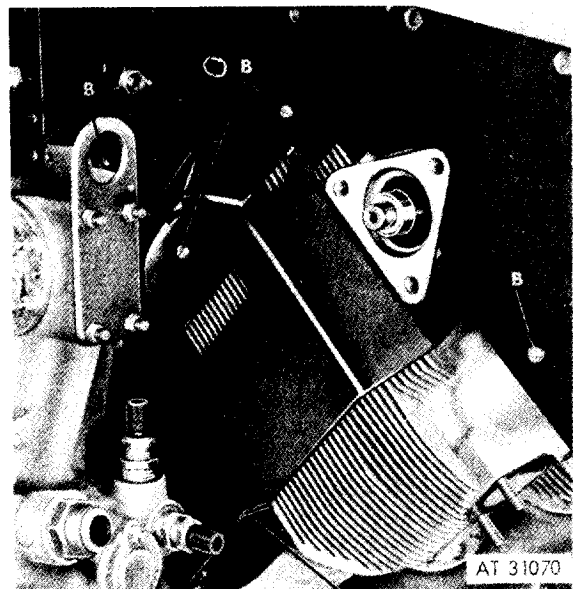
1. Install a new mounting bracket gasket (B).
2. Position fuel/ water separator filter mounting bracket on cylinder No. 1L. Install three hex head screws (A), flat washers, and lock washer-a securing bracket to cylinder.

Figure 5-41. Removing or installing fuel/ water separator filter mounting bracket.



Note. Cylinder barrel shrouds for cylinders No. lR and 6L are identical and are removed or installed in the same manner.

Figure 5-42. Removing or installing cylinder barrel shroud / cylinder No. lR.



Remove

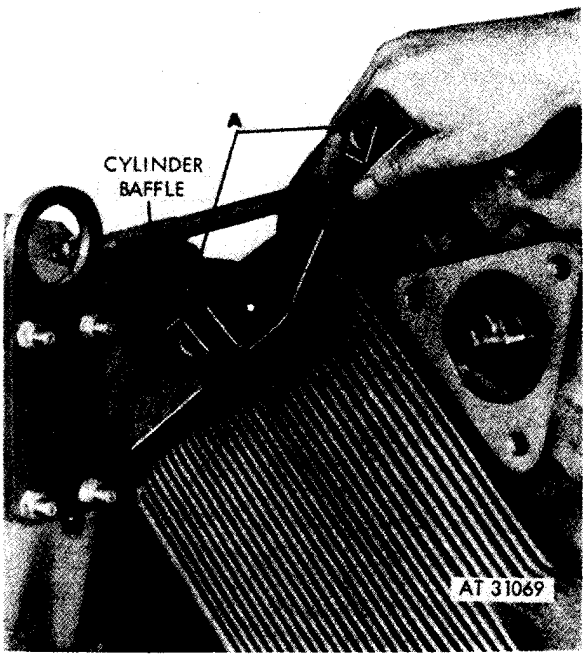
1. Remove two plate nuts (A).
2. Remove five machine screws (B) attaching right front shroud to cylinder and to cylinder No. 1R baffle. Remove shroud.

Note. Cylinder No. lR baffle will be disconnected when the five machine screws (B) are removed.

Install

1. Position right front shroud on engine and install five machine screws (B) securing shroud to cylinder and to cylinder No. 1 R baffle.
2. Install two plate nuts (A).

Figure 5-43. Removing or installing right front shroud.



Remove

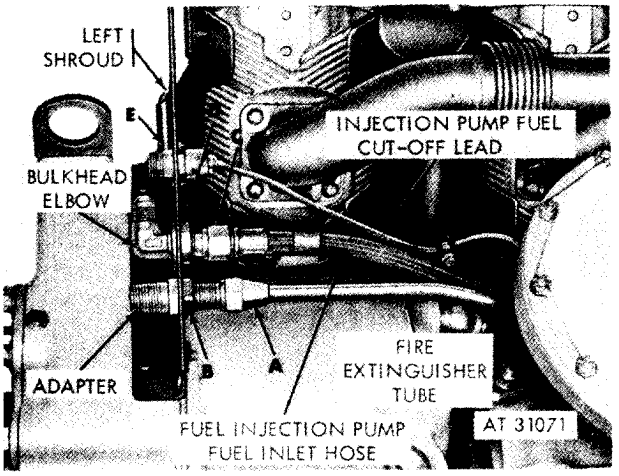
1. Remove two plate nuts (A) from cylinder baffle.
2. Remove cylinder baffle (B).

Note. Cylinder baffles for cylinder Nos. lR and 6L are-identical and are removed or installed in the same manner.

Install

1. Position cylinder baffle (B) over cylinder.
2. Install two plate nuts (A) on cylinder baffle.

Figure 5-44. Removing or installing cylinder baffle-cylinder No. lR.



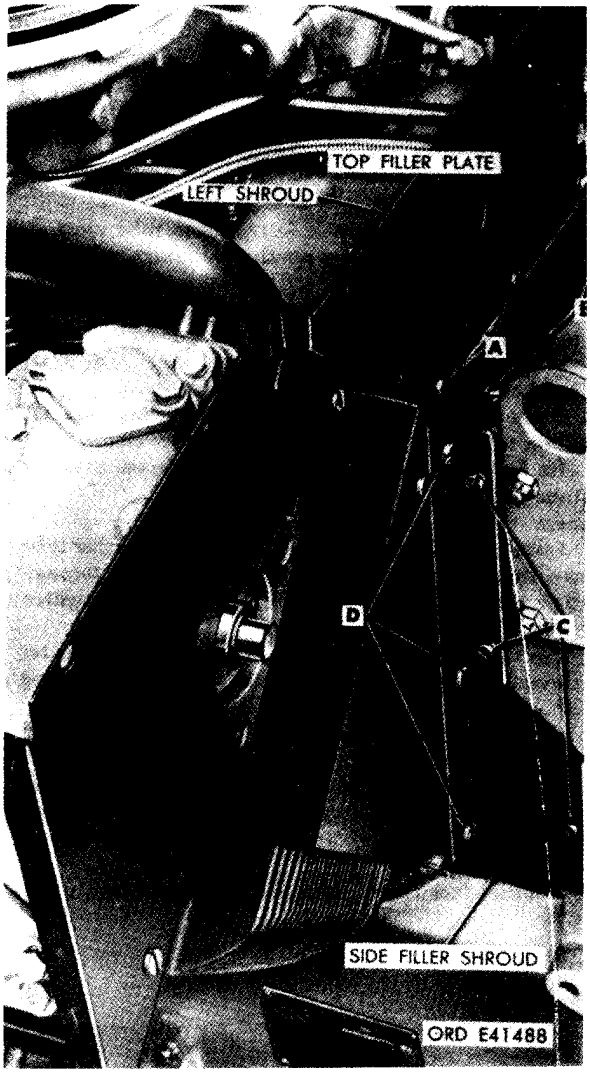
Disconnect

1. Disconnect fire extinguisher tube (A) from adapter.
2. Remove nut (B) attaching adapter to shroud and remove adapter.
3. Disconnect fuel injection pump fuel inlet hose (C) from bulkhead elbow.
4. Remove nut (D) and external teeth lock washer attaching bulkhead elbow to shroud. Remove elbow and flat washer.
5. Remove four nuts (E). external teeth lock washers. and machine screws attaching fuel injection pump fuel cutoff lead to shroud. Remove lead from shroud.

Connect

1. Position fuel injection pump fuel cutoff lead through shroud. Install four nuts (E), external teeth lock washers, and machine screws securing lead to shroud.
2. Position bulkhead elbow and flat washer in shroud. Install nut (D) and external teeth lock washer securing elbow to shroud.
3. Connect fuel injection pump fuel inlet hose (C) to bulkhead elbow.
4. Position adapter in shroud and install nut (B) securing adapter to shroud.
5. Connect fire extinguisher tube (A) to adapter.

Figure 5-45. Disconnecting or connecting fire extinguisher and fuel inlet tubes-front shroud.



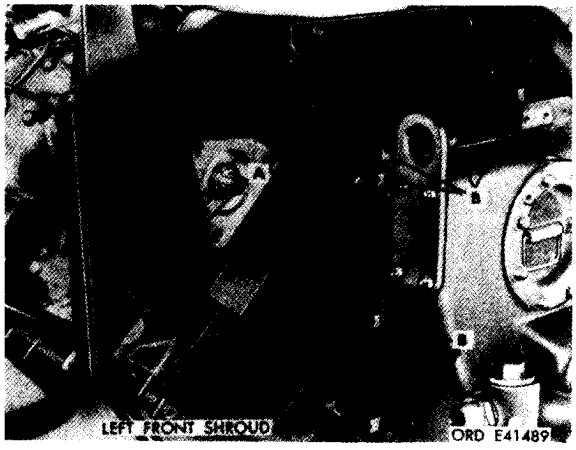
Remove

1. Remove two machine screws (A).
2. Remove three machine screws (B) and lock washers attaching top filler plate to crankshaft damper and oil filter housing. Remove top filler plate.
3. Remove three machine screws (C) and lock washers attaching side filler plate to housing.
4. Remove three machine screws (D) attaching side filler plate to left front shroud and remove filler plate.

Install

1. Position side filler plate on left front shroud and install three machine screws (D) securing plate to shroud.
2. Install three machine screws (C) and lock washers securing side filler plate to crankshaft damper and oil filter housing.
3. Position top filler plate on housing. Install three machine screws (B) and lock washers securing plate to housing.
4. Install two machine screws (A).

Figure 5-46. Removing or installing top and side filler plates-cylinder No. 1L.



Remove

1. Remove three machine screws (A) and remove left front shroud.
2. Remove eight plate nuts (B) from shroud.

Note. Remove or install cylinder baffle from cylinder No. 1L after left front shroud is removed and in the same manner as cylinder baffle No. lR was removed (fig. 5-44). Cylinder baffle for cylinder No. 6R is identical and interchangeable with baffle for cylinder No. 1L and is also removed or installed in the same manner.

Install

1. Install eight plate nuts (B) on left front shroud.
2. Position left front shroud on engine and install three machine screws (A).

Figure 5-47. Removing or installing left front shroud.

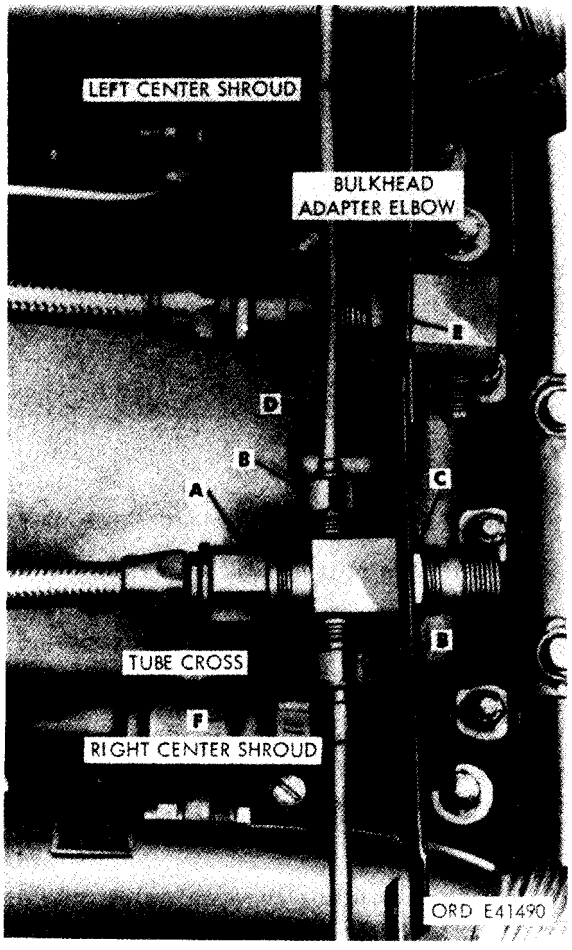


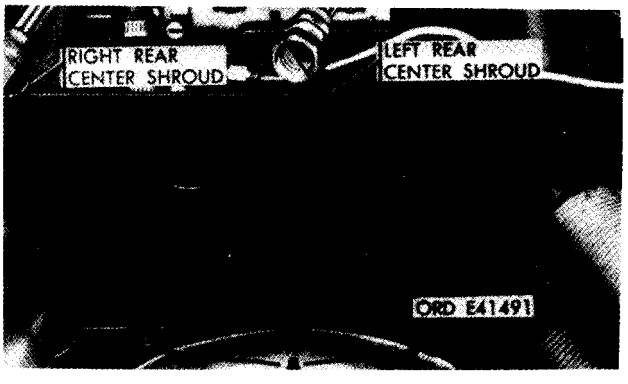
Figure 5-48. Disconnecting or connecting fuel and oil tubes-rear center shrouds.

Disconnect

1. Disconnect fuel return hose (A) from tube cross.
2. Disconnect fuel injector nozzle fuel return tubes (B) from tube cross.
3. Remove nut (C) and flat washer attaching tube cross to right rear center shroud and remove cross.
4. Disconnect turbosupercharger oil hose (D) from bulkhead adapter elbow.
5. Remove nut (E) and flat washer attaching adapter elbow to left rear center shroud and remove elbow.
6. Remove hose clamp (F) and rear crankcase breather tube tee.

Connect

1. Install hose clamp (F) on rear crankcase breather tube tee. Install rear crankcase breather tube hose through right rear center shroud onto breather tube and tighten clamp.
2. Position bulkhead adapter elbow in left rear center shroud and install nut (E) and flat washer securing elbow to shroud.
3. Connect turbosupercharger oil hose (D) to bulkhead adapter elbow.
4. Position tube cross in right rear center shroud and install nut (C) and flat washer securing cross to shroud.
5. Connect fuel injector nozzle fuel return tubes (B) to tube cross.
6. Connect fuel return hose (A) to tube cross.



Rem ove

1. Remove three machine screws (A) and lock washers.
2. Remove left and right rear center shrouds (B).

Install

1. Position left and right rear center shrouds (B) on engine.
2. Install three machine screws (A) and lock washers.

Figure 5-49. Removing or installing exhaust manifold left and right rear center shrouds.

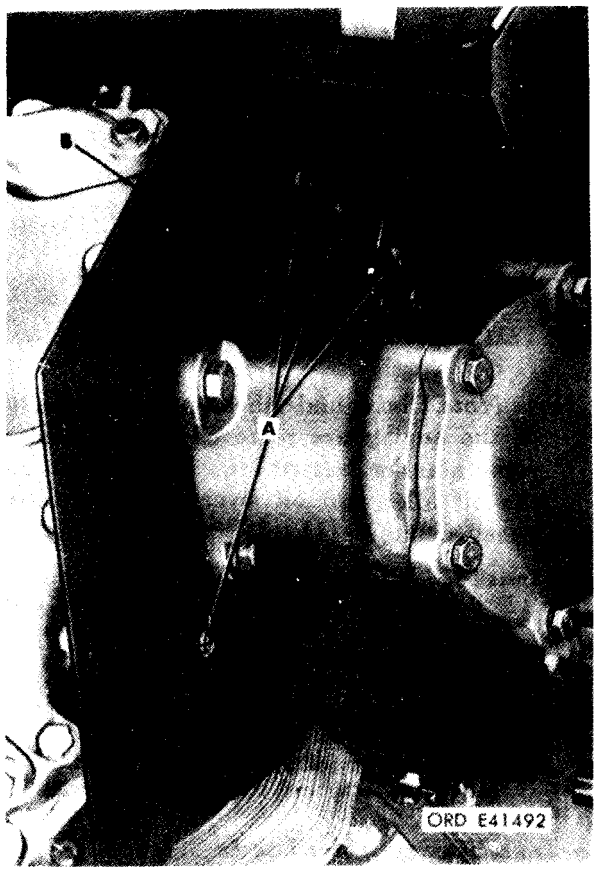


Figure 5-50. Removing or installing right near shroud.

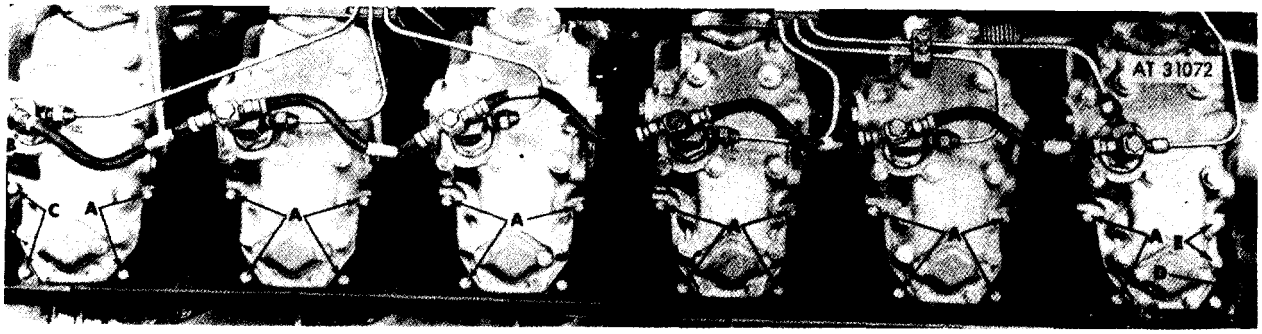
Remove

1. Remove four machine screws (A).
2. Remove right rear shroud (B).

Install

1. Position right rear shroud (B) on engine.
2. Install four machine screws (A).

Note. Remove or install left rear shroud in the same manner.



Remove

1. Remove 20 hex head screws(A) and lock washers and remove five cylinder head plates.
2. Remove plate nut (B) from front cylinder head end plate.
3. Remove two hex head screws (C) and lock washers and remove front end plate.
4. Remove plate nut (D) from rear cylinder head end plate.
5. Remove two hex head screws (E) and lock washers and remove rear end plate.

Note. The cylinder head plates on the left side of the engine are removed or installed in the same manner, except for the plates surrounding the oil filler and oil level indicator tubes (between cylinders lL, 2L, and 3L).

Install

1. Position rear cylinder head end plate and install two hex head screws (E) and lock washers securing plate.
2. Install plate nut (D) on end plate.
3. Position front cylinder head end plate and install two hex head screws (C) and lock washers securing plate.
4. Install plate nut (B) on end plate.
5. Position five cylinder head plates and install 20 hex head screws (A) and lock washers securing plates.

Figure 5-51. Removing or installing cylinder head plates-right side.

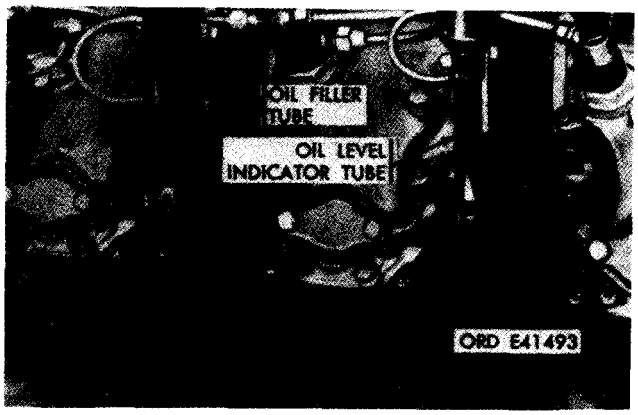


Figure 5-52. Removing or installing oil filler and oil level indicator tube plates - engines with one piece oil filler tube.

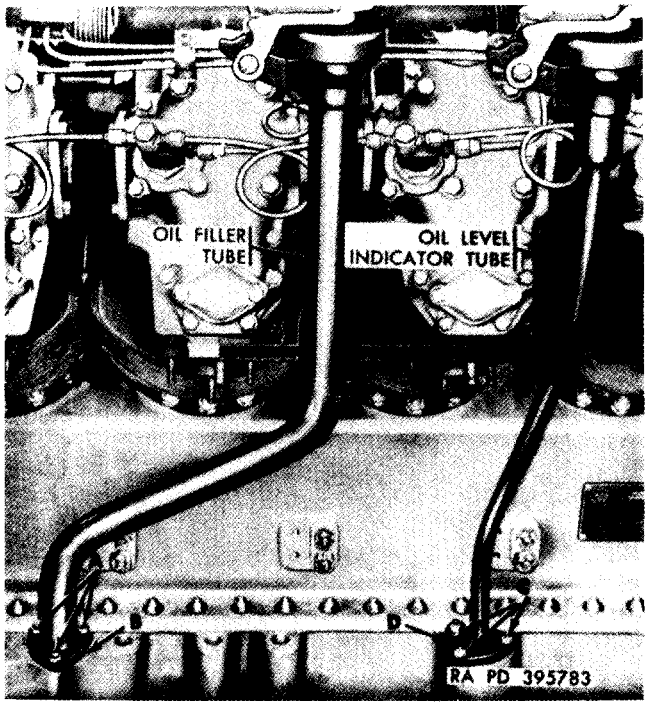
Remove

Note. The oil filler and oil level indicator tubes must be removed before cylinder head plates between cylinder Nos. 1L, 2L, and 3L can be removed.

1. Remove two machine screws (A) and lock washers and remove oil filler tube plate.
2. Remove two machine screws (B) and lock washers and remove oil level indicator tube plate.

Install

1. Position oil level indicator tube plate and install two machine screws (B) and lock washers securing plate.
2. Position oil filler tube plate and install two machine screws (A) and lock washers securing plate.



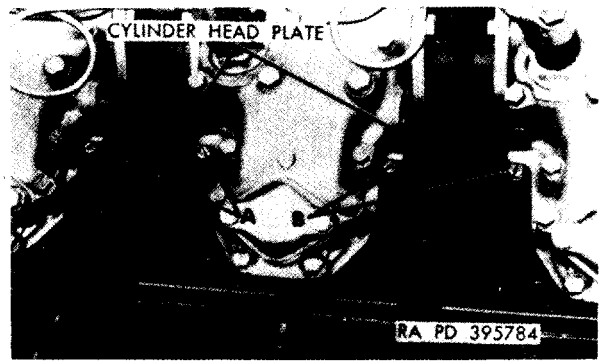
Remove

1. Remove three assembled washer bolts (A) and seal washers and remove oil filler tube and cap as a unit. Discard seal washers.
2. Remove and discard oil filler tube gasket (B).
3. Remove three self-locking nuts (C) and remove oil level indicator tube and cap as a unit.
4. Remove and discard oil level indicator tube gasket (D).

Install

1. Install a new oil level indicator tube gasket (D) on oil pan,
2. Position oil level indicator tube and cap as a unit on oil pan. Install three self-locking nuts (C) securing tube.
3. Install a new oil filler tube gasket (B) on oil pan.
4. Position oil filler tube and cap as a unit on oil pan. Install three assembled washer bolts (A) and new seal washers securing tube.

Figure 5-53. Removing or installing oil filler and oil level indicator tubes-engines with one piece oil filler tube.



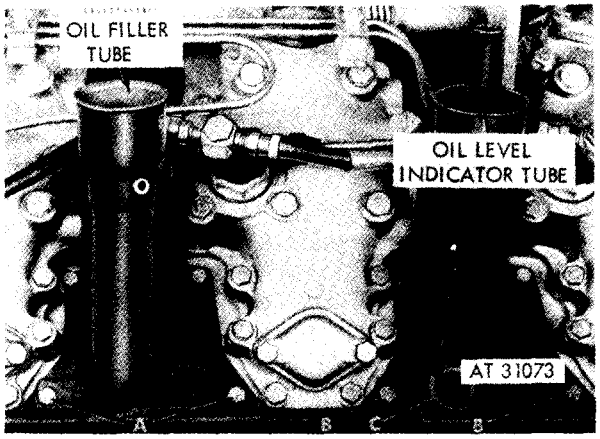
Remove

1. Remove two machine screws (A) and lock washers and remove cylinder head plate at oil filler tube.
2. Remove two machine screws (B) and lock washers and remove cylinder head plate at oil level indicator tube.

Install

1. Position cylinder head plate at oil level indicator tube position. Install two machine screws (B) and lock washers securing plate.
2. Position cylinder head plate at oil filler tube position. Install two machine screws (A) and lock washers securing plate.

Figure 5-54. Removing or installing cylinder head plates at oil filler and oil level indicator tubes-engines without splash pan installation.



Remove

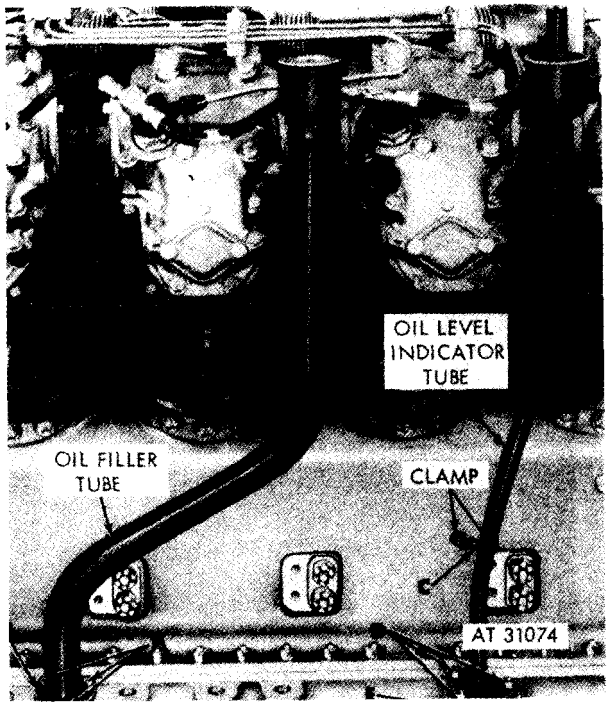
Note. The oil filler and oil level indicator tubes must be removed before cylinder head plates between cylinders Nos. 1L, 2L and 3L can be removed.

1. Remove two hex head screws (A) and lock washers and remove oil filler tube plate.
2. Remove two hex head screws (B) and lock washers and remove oil level indicator tube plate.
3. Remove and discard grommet (C).

Install

1. Install a new grommet (C) in oil level indicator tube plate.
2. Position indicator tube plate and install two hex head screws (B) and lock washers securing plate.
3. Position oil filler tube plate and install two hex head screws (A) and lock washers securing plate.

Figure 5-55. Removing or installing oil filler and oil level indicator tubes-engines with splash pan installation.



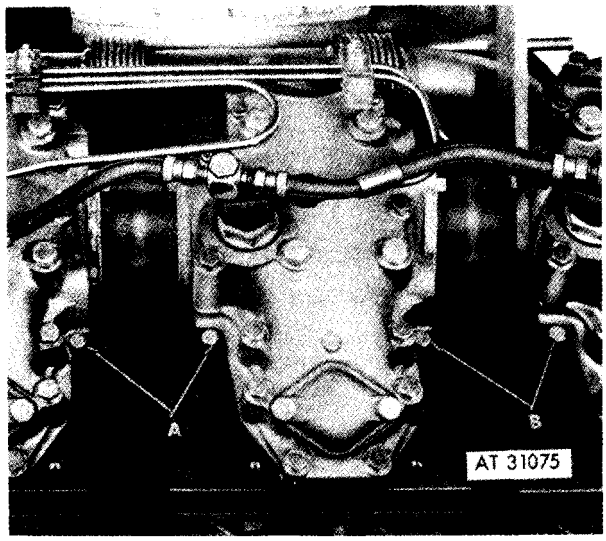
Remove

1. Remove three assembled washer bolts (A) and seal washers and remove oil filler tube. Discard seal washers.
2. Remove and discard oil filler tube gasket (B).
3. Remove pan head screw (C) and self-locking nut and remove two hose clamps from oil level indicator tube.
4. Remove three self-locking nuts (D) and remove oil level indicator tube.
5. Remove and discard oil level indicator tube gasket (E).

Install

1. Install a new oil level indicator tube gasket (E) on oil pan.
2. Position oil level indicator tube on oil pan. Install three self-locking nuts (D) securing tube.
3. Position two hose clamps, one on indicator tube, and install pan head screw (C) and self-locking nut securing clamps.
4. Install a new oil filler tube gasket (B) on oil pan.
5. Position oil filler tube on oil pan. Install three assembled washer bolts (A) and new seal washers securing tube.

Figure 5-56. Removing or installing oil filler and oil level indicator tube plates - engines with splash pan installation.



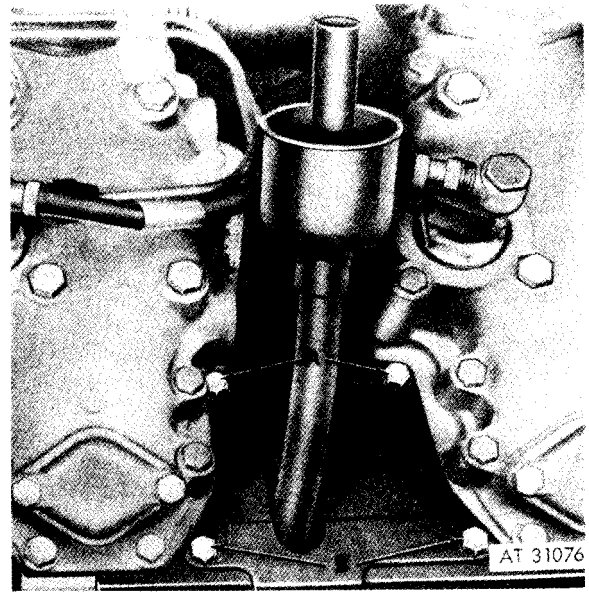
Remove

1. Remove two machine screws (A) and lock washers and remove cylinder head plate at oil filler tube.
2. Remove two machine screws (B) and lock washer-e and remove cylinder head plate at oil level indicator tube.

Install

1. Position cylinder head plate at oil level indicator tube position. Install two machine screws (B) and lock washers securing plate.
2. Position cylinder head plate at oil filler tube position. Install two machine screws (A) and lock washers securing plate.

Figure 5-57. Removing or installing cylinder head plates at oil filler and oil level indicator tubes—engines with splash pan installation.



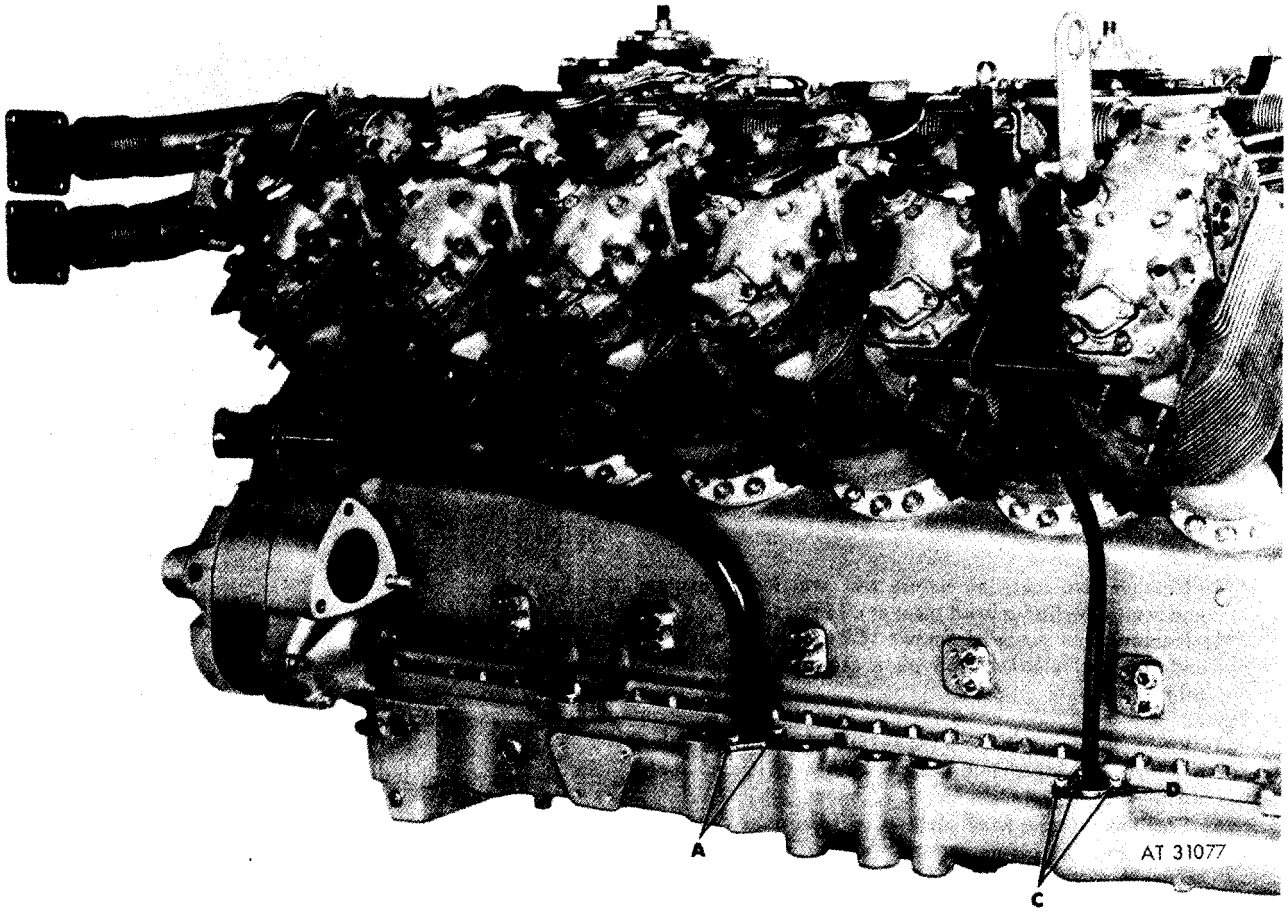
Remove

1. Remove two machine screws (A) and lock washers and remove oil level indicator tube plate.
2. Remove two machine screws (B) and lock washers attaching oil level indicator tube cylinder plate.

Install

1. Install two machine screws (B) and lock washers securing oil level indicator tube cylinder plate.
2. Position oil level indicator tube plate and install two machine screws (A) and lock washers securing plate.

Figure 5-58. Removing or installing oil level indicator tube plate-engines with relocated oil filler tube installation.



Remove

1. Remove three assembled washer bolts (A) and remove oil filler tube.
2. Remove and discard filler tube gasket (B).
3. Remove three self-locking nuts (C) and remove oil level indicator tube.
4. Remove and diaeard indicator tube gasket (D).

Install

1. Position new gasket (D) on studs on oil level indicator tube mounting.
2. Position oil level indicator tube on oil pan and install three self-locking nuts (C).
3. Position new gasket (B) on oil filler tube mounting.
4. Position oil filler tube on oil pan and install three assembled washer bolts (A).

Figure 5-59. Removing or installing oil filler and oil level indicator tubes-engines with relocated oil filler tube installation.

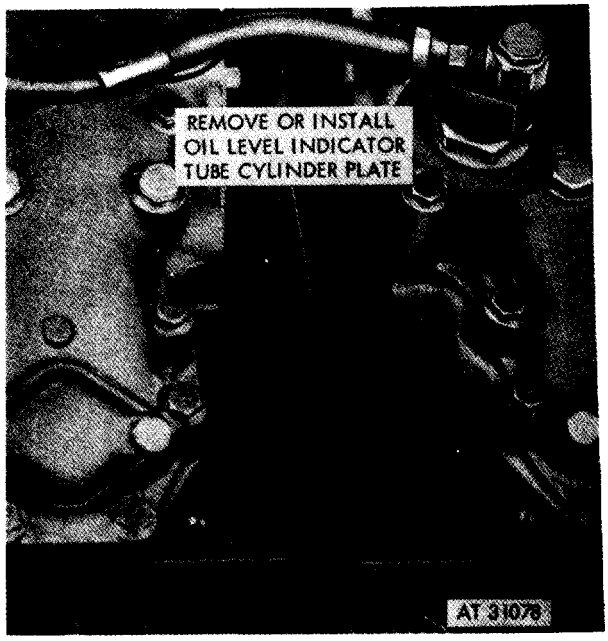


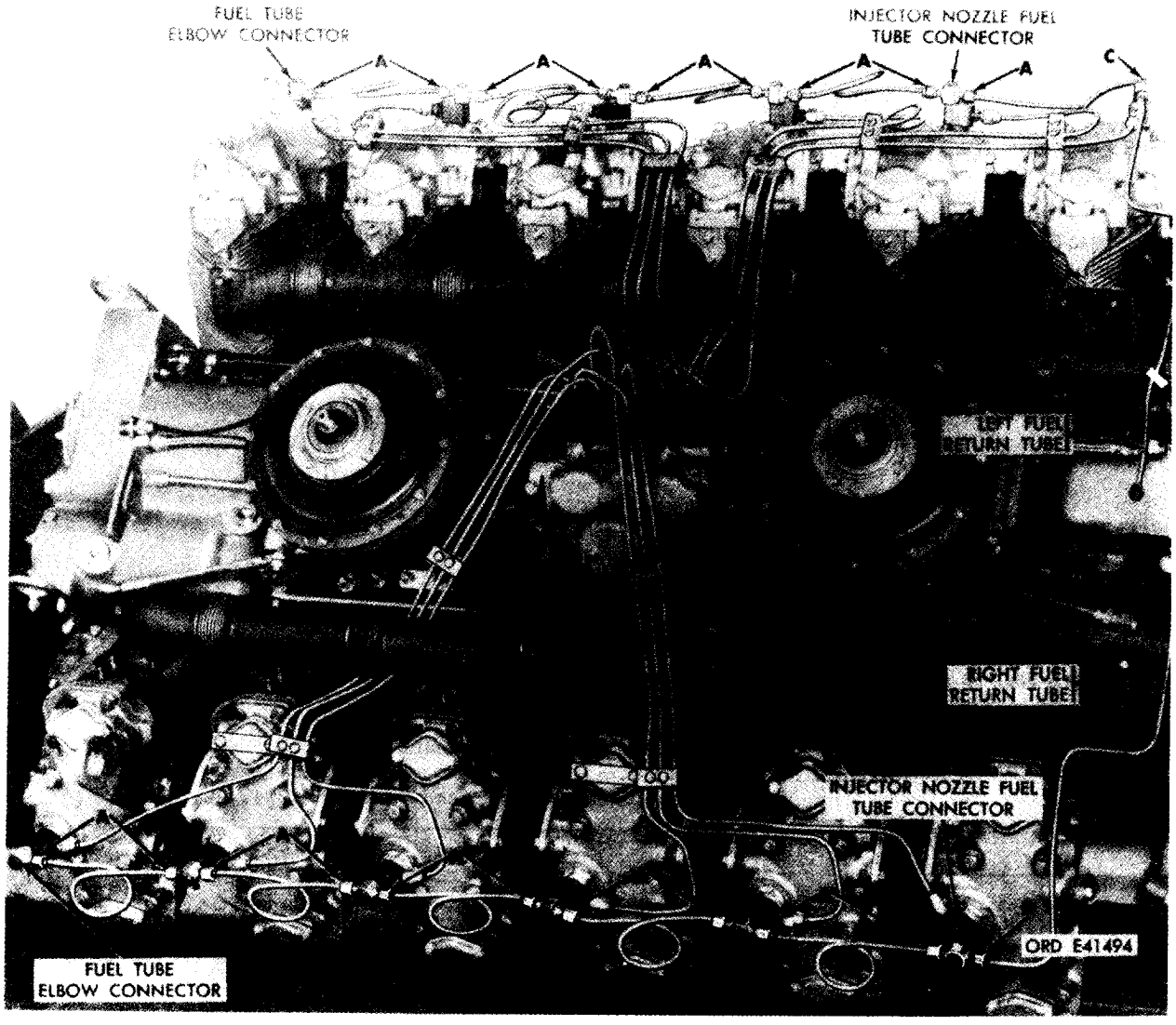
Figure 5-60. Removing or installing oil level indicator tube cylinder plate-engines with relocated oil filler tube installation.

5-8. Fuel Injector Tubes, Supports, and Clamps, Exhaust Pipes and Manifolds Fuel Inlet and Return Hoses Crankcase Breather Tubes, and Turbosupercharger Base, Supports and Tie Rods

Refer to Table 5-5 for illustrations and disassembly instructions. Figure references are listed in the table.

Table 5-5. Fuel Injector Tubes, Supports, and Clamps, Exhaust Pipes and Manifold, Fuel Inlet and Return Hoses, Crankcase Breather Tubes, and Turbosupercharger Base, Supports and Tie Rods

Component	Figure Reference
Fuel Injector Nozzle Fuel Return Tubes	5-61 through 5-63
Fuel Injector Clamps, Supports, and Tubes	5-64 through 5-67
Exhaust Pipes and Manifolds	5-68 through 5-70, 5-78
Fuel Inlet and Return Hoses and Crankcase Breather Tubes	5-71 through 5-76
Turbosupercharger Base, Supports, and Tie Rods	5-79 through 5-81



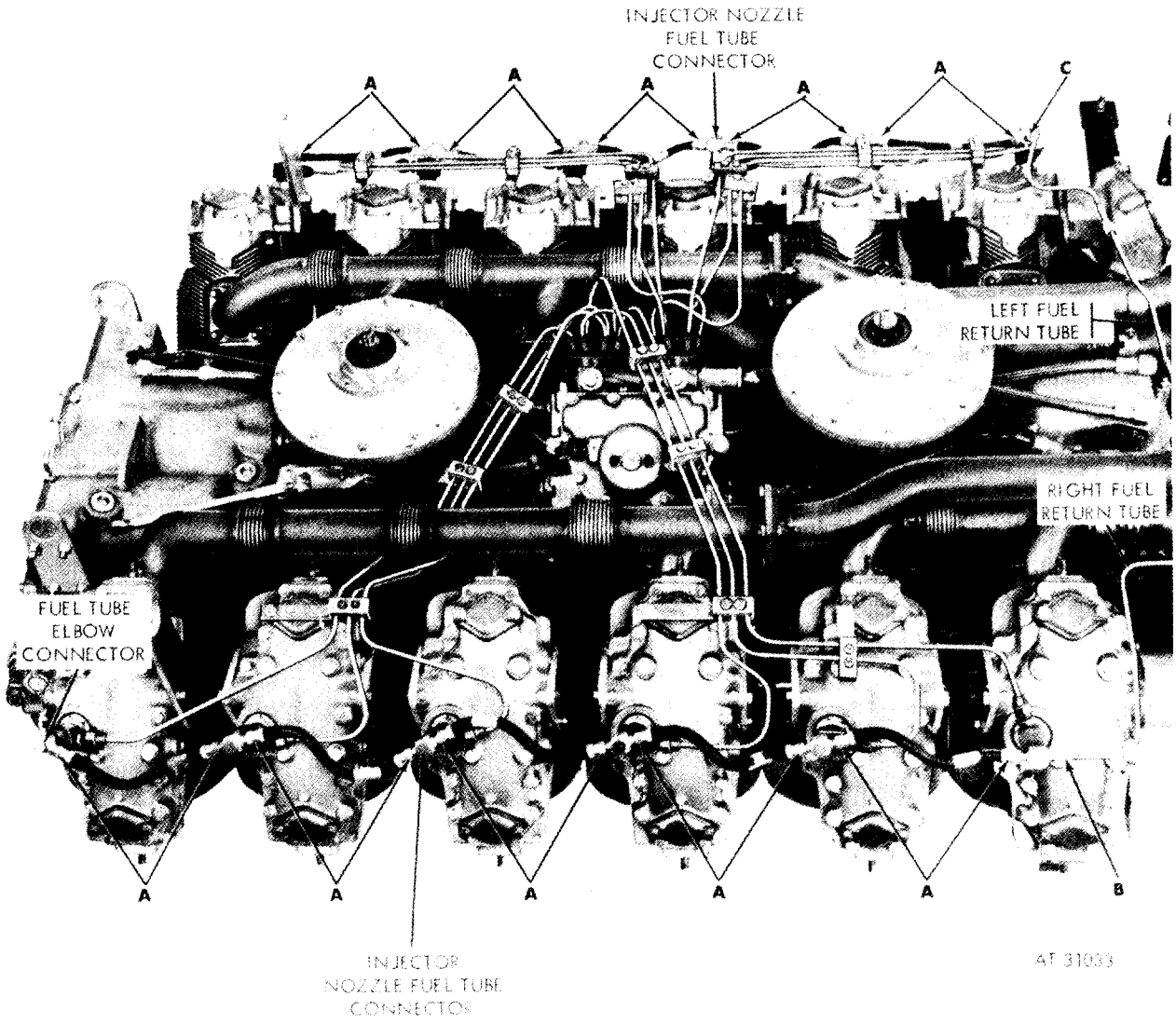
Remove

1. Disconnect and remove ten fuel injector nozzle fuel return tubes (A) from injector nozzle fuel tube connectors and fuel tube elbow connectors.
2. Disconnect and remove right nozzle fuel return tube (B) from fuel tube connector at cylinder No. 6R.
3. Disconnect and remove left nozzle fuel return tube (C) from fuel tube connector at cylinder No. 6L.

Install

1. Install and connect left nozzle fuel return tube (C) to fuel tube connector at cylinder No. 6L.
2. Install and connect right nozzle fuel return tube (B) to fuel tube connector at cylinder No. 6R.
3. Install and connect ten fuel injector nozzle fuel return tubes (A) to injector nozzle fuel tube connectors and fuel tube elbow connectors.

Figure 5-61. Removing or installing fuel injector nozzle fuel return tubes-engines with metallic tubes.



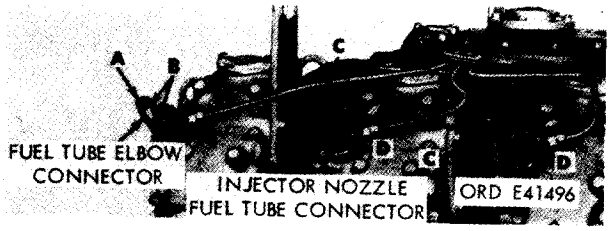
Remove

1. Disconnect and remove ten fuel injector nozzle fuel return tubes (A) from injector nozzle fuel tube connectors and fuel tube elbow connectors.
2. Disconnect and remove right nozzle fuel return tube (B) from fuel tube connector at cylinder No. 6R.
3. Disconnect and remove left nozzle fuel return tube (C) from fuel tube connector at cylinder No. 6L.

Install

1. Install and connect left nozzle fuel return tube (C) to fuel tube connector at cylinder No. 6L.
2. Install and connect right nozzle fuel return tube (B) to fuel tube connector at cylinder No. 6R.
3. Install and connect ten fuel injector nozzle fuel return tubes (A) to injector nozzle fuel tube connectors and fuel tube elbow connectors.

Figure 5-62. Removing or installing fuel injector nozzle fuel return tubes-engines with flexible tubes.



Remove

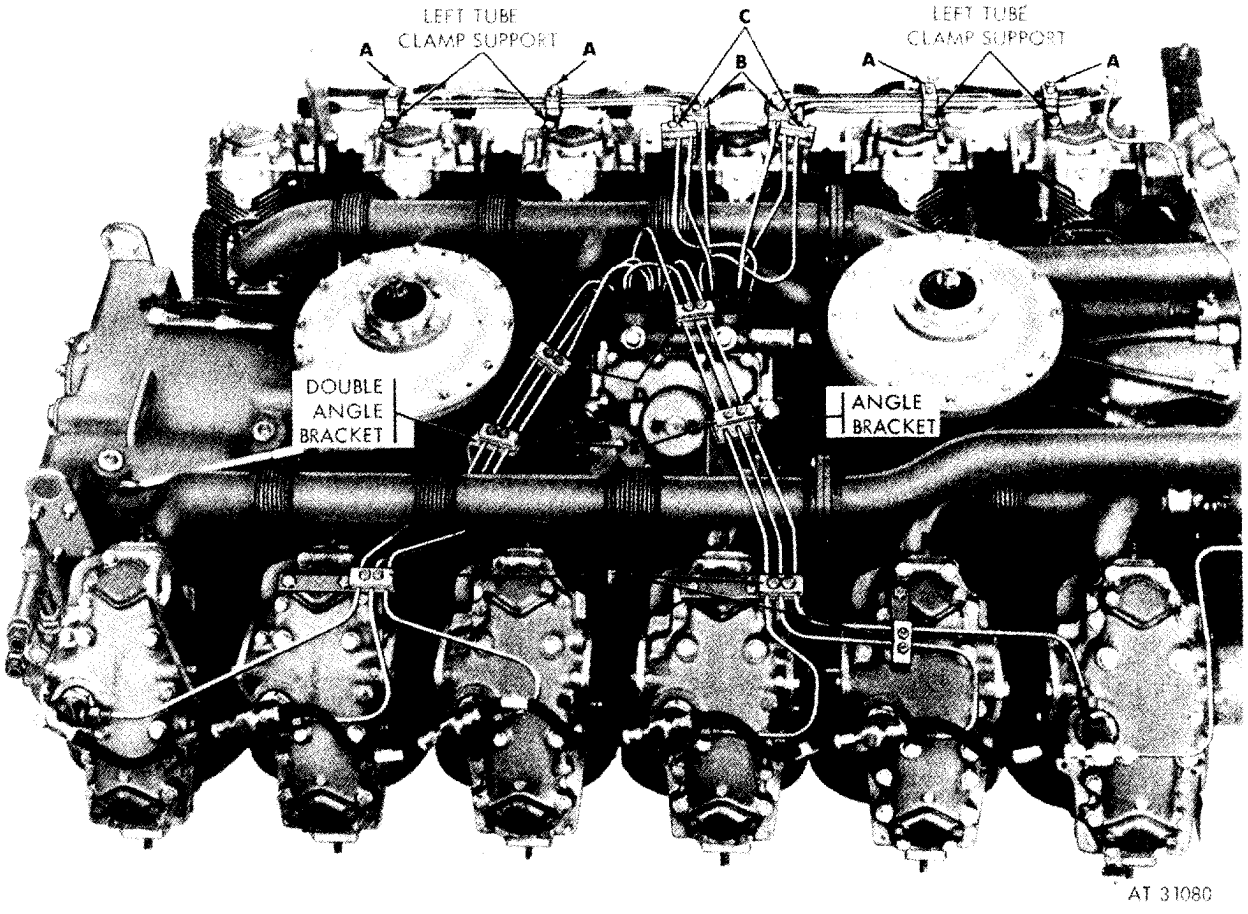
1. Remove special bolts (A) attaching fuel tube elbow connector to nozzle and holder in cylinder No. 1 R.
2. Remove and discard elbow connector gaskets (B) from bolt as bolt and elbow connector are separated.
3. Remove five special bolts (C) attaching fuel tube connectors to nozzle and holder assemblies in cylinder Nos. 2R, 3R, 4R, 5R, and 6R.
4. Remove and discard connector gaskets (D) from bolts as bolt and connector are separated.

Note. Fuel injector nozzle fuel tube connectors and elbow connectors on left side of engine are removed or installed in the same manner.

Install

1. Position a new connector gasket (B) on special bolt (A), insert bolt through fuel tube efbow connector, and position second new connector gasket (B) on bolt.
2. Install assembled special bolt (A), with gaskets and elbow connector in nozzle and holder at cylinder No. 1R.
3. Position a new connector gasket (D) on special bolt (C), insert bolt through fuel tube connector, and position second new connector gasket (D) on bolt.
4. Install five assembled special bolts (C), with gaskets and tube connectors in nozzle and holder assemblies at cylinder Nos. 2R, 3R, 4R, 5R and 6R.

Figure 5-63. Removing or installing fuel injector nozzle fuel tube connectors and elbow connector-right side.



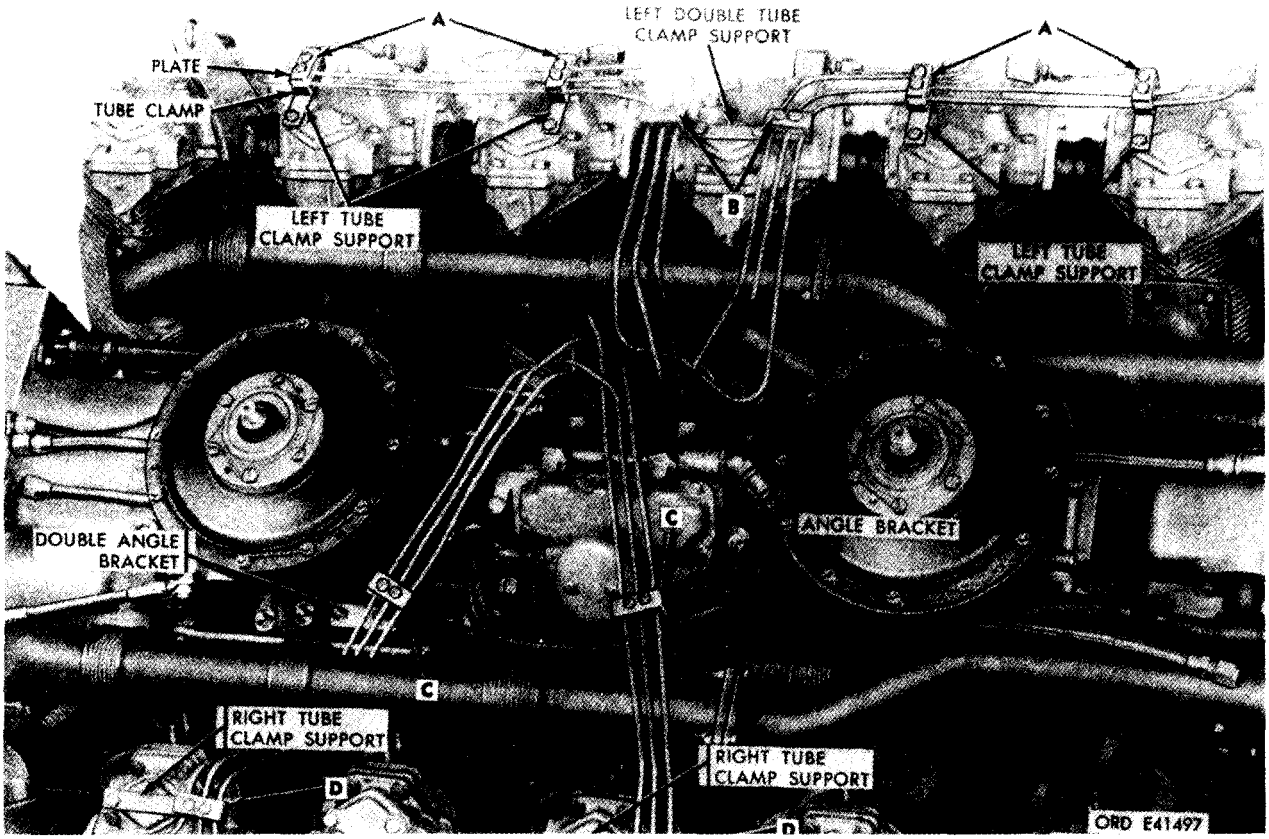
Remove

1. Remove eight self-locking nuts (A) and bolts. Remove four plates and eight tube clamps from four left tube clamp supports.
2. Remove four self-locking nuts (B) and bolts. Remove two plates and four tube clamps from double tube clamp support.
3. Remove four self-locking nuts (C) and bolts. Remove two plates and four tube clamps from double angle and single angle brackets.
4. Remove four self-locking nuts (D) and bolts. Remove two plates and four tube clamps from two right tube clamp supports.

Install

Note. Some engines were provided with four additional clamps to minimize the vibration of the fuel injection tube. When overhauling engines, install tube clamping to the current clamping arrangement, as described in instructions which accompany figure 5-65 and to dimensions shown in figures 4-41 and 4-42.

Figure 5-64. Removing fuel injector clamps-engines without additional clamps.



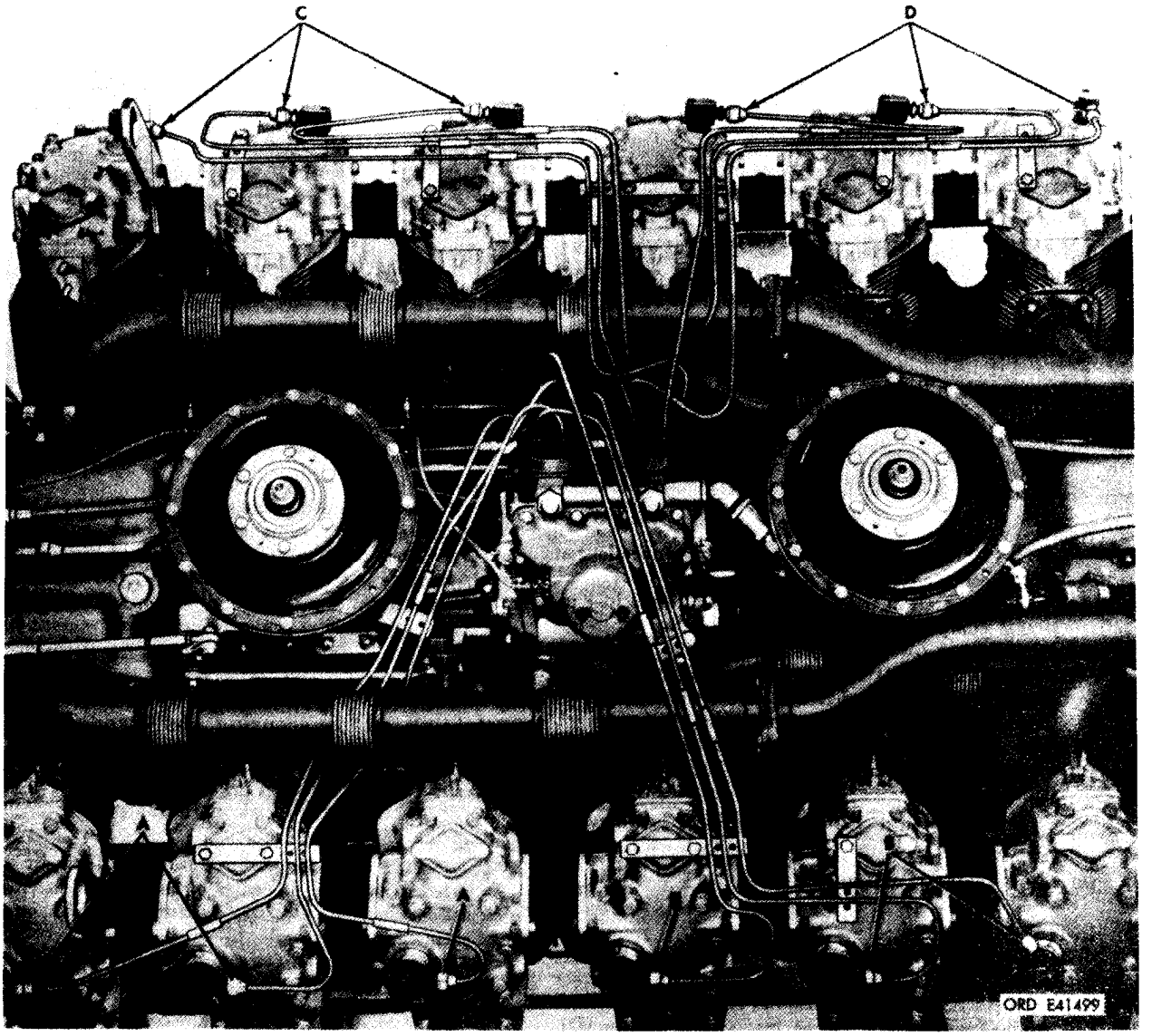
Remove

1. Remove eight self-locking nuts (A) and bolts. Remove four plates and eight tube clamps from four left tube clamp supports.
2. Remove four self-locking nuts (B) and bolts. Remove two plates and four tube clamps from double tube clamp support.
3. Remove four self-locking nuts (C) and bolts. Remove four plates and tube clamps.
4. Remove four self-locking nuts (D) and bolts. Remove four plates and tube clamps.
5. Remove four self-locking nuts (E) and bolts. Remove two plates and four tube clamps from angle brackets.
6. Remove six self-locking nuts (F) and bolts. Remove three plates and six tube clamps from three right tube clamp supports.

Install

1. Position two tube clamps, one under and one over fuel injector tubes, and plate on top of each clamp at each right tube clamp support. Install six self-locking nuts (F) and bolts securing clamps.
2. Position two tube clamps, one under and one over fuel injector tubes, and plate on top of each clamp at angle brackets. Install four self-locking nuts (E) and bolts securing clamps.
3. Position two clamps, one under and one over fuel injector tubes, and one plate under and one over each clamp at location shown. Install four self-locking nuts (D) and bolts securing clamps.
4. Position two clamps, one under and one over outer two fuel injector tubes at location shown, and one plate under and one over each clamp. Install four self-locking nuts (C) and bolts securing clamps.
5. Position two clamps, one under and one over fuel injector tubes and one plate on top of each clamp at double tube clamp support. Install four self-locking nuts (B) and bolts securing clamps.
6. Position two clamps, one under and one over fuel injector tubes, and plate on top of each clamp at each left tube clamp support. Install eight self-locking nuts (A) and bolts securing clamps.

Figure 5-65. Removing or installing fuel injector tube clamps-engines with additional clamps.



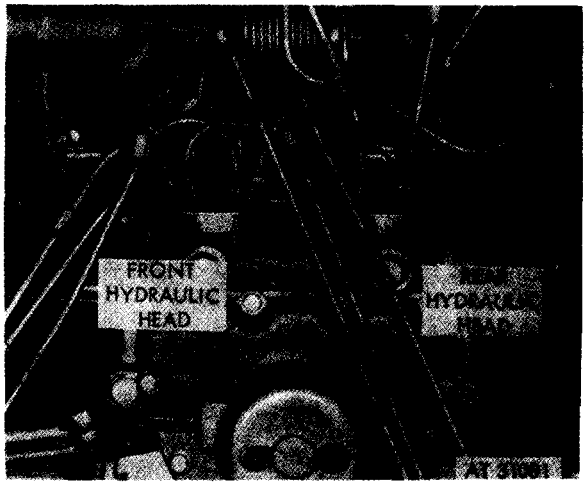
Disconnect

1. Disconnect fuel injector tubes (A) for cylinder Nos. 1R, 2R and 3R from injector nozzle and holder assemblies
2. Disconnect fuel injector tubes (B) for cylinder Nos. 4R, 5R, and 6R from injector nozzle and holder assemblies.
3. Disconnect fuel injector tubes (C) for cylinder Nos. 1L, 2L, and 3L from injector nozzle and holder assemblies.
4. Disconnect fuel injector tubes (D) for cylinder NOS. 4L, 5L, and 6L from injector nozzle and holder assemblies.

Connect

1. Connect fuel injector tubes (D) for cylinder NOS. 4L, 5L and 6L to injector nozzle and holder assemblies.
2. Connect fuel injector tubes (C) for cylinder NOS. 1L, 2L, and 3L to injector nozzle and holder assemblies.
3. Connect fuel injector tubes (B) for cylinder Nos.. 4R, 5R, and 6R to injector nozzle and holder assemblies.
4. Connect fuel injector tubes (A) for cylinder NOS. 1R, 2R, and 3R to injector nozzle and holder assemblies.

Figure 5-66. Disconnecting or connecting fuel injector tubes-at fuel injector nozzle and holder assemblies.



Remove

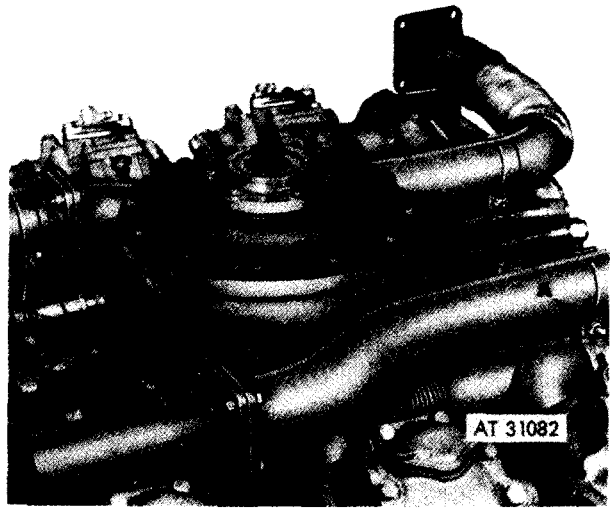
1. Move 12 dust caps (A) away from tube connections at fuel injection pump.
2. Disconnect six fuel injector tubes (B) from fuel injection pump front hydraulic head. Remove tubes (C) 4R, 5R, and 6R.
3. Remove tubes (D) 1R, 2R, and 3R by pulling tubes, singularly, between exhaust manifold and cylinder.
4. Disconnect six fuel injector tubes (E) 1L through 6L from fuel injection pump rear hydraulic head. Individually remove tubes.

Note. After fuel tubes have been removed, plug all fuel injection pump hydraulic head fuel ports to prevent entrance of dirt.

Install

1. Individually position six fuel injector tubes (E) from cylinder NOS. 1L through 6L to fuel injection pump rear hydraulic head. Connect tubes to rear hydraulic head.
2. Individually position three fuel injector tubes (D), between exhaust manifold and cylinder, from cylinder Nos. 1R, 2R, and 3R to fuel injection pump front hydraulic head.
3. Individually position three fuel injector tube cylinders (C) from cylinder Nos. 4R, 5R, and 6R to front hydraulic head. Connect six tubes (B) to hydraulic head.
4. Install 12 dust caps (A) to tube connections at hydraulic heads.

Figure 5-67. Removing or installing fuel injector tubes at fuel injection pump.



Remove

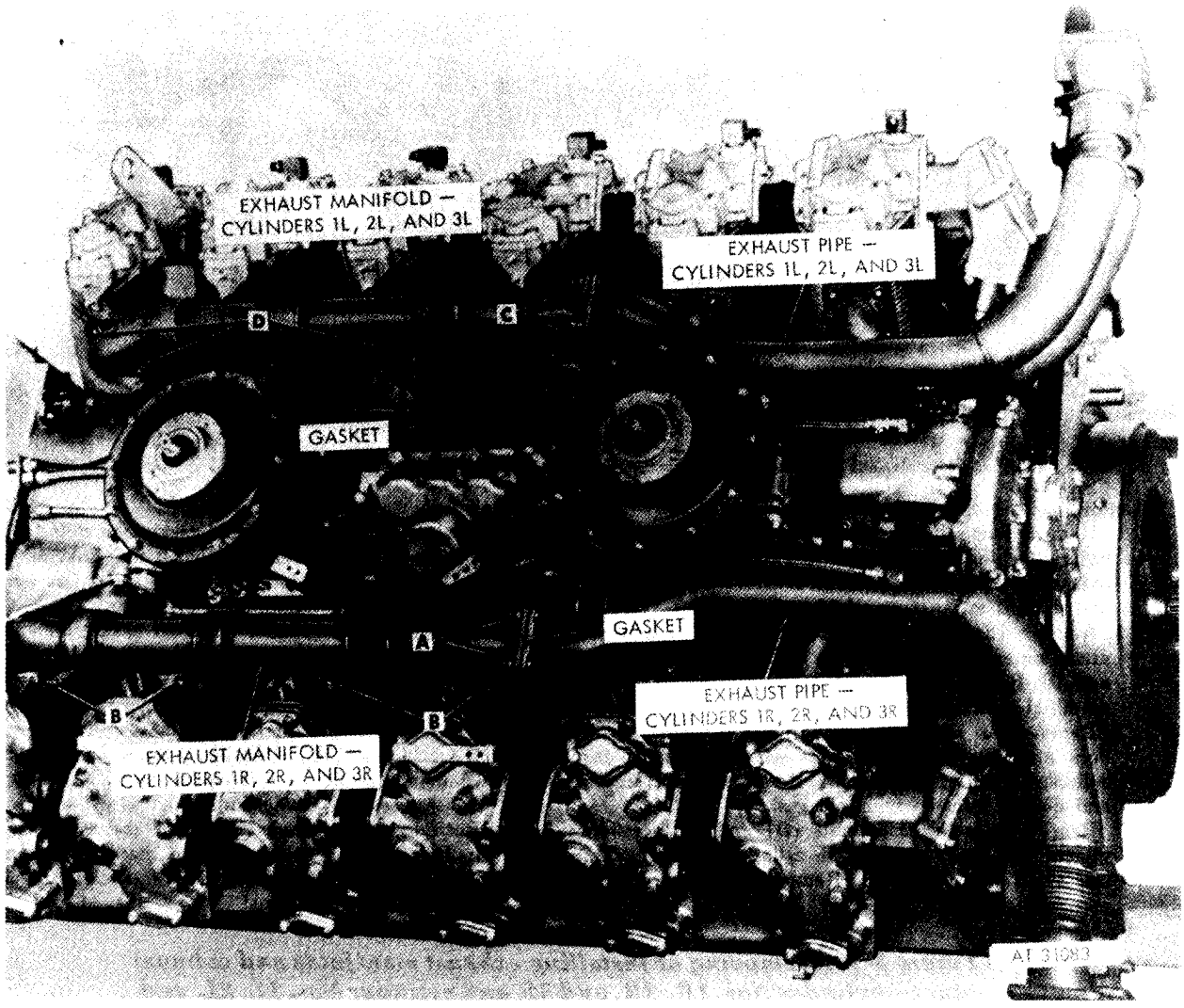
1. Remove two setf-locking nuts (A), flat washers, and bolts attaching right and left bank exhaust pipe retaining straps at rear of engine and remove straps.
2. Remove two self-locking nuts (B), flat washers, and bolts attaching right and left bank exhaust manifold retaining straps at center of engine and remove straps.

Install

Note. Some engines had only two sets of retaining straps securing right and left bank exhaust pipes. When rebuilding engine, install the additional pair of clamps (step 1) securing the right and left bank exhaust pipes.

1. Position retaining straps on right and left bank exhaust manifold at center of engine and insta11 two self-locking nuts (B), flat washers, and bolts securing straps.
2. Position retaining straps on right and left bank exhaust pipes at rear of engine and install two self-locking nuts (A), flat wasbers, and bolts securing straps.

Figure 5-68. Removing or installing exhaust manifold and exhaustpipe retaining straps.



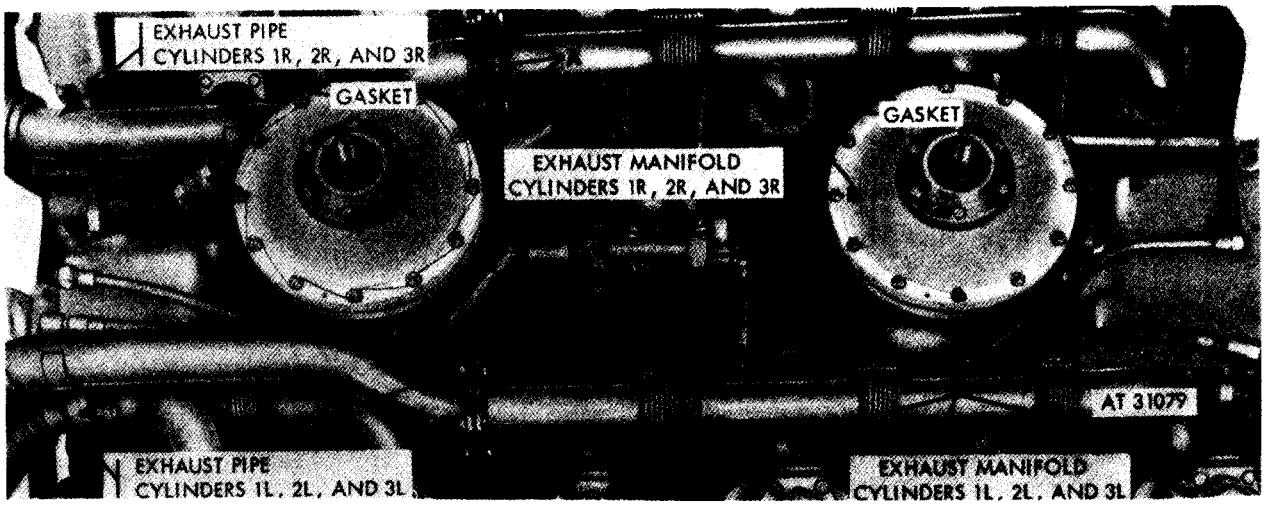
Remove

1. Remove four self-locking nuts (A), flat washers, and bolts attaching exhaust pipe to exhaust manifold for cylinder Nos. lR, 2R, and 3R. Remove pipe. Remove and discard exhaust manifold gasket.
2. Remove 12 self-locking nuts (B) and flat washers attaching exhaust manifold to cylinder Nos. lR, 2R, and 3R. Remove manifold. Remove and discard three manifold gaskets.
3. Remove four self-locking nuts (C), flat washers, and bolts attaching exhaust pipe to exhaust manifold for cylinder Nos. 1L, 2L, and 3L. Remove pipe. Remove and discard exhaust manifold gasket.
4. Remove 12 self-locking nuts (D) and flat washers attaching exhaust manifold to cylinder Nos. 1L, 2L, and 3L. Remove manifold. Remove and discard three manifold gaskets.

Install

1. Position three new manifold gaskets on cylinder Nos. 1L, 2L, and 3L. Position exhaust manifold on cylinders. Install 12 self-locking nuts (D) and flat washers securing exhaust manifold to cylinders.
2. Position a new exhaust manifold gasket on exhaust manifold . Position exhaust pipe on manifold and install four self-locking nuts (C), flat washers, and bolts securing pipe to manifold.
3. Position three new manifold gaskets on cylinder Nos. 1R, 2R, and 3R. Position exhaust manifold on cylinders. Install 12 self-locking nuts (B) and flat washers securing exhaust manifold to cylinders.
4. Position a new exhaust manifold gasket on exhaust manifold. Position exhaust pipe on manifold and install four self-locking nuts (A), flat washers, and bolts securing pipe to) manifold.

Figure 5-69. Removing or installing exhaust manifolds and exhaust pipes-cylinder Nos. IR, 2R, and 3R and cylinder Nos. 1L, 2L, and 3L-engines prior to rerouting of crankcase breather tube.



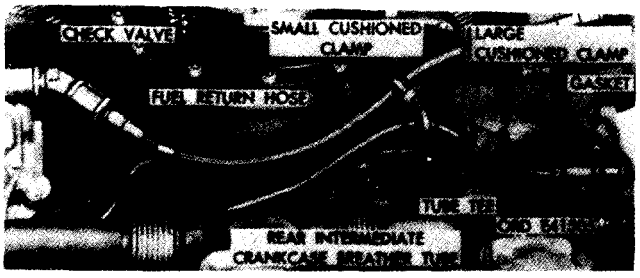
Remove

1. Remove four self-locking nuts (A), flat washers, and bolts attaching exhaust pipe to exhaust manifold for cylinder Nos. 1R, 2R, and 3R. Remove pipe. Remove and discard exhaust manifold gasket.
2. Remove 12 self-locking nuts (B) and flat washers attaching exhaust manifold to cylinder Nos. 1R, 2R, and 3R. Remove manifold. Remove and discard three manifold gaskets.
3. Remove four self-locking nuts (C), flat washers, and bolts attaching exhaust pipe to exhaust manifold for cylinder Nos. 1L, 2L, and 3L. Remove pipe. Remove and discard exhaust manifold gasket.
4. Remove 12 self-locking nuts (D) and flat washers attaching exhaust manifold to cylinder Nos. 1L, 2L, and 3L. Remove manifold. Remove and discard three manifold gaskets.

Install

1. Position three new manifold gaskets on cylinder Nos. 1L, 2L, and 3L. Position exhaust manifold on cylinders. Install 12 self-locking nuts (D) and flat washers securing exhaust manifold to cylinders.
2. Position a new exhaust manifold gasket on exhaust manifold. Position exhaust pipe to manifold and install four self-locking nuts (C), flat washera, and bolts securing pipe to manifold.
3. Position three new manifold gasketa on cylinder Nos. 1R, 2R, and 3R. Position exhaust manifold on cylinders. Install 12 self-locking nuts (B) and flat washers securing exhaust manifold to cylinders.
4. Position a new exhaust manifold gasket on exhaust manifold. Position exhaust pipe on manifold and install four self-locking nuts (A), flat washers, and bolts securing pipe to manifold.

Figure 5-70. Removing or installing exhaust manifolds and exhaust pipes-cylinder Nos. 1R, 2R, and 3R and cylinder Nos. 1L, 2L, and 3L-engines with rerouted crankcase breather tube.



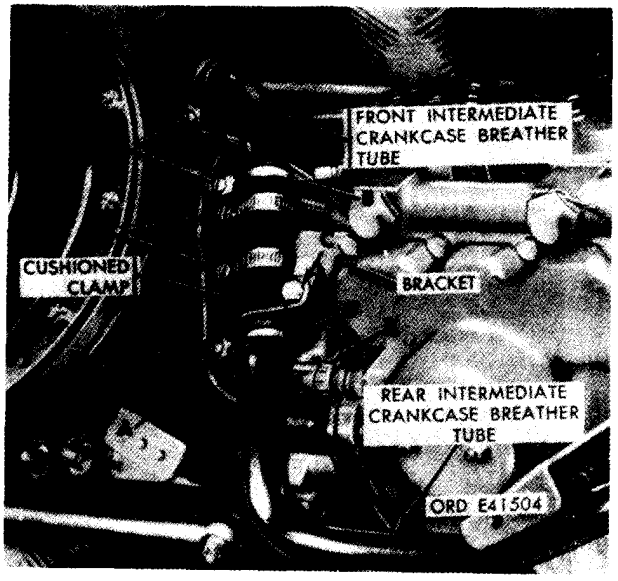
Remove

1. Remove self-locking nut and machine screw (A) attaching large and small cushioned clamps from intermediate crankcase breather tube and fuel return hose.
2. Disconnect fuel return hose (B) at check valve and remove hose.
3. Loosen breather tube hose clamps (C).
4. Remove two bolts and lock washers (D) attaching crankcase breather tube tee to rear fan drive and accessory drive housing. Remove tube tee and hose from intermediate crankcase breather tube. Remove and discard tube tee gasket.
5. Remove fuel check valve (E).

Install

1. Install fuel check valve (E).
2. Install a new hose on tube tee. Connect tube tee to intermediate crankcase breather tube. Position new gasket and install breather tube tee to rear fan and accessory drive housing and secure with two bolts and lock washers (D).
3. Tighten breather tube hose clamps (C).
4. Position fuel return hose (B) and connect to check valve.
5. Position large and small cushioned clamp and install a machine screw and self-locking nut (A) securing large and small cushioned clamps at intermediate crankcas, breather tube and fuel return hose.

Figure 5-71. Removing or installing fuel return hose and crankcase breather tube t e e -engines prior to rerouting of fuel return hose.



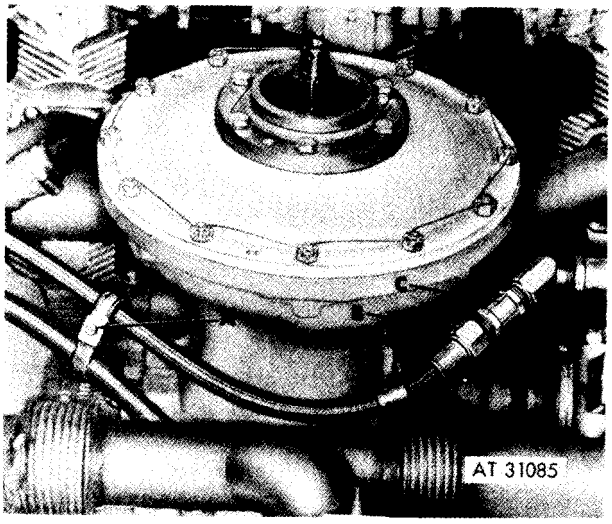
Disconnect

1. Remove three self-locking nuts and machine screws (A) attaching three small cushioned clamps on electrical lead to three large cushioned clamps on intermediate crankcase breather tube.
2. Remove three large cushioned clamps (B) from front and rear intermediate crankcase breather tubes and front intermediate crankcase breather tube.
3. Remove self-locking nut and bolt (C) securing breather tube clamp to bracket.
4. Loosen two hose clamps (D) and remove rear intermediate crankcase breather tube. Remove cushioned clamp and hose from tube.
5. Disconnect fuel injection pump electrical lead (E) from injection pump.

Connect

1. Connect fuel injection pump electrical lead (E) to fuel injection pump.
2. Install cushioned clamp and hose on rear intermediate crankcase breather tube and position tube. Tighten two hose clamps (D).
3. Install bolt and self-locking nut (C) securing breather tube clamp to bracket.
4. Install one large cushioned clamp (B) on rear intermediate breather tube and two large cushioned clamps (B) on front intermediate breather tube.
5. Install three machine screws and self-locking nuts (A) securing three small cushioned clamps on the electrical lead to the three large cushioned clamps on the crankcase front and rear intermediate breather tubes.

Figure 5-72. Disconnecting or connecting intermediate crankcase breather tubes at fuel injection pump clamp.



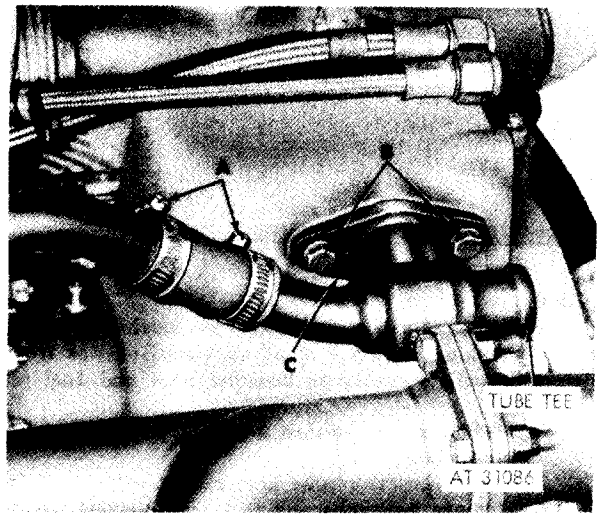
Remove

1. Remove pan head screw (A) and self-locking nut attaching two cushioned clamps to fuel return hose and turbosupercharger oil inlet hose.
2. Disconnect fuel return hose (B) from fuel return check valve (C) and remove hose.
3. Remove fuel return check valve (C) from fuel injection pump.

Install

1. Install fuel return check valve (C) in fuel injection pump.
2. Install fuel return hose (B) and connect to fuel return check valve (C).
3. Position one cushioned clamp on fuel return hose and one cushioned clamp on turbosupercharger oil inlet hose at position shown. Install pan head screw (A) and self-locking nut securing clamps.

Figure 5-73. Removing or installing fuel return hose-engines with rerouted fuel return hose.



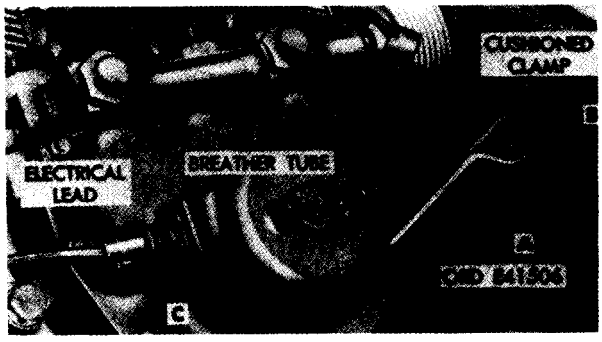
Remove

1. Loosen two breather tube hose clamps (A).
2. Remove two bolts (B) and lock washers attaching crankcase breather tube tee to rear fan drive housing.
3. Remove tube tee. Remote and discard tube tee gasket (C).

Install

1. Position a new tube tee gasket (C) on rear fan drive housing. Position crankcase breather tube tee on housing.
2. Install two bolts (B) and lock washers securing tube tee to drive housing.
3. Tighten two breather tube hose clamps (A).

Figure 5-74. Removing or installing crankcase breather tube tee-engines with rerouted crankcase breather tube.



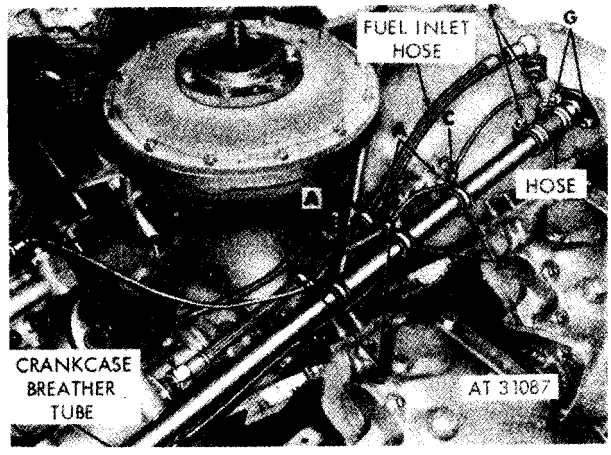
Remove

1. Remove self-locking nut (A) and flat washer attaching breather tube cushioned clamp (B) to rear fan drive housing.
2. Remove cushioned clamp (B) from breather tube.
3. Disconnect fuel injection pump electrical lead (C) from injection pump.

Install

1. Connect fuel injection pump electrical lead (C) to injection pump.
2. Install breather tube cushioned clamp (B) on breather tube.
3. Install self-locking nut (A) and flat washer securing cushioned clamp (B) to rear fan drive housing.

Figure 5-75. Removing or installing breather tube cushioned clamp at rear fan drive housing-engines with rerouted crankcase breather tube.



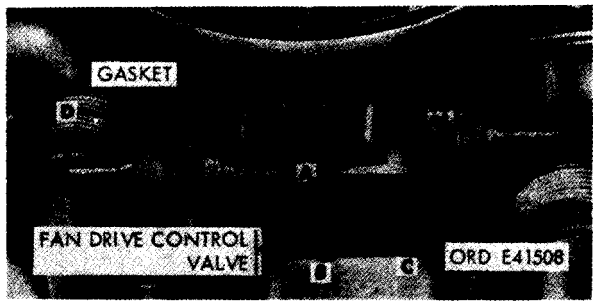
Remove

1. Remove three pan head screws (A) and self-locking nuts.
2. Remove fuel injection pump electrical lead (B).
3. Remove three small cushioned clamps (C) from electrical lead.
4. Remove three large cushioned clamps (D) from crankcase breather tube.
5. Remove remaining two cushioned clamps (E) from fuel inlet hose.
6. Loosen two hose clamps (F) and remove breather tube, clamps, and hose.
7. Remove two self-locking nuts (G) attaching breather tube to crankshaft damper and oil filter housing. Remove breather tube. Remove and discard breather tube gasket.
8. Disconnect and remove fuel inlet hose (H).

Install

1. Install and connect fuel inlet hose (H) 10 fuel injection. pump.
2. Position a new breather tube gasket on crankshaft damper and oil filter housing. Position breather tube on housing and install two self-locking nuts (G) securing tube to housing.
3. Install breather tube with clamps and hose. Tigh ten hose clamps (F) securing breather tubes.
4. Position two cushioned clamps (E) on fuel inlet hose at position shown.
5. Position three large cushioned clamps (D) on breather tube at position shown.
6. Position three small cushioned clamps (C) on fuel injection pump electrical lead (B).
7. Install electrical lead (B) and move three clamps to position shown.
8. Install three pan head screws(A) and self-locking nuts securing clamps.

Figure 5-76. Removing or installing fuel inlet hose and crankcase breather tube.



Remove

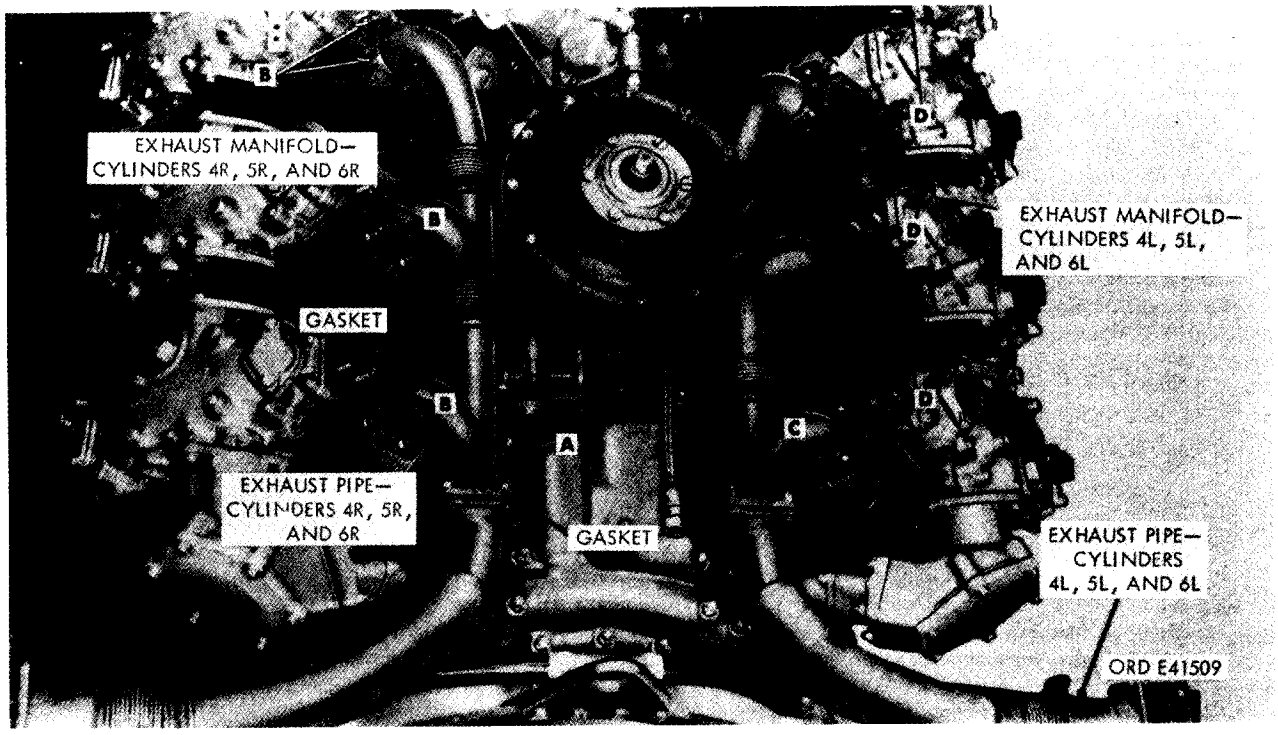
1. Cut locking wire and remove three cap screws (A) and flat washers attaching fan drive control valve (C) to rear fan drive housing. Discard cap screws.
2. Loosen cap screw (B) until screw is free of threads.
3. Remove and discard control valve (C) and cap screw (B).
4. Remove brass gasket (D). Remove and discard mounting gasket.

Install

Note. A limited number of engines were equipped with a fan control valve. The need for a valve has since been eliminated and. on those engines so equipped, a cover plate is used to cover the valve oil passages and will be installed during engine overhaul. The fan tower has been redesigned to eliminate the valve mounting surface and the need for the cover plate.

1. Install new mounting gasket, brass gasket (D), and cover. Secure cover with four cap screws, flat washers, and locking wire.

Figure 5-77. Removing fan drive control valve-engines with fan control valve.



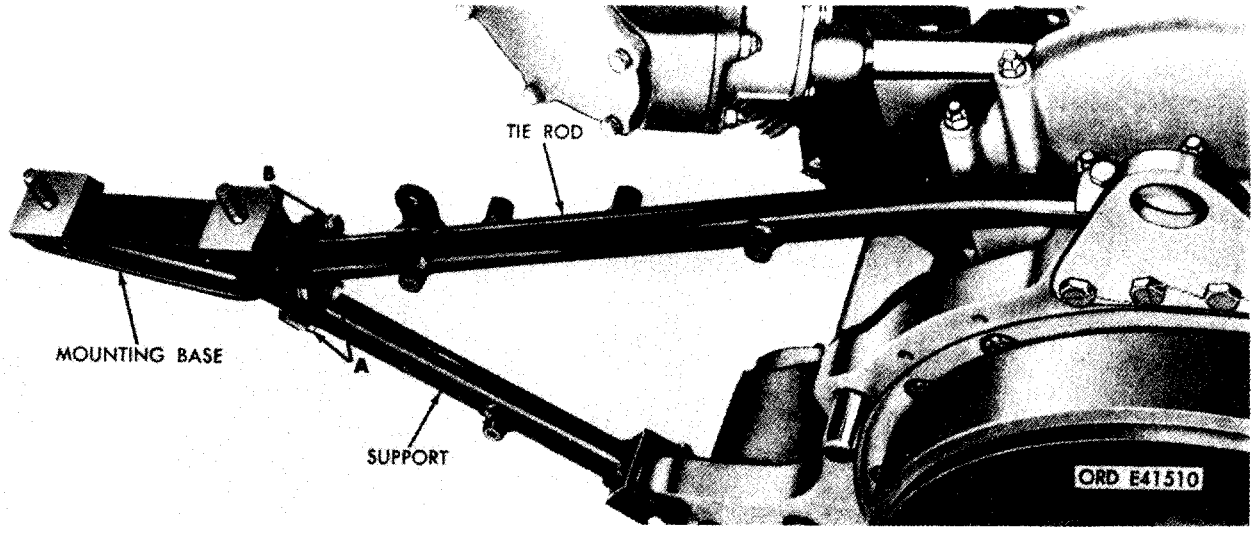
Remove

1. Remove four self-locking nuts (A), flat washers, and cap screws attaching exhaust pipe tu exhaust manifold for cylinder Nos. 4R, 5R, and 6R. Remove pipe. Remove and discard exhaust manifold gasket.
2. Remove 12 self-locking nuts (B) and flat washers attaching exhaust manifold to cylinder Nos. 4R, 5R, and 6R. Remove manifold. Remove and discard three manifold gaskets.
3. Remove four self-locking nuts (C), flat washers, and cap screws attaching exhaust pipe to exhaust manifold for cylinder Nos. 4L, 5L, and 6L. Remove pipe. Remove and discard exhaust manifold gasket.
4. Remove 12 self-locking nuts (D) and flat washers attaching exhaust manifold to cylinder Nos. 4L, 5L, and 6L. Remove manifold. Remove and discard three manifold gaskets.

Install

1. Position three new manifold gaskets on cylinder Nos. 4L, 5 L, and 6 L. Position exhaust manifold on cylinders. Install 12 self-locking nuts (D) and flat washers securing exhaust manifold to cylinders.
2. Position a new exhaust manifold gasket on exhaust manifold. Position exhaust pipe to manifold and install four self-locking nuts (C), flat washers, and bolts securing pipe to manifold.
3. Position three new manifold gaskets on cylinder Nos. 4R, 5R, and 6R. Position exhaust manifold on cylinders. Install 12 self-locking nuts (B) and flat washers securing exhaust manifold to cylinders.
4. Position a new exhaust manifold gasket on exhaust manifold. Position exhaust pipe on manifold and install four self-locking nuts (A), flat washers, and bolts securing pipe to manifold.

Figure 5-78. Removing or installing exhaust manifolds and exhaust pipes-cylinder Nos. 4R, 5R, and 6R and cylinder Nos. 4L, 5L, and 6L.



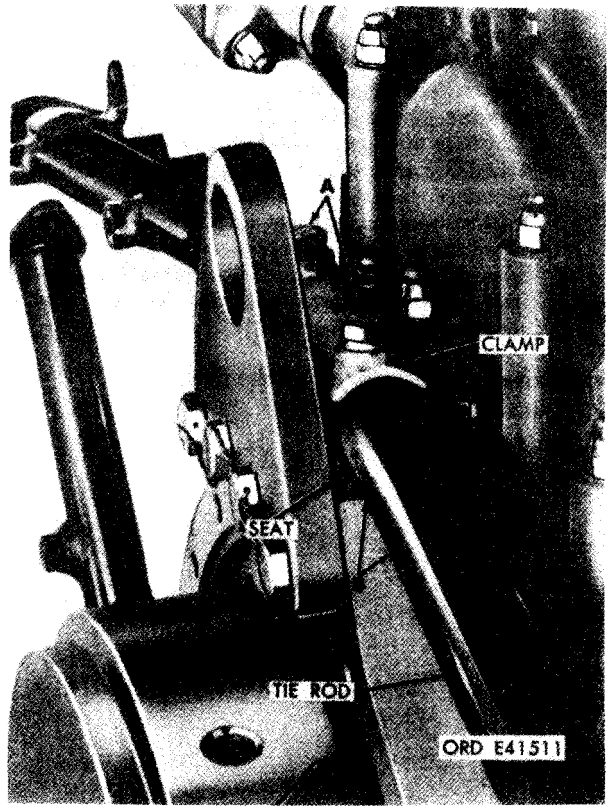
Remove

1. Remove two cap screws (A) and lock washers attaching right turbosupercharger mounting base to support.
2. Remove two cap screws (B) and lock washers attaching mounting base to tie rod. Remove base.

Install

1. Position right turborsupercharger mounting base on tie rod, Install two cap screws (B) securing base to tie rod.
2. Install two cap screws (A) and lock washers securing base to support.

Figure 5-79. Removing or installing right turbosupercharger mounting base.



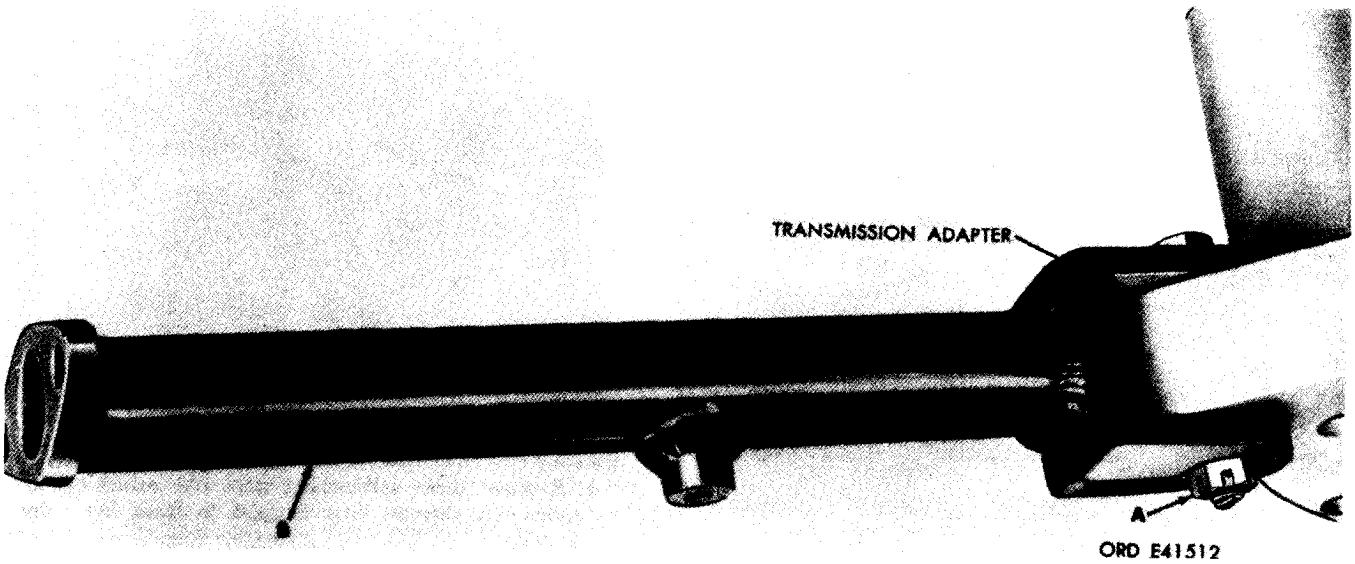
Remove

1. Remove two cap screws (A), lock washers, and one tie rod clamp attaching turbsupercharger tie rod (B).
2. Remove tie rod and tie rod clamp seat.

Install

1. Position tie rod clamp seat and turbosupercharger tie rod (B) on transmission adapter.
2. Position tie rod clamp on tie rod and install two cap screws (A) and lock washers securing tie rod.

Figure 5-80. Removing or installing right and left turbosupercharger mounting base tie rod.



Remove

1. Remove cotter pin, slotted nut (A), and bolt attaching turbosupercharger mounting base support (B) to transmission adapter.
2. Remove support.

Note. Left turbosupercharger mounting base support is removed or installed in the same manner.

Install

1. Position turbosupercharger mounting base support (B) on transmission adapter.
2. Install bolt, slotted nut (A) and cotter pin securing support.

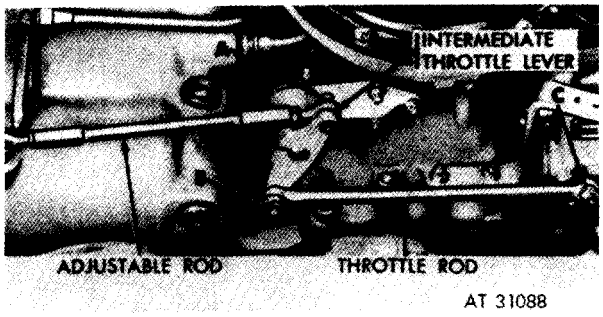
Figure 5-81. Removing or installing right turbo supercharger mounting base support.

5-9. Throttle Control Rods and Lever, Fuel Injection Pump Oil Inlet Hose, Turbosupercharger Oil Inlet Hose and Fire Extinguisher Tube, and Fuel Injection Pump

Refer to Table 5-6 for illustrations and disassembly instructions. Figure references are listed in the table.

Table 5-6. Throttle Control Rods and Lever, Fuel Injection Pump Oil Inlet Hose, Turbosupercharger Oil Inlet Hose and Fire Extinguisher Tube, and Fuel Injection Pump

Component	Figure Reference
Throttle Control Rods and Intermediate Throttle Lever	5-82 through 5-84
Fuel Injection Pump Oil Inlet Hose	5-85 Through 5-87
Turbosupercharger Oil Inlet Hose and Fire Extinguisher Tube	5-88 through 5-90
Fuel Injection Pump	5-91 through 5-96



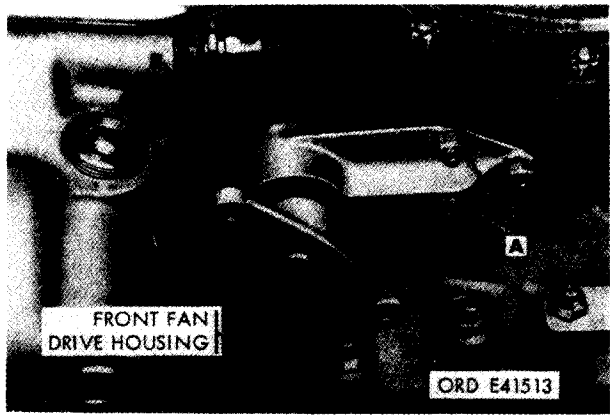
Disconnect

1. Remove cotter pin, slotted nut (A), and bolt attaching throttle adjustable rod. Remove adjustable rod.
2. Remove cotter pin, slotted nut (B), and bolt attaching throttle rod to intermediate throttle lever.
3. Remove cotter pin, slotted nut (C), flat washer, and bolt attaching throttle rod to injection pump lever. Remove red.

Connect

1. Position throttle rod on injection pump lever. Install bolt, flat washer, slotted nut (C), and cotter pin securing rod.
2. Install bolt, slotted nut (B), and cotter pin securing throttle rod to intermediate throttle lever.
3. Position throttle adjustable rod on intermediate throttle lever. Install bolt, slotted nut (A), and cotter pin securing rod.

Figure 5-82. Disconnecting or connecting throttle rods at intermediate throttle lever.



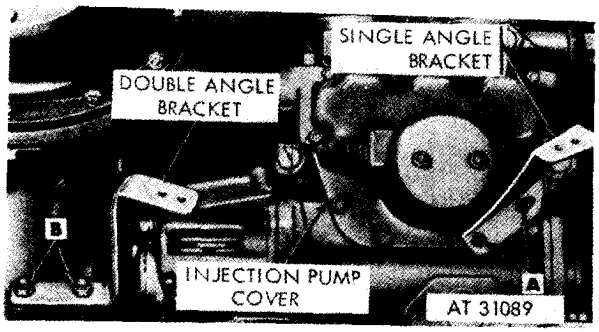
Remove

1. Remove three self-locking nuts (A) attaching intermediate throttle lever support to front fan drive housing.
2. Remove lever support (B), shaft, and throttle lever as a unit.

Install

1. Position lever support (B), shaft, and throttle lever as a unit on front fan drive housing.
2. Install three self-locking nuts (A) securing lever support to drive housing.

Figure 5-83. Removing or installing intermediate throttle lever support.



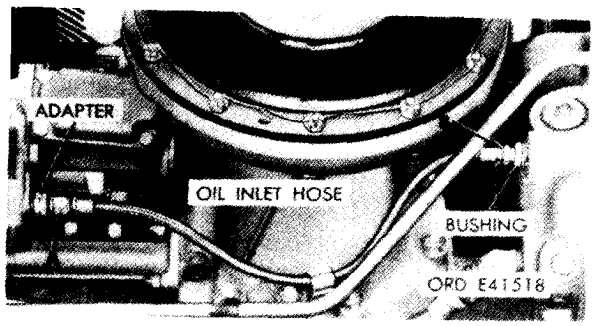
Remove

1. Remove two cap screws (A) attaching single angle bracket to fuel injection pump. Remove bracket.
2. Remove two self-locking nuts (B) attaching double angle bracket to front fan drive housing. Remove bracket.

Install

1. Position double angle bracket on front fan drive housing. Install two self-locking nuts (B) securing bracket to housing.
2. Position single angle bracket on fuel injection pump. Install two cap screws (A) securing bracket to pump.

Figure 5-84. Removing or installing fuel injector tube angle brackets.



Disconnect

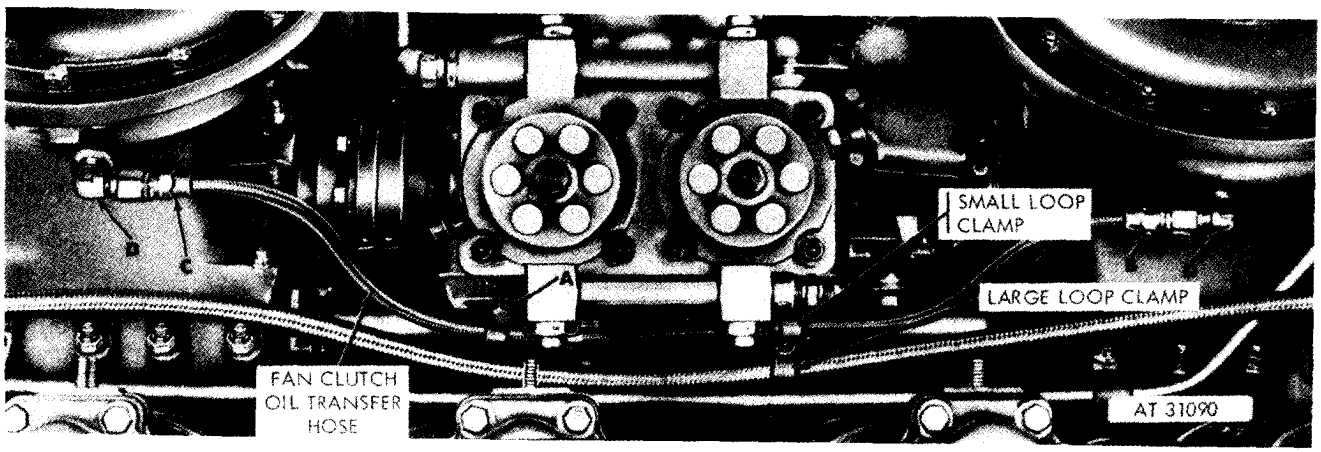
1. Disconnect fuel injection pump oil inlet hose adapter (A) in fuel injection pump adapter.
2. Disconnect inlet hose from pipe hushing (B) at crankshaft damper and oil filter housing. Remove inlet hose.

Connect

Note. The fuel injection pump oil inlet hose has a swivel nut at only one end. This swivel end must be connected to the adapter (A).

1. Connect inlet hose to pipe bushing (B) at crankshaft damper and oi[filter housing.
2. Position inlet hose in engine with swivel nut end at adapter (A) and connect hose to adapter.

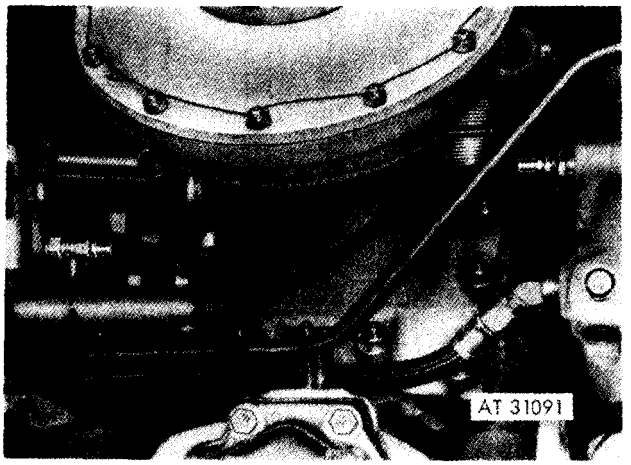
Figure 5-85. Disconnecting or connecting fuel injection pump oil inlet hose-engines prior to rerouting of hose and clamps.



1. Remove assembled washer bolt (A) attaching small loop clamp to mounting base. Remove and discard clamp.
2. Disconnect fan clutch oil transfer hose at elbow (B) in front fan drive housing.
3. Disconnect oil transfer hose at elbow (C) in rear fan drive housing and remove and discard hose.
4. Remove and discard elbows (D).

Note. Pipe plugs will be installed in these openings during rebuild of the fan drive housings.

Figure 5-86. Disconnecting fan clutch oil transfer hose-engines with transfer hose.



Disconnect

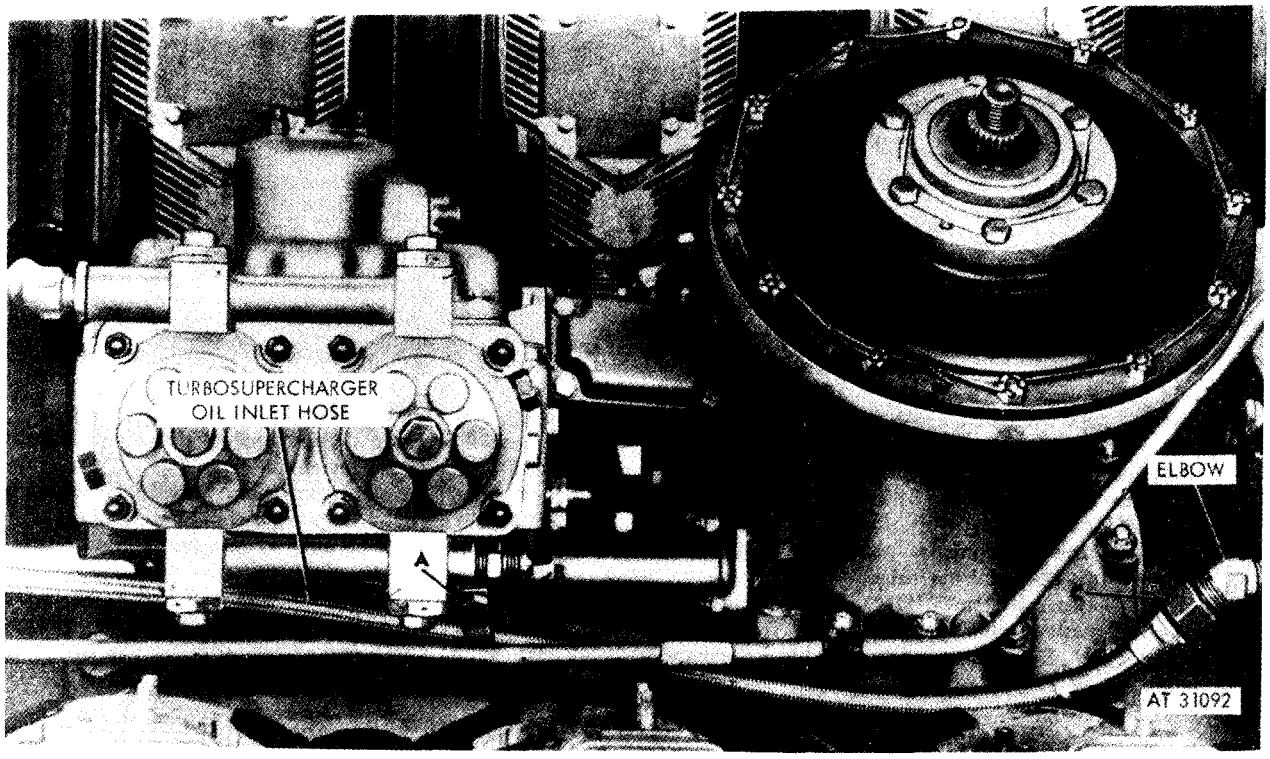
1. Disconnect fuel injection pump oil inlet hose at fuel injection pump adapter (A).
2. Disconnect inlet hose from pipe bushing (B) at crankshaft damper and oil filter housing. Remove inlet hose.

Connect

Note. The fuel injection pump oil inlet hose has a swivel nut at only one end. This swivel end must be connected to the fuel injection pump adapter (A).

1. Connect inlet hose to pipe bushing (B) at crankshaft damper and oil filter housing.
2. Position inlet hose in engine with swivel nut end at adapter (A) and connect hose to adapter.

Figure 5-87. Disconnecting or connecting fuel injection pump oil inlet hose-engines with relocated hose clamps.



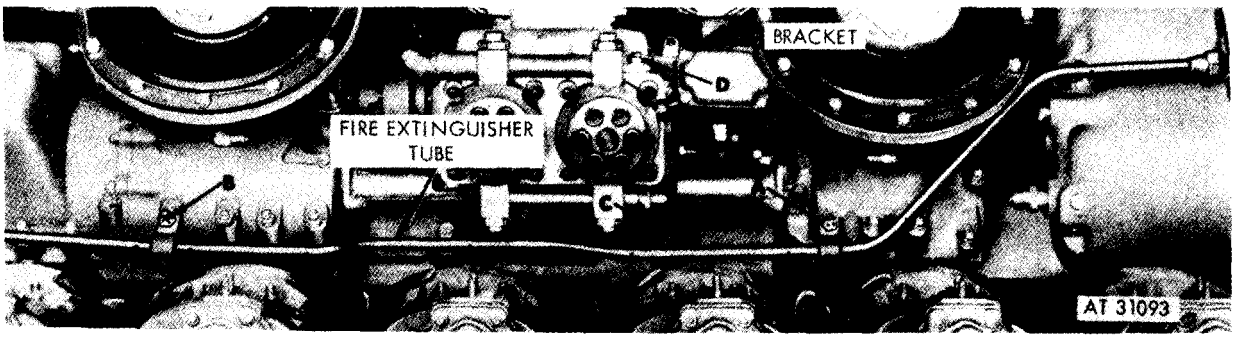
Disconnect

1. **Remove bolt (A) and lock washer attaching turbosupercharger oil inlet hose clamp (B) to fuel injection pump base.**
2. **Disconnect turbosupercharger oil inlet hose (C) from elbow in crankshaft damper and oil filter housing. Remove clamp (B) from hose.**

Connect

1. **Position turbosupercharger oil inlet hose clamp (B) on turbosupercharger oil inlet hose. Connect inlet hose (C) to elbow.**
2. **Install bolt (A) and lock washer securing clamp (B) to fuel injection pump base.**

Figure 5-88. Disconnecting or connecting turbosupercharger oil inlet hose-engines prior to rerouting of hoses and clamps.



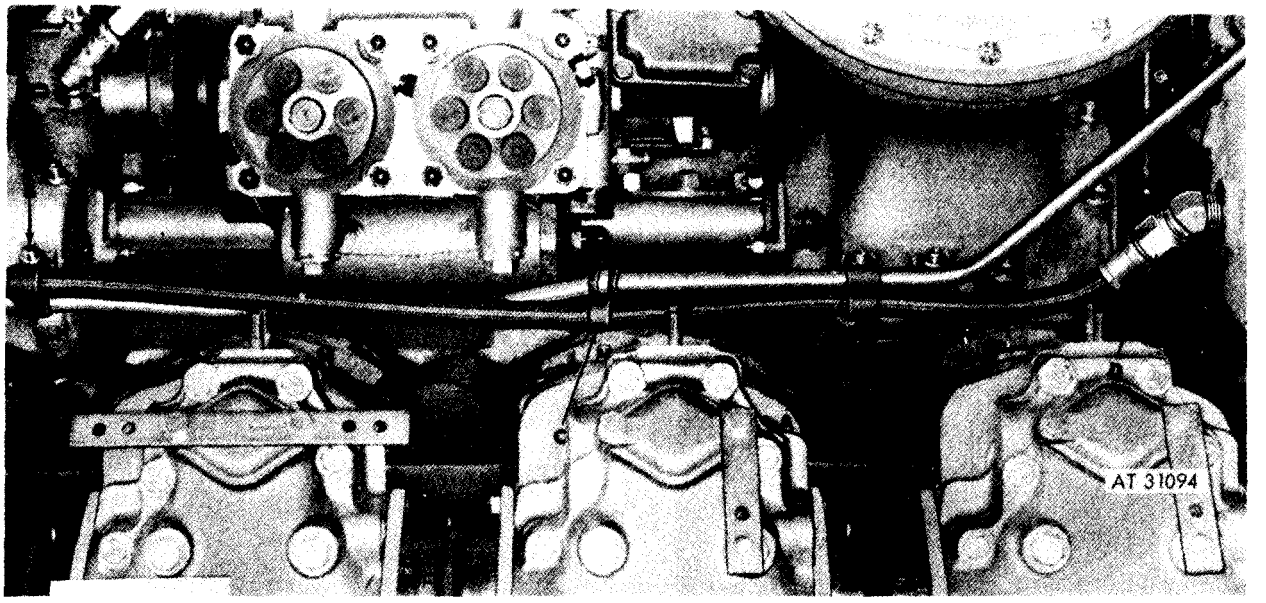
Remove

1. Remove self-locking nut (A) attaching loop clamp to front fan drive housing.
2. Remove self-locking nut (B) attaching loop clamp to rear fan drive housing,
3. Remove fire extinguisher tube (C) and clamps, Remove two clamps from tube.
4. Remove two cap screws (D) and lock washers and remove breather tube support bracket from fuel injection pump. Reinstall cap screws and lock washers in pump.

Install

1. Install two loop clamps on fire extinguisher tube (C) and position tube in engine.
2. Position clamps as shown and install self-locking nut (B) securing one clamp to rear fan drive housing.
3. Install self-locking nut (A) Becuring second clamp to front fan drive housing.
4. Remove two cap screws (D) and lock washers from fuel injection pump. Install breather tube support bracket on pump and secure with two cap screws and lock washers.

Figure 5-89. Removing or installing fire extinguisher tube-engines prior to new tube and clamps.



Remove

1. Remove self-locking nut (A) attaching two cushioned loop clamps securing oil inlet hose and fire extinguisher tube to front fan drive housing.
2. Remove self-locking nut (B) attaching two cushioned loop clamps securing oil inlet hose and fire extinguisher tube to rear fan drive housing.
3. Remove self-locking nut and machine screw (C) attaching turbosupercharger oil inlet hose and fire extinguisher tube clamps. Remove clamps.
4. Disconnect and remove turbosupercharger oil inlet hose (D) from elbow in crankshaft damper and oil filter housing.
5. Remove fire extinguisher tube (E) and clamps. Remove two clamps from tube.

Install

1. Install two cushioned loop clamps on fire extinguisher tube (E) and position tube in engine.
2. Position turbosupercharger oil inlet hose (D) in engine and connect to elbow in crankshaft damper and oil filter housing.
3. Position turbosupercharger oil inlet hose and fire extinguisher tube clamps as shown. Install self-locking nut and machine screw (C) securing clamps.
4. Position two cushioned loop clamps on fire extinguisher tube as shown and aline with clamp on oil inlet hose. Install self-locking nut (B) securing clamp to rear fan drive housing.
5. Install self-locking nut (A) securing clamps to front fan drive housing.

Figure 5-90. Removing or installing turbo supercharger oil inlet hose and fire extinguisher tube-engines with new tube and relocated clamps.

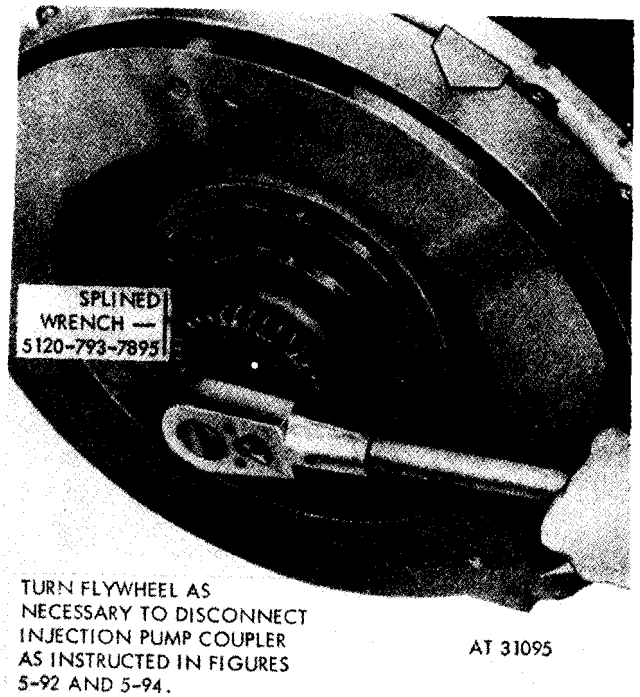
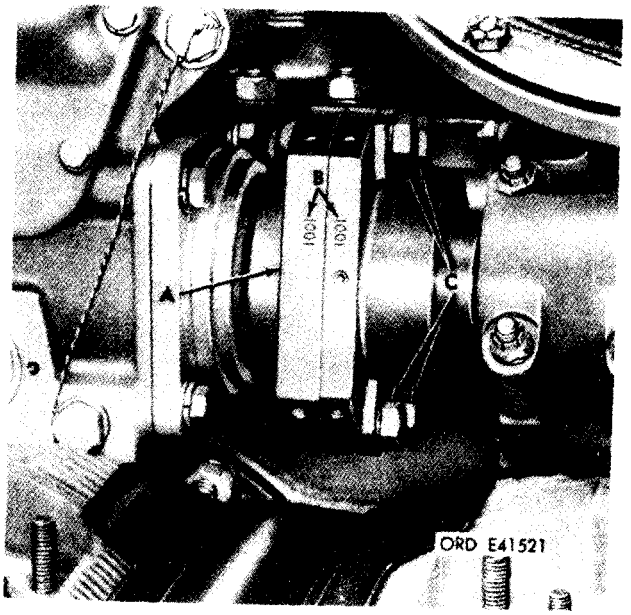


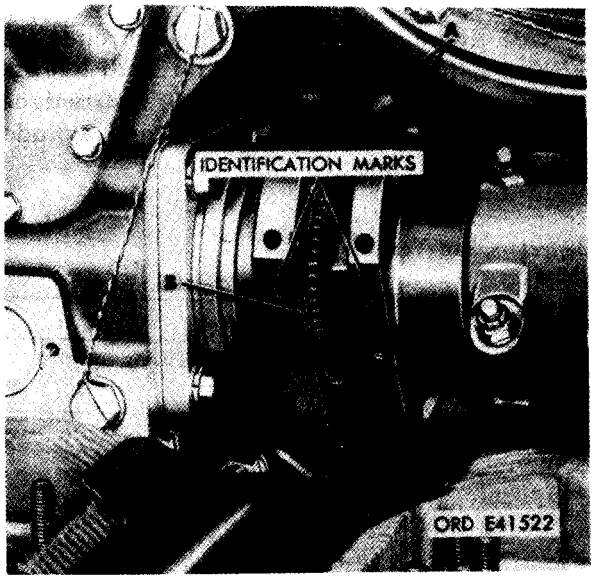
Figure 5-91. Positioning injection pump coupler by turning flywheel using splined wrench-5120-793-7895.



Note. The fuel injection pump splined coupler sleeves and hubs must be identified with identical marks to prevent mismating of parts. The sleeves and hubs are matched for each assembly and must not be interchanged between assemblies.

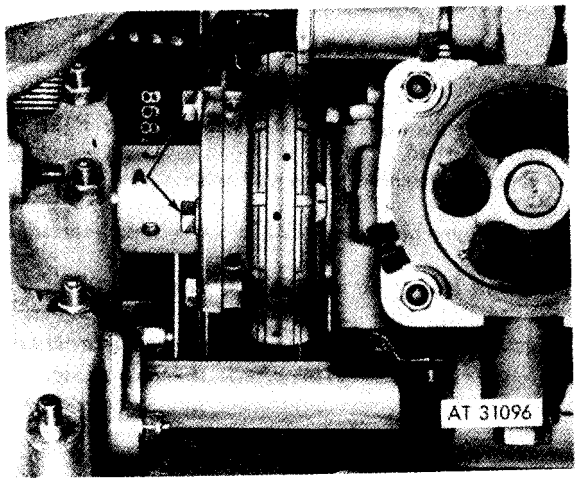
1. **Turn engine using splined wrench -5120-793-7895 as shown in figure 5-91 until fuel injection pump coupling bolts (C) are accessible.**
2. **Stamp identification marks (B) on both injection pump coupler sleeves (A).**
3. **Remove four bolts (C), lock washers, and lock plates attaching coupler sleeves.**

Figure 5-92. Removing fuel injection pump splined coupler bolts.



1. Separate coupler sleeves (A).
2. Remove and discard preformed packing (B) from coupler sleeves.

Figure 5-93. Separating fuel injection pump splined coupler sleeves.



Note. The fuel injection pump diaphragm couplers are not matched and do not require any special markings.

1. Turn engine using splined wrench -5120-793-7895 as shown in figure 5-91 until two fuel injection pump coupler bolts (A) are accessible. Remove bolts and lock washers.
2. Repeat procedure in step 1 and remove remaining two bolts and lock washers.

Figure 5-94. Removing fuel injection pump diaphragm coupler bolts.

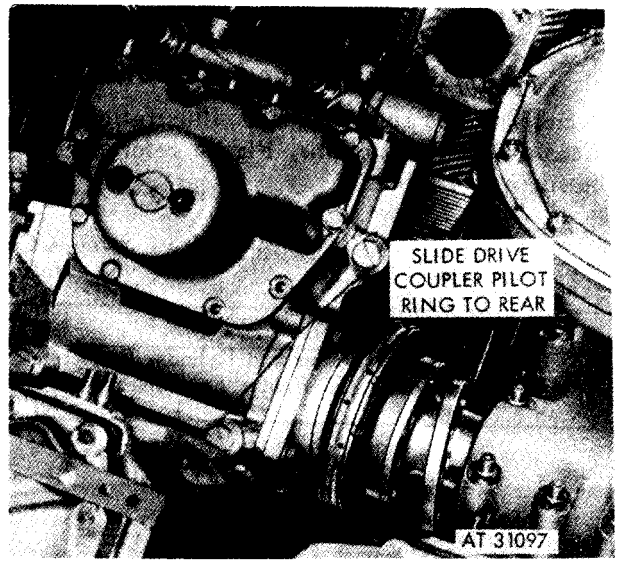
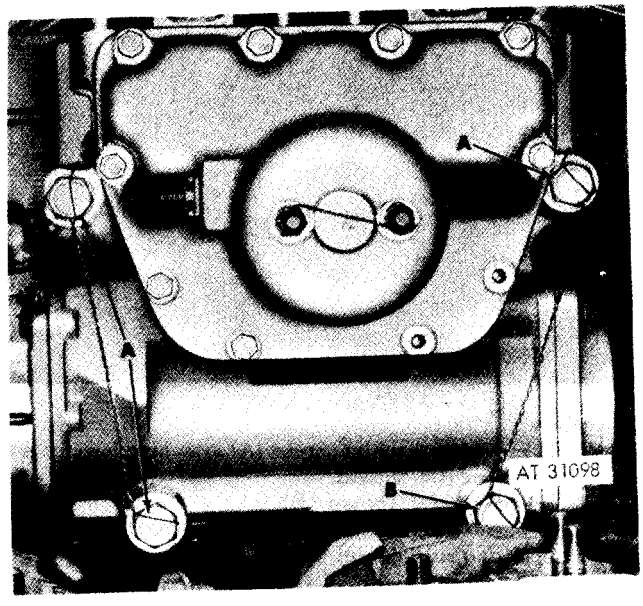


Figure 5-95. Separating fuel injection pump diaphragm coupler.



1. Cut locking wire and remove three bolts (A) and recessed washers.
2. Loosen bolt (B) until threads are free. Bolt cannot be rem oved until fuel injection pump is removed from engine. Remove pump and remove bolt (B) and recessed washer from pump.

Figure 5-96. Removing fuel injection pump.

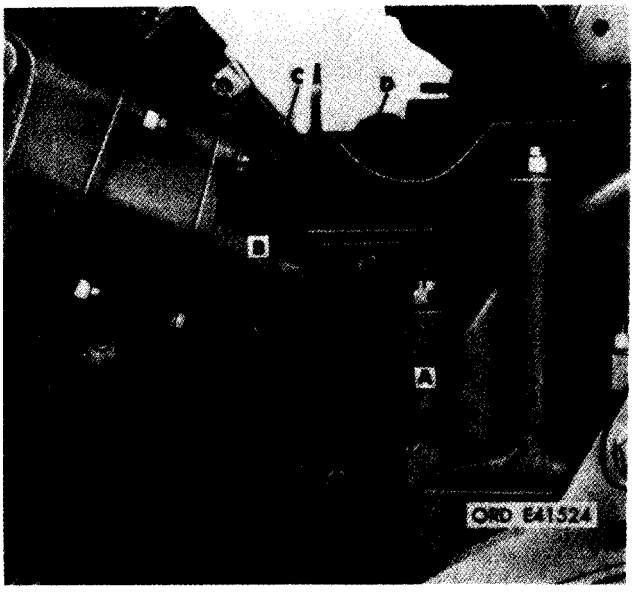
5-10. Shrouds, Cylinder Deflectors and Nozzle and Holder Assemblies

Refer to Table 5-7 for illustrations and disassembly instructions. Figure references are listed in the table.

Note. Removal or installation of shrouds and cylinder deflectors is the same for both left and right banks of the engine. For instructional purposes, the right bank shrouds and cylinder deflectors are shown.

Table 5-7. Shrouds, Cylinder Deflectors, and Nozzle Holder Assemblies

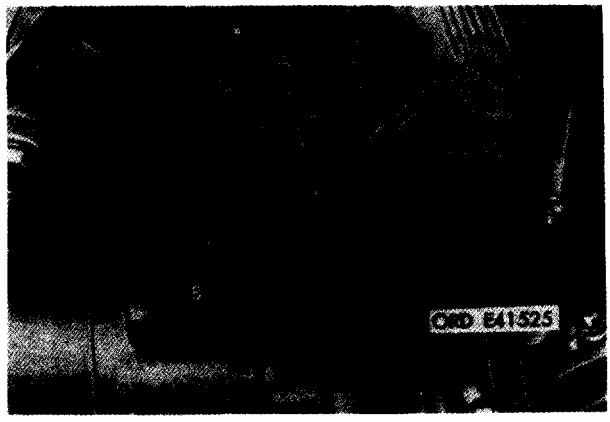
Component	Figure Reference
Shroud Plates and Cylinder Deflectors	5-97 through 5-102
Nozzle and Holder Assemblies	5-103



Remove
1. Remove two machine screws (A) attaching lower right camshaft drive shroud.
2. Remove lower shroud (B).
3. Remove machine screw (C) attaching upper right camshaft drive shroud.
4. Remove upper shroud (D).

Install
1. Position upper right camshaft drive shroud (D) on engine.
2. Install machine screw (C) securing upper shroud.
3. Position lower right camshaft drive shroud (B) on ermine.
4. Install two machine screws (A) securing lower shroud.

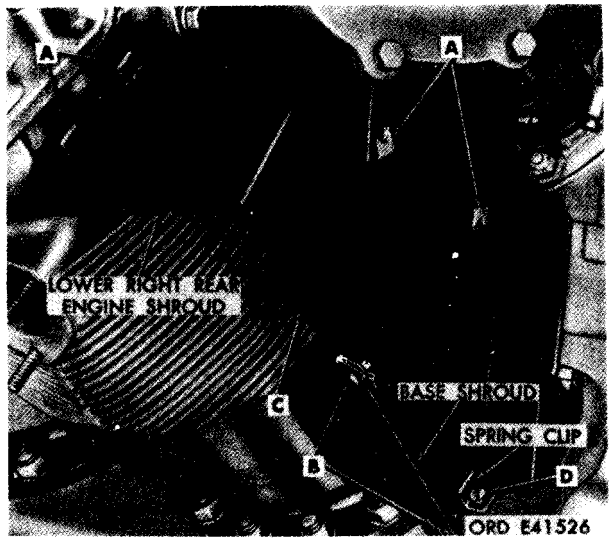
Figure 5-97. Removing or installing camshaft drive shrouds-right side.



Disconnect
1. Remove four plate nuts (A) from lower right rear engine shroud.
2. Remove machine screw (B) from shroud.

Connect
1. Install machine screw (B) in lower right rear engine shroud.
2. Install four plate nuts (A) on shroud.

Figure 5-98. Disconnecting or connecting lower right engine shroud-top view.



Remove

1. Remove four plate nuts (A) from lower right rear engine shroud.
2. Remove two machine screws (B) attaching cylinder base shroud to lower right rear engine shroud. Remove base shroud.
3. Remove lower right rear engine Shroud (C).
4. Remove machine screw (D), lock washer, and spring clip from crankcase.

install

1. Position spring clip on lower right rear of crankcase and install machine screw (D) and lock washer.
2. Position lower right rear engine shroud (C) on engine and engage clip.
3. Position cylinder base shroud on engine shroud (C). Install two machine screws (B) securing base shroud to engine shroud.
4. Install four plate nuts (A) on engine shroud.

Figure 5-99. Removing or installing lower right rear engine shroud-side view.



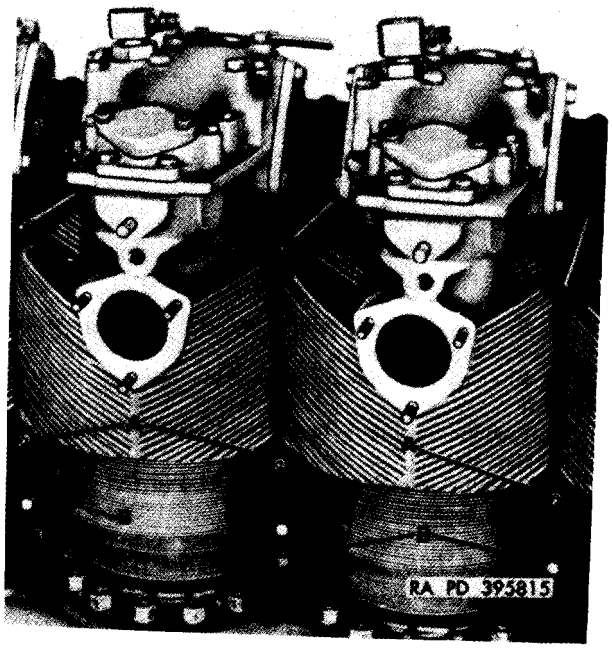
Remove

1. Remove five self-locking nuts (A) and flat washers from hooks.
2. Remove five intercylinder head deflectors (B).

Install

1. Position five intercylinder head deflectors (B) between cylinders.
2. Install five self-locking nuts (A) and flat washers on hooks securing deflectors.

Figure 5-100. Removing or installing inter-cylinder head deflectors-right side.



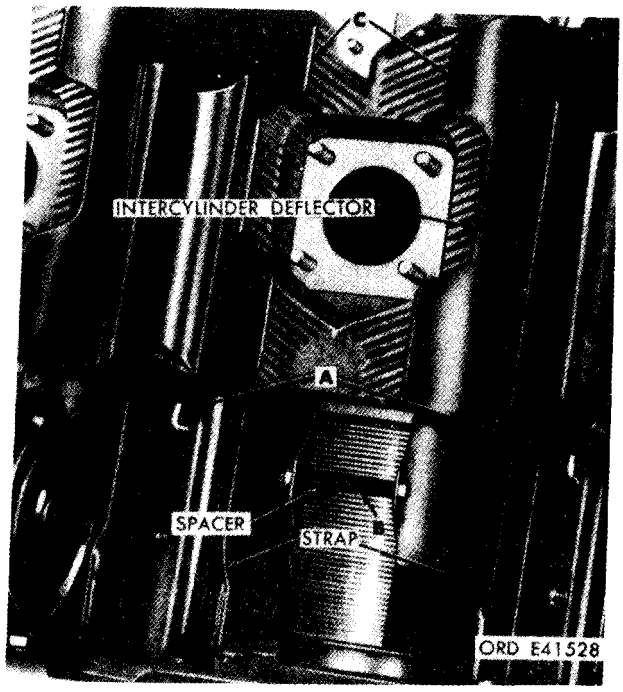
Disconnect

1. Remove five self-locking nuts (A) and flat washers from right intercylinder deflector hooks.
2. The right lower cylinder deflector straps (B) should not be removed since the remaining attaching parts will be more accessible during removal of the cylinders (para. 5-12).

Connect

1. Install five self-locking nuts (A) and flat washers on right intercylinder deflector hooks.

Figure 5-101. Disconnecting or connecting right intercylinder deflector hooks.



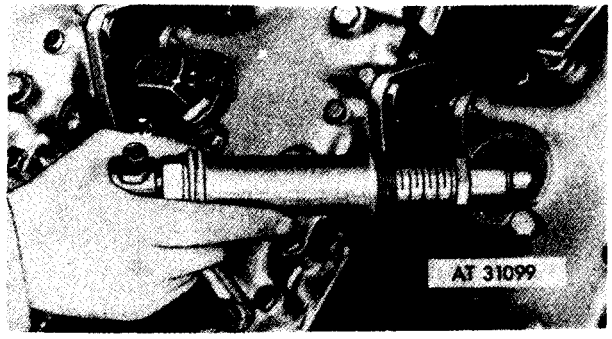
Remove

1. Remove five right intercylinder deflector hooks (A).
2. Remove five self-locking nuts, cap screws, and spacers (B).
3. Remove five right intercylinder deflectors (C).

Install

1. Position five right intercylinder deflectors (C) between cylinders.
2. Install five spacers (B), cap screws, and self-locking nuts.
3. Install five right intercylinder deflector hooks (A).

Figure 5-102. Removing or installing right intercylinder deflectors.



Note. Refer to figure 4-152, 4-153, and 4-165 for instructions covering removal and installation of the fuel injector nozzle and holder assemblies.

Figure 5-103. Removing or installing fuel injector nozzle and holder assembly.

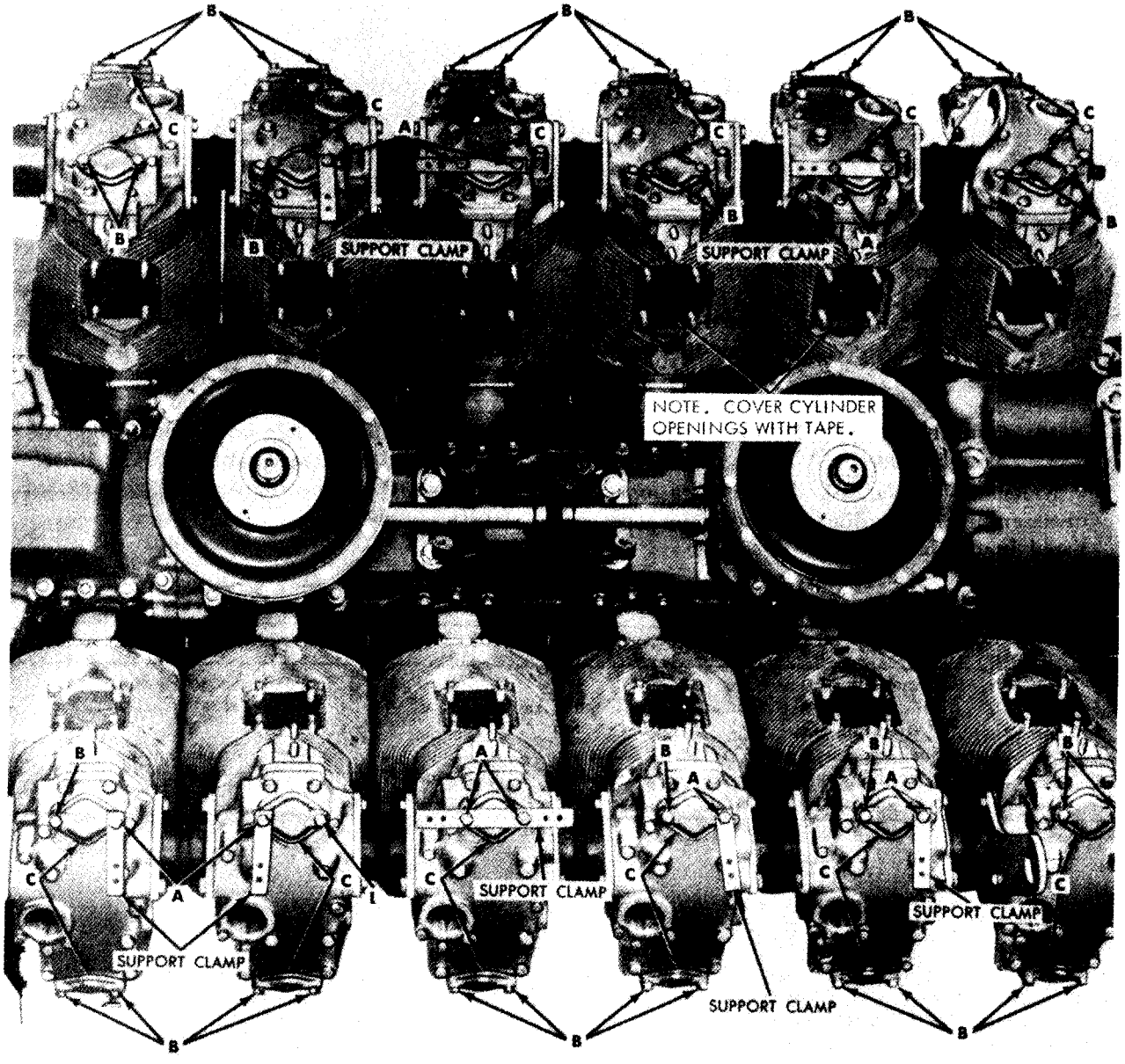
5-11. Camshaft, Fan Drives, Housings, and Bases

Refer to Table 5-8 for illustrations and disassembly instructions. Figure references are listed in the table.

Note. Both the left and right camshafts are removed in the same manner. For instructional purposes, the right camshaft has been used for typical procedures.

Table 5-8. Camshafts, Fan Drives, Housings, and Bases

Component	Figure Reference
Camshaft	5-104 through 5-116
Front Fan Drive Housing with Clutch Assembly and Mounting Base	5-117 through 5-126
Fuel Injection Pump Mounting Base	5-127, 5-128
Rear Fan and Accessory Drive Housing with Clutch Assembly and Mounting Base	5-129 through 5-134



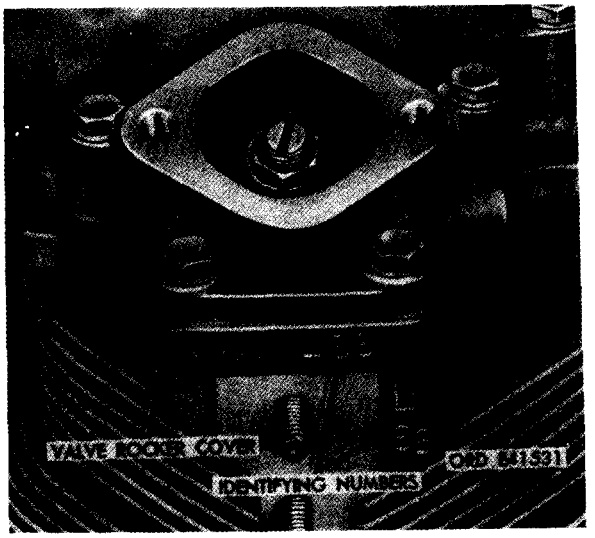
Remove

1. Remove 11 bolts (A) attaching eight injector tube clamp supports to valve adjusting screw cover plates and remove supports.
2. Remove 37 bolts (B) and flat washers attaching 24 valve adjusting screw cover plates to rocker arm covers. Remove plates.
3. Remove and discard 24 cover plate gaskets (C).

Install

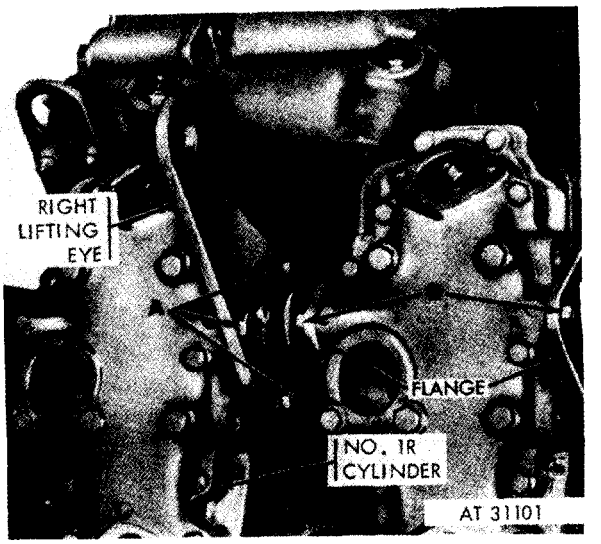
1. Position two new cover plate gaskets (C) on each of 12 rocker arm covers.
2. Position 24 valve adjusting screw cover plates on rocker arm covers. Position eight injector tube clamp supports on cover plates at locations shown and install 11 bolts (A) securing supports and plates to covers.
3. Install 37 bolts (B) and flat washers in remaining locations securing cover plates to covers.

Figure 5-104. Removing or installing* valve *adjusting screw cover plates.



Note. **The cylinder and valve rocker arm covers are machined as an assembly. Each rocker arm cover must be kept with its mating cylinder to insure camshaft bearing alinement and running clearance. Identifying numbers are used to prevent mismating of parts.**

Figure 5-105. Location of valve rocker arm cover and cylinder identifying marks.



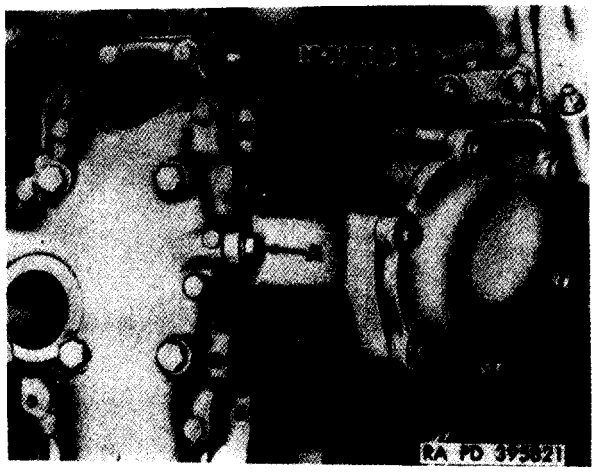
Disconnect

1. Remove three cap screws (A) attaching right lifting eye to rocker arm cover and cylinder No. 1R.
2. Remove three cap screws (B) attaching each intercylinder hose flange to remaining covers and cylinders on right side of engine. Slide flanges and lifting eye away from rocker arm covers and cylinders.

Con nect

1. Slide intercylinder hose flanges and right lifting eye against rocker arm covers and cylinders. Install three cap screws (B) securing each hose flange to rocker arm cover and cylinder on right side of engine.
2. Install three cap screws (A) securing lifting eye to cover and cylinder No. lR.

Figure 5-106. Disconnecting or connecting right front lifting eye and intercylinder hose flanges.



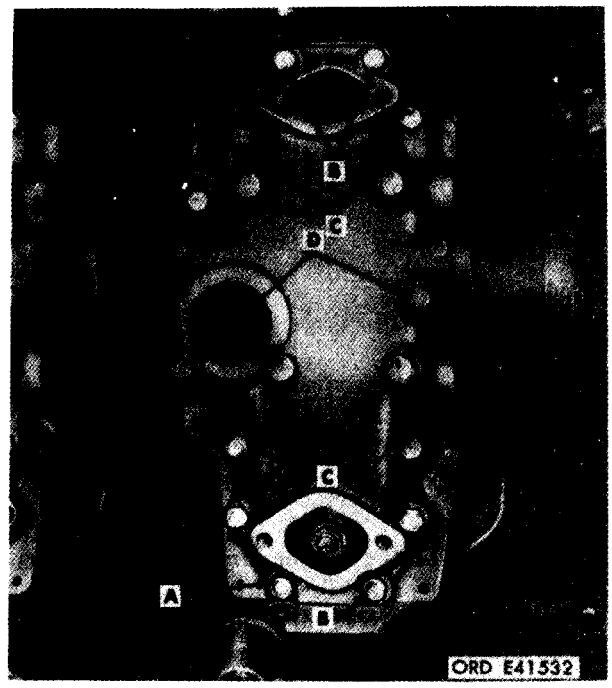
Disconnect

1. Remove cap screw (A) and flat washer attaching right camshaft gear housing to rocker arm cover.
2. Do not remove two cap screws (B) and flat washers attaching housing to cylinder until camshaft is removed (fig. 5-115).

Connect

1. The two cap screws (B) and flat washers securing right camshaft gear housing to cylinder are installed when camshaft is installed (fig. 5-115).
2. Install cap screw(A) and flat washer securing housing to rocker arm cover.

Figure 5-107. Disconnecting or connecting right camshaft gear housing at cylinder 6R rocker arm cover,



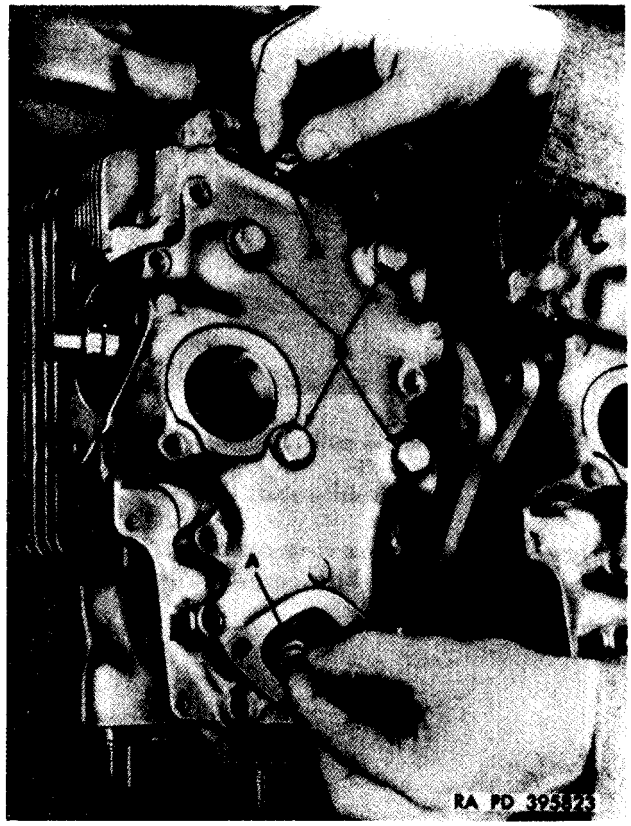
Remove

1. Remove bolt (A) attaching transmission oil cooler end shroud retaining tab to cylinder No. 6R rocker arm cover. Remove tab.
2. Remove three bolts (B) and flat washers.
3. Remove seven bolts (C) and flat washers.
4. Remove two cap screws (D) and flat washers.

Install

1. Install two cap screws (D) and flat washers.
2. Install seven bolts (C) and flat washers.
3. Install three bolts (B) and flat washers.
4. Position transmission oil cooler end shroud retaining tab on cylinder No. 6R rocker arm cover. Install bolt (A) securing tab and cover.

Figure 5-108. Removing or installing rocker arm cover bolts and cap screws.



Note. Before removing rocker arm cover bolts (B) the tension on valve rocker arm, caused by valve springs, must be released. Turn engine (fig. 5-91) until valve rocker arm rollers are on camshaft base circle or until both valves are closed to relieve tension before removing any cover.

Remove

1. Check both cylinder No. 1 R valve rocker arms by moving arms (A) up and down. If clearance cannot be felt, turn engine until clearance is evident. When clearance is felt between botb adjusting screw pads and valve stems, the rocker arm rollers are on the camshaft base circle, and valves are completely closed.
2. Remove remaining four bolts (B) and four packings with retainers. Remove rocker arm covers as shown in figure 5-110. Remove remaining 11 covers in tbe same manner.

Install

1. Install four new packings with retainers on four bolts (B).
2. Install four bolts (B) securing rocker arm covers.

Figure 5-109. Checking valve clearance before removing valve rocker arm covers and removing or installing remaining cover bolts.

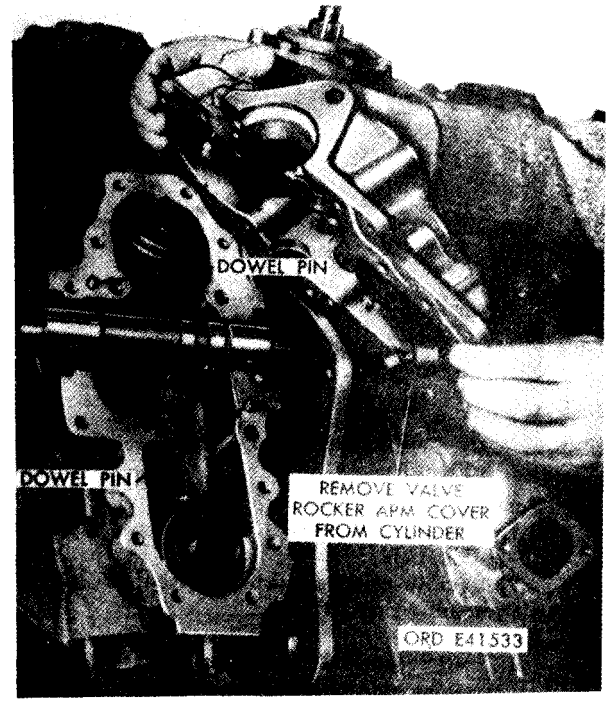
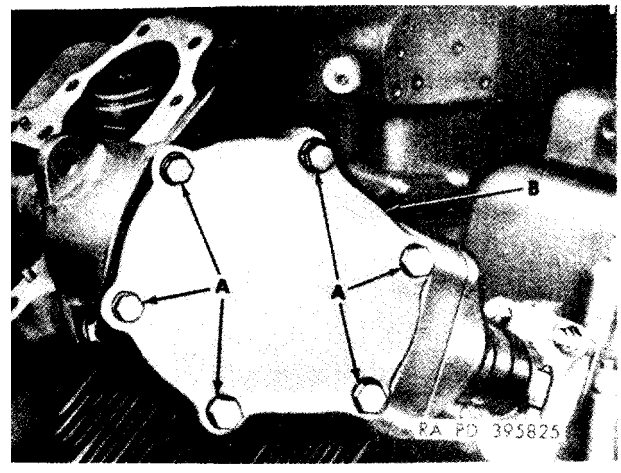


Figure 5-110. Removing valve rocker arm covers.



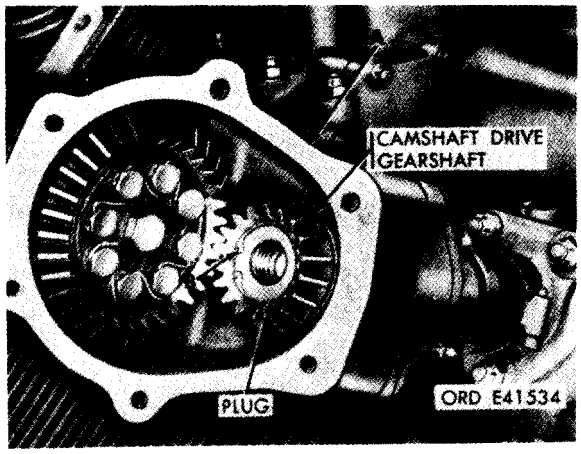
Remove

1. Remove six drilled hex-head bolts (A) and flat washers.
2. Remove right camshaft gear housing cover (B).

Install

1. Position right camshaft gear housing cover (B) on camshaft g-ear housing.
2. Install six drilled hex-head bolts (A) and flat washers securing cover.

Figure 5-111. Removing or installing right camshaft gear housing cover.



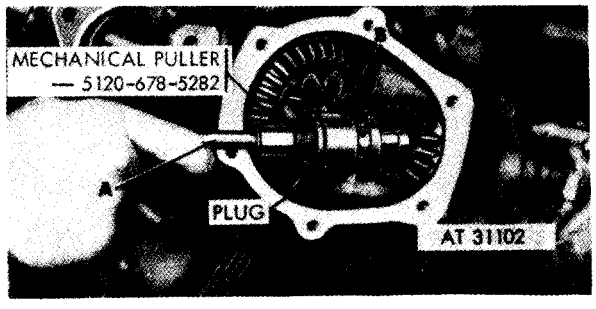
Remove

1. Remove and discard camshaft gear housing cover gasket (A).
2. Remove camshaft drive gearshaft oil transfer plug retaining ring (B).

Install

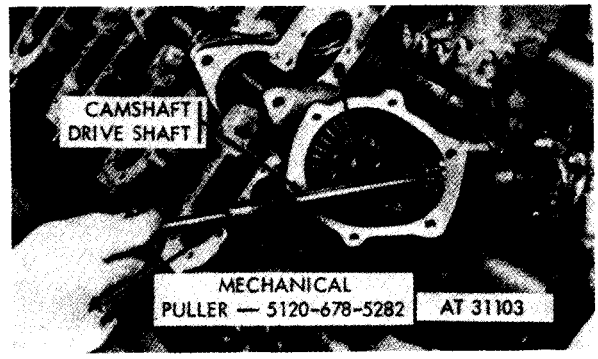
1. Install camshaft drive gearshaft oil transfer plug retaining ring (B).
2. Install a new camshaft gear housing cover gasket (A).

Figure 5-112. Removing or installing camshaft drive gearshaft oil transfer plug retaining ring.



1. Install mechanical puller (A) - 5120-678-5282 into threaded end of camshaft drive gearshaft oil transfer plug.
2. Remove oil transfer plug (B).

Figure 5-113. Removing camshaft drive gearshaft oil transferplug using mechanical puller-5120-678-5282.



1. Install mechanical puller (A) into threaded end of camshaft drive shaft.
2. Remove camshaft drive shaft (B).

Figure 5-114. Removing camshaft drive shaft using mechanical puller-5120-678-5282.



Disconnect

1. Loosen two hose clamps (A).
2. Remove two cap screws (B) and flat washers attaching camshaft gear housing to cylinder 6R.

Connect

1. Install two cap screws (B) and flat washers securing camshaft gear housing to cylinder 6R.
2. Tighten two hose clamps (A).

Figure 5-115. Disconnecting or connecting right camshaft gear housing at cylinder 6R.

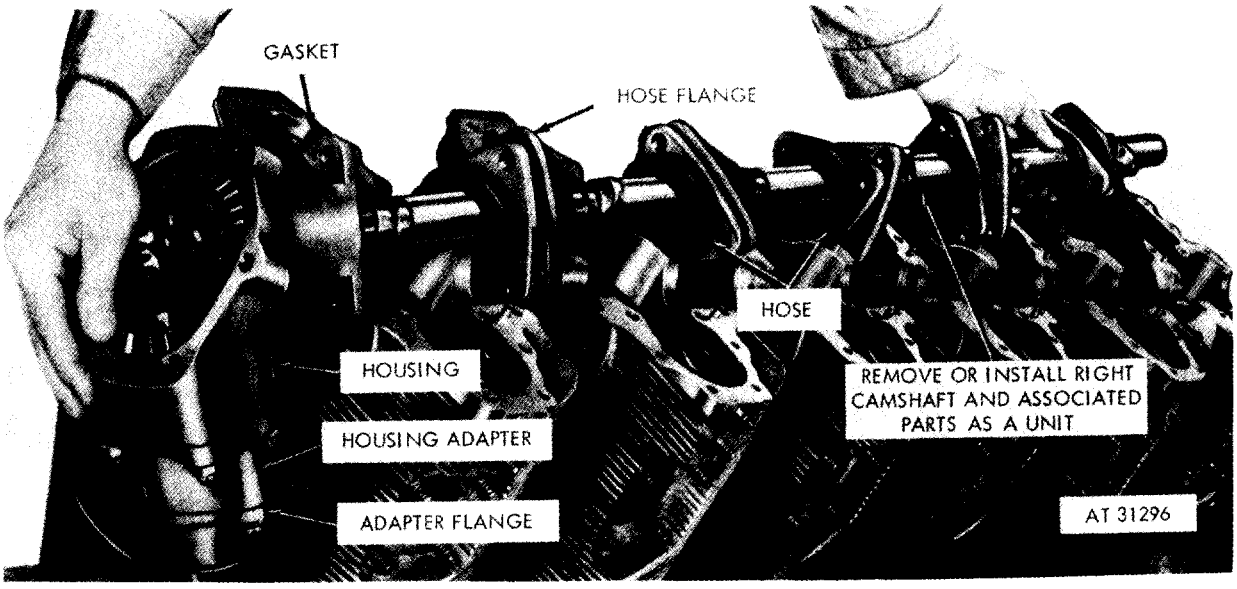
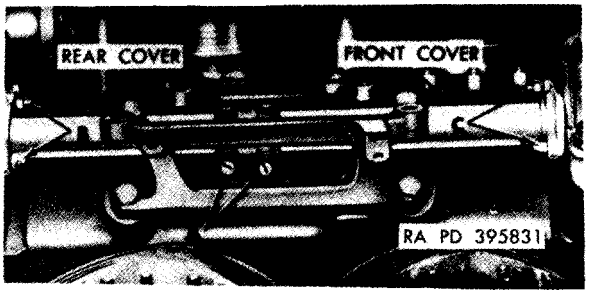


Figure 5-116. Removing or installing right camshaft.



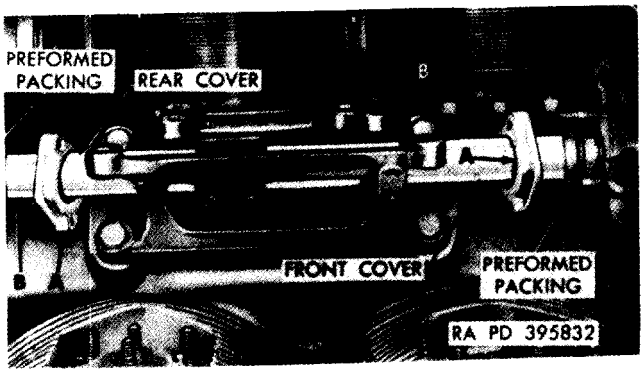
Disconnect

1. Loosen two hose clamps (A).
2. Remove two self-locking nuts (B) and flat washers attaching rear horizontal fan drive shaft cover adapter to rear fan drive housing.
3. Remove two self-locking nuts (C) and flat washers attaching front cover adapter to front fan drive housing.

Connect

1. Install two self-locking nuts (C) and flat washers securing front horizontal fan drive shaft cover adapter to front fan drive housing.
2. Install two self-locking nuts (B) and flat washers securing rear cover adapter to rear fan drive housing.
3. Tighten two hose clamps (A).

Figure 5-117. Disconnecting or connecting horizontal fan drive shaft front and rear cover adapters.



1. Separate cover adapters (A) from front and rear fan drive housing.
2. Push the front and rear fan drive shaft covers (B) together to expose the preformed packings.

Figure 5-118. Front and rear fan drive shaft covers disconnected showing location of preformed packings.

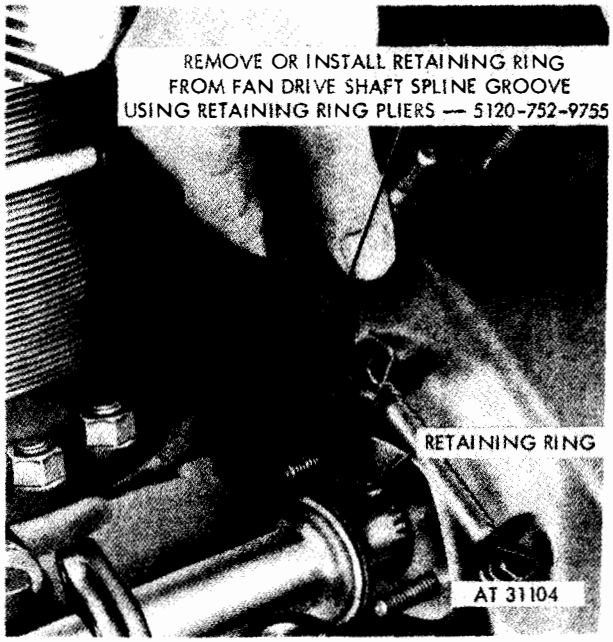


Figure 5-119. Removing or installing horizontal fan drive shaft retaining ring using retaining ring pliers—5120-752-9755.

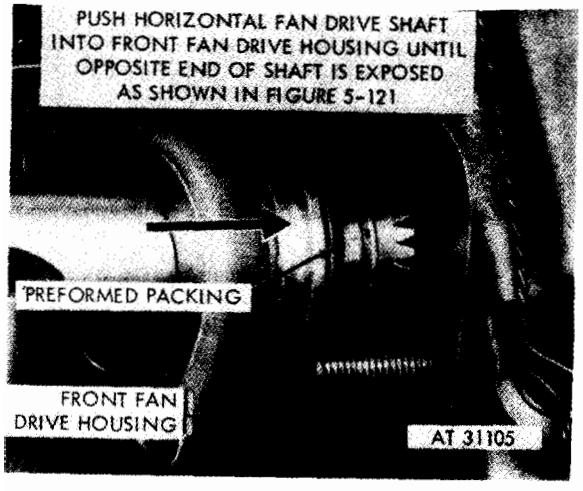


Figure 5-120. Positioning horizontal fan drive shaft in rear fan drive housing.

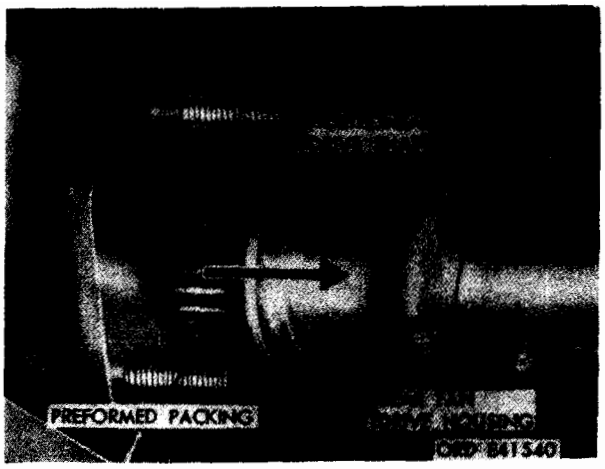
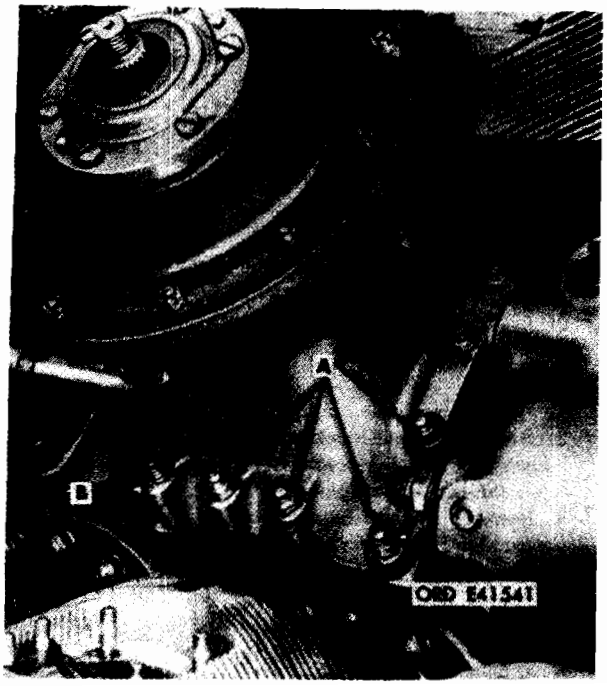


Figure 5-121. Horizontal fan drive shaft positioned for removal of front fan drive housing.



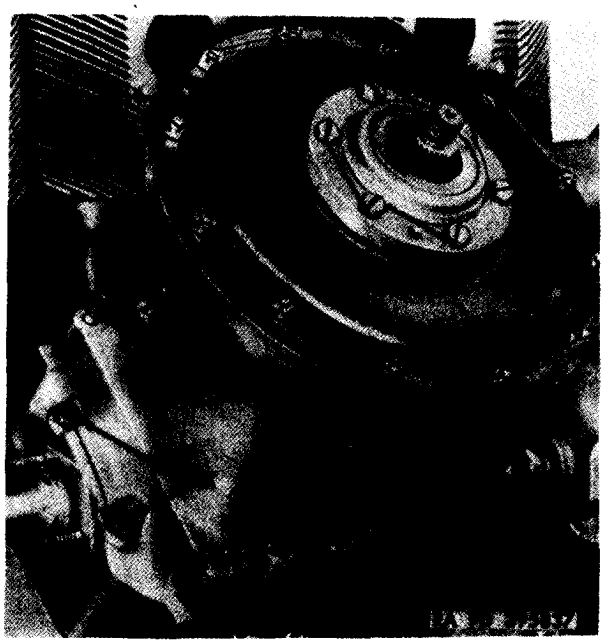
Remove

1. Remove seven self-locking nuts (A) and flat washers attaching front fan drive housing to mounting base.
2. Note that one self-locking nut at stud (B) was removed when fire extinguisher tube was removed (figs. 5-89 and 5-90).

Install

1. Install seven self-locking nuts (A) and flat washers securing front fan drive housing to mounting base.
2. One self-locking nut will be installed at stud (B) when fire extinguisher tube is installed (figs. 5-89 and 5-90).

Figure 5-122. Removing or installing front fan drive housing attaching parts.



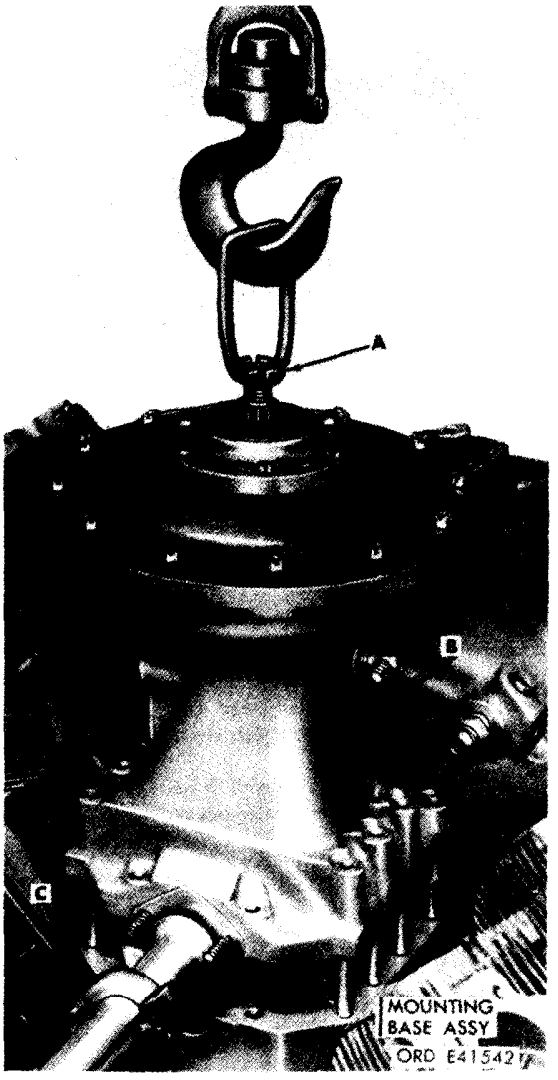
Remove

1. Cut locking wire and remove two drilled head cap screws (A) and flat washers attaching front fan drive housing to mounting base.
2. Note that two self-locking nuts were removed from studs (B) when the double angle bracket was removed (fig. 5-84).

Install

1. Install two drilled head cap screws (A) and flat washers and install locking wire securing front fan drive housing to mounting base.
2. Two self-locking nuts at studs (B) will be installed when the double angle bracket is installed (fig. 5-84).

Figure 5-123. Removing or installing front fan drive housing attaching parts.



Note. To facilitate lifting the fan drive housing and clutch assembly, an improvised lifting tool can be made from a piece of 3/8-in. dia. bar stock and a discarded slotted fan nut. Bend bar stock to shape and securely weld ends of bar to nut as illustrated in figure 2-1.

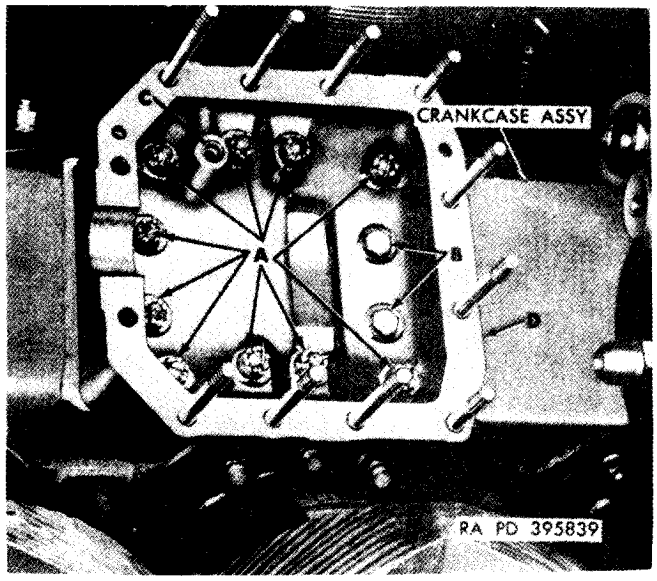
1. Install improvised lifting tool (A) on fan vertical drive shaft.

2. Lift front fan drive housing and clutch assembly with attached horizontal fan drive shaft from the mounting base assembly.

Caution: Make certain the improvised tool is properly secured before removing housing and that the fan drive housing is being lifted straight Up off the studs.

3. Remove horizontal fan drive shaft, cover and adapters. Remove and discard preformed packings (figs. 5-120 and 5-121).

Figure 5-124. Removing front fan drive housing and clutch assembly using improvised lifting tool.



Remove

1. Remove ten cotter pins, slotted nuts (A), and flat washers.
2. Remove two cap screws (B) and flat washers.
3. Remove and discard preformed packing (C) from oil transfer tube counterbore in mounting base assembly (D) (or from oil transfer tube in fan drive housing).
4. Remove front fan drive housing mounting base assembly (D) from crankcase assembly.

Install

1. Position frunt fan drive housing mounting base assembly (D) on crankcase assembly,
2. Install a new preformed packing (C) in oil transfer tube counterbore in mounting base assembly.
3. Install two cap screws (B) and flat washers,
4. Install ten cotter pins, slotted nuts (A), and flat washers.

Figure 5-125. Removing or installing front fan drive housing mounting base assembly from crankcase assembly.

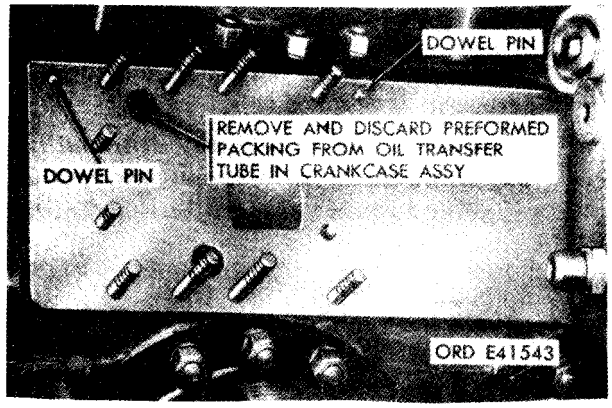
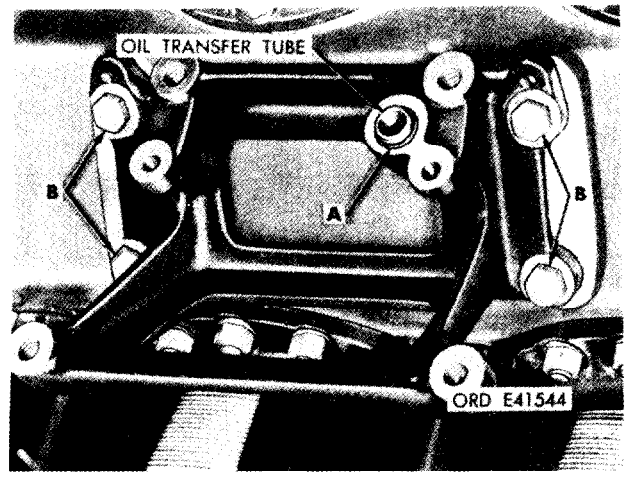


Figure 5-126. Location of preformed packing at oil transfer boss in crankcase assembly.



Remove

1. Remove and discard preformed packing (A) from oil transfer tube in fuel injection pump mounting base.
2. Remove four bolts (B) and lock washers and remove mounting base from crankcase assembly.

Install

Note. Due to design change the current engines use longer bolts and the addition of lock washers. Check all bolts and discard any- that are 1-7 / 32-inch long. Replace with current 1-3 / 8-inch bolts FSN 5305-725-0154 and lock washers FSN 5310-584-5272.

1. Position fuel injection pump mounting base on crankcase assembly and install four bolts (B) and lock washers and torque tighten to 750 pounds-inch.
2. Install a new preformed packing (A) in oil transfer tube on mounting base.

Figure 5-127. Removing or installing fuel injection pump mounting base.

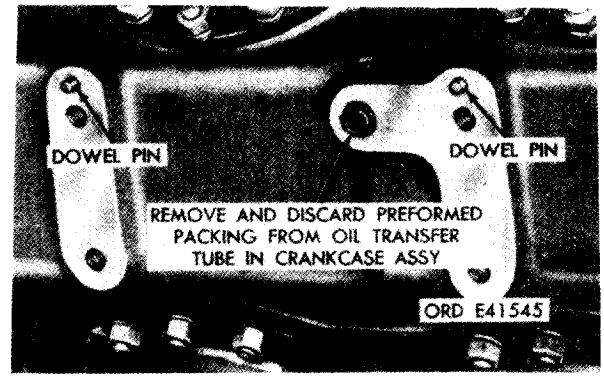
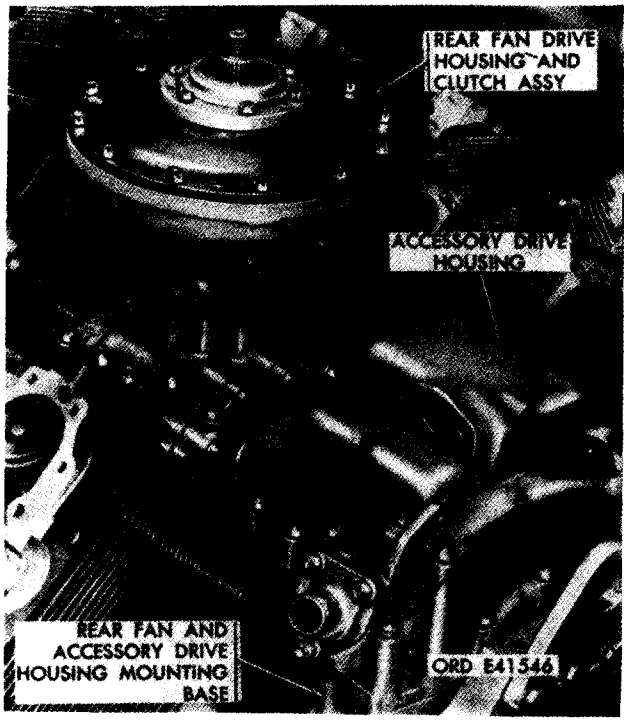


Figure 5-128. Location of preformed packing at oil transfer tube for fuel injection pump mounting base.



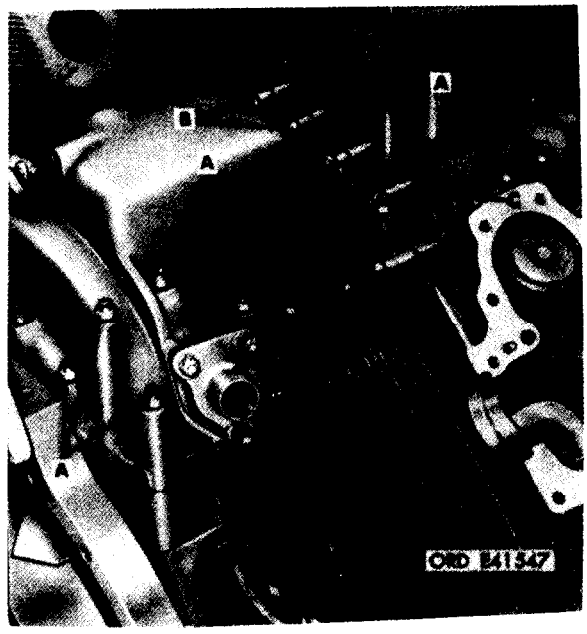
Remove

1. Remove nine self-locking nuts (A) and flat washers attaching accessory drive housing to rear fan and accessory drive housing mounting base.
2. Remove five self-locking nuts (B) and flat washers attaching rear fan drive housing to mounting base.

Install

1. Install five self-locking nuts (B) and flat washers securing rear fan drive housing to rear fan and accessory drive housing mounting base.
2. Install nine self-locking nuts (A) and flat washers securing rear fan drive housing to mounting base.

Figure 5-129. Removing or installing attaching parts for rear fan and accessory drive housing assemblies-right side.



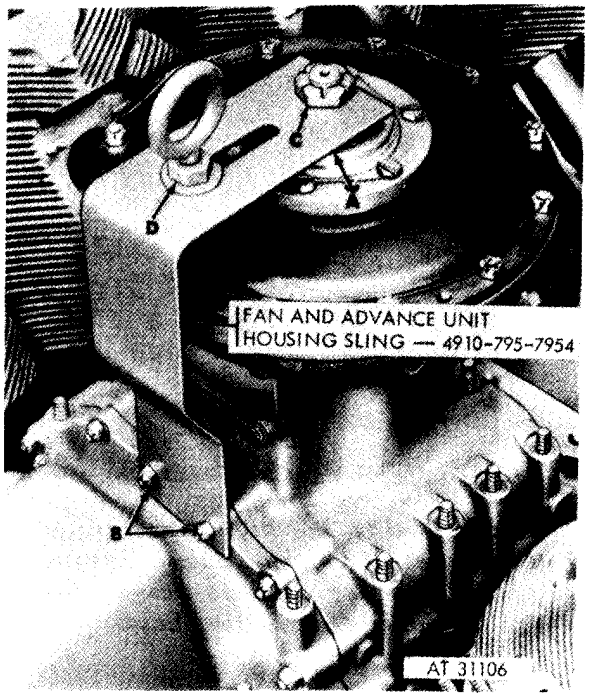
Remove

1. Remove the remaining 12 self-locking nuts (A) and flat washers attaching rear fan and accessory drive housing assembly to mounting base.
2. Remove two self-locking nuts (B) and lock washers to provide for the attachment of fan and advance unit housing sling - 4910-795-7954.
3. Note that self-locking nut was removed from stud (C) when fire extinguisher tube was removed (figs. 5-89 and 5-90).
4. Remove one self-locking nut (D) and flat washer from each side of the drive housing mounting base flange.

Install

1. Install one self-locking nut (D) and flat washer on each side of the drive housing mounting base flange.
2. One self-locking nut will be installed at stud (C) when fire extinguisher tube is installed (figs. 5-89 and 5-90).
3. Install two self-locking nuts (B) and lock washers used for the attachment of fan and advance unit housing sling - 4910-795-7954.
4. Install the remaining 12 self-locking nuts (A) and flat washers securing rear fan and accessory drive housing assembly to mounting base.

Figure 5-130. Removing or installing attaching parts for rear fan and accessory drive housing assemblies-left side.



Install

1. Position fan and advance unit housing sling (A) - 4910-795-7954 on rear fan drive housing and clutch assembly as shown.
2. Secure lifting sling to rear fan and accessory drive housing with two self-locking nuts (B) and lock washers that were removed in figure 5-130.
3. Secure lifting sling to fan vertical drive shaft with fan slotted nut (C).
4. Adjust lifting eye (D) in slot to assure balanced position of the assembly during removal (fig. 5-132).

Remove

1. Remove slotted nut (C) attaching fan and advance unit housing sling (A) - 4910-795-7954 to fan vertical drive shaft.
2. Remove two self-locking nuts (B) and lock washers attaching lifting sling to rear fan and accessory drive housing.
3. Remove lifting sling (A).

Figure 5-131. Installing or removing rear fan drive housing using fan and advance unit housing sling - 4910-795-7954.

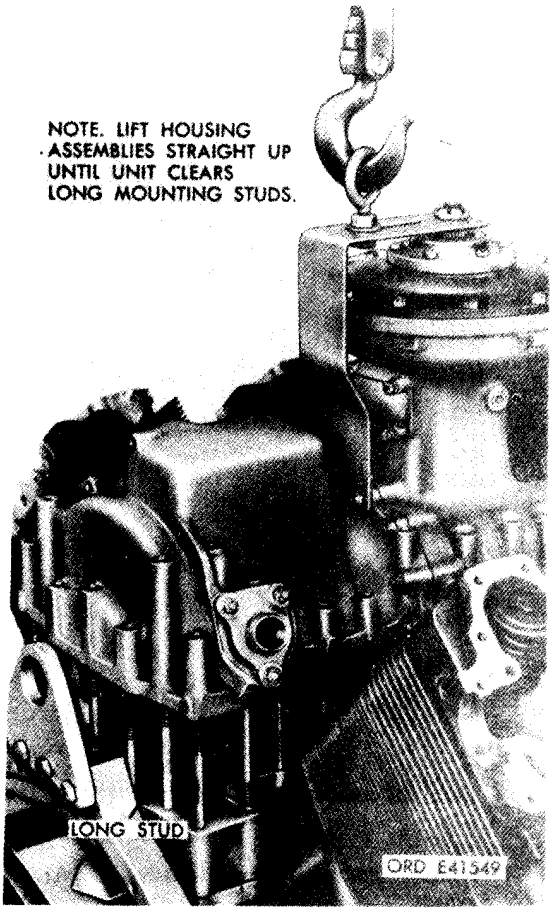
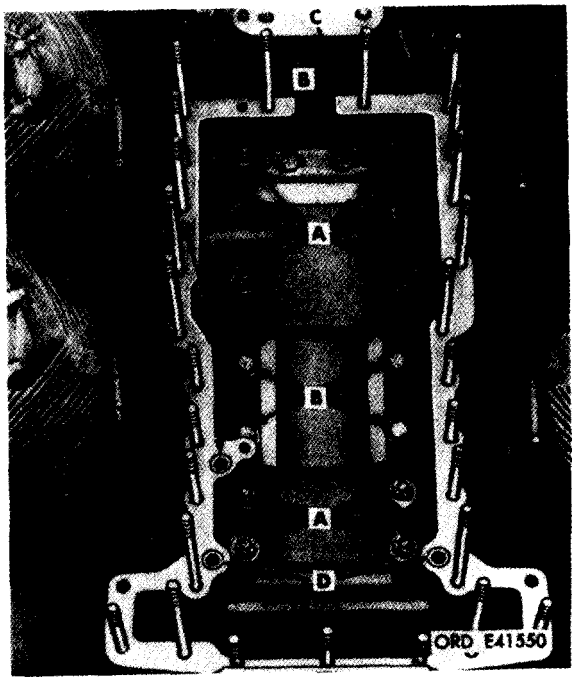


Figure 5-132. Removing rear fan and accessory drive housing assemblies.



Remove

1. Remove ten cotter pins, slotted nuts (A), and flat washers.
2. Remove six cap screws (B) and flat washers.
3. Remove rear fan and accessory drive housing mounting base (C) from crankcase assembly.
4. Remove and discard four preformed packings (D) from oil transfer counterbores in mounting base (or from oil transfer tubes in rear fan and accessory drive housing).

Install

1. Position mounting base (C) on crankcase assembly.
2. Install six cap screws (B) and flat washers.
3. Install ten cotter pins, slotted nuts (A), and flat washers.
4. Install four new preformed packings (D) in oil transfer counterbores in rear fan and accessory drive housing mounting base (C).

Figure 5-133. Removing or installing rear fan and accessory drive housing mounting base.

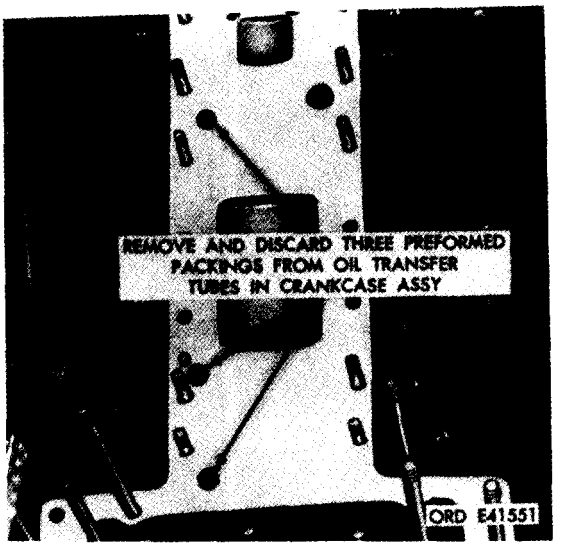


Figure 5-134. Location of preformed packings at oil transfer tubes in crankcase assembly- rear fan and accessory drive housing mounting base.

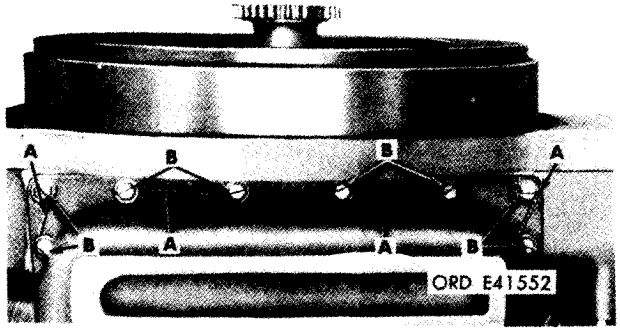
5-12. Oil Pan, Crankshaft Damper and Oil Filter Housing, Cylinder Air Deflectors, Cylinder Assemblies, and Pistons and Pins

Refer to Table 5-9 for illustrations and disassembly instructions. Figure references are listed in the table.

Note. For instructional purposes the removal of one right bank cylinder assembly, piston, and pin is described. Remove balance of cylinders in a similar manner.

Table 5-9. Oil Pan, Crankshaft Damper and Oil Filter Housing, Cylinder Air Deflectors, Cylinder Assemblies, and Pistons and Pins

Component	Figure Reference
Oil Pan	5-135 through 5-137
Crankshaft Damper and Oil Filter Housing	5-138 through 5-140
Cylinder Air Deflectors, Cylinder Assemblies, Pistons and Pins	5-141 through 5-147



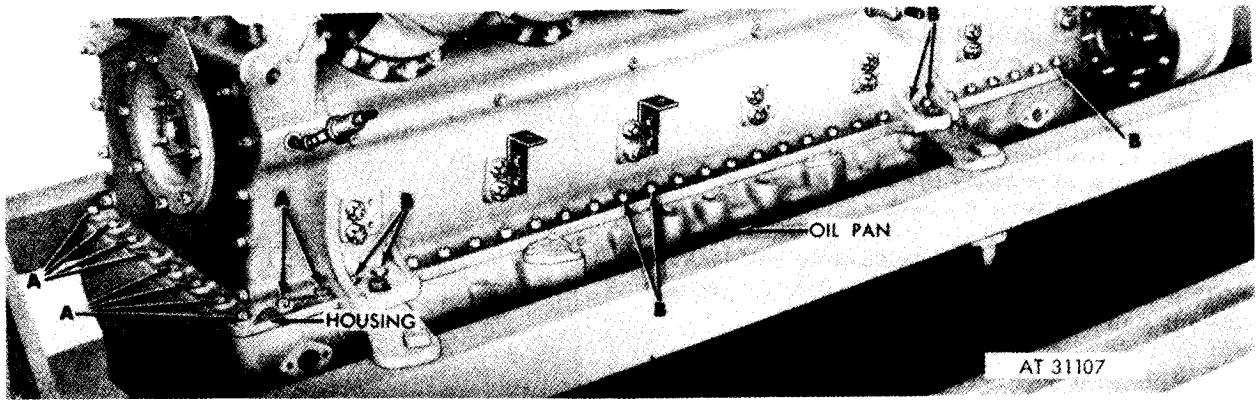
Remove

1. Cut locking wire (A) securing eight bolts.
2. Remove eight bolts (B) and flat washers attaching oil pan to rear of crankcase assembly.

Install

1. Install eight bolts (B) and flat washers securing oil pan to rear of crankcase assembly.
2. Install locking wire (A) securing bolts.

Figure 5-135. Removing or installing oil pan rear bolts.



Remove

1. Cut locking wire and remove 12 drilled head bolts (A) and flat washers attaching oil pan to crankshaft damper and oil filter housing.

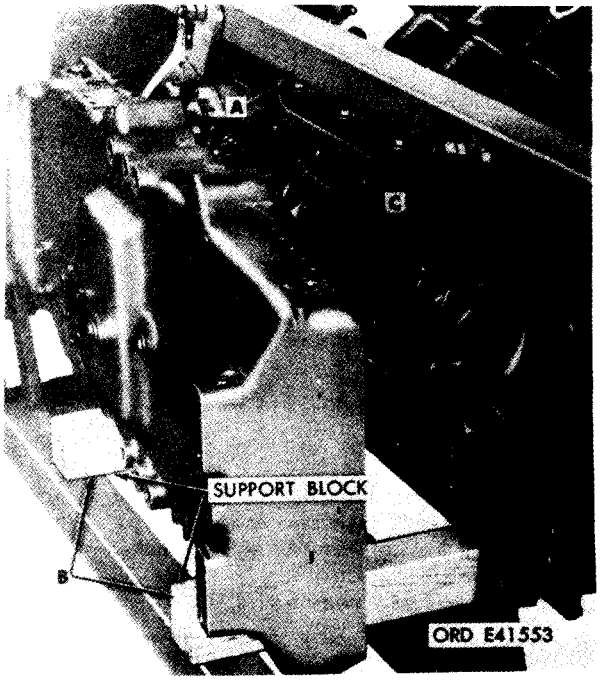
Note. One self-locking nut (B) and flat washer must remain on each side of oil pan until oil pan is removed to prevent oil pan from falling and being damaged.

2. Remove 27 of the 28 self-locking nuts (B) and flat washers attaching oil pan to each side of crankcase assembly.

install

1. Install 27 self-locking nuts (B) and flat washers securing oil pan to each side of crankcase assembly.
2. Install 12 drilled head bolts (A) and flat washers securing oil pan to crankshaft damper and oil filter housing. Install locking wire securing bolts.

Figure 5-136. Removing or installing oil pan bolts-right front view.



Remove

1. Rotate engine overhaul stand (A) until engine is in position shown.
2. Position wooden blocks (B) as shown to support oil pan while it is being removed.

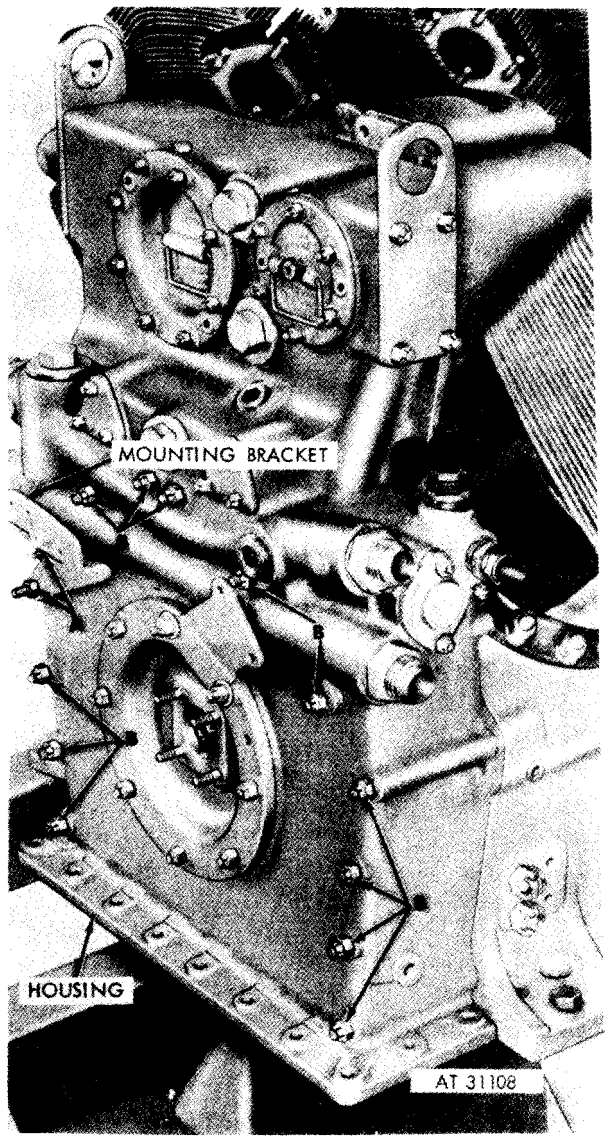
Note. Remove the two remaining self-locking nuts and flat washers that were left to prevent the oil pan from falling (fig. 5-136).

3. Remove oil pan (C). Remove and discard oil pan sealing thread (fig. 4-125).

Install

1. Rotate engine overhaul stand (A) until engine is in position shown.
2. Position wooden blocks (B) as shown to support oil pan while it is being installed.
3. Install new oil pan sealing thread (fig. 4-125) on oil pan and position oil pan (C) on crankcase assembly. Install one self-locking nut and washer on each side of oil pan to prevent pan from falling when engine is rotated to upright position.

Figure 5-137. Removing or installing oil pan.



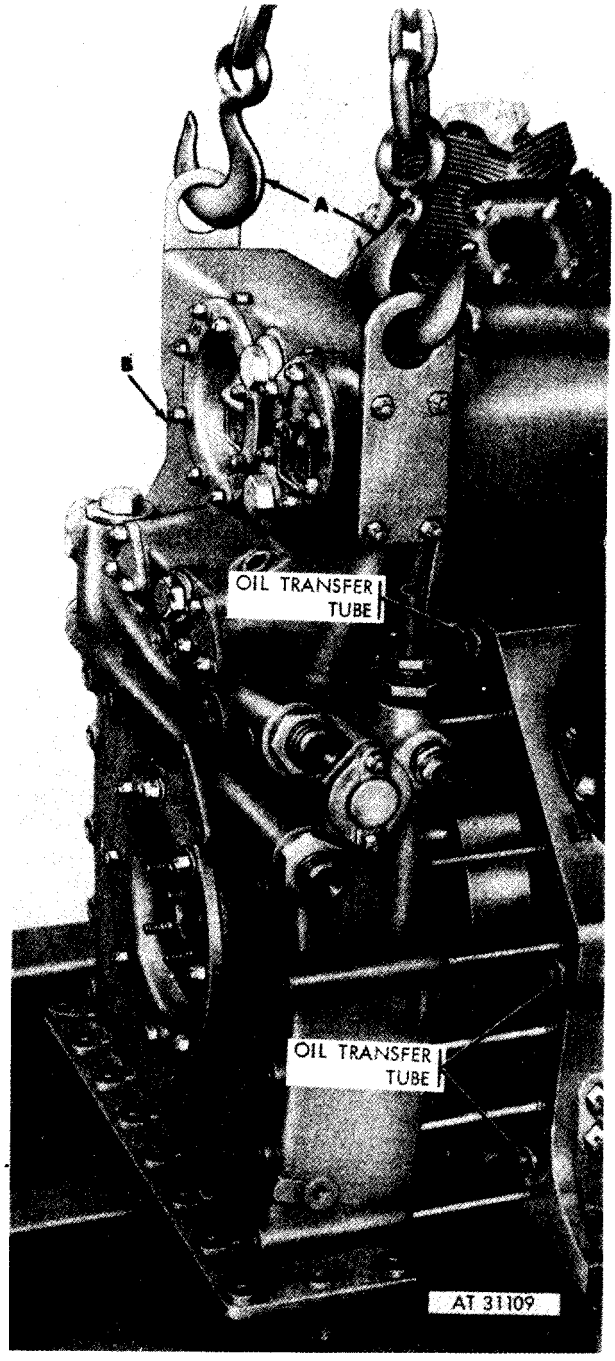
Remove

1. Remove two self-locking nuts (A) attaching manifold heater fuel solenoid valve and fuel filter mounting bracket. Remove bracket.
2. Remove 12 self-locking nuts (B) and flat washers attaching crankcase damper and oil filter housing.

Install

1. Install 12 self-locking nuts (B) and flat washers securing crankcase damper and oil filter housing.
2. Position manifold heater fuel solenoid valve and fuel filter mounting bracket on housing. Install two self-locking nuts (A) securing bracket.

Figure 5-138. Removing or installing crankshaft damper and oil filter housing attach parts.



Remove

1. Hook suitable chain (A) or hoist into crankshaft damper and oil filter housing lifting eyes.
2. Take up housing weight on chain or hoist and separate housing (B) from crankcase assembly.

Note. Do not allow housing to rest on studs after housing is separated from crankcase and oil transfer tubes.

Install

1. Hook suitable chain (A) or hoist into crankshaft damper and oil filter housing lifting eyes.
2. Take up housing weight on chain or hoist and position housing (B) on crankcase assembly.

Figure 5-139. Removing or installing crankshaft damper and oil filter housing.

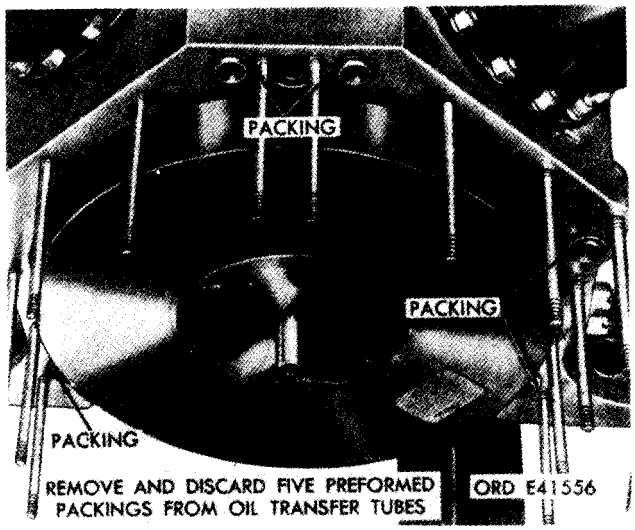
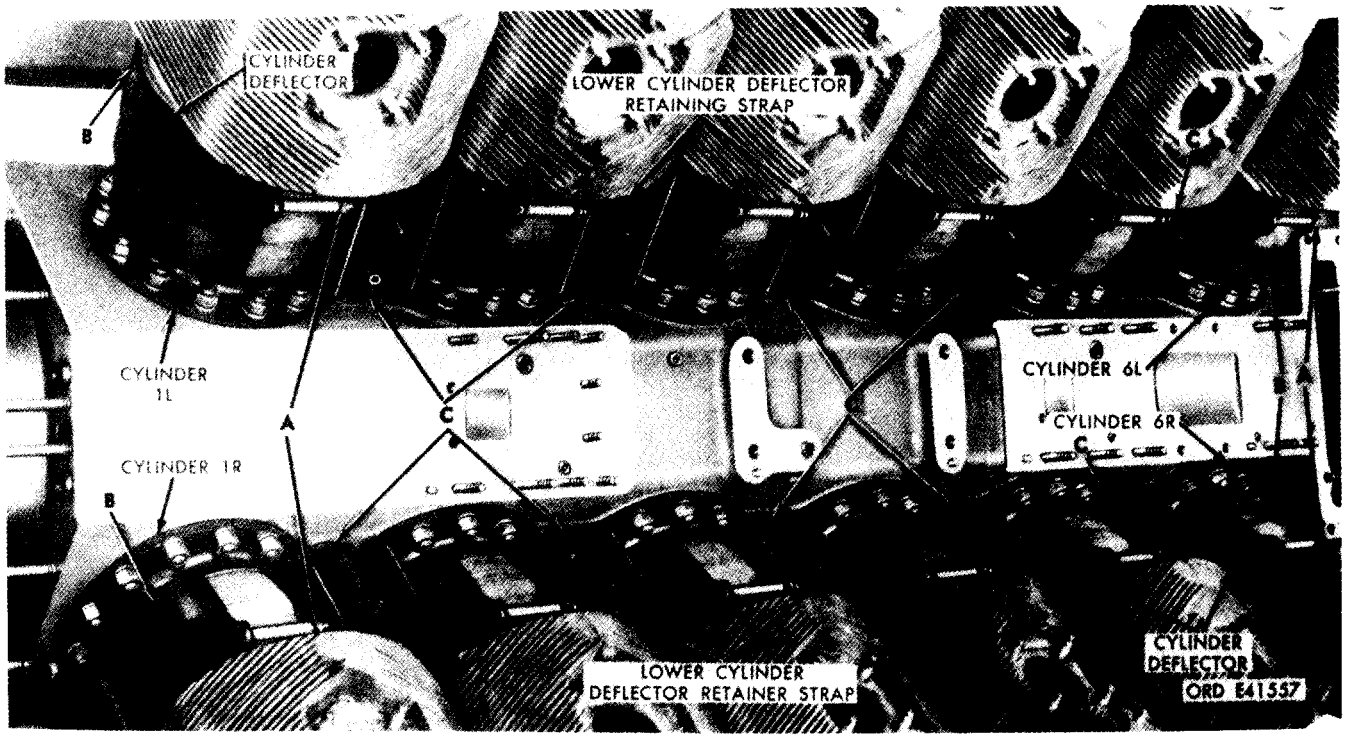


Figure 5-140. Front end of crankcase assembly showing locations of oil transfer tube preformed packings.



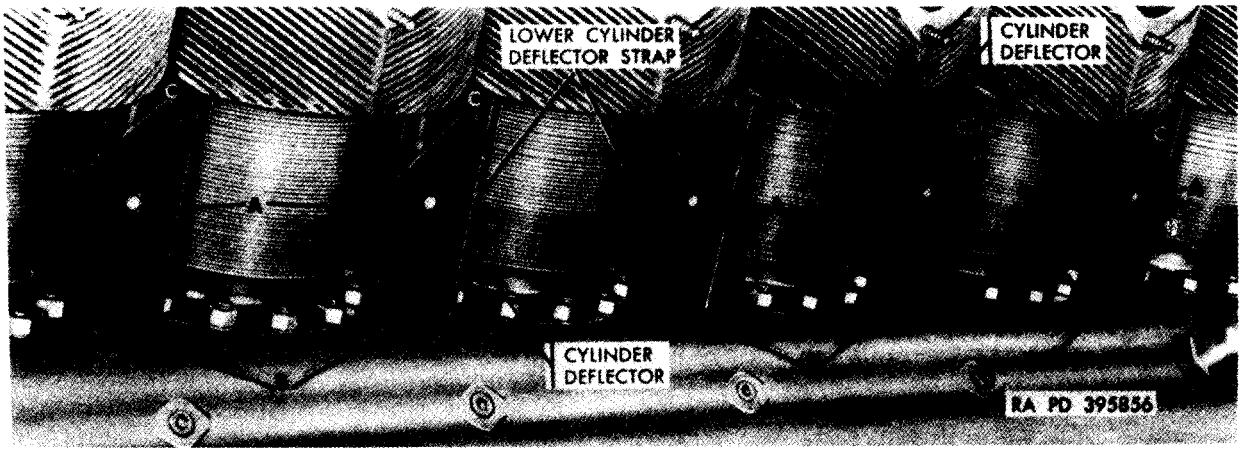
Disconnect

1. Remove 12 self-locking nuts (A), cap screws, and spacers attaching cylinder air deflectors around cylinder assemblies.
2. Remove the four air deflectors (B) located at cylinder Nos. lR, lL, 6R, and 6L.
3. The ten lower cylinder deflector retainer straps (C) are secured by ten bolts. Remove bolts (fig. 5-142).

Connect

1. The ten cylinder deflector retainer straps (C) are secured by ten bolts. Install bolts (fig. 5-142).
2. Position the four air deflectors (B) located at cylinder Nos. lR, lL, 6R, and 6L.
3. Install 12 self-locking nuts (A), cap screws, and spacers securing cylinder air deflectors around cylinder assemblies.

Figure 5-141. Disconnecting or connecting cylinder deflectors at cylinders.



Remove

1. Remove five bolts (A) that attach the five lower cylinder deflector straps on each side of engine.
z. Remove ten lower cylinder deflector straps (B).

Note. Remove the ten lower cylinder deflector retainer straps (C, fig. 5-141).

3. Remove all cylinder deflectors (C) from cylinder assemblies.

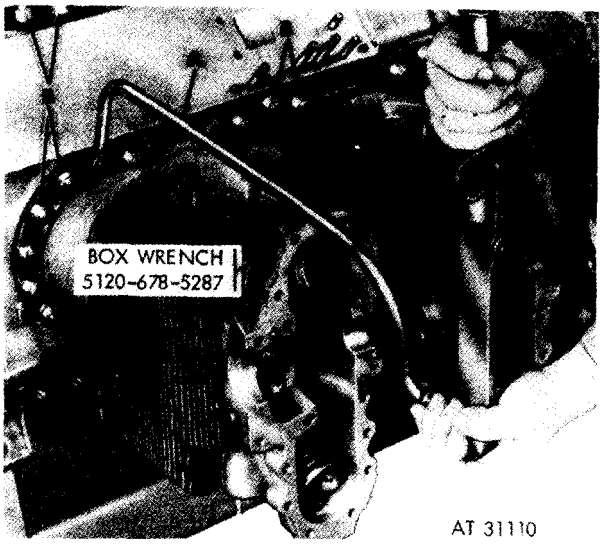
Install

1. Position all cylinder deflectors *(C)* except deflectors at outside of cylinder Nos. 1R, lL, 6R, and 6L, on cylinder assemblies.
z. Install ten lower cylinder deflector straps (B).

Note. Install the ten lower cylinder deflector retainer straps (C, fig. 5-141).

3. Install five bolts (A) that secure the five lower cylinder straps on each side of engine.

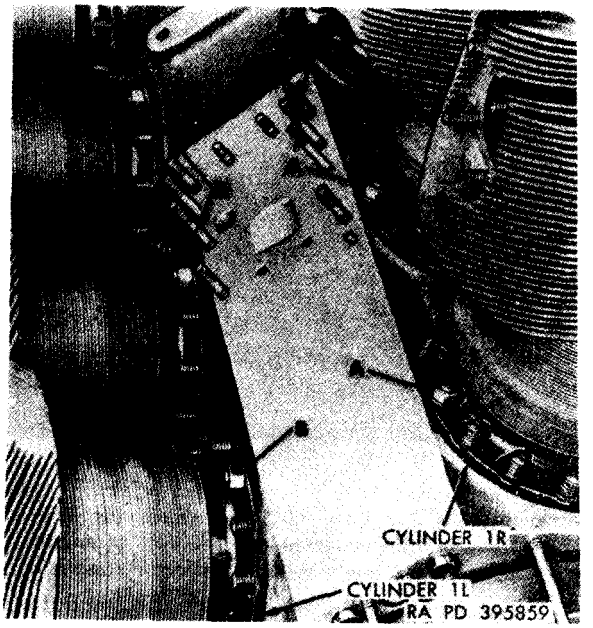
Figure 5-142. Removing or installing lower cylinder deflector straps and deflectors-right side.



Note. Before removing cylinder assemblies, it will be necessary to check the breaking torque of the 14 nuts attaching each cylinder assembly to crankcase assembly. This check is necessary to determine whether base nut stud has stretched. All stretched studs must be replaced.

1. Check breaking torque of the 14 nuts (B) securing cylinder assembly to crankcase assembly using box wrench (A)-5120-678-5287 in combination with torque wrench. When torque required to break a nut loose is less than 600 pound inches, remove nut, apply antiseize compound FSN 9150-663-1770 to stud, install nut and tighten to a torque of 600 to 660 pound inches. When nut does not tighten to the recommended torque, stud is stretching and must be replaced, Mark stud for replacement. Refer to paragraph 6-4e for instructions on replacement of studs.
2. After checking the breaking torque, remove all nuts (B) except one on each side of cylinder. The remaining two nuts are removed after piston has been positioned to top dead center for removal (fig. 5-144).

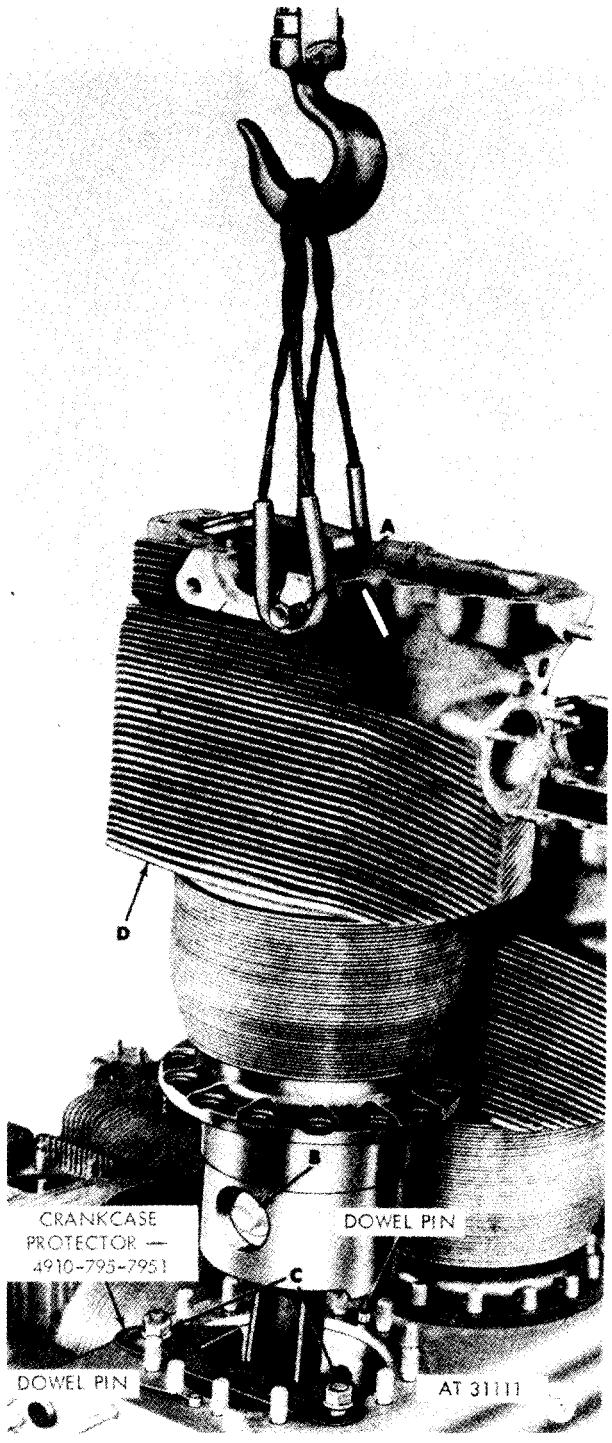
Figure 5-143. Checking breaking torque of cylinder base nuts, using box wrench-5120-678-5287.



Note. Before removing each cylinder assembly, the crankshaft must be turned to position the piston of the cylinder being removed to top dead renter. Rotate crankshaft using splined wrench -5120-793-7895 (fig. 5-91) and observe when (connecting rod has raised piston to top dead center. Make certain each piston is properly positioned before attempting cylinder removal.

1. With right bank cylinder assemblies in a vertical (upright) position remove the remaining two nuts (A) from each right cylinder assembly. Make certain each piston is positioned at top dead center before attempting removal.
2. Do not remove the nuts (B) holding the left cylinder assemblies to crankcase until left cylinders have been rotated to an upright position for removal.

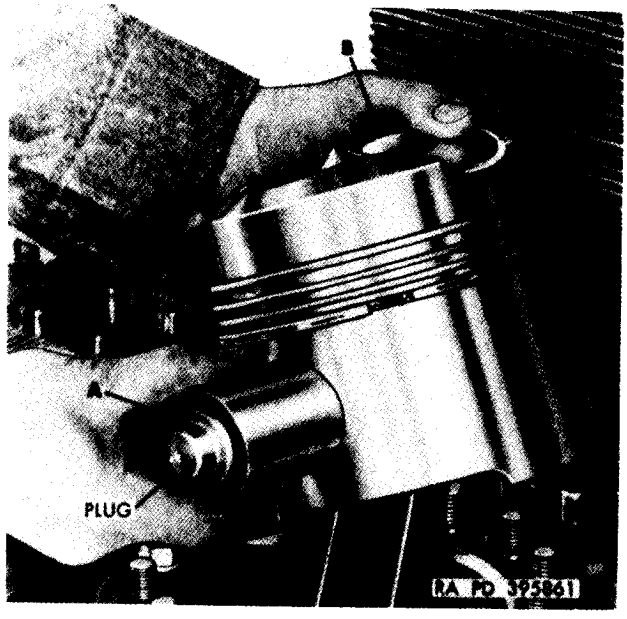
Figure 5-144. Right bank cylinders in vertical position for removing or installing cylinders from crankcase.



1. Attach a suitable lifting sling to top of cylinder assembly using two 7 / 16 x 1-1 / 4 in. cap screws (A).
2. Carefully lift cylinder assembly until cylinder is just above piston pin bore (B).
3. Install crankcase protector - 4910-795-7951 on cylinder mounting pad studs and secure with two cylinder base nuts (C).
4. Remove cylinder assembly (D).

Note. Crankcase protector - 4910-795-7951 is installed on cylinder pad before removing cylinder assembly from piston. The protector will guard against damage to cylinder pad and mounting studs in the event connecting rod should strike the pad as cylinder is lifted from piston.

Figure 5-145. Removing cylinder No. lR.

