TM 5-5009

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

GENERATOR SET ELECTRIC, PORTABLE DIESEL-DRIVEN SKID-MOUNTED, 30 KW 60-CYCLE, 120/208- OR 240/416-VOLT, 3-PHASE CONVERTIBLE TO 50-CYCLE, 120/208- OR 240/416-VOLT, 3-PHASE

STEWART AND STEVENSON MODEL WGD-3012 (LESS ENGINE)

DEPARTMENT OF THE ARMY • DECEMBER 1954

SUMMARY OF SAFETY PRECAUTIONS

The power generated by the generator set is dangerous and can kill. Never touch any uninsulated line or bus bar while the unit is in operation.

Do not work on any part of the electrical equipment or the generator service lines while the set is in operation.

In case a person comes in contact with a live conductor, shut off the power at once. If impossible to do this without delay, free the victim from contact with the live conductor by using a dry board, dry clothing or other nonconductor. Avoid direct contact with either the live conductor or the victim's body. An axe may be used to cut the conductor. If, after release from contact, the victim is unconscious, commence artificial respiration without delay.

Do not perform other than routine maintenance work on the engine without first disconnecting the battery.

Do no operate the generator set in a closed building unless the exhaust gas is piped to the outside. The exhaust gases contain carbon monoxide, which is a colorless and odorless deadly poison.

If the winterization heater fails to ignite or goes out during starting procedure, the air ducts must be cleared of gasoline fumes to prevent an explosion. Turn the HIGH-LOW valve to OFF position; the heater control switch to RUN, and the blower switch to HIGH. Permit at least one minute to elapse before an attempt is made to ignite the heater again.

Never run a cold engine at full load or high speed.

Under no circumstances exceed the maximum permissible speed.

Keep the cooling system filled with clean coolant. Never add coolant to an overheated engine.

Stop the engine immediately if the oil pressure gage reading is less than 20 psi.

Use only the specified filter elements in the diesel and lubricating oil filters.

When handling fuel, provide a metallic contact between the fuel container and tank to prevent the generation of a static spark.

Do not add water to a battery in below freezing temperatures unless the battery is to be charged immediately. If water is added and the battery not charged, the added water will remain at the cell tops and freeze before having a chance to mix with the acid. Continuous use of water with a high mineral content will damage the battery.

Never use emery cloth or metal surfaced grinding or polishing stones to service the commutator or slip rings, as these abrasive particles will conduct electricity.

When operating generator sets in parallel, ascertain that the load does not exceed the remaining available power before removing any of the generator sets from the line.

Devices such as governors to control the engine speed, air cleaners, oil filters, circuit breakers, and similar fixtures are installed to protect and prolong the life of the equipment. Failure to maintain them in operating condition or to replace them when they become faulty will result in greatly increased wear and may lead to serious damage. If trouble develops, correct it or report it before it becomes serious. Do not run equipment that is not operating properly.

TECHNICAL MANUAL
No. 5–5009

DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *27 December 195*

GENERATOR SET, ELECTRIC, PORTABLE, DIESEL DRIVEN, SK MOUNTED, 30 KW, 60 CYCLE, 120/208 OR 240/416 VO 3 PHASE, CONVERTIBLE TO 50 CYCLE, 120/208 OR 240/4 VOLT, 3 PHASE, STEWART AND STEVENSON MOD WGD–3012 (LESS ENGINE)

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CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

a. These instructions are published for the information and guidance of the personnel to whom this generator set is issued. They contain information on the operation, organizational maintenance, and field and depot maintenance, as well as a description of the major units and their functions in relation to other components of the materiel. They apply only to the Stewart and Stevenson Model WGD–3012 generator set.

b. Supply manuals, technical manuals, and other publications applicable to the equipment covered by this manual are listed in appendix I. Appendix II tabulates the replaceable parts available for the equipment. Appendix III lists the tools issued with and carried on or with the equipment.

2. Record and Report Forms

Maintenance record forms listed and briefly described in *a* through *l* below will be used in the maintenance of this equipment.

a. DA Form 5–13, Spot Check Inspection Report of Organizational Maintenance of Engineer Equipment. Organizations having engineer field maintenance responsibility use this form for reporting the results of semiannual spot check inspections.

b. DA Form 5–14, Annual Technical Inspection Report of Engineer Equipment. Organizations having engineer field maintenance responsibility use this form for reporting the results of annual technical inspections.

c. DD Form 110, Vehicle and Equipment Operational Record. This form is used by equipment operators for reporting the accomplishment of daily preventive maintenance services, and for reporting any equipment deficiencies observed during operation.

d. DA Form 285, Accident (Report of Personal or Property Damage). DA Form 285 is used by supervisors for reporting all accidents

causing serious injury or death to personnel or damage to property and equipment, including Army aircraft accidents, non-Army motor vehicle accidents, and Army fires.

e. DA Form 464, Work Sheet for Preventive Maintenance and Technical Inspection of Engineer Equipment. This form is used by personnel of the using organization and higher echelons for reporting the results of preventive maintenance services and technical inspections.

f. DA Form 460, Preventive Maintenance Roster. This form is used for scheduling preventive maintenance services at prescribed intervals.

g. DA Form 478, Organizational Equipment File. Major repairs or rebuilding, replacement of major unit assemblies, and accomplishment of equipment modifications are recorded on this form.

h. DA Form 468, Unsatisfactory Equipment Report. This form is used for reporting manufacturing, design, or operational defects in the materiel, with a view to correcting such defects; it is also used for recommending modifications of the materiel. Form 468 is not used for reporting failures, isolated materiel defects, or malfunctions of materiel resulting from fair wear and tear or accidental damage. Form 468 is not used to report issue of parts and equipment, or for reporting replacements or repairs.

i. DD Form 6, Report of Damaged or Improper Shipment. This form is used for reporting damages incurred in shipment.

j. DA Form 9–81, Exchange Part or Unit Identification Tag. This form is used to accomplish the direct exchange of unserviceable for serviceable parts.

k. DA Form 811, Work Request and Job Order. This form is used to request work done by higher echelon organizations.

l. DA Form 867, Status of Modification Work Order. This form is used to maintain records of all modification work performed on equipment.

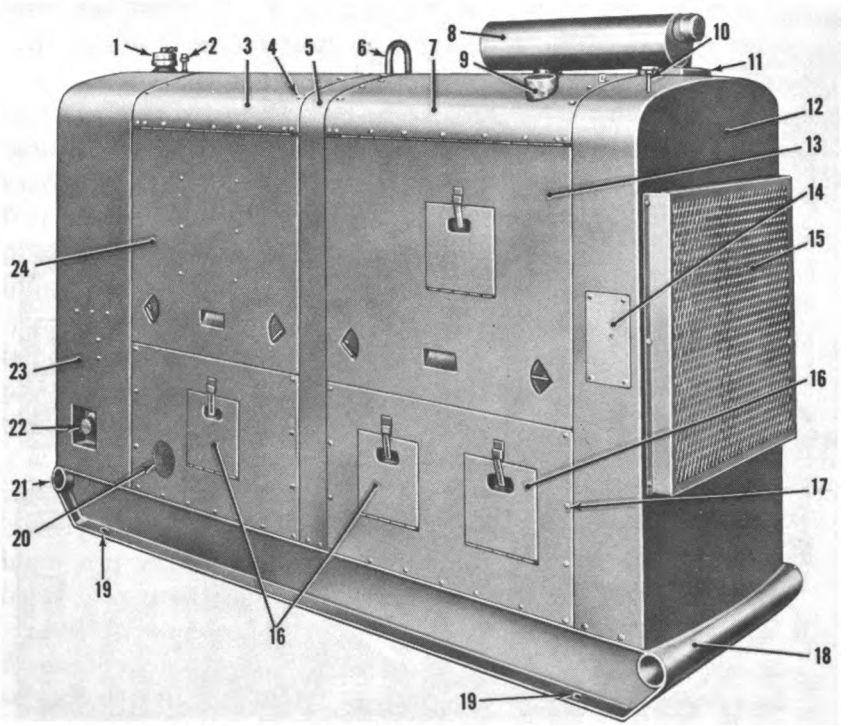
Section II. DESCRIPTION AND DATA

3. Description

a. General Information. Stewart and Stevenson Services generator set Model WGD–3012 is a self-contained, weather-resistant, winterized, skid-mounted unit (figs. 1 to 4), complete with all controls, switches, and indicators necessary for normal operation. A three-cylinder diesel engine (24, fig. 3) is direct-coupled to the a-c generator (33) and to the d-c exciter (38) by means of a common drive shaft. All parts of the unit are readily accessible through hinged side and rear access doors (19 and 8, fig. 2) located in the canopy.

b. Engine. The generator assembly (33, fig. 3) is driven by General Motors Model 3–71RC55(3045C) (24). The engine is a three-

cylinder, 2-cycle, valve-in-head, liquid-cooled diesel engine developing 45 hp at 1200 rpm. Refer to the applicable engine manual for complete information.



