TM-11-919A.

H5_095A

INSTRUCTION BOOK

FOR

GASOLINE ENGINE GENERATOR SET PU-107A/U

PREPARED FOR
THE SIGNAL CORPS
ON ORDER No. 29E-7955-29
25 FEBRUARY 1955

FORWARD COMMENTS ON THIS PUBLICATION DIRECTLY TO:

Commanding Officer
The Signal Corps Publications Agency
Fort Monmouth, New Jersey
ATTN: Standards Division

WARNING

Dangerous voltages are generated by this equipment. Do not attempt to change output connections or the setting of the Wye-Delta change board while the equipment is in operation.

Provide proper and adequate ventilation if the equipment is operated in a confined space. Exhaust gases, produced by a gasoline engine, are poisonous. Excessive inhalation may cause serious sickness or death.

INSTRUCTION BOOK

FOR

GASOLINE ENGINE GENERATOR SET PU-107A/U

PREPARED FOR
THE SIGNAL CORPS
ON ORDER No. 29E-7955-29
25 FEBRUARY 1955

CONTENTS

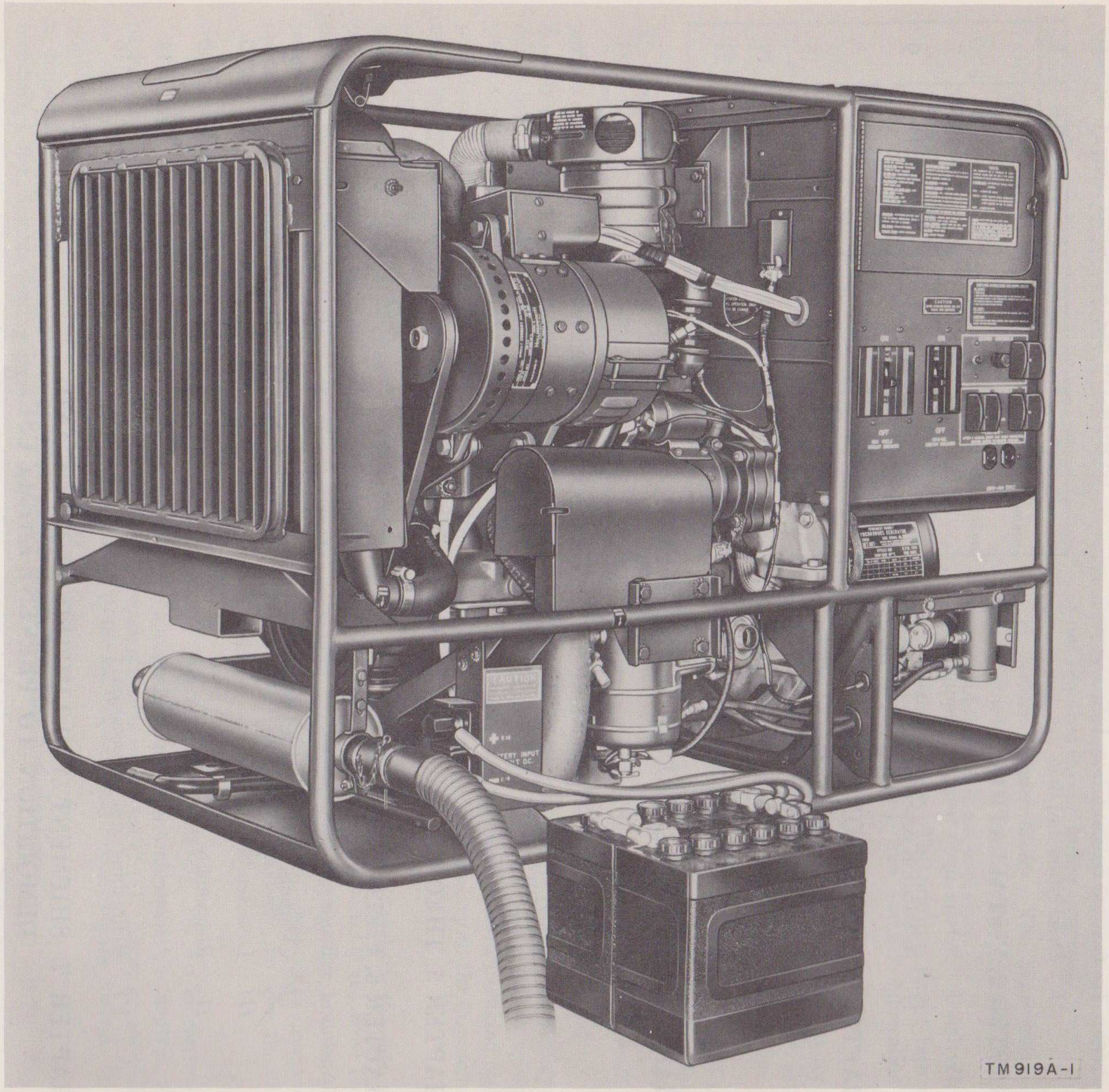


Figure 1. Gasoline Engine Generator Set PU-107A/U.

Note. This instruction book will be replaced by TM11-919A which when published, will be listed Department of the Army Pamphlet No. 310-4.

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

These instructions are published for the information of all concerned. They include complete information for operating, servicing, maintaining, and overhauling Gasoline Engine Generator Set PU-107A/U. Also included are a detailed description of all major parts and a discussion of the theory of operation.

2. Forms and Records

a. The following forms will be used for reporting unsatisfactory conditions of Army materiel and equipment and in performing preventive maintenance.

(1) DD Form 6, Report of Damaged or Improper Shipment, will be filled out and forwarded as prescribed in SR 745-45-5 (Army); Navy Shipping Guide, Article 1850-4 (Navy); and AFR 71-4 (Air Force).

(2) DA Form 468, Unsatisfactory Equipment Report, will be filled out and forwarded to the Office of the Chief Signal Officer, as prescribed in SR 700-45-5.

(3) DD Form 535 Unsatisfactory Report, will be filled out and forwarded to Commanding General, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio, as prescribed in SR 700-45-5 and AF TO 00-35D-54.

(4) DA Form 11-260, Operator First Echelon Maintenance Check List for Signal Corps Equipment (Power Units, Reel Units (Engine-Driven)), will be used in accordance with instructions appearing on the form.

(5) DA Form 11-261, Second and Third Echelon Maintenance Check List for Signal Corps Equipment (Power Units, Reel Units (Engine-Driven)), will be used in accordance with instructions appearing on the form.

(6) WD Form 460 (Preventive Maintenance Roster) will be used in accordance with current practices.

b. Use other forms and records as authorized.

3. Purpose and Use

a. Gasoline Engine Generator Set PU-107A/U is intended as a source of power for Electronic Search Central AN/GSS-1. It also may be used as a source of power for transportable or mobile radar and similar Signal Corps equipment.

b. The 28-volt direct-current (dc) generator can be used to charge groups of wet cell storage batteries in either series or parallel circuits. Using a 20-ampere charging rate with a series circuit, it is possible to charge four 6-volt batteries, or one 24-volt battery. Using a 20-ampere charging rate with a parallel circuit, it is possible to charge five groups of four 6-volt batteries, five groups of two 12-volt batteries, or five 24-volt batteries.

Section II. DESCRIPTION AND DATA

Note. All left and right designations are assumed as viewed from the rear, or generator end, facing the set.

4. Description

Gasoline Engine Generator Set PU-107A/U is a portable electric generating set that consists of the

following major assemblies: a single bearing, permanent magnet, 400-cycle alternator; a 28-volt dc generator; a four-cylinder, four-stroke cycle, liquid cooled, gasoline engine; a winterization system to aid starting in low temperatures; and necessary controls and instruments for the operation and regulation of the equipment. The 400-cycle alternator is directly coupled to the engine flywheel and the 28-volt dc generator is belt driven from the engine crankshaft. All necessary controls and instruments are mounted on panels on the left-hand side at the generator end of the unit. Power output and remote control connections are provided on the right-hand side of the unit. The entire equipment is mounted within a tubular steel frame and a canvas cover is provided to protect the equipment when it is not in operation.

5. Major Systems and Assemblies

a. Engine. The generator is driven by a conventional, L-head, four-stroke cycle, four-cylinder, liquid cooled, gasoline engine. Ignition is provided by a high-tension magneto (11, fig. 3) and self shielded spark plugs (3, fig. 3). A 15-quart, tubular-cell radiator (27, fig. 2), belt driven fan and water pump comprise the major elements of the cooling system. The engine is lubricated by a gear-type oil pump that delivers oil under pressure to the main bearings and connecting rod bearings. The fuel system consists of an up-draft carburetor (14, fig. 3), a diaphragm-type fuel pump (16, fig. 3), and a remote fuel line and fuel drum adapter. There is no fuel tank on the unit. The engine may be started by means of a hand crank or by a 24-volt electric starting system. Two 12-volt storage batteries, connected in series, are provided to supply power for the electric starting motor. A belt-driven, 24-volt dc generator (5, fig. 3) maintains the batteries in a charged condition.

b. Winterization system. A winterization system is provided to aid in starting the engine in low temperatures. The winterization unit consists of a fuel pump (15, fig. 2), fuel control valve (16, fig. 2), blower (17, fig. 2), heat exchanger pan (18, fig. 2), and shield (21, fig. 2). A switch, circuit breaker, and indicator lamp for control of the winterization system are mounted on the unit control panel.

c. Alternator. (9, fig. 4). The alternator is of the permanent magnet-type with 28 poles. It is directly coupled to the engine and, when operated at 1,714 revolutions per minute (rpm), develops 12.5 kilowatts (kw), 120 or 208 volt, three-phase, four-wire output at .8 power factor. A compensator assembly, consisting of a transformer (1, fig. 4) and a capacitor assembly (4, fig. 4), is provided to maintain voltage stability.

d. Dc power generator. A separate, 28-volt dc generator (1, fig. 2) is mounted to one side of the engine and driven by a V-belt from the engine crankshaft. This generator, when operated at 4,500 rpm, will deliver 2.5 kw, 28 volts dc.

e. Radio-frequency Suppression Equipment. Radio frequencies produced by the operation of the set are suppressed by shielding, ground straps, grounded capacitors, resistor-suppressors, and bonds formed by external-internal-toothed lock washers. A complete description of suppression equipment is contained in paragraph 67.

f. Frame. The frame structure (12, fig. 3) supports the entire generator set assembly and is comprised of two parts. The lower frame acts as a skid and also shock-mounts the engine and alternator. The upper frame mounts the instrument and control panels, the wye-delta change board, and terminal panel.

6. Performance Characteristics

a. Output combinations. The generator set is rated at the following output combinations:

(1) Ten kilowatts (kw) at .8 power factor, 120 volts alternating-current (ac), single-phase, 400 cycles, 2.5 kw at 28 volts dc.

(2) Ten kw at .8 power factor, 120/208 volts ac, three-phase, four-wire, 400 cycles, 2.5 kw at 28 volts dc.

(3) Twelve and one-half kw at .8 power factor, 120/208 volts ac, three-phase, four-wire, 400 cycles.

b. Alternating Current.

(1) *Single-phase, 120-volt, .8 power factor.*

Approx. load	Amperes	Volts	Kilowatts	Cycles
0	0	124	0	400-415
¼	25.5	122-124	2.5	400-415
½	52.0	120-122	5.0	400-415
¾	78.0	120-122	7.5	400-415
Full	104.0	118-120	10.0	400-415

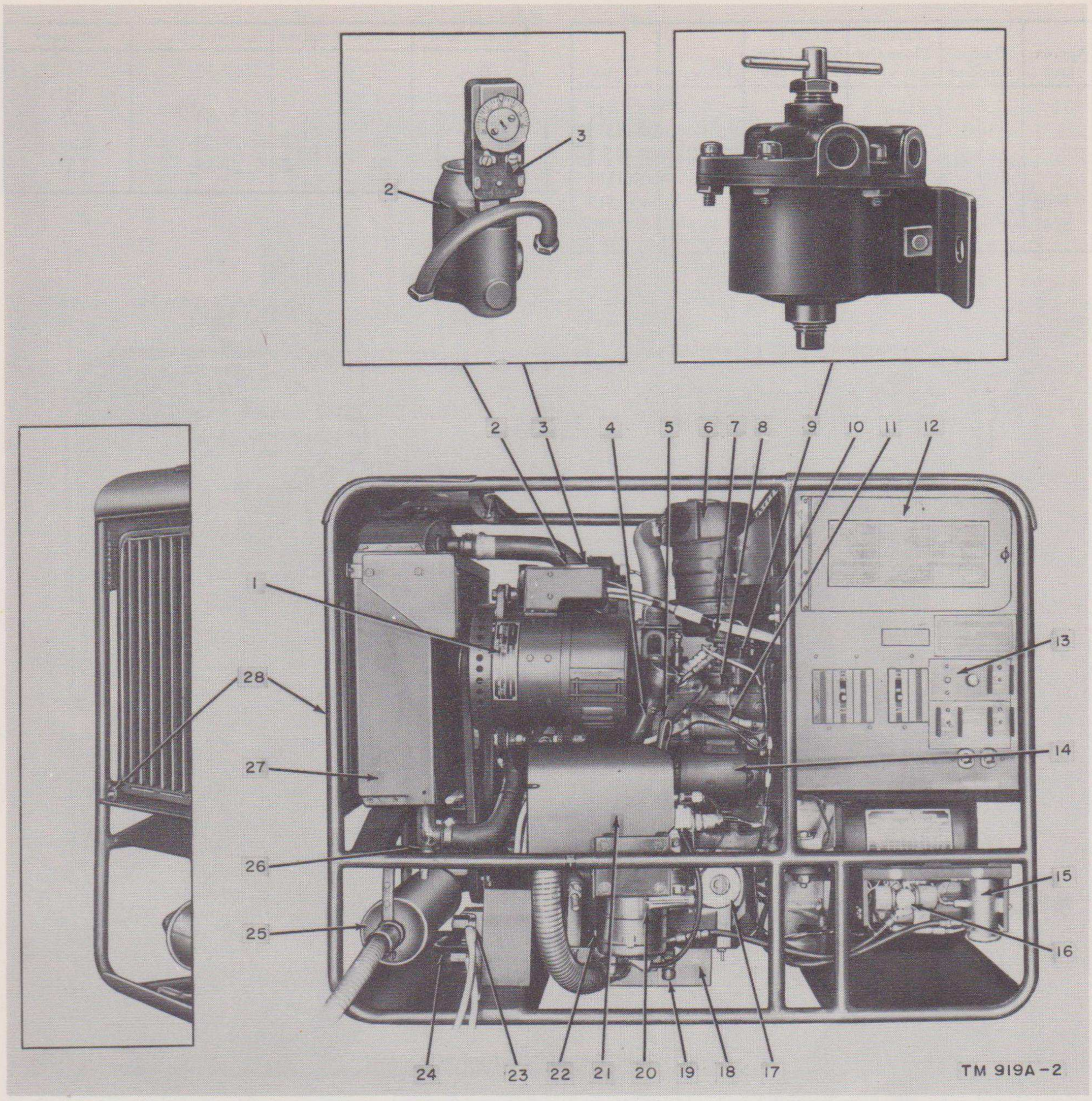


Figure 2. Gasoline Engine Generator Set PU-107A/U, left side.

1. 28-v, 2.5-kw generator (G3).
2. Coolant outlet neck (A 1).
3. Coolant temperature cutoff switch (S3)
4. Oil filler tube (MP3).
5. Bayonet gage (M21).
6. Air cleaner.
7. Low-oil-pressure cutoff switch (S2).
8. Oil-pressure transmitter (E8).
9. Oil filter (FL1).
10. Ten-conductor socket (P1 and J2).
11. Starting motor solenoid (L2).
12. Instrument panel door (A 136).
13. Control panel (MP530).
14. Starting motor (B1).
15. Heater fuel pump (L5).
16. Heater fuel control valve (L4).
17. Heater blower (B2).
18. Heater heat exchanger pan (HR1).
19. Crankcase drain (H535).
20. Heater (HR2).
21. Heater shield (MP550).
22. Crankcase.
23. Battery input terminals (H1953 and H1954).
24. Hand crank (MP557).
25. Muffler (MP201).
26. Radiator drain (MP207).
27. Radiator (A 41).
28. Manual choke (MP534).

(2) *Three-phase, 208-volt, .8 power factor.*

Approx. load	Output Amperes	Phase-to-Phase Output Volts	Phase-to-Neutral Output Volts	Kilowatts	Cycles
0	0	215-218	124	0	400-415
¼	10.0	213-215	123	3.0	400-415
½	21.5	210-212	121	6.25	400-415
¾	32.5	210-212	121	9.5	400-415
Full	43.5	208-211	120	12.5	400-415
5/4	54.0	206-208	119	15.5	400-415

c. Direct current.

Approx. load	Output Amperes	Output Volts	Kilowatts
0	0	27-30	0
¼	22	27-30	.625
½	45	27-30	1.25
¾	71	27-30	2.0
Full	90	27-30	2.5

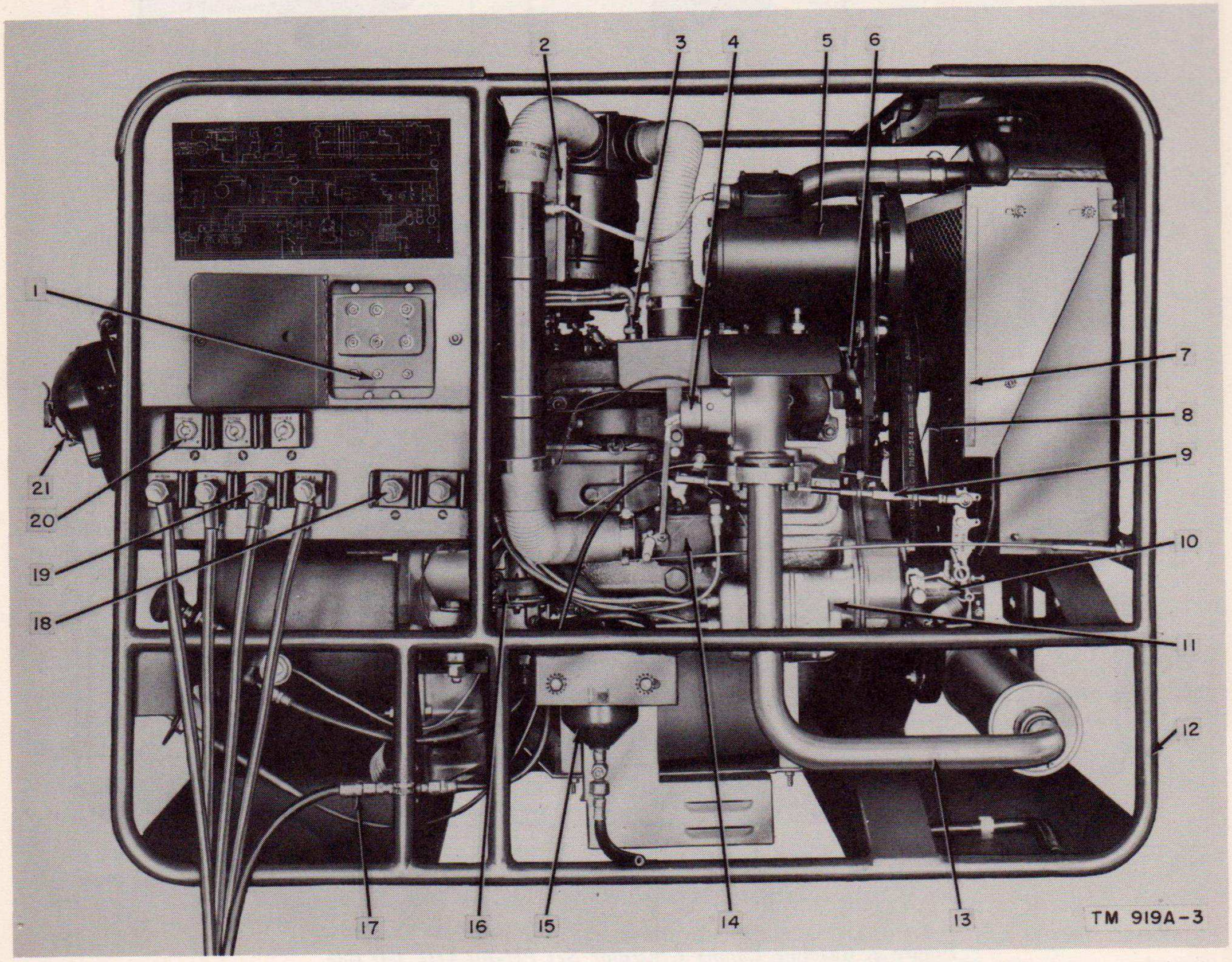


Figure 3. Gasoline Engine Generator Set, PU-107A/U, right view.

1. Wye-delta change board.
2. Suppression box (VR5).
3. Spark plugs (E195 and E198).
4. Electric choke (L3).
5. 24-volt battery-charging generator (G3).
6. Water pump.
7. Fan guards (A 44 and A 45).
8. Fan (B26).
9. Carburetor-to-governor linkage.
10. Governor (MP535).
11. Magneto (E13).
12. Frames (A 178 and A 179).
13. Exhaust system.
14. Carburetor (MP292).
15. Fuel filter (FL12).
16. Fuel pump (MP272).
17. Auxiliary fuel line adapter (MP558).
18. Dc voltage output terminals (E18 and E19).
19. Ac voltage output terminal.
20. Remote control terminal.
21. Fire extinguisher (MP556).

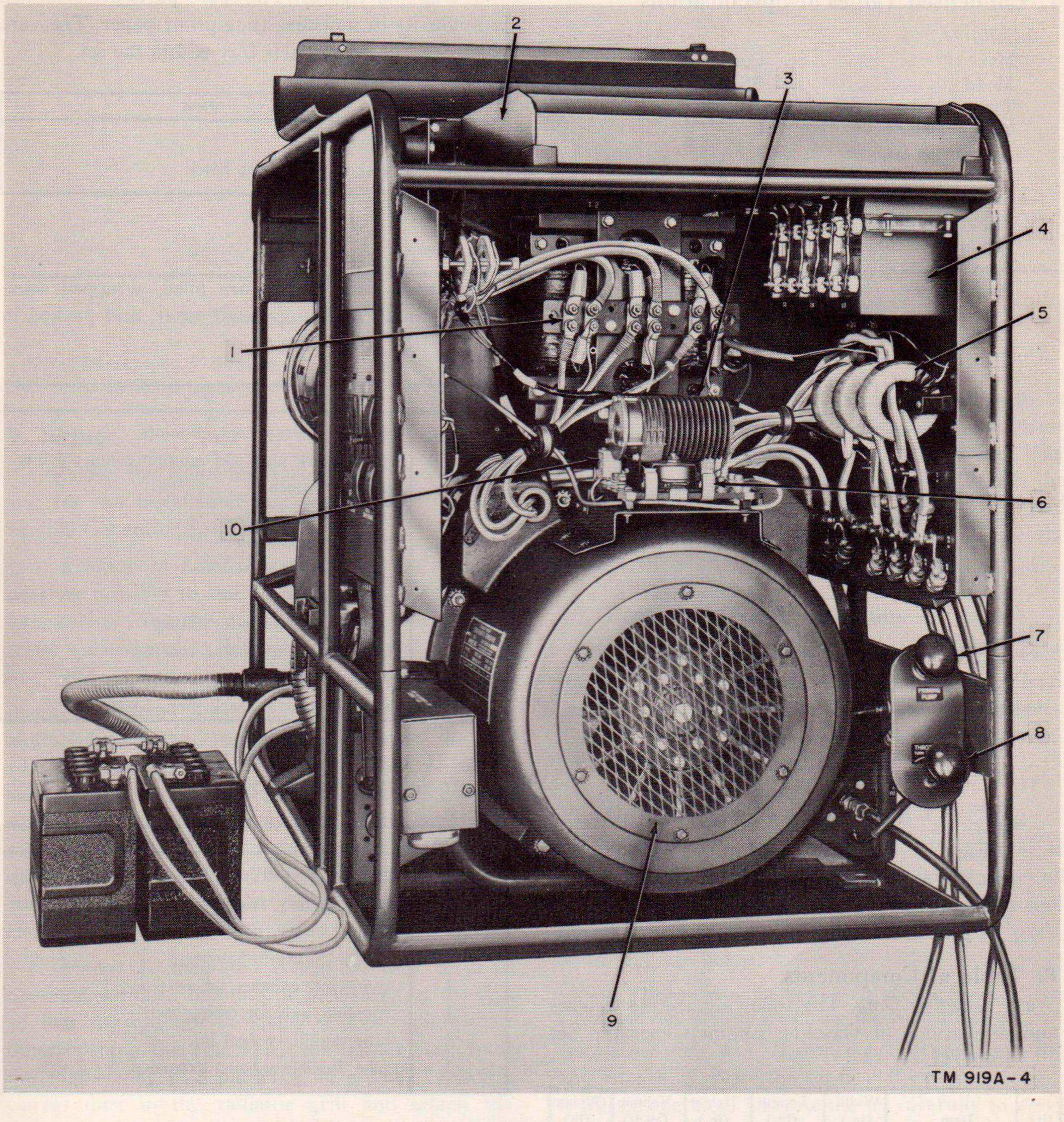


Figure 4. Gasoline Engine Generator Set PU-107A/U, rear view.

1. Compensator transformer (T2).
2. Tool tray (MP546)
3. Dc voltage regulator (E14)
4. Compensator capacitor assembly (C26)
5. Ammeter current transformers (T4 and T6).
6. Stop relay (K3).
7. Primer pump (MP431).
8. Manual throttle (MP531).
9. Alternator (G2).
10. Start relay (K1).

7. Condensed Tables of Specifications

a. Engine.

Make ..... Continental.
Model ..... FS-162-6011.
Type ..... 4-stroke cycle.
Type cylinder head ..... L.
Number of cylinders ..... 4.
Bore ..... $3\text{-}^{7}/_{16}$.
Stroke ..... $4\text{-}^{3}/_{8}$.
Piston displacement ..... 162 cu in.
Compression ratio ..... 6.3 to 1.
Speed ..... 1,714 rpm.
Horsepower ..... 41.
Type cooling ..... Liquid.
Cooling system capacity .... 15 qt.
Type lubrication ..... Pressure and splash system
Lube oil capacity ..... 4½ qt.
Fuel consumption (gal per hr). ..... 2.5.
Air cleaner ..... Oil bath.
Spark plugs ..... XE-8 Coml (Champion).
Ignition system ..... Magneto.
Batteries (2) ..... 12-v each.

b. Alternator.

Make ..... Hollingsworth.
Model ..... APG-H-11636.
Voltage ..... 120/208.
Phase ..... Single or three.
Cycle ..... 400.
Power factor 0.8
Speed ..... 1,714 rpm.
Drive ..... Direct.

c. Dc Generator.

Make ..... Hollingsworth.
Model ..... DG.
Voltage ..... 28.
Ampere rating ..... 90.
Speed ..... 4,500 rpm.
Drive ..... Pulley and belt.

8. Table of Components

a. Packaging Data. The following are the weights and dimensions of Gasoline Engine Generator Set PU-107A/U.

Quantity	Item	Width (in.)	Length (in.)	Height (in.)	Volume (cu ft)	Weight (lb)
1	Gasoline Engine Generator Set PU-107A/U	28	48	37	28.8	1,150
	1 Engine	22	24	22	7.77	335
	1 Alternator	18.5	11.06	18.88	1.79	245
	2 Battery (crated)	9	14	12	0.087	35

b. Running Spares. The spare parts are wrapped individually in moisture-fungiproof paper. They are packed in the spare parts tray within the set.

Quantity	Item
4	spark plugs
4	gaskets, fuel pump bowl

c. Tools.

The tools listed below are oiled, wrapped separately in moisture-fungiproof paper, and packed in the tool tray within the set.

Quantity	Item
1	dresser, ignition contact points
1	gage, spark plug and ignition contact points
1	handle, wrench
1	oiler, hand
1	pliers, combination
2	sandpaper, flint
1	screw driver
1	screw, eye, alternator lifting
1	bolt, puller, alternator bearing
1	wrench, adjustable
1	wrench, socket, spark plug, 13/16 in.

d. Installation Equipment.

Quantity	Item
1	adapter, fuel drum
1	cable, battery, negative
1	cable, battery, positive
1	cable, battery-to-battery
1	connector, exhaust tubing pipe
1	coupling, exhaust tubing lock
1	hose, auxiliary fuel line
1	tube, flexible exhaust extension

e. Miscellaneous Equipment.

Quantity	Item
2	battery, 12-volt storage (separately packaged)
1	cover, canvas
1	crank, hand
1	fire extinguisher

CHAPTER 2

INSTALLATION

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

Note. Paragraphs 9 through 17 cover service for new, old, or reconditioned equipment.

9. Siting

Consider the following factors when selecting a site for the installation and operation of Gasoline Engine Generator Set PU-107A/U.

a. Relation to Load. Locate the generator set as near as possible to the electrical load. Excessively long cables from the unit to the load increase line resistance and cause a definite voltage drop.

b. Outdoor Installation. When the unit is to be operated outdoors, select a site that is reasonably dry and solid enough to support the weight of the unit (1,250 pounds). No special foundation is necessary; however, the unit should be operated in as near a level position as possible. If the terrain is soft or muddy, make a foundation out of planks or other similar material. If possible, provide some form of shelter to protect the equipment from the elements.

c. Indoor Installation. When the unit is to be operated within a building or inclosure, set the unit so that the radiator is facing a door, window, or other opening through which the hot-air blast from the engine may pass outdoors. If possible, attach a canvas duct to the radiator grill and attach the other end of the duct to the building opening. Connect the flexible exhaust tubing to the muffler outlet and extend the free end of the exhaust tubing to the outside of the building or shelter. Be sure that all exhaust connections are gastight. *Carbon monoxide fumes from a gasoline engine are extremely dangerous and, when inhaled, may cause serious illness or death.* Provide not less than 2 feet of space on all sides of the unit to facilitate working on and operating the equipment.

d. Location of Fuel Supply. If the unit is to be operated indoors, locate the fuel supply tank outside the inclosure within easy range of the 20-foot long fuel line furnished with the equipment. Locate the fuel supply drum so that the bottom of the fuel drum adapter is not more than 6 feet below the level of the engine fuel pump.

10. Preparation of Foundation

No special foundation is necessary; however, the generator set should be placed on a firm, level surface capable of supporting at least 1,250 pounds. The base of the packing crate will serve as a temporary foundation in mud or snow.

11. Uncrating, Unpacking, and Checking

Gasoline Engine Generator Set PU-107A/U is shipped in three packages. The set, including all spare parts, tools, and installation equipment, is contained in one large crate. The two batteries are packed in separate boxes.

Note. The bottom of the large crate is constructed to form a skid and can be used for sliding the set short distances.

a. Uncrating and Unpacking. Before uncrating and unpacking, place the set near the location where it will be operated. Uncrate the set carefully to avoid damage. Use a nail puller and other appropriate tools. Be sure to remove all packages and parts within the crate or they may be accidentally discarded with the packing material. The set is inclosed in waterproof paper and a vaporproof barrier only when prepared for overseas shipment. When prepared for domestic shipment, the vaporproof barrier is not used. Refer to figure 5 and uncrate and unpack the equipment as follows:

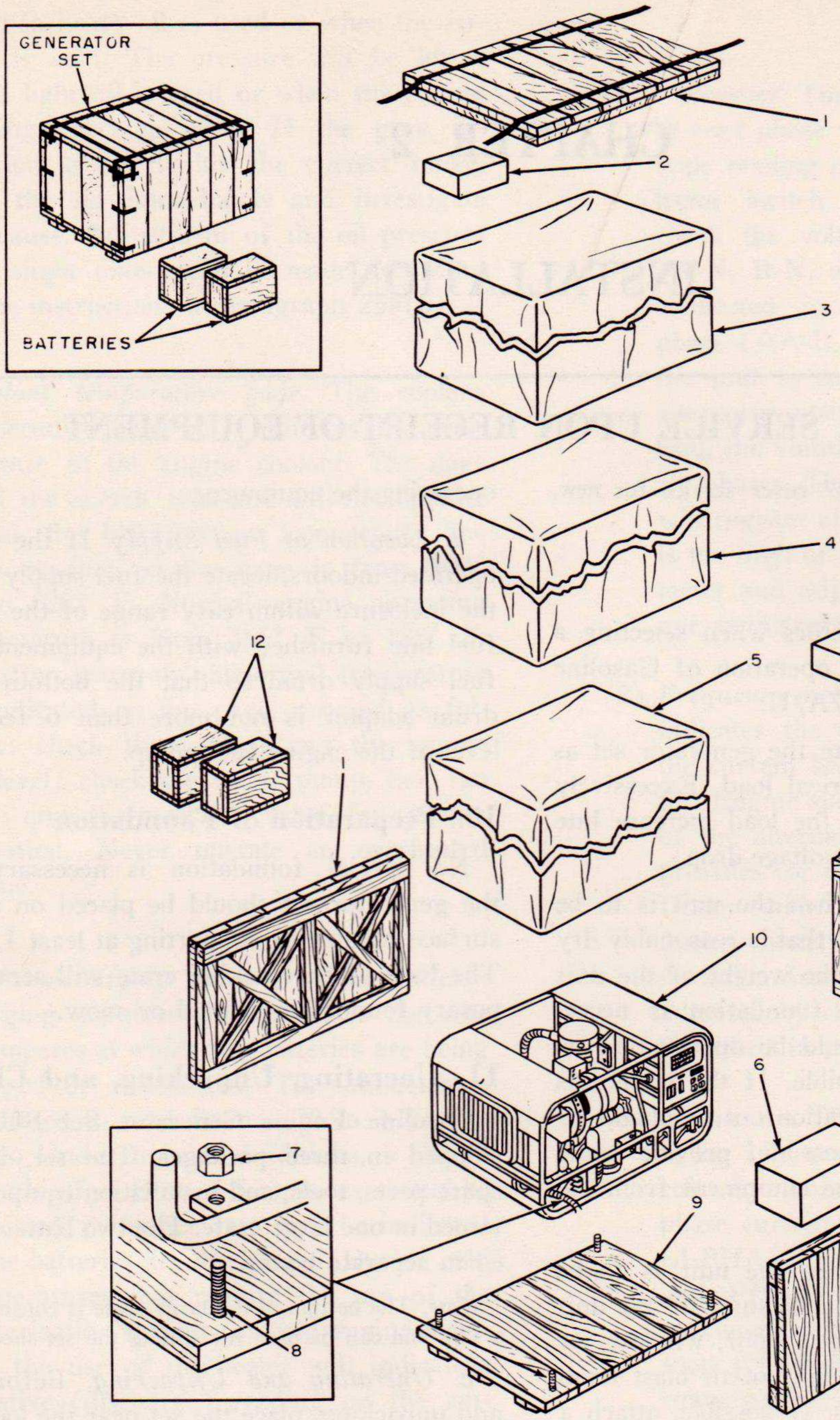


Figure 5. Generator set, packaging.

1. Top and sides.
2. Manuals.
3. Waterproof paper.
4. Vaporproof barrier.
5. Canvas cover (H2368).
6. Installation equipment.
7. Nuts.
8. Bolts.
9. Base.
10. Generator set.
11. Spare parts.
12. Batteries (BT1 and BT2).

(1) Remove the top and sides (1) of the large crate.
(2) Remove the manuals (2), located on top of the set.
(3) Remove the waterproof paper (3) and the vaporproof barrier (4).
(4) Remove the canvas cover (5), inclosing the entire set.
(5) Remove all the packaged installation equipment (6) located in the bottom of the lower frame.
(6) Remove the nuts (7) from the four bolts (8) fastening the set to the crate base (9). The generator set (10) can now be removed.
(7) Unpack the spare parts (11). The tools are wrapped individually in the tool tray in the top rear of the unit. Unwrap these only as required.
(8) Do not uncrate the batteries (12) until the equipment has been set up for operation.

b. Checking. A list of all spare parts and tools packed with the equipment is mounted on the underside of the tool tray cover. Check to be sure the equipment is complete and has not been damaged in shipment and handling.

(1) Check the tools, spare parts, installation equipment, and all major components with the packing lists.
(2) Inspect the over-all unit carefully for damage. Give particular attention to the following: Examine the carburetor, magneto, air cleaner, and fuel pump for dents and breakage. Check the fuel line from the fuel pump to the carburetor for loose connections and kinks. Examine the instruments and controls or damage. Check all wiring for torn insulation and broken wires. If any damage is noted or if the equipment does not check with the packing lists, fill out and forward DD Form 6 in accordance with the instructions in paragraph 2.

Section II. INSTALLATION PROCEDURE

12. Setting Up Equipment

After a suitable location has been chosen (par. 9) and the equipment has been checked (par. 11*b*), set up the equipment as follows:

a. Mounting on Foundation. Determine whether the equipment is to be installed indoors or outdoors, and follow the instructions in subparagraphs (1) or (2) below, as applicable.

(1) For permanent indoor installation, fasten the set to the floor or foundation. Four holes are located in the mounting pads on the bottom four corners of the lower frame. Fasten the set to the floor with ½-inch bolts or lag screws of proper length.
(2) For outdoor installation, locate the set on level ground. If this is impossible, the alternator end of the set must be the lower end.

Warning: Never operate the generator set in a position more than 10° off level, longitudinally or laterally.

b. Connecting Exhaust Tube. For indoor operation, connect the exhaust extension tube to the muffler (fig. 6). Extend the tube to an exterior wall by the most direct route with as few turns as possible. Pitch the tube downward so all condensate will drain out. If the tubing passes through an inflammable wall, install appropriate fireproof insulation.

Warning: Be sure that all connections are gastight. Carbon monoxide is deadly poisonous. Inhaling exhaust gases may be fatal.

c. Installing Fuel Hose. Connect the 20-foot

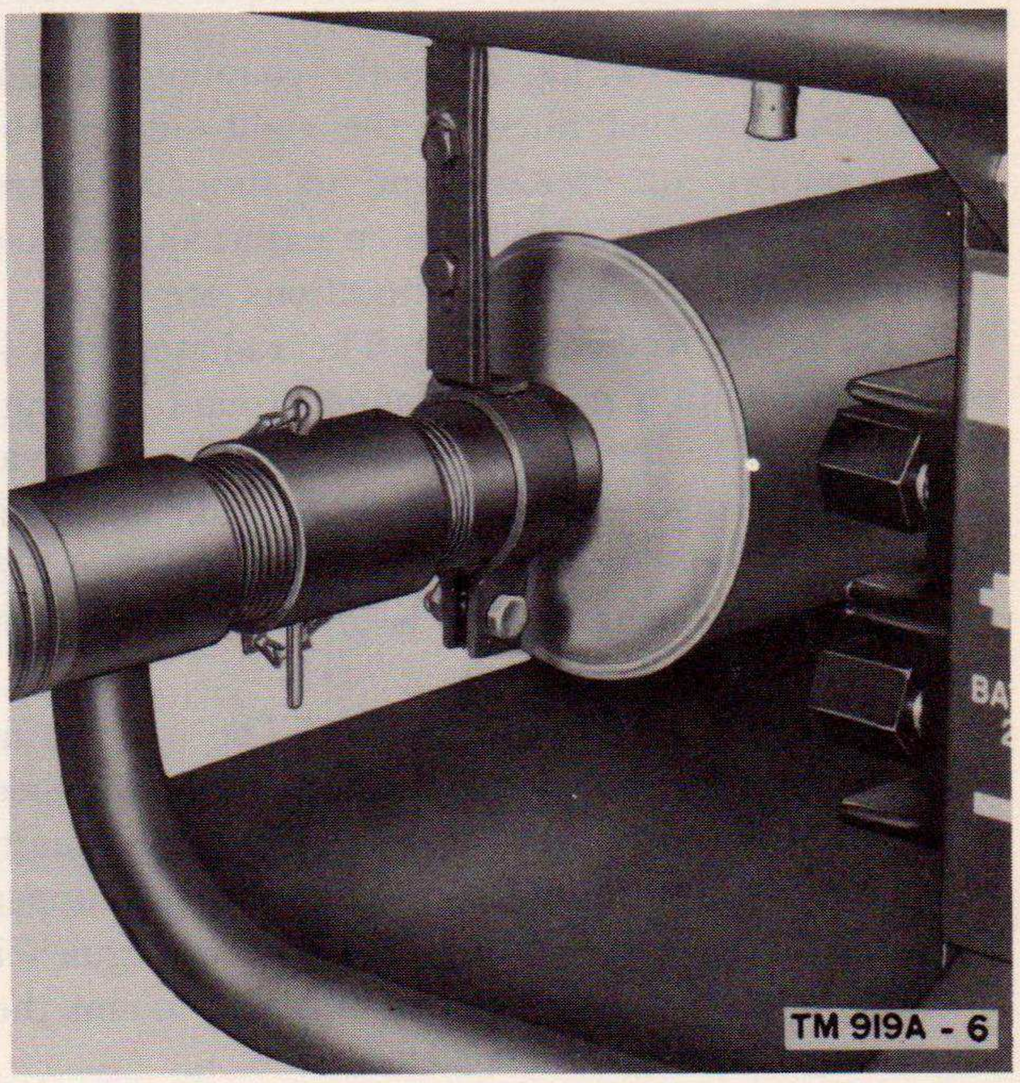


Figure 6. Exhaust tube connection to muffler.

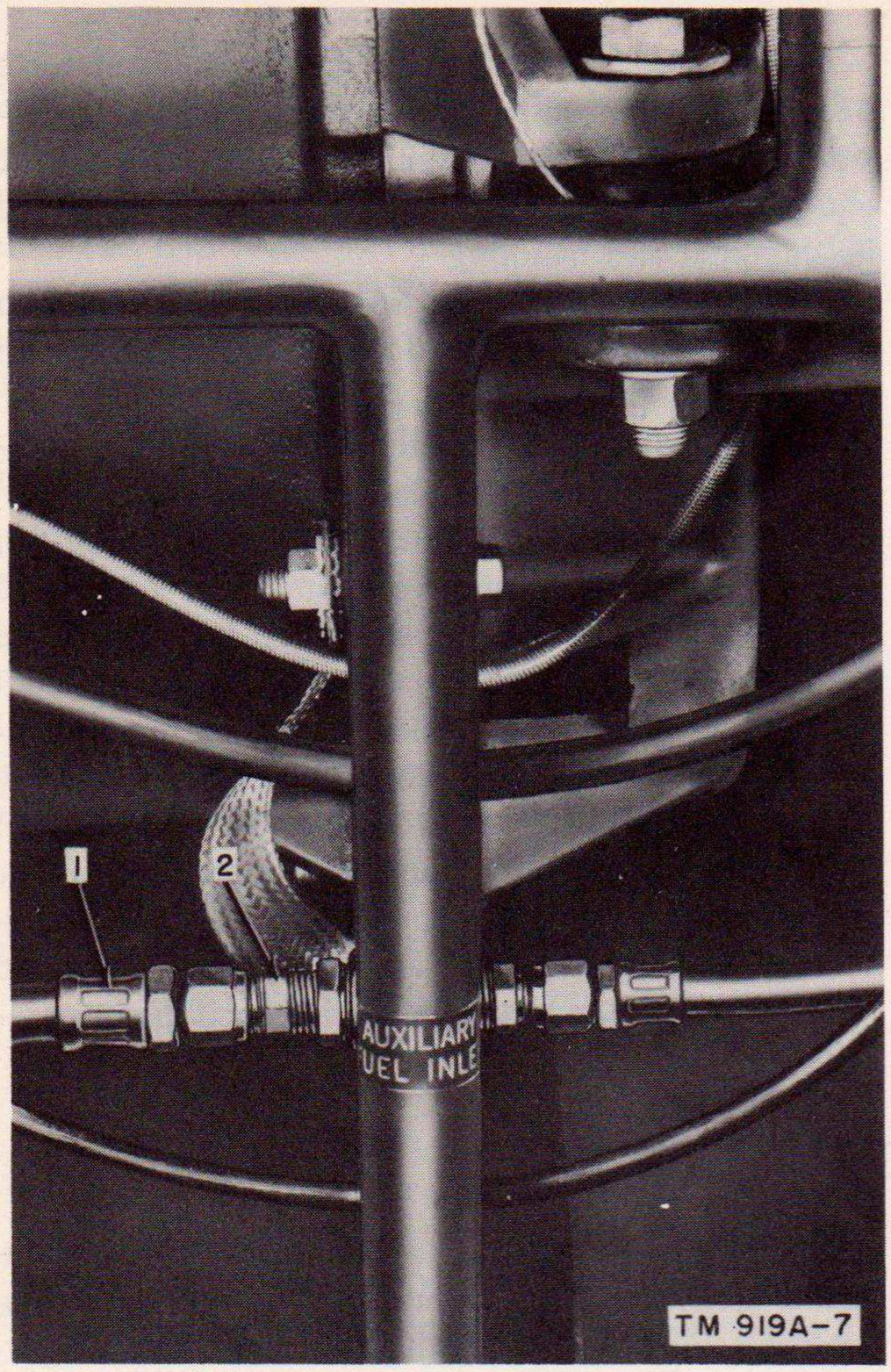


Figure 7. Fuel supply hose connection.
1. Remote fuel line. 2. Remote fuel line adapter.

remote fuel line (1, fig. 7) to the coupling (2) located near the fuel filter on the right side of the unit. Connect the opposite end to the fuel drum adapter. Mount the adapter in an externally located fuel container. Be sure all connections are tight.

d. Installing Radiator Duct. The radiator grill is constructed with a channel flange around the outside edge. For indoor operation, attach a canvas duct to the flange. Use a window or make an opening in an exterior wall and attach the outlet end of the duct. This opening must be at least as large as the radiator grill flange.

e. Installing Fire Extinguisher. The fire extinguisher, mounting bracket, and hardware are shipped with the equipment but detached from the unit. Mounting holes have been drilled in the rear upper frame panel for mounting the fire-extinguisher bracket. Bolt the bracket to the unit and mount the fire extinguisher in the bracket.

13. Removal of Corrosion Preventives

Corrosion preventives are for permanent protection and must not be removed. There are no protective seals installed on the unit.

14. Connections and Interconnections

All internal connections for the operation of the generator set are made at the factory and no additional connections within the unit are needed. Make ac output connections, dc output connections, remote start connections, and battery connections as follows:

a. Ac Output Connections. The wye-delta change board and the output terminals are located on the right side of the unit. Open the change board door to check the ac output rating in which the generator set is connected. The symbol of the rated load will be either Y (wye) or Δ (delta). To change the voltage connections, remove the six nuts and washers that secure the jumper board to the terminal board. For 120-volt, single-phase, 10-kw operation, connect the jumper board in the delta position (fig. 8). Connect cables from the load to output terminals marked PHASE A (1, fig. 8) and PHASE C (2). Use #O AWG (American Wire Gauge) cable. For 120/208-volt, three-phase, 12.5-kw operation, connect the jumper board in the wye position (fig. 9). Connect cables from the load to output terminals marked PHASE A (1, fig. 9), PHASE B (2), PHASE C (3), and NEUTRAL (if required). Use #4 AWG cable. Figures 8 and 9 show the proper delta and wye connections.

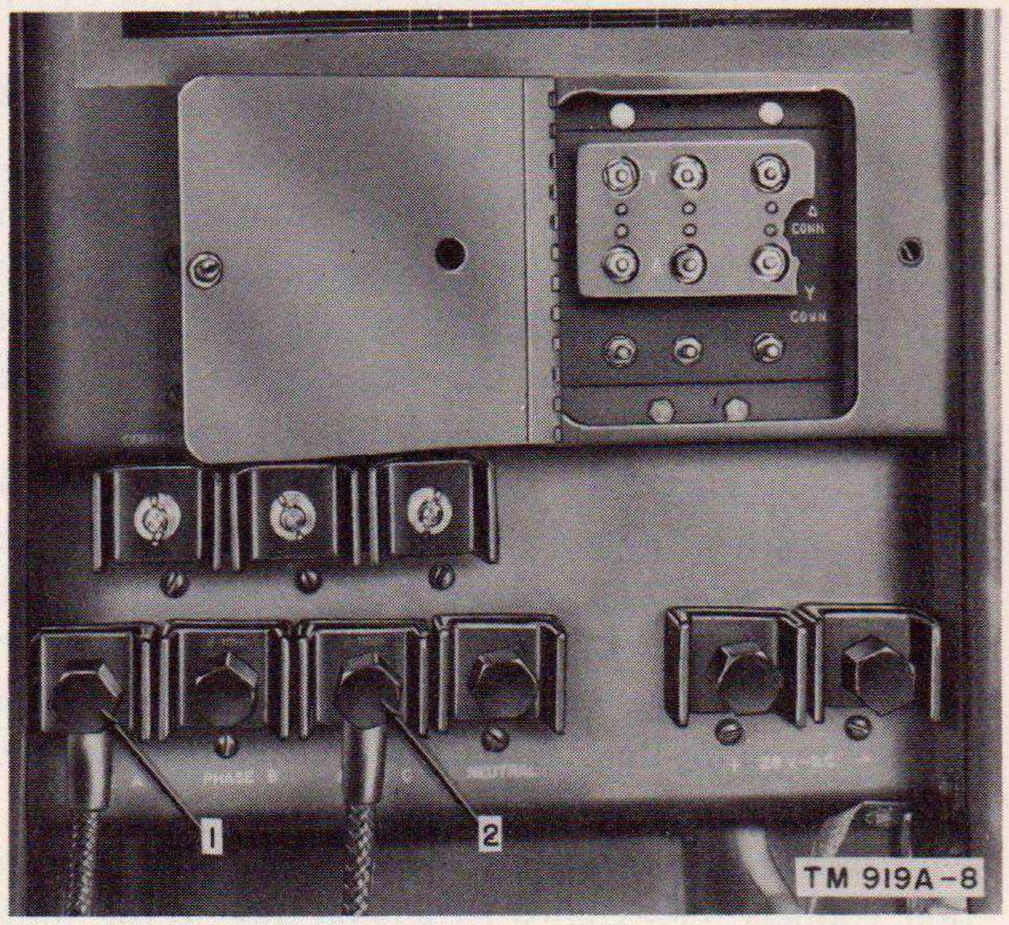


Figure 8. Single phase, 120 volt connections (Delta).
1. PHASE A terminal. 2. PHASE B terminal.

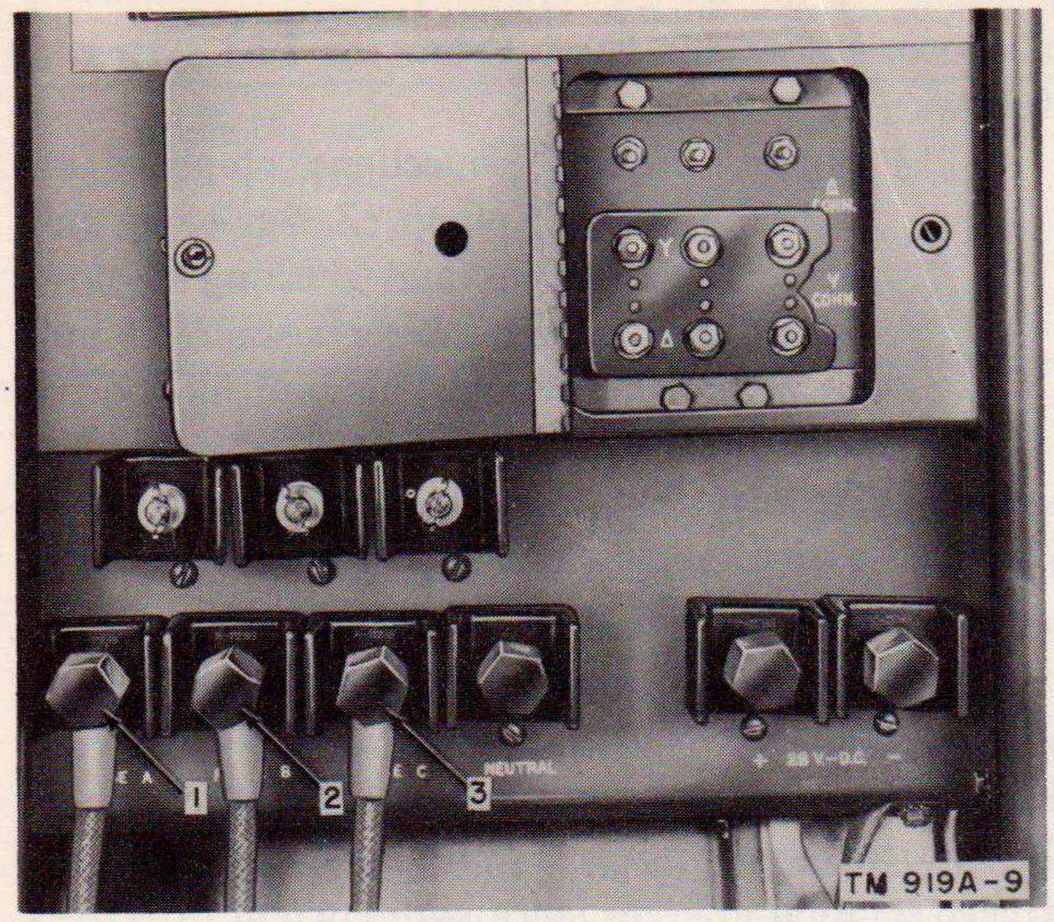


Figure 9. Three-phase, 120/208-volt connections (Wye).

1. PHASE A terminal. 2. PHASE B terminal. 3. PHASE C terminal.

Warning: Never change the output voltage with the unit in operation.

b. Dc Output Connections. A dc load of 2.5 kw at 28 volts may be connected to the unit at any time that the total ac load is not in excess of 10 kw, three-phase, or single-phase. Connect the dc load to the positive (+) and negative (—) output terminals located adjacent to the ac output terminals on the left side of the unit. Use #O AWG cable.

c. Remote Control Connections (fig. 10). Three remote control terminals are located on the right side of the unit, above the ac output terminals. The terminals are marked STOP, COMMON, and START. By using a three-conductor cable, #14 AWG or larger, the remote location may be extended up to 150 feet. To operate the unit from a remote location, it will be necessary to install a start-stop switch at the remote point. With a single-pole, double-throw, center-off toggle switch, make the following connections:

(1) Connect one wire of the cable from the stop terminal on the switch to the remote stop terminal on the unit.

(2) Connect one wire of the cable from the start terminal on the switch to the remote start terminal on the unit.

(3) Connect the remaining wire from the common terminal on the unit to the center (common) terminal of the switch.

d. Battery Connections. Two terminals for connecting the battery cables are located on the left side of the unit. After preparing the batteries for use as instructed in paragraph 17, position the batteries near the unit and connect them as follows: Attach the battery jumper cable from the negative post of one battery to the positive post of the other battery. Connect a cable from the positive (+) terminal (1, fig. 11) on the unit to the battery with the *open* positive post. Connect a cable from the negative (—) terminal (2) on the unit to the battery with the *open* negative post. Figure 11 shows the proper battery connections.

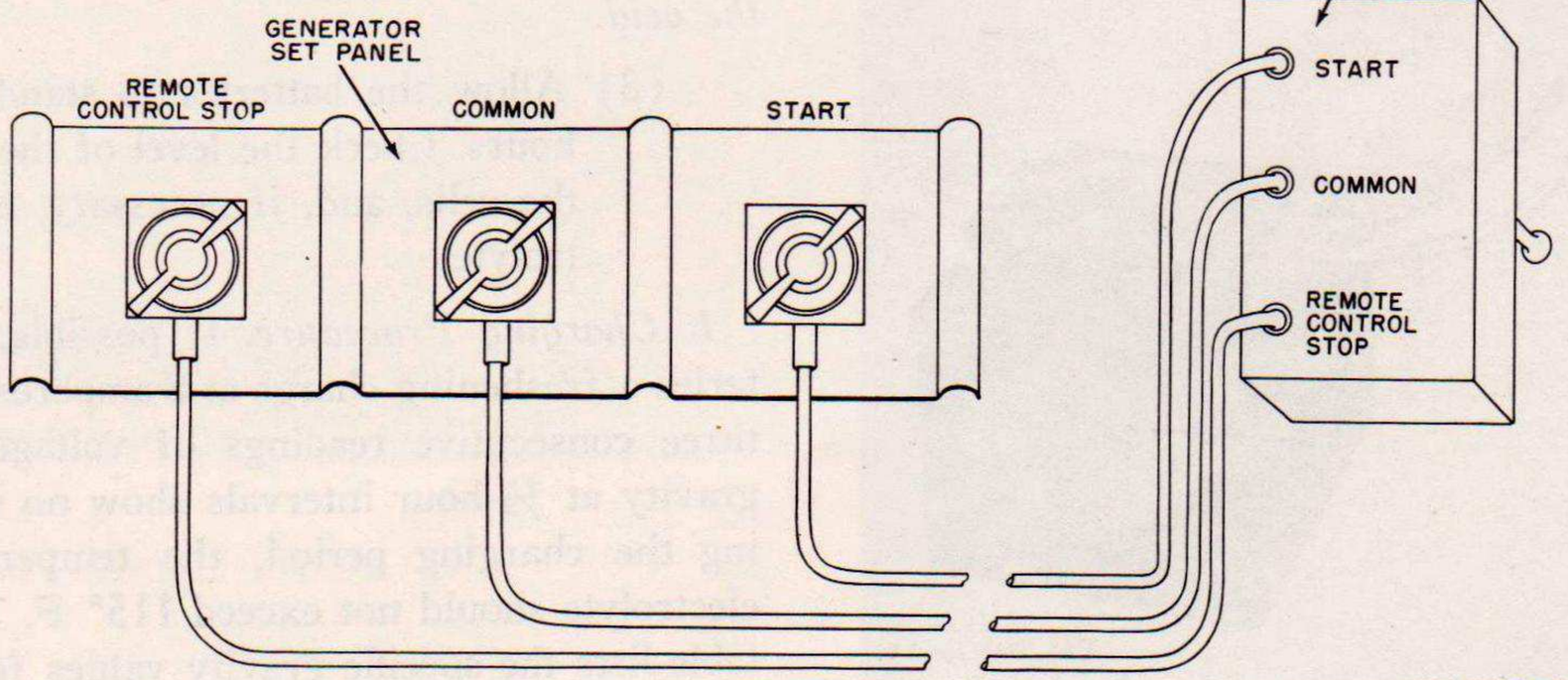


Figure 10. Remote control connections.

15. Initial Lubrication

Inspect the crankcase oil drain valve to be sure it is closed. Remove the cap from the oil filler tube and fill the crankcase with oil as specified in the lubrication chart (fig. 17). The capacity of the lubrication system is 4½ quarts. Replace the oil-filler tube cap. Unfasten the two clamps on the air cleaner and remove the bowl. Clean the bowl with Solvent, Dry Cleaning (SD) and fill to the normal oil level mark with oil as specified in the lubrication chart. The remainder of the set is factory-lubricated and does not require initial preparation.

16. Preparation of Fuel System and Cooling System

a. Install the flexible fuel line and the fuel drum adapter as instructed in paragraph 12*c*. If possible, the container from which fuel is drawn should be located so that the bottom of the fuel drum adapter is about on the same level as the carburetor on the engine. Avoid placing the fuel container too much above or below this level. Prime the fuel system as follows:

(1) With all the fuel connections completed, operate the priming pump (7, fig. 4) by pulling the handle up and pushing it down again, until considerable resistance is built up within the pump. This will fill the fuel filter and fuel lines.

(2) Be sure that the priming pump handle is pushed all the way in before attempting to start the engine.

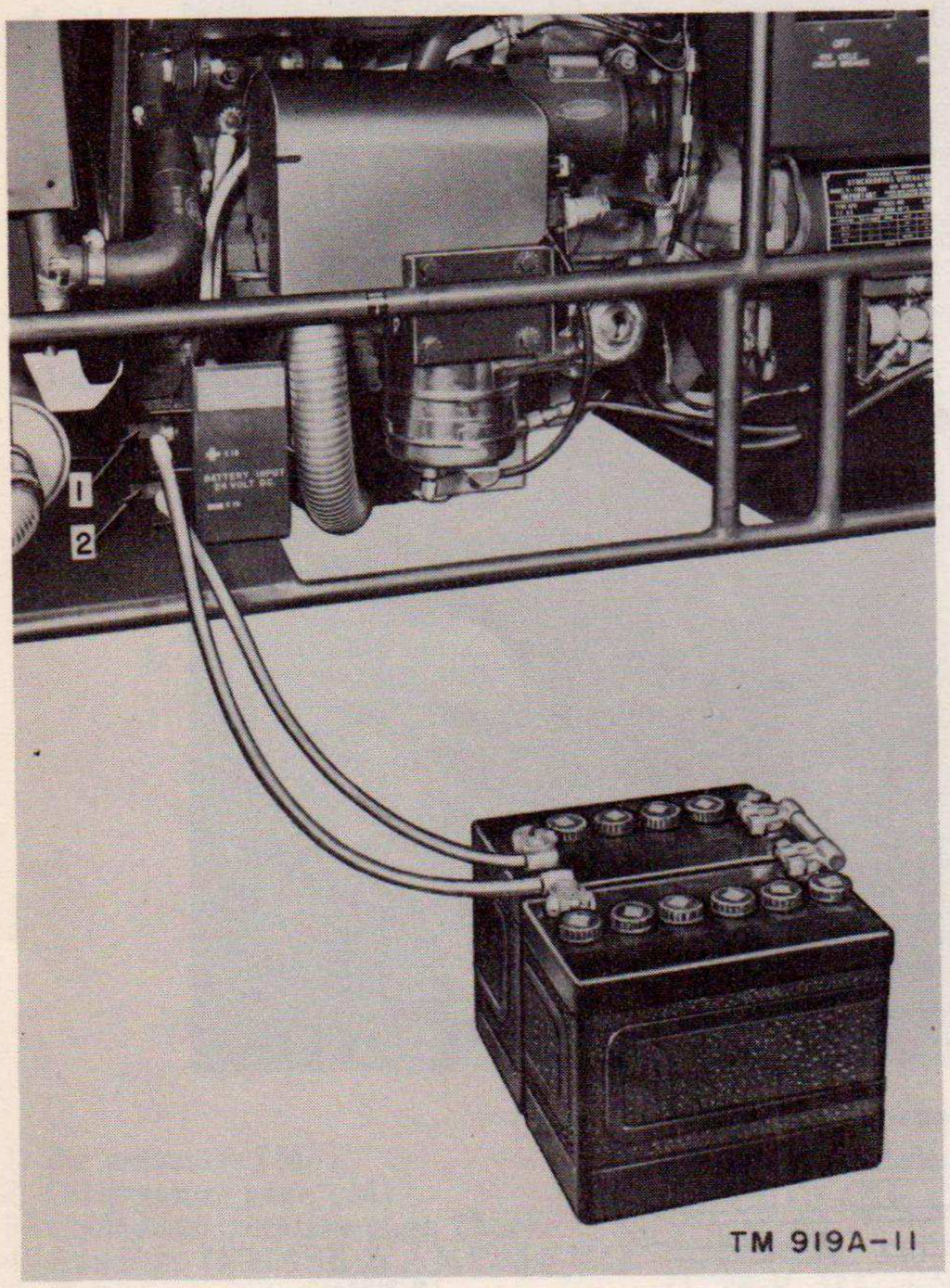


Figure 11. Battery connections.
1. Positive (+) terminal. 2. Negative (—) terminal.

b. Be sure the coolant drain cocks on the radiator and the winterization heater are closed. Fill the cooling system with clear water for temperatures above 32° F. In temperatures 32° F or lower, add antifreeze solution in accordance with current directives. The liquid capacity of the cooling system is 15 quarts.

17. Preparation of Storage Batteries

a. Initial Preparation. The two 12-volt lead-acid storage batteries are shipped in a dry-charged condition. The manufacturer's instructions for preparing the batteries are lettered on each battery. Additional instructions follow:

(1) Remove or destroy any sealing device that may have been used to close or restrict the vent openings.

(2) Fill the cells to ½ inch above the separators with electrolyte (sulphuric acid diluted with distilled water). The electrolyte should have a specific gravity of 1.280 at a temperature of 80° F.

Warning: When preparing the electrolyte, add the acid slowly to the water. *Never add water to the acid.*

(3) Allow the batteries to stand from 1 to 4 hours. Check the level of the electrolyte in the cells, and, if necessary, add more electrolyte.

b. Charging Procedure. If possible, give the batteries a freshening charge at 8 amperes. Charge until three consecutive readings of voltage and specific gravity at ½-hour intervals show no increase. During the charging period, the temperature of the electrolyte should not exceed 115° F. The following table lists the specific gravity values for batteries in various states of charge. All the values shown are for electrolyte at the correct filling height and at 80° F.

State of Charge	Standard specific gravity in temperate climates
Fully charged	1.280
75% charged.	1.230
50% charged.	1.180
25% charged.	1.130
Discharged.	1.080

c. Temperature Changes of Specific Gravity.

(1) The hydrometer readings will be correct only when the electrolyte in the battery is at a temperature of 80° F. If the temperature is higher or lower than 80° F, an allowance must be made to correct the reading obtained.

(2) Draw electrolyte in and out of the hydrometer barrel several times to bring the temperature of the hydrometer float to that of the acid in the cell and then measure the electrloyte temperature in the cell. Some hydrometers have a small thermometer and a correction scale built into them so that the temperature corrections can be made readily. The temperature correction is approximately .004 specific gravity, sometimes referred to as four points of gravity for each 10° F change in temperature.

(3) The following table lists the correction for hydrometer readings with the amount to be added or subtracted when the electrolyte temperature (not the air temperature) is above or below 80° F.

