

TM 5-6115-440-34

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

TECHNICAL MANUAL

DIRECT SUPPORT AND GENERAL SUPPORT

MAINTENANCE MANUAL

GENERATOR SET, 7.5KW, 28V, DC,

G.E.D. AIR COOLED, 2 WHEEL

MTD, PNEUMATIC TIRES

JOHN R. HOLLINGSWORTH

MODEL JHGV7.5A

FSN 6115-074-6396

HEADQUARTERS, DEPARTMENT OF THE ARMY

MARCH 1971

WARNING

Take particular heed to specific cautions and warnings throughout this manual.

HIGH VOLTAGE

is used in the operation of this equipment.

DEATH

or severe burns

may result if personnel fail to observe safety precautions.

Do not operate this generator set until the ground terminal stud has been connected to a suitable ground.

Disconnect the battery ground cable before removing and installing components on engine or in electrical control panel system.

Before making load connections be sure the generator sets are not operating and main load control switch is in the OFF position.

On gasoline engine driven generator sets utilizing magnetos, set magneto switch to OFF or STOP position.

Do not attempt to change load connects when generator is running.

Before servicing any part of a generator set, make sure unit is completely de-energized.

DANGEROUS GASES

are generated as a result of operating of this equipment.

DEATH

or severe injury may result if personnel fail to observe safety precautions.

Utilize extreme caution, do not smoke, or use open flame in vicinity when servicing batteries.

Batteries generate explosive gas during charging.

Always maintain metal to metal contact when filling the fuel tank.

Do not smoke or use open flame in vicinity when filling the fuel tank.

Do not attempt to fill fuel tank when generator is running.

Do not operate generator sets in inclosed areas unless exhaust gases are properly vented to the outside.

Exhaust discharge contains noxious and deadly fumes.

Use extreme care, should a selenium rectifier malfunction, to avoid inhalation of poisonous fumes.

If generator set is shut-down by the operation of a safety device, do not attempt to operate unit until the cause has been determined andl eliminated.

TECHNICAL MANUAL }
NO. 5-6115-440-34 }

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 23 March 1971

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* This manual supersedes the direct support and general support portion of TM 5-6115-440-15, 17 June 1968, including all changes.

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CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Scope

a. These instructions are published for use by personnel to whom the John R. Hollingsworth Co. Model JHGV 7.5 generator is issued. Chapter 1 and 2 provides information on troubleshooting and direct and general support maintenance instructions: Also included are description of main units and their functions in relationship to other components.

b. Numbers in parenthesis following nomenclature callouts on illustrations indicate quantity; numbers preceding nomenclature callouts indicate preferred sequence.

1-2. Forms and Records

Maintenance forms, records and reports which are to be used by maintenance personnel at all maintenance levels are listed and prescribed by TM 38-750.

1-3. Reporting of Errors

Report of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications) and forwarded, direct to Commanding General U.S. Army Mobility Equipment Command, ATTN: AMSME-MPP, 4300 Goodfellow Blvd. St. Louis, Mo. 63120.

Section II. DESCRIPTION AND DATA

1-4. Description

A complete description of the 7.5 KW John R. Hollingsworth, Model JHGV7.5A generator set is described in TM 5-6115-440-20.

1-5. Difference between Models

This manual covers only the John R. Hollingsworth Co., Model JHGV7.5A generator set. No known unit differences exist for the model covered by this manual.

1-6. Tabulated Data

a. Starter Generator Classification and Rating.

Type	Short Shunt
Rated Current	300 amp
Output voltage (dc)	30v
Regulated field current	8 amp max
Lubrication	Grease lubricated
Drive	Belt drive
Cooling	Internal fan
Duty classification	Continuous

b. Starter Generator Repair Standards.

Stator:

Number of main field Poles	6
Number of interpoles	6
Pole shoe type	Laminated
Wire size	No. 17 AWG

Type of wire	Heavy Thermaleze
Insulating materials	Vacuum impregnated high temperature varnish
Lead connections	Silver brazed (MIL-B-7883)

Armature:

Number of slots	49
Number of coils	49
Type of wire	Heavy thermaleze
Wire size	.091 x .236
Insulating materials	Vacuum impregnated high temperature varnish
Armature core	Laminated
Coil connections	Silver brazed (MIL-B-7883)

c. Torque Data.

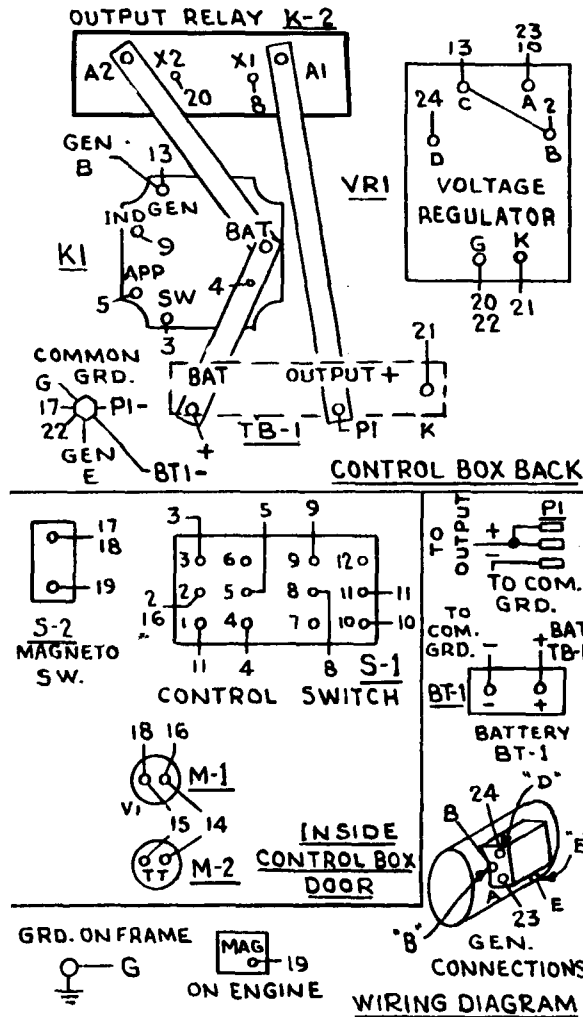
Spark plug	25—30 ft-lb
Cylinder head screws	22—24 ft-lb
Gear cover cap screws	14—18 ft-lb
Oil pan mounting screws	6—9 ft-lb
Cylinder block mounting nuts	40—50 ft-lb
Connecting rod nuts	22—24 ft-lb
Main bearing plate cap screws	25—30 ft-lb
Manifold mounting nuts	23 ft-lb (max).

d. *Repair and Replacement Standards.* Table 1-1 lists manufacturer's sizes, tolerances, desired clearances, and maximum allowable wear and clearances.

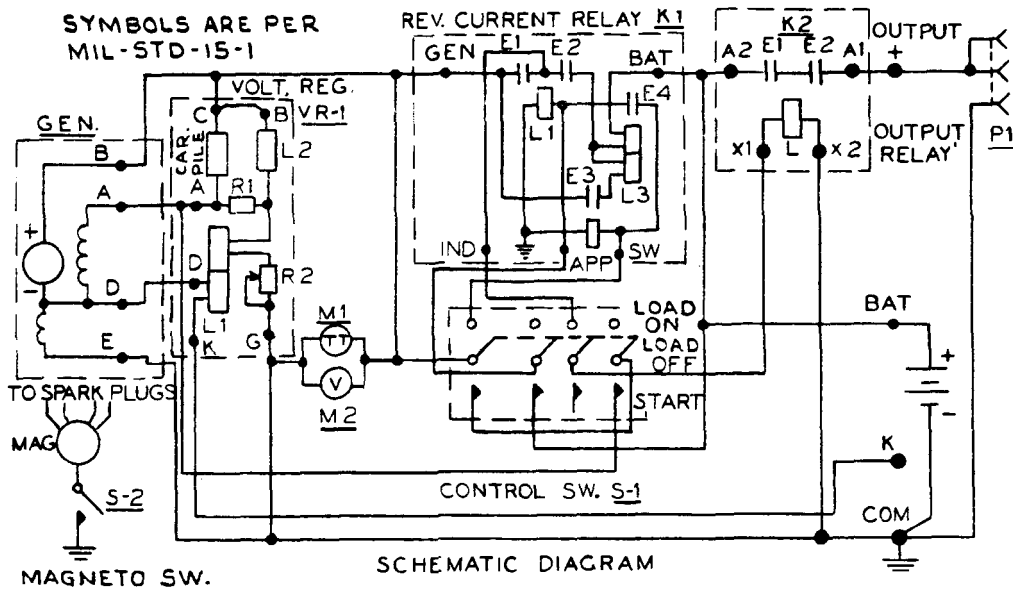
Table 1-1. Repair and Replacement Standards

Component	Manufacturer's dimensions and tolerances in inches		Desired clearances		Max allowable wear and clearance
	Minimum	Maximum	Minimum	Maximum	
Engine:					
Piston to cylinder clearance at piston skirt thrust faces			0.0032	0.0042	
Piston ring gap (compressed)			0.010	0.020	
Piston ring side clearance in grooves:					
Top ring			0.002	0.004	
Scraper ring			0.0015	0.0035	
Oil ring			0.000	0.003	
Connecting rod to crank pin side clearance			0.009	0.016	
Connecting rod shell bearing to crank pin clearance			0.0005	0.0020	
Piston pin to piston clearance			0.0000	0.0003	
Piston pin to connecting rod bushing clearance			0.0003	0.0006	
<i>NOTE</i>					
The thrust face on the piston skirt is 90° from the axis of the piston pin hole.					

e. Wiring Diagram. See figure 1-1 and 1-2 for wiring diagrams of generator set.



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Figure 1-2. Schematic wiring diagram.

CHAPTER 2

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

Section I. REPAIR PARTS, SPECIAL TOOLS AND EQUIPMENT

2-1. Tools and Equipment

Tools, equipment, and repair parts issued with or authorized for the generator set are listed in the basic issue items list, TM 5-6115-440-10.

2-2. Special Tools and Equipment

No special tools or equipment are required for performing maintenance on the generator set.

2-3. Maintenance Repair Parts

Repair parts and equipment are listed and illustrated in the repair parts and special tools list covering direct support and general support maintenance for this equipment in TM 5-6115-440-24P

Section II. TROUBLESHOOTING

Table 2-1. Troubleshooting

Malfunction	Probable cause	Corrective action
1. Engine fails to start or starts with difficulty	a. Magneto switch wiring defective b. Magneto defective c. Starter generator defective	a. Check wiring and correct as necessary (para 3-7). b. Disassemble and replace defective parts (para 3-13). c. Disassemble and replace defective parts (para 3-14).
2. Engine lacks power	a. Piston rings worn b. Damaged bearings c. Cylinders worn or scored	a. Replace piston rings (para 3-23). b. Replace bearings (para 3-22). c. If cylinder are worn more than 0.005 inch oversize, regrind and fit with oversize pistons and piston rings (para 3-24).
3. Engine overheats	Excessive carbon deposits	Disassemble and clean engine components.
4. Engine knocks	a. Carbon or lead deposits b. Loose or defective connecting rod shell bearing c. Worn or loose piston pin	a. Clean cylinder heads (para 2-6). b. Disassemble and correct trouble (para 3-23). c. Disassemble and correct trouble (para 3-23).
5. Generator output erratic	d. Valve springs weak or broken a. Voltage regulator defective b. Generator defective	d. Replace valve spring (para 3-28). a. Disassemble and replace defective parts (para 3-2). b. Disassemble and replace defective parts (para 3-6).

Section III. GENERAL MAINTENANCE

2-4. General

(Refer to TM 5-6115-440-10 for analysis of operation). Refer to TM 5-6115-440-20 for organizational maintenance instructions.

2-5. Wiring Harness

The electrical circuits in the generator set are completed by individual wire leads or by leads laced or enclosed to form a wiring harness. When testing, repairing or replacing the individual wires or harness refer to the wiring diagram (fig. 1-1 and 1-2).

2-6. General Cleaning and Inspection Methods

a. Cleaning.

(1) Clean all parts in an approved cleaning solvent (eg. FED-P-D-680).

(2) Clean surface and install new gaskets.

b. Inspection.

(1) Inspect all parts before installing for cracks, wear, rust or corrosion, deterioration of electrical wiring or any type damage.

(2) Inspect all hardware for damage, rust breaks and damaged threads.

Section IV. REMOVAL AND INSTALLATION OF MAJOR COMPONENTS

2-7. General

This section contains instruction for removal and installation of the engine, starter-generator and control box. Repair instructions for these components are contained in Chapter 3.

2-8. Starter-Generator

a. Removal.

(1) Disconnect leads from starter generator (fig. 1-1).

(2) Remove lock nuts (14, fig. 2-1) and slide assembled starter-generator (13) and adapter assembly (15) toward the engine.

(3) Remove drive belt from generator sheave (TM 5-6115-440-20).

(4) Lift assembled starter-generator (13) and adapter assembly (15) off adapter base plate (18).

(5) Remove six screws (12) and nuts (11) and separate starter-generator from adapter assembly.

b. Installation.

(1) Installation procedure for the starter generator is the reverse procedure of removal.

(2) Adjust the drive belt tension (TM 5-6115-440-20).

2-9. Engine

a. Removal.

(1) Remove battery (TM 5-6115-440-10).

(2) Disconnect control box leads leading to generator, ground stud and magneto.

(3) Remove battery leads and power cables from rear of control box.

(4) Drain fuel tank and disconnect fuel line leading from fuel tank to fuel selector valve.

(5) Remove fuel line leading from fuel strainer to fuel selector valve.

(6) Remove two screws (8) fig. 2-2 washers (9) and throttle and choke mounting bracket (10) from frame assembly (4).

(7) Remove four screws (2) and washers (3) securing tubular frame assembly (4) to base assembly. Lift frame assembly (with fuel tank and control box remaining in place) off base assembly.

(8) Remove drive belts (TM 5-6115-440-20).

(9) Remove two clamps that secure oil line to base assembly.

(10) Remove screw, washer and nut which secures the oil drain plug and chain assembly to the base assembly (TM 5-6115-440-20).

(11) Remove four screws (9,fig.2-1) and lock nuts (8) that secure engine (10) to base assembly (28).

(12) Lift engine off base assembly with a crane.

b. Installation. Installation procedure for the engine is the reverse of the removal procedure.

2-10. Control Box

a. Removal.

(1) Remove battery (TM 5-6115-440-10).

(2) Disconnect control box leads at generator, ground stud and magneto.

(3) Disconnect power cables and battery leads from rear of control box.

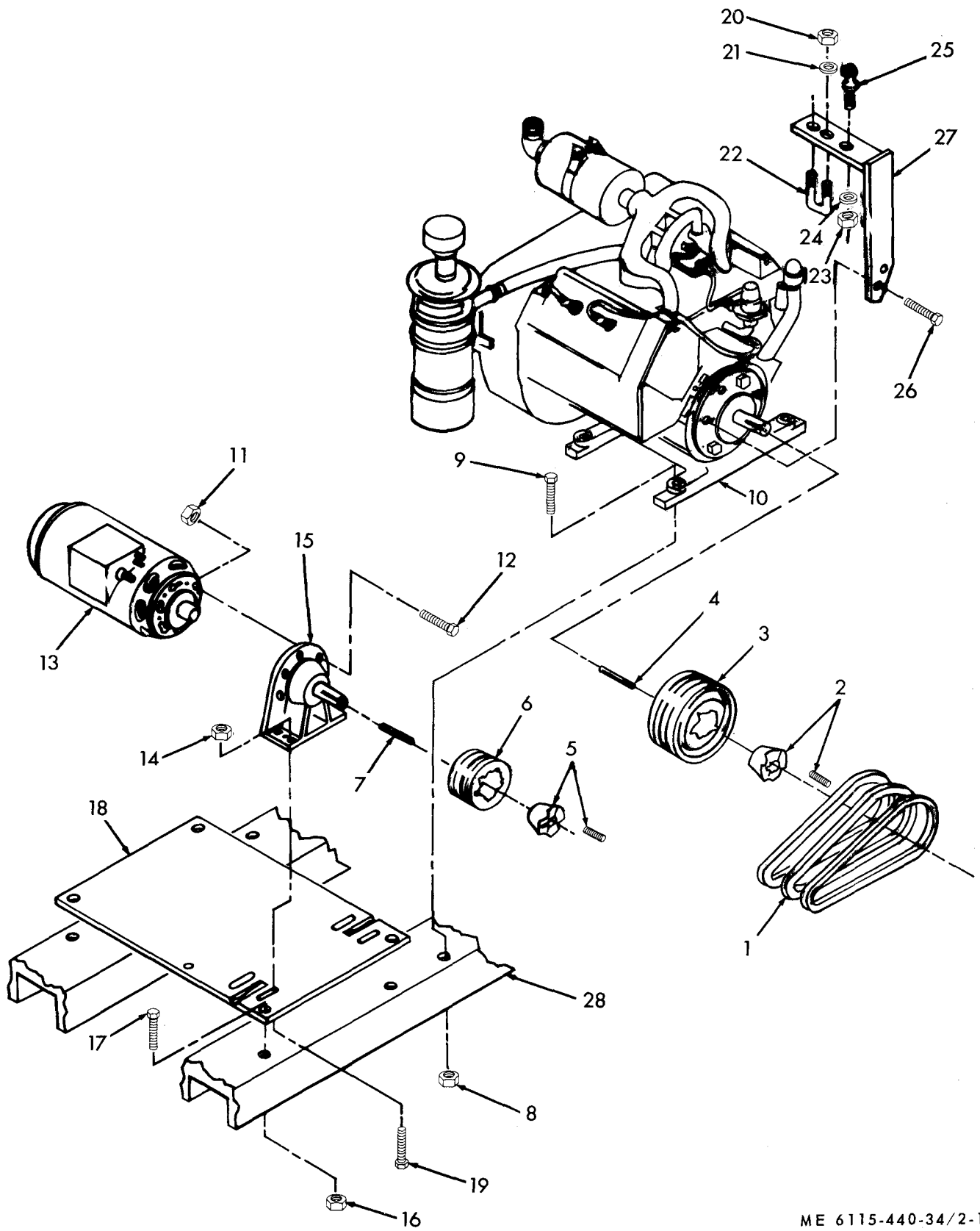
(4) Open control box door and remove four screws and flex nuts that secure control box to shelf of frame assembly.

(5) Lift control box out of shelf of frame assembly.

b. Installation. Installation procedure for the control box is the reverse of the removal procedure.

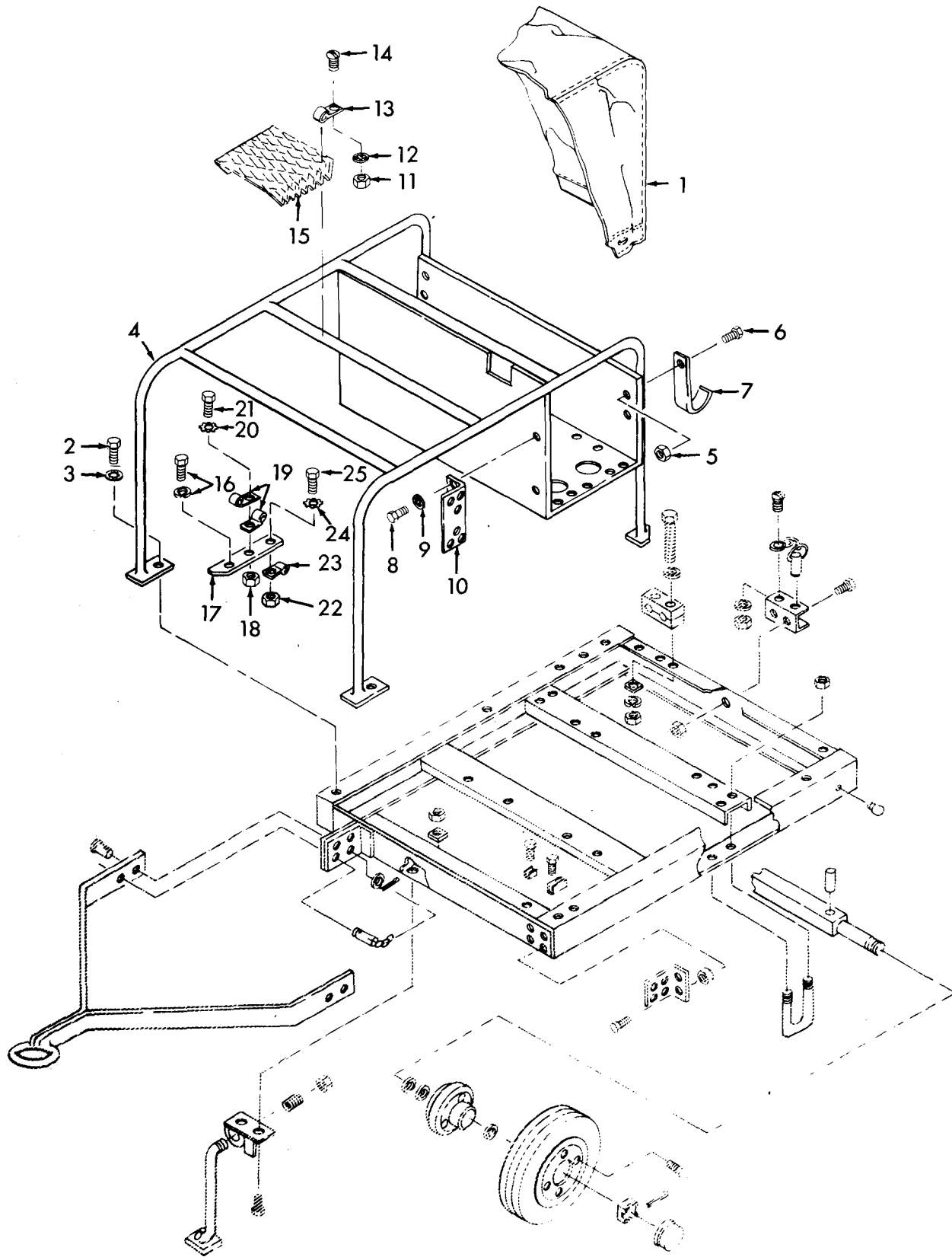
Key to Figure 2-1:

1. Belt, V, Matched set	15. Adapter Assy, Generator
2. Bushing, taper lock	16. Nut, lock hex
3. Sheave, engine	17. Screw, cap hex head
4. Key, engine sheave	18. Base plate, adapter
5. Bushing, taper lock	19. Screw, square-head
6. Sheave, generator	20. Nut, hex
7. Key, generator sheave	21. Washer, lock split
8. Nut, lock hex	22. U-bolt, lifting bar assy
9. Screw, cap hex head	23. Nut, hex
10. Engine, gas	24. Washer, lock split
11. Nut, lock hex	25. Bolt, eye, lifting bar assy
12. Screw cap hex head	26. Screw hex
13. Starter-generator	27. Bar assy lifting
14. Nut, lock hex	28. Base assembly



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Figure 2-1. Engine and starter-generator, removal and installation.