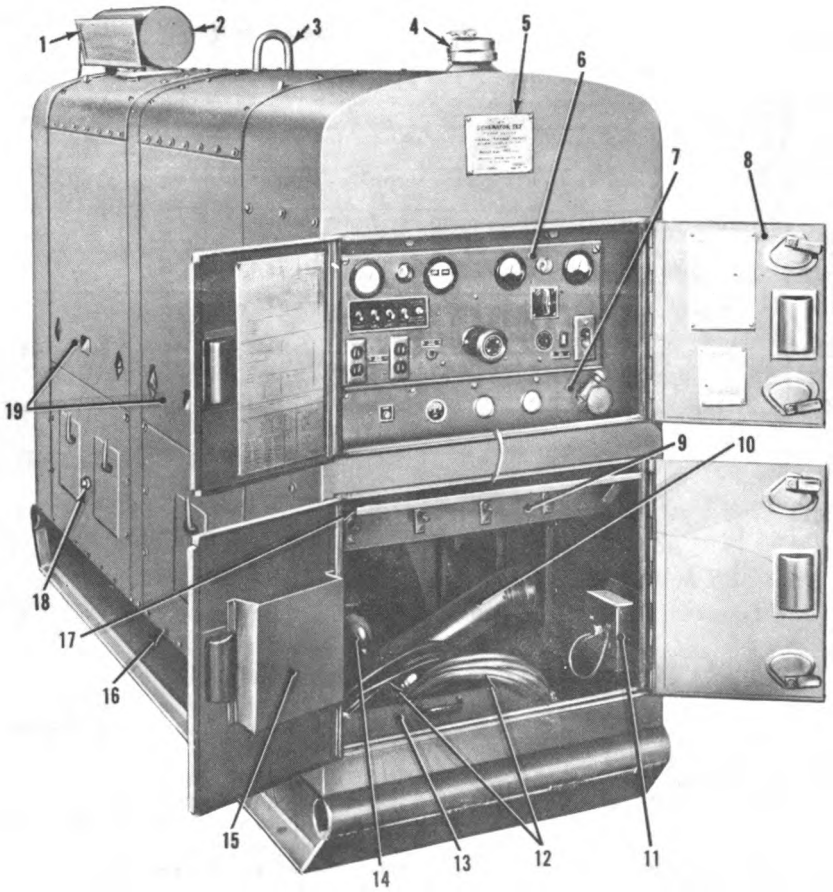
1 Fuel tank cap
2 Diesel fuel indicator
3 Rear canopy
4 Bolt, hex hd, 5/8–16 x 1 5/8 (46 req'd)
5 A-frame
6 Lifting eyebolt
7 Front canopy
8 Exhaust muffler
9 Winterization heater exhaust pipe
10 Radiator shutter manual control
11 Radiator filler cap access
12 Front cowl assembly
13 Front right side access door
14 Automatic shutter control access plate
15 Radiator screen
16 Side panel access doors
17 Bolt, hex hd, 5/16–18 x 1 (52 req'd)
18 Front skid towing tube
19 Generator set anchor points
20 Winterization heater blower inlet
21 Rear skid towing tube
22 Battery charging connection
23 Rear cowl assembly
24 Rear right side access door

Figure 1. Generator set, right front three-quarter view.

c. Main Generator. The Kato Engineering Company a-c generator Model 5MSSS (33) is a 50/60 cycle, Y-connected, 4-wire, 3-phase rotating field alternator. It is rated at 30 kw at 0.8 power factor. The following 60-cycle voltages may be obtained by the use of the proper bar position on the voltage changeover board.

(1) For single-phase loading, either 120 or 240 volts line-to-neutral.

(2) For 3-phase loading, either 208 or 416 volts line-to-line.



1	Exhaust muffler guard	11	Battery charging plug box
2	Exhaust muffler	12	Flexible fuel hoses
3	Lifting eyebolt	13	Toolbox
4	Fuel tank cap	14	Winterization kit blower
5	Generator set identification plate	15	Door pocket for manuals
6	Generator control panel	16	Bolt, hex hd, 5/16–18 x 1 (52 req'd)
7	Engine control panel	17	Load terminal board guard
8	Upper rear access door	18	Crankcase drain plug
9	Load terminal board assembly	19	Left side access doors
10	Winterization heater air inlet		

Figure 2. Generator set, left rear three-quarter view with rear access doors open.

d. Exciter. The Kato Engineering Company Model 24XUGS exciter (38) is a shunt-wound, 4-pole, d-c generator mounted on the rear of the main generator and direct-connected to the main generator

shaft. It provides direct current for energizing the six poles of the main generator rotating field. The exciter is equipped with a fan which provides induced cooling for the exciter and forced cooling for the generator.

e. Control Panel. The control panel (6, fig. 2) is enclosed in the rear cowl assembly. It contains all the meters, indicators, switches, and controls necessary for normal operation of the generator set.

f. Fuel Tank (fig. 5). A spill-proof fuel tank (11) with a capacity of 30 gallons is located in the rear cowl assembly above the control cabinet. The fuel system is governed by two, three-way fuel control valves (9) and (10) which permit normal operation in which engine fuel is supplied from the tank; outside drum operation which supplies fuel to the engine from a drum; or a combination which permits filling the tank from a drum while the engine is running.

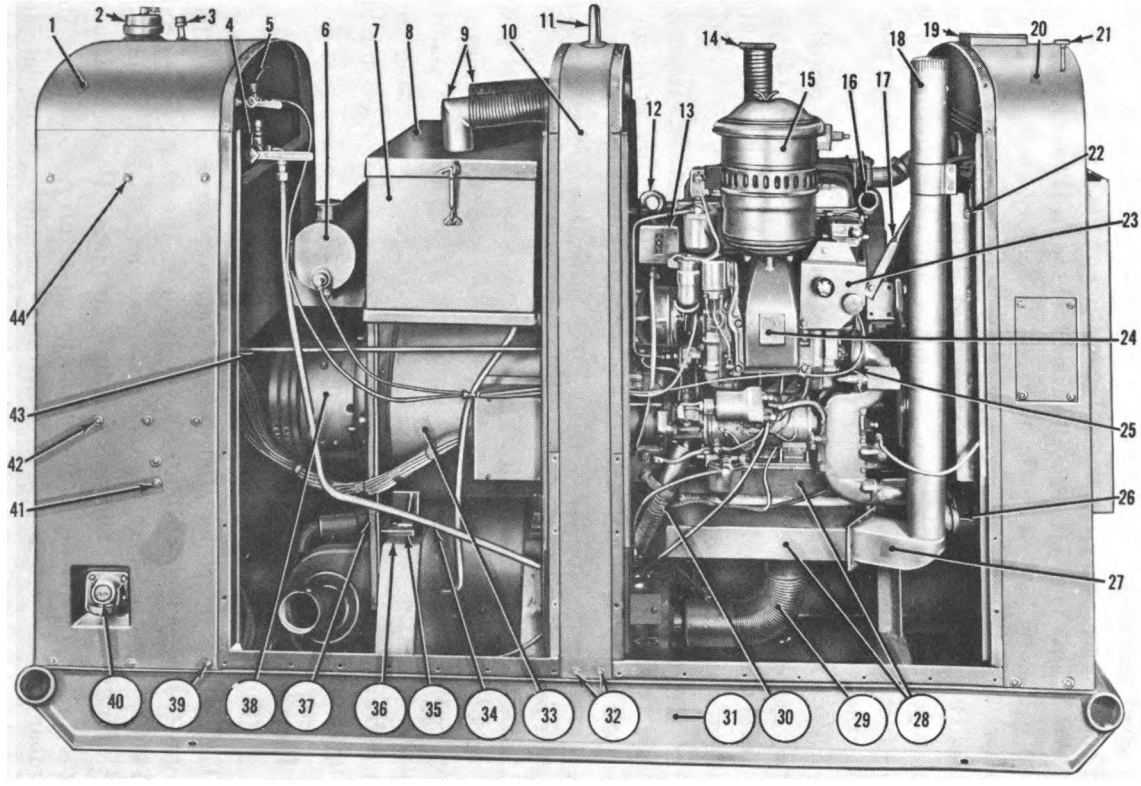
g. Winterization Kit. The winterization kit (19) is a self-contained gasoline-flame air-heating unit. A 4.5-gallon tank (6, fig. 3) provides the gasoline fuel, and flexible tubes (9, 29, and 30) channel the heated air to the various components.

h. Canopy. The front and rear canopies (3 and 7, fig. 1) are fabricated from sheet metal with a coat of insulating material on the inner surfaces. The hinged side access doors afford ventilation during warm weather operation as well as providing access for maintenance requirements.

i. Skid-Frame Base. The skid-frame base (31, fig. 3) is a steel frame braced and reinforced by crossmembers. It is designed to support the fully assembled generator set. Provisions are made for bolting down the base and for the attachment, of a towing cable. An A-frame (10) with lifting eye (11) provides the means for handling the generator set with a lifting device.