Temperature of electrolyte (° F)	Specific gravity correction factor
160	Add .032
155	Add .030
150	Add .028
145	Add .026
140	Add .024
135	Add .022
130	Add .020
125	Add .018
120	Add .016
115	Add .014
110	Add .012
105	Add .010
100	Add .008
95	Add .006
90	Add .004
85	Add .002
80	.000
75	Subtract .002
70	Subtract .004
65	Subtract .006
60	Subtract .008
55	Subtract .010
50	Subtract .012
45	Subtract .014
40	Subtract .016
35	Subtract .018
30	Subtract .020
25	Subtract .022
20	Subtract .024
15	Subtract .026
10	Subtract .028

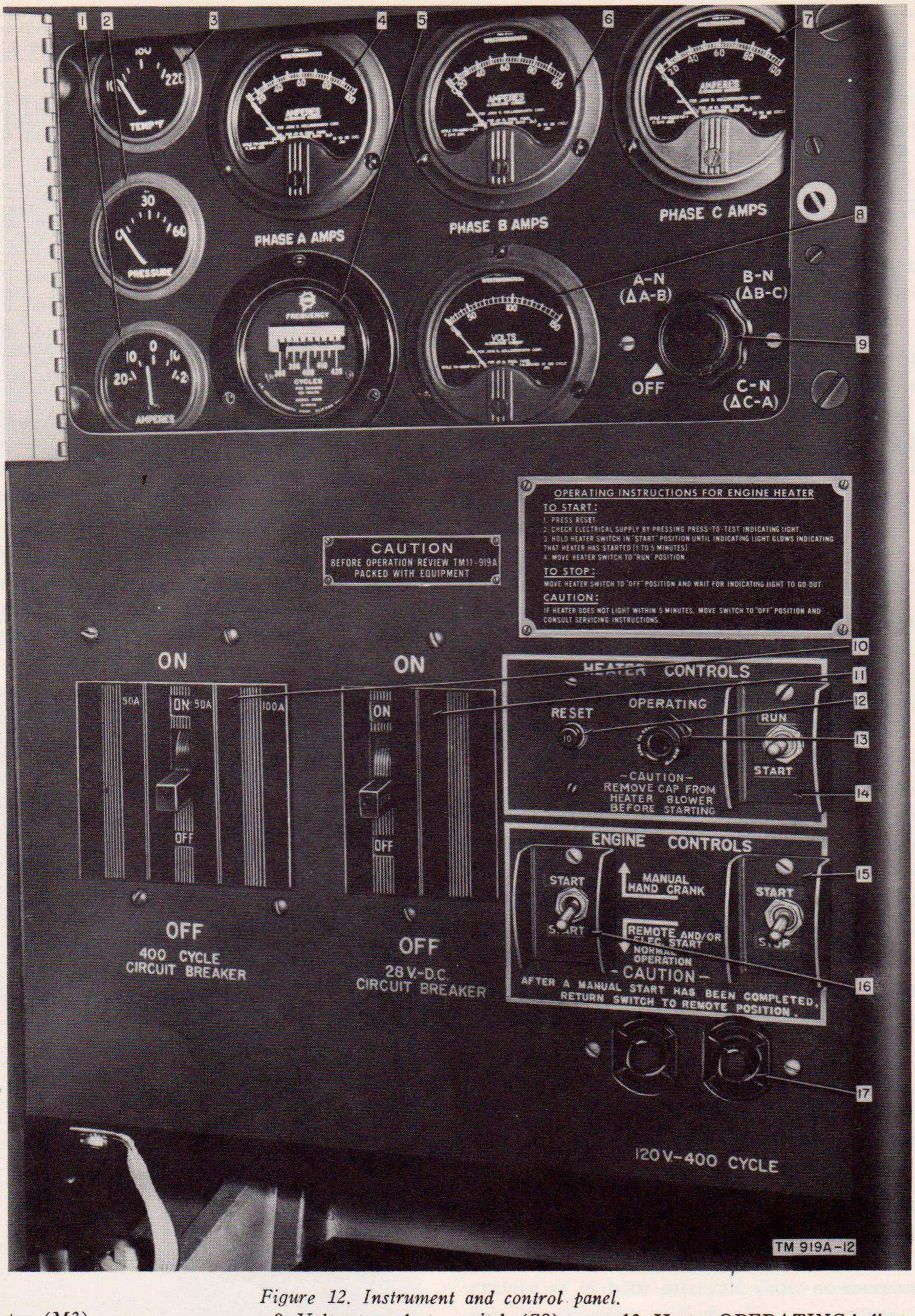


Figure 12. Instrument and control panel.

1. Dc ammeter (M3).
2. Oil pressure gage (M1).
3. Coolant temperature gage (M2).
4. Ammeter (PHASE A AMPS) (M6).
5. Frequency meter (M4).
6. Ammeter (PHASE B AMPS) (M7).
7. Ammeter (PHASE C AMPS) (M8).
8. Voltmeter (M4).
9. Voltmeter selector switch (S8).
10. 400 CYCLE CIRCUIT BREAKER (CD3).
11. 28-V.-D.C. CIRCUIT BREAKER (CD1).
12. Heater circuit breaker (RESET) (CD2).
13. Heater OPERATING indicator lamp (XDS1).
14. Heater RUN-START switch (S7).
15. START-STOP switch (S4).
16. Ignition switch (S1).
17. 120 V.-400 CYCLE duplex receptacle (J1).

CHAPTER 3

OPERATION

Section I. CONTROLS AND INSTRUMENTS

Note. This section describes, locates, illustrates, and furnishes the operating personnel with information pertaining to the various controls and instruments provided for the proper operation of the equipment.

18. Manual Controls

a. Engine.

(1) *Ignition switch* (16, fig. 12). A toggle-type switch, located on the control panel, selects the ignition circuit for MANUAL HAND CRANK or REMOTE AND/OR ELEC. START NORMAL OPERATION. If the unit is to be started by hand cranking, place the switch in the MANUAL HAND CRANK position; if the set is to be started remotely or by the START-STOP switch (subpar. (2) below), place the switch in the REMOTE AND/OR ELEC. START NORMAL OPERATION position.

(2) *START-STOP switch* (15, fig. 12). The three-position, START-STOP toggle switch is located on the control panel. To start the set, hold the switch in the START position; to stop the set, place the switch in the STOP position. The switch is designed so that the actuating handle returns to the center position when released from the START position.

(3) *CHOKE* (28, fig. 2). To assist in starting the set while hand cranking, a flexible wire-and-sleeve type manual choke is mounted on the right side of the radiator. Pull the CHOKE out when cranking a cold engine. After the set has started, push the CHOKE in all the way.

Note. Function of the automatic choke (par. 19*a*(4)) is sufficient after the engine has started, and manual choking is no longer necessary.

(4) *THROTTLE* (8, fig. 4). The manual THROTTLE is a wire-and-sleeve-type control mounted on the rear of the set on the lower frame. Use the manual THROTTLE to run the engine for prolonged periods of no load operation or when the unit is to be started in a cold temperature and it is necessary to warm the engine at idling speed. Lock the THROTTLE in the desired position by turning the knob clockwise.

Caution: Do not apply load to the set while the manual THROTTLE is in control.

(5) PRIMING PUMP (fig. 4). The set is provided with a PRIMING PUMP (7) located just above the manual THROTTLE. Use the pump when starting the set in low temperatures. To operate the pump, pull the knob out all the way and push it back to its original position. Operate the pump only while the engine is being cranked. One or two strokes are usually enough to start the engine. Be careful not to overprime.

b. Dc Generator. Two manual controls are used with the dc generator (1, fig. 2); a circuit breaker

and a variable voltage resistor. The 28-V. D. C. CIRCUIT BREAKER (11, fig. 12), mounted on the control panel, serves as the main load switch and the overload trip in the dc circuit. To connect the load, push the trip lever to ON; to disconnect the load, push the trip lever to OFF. The circuit breaker trips off automatically (par. 19*b*(1)) whenever the circuit becomes overloaded. To reset the circuit breaker after it has tripped, push the lever all the way down to the OFF position and then up to the ON position. The variable resistor on the dc voltage regulator (3, fig. 4) has a range of from 25 to 30 volts. Turn the slotted shaft of the variable resistor until the desired voltage is reached.

c. Winterization System (fig. 12). All the winterization controls are located on the control panel.

(1) *Circuit breaker* (RESET). The circuit breaker (RESET) (12) is used as the main switch to connect and disconnect the winterization system circuit. Push in the RESET button all the way to connect the system; pull out the button to disconnect the system. The circuit breaker trips off automatically (par. 19*c*(1)) whenever the circuit becomes heavily overloaded. To reset the circuit breaker after it has tripped, push in the RESET button.

(2) *Heater RUN-START switch.* The heater RUN-START switch (14) is used to start and run the winterization heater. To start the heater, after the RESET button has been pushed in (subpar. (1) above), hold the switch in the START position 2 to 4 minutes. After the heater OPERATING indicator lamp (subpar. (3) below) flashes on, place the switch in the RUN position. To shut off the heater, place the switch in the off (center) position.

(3) *Heater OPERATING indicator lamp.* The heater OPERATING indicator lamp (13) shows when the heater is in operation (par. 19*c*(2)). The lamp also may be used as a check on the power supply to the heater. To check the power supply, be sure the circuit breaker (RESET) button (subpar. (1) above) is in all the way. Then press the lamp. If power is available, the lamp will glow.

d. Alternator.

(1) *Circuit breaker* (fig. 12). The 400 CYCLE CIRCUIT BREAKER (10) mounted on the control panel, serves as the main load ON-OFF switch and the overload trip in the ac circuit. To connect the load, push the trip lever to ON; to disconnect the load, push the trip lever to OFF. The circuit breaker trips off automatically (par. 19*d*(1)) whenever the circuit becomes heavily overloaded. To reset the circuit breaker after it has tripped, push the lever all the way down to the OFF position and then up to the ON position.

(2) *Wye-delta change board* (fig. 3). The wye-delta change board (1), mounted on the right side of the set, is used to select the cutput voltage of the alternator, depending on the load requirements. Refer to paragraph 14*a* for instructions on changing the voltage connections by means of the wye-delta change board. The connection can be checked and/or changed after opening the change board door.

e. Miscellaneous. The 120V-400 CYCLE duplex receptacle (17, fig. 12) mounted on the control panel, is a means of connecting external power for trouble-shooting lamps, fans, or similar equipment requiring 120-volt, 400-cycle power. The receptacle is the Twistlock type and contains two connectors.

19. Automatic Controls

a. Engine.

(1) *Engine speed governor* (10, fig. 3). An engine speed governor, mounted on the right side of the engine, regulates the speed of the engine that governs the output frequency of the set. The governor is gear-driven from the camshaft timing gear and is connected to the carburetor throttle through adjustable linkage. The governor is set at the factory and should not require adjustment. However, if adjustment is necessary, follow the instructions in paragraph 25*b*.

(2) *High coolant temperature cutoff switch* (3, fig. 2). The engine is equipped with a thermostatically operated high coolant

temperature cutoff switch, mounted on the cylinder-head coolant outlet neck. If the coolant temperature exceeds a predetermined value, the switch grounds the magneto primary and thereby stops the engine. The switch is adjustable to permit selection of any desired temperature between 160° F and 220° F. It is set at 200° F at the factory.

(3) *Low-oil-pressure cutoff switch* (7, fig. 2). A low-oil-pressure cutoff switch, mounted on the left side of the engine, grounds the magneto circuit if the engine oil pressure drops below a safe minimum of approximately 5 psi for engine operation.

(4) *Automatic choke* (4, fig. 3). An automatic thermal-type choke is installed on the exhaust manifold adapter elbow. When the engine is cranked electrically, the carburetor is choked automatically to the extent required by the temperature of the engine.

b. Dc Generator.

(1) *Circuit breaker* (11, fig. 12). The 28-V. D.C. CIRCUIT BREAKER, mounted on the control panel, trips automatically if the circuit becomes heavily overloaded. The thermal trip release is factory-set for time-delay operation and the circuit breaker is sealed. To reset or manually operate the circuit breaker as a load switch, refer to paragraph 18*b*.

(2) *Dc voltage regulator* (3, fig. 4). A dc voltage regulator is mounted on a base secured to the top of the alternator stator housing. The carbon pile voltage regulator controls the 28-volt dc generator voltage output by automatically controlling the generator field current.

c. Winterization System.

(1) *Heater circuit breaker* (12, fig. 12). The heater circuit breaker (RESET) trips automatically when the heater circuit becomes heavily overloaded. For use as a master switch and for the method of resetting, refer to paragraph 18*c*(1).

(2) *Heater OPERATING indicator lamp*. The heater OPERATING indicator lamp (13), mounted on the control panel indicates when the heater is operating. The lamp will glow when the heater is burning on either high or low fire, or after the heater has been turned off and is purging itself of fuel. To operate the lamp as a check on the winterization system power supply, refer to paragraph 18*c*(3).

d. Alternator.

(1) 400 CYCLE CIRCUIT BREAKER. The 400 CYCLE CIRCUIT BREAKER (10), mounted on the control panel, trips automatically if the circuit becomes heavily overloaded. The thermal trip release is factory-set for time-delay operation and the circuit breaker is sealed. To reset or manually operate the circuit breaker as a load switch, refer to paragraph 18*d*(1).

(2) *Compensator assembly* (1, fig. 4). A compensator assembly, consisting of a three-phase transformer and a network of six capacitors (4), serves as a static voltage regulator by correcting the alternator internal power factor. The compensating transformer is mounted on the firewall above the alternator stator housing. The capacitors are mounted above and to the right of the transformer.

e. Battery Charging (5, fig. 3). The 24-volt dc automotive-type battery-charging generator is mounted on the right side of the engine, and is used to keep the engine starting batteries charged for regular use. The charging rate to the batteries is controlled by the automotive-type battery-charging voltage regulator mounted on the forward side of the firewall, inside of the suppression box (2).

20. Instruments

a. Engine Instruments (fig. 12). All the engine instruments are located on the instrument panel.

(1) *Oil-pressure gage*. The oil-pressure gage (2) indicates the pounds per square inch of oil pressure being delivered to the engine bearings. The gage is of the electric type and will not operate unless the batteries are connected. The gage has a 0 to 60-pound

scale, and normal operating oil pressure is 20 to 30 psi. The pressure will be higher when heavy oil is used or when the engine is cold. The pressure will be lower when light oil is used or when the engine bearings become worn. If the gage indication is not within the correct range, stop the set immediately and investigate the cause. Adjustment of the oil pressure to a slight extent can be made according to the instructions in paragraph 25*b*(6).

(2) *Coolant temperature gage.* The coolant temperature gage (3) indicates the temperature of the engine coolant. The gage is of the electric type and will not operate unless the batteries are connected. The scale reading on the gage is from 100° F to 220° F. Normal engine operating temperature is from 165° F to 185° F. If, after warm-up, abnormal temperature is indicated on the gage, proceed as follows: check the coolant and the engine oil level; check the water pump, fan, fan belt, and thermostatic valve for proper operation. Never operate an overheated engine.

(3) *Battery-charging ammeter.* The battery-charging ammeter (1) indicates the rate in amperes at which the batteries are being charged or discharged. The ammeter is calibrated to read from —20 to +20 amperes. Under normal conditions, a charging rate of +½ to +5 amperes should be indicated. A higher rate may be indicated if the batteries are discharged. During cold temperatures that require the use of the winterization system for cold engine starting, the use of the heater will indicate a negative (discharge) reading on the ammeter. Starting the heater will show a —12-ampere reading from 1 to 5 minutes; and running the heater will show approximately —¾ ampere. Negative readings, while the unit is operating, may also indicate that the battery leads are reversed or that there is a short circuit in the charging system. No reading indicates a faulty charging system or a loose or broken connection.

b. Alternator Instruments (fig. 12). All the alternator instruments are located on the instrument panel.

(1) *Voltmeter.* The voltmeter (8) is connected to read phase voltage and has a maximum scale reading of 150 volts. A voltmeter selector switch (9), provides facilities to check the voltage from phase to neutral (A-N, B-N, and C-N) when the unit is connected in wye and from phase to phase (△A-B, △B-C, and △C-A) when the unit is connected in delta. With the alternator operating under full balanced load, the voltmeter will indicate 120 volts in all phases. Under no load, the voltmeter will register about 124 volts. If the voltage is too high or too low, check the frequency meter and adjust the engine speed governor as instructed in paragraph 25*b*.

(2) *Frequency meter.* The frequency meter (5) indicates the cycles per second (cps) of the current being produced by the alternator. Engine speed determines the frequency of the alternator output. The meter scale provides for indications of 380 to 420 cps. Under stable operation at full load, the frequency meter must indicate 400 cps. Any deviation from the desired reading can be adjusted by changing the engine speed as described in paragraph 25*b*.

(3) *Ammeters.* The three ammeters (4, 6, and 7, fig. 12), connected to the alternator circuit by current transformers, register phase current. The ammeters are designated PHASE A AMPS, PHASE B AMPS, and PHASE C AMPS and provide a maximum scale reading of slightly more than 100 amperes. When the alternator is connected for single-phase, 120-volt output (delta), the PHASE A AMPS and PHASE C AMPS ammeters will register 104 amperes under full load. The PHASE B AMPS ammeter will indicate zero. When the alternator is connected for three-phase, 208-volt output (wye), all the ammeters will register 43.5 amperes under full load, Abnormal ammeter readings indicate an unbalanced load, defective ammeters, or defective lines to the load.

Section II. OPERATION UNDER USUAL CONDITIONS

Note. Personnel charged with the operation of the equipment covered in this manual will secure DA Form 11-260, and make appropriate entries thereon.

21. Preliminary Procedures

Before starting, check the set as follows:

a. Fuel System. Check the available supply for the correct grade of fuel. In temperatures above 0° F, use Gasoline, Automotive Combat (86A). Check the auxiliary fuel hose for proper connections (par. 12*c*). Examine all fuel fittings for loose connections.

b. Cooling System. Be sure the cooling system is filled to capacity (15 quarts) with clean water. Inspect all hose fittings and drains for evidence of looseness or leakage. Check the high coolant temperature cutoff switch for proper setting (par. 19*a*(2)).

c. Exhaust System. Check all exhaust connections for proper installation. Be sure the exhaust extension tube is assembled properly (par. 12*b*). All connections must be gastight.

d. Lubrication. The lubrication system must be prepared as instructed in paragraph 15. Recheck to be sure the crankcase oil level is correct.

e. Batteries. Check to be sure that the batteries have been prepared adequately for use (par. 17) and that all cable connections are correct and secure (par. 14*d*).

f. Instrument and Control Panel. Check all the instruments and controls located on the panel and within the unit for damage and insecure mounting. See that all electrical connections are tight and correct. The circuit breakers must be in the OFF position unless the unit is to be started remotely.

g. Remote Starting. If the unit is to be operated from a remote location, be sure the connections are correct as instructed in paragraph 14*c*. They must be clean and secure. The circuit breakers must be in the ON positions for remote operation.

h. Output Connections. Check the wye-delta change board for proper setting for desired output. If incorrect, change as instructed in paragraph 14*a*. The output terminals must be connected to the load correctly, and the connections must be secure and clean.

i. General Inspection. Inspect the fan belt, dc generator belt, and battery-charging generator belt for proper tension (par. 48). Check the entire unit for loose nuts, bolts, electrical connections, and fittings. Remove all tools and waste material from around the unit. Be sure the operating location is ventilated properly.

22. Starting

Caution: Do not attempt to start the set with the circuit breakers in the ON position, except when starting from a remote location.

a. Electrically. To start the set electrically, proceed as follows:

(1) Be sure both circuit breakers (10 and 11) are in the OFF position.

(2) Move the ignition switch (16) into the REMOTE AND/OR ELEC. START NORMAL OPERATION position.

(3) Move the START-STOP switch (15) to the START position and hold it there until the engine starts. As soon as the engine starts, release the switch. If the engine fails to start, release the switch for at least 10 seconds and then repeat the starting procedure. If the engine still fails to start, refer to the trouble-shooting chart (par. 50) for the possible cause and the remedy.

Caution: Do not operate the hand CHOKE when starting electrically.

(4) To start the set at idling speed, operate the manual THROTTLE as instructed in paragraph 18*a*(4).

b. Manually. The engine may be started by hand cranking in the event that the batteries do not supply sufficient power. To start the engine manually, proceed as follows:

(1) Be sure both circuit breakers (10 and 11) are in the OFF positions.

(2) Be sure the START-STOP switch (15) is in the run (center) position.

(3) Place the ignition switch (16) in the MANUAL HAND CRANK position.

(4) Insert the hand crank (24, fig. 2) and rotate it until it engages with the crankshaft.

(5) Pull out the manual CHOKE (28, fig. 2) in the front of the set if starting in cold temperatures.

(6) Crank the engine by using a strong, quick, upward pull. Repeat as necessary; be careful not to overchoke.

(7) After the engine starts, return the ignition switch to the REMOTE AND/OR ELEC. START NORMAL OPERATION position, and push in the manual CHOKE all the way.

c. Remotely. To start the engine from a remote location, connect the remote cables as instructed in paragraph 14*c* and proceed as follows:

(1) Place the ignition switch (16) into the REMOTE AND/OR ELEC. START NORMAL OPERATION position.

(2) Place the circuit breakers (10 and 11) into the ON positions.

(3) Continue remote starting procedure in accordance with subparagraph *a*(3) above. The ignition switch in the REMOTE AND/OR ELEC. START NORMAL OPERATION position serves the same function as the electric START-STOP switch on the control panel.

23. Precaution after Starting

Warning: Do not touch the wye-delta change board or the output terminals while the set is in operation. Perform the following immediately after starting the equipment.

a. Check the coolant, fuel, and oil lines for leakage. If leaks have developed, correct them immediately. Stop the set if necessary.

b. Check the reading of the engine oil-pressure gage. It may read high during the first minutes of operation. After the warm-up period, the gage should read between 20 and 30 psi. If a high- or low-oil pressure reading is observed, shut off the unit and refer to the trouble-shooting chart (par. 50) for the possible cause.

c. The battery-charging ammeter should indicate a charging rate of +½ to +5 amperes with the batteries fully charged. If no charge or a discharge is indicated, refer to the trouble-shooting chart (par. 50) for the possible cause.

d. Observe the readings of the voltmeter and the frequency meter. The voltmeter should register between 120 and 126 volts; the frequency meter should indicate between 400 and 407 cps. The frequency is factory-set and should be correct. However, if necessary to correct the frequency, refer to paragraph 25*b* and adjust the engine speed governor as instructed.

e. The coolant temperature indicated should be between 165° F and 185° F after the warm-up period. If the temperature is above normal, remove the radiator cap and check the coolant level. Add coolant if necessary. Be careful when removing the radiator cap to avoid scalding.

f. Observe the manual CHOKE to be sure it is all the way in.

24. Applying Load

Warning: Do not apply load to the set until the engine has warmed. Be sure the load is within the range of the unit.

To apply the ac or dc load to the set, place the appropriate circuit breaker in the ON position. If the ac load has been applied, check the ammeter, voltmeter, and frequency meter readings. Compare them with the correct readings listed in paragraph 20*b*. Any deviation must be investigated and corrected immediately. If the circuit breaker automatically trips off after applying the load, recheck for overload conditions and incorrect connections. To reset, switch the circuit breaker lever to the OFF position and then to ON. *Never manually hold the circuit breaker in the ON position.*

25. Operating Procedure

a. Instrument Readings. At frequent intervals during load operation, check the reading of the instruments located on the instrument panel. Refer to paragraph 23 for normal instrument indications and the corrections necessary to adjust abnormal readings.

b. Adjustments. Adjustments necessary to correct abnormal operation of the set are explained below:

(1) *Governor adjustment to correct frequency*

(fig. 13). If the indicated frequency is abnormal and thereby causes improper voltage output, correct the frequency by making the governor adjustments as instructed in subparagraph (1)(*a*) through (*d*) below.

(*a*) To adjust the governor to correct abnormal frequency, the engine must be stopped. Loosen the lock nuts (4) and rotate the adjusting sleeve (5) until the dimension A is approximately 11¼ inches. Check the eyebolt dimension B to see that it is ⅞ inch. To increase this dimension, loosen the upper adjusting nut (9) and tighten the lower adjusting nut (10). To decrease this dimension, loosen the lower adjusting nut (10) and tighten the upper adjusting nut (9).

(*b*) Start the engine and bring the unit up to operating speed and temperature. With the generator operating at approximately 400 cycles at no load, loosen the lock nuts (4) and rotate the adjusting sleeve (5) until an increase in engine speed is effected. Turn the sleeve back until the governor just begins to take control and the generator frequency is restored to 400 cycles. Tighten the lock nuts (4) when the adjustment has been completed.

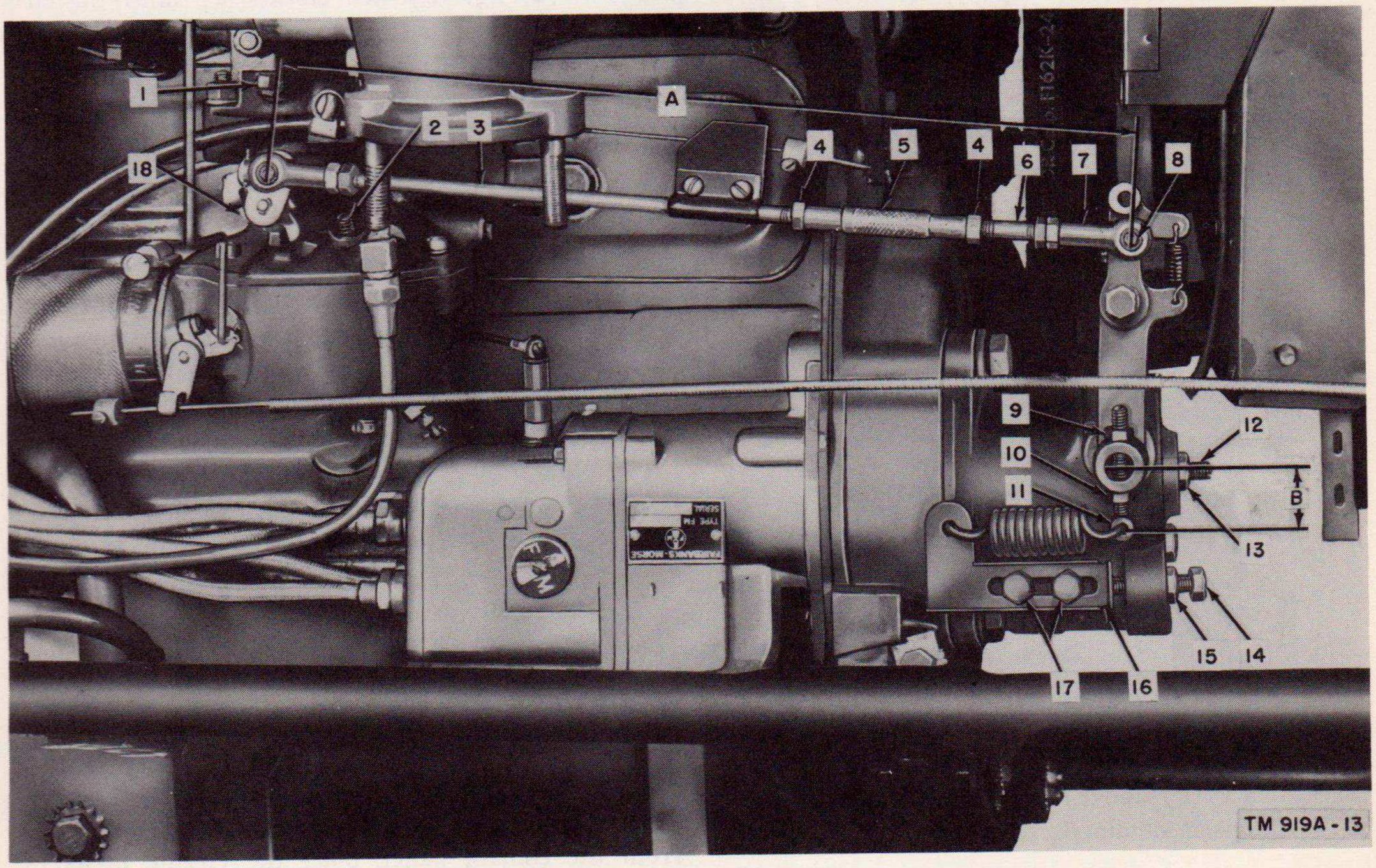


Figure 13. Engine speed governor adjustments.

1. Pipe plug.
2. Idle-adjusting needle.
3. Governor-to-throttle rod, long.
4. Lock nut.
5. Adjusting sleeve.
6. Governor-to-throttle rod, short.
7. Rod end.
8. Hexagonal nut.
9. Upper adjusting nut.
10. Lower adjusting nut.
11. Control arm eyebolt.
12. Bumper screw.
13. Lock nut.
14. Adjusting screw.
15. Lock nut.
16. Adjustment slide.
17. Shoulder bolt.
18. Throttle stop screw.

(*c*) Loosen the two shoulder bolts (17) that hold the adjustment slide (16). Loosen the lock nut (15) and change the engine speed by turning the adjustment screw (14). Turn the screw clockwise to increase the engine speed and counterclockwise to decrease the engine speed.

(*d*) When the frequency meter indicates 400 cps under load or about 405 cps under no load, secure the adjustment by tightening the lock nut (15) and shoulder bolts (17). If necessary, readjust the linkage between the governor and carburetor (subpar. (*a*) and (*b*) above).

(2) *Governor adjustment to correct engine surge under no load.* If the engine is hunting or surging under no load, correct the condition by adjusting the engine speed governor as follows:

(*a*) Loosen the lock nut (13) and turn the bumper screw (12) in, until the engine stops surging. Do not turn the bumper screw in too far or the engine speed will increase and the governor will not function properly.

(*b*) When the bumper screw has been adjusted properly, secure the setting by tightening the lock nut (13).

(*c*) If the frequency drop from no load to rated load is greater than the specified 407 to 400 cycles, decrease dimension B (fig. 13) by loosening the lower adjusting nut (10) and tightening the upper adjusting nut (9). Then readjust the no-load speed of the engine (subpar. (1)(*c*) above) until a frequency of 405 cps is obtained.

(3) *Governor adjustment to correct engine surge under load.* If the engine is hunting or surging under load, correct the condition by increasing dimension B. To do this, loosen the upper nut (9) and tighten the lower nut (10). Readjust the engine no-load speed in accordance with the instructions in subparagraph (1)(*c*) above.

(4) *Dc voltage regulator adjustment.* If necessary, refer to paragraph 18*b* and adjust the regulator to the desired output as instructed.

(5) *Carburetor adjustments.* The carburetor is provided with two external adjustments, the throttle stop screw (18, fig. 13) and the idle-adjusting needle (2). If the carburetor idling adjustment is required after the engine has warmed to operating temperature, proceed as follows: Set the hand throttle to an idling speed of approximately 500 to 700 rpm with the engine under *no load,* or to a point where the carburetor throttle stop screw (18) will touch or nearly touch the throttle stop pin (21, fig. 24). Turn the idle-adjusting needle (2, fig. 13) in (clockwise) until the engine begins to run roughly or falters, then slowly turn the screw out (counterclockwise) until the engine runs smoothly. Recheck the adjustment after the engine has been operating under load for about ½ hour.

(6) *Oil-pressure adjustment.* The engine oil-pressure adjustment should never need altering under normal conditions. However, the pressure can be slightly raised or lowered by adding or removing shims in the relief valve assembly (fig. 45) located on the right side of the cylinder block. Adding .030-inch shims between the plug (23) and the spring (26) will increase the oil pressure. Removing shims will decrease the pressure. This adjustment will change the pressure at load speed but not at idle speed.

26. Stopping

a. If the engine generator set is being controlled from the control panel, place the circuit breakers in OFF position. If the engine generator is being controlled from a remote point, leave the circuit breakers in ON position but, if possible, remove or disconnect the load at the using equipment.

b. Allow the unit to operate for a few minutes at no load and then place the START-STOP switch in STOP position.

c. Service the unit with fuel, coolant, and lubricants and, if it is not to be restarted immediately, cover it with the canvas cover provided.

Section III. OPERATION UNDER UNUSUAL CONDITIONS

27. Operation in Arctic Climates

To operate the set in subzero temperature, special precautions must be taken to prevent poor performance or total operational failure. The equipment can operate effectively under extreme cold conditions (to —65° F) only if the procedures listed below are followed carefully. If possible, install the unit in a properly ventilated, heated shelter.

a. Service and Maintenance.

(1) *Fuel system.* When freezing temperatures are expected, drain the fuel filters and fuel lines to remove any water that may have accumulated in the fuel system. Moisture, resulting from condensation, will accumulate in tanks, drums, and containers. At low temperatures, this condensation will form into ice crystals that will clog fuel lines and carburetor jets, unless the following precautions are taken:

(*a*) Be sure that all containers are thoroughly clean and free from rust before storing fuel in them.

(*b*) Keep all containers tightly closed to prevent snow, ice, dirt, and other foreign matter from entering.

(*c*) Add 2 to 3 ounces of denatured alcohol to each gallon of fuel.

(*d*) Inspect the fuel system for leaks and correct any that are found.

(*e*) Drain any water-alcohol precipitate from the fuel filter weekly or more frequently if necessary.

(2) *Lubrication.* For protracted low temperature operation (below —10° F), drain the oil filter, engine crankcase, and air cleaner and refill with Oil, Engine, Subzero (OES). Check the crankcase oil level every 4 hours. Drain the lubricating oil filter after every shut-down to prevent accumulated sludge from freezing. Drain the engine crankcase every third day of operation.

(3) *Cooling system.* If temperatures below freezing are anticipated, protect the cooling system with antifreeze. Drain the system and refill with a mixture of 50 per cent ethylene glycol noncorrosive antifreeze and 50 per cent clean water. If the temperature is expected to reach —30° F or lower, drain the system and refill with Compound Antifreeze, Arctic, (MIL-C-11755). Do not dilute the arctic-type antifreeze.

(4) *Batteries.* In arctic climates it is essential to keep the battery electrolyte at the proper level and the batteries fully charged. The danger of the electrolyte freezing depends on the full-charge specific gravity. The electrolyte will become mushy with ice crystals at —63° F with the specific gravity at 1.250 and at —18° with the specific gravity at 1.200. When the batteries are not in use, store them in a warm place.

b. Starting. To facilitate starting in subzero temperatures, the set is equipped with a winterization system which heats the coolant, engine oil, and intake manifold. To start the unit with the aid of the winterization system, remove the cap from the blower intake, and proceed as follows:

(1) Check the fuel supply and prime the fuel system as instructed in paragraph 16*a*.

(2) Disconnect the automatic choke rod. The automatic choke must be inoperative when starting in subzero temperature.

(3) Press in the heater circuit breaker (RESET) button.

(4) Check the electrical supply by pushing the heater OPERATING indicator lamp. If power is available, the lamp will glow.

(5) Hold the heater RUN-START switch in START position until the indicator lamp flashes on (approximately 2 to 4 minutes). This indicates that the heater has started.

(6) Move the RUN-START switch to RUN position.

Note. The sound of combustion may be heard before the indicator lamp flashes on; however, do not move the switch to the RUN position until the indicator lamp lights. If the lamp does not light within 5 minutes, move the RUN-START switch to off (center) position and consult the trouble-shooting chart (par. 50).

(7) Keep the heater on for approximately 20

to 30 minutes until the engine is sufficiently warm to start and operate smoothly.

(8) Start the set in accordance with instructions in paragraph 22. Pull out the manual CHOKE about ½ to ¾ of the way from its closed position. Prime the engine slowly with one stroke of the primer pump while the engine is being cranked. If the engine does not start within 15 to 20 seconds, stop cranking and wait for at least 5 minutes before repeating the starting procedure.

Caution: Fuel does not vaporize readily in sub-zero temperatures. Be careful not to overprime.

(9) To stop the heater, move the heater RUN-START switch to off (center) position. The indicator lamp will remain lighted until the heater has purged itself of fuel and will then go out automatically. Pull out the heater circuit breaker (RESET) button.

(10) Replace the cap on the blower intake.

c. Stopping. Refer to paragraph 26 and stop the set as instructed. Recheck the arctic service and maintenance instructions; use adequate precautions to protect the unit when not in use.

28. Operation in Desert Areas

Locate the equipment in an area protected from sand and dust. Inspect and clean the equipment more frequently than under normal operating conditions. Keep the unit covered when not in operation.

a. Fuel System. Be sure all fuel line connections are tight. Keep the fuel supply tank tightly closed to prevent the entrance of dirt and sand.

b. Lubrication. Keep all moving parts well cleaned and lubricated when the unit is being operated in desert areas. Always remove sand, dirt, and old lubricant from parts before relubrication. Check and change the engine oil often, depending on the severity of the climate, presence of excessive dust conditions, and frequency of operation.

c. Cooling System. Proper ventilation of the cooling system is of prime importance. Keep the system full of clean water, and keep the radiator cap tight.

d. Batteries. Check the level of the electrolyte in the batteries more frequently than under normal operating conditions. Keep the vent caps tightly in place.

e. Air Cleaner. Keep clean oil in the air cleaner to prevent dust from entering the engine. Clean the air cleaner and change the oil at frequent intervals, depending on the severity of the climate. Under these conditions, never operate the unit with the air cleaner dry.

29. Operation in Tropical Climates

When operating in hot, humid climates, the equipment must be provided with unobstructed ventilation. Locate the set so that it is protected from direct rays of the sun. Shorten the time between normal lubrication periods. Keep the cooling system full of clean water. If the set is to remain idle for long periods in humid areas, run it every few days for at least 1 hour to prevent the accumulation of moisture in the stator housing. In tropical climates, prepare the batteries as instructed in paragraph 17, with the following modifications: Batteries operating in tropical climates should use electrolyte of about 1.225 specific gravity when fully charged. This milder strength of acid is less deteriorating to separators and plates which results in longer battery life. The following chart lists the specific gravity values to be used in tropical climates for batteries in various states of charge. The values shown in the table are for electrolyte at the correct filling height and at 80° F.

State of charge	Specific gravity used in tropical climates
Fully charged.	1.225
75% charged.	1.180
50% charged.	1.135
25% charged.	1.090
Discharged.	1.045

30. Operation in High Altitudes

The set will operate at rated performance at elevations from sea level to 5,000 feet above with no major adjustments. At high altitudes, however, the engine is more apt to overheat than at sea level. It is important to keep the cooling system full and to provide adequate ventilation.

CHAPTER 4

ORGANIZATIONAL MAINTENANCE

Section I. ORGANIZATIONAL TOOLS

31. Tools

All tools required for organizational maintenance are supplied with Gasoline Engine Generator Set PU-107A/U. The tools are listed in paragraph 8*c* and are normally stored in the tool tray within the set.

32. Use of Tools

a. General. The proper use of tools is very important. Tools used improperly will result in damage to the tools or the equipment and may cause personal injury.

b. Wrenches. When tightening a nut, bolt, or cap screw, be sure to use the proper size wrench. A wrench that is worn or slightly oversize will round the nut, bolt, or cap screw, and may cause damage to the equipment or personal injury if it should slip. Never use pliers for tightening or loosening nuts or bolts. Use the correct size open-end, box, or socket wrench. When tightening cylinder-head nuts or bolts, use a tension wrench if one is available. Never use a piece of pipe or other means to increase the leverage of a wrench, as this will probably result in bending the wrench or stripping the threads of the fastening.

c. Screw Drivers. When tightening or loosening a fastening with a slotted head, use a screw driver with a blade that fits the head of the fastening. Do not use a wrench or pliers on the shaft of the screw driver to increase leverage. Be sure to keep the blade of the screw driver square in the slot of the fastening. Never use a screw driver as a pry bar or chisel.

33. Care of Tools

The condition in which a mechanic keeps his tools and equipment is a good indication of his ability. Do not abuse tools by using them for work for which they were not designed. Keep tools and equipment properly stored and protected at all times when not in use. After using a tool, clean it and replace it in its proper place in the tool box. Keep all tools free from rust and protected from moisture. Keep the tool box clean and free from rust and dampness.

Section II. LUBRICATION AND PRESERVATION

34. Lubricants

The following table lists the lubricants, solvents, and preservative materials approved for use with Gasoline Engine Generator Set PU-107A/U.

Symbol	Nomenclature	Specification	Application
OE	Oil, Engine, Heavy Duty	MIL-O-2104 (ORD)	Engine crankcase, air cleaner.
OES	Oil, Engine, Subzero	MIL-O-10295 (ORD)	Engine crankcase.
GL	Grease, Aircraft and Instruments (for low and high temperatures.)	MIL-G-3278	Carburetor-to-governor linkage bearings, primer pump, throttle, manual choke.
SD	Solvent, Dry Cleaning	Federal P-S-661a	Cleaning
D-40 or D-35	Fuel Oil, Diesel	MIL-F-896	Cleaning.
GAA	Grease, Automotive and Artillery	MIL-G-10924 (ORD)	Battery cables and terminals.

35. Lubrication Periods

Lubrication instructions frequently are given in periods of days, weeks, months, half-years, and years. A daily period of operation consists of any continuous 8-hour period or any number of consecutive periods of operation that total 8 hours. A weekly period of operation is any number of consecutive operating periods that total 50 hours. A monthly period of operation is any number of consecutive operating periods that total 250 hours. A half-yearly period of operation is any number of consecutive operating periods that total 1,000 hours. A yearly period of operation is any number of consecutive operating periods that total 2,000 hours.

36. Factory-lubricated Parts

a. Alternator Bearing. The alternator bearing is packed, at the factory, with grease conforming to specification MIL-G-3278. The bearing is a double-seal Fafnir Plya-Seal type. The Plya-Seal is a diaphragm-type contact seal, composed of two members, a flat, flexible sealing washer of synthetic rubber-impregnated fabric and a split retaining ring of thin spring steel. The two members of the seal can readily be removed for inspection, cleaning, and lubrication. At the time of disassembly and overhaul of the alternator, remove the bearing seals and, if necessary, add new grease (GL). If there is evidence of dirt or grit in the bearing, remove both seals and thoroughly flush the old grease from the bearing with hot oil.

b. Water Pump Bearing. The water pump has a factory-sealed, prelubricated bearing, and lubrication is not required except during overhaul.

c. Heater Blower Motor. The bearings of the heater blower motor are factory-lubricated and additional lubrication is not necessary.

d. Starting Motor. The starting motor bearings are factory-lubricated. No further lubrication is necessary.

e. Dc 28-volt Generator. All bearings in the dc generator are of the same type used in the alternator. Follow the instructions in subparagraph *a* above.

f. 24-volt Battery-charging Generator. The 24-volt battery-charging generator bearings are factory lubricated. No further lubrication is necessary.

37. Lubrication Requiring Disassembly

Lubrication operations that require disassembly of parts or assemblies are explained in subparagraphs *a* and *b* below and the detailed lubrication and cleaning information is supplementary to the instructions in the lubrication chart (fig. 17).

a. Air cleaner (fig. 14). To check the quantity of oil in the air cleaner, disassemble the bowl from the body by loosening the spring clips, and see that oil is up to the caution level. Add oil as necessary. Reassemble the bowl to the body; be sure the clips are secure.

b. Manuel Choke (28, fig. 2). To lubricate the manual choke control, disassemble the control, and wash all parts in solvent (SD). Apply grease (GL) to the control wire and reassemble the control.

38. Routine Lubrication

a. Lubrication Orders. Each power unit is provided with an official lubrication order or a lubrication chart. Official lubrication orders are illustrated, numbered or dated cards, or decalcomania labels that prescribe approved lubrication instructions for mechanical equipment which requires lubrication by using organizations. Current lubrication orders

should be requisitioned in conformance with instructions and lists in Dept. of the Army Pamphlet No. 310-4 Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders. Instructions contained in lubrication orders are mandatory and supersede all conflicting lubrication instructions of an earlier date.

b. Lubrication Instructions. Subparagraphs (1) through (10) below contain detailed lubrication and cleaning information and are supplementary to the instructions in the lubrication chart (fig. 17).

(1) *Engine crankcase.* Check the crankcase oil level daily (after 8 operating hours) and add oil (OE) if necessary. Change the engine oil weekly (after 50 operating hours). Drain the oil by opening the drain cock located on the left side of the engine oil pan. (Drain oil while engine is warm.) Refill the crankcase with 4½ quarts of oil (OE), in accordance with the lubrication chart (fig. 17).

(2) *Air Cleaner* (fig. 14). Check the quantity of oil in the air cleaner bowl weekly (after 50 operating hours). If the oil is below the caution level, add oil (OE) up to the normal level of the bowl. At monthly. intervals (after 250 operating hours), remove the air cleaner element and wash it in solvent (SD). At the same time, clean the air cleaner bowl and refill with engine oil (OE). To remove the element, remove the bowl and unscrew the wing screw located on the bottom of the element housing. Then pull the element out of the housing. (The wing screw does not come out of the element.)

(3) *Oil filter* (fig. 15). Clean the oil filter element at least once every day (after 8 operating hours) by rotating the external handle 1 complete turn in either direction. Remove the plug in the filter bowl and drain the sludge from the filter with each crankcase oil change (after 50 operating hours). If the handle becomes difficult to rotate, remove the element from the housing and wash it in solvent (SD). Clean the bowl and replace the bowl gasket. If the element disks or blades are damaged, replace the body and element assembly.

(4) *Fuel filter* (fig. 16). After each day of operation (8 operating hours), open the fuel filter drain to remove any accumulated dirt and water. This is particularly important when operating in damp or cold climates. At least once each month, after 250 operating hours, remove the filter element and wash it in fuel oil (D-40 or D-35) or solvent (SD). Be careful not to damage the element disks. Worn gaskets must be replaced.

(5) *Fuel pump* (fig. 25). To avoid difficulties created by water and other foreign matter, refer to paragraph 56*d*(1)(*a*) and remove the cover cap plate (6), gasket (5), and screen (4). Clean parts thoroughly with solvent (SD) at least twice a year (after

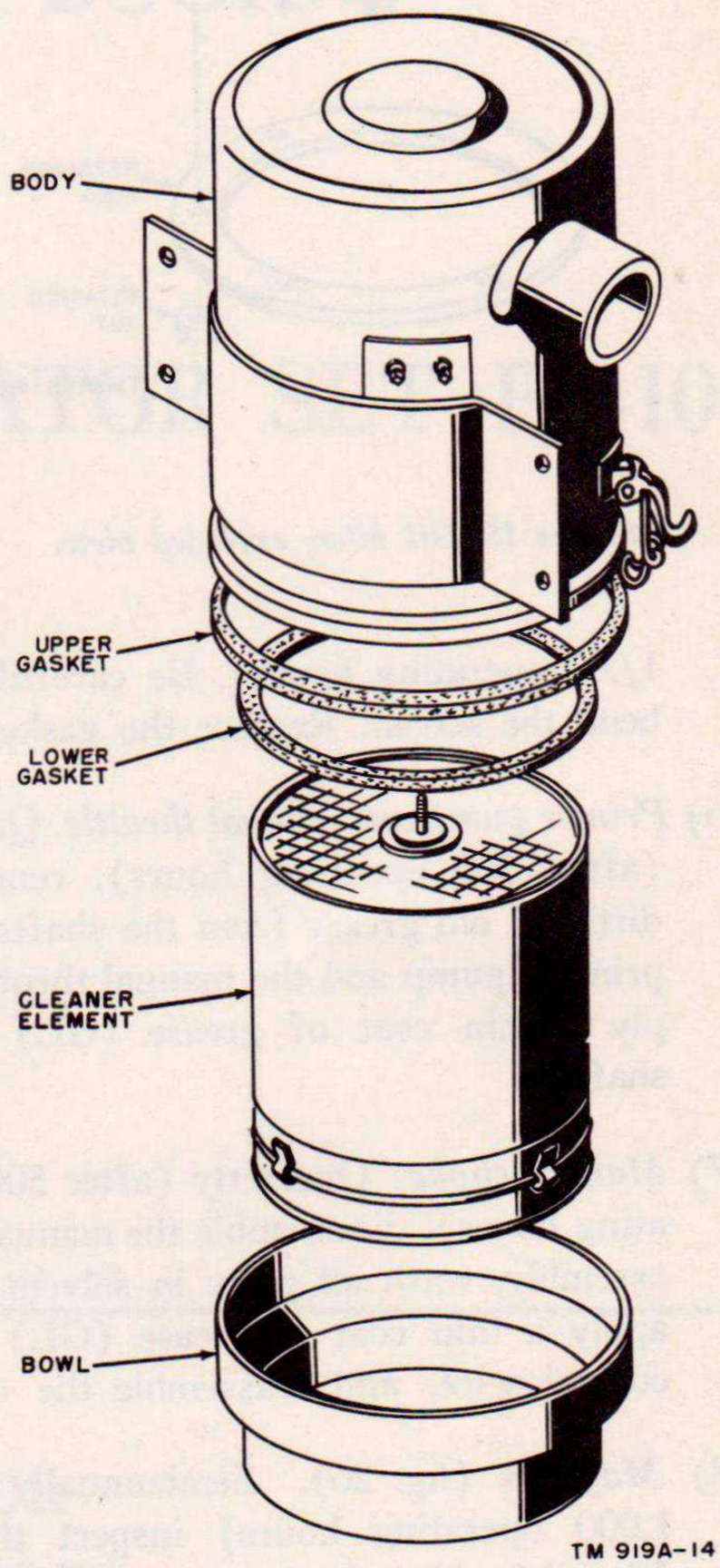


Figure 14. Air cleaner, exploded view.

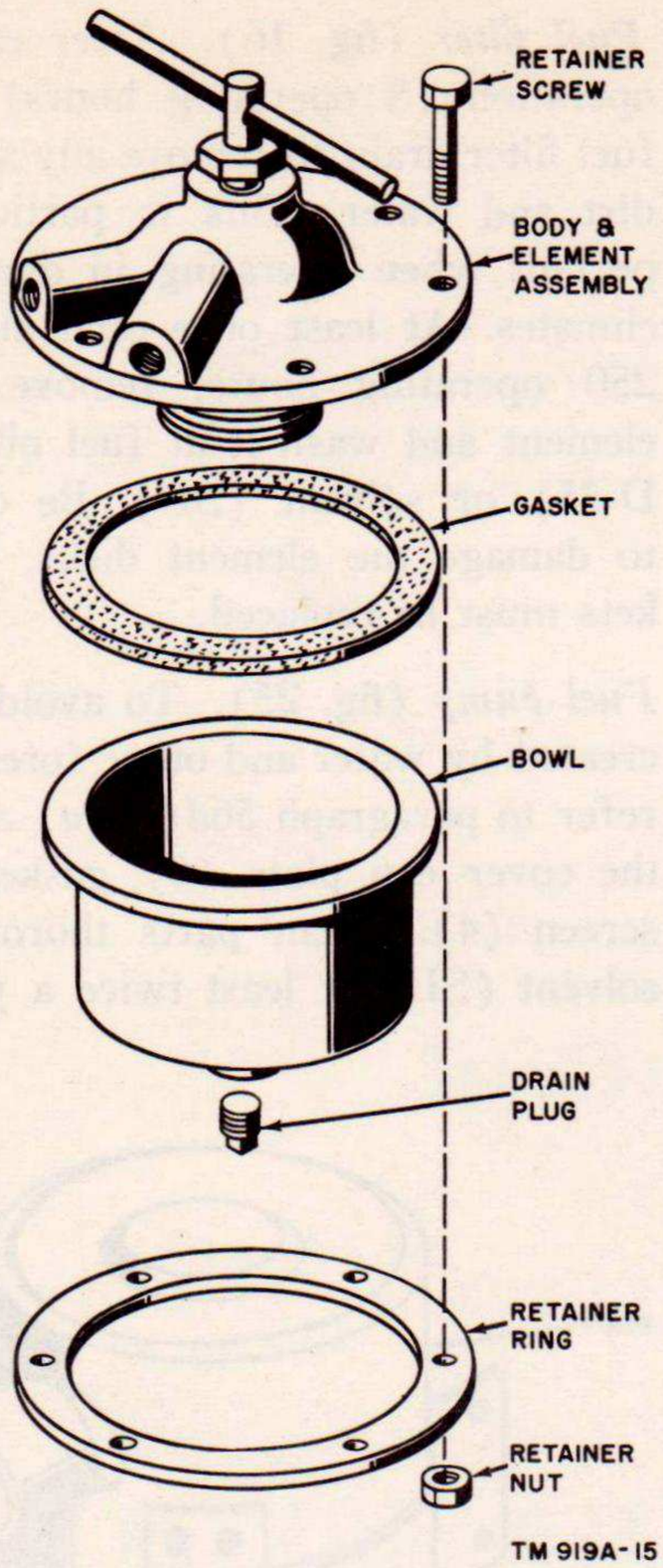


Figure 15. Oil filter, exploded view.

1,000 operating hours). Be careful not to bend the screen. Replace the gasket (5).

(6) *Primer pump and manual throttle.* Quarterly (after 500 operating hours), remove all dirt and old grease from the shafts of the priming pump and the manual throttle. Apply a thin coat of grease (GL) to the shafts.

(7) *Manual choke.* Quarterly (after 500 operating hours), disassemble the manual choke assembly, wash all parts in solvent (SD), apply a thin coat of grease (GL) to the control wire, and reassemble the control.

(8) *Magneto* (fig. 26). Semiannually (after 1,000 operating hours) inspect the cam felt wick. If it is dry or hard; replace it with a new factory-impregnated wick. The magneto is factory-lubricated and will require no further lubrication except during overhaul.

(9) *Heater fuel pump* (fig. 35). When operating the heater every day, remove and clean the heater fuel pump strainer and cover daily (after 8 equipment operating hours) with solvent (SD) or fuel oil (D-40 or D-35). Apply air pressure to remove any foreign particles that may have accumulated in the small magnetic separator chamber in the center of the fuel pump cover. If the heater is in frequent operation, clean the fuel pump subassembly twice a year (after 1,000 equipment operating hours) with solvent (SD) or fuel oil (D-40 or D-35). To remove the strainer and subassembly follow the instructions in paragraph 56*l*.

(10) *Engine speed governor.* The engine speed governor is factory-lubricated and the drive gear is lubricated by engine oil during operation. No lubrication is necessary at overhaul.

39. Weatherproofing

a. General. Signal Corps equipment, when operated under severe climatic conditions, requires special treatment and maintenance. Fungus growth, insects, dust, corrosion, salt spray, excessive moisture, and extreme temperatures are harmful to most materials.

b. Tropical Maintenance. A special moisture-proofing and fungiproofing treatment has been devised, which, if properly applied, provides a reasonable degree of protection. This treatment is fully explained in TB SIG 13 and TB SIG 72, Moisture-proofing and Fungiproofing Signal Corps Equipment, and Tropical Maintenance of Ground Signal Equipment, respectively.

c. Lubrication. The effects of extreme cold and heat on materials and lubricants are explained in TB SIG 69, Lubrication of Ground Signal Equipment. Observe all precautions outlined in TB SIG 69 and pay strict attention to all lubrication orders when operating equipment under conditions of extreme cold or heat.

40. Rustproofing

Whenever the equipment is to be placed in storage or is to be out of service for a period of 30 days or more, precautions must be taken to guard against

ADDITIONAL INFORMATION TO INSTRUCTION BOOK
FOR
GASOLINE ENGINE GENERATOR SET PU-107A-U

REFERENCE: Engine Speed Governor - Page 28 Item (10)

A restricted adapter has been added to the hose assembly from filter to governor at the filter end so that appropriate oil pressure registers on oil gage and sufficient flow of oil to governor is maintained.

rust and against the formation of gum in the fuel system. Process the equipment as follows:

a. Materials Required. Requisition the materials below through regular channels and proceed with the rustproofing and gumproofing treatment immediately after shutting down the unit. Rustproofing must be done while the engine is still warm.

(1) Fuel Oil, Diesel (D-40 or D-35), Specification MIL-F-896.

(2) Oil, Engine, Heavy Duty (OE), Specification MIL-O-2104 (ORD).

(3) Oil, Lubricating, Preservative, Special (PL Special), Specification MIL-L-644A.

(4) Compound, Insulation, Ignition, Ordnance Specification 3-182.

(5) Compound, Gum Preventive, Federal stock No. 51-C1586-225.

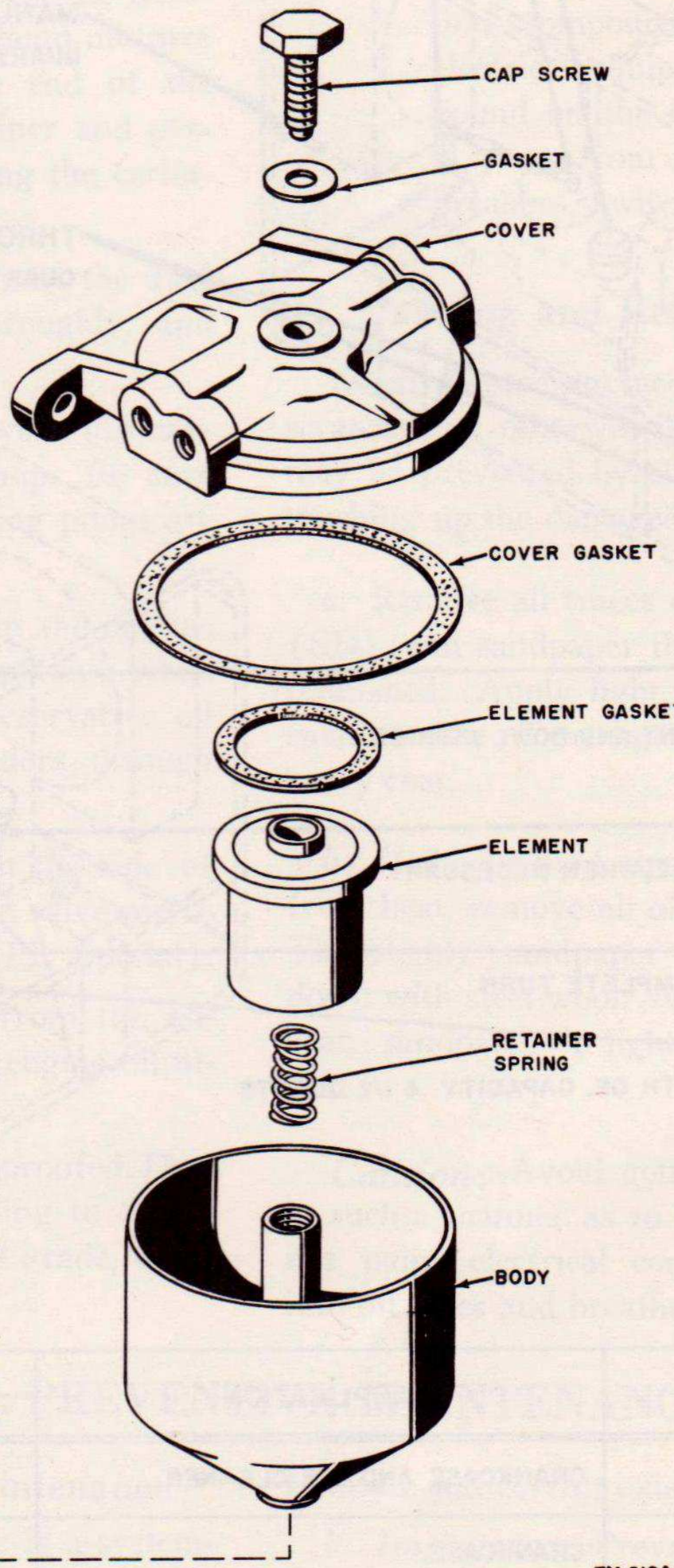
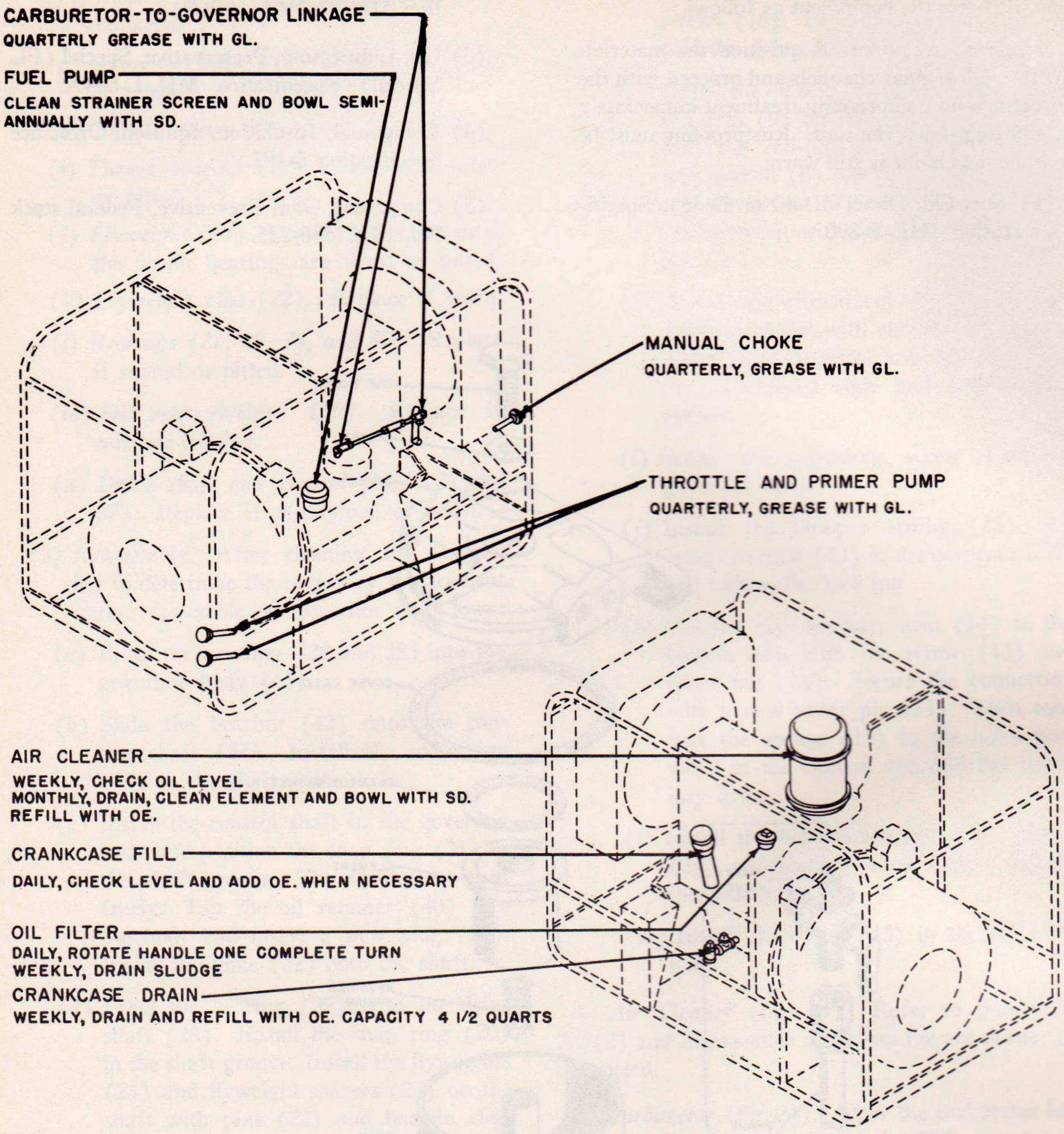


Figure 16. Fuel filter, exploded view.



LUBRICANT	APPLICATION	TEMPERATURE	
		ABOVE +32°F	+32°F TO-10°F
OE - OIL, ENGINE	CRANKCASE AND AIR CLEANER	OE 30	OE 10
OES - OIL ENGINE, SUB ZERO	CRANKCASE	BELOW-10°F	
GL- GREASE, AIRCRAFT AND INSTRUMENTS	MANUAL CHOKE, THROTTLE, PRIMER AND CARBURETOR-TO-GOVERNOR LINKAGE	ALL TEMPERATURES	

TM 919A-17

Figure 17. Lubrication chart.

(6) Tape, nonhygroscopic, adhesive, Ordnance Specification AXS-871.

b. Procedure.

(1) Drain the lubricating system and fill the engine oil reservoir with preservative oil (PL Special).

(2) Connect the fuel line to a container of 5 gallons of gasoline to which one-quarter of a container of gum preventive compound has been added.

(3) Start the unit and operate it on the gasoline and gum preventive compound mixture for 5 minutes. Lift the free end of the fuel line from the fuel container and permit the unit to stop by pumping the carburetor and fuel system dry.

(4) Remove the sediment bowl from the fuel pump assembly, clean it thoroughly, and replace it on the unit.

(5) Disconnect the fuel line between the carburetor and the priming pump. Be sure that the carburetor and priming pump are drained completely.

(6) Remove the spark plugs from the engine. Have someone crank the engine and, while it is being cranked, spray preservative oil (PL Special) into the cylinders through the spark plug holes.

(7) Remove the valve cover from the side of the engine block and spray the valve mechanism with preservative oil (PL Special).

(8) Drain the preservative oil from the engine. Attach a red tag to the engine oil filler which reads as follows:

Caution: This engine has been rustproofed. Date . . . . Use engine oil (OE) conforming to Specification MIL-O-2104 (ORD), seasonal grade, when placing the unit back in service.

(9) After the engine has cooled, remove all grease, oil, and dirt from the exterior of the unit. Use solvent (SD) for this purpose. Remove all traces of rust and touch up all painted surfaces which have become damaged.

(10) Seal all breathers and breather holes, air intakes, and the exhaust outlet with nonhygroscopic tape.

(11) Be sure that all surfaces are dry, and spray all unpainted surfaces with insulation compound. Include all wiring and electrical equipment. Do not get this compound on the interior of generators; keep it away from such components as circuit breakers, switches, etc.

41. Painting and Refinishing

When painted surfaces of the equipment become scratched or otherwise damaged, rust and corrosion may be prevented by cleaning thoroughly and then touching up the damaged surfaces.

a. Remove all traces of oil or grease with solvent (SD), and sandpaper thoroughly the portions to be refinished. Apply light, even coats of paint with a small brush. Two light coats are better than one heavy coat.

b. If the painted surfaces have become blistered from heat, remove all old paint with paint remover. Thoroughly sandpaper the surfaces or rub them down with steel wool. Apply a smooth, even priming coat, sandpaper it lightly, and then apply a finish coat.

Caution: Avoid getting paint into moving parts in such a manner as to hinder their movement. Do not paint electrical contacts; avoid getting paint into oil holes and breather holes.

Section III. PREVENTIVE MAINTENANCE

42. Definition of Preventive Maintenance

a. Purpose. Preventive maintenance is a systematic series of operations performed periodically to keep equipment operating at top efficiency. The primary purpose of preventive maintenance is to prevent major break-downs and the consequent need for repair. The primary function of troubleshooting is to locate and correct existing defects.

b. Importance. Preventive maintenance is of utmost importance since the failure or inefficient operation of one piece of equipment may cause the failure of an entire system. It is necessary to inspect the equipment systematically each day that it is operated and at weekly intervals, so that defects may be

discovered and corrected before they result in serious damage or failure.

c. Responsibility. Preventive maintenance services are the responsibility of operating organizations. They comprise the scheduled maintenance services performed by the equipment operator and maintenance personnel, respectively. Ordinarily, the operator will replenish fuel and lubricants. He will perform necessary cleaning operations, tighten loose nuts, bolts, screws, and other fastenings, care for tools and accessories, and make such emergency repairs as are within the scope of his ability, tool equipment, and parts available. He will perform all daily lubrication operations, before operation, at halt (during shut-down periods), and after operation. Maintenance personnel will perform the weekly and monthly maintenance operations with the assistance of the unit operator. Any maintenance operations beyond the scope of maintenance personnel will be reported to the officer in charge.