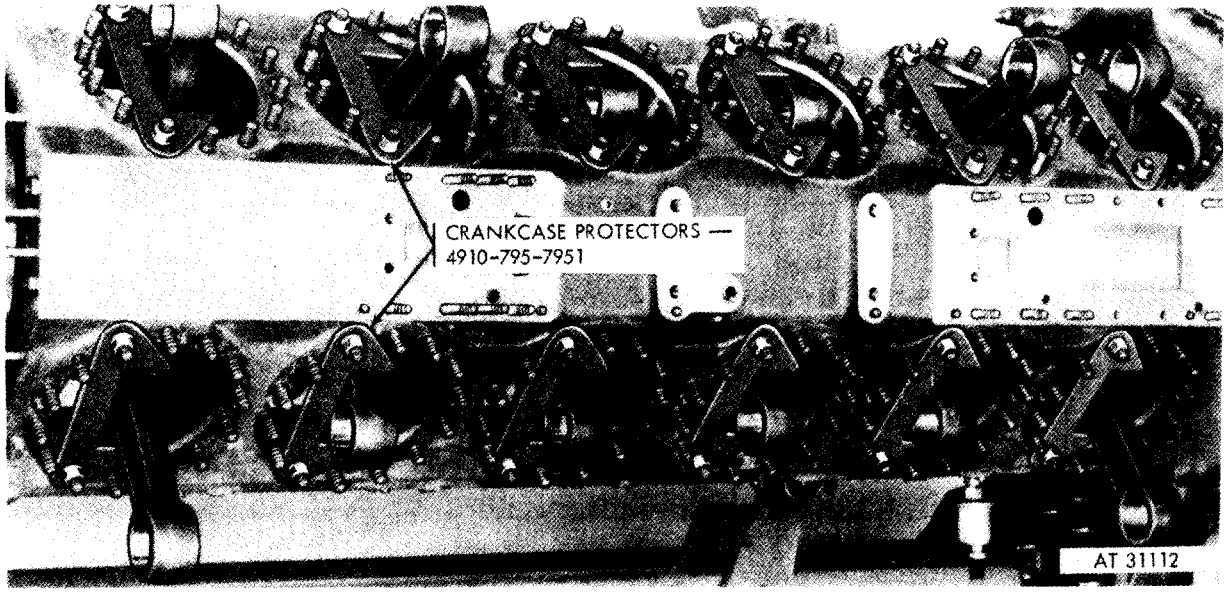


Note. When carbon deposits make removal of piston pin difficult, tap end of piston pin plug with a soft faced hammer.

1. Remove piston, piston pin (A), and piston pin plugs as a unit.
2. Remove piston (B) from connecting rod.

Note. Cylinder No. 6R piston is at top center at the same time as cylinder No. lR, and can be removed in a similar manner without turning crankshaft. Turn crankshaft, using splined wrench - 5120-793-7895 (fig. 5-91), until piston in cylinder No. 2R is at top center. The pistons in cylinder Nos. 2R and 5R will be at top center together, as will pistons for cylinder Nos. 3R and 4R. The left bank pairs of pistons will be at top center together and can be removed in a similar manner.

Figure 5-146. Removing piston pin and piston-cylinder No. 1R.



Note. Do not remove crankcase protectors - 4910-795-7951 until the crankshaft and connetting rods have been removed (para 5-15).

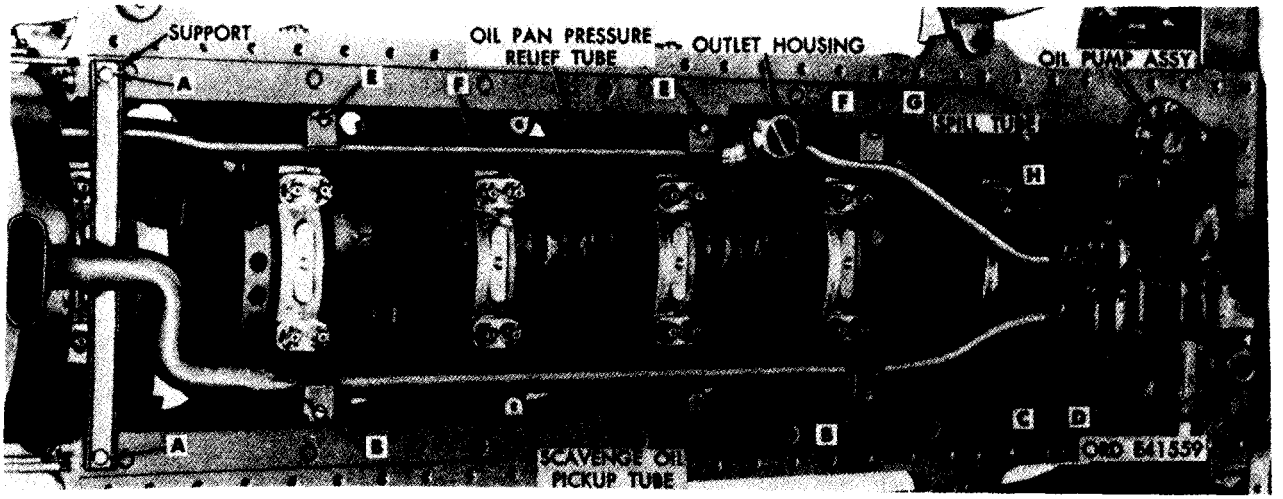
Figure 5-147. Engine with cylinder assemblies and pistons removed showing crankcase protectors-4910-795-7951 installed.

5-13. Oil Pump, Oil Tubes, Vibration Damper, Starter and Generator Drive Adapters

Refer to Table 5-10 for illustrations and disassembly instructions. Figure references are listed in the table.

Table 5-10. Oil Pump, Oil Tubes, Vibration Damper, Starter and Generator Drive Adapters

Component	Figure Reference
Oil Pump, Oil Tubes and Oil Pressure Sending Unit and Switch	5-148 through 5-150
Fuel Pump Drive Shaft Coupling and Crankshaft Torsional Vibration Damper	5-151 and 5-152
Starter Drive Adapter and Starter Driven Gear	5-153 through 5-155
Generator Drive Adapter and Drive Gearshaft	5-156 through 5-158



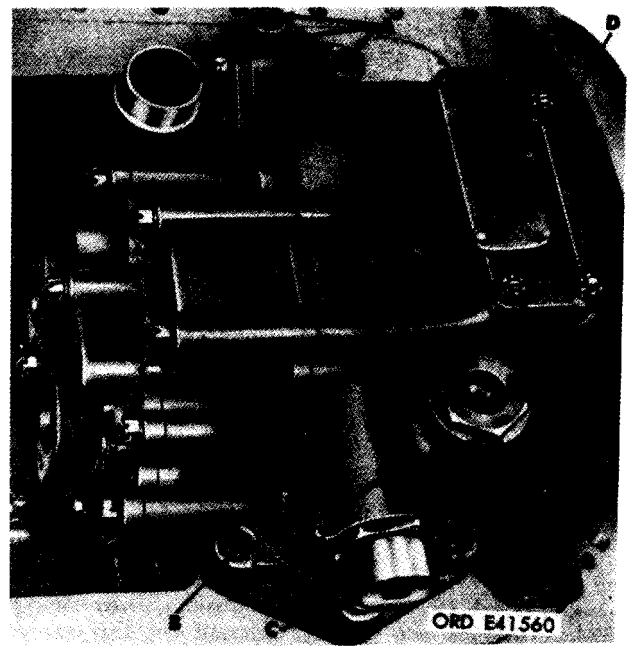
Remove

1. Cut locking wire and remove two drilled head bolts (A) attaching scavenge oil pickup tube support to crankcase assembly.
2. Cut locking wire and remove two drilled head bolts (B) attaching pickup tube brackets to crankcase.
3. Cut locking wire and remove two drilled bead bolts (C) attaching scavenge oil pickup tube to oil pump assembly.
4. Remove the support and oil pickup tube as a unit. Remove and discard scavenge oil pickup tube gasket (8).
5. Cut locking wire and remove two drilled head bolts (E) attaching oil pan pressure relief tube brackets to crankcase assembly.
6. Remove pressure relief tube and spill tube junction outlet housing (F) as a unit.
?. Cut locking wire and remove drilled head bolt (G) attaching spill tube bracket to crankcase assembly.
8. Cut locking wire and remove two drilled head bolts (H) attaching spill tube to oil pump assembly. Remove tube. Remove and discard spill tube gasket.

Install

1. Position a new spill tube gasket on oil pump assembly. Position spill tube on oil pump. Install two drilled head bolts (H) securing tube to oil pump and install locking wire securing bolts.
2. Install drilled head bolt (G) securing spill tube bracket to crankcase assembly and install locking wire securing bolt.
3. Position pressure relief tube and spill tube junction outlet housing (F) in crankcase assembly.
4. Install two drilled head bolts (E) securing oil pan pressure relief tube brackets to crankcase assembly and install locking wire securing bolts.
5. Position a new scavenge oil pickup tube gasket (D) on oil pump. Position the support and scavenge oil pickup tube as a unit in crankcase assembly.
6. Install two drilled head bolts (C) securing oil pickup tube to oil pump and install locking wire securing bolts.
7. Install two drilled head bolts (B) securing pickup tube brackets to crankcase and install locking wire securing bolts.
8. Install two drilled head bolts (A) securing scavenge oil pickup tube support to crankcase and install locking wire securing bolts.

Figure 5-148. Removing or installing scavenge oil pickup, oil pan pressure relief tube, and oil spill tube.



Remove

1. Cut locking wire and remove three drilled head cap screws (A) and flat washers attaching oil pump assembly to crankcase.
2. Cut locking wire and remove two drilled head cap screws (B) and flat washers.
3. Loosen remaining drilled head cap screw (C) as oil pump assembly is being removed.

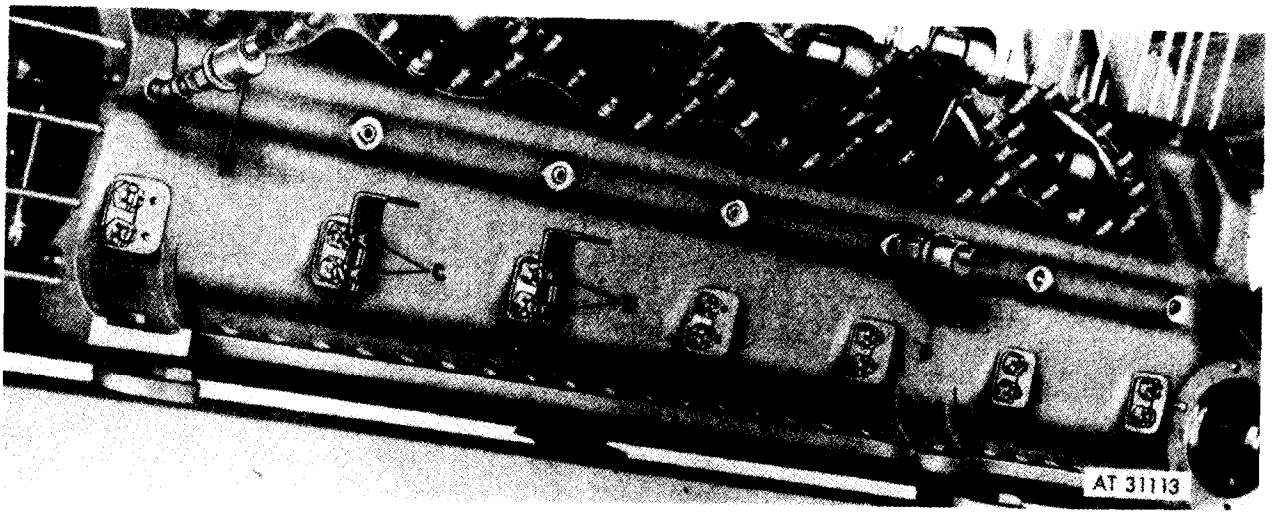
Note. This cap screw (C) cannot be removed until oil pump is disassembled.

4. Remove oil pump assembly (D) from crankcase.

Install

1. Position oil pump assembly (D) in crankcase assembly.
2. Tighten drilled head cap screw (C) as oil pump is being installed.
3. Install two drilled head cap screws (B) and flat washers and install locking wire securing screws.
4. Install three drilled head cap screws (A) and flat washers securing oil pump to crankcase and install locking wire securing screws.

Figure 5-149. Removing or installing oil pump assembly.



Remove

1. Remove oil pressure sending unit (A).
2. Remove low oil pressure warning switch (B).
3. Remove two cap screws (C), lock washers, and flat washers attaching generator air intake tube front support bracket to crankcase and remove bracket.
4. Remove two cap screws (D), lock washers, and flat washers attaching rear support bracket to crankcase and remove bracket.

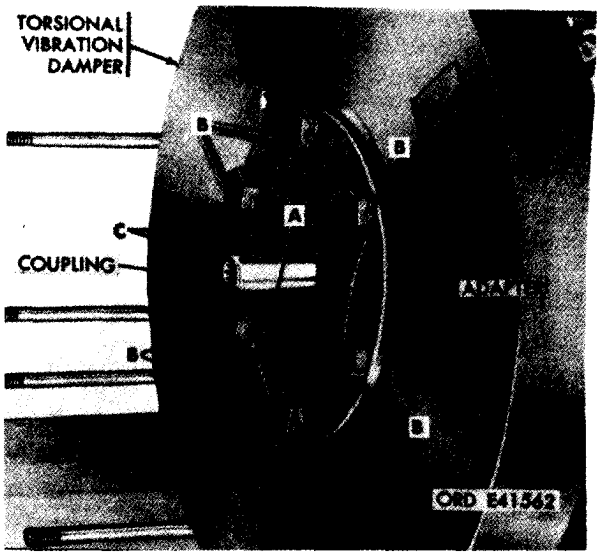
Install

1. Position generator air intake tube rear support bracket on crankcase and install two cap screws (D). lock washers, and flat washers securing bracket to crankcase.
2. Position front support bracket on crankcase and install two cap screws (C), lock washers, and flat washers securing bracket to crankcase.

Note. It may be necessary to adjust the bracket height when the generator air intake tube is installed.

3. Install low oil pressure warning switch (B).
4. Install oil pressure sending unit (A).

Figure 5-150. Removing or installing oil pressure sending unit, oil pressure warning switch and generator air intake tube support brackets.



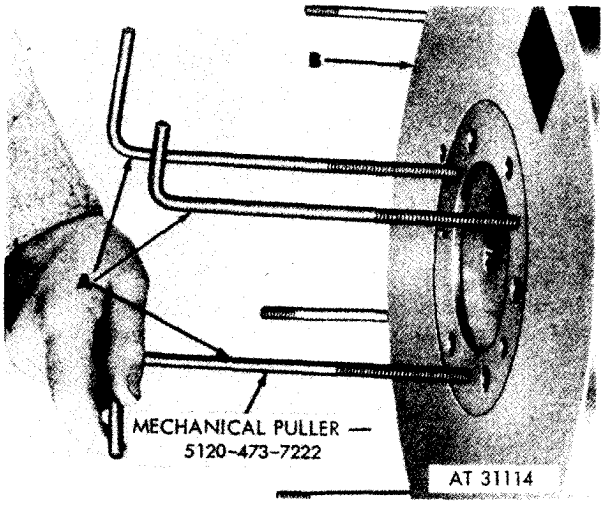
Remove

1. Cut locking wire (A).
2. Remove six drilled head bolts (B) attaching fuel pump drive coupling adapter and crankshaft torsional vibration damper to crankshaft.
3. Remove adapter and fuel pump drive coupling (C).

Install

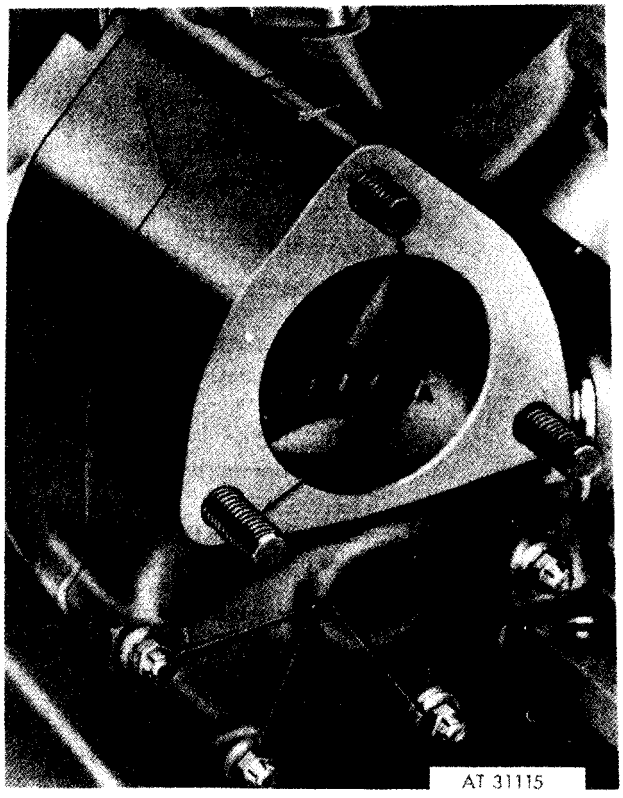
1. Position fuel pump drive coupling adapter and fuel pump drive coupling (C) on crankshaft.
2. Install six drilled head bolts (B) securing adapter and crankshaft torsional vibration damper to crankshaft
3. Install locking wire (A) securing bolts.

Figure 5-151. Removing or installing fuel pump drive coupling adapter and coupling.



1. Install three mechanical pullers (A) - 5120-473-7222 into puller screw boles provided in crankshaft torsional vibration damper.
2. Alternately tighten puller screws and pull damper (B) from dowel pine in flange of crankshaft. Remove damper.

Figure 5-152. Removing crankshaft torsional vibration damper using mechanical pullers-5120-473-7222.



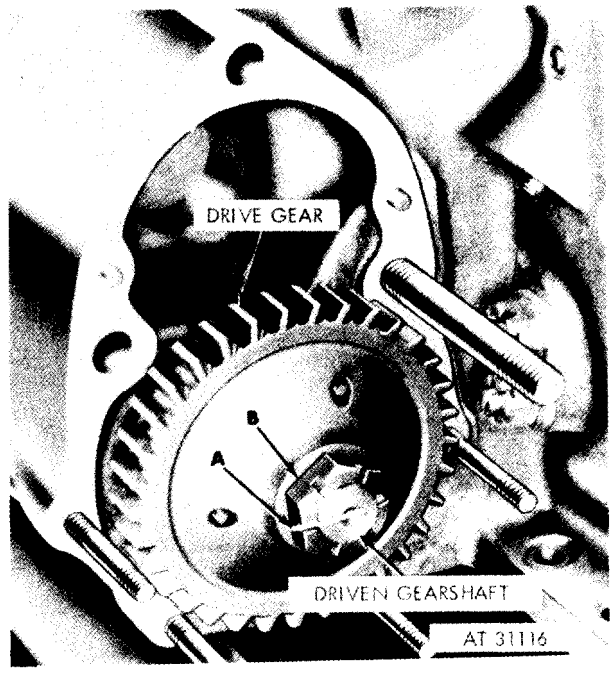
Remove

1. Remove two starter mounting bolts (A).
2. Remove four eelf-locking nuts (B) and flat washers attaching starter drive adapter (C) to crankcase assembly.
3. Remove adapter (C) from crankcase.
4. Remove and discard gasket (D).

Install

1. Install new starter drive adapter gasket (D).
2. Position starter drive adapter (C) on crankcase assembly.
3. Install four self-locking nuts (B) and flat washers securing adapter (C) to crankcase.
4. Install two starter mounting bolts (A).

Figure 5-153. Removing or installing starter drive adapter.



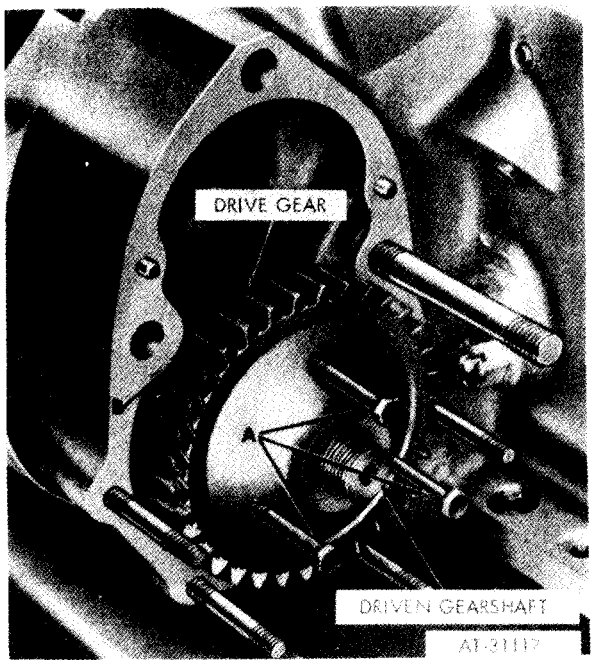
Remove

1. Remove cotter pin (A).
2. Remove slotted nut (B) attaching starter driven gear to starter driven gearshaft.

Install

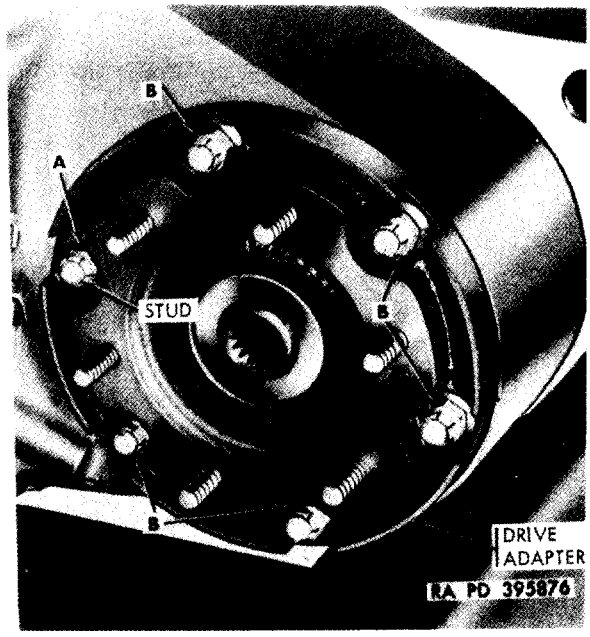
1. Install slotted nut (B) securing starter driven gear to starter driven gearshaft.
2. Install cotter pin (A).

Figure 5-154. Removing or installing starter driven gear attaching parts.



1. Install three 5 / 16-24 x 3 in. bolts (A) for use as puller screws into threaded holes provided in starter driven gear (B).
2. Alternately tighten bolts and pull driven gear (B) from driven gearshaft.

Figure 5-155. Removing starter driven gear.



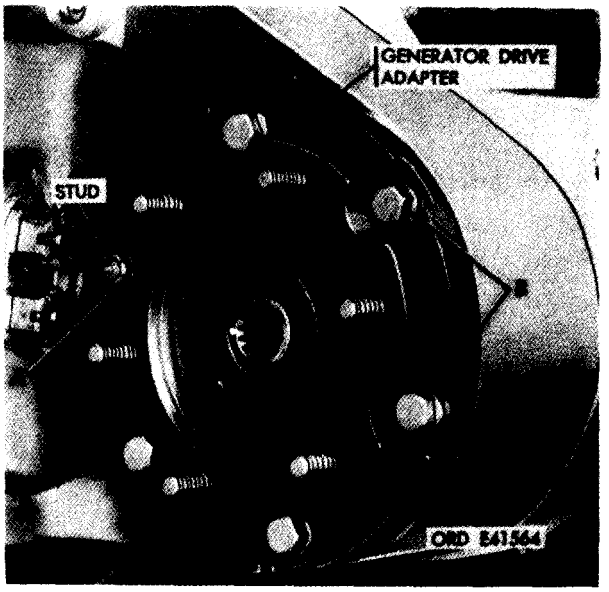
Remove

1. Remove self-locking nut (A) and flat washer from stud.
2. Remove five self-locking nuts (B) and bolts attaching generator drive adapter to crankcase assembly.

Install

1. Install five self-locking nuts (B) and bolts securing generator drive adapter to crankcase assembly.
2. Install self-locking nut (A) and flat washer on stud.

Figure 5-156. Removing or installing generator drive adapter attach parts-engines with mounting nuts.



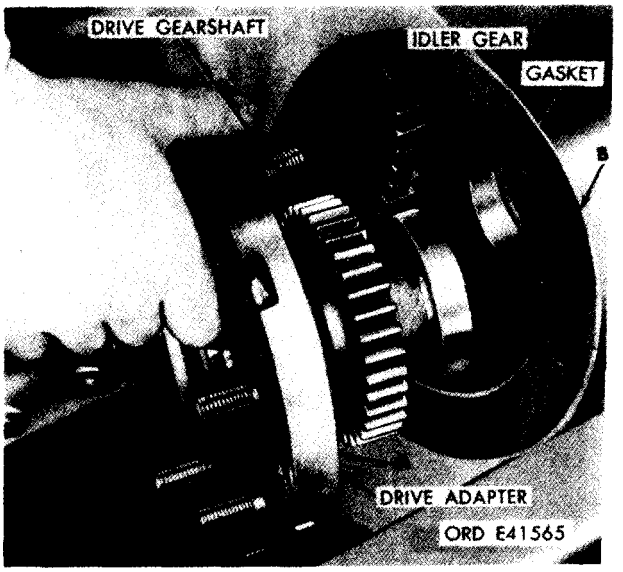
Remove

1. Remove self-locking nut (A) and flat washer from stud.
2. Remove five bolts (B) and lock washers attaching generator drive adapter to crankcase assembly.

Install

1. Install five bolts (B) and lock washers securing generator drive adapter to crankcase assembly.
2. Install self-locking nut (A) and flat washer on stud.

Figure 5-157. Removing or installing generator drive adapter attaching parts-engines with mounting bolts.



Remove

1. Remove generator drive adapter (A) with drive gearshaft and bearings as a unit.
2. Remove and discard generator drive adapter gasket (B).

Install

1. Install a new generator drive adapter gasket (B).
2. Install generator drive adapter (A) with drive gearshaft and bearings as a unit.

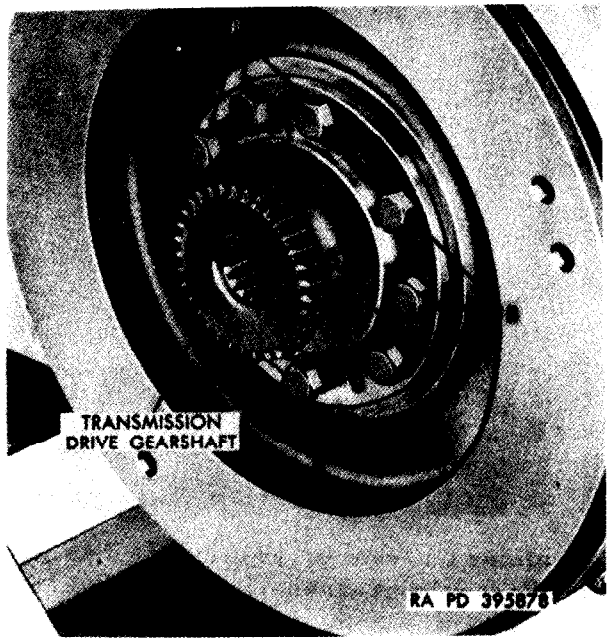
Figure 5-158. Removing or installing generator drive adapter and associated parts.

5-14. Flywheel, Transmission Adapter, Crankshaft Oil Seal, and Accessory Drive Gear

Refer to Table 5-11 for illustrations and disassembly instructions. Figure references are listed in the table.

Table 5-11. Flywheel Transmission Adapter, Crankshaft Oil Seal, and Accessory Drive Gear

Component	Figure Reference
Transmission Drive Gearshaft Assembly, Flywheel, and Transmission Adapter	5-159 through 5-164
Crankshaft Oil Seal Housing and Accessory Drive Gear	5-165 through 5-170



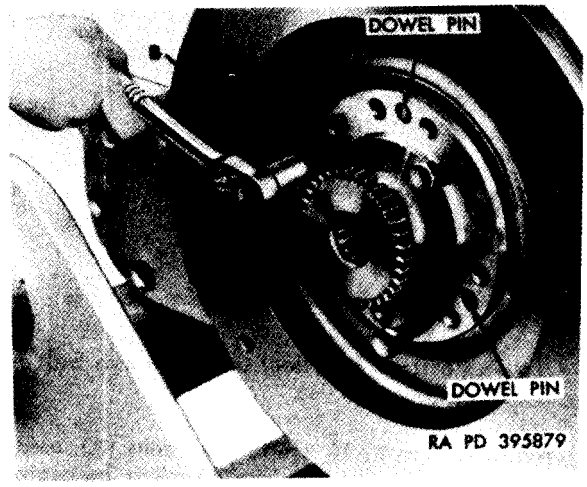
Remove

1. Straighten tabs on three lock plates (A) securing nine bolts.
2. Remove nine bolts (B) and three lock plates attaching transmission drive gearshaft assembly and flywheel to crankshaft. Discard lock plates.

Install

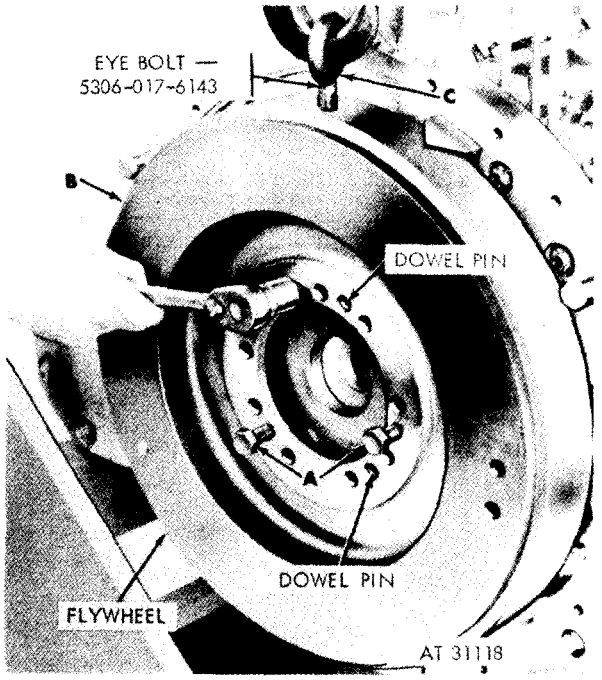
1. Install three new lock plates (A) and nine bolts (B) securing transmission drive gearshaft assembly and flywheel to crankshaft.
2. Bend taps on three lock plates (A) securing nine bolts (B).

Figure 5-159. Removing or installing transmission drive gearshaft attaching parts.



1. Install three 9 / 16 x 1-3/4 in. bolts (A), used for attaching transmission drive gearshaft assembly, as puller screws in puller screw holes provided.
2. Alternately tighten bolts and pull gearshaft from crankshaft dowel pins. Remove the three bolts from the gearshaft.

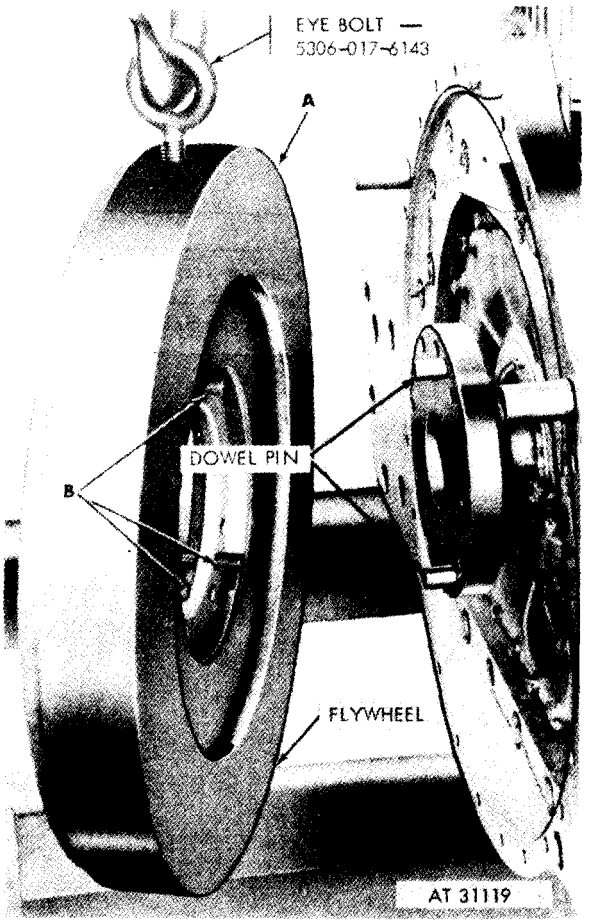
Figure 5-160. Removing transmission drive gearshaft assembly using mounting bolts as puller screws.



Note. Position flywheel to locate eye bolt hole at top center.

1. Install three 9 / 16 x 1-3/4 in. bolts (A), used for attaching transmission drive gearshaft assembly, as puller screws into puller screw holes in flywheel
2. Alternately tighten bolts and pull flywheel (B) from crankshaft dowel pins only far enough to permit installation of lifting eye bolt (C).
3. Install eye bolt - 5306-017-6143 and attach suitable chain hoist. Continue tightening puller bolts to remove flywheel from crankshaft dowel pins (fig. 5-162).

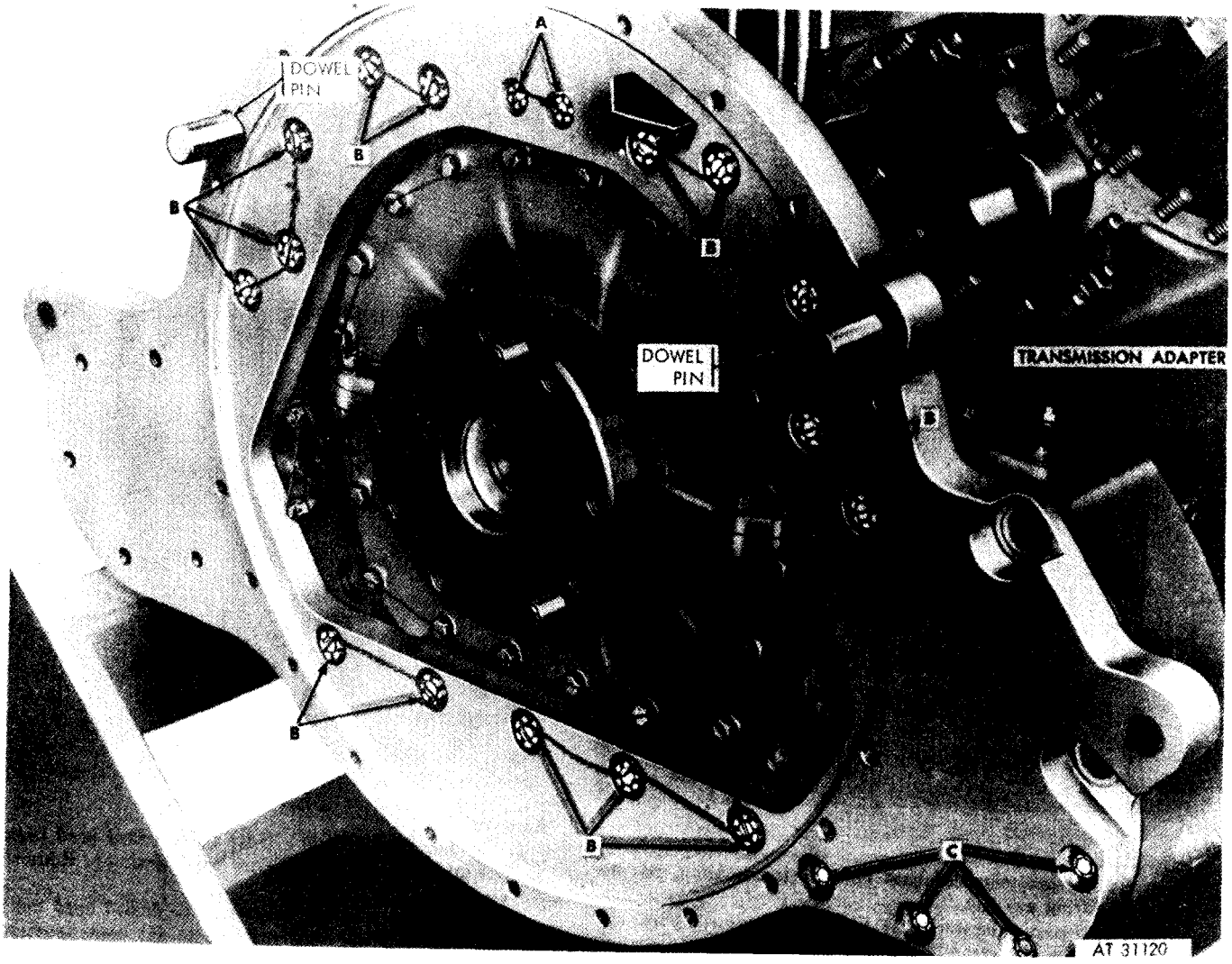
Figure 5-161. Preparing flywheel for removal.



Caution: Use care in removing the flywheel from the dowel pins so as not to bind the flywheel on the pins.

1. Remove flywheel (A) from the two dowel pins in flange on crankshaft.
2. Remove three puller bolts (B) from flywheel.

Figure.5-162. Removing flywheel using eye bolt-5306-017-6143.



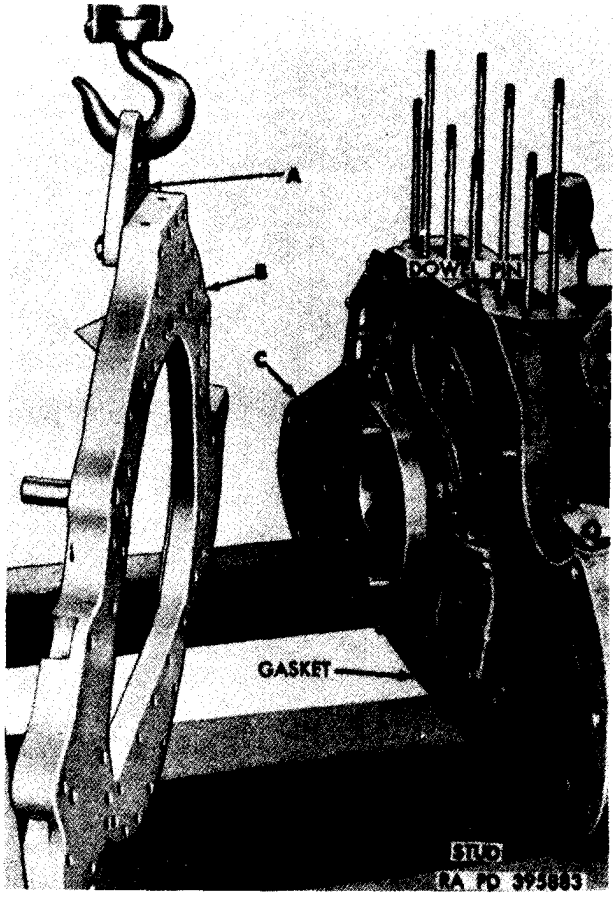
Remove

1. Cut locking wire and remove two slotted nuts (A).
2. Cut locking wire and remove 15 slotted nuts (B).
3. Remove four self-locking nuts (C) and remove transmission adapter.

Install

1. Install transmission adapter as shown in figure 5-164. Install four self-locking nuts (C).
2. Install 15 slotted nuts (B) in adapter and install locking wire securing nuts.
3. Install two slotted nuts (A) in adapter and install locking wire securing nuts.

Figure 5-163. Removing or installing transmission adapter attaching parts.



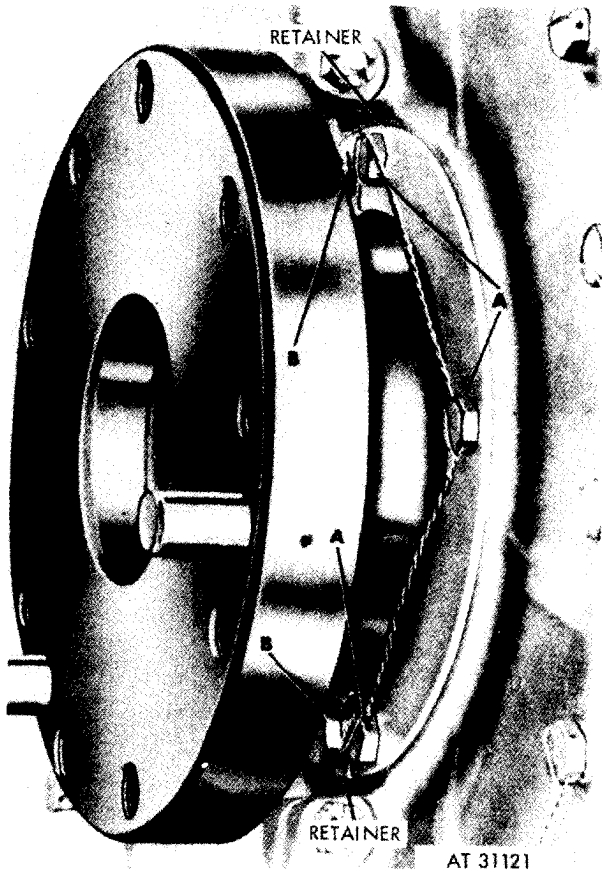
Remove

1. Attach suitable chain hoist in transmission adapter lifting eye (A).
2. Separate adapter (B) from studs, dowel pine, and crankcase assembly. Remove adapter.
3. Remove and discard transmission adapter gasket (C).

Install

1. Position a new transmission adapter gasket (C) on crankcase assembly.
2. Attach a suitable chain hoist in transmission adapter lifting eye (A).
3. Position transmission adapter (B) on studs and dowel pins in crankcase.

Figure 5-164. Removing or installing transmission adapter.



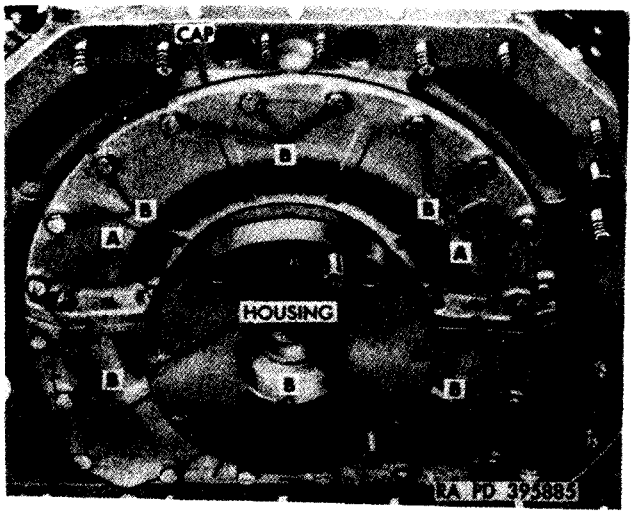
Remove

1. Cut locking wire and remove three drilled head bolts (A) attaching oil seal retainer to oil seal cap. Remove retainer.
2. Cut locking wire and remove three drilled head bolts (B) attaching oil seal retainer to oil seal housing. Remove retainer.

Install

1. Position retainer on oil seal housing. Install three drilled head bolts (B) securing retainer to housing and install locking wire securing bolts.
2. Position retainer on oil seal cap. Install three drilled head bolts (A) securing retainer to cap and install locking wire securing bolts.

Figure 5-165. Removing or installing crankshaft oil seal retainers.



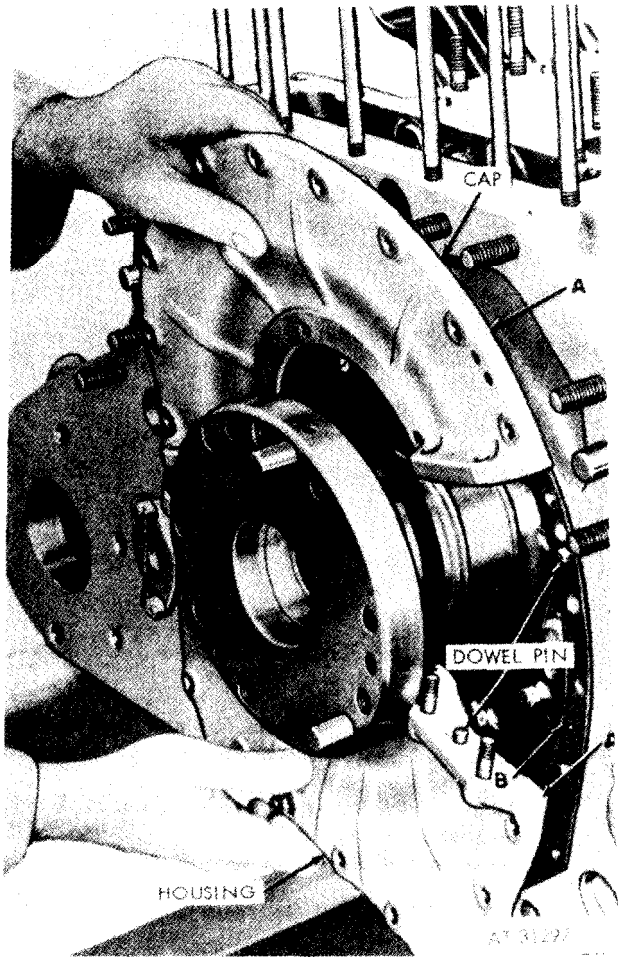
Remove

1. Cut locking wire and remove four slotted nuts (A) and flat washers attaching oil seal cap to oil seal housing.
2. Cut locking wire and remove 20 drilled head bolts (B) and flat washers attaching oil seal cap and housing to crankcase assembly.

Install

1. Install 20 drilled head bolts (B) and flat washers securing oil seal cap and housing to crankcase assembly. Install locking wire securing bolts.
2. Install four slotted nuts (A) and flat washers securing oil seal cap to oil seal housing. Install locking wire securing nuts.

Figure 5-166. Removing or installing crankshaft oil seal cap and housing attaching parts.



Rem ove

Note. Free the oil seal cap and housing from dowel pins by tapping edges of the oil seal cap and housing with a soft faced hammer.

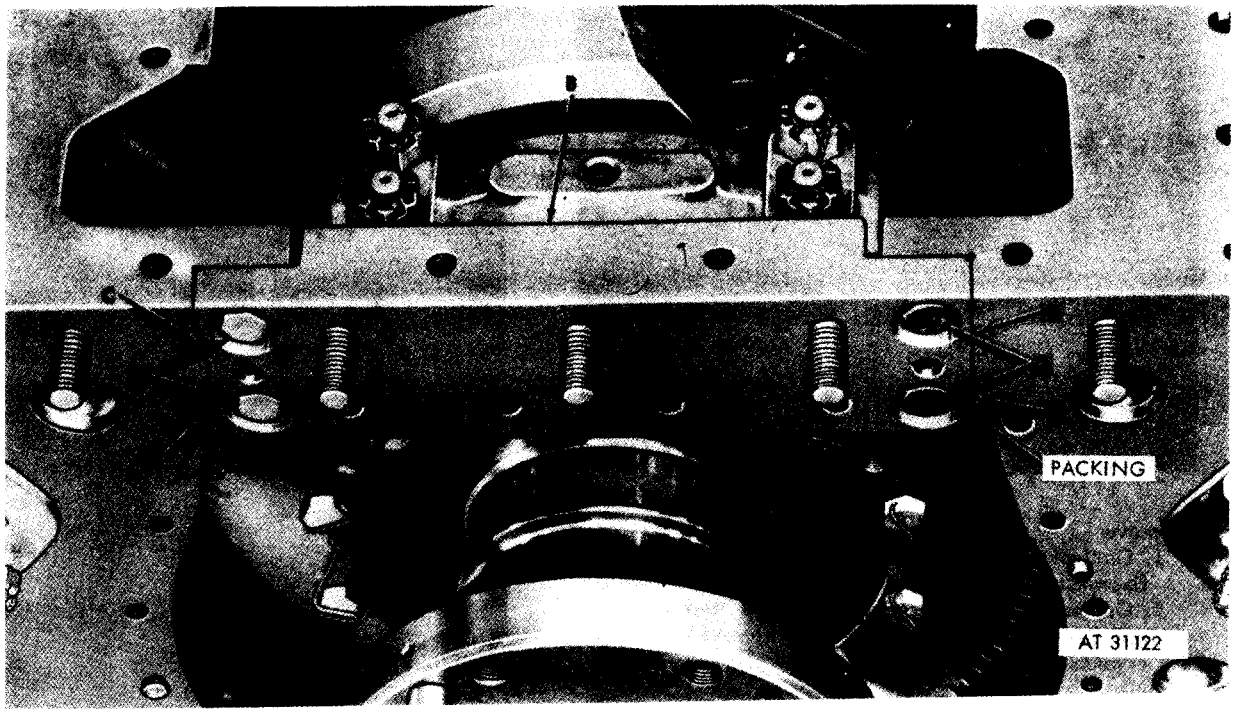
1. Separate and remove oil seal cap and housing (A).
2. Remove and discard oil seal cap and housing gasket (B).

Note. The oil seal housing is machined with the crankcase and is a mating part. Always keep oil seal housing with the crankcase it was removed from.

Install

1. Position a new oil seal cap and housing gasket (B) on crankcase assembly.
2. Position oil seal cap and housing (A) around crankshaft and on locating dowel pins in crankcase assembly and housing.

Figure 5-167. Removing or installing oil seal cap and housing.



Remove

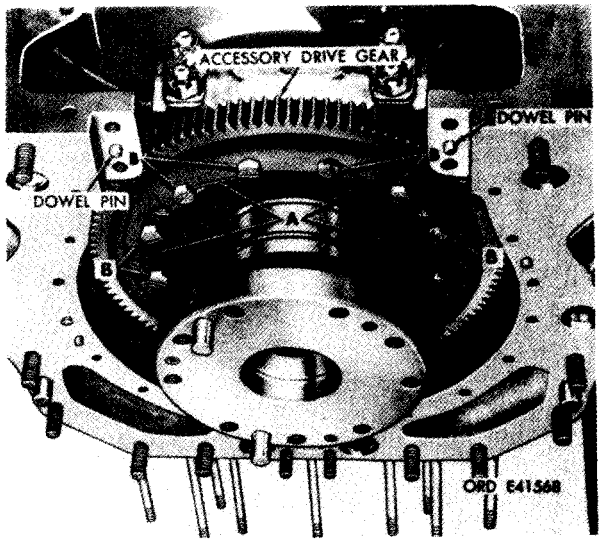
1. Remove four cap screws (A) and flat washers attaching oil seal housing support (B) to crankcase assembly.
2. Remove support from dowel pins (fig. 5-169) in crankcase.
3. Remove and discard candlewick packing (C).

Note. It may be necessary to loosen No. 7 main bearing crankcase tie rod nuts before removing support. Refer to figure 5-171.

Install

1. Position oil seal housing support (B) on dowel pins (fig. 5-169) in crankcase.
2. Install four cap screws (A) and flat washers securing support to crankcase assembly.
3. Install new candlewick packing (C).

Figure 5-168. Removing or installing oil seal housing support.



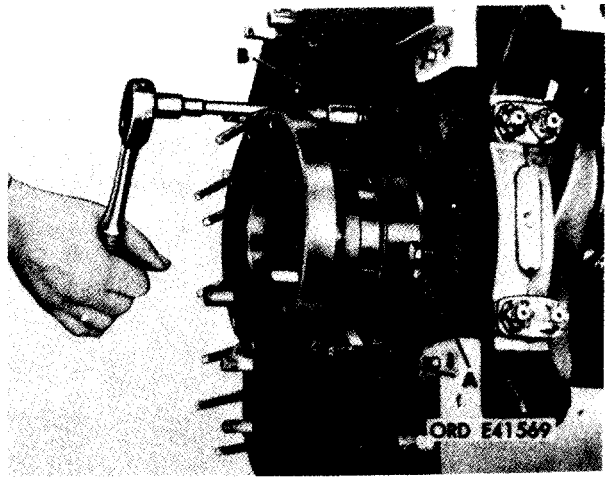
Remove

1. Cut locking wire (A).
2. Remove 12 bolts (B) attaching accessory drive gear to flange on crankshaft.

Install

1. Install 12 bolts (B) securing accessory drive gear to flange on crankshaft.
2. Install locking wire (A) securing bolts.

Figure 5-169. Removing or installing accessory drive gear attaching parts.



1. Install three 7/16 x 1-1/8 in. accessory drive gear mounting bolts (A) in tapped holes provided in accessory drive gear.
z. Alternately tighten bolts (B) and pull accesory drive gear from flange on crankshaft. Remove puller bolts from gear.

Figure 5-170. Removing accessory drive gear using mounting bolts as puller screws.

5-15. Crankshaft and Connecting Rod Assembly, Piston Oiler Nozzles, Generator and Starter Idler Gears, and Starter Driven Gearshaft

Refer to Table 5-12 for illustrations and disassembly instructions. Figure references are listed in the table.

Table 5-12. Crankshaft and Connecting Rod Assembly, Piston Oiler Nozzles, Generator and Starter Idler Gears, and Starter Driven Shaft

Component	Figure Reference
Crankshaft and Connecting Rod Assembly and Piston Oiler Nozzles	5-171 through 5-176
Generator and Starter Idler Gears and Starter Driven Gearshaft	5-177 through 5-184



Remove

Note. To avoid interference with the starter driven gearshaft (fig. 5-172), it is necessary to remove lower No. 7 main bearing crankcase tie rod from right side of crankcase.

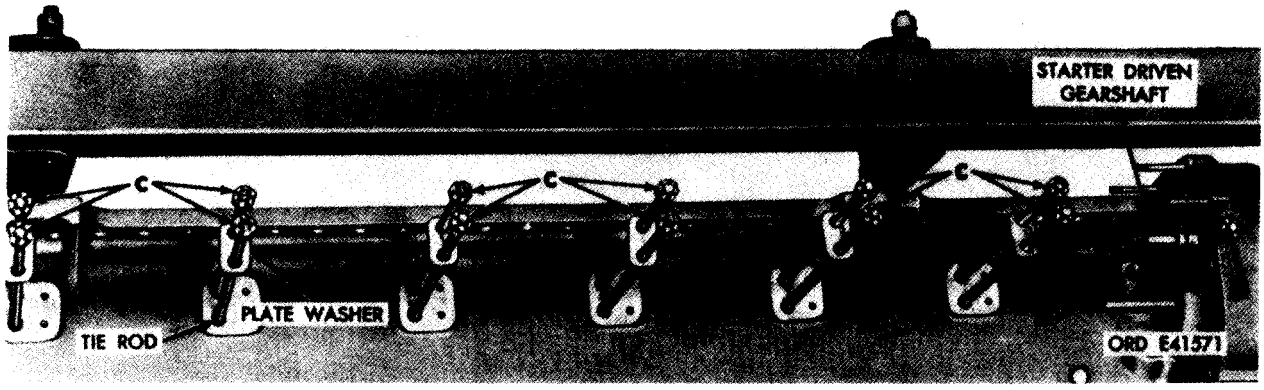
1. Remove 12 cotter pins, slotted nuts (A), and six plate washers from 12 crankcase tie rods (D). Hold tie rod nuts on opposite ends as necessary to keep rods from turning while removing the nuts.
2. Remove cotter pins and slotted nut (B) from upper tie rod.
3. Remove cotter pin and slotted nut from opposite (left) side of lower tie rod (C).
4. Using a suitable brass rod, push the 13 tie rode (D) through crankcase assembly.

Install

Note. Do not install the 14 cotter pins until tie rod nuts have been torque tightened (para 7-6c).

1. Push the 13 tie rods (D) through crankcase assembly.
2. Install slotted nut on opposite (left) side of lower tie rod (C).
3. Install slotted nut (B) on upper tie rod.
4. Install six plate washers and 12 slotted nuts (A) on 12 crankcase tie rods (D).

Figure 5-171. Removing or installing crankcase tie rod attaching parts-right front view.



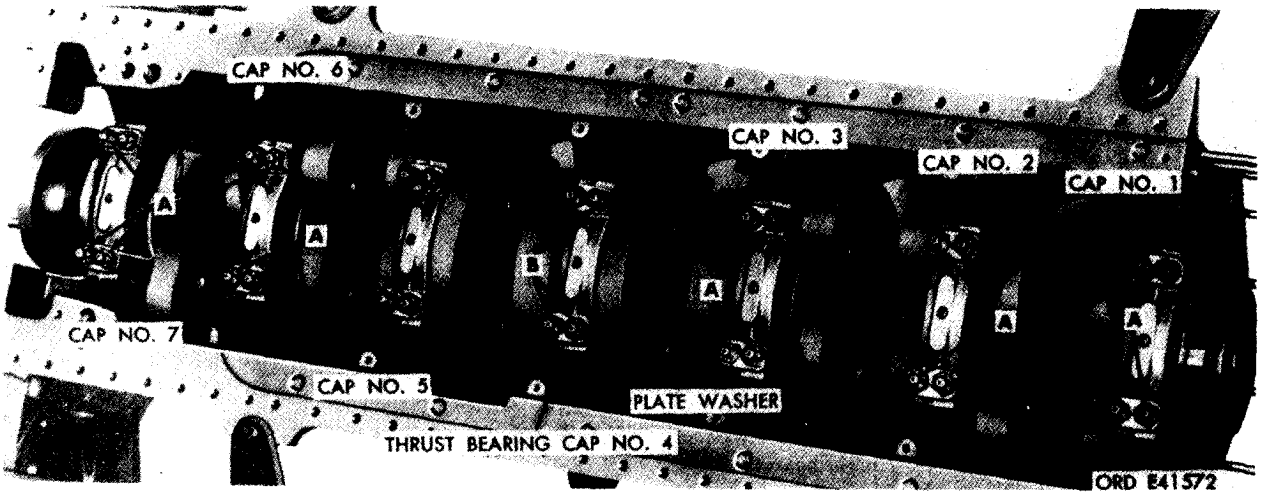
Remove

1. Remove cotter pin, slotted nut (A), and plate washer and remove upper tie rod at No. 7 main bearing, from left side of crankcase assembly.
2. Remove lower No. 7 main bearing tie rod (B) slotted nut and plate washer from opposite (right) side of crankcase and remove tie rod.
3. Remove 12 cotter pins, tie rod slotted nuts (C), and six plate washers from crankcase. Separate parts.

Install

1. Position 12 tie rods through crankcase and install six plate washers, 12 slotted nuts (C), and cotter pins.
2. Position lower No. 7 main bearing tie rod (B) through crankcase from opposite (right) side of crankcase and install plate washer, slotted nut, and cotter pin.
3. Position upper tie rod at No. 7 main bearing through crankcase and install plate washer, slotted nut (A) and cotter pins.

Figure 5-172. Removing or installing tie rods and attaching parts-left side view.



Remove

Note. The main bearing caps are marked 1 through 7 (front to rear) to identify their locations. Identifying numbers also appear on bearing web in crankcase assembly. The caps are not interchangeable with each other and must be returned to their original positions during installation.

Note. Do not use a scriber or other sharp instrument for marking bearing halves. It is recommended that a grease pencil be used for mat-king bearing halves.

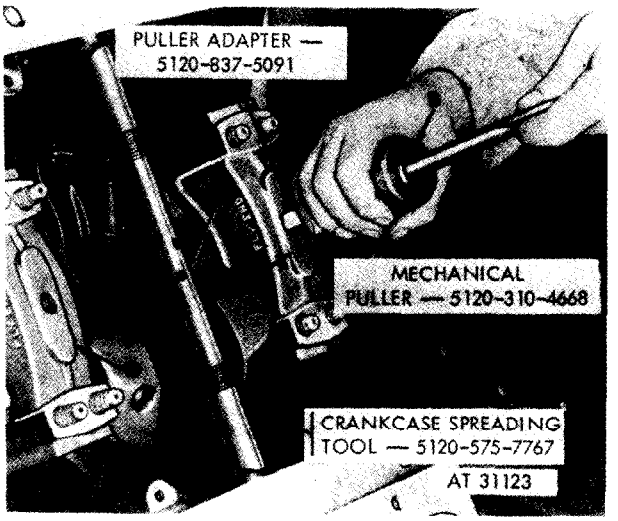
1. Cut locking wire and remove 24 slotted nuts (A) and 12 plate washers attaching main bearing caps, numbers 1, 2, 3, 5,6, and 7 to crankcase assembly.
2. Cut locking w ire and remove four slotted nuts (B) and two plate washers attaching main thrust bearing cap (No. 4 or center) to crankcase assembly.

Install

Note. Do not install locking wire until bearing cap nuts have been torque tightened (para 7-5c).

1. Apply antiseize compound (FSN 9150-663-1770) and install two plate washers and four slotted nuts (B) securing main thrust bearing cap (No. 4) to crankcase assembly.
2. Apply antiseize compound (FSN 9150-663-1770) and install 12 plate washers and 24 slotted nuts (A) securing main bearing caps, numbers 1, 2, 3, 5, 6, and 7 to crankcase assembly.

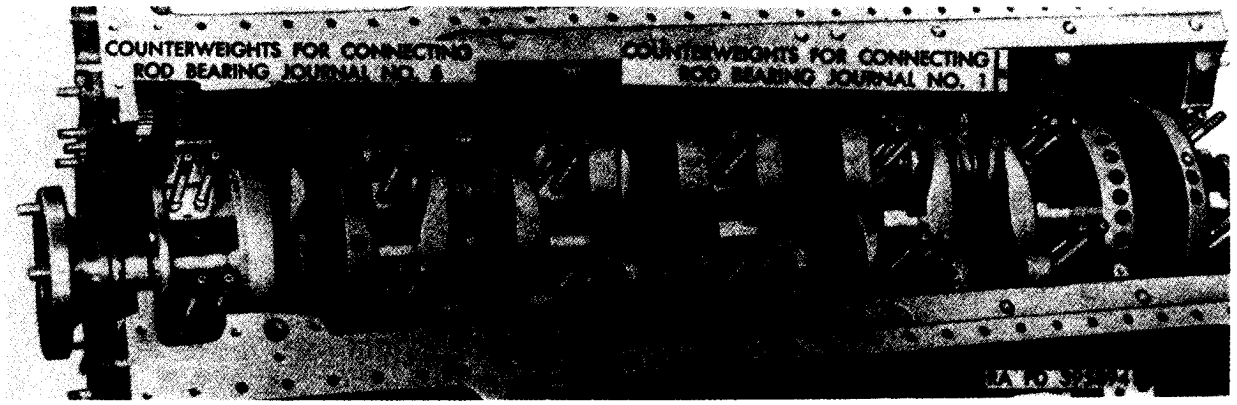
Figure 5-173. Removing or installing main bearing attaching parts.



Note. Use caution when removing main bearing cap so that lower main sleeve bearing half does not drop out accidentally. Sleeve bearing halves can be easily damaged.

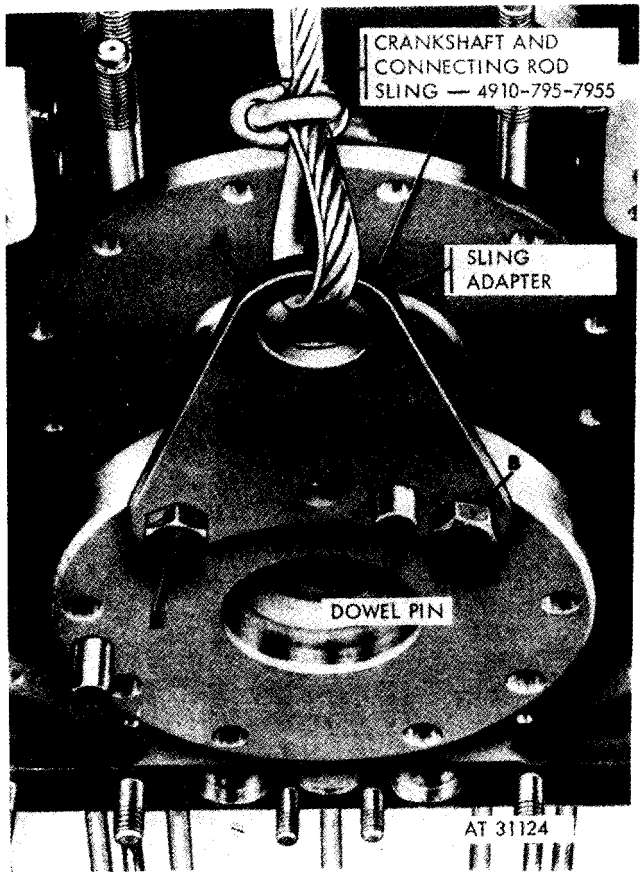
1. Install crankcase spreading tool -5120-575-1767 (A) in crankcase assembly midway between two main bearing caps. Tighten spreading tool just enough to release pressure of crankcase from ends of main bearing caps.
2. Install mechanical puller - 5120-310-4668 (B) in mechanical adapter - 5120-837-5091. Install puller adapter into threaded bole provided in No. 1 main bearing cap (C).
3. Gently tap the main bearing cap free of the crankcase using the slide hammer on puller. Remove main bearing cap and lower main sleeve bearing half and separate tbe bearing half from the cap. Mark sleeve bearing half with its respective location, using a grease pencil, for identification; e, g., " 1 cap, " "2 cap, " etc.
4. Remove remaining bearing caps (D) (Nos. 2 through 7) and tbe lower sleeve bearing halves in similar manner using puller - 5120-310-4668 and positioning the spreading tool - 5120-575-7767 between bearing caps as necessary. Remove sleeve bearings from bearing caps.

Figure 5-174. Removing main bearing cap using crankcase spreading tool-5120-575-7767, mechanical adapter-5120-837-5091, and mechanical puller-5120-310-4668.



Note. The crankshaft counterweights for connecting rod bearing journals 1R and 1L and 6R and 6L must be in the position shown. The crankshaft will then clear the sides of the crankcase when it is removed. Rotate crankshaft as necessary to obtain this position.

Figure 5-175. Crankshaft with main bearing caps removed showing correct position of crankshaft counterweights before removal or after installation of crankshaft.



Install

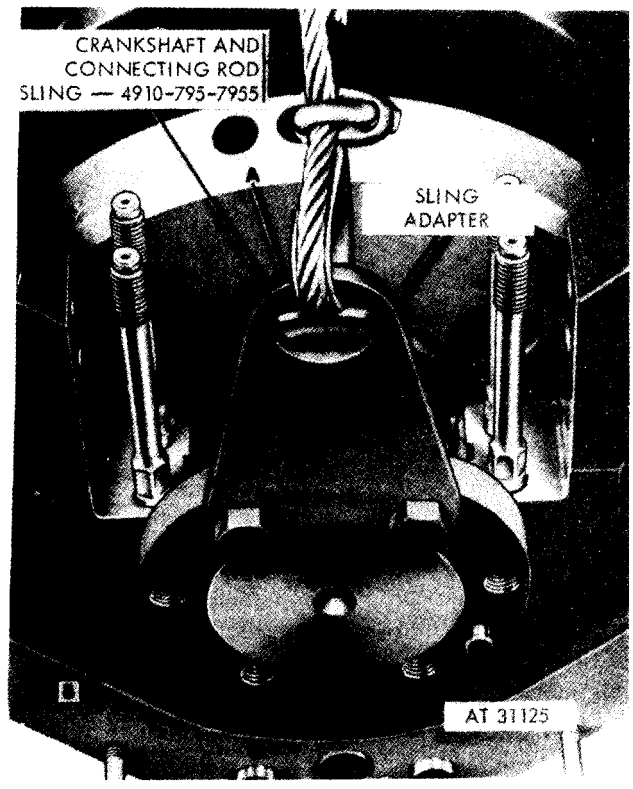
Note. The crankshaft and connecting rod sling 4910-795-7955 consists of a cable and two adapters. The adapter with the dowel pin hole attaches to the crankshaft flywheel flange. The other adapter attaches to the torsional vibration damper mounting flange.

1. Install the sling adapter (A) on flywheel flange dowel pin.
2. Secure adapter to flange with two bolts (B) used to secure flywheel.

Remove

1. Remove two f lywheel bolts (B) attaching sling adapter (A) to flywheel.
2. Remove adapter from flywheel flange dowel pin.

Figure 5-176. Installing or removing crankshaft and connecting rod sling- 4910-795-7955 at crankshaft flywheel flange.



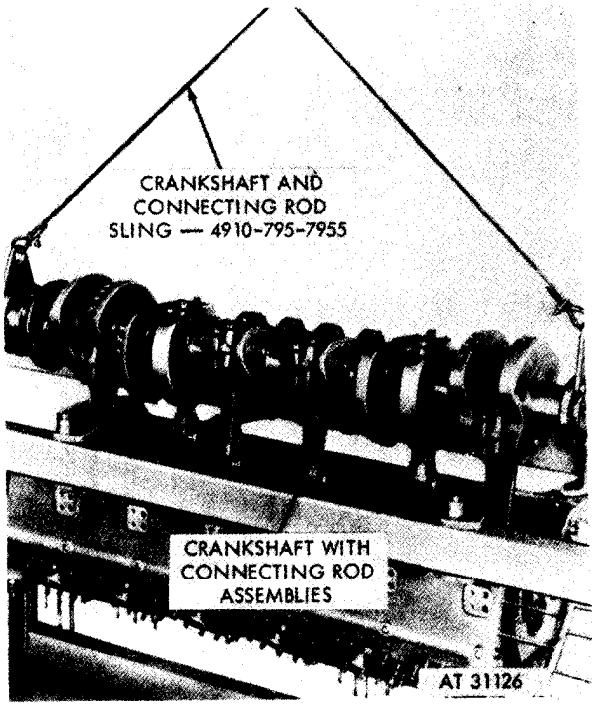
Install

1. Install the sling adapter (A) to torsional vibration damper flange (B) and secure with two vibaration damper mounting bolts.

Remove

1. Remove two vibration damper mounting bolts attaching sling adapter (A) to torsional vibration damper flange (B).

Figure 5-177. Installing or removing crank - shaft and connecting rod sling- 4910-795-7955 at crankshaft torsional vibration damper flange.



Note. Exercise care when removing or installing crankshaft assembly to prevent damage to the main bearing cap studs and crankshaft journals.

Remove

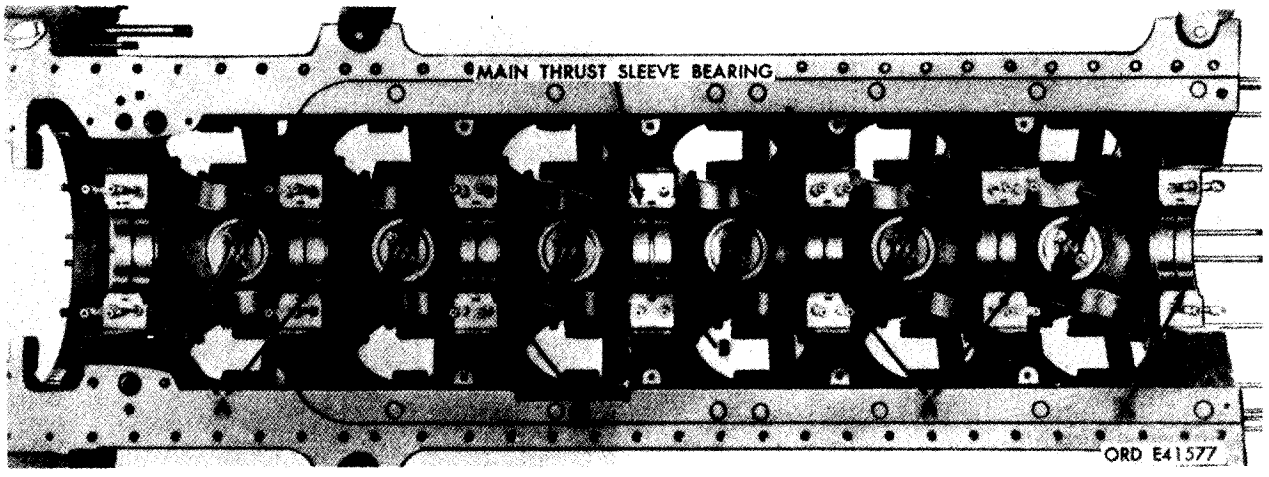
1. Remove crankshaft with connecting rod assemblies installed as shown, using a suitable hoist.
2. Place crankshaft assembly on suitable "V" blocks with crankshaft resting on bearing journals.

Install

1. Before installing crankshaft and connecting rod assemblies in crankcase, place cardboard or plastic tubes over main bearing studs for protection. If such tubes are not available, cover studs with industrial tape.
2. Install crankshaft and connecting rod assemblies in crankcase as shown using a suitable hoist. Guide the connecting rods through the cylinder mounting holes and past the connecting rod protectors.

Note. The connecting rods are installed on the crankshaft in pairs. The connecting rod of each pair toward the flywheel end (rear) serves the left bank cylinders; the connecting rod toward the front of the engine serves the right bank.

Figure 5-178. Removing or installing crankshaft and connecting rod assemblies using crankshaft and connecting rod sling-4910-795-7955.



Remove

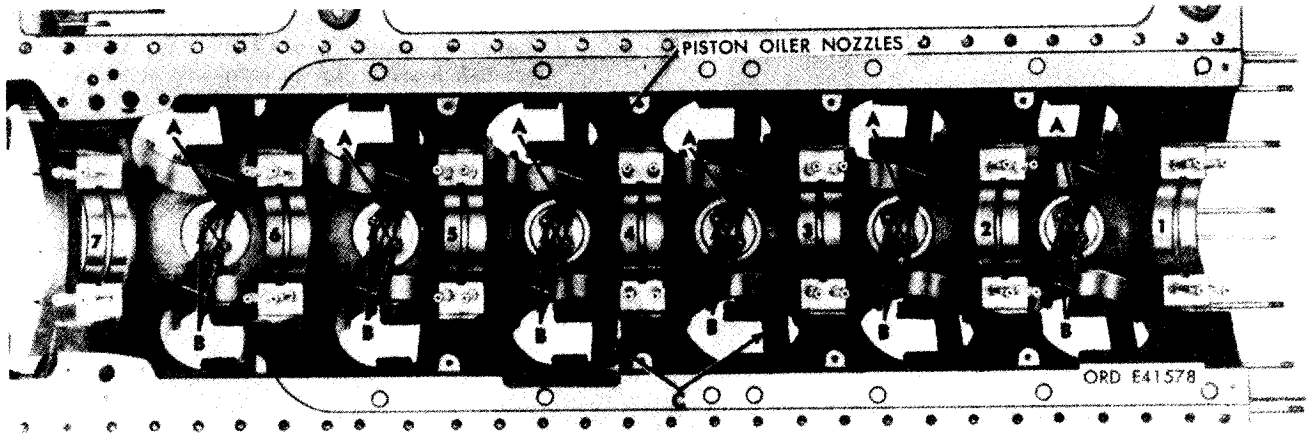
1. Remove six upper main sleeve bearing halves (A) from bearing bores in crankcase assembly. Mark respective locations of bearings on the back of bearing half using a grease pencil; e.g., "l-case", "2-case", etc.
2. Remove upper main thrust sleeve bearing half(B) and mark as "4-case" for identification.

Install

Note. Numbers 1 through 7 indicate main bearing sleeve locations beginning from the front.

1. Install upper main thrust sleeve bearing half (B) marked "4-case" in main bearing bore.
2. Install six upper main sleeve bearing halves (A) in bearing bores in accordance with respective location marks.

Figure 5-179. Removing or installing upper main sleeve bearing halves.



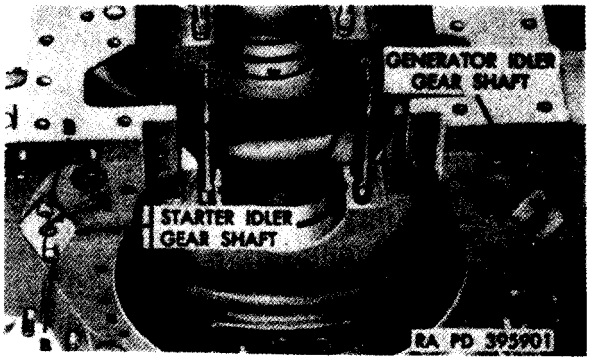
Remove

1. Cut locking wire (A). Remove 12 slotted nuts (B) and remove six piston oiler nozzle assemblies.
2. Refer to figure 5-147 and remove 12 crankcase protectors - 4910-795-7951 (C).

Install

1. Refer to figure 5-147 and install 12 crankcase protectors - 4910-795-7951 (C).
2. Position six piston oiler nozzle assemblies in crankcase and install 12 slotted nuts (B) securing nozzle assemblies to crankcase. Install locking wire (A) securing slotted nuts (B).

Figure 5-180. Removing or installing piston oiler nozzle assemblies.



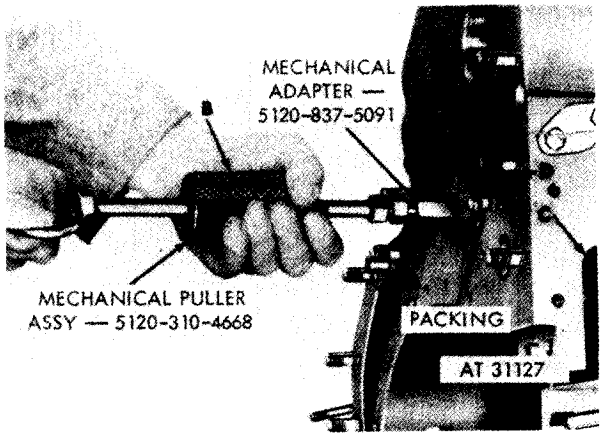
Remove

1. Cut locking wires (A).
2. Remove two slotted nuts (B) attaching starter idler gear shaft to crankcase.
3. Remove two slotted nuts (C) attaching generator idler gearshaft to crankcase.

Install

1. Install two slotted nuts (C) securing generator idler gearshaft to crankcase.
2. Install two slotted nuts (B) securing starter idler gearshaft to crankcase.
3. Install locking wire (A) securing slotted nuts.

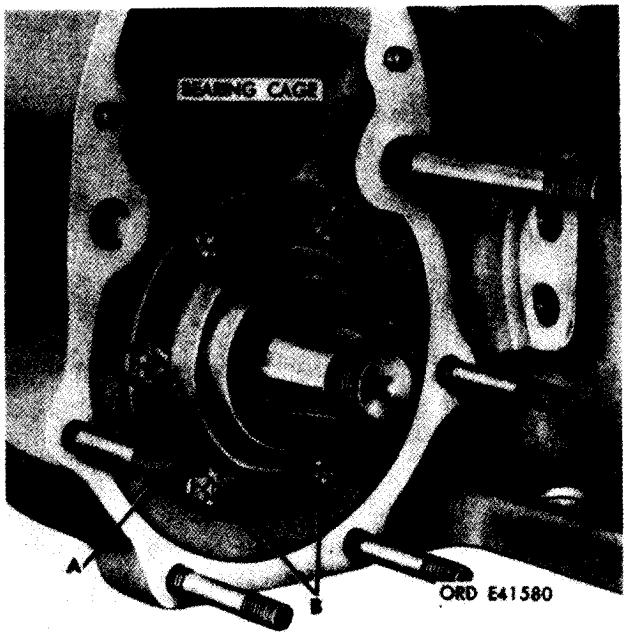
Figure 5-181. Removing or installing starter and generator idler gearshaft flange nuts.



1. Install mechanical adapter - 5120-837-5091 (A) into tapped hole provided in end of starter idler gearshaft.
2. Install mechanical puller - 5120-310-4668 (B) into adapter. Slide hammer on puller against handle to pull starter idler gearshaft from crankcase assembly.
3. Support starter idler gear (C) with wooden block while removing gearshaft and then remove idler gear.
4. Remove and discard preformed packing (D).

Note. The generator idler gearshaft and idler gear are removed in the same manner as instructed for starter idler gearshaft and idler gear.

Figure 5-182. Removing starter and/or generator idler gearshaft.



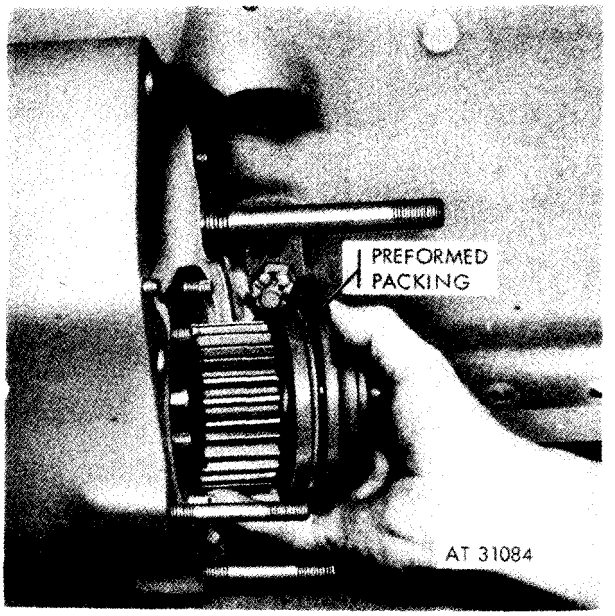
Remove

1. Cut locking wire (A).
2. Remove six slotted nuts (B) attaching starter driven gearshaft bearing cage to crankcase assembly. Install two 5 / 16-24 jack screws in holes provided in cage. Alternately tighten jack screws until cage separates from crankcase.

Install

1. Install six slotted nuts (B) securing starter driven gearshaft bearing cage to crankcase assembly.
2. Install locking wire (A) securing slotted nuts.

Figure 5-183. Removing or installing starter driven gearshaft bearing cage attaching parts.



Remove

1. Remove starter driven gearshaft bearing cage from crankcase assembly.
2. Remove and discard preformed packing.

Install

1. Install new preformed packing in starter driven gearshaft bearing cage.
2. Position bearing cage in crankcase assembly.

Figure 5-184. Removing or installing starter gearshaft bearing cage.

CHAPTER 6
OVERHAUL OF ENGINE COMPONENTS

Section I. GENERAL CLEANING, INSPECTION, REPAIR, AND ASSEMBLY PROCEDURES

6-1. General

a. Procedures. The procedures for cleaning, inspection, repair and assembly of the various parts and components which make up the engine subassemblies will be the same for a great percentage of parts and components. To avoid repetition, the general procedures are detailed in paragraphs 6-2 through 6-6 and will be referenced throughout this chapter. Any cleaning, inspection, repair, and assembly procedures which are peculiar to a specific part or component will be covered in the section or paragraph relating to that item. Aluminum castings must be realodized or coated in accordance with MIL-C-5541A whenever coating is marred.

b. Tables will be used to list the various operations and components involved in the overhaul of engine sub-assemblies. Paragraph and / or figure references for disassembly, cleaning, inspection, repair, and assembly procedures will be listed in these tables under their appropriate heading.

c. The Repair Parts section of the manual. Appendix B, will be used to identify parts and to locate points of measurement for overhaul limits.

6-2. Cleaning Instructions

a. General. The importance of cleaning must be thoroughly understood by maintenance personnel. Great care and conscientious effort are required in all cleaning operations. The presence of dirt or foreign material is a constant threat to satisfactory engine operation and maintenance. A dirty operation can result in cylinder scuffing or scratching, high oil consumption, bearing destruction, and a variety of component failures directly attributed to the entrance of dirt. Maintain rigid cleaning standards during all phases of the cleaning operation. The following general instructions apply to all cleaning operations.

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

(2) Hands should be kept free of any accumulation of grease, which can collect dust and grit.

(3) After cleaning, all parts should be covered or wrapped to protect them from dirt and dust accumulation.

b. Castings.

(1) Remove sludge and gum deposits using a stiff brush.

(2) Clean all surfaces with dry-cleaning solvent or mineral spirits paint thinner. Repeat operation if surface is not free of scale or adhering material which might be dislodged later.

(3) Blow out all tapped holes with compressed air.

(4) After cleaning, dry casting with compressed air.

Warning: Particles blown by compressed air are hazardous. Make certain air stream is directed away from user and that other persons are not exposed. Protect eyes and face with appropriate shields.

c. Oil Passages. Particular attention must be given to all oil passages in machined parts. All oil passages must be free of obstructions.

(1) Clean passages with wire or probes to break up all sludge or gum deposits.

(2) Wash passages by flushing with dry-cleaning solvent or mineral spirits paint thinner. Be sure passages are free from obstructions and clear any particles which might later become dislodged and contaminate the oil system.

(3) After cleaning, dry passages with compressed air.

d. Electrical Cables and Flexible Hoses. Clean cables and flexible hoses with soap and water.

Note. Do not allow dry-cleaning solvent or mineral spirits pain thinner to be in prolonged contact with the rubber components and flexible hoses. These cleaners cause leather, rubber, and synthetic materials to dry, rot, and lose pliability, making them unserviceable.

e. Ball and Needle Bearings.

(1) Bearings require special attention in cleaning and oiling. After removing the surface dirt, oil, or grease, the bearings, except the sealed, permanently lubricated type, should be placed in hot oil (about 150°F.) to loosen congealed oil and grease. After cleaning, the bearings should be coated with a film of lubricant and wrapped tightly in oiled or waxed paper until inspection and assembly.

Note. Do not immerse sealed type ball bearings in dry-cleaning solvent, mineral spirits paint thinner, or hot oil. Entrance of cleaning agent will destroy lubricants sealed in bearing at time of manufacture. Loss of lubricant will result in premature failure of bearing and possible severe damage to the engine.

(2) Clean sealed ball bearings by wiping the exterior surfaces with a clean cloth moistened in dry-cleaning solvent. Compressed air must never be used in cleaning or drying of ball or needle bearings. Damage to bearings will result from spinning of bearing by air blast.

(3) Refer to TM 9-214 for information on inspection, care, and maintenance of bearings.

f. Painted Parts. The reconditioning of painted parts should be a matter of good judgment. Parts that appear to be in good condition after cleaning, need not be stripped and repainted in their entirety, but should be cleaned and designated for touch-up only. Parts that are rusted, or otherwise devoid of paint, must be stripped to bare metal. Rubber composition shroud seals must be removed and discarded before the parts can be stripped of paint.

6-3. Inspection

a. General. The engines are precision built, and the overhaul standards tables listed in this chapter have been fixed at extremely close limits. The following general instructions apply to all inspection procedures.

(1) Use modern methods and equipment such as magnaflux, zyglo and ultrasonic inspection for inspecting component parts where cracks and other damage cannot be detected visually.

(2) Extreme care must be exercised in all phases of inspection. Inspect components following instructions in paragraph b.

(3) Inspect finish of all parts. Mark all parts that require refinishing.

b. Overhaul Standards. To identify parts, the Overhaul Standards Tables of this chapter refer to the exploded views in the repair parts section (Appendix B). Key letters are used on the exploded views to locate points of measurement for overhaul limits. Each table contains the maximum, minimum, and key clearances of new or overhaul parts. The clearances, listed mainly for reference, will automatically be achieved if the mating parts are within the dimensional tolerances listed in the tables. In some cases, a part that is out of dimensional tolerance may be used, providing the mating part has been carefully selected and, when mated, is within the maximum clearance limits specified in the wear limits column of the tables. The wear limits indicate the point at which parts may be worn before replacement, in order to assure maximum service and minimum replacement. Normally all parts which have not worn beyond dimensions shown in the "Wear limits" columns or are damaged from corrosion, will be approved for service.

(1) Symbols employed in the Overhaul Standards Tables are identified as follows:

*-An asterisk in the "Wear limits" column indicates that part must be replaced when worn beyond the limits given in the "Sizes and fits of new parts" column.

L-The letter "L", following the tolerance dimensions given in the "Sizes and fits of new parts" column and the "Wear limits" column, indicates a loose fit (clearance).

T-The letter "T", following the tolerance dimensions given in the "Sizes and fits of new parts" column and the "Wear limits" column, indicates a tight fit (interference).

(2) The following is a check list of parts to be magnetic-particle or flourescent-penetrant inspected:

A. *MAGNETIC-PARTICLE INSPECTION CHECK LIST*

Army Part No.	Nomenclature	Qty Req'd	Fig. No.	Item No.
7320430	SHAFT, SHOULDERED: camshaft drive	2	B-5	7
7320464	GEARSHAFT, SPUR: injection pump driven	1	B-26	11
7320478	GEARSHAFT, BEVEL: fan drive	1	B-26	50.1
7320496	PIN, PISTON:	12	B-4	10.2
7341633	BOLT, MACHINE: advance unit (early)	6	B-27	7
8682553	GEARSHAFT, BEVEL: fan drive	1	B-26	74.2
8682684	GEARSHAFT, BEVEL: fan drive driven	2	B-26	50.2
			B-26	74.1
8682689	GEAR, SPUR: generator driven drive idler	1	B-14	34
8682691	GEAR, SPUR: starter drive	1	B-14	15
8682729	GEARSHAFT, SPUR: advance unit	1	B-27	13
8682814	GEARSHAFT, SPUR: generator drive	1	B-14	31
8682817	COVER, CAMSHAFT: oil retaining	2	B-5	21
8682820	GEAR, SPUR: transmission accessory drive	1	B-3	10
8724976	ROD, CONNECTING, ENGINE:	12	B-4	6
8724977	CAP: connecting rod	12	B-4	4
8724978	NUT, EXTENDED WASHER: connecting rod	24	B-4	3
8724979	BOLT, EXTERNALLY RELIEVED: connecting rod	24	B-4	7
8725084	CRANKSHAFT: engine	1	B-3	16
8725087	GEAR, CLUSTER SPUR:	1	B-9	50
8725119	IMPELLER: oil pump	1	B-9	20
8725120	IMPELLER: oil pump	1	B-9	24
8725121	IMPELLER: oil pump	1	B-9	25
8725130	IMPELLER: oil pump	1	B-9	46
8725134	IMPELLER: oil pump	1	B-9	45
8725225	GEAR, BEVEL: camshaft drive	2	B-5	16.2
8725226	SUPPORT, BEARING FAN:	1	B-26	84
8725227	SUPPORT, FAN DRIVE SHAFTGEAR:	2	B-26	53
8725229	GEARSHAFT, BEVEL: camshaft drive	2	B-5	16.1
8725233	SUPPORT, FAN DRIVE:	1	B-26	39
8725243	CLAMP HUB: support injection advance drive	1	B-26	48
8725248	GEARSHAFT, BEVEL, SPUR: advance unit	1	B-27	4
8725254	ROD, ENGINE, CRANKCASE: thru bolts	14	B-2	79
8761020	SHAFT, STRAIGHT: fan drive	1	B-26	54
8761022	CAGE, BEARING ENGINE: starter driven bearing	1	B-14	12
8761279	NUT, SLOTTED, HEXAGON: thru and main	56	B-2	77
8761280	CAMSHAFT, ENGINE:	1	B-5	41
8761281	CAMSHAFT: engine	1	B-5	42
8761287	SHAFT, FAN DRIVE: (fly end)	1	B-26	49
8761440	SHAFT, IDLER GEAR: generator driven drive gear	1	B-14	32
10865184	BOLT, MACHINE: crankpin plugs	6	B-3	24
10865383	GEARSHAFT, BEVEL: accessory cam drive bevel	1	B-26	99
10882610	PLATE, CRANKSHAFT DAMPER: fuel pump coupling	1	B-3	4
10882613	GEAR, SPUR: fuel pump drive	1	B-3	5
10898746	BOLT, MACHINE: advance unit (late)	6	B-27	12
10898777	GEAR, SPUR: starter driven drive idler	1	B-14	33
10898778	GEAR, SPUR: accessory drive	1	B-3	8
10898779	GEARSHAFT, SPUR: starter driven	1	B-14	10
10898875	SHAFT: oil pump drive gear	1	B-9	51
10898888	SHAFT: oil pump	1	B-9	21
10898915	SHAFT, IDLER GEAR: starter driven drive idler	1	B-14	7
10898962	GEAR, SPUR: oil pump	1	B-9	42

B. *FLOURESCENT-PENETRANT INSPECTION CHECK LIST:*

8761242	FAN ASSY, ENGINE:	2	B-25	18

c. *Castings.*

(1) Inspect all ferrous (cast iron, steel, etc.) castings for cracks with magnetic-particle inspection equipment. Inspect all nonferrous (aluminum castings) for cracks using flourescent-penetrant inspection equipment. Suspected cracks in the nonferrous casting can also be inspected with a spot check dye penetrate or a magnifying glass (five power magnification minimum) and a strong light or a dye check method. Check particularly the areas adjacent to studs, pipe plugs, or threaded inserts and in sharp corners and fillets.

(2) Inspect machined surfaces of castings for nicks, burs, or raised metal. Mark damaged areas for repair.

(3) Check all mating flanges and mounting pads with a straight edge or surface plate for warpage. Inspect mating flanges and mounting pads for discoloration which may indicate persistent oil leakage.

(4) Inspect all tapped openings for stripped or damaged threads.

(5) Check all castings for conformance to the applicable repair and rebuild standards.

d. Ball and Needle Bearings. Refer to TM 9-214 for inspection of anti friction bearings. Check all bearings for conformance to the applicable overhaul standards.

e. Studs. Inspect all studs for damaged or stripped threads, bent or loose condition, or for any signs of stretching.

f. Dowel Pins. Inspect dowel pins for looseness or damage. Mark loose pins for repair.

g. *Gears and Shafts.*

Note. There are no established wear limits for gear teeth and splines. Good judgment is required to determine need for replacement.

(1) Inspect all gears and shafts for cracks using magnaflux equipment. When magnaflux equipment is not available, use a magnifying glass (five power magnification minimum) and a strong light.

(2) Inspect all gear teeth and splines for wear, sharp fins, burs, and galled or pitted surfaces.

(3) Inspect shaft and gear hub splines for damage, wear, and for fit with splines on mating parts. Mating splines must match without binding or looseness.

(4) Check all gears and shafts for conformance to the applicable overhaul standards.

h. Bushings, Liners, and Bushing-type Bearings.

(1) Check all bushings, liners, and bushing-type bearings for secure fit in their respective casting or mating part, and for evidence of heating, which may be indicated by discoloration of bushing or bearing surface.

(2) Inspect for wear, burs, nicks or out-of-round condition.

(3) Check for dirt in lubrication holes or grooves. Holes and grooves must be clean and free from damage to insure proper lubrication.

(4) Inspect thrust faces of bushing-type bearings for wear and by temporarily assembling mating parts and checking end play with a feeler gage inserted between the thrust faces.

(5) Check for conformance to the applicable overhaul standards.

i. Oil Seals. All oil seals must be replaced at engine overhaul. Generally, metal encased oil seals are long-life parts and do not have to be replaced during field repair if inspection indicates seals are in good condition.

(1) Inspect for damage to the thin feather edge of oil seal which contacts rotating part.

(2) Inspect sealing feather edge for softness and pliability.

(3) Replace damaged or questionable seals during field engine repair.

j. Helical-coil and Screw Thread Inserts.

(1) *Description.* To permit higher stresses on studs and bolts which are set in aluminum castings, it is common practice to install insets of a stronger metal into which the studs or bolts are threaded. Helical-coil and screw thread inserts are designed to perform this function. The inserts are spiral steel coils having a right hand thread-shaped form on the inside and on the outside of the coils. A bar or tang at the bottom end of the coil, which is engaged by an inserting tool, is used for threading the insert into the casting. Some inserts have a serrated tooth section at the top end of the coil to stake them in place in the castings. Other inserts have turns at the center of the coil in the form of a hexagon. This provides a locking effect when the stud or bolt is threaded into the insert.

(2) *Inspection.* Inspect all helical-coil and screw thread inserts for secure fit in the casting and for galled or stripped threads.

k. Painted Parts. Straighten parts as

necessary and check for broken welds, loose rivets or weld nuts. If parts are cracked or torn, they must be repaired or replaced. Check shroud seals for hardness, tears, or other damage. Mark damaged seals for replacement if the part is otherwise serviceable.

6-4. Repair

a. General. Most engine parts and components may be repaired as outlined below. After repair, clean all parts thoroughly to prevent metal chips from repair operations, or abrasives used in repair operations, from entering working parts of the engine.

b. General Repair of Castings.

(1) Replace all castings when cracks have penetrated high stress areas such as fillets or webbing.

(2) Replace all castings which do not conform to tolerances specified in the appropriate repair and rebuild standards table.

(3) Replace all castings on which machined surfaces are burred or nicked to the point of impairing subsequent assembly or operation. Repair minor damage to machined surfaces with a fine mill file or crocus cloth dipped in dry-cleaning solvent or mineral spirits paint thinner.

(4) Replace all castings having flanges which are severely warped and cannot be repaired to provide a proper seating surface with its mating part. Repair minor warpage of mounting flanges and mounting pads by working surface across a sheet of crocus cloth held tightly on a surface plate or similar flat surface.

(5) Repair damaged pipe threads in tapped holes with a used tap.

Note. Pipe plug threads in castings must be in good condition to prevent oil leakage.

c. *Welding of Aluminum Alloy Castings.*

Note. The following procedures (1) through (7) are based on the applicable paragraphs in Specification MIL-W-8604 and MIL-W-45205, and outline the requirements, equipment, and welding process used for the repair of aluminum alloy castings. Specific information relating to the welding of individual castings will be covered in the appropriate section of this chapter.

(1) *Operator.* Welding shall be performed by welding operators who have successfully met the requirements of Specification MIL-T-5021, for Material Group IV (Aluminum Alloys). Operational: TM 9-237 (Nov. 1967). The base material covered in this procedure is Type 355-T71 Federal Specification QQ-A-601.

(2) *Equipment.* An alternating current arc welding machine shall be used for heliarc welding. Class 4043, conforming to Specification QQ-R-566a or MIL-E-16053 welding rod, is compatible with the base material and shall be used for all welding repairs in this material group. All equipment shall be consistent with good standard welding practices, and be acceptable to the Government Inspector.

(3) *Processes.*

(a) *MIG (Metal Inert Gas) process.* The MIG process is recommended when welding aluminum plate greater than 1/8 inch thickness.

(b) *TIG (Tungsten Inert Gas) process.* When welding aluminum plate 1/8 inch thick and under, the TIG process is recommended.

(4) *Casting preparation.*

(a) *Cleaning.* All foreign material must be removed from the area to be welded prior to repair operations. The area shall be cleaned using a stainless steel wire brush, drill, burring tool, or approved chemical process, whichever is applicable.

(b) *Cracks.* Determine flow of cracks by using dye check method. Drill stop holes at crack ends with a 1 / 4-inch drill and mill out cracks to provide a "V" aperture.

(c) *Fractures.* Check area around the fracture for cracks using dye check. Drill stop holes at the ends of detected cracks with a 1/4-inch drill and mill out crack to provide a "V" aperture.

(d) *Missing metal.* If the size of the damaged area permits, mill out and chamfer that area to 30 degrees to provide a 60 degree included angle. The insert piece required for this area must be identical in composition and may be cut from scrapped castings or suitable sheet stock. Fit insert piece into milled area, so that 1/6- to 1/8-inch is maintained between insert and casting wall.

(5) *Preparation for welding.* Precisely measure castings at appropriate locations to detect dimensional changes caused by welding repair. Record dimensions for checking after repair has been made to be sure that critical dimensions have been held.

(6) *Preheat prior to welding.* Preheat

castings as outlined in Specifications QQ-A-601 and MIL-W-8604. Preheat slowly in an oven or by other suitable method for two hours to approximately 350 degrees ± 35 degrees F. Control preheat process to avoid incipient melting, excessive grain growth or other undesirable structural changes which might reduce the mechanical properties.

Caution: Do not attempt to preheat by using welding torch.

(7) *Welding.*

(a) *Cracks.* The inert gas shielded arc welding process shall be used when making repairs on aluminum alloy. After casting has reached the prescribed preheat temperature, position the casting into the most advantageous welding position. Cover casting with asbestos blankets, except for area to be welded. Weld the outside milled groove with a good root weld. Apply fillet welds until groove is closed. Rotate casting and weld inside groove in the same manner if double "V" is used. Remove asbestos blankets and allow castings to cool progressively to room Temperature.

(b) *Fracture and missing metal.* Following the procedure outlined in (a), above, place insert piece in opening, aline and secure with clamps or tack weld in three or four places with one inch welds. Place a good root weld in groove and apply fillet welds until groove is closed. Rotate casting and weld inside groove in the same manner.

Note. The temperature of the casting surrounding the welded area should not exceed 395 degrees. If necessary, stop welding, cover casting with asbestos blanket and allow to cool to a satisfactory temperature then resume welding.

(8) *Final inspection and clean up.* Repaired cracks and areas where metal has been replaced must be radiographically inspected and be equal to or better than reference standard 3, TACOM STD 113, Apr 69 (available from USTACOM AMSTA-R). All other areas shall be inspected by dye penetrant. Defects must be re-welded in accordance with above methods. Measure casting and compare dimensions taken before repair. Dimensional change will not exceed that as specified on applicable engineering drawing, except as noted. Check machined surfaces for warpage or other dimensional changes. Clean seams with a wire brush and remove weld beads and all sharp edges. X-ray entire repaired area. Remove excess flux with suitable material, rinse with clean water, dry and alodize. Pressure test oil passages that have been repaired to 90 psi hydrostatic pressure using engine oil (OE).

d. Ball and Needle Bearings.

(1) Replace all galled, pitted, or damaged bearings.

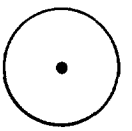
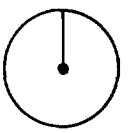
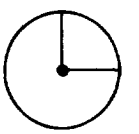
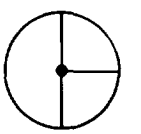
(2) Replace all bearings which do not conform to tolerances specified in the appropriate repair and rebuild standards table.

(3) Refer to TM 9-214 for information on inspection, care, and maintenance of anti-friction bearings.

e. Studs. Replace all bent or loose studs or studs showing evidence of stretching. Repair minor damage with a thread chaser. Replace all studs having stripped or damaged threads. Remove and replace studs as outlined in (1) and (2), below.

(1) *Stud identification.* Stud identification tables appear in the overhaul sections of this chapter. Each table contains the appropriate inform ation regarding stud setting heights, oversize studs, number required and reference figures of stud identification and location.

(2) *Removal. Using* stud extractor, back studs out slowly to avoid heating and possible seizure. When studs are broken off too short to use stud extractor, drill stud and extract with a suitable remover. Short studs may also be removed by welding a piece of bar stock or a nut to stud and removing with a wrench.

STUD	STANDARD	0.003 OVERSIZE	0.007 OVERSIZE	0.012 OVERSIZE
COLOR CODE	NONE	RED	BLUE	GREEN
MARK				

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Figure 6-1. Standard and oversize stud identification.

(3) Replacement.

(a) When threads in tapped holes appear to be in good condition, clean threads with a tap.

(b) When threads are stripped or damaged, or when stud was removed from an aluminum casting for loose fit, always replace stud with next larger oversize or in cases of complete thread pullout, drill out threaded holes, tap hole for thread insert, install insert and standard stud for repair. Markings and color code indicates whether stud is standard or oversize. Check marking and color code as shown in figure 6-1 to be sure replacement is of proper size.

Note. When the threads on each end of the stud are a different size, the coarse thread end must enter the aluminum casting.

(c) Studs available for replacement as shown in figure 6-1 are marked on the coarse thread end of stud.

(d) Apply a small amount of mica-base antiseize compound, Military Specification MIL-T-22361, to threads before installing stud.

(e) Drive stud into tapped hole slowly to prevent heating. Drive to setting height given in appropriate table.

(f) When tapped holes in castings cannot be fitted with oversize studs, the holes in the castings can be fitted with helical-coil inserts (par. 6-5) and studs of the original size can then be installed.

f. Dowel Pins. Replace loose dowel pins. If original dowel pin was only slightly loose, install new pin using sealing compound, Specification MIL-S-22473. In cases where the dowel pin hole is grossly out-of-round, it will be necessary to drill the hole oversize, fashion a bushing, and install a new pin in the bushing.

g. Painted Parts. Retouch or paint parts as necessary to produce an acceptable part. Retouch or repaint parts in their original color in accordance with instructions contained in TM 9-213.

h. Gears and Shafts.

(1) Replace all cracked gears and shafts, and shafts that are bent or twisted.

(2) Replace all gears and shafts which do not conform to tolerances specified in the overhaul standards tables.

(3) Replace all gears and shafts having worn, galled, nicked, burred, or pitted teeth and splines. Remove any sharp fins and burs from splines with crocus cloth dipped in dry-cleaning solvent or mineral spirits paint thinner.

(4) Replace all splined gears and shafts that are damaged to the point of impairing assembly or operation. Replace all gears and shafts having splines which do not match properly with mating splines.

i. Bushings, Liners, and Bushing-type Bearings. When bushings, litters, and bushing-type bearings are damaged or worn beyond specified limits, generally the associated parts with which they are used must be replaced. Reference to (1) and (2), below, will be made in the rebuild section for the particular part when replacement of bushings, liners, and bushing-type bearings is required.

(1) *Removal. Drill* out bearing retaining pins when used to secure bearings in castings or retaining cages when applicable.

(2) Installation.

(a) Aline bushing, liner, or bushing-type bearing in casting or retaining cage. Press into place with a suitable pressing arbor.

(b) Select proper drill size for installation of bearing retaining pins. Drill through bearing and into casting or retaining cage to the proper depth so that the pin will be flush with the bearing surface after installation. Drive retaining pin through bearing and into casting or retaining cage. Cut off any portion of pin that extends above bearing.

(c) Ream or burnish bushing liner, or bushing-type bearing to size specified in appropriate overhaul standards table.

(d) Clean repaired parts thoroughly before assembly or installation.

j. Oil Seals. Replace all oil seals at engine overhaul. During field repair, replace oil seal when thin feather edge is damaged or when seal has become hard or brittle.

(1) Removal. Press or pry damaged oil seal from casting or adapter, being careful not to damage bore in casting or adapter.

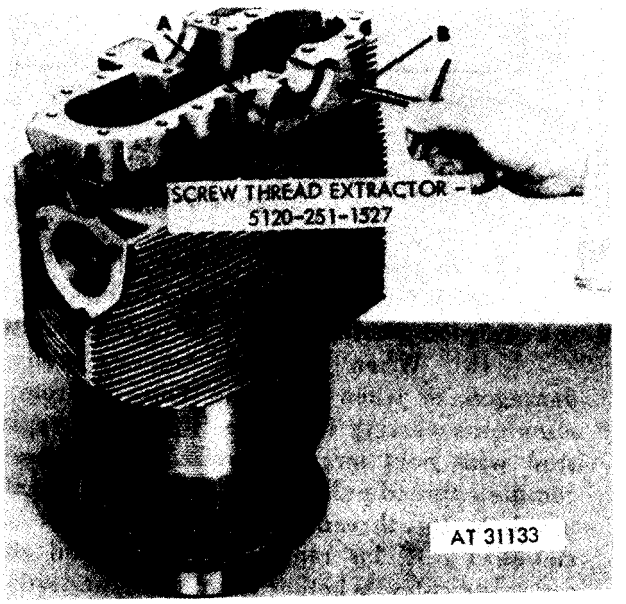
(2) *Repair.* When oil seal bore in casting or adapter is burred or damaged to a point where an oil-tight seal is impossible, repair or replace casting or adapter. Remove slight nicks, burs, and scratches from oil seal bore in casting or adapter with crocus cloth dipped in dry-cleaning solvent or mineral spirits paint thinner.

(3) Installation. Install new oil seal in bore of casting or adapter.

6-5. Replacement of Helical-Coil and Threaded Inserts

a. General. Replace all helical-coil and screw thread inserts which do not fit securely in the casting or when casting threads have become galled or stripped.

b. Replacement. Replace all unserviceable helical-coil and screw thread inserts in the same manner, following instructions which accompany figures 6-2 and 6-3. For instructional purposes helical-coil inserts in the cylinder assembly will be replaced.



1. Use a diamond-shaped punch is the insert (A) is the serrated-teeth type to drive staked, serrated-teeth section of insert from the thread in cylinder casting.
2. Install screw thread extractor - 5120-251-1527 into insert. Remove insert by applying constant pressure while turning extractor (B) counterclockwise until insert is removed.

Figure 6-2. Removing helical-coil threaded insert from cylinder assembly using screw thread extractor-5120-251-1527.5



Note. The special coil screw lock inserter tools listed in special tool table 2-1 must be used when installing the self-locking thread type inserts. These special inserters are further identified by painted areas marked either with a red handle or a red stripe around the body.

1. Thread new insert (A) into the threaded guide of inserter -5120-797-2407 by slowly turning the pilot until insert is flush with the end of the tool.
2. Insert the pilot of the screw thread inserter (B) - 5120-797-2407 into the threaded hole in cylinder, with face of the inserter resting solidly against the casting as shown.
3. Slowly turn handle (C) of pilot clockwise until no further resistance is felt. The insert will then be flush with cylinder casting. Remove inserter.

Figure 6-3. Installing helical-coil threaded insert in cylinder assembly using screw thread inserter-5120-797-2407.

6-6. Assembly

a. General. Extreme care must be exercised in all assembly operations to insure satisfactory engine performance. General rules for assembly are outlined below. Step-by-step procedures for assembling the various components are covered in the paragraph relating to the specific component.

b. Precautionary Rules.

(1) Cleanliness is essential in all assembly operations. Dirt and dust, even in minute quantities, are abrasive. Parts must be cleaned as specified and kept clean. Wrap or cover parts and components when assembly procedures are mot immediately completed.

(2) Coat all bearings, shafts, and all contact surfaces with engine oil (OE) to insure lubrication of parts during initial engine starting.

(3) Always use new gaskets and preformed packings when assembling engine.

(4) Use flat washers under all lockwashers, nuts and bolts to protect aluminum surfaces.

(5) Most bolts, cap screws, and nuts must be secured with lockwashers, tab washers, locking wire, or cotter pins, depending on method of locking specified.

(6) Whenever a locking method is not specified for bolts and cap screws, the mid-grip helical-coil threaded inserts into which the bolts or screws are threaded serve as the locking device.

(7) It is also important that all hardware be tightened to the specified torque. Refer to torque specifications, paragraph 6-7.

6-7. Torque Specifications

a. Standard Torques for Studs and Bolts. Apply a light film of anti-seize thread compound FSN 9150-663-1770 to stud, bolt, cap screw threads, and contact face of nuts, bolt heads, and cap screws. Avoid excessive amounts of compound in blind tapped holes.

Size (dia. in.)	Torque (lb-in.)
1/4	75-100
5/16	150-175
3/8	275-325
7/16	400-450
1/2	550-600
9/16	800-850

b. Special Torques for Studs and Bolts. Apply a light film of anti-seize thread compound FSN 9150-663-1770 to stud, bolt, cap screw threads, and contact face of nuts, bolt heads, and cap screws (except as noted). Avoid excessive amounts of compound in blind tapped holes.

Crankcase Tie-rod Bolts 640
Main Bearing Stud 450
Crankcase Main Bearing Stud Nuts (Procedure):

(1) Tighten all nuts to 500

(2) Tighten all nuts to 700-825

(3) Check stud stretch, it must be 0.019-0.022 in.

(4) Tighten nuts as necessary to obtain proper stretch. Do not exceed 0.024 stretch when alining locking wire holes.

(5) All studs which exceed stretch limits at less than 700 pound-inches must be replaced. All studs which exceed the stretch limits above 700 pound-inches must be loosened and resubjected to operations 1, 2, 3, and 4, above.

Note. Retorquing any singular stud is not allowable. The adjacent stud nut must also be loosened and retorqued in sequence.

Connecting rod bolt nuts 950
Cylinder base nuts 640

(use lubriplate - 9150-527-1752, 9150-663-1770)

Damper housing to crankcase . . . 225
Damper mounting cap screws 1000
Fan adapter to fan cap screws 150
Fan adapter to fan housing shaft nut . 600
Fan housing base to crankcase nuts and cap screws 275
Fan housing to fan housing base nuts . 275
Flywheel mounting cap screws 1000
Fuel adapter fitting bolt to injector nozzle 300
Fuel injector nozzle and holder nut 500*
Fuel injection pump base cap screws 750
Fuel injection pump cap screws 600
Fuel injection pump drive coupler hub nut 900
Fuel return tube to adapter on injector nozzle holder 100

*(Use special thread compound FSN 8030-275-8118)

Fuel return tube to bulkhead tube cross fitting 100
Oil pan mounting cap screws 175
Oil pan mounting nuts (no lubrication) 225
Oil pump cluster gear shaft spanner nut 575-625
Oil pump drive gear nut . . . . . .600 -1500
Oil pump to crankcase 275
Piston oiler nozzle to crankcase .. . 125
Starter driven gearshaft nut 1000
Turbosupercharger oil inlet hose nipple 150
Valve rocker adjusting screw lock nut 175
Valve rocker cover bearing cap screws (4) 275-325
Valve rocker cover cap screws (except for bearing cap screws) 100

Note. On assemblies subjected to wire or cotter pin hole alinement, set torque wrench to low limit and torque nut. To facilitate alinement, it is permissible to tighten nut to first hole beyond torque setting.

c. Standard Pipe Plug Torques (using thread lubricant). Coat pipe plug threads with anti-seize compound FSN 8030-275-8118 or equivalent.

Pipe Thread Size	Torque (lb-in.)
1/8-27	60-80
1/4-18	125-145
3/8-18	185-215
1/2-14	250-280
3/4-14	305-345
1-11-1 / 2	500-1000

Section II. OVERHAUL OF CRANKCASE ASSEMBLY, TRANSMISSION ADAPTER, AND STARTER AND GENERATOR DRIVE COMPONENTS

6-8. General

This section covers the overhaul of the crankcase assembly, transmission adapter, and starter and generator drive components. Specific instructions on disassembly, cleaning, inspection, repair, and assembly accompany the overhaul operations. Overhaul standards of individual components follow the inspection procedures. Stud identification tables are included where applicable. Refer to table 6-1 for applicable illustrations and instructions for overhaul operations.

Table 6-1. Crankcase Assembly, Transmission Adapter, and Starter and Generator Drive Components

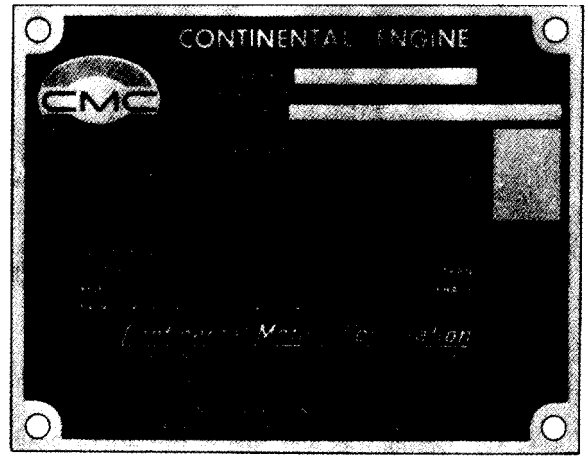
Component	Disassembly	Cleaning	Inspection	Repair	Assembly
Crankcase Assembly	Para 6-9b Figs. 6-5 through 6-8	Para 6-9c Fig. 6-9	Para 6-9d Table 6-2 Figs. 6-10 through 6-12	Para 6-4 Para 6-9e Table 6-3	Para 6-9f Figs. 6-7 through 6-5
Transmission Adapter	Para 6-10a Fig. 6-18	Para 6-2	Para 6-3	Para 6-4	Para 6-10c Fig. 6-18
Starter Drive	Para 6-11a Fig. 6-19 and 6-20	Para 6-2	Para 6-4 and 6-11b Table 6-4	Para 6-4	Para 6-11c Fig. 6-22 and 6-23
Generator Drive	Para 6-12a Figs. 6-24 and 6-25	Para 6-2	Para 6-3c, 6-3e Table 6-5	Para 6-4d Table 6-6	Para 6-12c Figs 6-26 and 6-27
Generator and Starter Idler Gears	Para 6-13a Fig. 6-28	Para 6-2	Para 6-3 Table 6-7	Para 6-4h	Para 6-13c Fig. 6-29

6-9. Overhaul of Crankcase Assembly

a. General.

(1) The crankcase assembly consists of those parts that are machined with the crankcase. They include main bearing caps, oil seal housing, oil seal housing cap, and oil seal housing support.

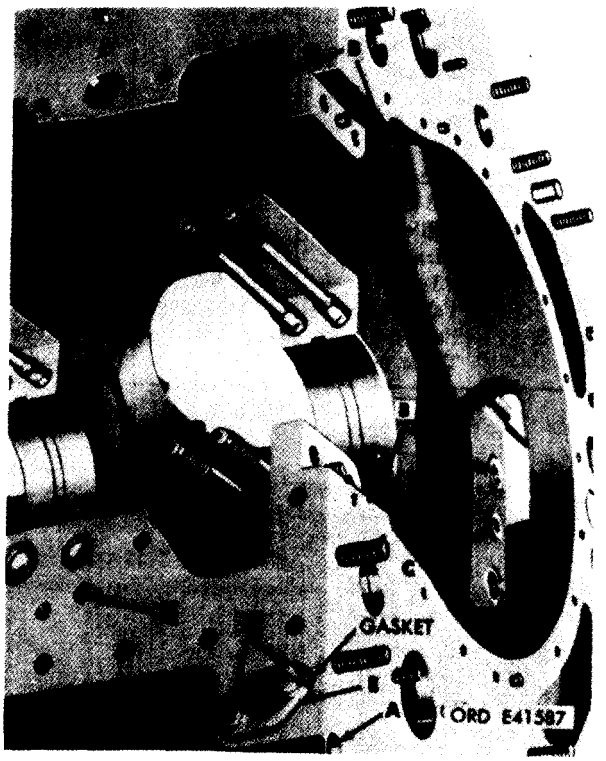
(2) The engine name plate (fig. 6-4), located on the left side of the crankcase, contains the engine serial No., timing data, and valve settings. Any modifications to this information or addition of overhaul and modification kit data must be incorporated either on the engine name plate or on a modification tag mounted on a designated location elsewhere on the engine.



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Figure 6-4. Engine name plate.

b. Disassembly. Disassemble the crankcase and remove the crankcase from the overhaul stand following instructions which accompany figures 6-5 through 6-8.



Remove

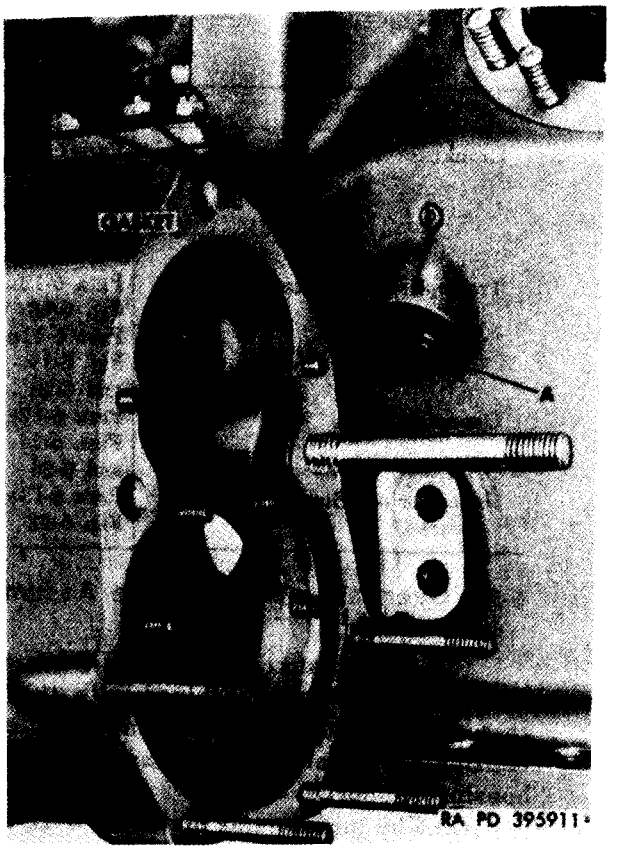
1. Remove two pipe plugs (A).
2. Remove four pipe plugs (B).
3. Remove pipe plug (C).
4. Cut locking wire and remove two drilled head bolts (D) attaching fuel pump drive gearshaft replacement cover.
5. Remove cover (E) and discard gasket.

Note. Instructions covering pipe plugs (A) and fuel pump driven gearshaft replacement cover (E) are applicable to engines having a cover.

Install

1. Position a new gasket and fuel pump driven gearshaft replacement cover (E) on crankcase.
2. Install two drilled head bolts (D) securing cover to crankcase and install locking wire securing bolts.
3. Install pipe plug (C).
4. Install four pipe plugs (B).
5. Install two pipe plugs (A).

Figure 6-5. Removing or installing pipe plugs and fuel pump driven gearshaft replacement cover.



Remove

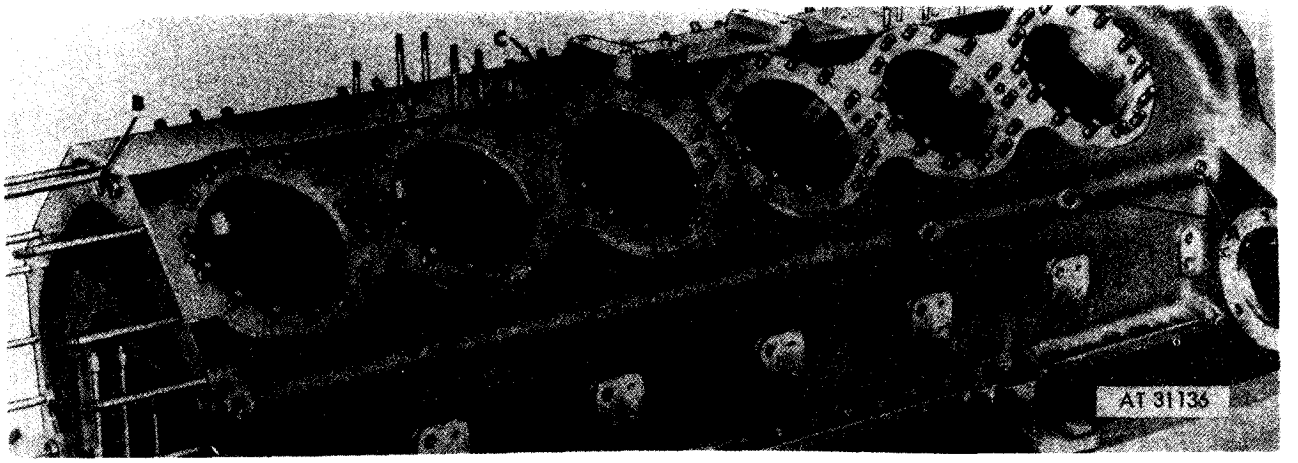
1. Remove pipe plug (A).
2. Remove pipe plug (B).
3. Remove three self-locking nuts (C) and flat washers attaching fuel supply pump adapter replacement cover (D).
4. Remove cover (D) and discard gasket.

Note. Instructions covering fuel supply pump adapter replacement cover (D) are applicable to engines having a cover.

Install

1. Position a new gasket and fuel supply pump adapter replacement cover (D) on crankcase.
2. Install three self-locking nuts (C) and flat washers securing cover to crankcase.
3. Install pipe plug (B).
4. Install pipe plug (A).

Figure 6-6. Removing or installing pipe plugs and fuel supply pump adapter replacement cover.



Remove

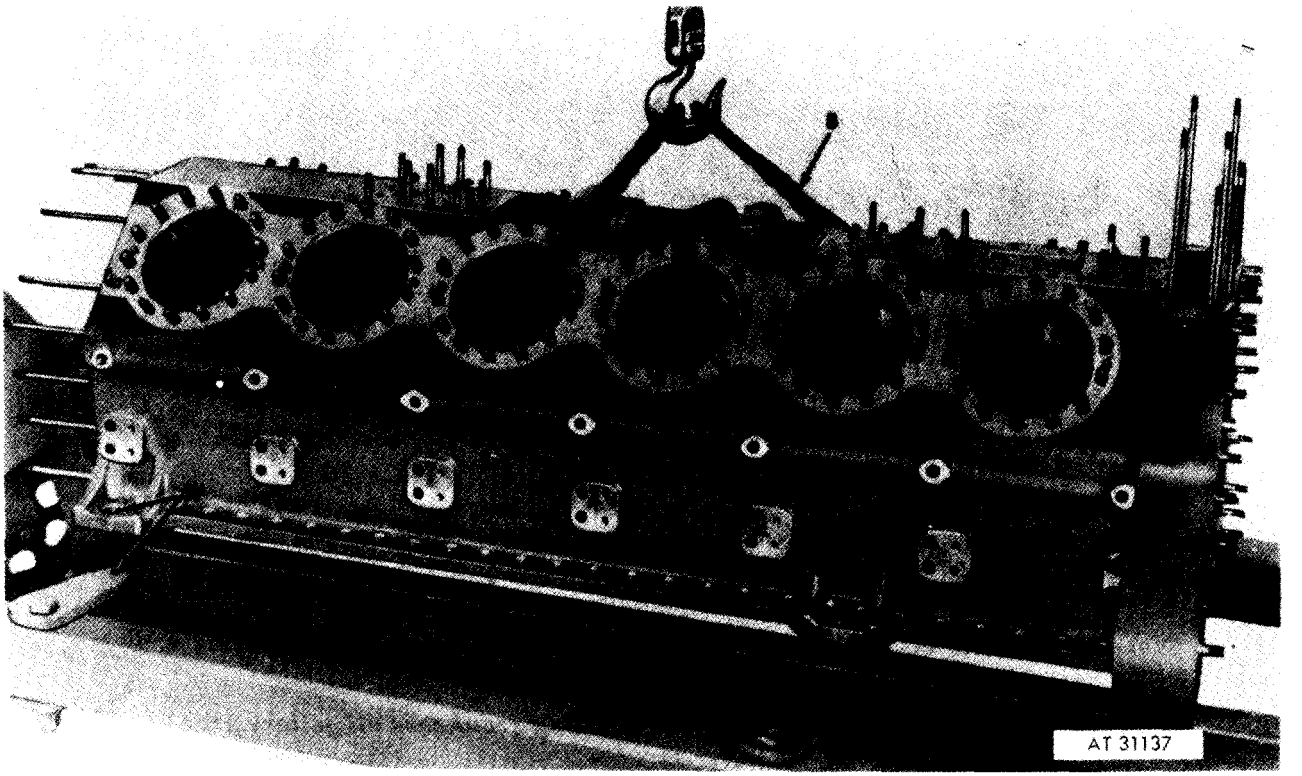
1. Remove six pipe plugs (A) from crankcase oil gallery.
2. Remove pipe plug (B).
3. Remove pipe plug (C).

Install

1. Install pipe plug (C).
2. Install pipe plug (B).
3. Install pipe plugs (A) in crankcase oil gallery.

Note. Instruction covering pipe plug (C) is applicable to engines having a plug.

Figure 6-7. Removing or installing crankcase oil gallery pipe plugs.



Remove

1. Remove four bolts (A) and flat washers attaching crankcase to engine overhaul stand.
2. Attach a rope sling (B) as shown, with weight equally balanced, and remove crankcase from stand.

Install

1. Attach a rope sling (B) as shown, with weight equally balanced, and position crankcase on engine overhaul stand.
2. Install four bolts (A) and flat washers securing crankcase to stand.

Figure 6-8. Removing or installing crankcase from engine overhaul stand using improvised rope sling.

c. Cleaning.

(1) Refer to paragraph 6-2b for general instructions on cleaning the crankcase. Thoroughly clean crankcase oil passages (fig. 6-9) using compressed air and brass wire probes.

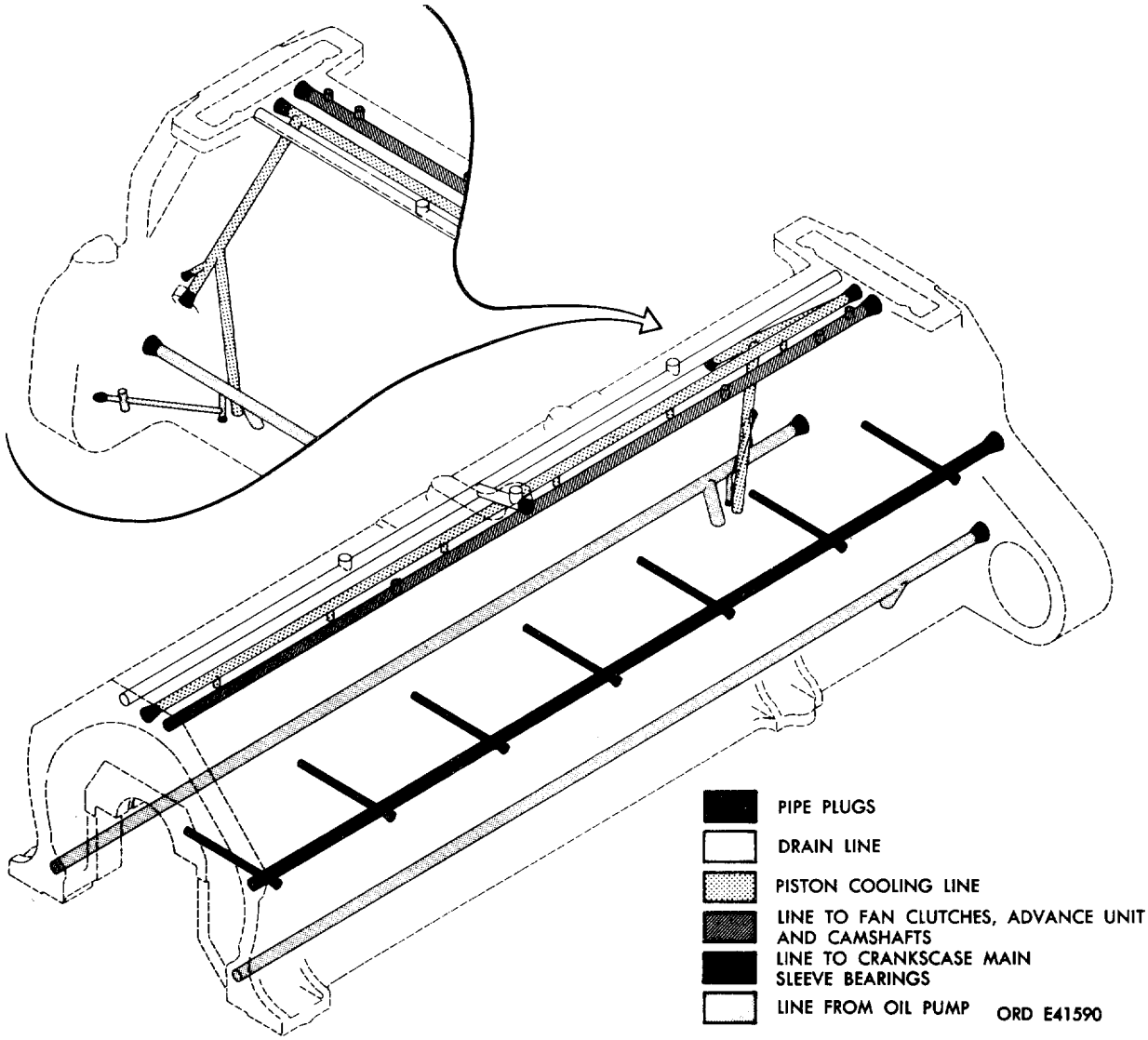


Figure 6-9. Crankcase oil passages-schematic diagram.

(2) Clean the main sleeve bearing halves with dry-cleaning solvent or mineral spirits paint thinner. Use a wooden scraper to remove sludge or gum deposits from bearing grooves and oil holes. Do not remove the bearing location markings made during engine disassembly.

d. Inspection.

(1) *Castings.* inspect the crankcase and related parts according to instructions covering castings in paragraph 6-3b and c.

(2) *Miscelaneous metal components.* Refer to figure B-2 in Appendix B for parts identification. Inspect crankcase tie rods (79) and oil seal retainer (44) for damaged threads and other unserviceable conditions.

(3) *Inspection of main sleeve bearings.*

(a) Inspection of main sleeve bearing surfaces (7.1, 7.2, 7.3, and 7.4, fig. B-3) is largely a matter of judgment and experience. The following instructions will assist in determining whether a bearing is serviceable or whether it should be replaced. Replace any questionable bearings.

(b) Separation of bearing metal, or signs of possible separation, requires that the bearing be replaced.

(c) Fine scratches on sleeve bearing are not cause for rejection. Pitting or any other form of destruction to the bearing surface is cause for rejection. Replace bearings showing raised metal at edges of scratches.

(d) Minute pieces of metal and dirt particles embedded in bearing surfaces are not cause for rejection.

Note. Do not attempt to remove such particles. However, if a concentration of embedded particles affects five percent of the surface, replace the bearing.

(4) *Stud (tie rod) torque and main bearing bore inspection.*

Note. Main sleeve bearing halves should be installed in their original location when they are to be re-used. Use new bearings when a visual inspection indicates bearings are unserviceable. Use only new or serviceable bearings for main bearing-bore check.

(a) Refer to figure 6-8 for instructions to install crankcase on engine overhaul stand.

(b) Check main bearing cap stud torque using a torque wrench as shown in figure 6-10. Torque on studs must be 450 pound-inches. Studs that do not tighten to specified torque must be removed for further inspection. Refer to table 6-3 when replacing studs.

Note. Never tighten main bearing studs above recommended torque.

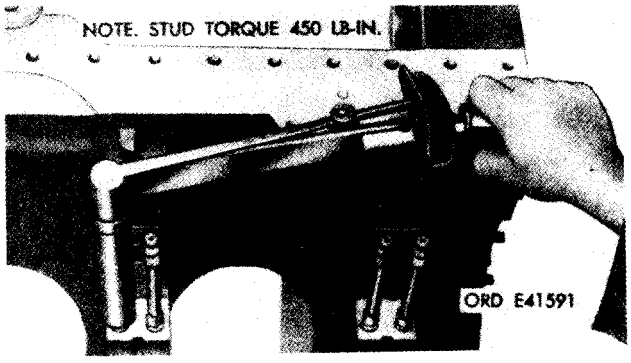
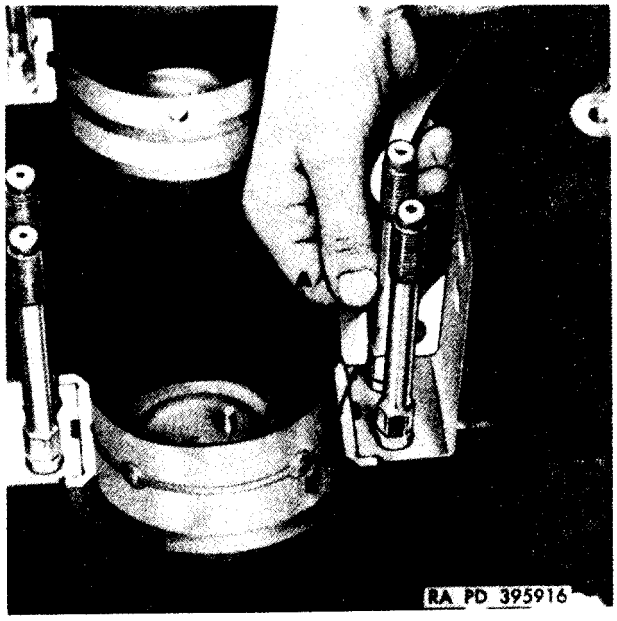


Figure 6-10. Checking torque of main bearing cap studs.

(c) Spread a thin coat of Prussian blue, FSN 8010-247-8706, over steel backs of upper and lower main sleeve bearing halves to show the sleeve bearing contact surface with the main bearing bore in crankcase. Install bearings in their original location in crankcase and main bearing caps.

(d) Check clearance between upper bearing flange and crankcase as shown in figure 6-11.

(e) Check clearance between the lower main thrust bearing flange and thrust bearing cap in the same manner as shown in figure 6-11.



1. Install upper main thrust sleeve bearing (A) into No. 4 main bearing seat of crankcase.
2. Measure clearance between bearing flange and crankcase using feeler gage (B). Clearance should be 0.0040 to 0.0080-inch.

Figure 6-11. Checking clearance between upper main thrust bearing flange and crankcase.

(f) Apply a light coating of engine oil, Military Specification MIL-L-45199, to the ends of the seven main bearing caps with sleeve bearing halves installed. Using crankcase spreading tool - 5120-575-7767 as shown in figure 5-174 install the bearing caps with bearing halves in their proper locations in the crankcase. according to the location number stamped on the crankcase and cap. The side of the bearing cap marked “FLY END” must face the rear of the crankcase.

(g) Apply a small amount of antiseize

compound, FSN 9150-663-1770, to the threaded area of each main bearing cap stud. Install a plate washer on each pair of main bearing studs. Install a slotted nut on each main bearing stud but do not tighten nuts at this time.

(h) Place a surface plate and dial indicator gage on crankcase flange with gage indicator resting on end of stud. Measure and record height of each stud. Torque tighten main bearing stud nuts to 500 pound-inches. Alternately tighten all four nuts on each main bearing to a torque of 700-825 pound-inches. Measure the height of each stud after final torque. The difference between the stud height before and after torque tightening, indicates stud stretch. Normal stud stretch is 0.010 to 0.022-in. If any stud has stretched more than 0.024-in. at 700 pound-inches torque, it must be replaced. Refer to table 6-3 when replacing studs.

(i) Install the 14 crankcase tie rods in the holes provided through the crankcase and main bearing caps. Equalize the extension of the threaded portions of the tie rods on each side of the crankcase. Apply a small amount of antiseize compound, FSN 9150-663-1770, to the threaded portions of each tie rod. Install a plate washer and a 9 / 16 slotted nut on each end of the tie rods.

(j) Starting at the main thrust bearing cap, with aid of an assistant to hold the nuts on the opposite side of crankcase, alternately tighten all main bearing cap tie rod nuts to 640 pound-inches torque.

(k) Check the inside diameter of the main bearings with a dial bore indicator as shown in figure 6-12 against the limits specified in overhaul standards (table 6-2). Replace bearings which do not meet these requirements. New bearings must also be dial bore checked. Remove the main bearing caps and bearing halves from the crankcase and check contact surface as indicated by Prussian blue, FSN 8010-847-8706 transfer. Replace bearings that do not make 75 percent contact with crankcase bearing bores. Repeat dial bore check of new bearings installed.

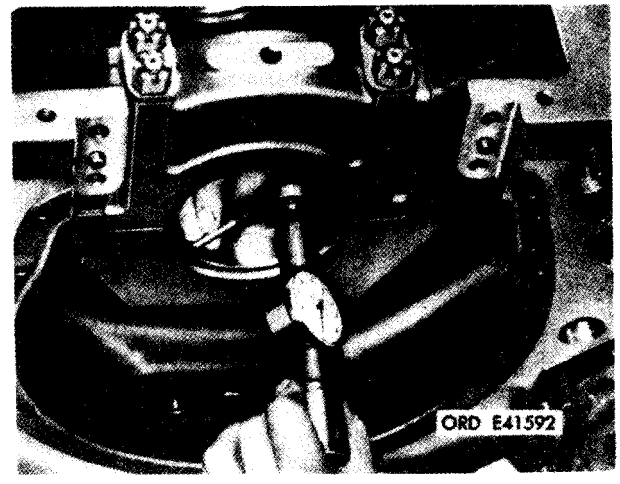


Figure 6-12. Checking inside diameter of main bearings.

Table 6-2. Crankcase Assembly Overhaul Standards

Component	Fig. No.	Ref. letter	Point of measurement	Sizes and fits of new parts		Wear limits
Crankcase	B-2	A	Inside diameter of bearing bore in crankcase	4.7538	4.7553	**
	B-2	B	Outside width of main thrust bearing cap and thrust bearing surface in crankcase	2.0240	2.0260	**
	B-3	E	Thickness of main bearing half at center (refer to B-3, D-C, below)	0.2492	0.2499	
	B-3	V	Thickness of main bearing half 1 / 2 inch from ends (to be 0.0005 to 0.0010 less than at center "E")			
	B-3	D	Inside diameter of main bearing at proper torque tightness (90 degrees to split line) (STD)	4.2545	4.2575	4.2585
			0.003 undersize	4.2515	4.2545	4.2555
			0.010 undersize	4.2445	4.2475	4.2485
	B-3	F	Inside width of main thrust bearing face	2.0300	2.0320	*
	B-3	F	Fit of main thrust bearing over bearing cap and	0.0040L	0.0080L	*
	B-2	B	thrust bearing surface in crankcase			
	B-3	C-D	Fit (oil clearance) of bearings on journals (refer to table 6-9)	0.0040L	0.0080L	0.0100L
	B-3	T	Outside width of main thrust bearing	2.4860	2.4880	2.4840
	B-3	U	Thickness of main thrust bearing flange (refer to B-3, D-C, above)	0.2270	0.2290	
	B-14	H	Inside diameter of bearing bore in crankcase liner (starter)	2.8346	2.8353	2.8356
	B-14	Q	Inside diameter of bearing bore in crankcase liner (generator)	2.8346	2.8353	2.8356
	B-3	T-G	Fit (crankshaft end play) of thrust bearing in journal (refer to table 6-9)	0.0110	0.0150L	0.0190L

Note. Refer to paragraph 6-3b for explanation of symbols.

e. Repair. Repair or replace damaged parts. Refer to paragraph 6-4e, table 6-3, and figure 6-15 through 6-17 when replacing crankcase studs. Repair of crankcases by welding is permissible except in areas of high stress such as radii, webbing, and bosses. Refer to paragraph 6-4c for general welding instructions and (1) through (3) below for specific information on welding repair of the crankcase.

(1) Repair by blending, of nicks, grooves, or impact damage on the inside of crankcase on the underside of the cylinder deck machined surface is permitted providing damage does not progress into restricted area indicated in figure 6-13. Damaged cylinder stud holes may be repaired, but entire missing sections may not be replaced. It is permissible to repair machined surface mounting bosses on pads which have been damaged by fretting, scoring or impact except in those areas indicated in figure 6-13. Weld surfaces must be restored to specified dimensions by machining.

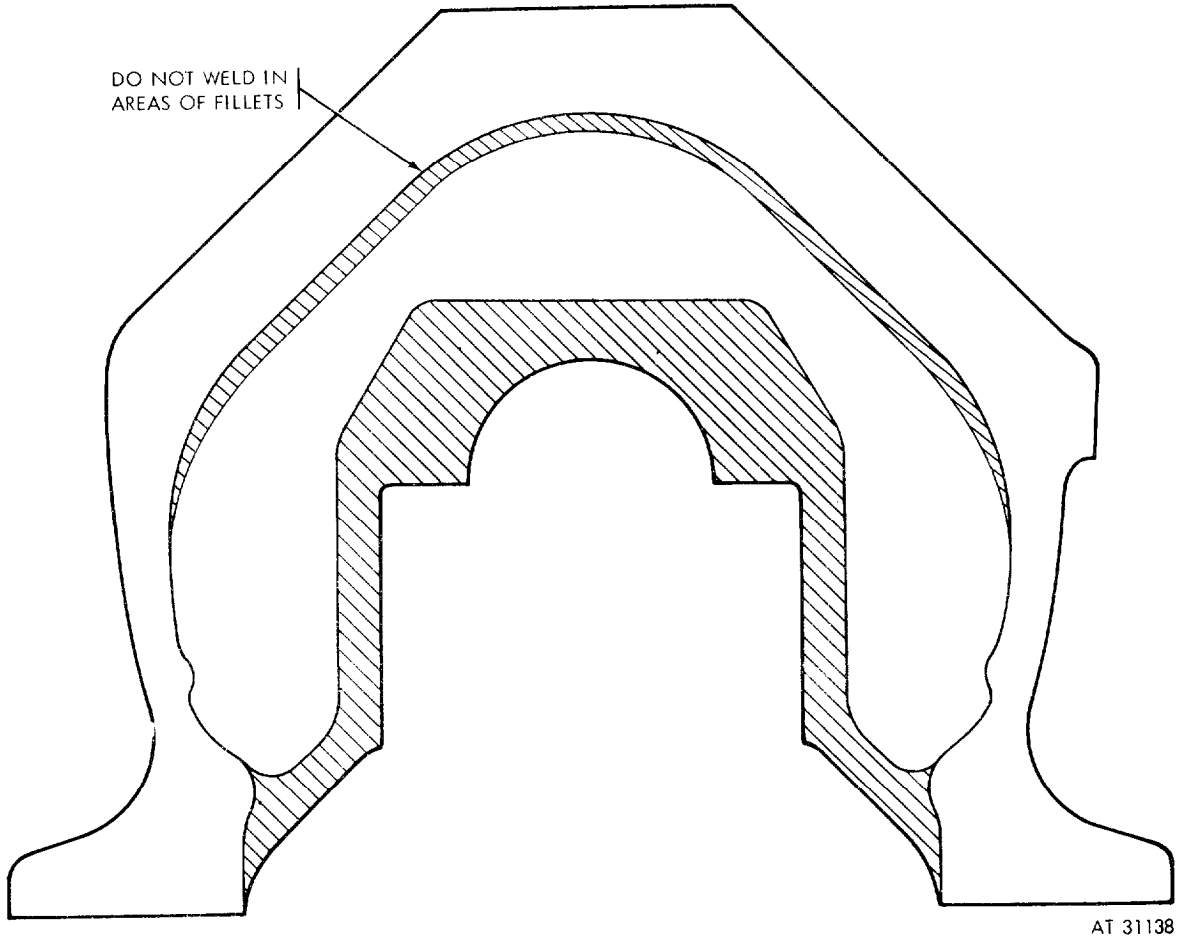


Figure 6-13. Crankcase restricted welding areas.

(2) To detect dimensional changes caused by welding repair, precisely measure crankcase at several key positions depending upon the location of the repair. For repair to side walls, measure the positions outlined in steps (a) through (d).

(a) Across the main bearing cap support web machined surfaces (B, fig. 6-14).

(b) Across the inside of the crankcase at the junction of the side wall and the oil pan rail (D).

(c) From oil pan rail face to main bearing cap support face (C).

(d) From cylinder mounting deck to crankshaft bearing support bore centerline using a suitable plug or bore in the crankcase bearing bore (A). This measurement shall be within 8.377-8.369 inch.

(e) Oil pan rail shall be flat within 0.010-inch when all four corners are on the same plane.

(3) For repair in other locations, measure in the appropriate locations to insure that critical dimensions are held. Record dimensions for future use.

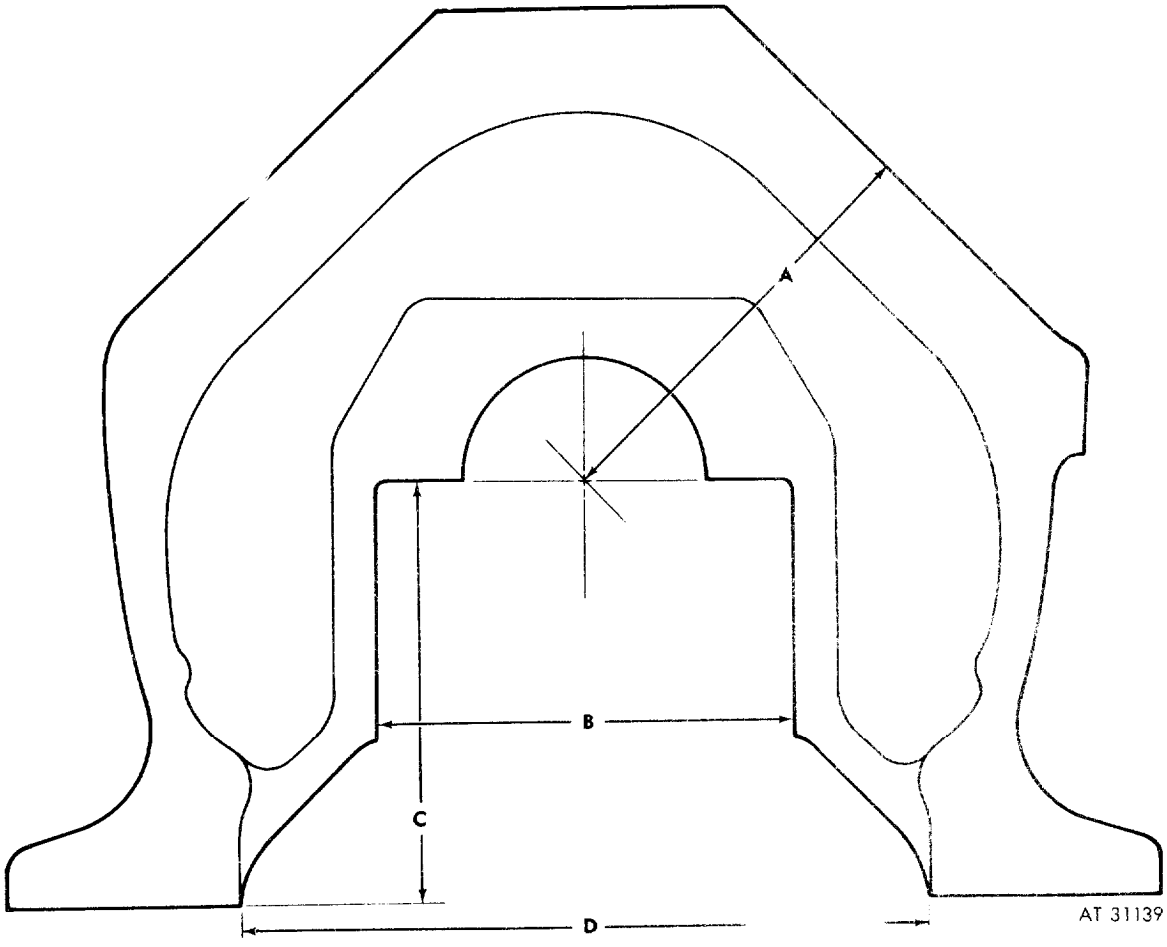


Figure 6-14. Points of measurement for checking crankcase.

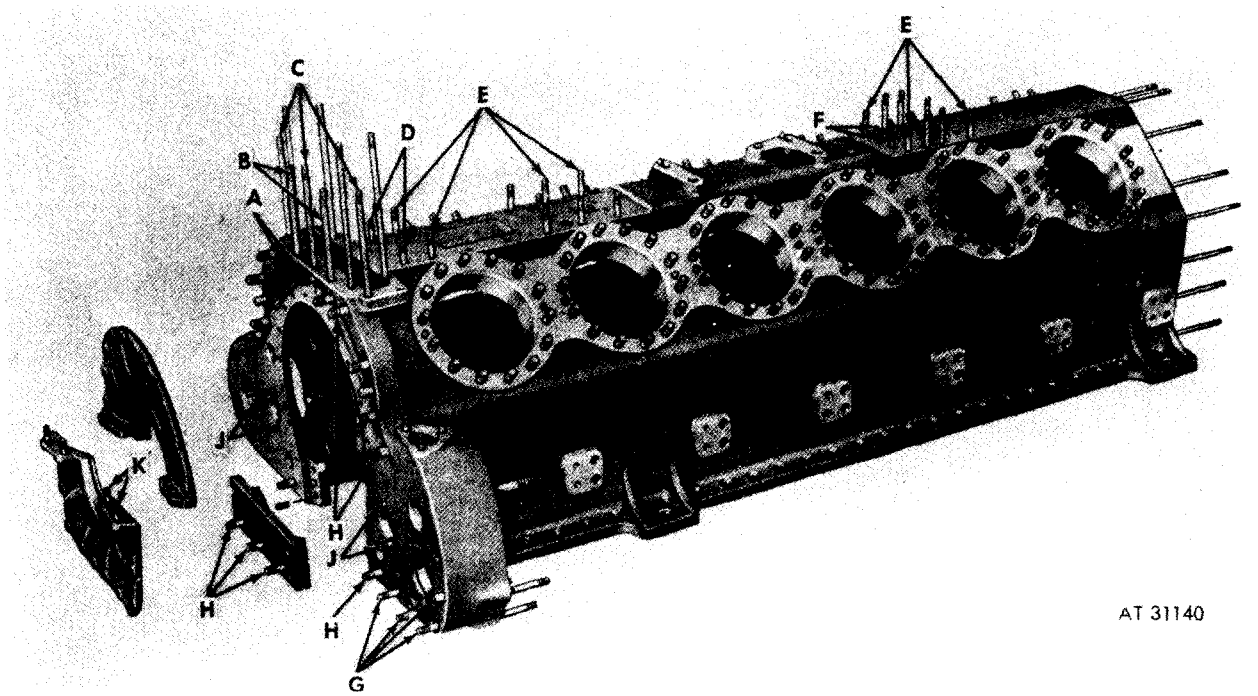


Figure 6-15. Crankcase studding-¾ right rear exploded view.

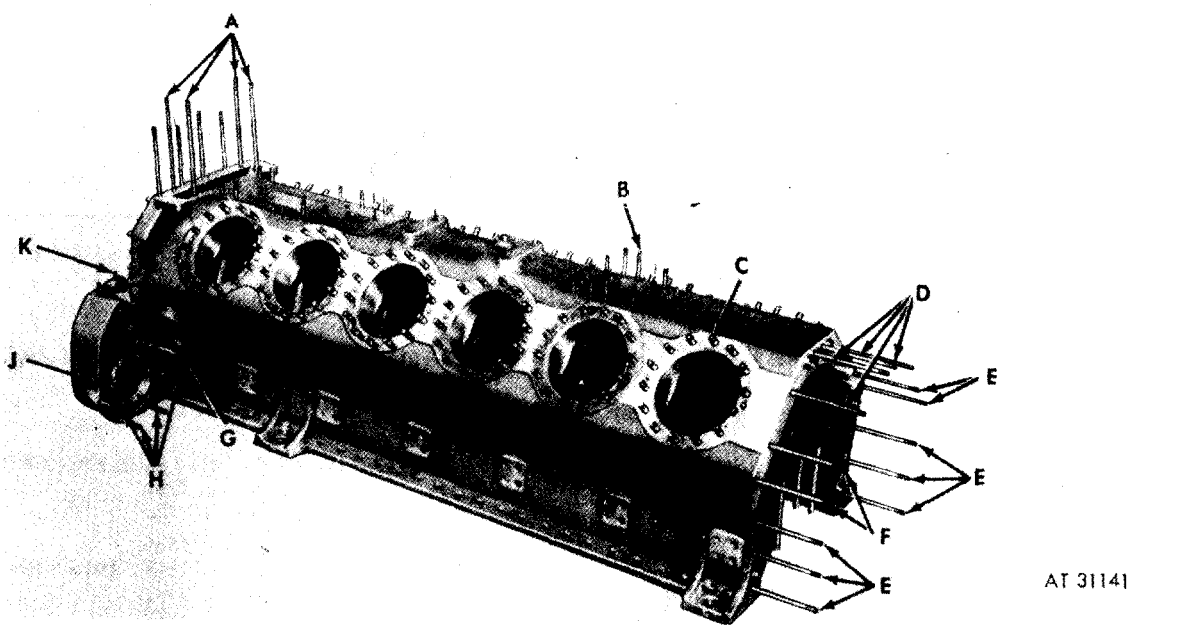


Figure 6-16. Crankcase studding-¾ left rear view.

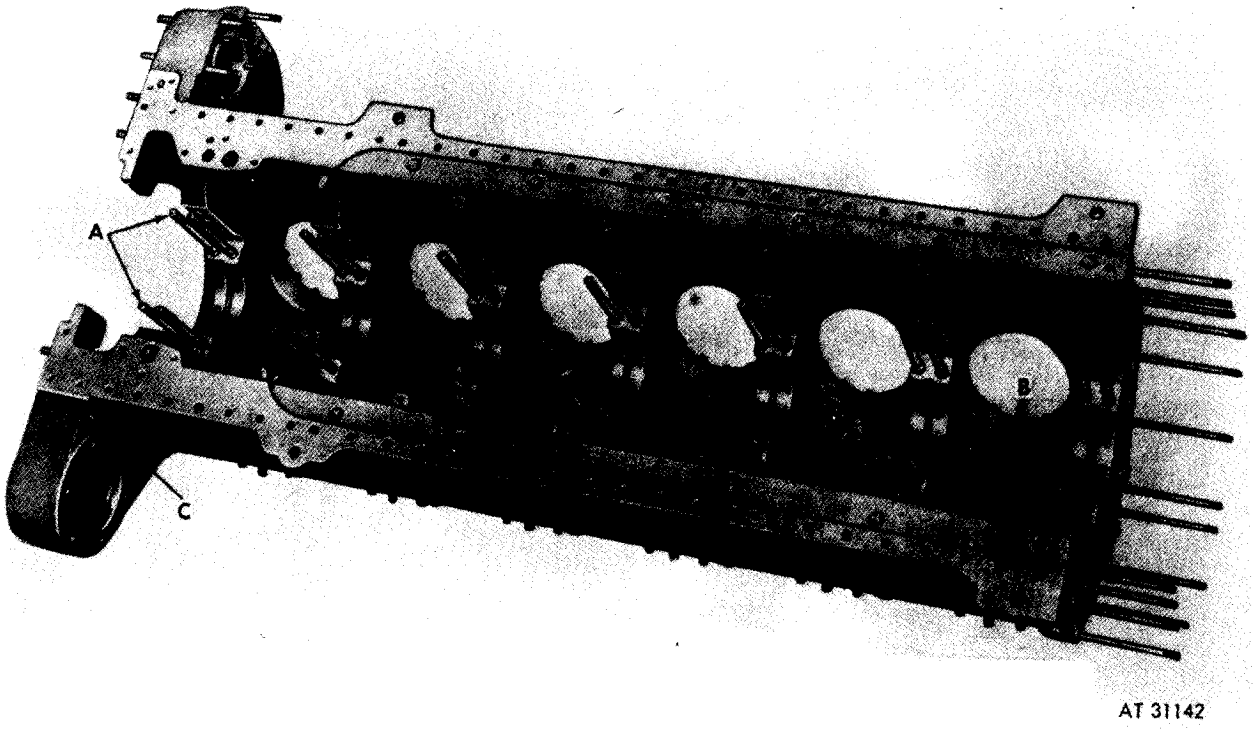


Figure 6-17. Crankcase studding-bottom view.

Table 6-3. Crankcase Standard and Oversize Stud Identification

Fig. No.	Ref. letter	Setting height	No. req'd	Stud size and length
6-15	A	59 / 64	2	3 / 8-16(27 / 32) x 3 / 8-24(7 / 8) x 1-3 / 4 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-15	B	5-7 / 16	2	3 / 8-16(15 / 16) x 3 / 8-24(13 / 16) x 6-1 / 4 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-15	C	6-1 / 8	3	3 / 8-16(15 / 16) x 3 / 8-24(13 / 16) x 6-7 / 8 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-15	D	1-7 / 32	2	3 / 8-16(15 / 16) x 3 / 8-24(13 / 16) x 2 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-15	E	1-5 / 8	12	3 / 8-16(29 / 32) x 3 / 8-24(11 / 16) x 2-1 / 4 (STD) (0 003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-15	F	31 / 32	2	3 / 8-16(27 / 32) x 3 / 8-24(7 / 8) x 1-3 / 4 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)

Table 6-3. Crankcase Standard and Oversize Stud Identification- **Continued**

Fig. No.	Ref. letter	Setting height	No. req'd.	Stud size and length
6-15	G	1-11 / 32	4	7 / 16-14(1) x 7 / 16-20(3 / 4) x 2-1 / 4 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-15	J	9 / 16	4	5 / 16-18(19 / 32) x 5 / 16-24(17 / 32) x 1-1 / 8 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-15	H	1-1 / 16	15	1 / 2-13(1-3 / 16) x 1 / 2-20(15 / 16) x 2-1 / 4 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-15	K	31 / 32	4	5 / 16-18(51 / 64) x 5 / 16-24(21 / 32) x 1-5 / 8 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-16	A	8-5 / 16	4	3 / 8-16(15 / 16) x 3 / 8-24(13 / 16) x 9-1 / 8 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-16	B	2-29 / 64	4	3 / 8-16(15 / 16) x 3 / 8-24(13 / 16) x 3-1 / 4 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-16	C	15 / 16	168	1 / 2-13(63 / 64) x 1 / 2-20(3 / 4) x 2-1 / 8 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-16	D	5-1 / 2	4	3 / 8-16(15 / 16) x 3 / 8-24(13 / 16) x 6-1 / 4 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-16	E	5-1 / 16	8	3 / 8-16(15 / 16) x 3 / 8-24(11 / 16) x 5-7 / 8 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-16	F	5-1 / 4	2	3 / 8-16(51 / 64) x 3 / 8-24(11 / 16) x 6 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-16	G	4-19 / 32	1	5 / 8-11(1-11 / 32) x 5 / 8-18(29 / 32) x 5-1 / 2 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-16	H	2-1 / 2	4	3 / 8-16(15 / 16) x 3 / 8-24(11 / 16) x 3-1 / 8 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-16	J	1 / 2	6	5 / 16-18(1 / 2) x 5 / 16-24(7 / 16) x 1 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-16	K	17 / 32	3	5 / 16-18(19 / 32) x 5 / 16-24(17 / 32) x 1-1 / 8 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-17	A	6-5 / 64	28	9 / 16-12(1-3 / 8) x 9 / 16-18(1-13 / 64) x 8-3 / 4 (STD) (0.010 in. OS)

Table 6-3. Crankcase Standard and Oversize Stud Identification - Continued

Fig. No.	Ref. letter	Setting height	No. req'd	Stud size and length
6-17	B	17 / 32	12	5 / 16-18(19 / 32) x 5 / 16-24(17 / 32) x 1-1 / 8 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-17	C	7 / 8	1	7 / 16-14(1) x 7 / 16-20(3 / 4) x 1-3 / 4 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)

f. Assembly.

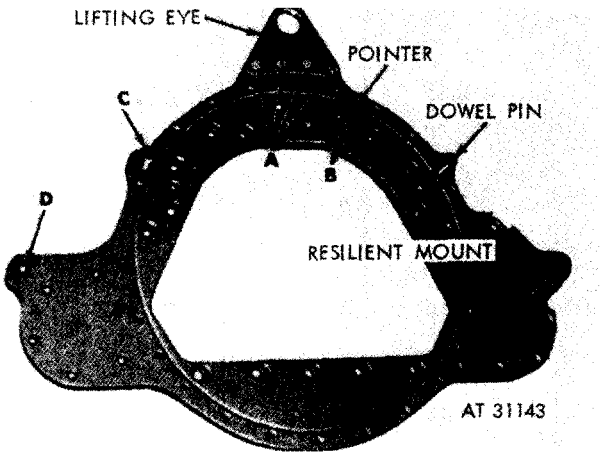
(1) *Preliminary instructions.* Refer to general assembly procedures (para 6-6).

(2) *Position crankcase.* Rotate the engine overhaul stand so the crankcase is in the upright position.

(3) *Install pipe plugs.* Refer to figures 6-5 through 6-7.

6-10. Overhaul of Transmission Adapter

a. Disassembly. Disassemble transmission adapter following the sequence of instructions which accompany figure 6-18.



Remove

1. Cut locking wire and remove four bolts (A) attaching lifting eye to transmission adapter. Remove lifting eye.
2. Cut locking wire and remove two bolts (B) attaching timing pointer to adapter. Remove timing pointer.
3. Do not remove the two dowel pins (C) or the two resilient mounts (D) unless inspection (para 6-3f) shows replacement is necessary. To remove dowel pins or resilient mounts, press from adapter using an arbor press.

Install

1. If dowel pins (C) or resilient mounts (D) were removed from transmission adapter, install new parts using an arbor press.
2. Position timing pointer on adapter and install two bolts (B) securing pointer on adapter. Install locking wire securing bolts.
3. Position lifting eye on adapter and install four bolts (A) securing eye on adapter. Install locking wire securing bolts.

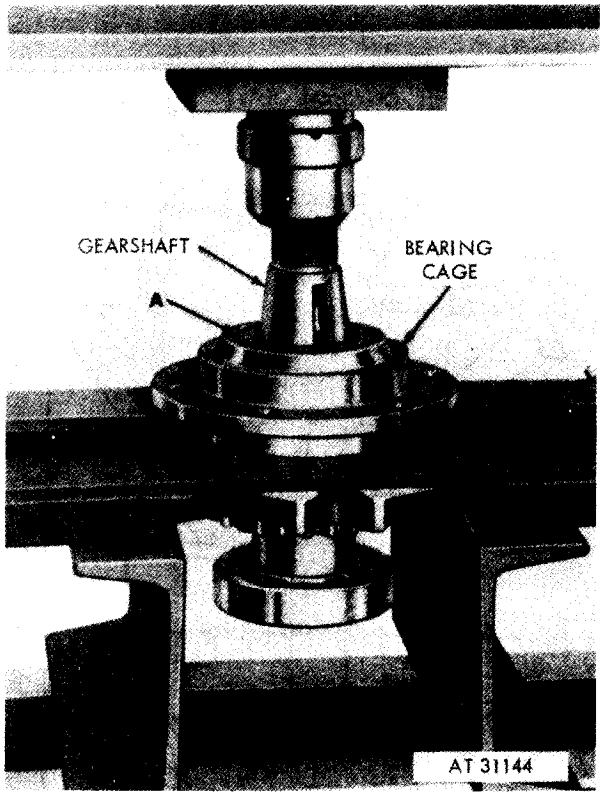
Figure 6-18. Removing or installing transmission adapter lifting eye and timing pointer.

b. Cleaning, Inspection, and Repair. Refer to paragraphs 6-2 through 6-4.

c. *Assembly.* Refer to figure 6-18.

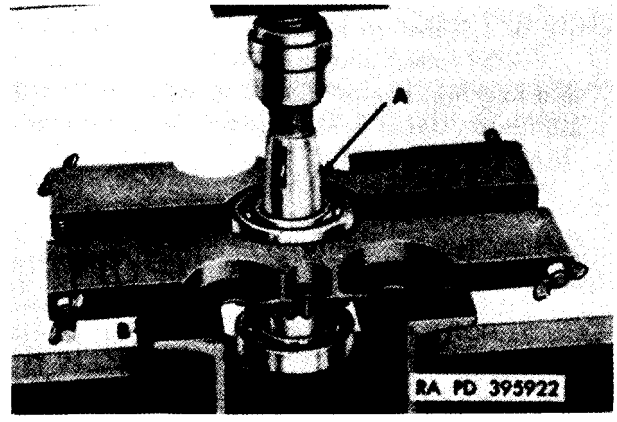
6-11. Rebuild of Starter Drive

a. Disassembly. Disassemble starter driven gearshaft following the sequence of instructions in figures 6-19 and 6-20.



1. Press the starter driven gearshaft from bearing cage.
2. To remove oil seal (A), press it from the bearing cage using a suitable arbor press. Discard oil seal.

Figure 6-19. Pressing starter driven gearshaft and bearings from bearing cage.



Note. If the engine is equipped with a bearing cage that does not have a groove on the pilot diameter for the installation of a preformed packing, discard this bearing cage. Although both the old and new bearing cages maintain the same part number 8761022, only the late bearing cage is carried through normal replacement part channels and must be used when rebuilding starter driven gearshaft. Preformed packing MS 28775-236 cannot be used on a bearing cage unless there is a groove in the cage pilot to accommodate it.

1. Press starter driven gearshaft (A) from upper ball bearing.
2. Press gearshaft from the lower ball bearing (B) in a similar manner.

Figure 6-20. Pressing starter driven gearshaft from ball bearings.

b. Cleaning, Inspection, and Repair.

(1) Refer to paragraphs 6-2 through 6-4.

(2) Inspect starter driven gearshaft, oil seal, and bearings against limits specified in overhaul standards (table 6-4). Replace parts not meeting hese requirements.

(3) Minor damage incurred to the leading edge of the starter drive gear may be repaired by regrinding the leading surface to dimensions shown in figure 6-21. Regrind gear tooth chamfer to original configuration after rework of starter drive leading face.

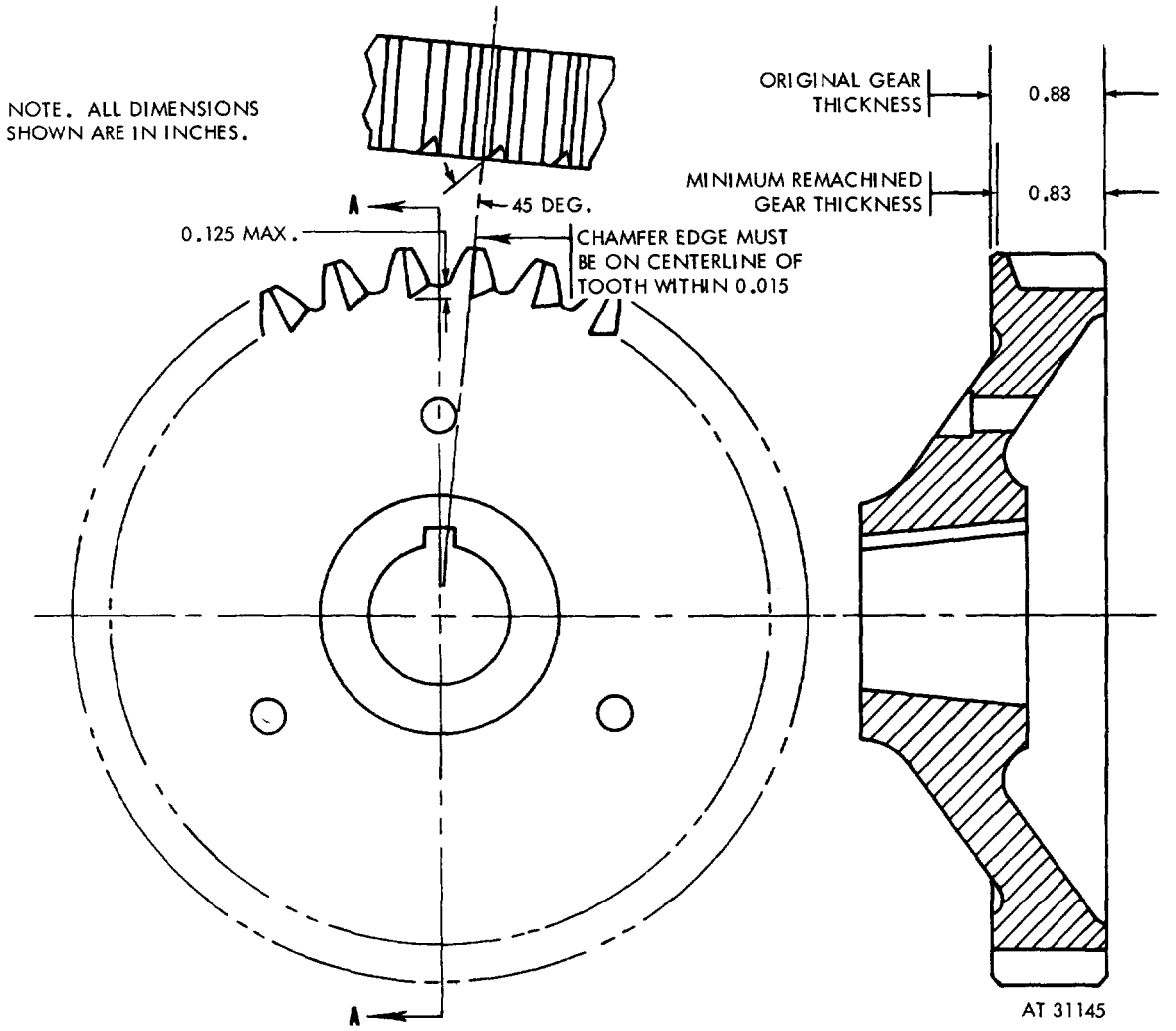


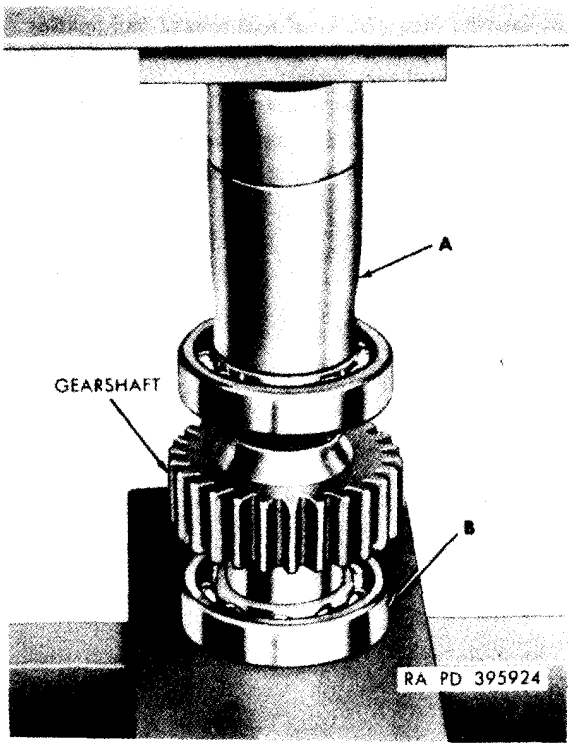
Figure 6-21. Starter drive gear-rework.

Table 6-4. Starter Driven Gearshaft Overhaul Standards

Component	Fig. No.	Ref. letter	Point of measurement	Sizes and fits of new parts		Wear limits
Starter drive gearshaft oil seal	B-14	F	Outside diameter of oil seal	2.1270	2.1310	*
	B-14	E	Inside diameter of bore in cage	2.1240	2.2160	*
	B-14	F-E	Fit of seal in cage	0.0010T	0.0070T	*
Starter driven gearshaft bearing	B-14	A	Outside diameter of bearings	2.8341	2.8346	*
	B-14	D	Inside diameter of bearing bore in cage	2.8346	2.8353	2.8356
	B-14	A-D	Fit of bearing cage	0.0000	0.0012L	0.0015L
	B-14	H	Inside diameter of bearing bore in crankcase liner	2.8346	2.8353	2.8356
	B-14	A-H	Fit of bearing in crankcase	0.0000	0.0012L	0.0015L
	B-14	B	Inside diameter of bearing	1.3775	1.3780	*
	B-14	C	Outside diameter of bearing hubs on gearshaft	1.3781	1.3785	1.3779
	B-14	B-C	Fit of bearings on gearshaft hubs	0.0001T	0.0010T	0.0001L
	B-14	G	Tooth width of starter drive gear	0.8700	0.8900	0.8300

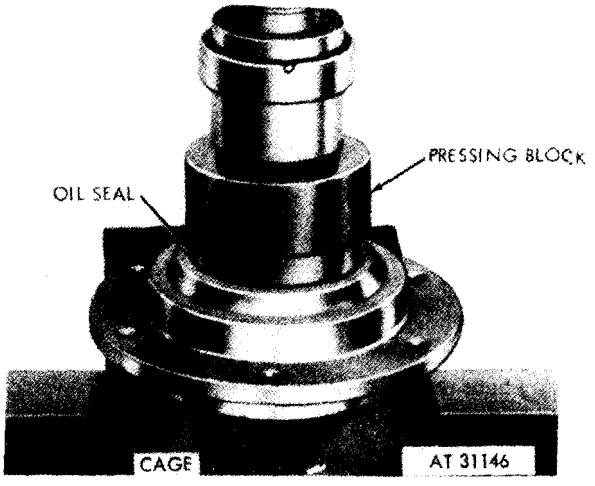
Note. Refer to paragraph 6-3b for explanation of symbols.

c. Assembly. Assemble starter driven gearshaft following instructions which accompany figures 6-22 and 6-23.



1. Coat ball bearing with engine oil, Military Specification MIL-L-45199, and position bearing on bearing flange of gearshaft. Press bearing on gearshaft using a suitable pressing sleeve (A).
2. Coat ball bearing (B) with engine oil, Military Specification MIL-L-45199, and press bearing on opposite end of gearshaft in the same manner.

Figure 6-22. Pressing ball bearings on starter driven gearshaft.



1. Coat new oil seal with engine oil, Military Specification MIL-L-45199. Position seal on bore of bearing cage with lip of seal toward ball bearing seat.
2. Carefully press oil seal into cage until seal is tight against seal seat flange.
3. Press starter driven gearshaft in the bearing cage.

Figure 6-23. Pressing oil seal into bearing cage.

6-12. Overhaul of Generator Drive

a. Disassembly. Disassemble generator drive gearshaft and adapter following instructions accompanying figures 6-24 and 6-25.

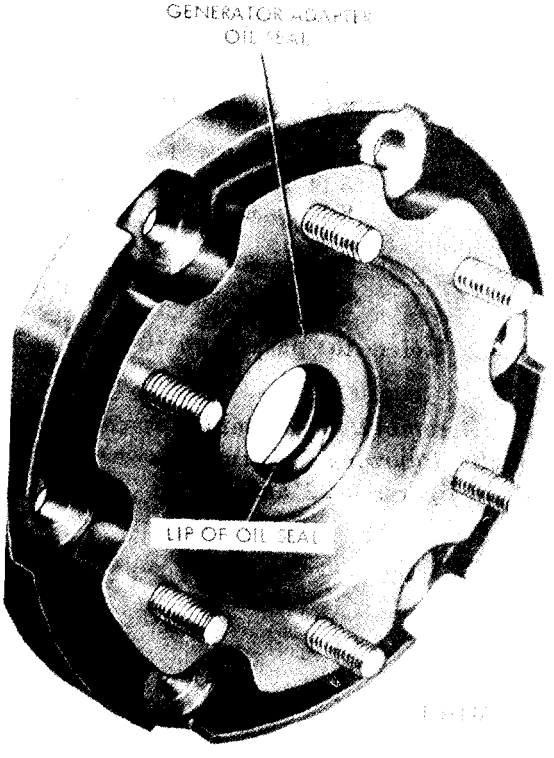
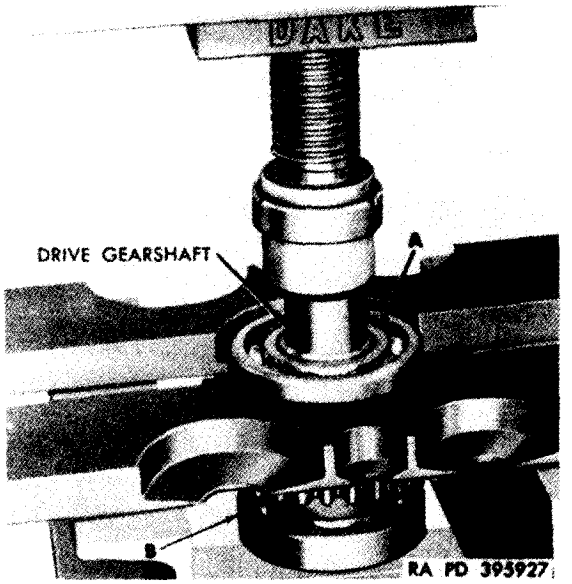


Figure 6-24. Removing generator adapter oil seal.



1. Remove generator adapter oil seal from the adapter using a suitable arbor press.

Note. It is not necessary to remove generator drive gearshaft ball bearings unless inspection (para 6-3d) indicates replacement is needed.

2. Press generator drive gearshaft from upper ball bearings (A).
3. Press the gearshaft from lower ball bearing (B) in the same manner.

Figure 6-25. Pressing generator drive gearshaft from ball bearings.

b. Cleaning, Inspection, and Repair. Refer to paragraphs 6-2 through 6-4.

(1) Inspect generator drive gearshaft, oil seal, and bearings against limits specified in the overhaul standards (table 6-5). Replace parts not meeting these requirements.

(2) Refer to paragraphs 6-3c and 6-3e for inspection of generator adapter and studs. Refer to paragraph 6-4e and table 6-6 when replacing adapter studs.

Table 6-5. Generator Drive Overhaul Standards

Component	Fig. No.	Ref. letter	Point of measurement	Sizes and fits of new parts		Wear limits
Generator drive gearshaft, oil seal and bearings	B-14	J	Outside diameter of oil seal	2.2520	2.2560	*
	B-14	K	Inside diameter of oil seal bore in adapter	2.2490	2.2510	*
	B-14	J-K	Fit of oil seal in adapter	0.0010T	0.0070T	*
	B-14	N	Outside diameter of bearings on generator drive gearshaft	2.8341	2.8346	*
	B-14	L	Inside diameter of bearing bore in adapter	2.8346	2.8353	2.8356
	B-14	N-L	Fit of bearing in adapter	0.0000	0.0012L	0.0015L
	B-14	Q	Inside diameter of bearing bore in crankcase liner	2.8346	2.8353	2.8356
	B-14	N-Q	Fit of bearing in crankcase	0.0000	0.0012L	0.0015L
	B-14	P	Outside diameter of bearing hubs on gearshaft	1.3781	1.3785	1.3779
	B-14	M	Inside diameter of bearings	1.3775	1.3780	*
	B-14	M-P	Fit of bearings on gearshaft	0.0001T	0.0010T	0.0001L

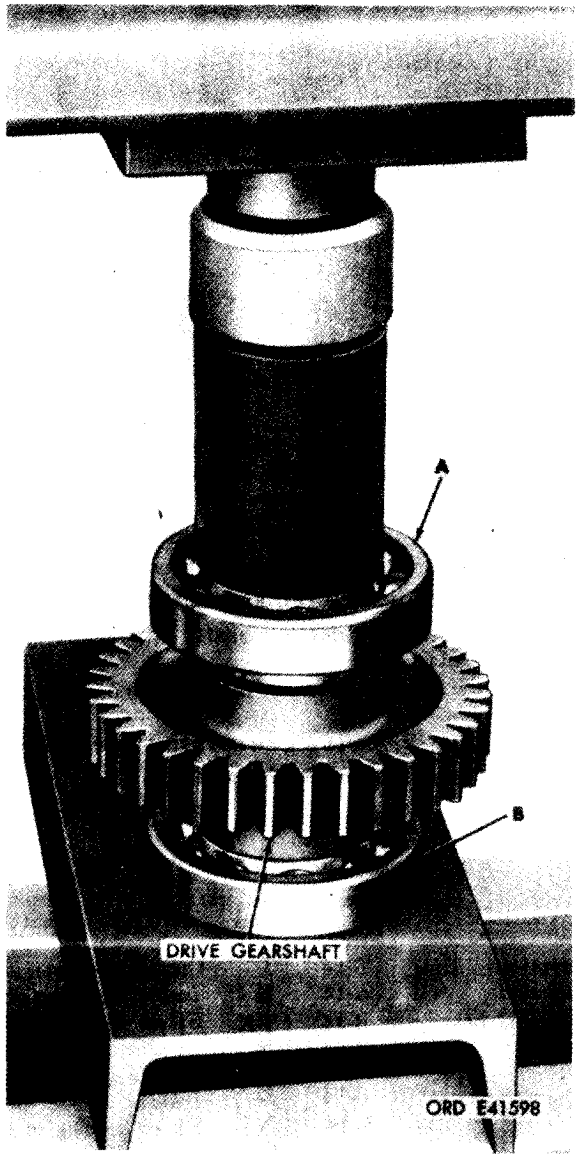
Note. Refer to paragraph 6-3b for explanation of symbols.

Table 6-6. Generator Adapter Standard and Oversize Stud Identification

Fig. No.	Ref. letter	Setting height	No. req'd.	Stud size and length
B-14	26	7 / 8	6	3 / 8-16(15 / 64) x 3 / 8-24(5 / 8) x 1-13 / 32 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)

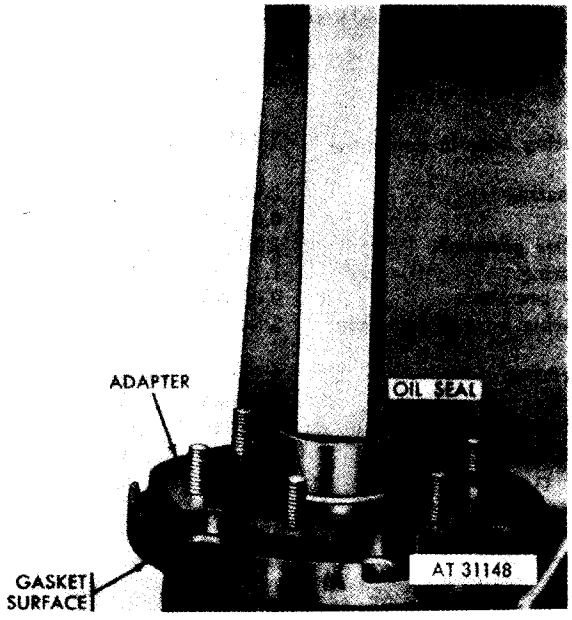
Note. Refer to figure 6-1 for oversize stud identification.

c. Assembly. Assemble generator drive gearshaft and adapter following instructions which accompany figures 6-26 and 6-27.



1. If ball bearings were removed from generator drive gearshift, coat ball bearing (A) with engine oil, Military Specification MIL-L-45199, and position bearing on flange of gearshaft. Press bearing on gearshaft.
2. Coat ball bearing (B) with engine oil, Military Specification MIL-L-45199, and press the bearing on the other end of the gearshaft in the same manner.

Figure 6-26. Pressing ball bearings on generator drive gearshaft.

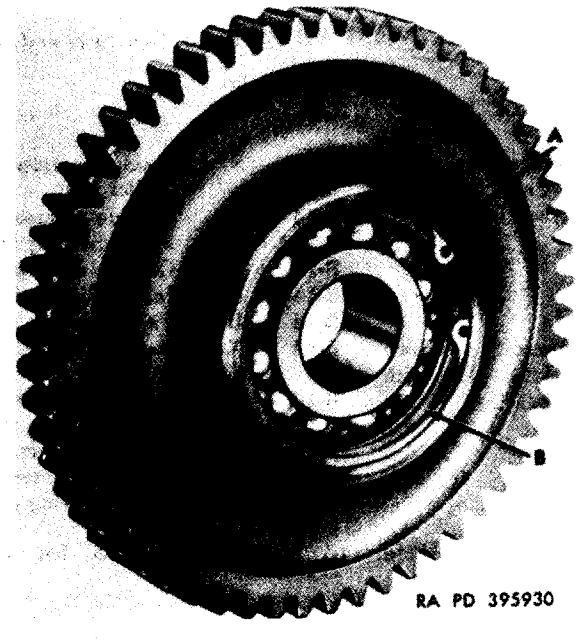


1. If generator adapter oil seal (A) was removed from generator adapter, position oil seal on seal bore. The side of the seal with the trade mark and part number must be toward the stud side of the adapter. The lip of the seal must be directed toward the side opposite the studs.
2. Carefully press oil seal into adapter until seal is tight against seal seating flange in adapter.

Figure 6-27. Pressing oil seal into generator drive gearshaft adapter.

6-13. Overhaul of Generator and Starter Idler Gears

a. Disassembly. Disassemble generator idler gear following instructions which accompany figure 6-28. The starter idler gear is similar and may be disassembled in the same manner.



1. Remove retaining ring (A) securing ball bearing (B) in generator idler gear.
2. Press bearing from gear.

Figure 6-28. Removing generator idler gear retaining ring and ball bearing.

b. Cleaning, Inspection, and Repair. Refer to paragraphs 6-2 through 6-4.

(1) Inspect starter idler gear and bearing against limits specified in overhaul standards (table 6-7). Replace parts not meeting these requirements.

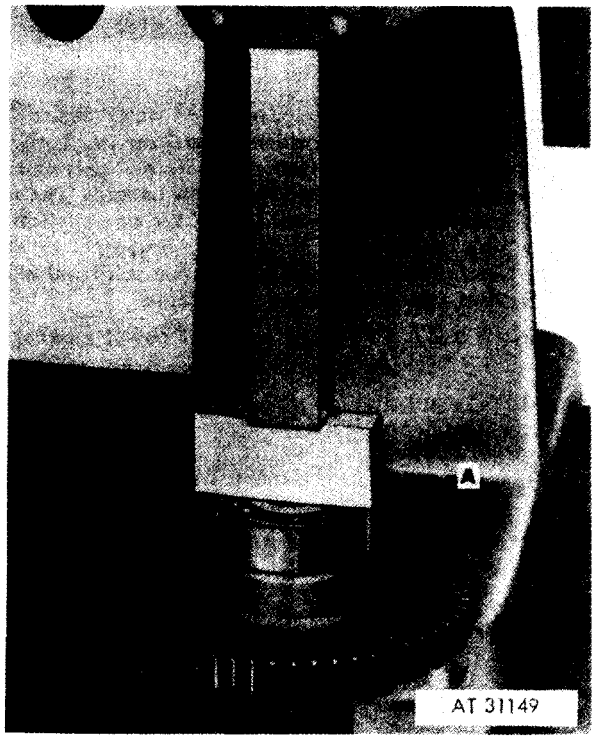
(2) Inspect generator idler gear and bearing against limits specified in overhaul standards (table 6-7). Replace parts not meeting these requirements.

Table 6-7. Generator and Starter Idler Gears Overhaul Standards

Component	Fig. No.	Ref. letter	Point of measurement	Sizes and fits of new parts		Wear limits
Generator idler gear with bearings	B-14	S	Inside diameter of bearing bore in generator idler gear	2.8334	2.8346	2.8348
	B-14	T	Outside diameter of bearing	2.8341	2.8346	*
	B-14	T-S	Fit of bearing in gear	0.0005L	0.0012T	0.0007L
	B-14	R	Outside diameter of idler gearshaft	1.1804	1.1808	1.1802
	B-14	U	Inside diameter of bearing	1.1807	1.1811	*
	B-14	U-R	Fit of bearing on idler gearshaft	0.0001T	0.0007L	0.0090L
Starter driven idler gear with bearings	B-14	X	Inside diameter of bearing bore in idler gear	3.5419	3.5433	3.5440
	B-14	V	Outside diameter of bearing	3.5427	3.5433	*
	B-14	V-X	Fit of bearing in gear	0.0006L	0.0014T	0.0013L
	B-14	Y	Outside diameter of idler gearshaft	1.1804	1.1808	1.1802
	B-14	W	Inside diameter of bearing	1.1807	1.1811	*
	B-14	W-Y	Fit of bearing on idler gearshaft	0.0001T	0.0007L	0.0009L

Note. Refer to paragraph 6-3b for explanation of symbols.

c. Assembly. Assemble generator idler gear following instructions which accompany figure 6-29. The starter idler gear is similar and may be assembled in the same manner.



1. Coat ball bearing (A) with engine oil Military Specification MIL-L-45199, and position bearing in bearing bore of generator idler gear.
2. Carefully press bearing into gear untill bearing seats against flange in gear. Secure bearing in gear with retaining ring (A) as shown in figure 6-28.

Figure 6-29. Pressing ball bearing into generator idler gear.

Section III. OVERHAUL OF CONNECTING ROD, CRANKSHAFT, AND ASSOCIATED PARTS

6-14. General

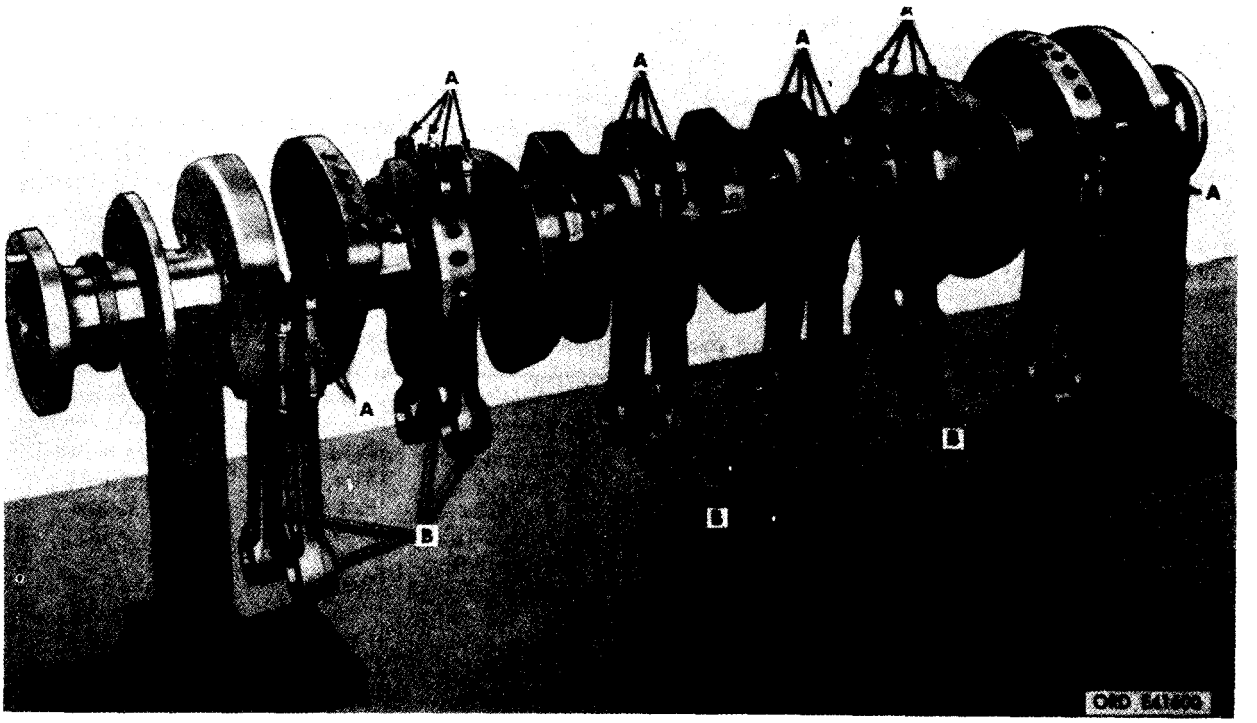
This section covers the overhaul of the connetting rods, crankshaft, and crankshaft oil seal and oil retaining plugs. Specific instructions on disassembly, cleaning, inspection, repair and assembly accompany the overhaul operations. Overhaul standards of individual components follow the inspection procedures. Refer to the following table (table 6-8) for applicable instructions and illustrations for overhaul operations.

Table 6-8. Connecting Rods, Crankshaft, and Associated Parts

Component	Disassembly	Cleaning	Inspection	Repair	Assembly
Connecting Rods	Para 6-15a Figs. 6-30 and 6-31	Para 6-2	Para 6-16c Table 6-9 Fig. 6-34	Para 6-17b Figs. 6-35 and 6-36	Para 6-18c Figs. 6-37, 6-31, and 6-30
Crankshaft		Para 6-16b	Para 6-16b Table 6-9	Para 6-17a	
Crankshaft Oil Seal	Para 6-15b Fig. 6-32	Para 6-2	Para 6-3	Para 6-4	Para 6-18b Fig. 6-32
Crankshaft Oil Retaining Plugs	Para 6-15c Fig. 6-33	Para 6-2	Para 6-3	Para 6-4	Para 6-18a Fig. 6-33

6-15. Disassembly

a. Connecting Rod Assemblies. Remove and disassemble the 12 connecting rod assemblies following instructions which accompany figures 6-30 and 6-31.



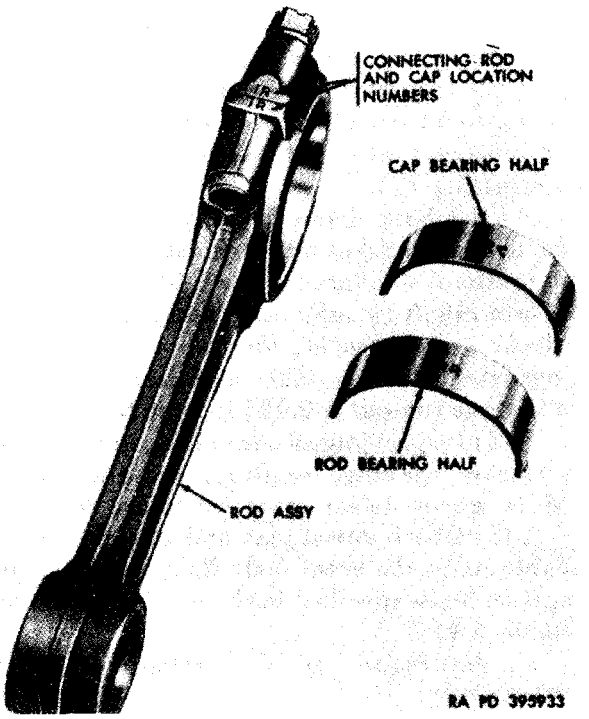
Note. Do not use a scriber or other sharp instrument for marking connecting rod bearing halves. After bearings are removed, reassemble connecting rods and caps since they are matched units and must be kept together for inspection and installation.

1. Remove 24 cotter pins (A).

Note. Care must be exercised in the handling of the connecting rods to avoid nicks and scratches which act as stress risers and can lead to premature failure.

2. Remove 24 connecting rod cap bolt nuts attaching rod caps to connecting rods (B). Remove rod caps, bearings, and connecting rods from crankshaft.

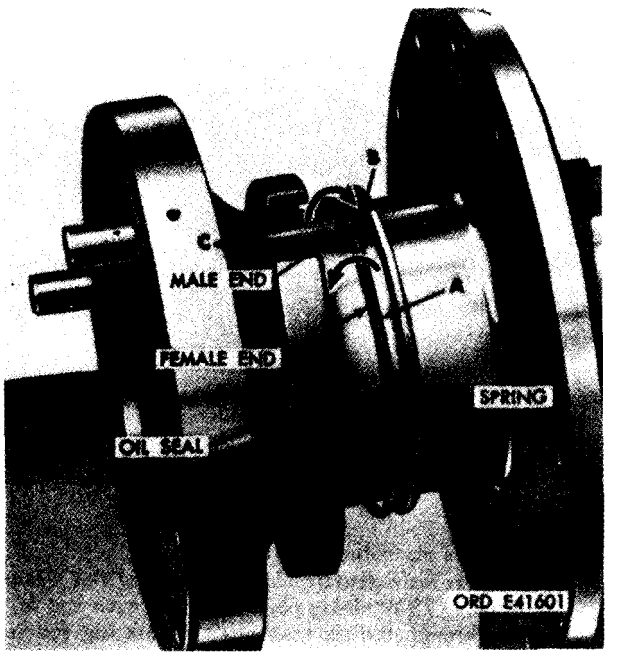
Figure 6-30. Removing or installing connecting rod assemblies.



Note. For location identification connecting rods and caps are stamped with a location number on the side of one of the bosses. For example, "1R" would identify connecting rod and cap for No. 1 cylinder on the right bank. Bearings are also marked to indicate their locations; for example, the connecting rod bearing half for cylinder "1R" is marked "1RR" and the bearing cap half for the same cylinder is marked "1RC". If the connecting rod, cap, or bearing markings are obliterated, restamp connecting rods, caps, or bearings, so that they can be installed in their original positions. In addition, the connecting rod and cap, which are a matched assembly, are marked with identifying serial numbers. These identifying serial numbers are located on the side opposite the cylinder location numbers. The rod and cap must be kept as a matched assembly, as parts are not interchangeable.

Figure 6-31. Connecting rod and bearing identification marks.

b. Crankshaft Oil Seal. Remove crankshaft oil seal following instructions which accompany figure 6-32.



Remove

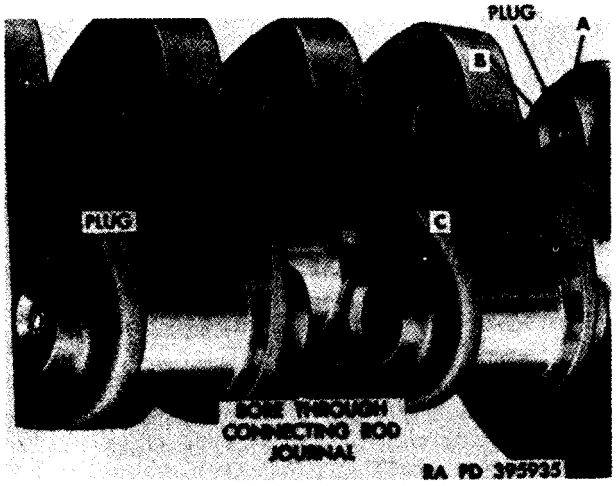
1. Separate the retaining spring (A) from spring retaining lip of the oil seal.
2. Disengage the ends of the spring ı(B) at its parting line with half turn as shown.
3. Separate seal (C) at split line and remove from the crankshaft. Discard seal and spring.

Install

1. Apply a light coating of automotive and artillery grease (GAA), FSN 9150-190-0905, to new crankshaft oil seal (C). Install oil seal on crankshaft with closed, or flat, side toward flywheel flange.
2. Place a new seal spring (A) around crankshaft as shown. Turn one end of spring one half turn clockwise and the other end one half turn counterclockwise. Insert male end into female end and release spring ends. Spring ends must be properly engaged.
3. Insert the spring in the retaining groove in the oil seal.

Figure 6-32. Removing or installing crankshaft oil seal.

c. Crankshaft. Remove crankshaft oil retaining plugs following instructions which accompany figure 6-33.



Remove
1. Remove six cotter pins (A).
2. Remove six bolts (B), slotted nuts, and flat washers.
3. Remove 12 retaining plugs (C) from each end of the bore through the six crankshaft connecting rod journals.

Install
1. position 12 retaining plugs (C) in each end of the bore through the six crankshaft connecting rod journals.
2. Install six bolts (B), slotted nuts, and flat washers securing plugs.
3. Install six cotter pins (A) securing slotted nuts.

Figure 6-33. Removing or installing crankshaft oil retaining plugs.

Note. Do not remove dowel pins (18, fig. B-3) and straight pins (25) from crankshaft unless inspection (para 6-16) indicates replacement is necessary. Dowel pins in flywheel end are secured with setscrews.

6-16. Cleaning and Inspection

a. Cleaning. Refer to paragraph 6-2. Clean crankshaft oil passages with compressed air and brass wire probes.

Note. Care must be taken not to destroy or remove main and connecting rod bearing location markings.

b. Inspection of Crankshaft.

(1) Inspect crankshaft for cracks with magnetic particle inspection equipment or similar equipment when available. When magnetic particle inspection equipment is not available use a magnifying glass (five power magnification minimum) and a strong light or dye check method. Pay particular attention to areas around crankshaft oil holes and fillets adjacent to the crank cheeks.

(2) Inspect connecting rod journal radii of crankshaft for evidence of specific points of wear or damages that would indicate a bent or twisted connecting rod.

(3) Check diameters of main bearing and connecting rod journals against limits specified in overhaul standards (table 6-9). Check run-out of crankshaft by supporting end journals in "V" blocks and measuring the run-out at the center journals with a dial indicator. Maximum allowable run-out is 0.025 inch at No. 4 journal.

(4) Inspect journals for nicks, burs, grooves. scratches, galling, scuffing, or discoloration. Mark minor defect areas for future repair.

(5) Check dowel pins and straight pins for tightness in the crankshaft flanges. Check pins against limits specified in the overhaul standards (table 6-9).

c. Inspection of Connecting Rods and Bearings.

(1) Connecting rod bearings. Inspect connecting rod bearing halves (fig. 6-31) in the same manner as described for main sleeve bearings. Apply a thin coating of Prussian blue, FSN 8010-247-8706, to the backs of the connecting rod bearings and install in their respective connecting rods and caps according to the location markings (fig. 6-31). Assemble rod and cap, and torque tighten nuts to 950-pound-inches. Check bearing inside diameter, using a dial indicator as shown in figure 6-34, against the limits specified in the overhaul standards (table 6-9) for contact as shown by Prussian blue, FSN 8010-247-8706, transfer in the same manner in which the main sleeve bearings were checked (para 6-9d). Replace any bearing that does not make at least 75 percent contact.

(2) *Connecting rod assembly.*

(a) Check connecting rod bearing bore with a dial indicator against limits specified in overhaul standards (table 6-9).

(b) Check rods for cracks and for twisted or bent condition. Bent or twisted connecting rods must be replaced. Under no circumstances should connecting rods be straightened. Destroy any rod found damaged to insure it will not be reused in an engine.

(c) Inspect for sharp corners at rod bolt counterbore and contour areas (fig. 6-35). Mark rods having sharp corners for repair.

(d) Check dimension between centerline of small and large end bores (fig. 6-36). This dimension must be 10.998 to 11.002 inches. If rods do not meet this limit, destroy to insure rods are not reused in an engine.

(e) Inspect piston pin sleeve bearing bore (fig. 6-34) for pitting, galling, scoring, or discoloration. Mark damaged bearings for replacement.

(f) Connecting rods should be matched by weight. Weight variations between connecting rods in an engine should not exceed 0.5 ounce.

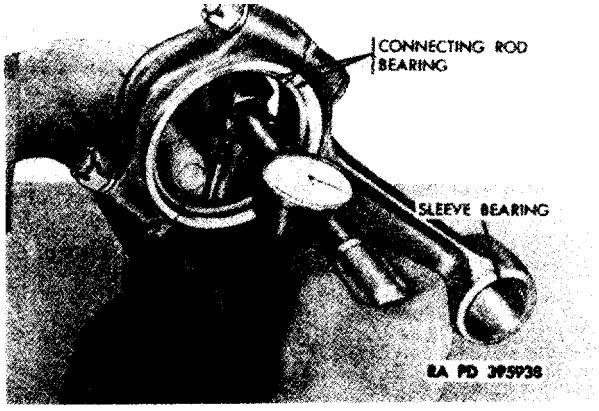


Figure 6-34. Checking connecting rod bearing bore using dial bore indicator.

Table 6-9. Connecting Rods, Crankshaft and Associated Parts Overhaul Standards

Component	Fig No.	Ref. letter	Point of measurement	Sizes and fits of new parts		Wear limits
Crankshaft	B-3	K	Outside diameter of flywheel hub on crankshaft	7.9980	7.9990	7.9970
	B-3	M	Inside diameter of crankshaft pilot bore in flywheel	8.0000	8.0010	8.0020
	B-3	M-K	Fit of flywheel on crankshaft	0.0010L	0.0030L	0.0050L
	B-3	P	Inside diameter of dowel pin holes in crankshaft hub			
			STD	0.6245	0.6255	*
			0.005 oversize	0.6295	0.6305	*
			0.010 oversize	0.6345	0.6355	*
	B-3	S	Outside diameter of dowel pin			
			STD	0.6255	0.6257	*
			0.005 oversize	0.6305	0.6307	*
			0.010 oversize	0.6355	0.6357	*
	B-3	S-P	Fit of dowel pin in crankshaft hub			
			STD	0.0000	0.0012T	*
			0.005 oversize	0.0000	0.0012T	*
			0.010 oversize	0.0000	0.0012T	*
	B-3	R	Inside diameter of transmission accessory drive gearshaft pilot bore in crankshaft	2.8338	2.8346	2.8350
	B-3	N	Outside diameter of hub on transmission accessory drive gearshaft	2.8320	2.8330	2.8315
	B-3	N-R	Fit of transmission accessory drive gearshaft in crankshaft	0.0008L	0.0026L	0.0035L
	B-3	A	Inside diameter of crankshaft pilot bore in damper	4.2515	4.2525	4.2535
	B-3	B	Outside diameter of damper hub on crankshaft	4.2490	4.2510	4.2475
	B-3	A-B	Fit of damper on crankshaft	0.0005L	0.0035L	0.0060L

Note. Refer to paragraph 6-3b for explanation of symbols.

Table 6-9. Connecting Rods, Cranksahft and Associated Parts Overhaul Standards-Continued

Component	Fig. No.	Ref. letter	Point of measurement	Sizes and fits of new parts		Wear limits
	B-3	C	Outside diameter of main bearing journals on crankshaft			
			STD	4.2495	4.2505	4.2485
			0.003 undersize	4.2465	4.2475	4.2455
			0.010 undersize	4.2395	4.2405	4.2385
	B-3	C-D	Fit (oil clearance) of bearings on journals (refer to table 6-2)	0.0040L	0.0080L	0.0100L
	B-3	W	Outside diameter of connecting rod journals on crankshaft			
			STD	3.7495	3.7505	3.7485
			0.003 undersize	3.7465	3.7475	3.7455
			0.010 undersize	3.7395	3.7405	3.7385
	B-3	L	Inside diameter of crankshaft pilot bore in accessory drive gear	9.7500	9.7520	9.7530
	B-3	J	Outside diameter of accessory drive gear mounting flange on crankshaft	9.7480	9.7500	9.7470
	B-3	L-J	Fit of accessory drive gear on crankshaft	0.0000	0.0040L	0.0060L
	B-3	G	Inside width of main thrust crankshaft journal	2.4990	2.5010	2.5030
Crankshaft	B-3	T-G	Fit (crankshaft end play) of thrust bearing in journal (refer to table 6-2)	0.0110L	0.0150L	0.0190L
	B-3	H	Inside width of connecting rod journal of crankshaft	3.1470	3.1510	3.1520
Connecting rod, bearings, and bolts	B-4	C	Thickness of bearing at center	0.1698	0.1703	0.1693
	B-4	T T	Thickness of bearings at ends (to be 0.0003 to 0.0006 less than "C")			
	B-4	VV	Inside diameter of bearing at proper torque tightness			
			STD	3.7546	3.7568	3.7573 Ref.
			0.003 undersize	3.7516	3.7538	3.7543 Ref.
			0.010 undersize	3.7446	3.7468	3.7473 Ref.
	B-3 B-4	W VV	Oil clearance between bearing and journal	0.0041L	0.0073L	0.0088L
	B-4 B-3	U U H	Outside width of connecting rod	1.5670	1.5690	*
			Side clearance of (two) rods on crankshaft journal	0.0090L	0.0180L	0.0020L
			Allowable twist of connecting rods	0.0005 per in. of bearing length (NO straightening permitting)		
	B-4	A	Inside diameter of connecting rod (crankshaft end) at proper torque tightness	4.0941	4.0946	*
	B-4	E	Inside diameter of connecting rod (piston pin end)	2.1245	2.1255	*
	B-4	B	Inside diameter of bolt hole in connecting rod and cap	0.6245	0.6255	*
	B-4	D	Outside diameter of connecting rod bolt	0.6238	0.6243	*
	B-4	B-D	Fit of bolt in rod and cap	0.0002L	0.0017L	*

Note. Refer to paragraph 6-3b for explanation of symbols.

Table 6-9. Connecting Rods, Crankshaft and Associated Parts Overhaul Standards - Continued

Component	Fig. No.	Ref. letter	Point of measurement	Sizes and fits of new parts		Wear limits
	B-4	RR	Outside diameter of split sleeve bearing must be press fit in bore. Burnish to seat sleeve bearing prior to finish diameter			
	B-4	SS	Inside diameter of bushing-type sleeve bearing	2.0025	2.0027	2.0040
	B-4	H	Outside diameter of piston pin	2.0000	2.0002	1.9998
	B-4	SS-H	Fit of pin in bearing	0.0023L	0.0027L	0.0042L

Note. Refer to paragraph 6-3b for explanation of symbols.

6-17. Repair

a. Crankshafts.

(1) Replace crankshafts that are deeply scratched, nicked, burred, scuffed or galled. Minor imperfections in the journals may be repaired by polishing with a crocus cloth dipped in dry-cleaning solvent or mineral spirits paint thinner.

(2) Crankshafts that are worn beyond standard wear limits specified in the overhaul standards (table 6-9) or with journal or crankcase damage may be ground undersize to the limits established for crankshaft rework (table 6-9).

(3) In the event any of the crankpins or journals are found unserviceable, it will be necessary to polish or grind all crankpins or journals uniformly undersize to maintain the balance of the crankshaft. Extreme care must be taken when regrinding, to maintain the concentricity of the entire crankshaft and not to exceed a surface roughness of 12 micro inches. All radii on the crankpins and journals, effected by grinding undersize, must be re-established to original configuration. The crankshaft nitride finish of crankpins and journals must be inspected by magnaflux or similar method for fractures and surface cracks after finishing.

(4) Replace dowel pins (18 fig. B-3) and straight pins (25) in crankshaft flange if pins do not fit securely in flange, are out-of-round or if pins do not conform to limits specified in the overhaul standards (table 6-9).

Note. The headless grooved dowel pins in the flywheel end flanges are available in 0.005 and 0.010 in. oversize. Ream crankshaft flywheel mounting flange to necessary oversize dimensions and install new pins. Whenever oversize pins are used, it will be necessary to ream the flywheel and transmission drive gearshaft accordingly.

(5) Replace a cracked crankshaft or a crankshaft showing evidence of wear due to bent or twisted connecting rods.

b. Connecting Rods and Bearings.

(1) Connecting rod bolts.

(a) Replace bolts that do not fit snugly in rod and cap.

(b) Replace bolts that have damaged threads, galled pilot diameters, or diameters that are not within limits specified in overhaul standards (table 6-9).

(c) Replace bolts that are cracked or scratched, or that show any evidence of stretching.

(2) *Connecting rod bearings*. Replace all bearings that do not check within limits specified in overhaul standards (table 6-9) or when bearings do not show 75 percent contact by Prussian blue transfer after bore check.

(3) Connecting rod assembly. Discard connecting rods that are bent or distorted. Straightening of connecting rods is not permitted. Break and polish sharp edges at connecting rod counterbore and rod contour (fig. 6-35). Replace connecting rod assemblies which are not within limits specified in overhaul standards (table 6-9). Connecting rods with worn or damaged piston pin bearing may be repaired. Replace worn or damaged piston pin bushing-type bearing using an arbor press. Bearing split line must be 90 degrees from longitudinal center line. Line-ream new bearing to size shown in overhaul standards (table 6-9).

Take half of the connecting rod base dimension of 4.0941 to 4.0946 in. to achieve 10.998 to 11.002 between centers (fig. 6-36).

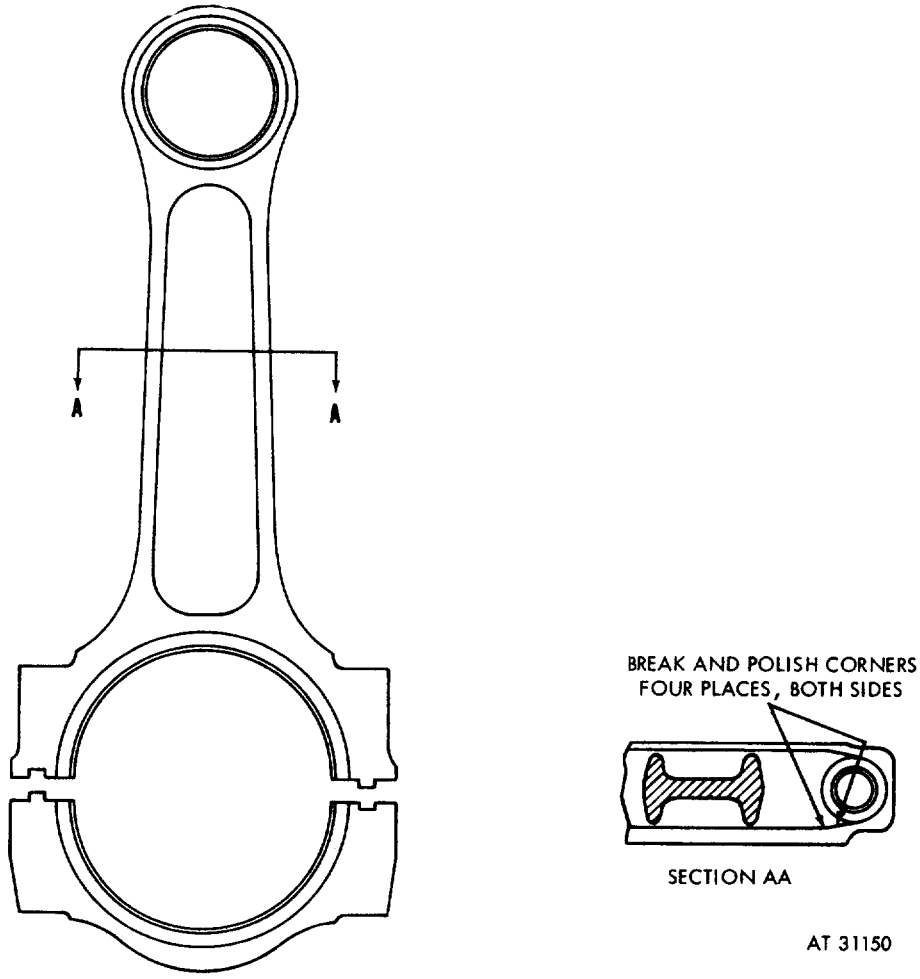


Figure 6-35. Break and polish sharp edges of connecting rod counterbore and rod contour.

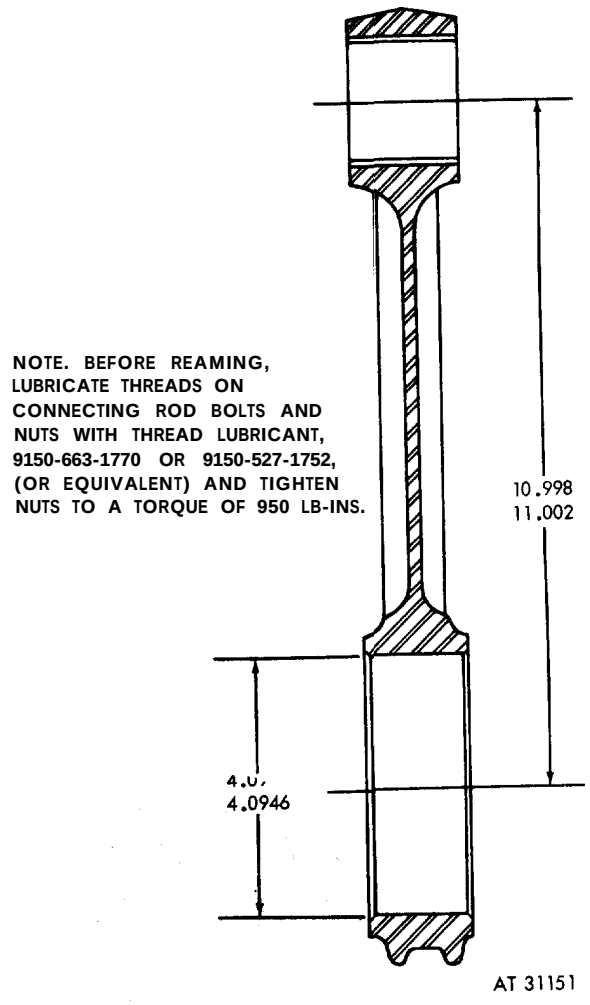


Figure 6-36. Connecting rod bore center dimensions.

6-18. Assembly

a. Crankshaft. Refer to figure 6-33.

b. Crankshaft Oil Seal. Refer to figure 6-32.

c. *Connecting Rod Assemblies.*

Note. Total weight variation between individual connecting rods on any one engine shall not exceed 0.5 ounce.

(1) Position connecting rod bearing halves in their respective rods and caps (fig. 6-31). Install two connecting rod bolts in each connecting rod making certain each bolt is properly seated in the recess provided.

(2) Position rods on crankshaft in proper location according to their identifying number. Connecting rod Nos. 1R and 1L are assembled on the journal at the damper flange end of the crankshaft. Right bank rods (marked R) are installed on the damper flange side of journal.

Note. All location numbers must be visable from the oil pan side when crankshaft and rods are installed in the crankcase.

(3) Position connecting rod cap, with bearing installed, on journal and mate it with the corresponding rod. Secure rod and cap to crankshaft with two slotted nuts.

(4) Tighten nuts to 950 pound-inches torque, plus sufficient additional torque to aline slots in nuts with cotter pin holes in bolts.

(5) Check the side clearance of each pair of connecting rods against limits specified in overhaul standards (table 6-9), using a feeler gage as shown in figure 6-37. Disassemble and replace connecting rods and bearings as necessary to obtain the proper clearance.

(6) Secure slotted nuts to connecting rod bolts with cotter pins as shown in figure 6-30.

