PART 2

OVERHAUL INSTRUCTIONS

PART 2

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont)

LIST OF ILLUSTRATIONS

LIST OF TABLES

PART 2

OVERHAUL INSTRUCTIONS

SECTION I
INTRODUCTION AND GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. Part 2 of this manual covers overhaul instructions for the Model 1M750PVC, Four-Wheel Trailer Mounted, Diesel Engine Driven, 750 CFM, 100 PSI, Rotary Air Compressor manufactured by Davey Compressor Company. Part number 64945 has been assigned to the unit. Refer to Part 1, figure 1-1 for an identifying view. Instructions contained in this Part are for the guidance of personnel responsible for the overhaul of the equipment. Operation and Maintenance Instructions are contained in Part 1 and an Illustrated Parts Breakdown is found in Part 3.

1-3. This Part 2 is divided into sections providing the overhaul personnel with detailed instructions for the disassembly, cleaning, inspection, repair or replacement, assembly, and testing of the unit components and final assembly. Part 3 is referenced throughout and shall be used to identify components and detail parts. A table of contents for Part 2 is provided for ready reference in locating text topics, illustrations, and tables.

1-4. GENERAL INFORMATION.

1-5. Refer to Part 1, Sections I through V, for description of components, leading particulars, preparation for use and shipment, operation instructions, and maintenance of the Model 1M750PVC, Rotary Air Compressor unit.

NOTE

Illustrations contained in Part 3 of this manual and referenced in Part 2, are indexed in order of disassembly except attaching parts for an item or component follows immediately the part they attach and are coded with the abbreviation (AP) in the description column. Where disassembly is such that following the index numbers cannot be accomplished, supplementary text is provided in this Part in step-by-step procedures. Assembly is generally in the reverse of disassembly. Likewise, if assembly cannot be accomplished by following the reverse index number order, step-by-step procedures are provided.

1-6. SPECIAL TOOLS AND TEST EQUIPMENT.

1-7. There are no special tools or test equipment required for the overhaul of the Model 1M750PVC, Rotary Air Compressor unit.

SECTION II
DISASSEMBLY, CLEANING, INSPECTION, REPAIR OR REPLACEMENT, AND ASSEMBLY

2-1. PRELIMINARY PROCEDURES.

2-2. Prior to overhaul, the following procedures shall be followed.

a. Set the parking brakes by actuating the parking brake hand lever.

b. Disconnect the battery cables from the batteries.

c. Remove the batteries from the unit and store in a heated storage area. See figure 2, Part 3, for details.

WARNING

Never attempt to disassemble any part of the air compressor without first relieving all air pressure from the entire system.

d. Make certain that all air pressure is relieved from the air system by opening the air service valves.

e. Place a container under the radiator drain, loosen radiator cap, open radiator drain and drain off coolant. Place container under the engine, remove engine block drain plug and drain coolant from engine. Close drains after coolant flow stops.

f. Place a container under engine, remove oil pan drain plug and drain lubricating oil from engine. Install drain plug when oil flow stops.

g. Place a container under the oil separator tank, remove separator drain plug and drain compressor lubricating oil from tank. Install drain plug when oil flow stops.

h. Place a container under fuel tanks, loosen fillercaps, remove drain plugs and drain fuel from the tanks. Install drain plugs when fuel flow stops.

2-3. GENERAL CLEANING.

2-4. Clean all disassembled metal parts using a cleaning solvent that is in accordance with Federal Specification P-D-680, or equivalent. Wipe nonmetallic parts with a clean, lint-free cloth moistened with this solvent and air dry. Specific cleaning of components which differs from this general cleaning method is contained in paragraphs pertaining to that component.

WARNING

Provide a well ventilated area for cleaning with solvents or other chemicals. Repeated or prolonged inhalation of solvent fumes can cause illness or death. When cleaning or air drying with compressed air, the air pressure must not exceed 30 psi at the air nozzle to avoid injury.

NOTE

The manufacturer recommends the replacement of gaskets and preformed packing (o-rings) at overhaul; therefore, no cleaning of these parts is covered by this manual.

2-5. PAINTED SURFACES. After cleaning, all painted surfaces requiring paint touch-up should have applied pretreatment primer in accordance with Military Specification MIL-P-15328, or equivalent. Application should be in accordance with MIL-T-704. After pretreatment, apply one coat of a commercial grade red oxide primer, or equivalent. Finish paint shall be Color Number 14064, Green, per Federal Standard 595.

2-6. INSPECTION, REPAIR, OR REPLACEMENT.

2-7. Refer to tables 2-1, 2-2, and 2-3 of this Part 2 for inspection, repair or replacement, table of limits, and spring data. Inspection, Repair, or Replacement not covered in these tables will be found in the applicable text portion of Disassembly and Assembly or in Section III, Testing.

2-8. DISASSEMBLY AND ASSEMBLY.

2-9. MAJOR COMPONENTS (figure 1, Part 3). Disassembly and assembly procedures in this paragraph cover the unit-major components. Disassembly and assembly of these components is covered in detail in subsequent paragraphs. Disassembly should be limited to the extent necessary to overhaul a given component requiring repair or replacement.

a. Discharge Service Valves and Piping. Unscrew and

Table 2-1. Inspection, Repair, or Replacement

COMPONENT	INSPECTION	REPAIR OR REPLACEMENT
Battery cables and batteries (figure 2)	a. Inspect battery cable clamp terminals for corrosion and tightness on battery terminals.	a. Remove corrosion with a solvent or wire brush and lubricate with MIL-L-7866 grease. If clamp terminals do not make tight connection, replace terminal.
	b. Inspect cables for evidence of burning and insulating cover breaks.	b. Replace all defective cables.
	c. Inspect batteries for loose terminals, missing cell caps, and cracks in case.	c. Replace missing cell caps. Replace batteries that have loose terminals or cracked cases.
Air cleaner assemblies (figure 3)	a. Inspect element for enlarged holes and rupture.	a. Replace a damaged element.
	b. Inspect unloader for tears, hardening, and deterioration.	b. Replace damaged unloader.
Damper valve assembly (figure 4)	a. Inspect damper valve for any distortion and bending of shaft.	a. Replace the damper valve and shaft if damaged.
	b. Inspect the detent spring. Refer to table 2-2.	b. Replace defective spring.
Compressor oil filter (figure 5)	a. Inspect element for any cracks or other defect.	a. Replace a damaged element.
	b. Inspect tube connectors, tube, and fittings for damaged threads and leakage.	b. Replace all defective parts.
Thermal bypass valve (figures 6, 7)	a. Inspect tube connectors, tubes, and fittings for damaged threads and leakage.	a. Replace all defective parts.
	b. Inspect power element for distortion, jamming, or any other defect.	b. Replace a faulty power element.
	c. Inspect springs for broken coils. Refer to table 2-2.	c. Replace defective springs.
Radiator and oil cooler (figures 8, 9)	a. Inspect oil cooler for leakage in accordance with paragraph 2-18.	a. Repair oil cooler leaks by soldering or brazing. If damaged beyond this repair, replace the cooler.
	b. Inspect radiator for leakage in accordance with paragraph 2-18.	b. Repair radiator leaks by soldering or brazing. If damaged beyond this repair, replace necessary component of radiator assembly (figure 9).

Table 2-1. Inspection, Repair, or Replacement (Cont)

COMPONENT	INSPECTION	REPAIR OR REPLACEMENT
Air compressor (figure 17)	a. Inspect all springs for broken coils and distortion. Refer to table 2-2.	a. Replace defective springs.
	b. Inspect intake control diaphragm for rupture and deterioration.	b. Replace a damaged diaphragm.
	c. Inspect intake valve for cracks, distortion, and condition of seat.	c. Replace a damaged intake valve.
	d. Inspect rotor blades for breaks, chips, and wear. Refer to table 2-3.	d. Replace damaged or worn blades.
	e. Inspect rotor and stator for cracks, raised metal, such as burrs, and for wear. Inspect rotor blade slots for any burrs and chipping. Refer to table 2-3.	e. Raised metal (burrs) may be removed with a metal scraper; then, smooth the surface with emery cloth.
	f. Inspect bearings for freedom of rotation, wear, and any other defect. Refer to table 2-3.	f. Replace defective bearings. Refer to paragraph 2-27 for disassembly.
	g. Inspect rotor shaft for journal wear and concentricity. Refer to table 2-3.	g. Replace damaged shaft.
Instrument panel (figure 18)	a. Inspect all wires for damaged insulation and tightness of terminal connections. Inspect wires for evidence of shorts and burning.	a. Tighten connections as required. Damaged insulation may be repaired by wrapping with insulation tape, MIL-I-15126. If wires show evidence of shorts and burning, replace wire assembly.
	b. Inspect all gauges for loose mounting and broken faces.	b. Tighten mounting as required. Replace all damaged gauges.
	c. Inspect all gauges for proper function. Correct readings are: Engine RPM: 1200 idle - 2100 full load Oil Pressure: 45-55 PSI at 2100 RPM Water Temperature: 170°F - 190°F Air Pressure: 80-105 PSI loaded 115-120 PSI unloaded	c. Replace all gauges which do not function properly.
	d. Inspect all hoses for deterioration, condition of threads, and leaking connections.	d. Replace all defective hose assemblies.
	e. Inspect control cables for kinks and breaks.	e. Replace defective control cables.

Table 2-1. Inspection, Repair, or Replacement (Cont)

COMPONENT	INSPECTION	REPAIR OR REPLACEMENT
Air line system (figure 10)	a. Inspect all air line hose assemblies for deterioration, damaged threads, and connection leakage.	a. Replace all damaged hose assemblies and fittings with damaged threads.
	b. Inspect the element of strainer assembly for clogging of mesh and damage.	b. Replace element if damaged. If clogged, clean in solvent, Specification P-D-680.
Fuel line system (figure 11)	a. Inspect all fuel hose assemblies for deterioration, damaged threads, and connection leakage.	a. Replace all damaged hose assemblies and fittings with damaged threads.
Oil separator assembly (figure 12)	a. Inspect non-return valve for worn facing washer, bent stem, and free movement in bore of piston.	a. Replace any defective part of non-return valve (figure 15).
	b. Inspect piston for any nicks that may cause binding in housing bore and for cracks.	b. Remove any raised portion or nicks with a metal scraper. Remove minor scratches with fine emery cloth. Replace piston if other defects are noted.
	c. Inspect non-return valve spring for broken coils and distortion. Refer to table 2-2.	c. Replace defective spring.
	d. Inspect oil separator element for enlarged holes, rupture, or any other defect.	d. Replace a damaged element.
Air pressure regulator (figure 13)	a. Inspect diaphragm for cuts, tears, and deterioration.	a. Any defect is cause for replacement.
	b. Inspect springs for broken coils and distortion. Refer to table 2-2.	b. Replace defective springs.
	c. Inspect valve and seat for any evidence of wear and burring.	c. Replace these components if defect is in evidence.
Blowdown valve (figure 14)	a. Inspect spring for broken coils and distortion. Refer to table 2-2.	a. Replace defective spring.
	b. Inspect piston for burrs that may cause sticking in bore of body.	b. Remove burrs with metal scraper and smooth surface with emery cloth. Any other defect is cause for replacement of defective component.
Speed control linkage (figure 16)	a. Inspect springs for broken coils and distortion. Refer to table 2-2.	a. Replace defective springs.
	b. Inspect control rods for bending and condition of threads.	b. Replace defective control rods.

Table 2-1. Inspection, Repair, or Replacement (Cont)

COMPONENT	INSPECTION	REPAIR OR REPLACEMENT
Cold weather starting aid (figure 19)	a. Inspect tubing for kinks and leakage at connections.	a. Replace tubing if kinked or otherwise defective.
	b. Inspect valve assembly actuating arm for freedom of movement when QUICK START control cable is actuated.	b. With fuel cylinder removed, apply 3 to 5 drops of engine oil around the pusher pin within the valve assembly opening. Apply a few drops of oil on the actuating cable. Actuate the control cable a few times to distribute oil through the valve assembly. If actuating arm of valve assembly does not function easily, replace the valve assembly.
Primary fuel filter (figure 22)	a. Inspect element for damage.	a. Replace element if damaged.
	b. Inspect stud and body threads for cross-threading.	b. If threads can not be repaired by chasing, replace damaged parts.
Overspeed switch (figure 20)	a. Inspect transmitter for breaks in transmitting cable and cross-threading of end connections.	a. Replace a damaged transmitter and cable.
	b. Inspect wiring harness for worn insulation and evidence of shorts and burning.	b. Repair worn insulation by wrapping with insulation tape, MIL-I-15126. Replace harness that shows evidence of shorting and burning.
	c. Inspect reset switch for proper operation.	c. Any defect in operation of overspeed switch is cause for replacement of the switch assembly.
Starting motor (figure 24)	a. Inspect brushes for cracks, chips, excessive wear, or any other defect.	a. Replace brush set if any defect is found.
	b. Inspect bearings for wear, scoring, pitting, freedom of rotation or any other defect.	b. Replace any defective bearing.
	c. Inspect brush springs and arms for cracks, breaks, distortion, or any other defect.	c. Replace defective springs.
	d. Inspect commutator for rough spots, discoloration, pitting, scoring, and high mica. Inspect commutator for out-of-round with a dial indicator. Out-of-round shall not exceed 0.001 inch total indicator reading.	d. If commutator is rough, pitted, or worn, turn commutator using a lathe. Take light cuts until all pits are removed. Remove burrs by holding No. 00 sandpaper lightly against commutator while armature is turning in lathe. Undercut mica after turning commutator. The mica must be undercut to a depth of 1/32 inch.

Table 2-1. Inspection, Repair, or Replacement (Cont)

COMPONENT	INSPECTION	REPAIR OR REPLACEMENT
Starting motor (figure 24) (Cont)	e. Inspect armature shaft for pitting, scoring, and wear.	e. Replace a damaged armature.
	f. Inspect drive for broken teeth on pinion.	f. Replace drive if teeth are broken or cracked.
	g. Check to see that clutch assembly moves on shaft and that pinion spring compresses. Slide drive on armature shaft to make certain splines fit properly.	g. Replace drive if spring is broken, if drive sticks on shaft, or if splines are damaged.
	h. Check solenoid for moving core operation, condition of sealing boot, and contact assembly and terminal studs for pitting and burning.	h. Replace a faulty solenoid assembly.
Alternator regulator (figure 25)	a. Inspect regulator connector leads for evidence of shorting and burning.	a. Replace the regulator if leads or connector are damaged.
	b. Check the operation of the regulator.	b. Replace a faulty regulator.
Alternator assembly (figure 26)	a. Inspect brush set for cracks, chips, and wear. Test in accordance with section III.	a. Replace brush set if length is less than 3/16 inch, if cracked, or if oil soaked.
	b. Inspect rear housing for stripped threads, broken casting, and bearing bore for severe wear.	b. Replace a damaged housing.
	c. Perform inspection test of rectifier diodes in accordance with section III.	c. Replace defective diode assembly.
	d. Perform inspection test of stator in accordance with section III.	d. Replace defective stator.
	e. Perform inspection test of rotor in accordance with section III.	e. Replace defective rotor.
	f. Inspect bearings for freedom of rotation and excessive wear.	f. Replace defective bearings.
Turbocharger (figure 29)	a. Inspect impeller and turbine wheel for cracks, chipping, blade distortion or any other defect. Refer to table 2-3.	a. Replace damaged parts.
	b. Inspect bearings for cracks and wear. Refer to table 2-3.	b. Replace defective bearings.
	c. Inspect shaft and wheel assembly for runout, cracks, roughness, ring groove and journal wear. Refer to table 2-3.	c. Replace shaft and wheel assembly if defect is found.

Table 2-1. Inspection, Repair, or Replacement (Cont)

COMPONENT	INSPECTION	REPAIR OR REPLACEMENT
Turbocharger (figure 29) (Cont)	d. Inspect housing bearing bores for wear and housing for cracks. Refer to table 2-3.	d. Replace housing if cracked or beyond acceptable limits.
Fuel injection lines and injection valve (figure 30)	a. Inspect each fuel injection line for crimping, leakage, and damaged threads in tubing nut.	a. Replace a damaged fuel line.
	b. Inspect tip of nozzle and orifice for excessive carbon.	b. Clean as necessary.
	c. Inspect orifice for erosion.	c. Replace nozzle assembly if defective.
Fan belts and fan drive (figure 32)	a. Inspect belts for fraying, cracks, and deterioration.	a. Replace belts.
	b. Inspect pulley for chipping and breaks.	b. Replace pulley if damaged.
	c. Inspect bearings for freedom of rotation and wear.	c. Replace defective bearings.
	d. Inspect hub for any cracks, breaks, and wear in bearing core.	d. Replace a damaged hub.
	e. Inspect shaft for scoring and wear.	e. Replace if defective.
Water pump (figure 33)	a. Inspect bearings for freedom of rotation, gritty operation, and wear.	a. Replace damaged bearing.
	b. Inspect shaft for any cracks, pitting and wear.	b. Replace defective shaft.
	c. Inspect gear and impeller for nicks, cracks, and breaks.	c. Replace damaged impeller or shaft.
	d. Inspect seal assembly, broken spring and seating wear.	d. Replace a defective seal assembly.
Flywheel and housing (figure 35)	a. Inspect drive bushings for cuts, nicks, and deterioration.	a. Replace all defective bushings.
	b. Inspect drive pins for bending and stripped threads.	b. Replace damaged drive pins.
	c. Inspect ring gear for chipped or broken teeth.	c. Replace ring gear.
Oil pan (figure 36)	a. Inspect pan for any cracks and damaged drain threads.	a. If pan is cracked, replace. If threads can not be repaired by chasing, replace pan.

Table 2-1. Inspection, Repair, or Replacement (Cont)

COMPONENT	INSPECTION	REPAIR OR REPLACEMENT
Oil pan (figure 36) (Cont)	b. Inspect oil level gage tube for distortion.	b. Replace tube if distorted.
Oil pump (figure 37)	a. Inspect bell assembly for broken screen and damaged tube.	a. Replace assembly if damaged.
	b. Inspect all gears for cracks, nicked and broken teeth, and shaft fit.	b. Replace all damaged gears.
	c. Inspect shafts for nicks, scoring, and wear. Refer to table 2-3.	c. Replace damaged or worn shafts.
	d. Inspect bearings for freedom of rotation and wear. Refer to table 2-3.	d. Replace damaged bearings.
	e. Inspect spring for cracks, breaks, and distortion. Refer to table 2-2.	e. Replace damaged spring.
Engine oil filter (figure 38)	a. Inspect for any leakage, deterioration, and damaged threads.	a. Replace all defective parts.
	b. Inspect relief valve spring for breakage and distortion.	b. Replace defective spring.
Oil filler (figure 39)	a. Inspect filler cap for cuts and deterioration of sealing portion.	a. Replace if defective.
	b. Inspect for proper sealing operation of handle.	b. Replace cap if action of handle does not seal filler opening.
Valve cover breather (figure 40)	a. Inspect hose for deterioration and breaks.	a. Replace a defective hose.
	b. Inspect hose clamps for breaks and tightening action.	b. Replace clamps if damaged.
	c. Inspect breather tube for dents and holes.	c. Straighten dents if possible. Replace tube if holes are found.
	d. Inspect breather assembly for torn or damaged element.	d. Replace breather if element is damaged.
Engine oil cooler (figure 41)	a. Inspect tube assemblies for dents and cracks.	a. Straighten dents if possible; otherwise, replace a damaged tube assembly.
	b. Inspect hose for breaks and deterioration.	b. Replace hose if damaged.
	c. Inspect hose clamps for breaks and tightening action.	c. Replace broken or defective clamps.

Table 2-1. Inspection, Repair, or Replacement (Cont)

COMPONENT	INSPECTION	REPAIR OR REPLACEMENT
Engine oil cooler (figure 41) (Cont)	d. Inspect oil cooler tubes for corrosion and scaling.	d. Clean tubes by carefully reaming or soaking in suitable solvent.
Fuel filter and priming tank (figure 42, 43)	a. Inspect tube assemblies for crimping and leaks.	a. Replace tube assemblies if crimped or leaking.
	b. Inspect fittings for damaged threads.	b. Replace all damaged fittings.
	c. Inspect bypass valve spring for broken coils and distortion.	c. Replace a damaged spring.
	d. Inspect plunger for nicks and cracks.	d. Replace damaged plunger.
	e. Inspect bypass valve bore in tank cover for nicks and scratches.	e. Smooth bore with emery cloth. If nicks and scratches can not be removed in this manner, replace tank cover.
Service meter and tachometer drive (figure 44)	a. Inspect meter window for cracks and breaks.	a. Replace window.
	b. Inspect teeth on both shaft assemblies for nicks and cracks.	b. Replace shaft assembly if damaged.
	c. Inspect meter assembly for rotation ease when shafts are turned.	c. If meter binds, replace meter assembly.
Fuel transfer pump (figure 45)	a. Inspect all gears for chipped or cracked teeth.	a. Replace all damaged gears.
	b. Inspect shaft for cracks, distortion, and wear. Refer to table 2-3.	b. Replace a damaged shaft.
	c. Inspect bearings for freedom of rotation and wear. Refer to table 2-3.	c. Replace binding or worn bearings.
	d. Inspect sealing surfaces of seals for nicks and deterioration.	d. Replace all damaged seals.
	e. Inspect sealing faces between cover and body for any nicks and scratches that would cause leakage.	e. Remove nicks and scratches with emery cloth. If leakage occurs, replace damaged part.
Accessory drive (figure 46)	a. Inspect all gears for nicked, cracked, or broken teeth.	a. Replace all damaged gears.
	b. Inspect bearings for freedom of rotation, gritty action, and wear. Refer to table 2-3.	b. Replace damaged bearings.

Table 2-1. Inspection, Repair, or Replacement (Cont)

COMPONENT	INSPECTION	REPAIR OR REPLACEMENT
Accessory drive (figure 46) (Cont)	c. Inspect shaft for cracks, damaged splines, wear, and distortion. Refer to table 2-3.	c. Replace a damaged shaft.
Fuel injection pump (figure 47)	a. Inspect discharge bonnet for damaged threads, cracks, and distortion.	a. Replace all damaged discharge bonnets.
	b. Inspect spring for broken coils and distortion. Refer to table 2-2.	b. Replace all broken springs.
	c. Inspect retaining rings, check valves, plunger and barrel, and washers for cracks, distortion, or any other defect. Measure length of plunger for wear. Refer to table 2-3. Inspect end of plunger which makes contact with lifter.	c. Replace all damaged parts. NOTE When a plunger is replaced, it is necessary to replace associated fuel pump lifter assembly.
Fuel injection pump housing (figure 47)	a. Inspect fuel injection pump lifters for cracks, breaks, distortion, or any other damage.	a. Replace damaged lifters. NOTE When a lifter is replaced, it is necessary to replace the associated fuel injection pump plunger.
	b. Inspect fuel rack for damaged threads, cracks, and distortion.	b. Replace damaged rack.
	c. Inspect fuel rack bearings for cracks, wear. Refer to table 2-3.	c. Replace defective bearings.
	d. Inspect camshaft for cracks, distortion, or any other defect.	d. Replace damaged camshaft.
	e. Inspect camshaft bearings for cracks, breaks, and wear. Refer to table 2-3.	e. Replace defective bearings.
	f. Inspect gear for cracked and broken teeth.	f. Replace damaged gear.
Governor assembly (figure 47)	a. Inspect all thrust and sleeve bearings for scoring, cracks, and distortion.	a. Replace all defective thrust and sleeve bearings.
	b. Inspect all springs for broken coils and distortion. Refer to table 2-2.	b. Replace all defective springs.
	c. Inspect weights for sticking on pins.	c. Replace weights or pins as necessary.
	d. Inspect weight assembly piston and valve for cracks, distortion, or any other defect.	d. If either piston or valve is defective, replace both with a matched new set.

Table 2-1. Inspection, Repair, or Replacement (Cont)

COMPONENT	INSPECTION	REPAIR OR REPLACEMENT
Governor assembly (figure 47) (Cont)	e. Inspect gear for cracked or broken teeth.	e. Replace damaged gear.
	f. Inspect all shafts for distortion, out-of-round, and score marks.	f. Replace damaged shafts.
	g. Inspect insulators for cracks and breaks.	g. Replace damaged insulators.
	h. Inspect all parts for cracks, breaks, damaged threads, and distortion.	h. Replace all defective parts.
Glow plug wiring and valve cover (figure 48)	a. Inspect cable assembly for broken, frayed, or deteriorated insulation.	a. Insulation may be repaired by wrapping with insulation tape, MIL-I-15126. If not repairable, replace the cable assembly.
	b. Inspect each glow plug connector for corrosion and crimping.	b. It is recommended that wire assembly be replaced if connectors are damaged.
	c. Inspect valve cover for dents and distortion around gasket sealing face.	c. Straighten any dents if sealing area is not affected. If sealing to head is affected, replace cover.
Rocker arms and push rods (figure 49, sheet 1 of 2)	a. Inspect rocker arms for any cracks or breaks.	a. Replace all damaged rocker arms.
	b. Inspect springs for broken coils and distortion. Refer to table 2-2.	b. Replace defective springs.
	c. Inspect bearing bores for excessive wear. Refer to table 2-3.	c. Replace worn bearings.
	d. Inspect rocker arm shaft for wear and distortion. Refer to table 2-3.	d. Replace a damaged shaft.
	e. Inspect push rods for cracks and bending.	e. Replace defective push rods.
	f. Inspect valve lifters for cracks, wear, and any other defect. Refer to table 2-3.	f. Replace all defective valve lifters.
Cylinder head (figure 49, sheet 2 of 2)	a. Inspect temperature regulator for proper operation in accordance with figure 5-42, Part 1.	d. Replace defective regulator.
	b. Inspect glow plugs and precombustion chamber for damaged threads, distortion, or any other defects.	b. Replace all damaged glow plugs and precombustion chambers.

Table 2-1. Inspection, Repair, or Replacement (Cont)

COMPONENT	INSPECTION	REPAIR OR REPLACEMENT
Cylinder head (figure 49, sheet 2 of 2) (Cont)	c. Inspect valve springs for broken coils and distortion. Refer to table 2-2.	c. Replace all defective valve springs.
	d. Inspect valves and valve seats for pitting, excessive wear, and bending of stem. Refer to table 2-3.	d. Repair or replace defective parts.
	e. Inspect valve guides for cracks and excessive wear. Refer to table 2-3.	e. Replace guide if cracked or worn beyond limits.
	f. Inspect cylinder head for any cracks stripped threads, and distortion.	f. Replace a damaged cylinder head.
Camshaft, bearings, and gear (figure 50)	a. Inspect gear for cracked or broken teeth.	a. Replace damaged gear.
	b. Inspect thrust plate for cracks, scoring, and wear. Refer to table 2-3.	b. Replace damaged or worn plate.
	c. Inspect camshaft for cracks, chipping, and journal wear. Refer to table 2-3.	c. Replace damaged or worn camshaft.
Connecting rods, pistons, and rings (figure 51)	a. Inspect pistons for excessive wear, burned condition, cracks, or other defect. Refer to table 2-3.	a. Replace damaged pistons.
	b. Inspect piston pins and bearings for scoring, galling and wear. Refer to table 2-3.	b. Replace pins and bearings as necessary.
	c. Inspect connecting rods and caps for cracks, breaks, and distortion. Check bearing bore and center-to-center distance. Refer to table 2-3.	c. Replace defective connecting rods.
	d. Inspect connecting rod bearings for scoring and pitting and for wear. Refer to table 2-3.	d. Replace connecting rod bearing halves in sets only.
	e. Inspect piston rings for cracks, breaks, and excessive wear. Refer to table 2-3 for wear limits.	e. Replace all defective rings.
Crankshaft and bearings (figure 52)	a. Inspect crankshaft seals for cut or deteriorated sealing surfaces.	a. Replace defective seals.
	b. Inspect crankshaft gear for cracked or broken teeth.	b. Replace crankshaft gear when damaged.