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- | | | | | |
|-------------------|---------------|------------|-------------|------------|
| 1. Cover | 6. Screw | 11. Nut | 16. Bolt | 21. Nut |
| 2. Screw | 7. Cable hook | 12. Washer | 17. Bracket | 22. Nut |
| 3. Washer | 8. Screw | 13. Clamp | 18. Nut | 23. Clamp |
| 4. Frame assembly | 9. Washer | 14. Screw | 19. Clamp | 24. Washer |
| 5. Nut | 10. Bracket | 15. Screw | 20. Washer | 25. Screw |

Figure 2-2. Frame assembly, removal and installation.

CHAPTER 3

REPAIR OF GENERATOR SET

Section I. CONTROL BOX ASSEMBLY

3-1. General

The control box assembly is located on the left side of the generator set. The control box houses the voltage regulator, reverse current relay, output relay, terminal board assembly, load stud assembly and wiring harness.

3-2. Voltage Regulator

a. Removal. Refer to figure 3-1 and remove the voltage regulator.

b. Disassembly.

- (1) Back out the pile screw (5, fig. 3-2) to relieve pressure on the carbon pile.
- (2) Remove the pile screw assembly (5 to 17).
- (3) Remove the carbon pile (18). Keep free from dirt and grease on a small rod of screwdriver.
- (4) Remove the glass tube (19).
- (5) Remove the magnet cup (39).
- (6) Remove the magnet plate and stop (46).
- (7) Remove the base assembly (24).
- (8) Remove the spring rest (47).
- (9) Pull the armature assembly (48) out of the housing.

c. Cleaning. Make sure that all parts are free from dust dirt, metal filling and other foreign particles. All parts should be free of grease or oil, except for the spring (59, fig. 3-2) which has a very thin film of oil, for corrosion resistance. This film of oil should not be removed. Wipe insulation tube clean. No cleaning agents are required.

d. Inspection. After 500 hours of operating time, check the regulator performance, preferably on a test bench. Adjust the pile screw if necessary. Refer to test procedures (para g below). Then return the regulator to service. If the proper adjustment cannot be obtained, install a new carbon pile; otherwise remove the regulator for overhaul. Remove

the regulator for overhaul after 1000 hours of operating time and accomplish the following:

(1) Check condition of contact surface of pile screw including both ends of the compression piece. If blackened or pitted, clean with fine file or crocus cloth. If these surfaces cannot be cleaned without wearing through the silver plating, install a new part. Also inspect the threads on the pile screw.

(2) Make sure that the surface around the small tapped hole of the screw holders is clean. Scrape if necessary.

(3) Discard the whole carbon pile if any of the washers are pitted, rough or broken. If in doubt, install a new pile. Avoid unnecessary handling if the pile is to be reused.

(4) Wipe the insulation tube clean. Discard if cracked or chipped.

(5) Clean the ends of the terminal pins on bracket if necessary with a fine file or crocus cloth

(6) Discard insulation bushings if broken, cracked or chipped.

(7) Discard the coil if the insulation of the leads or coil body is damaged.

(8) Discard the resistors if enamel is broken or charred. Check the small resistor for fatigue terminal wires or broken insulation.

(9) Discard the rheostat if the winding is damaged, if there is no contact pressure on the contact arm, or if rotation is rough or uneven.

(10) Discard any wires with chafed or broken insulation.

(11) Test the parts with a resistance bridge, measure the resistance of the coil windings, resistors and rheostat.

(a) Discard any part that does not check within the following limits shown in table 3-1.

Table 3-1. Resistance Limits

Part	resistance in Ohms at 25°C (77°F)	
		Maximum
Coil		
Potential winding (red and green leads)	4.8	6.0
Equalizer winding (brown and black leads)	0.36	0.44
Rheostat	9.0	11.0
Potential resistor (25 watts)	29.5	32.6
Stabilizing resistor (1 watt)	450	550

(b) If hipot equipment is available, test the coil insulation to the spool at 600 volts for one second.

e. *Repair or Replacement.* With the exception of cleaning pitted or blackened surfaces as described in d (1) and (5), defective parts cannot be repaired and must be replaced.

f. *Reassembly.* The regulator can be reassembled by reversing the disassembly procedures being careful to make connections in accordance with figure 3-3. Observe special instructions described below:

(1) If the magnet core has been removed, screw it up until 10 mils under flush, measuring from the raised rim on the hole of the magnet plate and stop (46, fig. 3-2).

(2) When replacing the armature in the housing, the terminal on the armature should be near the upper left tapped hole.

(3) Insert the magnet plate with chamfered outer edge in.

(4) The magnet assembly should be securely in place before inserting the carbon pile.

(5) When inserting the carbon pile hold the regulator with the glass tube in a vertical position to minimize carbon breakage. While in this position the pile screw should be turned in to apply slight pressure to the pile.

(6) Replace parts should be sprayed or brushed with a moisture or fungus-resistant, varnish (Military Specification MIL-V-173A, Type I, or equivalent). Do not apply varnish to terminal boards, resistors, or rheostats.

g. *Test Procedure.* It is preferable to use the same type of generator that the regulator will be used with in service. The rpm values in the text below refer to a generator with a speed range of 3000-8000 rpm. These values will be different for other ratings.

(1) Mount the regulator on the test stand and make connections shown in figure 3-4.

(2) The regulator should be wired in accordance with figure 3-3.

(3) Resistance values for checking the coil windings, resistors and rheostat are given in d (11).

(4) Set the rheostat at its midposition. Make sure that the magnet locking screws are tight.

(5) Turn the pile screw out (counterclockwise) until pressure on the carbons is relieved. Do not back out pile screw too far as end carbons may become dislocated and will break when the pile screw is turned in (clockwise). Start the generator and note the voltage. It should be less than 10 volts. If it is not, the carbon pile is too long and one washer should be removed. The voltage should start to rise when the pile screw is turned in (clockwise).

(6) Increase the speed slowly to 8000 rpm and turn the pile screw slowly. The regulated voltage will at first rise and then drop slightly. Set the pile screw approximately in the position shown in figure 3-5. The coil current (at no-load, 8000 rpm) should be about 0.65 ampere. If the current is high, turn the magnet core in. Tighten the locking screws uniformly. If the current is low, loosen magnet locking screw and turn magnet body out.

(7) Allow the regulator to come up to operating temperature by operating at 3500 rpm for ten minutes.

(8) A pair of earphones connected as shown in figure 3-4 can be used to check the stability of the regulator. A stable regulator produces a humming noise or steady roar. A rapid series of popping noises indicates instability. Listen carefully at high speeds when shocking (applying and removing full load) the regulator to detect instability. An oscilloscope may also be used to check stability. When using an oscilloscope, instability is indicated by low frequency, high-amplitude discontinuous oscillations, usually off scale on the screen. Do not confuse with the higher frequency commutator ripple.

(9) The exact position of the pile screw should be obtained by checking the full load and no-load regulated voltage at 8000 rpm. The full load voltage should not vary more than plus or minus 0.1 volt from the no-load voltage. The coil current must be between 0.645 and 0.655 ampere. At 3500 rpm, the full-load voltage should not be more than 0.5 volt lower than the no-load voltage. Adjust the magnet body as described in g (6). Recheck the pile screw setting and coil current until both voltage and current requirements are satisfied.

(10) Record the no-load voltages at 3500, 4500, 6000, and 8000 rpm, also read voltage at 10,000 rpm, no-load, without shocking. The regulated voltage should remain between 27.5 volts and 28.3 volts for all readings. If the voltage does not remain between these limits, turn the pile screw in slightly and recheck para g(9).

(11) Increase the speed from 3500 to 8000 rpm without shocking and record the voltage at 8000 rpm. Shock several times at 8000 rpm and note the voltage. The difference between the two readings should not be greater than 0.3 volt. If it is greater, replace the carbon disks and check the insulation tube for cleanliness and cracks.

(12) With the regulator operating, close the equalizer switch and adjust the voltage drop across the equalizer coil at the regulator terminals to 0.25 volt. Make sure the polarity is as shown on figure 3-4. Read the voltage with the switch open at 5500 rpm (no-load). Close the switch and again read the voltage. The voltage should drop between 2.25 and

2.75 volts when the switch is closed. If the voltage drop does not fall between the above limits, replace the coil. If there is no change, check for an open equalizer circuit. If a rise occurs, check for reversed equalizer connections.

(13) Lower the speed to 4375 rpm at no-load. Move the rheostat through its travel to determine if it will adjust the voltage from 26 to 30 volts. If this is not the case, recheck the coil current. g(6). Set

the rheostat to 28.0 volts at 4375 rpm, no-load, after this check.

(14) Safety wire the clamping screw on the shock mount, if used.

(15) Hipot all terminal studs together to the resistor housing at 600 volts, 60 cycles for one second.

h. *Installation.* Refer to figure 3-1 and install the voltage regulator.

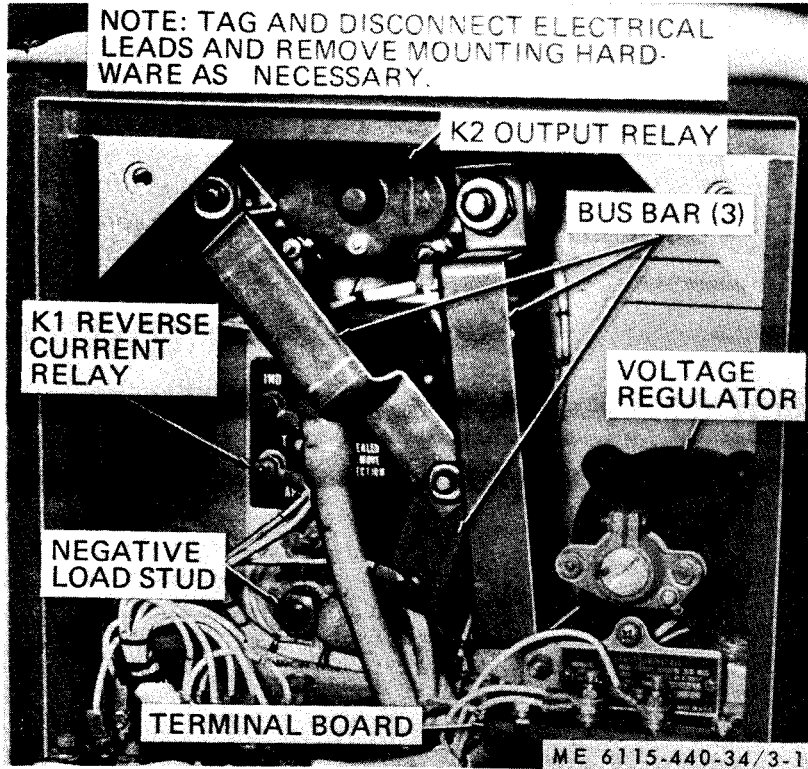
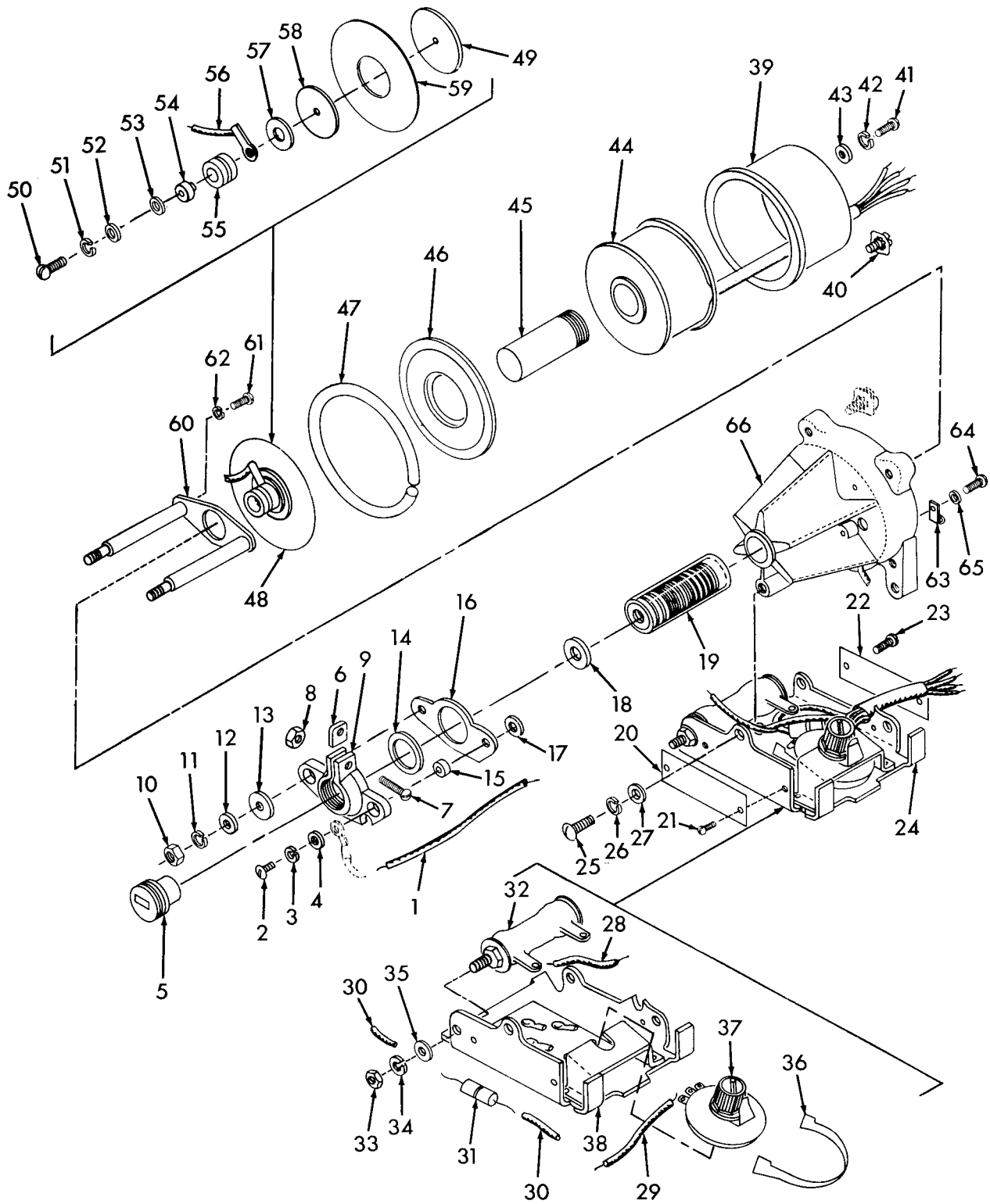


Figure 3-1. Control box components, removal and installation.

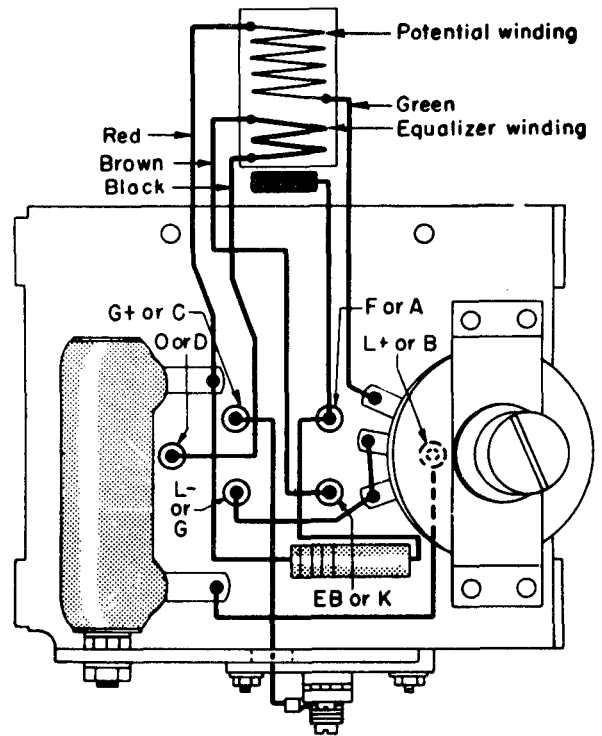


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Figure 3-2. Voltage regulator assembly, exploded view.

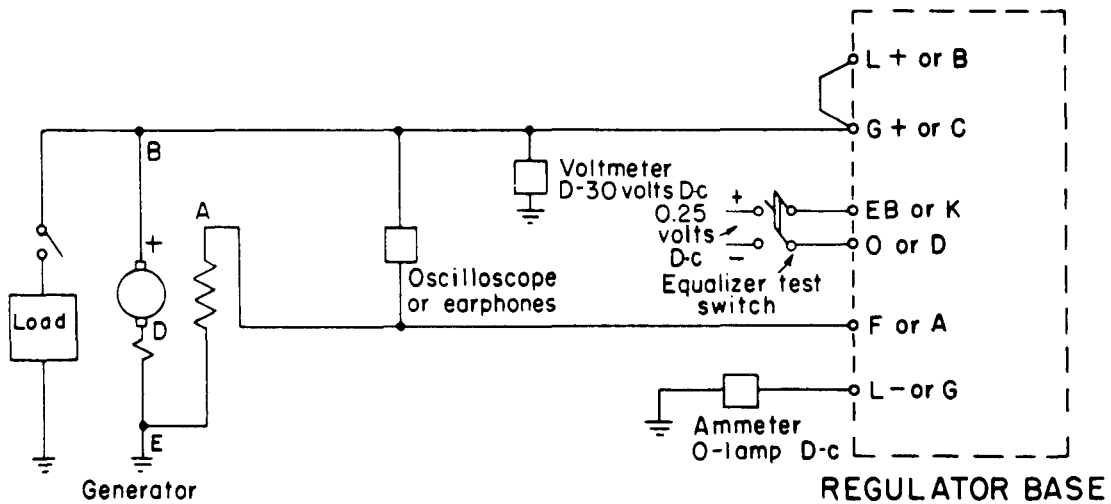
Key to figure 3-2:

- | | |
|-----------------------------|----------------------------------|
| 1. Lead | 34. Washer, lock |
| 2. Screw | 35. Washer |
| 3. Washer, lock | 36. Insulation, rheostat |
| 4. Washer | 37. Rheostat assy, adjusting |
| 5. Screw, pile | 38. Sub base assy |
| 6. Seal, dust | 39. Cup, magnet |
| 7. Screw | 40. Fastener (4) |
| 8. Nut | 41. Screw (2) |
| 9. Holder, screw | 42. Washer, lock (2) |
| 10. Nut (2) | 43. Washer (2) |
| 11. Washer, lock (2) | 44. Coil |
| 12. Washer (2) | 45. Core |
| 13. Washer, insulating (2) | 46. Plate and stop assy, magneto |
| 14. Washer, insulation | 47. Rest, spring |
| 15. Bushing, insulation (2) | 48. Armature assy |
| 16. Plate, insulator | 49. Armature |
| 17. Washer (2) | 50. Screw |
| 18. Pile, carbon | 51. Washer, lock |
| 19. Tube insulation | 52. Washer |
| 20. Nameplate | 53. Washer, insulation |
| 21. Screw (2) | 54. Bushing, insulation |
| 22. Nameplate | 55. Compression piece |
| 23. Screw (2) | 56. Connector assy |
| 24. Base assembly | 57. Washer, insulation |
| 25. Screw (3) | 58. Clam |
| 26. Washer, lock (3) | 59. Spring |
| 27. Washer, lock (3) | 60. Guide assy |
| 28. Lead | 61. Screw |
| 29. Lead | 62. Washer, lock |
| 30. Tube (2) | 63. Cleat |
| 31. Resistor | 64. Screw |
| 32. Resistor | 65. Washer, lock |
| 33. Nut | 66. Housing, resistor |



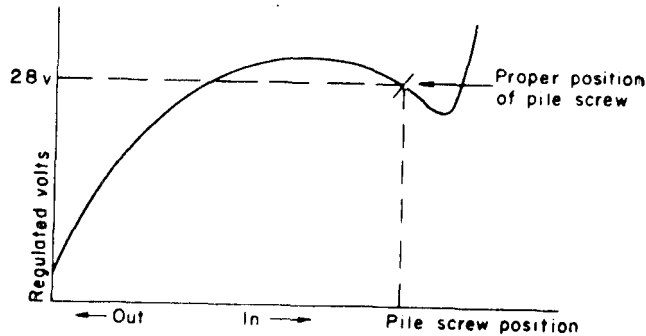
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Figure 3-3. Voltage regulator, internal wiring diagram.



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Figure 3-4. Voltage regulator, test circuit.



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Figure 3-5. Pile screw adjustment curve.

3-3. Reverse Current Relay (K1)

a. *Removal.* Refer to figure 3-1 and remove the reverse current relay.

b. *Test.* Using an ohmmeter, check reverse current relay (fig. 3-1) as follows:

(1) Check the resistance between APP terminal and the case (Ground). The resistance should measure approximately 90 ohms.

(2) Check the resistance between the APP and SW terminals. The resistance should measure approximately 330 ohms.

(3) Check the resistance between the SW terminal and the case (ground). The resistance should measure approximately 220 ohms.

(4) Check the resistance between the BAT and IND terminals. The resistance should measure approximately 6 ohms.

(5) Replace reverse current relay K1 if it does not pass the tests.

b. *Installation.* Refer to figure 3-1 and install the reverse current relay.

3-4. Output relay (K-2)

a. *Removal.* Refer to figure 3-1 and remove the output relay.

b. *Test.*

(1) Connect a variable 28-volt D. C. supply to

terminals X1 and X2, and an ohmmeter across terminals A1 and A2.

(2) With no voltage applied, the ohmmeter should indicate an open circuit.

(3) Slowly increase the applied voltage until the relay actuates (continuity indicated). The relay should actuate when the applied voltage reaches 18 volts.

(4) Slowly reduce the applied voltage until the relay drops out (open circuit indicated). The relay should drop out when the applied voltage is decreased to between 1.5 and 7 volts.

(5) Replace relay K2 if it does not pass the test.

c. *Installation.* Refer to figure 3-1 and install the output relay.

3-5. Terminal Board Assembly

a. *Removal.* Refer to figure 3-1 and remove the terminal board assembly.

b. *Inspection.* Inspect terminal lugs of all assemblies for corrosion, cracks or other damage. Replace if damaged.

c. *Installation.* Refer to figure 3-1 and install the terminal board assembly.

3-6. Load Stud Assembly

a. *Removal.* Refer to figure 3-1 and remove the load stud assembly.

b. *Installation.* Refer to figure 3-1 and install the load stud assembly.

3-7. Wiring Harness

a. *Removal.* Refer to figures 1-1 and 1-2 for removing wiring harness. Remove plastic clips where necessary when removing the wiring harness.

b. *Replacement.* To replace a lead, disconnect it at each end and install a new lead of the same size and number. Solder or secure as applicable all terminal connections to insure good electrical contact. Reinstall the plastic clips after replacing wiring harness.

Section II. FUEL SYSTEMS

3-8. General.

The fuel system maintenance consists of the fuel tank governor control and the governor.

3-9. Fuel Tank

a. *Removal.* Remove the fuel tank (TM 5-6115-440-20).

b. *Repair.* Repair the fuel tank by welding or brazing.