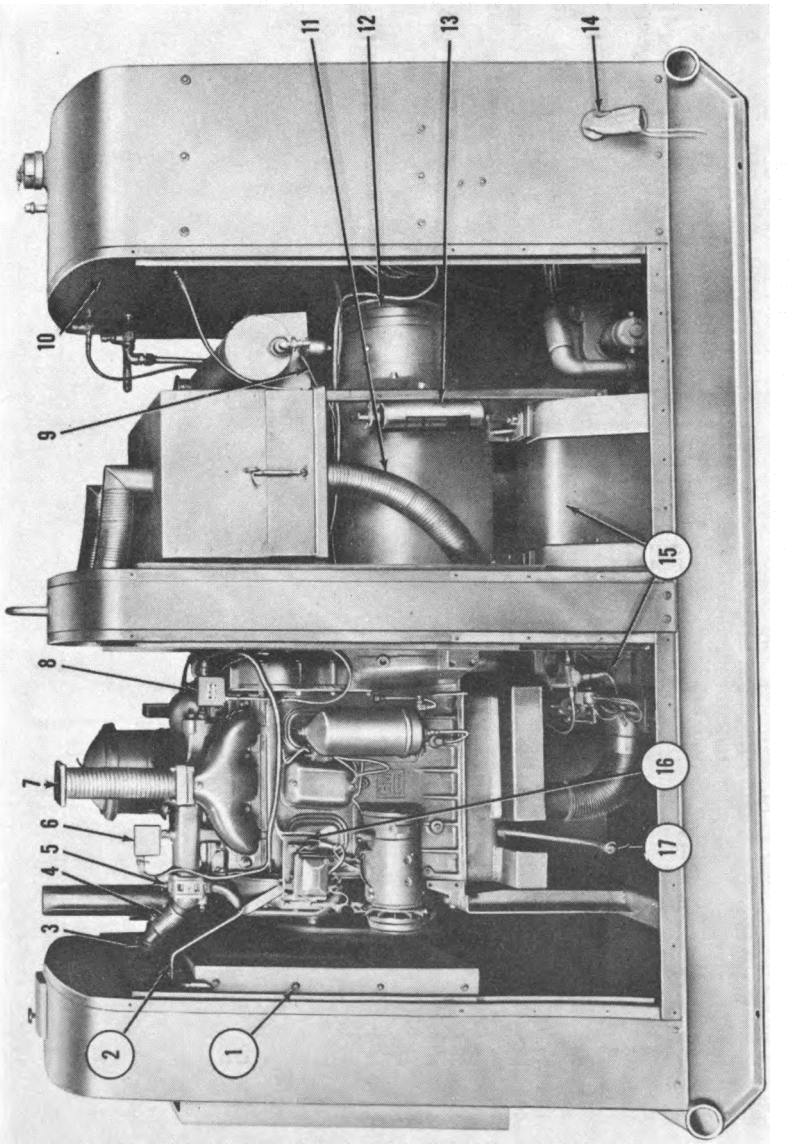
4. Identification
(fig. 6)

The generator set has four identification plates. The Corps of Engineers identification plate (A), located on the rear cowl, specifies the official nomenclature, the model number, and the serial number of the equipment. The engine identification plate (B) located on the right flywheel housing specifies the manufacturer, model, and unit number of the engine. The generator assembly nameplate (C) located on the right generator housing specifies the manufacturer, rating, and serial number of the generator assembly. The options and accessories identification plate (D) located on the right side of the valve rocker cover specifies all nonstandard groups of parts used on the engine.



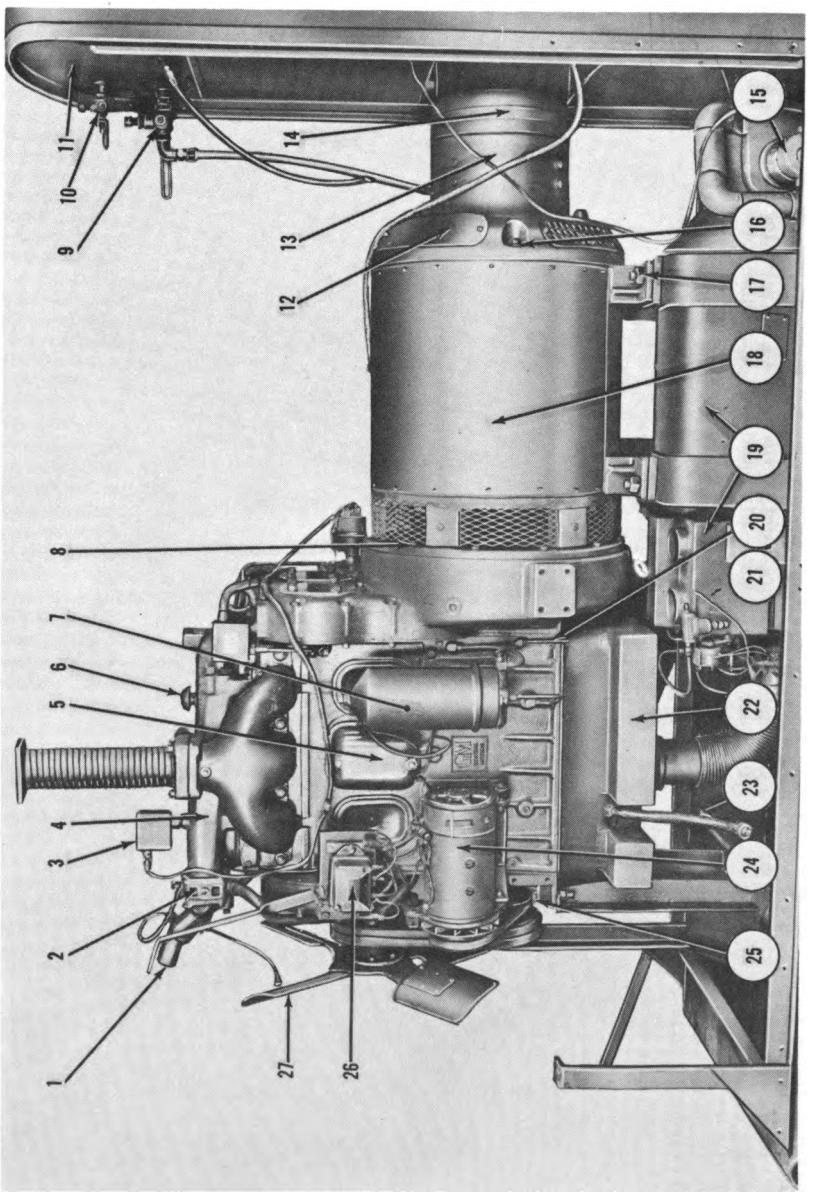
1 Rear cowl assembly
2 Fuel tank cap
3 Diesel fuel indicator
4 Fuel supply valve
5 Fuel return valve
6 Heater fuel tank
7 Battery box
8 Battery box cover
9 Battery box air tube elbow
10 A-frame
11 A-frame lifting eye
12 Engine rear lifter bracket
13 Fuel pressure safety switch
14 Engine exhaust connection
15 Air cleaner
16 Engine front lifter bracket
17 Radiator brace
18 Heater exhaust pipe
19 Radiator filler cap access
20 Front cowl assembly
21 Radiator manual shutter control
22 Bolt, hex hd, ¼–20 x ¾ (16 req'd)
23 Auxiliary starting panel
24 Model 3–71RC55(3045C) diesel engine
25 Gasoline supply line to air heater pump assembly
26 Lower radiator hose
27 Shroud elbow outlet
28 Shrouded engine oil pan
29 Heater air outlet tube
30 Starter air tube
31 Skid base
32 Bolt, hex hd, ⅝–11 x 1⅛ (12 req'd)
33 Generator assembly
34 Diesel fuel supply line
35 Generator cover pad
36 Generator pad
37 Battery box support
38 Exciter
39 Bolt, hex hd, ⅜–16 x 2 (6 req'd)
40 External battery charging receptacle
41 Bolt, hex hd, ⅜–16 x 1¼ (5 req'd)
42 Bolt, hex hd, ⅜–16 x 1¼ (5 req'd)
43 Throttle control rod
44 Bolt, hex hd, ⅜–16 x 1¼ (12 req'd)

Figure 3. Generator set, right side, canopy removed.



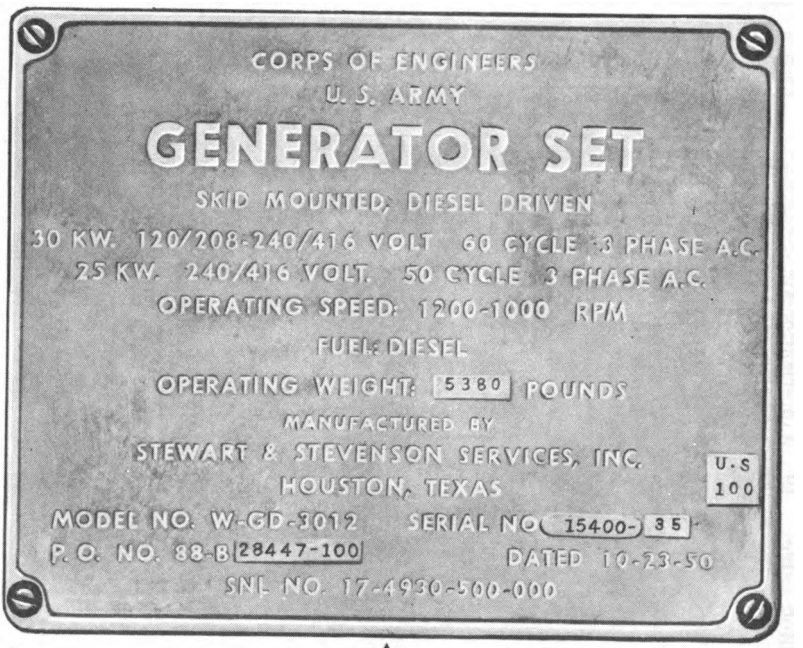
1 Bolt, hex hd, ¼–20 x ¾ (16 req'd)
2 Radiator brace
3 Upper water tube
4 Upper radiator hose
5 Coolant thermostat housing
6 Coolant thermostat safety switch
7 Flexible exhaust connection
8 Low oil pressure safety switch
9 Fuel valve line to winterization heater
10 Diesel fuel tank
11 Battery box air tube
12 Commutator end bell shield
13 Fire extinguisher
14 Cable opening
15 Winterization heater
16 Regulator bracket
17 Oil drain hose

Figure 4. Generator set, left side, canopy removed.