Table 2-1. Inspection, Repair, or Replacement (Cont)

COMPONENT	INSPECTION	REPAIR OR REPLACEMENT
Crankshaft and bearings (figure 52) (Cont)	c. Inspect main bearings for burrs, high spots, cracks, and excessive wear. Refer to table 2-3.	c. Replace defective main bearing halves as a set.
	d. Inspect crankshaft for cracks, scored and rough journals. Check journal diameters. Refer to table 2-3.	d. Replace a damaged crankshaft. NOTE: Rough, worn, or scored journals may be ground to 0.010, 0.020, or 0.030 inch undersize and used with matching main bearings.
Cylinder block, cylinder liners, and main bearing caps (figure 53)	a. Inspect cylinder liners for cracks, scoring, and excessive wear. Refer to table 2-3 for wear limits and check points.	a. Replace damaged liners.
	b. Inspect all covers for cracks, damaged sealing surfaces, or other defect.	b. Replace all damaged covers and gaskets.
	c. Inspect cylinder block for cracks, breaks, leaking freeze plugs, or other defect.	c. Replace leaking freeze plugs. Replace block if cracked or broken.
	d. Check cylinder bores for out-of-round and liner counterbore diameter. Refer to table 2-3. Check main bearing bore.	d. If block critical dimensions are beyond limits, replace block.
Front axle (figure 54)	a. Inspect center arm hinge pin for cracks, distortion and wear.	a. Replace damaged hinge pin.
	b. Inspect steering knuckle for any cracks or breaks. Check hinge pin hole diameter.	b. Replace damaged steering knuckle and spindle assembly.
	c. Inspect spindles for cracks, damaged threads, and excessive wear.	c. Replace damaged steering knuckle and spindle assembly.
	d. Inspect wheel bearings for freedom of rotation, gritty action, and wear.	d. Replace defective bearings.
	e. Inspect spindle seals for cut or deteriorated sealing surfaces.	e. Replace damaged seals.
	f. Inspect hubs for cracks and bearing bore wear.	f. Replace damaged hubs.
	g. Inspect tie rods for cracks, bends, and damaged threads.	g. Replace if damaged.

Table 2-1. Inspection, Repair, or Replacement (Cont)

COMPONENT	INSPECTION	REPAIR OR REPLACEMENT
Front axle (figure 54) (Cont)	h. Inspect springs for broken leaves and broken shackle bushings.	h. Replace spring if broken.
	i. Inspect spring shackles and axle beam for cracks and breaks.	i. Replace defective parts.
Parking brake and rear axle (figure 55)	a. Inspect parking brake lever for any cracks, breaks, and binding.	a. Replace lever assembly if damaged. Adjust as necessary.
	b. Inspect parking brake cable assemblies for any kinks, breaks in cable, and damaged threads.	b. Replace a damaged cable assembly.
	c. Inspect sealing surface of seals for cuts and deterioration.	c. Replace damaged seals.
	d. Inspect bearings for freedom of rotation, gritty action, and wear.	d. Replace defective bearings.
	e. Inspect hub for cracks and bearing bore wear.	c. Replace damaged hub.
	f. Inspect brake drum for cracks, breaks, scoring, and scratches.	f. If damaged, replace drum.
	g. Inspect brake rigging yokes and shaft for cracks, breaks, and distortion.	g. Replace all damaged parts.
	h. Inspect springs for broken leaves and cracked shackle bushings.	h. Replace damaged springs.
	i. Inspect axle spindle for cracks, scoring, and wear. Inspect axle beam for cracks.	i. Replace axle beam and spindle assembly if damaged.
Brake assembly (figure 56)	a. Inspect all springs for broken coils and distortion.	a. Replace damaged springs.
	b. Inspect brake shoes for crack, distortion, and excessive lining wear.	b. Replace damaged brake shoe assemblies.
	c. Inspect strut for cracks, distortion, and deformation of end slots.	c. Replace damaged struts.
	d. Inspect brake lever for cracks and distortion.	d. Replace if damaged.

Table 2-1. Inspection, Repair, or Replacement (Cont)

COMPONENT	INSPECTION	REPAIR OR REPLACEMENT
Brake assembly (figure 56) (Cont)	e. Inspect push rod ends for any cracks and deformed slots.	e. Replace damaged push rods.
	f. Inspect cylinder assembly for cracks, damaged threads, and for free actuation.	f. Replace defective cylinder assembly.
	g. Inspect backing plate for cracks and distortion.	g. Replace damaged backing plate.
	h. Inspect all other parts for cracks, breaks, damaged threads, and distortion.	h. Replace all damaged parts.
Fuel tanks and main frame (figure 57)	a. Inspect fuel level sending unit ground wire for damaged terminals lugs and frayed insulation.	a. Insulation may be repaired by wrapping with insulation tape, MIL-I-15126. If wire strands are broken or lugs damaged, replace wire assembly.
	b. Inspect fuel level sending unit for bent float rod, damaged float, and any other defect.	b. Float rod may be straightened carefully. Replace if any other defect is detected.
	c. Inspect fuel tanks for cracked seams, damaged threads, missing filler caps, and any other defect.	c. Replace missing filler caps. Chase threads if possible to repair and replace plugs or fittings. Repair or replace fuel tanks as necessary.
	d. Inspect all felt strips for tearing, hardening, and missing pieces.	d. Replace felt strips as necessary.
	e. Inspect frame weldment and attached members for broken welds.	e. Repair frame and member weldments as necessary.

Table 2-2. Spring Data

FIG. & INDEX NO.	DESCRIPTION	TEST FORCE (LBS) (WHEN APPLICABLE) MIN	TEST FORCE (LBS) (WHEN APPLICABLE) MAX	LG UNDER TEST (IN.)	FREE LENGTH (IN.)	ACTIVE COILS	OD (IN.)
4-6	Damper detent spring				1	6	0.688
7-12	Relief valve spring				1-5/8	12	0.353
7-14	Shuttle spring		15	7/8	1-3/16	4-1/2	0.830
7-19	Plunger spring		24	11/16	1-1/16	6	0.642
12-26	Min press. valve spring				6-1/8	10	2.013
13-7	Press. regulator spring				2-3/8	5	1.125
14-2	Blowdown valve spring				1-3/8	6	0.500
16-3	Control rod spring				4-5/16	22	0.572
16-8	Return spring				7-3/8	110	0.467
16-29	Throttle rod spring				2	8	0.965
17-41	Piston spring				3	4	3.925
17-45	Guide spring				3-5/8	22	0.478
17-55	Relief spring				1	12	0.262
17-101	Relief spring				7/8	6	0.544
38-5	Bypass valve spring		8.92	2.5	3.61		0.81
42-15	Fuel bypass valve spring	3.00	3.32	1.03	1.88		0.70
47-44 sheet 1	Speed limiter spring	2.19	2.57	0.86	2.62		0.671
47-24 sheet 2	Fuel injection pump spring	14.6	16.2	1.39	1.59		0.979
49-16	Rocker arm shaft spring				4.00		
49-50	Valve spring	54.8	60.6	1.766	2.05		1.38

remove the service valves (1), manifold (2), close nipple (3), globe valves (4), close nipples (5), pipe cross (6), pipe nipple (7), and reducing bushing (8). Assemble in the reverse of above disassembly.

b. Remove the two air cleaner caps (9) and rain cap (10).

c. Loosen hose clamps (11, 12), remove hoses (13, 14, 15), and clamps (11, 12). Remove lock nut and cap screw securing adapter (16) to bulkhead and remove adapter (16). Remove the four cap screws and lock washers securing adapter (17) and damper control assembly (19) to compressor intake. Remove adapter (17), gaskets (18), and damper assembly (19) (see figure 4, Part 3, for damper control assembly details). Loosen clamp (20) and remove exhaust extension (21) and clamp (20).

d. Air Cleaner Assemblies (22, figure 1, Part 3). Remove the cap screws, lock washers, and flat washers (4 each per air cleaner assembly). Remove the air cleaners (22) from the unit. See figure 3, Part 3, for details. Assemble air cleaners on unit in reverse of disassembly.

e. Housing Assembly (23, figure 1, Part 3). Disassemble the housing components only to the extent necessary. See figure 1, sheet 2, Part 3 for details.

NOTE

Specific disassembly procedures applying to the housing assembly are not provided. Only those housing components providing access to a repairable item should be removed.

f. Compressor Oil Filter Group (24, figure 1, Part 3). Disconnect oil tube assembly from thermal bypass assembly (25). Remove the two cap screws and lock washers securing oil filter to compressor. Remove the oil filter group (24) from the unit and remove gasket from flange. See figure 5, Part 3, for details. Assemble in the reverse of disassembly.

g. Thermal Bypass Valve Group (25, figure 1, Part 3). Disconnect the oil tubes from the thermal bypass valve. Remove the two lock nuts and cap screws securing the thermal bypass valve to the frame. Remove the thermal

Table 2-3. Table of Limits

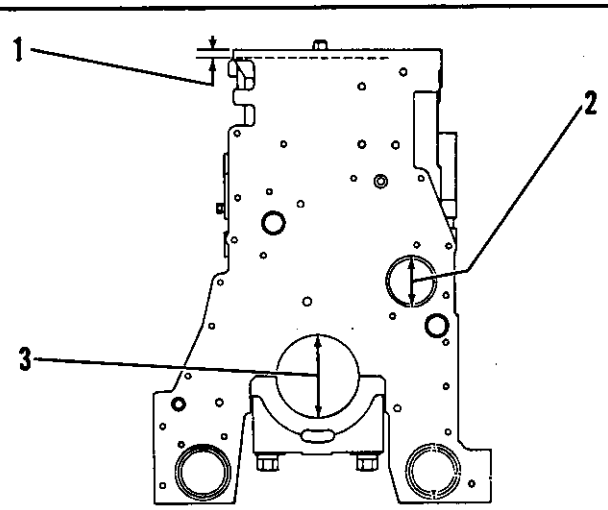
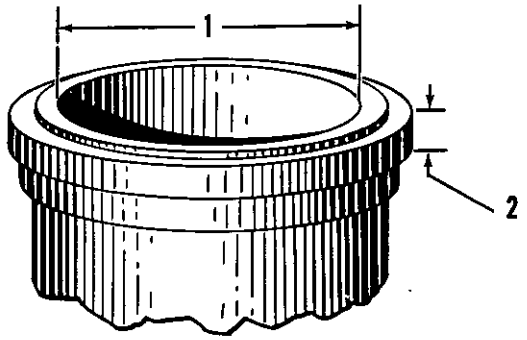
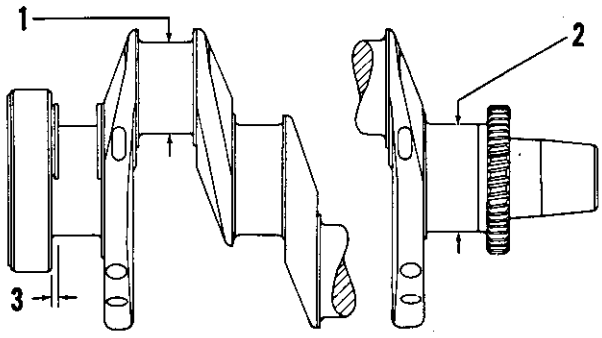
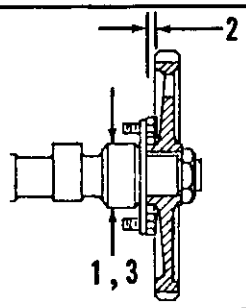
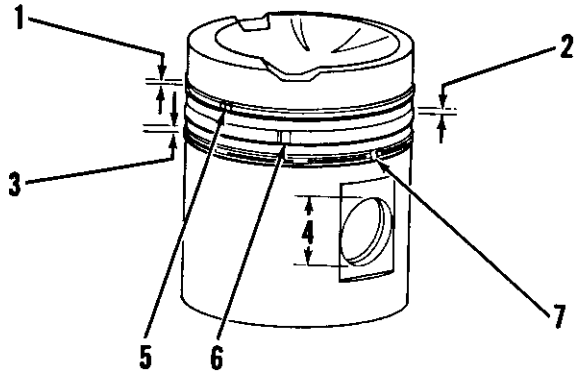
REF NO.	DESCRIPTION	
	ENGINE:	
	CYLINDER BLOCK	
1	Liner counterbore depth 0.400 in. min - 0.402 in. max	
2	Camshaft bearing bore 2.562 in. min - 2.564 in. max	
3	Main bearing bore 3.8155 in. min - 3.8165 in. max	
	CYLINDER LINER	
1	Inside diameter 4.750 in. min - 4.752 in. max Replacement 4.758 in. max	
2	Flange thickness 0.4040 in. min - 0.4056 in. max	
	Projection above block 0.0020 in. min - 0.0056 in. max	
	CRANKSHAFT	
1	Connecting rod journal dia 2.9984 in. min - 3.0000 in. max Replacement 2.992 in. dia	
	Connecting rod journal out-of-round Replacement 0.004 in. max	
2	Main bearing journal dia 3.4984 in. min - 3.5000 in. max Replacement 3.491 in. dia	
	Bearing clearance 0.0030 in. min - 0.0059 in. max Replacement 0.010 in. max	
3	End clearance 0.0025 in. min - 0.0145 in. max Replacement 0.025 in. max	
	CAMSHAFT	
1	Bearing journal dia 2.3105 in. min - 2.3115 in. max	
2	End clearance 0.004 in. min - 0.010 in. max Replacement 0.025 in. max	
3	Bearing clearance 0.002 in. min - 0.006 in. max Replacement 0.008 in. max	

Table 2-3. Table of Limits (Cont)

REF NO.	DESCRIPTION
	ENGINE (Cont):
	PISTON AND PISTON RINGS
1	Top ring and groove clearance 0.0028 in. min - 0.0046 in. max Replacement 0.006 in. max
2	Center ring and groove clearance 0.0023 in. min - 0.0041 in. max Replacement 0.006 in. max
3	Bottom ring and groove clearance 0.0015 in. min - 0.0033 in. max Replacement 0.006 in. max
4	Piston pin bore 1.7003 in. min - 1.7009 in. max Replacement clearance 0.002 in. max
5	Top ring end clearance 0.017 in. min - 0.033 in. max
6	Center ring end clearance 0.017 in. min - 0.033in. max
7	Bottom ring end clearance 0.013 in. min - 0.023 in. max
	(Increase clearance between ends of rings 0.003 in. for each 0.001 in. increase in cylinder liner bore, based on 4.750 in. nominal)



	CONNECTING ROD
1	Pin bearing bore 1.7009 in. min - 1.7015 in. max Replacement wear 0.003 in. max
2	Center distance 9.594 in. min - 9.596 in. max
3	Rod bearing bore 3.2495 in. min - 3.2505 in. max
4	Piston pin diameter 1.6996 in. min - 1.7000 in. max
5	Crankshaft bearing bore 3.002 in. min - 3.004 in. max Replacement wear 0.010 in. max
6	Cap nut torque 27 ft lb - 33 ft lb mark end of bolt and nut; tighten additional 90° from mark

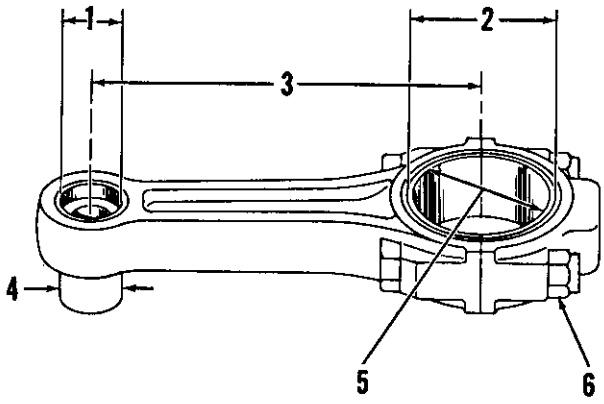
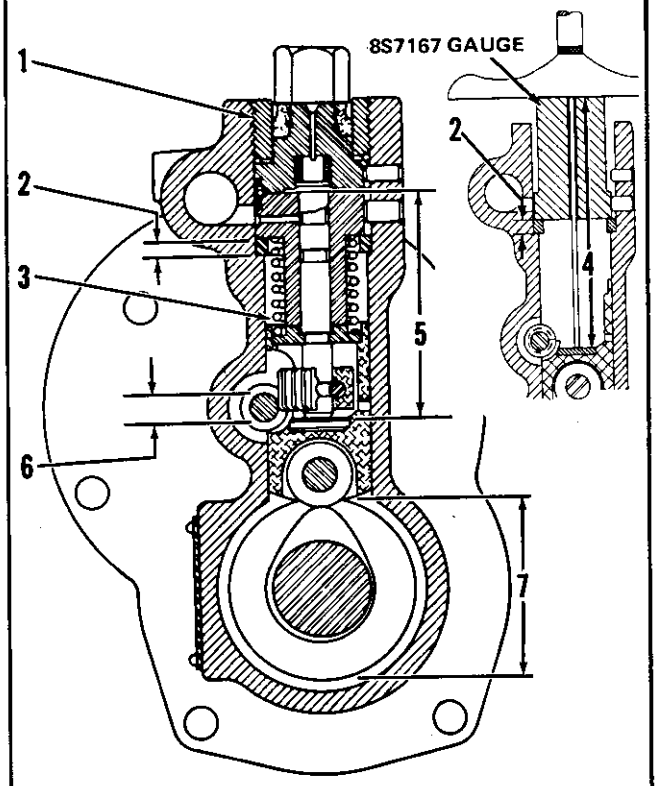


Table 2-3. Table of Limits (Cont)

REF NO.	DESCRIPTION
	ENGINE (Cont):
	FUEL INJECTION EQUIPMENT
1	Bushing torque 140 ft lb - 160 ft lb
2	Spacer thicknesses: 0.170, 0.174, 0.178, 0.182, 0.186, 0.190, 0.194, 0.198
3	Spring (see spring chart) 0.970 - 0.984 OD
4	Timing dimensions (with gage) OFF engine 4.2655 in. min - 4.2695 in. max ON engine 4.2159 in. min - 4.2199 in. max
5	Pump plunger length 2.5919 in. min - 2.5949 in. max Replacement 2.5869 in.
6	Rack front bearing bore 0.5008 in. min - 0.5038 in. max Rack rear bearing bore 0.5004 in. min - 0.5036 in. max Fuel rack diameter 0.4983 in. min - 0.4987 in. max Bearing clearance, wear 0.005 in.
7	Camshaft bearing bore 1.8750 in. min - 1.8760 in. max Bearing journal diameter 1.8725 in. min - 1.8735 in. max Bearing clearance, wear 0.010 in.
8	Fuel line nut torque 25 ft lb - 35 ft lb
9	Retaining nut torque 100 ft lb - 110 ft lb
10	Body (reference)
11	Glow plug torque 96 in. lb - 144 in. lb
12	Nozzle: tighten finger tight in body (10).
13	Precombustion chamber torque 140 ft lb - 160 ft lb



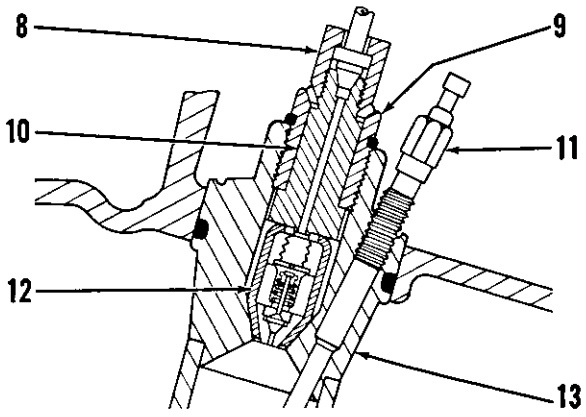
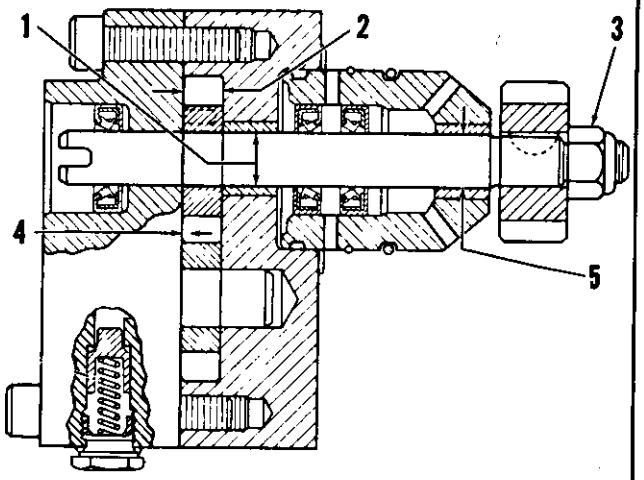
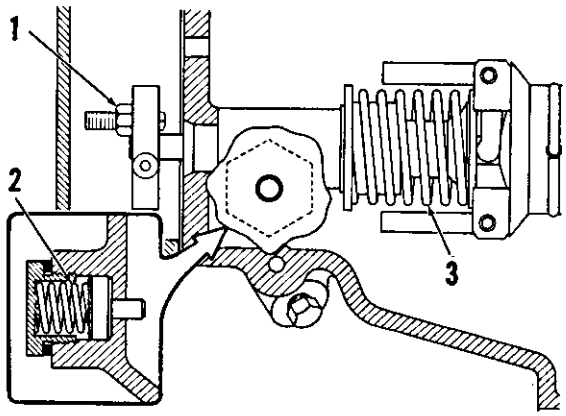


Table 2-3. Table of Limits (Cont)

REF NO.	DESCRIPTION	
	ENGINE (Cont):	
	FUEL TRANSFER PUMP	
1	Bearing bore	0.4950 in. min - 0.4956 in. max
2	Depth of bore in body	0.3747 in. min - 0.3753 in. max
3	Retaining nut torque	17 ft lb - 27 ft lb
4	Gear to cover clearance	0.001 in. min - 0.003 in. max Replacement wear 0.0035 in.
5	Shaft diameter	0.4936 in. min - 0.4938 in. max
	Bearing bore	0.4950 in. min - 0.4956 in. max
	Shaft and bearing clearance	Replacement wear 0.003 in. max
	GOVERNOR	
1	Nut torque	10 ft lb - 12 ft lb
2	Speed limiter spring (see spring chart)	0.671 OD max
3	Spring (see spring chart)	OD max
	Drive to driven gear backlash	0.000 in. min - 0.006 in. max
	WATER PUMP	
1	Impeller bolt torque	27 ft lbs - 29 ft lbs
	Impeller to housing clearance	0.010 in. min - 0.030 in. max





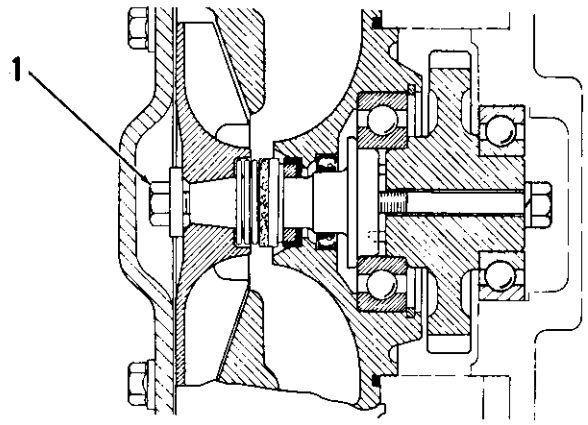
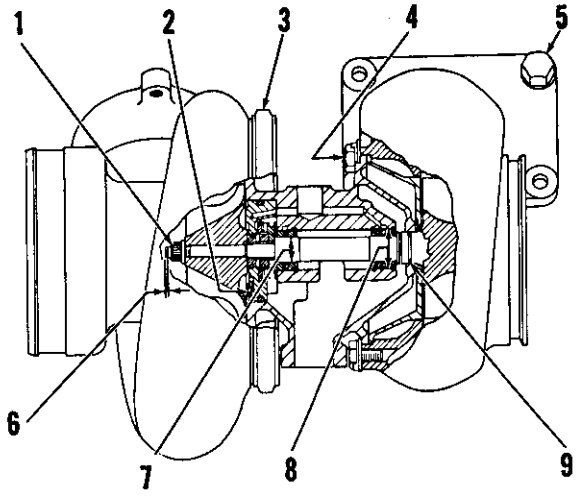


Table 2-3. Table of Limits (Cont)

REF NO.	DESCRIPTION
	ENGINE (Cont):
	TURBOCHARGER
1	Shaft nut torque (see torque table)
2	Thrust plate bolt torque 35 in. lb - 45 in. lb
3	Band clamp bolt torque 110 in. lb - 130 in. lb
4	Turbine housing bolt torque 160 in. lb - 190 in. lb
5	Mounting bolt torque 36 ft lb - 44 ft lb
6	Shaft end play 0.006 in. min - 0.011 in. max
7	Bearing bore 0.6268 in. min - 0.6272 in. max Shaft bearing journal 0.6250 in. min - 0.6254 in. max
8	Housing bore 0.9827 in. min - 0.9832 in. max Bearing outside dia 0.9780 in. min - 0.9785 in. max
9	Oil seal ring clearance between ends 0.008 in. min - 0.015 in. max



REF NO.	DESCRIPTION
	OIL PUMP
1	Drive shaft diameter 0.8745 in. min - 0.8749 in. max Replacement wear 0.005 in.
2	Gear to cover clearance 0.002 in. min - 0.004 in.max
3	Drive gear bolt torque 27 ft lb - 37 ft lb
4	Idler gear shaft diameter 0.8745 in. min - 0.8749 in. max Shaft to bearing wear 0.008 in.
5	Drive idler gear shaft dia 1.1220 in. min - 1.1230 in. max Shaft to bearing wear 0.008 in.