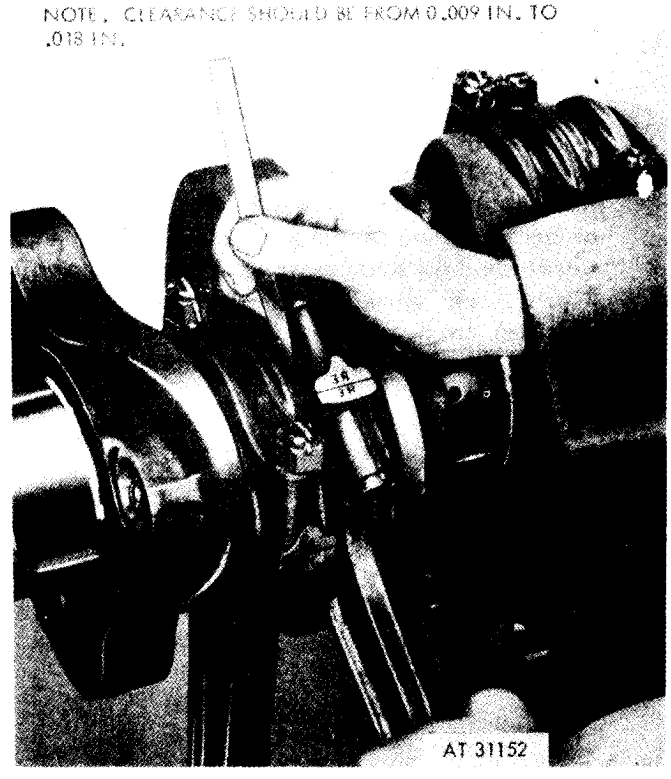


Figure 6-37. Checking connecting rod side clearance.

Section IV. OVERHAUL OF TORSIONAL VIBRATION DAMPER, FLYWHEEL, ACCESSORY DRIVE GEAR, AND TRANSMISSION DRIVE GEAR SHAFT

6-19. General

This section covers the cleaning, inspection, and repair of the torsional vibration damper, flywheel, accessory drive gear, and transmission drive gearshaft. Overhaul standards of the individual components follow the inspection procedures. Refer to the following table (table 6-10) for applicable illustrations and instructions for individual operations.

Table 6-10. Torsional Vibration Damper, Flywheel, Accessory Drive Gear, and Transmission Drive Gearshaft

Component	Cleaning	Inspection	Repair
Torsional Vibration Damper	Para 6-2	Para 6-20b Table 6-11 Fig. 6-38 and 6-39	Para 6-21b
Flywheel	Para 6-2	Para 6-20b Table 6-11 Figs. 6-40 and 6-41	Para 6-21c
Accessory Drive Gear	Para 6-2	Para 6-20b Table 6-11	Para 6-4h
Transmission Drive Gearshaft	Para 6-2	Para 6-20b Table 6-11	Para 6-21c Figs. 6-42 and 6-43

6-20. Cleaning and Inspection

a. Cleaning. Refer to paragraph 6-2.

b. Inspection. Refer to paragraph 6-3.

(1) Torsional vibration damper. Inspect torsional vibration damper (6, fig. B-3) for dents or distortion of the outer surfaces. Name and warning plates must be intact (figs. 6-38 and 6-39). Check vibration damper against limits specified in overhaul standards (table 6-11). Replace damper that is questionable or unserviceable.



Figure 6-38. Torsional vibration damper warning plate.

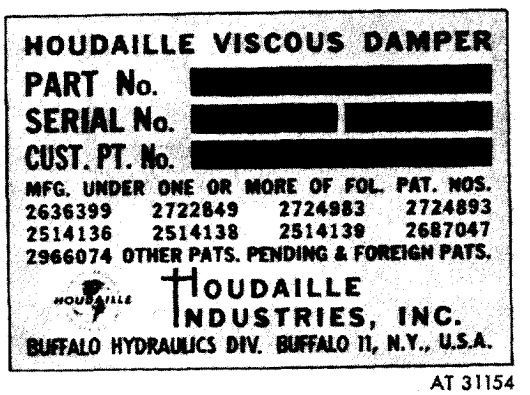


Figure 6-39. Torsional vibration damper nameplate.

(2) Flywheel. Inspect flywheel (9, fig. B-3) for elongated dowel pin holes. Mark oversize or out-of-round dowel pin holes for repair. Check flywheel fuel injection pump timing mark (IR INJ PORT CLOSE) location to be certain flywheel has been marked properly. Original production engine flywheel marks were set at 26 degrees BTC. Improved design engine flywheel marks were set at 30 degrees BTC at production and were later remarked with a dotted line to a 26 degree setting. All flywheels must be marked to the 26 degree setting with a dotted line as shown in figures 6-40 and 6-41. In the event of a flywheel having original markings only and without a dotted line to indicate the proper 26 degree BTC setting, carefully measure to determine correct degree setting and mark flywheel with a dotted line as shown in figures 6-40 and 6-41.

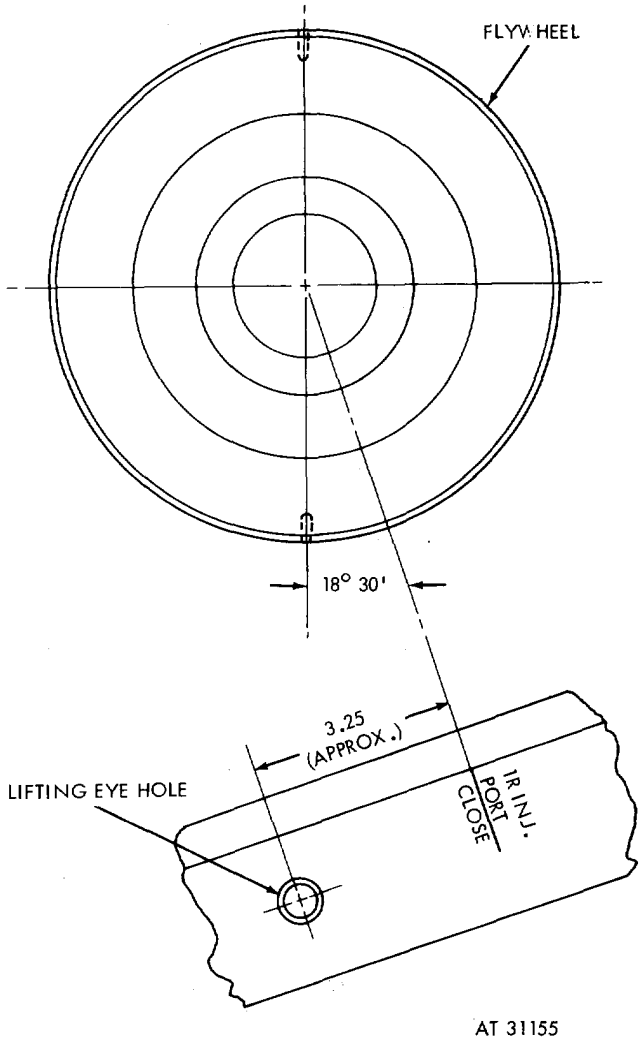


Figure 6-40. Original production engine flywheel fuel injection pump timing mark location.

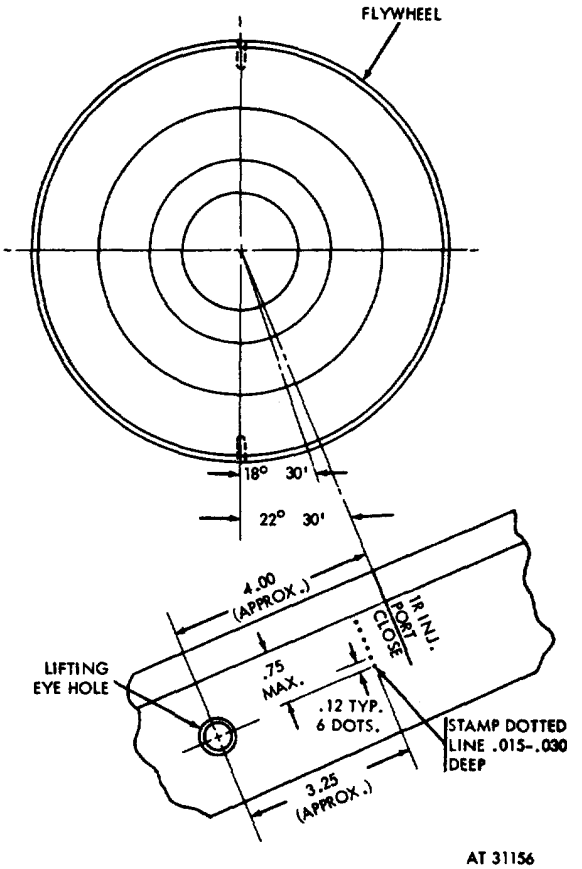


Figure **6-41.** *Improved design engine flywheel fuel injection pump timing mark location.*

(3) Transmission drive gearshaft, **Inspect gearshaft (10, figure B-3) for oversize or out-of-round dowel pin holes. Mark dowel pin holes for repair. Check bushing-type bearing against limits specified in overhaul standards (table 6-11).**

(4) ***Accessory drive gear.*** **Check accessory drive gear (8, figure B-3) against limits specified in overhaul standards (table 6-11).**

Table 6-11. Torsional Vibration Damper, Flywheel, Accessory Drive Gear, and Transmission Drive Gearshaft Overhaul Standards

Component	Fig. No.	Ref. letter	Point of measurement	Sizes and fits of new parts		Wear limits
Torsional vibration damper	B-3	A	Inside diameter of crankshaft pilot bore in damper	4.2515	4.2525	4.2535
	B-3	B	Outside diameter of damper hub on crankshaft	4.2490	4.2510	4.2475
	B-3	A-B	Fit of damper on crankshaft	0.0005L	0.0035L	0.0060L
Flywheel	B-3	K	Outside diameter of flywheel hub on crankshaft	7.9980	7.9990	7.9970
	B-3	M	Inside diameter of ‘crankshaft pilot bore in flywheel	8.0000	8.0010	8.0020
	B-3	K-M	Fit of flywheel on crankshaft	0.0010L	0.0030L	0.0050L
	B-3	Q	Flywheel runout	0.0000	0.0150	0.01.50
	B-3	P	Inside diameter of dowel pin holes in flywheel			
			STD	0.6245	0.6255	*
			0.005 oversize	0.6295	0.6305	*
			0.010 oversize	0.6345	0.6355	
	B-3	S	Outside diameter of dowel pin in crankshaft			
			STD	0.6255	0.6257	*
			0.005 oversize	0.6305	0.6307	*
			0.010 oversize	0.6355	0.6357	*
	B-3	S-P	Fit of dowel pin in flywheel			
			STD	0.0000	0.0012T	*
			0.005 oversize	0.0000	0.0012T	*
			0.010 oversize	0.0000	0.0012T	*
Accessory drive gear	B-3	J	Outside diameter of accessory drive gear mounting flange on crankshaft	9.7480	9.7500	9.7470
	B-3	L	Inside diameter of crankshaft pilot bore in accessory drive gear	9.7500	9.7520	9.7530
	B-3	L-J	Fit of accessory drive gear in crankshaft	0.0000	0.0040L	0.0060L
Transmission drive gearshaft	B-3	N	Outside diameter of hub on transmission accessory drive gearshaft	2.8320	2.8330	2.8315
	B-3	R	Inside diameter of transmission accessory drive gearshaft pilot bore in crankshaft	2.8338	2.8346	2.8350
	B-3	N-R	Fit of transmission accessory drive gearshaft in crankshaft	0.0008L	0.0026L	0.0035L
	B-3	P	Inside diameter of dowel pin hole in transmission drive gearshaft			
			STD	0.6245	0.6255	*
			0.005 oversize	0.6295	0.6305	*
			0.010 oversize	0.6345	0.6355	*
	B-3	S	Outside diameter of dowel pin in crankshaft			
			STD	0.6255	0.6257	*
			0.005 oversize	0.6305	0.6307	*
			0.010 oversize	0.6355	0.6357	*
	B-3	S-P	Fit of dowel pin in transmission drive gearshaft			
			STD	0.0000	0.0012T	*
			0.005 oversize	0.0000	0.0012T	*
			0.010 oversize	0.0000	0.0012T	*

Note. Refer to paragraph 6-3b for explanation of symbols.

6-21. Repair

a. General. Refer to paragraph 6-4.

b. Torsional Vibration Damper. Replace torsional vibration damper when it does not conform to limits specified in overhaul standards (table 6-11). Replace damper when dented or distorted. Remove minor imperfections with crocus cloth.

c. Flywheel and Transmission Drive Gearshaft. Repair elongated dowel pin holes in flywheel and gearshaft by reaming to either 0.005 or 0.010 inch oversize. Install the appropriate oversize dowel pins. It will be necessary to line ream the crankshaft flange, flywheel, and transmission drive gearshaft to install the replacement oversize pins.

d. Transmission Drive Gearshaft Bushing-type Bearing. When the gearshaft bushing-type bearing needs replacement, use a suitable arbor and an arbor press to remove bushing-type bearing as shown in figure 6-42. Press new bushing-type bearing into gearshaft using arbor press as shown in figure 6-43. Ream the bushing-type bearing from 1.3775 to 1.3780 inch after installation. When oversize dowel pins have been installed in the crankshaft, transmission drive gearshaft dowel pin holes must be reamed to the proper oversize dimension.

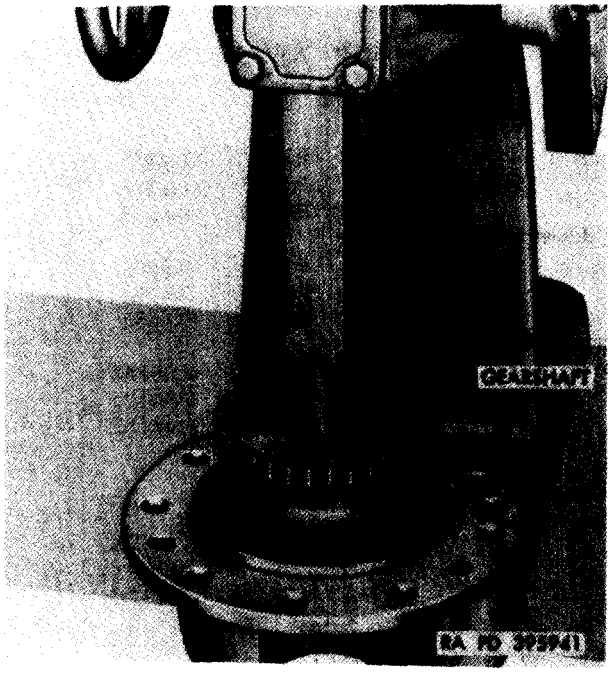


Figure 6-42. Pressing bushing-type bearing from transmission drive gearshaft.



Figure 6-43. Pressing bushing-type bearing into transmission drive gearshaft.

e. Accessory Drive Gear. Refer to paragraph 6-4h for repair of accessory drive gear.

Section V. OVERHAUL OF PISTONS, RINGS, AND PISTON PINS

6-22. General

This section covers the overhaul of the pistons, rings, and piston pins. Specific instructions on disassembly, cleaning, inspection, repair, and assembly accompany the overhaul operations. Overhaul standards of individual components follow the inspection components. Refer to the following table (table 6-12) for applicable illustrations and instructions for overhaul operations.

Table 6-12. Pistons, Rings, and Piston Pins

Component	Disassembly	Cleaning	Inspection	Repair	Assembly
Piston	Para 6-23 Figs. 6-44 and 6-45	Para 6-24	Para 6-25a Table 6-13	Para 6-26a	Para 6-27 Figs. 6-46 through 6-44
Piston Rings			Para 6-25b Table 6-13	Para 6-26b	
Piston Pins		Para 6-24	Para 6-25c Table 6-13	Para 6-26c	

6-23. Disassembly

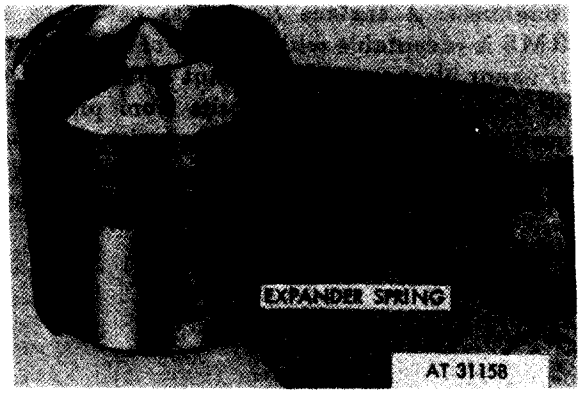
a. Pistons. Disassemble pistons following instructions which accompany figures 6-44 and 6-45.



Note. Before removing compression rings and oil control ring, check to see if they are free in piston grooves. Mark ring grooves of sticking rings for further detailed inspection.

1. Place jaws of remover and replacer - 5120-795-0177 in the end gap of upper piston ring (A). Spread ring, lift out of groove, and remove from piston. Discard piston ring.
2. Remove and discard two intermediate compression rings (B) and oil control ring in the same manner.

Figure 6-44. Removing or installing piston compression rings using remover and replacer-5120-795-0177.



Remove

1. Remove oil control piston ring expander spring (A) by separating at parting line as shown. Discard spring.

Install

1. Install new oil control ring expander spring (A) in oil control groove of piston and join ends of spring together as shown.

Figure 6-45. Removing or installing oil control piston ring expander spring.

6-24. Cleaning

a. Pistons.

(1) Clean pistons (9.3, fig. B-4) and piston pins (9.2) by soaking in carbon removing compound, Specification MIL-S-12382 (Ord Type 1).

Warning: Use goggles, rubber gloves, and rubber apron when cleaning parts in carbon removing compound. Provide adequate ventilation. Avoid inhalation of fumes and skin contact. If compound is splashed on skin, flush with fresh water and wash with alcohol. Alcohol containing 2 to 3 percent camphor is preferable.

(2) Optional cleaning of the piston can be accomplished with a vapor blast using glass heads to provide the cleaning action and surface roughness. A surface roughness of 50 to 100 RMS is exceptable with a RMS of 80 preferred. If vapor blast equipment is not available, scrape off remaining carbon deposits from piston ring grooves with a scraper or broken piston ring. Be careful not to scratch or gouge ring lands on piston. Clean oil drain holes and oil ring grooves in piston. Remove carbon from oil holes in ring grooves. Clean carbon from piston pins with crocus cloth dipped in dry-cleaning solvent or mineral spirits paint thinner.

6-25. Inspection

a. Pistons. Inspect piston for cracks, flaws or distortion. Use a magnifying glass and a strong light. Small cracks will show under the light as irregular or dark streaks. Check piston ring grooves against limits specified in overhaul standards (table 6-13). Inspect piston for dam age or broken ring lands, nicks, burrs, or scratches. Inspect piston pin bores for wear, cracks, or abrasions. Replace piston if found unserviceable.

b. Piston *Rings.* Inspection of piston rings rem oved from piston is not required. New rings will be installed during piston assembly.

c. Piston Pins and Plugs. Inspect piston pin and plugs for cracks, nicks, or wear. Inspect end plugs for large wear pattern and replace if found unserviceable. Check diameter of pins against limits specified in overhaul standards (table 6-13).

Table 6-13. Pistons, Piston Rings and Piston Pins overhaul Standards

Component	Fig. No.	Ref. letter	Point of measurement	Sizes and fits of new parts		Wear limits
Piston	B-4	QQ	Diameter at bottom of skirt 90 degrees to piston pin	5.7415	5.7425	5.7385 to 5.7435
	B-4	K K	Diameter of top groove in piston (measured over 0.11547 dia. pins)	5.7380	5.7480	5.7280
	B-4	L L	Inside width of top intermediate groove in piston	0.0990	0.1000	0.1035
	B-4	M M	Inside width of lower intermediate groove in piston	0.0980	0.0990	0.1025
	B-4	N N	Inside width of oil control ring groove in piston	0.1880	0.1890	0.1910
	B-4	J	Inside diameter of piston pin bore in piston	2.0018	2.0020	2.0012 to 2.0030
Piston Pins	B-4	H	Outside diameter of piston pin	2.0000	2.0002	1.9998
	B-4	J-H	Fit of piston pin in Piston	0.0016L	0.0020L	0.0006L: to 0.0032L
	B-4	F	Outside diameter of piston pin plugs	0.9975	0.9985	*
	B-4	G	Inside diameter of bore in piston pin	0.9995	1.0005	*
	B-4	F-G	Fit of piston pin plug in piston pin	0.0010L	0.0030L	*
Piston Rings	B-4	C C	Gap clearance of top compression ring when fitted in gage	0.0500	0.0600	*
	B-4	E E	Outside width of top intermediate compression ring	0.0925	0.0935	*
	B-4	LL-E E	Clearance between ring and piston	0.0055L	0.00075L	0.0110L
	B-4	D D	Gap clearance of ring when fitted in gage	0.0500	0.0600	*
	B-4	G G	Outaide width of lower compression ring	0.0925	0.0935	*
	B-4	MM-G G	Clearance between ring and piston	0.0045L	0.0065L	0.0100L
	B-4	F F	Gap clearance of ring when fitted in gage	0.0500	0.0600	*
	B-4	J J	Outaide width of oil control ring	0.1850	0.1865	*
	B-4	NN-J J	Clearance between ring and piston	0.0015L	0.0040L	0.0060L
Piston Rings	B-4	H H	Gap clearance of ring when fitted in gage	0.0300	0.0500	*
	B-4	L	Cylinder bore diameter measured up 2.250 inches from bottom of cylinder skirt	5.7510	5.7530	5.7600
	B-4	0 0 - L	Fit of piston in cylinder bore, measured up 2.250 inches from bottom of cylinder skirt, 90 degrees to piston pin	0.0075L	0.0115L	0.0215L

Note. **Refer to paragraph 6-3b for explanation of symbols.**

6-26. Repair

a. Pistons.

(1) *Replace* pistons which are not within limits specified in overhaul standards (table 6-13).

(2) Replace pistons which are distorted, cracked, worn, or abraded.

(3) Replace piston if oil holes in the ring lands cannot be cleared or if lands are damaged or broken.

(4) Replace pistons that are badly burred, nicked, or scratched. Remove minor burs, nicks, or scratches from pistons with crocus cloth dipped in dry-cleaning solvent or mineral spirits paint thinner.

b. Piston Rings. Piston rings cannot be repaired. All piston rings must be replaced with new rings at engine overhaul.

c. Piston Pins and Plugs. Replace piston pins and plugs which are cracked, or have deep nicks or scratches. Remove minor nicks or scratches with crocus cloth dipped in dry-cleaning solvent or mineral spirits paint thinner. Replace piston pin plugs which have a large wear pattern on the end. Replace piston pins and plugs not within limits specified in overhaul standards (table 6-13).

6-27. Assembly

a. Check marking on new rings and install the upper (tapered) compression ring and the two intermediate compression rings with the marking "UP" toward the piston dome. Install all rings using remover and replacer - 5120-795-0177 as shown in figures 6-44 and 6-45. Use care in installing rings to avoid damaging ring lands or distorting rings.

b. Measure side clearance of all new ring (fig. 6-46). Replace rings when side clearance does not conform to limits specified in overhaul standards (table 6-13).



Figure 6-46. Checking piston ring side clearance.

c. Install piston in bore of piston and install a piston pin plug at each end of piston pin.

d. Select pistons according to weight. Variations in the weight of pistons in an engine should not exceed 0.5 ounce.

Section VI. OVERHAUL OF CYLINDER ASSEMBLY

6-28. General

This section covers the overhaul of the cylinder assembly. Specific instructions on disassembly, cleaning, inspection, repair, and assembly accompany the overhaul operations. Overhaul standards of individual components follow the inspection procedures. Stud identification information is included in the repair procedures. Refer to tbe following table (table 6-14) for applicable illustrations and instructions for overhaul operations.

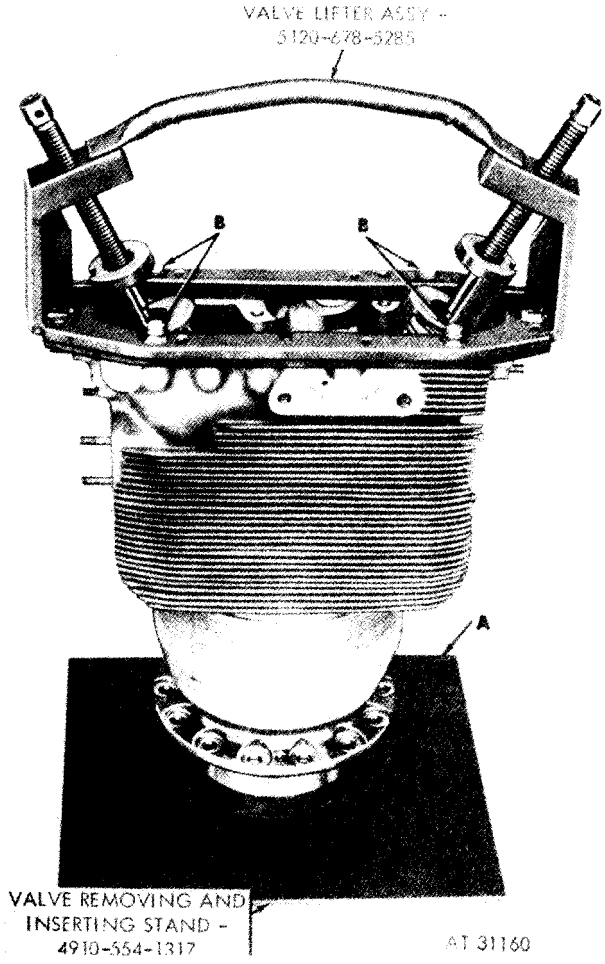
Table 6-14. CylinderAssembly

Component	Disassembly	Cleaning	Inspection	Repair	Assembly
Cylinder	Para 6-29 Figs. 6-47 through 6-49	Para 6-30 Fig. 6-50	Para 6-31 and 6-32 Table 6-15 Figs. 6-52 through 6-57	Pam 6-33 Table 6-16 Figs. 6-8 through 6-64	Para 6-34 Fig. 6-65

6-29. Disassembly

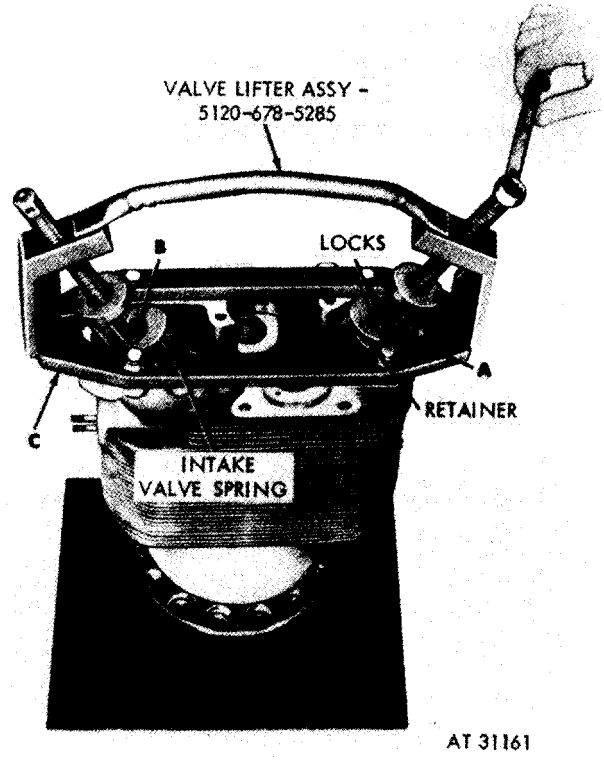
a. Cylinder. Disassemble cylinder assembly following instructions which accompany figures 6-47 through 6-49.

Note. The 12 rocker arm cover assemblies are machined with cylinder assemblies as matched units. The covers are stamped with matching numbers (fig. 5-105) to correspond with the number stamped on the cylinder. Keep covers with their respective cylinders.



1. Place cylinder with valves, springs, and retainers on removing and inserting valve stand - 4910-554-1317 (A).
2. Secure valve lifter assembly - 5120-678-5285 to the cylinder head with four bolts (B) and flat washers.

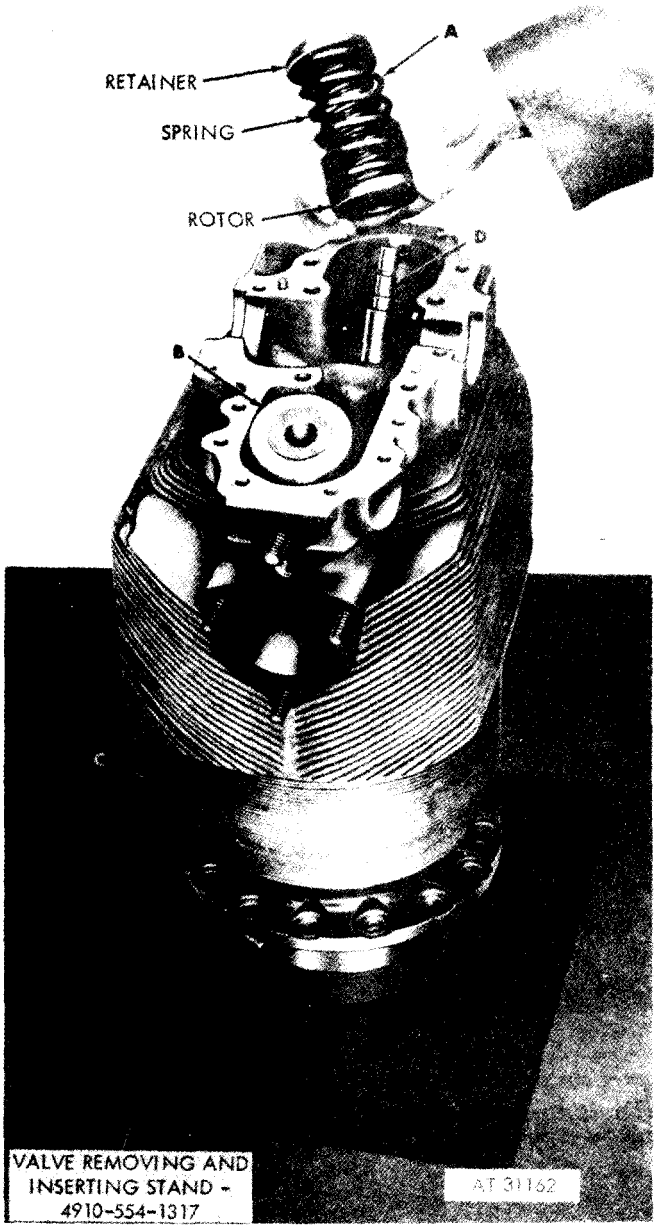
Figure 6-47. Cylinder showing position of valve lifter assembly - 5120-678-5285 and removing and inserting valve stand - 4910-554-1317.



Warning: The valves and locks are under heavy spring tension. Exercise extreme care when removing locks, retainers and springs.

1. Compress exhaust valve spring and upper retainer.
2. Remove two valve locks (A) from the groove in valve stem. Tap valve spring retainers to free locks. Carefully loosen lifter screw to release valve springs.
3. Remove intake valve spring upper retainer locks (B) in the same manner.
4. Remove lifter assembly (C).

Figure 6-48. Compressing exhaust valve springs to remove or install upper valve spring retainer and locks.



1. Remove exhaust valve inner, intermediate, and outer valve springs, upper retainer and exhaust valve rotor (A) from valve stem.
2. Remove intake valve springs (B), retainer, and seat in the same manner.
3. Hold the valve stems in position in the cylinder head and remove the cylinder from removing and inserting valve stand - 4910-554-1317 (C).
4. Place cylinder on side and remove the intake and exhaust valves (D) through the cylinder bore.

Note. Temporarily install valve rocker arm covers on cylinders with two bolts to prevent damage arid mismating of parts. Refer to figure 5-105 for cover and cylinder identification.

Figure 6-49. Removing or installing valve springs, upper retainers, and exhaust valve rotor.

b. Value Rocker Arm Covers. Refer to paragraph *4-14*.

6-30. Cleaning.

a. Clean cylinder and associated parts, and remove heavy carbon deposits from combustion chamber with a scraper or blunt tool which will not nick or scratch the surface, Remove only the heavy carbon deposits. Surface need not be cleaned to a mirror finish.

b. Clean carbon from fuel injector nozzle seat using nozzle carbon cutter - 4910-795-7958 as shown in figure 6-50.

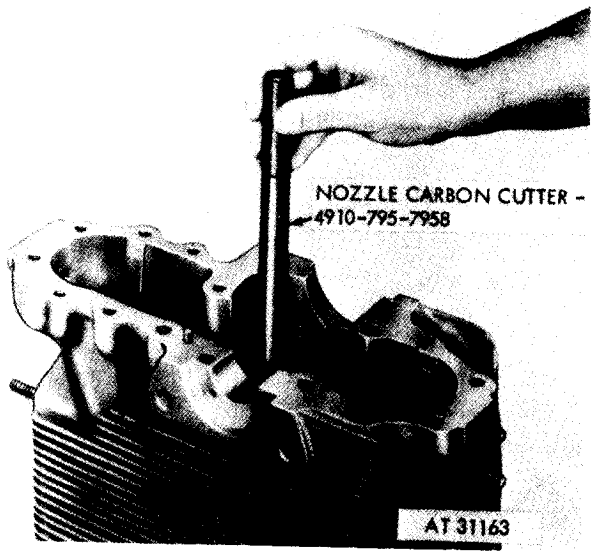


Figure 6-50. Clean ing carbon deposits from fuel injector nozzle seal using nozzle carbon cutter - 4910-795-7958.

c. Soak cylinder in carbon removing compound to remove carbon and other foreign material from dome, valve ports, and the area between the top of the barrel and the head casting.

6-31. Inspection

a. Valve Guides. Inspect valve guides (14 and 37, fig. B-4), for cracks, galling, erosion, or scuffing. Check guides for secure fit in cylinder. Check guides against limits specified in the overhaul standards (table 6-15).

Note. Do not remove valve guides unless replacement is necessary.

b. Valve Seat Inserts. Check valve seat inserts for secure fit in the cylinder (41, fig. B-4). Inserts must have tight fit. Inspect inserts for burned or pitted surfaces. Check valve seat contact by lightly bluing face of insert with Prussian blue - 8010-247-8706 and placing a new valve into position on valve insert. Rotate valve one-half turn on insert and check valve seat for Prussian blue contact. Valve seat must show perfect contact, as indicated by Prussian blue transfer, to qualify as a serviceable insert. Inserts that do not show perfect contact must be marked for repair. If inserts are cracked, loose, or damaged beyond repair, the cylinder must be replaced. If valve seat inserts can be made serviceable by grinding; repair as outlined in-paragraph 6-33a(2). Check the inserts against limits specified in overhaul standards (table 6-15).

c. Cylinder. Two types of cylinders have been used on the ADVS-1790 series engines. The latest type cylinder has a wall thickness increased by 0.030 inch to provide greater strength. These cylinders can be identified by a machined groove on the cylinder mounting flange periphery, refer to figure 6-51.

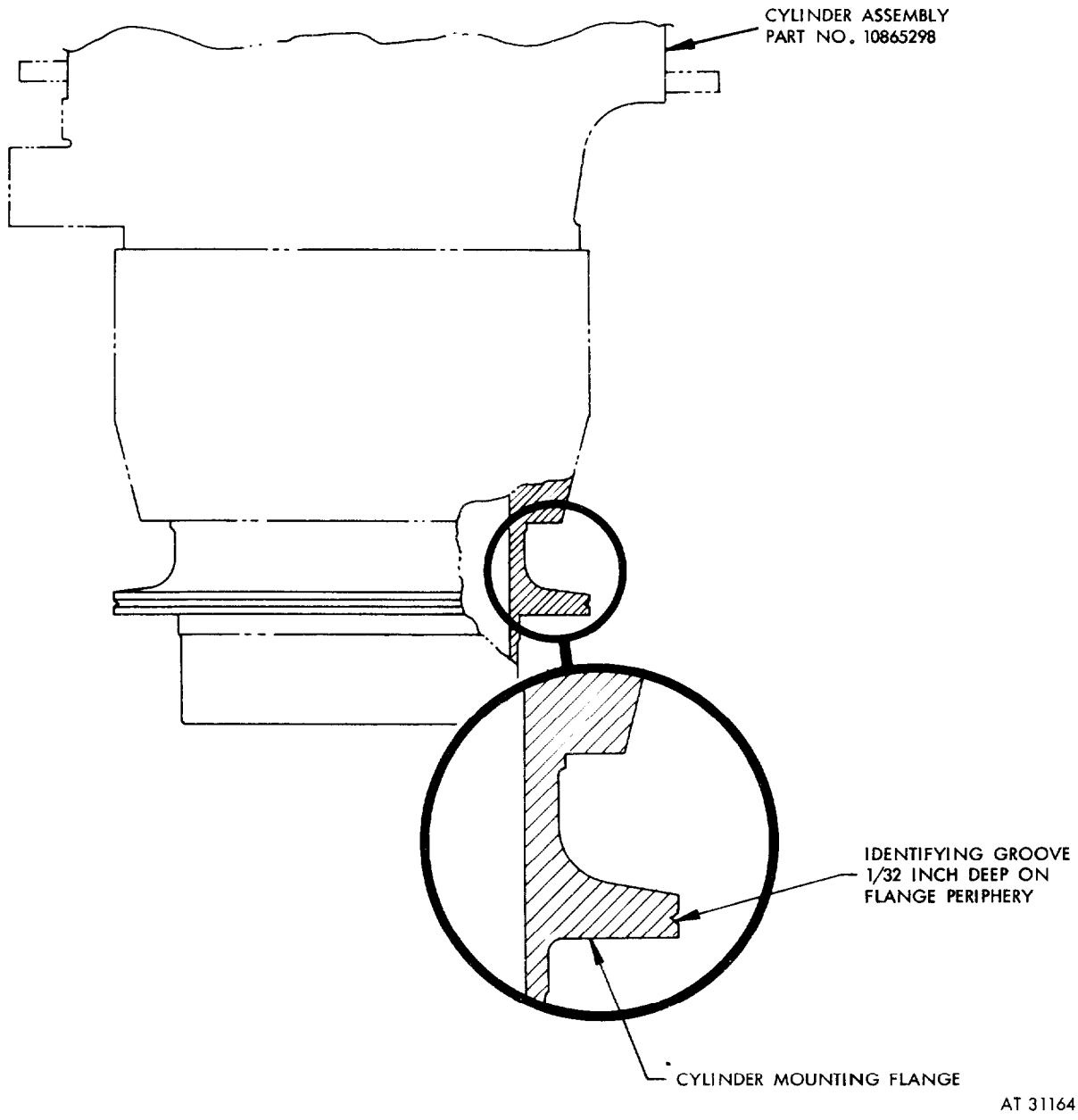


Figure 6-51. Cylinder identifying groove.

(1) *Cylinder barrel.* Refer to paragraph 6-32. Ultrasonic Inspection of Cylinder Barrel, for inspection procedures of the cylinder barrel.

(2) *Cylinder bore.* Inspect cylinder bore for deep scratches, scoring, or metal pickup. Inspect joint between cylinder head and cylinder barrel for pitting or erosion. Carefully run finger over cylinder wall to check for ring ridge.

(3) *Cylinder bore dimensions.* Cylinder bores taper slightly at the head end (a room temperature). The tapered section expands, and is essentially straight at operating temperature. Check bore dimensions, as described in (a) through (d), below, against limits specified in overhaul standards (table 6-15).

(a) With cylinder at room temperature, take two cylinder bore measurements at top of ring travel. Measure diameter approximately parallel to line of valves, and then take cross

measurement (90 degrees) to first measurement. Average the two measurements.

(b) Take two measurements of diameter bore at bottom of ring travel. Measure diameter of bore approximately parallel to line of valves, and then take cross measurement (90 degrees) to first measurement. Average the two measurements.

(c) Head-end average must not exceed flange-end average.

(d) Compare the measurements taken 90 degrees apart. Each two measurements (top or bottom) must be within 0.003 inches of each other. If the difference exceed 0.003 inches, the cylinder is out-of-round and must be marked for repair.

(4) *Camshaft bearing surface.* Inspect cam shaft bearing surface for pitting, galling, burs, and nicks. Check bearing diameter, with rocker arm cover installed, against limits specified in overhaul standards (table 6-15).

(5) *Cylinder exterior.* Inspect cylinder head and barrel cooling fins for possible repair (para 6-33 f).

d. Valve Rocker Arm Covers and Associated Parts. (Refer to fig. B-4)

(1) *Valve rocker arm cover.* Inspect valve rocker arm cover (39) for cracks. Inspect cam shaft bearing surface in cover for galling, pitting, burs, and nicks. Check cover against limits specified in overhaul standards (table 6-15). Check valve adjusting cover plate (29) for cracks and for warpage. Replace cylinder assembly when cover is unserviceable.

(2) *Valve rocker arms.* Inspect valve rocker arms (33 and 34) for cracks, using a magnifying glass and a strong light. Inspect the bushing-type bearings in the rocker arms for scoring and secure fit. Check bearings against limits specified in overhaul standards (table 6-15). Inspect valve rocker arm rollers for scuff or score marks and for looseness on hub. Rotate roller and check clearance between roller and hub by mounting rocker arm securely in a soft-jawed vise. Set a dial indicator against contact surface of roller and move roller through the extremes of its travel. Check reading on the dial indicator. Limits should be 0.006L in. maximum. Mark worn or damaged rollers and hubs for repair. Inspect adjusting screws (36) for stripped or dam aged threads. Check screw by turing screw in and out of rocker arms. Screw must turn freely. Check swivel pad on adjusting screw for free rotation, Mark damaged parts for replacement.

(3) *Valve rocker arm shafts.* Check valve rocker arm shafts (22 and 35) for cracks, nicks, scoring, or plugged oil passages. Check shafts against limits specified in overhaul standards (table 6-15). Replace unserviceable shafts.

(4) Valves.

(a) *Valve head.* Check intake and exhaust valve (11 and 12) for evidence of pitting, imperfect seating, or warping on valve head. Heavy discoloration, burning, erosion, or a heavy carbon deposit on valve face indicates a warped valve. A light frosted appearance or minor discoloration on valve face does not indicate a warped or unserviceable valve.

(b) *Value stem.* Inspect the valve stems and the locking groove in the stems for pitting, scoring cracks, or damaged tips. Checks valves against limits specified in overhaul standards (table 6-15). Replace valves that are warped, cracked, or unserviceable.

(5) *Valve* springs. Inspect inner spring (18), intermediate spring (17), and outer spring (16) for wear, cracks, set, or other evidence of failure. Check all springs against limits specified in the overhaul standards (table 6-15).

(6) *Valve spring retainers, valve rotors, and locks.* Inspect valve spring retainers (19 and 38) and intake valve spring seat (15) for wear and cracks. Check exhaust valve rotor (40) by rotating inner section. Inner section must rotate freely. Inspect rotor for wear or cracks. Inspect spring retainer locks for wear or cracks. Worn locks will have ridges on top face. Replace any unserviceable parts.

Table 6-15. Cylinder Assembly Overhaul Standards

Component	Fig. No.	Ref. letter	Point of measurement	Sizes and fits of new parts		Wear limits
Cylinder	B-4	L	Bore diameter 2.250 inch from bottom of skirt	5.7510	5.7530	5.7600
			Bore diameter 6.250 inch from bottom of skirt	5.7510	5.7530	5.7600
			Bore diameter 8.750 inch from bottom of skirt	5.7510	5.7530	5.7600
			Bore diameter 10.000 inch from bottom of skirt	5.7438	5.7473	5.7520
			Bore diameter 10.500 inch from bottom of skirt	5.7410	5.7449	5.7449 to 5.7540
			Bore diameter 10.750 inch from bottom of skirt	5.7396	5.7439	5.7438 to 5.7535
			Maximum out-of-round of cylinder bore	0.0020		0.0040
	B-4	QQ	Piston diameter at bottom of skirt, 90 degrees to piston pin	5.7415	5.7425	5.7385 to 5.7435
Cylinder	B-4	QQ-L	Fit of piston in cylinder bore measured up 2.250 inches from bottom of cylinder skirt, 90 degrees to piston pin	0.0075L	0.0115L	0.0215L
	B-4	M	Inside diameter of intake valve guide bore in cylinder head	0.6870	0.6880	*
	B-4	W	Outside diameter of intake valve guide			
			STD	0.6890	0.6895	*
			0.0100 oversize	0.6990	0.6995	*
			0.0200 oversize	0.7090	0.7095	*
	B-4	W-M	Fit of intake valve guide in cylinder head bore	0.0010T	0.0025T	*
	B-4	AA	Inside diameter of exhaust valve guide bore in cylinder head	0.7495	0.7505	*
	B-4	Z	Outside diameter of exhaust valve guide			
			STD	0.7525	0.7530	*
			0.0100 oversize	0.7625	0.7630	*
			0.0200 oversize	0.7725	0.7730	*
Cylinder	B-4	Z-AA	Fit of exhaust valve guide in cylinder head bore	0.0020T	0.0035T	*
	B-4	X	Inside diameter of camshaft bearing in cylinder	1.3120	1.3130	1.3135
	B-5	L	Outside diameter of journals on camshafts	1.3090	1.3100	1.3085
	B-5	L	Fit of journal in bearing	0.0020L	0.0040L	0.0050L
	B-4	X				
Valve Guides and Valves	B-4	W	Outside diameter of intake valve guide			
			STD	0.6890	0.6895	*
			0.0100 oversize	0.6990	0.6995	*
			0.0200 oversize	0.7090	0.7095	*

Note. Refer to paragraph 6-3b for explanation of symbols.

Table 6-15. Cylinder Assembly Overhaul Standards —Continued

Component	Fig. No.	Ref. letter	Point of measurement	Sizes and fits of new parts		Wear limits
Valve guides and Valves	B-4	M	Inside diameter of intake valve guide bore in cylinder head	0.6870	0.6880	*
	B-4	W-M	Fit of intake valve guide of bore	0.0010T	0.0025T	*
	B-4	V	Inside diameter of intake valve guide	0.4995	0.5005	0.5035
	B-4	K	Outside diameter of intake valve stem	0.4975	0.4980	0.4970
	B-4	K-V	Fit of intake valve stem in guides	0.0015L	0.0030L	0.0065L
	...	...	Angle of intake valve seat with valve stem	45 degrees, 00 minutes to 45 degrees, 15 minutes		
	B-4	Z	Outside diameter of exhaust valve guide			
			STD	0.7525	0.7530	*
			0.0100 oversize	0.7625	0.7630	*
			0.0200 oversize	0.7725	0.7730	*
	B-4	AA	Inside diameter of exhaust valve guide bore in cylinder head	0.7495	0.7505	*
	B-4	Z-AA	Fit of exhaust valve guide in bore	0.0020T	0.0035T	*
	B-4	Y	Inside diameter of exhaust valve guide	0.5615	0.5625	0.5655
	B-4	BB	Outside diameter of exhaust valve stem in guide	0.5570	0.5580	0.5565
	B-4	BB-Y	Fit of exhaust valve stem in guide	0.0035L	0.0055L	0.0090L
	...	...	Angle of exhaust valve seat with valve stem	45 degrees, 00 minutes to 45 degrees, 15 minutes		
Valve springs	B-4	U	Outer valve compression spring (large)			
			Scale reading at 1.56 inch length	134.2 lbs ±13.42 lbs		*
			Scale reading at 2.26 inch length	85.4 lbs ±4.27 lbs		*
			Maximum solid height	1.28 inch		*
	B-4	T	Intermediate valve compression spring (medium)			
			Scale reading at 1.56 inch length	81.4 lbs ±8.14 lbs		*
			Scale reading at 2.26 inch length	51.7 lbs ±2.585 lbs		*
			Maximum solid height	1.34 inch		*
	B-4	S	Inner valve compression spring (small)			
			Scale reading at 1.37 inch length	43.9 lbs ±4.39 lbs		*
			Scale reading at 2.07 inch length	26.2 lbs ±1.31 lbs		*

Note. Refer to paragraph 6-3b for explanation of symbols.

Table 6-15. Cylinder Assembly Overhaul Standards — Continued

Component	Fig. No.	Ref. letter	Point of measurement	Sizes and fits of new parts		Wear limits
Valve springs	B-4	S	Inner valve compression spring (small) Maximum solid height	1.28 inch		*
Rocker arms and rocker arm shafts	B-4	N	Outside diameter of valve rocker arm shafts	0.7480	0.7485	0.7470
	B-4	R	Inside diameter of sleeve in rocker arm	0.7495	0.7505	0.7520
	B-4	N-R	Fit of shaft in sleeve bearing	0.0010L	0.0025L	0.0050L
	B-4	P	Side clearance between rocker covers and rocker arms	0.0060	0.0140	0.0200
	B-4	Q	Rocker roller radial clearance	0.0015L	0.0035L	0.0060L

Note. Refer to paragraph 6-3b for explanation of symbols.

6-32. Ultrasonic Inspection of Cylinder Barrel (Part No. 10865297, FSN 2815-765-9711)

a. General. The following paragraphs, b through e, contain the procedure for using cylinder barrel tester on part No. 10865297 (2815-765-9711) cylinder only.

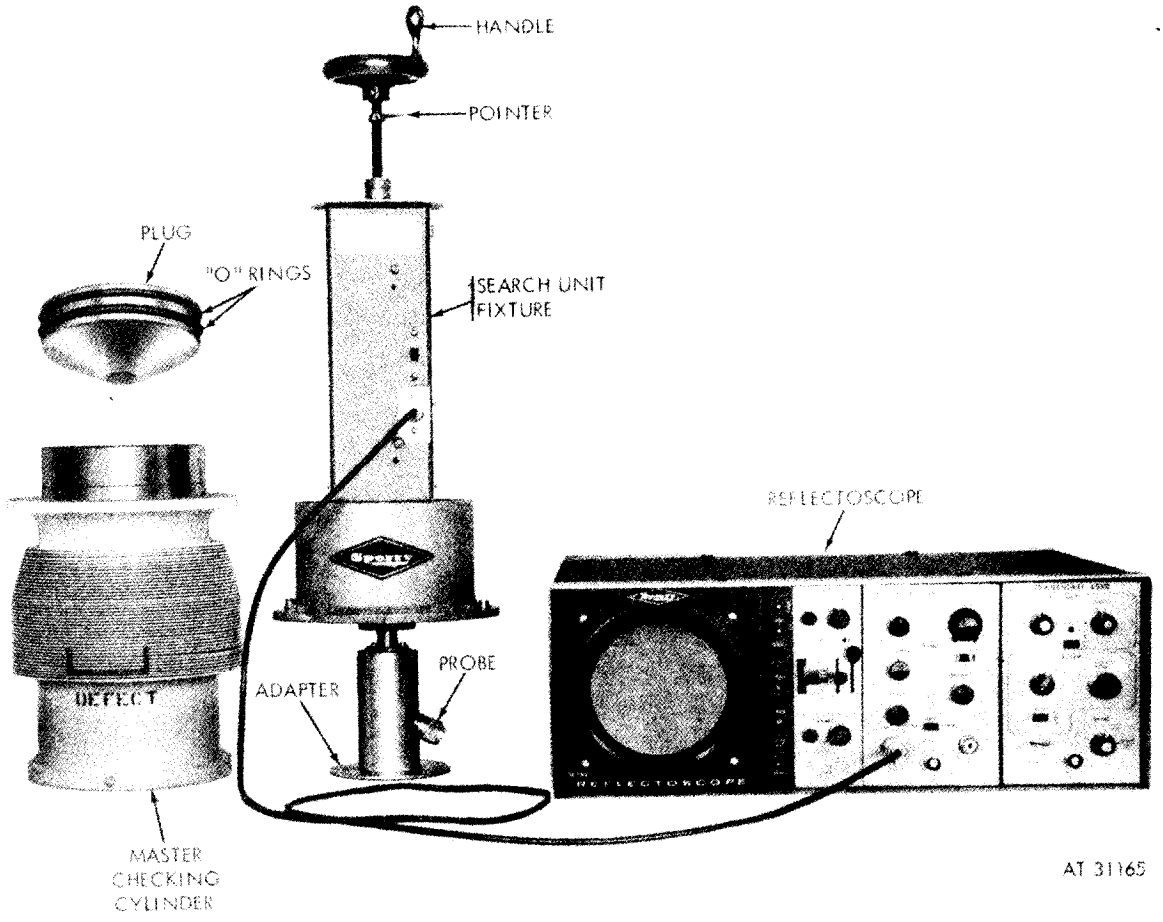


Figure 6-52. Cylinder barrel tester - 4910-937-4261.

b. Description of Test Equipment.

(1) *Reflectoscope.* An electronic instrument to provide means of transmitting and receiving pulsed ultrasonic energy, and interpretation for detection of flaws in the cylinder.

(2) *Search unit fixture.* An adapter that directs ultrasonic energy into the proper area of the cylinder assembly, and is oriented to receive energy reflected back from defective areas.

(3) *Master checking cylinder.* A portion of the cylinder, properly prepared with a specific defect, to act as a comparator tool. This cylinder compares to a no-go gage relative to cracks in the cylinder.

c. Functional Description of Equipment.

(1) *General.* This inspection technique utilizes ultrasonic wave propagation for a non-destructive method of finding incipient cracks in the cylinder. The principle of ultrasonic flaw detection employs short bursts of high frequency sound vibrations, generated by a piezoelectric probe, transmitted into the cylinder barrel being inspected. Should a crack or discontinuity exist in the barrel, some of the sound wave energy will be reflected back to the source. A return sound wave, or echo, is converted into electrical energy which is displayed on the screen as a vertical indication on the horizontal (time) base line.

(2) *Specific application to part No. 10865297 cylinder (thick wall cylinder with groove in periphery of mounting flange).* The reflectoscope, search unit fixture, and master checking cylinder combination provides a specific functional detection method. The pulser of the reflectoscope transmits short bursts, or pulses, of electrical energy through a cable to the search unit fixture at which point these pulses are routed to the piezoelectric probe. The probe changes the electrical pulses into ultrasonic energy and transmits them through the transmitting medium (water) into and through the cylinder barrel wall, toward the outside diameter of the aluminum muff or crack, and back by the same route to the probe. The probe then changes the ultrasonic energy into electrical pulses which are transmitted by cable back to the reflectoscope where a characteristic wave form is displayed in the screen. Additionally, the reflectoscope embodies an alarm system which may be set to a specific level, to signal when the crack or flaw is detected in the cylinder.

d. Detailer Calibration of the Cylinder Barrel Tester.

(1) *General.* The following adjustments apply to a new tester. Once these adjustments have been made, they will seldom require readjustment under normal conditions. Should the inspection procedure reveal an abnormally high cylinder reject rate, the tester adjustments should be checked to be certain the readings are correct. However, it is good practice to check all adjustments periodically to insure against accidental tampering. The reflectoscope cover and search fixture probe protector should be in place whenever the tester is not in use.

Note. The cylinder barrel tester should not be operated in close proximity to electrical appliances, or false alarming may result.

(2) *Establish the wave form on the reflectoscope display screen and set the alarm.*

(a) Remove the cover from the reflectoscope.

(b) Plug the reflectoscope into a 115 volt 10 volt, 50 / 60 cycle single phase power source. Turn the POWER (SCALE ILLUM) knob clockwise and allow time for warm-up (approximately 10-15 minutes).

(c) Adjust the sweep delay (upper left hand control panel).

(1) Turn the SWEEP DELAY knob (red) clockwise to "1".

(2) Adjust the SWEEP DELAY knob (inner black) to adjust the initial pulse wave over the left hand vertical division marker on the display screen.

(3) Place the SWEEP toggle switch to "PRESET".

(4) Place the left hand INCHES / DIV lever to "2", and, place the right hand lever to "1".

(5) Turn the MARKERS knob (red) counterclockwise to "OFF".

(6) Turn theALT. DISPLAY SHIFT VERT screw fully counterclockwise.

(d) Pulser / receiver unit adjustment.

(1) Place the TEST switch to "NORMAL".

(2) Turn the FREQUENCY knob to "5.0".

(3) Place the SENSITIVITY switch to "X1" and turn the SENSITIVITY control knob to "1".

(4) Turn the REJECT knob counterclockwise to "OFF".

(5) Turn the PULSE LENGTH knob so that the dot is at the "12:00 o'clock" position.

(e) Display screen adjustment.

(1) Turn the POWER (SCALE ILLUM) knob counterclockwise, but not "OFF".

(2) Place the GATE OFF switch to "GATE OFF".

(3) Adjust the VERT screw to place the horizontal wave form line on the zero horizontal scale line (view A, fig. 53).

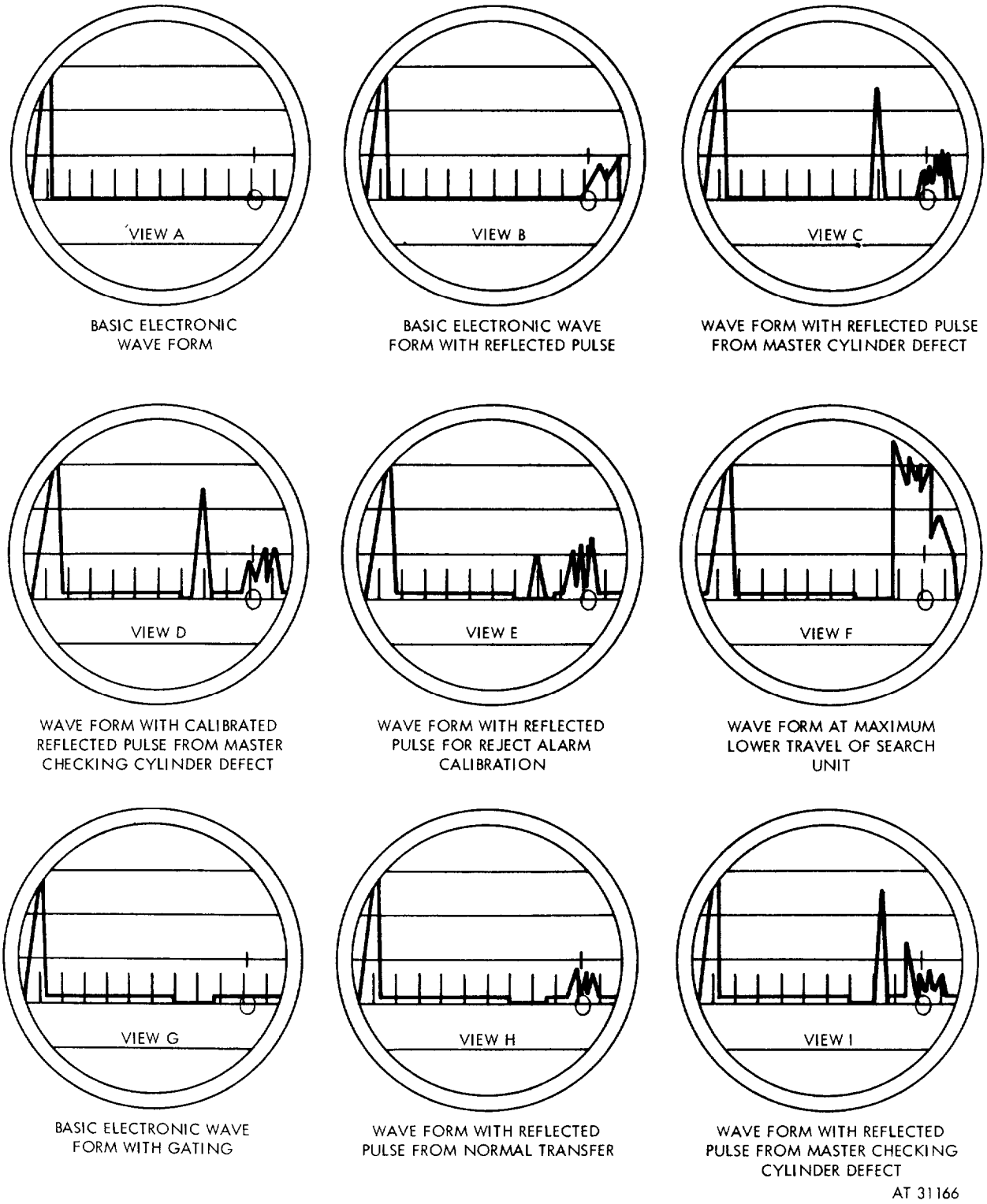


Figure 6-53. Reflectoscope wave forms.

(4) Adjust the INTENSITY screw clockwise to brighten the wave form, but not to the point where a bright spot occurs at the beginning of the wave form.

Caution: Too much intensity can damage display screen phosphor coating.

(5) Adjust the ASTIG screw to the sharpest wave form.

(6) Adjust the FOCUS screw to the sharpest wave form.

(3) *Adjust the reflectoscope using the master checking gage.*

(a) Pour water into the master checking gage, part No. 10935515, to the "FILL" level (five inches from top). Place the marked defect portion of the gage facing the operator.

Note. Fresh water should not be used for test. Allow the water to stand twenty-four hours before use. Add approximately one fluid ounce of anti-coalescent agent, such as "Jet Dry", to each ten gallons (37.85 liters) of water. The water, master gage, and test cylinders should be at room temperature during test.

Note. Wipe all air bubbles from the cylinder wall. Bubbles may cause a false alarm signal.

(b) Remove the protector from search fixture probe. Place the search fixture on the master checking gage (fig. 6-54), with the UPPER-LOWER switch facing the operator. Place the search fixture UPPER-LOWER switch to "UPPER".

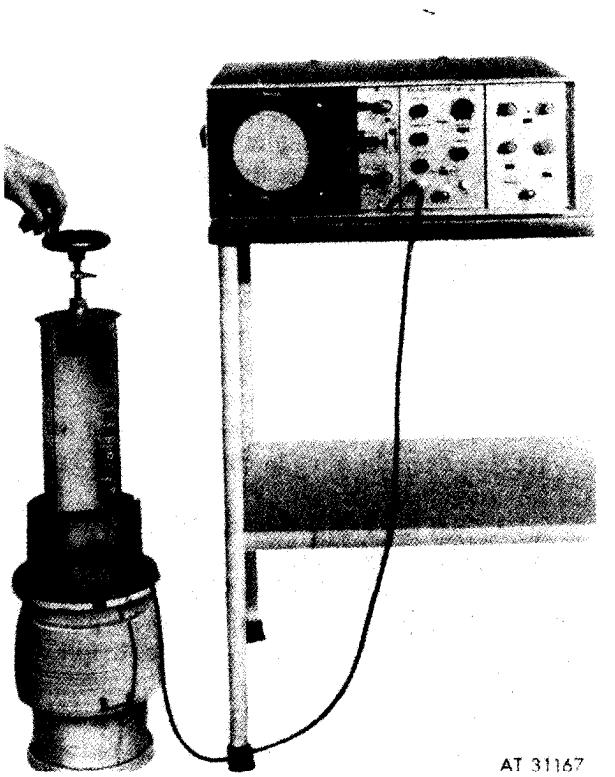


Figure* 6-54. *Ultrasonic search fixture installed on master checking cylinder.

(c) Connect the cable to the search fixture, and to the reflectoscope at connector "R".

(d) Rotate the search fixture handle counterclockwise to move the probe to the uppermost position. The wave form on the display screen will be similar to view B, fig. 6-53.

(e) Rotate the search fixture handle clockwise to move the probe downward. Rotate the search fixture handle until the echo pulse, or spike (view C, fig. 6-53), is shown on the display screen when the fixture pointer alines with the master checking gage defect.

(f) Move the search fixture probe upward and downward until a maximum pulse is obtained on the display screen (view C, fig. 6-53).

(g) Adjust the PULSE TUNING knob (on pulser / receiver unit) to obtain the maximum pulse height on the display screen.

(h) Adjust the SENSITIVITY control knob (on pulser / receiver unit) to provide an echo pulse height of 2-1 / 2 inches (view C, fig. 6-53).

(i) Place the search fixture UPPER-LOWER switch to "LOWER".

(j) Turn the SYNC switch (on transigate) to MAIN PULSE, and the GATE OFF switch on.

(k) Turn the START knob (on transigate) to "2". Adjust the START VERNIER knob so that a downward jog is in line with the 7th from the left vertical scale line on the display screen. Place the search fixture UPPER-LOWER switch to "UPPER".

(l) Turn the LENGTH knob (on transigate) to "1". Adjust the LENGTH VERNIER knob to end the gate at the right hand edge of the flaw signal (approximately 9-1 / 2 vertical scale lines from the left of display screen).

(m) Adjust the VERT screw to place the lower gate line over the zero horizontal scale line on display screen.

(n) Adjust the FOCUS and ASTIG knobs for the sharpest wave form.

(0) Adjust the SENSITIVITY control knob (Pulser / receiver unit) until the echo pulse measures 2-1 / 2 inches high on the display screen (view D, fig. 6-53).

(p) Turn the REJECT knob (pulser / receiver unit) clockwise to the reduce the echo pulse height to 1 inch (view E, fig. 6-53).

(q) Turn the ALARM LEVEL knob (on transigate) to + AUTO RESET. Rotate the ALARM LEVEL vernier knob clockwise, then counterclockwise until the light just appears on RESET button. Place the AUDIO switch to "ON" and the alarm will sound (buzz).

(r) Turn the REJECT knob (on pulser / receiver unit) counterclockwise to "OFF". The echo pulse height will then return to 2-1 / 2 inches (view D, fig. 6-53).

(s) Continue clockwise rotation of the search until handle until a heavy echo reflection enters the gate (view F, fig. 6-53). The heavy reflection indicates that the search fixture probe has reached the maximum downward travel. The cylinder barrel tester is now adjusted to establish the wave form.

(t) Turn the POWER KNOB to "OFF". Disconnect cable and remove the search fixture from the master checking gage. Install probe protector and reflectoscope cover. Pour water from checking gage.

e. Establish the Wave From on the Reflec-. toscope Display Screen for Daily Operation.

(1) Preliminary calitiration.

(a) Remove the reflectoscope cover.

(b) Plug the reflectoscope into a 115 volt 10 volt, 50 / 60 cycle single phase power source. Turn the POWER (SCALE ILLUM) knob clockwise and allow time for warm-up.

(c) Turn the POWER (SCALE ILLUM) knob counterclockwise, but not to "OFF".

(d) Turn the SENSITIVITY control knob to "l", and the REJECT knob to "OFF".

(e) The wave form on the display screen should be similar to view G, fig. 6-53.

Note. Should the wave form not appear, or is markedly different than that shown in view G, figure 6-53, recalibrate the tester in accordance with the instructions in paragraph d, above.

(f) Pour water into the master checking gage to the "FILL" level (five inches from top), refer to paragraph d (3) (a). Place the marked defect portion of the gage facing the operator.

Note. Wipe all air bubbles from the cylinder wall. Bubbles may cause a false alarm signal.

(g) Remove the protector from the search fixture probe. Place the search fixture in the master checking gage with the fixture flange resting on the cylinder mounting flange. Move the probe to the top of its travel and place the fixture UPPER-LOWER switch to "UPPER".

(h) Connect the cable to the search fixture and the reflectoscope at connector "R". The wave form on the display screen will be similar to view H, fig. 6-53.

(i) Rotate the search fixture handle clockwise to move the probe downward. Rotate the search fixture handle until the echo pulse, or spike (view D, fig. 6-53) is shown on the display screen when the fixture pointer alines with the defect on the master checking gage.

(j) Rotate the search fixture handle to move probe slightly upward and downward until a maximum pulse is seen on the display screen.

(k) Adjust the SENSITIVITY control knob to probe an echo pulse height of 2-1 / *2* inches (view I, fig. 6-53).

(l) Turn the REJECT knob clockwise to reduce the echo pulse height to 1 inch.

(m) Turn the ALARM LEVEL knob (on transigate) to + AUTO RESET. Rotate the ALARM LEVEL vernier knob until the light just appears on RESET button. The alarm will sound (buzz) when the AUDIO switch is "ON".

(n) Turn the REJECT knob (on pulser / receiver unit) counterclockwise to "OFF". The echo pulse height will then return to 2-1 / 2 inches high.

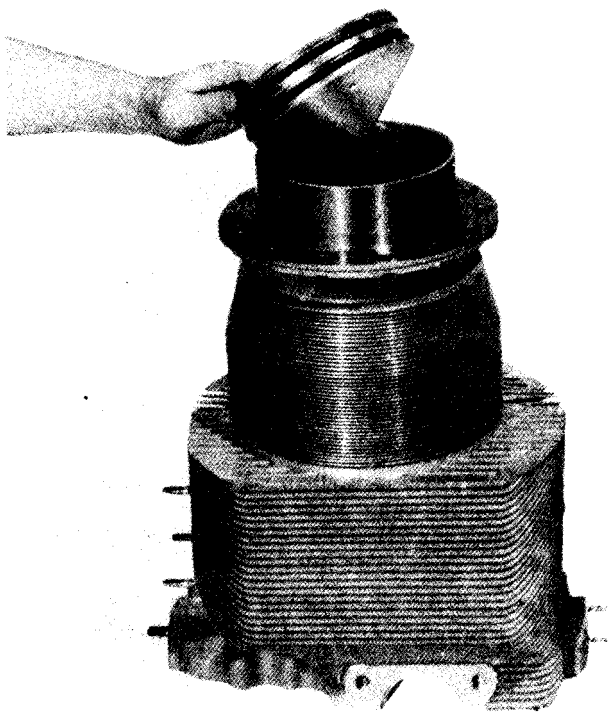
(o) Remove the search fixture from the master checking gage. The cylinder barrel tester is now calibrated in preparation for cylinder inspection.

Note. Steps (f) through (o) above, should be preformed twice each eight hour shift to assure accuracy of the tester.

(2) *Cylinder inspection.*

(a) Clean and degrease the cylinder bore. Remove rust if present.

(b) Position the cylinder with the bore facing upward using suitable protection for the cylinder head. Insert plug, part No. 10935522 (fig. 6-55) in the cylinder bore until it bottoms. Pour water into the cylinder and fill to about five inches from the top. Refer to paragraph d (3) (a).

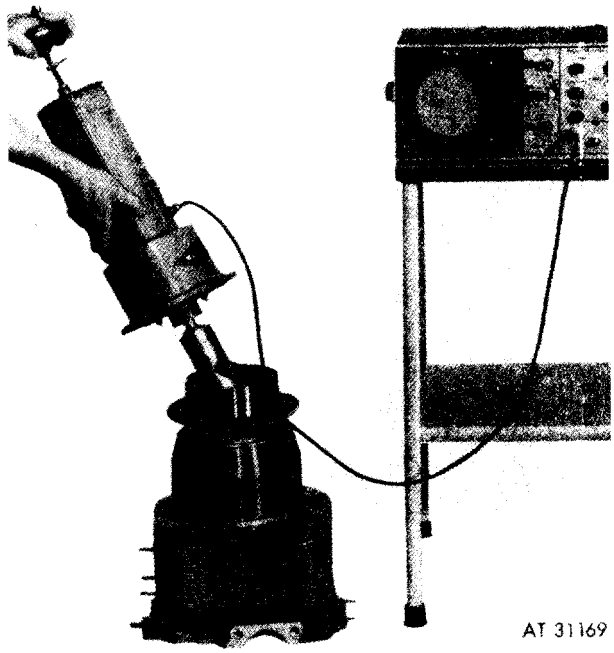


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Figure 6-55. Installing plug - 10935522 in cylinder bore.

Note. Wipe all air bubbles from cylinder walls. Bubbles may cause false alarm signal.

(c) Place the search fixture in the cylinder with the fixture flange resting on the cylinder mounting flange (figs. 6-56 and 6-57).



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Figure 6-56. Positioning ultrasonic search fixture in cylinder bore.

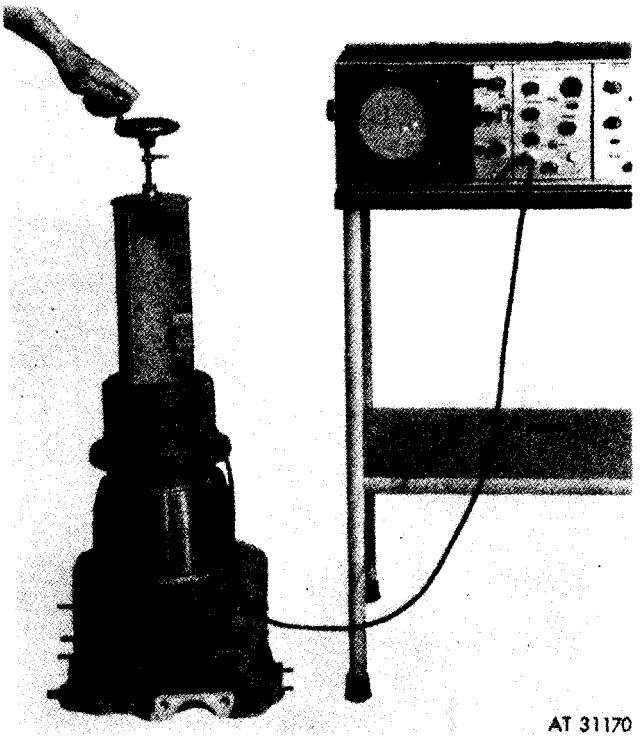


Figure 6-57. Ultrasonic search fixture installed in cylinder barrel mounting flange.

(d) With the search fixture UPPER-LOWER switch in the "UPPER" position, move the search fixture probe through the full upward and downward travel.

Note. When a heavy pulse echo enters the right hand edge of the gate (view F, fig. 6-53), the detector has reached the maximum downward travel. Any alarm indicates a crack or defect in the cylinder. Re-inspect the defect suspect area. If the alarm sounds again, the cylinder must be scrapped.

Note. Should the inspection reveal an abnormally high cylinder reject rate, the tester adjustments should be checked to be certain the readings are correct.

(e) A signal appearing immediately to the left of the gate indicates cylinder bore roughness. The gate start may require minute adjustment to the right to exclude this extraneous signal.

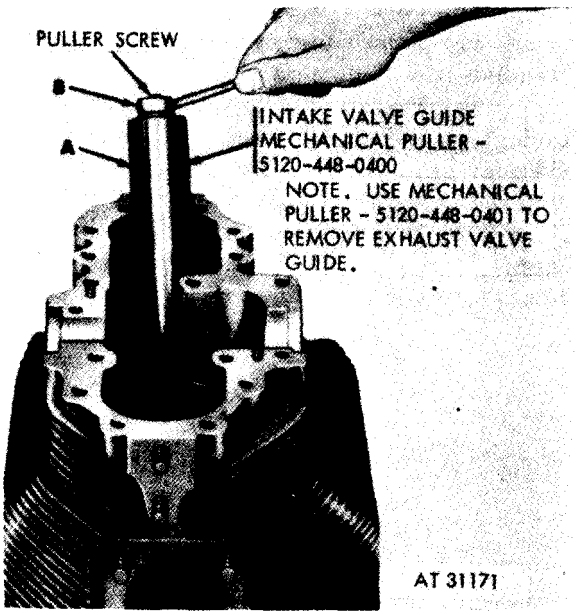
(f) Remove the search fixture from the cylinder, empty the water, and remove the plug from the bottom of the cylinder bore. If the cylinder has no defects, treat it to prevent rust.

6-33. Repair

a. Cylinder Interior.

(1) *Valve guide replacement.*

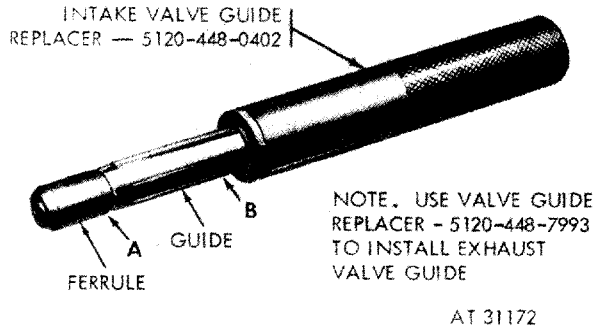
(a) Replace any cracked, galled, eroded, or scuffed intake and exhaust valve guides (14 and 37, fig. B-4) or guides which do not conform to limits specified in overhaul standards (table 6-15). Replace and ream valve guides following instructions which accompany figures 6-58 through 6-62.



Note. The intake and exhaust valve guides are removed from the cylinder in the same manner. Mechanical puller - 5120-448-0400 is used for intake valve guide removal and mechanical puller - 5120-448-0401 is used for exhaust valve guide reinoval.

1. Insert screw of mechanical puller - 5120-448-0400 through the valve guide and puller (A).
2. Install nut (B) on end of puller screw and tighten to remove valve guide from cylinder.

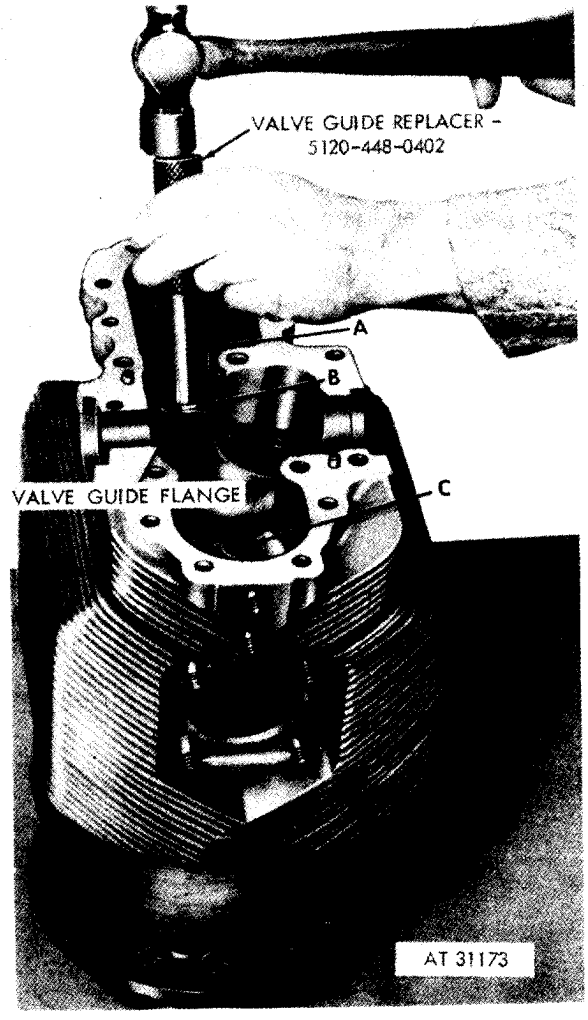
Figure 6-58. Removing intake valve guide using mechanical puller - 5120-448-0400.



Note. The intake and exhaust valve guides are installed in the same manner. Valve guide replacer - 5120-448-0402 is used for replacing intake valve guide, and valve guide replacer-5120-448-7993 is used for replacing exhaust valve guide.

1. Remove ferrule (A) from end of valve guide replacer (B).
2. Place new valve guide over replacer (B) with short end of guide entering hollow replacer handle. Replace ferrule to retain guide or replacer.

Figure 6-59. Positioning intake valve guide on valve guide replacer - 5120-448-0402.



1. Place assembled intake valve guide (A) and valve guide replacer - 5120-448-0402 into valve guide bore in cylinder.
2. Carefully drive valve guide into cylinder until flange on guide is positioned against top face of guide bore.
3. Remove ferrule (B) from replacer and withdraw replacer from valve guide.
4. Install exhaust valve guide (C) in the same manner using valve guide replacer - 5120-448-7993.

Figure 6-60. Installing intake valve guide using valve guide replacer - 5120-448-0402.

Note. After new valve guides are installed, they must be reamed to specified size to assure proper clearance between valve guide and valve stem.

(b) Install the reamer bushing - 4910-795-7950 into intake valve seat as shown in figure 6-61. Use hand reamer - 5110-708-3698 to rough ream and hand reamer - 5110-708 3699 to finish ream intake valve guides as shown in figures 6-61 and 6-62. The exhaust valve guides may be reamed in a similar manner using reamer bushing - 4910-795-7957, rough hand reamer - 5110-708-3696, and finish hand reamer 5110-708-3697.

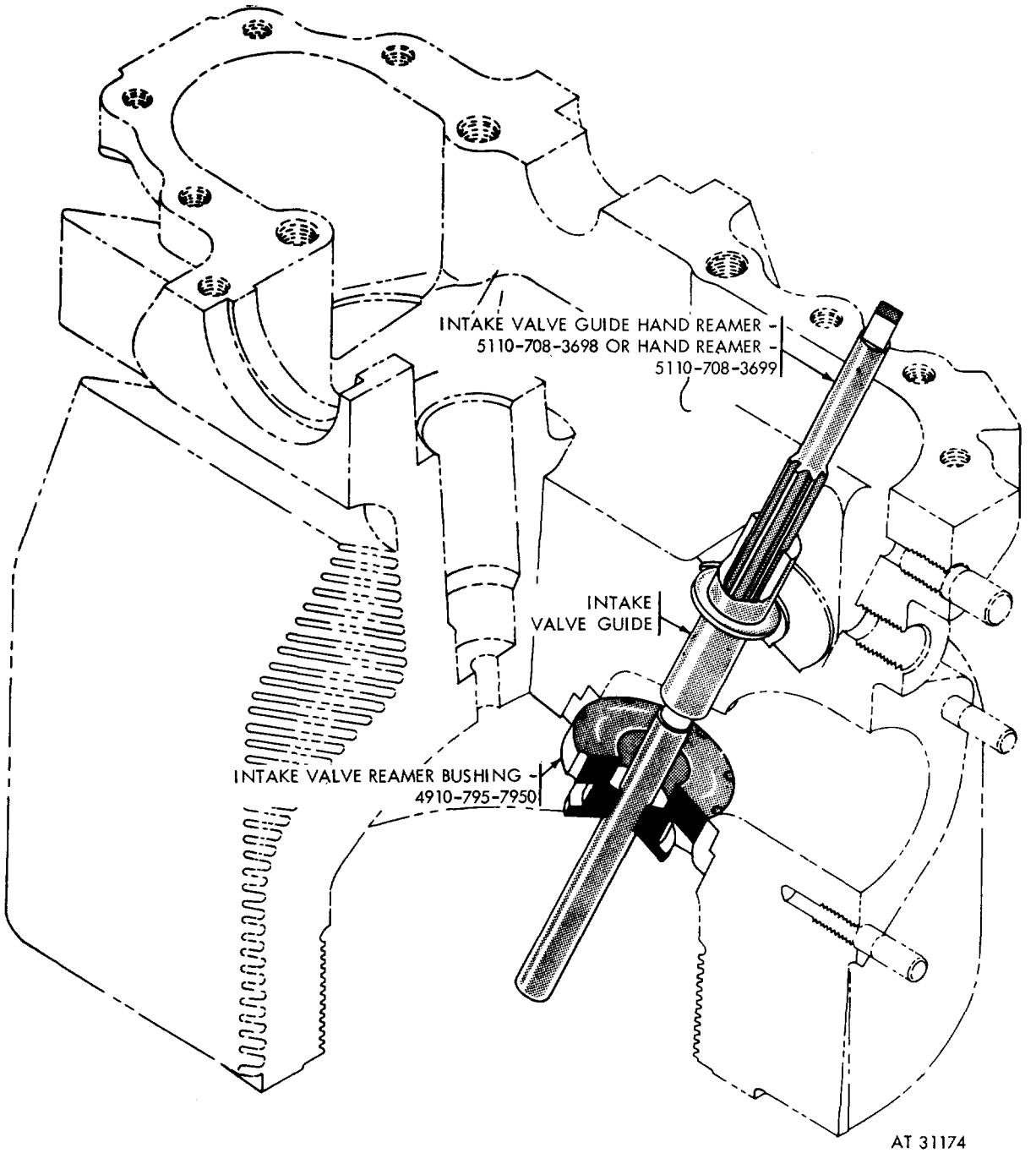


Figure 6-61. Intake valve guide hand reamer - 5110-708-3698 or 5110-708-3699 and reamer bushing - 910-795-7950 positioned in cylinder head-sectional view.

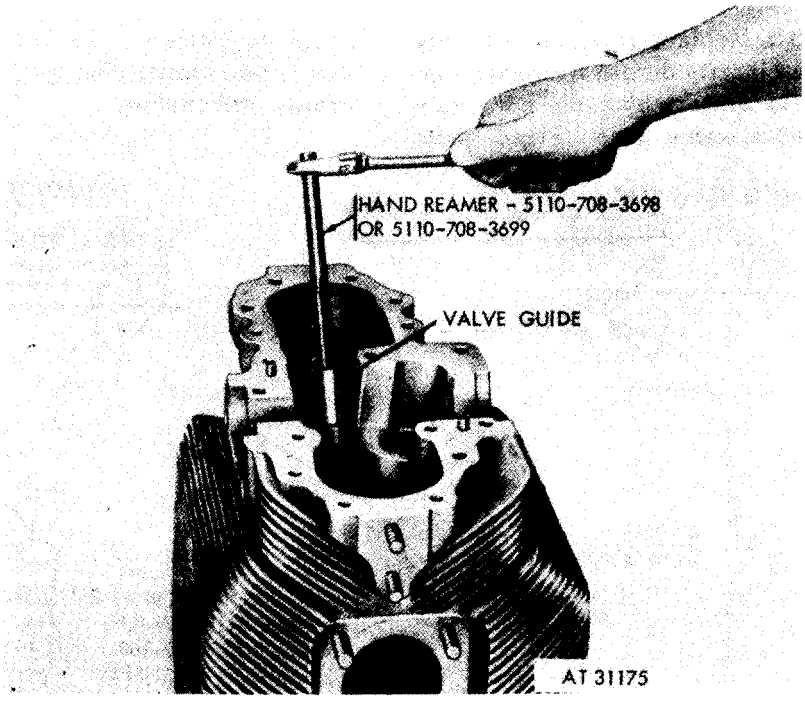


Figure 6-62. Reaming intake valve guide, using hand reamer - 5110-708-3598 or 5110-708-3699 and reamer bushing - 4910-795-7950.

(2) *Valve seats.* Replace cylinder assembly (41, fig. B-4) when inserts do not fit securely in the cylinder. Grind seats which do not show perfect contact with valve face. Grind seats which do not show perfect contact with valve face. Grind inserts (fig. 6-63) as described in (a) through (e), below.

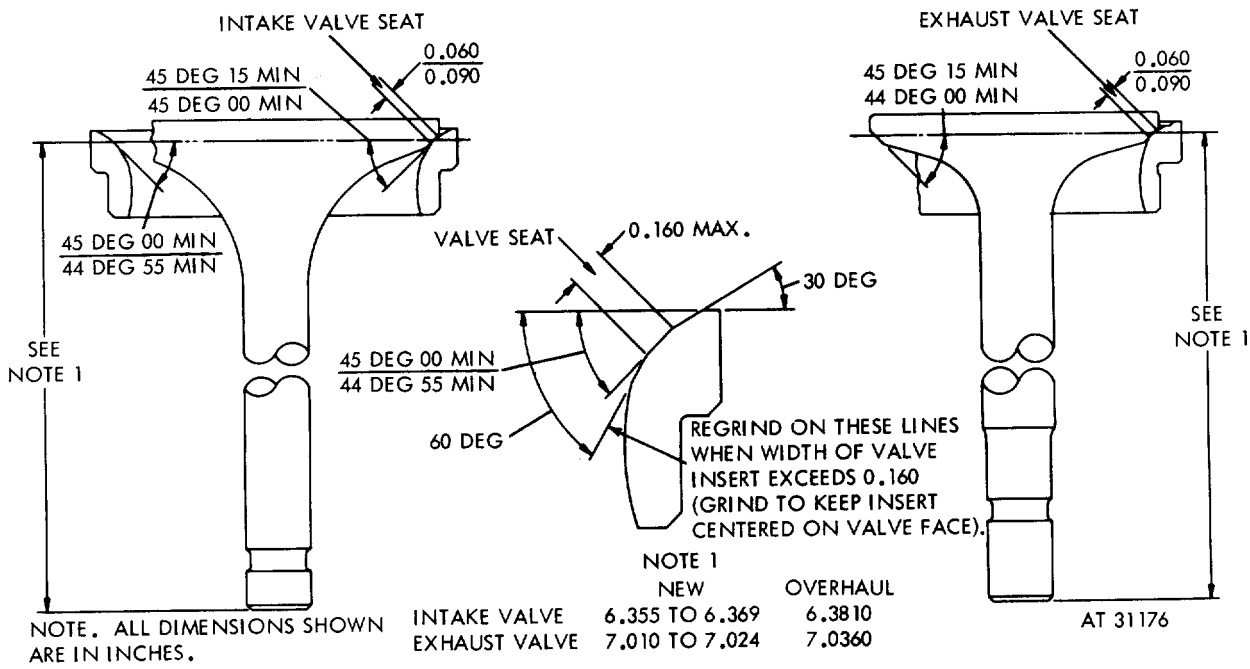


Figure 6-63. Valve and valve seat insert grinding diagram.

(a) A *45* degree angle grinding stone must be used to grind valve seat inserts.

(b) Dress seat on the insert with stone, using valve seat grinding machine.

(c) After dressing seat of insert, check valve contact as described in paragraph 6-31b.

(d) When perfect contact is obtained, narrow seat on insert to width specified in figure 6-63 by grinding inner wall and exposed face of insert to the angles specified.

(e) Keep valve seat area as near as possible to center of valve face. Valves should never seat at the top or bottom of the valve face area.

b. Cylinder Bore. Replace cylinder assembly when joint between cylinder head and cylinder barrel is pitted or eroded. Replace cylinder assembly when cylinder bore dimensions are not within limits specified in the overhaul standards (table 6-15), or when average dome end measurement is larger than average flange end measurement. Reanodize head if required. Hone cylinder to remove scratches, scoring or ring ridge. Hone cylinder when out-of-round more than 0.003 in. Hone cylinders as described in c and d, below.

c. *Honing Specifications.* (Part No. 10865297, FSN 2815-765-9711 cylinder only)

(1) Cross hatch angle to be 35 degrees off the horizontal.

(2) Cross hatch to be cut uniformly in both directions.

(3) Cross hatch to be clean-cut, but not sharp, and free from torn or folded metal.

(4) The micro-finish roughness should average between 35 and 45 micro-inches, rms (root mean square deviation from the mean), as measured on the profilometer machine (Micrometrical Mfg. Company, Ann Arbor, Michigan, Type QA, Type V Moto-Trace or equivalent).

(5) The plateau area should be 1 / 2 to 2 / 3 of the surface area.

(6) The plateau should be free from burnished or glazed surface.

(7) The surface is to be free of imbedded particles.

d. Honing Recommendations. (Part No. 10865297, FSN 2815-765-9711 cylinder only)

(1) Honing stones should be Army Nos. 11662775-1 and 11662775-2 used alternately around the honing head. The stones are ap-

proximately 4 inches long and slotted at 0.80 inch intervals 15 degrees to the horizontal to a depth of 0.12 inch from the bottom of the stone. The stones are mounted to 1 / 16 inch thick cork backing before mounting in the shell. This design allows the stone to conform to the tapered section of the bore. The stones should be mounted as per Micromatic Design No. 47415 - SA or equivalent. This number represents size 7 / 16 x 1 / 2 x 4 stones mounted with cork backing and slotted. This design will fit Micromatic stone holder No. 33960-5 and Micromatic Model 5R-SFE-8 Blind End Tool.

(2) The surface finish should be developed in two stages. Rough hone the entire length of the bore, using moderately heavy stone pressure, until the ring ridge is removed and entire bore has a cross hatch pattern. Finish hone using the same stones, with a very light pressure, for approximately 5 to 8 strokes. This operation will remove rough edges and fragmented metal left from the rough hone operation.

Note. The ring ridge may be removed using short stones and a short stroking action prior to the full rough and finish hone cycle. Under no circumstances are short cycle strokes to be performed after the full length strokes have been completed.

(3) Honing oil should be principally kerosene with a sulphurized base oil. Adequate filtration should be provided with both magnetic and paper filters recommended. A suggested oil is twenty-seven and one half (27-1 / 2) parts kerosene to twenty-two and one half (22-1 / 2 parts Stuarts' Superkool base oil. This may be purchased from the D. A. Stuart Oil Company, 8350 Military Avenue, Detroit, Michigan 48204.)

(4) The hone angle should be 35 degrees to horizontal (70 degrees included angle). Spindle speed should be 77 rpm, with a vertical reciprocating rate of 43 cycles per minute.

(5) When diameter of bore at top of ring travel is more than 5.7610 inches after honing, replace cylinder.

(6) Clean cylinder with a power brush and hot (160°F) soapy water. Dry thoroughly. Lubricate cylinder bore to prevent rust.

e. Camshaft Bearings. Remove minor nicks, burs, or scratches from camshaft bearing surfaces with crocus cloth dipped in dry-cleaning solvent or mineral spirits paint thinner. Replace cylinder assembly when camshaft bearing surfaces are scored, galled, or deeply pitted, or when they do not conform to limits specified in overhaul standards (table 6-15).

f. Cylinder Exterior.

(1) *Cooling fins.* Straighten bent fins as near as possible to their original spacing. Replace cylinder assembly when more than one percent of barrel cooling fin area is broken. Replace cylinder assembly if head finis broken more than half the depth of the fin or more than two inches long. A cylinder assembly can be used if it has not more than three acceptable defects, or if no two of the defects are on adjacent fins. Repair damaged cylinder head fins as described in (a) through (c), below, and in TB 9-2800-207-50.

(a) Use a fine mill file to remove sharp corners of broken head fins.

(b) Do not remove more metal than necessary to produce a smoothly blended edge on the damaged fin.

(c) Depth of any blended fin must not be less than 50 percent of its original depth, when blended fin is less than 50 percent of original depth, replace cylinder assembly.

(2) *Studs and inserts.* Replace damaged, bent, or stripped studs as described in paragraph 6-4e and table 6-16. Replace defective helical-coil inserts as described in paragraph 6-5.

Table 6-16. Cylinder Standard and Oversize *Stud Idenfication*

Fig. No.	Ref. letter	**Setting height**	No. req'd.	Stud size and length
B-4	43	3 1 / 3 2	36	5/ 16-18(13/ 16) x5/ 16-24(19/32) x 1-11/ 16 (STD) (0.003 in. OS) (0.007 *in.* OS) (0.012 in. Os)
B-4	45	3 / 4	12	7/ 16-14(3/4) x7/16-20(5/8) X 1-1/2 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
B-4	51	2 1 / 3 2	24	5/ 16-18(11/ 16) x5/ 16.24(9/ 16) x 1.5/16 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
B-4	52	3 1 / 3 2	*48*	3/8-16(53/64)x3/8-24(7/8) x 1-3/4 (STD)

Note. **Refer to figure 6-1 for oversize stud identification.**

g. *Valve Rocker Arm Covers.*

(1) Repair or replace damaged parts. Welding is permissible on the two valve rocker arm shaft plug bosses on the outside of the cover. Welding in other areas of the cover is *not* permissible. Refer to paragraph 6-4c for general welding instructions, and paragraph (e), below.

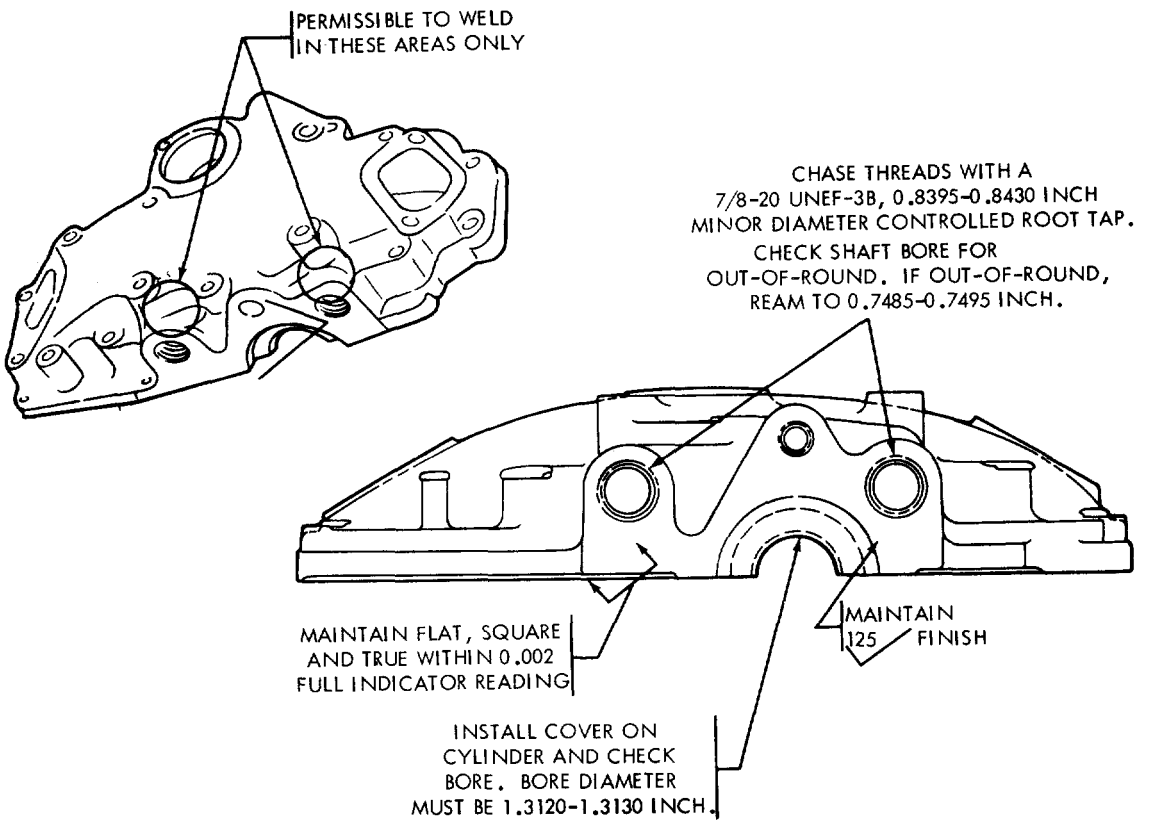
(a) Replace cylinder assembly when valve rocker arm cover is cracked (except at the rocket arm shaft plug boss which can be welded), or has deep scratches or nicks on the mating surface or camshaft bearing bore surface. Replace cylinder when cover damage cannot be removed by polishing with crocus cloth dipped in dry-cleaning solvent or mineral spirits paint thinner.

(b) Replace cylinder assembly when valve rocker cover does not conform to limits specified in the overhaul standards (table 6-15).

(c) Replace damaged screw thread inserts as instructed in paragraph 6-5.

(d) Replace cracked adjusting cover plates. Remove minor nicks, burs, or scratches from mating surface with crocus cloth dipped in dry-cleaning solvent or mineral spirits paint thinner.

(e) Covers that have been repaired by welding must meet the requirements specified in figure 6-64.



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Figure 6-64. ***Valve rocker arm cover welding standards.***

h. Valve Rocker Arm. (Refer to fig. B-4)

(1) Replace valve rocker arms (33 and 34) when cracked or worn or if the bushing-type bearings are damaged.

(2) Replace damaged valve rocker arm roller and bushing.

(3) Replace adjusting screw (36) when threads are stripped or damaged or when screw binds in rocker arm. Replace adjusting screw when swivel pad does not rotate freely on screw.

i. Valve Rocker Arm Shaft Assemblies. (Refer to fig. B-4)

(1) Replace cracked or deeply scored rocker arm shaft assemblies (22 and 35).

(2) Replace rocker arm shafts that do not conform to limits specified in the overhaul standards (table 6-15).

Valve, Springs, Spring Retainers and Rotors. (Refer to fig. B-4)

(1) *Valves.*

(a) Discard warped valves (11 and 12) or valves which do not conform to limits specified in repair and, rebuild standards (table 6-1 5). Discard valves having badly pitted or burned

faces. Discard valves having badly pitted, scored, scratched stems or locking grooves.

(b) Reface slightly pitted or burned valves that do not seat perfectly to limits specified in figure 6-63. Discard valves that cannot be refaced to these limits.

(c) Check valve length from seat contact to tip of stem after grinding, as shown in figure 6-63. Discard valve if length is not within limits specified (fig. 6-63).

(2) *Valve springs.* Replace springs (16, 17, and 18) when worn, cracked, or otherwise dam aged. Replace springs that do not conform to limits specified in overhaul standards (table 6-15).

(3) *Valve spring retainers, valve rotors, and valve locks.* (Refer to fig. B-4)

(a) Replace upper intake and exhaust valve spring retainers (19 and 38) and valve spring seat (15) when cracked or worn.

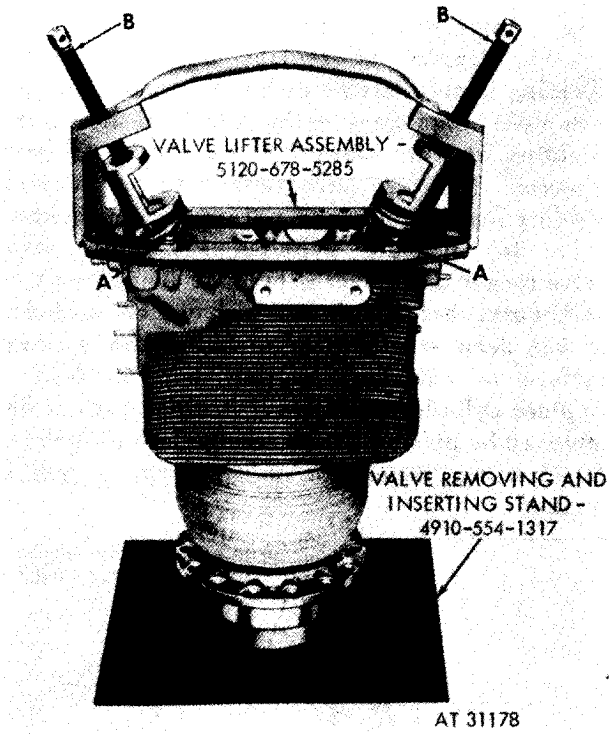
(b) Replace valve rotors (40) when inner section does not rotate freely or when assembly is worn or cracked.

(c) Replace valve locks (20) when worn or cracked.

6-34. Assembly

a. Cylinders. (Refer to fig. B-4)

(1) Install intake valve (12) and exhaust valve (11) in their respective guides in cylinder (41). Hold valves in position and place the cylinder on valve removing and inserting stand - 4910-554-1317 following instructions which accompany figure 6-65.



1. Position the valve lifter assembly - 5120-678-5285 over the valve springs and retainers (A) and secure in position with four 5 / 16 x 1-3/8 bolts and 5 / 16-in. flat washers.
2. Compress valve springs and retainers with screws (B) and install two valve locks (20) in the groove of each valve stem. Release valve spring compression. Remove valve lifter assembly - 5120-678-5285 from cylinder and remove cylinder from stand.

Figure 6-65. Co repressing valve springs using valve lifter assembly-5120-678-5285.

(2) Install the exhaust valve rotor (40), outer, intermediate, and inner springs (16, 17, and 18), and upper exhaust valve spring retainer (38) over the exhaust valve stem as shown in figure 6-49. Install the lower intake valve spring seat (15), outer, intermediate, and inner springs (16, 17, and 18), and upper intake valve spring retainer (19) over the intake valve stem in the same manner. Compress valve springs and install valve locks following instructions which accompany figure 6-65.

b. Valve Rocker Arm Covers. Refer to paragraph 4-14.

Section VII. OVERHAUL OF OIL PUMP, OIL PAN, DAMPER AND OIL FILTER HOUSING AND ASSOCIATED PARTS

6-35. General

This section covers the overhaul of the oil pump, oil pan, damper and oil filter housing, and associated parts. Specific instructions on disassembly, cleaning, inspection, repair and assembly accompany the overhaul operations. Stud identification information is included in the overhaul procedures. Refer to the following table (table 6-17) for applicable illustrations and instructions for overhaul operations.

Table 6-17. Oil Pump, Oil Pan, Damper and Oil Filter Housing and Associated Parts

Component	Disassembly	Cleaning	Inspection	Repair	Assembly
Oil Pump	Para 6-36b Figs. 6-67 through 6-86	Para 6-2	Para 6-36d Table 6-19	Para 6-36e Table 6-20	Para 6-36f Figs. 6-87 through 6-67
Oil Pan and Associated Parts	Para 6-37a Figs. 6-88 through 6-97	Para 6-2	Para 6-3	Para 6-4 Para 6-37d Table 6-21	Figs. 6-97 through 6-88
Damper and Oil Filter Housing and Associated Parts	Para 6-38a Figs 6-99, 6-100, 4-89, 6-101 through 6-111	Para 6-38 b, Fig. 6-112	Para 6-38c Table 6-22	Para 6-38d Table 6-23 Fig. 6-113	Figs. 6-111 through 6-101,4-92 through 4-89,6-100,6-99

6-36. Rebuild of Oil Pump

a. General. Two different oil pump assemblies. have been used in production. It is important to recognize the difference between the oil pumps before attempting disassembly. Throughout this paragraph the oil pumps will be referred to by part numbers FSN 2815-679-4965 or FSN 2815-895-6430 where differences occur. Refer to table 6-18 for the different oil pump characteristics.

Table 6-18. Visual Oil Pump Identification Characteristics

Item	FSN 2315-679-4965 Oil pump	FSN 2815- 895-6430 Oil Pump
Scavenge oil pump inlet screen	Integral part of scavenge oil pump inlet scoop (riveted)	Separate part, mounted under inlet scoop
Oil pump drive shaft lock plate	None	Dual purpose lock plate for oil pump drive shaft and driven impeller shaft. See figure 6-71.
Casting part number of oil pump housing	8725174	10898878

b. Disassembly. Disassemble oil pump (fig. 6-66) following instructions which accompany figures 6-67 through 6-86.

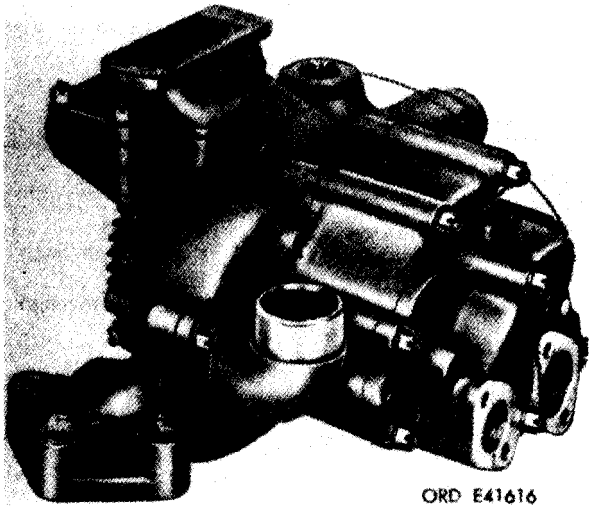


Figure 6-66. FSN 2815-895-6430 oil pump assembly as removed from engine.

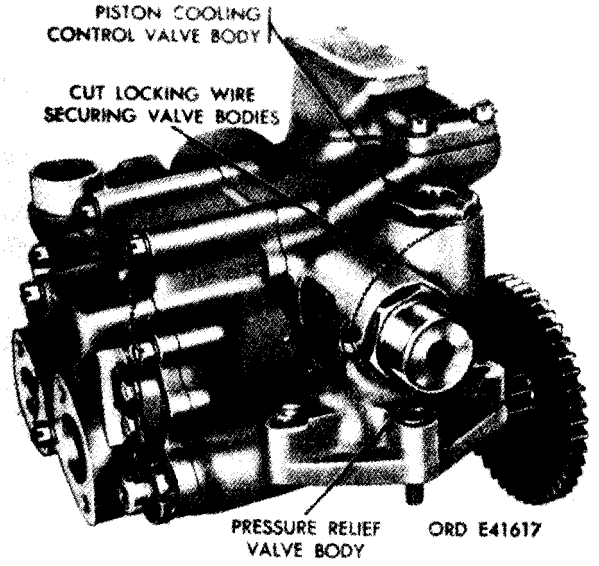
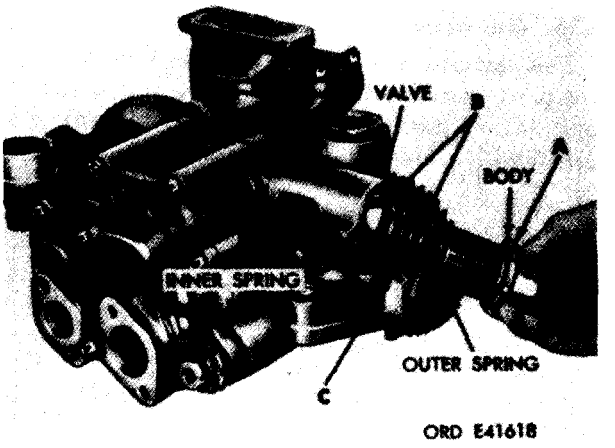


Figure 6-67. Removing or installing locking wire securing oil pump pressure relief valve and piston cooling control valve bodies.



Remove

1. Remove oil pump pressure relief valve body (A).
2. Separate pressure relief valve (B), outer valve spring. and inner valve spring from valve body.
3. Remove cap screw (C) and flat washer.

Install

1. Install cap screw (C) and flat washer.
2. Position inner valve spring, outer valve spring, and pressure relief valve (B) in oil pump pressure relief valve body (A).
3. Install assembled valve body (A) in pump housing.

Figure 6-68. Removing or installing oil pump pressure relief valve.

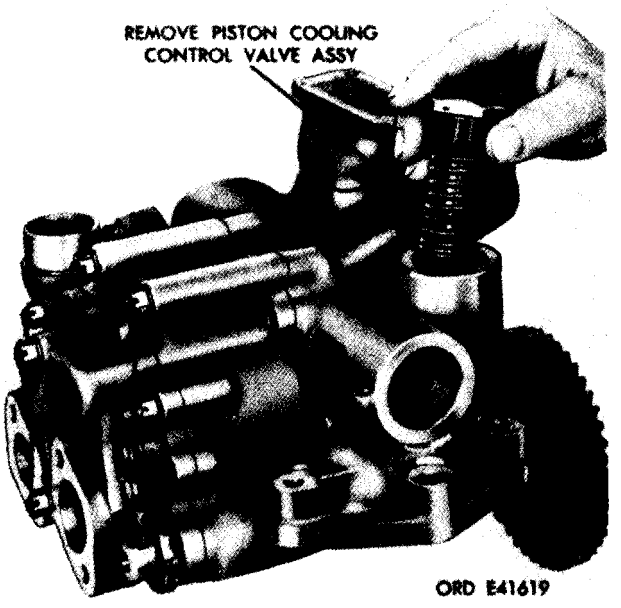
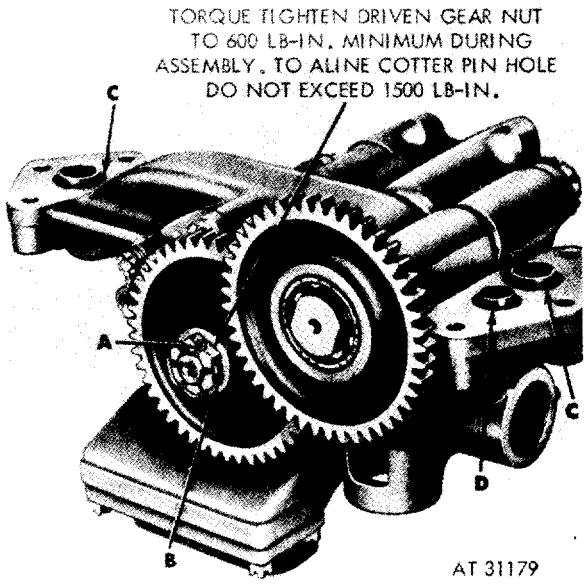


Figure 6-69. Removing or installing piston cooling control valve.



NOTE. THE OIL PUMP DRIVEN GEAR NUT HAS A RIGHT-HAND THREAD ON FSN 2815-679-4965 PUMPS. FSN 2815-895-6430 PUMPS HAVE A NUT WITH LEFT-HAND THREAD.

Remove

1. Remove cotter pin (A).
2. Remove slotted nut (B).
3. Remove and discard two preformed packings (C).
4. Remove and discard preformed packing (D).

Install

1. Install new ¾-in. preformed packing (D) in pump housing.
2. Install two new 1-in. preformed packings (C) in pump housing.
3. Install slotted nut (B) securing oil pump driven gear.
4. Install cotter pin (A) securing nnt (B).

Figure 6-70. Removing or installing oil pump driven gear attaching parts and preformed packing.



NOTE. THESE STEPS APPLY TO FSN 2815-895-6430 OIL PUMPS ONLY.

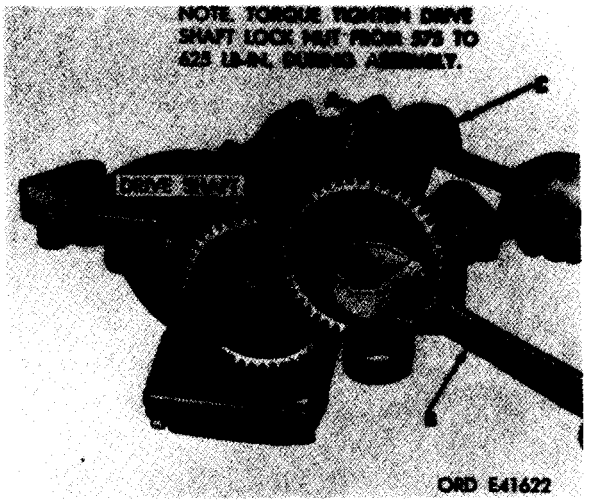
Remove

1. Cut locking wire (A).
2. Remove two bolts (B).
3. Remove lock plate (C).

Install

1. Position lock plate (C) on scavenge housing cover.
2. Install two bolts (B) securing plate to cover.
3. Install locking wire (A).

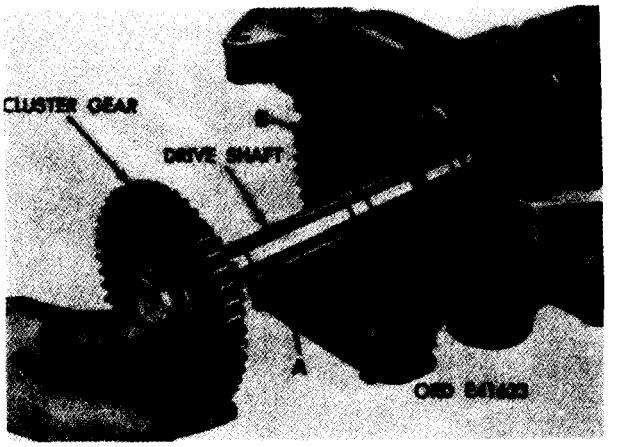
Figure 6-71. Removing or installing oil pump drive shaft lock plate (FSN 2815-895-6430 oil pump).



Remove
1. Straighten tabs on lockwasher (A) securing lock nut.
2. Hold oil pump drive shaft with wrench (B).
3. Remove lock nut from drive shaft using a spanner wrench (C). Remove lock washer from drive shaft.

Install
1. Install lock washer (A) on oil pump drive shaft. Install lock nut on drive shaft.
2. Hold drive shaft with wrench (B) and tighten lock nut using a spanner wrench (C).
3. Bend tabs on lock washer(A) securing lock nut.

Figure 6-72. Removing or installing oil pump drive shaft lock nut.



Remove
1. Remove oil pump drive shaft (A) with assembled cluster gear.
2. Remove thrust washer (B) from drive shaft.

Install
1. Position thrust washer (B) on oil pump drive shaft.
2. Install drive shaft (A) with assembled cluster gear in pump housing.

Figure 6-73. Removing or installing oil pump drive shaft and cluster gear (FSN 2815-895-6430 oil pump).

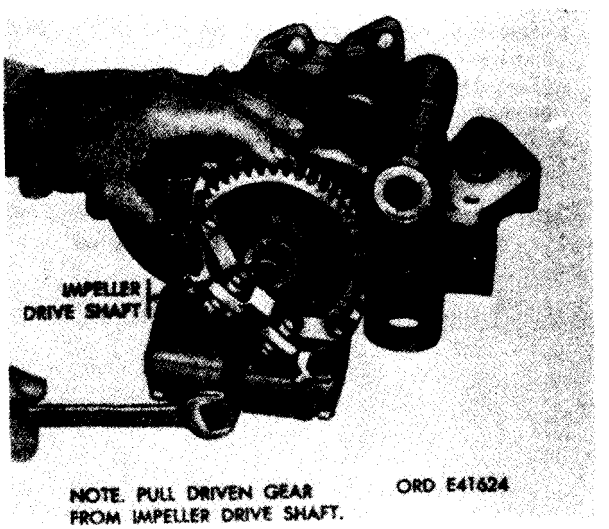
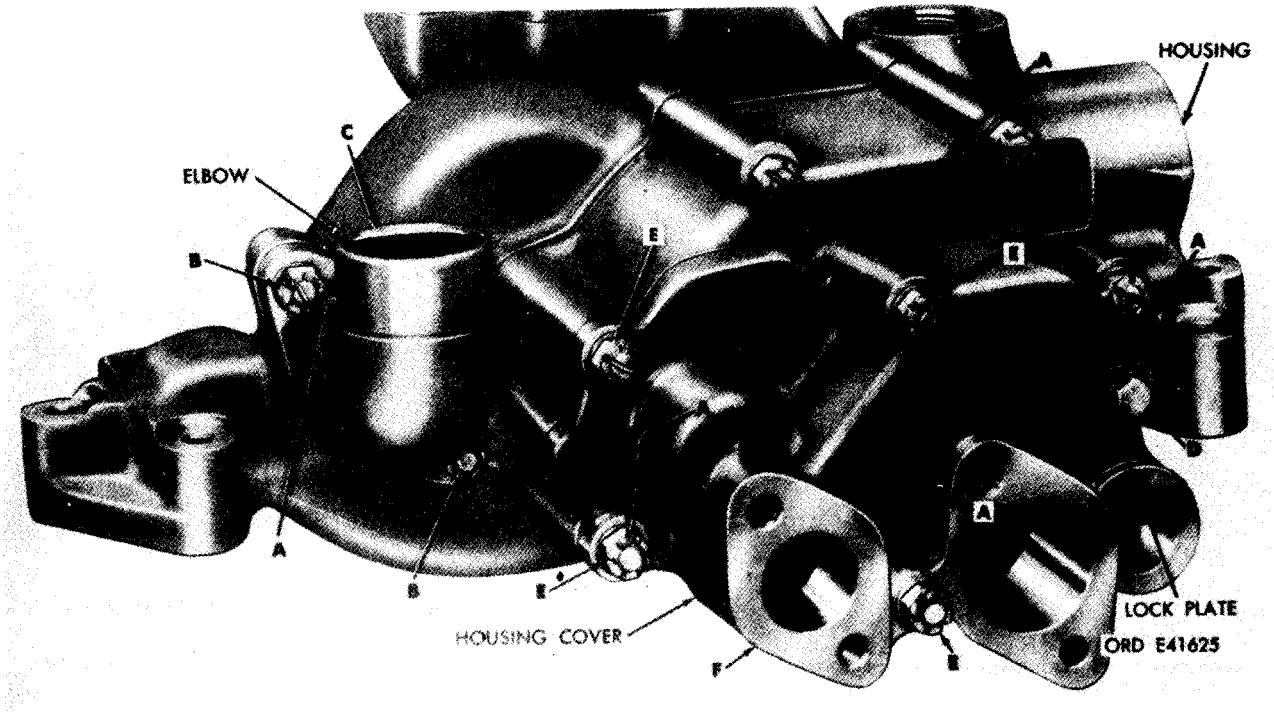


Figure 6-74. Removing oil pump driven gear from impeller drive shaft using suitable puller.



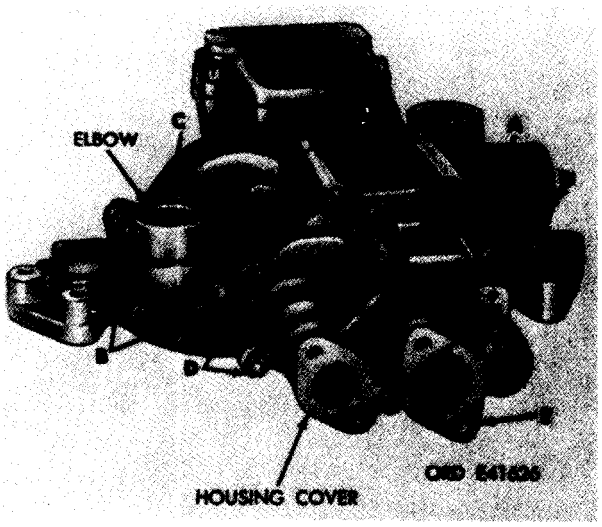
Remove

1. Cut locking wire (A).
2. Remove two dotted nuts (B) and flat washers attaching oil pickup elbow to pump housing.
3. Remove pickup elbow (C) from housing.
4. Remove bolt (D) and lock plate.
5. Remove five slotted nuts (E) and flat washers attaching scavenge housing cover.
6. Remove housing cover (F) from scavenge housing.

Install

1. Position scavenge housing cover (F) on scavenge housing.
2. Install five slotted nuts (E) and flat washers securing housing cover (F) to housing.
3. Position lock plate on cover and install bolt (D) securing plate.
4. Position pickup elbow (C) on pump housing.
5. Install two slotted nuts (B) and flat washers securing elbow (C) to housing
6. Install locking wire (A) securing nuts.

Figure 6-75. Removing or installing scavenge housing cover and oil pickup elbow (FSN 2815-679-4965 oil pump).



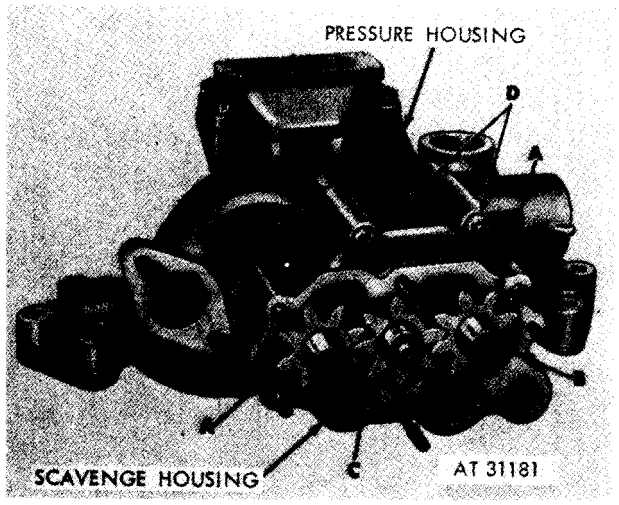
Remove

1. Cut locking wire (A).
2. Remove two slotted nuts (B) and flat washers attaching oil pickup elbow to pump housing.
3. Remove pickup elbow (C) from housing.
4. Remove five slotted nuts (D) and flat washers attaching scavenge housing cover.
5. Remove housing cover (E) by tapping cover gently to loosen cover from locating dowel pins.

Install

1. Position scavenge housing cover (E) on scavenge housing dowel pins.
2. Install five slotted nuts (D) and flat washers securing housing cover (E) to housing.
3. Position pickup elbow (C) on pump housing.
4. Install two slotted nuts (B) and flat washers securing elbow (C) to housing
5. Install locking wire (A) securing nuts.

Figure 6-76. Removing or installing scavenge housing cover and oil pickup elbow (FSN 2815-895-6430 oil pump).



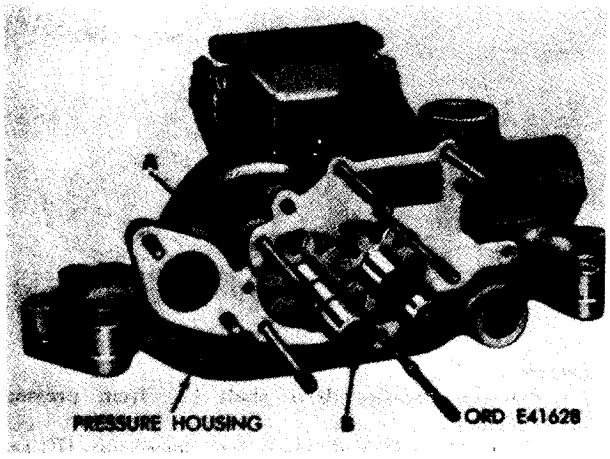
Remove

1. Slide two scavenge driven impellers (A) from impeller shafts.
2. Remove driven impeller shaft (B) from scavenge housing.
3. Slide scavenge drive impeller (C) from impeller drive shaft.
4. Remove two slotted nuts (D) and flat washers. Separate and remove scavenge housing from pressure housing.

Install

1. Position scavenge housing on pressure housing. Install two slotted nuts (D) securing scavenge housing on pressure housing.
2. Slide scavenge drive impeller (C) on impeller drive shaft.
3. Install driven impeller shaft (B) in scavenge housing.
4. Slide two scavenge driven impellers (A) on impeller shafts.

Figure 6-77. Removing or installing oil pump scavenge driven impellers, driven impeller shaft, and scavenge housing.



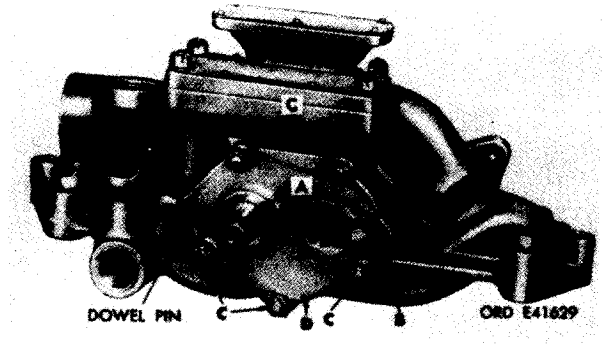
Remove

1. Slide pressure driven impeller (A) from oil pump driven impeller shaft.
2. Remove driven impeller shaft (B) from pressure housing.

Install

1. Install driven impeller shaft (B) in pressure housing.
2. Slide pressure driven impeller (A) on oil pump driven impeller shaft.

Figure 6-78. Removing or installing oil pump driven impeller and shaft.



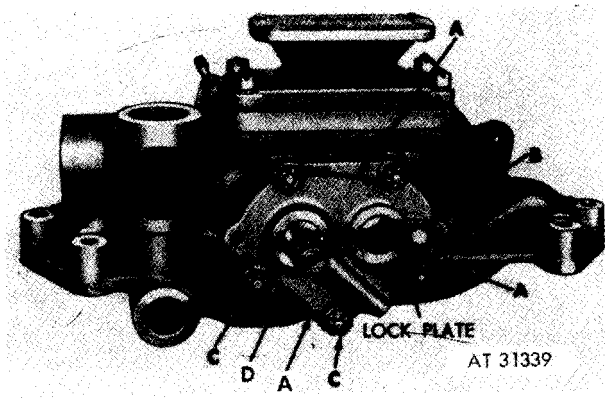
Remove

1. Remove Woodruff key (A) from impeller drive shaft.
2. Remove drilled head bolt (B) and lock plate.
3. Cut locking wire and remove five slotted nuts (C) and flat washers attaching pressure housing cover to pressure housing.
4. Separate and remove cover (D) from housing.

Install

1. Position pressure housing cover (D) on pressure housing.
2. Install five slotted nuts (C) and flat washers securing cover on housing and install locking wire securing nuts.
3. Position lock plate on cover and install drilled head bolt (B).
4. Install Woodruff key (A) in impeller drive shaft.

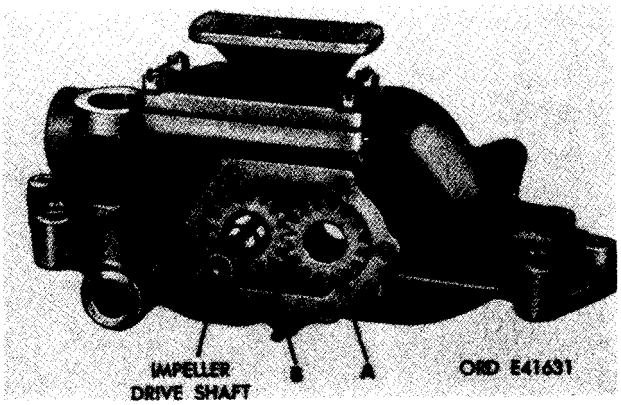
Figure 6-79. Removing or installing pressure housing cover (FSN 2815-679-4965 oil pump).



Remove
1. Cut locking wire (A).
2. Remove drilled head bolt (B) and lock plate.
3. Remove five slotted nuts (C) and flat washers attaching pressure housing cover to pressure housing.
4. Separate and remove cover (D) from housing.

Install
1. Position pressure housing cover (D) on pressure housing.
2. Install five slotted nuts (C) and flat washers securing cover on housing.
3. Position lock plate on cover and install drilled head bolt (B).
4. Install locking wire (A) securing nuts.

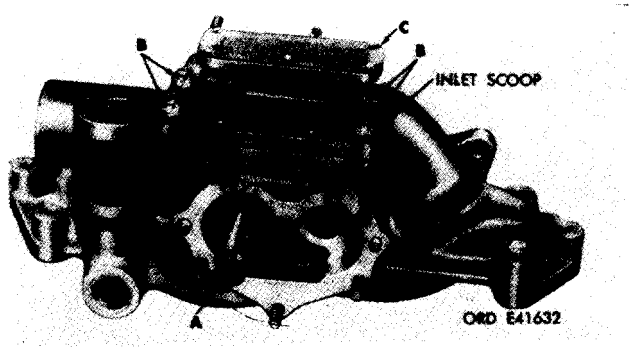
Figure 6-80. Removing or installing pressure housing cover (FSN 2815-895-6430 oil pump).



Remove
1. Remove driven impeller (A) from pressure housing.
2. Remove drive impeller (B) from impeller drive shaft.

Install
1. Install drive impeller (B) on impeller drive shaft.
2. Install driven impeller (A) in pressure housing.

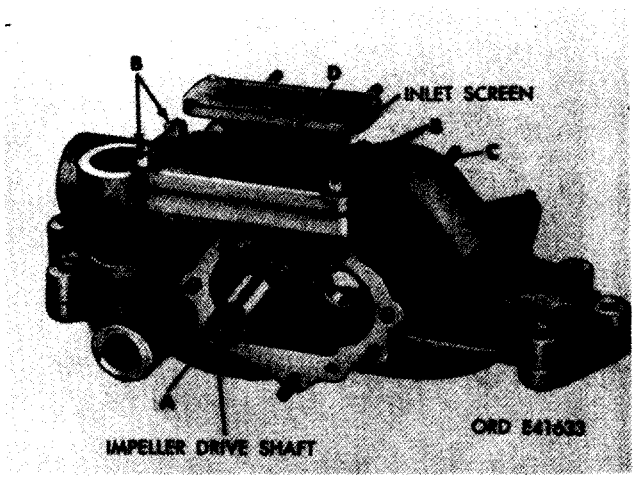
Figure 6-81. Removing or installing oil pump piston cooling drive and driven impellers.



Remove
1. Remove impeller drive shaft (A) from pressure housing.
2. Cut locking wire and remove four slotted nuts (B) and flat washers attaching scavenge oil pump inlet scoop on housing.
3. Remove inlet scoop (C). Do not remove screens.

Install
1. Position scavenge oil pump inlet scoop(C) on pressure housing.
2. Install four slotted nuts (B) and flat washers securing inlet scoop on housing and install locking wire securing nuts.
3. Install impeller drive shaft (A) in pressure housing.

Figure 6-82. Removing or installing scavenge oil pump inlet scoop (FSN 2815-679-4965 oil pump).



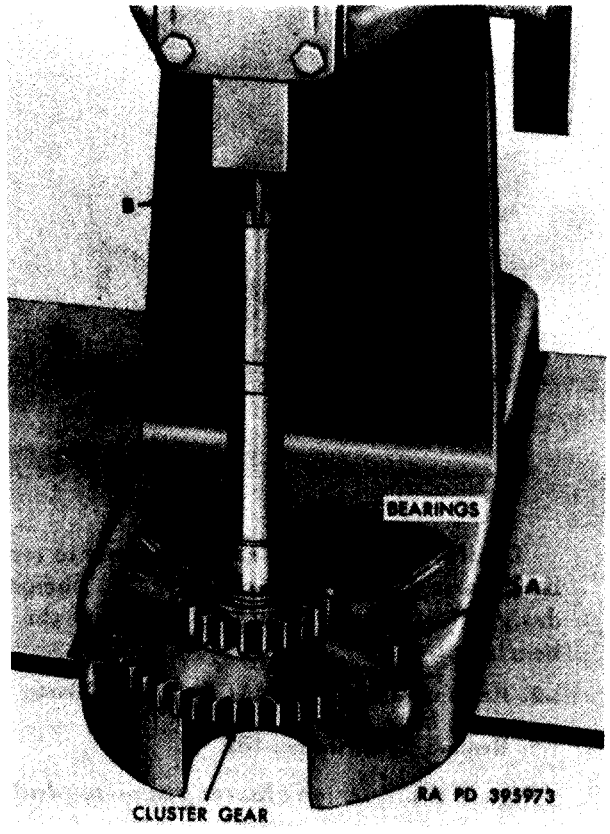
Remove

1. Remove impeller drive shaft (A) from pressure housing.
2. Cut locking wire and remove four slotted nuts (B) and flat washers attaching scavenge oil pump inlet scoop on housing.
3. Remove inlet scoop (C) from housing.
4. Remove scavenge oil pump inlet screen (D) from housing.

Install

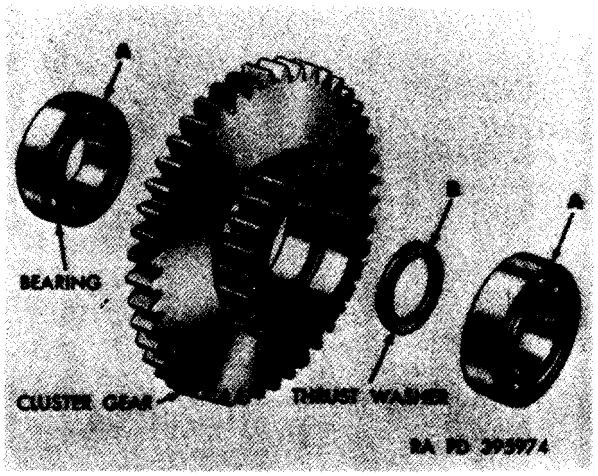
1. Position scavenge oil pump inlet screen (D) in housing.
2. Position scavenge oil pump inlet scoop (C) on housing.
3. Install four slotted nuts(B) and flat washers securing inlet scoop on housing and install locking wire securing nuts.
4. Install impeller drive shaft (A) in pressure housing.

Figure 6-83. Removing or installing scavenge oil pump oil inlet scoop (FSN 2815-895-6430 oil pump).



1. Mount impeller drive shaft with assembled cluster gear (A) in arbor press.
2. Press drive shaft(B) from ball bearing in gear.

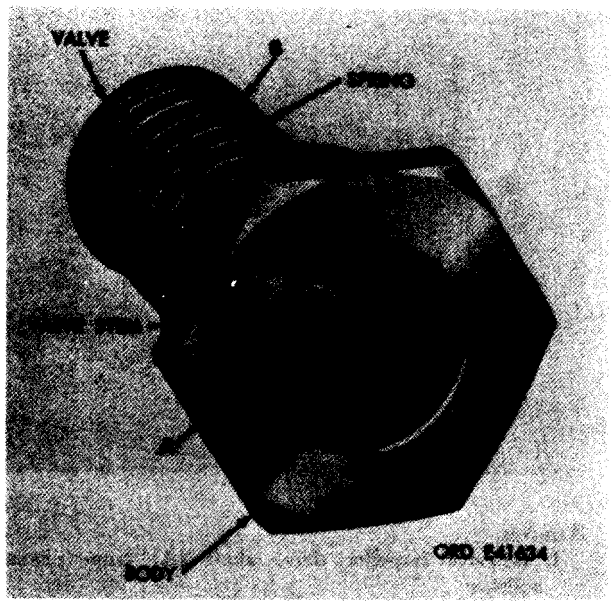
Figure 6-84. Pressing impeller drive shaft from ball bearings in drive cluster gear.



Caution: Do not use an arbor press to remove ball bearings from drive cluster gear. The gear is designed with a shoulder between the two bearings.

1. Remove ball bearings (A) from drive cluster gear using a brass drift.
2. Remove thrust washer (B).

Figure 6-85. Drive cluster gear - exploded view.



Disassemble

Caution: The piston oil cooling valve is a spring loaded assembly. Exercise care when disassembling.

1. Compress valve spring and remove retaining ring (A) from valve stem.
2. Gradually release spring compression and remove valve and spring (B) from body.

Assemble

1. Position valve and spring (B) in body.
2. Compress spring until valve stem protrudes from body and install retaining ring (A).

Figure 6-86. Disassembling or assembling piston oil cooling valve assembly. cluster gear.

c. Cleaning. Refer to paragraph 6-2.

d. Inspection. Refer to paragraph 6-3. Inspect parts to the limits specified in overhaul standards (table 6-19).

Table 6-19. Oil Pump Overhaul Standards

Component	Fig. No.	Ref. letter	Point of measurement	Sizes and fits of new parts		Wear limits
Depth of Impeller bore	B-9	A	Piston sprayer pump	0.8750	0.8770	0.8775
	B-9	B	Pressure pump	2.0000	2.0020	2.0025
	B-9	F	Scavenge pump	2.3500	2.3520	2.3525
Length of impeller	B-9	L	Pieton sprayer pump	0.8720	0.8730	0.8710
	B-9	L-A	End play between impellers and impeller housings with housings correctly assembled	0.0020L	0.0050L	0.0065L
	B-9	Z	Pressure pump	1.9965	1.9975	1.9960
	B-9	Z-B	End play between impellers and impeller housings with housings correctly assembled	0.0025L	0.0055L	0.0065L
	B-9	D D	Scavenge pump	2.3460	2.3470	2.3455
	B-9	DD-F	End play between impellers and impeller housings with housings correctly assembled	0.0030L	0.0060L	0.0070L
Impellers and shafts	B-9	E	Outside diameter of piston sprayer pump cover end of oil pump impeller drive shaft	0.9830	0.9835	0.9827
	B-9	M	Inside diameter of bearing bore in cover	0.9850	0.9860	0.9870
Impellers and shafts	B-9	E-M	Fit of shaft in cover bore	0.0015L	0.0030L	0.0043L
	B-9	AA	Outside diameter of pressure pump and scavenge pump bearing surfaces on oil pump impeller drive shaft	1.1310	1.1315	1.1307
	B-9	W	Inside diameter of bearing in oil pressure pump housing	1.1330	1.1340	1.1350
	B-9	AA-W	Fit of impeller drive shaft in housing bore	0.0015L	0.0030L	0.0043L
	B-9	C C	Inside diameter of bearing bore in scavenge pump housing	1.1330	1.1340	1.1350
	B-9	AA-C C	Fit of impeller drive shaft in housing bore	0.0015L	0.0030L	0.0043L
	B-9	B B	Outside diameter of scavenge pump cover bearing surface end of impeller drive shaft	0.9830	0.9835	0.9827
	B-9	J	Inside diameter of bearing bore in scavenge pump cover	0.9850	0.9860	0.9870
Impellers and shafts	B-9	BB-J	Fit of impeller drive shaft in scavenge pump cover	0.0015L	0.0030L	0.0043L
	B-9	D-E E	Outside diameter of pressure and scavenge pump drive and driven impellers	2.4814	2.4818	2.4810
	B-9	Y-G	Inside diameter of pressure and scavenge pump impeller bores	2.4850	2.4862	2.4875
	B-9	D-E E G-Y	Fit (radial clearance) of impellers in housing	0.0032L	0.0048L	0.0065L
	B-9	K	Outside diameter of piston sprayer pump impellers	2.2490	2.2500	2.2485
	B-9	X	Inside diameter of piston sprayer pump impeller bores	2.2530	2.2542	2.2550
	B-9	K-X	Fit (radial clearance) of impellers in housing	0.0030L	0.0052L	0.0065L
	B-9	C	Inside diameter of pressure oil pump driven impeller	0.9860	0.9865	0.9870
	B-9	H	Outside diameter of oil pump driven impeller shaft	0.9834	0.9839	0.9829
	B-9	C-H	Fit of impeller on shaft	0.0021L	0.0031L	0.0041L
	B-9	L L	Inside diameter of scavenge oil pump driven impeller	0.9860	0.9865	0.9870
	B-9	H-L L	Fit of impeller on shaft	0.0021L	0.0031L	0.0041L
	B-9	F F	Inside diameter of scavenge oil pump driven impeller	0.9860	0.9865	0.9870
	B-9	G G	Outside diameter of oil pump driven impeller shaft	0.9834	0.9839	0.9829
	B-9	FF-G G	Fit of impeller on shaft	0.0021L	0.0031L	0.0041L

Note. Refer to paragraph 6-3b for explanation of symbols.

Table 6-19. Oil Pump Overhaul Standards - Continued

Component	Fig. No.	Ref. letter	Point of measurement	Sizes and fits of new parts	Wear limits
Impellers and shafts - Cont' d	B-9	H H	Inside diameter of pieton sprayer pump impellers	0.9860 0.9865	0.9870
	B-9	H-HH	Fit of impellers on shaft	0.0021L 0.0031L	0.0041L
Oil pump drive gear and bearings	B-9	K K	Outside diameter of bearings	2.0467 2.0472	*
	B-9	J J	Inside diameter of small gear end of drive gear	2.0463 2.0470	2.0473
	B-9	**KK** JJ	Fit of bearing in drive gear	0.0003L 0.0009T	0.0006L
	B-9	P	Inside diameter of large gear end of drive gear	2.0463 2.0470	2.0473
	B-9	K K-P	Fit of bearing in drive gear	0.0003L 0.0009T	0.0006L
	B-9	**N**	Inside diameter of bearings	0.9839 0.9843	*
	B-9	Q	Outside diameter of oil pump drive shaft	0.9835 0.9840	0.9833
	B-9	N-Q	Fit of bearings on shaft	0.0008L 0.0001T	O.OO1OL
Oil pump pressure relief valve	B-9	s	Spring helical compression (small)		
			Approximate free length	4.27 inch	*
			Load at 3.22 inch	95 lb to 105 1b	*
			Maximum solid height	2.94 inch	*
	B-9	R	Spring helical compression (large)		
			Approximate free length	4.96 inch	*
			Load at 3.22 inch	141.5 lb to 156.5 lb	*
			Maximum solid height	2.90 inch	*
	B-9	V	Outside diameter of valve stem	0.3110 0.3115	0.3105
	B-9	T	Inside diameter of pressure relief valve body	0.3140 0.3160	0.3170
	B-9	V-T	Fit of valve stem in valve body	0.0025L 0.0050L	0.0065L
Piston oil cooling valve	B-9	U	Spring, helical compression:		*
			Approximate free length	2.69 inch	*
			Load at 1.38 inch	63.4 lb to 75.4 lb	*
			Maximum solid height	1.31 inch	

Note. Refer to paragraph 6-3b for explanation of symbols.

e. Repair. Replace defective parts. Refer to paragraph 6-4e and table 6-20 when replacing studs.

Note. Pump parts are not interchangeable. Do not attempt to replace individual parts; replace entire pump assembly with FSN 2815-895-6430 oil pump assembly when service of FSN 2815-679-4965 pump stock is exhausted. Refer to Appendix B.

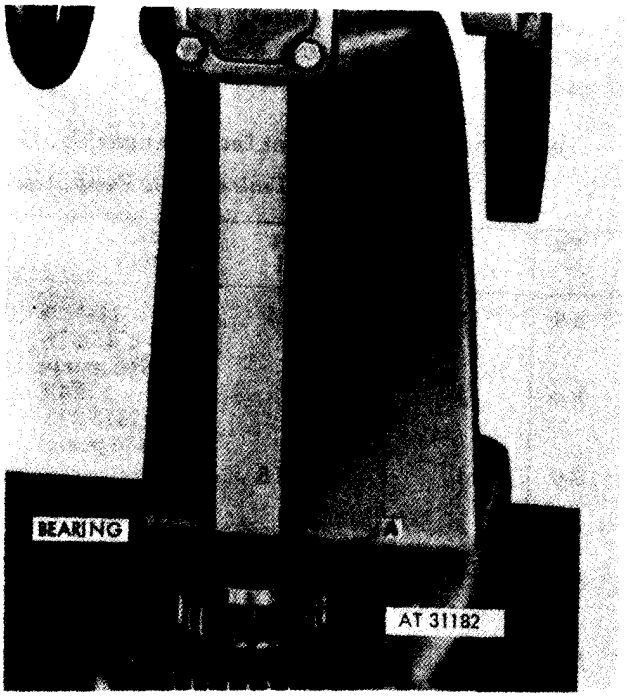
Table 6-20. Oil Pump Standard and Oversize Stud Identification

Fig. No.	Ref. No.	Setting height	No. req'd.	stud size and length
B-9	13-59	13/16	11(FSN 2815-679-4965 pump)	5/ 16-18(3/4) x5/ 16-24(17/32) x 1-3/8 (STD) (0.003 in. OS) (0.007 in. OS)
B-9	13		7 (FSN 2815-895-6430 pump)	
B-9	14	3-7 /8	2	5/ 16-18(23/32) x5/ 16-24(29/64)x4-1/2 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
B-9	15	5-3/16	2	5/ 16-18(3/4) x5/ 16-24(7/8) x 5-51/64 (STD) (0.003 in. OS) (0.007 in. OS)
B-9	34	29/ 32	1	5/ 16-18(3/4) x5/ 16-24(19/ 32) x 1-7/16 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
B-9	35	3-7/ 16	2	5/ 16-18(23/32) x5/ 16-24(39/64) x 4-1/8 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
B-9	59	7 / 8	4	5/ 16-18(3/4) x5/ 16-24(19/32) x 1-1/2 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)

Note. Refer to figure 6-1 for oversize stud identification.

f. Assembly. Refer to figures 6-87 through 6-67. Torque tighten the drive shaft lock nut (fig. 6-72) and driven gear nut (fig. 6-70) as specified.

Note. The drive shaft (B, fig. 6-84) must be pressed into the bearings from the large gear end of the cluster gear.



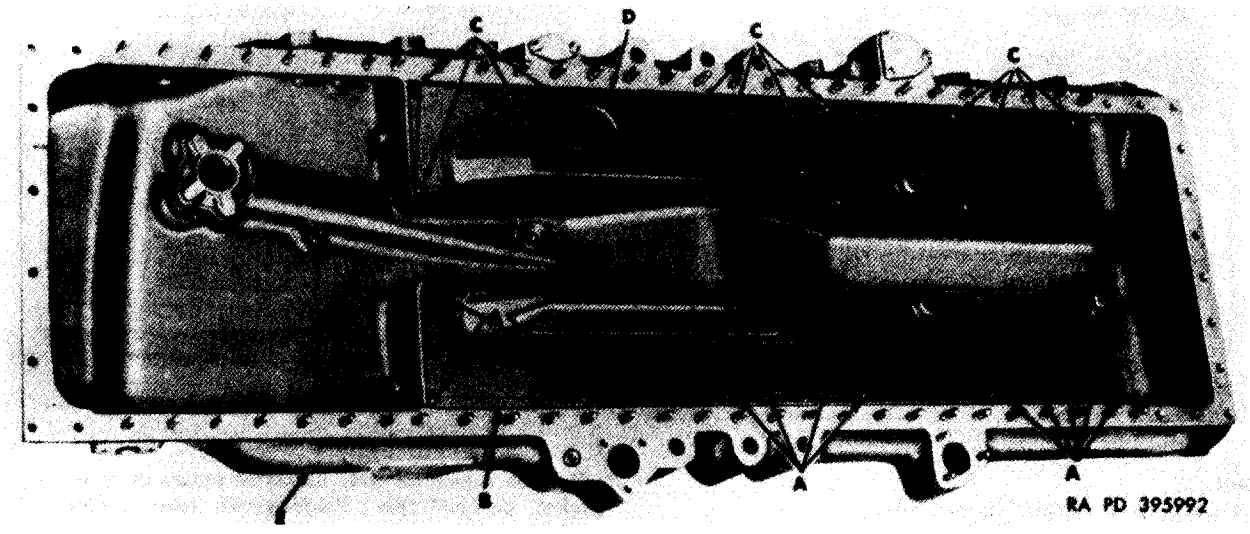
1. Position ball bearing (A) in bore of drive cluster gear.
2. Press bearing into gear until bearing is seated against the gear.

Note. Turn gear over and install thrust washer (B, fig. 6-85). Aline thrust washer with installed bearing and press second bearing in gear, as outlined above, until seated against thrust washer.

Figure 6-87. Pressing ball bearing into drive cluster gear.

6-37. Overhaul of Oil Pan Assembly

a. Disassembly. Disassemble oil pan following instructions which accompany figures 6-88 through 6-97.



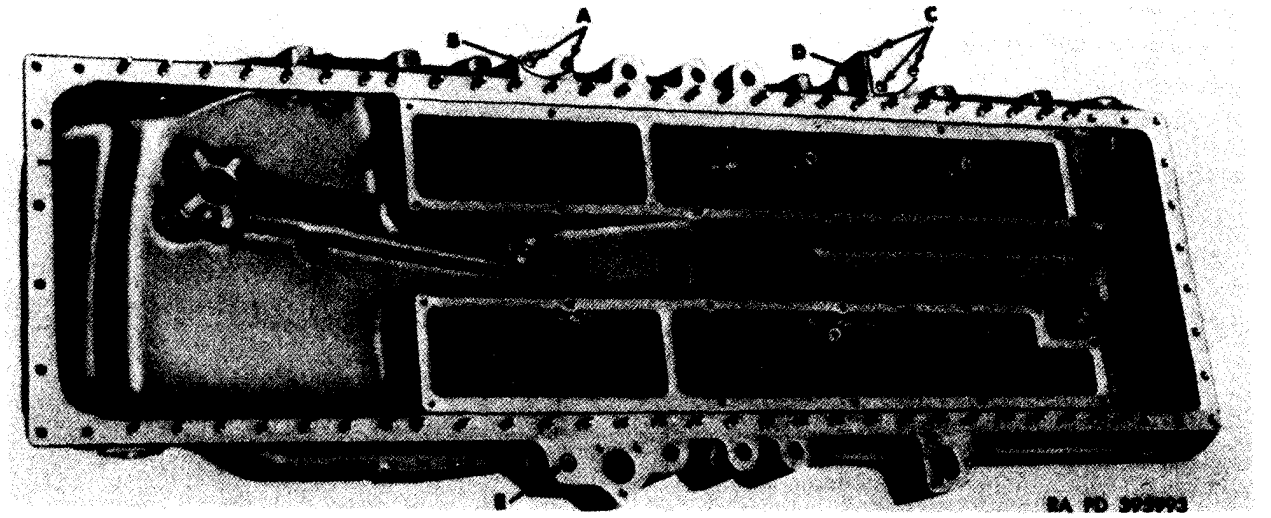
Remove

1. Cut locking wire and remove 13 cap screws (A).
2. Remove left oil pan baffle (B).
3. Cut locking wire and remove 12 cap screws (C).
4. Remove right oil pan baffle (D).
5. Remove pipe plug (E).

Install

1. Install pipe plug (E).
2. Position right oil pan baffle (D) in oil pan.
3. Install 12 cap screws (C) and install locking wire securing screws.
4. Position left oil pan baffle (B) in oil pan.
5. Install 13 cap screws (A) and install locking wire securing screws.

Figure 6-88. Removing or installing oil pan baffles.



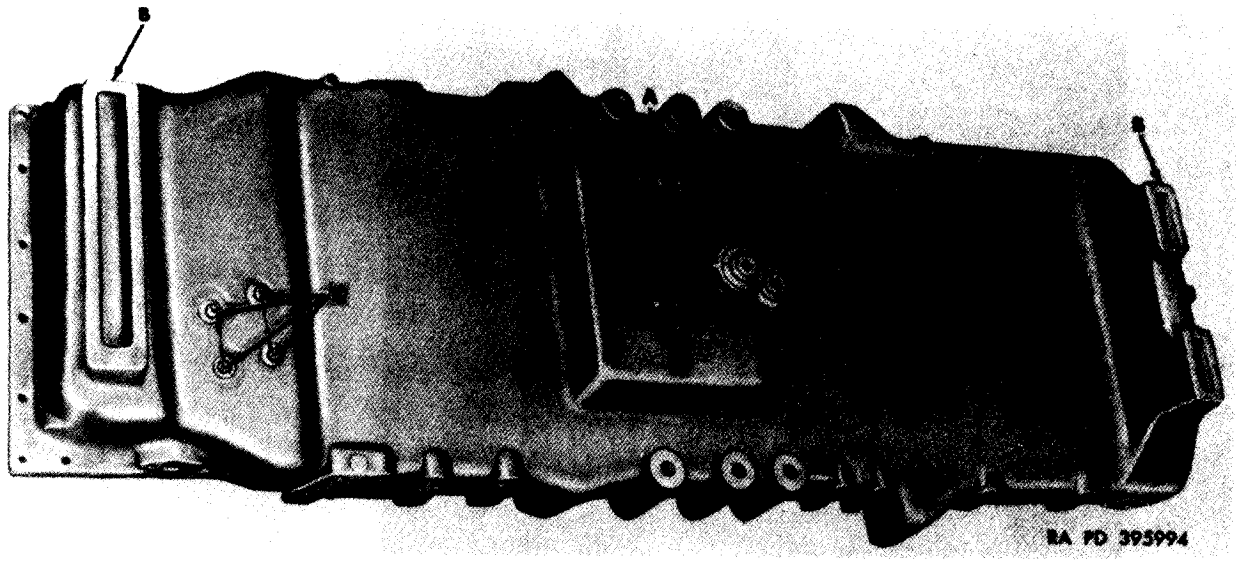
Remove

1. Remove two self-locking nuts (A).
2. Remove oil separator drain replacement cover (B). Remove and discard gasket.
3. Remove three self-locking nuts (C).
4. Remove oil level indicator replacement cover (D). Remove and discard gasket.
5. Remove pipe plug (E).

Install

1. Install pipe plug (E).
2. Position a new oil level indicator replacement cover gasket on oil pan. Position oil level indicator replacement cover (D) on oil pan.
3. Install three self-locking nuts (C).
4. Position a new oil separator drain replacement cover gasket on oil pan. Position oil separator drain replacement cover (B) on oil pan.
5. Install two self-locking nuts (A).

Figure 6-89. Removing or installing oil separator drain and oil level replacement covers.



Remove

1. Remove six bolts (A) and lock washers.
2. Remove two pipe plugs (B).
3. Cut locking wire and remove four slotted nuts (C).

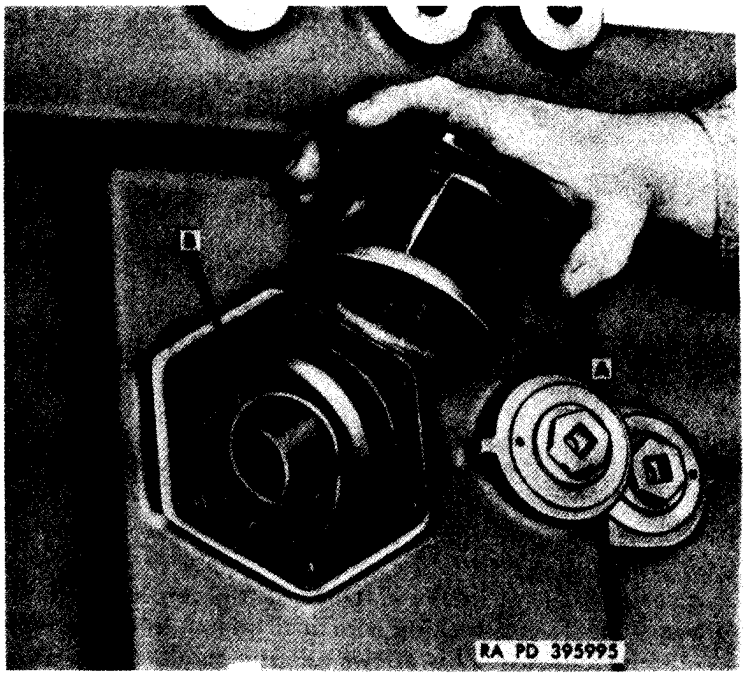
Install

1. Install four slotted nuts (C).

Note. Do not tighten nuts (C) or install locking wire until oil pan is in position on engine. This allows adapter to aline with oil spill tube.

2. Install two pipe plugs (B).
3. Install six bolts (A) and lock washers.

Figure 6-90. Removing or installing pressure oil pump elbow adapter and oil pickup screen assembly attaching parts (M60 series vehicle application engines).



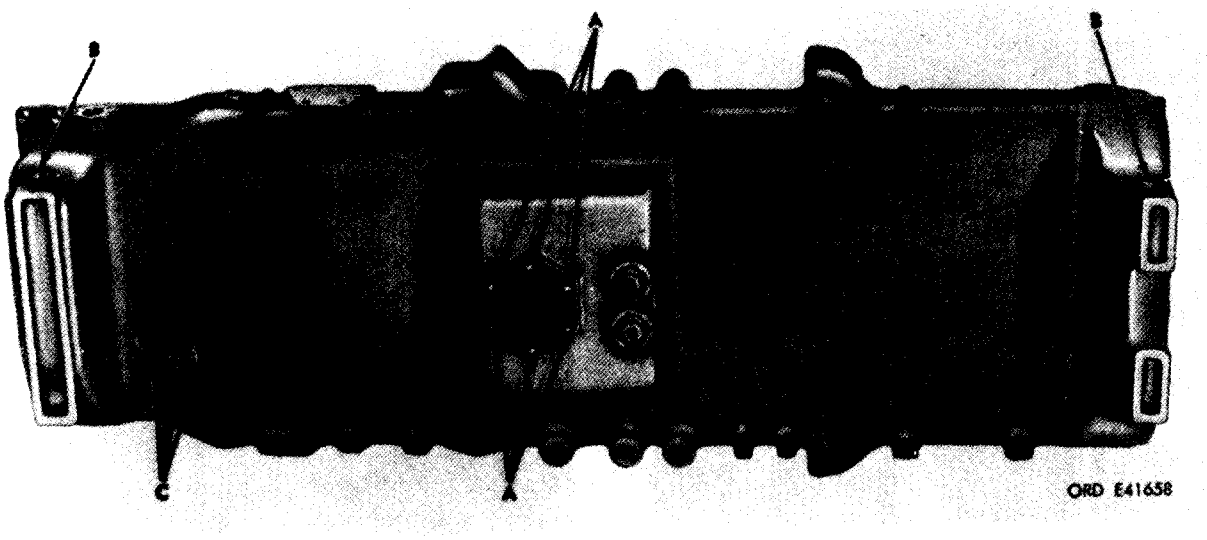
Remove

1. Remove pressure oil pickup screen assembly (A).
2. Remove and discard gasket (B).

Install

1. Position a new pressure oil pickup screen assembly gasket (B) on oil pan.
2. Position pressure oil pickup screen assembly (A) on oil pan.

Figure 6-91. Removing or installing pressure oil pickup screen assembly (M60 series vehicle application engines).



Remove

1. Remove six bolts (A) and lock washers.
2. Remove two pipe plugs (B).
3. Cut locking wire and remove four slotted nuts (C).

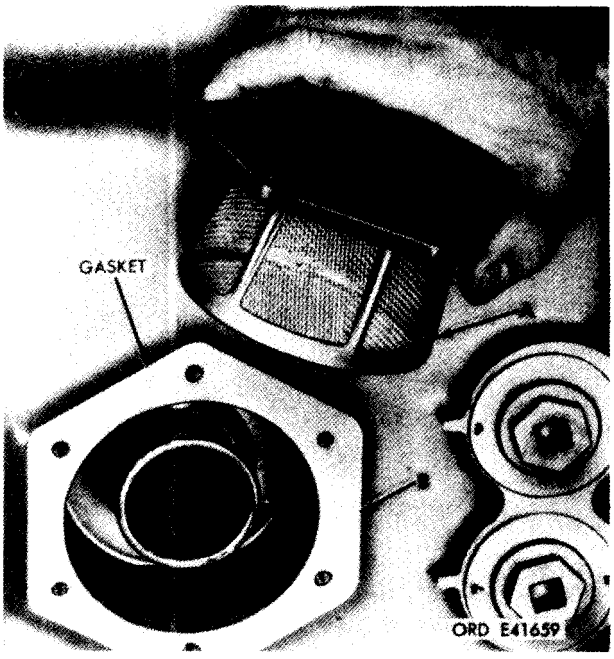
Install

1. Install four slotted nuts (C).

Note. Do not tighten nuts (C) or install locking wire until oil pan is in position on engine. This allows adapter to aline with oil spill tube.

2. Install two pipe plugs (B).
3. Install six bolts (A) and lock washers.

Figure 6-92. Removing or installing pressure oil pump elbow adapter and oil pickup screen assembly attaching parts (universal vehicle application engines).



Remove
1. Remove pressure oil pickup screen assembly (A).
2. Remove and discard gasket (B).

Install
1. Position a new pressure oil pickup screen assembly gasket (B) on oil pan.
2. Position pressure oil pickup screen assembly (A) on oil pan.

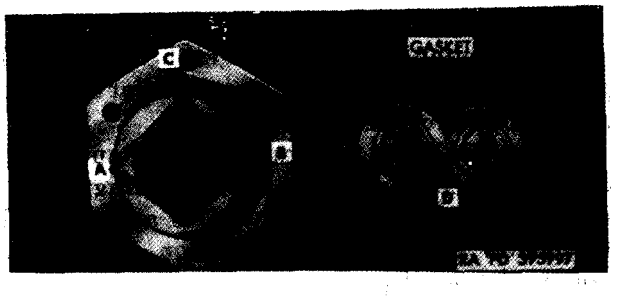
Figure 6-93. Removing or installing pressure oil pickup screen assembly (universal vehicle application engines).



Remove
1. Remove oil pump elbow adapter (A).
2. Remove and discard gasket (B).
3. Remove and discard two preformed packings (C).

Install
1. Position two new preformed packings (C) in oil pump elbow adapter (A).
2. Position a new adapter gasket (B) on oil pan.
3. Position elbow adapter (A) on oil pan.

Figure 6-94. Removing or installing oil pump elbow adapter.



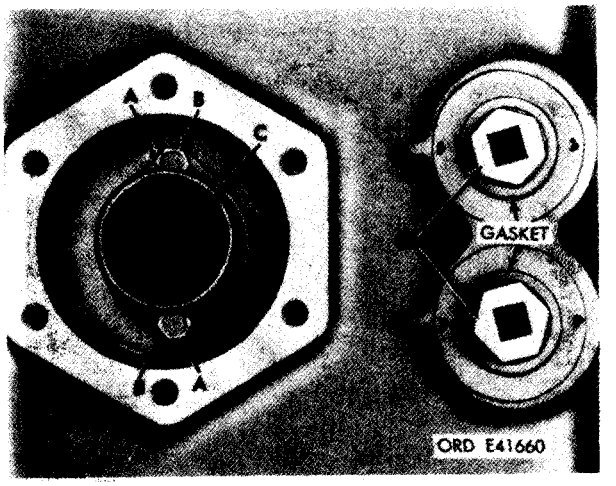
Remove

1. Straighten tabs on two tab washers (A).
2. Remove two bolts (B) and tab washers. Discard tab washers.
3. Remove pressure oil pickup funnel assembly (C).
4. Remove two magnetic drain plugs (D) and discard plug gaskets.

Install

1. Position a new drain plug gasket on each magnetic drain plug (D) and install plugs in oil pan.
2. Position pressure oil pick up funnel assembly (C) in oil pan.
3. Install two bolts (B) and new tab washers (A).
4. Bend tabs on tab washers (A) securing bolts (B).

Figure 6-95. Removing or installing oil pickup funnel assembly and magnetic drain plugs, (M60 series vehicle application engines).



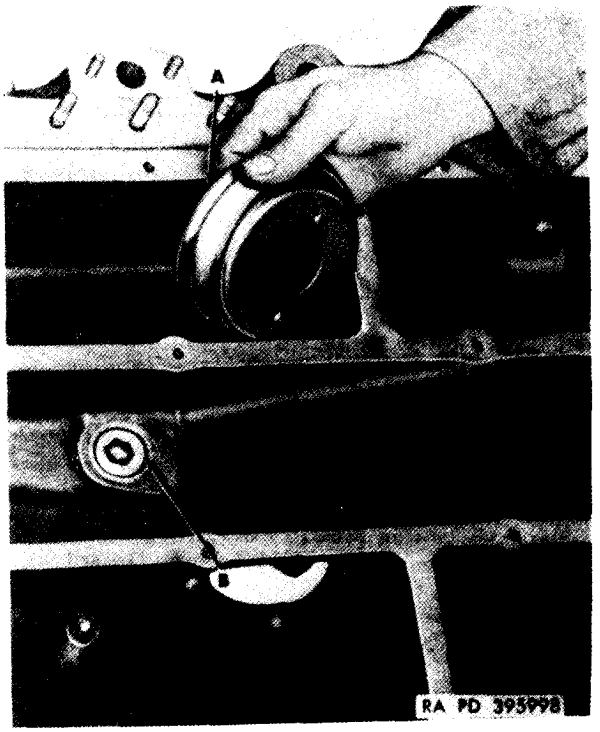
Remove

1. Straighter tabs on two tab washers (A).
2. Remove two bolts (B) and tab washers. Discard tab washers.
3. Remove pressure oil pickup funnel assembly (C).
4. Remove two magnetic drain plugs (D) and discard plug gaskets.

Install

1. Position a new drain plug gasket on each drain plug (D) and install plugs in oil pan.
2. Position pressure oil pickup funnel assembly (C).
3. Install two bolts (B) and new tab washers (A).
4. Bend tabs on tab washers(A) securing bolts(B).

Figure 6-96. Removing or installing oil pickup funnel assembly and drain plugs (universal vehicle application engines).



Remove
1. Remove pressure oil pickup cover (A).
2. Remove oil pan pipe plug (B).

Install
1. Install oil pan pipe plug (B).
2. Install pressure oil pickup cover (A).

Figure 6-97. Removing or installing pressure oil pickup cover.

b. Cleaning. Refer to paragraph 6-2.

c. Inspection. Refer to paragraph 6-3. The oil pan gasket flange must not be out-of flat by more than 0.004-inch per foot.

d. Repair. Refer to paragraph 6-4e and table 6-21 when replacing studs. Refer to paragraph 6-4C for general welding instructions and (1) and (2), below, for specific information on welding repair of the oil pan.

(1) Oil pan bottom surfaces. The welding repair of chips, cracks, and the replacement of metal is permissible in the oil pan to prevent oil leakage between compartments or from cast passages. Repair cracks that do not extend over 12 inches lengthwise and when there are not more than three cracks running crosswise within a six inch area.

(2) *Oil pan baffles.* Sections of missing metal in oil baffles may be replaced, but care must be exercised when replacing baffles immediately adjacent to and attaching to the oil pan outer walls at the engine mounting bosses. Mount bosses may also be repaired if chipped or cracked. After welding repair of the oil pan, leak test compartments and cast passages. Pressure test is not necessary.

Table 6-21. Oil Pan Standard and Oversize Stud Identification

Fig. No.	Ref No.	Set ting height	No. req'd	Stud size and length
B-7	21	2-13 / 16	2	5/16-18(3/4) x5/ 16(23/32) x 3-9/32 (STD) (0.003 in. OS) (0.007 in. OS)
B-7	24	1-21 / 32	2	5/16-18(15/16) x5/ 16-24(25/32) x 2-1/8 (STD) (0.003 in. OS) (0.007 in. OS) (0.012in. OS)
B-8	17	25 / 32	8	5/ 16-18(3/4) x5/ 16-24(19/32) *x* 1-7/16 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
B-8	14	1-11 / 32	56	3/8-16(15/16) x3/ 8-24(13/16) x 2-3/32 (STD) (0.003 in. OS) (0.007 in. OS)

Note. Refer to figure 6-1 for oversize stud identification.

e. Assembly. Refer to figures 6-97 through 6-88.

6-38. Overhaul of Crankshaft Damper and Oil Filter Housing, Oil Filters, Switches, and Transmitters

a. Disassembly. Disassemble crankshaft damper and oil filter housing and oil filters following instructions which accompany figures 6-99, 6-100, 4-89 through 4-92, and 6-101 through 6-111.

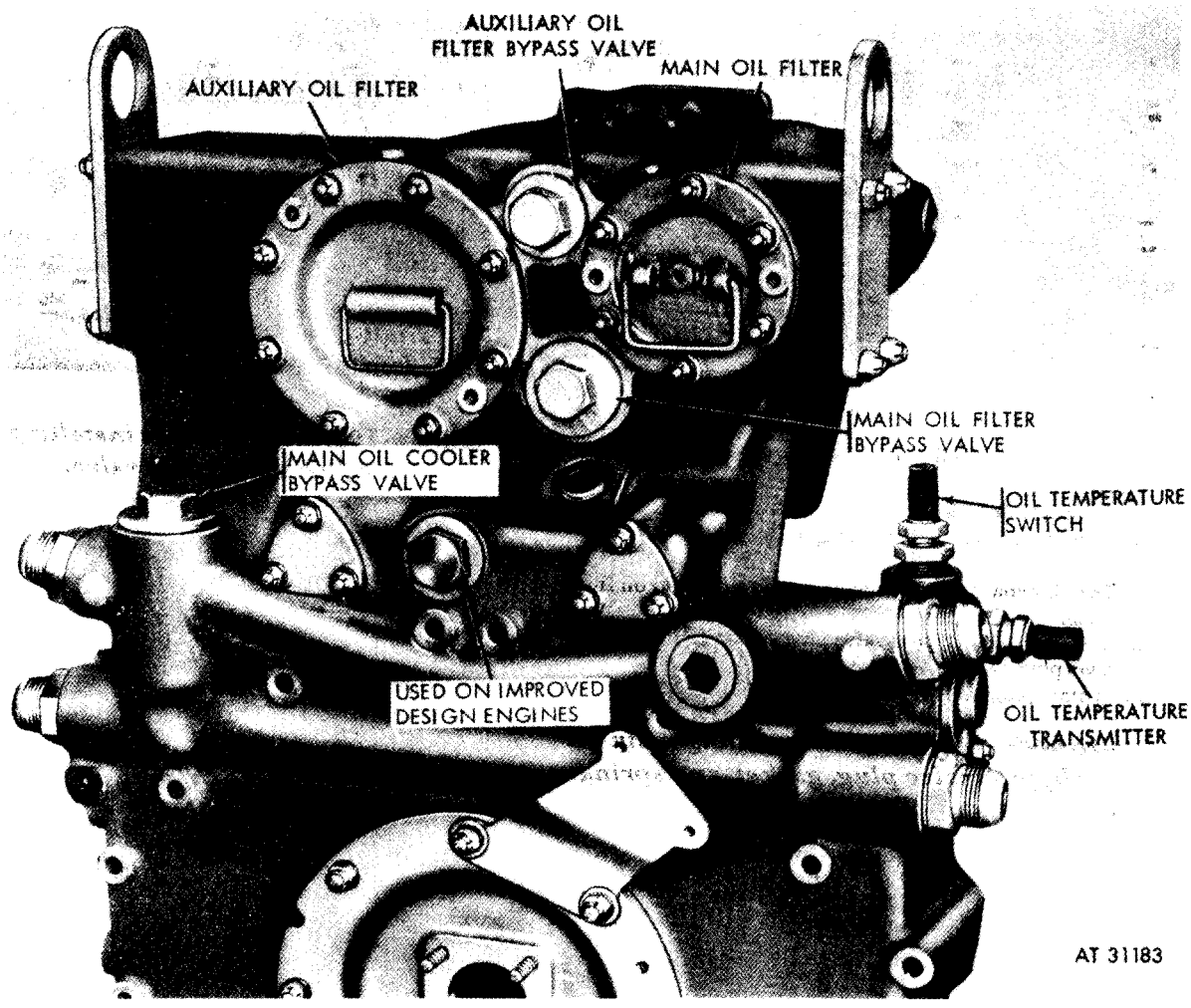
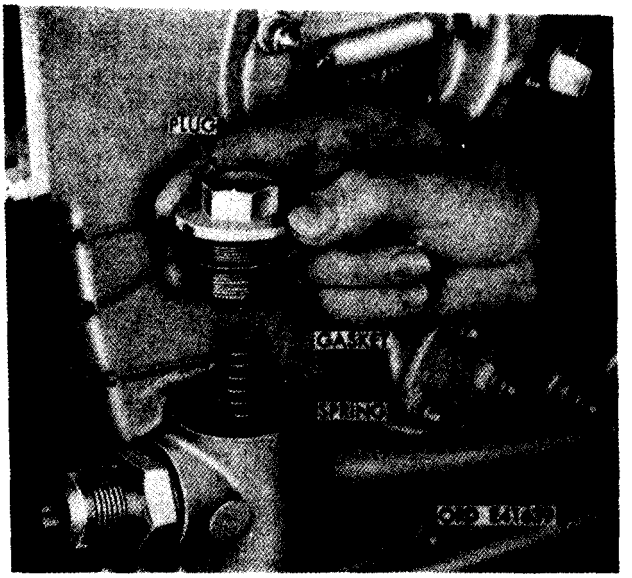


Figure 6-98. Crankshaft damper and oil filter housing as removed from engine.



Remove

1. Remove main oil cooler bypass valve plug (A) and gasket (B).
2. Remove and discard gasket (B).
3. Remove bypass valve spring (C).

Install

1. Install bypass valve spring (C) in damper and oil filter housing.
2. Position a new bypass valve plug gasket (B) on bypass valve plug (A).
3. Install plug (A) in housing.

Figure 6-99. Removing or installing main oil cooler bypass valve plug, gasket, and spring.

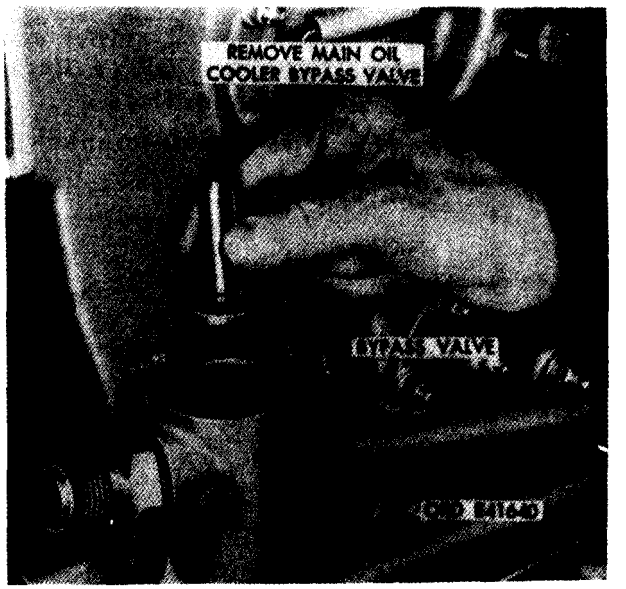
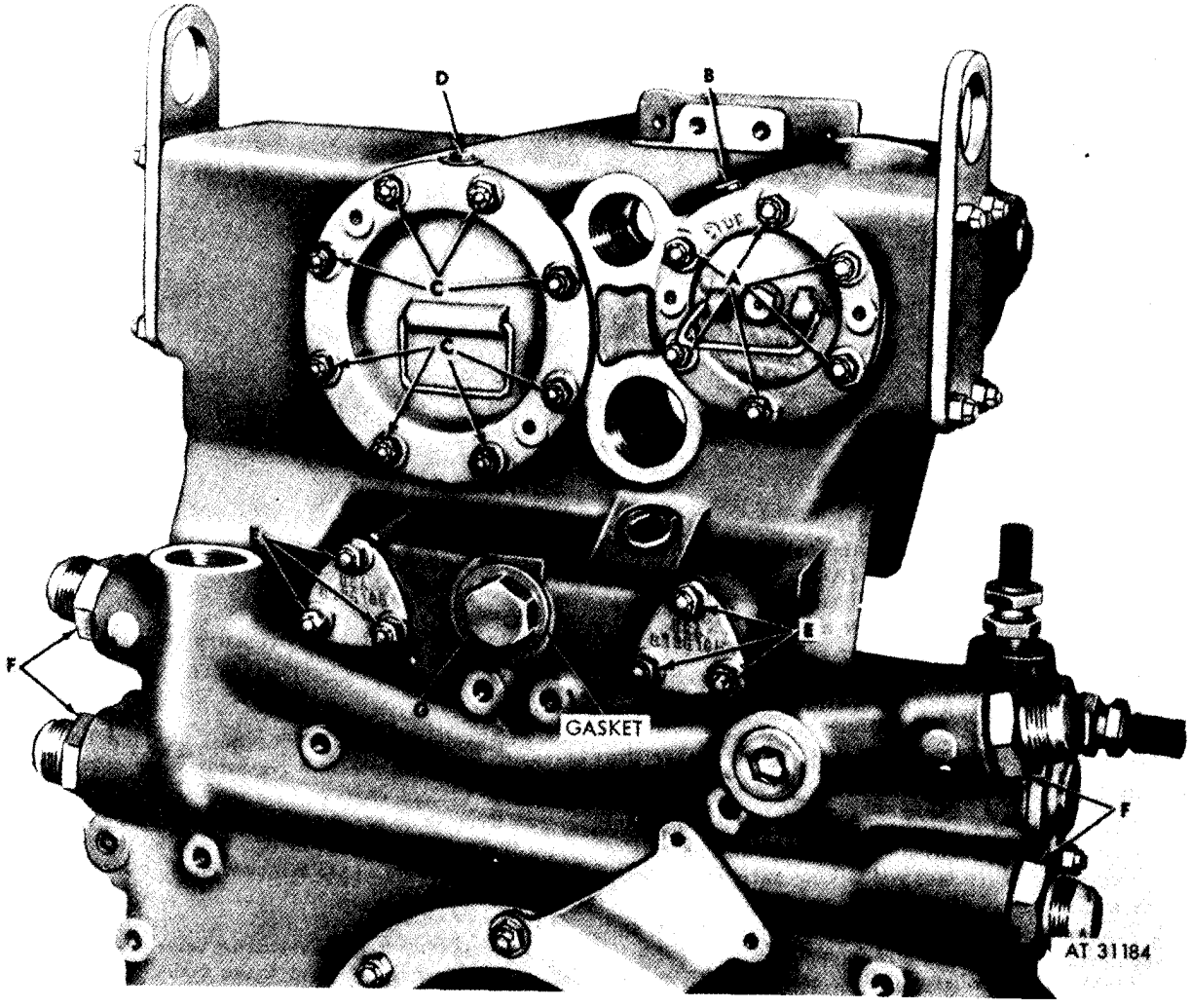


Figure 6-100. Removing or installing main oil cooler bypass valve.



Remove

1. Remove six self-locking nuts (A) and flat washers attaching main oil filter assembly to damper and oil filter housing.
2. Loosen main oil filter stop bolt (B) several turns and pull filter from housing until it engages stop bolt. Collect oil in a suitable container.

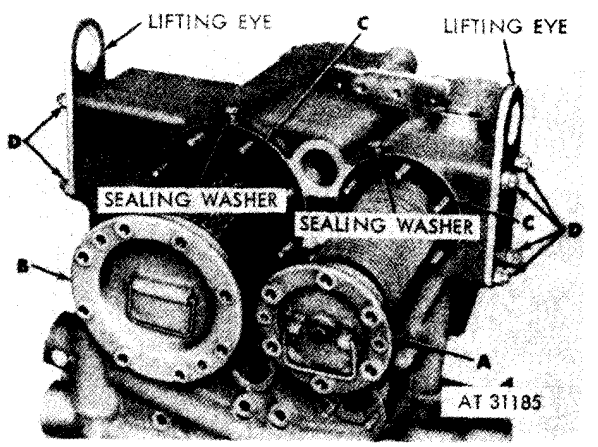
Note. It may be necessary to use two 5 / 16-24 x 1½-inch jack screws in the puller screw holes to break the gasket seal between the filter flange and the housing.

3. Remove eight self-locking nuts (C) and flat washers attaching auxiliary oil filter to housing.
4. Loosen auxiliary oil filter stop bolt (D) and drain filter as described in step 2, above.
5. Remove six self-locking nuts (E) and flat washers attaching two oil drain covers to housing. Remove covers and discard drain cover gaskets.
6. Remove four oil cooler tube nipples (F) from housing.
7. Remove core hole plug (G) and gasket from housing. Discard gasket.

Install

1. Position a new gasket on core hole plug (G) and install plug in damper and oil filter housing.
2. Install four oil cooler tube nipples (F) in housing.
3. Position new drain cover gaskets and two oil drain covers on housing. Install six self-locking nuts (E) and flat washers securing drain covers to housing.
4. With auxiliary oil filter positioned in housing, tighten auxiliary oil filter stop bolt (D) to 125 inch-pounds torque.
5. Install eight self-locking nuts (C) and flat washers securing filter in housing.
6. With main oil filter assembly positioned in housing tighten main oil filter stop bolt (B) to 125 inch-pounds torque.
7. Install six self-locking nuts (A) and flat washers securing filter in housing.

Figure 6-101. Removing or installing auxiliary and main oil filter attaching parts.



Remove

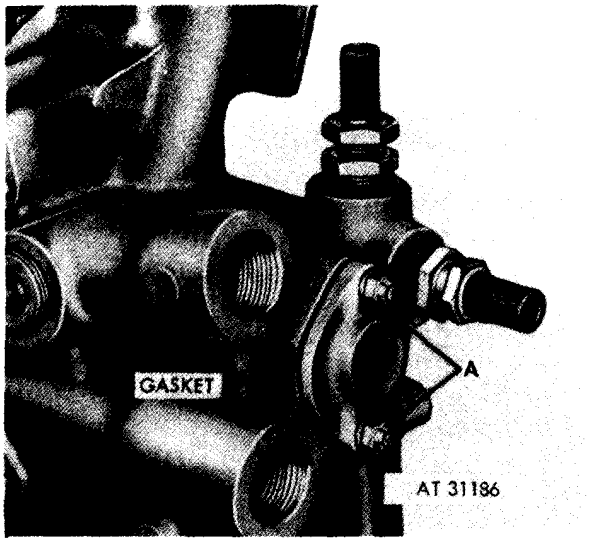
1. Remove the main oil filter stop bolt, sealing washer, and main oil filter assembly (A).
2. Remove the auxiliary oil filter stop bolt, sealing washer, and auxiliary oil filter assembly (B).
3. Remove and discard oil filter gaskets (C).
4. Remove eight self-locking nuts (D) and remove two lifting eyes. Remove and discard lifting eye gasket.

Install

Note. The lifting eye gasket is used under the left lifting eye only.

1. Position lifting eye gasket on left side of damper and oil filter housing. Position one lifting eye on each side of housing and install four self-locking nuts (D) securing each lifting eye.
2. Position a new oil filter gasket (C) on main and auxiliary oil filter openings in housing.
3. Position the auxiliary oil filter assembly (B), sealing washer, and auxiliary oil filter stop bolt in housing.
4. Position the main oil filter assembly (A), sealing washer, and main oil filter stop bolt in housing.

Figure 6-102. Removing or installing main and auxiliary oil filters.



Remove

Warning: The oil pressure regulator cover is spring loaded. Exercise care when removing cover.

1. Remove two self-locking nuts (A) and flat washers attaching oil pressure regulator valve cover. Remove and discard gasket.
2. Remove oil pressure regulator valve assembly parts in the sequence shown in figure 6-104. Note number of flat washers (A) removed for reference during assembly.

Install

1. Install oil pressure regulator valve assembly parts in the sequence shown in figure 6-104. Install the same number of flat washers (A) as removed.
2. Position a new valve cover gasket on housing. Position valve cover on housing and install two self-locking nuts (A) and flat washers securing cover on housing.

Figure 6-103. Removing or installing oil pressure regulator valve cover and gasket.

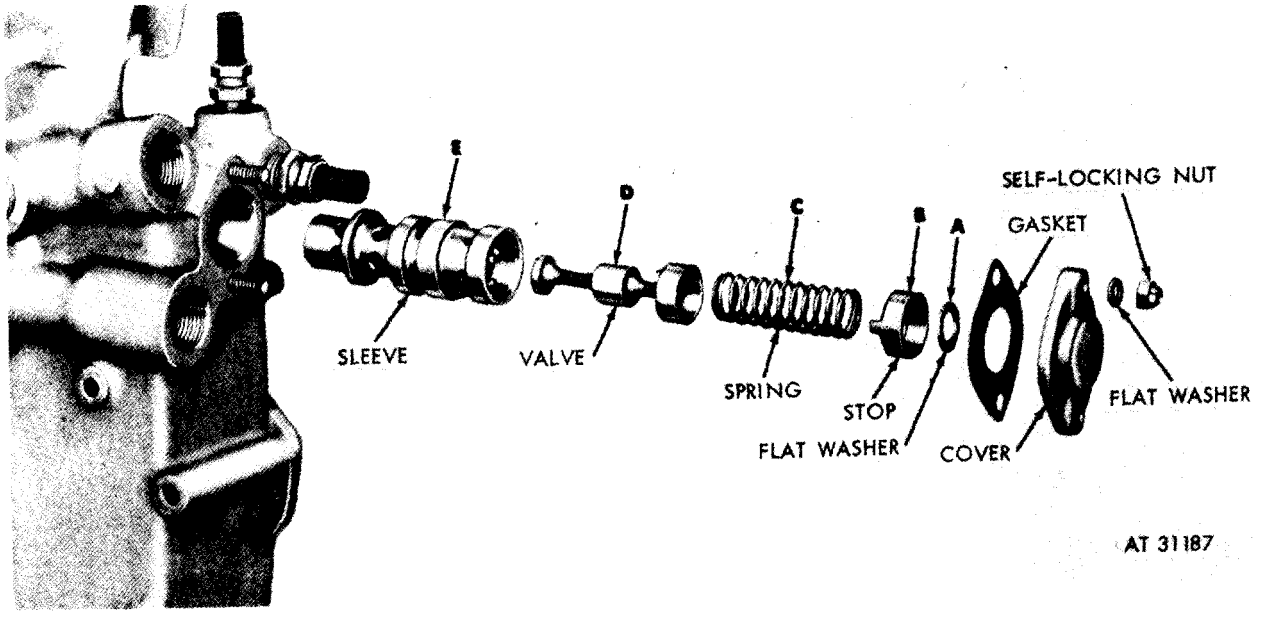
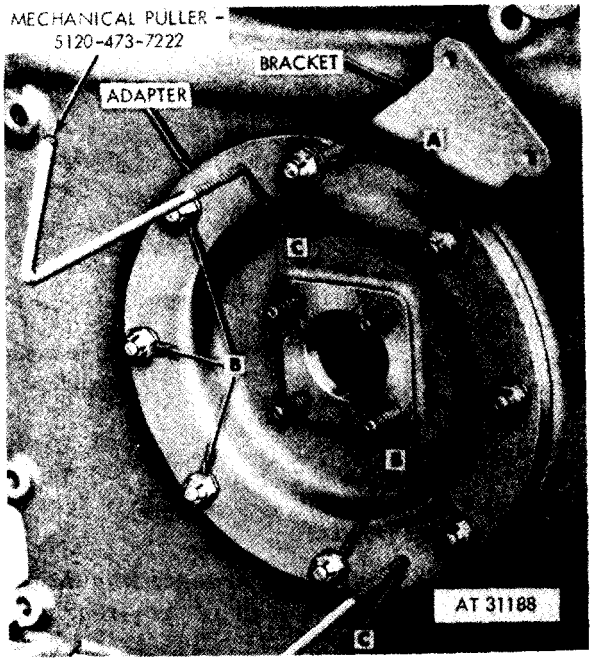


Figure 6-104. Disassembling or assembling oil pressure regulator valve.



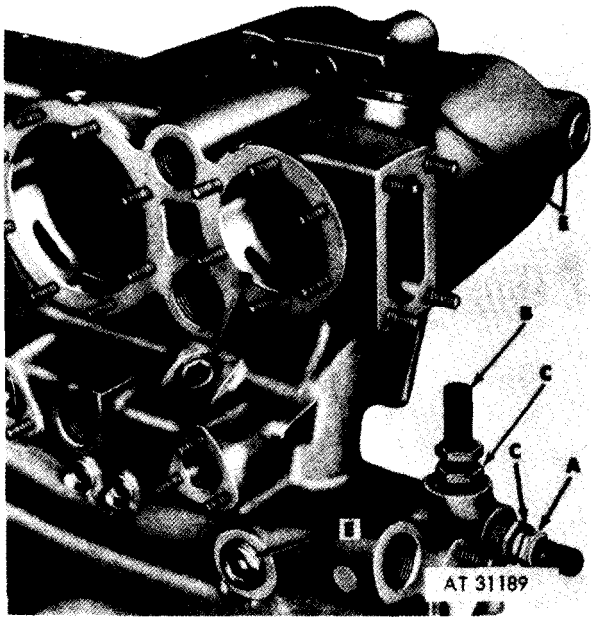
Remove

1. Remove two self-locking nuts (A) and flat washers, attaching fuel check valve bracket and remove bracket.
2. Remove six self-locking nuts (B) and fiat washers attaching fuel pump adapter
3. Remove adapter using two mechanical pullers - 5120-473-7222 (C).

Install

1. Position fuel pump adapter on housing and install six self-locking nuts (B) securing adapter.
2. Position fuel check valve bracket on adapter and install two self-locking nuts (A) securing bracket.

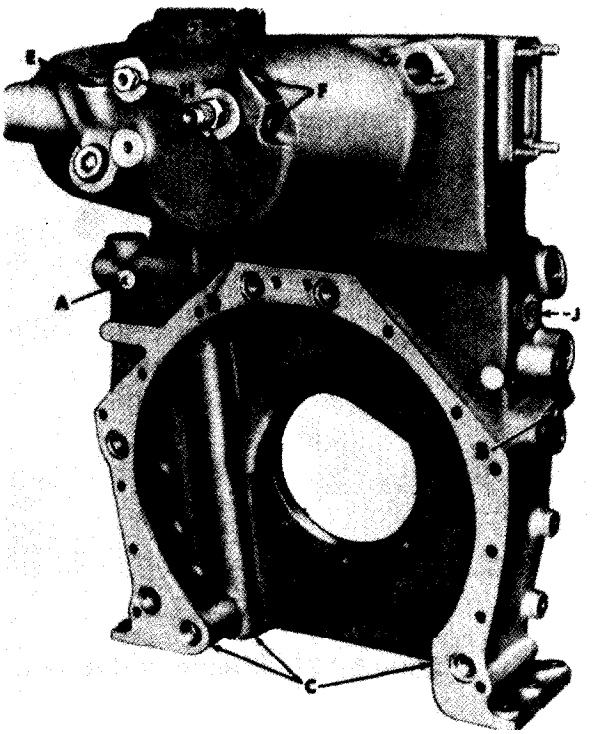
Figure 6-105. Removing or installing fuel pump adapter using mechanical pullers - 5120-473-7222.



Remove
1. Remove oil temperature transmitter (A).
2. Remove oil temperature switch (B).
3. Remove two reducer bushings (C).
4. Remove pipe plug (D).
5. Remove three pipe plugs (E).

Install
1. Install three pipe plugs (E).
2. Install pipe plug (D).
3. Install two reducer bushings (C).
4. Install oil temperature switch (B).
5. Install oil temperature transmitter (A).

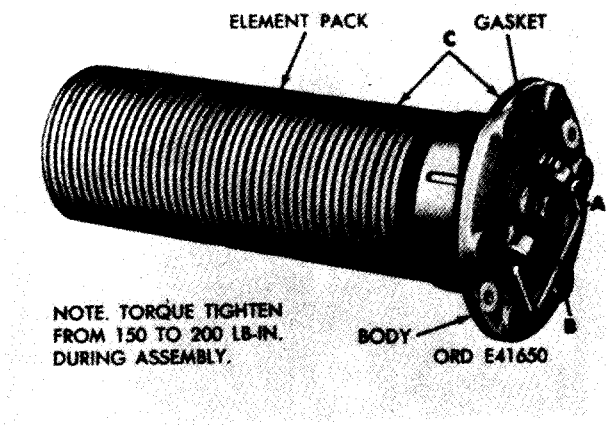
Figure 6-106. Removing or installing damper and oil filter housing switches, bushings, and pipe plugs - front view.



Remove
1. Remove pipe plug (A).
2. Remove pipe plug (B) (if used on engine).
3. Remove three pipe plugs (C).
4. Remove pipe plug (D) (if used on engine).
5. Remove two pipe plugs (E).
6. Remove two pipe plugs (F).
7. Remove nipple (G) or elbow (whichever is used on engine).
8. Remove bushing (H).
9. Remove pipe plug (J) (if used on engine).

Install
1. Install pipe plug(J) (if used on engine).
2. Install bushing (H).
3. Install nipple (G) or elbow (whichever is used on engine).
4. Install two pipe plugs (F).
5. Install two pipe plugs (E).
6. Install pipe plug(D) (if used on engine).
7. Install three pipe plugs (C).
8. Install pipe plug(B) (if used on engine).
9. Install pipe plug (A).

Figure 6-107. Removing or installing damper and oil filter housing pipe plugs - rear view.



Disassemble

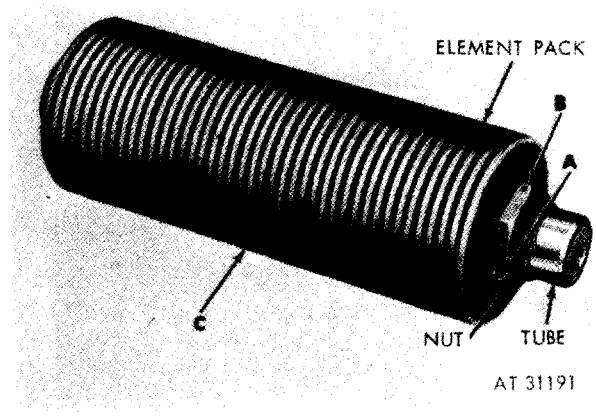
1. Cut and remove locking wire (A).
2. Remove bolt (B) from filter. Remove and discard gasket.
3. Separate filter body (C) from filter element pack and tube.

Note. Do not remove handle or spring from filter body unless inspection (para 6-38c) indicates replacement is necessary.

Assemble

1. Position filter body (C) on filter element pack and tube.
2. Position a new gasket on bolt (B). Install bolt securing body to element. Torque tighten bolt as specified.
3. Install locking wire (A) securing bolt.

Figure 6-108. Disassembling or assembling main oil filter body and filter element pack.



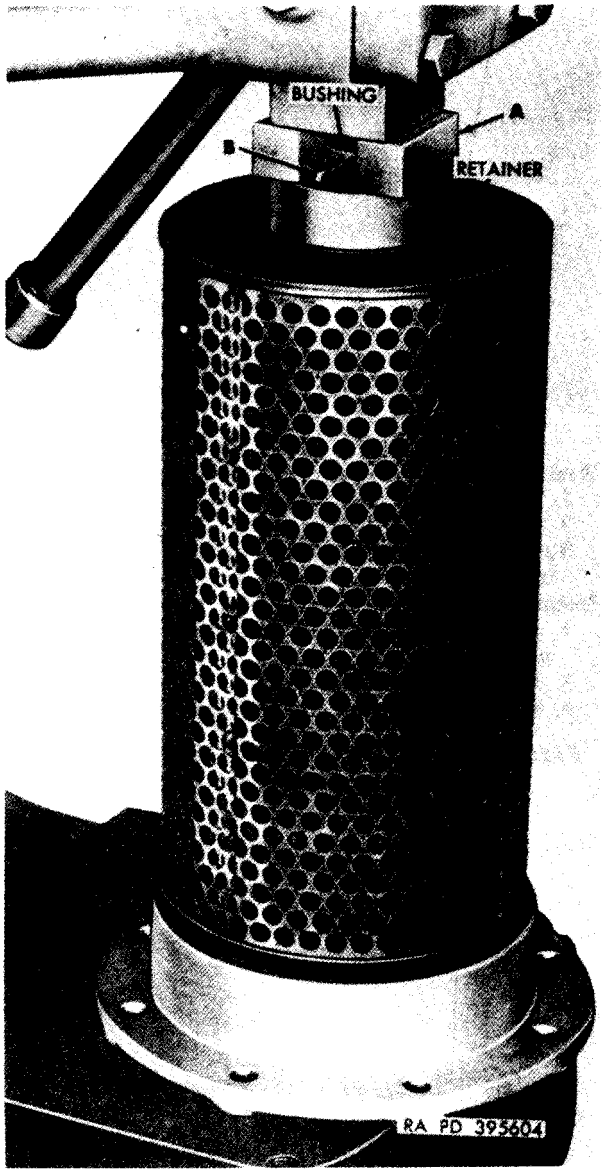
Remove

1. Cut and remove locking wire (A).
2. Remove nut (B) from tube.
3. Remove 42 filter elements (C) and flat washers from tube.

Install

1. Alternately position 42 filter elements (C) and flat washers on tube.
2. Install nut (B) on tube.
3. Install locking wire (A) securing nut.

Figure 6-109. Removing or installing filter element pack from tube.



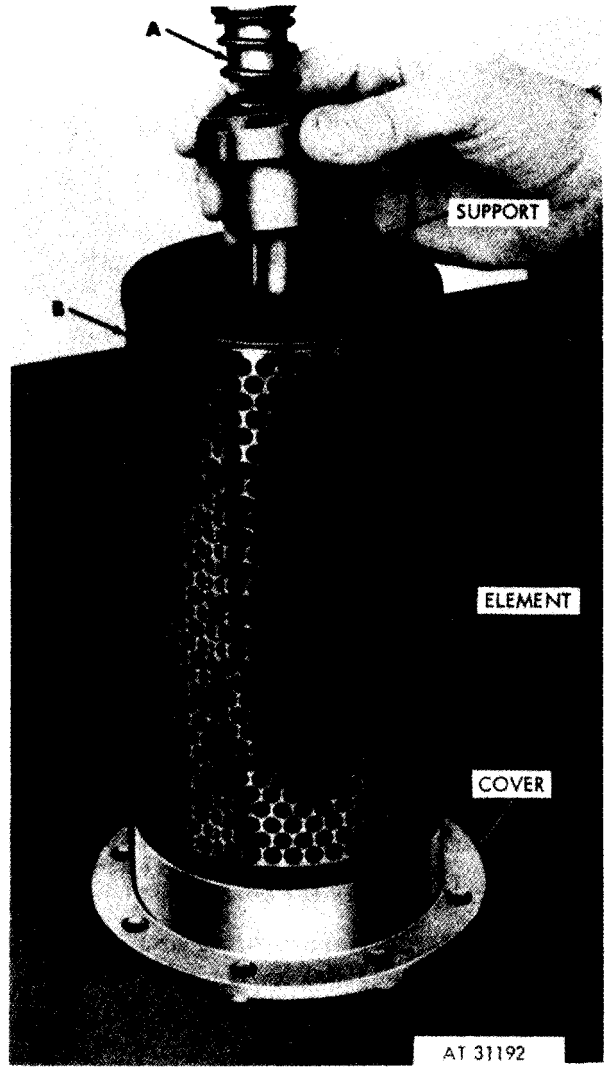
Disconnect

1. Position auxiliary oil filter in arbor press and compress retainer as shown using suitable blocks (A).
2. Remove cotter pin (B) and remove filter from arbor press.

Connect

1. Position auxiliary oil filter in arbor press and compress retainer as shown using suitable blocks (A).
2. Install cotter pin (B) and remove filter from arbor press.

Figure 6-110. Disconnecting or connecting auxiliary oil filter element retainer and bushing.



Remove

1. Remove bushing (A), spring, and retainer from support.
2. Remove and discard oil filter element (B).

Note. Do not remove support or handle from filter cover unless inspection (para 6-38c) indicates replacement is necessary.

Install

1. Position a new auxiliary oil filter element (B) on cover.
2. Position retainer, spring, and bushing (A) on support.

Figure 6-111. Removing or installing auxiliary oil filter element.

b. Cleaning. Refer to paragraph 6-2. Make certain all oil passages (fig. 6-112) are clear and not obstructed.

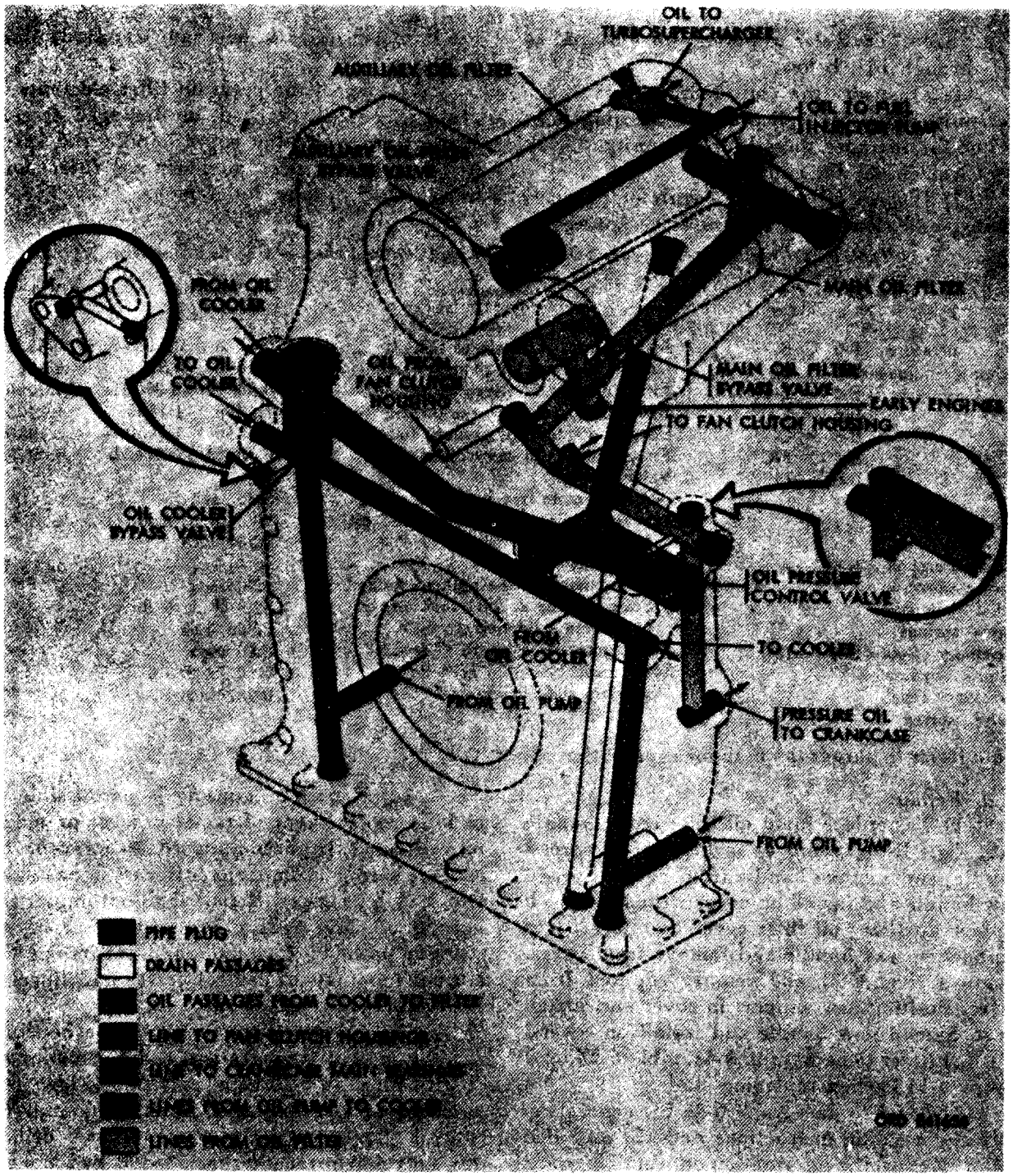


Figure 6-112. Crankshaft damper and oil filter housing oil passages.

c. Inspection. Refer to paragraph 6-3, and to (1) through (3), below.

(1) Inspect the oil temperature gage transmitter and high oil pressure warning light switch for damaged threads or deformity. Check electrical circuit for continuity.

(2) Inspect oil presure regulator plunger, spring, and sleeve and bypass valve springs to the limits specified in overhaul standards (table 6-22).

(3) Inspect the main oil filter elements for plugged, coated, cracked, or damaged screens. Inspect main oil filter cover handle and spring for damage. Inspect auxiliary oil filter cover handle and support for damage.

Table 6-22. Crankshaft Damper and Oil Filter Housing Control Valves - Overhaul Standards

Component	Fig. No.	Ref. letter	Point of measurement	Sizes and fits of new parts		Wear limits
Oil pressure regulator plunger	B-6	B	Inside diameter of sleeve (small)	0.8125	0.8135	0.8145
	B-6	E	Outside diameter of plunger (small)	0.8095	0.8105	0.8085
	B-6	B-E	Fit of plunger in sleeve (small)	0.0020L	0.0040L	0.0060L
	B-6	F	Inside diameter of sleeve (large)	1.1865	1.1885	1.1905
	B-6	C	Outside diameter of plunger (large)	1.1840	1.1850	1.1830
	B-6	F-C	Fit *of* plunger in sleeve (large)	0.0015L	0.0045L	0.0075L
	B-6	D	Valve spring:			
			Approximate free length of spring	2.83 inch		*
			Scale reading at 1.825 inch length	29.3 lb ± 3 lb		*
			Maximum solid height	1.284 inch		*
Oil filter and oil cooler pressure relief bypass valve springs	B-6	A	Bypass valve spring:			
			Approximate free length of spring	4.28 inch		*
			Scale reading at 2.81 inch length	52.3 lb ± 5 lb		*
			Maximum solid height	2.261 inch		*
Auxiliary oil filter bypass pressure relief valve spring	B-6	G	Approximate free length of spring	2.40 inch		*
			Scale reading at 1.75 inch length	9.12 lb ± 1.0 lb		*
			Maximum solid height	0.988 inch		*
						*

Note. Refer to paragraph 6-3b for explanation of symbols.

d. Repair.

(1) To replace main oil filter cover handle (63, fig. B-6), remove spring (66), spread handle, and remove handle from cover. Spread new handle and install on cover with spring. To replace auxiliary oil filter cover handle (20) or support, spread handle and remove from cover. Remove rivet (22) and remove support from cover. Position new support in cover and install rivet. Spread new handle and install on cover.

(2) Refer to paragraph 6-4e, table 6-23, and figure 6-113 when replacing studs.

(3) Refer to paragraph 6-4c for general repair and welding instructions and (2) and (b), below, for specific information on welding repair of the crankshaft damper and oil filter housing.

(a) Repair of housing is permissible to include replacement of metal cracks, or chips. Repair shall be accomplished to prevent oil leakage between compartments, cast in passages, and drilled passages. Repair shall not impair the normal oil flow pattern (fig. 6-112) or be restrictive to the oil flow and shall not impair the normal functions of control valves and filtering functions.

(b) After welding repair of the housing, visually inspect passages and compartments for obstructions and foreign material. Flow test passages to assure proper functioning and oil control. Leak test compartments and drilled passages and pressure check to 20 psi.

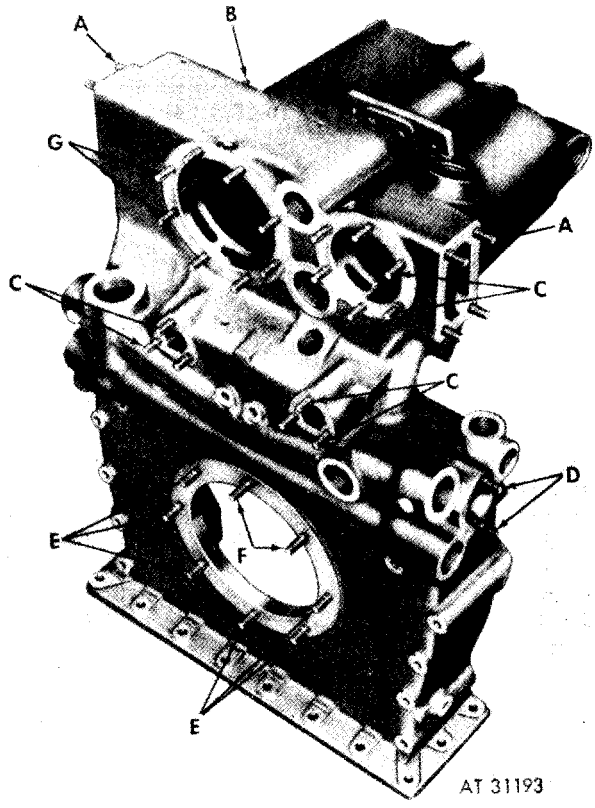


Figure 6-113. Crankshaft damper and oil filter housing studs.

Table 6-23. Crankshaft Damper and Oil Filter Housing Standard and Oversize Stud Identification

Fig. No.	Ref. letter or No.	Setting height	No. req'd.	Stud size and length
B-6	50	7 / 8	4	5/16-18(3/4) x 5/16-24(19/32) x 1-1/2 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-113	A	15 / 16	8	3/8-16(51/64) x 3/8-24(11/16) x 1-5/8 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-113	B	2 5 / 3 2	2	5/16-18(11/16) x 5/16-24(9/16) x 1-5/16 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-113	C	7 / 8	12	5/16-18(3/4) x 5/16-24(19/32) x 1-1/2 (STD)
6-113	D	27 / 32 (oil pressure access cover)	2	(0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-113	E	1-1 / 16	6	3/8-16(27/32) x 3/8-24(7/8) x 1-3/4 (STD)
6-113	F	1-3/ 16 (fuel pump check valve bracket)	2	(0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-113	G	1	8	5/16-18(13/16) x 5/16-24(19/32) x 1-11/16 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)

Note. Refer to figure 6-1 for oversize stud identification.

e. Assembly. Refer to figures 6-111 through 6-101, 4-92 through 4-89, 6-100, and 6-99.

Section VIII. OVERHAUL OF FRONT FAN DRIVE HOUSING AND CLUTCH ASSEMBLY

6-39. General

a. This section covers the overhaul of the front fan drive housing and clutch assembly. Specific instructions on disassembly, cleaning, inspection, repair and assembly accompany the overhaul operations. Overhaul standards of individual components follow the inspection procedures. Stud identification information is included in the repair procedures. Refer to the following table (table 6-24) for applicable illustrations and instructions for overhaul operations.

b. Fan drive housings on original production engines were modified. to include an oil restrictor in the horizontal oil passage, and can be identified by the hex-head on the restrictor (fig. 6-127). The housings on improved design engines were redesigned to eliminate the need for restrictors, and can be identified by the hex socket head pipe plug in the horizontal oil passage on the side of the housing. These changes were made without part number change, which necessitates identification as "engines having oil restrictors".

c. The clutch assemblies were redesigned for simplification and are identified by different part numbers. Although the clutches are similar, disassembly and assembly procedures differ. Visual identification of piston actuated and mechanical clutches is shown in figure 4-102. *The clutches are interchangeable as assemblies only.*

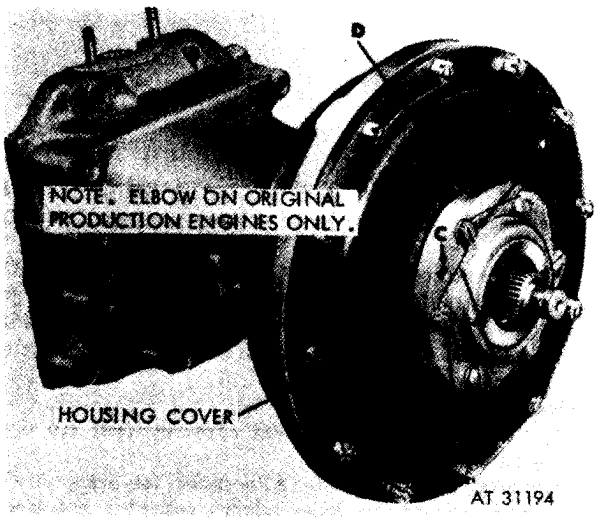
Table 6-24. Front Fan Drive Housing and Clutch Assembly

Component	Disassembly	Cleaning	Inspection	Repair	Assembly
Front Fan Drive Housing	Para 6-40a Figs. 6-114 through 6-127	Para 6-2	Para 6-40c Table 6-25	Para 6-40c Table 6-28 Fig. 6-148	Para 6-40d Figs. 6-127, 6-150 through 6-152, 6-124, 5-153, 6-122 through 6-119, 6-154,6-155, 6-115, 6-114
Piston Actuated Clutch Assembly	Para 6-40a Figs. 6-128 through 6-130, 6-132, 6-134, 6-137 through 6-146	Para 6-2	Para 6-40c Table 6-26	Para 6-40c	Para 6-40d Figs. 6-149,/6-146 through 6-137, 6-134, 6-132 through 6-130, 6-128
Mechanical Clutch Assembly	Para 6-40a Figs. 6-129 through 6-131, 6-133; 6-135, 6-136, 6-138, 6-144, 6-147	Para 6-2	Para 6-40c Table 6-27	Para 6-40c	Para 6-40d Figs. 6-147, 6-144,6-138,6-136, 6-135, 6-133, 6-131 through 6-129

6-40. Overhaul of Front Fan Drive Housing and Clutch Assembly

a. Disassembly.

(1) *Front fan drive housing and cover.* Disassemble front fan drive housing and cover following instructions which accompany figures 6-114 through 6-127.



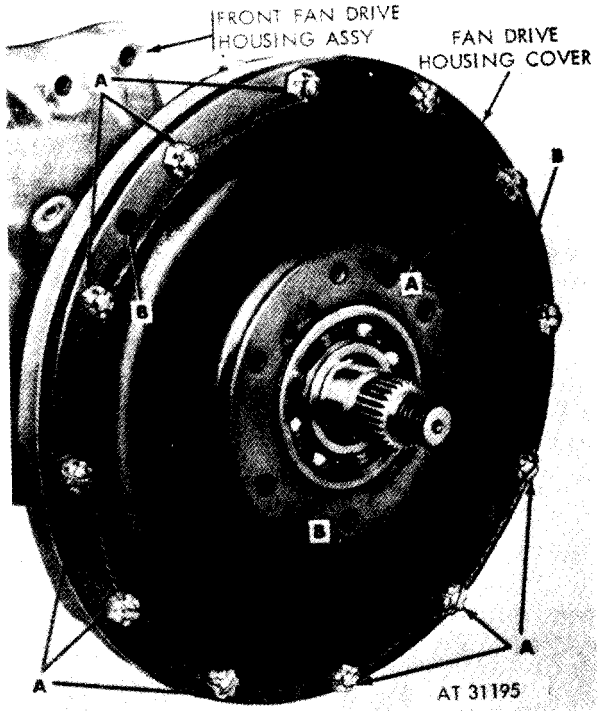
Remove

1. Cut locking wire (A).
2. Remove six drilled head bolts (B) and flat washers attaching fan drive oil seal housing to fan drive housing cover.
3. Install two mechanical pullers - 5120-473-7222 in puller screw holes (C) in oil seal housing (D). Turn screws alternately to remove housing.

Install

1. Position fan drive oil seal housing (D) on fan drive housing cover.
2. Install six drilled head bolts (B) and flat washers securing housing to cover.
3. Install locking wire (A) securing bolts.

Figure 6-114. Removing or installing fan drive oil seal housing.



Remove

1. Cut locking wire and remove 12 slotted nuts (A) attaching fan drive housing cover to front fan drive housing assembly.
2. Install three drilled head bolts (B, fig. 6-114), used to secure fan drive oil seal housing, into screw holes (B, fig. 6-115) and using bolts as puller screws, remove fan drive housing cover from front fan drive housing assembly.

Install

1. Position fan drive housing cover in front fan drive housing assembly.
2. Install 12 slotted nuts (A) securing fan drive housing cover to front fan drive housing assembly and install locking wire securing nuts.

Figure 6-115. Removing or installing fan drive housing cover.

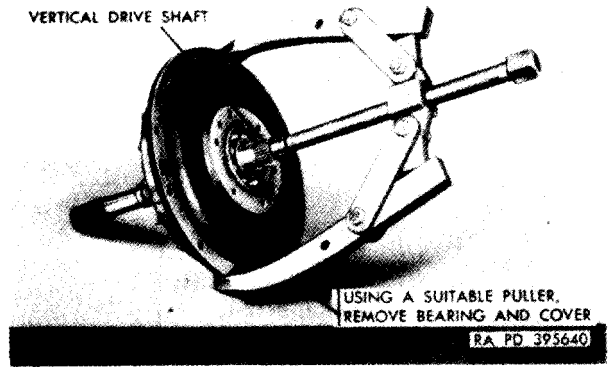


Figure 6-116. Removing clutch cover and fan drive vertical shaft bearing using puller.

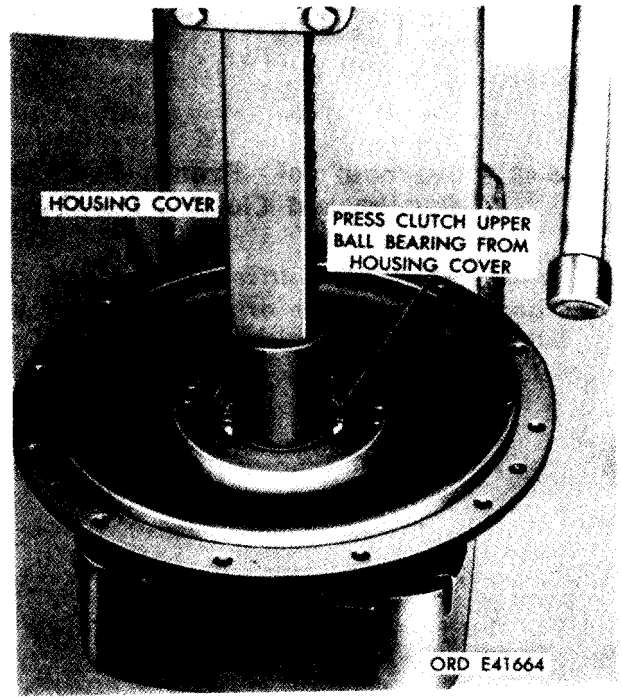


Figure 6-117. Remove fan drive clutch upper ball bearing from housing cover.