43. Daily Maintenance Services

For purposes of the following instructions, a daily maintenance period is defined as being 8 hours of operation. Daily services will be performed in accordance with DA Form 11-260 (fig. 68) and in the specified sequence.

a. Before Operation. Before operating the set, perform the following services:

(1) See that the auxiliary fuel hose is connected properly (par. 12*c*) and that the available fuel supply is adequate.

(2) Check the exhaust extension tube for correct installation (par. 12*b*).

(3) Be sure the cooling system and lubrication system are full. Check the oil level in the air cleaner.

(4) Examine all instruments and controls on the panel for damage and loose electrical connections.

(5) Check the fan belt, battery-charging generator belt, and dc generator belt for proper tension.

(6) If the set is to be started other than remotely, be sure the circuit breakers are in the OFF position. If the set is to be started remotely, the circuit breakers should be in the ON position. The load switch on the using equipment should be off until the engine generator has reached operating temperature.

(7) Check the wye-delta change board for proper setting for the desired output (par. 14*a*). See that all output connections are correct and well secured.

(8) Check all fuel, coolant, lubrication, and exhaust connections for evidence of leakage.

(9) Examine the surrounding area for foreign matter and obstructions that may damage the equipment.

(10) If the equipment is to be operated in an inclosure, be sure it is properly ventilated.

b. During Operation. After the engine has been started (par. 22) and warmed, perform the following services:

(1) Check the engine instruments for any abnormal indications (par. 20) before applying any load.

(2) After the load has been applied, check all the instruments (par. 20) to be sure the indicated values are within the rated range of the equipment. Check the instrument readings frequently during operation.

(3) Check the fuel supply periodically to prevent running out of fuel.

(4) Always be alert for any evidence of abnormal operation and for unusual noises or conditions.

c. At-halt. Disconnect the load by placing the circuit breakers in the OFF position; then stop the set (par. 26), and proceed as follows:

(1) Check the fuel supply, coolant level, and oil level. Replenish as required.

Caution: If it is necessary to add coolant to a hot engine, first, restart the engine and set the manual throttle at slow or near idling speed (under no load). *Add the coolant slowly.* After the coolant has been added and the engine has run for about 1 or 2 minutes and is somewhat cooler, stop the engine.

(2) Inspect all fuel, oil, and coolant fittings, gaskets, and connections for evidence of leakage.

(3) Inspect the condition of the wiring and check all electrical connections.

(4) Check the entire equipment to be sure it is in proper operational order.

d. After Operation. Perform the services as instructed in subparagraph *c* above. Then proceed as follows:

(1) Wipe the set clean as required.

(2) Perform the daily lubrication services as instructed in paragraph 38*b* and as indicated on the lubrication chart (fig. 17).

(3) Add water to the batteries, if necessary.

(4) Correct or report any troubles developed during the operation.

(5) Clean all tools and stow them properly.

(6) Perform any function necessary to prepare the set for the next operation.

44. Weekly Maintenance Services

For purposes of the following instructions, a weekly maintenance period is defined as being 50 operating hours. Perform all daily maintenance and lubrication services as instructed in pargaraph 43 and in the lubrication chart (fig. 17). Perform all other weekly services as specified in the W (weekly) column in paragraph 48. Make a record of the services actually performed and repairs or additional services required.

45. Monthly Maintenance Services

For purposes of the following instructions, a monthly maintenance period is defined as being 250 operating hours. Perform all daily and weekly maintenance and lubrication services as instructed in paragraphs 43 and 44 and in the lubrication chart (fig. 17). Perform all the other monthly services as specified in the M (monthly) column in paragraph 48. Make a record of the services actually performed and repairs or additional services required.

46. Semiannual Maintenance Services

For the purposes of the following instructions, a semiannual maintenance period is defined as being 1,000 operating hours. Perform all daily, weekly, and monthly maintenance and lubrication services as instructed in paragraphs 43, 44, and 45 and in the lubrication chart (fig. 17). Perform all other semiannual services specified in paragraph 48. Make a record of the services actually performed and repairs or additional services required.

47. Annual Maintenance Services

For purposes of the following instructions, an annual maintenance period is defined as being 2,000 operating hours. Perform all daily, weekly, monthly and semiannual maintenance and lubrication services as instructed in paragraphs 43, 44, 45, and 46 and in the lubrication chart (fig. 17). Perform all other annual services as specified in paragraph 48. Make a record of the services actually performed and repairs or additional services required.

48. Preventive Maintenance Procedures

Perform the following maintenance services at the intervals indicated in the frequency columns of the following subparagraphs. Report all unsatisfactory conditions to the officer in charge.

a. General.

Item No.	Item	Frequency M	Frequency W	Action
1	Before-operation services.	*	*	Perform all before-operation services as instructed in paragraph 43*a*.
2	Lubrication.	*	*	Lubricate the set as instructed in paragraph 38*b* and in accordance with the lubrication chart (fig. 17).
3	Tools and equipment.	*	*	See that all tools, spare parts, and equipment are present by checking with the packing list on the set or the tables in paragraph 8. Examine the condition of the tools and clean them and the tool trays thoroughly. Stow the tools properly.
4	Fire extinguishers.	*	*	Inspect the condition of the fire extinguisher. See that it is fully charged.

a. General (cont).

Item No.	Item	Frequency M	Frequency W	Action
5	Publications.	*	*	An adequate supply of DA Forms 11-260 and 11-261 should be available. The manual for the equipment and other required publications should be present and in legible condition.
6	Appearance.	*	*	Examine the entire set for damage to the finish. Remove all traces of rust and dirt. If necessary, refer to paragraph 41 and refinish as instructed.
7	Modifications.	*	*	See that all modification work orders and other directives have been completed.
8	Noise and vibration.	*	*	While operating the set, with or without load, be alert for any unusual noises which may indicate trouble. Also, be aware of any excessive vibrations which may indicate loose or damaged parts or inadequate lubrication.
9	Housing.	*	*	Inspect the canvas cover supplied with the generator set for general condition and cleanliness. Install the canvas cover whenever the set is not operated for any appreciable period of time.

b. Engine and Accessories.

Item No.	Item	Frequency M	Frequency W	Action
10	Cylinder head, manifold, and gaskets.	*	*	Check the cylinder head and exhaust manifold for cracks. Examine for coolant, oil, and compression leaks around the cylinder head gasket and stud nuts. See that the manifold nuts are secure. Check the cylinder-head stud nuts for tightness. Use a torque wrench and tighten each nut to a tension of 70-75 foot-pounds in sequence shown in figure 60.
11	Valve mechanism.	*		Remove the valve cover and examine the valve mechanism as follows: Remove the two hexagonal-head valve cover retaining bolts and remove the valve cover by moving it away from the cylinder block and then downward behind the carburetor. Have some clean rags ready to catch or wipe up the small amount of oil that will come out of the valve spring chamber. See that the valve tappets and springs are in good condition and that they are well lubricated. Check all valve clearances. Both intake and exhaust clearances should be .014 inch (engine hot). If the valve check shows the clearances to be too close or too wide, adjust the valves in accordance with instructions in paragraph 64*c*. When replacing the valve cover, replace the gasket also, and be sure the fit is oil tight.
12	Compression test.	*		Before testing the engine for compression, allow the set to run until normal operating temperature is reached. Remove all the spark plugs and hold a compression gage firmly in the spark plug hole of No. 1 cylinder. Push in the manual choke and throttle all the way. Crank the engine with the starting motor until the maximum compression reading is shown on the compression gage. Perform the test on the remaining three cylinders. The standard compression for each cylinder is 105 psi. Satisfactory engine performance cannot be expected if the compression is below 95 psi, or if the reading varies more than 10 pounds between the cylinders. Refer to the trouble chart (par. 50) to determine the cause and remedy for low or variant engine compression.
13	Crankcase, Breathers.	*	*	With the engine running at idle speed, check the oil pan, gear cover, and valve spring cover for oil leaks. Change oil as instructed in paragraph 38*b*(1) and in the lubrication chart (fig. 17). Semiannually, clean the crankcase breather tube, which is attached to the valve cover, in solvent (SD). Also clean all carbon and sludge from the valve chamber.

b. Engine and Accessories (cont).

Item No.	Item	Frequency M	Frequency W	Action
14	Oil filters.	*	*	Examine the oil filter, oil lines, and connections for evidence of leakage. Drain the filter whenever the crankcase oil is changed (par. 38*b*(3)).
15	Radiator.	*		Inspect the radiator core and hoses for evidence of leakage. See that the hoses are in good condition and are tight. Be sure the radiator is mounted securely. Check the air passages in the core for such obstructions as dirt, insects, and any other foreign matter. Remove the obstructions in the core with a stream of compressed air. Examine the coolant for rust or other foreign matter. Test the antifreeze and note the lowest temperature to which the set is protected. If the coolant is badly contaminated, clean the system in accordance with current directives.
16	Water pump, fan, shroud.	*	*	Inspect the water pump for evidence of leakage. Tighten the pump mounting bolts. Check the fan blades for nicks and for other signs of damage. Tighten the bolts securing the fan to the pulley.
17	Belts and pulleys.	*	*	See that the drive pulleys are in good condition and are mounted securely. Examine the three drive belts for evidence of deterioration, wear, or fraying. Adjust the 2.5-kw generator belt for about ¾-inch deflection. Adjust the fan belt for about ½-inch deflection. Adjust the 24-volt battery-charging generator drive belt for about ¾-inch deflection.
18	Oil pump, pressure-relief valve.	*		The oil pump will usually require no attention except during major overhaul of the engine (ch 4). During normal operation the oil pressure should be 20 to 30 psi. The oil-pressure relief valve, mounted on the right side of the cylinder block, requires little or no attention. However, if it becomes necessary to adjust the pressure by means of the relief valve, follow the instructions in paragraph 25*b*(6).
19	Governor and linkage.	*		Examine the engine speed governor-to-throttle linkage for any evidence of binding and for wear. See that the linkage is secured properly and operating freely. Once a year (after 2,000 operating hours), disassemble, clean, and inspect the governor as instructed in paragraph 56*a*.
20	Vacuum test.	*		Remove the ⅜-inch pipe plug (1, fig. 13) located directly above the carburetor on the intake manifold, install a ⅜-inch to ⅛-inch pipe reducing bushing, and connect a vacuum gage to the manifold. Be sure the connection is tight. Start the engine and allow it to run until normal operating temperature is reached. With the set running at load speed at an altitude between sea level and 2,000 feet, the vacuum gage should indicate not less than 16 inches of mercury at no load. At higher altitudes, deduct 1 inch of vacuum for each 1,000 feet of increase in altitude. Refer to the trouble-shooting chart (par. 50) to determine the cause and remedy for abnormal vacuum indications.

c. Fuel System.

Item No.	Item	Frequency M	Frequency W	Action
21	Fuel pump.	*		See that all connections on the engine fuel pump are tight. Note any evidence of leakage. Clean the filter bowl and screen as instructed in paragraph 38*b*(5) and in the lubrication chart (fig. 17).
22	Carburetor and linkage.	*	*	Examine the carburetor throttle housing gasket, bowl cover gasket, fuel inlet line and all jets for evidence of leakage. See that the carburetor is mounted securely. Check all the linkage for free operation.

c. Fuel System (cont).

Item No.	Item	Frequency M	Frequency W	Action
23	Filters.	*	*	Check the fuel filter and fittings for evidence of leakage. Clean the filter element as instructed in paragraph 38*b*(4) and in the lubrication chart (fig. 17).
24	Air cleaner.	*	*	See that the air cleaner hoses are well-secured and in good condition. Clean and service the air cleaner as instructed in paragraph 38*b*(2) and in the lubrication chart (fig. 17).
25	Fuel lines.	*	*	Carefully examine all fuel lines and fittings for evidence of leakage and damage. See that all connections are tight.

d. Electric System.

Item No.	Item	Frequency M	Frequency W	Action
26	Spark plugs.	*		Check for leakage around the spark plug gaskets. Remove the spark plugs and examine for cracked insulation, excessive carbon deposits, and electrode erosion. If necessary, clean off carbon deposits by applying an abrasive to the plugs for not more than 3 seconds. (Prolonged use of abrasive will wear away the insulator and electrodes.) Use an air blast to remove loose particles of abrasive. Examine the spark plug again for cracked insulator. If no spark plug cleaner is available, install new or reconditioned plugs. Measure the spark plug gap and adjust to .025 inch.
27	Batteries.	*	*	Examine the batteries for cracks and for evidence of leakage. Clean corrosion off the battery terminal posts and cable terminals and lubricate with a light coat of grease (GAR). Make sure the cable terminals are well secured and are making a good contact with the battery posts. Check the level of the electrolyte. The level should be ½-inch above the separators. If the electrolyte is below this level, add distilled water. Test the voltage of each cell. Each cell should measure 2 volts. Refer to paragraph 17 and test the specific gravity of each cell as instructed.
28	Starter.	*		See that the starting motor is mounted securely and that all cable connections are clean and tight. Check the brushes for free movement in the holders. Examine the brushes for wear and replace them if they are worn to ½ inch in length. To replace the brushes, first remove the starter and the commutator end plate. Remove the old brushes by disconnecting the brush screws on the brush wire terminals and pulling them out of the brush holders. Connect the new brushes and slip them into the holders. Replace the end plate. Refer to paragraph 56*j*(2)(*a*) and seat-in the brushes as instructed. Check the brush spring tension with a spring scale as instructed in paragraph 56*j*(2)(*a*). If the brushes have been arcing, as evidenced by a dirty commutator, clean the commutator with fine sandpaper (#0000). Blow out the sand with compressed air and seat-in the brushes. If the commutator is dirty or worn to the extent that sandpaper will not clean it, refer to paragraph 56*j* (2)(*b*) and turn it down in a lathe as instructed.

d. Electric System (cont).

Item No.	Item	Frequency M	Frequency W	Action
29	Magneto.	*		Remove the magneto end cap; be careful not to damage the lead gasket. Remove the distributor rotor and clean the distributor compartment thoroughly, observing whether the air vents are open or clogged. *Air vents must be free of all dirt and foreign matter.* Examine the high-tension lead brush and replace it if it is noticeably worn or damaged. This brush should move freely in its holder and should be under light spring pressure. Inspect the breaker points for pitting or pyramiding. If pitted or pointed, resurface the points with a small tungsten file or fine stone. If the points are badly pitted, replace them. Refer to paragraph 56*g* when resurfacing or replacing breaker points and proceed as instructed. Inspect the cam felt wick and replace it if it is hard or dry.
30	Wiring, switches.	*		See that all wiring and cables are in good condition and are mounted properly. Examine for poor connections and worn insulation. Check all switches for correct connections and mountings and for proper operation.
31	High temperature cutoff switch.			Check the accuracy of the cutoff switch as follows: Insert a thermometer in the upper tank of the radiator. Set the dial of the cutoff switch at 220° F. Cover the radiator and start the engine. When the temperature exceeds 180° F, slowly move the dial counterclockwise until the engine shuts off. The reading on the dial should coincide with the thermometer reading. If the readings differ, adjustment is necessary. Adjust the cutoff switch as follows: Loosen the two screws in the dial; be careful not to disturb the dial setting. With the screws loose, break the seal on the dial scale and set the scale to correspond with the thermometer reading just taken. Tighten the screws and reset. *Caution.* The factory setting of the dial scale is sealed with compound on both the scale and the central disk of the dial. Do not break this seal except during adjustment. After adjustment has been made, set the dial at 200° F.
32	Low-oil-pressure cutoff switch.			Test the accuracy of the cutoff switch as follows: Remove the switch from the engine. With a pressure regulating valve, pressure gage, and a continuity tester, check the pressure at which the switch opens. If the pressure is above or below 5 psi (± 1 pound), replace the switch.

e. Generators.

Item No.	Item	Frequency M	Frequency W	Action
33	Dc generator.	*		See that the dc generator is mounted securely and that all cable connections are clean and tight. To examine the brush rigging, loosen the mounting bolts and adjusting bolts and remove the drive belt. Then swing the generator outboard for easy access. Remove the commutator end cover. Check the brushes for free movement in the holders. Test the brush spring pressure. It must be between ½ and ¾ pound when deflected ½ inch. Examine the brushes for wear and replace them if they are worn to ⅜ inch in length. Refer to paragraph 56*h* and seat-in the brushes as instructed. Blow out the brush dust from the brush rigging, armature assembly, and field ring assembly with dry, compressed air. If the brushes have been arcing, as evidenced by a dirty commutator, clean with fine sandpaper (#0000). Blow out the sand with compressed air and seat-in the brushes. If the commutator is dirty or worn to the extent that the sandpaper will not clean it, refer to paragraph 56*h* and turn it down on a lathe as instructed.

e. Generators (cont).

Item No.	Item	Frequency M	Frequency W	Action
34	Alternator.	*		The alternator is of the permanent-magnet type and has no commutator, brushes, etc. Examine the bearing and bearing liner of the alternator for evidence of overheating. Blow dirt and dust out of the alternator with dry, compressed air.
35	Battery-charging generator.	*		See that the 24-volt battery-charging generator is mounted securely and that all cable connections are clean and tight. To examine the brush rigging, remove the cover band on the commutator end of the generator. Examine the brushes for wear and replace if worn to 5/8 inch in length. Refer to paragraph 56*h* and seat-in the brushes as instructed. If the brushes have been arcing, as evidenced by a dirty commutator, clean with fine sandpaper (#0000). Blow out the sand with dry, compressed air. If the commutator is dirty or worn to the extent that sandpaper will not clean clean it, refer to paragraph 56*h* and turn it down in a lathe as instructed.
36	Circuit breakers.	*		See that the dc and ac circuit breakers are secured tightly to the instrument panel. Examine the condition of all connections.
37	Voltage regulator.	*		See that the dc voltage regulator is mounted securely and that all cable connections are clean and tight. Remove dust and dirt particles from the regulator with dry, compressed air. Wipe off any accumulation of grease.
38	Compensator assembly.	*		Examine the condition of the transformers. Check for damaged insulation and bare wires. See that the transformer is mounted securely. Check all transformer connections; be sure they are clean and tight. Remove dust and dirt from the transformer-to-capacitor network with dry, compressed air.
39	Wye-delta change board.	*		See that all the cable connections on the change board are clean and tight. Check for short circuits.
40	Drive couplings.	*		Inspect area of alternator housing and flywheel housing and be sure there are no loose particles or foreign matter in the ventilation openings.

f. Winterization System.

Item No.	Item	Frequency M	Frequency W	Action
41	Tubes and hoses.	*		Examine the condition of all metal tubes and hoses. See that all connections are tight. Check the condition of all the wiring for worn insulation and loose connections. Examine the heater controls for proper mounting. Operate the winterization system at least once a month.
42	Heater.			Examine the combustion area and exhaust passages by removing the burner assembly (par. 56*k*). Inspect the primary air holes in the top section of the burner. If the holes are plugged, clean them with a piece of wire. Examine the heat exchanger and exhaust outlet with a flashlight and an inspection mirror. If uniform carbon deposits on surfaces visible with the mirror exceed 1/8 inch in thickness, clean all tubing and heat exchanger parts. Check the exchanger for cracks. Inspect the burner wick for wear and deterioration. Replace the wick if it is charred or burned to a point 1/4 inch below the top edge of the igniter tube. See that the insulation on the electrode is not cracked or damaged.
43	Heater fuel pump.	*		Refer to paragraph 56*l*(2) and clean the pump subassembly as instructed.

g. Miscellaneous Items.

Item No.	Item	Frequency M	Frequency W	Action
44	Gages.	*	*	Observe the oil pressure gage and coolant temperature gage for correct readings. Refer to paragraph 20*a* fo normal gage indications. Investigate any abnormal reading.
45	Meters.	*	*	Observe the dc ammeter, ac ammeters, voltmeter, and frequency meter for correct readings. Refer to paragraph 20 for normal meter indications. Investigate any abnormal reading.
46	Frame and mountings.	*		Examine the upper and lower frame for warpage and for cracks around the welds. See that the engine and alternator mounting bolts are tight. Examine the condition of the shock mounts.
47	Suppression equipment.	*		Inspect the condition of all the radio-frequency suppression equipment. Be sure that all bonding straps, capacitors, and external-internal-toothed lock washers are well secured. Refer to paragraph 67 for suppression equipment details.

Section IV. TROUBLE SHOOTING

49. Meaning of Trouble Shooting

The primary function of trouble shooting is to locate and correct causes of faulty operation and equipment failure. All mechanical and electrical equipment is subject to occasional failure. Whenever difficulty with the equipment is experienced, the operator or repair man must be able to locate and correct the cause as quickly as possible. The trouble-shooting charts (par. 50) indicate various difficulties that may be experienced, symptoms which indicate that trouble exists, the possible causes, and suggested remedies. Reference to various illustrations and diagrams in this manual will aid in localizing the trouble.

50. Trouble-shooting Chart

a. Engine.

Symptom	Possible Cause	Remedy
1. Starting motor will not crank engine; cranks engine too slowly.	Discharged battery or shorted cell.	Recharge or replace battery.
	Corroded battery terminals.	Clean terminals.
	Loose or dirty battery cable connections.	Clean and tighten connections.
	Engine seized.	Try with hand crank.
	Defective start relay.	Replace relay.
	Too heavy oil in crankcase.	Refer to lubrication chart (fig. 17). Drain and refill with lighter oil.
	Engine ground strap connections loose.	Clean and tighten connections.
	Wire connections loose at starting motor.	Tighten connections.
	Worn starting motor brushes.	Replace brushes.
	Dirty starting motor commutator.	Clean with #0000 sandpaper
	Worn starting motor bearings.	Replace bearings.
	Burned start solenoid contacts.	Replace solenoid.

a. Engine (cont).

Symptom	Possible Cause	Remedy
2. Engine is cranked electrically, but will not start.	Defective spark plugs.	Clean, adjust, or replace (par. 48).
	Magneto breaker contacts pitted or out of adjustment.	Resurface or replace contacts and adjust gap (par. 56).
	Empty fuel supply tank.	Refill.
	Clogged or frozen fuel line.	Disconnect and clean (par. 27*a*(1)).
	Dirty fuel filter.	Clean (par. 38*b*(4)).
	Clogged fuel pump screen.	Clean (par. 38*b*(5)).
	Defective electric choke.	Use manual choke. Replace.
	Poor fuel.	Drain, refill with correct grade of fuel.
	Dirt in carburetor.	Clean.
	Low compression.	Refer to symptom 21 below.
	Incorrect magneto timing.	Retime (par. 63*i*).
	No ignition current or weak ignition current.	Replace defective ignition capacitor or coil.
	Distributor block or rotor cracked, burned, or carbonized.	Replace defective part.
	Leaking fuel line connection.	Tighten.
	Fuel pump cover plate loose.	Tighten cap screw.
	Carburetor inlet valve stuck.	Replace needle valve assembly.
3. Low oil pressure.	Oil too light or badly diluted.	Drain and refill with oil of correct grade and weight. Refer to lubrication chart (fig. 17).
	Oil too low.	Add oil. Refer to lubrication chart (fig. 17).
	Oil-pressure relief valve not seating.	Remove and clean.
	Worn crankshaft bearings.	Deadline for repair.
	Restricted oil pump intake.	Remove intake screen and clean.
	Worn oil pump.	Replace.
	Defective oil gage.	Replace.
4. High oil pressure.	Oil too heavy.	Drain and refill with oil of correct grade and weight. Refer to lubrication chart (fig. 17).
	Oil-pressure relief valve stuck.	Remove and clean.
	Clogged oil passage.	Drain oil and clean passage .
	Defective oil gage.	Replace.
5. Excessive oil consumption, light blue smoky exhaust.	Poor compression.	Refer to sympton 21 below.
	Oil leaking from pan or connections.	Replace gaskets and leaking hoses. Tighten screws and connections.
	Oil too light or diluted.	Drain and refill with oil of correct grade and weight. Refer to lubrication chart (fig. 17).
	Bearing clearance too great.	Deadline for repair.
	Too much oil in crankcase.	Drain excess oil.

a. Engine (cont).

Symptom	Possible Cause	Remedy
	Excessive clearance between valve stems and guides.	Deadline for repair.
	Piston rings stuck in grooves, worn, or broken.	Deadline for repair.
	Piston rings improperly fitted or weak.	Deadline for repair.
	Oil leaks at gaskets or seals.	Replace.
	Too much clearance between piston and cylinder bore.	Deadline for repair.
	Misaligned connecting rods.	Deadline for repair.
6. Engine stops unexpectedly.	Fuel tank empty.	Refill.
	Broken or clogged fuel line.	Repair or clean fuel line.
	Coolant temperature too high.	Refer to symptom 24 below.
	Coolant high temperature switch set too low.	Adjust setting (par. 19*a*(2)).
	Low oil pressure.	Refer to symptom 3 above.
	Grounded ignition wire.	Check ignition circuit.
7. Engine will not idle satisfactorily.	Carburetor out of adjustment.	Adjust (par. 25*b*(5)).
8. Engine misses.	Fouled spark plugs.	Clean, adjust, or replace (par. 48).
	Uneven compression.	Refer to symptom 21 below.
	Intake manifold air leak.	Tighten or replace gaskets.
	Pitted or improperly adjusted ignition contacts.	Resurface, adjust, or replace contacts (par. 56*g*(2)).
	Defective ignition capacitor.	Replace capacitor.
	Faulty ignition coil.	Replace.
	Tappet adjustment too close.	Adjust (par. 64*c*).
	Defective ignition cable.	Replace.
	Sticking valves.	Clean valve guides and valve stems.
	Weak or broken valve spring.	Replace spring.
	Faulty wiring.	Check ignition circuit.
	Water or dirt in fuel.	Drain and refill with clean fuel.
	Clogged carburetor jets.	Remove and clean.
	Engine overheated.	Refer to symptom 24 below.
9. Engine will not take full load.	Caburetor-to-governor linkage too short.	Adjust (par. 25*b*).
	Incorrect valve timing.	Retime (par. 64*b*).
	Magneto timing late.	Adjust timing (par. 63*i*).
10. Engine hunting under load.	Carburetor-to-governor linkage too short.	Adjust (par. 25*b*).
	Governor spring eyebolt out of adjustment.	Adjust (par. 25*b*).

a. Engine (cont).

Symptom	Possible Cause	Remedy
11. Engine hunting under no-load.	Carburetor-to-governor linkage too short.	Adjust (par. 25*b*).
	Governor bumper screw out of adjustment.	Adjust (par. 25*b*).
	Governor spring eyebolt out of adjustment.	Adjust (par. 25*b*).
12. Engine backfires through carburetor.	Lean fuel mixture.	Adjust and clean carburetor. Clean fuel filter. Tighten or replace intake manifold gasket.
	Poor grade fuel.	Drain and refill with correct grade fuel.
	Incorrect ignition timing.	Retime ignition (par. 63*i*).
	Distributor wires crossed.	Install wires correctly.
	Intake valves leaking.	Grind and reseat valves.
	Incorrect valve timing.	Retime (par. 64*b*).
	Air leak in intake manifold.	Locate and correct leak; replace gasket.
13. Light pounding knock.	Loose connecting rod bearing.	Deadline for repair.
	Low oil supply.	Add oil. Refer to lubrication chart (fig. 17).
	Low oil pressure.	Refer to symptom 3 above.
	Oil badly diluted.	Change oil. Refer to lubricaton chart (fig. 17).
14. Dull metallic thud, increases with load.	Loose crankshaft bearings.	Deadline for repair.
15. Sharp metallic thud in cold starting.	Low oil supply.	Add oil. Refer to lubrication chart (fig. 17).
	Low oil pressure.	Refer to symptom 3 above.
	Oil badly diluted.	Change oil. Refer to lubrication chart (fig. 17).
16. Pinging sound during rapid acceleration or overload.	Carbon in cylinders.	Remove carbon.
	Spark too early.	Retime ignition (par. 63*i*).
	Wrong spark plugs.	Replace with new plugs of correct heat range.
	Spark plugs burned or carboned.	Clean or install new plugs (par. 48).
	Fuel stale or low octane.	Use fresh fuel of the correct grade.
17. Clicking Sound.	Tappet clearance too great.	Adjust tappets (par. 64*c*).
	Broken valve spring.	Install new spring.
18. Hollow clicking sound.	Loose pistons.	If noise is slight, and disappears after warm up, no immediate attention is needed.
		If noise increases, deadline for repair.
19. Popping, spitting, or detonation.	Incorrect ignition timing.	Retime (par. 64*b*).
	Improper carburetion.	Adjust and clean carburetor.
	Poor valve seating.	Grind valves and reseat.
	Sticking valves.	Refer to symptom 23 below.
	Broken valve spring.	Replace spring.

a. Engine (cont).

Symptom	Possible Cause	Remedy
	Tappets adjusted too close.	Adjust tappets (par. 64*c*).
	Spark plug electrodes burned.	Replace spark plugs.
	Water or dirt in fuel.	Drain fuel.
	Clogged fuel lines.	Blow out lines.
20. Engine lacks power.	Low compression.	Refer to symptom 21 below.
	Dirt in carburetor or fuel pump.	Clean.
	Dirty air cleaner.	Clean, refill to proper level. Refer to lubrication chart (fig. 17).
	Choke inoperative.	Use manual choke. Replace electric choke.
	Carbon in cylinders.	Remove carbon.
	Restricted exhaust line.	Clean.
	Incorrect ignition timing.	Retime (par. 63*i*).
	Carburetor flooded or dirty.	Clean carburetor.
	Engine overheated.	Refer to symptom 24 below.
	Fuel lines clogged.	Drain and clean.
	Improper tappet clearance.	Adjust (par. 64*c*).
	Sticking valves.	Grind and reseat valves.
	Piston rings broken or worn.	Deadline for repair.
21. Low or fluctuating engine compression.	Faulty cylinder head gasket.	Replace.
	Insufficient tappet clearance.	Adjust tappets (par. 64*c*).
	Improperly fitted pistons or piston rings.	Deadline for repair.
	Valves not seating properly.	Grind and reseat valves.
	Valve spring weak or broken.	Replace spring.
	Burned valves.	Grind or replace valves.
22. Lack of vacuum.	Incorrect ignition timing.	Retime (par. 63*i*).
	Weak valve springs.	Replace springs.
	Worn valve guides.	Deadline for repairs.
	Leakage of carburetor gasket, manifold gasket.	Replace gaskets.
	Exhaust line clogged.	Clean.
	Burned valves.	Grind or replace valves.
23. Valves sticking.	Warped valve.	Replace.
	Improper tappet clearance.	Adjust (par. 64*c*).
	Carbonized or scored valve stems.	Buff or replace valve.
	Valve stem-to-guide clearance insufficient.	Deadline for repair.
	Weak or broken valve spring.	Replace spring.
	Valve spring cocked.	Replace spring.

a. Engine (cont).

Symptom	Possible Cause	Remedy
	Contaminated oil.	Drain and refill. Refer to lubrication chart (fig. 17).
24. Engine overheating.	Lack of proper lubrication.	Refer to lubrication chart (fig. 17).
	Stoppage of coolant circulation.	Check for sludge in radiator.
	Faulty thermostat.	Replace.
	Lack of coolant.	Refill. Refer to symptom 26 below.
	Slipping fan belt.	Tighten (par. 48).
	Incorrect ignition timing.	Retime (par. 63*i*).
	Clogged muffler.	Clean.
	Water pump inoperative.	Overhaul or replace.
	Lack of ventilation.	Provide better ventilation.
25. Engine overcooling.	Thermostatic valve sticking open.	Replace.
	Climatic conditions.	Cover radiator to bring temperature to proper range.
26. Loss of coolant.	Loose hose connections.	Tighten.
	Damaged hose.	Replace.
	Leaking water pump.	Overhaul or replace.
	Leaking radiator.	Remove and repair.
	Leaking cylinder-head gasket.	Replace.
	Crack in cylinder-head or block.	Deadline for repair.
27. Poor fuel economy.	Ignition timing late.	Retime (par. 63*i*).
	Carburetor float too high.	Adjust float by bending float lip.
	Fuel leakage.	Check lines. Tighten connections.
	Leaking fuel pump diaphragm.	Replace diaphragm or fuel pump.
	Low compression.	Refer to symptom 21 above.
	Valves sticking.	Grind and reseat.
	Fouled spark plugs.	Replace.
	Weak ignition coil or capacitor.	Replace.
	Improper valve tappet clearance.	Adjust tappets (par. 64*c*).
	Dirty air cleaner.	Clean and refill. Refer to lubrication chart (fig. 17).
	Clogged muffler.	Clean.
28. Bearing failure.	Crankshaft bearing journal out-of-round.	Deadline for repair.
	Lack of oil.	Fill crankcase.
	Oil leakage.	Replace leaking oil seals and gaskets.
	Dirty oil.	Refer to lubrication chart (fig. 17).
	Low oil pressure.	Refer to symptom 3 above.
	Connecting rod bent.	Deadline for repair.
29. Rear main bearing leak.	Excessively worn bearing and/or packing.	Deadline for repair.

b. Alternator.

Symptom	Possible Cause	Remedy
1. Abnormal frequency regulation.	Carburetor-to-governor linkage out of adjustment.	Adjust (par. 25*b*).
	Governor spring eyebolt out of adjustment.	Adjust (par. 25*b*).
2. Voltage too high.	Governor out of adjustment.	Adjust (par. 25*b*).
3. Voltage too low.	Governor out of adjustment.	Adjust (par. 25*b*).
	Rotor has lost magnetism because of severe jolt, coming in contact with another rotor, or being allowed to roll on a steel bench. *Note.* Loss of magnetism can occur only while rotor is out of unit.	Deadline for repair.
4. Low or no voltage on one phase with other phase abnormally high.	Short circuit across the particular phase.	Check stator with internal growler. Repair short circuit or replace stator.
5. No voltage reading in any one or all phases under no load.	Voltmeter circuit open.	Repair open circuit.
6. Unbalanced phase voltage under balanced load conditions.	Failure of one or more capacitors in the compensator capacitor assembly (C26). (Maximum upper limit of the capacitors, per phase, is 5.60 uf. Minimum lower limit, per phase, is 5.40 uf. Maximum allowable deviation, between phases, is ±.015 uf).	Replace entire capacitor assembly (C26). Do not change individual capacitors. Always use a factory-matched set.

c. 28-volt, 2.5-kw, Dc Generator.

Symptom	Possible Cause	Remedy
1. Generator operating at rated rpm. but has low or no voltage.	Connections loose, dirty, or have high resistance.	Clean and tighten connections.
	Brushes binding in holders.	Remove brushes and clean with lint-free dry cloth.
	Brush spring tension too low.	Replace brush springs.
	Brushes worn.	Replace.
	Commutator rough, pitted, or eccentric.	Clean or resurface (par. 56*i* (2)).
	Armature winding short-circuited or grounded.	Replace armature.
	Generator field polarity reversed (magnetized in wrong direction).	Flash shunt field in proper direction as follows: Connect two #8 AWG or larger cables to a 24-volt battery. With engine operating at 1,714 rpm, connect the negative lead of the battery to the negative terminal on the generator and momentarily touch the hot or positive lead to the positive terminal on the generator.
	Generator drive belt loose or slipping.	Tighten belt.

c. 28-volt, 2.5-kw, Dc Generator (cont).

Symptom	Possible Cause	Remedy
	Regulator armature spring weak or broken.	Replace armature assembly.
	Armature lead in regulator broken.	Repair lead or replace armature assembly.
	Regulator-pile adjusting screw contact lead broken.	Repair adjusting screw lead assembly.
	Regulator adjusting screw not making contact with carbon stack.	Readjust regulator (par. 64*g*).
	Regulator carbons pitted or burned.	Replace carbon stack and readjust regulator (par. 64*g*).
	Regulator core screwed in too far.	Readjust regulator (par. 64*g*).
	Regulator operating coil is shorted.	Repair or replace operating coil.
2. Voltage flutters.	Regulator stabilizing resistors open.	Replace resistor.
	Regulator not properly adjusted.	Readjust regulator (par. 64*g*).
3. Generator operating at rated rpm, but voltage is too high.	Short circuit between the two cables to the regulator terminals A and B.	Restore to correct condition.
	Regulator cannot be adjusted.	Replace voltage regulator.
	Voltage regulator operating coil lead broken or unsoldered.	Resolder.
	Voltage regulator operating coil burned out.	Replace operating coil.
	Fixed resistor on regulator (18 ohms) burned out or open.	Replace resistor.
	Regulator armature contact sticking in pile tube.	Disassemble and free armature.
	Regulator core screwed out too far.	Readjust core (par. 64*g*).
	A and B leads reversed at regulator base.	Check wiring.
	Regulator voltage variable resistor is open or shorted.	Replace resistor.
	Dirty contact buttons and contact blades in regulator base.	Clean contact buttons and blades.
4. Excessive arcing present at generator brushes.	Brushes worn too short to be held against commutator.	Replace brushes.
	Brushes binding in their holders.	Remove brushes and clean with lint-free dry cloth.
	Brush spring tension too low.	Replace the brush springs.
	Rough or burned commutator.	Clean and polish with #0000 sandpaper.
	Rough, burned, pitted, or eccentric commutator.	Resurface.
	High voltage.	Check voltage regulator adjustments.
	Wrong connections between generator and switch relay.	Check and correct according to wiring diagram (fig. 61).
5. Generator commutator throwing solder.	Excessive arcing at generator brushes.	Refer to symptom 4 above.

c. 28-volt, 2.5 kw, Dc Generator (cont).

Symptom	Possible Cause	Remedy
6. Field current cannot be adjusted within the specified limits.	Faulty wiring connections.	Clean and tighten all connections, replace defective wires or connections.
	Field circuit is either open-circuited, short-circuited, or field resistance incorrect.	Replace the field frame assembly.
	Brushes not seating properly.	Check and apply remedies given.
7. Generator overheats.	Brushes improperly seated.	Reseat.
	Armature is short-circuited.	Replace armature.
	Bearings tight.	Replace bearings.
	Commutator bars high or out of alignment.	Replace the armature assembly if the commutator bars are out of alignment; turn down the bars on a lathe if they are too high.

d. 24-volt Battery-charging Generator.

Symptom	Possible Cause	Remedy
1. Generator output low or none at all.	Battery electrolyte low.	Fill batteries.
	Electrical charging circuit connections loose and/or dirty.	Clean and tighten connections.
	Dirty commutator.	Clean commutator.
	Worn commutator.	Turn down on lathe and undercut mica strips.
	Dirty or worn brushes.	Clean, free up, or replace brushes.
	Broken circuit in field or armature.	Overhaul generator.
	Voltage regulator not functioning properly.	Clean, test, and adjust regulator. Replace regulator if results are unsatisfactory.
2. Generator output too high.	Voltage regulator not functioning properly.	Clean, test, and adjust regulator. Replace regulator if results are unsatisfactory.

CHAPTER 5

THEORY

51. Engine and Dc Generators

a. Engine (fig. 18). The internal combustion, four-stroke cycle engine is of the conventional automotive type. Four-stroke cycle means that there are four strokes of the piston, two up and two down, to each operating cycle. Only every fourth stroke of the piston is a power stroke. A complete cycle of one piston, with the individual operation of each stroke, is described in the following subparagraphs.

(1) *Intake stroke.* With the exhaust valve closed and the intake valve open, a correctly metered, highly combustible mixture of air and gasoline is drawn from the carburetor through the intake manifold and intake valve port into the combustion chamber. The mixture is drawn into the cylinder as the piston travels downward, and the intake valve for that cylinder is open.

(2) *Compression stroke.* As the piston travels past bottom dead center, the intake valve closes and with the exhaust valve closed, the fuel-air mixture then is compressed between the piston and the cylinder head. As the piston reaches the top of the stroke, the spark plug emits a spark and ignites the highly compressed fuel-air mixture.

(3) *Power stroke.* With both valves closed, the rapidly expanding gases that result from the burning fuel mixture force the piston downward. This movement is transmitted through the connecting rod to the crankshaft which converts the reciprocating motion to rotary motion.

(4) *Exhaust stroke.* The exhaust valve, as is the intake valve, is operated by a tappet in contact with the camshaft. The exhaust valve opens 45° before bottom dead center and permits the upward travel of the piston to expel the exhaust gases through the exhaust port. As the piston approaches top dead center, the intake valve again starts to open, the exhaust valve starts to close, and a new cycle is under way.

b. Engine Speed Governor (fig. 23). The engine speed governor is of the flyweight type, gear-driven from the camshaft gear in the engine. The centrifugal force of the revolving flyweights (24) is transmitted by a pivoted yoke (32) to lateral motion which acts against the tension of the control arm spring (2). This action also moves the carburetor throttle towards the closed position. When the predetermined speed setting is reached, the governor maintains the engine speed at 1,714 rpm which is the synchronous speed for 400-cycle operation. Governor adjustments are described in paragraph 25*b*.

c. 24-volt Battery-charging System. The two 12-volt storage batteries are maintained in a full state of charge by the 24-volt battery-charging generator (fig. 28) which is belt-driven from the engine fan pulley. The rate of charge is controlled automatically by the automotive-type voltage regulator (fig. 29) which is mounted in the suppression box on the firewall.

d. 28-volt, 2.5-kw Dc System. The 28-volt, dc system consists of two main components, a self-excited belt-driven generator (fig. 27) and an aircraft-type, carbon-pile voltage regulator (fig. 36). The generator develops 2.5 kw at 28 volts, operating at a shaft speed of 4,500 rpm (engine speed of 1,714 rpm). The voltage regulator provides a means

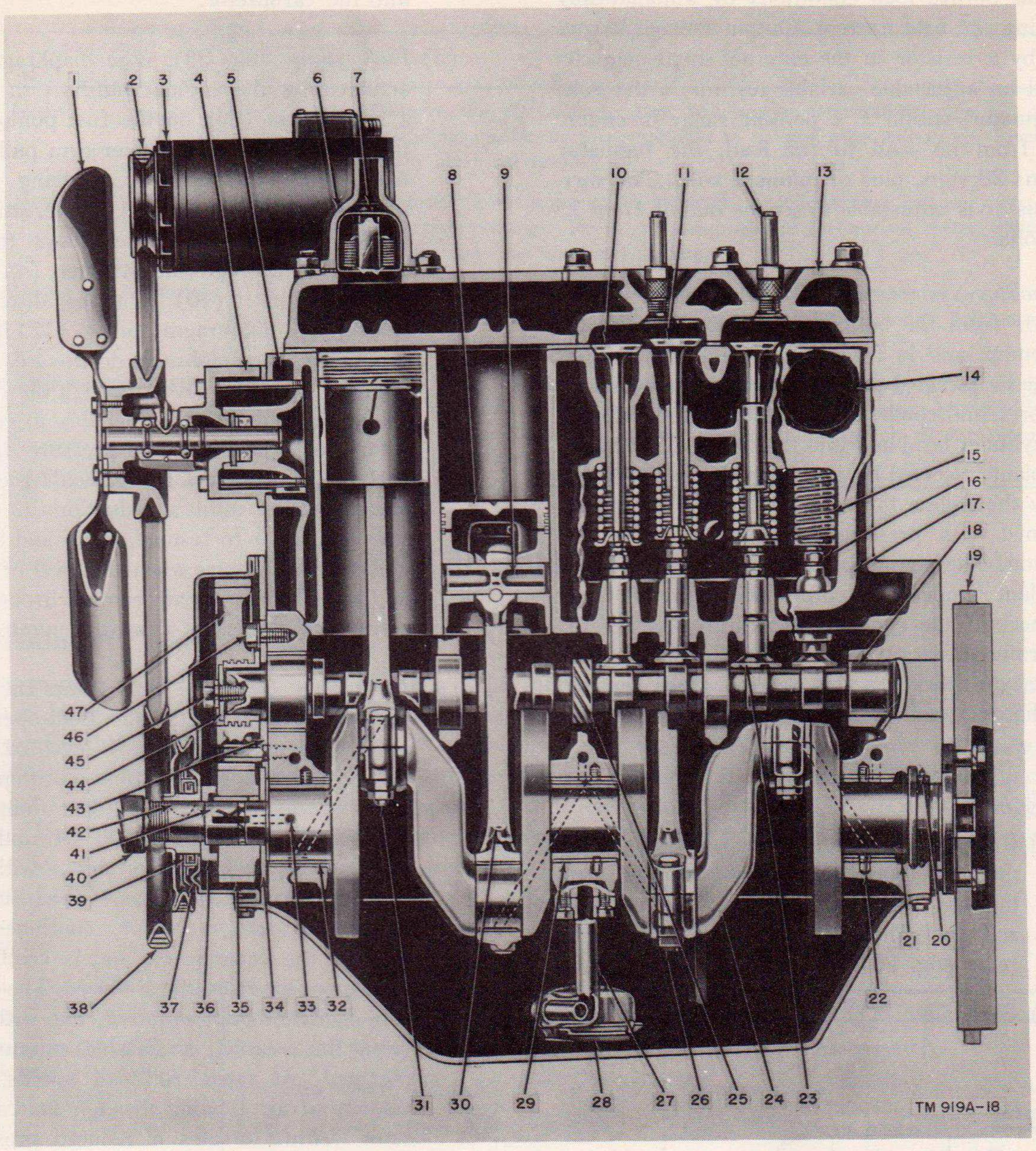


Figure 18. Engine, cross section, side view.

1. Fan (B26).
2. Fan belt (MP208).
3. 24-volt generator (C3).
4. Water pump.
5. Water pump impeller (MP186).
6. Coolant outlet neck (A 1).
7. Coolant thermostat (S 15).
8. Pistons (MP17 to MP20).
9. Wrist pins (MP21 to MP24).
10. Exhaust valves (MP76 to MP to MP79).
11. Intake valves (MP80 to MP83).
12. Spark plugs (E195 to E198).
13. Cylinder head (A 2).
14. Manifold group (A 12).
15. Valve springs (MP96 to MP103).
16. Valve tappet adjusting screw (H251).
17. Cylinder block (A 4).
18. Camshaft (MP128).
19. Flywheel ring gear (MP156).
20. Rear bearing oil guard felt (H333).
21. Rear bearing packings (H334 and H335).
22. Rear main bearings (MP39 and MP40).
23. Valve tappets (MP120 to H127).
24. Crankshaft (MP54).
25. Oil pump drive gear.
26. Connecting rod cap bolts (H201 to H208).
27. Oil pump drive shaft (MP174).
28. Oil pump.
29. Center main bearings (MP41 and MP42).
30. Connecting rod assemblies (MP15 and MP16).
31. Connecting rod lock nuts (H233 to H240).
32. Front main bearings (MP51 and MP52).
33. Crankshaft oil passages.
34. Crankshaft thrust plate (MP55).
35. Crankshaft gear (MP56).
36. Crankshaft oil thrower (MP58).
37. Timing gear cover (MP142).
38. Crankshaft pulley (MP153).
39. Crankshaft pulley seal (H241).
40. Starting jaw bolt (MP154).
41. Crankshaft gear key (MP56).
42. Crankshaft pulley key (H308).
43. Camshaft thrust plate (MP129).
44. Camshaft gear lockwasher (H267).
45. Camshaft gear retaining nut (H262).
46. Camshaft gear thrust plate retaining screws (H259 and H260).
47. Camshaft gear (MP133).

for maintaining an almost constant output voltage under all normal load conditions by automatically controlling the field current. Output voltage is controlled by a resistor in the external shunt-field circuit and an adjustable variable resistor in the voltage regulator, within a 4 percent range in engine speed; from no load to full load, the regulator maintains 28 volts, plus or minus 2 volts. The variable resistor is adjustable to set the output from 25 to 30 volts.

e. Cooling System (fig. 19). The engine coolant is drawn from the bottom of the radiator by the water pump, and is forced into the cylinder block through the jacketed passages around the cylinders, valve ports, and combustion chambers, and then out of the cylinder head and into the top of the radiator. The coolant is cooled by air blown through the radiator by the engine fan. The engine temperature is maintained at a pre-established minimum by the thermostat. The engine is automatically stopped by the coolant temperature cutoff switch in the water outlet neck if the coolant temperature reaches the predetermined setting of the cutoff switch. The pressure-type filler cap will release vapor through the radiator overflow if the pressure in system exceeds 4 psi.

f. Fuel System.

(1) *General.* The generator set operates on fuel pumped from an external supply tank through the auxiliary fuel line (fig. 7) and fuel filter (15, fig. 3) to the carburetor (fig. 20) by fuel pump (fig. 25).

(2) *Fuel filter.* The fuel passes through the disk-type fuel filter before being pumped into the carburetor.

(3) *Fuel pump* (fig. 25). The diaphragm is actuated by the engine camshaft through a rocker arm (23) on the fuel pump. On the intake stroke, the rocker arm pulls the diaphragm (15) upward, reducing pressure within the cover (2) and creating a suction on the inlet. Fuel flows to the cover (2) through the strainer (4) and the inlet valve (10). On the discharge stroke, the diaphragm spring (17) pressure pushes the diaphragm downward, forcing fuel from the cover through the outlet valve (9) and into the fuel line to carburetor float chamber. The pressure of the fuel, within the fuel pump, holds the diaphragm down until a reduction in pressure permits it to resume its up and down motion. This occurs when the level of fuel in the carburetor float chamber drops and permits fuel to flow from the pump.

(4) *Carburetor* (fig. 20). Fuel enters the carburetor bowl through the float-operated needle valve assembly; the level of fuel being governed by the float position. At idling speeds and light-load operation, fuel flows through the idle well jet and the low speed jet where it combines with air entering through the bypass. The fuel is broken up into a vapor, continues on through the economizer, and is combined with more air from the air bleed. The mixture is richer than required, but with air from the venturi, a suitable mixture is obtained. At rated full-load speeds, the velocity of air flowing through the carburetor venturi creates a reduced pressure at the tip of the main nozzle. The low pressure causes fuel to flow from the float chamber through the metering jet and out of the main nozzle into the carburetor venturi.

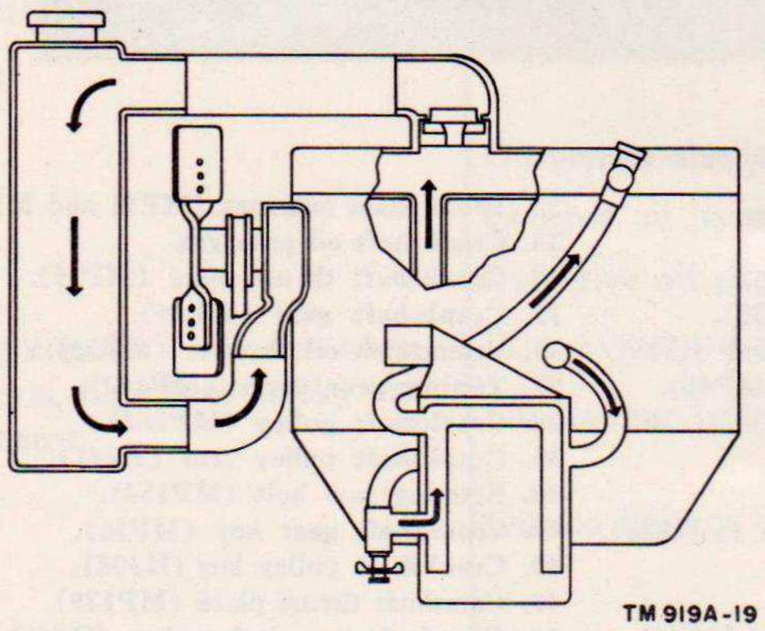
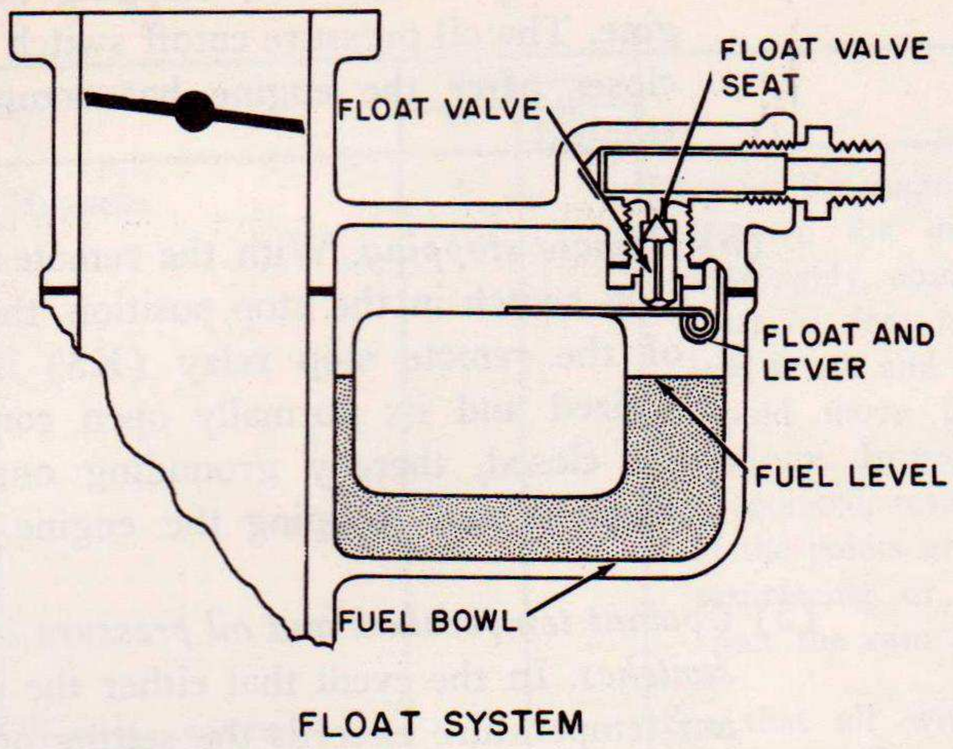


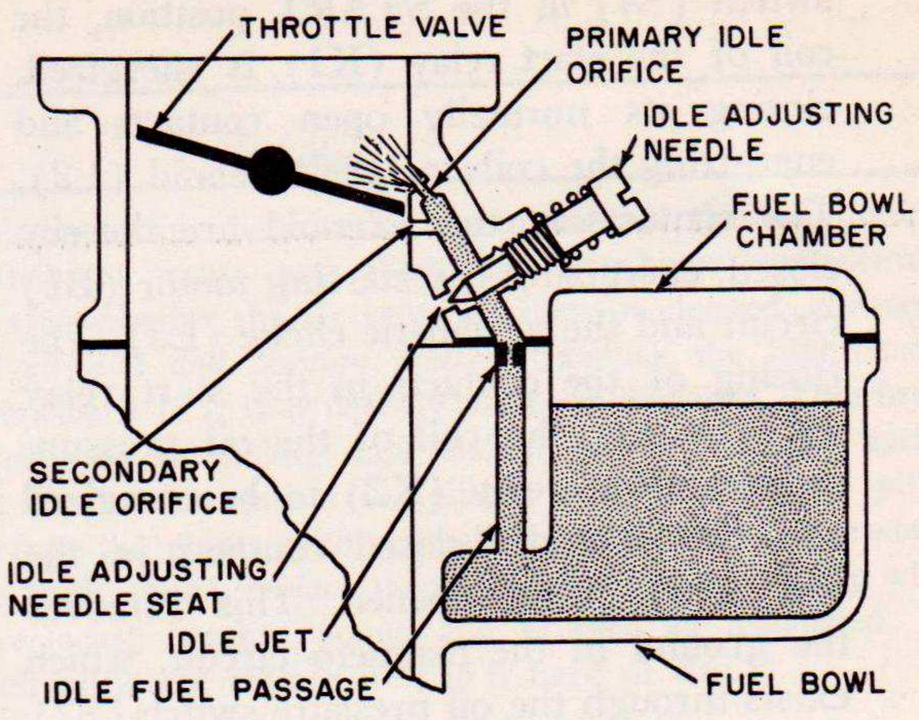
Figure 19. Cooling system flow diagram.

g. Starting System (fig. 21).

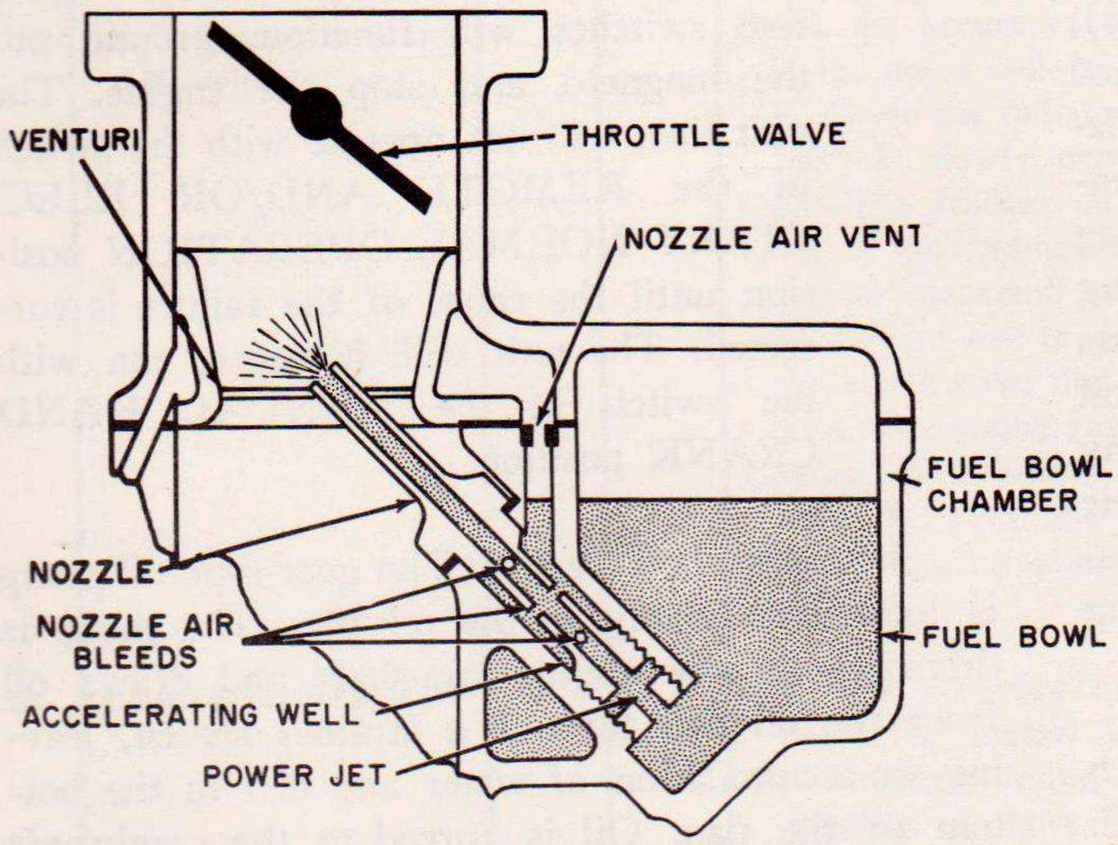
(1) *Automatic starting.* With the ignition switch (S1) in the REMOTE AND/OR ELEC. START NORMAL OPERATION position and the START-STOP



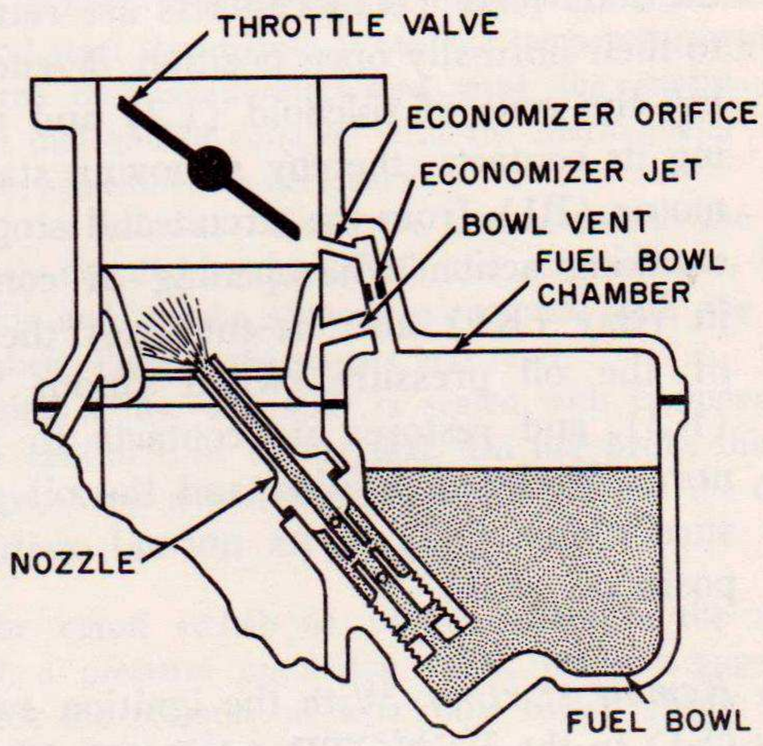
FLOAT SYSTEM



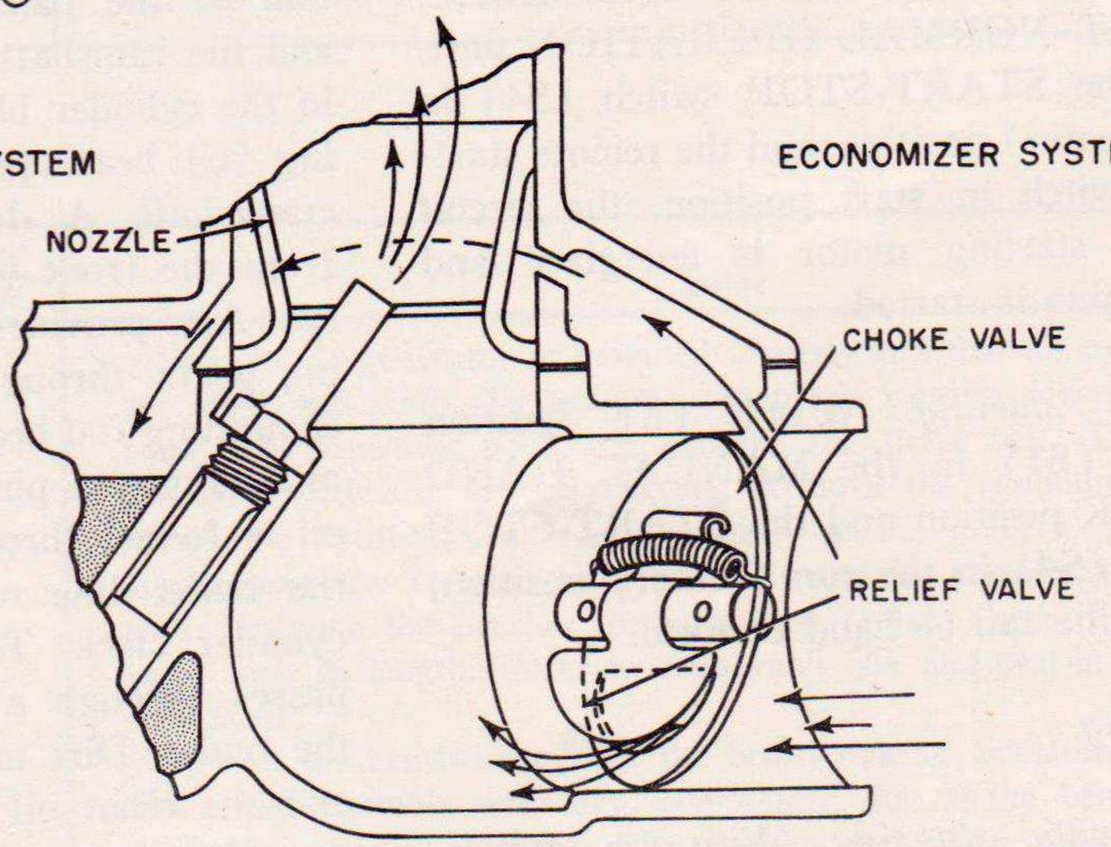
IDLE SYSTEM



POWER FUEL FEED SYSTEM



ECONOMIZER SYSTEM



CHOKE SYSTEM

TM 919A-20

Figure 20. Carburetor flow diagram.

switch (S4) in the START position, the coil of the start relay (K1) is energized, closing its normally open contacts and energizing the coils of the solenoid (L2). The contacts in the solenoid are thereby closed, energizing the starting motor (B1) circuit and the automatic choke (L3). The closing of the contacts in the start relay (K1) causes the coil of the oil pressure switch cutout relay (K2) to be energized and the normally closed contacts in the coil (K2) to be opened. This removes the ground in the magneto circuit, which exists through the oil pressure switch (S2) until the engine oil pressure reaches 5 psi plus or minus 1 pound. After the engine starts and the oil pressure builds up to its operating pressure (greater than 5 psi), the start relay (K1) contacts are returned to their normally open position, de-energizing the coils of solenoid (L2) and opening its contacts, thereby removing starting motor (B1) from the circuit and stopping cranking action. The opening of contacts in relay (K1) also de-energizes the coil of the oil pressure switch cutout relay (K2), and restores its contacts to their normally closed position and the oil pressure switch (S2) to its normal operating position.

(2) *Remote starting.* With the ignition switch (S1) in the REMOTE AND/OR ELEC. START NORMAL OPERATION position, the START-STOP switch (S4) in run (center) position, and the remote start-stop switch in start position, the circuit to the starting motor is energized and the engine is started.

(3) *Manual starting.* With the ignition switch (S1) in the MANUAL HAND CRANK position and the START-STOP switch (S4) in the run (center) position, the engine can be hand cranked.