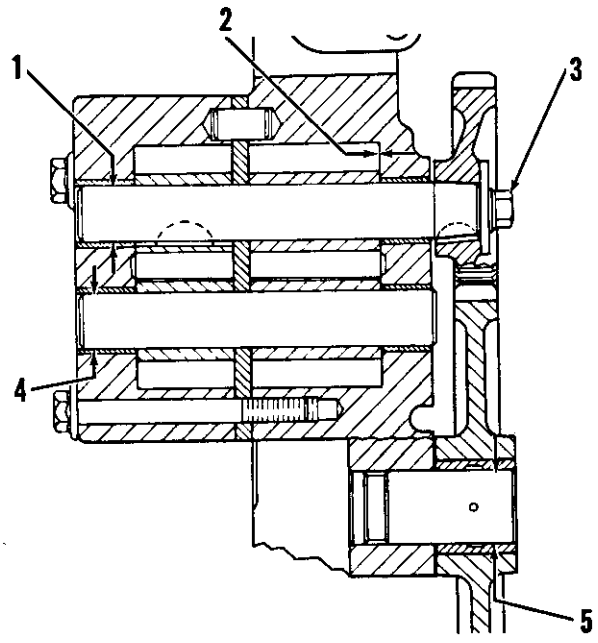
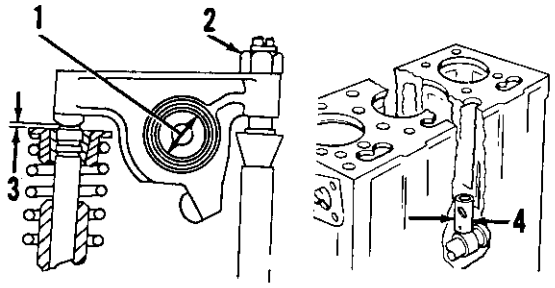


Table 2-3. Table of Limits (Cont)

REF NO.	DESCRIPTION	
	ENGINE (Cont):	
	VALVE ROCKER ARMS AND LIFTERS	
1	Bearing bore (new)	0.7258 in. min - 0.7268 in. max
	Shaft diameter (new)	0.7240 in. min - 0.7250 in. max
	Bearing to shaft wear	0.008 in.
2	Adjusting screw nut torque	16 ft lb - 26 ft lb
3	Intake valve clearance	0.015 in. max
	Exhaust valve clearance	0.025 in. max
4	Valve lifter diameter	1.3100 in. min - 1.3110 in. max
	Bore in block	1.3135 in. min - 1.3155 in. max
	Bore to lifter wear	0.010 in.
	DRIVE GEAR TRAIN	
1	Accessory drive gear nut torque	90 ft lb - 110 ft lb
2	Camshaft end play	0.004 in. min - 0.010 in. max maximum wear 0.025 in.
3	Idler gear end play	0.004 in. min - 0.016 in. max maximum wear 0.034 in.
	Idler gear bearing bore	1.3762 in. min - 1.3800 in. max
	Idler gear shaft diameter	1.3736 in. min - 1.3746 in. max maximum wear 0.009 in.



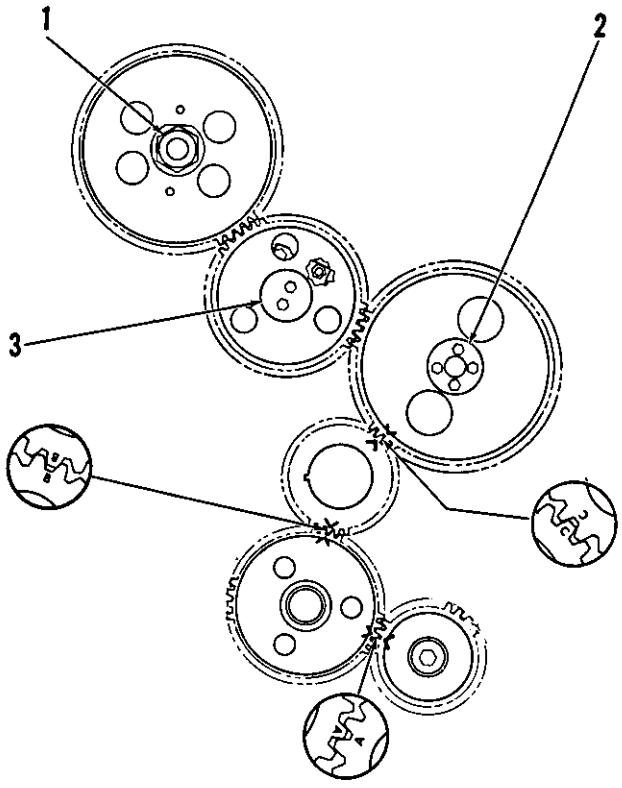
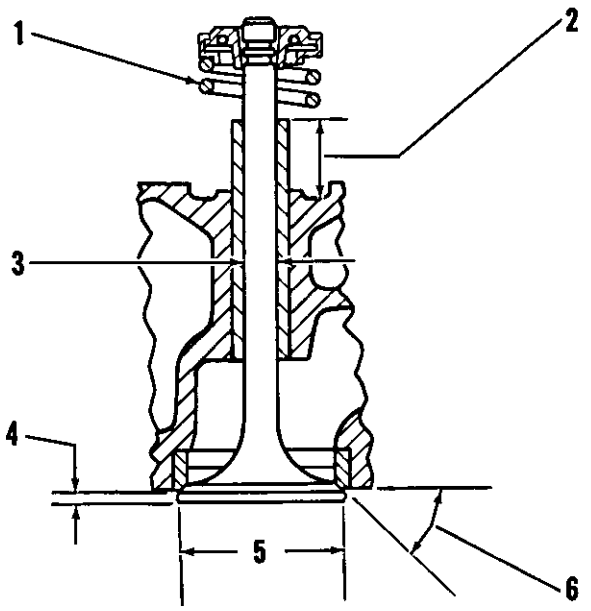


Table 2-3. Table of Limits (Cont)

REF NO.	DESCRIPTION
	ENGINE (Cont):
	VALVES, VALVE GUIDES, SEAT INSERTS
1	Valve springs (see spring chart)
2	Height to top of valve guide 0.875 in.
3	Dia of valve stem (new)
	0.3712 in. min - 0.3722 in. max
	Permissible wear 0.3702 in.
	Valve guide bore (installed)
	0.3736 in. min - 0.3756 in. max
	Permissible wear 0.3766 in.
4	Minimum thickness of valve lip
	Intake & exhaust 0.057 in.
5	Valve head diameter
	Exhaust valve
	1.891 in. min - 1.901 in. max
	Inlet valve
	2.015 in. min - 2.025 in. max
6	Valve face angle 29-¼°
7	Insert bore depth in head
	0.447 in. min - 0.451 in. max
8	Exhaust valve seat insert dia
	2.0030 in. min - 2.0040 in. max
	Exhaust valve seat insert bore
	2.0000 in. min - 2.0010 in. max
	Intake valve seat insert dia
	2.1280 in. min - 2.1290 in. max
	Intake valve seat insert bore
	2.1250 in. min - 2.1260 in. max
9	Valve seat insert angle 30°
10	Valve seat width
	0.030 in. min - 0.076 in. max
11	Top of closed valve to face of head
	Exhaust valve
	0.111 in. min - 0.157 in. max
	Intake valve
	0.088 in. min - 0.134 in. max
12	OD of insert face
	Exhaust seat (new insert) 1.810 in.
	Permissible wear 1.860 in.
	Intake seat (new insert) 1.934 in.
	Permissible wear 1.984 in.
13	Angle to grind seat face of insert to reduce maximum seat diameter 15°



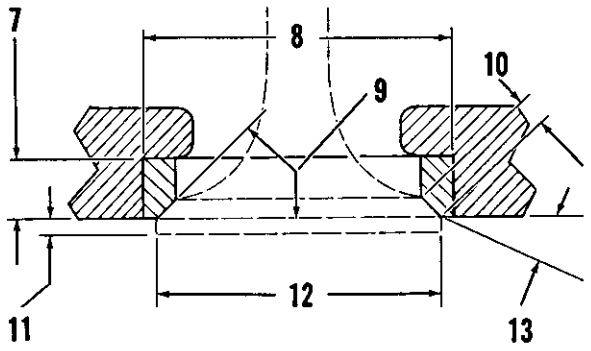


Table 2-3. Table of Limits (Cont)

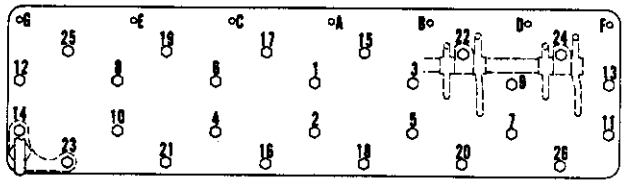
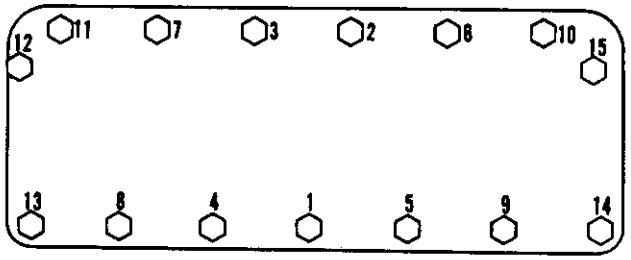
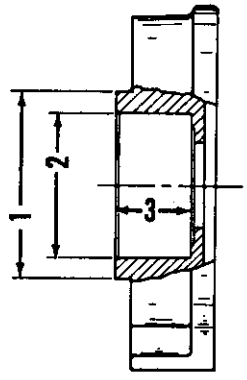
REF NO.	DESCRIPTION	
	ENGINE (Cont): CYLINDER HEAD Step 1. Tighten bolts in number sequence to — 115 ft lb Step 2. Again tighten bolts in number sequence to — 170 - 180 ft lb Step 3. Repeat step 2. Step 4. Tighten all bolts in letter sequence to — 22 ft lb Step 5. Again tighten bolts in letter sequence to — 27 - 37 ft lb Step 6. Repeat step 5.	
	VALVE COVER Tighten valve cover bolts in number sequence to: — 72 - 120 in. lb	 VIEW FROM RIGHT SIDE OF ENGINE
	COMPRESSOR END COVERS (Both ends)	
1	Mounting register dia — 7.747 in. min - 7.750 in. max	
2	Bearing bore diameter — 5.9055 in. min - 5.9071 in. max	
3	Bearing bore depth — 3.115 in. min - 3.125 in. max	

Table 2-3. Table of Limits (Cont)

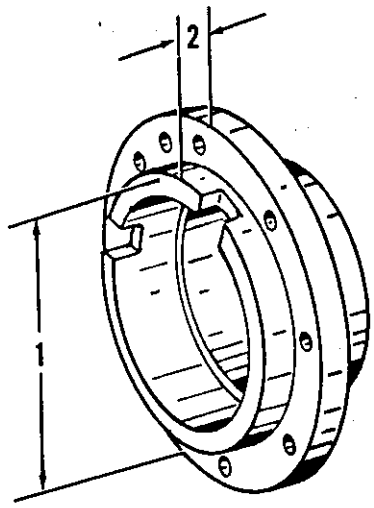
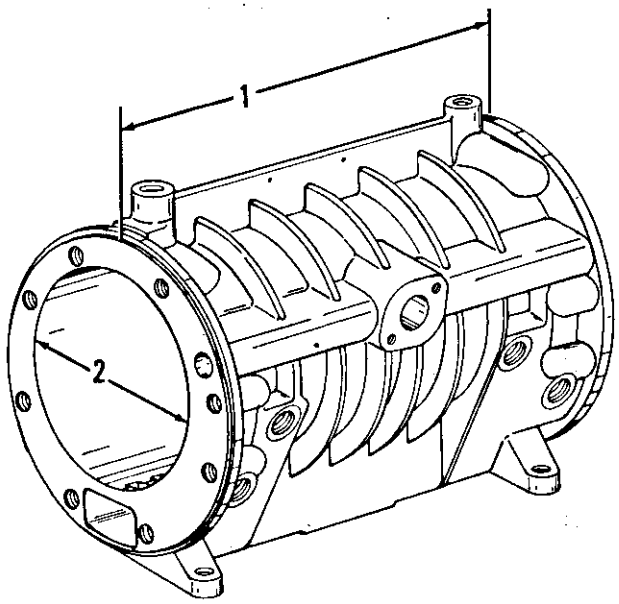
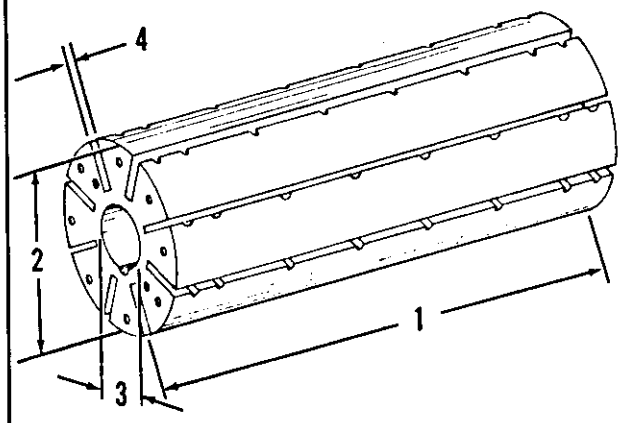
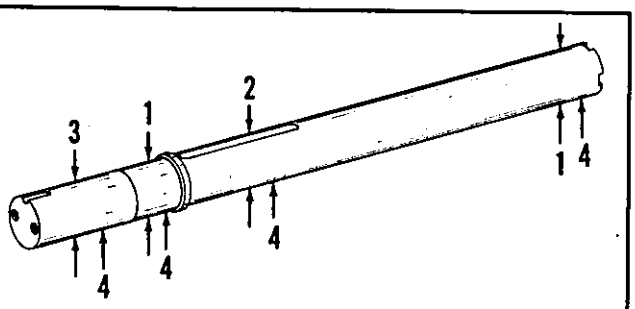
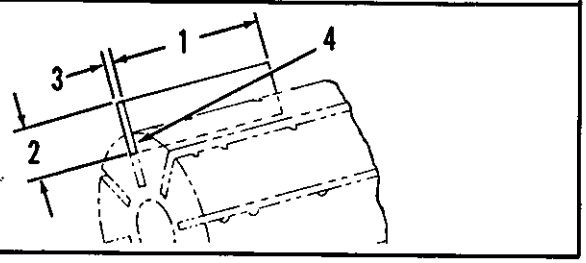
REF NO.	DESCRIPTION	
	COMPRESSOR (Cont):	
	BEARING RETAINING COVERS	
1	Mounting register dia 5.902 in. min - 5.904 in. max	
2	Mounting flange to face 0.615 in. min - 0.620 in. max	
	STATOR	
1	Length: 19.007 - 19.010 in.	
2	Bore: 9.798 - 9.804 in.	
	ROTOR	
1	Length: 18.993 - 18.996 in.	
2	Diameter: 8.497 - 8.500 in.	
3	Bore: 2.7583 - 2.7593 in.	
4	Blade slot: 0.312 - 0.315 in.	

Table 2-3. Table of Limits (Cont)

REF NO.	DESCRIPTION		
	COMPRESSOR (Cont):		
	SHAFT		
1	Bearing journals:	2.7567 - 2.7574 in.	
2	Rotor journal:	2.7567 - 2.7574 in.	
3	Coupling journal:	2.749 - 2.750 in.	
4	Concentricity (TIR):	0.001 in.	
	BLADES (new)		
1	Length:	6.318 - 6.320 in.	
2	Height:	2.185 - 2.190 in.	
3	Thickness:	0.3088 - 0.3118 in.	
4	Slot clearance:	0.0002 - 0.0062 in.	

bypass valve group (25) from the unit. See figure 6 and 7, Part 3, for details. Assemble in the reverse of disassembly.

h. Radiator and Oil Cooler Assembly (26, figure 1, Part 3). Remove the hardware (27) attaching the assembly to the frame. Disconnect the upper and lower radiator hoses from the engine. Disconnect the radiator drain to the extent necessary to lift assembly away from unit. Remove the fan guards. Disconnect oil lines from oil cooler. Attach a chain hoist, or other lifting device, to the assembly and lift the radiator and oil cooler assembly (26) off unit. See figures 8 and 9, Part 3, for details. Assemble in the reverse of disassembly.

i. Air Lines and Fittings (28, figure 1, Part 3). Disconnect the air lines and fittings as necessary for overhaul. See figure 10, Part 3, for details. Assemble in the reverse of disassembly.

j. Oil Separator Assembly (29, figure 1, Part 3). Remove discharge piping from separator, paragraph 2-9a. Remove compressor discharge tube adapter (31) from separator tank. Disconnect air lines (refer to figure 10, Part 3). Disconnect oil tube assembly from bottom of separator tank. Remove attaching hardware (30, figure 1, Part 3). Attach a lifting device to the eyes on separator cover and remove separator assembly (29) from unit. See figures 12, 13, 14, 15, Part 3, for details. Assemble in the reverse of disassembly.

k. Speed Control Linkage Group (32, figure 1, Part 3). Disconnect speed control linkage from engine governor and compressor. Remove the two cap screws and lock washers securing speed control to flywheel housing adapter. Remove the speed control linkage group (32) from the unit. See figure 16, Part 3, for details. Assemble in the reverse of disassembly.

l. Air Compressor Assembly and Mounting Group (33, figure 1, Part 3). Disconnect air lines from compressor (refer to figure 10, Part 3). Remove nuts, washers, and cap screws securing mounting support to frame. Remove the cap screws and lock washers securing adapter to engine flywheel housing. Attach a lifting device to the compressor and remove from unit. See figure 17, Part 3, for details. Assemble in the reverse of disassembly.

m. Instrument Panel Assembly (34, figure 1, Part 3). Disconnect wiring harness leads from gauge terminals, air hose, oil pressure hose, and tachometer cable from rear of panel. Remove water temperature sensing bulb from engine. Disconnect stop control cable from governor. Disconnect cold weather starting aid control cable from actuating valve. Loosen cable clips and remove cables from clips. Remove lock nuts and cap screws securing instrument panel (34) to unit; remove instrument panel. See figure 18, Part 3, for details. Assemble in the reverse of disassembly. Refer to figure 1-6, Part 1, for wiring diagram.

n. Cold Weather Starting Aid (35, figure 1, Part 3). Remove fuel line fitting (atomizer) from engine intake manifold. Disconnect tubing clips securing fuel line. Disconnect actuating control cable from valve assembly. Remove lock nuts and cap screws securing valve assembly to side of instrument panel. Remove cold weather starting aid (35) from the unit. Remove cylinder clamp only when necessary. See figure 19, Part 3, for details. Assemble in the reverse of disassembly.

Table 2-4. Torque Limits

GENERAL TORQUE LIMITS – ENGINE

STANDARD THREAD DIAMETER	STANDARD TORQUE (FT LB)	STANDARD THREAD DIAMETER	STANDARD TORQUE (FT LB)
1/4	6 to 12	3/4	230 to 300
5/16	13 to 23	7/8	360 to 480
3/8	28 to 37	1	560 to 740
7/16	40 to 60	1-1/8	700 to 900
1/2	65 to 85	1-1/4	880 to 1120
9/16	95 to 125	1-3/8	1050 to 1350
5/8	130 to 170	1-1/2	1300 to 1700
TAPERLOCK STUD	**TORQUE (FT LB)**	**TAPERLOCK STUD**	**TORQUE (FT LB)**
1/4	3 to 7	3/4	95 to 125
5/16	7 to 13	7/8	150 to 190
3/8	17 to 23	1	230 to 290
7/16	25 to 35	1-1/8	290 to 350
1/2	35 to 45	1-1/4	360 to 440
9/16	50 to 70	1-3/8	440 to 520
5/8	65 to 85	1-1/2	500 to 600

SPECIFIC TORQUE LIMITS – ENGINE	TORQUE	FIG. & INDEX NO.
ENGINE		
Main bearing cap bolts.	27 to 33 ft lb	53-30
(mark each bolt and cap and tighten 90° from mark)		
Connecting rod nuts.	27 to 33 ft lb	51-7
(mark each bolt and nut and tighten 90° from mark)		
Injection valve retaining bushings.	140 to 160 ft lb	47(2)-17
Fuel line nuts.	25 to 35 ft lb	30-11 thru 16
Nozzle retaining nuts.	100 to 110 ft lb	30-19
Fuel injection nozzle in body.	finger tight	30-21
Glow plugs.	96 to 144 in. lb	49-51
Precombustion chamber.	140 to 160 ft lb	49-52
Fuel transfer retaining nut.	17 to 27 ft lb	45-7
Governor nut.	10 to 12 ft lb	47(1)-41
Shut off solenoid terminal nuts.	11 to 17 in. lb	47(1)-11
Turbocharger thrust plate cap screws.	35 to 45 in. lb	29-26
Turbocharger band clamp nuts.	110 to 130 in. lb	29-17
Turbine housing cap screws.	160 to 190 in. lb	29-18
Turbocharger mounting cap screws.	36 to 44 ft lb	29-13
Oil pump gear retaining bolt.	27 to 37 ft lb	37-10
Valve adjusting screw lock nuts.	16 to 26 ft lb	49-7
Water pump impeller bolt.	27 to 29 ft lb	33-13
Accessory drive gear nut.	90 to 110 ft lb	46-10
Crankshaft pulley cap screw.	210 to 250 ft lb	52-4
Alternator pulley nut.	40 to 50 ft lb	26-30
Exhaust manifold nuts.	29 to 35 ft lb	31-5
Starting motor terminal nuts.	20 to 25 ft lb	24-15, 34
Cylinder head to cylinder block.	refer to table of limits	49-41, 43
Valve cover cap screws.	refer to table of limits	48-6

Table 2-4. Torque Limits (Cont)

GENERAL TORQUE LIMITS – COMPRESSOR			
SIZE	TORQUE (FT LB)	SIZE	TORQUE (FT LB)
1/4-20	6	9/16-12	60
1/4-28	8	9/16-18	66
5/16-18	11	5/8-11	104
5/16-24	12	5/8-18	116
3/8-16	20	3/4-10	143
3/8-24	22	3/4-16	140
7/16-14	33	7/8-9	218
7/16-20	35	7/8-14	217
1/2-13	45	1 - 8	322
1/2-20	47	1 - 14	291

o. Overspeed Switch (36, figure 1, Part 3). Disconnect transmitter from tachometer drive adapter. Disconnect wiring leads from overspeed switch terminals. Remove nuts and lock washers securing overspeed switch (36) to lifting frame and remove switch (36). See figure 20, Part 3, for details. Assemble in the reverse of disassembly. Refer to figure 1-6, Part 1 for wiring diagram.

p. Lifting Frame (37, figure 1, Part 3). Remove the eight lock nuts and cap screws, four each side, which secure the lifting frame to the unit main frame. Remove the lifting frame (37). Assemble in the reverse of disassembly.

q. Fuel Lines and Fittings (38, figure 1, Part 3). Disconnect and remove fuel lines and fittings as necessary to accomplish overhaul. See figure 11, Part 3, for details. Assemble in the reverse of disassembly.

r. Engine Assembly (39, figure 1, Part 3). Disassemble fan guards from radiator shroud. Disconnect the two radiator hoses. Remove the lock nuts, beveled washers, flat washers, and cap screws securing engine front trunnion and rear mounting brackets to the main frame. Attach a lifting device to the engine assembly (39) and lift off unit. See figures 21 through 53, Part 3, for engine details. Assemble engine assembly on unit in the reverse of disassembly. Refer to figure 1-6, Part 1, for wiring diagram.

s. Tires and Tubes (40, 41, figure 1, Part 3). Deflate and remove the tires and tubes (40, 41) as required. Assemble in the reverse of disassembly. Refer to table 1-1, Part 1, for inflation pressure.

t. Drawbar and Front Axle Group (42, figure 1, Part 3). Disassemble this group only when necessary and to extent required for overhaul. See figure 54, Part 3, for details. Assemble in the reverse of disassembly.

u. Handbrake Lever, Cross Shaft, and Rear Axle Group (43, figure 1, Part 3). Disassemble this group only when necessary and to extent required for overhaul. See figures 55 and 56 for details. Assemble in the reverse of disassembly.

v. Fuel Tank Mounting and Main Frame Group (44, figure 1, Part 3). Disassemble this group only when necessary and to extent required for overhaul. See figure 57, Part 3, for details. Assemble in the reverse of disassembly. Refer to figure 11, Part 3, for fuel lines and fittings diagram.

2-10. DETAILED COMPONENT DISASSEMBLY AND ASSEMBLY.

2-11. The following paragraphs cover in detail the disassembly, special inspection and cleaning, and assembly of removed repairable components. Components not found in these paragraphs are considered nonrepairable and should be replaced as an assembly. All references to figure numbers and index numbers are those found in Part 3, except as otherwise noted.

2-12. BATTERY CABLES, BATTERIES, AND BATTERY MOUNTING (figure 2). Disassemble the battery cables, batteries, and battery mounting in order of key index numbers assigned on figure 2. Assemble in the reverse of disassembly.

2-13. AIR CLEANER ASSEMBLY (figure 3).

a. Disassemble the air cleaner assembly in the order of key index numbers assigned on figure 3.

b. Immerse and clean element (4) in a container of water and low-sudsing household type detergent. Rinse thoroughly with clean water and air dry.

NOTE

Replace element after eight cleanings.

c. Assemble the air cleaner assembly in the reverse of disassembly.

2-14. DAMPER CONTROL ASSEMBLY (figure 4). Disassemble the damper control assembly in the order of key index numbers assigned on figure 4. Assemble in the reverse of disassembly.

2-15. COMPRESSOR OIL FILTER GROUP (figure 5).

a. Disassemble the compressor oil filter group in the order of key index numbers assigned on figure 5.

b. Clean the housing (10) and element (13) in a container of solvent, Specification P-D-680. Wipe the housing (10) dry with a clean, lint-free cloth. Dry the element (13) with compressed air.

CAUTION

Agitate and soak the element (13) in solvent to clean. Do not scrape or wire brush the element as damage may occur. Refer to figure 5-9, sheet 2, Part 1.

NOTE

If a varnish condition is in evidence on the compressor oil filter element, the compressor oil separator, oil cooler, and oil filter must be cleaned. See paragraph 2-22 following for special oil separator cleaning procedure.

c. If a varnish condition exists, a prolonged soaking in methyl ethyl ketone (MEK) will remove the varnish.

WARNING

Methyl ethyl ketone (MEK) is toxic and flammable. Use in a well ventilated area.

d. Assemble compressor oil filter in reverse of disassembly.

2-16. THERMAL BYPASS VALVE GROUP (figure 6). Disassemble the thermal bypass valve group in the order of key index numbers assigned on figure 6. Assemble in the reverse of disassembly.

2-17. THERMAL BYPASS VALVE ASSEMBLY (figure 7). Disassemble the thermal bypass valve assembly in the order of key index numbers assigned on figure 7. Assemble in the reverse of disassembly.

CAUTION

Do not overtighten nut (6). Overtightening can cause distortion of power element (5), resulting in malfunction.

2-18. RADIATOR AND OIL COOLER GROUP (figure 8).

a. Disassemble the radiator and oil cooler group in the order of key index numbers assigned on figure 8.

b. Flush and drain the oil cooler (42, figure 8) with solvent, Specification P-D-680, or equivalent. Plug the outlet connection and fill the oil cooler with clean compressor oil. Apply air pressure of from 4 to 10 psi to inlet connection and check oil cooler for leaks. Mark each leak detected. Remove the air pressure and drain oil from the cooler. Solder or braze all leaks detected. Recheck as described above.

c. Flush and drain the radiator assembly (43, figure 8) with solvent. Plug or cap the inlet and outlet openings, remove radiator cap and fill radiator with clean water. Apply air pressure of from 4 to 10 psi at filler neck. Check for leaks and mark any detected. Remove air pressure and drain water from radiator. Solder or braze all leaks detected. Recheck as described above. If leaks are such that they cannot be repaired in this manner, disassemble radiator and replace defective parts. (See figure 9 for details).

d. Assemble the radiator and oil cooler group in the reverse of disassembly.

2-19. RADIATOR ASSEMBLY (figure 9). Disassemble the radiator in the order of key index numbers assigned on figure 9. Assemble in the reverse of disassembly.