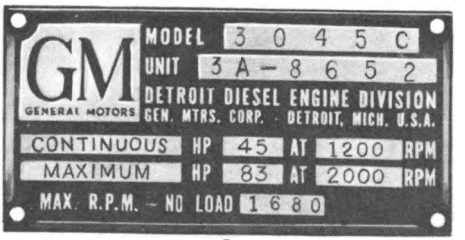


1 Upper radiator hose
2 Coolant thermostat assembly
3 Coolant thermostat safety switch
4 Water outlet manifold
5 Air heater assembly
6 Rocker cover knob
7 Lubricating oil filter
8 Cap screw, hex hd ½–13 x 2¾ (12 req'd)
9 Diesel fuel supply shutoff valve
10 Diesel fuel return shutoff valve
11 Diesel fuel tank
12 Slip ring inspection plate
13 Exciter
14 Exciter end bell shield
15 Blower motor
16 Cap screw, hex hd, ½–13 x 1¼ (4 req'd)
17 Bolt, hex hd, ⅝–18 x 3 (4 req'd)
18 A-C generator assembly
19 Winterization kit
20 Air box drain tube assembly
21 Winterization kit combustion chamber
22 Air jacketed oil pan
23 Oil drain hose
24 Battery charging generator
25 Bolt, hex hd, ½–13 x 2 (4 req'd)
26 Battery voltage regulator
27 Cooling fan

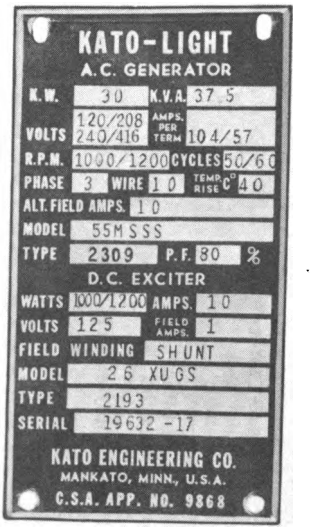
Figure 5. Generator set, left side, "A" frame and radiator removed.



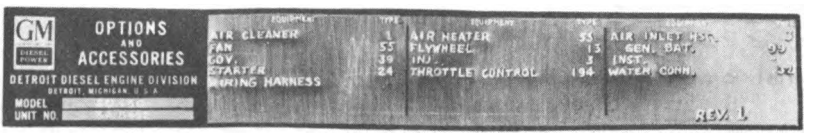
A



B



C



D

Figure 6. Identification plates.

5. Tabulated Data

a. Dimensions and Weight.

Dry weight	4910 lb.
Operating weight	5380 lb.
Center of gravity of unit	Lifting eye on A-frame
Center of gravity of engine	Mid-point between two lifting eyes on engine.
Center of gravity of generator assembly.	Mid-point between two lifting eyes on generator assembly.
Overall length	110 in.
Overall width	35 in.
Overall height	76.5 in.
Dimensions to which generator set can be conveniently disassembled for shipment.	See figure 7

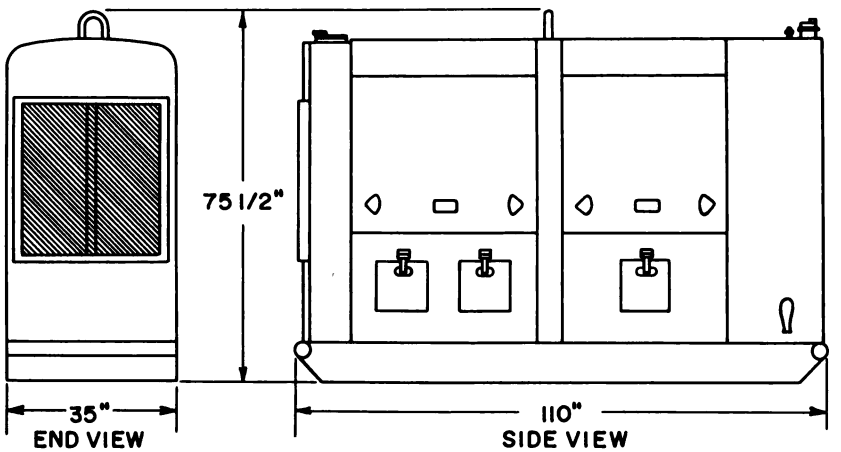


Figure 7. Shipping dimensions of generator set.

b. Classification and Ratings.

A-C Generator.

Manufacturer	Kato Engineering Co., Mankato, Minn.	
	50 cycles	*60 cycles*
Rated kw	25	30
Rated speed, rpm	1000	1200
Voltage	120/208–240/416	
Phase	1 and 3	
Amperes full load	104–57	
Power factor	0.8	
Temperature rise	40° C.	
Method of cooling	Air cooled	
Type lubrication	Sealed bearing	
Duty classification	Continuous	
Degree of enclosure	Dripproof	
Drive	Direct	
Excitation	Separate	
Mounting	4 bolts to skid	

Exciter.

Manufacturer	Kato Engineering Co., Mankato, Minn.
Volts	125 d-c
Amperes	10
Rated kw	1.5
Winding	Shunt interpole

Engine.

Manufacturer	General Motors, Detroit Diesel Div.
No. of cylinders	3
Bore	4¼ in.
Stroke	5 in.
Total displacement	212.69 cu in.
Maximum hp at 2000 rpm	83
Continuous hp at 1200 rpm	45
Maximum torque at 1000 rpm	262 ft-lb.

c. Capacities.

Cooling system including radiator	9 gal.
Lubrication system	15 qt.
Diesel fuel tank	30 gal.
Heater gasoline tank	4.5 gal.

d. Engine Equipment.

Air intake system.

Emergency shutdown solenoid	Delco-Remy model 1118191
Air cleaner	General Motors oil bath type

Fuel system.

Fuel oil strainer	General Motors cleanable-type element
Fuel oil filters	General Motors replaceable-type element
Fuel oil pressure safety switch	Unit Electric Controls No. IPE-O, 0–50 psi, normally open, closing position 20 psi.

Engine electrical system.

Storage battery	Four 6-volt units, series connected
Battery charging generator	Delco-Remy model 1106867, 24-volt, 10-amp at 1700 rpm.
Battery voltage regulator	Delco-Remy model 1118346, 3-unit type
Starting motor	Delco-Remy model 1108857, 24-volt, Dyer drive.
Starting solenoid	Delco-Remy model 1118099
Battery box overheat solenoid thermostat.	Unit Electric Control Co. 0–220° F. Normally closed. Opens at 180° F. ½ in. IPS connection.

Governors.

Hydraulic	Woodward, constant speed droop adjustment—full load setting 1200 rpm.
Overspeed	Synchrostart overspeed trip, Model GKG, ratio 195:1, contact setting normally open, contacts close at 1320 rpm.

Cooling system.

Water circulating pump	General Motors centrifugal type
Radiator	Young Radiator Co., uniflow, vertical tube.
Thermostat	General Motors bypass. Starts opening at 158° F., fully opened at 185° F.
Cooling fan	Blower type, 26 in., 4 blades
Shutter unit	Manual and automatic control. Cadillac Co.
Inlet hose	1¾ in. ID x 3¼ in.
Outlet hose	2 in. ID x 4½ in.
Coolant safety thermostat	United Electric Co. 0–220° F. Normally open, closes at 208° F., ½ in. IPS connection.

Lubricating system.

Oil filter	General Motors replaceable element type.
Low oil pressure safety switch	United Electric Controls Co. No. IPE–0, 0–50 psi, normally closed, contacts open at 10 psi.
Coupling assembly	Flange type, engine and generator side, Kato Engineering Co.

e. Main Generator Assembly Equipment.

Generator brushes	⅜-in. thick, ⅝-in. wide, 1⅜ in. long.
Exciter brushes	⅜-in. thick, ¾-in. wide, 1⅛ in. long.
Voltage regulator	Electric Regulator Corporation No. C–115–2515–1 and C–115–2539–1.

f. Winterization Kit.

Burner	Modified aircraft heater, porous brick burner.
Fuel filter	Autopulse ⅛-in.
Safety solenoid heater fuel supply valve.	Minneapolis Honeywell Regulator Co. 24-volt.
Heater safety thermostat	George Ulanet Co. strip type, normally closed, opens at 100° F.
Battery box overheat solenoid	George H. Leland Inc. No. 15ESR95–30–X4–X8.
Blower motor	Lamb Electric Co. No. 46718–A 24-volt d-c, ½₂ hp, 2500 rpm.

g. Fire Extinguisher. Chemical, carbon tetrachloride, hand operated.

h. Foundation Plan.