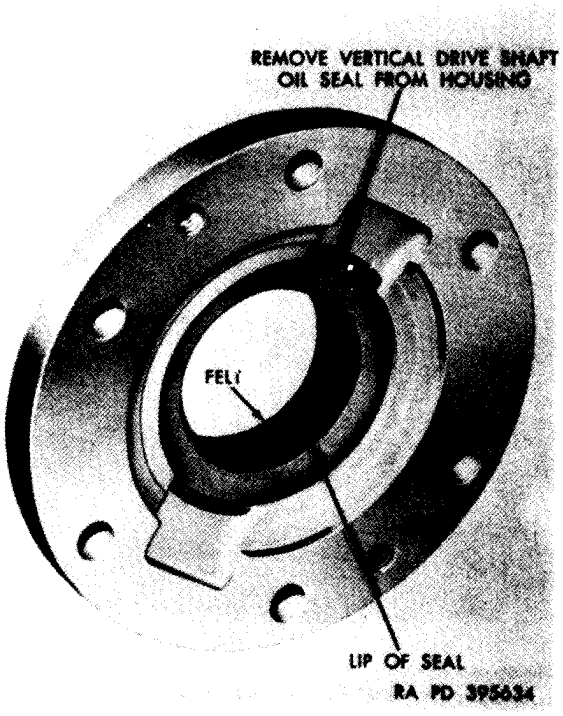
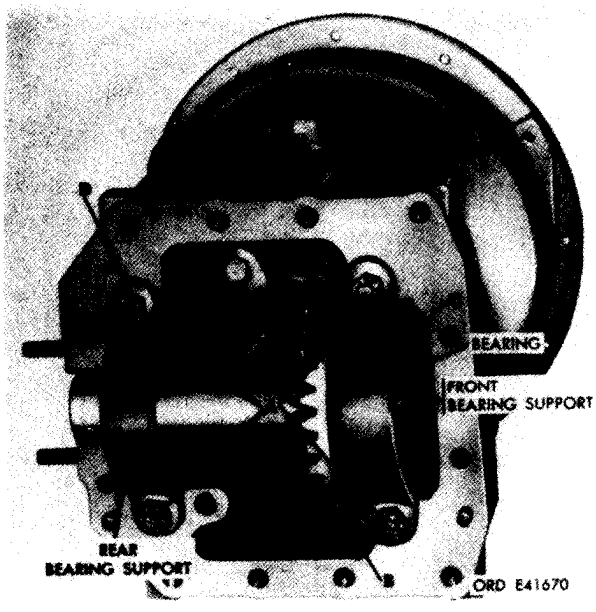


Figure 6-118. Removing fan vertical drive shaft oil seal from housing.



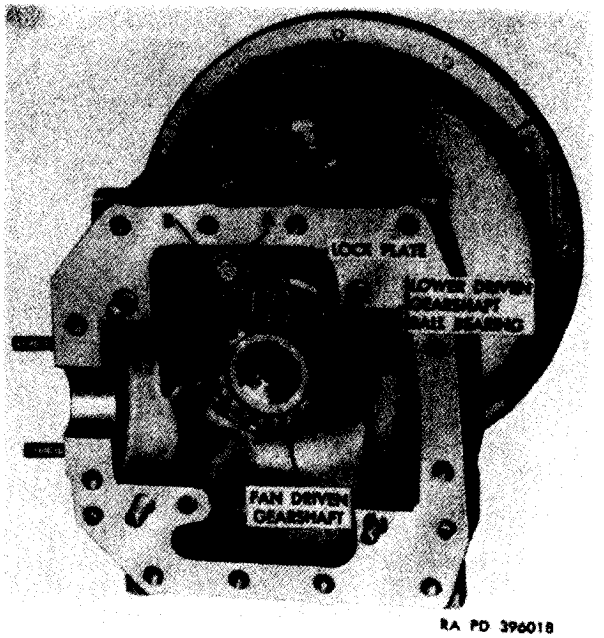
Remove

1. Remove four cotter pine and slotted nuts (A).
2. Remove fan drive bevel gearshaft (B), ball bearings, and bearing supports from housing as a unit
3. Remove bearing support (C) from front ball bearing.
4. Remove bearing support (D) from rear ball bearing.

Install

1. Position bearing support (D) on rear ball bearing.
2. Position bearing support (C) on front ball bearing.
3. Position fan drive bevel gearshaft (B), ball bearings, and bearing supports in housing as a unit.
4. Install four slotted nuts and cotter pins (A).

Figure 6-119. Removing or installing fan drive bevel gearshaft and associated parts.



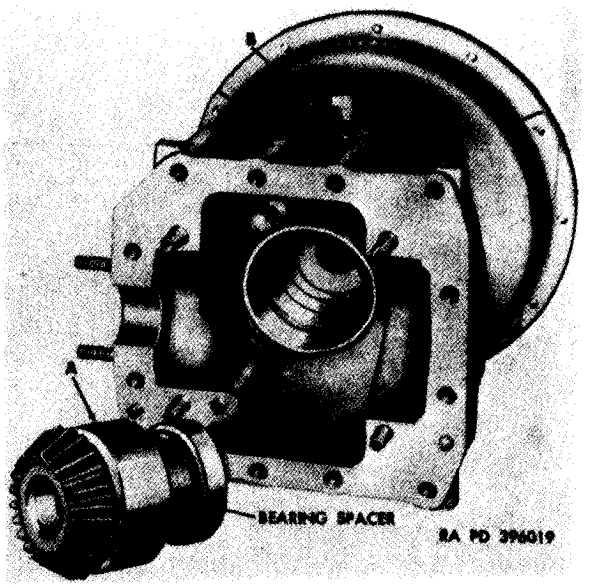
Remove

1. Straighten tab on tab washers (A).
2. Remove bolt (B), tab washer, and lock plate holding fan driven gearshaft and bearings in front fan drive housing assembly. Discard tab washer.

Install

1. Install bolt (B), new tab washer, and lock plate holding fan driven gearshaft and bearings in front fan drive housing assembly.
2. Bend tab on tab washer (A) over bolt,

Figure 6-120. Removing or installing lower driven gearshaft ball bearing lock plate.



Remove

1. Remove fan driven gearshaft (A), lower driven gearshaft ball bearing, gearshaft ball bearing, and bearing spacer as an assembly.
2. Remove and discard elbow (B) from housing on engines having an elbow. Other engines have a pipe plug at this location.

Install

1. Install pipe plug in this location (B).
2. Position fan driven gearshaft (A), lower driven gearshaft ball bearing, gearshaft ball bearing, and bearing spacer as an assembly in front fan driving housing assembly.

Figure 6-121. Removing or installing fan driven gearshaft and bearings..

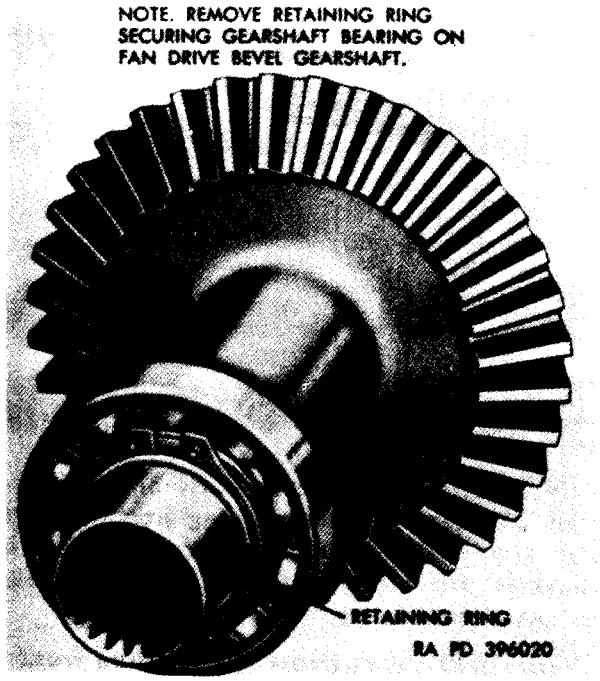
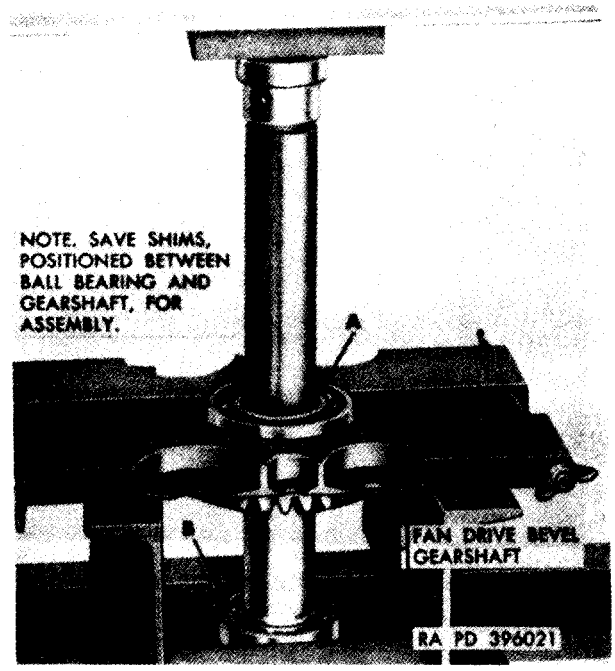


Figure 6-122. Removing or installing fan drive bevel gearshaft bearing retaining ring.



1. Press fan drive bevel gearshaft from front bevel gearshaft ball bearings (A). Remove and retain shim or shims for use during assembly.
2. Press fan drive bevel gearshaft from rear gearshaft ball bearing (B) in the same manner.

Figure 6-123. Removing fan drive bevel gearshaft ball bearings.

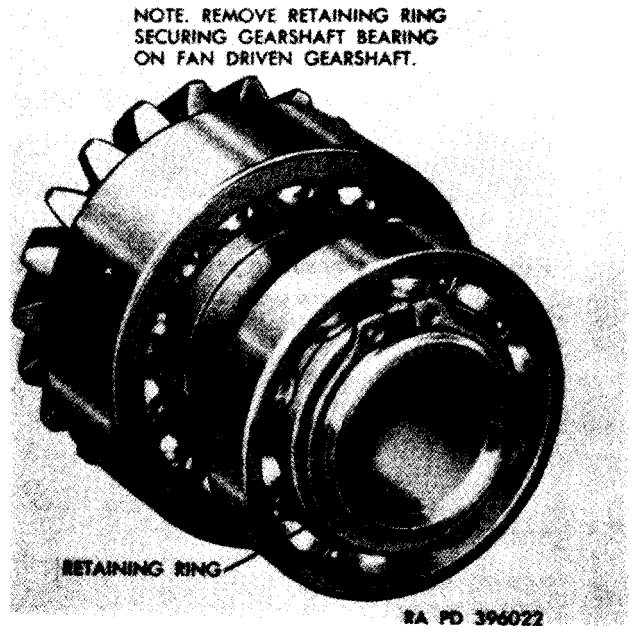


Figure 6-124. Removing or installing fan driven gearshaft bearing retaining ring.

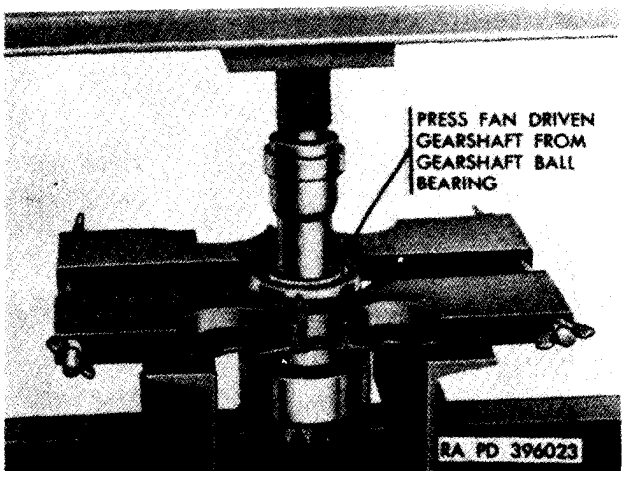


Figure 6-125. Pressing fan driven gearshaft from upper gearshaft ball bearing.

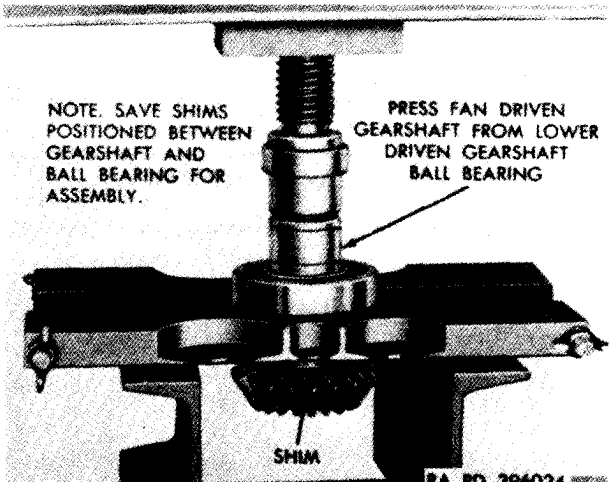
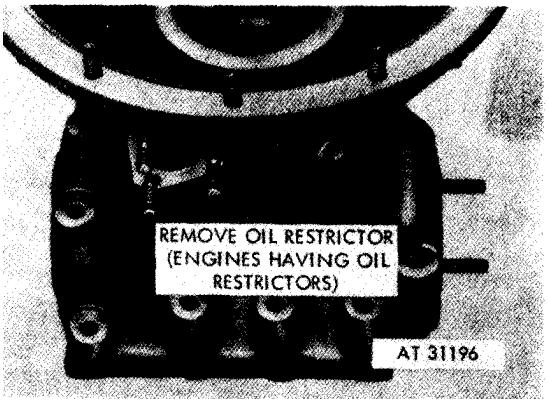


Figure 6-126. Pressing fan driven gearshaft from lower driven gearshaft ball bearing.



Note. The oil restrictor must be identified with, and kept with the housing from which it was removed. If restrictors are installed in housings not requiring them, or conversely, serious clutch damage will result.

Figure 6-127. Removing or installing front fan drive housing oil restrictor (engines having oil restrictors).

(2) *Clutch assembly.* Disassemble piston actuated and mechanical clutch assemblies following instructions which accompany figures 6-130 through 6-147.

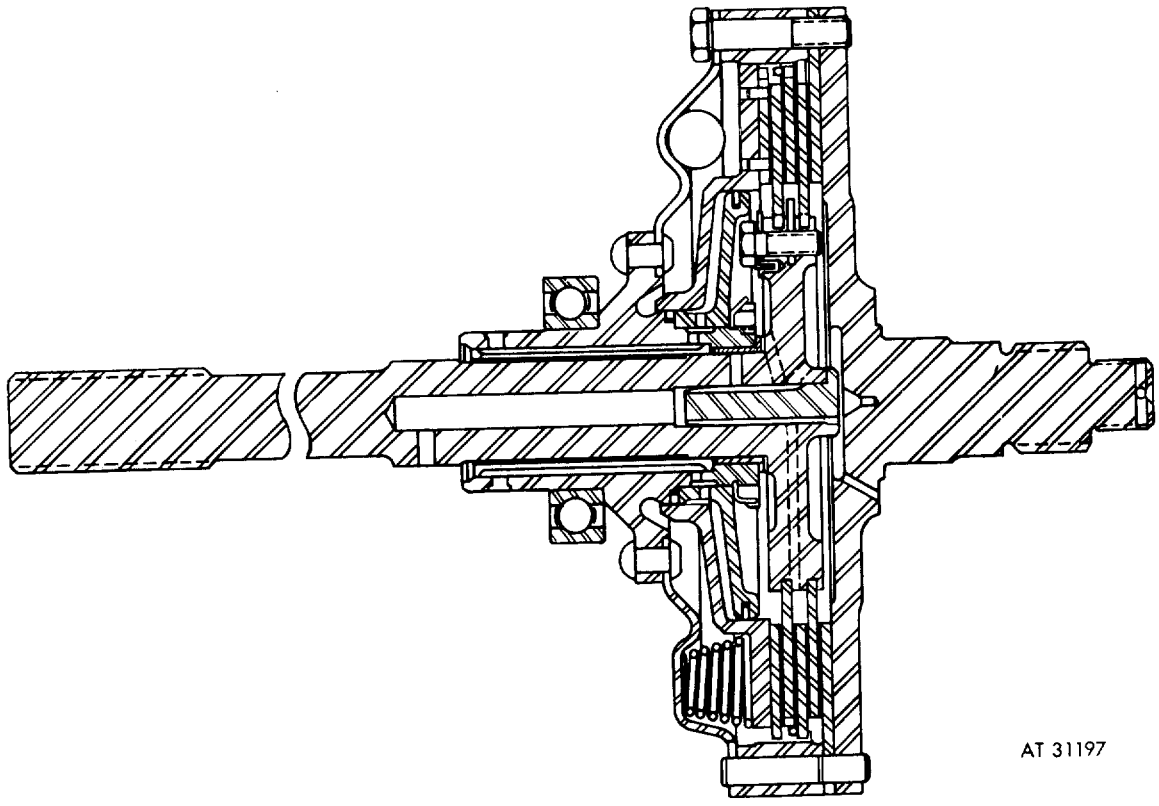


Figure 6-128. Piston actuated clutch assembly-sectional view.

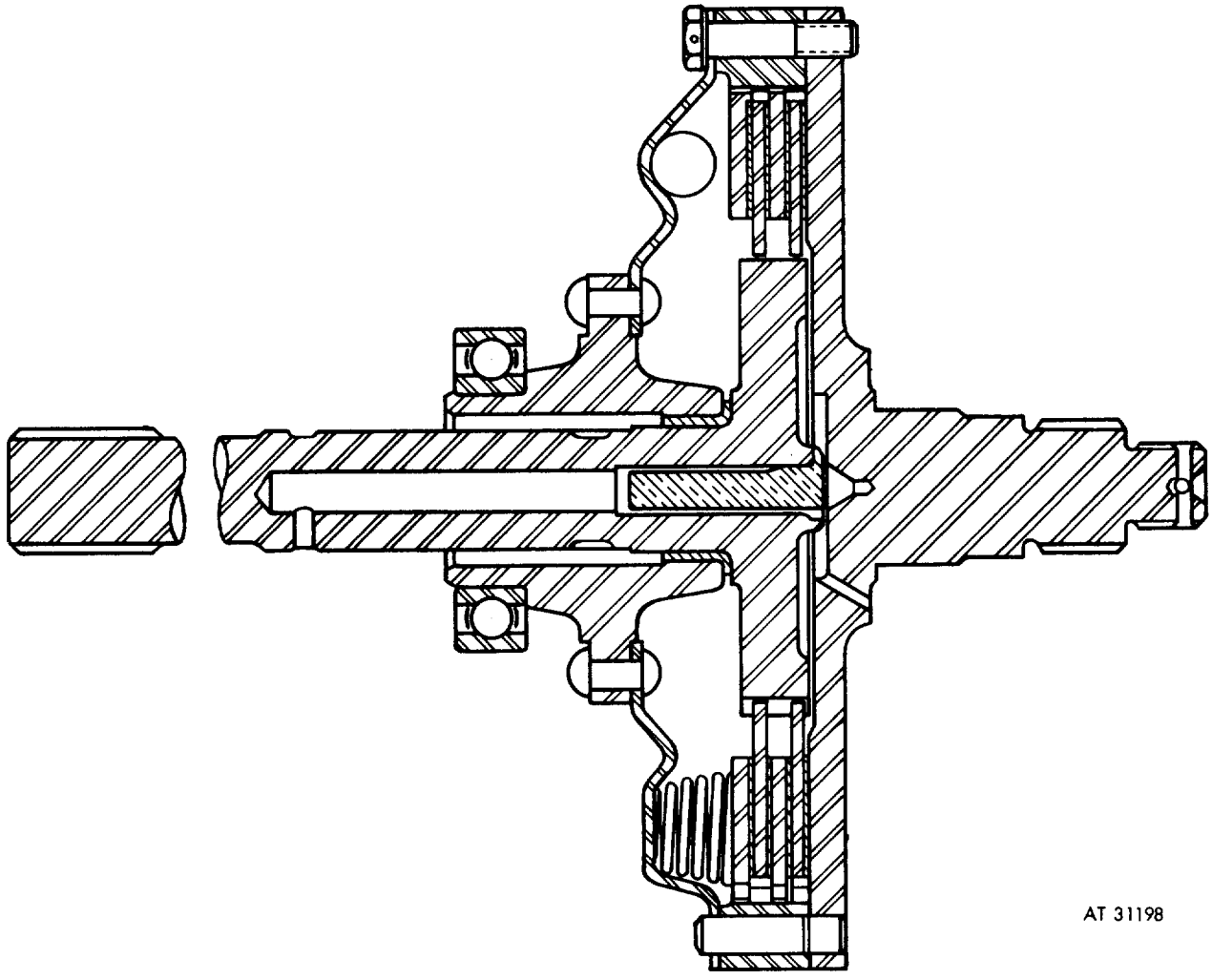


Figure 6-129. Mechanical clutch assembly-sectional view.

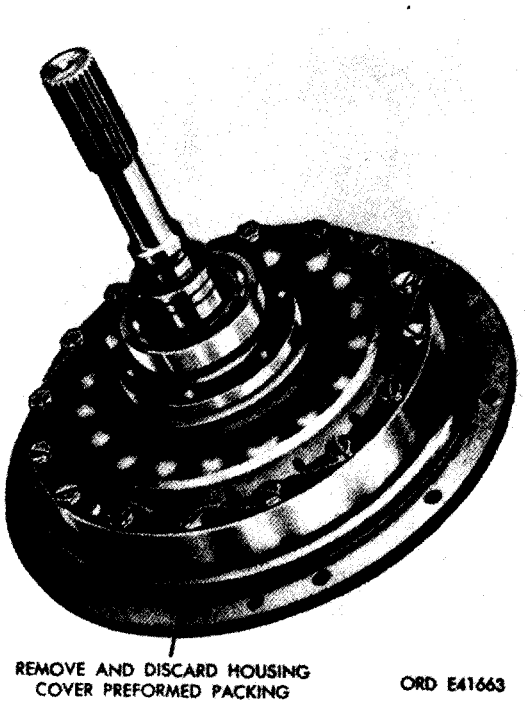
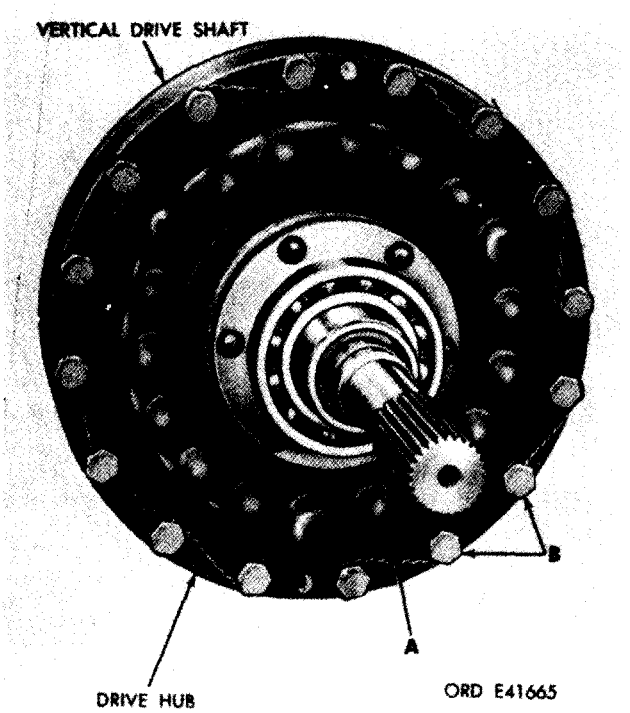


Figure 6-130. Removing or installing fan drive housing cover preformed packing.



Remove

1. Cut locking wire (A).
2. Remove 16 bolts (B) attaching fan drive hub to drive shaft.

Install

1. Install 16 bolts (B) securing fan drive hub to drive shaft.
2. Install locking wire (A) securing bolts.

Figure 6-131. Removing or installing fan drive hub attach ing parts.

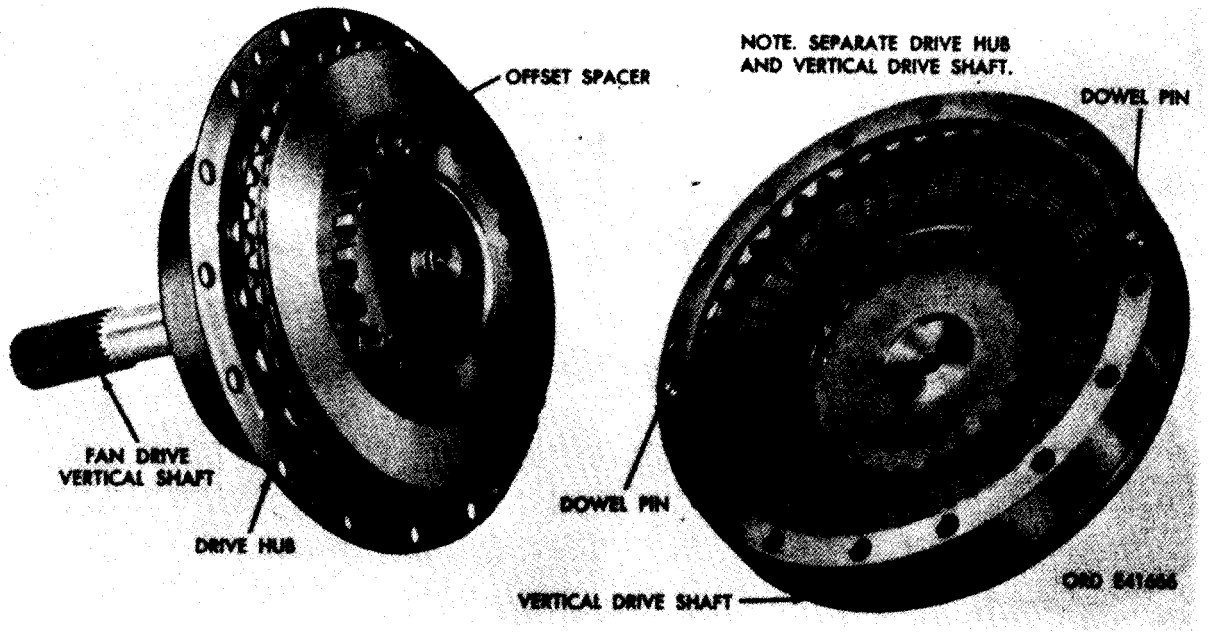


Figure 6-132. Separating or positioning fan drive hub and vertical drive shaft (piston actuated clutch).

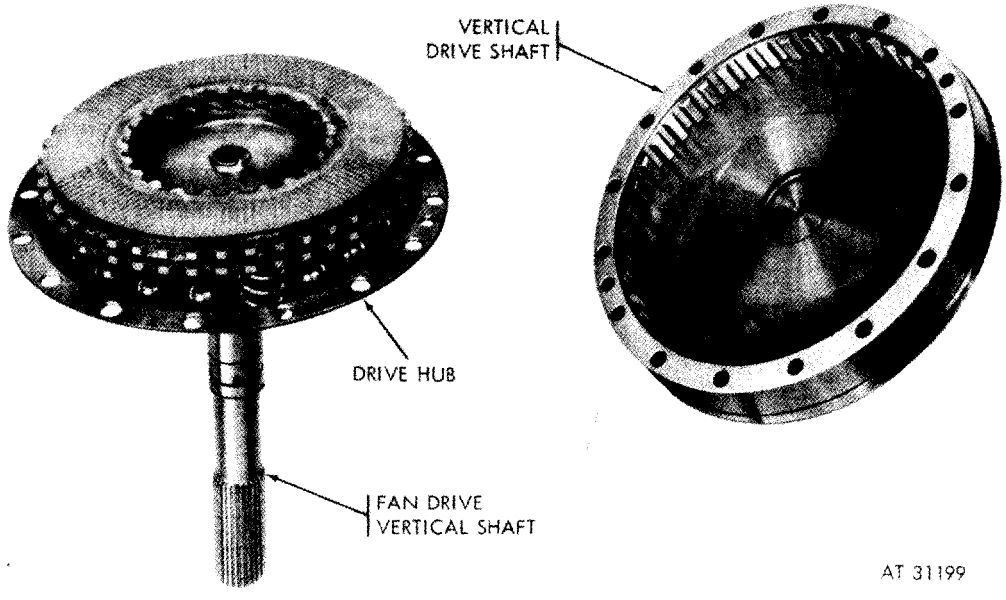


Figure 6-133. Separating or positioning fan drive hub and vertical drive shaft (mechanical clutch).

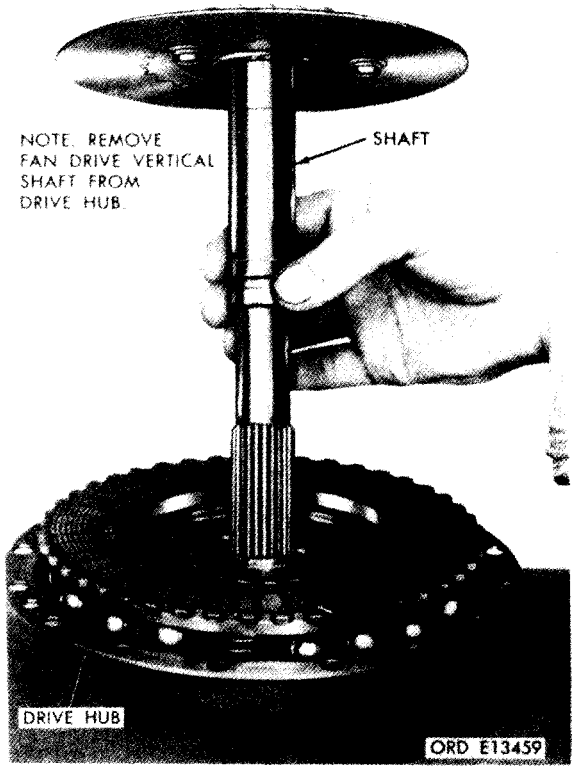
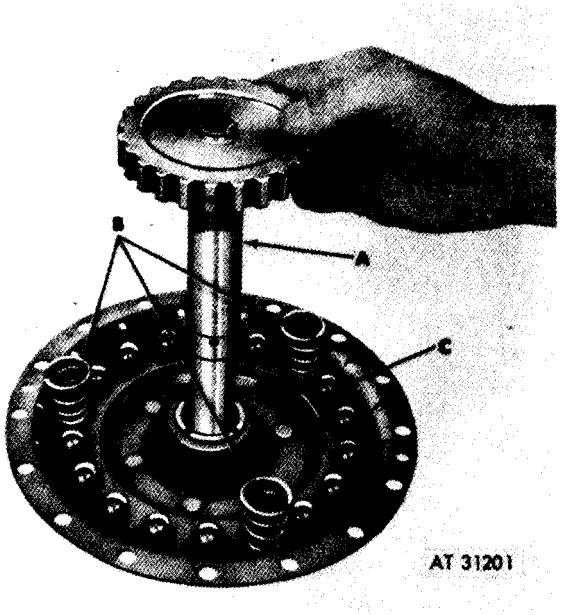


Figure 6-134. Removing or installing fan drive vertical shaft from fan drive hub (piston actuated clutch).



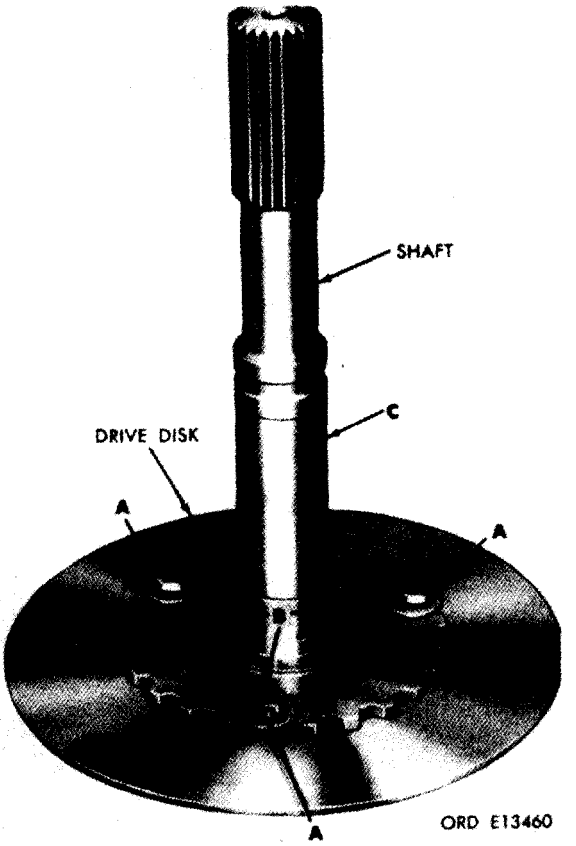
Figure 6-135. Removing or installing clutch discs from fan drive hub (mechanical clutch).



Remove
1. Remove fan drive vertical drive shaft (A) from hub.
2. Remove three clutch springs (B).
3. Remove 15 clutch balls (C).

Install
1. Position 15 clutch balls (C) in fan drive hub.
2. Position three clutch springs (B) in hub.
3. Position fan drive vertical drive shaft (A) in hub.

Figure 6-136. Removing or installing fan drive vertical drive shaft, balls, and springs from fan drive hub (mechanical clutch).



Remove
1. Straighten tab on three washers (A).
2. Remove three cap screws (B), tab washers, flat washers, and offset spacers (fig. 6-132). Discard tab washers.
3. Remove fan drive vertical shaft (C) from drive disc.

Install
1. Position fan drive vertical shaft(C) in drive disc.
2. Install three cap screws (B), new tab washers, flat washers, and offset spacers (fig. 6-132).
3. Bend tab on three tab washers (A).

Figure 6-137. Removing or installing fan drive disc (piston actuated clutch).

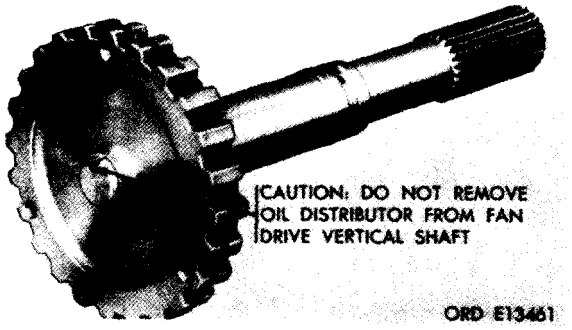


Figure 6-138. Fan drive shaft oil distributor location.

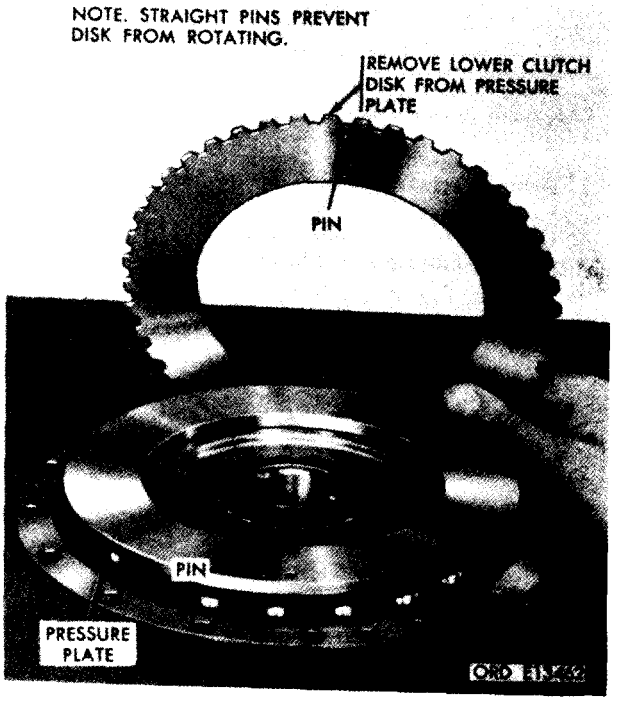


Figure 6-139. Removing or installing fan drive bottom clutch disc (piston actuated clutch),



Figure 6-140. Straightening or bending tabs on key washer securing actuating clutch piston spanner nut (piston actuated clutch).

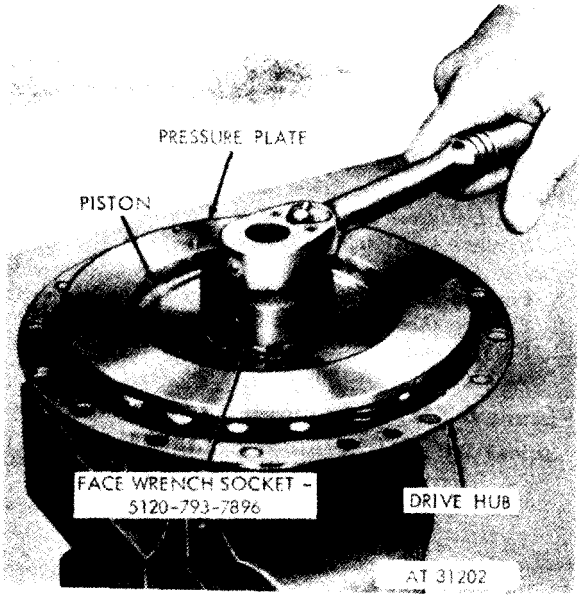
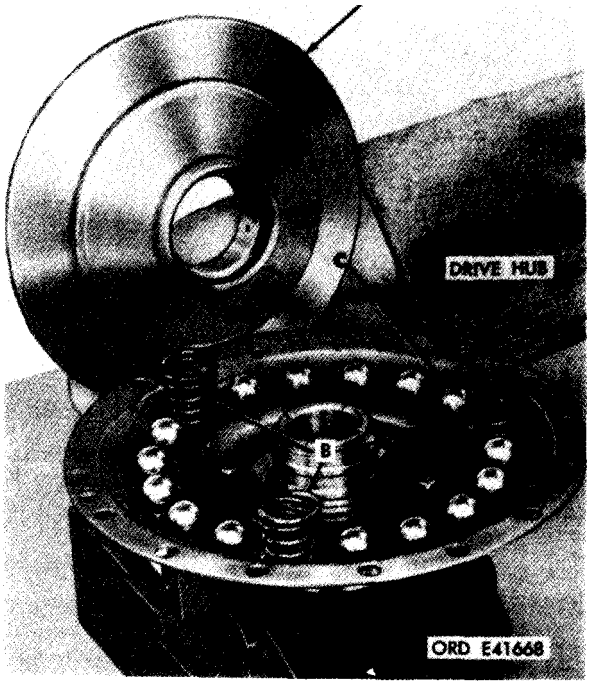


Figure 6-141. Removing or installing actuating clutch piston spanner nut using face wrench socket - 5120-793-7896.



Remove

1. Remove clutch pressure plate (A) with assembled clutch piston from drive hub.
2. Remove three clutch springs (B) from hub.
3. Remove 15 clutch balls (C) from hub.

Install

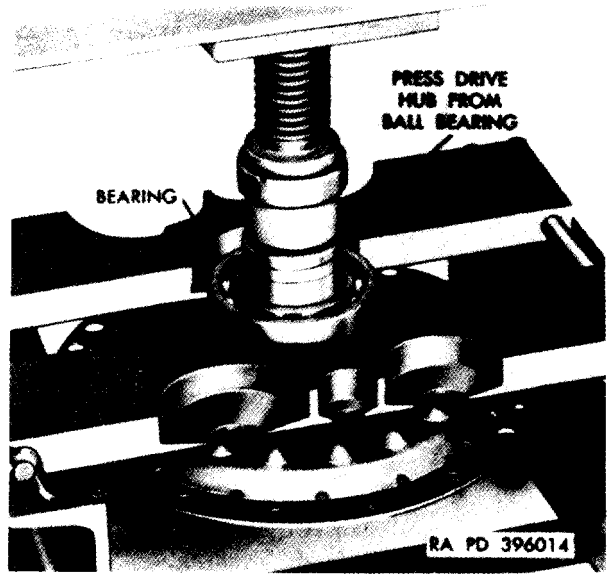
1. Position 15 clutch balls (C) in drive hub.
2. Position three clutch springs (B) in hub.
3. Position clutch pressure plate (A) with assembled clutch piston from hub.

Figure 6-142. Removing or installing clutch pressure plate, clutch springs, and balls (piston actuated clutch).



1. Remove actuating clutch piston (A) from pressure plate.
2. Carefully remove outer piston ring (B).
3. Remove inner piston ring (C).

Figure 6-143. Removing actuating clutch piston and piston rings (piston actuated clutch).



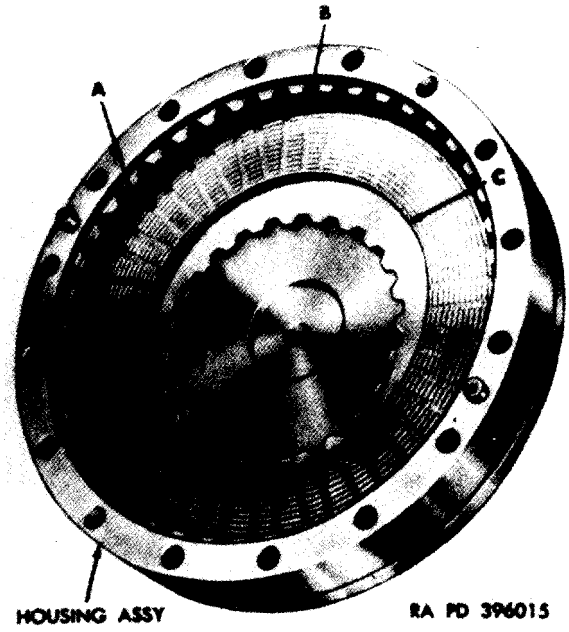
Remove

1. Support ball bearing in press
2. Press drive hub from ball bearing.

Install

1. Support drive hub in press.
2. Press ball bearing on drive hub using a suitable hollow tool the size of the inner race.

Figure 6-144. Removing or installing ball bearing from drive hub.



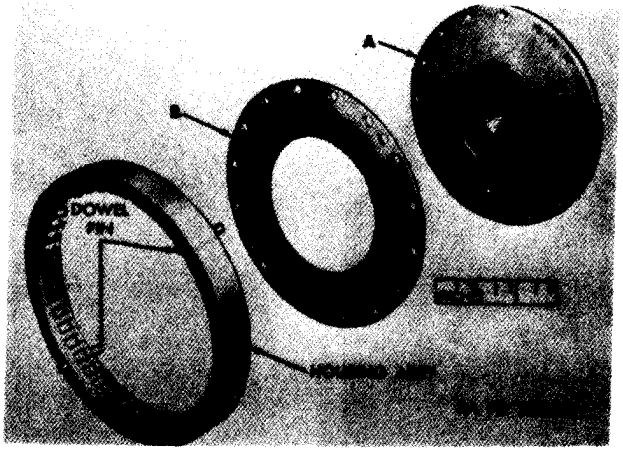
Remove

1. Remove retaining ring (A) from housing assembly.
2. Remove intermediate clutch diet (B) from housing.
3. Remove drive disc (C) from housing.

Install

1. Position drive diet (C) in housing assembly.
2. Position intermediate clutch disc (B) in housing.
3. Install retaining ring (A) in housing.

Figure 6-145. Removing or installing intermediate clutch and drive discs.



Remove

1. Separate vertical drive shaft (A) from housing assembly.
2. Separate top clutch disc (B) from housing.

Note. Do not remove the two dowel pins from housing unless inspection (para 6-40c) indicates the need for replacement. Use an arbor press to remove dowel pins from housing.

Install

1. Position top clutch diae (B) in housing assembly.
2. Position vertical drive shaft (A) in housing.

Figure 6-146. Separating or positioning vertical drive shaft, top clutch disc, and housing assembly (piston actuated clutch).

Note. Do not remove the two dowel pins from disc housing unless inspection (para 6-40c) indicates replacement is necessary. Use an arbor press to remove dowel pins from housing.

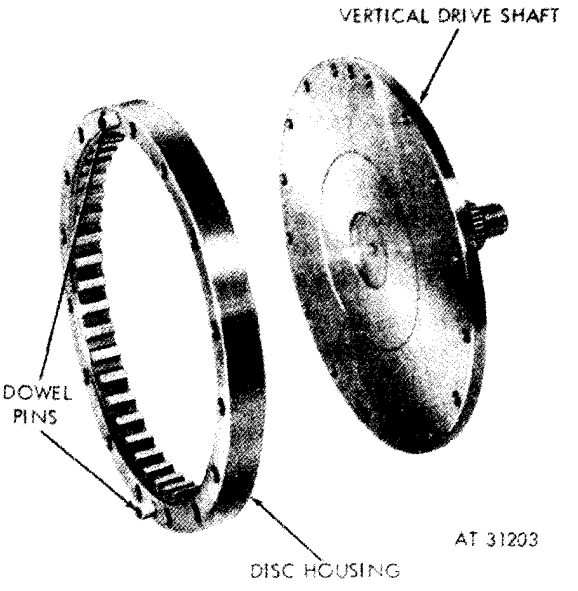


Figure 6-147. Separating or positioning vertical drive shaft and disc housing (mechanical clutch).

b. Cleaning. Refer to paragraph 6-2.

c. Inspection and Repair. Refer to paragraph 6-3 and 6-4, and (1) through (7), below.

(1) *Fan driven gearshaft and fan drive bevel gearshaft.* Inspect fan driven gearshaft (74.1, fig. B-26) and fan drive bevel gearshaft (74.2, fig. B-26) to limits specified in overhaul standards (table 6-25).

Note. If either the fan driven gearshaft or the fan drive bevel gearshaft require replacement, both must be replaced as they are a matched gear set and cannot be replaced individually.

(2) *Oil seal.* Replace the oil seal at each overhaul.

(3) *Housing assembly.* Inspect housing assembly (50, fig. B-27) or housing assembly (23, fig. B-27) for loose dowel pins.

(4) *Clutch compression springs and balls.* Inspect clutch compression springs (39, fig. B-27) for weakness, broken coils, and distorted condition. Check balls (40, fig. B-27) and springs to limits specified in overhaul standards (tables 6-26 or 6-27).

Note. Due to design changes on the mechanical clutch, two different size balls have been used. Carefully inspect all balls and discard any balls of 11 / 16 inch diameter. Overhaul clutch assembly using only the current 5 / 8 inch diameter balls, FSN 3110-462-0392.

(5) *Drive hub.* Inspect drive hub (41, fig. B-27) or (46, fig. B-27) for raised metal surfaces, loose rivets, warpage or pitted surfaces caused by ball wear. Check bearing surfaces against limits specified in overhaul standards (tables 6-26 or 6-27). Repair metal sufaces by polishing pitted areas smooth.

(6) *Clutch discs.* Inspect clutch discs (48 and 49, fig. B-27) or 21, 22, 24, and 27, fig. B-27) for cracks, warpage, wear, or other abrasive dam age. Inspect for excessive heat distortion. Repairs of clutch discs are not recommended. Replace discs if any of the above mentioned dam age is evident.

(7) Studs. Refer to paragraph 6-4e, table 6-28 and figure 6-148 when replacing studs.

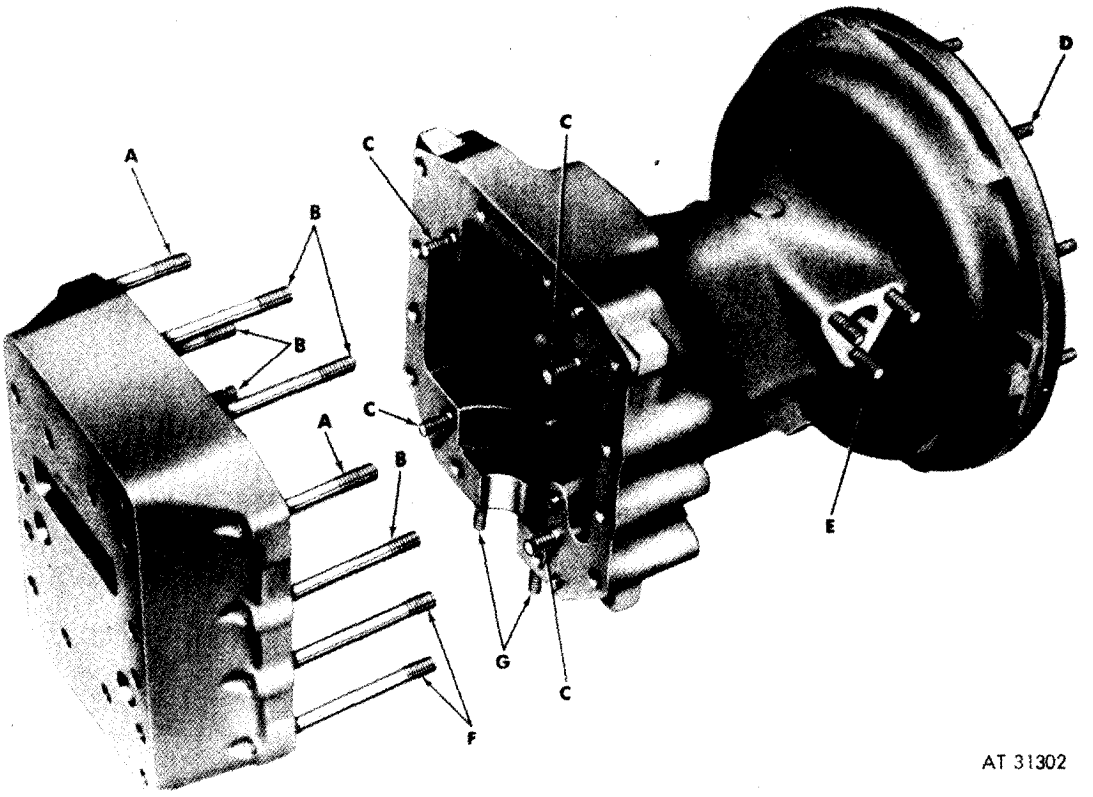


Figure 6-148. Front fan drive housing and mounting base - studding assembly.

Table 6-25. Front Fan Drive Housing Assembly Overhaul Standards

Component	Fig. No.	Ref. letter	Point of measurement	Sizes and fits of new parts		Wear limits
Front fan drive housing	B-26	QQ	Inside diameter (small) of liner in front fan drive housing	2.6772	2.6779	2.6782
	B-26	PP	Outside diameter of bearing	2.6767	2.6772	*
	B-26	PP-QQ	Fit of bearing in liner	0.0000	0.0012L	0.0015L
	B-26	RR	Inside diameter (large) of liner in front fan drive housing	3.1496	3.1503	3.1506
	B-26	LL	Outside diameter of bearing	3.1491	3.1496	*
	B-26	LL-RR	Fit of bearing in liner	0.0000	0.0012L	0.0015L
	B-26	NN	Inside diameter of bearing	1.5743	1.5748	*
	B-26	JJ	Outside diameter of bearing surface on gearshaft	1.5749	1.5753	1.5747
	B-26	NN-JJ	Fit of bearing on gearshaft	0.0001T	0.0010T	0.0001L
	B-26	MM	Inside diameter of spacer	1.5800	1.5850	1.5950
	B-26	MM-JJ	Fit of spacer on gearshaft	0.0047L	0.0101L	0.0203L
	B-26	KK	Inside diameter of bearing	1.5743	1.5748	*
	B-26	KK-JJ	Fit of bearing on gearshaft	0.0001T	0.0010T	0.0001L
	B-26	AA	Inside diameter of bearing support	3.1495	3.1501	3.1504
	B-26	CC	Outside diameter of bearing	3.1491	3.1496	*
	B-26	CC AA	Fit of bearing in bearing support	0.0010L	0.0001T	0.0013L
	B-26	BB	Inside diameter of bearing	1.5743	1.5748	*
	B-26	DD	Outside diameter of bearing surface on gearshaft	1.5749	1.5753	1.5747
	B-26	BB-DD	Fit of bearing on gearshaft	0.0001T	0.0010T	0.0001L
	B-26	FF	Inside diameter of bearing	1.5743	1.5748	*
	B-26	EE	Outside diameter of bearing surface on gearshaft	1.5749	1.5753	1.5747
	B-26	FF-EE	Fit of bearing on gearshaft	0.0001T	0.0010T	0.0001L
	B-26	GG	Outside diameter of bearing	2.6767	2.6772	*
	B-26	HH	Inside diameter of bearing support	2.6771	2.6777	2.6780
	B-26	GG-HH	Fit of bearing in bearing support	0.0010L	0.0001T	0.0013L
	B-27	L-P	Inside diameter of bearing	1.7712	1.7717	*
	B-27	J-M	Outside diameter of bearing surface on clutch hub	1.7718	1.7722	1.7716
	B-27	L-J P-M	Fit of bearing on clutch hub	0.0001T	0.0010T	0.0001L
	B-27	H-N	Outside diameter of bearing	2.9523	2.9528	*
	B-26	SS	Inside diameter of liner in fan drive housing	2.9528	2.9535	2.9538
	B-27	H-N	Fit of bearing in fan drive housing liner	0.0000	0.0012L	0.0015L
	B-26	SS				
	B-27	T	Outside diameter of bearing surface on clutch shaft	1.3781	1.3785	1.3779
	B-27	W	Inside diameter of bearing	1.3775	1.3780	*
	B-27	W-T	Fit of bearing on shaft	0.0001T	0.0010T	0.0001L
	B-27	U	Inside diameter of bearing bore in fan drive housing cover	3.1496	3.1503	3.1506
	B-27	V	Outside diameter of bearing	3.1491	3.1496	*
	B-27	V-U	Fit of bearing in cover	0.0000	0.0012L	0.0015L
	B-27	X	Inside diameter of fan drive oil seal housing	2.6220	2.6240	*
	B-27	Y	Outside diameter of oil seal	2.6260	2.6300	*
	B-27	Y-X	Fit of oil seal in housing	0.0020T	0.0080T	*

Note. Refer to paragraph 6-3b for explanation of symbols.

Table 6-26. Early Cooling Fan Clutch Overhaul Standards

Component	Fig. No.	Ref. letter	Point of measurement	Sizes and fits of new parts		Wear limits
Cooling fan clutch	B-27	YY	Outside width of piston ring (large)	0.0925	0.0935	0.0895
	B-27	RR	Inside width of ring groove in piston	0.0945	0.0960	0.0977
	B-27	YY-RR	Fit (side clearance) of ring in groove	0.0010L	0.0035L	0.0082L
	B-27	SS	Gap of piston ring when compressed in 4.750 id gage	0.0050	0.0130	0.0290
	B-27	G	Outside diameter of fan drive vertical shaft	1.1450	1.1460	1.1440
	B-27	K	Inside diameter of fan clutch hub	1.1470	1.1480	1.1490
	B-27	G-K	Fit of shaft in hub bearing	0.0010L	0.0030L	0.0050L
	B-27	XX	Inside diameter (large) of pressure plate	4.7500	4.7520	4.7560
	B-27	TT	Inside diameter (small) of pressure plate	2.1250	2.1270	2.1290
	B-27	UU	Gap of piston ring when compressed in 2.125 id gage	0.0050	0.0130	0.0290
	B-27	VV	Spherical diameter of clutch balls	0.6245	0.6255	*
	B-27	WW	Spring helical compression:			
			Approximate free length	1.19 inch		*
			Scale reading at 0.807 inch	31 lb to 39 lb		*
			Maximum solid height	0.607 inch		*

Note. Refer to paragraph 6-3b for explanation of symbols.

Table 6-27. Late Cooling Fan Clutch Overhaul Standards

Component	Fig. No.	Ref. letter	Point of measurement	Sizes and fits of new parts		Wear limits
Cooling fan clutch	B-27	S	Outside diameter of fan drive vertical shaft	1.1450	1.1460	1.1440
	B-27	Q	Inside diameter of fan clutch hub	1.1470	1.1480	1.1490
	B-27	S-Q	Fit of shaft in hub bearing	0.0010L	0.0030L	0.0050L
	B-27	ZZ	Spherical diameter of clutch balls			
	B-27	R	Spring helical compression: Approximate free length Scale reading at 0.807 inch Maximum solid height	1.19 inch 31 lb to 39 lb 0.607 inch		* * *

Note. Refer to paragraph 6-3b for explanation of symbols.

Table 6-28. Front Fan Drive Housing Standard and Oversize Stud Identification

Fig. No.	Ref. letter	Setting height	No. req'd	Stud size and length
6-148	A	2-1 / 16	2	3 / 8-16(51 / 64) x 3 / 8-24(7 / 8) x 2-25 / 32 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-148	B	3-1 / 16	6	3 / 8-16(51 / 64) x 3 / 8-24(11 / 16) x 3-7 / 8 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-148	C	3 / 4	4	3 / 8-16(13 / 16) x 3 / 8-24(3 / 4) x 1-7 / 8 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-148	D	23 / 32	12	5 / 16-18(3 / 4) x 5 / 16-24(19 / 32) x 1-7 / 16 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-148	E	7 / 8	3	5 / 16-18(3 / 4) x 5 / 16-24(19 / 32) x 1-1 / 2 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-148	G	1 (throttle bracket)	2	
6-148	F	3-1 / 2	2	3 / 8-16(27 / 32) x 3 / 8-24(11 / 16) x 4-5 / 16 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)

Note. Refer to figure 6-1 for oversize stud identification.

d. Assembly.

(1) *Clutch assemblies.*

(a) *Piston actuated clutch assembly.* Refer to figures 6-149, 6-146 through 6-137, 6-134, 6-132 through 6-130, and 6-128.

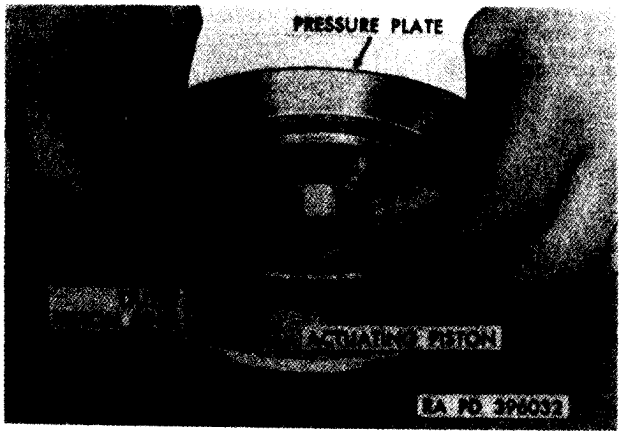


Figure 6-149. Installing outer piston ring on actuating piston (piston actuated clutch).

(b) Mechanical clutch assembly. Refer to figures 6-148, 6-144, 6-138, 6-136, 6-135, 6-133, and 6-131 through 6-129.

Note. When positioning balls in fan drive hub, place a dab of grease, (GAA) FSN 9150-190-0905, on each ball pocket to facilitate keeping balls in proper location during assembly.

(2) *Front fan drive housing.* Refer to figures 6-127, 6-150 through 6-152, 6-124, 6-153, 6-122 through 6-119, and (a) and (b), below.

Note. Before assembly of the front fan drive housing it will be necessary to determine the shim thickness required to control the end play of fan driven gearshaft and tbe backlash of fan drive bevel gearshaft.

(a) *Determine end play for fan drive gears haft.* Position original shims (fig. 6-126) on end of inner bearing race (side opposite bearing trade mark) of lower driven gearshaft ball bearing. Measure the total thickness of bearing race and shim, from shim on inner race to supper face of outer race, with end play removed. Thickness should be from 1.2635-inch minimum to 1.2655-inch maximum. When total thickness is greater than 1.2655-inch, strip 0.002-inch thick laminations from the shim pack until the correct thickness is obtained. When total thickness is less than 1.2635-inch, add 0.002-inch thick shims (stripped from a new shim pack FSN 2930-678-3271) as necessary. Figure 6-150 illustrates shim location and measuring points.

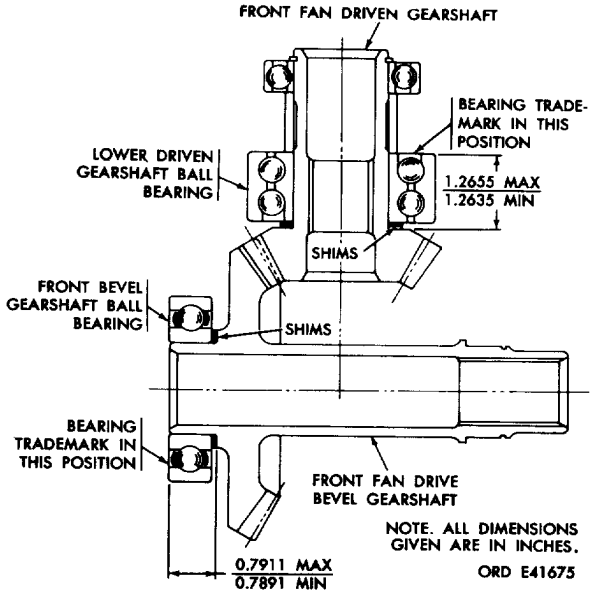
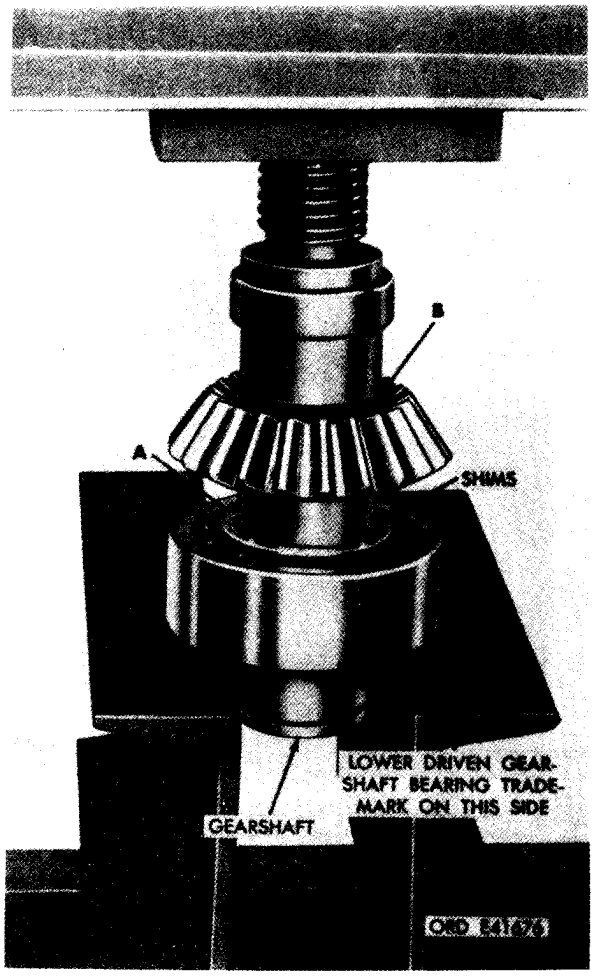
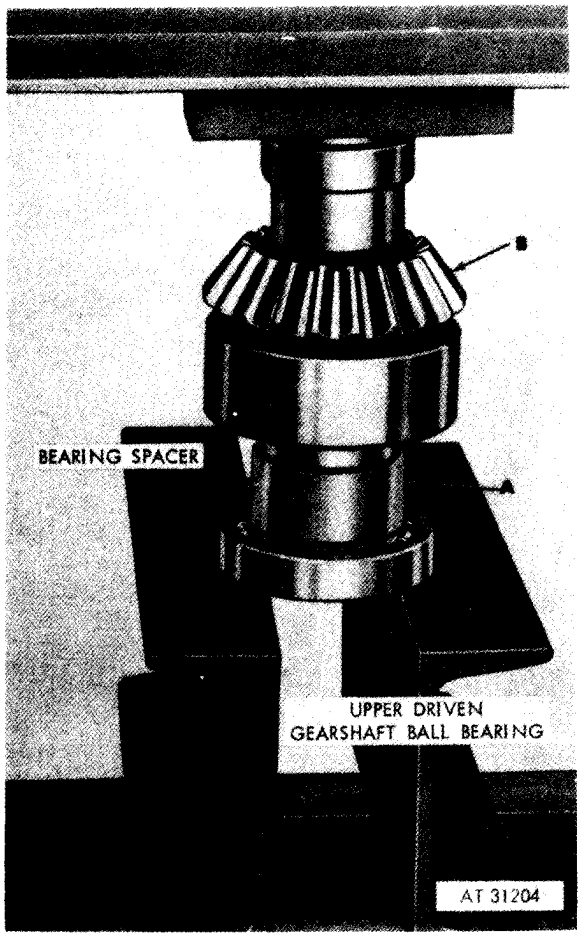


Figure 6-150. Determining shim thickness for front fan drive gearshaft and drive bevel gearshaft.



1. Position shim (A) of predetermined thickness (fig. 6-150) on inner race of lower driven gearshaft ball bearing.
2. Press fan driven gearshaft (B) into ball bearing.

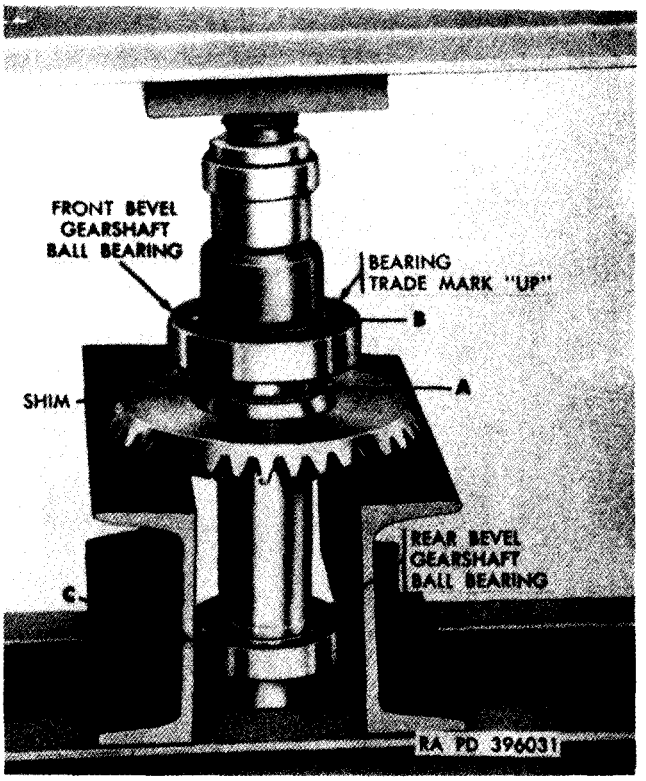
Figure 6-151. Pressing fart driven gearshaft into lower drive gearshaft ball bearing.



1. Position bearing spacer (A) on fan driven gearshaft and start upper driven gearshaft ball bearing on gearshaft
2. Press gearshaft (B) into ball bearing.

Figure 6-152. Pressing fan driven gearshaft into upper driven gearshaft ball bearing.

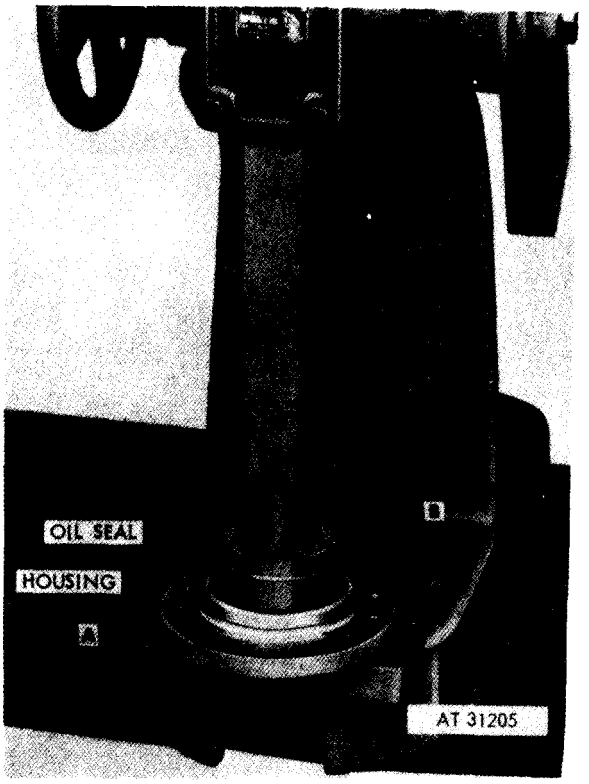
(b) *Determine backlash for fan drive bevel gearshaft.* Position original shims (fig. 6-123) on end of inner bearing race (side opposite bearing trade mark) of front bevel gearshaft ball bearing. Measure total thickness of bearing face and shim. from shim on inner race to face of outer race, with end play removed. Thickness should be from 0.7891-inch minimum to 0.791 1-inch maximum. When total thickness is more than 0.791 1-inch, strip 0.002-inch thick laminations from the shim pack until the correct thickness is obtained. When total thickness is less than 0.7891-inch, add 0.002-inch thick shims (stripped from a new shim pack FSN 2930-678-3271) as necessary. Figure 6-150 illustrates shim location and measuring points.



1. Position shim (A) of predetermined thickness (fig. 6-150) over bearing hub of front fan drive bevel gearshaft.
2. Position and press front bevel gearshaft ball bearing (B) on gearshaft.
3. Press rear bevel gearshaft ball bearing (C) on gearshaft in the same manner.

Figure 6-153. Pressing front bevel gearshaft ball bearing on gearshaft.

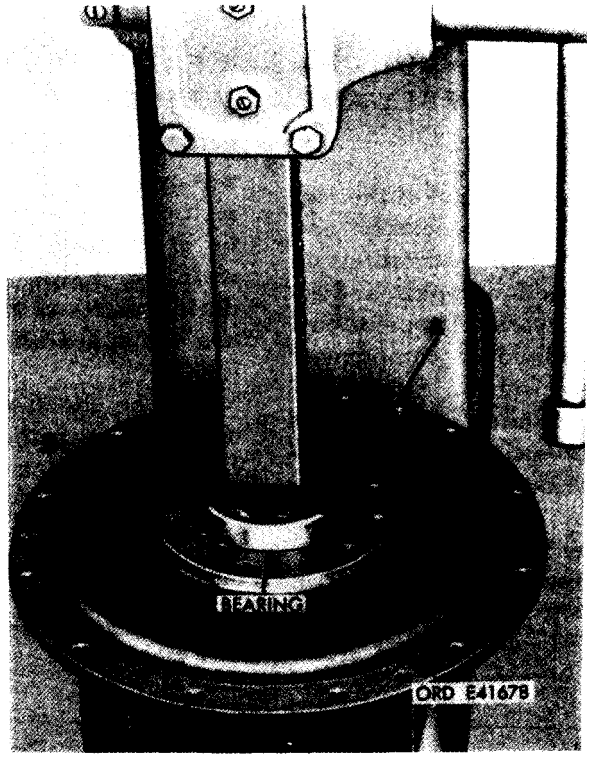
(3) *Fan drive oil seal housing.* Refer to figure 6-154.



1. **Position fan drive oil seal housing (A) on arbor press.**
2. **Coat flange face of new oil seal (B) with plastic lead sealer, FSN 8030-275-8111, and position oil seal on housing bore with lip of seal toward fan drive housing cover mounting surface.**
3. **Press oil seal in housing.**

Figure 6-154. Pressing oil seal into fan drive oil seal housing.

(4) *Fan drive housing cover.* Refer to figure 6-155.



1. Position fan drive housing cover (A) on arbor press using suitable blocks for support.
2. Preen clutch upper ball bearing (B) into cover.
3. Install housing cover and bearing on vertical drive shaft.

Figure 6-155. Pressing clutch upper ball bearing into fan drive housing cover.

(5) ***Front fan drive housing and clutch assembly.*** Refer to figures 6-115 and 6-114.

Section IX. OVERHAUL OF REAR FAN DRIVE HOUSING AND CLUTCH ASSEMBLY AND ACCESSORY DRIVE HOUSING

6-41. General

a. This section covers the overhaul of the rear fan drive housing and clutch assembly and accessory drive housing. Specific instructions on disassembly, cleaning, inspection, repair, and assembly accompany the overhaul operations. Overhaul standards of individual components follow the inspection procedures. Stud identification information is included in the repair procedures. Refer to the following table (table 6-29 for applicable illustrations and instructions for overhaul operations.

b. The rear fan drive housings on original production engines required an oil restrictor in the fan drive housing oil passage. The housing was redesigned to eliminate the need for restrictors on improved design engines. It cannot be determined whether a housing has an oil restrictor unless the housing is completely disassembled, as the exposed end of the restrictor has the appearance of a hexagon socket head pipe plug.

c. The clutch assembly used in the rear fan drive housing is the same as that used in the front fan drive housing. Refer to paragraph 6-39c for differences between piston actuated and mechanical clutch assemblies.

Table 6-29. Rear Fan Drive Housing and Clutch Assembly and Accessory Drive Housing

Component		Cleaning	Inspection	Repair	Assembly
Rear Fan and Accessory Drive Housing Assembly	Para 6-42a Figs. 6-156 through 6-158	Para 6-2	Para 6-42c Table 6-30	Para 6-42c Table 6-32	Para 6-42d Figs. 6-158, 6-157, 6-206, 6-156
Rear Fan and Accessory Drive Housing	Para 6-42a Figs. 6-116 through 6-118, 6-159 through 6-172, 6-124 through 6-126	Para 6-2	Para 6-42c Table 6-30	Para 6-42c Table 6-32 Fig. 6-187	Para 6-42d Figs. 6-205 through 6-202, 6-190 through 6-188, 6-206, 6-170 through 6-168, 6-167 or 6-166, 6-172, 6-164,6-162, 6-161, 6-159, 6-155, 6-154; 6-153 through 6-151, 6-157,6-156, 6-115, 6-114
Piston Actuated Clutch Assembly	Para 6-40a Figs. 6-128, 6-130 through 6-132, 6-134 through 6-137, 6-146	Para 6-2	Para 6-40c Table 6-26	Para 6-40c	Para 6-40d Figs. 6-149, 6-146 through 6-137, 6-134, 6-132 through 6-130, 6-128
Mechanical Clutch Assembly	Para 6-40a Figs. 6-129 through 6-131, 6-133, 6-135,6-136, 6-138, 6-144, 6-147	Para 6-2	Para 6-40c Table 6-27	Para 6-40c	Para 6-40d Figs. 6-147, 6-145, 6-144, 6-138, 6-135, 6-133, 6-1-31 through 6-129
Fuel Injection Pump Advance Assembly	Figs. 6-173 through 6-186	Para 6-2	Para 6-40c Table 6-31	Para 6-42c	Figs. 6-191, 6-192, 6-181, 6-193 through 6-198

6-42. Overhaul of Rear Fan Drive Housing and Clutch Assembly and Accessory Drive Housing

a. Disassembly.

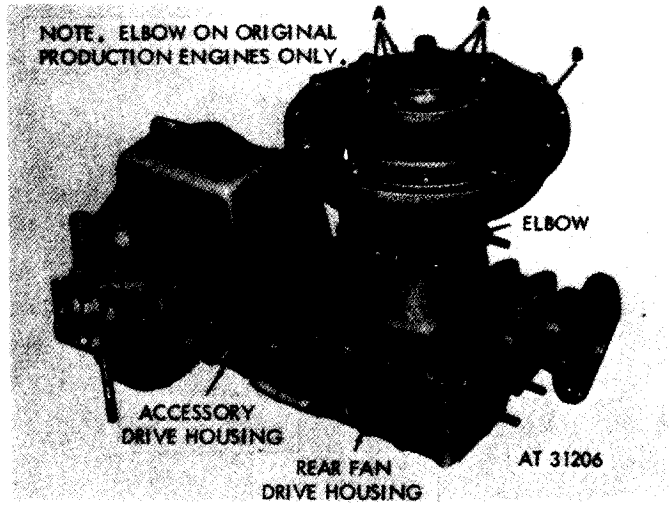
(1) *Rear fan and accessory drive housing assembly.* Refer to figures 6-156 through 6-158.

(2) *Clutch cover, bearing and vertical drive shaft oil seal.* Refer to figures 6-116 through 6-118.

(3) *Rear fan and accessory drive housing.* Refer to figures 6-116 through 6-118, 6-159 through 6-172, and 6-124 through 6-126.

(4) *Rear fan drive housing clutch assembly.* Refer to table 6-24 for appropriate clutch disassembly sequence.

(5) *Fuel injection pump advance assembly.* Refer to figures 6-172 through 6-186.



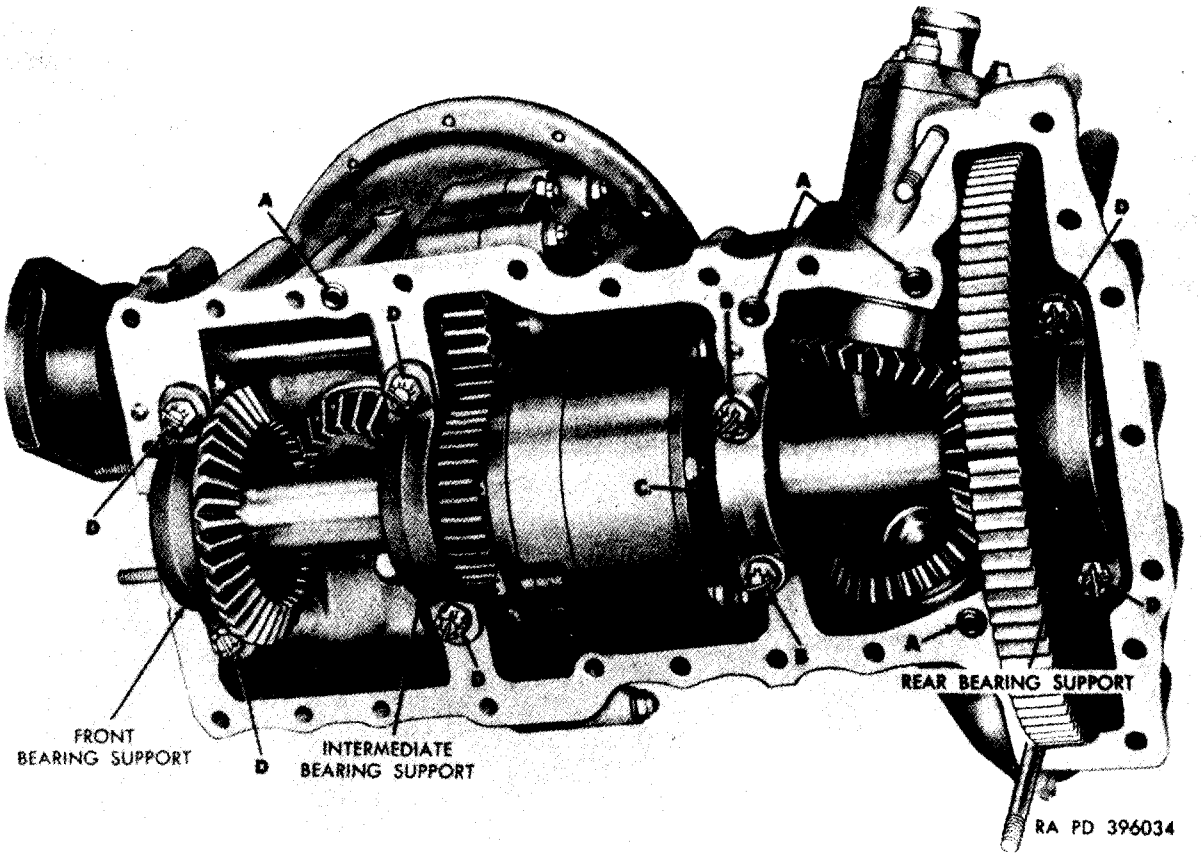
Remove

1. Cut locking wire. Remove six drilled head bolts (A) and flat washers. Refer to figure 6-114 and remove oil seal housing from fan drive housing cover.
2. Refer to figure 6-115 and remove fan drive housing cover (B).

Install

1. Refer to figure 6-115 and install fan drive housing cover (B).
2. Refer to figure 6-114 and install oil seal housing on fan drive housing cover. Install six drilled head bolts (A) and flat washers. Install locking wire securing bolts.

Figure 6-156. Removing or installing rear fan drive housing cover.



Remove

1. Remove and discard four preformed packings (A) from oil transfer tubes.
2. Remove two cotter pins, slotted nuts (B), and flat washers attaching injection advance bearing cap.
3. Remove injection advance bearing cap (C).

Note. Bearing cap and accessory drive housing are stamped with corresponding numbers (fig. 6-206) to prevent mismating of parts. Cap should be loosely attached on housing after advance assembly is removed.

4. Remove six cotter pins, slotted nuts (D), and flat washers attaching front, intermediate, and rear bearing supports.

Install

1. Install six cotter pine, dotted nuts (D), and flat washers securing front, intermediate, and rear bearing supports.
2. Refer to figure 6-206 and install injection advance bearing cap (C) in appropriate position.
3. Install two cotter pins, slotted nuts (B), and flat washers securing injection advance bearing cap.
4. Install four new preformed packings (A) in oil transfer tubes.

Figure 6-157. Removing or installing bearing cap and bearing support attaching parts.

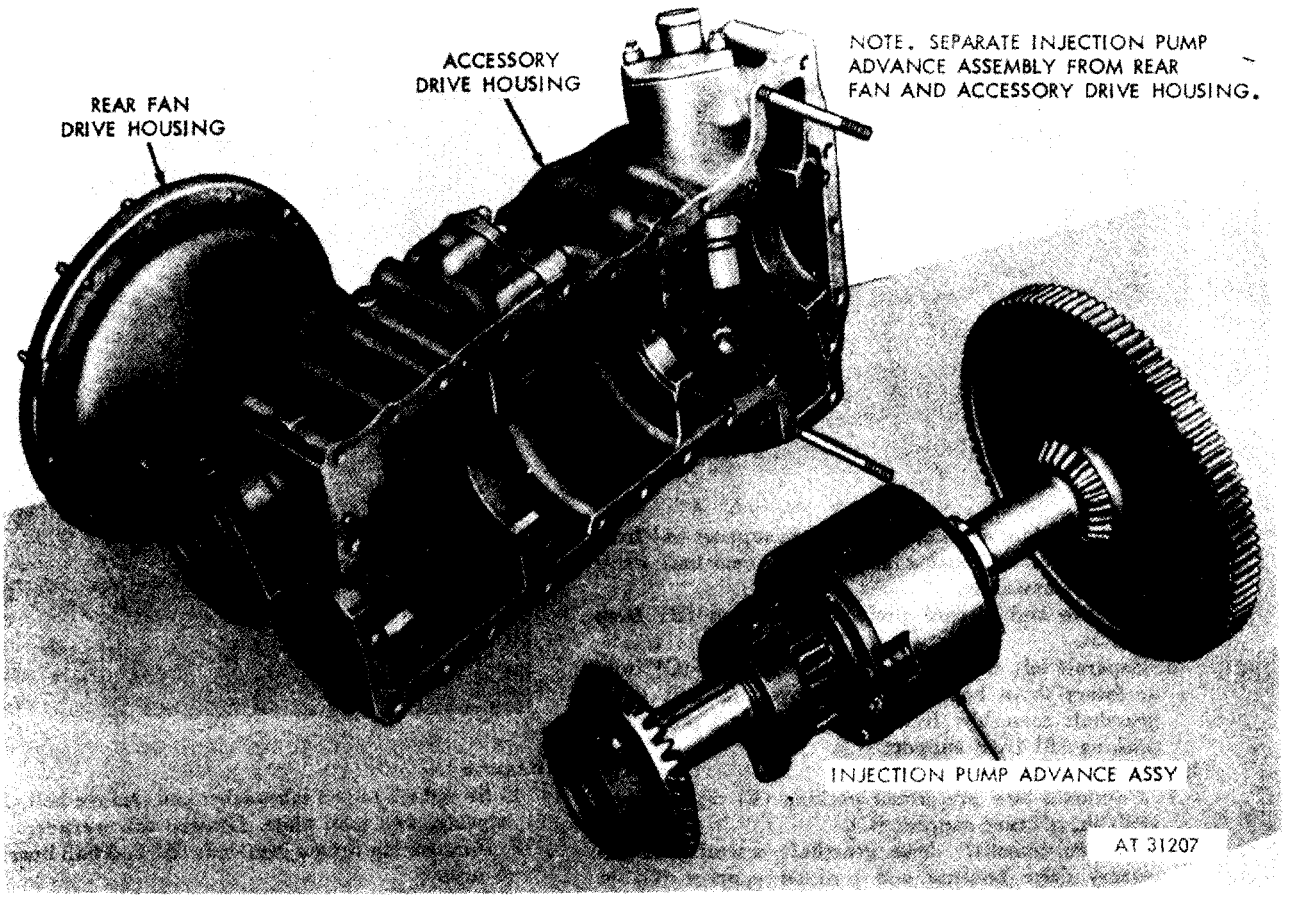
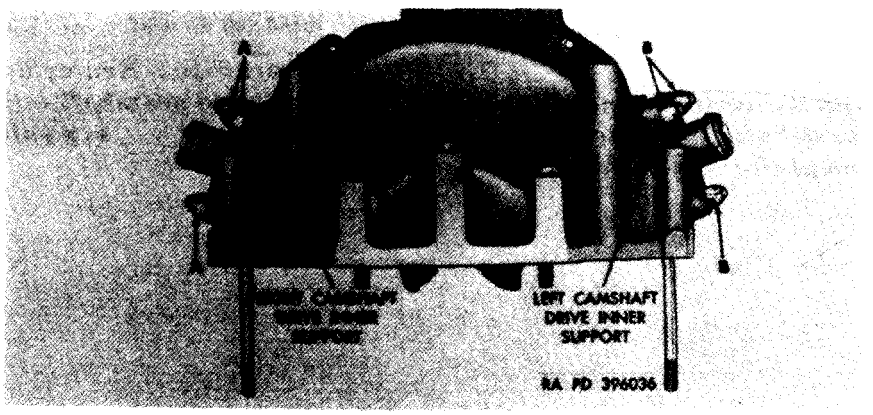


Figure 6-158. Removing or installing injection pump advance assembly.



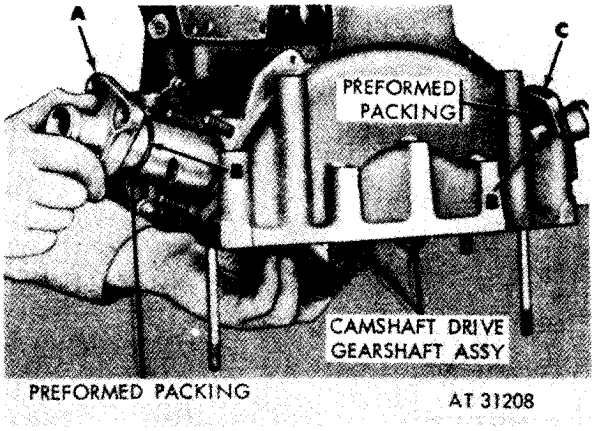
Remove

1. Remove three self-locking nuts (A) and flat washers attaching right camshaft drive inner support.
2. Remove three self-locking nuts (B) and flat washers attaching left camshaft drive inner support.

Install

1. Install three self-locking nuts (B) and flat washers securing left camshaft drive inner support.
2. Install three self-locking nuts (A) and flat washers securing right camshaft drive inner support.

Figure 6-159. Removing or installing left and right camshaft drive inner support attaching parts.



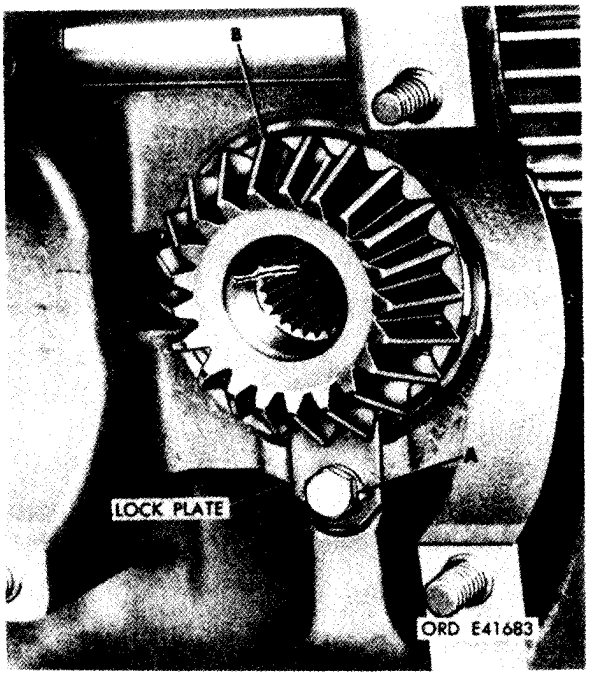
Remove

1. Separate right camshaft drive inner support (A) from accessory drive housing and remove camshaft drive gearshaft assembly.
2. Remove and discard preformed packing (B) from support.
3. Separate left camshaft drive inner support (C) from accessory drive housing and remove camshaft drive gearshaft assembly. Remove and discard preformed packing (B) from support.

Install

1. Position a new preformed packing (B) on left camshaft drive inner support (C).
2. Position camshaft drive gearshaft assembly in accessory drive housing and position support (C) in housing and on gearshaft assembly.
3. Position a new preformed packing (B) on right camshaft drive inner support (A). Position camshaft drive gearshaft assembly in accessory drive housing and position support (A) in housing and on gearshaft assembly.

Figure 6-160. Removing or installing right and left camshaft drive inner supports and preformed packing.



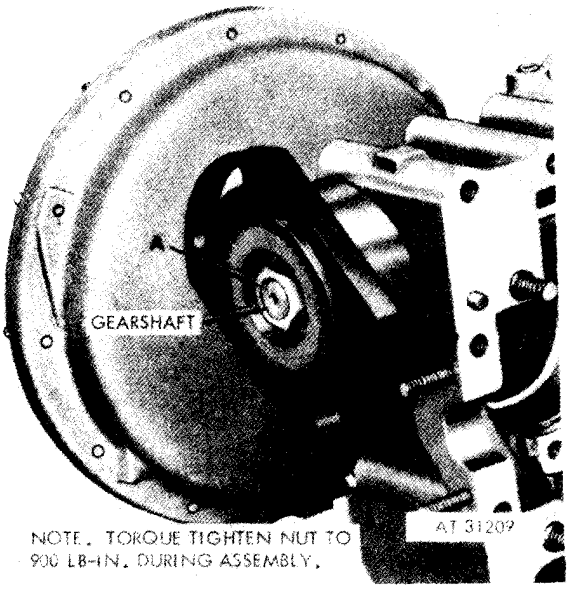
Remove

1. Straighten tab on tab washer and remove bolt (A), tab washer, and lock plate. Discard tab washer.
2. Remove fan driven gearshaft (B) and ball bearings as a unit

Install

1. Position fan driven gearshaft (B) and ball bearings as a unit in fan drive housing.
2. Install bolt (A), new tab washer, and lock plate and bend tab on washer over bolt.

Figure 6-161. Removing or installing fan driven gearshaft and ball bearings as a unit.



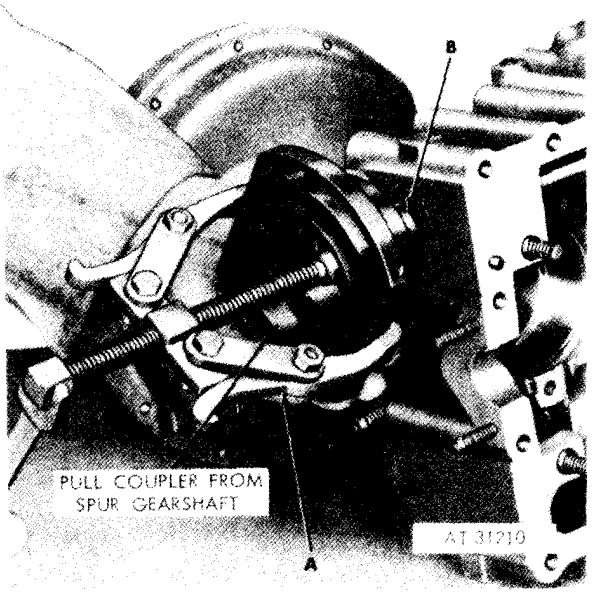
Remove

1. Remove plain nut (A) and lock washer attaching fuel injection pump drive coupler half to fuel injection pump spur gearshaft.

Install

1. Install plain nut (A) and lock washer securing fuel injection pump drive coupler half to fuel injection pump spur gearshaft. Torque tighten as specified.

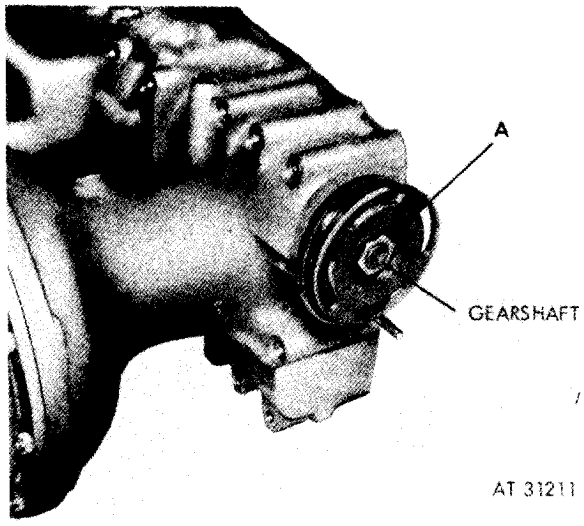
Figure 6-162. Removing or installing fuel injection pump splined drive coupler attaching parts.



1. Remove coupler half (A) from spur gear.
2. Remove Woodruff key (B) from spur gear.

Note. Keep the splined coupler half with the coupler half that is on (or removed from) the fuel injection pump (fig. 6-252). Coupler halves are mated parts and must be kept together for a correct assembly.

Figure 6-163. Removing fuel injection pump splined drive coupler half.



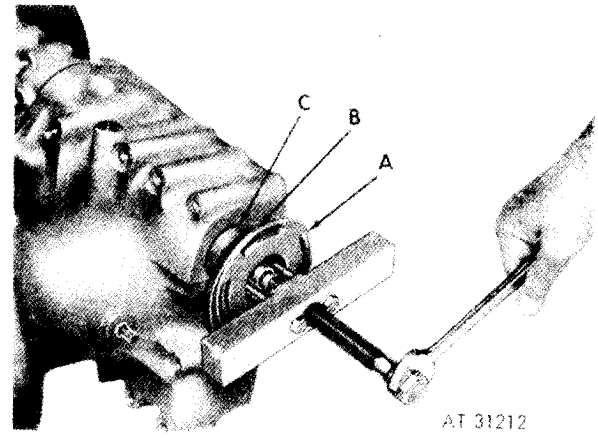
Remove

1. Remove plain nut (A) and lock washer attaching drive coupler half to fuel injection pump spur gearshaft.

Install

1. Install plain nut (A) and lock washer securing drive coupler half to fuel injection pump spur gearshaft. Tighten the nut to a torque of 900 pound-inches.

Figure 6-164. Removing or installing fuel injection pump diaphragm drive coupler half.

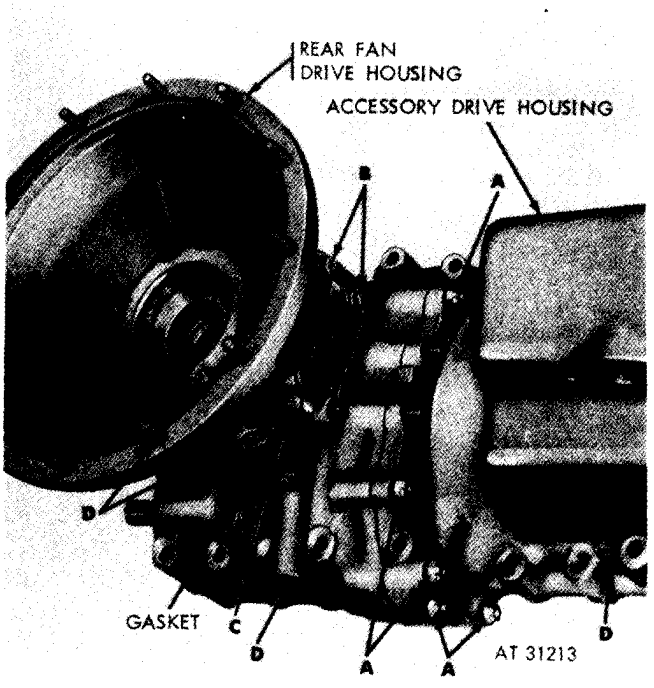


Caution; Do not attempt to remove the diaphragm drive coupler half from the shaft using a standard puller as shown in figure 6-163. This may distort the coupler and render it unserviceable. Use puller as shown.

1. Remove coupler half (A) from spur gearshaft using improvised tool (fig. 2-2).
2. Remove pilot ring (B) from gearshaft.
3. Remove Woodruff key (C) from gearshaft.

Note. The diaphragm type drive coupler halves are not matched sets and it is not necessary to maintain them in pairs. The parts are interchangeable between assemblies.

Figure 6-165. Removing fuel injection pump diaphragm drive coupler half.



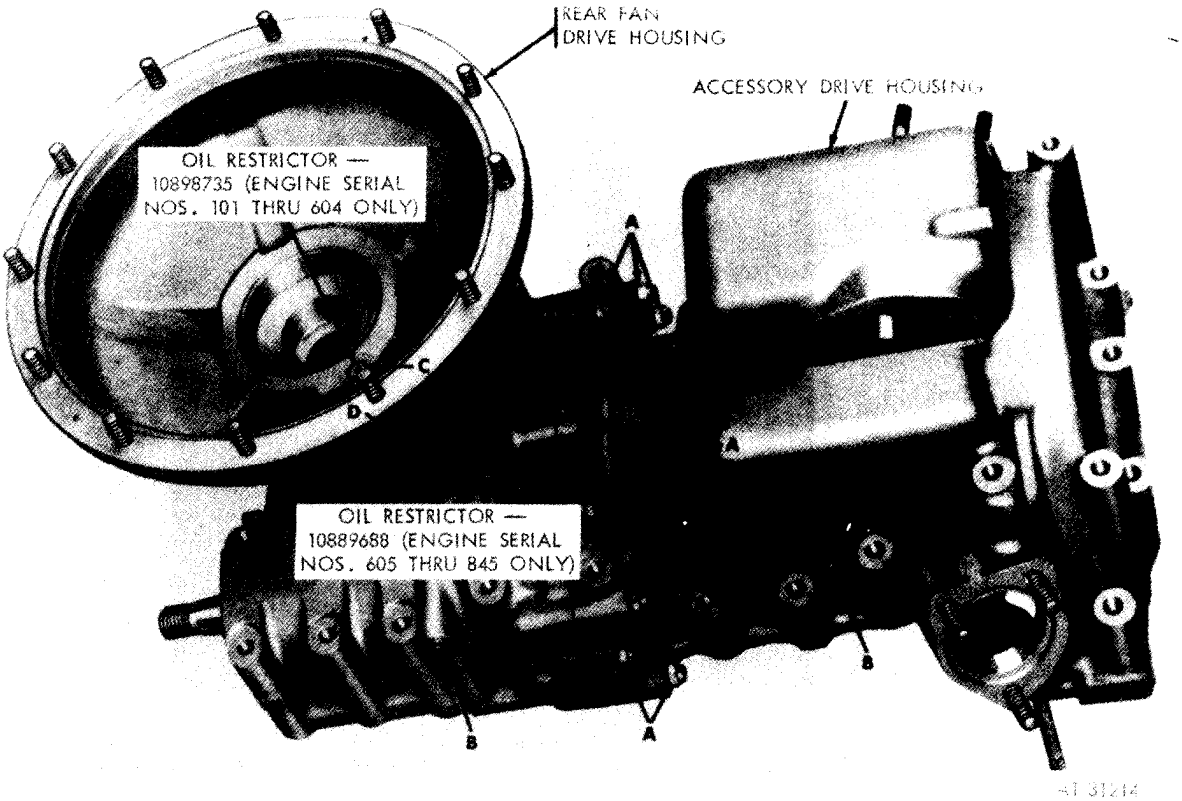
Separate

1. Remove seven self-locking nuts (A) and flat washers.
2. Separate rear fan drive housing and accessory drive housing.
3. Cut locking wire and remove four bolts (B) and flat washers attaching fan drive control cover to fan drive housing.
4. Remove fan drive control cover (C). Remove and discard cover gasket.
5. Remove four pipe plugs (D), one from accessory drive housing and three from fan drive housing.

Attach

1. Install four pipe plugs (D), one in accessory drive housing and three in fan drive housing.
2. Position a new fan drive control gasket on fan drive housing and position control cover (C) on gasket.
3. Install four bolts (B) and flat washers securing control cover to housing and install locking wire securing bolts.
4. Position accessory drive housing on fan drive housing.
5. Install seven self-locking nuts (A) and flat washers.

Figure 6-166. Separating or attaching rear fan and accessory drive housings (housings equipped with control covers).



Separate

1. Remove seven self-locking nuts (A) and flat washers.
2. Separate rear fan drive housing and accessory drive housing.
3. Remove two pipe plugs (B), one from accessory drive housing and one from fan drive housing.
4. Remove oil restrictor (C) from vertical oil passage in fan drive housing.
5. Remove oil restrictor (D) from horizontal oil passage in fan drive housing.

Note. The installation of oil restrictors in specified engines is critical. Be certain the restrictors are kept with their respective housings. If restrictors are installed in housings not requiring them, or conversely, serious clutch damage will result.

Attach

1. Install oil restrictor (D) in horizontal oil passage in fan drive housing.
2. Install oil restrictor (C) in vertical oil passage in fan drive housing.
3. Install two pipe plugs (B), one in fan drive housing and one in accessory drive housing.
4. Position accessory drive housing on fan drive housing.
5. Install seven self-locking nuts (A) and flat washers.

Figure 6-167. Separating or attaching rear fan and accessory drive housing (housings equipped with oil restrictors).

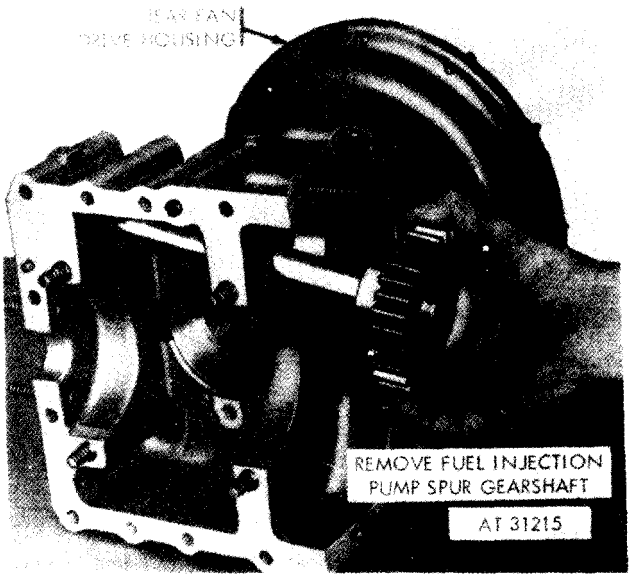


Figure 6-168. Removing or installing fuel injection pump spur gearshaft and bearing.

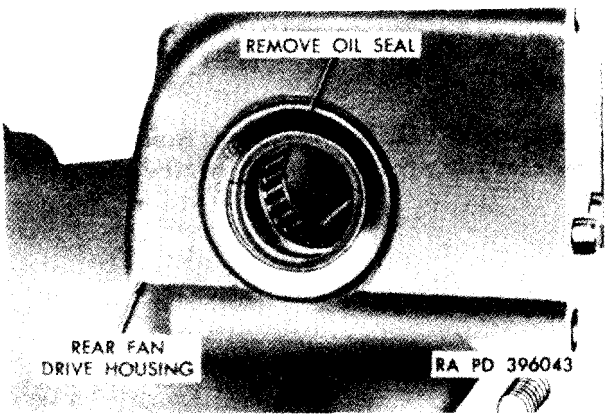
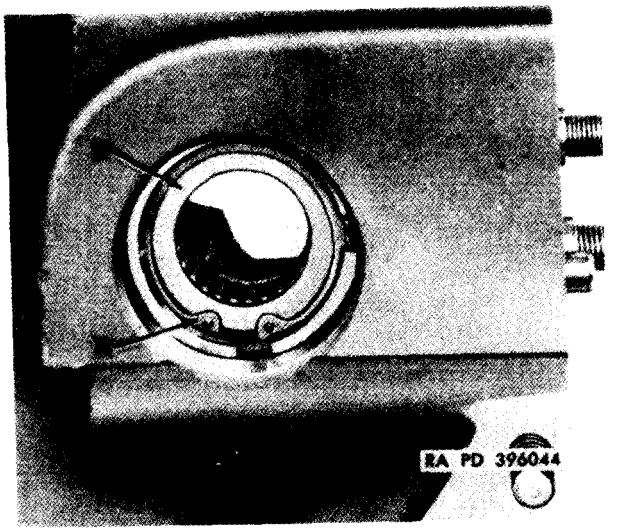


Figure 6-169. Removing or installing oil seal.



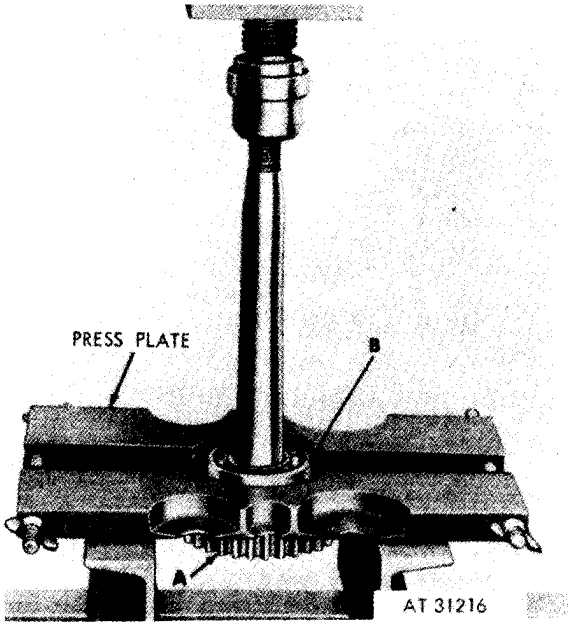
Remove

1. Remove bearing retaining ring (A).
2. Remove needle roller bearing (B) from rear fan drive housing.

Install

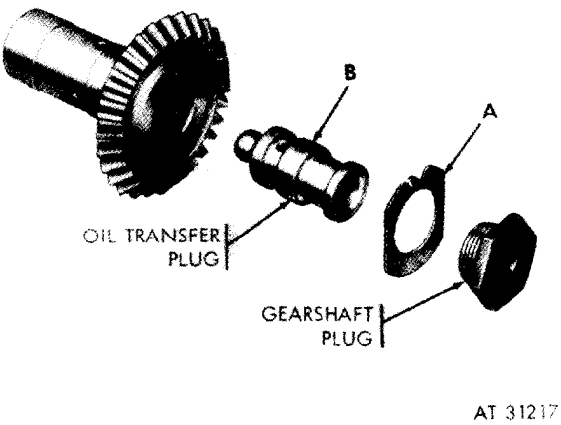
1. Position needle roller bearing (B) in rear fan drive housing.
2. Install bearing retaining ring (A).

Figure 6-170. Removing or installing needle roller bearing retaining ring and bearing.



1. Position fuel injection pump spur gearshaft (A) in arbor press.
2. Press gearshaft from spur gearshaft ball bearing (B) using press plate to support bearing.

Figure 6-171. Removing fuel injection pump spur gearshaft ball bearing.



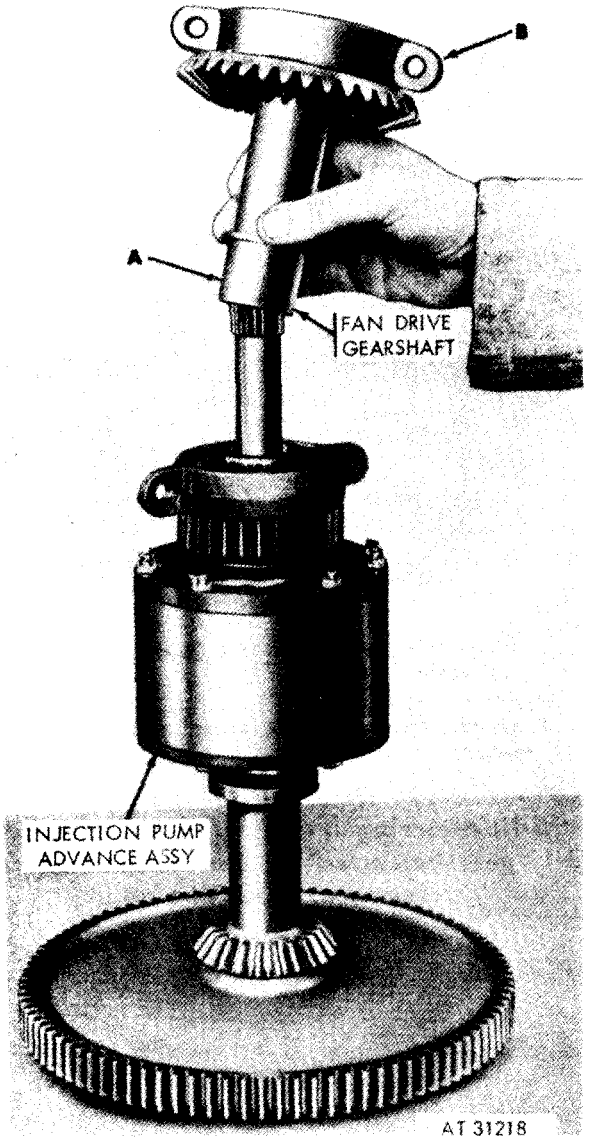
Remove

1. Straighten tab on retaining washer (A) and remove gearshaft plug and washer.
2. Remove oil transfer plug (B) from camshaft drive gearshaft.

Install

1. Position oil transfer plug (B) in camshaft drive gearshaft.
2. Install gearshaft plug and retaining washer (A) torque to 1000-1200 lb. in. and bend tab on washer securing plug.

Figure 6-172. Removing or installing oil transfer plug from camshaft drive gearshafts.



Remove

1. Remove fan drive gearshaft (A), front bevel gearshaft bearing, and front bearing support as a unit.
2. Remove front bearing support (B) from gearshaft bearing.

Install

1. Position front bearing support (B) on front bevel gearshaft bearing.
2. Position fan drive gearshaft (A), gearshaft bearing, and support on injection pump advance assembly.

Figure 6-173. Removing or installing fan drive gears haft, bearing, and support.

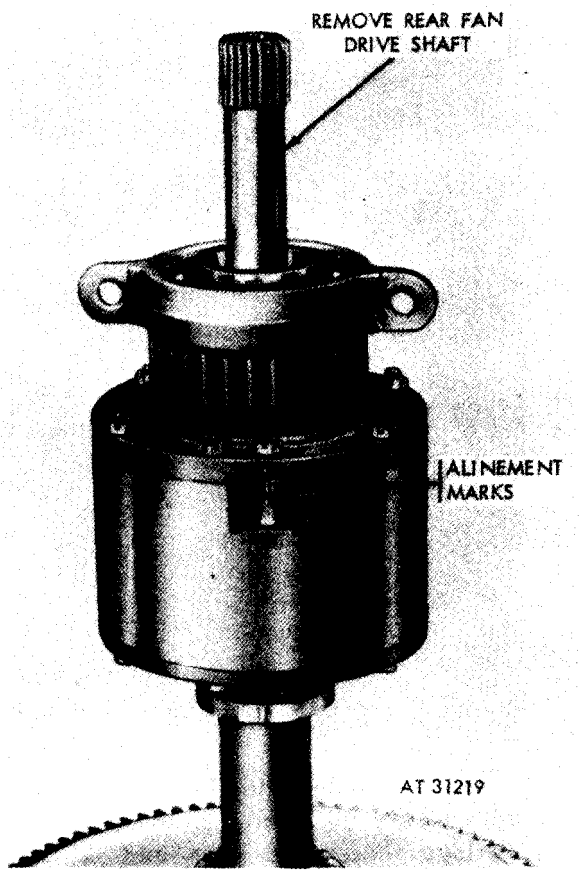
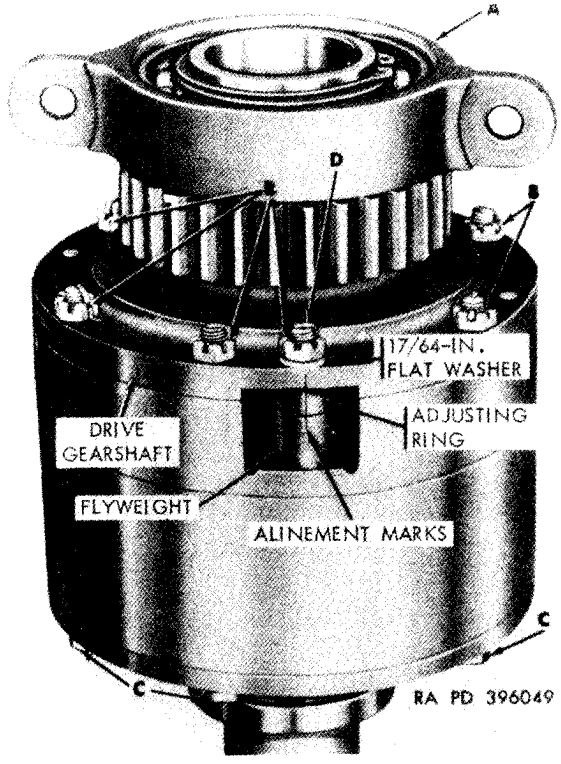


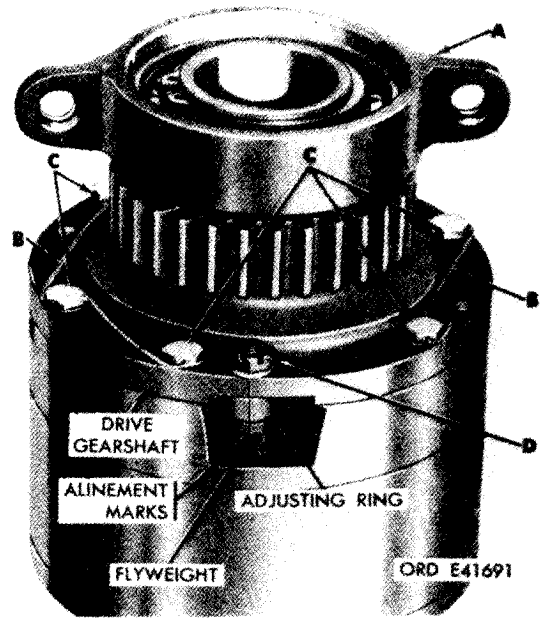
Figure 6-174. Removing or installing rear fan drive shaft.



Note. Before removing bolts and self-locking nuts securing the components of the advance assembly, check alinement and legibility of scribe marks on adjusting ring boss, flyweight, and drive gearshaft flange. The marks must be alined to insure proper assembly. If the scribe marks are not alined, scribe a new line on the gearshaft flange in alinement with the ring boss scribe line. Identify the new line using a prick punch dot or some other method. The new gear flange mark and ring boss must be in alinement for proper assembly.

1. Remove intermediate bearing support (A).
2. Remove eight cotter pins, slotted nuts (B) and two flat washers.
3. Remove six bolts (C).

Figure 6-175. Removing advance flyweight adjusting ring and injection pump drive gearshaft attaching parts (adjusting ring secured with nuts and washers).



1. Remove intermediate bearing support (A).
2. Cut locking wire (B).
3. Remove six bolts (C).
4. Remove two cotter pins, slotted nuts (D), and flat washers.

Figure 6-176. Removing advance flyweight adjusting ring and injection pump drive gearshaft attaching parts (adjusting ring secured with bolts).

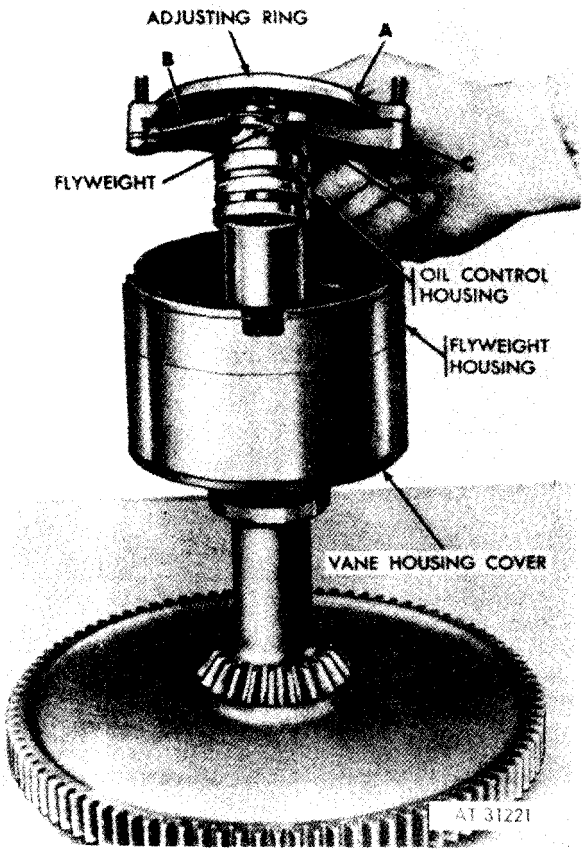
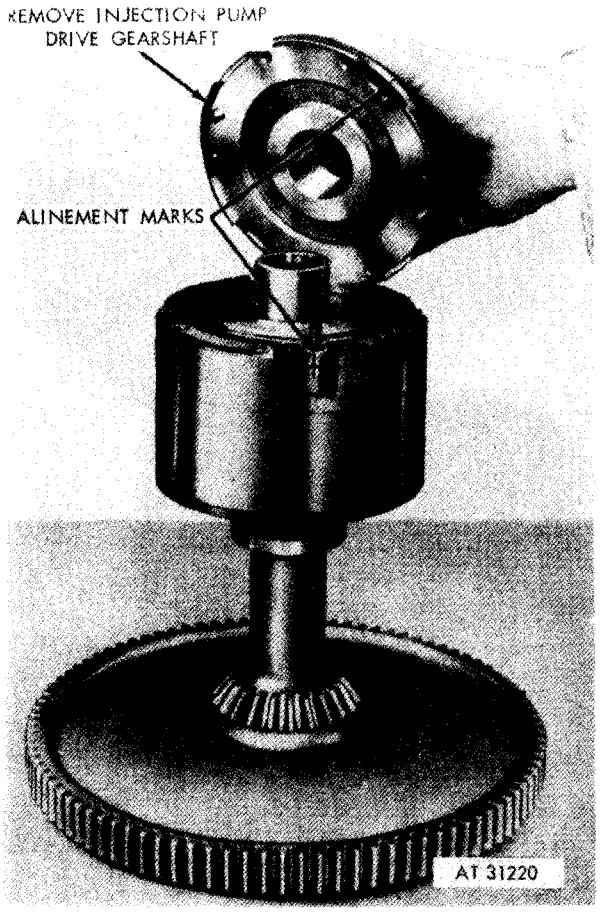


Figure 6-177. Removing injection pump drive gearshaft.

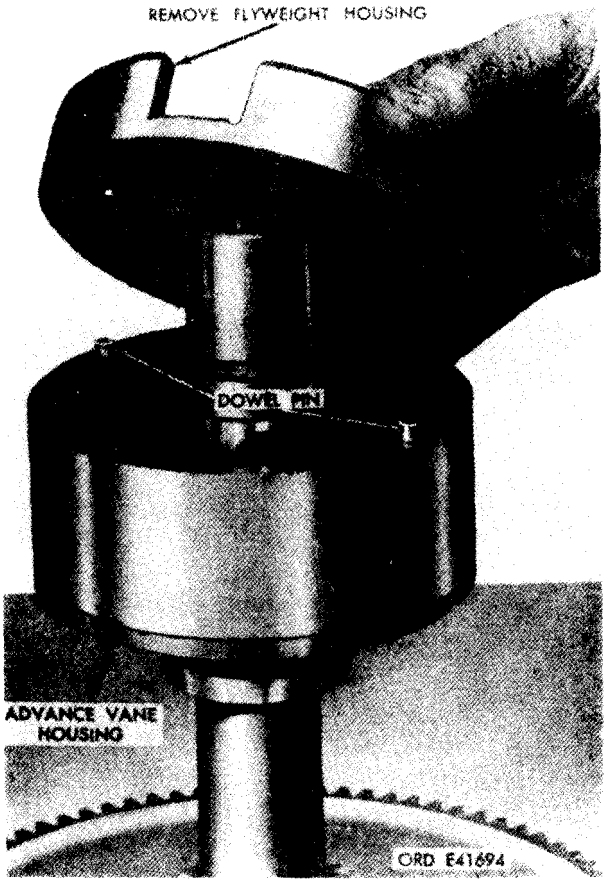


1. Remove advance flyweight adjusting ring (A), flyweights, and oil control housing from flyweight housing as an assembly.
2. Disconnect and remove flyweight extension helical springs (B) from flyweight extension.
3. Remove flyweights (C) from adjusting ring.

Note. Note position of flyweights as they must be installed in their original position to assure proper operation.

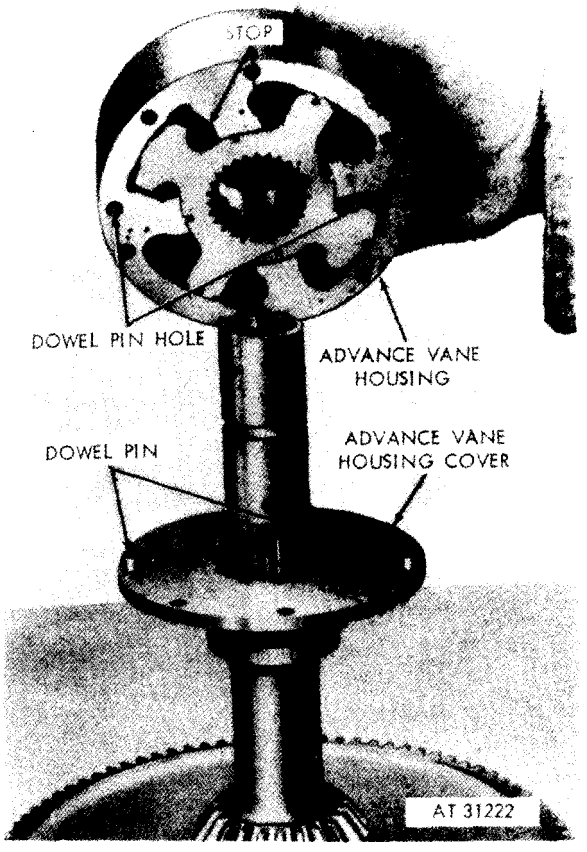
4. Separate adjusting ring (A) and remove from oil control housing.

Figure 6-178. Removing advance flyweight adjusting ring and flyweight.



Note. Observe location of dowel pins in advance vane housing for alinement with holes in flyweight housing during assembly.

Figure 6-179. Removing flyweight housing.



Note. Observe location of dowel pins in advance vane housing cover for alinement with holes in advance vane housing during assembly.

Figure 6-180. Removing advance vane housing and vane.

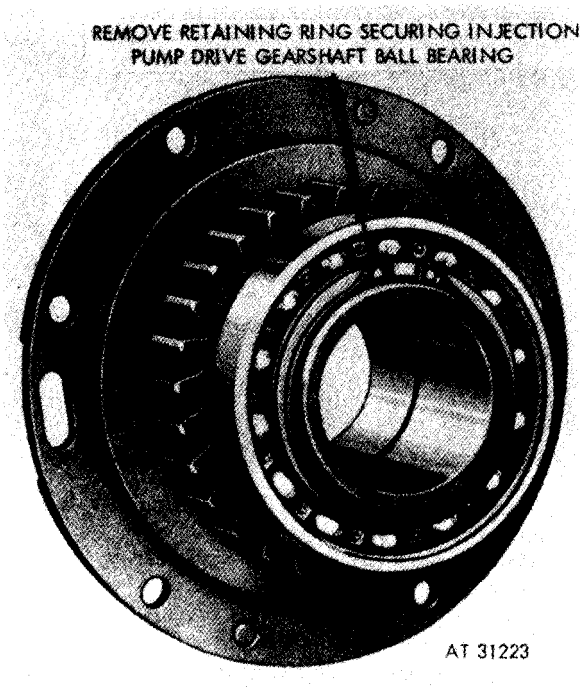
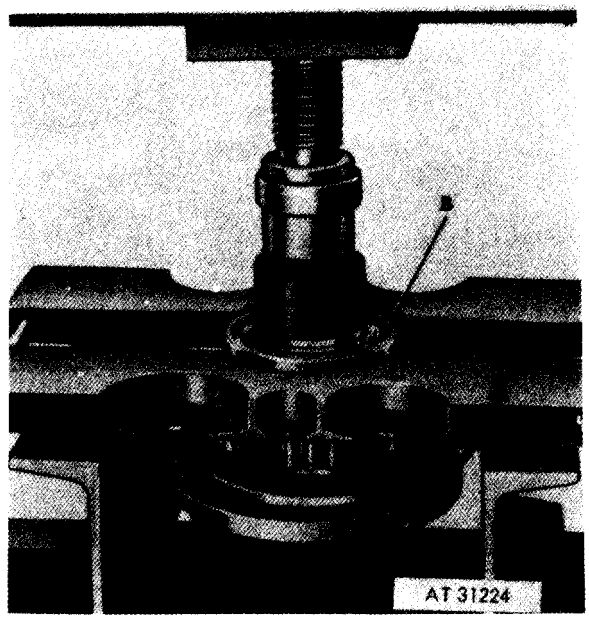
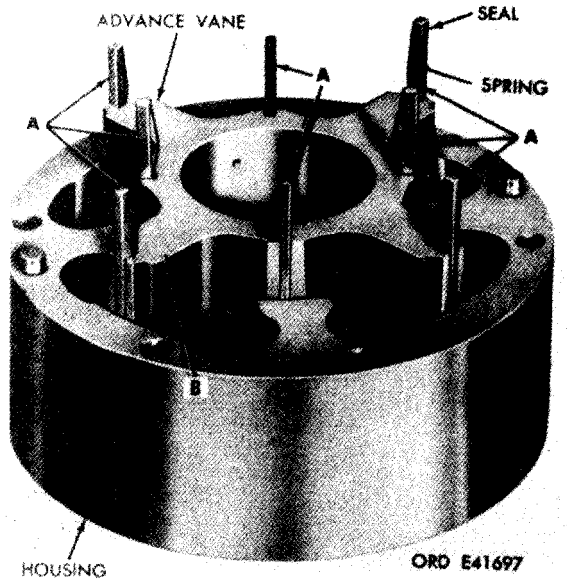


Figure 6-181. Removing or installing injection pump drive gearshaft ball bearing retaining ring.



1. Position injection pump drive gearshaft (A) in arbor press.
2. Press drive gearshaft from ball bearing (B) using press plate to support bearing.

Figure 6-182. Removing injection pump drive gearshaft ball bearing.



Remove

1. Partially separate advance vane and housing and remove eight seals and springs (A)
2. Remove vane (B) from housing.

Install

1. Position advance vane (B) in housing.
2. With vane partially separated from housing, install

Figure 6-183. Removing or installing automatic advance vane, housing, seals, and springs.

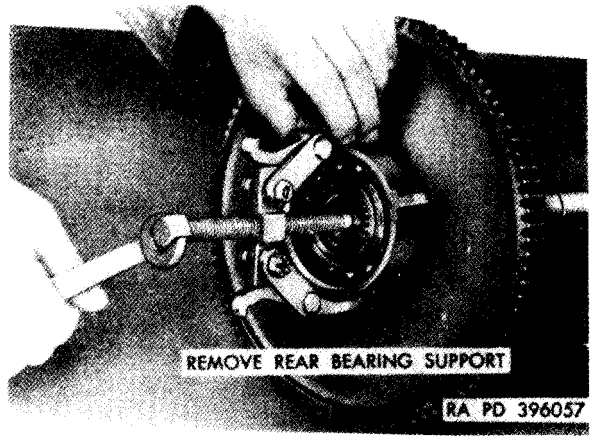
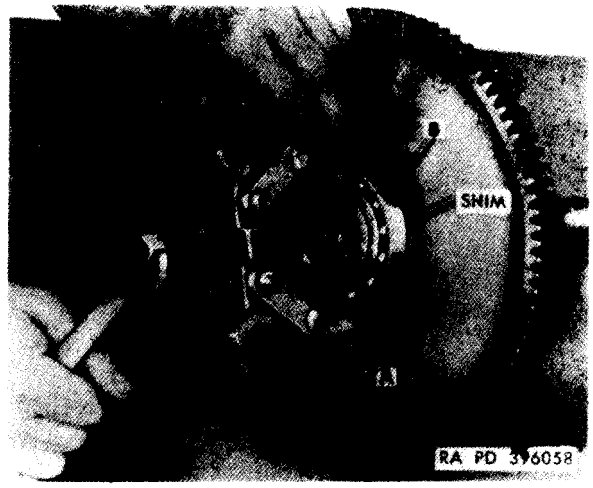


Figure 6-184. Removing rear bearing support using suitable gear puller.



1. Remove bevel gearshaft ball bearing (A) from accessory drive bevel gearshaft.
2. Remove shim (B) located behind bearing and retain for use during assembly.

Figure 6-185. Removing accessory drive bevel gearshaft ball bearing using suitable gear puller.

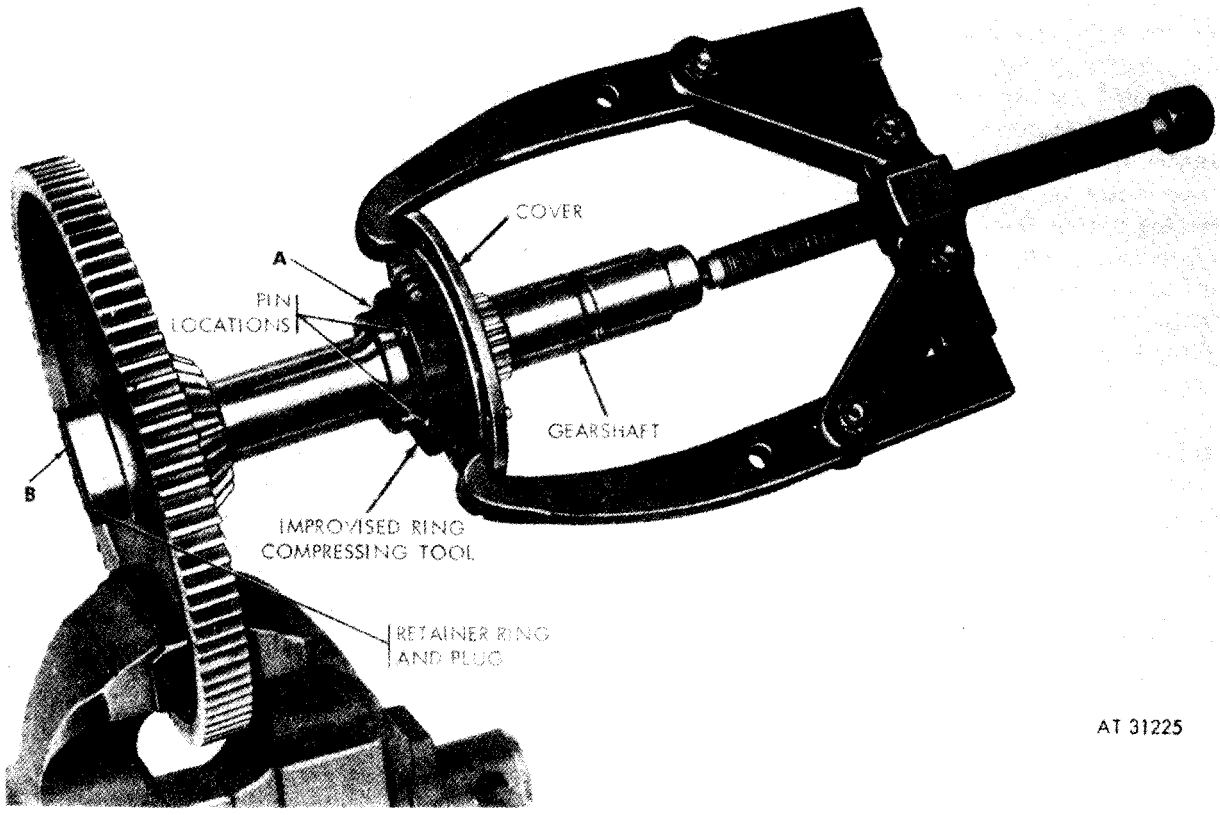


Figure 6-186. Removing advance vane housing cover, gearshaftplug, and retaining ring.

(6) *Advance vane housing cover and accessory drive gearshaft.* Refer to figure 6-186.

(a) Cut four pins 7 / 16-inch (approx.) long from 7 / 32-inch diameter brass brazing rod or other soft material. Insert the pins in the four equally spaced holes in bearing portion of advance vane cover. An improvised ring compressing tool of the type shown in figure 2-1 can be fabricated to facilitate removal, of the advance vane cover internal retaining ring. If the improvised tool is used, install it over the pins and tighten bolts sufficiently to compress the advance vane cover internal retaining ring.

(b) Install accessory drive gearshaft in a soft-jawed vise and remove advance vane housing cover (A) using a gear puller as shown in figure 6-186.

(c) Compress retaining ring and remove plug (B) from accessory drive gearshaft.

Caution; Use extreme care in this operation to prevent damage to vane cover or gearshaft.

b. Cleaning. Refer to paragraph 6-2.

c. Inspection and Repair. Refer to paragraphs 6-3 and 6-4, and (1) through (7), below.

(1) *Fan drive gearshaft and fan drive bevel gearshaft.* Inspect fan driven gearshaft (50.1, fig. B-26) and fan drive bevel gearshaft (5C2, fig. B-26) to limits specified in overhaul standards (table 6-30).

(2) *Oil seal.* Replace the oil seal each overhaul.

(3) *Clutch assembly.* Refer to paragraph 6-40c and tables 6-26 or 6-27.

(4) *Advance unit seals and springs.* Inspect seals and springs for cracks, indentations, and wear. Check seals to the limits specified in overhaul standards (table 6-31).

(5) *Flyweight springs.* Inspect flywheel springs for cracks and damage. Check spring tension to limits specified in overhaul standards (table 6-31).

(6) *Studs.* Refer to paragraph 6-4e, table 6-32, and figure 6-187 when replacing studs.

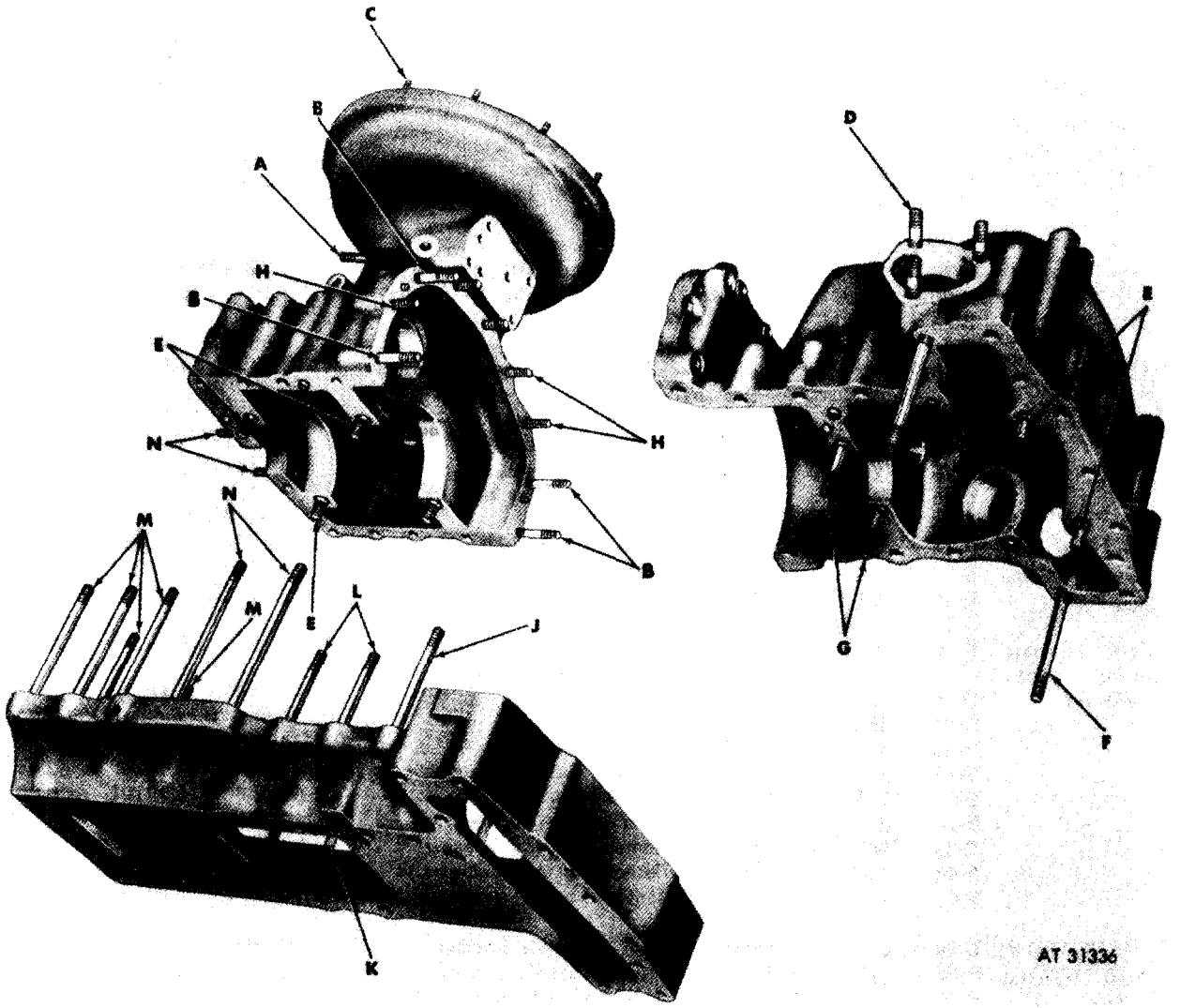


Figure 6-187. Rear fan and accessory drive housing and base studding assembly.

(7) *Fuel injection pump drive coupler half.*

(a) *Drive splined coupler.* Inspect the front and rear coupler sleeves and hubs for wear and mutilation and for fit with the splines of mating parts. Mating splines must match without binding and with a maximum total backlash of 0.006 inch from the input end through the output end. Check the quad rings for cracked or torn condition and for deterioration or loss of resilience.

(b) *Drive diaphragm coupler.* Inspect flange coupling for bent or distorted condition and for a mutilated keyway. Inspect pilot ring for distortion or elongated holes. Replace parts found unserviceable.

Table 6-30. Rear Fan and Accessory Drive Housing Assembly Overhaul Standards

Component	Fig. No.	Ref. letter	Point of measurement	Sizes and fits of new parts		Wear limits
Rear fan and accessory drive housing	B-26	Q	Inside diameter of bearing support	3.5432	3.5440	3.5444
	B-26	R	Outside diameter of bearing	3.5427	3.5433	*
	B-26	R-Q	Fit of bearing in support	0.0013L	0.0001T	0.0017L
	B-27	E	Outside diameter of bearing surface on gearshaft assembly	2.1655	2.1660	2.1653
	B-27	F	Inside diameter of bearing	2.1648	2.1654	*
	B-27	F-E	Fit of bearing on gearshaft assembly	0.0001T	0.0012T	0.0001L
	B-26	T	Outside diameter of bearing	3.1491	3.1496	*
	B-26	U	Inside diameter of bearing support	3.1495	3.1501	3.1504
	B-26	U-T	Fit of bearing in support	0.0010L	0.0001T	0.0013L
	B-26	W	Outside diameter of bearing surface on gearshaft	1.5749	1.5753	1.5747
	B-26	X	Inside diameter of bearing	1.5743	1.5748	*
	B-26	X-W	Fit of bearing on gearshaft	0.0001T	0.0010L	0.0001L.
	B-26	Y	Outside diameter of bearing	3.1491	3.1496	*
	B-26	Z	Inside diameter of bearing support	3.1495	3.1501	3.1504
	B-26	Z-Y	Fit of bearing in support	0.0010L	0.0001T	0.0013L
Rear fan and accessory drive housing	B-26	V	Outside diameter of gearshaft	1.6244	1.6248	1.6250
	B-27	AA	Inside diameter of drive gearshaft	1.6260	1.6270	1.6275
	B-26	AA-V	Fit of gearshaft in drive gearshaft	0.0012L	0.0026L	0.0030L
	B-27					
Fuel injection pump spur shaftgear	B-26	B	Outside diameter of bearing surface on fuel injection pump driven gearshaft	1.1814	1.1817	1.1813
	B-26	D	Inside diameter of bearing	1.1807	1.1811	*
	B-26	D-B	Fit of bearing on gearshaft	0.0003T	0.0010T	0.0002T
	B-26	E	Outside diameter of bearing	2.4404	2.4409	*
	B-26	F	Inside diameter of liner in housing	2.4409	2.4416	2.4419
	B-26	E-F	Fit of bearing in housing	0.0000	0.0012L	0.0015L
	B-26	J	Inside diameter of liner in housing	1.4995	1.5002	1.5005
	B-26	M	Outside diameter of needle bearing	1.4995	1.5000	*
	B-26	M-J	Fit of needle bearing in housing	0.0007L	0.0005T	0.0010L
	B-26	C	Outside diameter of needle bearing surface on gearshaft	0.9995	1.0000	0.9993
	B-26	L	Inside diameter of needle bearing	0.9995	1.0000	*
Fuel injection pump spur shaftgear	B-26	L-C	Fit of gearshaft in needle bearing	0.0005L	0.0005T	0.0007L
	B-26	K	Inside diameter of oil seal bore in housing	1.7500	1.7510	1.7520
	B-26	N	Outside diameter of oil seal	1.7540	1.7580	*
	B-26	N-K	Fit of oil seal in housing	0.0030T	0.0080T	0.0020T
	B-26	G	Inside diameter of bearing bore (small) in housing	2.6772	2.6779	2.6782
	B-26	XX	Outside diameter of bearing	2.6767	2.6772	*
	B-26	XX-G	Fit of bearing in housing	0.0000	0.0012L	0.0015L
	B-26	H	Inside diameter of bearing bore (large) in housing	3.1496	3.1503	3.1506
	B-26	ZZ	Outside diameter of bearing	3.1491	3.1496	
	B-26	ZZ-H	Fit of bearing in housing	0.0000	0.0012L	0.0015L
Rear fan and fuel injection drive	B-26	P	Outside diameter of bearing surface on gearshaft	1.5749	1.5753	1.5747
	B-26	YY	Inside diameter of bearing	1.5743	1.5748	*
Rear fan and fuel injection drive	B-26	YY-P	Fit of bearing on gearshaft	0.0001T	0.0010T	0.0001L
	B-26	AB	Inside diameter of bearing	1.5743	1.5748	*
	B-26	AB-P	Fit of bearing on gearshaft	0.0001T	0.0010T	0.0001L
	B-26	S	Inside diameter of injection advance bearing	2.3770	2.3780	*
	B-27	B	Outside diameter of hub on advance unit cover	2.3735	2.3745	2.3730
	B-27	B-S	Fit of cover in bearing	0.0025L	0.0045L	0.0050L
	B-26					*

Note. Refer to paragraph 6-3b for explanation of symbols.

Table 6-30. Rear Fan and Accessory Drive Housing Assembly Overhaul Standards — Continued

Component	Fig. No.	Ref. letter	Point of measurement	Sizes and fits of new parts		Wear limits
Lower camshaft drive quill bevel gearshaft	B-26	WW	Inside diameter of hub in gearshaft	1.1260	1.1270	*
	B-26	TT	Outside diameter of lower oil transfer plug	1.1250	1.1255	*
	B-26	TT-WW	Fit of plug in hub	0.0005L	0.0020L	*
	B-26	VV	Outside diameter of hub on gearshaft	1.4970	1.4980	1.4960
	B-26	A	Inside diameter of bore in inner support housing	1.5000	1.5010	1.5020
Lower camshaft drive quill bevel gearshaft	B-26	VV-A	Fit of hub in housing bore	0.0020L	0.0040L	0.0060L
	B-5	A	Inside diameter of camshaft drive quill (both ends)	0.6295	0.6305	0.6320
	B-26	UU	Spherical outside diameter of lower oil transfer plug	0.6275	0.6280	0.6265
	B-26 B-5	UU-A	Fit of lower transfer plug in quill	0.0015L	0.0030L	0.0060L

Table 6-31. Fuel Injection Pump Advance Unit Assembly Overhaul Standards

Component	Ref. letter	Fig No.	Point of measurement	Sizes and fits of new parts		Wear limits
Fuel injection pump advance unit assembly	B-27	GG	Inside diameter of cover	1.8125	1.8130	1.8135
	B-27	D	Outside diameter of mating surface on gearshaft	1.8115	1.8120	1.8110
	B-27	D-GG	Fit of cover on gearshaft	0.0005L	0.0015L	0.0025L
	B-27	E	Outside diameter of bearing surface on gearshaft assembly	2.1655	2.1660	2.1653
	B-27	F	Inside diameter of bearing	2.1648	2.1654	*
	B-27	F-E	Fit of bearing on gearshaft assembly	0.0001T	0.0012T	0.0001L
Fuel injection pump advance unit assembly	B-26	R	Outside diameter of bearing	3.5427	3.5433	*
	B-26	Q	Inside diameter of bearing support	3.5432	3.5440	3.5442
	B-26	Q-R	Fit of bearing in support	0.0013L	0.0001T	0.0015L
	B-27	B	Outside diameter of hub on cover	2.3735	2.3745	2.3730
	B-26	S	Inside diameter of injection advance bearing	2.3770	2.3780	2.3790
	B-26 B-27	S-B	Fit of hub on cover in advance bearing	0.0025L	0.0045L	0.0065L
	B-27		Inside diameter of vane	1.8730	1.8735	1.8740
	B-27	A QQ	Outside diameter of oil control advance housing	1.8710	1.8715	1.8708
	B-27	QQ-A	Fit of vane on housing	0.0015L	0.0025L	0.0035L
	B-27	C	Outside diameter of gearshaft	1.4996	1.5000	1.4994
	B-27	N N	Inside diameter of oil control advance housing	1.5015	1.5020	1.5030
	B-27	NN-C	Fit of oil control advance housing on gearshaft assembly	0.0015L	0.0024L	0.0036L
	B-27	F F	Width of seal	0.0990	0.1010	0.0980
Fuel injection pump advance unit assembly	B-27	E E	Width of slot in vane	0.1020	0.1060	0.1070
	B-27	EE-FF	Fit of seal in vane	0.0010L	0.0070L	0.0090L
	B-27	C C	Length of seal	2.1190	2.1210	*
	B-27	D D	Thickness of seal	0.1300	0.1350	*
	B-27	H H	Inside diameter of drive gearshaft gear	1.5015	1.5020	1.5030
	B-27	HH-C	Fit of drive gearshaft on gearshaft assembly	0.0015L	0.0024L	0.0036L
	B-27	J J	Outside diameter of pin on flyweight	0.2500	0.2510	0.2490
	B-27	P P	Width of slot in control housing	0.2510	0.2550	0.2560
	B-27	PP-JJ	Fit of pin in slot	0.0000	0.0050L	0.0070L
	B-27	L L	Outside diameter of flyweight pin	0.3110	0.3115	*
	B-27	K K	Inside diameter of flyweight pin hole in flyweight	0.3120	0.3130	*

Note. Refer to paragraph 6-3b for explanation of symbols.

Table 6-31. Fuel Injection Pump Advance Unit Assembly Overhaul Standards - **Continued**

Component	Fig No.	Ref. letter	Point of measurement	Sizes and fits of new parts		Wear limits
Fuel injection pump advance assembly	B-27	KK-LL	Fit of flyweight pin in flyweight	0.0005L	0.0020L	*
	B-27	BB	Outside diameter of bearing surface on spur gearshaft	1.9686	1.9690	1.9684
	B-27	Z	Inside diameter of bearing	1.9680	1.9685	*
	B-27	Z-BB	Fit of bearing on spur gearshaft	0.0001T	0.0010T	0.0001L
	B-27	M M	Spring, helical extension:			
			Free length	2.5470	2.5670	*
			Load at 3.17 inch (inside hooks)	9 lbs to 11 lbs		*
			Maximum extended length without set (inside hooks)	3.80 inch		*
	B-27	AA	Inside diameter of drive gearshaft	1.6260	1.6270	1.6275
	B-26	V	Outside diameter of drive gearshaft	1.6244	1.6248	1.6240
	B-26 B-27	V-AA	Fit of gearshaft in drive gearshaft	0.0012L	0.0026L	0.0035L

Note. Refer to paragraph 6-3b for explanation of symbols.

Table 6-32. Rear Fan and Accessory Drive Housings Standard and Oversize Stud Identification

Fig No.	Ref. letter	Setting Height	No. req'd	Stud size and length
6-187	A	5 / 8	1	5 / 16-18(19 / 32) x 5 / 16-24(17 / 32) x 1-1 / 8 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-187	B	1-11/16	4	5 / 16-18(3 / 4) x 5 / 16-24(23 / 32) x 2-5 / 16 (STD) (0.003 in. OS) (0.007 in. OS)
6-187	C	23/32	12	5 / 16-18(3 / 4) x 5 / 16-24(19 / 32) x 1-7 / 16 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-187	D	1-1/8	6	3 / 8-16(15 / 16) x 3 / 8-24(13 / 16) x 1-15 / 16 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-187	E	49 / 64	6	3 / 8-16(27 / 32) x 3 / 8-24(7 / 8) x 1-3 / 4 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-187	F	3-29 / 32	2	3 / 8-16(15 / 16) x 3 / 8-24(13 / 16) x 4-11 / 16 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-187	G	1-25/32	2	3 / 8-16(13 / 16) x 3 / 8-24(27 / 32) x 2-15 / 16 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-187	H	1	5	5 / 16-18(3 / 4) x 5 / 16-24(23 / 32) x 1-5 / 8 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)

Note. Refer to figure 6-1 for oversize stud identification.

Table 6-32. Rear Fan and Accessory Drive Housings Standard and Oversize Stud Identification on-Continued

Fig. No.	Ref. letter	Setting height	No. req'd	Stud size and length
6-187	J	3-1/2	2	3/8-16(27/32) x 3/8-24(11/16) x 4-5/16 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-181	K	4-5/8	1	3/8-16(51/64) x 3/8-24(11/16) x 5-1/4 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-187	L	2-9/16	4	3/8-16(25/32) x 3/8-24(7/8) x 3-5/16 (STD) (0.003 in. OS) (0.007 in. OS)
6-187	M	4-1/4	9	3/8-16(51/64) x 3/8-24(11/16) x 5 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-187	N	5-1/4	2	3/8-16(51/64) x 3/8-24(11/16) x 6 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
6-187	P	1	2	5/16(3/4) x 5/16-24(19/32) x 1-1/2 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)

Note. Refer to figure 6-1 for oversize stud identification.

d. Assembly.

(1) *Shimming procedures for rear fan driven gearshaft, rear fan drive bevel gearshaft, and accessory drive bevel gearshaft.*

Note. Before assembly of the rear fan and accessory drive housings, it is necessary to determine the shim thickness required to control the end play of the rear fan driven gearshaft and backlash of the fan drive bevel gearshaft. Figure 6-188 illustrates shim location and measuring points. The shim thickness for the accessory drive bevel gearshaft, which determines the backlash and end play of the two camshaft bevel gearshafts, is determined as shown in figure 6-189.

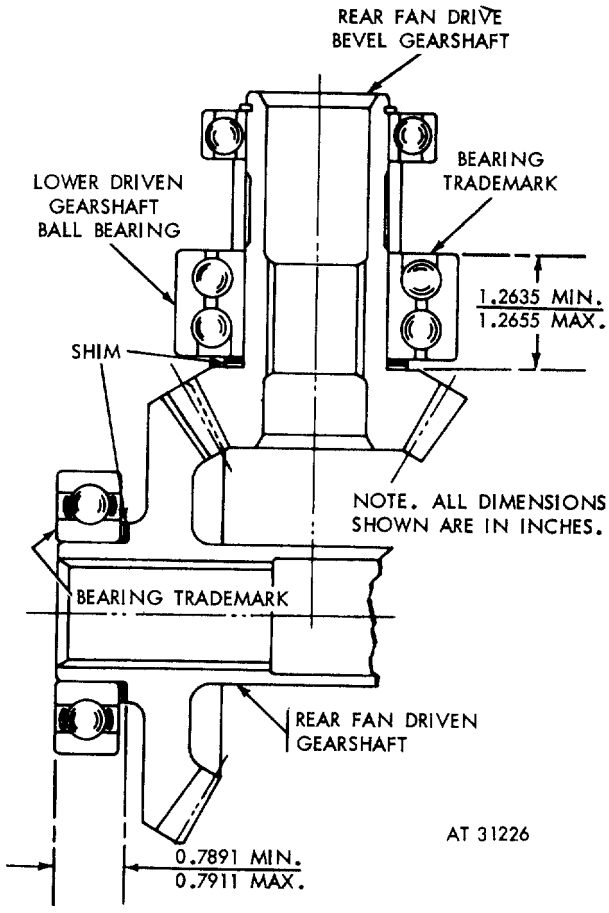
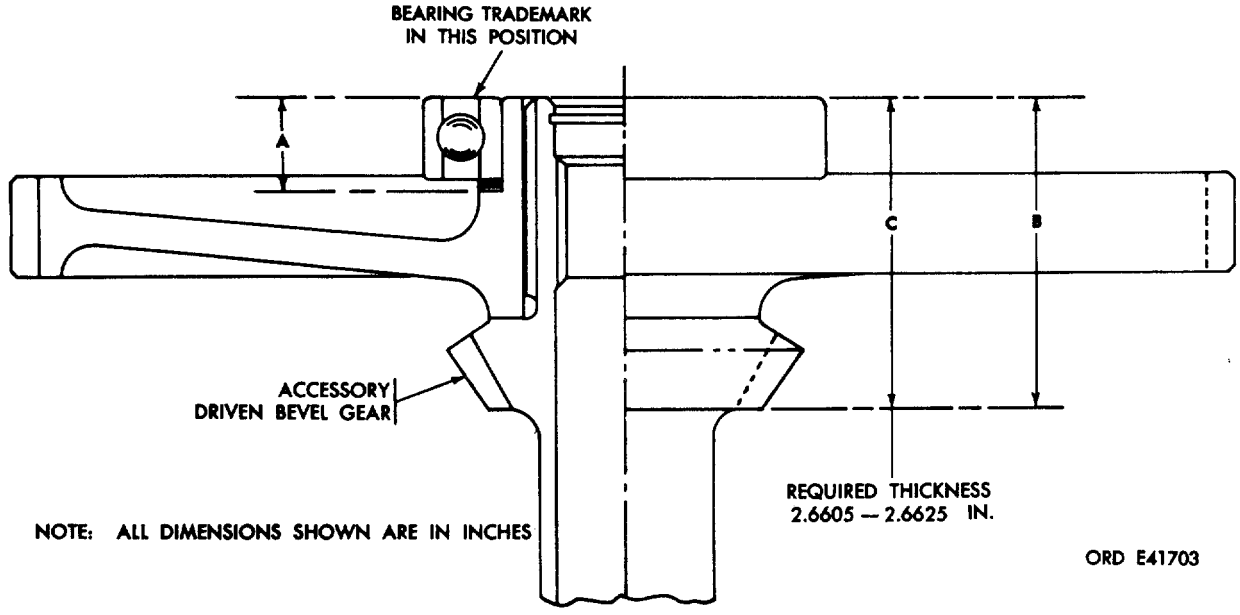


Figure 6-188. Determining shim thickness for rear fan driven gearshaft and rear fan drive bevel gearshaft.



1. Measure the total thickness (A) of ball bearing inner race to face of outer race, with end play removed.
2. Measure the total thickness (B) from inner face of bevel gear to outer face of gearshaft.
3. Add thickness of ball bearing race (A) and gearahaft movement (B) and subtract from 2.6605 to 2.6625-inch. Add or remove 0.002-inch shim lanimations from shim pack - 2930-678-3271 until required dimension (C) is established.

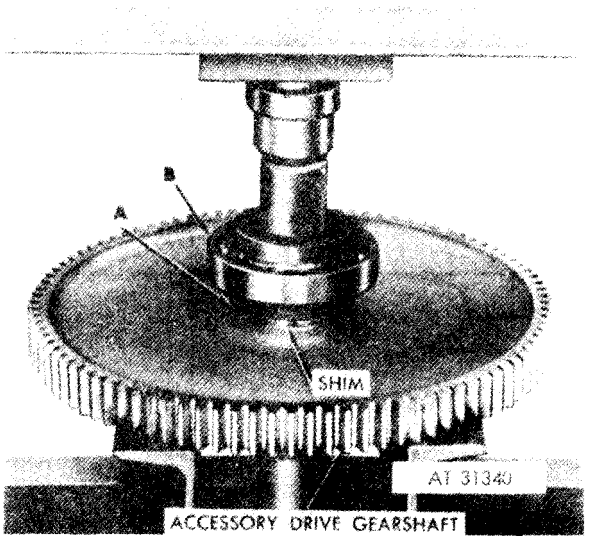
Note. The shim pack has several 0.002-inch laminations. Shims may be stripped from the pack to obtain correct shim dimensions. If shims must be added, they will have to be stripped from a new shim pack.

Figure 6-189. Determining shim thickness for accessory drive bevel gearshaft bearing.

(a) *Rear fan driven gearshaft end play*. Determining end play for the rear fan driven gearshaft is identical to the procedure outlined for the front fan driven gearshaft. Refer to paragraph 6-40d (2) (a) and figures 6-151 and 6-152 for pertinent instructions.

(b) *Rear fan drive bevel gearshaft backlash*. Determining backlash for the rear fan drive bevel gearshaft is identical to the procedure outlined for the front fan drive bevel gearshaft. Refer to paragraph 6-40d (2) (b) and figure 6-153.

(c) *Drive bevel gearshaft plug and retaining ring*. Refer to figure 6-186 to install plug and retaining ring.



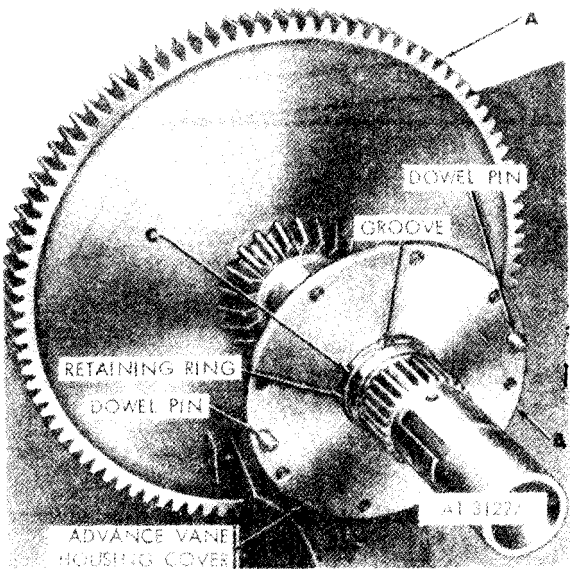
1. Position shim (A) of predetermined thickness (fig. 6-189) on bearing hub of accessory drive gearshaf.
2. Position bevel gearshaft ball bearing (B) on hub, with bearing trademark facing away from gearshaft.
3. Press bearing on gearshaft.

Note. Install rear bearing support (fig. 6-184) on bearing using a soft faced hammer.

Figure 6-190. Pressing bevel gear-shaft ball bearing on gearshaft.

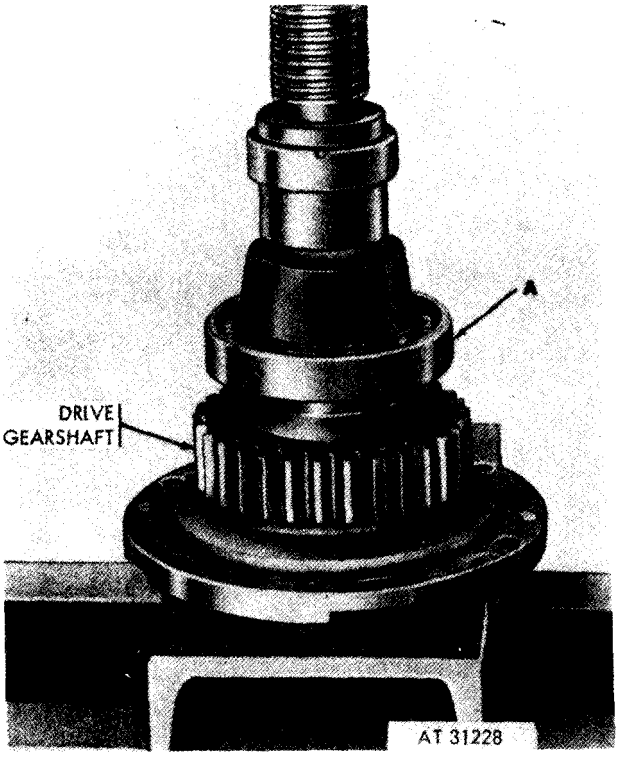
(2) *Rear fan drive clutch assembly.* Refer to table 6-24 for appropriate clutch assembly sequence.

(3) *Fuel injection pump advance assembly.* Refer to figures 6-191, 6-192, 6-181, 6-193 through 6-198, 6-174 and 6-173.



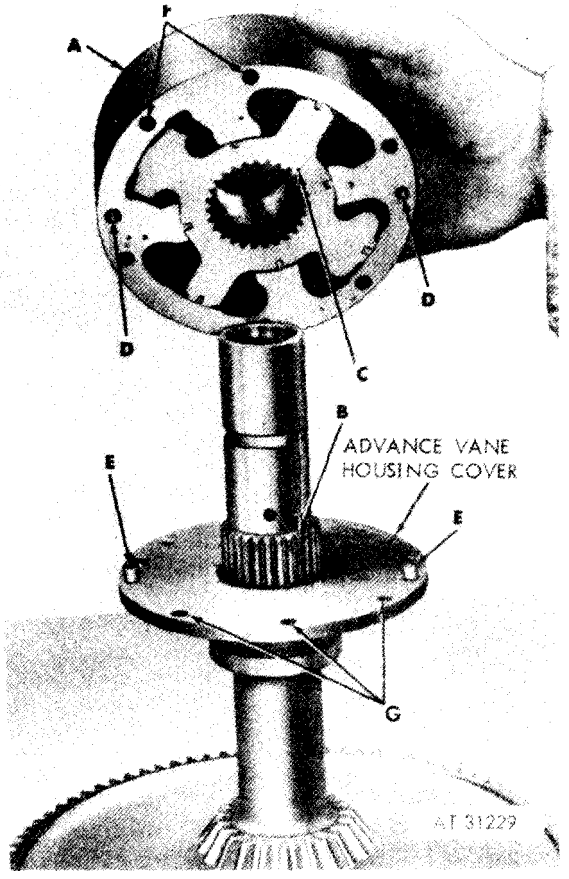
1. Place accessory drive bevel gearshaft (A) in a soft jawed vise.
2. Install vane housing cover (B) on gearshaft until it exposes the retaining ring groove.
3. Install retaining ring (C) in groove. Pull cover (B) forward until retaining ring is seated in the cover retaining ring groove.

Figure 6-191. Installing advance vane housing cover on accessory drive bevel gearshaft.



1. Position drive gearshaft ball bearing (A) on drive gearshaft.
2. Carefully press ball bearing on gearshaft.

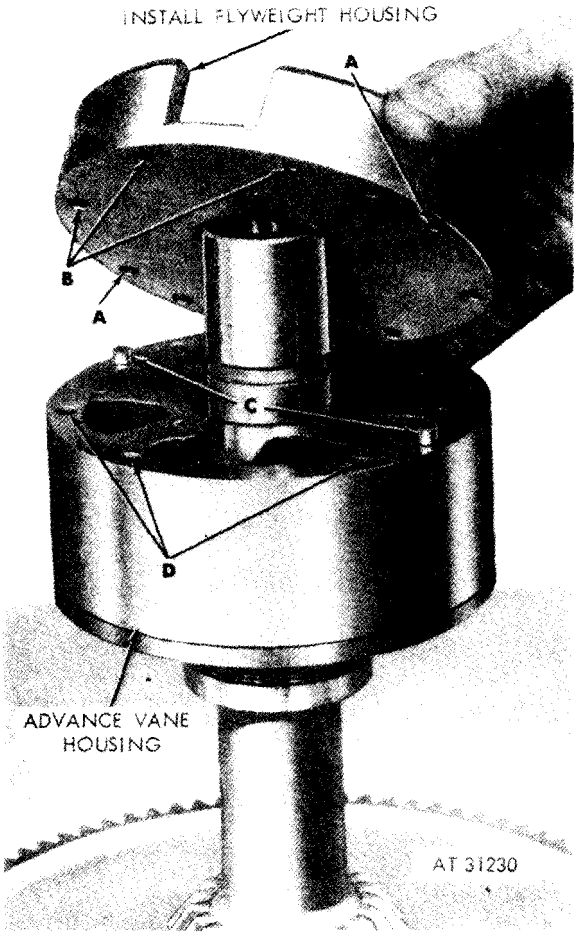
Figure 6-192. Pressing drive gearshaft ball bearing on drive gearshaft.



1. Position advance vane housing (A), with vane and seals (fig. 6-183), on advance vane housing cover.
2. The alinement dots on gearshaft spline (B) must aline with the dots on the vane spline (C).
3. The vane must have end clearance of 0.00l-inch. If vane splines (C) have a snug fit on the accessory drive gearshaft splines (B), insert a 0.001 inch feeler gage between vane and vane housing cover. Gently tap vane until proper end play is obtained, then remove feeler gage.
4. Mate dowel pin holes (D) in vane housing with dowel pins (E) in cover and housing bolt holes (F) with cover bolt holes (G). Tap housing lightly with a soft hammer to seat dowel pins.

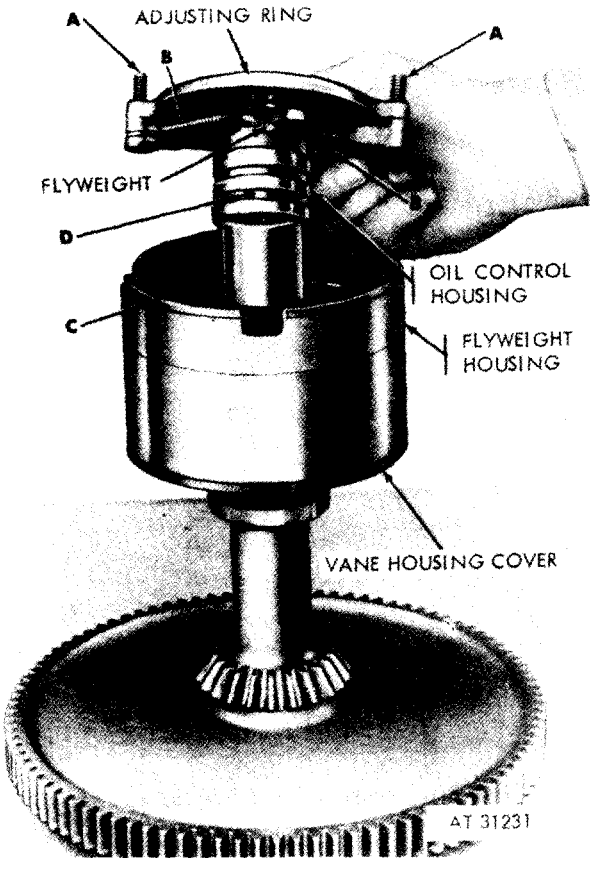
Note. Dowel pins and dowel pin holes will aline in two positions. However, the bolt holes in cover and housing will aline in one position only. Make certain that cover and housing are correctly positioned so that bolt holes are alined.

Figure 6-193. Installing advance vane housing and vane.



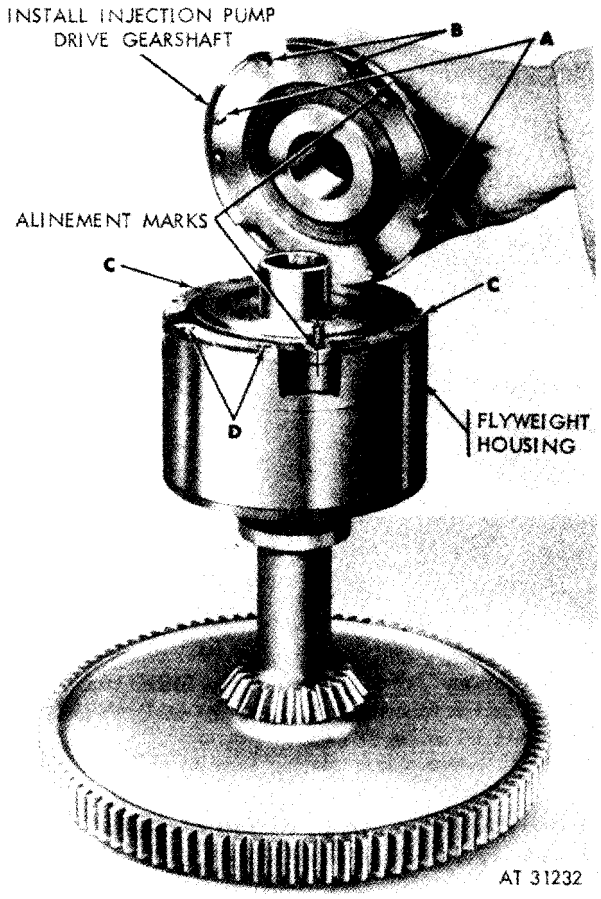
1. Position flyweight housing on advance vane housing.
2. Mate dowel holes (A) with dowel pins (C) and bolt holes (B) with bolt holes (D). (Refer to note fig. 6-193.)
3. Tap flyweight housing lightly with a soft hammer to seat dowel pins.

Figure 6-194. Installing flyweight housing.



1. Install two flyweights on adjusting ring with flyweight pins (A) installed. Flyweights must be installed in their original positions to assure proper operation.
2. Hook flyweight extension helical springs (B) to flyweights.
3. Spread flyweights against springs and install oil control housing in adjusting ring so the slots in control housing are alined with flyweight pins.
4. Install the assembled adjusting ring, oil control housing, and flyweights on accessory drive bevel gearshaft (C). Oil hole (D) in lower groove of oil control housing must aline with dot in gearshaft (C).

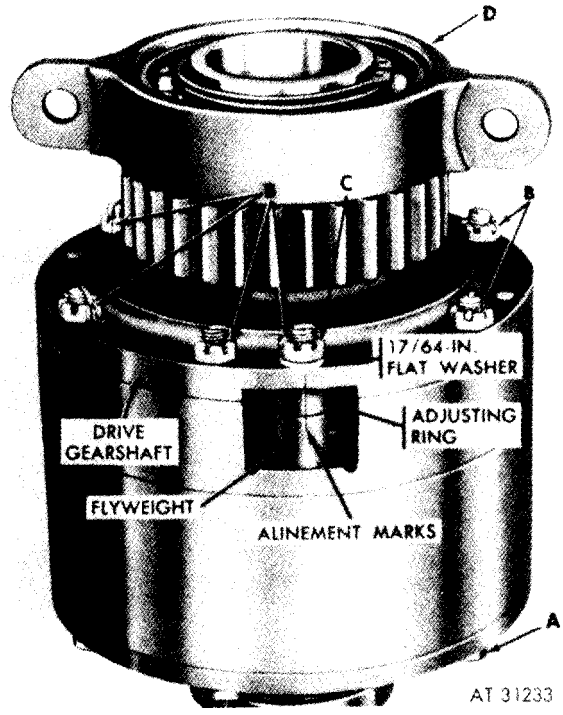
Figure 6-195. Installing advance flyweight adjusting ring and flyweight.



1. Position the assembled injection pump drive gearshaft on flyweight housing.
2. Mate dowel pins (A) and bolt holes (B) in gearshaft with dowel pin holes (C) and bolt holes (D) in housing. (Refer to note fig. 6-193).

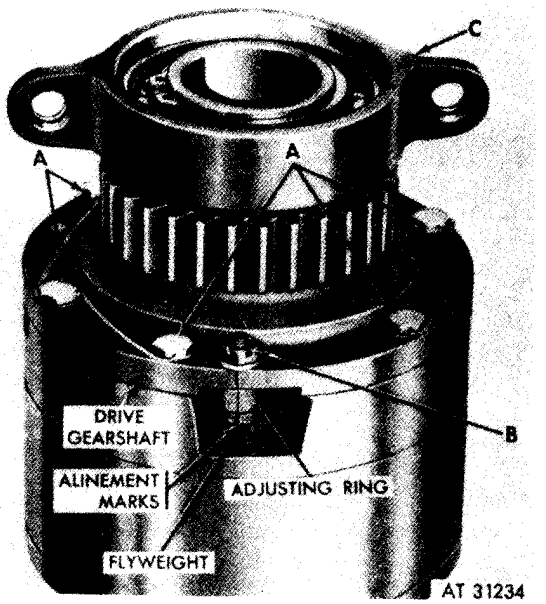
Note. The scribe line on gearshaft flange and adjusting ring boss must be alined. (Refer to note 6-175.)

Figure 6-196. Installing injection pump drive gearshaft.



1. Position six bolts (A) through advance vane housing cover, housing, flyweight housing, and drive gearshaft flange and install six slotted nuts (B) and cotter pins. Install locking wire securing bolts.
2. Move the adjusting ring to aline scribe marks on ring, flyweight, and drive gearshaft flange. Install two slotted nuts (C), flat washers, and cotter pins and flyweight pins securing adjusting ring.
3. Install intermediate bearing support (D).

Figure 6-197. Installing advance flyweight adjusting ring and injection pump drive gearshaft attaching parts (adjusting ring secured with nuts).



1. Install six bolts (A) through gearshaft flange, flyweight housing, advance vane housing, and secure in vane housing cover. Install locking wire securing bolts.
2. Move the adjusting ring to aline scribe marks on ring, flyweight and drive gearshaft flange. Install two slotted nuts (B), flat washers, and cotter pins on flyweight pine securing adjusting ring.
3. Install intermediate bearing support (C).

Figure 6-198. Installing advance flyweight adjusting ring and injection pump drive gearshaft attaching parts (adjusting ring secured with bolts).

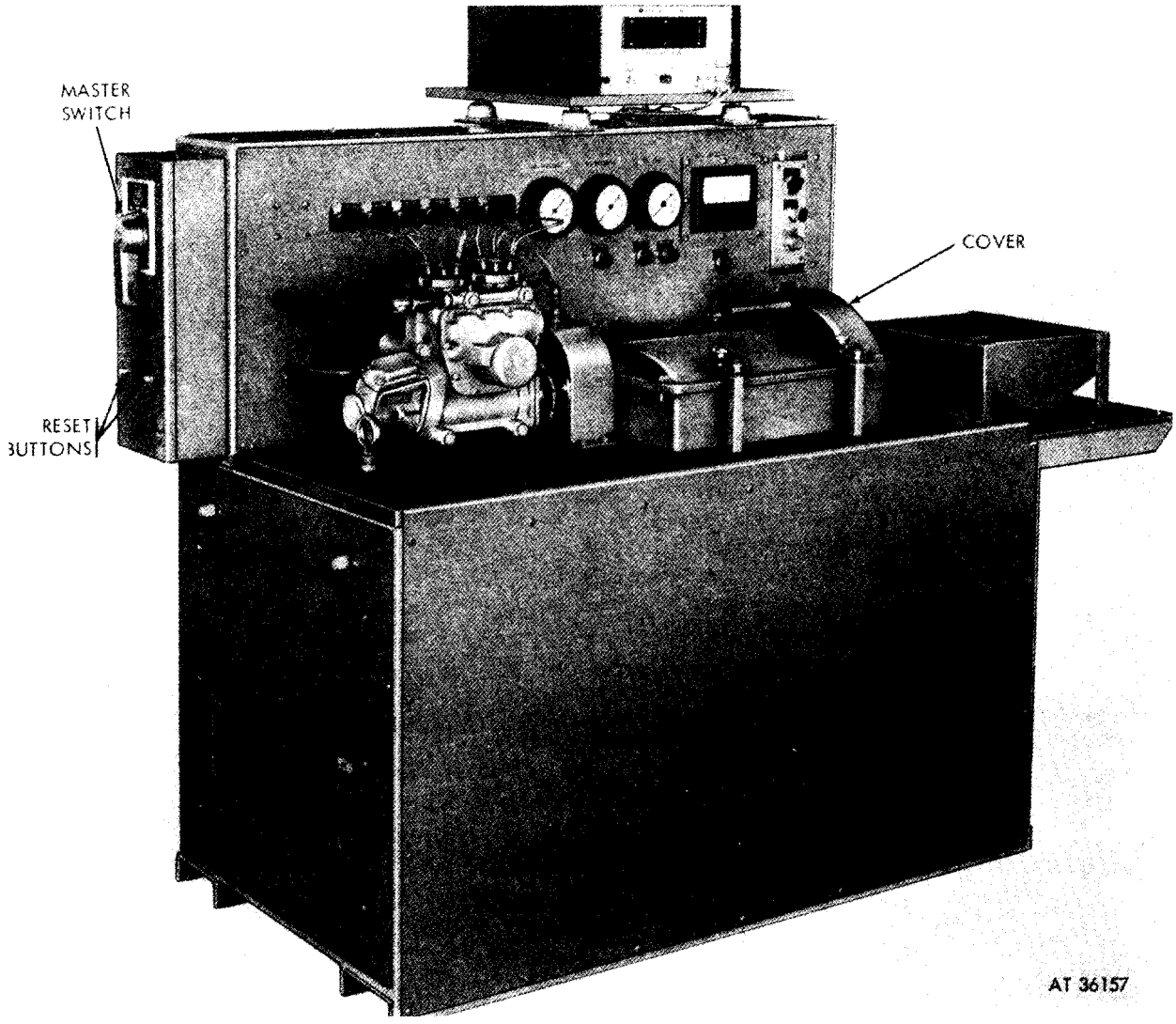
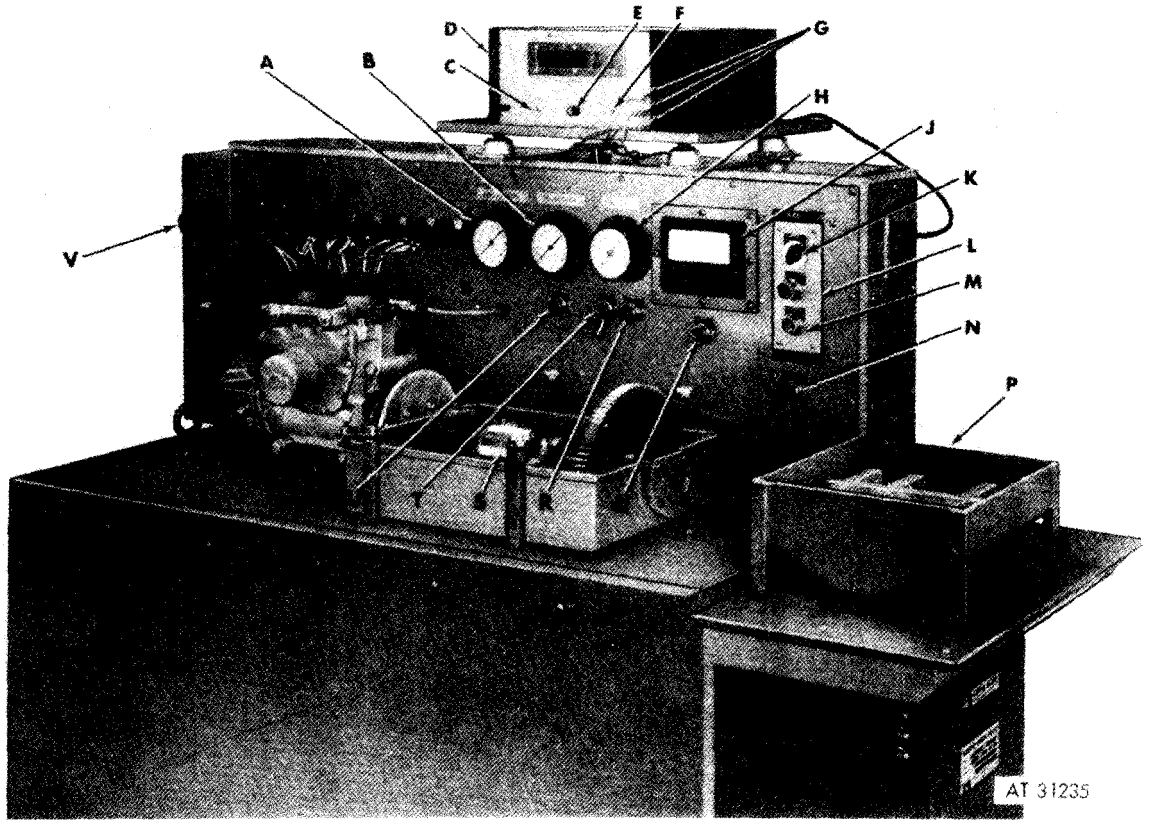


Figure 6-199a. Test stand assembly-FSN-4910-986-9873.

(4) *Testing fuel injection pump advance assembly using test stand - 4910-986-9873.* Testing of fuel injection pump advance assembly is required on all units that have been overhauled to insure optimum engine performance. This testing will be accomplished prior to assembly of the engine rear fan and accessory drive housing assembly. The test stand is designed to check and bench test the advance characteristics of the fuel injection pump advance assembly, under conditions simulating engine operation over an operating range of 200 to 2600 RPM. The advance assembly is mounted in bearing supports which simulate the mounting on the engine, and is loaded by using a basic AVDS-1790 series engine fuel injection pump which is coupled to a drive gear. The test stand is instrumented to permit direct observation of the advance assembly operating characteristics and adjustments may be made to the advance assembly without removing it from the test stand. Procedures for bench testing the advance assembly are as follows and covered in figures 6-199a through 6-201:



A. Fuel pressure indicator gage
B. Oil pressure indicator gage
C. Electronic counter switch
D. Electronic counter
E. Fuse
F. Reset button
G. Magnetic pickup cable
H. Oil temperature dial thermometer
J. Electronic tachometer
K. Speed regulator control
L. Jog run switch (clutch engage)
M. Stop switch (clutch disengage)
N. Power indicator light
P. Drain tank
Q. Motor switch
R. Heat indicator light
S. Fuel injector advance assembly
T. Oil heater switch
U. Oil drain push switch
V. Master switch

Figure 6-199b. Test stand with coupling guard and housing cover removed.

(a) Check fuel level and oil level gages (figure 6-199c). Fill supply tank (s) if either gage indicates less than half full (use oil, specification MIL-L-45199 (Grade 30) or fuel, specification VV-L-800).

(b) Check to insure that the master switch, the oil heater switch, the jog run (clutch engage) switch, and the motor switch are all in the "OFF" position and that the speed regulator control is at zero (0).

(c) Turn master switch handle to the "ON" position. Note that power indicator light comes on. If power indicator light does not light, press the reset buttons. If light still does not operate, investigate and correct the deficiency before starting.

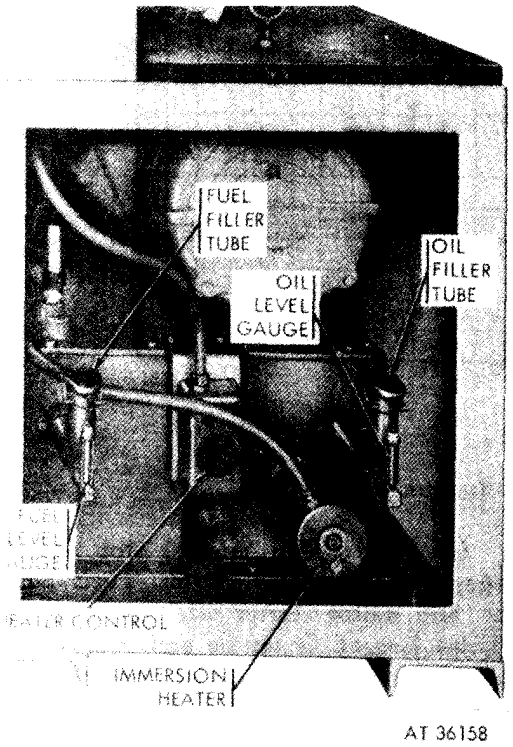


Figure 6-199c. Test stand heater control and supply tanks.

(d) Turn oil heater (thermostat) control, figure 6-199c, to a setting of 250 degrees and turn oil heater switch, figure 6-199b "ON". The oil heater indicator lamp will light when the heater switch is turned on and will go out when the oil has reached the selected oil temperature heater control setting (250 degrees).

(e) Turn the electronic counter switch, figure 6-199b, "ON". The electronic components in the counter will reach operating temperature by the time the test is begun.

(f) Loosen fasteners and remove fuel injection pump drive housing cover from top of test stand. Remove the two bearing caps and intermediate bearing support from the mounting fixture, figure 6-201.

(g) Install retaining ring on oil retaining shaft. Install short (stub) end of oil retaining shaft in driven (small) end of the advance assembly. Install support over bearing on large gear end of advance assembly and install advance assembly in bearing supports of mounting fixture and secure with hardware removed above. Install drive housing cover and secure with fasteners.

Caution: The fuel injector pump advance assembly drive housing cover must always be installed and secured before operating test stand.

(h) Push jog run (clutch engage) switch to engage eddy current clutch and turn speed regulator control to obtain advance assembly speed of 300 rpm on tachometer. Turn speed regulator control clockwise to increase rpm.

(i) Observe oil and fuel pressure indicator gages, figure 6-199b. These gages should register more than zero (0); however, maximum pressures will not be evident until a speed of 2000 rpm is obtained.

Caution: Turn master switch handle "OFF" if there is no indication of oil or fuel pressure on the gages. Investigate and correct the deficiency before starting the test.

(j) Operate test stand at 300 rpm until the oil temperature dial thermometer (H) stabilizes at 250 degrees. It may require several minutes to warm the entire system to operating temperature. Note and record electronic counter (K) reading (illuminated decimal digits on the front of the counter panel).

(k) Press oil drain push switch, located immediately below the oil pressure indicator gage. The gage should register zero (0) psi with the switch depressed. observe the counter reading. If the counter has changed more than one (1) degree, the advance assembly requires adjustment.

(1) Release oil pressure drain switch. Turn speed regulator control clockwise to increase the speed to 600 rpm. Note and record the

counter reading at each 200 rprn increment increase, beginning at 600 rpm and continue through to 2600 rpm.

(m) Reduce speed to 600 rpm and re-check counter reading. If this reading does not check with the original repeat the test. Check the readings taken at each 200 rpm increase against similar points on the approved advance unit curve, figure 6-200. If the recorded advance readings fall within the prescribed limits on the curve, the test is complete. If the advance readings do not meet the curve limits, proceed with step (p) below.

(n) Turn speed regulator control to zero (0), figure 6-199b, to reduce speed and counter switch, motor switch, and master switch handle to the "OFF" position.

Note. Injector pump advance assembly will be hot following test. Operator should wear gloves when removing unit from test stand.

(o) Loosen fasteners and remove cover. Remove bearing caps and remove unit from bench. Remove oil transfer shaft. Place injector advance pump assembly on oil drain tray with small gear end up. Place advance assembly in a clean dirt-free container, preferably a polyethylene bag, for storage after draining and cooling.

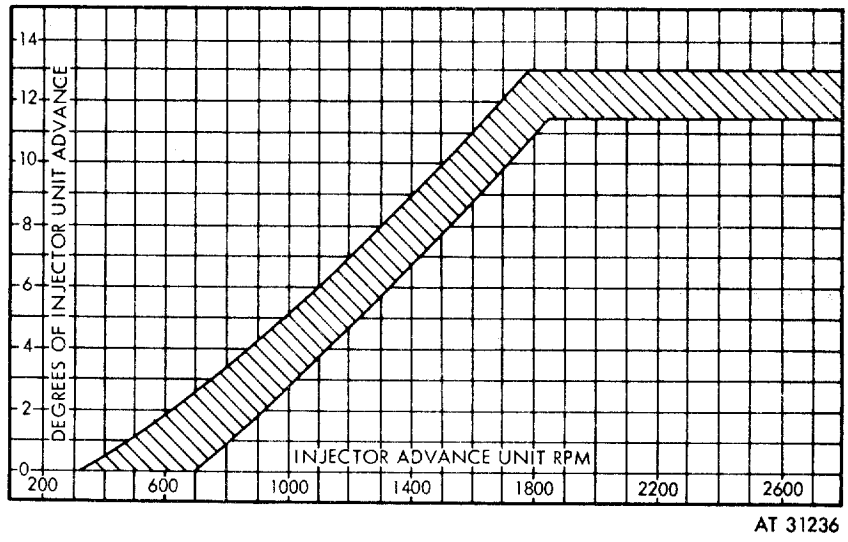


Figure 6-200. Fuel injector advance unit curve.

(p) Repeats steps (h) through (m) to check previous readings. If advance assembly fails to pass the test, it must be adjusted. Note whether advance assembly advances too soon or too late. Either condition can normally be corrected by rotating the advance flyweight adjusting ring.

Note. The advance assembly should be retarded slightly if the advance varies more than 2 degrees at 300 rpm when the oil pressure drain button is depressed. This variance indicates the mechanical retard stop is not in phase with the hydraulic valve.

(r) Push speed control stop switch to disengage eddy current clutch. Turn counter, motor, and motor starter off.

(s) Loosen fasteners and remove cover. Remove two cotter pins, and loosen the two slotted nuts enough to permit adjusting ring rotation. See figure 6-201.

Note. Do not turn the adjusting ring more than 1 / 16 of an inch during any one adjustment.

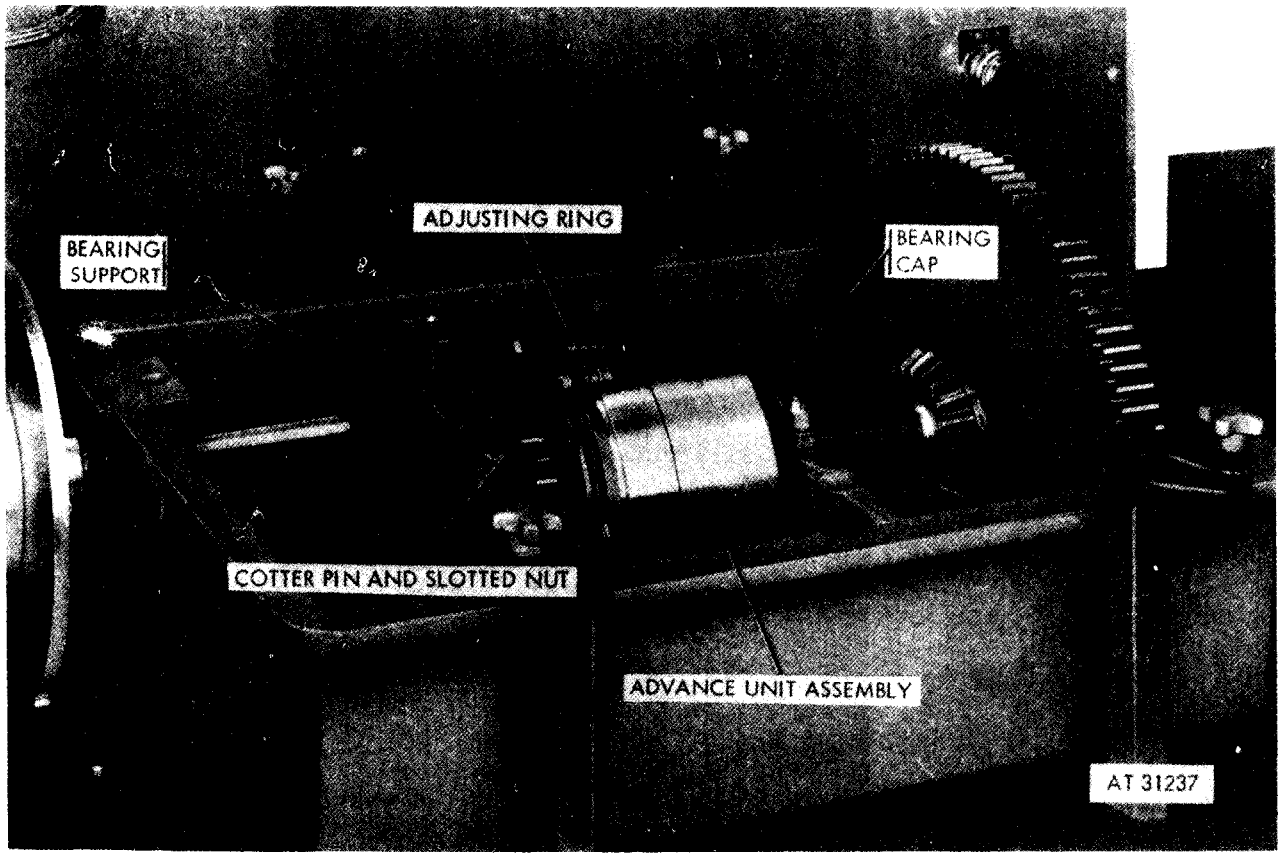
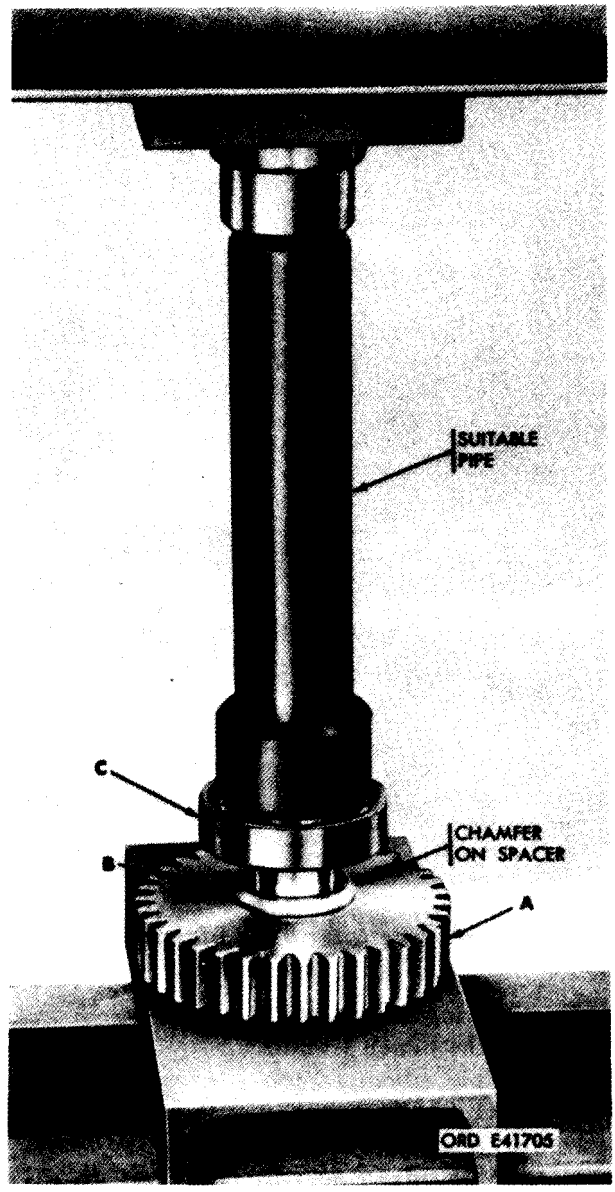


Figure 6-201. Fuel injection pump advance assembly adjusting ring.

(t) Rotate the adjusting ring (fig. 6-201) 1 / 16-inch toward the rear of the bench (retard position) if the advance assembly advanced too soon. Move the adjusting ring 1 / 16-inch in the opposite direction (advance position) toward operator, if the advance assembly advanced too late. Tighten the slotted nuts, install cover and repeat steps (c) through (h), above. When advance readings are within the prescribed limits. the advance assembly may be removed from the bench as outlined in step (i), above. Secure the adjusting ring slotted nuts with cotter pins.

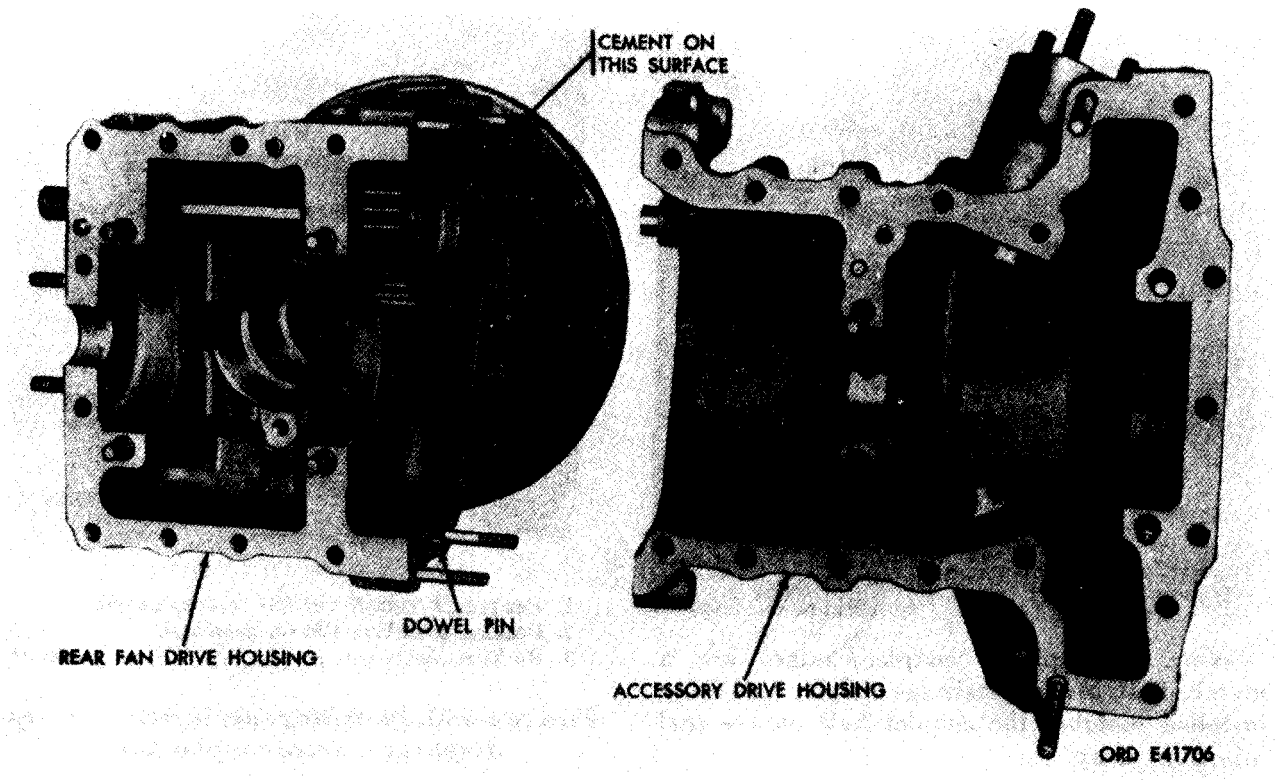
Note. If the advance assembly cannot be properly adjusted as outlined above, the flyweight springs must be checked in accordance with the limits specified in table 6-31.

(5) *Rear fan and accessory drive assembly.* Refer to figures 6-154, 6-155, 6-188, 6-151, 6-152, 6-153, 6-189, 6-190, 6-172, 6-202 6-170 through 6-168, 6-203, 6-153, or 6-152, 6-204 or 6-205, 6-164, or 6-162, 6-161 through 6-159.



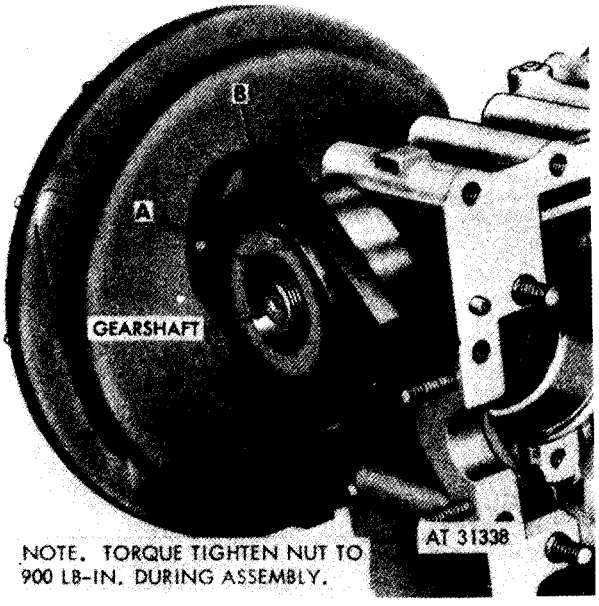
1. Position fuel injection pump spur gearshaft (A) in an arbor press.
2. Position bearing spacer (B) with chamfer up (toward threaded end of shaft}.
3. Press ball bearing (C) on gearshaft using pipe of a suitable size as an improvised pressing arbor.

Figure 6-202. Pressing driven gearshaft ball bearing on spur gearshaft.



Note. Apply a thin coat of gasket cement, Specification MIL-C-10523 (ORD), to the mating surface of the rear fan drive housing.

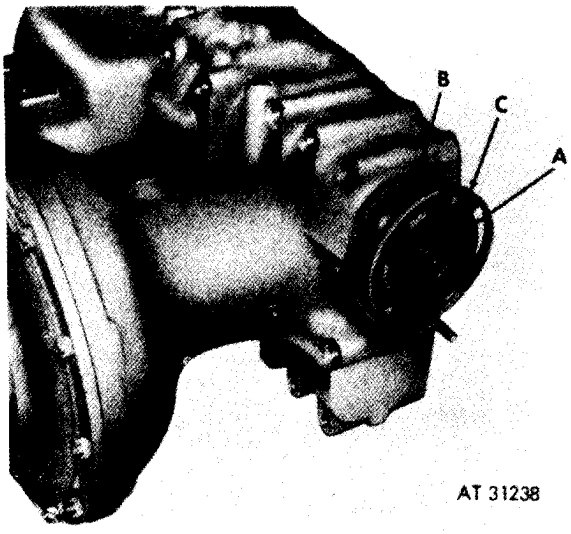
Figure 6-203. Assembling rear fan and accessory drive housing.



Note. The splined coupler halves are a matched set. Make certain the coupler half being installed matches the coupler half on the fuel injection pump.

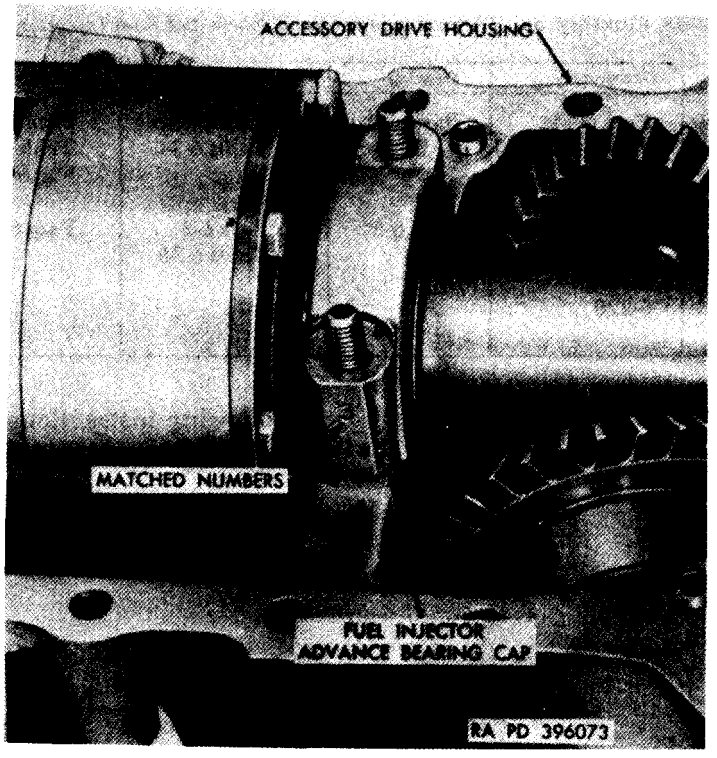
1. Position Woodruff key (A) in spur gearshaft.
2. Position coupler half (B) on spur gearshaft.

Figure 6-204. Installing fuel injection pump splined drive coupler half.



1. Position Woodruff key (A) in spur gearshaft.
2. Position pilot ring (B) on gearshaft.
3. Position diaphragm coupler half (C) on gearshaft.

Figure 6-205. Installing fuel injection pump diaphragm drive coupler half.



Note. Before installing assembled fuel injection advance assembly and fan drive bevel gearshaft, check gearshaft backlash and re-shim as necessary (fig. 6-189). Be sure bearing cap and accessory drive housing stamped numbers correspond to their proper location before assembling.

Figure 6-206. Installing fuel injection advance bearing cap.

Section X. OVERHAUL OF CAMSHAFT AND THROTTLE CONTROL CROSS SHAFT AND FUEL INJECTION PUMP LINKAGE

6-43. General

a. This section covers the overhaul of the cam shafts and throttle control cross shaft and fuel injection pump linkage. Specific instructions on disassembly, cleaning, inspection, repair, and assembly accompany the overhaul operations. Overhaul standards of individual components follow the inspection procedures. Stud identification information is included in the repair procedures where applicable. Refer to the following table (table 6-33) for applicable illustrations and instructions for overhaul operations.

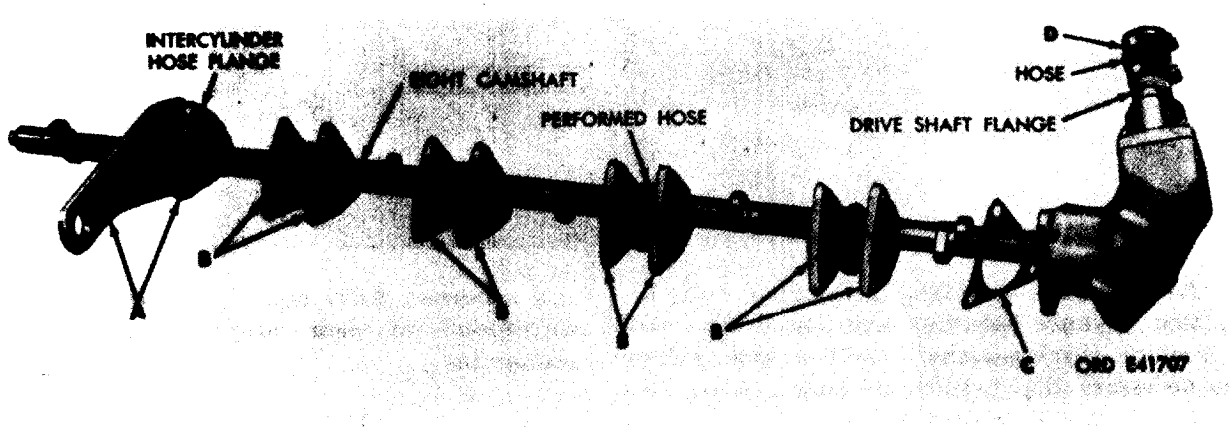
b. Overhaul of the right and left camshafts is similar. For instructional purposes, procedures for the right camshaft will be illustrated with references to the left camshaft only where overhaul procedures vary.

Table 6-33. Camshaft and Throttle Control Cross Shaft and Fuel Injection Pump Linkage

Component	Disassembly	Cleaning	Inspection	Repair	Assembly
Camshaft and Associated Parts	Para 6-44a Figs. 6-207 through 6-213	Para 6-2	Para 6-44c Table 6-34	Para 6-44c Table 6-35 Fig. 6-214	Para 6-44d Figs. 6-213 through 6-207
Throttle Control Cross Shaft and Fuel Injection Pump Linkage	Para 6-45a Figs. 6-215 through 6-220	Para 6-2	Para 6-3 Table 6-36	Para 6-4	Para 6-45d Figs. 6-220 through 6-215

6-44. Overhaul of Camshaft

a. Disassembly. Disassemble camshaft following instructions which accompany figures 6-207 through 6-213.



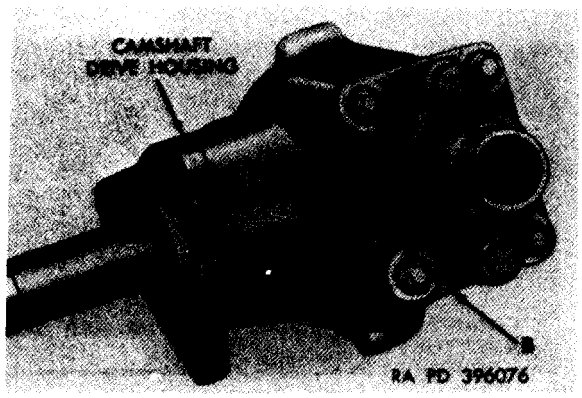
Remove

1. Remove lifting eye (A), preformed hose, and intercylinder hose flange, and separate the liiting eye and flange from hose.
2. Remove the remaing four groups of intercylinder hose flanges (B) and preformed hoses and separate tbe flanges from hoses.
3. Remove and discard the camshaft end cover plate gasket (C).
4. Remove two hose clamps (D) and the rubber hose from camshaft drive shaft flange.

Install

1. Position rubber hose on camshaft drive abaft flange and install two hose clamps (D).
2. Position a new camshaft end cover plate gasket (C) on camshaft.
3. Position two intercylinder hose flanges (B) on each of four preformed hoses and position hose assemblies on camshaft.
4. position lifting eye (A) and remaining intercylinder hose flange on remaining preformed hose and position hoee assembly on camshaft.

Figure 6-207. Removing or installing lifting eye, intercylinder hose flanges, and hoses.



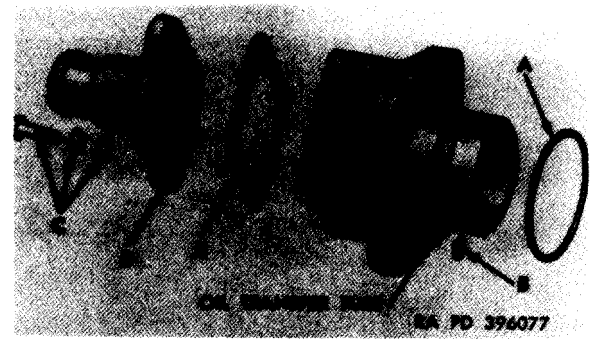
Remove

1. Remove four self-locking nuts (A) and flat washers.
2. Remove camshaft drive adapter (B) and associated parts as a unit from camshaft drive housing.

Install

1. Position camshaft drive adapter (B) and associated parts as a unit on camshaft drive housing.
2. Install four self-locking nuts (A) and flat washers.

Figure 6-208. Removing or installing camshaft drive adapter and associated parts.



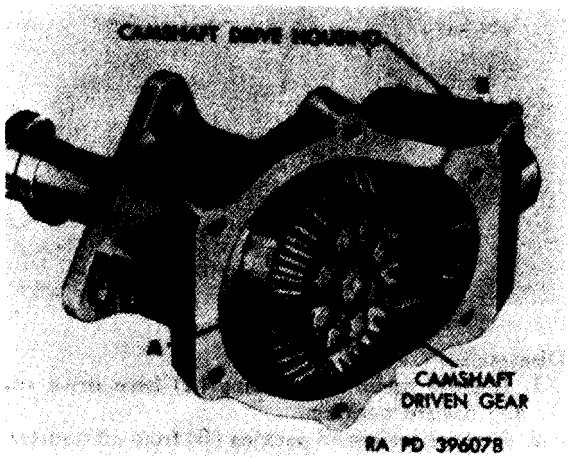
Disassemble

1. Remove preformed packing (A) from drive adapter and discard packing.
2. Remove preformed packing (B) from oil transfer tube in drive adapter and discard packing.
3. Remove two bolts (C), lock washers, and flat washers.
4. Remove camshaft drive shaft flange (D).
5. Remove and discard camshaft drive shaft flange gasket (E).

Assembly

1. Position a new camshaft drive shaft flange gasket (E) on camshaft drive adapter.
2. Position camshaft drive shaft flange (D) on drive adapter.
3. Install two bolts (C), lock washers, and flat washers.
4. Position a new preformed packing (B) on oil transfer tube in drive adapter.
5. Position a new preformed packing (A) on drive adapter.

Figure 6-209. Disassembling or assembling camshaft drive adapter and associated parts.



Remove

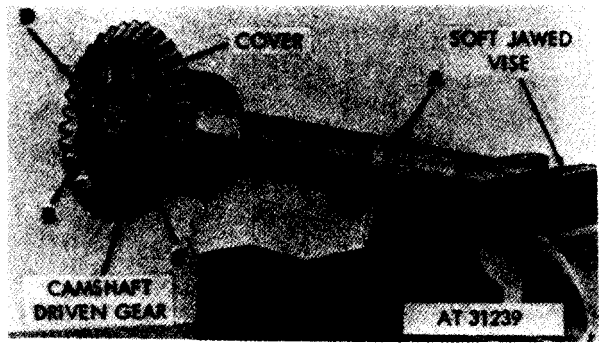
Note. It will be necessary to move the camshaft drive gear away from the camshaft driven gear to gain clearance for removal of the camshaft assembly.

1. Remove right camshaft assembly (A) from camshaft drive housing.
2. Remove camshaft drive gearshaft (B),

Install

1. Position camshaft drive gearshaft (B) in camshaft drive housing.
2. Position right camshaft assembly (A) in camshaft drive housing.

Figure 6-210. Removing or installing right camshaft assembly.



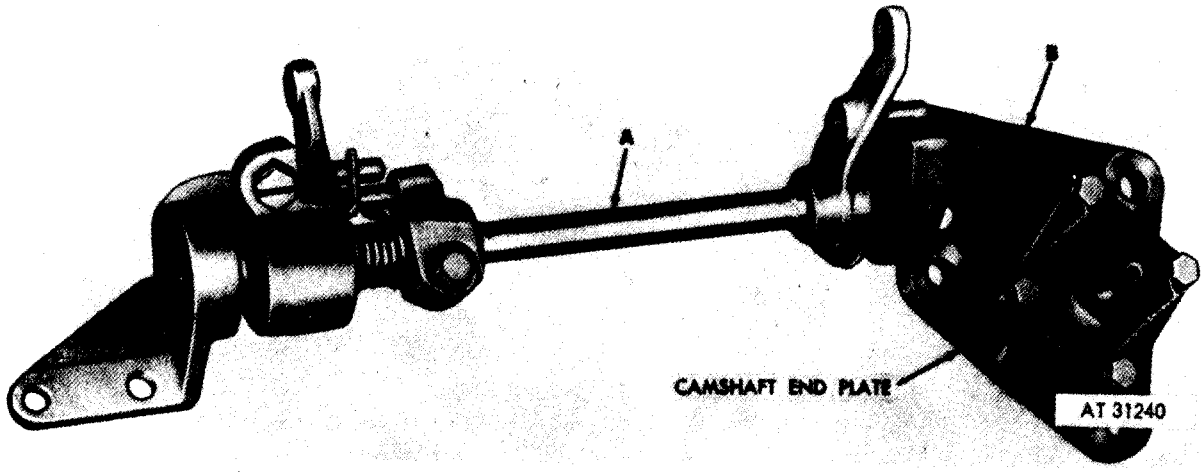
Disassemble

1. Place camshaft (A) assembly in a soft-jawed vise.
2. Cut locking wire and remove eight drilled head bolts (B).
3. Remove gear cover (C).
4. Remove camshaft driven gear (D).

Assemble

1. Place camshaft (A) in a soft-jawed vise.
2. Position camshaft driven gear (D) on camshaft.
3. Position gear cover (C) on camshaft.
4. Install eight drilled head bolts (B) and install locking wire securing bolts.

Figure 6-211. Disassembling or assembling camshaft assembly.



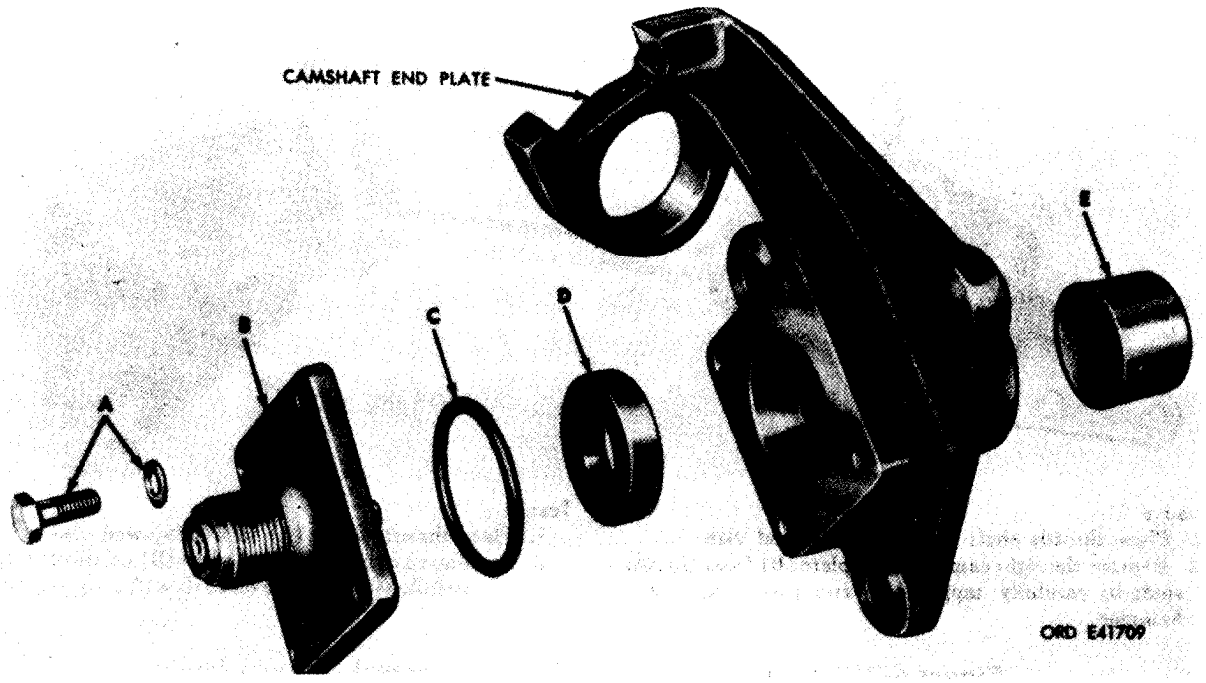
Remove

1. Place throttle shaft (A) in a soft-jawed vise.
2. Remove the right camshaft. end plate (B) from throttle shaft by carefully tapping on end plate with a soft hammer.

Install

1. Place throttle shaft (A) in a soft-jawed vise.
2. Position right camshaft end plate (B) on throttle shaft aud carefully tap end plate on shaft with a soft hammer.

Figure 6-212. Removing or installing right camshaft end plate.



Disassemble

Note. The left camshaft cover plate assembly and associated parts are similar to the right cam shaft cover plate and may be disassembled in a similar manner.

1. Cut locking wire and remove four cap screws (A) and flat washers.
2. Separate and remove tachometer drive adapter (B) from camshaft end plate.
3. Remove and discard preformed packing (C).
4. Remove, and discard camshaft end plate oil seal (D).
5. Remove bushing-type bearing (E) only if inspection (para. 6-44c) indicates the need for replacement. To remove, press bearing from end plate.