2-20. AIR LINE SYSTEM (figure 10). Disassemble the air line system, to the extent necessary, in the order of key index numbers assigned on figure 10. All defective parts shall be replaced. Assemble in the reverse of disassembly.

2-21. FUEL LINE SYSTEM (figure 11). Disassemble the fuel line system, to the extent necessary, in the order of key index numbers assigned on figure 11. All defective parts shall be replaced. Assemble in the reverse of disassembly.

2-22. OIL SEPARATOR ASSEMBLY (figure 12). Disassemble the oil separator assembly in the order of key index numbers assigned on figure 12. Special cleaning is as follows.

a. When a varnish condition is detected during cleaning of compressor oil filter, paragraph 2-15, mix a super detergent, such as THERMA-SOLVE CONCENTRATE, manufactured by Pennsylvania Refining Company, Cleveland, Ohio, with the compressor oil in the separator in a ratio of one gallon of THERMA-SOLVE to each ten gallons of oil.

b. Operate the compressor under normal conditions for 40-60 hours allowing the treated oil to dissolve and suspend the varnish.

c. After the above period of operation, stop the compressor while running under full load. This procedure will allow maximum air to mix with the oil and force the maximum amount of oil from the oil cooler into the separator tank.

d. Place a container under the separator tank and while the oil is still hot, remove separator drain plug and drain all of the oil from the tank. Install the drain plug.

e. Remove and replace the separator element.

WARNING

Destroy used element to prevent accidental reuse. Over pollution of metal salts collecting on the element can become a hazardous condition by lowering the flash point and causing a fire in the separator.

f. Clean the compressor oil filter (paragraph 2-15).

g. Remove the oil separator filler plug, fill the tank to overflow with clean oil, and install the filler plug.

NOTE

As an aid in preventing varnish buildup, THERMA-SOLVE CONCENTRATE may be added to the compressor oil at a ratio of one quart of THERMA-SOLVE to each ten gallons of oil approximately 40 hours prior to scheduled oil change.

h. Assemble the oil separator in the reverse of disassembly.

2-23. AIR PRESSURE REGULATOR ASSEMBLY (figure 13). Disassemble air pressure regulator assembly in the order of key index numbers assigned on figure 13. Assemble in the reverse of disassembly.

2-24. BLOWDOWN VALVE ASSEMBLY (figure 14). Disassemble the blowdown valve assembly in the order of key index numbers assigned on figure 14. Assemble in the reverse of disassembly.

2-25. NON-RETURN VALVE ASSEMBLY (Figure 15). Disassemble the non-return valve assembly in the order of key index numbers assigned on figure 15. Assemble in the reverse of disassembly.

2-26. SPEED CONTROL LINKAGE GROUP (figure 16). Disassemble the speed control linkage group, to extent necessary, in the order of key index numbers assigned on figure 16. Assemble in the reverse of disassembly.

2-27. AIR COMPRESSOR ASSEMBLY AND MOUNTING GROUP (figure 17). Disassembly of this group is essentially in the order of key index numbers assigned on figure 17, sheets 1 and 2. Details other than index number sequence follow.

a. Disassemble the air compressor assembly and mounting in order of key index numbers 1 through 90.

NOTE

Inner race of bearing (88) will remain on end of rotor shaft (95).

b. Remove drive end cover, rotor, and shaft combination (index numbers 91, 92, 93, 95, 96, 97, and 98) as a group.

NOTE

Do not disassemble this group of parts unless inspection reveals that defective parts need replacing.

CAUTION

Since excessive heat causes softening of metal, any inner bearing race heated for removal from shaft must be discarded and the entire bearing shall be replaced. Never heat bearing inner race unless it is intended to replace entire bearing.

c. If drive end cover, rotor, and shaft combination requires disassembly, remove bearing inner race (88) from shaft (95) with gear puller or the equivalent. If bearing inner race cannot be removed with gear puller, heat the race evenly with a torch and remove as quickly as possible.

d. Remove rotor (91) from shaft (95), remove key (92) from shaft (95) keyway.

NOTE

Make note of the drain holes in the rotor (91) blade slots. These holes shall be on the rotation leading edge when installed on rotor shaft.

e. Pull drive end cover (93) off shaft. Bearing (96) face ring will fall free. Remove bearing (96) outer race from end cover (93) bore. Remove self tapping screws (97) and rotation plate (98) only when replacement is necessary.

f. Remove bearing (96) inner race from rotor shaft (95) with gear puller or equivalent. If bearing inner race cannot be removed with gear puller, heat the inner race evenly with a torch and remove as quickly as possible. Observe CAUTION preceding step c above.

g. Disassemble the remainder of the compressor assembly in order of key index numbers (99 through 110).

h. Assembly is essentially the reverse of disassembly and the steps following. Apply a light film of clean compressor oil on all preformed packing (o-rings) to ease assembly. Assemble components (99 through 109) to stator (110) in reverse order of index numbers.

NOTE

If drive end cover, rotor and shaft assembly was disassembled, assemble components of this assembly (91, 92, 93, 95, 96, 97, 98) as follows.

CAUTION

Do not use a torch or any similar heating method on bearing inner races. Excessive or uneven heat will cause softening of the metal. To prevent galling the rotor shaft, do not allow an inner race to cool before it is installed.

i. Heat inner races of bearings (96, 88) by submerging in hot cooking oil and heat to 350°F maximum. While inner race of bearing (96) is still hot, assemble on shaft (95) to position against shaft shoulder. Assemble key (92) in shaft (95) keyway. Assemble rotor (91) on shaft (95) with oil drain holes in the rotor blade slots positioned on rotation leading edge. While inner race of bearing (88) is still hot, assemble on shaft (95) to position against shaft shoulder.

j. After bearing inner races have cooled to room temperature, assemble bearing (96) face ring and outer race, and drive end cover (93) on shaft (95).

k. If rotation plate (97) was removed from end cover (93), assemble with screws (98).

l. Assemble preformed packing (94) on drive end of stator (110), carefully slide drive end cover, rotor and shaft assembly into stator bore.

m. Dip rotor blades (90) in clean compressor oil and slide into rotor slots from non-drive end of stator (110).

n. If pipe plug (89) was removed from end cover (84), install pipe plug. Assemble bearing (88) outer race in end cover (84) bore.

o. Assemble preformed packing (87) on non-drive end of stator (110). Assemble end cover (84) to stator with seal washers (86) and cap screws (85). Assemble bearing retainer (81) to end of shaft (95) with lock washers (83) and cap screws (82). Assemble gasket (80), bearing cover (77), and secure to end cover with lock washers (79) and cap screws (78). Assemble remainder of rotor-stator assembly (76 through 57).

p. Rotate the coupling (57) in direction of rotation by hand to ensure free rotation with no binding or rubbing.

q. To test for air leakage, bolt the rotor-stator assembly to a stand on the stator discharge flange. Use a gasket between flange and stand mating surfaces.

r. Close off intake opening with a gasket and blank flange.

s. Install a gasket and flange on the stator oil filter connection. Equip the flange with an air pressure gauge capable of registering at least 125 psi, an on-off line valve, and a suitable "quick change" air hose connection to accommodate test facility air hose.

t. Connect test air supply to "quick change" connection. Turn line valve on and subject the rotor-stator

to an air pressure of 100 psi, plus or minus 10 psi, indicated on air pressure gauge.

u. Use a soap and water solution applied with a brush on stator, end covers, and all sealing surfaces to test for any leakage. Leakage will be indicated by bubbling of the solution.

v. Relieve the test air pressure, remove the test fixtures, make repair or replacement necessary to correct any leakage, and retest as outlined above.

w. After pressure test, assemble the remainder of compressor assembly and mounting in reverse sequence of index numbers (56 through 1).

2-28. INSTRUMENT PANEL GROUP (figure 18). Remove hose assemblies and wiring harness leads as necessary for disassembly. Disassemble wire assemblies and instrument panel components, to extent necessary, in order of key index numbers assigned on figure 18. The individual name plates and screws need not be removed unless replacement is required. Assemble in the reverse of disassembly. Refer to figure 1-6, Part 1, for wiring diagram.

2-29. COLD WEATHER STARTING AID GROUP (figure 19). Disassemble the cold weather starting aid group in the order of key index numbers assigned on figure 19. Assemble in the reverse of disassembly. When installing fuel tank, tighten only hand tight in valve assembly.

WARNING

Do not puncture or mishandle the fuel tank (not supplied by compressor manufacturer). This tank contains an ether mixture which is extremely toxic, volatile, and combustible. Do not leave fuel tank installed in warm weather. Accidental use could cause engine damage.

2-30. OVERSPEED SWITCH (figure 20). Disassemble the overspeed switch in the order of key index numbers assigned on figure 20. Assemble in the reverse of disassembly.

2-31. DIESEL ENGINE ASSEMBLY (figure 21). Disassemble the diesel engine assembly into its major components and groups in the order of key index numbers assigned on figure 21. Disassembly and assembly of these components is covered in subsequent paragraphs. Assemble the engine assembly in the reverse of disassembly.

2-32. PRIMARY FUEL FILTER (figure 22). Disassemble the primary fuel filter in the order of key index numbers assigned on figure 22. Assemble in the reverse of disassembly.

2-33. FUEL PRIMING PUMP (figure 23). Disassemble the fuel priming pump in the order of key index numbers assigned on figure 23. Assemble in the reverse of disassembly.

2-34. STARTING MOTOR ASSEMBLY (figure 24).

a. Disassemble the starting motor in the order of key index numbers assigned on figure 24 only to the extent necessary to make repair or replacement.

b. Assemble the starting motor in the reverse of disassembly. Remove pipe plugs and felt wicks from commutator end frame, lever housing, and drive housing. Saturate felt wicks with SAE 20 oil, install wicks in reservoirs, fill reservoirs with SAE 20 oil, and install pipe plugs.

c. Lubricate preformed packing with a light film of oil to prevent damage during assembly.

d. Lubricate armature bearing surfaces on shaft extensions with light coating of grease. Lubricate shaft splines and splines of drive assembly with light coating of grease. Grease should conform to Specification MIL-G-23827A or equivalent.

2-35. ALTERNATOR AND REGULATOR MOUNTING GROUP (figure 25). Disassemble the alternator and regulator from the engine in the order of key index numbers assigned on figure 25. Attaching parts for regulator are oil pan cap screws and lock washers shown for reference. Assemble the alternator and regulator to engine in the reverse of disassembly. Locate the regulator on the sixth and seventh oil pan cap screws from fan end on left side of engine (facing fan end).

2-36. ALTERNATOR ASSEMBLY (figure 26). Disassemble the alternator only when necessary in the sequence of steps below.

a. Mount the alternator in a vise, with the rear housing facing you.

b. Remove screws (2), hold cover (1) away from rear housing (17), remove screws (11), brush assembly (10), insulator (12), and gasket (9). Refer to section III for brush assembly inspection test.

c. Remove nuts, washers, and insulators (items 3 through 8) in order of key index numbers, as necessary.

d. Remove the four bolts (18). Carefully insert two screwdriver blades in opposite openings between the stator (28) and front housing (48) and pry units apart. Do not allow screwdriver blades to touch stator winding.

e. Place the open end of the stator (28) on a clean work surface, free of metal chips that could damage the stator windings. Remove all nuts, washers, insulators, and cable terminals (items 13 through 20) from diode terminal studs.

f. Carefully and evenly, tap the rectifier diode terminal studs out of the rear housing (17). Lift rear housing off the studs. Remove spacers (24) and insulators (23) from studs or stud holes. Remove bearing retainer (25) from housing (17).

g. It is necessary to unsolder the stator leads from the rectifier diode terminals, in order to properly test each diode. Place a pair of needle nose pliers on the diode terminal between the diode body and top of terminal. Secure the pliers handles with rubber bands. This will provide a heat dam to protect diode body when removing and replacing the stator leads. Apply heat to solder joint and remove the leads. Allow solder joint to cool a few seconds from removing heat dam. Avoid bending or twisting diode terminal. Refer to section III for diode inspection test.

h. Separate the diode assemblies (26, 27) from stator (28). Refer to section III for stator inspection test.

i. Remove nut (30), lock washer (31), pulley (29), fan (32), spacer (46), and key (33).

j. Remove screws (41) and lock washers (42). Tap the end of rotor (39) shaft extension on a wooden block to separate front housing (48) from bearing (45). Remove seal (47) from housing (48).

k. Remove bearing (45) from sleeve (44). Using a bearing pulley, remove sleeve (44) from rotor shaft.Remove spacer (43) and bearing retainer (40).

l. Unsolder rotor (39) leads from slip ring (34) terminals. Carefully unwind the ends of the rotor coil leads from the slip ring terminals. Remove screw (35), lock washer (36), and washer (37). Thread a 1/4-28 by 1-1/2 inch long cap screw into the slip ring hub, this will back the slip ring assembly off the rotor shaft.

m. Use a bearing puller and remove bearing (38) from rotor (39) shaft. Assembly is essentially in the reverse of disassembly and the following details.

n. Install new seal (47) in front housing (48) flush with outer surface.

o. Press bearing (45) on sleeve (44) until bearing sets on flange of sleeve. Press on bearing (45) inner race only. Assemble bearing and sleeve (45, 44) in bore of housing (48). Extra multipurpose grease may be placed between seal and bearing. Assemble washer (43), bearing retainer (40), and secure with lock washers (42) and screws (41).

p. Support the pulley end of rotor (39) on an arbor press. Place bearing (38) over end of shaft extension of rotor (39). Dress rotor leads away from work area. Use a bearing driver that contacts only the inner race of bearing (38) and press bearing onto shaft until inner race seats against shaft shoulder.

q. Guide rotor (39) winding leads through the square passage in the slip ring assembly (34) hub. Hand press the slip ring assembly (34) on the shaft while maintaining alignment of leads and passage. Assemble washer (37), lock washer (36), and screw (35). Tighten screw (35) to torque of 45 inch pounds.

r. The fiber washer on inner slip ring terminal is to prevent inner slip ring lead from touching outer slip ring causing a short circuit. Wrap leads around slip ring terminals, solder with rosin core solder. Do not overheat. Secure wires to the end of the rotor with a synthetic sealer, such as General Electric Silicone Rubber, or equivalent. Test electrical circuit as outlined in section III.

s. Place the rotor and slip ring assembly on the bed of an arbor press, using two steel blocks for support against rotor with slip ring assembly down. Place front bearing housing (48) over shaft extension of rotor. Using a driver sleeve that contacts inner bearing race only, press front housing down until inner bearing race contacts shoulder on rotor shaft.

t. Assemble spacer (46) on shaft extension. Install key (33) in keyway. Assemble fan (32), pulley (29), lock washer (31), and nut (30). Mount pulley in a vice and tighten nut (30) to torque of 35 to 50 foot pounds. Spin rotor by hand to check freedom of bearing and seals.

u. Assemble insulator (22) and bolt (21) to diode assembly (27). Assemble diode assemblies (26, 27) to stator assembly (28). Solder leads to diode assemblies in same order as removed. Use a heat dam when soldering

leads to protect diodes (refer to paragraph 2-36g). (Refer to section III for diode and stator inspection tests.)

v. Assemble insulators (23), spacers (24), and diode-stator assembly to housing (17). Secure with insulating washers (20), lock washers (16) and nuts (15, 19) as shown in figure 26.

w. Install a new bearing retainer (25) in recess of bearing bore in housing (17). Lubricate exposed surface of the ring with a minimum amount of hydraulic brake fluid to ease assembly over bearing.

NOTE

Do not use lubricating oil or grease.

x. Place rear housing (17) over the slip ring end of rotor and hand press housings (17, 48) together, positioning as shown on figure 26. Secure housings together with through bolts (18). Tighten bolts evenly to torque of 50 to 60 inch pounds. Spin rotor by hand to check freedom of bearings.

y. Assemble brush connector leads to rear cover (1) and assemble lead components (3 through 8). Install insulator (12). Assemble brush assembly (10) in housing (17) with screws (11). Tighten screws (11) to torque of 16 to 20 inch pounds.

z. Assemble gasket (9) and rear cover (1) on housing (17) with screws (2). Tighten screws (2) to 20 to 30 inch pounds. Refer to section III for test after overhaul.

2-37. ENGINE EXHAUST GROUP (figure 27). Disassemble the engine exhaust group in the order of key index numbers assigned on figure 27. Assemble in the reverse of disassembly.

2-38. INTAKE ELBOW GROUP (figure 28). Disassemble the engine intake elbow group in the order of key index numbers assigned on figure 28. Assemble in the reverse of disassembly.

2-39. TURBOCHARGER AND MOUNTING GROUP (figure 29).

a. Disassembly of the turbocharger and mounting group is essentially in the order of key index numbers assigned on figure 29. Details necessary for complete disassembly follow.

b. Remove cap screws (2, 8), lock washers (3, 9), oil tubes (1, 7), and gaskets (4, 10). Remove seal (11) and, as necessary, connector (5) and clip (6).

c. Remove nuts (12) and cap screws (13). Lift turbocharger assembly off engine and remove gasket (14).

d. Clean the exterior surfaces of the turbocharger. Punch mark the compressor housing (15), turbine housing (16), and center housing (39) to ensure correct positioning at assembly.

e. Before disassembly of rotating parts, measure shaft end clearance. End clearance shall be 0.006 to 0.011 inch. If clearance is excessive, or if either the turbine wheel or impeller has rubbed against housings, the bearings (31) and/or thrust washer (30) and thrust collar (29) must be replaced.

f. Remove clamp (17), housing (15), preformed packing (36), cap screws (18), lock plate (19), locking plate (20), and housing (16).

CAUTION

Before removing impeller (21), ensure alignment marks on impeller (21) and shaft (33) are visible. Rotating parts must be aligned during assembly to maintain previously established dynamic balance of turbocharger.

g. Attach housing (39) to an adapter and pressing fixture similar to that shown in figure 2-1 following.

CAUTION

Allow space below turbine wheel and provide a means of preventing wheel from being damaged by striking fixture when shaft is pressed. Approximately 1/2 inch is required to free shaft from impeller.

h. Remove nut (22, figure 29). Place the impeller only in a hot oil bath. Heat impeller (21) to 350°F for not more than 10 minutes. Remove from oil bath and press the shaft and turbine wheel (33) from impeller (21).

i. Remove shroud (35) and ring (34). Remove screws (26), retainers (27), and using a wooden dowel, remove cartridge plate (25) assembly from housing (39) as shown in figure 2-2 following.

j. Disassemble spacer (23), seal rings (24), retaining rings (32), sleeve bearings (31), thrust washer (30), and collar (29).

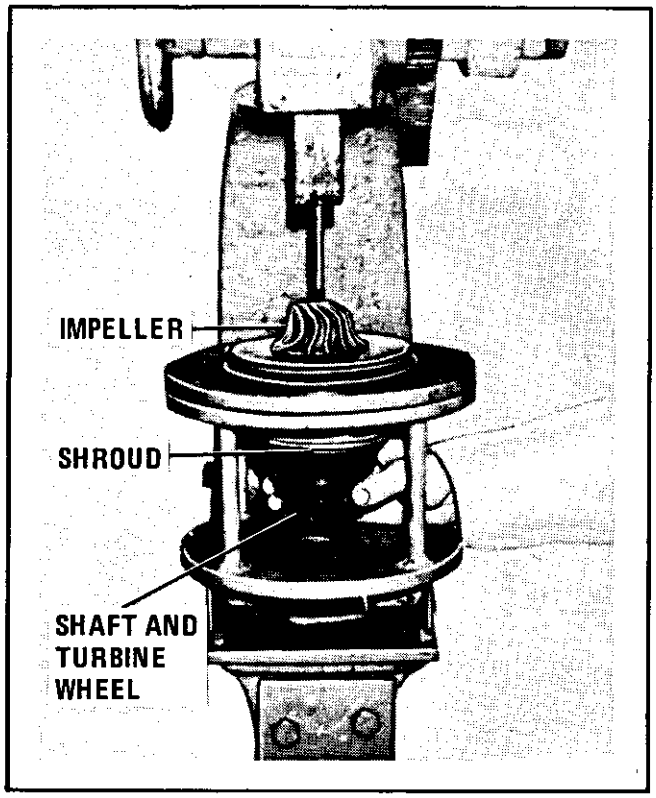


Figure 2-1. Pressing shaft and turbine wheel from turbocharger impeller

k. Assembly is essentially the reverse of disassembly and the following details. Use new gaskets, preformed packing, and seals at assembly.

l. Install thrust collar (29) with large outside diameter toward impeller end. (See figure 2-3).

m. Install thrust plate assembly so that piston ring is toward impeller and oil hole aligns with oil hole in housing.

n. Install impeller (21, figure 29) as follows:

1. Heat impeller (21) in an oil bath 350°F for not more than ten minutes.

2. Place heated impeller on shaft and immediately install nut (22). Tighten nut (22) to a torque of 120 inch pounds.

3. Allow impeller to cool, then remove nut (22).

4. Clean and smooth washer face of nut (22). Lightly oil threads of turbine shaft and nut.

5. Install nut (22) and tighten to torque of 20 inch pounds. After tightening, turn nut an additional 120 degrees.

o. Make certain that alignment marks made at disassembly are aligned at assembly (reference paragraph 2-39e above).

2-40. FUEL INJECTION VALVES AND LINES GROUP (figure 30). Disassemble the fuel injection valves and lines group in the order of key index numbers assigned on figure 30. Assembly is the reverse of disassembly. Tighten nozzle (21) finger tight on body (20). Tighten cap nut (19) to 100-110 foot pounds torque. Tighten tube assembly nuts to torque of 30 foot pounds.

2-41. EXHAUST MANIFOLD GROUP (figure 31). Disassemble the exhaust manifold group in the order of key index numbers assigned on figure 31. Assembly is the reverse of disassembly.

2-42. FAN BELTS AND FAN DRIVE GROUP (figure 32). Disassemble the fan belts and fan drive group in the order of key index numbers assigned on figure 32. Assemble in the reverse of disassembly and adjust belts.

2-43. WATER PUMP GROUP (figure 33).

a. Disassemble the water pump group in order of key index numbers assigned on figure 33 and the following details.

b. Remove cap screws (2, 3), lock washers (4), cover (1), and gasket (5).

c. Remove water pump from engine. Remove seal (6).

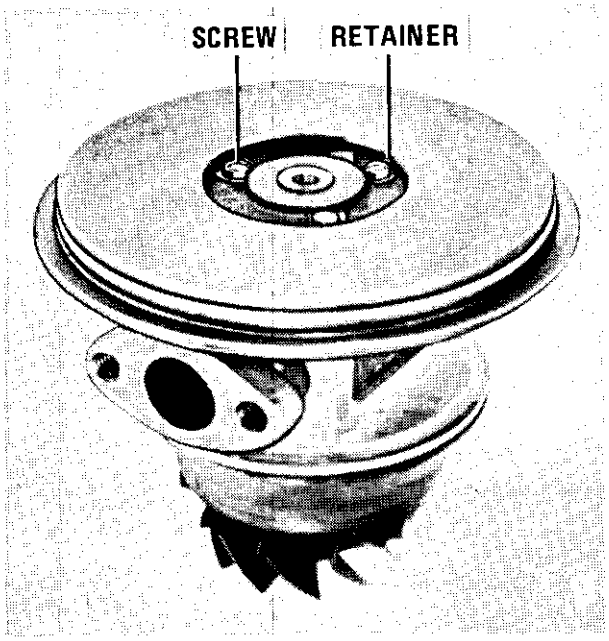
d. Remove cap screw (8), lock washer (9), and gear assembly from water pump. As necessary, remove bearing (11) and pins (10) from gear assembly (7).

e. Remove cap screw (13), washer (14), and impeller (12). Remove seal assembly (15) and seal ring (16) from shaft (19).

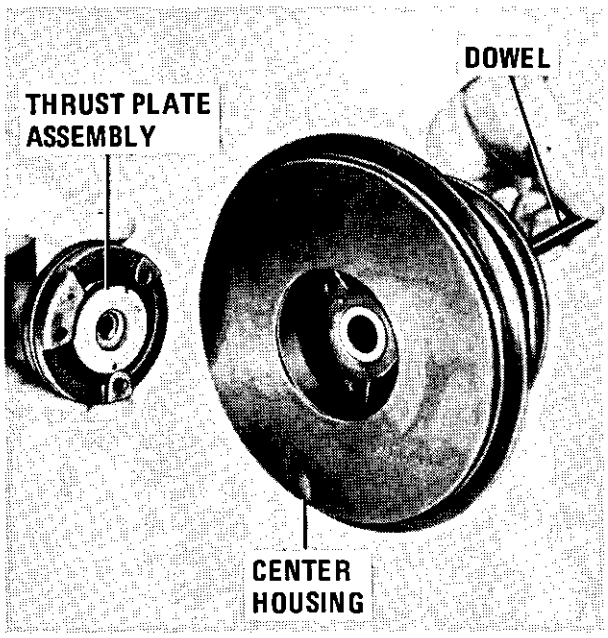
f. Remove retaining ring (17). Remove bearing (18) and shaft (19) from housing (23).

g. Press seals (20, 21) out of housing (23). Plug (22) need not be removed from housing (23) unless replacement is necessary.

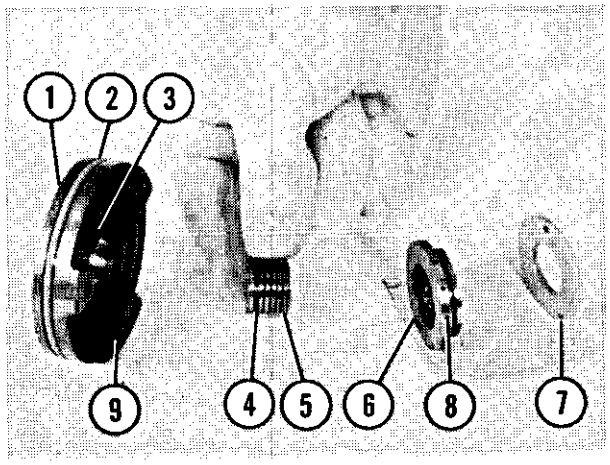
h. Assemble the water pump group in the reverse of disassembly and the following details.