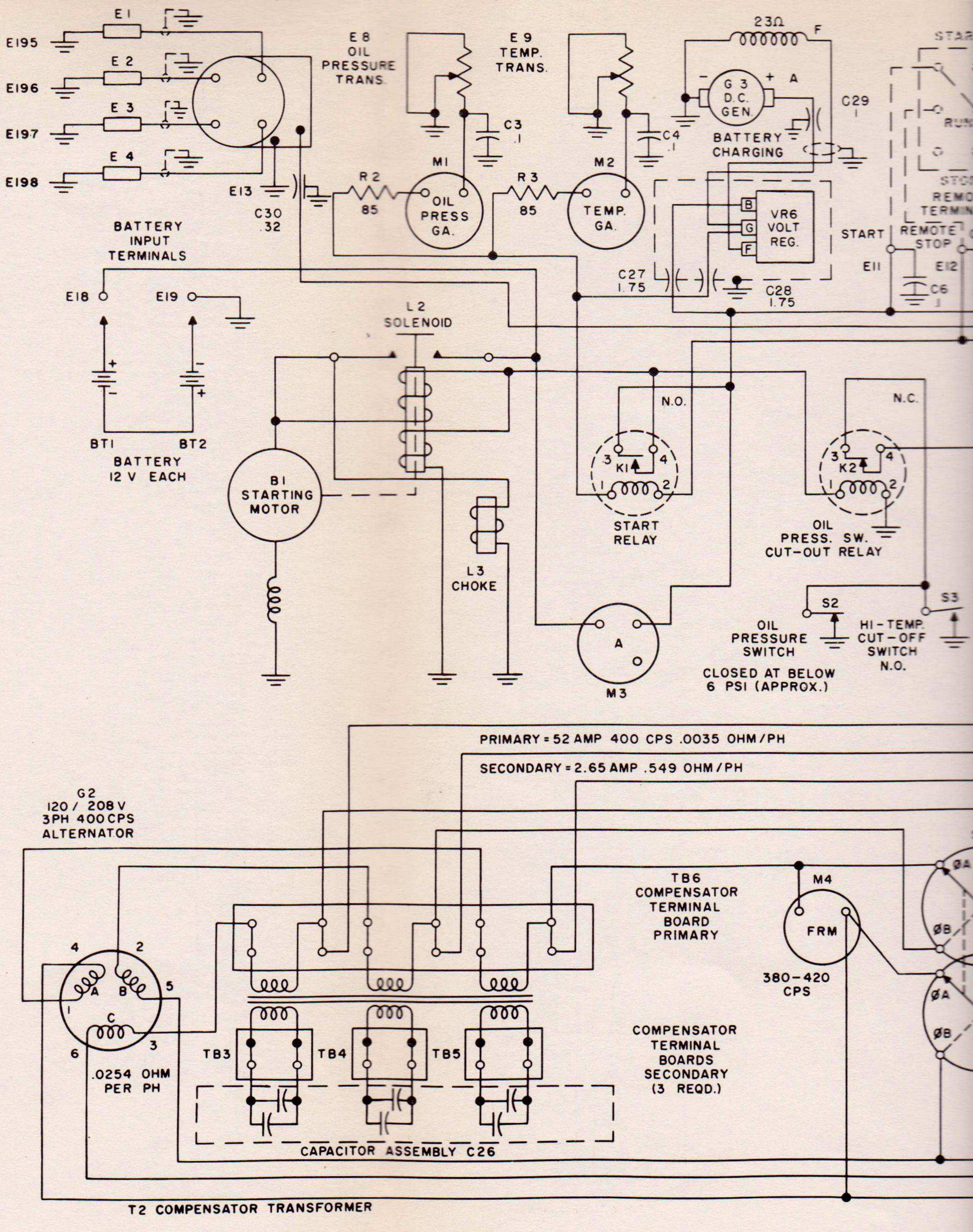
(4) *Stopping.*

(*a*) *Automatic stopping.* With the ignition switch (S1) in either of its two positions, and the START-STOP switch (S4) in the STOP position, the magneto is grounded out, stopping the engine. The oil pressure cutoff switch (S2) closes after the engine has completely stopped.

(*b*) *Remote stopping.* With the remote start-stop switch in the stop position, the coil of the remote stop relay (K3) is energized and its normally open contacts are closed, thereby grounding out the magneto and stopping the engine.

(5) *Coolant temperature and oil pressure cutoff switches.* In the event that either the coolant temperature exceeds the setting on the switch dial or the oil pressure falls below 5 psi, plus or minus 1 pound, the respective switches will function, ground out the magneto, and stop the engine. The unit then will not operate with the switch in the REMOTE AND/OR ELEC. START NORMAL OPERATION position until the cause of the failure is corrected. The unit will, however, run with the switch in the MANUAL HAND CRANK position.

h. Lubrication System. The gear-type oil pump is located internally in the oil pan. The pump is driven from the engine camshaft and draws oil from the oil pan through a strainer screen, leaving an accumulation of water and dirt in the bottom of the pan. Oil is forced to the crankshaft and the camshaft bearings through drilled passages in the cylinder block webs and then to the connecting rod bearings through drilled passages in the crankshaft. A drilled passage in the crankshaft, from the front bearing to holes in the crankshaft sprocket, provides positive lubrication for the timing gears through a jet. Direct spray from the connecting rod bearings lubricates the cylinder walls, pistons, piston pins, and the valve mechanism. The oil is forced through the disk-type oil filter from the outlet line on the left side of the engine cylinder block. The oil enters the filter bowl and passes through a stack of disks and spacers to the outlet. Dirt and solids lodge against the disks and the clean oil passes through. The oil leaving the filter is conducted down to the oil pan. If the oil pressure drops below a safe minimum of 5 psi, plus or minus 1 pound, the low-oil-pressure cutoff switch stops the engine.


E1
E195
E2
E196
E3
E197
E4
E198
E13
C30
.32
E8
OIL
PRESSURE
TRANS.
E9
TEMP.
TRANS.
C3
.1
C4
.1
M1
M2
R2
85
R3
85
OIL
PRESS
GA.
TEMP.
GA.
23Ω
F
G 3
D.C.
GEN.
BATTERY
CHARGING
C29
1
VR6
VOLT
REG.
B
G
F
C27
1.75
C28
1.75
START
E11
REMOTE
STOP
E12
C6
1
BATTERY
INPUT
TERMINALS
E18
E19
BT1
BT2
BATTERY
12 V EACH
L2
SOLENOID
B1
STARTING
MOTOR
L3
CHOKE
N.O.
N.C.
K1
K2
START
RELAY
OIL
PRESS. SW.
CUT-OUT RELAY
A
M3
S2
S3
OIL
PRESSURE
SWITCH
HI-TEMP.
CUT-OFF
SWITCH
N.O.
CLOSED AT BELOW
6 PSI (APPROX.)
PRIMARY = 52 AMP 400 CPS .0035 OHM/PH
SECONDARY = 2.65 AMP .549 OHM/PH
G2
120 / 208 V
3PH 400 CPS
ALTERNATOR
TB6
COMPENSATOR
TERMINAL
BOARD
PRIMARY
M4
FRM
380-420
CPS
ØA
ØB
ØA
ØB
.0254 OHM
PER PH
TB3
TB4
TB5
COMPENSATOR
TERMINAL
BOARDS
SECONDARY
(3 REQD.)
CAPACITOR ASSEMBLY C26
T2 COMPENSATOR TRANSFORMER

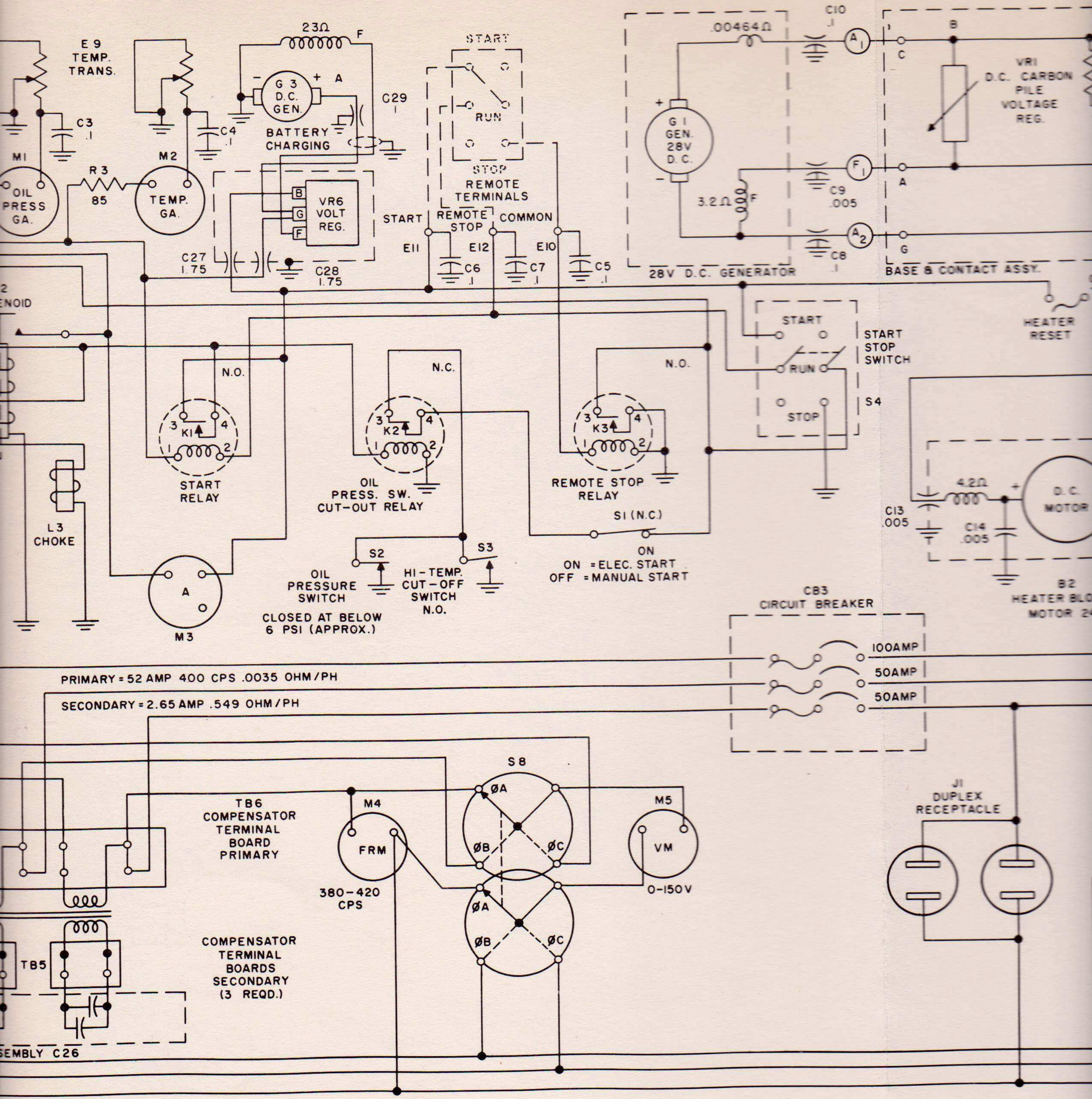
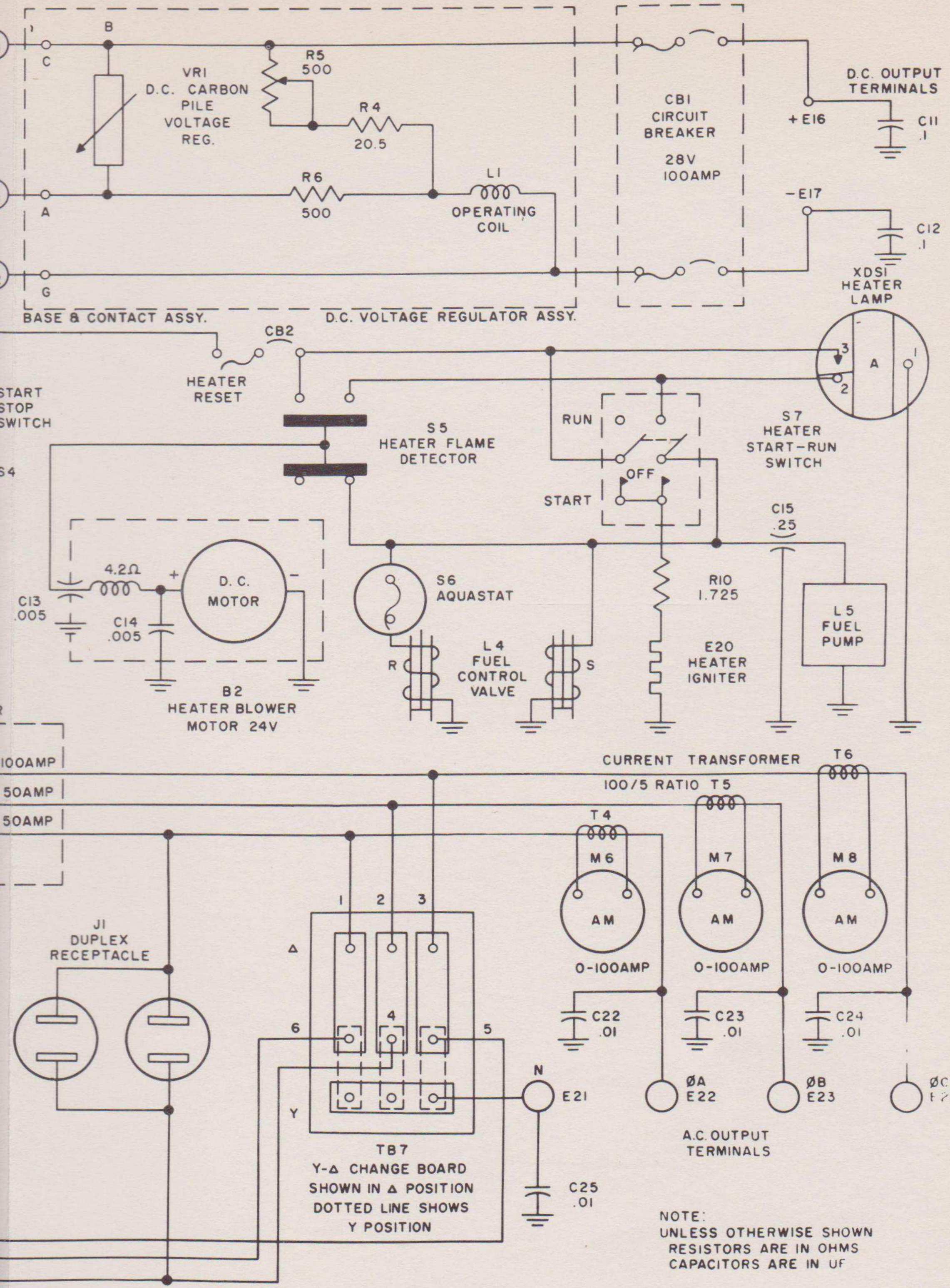


Figure 21. Schematic wiring diagram.



NOTE:
UNLESS OTHERWISE SHOWN
RESISTORS ARE IN OHMS
CAPACITORS ARE IN UF

52. Alternator and Winterization System

a. Alternator. Gasoline Engine Generator Set PU-107A/U is equipped with an alternator directly coupled to the engine flywheel and supported at the outboard end by a ball bearing. The alternator is of the rotating permanent magnet field type with 28 poles, resulting in a frequency of 400 cps with an engine speed of 1,714 rpm. The alternator is rated at 12.5 kw and generates 120 or 208 volts, depending on the connection used. The specific feature of the permanent magnet alternator is that it has no field windings; therefore, it requires no external excitation. The rotor is magnetized with the poles that have alternate north and south polarity around the circumference. The magnetic flux (fig. 22) leaves each north pole of the rotating field, passes through the iron core of the stator, and then returns to the adjacent south poles of the rotating field. The rotor with its magnetic field sweeps across the stator windings. There are three separate coils wound on the stator, 120 electrical degrees apart. As the lines of flux cut the stator conductors, voltages are induced in each separate stator winding, producing three-phase alternating voltage. The inherent voltage regulation varies from very close regulation for unity power factor loads to very poor regulation for highly lagging power factor loads. Leading power factor loads increase the voltage so that close voltage regulation can be obtained on single- or three-phase loading when each load is power factor corrected with parallel capacitance. The compensator assembly will increase the voltage of low power factor loads but cannot completely correct it for unity power factor voltage drop. The compensator assembly consists of a series current transformer and a network of six capacitors connected two in parallel across each transformer secondary. The primary windings of the transformer are connected in series with the respective stator windings. This assembly provides a static means of voltage regulation.

b. Winterization System. Incorporated within the unit is a winterization system designed to preheat the engine crankcase oil, coolant, and intake manifold for ease in starting under arctic conditions. The gasoline-burning, semiautomatic heater has an input capacity of 32,000 Btu (British thermal unit) per hour on high fire and 14,000 Btu per hour on low fire. The heater will start quickly under all temperature conditions to —65° F.

(1) *Air system.*

(*a*) *Blower and motor.* A paddle-wheel type blower mounted to a 24-volt motor supplies air for combustion and for diluting the burned gases. The blower motor must turn at least 4,000 rpm to provide satisfactory combustion.

(*b*) *Burner and throat.* The air delivered by the blower is conducted to the heater

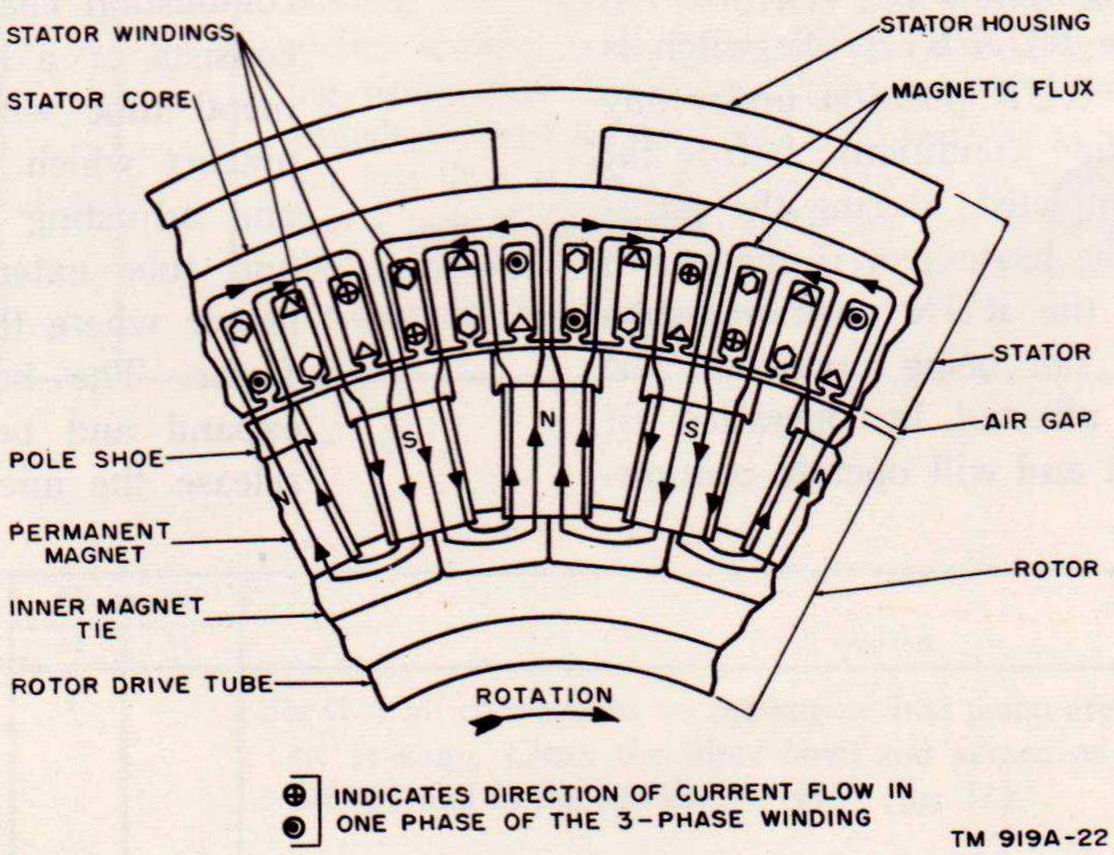


Figure 22. Alternator theory.

burner bowl and combustion chamber through an air box and gallery. It enters the burner bowl through the primary air holes. From the primary air holes in the burner bowl, the air mixes with fuel vapor, but the mixture remains too rich to burn until sufficient secondary air is introduced through the throat opening, where combustion takes place. Air is added to the exhaust gases through the relief holes in the throat. This additional air aids combustion, but its primary purpose is to lower the exhaust gas temperatures and to provide a larger volume of warm air for external heating of the oil pan and intake manifold.

(2) *Fuel system.*

(*a*) *Pump.* The heater fuel pump supplies fuel under pressure to a two-stage fuel control valve. This is accomplished by a solenoid which, when energized, activates a hollow plunger. The stroke of the plunger is controlled by a set of interrupter points (sealed in helium) in the electrical circuit and a calibrated plunger spring. The pump is self-priming and requires no bleeding or adjustment. The pump provides fuel when the heater RUN-START switch is held in the START position and also when it is thrown to the RUN position after the heater is ignited. The pump will not operate if the RUN-START switch is moved to the RUN position under any of the following conditions: before the ignition is completed; during the purging cycle of the heater; or if the switch is moved to the RUN position when the heater is not being operated. The pump is not affected by operation of the thermostat and will operate continuously whenever the heater is in use.

(*b*) *Fuel control valve.* The electrically operated fuel control valve consists essentially of a pressure regulator and two independent, solenoid-operated valves which control the flow of fuel to the heater through orifices. Both solenoid valves are normally closed (when the coils are not energized). The shut-off valve allows fuel to flow only when the coil is energized; the high-low valve is connected into the circuit with the heater thermostat. When the coil is not energized, fuel is forced to flow through a restricted orifice calibrated for low fire operation. When the high-low valve is energized, the valve is opened and fuel passes through a bypass calibrated for high fire operation.

(3) *Electrical system.*

(*a*) *Control panel.* Heater components of the control panel include a RUN-START switch, a heater OPERATING indicator lamp, and the circuit breaker (RESET). These components are discussed and the instructions for their operation are covered in paragraph 18.

(*b*) *Flame switch.* The flame switch controls the electrical supply to the pump, control valve, indicator lamp, and blower motor. This switch is actuated by the presence of flame in the heater combustion chamber. The flame switch consists of a quartz rod encased in a metal tube with an integral mounting bracket which supports a microswitch and adjusting spring. The quartz rod and tube extend into the top of the heater where they are subjected to the flame. The heat causes the tube to expand and permit the quartz rod to release the microswitch button.

CHAPTER 6

FIELD MAINTENANCE

Section I. PRE-REPAIR PROCEDURES

53. General

This chapter covers complete repair and overhaul instructions for Gasoline Engine Generator Set PU-107A/U and is written specifically for personnel in charge of field and depot maintenance and repair. The instructions include detailed steps to be followed in the stripping, disassembly, cleaning, inspection, and reassembly of the unit. Exploded view illustrations are provided to facilitate overhaul. A table of fits and tolerances and a paragraph covering adjustments after reassembly are included in the chapter. Requirements and methods for testing the unit after overhaul are furnished, together with instructions on refinishing. Installation details for radio-frequency suppression equipment are also included.

54. Preliminary Inspection

Before repairing any part of the equipment, check the unit for the extent of repair necessary as noted by the operating personnel. Inspect the unit as instructed in paragraph 48.

Section II. CLEANING, STRIPPING, AND INSPECTING

55. Cleaning and Stripping

Before stripping the unit, thoroughly clean all grease, oil, and dirt from the entire exterior of the unit. Use solvent (SD) for washing when necessary. Do not let the solvent come in contact with any electrical equipment. Blow dirt from not easily accessible places with dry, compressed air. The following paragraphs contain instructions for stripping the unit of all subassemblies and accessories. When performing a major overhaul, all components and accessories must be removed from the unit for accessibility to the engine and alternator.

Warning: If the unit has been operated for inspection purposes before stripping, disconnect the batteries before attempting to repair or overhaul any part of the equipment.

a. Upper Frame. The tubular frame is composed of two sections and is constructed to permit removal of the top half. For complete overhaul of the unit, remove the upper frame first. Proceed as follows:

(1) Remove the rear panel and disconnect the alternator leads connected to the compensator transformer (1, fig. 4) and to the wye-delta change board (1, fig. 3).

(2) Disconnect the electrical leads from the 28-volt, 2.5 kw dc generator (1, fig. 2). Pull the leads through the insulator bushings in the firewall. Disconnect the electrical leads from the 24-volt battery-charging generator (5, fig. 3).

(3) Remove the inlet and outlet air duct hose from the air cleaner.

(4) Unplug the 10-conductor socket (10, fig. 2) mounted on the firewall.

(5) Remove the clip securing the electrical lead for the automatic choke (4, fig. 3). This clip is located on the firewall.

(6) Remove two clips securing the ignition cables to the firewall.

(7) Disconnect the capacitor from the oil pressure transmitter (8, fig. 2).

(8) Disconnect the two ground straps from the right and left sides of the upper frame.

(9) Remove the bolts and nuts securing the upper radiator brackets to the radiator.

(10) Remove the four bolts and nuts that secure the upper frame to the lower frame.

(11) Lift the upper frame off the lower frame, being careful not to damage any parts on the unit.

b. Radiator. Before removing the radiator (27, fig. 2), open the radiator cap to prevent a vacuum. Drain the coolant through the rediator drain cock (26, fig. 2).

(1) Remove the fan guard (7, fig. 3).

(2) Loosen the radiator hose clamps and remove all necessary hose.

(3) Remove the fan assembly and leave it resting in the fan shroud on the radiator.

(4) Remove the nuts that secure the radiator to the lower frame. Slide the radiator forward in the slots and lift it off the frame. Remove the fan assembly.

c. Muffler (fig. 2).

(1) Remove thé two nuts that secure the exhaust pipe adapter to the exhaust manifold.

(2) Loosen the clamp that secures the muffler (25) to the lower frame.

(3) Slowly remove the muffler assembly. Be careful not to damage any parts of the engine.

d. Engine Speed Governor (fig. 3).

(1) Disconnect the carburetor-to-governor linkage (9) from the governor control arm.

(2) Remove the two mounting bolts and take the governor from the engine.

e. Air Cleaner (fig. 2).

(1) Disconnect all hoses (subpar. *a*(3) above).

(2) Unscrew the four bolts that hold the air cleaner (6) to the mounting brackets and remove the air cleaner.

f. Carburetor.

(1) Disconnect the cable for the manual choke (28, fig. 2) and disconnect the automatic choke rod from the carburetor choke control.

(2) Disconnect the cable for the manual throttle (8, fig. 4) and disconnect the carburetor-to-governor linkage (9, fig. 3) from the carburetor throttle lever.

(3) Remove the fuel line from the carburetor.

(4) Unscrew the two nuts that secure the carburetor to the intake manifold.

(5) Lower the carburetor from the manifold.

g. Fuel Pump (fig. 3).

(1) Disconnect the fuel lines from the fuel pump (16).

(2) Remove the two bolts that secure the fuel pump to the engine.

(3) Remove the fuel pump from the engine.

h. Oil-pressure Cut-off Switch and Oil-pressure Transmitter (fig. 2).

(1) Disconnect the electrical leads from the oil-pressure cut-off switch (7) and the oil-pressure transmitter (8).

(2) Screw the switch and transmitter out of the cross fitting.

i. Fuel Filter (fig. 3).

(1) Open the drain cock and drain the fuel from the fuel filter (15).

(2) Disconnect all hose fittings and remove the fuel lines from the filter.

(3) Remove the two bolts that secure the filter to the mounting bracket and remove the filter.

j. Coolant High Temperature Cutoff Switch (fig. 2).

(1) Disconnect the electrical lead from the coolant high temperature cutoff switch (3).

(2) Carefully screw the cutoff switch out of the coolant outlet neck. Do not damage the thermal element.

k. Oil Filter (fig. 2).

(1) Disconnect the hose fittings and remove the oil lines from the oil filter (9).

(2) Remove the two bolts that secure the oil filter to the bracket on the engine. Remove the filter.

l. Magneto (fig. 3).

(1) Disconnect the shielded ignition cables from the rear of the magneto assembly (11).

(2) Remove the capacitor from the top of the magneto.

(3) Remove the bolt that secures the governor and magneto to the engine timing gear cover at top, and remove the nut that secures the magneto to engine timing gear cover at the bottom.

(4) Slowly pull the assembly from the engine timing gear cover.

m. 24-volt Battery-charging Generator.

(1) Remove the terminal insulator cap from the terminal board on the capacitor cover. Disconnect the electrical leads from the terminals on top of the generator (5).

(2) Loosen the adjusting bolt in the generator adjusting arm and remove the drive belt from the generator pulley.

(3) Unscrew the bolt that secures the generator adjusting arm to the generator.

(4) Remove the two bolts that secure the generator to the mounting bracket on the engine.

(5) Lift the generator from the unit.

n. 28-volt, 2.5-kw Dc Generator (fig. 2).

(1) Remove the cover from the capacitor suppression shield assembly and disconnect all electrical leads from the top of the generator.

(2) Remove the adjusting bolt in the generator adjusting arm and remove the belt from the generator pulley.

(3) Remove the two bolts that attach the generator to the mounting bracket on the engine.

(4) Lift the generator from the unit.

o. Starting Motor (fig. 2).

(1) Remove the heater shield (21).

(2) Disconnect the electrical leads from the starting motor (14) and the solenoid switch (11).

(3) Unscrew the three mounting bolts that secure the starting motor to the flywheel housing.

(4) Remove the starting motor; be careful not to damage the drive gear or flywheel ring gear.

p. Winterization System. To remove individual components of the winterization system, follow the applicable instructions below:

(1) *Heater.*

(*a*) Drain the coolant by using the drain located on the side of the heater (20, fig. 2). This also will drain the coolant from the engine block.

(*b*) Remove the heater shield (21).

(*c*) Unplug the socket that contains the electrical leads.

(*d*) Disconnect the fuel line at the heater.

(*e*) Loosen the clamp that secures the heat exchanger tube to the combustion outlet on the heater.

(*f*) Remove the coolant hoses from the fittings on the heater.

(*g*) Remove the four bolts that secure the heater to the mounting bracket. Carefully remove the heater.

(2) *Heat exchanger pan.* Remove the tubes from the heat exchanger pan. Then remove the bolts that secure the exchanger to the engine oil pan. Carefully slide the exchanger from the oil pan.

(3) *Fuel pump and fuel control valve.*

(*a*) Carefully disconnect the fuel lines and electrical leads from the heater fuel pump (15) and fuel control valve (16).

(*b*) Remove the bolts and screws that secure the pump and valve to the heater control box and take the pump and valve from the unit.

q. 24-volt Battery-charging Voltage Regulator.

(1) Remove the cover from the suppression box (2, fig. 3).

(2) Disconnect the electrical leads from the voltage regulator (fig. 29).

(3) Remove the three nuts that secure the voltage regulator to the suppression box.

(4) Remove the voltage regulator from the unit.

r. 28-volt, 2.5-kw, Dc Voltage Regulator (fig. 4).

(1) Disconnect all electrical leads attached to the regulator base.

(2) Grip the bottom of the rubber vibration mounts with an open-end wrench to prevent tearing the rubber. Remove the attaching nuts.

(3) Lift the voltage regulator (3) and base from the bracket.

Note. To remove the voltage regulator without removing the base, press the spring clips of the regulator base outward, thereby releasing the voltage regulator. Remove the regulator by slipping the tabs from the slotted brackets in the base.

56. Detailed Inspection

This paragraph contains instructions for the disassembly, cleaning, inspection, and reassembly of all subassemblies and accessories removed from the unit in paragraph 55.

a. Engine Speed Governor (fig. 23). After the engine speed governor has been removed (par. 55*d*), proceed as follows:

(1) *Disassembly.*

(*a*) Remove the gasket (1).

(*b*) Remove the control arm spring (2).

(*c*) Remove the shoulder bolts (3) and adjustment slide (4).

(*d*) Unscrew the upper adjustment nut (5), remove the control arm eyebolt (6) with its lower adjustment nut (7).

(*e*) Remove the roll-pin (8) with a drift and hammer and slide the control arm (9) off the control shaft.

(*f*) Remove the spring (10) from the auxiliary arm. Remove the cotter pin (11), castle nut (12), auxiliary arm screw (13), and auxiliary arm (14) from the control arm.

(*g*) Carefully pull the drive shaft gear (15) from the drive shaft.

(*h*) Remove the four screws (16) that hold the diaphragm plate (17) to the governor body and pull the plate off with the governor drive shaft and weight assembly attached. Remove the gasket (18).

(*i*) Slide the thrust sleeve (19) and thrust bearing (20) off the drive shaft. Press the bearings off the sleeve.

(*j*) Remove the flyweights (24) from the drive shaft by removing hairpin clips (21), flyweight pins (22), and spacers (23).

(*k*) Remove the screw (25) that holds the bearing (27) in the diaphragm plate (17) with pliers or a screw driver, and drive the shaft with bearing (27) from the diaphragm plate. Remove the snap ring (26) and pull the bearing (27) off the drive shaft (28).

(*l*) Using a bearing puller, remove the bearing (29) from the governor body.

(*m*) Pry the plug (30) from the body with a screw driver or punch. Then remove the snap ring (31).

(*n*) Remove the yoke (32). Then remove the bumper screw (33), washer (34), and bumper spring (35) by loosening the lock nut (36).

(*o*) Drive the control shaft (37) out of the body. Remove the bearing (38) from the body with a bearing puller.

(*p*) Slide the oil retainer (39) and oil seal (40) off the shaft.

(*q*) Remove the snap ring (41) and pull the bearing (42) off the shaft.

(*r*) Remove the screw (43) and adjusting screw (44).

(2) *Cleaning and inspection.* Clean all parts of the governor with Diesel oil (D-40 or D-35) or solvent (SD). Inspect the governor parts for conditions indicated below.

(*a*) *Drive shaft gear (15).* Replace if gear teeth or shaft bore are damaged or excessively worn.

(*b*) *Mounting gasket (1).* Replace whenever removing or replacing governor.

(*c*) *Diaphragm plate (17).* Replace if worn or damaged.

(*d*) *Adjustment slide (4).* Replace if bent, worn, or dented.

(*e*) *Control arm spring (2).* Check the spring for free length and for tension. The free length should be 2⅝ inches. The pressure should be between 38 and 46 pounds at ¼ inch deflection, and 70 pounds at ½ inch deflection. Replace if out of tolerance.

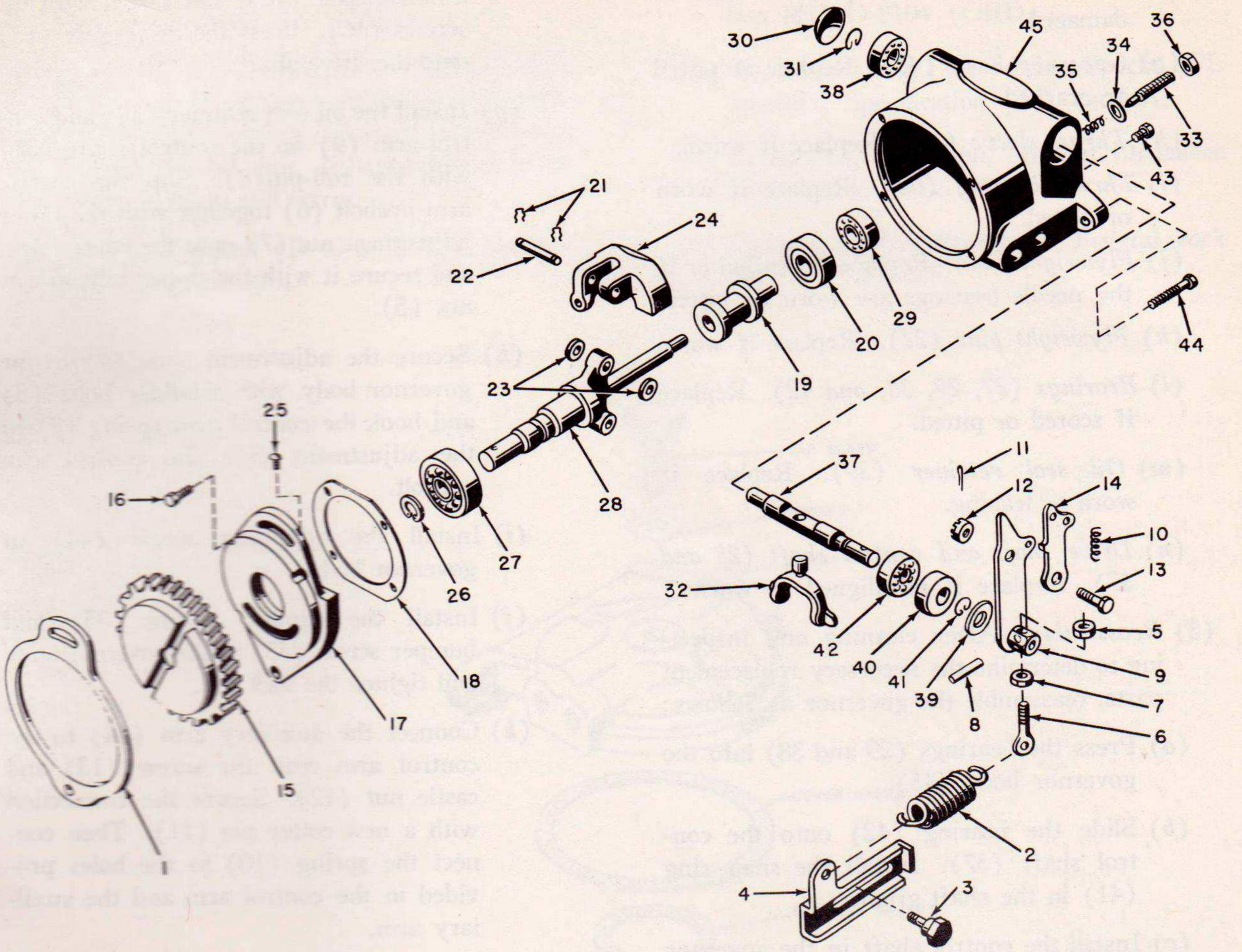


Figure 23. Engine speed governor, exploded view.

1. Gasket.
2. Control arm spring.
3. Shoulder bolt.
4. Adjustment slide.
5. Upper adjustment nut.
6. Control arm eyebolt.
7. Lower adjustment nut.
8. Roll-pin.
9. Control arm.
10. Auxiliary arm spring.
11. Cotter pin.
12. Castle nut.
13. Auxiliary arm screw.
14. Auxiliary arm.
15. Drive shaft gear.
16. Screw.
17. Diaphragm plate.
18. Body gasket.
19. Thrust sleeve.
20. Thrust bearing.
21. Hairpin clip.
22. Flyweight pin.
23. Pin spacers.
24. Flyweight.
25. Screw.
26. Snap ring.
27. Bearing.
28. Drive shaft.
29. Bearing.
30. Plug.
31. Snap ring.
32. Yoke.
33. Bumper screw.
34. Washer.
35. Bumper spring.
36. Lock nut.
37. Control shaft.
38. Bearing.
39. Oil seal retainer.
40. Oil seal.
41. Snap ring.
42. Bearing.
43. Screw.
44. Adjusting screw.
45. Governor body.

(*f*) *Control arm* (*9*). Replace if bent or damaged.

(*g*) *Governor body* (*45*). Replace if pitted or cracked.

(*h*) *Thrust sleeve* (*19*). Replace if worn.

(*i*) *Thrust bearing* (*02*). Replace if worn or pitted.

(*j*) *Flyweight* (*24*). Replace if scuffed or if the needle bearings are worn or pitted.

(*k*) *Flyweight pins* (*22*). Replace if worn.

(*l*) *Bearings* (*27, 29, 38, and 42*). Replace if scored or pitted.

(*m*) *Oil seal retainer* (*39*). Replace if worn or leaking.

(*n*) *Drive shaft and control shaft* (*28 and 37*). Replace if misaligned or worn.

(3) *Reassembly.* After cleaning and inspecting to determine the necessary replacement parts, reassemble the governor as follows:

(*a*) Press the bearings (29 and 38) into the governor body (45).

(*b*) Slide the bearing (42) onto the control shaft (37). Install the snap ring (41) in the shaft groove.

(*c*) Install the control shaft in the governor body and position the snap ring (31) in the shaft groove. The shaft must turn freely. Tap the oil retainer (40) into the body and insert a new plug (30). Install the yoke (32) onto the shaft.

(*d*) Press the bearing (27) onto the drive shaft (28). Install the snap ring (26) in the shaft groove. Install the flyweights (24) and flyweight spacers (23) on the shaft with pins (22) and hairpin clips (21).

(*e*) Press the thrust bearing (20) onto the thrust sleeve (19). Make certain that the bearing fits snugly against the shoulder on the sleeve. Then slide the sleeve and bearing onto the drive shaft.

(*f*) Install the drive shaft into the diaphragm plate (17) and install the screw (25) in the diaphragm plate. Position the diaphragm plate to the governor body using a new gasket (18), and fasten with the screws (16). Press the drive gear (15) onto the drive shaft.

(*g*) Install the oil seal retainer (39) and control arm (9) on the control shaft (37) with the roll-pin(8). Slip the control arm eyebolt (6) together with the lower adjustment nut (7) onto the control arm and secure it with the upper adjustment nut (5).

(*h*) Secure the adjustment slide (4) to the governor body with shoulder bolts (3) and hook the control arm spring (2) to the adjustment slide and control arm eyebolt.

(*i*) Install the adjusting screw (44) in governor body.

(*j*) Install the bumper spring (35) and bumper screw (33) in the governor body and tighten the lock nut.

(*k*) Connect the auxiliary arm (14) to the control arm with the screw (13) and castle nut (12). Secure the connection with a new cotter pin (11). Then connect the spring (10) to the holes provided in the control arm and the auxiliary arm.

(*l*) Install the bumper spring (35), washer (34), and bumper screw (33). Tighten the lock nut (36).

(*m*) Install the screw (43) in the governor body.

b. Air Cleaner (fig. 14). Refer to paragraph 38*b*(2) and disassemble and clean the air cleaner as instructed.

c. Carburetor (fig. 24). After the carburetor has been removed from the unit (par. 55*f*), proceed as follows:

(1) *Disassembly.*

(*a*) Remove the screws and lock washers (6). Separate the throttle body assembly (7) from the fuel bowl assembly (47).

(*b*) Remove the gasket (8).

(*c*) Remove the venturi (9).

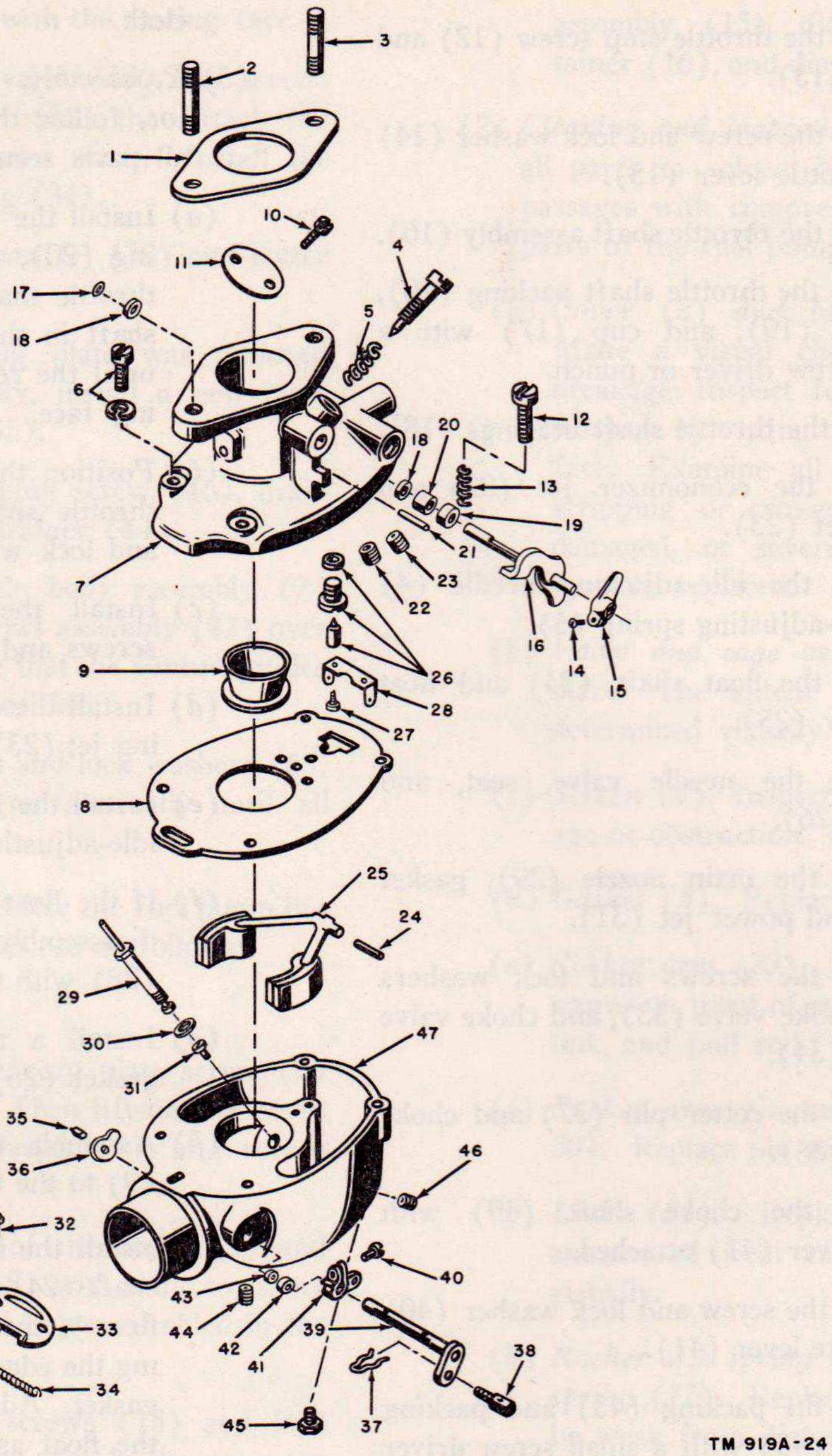


Figure 24. Carburetor, exploded view.

1. Carburetor gasket (H560).
2. Stud (H556).
3. Stud (H557).
4. Idle-adjusting needle.
5. Idle-adjusting spring.
6. Screw and lock washer.
7. Throttle body assembly.
8. Gasket (H569).
9. Venturi (MP291).
10. Screw and lock washer. (H558 and H559).
11. Throttle valve (MP281).
12. Throttle stop screw (H566).
13. Spring (MP285).
14. Screw and lock washer.
15. Throttle lever.
16. Throttle shaft assembly.
17. Cup.
18. Throttle shaft bearing.
19. Packing retainer.
20. Packing.
21. Throttle stop pin.
22. Economizer jet.
23. Idling jet.
24. Float shaft.
25. Float assembly.
26. Needle valve, seat, and gasket.
27. Drive screw.
28. Float bracket.
29. Main nozzle.
30. Gasket.
31. Power jet.
32. Screw and lock washer.
33. Choke valve.
34. Choke valve spring.
35. Ball.
36. Numbering plate.
37. Cotter pin.
38. Choke swivel.
39. Choke shaft.
40. Screw and lock washer.
41. Choke lever.
42. Packing retainer.
43. Packing.
44. Strainer.
45. Drain plug.
46. Drill plug screw.
47. Fuel bowl assembly.

(*d*) Remove the screw and lock washer (10) and throttle valve (11).

(*e*) Remove the throttle stop screw (12) and spring (13).

(*f*) Remove the screw and lock washer (14) and throttle lever (15).

(*g*) Remove the throttle shaft assembly (16).

(*h*) Remove the throttle shaft packing (20), retainer (19), and cup (17) with a small screw driver or punch.

(*i*) Remove the throttle shaft bearings (18).

(*j*) Remove the economizer jet (22) and idling jet (23).

(*k*) Remove the idle-adjusting needle (4) and idle-adjusting spring (5).

(*l*) Remove the float shaft (24) and float assembly (25).

(*m*) Remove the needle valve, seat, and gasket (26).

(*n*) Remove the main nozzle (29), gasket (30), and power jet (31).

(*o*) Remove the screws and lock washers (32), choke valve (33), and choke valve spring (34).

(*p*) Remove the cotter pin (37) and choke swivel (38).

(*q*) Remove the choke shaft (39) with choke lever (41) attached.

(*r*) Remove the screw and lock washer (40) and choke lever (41).

(*s*) Remove the packing (43) and packing retainer (42) with a small screw driver or punch.

(*t*) Remove the strainer (44), drain plug (45), and drill plug screw (46).

(*u*) Do not remove the throttle stop pin (21), float bracket (28), or numbering plate (36) unless they require replacing.

(2) *Cleaning and inspection.* Clean all castings and parts of the carburetor with solvent (SD). Blow out all passages with compressed air. Check each part, and replace those parts that show wear or damage. Clean the bore of the flange by scraping, or with sandpaper; do not use emery cloth.

(3) *Reassembly.* To resassemble the carburetor, follow the instructions below. Install all parts securely and use all new gaskets.

(*a*) Install the packing retainer (19), packing (20), and one bearing (18) on the throttle shaft assembly (16). Insert the shaft in the carburetor and tap lightly until the retainer is flush with the casting face.

(*b*) Position the throttle lever (15) on the throttle shaft and secure with a screw and lock washer (14).

(*c*) Install the throttle valve (11) with screws and lock washers (10).

(*d*) Install the economizer jet (22) and idling jet (23).

(*e*) Install the idle-adjusting needle (4) and idle-adjusting spring (5).

(*f*) If the float bracket was removed during disassembly, install the float bracket (28) with the drive screws (27).

(*g*) Install a new needle valve, seat, and gasket (26).

(*h*) Assemble the gasket (8) and venturi (9) to the throttle body assembly.

(*i*) Install the float assembly (25) and float shaft (24). Set the nearest edge of the float ¼ inch from the gasket face, keeping the edge of the float parallel with the gasket. Adjust by bending the lever on the float assembly.

(*j*) If the throttle stop pin (21) was removed during disassembly, drive a new one into the hole in the throttle body.

(*k*) Install the power jet (31), gasket (30), and main nozzle (29).

(*l*) Position the choke lever (41) on the choke shaft and fasten with a screw and lock washer (40).

(*m*) Install the packing retainer (42) and packing (43) on the choke shaft as-

sembly (39). Insert the shaft in the fuel bowl and tap lightly until the packing retainer is flush with the casting face.

(*n*) Install a choke valve (33) and screws and lock washers (32) that attach the valve to the choke shaft. Install the choke valve spring (34).

(*o*) Install the choke swivel (38) and cotter pin (37).

(*p*) If the numbering plate was removed during disassembly, install a new plate (36) and ball (35).

(*q*) Install the drill plug screw (46), drain plug (45), and strainer (44).

(*r*) Invert the throttle body assembly (7) and lower fuel bowl assembly (47) over the float; be sure that the venturi guides the bodies into position.

(*s*) Install the screws and lock washers (6). Tighten the screws gradually until all are tight.

d. Fuel Pump (fig. 25). After the fuel pump has been removed (par. 55*g*), proceed as follows:

(1) *Disassembly.*

(*a*) Remove the cover cap plate screw (8) and washer (7). Then lift out the cover cap plate (6), gasket (5), and screen (4).

(*b*) Mark the edges of the cover (2) and body assembly (18) with a file to assure that the parts will be reassembled in the same position.

(*c*) Remove the six screws (13) and lock washers (14) that attach the cover to the body assembly. With a screw driver handle, loosen the cover (2) from the body assembly (18) and lay it on a bench with the diaphragm flange up.

(*d*) Remove the screw (12) that holds the valve and cage retainer (11). Lift out the valve and cage retainer (11), the two valve and cage assemblies (10), and the two gaskets (9).

(*e*) Drive the rocker arm pin (19) out of the body with a punch and hammer. Remove the rocker arm (23), spring (22), and link (21). Lift out the diaphragm assembly (15), diaphragm spring retainer (16), and diaphragm spring (17).

(2) *Cleaning and inspection.* Clean and rinse all parts in solvent (SD). Blow out all passages with compressed air. Inspect all parts of the fuel pump as follows:

(*a*) *Cover* (*2*) *and body assembly* (*18*). Make a visual check for cracks and breakage. Inspect for diaphragm flange warpage by testing on a smooth, flat surface. Examine all threaded holes for stripping or crossed threads. Broken, damaged, or severely warped castings must be replaced.

(*b*) *Valve and cage assemblies* (*10*). Replace. The extent of wear cannot be determined visually.

(*c*) *Screen* (*4*). Inspect the screen for damage or obstruction. Replace if necessary.

(*d*) *Gasket* (*5*). Replace.

(*e*) *Rocker arm* (*23*). Inspect for wear or scores on point of contact with camshaft, link, and pull rod.

(*f*) *Rocker arm pin and washer* (*19 and 20*). Replace pin and washer.

(*g*) *Link* (*21*). Replace the link. The amount of wear cannot be determined visually.

(*h*) *Rocker arm spring* (*22*) *and diaphragm spring* (*17*). Replace. The spring may be weak from distortion or corrosion.

(*i*) *Diaphragm* (*15*). Always replace.

(*j*) *Gaskets* (*9*). Replace.

(3) *Reassembly.* After cleaning and inspection, reassemble the fuel pump as follows:

(*a*) Soak a new diaphragm (15) in clean Diesel oil (D-40 or D-35) while performing the following steps:

(*b*) Place the rocker arm (23) and the link (21) in the body assembly (18) with the link hook down. Then align the

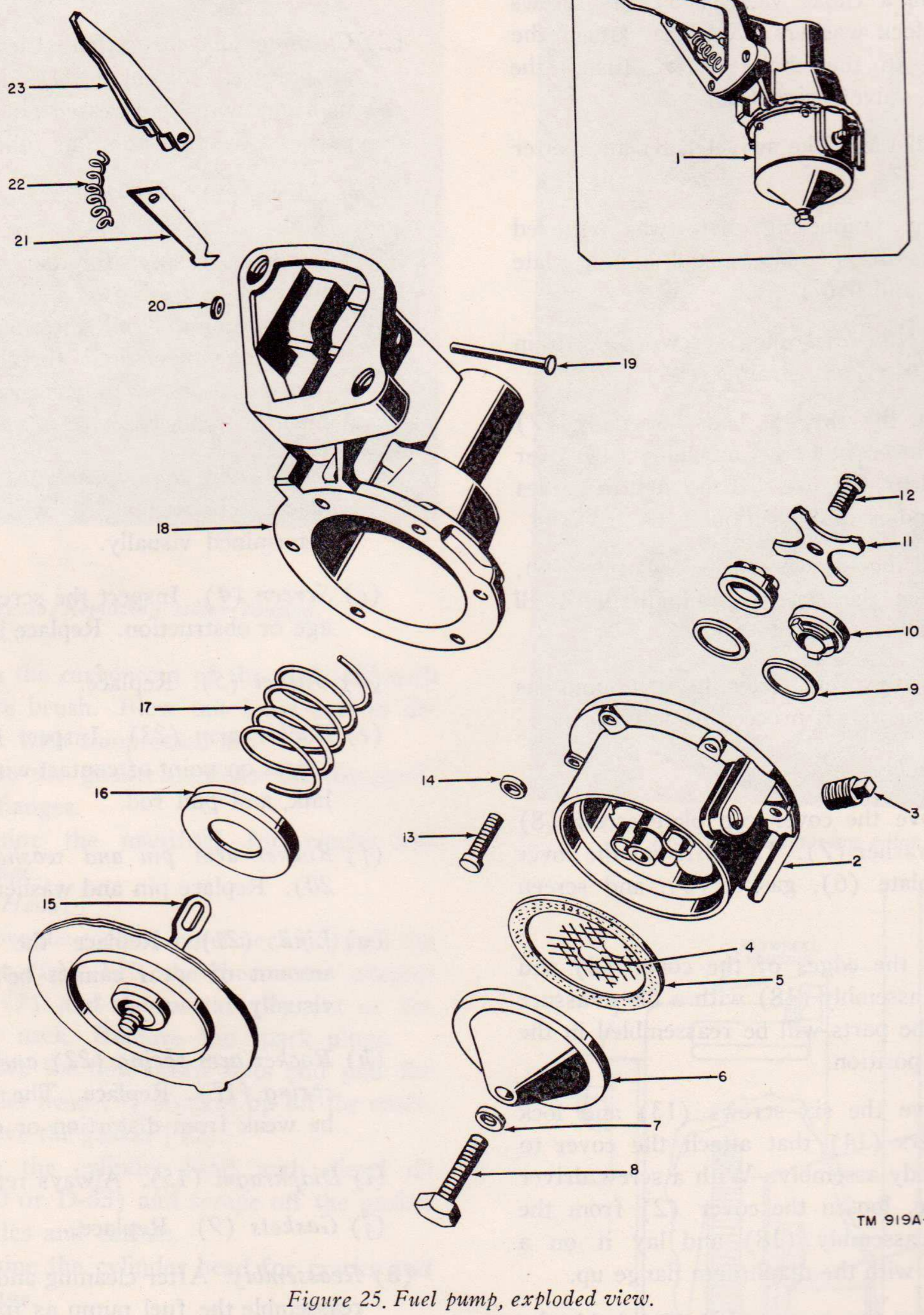


Figure 25. Fuel pump, exploded view.

1. Fuel pump assembly (MP272).
2. Cover (MP263).
3. Plug (H528).
4. Screen (H514).
5. Gasket (H513).
6. Cover cap plate (MP261).
7. Washer (H512).
8. Cover cap plate screw (H511).
9. Gasket (H529 and H530).
10. Valve and cage assembly (H265 and H266).
11. Valve and cage retainer (MP267).
12. Screw (H531).
13. Screw (H515 to H521).
14. Lock washer (H522 to H527).
15. Diaphragm assembly (D91).
16. Diaphragm spring retainer (MP262).
17. Diaphragm spring (MP264).
18. Body assembly (MP268).
19. Rocker arm pin (H532).
20. Washer.
21. Link (MP269).
22. Rocker arm spring (MP270).
23. Rocker arm (MP271).

rocker arm pin hole with the hole in the body assembly and drive in the rocker arm pin (19). Install the new washer (20) on rocker arm pin and peen over end of pin. Install the rocker arm spring (22).

(*c*) Place the diaphragm spring (17) over the pull-rod well in the body. Place the diaphragm spring retainer (16) on the spring and hook in the diaphragm assembly to the link by pressing the diaphragm against the spring.

(*d*) Place the valve and cage gaskets (9) in position in the cover (2) and insert the two valve and cage assemblies (10). The outlet valve must have the three-legged spider facing into the top cover, and the inlet valve must have the three-legged spider facing out of the top cover. Secure the valve and cage assemblies with the valve and cage retainer (11) and the screw (12).

(*e*) Turn the top cover so that the diaphragm flange rests on the bench, and install the screen (4), gasket (5), cover cap plate (6), washer (7), and cover cap plate screw (8) in that order. Tighten the cover cap plate screw securely.

(*f*) Install the cover on the body assembly. Be sure to line up file marks. Install the screws and lock washers and tighten until the screws just engage the lock washers. Push the rocker arm in a full stroke. Allow it to snap out under power of the diaphragm spring. Sufficient diaphragm cloth must be pulled inside the pump before the screws can be tightened, or the pump will deliver too much pressure.

(*g*) Tighten the cover screws alternately and securely.

e. Fuel Filter (fig. 16). Refer to paragraph 38*b*(4) and disassemble and clean the fuel filter as instructed.

f. Oil Filter (fig. 15). Refer to paragraph 38*b*(3) and disassemble and clean the oil filter as instructed.

g. Magneto Assembly (fig. 26). After the magneto assembly has been removed (par. 55*l*), proceed as follows:

(1) *Disassembly.*

(*a*) Hold the magneto flange in a vise and remove the nut (1) and lock washer (2).

(*b*) Grasp one of the drive lugs ot the impulse coupling shell (3) with a pair of pliers. Use a combined pulling and turning motion to remove the shell. Using a coupling puller, separate the coupling hub from the rotor shaft, and remove the key (6) from the shaft.

Note. Be careful not to stretch the drive spring (4) when removing the shell. If the drive spring does not free itself from the impulse coupling hub (5), pry it loose with a screw driver.

(*c*) Remove the oil slinger baffle disk (7), drive end seal outer washer (8), magnetic rotor drive end seal (9), and rotor drive end seal inner washer (10).

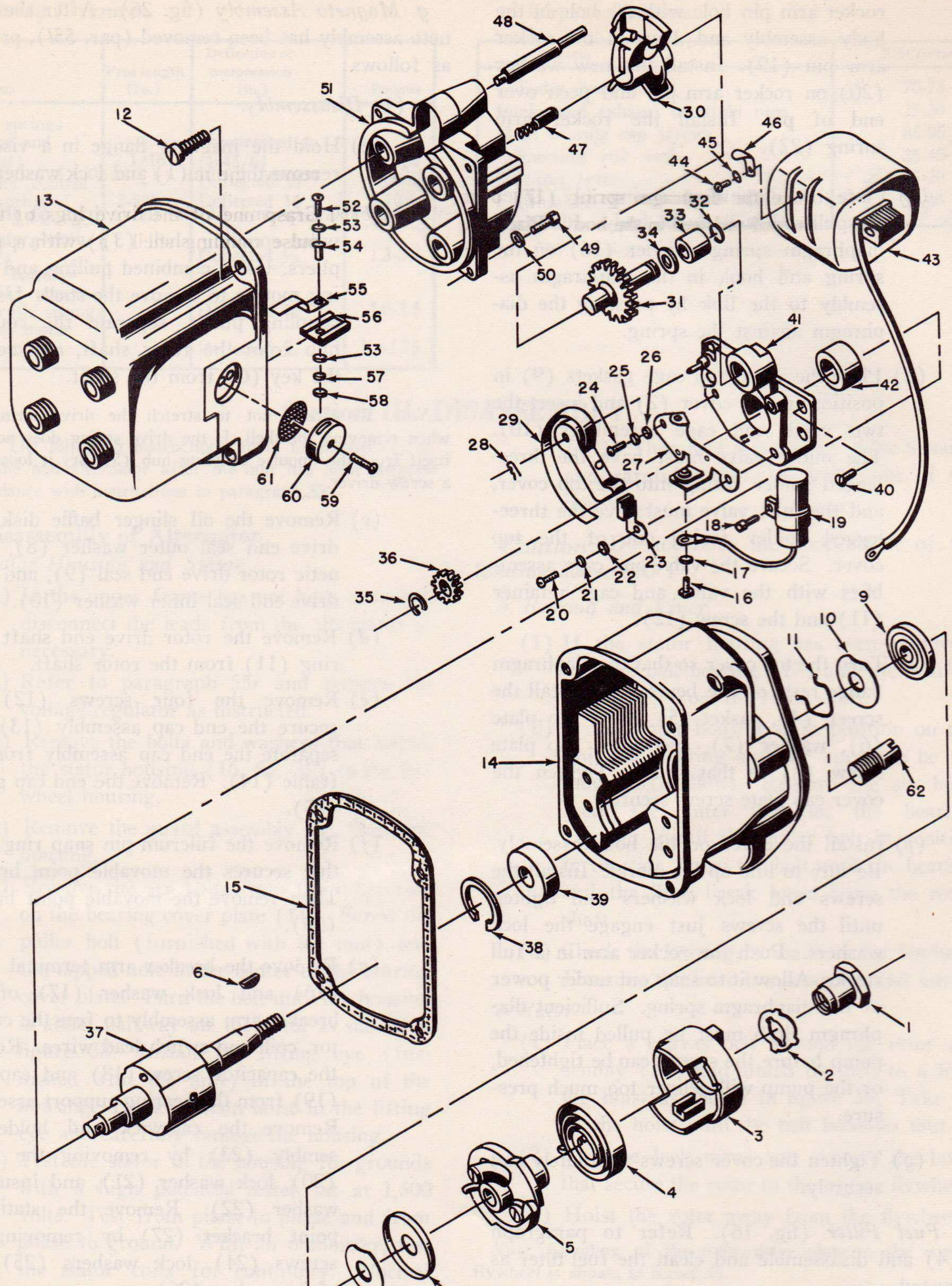
(*d*) Remove the rotor drive end shaft snap ring (11) from the rotor shaft.

(*e*) Remove the four screws (12) that secure the end cap assembly (13), and separate the end cap assembly from the frame (14). Remove the end cap gasket (15).

(*f*) Remove the fulcrum pin snap ring (28) that secures the movable point bracket. Then remove the movable point bracket (29).

(*g*) Remove the breaker arm terminal screw (16) and lock washer (17) off the breaker arm assembly to free the capacitor, coil, and switch lead wires. Remove the capacitor screw (18) and capacitor (19) from the bearing support assembly. Remove the camwick and holder assembly (23) by removing the screw (20), lock washer (21), and insulating washer (22). Remove the stationary point bracket (27) by removing the screws (24), lock washers (25), and plain washer (26).

(*h*) Lift the distributor rotor (30) off the distributor shaft (31). Remove the snap ring (32) from the distributor shaft.



TM 919A-26

Figure 26. Magneto, exploded view.

LEGEND FOR FIGURE 26

1. Impulse coupling nut (H671).
2. Lock washer (H670).
3. Impulse coupling shell (MP350).
4. Impulse coupling drive spring (MP349).
5. Impulse coupling hub (MP348).
6. Hub key (MP351).
7. Oil slinger baffle disk (MP347).
8. Drive end seal outer washer (H669).
9. Drive end seal (H668).
10. Drive end seal inner washer (H667).
11. Drive end snap ring (MP346).
12. Cover screw (H651 and H652, H657 and H658).
13. End cap assembly (H311).
14. Frame (E44).
15. End cap gasket (H663).
16. Breaker arm terminal screw.
17. Lock washer.
18. Capacitor screw (H661).
19. Capacitor (C31).
20. Screw.
21. Lock washer.
22. Insulating washer.
23. Camwick and holder assembly (M56 and MP341).
24. Locking screw.
25. Lock washer.
26. Washer.
27. Stationary point bracket (E41).
28. Fulcrum pin snap ring (H660).
29. Movable point bracket (E41).
30. Distributor rotor (E43).
31. Distributor shaft and gear assembly (MP335).
32. Snap ring (MP338).
33. Distributor shaft bearing (MP343).
34. Thrust washer (H659).
35. Snap ring (MP338).
36. Rotor shaft gear (MP339).
37. Rotor and shaft assembly (E43).
38. Rotor shaft bearing snap ring.
39. Rotor shaft drive end bearing (MP345).
40. Bearing support screw.
41. Bearing support assembly (MP342).
42. Rotor shaft bearing (MP346).
43. Coil (LU11).
44. Coil clip screw.
45. Coil clip washer.
46. Coil clip (E40).
47. Coil brush and spring (E35).
48. High-tension lead and suppressor (E34).
49. Distributor block screw.
50. Distributor block washer.
51. Distributor block (E33).
52. Primary ground screw.
53. Lock washer.
54. Ground terminal bushing (MP331).
55. Ground strip (E32).
56. Ground strip guide (MP332).
57. Lock washer.
58. Ground terminal nut.
59. Vent hood screw.
60. Vent hood (MP333 and MP334).
61. Vent screen (H654).
62. Impulse coupling stop pin (H666).