Assemble

1. If bushing-type bearing (E) was removed, press bearing into camshaft end plate.
2. Position a new camshaft end plate oil seal (D) in end plate.
3. Position a new preformed packing (C) in tachometer drive adapter (B).
4. Position tachometer drive adapter (B) on camshaft end plate.
5. Install four cap screws (A) and flat washers and install locking wire securing screws.

Figure 6-213. Disassembling or assembling right camshaft cover plate.

b. Cleaning. Refer to paragraph 6-2.

c. Inspection and Repair. Refer to paragraphs 6-3 and 6-4, and (1) through (3), below.

(1) Inspect bushing-type bearing in camshaft end plate to limits specified in overhaul standards (table 6-34).

(2) Refer to paragraph 6-4e and table 6-35 when replacing studs.

(3) Inspect and repair camshaft as follows and as shown in figure 6-214.

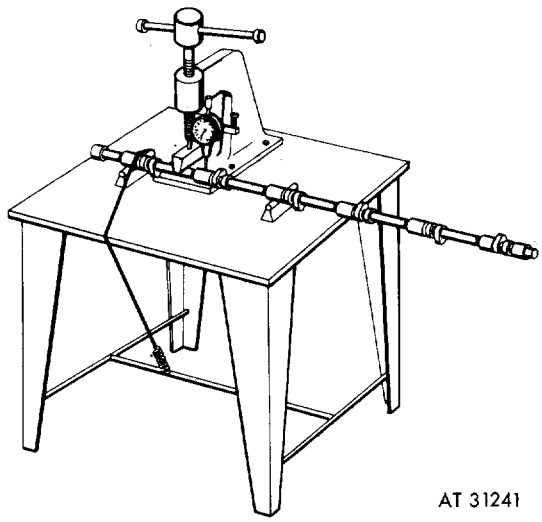


Figure 6-214. Improvised camshaft trueing device.

(a) *Checking camshaft bearing journal run-out.* Camshafts may be straightened if the runout of any one camshaft bearing surface (journal), when using a dial indicator, does not exceed 0.060 inch total indicator reading (TIR) when supported at the two adjacent bearing journals. Camshafts that exceed 0.060 inch runout between any two journals must be discarded. Maximum journal runout of straightened camshafts is 0.002 inch (TIR) when supported at the two adjacent journals. After straightening a camshaft, the maximum acceptable runout of the center bearing journal, when supported at the end journals, is 0.015 inch (TIR). Check camshaft bearing journal runout as follows:

(1) Support the camshaft at the two end journals in "V" blocks on a surface plate or other available centering device, such as a machine lathe.

(2) Position a dial indicator at the center bearing journal and obtain a zero reading on the dial.

(3) Rotate the camshaft and determine the maximum travel of the dial indicator needle. If travel (TIR) exceeds 0.015 inch the camshaft must be straightened.

(4) Repeat steps *(2)* and *(3)*, above for each bearing journal and mark position and dimension of maximum dial indicator reading at each journal.

(5) Check runout of each camshaft bearing journal. Support the camshaft in "V" blocks at the adjacent journals, and using a dial indicator, check and record journal runout (TIR) dimensions. If runout exceeds 0.002 inch, cam shaft must be straightened.

(b) *Straightening camshaft.*

(1) Install camshaft on trueing device with bearing journal having the maximum runout (TIR) positioned under the pressing spindle. (The camshaft journals must be resting on the support blocks when rotating the camshaft to determine the runout.) Set dial on indicator to "zero" and rotate camshaft to determine location of runout (TIR) and record reading.

(2) Turn camshaft until bearing journal marked to indicate the maximum runout (high side) is adjacent to the spindle (do not press on journals). Apply spindle pressure on the camshaft until dial indicator reads approximately one half of the TIR reading recorded in (a), above. Release pressure on cam shaft and recheck runout by turning camshaft several revolutions.

Note. Pressing force required to straighten cam shaft is a matter of judgement. It may be necessary to turn camshaft and apply pressing force several times in order to acquire the technique necessary to true the bearing journal.

(3) Apply pressure as required until the journal is within the 0.002 maximum TIR.

(4) Reposition camshaft on supports and true other bearing journals is a similar manner.

(5) After trueing all bearing journals, recheck camshaft as outlined in procedure (a), above. If readings do not meet dimensions specified, repeat trueing operation.

(c) *Inspection of camshaft after straightening.*

(1) Magnaflux each camshaft and inspect for cracks. Observe transition areas at bearing surfaces and at cam lobe bases. Camshafts with evidence of cracks must be discarded.

(2) Inspect for damage to bearing journals. Minor nicks and scratches can be removed using crocus cloth.

(3) Check bearing journals for out-of-round to be certain area was not flattened during trueing. Maximum acceptable out-of-round is 0.002 inch (TIR). Replace camshaft if this tolerance is exceeded.

Table 6-34. Camshafts and Drives Overhaul Standards

Component	Fig No.	Ref. letter	Point of measurement	Sizes and fits of new Parts		Wear limits
Camshafts	B-5	L	Outside diameter of journal on camshaft	1.3090	1.3100	1.3085
	B-4	X	Inside diameter of camshaft bearing in cylinder	1.3120	1.3130	1.3135
	B-4	X-L	Fit of journal in bearing	0.0020L	0.0040L	0.0050L
	B-5					
	B-5		Maximum out-of-round of camshaft journal (full indicator reading)	0.0010		0.0020
	B-5		Maximum runout of center journal when supported on end bearing (full indicator reading)	0.0020		0.0150
	B-5	N	Outside diameter of camshaft pilot bearing at end plate	1.3090	1.3100	*
	B-5	Q	Inside diameter of split bushing-type bearing in camshaft end plate	1.3120	1.3130	*
	B-5	Q-N	Fit of camshaft pilot in end plate bushing-type bearing	0.0020L	0.0040L	*
	B-5	M	Camshaft lobe lift	0.4030	0.4090	0.4000
Camshafts	B-5	K	Outside diameter of large journal on end of camshaft	2.4965	2.4975	2.4960
	B-5	G	Inside diameter of bearing surface in camshaft gear housing	2.5000	2.5010	2.5020
Upper camshaft drive quill bevel gearshafts	B-5	G-K	Fit of journal in bearing	0.0025L	0.0045L	0.0065L
	B-5	B	Outside diameter of hub on gearshaft	1.6220	1.6230	1.6210
	B-5	F	Inside diameter of bore in upper adapter	1.6250	1.6260	1.6270
	B-5	F-B	Fit of hub in adapter bore	0.0020L	0.0040L	*
	B-5	C	Inside diameter of hub on gearshaft	1.2710	1.2720	*
	B-5	E	Outside diameter of upper oil transfer plug	1.2700	1.2705	*
	B-5	E-C	Fit of plug in hub	0.0005L	0.0020L	*
Camshaft drive quills	B-5	A	Inside diameter of quill (both ends)	0.6295	0.6305	0.6320
	B-5	D	Spherical outside diameter of upper oil transfer plug	0.6275	0.6280	0.6265
	B-5	D-A	Fit of upper quill plug in quill bore	0.0015L	0.0030L	0.0060L
	B-26	UU	Spherical outside diameter of lower oil transfer plug	0.6275	0.6280	0.6265
Camshaft drive quills	B-26	UU-A	Fit of lower quill plug in quill bore	0.0015L	0.0030L	0.0060L
	B-5					
Camshaft end plate	B-5	J	Outside diameter of oil seal	1.5010	1.5050	*
	B-5	H	Inside diameter of camshaft end plate	1.4990	1.5000	*
	B-5	H-J	Fit of oil seal in end plate bore	0.0010T	0.0060T	*

Note. Refer to paragraph 6-3b for explanation of symbols.

Table 6-35. Camshaft Drive Housing and Cover Plate Standard and Oversize Stud Identification

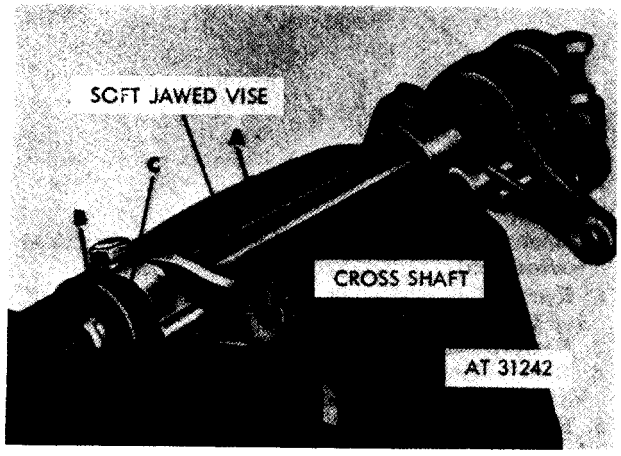
Fig. No.	Ref. No.	Setting height	No. req'd	Stud size Length
B-5	29	1-5 / 32	8	3 / 8-16 (15 / 16) x 3 / 8-24 (13 / 16) x 1-15 / 16 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)
B-5	40	3 / 4	4	1 / 4-20 (19 / 32) x 1 / 4-28 (21 / 32) x 1-5 / 16 (STD) (0.003 in. OS) (0.007 in. OS) (0.012 in. OS)

Note. Refer to figure 6-1 for oversize stud identification.

d. Assembly. Refer to figures 6-213 through 6-207.

6-45. Overhaul of Throttle Control Cross Shaft and Fuel Injection Pump Linkage

a. Disassembly. Disassemble throttle control cross shaft and fuel injection pump linkage following instructions which accompany figures 6-215 through 6-220.



Remove

1. Place the throttle control cross shaft and fuel injection pump linkage (A) in a soft-jawed vise.
2. Remove retaining ring (B).
3. Remove ball bearing (C) as shown in figure 6-216.

Install

1. Place the throttle control crow shaft and fuel injection pump linkage (A) in a soft-jawed vise.
2. Install ball bearing (C) on cross shaft.
3. Install retaining ring (B).

Figure 6-215. Removing or installing camshaft end plate ball bearing retaining ring and ball bearing.

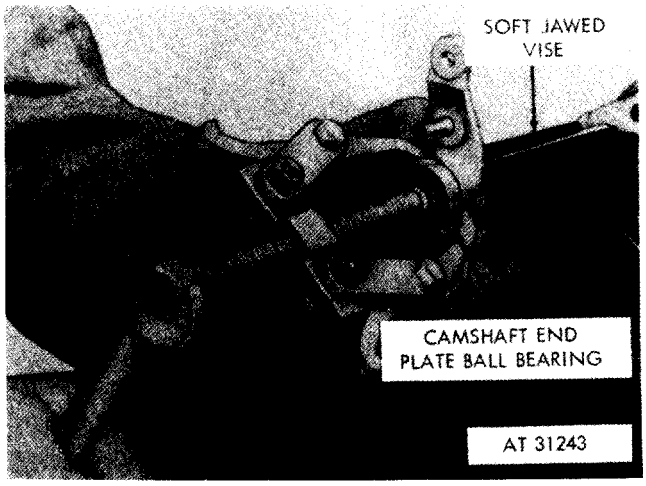
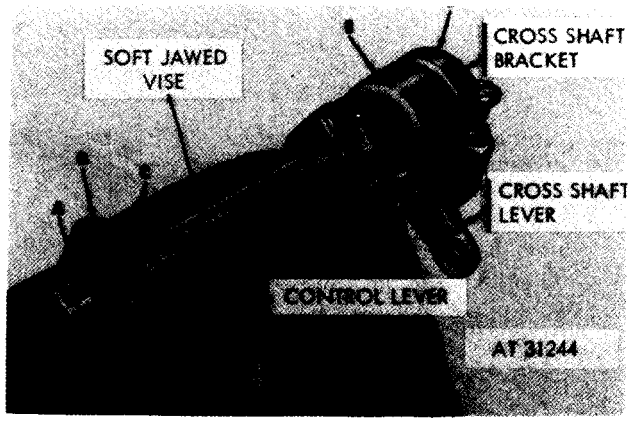


Figure 6-216. Removing camshaft end plate ball bearing.



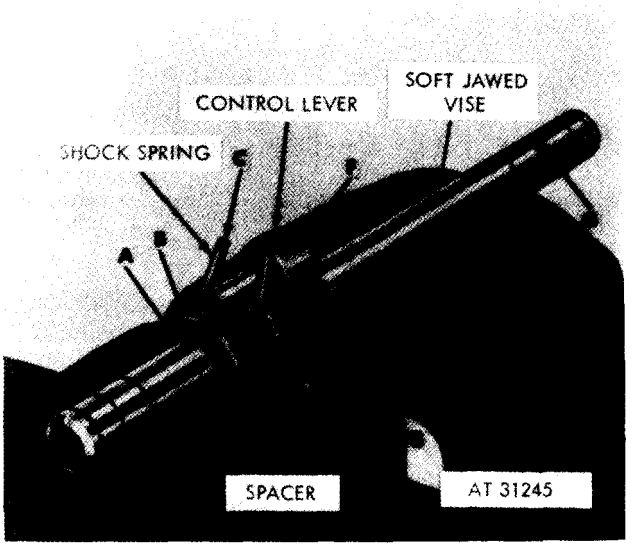
Remove

1. Remove camshaft end plate bearing inner retaining ring (A).
2. Remove cap screw (B) and lock washer (or assembled washer bolt).
3. Remove control lever (C) from cross shaft.
4. Remove cross shaft bracket bearing retaining ring and bracket (D) with bearing as shown in figures 6-215 and 6-216.
5. Remove cross shaft lever bearing retaining ring and lever (E) with two bearings as shown in figures 6-215 and 6-216.

Install

1. Install cross shaft lever (E) with bearings, and retaining ring as shown in figure 6-215.
2. Install cross shaft bracket (D), with bearing, and retaining ring as shown in figure 6-215.
3. Install control lever (C) on cross shaft.
4. Install cap screw (B) and lock washer.
5. Install camshaft end plate bearing inner retaining ring (A).

Figure 6-217. Removing or installing cross shaft levers and bracket.



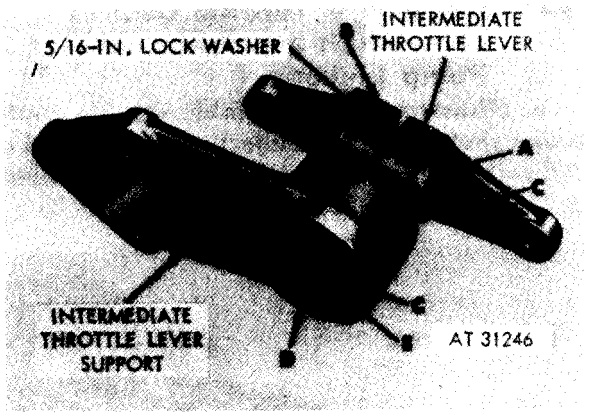
Remove

1. Remove retaining ring (A).
2. Remove one shock spring spacer (B).
3. Remove shock spring (C).
4. Remove remaining shock spring spacer (D).
5. Remove cap screw (E) and lock washer (or assembled washer bolt).
6. Remove shock spring control lever (F).
7. Remove Woodruff key (G) from cross shaft.

Install

1. Position Woodruff key (G) in cross sbaft.
2. Position shock spring control lever (F) on cross shaft.
3. Install cap screw (E) and lock washer.
4. Position one shock spring spacer (D) on shaft.
5. Position shock spring (C) on shaft with both ends of spring engaging straight pin in control lever (F).
6. Position remaining shock spring spacer (B) on shaft
7. Install retaining ring (A).

Figure 6-218. Removing or installing cross shaft shock spring and control lever.



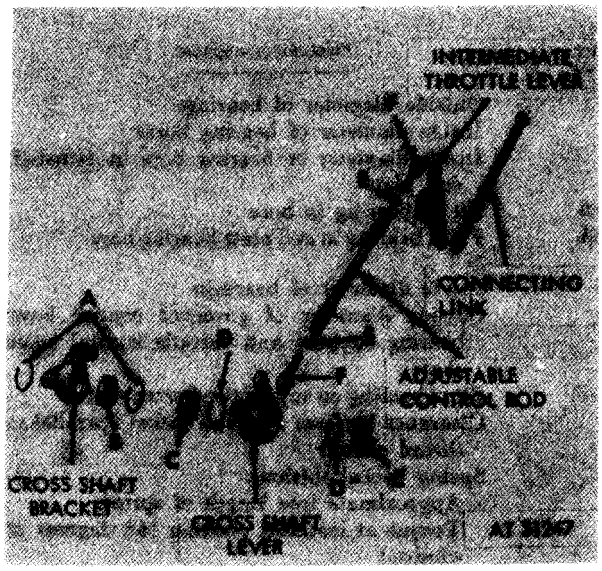
Disassemble

1. Remove cap screw (A) and lock washer (or assembled washer bolt).
2. Remove intermediate throttle lever (B) and Woodruff key from intermediate support shaft
3. Remove two retaining rings (C).
4. Remove intermediate throttle lever support (D) from intermediate support shaft.
5. Remove two retaining rings (E) and two ball bearings from lever support.

Assemble

1. Position two ball bearings in intermediate throttle lever support (D) and install two retaining rings (E).
2. Position lever support (D) on intermediate support shaft.
3. Install two retaining rings (C).
4. Position Woodruff key and intermediate throttle lever (B) on intermediate support shaft.
5. Install cap screw (A) and lock washer.

Figure 6-219. Disassembling or assembling intermediate throttle lever support.



Disassemble

1. Remove two retaining rings (A) from cross shaft bracket.
2. Remove ball bearing (B) from brakcet.
3. Remove two ball bearings (C) from cross shaft lever.
4. Remove two retaining rings (D) from lever.
5. Loosen two nuts (E) and remove left and right rod end bearings (F) from adjustable control rod.

Note. The rod bearings (F) are pinned and are not to be disassembled. Do not attempt to disassemble connecting link.

Assemble

1. Install left and right rod end bearings (F) in adjustable control rod and tighten nuts (E).
2. Install two retaining rings (D) in cross shaft lever.
3. Position two ball bearings (C) in lever.
4. Position ball bearing (B) in cross shaft bracket.
5. Install two retaining rings (A) in bracket.

Figure 6-220. Disassembling or assembling cross shaft lever, bracket, and adjustable control rod.

b. Cleaning. Refer to paragraph 6-2.

c. Inspection and Repair. Refer to paragraphs 6-3 and 6-4 for procedures and table 6-36 for overhaul standards.

Table 6-36. Trottle Control Cross Shaft and Fuel Injection Pump Linkage Overhaul Standards

Component	Fig. No.	Ref. letter	Point of measurement	Sizes and fits of new parts		Wear limits
Throttle control linkage	B-18	A	Outside diameter of bearings	1.3745	1.3750	*
	B-18	C	Inside diameter of bearing bores	1.3740	1.3746	1.3751
	B-5	P	Inside diameter or bearing bore in camshaft end plate	1.3755	1.3761	1.3763
	B-18	C-A	Fit of bearing in bore	0.0001L	0.0010T	0.0006L
	B-5	P-A	Fit of bearing in end plate bearing bore	0.0005L	0.0016L	0.0018L
	B-18					
	B-18	B	Inside diameter of bearings	0.6247	0.6250	*
	B-18	D	Outside diameter of governor control lever bearing support and throttle control cross shaft	0.6249	0.6252	0.6246
	B-18	D-B	Fit of bearing on support and cross shaft	0.0001L	0.0005T	0.0004L
	B-18	E	Clearance between ball and socket (parallel to thread shank)	0.0005L	0.0015L	0.0020L
Throttle control linkage	B-18	F	Spring helical torsion: Approximate free length of spring Torque at installed position (45 degrees of windup)	0.750 inch 30 lbs per in.		*
	B-5	R	Outside diameter of split bushing-type bearing (to be press fit in bore of camshaft end plate, then machine inside diameter to 1.3120-1. 3130)			
	B-5	Q	Inside diameter of split bushing-type bearing (installed)	1.3120	1.3130	*
	B-5	N	Outside diameter of camshaft pilot bearing at end plate	1.3090	1.3100	*
	B-5	N-Q	Fit of camshaft pilot in end plate bushing-type bearing	0.0020L	0.0040L	*
	B-5	J	Outside diameter of oil seal	1.5010	1.5050	*
	B-5	H	Inside diameter of oil seal bore in camshaft end plate	1.4990	1.5000	*
	B-5	H-J	Fit of oil seal in bore of end plate	0.0010T	0.0060T	*

Note. Refer to paragraph 6-3b for explanation of symbols.

d. Assembly. Refer to figures 6-220 through 6-215.

Section XI. OVERHAUL OF ENGINE AND TRANSMISSION OIL COOLERS AND ENGINE COOLING FAN

6-46. General

This section covers the overhaul of the engine and transmission oil coolers and cooling fan. Specific instructions on disassembly, cleaning, inspection, repair, and assembly accompany the overhaul operations. Stud identification information is included in the repair procedures where applicable. Refer to the following table (table 6-37) for applicable illustrations and instructions for overhaul operations.

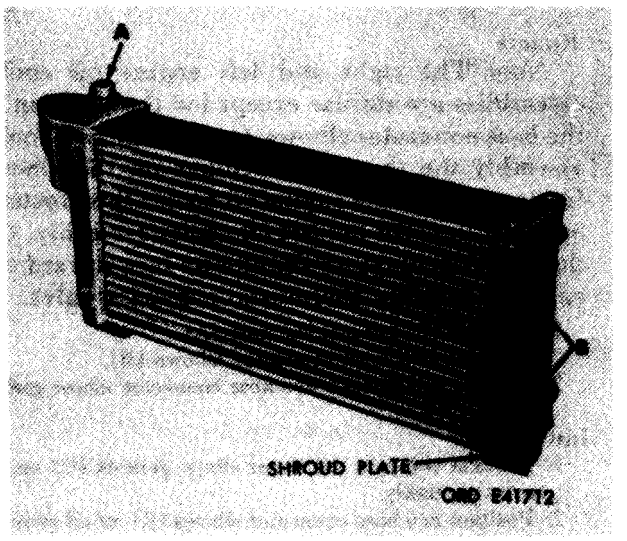
Table 6-37. Engine and Transmission Oil Coolers and Engine Cooling Fan

Component	Disassembly	Cleaning	Inspection	Repair	Assembly
Engine and Transmission Oil Coolers	Para 6-47b Figs. 6-221 through 6-223	Para 6-47c Fig. 6-224	Para 6-47d	Para 6-47e Table 6-38	Para 6-47f Figs. 6-223 through 6-221
Engine Cooling Fan	Para 6-48a Fig. 6-225	Para 6-2	Para 6-48c	Para 6-48d	Para 6-48e Fig. 6-225

6-47. Overhaul of Engine and Transmission Oil Cooler and Associated Parts

a. General. The engine oil coolers are identical and so are the transmission oil coolers. Adaptation to either right or left installation is accomplished by the addition of hose connections, elbows, and bypass valves. For instructional purposes, the engine and transmission oil coolers adapted for right bank installation will be disassembled.

b. Disassembly. Disassemble engine and transmission oil coolers following instructions which accompany figures 221 through 223.



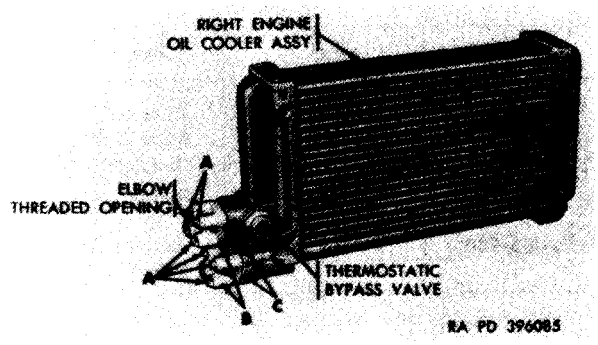
Remove

1. Remove transmission oil cooler bypass valve (A). Remove and discard valve gasket.
2. Remove two assembled washer bolts (B) and remove oil cooler shroud plate.

Install

1. Position oil cooler shroud plate on transmission oil cooler and install two assembled washer bolts (B).
2. Position a new valve gasket on cooler and install transmission oil cooler bypass valve (A).

Figure 6-221. Removing or installing transmission oil cooler bypass valve and shroud plate.



Remove

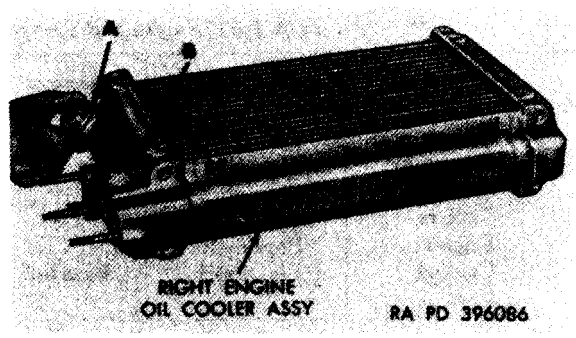
Note. The right and left engine oil cooler assemblies are similar except for the position of the hose connector elbows. On the right oil cooler assembly the threaded openings on the elbows face away from the engine oil cooler thermostatic bypass valve. On the left oil cooler assembly, the threaded openings on the elbows face toward the engine oil cooler thermostatic bypass valve.

1. Remove six self-locking nuts (A).
2. Remove two hose connector elbows (B).
3. Remove and discard two hose connector elbow gasket (C).

Install

1. Position two new connector elbow gaskets (C) on oil cooler assembly.
2. Position two hose connector elbows (B) on oil cooler.
3. Install six self-locking nuts (A).

Figure 6-222. Removing or installing engine right oil cooler hose connector elbows.



Remove

1. Remove thermostatic bypass valve (A) from oil cooler.
2. Remove and discard valve gasket (B).

Install

1. Position a new valve gasket (B) on oil cooler.
2. Install thermostatic bypass valve (A) in oil cooler.

Figure 6-223. Removing or installing engine right oil cooler thermostatic bypass valve.

c. Cleaning.

(1) External surfaces of coolers may be cleaned using oil cooler cleaning tool - 2940-927-3303. Clean thoroughly and blow dry with compressed air at 15 psi pressure.

(2) To clean the interior of an oil cooler assembly core, the pump equipment shown in figure 6-224 is required. Four solutions are used for the cleaning procedure. There are several possible arrangements of the equipment depending upon equipment availability and versatility. If provision can be made for flushing pump lines, one set of pump equipment can be used with four storage tanks to provide the required four solutions for rinsing, cleaning, and flushing. If such provisions cannot be made conveniently, four sets of pump equipment are required.

(3) Remove the thermostatic bypass valve (A) from the valve housing (fig. 6-223). Press a rubber plug into bypass opening in the valve housing. Reinstall valve into the valve housing so that the valve bears up against the rubber plug.

Note. Use only cleaning solutions recommended in these instructions or ones satisfactory for aluminum. Many solutions satisfactory for cleaning copper or copper nickel coolers are highly corrosive to aluminum and if used will result in the destruction of the cooler. If equipment has been previously used with any other cleaning solutions, it should be thoroughly washed out and flushed with the recommended solution.

Warning; Cleaning solvents and solvent cleaning compounds are toxic and flammable and must be used only in a well ventilated room. Take adequate safe guards for fire prevention in work area. Use protective clothing and avoid contact of these solutions with the skin.

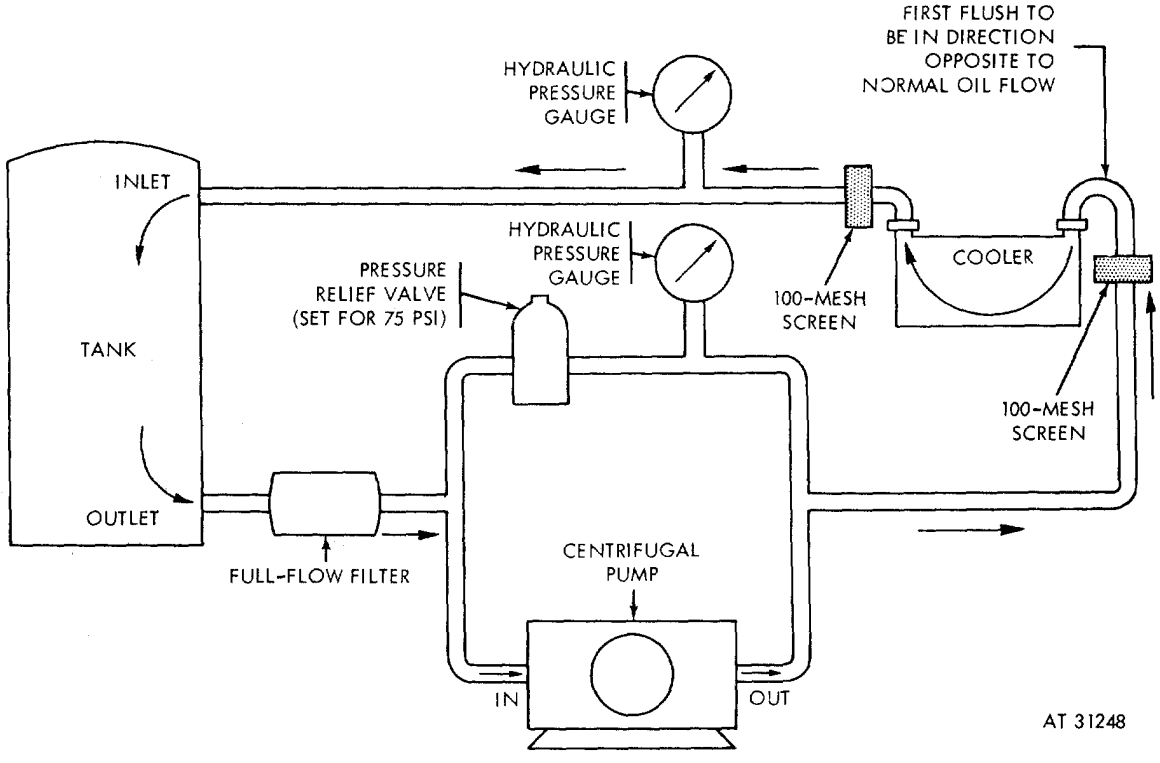


Figure 6-224. Oil cooler cleaning equipment setup-schematic diagram.

(4) Preclean core interior to remove oil and loose sludge from the core to reduce contamination of cleaning solution in subsequent operations. Connect pump equipment so that fluid flow will be in the reverse direction of normal flow. Use mineral spirits, Federal Specification TT-T-291, or kerosene, Federal Specification VV-K-211, or dry cleaning solvent, Federal Specification P-S-661. Flush core in reverse direction for 30 minutes or until solution appears clean. Reverse lines and flush approximately 15 minutes in the opposite direction. Drain cooler.

(5) Remove carbon deposits, engine oil, gums, lead deposits, and foreign contamination by flushing cooler in opposite direction to normal oil flow for 30-60 minutes. Use solvent cleaning compounds conforming to Specification MIL-C-6864. Reverse lines and flush in opposite direction for 15 minutes.

(6) Remove plug installed in bypass ((3), above) opening and block cooling section opening. Flush for 15 minutes to clean bypass passage. Remove plug from cooling section opening and replace in bypass opening.

(7) Rinse cooler for 10 minutes by circulating clear petroleum solvent such as dry-cleaning solvent, Federal Specification P-S-661, or kerosene, Federal Specification VV-K-211. System shall be suitably filtered to prevent circulation of foreign matter.

(8) Flush cooler with a preservative oil consisting of three parts MIL-L-6082, Grade 1065, and one part MIL-C-6529, or, for systems employing MIL-L-7808 oil, preservative oil MIL-C-8188B, or equivalent, in preparation for shipment or storage. Connect cooler to pump equipment and flush in each direction for 10 minutes, checking the mesh screen after each flush to insure that no metal particles have appeared. After flushing operations, install plugs in inlet and outlet ports.

(9) When the coolers have been cleaned it will be necessary to recoat them with zinc chromate primer per MIL-P-8585. In order to insure that the coating covers the entire core, the oil ports should be plugged and the cooler dipped in the zinc chromate. The dip solution should be prepared as follows: 1 part MIL-P-8585 to 1½ parts JAN-T-171.

(10) It is important that the dip tank be covered, continuously stirred, and frequent checks on the viscosity be made as the JAN-T-171 is so volatile that the concentration may change rapidly. After the cooler is dipped in the primer it should immediately be blown out with compressed air from both sides to insure against plugging. The nozzle used to blow air through the core should be a narrow slit 3 to 4 inches long. It is recommended that line air pressure at about 100 psi be used.

(11) The tanks may be sprayed with primer after the dip for appearance, if desired. For spray, the proportions should be: 1 part MIL-P-8585 to 1 part TT-6-916B.

d. Inspection. Refer to paragraph 6-3 and (1) through (4), below.

(1) *Oil cooler assemblies.* Inspect oil cooler assemblies for dented tubing or bent fins. Inspect gasket contact surfaces for burs and raised metal. Seal all oil cooler openings. Pressure check coolers by pumping engine oil (OE) into coolers at 400 psi hydrostatic pressure. Coolers must hold 400 psi for ten minutes without loss of pressure. Release pressure, drain oil, and flush with dry-cleaning solvent or mineral spirits paint thinner. Identify leaking coolers for possible repair.

(2) *Thermostatic bypass valves.* Inspect engine and transmission oil cooler thermostatic bypass valves for stripped or damaged threads. Check operation of valve assemblies by immersing valve in warm water. Check temperature of water with accurate thermometer. Gradually raise temperature of water to temperature indicated on valve cover. Valves marked 148 F must travel ¼-inch between 80 F and 185 F. Remove valve from water and clean with dry-cleaning solvent or mineral spirits paint thinner. Replace valve assembly when travel is less than ¼-inch.

(3) *Oil cooler hoses.* Inspect oil cooler outlet and inlet hoses for breaks and abrasions in woven shielding. Replace hose when woven shielding is broken or abraided.

(4) *Oil cooler screens.* Inspect oil cooler screens for bent, cracked, or broken mounting brackets. Check for torn or broken screening.

Replace screens that are unserviceable. Straighten bent screens to as near original shape as possible.

e. Repair. Refer to paragraph 6-4. Refer to TB 9-228 for repair of oil coolers. Refer to paragraph 6-4e and table 6-38 when replacing studs.

Note. Do not repair leaks by soldering. Soldering is not an acceptable repair because of high operating temperature and pressure.

Table 6-38. Engine Oil Cooler Standard and Oversize Stud Identification

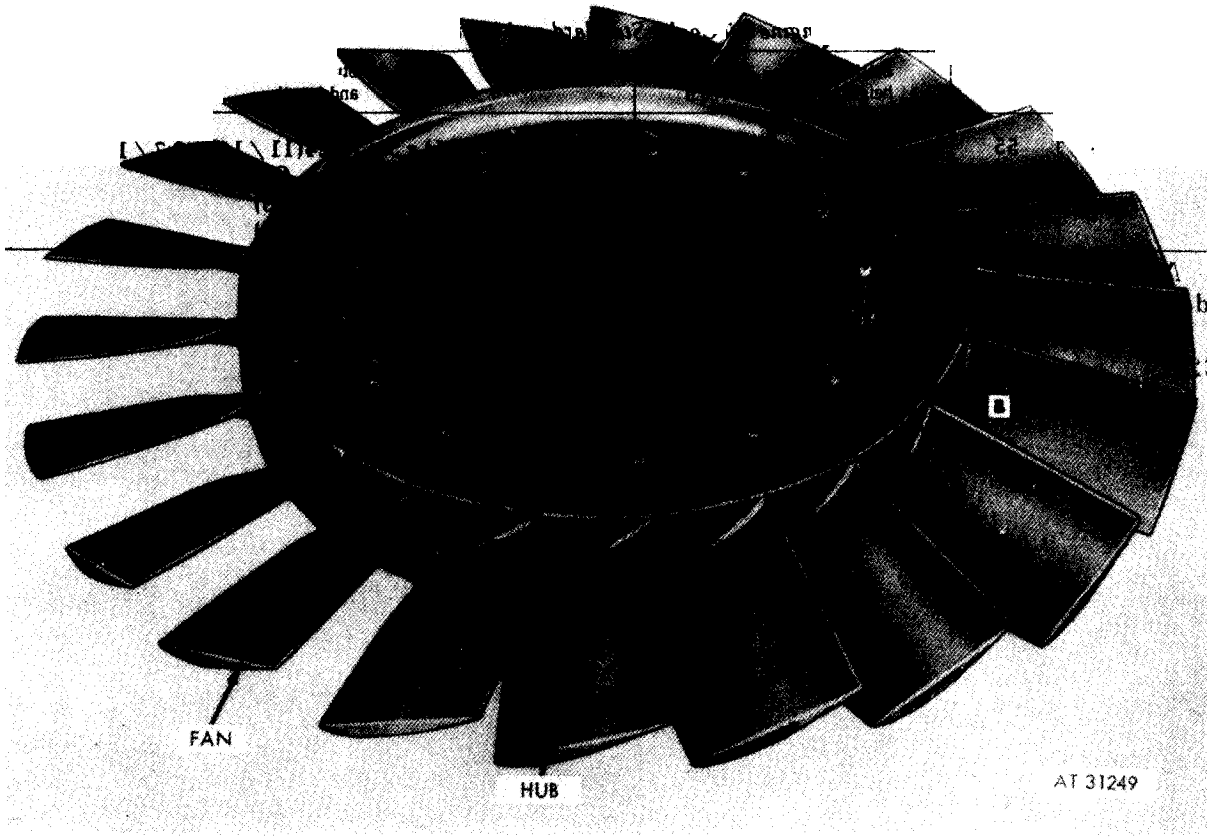
Fig. No.	Ref. No.	Setting height	No. req'd	Stud size and length
B-24	55	2	12	5 / 16-18 (11 / 16) x 5 /16-24(11 / 16) x 2-7 / 16 (STD) (0.003 in. OS) (0.007 in OS) (0.012 in. OS)

Note. Refer to figure 6-1 for oversize stud identification.

f. Assembly. Refer to figures 6-223 through 6-221.

6-48. Overhaul of Engine Cooling Fan and Associated Parts

a. *Dissassembly*. The cooling fan vane and housing were removed during disassembly, Chapter 5. Disassemble cooling fan following instructions which accompany figure 6-225.



Disassemble

1. Remove 16 cotter piss, slotted nuts (A), flat washers, and cap screws attaching cooling fan hub to fan.
2. Separate fan from hub (B).

Assemble

Note. The machined face of the fan is marked "TOP" to insure correct assembly.

1. Position cooling fan hub (B) inside of fan marked "TOP".
2. Install 16 cap screws, flat washers, slotted nuts (A), and cotter pins securing fan to hub.

Figure 6-225. Disassembling or assembling cooling fan and cooling fan hub.

b. Cleaning. Refer to paragraph 6-2.

c. Inspection. Inspect cooling fans using a magnifying glass under a strong light. Inspect for nicks, scratches, and cracks. A radial crack in area of a bolt hole is sufficient cause for replacement of the fan. Discard cooling fans that have bent, broken, or warped blades. Replace fan when bolt holes are elongated or show evidence of wear. Replace fan when erosion of the leading edge of the fan blade exceeds 25 or ¼ of the total blade width.

d. Repair. Repair scratches, nicks, and raised metal using a fine mill file.

Note. Care must be taken when using a file, not to remove excessive amounts of metal since this will disturb the delicate balance of the fan.

e. Assembly. Refer to figure 6-225. The cooling fan vane and housing will be assembled during engine assembly, Chapter 7.

Section XII. OVERHAUL OF ENGINE SHROUDING AND ASSOCIATED PARTS

6-49. General

This section covers the overhaul of the engine shrouding and associated components. Specific instructions on disassembly, cleaning, inspection, repair and assembly accompany the overhaul operations. Refer to the following table (table 6-39) for applicable illustrations and instructions for overhaul operations.

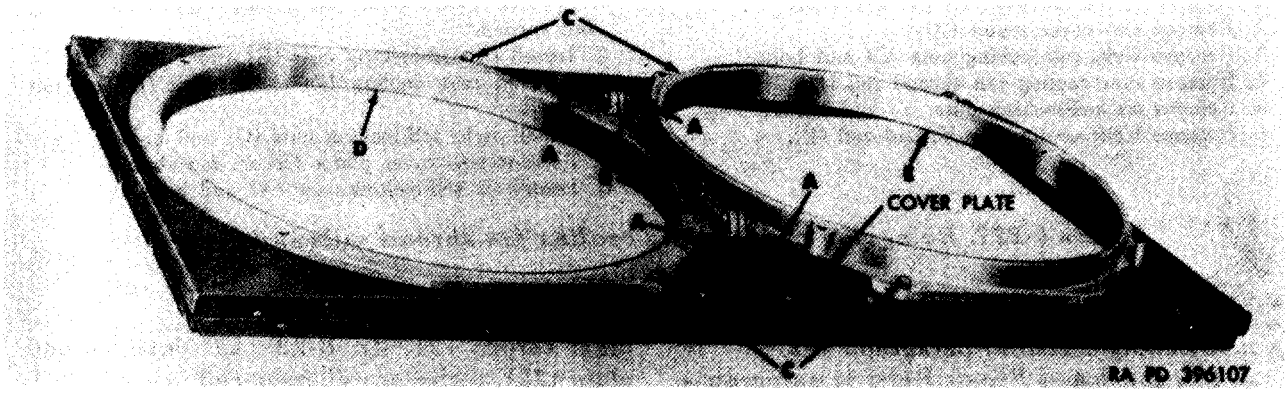
Table 6-39. Engine Shrouding and Associated Components

Component	Disassembly	Cleaning	Inspection	Repair	Assembly
Cooling Fan Vanes		Para 6-2	Para 6-3		
Engine and Transmission Shrouds	Para 6-50b Figs. 6-226, 6-227	Para 6-2	Para 6-50d	Para 6-50d	Para 6-50e Figs. 6-227, 6-226
Oil Cooler Frames, Brackets, and Associated Parts		Para 6-2	Para 6-3	Para 6-3	
Cylinder Air Deflectors		Para 6-2	Para 6-3	Para 6-3	

6-50. Overhaul of Engine Shrouding and Associated Components

a. General. Disassembly of the various shroud components other than the cooling fan housings, shroud rails, and cover plates was accomplished during engine disassembly, Chapter 5.

b. Disassembly. Disassemble cooling fan housings, shroud rails, and cover plates following instructions which accompany figures 6-226 and 6-227.



Remove

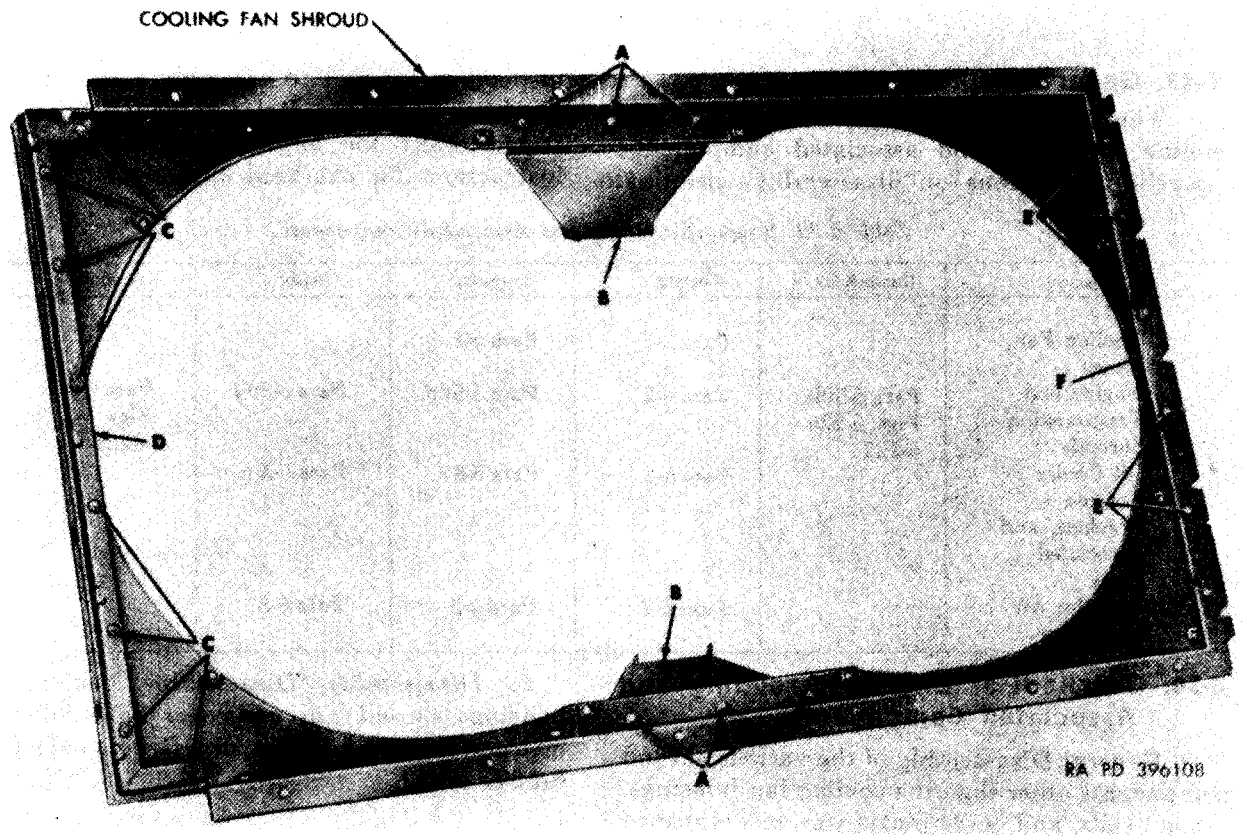
Note. The four screws (A) and flat washers are an integral part of the cover plate and cannot be removed without destruction of flat washers.

1. Loosen four screws (A).
2. Remove two cap screws (B), self-locking nuts, and flat washers.
3. Remove four cap screws (C), lock washers, and flat washers.
4. Remove front cooling fan housing (D).
5. Remove rear cooling fan housing (E).

Install

1. Position rear cooling fan housing (E) in cooling fan shroud.
2. Position front cooling fan housing (D) in shroud.
3. Install four cap screws (C), lock washers, and flat washers.
4. Install two cap screws (B), self-locking nuts, and flat washers.
5. Tighten four screws (A).

Figure 6-226. Removing or installing front and rear cooling fan housings.



Remove

1. Remove six-self-locking nuts (A) and bolts.
2. Remove two cover plates (B).
3. Remove eight self-locking nuts (C) and bolts.
4. Remove rear cooling fan shroud rail (D).
5. Remove six self-locking nuts (E) and bolts.
6. Remove front cooling fan shroud rail (F).

Install

1. Position front cooling fan shroud rail (F) on cooling fan shroud.
2. Install six self-locking nuts (E) and bolts.
3. Position rear cooling fan shroud rail (D) on fan shroud.
4. Install eight self-locking nuts (C) and bolts.
5. Position two cover plates (B) on fan shroud.
6. Install six self-locking nuts (A) and bolts.

Figure 6-227. Removing or installing cooling fan shroud rails and cover plates.

c. Cleaning. Refer to paragraph 6-2.

d. Inspection and Repair. Refer to paragraphs 6-3 and 6-4, and (1) and (2), below.

(1) In the event of complete reconditioning of the engine and transmission shrouds, the rubber seals found on some shrouds must be removed and discarded. All paint must be stripped off to the bare metal before repainting. After painting install new rubber seals on shrouds as required.

(2) Due to the high temperatures encountered near the turbosupercharger the left inner shroud (21, fig. B-22). left outer shroud plate (22), turbosupercharger end shroud (24), right outer plate (29), and right inner shroud plate (31) require painting with a high temperature heat resisting paint MIL-P-14276, FSN 8010-815-2692, or equivalent.

e. Assembly. Refer to figures 6-227 and 6-226. Remaining shroud components not assembled at this point will be assembled during engine assembly, Chapter 7.

Section XIII. OVERHAUL OF INTAKE MANIFOLDS, EXHAUST MANIFOLDS AND TUBES, CYLINDER HEAD OIL DRAIN TUBES, AND OIL FILLER AND INDICATOR TUBES

6-51. General

This section covers the overhaul of the intake manifolds, exhaust manifolds and tubes, cylinder head oil drain tubes, and oil filler and indicator tubes. Specific instructions on disassembly, cleaning, inspection, repair, and assembly accompany the overhaul operations. Stud identification information is included in the repair procedures where applicable. Refer to the following table (table 6-40) for applicable illustrations and instructions for overhaul operations.

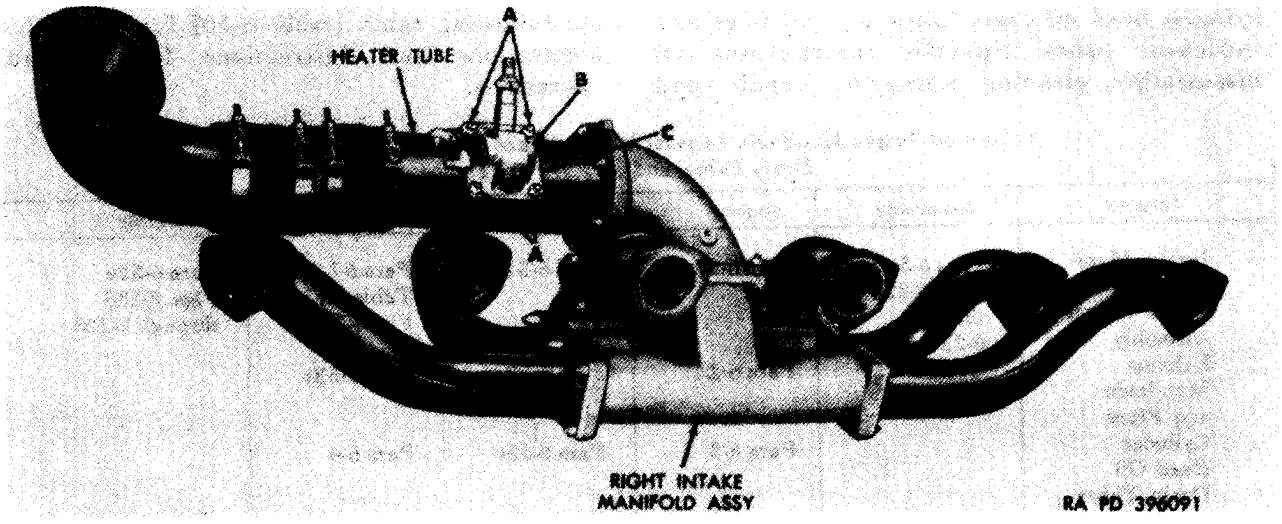
Table 6-40. Intake Manifolds. Exhaust Manifolds and Tubes. Cylinder Head Oil Drain Tubes, and Oil Filler and Indicator Tubes

Component	Disassembly	Cleaning	Inspection	Repair	Assembly
Intake Manifolds and Flame Heater Assembly	Para 6-52b Figs. 6-228 through 6-235	Para 6-52c	Para 6-52d	Para 6-52d Table 6-41 Fig. 6-236	Para 6-52e Figs. 6-235 through 6-228
Exhaust Manifolds and Pipes		Para 6-2	Para 6-53c	Para 6-53c	
Cylinder Head Oil Drain Tubes		Para 6-2	Para 6-53c	Para 6-4	
Oil Filler and Indicator Tubes	Para 6-53a Figs. 6-237 through 6-239	Para 6-2	Para 6-53c	Para 6-4	Para 6-53d Figs. 6-239 through 6-237

6-52. Overhaul of Intake Manifolds and Flame Heater Assembly

a. General. The right and left intake manifolds are similar and are disassembled in the same manner. For instructional purposes the right intake manifold will be disassembled. The left intake manifold is mentioned only where there is a difference in disassembly procedures.

b. Disassembly. Disassemble intake manifolds and flame heater following instructions which accompany figures 6-228 through 6-235.



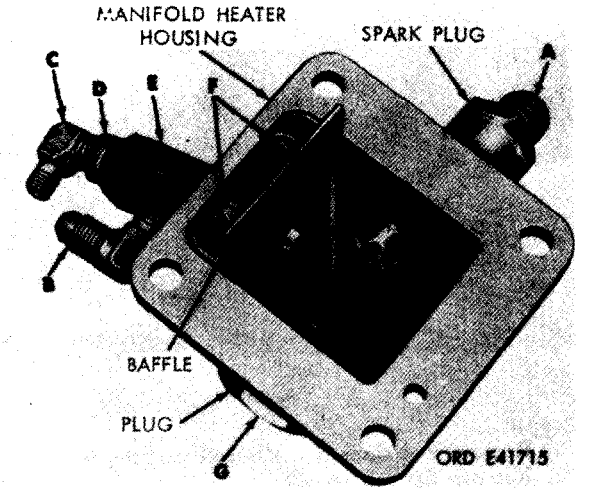
Remove

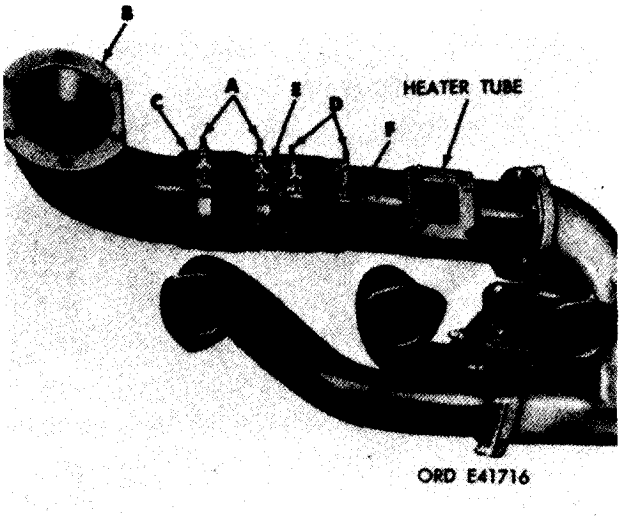
1. Remove four self-locking nuts (A) an flat washers attaching manifold heater assembly to heater tube.
2. Remove right mainfold heater (B) and fittings.
3. Remove and discard heater gasket (C).

Install

1. position a new heater gasket (C) on heater tube.
2. Position tight manifold heater (B) and fittings on tube.
3. Install four self-locking nuts (A) and flat washers securing manifold heater assembly to tube.

Figure 6-228. Removing or installing manifold heater assembly.





Disassemble

Note. The right and left manifold heater assemblies are similar except for the position of the spark plug and heater housing plug. The two parts are reversed for the left heater assembly.

1. Remove spark plug (A). Remove and discard spark plug gasket.
2. Remove pipe elbow (B).
3. Remove pipe elbow (C).
4. Remove bushing (D).
5. Remove manifold heater spray nozzle and holder assembly (E).
6. Remove two flat head screws (F) and remove baffle.

Note. The two screws (F) are staked in place. It may be necessary to remove the stake marks before attempting to remove screws.

7. Remove heater housing plug (G). Remove and discard plug gasket.

Note. Instruction covering housing plug (G) is applicable only to engines equipped with a plug.

Assemble

1. On engines equipped with a plug, position a new plug gasket on heater housing plug (G) and install plug in manifold heater housing.
2. Position baffle in housing and install two flat head screws (F). Stake screws in place.
3. Install manifold heater spray nozzle and holder assembly (E)
4. Install bushing (D) in holder assembly.
5. Install pipe elbow (C) in bushing.
6. Install pipe elbow (B) in holder assembly.
7. Position a new spark plug gasket on spark plug (A). Install spark plug in housing.

Figure 6-229. Disassembling or assembling manifold heater assembly.

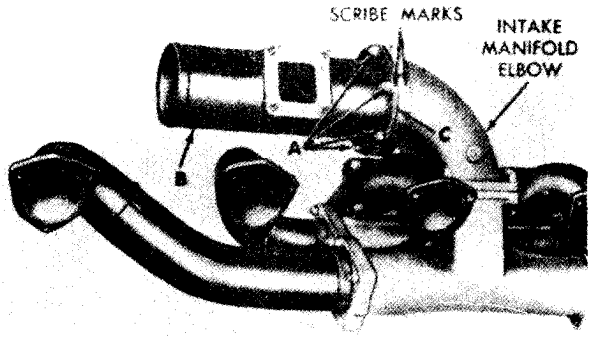
Remove

1. Loosen two hose clamps (A).
2. Remove right turbosupercharger air outlet elbow (B).
3. Remove rubber hose (C) and clamps. Separate two clamps from hose.
4. Loosen two hose clamps (D).
5. Remove air outlet tube (E) from hose.
6. Remove rubber hose (F) and clamps. Separate two clamps from hose.

Install

1. Position two hose clamps (D) on rubber hose (F). Position hose on heater tube.
2. Position air outlet tube (E) in hose.
3. Tighten two hose clamps (D).
4. Position two hose clamps (A) on rubber hose(C). Position hose on air outlet tube.
5. Position right turbosupercharger air outlet elbow (B) in hose.
6. Tighten two hose clamps (A).

Figure 6-230. Removing or installing air outlet tube and associated parts.



Remove

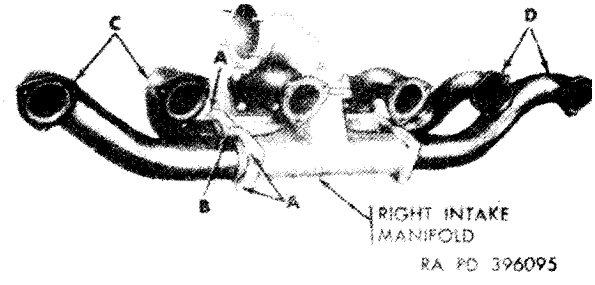
Note. Scribe a line across flange of heater tube and intake manifold elbow for correct positioning during assembly.

1. Remove six self-locking nuts (A).
2. Remove heater tube (B).
3. Remove and discard heater tube gasket (C).

Install

1. Position a new heater tube gasket (C) on intake manifold elbow.
2. Position heater tube (B) on elbow with scribe marks alined.
3. Install six self-locking nuts (A).

Figure 6-231. Removing or installing heater tube.



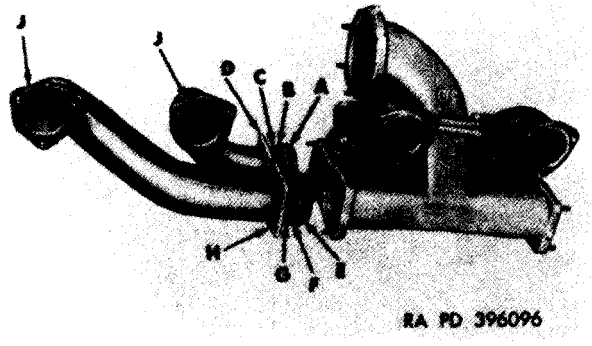
Remove

1. Remove four self-locking nuts (A).
2. Remove two self-locking nuts (B) and flat washers.
3. Separate intake manifold tubes (C) for cylinder Nos. 5R and 6R from right intake manifold.
4. Separate intake manifold tubes (D) for cylinder Nos. 1R and 2R in the same manner.

Install

1. Position intake manifold tubes (C) for cylinder Nos. 5R and 6R on right intake manifold.
2. Install two self-locking nuts (B) and flat washers.
3. Install four self-locking nuts (A).
4. Install intake manifold tubes (D) for cylinder Nos. 1R and 2R in the same manner.

Figure 6-232. Removing or installing intake manifold tube attaching parts.



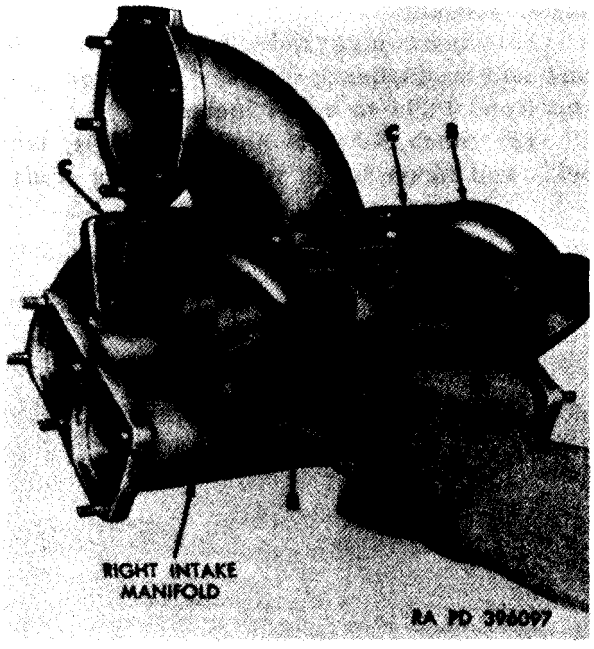
Remove

1. Remove and discard preformed packing (A).
2. Remove flat washer (B).
3. Remove spring tension washer (C).
4. Remove small flange (D).
5. Remove and discard preformed packing (E).
6. Remove flat washer (F).
7. Remove spring tension washer (G).
8. Remove large flange (H).
9. Remove flanges (J) from intake manifold tubes.
10. Remove flanges and associated parts from intake manifold tubes for cylinder Nos. 1R and 2R in the same manner.

Install

1. Install flanges (J) on intake manifold tubes for cylinder Nos. 5R and 6R.
2. Position large flange (H) on intake manifold tube for cylinder No. 6R.
3. Position spring tension washer (G) on intake manifold tube for cylinder No. 6R.
4. Position flat washer (F) on intake manifold tube for cylinder No. 6R.
5. Position a new preformed packing (E) on intake manifold tube for cylinder No. 6R.
6. Position small flange (D) on intake manifold tube for cylinder No. 5R.
7. Position spring tension washer (C) on intake manifold tube for cylinder No. 5R.
8. Position flat washer (B) on intake manifold tube for cylinder No. 5R.
9. Position a new preformed packing (A) on intake manifold tube for cylinder No. 5R.
10. Install flanges and associated parta on intake manifold tubes for cylinder Nos. 1R and 2R in the same manner.

Figure 6-233. Removing or installing flanges and associated parts from cylinder Nos. 5R and 6R intake manifold tubes.



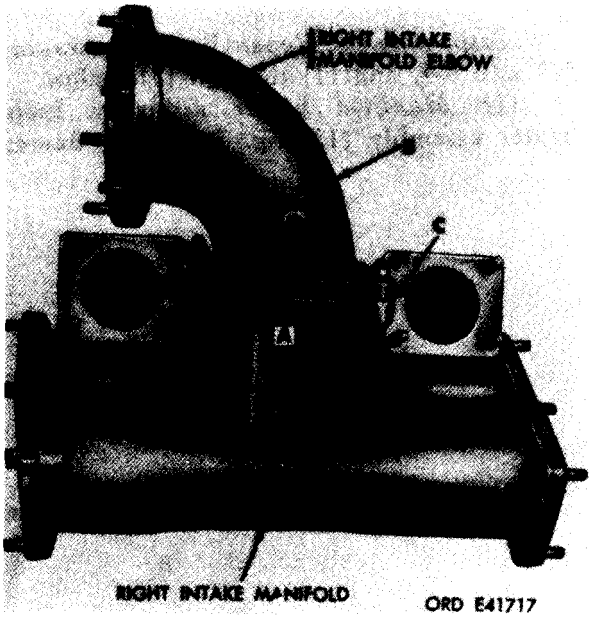
Remove

1. Remove eight self-locking nuts (A) attaching intake manifold tubes for cylinder Nos. 3R and 4R to right intake manifold.
2. Remove intake manifold tubes (B).
3. Remove and discard two intake manifold tube gaskets (C).

Install

1. Position two new intake manifold tube gaskets (C) on right intake manifold.
2. Position intake manifold tubes (B) for cylinder Nos. 3R and 4R on right intake manifold.
3. Install eight self-locking nuts (A) securing tubes to manifold.

Figure 6-234. Removing or installing intake manifold tubes for cylinder Nos. 3R and 4R.



Remove

Note. The right and left intake manifold elbows are identical. The position of the left intake manifold elbow is 180 degrees opposite from the position of the right elbow.

1. Remove six seff-locking nuts (A) and flat washers.
2. Remove right intake manifold elbow (B) from right intake manifold.
3. Remove and discard intake manifold elbow gasket (c).

Install

1. Position a new intake manifold elbow gasket (C) on right intake manifold.
2. Position right intake manifold elbow (B) on right intake manifold.
3. Install six self-locking nuts (A) and flat washers.

Figure 6-235. Removing or installing right intake manifold elbow.

c. Cleaning. Refer to paragraph 6-2. Clean intake manifold rubber hoses using a dry cloth only.

d. Inspection and Repair. Refer to paragraphs 6-3 and 6-4, and (1) through (3), below.

(1) *Manifold heater assembly.* Inspect heater assembly (15, fig. B-21) for damaged threads or plugged orifices. Replace damaged heater assembly.

(2) *Spark plug.* Refer to TM 9-8638 for care and maintenance of spark plugs. Set plug gap from 0.094 to 0.114 inches.

(3) *Studs.* Refer to paragraph 6-4e, table 6-41, and figure 6-236 when replacing studs.

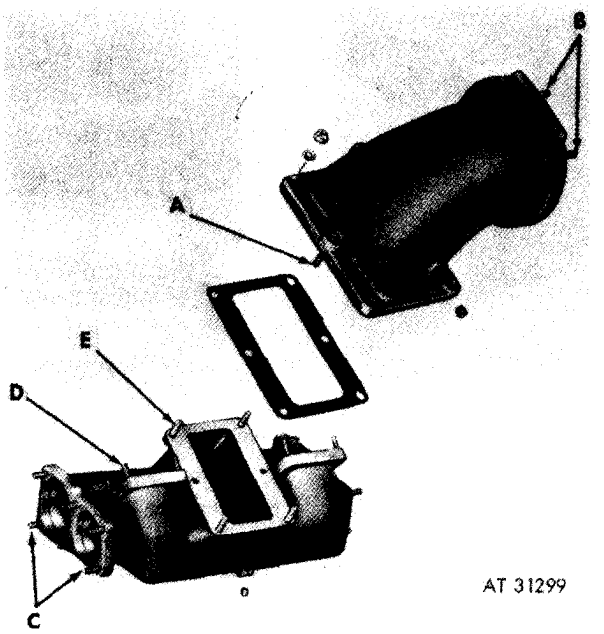


Figure 6-236. Right and left intake manifold-stud identification.

Table 6-41. Manifold Heater Induction and Intake Manifold Standard and Oversize Stud Identification

Fig. No.	Ref. No.	Setting height	No. req'd	Stud size and length
B-13	9	1-3 / 8	4	1 / 2-20(7 / 8) x 1 / 2-20(15 / 16) x 2-1 / 8 (STD)
B-13	15	13 / 16	8	5 / 16-24(25 / 32) x 5 / 16-24(19 / 32) x 1-7 / 16 (STD)
				(0.003 in. OS)
				(0.007 in. OS)
				(0.012 in. OS)
6-236	D	13 / 16	16	5 / 16-18(9 / 16) x 5 / 16-24(11 / 16) x 1-3 / 8 (STD)
				(0.003 in. OS)
				(0.007 in. OS)
6-236	A, E	1	12	5 / 16-18(3 / 4) x 5 / 16-24(23 / 32) x 1-5 / 8 (STD)
				(0.003 in. OS)
				(0.007 in. OS)
				(0.012 in. OS)
6-236	B	25 / 32	12	5 / 16-18(11 / 16) x 5 / 16-24(9 / 16) x 1-5 / 16 (STD)
	C	23 / 32	24	(0.003 in. OS)
				(0.007 in. OS)
				(0.012 in. OS)

Note. Refer to figure 6-1 for oversize stud identification.

e. Assembly. Refer to figures 6-235 through 6-228.

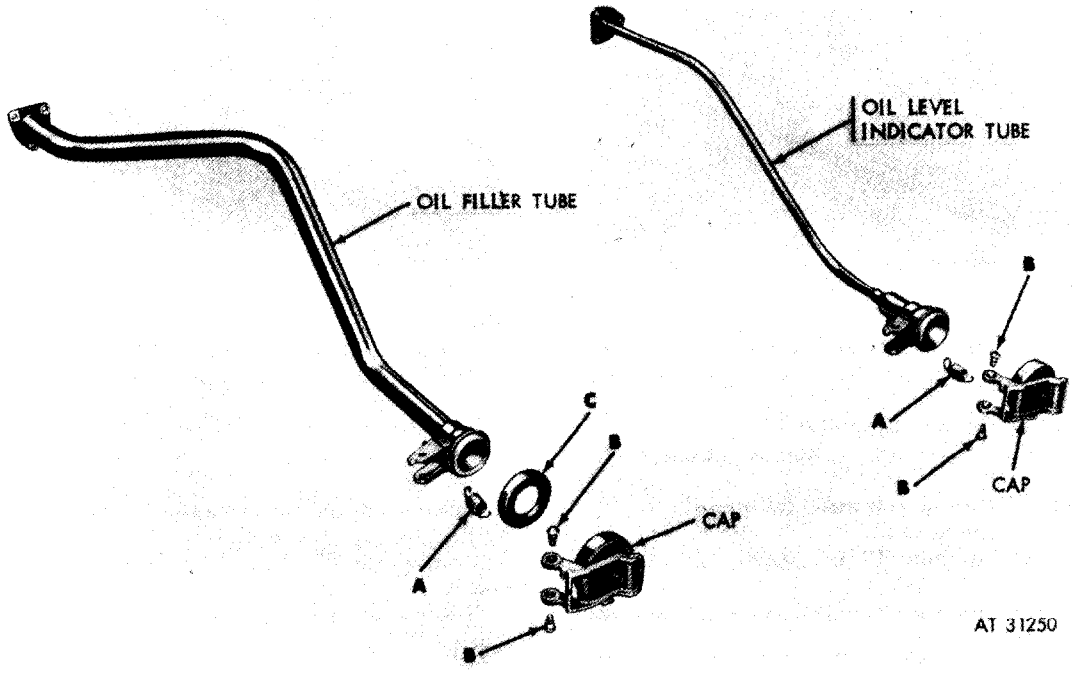
6-53. Exhaust Manifolds, Cylinder Head Oil Drain Tubes, and Oil Filler and Oil Level Indicator Tubes

a. Disassembly.

(1) *Exhaust manifolds and cylinder head oil drain tubes.* Disassembly of exhaust manifolds and cylinder head oil drain tubes was accomplished during engine disassembly, Chapter 5.

(2) *Oil filler and oil level indicator tubes.* Refer to figures 6-237 through 6-239.

Note. Due to design changes, two different oil level indicator tubes and three different oil filler tubes have been used on the engine. Basic disassembly procedures are the same for each tube design.



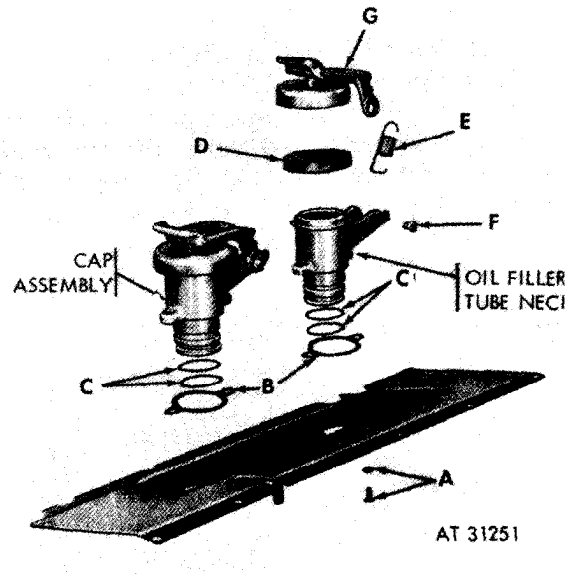
Disassemble

1. Remove cap spring (A).
2. Do not remove cap shoulder bolts (B) unless inspection (para 6-53c) indicates replacement is necessary. Bolts are staked in place.
3. Remove and discard seal (C). Oil filler tube only.

Assemble

1. Position seal (C) on oil filler tube only.
2. If necessary, install new cap shoulder bolts (B) and stake in place.
3. Install cap spring (A).

Figure 6-237. Disassembling or assembling oil filler and oil level indicator tubes (one piece oil filler and indicator tubes without splash pan drain).



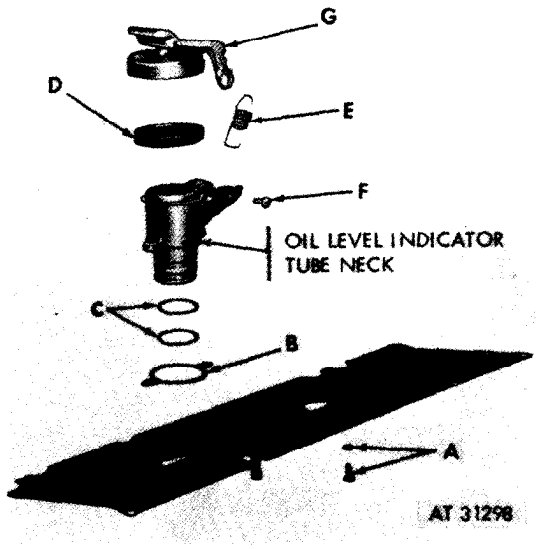
Disassemble

1. Remove two machine bolts (A) and lock washers attaching cap assembly to left front upper cover and remove cap.
2. Remove and discard cap gasket (B).
3. Remove and discard two preformed packings (C) from cap.
4. Remove and discard preformed packing (D).
5. Remove cap spring (E).
6. Remove machine bolt (F) and remove cap (G).

Assemble

1. Position cap (G) on cap assembly and install machine bolt (F).
2. Install cap spring (E).
3. Install a new preformed packing (D).
4. Position two preformed packings (C) on cap assembly.
5. Position a new cap gasket (B) on left front upper cover.
6. Install two machine bolts (A) and lock washers, securing cap assembly to upper cover.

Figure 6-238. Disassembling or assembling oil filler and oil level indicator tubes (improved oil filler indicator tubes with splash pan drain).



Disassemble

1. Remove two machine bolts (A) and lock washers attaching cap assembly to left front upper cover and remove cap.
2. Remove and discard cap gasket (B).
3. Remove and discard two preformed packings (C) from cap.
4. Remove and discard preformed packing (D).
5. Remove cap spring (E).
6. Remove machine bolt (F) and remove cap (G).

Assemble

1. Position cap (G) on cap assembly and install machine bolt (F).
2. Install cap spring (E).
3. Install a new preformed packing (D).
4. Position two preformed packings (C) on cap assembly.
5. Position a new cap gasket (B) on left front upper cover.
6. Install two machine bolts (A) and lock washers, securing cap assembly to upper cover.

Figure 6-239. Disassembling or assembling oil level indicator tube cap (relocated oil filler tube).

Note. Refer to figure 6-238 for disassembly or assembly procedures of the relocated oil filler tube.

b. Cleaning. Refer to paragraph 6-2.

c. *Inspection and Repair.* Refer to paragraphs 6-3 and 6-4, and (1) and (2), below.

(1) Inspect exhaust manifolds for cracks, broken welds, damaged bellows, and bent flanges.

(2) Inspect cap shoulder bolts (B, fig. 6-237) for looseness or damaged shoulder area.

d. Assembly. Refer to figures 6-237 through 6-239 for assembly of oil filler and oil level indicator tubes and caps. Exhaust manifolds and cylinder head oil drain tubes will be assembled during engine assembly, Chapter 7.

Section XIV. OVERHAUL OF GENERATOR AND STARTER SUPPORTS, FUEL CHECK VALVE, PRIMARY AND SECONDARY FUEL FILTERS, AND FUEL / WATER SEPARATOR

6-54. General

This section covers the overhaul of the generator and starter supports, fuel check valve, primary and secondary fuel filters, and fuel / water separator. Specific instructions on disassembly, cleaning, inspection, repair, and assembly accompany the overhaul operations. Stud identification information is included in the overhaul procedures where applicable. Refer to the following table (table 6-42) for applicable illustrations and instructions for overhaul operations.

Table 6-42. Generator and Starter Supports, Fuel Check Valve, Primary and Secondary Fuel Filters, and Fuel / Water Separator

	Disassembly	Cleaning	Inspection	Repair	Assembly
Generator and Starter Supports	Para 6-55a Fig. 6-240	Para 6-2	Para 6-3	Para 6-4 Table 6-43	Para 6-55d Fig. 6-240
Fuel Check Valve	Para 6-56a Figs. 6-241, 6-242	Para 6-2	Para 6-3	Para 6-4	Para 6-56c and Figs. 6-242, 6-241,6-243
Primary and Secondary Fuel Filters	Para 6-57a Figs. 6-244, 6-245	Para 6-57b	Para 6-57b	Para 6-57b	Para 6-57c Figs. 6-245, 6-244
Fuel / Water Separator and Fuel Drain Tubes	Para 6-58a Figs. 6-246, 6-247	Para 6-58b	Para 6-58b	Para 6-58b	Para 6-58c Figs. 6-247, 6-246

6-55. Overhaul of Generator and Starter Supports

a. Disassembly. Disassemble generator support following instructions which accompany figure 6-240. The starter support was disassembled during starter removal, Chapter 4.

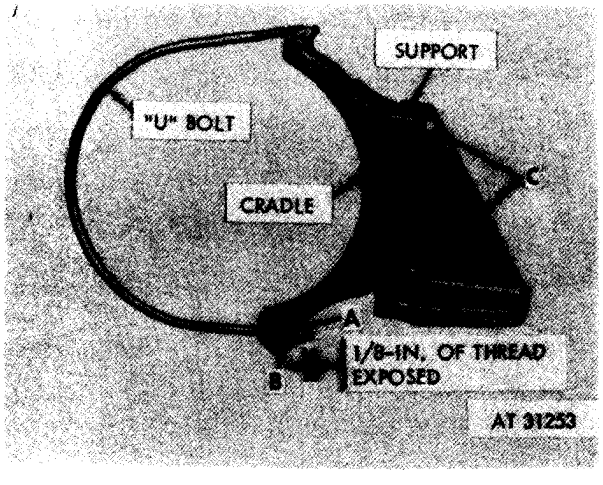


Figure 6-240. Disassembling generator cradle, support, and "U" bolt.

1. Remove self-locking nut (A).
2. Remove clamping bar (B) and "U" bolt.
3. Remove two self-locking nuts (C) and flat washers attaching cradle to support.

b. Cleaning. Refer to paragraph 6-2.

c. Inspection and Repair. Refer to paragraphs 6-3 and 6-4. Refer to paragraph 6-4e and table 6-43 when replacing studs.

Table 6-43. Generator and Starter Support Standard and Oversize Stud Identification

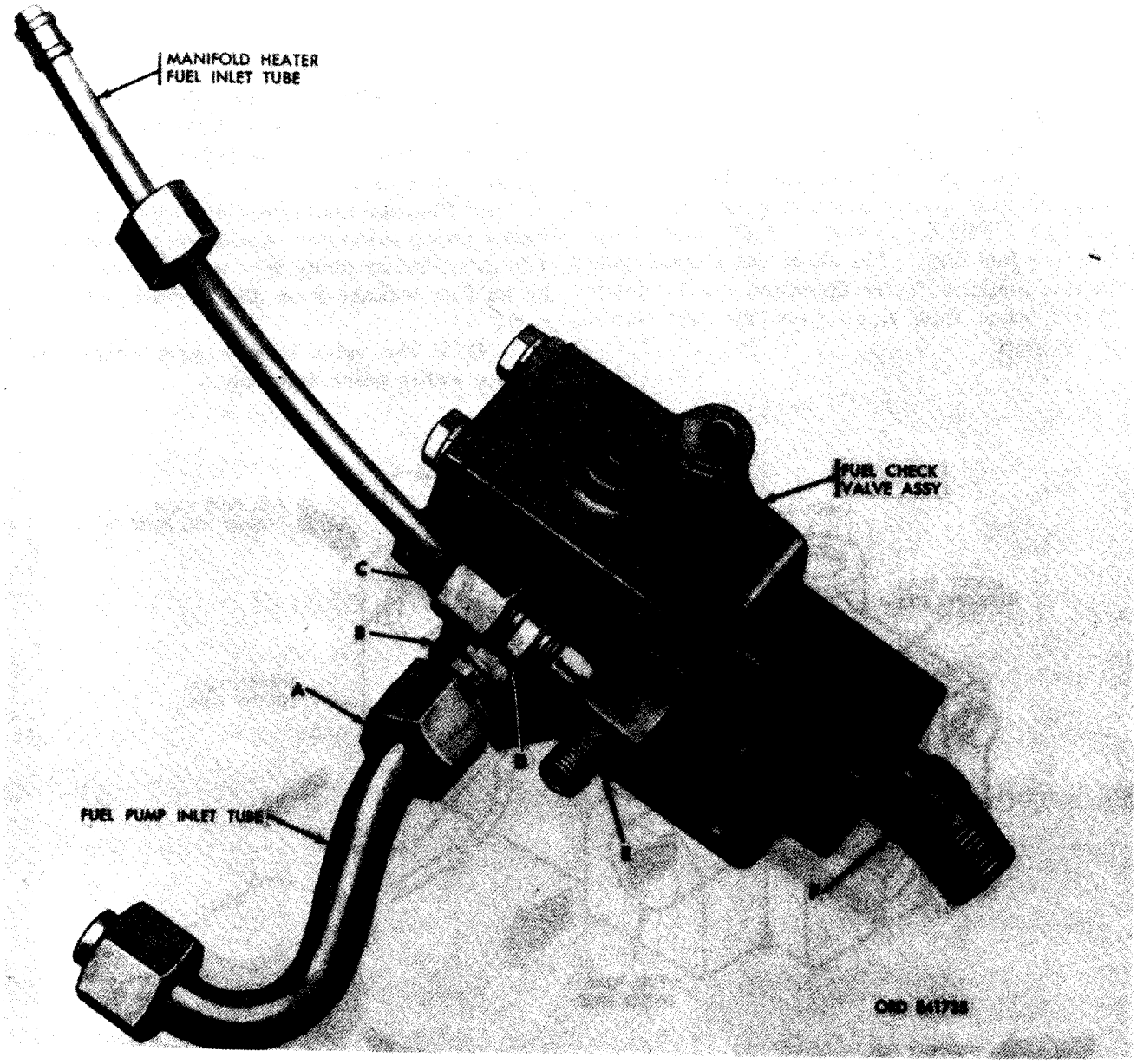
Fig. No.	Ref. No	Setting height	No. req'd	Stud size and length
B-7	27	1-5/16 (gener-ator)	2	3/8-16(15/16) x 3/8-24(13/16) x 2-3/32 (STD) (0.003 in. OS) (0.003 in. OS)
B-7	17	1-11/32 (starter)	4	3/8-16(15/16) x 3/8-24(13/16) x 2-3/32 (STD) (0.003 in. OS) (0.007 in. OS)

Note. Refer to figure 6-1 for oversize stud identification.

d. Assembly. The starter support is assembled during starter installation Chapter 4. The generator support is assembled during engine assembly, Chapter 7.

6-56. Overhaul of Fuel Check Valve

a. Disassembly. Disassemble fuel check valve following instructions which accompany figure 6-241.



Remove

1. Remove fuel pump inlet tube (A).
2. Remove pipe adapter (B).
3. Remove manifold heater fuel inlet tube (C).
4. Remove pipe adapter (D).
5. Remove pipe tee (E).
6. Remove 15 degree pipe adapter (F).

Install

1. Install 15 degree pipe adapter (F).
2. Install pipe tee (E).
3. Install pipe adapter (D).
4. Install manifold heater fuel inlet tube (C).
5. Install pipe adapter (B).
6. Install fuel pump inlet tube (A).

Figure 6-241. Removing or installing fuel check valve tubes and fittings.

Note. Components of the fuel check valve are not available as replacement parts. Therefore, no further disassembly is required.

Figure 6-242. Deleted.

b. Cleaning, Inspection and Repair. Refer to paragraphs 6-2, 6-3, and 6-4.

c. *Assembly*. Refer to figure 6-241.

d. Test and Adjustment (fig. 6-243).

(1) Fill valve with test fluid, MIL-F-7024A Type II, and apply a pressure of ½ psi to port marked "FREE FLOW" (fuel inlet from primary fuel filter). The check valve must open at this pressure. Valve operation can be determined when fluid flows from the fuel pump outlet port.

(2) Apply a pressure of 85 to 95 psi to the heater pump inlet port. The check ball must bypass fluid at this pressure. Adjust socket head adjusting screw (F, fig. 6-242) to obtain this opening pressure.

(3) Plug the fuel pump outlet port, and the heater pump outlet port, and apply a pressure of 100 psi at heater pump inlet port. There should be no fuel leakage from the "FREE FLOW" port.

(4) If the valve fails to pass either test, replace entire valve assembly.

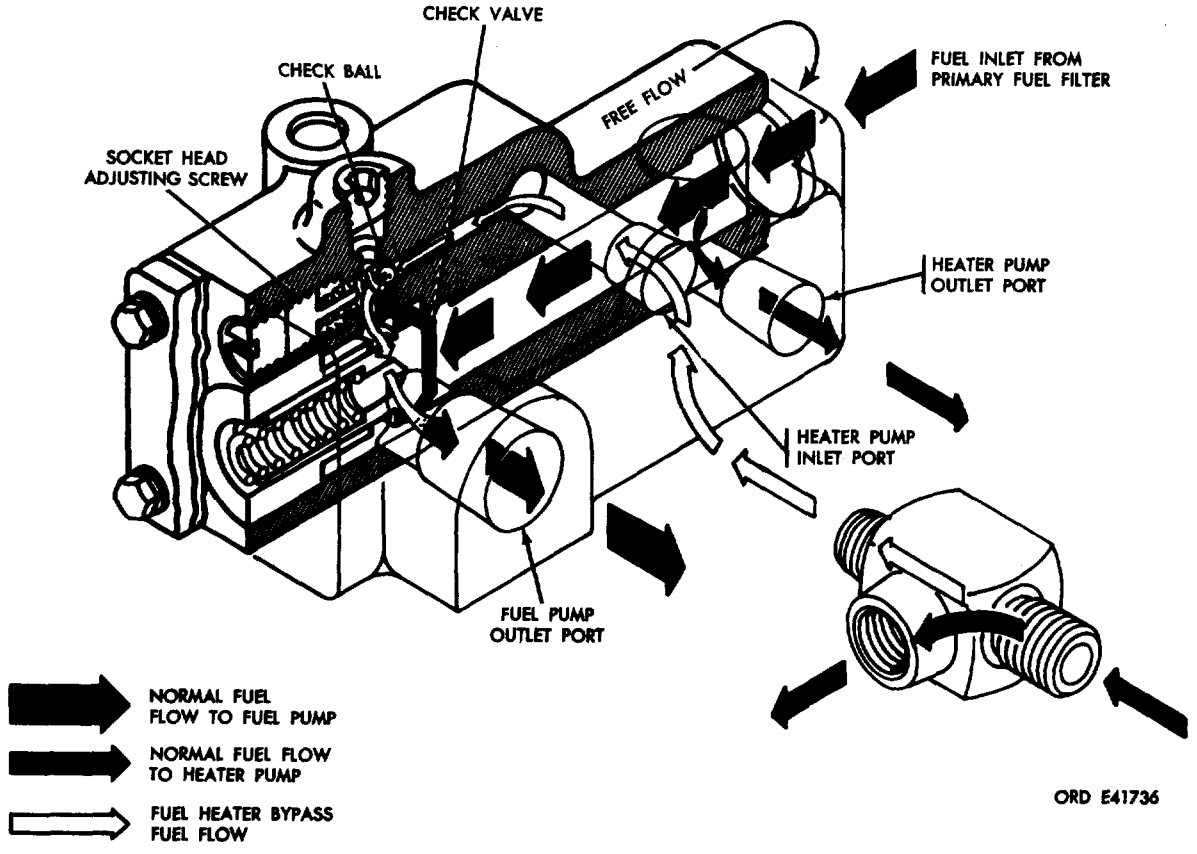


Figure 6-243. Fuel check valve flow diaphragm.

6-57. Overhaul of Primary and Secondary Fuel Filters and Associated Parts

a. Disassembly. Disassemble primary and secondary fuel filters following instructions which accompany figures 6-244 and 6-245. The mounting brackets, fuel hoses, and fittings were removed during engine disassembly, Chapter 5.

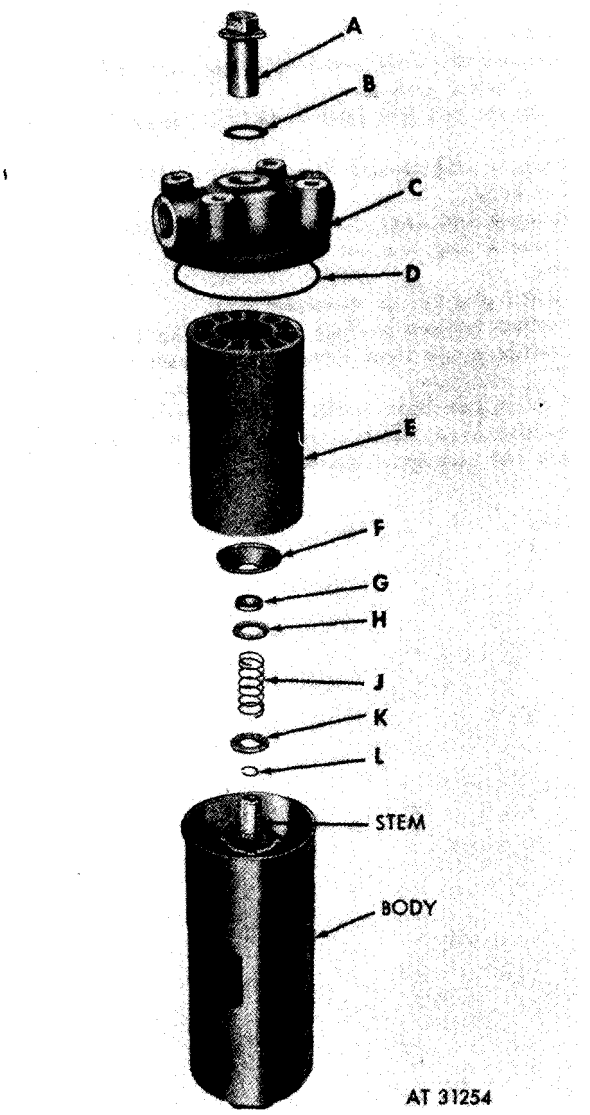


Figure 6-244. Disassembling or assembling primary fuel filter.

Disassemble

1. Remove retaining nut (A) and gasket (B). Discard gasket.
2. Remove filter head (C).
3. Remove and discard preformed packing (D).
4. Remove and discard filter element (E).
5. Remove disc (F), gasket (G), washer (H), spring (J), washer (K), and retaining ring (L) from filter body stem.

Assemble

1. Install retaining ring (L), washer (K), spring (J), washer (H), gasket (G), and disc (F) on filter body stem.
2. Install a new filter element (E).
3. Position a new preformed packing (D) in filter head (C).
4. Install filter head (C).
5. Position a new gasket (B) on retaining nut (A) and install nut.

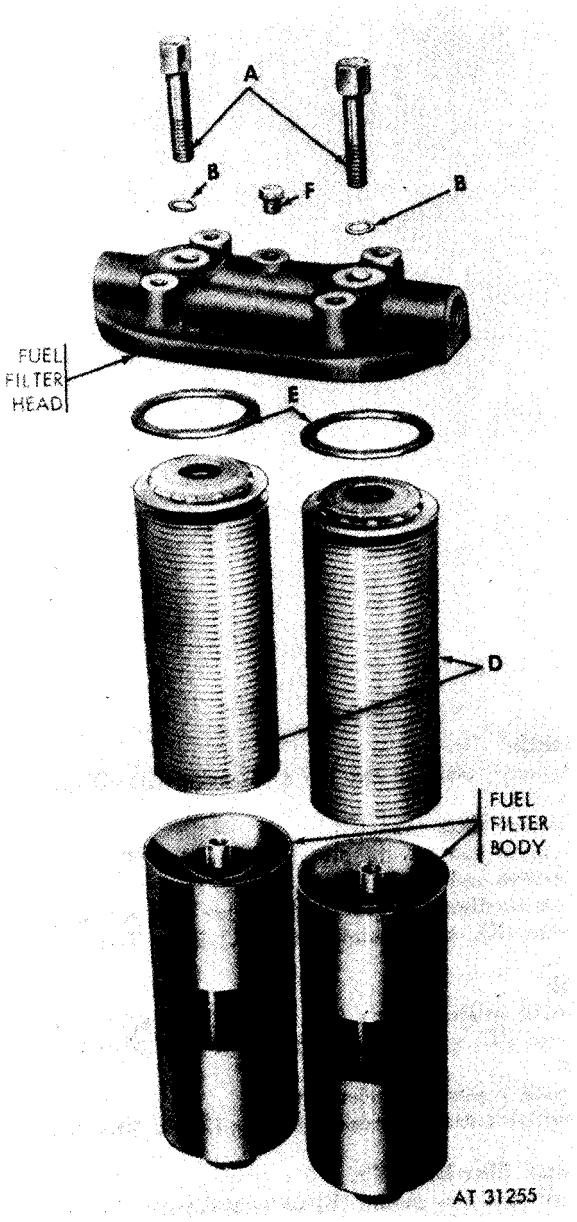


Figure 6-245. Disassembling or assembling secondary fuel filter.

Disassemble

1. Remove two body retaining screws (A) and gaskets (B). Discard gaskets.
2. Separate two fuel filter bodies (C) from fuel filter head.
3. Remove and discard filter elements (D) from each filter body.
4. Remove and discard two head gaskets (E).
5. Remove plug (F) from head.

Assemble

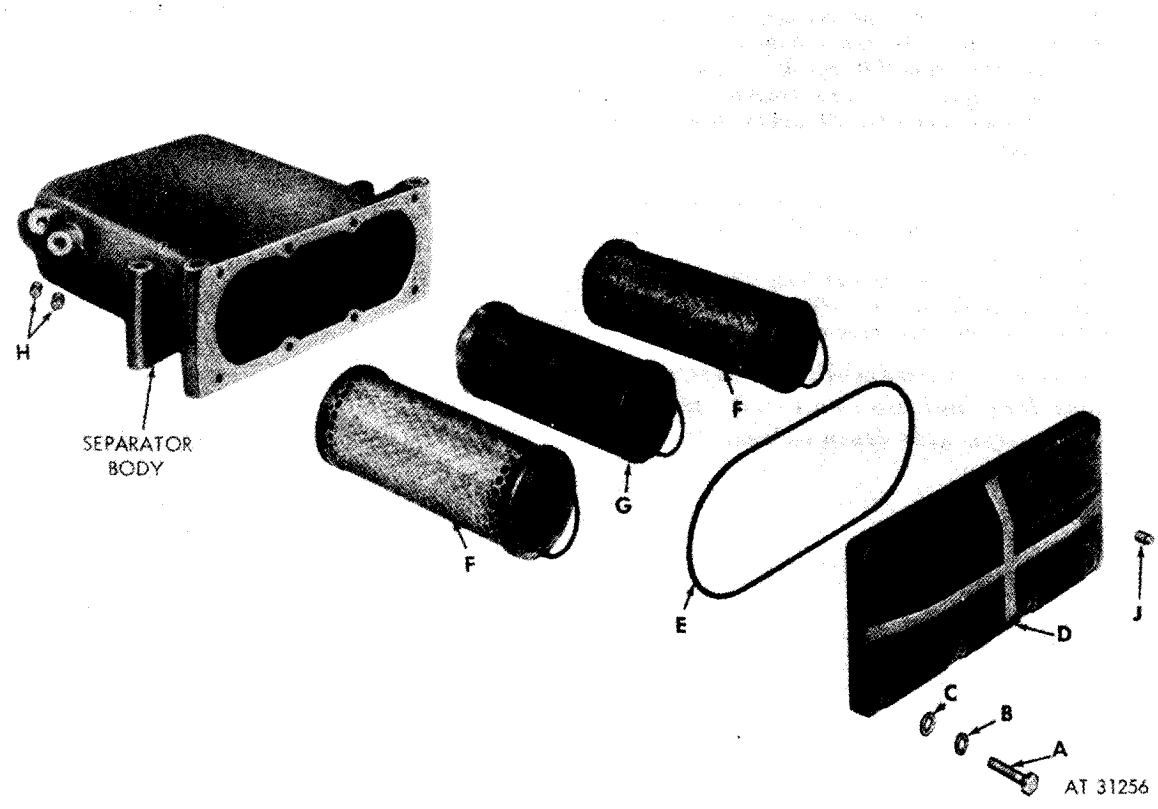
1. Install plug (F) in fuel filter head.
2. Position two new bead gaskets (E) in filter head.
3. Position a new filter element (D) in each filter body (C).
4. Position two filter bodies in filter head.
5. Position a new gasket (B) on each body retaining screw (A) and install screws.

b. Cleaning, Inspection, and Repair. Refer to paragraphs 6-2 through 6-4. Pressure check primary filter outlet hose and secondary filter inlet and outlet hoses to a proof pressure of 150 psi. Pressure check the fuel injection pump fuel inlet hose to a proof pressure of 200 psi. Replace hoses that do not withstand pressure check.

c. Assembly. Refer to figures 6-245 and 6-244. The mounting brackets, fuel hoses, and fittings are installed during engine assembly, Chapter 7.

6-58. Overhaul of Fuel / Water Separator, Secondary Fuel Filter and Fuel / Water Separator Drain Valves, and Associated Parts

a. Disassembly. Disassemble fuel / water separator and secondary fuel filter and fuel / water separator drain valves following instructions which accompany figures 6-246 and 6-247. The mounting brackets, fuel hoses, and fittings were removed during engine disassembly, Chapter 5.



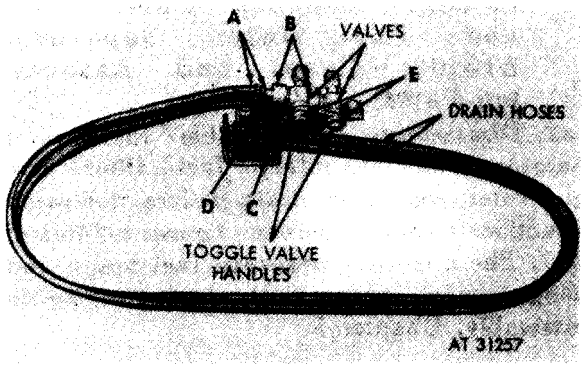
Disassemble

1. Remove eight screws (A), lock washers (B), and flat washers (C).
2. Remove cover (D) and remove and discard preformed packing (E).
3. Remove and discard enter two coalescer elements (F) and final filter element (G) from separator body.
4. Remove two pipe plugs (H) from body and one pipe plug (J) from cover.

Assemble

1. Install two pipe plugs (H) in body and one pipe plug (J) in cover.
2. Install new outer two coalescer elements (F) and a new final filter element (G) in separator body.
3. Install a new preformed packing (E) in cover (D) and position cover on body.
4. Install eight screws (A), lock washers (B), and flat washers (C).

Figure 6-246. Disassembling or assembling fuel / water separator.



Disassemble

1. Remove two hose clamps (A) and two hoses.
2. Remove two nuts (B) with sleeves and remove long tube (C) and short tube (D) from drain valves.
3. Place the toggle type valve handles in the open position. Remove two nuts (E) and remove two valves from bracket.

Assemble

1. Place the toggle type valve handles in the open position. Position two drain valves on bracket and install two nuts (E).
2. Position short tube (D) and long tube (C) in drain valves and install two nuts (B) with sleeves.
3. Install two hoses and hose clamps (A).

Figure 6-247. Disassembling or assembling secondary fuel filter and fuel / water separator drain valves.

b. Cleaning, Inspection, and Repair. Refer to paragraphs 6-2 through 6-4.

(1) Pressure check fuel / water separator inlet and outlet hoses to a proof pressure of 500 psi. Replace hoses that do not withstand pressure check.

(2) Flush drain valve tubes thoroughly with a high pressure cleaning device to assure tubes are cleaned and free of obstructions. Check tubes for cracks, dents, or signs of corrosive deterioration. Inspect tube fittings for burrs or mutilated sealing surfaces. Check drain valves for leakage. Valves that leak must be replaced.

c. Assembly. Refer to figures 6-247 and 6-242. The mounting brackets, fuel hoses, and fittings are installed during engine assembly, Chapter 7.

Section XV. OVERHAUL OF FUEL INJECTION PUMP FUEL TUBES, FUEL INJECTOR NOZZLE FUEL RETURN TUBES, INJECTION PUMP AND TURBOSUPERCHARGER OIL HOSES, AND GENERATOR AIR INTAKE AND EXHAUST TUBES AND ASSOCIATED PARTS

6-59. General

This section covers the overhaul of the fuel injection pump fuel tubes, fuel injector nozzle fuel return tubes, injection pump and turbosupercharger oil hoses, and generator air intake and exhaust tubes and associated parts. Specific instructions on disassembly, cleaning, inspection, repair, and assembly accompany the overhaul operations. Refer to the following table (table 6-44) for applicable illustrations and instructions for overhaul operations.

Table 6-44. Fuel Injection Pump Fuel Tubes, Fuel Injector Nozzle Fuel Return Tubes, Injection Pump and Turbosupercharger Oil Hoses, and Generator Air Intake and Exhaust Tubes and Associated Parts

Component	Disassembly	Cleaning	Inspection	Repair	Assembly
Fuel Injection Pump Fuel Tubes	Para 6-60a	Para 6-60b	Para 6-60b Figs. 6-248 and 6-249	Para 6-60b	Para 6-60c
Fuel Injector Nozzle Fuel Return Tubes	Para 6-60a	Para 6-60b	Para 6-60b	Para 6-60b	Para 6-60c
Injection Pump and Turbosupercharger Oil Hoses	Para 6-61a	Para 6-2	Para 6-61b	Para 6-61b	Para 6-61 c
Generator Air Intake and Exhaust Tubes	Para 6-62a Fig. 6-250	Para 6-2	Para 6-3	Para 6-4	Para 6-62c Fig. 6-250

6-60. Overhaul of Fuel Injection Pump Fuel Tubes, Fuel Return Hoses, and Nozzle Fuel Return Tubes

a. Disassembly. The fuel injection pump fuel tubes and nozzle return fuel return tubes were disassembled during disassembly of engine, Chapter 5.

b. Cleaning, Inspection, and Repair. Refer to paragraphs 6-2 through 6-4.

(1) *Fuel Injection Pump Fuel Tubes.* Flush the fuel tube assemblies with a high pressure flushing device. After flushing, blow dry with compressed air and plug tube ends with plugs or caps to assure cleanliness. Inspect tubes for correct inside diameter hole dimension. The correct inside dimension is 0.084-inch. Tubes with larger or smaller hole diameter are to be discarded. On original production engines, fuel tubes were hand formed from straight tubes. Carefully inspect all tubes for proper configuration using a current preformed tube of like function for comparison. Excessive bending or hand forming creates high stress points and greatly reduces tube life. Discard any tube that deviates from preformed comparison tube configuration. Inspect tube assemblies for cracks, splits or kinks and for defective safety sleeve nut and sleeves. Refer to figures 6-248 and 6-249 for comparison of original production and improvised design sleeve fittings shown in serviceable and unserviceable condition. Straighten minor bends in tubing when possible. Discard entire tube assembly if fittings are damaged or tubing has been kinked.

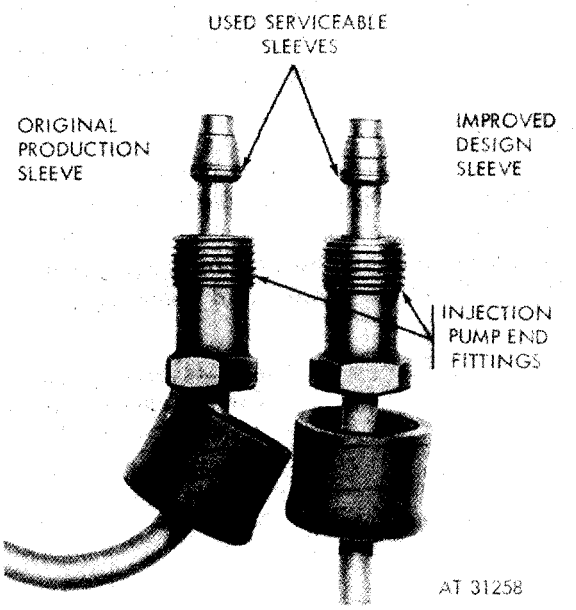


Figure 6-248. Comparison of serviceable original production and improvised design sleeves-fuel injection pump tube ends.

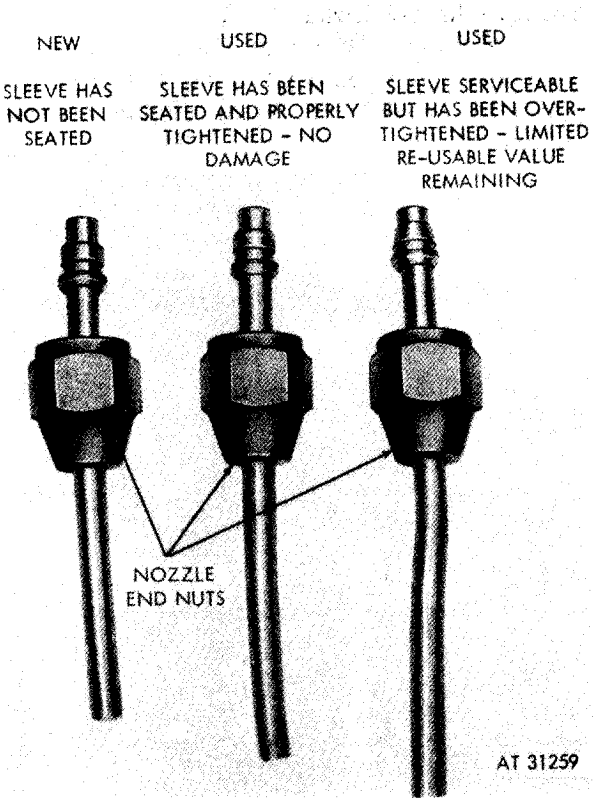


Figure 6-249. Comparison of serviceable sleeves-injector nozzle tube ends.

(2) *Nozzle fuel return tubes and hoses.* Clean nozzle fuel return tubes and hoses thoroughly. Inspect tube and hose connections for cracks, or mutilated sealing surfaces. Inspect hoses for pliability or signs of deterioration.

Note. Due to design change, there are two types of fuel returns used on engines. Original production engines had a rigid preformed metal tube, while improved design engines have a flexible rubber hose.

(3) *Fuel injection pump fuel return hose.* Pressure check fuel injection pump fuel return hose to a proof pressure of 200 psi. Replace tubes that are unserviceable.

c. Assembly. Fuel injection pump fuel tubes and nozzle fuel return tubes will be assembled during engine assembly, Chapter 7.

6-61. Injection Pump and Turbosupercharger Oil Hoses

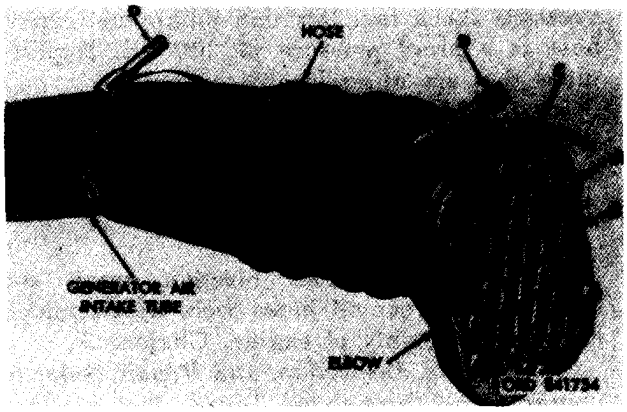
a. Disassembly. The injection pump and turbosupercharger oil hoses were disassembled during disassembly of engine, Chapter 5.

b. Cleaning, Inspection, and Repair. Refer to paragraph 6-2 through 6-4. Inspect fuel injection pump and turbosupercharger oil hoses for cracks, frayed or chafing of the woven metal sheathing. Pressure check the turbosupercharger oil inlet hose to a proof pressure of 300 psi. Pressure check the turbosupercharger oil inlet hose to a proof pressure of 200 psi and oil supply hose to 160 psi. Check hose connections for cracks or damage. Replace hose connections when pressure check indicates a leak or hose damage is apparent.

c. Assembly. Injection pump and turbosupercharger oil hoses will be assembled during engine assembly, Chapter 7.

6-62. Overhaul of Generator Air Intake and Exhaust Tubes and Associated Parts

a. Disassembly. Disassemble generator air intake tube assembly following instructions which accompany figure 6-250. The generator boot exhaust tube, and associated parts were disassembled during disassembly of engine, Chapter 5.



Disassemble

1. Remove six cap screws (A) and lock washers attaching screen to hose elbow.
2. Remove screen (B).
3. Remove and discard screen gasket (C).
4. Loosen two hose clamps (D) and remove hose from generator air intake tube and elbow. Remove clamps from hose.

Assemble

1. Position two hose clamps (D) on hose. Position hose on elbow and generator air intake tube and tighten hose clamps.
2. Position a new screen gasket (C) on elbow.
3. Position screen (B) on elbow.
4. Install six cap screws (A) and lock washers securing screen to elbow.

Figure 6-250. Disassembling or assembling generator air intake tube assembly.

b. Cleaning, Inspection, and Repair. Refer to paragraphs 6-2 through 6-4.

c. *Assembly.* Refer to figure 6-250. The generator boot, exhaust tube, and associated parts are assembled during engine assembly, Chapter 7.

Section XVI. OVERHAUL OF CRANKCASE BREATHER TUBES, FIRE EXTINGUISHER TUBE, INJECTION PUMP ELECTRICAL LEAD, AND MANIFOLD HEATER FUEL TUBES, FILTER AND ELECTRICAL COMPONENTS

6-63. General

This section covers the overhaul of the crankcase breather tubes, fire extinguisher tube, injection pump electrical lead, and manfiold heater fuel tubes, filter, and electrical components. Specific instructions on disassembly, cleaning, inspection, repair, and assembly accompany the overhaul operations. Refer to the following table (table 6-45) for applicable illustrations and instructions for overhaul operations.

Table 6-45. Crankcase Breather Tubes, Fire Extinguisher Tube, Injection Pump Electrical Lead, and Manifold Heater Fuel Tubes, Filter, and Electrical Components

Component	Disassembly	Cleaning	Inspection	Repair	Assembly
Crankcase Breather Tubes, Fire Extinguisher Tube, and Pump Eletrical Lead	Para 6-64a	Para 6-2	Para 6-64b	Para 6-64b	Para 6-64c
Manifold Heater Fuel Tubes, Filter, and Electrical Components	Para 6-65a Fig. 6-251	Para 6-65b	Para 6-65b	Para 6-65b	Para 6-65c Fig. 6-251

6-64. Overhaul of Crankcase Breather Tubes, Fire Extinguisher Tube, and Electrical Lead

a. Disassembly. The crankcase breather tubes, fire extinguisher tube, and electrical lead were disassembled during engine disassembly, Chapter 5.

b. Cleaning, Inspection, and Repair. Refer to paragraphs 6-2 through 6-4.

(1) *Breather tubes and tee.* Inspect breather tubes (10, 11, 30, 36, and 43, fig. B-11) and breather tube tee (16) for cracked, bent, or dented condition and for warping of tube mounting surface. Replace when cracked or badly dented or bent, or when mounting surfaces are badly warped. Straighten bent tubes to as near original shape as possible. Remove minor warpage of mounting surfaces by rubbing across abrasive cloth held tightly on a surface plate or similar flat surface.

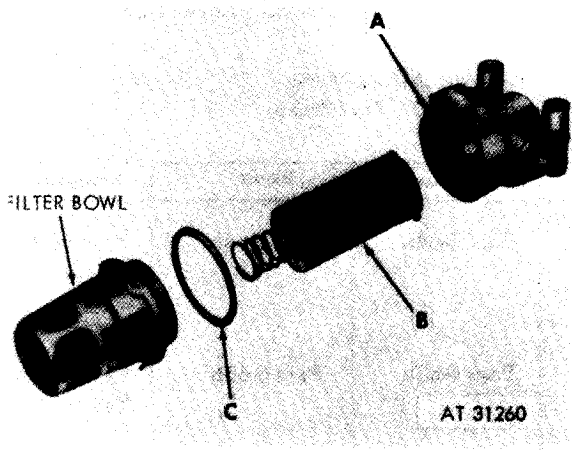
(2) *Fire extinguisher tube.* Inspect fire extinguisher tube (24, fig. B-11) for cracked, bent, or dented condition. Check spray holes in tube for obstructions and corrosion. Inspect tube fittings (25 and 26) for cracks and for stripped or damaged threads. Pressure check tube to withstand a maximum working pressure of 25 psi. Replace tube when cracked, badly bent, or when spray holes cannot be cleaned. Replace fittings when cracked or when threads are damaged.

(3) *Pump electrical lead.* Inspect pump electrical lead (51, fig. B-11) for cracked, frayed, or deteriorated insulation. Inspect lead for continuity with a low voltage circuit tester. Inspect electrical connectors for stripped or damaged threads. Replace electrical lead when insulation is cracked or broken, connector threads are damaged, or when low voltage tester indicates a failure,

c. Assembly. The crankcase breather tubes, fire extinguisher tube, and electrical lead are assembled during engine assembly, Chapter 7.

6-65. Overhaul of Manifold Heater Tubes, Filter, and Electrical Components

a. Disassembly. Disassemble the manifold heater filter following instructions which accompany figure 6-251. The heater tubes and electrical components were disassembled during engine disassembly.



Disassemble
1. Unscrew and separate filter head (A) and filter bowl.
2. Remove and discard filter element (B).
3. Remove and discard preformed packing (C).

Assemble
1. Position a new preformed packing (C) on filter bowl.
2. Position new filter element (B) in bowl
3. Install head (A) on bowl.

Figure 6-251. Disassembling or assembling manifold heater fuel filter.

b. Cleaning, Inspection, and Repair. Refer to paragraphs 6-2 through 6-4.

(1) *Heater tubes.* Flush rigid heater tubes (19, fig. B-21) thoroughly and dry with compressed air. Clean plastic tubes (50) with a clean dry cloth and blow tubes out with compressed air. Inspect tube fittings for stripped or damaged threads. Replace tubes that are split or kinked or when fittings are damaged.

(2) *Heater fuel filter.* Replace filter element if deformed or if foreign material is embedded.

(3) *Electrical components.* Inspect heater electrical leads (9, fig. B-21) and ignition units (8) for cracks, continuity, and other damage. Replace leads and ignition units that fail to pass continuity test.

c. Assembly. Refer to figure 6-251. The manifold heater tubes and electrical components are assembled during engine assembly, Chapter 7.

Section XVII. OVERHAUL OF FUEL INJECTION PUMP DRIVE COUPLERS, FUEL INJECTOR NOZZLES, PISTON OILER NOZZLES, AND TIME TOTALIZING METER

6-66. General

This section covers the overhaul of the fuel injection pump drive couplers, fuel injector nozzles, piston oiler nozzles, and time totalizing meter. Specific instructions on disassembly, cleaning, inspection, repair, and assembly accompany the overhaul instructions. Refer to the following table (table 6-46) for applicable illustrations and instructions for overhaul operations.

Table 6-46. Fuel Injection Pump Drive Couplers, Fuel Injector Nozzles, Piston Oiler Nozzles and Time Totalizing Meter

Component	Disassembly	Cleaning		Repair	Assembly
Fuel Injection Pump Drive Splined Coupler	Para 6-67a Fig. 6-252	Para 6-2	Para 6-67b	Para 6-67b	Para 6-67c Fig. 6-252
Diaphragm Coupler	Para 6-67a Fig. 6-253	Para 6-2	Para 6-67b	Para 6-67b	Para 6-67c Fig. 6-253
Fuel Injector Nozzles	Para 4-23 Fig. 4-169	Para 4-23	Para 4-23	Para 4-23	Para 4-26, 4-27, Figs. 4-169, 4-168 4-167
Piston Oiler Nozzle	Para 6-69a Fig. 6-254	Para 6-69b	Para 6-69b	Para 6-69b	Para 6-69c Fig. 6-254
Time Totalizing Meter			Para 6-70a Figs. 6-255, 6-256		

6-67. Overhaul of Fuel Injection Drive Couplers

a. Disassembly. Disassemble the drive splined coupler following instructions which accompany figure 6-252. Disassemble drive diaphragm coupler following instructions which accompany figure 6-253.

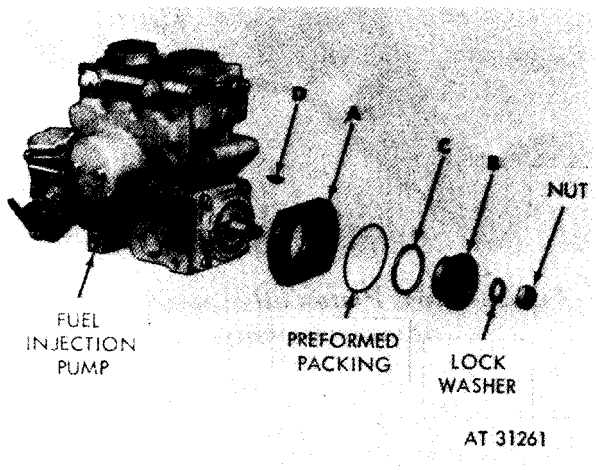


Figure 6-252. Disassembling or assembling fuel injection pump drive splined coupler.

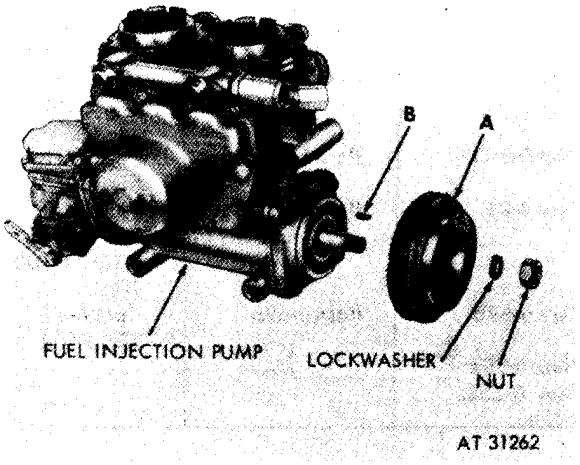
Disassemble

1. Refer to figure 4-59 and 4-61 to remove front coupler sleeve and hub from injection pump.
2. Separate front coupler sleeve (A) and injection pump hub (B).
3. Remove quad ring (C) from coupler sleeve.
4. Remove Woodruff key (D) from pump shaft.

Note. Keep front coupler sleeve and hub together. Place them with the rear coupler sleeve and drive shaft hub on rear fan drive housing. Check identification marks made during engine disassembly (fig. 4-52) to make sure these parts match. These parts are mated and must be kept together.

Assemble

1. Position Woodruff key (D) in pump shaft.
2. position quad ring (C) in internal groove of front coupler sleeve (A).
3. Install injection pump hub (b) in coupler sleeve.
4. Refer to figure 4-63 to install hub and sleeve on pump shaft and install preformed packing.



Disassemble

1. Refer to figure 4-60 and 4-62 to remove diaphragm coupler (A) from injection pump.
2. Remove Woodruff key (B) from pump shaft.

Assemble

1. Position Woodruff key (B) in pump shaft.
2. Refer to figure 4-64 to install diaphragm coupler (A) on fuel injection pump.

Figure 6-253. Disassembling or assembling fuel injection pump drive diaphragm coupler.

b. Cleaning, Inspection, and Repair. Refer to paragraphs 6-2 through 6-4, and (1) and (2), below.

(1) *Drive splined coupler.* Refer to paragraph 6-42c (7).

(2) Drive diaphragm coupler. When cleaning, Diaphragm must not be immersed in fluids or cleaners. Inspect diaphragm (10, fig. B-16) for cracks, scratches, or mars on rims or diaphragms. Inspect diaphragm pack and flange coupler (12) keyways for wear or mutilation. If diaphragm pack is cracked, do not attempt to repair by welding. Replace unserviceable parts by salvage or replace coupler assembly.

c. Assembly. Refer to figures 6-253 and 6-252.

6-68. Rebuild of Fuel Injector Nozzle and Holder Assembly

Refer to paragraphs 4-22 through 4-24 and figures 4-163 through 4-165 for rebuild of the fuel injector nozzle and holder assembly.

6-69. Overhaul of Piston Oiler Nozzle Assembly

a. Disassembly. Do not remove nozzles (fig. 6-254) unless the nozzle or holder cannot be cleaned without disassembly. To remove nozzles, position holder in a soft-jawed vise and remove nozzles.

b. Cleaning, Inspection, and Repair. Refer to paragraphs 6-2 through 6-4. Make sure oil passages in holder and oil holes in nozzles are clean and free of obstruction. Replace nozzles and holders as necessary, when oil passages and holes cannot be cleaned of obstructions.

c. Assembly. Refer to figure 6-254 to install the nozzle in the holder if removed. Stake nozzles on three flats, 120 degrees apart.

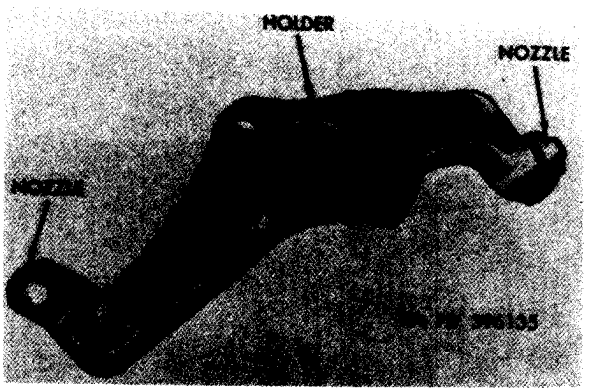


Figure 6-254. Piston oiler nozzle and holder assembly.

6-70. Time Totalizing Meter

a. Inspection and Test. Inspect the time totalizing meter for dents or other deformities which would impair its function. Test the totalizing meter to be sure it is functioning properly by connecting the meter electrical connection (fig. 6-255) to a 24 volt electrical system. The time totalizing meter is calibrated to record the electrical impulse in tenths of an hour and will numerically record every six minutes. Allow sufficient passage of time to be certain hour counter is performing properly.

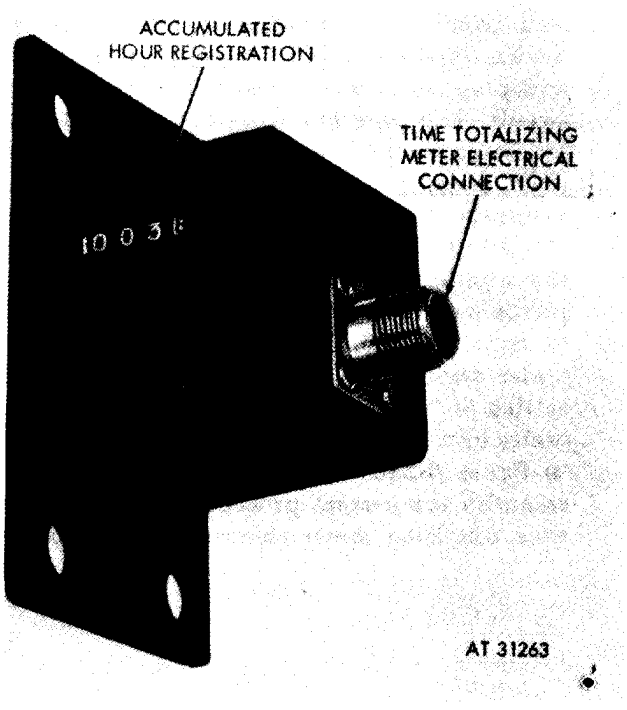
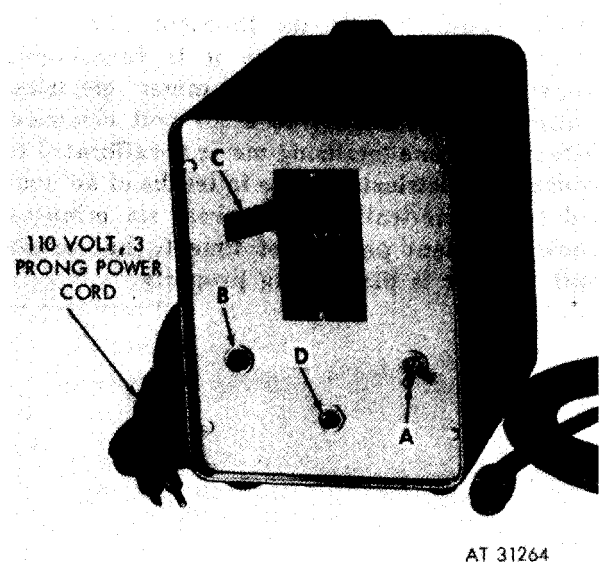


Figure 6-255. Time totalizing meter.

b. Resetting Time Totalizing Meter. Connect lead from time totalizing meter electric reset device - 6645-179-2712 to connection on meter and plug reset device into a 110 volt electrical circuit. The time totalizing meter and the time totalizing meter reset device both have a four digit, accumulative time, recording system. To determine the number of hours required to reset the time totalizing meter to a zero reading, add the number of hours registered on the time totalizing meter to the number of hours required to equal 10,000. Example: a time totalizing meter registration of 0500 and a reset device setting of 9500 will advance the time totalizing meter until a reading of 0000 is achieved. Refer to figure 6-256 and follow the instructions to establish the correct procedure to calibrate the time totalizing meter electric reset device.



1. Plug reset device into 110 volt electrical circuit being sure power switch (A) is in the off position.
2. Depress reset knob (B) and lock by turning ¼ turn clockwise until tbe white line on knob is in a horizontal position.
3. Open preset cover (C) and dial in the desired numbers, when added to the reading on the time totalizing meter equal a 10,000 hour meter reading.
4. Close preset cover (C) and unlock reset knob (B) by turning ¼ turn counterclockwise.
5. Turn power switch (A) on the depress start switch (C) to begin resetting. Unit will complete resetting and stop automatically.
6. Should unit stop slightly short of zero, introduce additional counts by momentarily depressing start switch (D).

Figure 6-256. Time totalizing meter electric reset device-6645-179-2712.

CHAPTER 7
ASSEMBLY OF ENGINE

Section I. GENERAL

7-1. Cleanliness

The engine is a precision product and extreme care and cleanliness must be exercised in all phases of assembly operations to insure satisfactory engine performance. Dirt and dust, even in minute quantities, are abrasive. After cleaning and just before assembly, coat all bearings, shafts, and contact surfaces with engine oil (OE). This will insure sufficient lubrication of moving parts when first put into operation.

7-2. General Assembly Instructions

a. Gaskets. Always use new gaskets when assembling the engine. Use new preformed packings and annular copper gaskets throughout engine assembly. An engine overhaul parts kit 2815-678-4245, consisting of all necessary gaskets and preformed packings, is available for use during engine overhaul.

b. Kits and Sets. Several of the components of the engine are available in kits or sets. Whenever a kit or set is used for parts replacement, all components of the kit or set should be installed, except for the auxiliary oil filter parts kit, FSN 2940-884-4801. This kit is the universal type. Refer to Appendix for specific information.

c. Attaching Parts. When torque tightening nuts, bolts, and screws, and a torque specification is not noted in the text or illustration covering the installation, it is understood that the standard torque values in paragraph 6-7 prevail. Whenever a nut, bolt, or screw requires that special attention be given, the torque value will be noted in the text or illustration pertaining to that operation. Torque wrench readings are of no value, unless properly used. It must be understood that it is not the force necessary to turn the nut, bolt, or screw that is important, but the resultant pull on the part that completes the union. Therefore, resistance of the nut to turning must be kept to a minimum. Threads must be clean and undamaged, and lubricated with antiseize compound FSN 9150-663-1770 to reduce the friction.

Note. When using a torque wrench, the final reading must be taken while the nut, cap screw, or bolt is turning. When torque reading is close to that specified when wrench is at the end of its swing, back off the nut slightly and change wrench position; then pull to the desired reading while the nut is turning. To start a partially tightened nut will require a much higher torque than that required to keep a nut turning. The ratio of pounds-torque to pounds-pull on a bolt is not an even ratio and excess torque may easily overstress the bolt. Under-torquing bolts and studs subject to cyclic loads such as cylinder base studs and connecting rod bolts will result in fatigue failures. It is therefore important that the torque values specified in this manual be followed to avoid failures of fasteners.

Note. Do not exceed torque specified.

d. Lock Nuts, Tab Washers, Locking Wire, Lock Washers, and Cotter Pins. All bolts and nuts should be secured with lock nuts, tab washers, locking wire, lockwashers, or cotter pins, as specified. Many engine failures have been traced to neglect of this simple precaution.

7-3. Installation Instructions

Note. References to figures in this Chapter are listed in the reverse order of disassembly both in text and tables, which is the sequence required to accomplish reassembly of the engine; i.e., 5-24 through 5-11.

Usually the step-by-step procedure to be followed for installing subassemblies on the engine are given immediately following the removal procedure in Chapter 5. This method of installation will be used throughout this chapter unless otherwise indicated in the contents table immediately following each paragraph. Each contents table lists engine components, grouped in proper assembly order, and the appropriate paragraph reference and / or figure reference for installation procedures.

Section II. ASSEMBLY OF ENGINE FROM SUBASSEMBLIES

7-4. General

This section covers the assembly of the engine from subassemblies. Components are grouped together in proper assembly order. The crankcase assembly was partially assembled during rebuild of engine components (Chapter 6). Normally the crankcase assembly will be on the overhaul stand after it has been inspected and the main bearing bosses have been checked. In case crankcase is not on stand, install on maintenance and overhaul stand - 4910-856-4137 (fig. 6-8) and rotate stand so that oil pan flanges are up.

7-5. Starter Drive Gearshaft, Generator and Idler Gears, Piston Oiler Nozzles, and Crankshaft and Connecting Rod Assembly

Refer to Table 7-1 for illustrations and assembly instructions. References are listed in the table.

Table 7-1. Starter Drive Gearshaft, Generator and Idler Gears, Piston Oiler Nozzles, and Crankshaft and Connecting Rod Assembly

Component	Reference
Starter Drive Gearshaft and Generator and Starter Idler Gears	Para 7-5a, Figs. 5-184, 5-183, 7-1, 5-181
Piston Oiler Nozzles and Crankshaft and Connecting Rod Assembly	Fig. 5-180, Para 7-5c, Figs. 5-179 through 5-175, 7-2, 7-3, 5-173, 7-4, 5-172, 5-171

a. Starter Drive Gearshaft and Generator and Starter Idler Gears. Refer to figures 5-184, 5-183, and 5-181 and to the instructions given in (1) and (2), below.

(1) *Starter drive gearshaft bearing cage.* There are two types of bearing cages being used on the engine. Early bearing cages have a flush mounting face and require the use of a sealent. Late bearing cages have a machined recess to accommodate a preformed packing. When overhauling an engine, do not attempt to use a preformed packing on a bearing cage that does not have a machined groove to accommodate the packing.

(2) *Generator and starter idler gears.* Install generator idler gear and assembled ball bearing retaining ring toward rear of crankcase in the same manner as the starter idler gear.

Note. Retaining ring securing ball bearing in starter idler gear must be toward rear of crankcase when idler gear is positioned in crankcase.



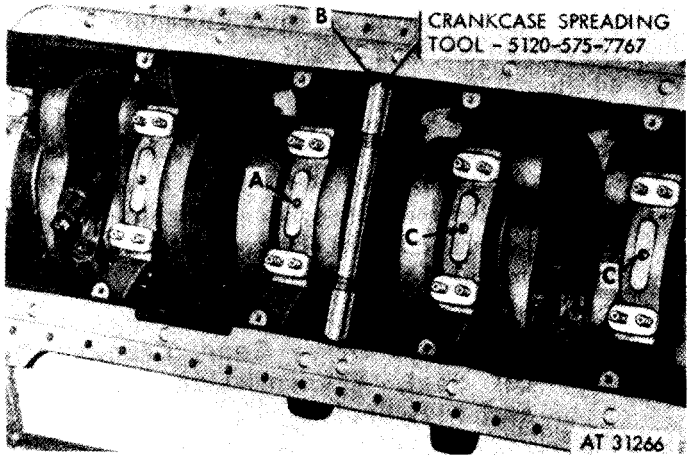
1. Install new preformed packing (A) on idler gearshaft (C).
2. Position starter idler gear (B) and a line with idler gearshaft bore in crankcase.

Figure 7-1. Installing starter idler gear.

b. Piston Oiler Nozzles. Refer to figure 5-180.

c. Crankshaft and Connecting Rod Assembly. Refer to figures 5-179 through 5-175 and to the instructions given in (1) through (3), below.

(1) *Main bearing caps.* Coat outer edges of the bearing cap and machined surfaces of the crankcase webs with engine oil to facilitate installation of caps.



1. Install number 4 (center) thrust bearing cap (A) and bearing half in position on crankcase studs (tie rods). Use crankcase spreading tool (B)-5120-575-7767 to spread crankcase so bearing caps will slide over studs and into position in the crankcase.

Note. Be sure main bearing caps and main bearing halves are installed in their original positions according to location number identification on the cap and bearing half.

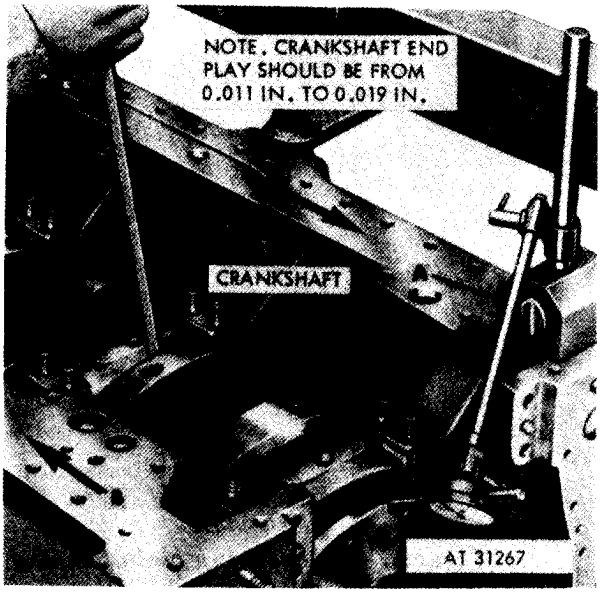
2. Install the remaining six bearing halves in caps (C) and similarly install caps and bearings in crankcase.

Note. The side of each main bearing cap identified as "fly end" must be installed toward flywheel end or rear of engine.

Figure 7-2. Installing main bearing caps using crankcase spreading tool-5120-575-7767.

(2) *Crankshaft end play.* Check crankshaft end play following the instructions which accompany figure 7-3.

Note. End play should be from 0.00740 to 0.019-inch. When end play exceeds 0.019-inch, remove bearing caps and crankshaft. Install bearing cap and recheck thrust bearing bore (para 6-9d). Then install crankshaft and recheck end play to make sure it is within limits.



1. Mount a dial indicator (A) on crankcase so indicator point contacts drive gear flange on crankshaft.
2. Using a heavy duty screwdriver, wedged between main bearing cap and crankshaft counterweight, push crankshaft toward front end (B) of crankcase.
3. Set indicator (C) on zero reading ("0").
4. Using heavy duty screwdriver, push crankshaft toward the rear (D) of crankcase and check indicator end play reading.

Figure 7-3. Checking crankshaft end play.

(3) *Main bearing attaching parts.*

(a) Refer to figure 5-173 and install all main bearing cap plate washers and nuts. Do not torque tighten nuts at this time. Check and record the height of each stud using a flat surface plate and dial indicator as shown in figure 7-4.

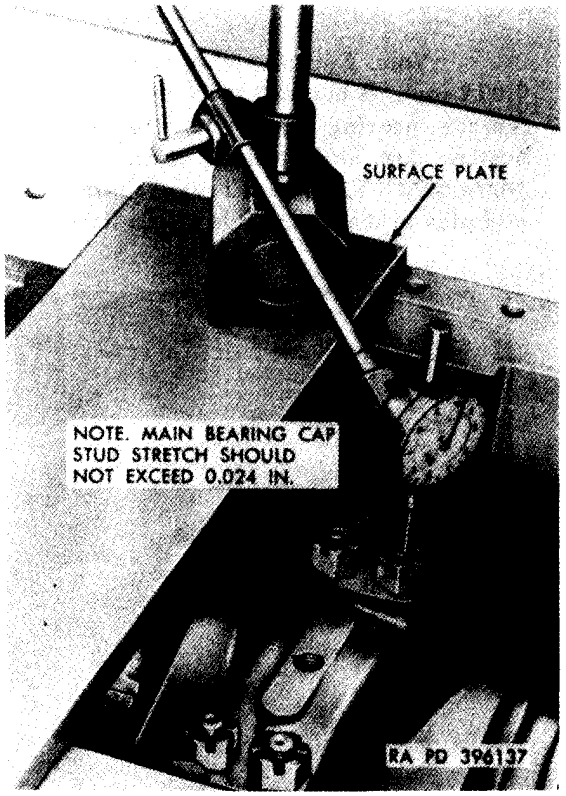


Figure 7-4. Measuring main bearing stud stretch using dial indicator.

(b) Refer to figures 5-172 and 5-171 and install crankcase tie rods but do not torque tighten at this time. Refer to paragraph 7-6c.

(c) Starting at number 4 main thrust bearing, and alternating right and left, successively torque tighten all main bearing stud nuts to 500 pound-inches, then, following the same procedure and sequence, torque tighten all nuts to a final torque of 700 to 825 pound-inches

(d) Following the same procedure as (a), above, recheck stud height and apply sufficient additional torque to each nut, as in (c), above, to aline nut slot with drilled hole in stud, and to obtain a stud stretch of 0.019 to 0.022-in. Do not exceed 0.024-in. Stud stretch is defined as the difference between the original height recorded in (a) above, and height observed after nuts have been torque tightened, refer to torque specifications (para 6-7).

7-6. Accessory Drive Gear, Crankshaft Oil Seal, Transmission Adapter, and Flywheel

Refer to Table 7-2 for illustrations and assembly instructions. References are listed in the table.

Table 7-2. Accessory Drive Gear, Crankshaft Oil Seal, Transmission Adapter, and Flywheel

Component	Reference
Accessory Drive Gear Crankshaft Oil Seal Housing	Para 7-6a and b, Figs. 5-169, 7-5, 5-168, 7-6, 7-7, 5-167 through 5-165
Transmission Adapter, Flywheel, and Transmission Drive Gearshaft Assembly	Para 7-6e through g, Figs. 5-182, 5-163, 7-8, 5-159, 7-9

a. Accessory Drive Gear.

(1) *Install accessory drive gear.* Refer to figure 5-169 and alternately tighten 12 bolts to draw drive gear on to crankshaft flange.

Note. Always use accessory drive gear, FSN 2815-861-3829 (part number - 10898778) during engine assembly. This gear can be identified by measuring the length of the gear teeth, which are approximately 1-15 / 32-inch.

(2) *Checking accessory drive gear backlash.* Check backlash between accessory drive gear teeth and starter drive idler gear teeth as shown in figure 7-5. Backlash should be from 0.004 to 0.009-inch. Check backlash between accessory drive gear teeth and generator drive idler gear in the same manner.

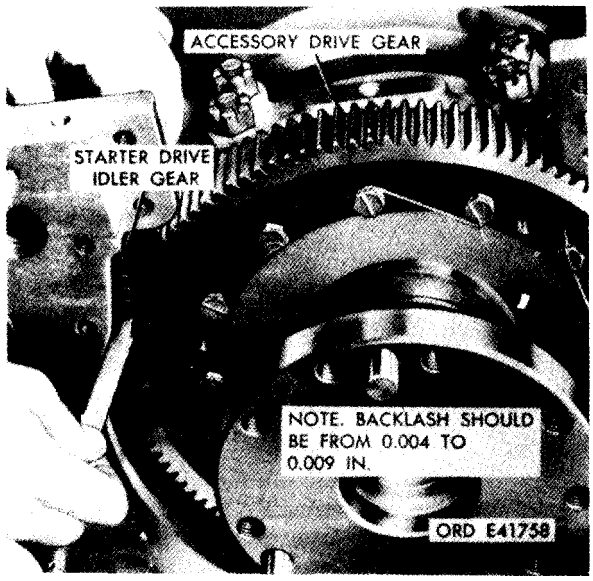


Figure 7-5. Checking accessory drive gear and starter idler gear backlash.

b. Crankshaft Oil Seal Housing and Support. Refer to figure 5-168 and install new candlewick packing in four openings, at the crankcase and oil seal housing support parting line as shown in figure 7-6. Refer to figures 5-167 through 5-165 and install oil seal cap and housing attaching parts and retainers.

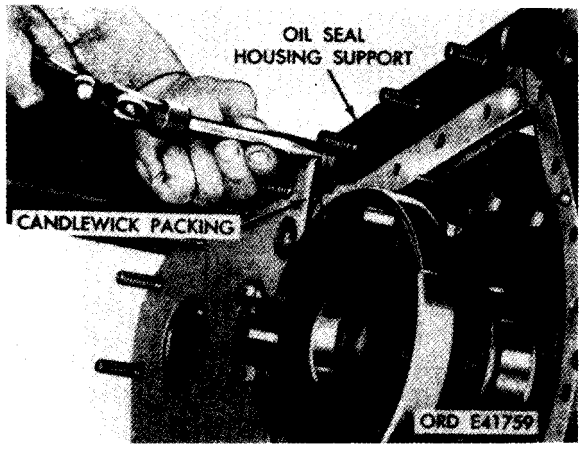


Figure 7-6. Installing candlewick packing between crankcase and oil seal housing support.

c. Torque Tighten Crankcase Tie Rod Nuts. Refer to figures 5-172 and 5-171 and, with the aid of an assistant holding the slotted nuts on opposite side of crankcase, tighten crankcase tie rod nuts to 640 pound-inches. Install 14 cotter pins to secure nuts. Care should be taken so that the tie rod extends equally on both sides of crankcase.

d. Crankshaft Oil Seal. The crankshaft oil seal is installed during overhaul of the crankshaft (fig. 6-32). Refer to figure 7-7 for correct position of oil seal split line.

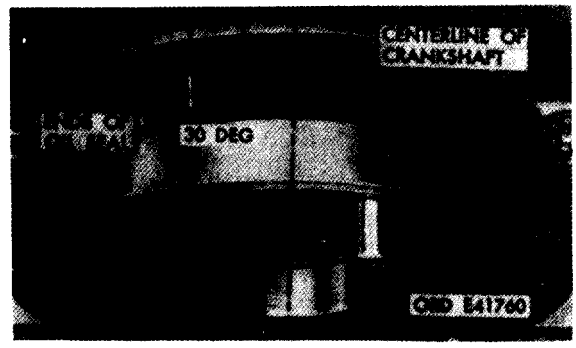


Figure 7-7. Correct position of crankshaft oil seal split line before installing seal retainer.

e. Transmission Adapter. Refer to figures 5-164 and 5-163.

f. Flywheel.

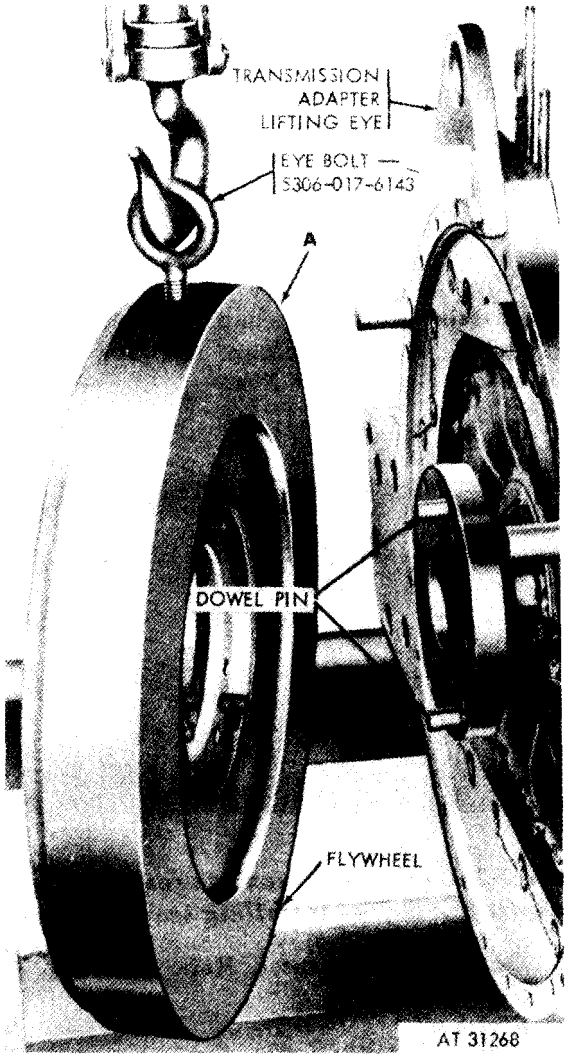
Note. The dowel pins (fig. 7-8) are so located that the flywheel can be installed on the flange on the crankshaft in only one position.

g. Transmission Drive Gearshaft Assembly.

(1) Position transmission drive gearshaft assembly on dowel pins (fig. 7-8) which protrude through flywheel.

(2) Refer to figure 5-159 and alternately tighten bolts to 1000 pound-inches.

(3) Check flywheel runout as shown in figure 7-9 using dial indicator. Runout should not exceed 0.015-inch. Replace flywheel if runout exceeds this limit.



1. Install eye bolt-5306-017-6143 in threaded hole provided in flywheel (A).
2. Attach suitable chain hoist eye bolt and aline dowel pin holes in flywheel with dowel pins in crankshaft flange. Position alined flywheel against flange on crankshaft.
3. Install three 9 / 16 x 1 ¾ in. bolts and alternately tighten bolts to draw flywheel toward flange on crankshaft. Bolts are used to secure transmission drive gearshaft.

Note. Eye bolt - 5306-017-6143 must be removed from flywheel, before flywheel is drawn tight against flange on crankshaft, to permit flywheel to clear transmission adapter lifting eye.

4. Remove lifting eye bolt and continue to tighten three bolts until flywheel is tight against flange, then remove bolts.

Figure 7-8. Installing flywheel using eye bolt-5306-017-6143.

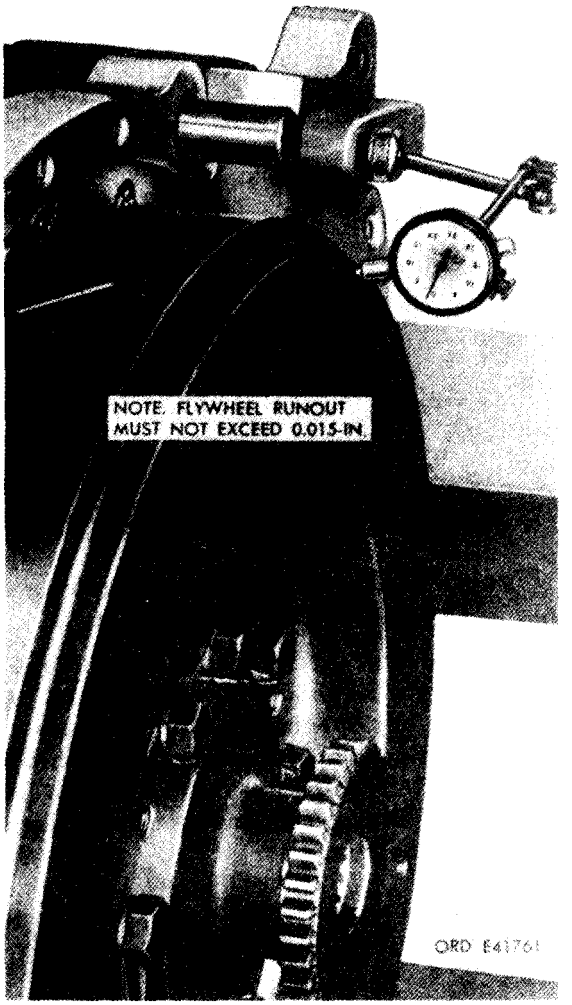


Figure 7-9. Checking flywheel runout using dial indicator.

7-7. Starter and Generator Drive Adapters, Vibration Damper, Sending Units, Oil Pump, and Oil Tubes

Refer to Table 7-3 for illustrations and assembly instructions. References are listed in the table.

Table 7-3. Starter and Generator Drive Adapters, Vibration Damper, Sending Units, Oil Pump, and Oil Tubes

Component	References
Generator Drive Adapter and Drive Gearshaft	Para 7-7a, Figs. 5-158 through 5-156
Starter Drive Adapter and Starter Driven Gear	Para 7-7b, Figs. 5-155 through 5-153
Crankshaft Torsional Vibration Damper and Fuel Pump Drive Shaft Coupling	Para 7-7c, Fig. 5-151
Sending Units, Oil Pump, and Oil Tubes	Para 7-7 and e, Figs. 5-156, 7-10, 5-149, 5-148

a. Generator Drive Adapter and Drive Gearshaft. Refer to figures 5-158 through 5-156.

b. Starter Drive Adapter and Starter Driven Gear. Refer to figures 5-155 through 5-153.

c. Crankshaft Torsional Vibration Damper and Fuel Pump Drive Shaft Coupling. Refer to figure 5-151 and position crankshaft torsional vibration damper on crankshaft. Tighten fuel pump drive coupling adapter and vibration damper mounting bolts to 1000 pound-inches.

d. Oil Pressure Sending Unit, Switch, and Generator Air Intake Tube Support Brackets. Refer to figure 5-150.

e. Oil Pump and Oil Tubes. Refer to figures 5-149 and 5-148. Always use new preformed packings on oil transfer tubes when installing the oil pump assembly. Make certain oil transfer tubes aline with openings in crankcase and mesh oil pump drive gear with accessory drive gear (fig. 7-10). Check oil pump drive gear to be certain there is 0.008 to 0.012 inch backlash between teeth of pump drive gear and accessory drive gear.

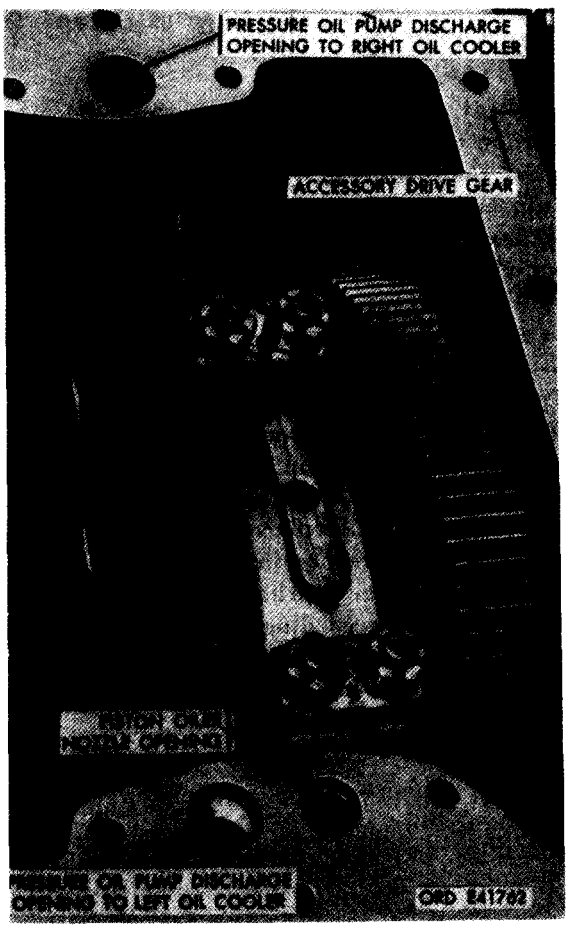


Figure 7-10. Oil pump mounting flange oil discharge locations.

7-8. Pistons and Pins, Cylinder Assemblies, Cylinder Air Deflectors, Crankshaft Damper and Oil Filter Housing, and Oil Pan

Refer to Table 7-4 for illustrations and assembly instructions. References are listed in the table.

Table 7-4. Pistons and Pins, Cylinder Assemblies, Cylinder Air Deflectors, Crankshaft Damper and Oil Filter Housing, and Oil Pan

Component	References
Pistons and Pins and Cylinder Assemblies	Para 7-8a, Figs. 7-11 through 7-13, 5-144, 5-143
Cylinder Air Deflectors	Para 7-8b, Figs. 5-142, 5-141
Crankshaft Damper and Oil Filter Housing	Para 7-8c, Figs. 5-139, 5-138
Oil Pan	Para 7-8d, Figs. 4-125, 5-137 through 5-135, 6-78, 6-80

a. Pistons and Pins and Cylinder Assemblies. Refer to the instructions given in (1) and (2), below.

(1) *Pistons.*

(a) The pistons are marked for identification as shown in figure 7-11 to aid in installing the pistons in their proper position. The piston boss is stamped with an arrow and the cylinder location (1R) to identify the cylinder from which the piston was removed and to assure piston will be returned to its original cylinder. The arrows on the piston pin bosses are pointed up, or to the exhaust outlet port. Cylinders are stamped with piston markings at the intake valve side (bottom) of valve rocker arm cover flange. Markings of any piston or cylinders must be renewed if position marks and / or arrows are not entirely legible. Replacement piston must be marked to the corresponding cylinder it is to be used with. At engine overhaul, all 12 pistons and pins are matched according to weight and cannot vary more than 5 oz. Always keep piston pin with its respective pin.

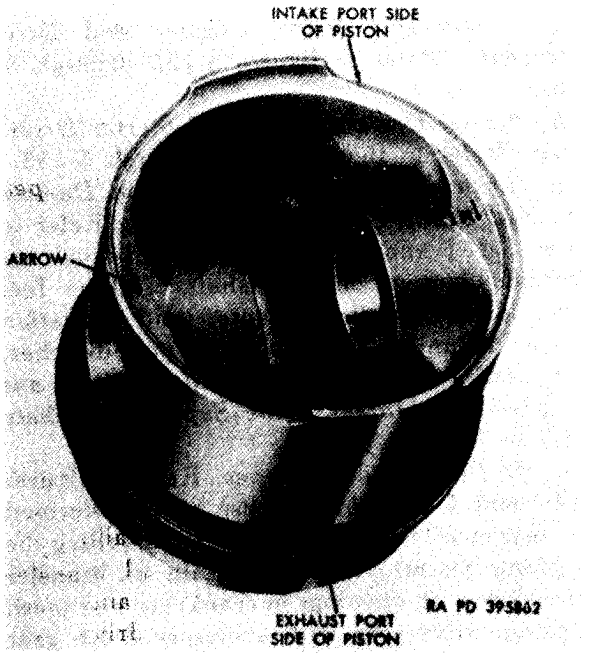


Figure 7-11. Piston installation position marks.

(b) Coat pistons with lubriplate or engine oil and stagger the four piston ring gaps 90 degrees apart.

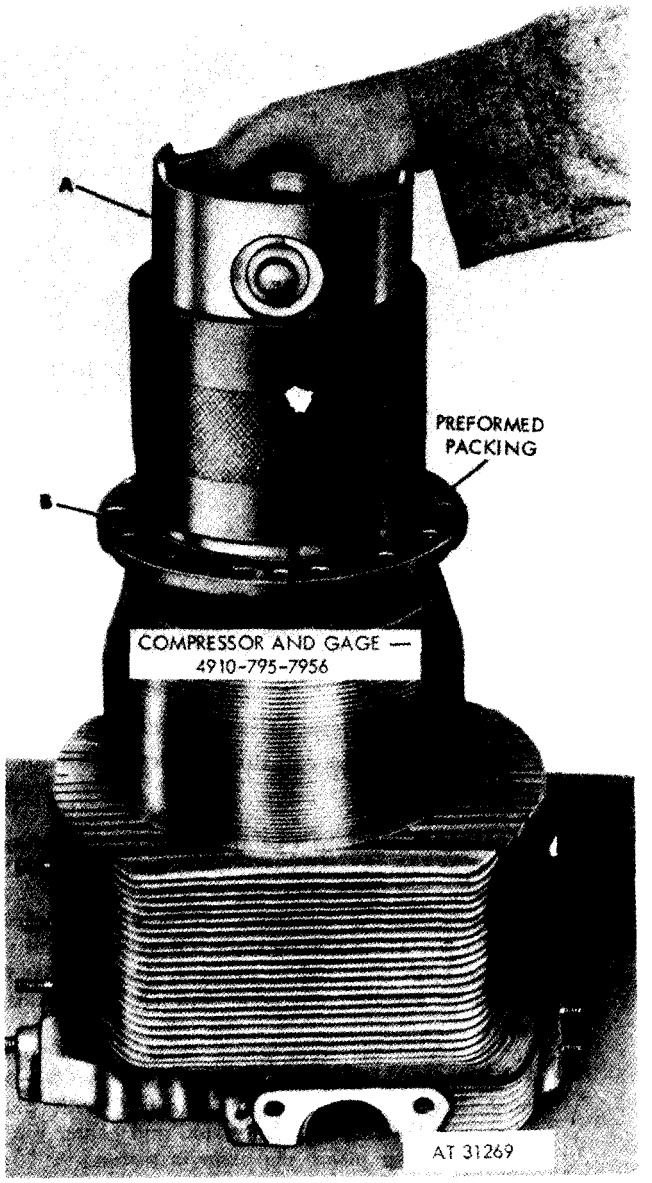
(2) *Cylinder assemblies.*

Note. For instructional purposes, the installation of only one cylinder assembly is described. The remaining cylinder assemblies should be installed in the same manner.

Note. Wash cylinder bores thoroughly just prior to engine assembly, using a power brush with hot (160 F) soap water. Cylinder bores should then be oiled to prevent rust.

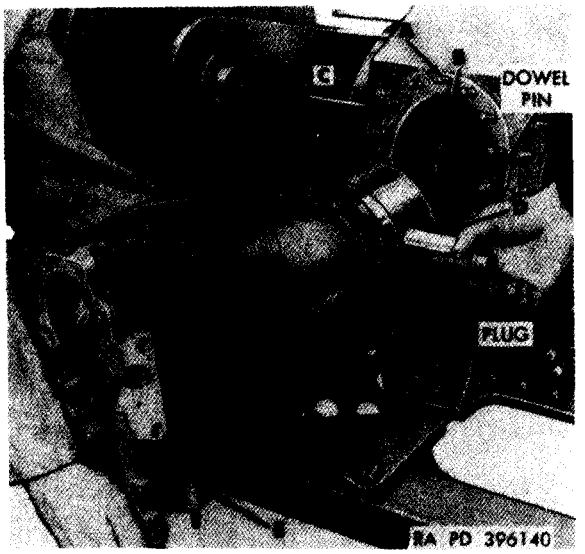
(a) Rotate engine overhaul stand until right bank cylinder holes, with connecting rod protectors, are positioned to receive cylinder Nos. 1R through 6R.

(b) Install piston with rings in cylinder and cylinder assemblies on crankcase following instructions which accompany figures 7-12 and 7-13.



1. Install piston and rings (A) in cylinder assembly using compressor and gage-4910-795-7956. The piston position number (fig. 7-11) must always correspond to the cylinder number marked on intake valve side of valve rocker arm cover flange. The arrow on the piston boss must he directed toward the exhaust port outlet. Guide piston and rings into cylinder until all piston rings have entered the cylinder bore. Slide the compressor from piston and ring assembly. Install remaining pistons in cylinders in the same manner.
2. Install new preformed packing (B) on each cylinder base making sure that packing is not twisted or otherwise improperly seated.

Figure 7-12. Installing piston in cylinder assembly using compressor and gage-4910-795-7956.



1. Sparingly coat cylinder stud threads (A) on crankcase with antiseize thread lubricant FSN 9150-527-1752 or 9150-663-1770.

Caution: If lubricant is extended to face of washer nut, reliable retaining torque cannot be obtained.

2. Rotate engine crankshaft using engine turning splined wrench-5120-793-7895 (fig. 5-91) until the No. 1R connecting rod (B) is at the top of its stroke.
3. Remove crankcase protector-4910-795-7951 from cylinder No. 1R mounting studs (C) being careful not to allow connecting rod to forceably drop against the crankcase cylinder mounting surface or mounting studs.
4. Remove piston pin from piston of No. 1R cylinder assembly and place piston and cylinder over No. 1R connecting rod. Insert piston pin (D) with plugs through connecting rod and piston and center pin in position. Center piston pin plugs in piston.
5. Slide cylinder (E) over piston on crankcase studs and temporarily secure with two extended washer nuts (fig. 5-144) positioned approximately 180 degrees apart.

Figure 7-13. Installing cylinder assemblies on crankcase.

(c) When all cylinder assemblies are installed as described and illustrated in figure 7-13, install remaining cylinder extended washer nuts and torque tighten the nuts alternately to 640 pound-inches. Use box wrench - 5120-678-5287 in combination with a torque wrench as shown in figure 5-143.

b. Cylinder Air Deflectors. Refer to figures 5-142 and 5-141.

c. Crankshaft Damper and Oil Filter Housing. Refer to figures 5-139 and 5-138.

d. Oil Pan. Refer to figures 4-125, 5-137 through 5-135 and torque tighten oil pan bolts to 175 pound-inches and self-locking nuts to 225 pound-inches. Tighten four slotted nuts (C, fig. 6-90 or C, fig. 6-92) and install locking wire.

Note. During overhaul operations, consideration must be given to engine model, when assembling oil pan to engine. Engine Model AVDS-1790-2-M had an oil pan (10865039, fig. 7-14) with oil drain plugs located specifically designed for a certain vehicle and the engine model was not interchangeable with other vehicles. The oil pan (10912162, fig. 7-15) on engine Models AVDS-1790-2-AM and AVDS-1790-2A provides an oil drain plug location that is accessible in all vehicles. Although limited numbers of early oil pans are in current use, care must be taken in Depot overhaul to identify the early oil pans and properly designate engine model.

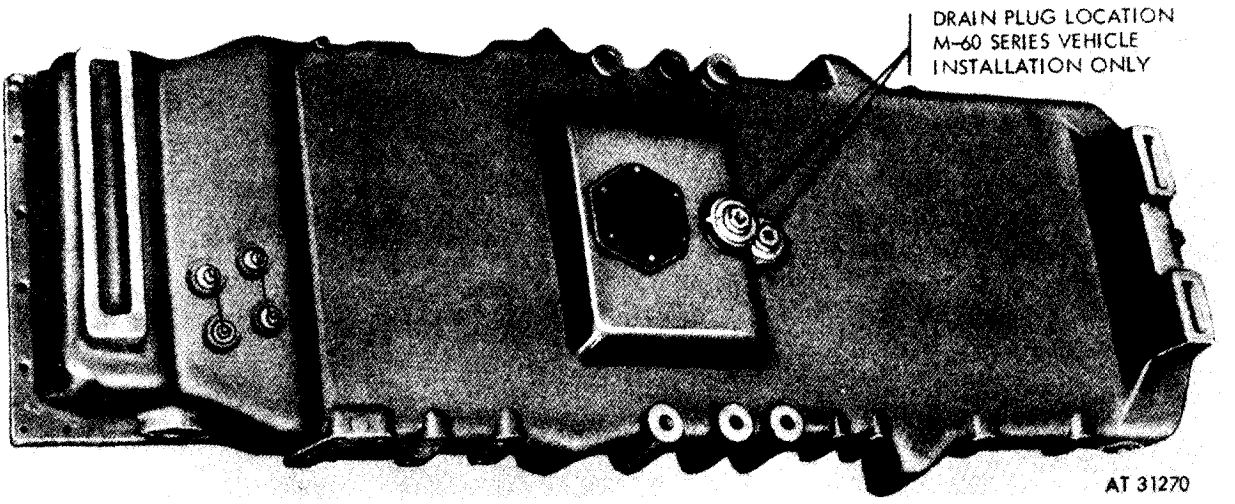


Figure 7-14. Oilpan (10865039) drain plug location-limited to M60 series vehicles.

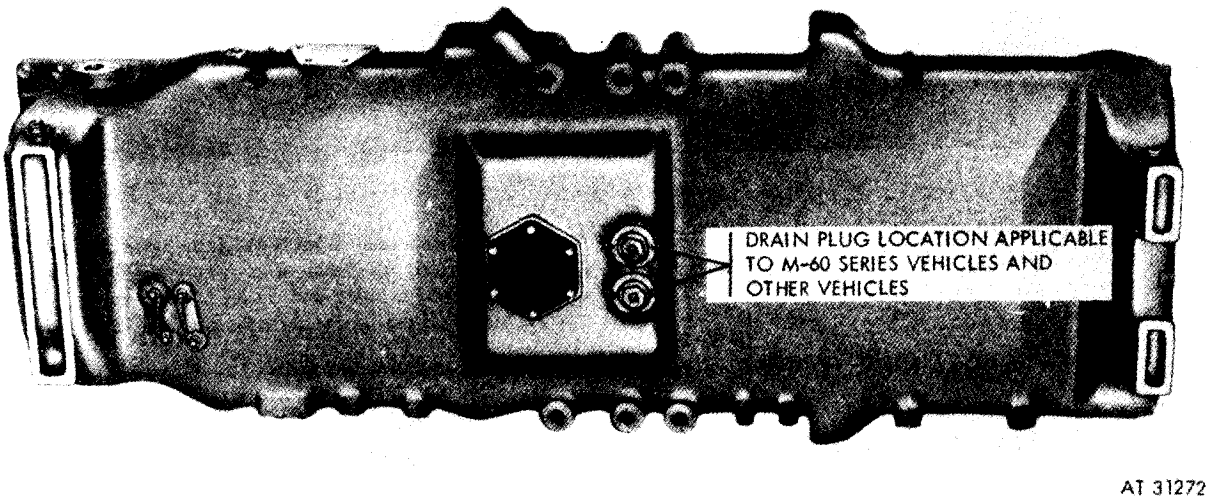
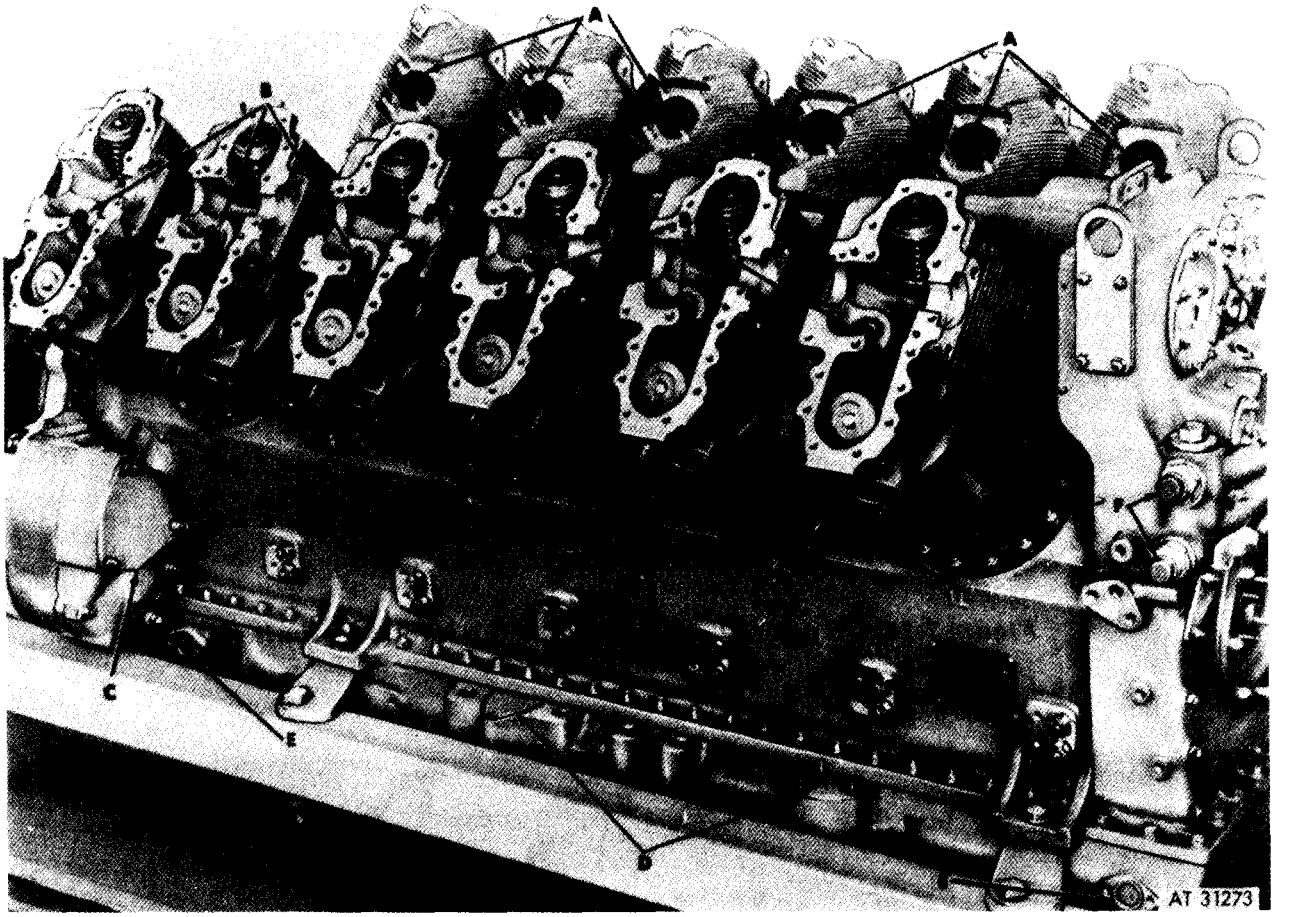


Figure 7-15. Oil pan (10912162) drain plug location for universal vehicle application.

e. Protective Coverings. Rotate engine stand, as shown in figure 7-16 and cover all cylinder and engine openings with plastic covers, or suitable improvised covers following instructions which accompany figure 7-16.

Note. All openings must be covered to prevent foreign material, dirt, loose metal parts, etc. from accidentally falling into openings, especially cylinder exhaust port openings.



1. Cover 12 cylinder exhaust ports (A).
2. Cover 12 fuel injector nozzle holder assembly ports (B).
3. Cover starter adapter opening (C).
4. Cover oil filler and oil level indicator openings (D) and cylinder head oil drain tube openings (E).
5. Cover oil cooler inlet and outlet hose openings (F) on each side of crankcase damper and oil filter housing.

Figure 7-16. Protecting openings to prevent entrance of dust and foreign objects.

7-9. Fan Drives, Housings, and Bases

Refer to Table 7-5 for illustrations and assembly instructions. References are listed in the table.

Table 7-5. Fan Drives, Housings, and Bases

Component	Reference
Rear Fan and Accessory Drive Housing with Clutch Assembly and Mounting Base	Para 7-9a, Fig. 5-134, 5-133, 5-131, 7-17, 5-130, 5-129
Fuel Injection Pump Mounting Base	Para 7-9b, Fig. 5-128, 5-127
Front Fan Drive Housing with Clutch Assembly and Mounting Base	Para 7-9c, Fig. 5-126, 5-125, B- , 7-18, 5-123, 5-122, 5-120 through 5-117, 7-19

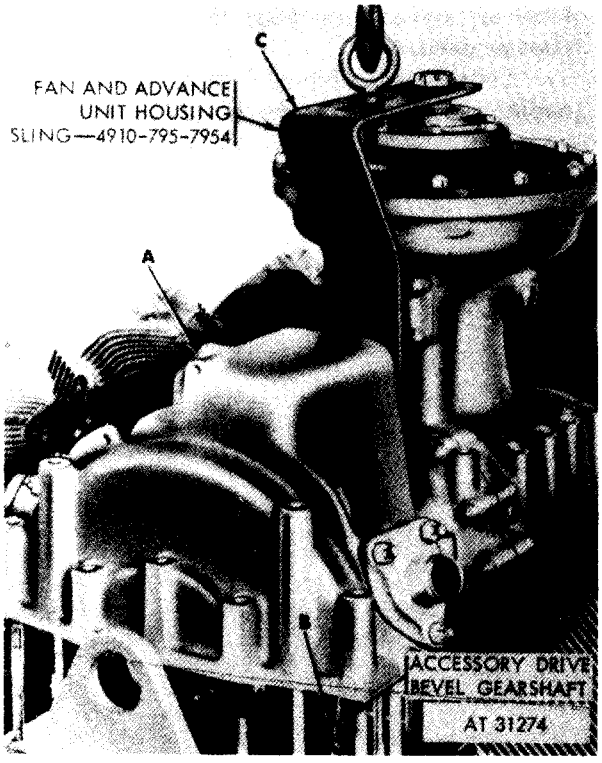
a. Rear Fan and Accessory Drive Housing with Clutch Assembly and Mounting Base.

(1) Install three new preformed packings on oil transfer tubes in crankcase (fig. 5-134). Apply a thin coat of gasket cement (MIL-C-10523 Ord) to mounting base lower mounting surface before assembly to crankcase.

(2) Refer to figure 5-133 and torque tighten screws and nuts to 275 pound-inches. Apply a thin coat of gasket cement (MIL-C-10523 Ord.) on the mounting surface of the base prior to assembling rear fan and accessory drive housing.

(3) Refer to figure 5-131 and install fan and advance unit housing sling - 4910-795-7954.

(4) Refer to figure 7-17 and install rear fan and accessory drive housing with clutch assembly.



1. Lower the rear fan and accessory drive housing assembly (A) until holes in housing aline with studs in mounting base.
2. Continue lowering housing until accessory drive bevel gearshaft gear teeth (B) engage with the gear teeth of the accessory drive gear.
3. Refer to figure 5-131 and remove lifting sling (C) after rear fan and accessory drive housing are positioned.

Figure 7-17. Installing rear fan and accessory drive housing using fan and advance unit housing sling-4910-795-7954.

(5) Refer to figure 5-130 and torque tighten the 12 self-locking nuts (A) to 275 pound-inches. Refer to figure 5-129 and torque tighten 14 self-locking nuts to 275 pound-inches.

b. Fuel Injection Pump Mounting Base.

(1) Install new preformed packing on oil transfer tube in crankcase (fig. 5-128).

(2) Refer to figure 5-127 and torque tighten four bolts to 750 pound-inches.

c. *Front Fan Drive Housing with Clutch Assembly and Mounting Base.*

(1) Install new preformed packing at oil transfer tube in crankcase assembly (fig. 5-126).

(2) Apply a thin coat of gasket cement (MIL-C-10523 Ord.) on the mounting base lower mounting surface.

(3) Refer to figure 5-125 and torque tighten ten slotted nuts and two cap screws to 275 pound-inches.

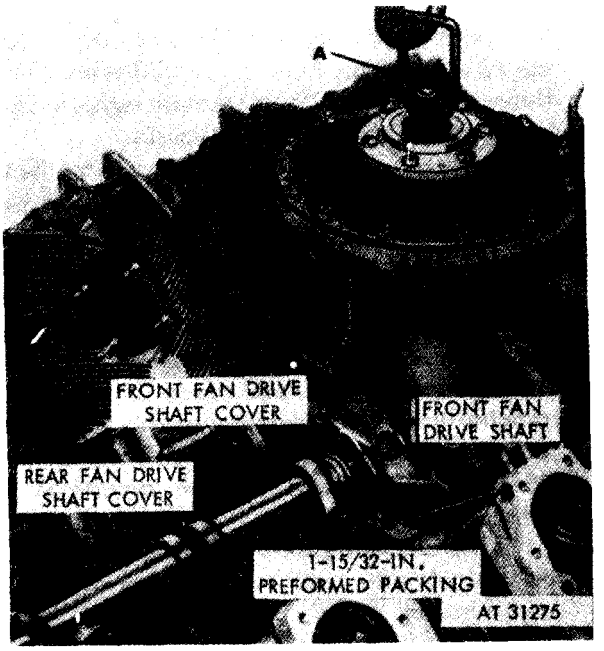
(4) Position cover adapter (58, fig. B-26) on front fan drive shaft cover (57). Similarly, position adapter (58) on rear fan drive shaft cover (62).

(5) Join the two shaft covers (58 and 621 using rubber hose (61) and two hose clamps (60). Tighten hose clamps just enough to hold the covers together as a unit. Install a preformed packing (56) on adapter end of each shaft cover

(6) Install retaining ring (55) on front far drive shaft (54).

Note. Do not install retaining ring in groove located on the front spline. Ring must be located beyond the spline at this time.

(7) Install front fan drive shaft with retaining ring, in front fan drive bevel gearshaft (50.1) of front fan drive housing and clutch assembly. Long spline must enter gearshaft. Install the assembled drive shaft covers (6), above) over the front fan drive shaft, with rt housing toward front fan drive housing as shown in figure 7-18.



Note. To facilitate lifting the front fan drive housing assembly, an improvised lifting tool can be made from a piece of 3 / 8-in. dia bar stock and a discarded slotted fan nut. Bend bar stock to shape and securely weld ends of bar to nut as illustrated in figure 2-1.

1. Install improvised lifting tool (A) on fan vertical drive shaft.
2. Apply light coat of gasket cement (MIL-C-10523 Ord.) on mounting base (B).
3. Lower front fan drive housing assembly and associated parts on mounting base.

Figure 7-18. Installing front fan drive housing assembly using improvised lifting tool.

(8) Refer to figure 5-123 and torque tighten two drilled head cap screws to 275 pound-inches. Refer to figure 5-121 and torque tighten seven self-locking nuts to 275 pound-inches.

(9) Refer to figures 5-120 through 5-117 and install the fan horizontal drive shaft. Center hose on drive shaft housing and tighten hose clamps securely.

(10) Refer to figure 7-19 for the view of the engine as it appears at this stage of assembly.

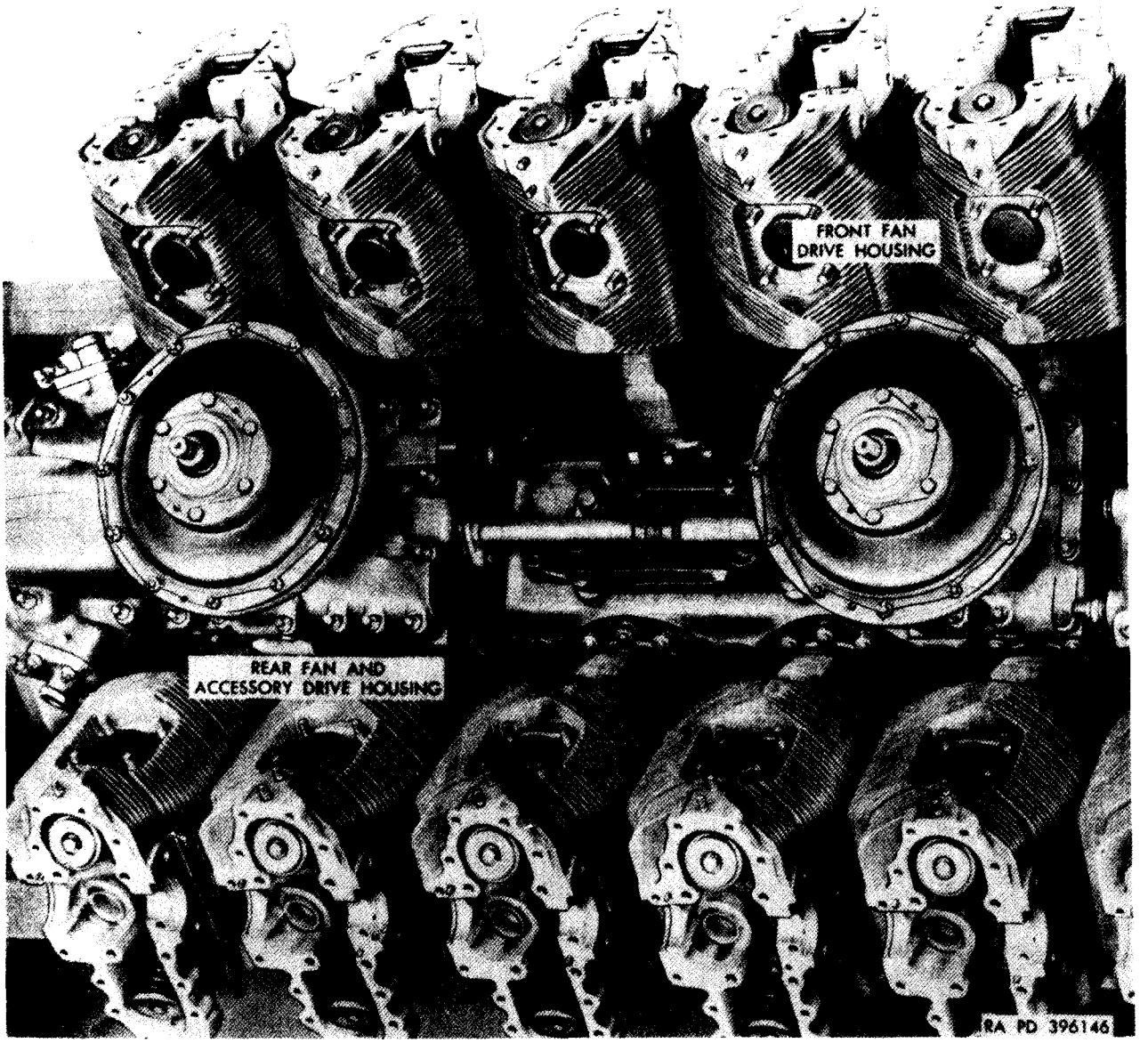


Figure 7-19. Engine with cylinders, front fan drive housing, and rear fan and accessory drive housing assemblies installed.

7-10. Camshafts and Fuel Injection Pump

Refer to Table 7-6 for illustrations and assembly instructions. References are listed in the table.

Table 7-6. Camshafts, Fuel Injection Pump, and Rocker Arm Covers

Component	References
Camshafts and Valve Timing	Para 7-10a, Figs. 5-116, 5-115, 7-20 through 7-22, 5-106, 5-109, 5-105, 5-108, 7-22, 7-23 through 7-26, 5-112, 5-111
Fuel Injection Pump and Timing	Para 7-10b, Figs. 4-71, 4-72, 7-27, 7-28, 4-65 through 4-68, 4-75 through 4-81, 7-29
Rocker Arm Covers	Para 7-10C, Figs. 5-109, 5-108, 7-22, 7-23, 7-27, 7-28, 7-30

Note. Both the left and right camshafts are installed in the same manner. For instructional purposes, the right camshaft has been used for typical procedures.

a. Camshafts and Valve Timing.

(1) Refer to figure 5-116 and position camshaft on bearings in cylinder heads. Attach camshaft gear housing to cylinder (5-115) but do not tighten screws at this time.

Note. Valve rocker arm covers for cylinder Nos. 2R through 5R are not installed until the engine is timed.

(2) Set cylinder No. 6R valve clearance and engine timing following instructions which accompany figures 7-20 through 7-22.

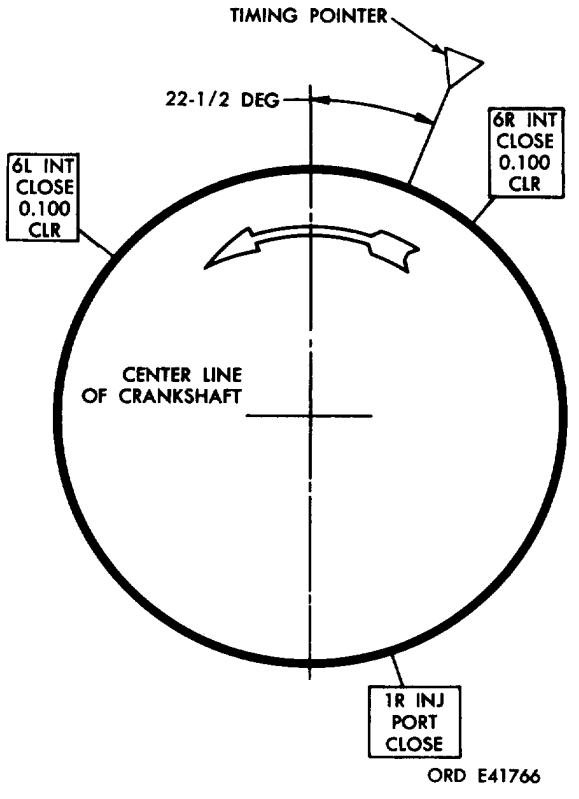


Figure 7-20. Flywheel timing mark locations.

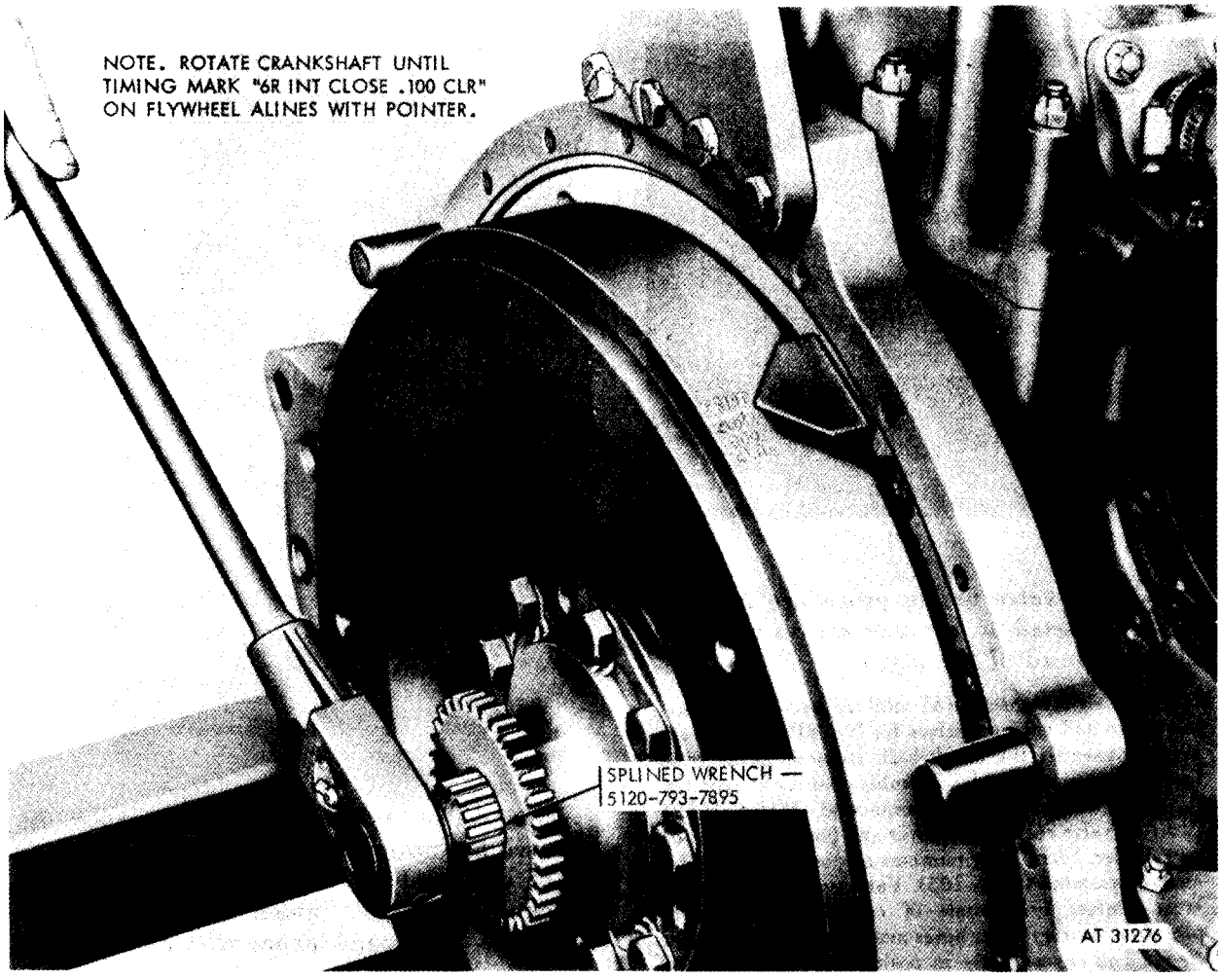
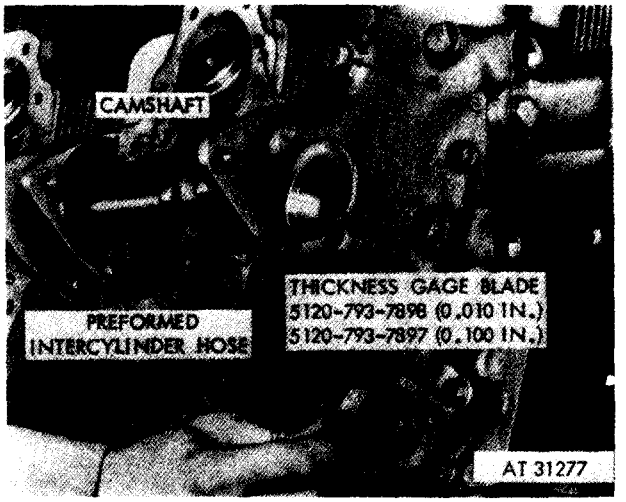


Figure 7-21. Positioning engine flywheel using splined wrench-5120-793-7895.

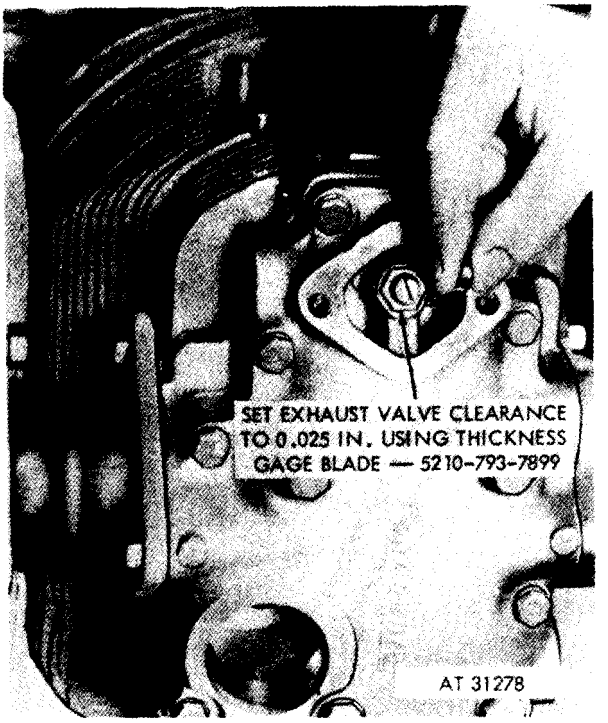


Note. The valve timing procedure must be followed in detail to prevent the valves from striking the head of the piston.

1. Rotate the right camshaft (A) until the two lobes (cams) for intake and exhaust valves for No. 6R cylinder are pointed towards the crankshaft. Remove cover from fuel injector nozzle holder assembly opening in cylinder.
2. Apply a light film of sealing compound (MIL-C-10523 Ord.) on valve rocker arm cover and position cover (B) on cylinder. Identifying numbers on cover and cylinder must correspond (fig. 5-105). Valve rocker arm rollers must contact base circle of camshaft and lip of preformed intercylinder hoses must not be folded under cover. Tap cover gently to position cover over dowel pins.
3. Refer to figure 5-109 and torque tighten four bolts (C) to 275 to 325 pound-inches. Refer to figure 5-108 and torque tighten all bolts and cap screws to 100 pound-inches.
4. Refer to figure 5-107 and secure camshaft gear housing to valve rocker arm cover and cylinder with bolts (D).
5. Using thickness gage blade-5210-793-7897 (E) set intake valve clearance to 0.100-inch by turning the adjusting screw clockwise to decrease the clearance or counterclockwise to increase the clearance.

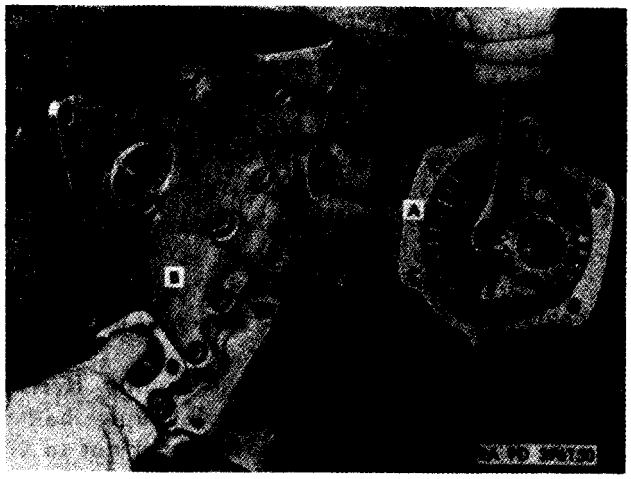
Note. Check position of valve adjusting screw pad. Pad must seat flat on valve stem.

Figure 7-22. Installing valve rocker arm cover and adjusting intake valve clearance (cylinder No. 6R).



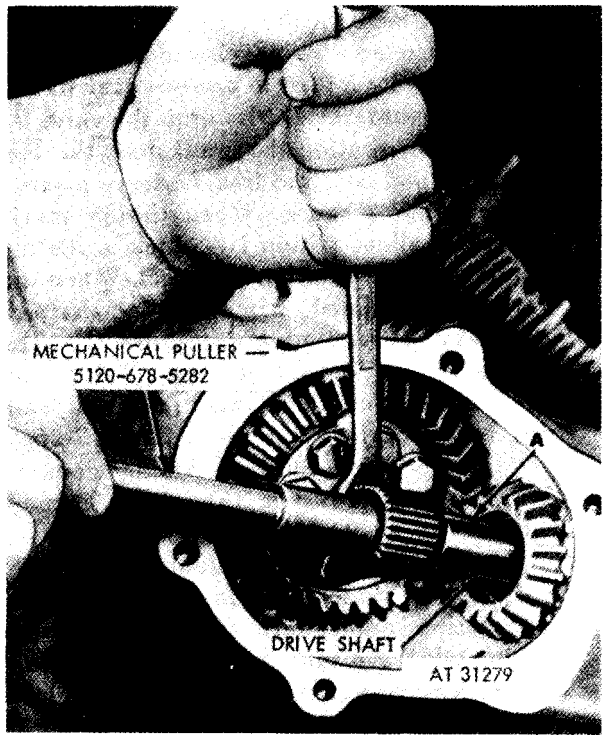
Note. The exhaust valve clearance is decreased by turning the adjusting screw clockwise or increased by turning the screw counterclockwise. Torque tighten adjusting screw lock nut to 175 pound-inches after adjustment.

Figure 7-23. Adjusting exhaust valve clearance.



1. Slowly turn camshaft (A) clockwise, as viewed from flywheel end, until No. 6R intake valve has just closed.
2. Closing point is determined by trying to rotate the swivel pad (B) on the intake valve adjusting screw while the camshaft is being rotated. The valve is closed the instant the swivel pad is free to move.

Figure 7-24. Determining closing point of No. 6 intake valve.



Note. Do not force camshaft drive shaft. The shaft is machined with a 24-tooth spline on inner end, and a 28-tooth spline on outer end. This difference in number of teeth provides a vernier effect which makes it possible to index the drive shaft so it will engage the splines of the camshaft drive gearshaft and camshaft drive bevel gearshaft at some point within 360 degrees. An accurate setting is then provided without changing the relationship of the camshaft and crankshaft.

1. Maintain the position of camshaft as set in figure 7-24 and the crankshaft position set in figure 7-21.
2. Insert camshaft drive shaft (A), using mechanical puller-5120-678-5282, and mate splines on drive shaft with splines in camshaft drive bevel gearshaft. When splines of drive shaft do not mate with splines of camshaft gearshaft, withdraw drive shaft and turn slightly before again attempting insertion.

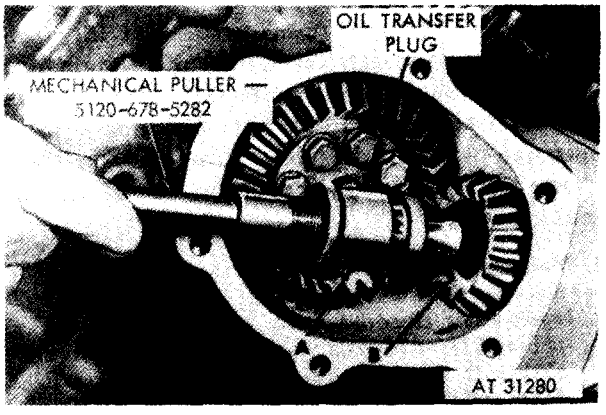
Note. It may be necessary to repeat this operation a number of times before splines will mate and allow drive shaft to be inserted into position.

Figure 7-25. Installing camshaft drive shaft.

(3) Check valve timing by rotating crankshaft clockwise as viewed from rear, approximately 1 / 8 turn to remove gear backlash, then turn counterclockwise until the valve is just closed. Stop rotating the crankshaft the instant the swivel pad becomes free. Observe position of flywheel timing mark. When timing mark on flywheel is alined within 1 / 8-inch of the timing pointer, the valve timing is correct. When timing mark is not alined, withdraw camshaft drive shaft, and repeat timing procedure ((2) above) and again check valve timing. When correct valve timing is obtained, install right oil transfer plug following instructions in figure 7-26.

Note. When correct timing cannot be obtained as described in (3), above, it may be necessary to set timing mark 1 / 8 to 1 / 4-inch out of alinement before installing drive shaft.

(4) Set cylinder No. 6 intake valve clearance by rotating crankshaft counterclockwise approximately 1 / 4 turn in order to have No. 6R intake valve rocker arm roller on base circle of camshaft. Set intake valve clearance to final 0.010-inch setting, using thickness gage blade - 5120-793-7897 as shown in figure 7-22. Torque tighten adjusting screw lock nut to 175 pound-inches after adjustment.



1. Install right oil transfer plug using mechanical puller-5120-678-5282.
2. Refer to figure 5-112 and install retaining ring.

Figure 7-26. Installing right camshaft oil transfer plug.

(5) Rotate the crankshaft counterclockwise approximately 270 degrees from "6L INT CLOSE .100 CLR" until flywheel timing mark "6R INT CLOSE .100 CLR" is alined with timing pointer. Install the left camshaft and No. 6L valve rocker cover following same procedure as outlined for right camshaft and No. 6R valve rocker cover.

(6) Refer to figure 5-111 and install the camshaft gear housing covers, using new mounting gaskets.

b. Fuel Injection Pump and Timing. Refer to figures 4-63 and 4-64 to install coupler half on fuel injection pump. Torque tighten nut to 900 pound-inches. Refer to figures 4-71, 4-72, 4-65 through 4-68, and 4-75 through 4-81. Additional pertinent instructions are listed below.

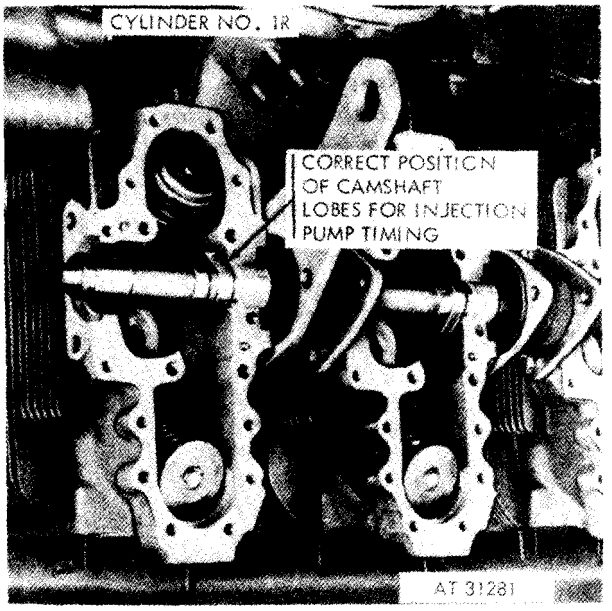


Figure 7-27. Correct position of cylinder 1R camshaft lobes (cams) for fuel injection pump installation-installed view.

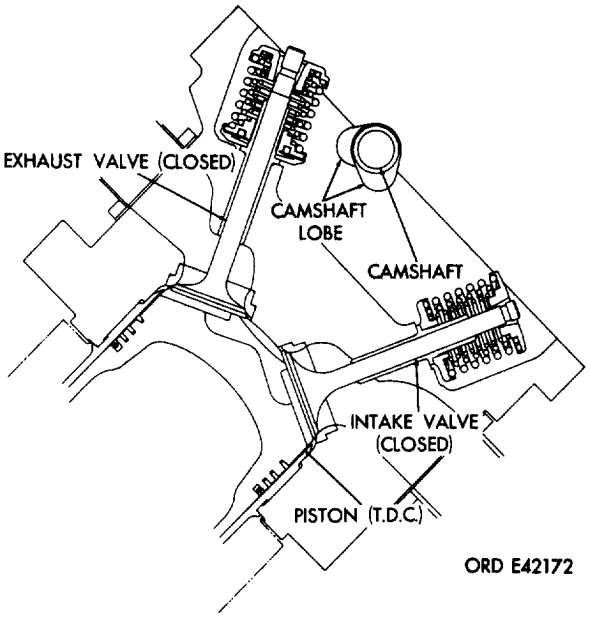
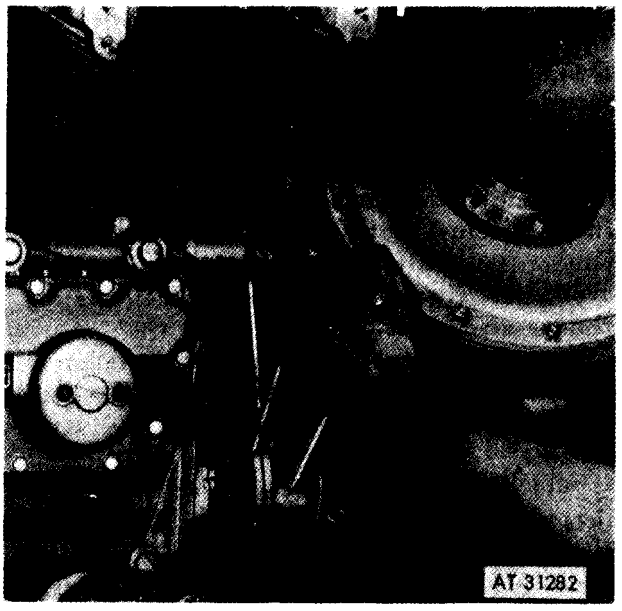


Figure 7-28. Correct position of camshaft lobes (cams) for fuel injection pump installation-sectional view.



1. Using two 5 / 16-in. steel rods (A), hold fuel injection pump diaphragm pack stationary. Rotate flange coupling counterclockwise to remove any backlash in injection pump gear train and bring the advance unit to the full retard position.
2. When backlash is removed and timing marks alined, install four lock washers and bolts (B) and tighten securely.

Note. When installing bolts in diaphragm coupling, be sure the proper length bolts - FSN 5306-944-7537 are used. Bolts longer than 53 / 64-inch can be threaded completely through the coupling flange and dent the diaphragm pack. This will create a high stress point and possible premature coupling failure.

Figure 7-29. Removing fuel injection pump drive gear train backlash and setting advance unit retard position-diaphragm coupling.

c. Install Rocker Arm Covers. The camshaft lobes (cams) for cylinder No. 1R must be down towards crankshaft, so valve rocker arm rollers are on base circle of camshaft as shown in figures 7-27 and 7-28 before installing rocker arm cover. The identification number stamped on rocker arm cover must match the number stamped on cylinder assembly (fig. 5-105). Rocker arm covers must always be installed on their mating cylinder assemblies.

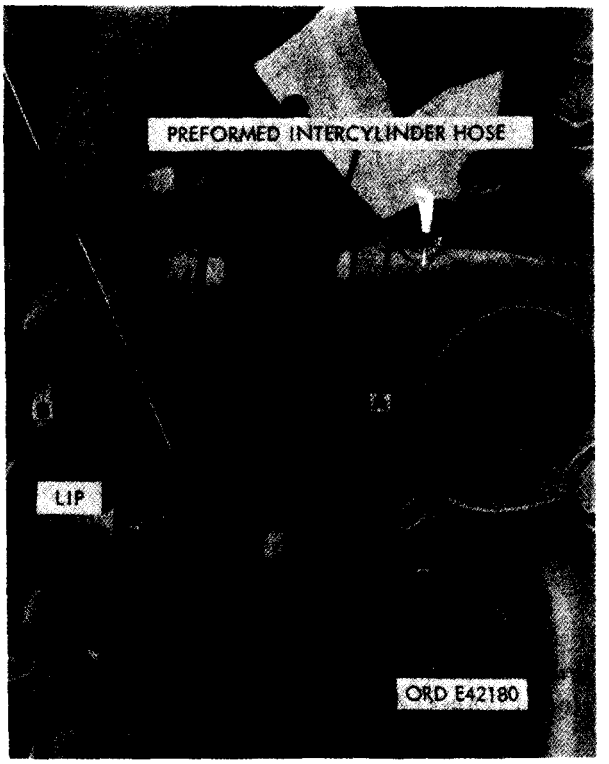
Note. For instructional purposes. installation of rocker arm cover for cylinder No. 1R is used. Remaining covers are installed in the same manner.

(1) Remove protective cover from fuel injector nozzle and holder opening in cylinder assembly. Apply a light film of sealing compound (MIL-C-10523 Ord.) to valve rocker arm cover and install cover. Refer to figure 5-109 and torque tighten four bolts to 275 to 325 pound-inches. Refer to figure 5-108 and torque tighten all bolts and cap screws to 100 pound-inches.

(2) Set valve clearance of No. 1R intake valve to 0.010-inch using thickness gage blade - 5210-793-7898 as shown in figure 7-22.

(3) Set valve clearance of No. 1R exhaust valve to 0.025-inch using thickness gage blade - 5210-793-7899 as shown in figure 7-23.

(4) Rotate crankshaft as necessary to position camshaft lobes (cams) in downward position (figs. 7-27 and 7-28) as each of the remaining valve rocker arm covers are installed.



1. Loosely install all camshaft preformed hose flange bolts (A).
2. Slide a piece of shim stock (B) between the lip of the preformed intercylinder hose and the mating faces of the valve rocker arm cover and cylinder to remove any possible creases. Tighten the flange bolts securely.

Note. Do not damage lip of preformed intercylinder hose. Any defect will be a source of an oil leak.

Figure 7-30. Installing camshaft intercylinder hose flange bolts.

7-11. Nozzle and Holder Assemblies, Cylinder Deflectors, and Shrouds

Refer to Table 7-7 for illustrations and assembly instructions. References are listed in the table.

Table 7-7. Nozzle and Holder Assemblies, Cylinder Deflectors, and Shrouds

Component	References
Nozzle and Holder Assemblies	Para 7-11a, Figs. 5-103, 4-165
Shroud Plates and Cylinder Deflectors	Para 7-11b, Figs. 5-102 through 5-97

a. Fuel Injector Nozzle and Holder Assemblies. Refer to figures 5-103 and 4-165.

Note. When installing new gasket on nozzle assembly, apply a thin coating of grease to the gasket to retain gasket in position on nozzle assembly.

b. Camshaft Drive Shrouds and Cylinder Deflectors. Refer to figures 5-102 through 5-97.

Note. Removal or installation of shrouds and cylinder deflectors is the same for both left and right banks of the engine. For instructional purposes, the right bank shrouds and cylinder deflectors are illustrated.

7-12. Turbosupercharger Oil Inlet Hose and Fire Extinguisher Tube, Fuel Injection Pump Oil Inlet Hose, and Throttle Control Rods and Lever

Refer to Table 7-8 for illustrations and assembly instructions. References are listed in the table.

Table 7-8. Turbosupercharger Oil Inlet Hose and Fire Extinguisher Tube, Fuel Injection Pump Oil Inlet Hose, and Throttle Control Rods and Lever

Component	References
Turbosupercharger Oil Inlet Hose and Fire Extinguisher Tube	Para 7-12a, Figs. 5-90 through 5-88
Fuel Injection Pump Oil Inlet Hose	Para 7-12b, Figs. 5-87 through 5-84
Throttle Control Rods and Intermediate Lever	Para 7-12c, Figs. 5-83 and 5-82

a. Turbosupercharger Oil Inlet Hose and Fire Extinguisher Tube. Refer to figures 5-90 through 5-88.

b. Fuel Injection Pump Oil Inlet Hose. Refer to figures 5-87 through 5-84.

c. Throttle Control Rods and Intermediate Throttle Lever. Refer to figures 5-83 and 5-82.

7-13. Turbosupercharger Base, Supports, and Tie Rods, Fuel Inlet and Return Hoses, Crankcase Breather Tubes, Exhaust Pipes and Manifolds, and Fuel Injector Clamps, Supports, and Tubes

Refer to Table 7-9 for illustrations and assembly instructions. References are listed in the table.

Table 7-9. Turbosupercharger Base, Supports, and Tie Rods, Fuel Inlet and Return Hoses, Crankcase Breather Tubes, Exhaust Pipes and Manifolds, and fuel Injector Clamps, Supports, and Tubes

Component	References
Turbosupercharger Base, Supports, and Tie Rods	Para 7-13a, Figs. 5-81 through 5-79
Fuel Inlet and Return Hoses and Crankcase Breather Tubes	Para 7-13b, Figs. 5-77 through 5-71
Exhaust Pipes and Manifolds	Para 7-13c, Figs. 5-78, 5-70 through 5-68
Fuel Injector Clamps, Supports, and Tubes	Para 7-13d, Figs. 5-67 through 5-64, 4-86
Fuel Injector Nozzle Fuel Return Tubes	Para 7-13e, Figs. 5-63 through 5-61

a. Turbosupercharger Base, Supports, and Tie Rods. Refer to figures 5-81 through 5-79.

b. Fuel Inlet and Return Hoses and Crankcase Breather Tubes. Refer to figures 5-77 through 5-71.

c. *Exhaust Pipes and Manifolds.* Refer to figures 5-78 and 5-70 through 5-68.

d. Fuel Injector Clamps, Supports, and Tubes. Refer to figures 5-67 through 5-64 and 4-86, and (1) through (6), below.

(1) Fuel tubes should be installed individually and in the sequence listed below to assure adequate wrench clearance. Beginning with the left bank fuel injector tubes (rear pump head) install tubes for cylinders 5, 3, 1, 6, 2, and 4 in that order. Install the right bank tubes for cylinders 2, 4, 1, 6, 5, and 3 in that order.

Note. Injector tubes for cylinders 1, 2, and 3 right bank, must be routed under the right exhaust manifold between cylinders 2R and 3R exhaust port manifold connections.

(2) Special precautions must be taken to ensure that all tube connections to a given injection pump port, terminates at the proper cylinder (figure 4-86). Current replacement fuel injector tubes have identification tags at each end to assure proper injection pump port connection and cylinder nozzle connection. Incorrect hook up of the injector tubes to a wrong cylinder or injection pump connection would result in damage to the piston rings and cylinder walls and severe damage to the engine if operated under full load.

(3) Check the alignment of each tube with its mating fitting. It may be necessary to bend the tube(s) to gain alignment. The tube MUST be aligned in its free state before attempting to engage the fittings, to minimize unwanted stresses.

(4) Start fittings on both ends by hand until the sleeve is seated. If a wrench is required, only low torques are necessary to seat the sleeve. When the sleeve is seated, an increase in torque will be quite evident. When this point is reached, draw the nut (each end) up approximately 1 / 6 of a turn (minimum), but not more than 1 / 3 of a turn (maximum), to complete the tightening operation.

Note. Overtightening will damage the sleeve and cause fuel leaks.

(5) NEVER OVER TIGHTEN when attempting to remedy a fuel leak. Overtightening will deform the sleeve and eventually lead to tube failure. It is permissible to loosen the nut, or fitting, and re-tighten. This procedure will, in many cases, seal the fuel leak. The loosening and tightening operation tends to re-seat the sleeve, thus providing an effective seal. Replace fittings and / or tubes rather than overtighten to stop leaks.

(6) The proper installation and positioning of the tube clamps is essential to ensure tube lift. Install all stationary clamps as shown in figure 7-31. The floating clamps, i.e., the four clamps located nearest the pump head, must be positioned as specified to ensure maximum vibration dampening. The two floating clamps on the right bank each support three tubes. Similar clamps on the left bank support only two tubes, i.e., tube No’s. 1 and 2, and 5 and 6.

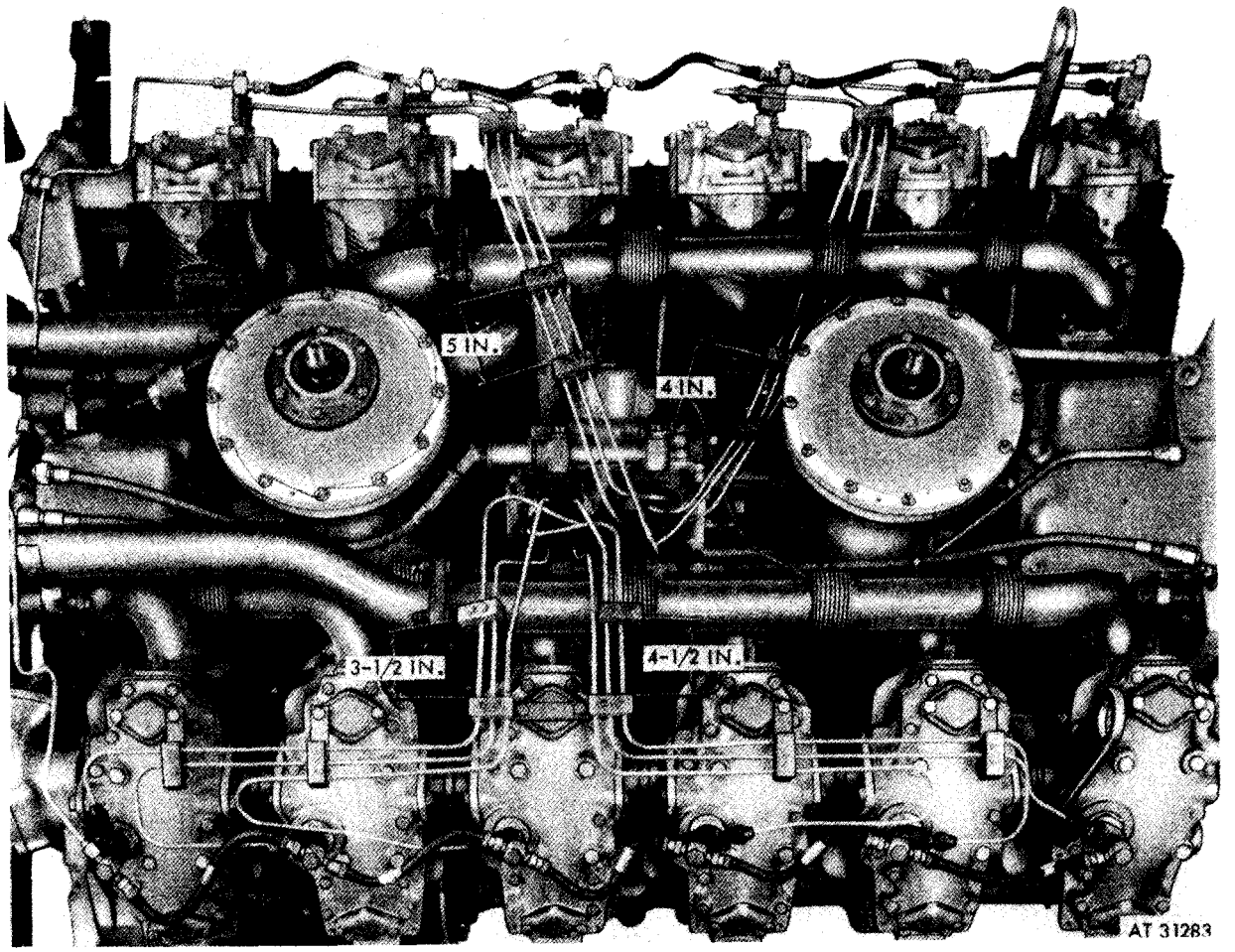


Figure 7-31. Fuel injector clamps, supports, and tubes-installed view.

e. Fuel Injector Nozzle Fuel Return Tubes. Refer to figures 5-63 through 5-61.

Note. Install rigid fuel drain tubes only if they are in a like new condition, otherwise install current flexible rubber hose as shown in figure 7-31. The drain tube on hose between cylinder numbers 6L and 5L (fig. 7-32 or 7-33) will be noticeably longer than the other drain tubes or hoses due to the position of the fuel injector nozzle and holder assembly drain connector.

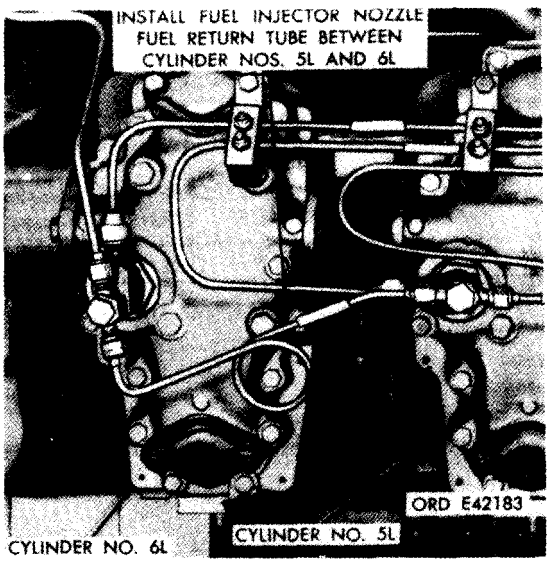


Figure 7-32. Fuel injector nozzle fuel return tube between cylinder numbers 6L and 5L-engines with tubes.