PREPARING TO DISASSEMBLE CENTER HOUSING

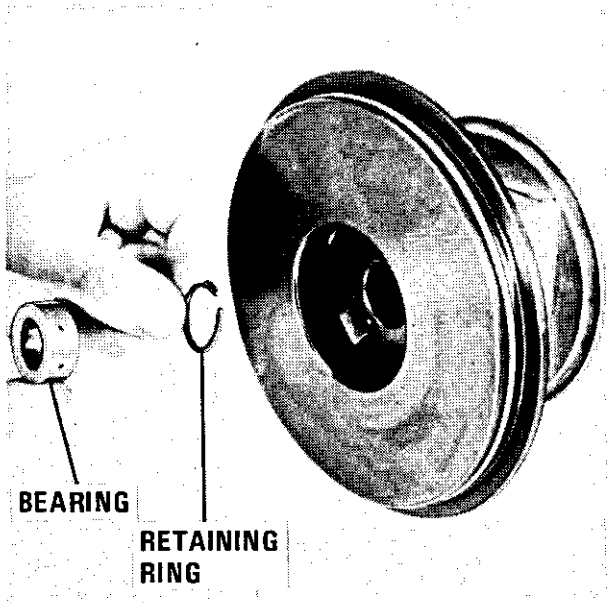


REMOVING THRUST PLATE



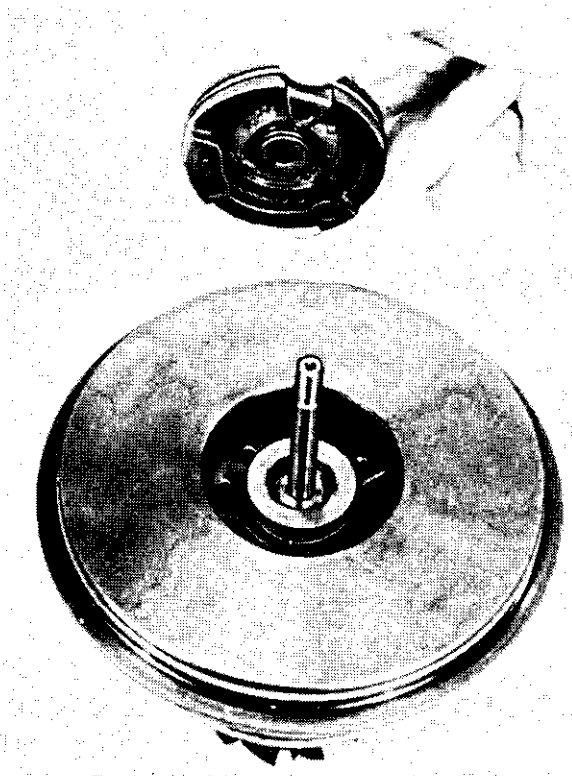
1. Thrust plate assembly
2. Preformed packing
3. Thrust bearing
4. Seal ring
5. Spacer
6. Thrust collar
7. Thrust washer
8. Oil holes
9. Oil hole

THRUST SPACER, PLATE, AND WASHER REMOVAL

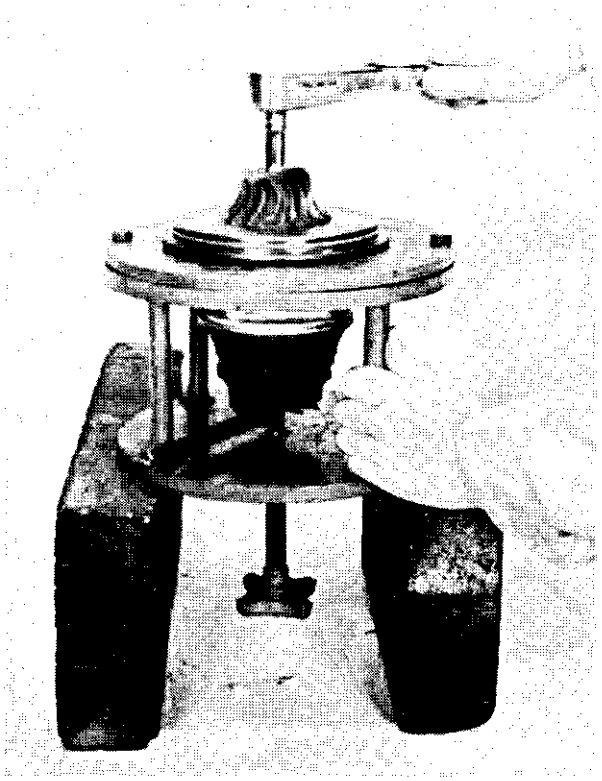


BEARING REMOVAL

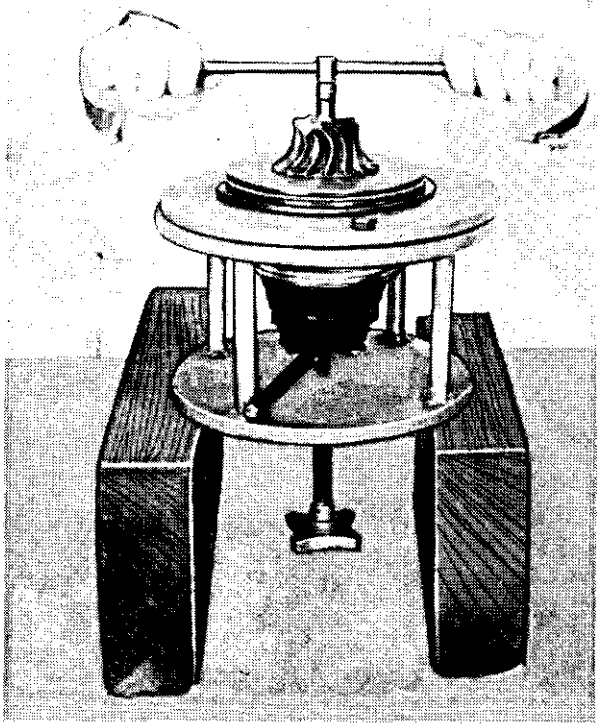
Figure 2-2. Turbocharger center housing disassembly



INSTALLING THRUST PLATE ASSEMBLY



INSTALLING NUT ON SHAFT



TIGHTENING IMPELLER NUT

Figure 2-3. Turbocharger assembly

i. Use new gaskets and seals at assembly.

j. Heat bearing (11) to 300°F before installing on gear (7) hub. Do not assemble this gear assembly until cooled to room temperature. Lubricate bearings with multipurpose type grease after assembly.

k. After installing seal (21) in housing (23), lubricate sealing lip with clean engine oil.

l. Coat the outside diameter of seal (20) and mating bore of housing (23) with a sealant. Install ring (16) with polished side toward seal (20).

m. Tighten cap screw (13) to torque of 25 to 35 foot pounds. Check clearance between impeller (12) and housing (23). Clearance should be 0.010 to 0.030 inch.

2-44. TIMING COVER AND FRONT MOUNTING GROUP (figure 34). Disassemble the timing cover and front mounting group as described below and following index numbers assigned on figure 34.

a. Remove the five bolts which secure the oil pan to bottom of timing gear cover.

b. Remove the cap screw and retaining washer which secure crankshaft pulley and vibration damper to crankshaft. Using a pulling device, such as a gear puller, remove vibration damper, pulley, and hub from crankshaft.

c. Remove cap screws (2), lock washers (3), and support cap (1) from front engine support (7). Remove shims (4, 5), support bushing (6), and engine support (7).

d. Remove cap screws (9), trunnion (8), and seal (10).

e. Remove cap screws (12), drive opening cover (11), and seal (13).

f. Remove cap screws (15, 16), washers (17), water pump opening cover (14), and gasket (18).

g. Remove cap screws (20), cover (19), and gasket (21).

h. Remove nuts (23), washers (24), accessory drive cover (22), and gasket (25).

i. Remove six nuts (31), six cap screws (34), thirteen cap screws (35), two cap screws (36), six flat washers (33), and twenty one lock washers (32). Remove front housing (26) and gasket (28). Do not remove studs (27) unless replacement is necessary.

j. Remove six cap screws (37), front housing plate (29), and plate gasket (30).

k. Remove oil seal (shown with crankshaft group) from front cover with a suitable puller.

l. Assemble the timing cover in the reverse of the above disassembly. Use a light coating of grease to hold gaskets in place when assembling. Replace gaskets (30, 28, 25, 21, 18) and seals (13, 10) at assembly. Trim gaskets (30, 28) flush with bottom of cylinder block to prevent leakage. Assemble the five oil pan cap screws removed in step a. When installing pulley hub, pulley, and vibration damper assembly removed in step b, tighten cap screw to a torque of 210 to 250 foot pounds, tap head of cap screw with a hammer and again tighten to 210 to 250 foot pounds.

2-45. FLYWHEEL, FLYWHEEL HOUSING, AND REAR MOUNTING GROUP (figure 35). Disassemble the flywheel, flywheel housing, and rear mounting group as described below.

a. Bend the corner locking tabs of compressor drive pin locking plates down to permit removal of drive pins. Unscrew and remove the eight drive pins, bushings, and four locking plates. Refer to figure 2-4 following.

b. Rotate flywheel to position alignment mark at top center of flywheel housing. Remove two retaining cap screws and install two guide studs as shown in figure 2-4.

c. Install a suitable lifting bracket to the flywheel as shown in figure 2-4, or equivalent. Support weight of the flywheel on lifting bracket using a chain hoist or other suitable lifting device. Remove remainder of retaining cap screws and slide flywheel from housing.

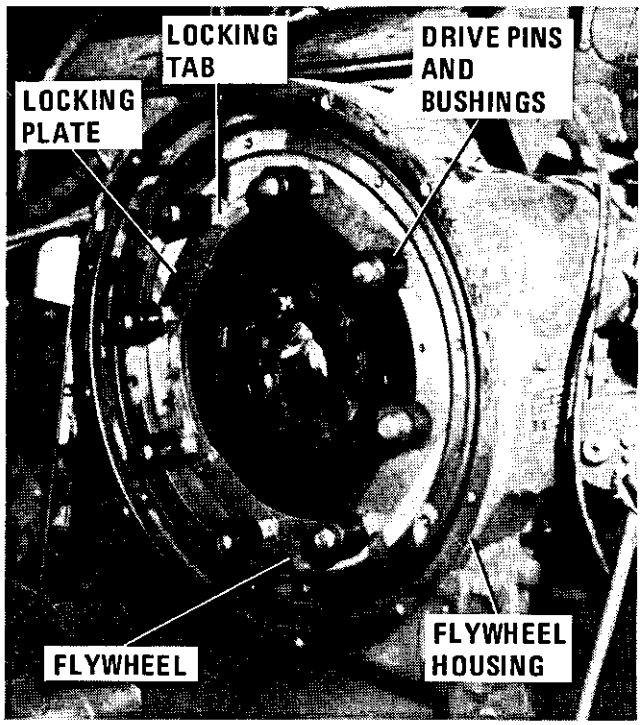
NOTE

Do not press ring gear from flywheel unless either is to be replaced.

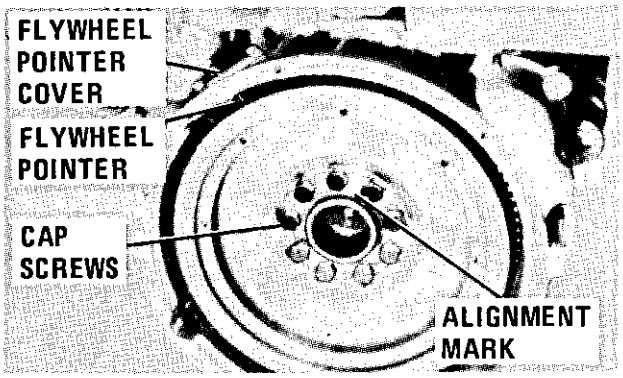
d. Disassemble remaining parts in the order of index numbers assigned on figure 35.

e. Discard gasket (10) and replace at assembly. Plugs (11, 12, 13) need not be removed from housing (17) unless replacement of damaged plugs is necessary. Remove oil seal (shown with crankshaft group, figure 52) from housing (17) bore with a suitable puller.

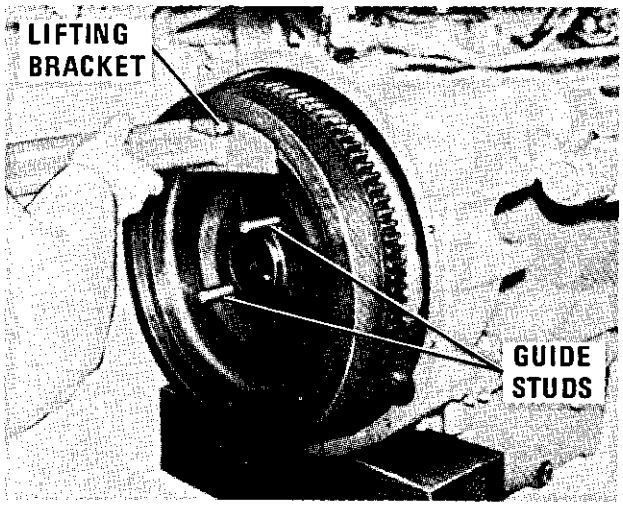
f. At assembly, apply a light film of grease on gasket (10) to hold in position on engine block. After assembly of



REMOVING DRIVE PINS



ALIGNING FLYWHEEL FOR REMOVAL



REMOVING FLYWHEEL

Figure 2-4. Flywheel disassembly and assembly

flywheel housing, trim this gasket flush with bottom face of cylinder block. Excessive gasket material will cause leakage if not cut square and flush with oil pan mounting face.

g. Assemble the flywheel housing parts in the reverse of disassembly (items 17 through 5) except (8) and (9) which are attaching parts for the housing.

h. Install two 1/2 inch guide studs in cylinder block. Using a suitable lifting device such as a chain hoist, carefully slide flywheel housing onto guide studs and seat housing against cylinder block.

NOTE

Make certain that flywheel housing gasket and oil pan plate gasket is properly seated.

i. Remove guide studs and secure flywheel housing (17) to cylinder block with cap screws (8, 9) and the six oil pan cap screws.

j. Install oil seal (11, figure 52) in housing (17, figure 35) with sealing lip of seal facing cylinder block.

k. If ring gear (3) was removed from flywheel (4), heat ring gear to maximum temperature of 600°F and install on flywheel with chamfered portion of ring gear teeth toward starter pinion opening in housing (17).

l. Attach a lifting bracket to flywheel assembly (refer to figure 2-4, this section). Install two guide studs in crankshaft tapped holes. Using a lifting device, slide flywheel assembly (1) onto guide studs and into mounting position with alignment mark on flywheel aligned with mark on crankshaft. Secure flywheel to crankshaft, remove guide studs, and install cap screws (2).

m. Install the four locking plates, eight drive pins, and bushings on flywheel. Bend corners of locking plates to secure drive pins (refer to figure 2-4, this section).

2-46. OIL PAN GROUP (figure 36). Disassemble the oil pan group in the order of key index numbers assigned on figure 36. Discard gaskets (12, 15) and replace at assembly. Assemble in the reverse of disassembly. Refer to figure 2-5 following for cap screw locations.

2-47. OIL PUMP GROUP (Figure 37). Disassemble the oil pump group in the order of index numbers assigned on figure 37. Before disassembly of shaft assemblies (30, 31) from body (36), measure clearance between face of gears and inner surface of body (36). Clearance should be 0.002 to 0.004 inch. Discard gaskets (6, 19) and replace at assembly. Assemble the oil pump group in the reverse of disassembly and the following details.

a. Install bearing (8) flush with gear hub face opposite timing mark side of gear (7).

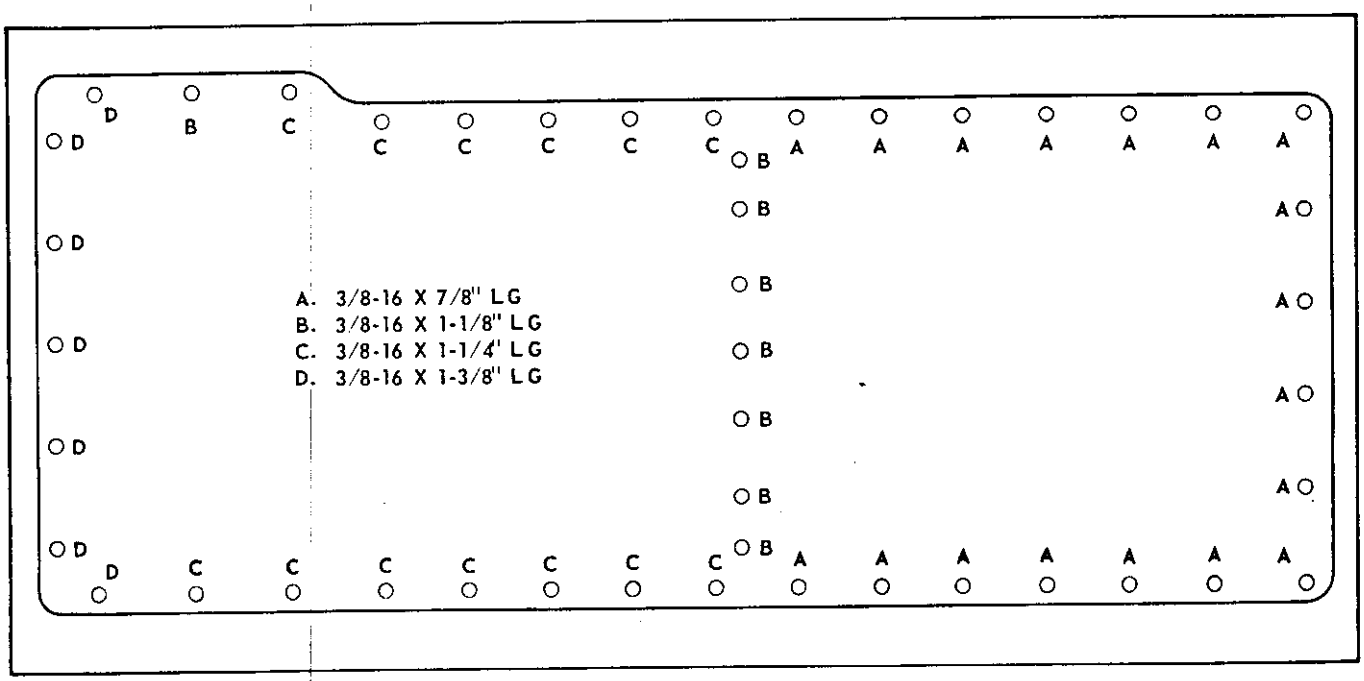


Figure 2-5. Oil pan and plate cap screw locations

b. The face of shaft bearings (34) must be recessed 0.020 inch beneath face of body (36) on gear side.

c. The face of shaft bearings (25) must be recessed 0.060 inch beneath face of body (26) on gear side.

d. Tighten gear retaining cap screw (10) to torque of from 27 to 37 foot pounds.

2-48. ENGINE OIL FILTER AND MOUNTING GROUP (Figure 38). Disassemble the engine oil filter and mounting group in the order of index numbers assigned on figure 38. Discard gaskets (4) and base seals (13); replace at assembly. Do not remove stud (12) from base (8) unless replacement is necessary. Replace filter assembly (7) as necessary. Assemble the oil filter and mounting group in the reverseof disassembly. When installing stud (12) in base (8), use a thread lock compound and tighten stud to a torque of from 40 to 60 foot pounds.

2-49. ENGINE OIL FILLER AND MOUNTING GROUP (Figure 39). Disassemble the engine oil filler and mounting group in the order of index numbers assigned on figure 39. Discard gasket (6) and replace at assembly. Assemble in the reverse of disassembly.

2-50. VALVE COVER BREATHER AND MOUNTING GROUP (Figure 40). Disassemble the valve cover breather and mounting group in the order of index numbers assigned on figure 40. Discard breather seal (9) and replace at assembly. Install cap screws and washers, used to attach clips (2), back on engine after tube (1) is removed. Clean the breather assembly (5) by flushing in a container of clean diesel fuel or solvent, Specification P-D-680, until oil is removed from element. Shake breather assembly (5) to remove cleaning agent or blow dry with low pressure compressed air. Do not disassemble breather assembly (5). Assemble in the reverse of disassembly.

2-51. OIL COOLER AND MOUNTING GROUP (Figure 41). Disassemble the oil cooler and mounting group in the order of index numbers assigned on figure 41. Discard gaskets (6, 7, 17, 23, 33, 36) and replace at assembly. Discard seals (24, 34, 42) and replace at assembly. Plugs (8, 9, 18, 19, 20) need not be removed except for replacement. Clean the oil cooler core assembly (43) as follows:

WARNING

Use extreme caution when mixing acid solution and when cleaning the cooler core assembly. Always add acid to water when mixing; never add water to acid. Avoid any contact of solution with skin. Keep solution away from eyes.

a. Clean tubes of core assembly (43) with a solution of 15% hydrochloric acid and 85% water. The core assembly should be immersed in or flushed with the solution until scale is softened.

b. Wash core assembly thoroughly with clean water to remove scale and acid solution. Repeat procedure as necessary to clean scale from tube bundle.

c. After thorough cleaning, assemble the oil cooler and mounting group in the reverse of disassembly.

2-52. FUEL FILTER AND PRIMING TANK GROUP (Figure 42). Disassemble the fuel filter and priming tank group in the order of index numbers assigned on figure 42. Discard gaskets (12, 14, 23) and replace at assembly. Discard seals (27, 29) and replace at assembly. See paragraph 2-53 for disassembly of fuel filter assembly (7). Assemble in the reverse of disassembly.

2-53. FUEL FILTER ASSEMBLY (Figure 43). Disassemble the fuel filter assembly in the order of index numbers assigned on figure 43. Plug (3) and stud (6) need not be removed from base (5) unless replacement is necessary. Replace filter (4) as required. Assemble in the reverse of disassembly.

2-54. SERVICE METER AND TACHOMETER DRIVE (Figure 44). Disassemble the engine service meter and tachometer drive in the order of index numbers assigned on figure 44. Discard preformed packing (8, 22) and replace at assembly. If service meter window requires replacement, use repair parts kit as indicated on figure 44 parts list. At assembly, apply a light film of clean engine oil on preformed packing (8, 22). Pack cavity of housing (20) with 7 cubic centimeters of lubricant conforming to MIL-L-7866. Use required number of shims (19) to produce 0.001 to 0.005 inch end play of shaft assembly (18). Torque screws (2) to 6 to 10 foot pounds.

2-55. FUEL TRANSFER PUMP (Figure 45). Disassemble the fuel transfer pump in the order of index numbers assigned on figure 45. Discard preformed packing (13) and gasket (5); replace at assembly. Discard seals (11, 16); replace at assembly.

CAUTION

Pry cover (17) and body (23) apart carefully. Sealant was used at assembly.

Assemble fuel transfer pump in the reverse of disassembly. Before installing seals (11, 16), lubricate lightly with clean

engine oil. Apply a thin coating of a suitable sealant between mating surfaces of cover (17) and body (23). Do not allow sealant to enter pump. Check clearance between bearing (10) and shaft (19). Clearance shall not exceed 0.003 inch. Tighten nut (7) to torque of from 17 to 27 foot pounds.

2-56. ACCESSORY DRIVE GROUP (Figure 46). Disassemble the accessory drive group in the order of index numbers assigned on figure 46. Use a gear puller to remove gears (3, 9). Discard gaskets (30, 35, 36); replace at assembly. Assemble the accessory drive group as follows:

a. Assemble accessory drive idler group in the reverse of index numbers (1 through 8).

b. Assembly of accessory drive housing (32), shaft (21), and bearing (20) group is essentially the reverse of index numbers (9 through 36), except that the drive gear groups (9, 10, 11, 17) should not be assembled until after accessory drive timing (refer to step c below and figure 2-6).

c. Accessory Drive Timing. Remove valve cover. Remove timing pointer cover from flywheel housing. Time the accessory drive shaft as follows:

1. Rotate the crankshaft counterclockwise (as viewed from flywheel end) at least 60°. Continue rotating until TC1-6 CYL mark on flywheel is aligned with timing pointer and both the inlet and exhaust valves of cylinder No. 1 are closed.

2. Install timing plate on rear face of accessory drive housing as shown in figure 2-6. If timing plate can be installed, timing is correct; proceed to step 4 below. If timing plate cannot be installed, proceed to step 3 and adjust timing.

3. Turn accessory drive shaft, using extension nut, until timing plate fits properly on accessory drive housing. When the plate fits, the drive shaft is properly timed.

4. Remove timing plate. Install drive gear group (9, 10, 11, 17). Tighten nut (10) to torque of from 90 to 110 foot pounds.

5. Install the timing pointer cover and valve cover.

2-57. GOVERNOR ASSEMBLY AND FUEL INJECTION PUMP GROUP (Figure 47). Disassemble the governor assembly and fuel injection pump group in the order of index numbers assigned on figure 47, sheets 1 and 2, and the following detailed instructions.

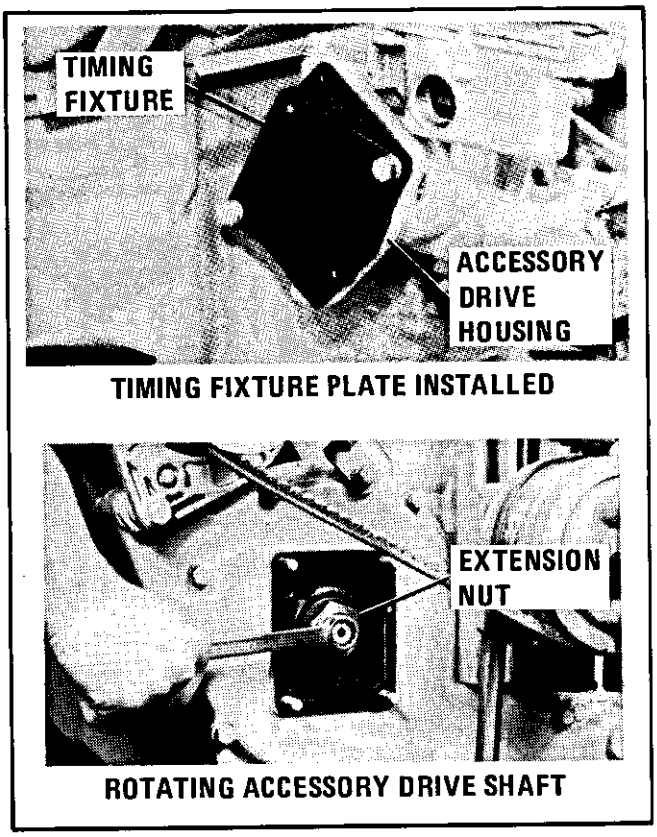


Figure 2-6. Accessory drive shaft timing

a. Governor Assembly (figure 47, sheet 1). Remove cap screw (2), lock washer (3), and ground wire (1). Loosen cap screw (5) and remove lever (4) from shaft (96). Loosen cap screw (7) and remove lever (6) and key (8) from shaft (55). Remove sealing wire (9) and seal (10). Remove nuts (12), lock washers (13), lift shutoff solenoid (11) slightly to disengage solenoid shaft from lever (51). Remove shutoff solenoid (11) and gasket (14). Remove cap screws (15, 16), lock washers (17), and remove governor assembly from fuel injection pump. Remove gasket (18). Disassemble the governor assembly as follows:

1. Remove cap screws (20), cover (19), and gasket (21). Remove cap screws (23), washers (24), cover (22), and gasket (25).

2. Remove cap screws (27, 28, 29), washers (30), plate assembly (26), and gasket (31).

3. Remove cap screw (33), washer (34), cover (32), and gasket (35). Unscrew and remove adjustment screws (36, 37) and preformed packing (38).

4. Remove cap screw (40), stop collar (39), lock nut (41), set screw (42), collar (43), and spring (44).

5. Remove nuts (45), lock washers (47), flat washers (48), insulator washers (49), and remove terminal screw (46).

6. Remove cap screws (52), lock plate (53), and shutoff levers (51, 54). Remove cap screws (50) and separate cover assembly from housing (109). Remove gasket (59).

7. Remove shaft (55) from cover (58), and as necessary, remove shaft seals (56) and bearing (57).

8. Remove rack stop (60) and, as necessary, disassemble in order of index numbers (61 through 68).

9. Remove cap screws (70), cylinder lock (71), and cylinder (69). Remove sleeve (72), preformed packing (73), and piston and valve (74).