WARNING

Before attempting to weld or braze the fuel tank, steam clean the tank

for a minimum of eight (8) hours. Remove fuel cap and open the discharge and return lines during welding process. Failure to observe this warning may result in serious injury or death.

c. *Installation.* Install the fuel tank (TM 5-6115-440-20).

3-10. Governor Control Assembly

a. *Removal.*

(1) Remove the intake manifold (TM 5-6115-440-20).

(2) Loosen stop block screw (1, fig. 3-6) and remove block stop (2) from control cable (3).

(3) Remove cotter pin (4) and washer (5) from speed lever support pin (6) and remove the support pin and washer (7).

(4) Disconnect spring (8) from governor control lever.

b. *Disassembly.* Refer to figure 3-6 and disassemble the governor control assembly in numerical sequence.

removing nut (18, fig. 3-6) and pulling cable thru control panel.

c. *Reassembly.* Refer to figure 3-6 and reassemble the governor control assembly.

d. *Installation.*

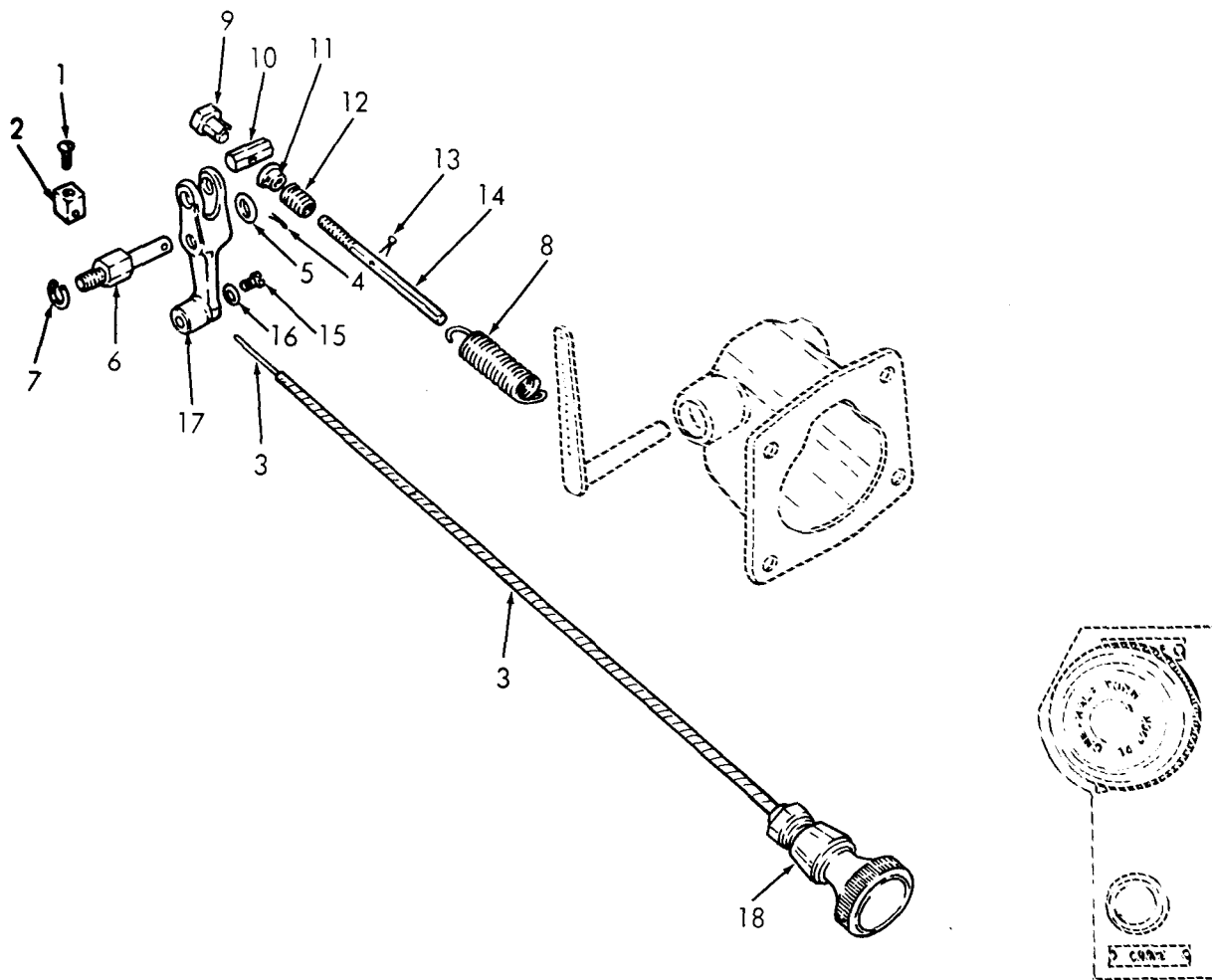
(1) Install in the reverse procedure of removal.

(2) Install the intake manifold assembly (TM 5-6115-440-20).

e. *Adjustment.* Adjust the governor control assembly (TM 5-6115-440-20).

NOTE

The control flex cable may be removed by



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- 1. Screw
- 2. Block stop
- 3. Control cable
- 4. Cotter pin
- 5. Washer
- 6. Support pin
- 7. Lock washer
- 8. Spring
- 9. Adjusting screw locknut

- 10. Swivel
- 11. Spring retainer
- 12. Spring
- 13. Cotter pin
- 14. Adjusting screw
- 15. Screw
- 16. Washer
- 17. Lever
- 18. Locknut

Figure 3-6. Governor control assembly disassembly and reassembly.

3-11. Governor Assembly

a. Removal.

(1) Remove the manifold (TM 5-6115-440-20).

(2) Remove oil line from the restricted oil line fitting (1, fig. 3-7).

(3) Remove nut (2) and washer (3), and remove the spacer (4) and control rod ball joint (5) from the carburetor.

(4) Remove nut (6) and washer (7) and remove control rod ball joint (8) from the control shaft and lever (12).

b. Disassembly. Refer to figure 3-7 and disassemble the governor assembly in numerical sequence.

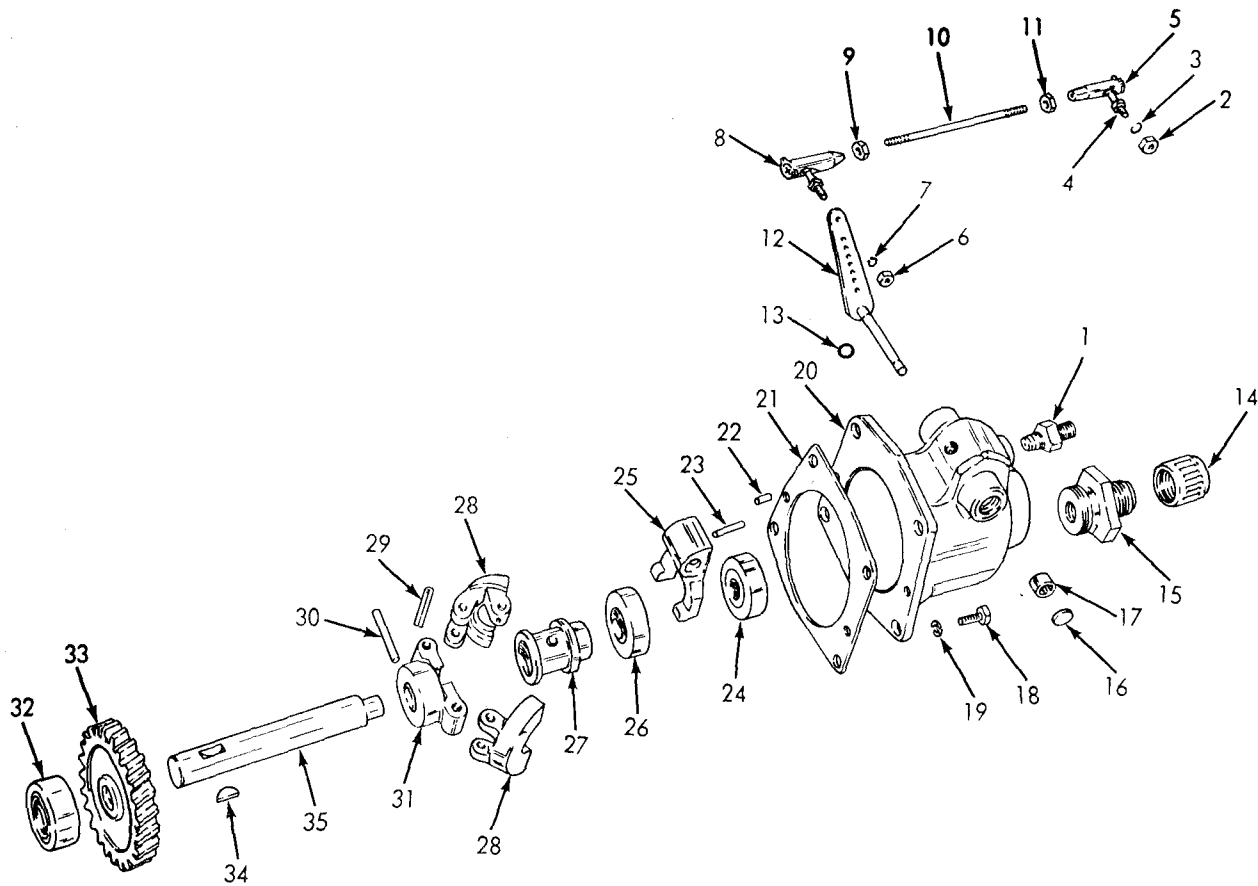
c. Reassembly. Refer to figure 3-7 and reassemble the governor assembly in the reverse order of disassembly.

d. Installation.

(1) Install in the reverse order of removal.

(2) Install the intake manifold (TM 5-6115-440-20).

e. Adjustment. Adjust the governor (TM 5-6115-440-20).



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- | | | | |
|---------------|------------------------|----------------------|-------------------|
| 1. Fitting | 10. Control rod | 19. Lockwasher | 28. Flyweight |
| 2. Nut | 11. Nut | 20. Governor housing | 29. Roll pin |
| 3. Washer | 12. Shaft and Lever | 21. Gasket | 30. Taper pin |
| 4. Spacer | 13. O-ring | 22. Dowel pin | 31. Flyweight hub |
| 5. Ball joint | 14. Adapter cap | 23. Taper pin | 32. Bearing |
| 6. Nut | 15. Tachometer adapter | 24. Bearing | 33. Gear |
| 7. Washer | 16. Plug | 25. Yoke | 34. Woodruff key |
| 8. Ball joint | 17. Bearing | 26. Housing | 35. Drive shaft |
| 9. Nut | 18. Screw | 27. Thrust sleeve | |

Figure 3-7. Governor assembly, disassembly and reassembly.

Section III. ELECTRICAL SYSTEM

3-12. General

The electrical system consist of the magneto and the starter generator. The magneto is a radio shielded assembly that contains the breaker points, capacitor and timing gear for determining the spark advance. The starter-generator serves the dual purpose of starting the engine and provides output voltage by being driven by the engine during normal operation.

3-13. Magneto

a. *Removal.* Remove the magneto (TM 5-6115-440-20).

b. *Disassembly.* Refer to figure 3-8 and disassemble the magneto in numerical sequence. Discard removed parts for which replacement parts are supplied in magneto repair kit.

c. *Inspection and Repair.*

(1) Inspect cam wick (35, fig. 3-8) for evidence of dirt or grease. Replace cam wick if dirty or saturated with grease.

(2) Check that coil (70) is not shorted or open.

Check that insulation is not damaged. Replace coil if necessary.

(3) Check teeth or rotor gear (42) and shaft and gear (46) for damage or wear. Replace if necessary.

d. *Reassembly.* Refer to figure 3-8 and reassemble in the reverse of numerical sequence. Note the following:

(1) Replace discarded parts with parts supplied in repair kit.

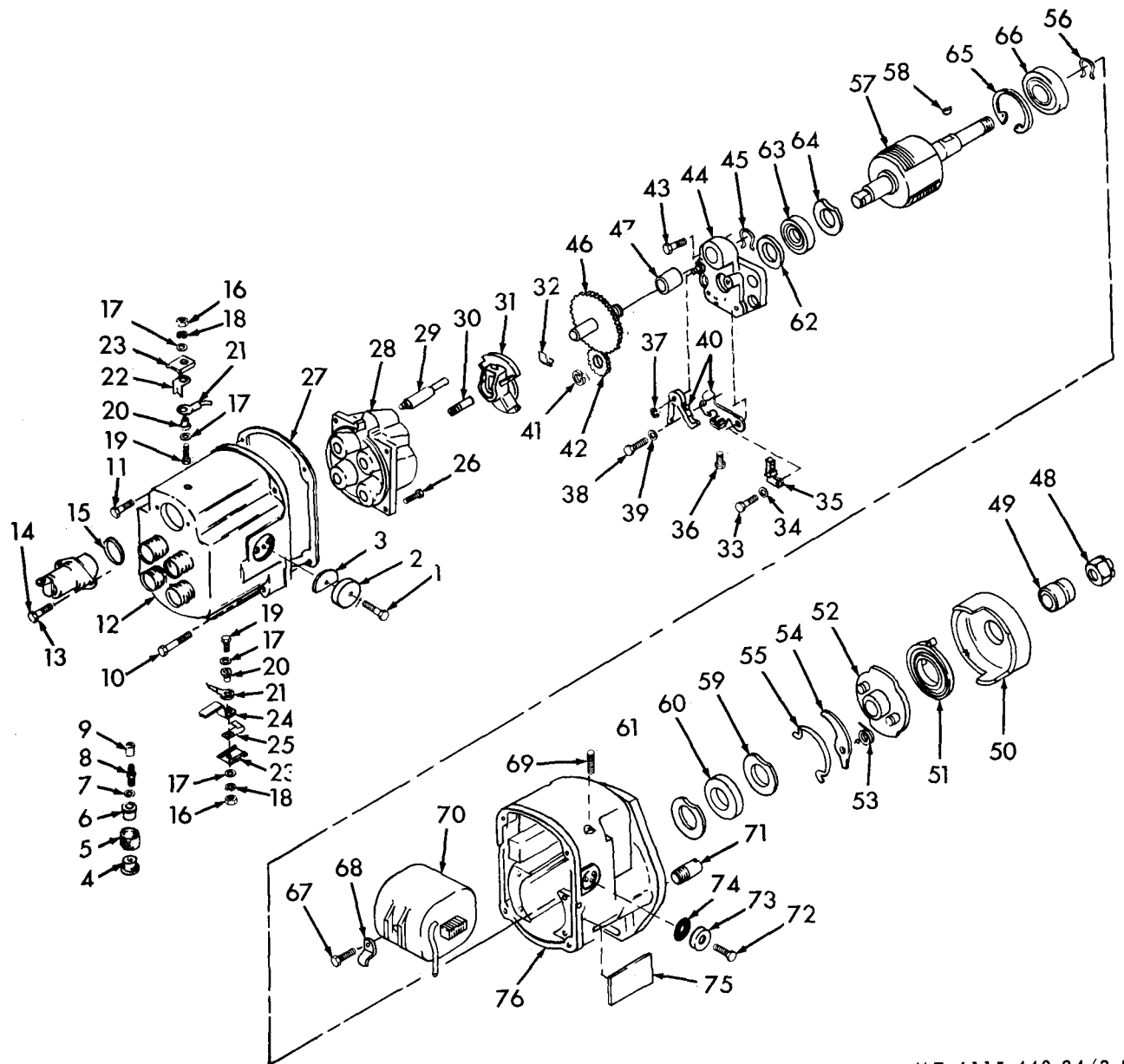
(2) Lubricate cam portion of rotor gear (42, fig. 3-8) with a light coating of grease before installing.

(3) Mate gear of shaft and gear (46) to rotor gear (42) when flat sides of shaft and gear and rotor gear are adjacent.

(4) Install new breaker point set (40). Adjust breaker point gap (TM 5-6115-440-20)

e. *Installation.* Install the magneto (TM 5-6115-440-20).

f. *Adjustment.* Adjust the magneto breaker points (TM 5-6115-440-20).



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- | | | | | |
|-----------------------------|-----------------------|-----------------------|----------------------|----------------------|
| 1. Screw | 17. Washer, lock | 32. Clip | 47. Bearing | 62. Washer |
| 2. Cover | 18. Washer, flat | 33. Screw | 48. Nut | 63. Bearing |
| 3. Screen | 19. Screw | 34. Washer | 49. Bushing | 64. Washer |
| 4. Button | 20. Bushing | 35. Cam wick | 50. Shell | 65. Pawl lock spring |
| 5. Nut | 21. Lead assembly | 36. Screw | 51. Spring | 66. Bearing |
| 6. Ferrule | 22. Condenser Contact | 37. Snap ring | 52. Hub assembly | 67. Screw |
| 7. Spring | 23. Guide | 38. Screw | 53. Spring | 68. Clip |
| 8. Plunger and nut assembly | 24. Support | 39. Washer | 54. Pawl | 69. Setscrew |
| 9. Spacer | 25. Support | 40. Breaker point set | 55. Pawl lock spring | 70. Coil |
| 10. Screw | 26. Screw | 41. Snap ring | 56. Snap ring | 71. Pin |
| 11. Screw | 27. Gasket | 42. Gear | 57. Rotor | 72. Pin |
| 12. Cap screw | 28. Block | 43. Screw | 58. Key | 72. Screw |
| 13. Screw | 29. Rod | 44. Bearing support | 59. Washer | 73. Cover |
| 14. Condenser | 30. Brush and spring | 45. Snap ring | 60. Seal | 74. Screen |
| 15. Gasket, O-ring | 31. Rotor | 46. Shaft and gear | 61. Washer | 75. Nameplate |
| 16. Nut | | | | 76. Housing |

Figure 3-8. Magneto, disassembly and reassembly.

3-14. Starter-generator

a. Removal. Remove the starter-generator (para 2-8).

b. Disassembly.

(1) Remove identification plate (26, fig. 3-9) by removing screws (27) only if replacement is necessary.

(2) Disassemble the filter box (1 through 25) in numerical sequence.

(3) Remove brush cover band assembly (28) and lift out six brushes (29) after removing six screws (30).

(4) Cut and remove safety wire on cap screws (32). Remove twelve cap screws (32) and washers (33) and lift off fan cover (31).

(5) Hold the drive spline with spline wrench, and remove two piece locknut (34) and washer (35). Then, using a soft faced mallet, tap commutator end of drive shaft assembly (36) to loosen internal splines. Pull drive shaft assembly out of armature assembly (48) using care so splines are not damaged.

(6) Disassemble drive shaft assembly into its components as follows: Remove nuts (37) and slide adapter retainer (33) off end of shaft, then remove springs (39) from shaft studs. Do not remove pressure plate (40) and friction plate (41) from shaft (42) unless replacement is necessary.

(7) After removing retaining ring (43) and outer baffle disc (46) from drive end of armature shaft, press armature from stator (with fan and support assembly still attached to armature).

(8) Pull fan (44) off end of armature shaft and remove key (45).

(9) Remove inner baffle disc (46) from drive end of armature shaft.

(10) Carefully press armature (48) from support assembly (52), then remove baffle disc (47) from armature shaft.

(11) Cut off lockwire from screws (50) and after removing screws, remove retaining ring (49).

(12) Applying pressure from recessed side of support assembly (52), carefully press ball bearing (51) out of support assembly.

(13) Carefully press ball bearing (53) from stator assembly also remove grommets (55) leaving stator (54).

(14) Remove nuts (2, fig. 3-10) and washers (3), and slide brush holder assembly (1) out of holes in support (10).

(15) Remove springs (4) and studs (5) from brush holder (6).

(16) Remove insulating washer (7), insulating plate (8) and insulating tube (9) from support (10).

c. Cleaning and Inspection.

(1) Clean all parts of generator except brush support assembly, armature, stator assembly and kitted parts by washing in cleaning solvent, Federal Specification No. P-S-661. When parts are thoroughly clean, rinse in clean solvent and dry with filtered compressed air.

(2) Blow dust and other foreign matter from brush support assembly, then wipe clean with a cloth moistened in cleaning solvent.

(3) Blow dust and other foreign matter from armature with filtered compressed air; then wipe with a cloth moistened in cleaning solvent.

(4) Blow dust and other foreign matter from inside field assembly with filtered-compressed air; then wipe with a cloth moistened in cleaning solvent.

(5) Visually inspect all parts for cracks, warpage, excessive wear and other apparent damage. See tables 3-2 and 3-3 for detailed inspection.

NOTE

Parts listed in table 3-2 are normally replaced at overhaul. New parts do not require inspection. This table is provided for instances where replacement parts are not readily available.

Table 3-2. Table of inspection for Parts Normal Replaced at Overhaul

Part identification		Type of inspection	Inspection procedure	Acceptability remarks
Names	Number			
Brush	30010-1026	Visual	Check for cracks, chipped edges, loose or frayed wire. Lateral wear groove in edge of brush is minimum worn length.	Replace for any of these conditions
Ball Bearing	JH203-35	Visual	Inspect for binding or excessive looseness	Replace if defective
Insulation Plate	G300-199	Visual	Check for cracks	Replace for this condition
Insulating Tube	05-631120	Visual	Check for cracks	Replace for this condition
Insulating Washer	05-374036	Visual	Check for cracks	Replace for this condition
Brush Spring	30010-1039	Visual	Check tension	Replace if not between 45 and 54 ounces
Dampener Spring	G26-138	Mechanical	Inspect for binding or excessive length approximately 0.468 inches. Test that force required to compress spring to 0.375 inches is 34-38 pounds	Replace if not within limits
Armature Assembly	30010-1020	Visual and Electrical	Inspect commutator for pitting caused by electrical failure. Burned adjacent bars indicate either open or shorted circuits in windings. A complete electrical test should be performed before reconditioning commutator	Replace armature if commutator is worn below a minimum diameter of 3.187 inches. Replace if electrical tests indicate a shorted, open circuited or grounded condition.
		Dimensional	Check bearing Journal diameters-minimum 1.1810 in.	Replace if diameter is below this limit
Stator Assembly	30010-320	Visual and electrical	Inspect for damage to coils, loose pole shoes and electrically as outlined in paragraph 3-14d (2). Pole shoes can be tightened by turning attaching screws clockwise	Replace if coils are damaged whether visually or electrically. (Restake attaching screws if they are tightened),

Table 3-3. Table of inspection

Part identification		Type of inspection	Inspection procedure	Acceptability remarks
Names	Number			
Bearing and Brush holder	30010-300	Visual	Check for cracks, warpage and damaged screw threads in brush holder	Replace for any of these conditions
Support Assembly		Dimensional	Check bearing bore diameter maximum 2.4409 inches	Replace if diameter exceeds this limit
Dampener Pressure Plate	30010-1031	Visual	Check for cracks and warpage	Replace for either condition.
Dampener Friction Plate	G300-280	Visual	Inspect for damaged splines also cracks and warpage	Replace for any of these conditions
Shaft	30010-1029	Visual and Mechanical	Inspect for damaged splines warpage and damaged threads. Inspect also for hidden cracks by electromagnetic process.	Replace for any of these conditions.

d. Testing.