Then remove the distributor shaft bearing (33) and thrust washer (34). Remove the distributor shaft and gear assembly (31).

(*i*) Remove the snap ring (35) from the rotor shaft (37). Using a gear puller, remove the rotor shaft gear (36) from the rotor shaft. Remove the rotor and shaft assembly (37). Then remove the snap ring (38) from the shaft.

(*j*) Place the magneto frame in an arbor press using a sheet of soft metal to protect it at point of contact. Press the rotor shaft drive end bearing (39) out of the frame.

(*k*) Remove the four bearing support screws (40) that secure the bearing support assembly. Place the bearing support assembly in an arbor press and press the rotor shaft bearing (42) out of the support.

(*l*) Remove the two coil bridge set screws that secure the coil bridge laminations. Remove the coil (43).

(*m*) Remove the coil clip screw (44), washer (45), and the coil clip (46).

(*n*) Lift the coil brush and spring (47) out of the distributor block.

(*o*) Screw the high-tension lead and suppressor (48) out of the distributor block.

(*p*) Remove the four distributor block screws (49) and washers (50, and remove the distributor block (51).

(*q*) Remove the primary ground screw (52), lock washers (53), round terminal bushing (54), ground strip (55), ground strip guide (56), lock washer (57), and ground terminal nut (58).

(*r*) Remove the vent hood screws (59). Remove the vent hoods (60) and vent screens (61).

(*s*) Screw the impulse coupling stop pins (62) out of frame.

(2) *Cleaning and inspection.*

(*a*) *Cleaning.* Wash all the mechanical parts

of the magneto in cleaning solvent (SD) and dry them thoroughly with compressed air. Do not allow cleaning solvent to come into contact with wires or windings.

(*b*) *Inspection.* Inspect all parts for excessive wear or damage. Grease or oil parts, as required, when reassembling. Replace the cam felt wick if it is dry or hard.

Note. The magneto does not require remagnetizing. Do not attempt to remagnetize it during overhaul.

(3) *Reassembly.*

(*a*) Install the vent screens (61) and vent hoods (60) on the end cap with screws (59).

(*b*) Install the ground nut (58), lock washer (57), ground strip guide (56), ground strip (55), ground terminal bushing (54), lock washer (53), and primary ground screw (52).

(*c*) Install the distributor block (51) in housing with distributor block screws (49) and washers (50).

(*d*) Screw the high-tension lead and suppressor (48) into the distributor block.

(*e*) Insert the coil brush and spring (47) in the distributor block.

(*f*) Secure the coil clip (46) to the housing with the coil clip screw (44) and washer (45).

(*g*) Install the coil (43) and secure the coil bridge laminations with the set screws.

(*h*) Place the bearing support assembly (41) in an arbor press and press the bearing (42) into the support. Then install the bearing support assembly (41) with the bearing support screws (40).

(*i*) Place the magneto frame in an arbor press, using a sheet of soft metal to protect it at points of contact, and press the bearing (39) into the frame.

(*j*) Press the rotor shaft gear (36) onto the rotor shaft (37). Install the snap ring (38) on the rotor shaft. Insert the long end of the rotor shaft (37) through the frame (14). Then install the snap ring (35) on the rotor shaft.

(*k*) Insert the long end of the distributor shaft and gear assembly (31) through the hole in the bearing support (41). Install the thrust washer (34) and distributor shaft bearing (33) on the distributor shaft and gear assembly with the snap ring (32). Then slip the distributor rotor (30) on the shaft.

(*l*) Install a new stationary point bracket (27) on the bearing support assembly with the locking screws (24) and washers (25) and (26). Install the camwick and holder assembly (23) with the screw (20) and washers (21) and (22). Position a new capacitor (19) on the bearing support assembly and secure with the capacitor screw (18). Install the lock washer (17) and breaker arm terminal screw (16) on the bearing support.

(*m*) Install a new movable point bracket (29) on the bearing support with the fulcrum pin snap ring (28). Adjust the breaker points to .015 inch opening at full separation.

(*n*) Position a new end cap gasket (15) on the frame and install the end cap assembly (13) to the frame (14) with cover screws (12). Coat the entire joint with gasket sealing varnish.

(*o*) Install the drive end snap ring (11) on the rotor shaft.

(*p*) Screw the impulse coupling stop pins (62) into the holes in the frame.

(*q*) Install the drive end seal inner washer (10), drive end seal (9), drive end seal outer washer (8), and the oil slinger baffle disk (7) on the rotor shaft.

(*r*) Make sure the impulse coupling parts are thoroughly clean. Do not oil or grease the impulse coupling hub (5) or its pawls. Keep the inside of the impulse

coupling shell (3) entirely free of oil or grease. Use a small amount of grease on the drive spring.

(*s*) Insert the impulse coupling drive spring (4) in the impulse coupling shell (3) and anchor the outside end in the round socket. Be sure the spring is coiled clockwise from the outer end. Connect the impulse coupling hub (5) to the inside end of the drive spring, and wind the spring one full turn. Then insert the hub key (6) in the keyway in the rotor shaft and push the hub in place. Check to be sure that both impulse coupling stop pins (62) are tightly screwed into the frame.

(*t*) Holding the magneto flange in a vise, install the impulse coupling nut (1) and lock washer (2). Bend the lugs of the lock washer up to prevent the nut from loosening.

(4) *Testing.* With the magneto reassembled, test it as follows:

(*a*) Obtain a piece of rubber-covered, single strand wire about 4 inches long and strip about ½ inch of the insulation from each end.

(*b*) Insert one end of the wire into one of the sockets into which the high-tension spark plug wires are normally inserted. Make sure that the end of the wire reaches the bottom of the socket and then bend the other end so that it is within ⅛ inch of the frame of the magneto.

(*c*) Rotate the rotor shaft of the magneto and watch for a spark between the end of the wire and the frame of the magneto. Test each socket in turn and if a spark jumps the ⅛ inch gap, the magneto may be assumed to be satisfactory.

(*d*) Slowly turn the impulse coupling by hand in a clockwise direction, noting the engagement, wind-up, and release for each pawl and stop pin. A characteristic snap sound can be heard if the impulse coupling is functioning properly.

h. 28-volt, 2.5 Dc Generator (fig. 27). After the 28-volt, 2.5-kw dc generator has been removed (par. 55*n*), proceed as follows:

(1) *Disassembly.*

(*a*) Remove the six screws that secure the capacitor suppression shield cover and remove the cover. Disconnect the electrical leads at the capacitors. Remove the four screws (21) and lock washers (20) that secure the capacitor suppression shield assembly (19) to the field frame. Then remove the capacitor suppression shield assembly (19) and gasket (18).

(*b*) Remove the pulley (8) and generator fan (7) by removing the hexagonal lock nut (8). Tap the shaft lightly with a hammer to break the pulley loose. Collect the square key (3). Remove the four screws and lock washers and separate the pulley from the generator fan.

(*c*) Remove the four Allen-head screws that secure the bearing bracket (5) to the field frame (16). Remove the bearing bracket and armature. To remove the bearing bracket from the armature, tap the bracket from the bearing. If the bearing bracket cannot be removed in this manner, use an arbor press.

(*d*) Loosen the two bolts that secure the band assembly (24) and slide the band off the bearing bracket.

(*e*) Remove the four Allen-head screws (22) that secure the bearing bracket to the field frame. Remove the bearing bracket (23).

(*f*) Pull the bearings (2) and (4) from the armature shaft.

(*g*) Remove the brushes (11), brush holder assemblies (12), brush holder shaft (13), and insulators (10).

(*h*) Remove the field coils (14), commutating coil assemblies (17), and field poles (15).

(2) *Cleaning and inspection.* Clean all the dc generator parts and inspect for abnormal conditions as instructed below:

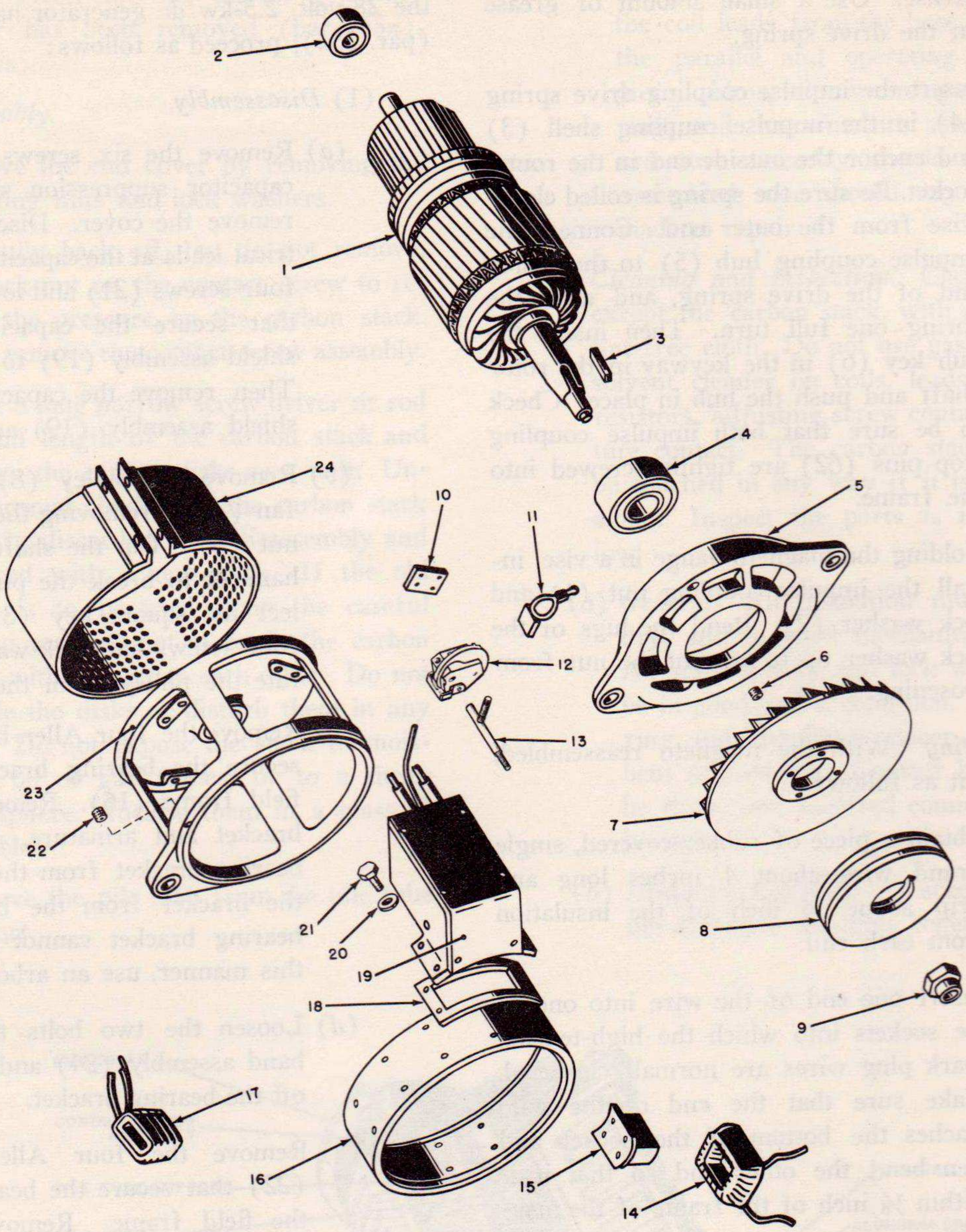


Figure 27. 28-volt 2.5-kw dc generator, exploded view.

1. Armature assembly (E91).
2. Bearing (MP456).
3. Square key.
4. Bearing (MP458).
5. Bearing bracket (E104).
6. Allen-head screw.
7. Generator fan (B31).
8. Pulley (MP475).
9. Lock nut (H1105).
10. Brush holder insulator.
11. Brush (E92 to E99).
12. Brush holder assembly.
13. Brush holder shaft.
14. Field coil (L23 to L26).
15. Field pole (E109 to E112).
16. Field frame (A 92).
17. Commutating coil assembly (L21 and L22).
18. Gasket.
19. Capacitor suppression shield assembly (E127).
20. Lock washer.
21. Screw.
22. Allen-head screw.
23. Bearing bracket (E113).
24. Band assembly (A 91).

(*a*) *Brushes* (*11*) *and brush springs.*

1. Blow out the dust from the brush holders (12) and bearing bracket (23) with dry, compressed air.

2. Replace all brushes when reassembling. All new brushes must be fully seated for proper commutation. Use a piece of #0000 sandpaper wrapped around the commutator with the sanded side facing the brushes, and rotate the armature slowly by hand. The brushes will seat themselves to the contour of the commutator.

3. The brush spring pressure must be between .5 and .9 pounds when the springs are deflected ½ inch. Replace springs that do not meet this requirement.

(*b*) *Armature* (*1*).

1. Clean the commutator with a cloth moistened with cleaning solvent (SD). Smooth the commutator with #0000 sandpaper. If a brownish brush film is established, do not sand the commutator unless absolutely necessary.

2. If the commutator is extremely rough or eccentric, mount the armature in a lathe and take a light cut across the face of the commutator (approximately .005 inch). Do not take a cut off the commutator risers into which the armature wires are soldered. The minimum diameter to which the commutator can be turned is 2⅝ inches. After turning, carefully undercut the mica to a depth of .020 inch. Smooth and polish the commutator to remove any burrs that might have developed from undercutting the mica. Use #0000 sandpaper.

3. Test the armature for short circuits, open circuits, or grounds. When testing for grounds, use a 110-volt ac line with a 50-watt lamp in series.

4. Touch one test lamp prod to the armature shaft or to the core laminations and the other prod to the commutator copper segments. If the lamp lights, the armature is grounded.

5. Inspect the armature to insure that all the wire ends are soldered firmly in the commutator risers. If such is the case, it may be assumed that there is no open circuit.

6. Test the armature for short circuits in a growler which is so constructed as to have its laminations in the same spacing as the main pole pieces in the field frame. Make certain that none of the copper segments on the commutator are joined electrically by conducting materials such as copper, steel chips, or solder.

(*c*) *Field frame* (*16*).

1. Touch the test lamp prods to the terminal ends of the field windings. If the test lamp lights, the circuit is complete.

2. Touch one test lamp prod to the terminal ends of the field windings and the other prod to the field frame. The lamp will light if the winding is grounded to the field frame or pole pieces.

3. Connect the terminals of the shunt field winding to 24 volts. A test ammeter should indicate 6.95 to 7.75 amperes. The total resistance of the field windings is 3.1 to 3.45 ohms. When a current of 50 amperes is passed through the interpole windings, a voltmeter connected across the leads should read .232 volt, plus or minus .02 volt.

(*d*) *Capacitor suppression shield cover.*

1. Examine the capacitor suppression shield cover for cracks.

2. Examine the insulated terminal block and replace if cracked.

3. Examine the terminal studs and jumpers for burns or damage.

(*e*) *Bearings*

1. Examine the bearings for pits, scratches, or binding. Remove the bearing seals and, if there is evidence of dirt or grit in the bearing, thoroughly flush the old grease from the bearing with hot oil.

2. If necessary, relubricate with grease, conforming to specification MIL-G-3278 and reinstall the seals.

(3) *Reassembly.* After cleaning and inspection, reassemble the dc 2.5-kw generator as follows:

(*a*) Install the field coils (14), commutating coils (17), and field poles (15) in the field frame (16).

(*b*) Install the brushes (11) in the brush holders and secure the leads.

(*c*) Install the brush holders (12) and brush holder insulators (10) in the bearing bracket (23).

(*d*) Attach the bearing bracket (23) to the field frame (16) with the four Allen-head screws (22).

(*e*) Press the bearings (2) and (4) into position in the bearing brackets (5 and 23).

(*f*) Slip the armature (1) into the field frame. Do not damage the brushes and examine for correct seating on the commutator.

(*g*) Install the bearing bracket (5) on the field frame. Align either mounting ear of the bearing bracket (5) with the ear on the bearing bracket (23) and secure the bearing bracket to the field frame with the four Allen-head screws (6).

(*h*) Position the suppression shield gasket (18) and capacitor suppression shield assembly (19) on the field frame. Be sure of clean metal-to-metal contact between the field frame, gasket, and capacitor suppression shield assembly. Connect the electrical leads. Slip the cover in position and secure with the six screws.

(*i*) Slip the band assembly (24) onto the bearing bracket (23) and tighten the bolts.

(*j*) Assemble the fan to the drive pulley with the four Allen-head screws.

(*k*) Position the key (3) in the shaft keyway and tap the assembled external fan (7) and pulley (8) onto the shaft. Lock the pulley into position with the lock nut (9).

i. 24-volt Battery-charging Generator (fig. 28). After the 24-volt battery-charging generator has been removed (par. 55*m*), proceed as follows:

(1) *Disassembly.*

(*a*) Remove the screws (24) and lock washers (23) that secure the shield cover (22). Remove the shield cover.

(*b*) Disconnect the electrical leads on the terminal plate assembly (13). Remove the screws (16), washers (14), and lock washers (15) that secure the terminal plate assembly (13). Then remove the terminal plate assembly.

(*c*) Remove the screws (21) and lock washers (20) that secure the capacitor (19) and terminal shield (12) to the generator frame assembly (29). Remove the capacitor (19), terminal shield (12), and terminal shield mounting plate (25).

(*d*) Remove the pulley (3) and fan (4) by removing the hexagonal nut (1) and lock washer (2). Tap the shaft lightly with a hammer to break the pulley loose. Collect the outside space collar (5) and the key (27).

(*e*) Remove the cover band (30).

(*f*) Remove the through bolts (33) and lock washers (34). Remove the drive end frame (6), static ground collector (9), and inside space washer (11).

(*g*) Remove the screws and lock washers (10) that secure the bearing retainer

(8) and static ground collector (9), to the drive end frame (6). Remove the bearing retainer (8), static ground collector (9), and ball bearing (7).

(*h*) Remove the commutator end frame and brush holder (31).

(*i*) Remove the screws and lock washers that secure the brush leads to the brush holders. Then remove the brushes (32).

(*j*) Remove the armature (26) from the frame assembly.

(*k*) Remove the ball bearing (28).

(2) *Cleaning and inspection.* Clean all the 24-volt battery-charging generator parts and inspect for abnormal conditions as instructed below.

(*a*) *Brushes and brush springs.*

1. Blow out the brush dust from the brush holders and commutator end frame (31) with dry, compressed air.

2. Replace all brushes upon reassembly. All new brushes must be fully seated for proper commutation. Use a piece of #0000 sandpaper wrapped around the commutator with the sanded side facing the brushes, and rotate the generator slowly by hand. The brushes will seat themselves to the contour of the commutator.

3. The brush spring pressure must be between 1.0 and 1.5 pounds when deflected ½ inch. Replace the springs that do not meet this specification.

(*b*) *Armature.*

1. Clean the commutator with a cloth moistened with cleaning solvent (SD). Smooth the commutator with #0000 sandpaper. If a brownish brush film is established, do not sand the commutator unless absolutely necessary.

2. If the commutator is extremely rough or eccentric, mount the armature in a lathe and take light cut across the face of the commutator (approximately .005 inch). Do not take a cut off the commutator risers into which the armature wires are soldered. The minimum diameter to which the commutator can be turned is 1¼ inches. After turning, carefully undercut the mica to a depth of .020 inch. Smooth and polish the commutator to remove any burrs that might have developed from undercutting the mica. Use #0000 sandpaper.

3. Test the armature for short circuits, open circuits, or grounds. When testing for grounds, use a 110-volt ac line with a 50-watt lamp in series.

4. Touch one test lamp prod to the armature shaft or to the core laminations and the other prod to the commutator copper segments. If the lamp lights, the armature is grounded.

5. Inspect the armature to insure that all the wire ends are soldered firmly in the commutator risers. If such is the case, it may be assumed that there is no open circuit.

6. Test the armature for short circuits in a growler which is so constructed as to have its laminations in the same spacing as the main pole shoes in the frame assembly. Make certain that none of the copper segments on the commutator are joined electrically by conducting materials such as copper, steel chips, or solder.

(*c*) *Frame assembly (29).*

1. Touch the test lamp prods to the terminal ends of the field windings. If the test lamp lights, the circuit is complete.

2. Touch one test lamp prod to the terminal of the field winding and the other prod to the frame. The lamp will light if the winding is grounded to the frame or pole pieces.

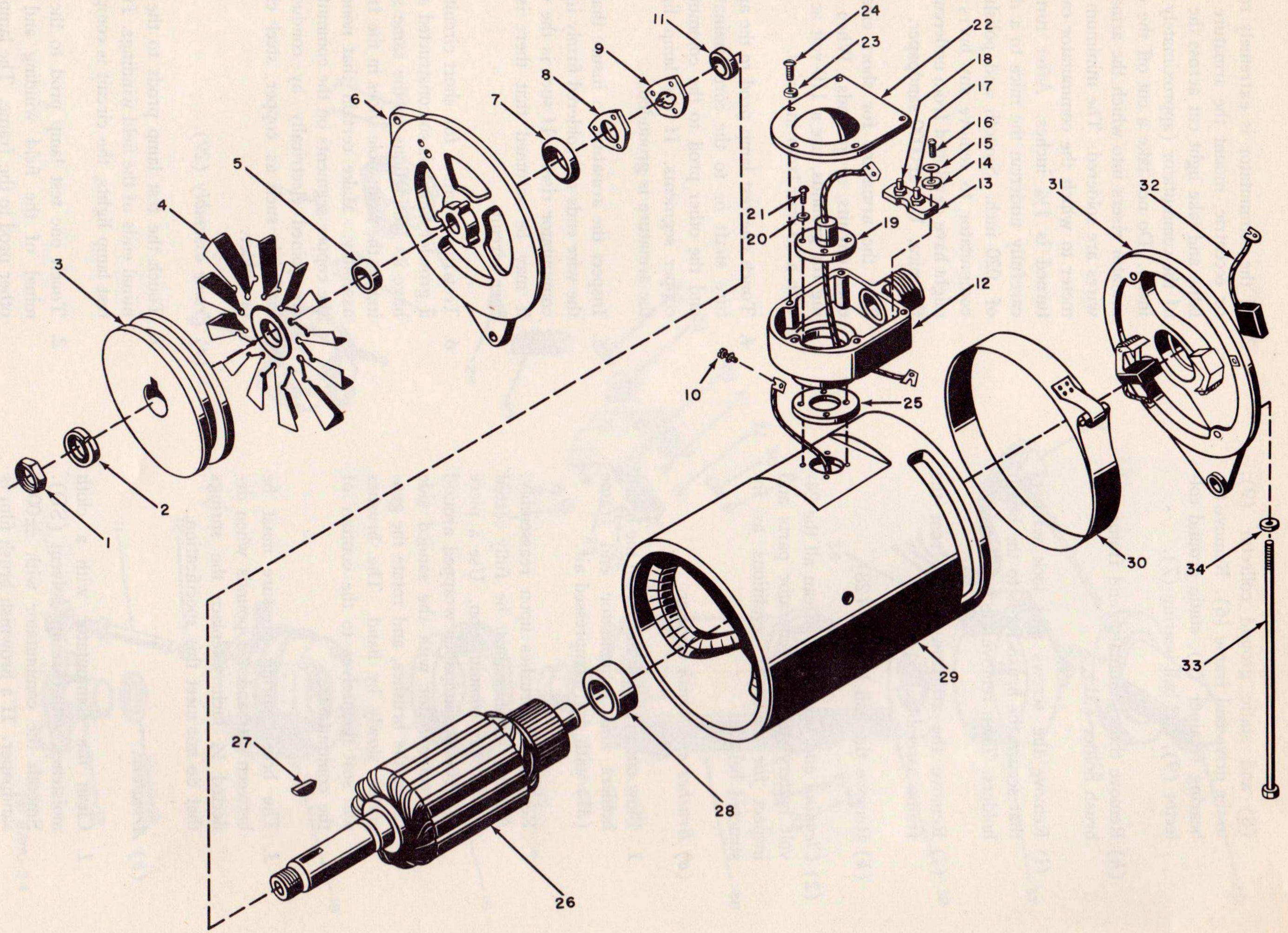


Figure 28. 24-volt battery-charging generator, exploded view.

LEGEND FOR FIGURE 28

1. Hexagonal nut (H1511).
2. Lock washer (H1510).
3. Pulley (MP511).
4. Fan (B36).
5. Outside space collar (H1509).
6. Drive end frame (E157).
7. Ball bearing (MP509).
8. Bearing retainer plate (MP508).
9. Static ground collector (E156).
10. Screw and lock washer.
11. Inside space washer (H1508).
12. Terminal shield (E155).
13. Terminal plate assembly (TB15).
14. Plain washer.
15. Lock washer.
16. Screw (H1482 and H1483).
17. Lock washer.
18. Nut (E151 and E152).
19. Capacitor (E154).
20. Lock washer.
21. Screw.
22. Shield cover (E153).
23. Lock washer.
24. Screw.
25. Terminal shield mounting plate (A 122).
26. Armature (E160).
27. Key (MP512).
28. Ball bearing (MP510).
29. Frame assembly (A 123).
30. Cover band (A 121).
31. Commutator end frame and brush holder (E150).
32. Brush (E148 and E149).
33. Through bolt (H1478 and H1479).
34. Lock washer (H1476 and H1477).

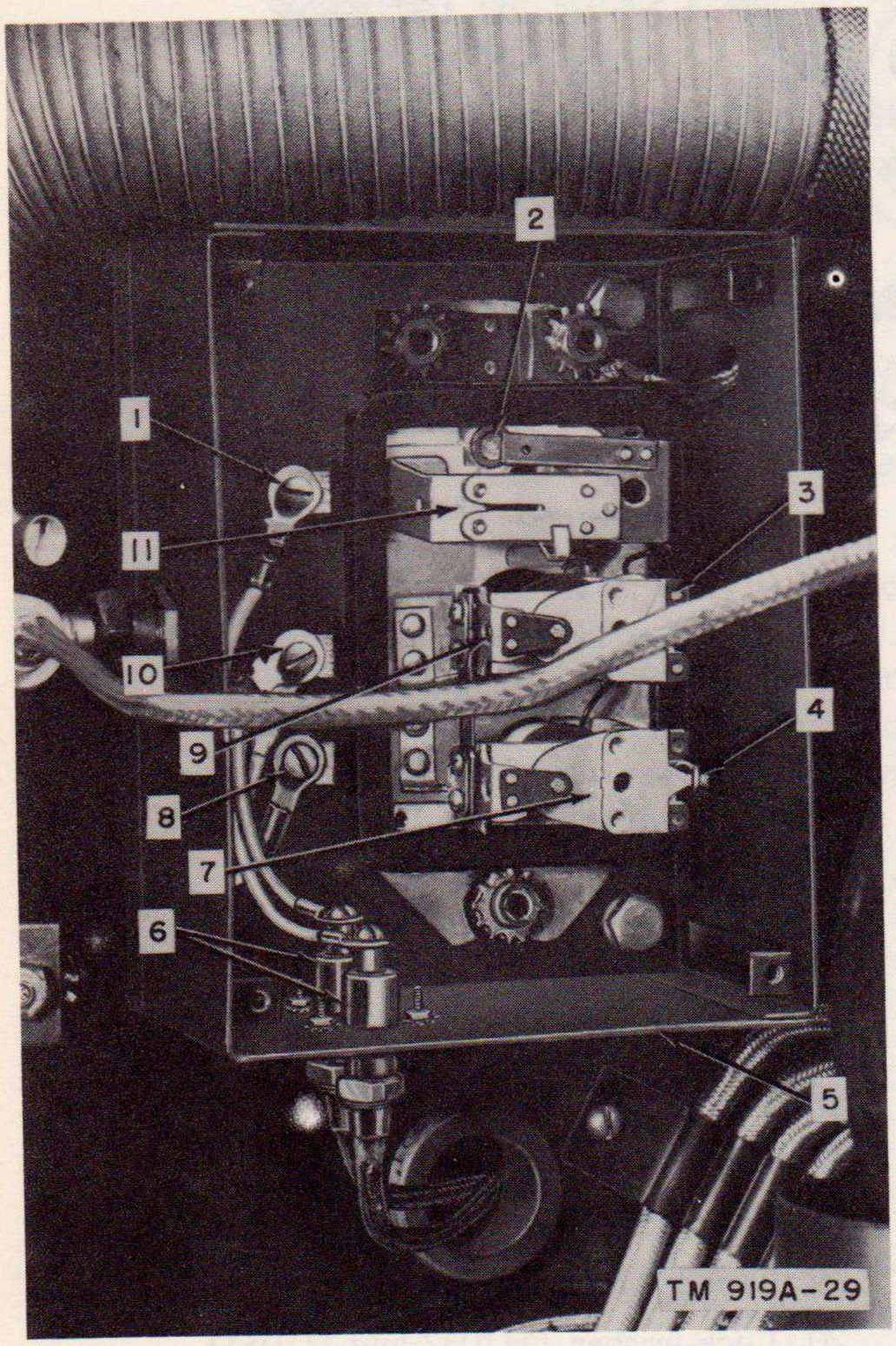


Figure 29. 24-volt battery-charging generator regulator.

1. Cutout relay BAT terminal
2. Cutout relay adjusting screw.
3. Current regulator adjusting spring hanger.
4. Voltage regulator adjusting spring hanger.
5. Suppression box.
6. Capacitors.
7. Voltage regulator.
8. Voltage regulator F terminal.
9. Current regulator.
10. Current regulator GEN terminal.
11. Cutout relay.

3. Connect the terminals of the shunt field winding to 24 volts. A test ammeter should indicate 6.95 to 7.75 amperes. The total resistance of the field winding is 3.1 to 3.45 ohms.

(*d*) *Terminal shield* (*12*).

1. Examine the shield cover for cracks.

2. Examine the terminal plate assembly for damage.

3. Test the capacitor. Replace if necessary.

(*e*) *Bearings* (*7*). Examine the bearings for pits, scratches, or binding. Replace the defective bearings. No lubrication is required since the bearings are prelubricated at the factory and sealed.

(3) *Reassembly.* After cleaning and inspection, reassemble the 24-volt battery-charging generator as follows:

(*a*) Install the brushes (32) and brush springs in the brush holders and secure the leads.

(*b*) Press the ball bearing (28) into the commutator end frame.

(*c*) Position the commutator end frame and brush holder (31) on the frame assembly (29).

(*d*) Slip the armature (26) into the frame assembly. Use care not to damage the brushes, and examine for correct seating on the commutator.

(*e*) Position the ball bearing (7) in the drive end frame and install the bearing retainer plate (8) and static ground collector (9).

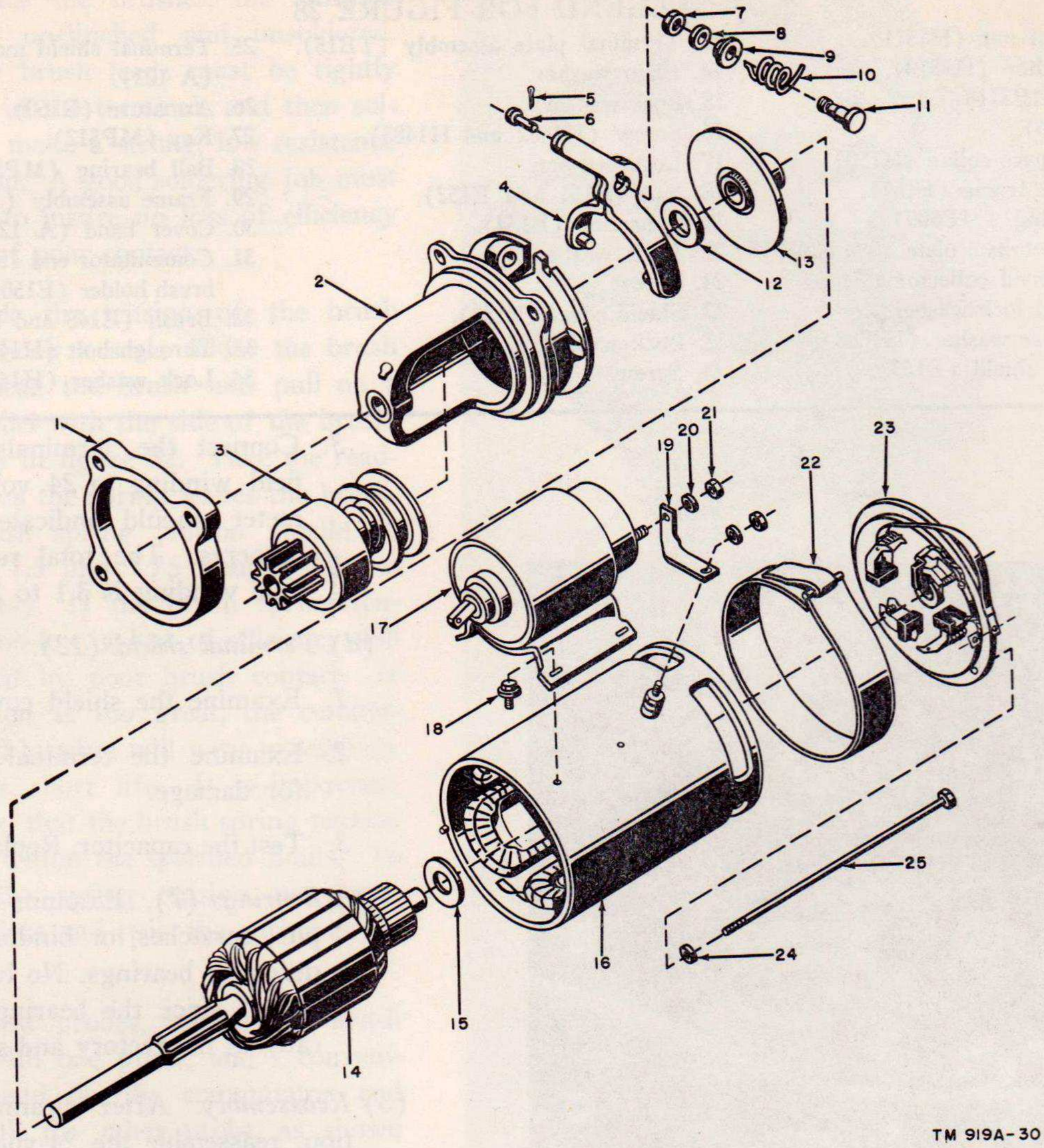


Figure 30. Starting motor, exploded view.

1. Spacer (MP436).
2. Motor drive housing (A 86).
3. Drive clutch (MP443).
4. Shift lever assembly (MP439).
5. Cotter pin (H1042).
6. Shift lever pin (H1041).
7. Nut (H1043).
8. Washer (H1044).
9. Spring support (H1045).
10. Spring (MP440).
11. Stud (H1046).
12. Brake washer (H1047).
13. Center bearing assembly (MP442).
14. Armature (E69).
15. Washer (H1064).
16. Frame assembly (A 87).
17. Solenoid switch (L2).
18. Bolt (H1048 to H1051).
19. Connector (E61).
20. Lock washer (H1052 and H1053).
21. Nut (H1054 and H1055).
22. Cover band assembly (A 88).
23. Commutator end frame assembly (E71).
24. Lock washer (H1056 and H1057).
25. Through bolt (H1058 and H1059).

(*f*) Slip the inside space washer (11) onto the armature shaft.

(*g*) Position the drive end frame (6) on the frame assembly. Install the through bolts (33) and lock washers (34).

(*h*) Slip the outside space collar (5) on the armature shaft. Position the key (27) in the shaft keyway and tap the fan (4) and pulley (3) onto the shaft. Lock the pulley into position with the hexagonal nut (1) and lock washer (2).

(*i*) Position the terminal shield mounting plate (25), terminal shield (12), and capacitor (19) on the frame assembly and install the screws (21) and lock washers (20).

(*j*) Install the terminal plate assembly (13) in the terminal shield. Connect the electrical leads.

(*k*) Install the shield cover (22).

j. Starting Motor. After the starting motor has been removed (par. 55*o*), proceed as follows:

(1) *Disassembly.*

(*a*) Remove the cotter pin (5, fig. 30) and slip out the shift lever pin (6) that connects the shift lever assembly (4) to the solenoid switch (17). Remove the nuts (21) and lock washers (20) that secure connector (19) to the solenoid switch and the frame assembly and remove the connector (19). Remove the bolts (18) that secure the solenoid switch (17) to the frame assembly (16). Then remove the solenoid switch.

(*b*) Remove the cover band assembly (22).

(*c*) Remove the two through bolts (25) and lock washers (24).

(*d*) Lift the brushes out of the brush holders as shown in figure 31. Slip the commutator end frame assembly (23, fig. 30) out of the frame assembly.

(*e*) Remove the motor drive housing (2) and drive clutch (3) by tapping the housing with a soft-faced hammer.

(*f*) Remove the shift lever assembly (4).

(*g*) Remove the armature (14) from the frame assembly (16). Slide the brake washer (12), center bearing assembly (13), and washer (15) off the armature (14).

(2) *Cleaning and inspection.* Clean all the starting motor parts and inspect for abnormal conditions as instructed below.

(*a*) *Brushes.*

1. The brushes should slide freely in their holders and make full contact on the commutator. Worn brushes must be replaced.

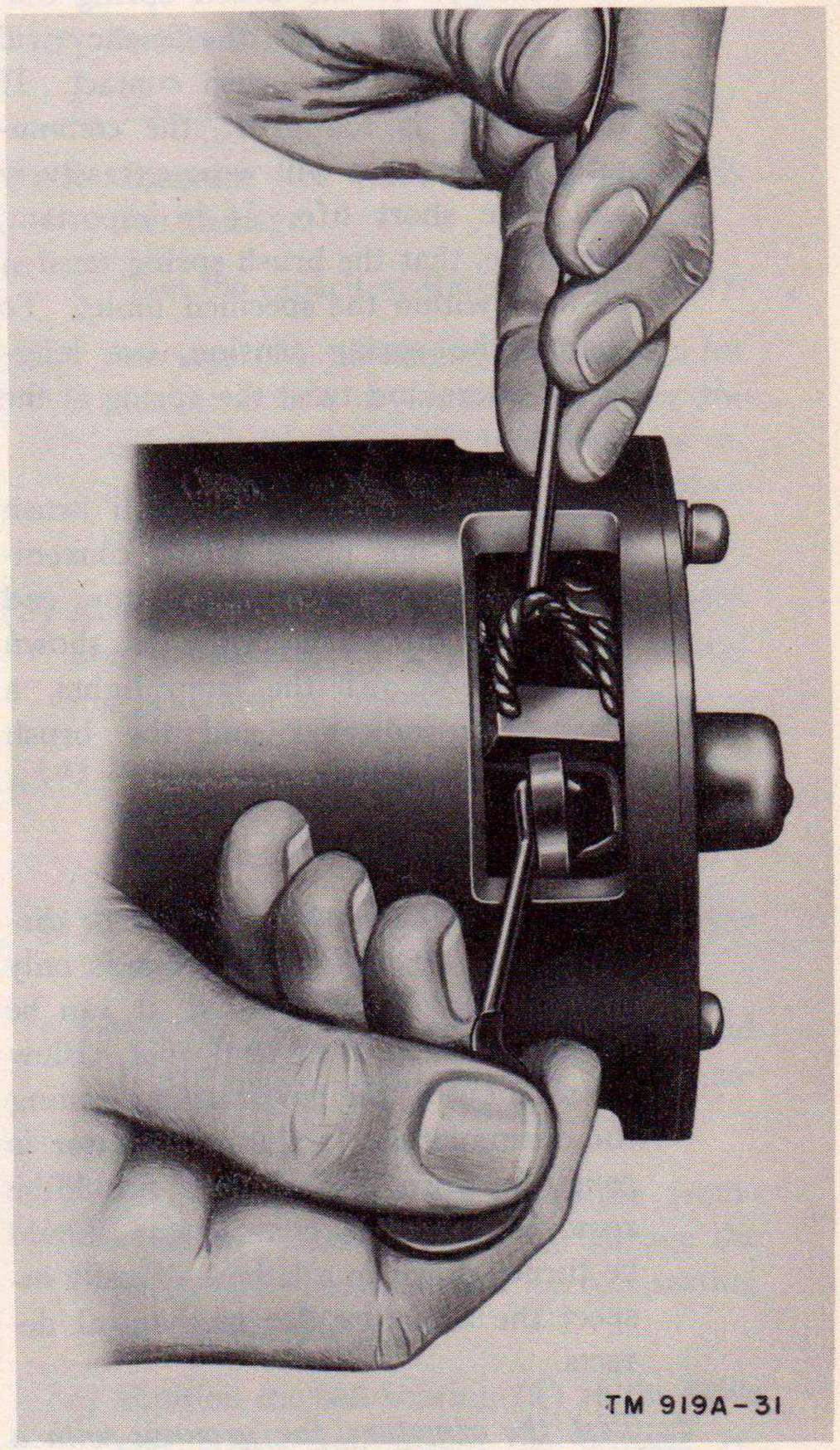


Figure 31. Removing brushes (starting motor).

2. To replace the brushes, the terminal must be unclinched and unsoldered. The new brush leads must be tightly clinched in the terminal, and then soldered to make a strong, low-resistance connection. A good soldering job must be done to insure no loss of efficiency because of poor contact.

3. To check the tension of the brush springs, hook a scale under the brush spring near the brush and pull on a line parallel with the side of the brush, as shown in figure 32. Take the reading just as the spring leaves the brush. The brush spring tension should be between 1.5 and 1.75 pounds (24 to 28 ounces). If the brush spring tension is too low, a loss of efficiency will be caused by poor brush contact. If the tension is too great, the commutator and brushes will wear excessively and have short life. It is important, therefore, that the brush spring tension be kept within the specified limits. To change the spring tension, use long-nosed pliers and twist the spring at the holder.

4. Using test probes, touch each brush holder with one probe, and a convenient ground on the commutator end plate with the other probe, as shown in figure 33. If the lamp lights, a ground is indicated and the brush holder must be replaced.

(*b*) *Armature* (14, fig. 30).

1. *Check the commutator for wear or discoloration.* If the commutator is only slightly dirty or discolored, it can be cleaned with #0000 sandpaper. Blow the sand out of the motor after cleaning the commutator. If the commutator is rough or worn, the armature should be removed, and the commutator should be turned down in a lathe. Visually inspect the armature for mechanical defects.

2. *Test the armature for grounds with a set of test probes.* Touch one probe to a commutator segment and touch the

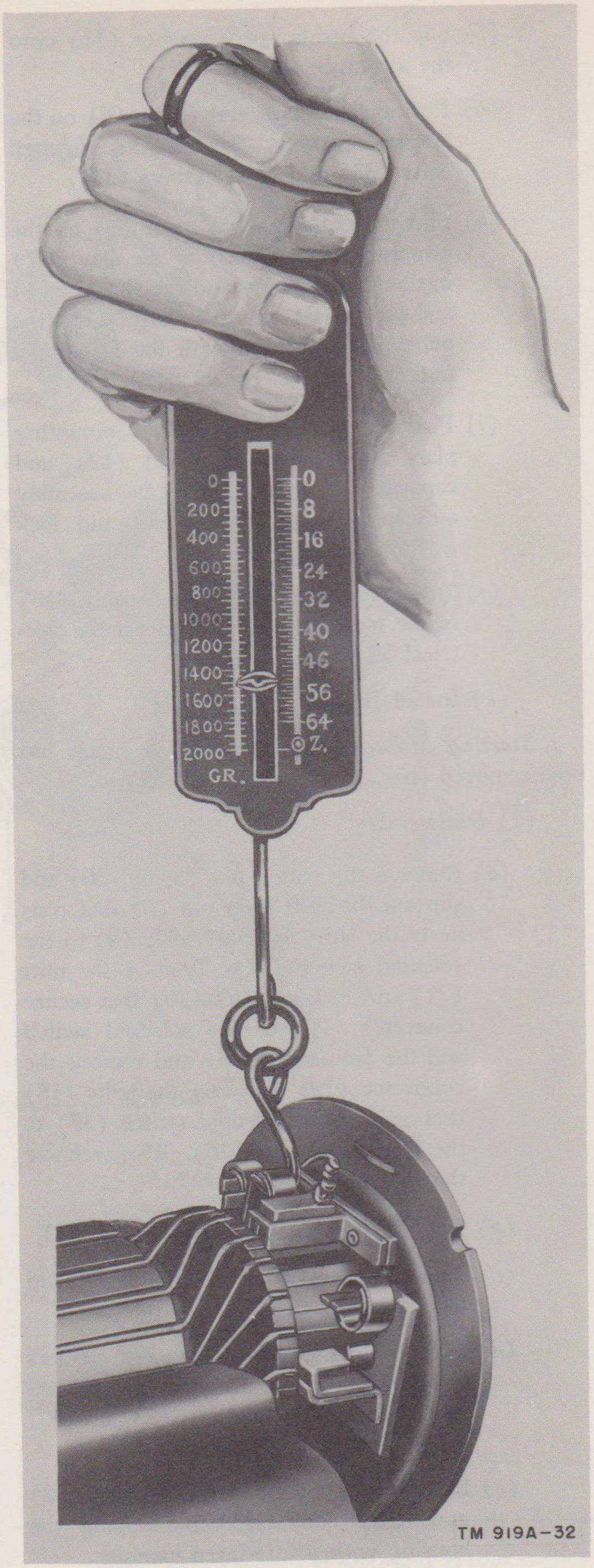


Figure 32. Measuring brush spring tension (starting motor).

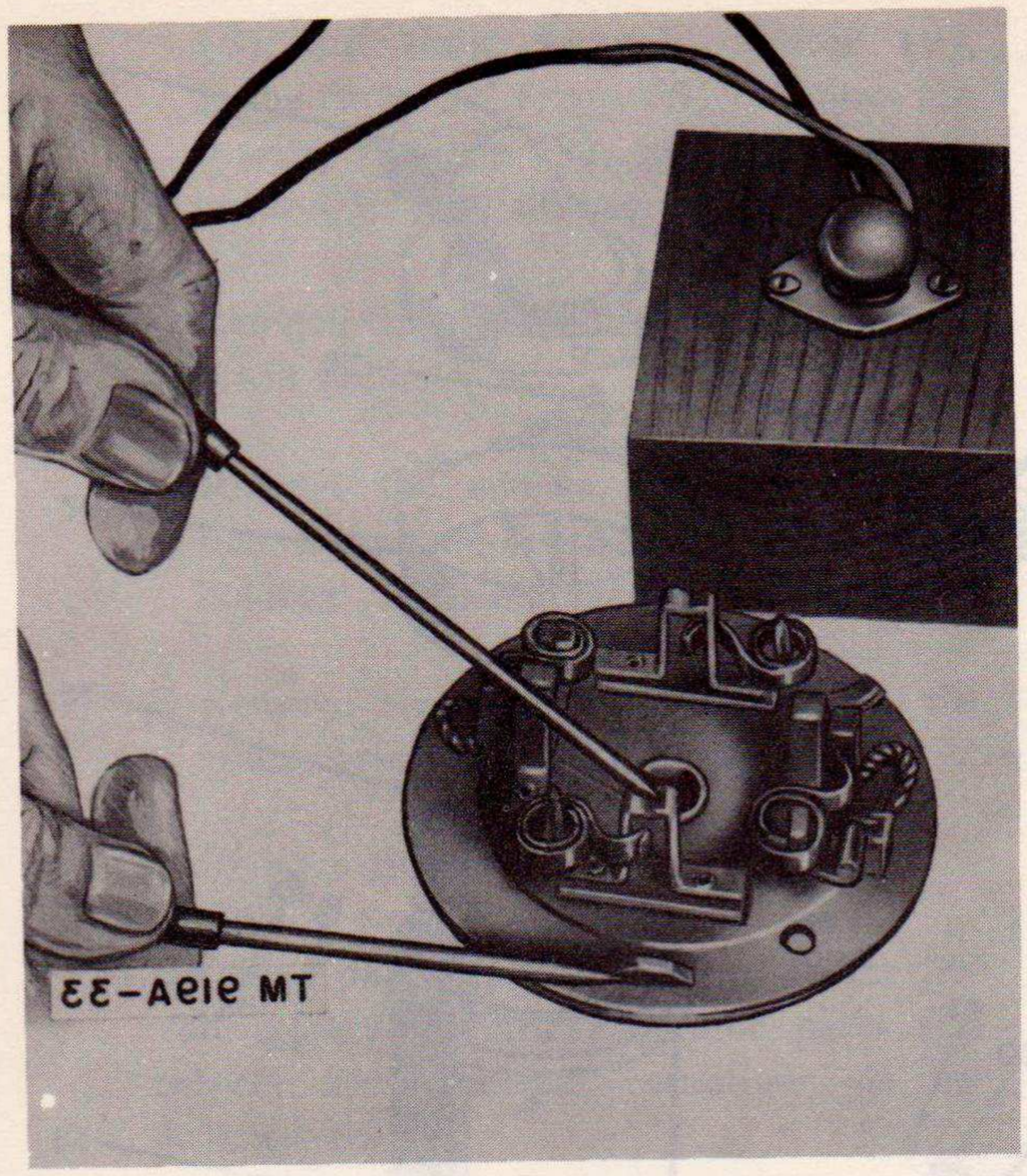


Figure 33. Testing brush holder for ground (starting motor).

core or the shaft with the other probe. Do not touch the probes to the bearing surface or to the brush surface because the arc formed will burn the smooth finish. If the lamp lights, the coil connected to the commutator segment is grounded.

3. *Test the armature for a shorted coil.* To test for a shorted armature coil, place the armature against the core of a growler and hold a steel strip on the armature. Then rotate the armature slowly by hand. If a coil is shorted, the steel strip will become magnetized and vibrate.

(*c*) Field coils.

1. Use test probes and check the field coils for grounds. Place one probe on the starting motor frame or pole piece and touch the other probe to the field coil terminals. If a ground is present, the lamp will light.

2. Inspect all connections to make sure they are properly clinched and soldered. Inspect the insulation for evidence of damage.

(*d*) *Motor drive housing* (*2*). Inspect the housing for cracks and the bearings for wear.

(*e*) *Drive clutch* (*3*). Clean with Diesel oil (D-40 or D-35) and examine for wear.

(3) *Reassembly.* After cleaning and inspection, reassemble the starting motor as follows:

(*a*) Wipe the drive end of the armature shaft with oil (OE-10). If the absorbent bronze bearings have been removed, soak them in engine oil (OE-10) before assembling in the bearing bore. Slip the center bearing assembly (13) and the brake washer (12) on the armature shaft. Slip the washer (15) on the commutator end of the armature shaft.

(*b*) Install the armature assembly (14) in the frame assembly (16).

(*c*) Hold the shift lever assembly (4) in position and slide the drive clutch (3) over the armature shaft. Position the motor drive housing (2) to the frame assembly.

(*d*) Apply a few drops of engine oil (OE-10) to the oil wick in the commutator end frame assembly (23). If the absorbent bronze bearing has been removed, soak in engine oil (OE-10) and assemble, using correct size arbor to insure proper bearing fit. Position the commutator end frame assembly (23) to the frame assembly (16) and install through bolts (25) and lock washers (24). Proper brush seating should be insured by sanding the brush to fit the commutator. Wrap a strip of #0000 sandpaper around the commutator with the abrasive side facing the brushes. Turn the armature slowly in the direction of rotation. Blow the abrasive out of the motor after sanding. Secure the cover band (22).

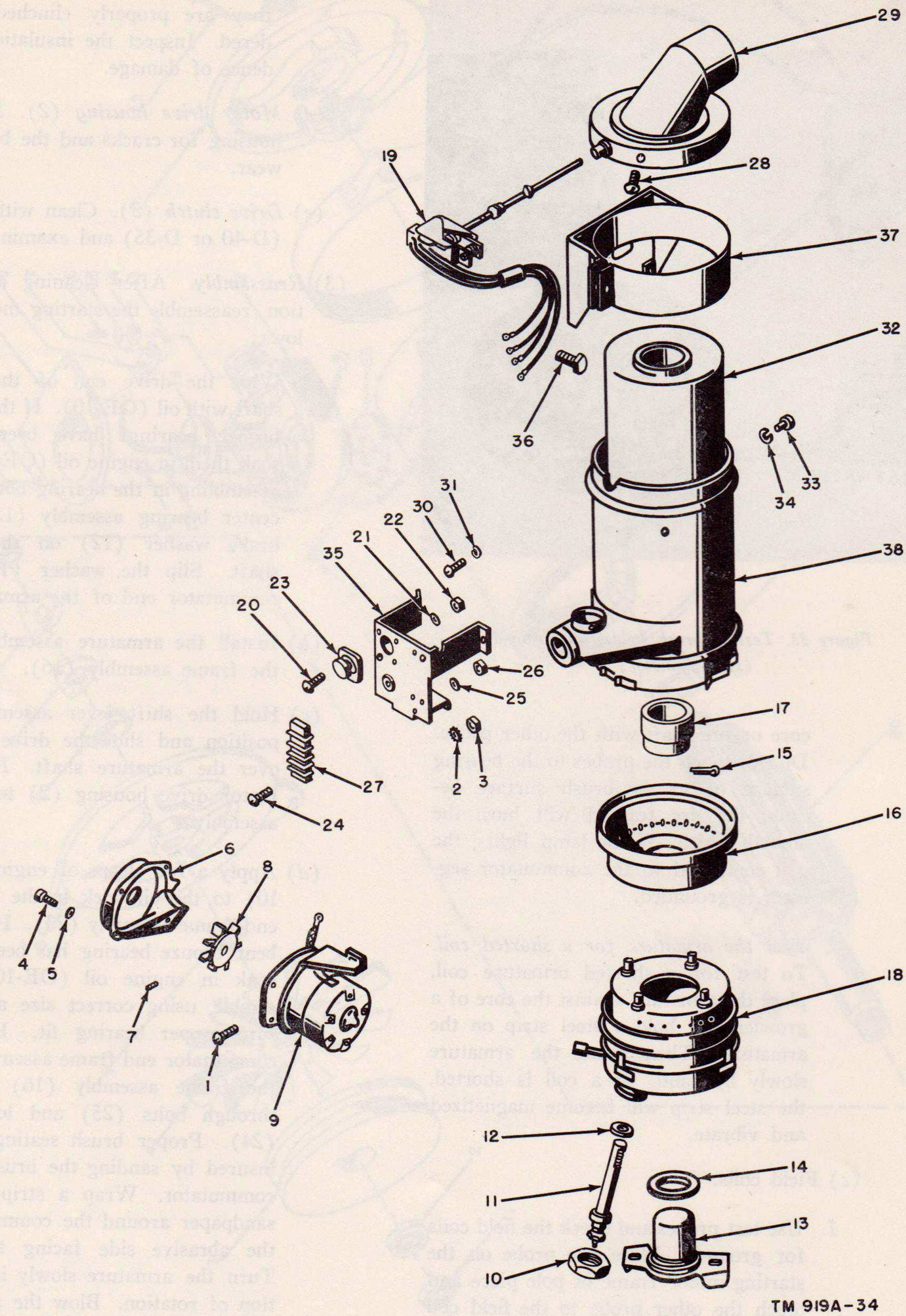


Figure 34. Heater, exploded view.

LEGEND FOR FIGURE 34

1. Screw.
2. Lock washer.
3. Nut.
4. Screw.
5. Lock washer.
6. Right half scroll (MP410).
7. Set screw (H794).
8. Blower wheel (B11).
9. Blower motor (B2).
10. Lock nut (H797).
11. Electrode (E20).
12. Gasket (H795).
13. Resistor (R10)
14. Gasket (H796).
15. Cotter pin.
16. Burner throat (MP411).
17. Igniter wick (MP409).
18. Burner bowl (MP413).
19. Flame switch (S5).
20. Screw.
21. Lock washer.
22. Nut.
23. Receptacle (J16).
24. Screw.
25. Lock washer.
26. Nut.
27. Terminal block (TB10).
28. Screw.
29. Top cover (MP406).
30. Screw.
31. Lock washer.
32. Heat exchanger (MP407).
33. Screw.
34. Lock washer.
35. Terminal block mounting plate (A 67).
36. Screw (H791).
37. Heater mounting bracket (A 66).
38. Combustion chamber (MP408).

(*e*) Secure the solenoid switch to the frame assembly. Attach the shift lever assembly (4) to the switch with the shift lever pin (6) and cotter pin (5). Secure the connector to the frame and switch.

k. Heater (fig. 34). After the heater has been removed (par. 55*p* (1)), proceed as follows:

(1) *Disassembly.*

(*a*) To remove the blower unit, disconnect the blower lead wire from the heater terminal block (27). Remove the mounting bracket screw (1) from the terminal block mounting plate (35). Remove the four screws (4) that secure the right half scroll (6). Loosen the set screw (7) and slide the blower wheel (8) off the blower motor shaft. Do not further disassemble the blower motor since critical clearances are maintained between the motor and scroll assembly.

(*b*) Disconnect the wires from the electrode (11) and the resistor (13). Disengage the locking lever on the burner (18) by rotating the burner counterclockwise. The burner assembly will then drop out of the heater. Remove the electrode (11) by loosening the lock nut (10). Remove the resistor (13) by turning it counterclockwise. Remove the cotter pins (15) and lift off the burner throat (16). Slip the igniter wick (17) upward over the igniter tube in the burner bowl.

(*c*) Disconnect the electrical leads on the flame switch (19) from the terminal block. Back off the switch mounting nut and remove the assembly from the top of the heater. Remove the adjusting screw and the adjusting spring. Open the bracket on the bracket and tube assembly and the spring retainer, and the spring will fall out. Carefully remove the quartz rod; it is extremely brittle. Remove the mounting screws, lock washers, and switch.

(*d*) Disconnect the remaining wires on the terminal block (27). Remove the screws (20) and receptacle (23). Then remove the screws (24) and terminal block (27).

(*e*) Take off the heater top cover (29) by removing the screws (28). Loosen the heat exchanger (32) by removing the screws (30). Lift the heat exchanger out of the combustion chamber (38).

(2) *Cleaning and inspection.* Clean the carbon deposits from the burner, resistor, combustion chamber, throat, top cover, and flame switch rod. Blow out loose deposits with compressed air. Inspect all the heater parts for abnormal conditions as instructed below.

(*a*) After reassembly (subpar. (3)(*e*) below) check the blower assembly with a storage battery of 24 volts and a strobo-

scope type of speed measuring instrument. If the blower wheel does not turn at least 5,000 rpm, replace the entire assembly.

(*b*) Inspect the air holes in the burner throat (16). If they are plugged, clean them with a pipe cleaner or wire. The igniter wick (17) should be replaced if charred or burned to a point ¼ inch below the top edge of the igniter tube in the burner bowl (18).

(*c*) Check the interior of the heat exchanger (32) for bulges or cracks. Examine the combustion chamber (38) and top cover (29) for dents and cracks.

(*d*) After reassembly (subpar. (3)(*c*) below), check the flame switch (19) operation by loosening the adjusting screw. Operate the switch manually by pressing the switch toward the heater and releasing. Check the continuity of circuits through the switch with a test lamp and prods or with an ohmmeter. Inspect the quartz rod in flame switch for breakage.

(*e*) Check the electrode (11) for proper operation as follows: Using a 6-volt battery, clamp the battery negative cable on the electrode terminal and the battery positive cable to ground. The electrode coil should turn cherry red immediately.

(*f*) To test the resistor (13), connect it in series with a good electrode. A resistor and electrode checked with 24 volts should draw 10 to 12 amperes from a good battery. If the combination does not draw 10 to 12 amperes, replace the resistor.

(3) *Reassembly.* After cleaning and inspection, reassemble the heater as follows:

(*a*) Slip the heat exchanger (32) into the combustion chamber (38) and secure it with the screws (30) and lock washers (31).

(*b*) Secure the receptacle (23) to the plate (35) with the screws (20), lock washers (21), and nuts (22). Then secure the terminal block (27) with the screws (24), lock washers (25), and nuts (26). Connect the wires as shown in figure 61.

(*c*) Insert and secure the flame switch assembly (19, fig. 34) in the top cover (29). Then install the top cover on the combustion chamber with the screws (28). Connect the wires as shown in figure 61. Check the operation of the flame switch (subpar. (2)(*d*) above).

(*d*) Slip the igniter wick over the igniter tube in the burner bowl (18). Secure the burner throat (16) to the burner bowl with the cotter pins (15). Position the gasket (14) over the resistor (13) and insert the resistor into the burner bowl. Position the gasket (12) on the electrode (11) and insert the electrode in the bowl. Be sure the index button on the electrode is inserted in the groove in the burner bowl. Install and tighten the lock nut (10). Insert the assembled burner bowl in the combustion chamber and rotate it clockwise to secure it. Connect the resistor and electrode wires.

(*e*) Slide the blower wheel (8) onto the blower motor shaft and fasten it with the set screw (7). Secure the right half scroll (6) to the blower motor (9) with the screws (4) and lock washers (5). Secure the motor ground strap to the scroll halves. Attach the assembly to the terminal block mounting plate (35) with the screw (1), lock washer (2), and nut (3). Connect the blower motor wire to the terminal block. Check the operation of the blower assembly (subpar. (2)(*a*) above).

l. Heater Fuel Pump (fig. 35). After the heater fuel pump has been removed (par. 55*p*(3)), proceed as follows:

(1) *Disassembly.*

(*a*) Apply a wrench to the nut on the bottom of the cover and remove the cover. Then carefully remove the screen.

(*b*) Remove the three screws and lift out the spring cup, gasket, plunger spring and plunger. Do not remove the buffer spring or valve assembly from the plunger. Do not remove the valve assembly from the spring cup.

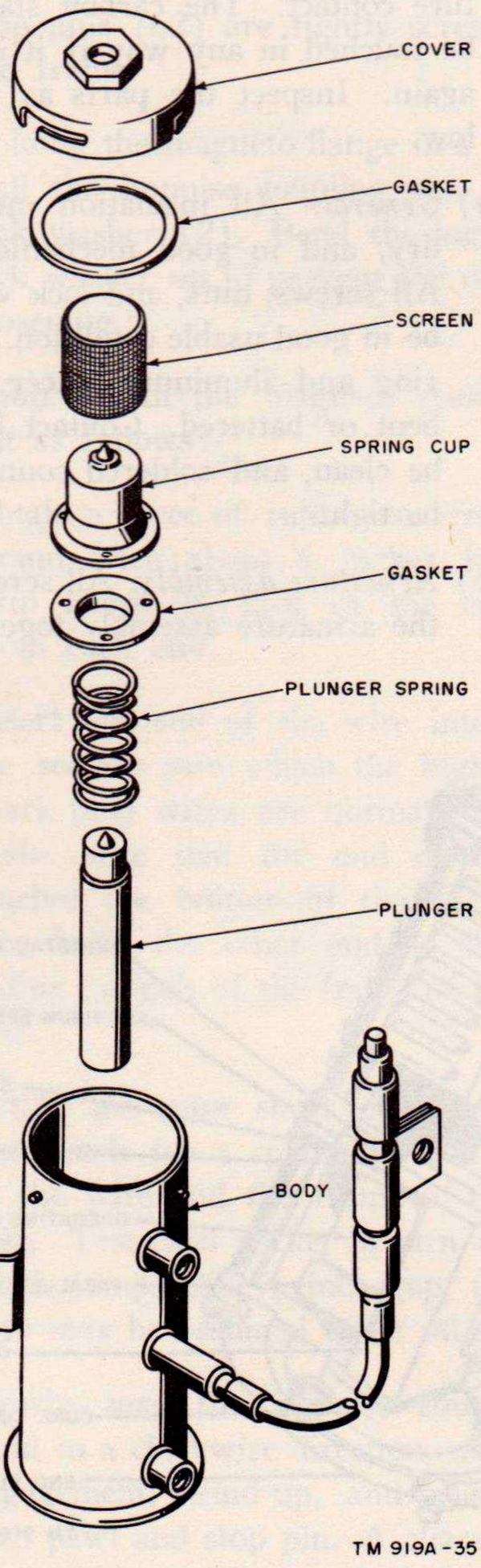


Figure 35. Heater fuel pump, exploded view.

(2) *Cleaning and inspection.* Clean all the heater fuel pump parts and inspect for abnormal conditions as instructed below.

(*a*) Clean the cover in solvent (SD) and blow dry with compressed air. Examine the cover for cracks or dents. Replace the cover gasket.

(*b*) Thoroughly clean the screen in solvent (SD). If the screen is badly distorted or collapsed, replace it.

(*c*) Clean the plunger and spring cup with solvent (SD). Do not use compressed air on these parts. Check the plunger fit by slowly raising and lowering the plunger in the cylinder. It should move freely without any tendency to stick. If the interrupter system is functioning properly, a click will be heard each time the plunger approaches the top of the cylinder.

(*d*) Flex the plunger spring and examine for cracks.

(*e*) Wash the pump body in solvent (SD) and blow out the cylinder with compressed air. Wipe the inside of the body dry with a piece of cloth.

(3) *Reassembly.* After cleaning and inspection, reassemble the heater fuel pump as follows:

(*a*) Insert the plunger in the cylinder with the buffer spring end first.

(*b*) Install the plunger spring over the plunger. Then install the spring cup gasket and the spring cup. Turn the fastening screws reasonably tight to insure a good seal, but avoid distorting the spring cup.

(*c*) Position the cover gasket in place. Seat the screen in the cover and then carefully guide the screen around the spring cup. Use a wrench to turn the cover to closed position.

m. 28-volt, 2.5-kw, Dc Generator Voltage Regulator (fig. 36). After the dc, 2.5-kw generator voltage regulator has been removed (par. 55*n*), proceed as follows:

(1) *Disassembly.*

(*a*) Remove the end cover by removing the attaching nuts and lock washers.

(*b*) Carefully back off, but do not remove, the lock nut on the contact screw to relieve the pressure on the carbon stack. Then remove the contact screw assembly.

(*c*) Insert a long narrow screw driver or rod the full length of the carbon stack and remove the carbon disks as a unit. Under normal conditions, the carbon stack must be discarded upon disassembly and replaced with a new stack. If the old stack is to be used again, be careful during removal not to rotate the carbon disks with respect to each other. Do not handle the disks or disturb them in any way. Do not expose the stack to moisture, oil or gas fumes, or to a dusty atmosphere. Inclose them in a glass if possible.

(*d*) Remove the pile tube from the pile tube support.