10. Remove lock ring (75); remove weight assembly. Remove pins (77) and weights (76) from gear (78).

11. Remove retaining ring (79), bearing races (80), and needle bearing (81).

12. Remove dowel (82), sleeve (83), flat washers (84), spring (85), stop bolt (86), and spring seat (87).

13. Remove retaining ring (88) and spring (89). Remove spring (90) and seat (91).

14. Remove plug (92), gasket (93), spring (94), and plunger (95). Remove lever shaft (96) and lever assembly (97).

15. Remove bolt (98), lock plate (99), pin (100), spring (101), and plunger (102).

16. Remove shaft seal (103), bearing (104), cup plug (105), bearing (106), and pipe plug (107) from housing (109) as necessary. Only when necessary, remove spring guide (108) from housing (109).

NOTE

Spring guide (108) will be damaged when removed from housing (109). Replace guide at assembly when removed.

b. Assembly of the governor assembly is essentially the reverse of disassembly and the following details.

1. Use all new gaskets, preformed packing, and seals at assembly.

2. When installing a new guide (108), form the end of the guide against and all the way around the chamfer in housing (109).

3. When assembling weights (76) to gear (78), stake four places around each pin (77) on both ends. Each weight must have 0.001 to 0.007 inch end play and must pivot freely on its pin.

4. Torque nut (41) to 10-12 foot pounds.

5. After governor is assembled to the fuel injection pump, the backlash between drive gear on housing and driven gear on shaft must be checked. Backlash should not exceed 0.006 inch. Also, the fuel rack must be set (see paragraph 2-57.e).

c. Fuel Injection Pump Group (figure 47, sheet 2). Disassemble the fuel injection pump group in the order of index numbers on figure 47, sheet 2 and the following details.

1. Remove cap screws (2, 3, 4, 5), lock washers (6), and bracket (1). Remove and discard preformed packing (7, 8, 9, 10). Plugs (11, 12) need not be removed from bracket (1).

2. Remove cap screws (13, 14), washers (15), and remove injection pump assembly from engine. Remove and discard gasket (51).

3. Remove felt washers (16), bushings (17), and seals (18) from each fuel injection pump cavity in housing (50).

4. Attach an extractor to the injection pump assemblies (items 19 through 25) and remove the assemblies from the housing (50) (see figure 2-7 following).

CAUTION

All service shall be performed with clean hands and with parts on a clean, lint-free cloth. Keep parts for each injection pump separated as each pump has matched parts that are not interchangeable.

5. To disassemble fuel injection pumps, remove retaining washer (25), spring (24), retaining ring (19), bonnet (20), spring (21), and check valve (22) from plunger and barrel (23).

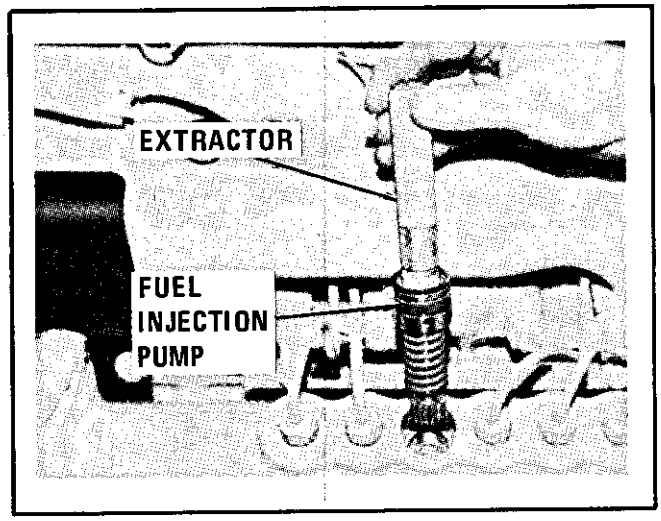


Figure 2-7. Injection pump extractor tool

CAUTION

Wire together each spacer (27) and lifter (28). Tag each pair and identify the pump bore from which each was removed.

6. Remove rack (26), spacers (27), and lifters (28).

7. Remove cap screw (30), lock plate (31), retaining plate (32), spring (33), gear assembly (29), and pin (34).

8. Remove sleeve (36), camshaft (37), pin (35), and bearings (39, 40).

9. Before removing rack bearing (41), scribe two marks on face of housing (50) above groove on bearing (41). This indicates alignment of groove on bearing with drilled lubrication passage at assembly (see figure 2-8).

10. Cup plug (43), pins (44, 45), ball plugs (46), pins (47), and plugs (48, 49) need not be removed from housing (50) unless replacement is necessary.

d. Assembly of the fuel injection pump group is essentially the reverse of disassembly and the following details.

1. At assembly use all new gaskets and preformed packing.

2. Preassemble the fuel injection pumps (items 19 through 25) in reverse of index numbers if these parts were disassembled. These pumps have matched parts that

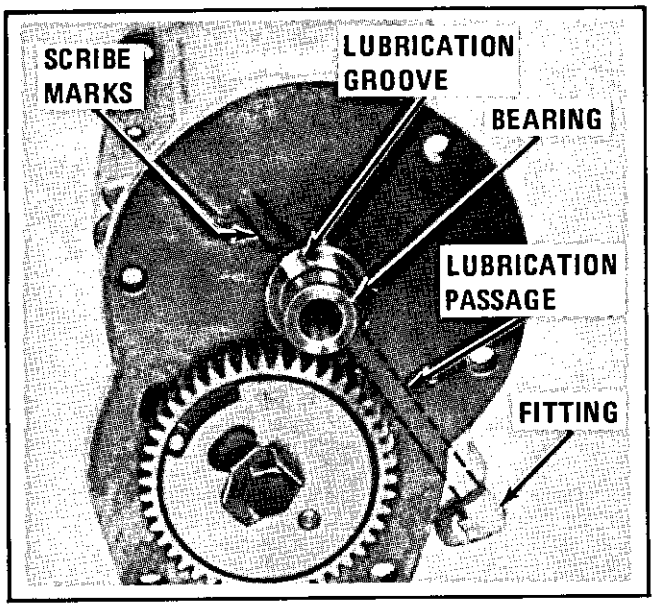


Figure 2-8. Rack bearing alignment

are not interchangeable. Disassembled parts are to be kept with appropriate assembly and each pump shall be assembled into the housing cavity from which it was removed. Align notches of injection pump assembly as shown in figure 2-9.

3. Install camshaft bearing (38) in housing (50) so that oil hole in bearing aligns with oil passage in housing.

4. Install fuel rack bearing (41) in housing (50) so that groove in bearing aligns with scribe marks on housing (refer to figure 2-8). Install bearing (41) at a depth of 0.190 to 0.200 inch from face of housing.

5. Assemble each lifter (28) and spacer (27) in same location (cavity) as removed. Lifters (28) must be assembled before rack (26).

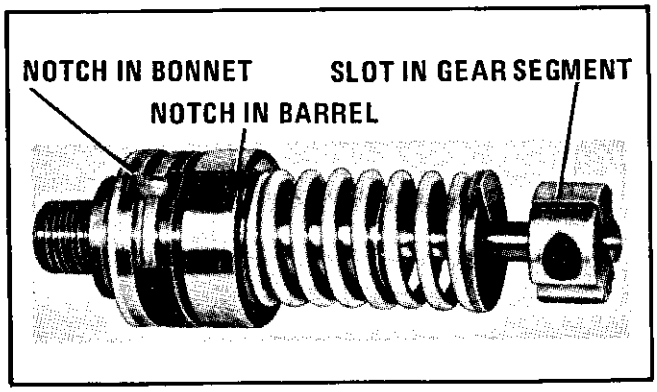


Figure 2-9. Aligning injection pump

CAUTION

The fuel rack (26) must be held at the center or zero position when installing a fuel injection pump. An injection pump installed in the "fuel on" side of its gear segment can cause engine to overspeed resulting in serious damage to the engine.

6. Use fuel rack setting gage when installing fuel rack (26). Position fuel rack so that gage indicates 0.000 inch (see figure 2-10).

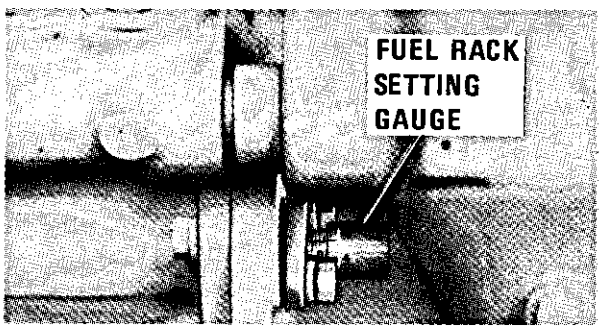


Figure 2-10. Fuel rack setting gage

7. Install each fuel injection pump assembly (pre-assembled in paragraph 2-57.d.2 above) so that notches engage with two locating pins in each housing bore. Use an extractor tool as shown in figure 2-7 to assemble injection pumps in housing.

CAUTION

When tightening retaining bushing (17), torque other than specified below will allow leakage or can damage housing.

8. Tighten each pump retaining bushing (17) to torque of 140 to 160 foot pounds.

9. After injection pump assemblies are installed, check fuel rack setting. With fuel rack (26) at extreme fuel position, rack setting gage should indicate +0.312 inch minimum. If reading is less than +0.312 inch, remove injection pump assemblies, position fuel rack to 0.000 inch, and re-install pumps. Recheck extreme "fuel on" rack position (reference figure 2-10).

10. To check fuel injection pump timing dimension and adjustment - off engine, refer to figure 2-11. Install pointer assembly on fuel injection pump housing.

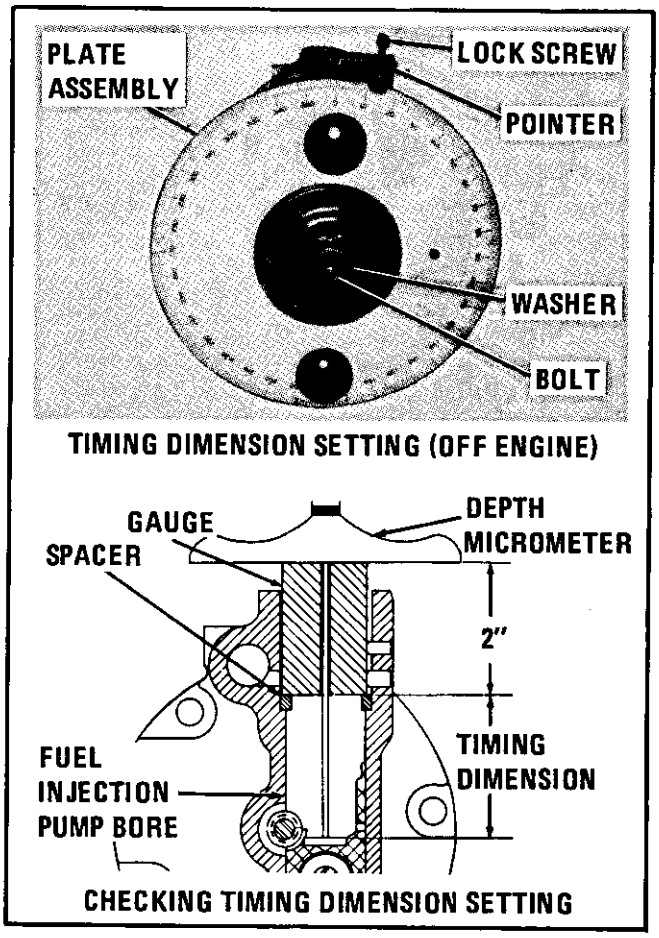


Figure 2-11. Fuel injection timing - off engine

11. Install timing plate on drive end of fuel injection camshaft.

12. Remove injection pump assembly for cylinder being checked. Install gage in pump bore.

13. Refer to table 2-5 and select the timing plate degree setting for lifter being checked. Rotate timing plate counterclockwise until proper degree setting aligns with pointer assembly. Tighten screw to lock in position.

14. Measure timing dimension with a depth micrometer. Dimension should be 4.2670 to 4.2680 inches. If timing dimension is correct, proceed to step 16 below. If timing dimension is not correct, proceed to step 15.

15. If timing dimension is not correct, replace spacer (27, figure 47, sheet 2). Select a spacer thickness

Table 2-5. Timing Plate Degree Setting

LIFTER NUMBER (CONSECUTIVE FRONT TO REAR)	TIMING PLATE DEGREES
1	170°30'
2	59°30'
3	299°30'
4	119°30'
5	239°30'
6	359°30'

that will correct the timing dimension. Spacers are available in varying thicknesses from 0.170 to 0.198 inch. Recheck timing dimension.

16. Install fuel injection pump assembly in location checked.

17. Check timing dimension for each cylinder as described above following firing order of engine: 1, 5, 3, 6, 2, 4.

18. Assemble fuel injection pump group on the engine in reverse of disassembly. Secure in position between governor and accessory drive housing with cap screws (13, 14) and washers (15).

19. Complete the assembly of component (1 through 12) in the reverse of index numbers.

e. Fuel Rack Setting Check and Adjustment. The fuel rack setting is based on the following principle: the distance the fuel rack travels from the centered position to the point where the governor stop collar adjustingscrew is just touching the stop bar. Check and adjust as follows:

1. Install fuel rack setting gage (figure 2-10). Adjust gage to +0.085 inch.

2. If speed control rod is attached to governor control lever, disconnect speed control rod.

3. Connect a continuity tester between brass screw terminal and housing (view A, figure 2-12).

4. Remove plug and manually depress speed limiter plunger (view A, figure 2-12).

NOTE

Speed limiter plunger must be depressed to permit full fuel rack travel when engine is not running.

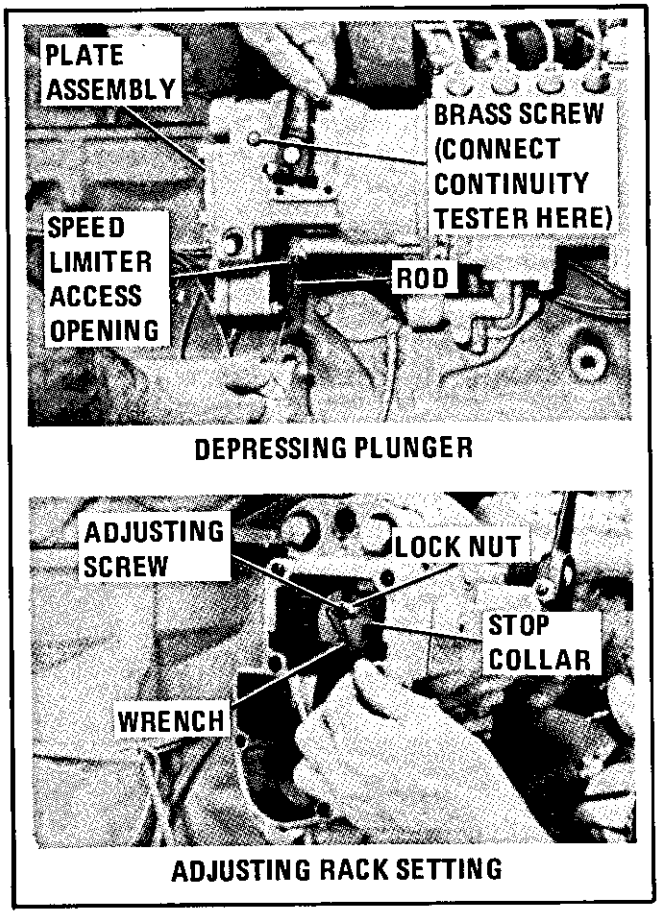


Figure 2-12. Governor assembly fuel rack setting adjustment

5. With speed limiter plunger depressed, move governor control lever in "fuel on" direction until continuity tester lights, then slowly reverse direction of lever until tester lamp just goes out.

6. Slowly, move governor control lever in "fuel on" direction until continuity tester just barely lights (dim). Rack collar adjusting screw is now just touching stop bar.

7. Adjust fuel rack setting gage until it is against end of fuel rack. Gage should indicate +0.070 inch if fuel rack is adjusted correctly. If fuel rack setting is correct, proceed to step 12. If setting is not correct, proceed to step 8.

NOTE

Because of engine dimensional tolerances, fuel rack setting may vary from engine to engine. The exact setting for each engine is stamped on engine data plate located on the engine block forward of the flywheel housing.

8. Remove plate assembly from governor to gain access to fuel rack stop collar adjusting screw (refer to figure 2-12). Loosen lock nut on adjusting screw.

CAUTION

When governor cover is removed, stop collar could rotate out of position resulting in a serious fuel rack misadjustment. Ensure that stop collar is always positioned properly so that adjusting screw is aligned with stop bar.

9. Adjust screw (view B, figure 2-12) and repeat steps 5 through 7 above to obtain correct fuel rack setting.

10. Tighten adjusting screw lock nut to a torque of 9 to 12 foot pounds. Recheck rack setting.

11. Ensure that stop collar is positioned properly and install governor plate assembly.

12. Install speed limiter access plug.

13. Disconnect and remove continuity tester.

14. Remove fuel rack setting gage and reinstall cover.

15. Connect engine stop control cable to governor control lever.

16. Connect speed control rod to governor control lever and adjust linkage as necessary.

f. Fuel Injection Pump Timing Dimensional Check and Adjustment - On Engine. Remove valve cover and the timing pointer cover from the flywheel housing. Check and adjust as follows (refer to figure 2-13).

1. Remove fuel injection pump for cylinder No. 1.

2. Rotate crankshaft counterclockwise (viewed from flywheel end) at least 60°. Continue rotating crankshaft until TC1-6 CYL mark on the flywheel is aligned with timing pointer and both the inlet and exhaust valves of cylinder No. 1 are closed.

3. Install gage in pump bore. Measure timing dimension using a depth micrometer. Timing dimension should be 4.2159 to 4.2199 inches. If timing dimension is

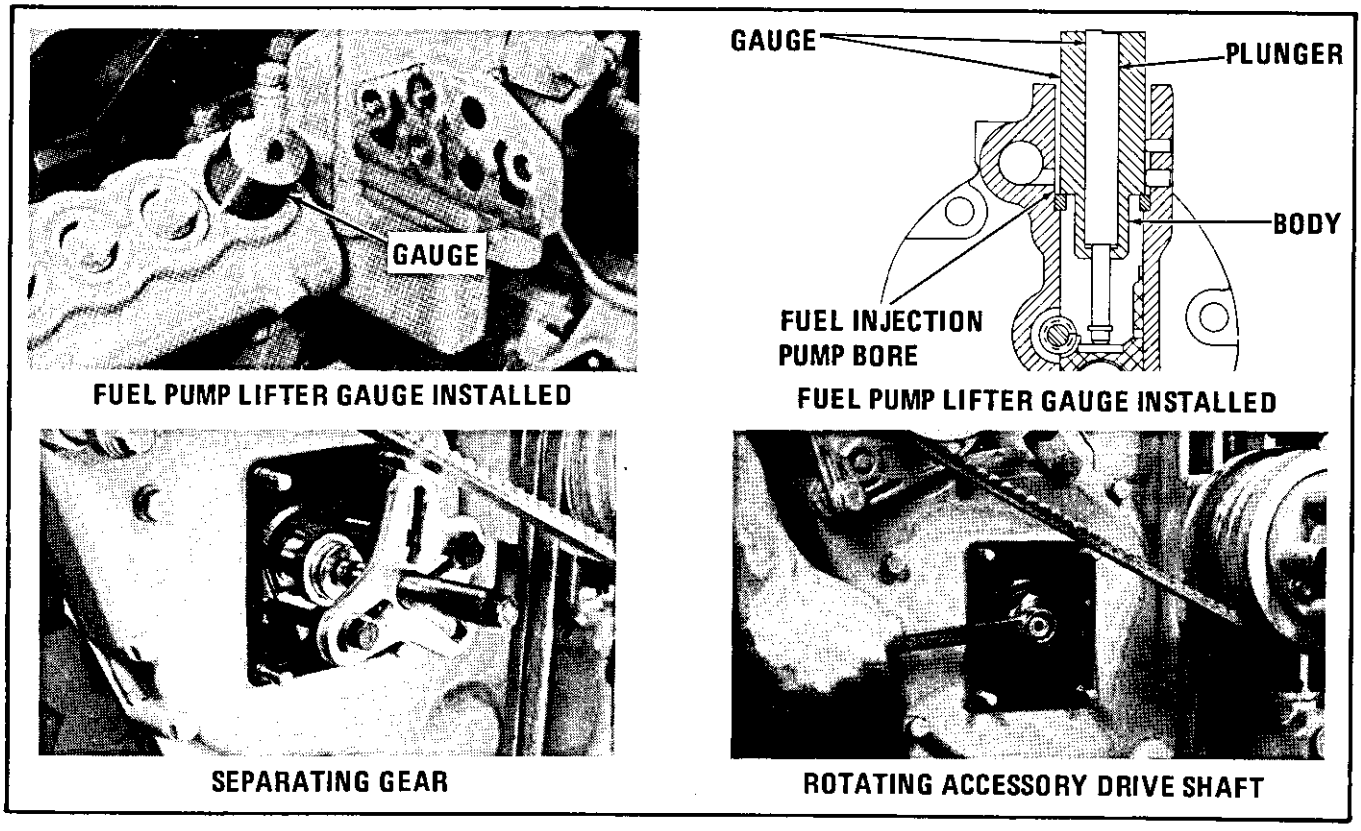


Figure 2-13. Fuel injection timing - on engine

correct, proceed to step 8 below. If timing is not correct, proceed to step 4 and make adjustment.

4. Remove accessory drive cover from front of timing gear cover and loosen accessory drive gear retaining nut (do not remove nut).

5. Separate gear from accessory drive shaft with a gear pulling tool, then, remove pulling tool (refer to figure 2-13).

6. Turn accessory drive shaft extension nut counterclockwise and adjust timing dimension. Timing dimension should be 4.2159 to 4.2199 inches.

7. Install accessory drive gear. Tighten retaining nut to torque of 90 to 110 foot pounds. Recheck dimension. Replace accessory drive cover.

8. Install fuel injection pump for cylinder No. 1, install timing pointer cover, and install valve cover.

2-58. GLOW PLUG WIRING AND VALVE COVER GROUP (Figure 48). Disassemble the glow plug wiring and valve cover group in the order of index numbers assigned on figure 48. Discard gasket (8) and replace at assembly. Assemble in the reverse of disassembly.

2-59. VALVE MECHANISM AND CYLINDER HEAD GROUP (Figure 49). Disassemble rocker arms and push rods from this group as follows:

a. Rocker Arms and Push Rods. Remove the six cap screws (9, figure 49, sheet 1) and washers (10) that secure the rocker arm assemblies to the cylinder head. Remove this assembled group from the cylinder head and remove the push rods (22).

1. Remove the two retaining rings (1), washer (2), two springs (3), and two washers (4).

2. Remove dowel pin (18) and bracket (19). Remove the four brackets (17), ten washers (15), five springs (16), and six arm assemblies (13). Remove the twelve bearings (14, 6) as necessary. Remove dowel pin (12) and bracket (11).

3. Remove twelve nuts (7), twelve screws (8), and six arm assemblies (5). The plugs (20) need not be removed from shaft (21) unless replacement is necessary. Remove the twelve lifters (23).

b. Cylinder Head Group. Remove cap screws (25, figure 49, sheet 2) and housing (24). Plug (27) need not be removed, except for replacement. Remove gasket (26) and temperature regulator (28). Remove glow plugs (51).

1. Remove six precombustion chambers (52), preformed packing (53), and gaskets (54).

2. Attach a lifting device to eyes (45). Remove cap screws (41, 43) and washers (42, 44). Lift cylinder head from engine.

CAUTION

When intake and exhaust valves are removed, tag location from which removed for assembly reference.

3. Remove the twenty four retaining locks (48), twelve rotocoil assemblies (49), twelve springs (50), six inlet valves (46), and six exhaust valves (47). Remove the inlet valve inserts (39), exhaust valve inserts (40), and bushings (37) from cylinder head (38) only as necessary.

4. Remove cap screws (30), lock washers (31), cover (29) and gasket (32) as necessary.

5. Remove eighteen water directors (34), three plugs (33), six plugs (35), and seven plugs (36) only as necessary.

6. Remove lifting eyes (45) from cylinder head (38). Remove cylinder head gasket (55) from engine block.

7. Discard gaskets (26, 54, 32, 55) and replace at assembly. Discard preformed packing (53) and replace at assembly.

c. Assemble the cylinder head group in essentially the reverse of disassembly and the following details.

1. Install water directors (34) aligning the opening in the director with "V" mark on head (38).

CAUTION

Make certain that intake and exhaust valves (46, 47) are installed in same location as tagged at disassembly.

2. If removed, install valve guide bushings (37) and valve seat inserts (39, 40) (refer to table of limits). Install valves (46, 47), valve springs (50) with painted end up, use a spring compressor and install retainers (49) and secure to valve stems with retaining locks (48).

3. Assemble valve lifters (23, figure 49, sheet 1) in cylinder block. Place a new, clean, and dry gasket (55, figure 49, sheet 2) on cylinder block. Use a lifting device and carefully place cylinder head on block.

4. Secure head to block with cap screws (41, 43) and washers (42, 44). Refer to table of limits for tightening sequence and torque.

5. Install and check precombustion chambers (52) positioning as follows:

a. Install thinnest gasket (54) (0.194 inch) first. Install precombustion chamber (52) and torque to 140 to 160 foot pounds.

b. If glow plug opening is not positioned in the "GO" range indicated on figure 2-14, remove the precombustion chamber and replace gasket with that called for on figure 2-14.

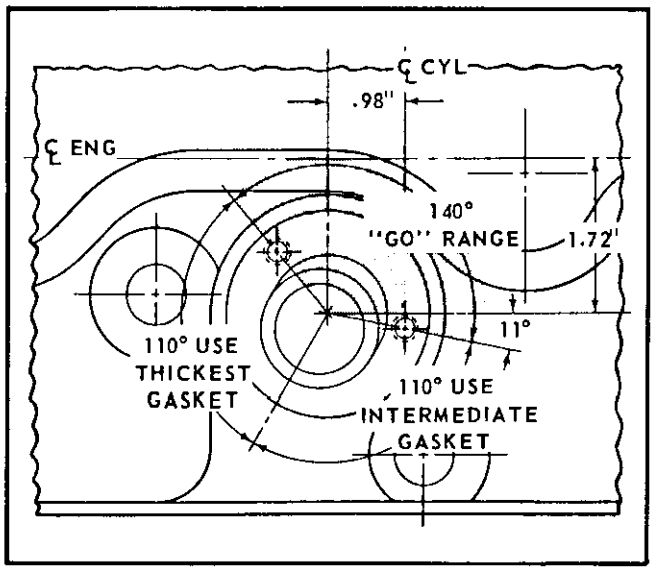


Figure 2-14. Precombustion chamber assembly

6. After precombustion chamgers are assembled properly, assemble glow plugs (51) and the remaining cylinder head components in the reverse of disassembly.

d. Assemble the rocker arms and push rod group essentially in the reverse of disassembly (figure 49, sheet 1) and the following details.

1. If bearings (6, 14) were removed from arm assemblies (5, 13), press bearings in arms with oil hole in bearing aligned with oil hole in arm.

2. Assemble the rocker arm assembly components (1 through 20) on shaft (21) in the reverse of disassembly.

3. Assemble push rods (22) in cylinder head.

4. Assemble the rocker arm assembly on head and attach with washers (10) and cap screws (9). Apply anti-seize compound on threads of cap screws (9). Refer to table 2-4 for torque limits.