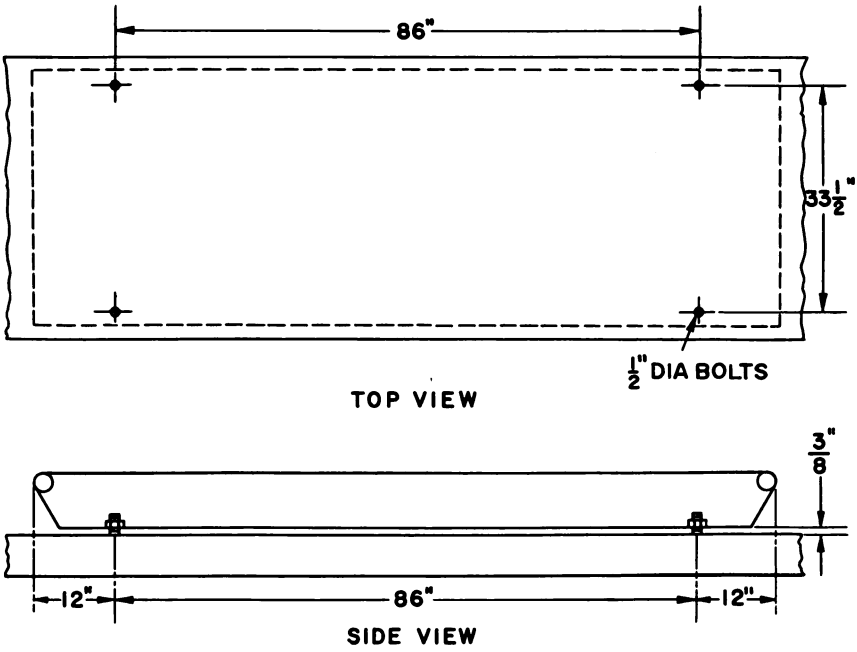


Figure 8. Foundation plan for generator set.

CHAPTER 2

OPERATING INSTRUCTIONS

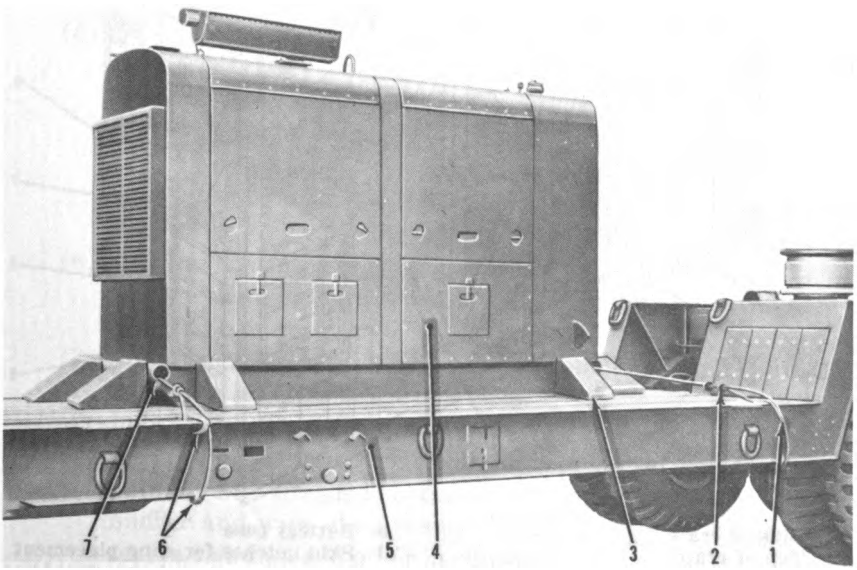
Section I. SERVICE UPON RECEIPT OF EQUIPMENT

6. New Equipment

a. General. New generator sets which are boxed and processed to meet military requirements for domestic and oversea shipment must be given definite services before being put into operation. Generator sets received uncrated will arrive blocked and tied to the carrier as illustrated in figure 9.

b. Unloading.

(1) If the generator set is shipped uncrated, as illustrated in figure 9, the following procedure is to be followed.



1 ½-inch cable
2 ½-inch cable clamps
3 Chock block, 6 inch x 8 inch
4 Generator set
5 Carrier
6 Heavy thimbles
7 Towing tube

Figure 9. Method of securing generator set to carrier.

(*a*) Remove the cables (1) from the front and rear towing tubes and the blocking (3) from the base of the set.

(*b*) Using a crane with a minimum lifting capacity of 10 tons, attach the crane lifting hook to the lifting eye on the top of the generator set and take a light strain on the cable.

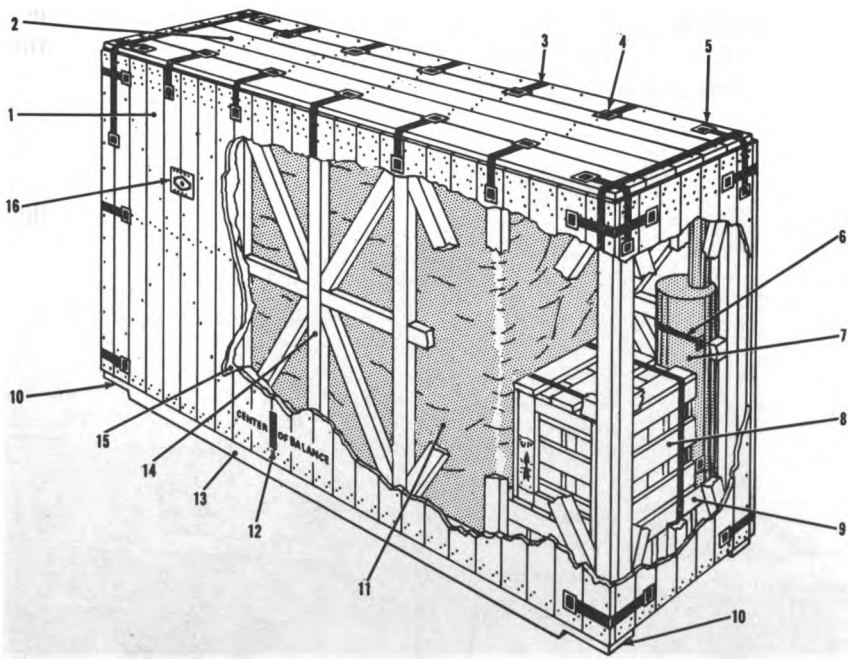
(*c*) Check to see that all blocking, holddown straps, and retaining cables have been removed.

Note. **Before lifting the set from the carrier, secure guide lines to the front and rear towing tubes to prevent the set from swaying while being removed.**

(*d*) Lift the set slowly from the carrier and move it to the point of installation.

(2) If the generator set is shipped crated, as illustrated in figure 10, the following unloading procedure is to be followed.

(*a*) Place loop slings around the ends of the crate so that they fit into the lifting sling notches (10) provided at the ends of the skid base.



1	Side of crate	9	Battery case
2	Top of crate	10	Skid notches for sling placement
3	Strap	11	Floating vapor-moisture-proof bag
4	Drive screw	12	Center of balance mark
5	Anchor plate	13	Skid
6	Strap	14	Frame
7	Muffler assembly	15	Barrier paper
8	Electrolyte case	16	Hydrotector plug-in terminals

Figure 10. Generator set, cutaway view showing packing.

(*b*) Draw the two slings together over the top of the crate and attach a lifting hook to the slings.

Note. Before lifting the crate take a light strain on the cables and adjust them so that the lifting hook of the crane is directly over the center of balance (12) marked on the crate.

(*c*) Lift the crate slowly from the carrier and move it to the point of installation.

c. Uncrating (fig. 10).

(1) Unpack the crate as close as possible to the point of installation.

(2) Remove the drive screws (4) from the anchor plates (5) and straps (3) which hold the top (2) of the packing crate. Lift the top from the crate.

Caution: Do not drive a crowbar into the crate, as this may damage the generator set.

(3) Cut the cable assembly connecting the hydrotector plug-in terminals (16) to the sensing element in the floating vapor-moistureproof bag (11).

Note. Be careful not to puncture or break the seal on the vapor-moistureproof bag barrier until ready for use.

(4) Remove the drive screws from the anchor plates (5) and straps (3) at the corners of the crate. Remove the nails holding the sides of the case to the platform and lift away the sides.

(5) Cut the straps (6) holding the muffler assembly (7), the wooden electrolyte case (8), and the wooden battery case (9). Remove these items and the remaining ends from the packing crate platform.

Note. If the muffler assembly is not fastened to the inside of the crate it will be found in an available space in the generator set within the floating bag. For example: within the battery box.

(6) Cut the floating bag, peel it down over the generator set and remove the desiccant. Remove the four nuts from the hold-down bolts in the platform.

(7) By means of a sling in the lifting eyebolt (6, fig. 1), lift the generator set clear of the platform.

d. Remove Barriers and Preservatives.

(1) Remove all barrier material and preservatives from unpainted and threaded surfaces of the generator set. Unpack muffler and wipe clean, using dry cloths. Wipe hinges, fasteners, handles, and other hardware.

(2) Open doors (13 and 24, fig. 1). Remove four screws and washers and lift end bell shield (14, fig. 5) from exciter. Remove any barrier material from commutator. Do not wipe or attempt to clean commutator as it is not coated. Exam-

ine brushes for cracks or chips caused in transit. Check freedom of brushes in brush holder, see that brushes seat properly on commutator, and that curve of brush face fits the commutator surface. See paragraph 161*b*(6) for seating brushes. Position brushes carefully and install end bell shield.

(3) Remove the inspection plate (12, fig. 5) from the generator. Remove any barrier material from the collector rings. Do not attempt to clean collector rings as they are not coated. Examine brushes for cracks or chips caused in transit. Check freedom of brushes in brush holders, see that brushes seat properly on slip rings, and that curve of brush face fits the slip ring surface. See paragraph 160*b*(6) for seating brushes. Carefully position brushes and replace inspection plate.

(4) Remove fire extinguisher (13, fig. 4) and unseal openings, wipe clean, and place in bracket ready for use.

(5) Remove barrier material from air cleaner (15, fig. 3) and flexible exhaust connection (7, fig. 4).