(*e*) Remove the core cover. Then remove the end plate, core, and coil pot. Unsolder the coil leads from the base and remove the parallel and operating coils, pole piece, shims, aluminum spacer, bimetal ring, and the armature assembly. The armature assembly should not be disassembled, nor should any attempt be made to repair it.

(2) *Cleaning and inspection.* Clean all parts, except the carbon stack, with a clean, dry, lint-free cloth. Do not use gasoline or any solvent cleaner on coils, leads, insulators, resistors, adjusting screw contact, or armature contact. The carbon stack must not be touched in any way if it is to be used again. Inspect the parts as indicated below.

(*a*) *General.* All insulation must be clean, dry, and in good mechanical condition. All screws, nuts, and lock washers must be in good usable condition. The bimetal ring and aluminum spacer must not be bent or battered. Contact buttons must be clean, and soldered connections must be tight.

(*b*) *Armature assembly.* All screws that hold the armature assembly together must be

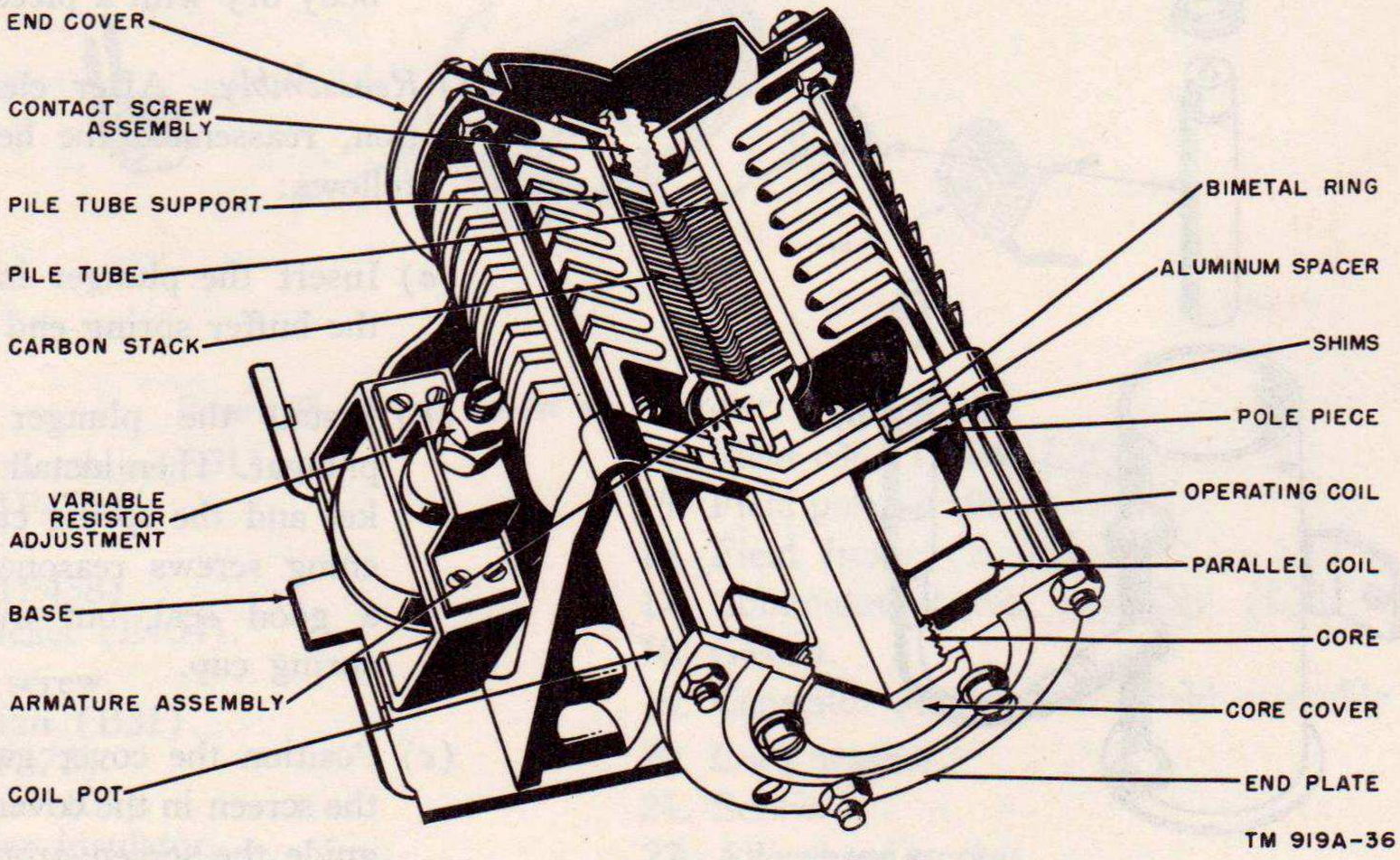


Figure 36. Voltage regulator, cutaway view.

tight. If the spring leaves are rusted, bent out of shape, or broken, replace the assembly. The armature contact must not be greasy, dirty, chipped, or broken, and the connecting lead from the contact must be intact. A small amount of carbon dust on the contact may be removed by dry-wiping with a soft cloth. Otherwise, replace the armature assembly.

(*c*) *Contact screw assembly.* The adjusting screw contact must not be dirty, greasy, chipped, pitted, or broken. If the contact screw is not free to turn on the small screw that passes through its center, or if the threads on the adjusting screw are worn or damaged, replace the assembly. A small amount of carbon dust may be removed by dry-wiping with a soft cloth.

(*d*) *Coils.* Examine the coils for electrical continuity with a test lamp, ohmmeter, or buzzer. Examine for frayed leads and broken or burned insulation.

(*e*) *Resistors.* Examine the resistors for continuity, broken leads or windings. The variable resistor must make contact throughout its rotation.

(3) *Reassembly.* After cleaning and inspection, reassemble the voltage regulator as follows:

(*a*) Insert the armature assembly in place. Position the bimetal ring, aluminum spacer, shims, and pole piece over the armature assembly. Place the coil pot on the regulator and insert the operating coil and parallel coil in the pot. Insert the core and secure the end plate and core cover. Then solder the coil leads to the base.

(*b*) Insert the pile tube in the pile tube support. Insert a small rod through the center hole of the carbon stack and carefully slide the stack into the pile tube on the rod. Do not disturb the carbon disks in any way.

(*c*) Secure the contact screw assembly in position and tighten the nut on the screw to apply pressure to the carbon stack. Then secure the end cover.

(*d*) After reassembly and before the regulator can be operated, it must be adjusted as instructed in paragraph 64*g*.

n. 24-volt Battery-charging Generator Regulator (fig. 29).

(1) *Disassembly.* Disassembly of the 24-volt battery-charging generator regulator is not recommended. Refer to subparagraph (2) below for instructions on testing and adjusting the regulator. If, after these instructions are followed, the regulator operation is unsatisfactory, replace the regulator.

(2) *Voltage regulator* (6). Two checks and adjustments are required on the voltage regulator; the air gap and the voltage setting.

(*a*) *Air gap.* Push down on the armature until the contact points are just touching. Measure the air gap between the armature and winding core. The air gap should be .070 inch. Adjust the air gap by loosening the contact mounting screws and raising or lowering the contact mounting bracket as required. Be sure the contact points are aligned and the screws are securely tightened after adjusting.

(*b*) *Voltage setting.*

1. Connect a variable resistance (not less than 25 watts) and an ammeter into the charging circuit (in series with the battery) at the BAT terminal of the regulator.
2. Connect a voltmeter from the regulator BAT terminal to ground.
3. Start the generator and adjust the variable resistance to obtain a current flow of not more than 10 amperes. Operate the generator at the specified speed for 15 minutes. The regulator cover must be in place. The regulator may now be considered to be at operating temperature.

4. Cycle the generator. Connect a variable resistance into the field circuit. Turn out all resistance. Operate the generator at specified speed. Slowly increase resistance until the generator voltage is reduced to 4 volts. Turn out all resistance again and note voltage setting. The regulator cover must be in place.

5. Adjust the voltage setting. Turn the adjusting screw (2) clockwise to increase the setting and counterclockwise to decrease the voltage setting. The standard setting should be 14.2 to 14.8 volts.

Caution: If the adjusting screw is turned down beyond range, the spring support may not return when the screw is backed off. In such a case, turn the screw counterclockwise until there is sufficient clearance between the screw head and the spring support. Then bend the spring support up carefully until it touches the screw head. Final setting of the unit should always be made by increasing the spring tension, never by reducing it. If the setting is too high, adjust until below required value and then raise it to the exact setting by increasing the spring tension. After each adjusment and before taking the reading, replace the regulator cover and cycle the generator.

6. Correct for temperature. It is important to note that the voltage setting is the normal setting at operating temperature when room temperature is 80°F. If the regulator is adjusted to room temperature higher than 80°F, set the voltage .1 volt less than the specified normal setting for each 10° above 80°F. For lower room temperature, set voltage setting .1 volt more for each 10° below 80°F.

Example 1. Voltage setting of a regulator at operating temperature but with room temperature at 90°F would be 14.5 minus .1 volt or 14.4 volts for normal setting.

Example 2. For a regulator at operating temperature but with room temperature at 60°F, normal setting would be 14.5 plus .2 volt or 14.7 volts.

(3) *Cutout relay checks and adjustments.* The cutout relay (11) requires three checks and adjustments; air gap, point opening, and closing voltage. Air gap and point opening adjustment must be made with the battery lead disconnected from the regulator.

(*a*) *Air gap.* Place fingers on the armature directly above the core, move the armature down until points just close. Measure the air gap between the armature and center of the core using a feeler gage. Be sure the points close simultaneously. Adjust the air gap by adjusting the two screws on the back of the relay, and raise or lower the armature as required. The air gap should be .020 inch. Tighten the screws after adjustment.

(*b*) *Point opening.* Check the point opening and adjust by bending the upper armature stop. The standard point opening should be .020 inch.

(*c*) *Closing voltage.*

1. Connect regulator to proper generator and battery. Connect voltmeter between the regulator GEN terminal and ground.

2. Slowly increase generator speed and note relay closing voltage. Closing voltage should be 11.8 to 13.6 volts. Decrease the generator speed and make sure the cutout relay points open.

3. Adjust the closing voltage by turning the adjusting screw (2) clockwise to increase the setting or counterclockwise to decrease the setting.

(4) *Current regulator.* Two checks and adjustments are required on the current regulator (9); air gap and current setting.

(*a*) *Air gap.* Check and adjust in exactly the same manner as for the voltage regulator (subpar. (2)(*a*) above).

(*b*) *Current setting.* To check the current regulator setting, the voltage regulator unit must be prevented from operating. Connect an ammeter into the charging circuit at the regulator BAT terminal. The first method listed below should be

used for preliminary checks wherever possible since it does not require removal of the regulator cover. The various methods are as follows:

1. *Quick check method.*

(*a*) Connect the ammeter into the charging circuit.

(*b*) Operate unit at specified speed for 15 minutes with the cover in place on the regulator.

(*c*) Short out the voltage regulator (7).

(*d*) Cycle the generator and note the current setting. The current setting should be 27 to 33 amperes.

(*e*) Adjust in same manner as instructed in subparagraph (2)(*b*) above.

2. *Load method.*

(*a*) Connect the ammeter into the charging circuit.

(*b*) Place a load across the batteries about equal to the current regulator setting. The load may be a carbon pile or bank of lights.

(*c*) Operate the generator at specified speed for 15 minutes with the cover in place on the regulator.

(*d*) Cycle the generator and note the current setting. The current should be 27 to 33 amperes.

(*e*) Adjust in same manner as instructed in subparagraph (1)(*b*) above.

(5) *Cleaning contact points.* The contact points will not operate indefinitely without some attention. A majority of all regulator trouble can be eliminated by a simple cleaning of the current and voltage regulator contact points and some possible readjustment. The large flat points should be cleaned with a spoon or rifler file. Loosen the upper contact bracket mounting screws so that the bracket can be tilted to one side. A flat file cannot be used successfully to clean the flat contact points since it will not touch the center where wear is most likely to ocur.

Caution: Never use emery cloth or sandpaper to clean the contact points. Remove all oxides from the contact points but note that it is not necessary to remove any cavity that may have developed. File very lightly on the soft (small) contact points to avoid excessive loss of metal.

57. Fits and Tolerances

This paragraph provides a table of fits and tolerances required to repair or overhaul Gasoline Engine Generator Set PU-107A/U. The *Min* and *Max* columns in this paragraph indicate the minimum and maximum tolerances for parts to be continued in use. Parts not conforming to the limits specified should be replaced. The table of fits and tolerances follows:

a. Clearances.

Item	Dimension (in.)	
	Min	Max
Engine bearings:		
Main bearings	.002	.0025
Connecting rod bearings	.0015	.002
Camshaft bearings	.0015	.002
Pistons and rings:		
Piston to cylinder wall clearance	.002	.0035
Piston pin clearance in piston	.003	.0003
Oil ring gap	.008	.013
Compression ring gap	.008	.013
Piston ring land clearance	.0015	.002
Valves:		
Intake valve stem clearance in guide	.0015	.00325
Exhaust valve stem clearance in guide	.0025	.0045
Valve tappet clearance (engine hot)	.013	.015
Valve tappet clearance in block	.0005	.002
Valve seat out-of-round	.000	.002
End play and backlash:		
Crankshaft end play	.006	.008
Camshaft end play	.006	.008
Main bearing side play	.004	.006
Connecting rod side play	.008	.012
Crankshaft gear to camshaft gear backlash	.000	.002
Starter armature end play	.005	.030
Oil pump:		
Inner surface of cover out-of-flat	.000	.001
Miscellaneous:		
Cylinder out-of-round	.000	.005
Flywheel runout	.000	.008
Spark plug gap	.025	.025
Breaker point gap	.020	.020
Concentricity of flywheel housing with flywheel	.000	.003
Face of flywheel housing with flywheel	.000	.003

b. Spring Pressures.

Item	Free length (In.)	Deflection or compression (in.)	Pounds
Valve springs (intake and exhaust)	2-1/16	Compressed to 1-45/64	47-53
Governor control arm spring	2-5/8	Deflected ¼	38-46
		Deflected ½	70
28-volt, 2.5-kw generator brush springs		Deflected ½	1.3-2.2
24-volt battery-charging generator brush springs		Deflected ½	1.0-1.5
Starting motor brush springs		Deflected ½	1.5-1.75

c. Wrench Tension.

Item	Foot pounds
Cylinder head nuts	70-75
Intake and exhaust manifold nuts	25-30
Main bearing cap screws	85-95
Connecting rod nuts	35-40
Oil pan bolts	15-20
Flywheel nuts	35-40

Section III. DISASSEMBLY

Note. The following instructions apply to disassembly of the engine and alternator after the unit has been stripped in accordance with instructions in paragraph 55.

58. Disassembly of Alternator

a. Stator Housing and Stator.

(1) If the upper frame has not been removed, disconnect the leads from the alternator as necessary.

(2) Refer to paragraph 55*r* and remove the voltage regulator as instructed.

(3) Remove the bolts and washers that secure the stator housing (16, fig. 37) to the flywheel housing.

(4) Remove the guard assembly (8) from the housing.

(5) Remove the six bolts from the inner row on the bearing cover plate (11). Screw the puller bolt (furnished with the unit) into the tapped hole in the center of the bearing cover plate. Turn the bolt until the housing is about halfway off the rotor as shown in figure 38. Install the lifting eye (furnished with the unit) in the top of the housing. Hook a chain hoist in the lifting eye and carefully remove the housing.

(6) Test the stator in the housing for grounds with a high potential tester set at 1,500 volts. Test from phase to phase and from phase to ground. With an ohmmeter, test the stator coils for continuity. Normal resistance should be .0245 ohm at 68°F.

(7) Remove the stator assembly (15, fig. 37) from the housing by first removing the bearing cap and the lead housing covers (14). Then heat the outside of the housing and carefully pull the stator out of the housing.

Caution: Do not raise the temperature of the housing above 180°F.

b. Bearing and Liner.

(1) If the stator housing has been removed, pull the ball bearing (17) and the bearing liner (18) from the rotor shaft.

(2) If the stator housing is in position on the unit, the bearing and the liner can be removed as follows. Remove the six bolts from the outer row on the bearing cap and install the puller bolt in position in the cap. Turn the bolt until the bearing and the liner break loose from the rotor shaft.

(3) Check the bearing in the liner for binding. Examine the liner for scratches and burrs.

c. Rotor.

(1) Place a canvas belt around the rotor assembly (24) and attach the belt to a lifting hoist as shown in figure 39. Take up on the hoist until the belt becomes taut.

(2) Cut the lock wires and remove the bolts that secure the rotor to the engine flywheel.

(3) Hoist the rotor away from the flywheel.

Note. Coupling of the rotor drive plate to the engine flywheel is shown in figure 40.

(4) Examine the rotor for scratches. If scratched, apply a thin coat of fungiproof lacquer to the surface. Check the rotor drive plate for cracks.

59. Removal of Engine

Before the engine can be removed, remove the muffler, radiator, and other subassemblies in accordance with pertinent instructions in paragraph 55. When the engine has been stripped of all subassemblies and components that would interfere with its removal, disconnect the ground strap on the front engine mount and remove the three engine mounting bolts. Hook a hoist to the engine lifting eyes and hoist the engine from the frame as shown in figure 41.

60. Disassembly of Engine

a. Manifold (fig. 42).

(1) Remove the nuts that secure the intake and exhaust manifold (1) to the block and remove the manifold and the gasket (2).

(2) Remove the nuts and lock washers that secure the manifold adapter (4) to the manifold and remove the adapter and gasket (3).

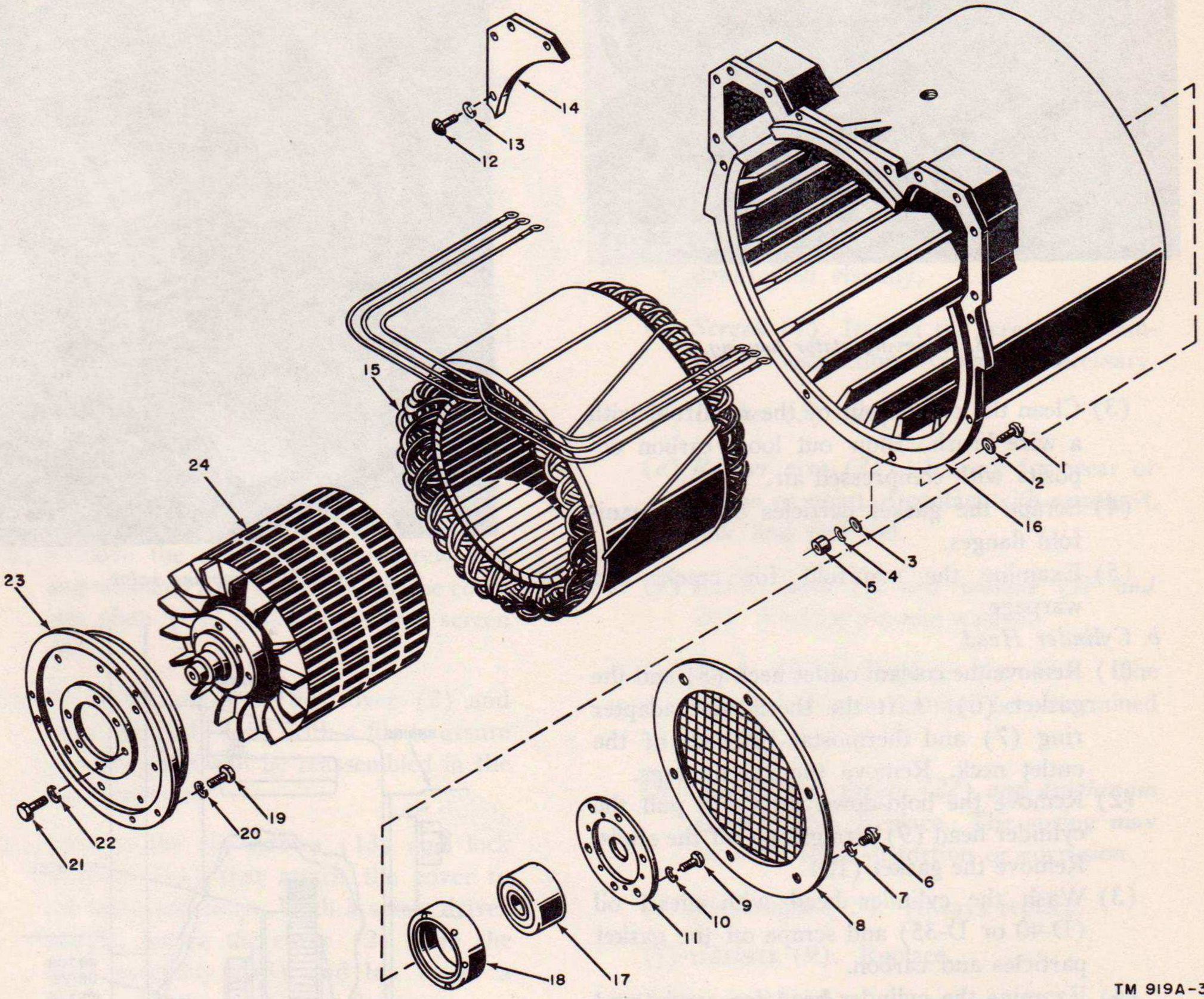


Figure 37. Alternator, exploded view.

1. Bolt.
2. Flat washer.
3. Flat washer.
4. Lock washer.
5. Nut.
6. Bolt.
7. Lock washer.
8. Guard assembly (A 109).
9. Bolt.
10. Lockwasher.
11. Bearing cover plate (A 110).
12. Screw.
13. Lock washer.
14. Lead housing cover (A 107 and A 108).
15. Stator (E139).
16. Stator housing (A 106).
17. Bearing (MP491).
18. Bearing liner (A 111).
19. Bolt.
20. Lock washer.
21. Bolt.
22. Lock washer.
23. Rotor drive plate (MP492).
24. Rotor (E140).

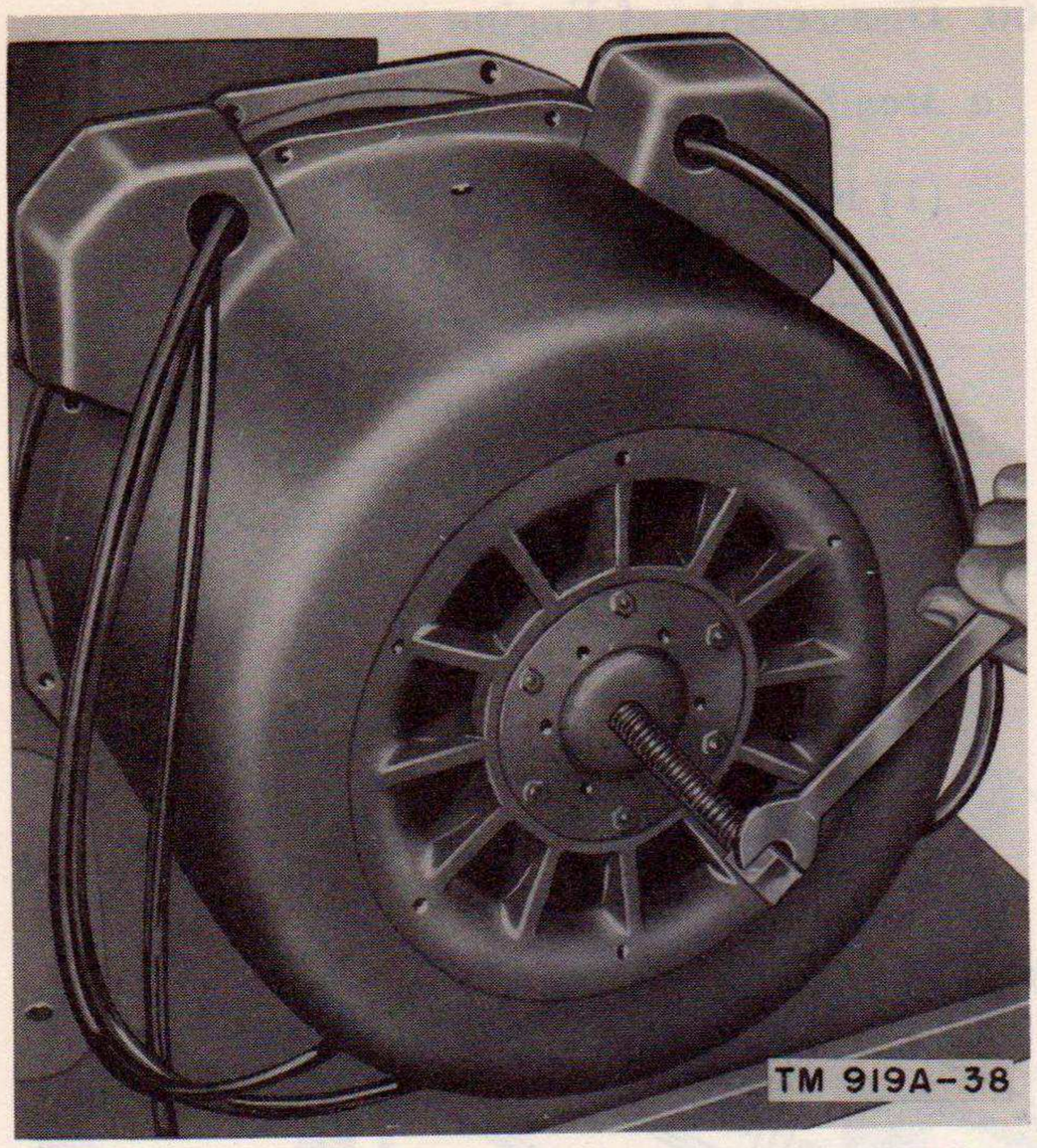


Figure 38. Removing stator housing.

(3) Clean the carbon out of the manifold with a wire brush. Blow out loose carbon deposits with compressed air.

(4) Scrape the gasket particles off the manifold flanges.

(5) Examine the manifold for cracks and warpage.

b. Cylinder Head.

(1) Remove the coolant outlet neck (5) and the gasket (6). Lift the thermostat adapter ring (7) and thermostat (8) out of the outlet neck. Remove the spark plugs.

(2) Remove the hold-down nuts and pull the cylinder head (9) straight up off the studs. Remove the gasket (10).

(3) Wash the cylinder head with diesel oil (D-40 or D-35) and scrape off the gasket particles and carbon.

(4) Examine the cylinder head for cracks and warpage.

c. Valve Mechanism.

(1) Refer to subparagraph *a* above and remove the manifold as instructed.

(2) Refer to subparagraph *b* above and remove the cylinder head as instructed.

(3) Remove the valve cover plate screws (11), valve cover plate (12), valve cover screw

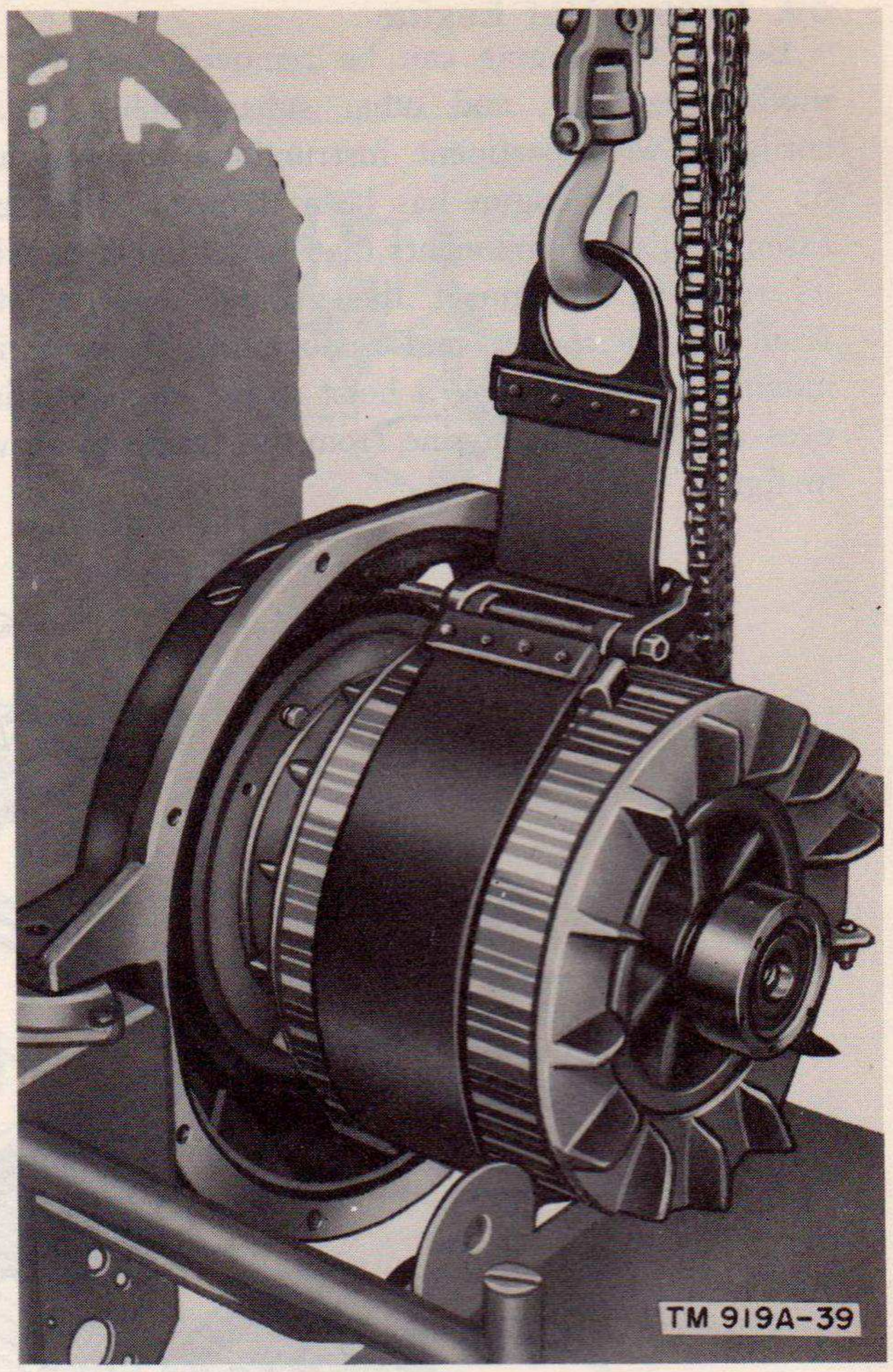


Figure 39. Removing rotor.

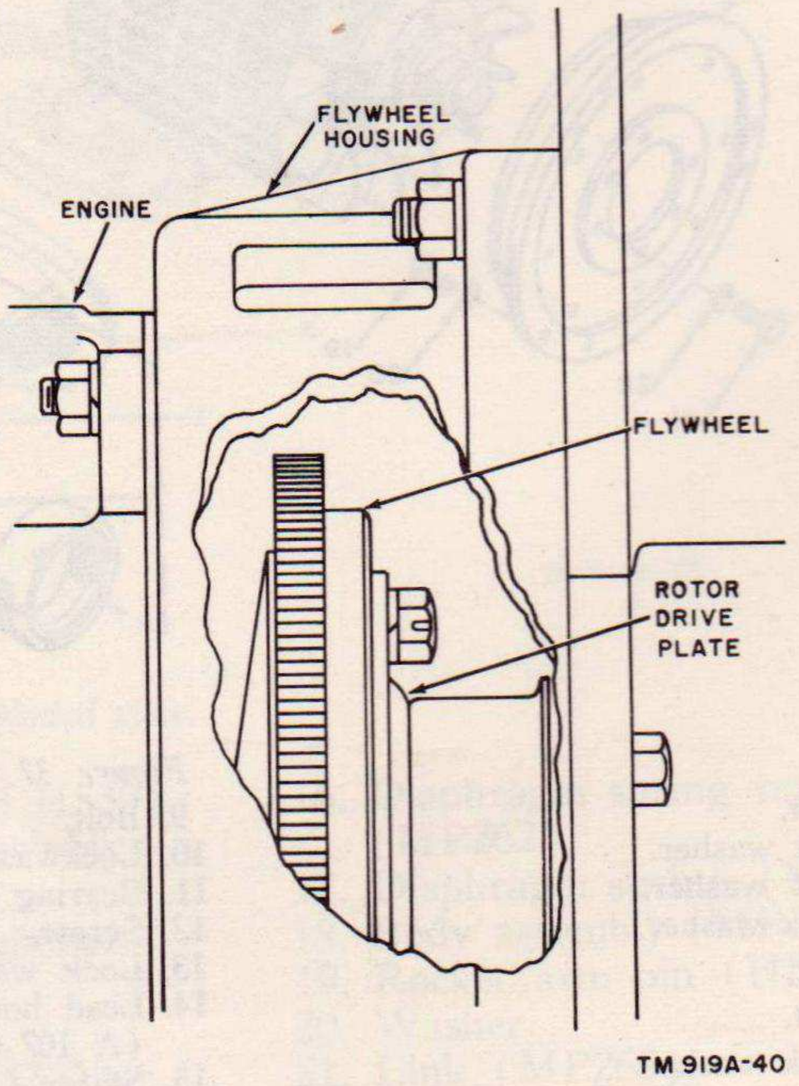


Figure 40. Engine-to-rotor coupling.

gaskets (13) and cover plate gasket (14). With a cloth, block off the holes in the valve chamber floor to prevent dropping valve locks into the crankcase.

(4) With a spring compressor raise the springs on the valves which are in a closed position, as shown in figure 43, and remove the valve locks (15). Then turn the crankshaft until any open valves become closed and remove the remaining valve locks. Remove the valve spring retainers (16) and keep them with their respective valves.

(5) Remove the valves (17) and place them in a wooden block drilled and numbered for identification. Remove the valve springs (18) and valve stem caps (19). Clean the valves on a wire wheel brush. Remove the carbon from the top and bottom of the valve heads and the gum from the stems. Reface the valve heads at an angle of 45°. Reface the intake valve seats in the cylinder block and check with a dial gage. Valve seats should not be out-of-round more than .002 inch. Check the condition of the exhaust valve seat inserts (23) and replace if necessary. Touch up the valves to the valve seats with a fine grinding compound.

(6) Clean carbon off the valve guides with a wire brush and check the clearance between the valve stems and valve guides

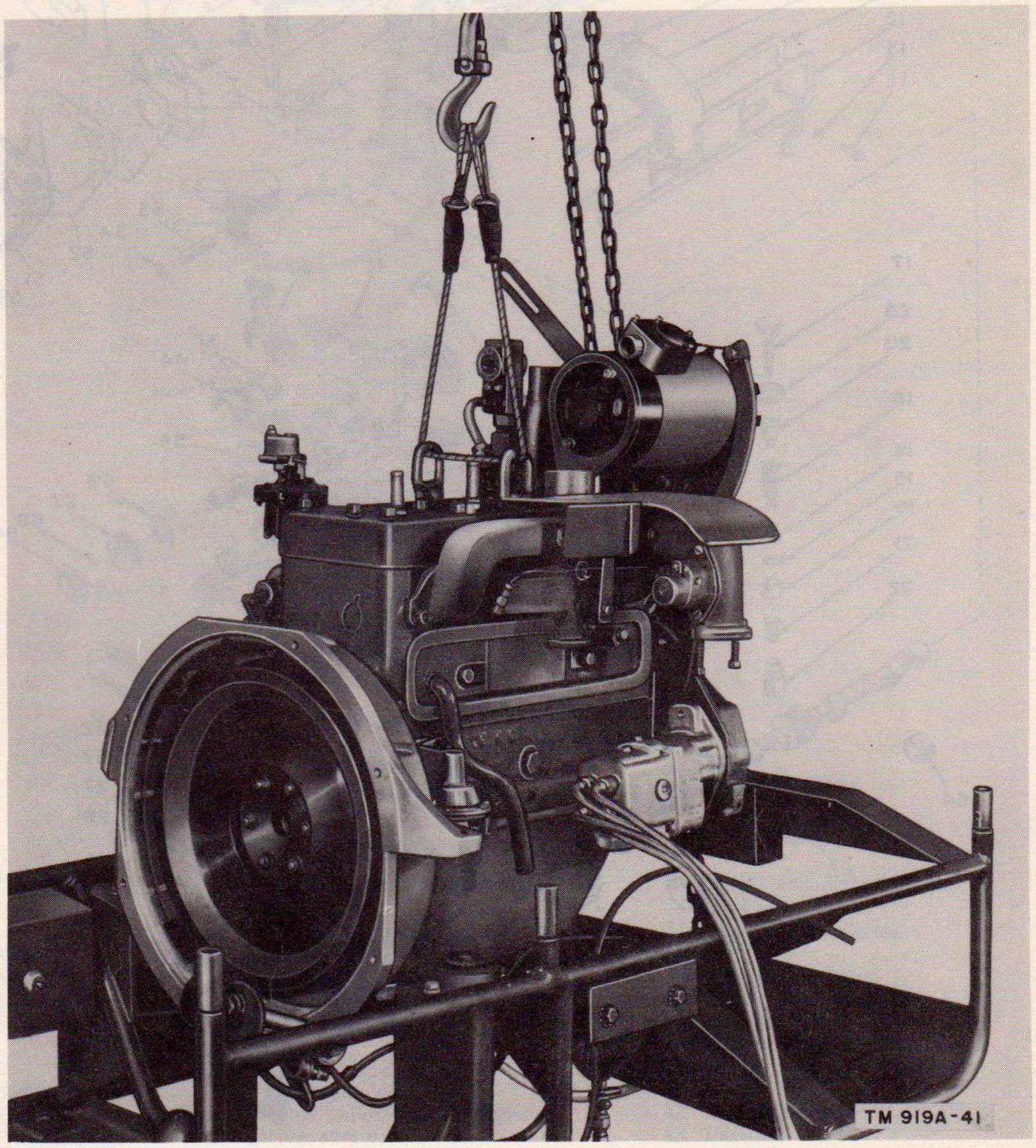
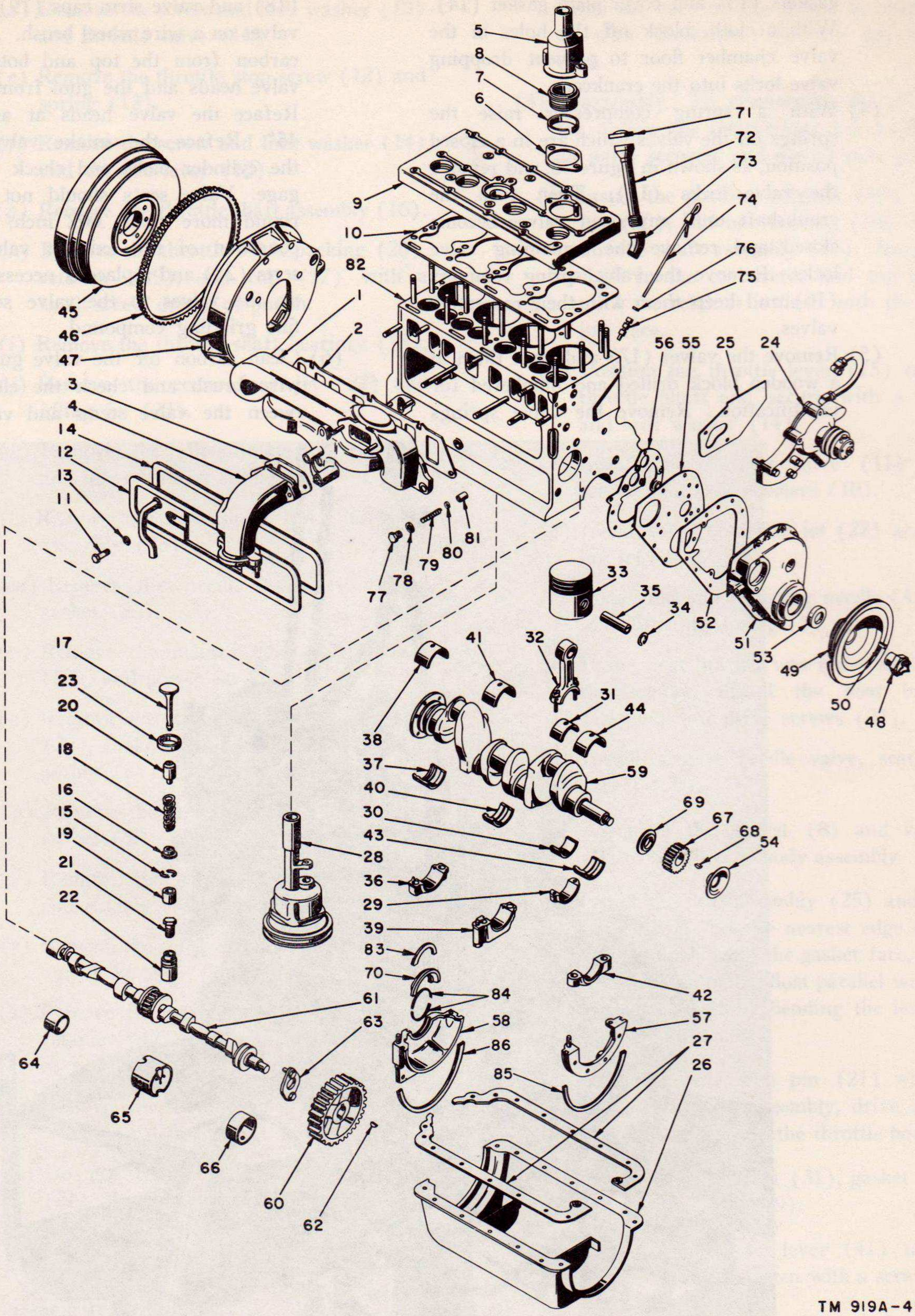


Figure 41. Removing engine from lower frame.



TM 919A-42

Figure 42. Engine, exploded view.

LEGEND FOR FIGURE 42

1. Intake and exhaust manifold (A 12).
2. Manifold gasket (H159).
3. Manifold adapter gasket (H158).
4. Manifold adapter (A 11).
5. Coolant outlet neck (A 1).
6. Outlet neck gasket (H37).
7. Thermostat adapter ring (MP1).
8. Thermostat (S15).
9. Cylinder head (A 2).
10. Cylinder head gasket (H38).
11. Valve cover plate screw (H170 and H171).
12. Valve cover plate (A 13).
13. Cover plate screw gasket (H168 and H169).
14. Cover plate gasket (H165).
15. Valve lock (H251 to H266).
16. Valve spring retainer (MP135 to MP150).
17. Valve (MP76 to MP83).
18. Valve spring (MP96 to MP103).
19. Valve stem cap (MP112 to MP119).
20. Valve guide (MP88 to MP95).
21. Tappet adjusting screw (H251-H258).
22. Valve tappet (MP120 to MP127).
23. Exhaust valve seat insert (MP84 to MP87.).
24. Water pump assembly.
25. Water pump gasket (H401).
26. Oil pan (MP164).
27. Oil pan gasket (H331 and H332).
28. Oil pump assembly.
29. Connecting rod cap.
30. Lower connecting rod bearing (MP43 to MP46).
31. Upper connecting rod bearing (MP47 to MP50).
32. Connecting rod (MP33 to MP34).
33. Piston (MP17 to MP20).
34. Piston pin retaining ring (MP25 to MP32).
35. Piston pin (MP21 to MP24).
36. Rear main bearing cap (MP59).
37. Lower rear main bearing (MP39).
38. Upper rear main bearing (MP40).
39. Center main bearing cap (MP60).
40. Lower center main bearing (MP41).
41. Upper center main bearing (MP42).
42. Front main bearing cap (MP62).
43. Lower front main bearing (MP51).
44. Upper front main bearing (MP52).
45. Flywheel (MP155).
46. Flywheel ring gear (MP156).
47. Flywheel housing (A 21).
48. Starting jaw (MP154).
49. Crankshaft pulley (MP153).
50. Pulley key (MP61).
51. Timing gear cover (MP152).
52. Timing gear cover gasket (H304).
53. Gear cover oil seal (H305).
54. Crankshaft oil thrower (MP58).
55. Crankcase end plate (MP151).
56. Crankcase end plate gasket (H292).
57. Front filler block (MP163).
58. Rear filler block (MP162).
59. Crankshaft (MP54).
60. Camshaft gear (MP133).
61. Camshaft (MP128).
62. Camshaft gear key (MP134).
63. Camshaft thrust plate (MP129).
64. Camshaft gear bearing (MP130).
65. Camshaft center bearing (MP131).
66. Camshaft front bearing (MP132).
67. Crankshaft gear (MP56).
68. Crankshaft gear key (MP57).
69. Crankshaft thrust plate (MP55).
70. Rear bearing oil guard (MP165).
71. Oil filler cap (MP2).
72. Oil filler pipe (MP3).
73. Street elbow (H67).
74. Oil bayonet gage (M21).
75. Oil gage rod support (A 3).
76. Felt (H70).
77. Oil-pressure relief valve plug (H64).
78. Copper gasket (H65).
79. Oil-pressure relief valve spring (MP4).
80. Washer (H66).
81. Oil-pressure relief valve (MP5).
82. Cylinder block (A 4).
83. Rear bearing guard felt (H333).
84. Rear filler block jute. (H334 and H335).
85. Front cork (H347).
86. Rear cork (H342).

(20). Standard clearance between the intake valve stem and valve guide is .0015 inch to .0032 inch; between the exhaust valve stem and valve guide the clearance should be .0025 to .0045 inch. If the clearance is excessive, remove the valve guides with a puller and discard them.

(7) Wash the valve springs in solvent (SD) and examine them for damage or corrosion caused by acid etching. The over-all free length of each spring should be measured and the spring pressure checked. The free length should be 2-1/16 inches. The standard spring pressure when compressed to 1-45/64 inches is 47 to 53 pounds. Replace any springs that do not meet the above specifications.

d. Water Pump.

(1) Remove the fan from the fan hub (20, fig. 44) on the water pump.

(2) Disconnect the recirculating tube assembly (11) at the water pump.

(3) Remove the attaching bolts and lift the water pump assembly (24, fig. 42) from the block. Collect the gasket (25, fig. 42).

(4) Remove the attaching screws (2, fig. 44). Remove the water pump cover (3) and gasket (4).

(5) Remove the screw and lock washer (18) and lock nut (19). Remove the fan belt adjusting flange (21) from the fan hub.

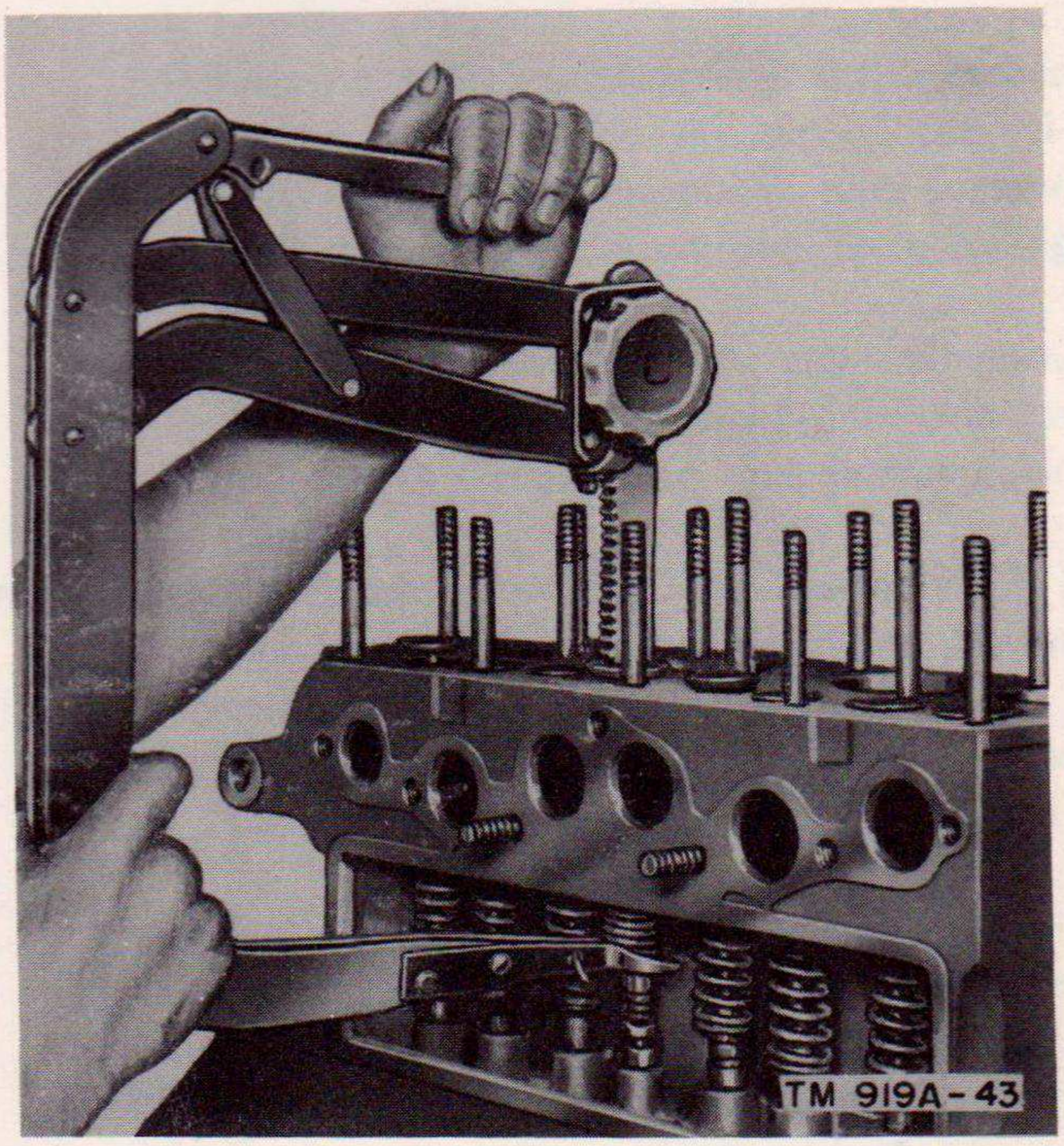


Figure 43. Removing valves.

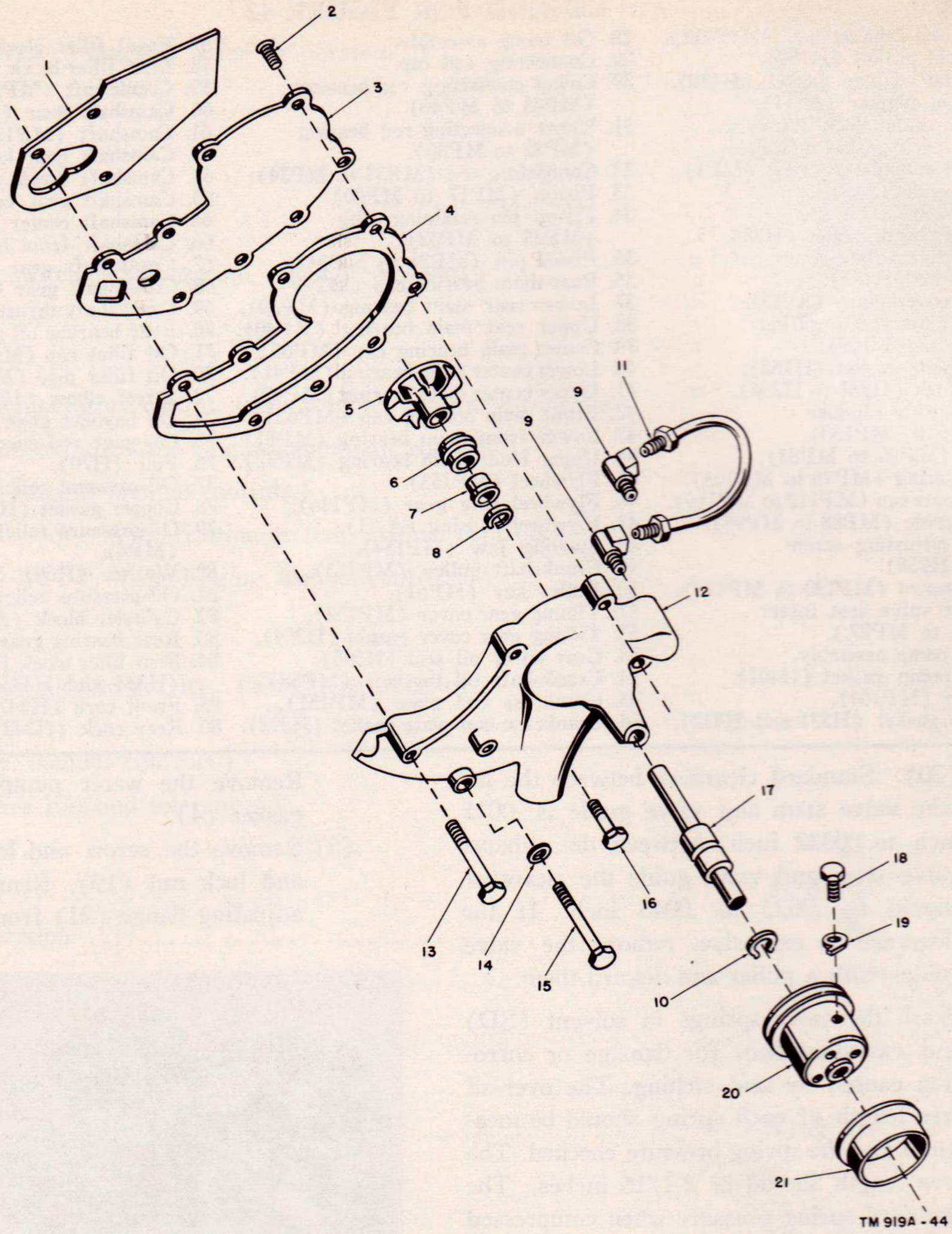


Figure 44. Water pump, exploded view.

1. Gasket.
2. Screw.
3. Water pump cover (A 31).
4. Cover gasket (H406).
5. Impeller (MP186).
6. Seal (MP187).
7. Water shedder (MP188).
8. Retainer ring (A 32).
9. Elbow (H407 and H408).
10. Retainer ring (MP191).
11. Recirculating tube assembly (H409).
12. Pump body (MP189).
13. Screw (H412 and H413).
14. Washer (H414).
15. Screw (H415).
16. Screw (H416).
17. Ball bearing shaft assembly (MP190).
18. Screw and lock washer (H417).
19. Lock nut (H418).
20. Fan hub (MP192).
21. Fan belt adjusting flange (MP193).

(6) Remove the fan hub (20) with a suitable puller.
(7) Remove the impeller (5) with a suitable puller.
(8) Slip the seal (6) and water shedder (7) off the ball bearing shaft.
(9) Remove the bearing seat ring (8) from the water pump body. Then remove the ball bearing shaft from the rear end of the water pump.
(10) Remove the bearing retainer (10) from the water pump body.
(11) Examine the seal for brittleness and cracks.
(12) Examine the bearings for bindings and the shaft for scuff marks and scratches.

e. Oil Pan.

(1) Remove the oil pan (26, fig. 42) by removing the bolts and lock washers. Remove the oil pan gasket (27).
(2) Remove the oil pump screen assembly (22, fig. 45) from the screen frame (20).
(3) Clean the oil pan with Diesel oil (D-40 or D-35) and examine it for dents and cracks. Scrape the gasket particles from the flange surface.
(4) Wash the screen with Diesel oil (D-40 or D-35) and remove any accumulation of dirt.

f. Oil Pump.

Note. To remove the oil pump, it is necessary first to remove the oil pan (subpar. *e.* above).

(1) Remove the oil pump (28, fig. 42) from the cylinder block by removing the nut (12, fig. 45) and washer (11).
(2) Remove the gear (2) by filing off one end of the pin (3). Then drive out the pin with a small punch. Remove the screen assembly (22), screws (18), spacer (21), strainer screen frame (20), cover (17), and gaskets (16 and 19). The idler gear (14), driver gear (8), and shaft (6) now can be removed through the cover opening. Remove the stud (13) from the body assembly (5).
(3) Remove the driver gear (8) from the shaft (6) by removing the snap ring (15). Remove the key (7) from the shaft.
(4) Inspect the gears for pitting, chipping, and excessive wear.
(5) Inspect the oil pump body for cracks, pitting, corrosion, and general condition.
(6) Examine the inner surface of the cover for scoring or scratches. Check the flatness of the cover as shown in figure 46. It must be flat within .001 inch. Assemble the gears in the pump body and install the cover without the gasket. Tighten the cover screws to normal tension. It should now be impossible to turn the pump shaft by hand. Remove the cover and replace it with the gasket in position. The shaft should now turn with ease, proving that the end float of the gears is less than the gasket thickness, or .007 inch.

g. Connecting Rods and Pistons.

(1) Refer to subparagraph *b* above and remove the cylinder head as instructed.
(2) Refer to subparagraph *e* above and remove the oil pan as instructed.
(3) Turn the crankshaft until the lower end of the desired connecting rod is accessible.
(4) Remove the cotter pins and nuts from the connecting rod cap (29, fig. 42). Loosen the cap from the rod by tapping the cap with a soft-faced hammer. Then remove the cap and lower bearing (30).
(5) Push the connecting rod away from the crankshaft journal and remove the upper bearing (31).
(6) Using a ridge reamer, remove the carbon deposit from around the top of the cylinder bore. Keep the piston tops covered with cloth to prevent cuttings from falling into the engine.
(7) Wrap the lower end of the connecting rod in a cloth to prevent scratching the cylinder wall as the connecting rod is being removed.
(8) Push the connecting rod assembly (32) and piston (33) out through the top of the cylinder bore.
(9) Repeat the steps given in subparagraphs (1) through (8) above for all the connecting rods and pistons.

Caution: Connecting rods and caps are matched and must be paired together to insure correct reinstallation. Caps and rods are marked with their respective cylinder numbers.

(10) Remove the piston rings with a conventional ring remover.

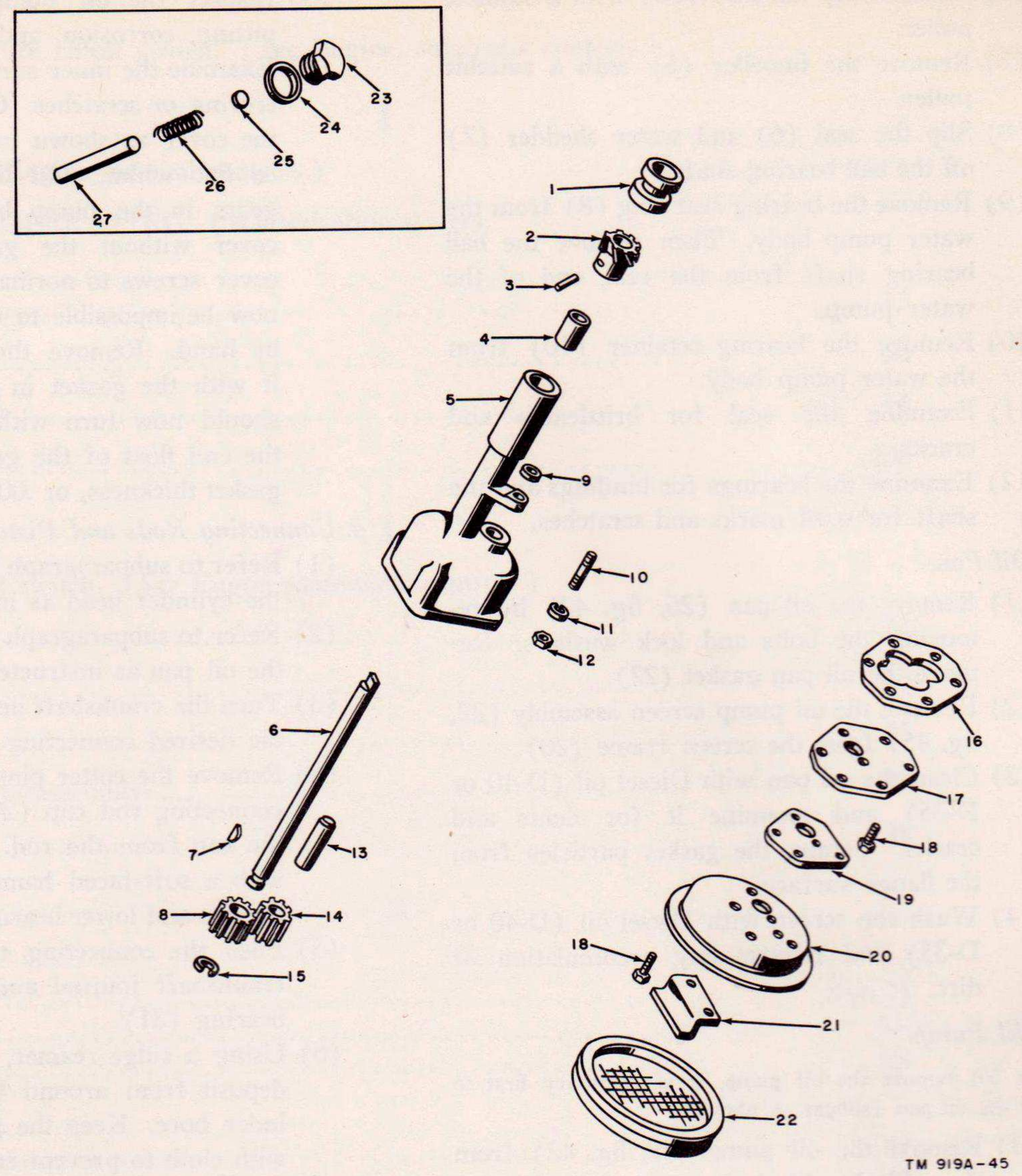


Figure 45. Oil pump, exploded view.

1. Sleeve (MP171).
2. Gear (MP172).
3. Pin (H376).
4. Bushing (H377).
5. Body assembly (MP173).
6. Shaft (MP174).
7. Key (MP175).
8. Driver gear (MP176).
9. Washer (H378).
10. Stud (379).
11. Washer (H380).
12. Nut (H381).
13. Stud (H383).
14. Idler gear (MP177).
15. Snap ring (H387).
16. Gasket (H382).
17. Cover assembly (A 26).
18. Screw (H384 and H385).
19. Gasket (H386).
20. Strainer screen frame (MP178).
21. Spacer (MP179).
22. Screen assembly (MP180).
23. Plug (H64).
24. Copper gasket (H65).
25. Washer (H66).
26. Spring (MP4).
27. Valve (MP5).

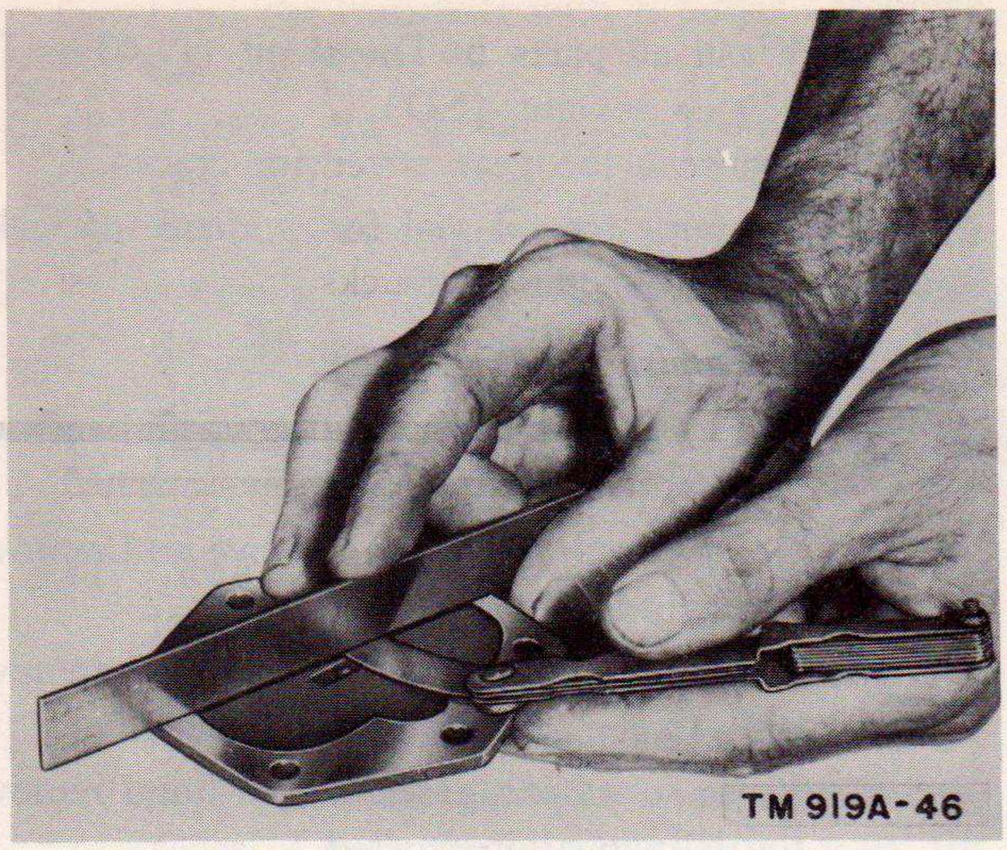


Figure 46. Checking oil pump cover.

(11) Remove the retaining rings (34) and then tap the piston pin (35) from the piston and connecting rod.
(12) Check the connecting rod on an aligning fixture as shown in figure 47.
(13) Examine the bearings for chipping, scoring, and cracking. Examine the back of the bearings for bright spots, which indicate a loose fit in the caps.
(14) Clean the bearings and caps with Diesel oil (D-40 or D-35) or solvent (SD).
(15) Scrape the carbon from the ring grooves and soak the pistons in solvent (SD). After soaking, clean the grooves again to be sure all carbon has been removed.
(16) Measure the clearance between the piston and cylinder wall as follows. Insert an inverted piston into the cylinder. Then measure the clearance with a .003 inch, ¾-inch wide feeler gage as shown in figure 48. This should give a 5- to 10-pound pull when being removed. (The gage should extend the full length of the piston on the thrust side, opposite slot.)

h. Main Bearings.

(1) Refer to subparagraph *e* above and remove the oil pan as instructed.
(2) Remove the cap screws and washers that secure the main bearing cap (36, fig. 42) to the block. Remove the bearing cap. Then remove the lower bearing (37) from the cap. Repeat the above steps for the other two main bearings.
(3) Refer to subparagraph *m* below and remove the upper main bearings as instructed.
(4) Clean the main bearings and the caps with Diesel oil (D-40 or D-35) or solvent (SD).
(5) Examine the bearings for chipping, scoring, and cracking. Examine the back of the bearings for bright spots, which indicate a loose fit in the caps.
(6) Refer to paragraph 61*a*(6) and check the bearing clearance as instructed.

i. Flywheel.