5. Adjust the valve lash setting in accordance with paragraph 5-56, Part 1.

2-60. CAMSHAFT GROUP (Figure 50). Disassemble the camshaft group in the order of index numbers assigned on figure 50. Assemble in the reverse of disassembly and the following details.

a. Carefully install camshaft (7) in cylinder block and seat on bearings.

b. Assemble thrust washer (4) on cylinder block and secure with lock (6) and cap screws (5).

c. Assemble camshaft gear (1) on camshaft (7) aligning letter "C" on camshaft gear (1) with letter "C" on crankshaft gear. Secure camshaft gear to camshaft with washers (3) and cap screws (2).

2-61. CONNECTING ROD AND PISTON ASSEMBLY (Figure 51). Disassemble the connecting rods and piston assemblies in the order of index numbers assigned on figure 51. Assemble as detailed below.

NOTE

At disassembly, keep bearing halves (11) together with their respective caps and rods (10).

a. Lubricate all bearings (11), piston rings (3, 4, 5), and the cylinder liner walls with clean engine oil. Use a piston ring expander when assembling rings (3, 4, 5) as shown on figure 2-15.

b. Insert piston and connecting rod, less cap and bearing halves, into each cylinder liner using a piston ring compression tool, see figure 2-16.

c. Install piston so that cylinder number stamped on side of connecting rod will be visible from inspection cover opening.

d. Install connecting rod upper bearing half on rod and guide lower end of each rod carefully over crankshaft journal so as not to damage the journal.

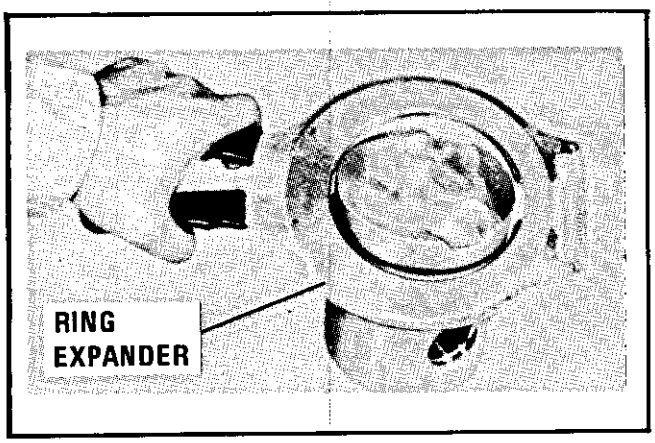


Figure 2-15. Piston ring installation

Figure 2-16. Piston installation

e. Check connecting rod bearing clearance as follows:

1. Cut one length of very soft wire or solder for each bearing. Length of wire should be the same as width of bearing.

2. Assemble bearing lower half in connecting rod cap. Coat wire lightly with grease to hold in place on bearing half.

3. Assemble bearing and cap on connecting rods. Torque nuts to 27-33 foot pounds.

4. Remove caps and bearings, one at a time, and measure thickness of wire. Thickness should be 0.010 inch maximum, representing bearing clearance.

f. Assemble bearing lower halves and rod caps. Torque nuts to 27-33 foot pounds; then, mark the end of bolt and nut. Turn nut an additional 90°.

2-62. CRANKSHAFT GROUP (Figure 52). Disassemble the crankshaft group as outlined below.

a. Remove cap screw (4, figure 52), and hub washer (5). Using a pulling device, remove the damper, hub, and pulley assembly from the crankshaft.

b. When necessary to replace a component of this assembly, remove cap screws (2) and separate damper (1) from hub (3). Remove cap screws (7), washers (8), and separate pulley (6) from hub (3).

NOTE

Oil seals (9, 11) and sleeves (10, 12) are shown with this group for parts relationship only. Oil seals should be removed from timing gear cover and flywheel housing at time of disassembly of these components. Refer to paragraphs 2-44 and 2-45. Sleeves (10, 12) are used only when crankshaft shows wear from seals and oversized replacement seals are used.

c. Use a suitable puller and remove crankshaft gear (13) from crankshaft. Remove key (14).

CAUTION

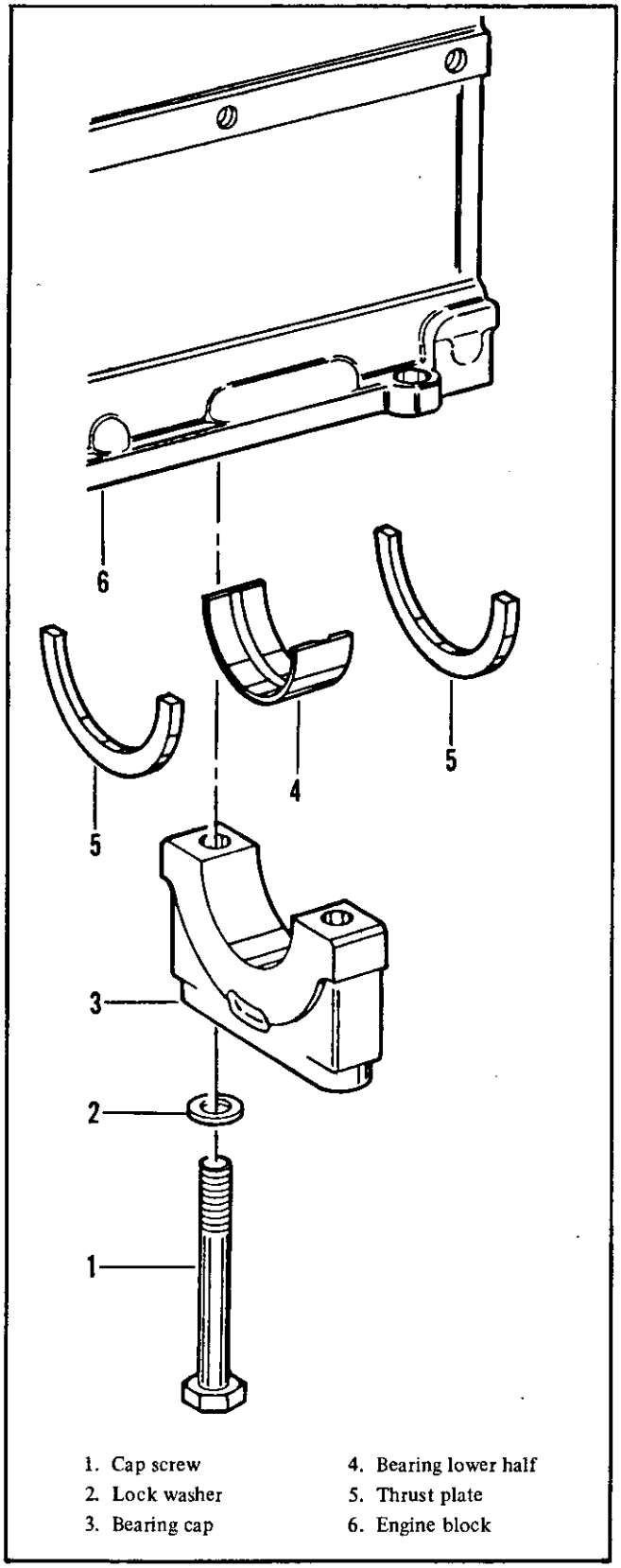
Protect bearing surfaces of crankshaft by wrapping with heavy cloth before attaching lifting cable.

d. Attach a lifting cable to the ends of the crankshaft in such a way as to allow the crankshaft to turn. Lift crankshaft just enough to hold the weight of the crankshaft when the upper bearing halves are removed.

e. Remove cap screws (1, figure 2-17) and washers (2) from each of the seven main bearing caps (3). Remove the bearing caps and bearing lower halves (4). Remove the two thrust plates (5) from rear bearing.

f. Place a suitable tool in the crankshaft oil hole and rotate crankshaft in direction so that the inserted tool "rolls" the upper bearing half out of its seat, tab end first. Refer to figure 2-18.

g. Repeat this bearing removal step for each upper bearing half.



1. Cap screw
2. Lock washer
3. Bearing cap
4. Bearing lower half
5. Thrust plate
6. Engine block

Figure 2-17. Crankshaft removal and installation

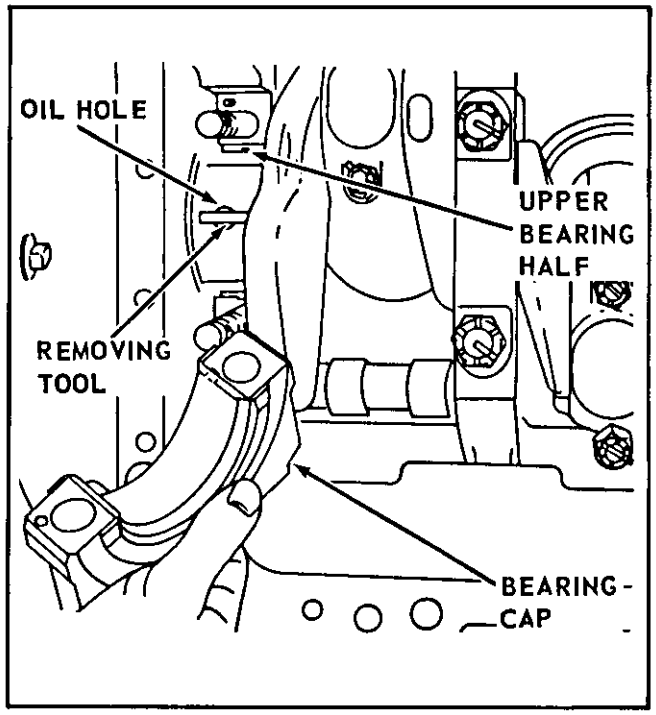


Figure 2-18. Main bearing upper half removal and installation

h. When bearings are all removed, lift the crankshaft out of the engine. The pipe plugs (16, figure 52) need not be removed from crankshaft (18) except for cleaning of oil passages in the crankshaft. All main bearing caps shall be marked with location removed or assembled to block in the same location.

NOTE

Bearing caps shall always be assembled in the same location as removed.

i. Assemble the crankshaft group as detailed in the following paragraphs.

j. If removed, install plugs (16, figure 52) in crankshaft (18).

k. Assemble key (14) in crankshaft keyway. Heat the crankshaft gear (13) to maximum temperature of 600°F and install on crankshaft aligning gear keyway with installed key. Shouldered side of gear (13) shall be against crankshaft shoulder.

l. If main bearing caps are installed on block, remove main bearing caps. Observe NOTE following step h above. Observe CAUTION following step c above.

m. Attach a cable around number one and number five connecting rod journals on crankshaft. Lift the crankshaft with chain hoist, or other suitable lifting device. Position crankshaft above main bearing journals; lower to a point where crankshaft can be turned by hand for installing bearing halves.

n. Place a suitable tool in oil hole of crankshaft bearing journal that will "roll" upper bearing half into position in cylinder block journal. Refer to figure 2-18. Turn crankshaft by hand and "roll" upper bearing half into position. Roll upper half so that tab on bearing is properly located (roll into position with tab end last).

o. Remove the "rolling" tool and repeat installation procedure above for each upper bearing half.

p. Lower crankshaft onto bearing upper halves and remove lifting device and cable.

q. Before permanently installing lower bearing halves and main bearing caps, check main bearing clearance as follows:

1. Cut two one-inch lengths of very soft wire or solder for each of the seven main bearings.

2. Assemble lower bearing halves in main bearing caps. Coat wire lightly with grease to hold them on bearing and place two pieces of wire on each bearing lower half as shown in figure 2-19.

3. Install lower bearing caps and torque cap screws to 165 - 185 foot pounds. Rotate crankshaft at least one revolution. Remove bearing caps with lower bearing halves.

4. Measure thickness of wires to obtain main bearing clearance. Clearance should be 0.0030 to 0.0059 inch.

r. Install bearing lower halves and main bearing caps. Torque cap screws to 165 - 185 foot pounds. Install thrust plates (5, figure 2-17) when installing rear bearing cap (3).

s. Push crankshaft as far as it will go to one end of cylinder block. Measure end clearance between machined face of crankshaft flange and flange of lower half of rear main bearing. Clearance should be 0.0060 to 0.0180 inch.

t. Assemble remaining components of crankshaft group, figure 52, in the reverse of disassembly.

2-63. CYLINDER BLOCK ASSEMBLY (Figure 53). Disassemble the cylinder block assembly to the extent necessary in the order of index numbers assigned on figure 53.

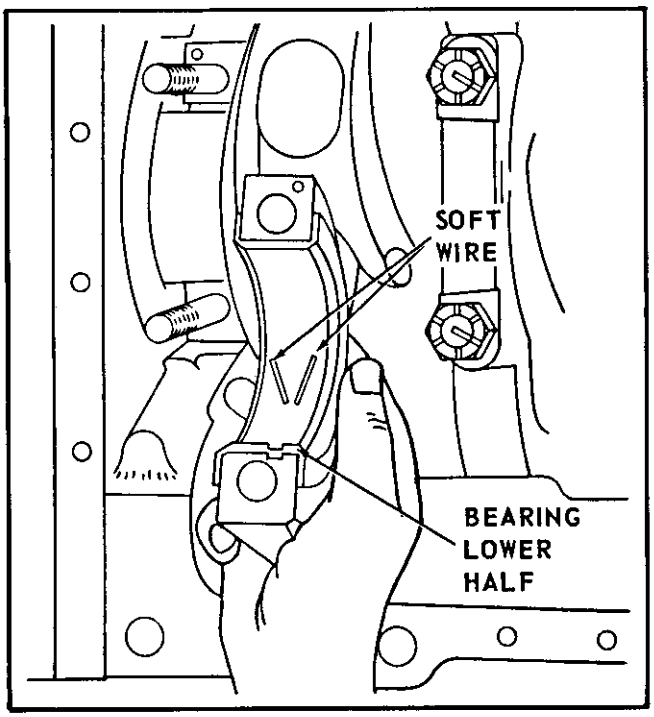


Figure 2-19. Main bearing clearance check

Press the camshaft bearings (17, 18) out of cylinder block with suitable tool and press. Use a hydraulic puller, or equivalent, to remove cylinder liners (9) as shown on figure 2-20. Discard all preformed packing and gaskets and replace at assembly. Assembly is essentially the reverse of disassembly and the following details:

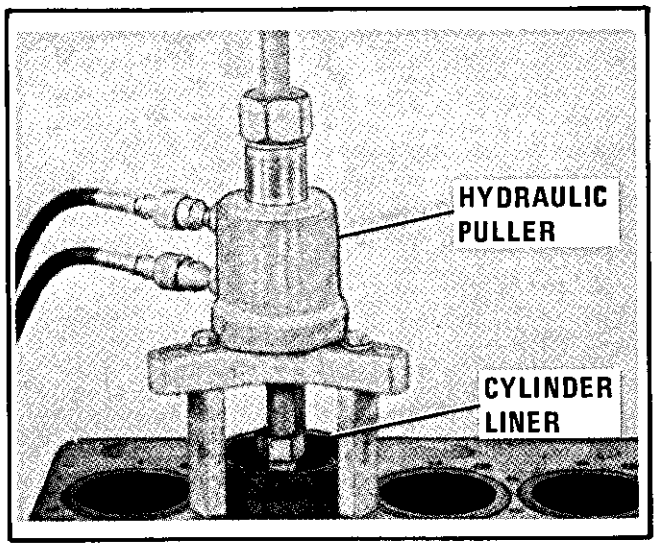


Figure 2-20. Cylinder liner removal

CAUTION

To prevent engine coolant from leaking into lubricating system, ensure cylinder liner preformed packing (10) are not twisted when installed.

a. Lubricate preformed packing (10) with liquid soap to ease installation.

b. Carefully lower each cylinder liner (9) into cylinder block. Use a block of wood and hammer to drive each liner into block until each bottoms; then, hit the block of wood several taps to ensure liner is bottomed. If the last blow of the hammer is too hard, liner may bounce back slightly. Properly installed liners must extend 0.0020 to 0.0056 inch above top surface of block to ensure proper holding and sealing of liner against cylinder head gasket when cylinder head is tightened.

c. Use a suitable tool to press camshaft bearings (17, 18) in block.

d. The camshaft front bearing must be recessed 0.06 inch from front face of bore, oil hole in bearing must align with oil hole in cylinder block, and joint in bearing must face centerline of cylinder block. Intermediate bearings must be flush with front face of bearing bore. Rear bearing must be recessed 0.06 inch from rear face of bore.

2-64. DRAWBAR AND FRONT AXLE GROUP (Figure 54). Disassemble the drawbar and front axle group in the order of index numbers assigned on figure 54. Assemble the drawbar and front axle group in the reverse of disassembly and adjust front wheel toe-in as follows (with front and rear wheels, tubes, and tires installed):

a. Insert thumbtack or pin markers into the front center of the tire tread on each front wheel. Carefully measure the distance between the markers.

b. Push the vehicle backwards in a straight line until the markers are positioned at the back of the wheel. Again measure the distance between the markers. The measured distance between the markers when at the rear must exceed the distance when markers are at the front by 1/4 inch.

c. If toe-in is not correct, remove cotter pins (34, figure 54) and nuts from ball joint (35). Disengage ball joint from steering knuckles (47).

d. Using a straightedge along the sides of the front and rear wheels, position the front wheels so that proper toe-in is obtained.

e. Loosen nuts (39) and turn ball joint (35) in or out on the tie rods (40) until the ball joint end aligns with steering knuckle (47) hole.

f. Insert ball joint end through steering knuckles (47).

g. Recheck toe-in and, if correct, tighten nuts (39) and secure ball joint (35) with nut and cotter pins (34).

2-65. HANDBRAKE LEVER, CROSS SHAFT, AND REAR AXLE GROUP (Figure 55). Disassemble the handbrake lever, cross shaft, and rear axle group in the order of index numbers assigned on figure 55 only to extent necessary. Assemble in the reverse of disassembly. See following paragraph for brake (49) details and brake adjustment.

2-66. BRAKE ASSEMBLY (Figure 56). Disassemble the brake assembly to extent necessary in the order of index numbers assigned on figure 56. Use brake spring pliers to remove and install springs (2). Assemble brake assembly in the reverse of disassembly. Adjust brakes as follows:

CAUTION

Block front wheels to prevent unit from slipping off jack while adjusting brakes.

a. Using a jack, raise the trailer so that the wheel to be adjusted is off the ground. Actuate the handbrake lever several times to center shoes on the drums.

b. Release brakes completely. Make certain that lever is in the off position.

c. Pry the grommet (1, figure 56) from the adjusting hole in the brake backing plate (24).

d. Insert a screwdriver through the adjusting hole so that the end of the blade engages the star wheel on the adjusting screw (11). Rotate the trailer wheel, turn the adjusting screw (11) tightening the brake shoes against the brake drum until the wheel will not turn.

e. Rotate the adjusting screw in the opposite direction just enough to fully release the brake, with no brake lining drag when wheel is rotated.

f. Remove screwdriver; install grommet (1), lower trailer, and move jack to the other side of trailer.

g. Adjust brake on the other wheel in the same manner.

h. To adjust handbrake lever, turn the adjusting knob on the end of the lever (3, figure 55) clockwise to increase the force applied to the brakes by the connecting linkage.

i. If excessive force is required to apply brakes, turn the lever adjusting knob counterclockwise until lever can be moved to the "on" position with normal hand force.

j. If handbrake lever cannot be adjusted in the above manner, it may be necessary to adjust the connecting linkage. To make this adjustment, turn the adjusting knob on the handbrake lever fully counterclockwise; then, turn the knob four or five turns clockwise.

k. Remove cotter pin (9, figure 55) and yoke pin (10). Loosen nut (4) and turn rod yoke (8) farther onto the rod (1) to shorten the effective length of the rod.

l. Connect the yoke (8, figure 55) to the cross shaft lever and install yoke pin (10) and cotter pin (9). Adjust handbrake lever as described in steps h and i above.

2-67. FUEL TANK MOUNTING AND MAIN FRAME GROUP (Figure 57). Disassemble the fuel tanks, mounting, and main frame group, to extent necessary, in the order of index numbers assigned on figure 57. Assemble in the reverse of disassembly.

SECTION III
TESTING-INSPECTION

3-1. GENERAL.

3-2. This section contains component testing and other specific inspection not covered in section II. Dimensional limits and torque data are found in tables 2-3 and 2-4. Specific test or inspection data are referenced to these tables or detailed in the following paragraphs. Table 2-1 should also be referenced for Inspection, Repair, or Replacement.

NOTE

Figure numbers referenced throughout this section will be found in Part 3, Illustrated Parts Breakdown, unless otherwise specified.

3-3. TESTING-INSPECTION.

3-4. ALTERNATOR ASSEMBLY (Figure 26). Standard test equipment required for alternator tests are: Volt-Ammeter that will provide: (DC Volts 0 to 16 volts and 0 to 40 volts) (DC Ammeter 0 to 10 amps and 0 to 100 amps), a Field Rheostat: 0 to 50 ohms resistance, 50 watts, a Fixed Resistor 1/4 ohm, a Carbon Pile, a Test Lamp, battery operated, and an Ohmmeter. Perform the following tests under conditions indicated.

a. Battery Circuit Test. Condition: Engine not running; oil pressure switch open.

1. Connect test ammeter between alternator POSITIVE OUTPUT terminal and battery positive terminal.

NOTE

Test ammeter remains in the same position throughout all alternator tests.

2. Connect voltmeter positive lead to battery positive terminal, negative lead to battery negative terminal. Read voltages. Correct voltage on 24 volt system should be 24.0 to 25.2 volts.

3. Move voltmeter positive lead to battery side of oil pressure switch. Leave negative lead on battery negative terminal. Read voltage. Then, move positive lead to alternator POSITIVE OUTPUT terminal. Read voltage. Voltage should read the same as above. If voltage is lower, check and repair cables, leads, or terminals as required.

4. Ammeter should read zero at all times during these tests. If ammeter reads down scale, it indicates a shorted diode in the alternator.

b. Control Switch Positive Diode Test. Condition: Engine not running; oil pressure switch open.

1. Connect positive lead of voltmeter to alternator TACHOMETER terminal, negative lead to battery negative terminal. Voltmeter should read zero. If voltmeter reads above zero, one or more of the positive rectifier diodes in alternator is shorted.

2. Connect voltmeter positive lead to alternator side of oil pressure switch, negative lead to battery negative terminal. Voltmeter should read zero. If voltmeter reads above zero, oil pressure switch may be shorted.

3. Test ammeter should show zero throughout these tests.

c. Rotor (Field) Current Draw Test. Condition: Engine not running; oil pressure switch open. This test requires temporary addition of test carbon pile to battery to reduce voltage to reference level and a field rheostat.

1. Turn load control knob of carbon pile to OFF position and connect leads to battery.

2. Remove lead from No. 1 FIELD terminal of alternator.

3. Place field rheostat knob in maximum resistance position; connect leads to No. 1 FIELD terminal and POSITIVE OUTPUT terminal of alternator.

4. Connect test voltmeter negative lead to NEGATIVE OUTPUT terminal of alternator, positive lead to No. 1 FIELD terminal.

5. Read all test instruments. Carbon pile voltmeter should read battery voltage. Ammeter should read zero amps. Test voltmeter and test ammeter may indicate near zero depending on resistance value of field rheostat.

6. Slowly decrease resistance of rheostat to zero. Test voltmeter will indicate battery voltage. Ammeter will indicate current draw of rotor (field winding). If ammeter reads excessive current (more than 5 amps) reverse rheostat

to maximum resistance. This indicates a short. Disconnect leads and inspect brushes and rotor circuit for cause of high current draw.

7. Slowly apply carbon pile load to batteryuntil test voltmeter reaches reference point shown below. Check test ammeter for rotor (field) current draw; it should be within limits shown.

BATTERY VOLTAGE REDUCED TO 20V
ROTOR (FIELD)
CURRENT DRAW ..... 1.20 - 1.80 AMPS

8. If field current draw falls within the limits shown, rotor winding is good. If field current exceeds the maximum, alternator should be bench tested. Check for defective or dislocated brushes, shorted brush leads, foreign material between slip rings, or shorted rotor (field) winding.

9. Turn off carbon pile load immediately after test to avoid discharging battery.

d. Regulator Load Circuit Loss Test. Condition: Engine not running; oil pressure switch bypassed with jumper cable.

1. Connect negative lead of test voltmeter to alternator NEGATIVE OUTPUT terminal, positive lead to No. 1 FIELD terminal. Voltmeter should read 0.9 to 1.5 volts less than battery voltage for all systems. This is the maximum allowable voltage drop through the voltage regulator. A reading lower than 0.9 volts or higher than 1.5 volts indicates a defective voltage regulator.

2. Remove jumper wire from oil pressure switch after completion of test.

e. Current Output Test. Condition: Engine not running; oil pressure switch open.

1. Connect voltmeter and ammeter leads from carbon pile to battery terminals.

2. Turn load control knob to OFF.

3. Connect test voltmeter and ammeter. Voltmeter should read battery; ammeter should read zero amps.

4. Start engine (oil pressure switch will activate alternator) and run for 5 minutes to stabilize alternator unit temperature.

5. Slowly increase load with carbon pile and increase engine speed until minimum rated current output is reached.

6. Check voltage on test voltmeter.

MINIMUM CURRENT OUTPUT ..... 25 AMPS
VOLTAGE OUTPUT ..... 26V MIN - 29V MAX

7. If volts exceed maximum limit, check or replace voltage regulator. If system operates normally at low speeds but cannot obtain minimum rated current output at high engine speeds, check fan belts for proper tension.

8. Disconnect carbon pile load immediately after alternator is stopped to avoid discharging battery.

f. Disconnect and remove all test equipment upon completion of alternator testing.

3-5. ALTERNATOR BRUSH ASSEMBLY. With brush assembly (10, figure 26) disassembled from alternator, perform the inspection test shown on figure 3-1 following.