(1) *Equipment.* Use a 110 volt lamp connected in series with test leads and a 110 volt power source for checking continuity in armature and stator assembly. A proper size "growler" should be used for checking armature for open or short circuits.

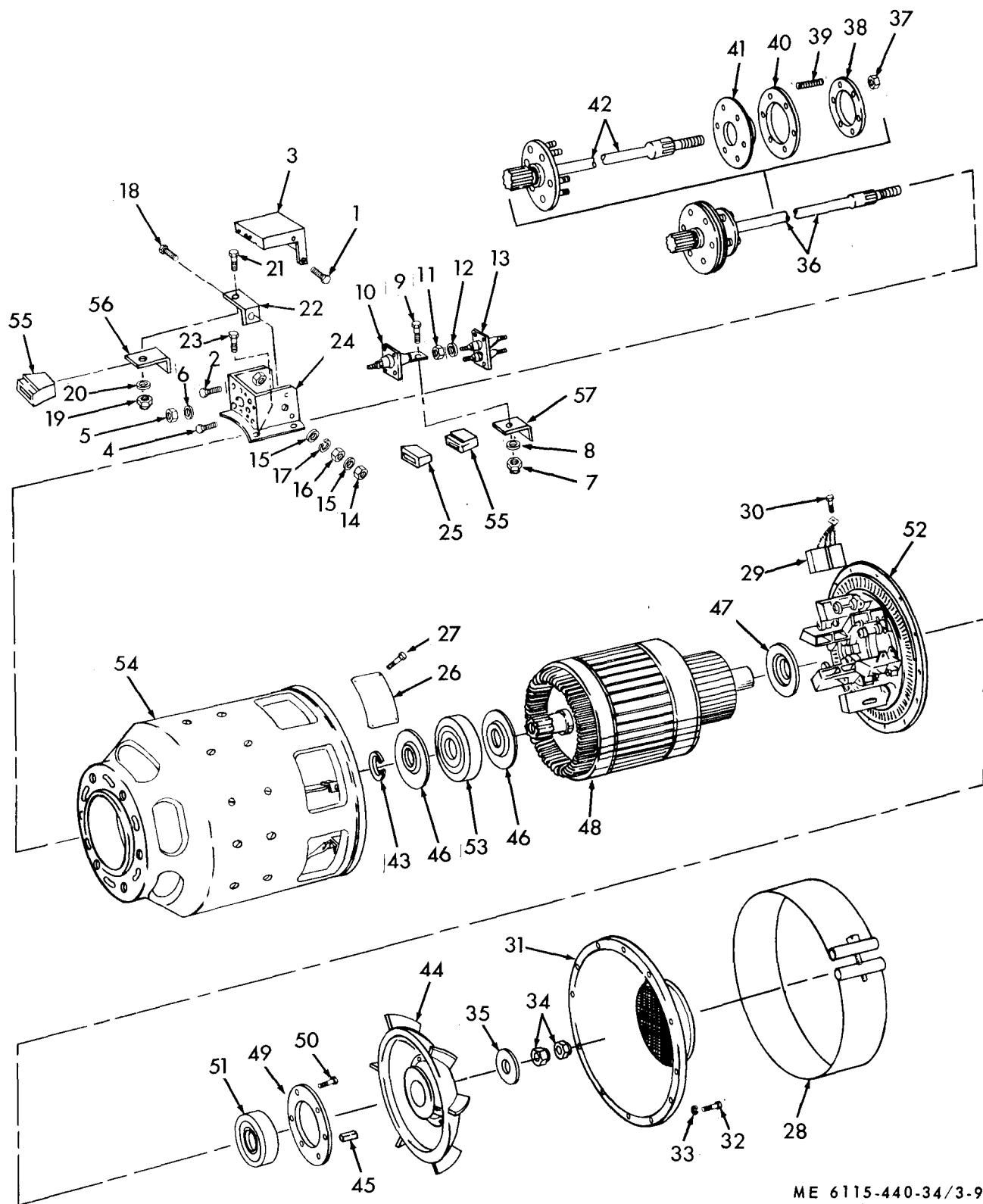
(2) *Armature.* Test armature for grounds by touching one test lead to core laminations and other test lead to each of the commutator risers. If the lamp lights, the windings are grounded and armature must be replaced. If the "growler" test indicates either open or short circuits, the armature must be replaced.

NOTE

Make certain that commutator is free of metallic particles and carbon dust wedged

between bars as this could give an indication of a shorted condition.

(3) *Stator assembly.* Test field coils for grounds by touching one test lead to stator core and other test lead to each of the field leads. If the lamp lights, the field is grounded and the entire stator must be replaced. Using an ohmmeter, check field coils for resistance (fig. 3-11) connect one test lead of ohmmeter circuit to terminal "A" and the other test lead to terminal "D"; the resistance between these two terminals should be from 2.0 to 2.3 ohms. Resistance values outside these limits indicate faulty circuitry. If the conditions require extensive repairing the stator assembly must be replaced.

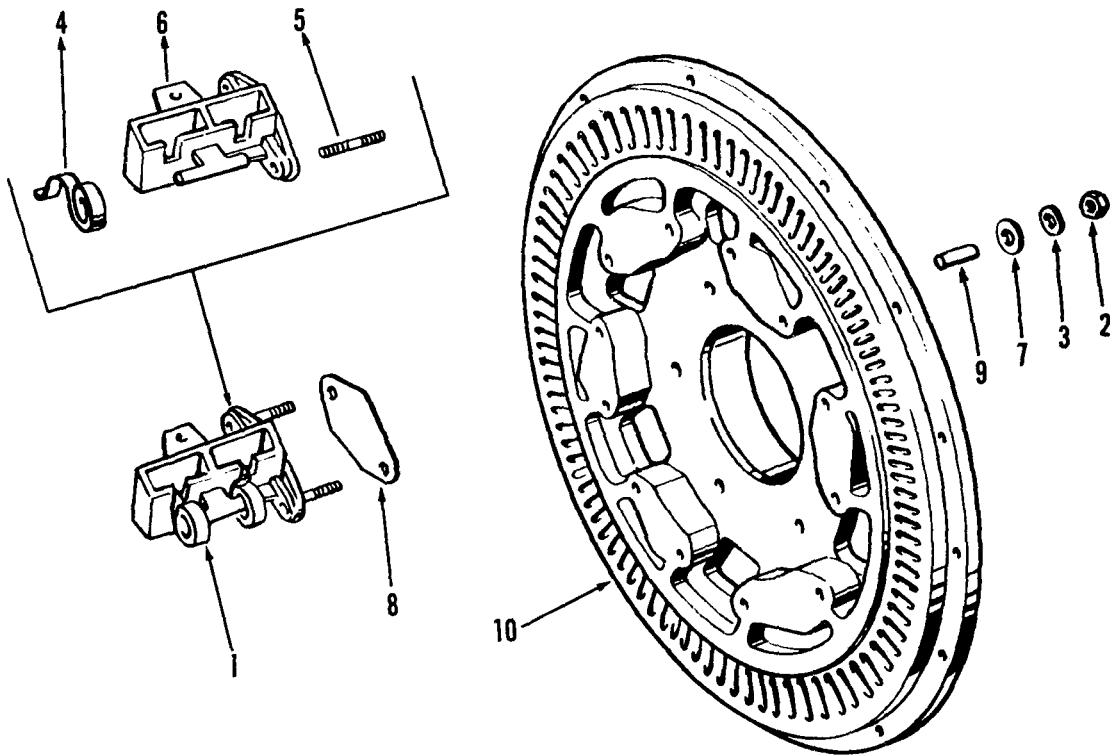


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Figure 3-9. Starter-generator assembly, disassembly and reassembly.

Key to figure 3-9:

- | | | | |
|---------------|--------------------------|--------------------|-----------------------|
| 1. Screw | 15. Washer | 29. Brush | 43. Ring |
| 2. Screw | 16. Nut | 30. Screw | 44. Fan |
| 3. Cover | 17. Washer | 31. Cover | 45. Key |
| 4. Screw | 18. Screw | 32. Screw | 46. Disc |
| 5. Nut | 19. Nut | 33. Washer | 47. Disc |
| 6. Washer | 20. Washer | 34. Nut | 48. Armature assembly |
| 7. Nut | 21. Screw | 35. Washer | 49. Ring |
| 8. Washer | 22. Lead | 36. Shaft assembly | 50. Screw |
| 9. Screw | 23. Screw | 37. Nut | 51. Bearing ball |
| 10. Capacitor | 24. Housing | 38. Retainer | 52. Support assembly |
| 11. Nut | 25. Grommet | 39. Spring | 53. Bearing ball |
| 12. Washer | 26. Identification plate | 40. Plate | 54. Stator assembly |
| 13. Capacitor | 27. Screw | 41. Plate | 55. Grommet |
| 14. Nut | 28. Band assembly | 42. Shaft | 56. Bus bar |
| | | | 57. Bus bar |



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- | | |
|--------------------------|----------------------|
| 1. Brush holder assembly | 6. Brush holder |
| 2. Nut | 7. Insulating washer |
| 3. Washer | 8. Insulating plate |
| 4. Spring | 9. Insulating tube |
| 5. Stud | 10. Support |

Figure 3-10. Bearing and brush holder support assembly, disassembly and reassembly.

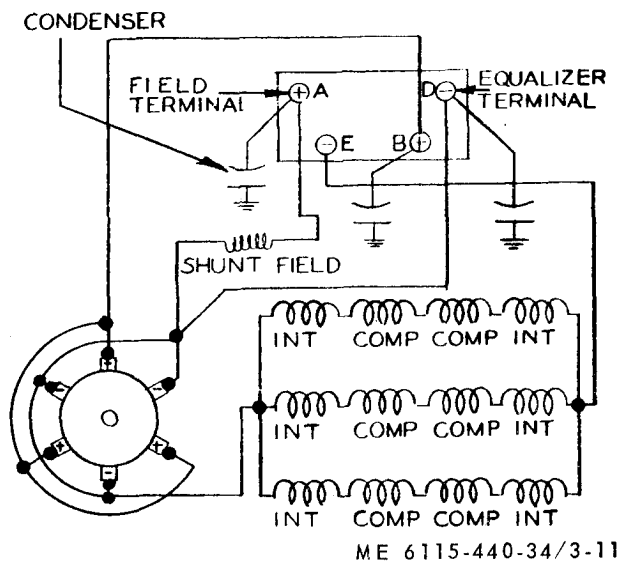


Figure 3-11. Internal wiring diagram.

e. Refinishing Commutator.

(1) *Equipment required.* To recondition the commutator within the tolerance limits, the work must be performed on a good lathe accurately set up and adjusted. The commutator end of the armature shaft should be supported on a bearing which can be used as a master by lapping out the inner race to obtain a slip fit to the armature shaft. The bearing should be supported by the turning center to support it in the tail stock of the lathe. The splined end of the armature should be driven by a suitable collet or held on a center in the head stock and driven with a lathe dog.

(2) *Making the cut.* Adjust the lathe speed to rotate the armature at approximately 600 rpm and, using a sharp carboloy tool, take the lightest cut possible with a fine feed. Remove only the amount of material necessary to true the commutator surface. This may require making several cuts since no more than 0.002 inch of material should be removed at any one time.

CAUTION

When new, the outside diameter of the commutator is 3.312 inches. When repeated turning reduces this diameter to less than 3.187 inches the armature must be replaced.

(3) *Undercutting the mica.* Using a reliable undercutting machine, undercut the mica between the commutator bars 0.032 inch deep by 0.052 inch wide. Using a triangular scraper, remove all sharp edges and burrs from the commutator bars. Remove all metal chips and mica particles from the slots with a bristle brush and compressed air.

(4) *Polishing the commutator.* With the armature rotating at approximately 600 rpm, hold a

strip of 5/0 sandpaper against the commutator to polish the surface and remove burrs which might have been left by the undercutting process. Stop the lathe and set up a dial indicator gage to check the accuracy of the finished commutator. The maximum allowable eccentricity after polishing is 0.0001 inch total indicated run-out, and 0.0005 inch bar-to-bar.

f. *Balancing the Armature.* After the commutator has been refinished, check the armature for proper balance, which should be within 20-grain inches at each end. If a balance correction is required, mill the retaining bands 0.032 inch deep with a 0.25 inch diameter cutter. Mill until the proper balance is obtained.

g. *Reassembly.*

(1) Install new brush springs (4, fig. 3-10) to brush holder assembly (1). It will be necessary to wind each spring approximately 3/4 turn in order to slide it on the spring support bar of the brush holder (6).

CAUTION

Do not wind spring more than necessary to engage into position as spring may take a permanent set

(2) Install studs (5) to brush holder assembly (1).

(3) Slide the insulating tubes (9) into holes in support (10), and after coating both sides of insulating plates (8) with insulating resin, assemble while still wet with brush holder assembly (1) to support (10).

(4) Slide an insulating washer (7) and washer (3) over each stud and secure with nuts (2).

NOTE

The brush holder assemblies must be positioned so that brushes will be angled toward direction of armature rotation.

(5) Apply insulating resin over insulation and support (10), extending at least 0.06 inch from brush holder insulators. Bake for one hour at 150° F.

(6) Slide inner baffle disc (46, fig. 3-9) on drive end of armature assembly (48), making sure that hub of disc projects away from ball bearing (53). Carefully press ball bearing (53) on drive end of armature until inner race of bearing in flush against baffle disc. Install outer baffle disc (46) and replace retaining ring (43).

(7) Carefully press ball bearing (51) into bearing and brush holder support assembly (52), pressing only on outer race of bearing.

(8) Position retaining ring (49) over ball bearing (51) and secure with screws (50). Lock wire screws in pairs.

(9) Slide baffle disc (47) on commutator end of armature assembly (48). The hub of baffle disc must project away from ball bearing (51).

(10) Carefully press bearing and brush holder support assembly (52), with ball bearing (51) onto shaft of armature assembly (48) until bearing is flush against baffle disc (47). Press only on inner race of bearing.

(11) Install grommet (55) into stator (54).

(12) Install armature into stator assembly, aligning holes for cap screws (32) so that brush holders are centered in the brush inspection window of the stator assembly.

(13) Position fan (44) on armature shaft using key (45).

(14) Assemble drive shaft assembly as follows: If clutch parts were removed, slide friction plate (41) and pressure plate (40) over shaft (42) and onto studs. See table 3-4 for method of lubrication. Position the six springs (39) over studs and hold in place with adapter retainer (38). Secure with nuts (37).

NOTE

Adjust drive shaft holding torque to 10–12 foot-pound by tightening or loosening nuts (37). There are two file marks on flange of the shaft and one on perimeter of friction plate (41). After checking torque, the file mark on

friction plate (41) must line up between file marks on flange of drive shaft.

(15) Install drive shaft assembly (36) into the hollows shaft of armature assembly (48), making certain that splines of drive shaft assembly engage those of armature shaft.

(16) After placing washer (35) on end of shaft and so that it rests against fan (44), secure with two piece locknut (34).

(17) Hold splined end of drive shaft with spline wrench, and torque inner portion of nut (34) to 180-200 inch-pounds, then torque outer portion of nut (34) to 125-150 inch-pounds.

(18) Install fan (cover (31) and secure with the twelve cap screws (32) and washers (33). Lockwire cap screws in pairs.

(19) Install the six brushes (29) securing brush leads with screws (30). Install brush cover band assembly (28).

(20) Reassemble filter box (1 through 25).

(21) Replace identification plate (1) and secure with Screws (2), if removed during disassembly.

(22) Refer to TM 5-6115-440-20 for brush treatment.

Table 3-4. Table of Lubrication Data

Location	Lubricant	Application
Drive Shaft	Grease MIL-L-3545	Make certain that all splines surfaces are liberally covered with a film of lubricant
Dampener Friction Plate	Grease MIL-L-3545	Apply a thin film of grease to clutch faces whenever assembling friction and dampener plates to drive shaft.

3-15. Starter-Generator Brush Run-in.

a. Equipment Required. The usual equipment required for the brush run-in procedure follows:

(1) A 28-volt direct current power source.

(2) A set of V-blocks, padded with sponge rubber to support the generator.

(3) A single-pole, single-throw switch capable of handling an excess of 400 amperes.

(4) A rheostat having a minimum rating of 10 ohms and 20 amperes.

(5) A tachometer of suitable range, or a stroboscopic light for indicating generator speed.

(6) A resistor in the armature circuit with an 0.1 ohm. 100 to 400 ampere rating.

b. Run-In Procedure (fig. 3-12).

(1) Mount the generator in the V-block for support and connect terminal "E" of the generator to the negative terminal of the 28-volt direct current power source.

(2) Connect terminal "B" through the resistor and switch to the positive terminal of the power source.

(3) Connect terminal "A" to the generator side of the switch through 10-ohm rheostat.

(4) Rotate the rheostat control to the minimum resistance reading and close the circuit with the switch. The generator should start and run as a motor in a clockwise direction when viewed from the air inlet end. If rotation is counterclockwise, thoroughly check all internal and external connections.

CAUTION

Make certain the rheostat is blocked off in such a manner that it cannot be set to an infinite resistance value as this would cause the generator to attain excessive speed.

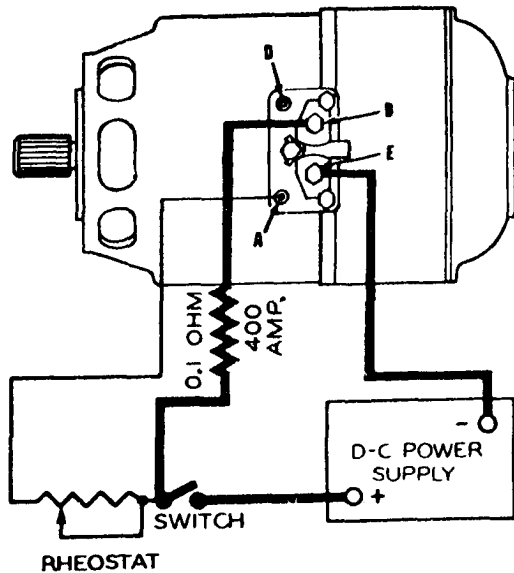
(5) Adjust the speed of rotation until the armature is revolving at approximately 4,500 rpm.

(6) Allow the generator to operate as a motor until the brushes show a minimum seating of 90 percent in an axial direction and 100 percent in the direction of rotation.

NOTE

Instead of running the generator as a motor, brush run-in may be accomplished by using a test stand to drive the generator.

(7) Remove all carbon dust with filtered, compressed air.



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Figure 3-12. Electrical connection for running-in brushes.

3-16. Starter-Generator Test Procedures

a. *General.* After brushes have been properly seated and run-in, the generator should be mounted on a test stand having sufficient capacity to handle a 300 ampere unit. The test stand should be equipped with a variable drive capable of attaining generator speeds up to 10,000 rpm.

b. *Test Equipment Required (fig. 3-13).*

(1) The variable drive, or prime mover, for operating the generator should have a rating of at least 30 horse power and a maximum speed in excess of 10,000 rpm.

(2) A direct current voltmeter (0 to 30 volts) must be available for measuring terminals voltage.

(3) A direct current ammeter (0 to 300 amperes) must be available for measuring generator output.

(4) A direct current ammeter (0 to 10 amperes) must be available for measuring generator field current.

c. *Performance Tests.* Performance tests shall be conducted in accordance with the following paragraphs after brushes have been seated 100 percent in direction of rotation and at least 90 percent in the axial direction.

(1) Mount generator on test stand and make connections to voltage regulator and reverse current relay in accordance with figure 3-13. Attach thermocouple to generator frame.

NOTE

Record field current, frame temperature, commutation, and generator speed as applicable during each test procedure.

(2) Without operational warm-up, operate generator with self excitation at 8000 rpm, 30 volts and no load. Shunt field current shall not be less than 0.81 amperes. Commutation must be black.

(3) With regulator connected to generator, operate at 6500 rpm, 30 volts, and 300 amperes until frame temperatures show no more than 2.0°F. (1.1°C) rise in five minutes. Commutation should not be worse than pin points along the edges of brushes. The paralleling voltage between terminals "D" and "E" must be within limits shown on calibration chart (fig. 3-14). Frame temperature must not exceed the air inlet temperature by more than 230°F (110°C).

(4) Operate at 5000 rpm, 30 volts, 300 amperes for demonstrating ability to operate at minimum speed for regulation. Shunt field current shall not exceed 8.0 amperes. Commutation shall be no worse than pin points along the edges of brushes.

(5) Operate at 6500 rpm (revolutions per minute), 30 volts, and vary load from 0 to 300 amperes in increments of 100 amperes to check for compounding. The field current must increase in load:

(6) Reduce speed to approximately 4500 rpm. operate no load and open field until frame temperature is 140°F. (60°C) or less. Substitute a resistance of 1.25 ohms for regulator in the field circuit and adjust speed to produce 26 volts and 300 amperes. Operate until speed is not over 4500 rpm with frame temperature stabilized or showing no more than 2.0°F. (1.1°C) rise in five minutes. Commutation should not be worse than pin points along edges of brushes.

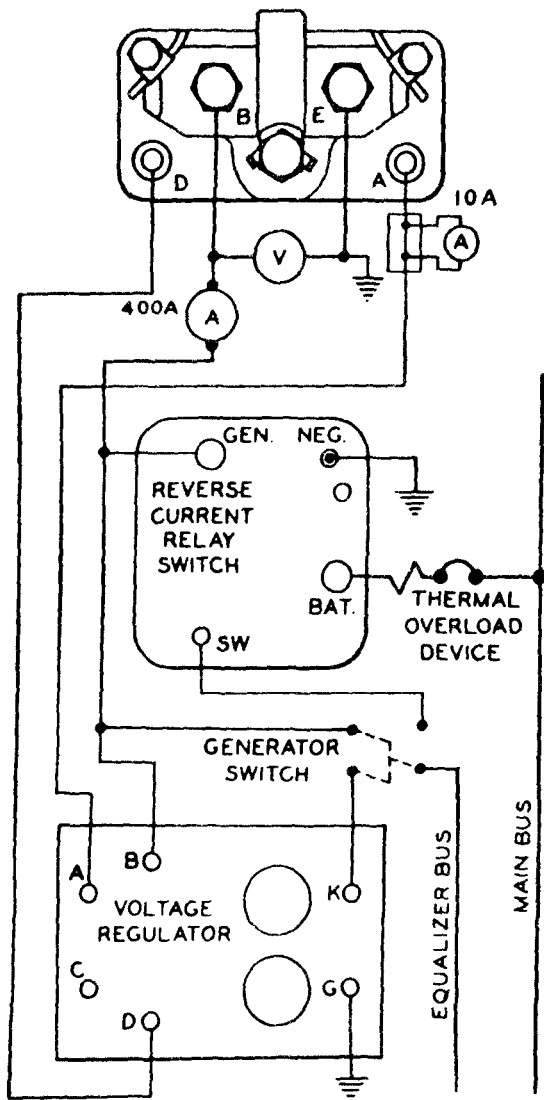
(7) Reconnect regulator and observe commutation at 30 volts, zero amperes, 200 amperes and 300 amperes at speeds of 5000 and 6500 rpm. Record the worse condition of commutation and the speed at which it occurs. Commutation must not exceed pin points along the brush edges.