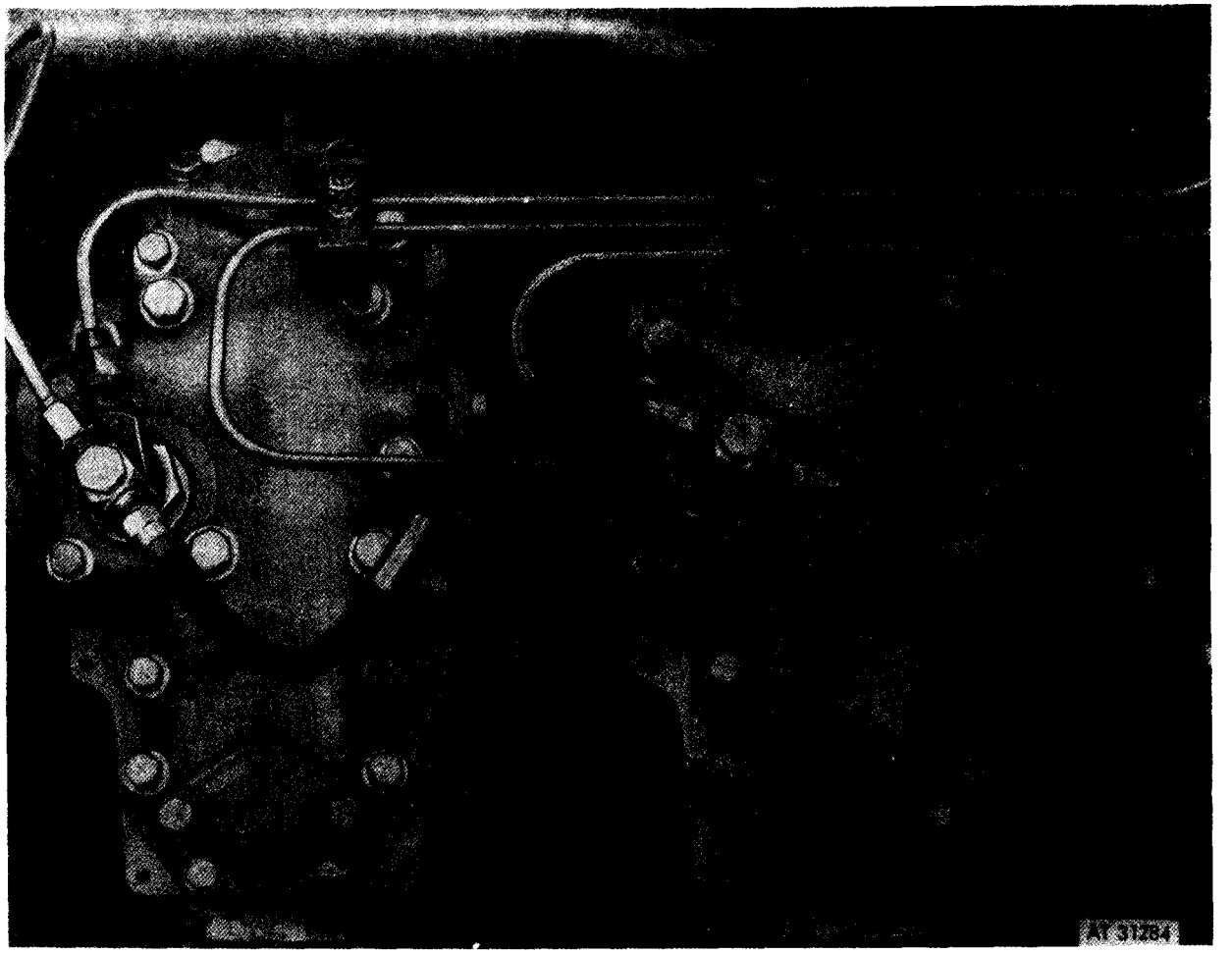


Figure 7-33. Fuel injector nozzle fuel return hose between cylinder numbers 6L and 5L-engines with hoses.

7-14. Oil Filler and Indicator Tubes, Rear and Front Shrouds, Throttle Linkage, and Fuel Filters

Refer to Table 7-10 for illustrations and assembly instructions.

Table 7-10. Oil Filler and Indicator Tubes, Rear and Front Shrouds, Throttle Linkage, and Fuel Filters

Component	References
Cylinder Head Plates, Oil Filler Tube, and Oil Level Indicator Tube	Para 7-14a, Figs. 5-60 through 5-51
Rear Shroud	Para 7-14b, Figs. 5-50 through 5-48
Front Shroud	Para 7-14c, Figs, 5-47 through 5-42
Throttle Linkage, Fuel Drain Tubes, Fuel / Water Separator, Secondary Fuel Filter, and Primary Fuel Filter	Para 7-14d, Figs. 5-41 through 5-39, 4-84, 4-85, 5-38 through 5-34

a. Cylinder Head Plates, Oil Filler Tube, and Oil Level Indicator Tube. Refer to figures 5-60 through 5-51.

b. Rear Shrouds. Refer to figures 5-50 through 5-48.

c. Front Shrouds. Refer to figures 5-47 through 5-42.

d. Throttle Linkage, Fuel Drain Tubes, Fuel / Water Separator, Secondary Fuel Filter, and Primary Fuel Filter. Refer to figures 5-41 through 5-39, 4-84, 4-85, 5-38 through 5-34.

7-15. Intake Manifold Assemblies, Cylinder Head Oil Drain Lines, and Manifold Heater Tubes, Solenoids, and Filter

Refer to Table 7-11 for illustrations and assembly instructions. References are listed in the table,

Table 7-11. Intake Manifold Assemblies, Cylinder Head Oil Drain Lines, and Manifold Heater Tubes, Solenoids, and Filter

Component	References
Intake Manifold, Manifold Heater, and Turbosupercharger Air Outlet Elbow	Para 7-15a, Fig. 5-33
Cylinder Head Oil Drain Tubes	Para 7-15b, Figs. 5-32 through 5-28
Manifold Heater Tubes, Hoses, Fuel Check Valve, Fuel Filter, Filter Bracket, and Solenoid Valves	Para 7-15c, Figs. 5-27 through 5-23

a. Intake Manifold, Manifold Heater, and Turbosupercharger. Refer to figure 5-28 and (1) and (2), below.

(1) After tubes for cylinder Nos. 3R and 4R are secured, tighten tube flange nuts at cylinder Nos. lR, 2R, 5R, and 6R at intake manifold.

(2) Cover turbosupercharger air outlet elbow opening to prevent entrance of foreign objects.

b. Cylinder Head Oil Drain Tubes. Refer to figures 5-32 through 5-28.

c. *Manifold Heater Tubes, Hoses, Fuel Check Valve, Fuel Filter, Filter Bracket and Solenoid Valves.* Refer to figures 5-27 through 5-23.

7-16. Oil Coolers, Beams, Cooling Fans, Shrouding, and Associated Parts

Refer to Table 7-12 for illustrations and assembly instructions. References are listed in the table.

Table 7-12. Oil Coolers, Beams, Cooling Fans, Shrouding and Associated Parts

Component	References
Turbosupercharger Oil Inlet Hoee and Transmission Shrouds	Para 7-16a, Fig. 5-22
Oil Coolers, Support Beams, Upper Cover Frame, and Frame Support Bracket	Para 7-16b, Figs. 5-21 through 5-7
Cooling Fan Shroud and Upper Covers	Para 7-16c, Figs. 4-141 through 4-136, 5-9 through 5-7, 4-132 through 4-128
Cooling Fan Vanes and Cooling Fane	Para 7-16d, Fige. 4-35, 4-34, 4-88

a. Turbosupercharger Oil Inlet Hose and Transmission Shrouds. Refer to figure 5-22.

b. Oil Coolers, Support Beams, Upper Cover Frame, and Frame Support Bracket. Refer to figures 5-21 through 5-7 and figure 7-34.

c. Cooling Fan Shroud and Upper Covers. Refer to figures 4-141 through 4-136, figures 5-9 through 5-7, and figures 4-132 through 4-128.

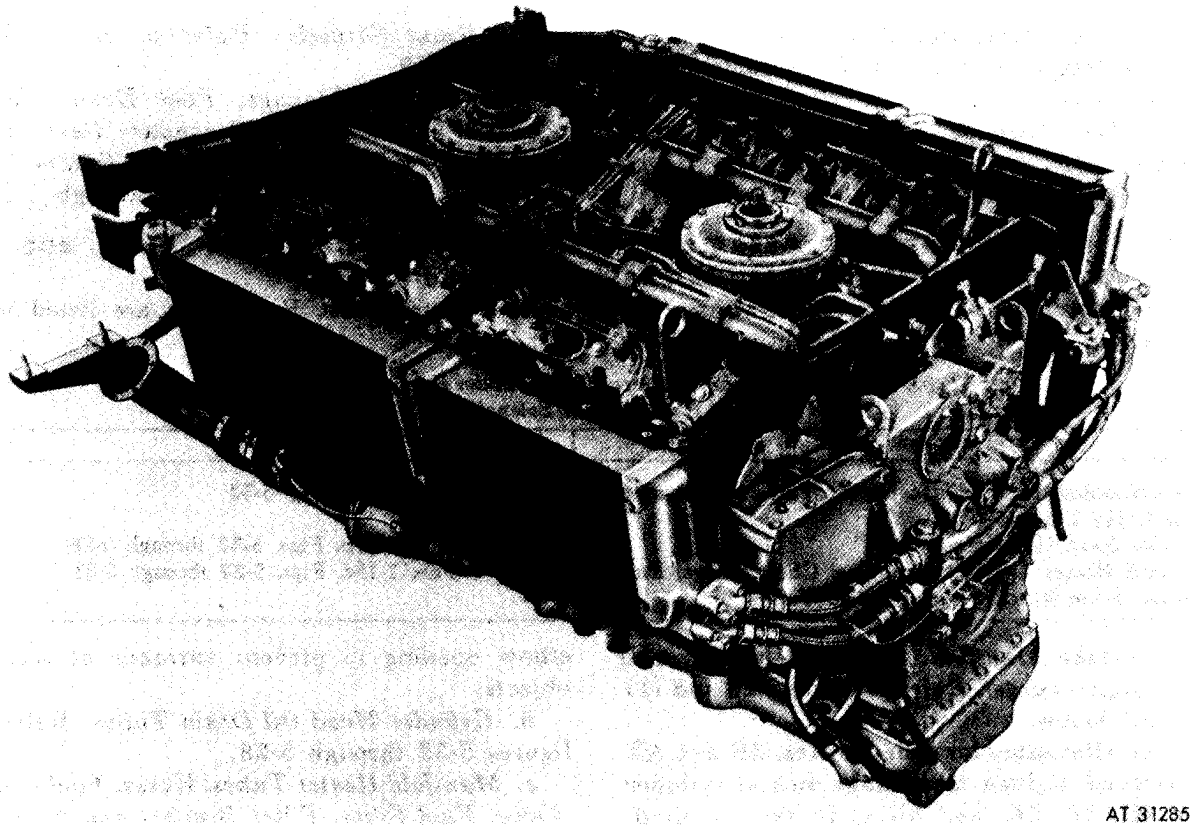


Figure 7-34. Overall view of engine showing progress of engine assembly at this point.

d. Cooling Fan Vanes and Cooling Fans. Refer to figures 4-35, 4-34, and 4-88.

7-17. Engine Accessories

Refer to Table 7-13 for illustrations and assembly instructions. References are listed in the table.

Table 7-13. Installing Engine Accessories

Component	References
Fuel Pump	Para 7-17a, Figs. 4-3 through 4-1
Turbosupercharger and Lower Shroud Plates	Para 7-17b, Figs. 4-33 through 4-18
Starter	Para 7-17c, Figs. 4-8, 4-7, 5-1, 4-9, 4-4
Time Totalizing Meter	Para 7-17d, Figs. 5-5, 5-4, 4-10
Generator	Para 7-17e, Figs. 7-31, 4-17 through 4-13, 4-11

a. Fuel Pump. Refer to figures 4-3 through 4-1.

b. Turbosupercharger and Lower Shroud Plates. Refer to figures 4-33 through 4-18.

c. Starter. Refer to figures 4-8, 4-7, 5-1, 4-9, and 4-4 and (1) through (3), below.

(1) Install starter while engine is still mounted on overhaul stand (figs. 4-8 and 4-7).

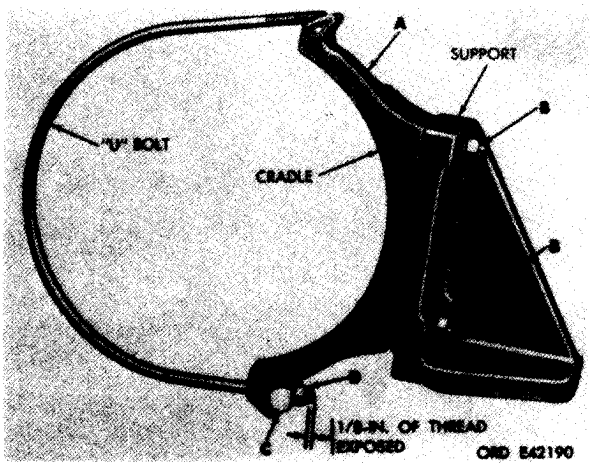
(2) Install multiple leg sling - 4910-919-2884 (fig. 5-1) on suitable chain hoist. Install hooks of sling in engine lifting eyes and take up the slack. Remove four bolts and flat washers securing engine to overhaul stand bracket. Lift engine and move overhaul stand. Lower engine on suitable blocks or moveable dolly maintaining lifting sling hook-up as a precaution against engine tipping during remaining assembly operations.

(3) Install starter cradle and support on engine (fig. 4-9 and 4-4).

d. Time Totalizing Meter. Refer to figures 5-5, 5-4, and 4-10.

Note. After installing time totalizing meter on engine, the engine name plate must be stamped with an "X" after the engine serial number. This will show engine has a time totalizing meter installed. The time totalizing meter must be set back to zero (para 6-70b) before being installed.

e. Generator and Associated Parts. Refer to figures 7-35, 4-17 through 4-13, and figure 4-11.



1. Position cradle (A) on generator support,
2. Install two self-locking nuts (B) and flat washers but do not tighten.
3. Install clamping bar (C) on "U" bolt.
4. Install self-locking nut (D). Tighten nut until approximately ⅛ -inch of bolt is exposed through the nut. This is the approximate position of nut after "U" bolt has been positioned over the generator, prior to installing the outside bar and nut.

Note. The preformed packing (fig. 4-12) is a generator part and must be in place before installing generator air intake tube.

Figure 7-35. Assembling generator cradle, support, and "U'' bolt.

f. Test and Adjustments. After the egine has been completely assembled it should be tested and the necessary adjustments made as directed in Chapter 8 of this manual.

CHAPTER 8
ENGINE TEST AND ENGINE CONTAINER

Section I. ENGINE TEST AND ADJUSTMENTS

8-1. Engine Specifications

a. Speed Range. The engine must operate satisfactorily under all loads through a speed range of 1400 to 2400 rpm and must idle satisfactorily at 675 to 725 rpm.

b. Gross Horsepower (Without Accessories). Under full throttle setting, engine will develop 750, plug or minus 15, gross horsepower at 2400 rpm, using fuel conforming to specification VV - F-800 (DF-2) and the correction factors provided in tables 8-2 through 8-5.

c. Gross Torque (Without Accessories). Under full throttle setting, engine will develop the following gross torque using fuel conforming to Specification VV-F-800, DF-2.

(1) 1720 lbs/ft. - plus or minus 2.0% @ 1800 rpm.

(2) 1635 lbs/ft. - plus or minus 2.0% @ 2400 rpm.

d. Oil Consumption. Engine shall not consume more than 0.0075 pounds per brake horsepower hour (lbs / bhp / hr) of lubricating oil when operating under full load and using engine oil conforming to Military Specification MIL-L-45199 Grade 2 (SAE 30).

e. *Fuel Consumption (Without Accessories).* When operating at full throttle under full load, on a dynamometer, at a speed of 2400 rpm, engine shall consume not more than 0.420 pounds per brake horsepower hour (lbs / bhp / hr) fuel conforming to Specification VV-F-800 (DF-2).

f. Exhaust Gas Temperature. Exhaust gas temperatures, measured at individual cylinder ports, shall not exceed 1250” F. Temperature variation between cylinders shall not exceed 150°F.

g. Blow-by Pressure. With engine under full throttle and full load, blow-by shall not exceed 18 cfm.

h. Lubricating Oil Temperature. Temperature of oil in the engine pan sump shall not exceed 230 F. Temperature of oil entering the engine through the oil pump shall be maintained between 160°F and 22°F.

i. Oil Pressure.

(1) Engine oil pressure shall not be more than 70 psi or less than 40 psi when engine is operating at 2400 rpm, and shall not be less than 15 psi when engine is idling at 675 to 725 rpm, measured at and / or adjacent to the oil pressure sending unit, with the oil temperature of 160°F to 180°F, using engine oil specified in paragraph d, above.

(2) Piston oiler nozzle oil pressure shall be 35 psi minimum at 2400 rpm measured at plug on left side of crankcase, at rear, above starter.

j. Temperatures. The preferred induction air inlet temperature is 85°F plus or minus 10 F.

k. Fuel Pressure. The fuel pressure at the injection pump inlet shall be 30-40 psi at engine speeds of 1800 to 2400 rpm.

l. Manifold Pressure. Intake manifold pressure rise above atmospheric after the turbosupercharger with boost, shall not exceed 35 inches Hg.; without boost 28 to 32 inches Hg. Variation between left and right banks shall not exceed 4 inches Hg.

m. Exhaust Smoke Density Test. The maximum exhaust smoke density at full power position, when measured within one foot of the exhaust outlet, shall not exceed the following conditions when using fuel in accordance with grade DF-2 of Specification VV-F-800.

Speed	RPM Engine	No.	Visual	Robert Bosch Meter No.
	1800	3	Light Gray	3.5
	2000	3	Light Gray	3.2
	2200	2	Haze	2.6
	2400	1	Clear	2.4

Note. The meter readings shall have precedence over the visual reading.

8-2. Crankcase and Induction System Leakage Test

a. General. The engine crankcase and induction systems should be pressure tested to determine whether or not all connections are water-tight and airtight. The complete assembled engine is air-pressure tested for leaks. Leaks that are present will be indicated by the presence of air bubbles when using a soap solution on the joints as outlined below.

b. Seal Openings. Seal all openings as directed in (1) through (3), below.

(1) Seal exhaust outlet openings on left and right turbosuperchargers (fig. 8-2).

(2) Seal air inlet openings in left and right turbosuperchargers (fig. 8-1).

(3) Seal oil filler and indicator tube caps (fig. 1-2 or 1-7).

c. Remove Engine Cooling Fans. Remove engine cooling vanes and cooling fans (fig. 4-34 and 4-35). The fans are removed in order to gain access to several of the points of application of the soap solution (f, below).

d. Install Sleeve Spacer. Install two fan rotor hub sleeve spacers -4910-795-7952, to prevent oil seepage (fig. 4-87).

e. Apply Air Pressure. Install a tee-type connection in crankcase breather tube (fig. 1-7). Connect manometer and air hose connection in tee. Apply air pressure and regulate air pressure to indicate ten inches of mercury (in. Hg.) on manometer.

f. Apply Soap Solution. Apply soap solution to all locations listed in (1) through (10), below.

(1) Air indication system and intake manifolds.

(2) Exhaust system.

(3) Pipe plugs in crankcase, oil pan, intake manifold, exhaust manifold and crankcase damper and oil filter housing.

(4) All ventilation and vacuum line fittings. This shall include all hose connections.

(5) Oil level indicator tube flange.

(6) Oil filler tube flange.

(7) Intercylinder preformed hoses.

(8) Injector nozzle and holder (at rocker arm cover).

(9) Cylinder head oil drain system.

(10) Fan drive housings.

g. Minor Pressure Leakage. Minor leaks should be repaired (h, below) during this test procedure and rechecked. However, some minor leaks are acceptable providing the engine passes the final acceptance test outlined below. Mark any area where leaks are evident so that the leak may be repaired.

(1) Reduce air pressure to zero.

(2) Remove seal (tape) from oil filler and indicator tube caps and close caps securely.

(3) Pressurize system six inches of mercury (in. Hg.).

(4) Test pressure loss after a five-minute (exposure) time interval must not exceed 3-1 / 2 inches mercury (in. Hg.).

h. Repair of Minor Pressure Leakage. Examine marked areas (g, above) for loose hose clamps, loose attaching parts at mounting flanges, defective gaskets, or defective hoses, whichever may exist. Repair leak by replacing defective hoses or gaskets or by tightening loose hose clamps or loose mounting flange attaching parts.

i. Remove Sleeve Spacer. Remove two fan rotor hub sleeve spacers - 4910-795-7952 (fig. 4-87).

j. Installation of Cooling Fans. Install engine cooling fans (fig. 4-35).

k. Check Cooling Fan Clearance. Check fan blade clearance following instructions which accompany figure 4-88.

l. Install Cooling Fan Vanes. Install cooling fan vanes (fig. 4-34).

8-3. Fuel and Oil System Leakage Test

a. General. This test is made to determine if an oil or fuel leak exists within the engine "V" prior to and in conjunction with engine run-in

(para 8-4) and cannot be found through visual inspection. Perform test as directed in b through d, below.

b. Remove Cooling Fan Vanes and Cooling Fans. Remove cooling fan vanes and cooling fans (figs. 4-34 and 4-35).

c. Install Sleeve Spacers. Install two fan rotor hub sleeve spacers - 4910-795-7952 (fig. 4-87).

d. Test for oil and Fuel Leakage.

(1) Start engine and check for oil and fuel leaks at hoses, tubes, and all connections inside engine "V" and around engine. Tighten hose connections or replace leaking hoses, elbows, tee, and nipples as necessary to correct oil or fuel leaks.

Note. Slide fuel injection tube, dust caps (C, fig. 4-87) away from tube connections at fuel injection pump to check for fuel leaks.

Note. DO NOT run engine above idle speed, and DO NOT apply load to engine.

(2) Refer to troubleshooting (paras 3-1 through 3-11) for probable causes and corrections for other possible leakage points around engine.

(3) When all points for oil and fuel leaks have been inspected and / or corrected, remove fan rotor hub sleeve spacers - 4910-795-7952 (fig. 4-87).

e. Install Cooling Fans. Install engine cooling fans (fig. 4-35).

f. Check Cooling Fan Blade Clearance. Check fan blade clearance following instructions accompanying figure 4-88.

g. Install Cooling Fan Vanes. Install cooling fan vanes (fig. 4-34).

8-4. Engine Run-in

a. General. This paragraph describes run-in schedules for overhauled engines prior to being placed in service. Engine run-in is performed after overhaul to assist in breaking-in new parts, to detect faulty assembly. to check for oil leaks, and to determine whether an engine will operate satisfactorily when installed in vehicle.

b. Preparation for Run-in.

(1) Couple engine to suitable load. The load may be a water brake or electric dynamometer.

(2) Remove engine right and left rear upper covers (figs. 4-127 and 4-141). Remove pipe plugs from each bank and attach thermocouples to exhaust manifolds. Reinstall upper covers.

(3) Attach $C0_2$ fire extinguisher (fig. 8-1).

(4) Remove pipe plug from secondary fuel filter or pipe plug from fuel/ water separator (fig. 8-1).

(5) Remove pipe plug (B, fig. 6-6) and attach piston oil sprayer pressure gage or connection.

(6) Install oil fitting in oil pan.

(7) Remove main oil gallery pipe plug (fig. 8-1) and install main oil gallery thermocouple.

(8) Install main oil gallery pressure connector or attach to oil pressure sending unit (fig. 8-1).

(9) Attach oil inlet and outlet lines to crankshaft damper housing if external oil circulating system is to be used. If engine is not to be run on a circulating oil system, lubricate engine by forcing engine oil under pressure into the lubrication system to assure adequate lubrication of engine parts until the engine oil pump has time to circulate oil. Fill engine oil pan with proper grade oil to fill mark on oil level gage.

(10) Attach fuel inlet line to primary fuel filter (fig. 8-1).

(11) Attach fuel return line, flywheel end (fig. 8-2).

(12) Attach turbosupercharger induction air inlet (fig. 8-1) and exhaust outlet tubes (fig. 8-2). Connect same type air cleaners that are used with engine installed in vehicle. (Refer to applicable Vehicle Technical Manual.) Air intake should be located so that only cool, fresh air will be inducated into engine. A means must be provided for conducting exhaust gases and cooling air from engine to avoid recirculation through engine cooling fans.

(13) Install thermocouple in intake manifold elbow, both banks (fig. 8-1).

(14) Install manifold pressure gages or connections in intake manifold elbows (fig. 8-1), both banks, set manometers to current wet barometer reading.

(15) Attach fuel shutoff connection, damper end, and ascertain to be operative (fig. 8-1).

(16) Turn on oil circulating pump and fuel supply purge pump.

(a) When fuel flows from secondary fuel filter or fuel / water separator pipe plug hole, air has been removed from fuel system. Attach fuel pressure gage or connection at pipe plug hole.

(b) Oil circulation is checked by loosening the externally-relieved body bolt (fig. 8-1) on No.

1 cylinder on both banks, when oil flows tighten bolts.

(17) Install starter cables (fig. 1-2).

(18) Wash all fuel and oil from engine.

(19) Check all thermocouple connections. If connected correctly, should read ambient temperature; if connected incorrectly, scale reading will go to top of scale.

(20) Start engine at IDLE speed (para c, below).

(21) Check engine main oil pressure (para 8-1i, (1) and (2)).

(22) Piston oiler nozzle pressure should be readable.

Note. Pressure will not reach the desired operating level until the engine speed has been increased (para 8-1i. (2)).

(23) Exhaust manifold temperatures should register (para 8-1f).

(24) Visually inspect engine for fuel and oil leaks.

(25) Ready for engine test schedule (table 8-1).

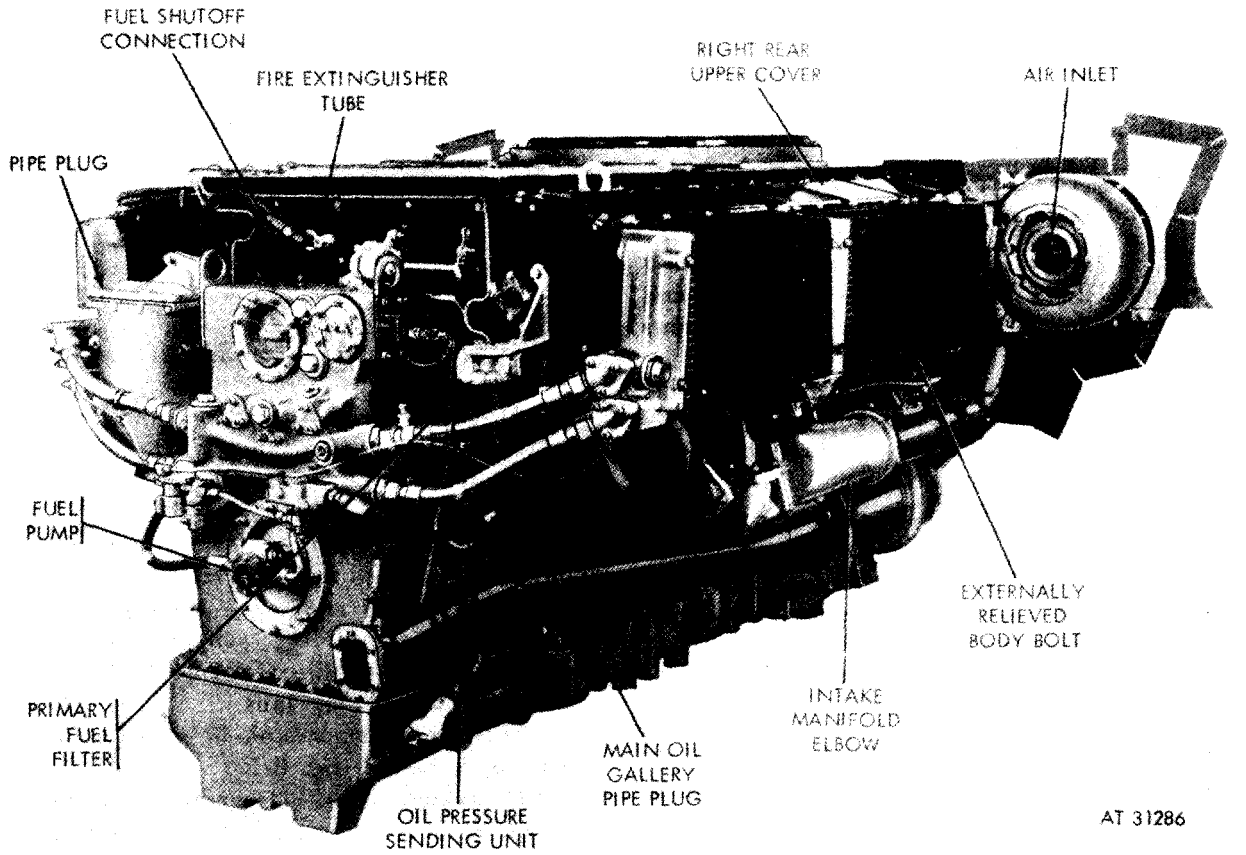


Figure 8-1. Engine connection points—right front view.

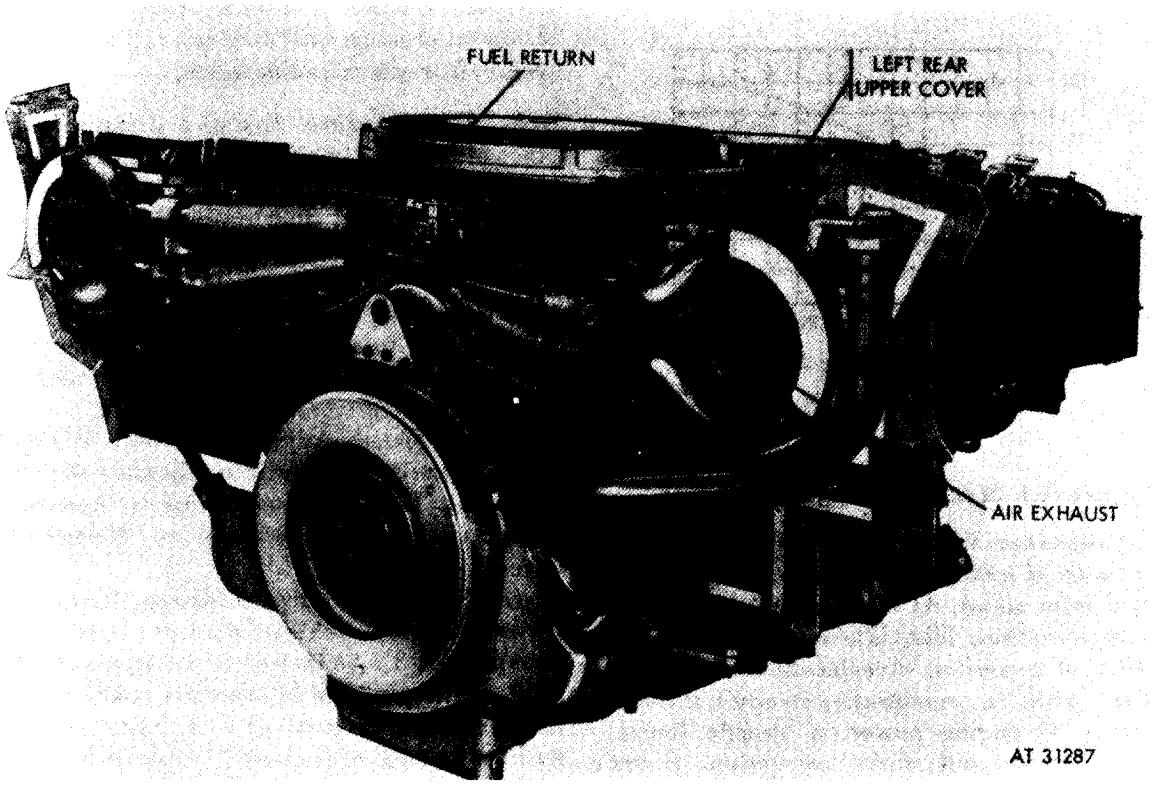


Figure 8-2. Engine connection points - left rear view.

c. Starting Procedures. During cold weather, when ambient temperature is below 30 degrees F, use engine manifold flame heaters to start engine.

Note. Do not attempt an engine start until the fuel shutoff solenoid is connected and ascertained to be operative.

Caution: Do not operate the starter motor continuously for more than one minute. Allow a two-minute cool-off period before re-energizing the starter.

(1) Remove pipe plug (F, fig. 6 245 or 8-1), purge system and bleed the secondary fuel filter or water separator filter to remove trapped air. Install pipe plug.

(2) Crank the engine several revolutions with the fuel shutoff switch in the "OFF" position to make certain the engine is not hydrostatically locked and is otherwise free.

(3) Turn on the master switch.

(4) Start engine by operating electric starting motor with throttle in idle position (Refer to Caution, above.)

(5) When engine oil pressure does not reach the minimum 15 psi pressure within 20 seconds, *STOP THE ENGINE IMMEDIATELY* by holding the fuel shutoff switch in the "OFF" position. Determine the cause of low pressure. Refer to troubleshooting, paragraph 3-9.

Note. After starting engine, run at idle, 675 to 725 rpm, for five minutes to permit the engine to warm up and to circulate the oil. Check oil level and add sufficient oil to bring oil level to "FULL" mark on oil level gage. Oil level must be determined with engine idling. Check all items vital to safe engine operation, such as fuel lines, oil lines, oil pressure, throttle control, mounting bolts, coupling, thermocouple harness, etc.

d. Run-in Schedule. An overhauled engine should be started and tested in accordance with the schedule (table 8-1).

e. Performance Curve. Figure 8-3 is a mean performance curve. A variation of 2 is acceptable.

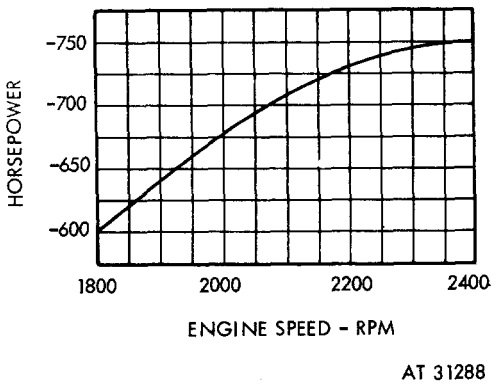


Figure 8-3. Mean performance curve.

f. Acceptance Test. Repair all fuel and oil leaks at start of test. Check again before engine is removed from stand. At completion of test run, check acceleration, idle, idle oil pressure, and operation of governor. Acceleration should be checked with a moderate steady throttle movement. If engine power is outside limits, check for cause and make correction. Gross corrected horsepower shall be maintained between 735 and 765 horsepower. The governor shall be adjusted to limit the engine speeds as follows:

(1) Low idle - 675 to 725 rpm.

(2) High idle (no load) - 2640 rpm maximum.

g. Overhaul/ MWO Engine Data Plate. After engine is overhauled, install overhaul/ MWO data plate on engine as outlined in TB ORD-1030.

h. Engine Storage. After engine has successfully completed the acceptance test the engine is to be stored or shipped in accordance with instructions provided in section II of this Chapter.

8-5. Engine Test and Adjustments

a. Oil Pressure. Oil pressures shall be measured in accordance with paragraph 8-1i, (1) and (2). The oil pressure regulator valve (D, fig. 6-104) is adjustable, within limits, by the addition or removal of washer-type shims (A) between relief valve cover and spring. Add shims to increase pressure and remove shims to reduce pressure. When oil pressure cannot be adjusted to within the 40-70 psi range, in this manner. replace valve spring (C).

Note. Do not add more than three shims, When oil pressure still does not fall within limits specified, replace faulty valve.

b. Fuel Pressure. Install a pressure gage in place of the pipe plug (fig. 8-1) in the top, center of the secondary fuel filter and / or water separator to check fuel pressure. Fuel pressure should be adjusted to 40 psi by turning adjusting screw of the fuel pump (fig. 8-1). Turn screw clockwise to increase pressure and counterclockwise to decrease pressure. Refer to TM 9-2910-213-34 for further information on the fuel pump.

c. Idle Speed. Adjust for smooth idle at 675 to 725 rpm by turning idle adjusting screw (D, fig. 4-85). Turn screw clockwise to increase idle speed and counterclockwise to decrease idle speed.

d. Throttle Control Linkage. Normal pin travel on the vehicle control lever is approximately 3 / 16 inch from the stop at both the idle position and the full throttle position. W hen the pin travel is more or less than 3 / 16 inch without spring movement, adjust rod to bring within limits specified (fig. 4-85).

e. Manifold Heater. Pump fuel into the engine using a purge pump and press heater button. If heater is operative, heat will be felt at intake manifold turbosupercharger tube (feel intake manifold turbosupercharger tube with hand). When no heat is felt, check harness and heater spark plug for faulty connections. Inspect purge pump and heater nozzle for proper operation. Repair faulty connections or replace purge pump or heater nozzles.

f. Oil Consumption Check.

(1) Inspect engine for oil leaks.

(2) Operate engine until normal operating temperature is reached (180°F).

(3) Idle engine for five minutes to allow oil level to stabilize. Check oil level with engine idling, When necessary, add oil to bring level in oil pan to full level, as indicated on level gage. (Refer to applicable Lubrication Order.)

(4) Operate engine for 1-1 / 2 hours at 2400 rpm and maximum horsepower.

(5) Idle engine for five minutes to allow oil level to stabilize.

(6) Check oil level, with engine idling, using oil level gage.

(7) Add oil as required to bring oil in oil pan to full level as indicated on oil level gage, carefully measuring amount added.

(8) Maximum allowable oil consumption at 2400 rpm, with SAE 30 oil, is 0.0075 pounds per brake horsepower hour (lbs / bhp / hr).

g. Checking Exhaust Gas Temperature. Pipe plugs (4, fig. B-12) are provided in exhaust manifold elbows for installation of thermocouples to measure exhaust gas temperatures (para 8-1f). Variations of temperatures between cylinders should not exceed 150°F. Check fuel injector nozzles of cylinders that exceed this variation.

h. Lubricating Oil Pressure Outlets. Lubricating oil pressure outlets are provided in the main and piston oiler nozzle gallery lines for installation of pressure sensing gages to measure the engines oil pressures (para 8-1i, (1) and (2)).

i. Induction Air Temperature. An outlet is provided in the bottom of the intake manifold, on each side of the engine, for installation of thermocouples to measure induction air temperature (para 8-1j).

j. Manifold Pressure. An outlet is provided in the intake manifold elbows, on each side of the engine, for installation of a manometer gage and / or connection (para 8-11).

Table 8-1. Overhaul Test Schedule-Beam Length...1.75 Ft. (or 21.008 in.)

Run No.	Time Min.	RPM	Scale limits	Obs. BHP	Torque Lh-Ft.
1	10	700	Warm-up		
2	15	1000	16.0	16.0	84
3	15	1400	83.5	116.9	438
4	20	1800	159.5	287.1	837
5	20	2200	195.0	429.0	1024
6	20	2400	208.0	499.2	1092
7	30	2400	229.0	549.6	1202
8	30	2400	F.R. - F.L.	F.R. - F.L.	F.R. - F.L.
9	Check for low idle at 675 to 725 rpm. Adjust if necessary.				
10	Check oil filter and inspect for oil and fuel leaks.				
11					
12	5	2200	F.R. - F.L.		
13	5	2000	F.R. - F.L.		
14	5	1800	F.R. - F.L.		
15	Check governor high idle speed. This shall not exceed 2640 rpm, (No-Load, water off). If adjustment is required, recheck horsepower at 2400 full load.				
16	Borescope cylinders (para 8-6), check for fuel and oil leaks, prepare engine for removal from stand.				

Note. Run numbers 1 through 8, and 11 through 14, shall equal three hours. Sequence of operations may be varied.

8-6. Inspection of Cylinders for Scuffing

a. *General.*

(1) As used in this publication, cylinder wall "scuffing" is defined as a streak or streaks, running the length of the piston ring travel, on the cylinder wall, which are greater than 1 / 4 inch wide and which reveal a high gloss or polish where the cylinder wall honing pattern has been completely worn away.

(2) Scuffing is caused by excessive localized heat on the contact face of the piston ring and cylinder bore. The excessive heat is due to a breakdown of the oil lubricating film and is the result of one or more conditions such as; abrasives in the oil or induction air, lack of or improper honing, defective piston ring, etc. The heat and pressures involved during the scuffing process will flow or smear the cylinder wall metal and destroy the honing pattern. The process in general generates additional heat due to friction and in many cases the scuffing will progress or the width of the afflicted area will grow and may envelope the entire cylinder bore. Scuffing is detrimental to the engine, since oil consumption and blow-by gases can no longer be controlled.

b. Borescope Inspection.

(1) After completion of dynamometer inspection, all overhauled engines shall have cylinders inspected by borescope as follows:

(a) *First production inspection*. The first ten engines when completed, and after successful performance of the overhaul engine test schedule, shall have all cylinders, of each engine, inspected by borescope. If no evidence of scuffing is detected, the sampling inspection method may be applied.

(b) *Sampling inspection*. Under this method, after successful performance of the overhaul engine test schedule, sample engines shall be selected for borescope inspection at the rate of one in every 25 engines or one per month when monthly production is less than 25. If scuffing of cylinder walls is detected, the five engines produced preceding the sample engine and the five engines produced after the sample engine will have all cylinders borescoped. Should there be evidence of scuffing as a result of this inspection, the inspector shall refuse acceptance of these engines and subsequent production engines, until required corrections have been made and evidence to this effect has been presented to inspector.

(2) Refer to figures 4-126 through 4-141 to remove upper cover shroud plates. Remove as many fuel injection pump fuel tube support clamps as are accessible with the cover plates removed. Disconnect fuel injector fuel return hoses or tubes and fuel injection pump fuel tubes from injector nozzles (fig. 4-150) using extreme caution not to bend or kink the fuel tubes.

(3) Loosen the fuel injector nozzles using open end fixed wrench - 5120-871-7198 (fig. 4-152). Remove fuel injector nozzle and holder assemblies from the 12 cylinder heads (fig. 4-153). To facilitate removal of No. 6L nozzle and holder assembly, remove the connector from the nozzle head. This will allow the necessary clearance with the shrouding to remove the nozzle and holder.

(4) The relative position of the piston for borescoping the cylinders is in the down position or at the lowest most point of the downward stroke. This enables the inspection of the longest portion of cylinder bore affected by piston travel. To achieve this, the flywheel must be rotated using splined wrench - 5120-793-7895 (fig. 4-51) allowing two pistons on each bank of cylinders to be in the down position and enabling the complete inspection of an engine with only three turns of the flywheel. The combinations of cylinders that can be inspected at one time are as follows: (a) Nos. 2 and 5 right bank, - 3 and 4 left bank, (b) Nos. 3 and 4 right bank, - 1 and 6 left bank, (c) Nos. 1 and 6 right bank and 2 and 5 left bank. To determine when the pistons to be checked are at the lowest point of the downward stroke, use a brass rod as a gage and insert it through the fuel injector nozzle opening in the cylinder head (fig. 8-5). When piston stroke is in the maximum down position, mark the gage rod at the point where the rod protrudes from the cylinder head nozzle opening. This will facilitate the proper positioning of the following cylinders to be checked.

Note. Do not use borescope as a probe or gage in determining position of the piston in the cylinders. The instrument can easily be damaged when engine flywheel is rotated to position pistons for borescoping.

(5) During inspection of the cylinders, it is recommended that a record be made of each cylinder checked and the position of any discrepancies noted. Relative position of a cylinder defect can be determined as though reading a clock with the top of the cylinder in the 12:00 position. A wear pattern beginning at the top of the cylinder and extending on a 30 degree angle clockwise, would be recorded as a wear pattern extending from the 12:00 to 1:00 position.

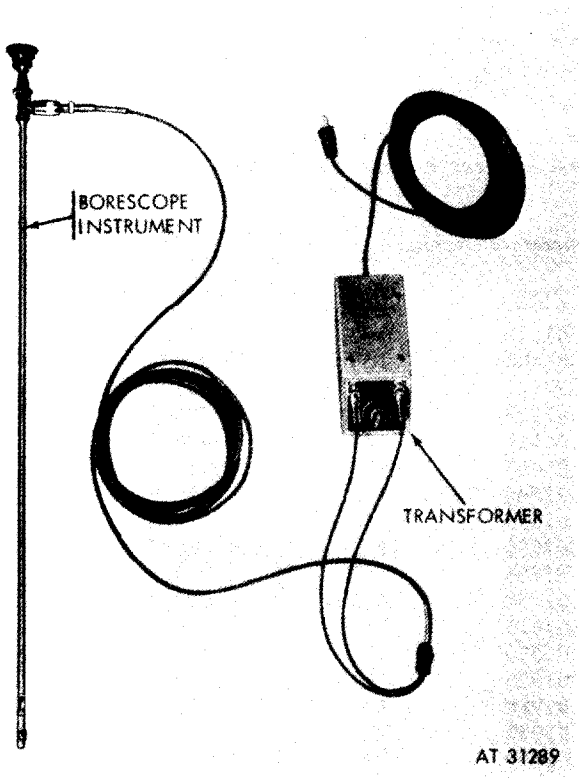


Figure 8-4. Borescope instrument.

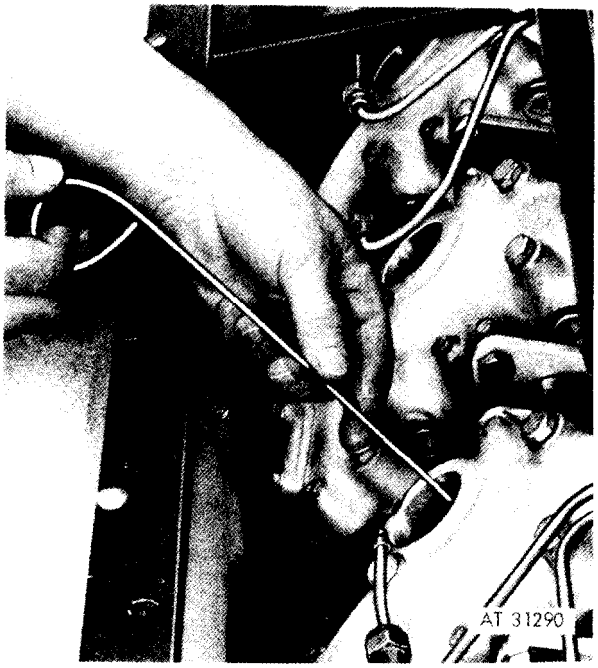


Figure 8-5. Checking piston position with brass rod.

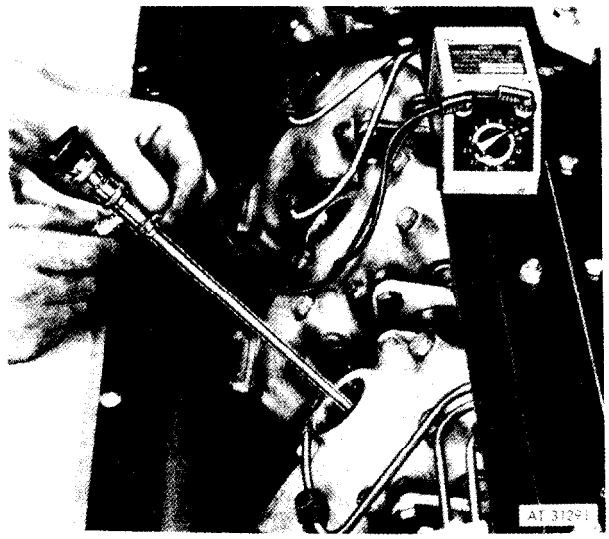


Figure 8-6. Borescope instrument in position for cylinder bore inspection.

(6) Connect borescope control transformer (fig. 8-4) in 110 volt electrical circuit and insert borescope into cylinder (fig. 8-6), Visually adjust light intensity and mirror angle until a sharp clean image of the cylinder bore is apparent. Inspection of the cylinder bore should be made at three levels, lower, middle, and upper position of the cylinder to assure maximum coverage of the cylinder wall surface. Polish marks the length of the piston pin travel may be evident on the cylinder side walls on a line parallel with the cylinders. These lines normally are not serious and are caused by the movement of the piston pin allowing the pin end plugs to come in contact with the cylinder walls. Other wear lines, surface scratches, and wear patches that are not continuous the full length of the cylinder bore are usually not significant.

(7) A normal shiny area will often appear at midbore and usually on the anti-thrust side of the bore (below exhaust valve on left bank and below intake valve on right bank). This shiny area will not extend the full length of ring travel and should not be confused with scuffing of the cylinder wall.

(8) Cylinder bores that show evidence of ¼ in. or more scuff marks, must be replaced. Rehone cylinders and thoroughly inspect (para 6-31 and 6-32), dimensionally check and clean thoroughly before reinstalling cylinders on engine. Replacement cylinders will require

complete re-test and borescoping after test. Always install new piston rings in cylinders that have been re-honed. Pistons must be thoroughly inspected (para 6-25) and cleaned thoroughly before assembly.

(9) Install fuel injector nozzle and holder assembly (fig. 4-165), connect fuel injector fuel return hoses or tubes and fuel injection pump fuel tubes to injector nozzles (fig. 4-150) and install upper shroud plates (fig. 4-141 through 4-126).

(10) Operate engine at normal temperature and inspect engine for leaks.

Table 8-2. Air Entrance Temperature Correction

Temp	F Corr	Temp	F Corr	Temp	F Corr
60	+.00000	82	+.01210	104	+.02420
61	+.00055	83	+.01265	105	+.02475
62	+.00110	84	+.01320	106	+.02530
63	+.00165	85	+.01375	107	+.02585
64	+.00220	86	+.01430	108	+.02640
65	+.00275	87	+.01485	109	+.02695
66	+.00330	88	+.01540	110	+.02750
67	+ .00385	89	+.01595	111	+.08205
68	+ .00440	90	+.01650	112	+.02860
69	+.00495	91	+.01705	113	+.02915
70	+.00550	92	+.01760	114	+.02970
71	+ .00605	93	+.01815	115	+.03025
72	+ .00660	94	+.01870	116	+.03080
73	+.00715	95	+.01925	117	+.03135
74	+.00770	96	+.01980	118	+.03190
75	+.00825	97	+.02035	119	+.03245
76	+.00880	98	+.02090	120	+.03300
77	+.00935	99	+.02145	121	+.03355
78	+ .00990	100	+.02200	122	+.03410
79	+.01045	101	+.02255	123	+.03465
80	+.01100	102	+.02310	124	+.03520
81	+.01155	103	+.02365	125	+.03575

Table 8-3. Air Entrance Pressure Correction

In. HB-Abs	Corr	In. HG-Abs	Corr	In. HG-Abs	Corr
29.92	.0000	29.30	+.0073	28.60	+.0155
29.90	+.0003	29.25	+.0079	28.55	+.0161
29.85	+.0009	29.20	+.0085	28.50	+.0167
29.80	+.0015	29.15	+.0091	28.45	+.0173
29.75	+.0021	29.10	+.0097	28.40	+.0178
29.70	+.0027	29.05	+.0102	28.35	+.0184
29.65	+.0032	29.00	+.0108	28.30	+.0190
29.60	+.0038	28.95	+.0114	28.25	+.0196
29.55	+.0044	28.90	+.0120	28.20	+.0202
29,50	+.0050	28.85	+.0126	28.15	+.0207
29.45	+.0056	28.80	+.0132	28.10	+.0213
29.40	+.0062	28.75	+.0137	28.05	+.0219
29.35	+.0067	28.70	+.0143	28.00	+.0225
		28.65	+.0149		

Table 8-4. Fuel Temperature Correction

Temp. °F	Corr	Fuel Flow No. / Hr. Max.	Temp. °F	Corr	Fuel Flow No. / Hr. Max.
60	.000	313.0	80	+.020	307.0
61	+.001	312.7	81	+.021	306.7
62	+.002	312.4	82	+.022	306.4
63	+.003	312.1	83	+ .023	306.1
64	+ .004	311.8	84	+.024	305.8
65	+ .005	311.5	85	+ .025	305.5
66	+ .006	311.2	86	+.025	305,2
67	+.007	310.9	87	+.027	304.9
68	+ .008	310.6	88	+.028	304.6
69	+.009	310.3	89	+.029	304.3
70	+.010	310.0	90	+.030	304.0
71	+.011	309.7	91	+.031	303.7
72	+.012	309.4	92	+.032	303.4
73	+.013	309.1	93	+.033	303.1
74	+.014	308.8	94	+.034	302.8
75	+.015	308.5	95	+.035	302.5
76	+.016	308.2	96	+.036	302.2
77	+.017	307.9	97	+.037	301.9
78	+.018	307.6	98	+.038	301,6
79	+.019	307.3	99	+ .039	301.3

Table 8-5. Fan Horsepower to be Used for Correcting Engine Gross Horsepower

Engine Speed (rpm)	Horsepower
2520	125.0
2400	108.0
2200	83.5
2000	62.5
1800	45.6
1600	32.0
1400	21.5
1200	13.5
1000	7.2
900	5.7

FORMULAE - AVDS-1790-2A

1. $$\text{Observed BHP} = \frac{2\pi NT}{33000} = \frac{NT}{5252} = \frac{NLWZ}{5252}$$

π = 3.1416
N = RPM of Dynamometer shaft
T = Torque in lb. ft = LWZ
L = Length of torque arm in feet
W = Weight of scale reading (lbs) (Beam reading)
Z = Scale reading factor (ratio to actual weight, in units)

If length of torque arm is 21.00 inches or 1.75 feet, and scale reading factor is 3, then

$$OBHP = \frac{W\ N}{1000}$$

2. Corrected net BHP -Observed BHP x) 1 + air temp. correction + Induction air pressure correction + fuel temperature correction)

3. Gross horsepower = corrected net BHP + fan horsepower.

4. Correction factor references
   a. Induction air temperature correction factor - Table 8-2
   b. Induction air pressure correction factor - Table 8-3
   c. Fuel temperature correction factor and maximum fuel flow - Table 8-4

5. Specific fuel consumption = $\frac{\text{Fuel flow lb/ hr.}}{\text{Corrected gross BH P}}$

6. Specific oil consumption = $\frac{\text{Oil Consumption lb/ hr.}}{\text{Corrected gross BHP}}$

7. Fuel Air Ratio = $\frac{\text{Fuel lb/ hr.}}{\text{Air lb/ hr.}}$

SAMPLE CALCULATIONS:

Example: rpm = 2400
torque = 1339
beam = 255
wet barometer = 29.64

1. Dry barometer = 29.35
2. Average entrance pressure in inches of water = 0

3. Average entrance temperature = 88° F
4. Fuel temperature = 70° F
5. Torque arm = 1.75 feet

Correction Factors:

1. Dry entrance pressure (1) in inches Hg - Absolute 29.35-0 (2) = 29.35 = Correction = .0067
2. Average entrance temperature 88 F (3) - Correction = .0154
3. Fuel temperature (4) - Correction = .010
4. Total correction - .0067 + .0154 + .010 = 1.0321

SAMPLE CALCULATIONS:

bhp Observed

$$\frac{\text{rpm x Scale units}}{1000} = \frac{2400 \times 255}{1000} = 612.0$$

$$\frac{\text{rpm x Torque}}{5252} = \frac{2400 \times 1339}{5252} = 612.0$$

Correction Net bhp

612.0 X 1.0321 = 631.65

Fan hp

Fan hp@2400 rpm (Table 8-5) = 108

Corrected Gross *bhp*

Corrected net bhp + Fan hp = 631.65 + 108 = 739.65

Corrected Gross Torque

Corrected gross bhp x 5252 =

$$\frac{739.65 \times 5252}{2400} = 1618 \text{ lb-ft}$$

Brake Specific Fuel Consumption

$$\text{310 lb / Fuel} — \text{Corrected gross bhp} = \frac{310}{739.65} = .419$$

8-7. Quality Control Test

a. General. A 50-hour quality control test shall be conducted for the purpose of determining the continued quality of the engine.

b. Control Test.

(1) Selection of test *sample.* Engines shall be selected at the rate of one per month when production is below 100 per month; or one in every 100 engines when production exceeds 100 units per month; or on curtailed production at least one every 60 days. Test engines shall be identified as to production period, examined for defects and subjected to the tests outlined in the technical manual.

(2) *Fifty-hour quality control test schedule.* Each engine selected in accordance with sub paragraph (1), above, shall be operated, as specified in table 8-6, for 50 hours as nearly continuously as possible

(a) Starting with run No. 3, an oil consumption reading shall be taken each one-half (½) hour when operating at 2400 rpm full load.

(b) A blow-by check shall be made at 2400 rpm full load prior to runs No.'s. 3-11-15-19 and 22. Normal reading will be 11 to 15 cubic feet per minute (CFM). Maximum permissible blow-by is 18 cfm. The blow-by can be measured with a volumeter or gas meter between the crankcase breather tube and exhaust pipe.

(c) Approximately 100 amp's load shall be applied to the generator during the complete test.

(d) Readings shall be taken every one-half (½) hour and will include all data taken on the regular test.

(3) *Corrections.* Engine subjected to this test shall be completely disassembled and all interchangeable parts subjected to wear or stress shall be inspected. A complete report including the inspection and testing of the engine shall be submitted to the Government inspector. Should there be evidence of failure of parts requiring correction as a result of this test, the inspector shall refuse acceptance of subsequent production engines until such corrections have been made and objective evidence presented to the Government inspector. Engines subjected to this test shall be reassembled with new parts replacing those found unsatisfactory during examination.

(4) *Disposition of engines.* After correction of all defects disclosed by the test, engine shall be reassembled, given a final run in accordance with paragraph 8-4, inspected in accordance with paragraph 8-6, and if found acceptable, shipped as a regular production engine.

(5) *Control test failure.* Failure of a control test engine to pass any specified examination or test shall be cause for rejection of subsequent lots until satisfactory evidence is submitted to the government inspector that the faults revealed by the examination or test have been corrected.

Table 8-6.50 Hour Quality Control Test

Run No.	Time	Engine Speed	Rack Setting
1	1 hour	½ load	2000 rpm
2	½ hour	Idle	700 rpm
3	1½ hour	Full load	2400 rpm
4	½ hour	Idle	700 rpm
5	2 hours	½ load	2000 rpm
6	½ hour	Idle	700 rpm
7	2 hours	Full load	2400 rpm
8	1 hour	Idle	700 rpm
9	5 hours	Full load	2400 rpm
10	1 hour	Idle	700 rpm
11	5 hours	Full load	2400 rpm
12	1 hour	Idle	700 rpm
13	5 hours	Full load	2400 rpm
14	1 hour	Idle	700 rpm
15	5 hours	Full load	2400 rpm
16	1 hour	Idle	700 rpm
17	5 hours	Full load	2400 rpm
18	1 hour	Idle	700 rpm
19	5 hours	Full load	2400 rpm
20	1 hour	Idle	700 rpm
21	5 hours	Full load	2400 rpm
22	5 min.	Full load	2200 rpm
23	5 min.	Full load	2000 rpm
24	5 min.	Full load	1800 rpm

Section II. ENGINE AND CONTAINER

8-8. General

This section of the manual covers the reusable metal container, Army Part No. 10912269, and procedures for preservation of engines for storage. The container is designed to provide substantial protection against damage for the engine during transit, and also against environmental deterioration over extended periods of storage. The following instructions will cover the removal of the engine from the container, reconditioning and testing of the container, preservation of engines for storage, the installation of the engine in the container, sealing, and periodic inspection.

8-9. Disassembling Container and Removing Engine

a. Prior to disassembling the metal container, the pressure must first be released through the pressure relief valve (fig. 8-7), located in a recessed insert on the end of the container. Remove all nuts, lock washers and bolts securing the upper and lower container sections together. Remove upper section of container and retain sealing gasket (providing it has not been mutilated and is still serviceable). Remove the seven bolts and lock washers securing the engine to the transmission adapter support flange and the four nuts and lock washers securing the engine mounting brackets to the mounting flanges on the engine support cross members. Remove all engine parts previously removed from the engine and secured separately in the container. In cases where the engine has been returned for rebuild, forward these parts to the proper reconditioning area.

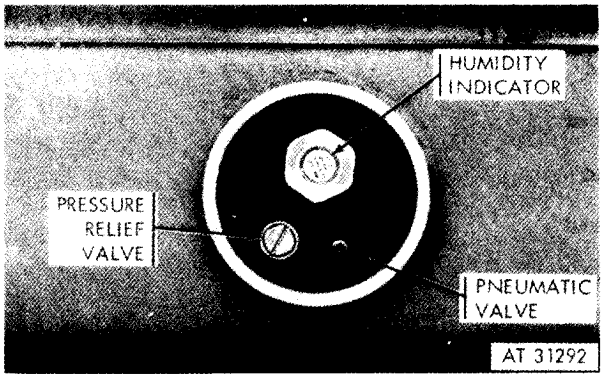


Figure 8-7. Pressure relief valve, humidity indicator, and pneumatic valve - installed view.

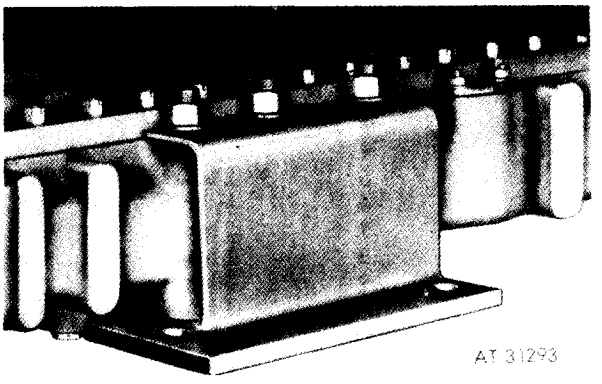


Figure 8-8. Engine mounting bracket - installed view.

b. Remove the engine from the container using engine lifting multi-leg sling - 4910-919-2884 and place engine on suitable supports before removing the mounting brackets (fig. 8-8) secured to the oil pan. Remove six nuts, washers, and bolts and remove mounting brackets from the oil pan. Retain engine mounting brackets and all attaching hardware with container to assure availability of all parts when engine container is to be reused. Install all disassembled engine parts, removed from containers, on engines that are to be made operational.

8-10. Reconditioning Container

a. Cleaning. Clean the interior and exterior of container using the process in C-1 of MIL-P-116. Remove minor paint scale and rust with a power buffer. If major rust exists, remove by abrasive blasting.

b. Inspection. Inspect interior and exterior of upper and lower container sections for dents, cracks, or defective weld. Check mounting flanges for bends. Bents that do not effect proper alinement of the upper and lower sections of container are permissible. Inspect the lower

section of the container (fig. 8-9) for cracked mounting flanges, bent or stripped studs. Inspect vibration damper mounts for cracks, tears or separation of bonding between metal and rubber. Inspect container skids for splits or cracks. Minor checks and dents are acceptable if serviceable is not affected. Check the gaskets and discard if permanently deformed. Check humidity indicator (fig. 8-7) and discard if pink discoloration is evident. Pressure test relief valve to be sure valve functions properly. Apply a soap solution to the valve and replace any valve that does not open with a gage reading of seven to ten psi.

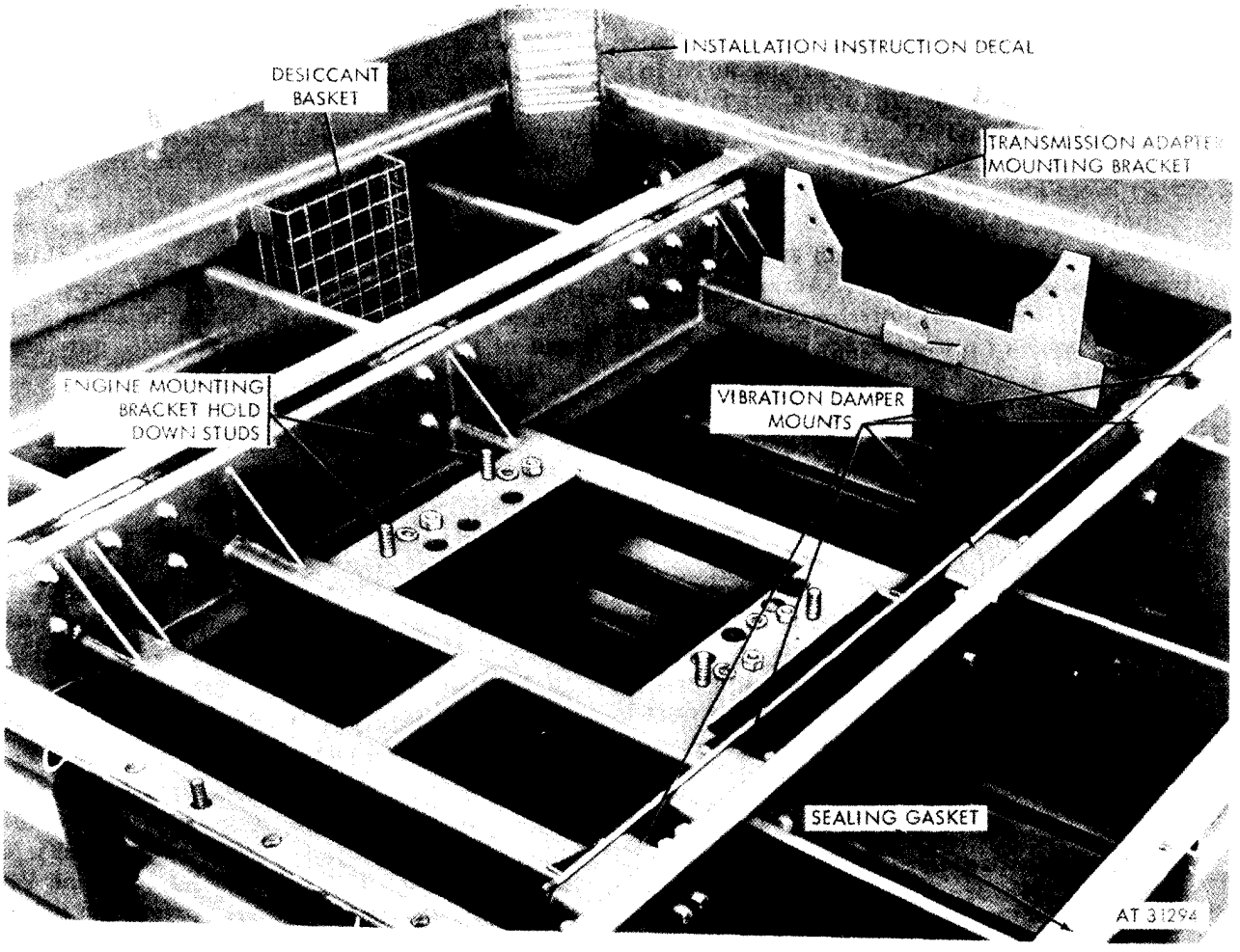


Figure 8-9. Interior of lower section of engine container.

c. Repair.

(1) Straighten all dents which would interfere with required clearance, i.e., approximately three to four inches of clearance between component and inside surface of container. Weld all cracks and defective welding. Remove weld splatter.

(2) Straighten or repair bends and distortions in flanges that would affect proper alinement.

(3) Replace broken mounting brackets or repair cracks by welding. Remove weld splatter.

(4) Replace vibration damper mounts if there is evidence of cracks, tears, or separation of bonding between metal and rubber. Do not use mounts over five years old unless a represen-

tative sample indicates that such mounts will perform in accordance with test requirements of Specification MIL-M-45907.

(5) Replace unserviceable skids. Fabricate skids from wood conforming to Class A of MIL-W-3912. Wood shall be pressure creosoted in accordance with requirements of TT-W-57.

(6) If interior or exterior of container required removal of paint or rust by power buffing, apply spot prime and paint, as required. If container required abrasive blasting, remove grit and coat with one coat of primer 8010-161-5718 (TT-P-636) or 8010-298-3867 (TT-E-529) or 8010-292-3741 (TT-E-485) Type IV) as prescribed by TM 9-213.

e. Assembly and Pressure Check.

(1) *Assembly.* Coat a new or serviceable sealing gasket or "O" ring with a thin, uniform film of sealing compound conforming to MIL-1-8660 and install on lower section mounting flange. Install air pressure gage in place of relief valve (fig. 8-7). Assemble upper and lower sections of container and torque tighten bolts to 90-105 lbs. ft.

(2) *Pressure* test. Pressurize the container to 10 psi using air that has passed through water separator - 4920-242-400 or equivalent. Immerse container in water. Evidence of air bubbles due to air leaks will be cause for rejection and rework. The alternate method of checking is to pressurize container to the specified 10 psi and allow container to stand for a-minimum of 12 hours. Any appreciable drop in pressure will be sufficient cause for rejection. If the container air pressure is maintained satisfactorily, release pressure, remove air pressure gage and install relief valve.

f. Container Markings. The container shall be marked in accordance with MIL-STD-129 and as follows:

(1) Adjacent to lifting rings, eyes, or lugs, (with arrows 5 inches long pointing thereto), mark in 10 inch letters, LIFT HERE.

(2) Adjacent to and above air-filling valve, mark in 1-inch letters, AIR VALVE, and below, FILL TO 5 POUNDS PRESSURE.

(3) Adjacent to and below air-filling valve, mark in 1-inch letters, USE DRY AIR ONLY.

(4) Adjacent to and above the item-record receptacle, mark in ½-inch letters, RECORDS.

(5) Adjacent to and above the humidity indicator, mark in ½-inch letters, HUMIDITY INDICATOR.

(6) Adjacent to and, above the relief valve, mark in ½-inch letters, RELIEF VALVE, and below, DO NOT DISTURB.

(7) Along warning closure flange on both sides of the container, mark in 1-inch letters, WARNING: RELEASE PRESSURE BEFORE OPENING CONTAINER.

(8) At loaded center of balance (43-inches from relief valve end) on both sides of the lower section of the container, mark a vertical line 6-inches high and 1-inch wide with adjacent 1-inch letters, CENTER OF BALANCE.

(9) Each container shall be provided with a name plate conforming to Specification MIL-P-13525 and shall be secured to the record receptacle end of container.

(10) Each container shall contain a decal (10912360) with instruction for assembling container. Decal will be secured to the inner wall (fig. 8-9) of the lower section at the name plate end of the container.

g. Preparation of empty container for Shipment or Storage. After the container has been reconditioned, pressure checked, and has had the proper markings added, remove the upper section of the container. Install and secure the mounting brackets and hardware used to secure the engine in the container. Apply a film of sealing compound conforming to MIL-I-8660 on the container gasket and assemble container. Torque tighten the bolts to 90-105 lbs ft. Add 5 to 7 psi of dry air and allow sufficient time to insure that the air pressure is retained.

8-11. Engine Preservation

a. Preservation Through the Fuel System. Equip an auxiliary fuel container, with a fuel line, and fill with a sufficient amount of preservative oil, conforming to Specification VV-L-800, to operate the engine as prescribed below. Arrange the container to provide adequate pressure to assure proper supply of the preservative oil to the fuel system. Disconnect the fuel line at the most convenient point nearest to the engine fuel pump and connect the line from the auxiliary fuel container to the fuel-to-engine line at the point of disconnect. Disconnect the engine fuel return line at the quick disconnect coupling and connect a transparent plastic line to the disconnected engine fuel return line with the other end inserted into a recovery container to collect the returned diesel fuel. The fuel valve on the auxiliary fuel container shall be

turned to the "ON" position, and the engine started and operated not over 1200 revolutions per minute (RPM) until observed fuel return is purged of diesel fuel and the system filled with preservative oil.

b. All openings such as exhaust manifolds, air intakes, breathers, etc. shall not be sealed.

Note. The engine requires no special de-preservation procedures to be made serviceable.

8-12. Engine Installation

a. The turbosupercharger outer shroud plate assembly and the intermediate shroud plate on both the right and left bank must be removed, in order to provide proper clearance for the engine in the container. On engines which have the oil filler tube installation at the rear of the engine, the upper portion of the two piece tube must be disconnected and removed. Refer to figure 4-18 through 4-21 and 4-23 for removal of the shroud plates and upper portion of the oil filler tube. The parts that have been removed from the engine, must be packaged separately to prevent damage and secured to the engine or container prior to assembling container halves.

b. Inspect engine thoroughly for loose or missing parts or components. Check to be sure engine has been properly identified as having been preserved for storage. Install the two engine mounting brackets on the three centrally located oil pan mounting bosses on either side of the engine (fig. 8-8). Install the six bolts from the underside of the oil pan and assemble a washer and a nut on each bolt. Tighten securely. The engine mounting brackets must be installed on the engine prior to installing engine in container.

c. Loosen but do not remove the six nuts securing transmission adapter support flange to the container cross member (fig. 8-10). Using engine lifting multi-leg sling - 4910-919-2884, carefully guide the engine into position on the engine mounting bracket hold-down studs in the container. Aline the rear transmission adapter support flange screw holes with the screw holes in the engine transmission adapter and install six 1¾ in. screws and lock washers starting with the upper right and left screw holes on the support flange. Install one 1½ in. screw and lock washer in the remaining screw hole in the lower center of the support flange. Tighten all screws securely. Install the four nuts and lock washers on the engine mounting bracket hold-down studs and securely tighten engine-to-container engine mounting flange. Tighten the six nuts that secure the transmission adapter support flange. Position parts that have been removed from the engine and tape or strap separately to engine and support cross members.

Note. Engines that are being returned for rebuild should be securely mounted in container. The loose parts that have been removed from the engine should also be secured by some means to prevent shifting and causing additional damage to the engine and container during transit.

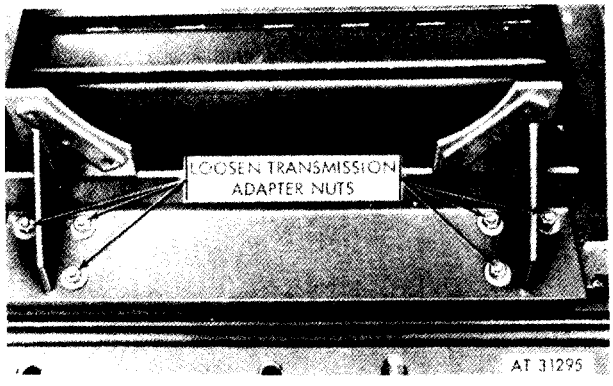


Figure 8-10. Transmission adapter - installed view.

d. Fill each of the two desiccant baskets (fig. 8-9) mounted on the side wall of the container, with eight bags of desiccant (MIL-D-3464, 16 unit bags, Class 1). Apply sealing compound conforming to MIL-I-8660 on the sealing gasket and position the sealing gasket on the container flange. Assemble the upper section of the container to the lower section. Torque tighten assembly bolts to 90-105 lbs ft.

e. When assembly is complete, pressurize the container 5 to 7 psi of dehydrated air and allow container to stand for a minimum of twelve hours to be sure air pressure is maintained.

f. Periodic inspection of containers that are to be stored for extended periods of time should be made to determine if the pressure of moisture is evident in the container. This is determined by the humidity indicator located in the recessed insert on the end of the container (fig. 8-7). Under moisture-free conditions, the indicator will show blue in color. As the presence of

moisture in the container increases, the indicator will turn from blue to purple, then pink, if the moisture content of the container is sufficient. At the first indication of moisture, the container should be disassembled and the engine represerved (para 8-11). Replace all desiccant bags and replace container sealing gasket. Reassemble and test container as indicated in d and e, above.

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APPENDIX A
LIST OF APPLICABLE PUBLICATIONS

Section I. GENERAL INFORMATION

1. Purpose. The information contained in this Appendix has been prepared as a reference list of those army publications pertinent to the operation and maintenance of the vehicle / weapons systems incorporating the materiel supported by this public action.

2. Arrangement of Listings. The publications listings contained in each section of this Appendix are arranged in numerical order by publication number.

3. Requisitioning of Publications. Copies of the publications referenced herein, which are required in the performance of your Mission, may be requisitioned on DA Form 17 from, Commanding Officer AG Publications Center, 1655 Woodson Road, St. Louis, Missouri 63144.

Section II. TECHNICAL MANUALS
(Operator and Maintenance)

PUBLICATION NUMBER	*TITLE*	*DATE*
	Launcher, M60A1 Tank Chassis, Transporting: for Bridge, Armored-Vehicle Launched, Scissoring Type, Class 60 (5420-889-220)	
TM5-5420-202-10	Operator's Manual	25 Feb 68
TM 5-5420-202-20	Organizational Maintenance Manual	25 Feb 68
TM 5-5420-202-35	DS, GS and Depot Maintenance Manual.	29 Sept 69
	Tank, Combat, Full-Tracked: M60A1, w/e (2350-756-8497); M60, w/e, (2350-678-5773) and Vehicle, Combat Engineer, Full-Tracked, M728, w/e (2350-756-1797):	
TM 9-2300-378-35/1	DS, GS and Depot Maintenance Manual	24 Jan 68
	Tank, Combat, Full-Tracked: M60A1 w/e (2350-756-8497) and M60, w/e (2350-678-5773):	
TM 9-2350-215-10	Operator's Manual	Feb 65
TM 9-2350-215-20	Organizational Maintenance Manual	23 Feb 65
TM 9-2350-215-50	Depot Maintenance Manual	3 Jun 63
	Vehicle, Combat Engineer, Full-Tracked, M728, w/e (2350-795-1797)	
TM 9-2350-222-10	Operator's Manual	13 Aug 65
TM 9-2350-222 -20	Organizational Maintenance Manual	27 Sep 65
	Tank, Combat Full-Tracked: 90-MM Gun, M48A3, w/e (2350-895-9145)	
TM 9-2350-224-10	Operator's Manual,	28 Jan 66
TM 9-2350-224 -20	Organizational Maintenance Manual	28 Jan 66
TM 9-2350-224-35	Field and Depot Maintenance Manual	24 Jan 63
	Transmission, CrossDrive, Assembly, Model CD-850-5 (2520-333-3522)	
TM 9-2520-223-35	Field and Depot Maintenance Manual	21 Jul 59
	Pump, Metering, Fuel Injection, Assembly (2910-473-8003 and 2910-064-6265)	
TM 9-2910-212-34	Field Maintenance Manual (Including RPSTL)	28 Nov 62

PUBLICATION NUMBER	TITLE	DATE
	Pump, Fuel, Engine Assembly	
TM 9-2910-213-34	Field Maintenance Manual	8 Nov 62
TM 9-2910-213-35	Field and Depot Maintenance Manual	13 Jan 64
	Generator, Engine, Assembly (300 Amp) (2920-294-3472, 2920-445-0857, 2920-563-0299, 2920-786-1175, 2920-830-1293, 2920-830-6660, and 6115-629-1149)	
TM 9-2920-224-35	Field and Depot Maintenance Manual (including RPSTL)	26-Feb 64
	Starter, Engine, Electrical Assembly (2920-796-2616 and 2920-793-1557)	
TM 9-2920-232-34	DS and GS Maintenance Manual (Including Repair Parts List)	19 Nov 62
	Turbosupercharger, Engine, Assembly (2990-678-4677 and 2990-678-4678)	
TM 9-2990-200-34	Field Maintenance Manual	8 Nov 62
TM 9-2990-200-35	Field and Depot Maintenance Manual	Jun 60

Section III. TECHNICAL MANUAL

(Repair Parts and Special Tools List (RPSL))

PUBLICATION NUMBER	TITLE	DATE
	Tank, Combat Full-Tracked, M60A1E2, w/e (2350-930-3590); M60A1, w/e (2350-756-8497); M60, w/e (2350-678-5773); M48A3, w/e (2350-895-9154 and Vehicle, Combat Engineer, Full-Tracked, M728, w/e (2350-795-1797)	
TM 9-2300-378-20P/1	Organizational Maintenance RPSTL (Hull)	19 Aug 69
TM 9-2300-378-35 P/1-1	DS, GS and Depot RPSTL (Hull)	20 Feb 70
	Transmission, Cross Drive, Assembly, Model CD-850-5 (2520-333-3522)	
TM 9-2520-223-35P	Field and Depot Maintenance RPSTL	14 May 63

Section IV. LUBRICATING ORDERS (LO)

PUBLICATION NUMBER	TITLE	DATE
LO 0-2350-215-12	Tank, Combat Full-Tracked: 105-MM Gun, M60A1 and M60	27 Jun 69
LO 9-2350-222-12	Vehicle, Combat Engineer, Full-Tracked, M728	27 Jun 69
LO 9-2350-224-12	Tank, Combat Full-Tracked, M48E1	12 Jun 69

Section V. GENERAL TYPE EQUIPMENT PUBLICATIONS

PUBLICATION NUMBER	*TITLE*	*DATE*
DA PAM 310-1	Index of Administrative Publications	
DA PAM 310-2	Index of Blank Forms	
DA PAM 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manual (Type 7, 8 and 9), Supply Bulletins and Lubrication Orders	
DA PAM 310-5	Index of Graphic Training Aids and Devices	
DA PAM 310-6	Index of Supply Catalogs and Supply Manuals	
TM 9-207	Operation and Maintenance of Army Material in Extreme Cold Weather O° to -65°	
TM 9-208-1	Cleaning of Ordnance Materiel	
TM 9-214	Inspection, care and Maintenance of Anti-Friction Bearings	19 Nov 59
TM 9-273	Lubrication of Ordnance Material	
TM 21-306	Manual for the Tracked Vehicle Driver	
TM 38-750	Army Equipment Record Procedures	

APPENDIX B
DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE REPAIR PARTS AND SPECIAL TOOLS LIST

Section I INTRODUCTION

1. Scope

This appendix lists repair parts and special tools required for the performance of direct support, general support and depot maintenance of Engine, with Container: Turbosupercharged, Diesel, Fuel Injection, 90-degree "V" Type, Air Cooled, 12 Cylinder Assembly, Continental Models AVDS-1790-2M (2815-856-4996), AVDS-1790-2A and AVDS-1790-2AM (2815-856.9005). Part number and Federal stock number indexes are also included.

2. General

This Repair Parts and Special Tools List is divided into the following sections:

a. Repair Parts - Section II. A list of engine parts, in Government Group number sequence and keyed to figure and number, showing authorized repair parts for the performance of maintenance at the direct support, general support and depot levels.

b. Special Tools and Test Equipment - Section III. A list of special tools and test equipment authorized for the performance of maintenance at the direct support, general support and depot levels is given in ascending Federal stock number sequence, cross-referenced to illustration figure number and item number. Quantities shown in the Special Tools List are those required for each support unit charged with the responsibility of supporting this equipment.

c. General Use Standardized Parts - Section IV. A list of all standard hardware and parts in alphabetical part name order with the hardware listed in ascending sizes.

d. Part Number and Federal Stock Number Indexes - Section V. A list of part numbers and Federal Stock numbers in ascending numerical sequence, cross-referenced to the illustration figure number and item number.

3. Explanation of columns

The following provides an explanation of columns in the tabular lists in Sections II and III:

a. Source, Maintenance, and Recoverability Codes (SMR), Column 1.

(1) Source code, indicates the selection status and source for the listed item. Source codes used are:

Code	Explanation
"M"	**Repair parts which are not procured or stocked as separate supply items but are to be manufactured in indicated maintenance levels. The lowest maintenance level authorized to manufacture the item will be entered in the second digit position of the source code.**
"P"	**Repair parts which are high mortality parts, stocked in or supplied from the GSA/DSA or Army supply system, and authorized for use as indicated maintenance categories**
"P2"	**Repair parts which are procured and stocked for insurance purposes because the combat or military essentiality of the end item dictates that a minimum quantity be available in the supply system.**
"X1"	**Applied to repair parts which are not procured or stocked, the requirement for which will be supplied by use of the next higher procured or stocked component or assembly.**
"X2"	**Applied to repair parts which are not stocked. The indicated maintenance category requiring such repair parts will attempt to obtain these parts by cannibalization; if not obtainable by cannibalization, such repair parts will be requieitioned with supporting justification through normal supply channels.**

(2) Maintenance code, indicates the lowest category of maintenance authorized to install the list item. The maintenance level codes are:

Code	*Explanation*
O	**Organizational maintenance level, providing local end item repair and return to service, or on cite repair service.**
F	**Direct support maintenance level, providing either local mobile or direct service unit fried shop repair and return to use service.**
H	**General support maintenance level, providing mobile or fixed shop repair and return to user, or to supply stock center.**
D	**Depot maintenance level, providing fried shop repair, Major facilities, and return to supply stock service.**

(3) Recoverability code, indicates whether unserviceable items should be returned for recovery or salvage. Items not coded are expendable. Recoverability codes are:

Code	*Explanation*
"R"	**Applied to repair parta and assemblies which are repaired at DSU and GSU levels. These repair parts which are not economically repairable at depot level will be recovered at DS / GS maintenance levels and will be replaced from supply on an exchange basis.**
"T	**Applied to high dollar value recoverable repair parts which are subject to special handling and are most economically repaired, overhauled or rebuilt at depot maintenance level. These parts will be recovered at depot level and will he replaced from supply on an exchange basis. Such repair parts normally are repaired or overhauled at depot maintenance activities.**

b. Federal Stock Number, Column 2. This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description, Column 3. This column indicates the Federal item name and a brief description of the item. A part number or other reference number is preceded by the applicable five-digit Federal supply code for manufacturers in parentheses. All reference numbers that are not preceded by a Federal supply code are to be construed as 19207 items (Army Tank-Automotive Command, Warren, Michigan). The words "early", "intermediate", and "late" are used to denote engine production engineering changes. These descriptive words are used in lieu of engine serial number effective points. Reference to the pertinent illustration will enable identification of part (s) required. Repair parts quantities included in kits, sets, and assemblies are shown in front of the repair part name. Material required for manufacture or fabrication is identified. The Description Column also has a heading denoting the Government Grouping that parts belong to, as shown in TM 750-93-1 All standard hardware and Military standard parts are identified in the Description Column with sizes and given in Group 9501 list. Standard parts are arranged within the group in alphabetical part name order, in ascending sizes.

d. Unit of Measure, Column 4. A two character alphabetical abbreviation indicating the amount or quantity of the item upon which the allowances are based, e.g., ea, pr, ft, yd, etc.

e. Quantity Incorporated in Unit, Column 5. This column indicates the quantity of the item used in an engine.

f. 30-Day DS/GS Maintenance Allowances, Columns 6 and 7.

Note. Allowances in GS column are for GS maintenance only.

(1) The allowance columns are divided into three subcolumns. Indicated in each subcolumn, opposite the first appearance of each item, is the total quantity of items authorized for the number of equipments (engines) supported, Items authorized for use as required but not for initial stockage are identified with an asterisk in the allowance column.

(2) The quantitive allowances for DS/GS levels of maintenance will represent initial stockage for a 30-day period for the number of equipments (engines) supported.

g. 1-Year Allowances Per 100 Equipments/Contingency Planning Purposes, Column 8. This column indicates opposite the first appearance of each item the total quantity required for distribution and contingency planning purposes. The range of items indicates total quantities of all authorized items required to provide for adequate support of 100 equipments (engines) for one year.

h. Depot Maintenance Allowance Per 100 Equipments (Engines), Column 9. This column indicates opposite the first appearance of each item, the total quantity authorized for depot maintenance of 100 equipments (engines). Items authorized for use but not for initial stockage are identified with an asterisk in the allowance column.

i. Illustration, Column 10.

(1) Figure Number, Column 10a. Indicates the figure number of the illustration in which the item is shown.

(2) *Item Number or Symbol, Column 10b.* Indicates the callout number used to reference the item in the illustration.

(3) Each illustration carries a legend for every item on the illustration, cross-referenced to the Government Grouping number where it appears in the parts listing.

(4) Components of kits and sets appear in the listing of the kit or set and parts may not be in the normal figure and item number sequence. These parts are listed only in the kit or set.

4. How to Locate Repair Parts

a. When Federal Stock Number or *Part Number is Unknown.*

(1) Use the Table of Contents and determine the functional group or assembly group by illustration number where the part belongs. Illustrations are prepared by functional groups, which may contain more than one government group.

(2) Identify the repair part on the. illustration and note the illustration and item number of the repair part.

(3) In the repair parts list (Section 2 of this Appendix), find the functional group number and locate the repair part by illustration and item number.

b. When Federal Stock Number or Part Number is Known.

(1) Using the index of Federal stock numbers to illustration or part number to illustration and item number, find the Federal Stock Number or part number. These indexes are arranged in ascending Federal Stock Number and alpha-numerical sequence, cross--referenced to illustration, figure, and item number.

(2) Find the repair part item on the legend of the illustration and note the functional group.

(3) Using the repair parts listing (Section 2), find the functional group of the repair part and the illustration and item number as noted in the index of Federal stock numbers.

5. Abbreviations and Symbols.

a. Abbreviations.

al . . . . aluminum
asb . . . . . asbestos
assy . . . . . assembly
br . . . . . brass
carb-S . . . . . carbon steel
cd . . . . . cadmium
cop. . . . . copper
corr-res-S . . . . . corrosion resistant steel
D.C. . . . . Direct Current
deg . . . . . degree
dia . . . . . diameter
dld . . . . . drilled
did-f/c-pin . . . . . drilled for cotter pin
did-f/lkg-wire . . drilled for locking wire
DR . . . . . double row
ea . . . . . each
e.g. . . . . for example
etc . . . . . and so forth
ext-teeth . . . . . external teeth
ext-thd . . . . . external thread
exter . . . . . external
f/ . . . . . for
fig. . . . . figure
fin. . . . . finish
ft . . . . . feet
hd . . . . . head
hex . . . . . hexagon
hex-hd . . . . . hexagon head
id . . . . . inside diameter
in . . . . . inch
inc . . . . . incorporated
int-thread . . . . . internal thread
inter . . . . . internal
lg . . . . . long
LH . . . . . left hand
lkg . . . . . locking
it . . . . . light (weight)
max . . . . . maximum
med . . . . . medium
med-carb-S . . . . . medium carbon steel
min . . . . . minimum
NC . . . . . American National Coarse Thread
ni b . . . . . nickel
NF . . . . . American National Fine Thread

No . . . . . **number**
nom . . . . . **nominal**
NPT **American Standard Taper Pipe Thread**
NPTF American Standard Taper Pipe Thread (Dryseal)
od . . . . . **outside diameter**
pc(s) . . . . . **piece(s)**
phos-ctd phosphate coated
pltd . . . . . **plated**
pr . . . . . **pair**
psi . . . . . **pounds per square inch**
pt. . . . . . **point**
rad . . . . . **radial**
rd-hd . . . . . **round head**
RH . . . . . **right hand**
S . . . . . **steel**
sltd . . . . . **slotted**
SR . . . . . **single row**
st. . . . . . **street**
stld-S . . . . . **stainless steel**
thd . . . . . **thread (ed) (s)**
thk. . . . . . **thick**
TM . . . . . **Technical Manual**
UNC ., ... **Unified National Coarse**
UNF . . . . . **Unified National Fine**
w / . . . . . **with**
wd . . . . . **wide (width)**
w/o . . . . . **without**
x . . . . . **by (as in 2 x 4)**
yds . . . . . **yards**
zn . . . . . **zinc**
zn-pltd . . . . . **.zinc plated**

b. Symbols.

*Indicates items are authorized for replacement, but not authorized for stockage. ** Indicates items available as part of SET or KIT shown.

6. Federal Supply Codes for Manufacturers

00736	Air-Maze Division North American Rockwell Corporation
01843	American Bosch Division American Bosch Arms Corporation
08181	Bowser, Inc. Bowser & Briggs Filtration Division
11583	Champion Spark Plug Company
14351	Continental Motors Corporation
19207	Army Tank-Automotive Center
21335	Fafnir Bearing Company Division of Textron, Inc.
21450	Ordnance Corps Engineering Standards Rock Island Arsenal
24617	General Motors Corporation
29337	Hoover Ball Division Hoover Ball and Bearing Company
43991	Norma-Hoffman Bearings Corporation
53477	Schraders A. and Son Division Scovill Manufacturing Company
70040	A C Spark Plug Division General Motors Corporation
73134	Heim Universal Corporation
73370	Fram Corporation
81348	Federal Specifications Promulgated by General Services Administration
81349	Military Specifications Promulgated by Standardization Division Director of Logistic Services DSA
86988	Sier-Bath Gear Company, Inc.
88044	Aeronautical Standards Group, Departments of Navy and Air Force
90005	Bendix Corporation Filter Division
94581	National Utilities Corporation
96906	Military Standard
99551	Bendix Corporation Utica Division

7. Recommendations for Maintenance Publication Improvements

Report of errors, omissions and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to DA Publications) and forwarded direct to Commanding General, U.S. Army Tank-Automotive Command, Warren, Michigan, 48090, ATTN: AMSTA-MCP.

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION (a) FIGURE NO.	(b) ITEM NO.
		GROUP 01 — ENGINE												
		Note. Refer to TM 9-2350-214-35P, TM 9-2350-215-35P, TM 9-2350-222-35P, TM 9-2350-224-35P, TM 5-5420-202-35P, and TM 9-2350-232-35P for list of engine assembly, attaching, and associated parts and their issue allowances.												
		0100 — ENGINE ASSEMBLY												
P F T	2815-856-4996	ENGINE AND CONTAINER: (Model AVDS-1790-2M) (5702666) Composed of:												
P F	2815-679-4963	ENGINE, DIESEL: (8725265)											1-1	
P F	8115-856-8147	SHIPPING AND STORAGE CONTAINER, ENGINE: (Refer to Group 3301 for component parts) (10912269)											B-1	
P F T	2815-856-9005	ENGINE AND CONTAINER: (Model AVDS-1790-2A, -2AM) (5702670) Composed of:												
P F	2815-064-6270	ENGINE, DIESEL: (10912450)											1-1	
P F	8115-856-8147	SHIPPING AND STORAGE CONTAINER, ENGINE: (Refer to Group 3301 for component parts) (10912269)											B-1	
P F	5330-772-3892	PACKING, PREFORMED: transmission to engine (7723892)												
P2 H	2815-489-2575	ADAPTER ASSEMBLY, CRANKCASE: transmission case to engine crankcase (8682737)	ea	1				*	*	*	1	*	B-2	7
X1 H		ADAPTER: transmission case to engine crankcase (8682736)	ea	1									B-2	8
P H	5355-776-7331	POINTER, DIAL: engine timing (7767331)	ea	1				*	2	2	6	10	B-2	9
X1 H		BOLT: engine timing pointer (7415112)	ea	2									B-2	10
P H	9525-803-3044	WIRE, NICKEL COPPER: timing pointer to adapter (1 pc 6 in. lg) (96906-20995NC32)	ft	1				*	*	*	8	50	B-2	11
X1 F		EYE, ENGINE LIFTING: flywheel end (8761080)	ea	1									B-2	12

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION (a) FIGURE NO.	(b) ITEM NO.
		0100 — ENGINE ASSEMBLY — Continued												
P2 F	5306-400-7637	BOLT, MACHINE: engine lifting eye to transmission adapter (7416636)	ea	4	*	*	*	*	*	*	2	*	B-2	13
P F	9525-990-7799	WIRE, NICKEL COPPER: engine lifting eye to adapter (2 pcs 12 in. lg) (96906-20995NC40)	ft	2	*	*	1	*	*	1	16	200	B-2	14
P H	5315-753-9735	PIN, STRAIGHT, HEADLESS: transmission adapter (7539735)	ea	2				2	2	3	24	50	B-2	34
P2 H	2815-177-9897	EYE, ENGINE LIFTING: No. 1 left and right (10865498)	ea	2				*	*	*	1	*	B-5	33
		STUD, PLAIN: engine lifting eye damper end												
P H	5307-734-8812	0.003 oversize (7348812)	ea	8				2	3	6	48	64	B-6	8
P H	5307-734-8813	0.007 oversize (7348813)	ea	8				2	3	6	48	64	B-6	8
P H	5310-950-0039	NUT, SELF-LOCKING: to attach engine lifting eye, left bank (4), engine lifting eye and time meter, right bank (4) (96906-21044N6)	ea	8				1	4	7	160	800	B-6	29
X2 H		EYE, LIFTING: engine, damper end (8761295)	ea	2									B-6	30
P H	2815-899-1504	GASKET: fiber, engine lifting eye, damper end, left side (☆☆parts kit—2815-678-4245) (10898933)	ea	1				2	2	3	25		B-6	31
X2 O	4710-150-6187	TUBE ASSEMBLY, FIRE EXTINGUISHER SYSTEM: (8761131)	ea	1									B-11	24
P F	5310-208-5775	NUT, PLAIN, HEXAGON: fire extinguisher tube bulk head adapter (96906-24400-8)	ea	1	*	*	1	*	*	1	15	100	B-11	25
P F	4730-933-3138	ADAPTER, SPECIAL: fire extinguisher tube bulkhead fitting (8761555)	ea	1	*	2	2	*	2	2	6	10	B-11	26
P H	2815-678-4245	PARTS KIT, ENGINE OVERHAUL: (5702625)	ea	1				2	2	3	25	100		
P H	5330-582-2855	Composed of: 1-PACKING, PREFORMED: injection pump base assembly, oil transfer tube to crankcase (96906-28775-113)											B-2	3

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE			(7) 30-DAY GS MAINT. ALLOWANCE			(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION	
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0100 — ENGINE ASSEMBLY — Continued												
P H	5330-411-2513	1-GASKET: transmission adapter (8682754)											B-2	6
X1 H		1-GASKET: crankshaft oil seal housing (8725273)											B-2	47
P H	5330-292-7363	2-PACKING MATERIAL: crankshaft oil seal housing support to crankcase (7416751)											B-2	90
P F	5330-632-2098	48-PACKING WITH RETAINER: valve rocker support cover through bolt (7033684)											B-4	27
P F	5330-678-3313	24-GASKET: valve adjusting cover (8725296)											B-4	31
P H	5330-291-7390	12-PACKING, PREFORMED: cylinder base (5165292)											B-4	55
P H	2815-679-8056	2-GASKET: camshaft drive shaft flange, right and left banks (8761414)											B-5	5
P H	5330-579-7918	2-PACKING, PREFORMED: camshaft drive bevel gearshaft adapter, right and left banks (96906-28775-229)											B-5	8
P F	2815-679-8054	2-GASKET: camshaft gear housing cover, right and left banks (8682564)											B-5	13
P H	5330-582-2133	2-PACKING, PREFORMED: camshaft drive gearshaft adapter oil transfer tube, right and left banks (96906-28775-011)											B-5	28
P H	2815-679-8059	4-GASKET: camshaft end cover plate, left and right banks (2), camshaft gear housing (2) (8682468)											B-5	30
P H	5330-738-0543	1-GASKET: tachometer drive cover, left bank (7767519)											B-5	39
P F	5330-269-2844	2-GASKET: oil filter bypass valve (1), oil cooler bypass valve (1) (96906-35769-47)											B-6	2
P O	2815-678-3221	1-GASKET: oil pressure regulator valve (8725239)											B-6	16
P O	2940-678-3277	1-GASKET: auxiliary oil filter cover (8725201)											B-6	23.3

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION (a) FIGURE NO.	(b) ITEM NO.
		0100 — ENGINE ASSEMBLY — Continued												
P H	2815-899-1504	1-GASKET: fiber, engine lifting eye, damper end, left side (10898933)											B-6	31
P O	5330-290-8154	2-PACKING, W / RETAINER: oil filter stop bolt (1), auxiliary oil filter stop bolt (1) (7045881)											B-6	33
P H	5330-579-8156	5-PACKING, PREFORMED: "O" ring, crankcase oil transfer tube (96906-28775-212)											B-6	39
P O	5330-269-2845	4-GASKET: engine oil cooler line adapter to crankshaft damper and oil filter housing (96906-35769-34)											B-6	40
P H	2520-678-3171	1-GASKET: fuel pump adapter (8725277)											B-6	47
P O	2940-678-3278	1-GASKET: oil filter (main) cover (8725203)											B-6	53
P F	5330-199-5886	2-GASKET: auxiliary, oil filter bypass valve (1), damper housing core hole plug (1) (96906-35769-35)											B-6	68
P O	2940-678-3279	2-GASKET: main oil filter drain cover (1), auxiliary oil filter drain cover (1) (8725286)											B-6	73
P O	5330-290-8154	3-PACKING, W / RETAINER: oil filler tube to oil pan (7045881)											B-7	13
P O	2815-679-4961	2-GASKET: oil filler tube mounting (1), oil level indicator tube mounting (1) (8682523)											B-7	19
P H	2805-678-4243	1-GASKET: pressure oil pump elbow adapter (7320442)											B-7	20
P H	5330-641-3407	2-PACKING, PREFORMED: pressure oil pump adapter (96906-28775-224)											B-7	23
P O	5325-720-9054	1-GROMMET, RUBBER: drain hose to filler plate (96906-35490-26)											B-7	36
P O	5330-579-8157	1-PACKING, PREFORMED: oil filler and indicator tubes to cap assembly (96906-28775-327)											B-7	38
P O	5330-410-9803	2-GASKET: oil filler and oil gage rod cap to plate (10935621)											B-7	39

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION (a) FIGURE NO.	(b) ITEM NO.
		0100 — ENGINE ASSEMBLY — Continued												
P O	2805-599-0942	2-PACKING, PREFORMED: oil filler tube cap and oil gage tube cap (8717158)											B-7	43
P H	5330-678-3508	1-GASKET: breather, oil separator drain replacement cover (8682764)											B-8	6
P H	2815-679-4961	1-GASKET: oil level indicator or replacement cover (8682523)											B-8	7
P O	5330-199-5884	2-GASKET: oil drain plug, pressure and reserve compartment (96906-35769-31)											B-8	23
P H	2805-678-4244	1-GASKET: pressure oil pickup screen (7320462)											B-8	27
P H	5330-411-2512	1-GASKET: oil pump spill tube (7320441)											B-9	6
X1 H		2-GASKET: scavenge oil pickup tube (7320461)											B-9	7
P H	5330-542-1329	2-PACKING, PREFORMED: pressure oil pump housing oil transfer tube to crankcase oil hole (96906-28775-120)											B-9	8
P H	5330-579-3156	1-PACKING, PREFORMED: pressure oil pump housing transfer tube to crankcase cooling oil hole (96906-28775-116)											B-9	9
P H	5330-411-5803	1-PACKING, PREFORMED: spill tube junction outlet housing (8761274)											B-9	61
P O	2815-679-6482	4-GASKET: oil pan inlet drain flange (8682772)											B-10	12
P O	5330-855-6045	12-GASKET: cylinder head oil drain tube connector (96906-35769-9)											B-10	14
P O	5330-678-5386	1-GASKET: crankcase breather tube tee (8682770)											B-11	15
P O	5330-678-5388	1-GASKET: crankcase breather tube (damper end) (8682680)											B-11	28
P F	2815-678-3216	16-GASKET: exhaust manifold to cylinder head (8761547)											B-12	5

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION (a) FIGURE NO.	(b) ITEM NO.
		0100 — ENGINE ASSEMBLY — Continued												
P F	2990-678-4681	2-GASKET: intake manifold tube, turbosupercharger (left and right) (8682797)											B-13	16
P F	2815-679-7063	4-GASKET: intake maniflold tube (cylinder No. 3 and 4, left and right) (8698759)											B-13	19
P F	2815-679-7062	12-GASKET: intake manifold tube to cylinder head (8682800)											B-13	24
P F	5330-618-0800	4-PACKING, PREFORMED: intake manifold tube cylinders No. 1 and 6 right and left bank (96906-28775-335)											B-13	26
P F	2815-679-7064	2-GASKET: intake manifold elbow to intake manifold (8682769)											B-13	43
P H	5330-171-6649	2-PACKING, PREFORMED: generator driven drive idler gearshaft (1), starter driven drive idler gearshaft (1) (96906-28775-223)											B-14	8
P H	5330-438-1861	1-GASKET: starter adapter to crankcase (10912558)											B-14	17
X1 H		1-GASKET: generator adapter to crankcase (8761081)											B-14	30
P F	2815-678-3270	4-GASKET: exhaust elbows to turbosupercharger, right and left banks (8682505)											B-15	4
P O	5330-679-6483	2-GASKET: turbosuperchager oil drain tube flange, right and left banks (8761087)											B-15	5
P F	5330-579-3156	1-PACKING, PREFORMED: fuel injection pump base oil transfer tube to fuel injection metering pump (96906-28775-116)											B-15	11
P O	2920-318-4127	1-GASKET: generator mounting (8666738)											B-15	17
P F	2910-741-5354	1-GASKET: fuel pump mounting (7415354)											B-15	23
P O	2920-678-7101	1-GASKET: starter mounting (7084278)											B-15	27
P F	2990-678-4676	2-GASKET: turbosupercharger outlet elbow, right and left (7320459)											B-15	29

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE			(7) 30-DAY GS MAINT. ALLOWANCE			(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION	
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0100 — ENGINE ASSEMBLY — Continued												
P F	5330-542-1586	12-PACKING, PREFORMED: fuel injector nozzle holder to retainer (96906-28775-118)											B-16	6
P O	2910-078-4866	12-PACKING, PREFORMED: fuel injector nozzle holder (10935359)											B-16	8
P O	5310-861-1406	12-GASKET: fuel injector nozzle seat (7748837)											B-16	24
P O	5310-678-5370	24-WASHER, FLAT: fuel return adapter and elbow to fuel injector nozzle (7323994)											B-17	13
P O	2990-678-4695	2-GASKET: manifold air heaters (8682503)											B-21	10
P O	5340-740-3580	4-SPACER, RING: valve bypass transmission oil cooler (2), valve bypass engine oil cooler, (2) (7403580)											B-24	23
P O	2930-678-4669	4-GASKET: engine oil cooler male connector (8682679)											B-24	52
P H	5330-576-9732	2-PACKING, PREFORMED: accessory cam drive bevel gearshaft (96906-28775-226)											B-26	4
P F	2930-765-4364	1-GASKET: fan drive cover (10865351)											B-26	9
P H	5330-585-6663	7-PACKING, PREFORMED: crankcase oil transfer tube to accessory drive housing (3), accessory drive housing oil transfer tube to accessory drive housing base (3), fan drive housing oil transfer tube to accessory drive housing base (1) (96906-28775-110)											B-26	42
P H	5330-580-3846	2-PACKING, PREFORMED: interfan drive shaft cover (96906-28775-325)											B-26	56
P H	5330-582-2133	1-PACKING, PREFORMED: fan drive housing base to fan drive housing oil tube (96906-28775-011)											B-26	73
P H	5330-599-2934	1-PACKING, PREFORMED: crankcase to fan drive housing base oil transfer tube (96906-28775-112)											B-26	81
P O	5330-187-3615	2-PACKING, PREFORMED: fan drive housing cover (21450-546908)											B-27	52

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION (a) FIGURE NO.	(b) ITEM NO.
		0101—CRANKCASE, CYLINDER HEAD												
P2 H T	2815-117-0829	ENGINE BLOCK, DIESEL: studded (10898862)	ea	1				*	*	*	5	*	B-2	1
P H	5330-411-2513	GASKET: transmission adapter (☆☆ parts kit-2815-678-4245) (8682754)	ea	1				2	2	3	25		B-2	6
P H	5310-842-1488	NUT, SLOTTED, HEXAGON: transmission adapter to crankcase (96906-35692-21)	ea	2				*	1	2	40	200	B-2	15
P H	9525-990-7799	WIRE, NICKEL COPPER: transmission adapter to crankcase (3 pcs 24 in. lg) (4 pcs 12 in. lg) crankshaft oil seal housing (2 pcs 12 in. lg) (6 pcs 18 in. lg) (96906-20995NC40)	ft	21				2	4	8	210	2100	B-2	16
		STUD, PLAIN: cylinder barrel												
P H	5307-678-3536	0.003 oversize (7044068)	ea	168				11	25	47	1008	1340	B-2	23
P H	5307-678-3535	0.007 oversize (7044069)	ea	168				11	25	47	1008	1340	B-2	23
P H	5310-088-0552	NUT, SELF-LOCKING, HEXAGON: transmission adapter to crankcase (96906-21044-N7)	ea	4				1	2	3	80	400	B-2	32
P H	5310-682-5851	NUT, PLAIN, BLIND RIVOT: transmission adapter to crankcase (7323991)	ea	15				7	16	29	300	1500	B-2	33
X1 H		CAP: crankshaft oil seal housing (8725146)	ea	1									B-2	46
X1 H		GASKET: crankshaft oil seal housing (☆☆ parts kit-2815-678-4245) (8725273)	ea	1									B-2	47
P H	5340-291-3495	INSERT, SCREW THREAD: crankshaft oil seal housing support (96906-124697)	ea	20				3	7	13	120	120	B-2	48
P H	4730-753-8997	PLUG, PIPE: oil header hole (2), crankshaft bearing oil header hole (1), oil port machining hole (1) (7538997)	ea	4				2	2	3	25	50	B-2	50
P H	4730-776-7337	PLUG, PIPE: piston cooling oil gallery (7767337)	ea	3				2	2	3	25	50	B-2	52
		STUD, PLAIN: transmission case adapter												
P H	5307-734-8803	0.003 oversize (7348803)	ea	2				2	2	2	12	16	B-2	53
P H	5307-734-8804	0.007 oversize (7348804)	ea	2				2	2	2	12	16	B-2	53

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE			(7) 30-DAY GS MAINT. ALLOWANCE			(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION	
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0101 — CRANKCASE, CYLINDER HEAD — Continued												
P H	5315-058-9929	PIN, STRAIGHT HEADLESS: fan drive housing base (2), fuel injection pump base (2), accessory drive housing base to crankcase (2), crankshaft oil seal housing (2), crankshaft oil seal housing to crankcase (2) (21450-589929)	ea	10				5	11	20	200	1000	B-2	60
X1 H		ENGINE BLOCK, DIESEL: (10898861)	ea	1									B-2	61
P H	9905-410-5829	PLATE, IDENTIFICATION: engine (10912455)	ea	1				*	*	*	5		B-2	63
P H	4730-044-4689	PLUG, PIPE: pressure check oil hole (7538990)	ea	1				2	2	2	12	20	B-2	64
P H	5340-291-3495	INSERT, SCREWTHREAD: electrical wiring harness clip (96906-124697)	ea	24				4	9	16	144	144	B-2	66
P H	4730-776-7336	PLUG, PIPE: crankshaft bearing oil hole (7767336)	ea	1				2	2	2	12	20	B-2	68
X1 H		PIN, STRAIGHT, HEADLESS: crankshaft bearing (8725238)	ea	7									B-2	70
P H	5305-253-5618	SCREW, DRIVE: engine identification plate to crankcase (96906-21318-27)	ea	4				1	2	3	80	120	B-2	74
P H	5310-167-0816	WASHER, FLAT: engine identification plate (88044-960-6)	ea	4				1	2	3	80	400	B-2	75
P H	5315-234-1864	PIN, COTTER: crankcase through stud nuts (96906-24665-302)	ea	28				5	12	24	560	2800	B-2	76
P H	5310-720-7627	NUT, SLOTTED, HEXAGON: crankcase through stud (8761279)	ea	28				5	12	24	560	2800	B-2	77
X1 H		WASHER, FLAT: crankcase through stud and bearing cap (8725170)	ea	28									B-2	78
P H	2815-678-3227	ROD, ENGINE CRANKCASE: crankcase through bolt (8725254)	ea	14				1	2	4	84	112	B-2	79
X1 H		PIN, STRAIGHT, HEADLESS: cylinder to crankcase (7416591)	ea	24									B-2	80

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION (a) FIGURE NO.	(b) ITEM NO.
		0101 — CRANKCASE, CYLINDER HEAD — Continued												
X1 H		PIN, STRAIGHT, HEADLESS: transmission case adapter to crankcase (7053981)	ea	2									B-2	85
		STUD, PLAIN: transmission case adapter												
P H	5307-734-8671	0.003 oversize (7348671)	ea	4				2	2	3	24	32	B-2	87
P H	5307-727-4938	0.007 oversize (7767340)	ea	4				2	2	3	24	32	B-2	87
		STUD, PLAIN: transmission case adapter												
P H	5307-678-3514	0.003 oversize (7992697)	ea	15				3	6	11	90	120	B-2	92
P H	5307-678-3513	0.007 oversize (7992698)	ea	15				3	6	11	90	120	B-2	92
P H	5310-638-6274	NUT, SLOTTED, HEXAGON: crankshaft oil seal housing cap to housing (21450-596610)	ea	4				1	2	4	80	400	B-2	96
P H	5310-167-0820	WASHER, FLAT: crankcase oil seal housing (20), crankshaft oil seal housing cap to crankshaft oil seal housing (4) (88044-960-516)	ea	24				4	10	20	480	2400	B-2	97
		STUD, PLAIN: oil seal housing												
P H	5307-438-1809	0.003 oversize (7084497)	ea	4				2	2	3	24	32	B-2	98
P H	5307-477-3736	0.007 oversize (7084498)	ea	4				2	2	3	24	32	B-2	98
X1 H		HOUSING ASSEMBLY, CRANKSHAFT OIL SEAL: (8725145)	ea	1									B-2	99
P H	5306-182-2026	BOLT, MACHINE: crankshaft oil seal housing (88044-5H7A)	ea	20				3	8	16	400	400	B-2	100
P H R	2815-765-9711	CYLINDER ASSEMBLY: engine, w/o piston, complete (10865297)	ea	12				3	7	13	120	600	B-4	13
X1 H		CYLINDER AND HEAD: part of cylinder and head assembly 10865297 (10865298)	ea	12									B-4	41
		STUD, PLAIN: intake manifold												
P F	5307-774-4803	0.003 oversize (7744803)	ea	36	6	12	22	6	12	22	216	288	B-4	43
P F	5307-774-4555	0.007 oversize (7744555)	ea	36	6	12	22	6	12	22	216	288	B-4	43
		STUD, PLAIN: cooling fan shroud support												
P F	5307-678-3315	0.003 oversize (7039742)	ea	12	2	4	8	2	4	8	72	96	B-4	45
P F	5307-806-6047	0.007 oversize (7039744)	ea	12	2	4	8	2	4	8	72	96	B-4	45

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION (a) FIGURE NO.	(b) ITEM NO.
		0101 — CRANKCASE, CYLINDER HEAD — Continued												
		STUD, PLAIN: cooling fan shroud support bracket to cylinder												
P F	5307-776-7804	0.003 oversize (7767804)	ea	24	4	9	16	4	9	16	144	192	B-4	51
P F	5307-776-7805	0.007 oversize (7767805)	ea	24	4	9	16	4	9	16	144	192	B-4	51
		CYLINDER: included in fig. B-4, item No. 41											B-4	53
P H	5310-753-4014	NUT, EXTENDED WASHER: cylinder to crankcase studs (8725151)	ea	168				38	85	159	3360	9999	B-4	54
P H	5330-291-7390	PACKING PREFORMED: cylinder base (☆☆ parts kit-2815-678-4245) (5165292)	ea	12				7	16	29	300		B-4	55
		0102 — CRANKSHAFT												
		STUD, PLAIN: crankshaft damper and oil filter housing												
P H	5307-678-3522	0.003 oversize (7992677)	ea	4				2	2	3	24	32	B-2	24
P H	5307-678-3521	0.007 oversize (7992678)	ea	4				2	2	3	24	32	B-2	24
		STUD, PLAIN: crankshaft damper and oil filter housing												
P H	5307-678-3528	0.003 oversize (7992653)	ea	8				2	3	6	48	64	B-2	25
P H	5307-678-3527	0.007 oversize (7992654)	ea	8				2	3	6	48	64	B-2	25
		STUD, PLAIN: crankshaft damper and oil filter housing												
P H	5307-678-6891	0.003 oversize (8761442)	ea	2				2	2	2	12	16	B-2	26
P H	5307-678-6890	0.007 oversize (8761443)	ea	2				2	2	2	12	16	B-2	26
P H	9525-990-7799	WIRE, NICKEL COPPER: crankshaft oil seal retainer (2 pcs 18 in. lg) main bearing cap nuts (14 pcs 12 in. lg) (96906-20995NC40)	ft	17				1	4	7	170	1700	B-2	42
P H	5306-182-2023	BOLT, MACHINE: crankshaft oil seal retainer (7346699)	ea	6				4	8	14	120	120	B-2	43
P2 H	2815-238-9191	RETAINER, CRANKSHAFT: oil seal (8725184)	ea	2				*	*	*	2	*	B-2	44
P H	5340-514-2321	INSERT, SCREW THREAD: crankshaft oil seal retaining plate (96906-21208F5-20)	ea	6				2	2	2	15	29	B-2	45

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		0102 — CRANKSHAFT — Continued												
P2 H	2815-678-3228	TIE ROD, ENGINE CRANKCASE: crankshaft bearing cap (8725140)	ea	28				*	*	*	5	*	B-2	71
P2 H	5307-410-5830	STUD, SHOULDERED: crankshaft bearing cap (0.010 oversize) (10882970)	ea	28				*	*	*	5	*	B-2	71
P H	5310-720-7627	NUT, SLOTTED, HEXAGON: main bearing cap stud (8761279)	ea	28				2	6	12	280	2800	B-2	77
P2 H	5315-238-9239	PIN, STRAIGHT, HEADED: crankshaft main bearing cap (8725256)	ea	7				*	*	*	5	*	B-2	82
X1 H		BEARING CAP: crankshaft main thrust (7320476)	ea	1									B-2	83
X1 H		BEARING CAP: crankshaft main (8725141)	ea	6									B-2	88
X1 H		PIN, STRAIGHT, HEADLESS: crankshaft oil seal housing support (7416591	ea	2									B-2	89
P H	5330-292-7363	PACKING MATERIAL: crankshaft oil seal housing support to crankcase (☆☆ parts kit—2815-678-4245) (7416751)	ft	3				2	3	5	30		B-2	90
X1 H		SUPPORT: oil seal housing crankshaft (8725181)	ea	1									B-2	91
P H	5310-167-0822	WASHER, FLAT: crankshaft oil seal housing to support (88044-960-716)	ea	4				1	2	4	80	400	B-2	93
P H	5305-710-4189	SCREW, CAP, HEXAGON HEAD: crankshaft oil seal housing support (96906-90726-84)	ea	4				1	2	4	80	120	B-2	94
P H	5340-634-7860	INSERT, SCREW THREAD: crankshaft oil seal housing support (96906-21208F7-15)	ea	4				*	1	1	24	24	B-2	95
P H	9525-990-7799	WIRE, NICKEL COPPER: fuel pump drive and damper to crankshaft (3 pcs 16 in. lg) (96906-20995NC40)	ft	5				*	*	*	50	500	B-3	1
P H	5306-817-6131	BOLT, MACHINE: fuel pump coupling adapter and damper to crankshaft (21450-596281)	ea	6				1	3	5	120	120	B-3	2

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		0102 — CRANKSHAFT — Continued												
P H	2815-679-4969	DAMPER, ENGINE CRANKSHAFT: vibration torsional (7025892)	ea	1				*	2	2	6	6	B-3	6
P H	2815-678-3230	BEARING, HALF SET, SLEEVE: crankshaft main (standard) (5702616)	ea	1				2	2	3	20	44	B-3	
		Composed of:												
X1 H		6—Bearing half, sleeve (upper) (8724986)											B-3	7.1
X1 H		1—Bearing half, sleeve (upper) (8724995)											B-3	7.2
X1 H		1—Bearing half, sleeve (lower) (8724996)											B-3	7.3
X1 H		6—Bearing half, sleeve (lower) (8724987)											B-3	7.4
P H	3120-491-0314	BEARING, HALF SET, SLEEVE: crankshaft main (0.003 undersize) (5704348)	ea	1				*	2	2	10	10	B-3	
		Composed of:												
X1 H		6—Bearing half, sleeve: (upper) (8724986-1)											B-3	7.1
X1 H		1—Bearing half, sleeve: (upper) (8724995-1)											B-3	7.2
X1 H		1—Bearing half, sleeve: (lower) (8724996-1)											B-3	7.3
X1 H		6—Bearing half, sleeve: (lower) (8724987-1)											B-3	7.4
P H	2815-678-3229	BEARING, HALF SET, SLEEVE: crankshaft main (0.010 undersize) (5702617)	ea	1				*	2	2	10	10	B-3	
		Composed of:												
X1 H		6—Bearing half, sleeve: (upper) (8761328)											B-3	7.1
X1 H		1—Bearing half, sleeve: (upper) (8761330)											B-3	7.2
X1 H		1—Bearing half, sleeve: (lower) (8761331)											B-3	7.3
X1 H		6—Bearing half, sleeve: (lower) (8761329)											B-3	7.4
P F	2815-678-3225	SEAL, PLAIN: crankshaft oil (8764948)	ea	1	2	3	6	2	3	6	48	100	B-3	15
P2 H T	2815-679-4970	CRANKSHAFT, ENGINE: assembly (8682734)	ea	1				*	*	*	2	*	B-3	16
X1 H		CRANKSHAFT: engine (8725084)	ea	1									B-3	19
P H	5315-842-3044	PIN, COTTER: crankpin oil retainer plug (96906-24665-283)	ea	6				3	7	14	360	600	B-3	20

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		0102 — CRANKSHAFT — Continued												
P H	5310-842-1488	NUT, SLOTTED, HEXAGON: crankpin bearing oil retaining plug (96906-35692-21)	ea	6				1	3	5	120	600	B-3	21
P H	5310-167-0821	WASHER, FLAT: crankpin bearing oil retaining plug (early engines) (21450-502204)	ea	12				1	2	3	72	120	B-3	22
X1 H		PLUG, CRANKPIN: bearing oil retaining (10865183)	ea	12									B-3	23
X1 H		BOLT, MACHINE: crankpin bearing oil retainer plug (10865184)	ea	6									B-3	24
P H	5315-776-7363	PIN, STRAIGHT, HEADLESS: crankshaft damper to crankshaft (7767363)	ea	1				*	2	2	6	10	B-3	25
		0103 — FLYWHEEL ASSEMBLY												
P2 F	2815-404-7444	FLYWHEEL, ENGINE: (10912453)	ea	1	*	*	*	*	*	*	2	*	B-3	9
P F	2815-679-4972	GEAR, SPUR: transmission accessory drive (8682820)	ea	1	*	2	2	*	2	2	8	12	B-3	10
P F	5306-206-3850	BOLT, MACHINE: flywheel and gearshaft to crankshaft (8717322)	ea	9	2	4	8	2	4	8	180	180	B-3	11
P F	2815-679-4971	LOCK, PLATE, NUT BOLT: flywheel and gearshaft to crankshaft (8725249)	ea	3	2	6	12	2	6	12	300	300	B-3	12
P F	5305-715-1221	SET SCREW: flywheel dowel pin (96906-51981-36)	ea	2	*	1	2	*	1	2	40	60	B-3	17
		PIN, GROOVED, HEADLESS: flywheel to crankshaft												
P F	5315-141-6337	0.005 oversize (8717298)	ea	2	2	2	3	2	2	3	40	100	B-3	18
P F	5315-141-6338	0.010 oversize (8717299)	ea	2	2	2	3	2	2	3	40	100	B-3	18
		0104 — PISTONS, CONNECTING RODS												
P H	9525-990-7799	WIRE, NICKEL COPPER: piston oil sprayer to crankcase (6 pcs 12 in. lg) (96906-20995NC40)	ft	6				1	2	3	60	600	B-2	37
P H	5310-849-6883	NUT, SLOTTED, HEXAGON: piston oil sprayer to crankcase (96906-35692-13)	ea	12				1	3	5	120	1200	B-2	38

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		0104 — PISTONS, CONNECTING RODS — Continued												
P2 H	2815-678-3226	NOZZLE ASSEMBLY, PISTON: oiler (8725261)	ea	6				*	*	*	2	*	B-2	39
		STUD, PLAIN: piston oil sprayer to crankcase												
P H	5307-734-8782	0.003 oversize (7348782)	ea	12				2	4	8	72	96	B-2	67
P H	5307-734-8783	0.007 oversize (7348783)	ea	12				2	4	8	72	96	B-2	67
P2 H	2815-678-1841	CONNECTING ROD, CRANKSHAFT: rod assembly (8724974)	ea	12				*	*	*	5	*	B-4	1
P H	5315-816-1794	PIN, COTTER: connecting rod cap bolt (96906-24665-285)	ea	24				4	10	20	480	2400	B-4	2
P H	5310-655-9937	NUT, EXTENDED WASHER: connecting rod cap bolt (8724978)	ea	24				2	5	10	240	480	B-4	3
X1 H		CAP: connecting rod, engine (8724977)	ea	12									B-4	4
P H	2815-678-1838	BEARING HALF SET, SLEEVE: connecting rod (standard) (5702614)	ea	1				*	2	2	6	13	B-4	5
X1 H		Composed of: 24-Bearing (8724985)												
P H	3120-477-3780	BEARING HALF SET, SLEEVE: connecting rod (0.003 undersize) (5704351)	ea	1				*	2	2	10	10	B-4	5
X1 H		Composed of: 24-Bearing (8724985-1)												
P H	2815-678-1837	BEARING HALF SET, SLEEVE: connecting rod (0.010 undersize) (5702615)	ea	1				*	2	2	10	10	B-4	5
X1 H		Composed of: 24-Bearing (8761327)												
X1 H		ROD, CONNECTING, ENGINE: (8724976)	ea	12									B-4	6
P H	5306-678-1887	BOLT, EXTERNALLY RELIEVED: connecting rod cap (8724979)	ea	24				1	3	5	120	480	B-4	7
P H	3120-678-1869	BEARING, SLEEVE: connecting rod, piston pin (8724980)	ea	12				3	7	13	120	500	B-4	8

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		0104 — PISTONS, CONNECTING RODS — Continued												
P H	2815-678-1842	PISTON, INTERNAL COMBUSTION: (standard) (5702609)	ea	12				7	16	29	300	592	B-4	
		Composed of:												
X1 H		2-PLUG: piston pin (7320495)											B-4	9.1
X1 H		1-PIN: piston connecting rod (7320496)											B-4	9.2
X1 H		1-PISTON: engine (10865369)											B-4	9.3
P H	2815-179-7047	RING SET, PISTON: (standard) (5704344)	ea	12				14	31	58	576	1200	B-4	
		Composed of:												
X1 H		1-RING: piston, oil control (10951396)											B-4	10.1
X1 H		2-RING: piston (10951395)											B-4	10.2
X1 H		1-RING: piston (10951394)											B-4	10.3
		or												
X1 H		1-RING: piston (11642029)											B-4	10.1
X1 H		2-RING: piston (11642028)											B-4	10.2
X1 H		1-RING: piston (11642030)											B-4	10.3
		0105 — VALVES, CAMSHAFTS AND TIMING SYSTEM												
P H	2815-545-1563	VALVE, POPPET ENGINE: exhaust (10882968)	ea	12				2	3	6	50	120	B-4	11
P H	2815-765-9712	VALVE, POPPET ENGINE: intake (10865299)	ea	12				3	6	11	100	800	B-4	12
		GUIDE, POPPET VALVE: engine intake												
P H	2815-678-3203	Standard (8725003)	ea	12				2	3	6	40	57	B-4	14
P2 H	2815-678-3201	0.010 oversize (8725176)	ea	12				*	*	*	3	*		
P2 H	2815-678-3200	0.020 oversize (8725177)	ea	12				*	*	*	2	*		
P2 H	2805-679-1591	SEAT, HELICAL COMPRESSION: intake valve spring (7744617)	ea	12				*	*	*	3	*	B-4	15
P H	2815-678-3208	SPRING, HELICAL COMPRESSION: valve outer (7320428)	ea	24				3	7	13	120	120	B-4	16
P H	2815-678-3207	SPRING, HELICAL COMPRESSION: valve intermediate (7320429)	ea	24				3	7	13	120	120	B-4	17

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		0105 — VALVES, CAMSHAFTS AND TIMING SYSTEM — Continued												
P H	2815-678-3209	SPRING, HELICAL COMPRESSION: valve inner (7320427)	ea	24				3	7	13	120	120	B-4	18
P H	2805-774-4798	RETAINER: intake valve spring, upper (7744798)	ea	12				*	2	2	10	20	B-4	19
P H	2805-774-4610	LOCK VALVE SPRING RETAINER: intake and exhaust (7744610)	ea	48				3	7	13	120	480	B-4	20
P F	5365-408-1268	PLUG, MACHINE THREAD: valve rocker shaft hole (7320384)	ea	24	3	6	11	3	6	11	100	300	B-4	21
P F	2815-678-3210	SHAFT, VALVE ROCKER: intake (7320396)	ea	12	2	4	7	2	4	7	60	144	B-4	22
P F	5310-167-0820	WASHER, FLAT: valve rocker support cover (156) valve adjusting cover plate (48) (88044-960-516)	ea	204	9	20	38	9	20	38	400	9999	B-4	23
P F	5306-616-2618	BOLT, MACHINE: valve rocker support cover (88044-5-12A)	ea	48	6	13	25	6	13	25	240	960	B-4	24
P F	5306-151-2623	BOLT, MACHINE: valve rocker support cover (88044-5-20A)	ea	84	5	11	20	5	11	20	200	840	B-4	25
P F	5306-678-3316	BOLT, MACHINE: valve rocker support cover through valve rocker shaft (7320407)	ea	48	6	13	25	6	13	25	240	960	B-4	26
P F	5330-632-2098	PACKING WITH RETAINER: valve rocker support cover through bolt (☆☆ parts kit-2815-678-4245) (7033684)	ea	48	11	25	47	11	25	47	480		B-4	27
P F	5306-051-4087	BOLT, MACHINE: valve rocker support cover (96906-90727-45)	ea	24	2	5	10	2	5	10	240	480	B-4	28
P2 F	2815-454-8599	COVER, ACCESS: valve adjusting (7320408)	ea	24	*	*	*	*	*	*	2	*	B-4	29
P F	5306-335-4244	BOLT, MACHINE: valve adjusting cover (8365671)	ea	48	11	25	47	11	25	47	480	960	B-4	30
P F	5330-678-3313	GASKET: valve adjusting cover (☆☆ parts kit-2815-678-4245) (8725296)	ea	24	14	31	58	14	31	58	600		B-4	31
P F	5310-776-7317	NUT, PLAIN, HEXAGON: valve rocker adjusting screw (7767317)	ea	24	8	18	33	8	18	33	360	2400	B-4	32

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		0105 — VALVES, CAMSHAFTS AND TIMING SYSTEM — Continued												
P F	2815-678-3194	ROCKER ARM POPPET VALVE: valve rocker exhaust (8725293)	ea	12	2	3	6	2	3	6	48	48	B-4	33
P F	2815-678-3195	ROCKER ARM, POPPET VALVE: valve intake (8725281)	ea	12	2	3	6	2	3	6	48	48	B-4	34
P F	2815-678-3211	SHAFT, VALVE ROCKER: exhaust (7320395)	ea	12	3	6	11	3	6	11	96	144	B-4	35
P F	2805-776-7321	SCREW, ADJUSTING: valve rocker (7767321)	ea	24	2	3	6	2	3	6	48	120	B-4	36
		GUIDE, POPPET VALVE: engine exhaust												
P H	2815-678-3202	Standard (8725004)	ea	12				2	3	6	40	57	B-4	37
P2 H	2815-678-3199	0.010 oversize (8725179)	ea	12				*	*	*	3	*	B-4	37
P2 H	2815-678-3198	0.020 oversize (8725180)	ea	12				*	*	*	2	*	B-4	37
P H	2805-753-9839	RETAINER: exhaust valve spring, upper (7539839)	ea	12				2	2	3	30	60	B-4	38
X1 F		COVER ASSEMBLY: valve rocker support (7320420)	ea	12									B-4	39
P2 H	2805-753-9838	ROTOR, ENGINE POPPET: exhaust valve (7539838)	ea	12				*	*	*	2	*	B-4	40
P H	5340-678-3310	INSERT, SCREW THREAD: cylinder head to camshaft gear cover plate (48), valve rocker support cover to camshaft gear housing and camshaft cover plate bolt (24) (8352635)	ea	72				2	2	3	20	30	B-4	42
P H	5340-678-3311	INSERT, SCREW THREAD: cylinder head to valve rocker support cover (8352634)	ea	48				7	16	29	288	288	B-4	46
P H	5340-847-0734	INSERT, SCREW THREAD: valve adjusting cover bolt (96906-21209-F5-15)	ea	48				7	16	29	288	288	B-4	47
		COVER: (included in fig. 4, item No. 39)											B-4	48
P H	5340-679-8116	INSERT, SCREW THREAD: cylinder head to valve rocker support cover (7017550)	ea	156				20	44	84	936	936	B-4	49
P H	5315-241-2916	PIN, STRAIGHT, HEADLESS: valve rocker cover to cylinder head (88044-122718)	ea	24				2	3	6	40	200	B-4	50

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					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0105 — VALVES, CAMSHAFTS AND TIMING SYSTEM — Continued												
P H	4730-278-2065	CLAMP, HOSE: camshaft drive flange hose to accessory cam drive bevel gearshaft support, right and left banks (21450-502919)	ea	4				2	3	6	40	80	B-5	1
P H	5306-182-2026	BOLT, MACHINE: camshaft drive shaft flange, right and left banks (88044-5H7A)	ea	4				3	5	10	80	80	B-5	2
P H	5310-407-9566	WASHER, LOCK: camshaft drive shaft flange, right and left banks (96906-35338-45)	ea	4				3	5	10	80	400	B-5	3
P F	5310-167-0820	WASHER, FLAT: camshaft gear housing cover (12), camshaft drive flange shaft (4), right and left banks (88044-960-516)	ea	16	8	18	33	8	18	33	320	1600	B-5	4
P H	2815-679-8056	GASKET: camshaft drive shaft flange, right and left banks (☆☆parts kit—2815-678-4245) (8761414)	ea	2				2	3	6	50		B-5	5
P2 H	2815-455-9496	ADAPTER, CAMSHAFT DRIVE: bevel gearshaft, right and left bank (8682540)	ea	2				*	*	*	2	*	B-5	6
P F	2815-679-8058	SHAFT, SHOULDERED: camshaft drive, right and left bank (7320430)	ea	2	2	2	2	2	2	2	16	12	B-5	7
P H	5330-579-7918	PACKING, PREFORMED: camshaft drive bevel gearshaft adapter, right and left bank (☆☆ parts kit-2815-678-4245) (96906-28775-229)	ea	2				2	4	7	60		B-5	8
P2 H	2815-489-2576	HOUSING, CAMSHAFT ASSEMBLY: camshaft gear, right bank (7320415)	ea	1				*	*	*	5	*	B-5	9
P H	5340-679-8116	INSERT, SCREW THREAD: camshaft gear housing cover, left and right (7017550)	ea	12				2	4	8	72	72	B-5	10
P H	5305-709-8523	SCREW, CAP, HEXAGON HEAD: camshaft gear housing to cylinder head (6), intercylinder camshaft cover (60), right and left banks (96906-90727-87)	ea	66				6	14	28	660	2000	B-5	11
P H	5310-167-0822	WASHER, FLAT: camshaft gear housing to cylinder head, right and left bank (88044-960-716)	ea	6				3	7	13	120	600	B-5	12

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION (a) FIGURE NO.	(b) ITEM NO.
		0105 — VALVES, CAMSHAFTS AND TIMING SYSTEM — Continued												
P F	2815-679-8054	GASKET: camshaft gear housing cover, right and left banks (☆☆parts kit—2815-678-4245) (8682564)	ea	2	2	3	6	2	3	6	50		B-5	13
P2 F	2815-125-3891	COVER, CAMSHAFT GEAR: right and left banks (8725253)	ea	2	*	*	*	*	*	*	1	*	B-5	14
P F	5306-051-4076	BOLT, MACHINE: camshaft gear housing cover, right and left banks (96906-90727-34)	ea	12	2	5	10	2	5	10	240	240	B-5	15
P H	2815-679-8057	GEAR SET, BEVEL, MATCHED: camshaft drive, right and left banks (5702619)	ea	2				*	2	2	8	12	B-5	
		Composed of:												
X1 H		1-Gearshaft, bevel: (8725229)											B-5	16.1
X1 H		1-Gear, bevel: (8725225)											B-5	16.2
P2 F	2815-760-5871	PLUG, CAMSHAFT DRIVE: bevel shaft gear, right and left bank (8682721)	ea	2	*	*	*	*	*	*	5	*	B-5	17
P F	5340-754-1083	RING, RETAINING: camshaft drive bevel shaft gear, right and left bank (96906-16625-1137)	ea	2	2	3	5	2	3	5	30	58	B-5	18
P H	9525-990-7799	WIRE, NICKEL COPPER: camshaft gear and cover, left and right banks (4 pcs 12 in. lg) (96906-20995NC40)	ft	4				*	*	*	40	400	B-5	19
P H	5306-774-4685	BOLT, MACHINE: camshaft gear and cover, right and left banks (7744685)	ea	16				5	10	18	160	320	B-5	20
P2 H	2815-136-1201	COVER, CAMSHAFT: oil retainer, right and left banks (8682817)	ea	2				*	*	*	2	*	B-5	21
P2 H	2815-110-4093	HOUSING, CAMSHAFT: camshaft gear, left bank (7320414)	ea	1				*	*	*	3	*	B-5	22
M H		HOSE, RUBBER: camshaft drive shaft flange to accessory cam drive bevel gearshaft support, fabricate from 4720-278-1112 (2 pcs 2.25 un. lg) (8761223)	ft										B-5	23
P H	4720-278-1112	HOSE, RUBBER: (33-H-00344082)	ft	1				*	2	2	6	40	B-5	23

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					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0105 — VALVES, CAMSHAFTS AND TIMING SYSTEM — Continued												
P2 H	4730-223-7014	ADAPTER, STRAIGHT, FLANGE TO HOSE: camshaft drive shaft, right and left banks (8682816)	ea	2				*	*	*	2	*	B-5	24
P H	5340-514-2321	INSERT, SCREW THREAD: camshaft drive gear-shaft cover, right and left banks (96906-21208F5-20)	ea	4				*	*	2	16	29	B-5	25
P H	5310-950-0039	NUT, SELF-LOCKING, HEXAGON: camshaft drive bevel gearshaft adapter to housing, right and left bank (96906-21044N6)	ea	8				1	3	6	160	800	B-5	26
P H	5310-333-7348	WASHER, FLAT: camshaft drive bevel gearshaft adapter to camshaft gear housing, right and left bank (8679576)	ea	8				5	10	18	160	800	B-5	27
P H	5330-582-2133	PACKING, PREFORMED: camshaft drive bevel gearshaft adapter oil transfer tube, right and left banks (☆☆ parts kit—2815-678-4245) (96906-28775-011)	ea	2				*	1	2	60		B-5	28
		STUD, PLAIN: camshaft drive bevel gearshaft adapter, right and left banks												
P H	5307-264-2472	0.003 oversize (7744813)	ea	8				2	3	6	48	64	B-5	29
P H	5307-264-2471	0.007 oversize (7744564)	ea	8				2	3	6	48	64	B-5	29
P F	2815-679-8059	GASKET: camshaft end cover plate, left and right banks (2), camshaft gear housing (2) (☆☆parts kit - 2815-678-4245) (8682468)	ea	4	3	6	11	3	6	11	100		B-5	30
X2 H	2805-407-6761	FLANGE, CAMSHAFT, ENGINE: intercylinder sleeve, right and left banks (10865283)	ea	18									B-5	31
P H	2815-708-3018	SLEEVE, INTERCYLINDER: camshaft right and left (10865289)	ea	10				6	13	25	250	1000	B-5	32
X2 H	2815-406-4618	COVER PLATE ASSEMBLY: camshaft end plate, left bank (8682467)	ea	1									B-5	34
P H	5330-291-2830	SEAL, PLAIN, ENCASED: camshaft end cover plate, right bank (21450-500241)	ea	1				2	2	3	20	100	B-5	35

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		0105 — VALVES, CAMSHAFTS AND TIMING SYSTEM — Continued												
P2 H	5340-409-8060	COVER: left camshaft (7403615)	ea	1				*	*	*	3	*	B-5	36
P H	2815-679-8053	CAMSHAFT, ENGINE: left bank (8761280)	ea	1				*	2	2	8	10	B-5	41
P H	2815-679-8055	CAMSHAFT, ENGINE: right bank (8761281)	ea	1				*	2	2	8	10	B-5	42
P2 H	2815-177-7918	PLATE, CAMSHAFT ENGINE: camshaft end cover, right bank (8682751)	ea	1				*	*	*	1	*	B-5	43
P H	2590-851-4909	PLATE, THROTTLE CROSS SHAFT: camshaft end cover bearing, right bank (8682683)	ea	1				*	2	2	6	10	B-5	49
P H	3120-679-8098	BEARING, SLEEVE: camshaft end cover bearing plate right bank (8682745)	ea	1				*	2	2	10	20	B-5	50
P H	5305-709-8515	SCREW, CAP HEXAGON HEAD: camshaft end cover plates and fuel filter brackets to cylinder (96906-90727-88)	ea	6				3	7	13	120	180	B-19	3
P H	5310-209-0965	WASHER, LOCK: camshaft end cover plates and fuel filter brackets to cylinder (96906-35338-47)	ea	6				3	7	13	120	600	B-19	4
P H	5310-950-0039	NUT, SELF-LOCKING, HEXAGON: accessory cam drive bevel gearshaft support (96906-21044N6)	ea	6				4	8	14	120	600	B-26	1
P H	5310-333-7348	WASHER, FLAT: accessory cam drive bevel gearshaft support (8679576)	ea	6				4	8	14	120	600	B-26	2
P2 H	2990-068-6115	SUPPORT, ACCESSORY CAM DRIVE BEVEL SHAFTGEAR: (10865361)	ea	2				*	*	*	4	*	B-26	3
P H	5330-576-9732	PACKING, PREFORMED: accessory cam bevel gearshaft (☆☆parts kit - 2815-678-4245) (96906-28775-226)	ea	2				1	2	3	60		B-26	4
P H	2815-767-3200	GEARSHAFT ASSEMBLY: bevel, accessory cam drive (10865393)	ea	2				2	2	2	16	20	B-26	93
X1 H		PLUG: accessory cam drive bevel gearshaft (8682539)	ea	2									B-26	98

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					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0105 — VALVES, CAMSHAFTS AND TIMING SYSTEM — Continued												
X1 H		GEARSHAFT, BEVEL: accessory cam drive (10865383)	ea	2									B-26	99
		0106 — ENGINE LUBRICATION SYSTEM												
X1 H		TUBE: crankcase to fan drive housing base (8682469)	ea	1									B-2	20
P O	4730-278-3912	BUSHING, PIPE: engine oil pressure transmitter (1), engine low oil pressure warning switch (crankcase right bank) (1) (21450-125837)	ea	2	2	2	2	2	2	2	16	100	B-2	35
P O	4730-254-1801	ELBOW, PIPE: oil pressure sending unit (96906-39231-3)	ea	1	*	*	1	*	*	1	12	100	B-2	40
P H	5340-490-0872	PLUG, EXPANSION: crankcase oil hole (8725236)	ea	5				2	4	6	40	60	B-2	49
P H	5340-177-4213	PLUG, EXPANSION: piston cooling oil gallery (21450-501522)	ea	1				*	2	2	8	12	B-2	51
X1 H		TUBE: oil transfer to accessory drive housing base (8682513)	ea	3									B-2	58
X1 H		TUBE: oil transfer to injection pump base (8682512)	ea	1									B-2	62
P H	5340-291-3495	INSERT, SCREW THREAD: oil pan pressure relief tube (4), scavenge oil pickup tube support (2), scavenge oil pickup tube (4) (96906-124697)	ea	10				2	4	7	60	60	B-2	65
P H	5340-990-7159	INSERT, SCREW THREAD: oil pan (4), oil pump bolt (6) (96906-21208-F6-20)	ea	10				2	4	7	60	60	B-2	72
P H	5340-291-3492	INSERT, SCREW THREAD: oil pan (96906-21208F6-15)	ea	4				2	2	3	24	74	B-2	73
P H	5310-950-0039	NUT, SELF-LOCKING, HEXAGON: crankcase to oil pan (96906-21044-N6)	ea	56				4	10	20	500	5600	B-2	81
P H	5310-333-7348	WASHER, FLAT: crankcase to oil pan (8679576)	ea	56				4	10	20	500	5600	B-2	84
P H	5340-291-3488	INSERT, SCREW THREAD: cylinder head to cylinder head oil drain tube (96906-21208F8-15)	ea	12				1	2	3	72	72	B-4	44

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		0106—ENGINE LUBRICATION SYSTEM — Continued												
X2 F	5365-402-8380	PLUG, MACHINE THREAD: oil filter bypass valve (1), oil cooler bypass valve (1) (8725218)	ea	2									B-6	1
P F	5330-269-2844	GASKET: oil filter bypass valve (1), oil cooler bypass valve (1) (☆☆parts kit—2815-678-4245) (96906-35769-47)	ea	2	*	1	2	*	1	2	50		B-6	2
P F	2940-678-3276	SPRING, HELICAL, COMPRESSION: oil filter bypass valve (1), oil cooler bypass valve (1) (8682815)	ea	2	2	2	3	2	2	3	24	40	B-6	3
P F	2815-678-3218	PLUNGER RELIEF VALVE: oil filter bypass valve (1), oil cooler bypass valve (1) (8725222)	ea	2	2	2	3	2	2	3	16	24	B-6	4
P H	4730-776-7336	PLUG, PIPE: oil filter housing oil port (7767336)	ea	2				2	2	3	20	20	B-6	6
P H	4730-044-4715	PLUG, PIPE: oil filter housing oil port (21450-444715)	ea	1				2	2	2	12	20	B-6	7
		STUD, PLAIN: main oil filter cover (6), main drain cover (3), auxiliary drain cover (3), oil pressure regulator cover (2)												
P F	5307-734-8668	0.003 oversize (7348668)	ea	14	2	4	8	2	4	8	84	112	B-6	9
P F	5307-638-7608	0.007 oversize (14351-401975P007)	ea	14	2	4	8	2	4	8	84	112	B-6	9
P F	4730-044-4689	PLUG, PIPE: pressure regulator sending line (7538990)	ea	1	2	2	2	2	2	2	12	20	B-6	10
P F	2815-678-3219	SLEEVE, REGULATOR VALVE: oil pressure regulator (8725266)	ea	1	*	2	2	*	2	2	8	12	B-6	11
P F	2815-678-3223	PLUNGER, REGULATOR VALVE: oil pressure regulator (8725276)	ea	1	*	2	2	*	2	2	8	12	B-6	12
P F	2815-678-3222	SPRING, HELICAL, COMPRESSION: pressure regulator valve (8725240)	ea	1	2	2	2	2	2	2	12	20	B-6	13
X2 F	4820-406-4619	STOP, RELIEF VALVE: pressure relief valve, oil pressure regulator (8725224)	ea	1									B-6	14
P F	5310-737-2030	WASHER, FLAT: oil pressure control valve spring (7372030)	ea	1	2	2	3	2	2	3	20	100	B-6	15

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		0106 — ENGINE LUBRICATION SYSTEM — Continued												
P F	2815-678-3221	GASKET: oil pressure regulator valve (☆☆parts kit—2815-678-4245) (8725239)	ea	1	2	2	3	2	2	3	24		B-6	16
X2 F		COVER, ACCESS: oil pressure regulator valve (8725211)	ea	1									B-6	17
P F	5310-167-0820	WASHER, FLAT: oil pressure regulator valve cover (88044-960-516)	ea	2	*	1	2	*	1	2	40	200	B-6	18
P F	5310-982-4912	NUT, SELF-LOCKING, HEXAGON: oil pressure regulator valve (96906-21045-5)	ea	2	*	1	2	*	1	2	40	200	B-6	19
P O	5340-834-3854	HANDLE, BAIL: oil filter cover (8343854)	ea	1	*	2	2	*	2	2	6	8	B-6	20
P2 O	2940-067-7900	COVER, OIL FILTER: auxiliary oil filter (8725257)	ea	1	*	*	*	*	*	*	5	*	B-6	21
P O	5320-264-4293	RIVET, SOLID: auxiliary oil filter support (96906-20426A4-20)	ea	1	*	*	*	*	*	*	6	10	B-6	22
P O	2940-884-4801	PARTS KIT, OIL FILTER: auxiliary (5702659)	ea	1	6	12	22	6	12	22	220	100	B-6	
		Composed of:												
P O	2940-863-7737	1-ELEMENT (8748329)											B-6	23.1
P O	5315-816-1794	1-PIN, COTTER (96906-24665-285)											B-6	23.2
P O	2940-678-3277	1-GASKET (8725201)											B-6	23.3
P O	5315-252-5987	1-PIN, COTTER (96906-24665-138) not used on this engine												
X1 O		1-GASKET (7748870) not used on this engine												
X1 O		1-GASKET (7748905) not used on this engine												
P O	2940-678-3277	GASKET: auxiliary oil filter cover (☆☆ parts kit-2815-678-4245) (8725201)	ea	1	2	2	3	2	2	3	25		B-6	23
X1 O		BUSHING, SLEEVE: oil filter element spring (8725207)	ea	1									B-6	24
P2 O	5340-220-5168	SPRING, HELICAL COMPRESSION: oil filter element (8725196)	ea	1	*	*	*	*	*	*	4	*	B-6	25
X1 O		RETAINER: oil filter element (8725197)	ea	1									B-6	26

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION (a) FIGURE NO.	(b) ITEM NO.
		0106 — ENGINE LUBRICATION SYSTEM — Continued												
P2 O	2940-115-9014	SUPPORT, OIL FILTER: auxiliary oil filter (8725193)	ea	1	*	*	*	*	*	*	3	*	B-6	27
P2 O	2940-436-3223	FILTER, FLUID, PRESSURE: element, auxiliary oil filter (8761542)	ea	1	*	*	*	*	*	*	2	*	B-6	28
P O	5305-678-3327	SET SCREW: main oil filter drain stop (1) and auxiliary oil filter drain stop (1) (8725291)	ea	2	2	2	3	2	2	3	24	30	B-6	32
P O	5330-290-8154	PACKING, W / RETAINER: oil filter stop screw (1), auxiliary oil filter stop screw (1) (☆☆parts kit-2815-678-4245) (7045881)	ea	2	2	3	6	2	3	6	50		B-6	33
P2 H	2815-235-4445	HOUSING, CRANKSHAFT DAMPER AND OIL FILTER ASSEMBLY: (8682662)	ea	1				*	*	*	5	*	B-6	34
P F	4730-753-8997	PLUG, PIPE: oil filter housing oil port (7538997)	ea	4	2	3	6	2	3	6	48	80	B-6	35
P O	4730-196-0888	BUSHING, PIPE: oil temperature transmitter (1), high oil temperature switch (1) WWP471-TYPE 2, STYLE C - CLASS 1 (81348)	ea	2	2	2	3	2	2	3	20	100	B-6	37
P H	5330-579-8156	PACKING, PREFORMED: "O" ring, crankcase oil transfer tube (☆☆parts kit-2815-678-4245) (96906-28775-212)	ea	5				2	3	6	50		B-6	39
P O	5330-269-2845	GASKET: engine oil cooler line adapter to crankshaft damper and oil filter housing (☆☆parts kit-2815-678-4245) (96906-35769-34)	ea	4	1	2	4	1	2	4	100		B-6	40
P O	4730-678-3303	ADAPTER, STRAIGHT TUBE: oil cooler line to crankshaft damper and oil filter housing (7324900)	ea	4	*	2	2	*	2	2	10	10	B-6	41
P H	5310-333-7348	WASHER, FLAT: crankshaft damper and oil filter housing to oil pan (12), crankshaft and oil filter housing to crankcase (9) (8679576)	ea	21				10	22	41	420	2100	B-6	42
P H	5310-950-0039	NUT, SELF-LOCKING: crankshaft and oil filter housing to crankcase (14), fuel pump adapter to damper housing (6) (96906-21044N6)	ea	20				3	8	16	400	2000	B-6	43

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					(a) 1-29	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0106—ENGINE LUBRICATION SYSTEM — Continued												
P H	5306-678-3324	BOLT, MACHINE: crankshaft damper and oil filter housing to oil pan (7039746)	ea	12				6	12	23	240	240	B-6	44
P H	9525-990-7799	WIRE, NICKEL COPPER: crankshaft damper and oil filter housing to oil pan (4 pcs 18 in. lg) (96906-20995NC40)	ft	6				1	2	3	60	600	B-6	45
P H	2520-678-3171	GASKET: fuel pump adapter (☆☆parts kit-2815-678-4245) (8725277)	ea	1				2	2	3	25		B-6	47
P2 H	2815-617-8626	ADAPTER ASSEMBLY, FUEL PUMP: (10882611)	ea	1				*	*	*	4	*	B-6	48
P H	5310-333-7348	WASHER, FLAT: fuel pump adapter to damper housing (8679576)	ea	4				2	4	8	80	400	B-6	49
		STUD, PLAIN: fuel pump adapter to fuel pump												
P F	5307-734-8668	0.003 oversize (7348668)	ea	4	2	2	3	2	2	3	24	32	B-6	50
P F	5307-638-7608	0.007 oversize (14351-401975P007)	ea	4	2	2	3	2	2	3	24	32	B-6	50
P H	5310-535-6688	WASHER, FLAT: fuel pump adapter to damper housing (8745480)	ea	2				2	3	5	40	200	B-6	51
P O	2940-937-1450	BRACKET, DAMPER HOUSING: fuel pump check valve (10882766)	ea	1	*	2	2	*	2	2	6	8	B-6	52
P O	2940-678-3278	GASKET: oil filter (main) cover (☆☆parts kit-2815-678-4245) (8725203)	ea	1	2	2	3	2	2	3	25		B-6	53
P O	5310-167-0820	WASHER, FLAT: main oil filter assembly (6), auxiliary oil filter to damper housing (8) (88044-960-516)	ea	14	2	6	12	2	6	12	280	1400	B-6	54
P O	5310-982-4912	NUT, SELF-LOCKING, HEXAGON: main oil filter assembly (6), auxiliary oil filter assembly to damper housing (8) (96906-21045-5)	ea	14	2	4	8	2	4	8	210	1400	B-6	55
P2 O	2815-884-1981	FILTER ASSEMBLY, OIL: fluid pressure, oil main (7025886)	ea	1	*	*	*	*	*	*	5	*	B-6	56
X1 O		TUBE, OIL FILTER: main (00736-03T498-218)	ea	1									B-6	57

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION (a) FIGURE NO.	(b) ITEM NO.
		0106 — ENGINE LUBRICATION SYSTEM — Continued												
P O	2940-939-7123	FILTER ELEMENT, FLUID PRESSURE: main oil filter (7087519)	ea	42	10	22	42	10	22	42	420	420	B-6	58
P O	5340-737-4145	SPACER, RING: main oil filter element (7374145)	ea	42	10	22	42	10	22	42	420	420	B-6	59
X1 O		NUT: main oil filter (00736-03T177C164)	ea	1									B-6	60
P2 O	2940-121-6177	BODY, OIL FILTER: main oil filter (00736-03T786-140)	ea	1	*	*	*	*	*	*	2	*	B-6	61
P O	5330-543-3261	GASKET: main oil filter bolt (96906-35769-6)	ea	1	4	9	18	4	9	18	420	100	B-6	62
P O	5340-834-3854	HANDLE, BAIL: main oil filter (8343854)	ea	1	*	2	2	*	2	2	6	10	B-6	63
P O	9525-990-7799	WIRE, NICKEL COPPER: main oil filter bolt to body (1 pc 6 in. lg) (96906-20995NC40)	ft	1	*	*	*	*	*	*	10	100	B-6	64
P O	5306-678-3323	BOLT, MACHINE: main oil filter (7039747)	ea	1	*	2	2	*	2	2	10	10	B-6	65
P O	5340-799-4794	SPRING, HELICAL, TORSION: main oil filter bail (7994794)	ea	1	*	2	2	*	2	2	6	10	B-6	66
		STUD, PLAIN: fuel pump adapter												
P H	5307-774-4572	0.003 oversize (7744572)	ea	8				2	3	6	48	64	B-6	67
P H	5307-774-4573	0.007 oversize (7744573)	ea	8				2	3	6	48	64	B-6	67
P F	5330-199-5886	GASKET: auxiliary oil filter bypass valve (1), crankshaft damper and oil filter housing core hole plug (1) (☆☆parts kit-2815-678-4245) (96906-35769-35)	ea	2	*	1	2	*	1	2	50		B-6	68
X2 F	5365-408-1270	PLUG, MACHINE THREAD: oil filter bypass valve (1), crankshaft damper and oil filter housing core hole (1) (8725246)	ea	2									B-6	69
P O	5310-982-4912	NUT, SELF-LOCKING, HEXAGON: main oil filter drain cover (3), auxiliary oil filter drain cover (3) (96906-21045-5)	ea	6	3	7	13	3	7	13	120	600	B-6	70
P O	5310-167-0820	WASHER, FLAT: main oil filter drain cover (3), auxiliary oil filter drain cover (3) (88044-960-516)	ea	6	3	7	13	3	7	13	120	600	B-6	71

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE			(7) 30-DAY GS MAINT. ALLOWANCE			(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION	
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0106 — ENGINE LUBRICATION SYSTEM — Continued												
X2 O		COVER, ACCESS: main oil filter drain (1), auxiliary oil filter drain (1) (8725195)	ea	2									B-6	72
P O	2940-678-3279	GASKET: main oil filter drain cover (1), auxiliary oil filter drain cover (1) (☆☆ parts kit-2815-678-4245) (8725286)	ea	2	2	3	6	2	3	6	50		B-6	73
P H	4730-278-3030	PLUG, PIPE: crankshaft damper housing clean out hole (7403610)	ea	1				2	2	2	12	20	B-6	74
P F	2940-678-3280	SPRING, HELICAL, COMPRESSION: auxiliary oil filter bypass (8725250)	ea	1	2	2	3	2	2	3	12	20	B-6	75
P F	2815-678-3220	PLUNGER, RELIEF VALVE: auxiliary oil filter bypass (8725255)	ea	1	*	2	2	*	2	2	8	12	B-6	76
		STUD, PLAIN: auxiliary oil filter cover												
P F	5307-774-4803	0.003 oversize (7744803)	ea	8	2	3	6	2	3	6	48	64	B-6	77
P F	5307-774-4555	0.007 oversize (7744555)	ea	8	2	3	6	2	3	6	48	64	B-6	77
		STUD, PLAIN: crankcase breather tube												
P F	5307-776-7804	0.003 oversize (7767804)	ea	2	2	2	2	2	2	2	12	16	B-6	78
P F	5307-776-7805	0.007 oversize (7767805)	ea	2	2	2	2	2	2	2	12	16	B-6	78
P O	5310-656-0111	WASHER, FLAT: plate identification to cap assembly (96906-15795-703)	ea	4	*	1	1	*	1	1	24	40	B-7	1
P O	5305-253-5618	SCREW, DRIVE: plate identification to cap assembly (96906-21318-27)	ea	4	*	1	1	*	1	1	24	40	B-7	2
P2 O	9905-407-5099	PLATE, IDENTIFICATION: oil filler tube cap assembly (10882826)	ea	1	*	*	*	*	*	*	5	*	B-7	3
P O	5305-206-3851	SCREW, EXTERNALLY RELIEVED: oil filler cap assembly to oil filler tube (2), oil level indicator cap assembly to oil indicator tube (2) (8717161)	ea	4	2	2	3	2	2	3	24	40	B-7	4
P O	5340-205-4658	SPRING, HELICAL, EXTENSION: oil filler and oil level indicator tube caps (early) (8717162)	ea	2	2	2	3	2	2	3	22	20	B-7	5
X1 O		TUBE ASSEMBLY: oil filler engine (early) (8761124)	ea	1									B-7	6

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		0106 — ENGINE LUBRICATION SYSTEM — Continued												
P O	2815-679-4962	GAGE ROD, LIQUID LEVEL: oil indicator (8761130)	ea	1	2	2	2	2	2	2	12	10	B-7	7
P2 O	5340-242-5599	STRAP, RETAINING: oil filler and oil indicator tubes (early) (8682771)	ea	2	*	*	*	*	*	*	4	*	B-7	8
P O	5306-051-4075	BOLT, MACHINE: oil level indicator tube to upper engine cover (2), oil filler tube to upper engine cover frame (2) (early and intermediate) (96906-90727-33)	ea	4	2	4	8	2	4	8	80	80	B-7	9
P O	5306-051-4076	BOLT, MACHINE: oil filler tube to oil pan (96906-90727-34)	ea	3	2	4	7	2	4	7	60	150	B-7	12
P O	5330-290-8154	PACKING W/RETAINER: oil filler tube to oil pan (☆☆parts kit—2815-678-4245) (7045881)	ea	3	2	4	8	2	4	8	75		B-7	13
P O	2815-679-4961	GASKET: oil filler tube mounting (1), oil level indicator tube mounting (1) (☆☆parts kit - 2815-678-4245) (8682523)	ea	2	2	3	6	2	3	6	50		B-7	19
P H	2805-678-4243	GASKET: pressure oil pump elbow adapter (☆☆ parts kit - 2815-678-4245) (7320442)	ea	1				2	2	3	25		B-7	20
		STUD, PLAIN: elbow adapter to oil pan												
P H	5307-678-3534	0.003 oversize (7084438)	ea	2				2	2	2	12	16	B-7	21
P H	5307-678-3533	0.007 oversize (7084439)	ea	2				2	2	2	12	16	B-7	21
X2 H	2815-406-4613	ADAPTER, OIL PUMP: oil pan to pressure oil pump inlet elbow (8682441)	ea	1									B-7	22
P H	5330-641-3407	PACKING, PREFORMED: pressure oil pump adapter (☆☆ parts kit - 2815-678-4245) (96906-28775-224)	ea	2				2	4	7	60		B-7	23
		STUD, PLAIN: elbow adapter to oil pan												
P H	5307-776-7348	0.003 oversize (7767348)	ea	2				2	2	2	12	16	B-7	24
P H	5307-776-7361	0.007 oversize (7767361)	ea	2				2	2	2	12	16	B-7	24
X2 O	2815-406-4616	TUBE, OIL GAGE ROD: (intermediate and late) (10935613)	ea	1									B-7	35

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					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0106—ENGINE LUBRICATION SYSTEM — Continued												
P O	5325-174-9038	GROMMET, RUBBER: drain hose to filler plate (intermediate) (☆☆parts kit - 2815-678-4245) (96906-35489-20)	ea	1	2	3	6	2	3	6			B-7	36
M O		TUBING: rubber oil splash drain (intermediate) (fabricate from 4720-477-3712) (1 pc. 37.50 in. lg) (10935214-1)	ft										B-7	37
P O	4720-477-3712	TUBING, RUBBER: (10935214-3)	ft	4	*	8	8	*	8	8	40	400	B-7	37
P O	5330-579-8157	PACKING, PREFORMED: oil filler and indicator tubes to cap assembly (☆☆parts kit - 2815-678-4245) (96906-28775-327)	ea	4	3	6	11	3	6	11	100		B-7	38
P O	5330-410-9803	GASKET: oil filler and oil gage rod cap to cover (☆☆parts kit—2815-678-4245) (10935621)	ea	2	2	3	6	2	3	6	50		B-7	39
X1 O		PLATE: oil splash, oil filler tube (10951123)	ea	1									B-7	40
P2 O	2815-406-4621	CAP ASSEMBLY, OIL GAUGE: (10935623)	ea	1	*	*	*	*	*	*	5	*	B-7	41
P2 O	2990-897-2849	CAP ASSEMBLY, OIL FILLER W/PACKING: oil filler tube (1), oil gage tube (1) (8761109)	ea	2	*	*	*	*	*	*	5	*	B-7	42
P O	2805-599-0942	PACKING, PREFORMED: oil filler tube cap and oil gage tube cap (☆☆ parts kit - 2815-678-4245) (8717158)	ea	2	2	2	3	2	2	3	20		B-7	43
X1 O		CAP: (8717157)	ea	2									B-7	44
X1 O		CAP ASSEMBLY, OIL TUBE: oil filler tube (10935622)	ea	1									B-7	45
P O	5360-410-5836	SPRING, HELICAL, EXTENSION: oil gage tube (1), oil filler tube (1) (10935614)	ea	2	2	2	2	2	2	2	12	20	B-7	46
X1 O		NECK: oil filler tube (1), oil gage rod tube (1) (10935619)	ea	2									B-7	47
P O	5310-407-9566	WASHER, LOCK: oil filler and gage rod cap assemblies to cover (96906-35338-45)	ea	4	1	2	4	1	2	4	80	400	B-7	48

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					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0106 — ENGINE LUBRICATION SYSTEM — Continued												
P O	5306-225-9086	BOLT, MACHINE: oil filler and gage rod cap assemblies to cover (96906-90726-31)	ea	4	2	4	8	2	4	8	80	80	B-7	49
P2 O	5340-242-5600	STRAP, RETAINING: oil filler or oil indicator tubes (intermediate) (10912444)	ea	1	*	*	*	*	*	*	4	*	B-7	50
P O	4730-908-3194	CLAMP, HOSE: oil drain hose to upper cover (96906-35842-11)	ea	1	*	2	2	*	2	2	10	20	B-7	51
X1 O		TUBE: oil filler tube (10935615)	ea	1									B-7	52
P O	5305-993-1848	SCREW, MACHINE: drain hose clamp to indicator tube (96906-35207-265)	ea	1	*	*	1	*	*	1	20	30	B-7	53
P O	5340-193-0104	CLAMP, LOOP: drain hose to indicator tube (88044-735-12)	ea	2	*	2	2	*	2	2	10	20	B-7	54
P O	5310-877-5797	NUT, SELF-LOCKING, HEXAGON: drain hose clamp to indicator tube (96906-21044N3)	ea	1	*	*	1	*	*	1	20	100	B-7	55
P O	4730-909-8627	CLAMP, HOSE: oil filler upper tube to lower tube (96906-35842-13)	ea	2	*	*	1	*	*	1	20	40	B-7	56
P O	5306-050-1238	BOLT, MACHINE: upper oil filler tube clamp to turbosupercharger base (96906-90727-32)	ea	1	*	*	*	*	*	*	10	20	B-7	57
P O	5310-407-9566	WASHER, LOCK: bracket to upper oil filler tube clamp (96906-35338-45)	ea	1	*	*	1	*	*	1	20	100	B-7	58
P O	5310-088-0553	NUT, SELF-LOCKING, HEXAGON: bracket to upper oil filler tube clamp (96906-21044N5)	ea	1	*	*	1	*	*	1	15	100	B-7	59
P2 O	2815-406-4615	FILLER NECK: (11641922)	ea	1	*	*	*	*	*	*	4	*	B-7	60
P O	5306-050-1238	BOLT, MACHINE: bracket to upper oil filler tube clamp (96906-90727-32)	ea	2	*	1	2	*	1	2	40	60	B-7	61
P2 O	5340-409-8055	BRACKET: upper filler tube clamp to turbosupercharger (11641928)	ea	1	*	*	*	*	*	*	4	*	B-7	62
X1 O		TUBE ASSEMBLY: oil filler upper (11641923)	ea	1									B-7	63

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					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0106 — ENGINE LUBRICATION SYSTEM — Continued												
M O		HOSE, RUBBER: oil filler upper tube to lower tube (fabricate from 4720-278-1110- (1 pc. 3.50- in. lg) (8357967-4)	ft	1									B-7	64
P O	4720-278-1110	HOSE, RUBBER: (81349-MIL-H-6000)	ft	1	*	2	2	*	2	2	10	100	B-7	64
X2 O	4710-192-9436	TUBE ASSEMBLY, METAL: oil filler (lower) (11641927)	ea	1									B-7	65
P H	5310-685-8218	WASHER, FLAT: pressure oil pump adapter to oil pan (7340061)	ea	4				2	4	8	80	400	B-7	66
P H	5310-849-6883	NUT SLOTTED, HEXAGON: pressure oil pump elbow adapter to oil pan (96906-35692-13)	ea	4				1	2	3	80	400	B-7	67
P H	9525-990-7799	WIRE, NICKEL COPPER: pressure oil pump elbow adapter to oil pan (2 pc 12 in. lg) (96906-20995NC40)	ft	2				*	*	*	20	200	B-7	68
P2 H	2815-457-9309	OIL PAN, ENGINE CRANKCASE: complete assembly (10912162)	ea	1				*	*	*	5	*	B-7	69
P H	2590-629-1268	THREAD: silk, oil pan to crankcase (730 yds per spool) (8679577)	sp	1				*	*	*	1	1	B-7	70
P O	5310-088-0553	NUT, SELF-LOCKING, HEXAGON: oil level indicator tube to oil pan (96906-21044N5)	ea	3	1	2	3	1	2	3	60	300	B-7	74
P2 O	2815-406-4617	FILLER NECK: oil gage rod (early) (8761128)	ea	1	*	*	*	*	*	*	3	*	B-7	75
X1 O		TUBE, OIL LEVEL INDICATOR: (early) (8761129)	ea	1									B-7	76
P2 O	9905-407-5100	PLATE, IDENTIFICATION: oil gage rod tube cap assembly (10882827)	ea	1	*	*	*	*	*	*	5	*	B-7	77
X1 O		TUBE, OIL FILLER: (early) (8761127)	ea	1									B-7	78
P2 H	2815-833-8162	BAFFLE, OIL PAN, LEFT: oil pan compartment (8682527)	ea	1				*	*	*	2	*	B-8	1

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		0106—ENGINE LUBRICATION SYSTEM — Continued												
P2 H	2815-834-1158	BAFFLE, OIL PAN, RIGHT: oil pan compartment (8682524)	ea	1				*	*	*	2	*	B-8	2
X1 H		COVER, OIL PICKUP: pressure oil pickup (7320444)	ea	1									B-8	3
P H	5310-982-4912	NUT, SELF-LOCKING, HEXAGON: oil level indicator replacement cover (3), breather oil separator drain replacement cover (2) (96906-21045-5)	ea	5				1	2	4	100	500	B-8	4
X1 H		COVER, OIL DRAIN: breather, oil separator drain replacement (8761125)	ea	1									B-8	5
P H	5330-678-3508	GASKET: breather, oil separator drain replacement cover (☆☆parts kit - 2815-678-4245) (8682764)	ea	1				2	2	3	25		B-8	6
P H	2815-679-4961	GASKET: oil level indicator replacement cover (☆☆parts kit - 2815-678-4245) (8682523)	ea	1				2	2	3	25		B-8	7
X1 H		COVER, LEVEL INDICATOR: oil level indicator replacement cover (8761132)	ea	1									B-8	8
P H	5305-682-5881	SCREW, CAP, HEXAGON HEAD: oil pan baffle to oil pan (96906-51093-4)	ea	25				4	10	20	500	750	B-8	9
P H	9525-990-7799	WIRE, NICKEL COPPER: oil pan baffles (2 pcs. 84 in. lg) (oil pan to crankcase (2 pcs 12 in. lg) (96906-20995NC40)	ft	16				1	4	7	160	1600	B-8	10
P H	4730-776-7337	PLUG, PIPE: oil pan drain (2), oil pan heater temperature sensing hole (1) (7767337)	ea	3				2	3	5	36	50	B-8	11
X1 H		OIL PAN, ENGINE CRANKCASE: (10912261)	ea	1									B-8	13
		STUD, PLAIN: oil pan to crankcase												
P H	5307-866-6736	0.003 oversize (8666736)	ea	56				8	17	31	312	448	B-8	14
P H	5307-866-6737	0.007 oversize (8666737)	ea	56				8	17	31	312	448		
P H	4730-044-4715	PLUG, PIPE: oil pan heater outlet (1), oil pan core support (1) (21450-444715)	ea	2				*	1	1	24	40	B-8	15

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE			(7) 30-DAY GS MAINT. ALLOWANCE			(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION	
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0106 — ENGINE LUBRICATION SYSTEM — Continued												
		STUD, PLAIN: oil level indicator tube (3), oil level indicator replacement cover (3), breather separator drain cover (2)												
P H	5307-741-0395	0.003 oversize (7410395)	ea	8				2	3	6	48	64	B-8	17
P H	5307-734-8596	0.007 oversize (7348596)	ea	8				2	3	6	48	64	B-8	17
P H	5340-291-3492	INSERT, SCREW THREAD: oil pan to crankshaft damper and oil filter housing bolt (96906-212 08F615)	ea	12				1	2	3	72	74	B-8	18
P H	5340-291-3495	INSERT, SCREW THREAD: cylinder head oil drain flange (8), oil filler tube (3), pressure oil pickup screen cover (6), pressure oil pickup funnel and screens (2) (96906-124697)	ea	19				1	3	5	114	114	B-8	19
P2 H	3120-735-0201	BUSHING, OIL PAN DRAIN PLUG: (7350201)	ea	2				*	*	*	5	*	B-8	20
P O	4730-699-7899	PLUG, MACHINE THREAD: oil drain, pressure and reserve compartments (7954708)	ea	2	2	2	3	2	2	3	24	40	B-8	21
P O	9525-990-7799	WIRE, NICKEL COPPER: oil pan drain plug (1 pc 12 in. lg) (96906-20995NC40)	ft	1	2	4	8	2	4	8	200	100	B-8	22
P O	5330-199-5884	GASKET: oil drain plug, pressure and reserve compartments (☆☆ parts kit - 2815-678-4245) (96906-35769-31)	ea	2	5	11	20	5	11	20	200		B-8	23
P2 H	5315-282-1510	PIN, STRAIGHT, HEADLESS: oil pan drain plug bushing (7338669)	ea	4				*	*	*	5	*	B-8	24
X1 H		OIL PAN: (10912262)	ea	1									B-8	25
X1 H		FUNNEL, OIL PICKUP: pressure oil pickup (7320465)	ea	1									B-8	26
P H	2805-678-4244	GASKET: pressure oil pickup screen (☆☆ parts kit 2815-678-4245) (7320462)	ea	1				2	2	3	25		B-8	27
P H		BOLT, MACHINE: pressure oil pickup screen to oil pan (7323983)	ea	6				2	4	7	60	60	B-8	28

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		0106 — ENGINE LUBRICATION SYSTEM — Continued												
P H	5310-407-9566	WASHER, LOCK: pressure oil pickup screen to oil pan (96906-35338-45)	ea	6				1	3	5	120	600	B-8	29
X1 H		SCREEN, OIL PICKUP: pressure oil pickup (7320466)	ea	1									B-8	30
P H	5306-182-2025	BOLT, MACHINE: funnel assembly and cover to oil pan (88044-5H6A)	ea	2				*	*	1	12	40	B-8	31
P H	5310-209-2629	WASHER, KEY: funnel assembly and cover to oil pan (7767350)	ea	2				2	2	3	20	200	B-8	32
P H	5310-333-7348	WASHER, FLAT:: oil pan to crankcase (8679576)	ea	8				5	11	20	160	800	B-8	33
P H	5306-678-3531	BOLT, MACHINE: oil pan to crankcase (7340060)	ea	8				3	5	10	80	160	B-8	34
P H	5306-182-2023	BOLT, MACHINE: oil pump spill tube to crankcase (1), oil pickup tube support to crankcase (2), oil pickup tube to support (1), oil pickup tube to crankcase (2), oil pan pressure relief tube to crankcase (2) (7346699)	ea	8				3	5	10	80	160	B-9	1
P H	9525-990-7799	WIRE, NICKEL COPPER: oil pump spill tube to pump (2 pcs 12 in. lg), scavenge oil pickup tube to pump (2 pcs 12 in. lg), oil pump pressure relief tube to crankcase (2 pcs 12 in. lg), scavenge oil pickup tube to crankcase (2 pcs 6 in. lg), scavenge oil pickup tube to support (1 pc 6 in. lg), oil pickup tube support to crankcase (2 pcs 6 in. lg), oil spill tube to crankcase (1 pc 6 in. lg), oil pump assembly to crankcase (2 pcs 12 in. lg) (96906-20995NC40)	ft	11				*	*	*	110	1100	B-9	2
P2 H	2815-071-8125	TUBE ASSEMBLY, SCAVENGE: oil pickup (8761037)	ea	1				*	*	*	3	*	B-9	3
P2 H	2815-834-1159	TUBE ASSEMBLY, OIL PUMP: spill (8761162)	ea	1				*	*	*	5	*	B-9	4
P H	5306-182-2024	BOLT, MACHINE: scavenge oil pickup tube to pump (2), oil pump spill tube to pump (2) (88044-5H5A)	ea	4				1	2	3	80	80	B-9	5
P H	5330-411-2512	GASKET: oil pump spill tube (☆☆parts kit - 2815-678-4245)(7320441)	ea	1				*	*	*			B-9	6

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		0106 — ENGINE LUBRICATION SYSTEM — Continued												
X1 H		GASKET: scavenge oil pickup tube (☆☆parts kit - 2815-678-4245) (7320461)	ea	1									B-9	7
P H	5330-542-1329	PACKING, PREFORMED: pressure oil pump housing oil transfer tube to crankcase oil hole (☆☆parts kit - 2815-678-4245) (96906-28775-120)	ea	2				*	1	2	50		B-9	8
P H	5330-579-3156	PACKING, PREFORMED: pressure oil pump housing transfer tube to crankcase cooling oil hole (☆☆parts kit- 2815-678-4245) (96906-28775-116)	ea	1				*	1	1	25		B-9	9
P H	5310-333-7348	WASHER, FLAT: oil pump assembly to crankcase (8679576)	ea	6				4	8	14	120	600	B-9	10
P H	5305-811-0638	SCREW, CAP, HEXAGON HEAD: oil pump to crankcase (96906-51096-64)	ea	6				1	3	5	120	180	B-9	11
P H	2815-895-6430	PUMP, OIL, ENGINE LUBRICATING: (10898891)	ea	1				*	2	2	10	10	B-9	12
		STUD, PLAIN: pressure oil pump elbow (2) housing cover (5)												
P H	5307-272-6334	0.003 oversize (8691451)	ea	7				2	4	6	42	56	B-9	13
P H	5307-272-6335	0.007 oversize (8691452)	ea	7				2	4	6	42	56	B-9	13
		STUD, PLAIN: scavenge oil pump housing cover												
P H	5307-679-4990	0.003 oversize (7363442)	ea	2				2	2	2	12	16	B-9	14
P H	5307-679-4987	0.007 oversize (7363443)	ea	2				2	2	2	12	16	B-9	14
		STUD, SHOULDERED: scavenge oil pump housing and cover												
P H	5307-533-3383	0.003 oversize (10882637)	ea	2				2	2	2	12	16	B-9	15
P H	5307-533-3382	0.007 oversize (10882638)	ea	2				2	2	2	12	16	B-9	15
X1 H		ELBOW, TUBE: pressure oil pump pickup (8725232)	ea	1									B-9	16
P H	5310-167-0820	WASHER, FLAT: pressure oil pump housing cover (5), scavenge oil pump housing to pressure oil pump housing (2), scavenge oil pump housing cover (5), scavenge oil pump inlet scoop to pressure oil pump housing (4), pressure oil pump pickup elbow to pressure oil pump housing (2) (88044-960-516)	ea	18				3	7	14	360	1800	B-9	17

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		0106—ENGINE LUBRICATION SYSTEM — Continued												
P H	5310-849-6883	NUT, SLOTTED, HEXAGON: pressure oil pump housing cover (5), scavenge oil pump housing to pressure oil pump housing (2), scavenge oil pump housing cover (5), scavenge oil pump inlet scoop to pressure oil pump housing (4), pressure oil pump pickup elbow to pressure oil pump housing (2) (96906-35692-13)	ea	18				3	7	14	360	1800	B-9	18
P H	9525-990-7799	WIRE, NICKEL COPPER: pressure oil pump cover to housing (3 pcs 12 in. lg), pressure oil pump pickup elbow to housing (1 pc 12 in. lg), scavenge oil pump housing cover (2 pcs 12 in. lg), scavenge oil pump housing to pressure oil pump housing (1 pc 12 in. lg), scavenge oil pump inlet scoop to pressure oil pump housing (2 pcs 12 in. lg), oil pump driven impeller shaft (1 pc 12 in. lg), oil pump drive gearshaft and scavenge drive impeller shaft (1 pc 12 in. lg), oil pump pressure relief valve cap (1 pc 12 in. lg), pressure relief valve body, piston oil cooling (1 pc 12 in. lg), (96906-20995NC40)	ft	13				*	*	*	130	1300	B-9	19
X1 H		IMPELLER: pressure oil pump driven (8725119)	ea	1									B-9	20
X1 H		SHAFT: oil pump impeller drive (10898888)	ea	1									B-9	21
P H	4730-044-4689	PLUG, PIPE: oil pump drive impeller shaft oil hole (7538990)	ea	1				*	2	2	6	10	B-9	22
X1 H		HOUSING ASSEMBLY: scavenge oil pump (10898874)	ea	1									B-9	23
X1 H		IMPELLER: scavenge oil pump driven (8725120)	ea	2									B-9	24
X1 H		IMPELLER: scavenge oil pump drive (8725121)	ea	1									B-9	25
X1 H		SHAFT: oil pump driven impeller (10898908)	ea	1									B-9	26
X1 H		COVER ASSEMBLY: scavenge oil pump housing (10898877)	ea	1									B-9	27
P H	5340-291-3495	INSERT, SCREW THREAD: scavenge oil pickup tube and spill tube (96906-124697)	ea	4				2	2	3	24	24	B-9	28

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					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0106 — ENGINE LUBRICATION SYSTEM — Continued												
P H	3110-186-0964	WASHER, KEY: oil pump drive shaftgear (21450-711206)	ea	1				2	2	2	12	10	B-9	29
P H	3110-185-6535	NUT, PLAIN, ROUND: oil pump drive shaftgear (21450-711004)	ea	1				*	*	1	15	20	B-9	30
P H	5306-182-2014	BOLT, MACHINE: oil pump drive gearshaft and scavenge drive impeller shaft (2), oil pump driven impeller shaft (1) (88044-4H-3A)	ea	3				*	*	1	18	30	B-9	31
X1 H		PLATE, LOCKING: oil pump drive gearshaft and scavenge driven impeller shaft (10898910)	ea	1									B-9	32
X1 H		SHAFT: oil pump driven impeller (10898907)	ea	1									B-9	33
		STUD, PLAIN: scavenge oil pump housing cover												
P H	5307-679-4985	0.003 oversize (7046669)	ea	1				*	2	2	6	8	B-9	34
P H	5307-679-4989	0.007 oversize (7046670)	ea	1				*	2	2	6	8	B-9	34
		STUD, PLAIN: scavenge oil pump housing												
P H	5307-679-4986	0.003 oversize (7363446)	ea	2				*	2	2	6	8	B-9	35
P H	5307-679-4988	0.007 oversize (7363447)	ea	2				*	2	2	6	8	B-9	35
X1 H		VALVE: pressure relief oil pump (8725099)	ea	1									B-9	36
P H	2815-679-4966	SPRING, HELICAL COMPRESSION: (inner) oil pump pressure (8725101)	ea	1				*	2	2	10	20	B-9	37
P H	2815-679-4964	SPRING, HELICAL COMPRESSION: (outer) oil pump pressure relief valve (8725113)	ea	1				*	2	2	10	20	B-9	38
X1 H		CAP, PRESSURE RELIEF VALVE: oil pump (8725115)	ea	1									B-9	39
P H	5310-851-4278	NUT, PLAIN, BLIND RIVET: oil pump driven gear (7324901)	ea	1				2	2	2	15	100	B-9	40
P H	5315-298-1481	PIN, COTTER: oil pump driven gear (96906-24665-357)	ea	1				2	2	3	20	100	B-9	41
P H	2815-851-6551	GEAR, SPUR: oil pump driven (10898962)	ea	1				*	2	2	8	12	B-9	42

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		0106 — ENGINE LUBRICATION SYSTEM — Continued												
X1 H		PLATE, LOCKING: oil pump driven impeller shaft (8725100)	ea	1									B-9	43
X 1H		COVER ASSEMBLY: pressure oil pump housing (10882728)	ea	1									B-9	44
X 1H		IMPELLER: (driven) piston cooling oil (8725134)	ea	1									B-9	45
X 1H		IMPELLER: (drive) piston cooling oil (8725130)	ea	1									B-9	46
P H	2815-846-1824	WASHER, THRUST: oil pump drive gear bearing (10898919)	ea	1				*	2	2	8	20	B-9	47
P H	3110-144-8518	BEARING, BALL, ANNULAR: oil pump drive gear (21450-700078)	ea	2				*	2	2	10	20	B-9	48
X1 H		WASHER, THRUST: oil pump drive gear bearing (8725096)	ea	1									B-9	49
P H	2815-679-4968	GEAR, CLUSTER, SPUR: oil pump drive (8725087)	ea	1				*	2	2	8	12	B-9	50
X1 H		SHAFT: oil pump drive gear (10898875)	ea	1									B-9	51
P H	2815-876-2324	VALVE, PRESSURE REGULATING: oil pump piston cooling (10882925)	ea	1				*	2	2	8	12	B-9	52
X1 H		VALVE: oil pump piston cooling oil (10882926)	ea	1									B-9	53
P H	2815-866-2196	SPRING, HELICAL COMPRESSION: piston cooling relief valve (10882928)	ea	1				*	2	2	10	20	B-9	54
X1 H		BODY: oil pump piston cooling relief valve (10882927)	ea	1									B-9	55
P H	5340-282-5278	RING, RETAINING: oil pump piston cooling relief valve (96906-16624-3031)	ea	1				2	2	2	15	100	B-9	56
X1 H		SCOOP ASSEMBLY: scavenge oil pump inlet (8682711)	ea	1									B-9	57
X1 H		SCREEN: scavenge oil pump inlet (10865336)	ea	1									B-9	58

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		0106—ENGINE LUBRICATION SYSTEM — Continued												
P H	5307-776-7333	STUD, PLAIN: scavenge oil pump inlet scoop 0.003 oversize (7767333)	ea	4				2	2	3	24	32	B-9	59
P H	5307-776-7334	0.007 oversize (7767334)	ea	4				2	2	3	24	32	B-9	59
X1 H		HOUSING ASSEMBLY: pressure oil pump (10898878)	ea	1									B-9	60
P	5330-411-5803	PACKING, PREFORMED: spill tube junction outlet housing (☆☆parts kit-2815-678-4245) (8761274)	ea	1				*	*	*			B-9	61
P2 H	2815-122-4963	HOUSING: spill tube outlet (8761161)	ea	1				*	*	*	2	*	B-9	62
P2 H	2815-071-8126	TUBE ASSEMBLY, OIL: pressure relief (8761023)	ea	1				*	*	*	3	*	B-9	63
P2 H	2815-411-3965	SUPPORT ASSEMBLY, OIL PUMP: scavenge pickup tube (7320451)	ea	1				*	*	*	5	*	B-9	64
P O	5306-225-8504	BOLT, MACHINE: turbosupercharger oil drain tube, right (1), left (1) (96906-90725-40)	ea	2	*	1	2	*	1	2	40	40	B-10	1
P O	5310-407-9566	WASHER, LOCK: oil pan inlet drain tube (96906-35338-45)	ea	8	1	4	7	1	4	7	160	800	B-10	2
P O	5310-407-9566	WASHER, LOCK: turbosupercharger oil drain tube, right and left banks (96906-35338-45)	ea	4	1	2	3	1	2	3	80	400	B-10	2
X2 O	2990-402-4427	TUBE ASSEMBLY, TURBOCHARGER: oil drain (right bank) (8761189)	ea	1									B-10	3
P O	2815-869-3595	TUBE ASSEMBLY, CYLINDER: cylinder head oil drain (right bank, flywheel end) (8761190)	ea	1	*	2	2	*	2	2	6	8	B-10	4
P2 O	2815-485-9555	TUBE, CYLINDER HEAD OIL DRAIN: (intermediate cylinders) (8761193)	ea	8	*	*	*	*	*	*	4	*	B-10	5
P O	4730-278-2068	CLAMP, HOSE: cylinder head oil drain hose (20), oil pan inlet drain tube hose (12) turbosupercharger oil drain tube hose (8) (21450-502915)	ea	40	2	4	8	2	4	8	200	200	B-10	6

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		0106 — ENGINE LUBRICATION SYSTEM — Continued												
M O		HOSE, RUBBER: cylinder head oil drain, oil pan inlet drain tube, turbosupercharger oil drain tubes (fabricate from 4720-278-1113) (20 pcs 2.750 in. lg) (7350206)	ft										B-10	7
P O	4720-278-1113	HOSE, RUBBER: (MIL-H-600-1.000 in. id)	ft	5	2	3	6	2	3	6	50	500	B-10	7
P O	2815-073-5129	TUBE ASSEMBLY, CYLINDER: cylinder head oil drain (right bank damper end) (8761192)	ea	1	*	2	2	*	2	2	6	8	B-10	8
X2 O	4710-406-1528	TUBE, BENT STEEL: cylinder head oil drain (right bank damper end) (10882791)	ea	1									B-10	9
P O	2815-575-0398	TUBE, OIL PAN: cylinder head oil drain (right bank damper end) (8761598)	ea	1	*	2	2	*	2	2	6	8	B-10	10
P O	5306-051-4075	BOLT, MACHINE: cylinder head oil drain to oil pan (damper end) (96906-90727-33)	ea	4	1	2	3	1	2	3	80	80	B-10	11
P O	2815-679-6482	GASKET: oil pan inlet drain flange (☆☆parts kit - 2815-678-4245) (8682772)	ea	4	3	6	11	3	6	11	100		B-10	12
P2 O	4370-223-7007	ELBOW, FLANGE TO HOSE: oil pan inlet drain (left bank damper end) (8761597)	ea	1	*	*	*	*	*	*	1	*	B-10	13
P O	5330-855-6045	GASKET: cylinder head oil drain tube connector (☆☆parts kit—2815-678-4245) (96906-35769-9)	ea	12	7	16	29	7	16	29	300		B-10	14
P O	2815-833-8164	TUBE ASSEMBLY, CYLINDER: cylinder head oil drain (left bank, damper end) (10865180)	ea	1	*	2	2	*	2	2	6	8	B-10	15
P O	5310-679-5685	WASHER, FLAT: cylinder head oil drain connector bolt (8744055)	ea	12	6	13	25	6	13	25	240	1200	B-10	16
P O	4730-679-5682	BOLT, FLUID PASSAGE: internally relieved body, cylinder head oil drain (8761091)	ea	12	2	2	3	2	2	3	20	34	B-10	17
P O	9525-990-7799	WIRE, NICKEL COPPER: cylinder head oil drain tubes (12 pcs 12 in. lg) (96906-20995NC40)	ft	12	1	3	5	1	3	5	120	1200	B-10	18

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		0106 — ENGINE LUBRICATION SYSTEM — Continued												
P2 O	4710-457-0479	TUBE, BENT, STEEL: oil pan inlet drain (left bank, damper end) (10865182)	ea	1	*	*	*	*	*	*	2	*	B-10	19
P O	2815-071-8124	TUBE ASSEMBLY, CYLINDER: cylinder head oil drain (left bank, flywheel end) (8682753)	ea	1	*	2	2	*	2	2	6	8	B-10	20
X2 O	2815-406-4623	TUBE, OIL PAN DRAIN: left bank, flywheel end (10883083)	ea	1									B-10	21
P O	5306-051-4084	BOLT, MACHINE: oil pan inlet drain tube, flywheel end (96906-90727-42)	ea	4	3	5	10	3	5	10	80	80	B-10	22
X2 O	4710-477-9900	TUBE, BENT, STEEL: turbosupercharger oil drain, left bank (8761059)	ea	1									B-10	23
X2 O	2990-402-5201	TUBE ASSEMBLY, TURBOCHARGER: oil drain (left bank) (8761163)	ea	1									B-10	24
P O	5306-225-8511	BOLT, MACHINE: turbosupercharger oil drain tube, right (1), left (1) (96906-90725-47)	ea	2	*	1	2	*	1	2	40	40	B-10	25
P2 O	2815-406-4622	TUBE, OIL PAN DRAIN: flywheel end, right bank (10865022)	ea	1	*	*	*	*	*	*	1	*	B-10	26
X2 O	4710-477-9899	TUBE, BENT, STEEL: turbosupercharger oil drain, right bank (8761052)	ea	1									B-10	27
P O	2990-678-3286	HOSE ASSEMBLY, NON-METALLIC: turbosupercharger oil line tee to turbosupercharger swivel elbow oil hose assembly, right and left (8761507)	ea	2	*	2	2	*	2	2	10	10	B-11	1
P O	5310-282-7822	NUT, PLAIN, HEXAGON: turbosupercharger oil line elbow to engine shroud (96906-24400-10)	ea	1	*	*	1	*	*	1	15	100	B-11	2
P O	5310-809-8540	WASHER, FLAT: turbosupercharger oil line elbow to engine shroud (96906-27183-25)	ea	1	*	*	1	*	*	1	20	100	B-11	3
P2 O	4730-457-1984	CONNECTOR, MULTIPLE FLUID PRESSURE LINE: turbosupercharger oil line, bulkhead tee (8761449)	ea	1	*	*	*	*	*	*	4	*	B-11	4

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					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0106 — ENGINE LUBRICATION SYSTEM — Continued												
P O	5340-057-3043	CLAMP, LOOP: turbosupercharger oil hose, left and right (21450-573043)	ea	2	2	2	3	2	2	3	20	100	B-11	5
P O	4730-678-3494	ELBOW, TUBE: turbosupercharger oil inlet nipple to turbosupercharger oil hose, left and right (8764950)	ea	2	2	2	3	2	2	3	18	18	B-11	6
P O	4730-334-7838	ADAPTER, STRAIGHT, PIPE TO TUBE: turbosupercharger oil inlet flange to 90 deg swivel elbow, left and right (9402708)	ea	2	2	2	2	2	2	2	12	50	B-11	7
P O	4730-278-2065	CLAMP, HOSE: hose to crankcase breather tube and crankcase breather tube tee (2), crankcase breather tube to exhaust pipe (late) (2) (21450-502919)	ea	4	2	3	5	2	3	5	40	48	B-11	8
P O	4720-177-6186	HOSE, NON-METALLIC: crankcase breather tube to exhaust pipe (late) (10898793-1)	ea	1	*	2	2	*	2	2	10	12	B-11	9
P2 O	4710-401-4368	BENT TUBE, STEEL: crankcase breather (flywheel end) (late) (10951368)	ea	1	*	*	*	*	*	*	5	*	B-11	10
P2 O	4710-485-9651	TUBE, BENT STEEL: crankcase breather (flywheel end) (early) (8761479)	ea	1	*	*	*	*	*	*	5	*	B-11	11
P O	2815-896-6166	HOSE, AIR DUCT: crankcase breather tube to crankcase breather tube tee (10898794)	ea	1	*	2	2	*	2	2	10	50	B-11	12
P O	5306-051-4075	BOLT, MACHINE: crankcase breather tube tee to accessory drive housing (96906-90727-33)	ea	2	*	1	2	*	1	2	40	60	B-11	13
P O	5310-407-9566	WASHER, LOCK: crankcase breather tube tee to accessory drive housing (96906-35338-45)	ea	2	*	1	2	*	1	2	40	200	B-11	14
P O	5330-678-5386	GASKET: crankcase breather tube tee (☆☆parts kit - 2815-678-4245) (8682770)	ea	1	2	2	3	2	2	3	25		B-11	15
X2 O	2815-402-2170	TEE, CRANKCASE BREATHER: (10865422)	ea	1									B-11	16
P O	4730-908-3193	CLAMP, LOOP: hose to crankcase intermediate breather tube (rear) to breather tube tee (2), hose to crankcase breather tube (front) and intermediate breather tube (front) (2) (96906-35842-12)	ea	4	2	3	5	2	3	5	40	400	B-11	17

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					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0106—ENGINE LUBRICATION SYSTEM — Continued												
P O	2815-896-6165	HOSE, AIR DUCT: crankcase breather tube to crankcase breather tube tee (1), crankcase breather tube (damper end) to crankcase breather tube (intermediate) (damper end) (1) (10898793)	ea	2	2	2	3	2	2	3	20	55	B-11	18
P O	5340-738-4968	CLAMP, LOOP: fire extinguisher tube and turbosupercharger oil hose to fan drive housings (flywheel and damper end) (7384968)	ea	4	*	2	2	*	2	2	6	9	B-11	19
P O	5305-993-1851	SCREW, MACHINE: fire extinguisher tube to turbosupercharger oil hose (96906-35207-267)	ea	1	2	2	3	2	2	3	20	30	B-11	20
P O	5340-050-2740	CLAMP, LOOP: fire extinguisher tube to turbosupercharger oil hose (21450-502740)	ea	1	*	2	2	*	2	2	10	40	B-11	21
P O	5310-902-6676	NUT, SELF-LOCKING: fuel shutoff solenoid cable and fuel inlet hose to crankcase breather tube (3), fire extinguisher to turbosupercharger oil hose (1) (96906-21083N3)	ea	4	1	2	3	1	2	3	80	400	B-11	22
P O	5340-298-9406	CLAMP, LOOP: fire extinguisher tube to turbosupercharger oil hose (96906-21919-G9)	ea	1	*	2	2	*	2	2	10	40	B-11	23
P2 O	2815-194-2481	TUBE ASSEMBLY, CRANKCASE BREATHER: (damper end) (8761472)	ea	1	*	*	*	*	*	*	1	*	B-11	27
P O	5330-678-5388	GASKET: crankcase breather tube (damper end) (☆☆parts kit—2815-678-4245) (8682680)	ea	1	2	2	3	2	2	3	20		B-11	28
P O	5310-982-4912	NUT, SELF-LOCKING, HEXAGON: crankcase breather tube to crankcase damper and oil filter housing (2), crankcase breather tube to fan drive housing (rear) (1) (96906-21045-5)	ea	3	*	1	2	*	1	2	60	300	B-11	29
P2 O	4710-438-1811	TUBE, BENT, STEEL: crankcase breather (10882890)	ea	1	*	*	*	*	*	*	4	*	B-11	30
P O	5310-167-0820	WASHER, FLAT: crankcase breather tube to fan drive housing (rear) (88044-960-516)	ea	1	2	2	3	2	2	3	20	100	B-11	34
P2 O	5430-493-4057	CLAMP, LOOP: breather tube to fan drive housing (rear) (10865464)	ea	1	*	*	*	*	*	*	2	*	B-11	35

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		0106 — ENGINE LUBRICATION SYSTEM — Continued												
X2 O	4710-194-2531	TUBE, BENT, STEEL: crankcase breather (rear) (early) (10865420)	ea	1									B-11	36
P O	5306-150-9104	BOLT, MACHINE: clamp assembly and crankcase intermediate breather tube (rear) to crankcase breather tube bracket (7414569)	ea	1	2	2	3	2	2	3	20	20	B-11	37
P2 O	5430-493-4057	CLAMP, LOOP: breather tube to angle bracket (10865464)	ea	1	*	*	*	*	*	*	4	*	B-11	38
X2 O	2815-406-7289	BRACKET, BREATHER TURBOCHARGER: (8761481)	ea	1									B-11	39
P O	5310-982-4912	NUT, SELF-LOCKING, HEXAGON: crankcase breather tube to angle bracket (96906-21045-5)	ea	1	2	2	3	2	2	3	20	100	B-11	40
P O	4730-908-3193	CLAMP, HOSE: crankcase breather tube (front) to crankcase breather tube (rear) (96906-35842-12)	ea	2	2	2	3	2	2	3	20	200	B-11	41
P O	2815-896-6165	HOSE, AIR DUCT: crankcase breather tube (front) to crankcase breather tube (rear) (10898793)	ea	1	*	2	2	*	2	2	10	55	B-11	42
X2 O	4710-194-2566	TUBE, BENT, STEEL: crankcase breather (front) (8761448)	ea	1									B-11	43
P O	2910-678-3290	TUBE ASSEMBLY, NON-METALLIC: crankshaft damper and oil filter housing to fuel injection pump adapter (8761502)	ea	1	2	2	2	2	2	2	12	15	B-11	44
P O	4730-202-6692	BUSHING, PIPE: oil filter and damper housing to injector pump adapter hose (21450-127956)	ea	1	*	2	2	*	2	2	8	15	B-11	45
P O	4730-815-0248	ELBOW, PIPE TO TUBE: crankshaft damper and oil filter housing to turbosupercharger oil hose (9402827)	ea	1	2	2	2	2	2	2	12	100	B-11	46
P O	2990-678-3291	HOSE ASSEMBLY, NON-METALLIC: crankshaft damper and oil filter housing to turbosupercharger oil line tee (8761491)	ea	1	2	2	3	2	2	3	20	40	B-11	47
P O	5340-489-8347	CLAMP, LOOP: turbosupercharger oil hose to fuel injection pump base (early) (10882771)	ea	1	*	2	2	*	2	2	10	45	B-11	52

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					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0106 — ENGINE LUBRICATION SYSTEM — Continued												
P O	5306-050-1238	BOLT, MACHINE: turbosupercharger oil hose to fuel injection pump base (early) (96906-90727-32)	ea	1	2	2	3	2	2	3	20		B-11	53
P O	5330-679-6483	GASKET: turbosupercharger oil drain tube flange, right and left banks (☆☆ parts kit—2815-678-4245) (8761087)	ea	2	2	2	3	2	2	3	20		B-15	5
P2 O	2930-678-4667	SCREEN, OIL COOLER: transmission (8682693)	ea	2	*	*	*	*	*	*	5	*	B-24	1
P F	5340-616-5014	INSERT, CRES, HELICAL-COIL: engine and transmission upper cooler support beam (8) (96906-35914-114)	ea	16	1	2	4	1	2	4	96	96	B-24	2
X2 O	2815-412-9192	RETAINER ASSEMBLY: oil cooler seal (8761469)	ea	2								24	B-24	3
X2 O		RETAINER, OIL COOLER SEAL: transmission (8761470)	ea	2								24	B-24	4
P O	5330-498-6341	RETAINER, PACKING: oil coolers to engine upper cover frame and support beam (10935478)	ea	32	3	6	11	3	6	11	100	163	B-24	6
P O	5325-276-6096	GROMMET, RUBBER: oil cooler support beam, left and right bank (96906-35489-74)	ea	8	*	1	1	*	1	1	25	400	B-24	7
P O	5305-817-9326	SCREW, CAP, HEXAGON: oil coolers to support beam (8), oil coolers to engine upper cover frame (8) (96906-51096-60)	ea	16	4	9	16	4	9	16	160	320	B-24	8
P O	9525-990-7799	WIRE, NICKEL COPPER: oil coolers to support beam and oil coolers to engine upper cover frame (16 pcs 12 in. lg) (96906-20995NC40)	ft	16	1	4	7	1	4	7	160	1600	B-24	9
P O	6620-734-6573	THERMOSTAT, FLOW CONTROL: transmission oil cooler (7346573)	ea	2	*	2	2	*	2	2	8	8	B-24	22
P O	5340-740-3580	SPACER, RING: valve bypass transmission oil cooler (2), valve bypass engine oil cooler (2) (☆☆ parts kit-2815-678-4245) (7403580)	ea	4	2	2	3	2	2	3	25		B-24	23
P F	5340-434-6850	INSERT, CRES, HELICAL-COIL: engine and transmission oil cooler screen (96906-35914-112)	ea	16	1	2	4	1	2	4	96	96	B-24	24

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		0106—ENGINE LUBRICATION SYSTEM — Continued												
P O	2930-678-4671	RADIATOR, OIL COOLER: transmission (8761262)	ea	2	3	5	8	3	5	8	40	50	B-24	25
P O	5306-741-4584	BOLT, ASSEMBLED WASHER: engine and transmission oil cooler screens (7414584)	ea	16	4	10	18	4	10	18	160	320	B-24	29
M O		RUBBER STRIP: oil cooler to support beam (fabricate from 8682670-8) (2 pcs 22.625 in. lg) (8682673)	ft	2									B-24	35
P O	9320-181-0119	RUBBER STRIP: (8682670-8)	ft	4	8	8	12	8	8	12	100	400	B-24	35
P2 O	2930-678-4668	SCREEN, OIL COOLER: engine (8682692)	ea	2	*	*	*	*	*	*	5	*	B-24	41
P O	2805-304-9365	VALVE ASSEMBLY, THERMOSTATIC: engine oil cooler (8357819)	ea	2	2	2	2	2	2	2	16	20	B-24	42
P O	2930-678-4665	RADIATOR, OIL COOLER: engine oil cooler (8682802)	ea	2	2	4	6	2	4	6	24	40	B-24	43
P O	2930-766-0903	HOSE ASSEMBLY, PLASTIC: engine oil cooler (10865437)	ea	4	*	2	2	*	2	2	6	5	B-24	44
P O	5310-167-0822	WASHER, FLAT: oil cooler support beam to cylinder heads 2, 4, and 5-left and right banks (88044-960-716)	ea	6	1	3	5	1	3	5	120	600	B-24	47
P O	5310-088-0552	NUT, SELF-LOCKING, HEXAGON: oil cooler support beam to cylinder head (96906-21044N7)	ea	12	2	4	8	2	4	8	180	1200	B-24	48
M O		RUBBER STRIP: oil cooler to supprt beam (fabricate from 8682670-8) (8682671) (2 pcs 17 in. lg)	ft	2									B-24	49
P O	9320-181-0119	RUBBER STRIP: (8682670-8)	ft	4	6	6	9	6	6	9	100	400	B-24	49
P2 O	2815-411-5789	BEAM, OIL COOLER SUPPORT: right bank (8682739)	ea	1	*	*	*	*	*	*	3	*	B-24	50
P2 O	2930-168-2625	BEAM, OIL COOLER: left bank (8682738)	ea	1	*	*	*	*	*	*	3	*	B-24	51
P O	2930-678-4669	GASKET: engine oil cooler male connector (☆☆parts kit-2815-678-4245) (8682679)	ea	4	2	3	6	2	3	6	48		B-24	53

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		0106 — ENGINE LUBRICATION SYSTEM — Continued												
P O	2930-678-4670	ELBOW, TUBE TO FLANGE: engine oil cooler (8761149)	ea	4	2	3	5	2	3	5	40	60	B-24	54
P O	5310-982-4912	NUT, SELF-LOCKING, HEXAGON: elbow to engine oil cooler (96906-21045-5)	ea	12	2	5	10	2	5	10	240	1200	B-24	55
		STUD, PLAIN: engine oil cooler elbow												
P F	5307-995-8205	0.003 oversize (8365383-2)	ea	12	2	4	8	2	4	8	72	96	B-24	56
P F	5307-954-6460	0.007 oversize (8365383-3)	ea	12	2	4	8	2	4	8	72	96	B-24	56
		STUD, PLAIN: crankcase breather tube												
P F	5307-706-5766	0.003 oversize (7065766)	ea	1	*	2	2	*	2	2	10	20	B-26	19
P F	5307-706-5767	0.007 oversize (7065767)	ea	1	*	2	2	*	2	2	10	20	B-26	19
P H	5330-585-6663	PACKING, PREFORMED: crankcase oil transfer tube to accessory drive housing (3), accessory drive housing oil transfer tube to accessory drive housing base (3), fan drive housing oil transfer tube to accessory drive housing base (1) (☆☆parts kit-2815-678-4245) (96906-28775-110)	ea	7				1	2	3	70		B-26	42
		0108 — MANIFOLDS AND CONNECTING PARTS												
P F	5307-678-3314	STUD, PLAIN: exhaust manifold (8725298)	ea	48	7	16	29	7	16	29	288	288	B-4	52
P F	5305-531-1097	SCREW, CAP, HEXAGON HEAD: exhaust elbows to turbosupercharger (96906-35308-365)	ea	16	2	6	12	2	6	12	320	480	B-12	1
P F	2990-678-3252	PIPE, EXHAUST: cylinder No. 4, 5, and 6, right bank (8761499)	ea	1	*	2	2	*	2	2	6	10	B-12	2
P F	5305-801-5747	SCREW, CAP, HEXAGON HEAD: exhaust elbows to exhaust manifolds (96906-35308-364)	ea	16	2	6	12	2	6	12	320	480	B-12	3
P2 F	4730-406-7309	PLUG, PIPE: exhaust elbow boss (4), exhaust manifold pipe boss (12) (8761594)	ea	16	*	*	*	*	*	*	5	*	B-12	4
P F	2815-678-3216	GASKET: exhaust manifold to cylinder head (☆☆parts kit-2815-678-4245) (8761547)	ea	16	9	20	38	9	20	38	400		B-12	5

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					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0108 — MANIFOLDS AND CONNECTING PARTS — Continued												
P F	5310-774-4570	WASHER, FLAT: exhaust manifolds to cylinder head (48), exhaust manifolds to exhaust elbows (16) (7744570)	ea	64	29	66	123	29	66	123	1280	6400	B-12	6
P F	5310-489-8351	NUT, SELF-LOCKING, HEXAGON: exhaust manifolds to exhaust elbows (16), exhaust manifold to cylinder heads (48) (11640132)	ea	64	29	66	123	29	66	123	1280	6400	B-12	7
P F	5310-982-4912	NUT, SELF-LOCKING, HEXAGON: exhaust manifold retaining straps (96906-21045-5)	ea	4	1	2	3	1	2	3	80	400	B-12	8
P F	5310-167-0820	WASHER, FLAT: exhaust manifold retaining straps (88044-960-516)	ea	4	1	2	3	1	2	3	80	400	B-12	9
P2 F	5340-462-2908	STRAP, RETAINING: exhaust manifold elbow (8761243)	ea	4	*	*	*	*	*	*	2	*	B-12	10
P F	2815-678-3213	MANIFOLD, ENGINE EXHAUST: cylinder No. 4, 5, and 6 (left bank) (8761517)	ea	1	*	2	2	*	2	2	6	10	B-12	11
P F	2990-678-3251	PIPE, EXHAUST: cylinders No. 4, 5, and 6 (left bank) (8761549)	ea	1	*	2	2	*	2	2	6	10	B-12	12
P F	2990-678-3250	PIPE, EXHAUST: cylinders No. 1, 2, and 3 (left bank) (8761553)	ea	1	*	2	2	*	2	2	6	10	B-12	13
P F	5306-151-2626	BOLT, MACHINE: exhaust manifold retaining straps (7415117)	ea	4	2	4	8	2	4	8	80	80	B-12	14
P2 F	5340-437-7210	STRAP, RETAINING: exhaust manifold, left bank (10935443-1)	ea	2	*	*	*	*	*	*	5	*	B-12	15
P F	2815-678-3214	MANIFOLD, ENGINE EXHAUST: cylinder No. 1, 2, and 3, left bank (8761521)	ea	1	*	2	2	*	2	2	6	10	B-12	16
P F	2815-678-3215	MANIFOLD, ENGINE EXHAUST: cylinder No. 1, 2, and 3, right bank (8761527)	ea	1	*	2	2	*	2	2	6	12	B-12	17
P2 F	5340-437-7211	STRAP, RETAINING: exhaust manifold, support, right bank (10935443-2)	ea	2	*	*	*	*	*	*	5	*	B-12	18

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		0108 — MANIFOLDS AND CONNECTING PARTS — Continued												
P F	2990-678-3264	PIPE, EXHAUST: cylinder No. 1, 2, and 3, right bank (8761559)	ea	1	*	2	2	*	2	2	6	12	B-12	19
P F	2815-678-3217	MANIFOLD, ENGINE EXHAUST: cylinder No. 4, 5, and 6, right bank (8761513)	ea	1	*	2	2	*	2	2	6	6	B-12	20
P F	2815-679-7063	GASKET: intake manifold tube (cylinder No. 3 and 4, left and right) (☆☆ parts kit - 2815-678-4245) (8698759)	ea	4	3	6	11	3	6	11	100		B-13	19
P F	5310-982-4912	NUT, SELF-LOCKING, HEXAGON: intake manifold tube to intake manifold (40), intake manifold elbow to intake manifold (12) (96906-21045-5)	ea	52	6	16	32	6	16	32	780	5200	B-13	20
P F	5310-022-5853	NUT, PLAIN, HEXAGON: intake manifold tubes to cylinder head (21450-225853)	ea	36	4	11	22	4	11	22	540	3600	B-13	21
P F	5310-407-9566	WASHER, LOCK: intake manifold tubes to cylinder head (96906-35338-45)	ea	36	6	14	27	6	14	27	720	3600	B-13	22
P F	2815-679-5668	TUBE ASSEMBLY, METAL: intake manifold (cylinder No. 3 and 4, left and right bank) (8761021)	ea	4	2	2	2	2	2	2	16	40	B-13	23
P F	2815-679-7062	GASKET: intake manifold tube to cylinder head (☆☆ parts kit—2815-678-4245) (8682800)	ea	12	7	16	29	7	16	29	300		B-13	24
		STUD, PLAIN: intake manifold tube to intake manifold												
P F	5307-679-5684	0.003 oversize (7084530)	ea	16	3	6	11	3	6	11	96	128	B-13	25
P F	5307-801-4819	0.007 oversize (7084531)	ea	16	3	6	11	3	6	11	96	128	B-13	25
P F	5330-618-0800	PACKING, PREFORMED: intake manifold tube cylinders No. 1 and 6 right and left bank (☆☆ parts kit - 2815-678-4245) (96906-28775-335)	ea	4	3	6	11	3	6	11	100		B-13	26
P F	5340-205-9307	WASHER, FLAT: intake manifold seal (large) (8698764)	ea	4	2	4	8	2	4	8	80	400	B-13	27
X2 F	4730-406-4609	FLANGE, PIPE: intake manifold (small) (8761137)	ea	4									B-13	28

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		0108 — MANIFOLDS AND CONNECTING PARTS — Continued												
X2 F	4730-406-7308	FLANGE, PIPE: intake manifold (large) (8761138)	ea	4									B-13	29
P F	2815-679-5665	TUBE ASSEMBLY, METAL: intake manifold cylinders No. 1 right, No. 6 left (8761159)	ea	2	2	2	2	2	2	2	16	20	B-13	30
P F	2815-679-5666	TUBE, METAL, PREFORMED: intake manifold, cylinder No. 2 right and No. 5 left (8761158)	ea	2	2	2	2	2	2	2	16	20	B-13	31
X2 F	4730-406-7307	FLANGE, PIPE: intake manifold (8682799)	ea	4									B-13	32
P F	5310-679-9880	WASHER, SPRING TENSION: intake manifold seal (large) (8682774)	ea	4	2	4	8	2	4	8	80	400	B-13	33
P F	5310-637-3057	WASHER, SPRING TENSION: intake manifold seal (small) (8698690)	ea	4	2	4	8	2	4	8	80	400	B-13	34
P F	5340-209-0174	SPACER, RING: intake manifold seal (small) (8698689)	ea	4	2	4	8	2	4	8	80	400	B-13	35
P F	5330-584-1186	PACKING, PREFORMED: intake manifold tube (cylinders No. 2 and 5 left and right bank) (** parts kit - 2815-678-4245) (96906-28775-331)	ea	4	2	4	8	2	4	8	80		B-13	36
		STUD, PLAIN: intake manifold tube to intake manifold elbow (12), intake manifold tube to manifold (24)												
P F	5307-776-7804	0.003 oversize (7767804)	ea	36	6	13	24	6	13	24	216	288	B-13	37
P F	5307-776-7805	0.007 oversize (7767805)	ea	36	6	13	24	6	13	24	216	288	B-13	37
		STUD, PLAIN: intake manifold to intake manifold elbow (4), intake manifold elbow to intake manifold (8)												
P F	5307-272-6331	0.003 oversize (8365809)	ea	12	2	4	8	2	4	8	72	96	B-13	38
P F	5307-272-6332	0.007 oversize (8365810)	ea	12	2	4	8	2	4	8	72	96	B-13	38
P F	4730-044-4689	PLUG, PIPE: intake manifold elbow (4), intake manifold (2) (7538990)	ea	6	2	3	5	2	3	5	36	60	B-13	39
X2 F	2815-406-4620	MANIFOLD, INTAKE: air (8761033)	ea	2									B-13	40

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					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0108 — MANIFOLDS AND CONNECTING PARTS — Continued												
P F	2815-679-5664	TUBE, METAL, PREFORMED: intake manifold cylinders No. 2 left and No. 5 right (8761160)	ea	2	2	2	2	2	2	2	16	40	B-13	41
P F	2815-679-5667	TUBE ASSEMBLY, METAL: intake manifold cylinders No. 1 left and No. 6 right (8761157)	ea	2	2	2	2	2	2	2	16	40	B-13	42
P F	2815-679-7064	GASKET: intake manifold elbow to intake manifold (☆☆ parts kit - 2815-678-4245) (8682769)	ea	2	2	2	2	2	2	2	16		B-13	43
P F	5310-167-0820	WASHER, FLAT: intake manifold elbow to intake manifold (88044-960-516)	ea	12	2	5	10	2	5	10	240	1200	B-13	44
X1 F		ELBOW, MANIFOLD: intake (8761046)	ea	2									B-13	45
X2 F	2815-177-8243	ELBOW ASSEMBLY, MANIFOLD: intake (8761156)	ea	2	*	*	*	*	*	*	2	*	B-13	46
P F	5310-489-8351	NUT, SELF-LOCKING, HEAD: exhaust elbow to turbosupercharger, right and left banks (11640132)	ea	16	7	16	29	7	16	29	320	1600	B-15	2
P F	5310-774-4570	WASHER, FLAT: exhaust elbows to turbosupercharger, right and left banks (7744570)	ea	16	7	16	29	7	16	29	320	1600	B-15	3
P F	2815-678-3270	GASKET: exhaust elbows to turbosupercharger, right and left banks (☆☆ parts kit - 2815-678-4245) (8682505)	ea	4	3	6	11	3	6	11	100		B-15	4
		0109 — ACCESSORY DRIVING MECHANISMS AND RELATED PARTS												
P H	5340-678-3311	INSERT, SCREW THREAD: crankcase to accessory drive housing base (6), crankcase to fan drive housing base (2) (8352634)	ea	8				2	3	6	48	64	B-2	17
		STUD, PLAIN: crankcase to fan drive housing base												
P H	5307-734-8803	0.003 oversize (7348803)	ea	2				2	2	2	12	16	B-2	19
P H	5307-734-8804	0.007 oversize (7348804)	ea	2				2	2	2	12	16	B-2	19
		STUD, PLAIN: crankcase to fan drive housing base												
P H	5307-678-3516	0.003 oversize (7992693)	ea	4				2	2	3	24	32	B-2	21
P H	5307-678-3515	0.007 oversize (7992694)	ea	4				2	2	3	24	32	B-2	21

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		0109 — ACCESSORY DRIVING MECHANISMS AND RELATED PARTS — Continued												
		STUD, PLAIN: crankcase to fan drive housing base												
P H	5307-678-3530	0.003 oversize (7992645)	ea	4				2	2	3	24	32	B-2	22
P H	5307-678-3529	0.007 oversize (7992646)	ea	4				2	2	3	24	32	B-2	22
		STUD, PLAIN: crankcase to starter adapter												
P H	5307-678-3526	0.003 oversize (7992657)	ea	4				2	2	3	24	32	B-2	28
P H	5307-678-3525	0.007 oversize (7992658)	ea	4				2	2	3	24	32	B-2	28
		STUD, PLAIN: crankcase to starter driven idler shaftgear bearing cage												
P H	5307-678-3507	0.003 oversize (8682804)	ea	6				2	3	5	36	48	B-2	29
P H	5307-678-3506	0.007 oversize (8682805)	ea	6				2	3	5	36	48	B-2	29
		STUD, PLAIN: crankcase to accessory drive housing												
P H	5307-678-3522	0.003 oversize (7992677)	ea	2				2	2	2	12	16	B-2	54
P H	5307-678-3521	0.007 oversize (7992678)	ea	2				2	2	2	12	16	B-2	54
		STUD, PLAIN: crankcase to fan drive housing												
P H	5307-678-3520	0.003 oversize (7992681)	ea	3				2	2	3	18	24	B-2	55
P H	5307-678-3519	0.007 oversize (7992682)	ea	3				2	2	3	18	24	B-2	55
		STUD, PLAIN: crankcase to fan drive housing												
P H	5307-678-3518	0.003 oversize (7992685)	ea	4				2	2	3	24	32	B-2	56
P H	5307-678-3517	0.007 oversize (7992686)	ea	4				2	2	3	24	32	B-2	56
		STUD, PLAIN: crankcase to accessory drive housing base												
P H	5307-678-3524	0.003 oversize (7992669)	ea	2				2	2	2	12	16	B-2	57
P H	5307-678-3523	0.007 oversize (7992670)	ea	2				2	2	2	12	16	B-2	57
		STUD, PLAIN: crankcase to accessory drive housing base												
P H	5307-678-3530	0.003 oversize (7992645)	ea	8				2	3	6	48	64	B-2	59
P H	5307-678-3529	0.007 oversize (7992646)	ea	8				2	3	6	48	64	B-2	59
		STUD, PLAIN: crankcase to generator adapter												
P H	5307-734-8797	0.003 oversize (7348797)	ea	1				*	2	2	6	8	B-2	69
P H	5307-734-8798	0.007 oversize (7348798)	ea	1				*	2	2	6	8	B-2	69

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		0109 — ACCESSORY DRIVING MECHANISMS AND RELATED PARTS — Continued												
		STUD, PLAIN: crankcase to starter and generator drive idler gearshaft												
P H	5307-734-8782	0.003 oversize (7348782)	ea	4				2	2	3	24	32	B-2	86
P H	5307-734-8783	0.007 oversize (7348783)	ea	4				2	2	3	24	32	B-2	86
P H	5340-801-2500	RING, RETAINING: fuel pump drive shaft coupling (96906-16625-1112)	ea	1				*	2	2	10	20	B-3	3
P H	2815-795-1800	PLATE, CRANKSHAFT DAMPER: fuel pump coupling (10882610)	ea	1				*	2	2	8	8	B-3	4
P H	2815-817-9538	GEAR, SPUR: fuel pump drive (10882613)	ea	1				*	2	2	6	10	B-3	5
P H	2815-861-3829	GEAR, SPUR: accessory drive (10898778)	ea	1				*	2	2	6	6	B-3	8
P H	9525-990-7799	WIRE, NICKEL COPPER: accessory drive gear (6 pcs 12 in. lg) (96906-20995NC40)	ft	6				*	*	*	60	600	B-3	13
P H	5306-638-5288	BOLT, MACHINE: accessory drive gear to crankshaft (88044-7H10A)	ea	12				2	5	10	240	1200	B-3	14
P H	5310-877-5796	NUT, SELF-LOCKING, HEXAGON: tachometer drive adapter cover to camshaft end cover plate (left bank) (96906-21044N4)	ea	4				1	2	3	80	400	B-5	37
P H	5310-141-1795	WASHER, FLAT: tachometer drive adapter cover to camshaft end cover plate, left bank (88044-960-416)	ea	4				1	2	3	80	400	B-5	38
P H	5310-141-1795	WASHER, FLAT: tachometer drive adapter to camshaft end cover plate (right bank) (88044-960-416)	ea	4				1	2	3	80	400	B-5	38
P H	5330-738-0543	GASKET: tachometer drive cover, left bank (☆☆parts kit - 2815-678-4245) (7767519)	ea	1				2	2	3	25		B-5	
		STUD, PLAIN: tachometer drive cover (left bank)												
P H	5307-733-8646	0.003 oversize (7338646)	ea	4				2	2	3	24	32		
P H	5307-145-4675	0.007 oversize (77445-77913P8)	ea	4				2	2	3	24	?		