3-6. STARTING SYSTEM. Use a DC voltmeter to locate starting system components which do not function.

a. Turn the HEAT-START switch to the START position to energize the starter solenoid. Starter solenoid operation is audible as the starter motor pinion engages with the ring gear on the engine flywheel. The solenoid operation

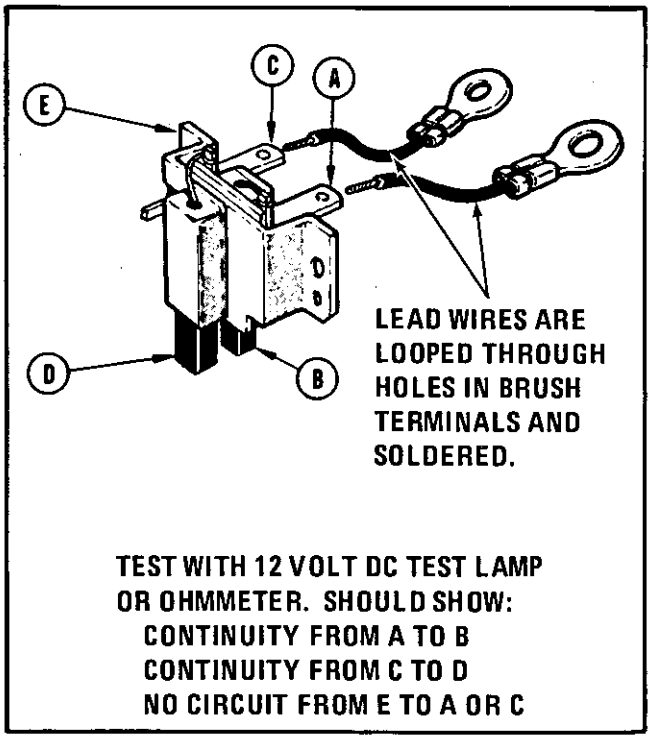


Figure 3-1. Alternator brush assembly inspection test

should also close the electric circuit to the motor. Attach one voltmeter lead to the solenoid terminal that is connected to the motor. Ground the other lead. Energize the starter solenoid and observe the voltmeter. A battery voltage reading indicates the malfunction is in the motor. The motor should be removed from the engine for further testing. No voltmeter reading indicates that the solenoid contacts do not close and the solenoid must be repaired or the starter pinion clearance should be adjusted to 0.36 inch.

b. A starting motor solenoid that will not operate may not be receiving battery current. Attach one lead of the voltmeter to the solenoid battery cable connection. Ground the other lead. No voltmeter reading indicates a faulty circuit from the battery. A voltmeter reading indicates further testing is necessary.

c. Continue the test by attaching one voltmeter lead to the starting motor solenoid small wire terminal and the other lead to ground. Observe the voltmeter and energize the starter solenoid. A voltmeter reading indicates that the malfunction is in the solenoid. No voltmeter reading indicates the starter switch or wiring is the fault.

d. Attach one lead of the voltmeter to the starter switch battery wire terminal and ground the other lead. A voltmeter reading indicates a defective switch.

e. A starting motor that operates too slow can be overloaded by excessive mechanical friction within the engine being started. Slow starting motor operation can also be caused by shorts, loose connections, and/or excessive dirt within the motor.

f. Glow plugs can be checked with an ammeter. Disconnect the wire lead from the glow plug terminal on the HEAT-START switch. Install an ammeter, in series, between the disconnected lead and the terminal on the switch. Observe the ammeter with the HEAT-START switch turned to the HEAT position. Each 24 volt glow plug draws approximately 6 amperes. The ampere draw of one glow plug multiplied by the number of cylinders will be the total ampere draw of the glow plugs in the engine. A low reading is an indication of one or more defective glow plugs. Disconnect one glow plug lead at a time and observe the ammeter with the switch turned to HEAT. The disconnected glow plug that does not change the ammeter reading is the defective glow plug.

g. When no ammeter reading is obtained, test the HEAT-START switch. Attach one lead of the voltmeter to the glow plug wire terminal on the HEAT-START switch and the other lead to the ground. Observe the voltmeter and turn the switch to HEAT. No voltage indicates that the HEAT-START switch is defective.

h. Pinion Clearance Adjustment. When the solenoid is installed, the pinion clearance should be adjusted. The adjustment is made with the starting motor removed from the engine. Bench test and adjust the pinion clearance at installation of solenoid as follows:

1. Install the solenoid without connector (1, figure 3-2) from the MOTOR terminal on solenoid to the motor.

2. Connect a battery, 24 volts, to the terminal (2), marked SW.

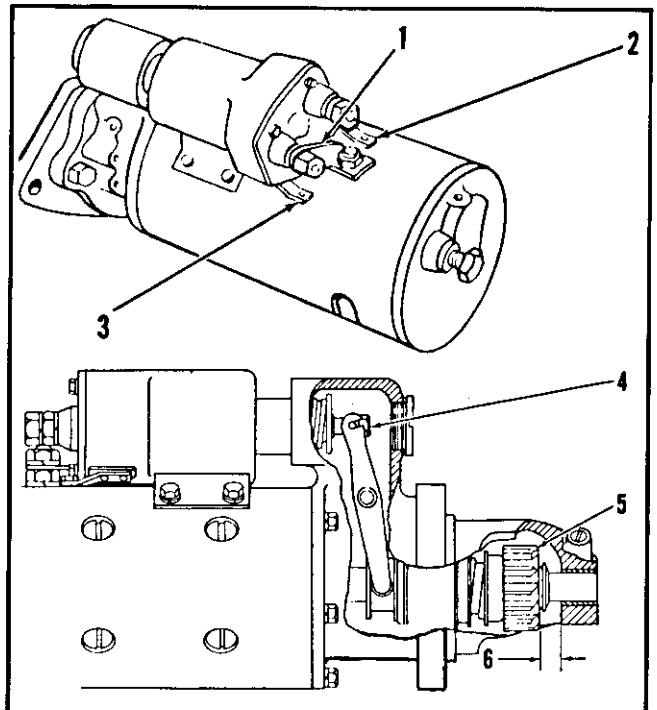
3. Connect the other side of battery to ground terminal (3).

4. MOMENTARILY flash a jumper wire from the solenoid terminal marked MOTOR to the ground terminal. The pinion will shift into cranking position and will remain there until the battery is disconnected.

5. Push pinion toward commutator end to eliminate free movement.

6. Pinion clearance (6) should be 0.36 inch.

7. Adjust clearance by removing plug and turning shaft nut (4).



1. Connector
2. SW terminal
3. Ground terminal
4. Shaft nut
5. Pinion
6. Clearance = 0.36 IN.

Figure 3-2. Checking and adjusting pinion clearance

3-7. ALTERNATOR REGULATOR (3, figure 25). To raise the voltage approximately 0.6 volt, remove the regulator from mounting bracket and remove the locknuts from the two terminals closest to the word "HI" on back of regulator. Place metal strap (supplied on regulator back) over these studs, replace nuts and tighten securely. To lower voltage approximately 0.6 volt, place this strap over studs closest to word "LO" in the same manner. No other adjustment is recommended.

3-8. PISTON RING END GAP CLEARANCE. Measure end gap clearance of each piston ring (3, 4, 5, figure 51) in the following manner.

a. Insert a piston in cylinder bore in an inverted position.

b. Insert each ring, one at a time, about two inches down in the cylinder bore and bring the bottom edge of the piston up against the ring to square the ring in cylinder bore.

c. Check end gap with a feeler gage. Refer to table 2-3 for gap clearances. If gap clearance for any ring is not as specified, the ring must be filed or honed to specifications, or replaced.

3-9. CYLINDER HEAD VALVES AND VALVE SEATS. Coat each valve (46, 47, figure 49) face with a thin film of Prussion blue, or equivalent. Rotate each valve in associated valve seat (39, 40). Remove valves and examine contact pattern on each valve and valve seat. A line of contact near top and around entire circumference of the valve seat indicates contact with valve. If line of contact is not completely around seat, grinding of seat is indicated. Grind the valve seats as follows:

CAUTION

Use extreme care when grinding valve seats. Too much material can be removed quickly and inadvertently.

a. Grind valve seats using a commercial standard valve grinding tool. Remove as little material as possible to produce a complete valve contact. Check valve contact with seat frequently, as described in paragraph above, during grinding operation.

b. After valve seats are ground smooth and concentric with valve guides, clean parts thoroughly.

c. Dimensional specifications shown in table 2-3 must be met. If specifications cannot be met, replace valves and valve seat inserts.

3-10. ROTOR-STATOR ASSEMBLY LEAKAGE TEST. Test the compressor rotor-stator assembly after overhaul and prior to assembly of complete compressor as follows. The compressor rotor-stator assembly consists of items 57 through 110, figure 17.

a. Rotate the coupling by hand in the direction of rotation to ensure free rotation with no binding or rubbing.

b. Bolt the rotor-stator assembly to a stand or test bench on the stator discharge flange. Use a gasket between the flange and stand mating surfaces.

c. Close off intake opening with a gasket and blank flange.

d. Install a gasket and flange on the stator oil filter connection. Equip the flange with an air pressure gauge capable of registering at least 125 psi, an on-off type line valve, and a suitable "quick-change" air hose connection to accommodate the test facility air hose.

e. Connect test air supply hose to "quick-change" connection. Turn line valve to "on" position and subject the rotor-stator assembly to an air pressure of 100 psi, $\pm$10 psi, indicated on air pressure gauge.

f. Use a soap and water solution applied with a brush on stator, end covers, and all sealing surfaces to test for any leakage. Leakage will be indicated by bubbling of the solution.

g. Relieve the test air pressure, remove the test fixtures, make any repairs or replacement necessary to correct any leakage. Retest as outlined above.

h. After pressure test of rotor-stator assembly, complete assembly of compressor.

3-11. DRIVE BELT TENSION ADJUSTMENT. Refer to figure 5-41 in Part 1 of this manual for drive belt tension adjustment.

3-12. SPEED CONTROL LINKAGE ADJUSTMENT. Refer to paragraph 5-5 and figure 5-1, Part 1, of this manual for speed control linkage adjustment.

3-13. AIR PRESSURE REGULATOR ADJUSTMENT. Refer to paragraph 5-6 and figure 5-2, Part 1, of this manual for air pressure regulator adjustment.

3-14. BRAKE DRUM TURNING. When inspection reveals scoring and scratches in brake shoe contact bore of brake drum, the drum may be machined in the following manner.

NOTE

Bearings and seals shall be removed from hub when turning brake drum.

a. Mount the brake drum on a lathe registering with hub bearing bores so that drum bore will be turned concentric with hub bores.

b. Turn the drum bore removing just enough material to remove score and scratch marks and to make drum bore concentric with hub bores.

c. When drum bore exceeds 12.090 inches diameter, replace the drum.

3-15. FINAL ASSEMBLY-AIR PRESSURE TEST. After all air end components have been assembled, perform an air pressure test to determine if there are any leaks as follows.

a. Close all discharge air service valves.

b. Remove the oil filler plug, packing, and adapter from the oil separator assembly. Install a 1-1/2NPT to 1/4NPT reducing bushing in the oil filler elbow.

c. Install a male half of a "quick change" air hose connection in the reducing bushing installed above.

d. Connect an air supply hose line to the "quick-change" connection and subject the components to an air pressure of 100 psi.

e. Check all tubing, piping, hoses, and fittings in the air end system at their joints or connections. Use a soap and water solution applied with a brush to check for leaks. Leaks will be indicated by bubbling of the solution.

f. Repair any leaks found, release air pressure, remove test items installed, and install oil filler adapter, packing, and filler plug removed in step b above.

3-16. UNIT RUN-IN. After overhaul, the unit shall be run-in for a period of four hours to allow for break-in of engine and compressor and to repair any leaks or malfunctions of the unit. To perform this run-in, follow the steps below.

a. Select a sight as near level as possible.

NOTE

Out-of-level should not exceed 15 degrees in any direction during operation of this equipment.

b. Set the parking brakes.

c. Check engine coolant level in radiator. Proper level is 2 inches below filler neck.

d. Fill the fuel tanks.

e. Check engine oil level and fill as necessary.

f. Check compressor oil separator oil level and fill to overflow, as necessary.

g. Check and adjust drive belt tension (figure 5-41, Part 1).

h. Check level of battery electrolyte and fill as necessary. Correct level is 3/8 inch above plates. Check battery cables for tightness on terminals.

i. Start the unit as outlined in paragraph 4-37, Part 1, of this manual. Adjust the speed control linkage in accordance with paragraph 5-5 and figure 5-1, Part 1. As necessary, adjust air pressure regulator in accordance with paragraph 5-6 and figure 5-2, Part 1.

j. Check readings of all gauges. Normal operating condition readings are listed in paragraph 4-38.1, Part 1.

k. After run-in period, stop the unit in accordance with paragraph 4-39, Part 1.

3-17. TROUBLESHOOTING.

3-18. During unit run-in period, and during operation, troubles that may be encountered, their probable causes, and possible remedies are listed in table 3-1.

Table 3-1. Troubleshooting

TROUBLE	PROBABLE CAUSE	REMEDY
Engine will not turn over.	a. Weak or dead batteries.	a. Charge or replace batteries.
	b. Battery cable connections loose or terminals corroded.	b. Clean terminals and tighten connections.
	c. Defective HEAT - OFF - START switch.	c. Replace switch.
	d. Defective starting motor.	d. Repair starting motor, para 2-34.
Engine turns over but will not start or is hard to start.	a. Engine stop control is in stop position.	a. Push stop control cable in and lock.
	b. Fuel tanks empty.	b. Fill fuel tanks and prime fuel system.
	c. Water or dirt in fuel system.	c. Drain fuel tanks, fill with clean fuel, clean fuel lines, service fuel filters, and prime the fuel system.
	d. Clogged fuel filters.	d. Service the filters.
	e. Defective fuel transfer pump.	e. Repair the fuel transfer pump. Refer to para 2-55.
	f. Air in fuel system.	f. Purge fuel lines using hand primer pump. Tighten connections.
	g. Overspeed switch tripped.	g. Press reset button on overspeed switch.
	h. Engine air cleaner dirty or clogged.	h. Service air cleaner.
	i. Fuel rack solenoid sticking.	i. Repair or replace solenoid.
	j. Fuel bypass valve sticking open.	j. Replace fuel bypass valve.
	k. Valve clearances incorrect.	k. Adjust valve clearances.
	l. Defective turbocharger.	l. Repair turbocharger, para 2-39.

Table 3-1. Troubleshooting (Cont)

TROUBLE	PROBABLE CAUSE	REMEDY
Engine turns over but will not start or is hard to start (Cont).	m. Safety pushbutton switch not being pushed with HEAT-OFF-START switch turned to START.	m. Push safety pushbutton simultaneously with the turning of switch to START position.
	n. No engine oil pressure.	n. Check oil level and fill as necessary. If oil pump defective, refer to para 2-47.
	o. Defective safety shutoff system switches.	o. Replace all defective switches.
Engine misses or runs erratically.	a. Engine too cold to run loaded compressor.	a. Allow engine to reach operating temperature before loading compressor.
	b. Water in fuel system.	b. Drain fuel system, service fuel filters, fill with clean fuel, and prime system with hand priming pump.
	c. Air in fuel system.	c. Purge lines using hand priming pump. Tighten connections.
	d. Defective fuel transfer pump.	d. Repair or replace pump. Refer to para 2-55.
	e. Fuel lines leaking or cracked.	e. Tighten connections. Replace defective lines.
	f. Valve clearances incorrect.	f. Adjust valve clearances.
	g. Defective fuel injection nozzle or fuel injection pump.	g. Operate engine at speed where defect is most noticeable. Momentarily loosen fuel line nut on each injection pump, one at a time, to cut out that cylinder. If one is found where loosening nut makes no difference in irregular operation, replace nozzle or pump for that cylinder. Refer to para 2-40.
	h. Defective fuel bypass valve.	h. Repair or replace fuel bypass valve, para 2-52.
Engine lacks power.	a. Fuel filters dirty or clogged.	a. Service fuel filters.
	b. Engine air cleaner clogged.	b. Service air cleaner.

Table 3-1. Troubleshooting (Cont)

TROUBLE	PROBABLE CAUSE	REMEDY
Engine lacks power (Cont).	c. Valve clearances incorrect.	c. Adjust valve clearances.
	d. Air in fuel system.	d. Purge lines using hand priming pump.
	e. Defective fuel injection nozzle or fuel injection pump.	e. Operate engine at speed where defect is most noticeable. Momentarily loosen fuel line nut at each injection pump, one at a time, to cut out that cylinder. If one is found where loosening nut makes no difference in improper operation, replace nozzle or pump for that cylinder. Refer to para 2-40.
	f. Fuel contaminated or improper grade.	f. Drain fuel system, service fuel filters, and fill with clean, proper grade of fuel.
	g. Defective fuel pump.	g. Repair fuel transfer pump. Refer to para 2-55.
	h. Turbocharger carboned or otherwise dragging.	h. Repair turbocharger, para 2-39.
	i. Fuel bypass valve defective.	i. Repair fuel bypass valve, para 2-52.
	j. Speed control linkage out of adjustment.	j. Adjust speed control linkage.
Engine knocks, develops excessive noise, or vibration.	a. Engine oil level low.	a. Fill crankcase to full mark on dipstick.
	b. Improper fuel grade.	b. Drain fuel tanks. Fill tanks with proper grade of fuel.
	c. Valve clearances incorrect.	c. Adjust valve clearances.
	d. Low engine operating temperature.	d. Replace water temperature regulator.
	e. Engine mounting bolts loose.	e. Tighten engine mounting bolts.
	f. Compressor vibrating.	f. See Noisy Compressor Operation.
	g. Loose pulley and damper.	g. Tighten pulley and damper.

Table 3-1. Troubleshooting (Cont)

TROUBLE	PROBABLE CAUSE	REMEDY
Engine knocks, develops excessive noise, or vibration (Cont).	h. Fan blade unbalanced.	h. Loosen or remove fan belts. Operate engine for short duration at affected speed range. If vibration is not present, replace fan.
	i. Defective fuel injection pump or nozzle.	i. Run engine at speed where defect is most noticeable. Momentarily loosen fuel line nut on each injection pump, one at a time, to cut out that cylinder. If one is found where loosening nut makes no difference in improper operation, replace nozzle or pump for that cylinder. Refer to para 2-40.
Engine stops suddenly.	a. Out of fuel.	a. Fill fuel tanks with proper grade of fuel.
	b. Fuel filters dirty or clogged.	b. Service fuel filters.
	c. Water or dirt in fuel system.	c. Drain fuel tanks. Fill tanks with uncontaminated fuel. Clean fuel lines. Service fuel filters.
	d. Engine overheating (safety switch shutoff).	d. Check engine coolant level. Inspect radiator and hoses for leaks or obstructions. Check drive belt adjustment.
	e. Low oil pressure (safety switch shutoff).	e. Check crankcse oil level. Fill to full mark on dipstick.
	f. Overspeed switch defective.	f. Replace overspeed switch.
	g. Air in fuel system.	g. Purge lines using hand priming pump. Tighten connections.
	h. Shutoff solenoid defective.	h. Replace shutoff solenoid.
	i. Air compressor overheating (safety switch shutoff).	i. Low compressor oil level. Fill to overflow. Dirty compressor oil filter element. Change element. Dust or dirt collected on oil cooler core external surface. Blow off all dirt and dust.

Table 3-1. Troubleshooting (Cont)

TROUBLE	PROBABLE CAUSE	REMEDY
Engine has low or no oil pressure.	a. Oil level in crankcase low.	a. Fill crankcase to full mark on dipstick.
	b. Improper lubricant.	b. Drain crankcase. Fill with proper lubricant.
	c. Oil pressure gauge defective.	c. Replace oil pressure gauge.
Engine overheats.	a. Coolant level low.	a. Fill radiator.
	b. Dust or dirt collected on radiator core external surfaces.	b. Blow off dust and dirt.
	c. Oil supply in crankcase low.	c. Fill crankcase to full mark on dipstick.
	d. Water pump defective.	d. Repair water pump, para 2-43.
	e. Water temperature regulator defective.	e. Replace water temperature regulator, para 2-59.
	f. Water temperature gauge defective.	f. Replace water temperature gauge.
	g. Fan drive belts slipping or broken.	g. Replace or adjust drive belts.
	h. Radiator hoses collapsed or deteriorated.	h. Replace radiator hoses.
	i. Radiator blocked.	i. Flush out radiator to remove blockage.
Engine exhaust excessively black or gray.	a. Air cleaner clogged.	a. Service air cleaner.
	b. Turbocharger carboned or defective.	b. Repair turbocharger, para 2-39.
	c. Fuel injection nozzle plugged or leaking.	c. Replace fuel injection valve nozzle, para 2-40.
Engine exhaust excessively white or blue.	a. Crankcase oil level too high.	a. Avoid overfilling. Determine cause and drain excess oil.

Table 3-1. Troubleshooting (Cont)

TROUBLE	PROBABLE CAUSE	REMEDY
Engine exhaust excessively white or blue (Cont).	b. Defective fuel injection nozzle or fuel injection pump.	b. Run engine at speed where defect is most noticeable. Momentarily loosen fuel line nut on each injection pump, one at a time, to cut out that cylinder. If one is found where loosening nut makes no difference in irregular operation, replace nozzle or pump for that cylinder. Refer to para 2-40.
	c. Valve clearances incorrect.	c. Adjust valve clearances.
	d. Improper fuel grade.	d. Drain fuel tanks. Fill tanks with proper grade of fuel.
	e. Engine operating temperature too low.	e. Replace water temperature regulator, para 2-59.
	f. Fuel transfer pump defective.	f. Repair fuel transfer pump. Refer to para 2-55.
	g. Fuel bypass valve defective.	g. Repair fuel bypass valve, para 2-52.
	h. Air in fuel system.	h. Purge lines using hand priming pump. Tighten connections.
	i. Fuel filters dirty or clogged.	i. Service fuel filters.
Excessive engine oil consumption.	a. High crankcase pressure.	a. Service crankcase breather.
	b. External oil leaks.	b. Inspect for visible evidence of leaks and repair accordingly.
	c. Crankcase oil level too high.	c. Avoid overfilling. Determine cause and drain excess oil.
Engine fails to stop.	a. Engine stop cable broken or out of adjustment.	a. Adjust or replace engine stop cable.
Excessive fuel consumption.	a. Leak in fuel system.	a. Pressurize fuel tanks to 5 PSI maximum. Watch for evidence of leaks. Inspect all external lines and connections. Engine internal leaks will probably be accompanied by low engine oil pressure and increased level in oil sump.

Table 3-1. Troubleshooting (Cont)

TROUBLE	PROBABLE CAUSE	REMEDY
Excessive fuel consumption (Cont).	b. Fuel grade improper.	b. Drain fuel tanks. Fill tanks with proper grade of fuel.
	c. Fuel and combustion knock.	c. See corrective actions for Misfiring and Low Power.
Engine stalls at low speed.	a. Air in fuel system.	a. Purge lines using hand priming pump. Tighten connections.
	b. Fuel bypass valve defective.	b. Repair fuel bypass valve, para 2-52.
	c. Fuel filters dirty or clogged.	c. Service fuel filters.
	d. Fuel transfer pump defective.	d. Repair fuel transfer pump. Refer to para 2-55.
	e. Fuel injection nozzle defective.	e. Replace fuel injection valve nozzle, para 2-40.
Valve train clicking noise.	a. Valve clearances incorrect.	a. Adjust valve clearances.
	b. Insufficient lubricant circulation.	b. Check lubrication in valve compartment. Should be very wet at high idle speed, but only damp at low idle. Oil passages should be cleaned, especially those leading to cylinder head.
	c. Engine oil level low.	c. Fill crankcase to full mark on dipstick.
Engine oil in coolant or coolant in engine oil.	a. Engine oil cooler defective.	a. Repair or replace engine oil cooler, para 2-51.
Little rocker arm movement and excessive valve clearances.	a. Insufficient lubricant circulation.	a. Check lubrication in valve compartment. Should be very wet at high idle speed, but only damp at low idle. Oil passages should be cleaned, especially those leading to cylinder head.
Premature engine wear.	a. Engine air cleaner defective.	a. Repair or replace engine air cleaner, para 2-13.
	b. Dirt in lubricating oil.	b. Locate and correct source of dirt entry. Change lubricating oil. Service oil filter.

Table 3-1. Troubleshooting (Cont)

TROUBLE	PROBABLE CAUSE	REMEDY
Compressor overheats.	a. Dirty compressor oil filter element.	a. Service compressor oil filter.
	b. Dust or dirt collected on oil cooler core external surface.	b. Blow off all dirt and dust.
	c. Low compressor oil level.	c. Refill oil separator to overflow.
	d. Faulty thermal bypass valve.	d. Repair thermal bypass valve, para 2-17.
Noisy compressor operation.	a. Low compressor oil level.	a. Refill oil separator to overflow.
	b. Air pressure regulator assembly defective.	b. Repair air pressure regulator assembly, para 2-23.
Compressor not operating to full capacity or pressure.	a. Air pressure regulator assembly defective or out of adjustment.	a. Adjust or repair air pressure regulator assembly, para 2-23.
	b. Leak in air hoses, piping, or connections.	b. Check all air hoses, piping and connections for leaks while unit is operating. Use soapy water solution on areas. Tighten or replace as required.
	c. Compressor air cleaner dirty or clogged.	c. Service air cleaner.
	d. Safety valve on oil separator leaking.	d. Replace safety valve.
Compressor fails to load or unload.	a. Dirt buildup on intake-unloader valve seat.	a. Clean valve seat.
	b. Unloading pressure too high or too low.	b. Adjust air pressure regulator assembly.
	c. Air hose between intake-unloader and air pressure regulator assembly damaged or leaking.	c. Replace air hose.
Compressor unloads but engine will not idle.	a. Speed control linkage defective.	a. Adjust or replace speed control linkage, para 2-26.
Condensate and/or emulsion in oil separator.	a. Unusually low oil temperature and high humidity.	a. If this is a climatic condition, replace compressor oil with a non-detergent oil.

Table 3-1. Troubleshooting (Cont)

TROUBLE	PROBABLE CAUSE	REMEDY
Condensate and/or emulsion in oil separator (Cont).	b. Faulty thermal bypass valve.	b. Repair thermal bypass valve, para 2-17.
Excessive compressor oil consumption.	a. Compressor oil system leaking.	a. Repair leaks as necessary.
	b. Low separator pressure (below 70 PSI).	b. If low pressure caused by air demand, close service valves partially. Replace a faulty air-assist pressure regulator.
	c. Rapid, repeated load and unload cycle.	c. Reduce air demand by closing service valves.
	d. Clogged line from separator to intake orifice or clogged orifice.	d. Remove line and orifice, clean, and replace.
	e. Ruptured separator element.	e. Replace element.
Compressor unit hunts.	a. Air pressure regulator assembly defective.	a. Repair air pressure regulator assembly, para 2-23.
Ammeter indicates low or no-charging rate when batteries are low or discharged.	a. Defective or loose wiring in charging circuit.	a. Repair or replace as required.
	b. Ammeter defective.	b. Replace ammeter.
	c. Alternator regulator assembly defective.	c. Replace alternator regulator assembly.
	d. Alternator assembly defective.	d. Repair alternator assembly, para 2-36.
	e. Loose or broken drive belts.	e. Tighten or replace drive belts.
Ammeter indicates excessive charge rate when batteries are fully charged.	a. Defective wiring in charging circuit.	a. Repair or replace as required.
	b. Ammeter defective.	b. Replace ammeter.
	c. Alternator regulator assembly defective.	c. Replace alternator regulator assembly.
Alternator overheats.	a. Defective wiring.	a. Check and repair or replace.
	b. Alternator regulator assembly defective.	b. Replace alternator regulator assembly.
	c. Alternator assembly defective.	c. Repair alternator assembly, para 2-36.

Table 3-1. Troubleshooting (Cont)

TROUBLE	PROBABLE CAUSE	REMEDY
Wheel wobbles.	a. Wheel bent.	a. Replace wheel.
	b. Wheel loose on hub.	b. Tighten nuts.
	c. Wheel bearing defective.	c. Replace wheel bearing.
Wheel bearing overheats.	a. Wheel bearing defective.	a. Replace bearing.
	b. Lack of lubrication.	b. Pack wheel bearings.
Tire wear abnormal.	a. Wheel loose on hub.	a. Tighten nuts.
	b. Improper tire inflation.	b. Inflate tires to proper pressure.
	c. Tie rod out of adjustment.	c. Adjust tie rod.
Parking brake does not hold.	a. Parking brake actuating mechanism not adjusted properly.	a. Adjust mechanism.
	b. Broken actuating cables or mounting.	b. Replace defective parts, para 2-65.
	c. Brakes out of adjustment.	c. Adjust brakes.