(8) Operate at 8000 rpm, 30 volts and 300 amperes. Commutation must not exceed pin points along the brush edges.

(9) Remove generator from test stand and test all circuits to ground with 200 volts A. C. rms, 60 cycle for a period of one minute. There shall be no grounds in any circuit.

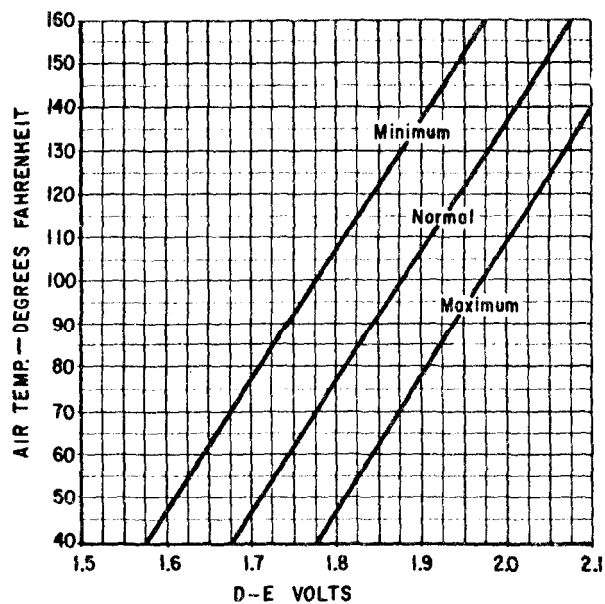
(10) Set up a dial indicator gage on generator frame and check the commutator for eccentricity by rotating the armature slowly by hand. The total indicated run-out must not exceed 0.001 inch and the bar to bar change must not exceed 0.0002 inch.

c. *Installation.* Install the starter-generator (para 2-8).



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Figure 3-13. Electrical test connection, starter-generator assembly.



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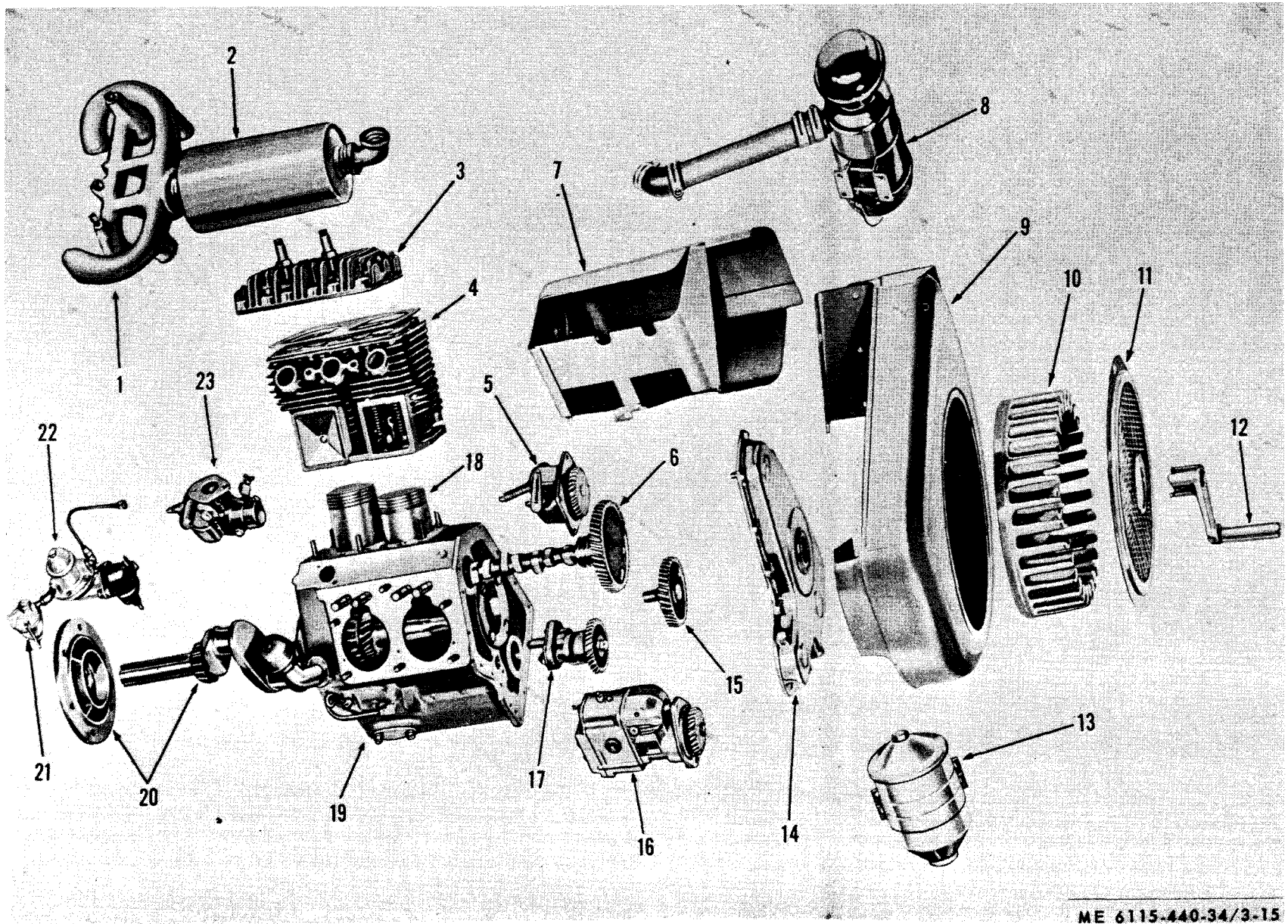
Figure 3-14. Calibration chart for paralleling voltage.

Section IV. ENGINE ASSEMBLY

3-17. General

This section contains repair and replacement instruction for the basic engine components. Accessory items such as the carburetor, fuel pump and

magneto are covered in TM 5-6115-440-20 and above sections. See figure 3-15 for a location view of the basic engine components.



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Figure 3-15. Basic engine components, location view.

Key to figure 3-15:

- | | |
|-------------------------|---|
| 1. Manifold | 13. Oil filter |
| 2. Muffler | 14. Cover |
| 3. Cylinder head | 15. Idler gear |
| 4. Cylinder block | 16. Magneto |
| 5. Governor assembly | 17. Oil pump assembly |
| 6. Camshaft and gear | 18. Pistons and connecting rods |
| 7. Air shroud | 19. Crankcase assembly |
| 8. Air cleaner | 20. Main bearing plate and
crankshaft assembly |
| 9. Flywheel shroud | 21. Fuel strainer |
| 10. Flywheel | 22. Pump fuel |
| 11. Screen | 23. Carburetor |
| 12. Starting hand crank | |

3-18. Engine Air Shroud and Deflector

a. Removal. Remove the air shroud and deflector (TM 5-6115-440-20).

b. Inspection and Repair.

(1) Inspect the air shroud and deflector for cracks and breaks.

(2) Repair cracks and breaks by welding.

c. Installation. Install the air shrouds and deflectors (TM 5-6115-440-20).

3-19. Flywheel and Flywheel Shroud

a. Removal.

(1) Remove engine sheave (TM 5-6115-440-20).

(2) Remove six screw and lockwashers securing the flywheel screen (1, fig. 3-16) to the flywheel shroud (10).

(3) Drive out the starting hand crank pin from the crankshaft.

(4) Remove nut (4) and lockwasher (5) from crankshaft.

(5) Take a firm hold on the flywheel (6) pins and pull outward, at the same time striking the end of the crankshaft with a wooden mallet (fig. 3-17). The flywheel will slide off the tapered end of crankshaft. Remove and retain the woodruff key (7, fig. 3-16) or installation.

CAUTION

Do not use a steel hammer as it may cause damage to the crankshaft and bearings. Remove flywheel shroud.

b. Inspection and Repair.

(1) Inspect the flywheel for cracks and breaks. Replace a defective flywheel.

(2) Inspect the flywheel shroud for dents, breaks or cracks. Repair a damaged shroud.

c. Installation.

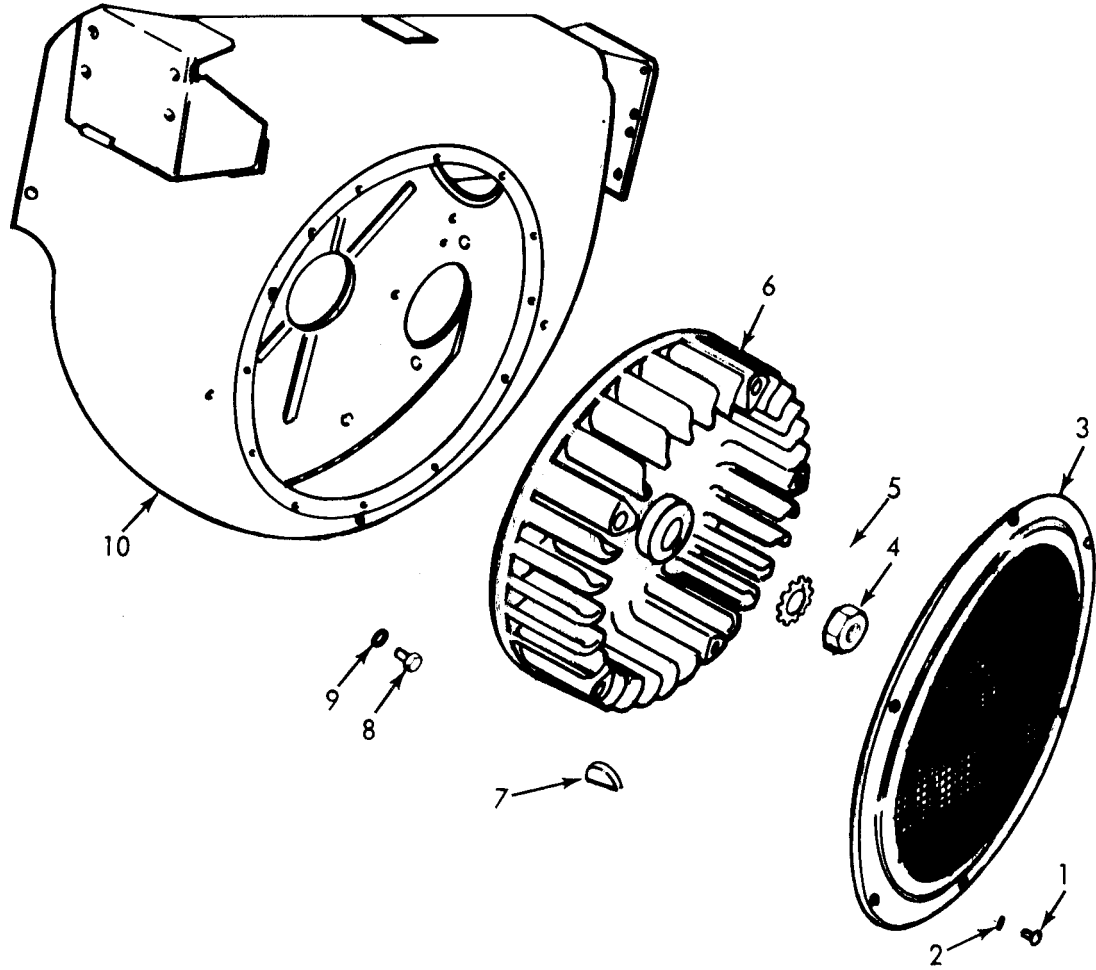
(1) Install the woodruff key (7, fig. 3-16).

(2) Install flywheel shroud (10).

(3) Install flywheel (6) on crankshaft.

(4) Install the washer (5) and nut (4) onto the crankshaft.

(5) Install starting hand crank pin into the crankshaft end.



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- | | |
|-----------|-----------------|
| 1. Screw | 6. Flywheel |
| 2. Washer | 7. Woodruff Key |
| 3. Shield | 8. Screw |
| 4. Nut | 9. Washer |
| 5. Washer | 10. Shroud |

Figure 3-16. Flywheel, shield and shroud, removal and installation.

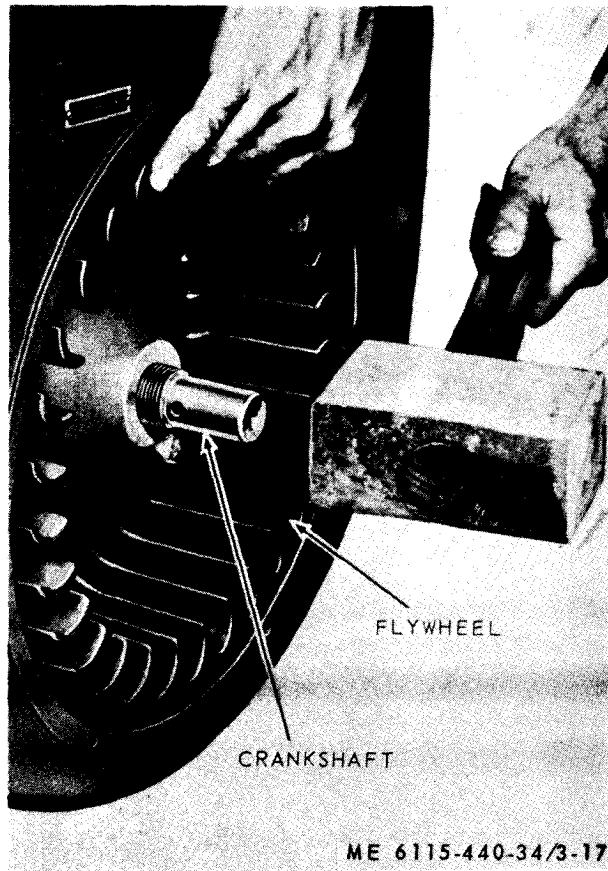


Figure 3-17. Removal of flywheel.

3-20. Gear Cover, Gear and Spacer

a. Removal.

(1) Remove flywheel and flywheel shroud (para 3-19).

(2) Refer to figure 3-18 and remove the gear cover, gear, and gear cover spacer.

b. *Disassembly.* Refer to figure 3-19 and disassemble the gear cover, gear, and gear cover spacer.

c. *Reassembly.* Refer to figure 3-19 and reassemble in the reverse order of disassembly.

d. *Installation.* Refer to figure 3-18 and install the gear cover spacer, gear, and gear cover.

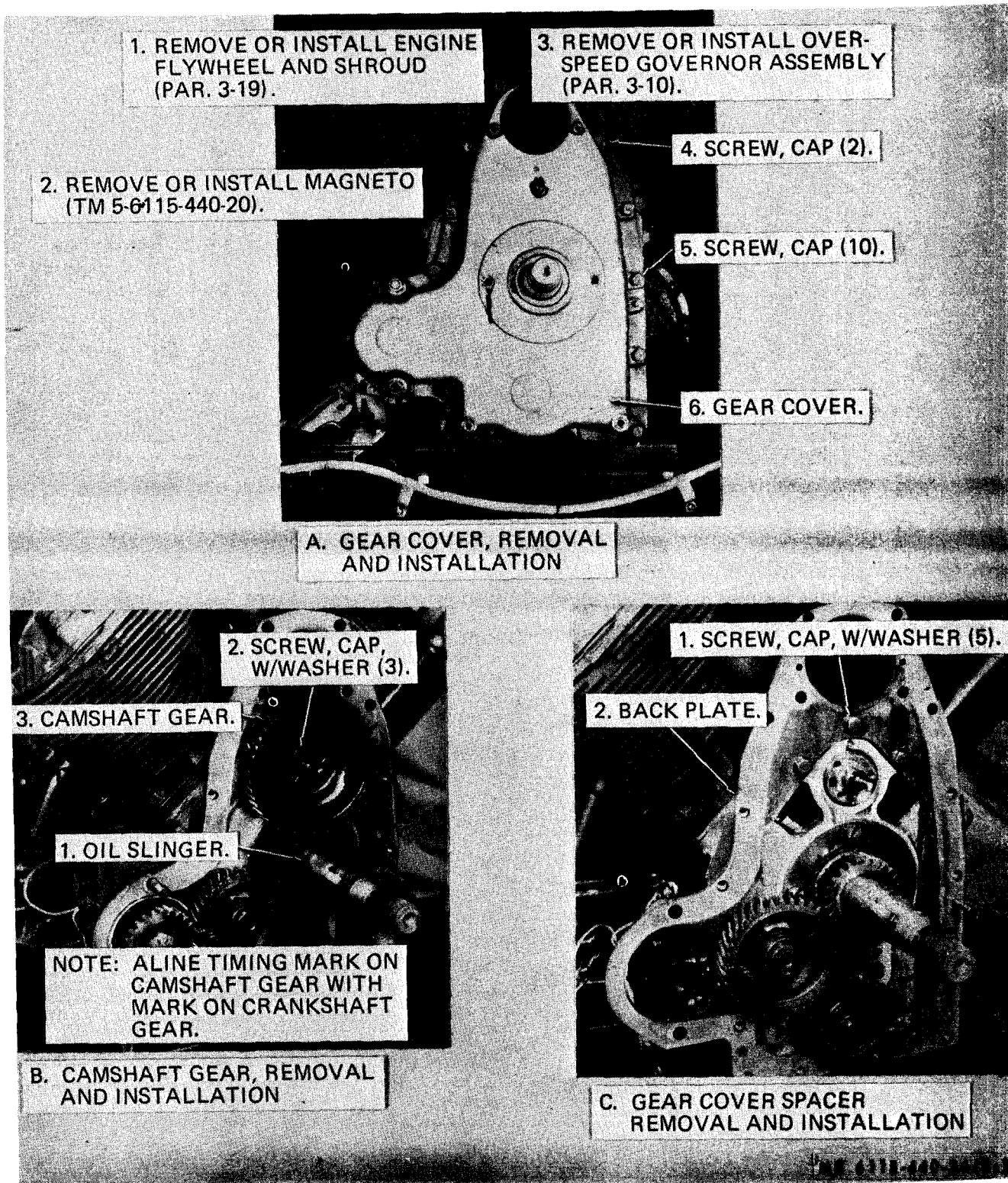
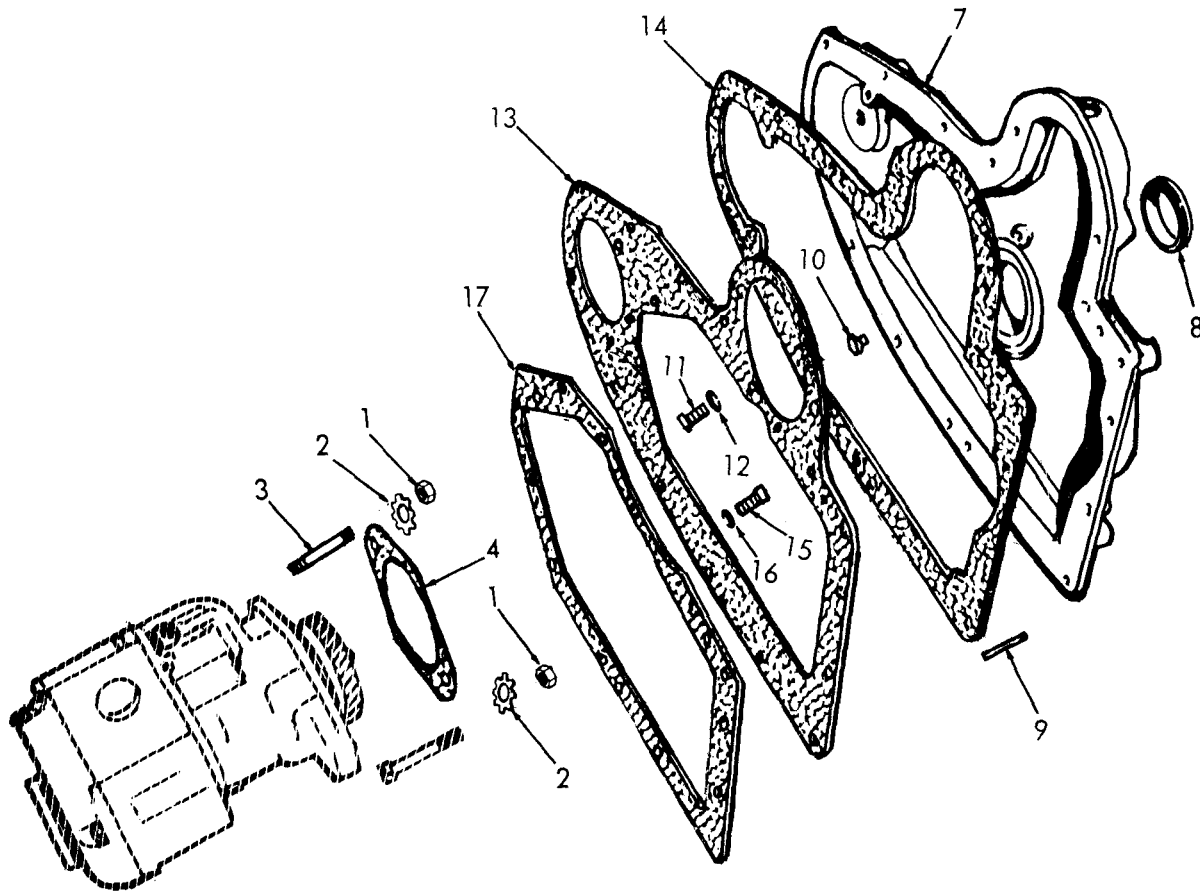


Figure 3-18. Gear cover, gear, and spacer, removal and installation.



- 1. Nut
- 2. Washer
- 3. Stud
- 4. Gasket
- 5. Screw
- 6. Lockwasher
- 7. Gear Cover
- 8. Oil Seal
- 9. Dowel Pin

- 10. Button
- 11. Screw
- 12. Lockwasher
- 13. Spacer
- 14. Gasket
- 15. Screw
- 16. Lockwasher
- 17. Gasket

Figure 3-19. Gear cover, gear, and spacer, disassembly and reassembly.

3-21. Crankcase Cover (Oil Pan) and Engine Supports

a. Removal.

- (1) Remove drain plug and drain engine oil.
- (2) Refer to figure 3-20 and remove the crankcase cover and engine supports.

b. Inspection.

- (1) Inspect crankcase cover for dents and cracks.

- (2) Inspect engine supports for cracks and breaks.

c. Installation.

- (1) Install a new crankcase cover gasket.
- (2) Refer to figure 3-20 and install the crankcase cover and engine support.
- (3) Fill the crankcase with engine oil in accordance with current lubrication order.