(1) Remove the nuts and lock washers that secure the flywheel (45) to the crankshaft. Remove the flywheel.

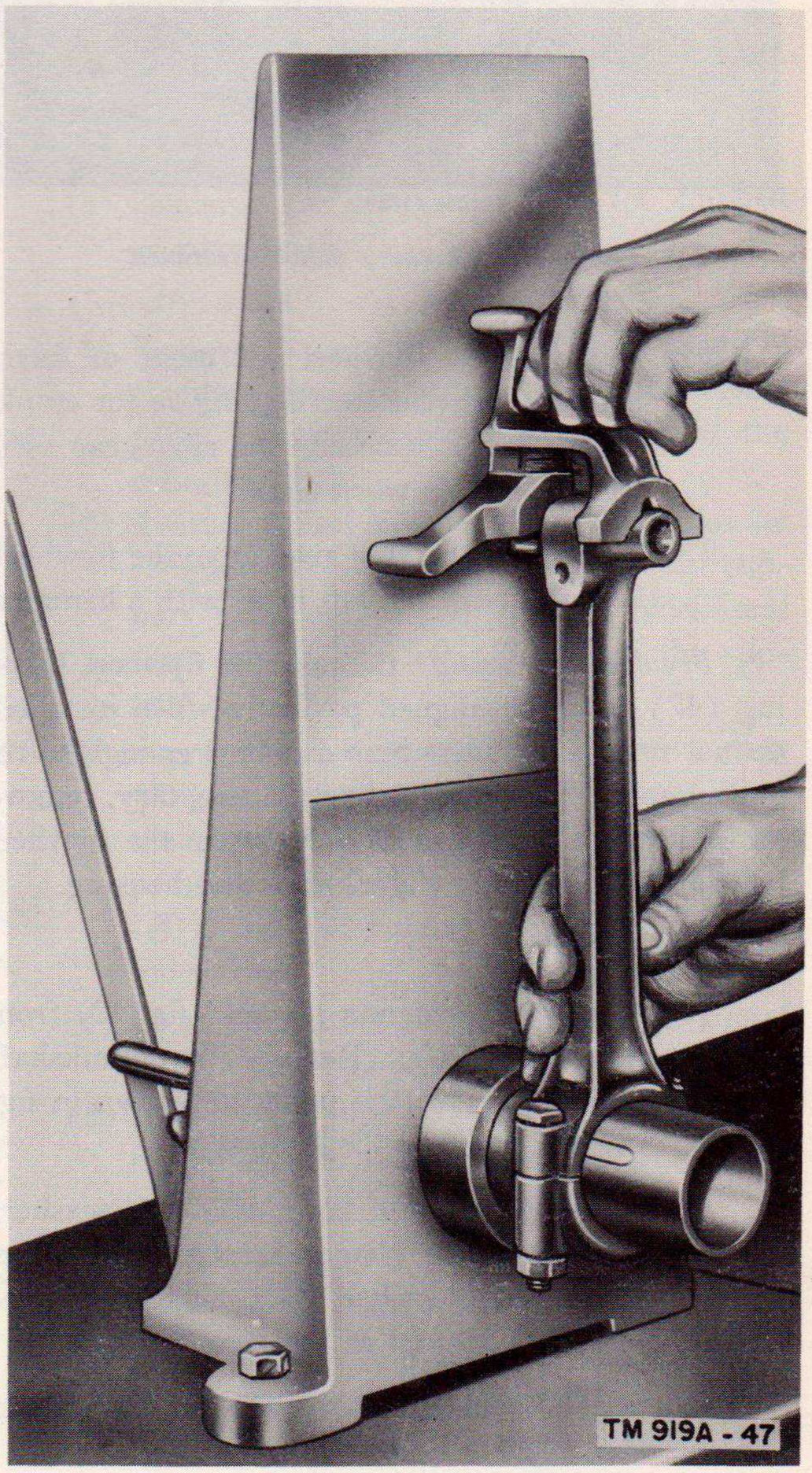


Figure 47. Aligning connecting rod.

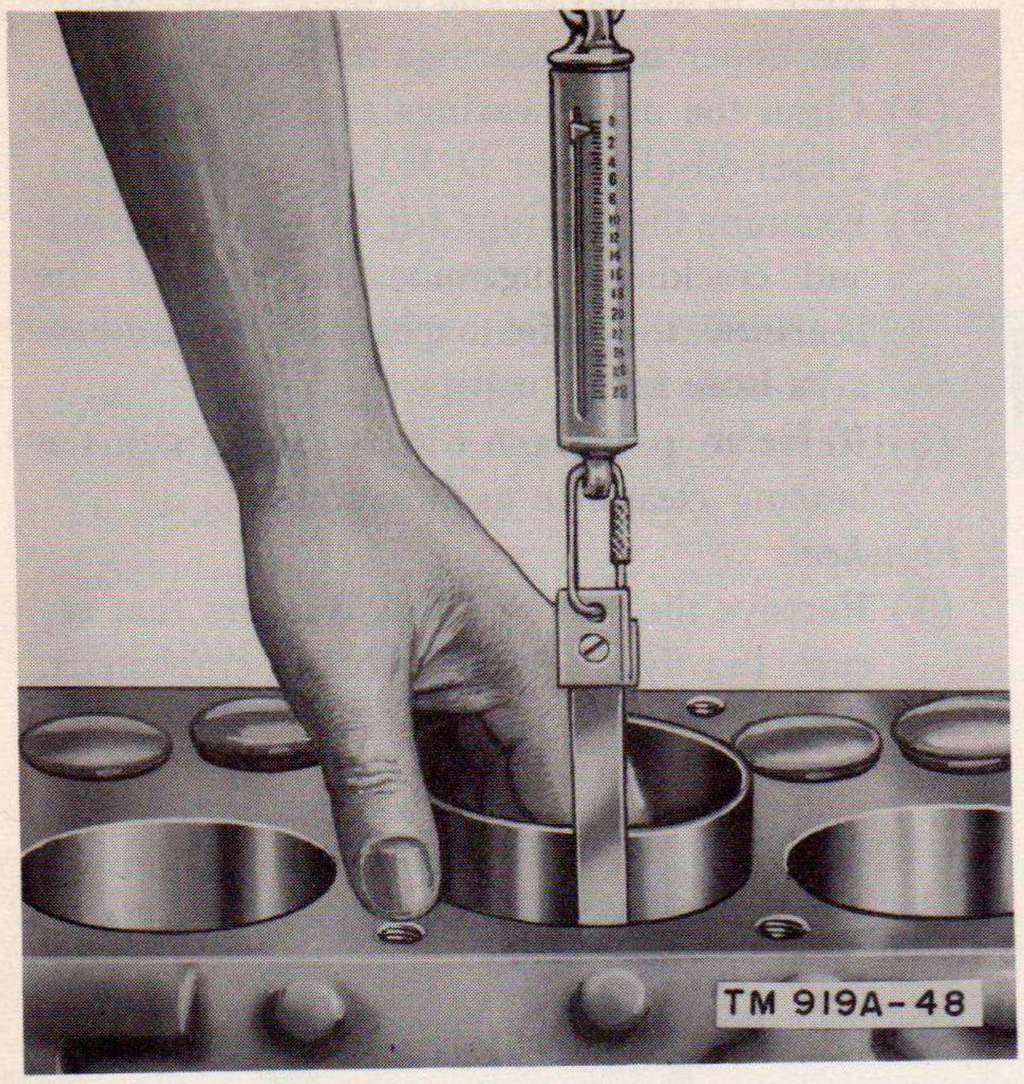


Figure 48. Checking piston clearance.

(2) Examine the flywheel for nicks or burrs that may prevent even seating on the crankshaft flange. Examine the ring gear (46) for chipped or worn teeth.

(3) To remove the ring gear from the flywheel, heat the gear and tap it off with a hammer.

j. Flywheel Housing. Because the flywheel housing (47) must be aligned perfectly when installed, do not remove it unless it is damaged enough to require replacement. If removal is necessary, remove the bolts and lock washers that secure the flywheel housing to the block and remove the housing.

k. Gear Cover.

(1) Remove the starting jaw (48, fig. 42) from the crankshaft. Remove the crankshaft pulley (49) with a puller as shown in figure 49. Remove the key (50).

(2) Remove the nuts, bolts, and lock washers that secure the gear cover (51) to engine. Remove the gasket (52). Then pull the oil seal (53) out of the gear cover.

(3) Slip the oil thrower (54) off the crankshaft (59).

(4) Remove the crankcase end plate (55) and gasket (56).

(5) Wash all parts in Diesel oil (D-40 or D-35) or solvent (SD).

(6) Examine the gear cover for cracks.

(7) Examine the oil seal for evidence of leakage, nicks, and burrs.

l. Camshaft (fig. 42).

(1) Refer to subparagraph *a* above and remove the manifold as instructed.

(2) Refer to subparagraph *b* above and remove the cylinder head as instructed.

(3) Refer to subparagraph *c* above and remove the valve mechanism as instructed.

(4) Refer to subparagraph *e* above and remove the oil pan as instructed.

(5) Refer to subparagraph *f* above and remove the oil pump as instructed.

(6) Refer to subparagraph *k* above and remove the gear cover as instructed.

(7) Remove the nut and lock washer that secure the camshaft gear (60) to the camshaft (61). Then pull the camshaft gear

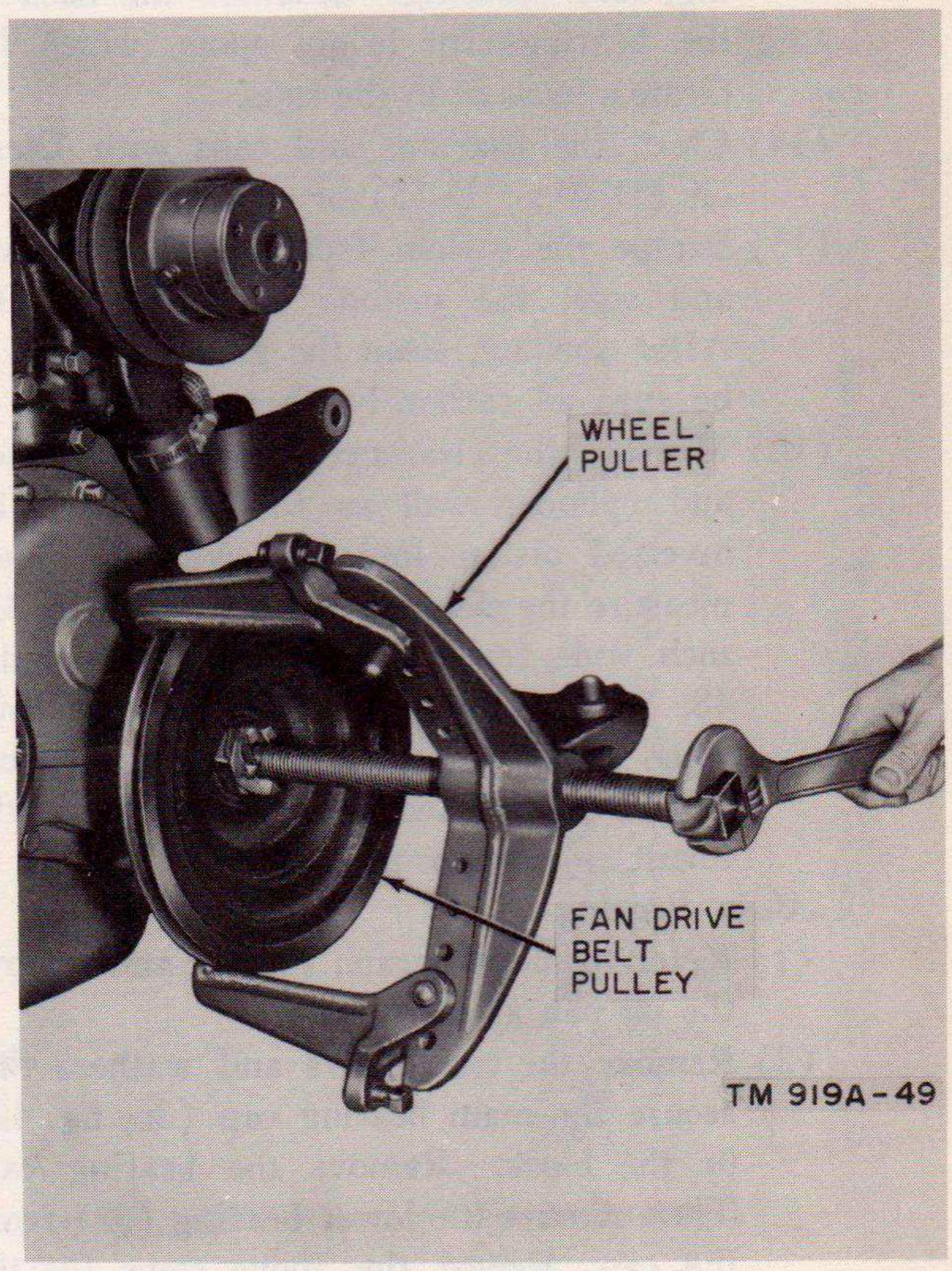


Figure 49. Removing crankshaft pulley.

from the camshaft with a puller. Remove the key (62).

(8) Remove the thrust plate (63) from the camshaft.

(9) Tie the valve tappets (22) up at their highest point of travel with strings tied around the adjusting screw (21) and the manifold studs.

(10) Pull the camshaft forward out of the block. Then remove the tappets.

(11) Clean the camshaft and the tappets with Diesel oil (D-40 or D-35) or solvent (SD).

(12) Carefully examine the camshaft for scores and roughness on the cam and bearing surfaces. Check the oil pump drive gear for chipped or worn teeth. Measure the camshaft bearing clearance with a feeler gage. Standard bearing clearance is .0015 inch to .002 inch. If the camshaft bearings (64, 65, and 66) are worn, drive them out with a drift.

(13) Examine the tappet faces and replace any that are scored, rough, or cracked. Standard clearance of the tappets in the guides is .0005 inch to .002 inch. Check and replace those that have worn excessively.

(14) Examine the camshaft thrust plate for rough edges, nicks, and burrs.

(15) Examine the camshaft gear for chipped and worn teeth.

m. Crankshaft (fig. 42).

(1) Refer to subparagraph *e* above and remove the oil pan as instructed.

(2) Refer to subparagraph *g* above and remove the connecting rod caps as instructed.

(3) Refer to subparagraph *h* above and remove the lower main bearings as instructed.

(4) Refer to subparagraph *i* above and remove the flywheel as instructed.

(5) Refer to subparagraph *k* above and remove the gear cover as instructed.

(6) Remove the screws and lock washers that secure filler blocks (57) and (58) to the cylinder block. Remove the filler blocks.

(7) Remove the crankshaft.

(8) Remove the upper main bearings (38, 41, and 44). Refer to subparagraph *h* above and clean and inspect the bearings as instructed.

(9) Remove the crankshaft gear (67) with a puller. Remove the key (68). Slip the thrust plate (69) off the crankshaft.

(10) Remove the rear bearing oil guard (70) from the cylinder block.

(11) If it is necessary to install new bearings, use a micrometer to determine if the crankshaft journals are out-of-round. If the journals are out-of-round, in excess of the standard connecting rod or main bearing clearance, regrind the shaft and install undersize bearings.

(12) Clean the crankshaft with Diesel oil (D-40 or D-35) or solvent (SD). Use a rifle brush and clean the oil passages in the shaft and the crankcase. Blow out with compressed air.

(13) Examine the crankshaft journals for cracks and score marks.

(14) Examine the crankshaft for misalignment.

(15) Examine the crankshaft gear for chipped or worn teeth.

n. Cylinder Block.

(1) Remove the oil filler cap (71). Screw the oil filler pipe (72) out of the street elbow (73). Screw the street elbow out of the cylinder block.

(2) Remove the oil bayonet gage (74) from the cylinder block. Pull the oil gage rod support (75) out of the cylinder block, and then remove the felt (76) from the support.

(3) Screw the oil pressure relief valve plug (77) out of the cylinder block. Collect the copper gasket (78). Remove the oil pressure relief valve spring (79), washer (80), and relief valve (81) from the cylinder block.

(4) Clean sludge out of the block with Diesel oil (D-40 or D-35) or solvent (SD).

(5) Remove the pipe plug on the flywheel end of the engine, and clean out the oil passage in the block with a rifle brush.

(6) Scrape carbon off the top of the block.

(7) Examine the block for cracks.

(8) Check the cylinder bores with a dial gage. If the cylinders are more than .005 inch out-of-round, rebore them within .002 inch of the size desired. Finish and polish the cylinders with a cylinder hone.

Section IV. REASSEMBLY

Note. This section provides complete instructions necessary to reassemble Gasoline Engine Generator Set PU-107A/U. Instructions are included for reassembly of the engine and alternator; details are also given for installation of those subassemblies removed in paragraph 55. The unit can be rewired completely by referring to the appropriate wiring diagrams.

61. Reassembly of Engine

a. Crankshaft and Main Bearings (fig. 42).

(1) Slip the thrust plate (69) onto the crankshaft (59). Be sure the side of the thrust plate with the inner beveled edge faces the front bearing. Insert the key (68) in the crankshaft groove and press the gear (67) onto the shaft.

(2) Place the upper main bearings (38, 41, and 44) in position in the block. If necessary, install a new jute (84) in the rear bearing oil guard (70). Follow the same procedure when installing this jute as when installing the jute in the rear filler block (subpar. (5) below). Install the rear bearing oil guard (70) in the cylinder block.

(3) Apply clean oil (OE) to the main bearing crankshaft journals. Then install the crankshaft (59) in the block.

(4) Install the lower main bearings (37, 40, and 43) on the crankshaft, and install bearing caps (36, 39, and 42).

(5) To install a new jute (84) in the rear filler block (58), insert the jute in the groove of the block. Roll the jute into the groove with a round piece of wood or steel as shown in figure 50. Start at one end and roll the jute to the center of the groove. Then start from the other end and again roll towards the center. Be sure the jute is pressed firmly into the bottom of the groove. The small portion of jute that protrudes above the surface of the block at each end must be cut off flush. Install the rear filler block (58).

(6) To check the clearance between the bearing and crankshaft journal, place a .002-inch shim between the journal and the bearing. Tighten the cap screws to the recommended torque of 85 to 95 pounds. A slight drag of the shaft, when turned by hand, proves the clearance (.002 inch to .0025 inch) is correct. Be sure to remove the shim.

(7) Reinstall the bearings and caps.

(8) Check the end play of the crankshaft with a feeler gage as shown in figure 51. Clearance should be between .006 inch and .008 inch. To adjust the end play, remove the crankshaft gear and thrust plate and insert shims as required between the thrust plate and the face of the front main bearing.

b. Flywheel and Flywheel Housing (fig. 42)

(1) Secure the flywheel housing (47) to the block.

(2) Heat the ring gear (46) and install it on the flywheel by tapping it lightly. Be sure the gear is seated properly.

(3) Install the flywheel (45) and flywheel ring gear (46) on the crankshaft and progressively tighten the attaching nuts with a torque wrench to a tension of 35 to 40 pounds.

Note. The flywheel can only be installed on the crankshaft one way because of the mounting hole spacing.

(4) Loosen the bolts and check the concentricity of the flywheel housing bore with the flywheel by positioning a dial indicator on

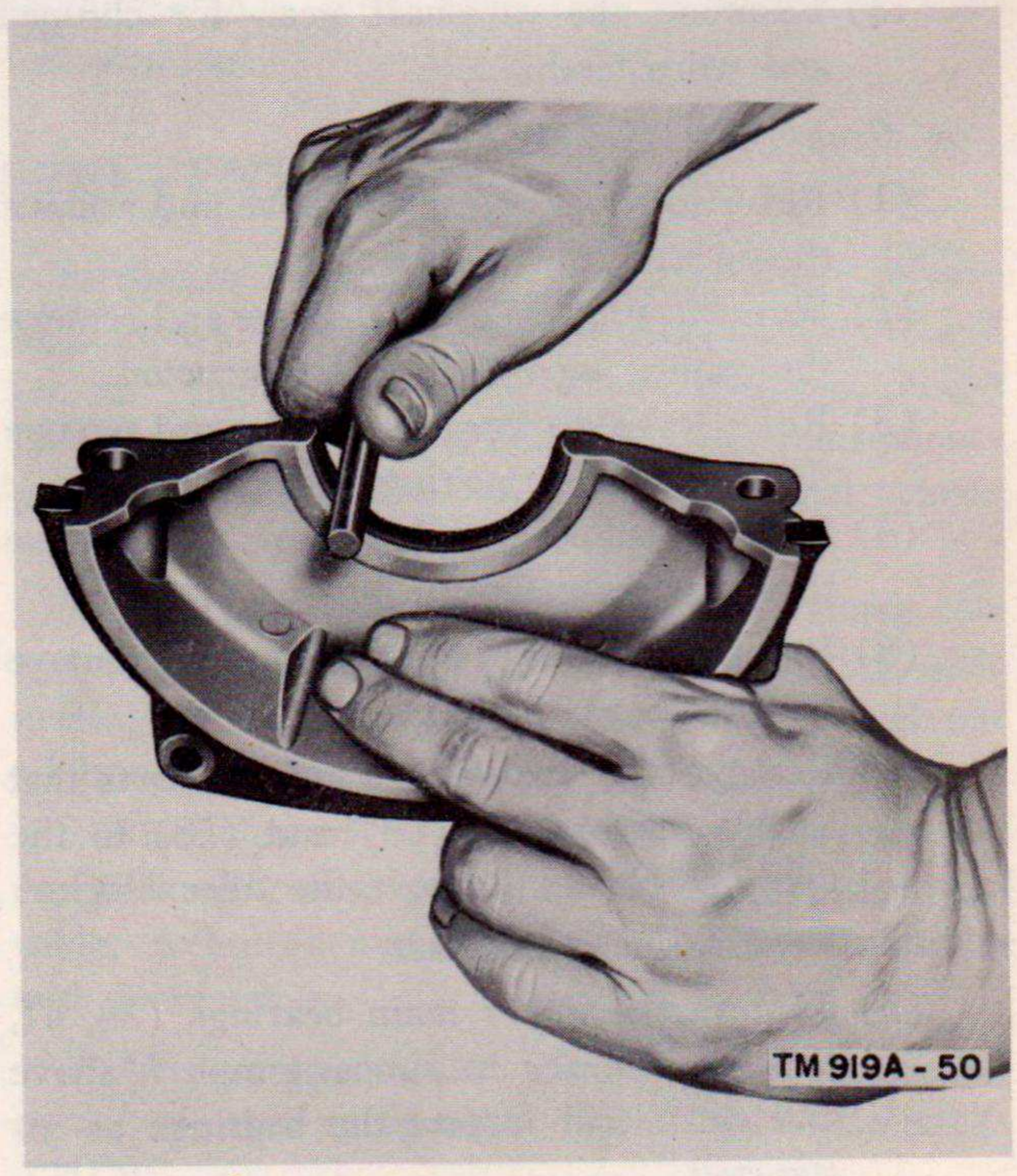


Figure 50. Installing rear filler block jute.

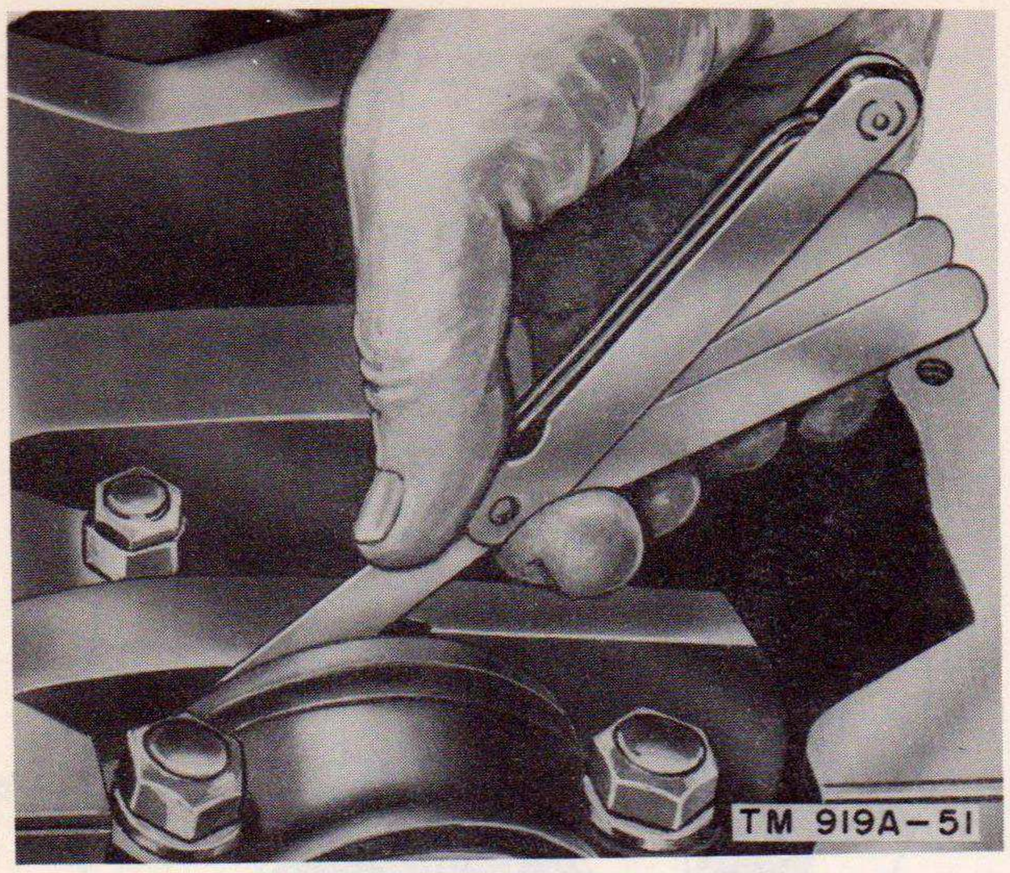


Figure 51. Checking crankshaft end play.

the flywheel as shown in figure 52. Turn the crankshaft slowly and observe the reading on the indicator. Shift the flywheel housing until centered within a tolerance of .003 inch. Then tighten the bolts. Recheck the concentricity after tightening.

(5) Check the face of the flywheel housing with a dial indicator as shown in figure 53. The housing should be parallel to the flywheel face within .003 inch. If the housing is not parallel, place shims between the engine block and the flywheel housing. Then recheck until the desired reading is reached. Be sure to tighten the bolts before each recheck.

Caution: It is essential that the above steps be taken when installing the flywheel housing. If the tolerances are greater than those specified, the resultant strain on the alternator bearing will cause serious damage to the rotor.

(6) Check the run-out of the flywheel with a dial indicator. It should not exceed .008 inch on the outer edge of the flywheel rear face.

c. Camshaft.

(1) Place the cylinder block in an arbor press. Position the camshaft bearing (1, fig. 54) on the block with the oil hole (3) in the bearing aligned with the oil hole in the block and press the camshaft bearing in until flush with the face of the block. Install the camshaft center and rear bearings in the same manner.

(2) Install the valve tappets (22, fig. 42) and tie them with the string attached to the manifold studs. Refer to paragraph 60*l*(13) and check the tappet clearance in the block as instructed.

(3) Install the camshaft (61) in the block and check the bearing clearance as instructed in paragraph 60*l*(12). Then secure the shaft with the thrust plate (63), screw, and lock washer assemblies.

(4) Position the key (62) in the camshaft keyway. Install the gear (60) with the camshaft and crankshaft positioned so that the timing gear marks are in alignment as shown in figure 55. Install the lock washer and nut that secure the gear to the camshaft.

(5) Check the end play of the camshaft with a feeler gage inserted between the camshaft

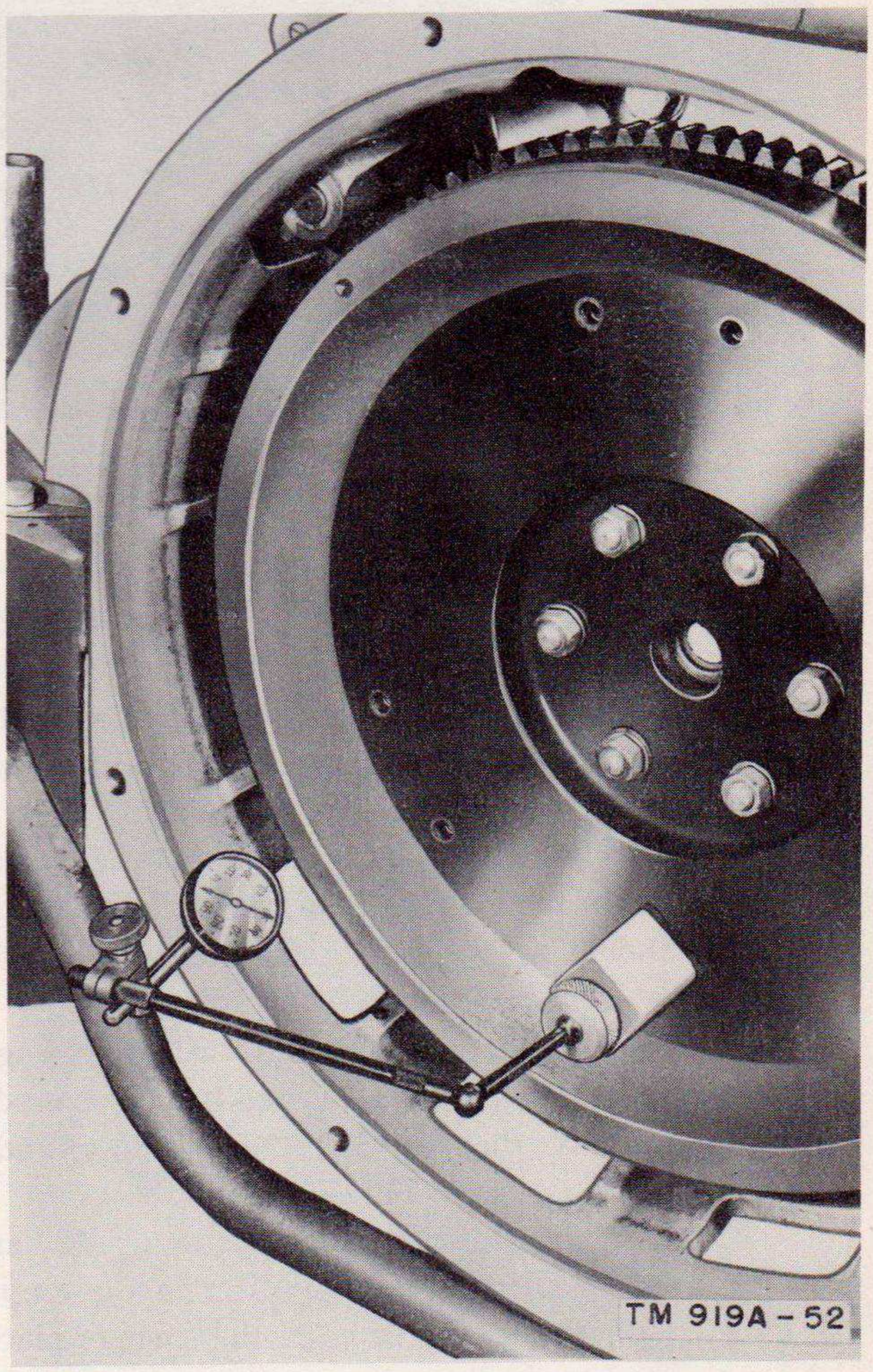


Figure 52. Checking concentricity of flywheel housing with flywheel.

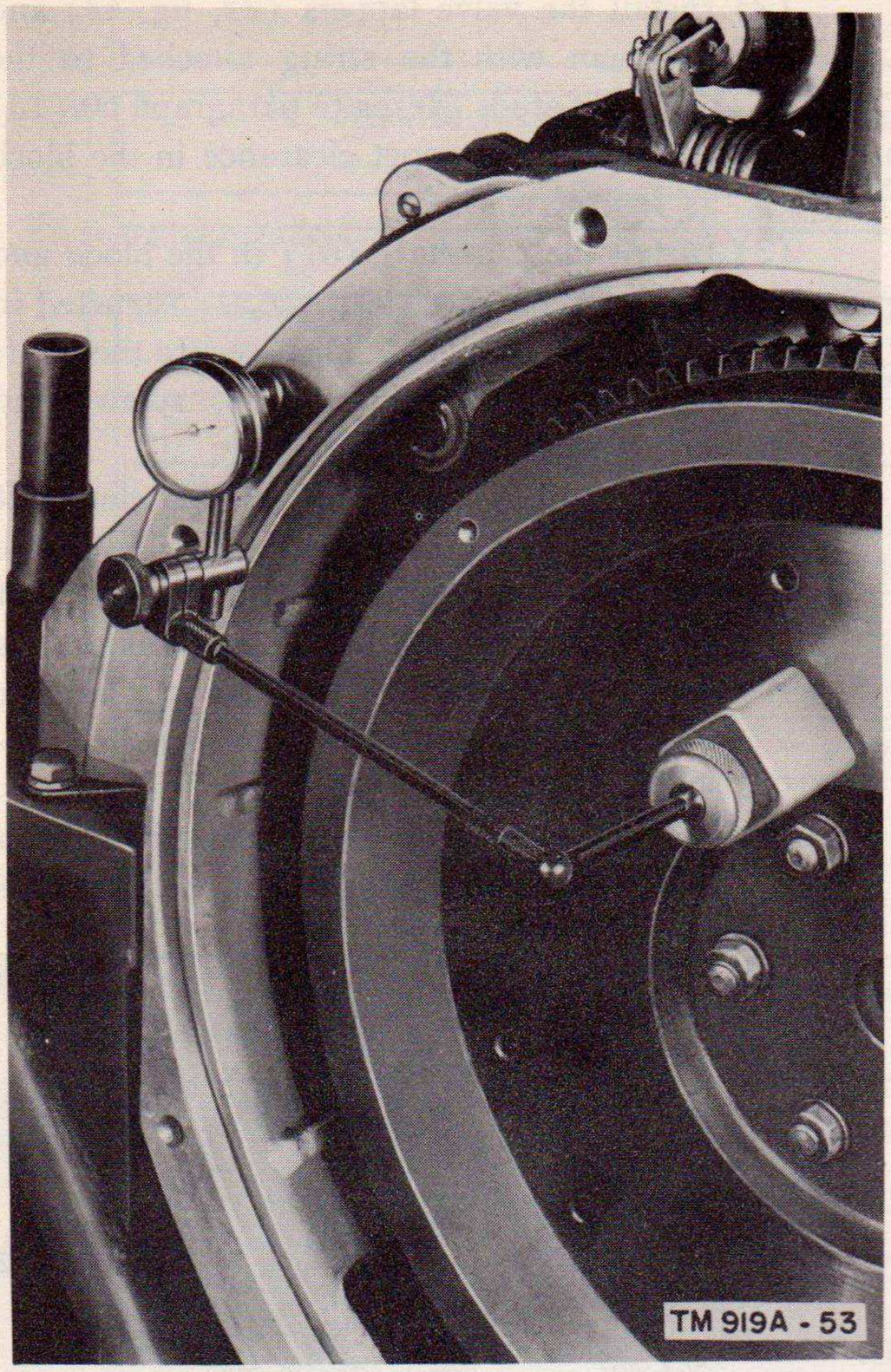


Figure 53. Checking face of flywheel housing with flywheel.

gear and the thrust plate. The clearance should be between .006 inch and .008 inch. Reduce the clearance by placing a thin shim between the thrust plate and the camshaft shoulder.

(6) Check the backlash between the timing gears with a dial indicator. The tolerance should not be more than .002 inch.

d. Valve Mechanism (fig. 42).

(1) Replace the valve guides (20) by using a valve guide driver. Drive the valve guides in until they are fully seated in cylinder block as shown in figure 56.

(2) Assemble the valve springs (18, fig. 42) and valve spring retainers (16) in the engine with the closed coils of the springs placed against the cylinder block.

(3) Install the valves (17) in the same positions from which they were removed.

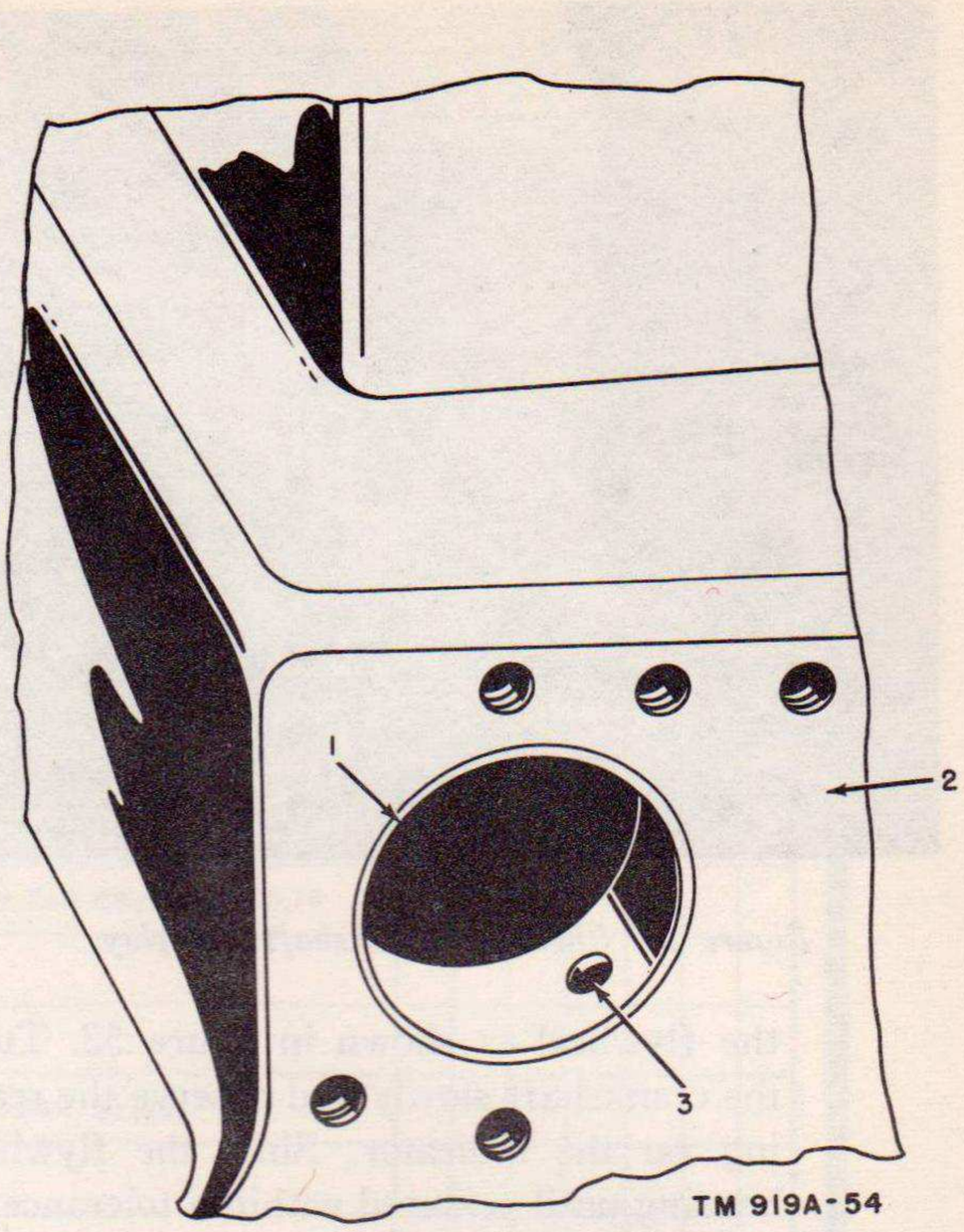


Figure 54. Camshaft bearing pressed into position.

1. Camshaft bearing.
2. Cylinder block
3. Oil hole.

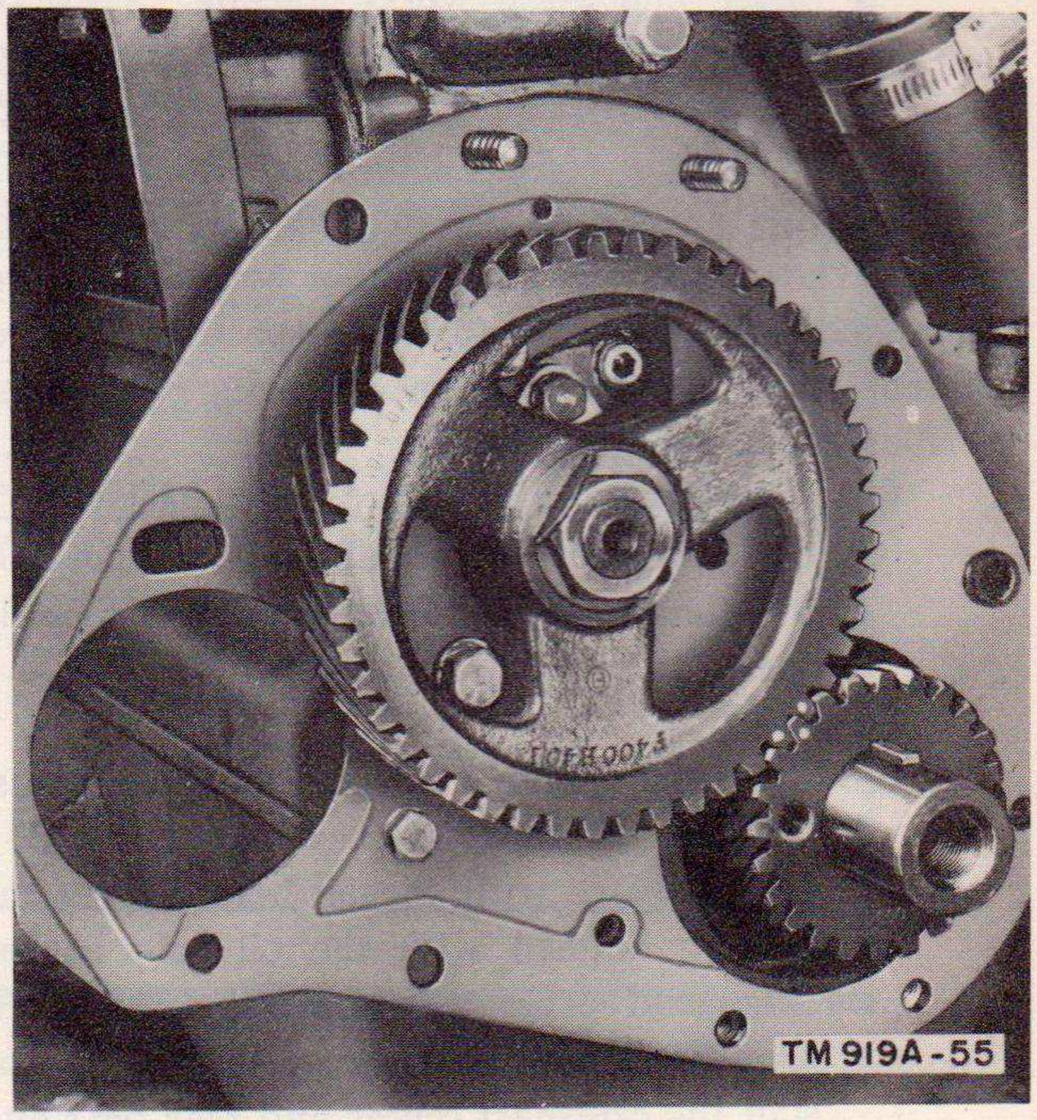


Figure 55. Aligning timing gear marks.

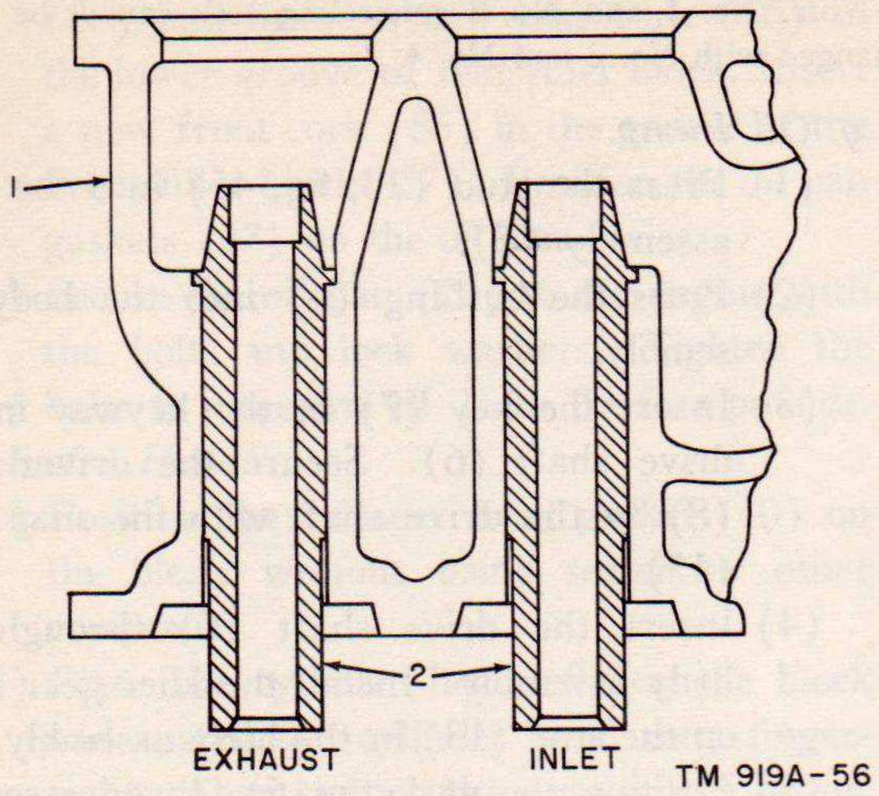


Figure 56. Position of valve guides.

1. Cylinder block. 2. Valve guide.

Then install the valve stem caps (19) on the valves.

(4) Compress the springs on the valves which are in a closed position. Insert the valve locks (15) in the valve stem groove. Turn the crankshaft until the open valves become closed and install the remaining valve locks.

(5) Refer to paragraph 64*c* and adjust the valve tappets as instructed.

(6) Remove the cloth from the valve compartment floor openings. Then cement a new gasket (14) in position on the valve cover plate. Install the valve cover plate (12). Be sure the copper ring gaskets (13) are under the attaching cover plate screws (11).

é. Gear Cover.

(1) Slip the crankshaft oil thrower (54) onto the crankshaft.

(2) Tap the oil seal (53) into the gear cover with a small block of wood.

(3) Coat the gear cover gasket (52) with gasket cement and position the gasket on the gear cover.

(4) Secure the gear cover (51) and gasket (52) to the block with the lock washers and nuts.

(5) Insert the key (50) in the crankshaft keyway and press the pulley (49) onto the shaft. Then secure the starting jaw (48) to the shaft.

f. Connecting Rods and Pistons.

(1) Refer to paragraph 60*g*(16) and check the piston clearance as instructed.

(2) To check the piston ring gap, push the piston ring into the cylinder with a piston. Check the end gap with a feeler gage as shown in figure 57. The end gap should be .008 inch to .013 inch. Check each piston ring individually.

(3) Check the piston ring groove clearance. Groove clearance should be .0015 inch to .002 inch.

(4) Clamp the connecting rod in a vise; use vise jaw shields of soft metal or hardwood. Start the piston pin into the piston. As-

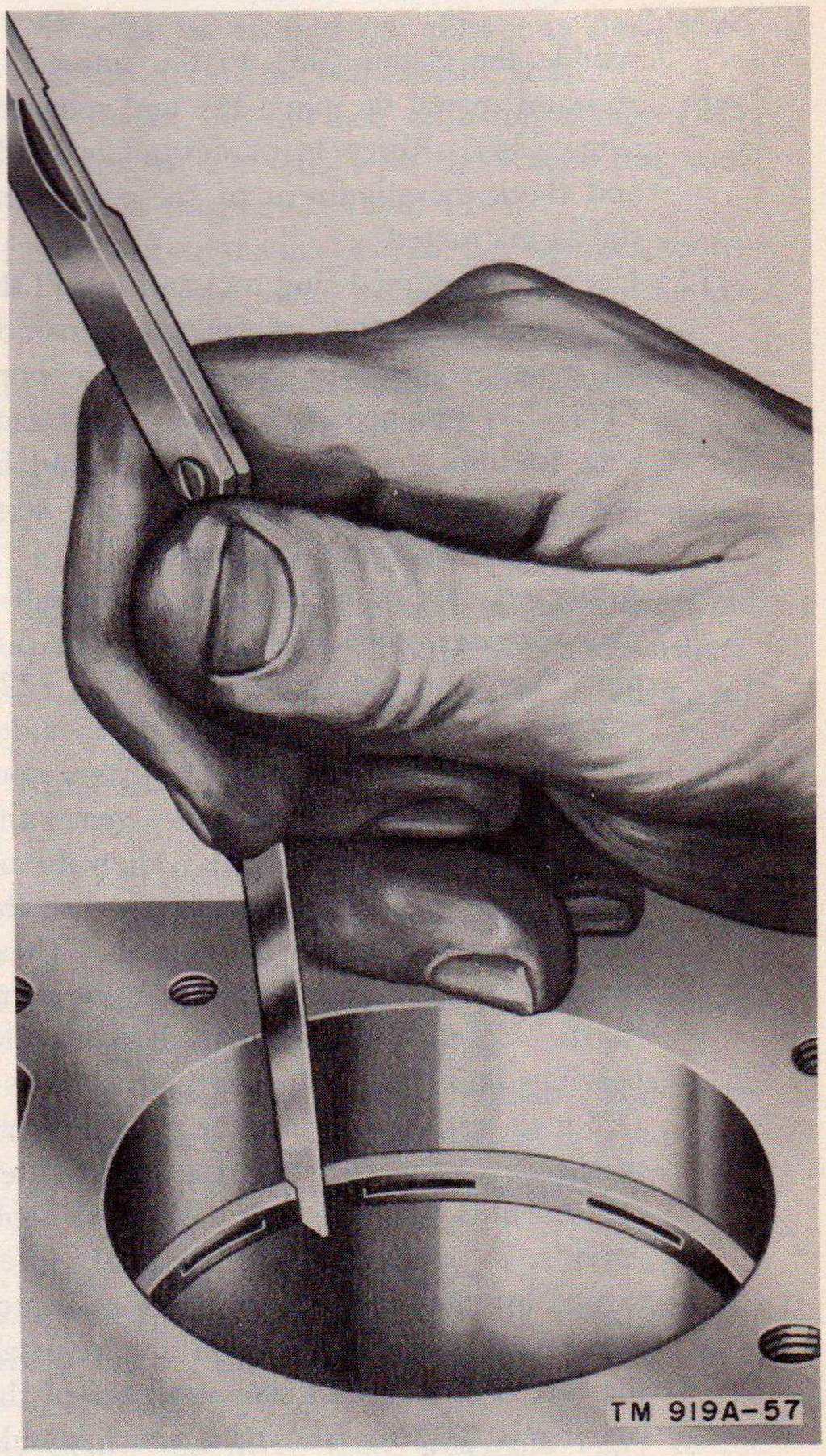


Figure 57. Measuring piston ring gap.

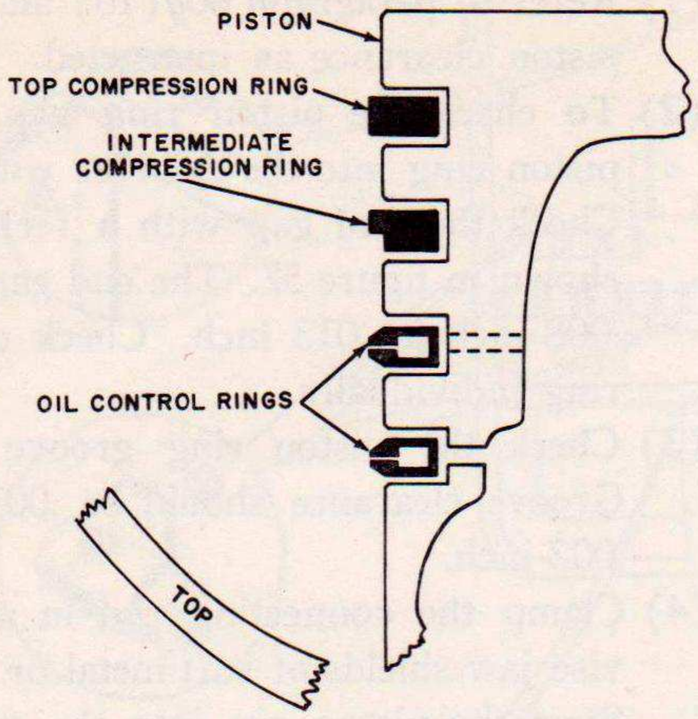


Figure 58. Piston ring installation.

semble the piston (33) to the connecting rod and install the pin (35) and retaining rings (34). Refer to paragraph 60*g*(13) and check the alignment of the connecting rod as instructed.

(5) Use a conventional ring tool and install the rings on the pistons as follows. Position the rings as shown in figure 58. The word "TOP" is stamped on upper edge of each ring to indicate how the ring should be installed. Install the rings with the ring gap staggered around the piston.

(6) Apply oil (OE) on the piston. Install a ring compressor over the rings on the piston. Then force the connecting rod (32) and piston (33) down through the cylinder bore by tapping the top of the piston with a hammer handle. Install the connecting rod bearings (30) and (31). Align the oil spray holes in the upper bearing with the spray holes in the connecting rods. These spray holes must face away from the camshaft. Check the clearance between the bearings and the crankshaft journal with a .002-inch test shim. Place the shim between the bearings and the shaft journal; tighten the cap nuts to a tension of 40 to 45 foot-pounds. A slight drag on the shaft when turned by hand indicates that the clearance is correct. Remove the shim and reinstall the cap. The standard side clearance of the bearing is .008 to .012 inch, which should be measured with a feeler gage as shown in figure 59.

Note. No. 1 and No. 3 connecting rods cannot be interchanged with No. 2 and No. 4.

g. Oil Pump.

(1) Press the stud (13, fig. 45) into the body assembly (5).

(2) Press the bushing (4) into the body assembly.

(3) Insert the key (7) in the keyway in the drive shaft (6). Secure the driver gear (8) to the drive shaft with the snap ring (15).

(4) Insert the drive shaft (6) through the body assembly. Install the idler gear (14) on the stud (13) in the body assembly.

(5) Position the gasket (16), cover assembly (17), gasket (19), oil pump strainer screen frame (20), and spacer (21) on the pump body and secure them with screws (18).

(6) Install the screen assembly (22) on the screen frame.

(7) Position the oil pump sleeve in the cylinder block. Install the oil pump assembly (28, fig. 42) using the nut and lock washer.

h. Oil Pan (fig. 42)

(1) Install a new rear bearing guard felt (83) on the outside of the rear bearing oil guard (70) and insert a new rear filler block jute (84) in the groove of the rear bearing oil guard.

(2) Insert a new rear filler block jute (84) in the top groove of the rear filler block

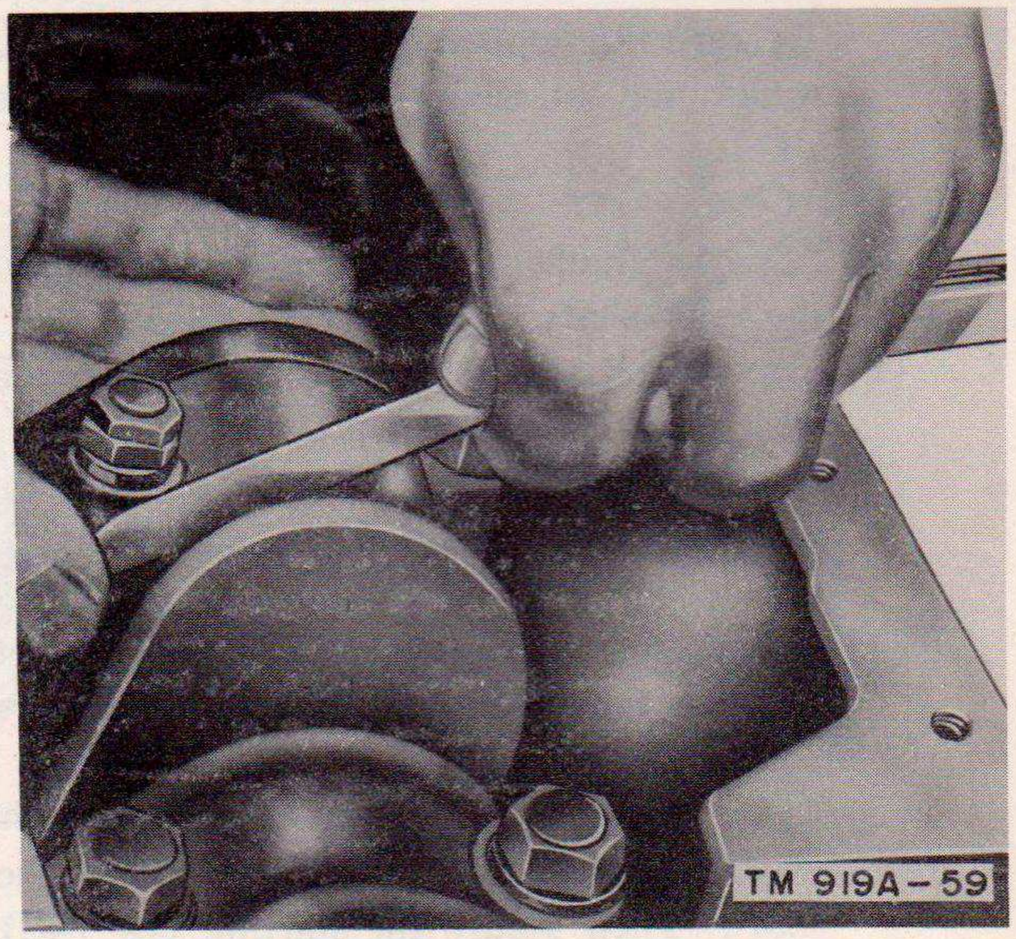


Figure 59. Checking connecting rod end play.

(58) and insert a new rear cork (86) in the lower groove of rear filler block. Insert a new front cork (85) in the groove of the front filler block (57). Position the oil pan gaskets (27) on the oil pan.

(3) Secure the oil pan (26) to the engine with the bolts and lock washers. Tighten the bolts to a tension of 15 to 20 foot-pounds.

i. Cylinder Head.

(1) Position the cylinder head gasket (10) on the block without using sealer or other compound.

(2) Place the cylinder head (9) on the block and install the cylinder head nuts finger-tight. Then tighten the nuts with a torque wrench to a tension of 70 to 75 foot-pounds in accordance with the sequence shown in figure 60. Tighten the nuts gradually two or three times to reach the recommended torque value.

(3) Adjust the spark plugs; set the electrode gap at .025 inch. Install the spark plugs to prevent any foreign matter entering the combustion chambers during the remaining operations.

(4) Install the thermostat (8) and thermostat adapter ring (7) in the coolant outlet neck.

(5) Position the outlet neck gasket (6) and secure the coolant outlet neck (5) on the cylinder head.

j. Water Pump.

(1) Install bearing retainer (10, fig. 44) in the front groove in the water pump body.

(2) Install the ball bearing shaft (17) in the water pump body from the rear end until the inside bearing butts against the bearing retainer.

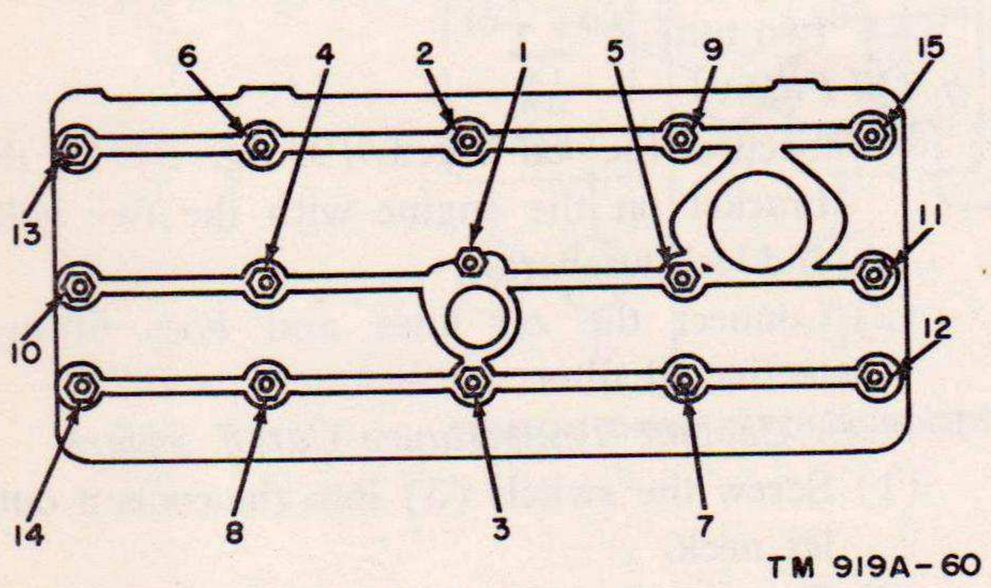


Figure 60. Cylinder head nut tightening sequence.

(3) Install the bearing seat ring (8) in the water pump body.

(4) Install the water shedder (7) on the ball bearing shaft.

(5) Dip the seal (6) in hydraulic brake fluid and then position it on the ball bearing shaft.

(6) Place the assembly on an arbor press and install the impeller (5) on the shaft until the impeller is .020 to .030 inch below the face of the water pump body.

(7) Position the gasket (4) and secure the water pump cover (3) to the water pump body with the screws.

(8) Support the assembly on the impeller end and install the fan hub (20). The hub must be pressed on until it is flush with the end of the ball bearing shaft.

(9) Install the fan belt adjusting flange (21) on the fan hub with the screw, nut, and lock washer (18) and (19).

(10) Position the gasket (25, fig. 42) and secure the water pump assembly (24) to the engine with the bolts and lock washers.

(11) Install the recirculating tube assembly (11, fig. 44) with elbows (9).

k. Manifolds (fig. 42).

(1) Position a new gasket (2) over the manifold studs on the block.

(2) Secure the intake and exhaust manifold (1) to the block with the nuts and washers. Tighten all manifold nuts to a tension of 25 to 30 foot-pounds.

l. Installation of Engine.

(1) Secure a hoist to the engine lifting eyes and position the engine in the lower frame. Secure the engine and shock mounts with the mounting bolts.

(2) Secure the ground strap on the front engine mount to the engine.

(3) Reinstall the muffler, radiator, and other subassemblies and accessories in accordance with the instructions in paragraph 63.

62. Reassembly of Alternator

a. Press the ball bearing (17, fig. 37) into the bearing liner (18). Then press the bearing onto the rotor shaft.

b. Secure the drive plate assembly (23) to the rotor assembly (24) with the bolts and lock washers.

c. Place a canvas belt around the rotor and at-

tach the belt to a lifting hoist. Lift the rotor into position against the engine flywheel. Then secure the rotor assembly to the flywheel with the bolts and lock washers.

d. Wipe the rotor clean. Make sure that there are no metal chips, shavings, washers, etc. held to it by magnetism.

e. Heat the outside of the stator housing (16). Slip the stator assembly into place. Be sure it is aligned correctly. Then feed the stator cables through the openings in the housing.

Caution: Do not raise the temperature of the stator housing above 180°F.

f. Hook a chain hoist into the lifting eye on the stator housing and swing the housing and stator assembly carefully over the rotor. Push the housing until it just touches the bearing liner.

g. Attach the bearing cover plate (11) to the stator housing by installing the bolts and lock washers in the outer row of the plate. Slip two long bolts through the cover plate and attach them to the bearing liner to keep the holes in line.

h. Heat the housing at the bearing end to facilitate pressing the liner into the housing. Then push the housing (16) and stator assembly (15) completely into position.

i. Secure the stator housing (16) to the flywheel housing with the bolts and washers.

j. Remove the two long aligning bolts from the bearing liner and install the correct bolts in the inner row of the bearing cover plate.

k. Position the guard assembly (8) to the stator housing and secure it with the bolts and lock washers.

63. Installation of Subassemblies and Accessories

a. Fuel Pump.

(1) Position the fuel pump gasket on the fuel pump flange.

(2) Install the fuel pump on the engine and secure it with the two bolts and lock washers.

(3) Connect the fuel lines from the carburetor and the fuel filter to the fuel pump.

b. Engine Speed Governor.

(1) Position the governor on the engine and secure it with the two bolts, lock washers, and nuts.

(2) Connect the carburetor-to-governor linkage to the governor control arm and the carburetor throttle.

c. Carburetor.

(1) Position the carburetor gasket on the flange of the carburetor and secure the carburetor to the intake manifold with the two nuts and lock washers.

(2) Connect the fuel line from the fuel pump to the carburetor.

(3) Connect the carburetor-to-governor linkage to the carburetor throttle control.

(4) Connect the manual throttle cable to the carburetor throttle control.

(5) Connect the automatic choke rod to the carburetor. Connect the manual choke cable to the carburetor choke lever.

d. Fuel Filter.

(1) Secure the fuel filter (15, fig. 3) to the mounting bracket with the two bolts and lock washers.

(2) Connect the fuel line from the filter to the fuel pump and the fuel line from the fuel inlet connection to the fuel filter.

(3) Be sure the drain cock is closed.

e. Oil-pressure Cutoff Switch and Oil-pressure Transmitter.

(1) Screw the switch (7, fig. 2) and transmitter (8) into the cross fitting.

(2) Connect the electrical leads as shown in figure 61.

f. Muffler.

(1) Place the muffler assembly (25, fig. 2) in position on the unit.

(2) Secure the muffler with the clamp located on the lower frame.

(3) Position a new gasket (3, fig. 42) between the exhaust pipe adapter and the exhaust and intake manifold. Then secure the muffler assembly to the manifold with the two nuts.

g. Oil Filter.