(6) Unpack fuel hoses (12, fig 2).

(7) Open toolbox located in generator assembly compartment. Check and clean the tools. A list of the tools supplied with the generator will be found in appendix III. Place them in the toolbox ready for use.

(8) Remove all loose packing material and wiping rags from the generator set in order to have it ready for immediate use.

e. Assembling.

(1) *Muffler.* Mount the muffler on the exhaust flange on top of the canopy, and the mating flanges with four ⅜- by 1½-inch hex head bolts, lockwashers, and hex nuts. Attach the front foot of the muffler to the canopy with a ¼-inch hex head bolt, lockwasher, and nut.

(2) *New batteries; preparing for use.*

(*a*) The batteries are shipped fully charged and dry. Remove them from the shipping container and remove seals from each battery. Open filler caps and break any sealing device used. Make sure vents in caps are open.

(*b*) Check each battery casing for any signs of cracking. Check for lost or broken vent caps. Uncrate the four cartons of electrolyte and remove the bottles from the cartons. If the batteries are in satisfactory condition, fill each cell with electrolyte to approximately three-eighths of an inch above the plates. Watch for leaks. Wipe up all spilled electrolyte. Keep batteries clean and dry.

(*c*) Place the hard rubber supports (4, fig. 11) in the battery box (2) and position the batteries (1) in the box.

1 Batteries
2 Battery box
3 Battery box thermostat
4 Hard rubber battery supports
5 Connector

Figure 11. Batteries mounted in battery box.

(*d*) Connect the batteries in series in the following manner. The negative terminal of the first battery is connected to the positive terminal of the second battery, the negative terminal of the second battery is connected to the positive terminal of the third battery, and the negative terminal of the third battery is connected to the positive terminal of the fourth battery. The positive terminal of the first battery and the negative terminal of the fourth battery are free and become the output terminals of the batteries. The negative terminal is then connected to the starter solenoid, and the positive terminal (plus 24 volts) is connected to the bat-

tery system ground lug. Cover terminals with a light coating to grease to retard corrosion.

(*e*) Check specific gravity and voltage of each cell. Charge batteries if specific gravity is less than 1.270 or if voltage is less than 2.2 volts per cell. If batteries are not to be used within 12 hours after filling, charge them.

f. Inspection.

(1) Make a complete inspection of the generator set, visually checking for any loss or damage which may have occurred during shipment.

(2) Inspect the control panel, throttle linkage, fuel lines, overspeed governor trip and cooling system connections.

(3) Check the tensions of the fan and generator belts. Correct tension permits the belts to be pushed in at a point midway between the pulleys to a distance of 1¼ inches on the fan belts and ½ and ¾ inch on the generator belt. Refer to paragraphs 146*b* and 155*b* for proper adjustment.

(4) Tighten any loose screws, nuts, or bolts. Check oil drain plug for tightness and see that cooling system drains are closed.

(5) Check all accessible wires and connections. See that wires and cables are not frayed, that insulation is sound, and that wires do not touch or rub on rotating sections of the generator set. Check all terminals and connections, and tighten where necessary. Check all external, visible connections for proper polarity and wiring.

g. Service.

(1) Lubricate generator set; refer to paragraph 67.

(2) Perform the before-operation services set out in paragraph 70*c*.

(3) Fill the radiator with clean water or, if it is below freezing, with antifreeze solution (par. 58*a*).

(4) Remove plugs from tops of fuel oil filters and fill filters with clean fuel oil.

(5) Fill the diesel fuel tank with fuel oil. Remove and clean filter bowl; see paragraph 149*a*. Replace bowl (par. 149*b*).

(6) Fill the heater fuel tank (6, fig. 3) with gasoline.

h. Installation.

(1) *Location recommendations.* If the unit is to be operated outdoors, locations exposed to high humidity or dust must be avoided. Moisture condenses on generator, engine, and controls, causing corrosion which seriously affects operation and efficiency. Dust and dirt cause extra wear on all moving parts. Use care to locate the machine so that there will be as little opportunity as possible for excess moisture, dust, or corrosive fumes to be drawn into the unit. Use a carpenter's or

mason's bubble level and level up the generator set. Place bubble level along left skid. Raise or lower front or back as required, using blocks, until bubble indicates that the unit is level. Block up skid in this position. Repeat procedure with opposite side and on ends in order to level the set. Drive stakes into the ground alongside the blocking to prevent the unit from shifting when in operation. Where possible the unit should be located close to existing power service lines.

(2) *Indoor installation requirements.* If the unit is to be operated indoors or within a vehicle, make sure there is adequate ventilation to carry off escaping exhaust fumes and provide an ample supply of air. Locate the unit so that a minimum number of bends are required in the exhaust line which carries the fumes out of the building. All exhaust connections must be gastight. Provide at least 3 feet of space around the unit to permit opening of access doors.

Warning: Prior to making any line connections or changes, be sure generator set is not running and that main circuit breaker is open.

(3) *Voltage changeover board connections.* The main load terminal board assembly (9, fig. 2) is located in the compartment below the control cabinet. It is marked T–1, T–2, T–3, and T–0, and is Y-connected, 3-phase, 4-wire. T–0 is the neutral terminal. The single-phase load should be divided equally, as near as possible, among the three phases. That is: one-third of the single-phase load should be connected between T–0 and T–1; one-third between T–0 and T–2; and one-third between T–0 and T–3. When the 3-phase voltage is 208 volts as indicated on the a-c voltmeter, the single-phase voltage is 120 volts. Likewise, when the 3-phase voltage is 416 volts, the single-phase voltage is 240 volts. The voltage changeover board is located inside the control cabinet and voltage changes are made by altering the positions of the connecting bars on the terminals.

(*a*) For 120/208-volt, 60-cycle output, connect the T–1 and T–7 terminals, the T–2 and T–8 terminals, the T–3 and T–9 terminals, and the T–4, T–5, T–6, and T–0 terminals terminals (fig. 12Ⓑ).

(*b*) For 240/416-volt, 50/60-cycle output, connect the T–7 and T–4 terminals, the T–8 and T–5 terminals, the T–9 and T–6 terminals (fig. 12Ⓑ).

7. Used Equipment

Used generator sets which have been stored and shipped in accordance with Army specifications are ready for use on arrival after a brief

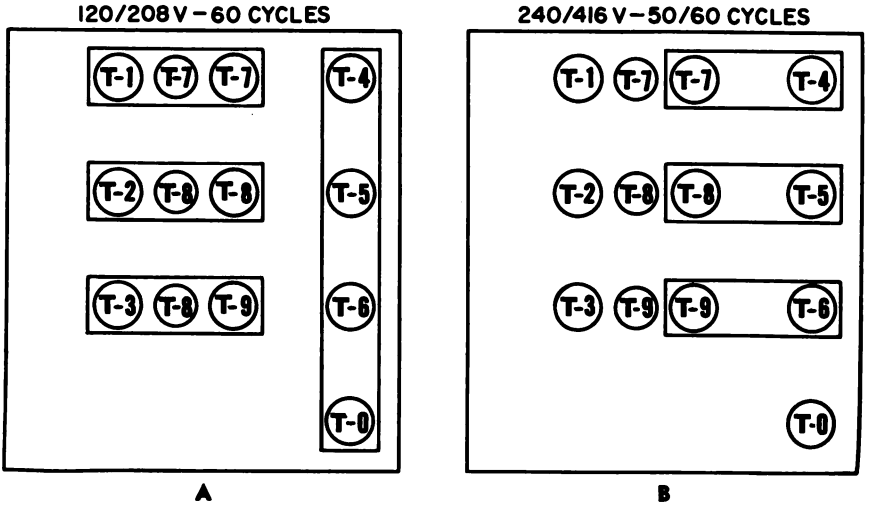


Figure 12. Voltage changeover-board connections.

check. Unload, uncrate, and assemble the used generator sets as outlined in paragraph 6.

Section II. CONTROLS AND INSTRUMENTS

8. General

This section describes, locates, illustrates, and furnishes the operator sufficient information about the various controls and instruments for the proper operation of the WGD–3012 generator set.

9. Radiator Manual Shutter Control

a. Location. The radiator manual shutter control (21, fig. 3) is located on the right top of the front cowl assembly.

b. Description. A mechanical linkage to the radiator shutter vanes.

c. Purpose. To control the radiator shutter vane position.

10. Fuel Pressure Safety Switch

a. Location. The fuel pressure safety switch (13, fig. 3) is located at the right upper side of the engine block.

b. Description. This is a pressure switch, set to close at 20 psi.

c. Purpose. To render other safety devices inoperative during starting procedure, until diesel fuel pressure has been built up.

11. Low Oil Pressure Safety Switch

a. Location. The low oil pressure safety switch (8, fig. 4) is located on the upper left rear side of the engine block.

b. Description. A pressure switch, normally open, set to close when oil pressure drops to 20 psi.

c. Purpose. To shut down the engine when the lubricating oil pressure falls to 20 psi.

12. Engine Coolant Thermostat Safety Switch

a. Location. The engine coolant thermostat safety switch (3, fig. 5) is located on top of the water outlet manifold.

b. Description. A thermostat and a normally open switch set to close at 208° F.

c. Purpose. To shut down the engine when the coolant reaches 208° F.

13. Fuel Control Valves

a. Location. The supply valve (9, fig. 5) and the return valve (10) are located at the right front side of the fuel tank (11).

b. Description. These valves are three-way angle cock valves.

c. Purpose. To control the flow of diesel fuel as indicated in table I. Refer to figure 26 for a diagram of the fuel oil flow.