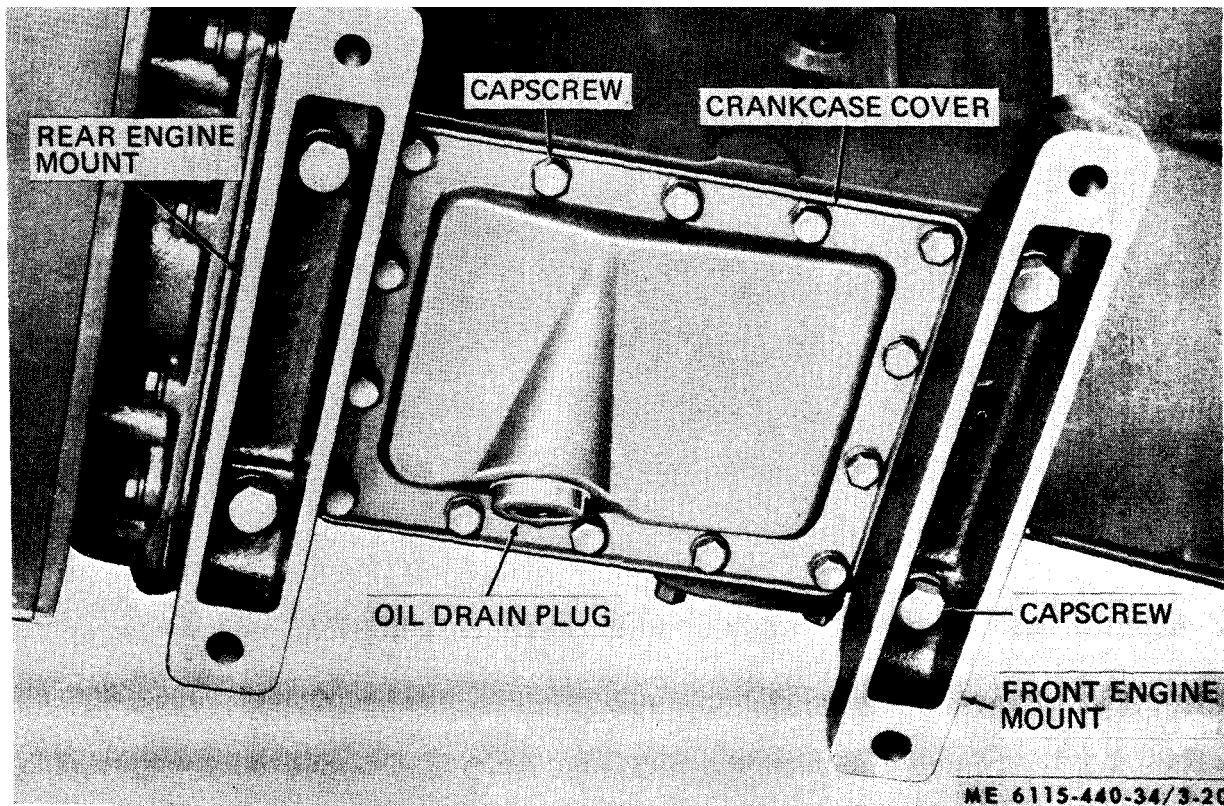


Figure 3-20. Crankcase cover (oil pan) and engine supports, Removal and installation.

3-22. Oil Pump

a. General. The engine lubrication oil pump is submerged in the lubrication oil and force feeds the oil to spray nozzles, which spray oil to the connecting rod bearings and other operating parts of the engine.

b. Removal

(1) Remove the gear cover (para 3-20).

(2) Remove crankcase cover and engine supports (para 3-21).

(3) Remove oil pump and pump drive gear (fig. 3-21) as follows:

(a) Remove slotted pipe plug and oil pump lock screw.

(b) Remove locknut holding oil pump driving gear to shaft.

(c) Use a soft brass rod or punch and drive shaft through gear.

(d) Withdraw oil pump toward center of crankcase.

c. Disassembly. Refer to figure 3-22 and disassemble the oil pump in numerical sequence.

d. Inspection.

(1) Inspect the gears for cracked, chipped, or worn teeth.

(2) Inspect body for cracks.

(3) Test the fit of the idler gear on the idler gear shaft. The gear should turn freely but should have no perceptible wobble. Replace a defective gear or shaft.

(4) Measure the oil pump drive shaft diameter and body bore. If the drive shaft is worn less than 0.4993 inch or if the pump body bore is more than 0.5015 inch, replace the drive shaft and pump body.

(5) Inspect the strainer screen for tears or enlarged openings and replace if defective.

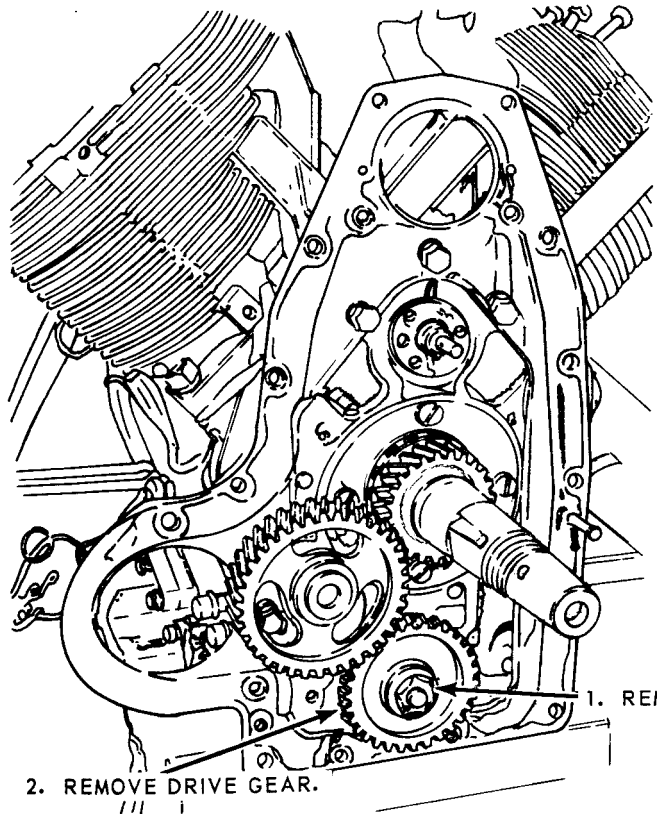
e. Reassembly. Refer to figure 3-22 and reassemble the oil pump in the reverse order of disassembly.

f. Installation.

(1) Install the oil pump in the reverse procedure of removal (fig. 3-21).

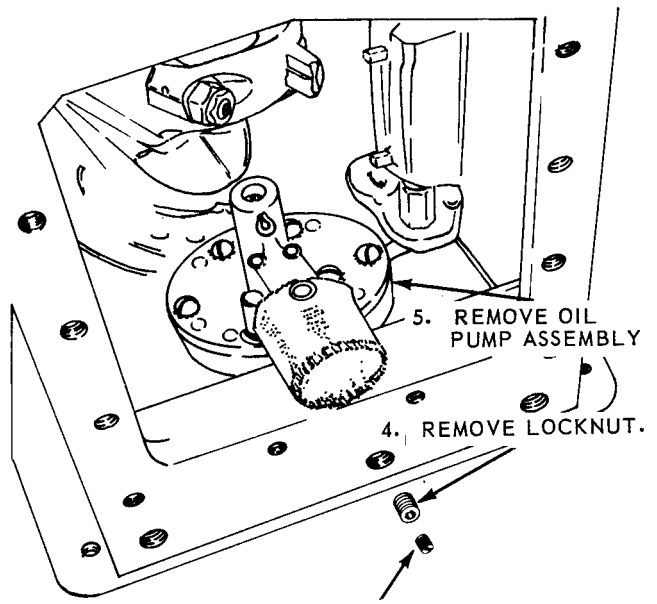
(2) Install the crankcase cover and engine supports (para 3-21).

(3) Install the gear cover (para 3-20).



2. REMOVE DRIVE GEAR.

1. REMOVE LOCKNUT.



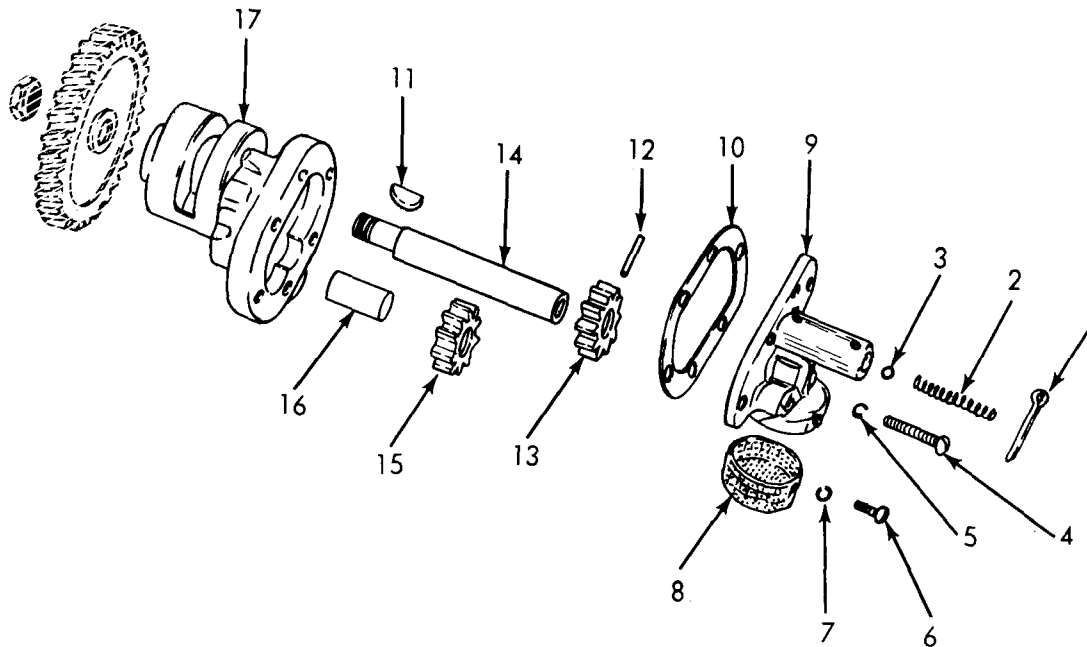
5. REMOVE OIL PUMP ASSEMBLY

4. REMOVE LOCKNUT.

3. REMOVE PIPE PLUG.

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Figure 3-21. Oil pump removal and installation.



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- | | |
|-------------------|------------------|
| 1. Cotter pin | 10. Gasket |
| 2. Spring | 11. Woodruff key |
| 3. Check ball | 12. Pin |
| 4. Screw | 13. Gear |
| 5. Lockwasher | 14. Drive shaft |
| 6. Screw | 15. Gear |
| 7. Lockwasher | 16. Stub gear |
| 8. Screen | 17. Body |
| 9. Cover assembly | |

Figure 3-22. Oil pump, disassembly and reassembly.

3-23. Connecting Rods and Pistons

a. *General.* The connecting rods and caps are drop forged. The pistons are made of aluminum alloy and have three rings fitted on each piston. The top ring is a compression ring. The center ring is the scraper ring and the bottom ring is an oil ring.

b. *Removal.*

- (1) Remove the oil pump (para 3-22).
- (2) Refer to figure 3-23 and remove the cylinder head.

NOTE

Replace rod caps immediately so they are on the correct rod for reassembly. Rods and caps are numbered on one side. These numbers must be on the same side for reassembly. Rod assemblies should be marked or tagged for reassembly into same cylinder.

- (3) Remove the piston and connecting rod as shown in figure 3-24A.

c. *Disassembly.* Refer to figure 3-25 and disassemble piston and connecting rod in numerical sequence.

d. *Inspection.*

- (1) Use an inside micrometer to measure the cylinder bores for wear. If the cylinder bores are worn in excess of 3.2485 inches rebore to fit the next size of available oversize pistons.

- (2) Place ring in cylinder bore in approximate operating position and measure gap with a feeler gage. Refer to table 1-1 for proper piston ring gap. If ring gap is too large, replace piston ring. If ring gap is too small, clamp a file in a vise and position the ring on file with the file in ring gap. Lightly squeeze ring together and move ring back and forth

to file both ends at one time. Measure the gap frequently to keep from cutting off too much stock.

(3) Refer to table 1-1 for repair and replacement standards.

e. Reassembly. Refer to figure 3-25 and reassemble the piston, and connecting rod in reverse order of disassembly.

f. Installation.

NOTE

Stagger piston ring gaps 90 degrees apart around the piston.

(1) Install oil ring and scraper ring with scraper edge down.

(2) Coat cylinder walls, bearings, rings and pistons with OE30 oil.

(3) Place the open end of the ring on piston first. Spread ring only far enough to slip over piston and into groove.

(4) Refer to figure 3-24B and install the piston and connecting rod.

(5) Refer to figure 3-23 and install the cylinder head.

(6) Install the oil pump (para 3-22).

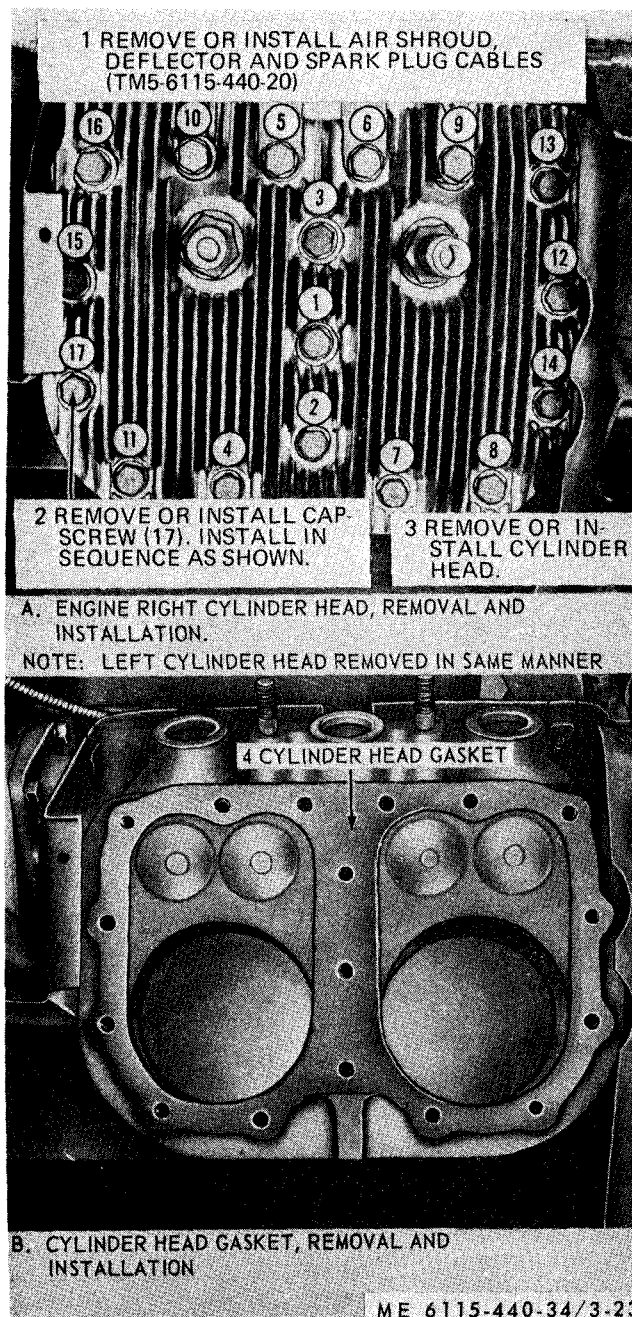


Figure 3-23. Cylinder head, removal and installation.

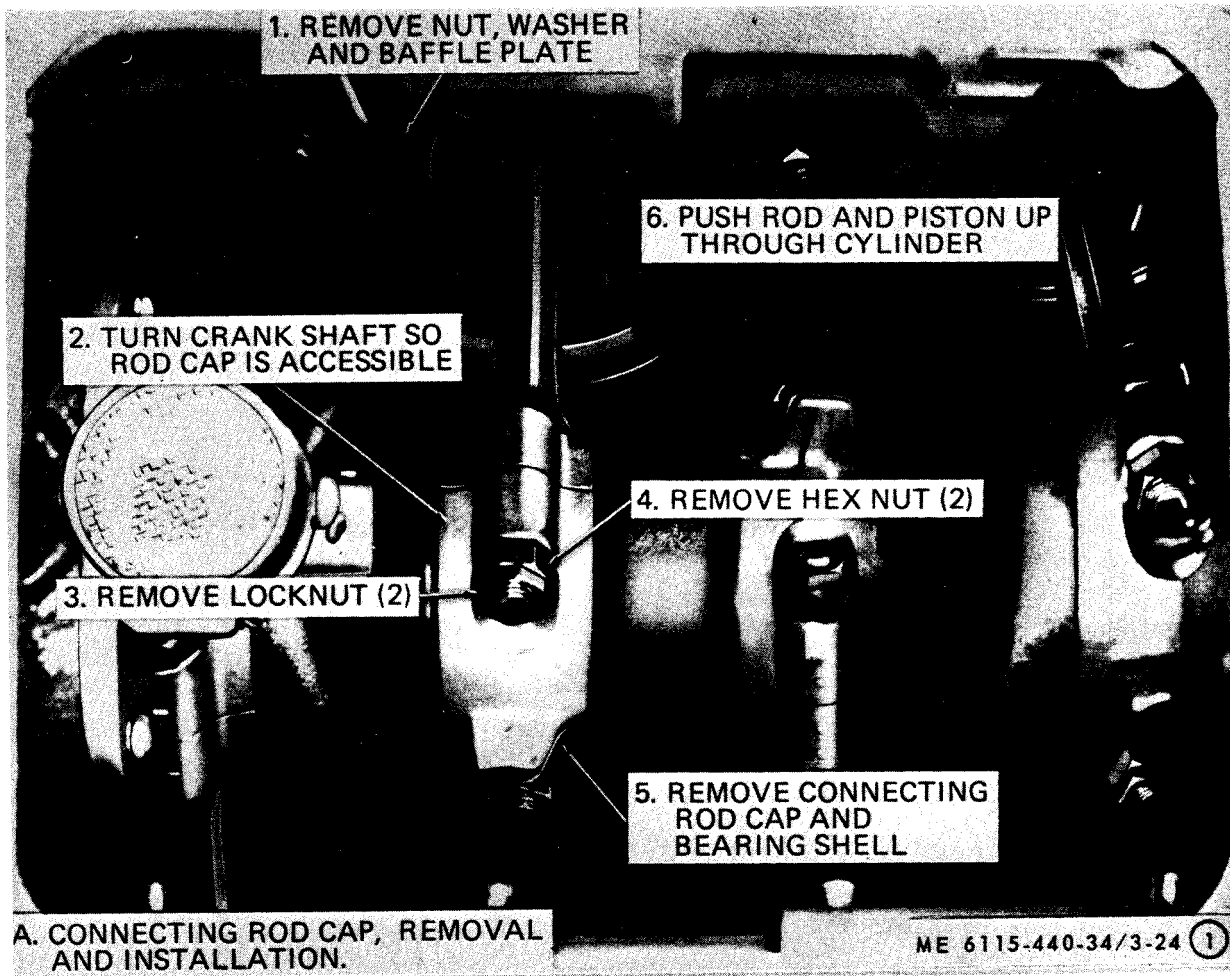


Figure 3-24. Piston and connecting rod, removal and installation (sheet 1 of 2).

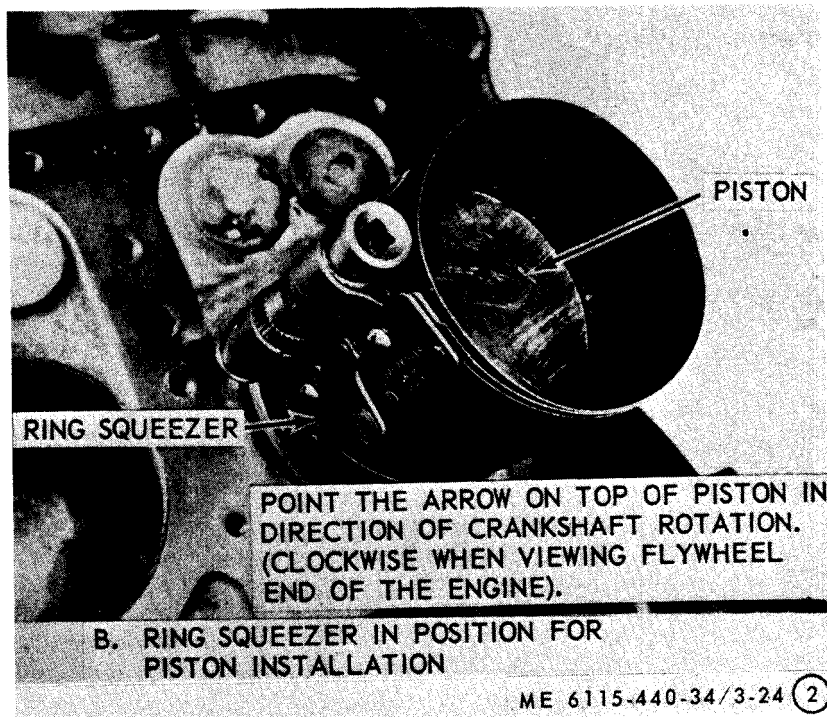
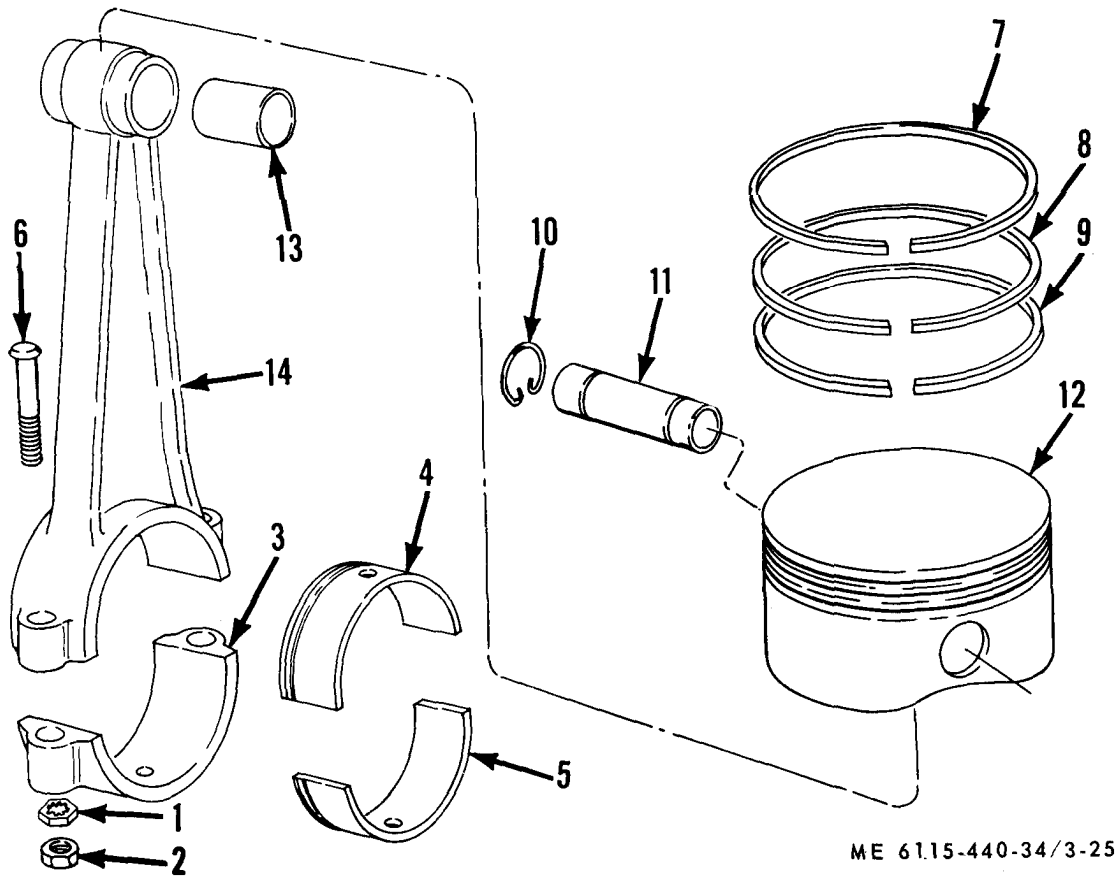


Figure 3-24. Piston and connecting rod, removal and installation (sheet 2 of 2).