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		0109 — ACCESSORY DRIVING MECHANISMS AND RELATED PARTS — Continued												
P H	5330-297-9990	PACKING, PREFORMED: tachometer drive (right bank) (96906-28775-222)	ea	1				2	3	6	25	100	B-5	44
P H	9525-990-7799	WIRE, NICKEL COPPER: tachometer drive adapter to camshaft end cover plate (2pcs 12 in. lg) (96906-20995NC40)	ft	2				*	*	*	20	200	B-5	45
P H	5305-910-7369	SCREW, CAP, HEXAGON HEAD: tachometer drive adapter (right bank) (96906-51096-306)	ea	4				*	1	2	40	80	B-5	46
X1 H		ADAPTER: tachometer drive (right bank) (70040-1581742)	ea	1									B-5	47
P H	6680-973-1263	ADAPTER ASSEMBLY, SPEEDOMETER: tachometer drive, right bank (96906-39132-1)	ea	1				2	2	3	25	50	B-5	48
P H	5340-291-3495	INSERT, SCREW THREAD: crankshaft damper and oil filter housing to throttle control cross shaft bracket (2), electrical bracket (2) (96906-124697)	ea	4				2	2	3	24	24	B-6	5
P H	5340-882-5939	RING, RETAINING: generator idler gear bearing (96906-16625-3283)	ea	1				*	2	2	10	10	B-14	1
P H	3110-554-6080	BEARING, BALL, ANNULAR: generator idler gear (43991-5306)	ea	1				*	2	2	10	20	B-14	2
P H	5340-282-1619	RING, RETAINING: starter idler gear bearing (96906-16625-3354)	ea	1				*	2	2	10	10	B-14	3
P H	3110-155-6675	BEARING, BALL, ANNULAR: starter idler gear (21450-700580)	ea	1				*	2	2	10	20	B-14	4
P H	9525-990-7799	WIRE, NICKEL COPPER: starter and generator idler gear bearing shafts to crankcase (4 pcs 12 in. lg) starter driven gearshaft bearing cage (2 pcs 18 in. lg) (96906-20995NC40)	ft	7				*	*	*	70	700	B-14	5
P H	5310-638-6274	NUT, SLOTTED, HEXAGON: generator and starter idler gearshafts to crankcase (21450-596610)	ea	4				1	2	3	80	400	B-14	6
P H	2815-861-1448	SHAFT, IDLER GEAR: starter (10898915)	ea	1				*	2	2	6	6	B-14	7

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		0109 — ACCESSORY DRIVING MECHANISMS AND RELATED PARTS — Continued												
P H	5330-171-6649	PACKING, PREFORMED: generator idler gearshaft (1), starter idler gearshaft (1)(☆☆parts kit - 2815-678-4245) (96906-28775-223)	ea	2				*	1	2	50		B-14	8
P H	3110-516-5490	BEARING, BALL, ANNULAR: starter driven gearshaft (2), generator drive gear (2) (21335-207K)	ea	4				*	1	2	40	75	B-14	9
P H	2815-861-1447	GEARSHAFT, SPUR: starter driven (10898779)	ea	1				*	2	2	6	6	B-14	10
P H	5315-012-4553	KEY, WOODRUFF: starter driven gearshaft (96906-35756-17)	ea	1				*	2	2	8	10	B-14	11
P H	2815-937-1467	CAGE, BEARING, ENGINE: starter driven gearshaft bearing (8761022)	ea	1				*	2	2	10	50	B-14	12
P H	5310-849-6883	NUT, SLOTTED, HEXAGON: starter driven gearshaft bearing cage (96906-35692-13)	ea	6				3	5	10	90	600	B-14	13
P H	5330-678-7106	SEAL, PLAIN, ENCASED: starter driven gearshaft (8395460)	ea	1				2	2	3	20	100	B-14	14
P2 H	2815-678-4238	GEAR, SPUR: starter drive (8682691)	ea	1				*	*	*	4	*	B-14	15
P H	5315-019-0777	PIN, COTTER: starter driven gear to starter driven gearshaft nut (96906-24665-291)	ea	1				2	2	3	20	100	B-14	16
P H	5330-438-1861	GASKET: starter adapter to crankcase (☆☆parts kit - 2815-678-4245) (10912558)	ea	1				2	2	3	25		B-14	17
P H	5310-333-7348	WASHER, FLAT: starter adapter to crankcase (8769576)	ea	4				3	5	10	80	400	B-14	18
P H	5310-950-0039	NUT, SELF-LOCKING: starter adapter to crankcase (96906-21044N6)	ea	4				3	5	10	80	400	B-14	19
P2 H	2990-498-2398	ADAPTER, STARTER ENGINE: (8725275)	ea	1				*	*	*	4	*	B-14	20
P H	5310-655-9859	NUT, SLOTTED, HEXAGON: starter drive gear (8761273)	ea	1				*	2	2	15	100	B-14	21

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		0109 — ACCESSORY DRIVING MECHANISMS AND RELATED PARTS — Continued												
P H	5330-579-6861	PACKING, PREFORMED: starter driven gearshaft bearing cage to crankcase (96906-28775-236)	ea	1				2	3	5	30	100	B-14	22
P H	5310-088-0552	NUT, SELF-LOCKING, HEXAGON: generator adapter to crankcase (96906-21044N7)	ea	1				2	2	3	20	100	B-14	23
P H	5310-167-0822	WASHER, FLAT: generator adapter to crankcase (88044-960-716)	ea	1				2	2	3	20	100	B-14	24
P H	5330-514-5678	SEAL, PLAIN, ENCASED: generator drive gear (8764886)	ea	1				2	2	3	20	100	B-14	25
P H	5305-988-1723	BOLT, MACHINE: generator adapter to crankcase and transmission adapter (7323986)	ea	5				3	6	11	100	150	B-14	27
P H	5310-655-9370	WASHER, LOCK: generator adapter to crankcase and transmission adapter (96906-35340-47)	ea	5				1	2	4	100	500	B-14	28
P2 H	2920-177-7844	ADAPTER, GENERATOR: (10882773)	ea	1				*	*	*	3	*	B-14	29
X1 H		GASKET: generator adapter to crankcase (☆☆parts kit-2815-678-4245) (8761081)	ea	1									B-14	30
P2 H	2815-678-4236	GEARSHAFT, SPUR: generator drive (8682814)	ea	1				*	*	*	5	*	B-14	31
P H	2815-678-4233	SHAFT, IDLER GEAR: generator idler gear (8761440)	ea	1				*	2	2	8	10	B-14	32
P H	2815-851-9176	GEAR, SPUR: starter idler (10898777)	ea	1				*	2	2	8	8	B-14	33
P2 H	2815-678-4239	GEAR, SPUR: generator idler (8682689)	ea	1				*	*	*	3	*	B-14	34
		STUD, PLAIN: injection advance bearing cap to accessory drive housing												
P H	5307-678-6884	0.003 oversize (7992689)	ea	2				*	2	2	12	16	B-26	10
P H	5307-678-6885	0.007 oversize (7992690)	ea	2				*	2	2	12	16	B-26	10
P H	2910-678-4722	GEARSHAFT, SPUR: fuel injection metering pump (7320464)	ea	1				*	2	2	6	5	B-26	11

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		0109 — ACCESSORY DRIVING MECHANISMS AND RELATED PARTS — Continued												
X2 H	5310-402-8379	WASHER, RECESSED: injection pump driven gearshaft (8761420)	ea	1									B-26	12
P H	5315-241-2916	PIN, STRAIGHT, HEADLESS: accessory drive housing to rear fan drive housing (88044-112718)	ea	2				*	2	2	6	20	B-26	13
P H	3110-554-3197	BEARING, BALL, ANNULAR: injection pump driven gearshaft (21335-206KFS10179)	ea	1				*	2	2	10	20	B-26	14
		STUD, PLAIN: fan drive housing to accessory drive housing												
P H	5307-272-6331	0.003 oversize (8365809)	ea	5				2	2	3	30	40	B-26	15
P H	5307-272-6332	0.007 oversize (8365810)	ea	5				2	2	3	30	40	B-26	15
P H	4730-044-4689	PLUG, PIPE: oil port machining holes, accessory drive housing (7538990)	ea	4				*	2	2	6	10	B-26	17
		STUD, PLAIN: fan drive housing to accessory drive housing												
P H	5307-207-8620	0.003 oversize (7971982)	ea	4				2	2	3	24	32	B-26	20
P H	5307-207-8619	0.007 oversize (7971983)	ea	4				2	2	3	24	32	B-26	20
		STUD, PLAIN: accessory driven gear bearing support (2), injection pump drive gearshaft bearing support (2), fan drive bevel gearshaft bearing support (2)												
P H	5307-734-8803	0.003 oversize (7348803)	ea	6				2	3	5	36	48	B-26	22
P H	5307-734-8804	0.007 oversize (7348804)	ea	6				2	3	5	36	48	B-26	22
		STUD, PLAIN: fan drive housing to interfan drive shaft cover adapter												
P H	5307-734-8668	0.003 oversize (7348668)	ea	2				2	2	2	12	16	B-26	23
P H	5307-638-7608	0.007 oversize (14351-401975P007)	ea	2				2	2	2	12	16	B-26	23
P H	3110-120-4367	BEARING, ROLLER, NEEDLE: injection pump driven gearshaft (21450-709460)	ea	1				*	2	2	10	20	B-26	24
P H	2910-678-4734	SEAL, PLAIN-ENCASED: injection pump driven gearshaft (8764982)	ea	1				2	2	3	24	100	B-26	25

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		0109 — ACCESSORY DRIVING MECHANISMS AND RELATED PARTS — Continued												
P H	5340-804-3891	RING, RETAINING: injection pump driven gearshaft needle bearing (96906-16625-1150)	ea	1				2	2	2	15	100	B-26	26
P H	5315-058-9929	PIN, STRAIGHT, HEADLESS: accessory drive housing (1), rear fan drive housing (1) (21450-589929)	ea	2				*	2	2	6	200	B-26	27
P H	5310-950-0039	NUT, SELF-LOCKING: accessory drive housing to base (96906-21044N6)	ea	29				5	12	24	580	2900	B-26	35
P H	5310-333-7348	WASHER, FLAT: accessory drive housing (27), accessory drive housing base (16), injection advance bearing cap (2) (8679576)	ea	45				20	44	84	900	4500	B-26	36
P2 H	2930-438-1590	SUPPORT, FAN DRIVE: accessory driven gear (8725233)	ea	1				*	*	*	4	*	B-26	39
P H	5310-842-1488	NUT, SLOTTED, HEXAGON: accessory driven gear bearing support (2), accessory drive housing base (10), rear fan drive shaft bearing support (2), injection pump gearshaft drive bearing support (2), injection advance bearing cap (2) (96906-35692-21)	ea	18				3	7	14	350	1800	B-26	40
P H	5315-753-8333	PIN, COTTER: accessory driven gear bearing support to accessory drive housing (2), fuel injection metering pump gearshaft drive bearing support (2), accessory drive housing base to crankcase (10), injection advance bearing cap to accessory drive housing (2), rear fan drive gearshaft bearing support (2) (96906-24665-145)	ea	18				3	8	16	360	1800	B-26	41
P2 H	2910-135-6523	ADVANCE ASSEMBLY: automatic fuel injection (late) (10898738)	ea	1				*	*	*	1	*	B-26	43
X1 H		HOUSING, ACCESSORY DRIVE: (8761186)	ea	1									B-26	44
P H	5310-982-4912	NUT, SELF-LOCKING, HEXAGON: accessory drive housing to fan drive housing (96906-21045-5)	ea	9				1	3	6	135	900	B-26	45

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		0109 — ACCESSORY DRIVING MECHANISMS AND RELATED PARTS — Continued												
P H	5310-167-0820	WASHER, FLAT: accessory drive housing to fan drive housing (88044-960-516)	ea	9				2	4	8	180	900	B-26	46
X1 H		HOUSING, COOLING FAN DRIVE: rear (10935540)	ea	1									B-26	47
P2 H	3040-179-6656	CLAMP, HUB: injection pump drive gearshaft (8725243)	ea	1				*	*	*	4	*	B-26	48
P H	5310-088-0553	NUT, SELF-LOCKING, HEXAGON: interfan drive cover adapter to base (96906-21044-N5)	ea	4				*	2	2	60	400	B-26	59
P H	5305-269-3237	SCREW, CAP, HEXAGON HEAD: accessory drive housing base (96906-90727-61)	ea	6				1	3	5	120	120	B-26	63
X1 H		CAP, INJECTION BEARING: injection advance bearing cap (7320440)	ea	1									B-26	64
P2 H	2930-177-9162	HOUSING, FAN DRIVE: accessory drive housing base (8761206)	ea	1				*	*	*	2	*	B-26	65
		STUD, PLAIN: accessory drive housing base to accessory drive housing												
P H	5307-678-6876	0.003 oversize (7084444)	ea	4				2	2	3	24	32	B-26	89
P H	5307-678-6877	0.007 oversize (7084445)	ea	4				2	2	3	24	32	B-26	89
		STUD, PLAIN: accessory drive housing base to fan drive housing												
P H	5307-741-0163	0.003 oversize (7410163)	ea	9				2	3	5	36	45	B-26	90
P H	5307-741-0162	0.007 oversize (14351-401874S)	ea	9				2	3	5	36	45	B-26	90
P H	5340-291-3495	INSERT, SCREW THREAD: accessory drive housing breather tube flange (96906-124697)	ea	2				2	2	2	12	12	B-26	91
		STUD, PLAIN: accessory drive housing base to accessory drive housing (1), fan drive housing (1)												
P H	5307-678-6891	0.003 oversize (8761442)	ea	2				2	2	3	20	20	B-26	92
P H	5307-678-6890	0.007 oversize (8761443)	ea	2				2	2	3	20	20	B-26	92

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		0109 — ACCESSORY DRIVING MECHANISMS AND RELATED PARTS — Continued												
		STUD, PLAIN: accessory drive housing base to accessory drive housing												
P H	5307-678-6887	0.003 oversize (8761199)	ea	1				*	2	2	10	10	B-26	94
P H	5307-678-6888	0.007 oversize (8761200)	ea	1				*	2	2	10	10	B-26	94
		STUD, PLAIN: accessory drive housing base to accessory drive housing												
P H	5307-678-6880	0.003 oversize (7992649)	ea	2				2	2	2	12	16	B-26	95
P H	5307-678-6881	0.007 oversize (7992650)	ea	2				2	2	2	12	16	B-26	95
X1 H		KEY, WOODRUFF: injection pump driven gearshaft to injection pump drive coupling assembly (☆☆ parts kit - 2910-762-4857) (8761412)	ea	1									B-26	100
P2 H	5315-497-9650	PIN, STRAIGHT HEADED: injection pump driven shaftgear (8682763)	ea	1				*	*	*	5	*	B-26	101
X1 H		TUBE: accessory drive housing (3), rear fan drive housing (1) (8682513)	ea	4									B-26	102
		STUD, PLAIN: accessory drive housing to accessory drive housing base and crankcase												
P H	5307-678-6882	0.003 oversize (7992665)	ea	2				2	2	2	12	16	B-26	103
P H	5307-678-6883	0.007 oversize (7992666)	ea	2				2	2	2	12	16	B-26	103
		STUD, PLAIN: accessory drive housing to accessory cam drive bevel gearshaft support												
P H	5307-264-2472	0 003 oversize (7744813)	ea	6				2	3	5	36	48	B-26	104
P H	5307-264-2471	0.007 oversize (7744564)	ea	6				2	3	5	36	48	B-26	104
P2 H	4730-168-1935	RESTRICTOR, FLUID FLOW: rear fan drive housing (early) (10898735)	ea	1				*	*	*	2	*	B-26	105
P2 H	2910-402-4425	HOUSING ASSEMBLY: accessory drive (consists of items 44, 47 and 64, Fig. 26) (10935539)	ea	1				*	*	*	2	*	B-26	
X1 H		VANE, INJECTION ADVANCE:: (7320400)	ea	1									B-27	1
P H	5340-678-4257	RING, RETAINING: advance unit cover (8761413)	ea	1				2	2	2	15	100	B-27	2

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		0109 — ACCESSORY DRIVING MECHANISMS AND RELATED PARTS — Continued												
X1 H		COVER, INJECTION ADVANCE VANE HOUSING: early (8682733)	ea	1									B-27	3
X1 H		COVER, INJECTION ADVANCE VANE HOUSING: late (10889711)	ea	1									B-27	3
P H	2815-678-4246	GEARSHAFT, BEVEL, SPUR: accessory driven engine (8725248)	ea	1				2	2	2	12	10	B-27	4
P H	3110-554-3272	BEARING, BALL, ANNULAR: accessory driven gear, injection advance vane housing (29337-3L11M46)	ea	1				2	2	3	20	25	B-27	5
P H	2910-678-4730	SHIM: accessory driven gear bearing (8761041)	ea	1				2	2	2	12	20	B-27	6
P H	5306-678-4259	BOLT, MACHINE: injection advance vane housing to gearshaft (early) (7341633)	ea	6				3	7	13	120	120	B-27	7
P H	2910-545-1558	PARTS KIT, AUTOMATIC INJECTION ADVANCE ASSEMBLY: (5702641)	ea	1				*	2	2	6	8	B-27	
		Composed of:												
X1 H		8-SEAL, INJECTION ADVANCE VANE: (10882649)											B-27	8.1
X1 H		8-SPRING, INJECTION ADVANCE VANE SEAL: (10882650)											B-27	8.2
P H	5340-682-1619	RING, RETAINING: injection pump drive gear shaft bearing (21450-586365)	ea	1				2	2	2	15	100	B-27	9
P2 H	3110-529-9480	BEARING, BALL, ANNULAR: injection pump drive gearshaft (21335-911OK)	ea	1				*	*	*	1	*	B-27	10
P H	9525-803-3044	WIRE, NICKEL COPPER: injection advance vane housing (3 pcs 12 in. lg) (96906-20995NC32)	ft	3				*	*	*	30	300	B-27	11
P H	5306-837-9469	BOLT, MACHINE: injection advance vane housing (10898746)	ea	6				3	7	13	120	120	B-27	12

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		0109 — ACCESSORY DRIVING MECHANISMS AND RELATED PARTS — Continued												
P H	2910-678-4728	GEARSHAFT, SPUR: injection pump drive (8682729)	ea	1				*	2	2	8	12	B-27	13
X1 H		RING, ADJUSTING: injection advance flyweight (8682732)	ea	1									B-27	14
X1 H		PIN, STRAIGHT, THREADED: injection advance flyweight fulcrum (8682665)	ea	2									B-27	15
P H	2910-827-2816	SPRING, HELICAL, EXTENSION: fuel injection advance flyweight (10883098)	ea	2				2	2	3	24	50	B-27	16
P2 H	2910-678-4729	HOUSING, ADVANCE OIL: valve (8682731)	ea	1				*	*	*	2	*	B-27	17
X1 H		HOUSING, FLYWEIGHT: injection advance (7320404)	ea	1									B-27	18
X1 H		HOUSING, INJECTION ADVANCE VANE: (8682730)	ea	1									B-27	19
X1 H		FLYWEIGHT, INJECTION ADVANCE: (10865355)	ea	2									B-27	63
P H	5310-141-1795	WASHER, FLAT: injection advance flyweight fulcrum pin (88044-960-416)	ea	2				*	1	2	40	200	B-27	64
P H	5310-176-8108	NUT, SLOTTED, HEXAGON: injection advance flyweight fulcrum pin (88044-320-4)	ea	2				*	1	2	40	200	B-27	65
P H	5315-839-5820	PIN, COTTER: injection advance flyweight fulcrum pin (96906-24665-134)	ea	2				*	1	2	40	200	B-27	66
		FUEL SYSTEM **0301 — FUEL INJECTOR**												
P2 H	2910-402-4422	BASE, INJECTION: pump assembly (8761085)	ea	1				*	*	*	3	*	B-2	2
P H	5330-582-2855	PACKING, PREFORMED: injection pump base assembly, oil transfer tube to crankcase (☆☆parts kit - 2815-678-4245) (96906-28775-113)	ea	1				*	1	1	25		B-2	3

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					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0301 — FUEL INJECTOR — Continued												
P H	5305-725-0154	SCREW, CAP, HEXAGON: injection pump base assembly to crankcase (96906-90727-112)	ea	4				1	2	3	80	80	B-2	4
P H	5310-584-5272	WASHER, LOCK: injection pump base to crankcase (96906-35338-48)	ea	4				1	2	3	80	400	B-2	5
P H	5340-678-3309	INSERT, SCREW THREAD: crankcase to injection pump base (8352636)	ea	4				2	2	3	24	32	B-2	18
P F T	2910-064-6265	PUMP, FUEL METERING: (Refer to TM 9-2910-212-34 and 35P for component parts) (10912447)	ea	1	1	1	2	1	1	2	12	20	B-15	6
P F	5306-807-9371	BOLT, MACHINE: fuel injection metering pump assembly (88044-178H41A)	ea	2	*	1	2	*	1	2	40	40	B-15	7
P F	9525-990-7799	WIRE, NICKEL COPPER: fuel injection pump assembly to base (2 pcs 24 in. lg) (96906-20995NC40)	ft	4	*	1	2	*	1	2	40	400	B-15	8
P F	5310-149-9116	WASHER, RECESSED: fuel injection pump assembly to base (96906-20002C8)	ea	4	1	2	3	1	2	3	80	400	B-15	9
P F	5306-678-4260	BOLT, MACHINE: fuel injection metering pump assembly (7323988)	ea	2	2	4	7	2	4	7	60	60	B-15	10
P F	5330-579-3156	PACKING, PREFORMED: fuel injection pump base oil transfer tube to fuel injection metering pump (☆☆parts kit - 2815-678-4245) (96906-28775-116)	ea	1	2	3	5	2	3	5	30		B-15	11
P F	2910-936-2276	CONNECTOR: fuel injector nozzle inlet (99066-SD7877)	ea	12	*	2	2	*	2	2	6	50	B-16	1
X1 F		BODY: fuel injection nozzle (01843-HH78371)	ea	12									B-16	2
P F	5340-089-8836	SPACER, RING: fuel injection nozzle (99066-SR7827)	ea	12	*	2	2	*	2	2	6	30	B-16	3

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		0301 — FUEL INJECTOR — Continued												
P F	5365-235-1941	SHIM SET, FUEL INJECTOR NOZZLE AND HOLDER: nozzle operating pressure adjustment (5702674)	ea	1	2	4	7	2	4	7	60	120	B-16	
		Composed of:												
P F	2910-878-9932	1-SHIM: (01843-SR7828-1)											B-16	4.1
X1 F		1-SHIM: (01843-SR7828-2)											B-16	4.2
X1 F		1-SHIM: (01843-SR7828-3)											B-16	4.3
X1 F		1-SHIM: (01843-SR7828-4)											B-16	4.4
X1 F		1-SHIM: (10843-SR7828-5)											B-16	4.5
P F	2910-878-9933	SEAT, NOZZLE AND HOLDER: fuel injector (99066-GU7837)	ea	12	*	2	2	*	2	2	6	30	B-16	5
P F	5330-542-1586	PACKING, PREFORMED: fuel injector nozzle holder to retainer (☆☆ parts kit - 2815-678-4245) (96906-28775-118)	ea	12	8	18	33	8	18	33	360		B-16	6
X1 F		RETAINER: fuel injection nozzle (10865292)	ea	12									B-16	7
P O	2910-078-4866	PACKING, PREFORMED: fuel injector nozzle holder (☆☆ parts kit - 2815-678-4245) (10935359	ea	12	8	18	33	8	18	33	360		B-16	8
P F	2910-762-4587	PARTS KIT, FLEXIBLE COUPLING: fuel injection pump (5704366)	ea	1	2	3	4	2	3	4	30	50	B-16	
		Composed of:												
X1 F		2—KEY: (8761412)											B-16	9.1
P F	5330-256-0201	1—PACKING: (88044-6230-16)											B-16	9.2
P F	2910-106-1981	2—RING: (86988-C3062-8)											B-16	9.3
X1 F		4—SPACER: (86988-C3062-5)											B-16	9.4
P F	5310-637-9541	4—WASHER: (96906-35338-46)											B-16	9.5
X1 F		4—BOLT: (86988-03062-11)											B-16	9.6
X1 F		DIAPHRAGM PACK: (complete) (05821-2481528)	ea	1									B-16	10
X2 F	3010-087-9530	COUPLING, SHAFT, FLEXIBLE: injection pump drive assembly (use 7323990) (10951167)	ea	1									B-16	11
X1 F		FLANGE, COUPLING: (99551-2480888)	ea	1									B-16	12

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					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0301 — FUEL INJECTOR — Continued												
X1 F		RING, PILOT: (99551-648557)	ea	1									B-16	13
P F	5310-637-9541	WASHER, LOCK: pilot ring to diaphragm pack, fuel injection drive coupling (96906-35338-46)	ea	4	*	*	1	*	*	1	20	100	B-16	14
P F	5306-944-7537	BOLT, CLOSE TOLERANCE: pilot ring to diaphragm pack fuel injection pump drive assembly (88044-176C6A)	ea	4	*	*	1	*	*	1	20	20	B-16	15
P F	5310-584-7888	WASHER, LOCK: fuel injection pump (drive coupler), coupling to drive shaft (96906-35338-51)	ea	2	*	*	1	*	*	1	20	100	B-16	16
P F	5310-655-9590	NUT, PLAIN, HEXAGON: fuel injection pump coupling to drive shaft (7340058)	ea	2	*	*	1	*	*	1	20	100	B-16	17
X1 F		SLEEVE: fuel injection pump coupling (86988-C3062-2)	ea	1									B-16	18
X1 F		HUB: fuel injection pump coupling (86988-C3062-4)	ea	1									B-16	19
P F	2910-678-4725	COUPLING, SHAFT: injection pump drive assembly (7323990)	ea	1	*	2	2	*	2	2	10	10	B-16	20
X1 F		HUB: fuel injection pump coupling (86988-C3062-3)	ea	1									B-16	21
X1 F		PLUG: fuel injection pump coupling (86988-C3062-9)	ea	2									B-16	22
X1 F		SLEEVE: fuel injection pump coupling (86988-C3062-1)	ea	1									B-16	23
P O	5310-861-1406	WASHER, FLAT: fuel injector nozzle seat(☆☆ parts kit—2815-678-4245) (7748837)	ea	12	7	16	29	7	16	29	300		B-16	24
P O R	2910-064-6269	NOZZLE AND HOLDER, FUEL: fuel injector (10912452)	ea	12	2	2	3	2	2	3	20	20	B-16	25
X1 F		NUT: fuel injection nozzle (01843-NT7899)	ea	12									B-16	26
X1 F		BODY: fuel injection nozzle tip (01843-VB77144-4)	ea	12									B-16	27

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION (a) FIGURE NO.	(b) ITEM NO.
		0301 — FUEL INJECTOR — Continued												
P F	2910-064-6262	NOZZLE, FUEL INJECTOR: (10912481)	ea	12	4	9	16	4	9	16	144	1200	B-16	28
X1 F		VALVE: fuel injection nozzle (01843-VA77162)	ea	12									B-16	29
X1 F		SPACER: fuel injection nozzle (01843-SR7829)	ea	12									B-16	30
X1 F		SEAT: fuel injection nozzle (10951061)	ea	12									B-16	31
X1 F		SPRING: fuel injection nozzle (01843-SP7824)	ea	12									B-16	32
X1 F		SPRING: fuel injection nozzle (7320485)	ea	12									B-16	33
P O	2910-078-5313	TUBE ASSEMBLY, METAL: fuel injection pump to injector nozzle, cylinder No. 6R (10865404)	ea	1	*	2	2	*	2	2	8	12	B-17	1
P O	2910-078-5312	TUBE ASSEMBLY, METAL: fuel injection pump to injector nozzle, cylinder No. 5R (10865402)	ea	1	*	2	2	*	2	2	8	12	B-17	2
P O	2910-078-5311	TUBE ASSEMBLY, METAL: fuel injection pump to injector nozzle, cylinder No. 4R (10865400)	ea	1	*	2	2	*	2	2	8	12	B-17	3
P O	2910-078-5310	TUBE ASSEMBLY, METAL: fuel injection pump to injector nozzle, cylinder No. 3R (10865398)	ea	1	*	2	2	*	2	2	8	12	B-17	4
P O	2910-078-5309	TUBE ASSEMBLY, METAL: fuel injection pump to injector nozzle, cylinder No. 2R (10865396)	ea	1	*	2	2	*	2	2	8	12	B-17	5
P O	2910-078-5308	TUBE ASSEMBLY, METAL: fuel injection pump to injector nozzle, cylinder No. 1R (10865394)	ea	1	*	2	2	*	2	2	8	12	B-17	6
P O	5306-151-1420	BOLT, MACHINE: fuel injection tube assembly clamp (88044-4-14A)	ea	30	5	12	24	5	12	24	600	600	B-17	7
P O	2815-239-5810	PLATE, FUEL LINE CLAMPS: (10865334)	ea	19	*	2	2	*	2	2	10	20	B-17	8
P O	2910-907-9566	CLAMP: fuel injection lines (10865333)	ea	30	*	2	2	*	2	2	10	20	B-17	9
P O	5340-456-1792	BRACKET, DOUBLE ANGLE: fuel injection lines clamp to fan tower (10865317)	ea	1	*	2	2	*	2	2	6	11	B-17	10

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					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0301 — FUEL INJECTOR — Continued												
P O	5310-061-7325	NUT, SELF-LOCKING, HEXAGON: fuel injection lines clamps (96906-21045-4)	ea	30	5	12	24	5	12	24	600	3000	B-17	11
P O	4720-177-6189	HOSE ASSEMBLY: fuel return, cylinder No. 5—6 (left bank) (10951341-2)	ea	1	2	2	3	2	2	3	20	30	B-17	16
P O	4730-278-5824	CONNECTOR, MULTIPLE FLUID, PRESSURE LINE: fuel injector nozzle to intercylinder fuel return tubes (cylinder No. 2 through 6, left and right) (88044-779-4)	ea	10	*	2	2	*	2	2	10	23	B-17	17
P O	2910-678-3294	TUBE ASSEMBLY, METAL: cylinder No. 6 left bank, return tube to injection pump fuel return tube tee (8761492)	ea	1	*	2	2	*	2	2	8	8	B-17	18
P O	4730-803-7728	CROSS TUBE: injection pump fuel return (10865290)	ea	1	*	2	2	*	2	2	6	10	B-17	19
P O	5310-298-9252	NUT, PLAIN, HEXAGON: injection pump fuel return cross to shroud (21450-423884)	ea	1	*	2	2	*	2	2	20	100	B-17	20
P O	5310-809-8541	WASHER, FLAT: injection pump return tube cross to shroud (96906-27183-27)	ea	1	*	*	1	*	*	1	20	100	B-17	21
P O	2910-678-3292	TUBE ASSEMBLY, METAL: cylinder No. 6 right bank, fuel return tube to injection fuel return hose tee (8761485)	ea	1	*	2	2	*	2	2	8	10	B-17	22
P O	2910-078-5314	TUBE ASSEMBLY, METAL: fuel injection pump to injector nozzle, cylinder No. 1L (10865406)	ea	1	*	2	2	*	2	2	8	12	B-17	30
P O	2910-078-5315	TUBE ASSEMBLY, METAL: fuel injection pump to injector nozzle, cylinder No. 2L (10865408)	ea	1	*	2	2	*	2	2	8	12	B-17	31
P O	2910-078-5316	TUBE ASSEMBLY, METAL: fuel injection pump to injector nozzle, cylinder No. 3L (10865410)	ea	1	*	2	2	*	2	2	8	12	B-17	32
P O	2910-078-5317	TUBE ASSEMBLY, METAL: fuel injection pump to injector nozzle, cylinder No. 4L (10865412)	ea	1	*	2	2	*	2	2	8	12	B-17	33

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		0302 — FUEL PUMPS, LINES AND FITTINGS — Continued												
P O	2910-078-5318	TUBE ASSEMBLY, METAL: fuel injection pump to injector nozzle, cylinder No. 5L (10865414)	ea	1	*	2	2	*	2	2	8	12	B-17	34
P O	2910-078-5319	TUBE ASSEMBLY, METAL: fuel injection pump to injector nozzle, cylinder No. 6L (10865416)	ea	1	*	2	2	*	2	2	8	12	B-17	35
P O	2910-410-5756	SUPPORT, FUEL INJECTION LINES: clamps to valve adjusting cover, cylinders No. 2, 3, 5, 6L and 5R (10865335)	ea	5	*	2	2	*	2	2	10	23	B-17	36
P O	5305-225-3842	SCREW, CAP, HEXAGON HEAD: fuel tube bracket to injection pump cover (96906-90728-9)	ea	2	*	1	2	*	1	2	40	60	B-17	37
P2 O	5340-490-0871	BRACKET, DOUBLE ANGLE: fuel injection lines clamp to fuel injection cover (10865316)	ea	1	*	*	*	*	*	*	2	*	B-17	38
P O	5310-167-0835	WASHER, FLAT: fuel injection tube clamps and plate to fuel injection bracket (21450-502220)	ea	2	*	1	2	*	1	2	40	200	B-17	39
P O	2910-410-5755	SUPPORT, FUEL INJECTION LINES: clamp to valve adjusting cover (cylinders No. 2 and 4R) (10865332)	ea	2	*	2	2	*	2	2	6	11	B-17	40
		0302—FUEL PUMPS, LINES AND FITTINGS												
P O	5340-535-6471	CLAMP, LOOP: fuel shutoff solenoid cable and fuel inlet hose to crankcase breather tube (96906-21919-G16)	ea	3	*	1	1	*	1	1	30	62	B-11	31
P O	5340-535-6469	CLAMP, LOOP: fuel shutoff solenoid cable and fuel inlet hose to crankcase breather tube (96906-21919-G3)	ea	3	*	1	2	*	1	2	45	75	B-11	32
P O	5306-993-1851	SCREW, MACHINE: fuel shutoff solenoid cable and fuel inlet hose to crankcase breather tube (96906-35207-267)	ea	3	1	2	3	1	2	3	60	90	B-11	33
P O	5305-958-4346	SCREW, MACHINE: fuel shutoff cable to shroud (96906-35207-215)	ea	4	*	1	1	*	1	1	24	40	B-11	48

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					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0302 — FUEL PUMPS, LINES AND FITTINGS — Continued												
P O	5310-616-3554	WASHER, LOCK: fuel shutoff cable to shroud (96906-35335-29)	ea	4	1	2	3	1	2	3	80	400	B-11	49
P O	5310-934-9734	NUT, PLAIN, HEXAGON: fuel shutoff cable to shroud (96906-35650-342)	ea	4	1	2	3	1	2	3	80	400	B-11	50
P O	2910-879-1666	LEAD, ELECTRICAL: fuel injection pump fuel shutoff solenoid (10882641)	ea	1	*	2	2	*	2	2	10	31	B-11	51
P O	5310-982-4912	NUT, SELF-LOCKING, HEXAGON: fuel supply pump to adapter (96906-21045-5)	ea	4	2	4	8	2	4	8	80	400	B-15	20
P O	5310-167-0820	WASHER, FLAT: fuel supply pump to adapter (88044-960-516)	ea	4	2	4	8	2	4	8	80	400	B-15	21
P O R	2910-678-4673	FUEL PUMP KIT, ENGINE: (replaces production pump—10882763) (refer to TM 9-2910-213-34 and 35P for component parts) (8725292)	ea	1	*	2	2	*	2	2	10	12	B-15	22
P O	2910-741-5354	GASKET: fuel pump mounting (☆☆ parts kit—2815-678-4245) (7415354)	ea	1	2	3	6	2	3	6	50		B-15	23
P O	2910-678-3299	CONNECTOR, FLUID: fuel injector nozzle to intercylinder fuel return assembly (cylinder No. 1, left and right) (7324661)	ea	2	*	2	2	*	2	2	6	7	B-17	12
P O	5310-678-5370	WASHER, FLAT: fuel return adapter and elbow to fuel injector nozzle (☆☆ parts kit—2815-678-4245) (7323994)	ea	24	12	25	48	12	25	48	480		B-17	13
P O	4720-177-6188	HOSE ASSEMBLY: fuel return, cylinder No. 1-2, 2-3, 3-4, 4-5, and L and R banks and 5-6R bank (10951341-1)	ea	9	5	10	18	5	10	18	180	300	B-17	14
P O	4730-278-0375	BOLT, FLUID PASSAGE: fuel return adapter and elbow to fuel injector nozzle (88044-775-4)	ea	12	*	1	1	*	1	1	24	24	B-17	15
P O	5340-050-2740	CLAMP, LOOP: injection pump fuel return hose to turbosupercharger oil hose (21450-502740)	ea	1	*	2	2	*	2	2	10	20	B-17	23

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		0302 — FUEL PUMPS, LINES AND FITTINGS — Continued												
P O	5340-298-9406	CLAMP: injection pump fuel return hose to turbosupercharger oil hose (96906-21919-G9)	ea	1	*	2	2	*	2	2	10	17	B-17	24
P O	5305-993-1851	SCREW, MACHINE: fuel injection return hose to turbosupercharger oil hose clamp (96906-35207-267)	ea	1	*	*	1	*	*	1	20	30	B-17	25
P O	5310-902-6676	NUT, SELF-LOCKING: fuel injection return hose to turbosupercharger oil hose clamp (96906-21083-N3)	ea	1	*	*	1	*	*	1	20	100	B-17	26
P O	2910-792-5393	HOSE ASSEMBLY, TEFLON: fuel injection return (10882940)	ea	1	2	2	2	2	2	2	12	40	B-17	27
P O	2910-790-2301	VALVE, CHECK: fuel injection pump outlet elbow to fuel return hose (8759089)	ea	1	*	2	2	*	2	2	8	9	B-17	28
P O	2910-410-5758	SUPPORT, FUEL INJECTION LINES: clamp to valve adjusting cover plate (10865331)	ea	1	*	2	2	*	2	2	6	11	B-17	29
P O	4730-902-3188	ELBOW, PIPE TO TUBE: primary fuel filter (outlet) (1), secondary fuel filter (inlet) (1), outlet (1) (10935536)	ea	3	2	3	5	2	3	5	36	150	B-19	1
P O	4730-044-4035	BUSHING, PIPE: primary fuel filter (outlet) (1), secondary fuel filter (inlet) (1), (outlet) (1) (21450-444035)	ea	3	*	1	1	*	1	1	24	45	B-19	2
P O	4730-595-4402	ELBOW, TUBE: bulkhead fuel filter outlet hose (88044-833-8J)	ea	1	2	2	2	2	2	2	12	50	B-19	9
P O	5310-809-8533	WASHER, FLAT: fuel injection hose bulkhead elbow (96906-27183-23)	ea	1	2	2	3	2	2	3	20	100	B-19	10
P O	5310-208-5775	NUT, PLAIN, HEXAGON: fuel injection hose bulkhead elbow (96906-24400-8)	ea	1	*	*	1	*	*	1	12	30	B-19	11
P O	5340-298-9406	CLAMP, LOOP: fuel injection inlet hose to solenoid lead (96906-21919-G9)	ea	2	2	2	3	2	2	3	20	40	B-19	12
P O	2910-678-3285	TUBE ASSEMBLY, NON-METALLIC: fuel injection pump to bulkhead elbow (8761510)	ea	1	2	2	2	2	2	2	12	12	B-19	13

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					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0302 — FUEL PUMPS, LINES AND FITTINGS — Continued												
P O	5310-275-3683	WASHER, LOCK: fuel injection hose bulkhead elbow (96906-35335-40)	ea	1	2	2	3	2	2	3	20	100	B-19	14
P O	4720-461-9797	HOSE ASSEMBLY, NON-METALLIC: water separator fuel filter outlet elbow to bulkhead elbow (96906-28741-8-0300)	ea	1	*	*	1	*	*	1	20	100	B-19	42
P O	4720-420-4396	HOSE ASSEMBLY, NON-METALLIC: fuel pump outlet to water separator fuel filter inlet (96906-28741-8-0134)	ea	1	*	*	1	*	*	1	20	100	B-19	43
P O	4720-741-0397	HOSE ASSEMBLY, RUBBER: primary fuel filter outlet to check valve inlet (96906-28741-8-0204)	ea	1	*	*	1	*	*	1	20	100	B-19	48
P O	4730-753-9274	ELBOW, PIPE TO TUBE: primary fuel filter outlet hose to check valve inlet (7539274)	ea	1	2	2	2	2	2	2	12	50	B-19	49
P O	2910-795-1795	VALVE, FUEL BACK FLOW: (10882764)	ea	1	*	2	2	*	2	2	8	20	B-19	50
P O	5310-141-1795	WASHER, FLAT: fuel check valve to bracket (88044-960-416)	ea	2	*	1	2	*	1	2	40	200	B-19	51
P O	5310-582-5965	WASHER, LOCK: fuel check valve to bracket (96906-35338-44)	ea	1	*	*	1	*	*	1	20	100	B-19	52
P O	5305-267-8982	SCREW, CAP, HEXAGON HEAD: check valve to bracket (96906-90726-15)	ea	2	*	1	2	*	1	2	40	60	B-19	53
P O	4730-350-9786	ADAPTER, STRAIGHT PIPE TO TUBE: fuel check valve outlet (1), fuel pump inlet hose (1) (96906-39206-9)	ea	2	*	*	1	*	*	1	12	10	B-19	54
P O	2910-821-0659	TUBE ASSEMBLY, METAL: check valve outlet to fuel pump inlet (10882768)	ea	1	*	2	2	*	2	2	8	25	B-19	55
P O	4730-402-5143	ADAPTER, STRAIGHT, PIPE TO TUBE: fuel pump to outlet hose (10951334)	ea	1	*	2	2	*	2	2	6	10	B-19	56
P O	4720-996-8329	HOSE ASSEMBLY, RUBBER: fuel pump outlet adapter to secondary fuel filter inlet (96906-28741-8-0260)	ea	1	*	*	1	*	*	1	20	100	B-19	57

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		0302 — FUEL PUMPS, LINES AND FITTINGS — Continued												
P O	4720-720-2050	HOSE ASSEMBLY, RUBBER: secondary fuel filter outlet elbow to bulkhead elbow (96906-28741-8-0340)	ea	1	*	*	1	*	*	1	20	100	B-19	64
		0305—TURBOSUPERCHARGER												
P F	5340-678-3532	MOUNT, RESILIENT: turbosupercharger support yoke bolt (7320411)	ea	2	*	2	2	*	2	2	10	13	B-2	31
P F	5310-950-0039	NUT, SELF-LOCKING: left and right turbosupercharger support brace to left and right oil cooler support beam (2), left and right turbosupercharger support brace to left and right tie rod (2) (96906-21044N6)	ea	4	1	2	3	1	2	3	60	400	B-13	1
X2 F	2990-402-4430	TIE ROD, TURBOCHARGER: (8682558)	ea	1									B-13	2
X2 F	2990-453-5387	CLAMP, TURBOSUPERCHARGER: tie rod (8682451)	ea	1	*	*	*	*	*	*	1	*	B-13	3
P F	5305-269-3243	SCREW, CAP, HEXAGON HEAD: seat, clamp, and turbosupercharger tie rod to transmission adapter (96906-90727-67)	ea	2	*	1	2	*	1	2	40	60	B-13	4
P F	5310-637-9541	WASHER, LOCK: left and right turbosupercharger support to base (4), tie rod to base (4), tie rod to transmission adapter (2) (96906-35338-46)	ea	10	2	4	8	2	4	8	200	1000	B-13	5
P2 F	2910-402-4424	BRACE, TURBOCHARGER: support (right bank) (10912391)	ea	1	*	*	*	*	*	*	5	*	B-13	6
P F	5305-269-3236	SCREW, CAP, HEXAGON HEAD: left and right turbosupercharger support to left and right turbosupercharger base (4), turbosupercharger tie rod to left and right turbosupercharger base (4) (96906-90727-60)	ea	8	1	4	8	1	4	8	160	240	B-13	7
X2 F	2990-402-4432	SUPPORT ASSEMBLY, TURBOCHARGER: (8682750)	ea	2									B-13	8

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					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0305 — TURBOSUPERCHARGER — Continued												
P F	5307-682-5820	STUD, PLAIN: turbosupercharger base to turbosupercharger (8682787)	ea	4	2	3	6	2	3	6	40	60	B-13	9
X2 F	2990-402-4433	BASE ASSEMBLY, TURBOCHARGER: (8761086)	ea	2									B-13	10
X2 F	2815-406-4610	ELBOW, TURBOCHARGER: outlet (right bank) (8682749)	ea	1									B-13	11
P F	4730-032-2220	CLAMP, HOSE: intake manifold tube and turbosupercharger outlet elbow to tube connector (left and right) (94581-KU20-75-450S)	ea	8	*	2	2	*	2	2	10	20	B-13	12
M F		HOSE, RUBBER: intake manifold tubes, left and right banks (fabricate from 4720-202-7457) (4 pcs 4.125 in. lg) (8761490)	ft	4									B-13	13
P F	4720-202-7457	HOSE, RUBBER: (MIL-H-6000 4.000 in. id)	ft	2	4	4	4	4	4	4	48	150	B-13	13
P2 F	4710-245-8305	TUBE, STEEL: intake manifold tube and turbosupercharger outlet elbow connector, left bank (1), right bank (1) (7320458)	ea	2	*	*	*	*	*	*	3	*	B-13	14
P F	5307-837-7791	STUD, PLAIN: intake manifold turbosupercharger tubes to left and right manifold heater (7738011)	ea	8	2	3	6	2	3	6	48	64	B-13	15
P F	2990-678-4681	GASKET: intake manifold tube, turbosupercharger (left and right) (** parts kit-2815-678-4245) (8682797)	ea	2	2	3	6	2	3	6	50		B-13	16
P F	5310-088-0553	NUT, SELF-LOCKING, HEXAGON: intake manifold tubes to intake elbow (96906-21044N5)	ea	12	2	5	10	2	5	10	240	1200	B-13	17
X2 F	2815-406-4614	TUBE, INTAKE MANIFOLD: turbosupercharger, right and left banks (8761082)	ea	2									B-13	18
P F	5315-234-1863	PIN, COTTER: turbosupercharger support to transmission adapter (96906-24665-300)	ea	2	2	3	5	2	3	5	40	200	B-13	48
P F	5310-842-1295	NUT, PLAIN, BLIND RIVET: turbosupercharger support to transmission adapter (96906-35692-29)	ea	2	2	3	5	2	3	5	30	200	B-13	49

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		0305 — TURBOSUPERCHARGER — Continued												
X2 F	2815-406-4611	ELBOW, TURBOCHARGER OUTLET: (left bank) (8682748)	ea	1									B-13	50
P F	5306-180-0321	BOLT, MACHINE: turbosupercharger support to transmission adapter (88044-177-24)	ea	2	2	3	5	2	3	5	40	40	B-13	51
P2 F	2990-453-5386	SEAT, TIE ROD CLAMP: (8682752)	ea	2	*	*	*	*	*	*	4	*	B-13	52
P F	5310-080-6004	WASHER, FLAT: turbosupercharger support brace to oil cooler support beam, left and right bank (96906-15795-214)	ea	2	*	1	2	*	1	2	40	200	B-13	53
P F	5305-269-2806	SCREW, CAP, HEXAGON: turbosupercharger support brace to tie rod, left and right bank (96906-90726-63)	ea	2	*	1	2	*	1	2	40	60	B-13	54
P2 F	5310-809-4061	WASHER, FLAT: turbosupercharger support brace to tie rod, left and right banks (early) (96906-27183-15)	ea	2	*	*	1	*	*	1	12	20	B-13	55
P F	5330-498-6341	RETAINER, PACKING: turbosupercharger support brace to tie rod, left and right banks (late) (10935478)	ea	4	2	3	5	2	3	5	32	163	B-13	55
P2 F	2990-498-9356	BRACE, TURBOCHARGER: (left bank) (10912390)	ea	1	*	*	*	*	*	*	5	*	B-13	56
P F	5325-276-6096	GROMMET, RUBBER: turbosupercharger support brace, left and right banks (96906-35489-74)	ea	2	*	1	1	*	1	1	25	100	B-13	57
P F	5305-269-3236	SCREW, CAP, HEXAGON HEAD: turbosupercharger support brace to oil cooler support beam (right and left banks) (96906-90727-60)	ea	2	*	1	2	*	1	2	40	60	B-13	58
P F T	2990-064-6264	TURBOSUPERCHARGER: assembly (LH) (refer to TM 9-2990-200-34 and -35P for component parts) (10912477)	ea	1	1	2	2	1	2	2	10	5	B-15	1
P F T	2990-064-6263	TURBOSUPERCHARGER: assembly (RH) (refer to TM 9-2990-200-34 and -35P for component parts) (10912478)	ea	1	1	2	2	1	2	2	10	5	B-15	1

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		0305 — TURBOSUPERCHARGER — Continued												
P F	5310-982-4912	NUT, SELF-LOCKING, HEXAGON: turbosupercharger outlet elbows to turbosupercharger (left) (6), right (6), (96906-21045-5)	ea	12	2	5	10	2	5	10	240	1200	B-15	28
P F	2990-678-4676	GASKET, turbosupercharger outlet elbow, right and left (** parts kit-2815-678-4245) (7320459)	ea	2	2	3	6	2	3	6	50		B-15	29
P F	5310-167-0823	WASHER, FLAT: turbosupercharger to base, left and right (88044-960-816)	ea	4	1	2	3	1	2	3	80	400	B-15	30
P F	5310-062-4954	NUT, SELF-LOCKING: turbosupercharger to turbosupercharger base, right and left (96906-21045-8)	ea	4	1	2	3	1	2	3	80	400	B-15	31
		0308—ENGINE SPEED GOVERNOR AND CONTROLS												
P F	3110-227-3620	BEARING, BALL, ANNULAR: governor control lever support (2), throttle control cross shaft (4) (8393931)	ea	6	2	4	7	2	4	7	60	100	B-18	1
X2 F	2990-402-4429	SUPPORT, CONTROL LEVER: governor control lever, intermediate (8761016)	ea	1									B-18	2
P F	5310-982-4912	NUT, SELF-LOCKING, HEXAGON: governor control lever support to front fan drive housing (96906-21045-5)	ea	3	1	2	3	1	2	3	60	300	B-18	3
P F	5315-616-5526	KEY, WOODRUFF: control lever (1), governor control lever (1), throttle shock spring actuating lever (1) (96906-35756-8)	ea	3	*	1	1	*	1	1	24	30	B-18	4
P F	5306-180-3357	BOLT, MACHINE: control rod intermediate lever to governor lever (2), control rod throttle control cross shaft lever to intermediate lever (2) (88044-5CH11)	ea	4	1	2	3	1	2	3	80	80	B-18	5
P F	3120-516-0953	BEARING, PLAIN, ROD END: throttle control cross shaft to intermediate lever rod assembly (73134-HML5FG)	ea	1	*	2	2	*	2	2	10	20	B-18	6
X2 F	2990-402-4431	LEVER, GOVERNOR CONTROL: intermediate (8761018)	ea	1									B-18	7

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		0308 — ENGINE SPEED GOVERNOR AND CONTROLS — Continued												
P F	5315-753-8333	PIN, COTTER: control rod intermediate lever to governor lever (2), control rod throttle cross shaft to intermediate lever (2) (96906-24665-145)	ea	4	1	2	3	1	2	3	80	400	B-18	8
P F	5310-849-6883	NUT, SLOTTED, HEXAGON: governor control rod (2), cross shaft control rod (2) (96906-35692-13)	ea	4	1	2	3	1	2	3	80	400	B-18	9
P F	5310-167-0820	WASHER, FLAT: governor control rod to lever (1), governor control lever bolt (1) (88044-960-516)	ea	2	*	1	2	*	1	2	40	200	B-18	10
P F	2590-678-4129	CONNECTING LINK, RIGHT: intermediate lever to governor lever (8682781)	ea	1	*	2	2	*	2	2	10	20	B-18	11
P F	5310-407-9566	WASHER, LOCK: vehicle control lever (1), governor control lever (1), throttle shock spring actuating lever (1) (96906-35338-45)	ea	3	1	2	3	1	2	3	60	300	B-18	12
P F	5306-051-4076	BOLT, MACHINE: vehicle control lever (1), governor control lever (1), throttle shock spring actuating lever (1) (96906-90727-34)	ea	3	1	2	3	1	2	3	60	60	B-18	13
P2 F	2990-484-0771	ROD, CONTROL: throttle cross shaft lever to intermediate lever (8682783)	ea	1	*	*	*	*	*	*	2	*	B-18	14
P F	5310-012-2198	NUT, PLAIN, HEXAGON: throttle cross shaft to intermediate lever rod assembly lock (7403193)	ea	1	*	2	2	*	2	2	6	10	B-18	15
P F	5340-803-7305	RING, RETAINING: throttle control shaft (6), throttle control intermediate cross shaft (2) (96906-16624-1062)	ea	8	1	3	5	1	3	5	120	800	B-18	16
P2 F	2815-193-8213	LEVER ASSEMBLY, CONTROL: throttle shock spring actuating (8682676)	ea	1	*	*	*	*	*	*	5	*	B-18	17
P F	5315-828-4485	PIN, STRAIGHT, HEADLESS: lever control assemblies (96906-16555-655)	ea	3	1	2	3	1	2	3	60	150	B-18	18
X1 F		LEVER CONTROL: vehicle control lever (8682709)	ea	1									B-18	19
P2 F	2590-932-5001	LEVER ASSEMBLY, THROTTLE: control vehicle (8682677)	ea	1	*	*	*	*	*	*	5	*	B-18	20

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					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0308 — ENGINE SPEED GOVERNOR AND CONTROLS — Continued												
X1 F		LEVER CONTROL: vehicle (8682708)	ea	1									B-18	21
		PLATE, CAMSHAFT, ENGINE: camshaft end cover bearing (right bank) (refer to fig. B-5-43) (8682751)											B-18	22
X2 F	3040-406-1536	SHAFT, STRAIGHT: throttle control cross (8761015)	ea	1									B-18	23
P2 F	5310-491-0327	WASHER, FLAT: throttle shock spring (10889715)	ea	2	*	*	*	*	*	*	5	*	B-18	24
P F	2590-838-3596	SPRING, HELICAL, TORSION: throttle shock spring (10889714)	ea	1	*	2	2	*	2	2	6	6	B-18	25
P F	5340-754-1083	RING, RETAINING: governor control lever support (2), throttle control cross shaft bearings (4) (96906-16625-1137)	ea	6	2	3	6	2	3	6	48	58	B-18	26
P2 F	2990-402-4428	LEVER ASSEMBLY, CONTROL: cross shaft governor (10865324)	ea	1	*	*	*	*	*	*	5	*	B-18	27
X1 F		LEVER CONTROL: throttle control cross shaft governor (10865322)	ea	1									B-18	28
P F	5310-853-9335	NUT, PLAIN, HEXAGON: governor lever stop screw (96906-35691-13)	ea	1	*	*	1	*	*	1	20	100	B-18	29
P F	5305-891-7871	SCREW, MACHINE: governor lever stop (10865321)	ea	1	*	2	2	*	2	2	6	10	B-18	30
P F	5306-042-5592	BOLT, ASSEMBLED WASHER: throttle control shaft support to damper housing (24617-425592)	ea	1	*	2	2	*	2	2	10	20	B-18	31
X2 F	3040-402-5217	BRACKET, EYE, ROTATING SHAFT: throttle control cross shaft (10865323)	ea	1									B-18	32
P F	3120-516-0955	BEARING, PLAIN, ROD END: throttle control cross shaft to intermediate lever rod assembly (73134-HM5MG)	ea	1	*	2	2	*	2	2	10	50	B-18	33
P F	5310-638-2247	NUT, PLAIN, HEXAGON: throttle control cross shaft to intermediate lever rod assembly lock (21450-455332)	ea	1	*	*	1	*	*	1	15	100	B-18	34

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		0308 — ENGINE SPEED GOVERNOR AND CONTROLS — Continued												
X2 F	3040-406-1537	SHAFT, STRAIGHT: governor control lever housing (8682786)	ea	1									B-18	35
		0309—FUEL FILTERS												
P2 H	2910-455-5836	BRACKET, FILTER, FUEL: manifold heater (10882772)	ea	1				*	*	*	1	*	B-6	46
P F	5310-637-9541	WASHER, LOCK: primary fuel filter to bracket (4), secondary fuel filter to bracket (4) (96906-35338-46)	ea	8	1	4	7	1	4	7	160	800	B-19	5
P F	5305-269-2803	SCREW, CAP, HEXAGON HEAD: primary fuel filter to bracket (4), secondary fuel filter to bracket (4) (96906-90726-60)	ea	8	1	4	7	1	4	7	160	240	B-19	6
P2 F	2910-402-4423	BRACKET ASSEMBLY: secondary fuel filter (10865074)	ea	1	*	*	*	*	*	*	1	*	B-19	7
P O	2910-999-9454	TUBING, PREFORMED: secondary fuel filter drain tee to control valve (early) (10951427)	ea	1	*	2	2	*	2	2	8	10	B-19	8
P H	2910-168-2624	BRACKET, FUEL FILTER: primary (10865170)	ea	1				*	2	2	6	10	B-19	15
P2 O	2910-795-1783	FILTER, FLUID PRESSURE: primary (refer to fig. B-20) (8395476)	ea	1	*	*	*	*	*	*	4	*	B-19	16
P F	5306-225-9107	BOLT, MACHINE: water separator to bracket (96906-90726-52)	ea	2	*	1	2	*	1	2	40	40	B-19	17
X1 F		BRACKET: fuel filter secondary (10951434-1)	ea	1									B-19	18
P2 F	2910-134-4734	BRACKET, FUEL FILTER: assembly, secondary (10951434)	ea	1	*	*	*	*	*	*	1	*	B-19	19
P F	5340-847-0734	INSERT, SCREW THREAD: water separator bracket (96906-21209-F5-15)	ea	4	*	1	1	*	1	1	24	24	B-19	20
P O	4730-554-8015	NUT, TUBE COUPLING: fuel filter drain tubes to control valves (outlet) (96906-21921-4)	ea	4	*	1	2	*	1	2	48	120	B-19	21

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					(a) 1-20	(b) 21-60	(c) 61-100	(a) 1-20	(b) 21-60	(c) 61-100			(a) FIGURE NO.	(b) ITEM NO.
		0309 — FUEL FILTERS — Continued												
P O	2910-999-9452	VALVE ASSEMBLY: fuel filter drain (10947970)	ea	2	2	2	3	2	2	3	16	24	B-19	22
P O	5310-012-0239	WASHER, LOCK: fuel filter drain valve (96906-35337-29)	ea	2	*	1	2	*	1	2	40	200	B-19	23
X2 O	5340-407-0664	BRACKET, ANGLE: fuel filter outboard drain tube stowage (10951462)	ea	3									B-19	24
P O	5306-019-2417	BOLT, ASSEMBLED WASHER: fuel filter outboard drain tube stowage brackets and straps to oil cooler frame (5), fuel filter drain control valve bracket to oil cooler frame (2) (21450-192417)	ea	7	1	3	6	1	3	6	140	210	B-19	25
P O	2910-781-1462	STRAP, FUEL FILTER: outboard drain tube stowage (10951463)	ea	2	2	2	2	2	2	2	12	20	B-19	26
P O	2910-781-1457	HOSE, FILTER DRAIN: fuel filter outboard drain (10935214-4)	ea	2	*	2	2	*	2	2	20	200	B-19	27
X2 O	2815-406-4612	BRACKET ASSEMBLY: fuel filter drain control valves and tube end plugs (10951460)	ea	1									B-19	28
P O	2910-781-1461	TUBE ASSEMBLY, METAL: secondary fuel filter drain control valve outlet (10951429-2)	ea	1	*	2	2	*	2	2	8	10	B-19	29
P O	4730-958-4069	CLAMP, LOOP: fuel filter outboard drain tubes to control valve tubes (81348-WW-C440-Type E. 0.500 in. od)	ea	2	*	*	1	*	*	1	20	40	B-19	30
P O	2910-781-1458	TUBE ASSEMBLY, METAL: primary fuel filter drain control valve outlet (10951429-1)	ea	1	*	2	2	*	2	2	8	10	B-19	31
P O	4730-289-8619	SLEEVE, CLINCH TUBE: fuel filter drain tubes to control valves (outlet) (96906-21922-4)	ea	4	*	1	2	*	1	2	40	400	B-19	32
P O	2910-781-1463	HOLDER, FILTER DRAIN: primary and secondary fuel filter drain tubes (11591013)	ea	2	*	*	1	*	*	1	12	16	B-19	33
P O	5310-877-5797	NUT, SELF-LOCKING, HEXAGON: holders to primary and secondary fuel filter drain tubes (96906-21044N3)	ea	1	*	*	1	*	*	1	20	100	B-19	34

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		0309 — FUEL FILTERS — Continued												
P O	5305-993-1851	SCREW, MACHINE: holders to primary and secondary fuel filter drain tube (96906-35207-267)	ea	1	*	*	1	*	*	1	20	30	B-19	35
P O	5340-809-1490	CLAMP, LOOP: fuel filter drain tubes to shroud (96906-21333-98)	ea	4	*	1	2	*	1	2	32	100	B-19	36
P O	2910-999-9453	TUBING, PREFORMED: primary fuel filter drain to control valve (10951426)	ea	1	*	2	2	*	2	2	8	10	B-19	37
P O	4730-278-4496	ELBOW, PIPE TO TUBE: primary fuel filter to drain tube (1), water separator to drain tube (1) (96906-39202-3)	ea	2	*	1	1	*	1	1	24	100	B-19	38
P O	5340-282-7509	CLAMP, LOOP: water separator outlet hose (96906-21333-62)	ea	1	*	*	*	*	*	*	10	20	B-19	39
P H	5310-167-0822	WASHER, FLAT: water separator bracket (88044-960-716)	ea	3				2	4	7	60	300	B-19	40
P O	2815-808-2408	TUBE, BENT, STEEL: water separator drain elbow to control valve (10951482)	ea	1	*	2	2	*	2	2	8	10	B-19	41
P F	5306-225-9103	BOLT, MACHINE: water separator to bracket (96906-90726-48)	ea	2	*	1	2	*	1	2	40	40	B-19	44
P2 F	2815-808-2470	FILTER, FLUID PRESSURE: (Refer to Fig. B-20 for component parts) (11602063)	ea	1	*	*	*	*	*	*	5	*	B-19	45
P F	5310-167-0820	WASHER, FLAT: water separator to bracket (88044-960-516)	ea	4	1	2	4	1	2	4	80	400	B-19	46
P F	5310-407-9566	WASHER, LOCK: water separator to bracket (96906-35338-45)	ea	4	1	2	4	1	2	4	80	400	B-19	47
P O	4730-052-9876	NUT, TUBE COUPLING: secondary fuel drain tube to tee and connector (early) (96906-39210-3)	ea	3	*	1	1	*	1	1	30	30	B-19	58
P O	4730-052-9877	SLEEVE, CLINCH, TUBE: secondary filter drain tube to tee and connector (early) (96906-39212-3)	ea	3	*	1	1	*	1	1	30	100	B-19	59

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					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0309 — FUEL FILTERS — Continued												
P O	4730-200-0525	TEE, PIPE TO TUBE: secondary filter, right, to drain tube and crossover tube (early) (21450-189944)	ea	1	*	2	2	*	2	2	8	12	B-19	60
P O	2910-999-9455	TUBING, PREFORMED: secondary fuel filter drain crossover (early) (10951430)	ea	1	*	2	2	*	2	2	8	10	B-19	61
P O	4730-781-6530	ADAPTER, STRAIGHT, PIPE TO TUBE: secondary fuel filter left to crossover tube (early) (96906-39206-3)	ea	1	*	2	2	*	2	2	6	10	B-19	62
P2 F	2910-678-3282	FILTER, FLUID PRESSURE: secondary (refer to fig. B-20 for component parts) (8764641)	ea	1	*	*	*	*	*	*	4	*	B-19	63
P2 O	5305-486-2901	SCREW: fuel filter head to body (73370-X21820)	ea	2	*	*	*	*	*	*	4	*	B-20	1
P O	2910-967-9870	PARTS KIT, FLUID PRESSURE FILTER: (5702690)	ea	1	2	3	6	2	3	6	50	100	B-20	
		Composed of:												
P O	5330-663-4773	2—WASHER, NON-METALLIC: (8720953)											B-20	2.1
X1 O		2—GASKET: (10885485)											B-20	2.2
X1 O		2—ELEMENT, FUEL FILTER: (8737840)											B-20	2.3
X1 O		PLUG, PIPE: fuel filter (73370-10428)	ea	1									B-20	3
X1 O		HEAD, FILTER: fuel filter (73370-117228)	ea	1									B-20	4
P O	2815-808-2407	PARTS KIT, FLUID PRESSURE: primary fuel filter (5702757)	ea	1	2	3	6	2	3	6	50	100	B-20	
		Composed of:												
X1 O		1—FILTER ELEMENT: (11602943)											B-20	5.1
P O	5330-663-4773	1—WASHER, NON-METALLIC: (8720953)											B-20	5.2
X1 O		1—GASKET: (8729070)											B-20	5.3
P O	2910-851-5360	1—GASKET: (8729069)											B-20	5.4
P O	2910-791-3352	NUT ASSEMBLY: fuel filter, primary (8729071)	ea	1	2	2	2	2	2	2	15	50	B-20	6
X1 O		HEAD: primary fuel filter (90005-053340)	ea	1									B-20	7

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION (a) FIGURE NO.	(b) ITEM NO.
		0309 — FUEL FILTERS — Continued												
P O	2910-801-1152	PARTS KIT: water separator (5702738)	ea	1	9	20	38	9	20	38	400	100	B-20	
		Composed of:												
X1 O		2—ELEMENT, FILTER (11602062)											B-20	8.1
X1 O		1—PACKING, PREFORMED: (11610232)											B-20	8.2
P O	4730-278-3388	1—PLUG, PIPE: (21450-117243)											B-20	8.3
X1 O		COVER, FLUID FILTER: water separator (08181-28M94)	ea	1									B-20	9
P O	5305-225-3839	SCREW, CAP, HEXAGON HEAD: water separator cover (96906-90725-8)	ea	8	1	3	6	1	3	6	160	240	B-20	10
P O	5310-582-5965	WASHER, LOCK: water separator cover (96906-35338-44)	ea	8	1	3	6	1	3	6	160	800	B-20	11
P O	5310-809-4058	WASHER, FLAT: water separator cover (96906-27183-10)	ea	8	1	3	6	1	3	6	160	800	B-20	12
P O	2815-808-2421	FILTER, FLUID PRESSURE: (fine) secondary filter (11602061)	ea	1	3	6	11	3	6	11	100	100	B-20	13
X1 O		HEAD, FILTER: flame heater fuel (7416621)	ea	1									B-20	14
P O	2910-203-3322	FILTER ELEMENT, FLUID: flame heater fuel (90005-A26422)	ea	1	2	2	2	2	2	2	15	25	B-20	15
P O	5330-265-1089	PACKING, PREFORMED: head to bowl, flame heater fuel filter assembly (96906-29513-125)	ea	1	*	1	1	*	1	1	30	100	B-20	16
P2 O	2910-031-9083	BOWL, SEDIMENT: flame heater fuel filter assembly (7413736)	ea	1	*	*	*	*	*	*	4	*	B-20	17
X1 F		BODY, FLUID FILTER: water separator (08181-28M68)	ea	1									B-20	18
P O	4730-278-3388	PLUG, PIPE: water separator (21450-117243)	ea	2	*	*	1	*	*	1	12	20	B-20	19
P F	5340-286-2458	INSERT, SCREW THREAD: fuel water separator (96906-122161)	ea	8	*	1	2	*	1	2	48	48	B-20	20

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					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0309 — FUEL FILTERS — Continued												
X1 O		RETAINER: primary fuel filter (90005-053345)	ea	1									B-20	21
X1 O		WASHER, FLAT: primary fuel filter (90005-053347)	ea	2									B-20	22
X1 O		BODY: primary fuel filter (90005-053344)	ea	1									B-20	23
X1 O		RING, RETAINER: primary fuel filter (90005-053349)	ea	1									B-20	24
X1 O		SPRING: primary fuel filter (90005-053348)	ea	1									B-20	25
X1 O		BODY AND CENTRALIZER ASSEMBLY: secondary fuel filter (73370-X117220)	ea	2									B-20	26
P O	1660-025-3493	FILTER, FLUID PRESSURE: intake manifold heater (96906-51085-1)	ea	1	2	2	2	2	2	2	8	20	B-21	44
P O	5305-655-6556	SCREW, MACHINE: manifold heater filter assembly to bracket (96906-35266-70)	ea	2	*	1	2	*	1	2	40	60	B-21	46
P O	5310-045-3296	WASHER, LOCK: manifold heater filter assembly to bracket (96906-35338-43)	ea	2	*	1	2	*	1	2	40	200	B-21	47
		0311—ENGINE STARTING AIDS												
P O	9525-990-7799	WIRE, NICKEL COPPER: ignition unit mounting bracket to oil cooler (2 pcs 12 in. lg) (96906-20995NC40)	ft	2	*	*	*	*	*	*	20	200	B-21	1
P O	5305-817-9326	SCREW, CAP, HEXAGON: ignition unit mounting bracket to oil cooler (96906-51096-60)	ea	4	1	2	4	1	2	4	80	120	B-21	2
P O	5330-498-6341	RETAINER, PACKING: ignition unit mounting bracket to oil cooler (10935478)	ea	8	*	1	2	*	1	2	50	163	B-21	3
P O	5310-982-4912	NUT, SELF-LOCKING, HEXAGON: ignition unit to mounting bracket (left and right bank) (4), solenoid valve bracket to shroud, flywheel end (3) (96906-21045-5)	ea	7	1	2	4	1	2	4	105	700	B-21	4

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION (a) FIGURE NO.	(b) ITEM NO.
		0311 — ENGINE STARTING AIDS — Continued												
P2 O	2540-453-5404	BRACKET, DOUBLE ANGLE: ignition unit mounting, manifold air heaters (10882654)	ea	2	*	*	*	*	*	*	1	*	B-21	5
P O	5325-276-6096	GROMMET, RUBBER: ignition unit mounting bracket to oil cooler (96906-35489-74)	ea	4	1	2	4	1	2	4	100	200	B-21	6
P O	5340-114-0093	CLAMP, LOOP: ignition unit to mounting bracket (10865374)	ea	4	2	2	3	2	2	3	24	32	B-21	7
P O	2990-770-1641	IGNITION UNIT: manifold (7062198)	ea	2	*	2	2	*	2	2	6	4	B-21	8
P O	2920-767-1736	LEAD, ELECTRICAL: ignition unit to heater (7062196)	ea	2	2	2	3	2	2	3	24	50	B-21	9
P O	2990-678-4695	GASKET: manifold air heaters (☆☆parts kit—2815-678-4245) (8682503)	ea	2	2	3	6	2	3	6	50		B-21	10
P O	5310-081-4219	WASHER, FLAT: intake manifold heaters (96906-27183-12)	ea	8	1	4	7	1	4	7	160	800	B-21	11
P O	5310-088-0553	NUT, SELF-LOCKING, HEXAGON: manifold air heaters (96906-21044N5)	ea	8	1	4	7	1	4	7	160	800	B-21	12
P O	2920-647-3899	SPARK PLUG: manifold heater, left and right bank (11583-XED89D)	ea	2	2	3	5	2	3	5	30	50	B-21	13
P2 O	2815-117-9337	HEATER ASSEMBLY: manifold air, left bank (7062195)	ea	1	*	*	*	*	*	*	3	*	B-21	14
P O	2910-790-2303	NOZZLE ASSEMBLY, FUEL: manifold heater, left and right bank (7335555)	ea	2	*	2	2	*	2	2	10	20	B-21	15
P O	4730-196-0930	BUSHING, PIPE: heater inlet (81348-WW-P-471 type 1 class 1¼ x ⅛ in.)	ea	2	2	2	2	2	2	2	16	30	B-21	16
P O	4730-585-2906	ELBOW, PIPE TO TUBE: manifold air heater fuel inlet, left and right bank (21450-423185)	ea	2	*	*	*	*	*	*	8	100	B-21	17

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		0311 — ENGINE STARTING AIDS — Continued												
P O	4730-231-4009	ELBOW, PIPE TO TUBE: manifold heater outlet to fuel return tube (2), fuel solenoid valve outlet, flywheel end (1), solenoid valve outlet to bulkhead cross (1) (96906-20822-4)	ea	4	*	1	2	*	1	2	48	200	B-21	18
P2 O	2910-767-1735	TUBE ASSEMBLY, METAL: manifold air heater fuel return to solenoid valve, flywheel end (left bank) (10865425)	ea	1	*	*	*	*	*	*	3	*	B-21	19
P O	5340-809-1490	CLAMP, LOOP: manifold heater fuel return tube (96906-21333-98)	ea	4	*	1	1	*	1	1	32	48	B-21	20
P O	5325-182-4707	GROMMET, RUBBER: transmission shroud (lower) to manifold air heater fuel return tubes (10935447)	ea	2	2	2	3	2	2	3	24	100	B-21	21
P O	5325-184-9846	GROMMET, RUBBER: shroud plate to fuel solenoid valve outlet tube assembly, flywheel end (96906-35489-10)	ea	1	*	1	2	*	1	2	50	50	B-21	22
P O	2910-767-1734	TUBE ASSEMBLY, METAL: solenoid valve outlet to bulkhead cross tube (10865444)	ea	1	*	2	2	*	2	2	8	10	B-21	23
P O	5306-042-5828	BOLT, ASSEMBLED WASHER: solenoid valve bracket to fuel filter bracket (2), solenoid valve to bracket, damper end (2), flywheel end (2) (21450-425828)	ea	6	1	3	5	1	3	5	120	210	B-21	24
X2 O	5340-407-0666	BRACKET, ANGLE: solenoid valve to shroud, flywheel end (10865375)	ea	1									B-21	25
P O	5306-616-1248	BOLT, MACHINE: solenoid bracket to shroud, flywheel end (88044-5-4A)	ea	3	1	2	3	1	2	3	60	60	B-21	26
P O	4730-090-9182	COUPLING, PIPE: solenoid valve inlet, flywheel end (8698852)	ea	1	2	2	3	2	2	3	16	25	B-21	27
P O	4730-710-9486	ELBOW, PIPE: fuel solenoid valve inlet, flywheel end (1), fuel solenoid valve outlet to tee, damper end (1) (21450-444476)	ea	2	*	1	1	*	1	1	24	100	B-21	28

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		0311 — ENGINE STARTING AIDS — Continued												
P2 O	2990-974-7605	VALVE, SOLENOID: intake manifold heater, flywheel and damper end (7062194)	ea	2	*	*	*	*	*	*	5	*	B-21	29
P O	4730-277-9305	TEE, PIPE TO TUBE: solenoid valve inlet, flywheel end (88044-825-4)	ea	1	*	2	2	*	2	2	8	12	B-21	30
P O	2910-767-1733	TUBE ASSEMBLY, METAL: manifold air heater fuel return to solenoid valve, flywheel and (10865426)	ea	1	*	2	2	*	2	2	8	10	B-21	31
P2 O	2990-369-8766	HEATER ASSEMBLY, AIR: manifold, right bank (7062197)	ea	1	*	*	*	*	*	*	3	*	B-21	32
P O	5305-993-1851	SCREW, MACHINE: heater tube to oil cooler hose (2), cylinder drain back tube (8) (96906-35207-267)	ea	10	2	4	8	2	4	8	200	300	B-21	33
P O	5340-526-2559	CLAMP, LOOP: heater fuel tube to cooler hose (2), cylinder drain back tube (8) (96906-21919F2)	ea	10	1	2	3	1	2	3	80	120	B-21	34
P O	5340-535-6471	CLAMP, LOOP: manifold air heater fuel tubes to oil cooler hoses (2), cylinder head oil drain tubes (8) (96906-21919G16)	ea	10	1	2	3	1	2	3	62	62	B-21	35
P O	5310-902-6676	NUT, SELF-LOCKING, HEXAGON: manifold air heater fuel tubes to oil cooler clamps (2), fuel tubes to cylinder head drain tube clamps (8) (96906-21083-N3)	ea	10	1	3	6	1	3	6	150	1000	B-21	36
P O	5340-088-1255	CLAMP, LOOP: manifold heater tube assembly to check valve (96906-21333-96)	ea	1	*	2	2	*	2	2	10	37	B-21	37
M O		TUBE ASSEMBLY: check valve to manifold heater fuel filter (fabricate from 4710-805-4149) (1 pc 7.125 in. lg) (2) 4730-052-9877 and (2) 4730-052-9876 (10882777)	ft	1									B-21	38
P O	4730-052-9877	SLEEVE, CLINCH TUBE: check valve to manifold heater fuel filter tube assembly (96906-39212-3)	ea	2	2	2	3	2	2	3	20	200	B-21	39
P O	4710-805-4149	TUBING, PLASTIC: (7017826)	ft	1	*	2	2	*	2	2	10	100	B-21	40

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					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0311 — ENGINE STARTING AIDS — Continued												
P O	4730-052-9876	NUT, TUBE COUPLING: check valve to manifold heater fuel filter tube assembly (96906-39210-3)	ea	2	2	2	3	2	2	3	24	30	B-21	41
P O	4730-805-0676	TEE, PIPE: purge pump to check valve inlet (10865466)	ea	1	*	2	2	*	2	2	8	20	B-21	42
P O	4730-781-6530	ADAPTER, STRAIGHT PIPE TO TUBE: manifold heater fuel filter inlet (1), purge pump inlet tee to manifold heater fuel filter assembly (1) (96906-39206-3)	ea	2	*	*	1	*	*	1	12	20	B-21	43
P O	5310-167-0818	WASHER, FLAT: manifold heater filter to bracket (2), solenoid valve bracket to manifold heater fuel filter bracket (2), solenoid valve to bracket (2) (88044-960-10)	ea	6	1	3	5	1	3	5	120	600	B-21	45
P O	4730-640-6582	NIPPLE, PIPE: manifold heater fuel filter to solenoid valve (21450-443977)	ea	1	*	2	2	*	2	2	8	31	B-21	48
P2 O	5340-456-1799	BRACKET, ANGLE: solenoid valve, damper end (10882767)	ea	1	*	*	*	*	*	*	1	*	B-21	49
M O		TUBE ASSEMBLY: solenoid valve tee to manifold heater nozzle, right bank (fabricate from 4710-804-9249) (1 pc 75.00 in. lg) (10882780)	ft	1									B-21	50
M O		TUBE ASSEMBLY: solenoid valve tee to manifold heater nozzle, left bank (fabricate from 4710-804-9249) (1 pc 60.00 in. lg) (10882779)	ft	1									B-21	50
P O	4710-804-9249	TUBING, PLASTIC: (83616NS4 Type H)	ft	12	24	24	36	24	24	36	120	1200	B-21	51
P O	4730-069-1184	NUT, TUBE COUPLING: tube assemblies solenoid valve tee manifold heater nozzle, left and right banks (96906-39210-1)	ea	4	*	1	2	*	1	2	48	120	B-21	52
P O	4730-542-2813	SLEEVE, FLARED TUBE FITTING: tube assemblies solenoid valve tee manifold heater nozzle, left and right banks (96906-21922-2C)	ea	4	*	1	2	*	1	2	40	400	B-21	53
P2 O	4730-810-7039	TEE, PIPE TO TUBE: fuel solenoid valve outlet elbow to manifold air heater fuel inlet tube (21450-423618)	ea	1	*	*	*	*	*	*	3	*	B-21	54

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		05—COOLING SYSTEM												
		0502—DEFLECTORS AND SHROUDS												
P2 O	2815-193-8192	SHROUD, ENGINE: cooling fan (8761089)	ea	1	*	*	*	*	*	*	1	*	B-22	1
P O	5310-588-0393	NUT ASSEMBLY, RETAINER RING: cooling fan shroud (early) (8679574)	ea	24	6	13	25	6	13	25	240	288	B-22	2
P O	5310-886-3001	NUT, PLAIN PLATE: cooling fan shroud (late) (10912163-2)	ea	24	6	13	25	6	13	25	240	288	B-22	2
P O	5310-877-5796	NUT, SELF-LOCKING, HEXAGON: cooling fan shroud access cover plate (6), rails to cooling fan shroud (14) (96906-21044N4)	ea	20	3	8	16	3	8	16	400	2000	B-22	3
P O	5306-206-4931	BOLT, MACHINE: cooling fan shroud access cover plate (6), rails to cooling fan shroud (14) (88044-4-3A)	ea	20	3	8	16	3	8	16	400	400	B-22	4
P2 O	2815-193-8200	COVER ASSEMBLY: cooling fan shroud (8682560)	ea	2	*	*	*	*	*	*	1	*	B-22	5
P O	5305-655-9663	SCREW, PANEL FASTENER: cooling fan shroud access cover plate (7340190)	ea	4	2	3	6	2	3	6	40	80	B-22	6
P O	5310-682-5631	WASHER, FLAT: cooling fan access cover plate (8666561)	ea	4	2	3	6	2	3	6	40	400	B-22	7
P O	5310-982-4912	NUT, SELF-LOCKING, HEXAGON: turbosupercharger shroud to turbosupercharger (4), turbosupercharger inner shroud plate to transmission upper shroud (2), turbosupercharger outer shroud to transmission plate (intermediate) (2), cooling fan shroud to support brackets (12) (96906-21045-5)	ea	20	3	8	16	3	8	16	400	2000	B-22	8
P2 O	2930-442-5894	SHROUD, COOLING: cylinder barrel, 1 right and 6 left (8761269)	ea	2	*	*	*	*	*	*	1	*	B-22	9

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION (a) FIGURE NO.	(b) ITEM NO.
		0502 — DEFLECTORS AND SHROUDS — Continued												
P O	5310-655-9975	NUT, SELF-LOCKING: engine shroud flywheel end, lower right bank (9), left bank (9), engine shroud damper end (5), flywheel end (7), engine shroud damper end left (8), right (2), cylinder baffle No. 1 left and No. 6 right (4), No. 1 right and No. 6 left (4), cylinder head shroud plates left and right banks, damper and flywheel ends (4), camshaft drive shaft shroud upper left (1), right (1) (8764639)	ea	54	25	55	104	25	55	104	1080	5400	B-22	10
P O	2930-453-5362	PLATE, SHROUD: right bank damper end (1) left bank flywheel end (1) (10865319)	ea	2	*	2	2	*	2	2	10	11	B-22	11
P O	2930-402-4419	SHROUD, CAMSHAFT DRIVE: (left bank) (upper) (8761104)	ea	1	*	2	2	*	2	2	6	10	B-22	12
P2 O	2930-421-1591	SHROUD, ENGINE: left bank, flywheel end (upper) (8761068)	ea	1	*	*	*	*	*	*	5	*	B-22	13
P2 O	2930-436-3196	SHROUD, COOLING ENGINE: upper (left bank) (10865266)	ea	1	*	*	*	*	*	*	1	*	B-22	14
P O	2930-442-5896	SHROUD, COOLING: left bank (8761099)	ea	1	*	2	2	*	2	2	10	18	B-22	15
P O	2930-402-4420	SHROUD, EXHAUST MANIFOLD: right bank (10898756)	ea	1	*	2	2	*	2	2	6	10	B-22	16
P O	5305-897-7481	SCREW, MACHINE: exhaust manifold shrouds right and left bank (34), cylinder barrel shrouds (1 and 6 right), (1 and 6 left) (8), engine shroud right bank (8), left bank (damper end) (9), shroud filler plates (5) (10898763)	ea	64	10	26	52	10	26	52	1280	1920	B-22	17
P O	5350-068-0501	SCREW, CAP, HEXAGON HEAD: engine shroud, RH and LH, damper end and fuel filter drain tube clamps (3), exhaust manifold shrouds, RH and LH, and manifold heater fuel return tube clamps (4) (96906-90725-5)	ea	7	1	3	6	1	3	6	140	210	B-22	17
P2 O	2930-436-3208	SHROUD, COOLING ENGINE: lower left bank (10865250)	ea	1	*	*	*	*	*	*	1	*	B-22	18

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		0502 — DEFLECTORS AND SHROUDS — Continued												
P O	5306-616-1248	BOLT, MACHINE: turbosupercharger inner shroud plate to transmission upper shroud (2), turbosupercharger shroud to turbosupercharger (4) (88044-5-4A)	ea	6	1	3	5	1	3	5	120	120	B-22	19
P O	5310-741-4564	NUT, PLAIN, PLATE: transmission lower shroud (left and right) (6), turbosupercharger inner shroud plate (left and right) (8) (early) (7414564)	ea	14	4	9	16	4	9	16	140	168	B-22	20
P O	5310-886-3000	NUT, PLAIN, PLATE: transmission lower shroud (left and right) (6), turbosupercharger inner shroud plate (left and right) (8) (late) (10912163-1)	ea	14	4	9	16	4	9	16	140	168	B-22	20
P2 O	2930-107-1221	SHROUD, PLATE, TURBOSUPERCHARGER: left bank (inner) (10865268)	ea	1	*	*	*	*	*	*	1	*	B-22	21
P2 O	2930-446-1757	PLATE, TURBOSUPERCHARGER: left bank (outer) (10865272)	ea	1	*	*	*	*	*	*	4	*	B-22	22
P O	5306-741-4584	BOLT, ASSEMBLED WASHER: transmission shroud plates (8), transmission lower shroud plates to turbosupercharger support (10), turbosupercharger inner shroud plates (4), engine upper frames to engine shroud ends (8), transmission lower shroud to tie rods (2) (7414584)	ea	32	15	34	63	15	34	63	640	640	B-22	23
P O	2930-421-1592	SHROUD, ENGINE: turbosupercharger (right bank) (8761057)	ea	1	*	2	2	*	2	2	6	10	B-22	24
P O	2930-437-7179	SHROUD, TURBOSUPERCHARGER: (left bank) (late) (11641931)	ea	1	*	2	2	*	2	2	6	10	B-22	24
P2 O	2930-453-5364	PLATE, TRANSMISSION SHROUD: left bank (lower intermediate) (10865240)	ea	1	*	*	*	*	*	*	3	*	B-22	25
P2 O	2815-193-8211	PLATE, SHROUD ASSEMBLY: left bank (lower intermediate) (11641919)	ea	1	*	*	*	*	*	*	1	*	B-22	25
P2 O	2930-453-5376	PLATE, SHROUD: right bank (intermediate) (10865247)	ea	1	*	*	*	*	*	*	5	*	B-22	26

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					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0502 — DEFLECTORS AND SHROUDS — Continued												
P O	5306-616-1248	BOLT, MACHINE: turbosupercharger outer shroud to transmission plate (88044-5-4A)	ea	2	*	1	2	*	1	2	40	40	B-22	27
P2 O	2930-436-3197	SHROUD, COOLING ENGINE: lower (right bank) (10865252)	ea	1	*	*	*	*	*	*	1	*	B-22	28
P2 O	2930-998-4724	PLATE, ENGINE SHROUD: right bank (outer) (10865277)	ea	1	*	*	*	*	*	*	4	*	B-22	29
P O	5325-682-1471	GROMMET, RUBBER: turbosupercharger shroud plates (96906-35490-16)	ea	2	1	2	4	1	2	4	100	200	B-22	30
P2 O	2815-177-8216	PLATE, SHROUD, TURBOSUPERCHARGER: (right bank) (inner) (10865267)	ea	1	*	*	*	*	*	*	1	*	B-22	31
P2 O	2520-420-4982	SHROUD, TRANSMISSION: upper (right bank) (10865262)	ea	1	*	*	*	*	*	*	4	*	B-22	32
P2 O	2930-421-1590	SHROUD, ENGINE: right bank, flywheel end (upper) (8761069)	ea	1	*	*	*	*	*	*	4	*	B-22	33
P O	2930-453-5363	PLATE, SHROUD: left bank, damper end (1), right bank flywheel end (1) (10865320)	ea	2	2	2	3	2	2	3	20	46	B-22	34
P2 O	2930-436-3206	SHROUD, COOLING ENGINE: camshaft drive shaft (right bank) lower (8761107)	ea	1	*	*	*	*	*	*	1	*	B-22	35
P2 O	2815-455-9495	SHROUD, CAMSHAFT DRIVE: camshaft drive (right bank) (upper) (8761148)	ea	1	*	*	*	*	*	*	1	*	B-22	36
P2 O	2930-457-0319	SHROUD, CAMSHAFT DRIVE: camshaft drive shaft (left bank) (lower) (8761106)	ea	1	*	*	*	*	*	*	2	*	B-22	37
P2 O	2805-760-5838	BAFFLE, AIR FLOW: cylinder air No. 1 right and 6 left (8682757)	ea	2	*	*	*	*	*	*	2	*	B-22	38
P2 O	2930-436-3207	SHROUD, COOLING ENGINE: right bank, flywheel end (lower) (8682623)	ea	1	*	*	*	*	*	*	1	*	B-22	39

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		0502 — DEFLECTORS AND SHROUDS — Continued												
P2 O	2930-522-2576	SHROUD, FAN: left bank, flywheel end (lower) (8682626)	ea	1	*	*	*	*	*	*	2	*	B-22	40
P2 O	2815-356-8502	RAIL, COOLING FAN SHROUD: (flywheel end) (8761232)	ea	1	*	*	*	*	*	*	1	*	B-22	41
P2 O	2805-760-5837	BAFFLE, AIR FLOW: cylinder air (No. 1 left and 6 right) (8682756)	ea	2	*	*	*	*	*	*	2	*	B-22	42
P2 O	2815-193-8214	RAIL, COOLING FAN SHROUD: (8682755)	ea	1	*	*	*	*	*	*	1	*	B-22	43
P O	2930-402-4421	SHROUD, CYLINDER: (No. 1 left and No. 6 right) (8761270)	ea	2	*	2	2	*	2	2	6	10	B-22	44
M O		RUBBER STRIP: engine shroud, (damper end) (left and right bank), (2 pcs 9.810 in. lg) (fabricate from 8761271) (8761271-1)	ft	2									B-22	45
P O	9320-181-0118	RUBBER STRIP: (8761271)	ft	2	2	2	3	2	2	3	50	200	B-22	45
M O		STAPLE, TACKER: rubber seals to shroud (10 pcs 1.340 in. lg) (fabricate from 9525-990-7799) (8764887)	ft	10									B-22	46
P O	9525-990-7799	WIRE, NICKEL COPPER: (96906-20995-NC40)	ft	2	2	2	4	2	2	4	30	200	B-22	46
X1 O		SHROUD, ENGINE: right bank, damper end (8761388)	ea	1									B-22	47
P2 O	2815-193-8212	SHROUD ASSEMBLY, ENGINE: right bank damper end (8682761)	ea	1	*	*	*	*	*	*	1	*	B-22	48
P O	5305-071-2506	SCREW, CAP, HEXAGON HEAD: engine shroud plate clip (96906-90728-3)	ea	3	1	2	3	1	2	3	60	90	B-22	49
P O	5310-582-5965	WASHER, LOCK: engine shroud plate clip (96906-35338-44)	ea	3	1	2	3	1	2	3	60	300	B-22	50
P O	2930-774-4858	CLIP: engine shroud plate (7744858)	ea	3	2	3	6	2	3	6	40	61	B-22	51
P2 O	2815-193-8210	PLATE, ENGINE SHROUD: filler (side) (8761008)	ea	1	*	*	*	*	*	*	1	*	B-22	52

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		0502 — DEFLECTORS AND SHROUDS — Continued												
P2 O	2815-194-2453	PLATE, ENGINE SHROUD: filler (top) (8761009)	ea	1	*	*	*	*	*	*	1	*	B-22	53
P O	5310-209-0786	WASHER, LOCK: engine shroud filler plates to damper housing (5), engine shroud, damper end, to damper housing (left bank) (1), (right bank) (2), exhaust and camshaft drive shroud to accessory drive housing (3) (96906-35335-33)	ea	11	2	4	8	2	4	8	220	1100	B-22	54
X1 O		SHROUD, ENGINE: left bank, damper end (8761300)	ea	1									B-22	55
P2 O	2815-193-8203	SHROUD ASSEMBLY, ENGINE: left bank damper end (8682762)	ea	1	*	*	*	*	*	*	1	*	B-22	56
X2 F		PLATE, CYLINDER HEAD SHROUD: oil level indicator (10865364)	ea	1									B-23	1
P2 F	2815-193-8217	PLATE, FILLER, OIL LEVEL INDICATOR TUBE: (early) (8761101)	ea	1	*	*	*	*	*	*	1	*	B-23	2
P F	5310-209-0786	WASHER, LOCK: cylinder head shroud plates (96906-35335-33)	ea	48	8	20	40	8	20	40	960	4800	B-23	3
P F	5305-071-2506	SCREW, CAP, HEXAGON: cylinder head shroud plates (96906-90728-3)	ea	48	8	20	40	8	20	40	960	1440	B-23	4
P2 F	2815-193-8216	PLATE, CYLINDER HEAD SHROUD: oil filler tube (early and intermediate) (10865365)	ea	1	*	*	*	*	*	*	1	*	B-23	5
P2 F	2815-193-8215	PLATE, FILLER, OIL FILLER TUBE: (early and intermediate (1), oil level indicator tube, intermediate (1) (8761098)	ea	1	*	*	*	*	*	*	1	*	B-23	6
P2 F	2815-194-2450	PLATE, CYLINDER HEAD SHROUD: intermediate (10865363)	ea	9	*	*	*	*	*	*	1	*	B-23	7
P F	2930-679-8093	DEFLECTOR, AIR, ENGINE COOLING: deflector cylinder air, left (8682700)	ea	12	3	7	13	3	7	13	120	240	B-23	8
P F	2930-679-8090	DEFLECTOR, AIR, ENGINE COOLING: deflector cylinder air, right (8682701)	ea	12	3	7	13	3	7	13	120	240	B-23	9

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		0502 — DEFLECTORS AND SHROUDS — Continued												
P F	5306-678-1885	BOLT, MACHINE: cylinder barrel air deflector clamp (8761432)	ea	10	5	11	20	5	11	20	200	200	B-23	10
P F	5310-902-6676	NUT, SELF-LOCKING: intercylinder air baffle (96906-21083N3)	ea	20	2	6	12	2	6	12	300	2000	B-23	11
P F	5310-167-0818	WASHER, FLAT: cylinder air deflector retaining straps (10), intercylinder air baffle (20) (88044-960-10)	ea	30	5	12	24	5	12	24	600	3000	B-23	12
P F	5340-089-8830	STRAP, RETAINING: cylinder air deflector (outer) (8682702)	ea	10	3	6	11	3	6	11	100	200	B-23	13
P F	2930-679-8091	DEFLECTOR, AIR, ENGINE COOLING: cooling baffle intercylinder (8682492)	ea	10	3	6	11	3	6	11	100	200	B-23	14
P2 F	5340-402-4435	STRAP, RETAINING: cylinder air deflector (inner) (8761164)	ea	10	*	*	*	*	*	*	4	*	B-23	15
P F	2930-679-8092	DEFLECTOR, AIR, ENGINE COOLING: baffle intercylinder air (8682620)	ea	10	3	6	11	3	6	11	100	200	B-23	16
P F	5306-774-4720	BOLT, HOOK: cylinder air deflector (7744720)	ea	20	5	11	20	5	11	20	200	400	B-23	17
P F	5310-877-5796	NUT, SELF-LOCKING, HEXAGON: cylinder air deflectors (96906-21044N4)	ea	12	2	4	8	2	4	8	180	1200	B-23	18
P F	5365-407-7003	SPACER, SLEEVE: cylinder air deflectors (8761268)	ea	12	2	2	3	2	2	3	24	32	B-23	19
P F	5305-267-8983	SCREW, CAP, HEXAGON HEAD: cylinder air deflector (96906-90726-16)	ea	12	2	5	10	2	5	10	240	360	B-23	20
P O	5310-741-4564	NUT, PLAIN, PLATE: engine upper cover frame (52), oil filler and oil level indicator shroud plate (16) (Used on engine 101 thru 2390) (7414564)	ea	68	1	3	6	1	3	6	156	260	B-24	5
P F	5310-886-3000	NUT, PLAIN, PLATE: engine upper cover frames (50), turbocharger shroud plate, inner, R & L banks (8) Transmission shroud, lower R & L banks (6) (Used on engine 2390 and after) (10912163-1)	ea	64	14	28	52	14	28	52	500	640	B-24	5

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					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0502 — DEFLECTORS AND SHROUDS — Continued												
P O	5325-276-6096	GROMMET, RUBBER, shroud frame to oil coolers (96906-35489-74)	ea	8	*	1	1	*	1	1	25	400	B-24	7
P O	5325-682-7076	FASTENER, SPRING TENSION: retainers to frame (7998574)	ea	18	6	12	22	6	12	22	180	200	B-24	10
P2 O	2930-570-9707	FRAME, ENGINE UPPER COVER: left bank (early) (8761092)	ea	1	*	*	*	*	*	*	5	*	B-24	11
P2 O	2815-193-8218	FRAME, ENGINE UPPER COVER: left bank (late) (10951124)	ea	1	*	*	*	*	*	*	1	*	B-24	11
P2 O	2930-937-1430	COVER, RADIATOR SHROUD: left bank, damper end (early) (8761294)	ea	1	*	*	*	*	*	*	5	*	B-24	12
X2 O	2930-350-9400	COVER, ENGINE: left bank, damper end (late) (11641930)	ea	1									B-24	12
X2 O		COVER, ENGINE: left bank, damper end (intermediate) (10951122)	ea	1									B-24	12
P O	5310-088-0553	NUT, SELF-LOCKING: oil filler hole cover plate (96906-21044N5)	ea	2	*	*	*	*	*	*			B-24	13
X1 O		COVER PLATE, OIL FILLER HOLE: (early engines) (11641940)	ea	1									B-24	14
X1 O		COVER PLATE, OIL FILLER HOLE: (intermediate) (11641939)	ea	1									B-24	14
P O	5306-616-1248	BOLT, MACHINE: oil filler hole cover plate (88044-AN5-4A)	ea	2	*	*	*	*	*	*			B-24	15
P O	5306-741-4584	BOLT, ASSEMBLED WASHER: engine upper cover to frame (early (8), (late) (35), shroud plate to oil cooler (4) (7414584)	ea	47	11	24	45	11	24	45	470	940	B-24	16
P2 O	2930-457-6731	PLATE, SHROUD: oil filler and level indicator (early) (8761029)	ea	2	*	*	*	*	*	*	3	*	B-24	17

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		0502 — DEFLECTORS AND SHROUDS — Continued												
P2 O	2815-575-0399	PLATE, SHROUD, RADIATOR: oil filler and level indicator (early) (8761030)	ea	2	*	*	*	*	*	*	3	*	B-24	18
P2 O	2930-179-7051	COVER, OIL COOLER: left bank, flywheel end (8761049)	ea	1	*	*	*	*	*	*	3	*	B-24	19
P2 O	2930-169-5798	BRACKET, COOLING FAN: cooling fan shroud support (8682782)	ea	12	*	*	*	*	*	*	4	*	B-24	20
P O	5310-982-4912	NUT, SELF-LOCKING, HEXAGON: cooling fan shroud support bracket to cylinders (96906-21045-5)	ea	24	2	5	10	2	5	10	240	2400	B-24	21
P O	5305-897-7481	SCREW, MACHINE: cooler shroud (10898763)	ea	6	3	7	13	3	7	13	120	180	B-24	26
M O		STAPLE TACKER: rubber seals to shrouds and plates (fabricate from 9925-990-7799) (20 pcs 1.364 in. lg) (8764887)	ft	20									B-24	27
P O	9525-990-7799	WIRE, NICKEL COPPER: (96906-20995-NC40)	ft	3	2	4	7	2	4	7	32	300	B-24	27
M O		RUBBER STRIP: shroud to oil cooler (fabricate from 8761271) (4 pcs 9.810 in. lg) (8761271-1)	ft	4									B-24	28
P O	9320-181-0118	RUBBER STRIP: (8761271)	ft	4	8	8	12	8	8	12	100	400		
X1 O		PLATE, OIL COOLER SHROUD: right bank (8761010)	ea	1									B-24	30
P O	5310-655-9975	NUT, SELF-LOCKING: oil cooler end shroud flywheel end (10), oil cooler shroud (2) (8764639)	ea	12	5	10	18	5	10	18	180	1200	B-24	31
X1 O		SHROUD, OIL COOLER END: left bank (8761047)	ea	1									B-24	32
P2 O	2930-350-9394	SHROUD, ENGINE: oil cooler end, left bank, flywheel end (8761122)	ea	1	*	*	*	*	*	*	1	*	B-24	33
P O	5340-484-0865	BRACKET, ANGLE: oil cooler shroud, flywheel end (8761070)	ea	2	*	2	2	*	2	2	6	46	B-24	34
X2 O	2930-406-7294	FRAME, ENGINE COVER: upper right bank (8761103)	ea	1									B-24	36

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					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0502 — DEFLECTORS AND SHROUDS — Continued												
P2 O	2930-179-7049	COVER, OIL COOLER: right bank, damper end (8761058)	ea	1	*	*	*	*	*	*	3	*	B-24	37
X2 O	2930-350-9397	COVER, ENGINE: right bank, flywheel end (8761100)	ea	1									B-24	38
P2 O	2930-350-9398	SHROUD, ENGINE: oil cooler end, right bank, flywheel end (8761123)	ea	1	*	*	*	*	*	*	1	*	B-24	39
X1 O		SHROUD, OIL COOLER END: right bank (8761048)	ea	1									B-24	40
P2 O	2930-350-9396	PLATE, SHROUD: oil cooler (right bank) (8761477)	ea	1	*	*	*	*	*	*	1	*	B-24	45
X1 O		PLATE, OIL COOLER SHROUD: left bank (8761011)	ea	1									B-24	46
P2 O	2930-350-9395	PLATE, SHROUD: oil cooler (left bank) (8761476)	ea	1	*	*	*	*	*	*	1	*	B-24	52
		0505—FAN ASSEMBLY												
P O	5310-637-9541	WASHER, LOCK: cooling fan vane housing and fan housing to shroud (4), vane housing to fan housing (4), fan housing to shroud (4) (96906-35338-46)	ea	12	2	5	10	2	5	10	240	1200	B-25	1
P O	5306-180-0238	BOLT, MACHINE: cooling fan vane housing to cooling fan housing (88044-6-5A)	ea	4	1	2	3	1	2	3	80	80	B-25	2
P O	2930-350-9401	HOUSING, CENTRIFUGAL FAN: engine cooling fan, damper end (8682658)	ea	1	*	2	2	*	2	2	6	10	B-25	3
P O	5305-269-3240	SCREW, CAP, HEXAGON HEAD: cooling fan housing to shroud, flywheel end (2), damper end (2), fan housing, flywheel end to fan housing, damper end (2), vane housing and shroud, damper end (2) (96906-90727-64)	ea	8	1	4	7	1	4	7	160	160	B-25	4
P O	5315-013-7214	PIN, COTTER: fan drive clutch (96906-24665-359)	ea	2	1	2	4	1	2	4	100	200	B-25	5

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		0505 — FAN ASSEMBLY — Continued												
P O	5315-839-2325	PIN, COTTER: cooling fan adapter to engine cooling fan (96906-24665-132)	ea	32	6	15	30	6	15	30	640	3200	B-25	6
P O	5310-167-0820	WASHER, FLAT: cooling fan to hub (88044-960-516)	ea	32	6	15	30	6	15	30	640	3200	B-25	7
P O	5306-678-3325	BOLT, MACHINE: engine cooling fan to hub (8761337)	ea	32	4	9	16	4	9	16	150	320	B-25	8
P O	5305-269-3245	SCREW, CAP, HEXAGON HEAD: cooling fan vane housing and cooling fan housing to cooling fan shroud (96906-90727-69	ea	2	*	1	2	*	1	2	40	50	B-25	9
P2 O	2930-938-8179	VANE, FAN ENGINE COOLING: flywheel end (8761032)	ea	1	*	*	*	*	*	*	5	*	B-25	10
P O	5310-776-7728	NUT, SLOTTED, HEXAGON: fan drive clutch (7767728)	ea	2	2	3	5	2	3	5	40	200	B-25	11
P O	2930-678-3257	WASHER, THRUST: fan drive clutch (8761230)	ea	2	2	2	2	2	2	2	16	150	B-25	12
P O	5310-333-7348	WASHER, FLAT: cooling fan housing (damper end) to cooling fan housing (flywheel end) (2), cooling fan housing to cooling fan shroud (flywheel end, center) (2), damper end, center (2) (8679576)	ea	6	1	3	5	1	3	5	120	600	B-25	13
P O	2930-997-1537	HOUSING, ENGINE: cooling fan damper end (8682785)	ea	1	*	2	2	*	2	2	6	10	B-25	14
P F	5340-291-3492	INSERT, SCREW THREAD: engine cooling fan housings (96906-21208F6-15)	ea	4	*	1	1	*	1	1	24	74	B-25	15
P O	5310-950-0039	NUT, SELF-LOCKING: cooling fan housing, damper end, to cooling fan housing flywheel end (96906-21044N6)	ea	2	*	1	2	*	1	2	40	200	B-25	16
P2 O	2930-442-5895	HOUSING, ENGINE COOLANT: flywheel end (8682682)	ea	1	*	*	*	*	*	*	2	*	B-25	17
P O	2930-679-5742	FAN ASSEMBLY, ENGINE: cooling (8761242)	ea	2	*	2	2	*	2	2	10	20	B-25	18

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					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0505 — FAN ASSEMBLY — Continued												
P O	2930-678-3266	HUB, ENGINE COOLING: fan rotor (8761050)	ea	2	*	2	2	*	2	2	10	10	B-25	19
P O	5310-849-6883	NUT, SLOTTED, HEXAGON: engine cooling fan to hub (96906-35692-13)	ea	32	6	14	25	6	14	25	720	3200	B-25	20
P F	9525-990-7799	WIRE, NICKEL COPPER: fan control cover to housing (2 pcs 12 in. lg) (96906-20995NC40)	ft	2	*	*	1	*	*	1	20	200	B-26	5
P F	5306-852-7104	BOLT, MACHINE: fan drive housing control cover to fan drive housing (96906-51096-335)	ea	4	1	2	4	1	2	4	80	80	B-26	6
P F	5310-167-0820	WASHER, FLAT: fan drive control cover (88044-960-516)	ea	4	1	2	4	1	2	4	80	400	B-26	7
X2 F	5340-194-4714	COVER, FAN DRIVE CONTROL: (10899041)	ea	1									B-26	8
P F	2930-765-4364	GASKET: fan drive control valve (☆☆ parts kit—2815-678-4245) (10865351)	ea	1	2	2	3	2	2	3	25		B-26	9
P H	5340-514-2321	INSERT, SCREW THREAD: fan drive control (early) (96906-21208F5-20)	ea	4				*	1	1	24	24	B-26	16
		STUD, PLAIN: fan drive housing to cover												
P H	5307-679-4985	0.003 oversize (7046669)	ea	24				3	7	13	144	192	B-26	18
P H	5307-679-4989	0.007 oversize (7046670)	ea	24				3	7	13	144	192	B-26	18
X1 H		BUSHING, SLEEVE: fan drive bevel shaftgear bearing support, front and rear housing (8682469)	ea	12									B-26	21
P H	5340-803-7304	RING, RETAINING: fan drive driven bevel gearshaft (2), fan drive bevel shaftgear bearing (1) (96906-16624-1156)	ea	3				*	1	2	45	300	B-26	28
P H	3110-516-5290	BEARING, BALL, ANNULAR: fan drive driven bevel gearshaft (2), fan drive bevel gearshaft (1) (29337-3L08M46)	ea	3				*	*	*	10	25	B-26	29
X2 H	5365-407-7011	SPACER: sleeve fan drive driven bevel gearshaft (8682674)	ea	2									B-26	30

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		0505 — FAN ASSEMBLY — Continued												
P H	3110-144-8927	BEARING, BALL, ANNULAR: fan drive driven gearshaft—inner (21450-714038)	ea	2				*	*	*	6	6	B-26	31
X2 H	3110-481-2825	PLATE, RETAINING BEARING: fan driven bevel gearshaft (8761390)	ea	2									B-26	32
P H	5310-209-2629	WASHER, KEY: fan driven bevel gearshaft bearing (7767350)	ea	2				2	2	3	20	200	B-26	33
P H	5306-150-9104	BOLT, MACHINE: fan driven bevel gearshaft bearing (7414569)	ea	2				2	3	5	40	40	B-26	34
P H	5340-804-2786	RING, RETAINING: fan drive plug, flywheel end (96906-16625-1125)	ea	1				*	*	1	15	100	B-26	37
P2 H	5310-406-7319	WASHER, FLAT: fan drive shaft, flywheel end (8761244)	ea	1				*	*	*	2	*	B-26	38
P H	5310-167-0820	WASHER, FLAT: inter fan drive shaft cover adapter (88044-960-516)	ea	4				1	2	4	80	400	B-26	46
P H	2930-678-3255	SHAFT, FAN DRIVE: flywheel end (8761287)	ea	1				*	2	2	8	12	B-26	49
P H	2930-678-3269	GEAR SET, BEVEL, MATCHED: fan drive, rear (5702622)	ea	1				*	2	2	8	12	B-26	
		Composed of:												
X1 H		1—GEARSHAFT BEVEL: fan drive (7320478)											B-26	50.1
X1 H		1—GEARSHAFT BEVEL: fan drive driven (8682684)											B-26	50.2
P H	2930-678-3271	SHIM: fan drive bevel gearshafts, front and rear (8682455)	ea	4					3	6	48	80	B-26	51
P H	3110-144-8662	BEARING, BALL: fan drive bevel gearshafts, front and rear (21450-700081)	ea	2				*	*	1	20	60	B-26	52
P2 H	2930-498-9359	SUPPORT, FAN DRIVE GEARSHAFT: front and rear fan drive housing (8725227)	ea	2				*	*	*	1	*	B-26	53

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		0505 — FAN ASSEMBLY — Continued												
P2 H	2930-678-3265	SHAFT, STRAIGHT: fan drive horizontal, intermediate (8761020)	ea	1				*	*	*	3	*	B-26	54
P H	5340-200-8975	RING, RETAINING: interfan driveshaft (21450-583288)	ea	1				*	*	*	10	16	B-26	55
P H	5330-580-3846	PACKING, PREFORMED: interfan driveshaft cover (☆☆ parts kit—2815-678-4245) (96906-28775-325)	ea	2				*	1	2	50		B-26	56
X2 H	2930-350-9399	COVER, FAN DRIVESHAFT: forward (7320469)	ea	1									B-26	57
P2 H	2930-411-5749	ADAPTER, FAN DRIVE: shaft cover (7320463)	ea	2				*	*	*	3	*	B-26	58
P H	4730-278-2065	CLAMP, HOSE: interfan driveshaft cover hose (21450-502919)	ea	2				*	*	1	20	50	B-26	60
M H		HOSE, NON-METALLIC: interfan drive shaft cover (fabricate from 4720-278-1112) (1 pc 2.00 in. lg) (8761226)	ft	1									B-26	61
P H	4720-278-1112	HOSE, NON-METALLIC (MILH 6000)	ft	1				*	*	2	4	20	B-26	61
X2 H	2930-408-4684	COVER, INTERFAN DRIVESHAFT: rear (7320480)	ea	1									B-26	62
P2 H	4730-124-1376	RESTRICTOR, FLUID FLOW: front fan drive housing (early) (10889688)	ea	1				*	*	*	2	*	B-26	66
		STUD, PLAIN: throttle lever shaft bracket (3), interfan driveshaft cover adapter (2)												
P H	5307-734-8668	0.003 oversize (7348668)	ea	5				2	3	5	30	40	B-26	67
P H	5307-638-7608	0.007 oversize (14351-401975P007)	ea	5				2	3	5	30	40	B-26	67
P H	4730-044-4689	PLUG, PIPE: oil port machining holes (7538990)	ea	1				*	2	2	6	10	B-26	68
P H	5310-950-0039	NUT, SELF-LOCKING, HEXAGON: cooling fan drive housing, forward (96906-21044N6)	ea	10				2	4	8	200	1000	B-26	69
P H	5310-333-7348	WASHER, FLAT: cooling fan drive housing assembly (9), fan drive housing base assembly (12) (8679576)	ea	21				10	22	41	420	2100	B-26	70

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		0505 — FAN ASSEMBLY — Continued												
		STUD, PLAIN: fan drive shaft gear bearing support, forward												
P H	5307-678-3320	0.003 oversize (7992673)	ea	4				2	2	2	24	32	B-26	71
P H	5307-678-3321	0.007 oversize (7992674)	ea	4				2	2	2	24	32	B-26	71
P2 H	2805-733-8667	TUBE: fan drive housing base oil transfer (7338667)	ea	1				*	*	*	2	*	B-26	72
P H	5330-582-2133	PACKING, PREFORMED: fan drive housing base to fan drive housing oil tube (☆☆ parts kit—2815-678-4245) (96906-28775-011)	ea	1				*	1	1	30		B-26	73
P H	2930-678-7099	GEARSET, BEVEL, MATCHED: fan drive (5702621)	ea	1				*	2	2	8	12	B-26	
		Composed of:												
X1 H		1—GEARSHAFT, BEVEL: fan drive driven (8682684)											B-26	74.1
X1 H		1—GEARSHAFT, BEVEL: fan drive (8682553)											B-26	74.2
P H	5315-753-8333	PIN, COTTER: fan drive gearshaft bearing support (4), fan drive housing base (10) (96906-24665-145)	ea	14				2	6	12	280	1400	B-26	75
P H	5310-842-1488	NUT, SLOTTED, HEXAGON: fan drive gearshaft bearing support (4), fan drive housing base (10) (96906-35692-21)	ea	14				2	4	8	210	1400	B-26	76
		STUD, PLAIN: fan drive housing base to housing, forward												
P H	5307-678-3329	0.003 oversize (8761203)	ea	2				2	2	2	12	16	B-26	77
P H	5307-678-3328	0.007 oversize (8761204)	ea	2				2	2	2	12	16	B-26	77
		STUD, PLAIN: fan drive housing base to housing, forward												
P H	5307-774-4795	0.003 oversize (7744795)	ea	6				2	3	5	36	48	B-26	78
P H	5307-774-4605	0.007 oversize (7744605)	ea	6				2	3	5	36	48	B-26	78
P H	5340-678-3311	INSERT, SCREW THREAD: fan drive housing base, forward (8352634)	ea	2				2	2	2	12	12	B-26	79

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		0505 — FAN ASSEMBLY — Continued												
		STUD, PLAIN: fan drive housing base to housing, forward	e											
P H	5307-678-6880	0.003 oversize (7992649)	ea	2				2	2	2	12	16	B-26	80
P H	5307-678-6881	0.007 oversize (7992650)	ea	2				2	2	2	12	16	B-26	80
P H	5330-599-2934	PACKING, PREFORMED: crankcase to fan drive housing base oil transfer tube, forward (☆☆parts kit—2815-678-4245) (96906-28775-112)	ea	1				*	1	1	30		B-26	81
P H	2930-068-6113	BASE, FAN DRIVE HOUSING: fan drive housing assembly, forward (8761155)	ea	1				*	2	2	6	8	B-26	82
P H	5305-269-3238	SCREW, CAP, HEXAGON HEAD: fan drive housing base to crankcase (96906-90727-62)	ea	2				*	1	2	40	60	B-26	83
P H	2815-937-4846	SUPPORT, BEARING FAN: fan drive gearshaft (rear) (8725226)	ea	1				*	2	2	6	12	B-26	84
P H	5340-291-3495	INSERT, SCREW THREAD: fan drive bevel gear-shaft support, forward (96906-124697)	ea	2				*	*	1	12	12	B-26	85
P2 H	5315-058-9929	PIN, STRAIGHT, HEADLESS: fan drive housing base, forward (21450-589929)	ea	2				*	*	*	2	*	B-26	86
P H	5305-914-6131	SCREW, CAP, HEXAGON HEAD: cooling fan drive housing, forward, to crankcase (96906-18153-63)	ea	2				*	1	2	40	60	B-26	87
P2 H	2930-156-9408	HOUSING ASSEMBLY: cooling fan drive, forward (10935541)	ea	1				*	*	*	3	*	B-26	88
X1 H		PLUG, MACHINE THREAD: accessory cam drive bevel gearshaft (10865382)	ea	2									B-26	96
P2 H	5310-239-5848	WASHER, KEY: accessory cam drive bevel gearshaft plug (10865381)	ea	2				*	*	*	2	*	B-26	97
P2 H	4730-168-1935	RESTRICTOR, FLUID FLOW: rear fan drive housing (early) (10898735)	ea	1				*	*	*	2	*	B-26	105

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		0505 — FAN ASSEMBLY — Continued												
P2 F	2930-457-0314	SHAFT, FAN DRIVE CLUTCH: (8761258)	ea	2	*	*	*	*	*	*	2	*	B-27	20
X1 F		DISK, CLUTCH: fan drive top (8761259)	ea	2									B-27	21
P F	2930-933-6957	DISK, CLUTCH: fan drive (8761066)	ea	4	2	2	2	2	2	2	32	40	B-27	22
X1 F		HOUSING, FAN DRIVE CLUTCH DISK: (8761251)	ea	2									B-27	23
X1 F		DISK, CLUTCH: fan drive (intermediate) (8761261)	ea	2									B-27	24
X1 F		RING, RETAINING: fan drive clutch disk (8761255)	ea	2									B-27	25
X1 F		SHAFT, FAN DRIVE VERTICAL ASSEMBLY: (8761067)	ea	2									B-27	26
X1 F		DISK, CLUTCH: fan drive bottom (8761253)	ea	2									B-27	27
P F	5305-655-6361	SCREW, CAP, HEXAGON: clutch drive disk to vertical shaft (96906-90727-6)	ea	6	1	3	5	1	3	5	120	180	B-27	28
P2 F	5310-682-5824	WASHER, KEY: fan drive clutch disks to fan drive vertical shaft (8761241)	ea	6	*	*	*	*	*	*	4	*	B-27	29
P F	5310-408-2530	WASHER, FLAT: fan drive clutch disks to fan drive vertical shaft (8761238)	ea	6	1	3	5	1	3	5	120	600	B-27	30
P F	2930-077-2818	SPACER, FAN DRIVE CLUTCH DISK: (8761239)	ea	6	2	2	3	2	2	3	48	72	B-27	31
P2 F	5315-490-5588	PIN, STRAIGHT, HEADLESS: fan drive clutch flange and ball retaining plate (10882757)	ea	4	*	*	*	*	*	*	5	*	B-27	32
P F	5340-663-1245	RING, RETAINING: pin to fan drive clutch disk housing (96906-16632-1031)	ea	4	*	1	1	*	1	1	30	200	B-27	33
P F	5310-682-5823	WASHER, KEY: fan drive clutch piston to fan drive clutch ball retainer plate (8761229)	ea	2	2	3	5	2	3	5	40	200	B-27	34
P F	5310-685-8217	NUT, PLAIN, ROUND: fan drive clutch to fan drive clutch ball retainer plate (8761227)	ea	2	2	2	3	2	2	3	30	200	B-27	35

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					(a) 1-20	(b) 21-60	(c) 61-100	(a) 1-20	(b) 21-60	(c) 61-100			(a) FIGURE NO.	(b) ITEM NO.
		0505 — FAN ASSEMBLY — Continued												
X1 F		PISTON, FAN DRIVE CLUTCH: (8761250)	ea	2									B-27	36
P F	2930-678-3268	RING SET, PISTON: fan drive clutch (5702620)	ea	1	*	2	2	*	2	2	6	5	B-27	
		Composed of:												
X1 F		1—RING, PISTON: fan drive clutch (upper) (8761301)											B-27	37.1
X1 F		1—RING, PISTON: fan drive clutch (lower) (8343678)											B-27	37.2
X1 F		PRESSURE PLATE, FAN DRIVE CLUTCH: (8761257)	ea	2									B-27	38
P F	2930-678-3256	SPRING, HELICAL, COMPRESSION: fan drive (8761260)	ea	6	2	3	5	2	3	5	72	120	B-27	39
P F	3110-462-0392	BALL, BEARING: fan clutch (10951369)	ea	30	7	16	29	7	16	29	300	3000	B-27	40
P F	2930-435-7644	HUB ASSEMBLY, FAN DRIVE: (8761064)	ea	2	2	2	2	2	2	2	12	24	B-27	41
P F	5306-527-4128	BOLT, MACHINE: fan drive hub and housing to fan drive flange (88044-5PC14A)	ea	32	7	16	29	7	16	29	320	640	B-27	42
P F	9525-990-7799	WIRE, NICKEL COPPER: fan drive hub and housing to fan drive flange (2 pcs 36 in. lg) (96906-20995NC40)	ft	6	1	2	3	1	2	3	60	600	B-27	43
P F	3110-554-2979	BEARING, BALL, ANNULAR: fan drive vertical shaft, outer (21335-9109KFS179)	ea	2	2	2	3	2	2	3	20	15	B-27	44
P F	5306-182-2029	BOLT, MACHINE: fan drive hub and housing to fan drive flange (88044-5H12A)	ea	32	3	7	14	3	7	14	320	640	B-27	45
P F	2930-435-4568	HUB, FAN DRIVE: (10951079)	ea	2	*	2	2	*	2	2	12	24	B-27	46
X1 F		SHAFT, FAN DRIVE VERTICAL ASSEMBLY: (10951081)	ea	2									B-27	47
X1 F		DISK, CLUTCH: (10951083)	ea	4									B-27	48

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION (a) FIGURE NO.	(b) ITEM NO.
		0505 — FAN ASSEMBLY — Continued												
P F	2930-435-4572	DISK, CLUTCH: (10951084)	ea	4	2	3	5	2	3	5	32	40	B-27	49
X1 F		HOUSING, FAN DRIVE CLUTCH DISK: (10951077)	ea	2									B-27	50
X1 F		FLANGE, FAN DRIVE CLUTCH: (10951119)	ea	2									B-27	51
P O R	2930-435-4564	CLUTCH, FRICTION: fan drive (10951075)	ea	2	2	2	2	2	2	2	6	20	B-27	52
P O	5330-187-3615	PACKING, PREFORMED: fan drive housing cover (☆☆parts kit—2815-678-4245) (21450-546908)	ea	2	*	1	2	*	1	2	50		B-27	53
P O	5310-849-6883	NUT, SLOTTED, HEXAGON: fan drive housing cover (96906-35692-13)	ea	24	3	7	14	3	7	14	360	2400	B-27	54
P O	5310-167-0820	WASHER, FLAT: fan drive oil seal housing to fan drive housing cover (88044-960-516)	ea	12	2	5	10	2	5	10	240	1200	B-27	55
P O	5306-182-2026	BOLT, MACHINE: fan drive oil seal housing to fan drive housing cover (88044-5H7A)	ea	12	2	5	10	2	5	10	240	240	B-27	56
P O	9525-990-7799	WIRE, NICKEL COPPER: fan drive oil seal housing to fan drive housing cover (2 pcs 12 in. lg), fan drive housing cover (2 pcs 24 in. lg) (96906-20995NC40)	ft	6	1	2	3	1	2	3	60	600	B-27	57
P O	2930-902-3189	SEAL, PLAIN, ENCASED: fan drive vertical shaft (10935537)	ea	2	2	2	3	2	2	3	25	175	B-27	58
X1 O		HOUSING, FAN DRIVE OIL SEAL: (8761063)	ea	2									B-27	59
P O	2930-678-3267	RETAINER AND OIL SEAL: fan drive assembly (8761062)	ea	2	*	2	2	*	2	2	6	25	B-27	60
P O	3110-555-5207	BEARING, BALL, ANNULAR: fan drive clutch flange (21335-307K)	ea	2	*	*	1	*	*	1	20	100	B-27	61
P2 O	2920-248-4631	COVER, FAN DRIVE HOUSING: (8682765)	ea	2	*	*	*	*	*	*	2	*	B-27	62

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE (a) 1-30	(b) 31-60	(c) 61-100	(7) 30-DAY GS MAINT. ALLOWANCE (a) 1-30	(b) 31-60	(c) 61-100	(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION (a) FIGURE NO.	(b) ITEM NO.
		06—ELECTRICAL SYSTEM												
		0601—GENERATOR												
P O	2920-455-5835	BAR, CLAMPING, GENERATOR: (10882765)	ea	4	*	2	2	*	2	2	8	10	B-7	15
P O	5306-413-4373	BOLT, U: generator to cradle (10882750)	ea	1	*	2	2	*	2	2	6	10	B-7	25
P2 O	2920-498-9358	CRADLE, GENERATOR: engine accessory assembly (10882774)	ea	1	*	*	*	*	*	*	2	*	B-7	26
		STUD, PLAIN: generator cradle to support bracket												
P O	5307-866-6736	0.003 oversize (8666736)	ea	2	2	2	2	2	2	2	12	16	B-7	27
P O	5307-866-6737	0.007 oversize (8666737)	ea	2	2	2	2	2	2	2	12	16	B-7	27
P O	5310-088-0553	NUT, SELF-LOCKING, HEXAGON: generator to cradle (96906-21044N5)	ea	2	*	1	2	*	1	2	40	200	B-7	28
X2 O	2920-402-5205	SUPPORT, GENERATOR: (10882761)	ea	1									B-7	29
P O	5310-333-7348	WASHER, FLAT: generator support to generator cradle (8679576)	ea	2	2	3	5	2	3	5	40	200	B-7	30
P O	5310-950-0039	NUT, SELF-LOCKING: generator support to cradle (96906-21044N6)	ea	2	*	1	2	*	1	2	40	200	B-7	31
P O	9525-990-7799	WIRE, NICKEL COPPER: generator support to oil pan (2 pcs 12 in. lg) (96906-20995NC40)	ft	2	*	*	*	*	*	*	20	200	B-7	32
P O	5306-678-3324	BOLT, MACHINE: generator support to oil pan (7039746)	ea	4	2	4	8	2	4	8	80	80	B-7	33
P O	5310-776-7318	WASHER, FLAT: generator support to oil pan (7767318)	ea	4	2	4	8	2	4	8	80	400	B-7	34
P H	5340-291-3492	INSERT, SCREW THREAD: generator support (96906-21208F6-15)	ea	4				2	2	3	24	74	B-8	16
		STUD, PLAIN: generator adapter to generator												
P O	5307-741-5384	0.003 oversize (7415384)	ea	6	2	3	5	2	3	5	36	48	B-14	26
P O	5307-741-5385	0.007 oversize (7415385)	ea	6	2	3	5	2	3	6	36	48	B-14	26

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION (a) FIGURE NO.	(b) ITEM NO.
		0601 — GENERATOR — Continued												
P O	2920-318-4127	GASKET: generator mounting (☆☆parts kit—2815-678-4245) (8666738)	ea	1	2	2	3	2	2	3	25		B-15	17
P O	5310-950-0039	NUT, SELF-LOCKING, HEXAGON: generator to adapter (96906-21044N6)	ea	6	1	3	5	1	3	5	120	600	B-15	18
P O T	2920-830-6660	GENERATOR, ENGINE ACCESSORY: assembly (refer to TM 9-2920-224-35P for component parts) (10889713)	ea	1	1	2	2	1	2	2	10	20	B-15	19
P O	5306-051-4075	BOLT, MACHINE: generator air exhaust tube to turbosupercharger shroud plate boss (96906-90727-33)	ea	2	*	1	2	*	1	2	40	40	B-28	1
P O	5310-407-9566	WASHER, LOCK: generator air exhaust tube to turbosupercharger shroud plate boss (2), generator air intake tube angle brackets to crankcase and tube (6) (96906-35338-45)	ea	8	1	4	7	1	4	7	160	800	B-28	2
P O	5310-081-4219	WASHER, FLAT: generator air exhaust tube to turbosupercharger shroud plate boss (2), generator air intake tube angle brackets to crankcase and tube (6) (96906-27183-12)	ea	8	1	4	7	1	4	7	160	800	B-28	3
X2 O	5340-242-5601	STRAP, RETAINING: generator air exhaust tube to turbosupercharger shroud plate boss (10883940)	ea	1									B-28	4
P O	2920-902-3187	BREATHER CAP: generator air exhaust tube (10935473)	ea	1	*	2	2	*	2	2	6	10	B-28	5
P O	4730-908-6292	CLAMP, HOSE: generator air exhaust tube to cap (1), air intake hose to tube (1), boot to exhaust tube (1) (96906-35842-14)	ea	3	*	1	1	*	1	1	30	60	B-28	6
P2 O	5340-453-5595	STRAP, RETAINING: generator air exhaust tube to turbosupercharger shroud plate boss (10883941)	ea	1	*	*	*	*	*	*	5	*	B-28	7
P O	2990-411-8330	TUBE, EXHAUST AIR ASSEMBLY: generator (10935471)	ea	1	*	2	2	*	2	2	6	10	B-28	8

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE			(7) 30-DAY GS MAINT. ALLOWANCE			(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION	
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-200			(a) FIGURE NO.	(b) ITEM NO.
		0601 — GENERATOR — Continued												
P O	5310-080-6004	WASHER, FLAT: generator air exhaust tube retaining strap to turbosupercharger tie rod boss (96906-15795-214)	ea	2	*	1	2	*	1	2	40	200	B-28	9
P O	5310-637-9541	WASHER, LOCK: generator air exhaust tube retaining strap to turbosupercharger tie rod boss (96906-35338-46)	ea	2	*	1	2	*	1	2	40	200	B-28	10
P O	5305-269-3235	SCREW, CAP, HEXAGON HEAD: generator air exhaust tube retaining strap to turbosupercharger tie rod boss (96906-90727-59)	ea	2	*	1	2	*	1	2	40	40	B-28	11
P O	2990-771-6969	BOOT, GENERATOR AIR: exhaust (10883745)	ea	1	2	2	3	2	2	3	20	75	B-28	12
P O	4730-908-6293	CLAMP, HOSE: boot to generator (4), intake elbow to hose (1) (96906-35842-15)	ea	5	*	1	2	*	1	2	50	100	B-28	13
P O	5306-050-1238	BOLT, MACHINE: generator air intake tube angle brackets to crankcase and tube (96906-90727-32)	ea	6	1	3	5	1	3	5	120	120	B-28	14
P2 O	5340-449-2580	BRACKET, ANGLE: generator air intake tube to crankcase (10884034)	ea	1	*	*	*	*	*	*	5	*	B-28	15
P2 O	5340-456-1798	BRACKET, ANGLE: generator air intake tube to crankcase (10884033)	ea	1	*	*	*	*	*	*	5	*	B-28	16
P O	2920-063-8127	TUBE ASSEMBLY, GENERATOR: air intake (10884037)	ea	1	*	2	2	*	2	2	8	23	B-28	17
P O	2920-771-6968	HOSE, GENERATOR AIR: (10883740)	ea	1	*	2	3	*	2	3	20	75	B-28	18
P2 O	2920-245-8162	ELBOW: generator air intake hose (10883748)	ea	1	*	*	*	*	*	*	4	*	B-28	19
P O	2920-803-0259	GASKET: generator air intake hose to screen (10883737)	ea	1	2	2	3	2	2	3	25	41	B-28	20
P O	2815-763-1402	SCREEN ASSEMBLY: generator air intake (10883731)	ea	1	*	2	2	*	2	2	8	10	B-28	21
P O	5305-068-0515	SCREW, CAP, HEXAGON HEAD: generator air intake screen to hose elbow (96906-90727-8)	ea	6	1	3	5	1	3	5	120	180	B-28	22

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION (a) FIGURE NO.	(b) ITEM NO.
		0601 — GENERATOR — Continued												
P O	5310-582-5965	WASHER, LOCK: generator air intake screen to flange (96906-35338-44)	ea	6	1	3	5	1	3	5	120	600	B-28	23
P F	5340-291-3484	INSERT, SCREW THREAD: air intake elbow (96906-124696)	ea	6	*	1	2	*	1	2	36	57	B-28	24
		0603—STARTING MOTOR												
		STUD, PLAIN: crankcase to starter												
P O	5307-678-3510	0.003 oversize (8682500)	ea	1	*	2	2	*	2	2	6	8	B-2	27
P O	5307-678-3509	0.007 oversize (8682501)	ea	1	*	2	2	*	2	2	6	8	B-2	27
P O	5306-678-6889	BOLT, MACHINE: starter and adapter to crankcase (8761272)	ea	2	2	3	5	2	3	5	40	40	B-2	30
P O	5310-333-7348	WASHER, FLAT: starter support to cradle assembly (4), starter support bracket to oil pan (4) (8679576)	ea	8	1	4	7	1	4	7	160	800	B-7	10
P2 O	5306-453-5589	BOLT, "U": to secure starter to starter cradle (10883080)	ea	1	*	*	*	*	*	*	2	*	B-7	11
P H	2815-821-4002	CRADLE ASSEMBLY, STARTER: starter to engine (10883072)	ea	1				*	2	2	6	8	B-7	14
P O	5310-088-0553	NUT, SELF-LOCKING, HEXAGON: starter to cradle (96906-21044N5)	ea	2	*	1	2	*	1	2	40	200	B-7	16
		STUD, PLAIN: starter cradle to support bracket												
P O	5307-866-6736	0.003 oversize (8666736)	ea	4	2	2	3	2	2	3	24	32	B-7	17
P O	5307-866-6737	0.007 oversize (8666737)	ea	4	2	2	3	2	2	3	24	32	B-7	17
X2 O	2920-402-5204	SUPPORT, STARTER: (10865001)	ea	1									B-7	18
P O	5310-950-0039	NUT, SELF-LOCKING: starter support to cradle assembly (96906-21044N6)	ea	4	1	2	3	1	2	3	80	400	B-7	71
P O	5306-678-3324	BOLT, MACHINE: starter support bracket to oil pan (7039746)	ea	4	2	4	8	2	4	8	80	80	B-7	72

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE			(7) 30-DAY GS MAINT. ALLOWANCE			(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION	
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		0603 — STARTING MOTOR — Continued												
P O	9525-990-7799	WIRE, NICKEL COPPER: starter support bracket to oil pan (2 pcs 12 in. lg) (96906-20995NC40)	ft	2	*	*	*	*	*	*	20	200	B-7	73
P H	5340-291-3492	INSERT, SCREW THREAD: starter support (96906-21208F6-15)	ea	4				*	1	1	24	74	B-8	12
P O T	2920-973-1557	STARTER, ENGINE, ELECTRICAL: assembly (refer to TM 9-2920-232-34 for component parts) (8712242)	ea	1	1	2	2	1	2	2	10	15	B-15	24
P O	2590-437-0990	LEAD, ELECTRICAL: starter solenoid (10887592)	ea	1	*	2	2	*	2	2	10	30	B-15	25
P O	5310-982-6809	NUT, SELF-LOCKING, HEXAGON: starter to crankcase and transmission adapter (96906-21044N10)	ea	3	1	2	3	1	2	3	60	300	B-15	26
P O	2920-678-7101	GASKET: starter mounting(☆☆parts kit—2815-678-4245) (7084278)	ea	1	2	2	3	2	2	3	25		B-15	27
		0610—SENDING UNITS AND WARNING SWITCHES												
P O	6620-993-5546	TRANSMITTER, PRESSURE: engine oil pressure (high) (96906-24539-1)	ea	1	2	2	3	2	2	3	20	20	B-2	36
P O	5930-692-9258	SWITCH, PRESSURE: engine low oil pressure warning, crankcase (right bank) (96906-90530-2)	ea	1	2	2	3	2	2	3	20	30	B-2	41
P O	5930-688-9882	SWITCH, THERMOSTATIC: engine high oil temperature warning (81349-M12285-1-5)	ea	1	2	2	3	2	2	3	20	30	B-6	36
P O	6685-814-5271	TRANSMITTER, TEMPERATURE: engine oil temperature (96906-24537-1)	ea	1	2	2	2	2	2	2	12	50	B-6	38

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION (a) FIGURE NO.	(b) ITEM NO.
		33—SPECIAL PURPOSE KITS												
		3301—REUSABLE SHIPPING CONTAINERS												
X1 D		CONTAINER ASSEMBLY: upper section (10912298)	ea	1									B-32	1
P D	5310-763-8901	NUT, PLAIN, HEXAGON: engine to mount support (6), engine support to container (4) (oil pan end) (96906-51968-23)	ea	10								100	B-32	2
P D	5310-584-7888	WASHER, LOCK: engine to mount support (6), engine support to container (4) (oil pan end) (96906-35338-51)	ea	10								100	B-32	3
X1 D		BRACKET: (10951230)	ea	1									B-32	4
P D	5330-492-2938	GASKET: seal between upper and lower half of engine container (10912270)	ea	1								100	B-32	5
X1 D		CONTAINER ASSEMBLY: lower section (10912271)	ea	1									B-32	6
P D	4820-304-9415	VALVE, RELIEF ASSEMBLY: air (8376456)	ea	1								10	B-32	7
P D	6685-906-0156	INDICATOR: humidity (8355883)	ea	1								100	B-32	8
P D	4820-242-4064	VALVE, PNEUMATIC TANK: filling (53477-645A6)	ea	1								10	B-32	9
P D	5310-209-0965	WASHER, LOCK: transmission adapter to bracket, engine container (96906-35338-47)	ea	7								70	B-32	10
P D	5305-710-4194	SCREW, CAP, HEXAGON HEAD: transmission adapter to bracket engine container (96906-90726-89)	ea	1								10	B-32	11
P D	5305-710-4195	SCREW, CAP, HEXAGON HEAD: transmission adapter to bracket engine container (96906-90726-90)	ea	6								60	B-32	12
P D	5305-727-3804	SCREW, CAP, HEXAGON HEAD: engine container sections upper to lower (96906-90725-165)	ea	48								480	B-32	13

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE (a) 1-20	(b) 21-60	(c) 51-100	(7) 30-DAY GS MAINT. ALLOWANCE (a) 1-20	(b) 21-60	(c) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION (a) FIGURE NO.	(b) ITEM NO.
		3301 — REUSABLE SHIPPING CONTAINERS — Continued												
P D	6850-264-6572	DESSICANT, ACTIVATED: (150) 16 unit bags, reusable, engine container (81349-MIL-D-3464 Class I)	dr	1								5	B-32	14
P D	5306-678-4262	BOLT, MACHINE: engine to mount support (container) (10863824)	ea	6								60	B-32	15
Xl D		BRACKET: (10951231)	ea	1									B-32	16
P D	5310-820-6653	WASHER, LOCK: engine container sections upper and lower (96906-35338-50)	ea	48								480	B-32	17
P D	5310-763-8920	NUT, PLAIN, HEXAGON: engine container sections upper to lower (96906-51967-20)	ea	48								480	B-32	18
		42—ELECTRICAL EQUIPMENT												
		4210—INSTRUMENTS												
P D	6645-420-5072	METER, TIME-TOTALIZING, ELECTRICAL: (11640392)	ea	1								10	B-15	12
P O	2590-134-4815	LEAD ASSEMBLY, ELECTRICAL: branched, time totalizing meter to ground and to generator terminal (11641819)	ea	1	*	2	2	*	2	2	10	10	B-15	13
P O	5306-050-1238	BOLT, MACHINE: time totalizing meter lead clamps to crankcase (right bank) (96906-90727-32)	ea	2	*	1	2	*	1	2	40	40	B-15	14
P O	5310-407-9566	WASHER, LOCK: time totalizing meter lead clamps to crankcase (right bank) (96906-35338-45)	ea	2	*	1	2	*	1	2	40	200	B-15	15
P O	5340-738-5174	CLAMP, LOOP: time totalizing meter lead to crankcase (right bank) (7385174)	ea	2	2	2	2	2	2	2	12	30	B-15	16

Section III. SPECIAL TOOLS FOR DIRECT SUPPORT, GENERAL SUPPORT AND DEPOT MAINTENANCE

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE (a) 1-20	(b) 21-99	(c) 51-100	(7) 30-DAY GS MAINT. ALLOWANCE (a) 1-20	(b) 21-99	(c) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION (a) FIGURE NO.	(b) ITEM NO.
		26—TOOLS AND TEST EQUIPMENT												
		2604—SPECIAL TOOLS												
P H	4910-554-1317	STAND, VALVE, REMOVING AND INSERTING: cylinder, use with lifter 5120-678-5285 (8708419)	ea	1				1	1	1	10	1	B-29	5
P H	4910-795-7950	BUSHING, REAMER: used with reamers 5110-708-3699 and 5110-708-3698 to ream intake valve guide hole (10882892)	ea	1				1	1	1	7	1	B-30	33
P H	4910-795-7951	PROTECTOR, CRANKCASE: protecting crankcase at cylinder removal (10882790)	ea	12				12	12	12	7	12	B-30	7
P O	4910-795-7952	SPACER, FAN ROTOR HUB SLEEVE: retains fan clutch oil seal during fuel injection pump leak test (10882651)	ea	1	2	2	2	2	2	2	10	2	B-30	13
P F	4910-795-7953	TUBE, ATTACHING, NOZZLE: check fuel injector nozzles (10882963)	ea	1	1	1	1	1	1	1	8	1	B-30	20
P H	4910-795-7954	SLING, FAN DRIVE AND ADVANCE UNIT HOUSING: removing and installing rear fan and advance unit housing (10882945)	ea	1				1	1	1	7	1	B-29	8
P H	4910-795-7955	SLING, CRANKSHAFT AND CONNECTING ROD: removing and installing engine crankshaft (10882958)	ea	1				1	1	1	7	1	B-29	7
P H	4910-795-7956	COMPRESSOR AND GAGE: installing pistons and rings in cylinders (10882888)	ea	1				1	1	1	7	1	B-30	11
P H	4910-795-7957	BUSHING, REAMER: used with reamer—5110-708-3696 and 5110-708-3697 to ream exhaust valve guide hole (10882891)	ea	1				1	1	1	7	1	B-30	32
P F	4910-795-7958	CUTTER, CARBON NOZZLE: cleaning carbon from fuel injector nozzle holder seat in cylinder head (10882949)	ea	1	1	1	1	1	1	1	7	1	B-30	16
P F	4910-795-7961	ADAPTER, COMPRESSION: used with gage 4910-870-6283 to check cyiinder compression (8743025)	ea	1	1	1	1	1	1	1	7	1	B-30	27

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE			(7) 30-DAY GS MAINT. ALLOWANCE			(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION	
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		2604 — SPECIAL TOOLS — Continued												
P H	4910-856-4137	STAND, MAINTENANCE AND OVERHAUL: engine overhaul (10912260)	ea	1				1	1	1	7	1	B-29	1
P F	4910-870-6283	GAGE ASSEMBLY: used with adapter 4910-795-7961 to check cylinder compression (10899180)	ea	1	1	1	1	1	1	1	8	1	B-29	2
P F	4910-919-2884	SLING, MULTIPLE LEG: engine lifting (10952220)	ea	1	1	1	1	1	1	1	7	1	B-29	9
P D	4910-937-4261	TESTER, CYLINDER BARREL: check for cracks in cylinder barrel (10935532)	ea	1								1	B-31	1
P H	4910-986-9873	TEST STAND: test fuel injection pump advance unit (10898928)	ea	1				1	1	1	7	1		
P H	5110-708-3696	REAMER, HAND: used with bushing—4910-795-7957 for rough reaming exhaust valve guide hole (7083696)	ea	1				1	1	1	7	1	B-30	41
P H	5110-708-3697	REAMER, HAND: used with bushing—4910-795-7957 for finish reaming exhaust valve guide holes (7083697)	ea	1				1	1	1	7	1	B-30	43
P H	5110-708-3698	REAMER, HAND: used with bushing—4910-795-7950 for rough reaming intake valve guide holes (7083698)	ea	1				1	1	1	7	1	B-30	42
P H	5110-708-3699	REAMER, HAND: used with bushing—4910-795-7950 for finish reaming intake valve guide holes (7083699)	ea	1				1	1	1	7	1	B-30	39
P F	5120-078-3809	CROWFOOT, ATTACHMENT: tighten fuel injector tube nuts at pump head, use w/ wrench—5120-221-7947 (10935497)	ea	1	1	1	1	1	1	1	8	1	B-30	25
P F	5120-221-7947	WRENCH, TORQUE: used with crowfoot wrench—5120-871-7198 to torque nozzle (91348-GGG-W-686)	ea	1	1	1	1	1	1	1	7	1	B-30	28

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION (a) FIGURE NO.	(b) ITEM NO.
		2604 — SPECIAL TOOLS — Continued												
P H	5120-251-1527	EXTRACTOR, SCREW THREAD: removing threaded inserts, crankcase to cylinder, 7/16 to 1.00 in. (7751056)	ea	1				1	1	1	7	1	B-30	38
P H	5120-310-4668	PULLER, MECHANICAL: used with adapter—5120-837-5091 to remove starter and generator drive idler gearshaft and main bearings used with adapter—5120-837-5091 and spreading tool 5120-575-7767 (8708712)	ea	1				1	1	1	7	1	B-30	21
P H	5120-448-0400	PULLER, MECHANICAL: removing intake valve guides (10882953)	ea	1				1	1	1	7	1	B-30	10
P H	5120-448-0401	PULLER, MECHANICAL: removing exhaust valve guides (10882954)	ea	1				1	1	1	7	1	B-30	9
P H	5120-448-0402	REPLACER, VALVE GUIDE: installing intake valve guides (10883052)	ea	1				1	1	1	7	1	B-30	35
P F	5120-448-0404	WRENCH, OPEN END: turbosupercharger oil hose to engine (10883075)	ea	1	1	1	1	1	1	1	8	1	B-29	4
P H	5120-448-7993	REPLACER, VALVE GUIDE: installing exhaust valve guides (10883053)	ea	1				1	1	1	7	1	B-30	31
P H	5120-473-7222	PULLER, MECHANICAL: removing fan drive oil seal retainer or vibration damper and crankshaft oil seal housing (5379997)	ea	1				3	3	3	7	3	B-30	5
P H	5120-575-7767	SPREADING TOOL, CRANKCASE: used with puller 5120-310-4668 and adapter 5120-837-5091 to remove main bearing caps (8708361)	ea	1				1	1	1	7	1	B-30	36
P H	5120-672-8897	INSERTER, SCREW THREAD: install screw lock threaded insert, 1/2-20 (8761582)	ea	1				1	1	1	7	1	B-30	1
P F	5120-678-5282	PULLER, MECHANICAL: removing and installing camshaft driveshaft and upper gear oil transfer plug (8761297)	ea	1	1	1	1	1	1	1	7	1	B-30	34

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE			(7) 30-DAY GS MAINT. ALLOWANCE			(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION	
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		2604 — SPECIAL TOOLS — Continued												
P H	5120-678-5285	LIFTER ASSEMBLY, VALVE: used with stand 4910-554-1317 for removing and installing valves and valve springs (8761535)	ea	1				1	1	1	7	1	B-29	6
P O	5120-678-5286	WRENCH, OPEN END, FIXED: to remove or install fuel injector nozzle holders (8761560)	ea	1	1	1	1	1	1	1	8	1	B-30	44
P H	5120-678-5287	WRENCH, BOX: torquing cylinder hold-down nuts (8761561)	ea	1				1	1	1	8	1	B-30	30
P O	5120-678-5288	WRENCH, OPEN END: removing and installing starter mounting nuts (8761568)	ea	1	1	1	1	1	1	1	8	1	B-30	24
P H	5120-710-7437	INSERTER, SCREW THREAD: install screw lock threaded insert, 3/8-24 (8375324)	ea	1				1	1	1	7	1	B-30	2
P H	5120-723-6833	EXTRACTOR, SCREW THREAD: removing threaded inserts, size No. 10 thru 3/8 (81349-MILT0021309A Table VIII, Type V, Size 2)	ea	1				1	1	1	7	1	B-30	37
P H	5120-752-9755	PLIERS, RETAINING RING: remove or install inner fan driveshaft retaining ring (GGG-P-480A-Type 2, Class 3, Style B, Size 22)	ea	1				1	1	1	7	1	B-30	12
P O	5120-789-4881	WRENCH, BOX: removing and installing generator mounting nuts (10935476)	ea	1	1	1	1	1	1	1	7	1	B-30	26
P F	5120-793-7895	WRENCH, SPLINED: engine turning at transmission drive gearshaft (10882747)	ea	1	1	1	1	1	1	1	7	1	B-30	6
P H	5120-793-7896	SOCKET, WRENCH, FACE: removing and installing fan drive clutch piston to clutch ball retainer plate (10882653)	ea	1				1	1	1	8	1	B-30	8
P H	5120-795-0177	REMOVER AND REPLACER: removing and installing piston rings (7950177)	ea	1				1	1	1	8	1	B-30	22
P H	5120-797-2405	INSERTER, SCREW THREAD: install screw lock threaded inserts, 5/16-24 (81349-MILT21309 Type 3, Class 1, Style A)	ea	1				1	1	1	7	1	B-30	4

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION (a) FIGURE NO.	(b) ITEM NO.
		2604 — SPECIAL TOOLS — Continued												
P H	5120-797-2407	INSERTER, SCREW THREAD: install screw lock threaded insert, 7 / 16-20 (81349-MILT21309 Type 3, Class 1, Style A)	ea	1				1	1	1	7	1	B-30	3
P H	5120-837-5091	ADAPTER, MECHANICAL: used with puller 5120-310-4668 to remove starter and generator idler gearshaft and with spreading tool 5120-575-7767 to remove main bearing caps (8375091)	ea	1				1	1	1	7	1	B-30	14
P O	5120-871-7198	CROWFOOT ATTACHMENT: remove or install fuel injector nozzle holders (11610167)	ea	1	1	1	1	1	1	1	8	1	B-30	15
P O	5120-873-6943	PULLER, MECHANICAL: remove fuel injector nozzles (11610150)	ea	1	1	1	1	1	1	1	7	1	B-30	40
P O	5120-875-9556	SOCKET, WRENCH: remove fuel injector nozzle holders (11610171)	ea	1	1	1	1	1	1	1	10	1	B-30	23
P F	5210-793-7897	BLADE, THICKNESS GAGE: valve tappet adjusting .100 gap (10882617)	ea	1	1	1	1	1	1	1	10	1	B-30	19
P F	5210-793-7898	BLADE, THICKNESS GAGE: intake valve tappet adjusting .010 gap (10882615)	ea	1	1	1	1	1	1	1	10	1	B-30	17
P F	5210-793-7899	BLADE, THICKNESS GAGE: exhaust valve tappet adjusting .025 gap (10882616)	ea	1	1	1	1	1	1	1	10	1	B-30	18
P H	5220-988-8774	GAGE, RING, PLAIN: checking piston ring gap standard and .020 oversize (10912589)	ea	1				1	1	1	7	1	B-29	3
P F	5306-017-6143	BOLT, EYE: lifting, flywheel (96906-51937-7)	ea	1	1	1	1	1	1	1	7	1	B-30	29
P D	6645-179-2712	RESET DEVICE, HOURMETER: (11641917)	ea	1								1	B-31	2

Section IV. GENERAL USE STANDARDIZED PARTS

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION (a) FIGURE NO.	(b) ITEM NO.
	4730-781-6530	ADAPTER, STRAIGHT, PIPE TO TUBE: safety sleeve comp type, male pipe end, tube 1/4, 1/2-20UNF-2A (MS39206-3)		3										
	4730-350-9786	ADAPTER, STRAIGHT, PIPE TO TUBE: compression, safety sleeve, 1/2 in. tube (MS39206-9)		2										
	6680-973-1263	ADAPTER, TACHOMETER DRIVE: stght, 7/8-18NS-2A thd (MS39132-1)		1										
	3110-144-8518	BEARING, BALL: Jan111-02502-0000 (rad. SR, lt, non-loading groove, 0.9844 bore, 2.0472 od, 0.5906 in. wd) (700078)		2										
	3110-554-3197	BEARING, BALL, ANNULAR: MIL-STD-CODE 111-03002-000 (rad, SR, non-loading groove, 1.811 bore, 2.4409 od, 0.6299 in. wd) (21335-206KFS10179)		1										
	3110-516-5290	BEARING, BALL, ANNULAR: rad, SR, extra-lt, non-loading groove, type 1, 1.5748 bore, 2.6772 od, 0.5906 in. wd (28337-3L08M46)		3										
	3110-554-6080	BEARING, BALL, ANNULAR: angular contact, DR, loading groove assy, inwardly convergent contact angle, med series, S, type 2, 1.188 bore, 2.8346 od, 0.188 in. wd (43991-5306)		1										
	3110-516-5490	BEARING, BALL, ANNULAR: MIL-STD-CODE 111-0352-0000 (rad, SR, non-loading groove, 1.3780 bore, 2.8346 od, 0.6693 in. wd) (21335-207K)		4										
	3110-555-5207	BEARING, BALL, ANNULAR: rad, SR, med, non-loading groove, 1.3780 bore, 3.1496 od, 0.8268 in. wd (21335-307K)		2										
	3110-144-8927	BEARING, BALL, ANNULAR: angular contact, DR, lt, S, 1.5748 bore, 3.1496 od, 1.188 in. wd (714038)		2										
	3110-144-8662	BEARING, BALL, ANNULAR: MIL-STD-CODE 111-04002-000 (rad, SR, lt, non-loading groove, 1.5748 bore, 3.1496 od, 0.7087 in. wd) (700081)		2										

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION (a) FIGURE NO.	(b) ITEM NO.
	3110-529-9480	BEARING, BALL, ANNULAR: MIL-STD-CODE 111, rad, SR, extra lt, non-loading groove, type 1, 1.9684 bore, 3.1496 od, 0.6299 in. wd (21335-9110K)		1										
	3110-155-6675	BEARING, BALL, ANNULAR: SR, rad loading groove, 1.188 id, 3.5433 od, 0.9055 in. wd (700580)		1										
	3110-554-3272	BEARING, BALL, ANNULAR: MIL-STD-CODE 111, rad, SR, non-loading groove, extra-lt, type 1, 2.1654 bore, 3.5433 od, 0.7087 in. wd (29337-3L11M46)		1										
	3110-120-4367	BEARING, ROLLER, NEEDLE: open end, no inner race, 1.000 shaft dia, 1.500 od, 1.00 in. wd (709460)		1										
	5306-042-5828	BOLT, ASSEMBLED WASHER: hex-hd, int-teeth lockwasher, S, cd- or zn-pltd, No. 10 (0.190)-32NF-2A x 1/2 in. lg (425828)		6										
	5306-091-2417	BOLT, ASSEMBLED WASHER: ext-teeth lock-washer, hex-hd, S, cd- or zn-pltd, 5/16-24NF-3 x 3/4 in. lg (192417)		7										
	5306-944-7537	BOLT, CLOSE TOLERANCE: hex-hd, corr-res-S, 3/8-24UNF-3A x 27/32 in. lg (AN176C6A)		4										
	4730-278-0375	BOLT, FLUID, PASSAGE: S, 7/16-20NF-3 x 1-3/16 in. lg (AN775-4)		12										
	5306-182-2014	BOLT, MACHINE: hex-hd, alloy-S, dld-f/lkg-wire, cd- or zn-pltd, 1/4-28UNF-3A x 15/32 in. lg (AN4H-3A)		3										
	5306-206-4931	BOLT, MACHINE: hex-hd, S, cd- or zn-pltd, 1/4-28UNF-3A x 17/32 in. lg (AN4-3A)		20										
	5306-151-1420	BOLT, MACHINE: hex-hd, S, cd- or zn-pltd, 1/4-28UNF-3A x 1-17/32 in. lg (AN4-14A)		30										
	5306-616-1248	BOLT, MACHINE: hex-hd, S, cd- or zn-pltd, 5/16-24UNF-3A x 19/32 in. lg (AN5-4A)		11										

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE			(7) 30-DAY GS MAINT. ALLOWANCE			(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION	
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
	5306-225-9086	BOLT, MACHINE: med-carb-S, cd- or zn-pltd, 5/16-24UNF-2A x 5/8 in. lg (MS90726-31)		4										
	5306-182-2024	BOLT, MACHINE: hex-hd, alloy-S, dld-f/lkg-wire, cd- or zn-pltd, 5/16-24UNF-3A x 23/32 in. lg (AN5H5A)		4										
	5306-050-1238	BOLT, MACHINE: alloy-S, cd- or zn-pltd, 5/16-24UNF-2A x 3/4 in. lg (MS90727-32)		12										
	5306-182-2025	BOLT, MACHINE: hex-hd, alloy-S, dld-f/lkg-wire, cd- or zn-pltd, 5/16-24UNF-3A x 27/32 in. lg (AN5H6A)		2										
	5306-182-2026	BOLT, MACHINE: hex-hd, alloy-S, dld-f/lkg-wire, cd- or zn-pltd, 5/16-24UNF-3A x 31/32 in. lg (AN5H7A)		36										
	5306-051-4075	BOLT, MACHINE: alloy-S, cd-or zn-pltd, 5/16-24UNF-2A x 7/8 in. lg (MS90727-33)		12										
	5306-051-4076	BOLT, MACHINE: alloy-S, cd- or zn-pltd, 5/16-24UNF-2A x 1.00 in. lg (MS90727-34)		18										
	5306-180-3357	BOLT, MACHINE: hex-hd, alloy-S, dld-f/c-pin, cd- or zn-pltd, 5/16-24UNF-3A x 1-7/32 in. lg (AN5CH11)		4										
	5306-852-7104	BOLT, MACHINE: hex-hd, dld-f/lkg-wire, S, cd-pltd, 5/16-24UNF-2A x 1-1/4 in. lg (MS51096-335)		4										
	5306-182-2029	BOLT, MACHINE: hex-hd, S, dld-f/lkg-wire, cd- or zn-pltd, 5/16-24UNF-3A x 1-11/32 in. lg (AN5H12A)		32										
	5306-616-2618	BOLT, MACHINE: hex-hd, S, cd- or zn-pltd, 5/16-24UNF-3A x 1-11/32 in. lg (AN5-12A)		48										
	5306-151-2623	BOLT, MACHINE: hex-hd, S, cd- or zn-pltd, 5/16-24UNF-3A x 2-3/32 in. lg (AN5-20A)		84										
	5306-051-4084	BOLT, MACHINE: alloy-S, cd- or zn-pltd, 5/16-24UNF-2A x 2-1/2 in. lg (MS90727-42)		4										

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					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
	5306-051-4087	BOLT, MACHINE: alloy-S, cd- or zn-pltd, 5/16-24UNF-2A x 3-1/4 in. lg (MS90727-45)		24										
	5306-225-8511	BOLT, MACHINE: med-carb-S, cd- or zn-pltd, 5/16-18UNC-2A x 3-3/4 in. lg (MS90725-47)		2										
	5306-225-9103	BOLT, MACHINE: med-carb-S, cd-pltd, 5/16-24UNF-2A x 4.00 in. lg (MS90726-48)		2										
	5306-225-9107	BOLT, MACHINE: med-carb-S, cd-pltd, 5/16-24UNF-2A x 5.00 in. lg (MS90726-52)		2										
	5306-180-0238	BOLT, MACHINE: hex-hd, alloy-S, cd- or zn-pltd, 3/8-24UNF-3A x 45/64 in. lg (AN-6-5A)		4										
	5306-638-5288	BOLT, MACHINE: hex-hd, alloy-S, dld-f/lkg-wire, cd- or zn-pltd, 7/16-20UNF-3A x 1-3/32 in. lg (AN7H10A)		12										
	5306-180-0321	BOLT, MACHINE: hex-hd, S, cd- or zn-pltd, dld-f/c-pin, 7/16-20UNF-3A x 2-19/32 in. lg (AN177-24)		2										
	5306-807-9371	BOLT, MACHINE: hex-hd, alloy-S, dld-f/lkg-wire, cd- or zn-pltd, 1/2-20UNF-3A x 4-7/32 in. lg (AN178H41A)		2										
	5306-817-6131	BOLT, MACHINE: hex-hd, dld-f/lkg-wire, alloy-S, plain fin., 9/16-18UNF-3A x 1-1/2 in. lg (596281)		6										
	4730-196-0930	BUSHING, PIPE: 1/4 x 1/8 npt (WW-P-471, type 1, class 1, 1/4 x 1/8 in.)		2										
	4730-278-3912	BUSHING, PIPE: S, cd- or zn-pltd, 3/8-18NPTF x 1/4-18 NPTF (125837)		2										
	4730-202-6692	BUSHING, PIPE: shoulder, 3/8-18NPT male, 1/4-18NPT female (127956)		1										
	4730-044-4035	BUSHING, PIPE: 1/2 x 3/8 in. (21450-444035)		3										

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE			(7) 30-DAY GS MAINT. ALLOWANCE			(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION	
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
	4730-196-0888	BUSHING, PIPE: 3/4 x 1/2NPT (WW-P-471, type 2, style C, class 1)		2										
	4730-908-3194	CLAMP, HOSE: corr-res-S, 11/16 min dia, 1-1/4 max. dia (MS35842-11)		1										
	4730-908-3193	CLAMP, HOSE: S, cd- or zn-pltd, 1.00 min dia, 1-1/4 in. max. dia (MS35842-12)		6										
	4730-278-2068	CLAMP, HOSE: S, cd- or zn-pltd, 1-1/8 min dia, 1-3/8 max. dia (502915)		40										
	4730-278-2065	CLAMP, HOSE: S, cd- or zn-pltd, 1-5/8 min dia, 1-7/8 max. dia (502919)		10										
	4730-909-8627	CLAMP, HOSE: S, cd- or zn-pltd, 1-13/16 min dia, 2-3/4 max. dia (MS35842-13)		2										
	4730-908-6292	CLAMP, HOSE: corr-res-S, 2-9/16 min dia, 3-1/2 max. dia (MS35842-14)		3										
	4730-908-6293	CLAMP, HOSE: corr-res-S, 3-5/16 min dia, 4-1/4 max. dia (MS35842-15)		5										
	4730-032-2220	CLAMP, HOSE: stls-S, 4.500 nom dia (94581-KU20-75-450S)		8										
	5340-526-2559	CLAMP, LOOP: fuel resistant, S, 1/8 in. id, 13/64 fastener size (MS21919F2)		10										
	5340-088-1255	CLAMP, LOOP: closed, plain, 1/8 in. hose, 9/32 fastener size (MS21333-96)		1										
	5340-535-6469	CLAMP, LOOP: 3/16 od tube size, 13/64 fastener size (MS21919G3)		3										
	5340-809-1490	CLAMP, LOOP: S, cd-pltd, cushioned, 1/4 od tube, hole for No. 10 (0.190) screw size (96906-21333-98)		8										

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION (a) FIGURE NO.	(b) ITEM NO.
	5340-057-3043	CLAMP, LOOP: closed, cushioned, 1/2 od tube, hole for 5/16 in. bolt (573043)		2										
	5340-298-9406	CLAMP, LOOP: 9/16 in. hose, hole for No. 10 screw (MS21919G9)		4										
	5340-193-0104	CLAMP, LOOP: S, cd-pltd, 3/4 in. id (AN735-12)		2										
	5340-050-2740	CLAMP, LOOP: S, cushioned, 3/4 od hose, hole for No. 10 (0.190) screw size (502740)		2										
	5340-282-7509	CLAMP, LOOP: closed, plain, 3/4 in. hose, hole for 3/8 stud (MS21333-62)		1										
	5340-535-6471	CLAMP, LOOP: 1.00 od tube size, hole for No. 10 screw (MS21919G16)		13										
	4730-278-5824	CONNECTOR, MULTIPLE FLUID, PRESSURE LINE: S, 7/16-20NF-3, 1/4 tubing od (AN779-4)		10										
	4730-585-2906	ELBOW: 90 deg, S, cd- or zn-pltd, 1/8 tube, 1/8 male pipe end (423185)		2										
	4730-710-9486	ELBOW, PIPE: st, 90 deg, br, 1/8 in. (444476)		2										
	4730-254-1801	ELBOW, PIPE: 45 deg, S, (galvanized) 3/8-18NPT (MS39231-3)		1										
	4730-231-4009	ELBOW, PIPE TO TUBE: carb-S, 1/4 tube size (MS20822-4)		4										
	4730-278-4496	ELBOW, PIPE TO TUBE: 90 deg, 1/4 tube, 1/8 male pipe end (MS39202-3)		2										
	2910-203-3322	FILTER ELEMENT, FLUID: (90005-A26422)		1										
	1660-025-3493	FILTER, FLUID, PRESSURE: 1/8-27NPTF 2 places (MS51085-1)		1										

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE			(7) 30-DAY GS MAINT. ALLOWANCE			(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION	
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
	5330-543-3261	GASKET: annular, cop. and asb, ⅜ id, ⅝ od, 3 / 32 in. thk (MS35769-6)		1										
	5330-855-6045	GASKET: annular, cop. and asb, ½ id, ¾ od, 3 / 32 in. thk (MS35769-9)		12										
	5330-199-5884	GASKET: annular, cop. and asb, 1¼ id, 1½ od, 3 / 32 in. thk (MS35769-31)		2										
	5330-199-5886	GASKET: annular, cop. and asb, 1⅜ id, 1⅝ od, 3 / 32 in. thk (MS35769-35)		2										
	5330-269-2845	GASKET: annular, cop. and asb, 1-5 / 16 id, 1-11 / 16 od, 3 / 32 in. thk (MS35769-34)		4										
	5330-269-2844	GASKET: annular, cop. and asb, 1-11 / 16 id, 2-3 / 16 od, 5 / 64 in. thk (MS35769-47)		2										
	5325-184-9846	GROMMET, RUBBER: 5 / 16 id, 1.00 od, 5 / 16 thk, ¾ groove dia x ⅛ in. wd (MS35489-10)		1										
	5325-682-1471	GROMMET, RUBBER: split, 9 / 16 id, 1-1 / 16 od, 5 / 16 thk, 13 / 16 groove dia x 1 / 16 in. wd (MS35490-16)		2										
	5325-276-6096	GROMMET, RUBBER: 9 / 16 id, 1-1 / 16 od, 5 / 16 thk, 13 / 16 groove dia x 3 / 16 in. wd (MS35489-74)		22										
	5325-174-9038	GROMMET, RUBBER: split, ¾ id, 1⅜ od, ⅜ thk, 1-1 / 16 groove dia x 1 / 16 in. wd (MS35489-20)		1										
		HOSE ASSEMBLY, RUBBER: ½ od tube, 13½ in. lg (MS28741-8-0134)		1										
	2910-741-0397	HOSE ASSEMBLY, RUBBER: ½ od tube, 20½ in. lg (MS28741-8-0204)		1										
	4720-996-8329	HOSE ASSEMBLY, RUBBER: ½ od tube, 26.00 in. lg (MS28741-8-0260)		1										

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE			(7) 30-DAY GS MAINT. ALLOWANCE			(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION	
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
		HOSE ASSEMBLY, RUBBER: ½ od tube, 30.00 in. lg (MS28741-8-0300)		1										
	4720-720-2050	HOSE ASSEMBLY, RUBBER: ½ od tube, 34.00 in. lg (MS28741-8-0340)		1										
	5340-291-3484	INSERT, SCREW THREAD: fine thd, nom length 0.375, ¼-28 thd (notched) (MS124696)		6										
		INSERT, SCREW THREAD: fine thd, nom length ¼-20 thd (MS122161)		8										
	5340-291-3495	INSERT, SCREW THREAD: fine thd, nom length 0.469, 5/16-24 thd (notched) (MS124697)		85										
	5340-990-7159	INSERT, SCREW THREAD: fine thd, nom length 0.469, 5/16-24 thd (notched) (MS21208F6-20)		10										
	5340-514-2321	INSERT, SCREW THREAD: fine thd, nom length 0.625, 5/16-24 thd (notched) (MS21208F5-20)		14										
	5340-847-0734	INSERT, SCREW THREAD: fine thd, nom length 15/32, 5/16-24 thd (MS21209F5-15)		52										
	5340-291-3492	INSERT, SCREW THREAD: fine thd, nom length 0.562, ⅜-24 thd (notched) (MS21208F6-15)		60										
	5340-634-7860	INSERT, SCREW THREAD: fine thd, nom length 0.656, 7/16-20 thd (notched) (MS21208F7-15)		4										
	5340-291-3488	INSERT, SCREW THREAD: find thd, nom length 0.750, ½-20 thd (notched) (MS21208F8-15)		12										
		INSERT, SCREW THREAD, SELF-TAPPING: S, cd-pltd, 5/16-24UNF-3B int-thd, 5/32-16 ext-thd, 29/64 lg (MS35914-112)		32										
		INSERT, SCREW THREAD, SELF-TAPPING: S, cd-pltd, ⅜-24UNF-3B int-thd, 9/16-16 ext-thd, 9/16 lg (MS35914-114)		32										
	5315-616-5526	KEY, WOODRUFF: alloy-S, ⅛ x ⅜ in. lg (MS35756-8)		3										

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					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
	5310-012-4553	KEY, WOODRUFF: alloy-S, ¼ x 1.00 in. lg (MS35756-17)		1										
	4730-640-6582	NIPPLE, PIPE: S, cd- or zn-pltd, ⅛ in. (443977)		1										
	5310-842-1295	NUT, PLAIN, BLIND RIVET: S, cd- or zn-pltd, 7/16-20UNF-2B, ⅝ wd, 29/64 in. thk (96906-35692-29)		2										
	5310-934-9734	NUT, PLAIN, HEXAGON: S, cd- or zn-pltd, No. 4 (0.112)—48NF-2B, ¼ wd, 3/32 in. thk (MS35650-342)		4										
	5310-763-8901	NUT, PLAIN, HEXAGON: carb-S, cd-pltd, ¾-16UNF-2B, 1⅛ wd, 41/64 in. thk (MS51968-23)		10										
	5310-638-2247	NUT, PLAIN, HEXAGON: carb-S, cd- or zn-pltd, 5/16-24UNF-2B, 3/16 in. thk (455332)		1										
	5310-853-9335	NUT, PLAIN, HEXAGON: carb-S, cd- or zn-pltd, 5/16-24UNF-2B, ½ wd, 3/16 in. thk (MS35691-13)		1										
	5310-022-5853	NUT, PLAIN, HEXAGON: alloy-S, cd- or zn-pltd, 5/16-24UNF-2A, ½ wd, 17/64 in. thk (225853)		36										
	5310-763-8920	NUT, PLAIN, HEXAGON: carb-S, cd-pltd, ⅝-11UNC-2B, 15/16 wd, 35/64 in. thk (MS51967-20)		48										
	5310-208-5775	NUT, PLAIN, HEXAGON: S, phos-ctd, ¾-16UNF-3B, 1.00 wd, 5/16 in. thk (MS24400-8)		2										
	5310-282-7822	NUT, PLAIN, HEXAGON: S, 7/8-14UNF-3B, 1⅛ wd, 23/64 in. thk (MS24400-10)		1										
	5310-298-9252	NUT, PLAIN, HEXAGON: S, cd- or zn-pltd, 15/16-16NF-2, 1⅛ wd, ¼ in. thk (423884)		1										
	3110-185-6535	NUT, PLAIN, ROUND: bearing retaining, 8 slots, S, plain-fin., 0.969-32NS-3, 1-9/16 od, 13/32 in. thk (711004)		1										

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	5310-877-5797	NUT, SELF-LOCKING: S, cd-pltd, No. 10-32NF-3B, 3/8 wd, 15/64 thk (MS21044N3)		2										
	5310-061-7325	NUT, SELF-LOCKING: S, cd-pltd, 1/4-28UNF-3B (MS21045-4)		30										
	5310-982-6809	NUT, SELF-LOCKING: S, cd- or zn-pltd, 5/8-18UNF-3B, 15/16 wd, 3/4 in. thk (MS21044N10)		3										
	5310-902-6676	NUT, SELF-LOCKING, HEXAGON: S, cd-pltd, 10-32UNF-3B, 3/16 thk (MS21083N3)		25										
	5310-877-5796	NUT, SELF-LOCKING, HEXAGON: S, cd- or zn-pltd, 1/4-28UNF-3B, 7/16 wd, 5/16 in. thk (MS21044N4)		36										
	5310-088-0553	NUT, SELF-LOCKING, HEXAGON: S, cd- or zn-pltd, 5/16-24UNF-3B, 1/2 wd, 11/32 in. thk (MS21044N5)		36										
	5310-982-4912	NUT, SELF-LOCKING, HEXAGON: S, cd-pltd, 5/16-24UNF-3B, 23/64 thk (MS21045-5)		178										
	5310-950-0039	NUT, SELF-LOCKING, HEXAGON: S, cd- or zn-pltd, 3/8-24UNF-3B, 9/16 wd, 29/64 in. thk (MS21044N6)		134										
	5310-088-0552	NUT, SELF-LOCKING, HEXAGON: S, cd- or zn-pltd, 7/16-20UNF-3B, 5/8 wd, 29/64 in. thk (MS21044N7)		20										
	5310-062-4954	NUT, SELF-LOCKING, HEXAGON: S, cd-pltd, 1/2-20UNF-3B, 39/64 in. thk (MS21045-8)		4										
	5310-176-8108	NUT, SLOTTED, HEXAGON: S, cd- or zn-pltd, 1/4-28NF-3 x 3/32 in. thk (AN320-4)		8										
	5310-849-6883	NUT, SLOTTED, HEXAGON: carb-S, cd- or zn-pltd, 5/16-24UNF-2B, 1/2 wd, 17/64 in. thk (MS35692-13)		100										
	5310-638-6274	NUT, SLOTTED, HEXAGON: S, cd- or zn-pltd, 5/16-24UNF-2B, 1/2 wd, 21/64 in. thk (596610)		8										

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					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
	5310-842-1488	NUT, SLOTTED, HEXAGON: S, cd- or zn-pltd, 3/8-24UNF-2B, 9/16 wd, 5/32 in. thk (MS35692-21)		40										
	4730-069-1184	NUT, TUBE COUPLING: safety sleeve, comp. type, S, cd-pltd, 1/8 od tube, 5/16-24UNF-2A thd (MS39210-1)		4										
	4730-052-9876	NUT, TUBE COUPLING: S, cd- or zn-pltd, comp. safety sleeve, 1/4 in. (189894)		7										
	4730-554-8015	NUT, TUBE COUPLING: carb-S, comp., safety sleeve, 1/4 in. (MS21921-4)		4										
	5330-582-2133	PACKING, PREFORMED: "O" ring, 275 F, 0.300 id, 0.070 in. thk (MS28775-011)		3										
	5330-585-6663	PACKING, PREFORMED: "O" ring, 23/64 id, 7/64 in. thk (MS28775-110)		7										
	5330-599-2934	PACKING, PREFORMED: "O" ring, 31/64 id, 1/16 in. thk (MS28775-112)		1										
	5330-582-2855	PACKING, PREFORMED: "O" ring, 35/64 id, 7/64 in. thk (MS28775-113)		1										
	5330-579-3156	PACKING, PREFORMED: "O" ring, 47/64 id, 7/64 in. thk (MS28775-116)		2										
	5330-542-1586	PACKING, PREFORMED: "O" ring, 55/64 id, 7/64 thk (MS28775-118)		12										
	5330-579-8156	PACKING, PREFORMED: "O" ring, 57/64 id, 9/64 in. thk (MS28775-212)		5										
	5330-542-1329	PACKING, PREFORMED: "O" ring, 63/64 id, 7/64 in. thk (MS28775-120)		2										
	5330-265-1089	PACKING, PREFORMED: "O" ring, 1-19/64 id, 3/32 in. thk (MS29513-125)		1										
	5330-580-3846	PACKING, PREFORMED: "O" ring, 1-15/32 id, 7/32 in. thk (MS28775-325)		2										

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	5330-297-9990	PACKING, PREFORMED: "O" ring, 1-31/64 id, 9/64 in. thk (MS28775-222)		1										
	5330-171-6649	PACKING, PREFORMED: "O" ring, 1-39/64 id, 9/64 in. thk (MS28775-223)		2										
	5330-641-3407	PACKING, PREFORMED: "O" ring, 1-47/64 id, 9/64 in. thk (MS28775-224)		2										
	5330-579-8157	PACKING, PREFORMED: "O" ring, 1-47/64 id, 13/64 in. thk (MS28775-327)		4										
	5330-576-9732	PACKING, PREFORMED: "O" ring, 1-63/64 id, 9/64 in. thk (MS28775-226)		2										
	5330-584-1186	PACKING, PREFORMED: "O" ring, 2-7/32 id, 7/32 in. thk (MS28775-331)		4										
	5330-579-7918	PACKING, PREFORMED: "O" ring, 2-33/64 id, 9/16 in. thk (MS28775-229)		2										
	5330-618-0800	PACKING, PREFORMED: "O" ring, 2-23/32 id, 13/64 in. thk (MS28775-335)		4										
	5330-579-6861	PACKING, PREFORMED: "O" ring, 3-15/64 id, 9/64 in. thk (MS28775-236)		1										
	5330-256-0201	PACKING, PREFORMED: "O" ring, 3½ id, ⅛ in. thk (AN6230-16)		1										
	5330-187-3615	PACKING, PREFORMED: "O" ring, class "B" material, high flexibility, 9½ id, ⅛ in. thk (546908)		2										
	5315-839-2325	PIN, COTTER: carb-S, cd-pltd, 1/16 x ½ in. lg (MS24665-132)		32										
	5315-839-5820	PIN, COTTER: carb-S, cd-pltd, 1/16 x ¾ in. lg (MS24665-134)		8										
	5315-753-8333	PIN, COTTER: carb-S, cd-pltd, 1/16 x 3 in. lg (MS24665-145)		36										
	5315-234-1863	PIN, COTTER: corr-res-S, 3/32 x ¾ in. lg (MS24665-300)		2										

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					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
	5315-842-3044	PIN, COTTER: carb-S, cd-pltd, 3/32 x ¾ in. lg (MS24665-283)		6										
	5315-234-1864	PIN, COTTER: corr-res-S, 3/32 x 1.00 in. lg (MS24665-302)		20										
	5315-816-1794	PIN, COTTER: carb-S, cd-pltd, 3/32 x 1.00 in. lg (MS24665-285)		24										
	5315-019-0888	PIN, COTTER: carb-S, cd-pltd, 3/32 x 1¾ in. lg (MS24665-291)		1										
	5315-298-1481	PIN, COTTER: carb-S, cd-pltd, ⅛ x 1½ in. lg (MS24665-357)		1										
	5315-013-7214	PIN, COTTER: carb-S, cd-pltd, ⅛ x 1¾ in. lg (MS24665-359)		2										
	5315-241-2916	PIN, STRAIGHT, HEADLESS: S, case hardened, ¼ od x ⅝ lg (AN122718)		26										
	5315-828-4485	PIN, STRAIGHT, HEADLESS: carb- or alloy-S, ¼ od, 1½ lg (MS16555-655)		3										
	5315-058-9929	PIN, STRAIGHT, HEADLESS: stght, precision, S, case hardened, 0.3127 x ⅝ (589929)		14										
		PLUG, EXPANSION: al, plain-fin., 1⅛ dia, 0.083 thk (501522)		1										
		PLUG, PIPE: cast iron, cd- or zn-pltd, ⅛ npt (117243)		3										
	4730-044-4715	PLUG, PIPE: S, cd-pltd, 1.000 in. (444715)		3										
	5340-663-1245	RING, RETAINING: exter, 0.312 nom ring size (MS16632-1031)		4										
	5340-282-5278	RING, RETAINING: exter, S, phos-ctd, 5/16 shaft dia (MS16624-3031)		1										
	5340-803-7305	RING, RETAINING: exter, S, cd- or zn-pltd, ⅝ in. shaft dia (MS16624-1062)		8										

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION (a) FIGURE NO.	(b) ITEM NO.
	5340-801-2500	RING, RETAINING: inter, 1⅛ in. housing dia (MS16625-1112)		1										
	5340-200-8975	RING, RETAINING: exter-inverted lug, S, cd- or zn-pltd, 1⅛ in. shaft dia (583288)		1										
	5340-804-2786	RING, RETAINING: inter, 1.250 nom ring size, 1.351 free dia, 0.050 in. thk (MS16625-1125)		1										
	5340-754-1083	RING, RETAINING: inter, 1⅜ in. housing dia (MS16625-1137)		8										
	5340-804-3891	RING, RETAINING: inter, 1.622 in. free dia, 0.050 in. thk, 1½ in. housing dia (MS16625-1150)		1										
	5340-803-7304	RING, RETAINING: exter, S, cd- or zn-pltd, 1-9/16 in. shaft dia (MS16624-1156)		3										
	5340-682-1619	RING, RETAINING: exter-inverted lug, S, cd- or zn-pltd, 1-31/32 shaft dia (586365)		2										
	5340-882-5939	RING, RETAINING: inter, 2.834 in. housing dia (MS16625-3283)		1										
	5340-282-1619	RING, RETAINING: inter, 3/543 in. housing dia (MS16625-3354)		1										
	5320-264-4293	RIVET, SOLID: al-alloy, plain-hd, ⅛ od, 1¼ lg (MS20426-A4-20)		1										
	5305-071-2506	SCREW, CAP, HEXAGON HEAD: alloy-S, cd- or zn-pltd, ¼-20UNC-2A x ½ in. lg (MS90728-3)		51										
	5305-682-5881	SCREW, CAP, HEXAGON HEAD: dld-f/lkg-wire, S, plain-fin., ¼-20UNC-2A x 9/16 in. lg (MS51093-4)		25										
	5305-285-3889	SCREW, CAP, HEXAGON HEAD: alloy-S, cd- or zn-pltd, ¼-28UNF-2A x ¾ in. lg (MS35304-6)		6										
	5305-910-7369	SCREW, CAP, HEXAGON HEAD: dld-f/lkg-wire, S, cd- or zn-pltd, ¼-28UNF-2A x ¾ in. lg (MS51096-306)		4										

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE			(7) 30-DAY GS MAINT. ALLOWANCE			(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION	
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
	5305-225-3839	SCREW, CAP, HEXAGON HEAD: med-carb-S, cad-pltd, ¼-20UNC-2A x 1 in. lg (MS90725-8)		8										
	5305-068-0515	SCREW, CAP, HEXAGON HEAD: alloy-S, cd- or zn-pltd, ¼-28UNF-2A x 1.00 in. lg (MS90727-8)		6										
	5305-225-3842	SCREW, CAP, HEXAGON HEAD: alloy-S, cd- or zn-pltd, ¼-20UNC-2A x 1⅛ in. lg (MS90728-9)		2										
	5305-267-8982	SCREW, CAP, HEXAGON HEAD: S, cd- or zn-pltd, ¼-28UNF-2A x 2¼ in. lg (MS90726-15)		2										
	5305-267-8983	SCREW, CAP, HEXAGON HEAD: low-carb-S, cd- or zn-pltd, ¼-28UNF-2A x 2½ in. lg (MS90726-16)		12										
	5306-225-8504	SCREW, CAP, HEXAGON HEAD: med-carb-S, cd- or zn-pltd, 5 / 16-18UNC-2A x 2.00 in. lg (MS90725-40)		2										
	5305-269-3235	SCREW, CAP, HEXAGON HEAD: alloy-S, cd- or zn-pltd, ⅜-24UNF-2A x 7 / 8 in. lg (MS90727-59)		2										
	5305-269-3236	SCREW, CAP, HEXAGON HEAD: alloy-S, cd- or zn-pltd, ⅜-24UNF-2A x 1.00 in. lg (MS90727-60)		10										
	5306-817-9326	SCREW, CAP, HEXAGON HEAD: dld-f / lkg-wire, S, cd- or zn-pltd, ⅜-24UNF-2A x 1.00 in. lg (MS51096-60)		20										
	5305-269-2803	SCREW, CAP, HEXAGON HEAD: low-carb-S, cd- or zn-pltd, ⅜-24UNF-2A x 1.00 in. lg (MS90726-60)		8										
	5305-269-3237	SCREW, CAP, HEXAGON HEAD: alloy-S, cd- or zn-pltd, ⅜-24UNF-2A x 1⅛ in. lg (MS90727-61)		6										
	5305-269-3238	SCREW, CAP, HEXAGON HEAD: alloy-S, cd- or zn-pltd, ⅜-24UNF-2A x 1¼ in. lg (MS90727-62)		2										
	5305-269-3806	SCREW, CAP, HEXAGON HEAD: med-carb-S, cd- or zn-pltd, ⅜-24UNF-2A x 1⅜ in. lg (MS90726-63)		2										
	5305-269-3240	SCREW, CAP, HEXAGON HEAD: alloy-S, cd- or zn-pltd, ⅜-24UNF-2A x 1½ in. lg (MS90727-64)		8										

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE			(7) 30-DAY GS MAINT. ALLOWANCE			(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION	
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
	5305-801-5747	SCREW, CAP, HEXAGON HEAD: corr-res-S, passivated-fin., 3/8-24UNF-2A x 1½ in. lg (MS35308-364)		16										
	5305-914-6131	SCREW, CAP, HEXAGON HEAD: dld-f / lkg-wire, alloy-S, cd-pltd, 3/8-24UNF-2A x 1¾ in. lg (MS18153-63)		2										
	5305-531-1097	SCREW, CAP, HEXAGON HEAD: corr-res-S, passivated-fin., 3/8-24UNF-2A x 1¾ in. lg (MS35308-365)		16										
	5305-811-0638	SCREW, CAP, HEXAGON HEAD: dld-f / lkg-wire, S, plain-fin., 3/8-24UNF-2A x 2.00 in. lg (MS51096-64)		6										
	5305-269-3243	SCREW, CAP, HEXAGON HEAD: alloy-S, cd- or zn-pltd, 3/8-24UNF-2A x 2-1/4 in. lg (MS90727-67)		2										
	5305-269-3245	SCREW, CAP, HEXAGON HEAD: alloy-S, cd-or zn-pltd, 3/8-24UNF-2A x 2-3/4 in. lg (MS90727-69)		2										
	5305-710-4189	SCREW, CAP, HEXAGON HEAD: med-carb-S, cd- or zn-pltd, 7/16-20UNF-2A x 7/8 in. lg (MS90726-84)		4										
	5305-709-8523	SCREW, CAP, HEXAGON HEAD: alloy-S, cd- or zn-pltd, 7/16-20UNF-2A x 1-1/4 in. lg (MS90727-87)		66										
	5305-709-8515	SCREW, CAP, HEXAGON HEAD: alloy-S, cd- or zn-pltd, 7/16-20UNF-2A x 1-3/8 in. lg (MS90727-88)		6										
	5305-710-4194	SCREW, CAP, HEXAGON HEAD: med-carb-S, cd- or zn-pltd, 7/16-20UNF-2A x 1-1/2 in. lg (MS90726-89)		1										
	5305-710-4195	SCREW, CAP, HEXAGON HEAD: med-carb-S, cd- or zn-pltd, 7/16-20UNF-2A x 1-3/4 in. lg (MS90726-90)		6										
	5305-725-0154	SCREW, CAP, HEXAGON HEAD: alloy-S, cd- plgs, 1/2UNF-2A x 1-3/8 in. lg (MS90727-112)		4										

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE			(7) 30-DAY GS MAINT. ALLOWANCE			(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION	
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
	5305-753-7088	SCREW, CAP, HEXAGON HEAD: low-carb-S, cd- or zn-pltd, 5/8-11UNC-2A x 2-1/4 in. lg (MS35291-165)		48										
	5305-253-5618	SCREW, DRIVE: rd-hd, carb-S, cd-pltd, 0.060 body dia (MS21318-27)		4										
	5306-042-5592	SCREW, LOCKWASHER: ext-teeth lockwasher, hex-hd, S, cd- or zn-pltd, 5/16-24UNF-3 x 1.00 in. lg (425592)		1										
	5305-958-4346	SCREW, MACHINE: carb-S, cd- or zn-pltd, pan-hd, sltd, No. 4 (0.112)-48NF x 3/8 in. lg (MS35207-215)		4										
	5305-993-1848	SCREW, MACHINE: carb-S, cd- or zn-pltd, pan-hd, sltd, No. 10 (0.190)-32NF x 3/4 in. lg (MS35207-265)		1										
	5305-993-1851	SCREW, MACHINE: carb-S, cd- or zn-pltd, pan-hd, sltd, No. 10 (0.190)-32NF x 1.00 (MS35207-267)		16										
	5305-655-6556	SCREW, MACHINE: S, cd- or zn-pltd, pan-hd, No. 10 (0.190)-32UNF-2A x 1-3/4 in. lg (MS35266-70)		2										
	5330-291-2830	SEAL, PLAIN, ENCASED: oil, type ML, 3/4 x 25/64 in. thk (500241)		1										
	5305-715-1221	SETSCREW: hex-socket, oval-pt, No. 10 (0.190)-24NC-3A x 3/16 in. lg (MS51981-36)		2										
	4730-052-9877	SLEEVE, CLINCH, TUBE: S, cd- or zn-pltd, 1/4 in. (MS39212-3)		7										
	4730-289-8619	SLEEVE, CLINCH, TUBE: S, 1/4 tube size (MS21922-4)		4										
	4730-542-2813	SLEEVE, FLARED TUBE FITTING: 1/8 in. od tube (MS21922-2C)		4										
		SWITCH: thermostatic (long sensor) 245°F (MS12285/1-5)		1										

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 20-DAY DS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 20-DAY GS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION (a) FIGURE NO.	(b) ITEM NO.
	5930-692-9258	SWITCH, PRESSURE: 9-13 psi, 24 volt, dc (MS90530-2)		1										
	4730-810-7039	TEE, PIPE TO TUBE: tube, safety compression tube, S, cd- or zn-pltd, 1/8 in. tube, 1/8 male pipe side (423618)		1										
	4730-200-0525	TEE, PIPE TO TUBE: S, cd- or zn-pltd, 1/4 in. tube, 1/8 npt (189944)		1										
	4730-277-9305	TEE, PIPE TO TUBE: S, 1/4 tubing x 1/8 pipe thd (AN825-4)		1										
	6620-993-5546	TRANSMITTER, PRESSURE: 24 volt, dc, 120 psi (MS24539-1)		1										
	6685-814-5271	TRANSMITTER, TEMPERATURE: 24 volt, dc (MS24537-1)		1										
	5310-167-0816	WASHER, FLAT: S, cd- or zn-pltd, 5/32 id, 3/8 od, 1/32 in. thk (AN960-6)		4										
	5310-167-0818	WASHER, FLAT: S, cd- or zn- pltd, 13/64 id, 7/16 od, 1/16 in. thk (AN960-10)		36										
	5310-167-0835	WASHER, FLAT: S, cd- or zn-pltd, 17/64 id, 1/2 od, 0.031 in. thk (502220)		2										
	5310-141-1795	WASHER, FLAT: S, cd- or zn-pltd, 17/64 id, 1/2 od, 1/16 in. thk (AN960-416)		12										
	5310-167-0820	WASHER, FLAT: S, cd- or zn-pltd, 5/16 id, 9/16 od, 1/16 in. thk (AN960-516)		376										
	5310-809-4058	WASHER, FLAT: S, cd-pltd, 9/32 id, 5/8 od, 1/16 in. thk (MS27183-10)		8										
		WASHER, FLAT: S, cd- or zn-pltd, 25/64 id, 5/8 od, 0.064 in. thk (502204)		12										
	5310-081-4219	WASHER, FLAT: carb-S, cd- or zn-pltd, 11/32 id, 11/16 od, 1/16 in. thk (MS15795-212)		16										

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE			(7) 30-DAY GS MAINT. ALLOWANCE			(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION	
					(a) 1-20	(b) 21-50	(c) 51-100	(a) 1-20	(b) 21-50	(c) 51-100			(a) FIGURE NO.	(b) ITEM NO.
	5310-167-0822	WASHER, FLAT: S, cd- or zn-pltd, 29/64 id, 3/4 od, 1/16 in. thk (AN960-716)		25										
	5310-080-6004	WASHER, FLAT: carb-S, cd- or zn-pltd, 13/32 id, 13/16 od, 5/64 in. thk (MS15795-214)		4										
	5310-167-0823	WASHER, FLAT: S, cd- or zn-pltd, 1/2 id, 7/8 od, 1/16 in. thk (AN960-816)		4										
	5310-809-4061	WASHER, FLAT: S, cd-pltd, 7/16 id, 1.000 od, 53/64 in. thk (MS27183-15)		2										
	5310-809-8533	WASHER, FLAT: carb-S, cd- or zn-pltd, 13/16 id, 1-1/2 od, 9/64 in. thk (MS27183-23)		1										
	5310-809-8540	WASHER, FLAT: carb-S, cd- or zn-pltd, 15/16 id, 1-3/4 od, 9/64 thk (MS27183-25)		1										
	5310-809-8541	WASHER, FLAT: carb-S, cd- or zn-pltd, 7/64 id, 2.00 od, 9/64 in. thk (MS27183-27)		1										
	3110-186-0964	WASHER, KEY: key, bearing retaining, S, plain-fin., bore, 0.989 x 1-9/32 x 1-23/32 (711206)		1										
	5310-616-3554	WASHER, LOCK: flat, ext-teeth, S, cd-pltd, 0.120 id, 0.250 od, 0.017 thk (MS35335-29)		4										
	5310-209-0786	WASHER, LOCK: flat, ext-teeth, S, cd-pltd, 0.260 id, 0.500 od, 0.030 thk (MS35335-33)		59										
	5310-582-5965	WASHER, LOCK: split, carb-S, cd- or pltd, 0.260 id, 0.500 od, 0.060 thk (MS35338-44)		18										
	5310-045-3296	WASHER, LOCK: split, carb-S, cd- or zn-pltd, 0.323 id, 0.586 od, 0.125 thk (MS35338-43)		2										
	5310-407-9566	WASHER, LOCK: split, carb-S, cd- or zn-pltd, 0.320 id, 0.590 od, 0.080 thk (MS35338-45)		78										
	5310-407-9566	WASHER, LOCK: split, carb-S, cd- or zn-pltd, 0.330 id, 0.590 od, 0.080 thk (MS35338-26)		1										

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEAS.	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT. ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION (a) FIGURE NO.	(b) ITEM NO.
	5310-637-9541	WASHER, LOCK: split, carb-S, cd- or zn-pltd, 0.380 id, 0.690 od, 0.090 thk (MS35338-46)		40										
	5310-209-0965	WASHER, LOCK: split, S, cd- or zn-pltd, 0.450 id, 0.780 od, 0.090 thk (MS35338-47)		7										
	5310-209-0965	WASHER, LOCK: split, S, cd- or zn-pltd, 0.450 id, 0.780 od, 0.090 thk (MS35338-47)		6										
	5310-655-9370	WASHER, LOCK: split, carb-S, cd- or zn-pltd, 0.450 id, 0.790 od, 0.140 thk (MS35340-47)		5										
	5310-012-0239	WASHER, LOCK: split, S, cd- or zn-pltd, 0.510 id, 0.880 od, 0.100 thk (MS35337-29)		2										
	5310-584-5272	WASHER, LOCK: split, carb-S, cd-pltd, 0.520 id, 0.880 od, 0.130 thk (MS35338-48)		4										
	5310-820-6653	WASHER, LOCK: split, S, cd- or zn-pltd, 0.648 id, 1.082 od, 0.130 thk (96906-35338-50)		48										
	5310-275-3683	WASHER, LOCK: flat, ext-teeth, S, cd-pltd, 0.780 id, 1.280 od, 0.050 thk (MS35335-40)		1										
	5310-584-7888	WASHER, LOCK: split, S, cd- or zn-pltd, 0.780 id, 1.280 od, 0.160 thk (MS35338-51)		1										
	5310-584-7888	WASHER, LOCK: split, S, cd- or zn-pltd, 0.780 id, 1.280 od, 0.160 thk (MS35338-51)		10										
	5310-149-9116	WASHER, RECESSED: alloy-S, cd- pltd, 1/2 id, 7/8 od, 5/64 in. thk (MS20002C8)		4										
	9525-803-3044	WIRE, NICKEL COPPER: ni-cu-alloy (monel), 0.032 nom wire dia (MS20995-NC32)		UAR										
	9525-990-7799	WIRE, NICKEL COPPER: ni-cu-alloy (monel), 0.040 nom wire dia (MS20995-NC40)		UAR										

SECTION V. FEDERAL STOCK NUMBER AND PART NUMBER INDEXES

FEDERAL STOCK NUMBER CROSS REFERENCED TO PART NUMBER AND FIGURE AND ITEM NUMBER

Federal Stock No.	Part No.	Fig. No.	Item No.
1660-025-3493	96906-51085-1	B-21	44
2520-420-4982	1065262	B-22	32
2520-678-3171	8725277	B-6	47
2540-453-5404	10882654	B-21	5
2590-134-4815	11641819	B-15	13
2590-437-0990	10887592	B-15	25
2590-629-1268	8679577	B-7	70
2590-678-4129	8682781	B-18	11
2590-838-3596	10889714	B-18	25
2590-851-4909	8682683	B-5	49
2590-932-5001	8682677	B-18	20
2805-304-9365	8357819	B-24	42
2805-407-6761	10865283	B-5	31
2805-599-0942	8717158	B-7	43
2805-678-4243	7320442	B-7	20
2805-678-4244	7320462	B-8	27
2805-679-1591	7744617	B-4	15
2805-733-8667	7338667	B-26	72
2805-753-9838	7539838	B-4	40
2805-753-9839	7539839	B-4	38
2805-760-5837	8682756	B-22	42
2805-760-5838	8682757	B-22	38
2805-774-4610	7744610	B-4	20
2805-774-4798	7744798	B-4	19
2815-064-6270	10912450	B-1	1
2815-071-8124	8682753	B-10	20
2815-071-8125	8761037	B-9	3
2815-071-8126	8761023	B-9	63
2815-073-5129	8761192	B-10	8
2815-110-4093	7320414	B-5	22
2815-117-0829	10898862	B-2	1
2815-117-9337	7062195	B-21	14
2815-122-4963	8761161	B-9	62
2815-125-3891	8725253	B-5	14
2815-136-1201	8682817	B-5	21
2815-177-7918	8682751	B-5	43
2815-177-8216	10865267	B-22	31
2815-177-8243	8761156	B-13	46
2815-177-9897	10865498	B-5	33
2815-179-7047	5704344	B-4	
2815-193-8192	8761089	B-22	1
2815-193-8200	8682560	B-22	5
2815-193-8203	8682762	B-22	56
2815-193-8210	8761008	B-22	52
2815-193-8211	11641919	B-22	25
2815-193-8212	8682761	B-22	48
2815-193-8213	8682676	B-18	17
2815-193-8214	8682755	B-22	43
2815-193-8215	8761098	B-23	6
2815-193-8216	10865365	B-23	5
2815-193-8217	8761101	B-23	2
2815-193-8218	10951124	B-24	11
2815-194-2450	10865363	B-23	7
2815-194-2453	8761009	B-22	53
2815-194-2481	8761472	B-11	27
2815-235-4445	8682662	B-6	34
2815-238-9191	8725184	B-2	44
2815-239-5810	10865334	B-17	8
2815-356-8502	8761232	B-22	41
2815-402-2170	10865422	B-11	16
2815-404-7444	10912453	B-3	9
2815-406-4610	8682749	B-13	11
2815-406-4611	8682748	B-13	49
2815-406-4612	10951460	B-19	28
2815-406-4613	8682441	B-7	22
2815-406-4614	8761082	B-13	18
2815-406-4615	11641922	B-7	60
2815-406-4616	10935613	B-7	35
2815-406-4617	8761128	B-7	75
2815-406-4618	8682467	B-5	34
2815-406-4620	8761033	B-13	40
2815-406-4621	10935623	B-7	41
2815-406-4622	10865022	B-10	26
2815-406-4623	10883083	B-10	21
2815-406-7289	8761481	B-11	39
2815-411-3965	7320451	B-9	64
2815-411-5789	8682739	B-24	50
2815-412-9192	8761469	B-24	3
2815-454-8599	7320408	B-4	29
2815-455-9495	8761148	B-22	36
2815-455-9496	8682540	B-5	6
2815-457-9309	10912162	B-7	69
2815-485-9555	8761193	B-10	5
2815-489-2575	8682737	B-2	7
2815-489-2576	7320415	B-5	9
2815-545-1563	10882968	B-4	11
2815-575-0398	8761598	B-10	10
2815-575-0399	8761030	B-24	18
2815-617-8626	10882611	B-6	48
2815-678-1837	5702615	B-4	5
2815-678-1838	5702614	B-4	5
2815-678-1841	8724974	B-4	1
2815-678-1842	5702609	B-4	
2815-678-3194	8725293	B-4	33
2815-678-3195	8725281	B-4	34
2815-678-3198	8725180	B-4	37
2815-678-3199	8725179	B-4	37
2815-678-3200	8725177		
2815-678-3201	8725176		
2815-678-3202	8725004	B-4	37
2815-678-3203	8725003	B-4	14
2815-678-3207	7320429	B-4	17
2815-678-3208	7320428	B-4	16
2815-678-3209	7320427	B-4	18
2815-678-3210	7320396	B-4	22
2815-678-3211	7320395	B-4	35
2815-678-3213	8761517	B-12	11
2815-678-3214	8761521	B-12	16
2815-678-3215	8761527	B-12	17
2815-678-3216	8761547	B-12	5
2815-678-3217	8761513	B-12	20
2815-678-3218	8725222	B-6	4
2815-678-3219	8725266	B-6	11
2815-678-3220	8725255	B-6	76
2815-678-3221	8725239	B-6	16
2815-678-3222	8725240	B-6	13
2815-678-3223	8725276	B-6	12
2815-678-3225	8764948	B-3	15
2815-678-3226	8725261	B-2	39
2815-678-3227	8725254	B-2	79
2815-678-3228	8725140	B-2	71
2815-678-3229	5702617	B-3	
2815-678-3230	5702616	B-3	
2815-678-3270	8682505	B-15	4
2815-678-4233	8761440	B-14	32
2815-678-4236	8682814	B-14	31

Federal Stock No.	Part No.	Fig. No.	Item No.
2815-678-4238	8682691	B-14	15
2815-678-4239	8682689	B-14	34
2815-678-4246	8725248	B-27	4
2815-679-4961	8682523	B-7	19
2815-679-4961	8682523	B-8	7
2815-679-4962	8761130	B-7	7
2815-679-4963	8725265	B-1	1
2815-679-4964	8725113	B-9	38
2815-679-4966	8725101	B-9	37
2815-679-4968	8725087	B-9	50
2815-679-4969	7025892	B-2	6
2815-679-4970	8682734	B-3	16
2815-679-4971	8725249	B-3	12
2815-679-4972	8682820	B-3	10
2815-679-5664	8761160	B-13	41
2815-679-5665	8761159	B-13	30
2815-679-5666	8761158	B-13	31
2815-679-5667	8761157	B-13	42
2815-679-5668	8761021	B-13	23
2815-679-6482	8682772	B-10	12
2815-679-7062	8682800	B-13	24
2815-679-7063	8698759	B-13	19
2815-679-7064	8682769	B-13	43
2815-679-8053	8761280	B-5	41
2815-679-8054	8682564	B-5	13
2815-679-8055	8761281	B-5	42
2815-679-8056	8761414	B-5	5
2815-679-8057	5702619	B-5	
2815-679-8058	7320430	B-5	7
2815-679-8059	8682468	B-5	30
2815-708-3018	10865289	B-5	32
2815-760-5871	8682721	B-5	17
2815-763-1402	10883731	B-28	21
2815-765-9711	10865297	B-4	13
2815-765-9712	10865299	B-4	12
2815-767-3200	10865393	B-26	93
2815-795-1800	10882610	B-3	4
2815-808-2407	5702757	B-20	
2815-808-2408	10951482	B-19	41
2815-808-2421	11602061	B-20	13
2815-808-2470	11602063	B-19	45
2815-817-9538	10882613	B-3	5
2815-821-4002	10883072	B-7	14
2815-833-8162	8682527	B-8	1
2815-833-8164	10865180	B-10	15
2815-834-1158	8682524	B-8	2
2815-834-1159	8761162	B-9	4
2815-846-1824	10898919	B-9	47
2815-851-6551	10898962	B-9	42
2815-851-9176	10898777	B-14	33
2815-856-4996	5702666	B-1	
2815-856-9005	5702670		
2815-861-1447	10898779	B-14	10
2815-861-1448	10898915	B-14	7
2815-861-3829	10898778	B-3	8
2815-866-2196	10882928	B-9	54
2815-869-3595	8761190	B-10	4
2815-876-2324	10882925	B-9	52
2815-884-1981	7025886	B-6	56
2815-895-6430	10898891	B-9	12
2815-896-6165	10898793	B-11	18
2815-896-6165	10898793	B-11	42
2815-896-6166	10898794	B-11	12
2815-899-1504	10898933	B-6	31
2815-937-1467	8761022	B-14	12
2815-937-4846	8725226	B-26	84
2910-031-9083	7413736	B-20	17
2910-064-6262	10912481	B-16	28
2910-064-6265	10912447	B-15	6
2910-064-6269	10912452	B-16	25
2910-078-4866	10935359	B-16	8
2910-078-5308	10865394	B-17	6
2910-078-5309	10865396	B-17	5
2910-078-5310	10865398	B-17	4
2910-078-5311	10865400	B-17	3
2910-078-5312	10865402	B-17	2
2910-078-5313	10865404	B-17	1
2910-078-5314	10865406	B-17	30
2910-078-5315	10865408	B-17	31
2910-078-5316	10865410	B-17	32
2910-078-5317	10865412	B-17	33
2910-078-5318	10865414	B-17	34
2910-078-5319	10865416	B-17	35
2910-106-1981	86988-C3062-8	B-16	9.3
2910-134-4734	10951434	B-19	19
2910-135-6523	10898738	B-26	43
2910-168-2624	10865170	B-19	15
2910-203-3322	90005-A26422	B-20	15
2910-402-4422	8761085	B-2	2
2910-402-4423	10865074	B-19	7
2910-402-4424	10912391	B-13	6
2910-402-4425	10935539	B-26	
2910-410-5755	10865332	B-17	40
2910-410-5756	10865335	B-17	36
2910-410-5758	10865331	B-17	29
2910-455-5836	10882772	B-6	46
2910-545-1558	5702641	B-27	
2910-678-3282	8764641	B-19	63
2910-678-3285	8761510	B-19	13
2910-678-3290	8761502	B-11	44
2910-678-3292	8761485	B-17	22
2910-678-3294	8761492	B-17	18
2910-678-3299	7324661	B-17	12
2910-678-4673	8725292	B-15	22
2910-678-4722	7320464	B-26	11
2910-678-4725	7323990	B-16	20
2910-678-4728	8682729	B-27	13
2910-678-4729	8682731	B-27	17
2910-678-4730	8761041	B-27	6
2910-678-4734	8764982	B-26	25
2910-741-0397	96906-28741-8-0204	B-19	48
2910-741-5354	7415354	B-15	23
2910-762-4587	5704366	B-16	
2910-767-1733	10865426	B-21	31
2910-767-1734	10865444	B-21	23
2910-767-1735	10865425	B-21	19
2910-781-1457	10935214-4	B-19	27
2910-781-1458	10951429-1	B-19	31
2910-781-1461	10951429-2	B-19	29
2910-781-1462	10951463	B-19	26
2910-781-1463	11591013	B-19	33
2910-790-2301	8759089	B-17	28
2910-790-2303	7335555	B-21	15
2910-791-3352	8729071	B-20	6
2910-792-5393	10882940	B-17	27
2910-795-1783	8395476	B-19	16
2910-795-1795	10882764	B-19	50
2910-801-1152	5702738	B-20	
2910-821-0659	10882768	B-19	55
2910-827-2816	10883098	B-27	16
2910-851-5360	8729069	B-20	5.4
2910-878-9932	01843-SR7828-1	B-16	4.1
2910-878-9933	99066-GU7837	B-16	5

Federal Stock No.	Part No.	Fig. No.	Item No.
2910-879-1666	10882641	B-11	51
2910-907-9566	10865333	B-17	9
2910-936-2276	99066-SD7877	B-16	1
2910-967-9870	5702690	B-20	
2910-999-9452	1094790	B-19	22
2910-999-9453	10951426	B-19	37
2910-999-9454	10951427	B-19	8
2910-999-9455	10951430	B-19	61
2920-063-8127	10884037	B-28	17
2920-177-7844	10882773	B-14	29
2920-245-8162	10883748	B-28	19
2920-248-4631	8682765	B-27	62
2920-318-4127	8666738	B-15	17
2920-402-5204	10865001	B-7	18
2920-402-5205	10882761	B-7	29
2920-455-5835	10882765	B-7	15
2920-498-9358	10882774	B-7	26
2920-647-3899	11583-XED89D	B-21	13
2920-678-7101	7084278	B-15	27
2920-767-1736	7062196	B-21	9
2920-771-6968	10883740	B-28	18
2920-803-0259	10883737	B-28	20
2920-830-6660	10889713	B-15	19
2920-902-3187	10935473	B-28	5
2920-973-1557	8712242	B-15	24
2930-068-6113	8761155	B-26	82
2930-077-2818	8761239	B-27	31
2930-107-1221	10865268	B-22	21
2930-156-9408	10935541	B-26	88
2930-168-2625	8682738	B-24	51
2930-169-5798	8682782	B-24	20
2930-177-9162	8761206	B-26	65
2930-179-7049	8761058	B-24	37
2930-179-7051	8761049	B-24	19
2930-350-9394	8761122	B-24	33
2930-350-9395	8761476	B-24	52
2930-350-9396	8761477	B-24	45
2930-350-9397	8761100	B-24	38
2930-350-9398	8761123	B-24	39
2930-350-9399	7320469	B-26	57
2930-350-9400	11641930	B-24	12
2930-350-9401	8682658	B-25	3
2930-402-4419	8761104	B-22	12
2930-402-4420	10898756	B-22	16
2930-402-4421	8761270	B-22	44
2930-406-7294	8761103	B-24	36
2930-408-4684	7320480	B-26	62
2930-411-5749	7320463	B-26	58
2930-421-1590	8761069	B-22	33
2930-421-1591	8761068	B-22	13
2930-421-1592	8761057	B-22	24
2930-435-4564	10951075	B-27	52
2930-435-4568	10951079	B-27	46
2930-435-4572	10951084	B-27	49
2930-435-7644	8761064	B-27	41
2930-436-3196	10865266	B-22	14
2930-436-3197	10865252	B-22	28
2930-436-3206	8761107	B-22	35
2930-436-3207	8682623	B-22	39
2930-436-3208	10865250	B-22	18
2930-437-7179	11641931	B-22	24
2930-438-1590	8725233	B-26	39
2930-442-5894	8761269	B-22	9
2930-442-5895	8682682	B-25	17
2930-442-5896	8761099	B-22	15
2930-446-1757	10865272	B-22	22
2930-453-5362	10865319	B-22	11
2930-453-5363	10865320	B-22	34
2930-453-5364	10865240	B-22	25
2930-453-5376	10865247	B-22	26
2930-457-0314	8761258	B-27	20
2930-457-0319	8761106	B-21	37
2930-457-6731	8761029	B-24	17
2930-498-9359	8725227	B-26	53
2930-522-2576	8682626	B-22	40
2930-570-9707	8761092	B-24	11
2930-678-3255	8761287	B-26	49
2930-678-3256	8761260	B-27	39
2930-678-3257	8761230	B-25	12
2930-678-3265	8761020	B-26	54
2930-678-3266	8761050	B-25	19
2930-678-3267	8761062	B-27	60
2930-678-3268	5702620	B-27	
2930-678-3269	5702622	B-26	
2930-678-3271	8682455	B-26	51
2930-678-4665	8682802	B-24	43
2930-678-4667	8682693	B-24	1
2930-678-4668	8682692	B-24	41
2930-678-4669	8682679	B-24	53
2930-678-4670	8761149	B-24	54
2930-678-4671	8761262	B-24	25
2930-678-7099	5702621	B-26	
2930-678-5742	8761242	B-25	18
2930-679-8090	8682701	B-23	9
2930-679-8091	8682492	B-23	14
2930-679-8092	8682620	B-23	16
2930-679-8093	8682700	B-23	8
2930-765-4364	10865351	B-26	9
2930-766-0903	10865437	B-24	44
2930-774-4858	7744858	B-22	51
2930-902-3189	10935537	B-27	58
2930-933-6957	8761066	B-27	22
2930-937-1430	8761294	B-24	12
2930-938-8179	8761032	B-25	10
2930-997-1537	8682785	B-25	14
2930-998-4724	10865277	B-22	29
2940-067-7900	8725257	B-6	21
2940-115-9014	8725193	B-6	27
2940-121-6177	00736-03T786-140	B-6	61
2940-436-3223	8761542	B-6	28
2940-678-3276	8682815	B-6	3
2940-678-3277	8725201	B-6	23.3
2940-678-3278	8725203	B-6	53
2940-678-3279	8725286	B-6	73
2940-678-3280	8725250	B-6	75
2940-863-7737	8748329	B-6	23.1
2940-884-4801	5702659	B-6	
2940-937-1450	10882766	B-6	52
2940-939-7123	7087519	B-6	58
2990-064-6263	10912478	B-15	1
2990-064-6264	10912477	B-15	1
2990-068-6115	10865361	B-26	3
2990-369-8766	7062197	B-21	32
2990-402-4427	8761189	B-10	3
2990-402-4428	10865324	B-18	27
2990-402-4429	8761016	B-18	2
2990-402-4430	8682558	B-13	2
2990-402-4431	8761018	B-18	7
2990-402-4432	8682750	B-13	8
2990-402-4433	8761086	B-13	10
2990-402-5201	8761163	B-10	24
2990-411-8330	10935471	B-28	8
2990-453-5386	8682752	B-13	52
2990-453-5387	8682451	B-13	3