Table I. Fuel Control Valve Positions

Operation	Valve position	Effect
Normal	Both handles in TANK position.	Engine fuel from fuel tank and fuel return to fuel tank.
From external supply.	Both handles in DRUM position.	Engine fuel from external supply and fuel return to external supply.
Filling tank while operating.	SUPPLY valve handle in DRUM position, RETURN valve handle in TANK position.	Engine fuel from external supply and fuel return to fuel tank.

14. Heater Safety Thermostat Switch

a. Location. The heater safety thermostat switch (14, fig. 13) is located at the coolant outlet from the lubricating oil cooler (15).

b. Description. A thermostat and a normally closed switch designed to open at 180° F.

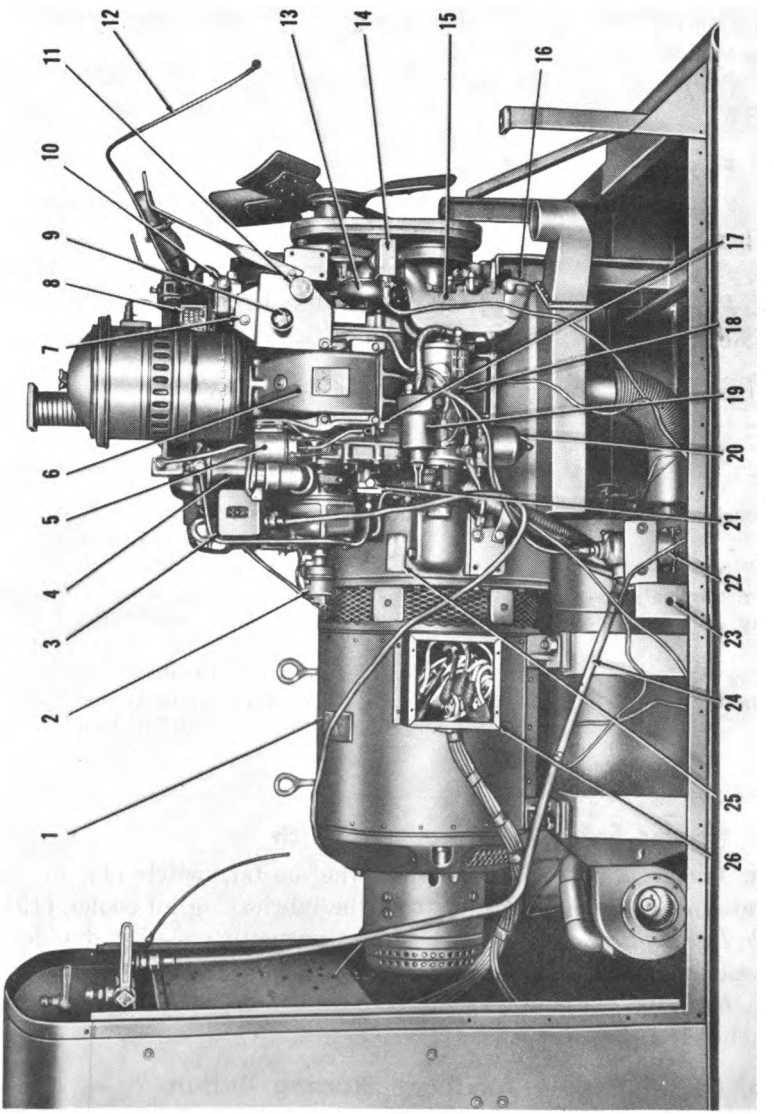
c. Purpose. To shut off the fuel to the heater when the engine coolant reaches 180° F.

15. Diesel Engine Auxiliary Starting Button

a. Location. The diesel engine auxiliary starting button (7, fig. 13) is located on the auxiliary control panel.

b. Description. This switch is a single-pole, single-throw, normally open pushbutton type switch.

c. Purpose. To energize the diesel engine auxiliary starting button when using the air heater for starting purposes.



1 Generator assembly nameplate
2 Overspeed governor
3 Engine safety shutdown relay
4 Secondary fuel filter assembly
5 Air box shutoff solenoid
6 Air inlet housing assembly
7 Auxiliary starting button
8 Options and accessory plate
9 Air heater pump assembly
10 Governor control rod knob
11 Air heater valve assembly
12 Water supply tube to shutter operating cylinder
13 Water pump
14 Heater safety thermostat switch
15 Oil cooler
16 Coolant inlet to oil cooler
17 Air shutoff rod
18 Starting motor
19 Starting motor solenoid
20 Primary fuel filter assembly
21 Fuel pump
22 Fuel strainer assembly
23 "A" frame attachment angle
24 Diesel fuel supply line
25 Engine model and serial number plate
26 Generator connection box, cover removed

Figure 13. Generator set, right side, "A" frame and radiator removed.

16. Air Heater Fuel Valve

a. Location. The air heater fuel valve (11, fig. 13) is located on the auxiliary control panel.

b. Description. The air heater fuel valve is a needle type valve.

c. Purpose. To control the gasoline fuel supply to the air heater.

17. Air Heater Pump Control

a. Location. The air heater pump control (9, fig. 13) is located on the auxiliary control panel.

b. Description. A hand-operated plunger-type pressure pump.

c. Purpose. To supply gasoline under pressure to the burner unit of the air heater assembly for cold weather starting.

18. Overspeed Governor

a. Location. The overspeed governor (2, fig. 13) is mounted on the rear end of the blower shaft.

b. Description. A centrifugal circuit-closing device, capable of adjustment.

c. Purpose. To shut down the engine when the speed exceeds a preset value (1320 rpm).

19. Air-Box Shutoff Solenoid

a. Location. The air-box shutoff solenoid (5, fig. 13) is located on the right side of the engine near the air inlet housing (6).

b. Description. A plunger type solenoid.

c. Purpose. To actuate the air shutoff rod (17) and consequently close the valve to the air inlet, thus cutting off the engine air supply and stopping the engine in case of an emergency.

20. Engine Safety Shutdown Relay

a. Location. The engine safety shutdown relay (3, fig. 13) is located at the right rear of the cylinder head.

b. Description. A 24-volt coil-actuated contact type relay with a contact capacity of 25 amperes.

c. Purpose. To relay the action of safety switches and thermostats, and to energize the air-box shutoff solenoid (5).

21. Battery Box Thermostat

a. Location. The battery box thermostat (3, fig. 11) is located inside the right end of the battery box (2).

b. Description. A strip type thermostat with switch normally closed and designed to open at 100° F.

c. Purpose. To control the rotary solenoid on the winterization kit, thereby controlling the position of the vane in the battery box heating tube.

22. Voltage Regulator Switch

a. Location. The voltage regulator switch (2, fig. 14) is located on the control panel.

b. Description. A double-pole, double-throw toggle switch rated 3 amperes at 250 volts, 6 amperes at 125 volts.

c. Purpose. To electrically connect the voltage regulator or to short-circuit it from the system when using the exciter field rheostat.

23. Cross-Current Switch

a. Location The cross-current switch (6, fig. 14) is located on the control panel.

b. Description. A single-pole, single-throw toggle switch.

c. Purpose. To connect the cross-current compensation resistor when the generator set is being operated in parallel with one or more units.

24. Exciter Field Rheostat

a. Location. The exciter field rheostat (9, fig. 14) is located on the control panel.

b. Description. A plate type with a contact arm moving over taps from the resistance unit to provide a variable resistance.

c. Purpose. To be used when the voltage regulator switch is in the OFF position, to manually control the exciter field and, hence, its output voltage. The output of the main generator is dependent upon the voltage impressed across the rotating field (rotor) by the exciter.

25. Ammeter-Voltmeter Phase Switch

a. Location. The ammeter-voltmeter phase switch (11, fig. 14) is located on the control panel.

b. Description. A rotary selector switch of the snap action type.

c. Purpose. To provide ammeter and voltmeter readings of each generator phase independently.

26. Voltage Regulator Adjusting Rheostat

a. Location. The voltage regulator adjusting rheostat (13, fig. 14) is located on the control panel.

b. Description. A rotary, vitreous-enameled, 100-ohm type.