INSTALL SCRAPER AND OIL RING
WITH SCRAPER EDGE DOWN.

OIL ALL PARTS AT ASSEMBLY
AND AT INSTALLATION.



ME 6115-440-34/3-25

1. Locknut
2. Nut
3. Connecting rod caps
4. Lower half bearing
5. Upper half bearing
6. Bolt
7. Compression ring

8. Scraper ring
9. Oil ring
10. Retaining ring
11. Piston pin
12. Piston
13. Bushing
14. Connecting rod

Figure 3-25. Piston and Connecting rod, disassembly and reassembly.

3-24. Engine Cylinder Blocks

a. General. The engine cylinder blocks are one piece castings with removable hardened valve seat inserts and guides. The cylinder block assemblies are interchangeable and will fit either the right or left bank of the crankcase.

b. Removal.

- (1) Remove the manifold (TM 5-6115-440-20).
- (2) Remove the cylinder head (fig. 3-23).
- (3) Remove the piston and connecting rods (para 3-23).
- (4) Refer to figure 3-26 and remove the engine cylinder block.

c. Disassembly. Refer to figure 3-27 and disassemble the engine cylinder block.

d. Inspection.

- (1) Inspect the cylinder blocks for cracks, broken fins, and other damage. Check cylinder bore for out-of-round.
- (2) Replace cylinder block if damaged or if cylinder bore is worn 0.005 inch or more.

e. Reassembly. Refer to figure 3-27 and reassemble engine cylinder block.

f. Installation.

- (1) Refer to figure 3-26 and install the engine cylinder block.
- (2) Install the piston and connecting rod (para 3-23).
- (3) Install the cylinder head (fig. 3-23).
- (4) Install the manifold (TM 5-6115-440-20).

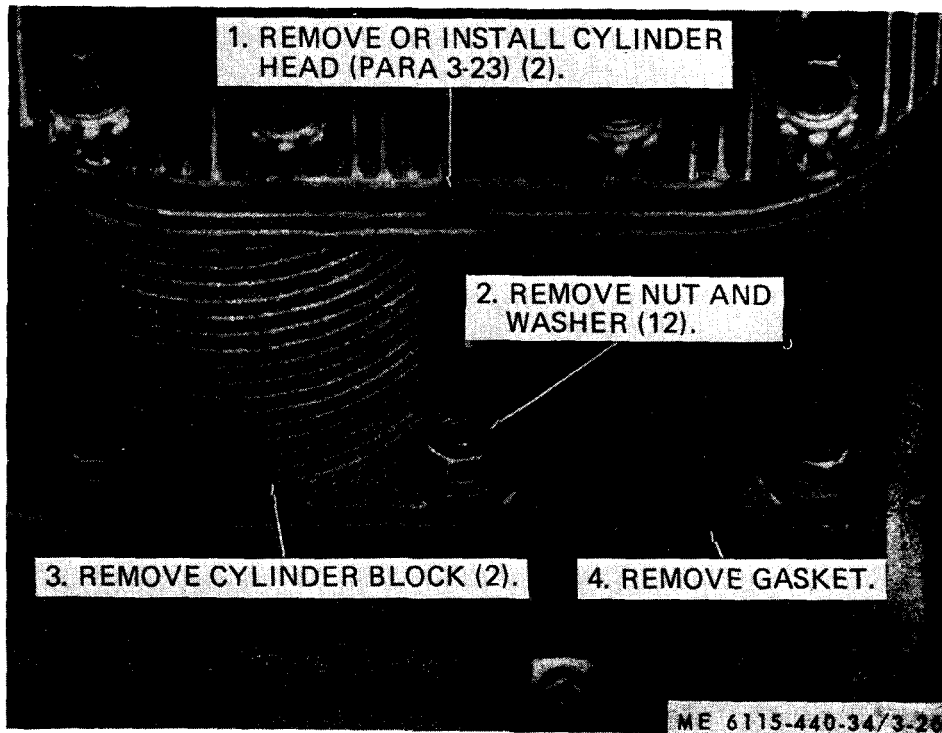


Figure 3-26. Engine cylinder block, removal and installation.

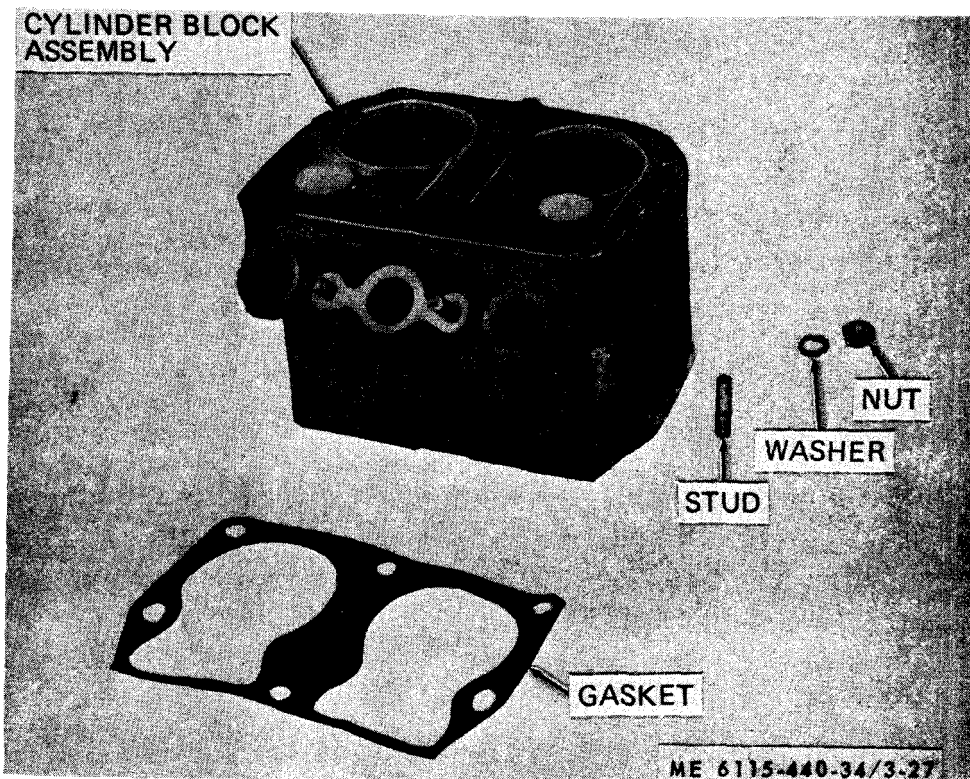


Figure 3-27. Engine cylinder block, disassembly and reassembly.

3-25. Valves, Valve Seats and Valve Guides

a. General. The valves are mounted in the cylinder block and are raised and lowered by the adjustable valve lifters, operating in contact with the camshaft. Screws threaded in the valve lifters

are used to adjust the valve clearance. The stem of each valve rides within a valve guide in the cylinder block. The valves are made of high, heat-resistant steel and seated in alloy-steel replaceable valve seat inserts.

b. Removal.

(1) Remove the cylinder block (para 3-24).

(2) Refer to figure 3-28 and remove the engine valves.

(3) Remove valve guides and seats as shown by step 1 and 2 figure 3-29.

c. Disassembly. Refer to figure 3-30 and disassemble the valves and attaching parts.

d. Cleaning.

(1) Clean the valve guide parts in the cylinder blocks and blow out with compressed air.

(2) Clean the valve seat insert recesses and the top of cylinder block.

e. Inspection and Repair.

(1) Inspect the valves (7, fig. 3-30) and seats for burned, pitted, or cracked faces.

(2) The cylinder blocks have replaceable valve guides. The valve stems should have a clearance of 0.0025 to 0.0045 inch in the guides. Replace valve guides that exceed 0.008 inch clearance.

(3) Grind serviceable valves (7) and seat inserts (10) to an angle of 45 degrees to the vertical center lines. After grinding, lap the valve and valve seat insert with suitable lapping compound, to provide proper fit. Clean the valve and apply lapping compound to the valve face. Insert the valve in their valve guide (11) and lap by rotating the valve back and forth with a reciprocating advancing valve tool. Occasionally lift the valve

reseat in a different position to insure uniform seating. After valves are properly lapped, remove them from cylinder block and wash valves and block thoroughly in an approved cleaning solvent (FED-PD-680). Tag each lapped valve with its mated valve guide for proper assembly.

(4) Inspect the valve springs (9) for damage and test for spring tension as follows:

(a) Test tension of spring with a suitable spring tension tester.

(b) Compress each spring to 1.271 inches and note reading on the tester. If reading is less than 51 pounds, replace spring.

f. Reassembly. Refer to figure 3-30 and reassemble the valves and attaching parts in reverse procedure of removal.

CAUTION

Make certain valve spring seat locks (6) are properly seated before releasing spring tension.

g. Installation.

(1) Install valve guides and seats as shown in steps 3, 4, and 5 figure 3-29.

(2) Refer to figure 3-28 and install the valves in reverse procedure of removal.

(3) Install the cylinder block (para 3-24).

h. Adjustment. Adjust the valve tappets (TM 5-

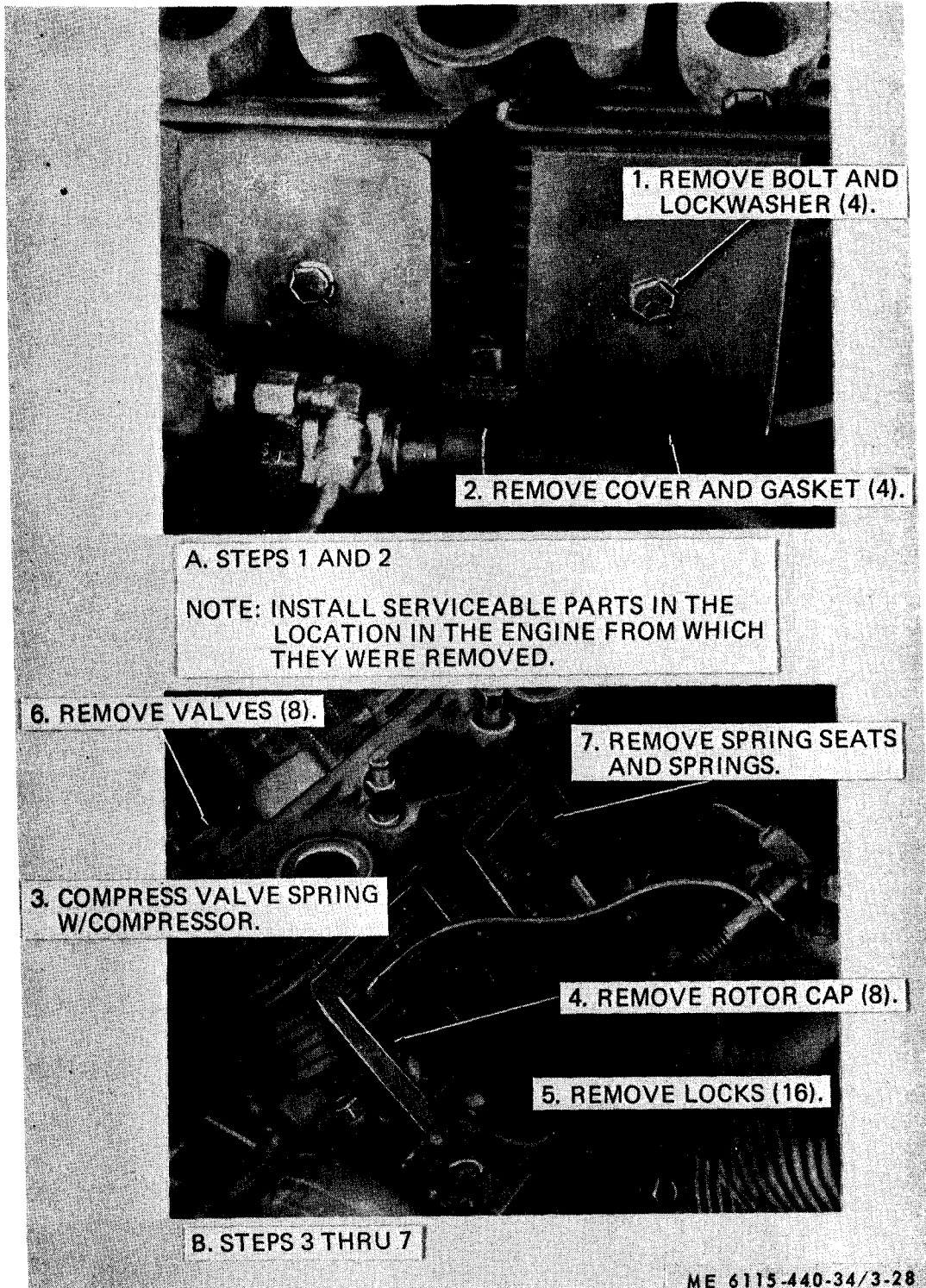


Figure 3-28. Engine valves, removal and installation.

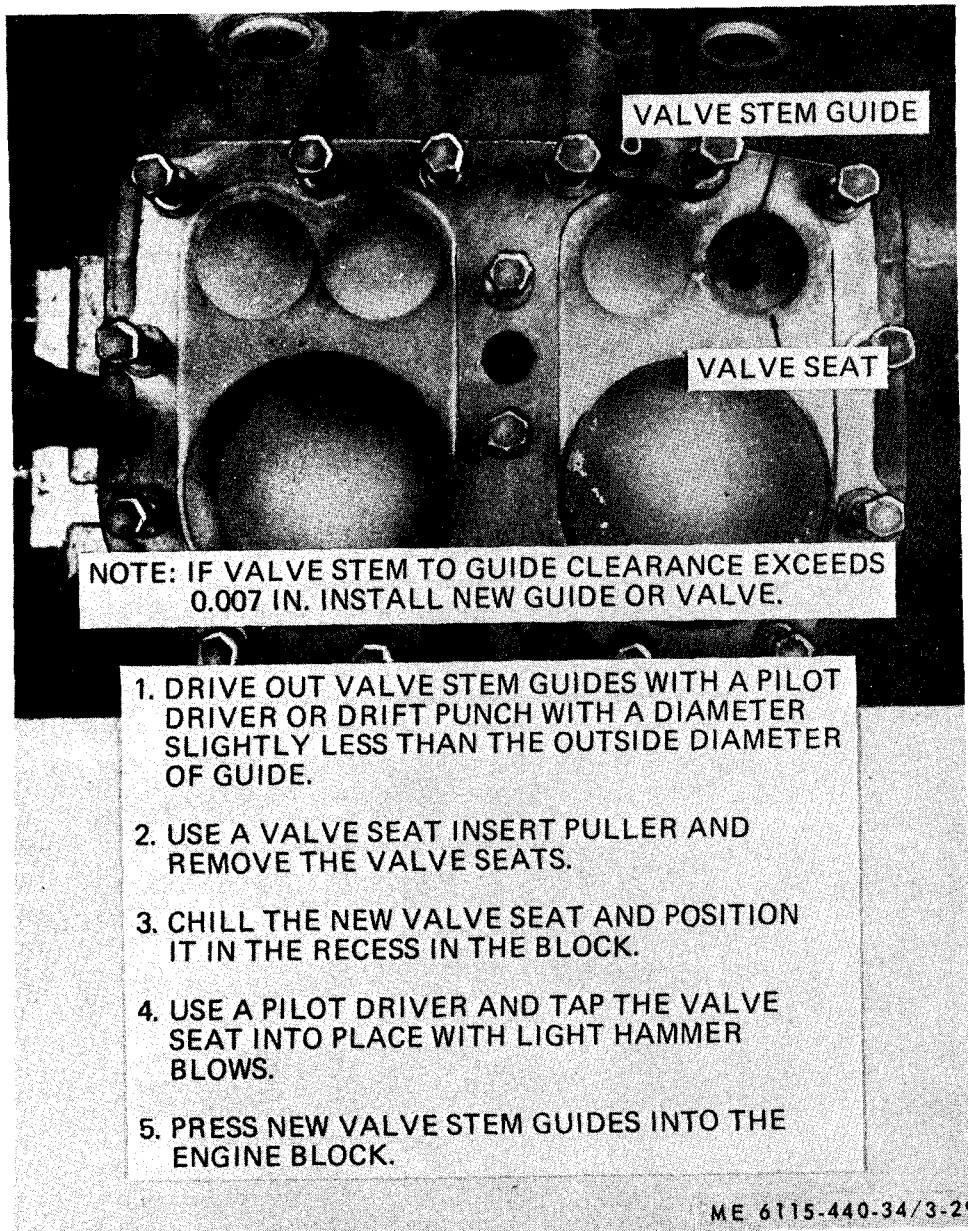
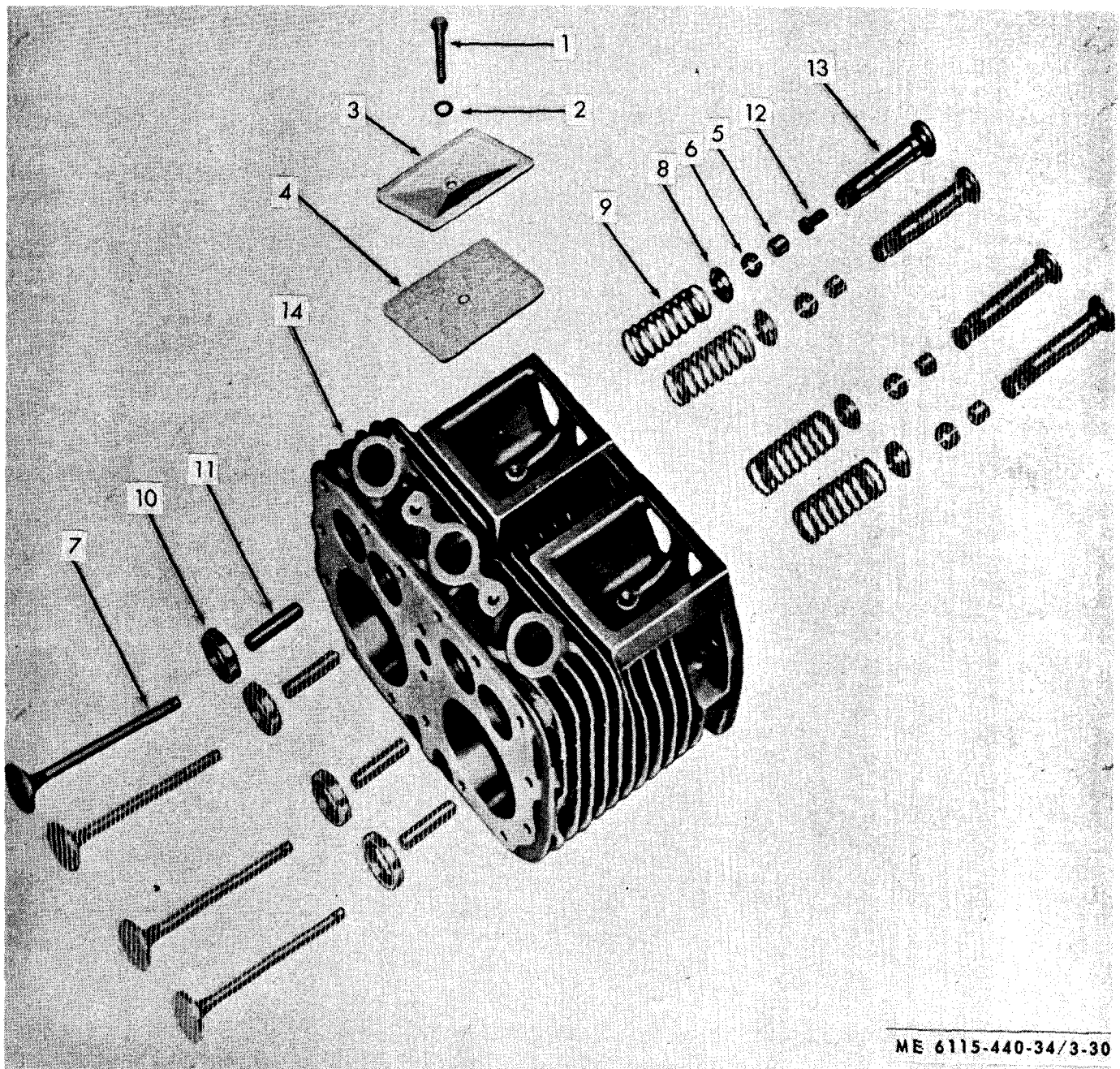


Figure 3-29. Valve seats and guides, removal and installation.



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- | | |
|-----------------------------|------------------------|
| 1. Screw | 8. Seat valve spring |
| 2. Washer | 9. Spring |
| 3. Cover Plate | 10. Insert, valve seat |
| 4. Gasket | 11. Valve guide |
| 5. Rotator Cap | 12. Adjusting Screw |
| 6. Lock | 13. Valve lifter |
| 7. Valve, inlet and exhaust | 14. Cylinder block |

Figure 3-30. Valves and attaching parts. disassembly, reassembly.

3-26. Idler Gear

a. General. The idler gear is located in the gear case on a shaft mounted in the engine crankcase. It is driven by the crankshaft gear and in turn drives the magneto gear and the oil pump gear. The idler gear shaft is secured in the crankcase by a retaining screw (A, fig. 3-31).

b. Removal.

- (1) Remove the gear cover (para 3-20).
- (2) Remove idler gear shaft retaining screw and remove gear and shaft as an assembly from the engine crankcase (fig. 3-31).

c. Disassembly. Refer to figure 3-31B and disassemble the idler gear and shaft.

d. Inspection.

(1) Inspect the idler gear for broken, cracked or chipped teeth.

(2) Inspect the shaft for scoring or pitting.

(3) Replace damaged or excessively worn gear or shaft.

e. Reassembly. Refer to figure 3-31B and reassemble idler gear and shaft.

f. Installation. Refer to figure 3-31 and install the idler gear and shaft assembly and secure shaft with retaining screw. Position idler gear stud and idler gear into crankcase assembly with the oil groove in idler gear stud facing up. Maintain a .003 to .004 inch clearance between idler gear and shoulder of shaft.