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2990-484-0771	8682783	B-18	14
2990-498-2398	8725275	B-14	20
2990-498-9356	10912390	B-13	55
2990-678-3250	8761553	B-12	13
2990-678-3251	8761549	B-12	12
2990-678-3252	8761499	B-12	2
2990-678-3264	8761559	B-12	19
2990-678-3286	8761507	B-11	1
2990-678-3291	8761491	B-11	47
2990-678-4676	7320459	B-15	29
2990-678-4681	8682797	B-13	16
2990-678-4695	8682503	B-21	10
2990-770-1641	7062198	B-21	8
2990-771-6969	10883745	B-28	12
2990-897-2849	8761109	B-7	42
2990-974-7605	7062194	B-21	29
3010-087-9530	10951167	B-16	11
3040-179-6656	8725243	B-26	48
3040-402-5217	10865323	B-18	32
3040-406-1536	8761015	B-18	23
3040-406-1537	8682786	B-18	35
3110-120-4367	21450-709460	B-26	24
3110-144-8518	21450-700078	B-9	48
3110-144-8662	21450-700081	B-26	52
3110-144-8927	21450-714038	B-26	31
3110-155-6675	214[illegible]700580	B-14	4
3110-185-6535	21450-711004	B-9	30
3110-186-0964	21450-711206	B-9	29
3110-227-3620	8393931	B-18	1
3110-462-0392	10951369	B-27	40
3110-481-4825	8761390	B-26	32
3110-516-5290	29337-3L08M46	B-26	29
3110-516-5490	21335-207K	B-14	9
3110-529-9480	21335-9110K	B-27	12
3110-554-2979	21335-9109KFS179	B-27	44
3110-554-3197	21335-206KFS10179	B-26	14
3110-554-3272	29337-3L11M46	B-27	5
3110-554-6080	43991-5306	B-14	2
3110-555-5207	21335-307K	B-27	61
3120-477-3780	5704351	B-4	5
3120-491-0314	5704348	B-3	
3120-516-0953	73134-HMS5FG	B-18	6
3120-516-0955	73134-HM5MG	B-18	33
3120-678-1869	8724980	B-4	8
3120-679-8098	8682745	B-5	50
3120-735-0201	7350201	B-8	20
4370-223-7007	8761597	B-10	13
4710-150-6187	8761131	B-11	24
4710-192-9436	11641927	B-7	65
4710-194-2531	10865420	B-11	36
4710-194-2566	8761448	B-11	43
4710-245-8305	7320458	B-13	14
4710-401-4368	10951368	B-11	10
4710-406-1528	10882791	B-10	9
4710-438-1811	10882890	B-11	30
4710-457-0479	10865182	B-10	19
4710-477-9899	8761052	B-10	27
4710-477-9900	8761059	B-10	23
4710-485-9651	8761479	B-11	11
4710-804-9249	83616-NS4 Type H	B-21	51
4710-805-4149	7017826	B-21	40
4720-177-6186	10898793-1	B-11	9
4720-177-6188	10951341-1	B-17	14
4720-177-6189	10951341-2	B-17	16
4720-202-7457	MIL-H-6000 4.000 in. id	B-13	13
4720-278-1110	81349-MIL-H-6000	B-7	64
4720-278-1112	33H00344082	B-26	61
4720-278-1113	MIL-H-600 - 1.000 in. id	B-10	7
4720-420-4396	96906-28741-8-0134	B-19	43
4720-461-9797	96906-28741-8-0300	B-19	42
4720-477-3712	10935214-3	B-7	37
4720-720-2050	96906-28741-8-0340	B-19	64
4720-741-0397	96906-28741-8-0204	B-19	48
4720-996-8329	96906-28741-8-0260	B-19	57
4730-032-2220	94581-KU20-75-450S	B-13	12
4730-044-4035	21450-444035	B-19	2
4730-044-4689	7538990	B-2	64
4730-044-4689	7538990	B-6	10
4730-044-4689	7538990	B-9	22
4730-044-4689	7538990	B-13	39
4730-044-4689	7538990	B-26	17
4730-044-4689	7538990	B-26	68
4730-044-4715	21450-444715	B-6	7
4730-044-4715	21450-444715	B-8	15
4730-052-9876	96906-39210-13	B-19	58
4730-052-9876	96906-39210-13	B-21	41
4730-052-9877	96906-39212-3	B-19	59
4730-052-9877	96906-39212-3	B-21	39
4730-069-1184	96906-39210-1	B-21	52
4730-090-9182	8698852	B-21	27
4730-124-1376	10889688	B-26	66
4730-168-1935	10898735	B-26	105
4730-196-0888	81348-	B-6	37
4730-196-0903	81348-WW-P-471 Type 1 Class 1 1¼ x ⅛ in.	B-21	16
4730-200-0525	21450-189944	B-19	60
4730-202-6692	21450-127956	B-11	45
4730-223-7014	8682816	B-5	24
4730-231-4009	96906-20822-4	B-21	18
4730-254-1801	96906-39231-3	B-2	40
4730-277-9305	88044-825-4	B-21	30
4730-278-0375	88044-775-4	B-17	15
4730-278-2065	21450-502919	B-5	1
4730-278-2065	21450-502919	B-11	8
4730-278-2065	21450-502919	B-26	60
4730-278-2068	21450-502915	B-10	6
4730-278-3030	7403610	B-6	74
4730-278-3388	21450-117243	B-20	8.3
4730-278-3388	21450-117243	B-20	19
4730-278-3912	21450-125837	B-2	35
4730-278-4496	96906-39202-3	B-19	38
4730-278-5824	88044-779-4	B-17	17
4730-289-8619	96906-21922-4	B-19	32
4730-334-7838	9402708	B-11	7
4730-350-9786	96906-39206-9	B-19	54
4730-402-5143	10951334	B-19	56
4730-406-4609	8761137	B-13	28
4730-406-7307	8682799	B-13	32
4730-406-7308	8761138	B-13	29
4730-406-7309	8761594	B-12	4
4730-457-1984	8761449	B-11	4
4730-542-2813	96906-21922-2C	B-21	53
4730-554-8015	96906-21921-4	B-19	21
4730-585-2906	21450-423185	B-21	17
4730-595-4402	88044-833-8J	B-19	9
4730-640-6582	21450-443977	B-21	48
4730-678-3303	7324900	B-6	41
4730-678-3494	8764950	B-11	6
4730-679-5682	8761091	B-10	17
4730-699-7899	7954708	B-8	21
4730-710-9486	21450-444476	B-21	28
4730-753-9274	7539274	B-19	49
4730-753-8997	7538997	B-2	50

Federal Stock No.	Part No.	Fig. No.	Item No.
4730-753-8997	7538997	B-6	35
4730-776-7336	7767336	B-2	68
4730-776-7336	7767336	B-6	6
4730-776-7337	7767337	B-2	52
4730-776-7337	7767337	B-8	11
4730-781-6530	96906-39206-3	B-19	62
4730-781-6530	96906-39206-3	B-21	43
4730-803-7728	10865290	B-17	19
4730-805-0676	10865466	B-21	42
4730-810-7039	21450-423618	B-21	54
4730-815-0248	9402827	B-11	46
4730-902-3188	10935536	B-19	1
4730-908-3193	96906-35842-12	B-11	17
4730-908-3193	96906-35842-12	B-11	41
4730-908-3194	96906-35842-11	B-7	51
4730-908-6292	96906-35842-14	B-28	6
4730-908-6293	96906-35842-15	B-28	13
4730-909-8627	96906-35842-13	B-7	56
4730-933-3138	8761555	B-11	26
4730-958-4069	81348-WW-C440 Type E 0.500 in. od	B-19	30
4820-242-4064	53477-645A6	B-32	9
4820-304-9415	8376456	B-32	7
4820-406-4619	8725224	B-6	14
4910-554-1317	8708419	B-29	5
4910-795-7950	10882892	B-30	33
4910-795-7951	10882790	B-30	7
4910-795-7952	10882651	B-30	13
4910-795-7953	10882963	B-30	20
4910-795-7954	10882945	B-29	8
4910-795-7955	10882958	B-29	7
4910-795-7956	10882888	B-30	11
4910-795-7957	10882891	B-30	32
4910-795-7958	10882949	B-30	16
4910-795-7961	8743025	B-30	27
4910-856-4137	10912260	B-29	1
4910-870-6283	10899180	B-29	2
4910-919-2884	10952220	B-29	9
4910-937-4261	10935532	B-31	1
4910-986-9873	10898928		
5110-708-3696	7083696	B-30	41
5110-708-3697	7083697	B-30	43
5110-708-3698	7083698	B-30	42
5110-708-3699	7083699	B-30	39
5120-078-3809	10935497	B-30	25
5120-221-7947	81348-GGG-W-686	B-30	28
5120-251-1527	7751056	B-30	38
5120-310-4668	8708712	B-30	21
5120-448-0400	10882953	B-30	10
5120-448-0401	10882954	B-30	9
5120-448-0402	10883052	B-30	35
5120-448-0404	10883075	B-29	4
5120-448-7993	10883058	B-30	21
5120-473-7222	5379997	B-30	5
5120-575-7767	8708361	B-30	36
5120-672-8897	8761582	B-30	1
5120-678-5282	8761297	B-30	34
5120-678-5285	8761535	B-29	6
5120-678-5286	8761560	B-30	44
5120-678-5287	8761561	B-30	30
5120-678-5288	8761568	B-30	24
5120-710-7437	8375324	B-30	2
5120-723-6833	81349-MILT-0021309A Table VIII, Type V Size 2	B-30	37
5120-752-9755	GGG-P-480A - Type 2, Class 3, Style B, Size 22	B-30	12
5120-789-4881	10935476	B-30	27
5120-793-7895	10882747	B-30	6
5120-793-7896	10882653	B-30	8
5120-795-0177	7950177	B-30	22
5120-797-2405	81349-MILT 21309 Type 3, Class 1, Style A	B-30	4
5120-797-2407	81349-MILT 21309 Type 3, Class 1, Style A	B-30	3
5120-837-5091	8375091	B-30	14
5120-871-7198	11610167	B-30	15
5120-873-6943	11610150	B-30	40
5120-875-9556	11610171	B-30	23
5210-793-7897	10882617	B-30	19
5210-793-7898	10882615	B-30	17
5210-793-7899	10882616	B-30	18
5220-988-8774	10912589	B-29	3
5305-068-0515	96906-90727-8	B-28	22
5305-071-2506	96906-90728-3	B-22	49
5305-071-2506	96906-90728-3	B-23	4
5305-206-3851	8717161	B-7	4
5305-225-3839	96906-90725-8	B-20	10
5305-225-3842	96906-90728-9	B-17	37
5305-253-5618	96906-21318-27	B-2	74
5305-253-5618	96906-21318-27	B-7	2
5305-267-8982	96906-90726-15	B-19	53
5305-267-8983	96906-90726-16	B-23	20
5305-269-2803	96906-90726-60	B-19	6
5305-269-2806	96906-90726-63	B-13	53
5305-269-3235	96906-90727-59	B-28	11
5305-269-3236	96906-90727-60	B-13	7
5305-269-3236	96906-90727-60	B-13	57
5305-269-3237	96906-90727-61	B-26	63
5305-269-3238	96906-90727-62	B-26	83
5305-269-3240	96906-90727-64	B-25	4
5305-269-3243	96906-90727-67	B-13	4
5305-269-3245	96906-90727-69	B-25	9
5305-486-2901	73370-X21820	B-20	1
5305-531-1097	96906-35308-365	B-12	1
5305-655-6361	96906-90727-6	B-27	28
5305-655-6556	96906-35266-70	B-21	45
5305-655-9663	7340190	B-22	6
5305-678-3327	8725291	B-6	32
5305-682-5881	96906-51093-4	B-8	9
5305-709-8515	96906-90727-88	B-19	3
5305-709-8523	96906-90727-87	B-5	11
5305-710-4189	96906-90726-84	B-2	94
5305-710-4194		B-32	11
5305-710-4195		B-32	12
5305-715-1221	96906-51981-36	B-3	17
5305-725-0154	96906-90727-112	B-2	4
5305-727-3804	96906-90725-165	B-32	13
5305-753-7088	96906-35291-165	B-32	13
5305-801-5747	96906-35308-364	B-12	3
5305-811-0638	96906-51096-64	B-9	11
5305-817-9326	96906-51096-60	B-21	2
5305-817-9326	96906-51096-60	B-24	8
5305-891-7871	10865321	B-18	30
5305-897-7481	10898763	B-22	17
5305-897-7481	10898763	B-24	26
5305-910-7369	96906-51096-306	B-5	46
5305-914-6131	96906-18153-63	B-26	87
5305-958-4346	96906-35207-215	B-11	48

Federal Stock No.	Part No.	Fig. No.	Item No.	Federal Stock No.	Part No.	Fig. No.	Item No.
5305-988-1723	7323986	B-14	27	5306-678-3531	7340060	B-8	34
5305-993-1848	96906-35207-265	B-7	53	5306-678-4259	7341633	B-27	7
5305-993-1851	96906-35207-267	B-11	20	5306-678-4260	7323988	B-15	10
5305-993-1851	96906-35207-267	B-17	25	5306-678-4262	10863824	B-32	15
5305-993-1851	96906-35207-267	B-19	35	5306-678-6889	8761272	B-2	30
5305-993-1851	96906-35207-267	B-21	33	5306-741-4584	7414584	B-22	23
5306-017-6143	96906-51937-7	B-30	29	5306-741-4584	7414584	B-24	16
5306-019-2417	21450-192417	B-19	25	5306-741-4584	7414584	B-24	29
5306-042-5592	24617-425592	B-18	31	5306-774-4685	7744685	B-5	20
5306-042-5828	21450-425828	B-21	24	5306-774-4720	7744720	B-23	17
5306-050-1238	96906-90727-32	B-7	57	5306-807-9371	88044-178H41A	B-15	7
5306-050-1238	96906-90727-32	B-7	61	5306-816-9326	96906-51096-60	B-21	2
5306-050-1238	96906-90727-32	B-11	53	5306-817-6131	21450-596281	B-3	2
5306-050-1238	96906-90727-32	B-15	14	5306-837-9469	10898746	B-27	12
5306-050-1238	96906-90727-32	B-28	14	5306-852-7104	96906-51096-335	B-26	6
5306-051-4075	96906-90727-33	B-7	9	5306-944-7537	88044-176C6A	B-16	15
5306-051-4075	96906-90727-33	B-10	11	5306-993-1851	96906-35207-267	B-11	33
5306-051-4075	96906-90727-33	B-11	13	5307-145-4675	77445-77913P8	B-5	40
5306-051-4075	96906-90727-33	B-28	1	5307-207-8619	7971983	B-26	20
5306-051-4076	96906-90727-34	B-5	15	5307-207-8620	7971982	B-26	20
5306-051-4076	96906-90727-34	B-7	12	5307-264-2471	7744564	B-26	104
5306-051-4076	96906-90727-34	B-18	13	5307-264-2472	7744813	B-5	29
5306-051-4084	96906-90727-42	B-10	22	5307-264-2472	7744813	B-26	104
5306-051-4087	96906-90727-45	B-4	28	5307-272-6331	8365809	B-13	38
5306-150-9104	7414569	B-11	37	5307-272-6331	8365809	B-26	15
5306-150-9104	7414569	B-26	34	5307-272-6332	8365810	B-13	38
5306-151-1420	88044-4-14A	B-17	7	5307-272-6332	8365810	B-26	15
5306-151-2623	88044-4-20A	B-4	25	5307-272-6334	8691451	B-9	13
5306-151-2626	7415117	B-12	14	5307-272-6335	8691452	B-9	13
5306-180-0238	88044-6-5A	B-25	2	5307-410-5830	10882970	B-2	71
5306-180-0321	88044-177-24	B-13	50	5307-438-1809	7084497	B-2	98
5306-180-3357	88044-5CH11	B-18	5	5307-477-3736	7084498	B-2	98
5306-182-2014	88044-4H-3A	B-9	31	5307-533-3382	10882638	B-9	15
5306-182-2023	7346699	B-2	43	5307-533-3383	10882637	B-9	15
5306-182-2023	7346699	B-9	1	5307-638-7608	14351-401975P007	B-6	9
5306-182-2024	88044-5H5A	B-9	5	5307-638-7608	14351-401975P007	B-6	50
5306-182-2025	88044-5H6A	B-8	31	5307-638-7608	14351-401975P007	B-26	23
5306-182-2026	88044-5H7A	B-2	100	5307-638-7608	14351-401975P007	B-26	67
5306-182-2026	88044-5H7A	B-5	2	5307-678-3314	8725298	B-4	52
5306-182-2026	88044-5H7A	B-27	56	5307-678-3315	7039742	B-4	45
5306-182-2029	88044-5H12A	B-27	45	5307-678-3320	7992673	B-26	71
5306-206-3850	8717322	B-3	11	5307-678-3321	7992674	B-26	71
5306-206-4931	88044-4-3A	B-22	4	5306-678-3328	8761204	B-26	77
5306-225-8504	96906-90725-40	B-10	1	5307-678-3329	8761203	B-26	77
5306-225-8511	96906-90725-47	B-10	25	5307-678-3506	8682805	B-2	29
5306-225-9086	96906-90726-31	B-7	49	5307-678-3507	8682804	B-2	29
5306-225-9103	96906-90726-48	B-19	44	5307-678-3509	8682501	B-2	27
5306-225-9107	96906-90726-52	B-19	17	5307-678-3510	8682500	B-2	27
5306-335-4244	8365671	B-4	30	5307-678-3513	7992698	B-2	92
5306-400-7637	7416636	B-2	13	5307-678-3514	7992697	B-2	92
5306-413-4373	10882750	B-7	25	5307-678-3515	7992694	B-2	21
5306-453-5589	10883080	B-7	11	5307-678-3516	7992693	B-2	21
5306-527-4128	88044-5PC14A	B-27	42	5307-678-3517	7992686	B-2	56
5306-616-1248	88044-5-4A	B-21	26	5307-678-3518	7992685	B-2	56
5306-616-1248	88044-5-4A	B-22	19	5307-678-3519	7992682	B-2	55
5306-616-1248	88044-5-4A	B-22	27	5307-678-3520	7992681	B-2	55
5306-616-1248	88044-5-4A	B-24	15	5307-678-3521	7992678	B-2	24
5306-616-2618	88044-5-12A	B-4	24	5307-678-3521	7992678	B-2	54
5306-638-5288	88044-7H10A	B-3	14	5307-678-3522	7992677	B-2	24
5306-678-1885	8761432	B-23	10	5307-678-3522	7992677	B-2	54
5306-678-1887	8724979	B-4	7	5307-678-3523	7992670	B-2	57
5306-678-3316	7320407	B-4	26	5307-678-3524	7992669	B-2	57
5306-678-3323	7039747	B-6	65	5307-678-3525	7992658	B-2	28
5306-678-3324	7039746	B-6	44	5307-678-3526	7992657	B-2	28
5306-678-3324	7039746	B-7	33	5307-678-3528	7992653	B-2	25
5306-678-3324	7039746	B-7	72	5307-678-3529	7992646	B-2	22
5306-678-3325	8761337	B-25	8	5307-678-3529	7992646	B-2	59

Federal Stock No	Part No.	Fig. No.	Item No.
5307-678-3530	7992645	B-2	22
5307-678-3530	7992645	B-2	59
5307-678-3533	7084439	B-7	21
5307-678-3534	7084438	B-7	21
5307-678-3535	7044069	B-2	23
5307-678-3536	7044068	B-2	23
5307-678-6876	7084444	B-26	89
5307-678-6877	7084445	B-26	89
5307-678-6880	7992649	B-26	80
5307-678-6880	7992649	B-26	95
5307-678-6881	7992650	B-26	80
5307-678-6881	7992650	B-26	95
5307-678-6882	7992665	B-26	103
5307-678-6883	7992666	B-26	103
5307-678-6884	7992689	B-26	10
5307-678-6885	7992690	B-26	10
5307-678-6887	8761199	B-26	94
5307-678-6888	8761200	B-26	94
5307-678-6890	8761443	B-2	26
5307-678-6890	8761443	B-26	92
5307-678-6891	8761442	B-2	26
5307-678-6891	8761442	B-26	92
5307-679-4985	7046669	B-9	34
5307-679-4985	7046669	B-26	18
5307-679-4986	7363446	B-9	35
5307-679-4987	7363443	B-9	14
5307-679-4988	736447	B-9	35
5307-679-4989	7046670	B-9	34
5307-679-4989	7046670	B-26	18
5307-679-4990	7363442	B-9	14
5307-679-5684	7084530	B-13	25
5307-682-5820	8682787	B-13	9
5307-706-5766	7065766	B-26	19
5307-706-5767	7065767	B-26	19
5307-727-4938	7767340	B-2	87
5307-733-8646	7338646	B-5	40
5307-734-8596	7348596	B-8	17
5307-734-8668	7348668	B-6	9
5307-734-8668	7348668	B-6	50
5307-734-8668	7348668	B-26	23
5307-734-8668	7348668	B-26	67
5307-734-8671	7348671	B-2	87
5307-734-8782	7348782	B-2	67
5307-734-8782	7348782	B-2	86
5307-734-8783	7348783	B-2	86
5307-734-8797	7348797	B-2	69
5307-734-8798	7348798	B-2	69
5307-734-8803	7348803	B-2	19
5307-734-8803	7348803	B-2	53
5307-734-8803	7348803	B-26	22
5307-734-8804	7348804	B-2	19
5307-734-8804	7348804	B-2	53
5307-734-8804	7348804	B-26	22
5307-734-8812	7348812	B-6	8
5307-734-8813	7348813	B-6	8
5307-741-0162	14351-401874S	B-26	90
5307-741-0163	7410163	B-26	90
5307-741-0395	7410395	B-8	17
5307-741-5384	7415384	B-14	26
5307-741-5385	7415385	B-14	26
5307-774-4555	7744555	B-4	43
5307-774-4555	7744555	B-6	77
5307-774-4572	7744572	B-6	67
5307-774-4573	7744573	B-6	67
5307-774-4605	7744605	B-26	78
5307-774-4795	7744795	B-26	78
5307-774-4803	7744803	B-4	43
5307-774-4803	7744803	B-6	77
5307-776-7333	7767333	B-9	59
5307-776-7334	7767334	B-9	59
5307-776-7348	7767348	B-7	24
5307-776-7361	7767361	B-7	24
5307-776-7804	7767804	B-4	51
5307-776-7804	7767804	B-6	78
5307-776-7804	7767804	B-13	37
5307-776-7805	7767805	B-6	78
5307-776-7805	7767805	B-13	37
5307-801-4819	7084531	B-13	25
5307-806-6047	7039744	B-4	45
5307-837-7791	7738011	B-13	15
5307-866-6736	8666736	B-7	17
5307-866-6736	8666736	B-7	27
5307-866-6736	8666736	B-8	14
5307-866-6737	8666737	B-7	17
5307-866-6737	8666737	B-7	27
5307-866-6737	8666737	B-8	14
5307-954-6460	8365383-3	B-24	56
5307-995-8205	8365383-2	B-24	56
5310-012-0239	96906-35337-29	B-19	23
5310-012-2198	7403193	B-18	15
5310-012-4553	96906-35756-17	B-14	11
5310-022-5853	21450-225853	B-13	21
5310-045-3296	96906-35338-43	B-21	47
5310-061-7325	96906-21045-4	B-17	11
5310-062-4954	96906-21045-8	B-15	31
5310-080-6004	96906-15795-214	B-13	52
5310-080-6004	96906-15795-214	B-28	9
5310-081-4219	96906-27183-12	B-21	11
5310-081-4219	96906-15795-212	B-28	3
5310-088-0552	96906-21044-N7	B-2	32
5310-088-0552	96906-21044-N7	B-14	23
5310-088-0552	96906-21044-N7	B-24	48
5310-088-0553	96906-21044-N5	B-7	16
5310-088-0553	96906-21044-N5	B-7	28
5310-088-0553	96906-21044-N5	B-7	59
5310-088-0553	96906-21044-N5	B-7	74
5310-088-0553	96906-21044-N5	B-21	12
5310-088-0553	96906-21044-N5	B-24	13
5310-088-0553	96906-21044-N5	B-26	59
5310-141-1795	88044-960-416	B-5	38
5310-141-1795	88044-960-416	B-19	51
5310-141-1795	88044-960-416	B-27	64
5310-149-9116	96906-20002C8	B-15	9
5310-167-0816	88044-960-6	B-2	75
5310-167-0818	88044-960-10	B-21	45
5310-167-0818	88044-960-10	B-23	12
5310-167-0820	88044-960-516	B-2	97
5310-167-0820	88044-960-516	B-4	23
5310-167-0820	88044-960-516	B-5	4
5310-167-0820	88044-960-516	B-6	18
5310-167-0820	88044-960-516	B-6	54
5310-167-0820	88044-960-516	B-6	71
5310-167-0820	88044-960-516	B-9	17
5310-167-0820	88044-960-516	B-11	34
5310-167-0820	88044-960-516	B-12	9
5310-167-0820	88044-960-516	B-13	44
5310-167-0820	88044-960-516	B-15	21
5310-167-0820	88044-960-516	B-18	10
5310-167-0820	88044-960-516	B-19	46
5310-167-0820	88044-960-516	B-25	7
5310-167-0820	88044-960-516	B-26	7
5310-167-0820	88044-960-516	B-26	46
5310-167-0820	88044-960-516	B-27	55
5310-167-0821	21450-502204	B-3	22

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5310-167-0822	88044-960-716	B-2	93
5310-167-0822	88044-960-716	B-5	12
5310-167-0822	88044-960-716	B-14	24
5310-167-0822	88044-960-716	B-19	40
5310-167-0822	88044-960-716	B-24	47
5310-167-0823	88044-960-816	B-15	30
5310-167-0835	21450-502220	B-17	39
5310-176-8108	88044-320-4	B-27	65
5310-208-5775	96906-24400-8	B-11	25
5310-208-5775	96906-24400-8	B-19	11
5310-209-0786	96906-35335-33	B-22	54
5310-209-0786	96906-35335-33	B-23	3
5310-209-0965	96906-35338-47	B-19	4
5310-209-0965	96906-35338-47	B-32	10
5310-209-2629	7767350	B-8	32
5310-209-2629	7767350	B-26	33
5310-239-5848	10865381	B-26	97
5310-275-3683	96906-35335-40	B-19	14
5310-282-7822	96906-24400-10	B-11	2
5310-298-9252	21450-423884	B-17	20
5310-333-7348	8679576	B-2	84
5310-333-7348	8679576	B-5	27
5310-333-7348	8679576	B-6	42
5310-333-7348	8679576	B-6	49
5310-333-7348	8679576	B-7	10
5310-333-7348	8679576	B-7	30
5310-333-7348	8679576	B-8	33
5310-333-7348	8679576	B-9	10
5310-333-7348	8679576	B-14	18
5310-333-7348	8679576	B-25	13
5310-333-7348	8679576	B-26	2
5310-333-7348	8679576	B-26	36
5310-333-7348	8679576	B-26	70
5310-402-8379	8761420	B-26	12
5310-406-7319	8761244	B-26	38
5310-407-9566	96906-35338-45	B-5	3
5310-407-9566	96906-35338-45	B-7	48
5310-407-9566	96906-35338-45	B-7	58
5310-407-9566	96906-35338-45	B-8	29
5310-407-9566	96906-35338-45	B-10	2
5310-407-9566	96906-35338-45	B-11	14
5310-407-9566	96906-35338-45	B-13	22
5310-407-9566	96906-35338-45	B-15	15
5310-407-9566	96906-35338-45	B-18	12
5310-407-9566	96906-35338-45	B-19	47
5310-407-9566	96906-35338-45	B-28	2
5310-489-8351	11640132	B-12	7
5310-489-8351	11640132	B-15	2
5310-491-0327	10889715	B-18	24
5310-535-6688	8745480	B-6	51
5310-582-5965	96906-35338-44	B-19	52
5310-582-5965	96906-35338-44	B-20	11
5310-582-5965	96906-35338-44	B-22	50
5310-582-5965	96906-35338-44	B-28	23
5310-584-5272	96906-35338-48	B-2	5
5310-584-7888	96906-35338-51	B-16	16
5310-584-7888	96906-35338-51	B-32	3
5310-588-0393	8679574	B-22	2
5310-616-3554	96906-35335-29	B-11	49
5310-637-3057	8698690	B-13	34
5310-637-9541	96906-35338-46	B-13	5
5310-637-9541	96906-35338-46	B-16	9.5
5310-637-9541	96906-35338-46	B-16	14
5310-637-9541	96906-35338-46	B-19	5
5310-637-9541	96906-35338-46	B-25	1
5310-637-9541	96906-35338-46	B-28	10
5310-638-2247	21450-455332	B-18	34
5310-638-6274	21450-596610	B-2	96
5310-638-6274	21450-596610	B-14	6
5310-655-9370	96906-35340-47	B-14	28
5310-655-9590	7340058	B-16	17
5310-655-9869	8761273	B-14	21
5310-655-9937	8724978	B-4	3
5310-655-9975	8764639	B-22	10
5310-655-9975	8764639	B-24	31
5310-656-0111	96906-15795-703	B-7	1
5310-678-5370	7323994	B-17	13
5310-679-5685	8744055	B-10	16
5310-679-9880	8682774	B-13	33
5310-682-5631	8666561	B-22	7
5310-682-5851	7323991	B-2	33
5310-682-5823	8761229	B-27	34
5310-682-5824	8761241	B-27	29
5310-685-8217	8761227	B-27	35
5310-685-8218	7340061	B-7	66
5310-720-7627	8761279	B-2	77
5310-737-2030	7372030	B-6	15
5310-741-4564	7414564	B-22	20
5310-741-4564	7414564	B-24	5
5310-753-4014	8725151	B-4	54
5310-763-8901	96906-51968-23	B-32	2
5310-763-8920	97906-51967-20	B-32	18
5310-774-4570	7744570	B-12	6
5310-774-4570	7744570	B-15	3
5310-776-7317	7767317	B-4	32
5310-776-7318	7767318	B-7	34
5310-776-7728	7767728	B-25	11
5310-809-4058	96906-27183-10	B-20	12
5310-809-4061	96906-27183-15	B-13	54
5310-809-8533	96906-27183-23	B-19	10
5310-809-8540	96906-27183-25	B-11	3
5310-809-8541	96906-27183-27	B-17	21
5310-820-6653	96906-35338-50	B-32	17
5310-842-1295	96906-35692-29	B-13	48
5310-842-1488	96906-35692-21	B-2	15
5310-842-1488	96906-35692-21	B-3	21
5310-842-1488	96906-35692-21	B-26	40
5310-849-6883	96906-35692-13	B-2	38
5310-849-6883	96906-35692-13	B-7	67
5310-849-6883	96906-35692-13	B-9	18
5310-849-6883	96906-35692-13	B-14	13
5310-849-6883	96906-35692-13	B-18	9
5310-849-6883	96906-35692-13	B-25	20
5310-849-6883	96906-35692-13	B-26	76
5310-849-6883	96906-35692-13	B-27	54
5310-851-4278	7324901	B-9	40
5310-853-9335	96906-35691-13	B-18	29
5310-861-1406	7748837	B-16	24
5310-877-5796	96906-21044N4	B-5	37
5310-877-5796	96906-21044N4	B-22	3
5310-877-5796	96906-21044N4	B-23	18
5310-877-5797	96906-21044N3	B-7	55
5310-877-5797	96906-21044N3	B-19	34
5310-886-3000	10912163-1	B-22	20
5310-886-3000	10912163-1	B-24	5
5310-886-3001	10912163-2	B-22	2
5310-902-6676	96906-21083N3	B-11	22
5310-902-6676	96906-21083N3	B-17	26
5310-902-6676	96906-21083N3	B-21	36
5310-902-6676	96906-21083N3	B-23	11
5310-934-9734	96906-35650-342	B-11	50
5310-950-0039	96906-21044-N6	B-2	81
5310-950-0039	96906-21044-N6	B-5	26
5310-950-0039	96906-21044-N6	B-6	29

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5310-950-0039	96906-21044-N6	B-6	43
5310-950-0039	96906-21044-N6	B-7	31
5310-950-0039	96906-21044-N6	B-7	71
5310-950-0039	96906-21044-N6	B-13	1
5310-950-0039	96906-21044-N6	B-14	19
5310-950-0039	96906-21044-N6	B-15	18
5310-950-0039	96906-21044-N6	B-25	16
5310-950-0039	96906-21044-N6	B-26	1
5310-950-0039	96906-21044-N6	B-26	35
5310-950-0039	96906-21044-N6	B-26	69
5310-982-4912	96906-21045-5	B-6	19
5310-982-4912	96906-21045-5	B-6	55
5310-982-4912	96906-21045-5	B-6	70
5310-982-4912	96906-21045-5	B-8	4
5310-982-4912	96906-21045-5	B-11	29
5310-982-4912	96906-21045-5	B-11	40
5310-982-4912	96906-21045-5	B-12	8
5310-982-4912	96906-21045-5	B-13	20
5310-982-4912	96906-20145-5	B-15	20
5310-982-4912	96906-21045-5	B-15	28
5310-982-4912	96906-21045-5	B-18	3
5310-982-4912	96906-21045-5	B-21	4
5310-982-4912	96906-21045-5	B-22	8
5310-982-4912	96906-21045-5	B-24	21
5310-982-4912	96906-21045-5	B-24	55
5310-982-4912	96906-21045-5	B-26	45
5310-842-1488	96906-35692-21	B-26	76
5310-982-6809	96906-21044N10	B-15	26
5315-012-4553	96906-35756-17	B-14	11
5315-013-7214	96906-24665-359	B-25	5
5315-019-0777	96906-24665-291	B-14	16
5315-058-9929	21450-589929	B-2	60
5315-058-9929	12450-589929	B-26	27
5315-058-9929	21450-589929	B-26	86
5315-141-6337	8717298	B-3	18
5315-141-6338	8717299	B-3	18
5315-234-1863	96906-24665-300	B-13	47
5315-234-1864	96906-24665-302	B-2	76
5315-238-9239	8725256	B-2	82
5315-241-2916	88044-122718	B-4	50
5315-241-2916	88044-122718	B-26	13
5315-252-5987	96906-24665-138	B-6	23.3
5315-282-1510	7338669	B-8	24
5315-298-1481	96906-24665-357	B-9	41
5315-490-5588	10882757	B-27	32
5315-497-9650	8682763	B-26	101
5315-616-5526	96906-35756-8	B-18	4
5315-753-8333	96906-24665-145	B-18	8
5315-753-8333	96906-24665-145	B-26	41
5315-753-8333	96906-24665-145	B-26	75
5315-753-9735	7539735	B-2	34
5315-776-7363	7767363	B-3	25
5315-816-1794	96906-24665-285	B-6	23.2
5315-828-4485	96906-16555-655	B-18	18
5315-839-2325	96906-24665-132	B-25	6
5315-839-5820	96906-24665-134	B-27	66
5315-842-3044	96906-24665-283	B-3	20
5320-264-4293	96906-20426A4-20	B-6	22
5325-174-9038	96906-35489-20	B-7	36
5325-182-4707	10935447	B-21	21
5325-184-9846	96906-35489-10	B-21	22
5325-276-6096	96906-35489-74	B-13	56
5325-276-6096	96906-35489-74	B-21	6
5325-276-6096	96906-35489-74	B-24	7
5325-682-1471	96906-35490-16	B-22	30
5325-682-7076	7998574	B-24	10
5330-171-6649	96906-28775-223	B-14	8
5330-187-3615	21450-546908	B-27	53
5330-199-5884	96906-35769-31	B-8	23
5330-199-5886	96906-35769-35	B-6	68
5330-256-0201	88044-6230-16	B-16	9.2
5330-265-1089	96906-29513-125	B-20	16
5330-269-2844	96906-35769-47	B-6	2
5330-269-2845	96906-35769-34	B-6	40
5330-290-8154	7045881	B-6	33
5330-290-8154	7045881	B-7	13
5330-291-2830	21450-500241	B-5	35
5330-291-7390	5165292	B-4	55
5330-292-7363	7416751	B-2	90
5330-297-9990	96906-28775-222	B-5	44
5330-410-9803	10935621	B-7	39
5330-411-2512	7320441	B-9	6
5330-411-2513	8682754	B-2	6
5330-438-1861	10912558	B-14	17
5330-411-5803	8761274	B-9	61
5330-493-2938	10912270	B-32	5
5330-498-6341	10935478	B-13	54
5330-498-6341	10935478	B-21	3
5330-498-6341	10935478	B-24	6
5330-514-5678	8764886	B-14	25
5330-542-1329	96906-28775-120	B-9	8
5330-542-1586	96906-28775-118	B-16	6
5330-543-3261	96906-35769-6	B-6	62
5330-576-9732	96906-28775-226	B-26	4
5330-579-3156	96906-28775-116	B-9	9
5330-579-3156	96906-28775-116	B-15	11
5330-579-6861	96906-28775-236	B-14	22
5330-579-7918	96906-28775-229	B-5	8
5330-579-8156	96906-28775-212	B-6	39
5330-579-8157	96906-28775-327	B-7	38
5330-580-3846	96906-28775-325	B-26	56
5330-582-2133	96906-28775-011	B-5	28
5330-582-2133	96906-28775-011	B-26	73
5330-582-2855	96906-28775-113	B-2	3
5330-584-1186	96906-28775-331	B-13	36
5330-585-6663	96906-28775-110	B-26	42
5330-599-2934	96906-28775-112	B-26	81
5330-618-0800	96906-28775-335	B-13	26
5330-632-2098	7033684	B-4	27
5330-641-3407	96906-28775-224	B-7	23
5330-663-4773	8720953	B-20	2.1
5330-663-4773	8720953	B-20	5.2
5330-678-3313	8725296	B-4	31
5330-678-3508	8682764	B-8	6
5330-678-5386	8682770	B-11	15
5330-678-5388	8682680	B-11	28
5330-678-7106	8395460	B-14	14
5330-679-6483	8761087	B-15	5
5330-738-0543	7767519	B-5	39
5330-772-3892	7723892	B-2	6
5330-855-6045	96906-35769-9	B-10	14
5340-050-2740	21450-502740	B-11	21
5340-050-2740	21450-502740	B-17	23
5340-057-3043	21450-573043	B-11	5
5340-088-1255	96906-21333-96	B-21	37
5340-089-8830	8682702	B-23	13
5340-089-8836	99066-SR7827	B-16	3
5340-114-0093	10865374	B-21	7
5340-177-4213	21450-501522	B-2	51
5340-193-0104	88044-735-12	B-7	54
5340-194-4714	10899041	B-26	8
5340-200-8975	21450-583288	B-26	55
5340-205-4658	8717162	B-7	5

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5340-205-9307	8698764	B-13	27
5340-209-0174	8698689	B-13	35
5340-220-5168	8725196	B-6	25
5340-242-5599	8682771	B-7	8
5340-242-5600	10912444	B-7	50
5340-242-5601	10883940	B-28	4
5340-282-1619	96906-16625-3354	B-14	3
5340-282-5278	96906-16624-3031	B-9	56
5340-282-7509	96906-21333-62	B-19	39
5340-286-2458	96906-122161	B-20	20
5340-291-3484	96906-124696	B-28	24
5340-291-3488	96906-21208F8-15	B-4	44
5340-291-3492	96906-21208F6-15	B-2	73
5340-291-3492	96906-21208F6-15	B-8	12
5340-291-3492	96906-21208F6-15	B-8	16
5340-291-3492	96906-21208F615	B-8	18
5340-291-3492	96906-21208F6-15	B-25	15
5340-291-3495	96906-214697	B-2	48
5340-291-3495	96906-124697	B-2	65
5340-291-3495	96906-124697	B-2	66
5340-291-3495	96906-124697	B-6	5
5340-291-3495	96906-124697	B-8	19
5340-291-3495	96906-124697	B-9	28
5340-291-3495	96906-124697	B-26	85
5340-291-3495	96906-124697	B-26	91
5340-298-9406	96906-21919-G9	B-11	23
5340-298-9406	96906-21919-G9	B-17	24
5340-298-9406	96906-21919-G9	B-19	12
5340-402-4435	8761164	B-23	15
5340-407-0664	10951462	B-19	24
5340-407-0666	10865375	B-21	25
5340-434-6850	96906-35914-112	B-24	24
5340-437-7210	10935443-1	B-12	15
5340-437-7211	10935443-2	B-12	18
5340-449-2580	10884034	B-28	15
5340-453-5595	10883941	B-28	7
5340-456-1792	10865317	B-17	10
5340-456-1798	10884033	B-28	16
5340-456-1799	10882767	B-21	49
5340-463-2908	8761243	B-12	10
5340-484-0865	8761070	B-24	34
5340-498-8347	10882771	B-11	52
5340-490-0871	10865316	B-17	38
5340-490-0872	8725236	B-2	49
5340-514-2321	96906-21208F5-20	B-2	45
5340-514-2321	96906-21208F5-20	B-5	25
5340-514-2321	96906-21208F5-20	B-26	16
5340-526-2559	96906-21919F2	B-21	34
5340-535-6469	96906-21919-G3	B-11	32
5340-535-6471	96906-21919-G16	B-11	31
5340-535-6471	96906-21919G16	B-21	35
5340-616-5014	96906-35914-114	B-24	2
5340-634-7860	96906-21208F7-15	B-2	95
5340-663-1245	96906-16632-1031	B-27	33
5340-678-3309	8352636	B-2	18
5340-678-3310	8352635	B-4	42
5340-678-3311	8352634	B-2	17
5340-678-3311	8352634	B-4	46
5340-678-3311	8352634	B-26	79
5340-678-3532	7320411	B-2	31
5340-678-4257	8761413	B-27	2
5340-679-8116	7017550	B-4	49
5340-679-8116	7017550	B-5	10
5340-682-1619	21450-586365	B-27	9
5340-737-4145	7374145	B-6	59
5340-738-4968	7384968	B-11	19
5340-738-5174	7385174	B-15	16
5340-740-3580	7403580	B-24	23
5340-754-1083	96906-16625-1137	B-5	18
5340-754-1083	96906-16625-1137	B-18	26
5340-799-4794	7994794	B-6	66
5340-801-2500	96906-16625-1112	B-3	3
5340-803-7304	96906-16624-1156	B-26	28
5340-803-7305	96906-16624-1062	B-18	16
5340-804-2786	96906-16625-1125	B-26	37
5340-804-3891	96906-16625-1150	B-26	26
5340-809-1490	96906-21333-98	B-19	36
5340-809-1490	96906-21333-98	B-21	20
5340-834-3854	8343854	B-6	20
5340-834-3854	8343854	B-6	63
5340-847-0734	96906-21209-F5-15	B-4	47
5340-847-0734	96906-21209-F5-15	B-19	20
5340-882-5939	96906-16625-3283	B-14	1
5340-990-7159	96906-21268-F6-20	B-2	72
5350-068-0501	96906-90725-5	B-22	17
5355-776-7331	7767331	B-2	9
5360-410-5836	10935614	B-7	46
5365-235-1941	5702674	B-16	
5365-402-8380	8725218	B-6	1
5365-407-7003	8761268	B-23	19
5365-407-7011	8682674	B-26	30
5365-408-1268	7320384	B-4	21
5365-408-1270	8725246	B-6	69
5430-493-4057	10865464	B-11	35
5430-493-4057	10865464	B-11	38
5930-688-9882	81349-M12285-1-5	B-6	36
5930-692-9258	96906-90530-2	B-2	41
6620-734-6573	7346573	B-24	22
6620-993-5546	96906-24539-1	B-2	36
6645-179-2712	11641917	B-31	2
6645-420-5072	11640392	B-15	12
6680-973-1263	96906-29132-1	B-5	48
6685-814-5271	96906-24537-1	B-6	38
6685-906-0156	8355883	B-32	8
6850-264-6572	81349-MIL-D-3464, Class I	B-32	14
8115-856-8147	10912269	B-32	
9320-181-0118	8761271	B-22	45
9320-181-0118	8761271	B-24	30
9320-181-0119	8682670-8	B-24	35
9320-181-0119	8682670-8	B-24	49
9525-803-3044	96906-20995NC32	B-2	11
9525-803-3044	96906-20995NC32	B-27	11
9525-990-7799	96906-20995NC40	B-2	14
9525-990-7799	96906-20995NC40	B-2	16
9525-990-7799	96906-20995NC40	B-2	37
9525-990-7799	96906-20995NC40	B-2	42
9525-990-7799	96906-20995NC40	B-3	1
9525-990-7799	96906-20995NC40	B-3	13
9525-990-7799	96906-20995NC40	B-5	19
9525-990-7799	96906-20995NC40	B-5	45
9525-990-7799	96906-20995NC40	B-6	45
9525-990-7799	96906-20995NC40	B-6	64
9525-990-7799	96906-20995NC40	B-7	32
9525-990-7799	96906-20995NC40	B-7	68
9525-990-7799	96906-20995NC40	B-7	73
9525-990-7799	96906-20995NC40	B-8	10
9525-990-7799	96906-20995NC40	B-8	22
9525-990-7799	96906-20995NC40	B-9	2
9525-990-7799	96906-20995NC40	B-9	19
9525-990-7799	96906-20995NC40	B-10	18
9525-990-7799	96906-20995NC40	B-14	5
9525-990-7799	96906-20995NC40	B-15	8

Federal Stock No.	Part No.	Fig. No.	Item No.	Federal Stock No.	Part No.	Fig. No.	Item No.
9525-990-7799	96906-20995NC40	B-21	1	9525-990-7799	96906-20995NC40	B-27	43
9525-990-7799	96906-20995NC40	B-22	46	9525-990-7799	96906-20995NC40	B-27	57
9525-990-7799	96906-20995NC40	B-24	9	9905-407-5099	10882826	B-7	3
9525-990-7799	96906-20995NC40	B-24	27	9905-407-5100	10882827	B-7	77
9525-990-7799	96906-20995NC40	B-26	5	9905-419-5829	10912455	B-2	63

PART NUMBER CROSS REFERENCED TO FEDERAL STOCK NUMBER AND FIGURE AND ITEM NUMBER

Part No.	Federal Stock No.	Fig. No.	Item No.
GGG-P-480A-Type 2, Class 3, Style B, Size 22	5120-752-9755	B-30	12
MIL-H-6000-1.000 in. id	4720-278-1113	B-10	7
MIL-H-6000-4.000 in. id	4720-202-7457	B-13	13
33H-00344082	4720-278-1112	B-26	61
00736-03T177C164		B-6	60
00736-03T786-140	2940-121-6177	B-6	61
01843-HH78371		B-16	2
01843-NT7899		B-16	26
01843-SP7824		B-16	32
01843-SR7828-1	2910-878-9932	B-16	4.1
01843-SR7828-2		B-16	4.2
01843-SR7828-3		B-16	4.3
01843-SR7828-4		B-16	4.4
01843-SR7828-5		B-16	4.5
01843-SR7829		B-16	30
01843-VB77144-4		B-16	27
01843-VA77162		B-16	29
05821-241528		B-16	10
08181-28M68		B-20	18
08181-28M94		B-29	9
11583-XED89D	2920-647-3899	B-21	13
14351-401874S	5307-741-0162	B-26	90
14351-401975P007	5307-638-7608	B-6	9
14351-401975P007	5307-638-7608	B-6	50
14351-401975P007	5307-638-7608	B-26	23
14351-401975P007	5307-638-7608	B-26	67
21335-206KFS10179	3110-554-3197	B-26	14
21335-207K	3110-516-5490	B-14	9
21335-307K	3110-555-5207	B-27	61
21335-9109KFS179	3110-554-2979	B-27	44
21335-9110K	3110-529-9480	B-27	12
21450-117243	4730-278-3388	B-20	8.3
21450-117243	4730-278-3388	B-20	19
21450-125837	4730-278-3912	B-2	35
21450-127956	4730-202-6692	B-11	45
21450-189944	4730-200-0525	B-19	60
21450-192417	5306-019-2417	B-19	25
21450-225853	5310-022-5853	B-13	21
21450-423185	4730-585-2906	B-21	17
21450-423618	4730-810-7039	B-21	54
21450-423884	5310-298-9252	B-17	20
21450-425828	5306-042-5828	B-21	24
21450-443977	4730-640-6582	B-21	48
21450-444035	4730-044-4035	B-19	2
21450-444476	4730-710-9486	B-21	28
21450-444715	4730-044-4715	B-6	7
21450-444715	4730-044-4715	B-8	15
21450-455332	5310-638-2247	B-18	34
21450-500241	5330-291-2830	B-5	35
21450-501522	5340-177-4213	B-2	51
21450-502204	5310-167-0821	B-3	22
21450-502220	5310-167-0835	B-17	39
21450-502740	5340-050-2740	B-11	21
21450-502740	5340-050-2740	B-17	23
21450-502915	4730-278-2068	B-10	6
21450-502919	4730-278-2065	B-5	1
21450-502919	4730-278-2065	B-11	8
21450-502919	4730-278-2065	B-26	60
21450-546908	5330-187-3615	B-27	53
21450-573043	5340-057-3043	B-11	5
21450-583288	5340-200-8975	B-26	55
21450-586365	5340-682-1619	B-27	9
21450-589929	5315-058-9929	B-2	60
21450-589929	5315-058-9929	B-26	27
21450-589929	5315-058-9929	B-26	86
21450-596281	5306-817-6131	B-3	2
21450-596610	5310-638-6274	B-2	96
21450-596610	5310-638-6274	B-14	6
21450-700078	3110-144-8518	B-9	48
21450-700081	3110-144-8662	B-26	52
21450-700580	3110-155-6675	B-14	4
21450-709460	3110-120-4367	B-26	24
21450-711004	3110-185-6535	B-9	30
21450-711206	3110-186-0964	B-9	29
21450-714038	3110-144-8927	B-26	31
24617-425592	5306-042-5592	B-18	31
29337-3L08M46	3110-516-5290	B-26	29
29337-3L11M46	3110-554-3272	B-27	5
43991-5306	3110-554-6080	B-14	2
53477-645A6	4820-242-4064	B-32	9
70040-1581742		B-5	47
73134-HM5MG	3120-516-0955	B-18	33
73134-HML5FG	3120-516-0953	B-18	6
73370-10428		B-20	3
73370-X21820	5305-486-2901	B-20	1
73370-X117220		B-20	26
73370-117228		B-20	4
77445-77913P8	5307-145-4675	B-5	40
81348-GGG-W-686	5120-221-7947	B-30	28
81348-WW-C400 Type E 0.500 in. od	4730-958-4069	B-19	30
81348-WW-P471 Type 1 Class 1-¼ x ⅛ in.	4730-196-0903	B-21	16
81349-M12285-1-5	5930-688-9882	B-6	36
81348-MIL-D-3464 Class I	6850-264-6572	B-32	14
81349-MIL-H-6000	4720-278-1110	B-7	64
81349-MILT 21309 Type 3 Class I Style A	5120-797-2407	B-30	3
81349-MILT 21309 Type 3 Class I Style A	5120-797-2405	B-30	4
81349-MILT 0021309A Table VII, Type V Size 2	5120-723-6833	B-30	37
83616-NS4 Type H	4710-804-9249	B-21	51
86988-C3062-1		B-16	18
86988-C3062-2		B-16	21
86988-C3062-3		B-16	19
86988-C3062-4		B-16	9.4
86988-C3062-5		B-16	9.3
86988-C3062-8	2910-106-1981	B-16	22
86988-C3062-9		B-16	9.6
86988-C3062-11		B-22	4
88044-4-3A	5306-206-4931	B-9	31
88044-4H-3A	5306-182-2014	B-17	7
88044-4-14A	5306-151-1420	B-21	26
88044-5-4A	5306-616-1248	B-22	19
88044-5-4A	5306-616-1248	B-22	27

Part No.	Federal Stock No.	Fig. No.	Item No.
88044-5-4A	5306-616-1248	B-24	15
88044-5CH11	5306-180-3357	B-18	5
88044-5H5A	5306-182-2024	B-9	5
88044-5H6A	5306-182-2025	B-8	31
88044-5H7A	5306-182-2026	B-2	100
88044-5H7A	5306-182-2026	B-5	2
88044-5H7A	5306-182-2026	B-27	56
88044-5-12A	5306-616-2618	B-4	24
88044-5H12A	5306-182-2029	B-27	45
88044-5PC14A	5306-527-4128	B-27	42
88044-5-20A	5306-151-2623	B-4	25
88044-6-5A	5306-180-0238	B-25	2
88044-7H10A	5306-638-5288	B-3	14
88044-176C6A	5306-944-7537	B-16	15
88044-177-24	5306-180-0321	B-13	50
88044-178H41A	5306-807-9371	B-15	7
88044-320-4	5310-176-8108	B-27	65
88044-735-12	5340-193-0104	B-7	54
88044-775-4	4730-278-0375	B-17	15
88044-779-4	4730-278-5824	B-17	17
88044-825-4	4730-277-9305	B-21	30
88044-883-8J	4730-595-4402	B-19	9
88044-960-6	5310-167-0816	B-2	75
88044-960-10	5310-167-0818	B21	45
88044-960-10	5310-167-0818	B-23	12
88044-960-416	5310-141-1795	B-5	38
88044-960-416	5310-141-1795	B-19	51
88044-960-416	5310-141-1795	B-27	64
88044-960-516	5310-167-0820	B-2	97
88044-960-516	5310-167-0820	B-4	23
88044-960-516	5310-167-0820	B-5	4
88044-960-516	5310-167-0820	B-6	18
88044-960-516	5310-167-0820	B-6	54
88044-960-516	5310-167-0820	B-6	71
88044-960-516	5310-167-0820	B-9	17
88044-960-516	5310-167-0820	B-11	34
88044-960-516	5310-167-0820	B-12	9
88044-960-516	5310-167-0820	B-13	44
88044-960-516	5310-167-0820	B-15	21
88044-960-516	5310-167-0820	B-18	10
88044-960-516	5310-167-0820	B-19	46
88044-960-516	5310-167-0820	B-25	7
88044-960-516	5310-167-0820	B-26	7
88044-960-516	5310-167-0820	B-26	46
88044-960-516	5310-167-0820	B-27	55
88044-960-716	5310-167-0822	B-2	93
88044-960-716	5310-167-0822	B-5	12
88044-960-716	5310-167-0822	B-14	24
88044-960-716	5310-167-0822	B-19	40
88044-960-716	5310-167-0822	B-24	47
88044-960-816	5310-167-0823	B-15	30
88044-6230-16	5330-256-0201	B-16	9.2
88044-122718	5315-241-2916	B-4	50
88044-122718	5315-241-2916	B-26	13
90005-A26422	2910-203-3322	B-20	15
90005-053340		B-20	7
90005-053344		B-20	23
90005-053345		B-20	21
90005-053347		B-20	22
90005-053348		B-20	25
90005-053349		B-20	24
94581-KU20-75-450S	4730-032-2220	B-13	12
96906-15795-212	5310-081-4219	B-21	11
96906-15795-212	5310-081-4219	B-28	3
96906-15795-214	5310-080-6004	B-13	52
96906-15795-214	5310-080-6004	B-28	9
96906-15795-703	5310-656-0111	B-7	1
96906-16555-655	5315-828-4485	B-18	18
96906-16624-1062	5340-803-7305	B-18	16
96906-16624-1156	5340-803-7304	B-26	28
96906-16624-3031	5340-282-5278	B-9	56
96906-16625-1112	5340-801-2500	B-3	3
96906-16625-1125	5340-804-2786	B-26	37
96906-16625-1137	5340-754-1083	B-5	18
96906-16625-1137	5340-754-1083	B-18	26
96906-16625-1150	5340-804-3891	B-26	26
96906-16625-3283	5340-882-5939	B-14	1
96906-16625-3354	5340-282-1619	B-14	3
96906-16632-1031	5340-663-1245	B-27	33
96906-18153-63	5305-914-6131	B-26	87
96906-20002C8	5310-149-9116	B-15	9
96906-20426A4-20	5320-264-4296	B-6	22
96906-20822-4	4730-231-4009	B-21	18
96906-20995NC32	9525-803-3044	B-2	11
96906-20995NC32	9525-803-3044	B-27	11
96906-20995NC40	9525-990-7799	B-2	14
96906-20995NC40	9525-990-7799	B-2	16
96906-20995NC40	9525-990-7799	B-2	37
96906-20995NC40	9525-990-7799	B-2	42
96906-20995NC40	9525-990-7799	B-3	1
96906-20995NC40	9525-990-7799	B-3	13
96906-20995NC40	9525-990-7799	B-5	19
96906-20995NC40	9525-990-7799	B-5	45
96906-20995NC40	9525-990-7799	B-6	45
96906-20995NC40	9525-990-7799	B-6	64
96906-20995NC40	9525-990-7799	B-7	32
96906-20995NC40	9525-990-7799	B-7	68
96906-20995NC40	9525-990-7799	B-7	73
96906-20995NC40	9525-990-7799	B-8	10
96906-20995NC40	9525-990-7799	B-8	22
96906-20995NC40	9525-990-7799	B-9	2
96906-20995NC40	9525-990-7799	B-9	19
96906-20995NC40	9525-990-7799	B-10	18
96906-20995NC40	9525-990-7799	B-14	5
96906-20995NC40	9525-990-7799	B-15	8
96906-20995NC40	9525-990-7799	B-21	1
96906-20995NC40	9525-990-7799	B-22	46
96906-20995NC40	9525-990-7799	B-24	9
96906-20995NC40	9525-990-7799	B-24	27
96906-20995NC40	9525-990-7799	B-26	5
96906-20995NC40	9525-990-7799	B-27	43
96906-20995NC40	9525-990-7799	B-27	57
96906-21044N3	5310-877-5797	B-7	55
96906-21044N3	5310-877-5797	B-19	34
96906-21044N4	5310-877-5796	B-5	37
96906-21044N4	5310-877-5796	B-22	3
96906-21044N4	5310-877-5796	B-23	18
96906-21044N5	5310-088-0553	B-7	16
96906-21044N5	5310-088-0553	B-7	28
96906-21044N5	5310-088-0553	B-7	59
96906-21044N5	5310-088-0553	B-7	74
96906-21044N5	5310-088-0553	B-21	12
96906-21044N5	5310-088-0553	B-24	13
96906-21044N5	5310-088-0553	B-26	59
96906-21044N6	5310-950-0039	B-2	81
96906-21044N6	5310-950-0039	B-5	26
96906-21044N6	5310-950-0039	B-6	29
96906-21044N6	5310-950-0039	B-6	43
96906-21044N6	5310-950-0039	B-7	31
96906-21044N6	5310-950-0039	B-7	71
96906-21044N6	5310-950-0039	B-13	1
96906-21044N6	5310-950-0039	B-14	19
96906-21044N6	5310-950-0039	B-15	18
96906-21044N6	5310-950-0039	B-25	16

Part No.	Federal Stock No.	Fig. No.	Item No.
96906-21044N6	5310-950-0039	B-26	1
96906-21044N6	5310-950-0039	B-26	35
96906-21044N6	5310-950-0039	B-26	69
96906-21044N7	5310-088-0552	B-2	32
96906-21044N7	5310-088-0552	B-14	23
96906-21044N7	5310-088-0552	B-24	48
96906-21044N10	5310-982-6809	B-15	26
96906-21045-4	5310-061-7325	B-17	11
96906-21045-5	5310-982-4912	B-6	19
96906-21045-5	5310-982-4912	B-6	55
96906-21045-5	5310-982-4912	B-6	70
96906-21045-5	5310-982-4912	B-8	4
96906-21045-5	5310-982-4912	B-11	29
96906-21045-5	5310-982-4912	B-11	40
96906-21045-5	5310-982-4912	B-12	8
96906-21045-5	5310-982-4912	B-13	20
96906-21045-5	5310-982-4912	B-15	20
96906-21045-5	5310-982-4912	B-15	28
96906-21045-5	5310-982-4912	B-18	3
96906-21045-5	5310-982-4912	B-21	4
96906-21045-5	5310-982-4912	B-22	8
96906-21045-5	5310-982-4912	B-24	21
96906-21045-5	5310-982-4912	B-24	55
96906-21045-5	5310-982-4912	B-26	45
96906-21045-8	5310-062-4954	B-15	31
96906-21083N3	5310-902-6676	B-11	22
96906-21083N3	5310-902-6676	B-17	26
96906-21083N3	5310-902-6676	B-21	36
96906-21083N3	5310-902-6676	B-23	11
96906-21208F5-20	5340-514-2321	B-2	45
96906-21208F5-20	5340-514-2321	B-5	25
96906-21208F-20	5340-514-2321	B-26	16
96906-21208F6-15	5340-291-3492	B-2	73
96906-21208F6-15	5340-291-3492	B-8	12
96906-21208F6-15	5340-291-3492	B-8	16
96906-21208F6-15	5340-291-3492	B-8	18
96906-21208F6-15	5340-291-3492	B-25	15
96906-21208F6-20	5340-990-7159	B-2	72
96906-21208F7-15	5340-634-7860	B-2	95
96906-21208F8-15	5340-291-3488	B-4	44
96906-21209F5-15	5340-847-0734	B-4	47
96906-21209F5-15	5340-847-0734	B-19	20
96906-21318-27	5305-253-5618	B-2	74
96906-21318-27	5305-253-5618	B-7	2
96906-21333-62	5340-282-7509	B-19	39
96906-21333-96	5340-088-1255	B-21	37
96906-21333-98	5340-809-1490	B-19	36
96906-21333-98	5340-809-1490	B-21	20
96906-21919F2	5340-526-2559	B-21	34
96906-21919G3	5340-535-6469	B-11	32
96906-21919G9	5340-298-9406	B-11	23
96906-21919G9	5340-298-9406	B-17	24
96906-21919G9	5340-298-9406	B-19	12
96906-21919G16	5340-535-6471	B-11	31
96906-21919G16	5340-535-6471	B-21	35
96906-21921-4	4730-554-8015	B-19	21
96906-21922-2C	4730-542-2813	B-21	53
96906-21922-4	4730-289-8619	B-19	32
96906-24400-8	5310-208-5775	B-11	25
96906-24400-8	5310-208-5775	B-19	11
96906-24400-10	5310-282-7822	B-11	2
96906-24537-1	6685-814-5271	B-6	38
96906-24539-1	6620-993-5546	B-2	36
96906-24665-132	5315-839-2325	B-25	6
96906-24665-134	5315-839-5820	B-27	66
96906-24665-138	5315-252-5987	B-6	23.3
96906-24665-145	5315-753-8333	B-18	8
96906-24665-145	5315-753-8333	B-26	41
96906-24665-145	5315-753-8333	B-26	75
96906-24665-283	5315-842-3044	B-3	20
96906-24665-285	5315-816-1794	B-6	23.2
96906-24665-291	5315-019-0777	B-14	16
96906-24665-300	5315-234-1863	B-13	47
96906-24665-302	5315-234-1864	B-2	76
96906-24665-357	5315-298-1481	B-9	41
96906-24665-359	5315-013-7214	B-25	5
96906-27183-10	5310-809-4058	B-20	12
96906-27183-15	5310-809-4061	B-13	54
96906-27183-23	5310-809-8533	B-19	10
96906-27183-25	5310-809-8540	B-11	3
96906-27183-27	5310-809-8541	B-17	21
96906-28741-8-0134	4720-420-4396	B-19	43
96906-28741-8-0204	2910-741-0397	B-19	48
96906-28741-8-0260	4720-996-8329	B-19	57
96906-28741-8-0300	4720-461-9797	B-19	42
96906-28741-8-0340	4720-720-2050	B-19	64
96906-28775-011	5330-582-2133	B-5	28
96906-28775-011	5330-582-2133	B-26	73
96906-28775-110	5330-585-6663	B-26	42
96906-28775-112	5330-599-2934	B-26	81
96906-28775-113	5330-582-2855	B-2	3
96906-28775-116	5330-579-3156	B-9	9
96906-28775-116	5330-579-3156	B-15	11
96906-28775-118	5330-542-1586	B-16	6
96906-28775-120	5330-542-1329	B-9	8
96906-28775-212	5330-579-8156	B-6	39
96906-28775-222	5330-297-9990	B-5	44
96906-28775-223	5330-171-6649	B-14	8
96906-28775-224	5330-641-3407	B-7	23
96906-28775-226	5330-576-9732	B-26	4
96906-28775-229	5330-579-7918	B-5	8
96906-28775-236	5330-579-6861	B-14	22
96906-28775-325	5330-580-3846	B-26	56
96906-28775-327	5330-579-8156	B-7	38
96906-28775-331	5330-584-1186	B-13	36
96906-28775-335	5330-618-0800	B-13	26
96906-29513-125	5330-265-1089	B-20	16
96906-35207-215	5305-958-4346	B-11	48
96906-35207-265	5305-993-1848	B-7	53
96906-35207-267	5305-993-1851	B-11	20
96906-35207-267	5306-993-1851	B-11	33
96906-35207-267	5305-993-1851	B-17	25
96906-35207-267	5305-993-1851	B-19	35
96906-35207-267	5305-993-1851	B-21	33
96906-35266-70	5305-655-6556	B-21	46
96906-35291-165	5305-753-7088	B-32	13
96906-35308-364	5305-801-5747	B-12	3
96906-35308-365	5305-531-1097	B-12	1
96906-35335-29	5310-616-3554	B-11	49
96906-35335-33	5310-209-0786	B-22	54
96906-35335-33	5310-209-0786	B-23	3
96906-35335-40	5310-275-3683	B-19	14
96906-35337-29	5310-012-0239	B-19	23
96906-35338-43	5310-045-3296	B-21	47
96906-35338-44	5310-582-5965	B-19	52
96906-35338-44	5310-582-5965	B-20	11
96906-35338-44	5310-582-5965	B-22	50
96906-35338-44	5310-582-5965	B-28	23
96906-35338-45	5310-407-9566	B-5	1
96906-35338-45	5310-407-9566	B-7	48
96906-35338-45	5310-407-9566	B-7	58
96906-35338-45	5310-407-9566	B-8	29
96906-35338-45	5310-407-9566	B-10	2
96906-35338-45	5310-407-9566	B-11	14

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96906-35338-45	5310-407-9566	B-13	22
96906-35338-45	5310-407-9566	B-15	15
96906-35338-45	5310-407-9566	B-18	12
96906-35338-45	5310-407-9566	B-19	47
96906-35338-45	5310-407-9566	B-28	2
96906-35338-46	5310-637-9541	B-13	5
96906-35338-46	5310-637-9541	B-16	9.5
96906-35338-46	5310-637-9541	B-16	14
96906-35338-46	5310-637-9541	B-19	5
96906-35338-46	5310-637-9541	B-25	1
96906-35338-46	5310-637-9541	B-28	10
96906-35338-47	5310-209-0965	B-19	4
96906-35338-47	5310-209-0965	B-32	10
96906-35338-48	5310-584-5272	B-2	5
96906-35338-50	5310-820-6653	B-32	17
96906-35338-51	5310-584-7888	B-16	16
96906-35338-51	5310-584-7888	B-32	3
96906-35340-47	5310-655-9370	B-14	28
96906-35489-10	5325-184-9846	B-21	22
96906-35489-20	5325-174-9038	B-7	36
96906-35489-74	5325-276-6096	B-13	56
96906-35489-74	5325-276-6096	B-21	6
96906-35489-74	5325-276-6096	B-24	7
96906-35490-16	5325-682-1471	B-22	30
96906-35650-342	5310-934-9734	B-11	50
96906-35691-13	5310-853-9335	B-18	29
96906-35692-13	5310-849-6883	B-2	38
96906-35692-13	5310-849-6883	B-7	67
96906-35692-13	5310-849-6883	B-9	18
96906-35692-13	5310-849-6883	B-14	13
96906-35692-13	5310-849-6883	B-18	9
96906-35692-13	5310-849-6883	B-25	20
96906-35692-13	5310-849-6883	B-26	76
96906-35692-13	5310-849-6883	B-27	54
96906-35692-21	5310-842-1488	B-2	15
96906-35692-21	5310-842-1488	B-3	21
96906-35692-21	5310-842-1488	B-26	40
96906-35692-21	5310-842-1488	B-26	76
96906-35692-29	5310-842-1295	B-13	48
96906-35756-8	5315-616-5526	B-18	4
96906-35756-17	5310-012-4553	B-14	11
96906-35769-6	5330-543-3261	B-6	62
96906-35769-9	5330-855-6045	B-10	14
96906-35769-31	5330-199-5884	B-8	23
96906-35769-34	5330-269-2845	B-6	40
96906-35769-35	5330-199-5886	B-6	68
96906-35769-47	5330-269-2844	B-6	2
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96906-35842-12	4730-908-3193	B-11	17
96906-35842-12	4730-908-3193	B-11	41
96906-35842-13	4730-909-8627	B-7	56
96906-35842-14	4730-908-6292	B-28	6
96906-35842-15	4730-908-6293	B-28	13
96906-35914-112	5340-434-6850	B-24	24
96906-35914-114	5340-616-5014	B-24	2
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96906-39202-3	4730-278-4496	B-19	38
96906-39206-3	4730-781-6530	B-19	62
96906-39206-3	4730-781-6530	B-21	43
96906-39206-9	4730-350-9786	B-19	54
96906-39210-1	4730-069-1184	B-21	52
96906-39210-13	4730-052-9876	B-19	58
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96906-39212-3	4730-052-9877	B-19	59
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96906-39231-3	4730-254-1801	B-2	40
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96906-51096-60	5306-816-9326	B-21	2
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96906-51096-64	5305-811-0638	B-9	11
96906-51096-306	5305-910-7369	B-5	46
96906-51096-335	5306-852-7104	B-26	6
96906-51037-7	5306-017-6143	B-30	29
96906-51967-20	5310-763-8920	B-32	18
96906-51968-23	5310-763-8901	B-32	2
96906-51981-36	5305-715-1221	B-3	17
96906-90530-2	5930-692-9258	B-2	41
96906-90725-5	5350-068-0501	B-22	17
96906-90725-8	5305-225-3839	B-20	10
96906-90725-40	5306-225-8504	B-10	1
96906-90725-47	5306-225-8511	B-10	25
96906-90726-15	5305-267-8982	B-19	53
96906-90726-16	5305-267-8983	B-23	20
96906-90726-31	5306-225-9086	B-7	49
96906-90726-48	5306-225-9103	B-19	44
96906-90726-52	5306-225-9107	B-19	17
96906-90726-60	5305-269-2803	B-19	6
96906-90726-63	5305-269-2806	B-13	53
96906-90726-84	5305-710-4189	B-2	94
96906-90726-89	5305-710-4194	B-32	11
96906-90726-90	5305-710-4195	B-32	12
96906-90727-6	5305-655-6361	B-27	28
96906-90727-8	5305-068-0515	B-28	22
96906-90727-32	5306-050-1238	B-7	57
96906-90727-32	5306-050-1238	B-7	61
96906-90727-32	5306-050-1238	B-11	53
96906-90727-32	5306-050-1238	B-15	14
96906-90727-32	5306-050-1238	B-28	14
96906-90727-33	5306-051-4075	B-7	9
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96906-90727-33	5306-051-4075	B-11	13
96906-90727-33	5306-051-4075	B-28	1
96906-90727-34	5306-051-4076	B-5	15
96906-90727-34	5306-051-4076	B-7	12
96906-90727-34	5306-051-4076	B-18	13
96906-90727-42	5306-051-4084	B-10	22
96906-90727-45	5306-051-4087	B-4	28
96906-90727-59	5305-269-3235	B-28	11
96906-90727-60	5305-269-3236	B-13	7
96906-90727-60	5305-269-3236	B-13	57
96906-90727-61	5305-269-3237	B-26	63
96906-90727-62	5305-269-3238	B-26	83
96906-90727-64	5305-269-3240	B-25	4
96906-90727-67	5305-269-3243	B-13	4
96906-90727-69	5305-269-3245	B-25	9
96906-90727-87	5305-709-8523	B-5	11
96906-90727-88	5305-709-8515	B-19	3
96906-90727-112	5305-725-0154	B-2	4
96906-90728-3	5305-071-2506	B-22	49
96906-90728-3	5305-071-2506	B-23	4
96906-90728-9	5305-225-3842	B-17	37
96906-122161	5340-286-2458	B-20	20
96906-124696	5340-291-3484	B-28	24
96906-124697	5340-291-3495	B-2	48
96906-124697	5340-291-3495	B-2	65
96906-124697	5340-291-3495	B-2	66
96906-124697	5340-291-3495	B-6	5
96906-124697	5340-291-3495	B-8	19
96906-124697	5340-291-3495	B-9	28
96906-124697	5340-291-3495	B-26	85
96906-124697	5340-291-3495	B-26	91
99066-GU7837	2910-878-9933	B-16	5

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99066-SD7877	2910-936-2276	B-16	1
99066-SR7827	5340-089-8836	B-16	3
99551-648557		B-16	13
99551-2480888		B-16	12
81348	4730-196-0888	B-6	37
5165292	5330-291-7390	B-4	55
5379997	5120-473-7222	B-30	5
5702609	2815-678-1842	B-4	
5702614	2815-678-1838	B-4	5
5702615	2815-678-1837	B-4	5
5702616	2815-678-3230	B-3	
5702617	2815-678-3229	B-3	
5702619	2815-679-8057	B-5	
5702620	2930-678-3268	B-27	
5702621	2930-678-7099	B-26	
5702622	2930-678-3269	B-26	
5702641	2910-545-1558	B-27	
5702659	2940-884-4801	B-6	
5702666	2815-856-4996	B-1	
5702670	2815-856-9005		
5702674	5365-235-1941	B-16	
5702690	2910-967-9870	B-20	
5702738	2910-801-1152	B-20	
5702757	2815-808-2407	B-20	
5704344	2815-179-7047	B-4	
5704348	3120-491-0314	B-3	
5704351	3120-477-3780	B-4	5
5704366	2910-762-4587	B-16	
7017550	5340-679-8116	B-4	49
7017550	5340-679-8116	B-5	10
7017826	4710-805-4149	B-21	40
7025886	2815-884-1981	B-6	56
7025892	2815-679-4969	B-2	6
7033684	5330-632-2098	B-4	27
7039742	5307-678-3315	B-4	45
7039744	5307-806-6047	B-4	45
7039746	5306-678-3324	B-6	44
7039746	5306-678-3324	B-7	33
7039746	5306-678-3324	B-7	72
7039747	5306-678-3323	B-6	65
7044068	5307-678-3536	B-2	23
7044069	5307-678-3535	B-2	23
7045881	5330-290-8154	B-6	33
7045881	5330-290-8154	B-7	13
7044669	5307-679-4985	B-9	34
7046669	5307-679-4985	B-26	18
7046670	5307-679-4989	B-9	34
7046670	5307-679-4989	B-26	18
7053981		B-2	85
7062194	2990-974-7605	B-21	29
7062195	2815-117-9337	B-21	14
7062196	2920-767-1736	B-21	9
7062197	2990-369-8766	B-21	32
7062198	2990-770-1641	B-21	8
7065766	5307-706-5766	B-26	19
7065767	5307-706-5767	B-26	19
7083696	5110-708-3696	B-30	41
7083697	5110-708-3697	B-30	43
7083698	5110-708-3698	B-30	42
7083699	5110-708-3699	B-30	39
7084278	2920-678-7101	B-15	27
7084438	5307-678-3534	B-7	21
7084439	5307-678-3533	B-7	21
7084444	5307-678-6876	B-26	89
7084445	5307-678-6877	B-26	89
7084497	5307-438-1809	B-2	98
7084498	5307-477-3736	B-2	98
7084530	5307-679-5684	B-13	25
7084531	5307-801-4819	B-13	25
7087519	2940-939-7123	B-6	58
7320384	5365-408-1268	B-4	21
7320395	2815-678-3211	B-4	35
7320396	2815-678-3210	B-4	22
7320400		B-27	1
7320404		B-27	18
7320407	5306-678-3316	B-4	26
7320408	2815-454-8599	B-4	29
7320411	5340-678-3532	B-2	31
7320414	2815-110-4093	B-5	22
7320415	2815-489-2576	B-5	9
7320420		B-4	39
7320427	2815-678-3209	B-4	18
7320428	2815-678-3208	B-4	16
7320429	2815-678-3207	B-4	17
7320430	2815-679-8058	B-5	7
7320440		B-26	64
7320441	5330-411-2512	B-9	6
7320442	2805-678-4243	B-7	20
7320444		B-3	8
7320451	2815-411-3965	B-9	64
7320458	4710-245-8305	B-13	14
7320459	2990-678-4676	B-15	29
7320461		B-9	7
7320462	2805-678-4244	B-8	27
7320463	2930-411-5749	B-26	58
7320464	2910-678-4722	B-26	11
7320465		B-8	26
7320466		B-8	30
7320469	2930-350-9399	B-26	57
7320476		B-2	83
7320478		B-26	50.1
7320480	2930-408-4684	B-26	62
7320485		B-16	32
7320495		B-4	9.1
7320496		B-4	9.2
7323983		B-8	28
7323991	5310-682-5851	B-2	33
7323994	5310-678-5370	B-17	13
7323986	5305-988-1723	B-14	27
7323988	5306-678-4260	B-15	10
7323990	2910-678-4725	B-16	20
7324661	2910-678-3299	B-17	12
7324900	4730-678-3303	B-6	41
7324901	5310-851-4278	B-9	40
7335555	2910-790-2303	B-21	15
7338646	5307-733-8646	B-5	40
7338667	2805-733-8667	B-26	72
7338669	5315-282-1510	B-8	24
7340058	5310-655-9590	B-16	17
7340060	5306-678-3531	B-8	34
7340061	5310-685-8218	B-7	66
7340190	5305-655-9663	B-22	6
7341633	5306-678-4259	B-27	7
7346573	6620-734-6573	B-24	22
7346699	5306-182-2023	B-2	43
7346699	5306-182-2023	B-9	1
7348596	5307-734-8596	B-8	17
7348668	5307-734-8668	B-6	9
7348668	5307-734-8668	B-6	50
7348668	5307-734-8668	B-26	23
7348668	5307-734-8668	B-26	67
7348671	5307-734-8671	B-2	87
7348782	5307-734-8782	B-2	67
7348782	5307-734-8782	B-2	86

Part No.	Federal Stock No.	Fig. No.	Item No.
7348783	5307-734-8783	B-2	86
7348797	5307-734-8797	B-2	69
7348798	5307-734-8798	B-2	69
7348803	5307-734-8803	B-2	19
7348803	5307-734-8803	B-2	53
7348803	5307-734-8803	B-26	22
7348804	5307-734-8804	B-2	19
7348804	5307-734-8804	B-2	53
7348804	5307-734-8804	B-26	22
7348812	5307-734-8812	B-6	8
7348813	5307-734-8813	B-6	8
7350201	3120-735-0201	B-8	20
7350206		B-10	7
7363442	5307-679-4990	B-9	14
7363443	5307-679-4987	B-9	14
7363446	5307-679-4986	B-9	35
7363447	5307-679-4988	B-9	35
7372030	5310-737-2030	B-6	15
7374145	5340-737-4145	B-6	59
7384968	5340-738-4968	B-11	19
7385174	5340-738-5174	B-15	16
7403193	5310-012-2198	B-18	15
7403580	5340-740-3580	B-24	23
7403610	4730-278-3030	B-6	74
7403615	5340-409-8060	B-5	36
7410163	5307-741-0163	B-26	90
7410395	5307-741-0395	B-8	17
7413736	2910-031-9083	B-20	17
7414564	5310-741-4564	B-22	20
7414564	5310-741-4564	B-24	5
7414569	5306-150-9104	B-11	37
7414569	5306-150-9104	B-26	34
7414584	5306-741-4584	B-22	23
7414584	5306-741-4584	B-24	16
7414584	5306-741-4584	B-24	29
7415112		B-2	10
7415117	5306-151-2626	B-12	14
7415354	2910-741-5354	B-15	23
7415384	5307-741-5384	B-14	26
7415385	5307-741-5385	B-14	26
7416621		B-20	14
7416591		B-2	80
7416591		B-2	89
7416636	5306-400-7637	B-2	13
7416751	5330-292-7363	B-2	90
7538990	4730-044-4689	B-2	64
7538990	4730-044-4689	B-6	10
7538990	4730-044-4689	B-9	22
7538990	4730-044-4689	B-13	39
7538990	4730-044-4689	B-26	17
7538990	4730-044-4689	B-26	68
7538997	4730-753-8997	B-2	50
7538997	4730-753-8997	B-6	35
7539274	4730-753-9274	B-19	49
7539735	5315-753-9735	B-2	34
7539838	2805-753-9838	B-4	40
7539839	2805-753-9839	B-4	38
7538990		B-13	45
7723892	5330-772-3892	B-2	6
7738011	5307-837-7791	B-13	15
7744555	5307-774-4555	B-4	43
7744555	5307-774-4555	B-6	77
7744564	5307-264-2471	B-26	104
7744570	5310-774-4570	B-12	6
7744570	5310-774-4570	B-15	3
7744572	5307-774-4572	B-6	67
7744573	5307-774-4573	B-6	67
7744605	5307-774-4605	B-26	78
7744610	2805-774-4610	B-4	20
7744617	2805-678-1591	B-4	15
7744685	5306-774-4685	B-5	20
7744720	5306-774-4720	B-23	17
7744795	5307-774-4795	B-26	78
7744798	2805-774-4798	B-4	19
7744803	5307-774-4803	B-4	43
7744803	5307-774-4803	B-6	77
7744813	5307-264-2472	B-5	29
7744813	5307-264-2472	B-26	104
7744858	2930-774-4858	B-22	51
7748837	5310-861-1406	B-16	24
7748870		B-6	
7748905		B-6	
7751056	5120-251-1527	B-30	38
7767317	5310-776-7317	B-4	32
7767318	5310-776-7318	B-7	34
7767331	5355-776-7331	B-2	9
7767333	5307-776-7333	B-9	59
7767334	5307-776-7334	B-9	59
7767336	4730-776-7336	B-2	68
7767336	4730-776-7336	B-6	6
7767337	4730-776-7337	B-2	52
7767337	4730-776-7337	B-8	11
7767340	5307-727-4938	B-2	87
7767348	5307-776-7348	B-7	24
7767350	5310-209-2629	B-8	32
7767350	5310-209-2629	B-26	33
7767361	5307-776-7361	B-7	24
7767363	5315-776-7363	B-3	25
7767519	5330-738-0543	B-5	39
7767728	5310-776-7728	B-25	11
7767804	5307-776-7804	B-4	51
7767804	5307-776-7804	B-6	78
7767804	5307-776-7804	B-13	37
7767805	5307-776-7805	B-6	78
7767805	5307-776-7805	B-13	37
7950177	5120-795-0177	B-30	22
7954708	4730-699-7899	B-8	21
7971982	5307-207-8620	B-26	20
7971983	5307-207-8619	B-26	20
7998574	5325-682-7076	B-24	10
7992645	5307-678-3530	B-2	22
7992645	5307-678-3530	B-2	59
7992646	5307-678-3529	B-2	22
7992646	5307-678-3529	B-2	59
7992649	5307-678-6880	B-26	80
7992649	5307-678-6880	B-26	95
7992650	5307-678-6881	B-26	80
7992650	5307-678-6881	B-26	95
7992653	5307-678-3528	B-2	25
7992657	5307-678-3526	B-2	28
7992658	5307-678-3525	B-2	28
7992665	5307-678-6882	B-26	103
7992666	5307-678-6883	B-26	103
7992669	5307-678-3524	B-2	57
7992670	5307-678-3523	B-2	57
7992673	5307-678-3320	B-26	71
7992674	5307-678-3321	B-26	71
7992677	5307-678-3522	B-2	24
7992677	5307-678-3522	B-2	54
7992678	5307-678-3521	B-2	24
7992678	5307-678-3521	B-2	54
7992681	5307-678-3520	B-2	55
7992682	5307-678-3519	B-2	55
7992685	5307-678-3518	B-2	56

Part No.	Federal Stock No.	Fig. No.	Item No.
7992686	5307-678-3517	B-2	56
7992689	5307-678-6884	B-26	10
7992690	5307-678-6885	B-26	10
7992693	5307-678-3516	B-2	21
7992694	5307-678-3515	B-2	21
7992697	5307-678-3514	B-2	92
7992698	5307-678-3513	B-2	92
7994794	5340-799-4794	B-6	66
8343678		B-27	37.2
8343854	5340-834-3854	B-6	20
8343854	5340-834-3854	B-6	63
8352634	5340-678-3311	B-2	17
8352634	5340-678-3311	B-4	46
8352634	5340-678-3311	B-26	79
8352635	5340-678-3310	B-4	42
8352636	5340-678-3309	B-2	18
8355883	6685-906-0156	B-32	8
8357819	2805-304-9365	B-24	42
8357967-4		B-7	64
8365383-2	5307-995-8205	B-24	56
8365383-3	5307-954-6460	B-24	56
8365671	5306-335-4244	B-4	30
8365809	5307-272-6331	B-13	38
8365809	5307-272-6331	B-26	15
8365810	5307-272-6332	B-13	38
8365810	5307-272-6332	B-26	15
8375091	5120-837-5091	B-30	14
8375324	5120-710-7437	B-30	2
8376456	4820-304-9415	B-32	7
8393931	3110-227-3620	B-18	1
8395460	5330-678-7106	B-14	14
8395476	2910-795-1783	B-19	16
8666561	5310-682-5631	B-22	7
8666736	5307-866-6736	B-7	17
8666736	5307-866-6736	B-7	27
8666736	5307-866-6736	B-8	14
8666737	5307-866-6737	B-7	17
8666737	5307-866-6737	B-7	27
8666737	5307-866-6737	B-8	14
8666738	2920-318-4127	B-15	17
8679574	5310-588-0393	B-22	2
8679576	5310-333-7348	B-2	84
8679576	5310-333-7348	B-5	27
8679576	5310-333-7348	B-6	42
8679576	5310-333-7348	B-6	49
8679576	5310-333-7348	B-7	10
8679576	5310-333-7348	B-7	30
8679576	5310-333-7348	B-8	33
8679576	5310-333-7348	B-9	10
8679576	5310-333-7348	B-14	18
8679576	5310-333-7348	B-25	13
8679576	5310-333-7348	B-26	2
8679576	5310-333-7348	B-26	36
8679576	5310-333-7348	B-26	70
8679577	2590-629-1268	B-7	70
8682441	2815-406-4613	B-7	22
8682451	2990-453-5387	B-13	3
8682455	2930-678-3271	B-26	51
8682467	2815-406-4618	B-5	34
8682468	2815-679-8056	B-5	30
8682469		B-2	20
8682469		B-26	21
8682492	2930-679-8091	B-23	14
8682500	5307-678-3510	B-2	27
8682501	5307-678-3509	B-2	27
8682503	2990-678-4695	B-21	10
8682505	2815-678-3270	B-15	4
8682512		B-2	62
8682513		B-2	58
8682513		B-26	102
8682523	2815-679-4961	B-7	19
8682523	2815-679-4961	B-8	
8682524	2815-834-1158	B-8	
8682527	2815-833-8162	B-8	1
8682539		B-26	98
8682540	2815-455-9496	B-5	6
8682553		B-26	74.2
8682558	2990-402-4430	B-13	2
8682560	2815-193-8200	B-22	5
8682564	2815-679-8054	B-5	13
8682620	2930-679-8092	B-23	16
8682623	2930-436-3207	B-22	39
8682626	2930-522-2576	B-22	40
8682658	2930-350-9401	B-25	3
8682662	2815-235-4445	B-6	34
8682665		B-27	15
8682670-8	9320-181-0119	B-24	35
8682670-8	9320-181-0119	B-24	49
8682671		B-24	49
8682673		B-24	35
8682674	5365-407-7011	B-26	30
8682676	2815-193-8213	B-18	17
8682677	2590-932-5001	B-18	20
8682679	2930-678-4669	B-24	53
8682680	5330-678-5388	B-11	28
8682682	2930-442-5895	B-25	17
8682683	2590-851-4909	B-5	49
8682684		B-26	50.2
8682684		B-26	74.1
8682689	2815-678-4239	B-14	34
8682691	2815-678-4238	B-14	15
8682692	2930-678-4668	B-24	41
8682693	2930-678-4667	B-24	1
8682700	2930-679-8093	B-23	8
8682701	2930-679-8090	B-23	9
8682702	5340-089-8830	B-23	13
8682708		B-18	21
8682709		B-18	19
8682711		B-9	57
8682721	2815-760-5871	B-5	17
8682729	2910-678-4728	B-27	13
8682730		B-27	19
8682731	2910-678-4729	B-27	17
8682732		B-27	14
8682733		B-27	3
8682734	2815-679-4970	B-3	16
8682736		B-2	8
8682737	2815-489-2575	B-2	7
8682738	2930-168-2625	B-24	51
8682739	2815-411-5789	B-24	50
8682745	3120-679-8098	B-5	50
8682748	2815-406-4611	B-13	49
8682749	2815-406-4610	B-13	11
8682750	2990-402-4432	B-13	8
8682751	2815-177-7918	B-5	43
8682752	2990-453-5386	B-13	52
8682753	2815-071-8124	B-10	20
8682754	5330-441-2513	B-2	6
8682755	2815-193-8214	B-22	43
8682756	2805-760-5837	B-22	42
8682757	2805-760-5838	B-22	38
8682761	2815-193-8212	B-22	48
8682762	2815-193-8203	B-22	56
8682763	5315-497-9650	B-26	101

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8682764	5330-678-3508	B-8	6
8682765	2920-248-4631	B-27	62
8682769	2815-679-7064	B-13	43
8682770	5330-678-5386	B-11	15
8682771	5340-242-5599	B-7	8
8682772	2815-679-6482	B-10	12
8682774	5310-679-9880	B-13	33
8682781	2590-678-4129	B-18	11
8682782	2930-169-5798	B-24	20
8682783	2990-484-0771	B-18	14
8682785	2930-997-1537	B-25	14
8682786	3040-406-1537	B-18	35
8682787	5307-682-5820	B-13	9
8682797	2990-678-4681	B-13	17
8682799	4730-406-7307	B-13	32
8682800	2815-679-7062	B-13	24
8682802	2930-678-4665	B-24	43
8682804	5307-678-3507	B-2	29
8682805	5307-678-3506	B-2	29
8682814	2815-678-4236	B-14	31
8682815	2940-678-3276	B-6	3
8682816	4730-223-7014	B-5	24
8682817	2815-136-1201	B-5	21
8682820	2815-679-4972	B-3	10
8691451	5307-272-6334	B-9	13
8691452	5307-272-6335	B-9	13
8698689	5340-209-0174	B-13	35
8698690	5310-637-3057	B-13	34
8698759	2815-679-7063	B-13	19
8698764	5340-205-9307	B-13	27
8698852	4730-090-9182	B-21	27
8708361	5120-575-7767	B-30	36
	4910-554-1317	B-29	5
	5120-310-4668	B-30	21
	2920-973-1557	B-15	24
		B-7	44
8717158	2805-599-0942	B-7	43
8717161	5305-206-3851	B-7	4
8717162	5340-205-4658	B-7	5
8717298	5315-141-6337	B-3	18
8717299	5315-141-6338	B-3	18
8717322	5306-206-3850	B-3	11
8720953	5330-663-4773	B-20	2.1
8720953	5330-663-4773	B-20	5.2
8724974	2815-678-1841	B-4	1
8724976		B-4	6
8724977		B-4	4
8724978	5310-655-9937	B-4	3
8724979	5306-678-1887	B-4	7
8724980	3120-678-1869	B-4	8
8724985		B-4	5
8724985-1		B-4	5
8724986		B-3	7.1
8724986-1		B-3	7.4
8724987		B-3	7.4
8724987-1		B-3	7.1
8724995		B-3	7.2
8724995-1		B-3	7.3
8724996		B-3	7.3
8724996-1		B-3	7.2
8725003	2815-678-3203	B-4	14
8725004	2815-678-3202	B-4	37
8725084		B-3	19
8725087	2815-679-4968	B-9	50
8725096		B-9	49
8725099		B-9	36
8725100		B-9	43
8725101	2815-679-4966	B-9	37
8725113	2815-679-4964	B-9	38
8725115		B-9	39
8725119		B-9	20
8725120		B-9	24
8725121		B-9	25
8725130		B-9	46
8725134		B-9	45
8725140	2815-678-3228	B-2	71
8725141		B-2	88
8725145		B-2	99
8725146		B-2	46
8725151	5310-753-4014	B-4	54
8725170		B-2	78
8725176	2815-678-3201		
8725177	2815-678-3200		
8725179	2815-678-3199	B-4	37
8725180	2815-678-3198	B-4	37
8725181		B-2	91
8725184	2815-238-9191	B-2	44
8725193	2940-115-9014	B-6	27
8725195		B-6	72
8725196	5340-220-5168	B-6	25
8725197		B-6	26
8725201	2940-678-3277	B-6	23.3
8725203	2940-678-3278	B-6	53
8725207		B-6	24
8725211		B-6	17
8725218	5365-402-8380	B-6	1
8725222	2815-678-3218	B-6	4
8725224	4820-406-4619	B-6	14
8725225		B-5	16.2
8725226	2815-937-4846	B-26	84
8725227	2930-498-9359	B-26	53
8725229		B-5	16.1
8725232		B-9	16
8725233	2930-438-1590	B-26	39
8725236	5340-490-0872	B-2	49
8725238		B-2	70
8725239	2815-678-3221	B-6	16
8725240	2815-678-3222	B-6	13
8725243	3040-179-6656	B-26	48
8725246	5365-408-1270	B-6	69
8725248	2815-678-4246	B-27	4
8725249	2815-679-4961	B-3	12
8725250	2940-678-3280	B-6	75
8725253	2815-125-3891	B-5	14
8725254	2815-678-3227	B-2	79
8725255	2815-678-3220	B-6	76
8725256	5315-238-9239	B-2	82
8725257	2940-067-7900	B-6	21
8725261	2815-678-3226	B-2	39
8725265	2815-679-4963	B-1-1	
8725266	2815-678-3219	B-6	11
8725273		B-2	47
8725275	2990-498-2398	B-14	20
8725276	2915-678-3223	B-6	12
8725277	2520-678-3171	B-6	47
8725281	2815-678-3195	B-4	34
8725286	2940-678-3279	B-6	73
8725291	5305-678-3327	B-6	32
8725292	2910-678-4673	B-15	22
8725293	2815-678-3194	B-4	33
8725296	5330-678-3313	B-4	31
8725298	5307-678-3314	B-4	52
8729069	2910-851-5360	B-20	5.4

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8729070		B-20	5.3
8729071	2910-791-3352	B-20	6
8737840		B-20	2.3
8743025	4910-795-7961	B-30	27
8744055	5310-679-5685	B-10	16
8745480	5310-535-6688	B-6	51
8748329	2940-863-7737	B-6	23.1
8759089	2910-790-2301	B-17	28
8761008	2815-193-8210	B-22	52
8761009	2815-194-2453	B-22	53
8761010		B-24	30
8761011		B-24	46
8761015	3040-406-1536	B-18	23
8761016	2990-402-4429	B-18	2
8761018	2990-402-4431	B-18	7
8761020	2930-678-3265	B-26	54
8761021	2815-679-5668	B-13	23
8761022	2815-937-1467	B-14	12
8761023	2815-071-8126	B-9	63
8761029	2930-457-6731	B-24	17
8761030	2815-575-0399	B-24	18
8761032	2930-938-8179	B-25	10
8761033	2815-406-4620	B-13	40
8761037	2815-071-8125	B-9	3
8761041	2910-678-4730	B-27	6
8761046		B-13	45
8761047		B-24	32
8761048		B-24	40
8761049	2930-179-7051	B-24	19
8761050	2930-678-3266	B-25	19
8761052	4710-477-9899	B-10	27
8761057	2930-421-1592	B-22	24
8761058	2930-179-7049	B-24	37
8761059	4710-477-9900	B-10	23
8761062	2930-678-3267	B-27	60
8761063		B-27	59
8761064	2930-435-7644	B-27	41
8761066	2930-933-6957	B-27	22
8761067		B-27	26
8761068	2930-421-1591	B-22	13
8761069	2930-421-1590	B-22	33
8761070	5340-484-0865	B-24	34
8761080		B-2	12
8761081		B-14	30
8761082	2815-406-4614	B-13	18
8761085	2910-402-4422	B-2	2
8761086	2990-402-4433	B-13	10
8761087	5330-679-6483	B-15	5
8761089	2815-193-8192	B-22	1
8761091	4730-679-5682	B-10	17
8761092	2930-570-9707	B-24	11
8761098	2815-193-8215	B-23	6
8761099	2930-442-5896	B-22	15
8761100	2930-350-9397	B-24	38
8761101	2815-193-8217	B-23	2
8761103	2930-406-7294	B-24	36
8761104	2930-402-4419	B-22	12
8761106	2930-457-0319	B-21	37
8761107	2930-436-3206	B-22	35
8761109	2990-897-2849	B-7	42
8761122	2930-350-9394	B-24	33
8761123	2930-350-9398	B-24	39
8761124		B-7	6
8761125		B-8	5
8761127		B-7	78
8761128	2815-406-4617	B-7	75
8761129		B-7	76
8761130	2815-679-4962	B-7	7
8761131	4710-150-6187	B-11	24
8761132		B-8	8
8761137	4730-406-4609	B-13	28
8761138	4730-406-7308	B-13	29
8761148	2815-455-9495	B-22	36
8761149	2930-678-4670	B-24	54
8761155	2930-068-6113	B-26	82
8761156	2815-177-8243	B-13	46
8761157	2815-679-5667	B-13	42
8761158	2815-679-5666	B-13	31
8761159	2815-679-5665	B-13	30
8761160	2815-679-5664	B-13	41
8761161	2815-122-4963	B-9	62
8761162	2815-834-1159	B-9	4
8761163	2990-402-5201	B-10	24
8761164	5340-402-4435	B-23	15
8761186		B-26	44
8761189	2990-402-4427	B-10	3
8761190	2815-869-3595	B-10	4
8761192	2815-073-5129	B-10	8
8761193	2815-485-9555	B-10	5
8761199	5307-678-6887	B-26	94
8761200	5307-678-6888	B-26	94
8761203	5307-678-3329	B-26	77
8761204	5307-678-3328	B-26	77
8761206	2930-177-9162	B-26	65
8761223		B-5	23
8761226		B-26	61
8761227	5310-685-8217	B-27	35
8761229	5310-682-5823	B-27	34
8761230	2930-678-3257	B-25	12
8761232	2815-356-8502	B-22	41
8761238	5310-408-2530	B-27	30
8761239	2930-077-2818	B-27	31
8761241	5310-682-5824	B-27	29
8761242	2930-679-5742	B-25	18
8761243	5340-462-2908	B-12	10
8761244	5310-406-7319	B-26	38
8761250		B-27	36
8761251		B-27	23
8761253		B-27	27
8761255		B-27	25
8761257		B-27	38
8761258	2930-457-0314	B-27	20
8761259		B-27	21
8761260	2930-678-3256	B-27	39
8761261		B-27	24
8761262	2930-678-4671	B-24	25
8761268	5365-407-7003	B-23	19
8761269	2930-442-5894	B-22	9
8761270	2930-402-4421	B-22	44
8761271	9320-181-0118	B-22	45
8761271	9320-181-0118	B-24	30
8761271-1		B-22	45
8761271-1		B-24	28
8761272	5306-678-6889	B-2	30
8761273	5310-655-9859	B-14	21
8761274		B-9	61
8761279	5310-720-7627	B-2	77
8761280	2815-679-8053	B-5	41
8761281	2815-679-8055	B-5	42
8761287	2930-678-3255	B-26	49
8761294	2930-937-1430	B-24	12
8761295		B-6	30
8761297	5120-678-5282	B-30	34
8761300		B-22	55

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8761301		B-27	37.1
8761327		B-4	5
8761328		B-3	7.1
8761329		B-3	7.4
8761330		B-3	7.2
8761331		B-3	7.3
8761337	5306-678-3325	B-25	8
8761388		B-22	47
8761390	3110-481-2825	B-26	32
8761412		B-16	9.1
8761412		B-26	100
8761413	5340-678-4257	B-27	2
8761414	2815-679-8056	B-5	5
8761420	5310-402-8379	B-26	12
8761432	5306-678-1885	B-23	10
8761440	2815-678-4233	B-14	32
8761442	5307-678-6891	B-2	26
8761442	5307-678-6891	B-26	92
8761443	5307-678-6890	B-2	26
8761443	5307-678-6890	B-26	92
8761448	4710-194-2566	B-11	43
8761449	4730-457-1984	B-11	4
8761469	2815-412-9192	B-24	3
8761470		B-24	4
8761472	2815-194-2481	B-11	27
8761476	2930-350-9395	B-24	52
8761477	2930-350-9396	B-24	45
8761479	4710-485-9651	B-11	11
8761481	2815-406-7289	B-11	39
8761485	2910-678-3292	B-17	22
8761490		B-13	13
8761491	2990-678-3291	B-11	47
8761492	2910-678-3294	B-17	18
8761499	2990-678-3252	B-12	2
8761502	2910-678-3290	B-11	44
8761507	2990-678-3286	B-11	1
8761510	2910-678-3285	B-19	13
8761513	2815-678-3217	B-12	20
8761517	2815-678-3213	B-12	11
8761521	2815-678-3214	B-12	16
8761527	2815-678-3215	B-12	17
8761535	5120-678-5285	B-29	6
8761542	2940-436-3223	B-6	28
8761547	2815-678-3216	B-12	5
8761549	2990-678-3251	B-12	12
8761553	2990-678-3250	B-12	13
8761555	4730-933-3138	B-11	26
8761559	2990-678-3264	B-12	19
8761560	5120-678-5286	B-30	44
8761561	5120-678-5287	B-30	30
8761568	5120-678-5288	B-30	24
8761582	5120-672-8897	B-30	1
8761594	4730-406-7309	B-12	4
8761597	4370-223-7007	B-10	13
8761598	2815-575-0398	B-10	10
8764639	5310-655-9975	B-22	10
8764639	5310-655-9975	B-24	31
8764641	2910-678-3282	B-19	63
8764886	5330-514-5678	B-14	25
8764887		B-22	46
8764887		B-24	27
8764948	2815-678-3225	B-3	15
8764950	4730-678-3494	B-11	6
8764982	2910-678-4734	B-26	25
9402708	4730-334-7838	B-11	7
9402827	4730-815-0248	B-11	46
10863824	5306-678-4262	B-32	15
10865001	2920-402-5204	B-7	18
10865022	2815-406-4622	B-10	26
10865074	2910-402-4423	B-19	7
10865170	2910-168-2624	B-19	15
10865180	2815-833-8164	B-10	15
10865182	4710-457-0479	B-10	19
10865183		B-3	23
10865184		B-3	24
10865240	2930-453-5364	B-22	25
10865247	2930-453-5376	B-22	26
10865250	2930-436-3208	B-22	18
10865252	2930-436-3197	B-22	28
10865262	2520-420-4982	B-22	32
10865266	2930-436-3196	B-22	14
10865267	2815-177-8216	B-22	31
10865268	2930-107-1221	B-22	21
10865272	2930-446-1757	B-22	22
10865277	2930-998-4724	B-22	29
10865283	2805-407-6761	B-5	31
10865289	2815-708-3018	B-5	32
10865290	4730-803-7728	B-17	19
10865292		B-16	7
10865297	2815-765-9711	B-4	13
10865298		B-4	41
10865299	2815-765-9712	B-4	12
10865316	5340-490-0871	B-17	38
10865317	5340-456-1792	B-17	10
10865319	2930-453-5362	B-22	11
10865320	2930-453-5363	B-22	34
10865321	5305-891-7871	B-18	30
10865322		B-18	28
10865323	3040-402-5217	B-18	32
10865324	2990-402-4428	B-18	27
10865331	2910-410-5758	B-17	29
10865332	2910-410-5755	B-17	40
10865333	2910-907-9566	B-17	9
10865334	2815-239-5810	B-17	8
10865335	2910-410-5756	B-17	36
10865336		B-9	58
10865351	2930-765-4364	B-26	9
10865355		B-27	63
10865361	2990-068-6115	B-26	3
10865363	2815-194-2450	B-23	7
10865364		B-23	1
10865365	2815-193-8216	B-23	5
10865369		B-4	9.3
10865374	5340-114-0093	B-21	7
10865375	5340-407-0666	B-21	25
10865381	5310-239-5848	B-26	97
10865382		B-26	96
10865383		B-26	99
10865393	2815-767-3200	B-26	93
10865394	2910-078-5308	B-17	6
10865396	2910-078-5309	B-17	5
10865398	2910-078-5310	B-17	4
10865400	2910-078-5311	B-17	3
10865402	2910-078-5312	B-17	2
10865404	2910-078-5313	B-17	1
10865406	2910-078-5314	B-17	30
10865408	2910-078-5315	B-17	31
10865410	2910-078-5316	B-17	32
10865412	2910-078-5317	B-17	33
10865414	2910-078-5318	B-17	34
10865416	2910-078-5319	B-17	35
10865420	4710-194-2531	B-11	36
10865422	2815-402-2170	B-11	16
10865425	2910-767-1735	B-21	19

Part No.	Federal Stock No.	Fig. No.	Item No.
10865426	2910-767-1733	B-21	31
10865437	2930-766-0903	B-24	44
10865444	2910-767-1734	B-21	23
10865464	5430-493-4057	B-11	35
10865464	5430-493-4057	B-11	38
10865466	4730-805-0676	B-21	40
10865498	2815-177-9897	B-5	33
10882610	2815-795-1800	B-3	4
10882611	2815-617-8626	B-6	48
10882613	2815-817-9538	B-3	5
10882615	5210-793-7898	B-30	17
10882616	5210-793-7899	B-30	18
10882617	5210-793-7897	B-30	19
10882637	5307-533-3383	B-9	15
10882638	5307-533-3382	B-9	15
10882641	2910-879-1666	B-11	51
10882649		B-27	8.1
10882650		B-27	8.2
10882651	4910-795-7952	B-30	13
10882653	5120-793-7896	B-30	8
10882654	2540-453-5404	B-21	5
10882728		B-9	44
10882747	5120-793-7895	B-30	6
10882750	5306-413-4373	B-7	25
10882757	5315-490-5588	B-27	32
10882761	2920-402-5205	B-7	29
10882764	2910-795-1795	B-19	50
10882765	2920-455-5835	B-7	15
10882766	2940-937-1450	B-6	52
10882767	5340-456-1799	B-21	49
10882768	2910-821-0659	B-19	55
10882771	5340-489-8347	B-11	52
10882772	2910-455-5836	B-6	46
10882773	2920-177-7844	B-14	29
10882774	2920-498-9358	B-7	26
10882777		B-21	38
10882780		B-21	50
10882790	4910-795-7951	B-30	7
10882791	4710-406-1528	B-10	9
10882826	9905-407-5099	B-7	3
10882827	9905-407-5100	B-7	77
10882888	4910-795-7956	B-30	11
10882890	4710-438-1811	B-11	30
10882891	4910-795-7959	B-30	32
10882892	4910-795-7950	B-30	33
10882925	2815-876-2324	B-9	52
10882926		B-9	53
10882927		B-9	55
10882928	2815-866-2196	B-9	54
10882940	2910-792-5393	B-17	27
10882945	4910-795-7954	B-29	8
10882949	4910-795-7958	B-30	16
10882953	5120-448-0400	B-30	10
10882954	5120-448-0401	B-30	9
10882958	4910-795-7955	B-29	7
10882963	4910-795-7953	B-30	20
10882968	2815-545-1563	B-4	11
10882970	5307-410-5830	B-2	71
10883052	5120-448-0402	B-30	35
10883058	5120-448-7993	B-30	31
10883072	2815-821-4002	B-7	14
10883075	5120-448-0404	B-29	8
10883080	5306-453-5589	B-7	11
10883083	2815-406-4623	B-10	21
10883098	2910-827-2816	B-27	16
10883731	2815-763-1402	B-28	21
10883737	2920-803-0259	B-28	20
10883740	2920-771-6968	B-28	18
10883745	2990-771-6969	B-28	12
10883748	2920-245-8162	B-28	19
10883940	5340-242-5601	B-28	4
10883941	5340-453-5595	B-28	7
10884033	5340-456-1798	B-28	16
10884034	5340-449-2580	B-28	15
10884037	2920-063-8127	B-28	17
10885485		B-20	2.2
10887592	2590-437-0990	B-15	25
10889688	4730-124-1376	B-26	66
10889711		B-27	3
10889713	2920-830-6660	B-15	19
10889714	2590-838-3596	B-18	25
10889715	5310-491-0327	B-18	24
10898735	4730-168-1935	B-26	105
10898738	2910-135-6523	B-26	43
10898746	5306-837-9469	B-27	12
10898756	2930-402-4420	B-22	16
10898763	5305-897-7481	B-22	17
10898763	5305-897-7481	B-24	26
10898777	2815-851-9176	B-14	33
10898778	2815-861-3829	B-3	8
10898779	2815-861-1447	B-14	10
10898793	2815-896-6165	B-11	18
10898793	2815-896-6165	B-11	42
10898793-1	4720-177-6186	B-11	9
10898794	2815-896-6166	B-11	12
10898861		B-2	61
10898862	2815-117-0829	B-2	1
10898874		B-9	23
10898875		B-9	51
10898877		B-9	27
10898878		B-9	60
10898888		B-9	21
10898891	2815-895-6430	B-9	12
10898907		B-9	33
10898908		B-9	26
10898910		B-9	32
10898915	2815-861-1448	B-14	7
10898919	2815-846-1824	B-9	47
10898928	4910-986-9873	B-32	1
10898933	2815-899-1504	B-6	31
10898962	2815-851-6551	B-9	42
10899041	5340-194-4714	B-26	8
10899180	4910-870-6283	B-29	2
10912162	2815-457-9309	B-7	69
10912163-1	5310-886-3000	B-22	20
10912163-1	5310-886-3000	B-24	5
10912163-2	5310-886-3001	B-22	2
10912260	4910-856-4137	B-29	1
10912261		B-8	13
10912262		B-8	25
10912269	8115-856-8147	B-32	
10912270	5330-493-2938	B-32	5
10912271		B-32	6
10912298		B-32	1
10912390	2990-498-9356	B-13	55
10912391	2910-402-4424	B-13	6
10912444	5340-242-5600	B-7	50
10912447	2910-064-6265	B-15	6
10912450	2815-064-6270	B-1-1	
10912452	2910-064-6269	B-16	25
10912453	2815-404-7444	B-3	9
10912455	9905-419-5829	B-2	63
10912477	2990-064-6264	B-15	1
10912478	2990-064-6263	B-15	1

Part No.	Federal Stock No.	Fig. No.	tem No.
10912481	2910-064-6262	B-16	28
10912558	5330-438-1861	B-14	17
10912589	5220-988-8774	B-29	3
10935214-1		B-7	37
10935214-3	4720-477-3712	B-7	37
10935214-4	2910-781-1457	B-19	27
10935359	2910-078-4866	B-16	8
10935443-1	5340-437-7210	B-12	15
10935443-2	5340-437-7211	B-12	18
10935447	5325-182-4707	B-21	21
10935471	2990-411-8330	B-28	8
10935473	2920-902-3187	B-28	5
10935476	5120-789-4881	B-30	27
10935478	5330-498-6341	B-13	55
10935478	5330-498-6341	B-21	3
10935478	5330-498-6341	B-24	6
10935497	5120-078-3809	B-30	25
10935532	4910-937-4261	B-31	1
10935536	4730-902-3188	B-19	1
10935537	2930-902-3189	B-27	58
10935539	2910-402-4425	B-26	
10935540		B-26	47
10935541	2930-156-9408	B-26	88
10935613	2815-406-4616	B-7	35
10935614	5360-410-5836	B-7	46
10935615		B-7	52
10935619		B-7	47
10935621	5330-410-9803	B-7	39
10935622		B-7	45
10935623	2815-406-4621	B-7	41
10947970	2910-999-9452	B-19	22
10951061		B-16	31
10951075	2930-435-4564	B-27	52
10951077		B-27	50
10951079	2930-435-4568	B-27	46
10951081		B-27	47
10951083		B-27	48
10951084	2930-435-4572	B-27	49
10951119		B-27	51
10951122		B-24	12
10951123		B-7	40
10951124	2815-193-8218	B-24	11
10951167	3010-087-9530	B-16	11
10951230		B-32	4
10951231		B-32	16
10951334	4730-402-5143	B-19	56
10951341-1	4720-177-6188	B-17	14
10951341-2	4720-177-6189	B-17	16
10951368	4710-401-4368	B-11	10
10951369	3110-462-0392	B-27	40
10951394		B-4	10.3
10951395		B-4	10.2
10951396		B-4	10.1
10951426	2910-999-9453	B-19	37
10951427	2910-999-9454	B-19	8
10951429-1	2910-781-1458	B-19	31
10951429-2	2910-781-1461	B-19	29
10951430	2910-999-8455	B-19	61
10951434	2910-134-4734	B-19	19
10951434-1		B-19	18
10951460	2815-406-4612	B19	28
10951462	5340-407-0664	B-19	24
10951463	2910-781-1462	B-19	26
10951482	2815-808-2408	B-19	41
10952220	4910-919-2884	B-29	9
11591013	2910-781-1463	B-19	33
11602061	2815-808-2421	B-20	13
11602062		B-20	8.1
11602063	2815-808-2470	B-19	45
11602943		B-20	5.1
11610150	5120-873-6943	B-30	40
11610167	5120-871-7198	B-30	15
11610171	5120-875-9556	B-30	23
11610232		B-20	8.2
11640132	5310-489-8351	B-12	7
11640132	5310-489-8351	B-15	2
11640392	6645-420-5072	B-15	12
11641819	2590-134-4815	B-15	13
11641917	6645-179-2712	B-31	2
11641919	2815-193-8211	B-22	25
11641922	2815-406-4615	B-7	60
11641923		B-7	63
11641927	4710-193-9436	B-7	65
11641928	5340-409-8055	B-7	62
11641930	2930-350-9400	B-24	12
11641931	2930-437-7179	B-22	24
11641939		B-24	14
11641940		B-24	14
11642028		B-4	10.2
11642029		B-4	10.1
11642030		B-4	10.3

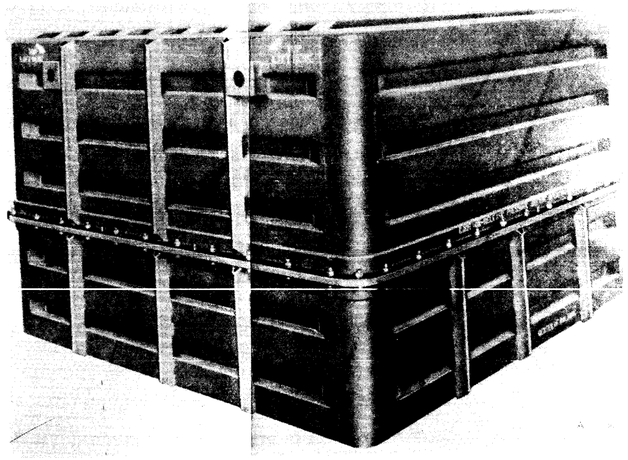


Figure B-1. Engine Shipping and Storage Container.

FIGURE B-2

GROUP NO.	ITEM NO.
0100	7, 8, 9, 10, 11, 12, 13, 14, 34
0101	1, 6, 15, 16, 23, 32, 33, 46, 47, 48, 50, 52, 53, 60, 61, 63, 64, 66, 68, 70, 74, 75, 76, 77, 78, 79, 80, 85, 87, 92, 96, 97, 98, 99, 100
0102	24, 25, 26, 42, 43, 44, 45, 71, 72, 82, 83, 88, 89, 90, 91, 93, 94, 95
0104	37, 38, 39, 67
0106	20, 35, 40, 49, 51, 58, 62, 65, 72, 73, 81, 84
0109	17, 19, 21, 22, 28, 29, 54, 55, 56, 57, 59, 69, 86
0301	2, 3, 4, 5, 18
0305	31
0603	27, 30
0610	36, 41

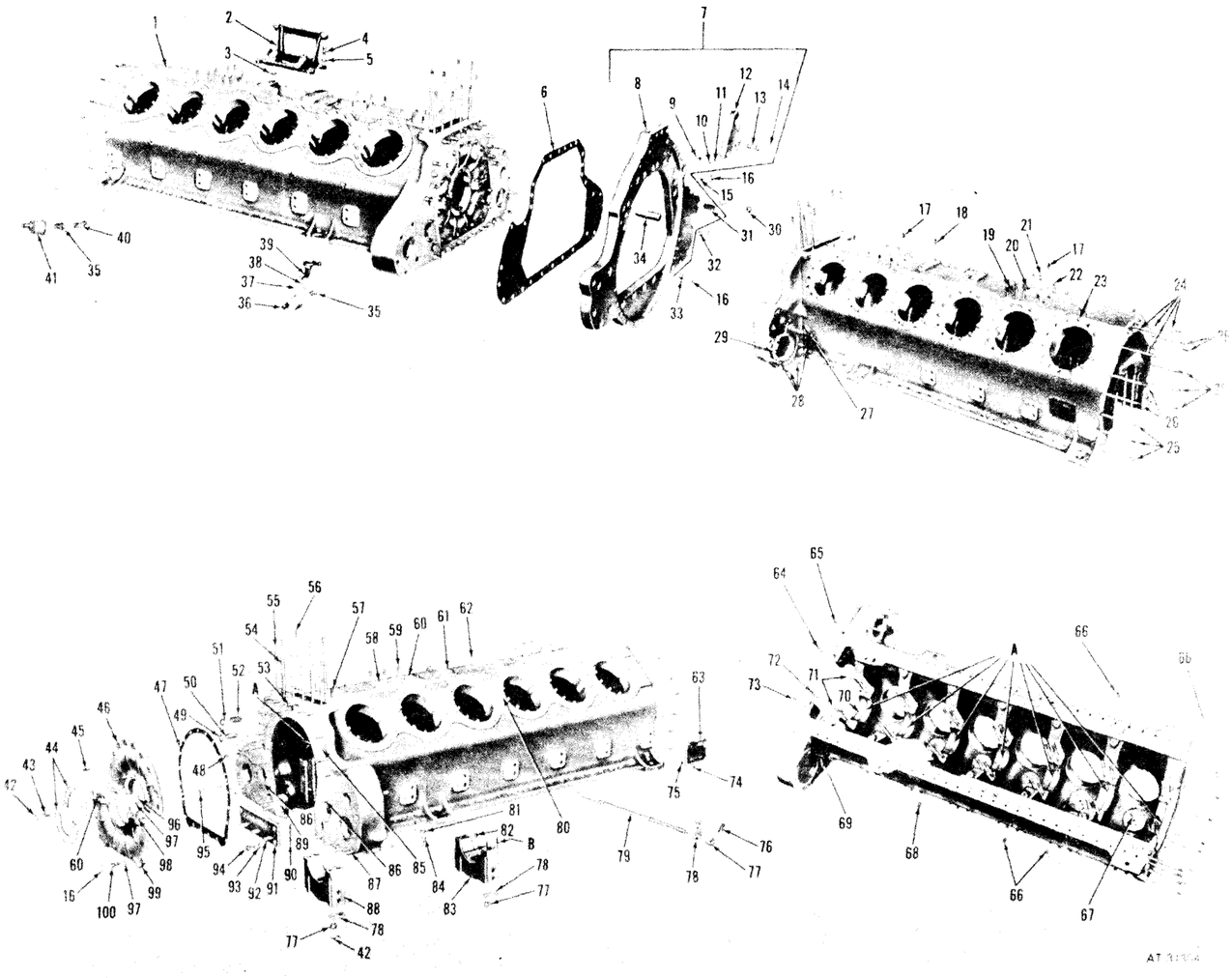


Figure B-2. Crankcase and Associated Parts-Partially Exploded View.

FIGURE B-3

GROUP NO.	ITEM NO.
0102	1, 2, 6, 7.1, 7.2, 7.3, 7.4, 15, 16, 19, 20, 21, 22, 23, 24, 25
0103	9, 10, 11, 12, 17, 18
0109	3, 4, 5, 8, 13, 14

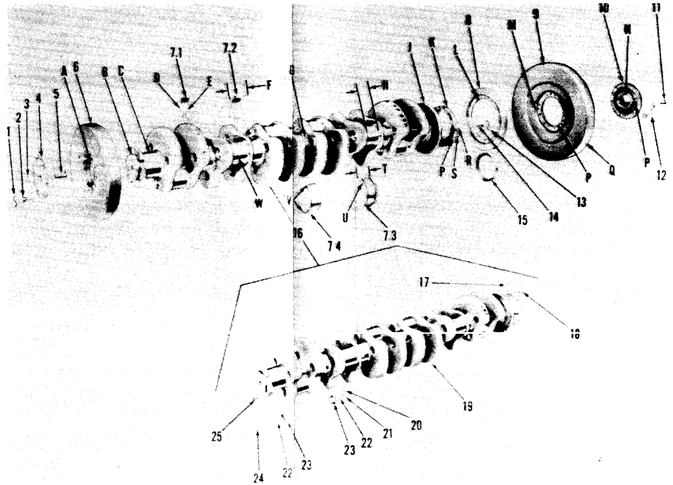


Figure B-3. Crankshaft Assembly, Flywheel Damper, Bearings and Associated Parts-Exploded View.

FIGURE B-4

GROUP NO.	ITEM NO.
0101	13, 41, 43, 45, 51, 53, 54, 55
0104	1, 2, 3, 4, 5, 6, 7, 8, 9.1, 9.2, 9.3, 10.1, 10.2, 10.3
0105	11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 42, 46, 47, 48, 49, 50
0106	44
0108	52

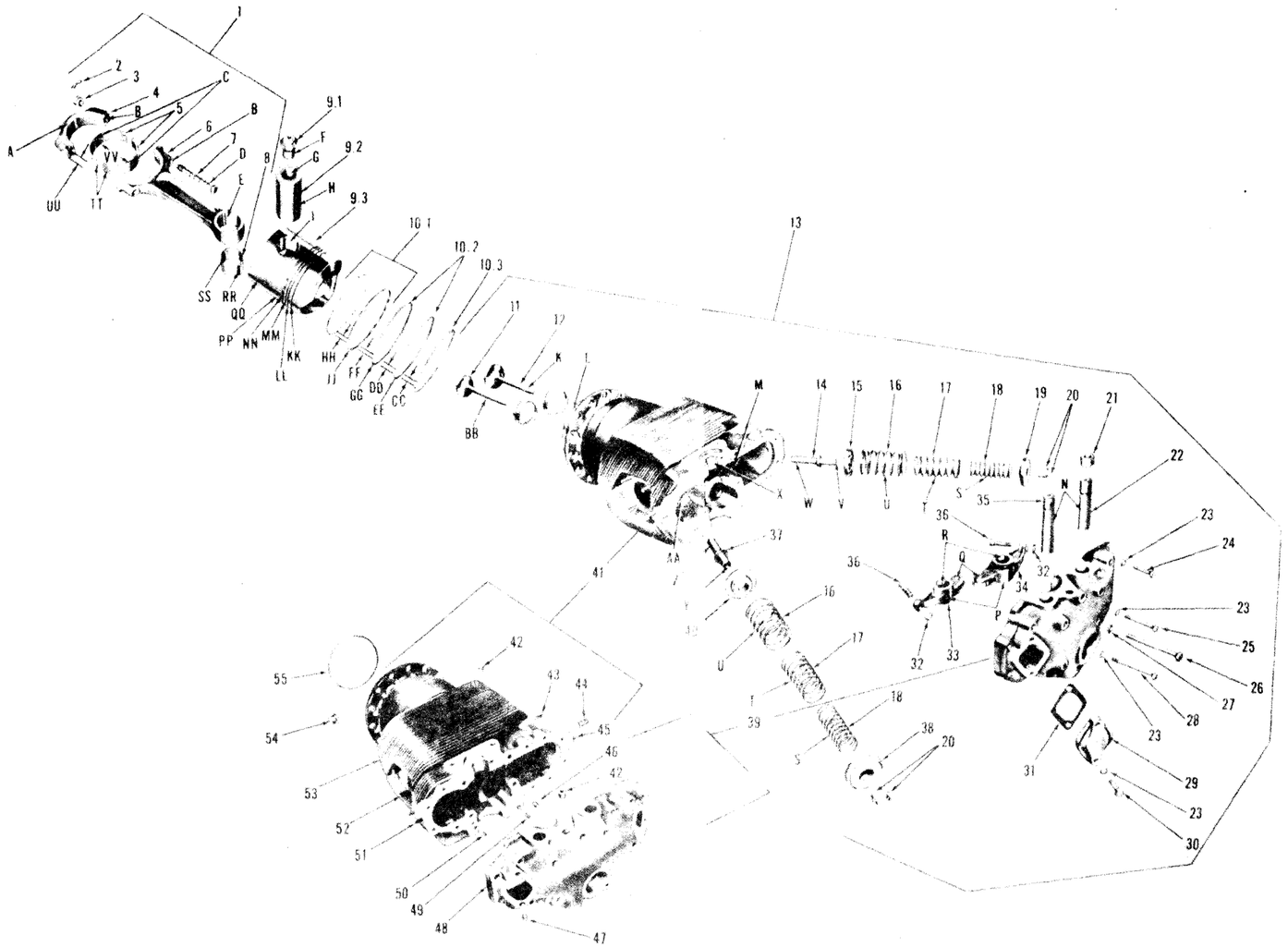
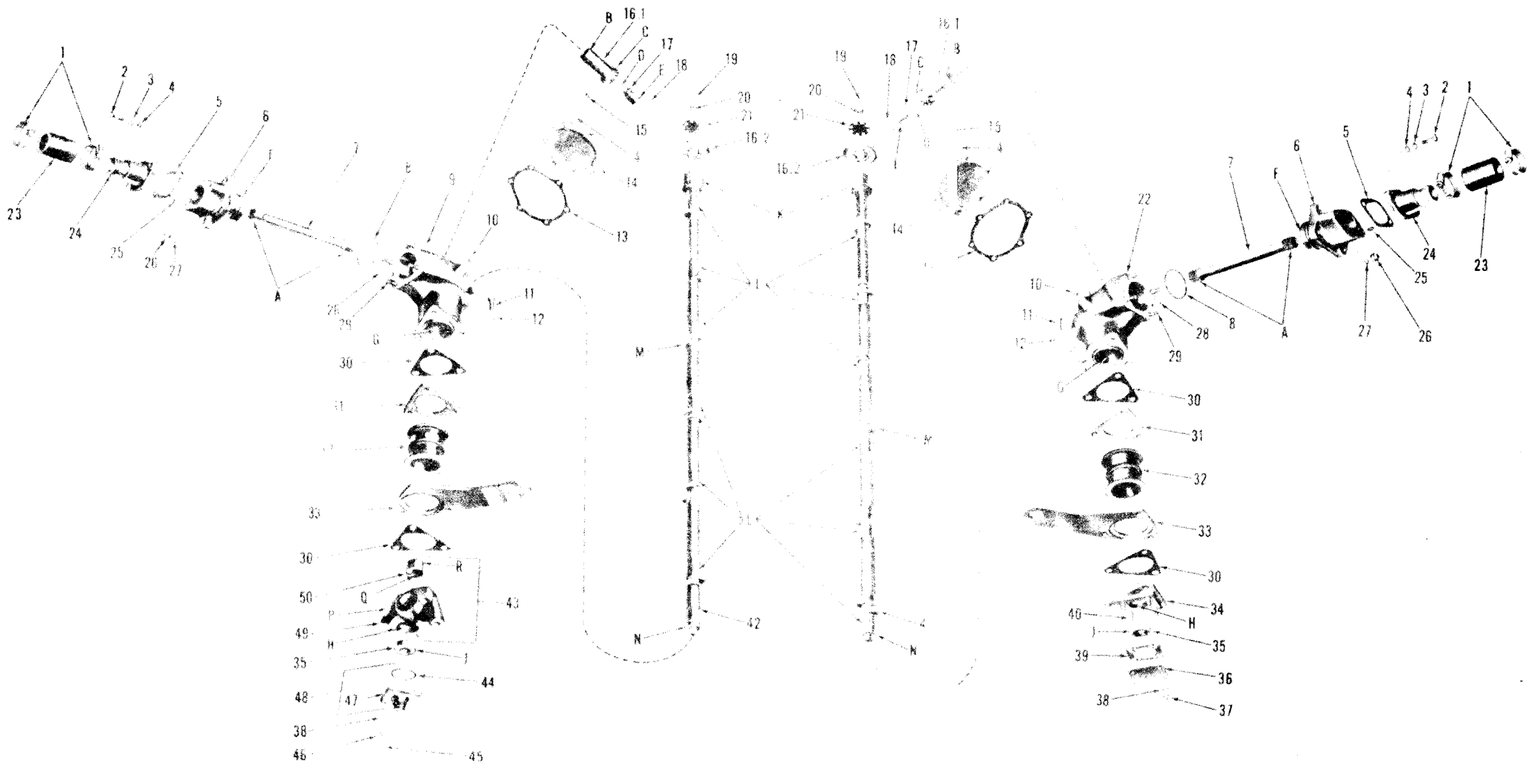


Figure B-4. Cylinder and Head Assembly, Piston, Connecting Rod and Associated Parts-Exploded View.

FIGURE B-5

GROUP NO	ITEM NO
0100	33
0105	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16.1, 16.2, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 34, 35, 36, 41, 42, 43, 49, 50
0109	37, 38, 39, 40, 44, 45, 46, 47, 48



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Figure B-5. Camshaft and Drive Gears-Exploded View.

FIGURE B-6

GROUP NO.	ITEM NO.
0100	8, 29, 30, 31
0106	1, 2, 3, 4, 6, 7, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23.1, 23.2, 23.3, 24, 25, 26, 27, 28, 32, 33, 34, 35, 37, 39, 40, 41, 42, 43, 44, 45, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78
0109	5
0309	46
0610	36, 38

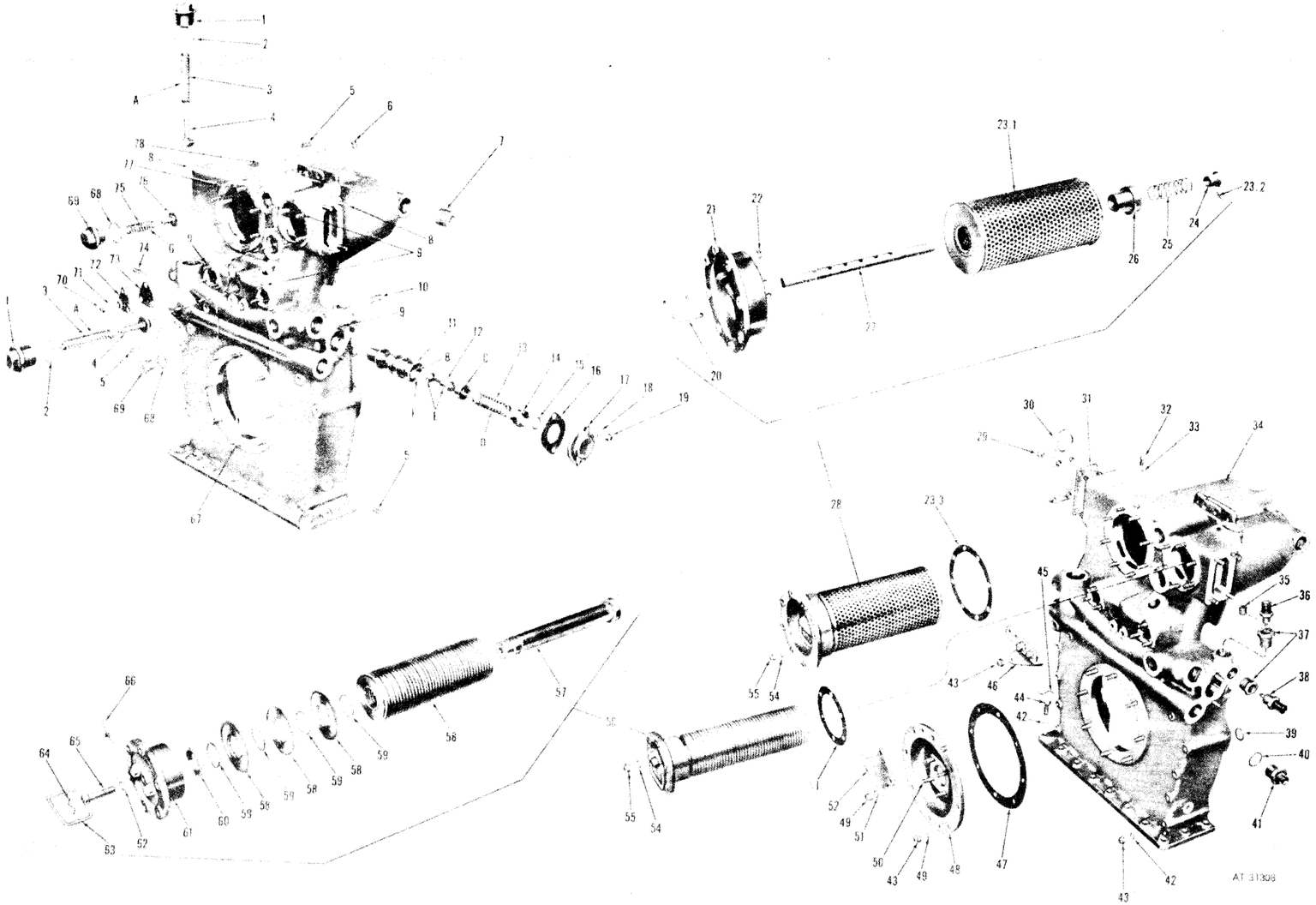


Figure B-6. Damper Housing, Oil Filters and Associated Parts-Exploded View.

FIGURE B-7

GROUP NO.	ITEM NO.
0106	1, 2, 3, 4, 5, 6, 7, 8, 9, 12, 13, 19, 20, 21, 22, 23, 24, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 74, 75, 76, 77, 78
0601	15, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34
0603	10, 11, 14, 16, 17, 18, 71, 72, 73

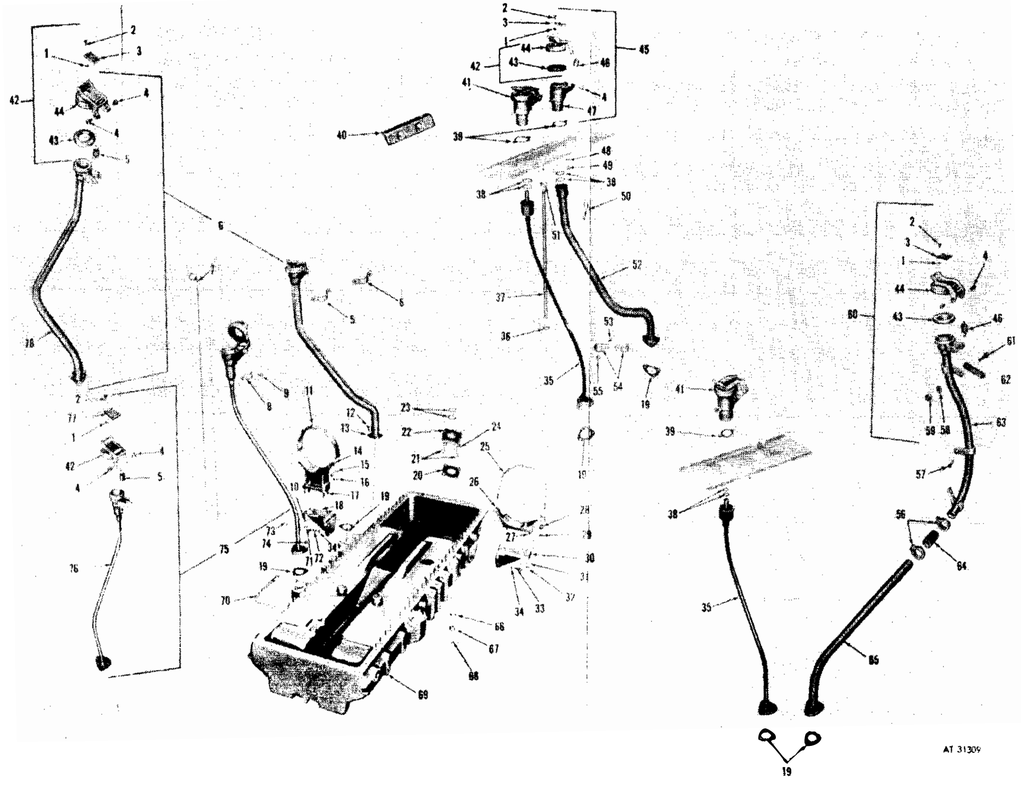


Figure B-7. Oil Pan, Tubes, Brackets and Associated Parts—Exploded View.

FIGURE B-8

GROUP NO.	ITEM NO.
0106	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34
0601	16
0603	12

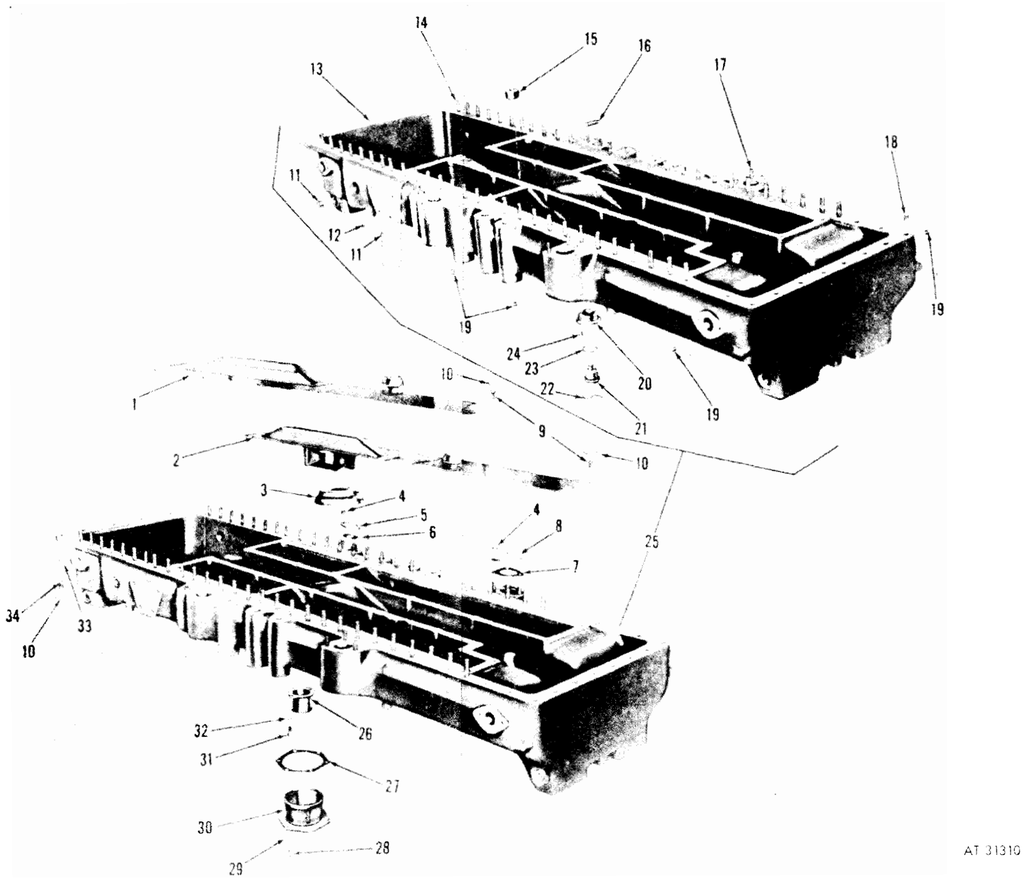


Figure B-8. Oil Pan, Baffles, Studs, Inserts and Associated Parts—Exploded View.

FIGURE B-9

GROUP NO	ITEM NO.
0106	ALL

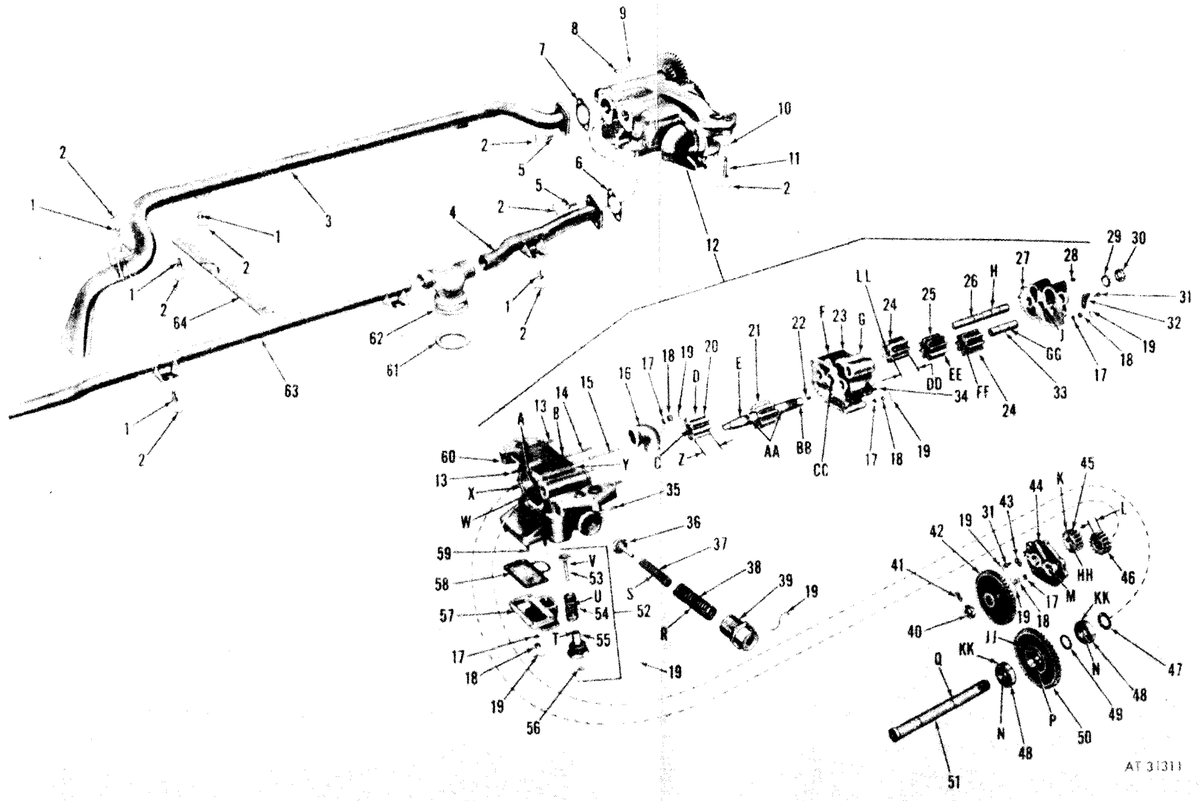


Figure B-9. Oil Pump, Tubes and Associated Parts—Exploded View.

FIGURE B-10

GROUP NO	ITEM NO
0106	ALL

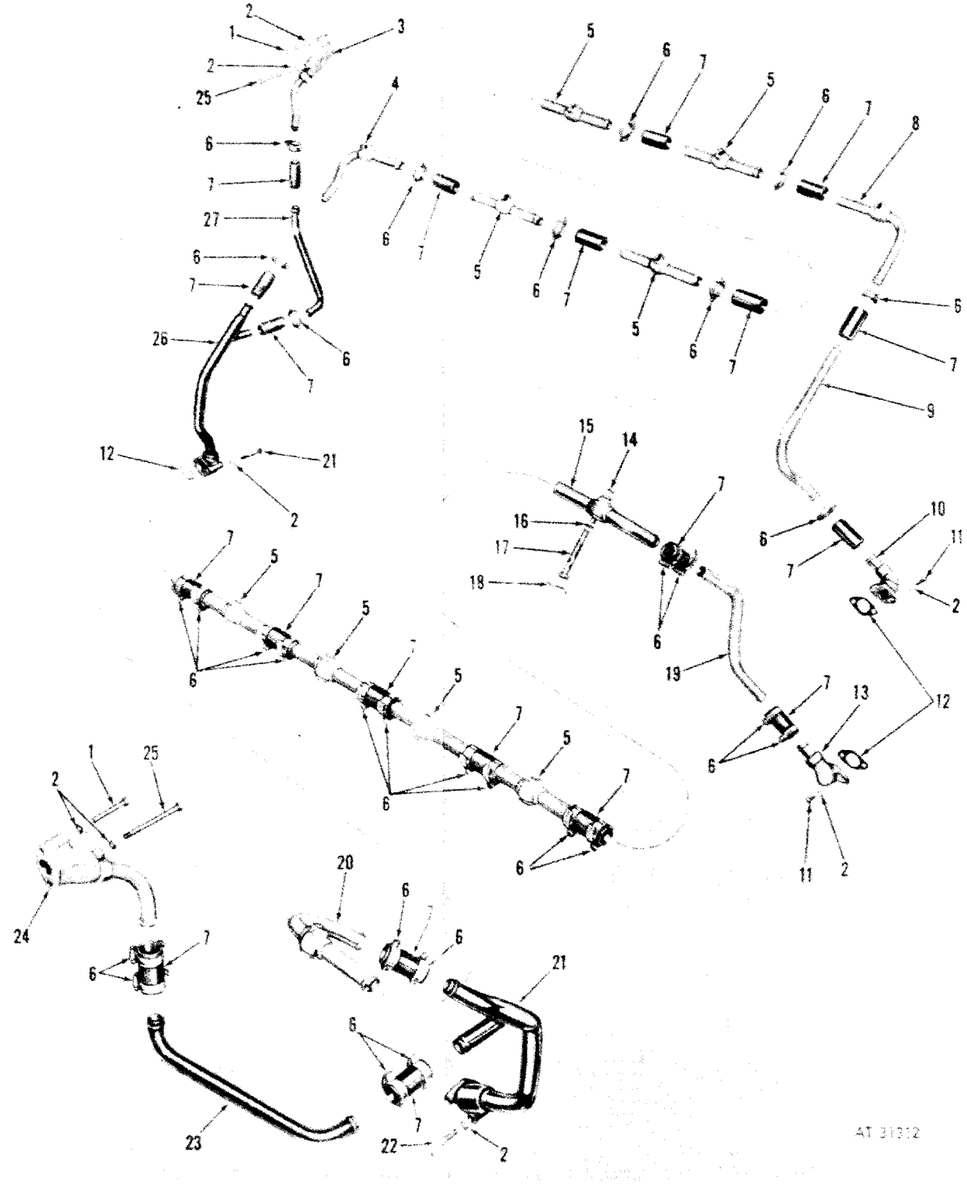


Figure B-10. Cylinder Head Oil Drain Tubes and Associated Parts—Exploded View.

FIGURE B-11

GROUP NO	ITEM NO.
0100	24, 25, 26
0106	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 27, 28, 29, 30, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 52, 53
0302	31, 32, 33, 48, 49, 50, 51

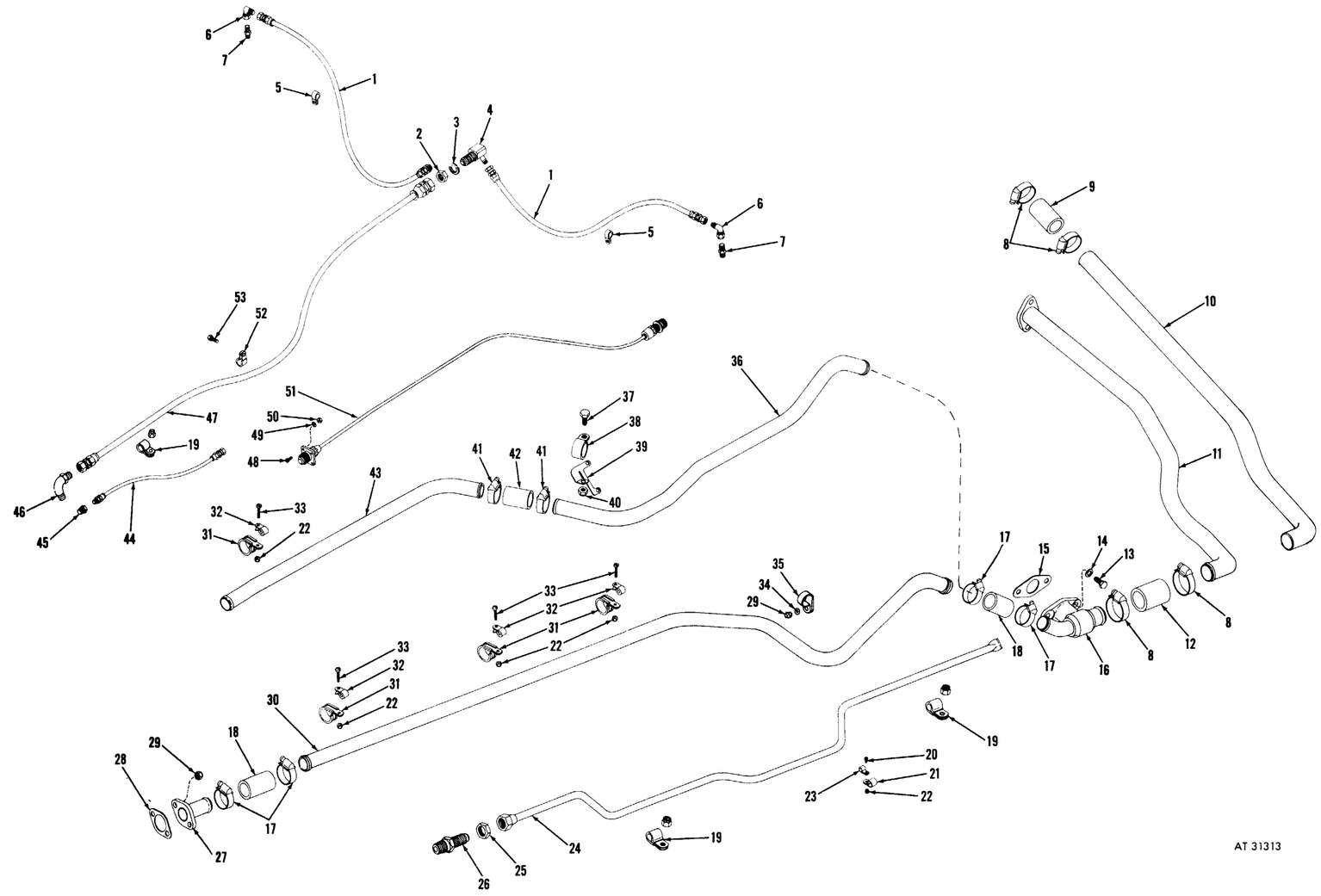
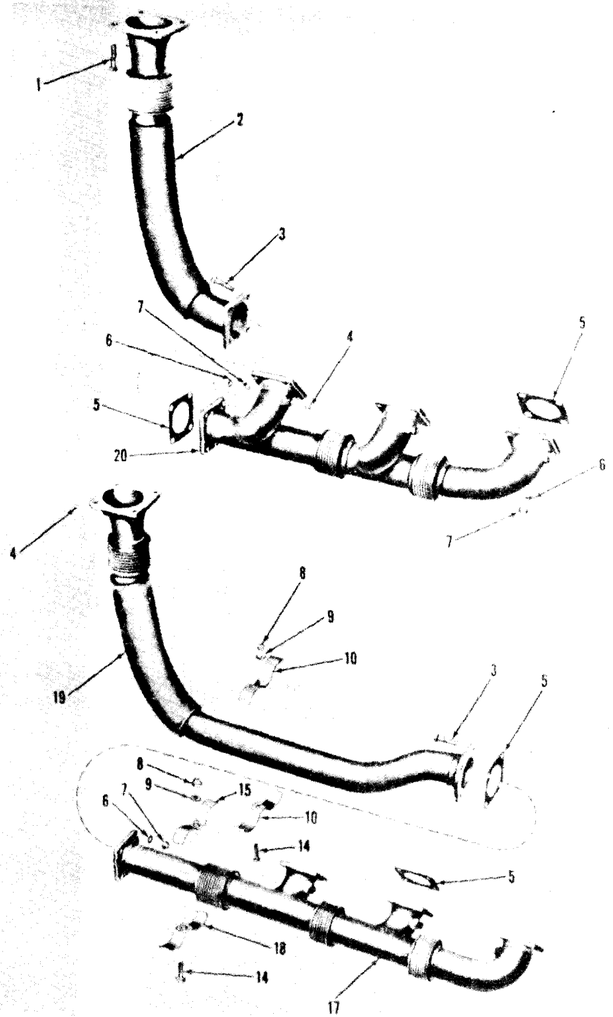


Figure B-11. Breather Tube, Fire Extinguisher Tube, Electrical Lead, Oil Lines and Associated Parts—Exploded View.

FIGURE B-12

GROUP NO.	ITEM NO.
0108	ALL



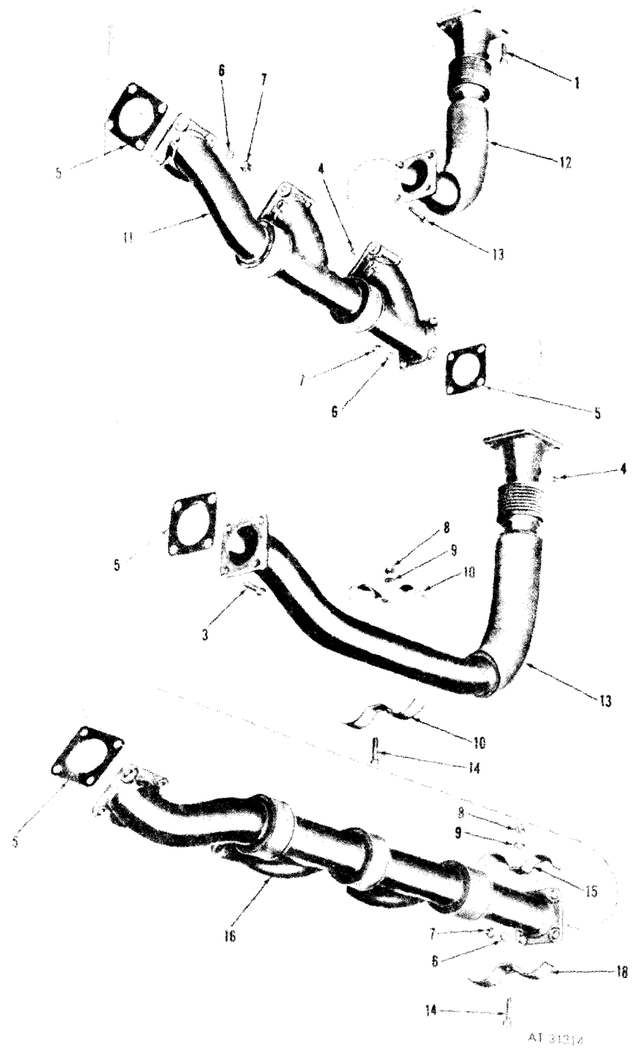


Figure B-12. Exhaust Manifolds and Associated Parts—Exploded View.

FIGURE B-13

GROUP NO.	ITEM NO.
0108	19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47
0305	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57

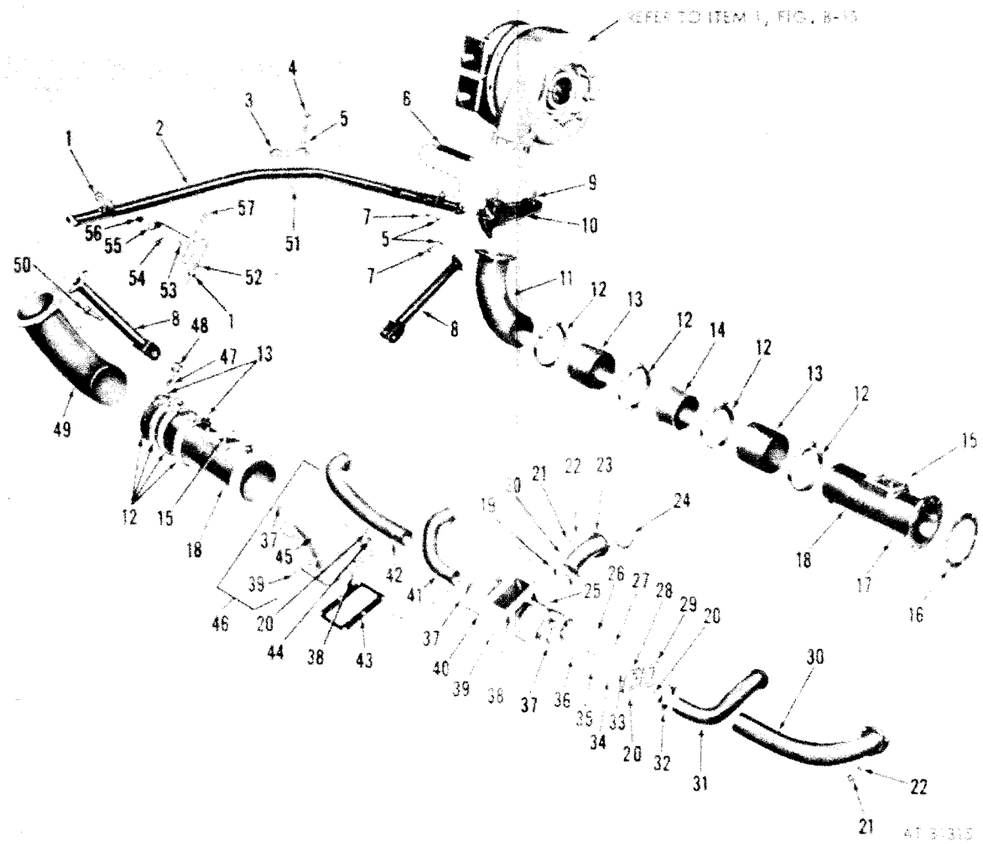


Figure B-13. Intake Manifold, Tubes, Turbosupercharger Tie Rod and Support and Associated Parts—Exploded View.

FIGURE B-14

GROUP NO.	ITEM NO.
0109	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17, 18,19,20,21,22,23,24,25,27,28,29,30,31,32,33, 34
0601	26

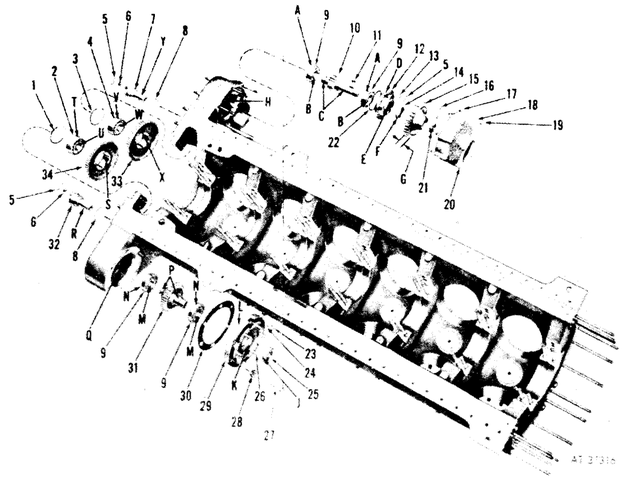


Figure B-14. Generator *and* Starter *Idler and Driven Gears and Shafts—Exploded View.*

FIGURE B-15

GROUP NO	ITEM NO.
0106	5
0108	2, 3, 4
0301	6, 7, 8, 9, 10, 11
0302	20, 21, 22, 23
0305	1, 28, 29, 30, 31
0601	17, 18, 19
0603	24, 25, 26, 27
4210	12, 13, 14, 15, 16

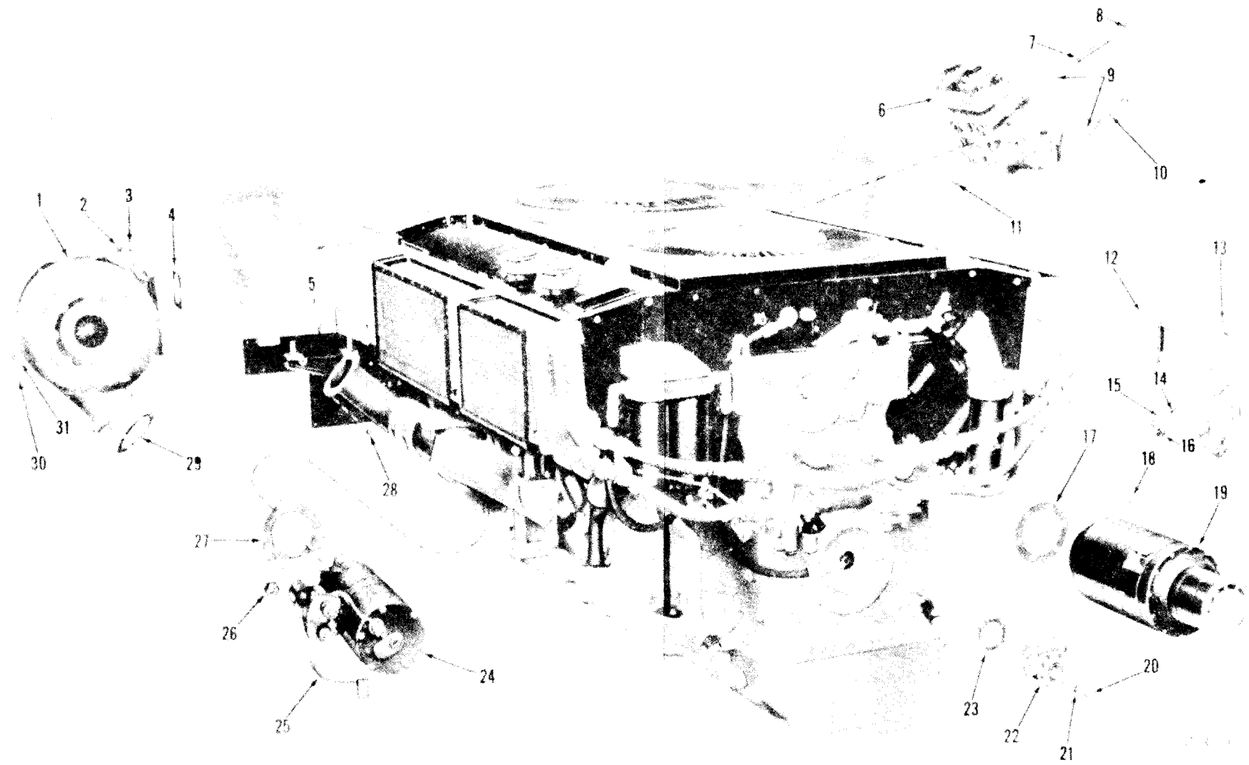


Figure B-15. Engine and Accessories—Exploded View.

FIGURE B-16

GROUP NO.	ITEM NO.
0301	ALL

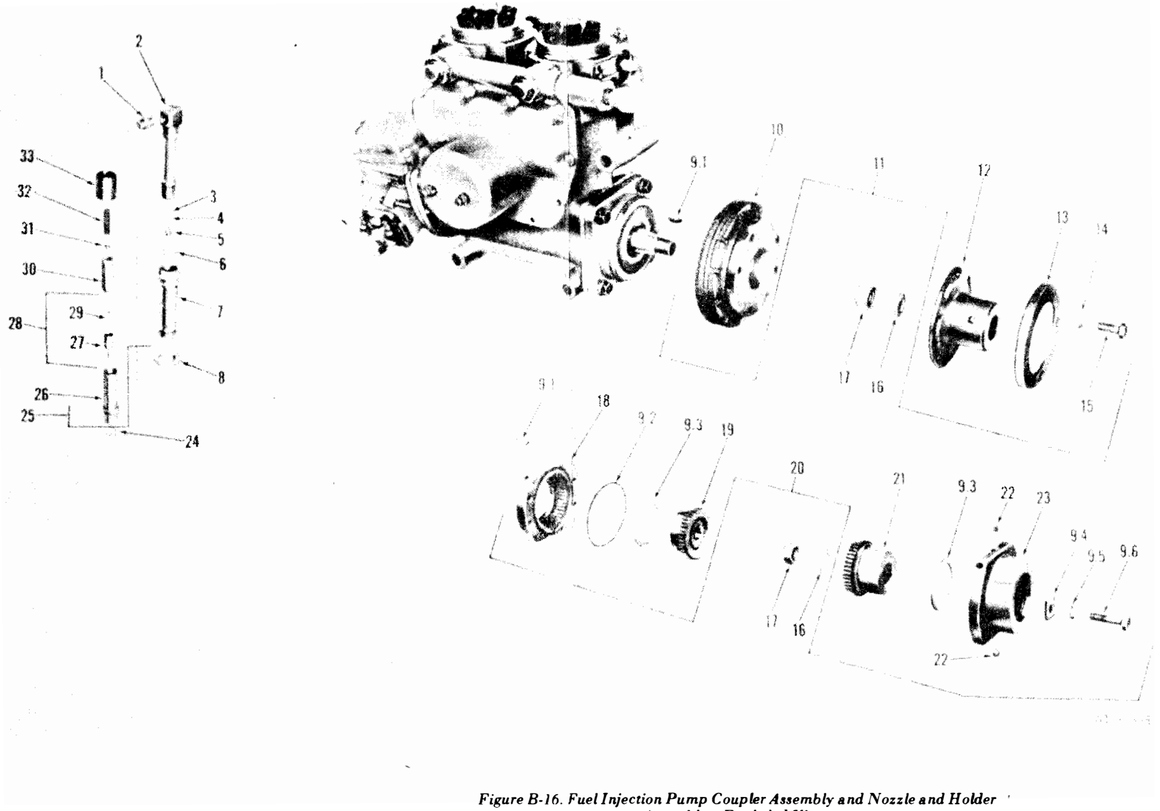


Figure B-16. Fuel Injection Pump Coupler Assembly and Nozzle and Holder Assembly—Exploded View.

FIGURE B-17

GROUP NO	ITEM NO.
0301	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 16, 17, 18, 19, 20, 21, 22, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40
0302	12, 13, 14, 15, 23, 24, 25, 26, 27, 28, 29

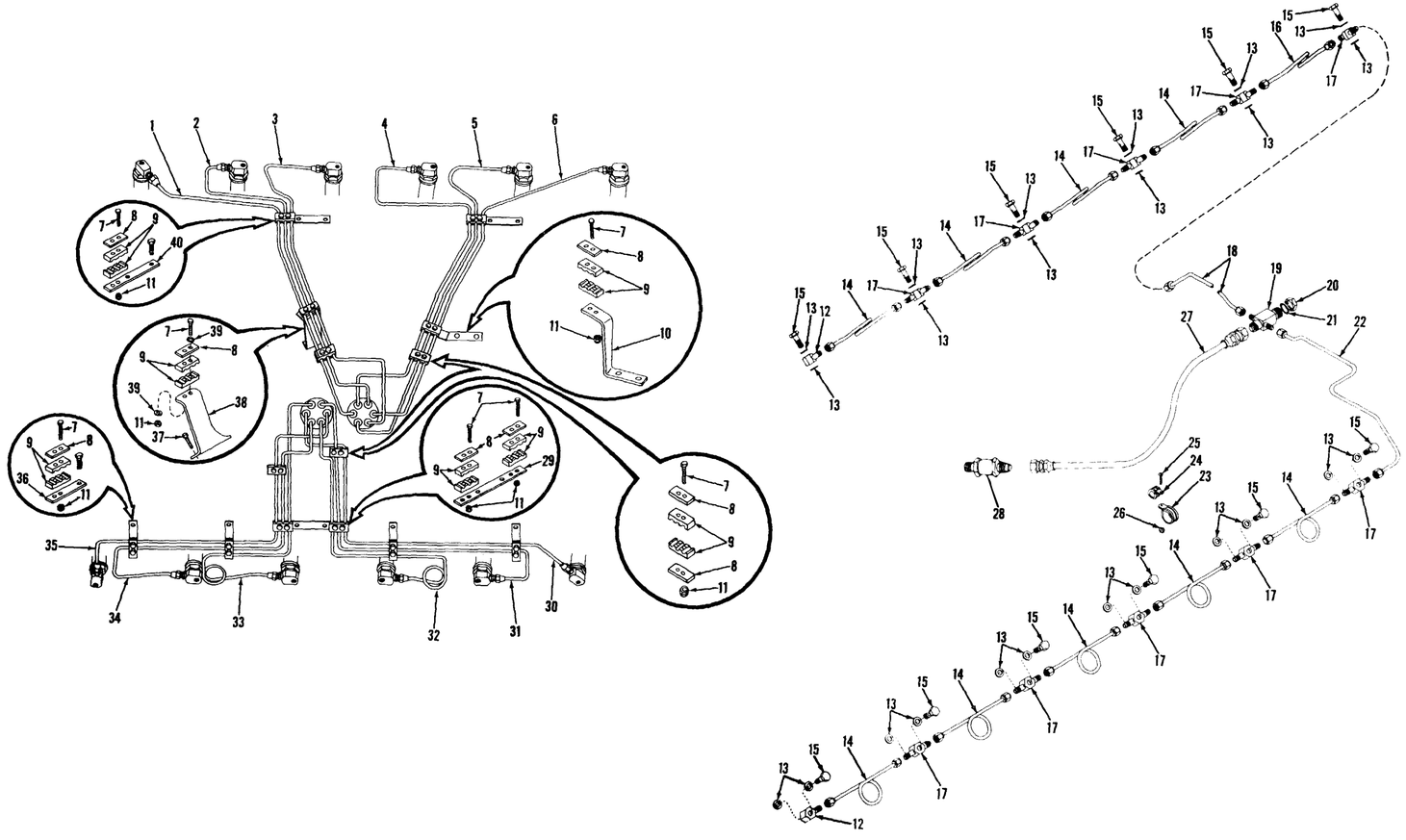


Figure B-17. Fuel Injection Pump Lines, Injector Nozzle Lines and Associated Parts—Exploded View.

FIGURE B-18

GROUP NO.	ITEM NO.
0308	ALL

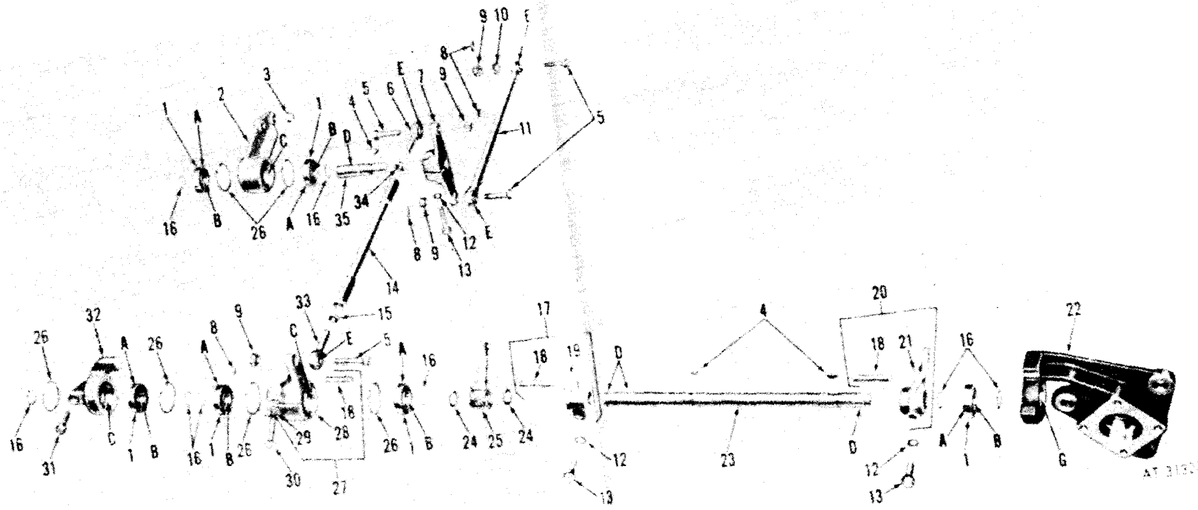


Figure B-18. Throttle Linkage—Exploded View.

FIGURE B-19

GROUP NO.	ITEM NO.
0105	3, 4
0302	1, 2, 9, 10, 11, 12, 13, 14, 42, 43, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 64
0309	5, 6, 7, 8, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 44, 45, 46, 47, 58, 59, 60, 61, 62, 63

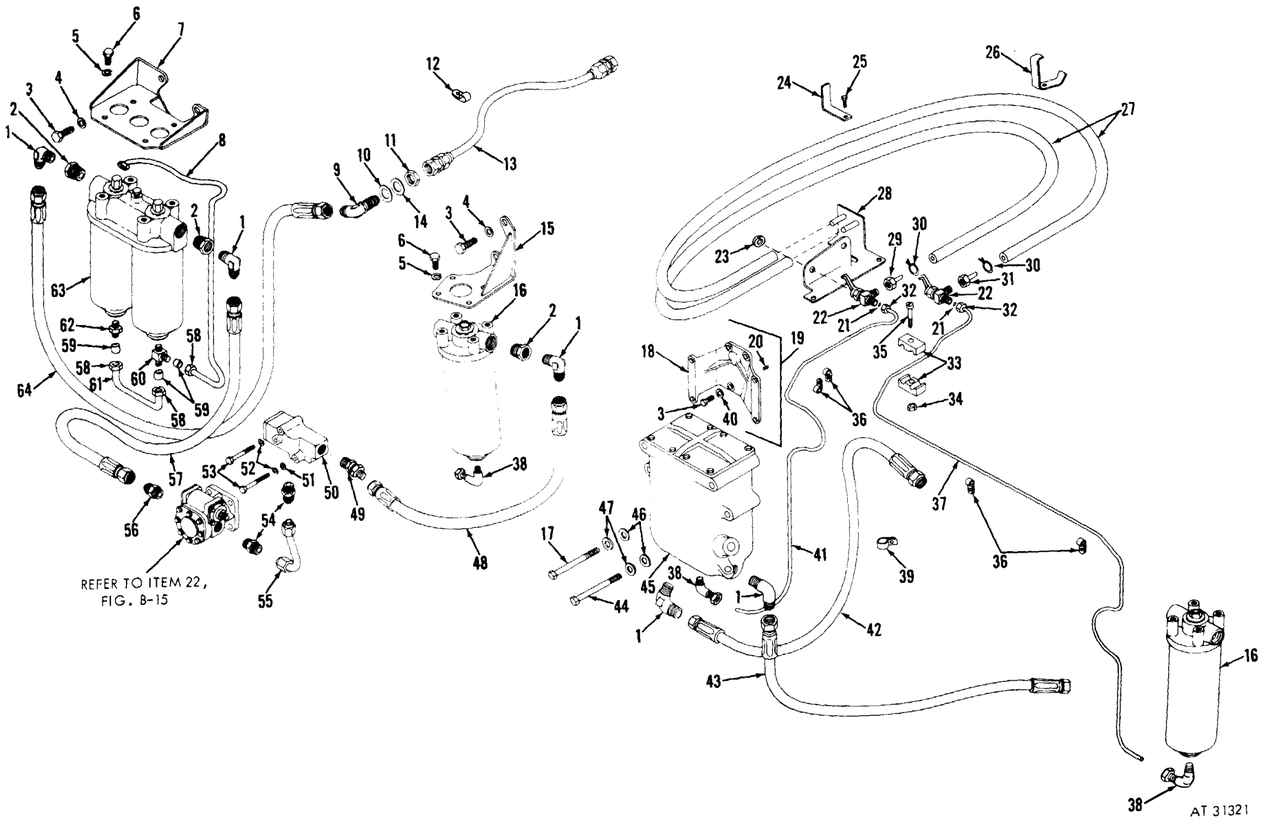
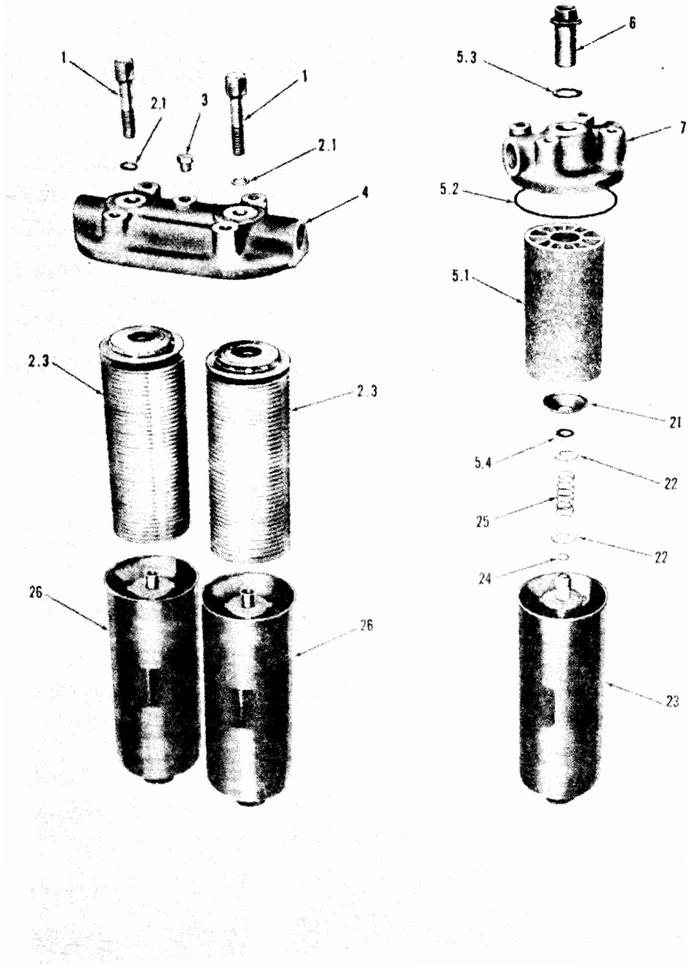
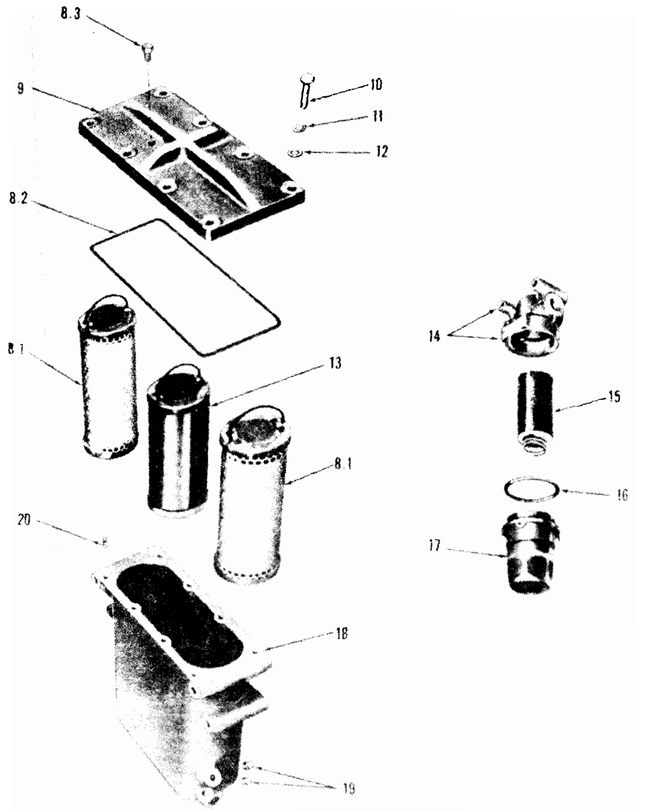


Figure B-19. Primary and Secondary Pressure Fluid Filters, Water Separator, Brackets, Hoses and Associated Parts—Exploded View.

FIGURE B-20

GROUP NO.	ITEM NO.
0309	ALL





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Figure B-20. Secondary Pressure Fluid Filter, Primary Pressure Fluid Filter, Water Separator and Pressure Fluid Filter Assemblies—Exploded View.

FIGURE B-21

GROUP NO.	ITEM NO.
0309	44, 46, 47
0311	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 45, 48, 49, 50, 51, 52, 53, 54, 55

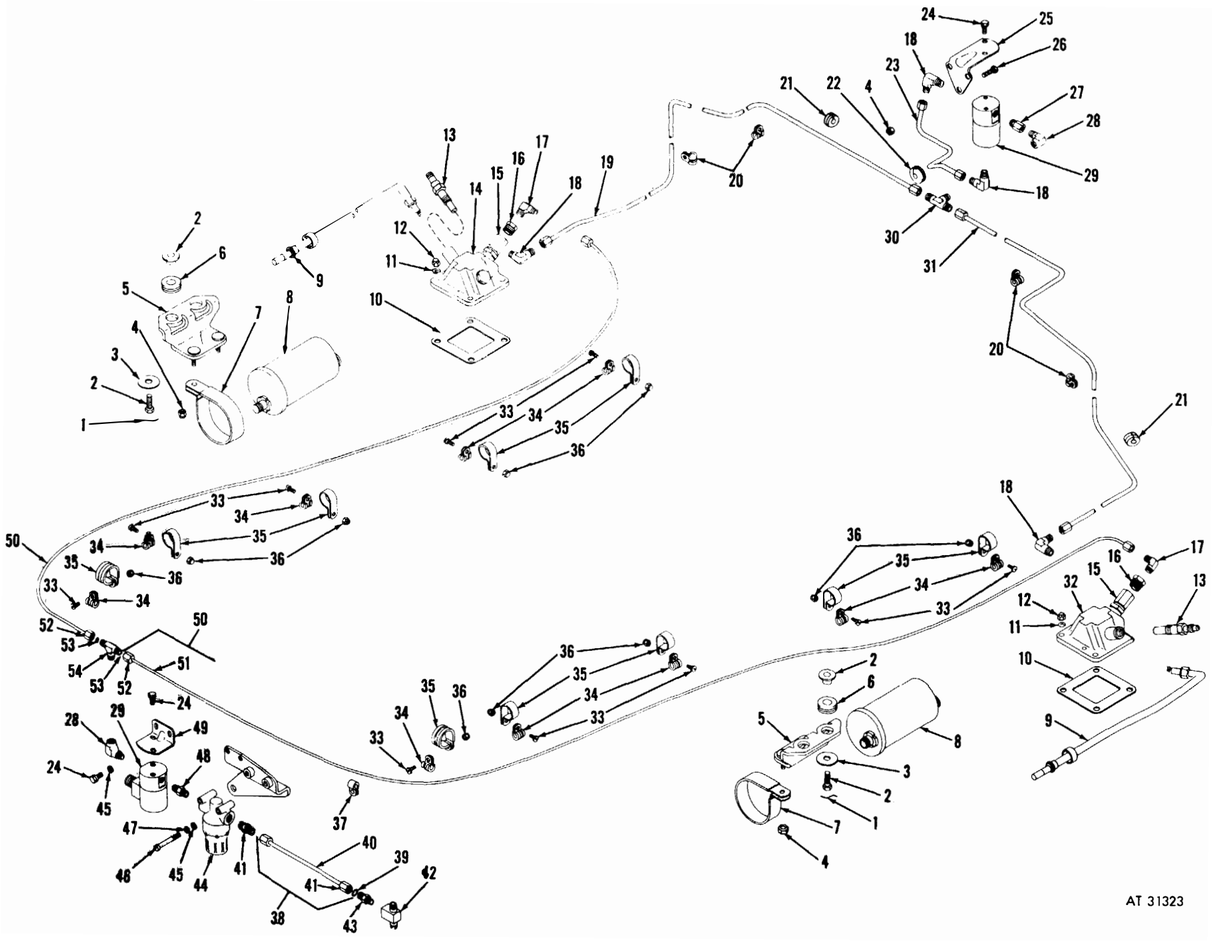


Figure B-21. Induction Heater System—Exploded View.

FIGURE B-22

GROUP NO.	ITEM NO.
0502	ALL

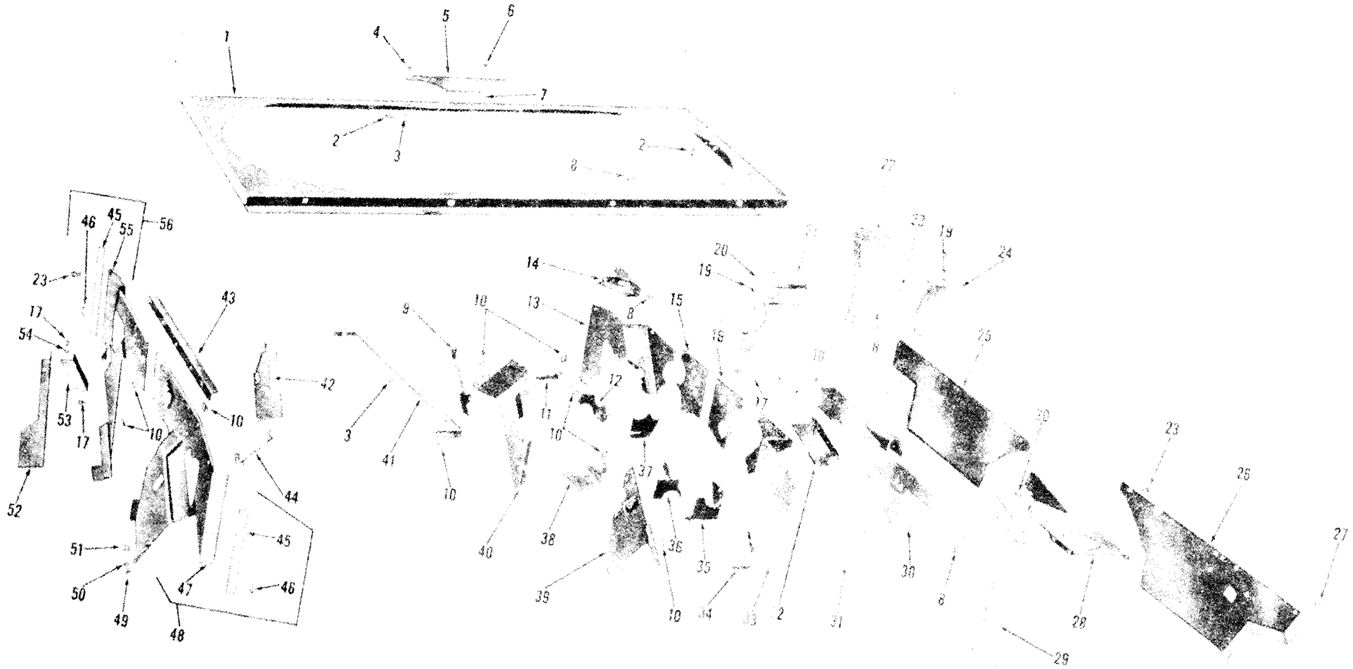


Figure B-22. Engine Shroud—Exploded View.

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FIGURE B-23

GROUP NO.	ITEM NO.
0502	ALL

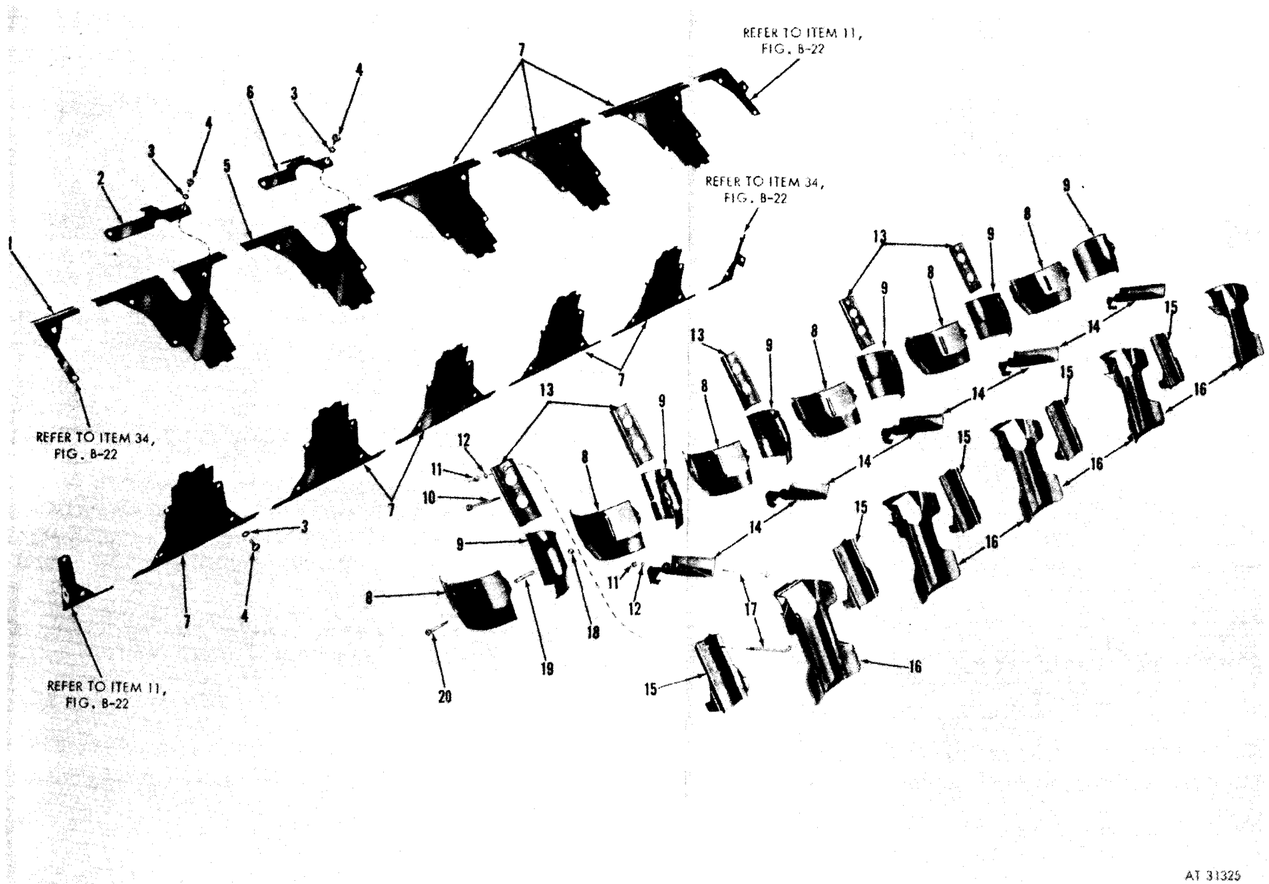


Figure B-23. Cylinder Deflectors and Plates—Exploded View.

FIGURE B-24

GROUP NO.	ITEM NO
0106	1, 2, 3, 4, 6, 8, 9, 22, 23, 24, 25, 29, 35, 41, 42, 43, 44, 47, 48, 49, 50, 51, 53, 54, 55, 56
0502	5, 7, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 26, 27, 28, 30, 31, 32, 33, 34, 36, 37, 38, 39, 40, 45, 46, 52

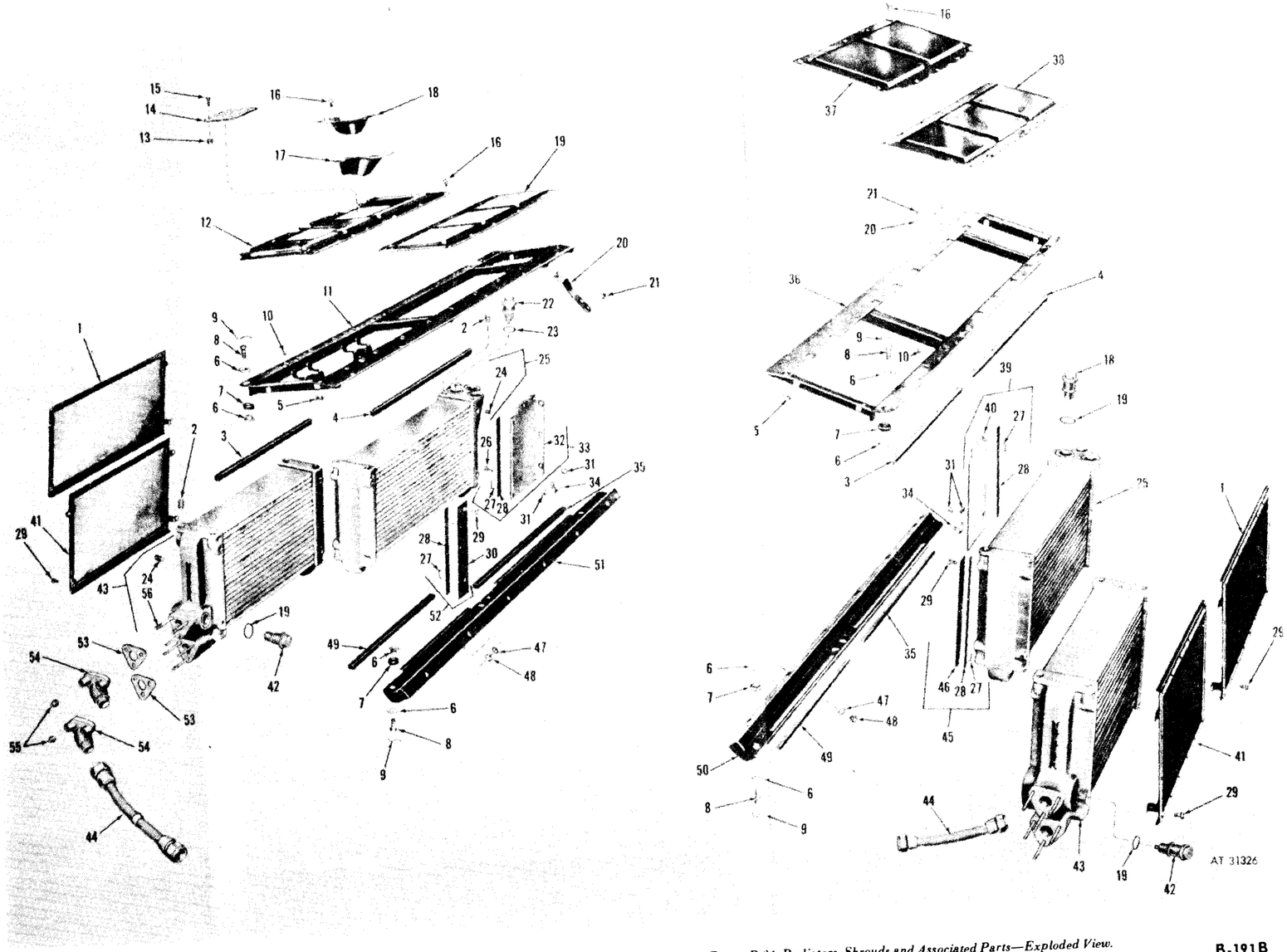


Figure B-24. Radiators, Shrouds and Associated Parts—Exploded View.

FIGURE B-25

GROUP NO.	ITEM NO.
0505	ALL

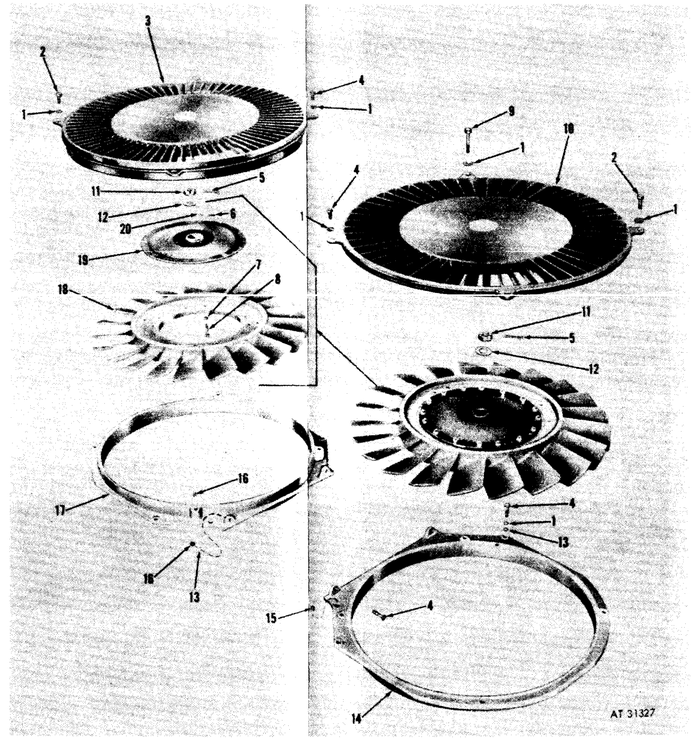


Figure B-25. Engine Cooling Fans—Exploded View.

FIGURE B-26

GROUP NO.	ITEM NO.
0105	1, 2, 3, 4, 93, 98, 99
0106	19, 42
0109	10, 11, 12, 13, 14, 15, 17, 20, 22, 23, 24, 25, 26, 27, 35, 36, 39, 40, 41, 43, 44, 45, 46, 47, 48, 59, 63, 64, 65, 89, 90, 91, 92, 94, 95, 100, 101, 102, 103, 104, 105
0505	5, 6, 7, 8, 9, 16, 18, 21, 28, 29, 30, 31, 32, 33, 34, 37, 38, 49, 50.1, 50.2, 51, 52, 53, 54, 55, 56, 57, 58, 60, 61, 62, 66, 67, 68, 69, 70, 71, 72, 73, 74.1, 74.2, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 96, 97

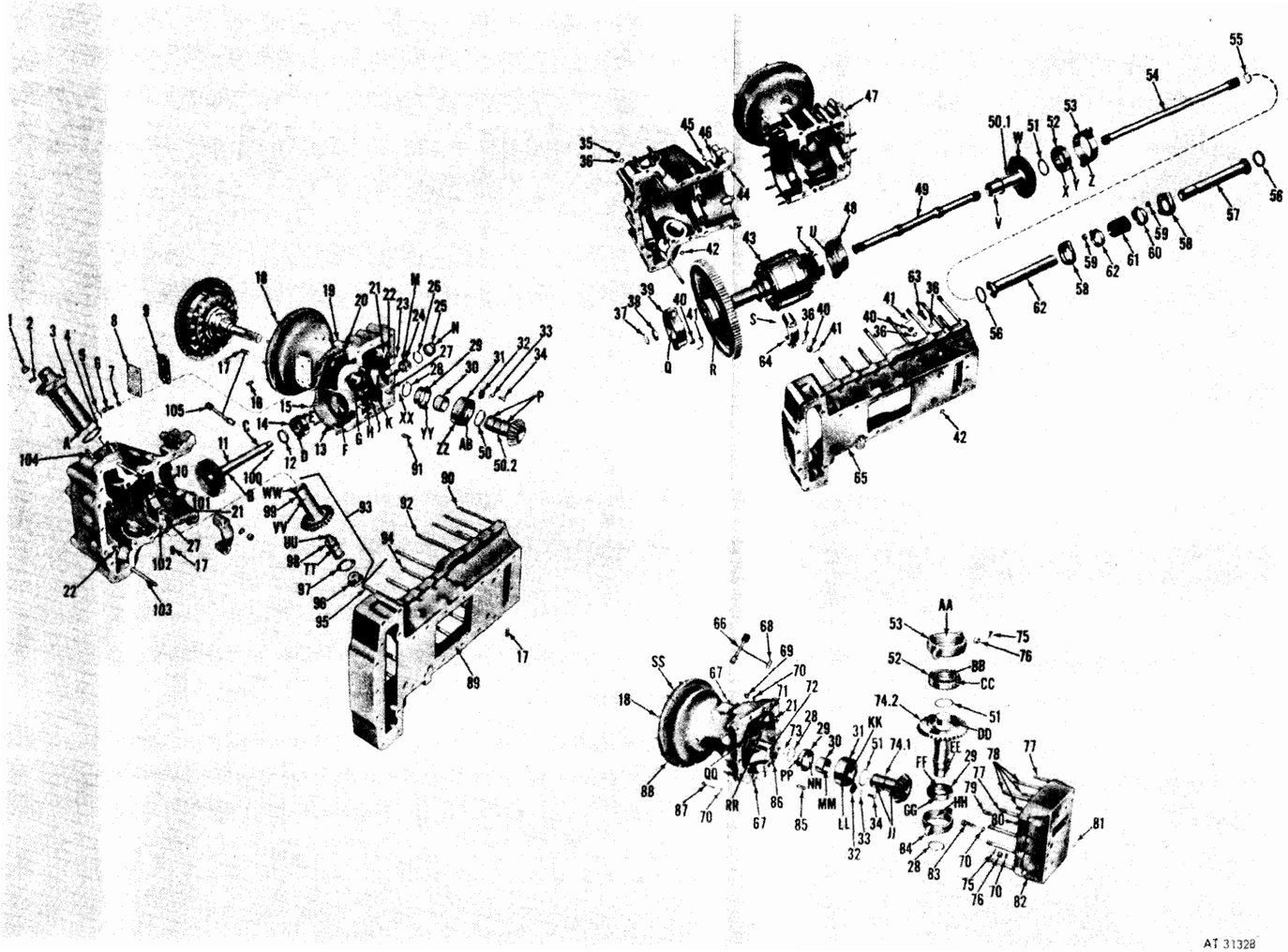


Figure B-26. Front and Rear Fan Drive Housing and Base Assemblies and Associated Parts—Exploded View.

FIGURE B-27

GROUP NO	ITEM NO.
0109	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 63, 64, 65, 66
0505	20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62

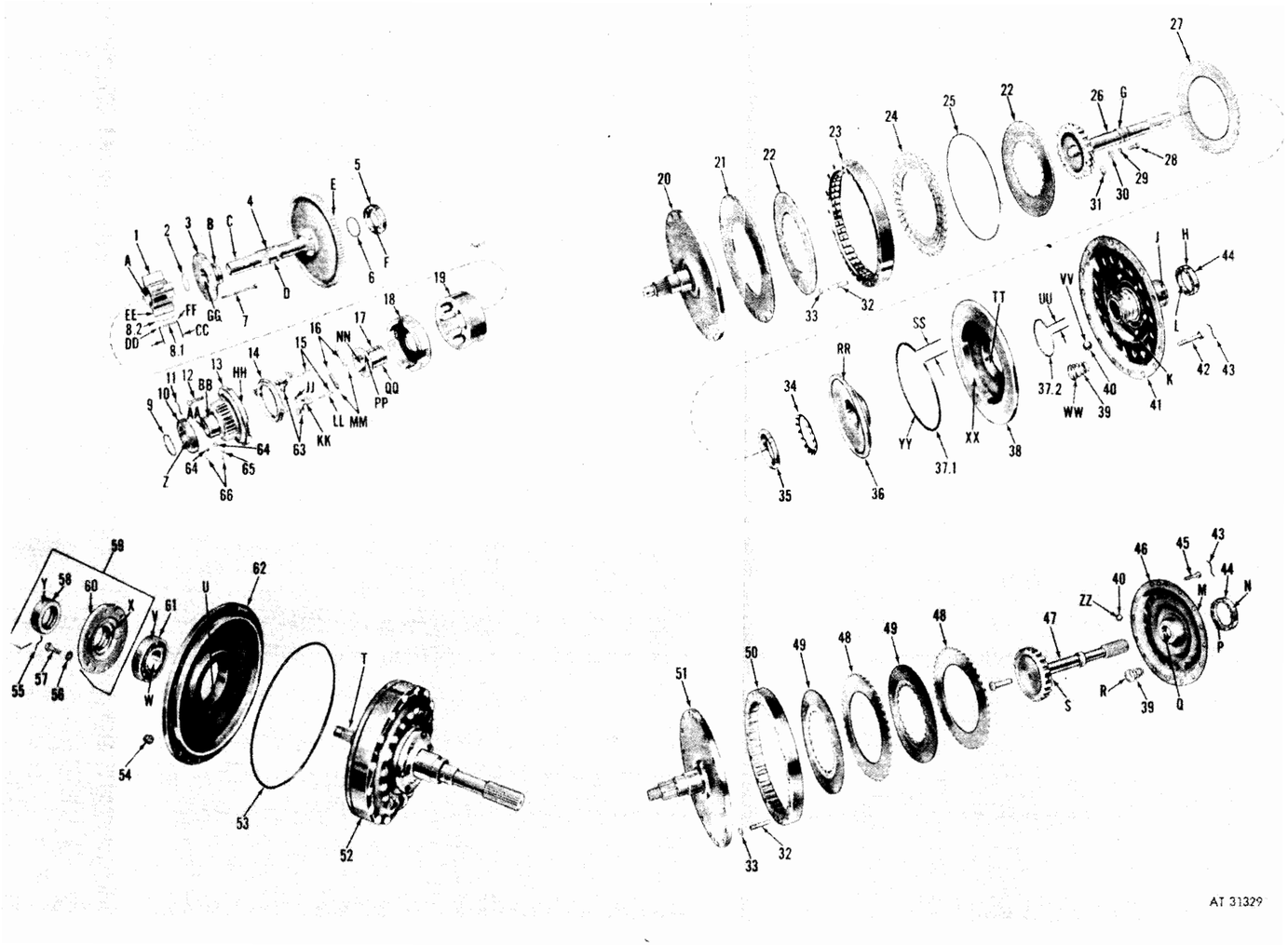


Figure B-27. Automatic Injection Advance Assembly, Fan Drive Clutch Assembly and Associated Parts—Exploded View.

FIGURE B-28

GROUP NO	ITEM NO
0601	ALL

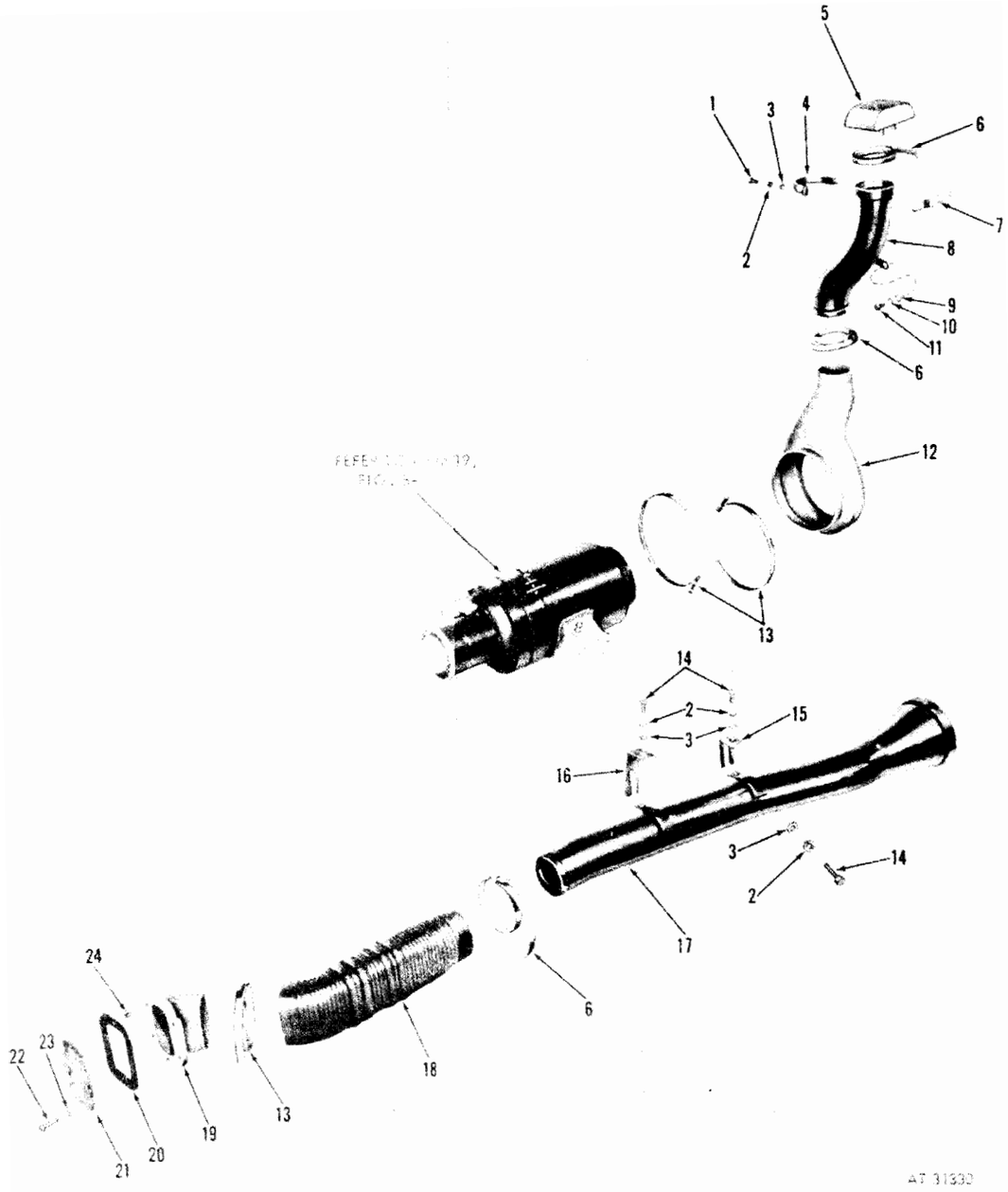


Figure B-28. Generator Exhaust Tube, Boot and Associated Parts—Exploded View.

FIGURE B-29

GROUP NO.	ITEM NO.
2604	ALL

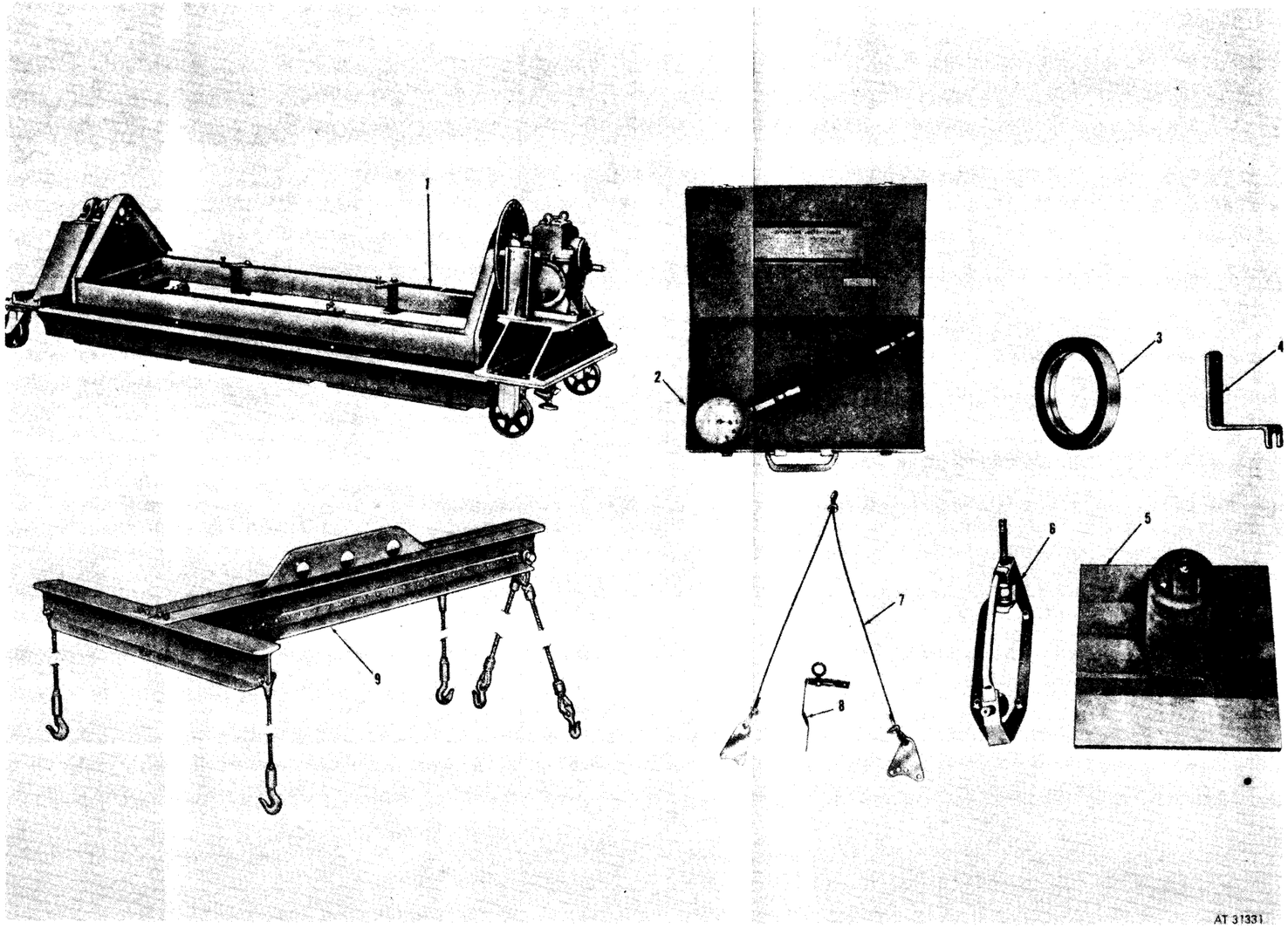


Figure B-29. Special Tools.

FIGURE B-30

GROUP NO	ITEM NO
2604	ALL

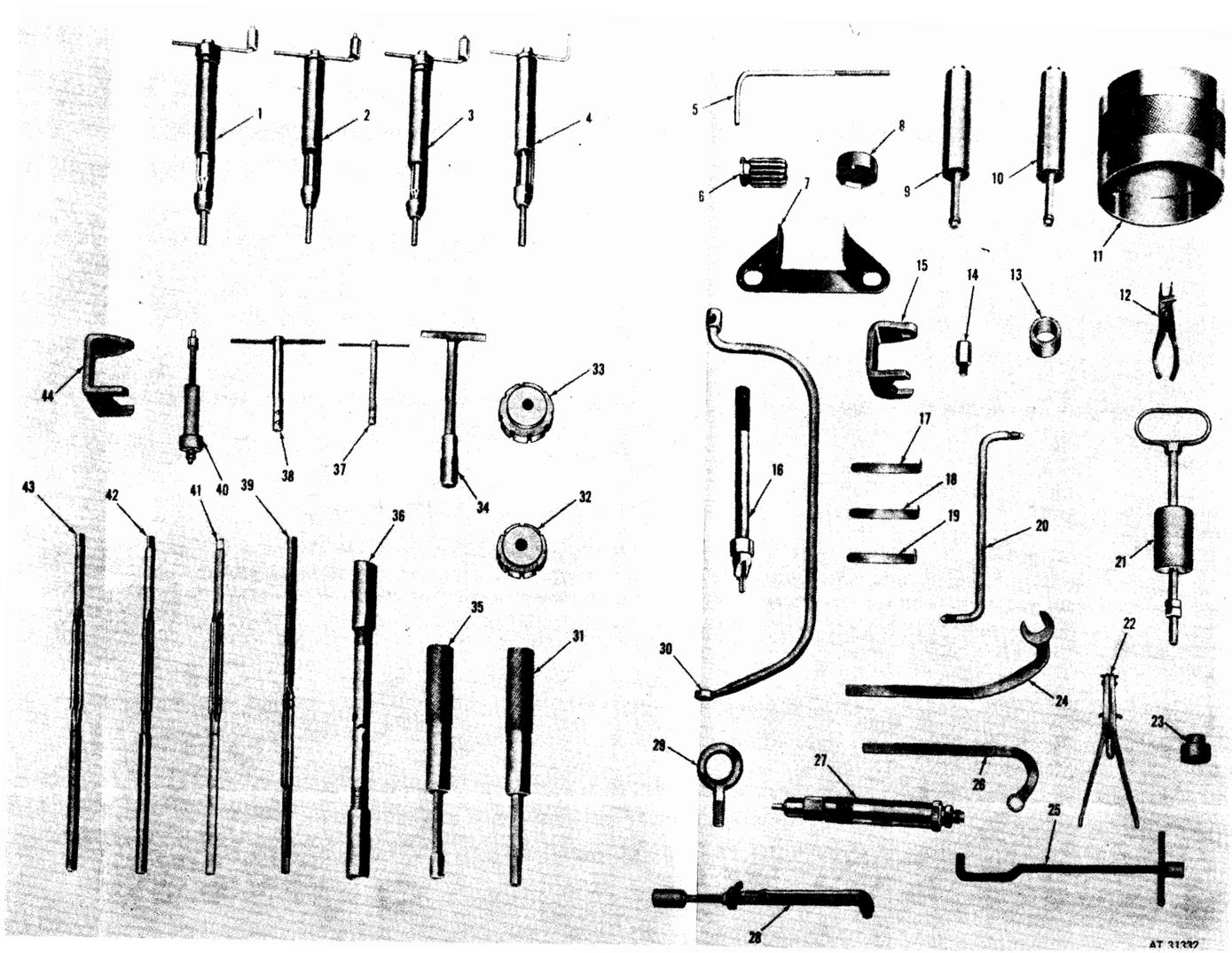


Figure B-30. Special Tools.

FIGURE B-31

GROUP NO.	ITEM NO.
2604	ALL

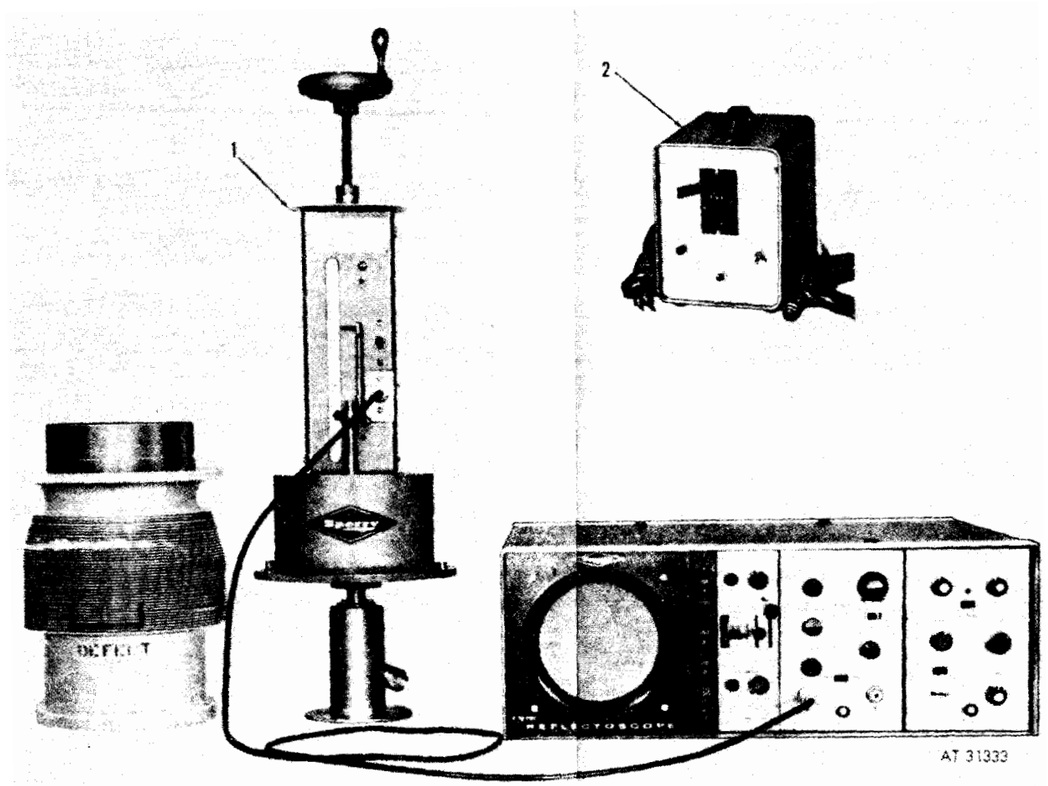


Figure B-31. Test Equipment.

FIGURE B-32

GROUP NO	ITEM NO
3301	ALL

Figure B-32. Reusable Shipping Container—Exploded View.

By Order of the Secretary of the Army:

W. C. WESTMORELAND,
General, United States Army,
Chief of Staff.

Official:

KENNETH G. WICKHAM,
Major General, United States Army,
The Adjutant General.

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THE METRIC SYSTEM AND EQUIVALENTS

'NEAR MEASURE

. 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

'VEIGHTS

Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
1 Kilogram = 1000 Grams = 2.2 lb.
1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inches
1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet
1 Sq. Kilometer = 1,000,000 Sq. Meters = 0.386 Sq. Miles

CUBIC MEASURE

1 Cu. Centimeter = 1000 Cu. Millimeters = 0.06 Cu. Inches
1 Cu. Meter = 1,000,000 Cu. Centimeters = 35.31 Cu. Feet

TEMPERATURE

5/9(°F - 32) = °C
212° Fahrenheit is evuivalent to 100° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
32° Fahrenheit is equivalent to 0° Celsius
9/5C° + 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
ıts	Liters	0.473
arts	Liters	0.946
allons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
ers	Gallons	0.264
ms	Ounces	0.035
ograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pounds-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
lometers per Liter	Miles per Gallon	2.354
meters per Hour	Miles per Hour	0.621