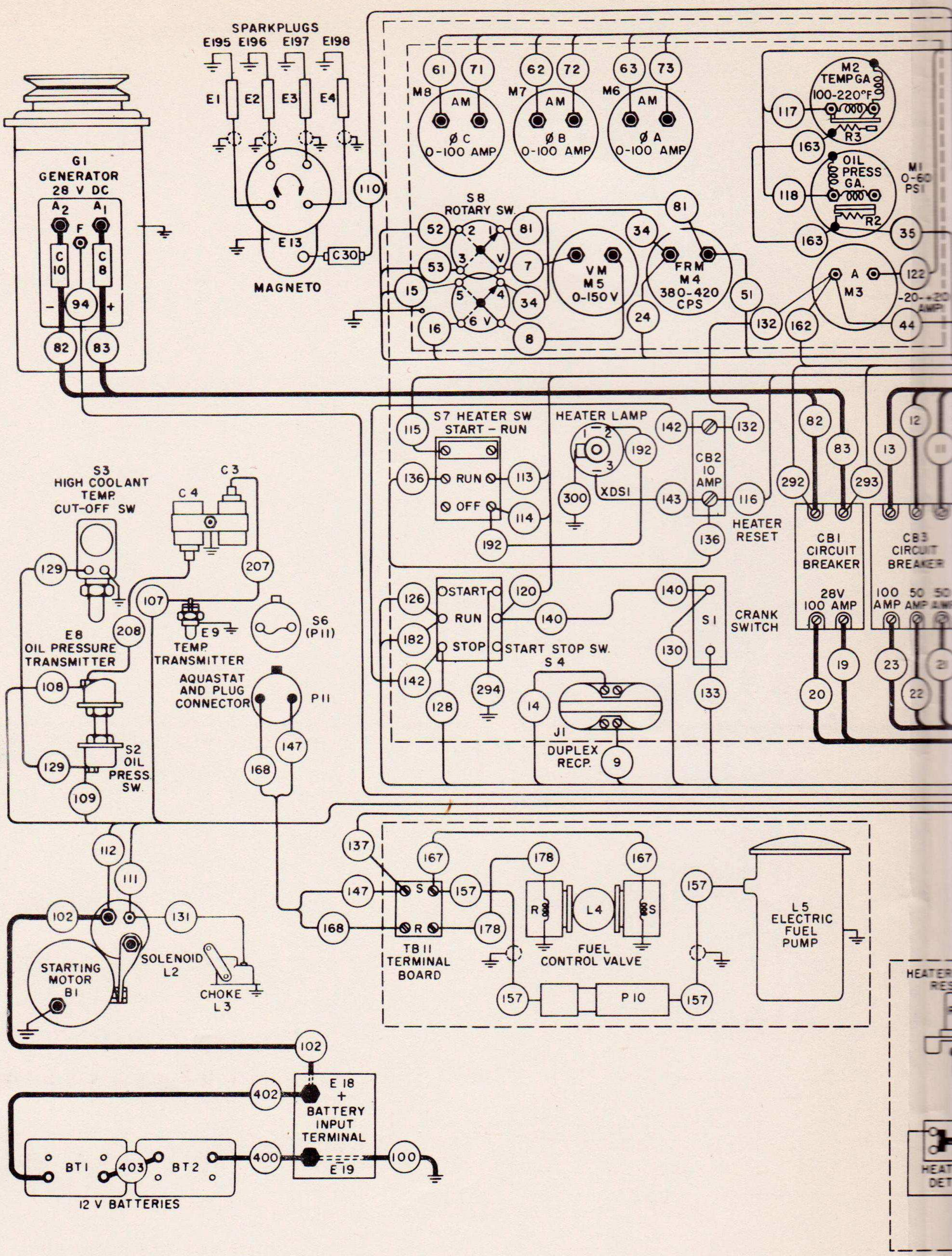
(1) Secure the oil filter (9, fig. 2) to the bracket on the engine with the two bolts and lock washers.

(2) Connect the oil lines and hose fittings to the oil filter.

h. High Coolant Temperature Cutoff Switch.

(1) Screw the switch (3) into the coolant outlet neck.

(2) Connect the electrical leads as shown in figure 61.


SPARKPLUGS
E195 E196 E197 E198
E1 E2 E3 E4
E13
MAGNETO
110
C30
G1
GENERATOR
28 V DC
A2 A1 F
C 10
C 8
94
82
83
S8
ROTARY SW.
61 71 62 72 63 73
M8 AM ØC 0-100 AMP
M7 AM ØB 0-100 AMP
M6 AM ØA 0-100 AMP
M2
TEMP GA
100-220°F
R3
117
163
OIL
PRESS
GA.
R2
118
M1
0-60
PSI
35
A
M3
122
-20-+20
AMP
44
VM
M5
0-150 V
FRM
M4
380-420
CPS
81
34
7
52
53
15
16
2 1 3 V
5 4 6 V
24
51
132
162
S3
HIGH COOLANT
TEMP.
CUT-OFF SW
C 4
C 3
129
207
107
208
E8
OIL PRESSURE
TRANSMITTER
E9
TEMP
TRANSMITTER
S6
(P11)
AQUASTAT
AND PLUG
CONNECTOR
P11
147
168
108
S2
OIL
PRESS.
SW.
109
112
111
102
131
STARTING
MOTOR
B1
SOLENOID
L2
CHOKE
L3
115
S7 HEATER SW
START – RUN
136
RUN
OFF
113
114
192
HEATER LAMP
1 2 3
300
XDSI
142
132
143
CB2
10
AMP
116
136
HEATER
RESET
82
83
292
293
CB1
CIRCUIT
BREAKER
28V
100 AMP
19
20
12
13
23
22
126
182
142
START
RUN
STOP
120
140
294
128
START STOP SW.
S 4
14
J1
DUPLEX
RECP.
9
140
130
S1
133
CRANK
SWITCH
137
147
168
167
178
157
S
R
TB 11
TERMINAL
BOARD
R
L4
S
FUEL
CONTROL VALVE
L5
ELECTRIC
FUEL
PUMP
P 10
402
E 18
+
BATTERY
INPUT
TERMINAL
E 19
400
100
BT1
403
BT2
12 V BATTERIES

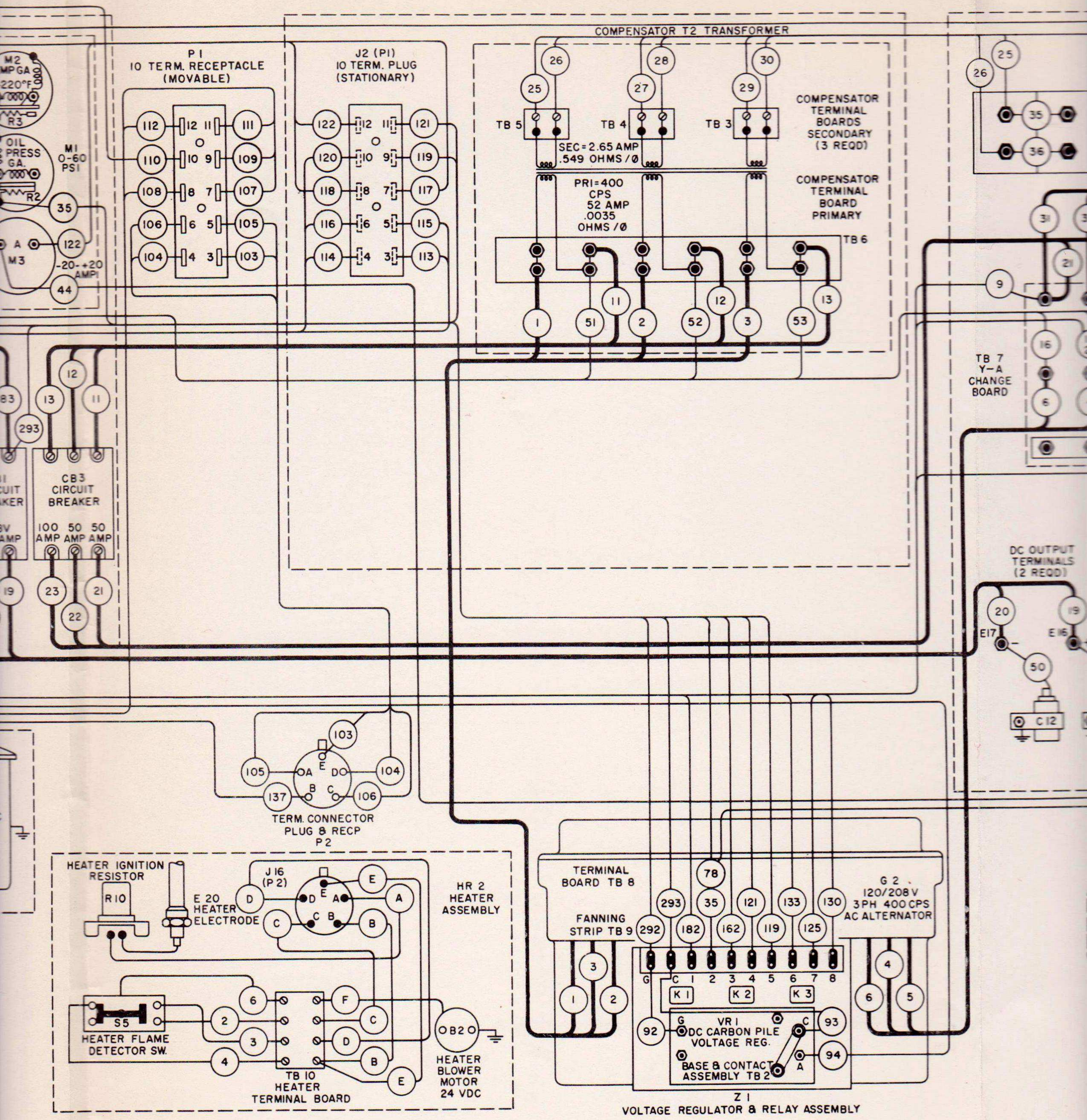
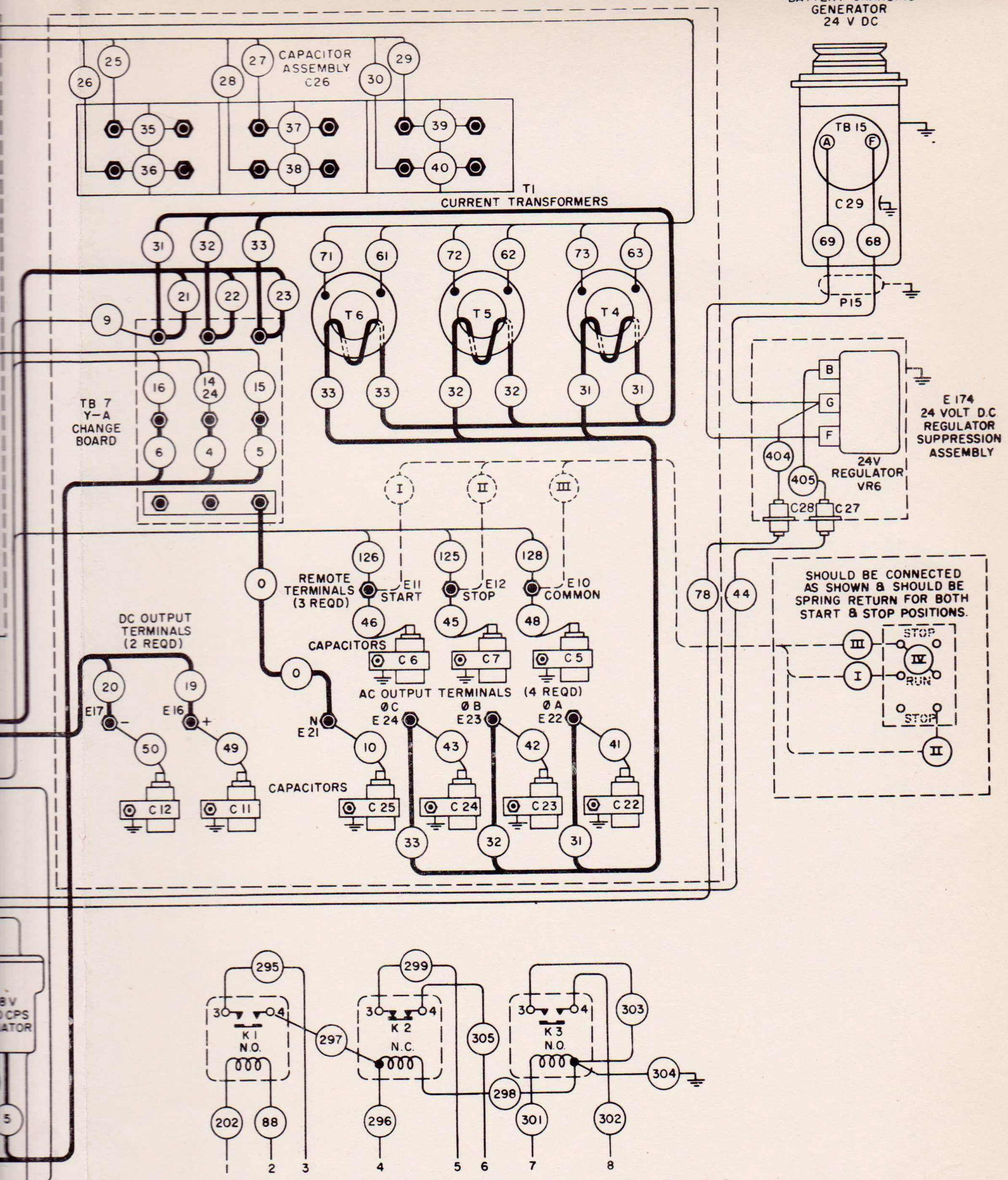
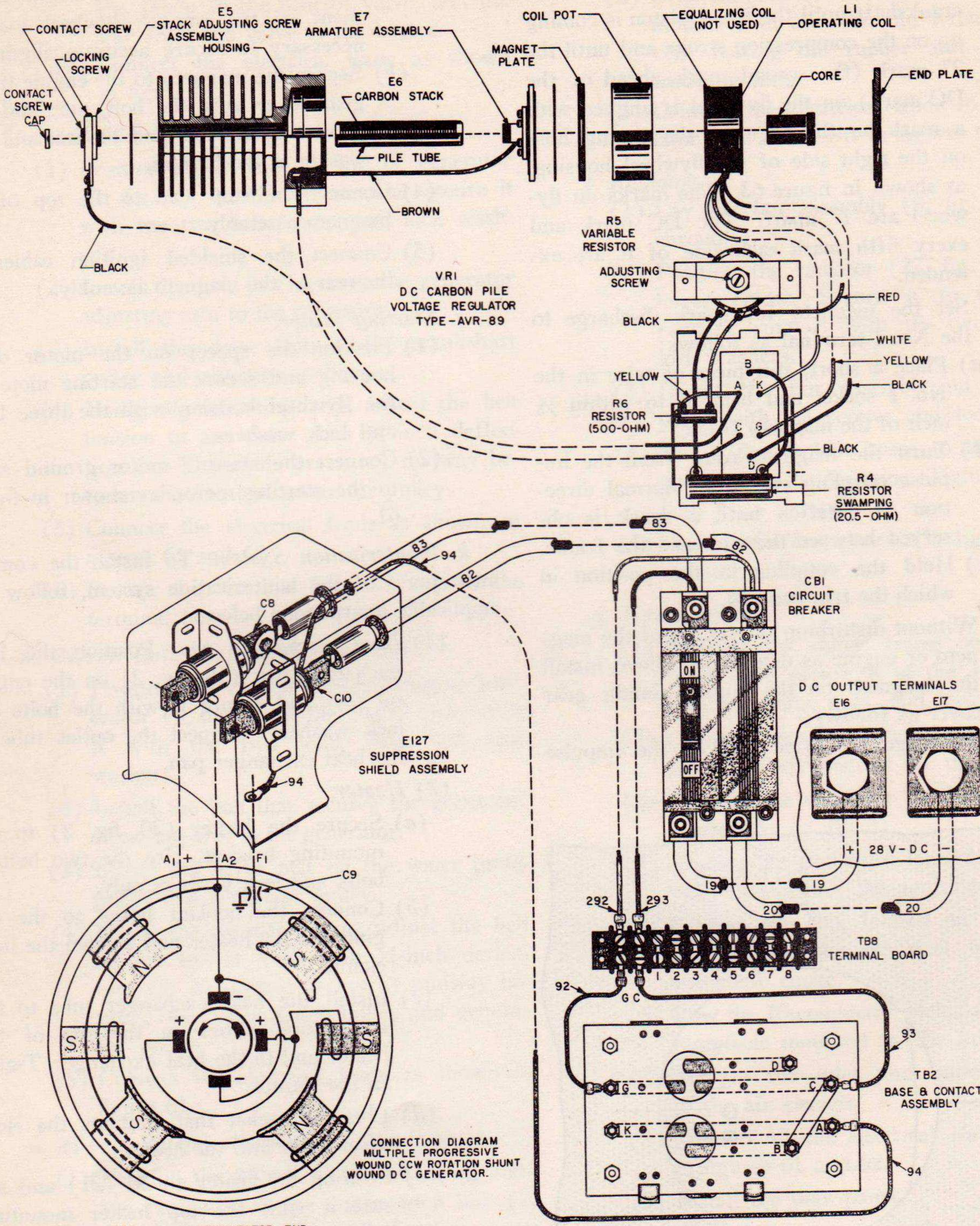


Figure 61. Pictorial wiring diagram.



NUMBERS SHOWN REFER TO RESPECTIVE TERMINALS ON TERMINAL BOARD TB 8



TM 919A-61

Figure 62. Dc system breakdown.

i. Magneto.

(1) Remove the No. 1 spark plug. Rotate the crankshaft until the No. 1 piston is coming up on the compression stroke and until the 2° mark (the second mark ahead of the DC mark) on the flywheel is aligned with a mark on the edge of the timing hole on the right side of the flywheel housing, as shown in figure 63. The marks on flywheel are 1° apart. The DC mark and every fifth mark each side of it are extended.

(2) Set the magneto for spark discharge to the No. 1 terminal as follows:

(*a*) Place a short, stiff piece of wire in the No. 1 socket and bend it to within 1/8 inch of the magneto frame.

(*b*) Turn the magneto rotor from the impulse coupling end in its normal direction of rotation until a spark is observed between the wire and the frame.

(*c*) Hold the coupling in the position in which the trip ocurred.

(3) Without disturbing the setting of the magneto or engine as determined above, install the magneto on the engine timing gear cover as follows:

(*a*) Engage the drive lugs of the impulse coupling with the driving slots in the governor drive gear. A slight movement of the engine flywheel may be necessary to secure accurate alignment.

(*b*) Secure the magneto to the engine timing gear cover with the bolt, nut, and lock washer at the top, and the nut and lock washer at the bottom.

(4) Connect the stop lead to the top of the magneto assembly.

(5) Connect the shielded ignition cables to the rear of the magneto assembly.

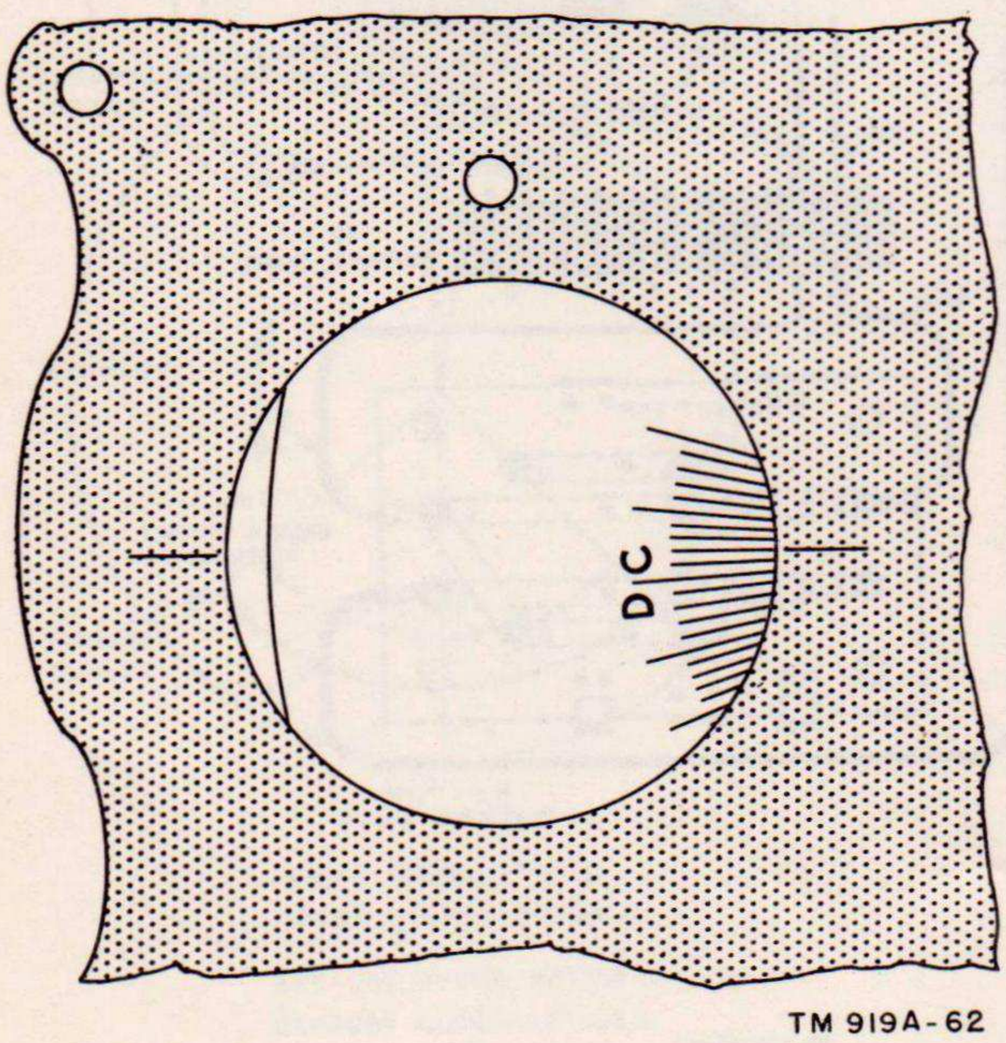


Figure 63. Flywheel timing marks.

j. Starting Motor.

(1) Position the spacer on the motor drive housing and secure the starting motor to the flywheel housing with the three bolts and lock washers.

(2) Connect the starting motor ground strap to the starting motor as shown in figure 61.

k. Winterization System. To install the component parts of the winterization system, follow the applicable instructions below:

(1) *Heat exchanger pan.* Position the heat exchanger pan (18, fig. 2) on the engine oil pan and secure it with the bolts and lock washers. Connect the outlet tube to the heat exchanger pan.

(2) *Heater.*

(*a*) Secure the heater (20, fig. 2) to the mounting bracket. Use the two bottom bolts and lock washers only.

(*b*) Connect the coolant hoses to the engine and the heater and tighten the hose clamps.

(*c*) Install the heat exchanger tube to the combustion outlet on the top of the heater and to the heat exchanger. Tighten the clamps.

(*d*) Plug the socket that contains the electrical leads into the heater.

(*e*) Position the heater shield (21) and secure it with the top heater mounting bolts and lock washers.

(3) *Fuel pump and fuel control valve.*

(*a*) Secure the fuel pump (15, fig. 2) in the heater control box with the two bolts, nuts, and lock washers. Mount the heater fuel control valve (16) with the four bolts and lock washers.

(*b*) Connect the fuel line from the fuel filter to the fuel pump, the line from the pump to the control valve, and the line from the valve to the heater.

(*c*) Connect the electrical leads as shown in figure 61.

l. 28-volt, 2.5-kw Dc Generator.

(1) Position the 28-volt, 2.5-kw, dc generator (1, fig. 2) on the engine and secure it with the two bolts, nuts, and lock washers.

(2) Install the bolt that secures the generator adjusting arm to the generator.

(3) Install the drive belt on the crankshaft pulley and generator pulley.

(4) Using the adjusting arm, adjust the belt tension to not more than ¾-inch deflection (at 20 pounds pressure) midway between the fan and generator pulley.

(5) Connect the electrical leads as shown in figures 61 and 62.

(6) Secure the terminal insulator cap to the terminal board.

m. 24-volt Battery-charging Generator.

(1) Position the 24-volt battery-charging generator (5, fig. 3) on the engine and secure it with the two bolts, nuts, and lock washers.

(2) Install the bolt that secures the generator adjusting arm to the generator.

(3) Install the drive belt on the water pump pulley and generator pulley.

(4) Using the adjusting arm, adjust the belt tension to not more than ¾-inch deflection (at 20 pounds pressure) midway between the water pump pulley and generator pulley.

(5) Connect the electrical leads as shown in figure 61.

n. 24-volt Battery-charging Voltage Regulator.

(1) Position the 24-volt battery-charging voltage regulator in the suppression box (2, fig. 3) and secure it with the three nuts.

(2) Connect the electrical leads to the voltage regulator as shown in figure 61.

(3) Install the cover on the suppression box.

o. 28-volt, 2.5-kw Dc Voltage Regulator.

(1) Position the regulator (3, fig. 4) and base on the mounting bracket secured to the alternator.

(2) Grip the bottom of the rubber vibration mounts with an open-end wrench to prevent tearing the rubber and secure the attaching nuts.

(3) Connect the electrical leads to the regulator base as shown in figures 61 and 62.

p. Radiator.

(1) Lay the fan assembly (8, fig. 3) in fan shroud.

(2) Position the radiator (27, fig. 2) on the lower frame. Secure it to the bottom radiator support with the two nuts and lock washers.

(3) Install the fan assembly on the water pump with the screws and lock washers.

(4) Install the coolant hoses to the radiator, water pump, and engine. Tighten the radiator hose clamps.

(5) Secure the fan guard (7, fig. 3) to the radiator.

q. Upper Frame.

(1) Position the upper frame on the lower frame and secure it at the four corners with the bolts, nuts, and lock washers.

(2) Connect the two ground straps to the right and left sides of the upper frame.

(3) Connect the capacitor to the oil pressure transmitter (8, fig. 2).

(4) Replace the two clips, located on the firewall, that secure the ignition cables.

(5) Replace the clip, located on the firewall, that secures the electrical lead for the automatic choke.

(6) Plug the 10-conductor socket (10) into the receptacle mounted on the firewall.

(7) Replace the inlet and outlet duct hose to the air cleaner.

(8) Connect all the electrical leads as shown in figures 61 and 62.

(9) Install the rear panel.

r. Air Cleaner.

(1) Secure the air cleaner (6, fig. 2) to the mounting brackets on the upper frame with the four bolts, nuts, and lock washers.

(2) Connect all hoses to the air cleaner.

Section V. ADJUSTMENTS AND FINAL TESTING

64. Adjustments Before Final Testing

Before final testing of the unit after overhaul, certain adjustments must be made to insure efficient operation. Make these adjustments as instructed below.

a. Ignition Timing. If the ignition has not been timed, refer to paragraph 63*i* and proceed as instructed.

b. Valve Timing. With the valves timed as instructed in paragraph 61*d*(4), check the timing as follows. Carefully adjust the inlet valve tappet for No. 1 cylinder to .018 inch. Rotate the crankshaft clockwise until the piston in the No. 1 cylinder is ready for the intake stroke. The intake opens 2° before top dead center as shown in figure 64. The 2° mark is the second mark ahead of the DC mark. With the crankshaft in this position, timing is correct if the tappet is just tight against the valve stem. Readjust the tappet to the running clearance of .014 inch.

c. Valve Tappets. Check the valve tappet clearance with a feeler gage (fig. 65). Both the intake and exhaust tappet clearance must be .014 inch with the engine hot.

d. Engine Speed Governor. Refer to paragraph 25*b* and adjust the engine speed governor as instructed.

e. Carburetor.

(1) *Idling mixture adjustment.* When adjusting the idle jet (always with the engine hot), it should be set on the rich side of the highest vacuum. Attach a vacuum gage to the manifold (par. 48) and screw the idle-adjusting needle in or out until the highest point of vacuum is reached. Then back out the needle until the vacuum starts to recede from the highest point.

(2) *Choke valve adjustment.* Place a .085-inch diameter pin through the hole in the engine side of the automatic choke shaft. Loosen the screw that secures the choke lever to the shaft. Hold a ¼-inch diameter dowel or rod between the carburetor choke valve and the front of the carburetor. Adjust the lever on the automatic choke until the choke valve in the carburetor is tight against the dowel. Tighten the screw that secures the choke lever. Remove dowel from the carburetor and pin from the hole in the choke shaft.

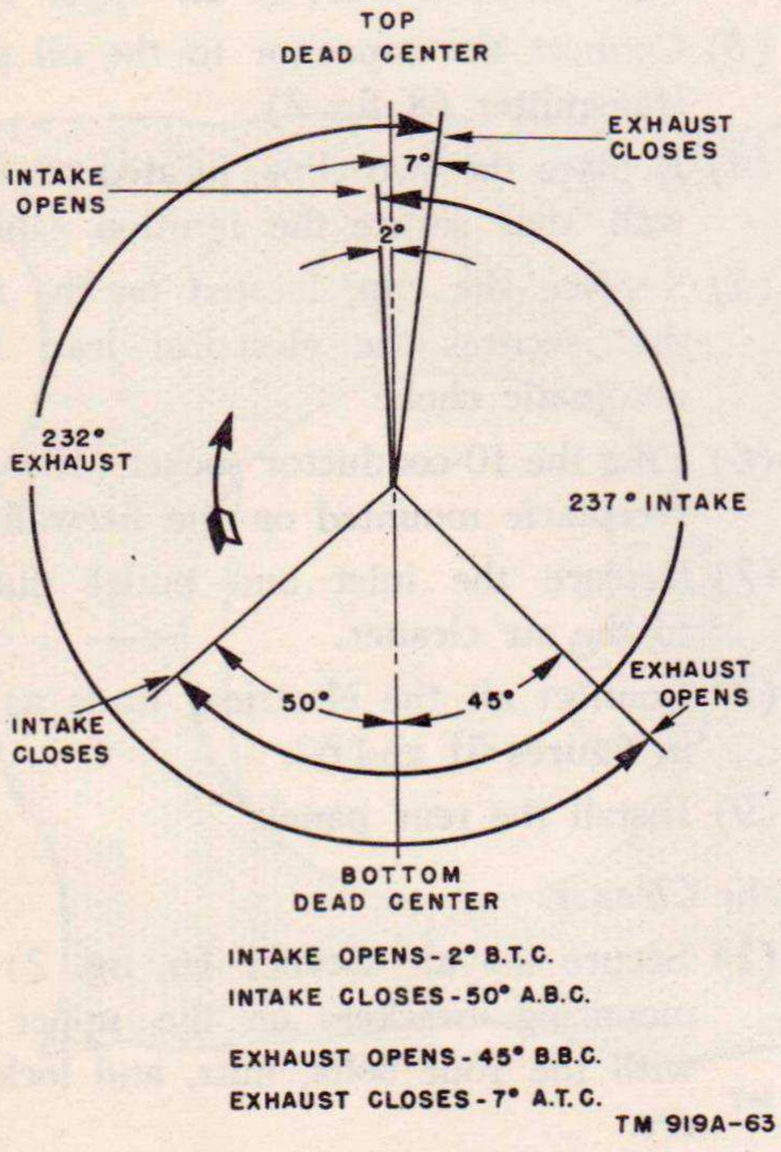


Figure 64. Valve timing.

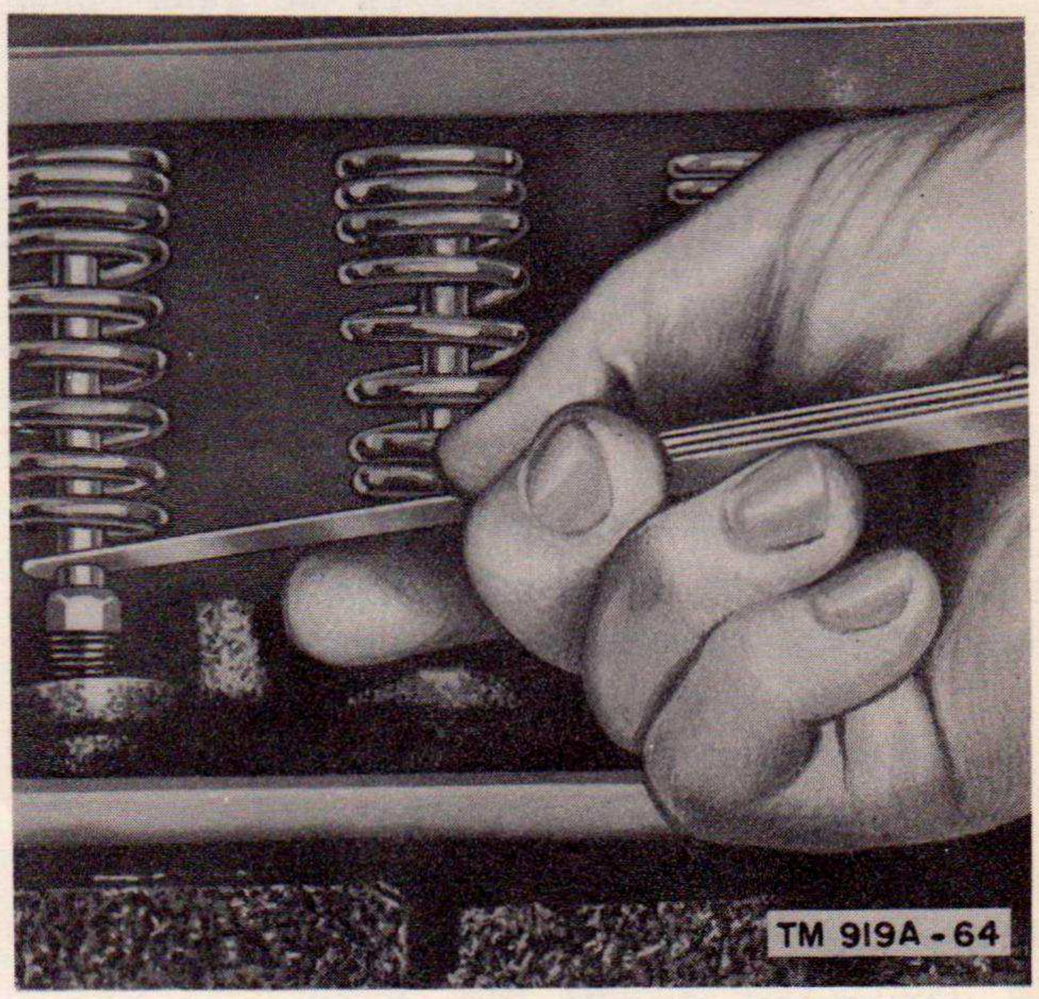


Figure 65. Checking valve tappet clearance.

f. Winterization System.

(1) *Fuel control valve.* Disconnect the fuel line at the heater and place a glass container graduated in cubic centimeters under the line. Start the heater and, with a stop watch, time the flow of fuel. Fill the glass container for approximately 2 or 3 minutes and measure the average fuel flow for 1 minute. Fuel flow should average 7 centimeters per minute with the heater operating on *low fire* and between 16 and 17 centimeters per minute with the heater operating on *high fire*. The adjustment screw, located on the dome in the center of the valve, controls the flow of fuel for both the high and low fire. It is, therefore, necessary to find the best median for both high and low rating.

(2) *Flame switch.* To adjust the flame switch, back the flame switch adjusting screw *out* until a click is heard. Then turn the adjusting screw *in* until a click is heard again. Turn the screw ¾ of a turn beyond this point.

g. 28-volt, 2.5-kw Dc Voltage Regulator.

(1) Check the regulator to make sure that the flush position of the core and pole piece is marked on the end plate and core with matching point marks.

(2) Turn the adjustment on the resistor to the middle of its range.

(3) Mount the regulator on the regulator base and connect the base as shown in the test wiring diagram (fig. 66).

(4) Start the unit and increase the speed to 1,500 rpm. Remove the end cover and turn the pile adjusting screw out (counterclockwise) until the voltage is 5 volts or less. Be sure the lock nut is drawn up snug on the pile adjusting screw.

(5) Increase the generator speed to 4,550 rpm and with no load turn the adjusting screw in (clockwise). The voltage should begin to rise. Continue to turn the adjusting screw in until the voltage reaches a peak and begins to decrease. Turn the screw until the lowest point is reached.

(6) At the lowest point the unit begins to function as a regulator and the adjustment is approximately correct.

(7) Adjust the voltage to 28.0 volts by turning the core *in* to decrease voltage or *out* to increase voltage.

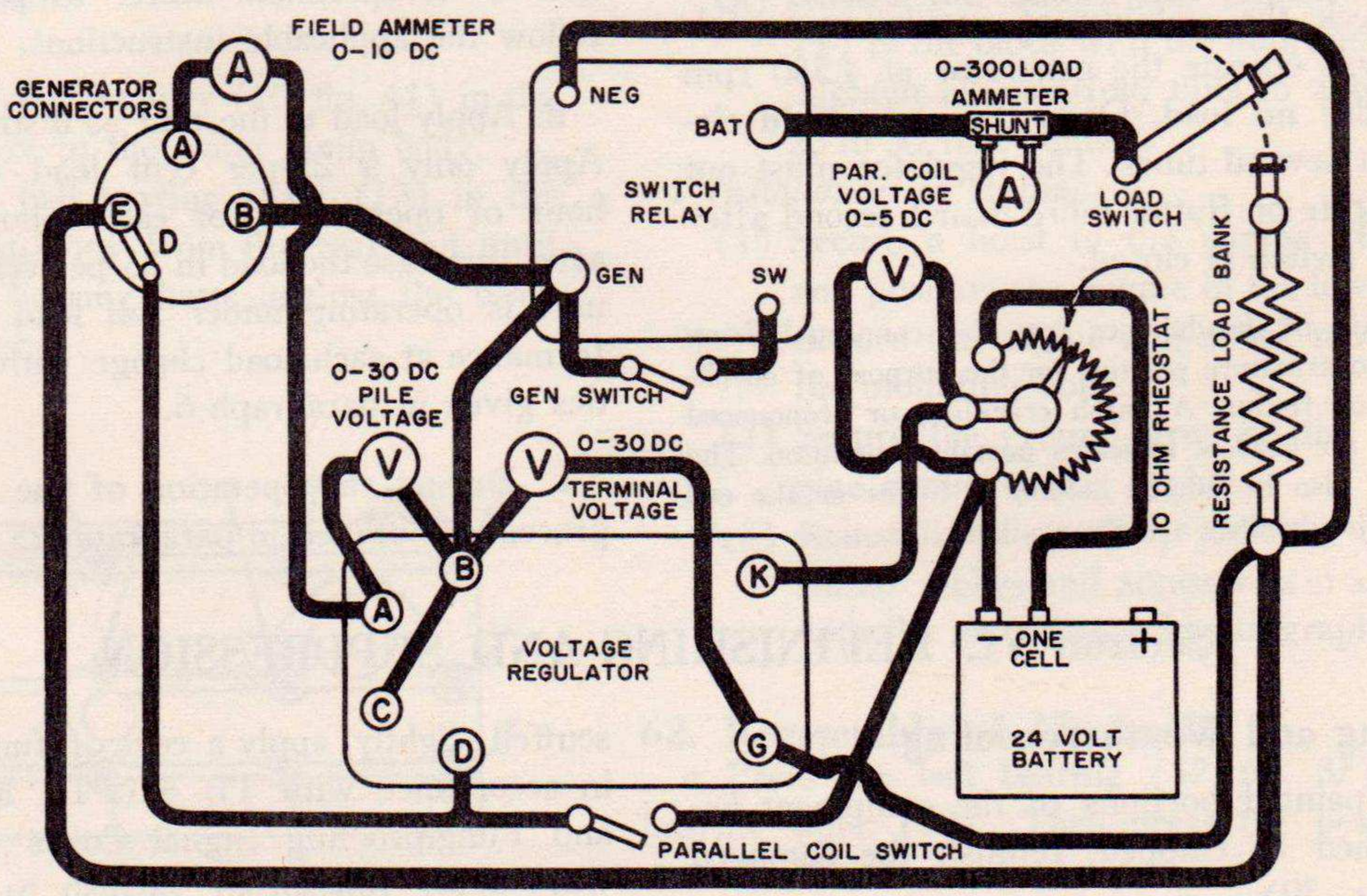


Figure 66. Voltage regulator test wiring diagram.

(8) Operate the regulator for approximately 30 minutes at no load with the generator running at a speed where the stack voltage equals one-half of the terminal voltage.

(9) Apply approximately 50 per cent of the generator output with the generator operating at 4,550 rpm. Note the change in voltage as the load is thrown on. The voltage should decrease not more than .1 volt. Turn the adjusting screw in or out (only a small fraction of a turn at a time), applying and removing load after each change, until the .1-volt (maximum) decrease with load is obtained.

(10) Again adjust the voltage to 28 volts by turning the core in or out. The generator should be operating without load for this adjustment.

Note. During the foregoing adjustment steps, the voltage resistor should not have been moved from the middle of its range. This is necessary to obtain the proper operating range of the regulator.

(11) Recheck the adjustment as follows: operate the generator at 4,550 rpm, no load with the resistor adjusted, to give terminal voltage of 28 volts. Apply 75-per cent load to the generator in 25-per cent steps. The maximum decrease in terminal voltage for 75-per cent load is .2 volt.

(12) Check the stability of regulation as follows: operate the generator at 4,550 rpm under no load. Open the shunt field circuit several times. The regulator must not vibrate or flutter more than 1 second after the switch is closed.

Note. A pair of headphones may be connected from field positive to armature positive for the purpose of checking vibration or flutter. A harsh crackling or pronounced hum heard in the headset indicates unstable operation. The vibration may also be felt by holding a finger on the end of the core if headphones are not available.

(13) Check the range of the regulator by operating the generator at no load (4,550 rpm). Rotate the resistor from one end of its range to the other. The terminal voltage should vary from 26 to 30 volts. The core may be turned in or out slightly to obtain the exact range.

(14) Check the minimum resistance of the regulator as follows: operate the generator at 4,550 rpm with a terminal voltage of 28 volts. Apply full load to the generator. Decrease the generator speed until the regulated voltage is 26.5 volts, plus or minus .1 volt. Read the stack voltage and the shunt field current. Calculate the ohms resistance. Resistance should be .7 ohm or less. After checking the minimum resistance readjust the resistor to obtain 28 volts at the regulator while at operating temperature.

65. Testing and Inspection after Overhaul

a. Before starting the unit, refer to paragraph 21 and complete the preliminary procedure as instructed.

b. Start the unit as instructed (par. 22).

c. Certain precautions must be taken after the unit is in operation. Refer to paragraph 23 and follow the applicable instructions.

d. Apply load to the unit as instructed (par. 24). Apply only a 25-per cent load during the first hour of operation. For each 1-hour period thereafter, increase the load in 25-per cent steps until the unit is operating under full load. Check the performance at each load change with the characteristics given in paragraph 6.

e. During the operation of the unit, follow the procedure outlined in paragraph 25.

Section VI. REFINISHING AND SUPPRESSION

66. Painting and Weatherproofing

a. When painted portions of the equipment become scratched or chipped, refinish the damaged surfaces (par. 39).

b. If the windings in the stator, compensator transformer, and current transformer have been scuffed slightly, apply a coat of fungiproof varnish in accordance with TB SIG 13, Moistureproofing and Fungiproofing Signal Corps Equipment. Always apply fungiproof varnish to newly soldered connections and to any bare copper wire which has been installed. No other part of the equipment need be treated.

67. Rf Suppression Equipment

Gasoline Engine Generator Set PU-107A/U is equipped to suppress rf interference with nearby radio and radar equipment. The unit is suppressed with shielding, bonding straps, capacitors, resistor-suppressors, and bonds made by external-internal-toothed lock washers. Examine the suppression equipment periodically in accordance with the instructions in paragraph 48. Whenever the unit has been overhauled, make sure that all suppression components have been installed correctly. The suppression equipment is designed to suppress rf interference only when the unit is in satisfactory condition. If the unit is operating abnormally, the suppression equipment may not control the radio frequencies produced. It is therefore essential that the unit be checked thoroughly before assuming that the fault lies with the suppression equipment. All suppression equipment is described and located in subparagraphs *a* through *p* below (fig. 67).

a. Magneto Assembly. The magneto wire (switch) is shielded and shielding is bonded to the frame. A standard automotive type capacitor is incorporated in the magneto circuit. A .32-uf, 20-ampere, 400-volt dc feedthrough-type capacitor is installed in the magneto housing and is connected to the primary lead. The magneto case is bonded to oil pan with a ground strap and ⅜-inch external-toothed lock washers.

b. Spark Plugs. The spark plugs are integrally shielded and suppressed (10,000 ohms each). The high-tension cables are shielded with metallic hose.

c. Ac Output Terminals. Four CA-472 capacitors (.01 uf each) are secured to the ac output terminals and are bonded to the frame with two ¼-inch external-internal-toothed lock washers each.

d. Remote Control Terminals. Three CA-442 capacitors (.1 uf each) are secured to the remote control terminals and are bonded to the frame with two ¼-inch external-internal-toothed lock washers each.

e. Dc Output Terminals. Two CA-442 capacitors (.1 uf each) are secured to the dc output terminals and are bonded to the frame with two ¼-inch external-internal-toothed lock washers each.

f. 28-volt, 2.5-kw, Dc generator. The 28-volt, 2.5-kw, dc generator is suppressed as follows. A ground strap bonds the generator to the generator mounting bracket with two ⅜-inch and two ½-inch external-internal-toothed lock washers. The mounting bracket is bonded to the engine block with a ⅜-inch external-internal-toothed lock washer. Two CA-491 capacitors (.01 uf each), in series with the plus and minus output terminals, are mounted in the capacitor suppression shield assembly with two ¼-inch and two No. 10 external-toothed lock washers each.

g. 24-volt Battery-charging Generator. The 24-volt battery-charging generator is bonded to the mounting bracket with four ⅜-inch external-internal-toothed lock washers, and the generator adjusting arm is bonded to the generator and the timing gear cover with three ⅜-inch external-internal-toothed lock washers. A capacitor is installed between the terminal shield and top of generator frame.

h. Heater Fuel Pump. The heater fuel pump contains a shielded lead and incorporates a feedthrough capacitor (.25 uf) sealed in the lead connector. The fuel pump is bonded to the heater fuel control box with two ¼-inch external-internal-toothed lock washers. The lead mounting clip is bonded to the box with three No. 10 external-internal-toothed lock washers. The ground clips are used to bond the box to the frame.

i. Heater. The heater is bonded to the heater mounting bracket with four ⅜-inch external-internal-toothed lock washers.

j. Engine. The front of the engine block is bonded to the front engine mount with a ground strap with two ⅜-inch external-internal-toothed lock washers and one ¼-inch ground clip. The rear engine mounts are bonded to the upper frame with two ground straps (left and right side) with two ¼-inch ground clips each.

k. Oil Pressure Transmitter. The oil pressure transmitter is suppressed by a CA-442 capacitor (.1 uf) bonded to the firewall with two ¼-inch external-internal-toothed lock washers.

l. Coolant Temperature Transmitter. The coolant temperature transmitter is suppressed by a CA-442 capacitor (.1 uf) bonded to the engine block with two ¼-inch external-internal-toothed lock washers.

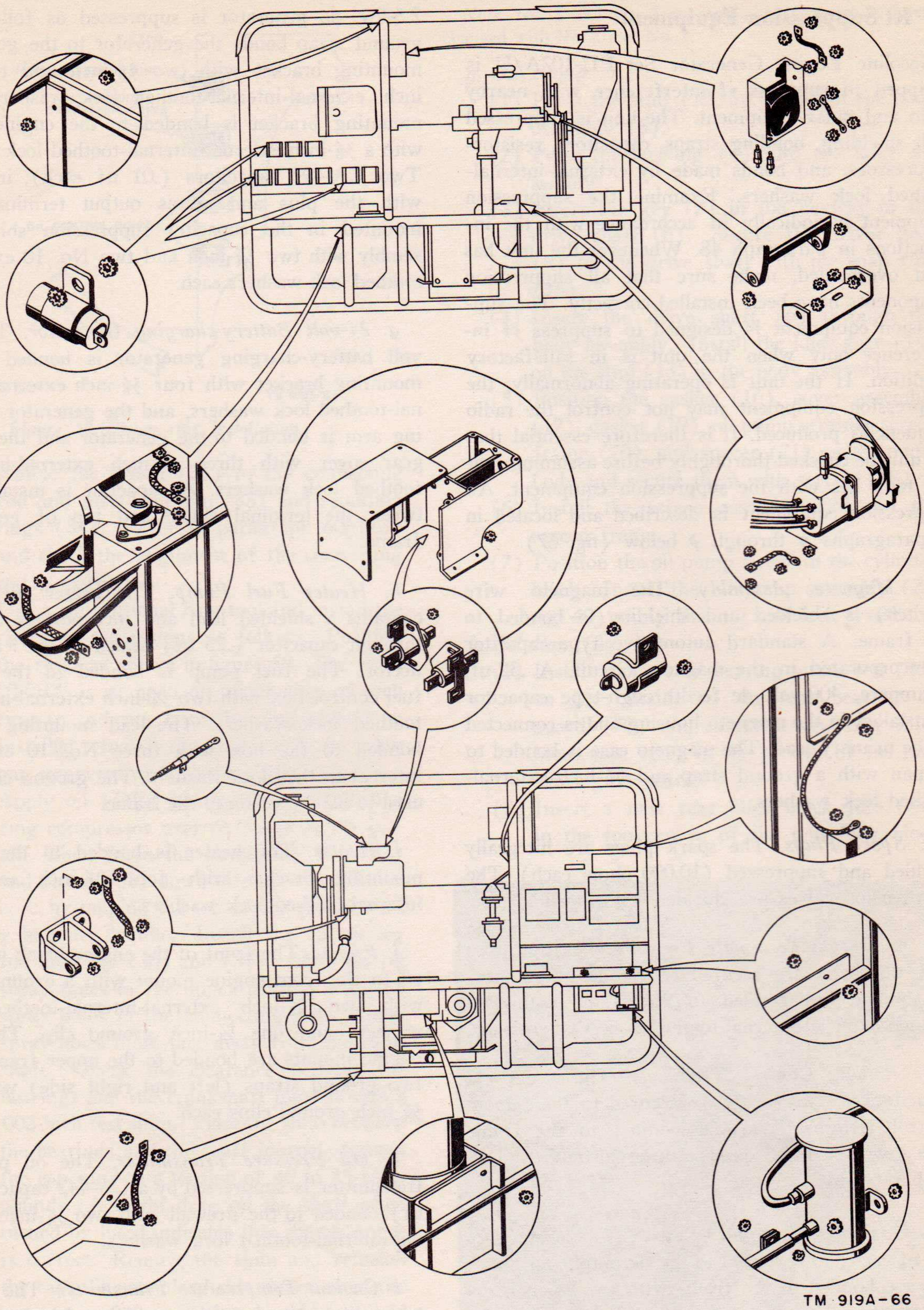


Figure 67. Rf suppression details.

m. Alternator. The alternator is bonded to the rear engine mounts with two ground straps (left and right side) with two 5/16-inch and two ⅜-inch external-internal-toothed lock washers each.

n. 24-volt Battery-charging Generator Regulator. The 24-volt battery-charging generator regulator is mounted in a special regulator housing attached to the firewall. The generator and armature field leads are shielded, and the regulator is bonded to the housing with three ¼-inch external-internal-toothed lockwashers. Two 1.75 uf, 20-ampere, 100-volt dc feedthrough-type capacitors are inserted in the battery and armature leads. Two ground straps bond the regulator housing to the firewall, with two ¼-inch external-internal-toothed lock washers.

o. Instrument Panel. The instrument panel is bonded to the control panel with one ground strap with four No. 10 external-internal-toothed lock washers.

p. Firewall. The firewall is bonded to the frame with 12 No. 10 and four ¼-inch external-internal-toothed lock washers.

OPERATOR FIRST ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

POWER UNITS, REEL UNITS *(Engine-Driven)*
(SR 750-405-10)

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE	EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; (X) Defect corrected
NOTE: Strike out items not applicable.

DAILY

NO.	ITEM	CONDITION						
		S	M	T	W	T	F	S
1	BEFORE OPERATION INSPECT FOR TAMPERING AND/OR DAMAGE. **PAR. 11 b**							
2	INSPECT FOR COMPLETENESS AND GENERAL CONDITION. INCLUDE TOOLS AND ACCESSORIES. **PAR. 11 b**							
3	FUEL AND LUBRICATING SYSTEMS - INSPECT FOR LEAKS. **PAR. 48, ITEMS 13,14,21,22,23 AND 25**							
4	EXHAUST SYSTEM; GASKETED JOINTS - INSPECT FOR LEAKS. **PAR. 48, ITEM 10**							
5	COOLING SYSTEM - INSPECT FOR LEAKS, CLEANLINESS, AND GENERAL CONDITION. **PAR. 48, ITEMS 15,16**							
6	CLEAN EXTERIOR OF EQUIPMENT. **PAR. 21**							
7	FUEL FILTER - CHECK SEDIMENT BOWL FOR FOREIGN MATTER. **PAR. 38 b(4)**							
8	AIR CLEANER; BREATHER - INSPECT FOR GENERAL CONDITION AND CLEANLINESS. **PAR. 38 b(2)**							
9	SPARK PLUGS ***(small units only)*** - REMOVE, INSPECT, AND CLEAN.							
10	LUBRICATION - LUBRICATE IN ACCORDANCE WITH LUBRICATION ORDER. **PAR. 38**							
11	FUEL; OIL; WATER - REPLENISH AS NEEDED. ADD ANTIFREEZE IN LOW TEMPERATURES. **PAR. 21**							
12	DURING OPERATION BE ALERT FOR UNUSUAL NOISE, VIBRATION, EXHAUST SMOKE, HEATING, MISFIRING, AND FAULTY OPERATION.							
13	AFTER OPERATION REPEAT BEFORE-OPERATION SERVICES. LEAVE EQUIPMENT READY TO OPERATE. **PAR. 43 d**							
14	RECORD DAILY HOURS OF OPERATION.							

WEEKLY

NO.	ITEM	CONDITION	NO.	ITEM	CONDITION
15	BATTERY - INSPECT CONNECTIONS, LOOK FOR CORRODED POSTS, CRACKED CASES. TEST ELECTROLYTE. ADD WATER. **PAR. 48, ITEM 27**		23	MAIN GENERATOR - INSPECT COMMUTATOR, SLIP RINGS, AND BRUSHES. **PAR. 48, ITEM 33 AND 34**	
16	WIRING - INSPECT EXPOSED WIRING FOR CUTS, CRACKS, FRAYING, LOOSE TERMINALS, LOOSE OR DIRTY CONNECTIONS. **PAR. 48, ITEM 30**		24	METERS; GAGES - INSPECT CONDITION, MOUNTING CONNECTIONS. CHECK FOR CORRECT INDICATION. **PAR. 48, ITEMS 44 AND 45**	
17	AIR CLEANER - INSPECT FOR DIRT OBSTRUCTIONS. IN OIL-BATH TYPE, CHECK OIL LEVEL AND CONDITION. SERVICE BREATHER. **PAR. 38 b(2)**		25	LUBRICATION - LUBRICATE IN ACCORDANCE WITH LUBE ORDER. **PAR. 38**	
18	FUEL TANK; CAP - INSPECT TANK FOR LEAKS, SECURITY. BLOW THROUGH CAP VENT. INSPECT CAP GASKET.		26	FINISH - INSPECT PAINTED SURFACES. REMOVE RUST. TOUCH UP PAINTED SURFACES. **PAR. 48, ITEM 6**	
19	COUPLINGS; ALIGNMENT - CHECK COUPLINGS AND ALIGNMENT OF COMPONENTS.		27	FUEL; LUBRICANT; COOLANT - INSPECT FOR CONTAMINATION. REPLENISH. **PAR. 21**	
20	TIGHTEN ALL LOOSE NUTS, BOLTS, SCREWS, AND OTHER FASTENINGS. **PAR. 21 I**		28	TEST - OPERATE EQUIPMENT AND OBSERVE OPERATION OF AUTOMATIC CONTROLS, GOVERNOR, SWITCHES, GAGES. **PAR. 48, ITEMS 57 & 58**	
21	BELTS - INSPECT CONDITION, TENSION, ALIGNMENT. **PAR. 48, ITEM 17**		29	ADJUST; REPAIR - MAKE ADJUSTMENTS AND REPAIRS AS AUTHORIZED.	
22	CARBURETOR - INSPECT MOUNTING AND LINKAGE. CHECK FOR LEAKS. CLEAN EXTERIOR. **PAR. 48, ITEM 22**		30	RECORD TOTAL HOURS OPERATED DURING PERIOD COVERED BY THIS REPORT.	

31 IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.

DA FORM 1 JAN 53 11-260 REPLACES DA AGO FORM 11-260, 1 MAY 51, WHICH MAY BE USED

TM 919A-67

Figure 68. DA Form 11-260.

SECOND AND THIRD ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

POWER UNITS, REEL UNITS *(Engine-Driven)*

INSTRUCTIONS: *See other side*

EQUIPMENT NOMENCLATURE	EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; (X) Defect corrected.
NOTE: Strike out items not applicable.

NO.	ITEM	CONDITION	NO.	ITEM	CONDITION
(1)	INSPECT FOR TAMPERING AND/OR DAMAGE. PAR. 11 b		(15)	SPARK PLUGS - REMOVE AND INSPECT FOR CRACKED, CHIPPED, OR BURNED INSULATORS, EXCESSIVE DEPOSITS AND BURNED ELECTRODES. PAR. 48, ITEM 26	
(2)	INSPECT FOR COMPLETENESS AND GENERAL CONDITION. INCLUDE TOOLS AND ACCESSORIES. PAR. 11 b		(16)	SUPPRESSION - INSPECT SUPPRESSION COMPONENTS FOR CONDITION AND GOOD CONTACT. PAR. 48, ITEM 47	
(3)	COOLING; LUBRICATING; AND FUEL SYSTEMS - INSPECT FOR LEAKS. PAR. 48, ITEMS 15,16,21,23 AND 25		(17)	RELAYS; SWITCHES - INSPECT FOR CONTACT PITTING, ALIGNMENT, CORROSION, AND PRESENCE OF DIRT AND MOISTURE. SEE THAT MOUNTINGS AND CONNECTIONS ARE SECURE.	
(4)	EXHAUST SYSTEM; GASKETED JOINTS - CHECK FOR LEAKS, GENERAL CONDITION. PAR. 48, ITEM 10		(18)	STARTING MOTOR - INSPECT COMMUTATOR, BRUSHES, MOUNTING. TEST OPERATION. PAR. 48, ITEM 28	
(5)	COOLING SYSTEM - INSPECT GENERAL CONDITION. CLEAN-FLUSH LIQUID-COOLED SYSTEMS. PAR. 48, ITEM 15		(19)	CHARGING GENERATOR - INSPECT COMMUTATOR, BRUSHES, MOUNTING. TEST OPERATION AND OUTPUT. PAR. 48, ITEM 35	
(6)	CLEAN EXTERIOR OF EQUIPMENT. PAR. 21		(20)	BELTS - INSPECT FOR CONDITION, ADJUSTMENT., ALIGNMENT. CLEAN OFF OIL AND GREASE. PAR. 48, ITEM 17	
(7)	FUEL STRAINER - CLEAN PAR. 38b(4)		(21)	FUEL PUMP - INSPECT MOUNTING. CHECK FOR LEAKS. TEST OPERATION. PAR. 48, ITEM 21	
(8)	GOVERNOR; THROTTLE - INSPECT MOUNTING; CONTROL LINKAGE FOR FREE MOVEMENT, WEAR, AND LUBRICATION. PAR. 48, ITEM 19		(22)	VALVES - INSPECT VALVE MECHANISM FOR BROKEN SPRINGS, STICKING, TAPPET, CLEARANCE. ADJUST TAPPETS. PAR. 48, ITEM 11	
9	FUEL TANK; CAP; GASKET - INSPECT TANK FOR LEAKS AND SECURITY; FILLER CAP CONDITION; GASKET CONDITION.		(23)	COMPRESSION - CRANK ENGINE BY HAND AND OBSERVE COMPRESSION. PAR. 48, ITEM 12	
(10)	AIR CLEANER - DISASSEMBLE AND CLEAN. SERVICE OIL-BATH TYPE IN ACCORDANCE WITH LUBE ORDER. PAR. 38b(2)		24	COUPLINGS AND ALIGNMENT - CHECK SECURITY AND ALIGNMENT OF COUPLINGS. CHECK ALIGNMENT OF DRIVING AND DRIVEN COMPONENTS.	
(11)	CRANKCASE; OIL FILTER - SERVICE CRANKCASE AND OIL FILTER IN ACCORDANCE WITH LUBE ORDER. PAR. 38.		(25)	NUTS; BOLTS; SCREWS - TIGHTEN LOOSE NUTS, BOLTS, SCREWS AND OTHER FASTENINGS. PAR. 21 I	
(12)	BATTERY - TEST ELECTROLYTE AND VOLTAGE. CHECK FOR LEAKS, CORRODED POSTS. LOOSE CONNECTIONS. INSPECT MOUNTING OR HANGER. PAR. 48, ITEM 27		(26)	MAIN GENERATOR; EXCITER - CHECK BRUSHES, COMMUTATOR, SLIP RINGS, BRUSH SPRINGS AND MOUNTINGS. PAR. 48, ITEM 33	
(13)	WIRING - INSPECT EXPOSED WIRING FOR CUTS, FRAYING, CRACKS, AND LOOSE OR BROKEN CONNECTIONS. PAR. 48, ITEM 30		(27)	METERS; GAGES - INSPECT FOR CONDITION, BENT INDICATOR, HANDS, BROKEN GLASS, LOOSE MOUNTING AND CONNECTIONS, CORRECT ZERO ADJUSTMENT. PAR. 48, ITEMS 44 AND 45	
(14)	MAGNETO OR DISTRIBUTOR - CLEAN EXTERIOR. INSPECT, CLEAN OR REPLACE AND ADJUST BREAKER POINTS. PAR. 48, ITEM 29		(28)	FUEL; OIL; COOLANT - REPLENISH.	
	OPERATION TEST				
(29)	STARTING - CRANK ENGINE AND OBSERVE OPERATION OF STARTING MECHANISM. NOTE ANY DIFFICULTY IN STARTING. PAR. 50, ITEM 1		(35)	MODIFICATIONS - SEE THAT REQUIRED MODIFICATIONS HAVE BEEN COMPLETED. CORRECT DIAGRAMS.	
(30)	OPERATION - OPERATE ENGINE AND NOTE ANY TENDENCY TO STALL OR MISFIRE. LISTEN FOR UNUSUAL NOISE. WATCH FOR OVERHEATED PARTS AND EXCESSIVE EXHAUST SMOKE.		(36)	ADJUSTMENTS - MAKE NECESSARY ADJUSTMENTS TO EQUIPMENT. PAR. 64	
(31)	GOVERNOR ACTION - APPLY AND REMOVE LOAD AND OBSERVE ACTION OF GOVERNOR. ADJUST IF NECESSARY. PAR. 48, ITEM 19		(37)	FINISH - REMOVE RUST AND CORROSION; TOUCH UP OR REFINISH PAINTED SURFACES. PAR. 48, ITEM 6	
32	CLUTCH - ENGAGE AND DISENGAGE. CHECK FOR INDICATIONS OF GRABBING OR SLIPPING.		38	FUNGIPROOF - TREAT EQUIPMENT IN ACCORDANCE WITH CURRENT DIRECTIVES.	
(33)	CONTROLS; SWITCHES - CHECK OPERATION. SEE THAT METERS AND GAGES INDICATE CORRECTLY.		(39)	TOOL BOX; TOOLS - CLEAN TOOLS AND TOOL BOX THOROUGHLY. SEE THAT TOOLS ARE STOWED PROPERLY. PAR. 48, ITEM 3	
(34)	GENERATOR - REMOVE PROTECTIVE COVERS AND CHECK FOR SPARKING BRUSHES. INSPECT SLIP RINGS AND COMMUTATOR. CHECK FOR HIGH, LOW OR FLUCTUATING VOLTAGE. PAR. 48 ITEMS 33 AND 34		(40)	FUEL; OIL; COOLANT - REPLENISH FUEL, OIL, AND COOLANT. PROTECT LIQUID COOLING SYSTEMS WITH ANTIFREEZE, WHEN NECESSARY.	
41	IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.				

DA FORM 1 JAN 53 11-261 REPLACES DA AGO FORM 11-261, 1 MAY 51, WHICH MAY BE USED

TM 919A-68

Figure 69. DA Form 11-261.

CHAPTER 7

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

68. Preparation for Storage or Shipment

a. If Gasoline Engine Generator Set PU-107A/U is not to be used for 30 days or more, or is to be transported to a remote point, rustproof the equipment as instructed in paragraph 40.

b. After the unit has been processed (par. 40), inspect the finish for possible damage. If any damage to the finish is noted, refinish as instructed in paragraph 41.

c. When the operations in subparagraphs *a* and *b* above have been completed, place the equipment in its canvas cover and fasten the cover securely. Check to see that all tools and spare parts are present and in good condition; replace any that may be missing. Wrap each tool and spare part in a moistureproof wrapping and mark it for identification.

69. Shipment

a. If the equipment is to be moved a short distance by truck or trailer, no crating will be required. However, protect the equipment with a tarpaulin or other suitable covering.

b. If the equipment is to be shipped a considerable distance, pack it in suitable crates or boxes in accordance with applicable joint Army-Navy specifications.

Section II. DEMOLITION TO PREVENT ENEMY USE

70. Methods of Demolition

a. Smash. Use sledges, axes, handaxes, pickaxes, hammers, crowbars, and heavy tools.

b. Cut. Use axes, handaxes, and machetes.

c. Burn. Use gasoline, kerosene, oil, flame thrower, and incendiary grenades.

d. Explode. Use firearms, grenades, and TNT.

e. Dispose. Bury in slit trenches, fox holes, other holes. Throw in streams. Scatter.

Note. Use anything immediately available for destruction of this equipment.

71. Destruction of Components

When ordered by your commander, destroy all equipment to prevent its being used or salvaged by the enemy.

a. Smash (par. 70a). Cylinder blocks, cylinder head, spark plugs, carburetor, muffler, air cleaner, oil and fuel filters, fuel pump, manifold, heater unit, radiator, governor, control panel instruments, priming pump, change board and terminal boards, and storage batteries.

b. Cut (par 70b). Remote fuel hose, remote control cables, engine and control panel wiring, connecting wires and cables, exhaust hose, fuel and oil lines, and canvas cover.

c. Burn (par. 70*c*). Fuel, lubricants, canvas cover, packing cases, generator windings, wire and cable, technical manuals and all other literature and documents.

d. Dispose (par. 70e). Dispose of all remaining parts of the equipment. DESTROY EVERYTHING.

INDEX

F

G

H