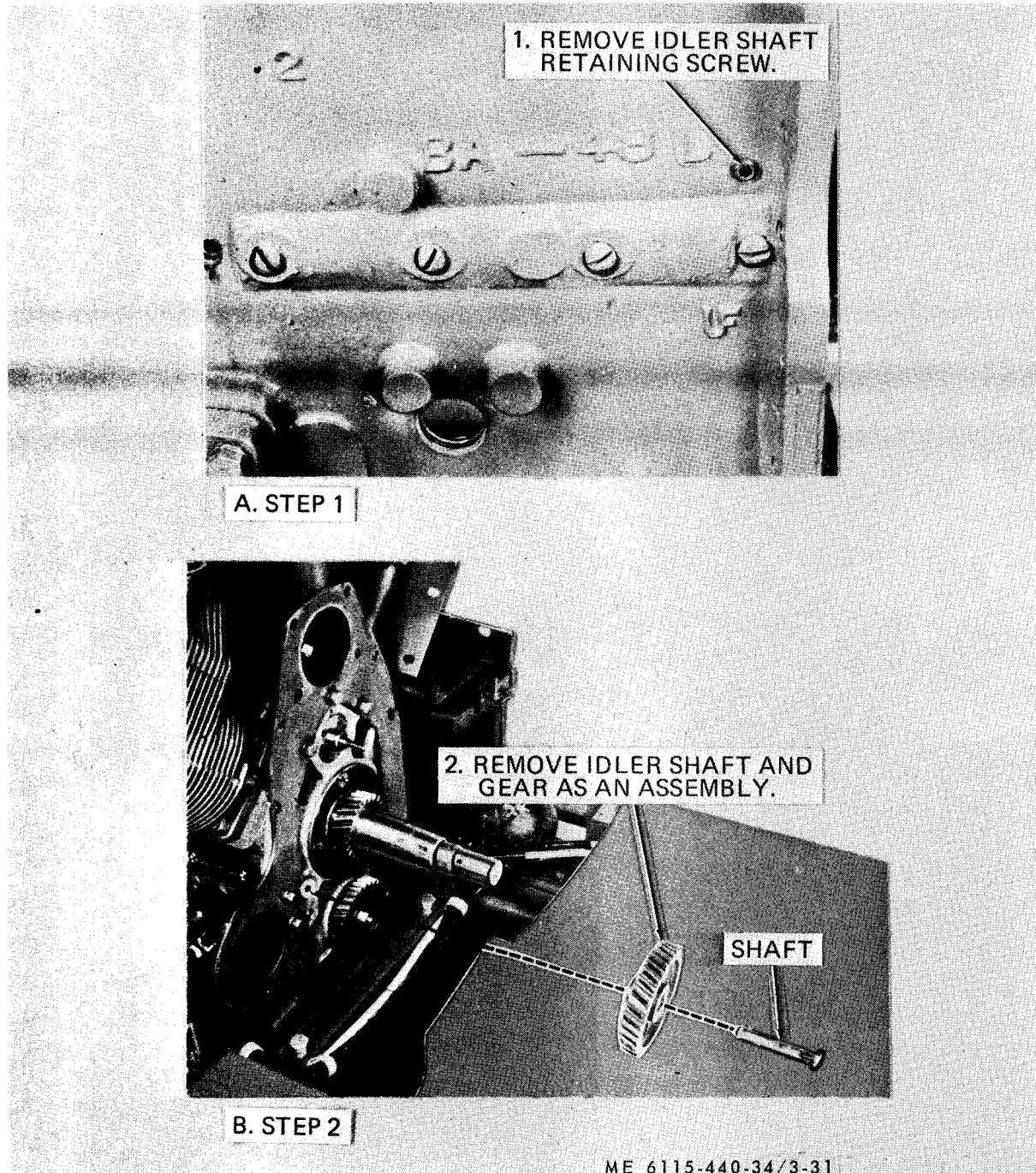


Figure 3-31. Idler gear and shaft, removal, disassembly, reassembly and installation.

3-27. Crankshaft, Crankshaft Gear and Bearing

a. General. The crankshaft is mounted on two roller-type main bearings. Main bearings adjustment is accomplished by adding or removing shims between the main bearings plate and the crankcase. The crankshaft gear is located in the gear case at the flywheel end of the engine.

b. Removal and Disassembly.

(1) Remove the connecting rods and pistons (para 3-23).

(2) Remove idler gear and shaft (para 3-26).

(3) Refer to figure 3-32 and remove and disassemble crankshaft assembly and related parts.

c. Inspection.

(1) Inspect connecting rod journals on the crankshaft for scoring measure rod journals for

wear and out-of-round with a micrometer. The desired dimension of journal is 1.8110 to 1.8115 inches and 1.1925 to 1.1975 inches in width.

(2) Inspect main bearing retaining plates for damage. Replace if defective.

(3) Inspect bearing cones and cups for damage.

(4) Replace a shaft that is worn more than 0.005 inch.

d. Reassembly and Installation.

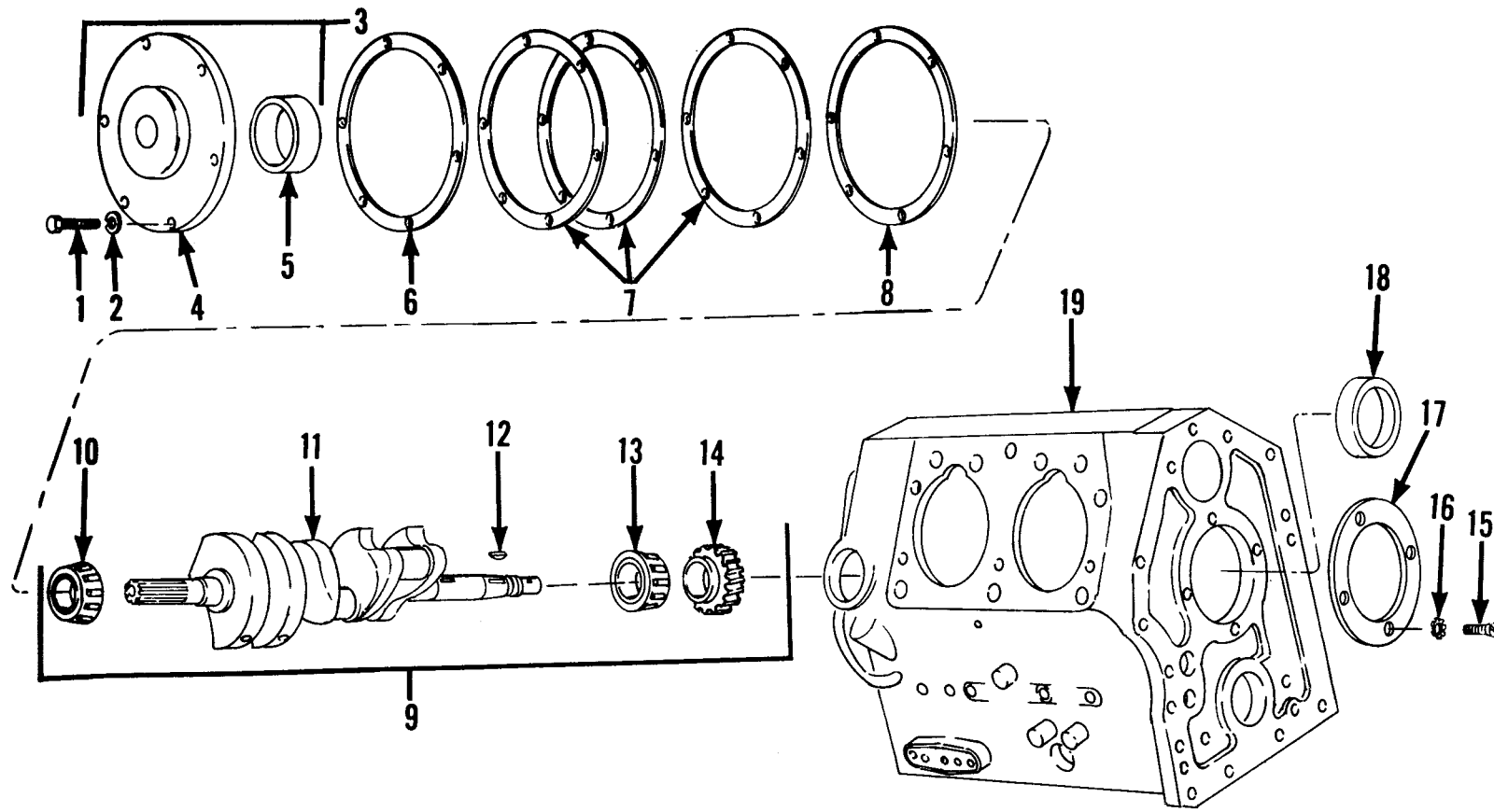
(1) Refer to figure 3-32 and reassemble and install the crankshaft and related parts.

(2) Install the idler gear and shaft (para 3-26).

(3) Install the piston and connecting rods (para 3-23).

Key to figure 3-32:

- | | |
|---------------------------------------|----------------------------|
| 1. Screw | 10. Bearing cone |
| 2. Lockwasher | 11. Crankshaft |
| 3. Main bearing plate and bearing cup | 12. Woodruff key |
| 4. Main bearing plate | 13. Bearing cone |
| 5. Main bearing cup | 14. Helical gear |
| 6. Gasket | 15. Screw |
| 7. Shims | 16. Washer |
| 8. Gasket | 17. Bearing retainer plate |
| 9. Bearing, crankshaft and gear | 18. Bearing cup |
| | 19. Engine crankcase |



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Figure 3-32. Crankshaft, removal, disassembly, reassembly and installation.

3-28. Camshaft and Valve Lifters

a. General. The camshaft is mounted in the center of the crankcase, above the crankshaft. Cams ground on the camshaft operate mushroom-type valve lifters. The mounting holes in the camshaft gear are staggered in such a manner that the gear can be assembled to the shaft only one way which will automatically time the gear to the shaft. The gear is also punch marks for timing to crankshaft, the camshaft must be removed before the valve lifters can be removed.

b. Removal.

- (1) Remove the crankshaft (para 3-27).

- (2) Remove the plunger (1, fig. 3-33), spring (2), screw (3), washer (4), and gear (5) from the camshaft (6).

- (3) With the engine block (8) resting on its opposite end from the flywheel, pull the valve tappets to outward position and with draw the camshaft from the flywheel end of the engine block, then remove the valve lifters (7).

c. Inspection.

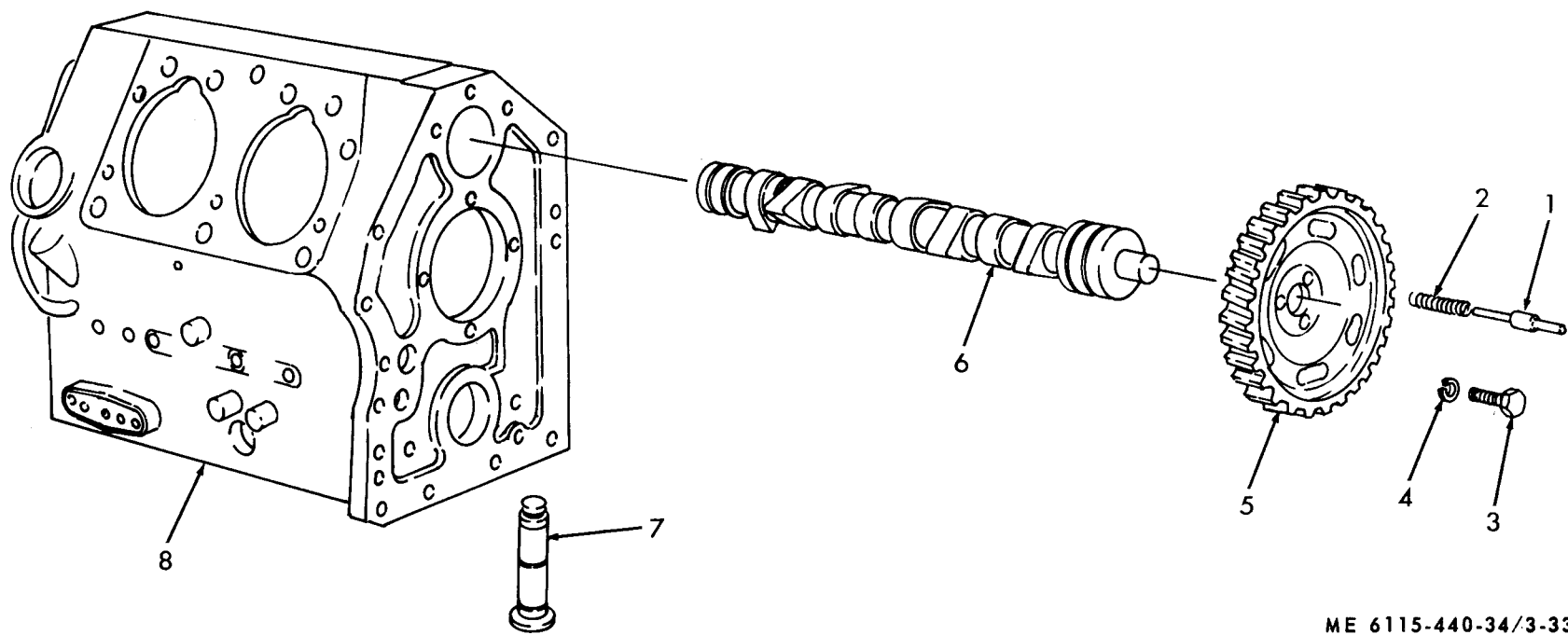
- (1) Inspect for worn or damaged parts

- (2) Replace parts that are worn or damaged.

d. Installation. Refer to figure 3-33 and install the valve lifter and camshaft in the reverse procedure of removal.

Key to figure 3-33:

- | | |
|------------|------------------|
| 1. Plunger | 5. Camshaft Gear |
| 2. Spring | 6. Camshaft |
| 3. Screw | 7. Valve lifter |
| 4. Washer | 8. Engine block |



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Figure 3-33. Camshaft and valve lifter, removal and installation.

3-29. Engine Crankcase and Related Parts

a. *General.* The crankcase is a one piece casting, with machine surfaces for mounting the cylinders, valve lifter, camshaft crankshaft, gears, and accessories. The lubricating oil reservoir is in the lower portion and it contains spray nozzles, which spray oil to the connecting rod bearings and other operating parts of the engine. The engine mounting supports bolt to the crankcase.

b. *Removal and Disassembly.*

- (1) Remove the crankshaft (para 3-27).
- (2) Remove the camshaft (para 3-28).
- (3) Refer to figure 3-34 and remove the splash plates and oil spray nozzles.

(4) Refer to figure 3-35 and remove remaining parts from engine crankcase.

c. *Inspection and Replace.*

(1) Inspect all parts for cracks, stripped threads or other damage.

(2) Replace all damaged parts. Replace gaskets with new ones at installation.

d. *Reassembly and Installation.*

(1) Refer to figure 3-34 and install the splash plates and nozzles.

(2) Refer to figure 3-35 and install remaining parts on the engine crankcase.

(3) Install the camshaft (para 3-28).

(4) Install the crankshaft (para 3-27).

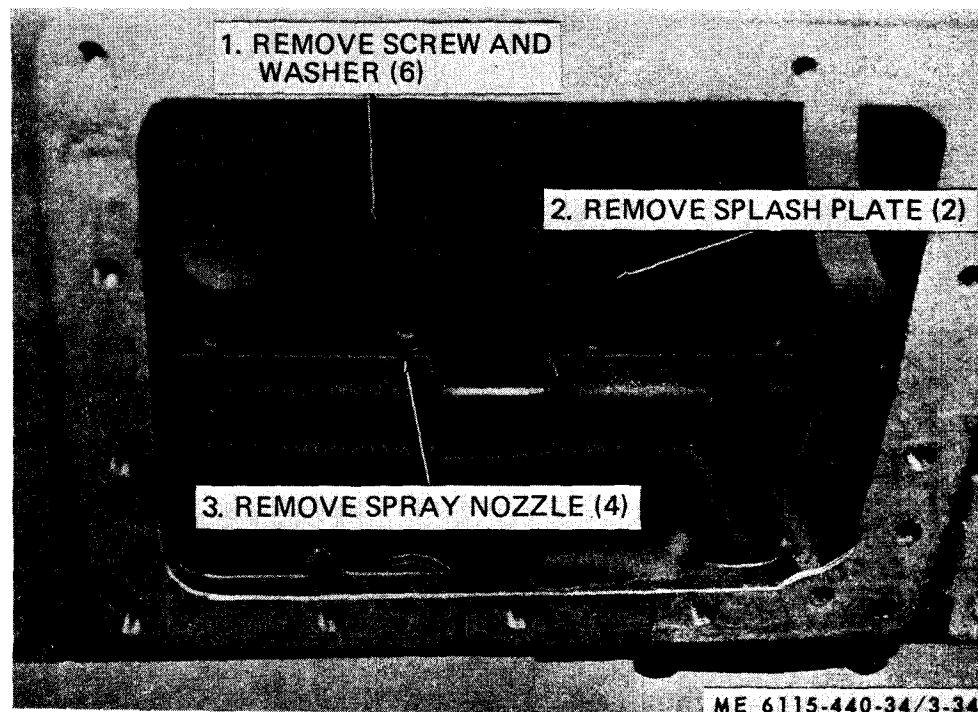
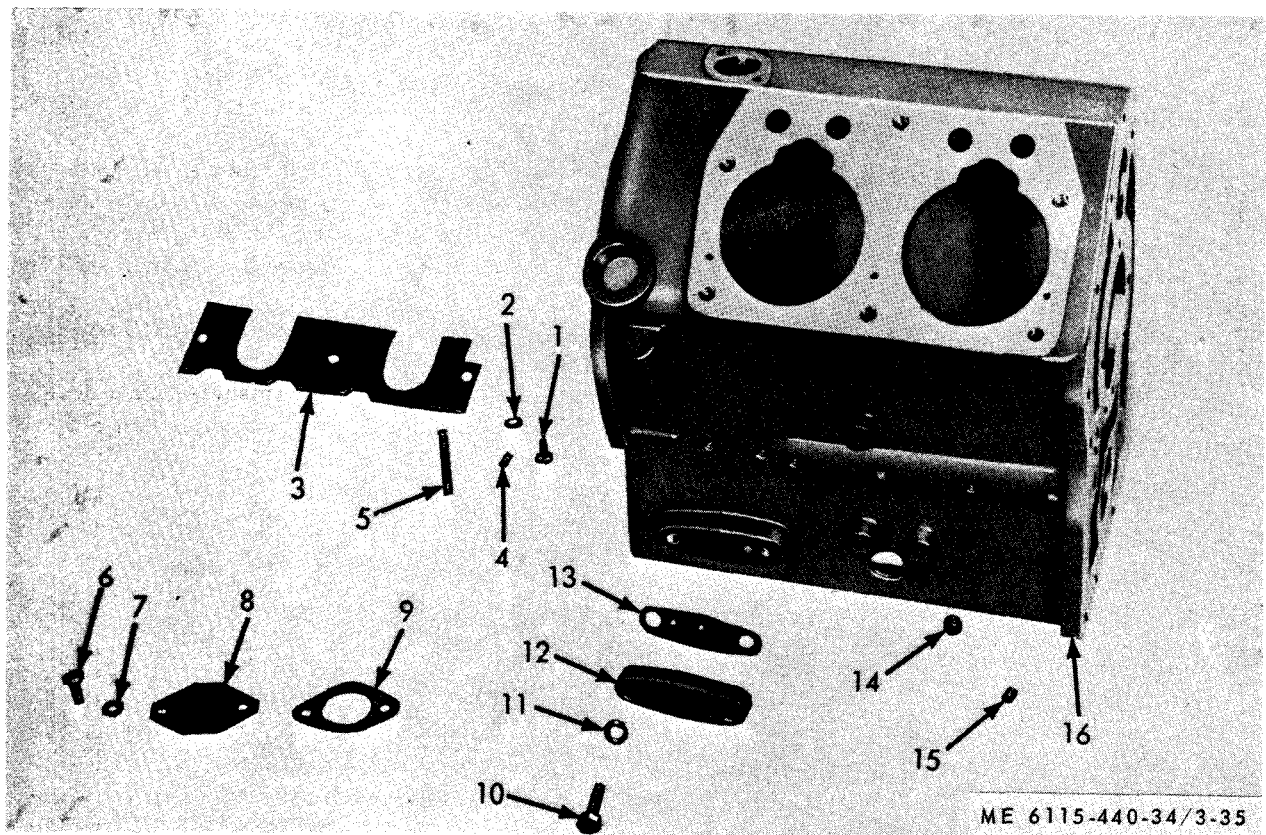


Figure 3-34. Splash plates and oil spray nozzles, removal and installation.



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- | | |
|---------------------------|----------------|
| 1. Screw | 9. Gasket |
| 2. Lockwasher | 10. Screw |
| 3. Splash plate | 11. Lockwasher |
| 4. Spray nozzle | 12. Cover |
| 5. Oil filter outlet pipe | 13. Gasket |
| 6. Screw | 14. Pipe plug |
| 7. Lockwasher | 15. Setscrew |
| 8. Plate | 16. Crankcase |

Figure 3-35. Crankcase, disassembly and reassembly.

APPENDIX A

REFERENCES

A-1. Fire Protection

TB 5-4200-200-10

Hand Portable Fire Extinguisher For Army User.

A-2. Lubrication

C91001L

Fuels, Lubricants, Oil and Waxes

LO 5-6115-440-12

Lubrication Order

A-3. Maintenance

TM 38-750

The Army Maintenance management System

TM 5-6115-440-10

Operators Maintenance Manual Generator Set:
7.5KW, 28V, DC, G. E. D. Air Cooled, 2 wheel
Mtd Pneumatic Tires (John R. Hollingsworth
Model JHGV7.5A) FSN 6115-074-6396

TM 5-6115-440-20

Organizational Maintenance Manual Generator
set: 7.5KW, 28V, DC, G.E.D. Air cooled, 2
Wheel Mtd, Pneumatic Tires (John R. Hollings-
worth Model JHGV7.5A) FSN 6115-074-6396

TM 5-6115-440-24P

Organization Direct Support and General Support
Maintenance Repair Parts and Special Tools
Lists Generator Set: 7.5KW, 28V, DC, G.E.D.
Air cooled, 2 wheel MTD, Pneumatic Tires
(John R. Hollingsworth Model JHGV7.5A) FSN
6115-074-6396

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General, United States Army,
Chief of Staff.

Official:

KENNETH G. WICKHAM,
Major General, United States Army,
The Adjutant General.

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To be distributed in accordance with DA Form 12-25, Section IV (qty rqr block no. 719) Direct and General Support Maintenance requirements for Generator Sets, Engine Driven, 7.5 KW, DC.

TM 5-6115-440-34 GENERATOR SET, 7.5KW, 28V-1971