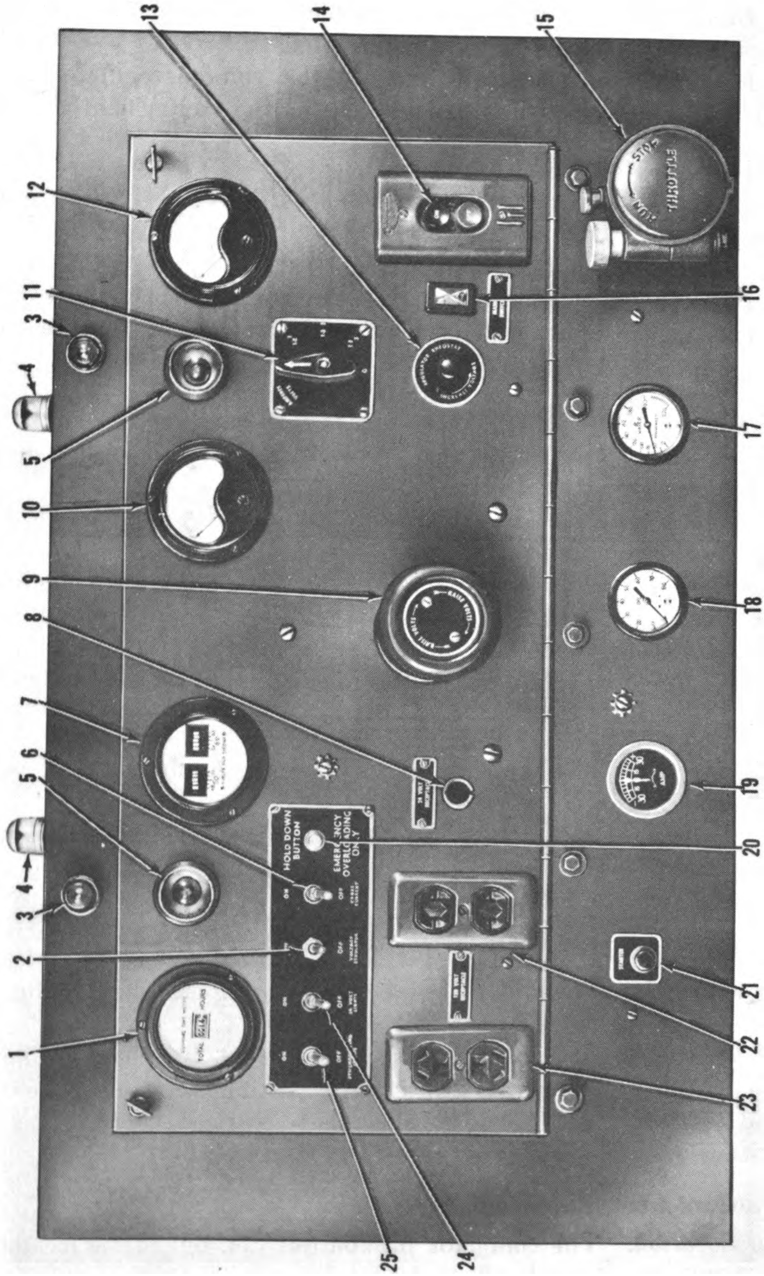
c. Purpose. To provide a means of adjusting the value of the regulated voltage when the voltage regulator switch (2) is in the ON position.

27. Contactor Pushbutton

a. Location. The contactor pushbutton (14, fig. 14) is located on the control panel.

b. Description. An ON-OFF, pushbutton type switch.

c. Purpose. To open or close the load contactor.



1 Engine hour-meter
2 Voltage regulator switch
3 Panel lights
4 Panel light shields
5 Synchronizing lights
6 Cross-current switch
7 Frequency meter
8 24-volt d-c receptacle
9 Exciter field rheostat
10 Voltmeter
11 Ammeter-voltmeter phase switch
12 A-c ammeter
13 Voltage regulator adjusting rheostat
14 Contactor pushbutton
15 Vernier throttle control
16 Contactor indicating light
17 Coolant temperature gage
18 Engine oil pressure gage
19 Battery charging ammeter
20 Emergency overload switch
21 Engine main starter button
22 120-volt a-c receptacle
23 120-volt a-c polarized receptacle
24 Panel light switch
25 Synchronizing light switch

Figure 14. Control panel.

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28. Vernier Throttle Control

a. Location. The vernier throttle control (15, fig. 14) is located on the lower right section of the control panel.

b. Description. A device designed to give fine adjustment to throttle movement.

c. Purpose. To permit final adjustment of engine speed within fine limits.

29. Emergency Overload Switch

a. Location. The emergency overload switch (20, fig. 14) is located on the control panel.

b. Description. A single-pole, single-throw, normally open push-button type.

c. Purpose. To permit overloading of the generator set for short periods, for reasons such as starting large induction motors which require high initial starting power.

30. Diesel Engine Main Starter Button

a. Location. The diesel engine main starter button (21, fig. 14) is located on the control panel.

b. Description. A single-pole, single-throw, normally open push-button type switch.

c. Purpose. To close the circuit to the engine starting motor which cranks over the engine for starting.

31. Panel Light Switch

a. Location. The panel light switch (24, fig. 14) is located on the control panel.

b. Description. A single-throw toggle switch.

c. Purpose. To control the panel illuminating lights (3).

32. Synchronizing Light Switch

a. Location. The synchronizing light switch (25, fig. 14) is located on the control panel.

b. Description. A three-pole, single-throw toggle type switch.

c. Purpose. To energize the synchronizing lights (5).

33. Engine Hour-Meter

a. Location. The engine hour-meter (1, fig. 14) is located on the control panel.

b. Description. An electrically operated, direct-reading indicator, with a five-place set of figure wheels.

c. Purpose. To record the elapsed operating time of the generator set for operational checks and periodic inspections.

34. Synchronizing Lights

a. Location. The synchronizing lights (5, fig. 14) are located on the control panel.

b. Description. 10-watt, 110–125-volt, type S11, intermediate screw base types.

c. Purpose. To indicate, during the paralleling procedure of two generators, when the speeds are equal and the generators may be interconnected.

35. Frequency Meter

a. Location. The frequency meter (7, fig. 14) is located on the control panel.

b. Description. A vibrating reed type which enables the operator to read the frequency directly from the reed which is vibrating at its maximum amplitude.

c. Purpose. To indicate the alternating current output frequency.

36. Voltmeter

a. Location. The voltmeter (10, fig. 14) is located on the control panel.

b. Description. A direct-reading, double-scale type; the top scale is graduated from 0 to 300 volts and the lower scale from 220 to 600 volts.

c. Purpose. The instrument is wired across a selector switch which enables the operator to read the voltage across the lines of each phase, and the voltage from T–3 to T–0.

37. Ammeter

a. Location. The a-c ammeter (12, fig. 14) is located on the control panel.

b. Description. A direct-reading, double-scale ammeter (0–75 amperes and 0–150 amperes).

c. Purpose. To indicate the amperage of each phase.

38. Contactor Indicating Light

a. Location. The contactor indicating light (16, fig. 14) is located on the control panel.

b. Description. A 115-volt neon lamp mounted back of a red lens.

c. Purpose. To indicate the open and closed positions of the main load contactor. When the light shows red it indicates that the main load contactor is in a closed position.

39. Coolant Temperature Gage

a. Location. The coolant temperature gage (17, fig. 14) is located on the lower section of the control panel.

b. Description. A direct-reading gage calibrated from 0° F. to 220° F. A danger zone of operation is indicated on the dial in red for temperatures above 212° F.

c. Purpose. To indicate the coolant temperature.

40. Engine Lubricating Oil Pressure Gage

a. Location. The engine oil pressure gage (18, fig. 14) is located on the lower section of the control panel.

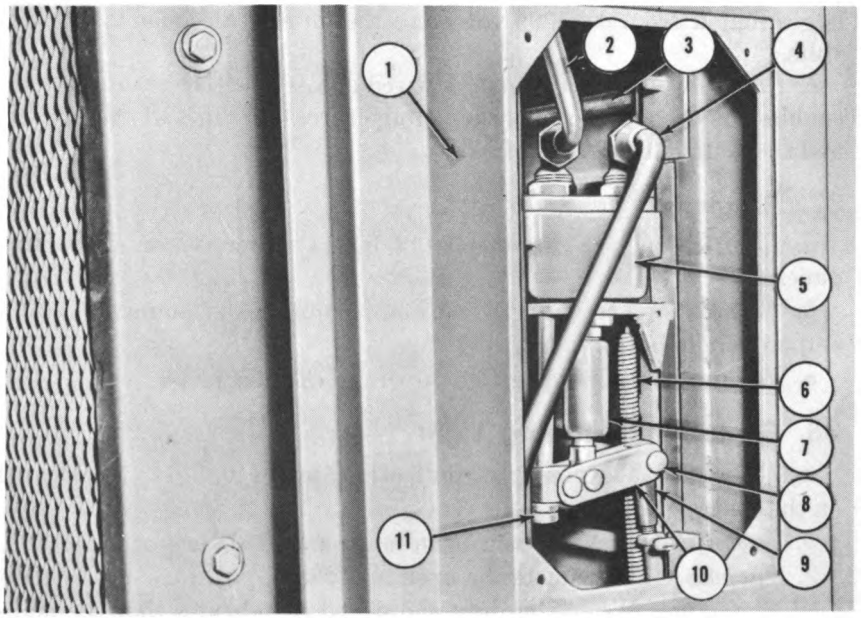
b. Description. A direct-reading gage, calibrated from 0 to 80 pounds. A danger zone of operation is indicated on the dial in red for pressure below 12 psi.

41. Battery Charging Ammeter

a. Location. The battery charging ammeter (19, fig. 14) is located on the lower section of the control panel.

b. Description. A direct-reading ammeter having the neutral position of the pointer in the center of the dial scale, thus permitting two polarity readings.

c. Purpose. To indicate the rate of battery charge or discharge, thus giving a rough check on both the state of charge in the battery and the charging condition of the generator.



1 Front cowl assembly
2 Inlet tube from engine
3 Radiator shutter vane
4 Outlet tube to lubrication oil cooler
5 Thermostat housing
6 Spring
7 Plunger
8 Clevis pin
9 Vane position control rod
10 Automatic shutter control lever arms
11 Adjusting nut and locknut

Figure 15. Automatic shutter control, access plate removed.

42. Automatic Shutter Control

a. Location. The automatic shutter control (fig. 15) is located to the right of the radiator shutter inside the front cowl assembly.

b. Description. A bellows type thermostat and plunger actuated by a flow of radiator coolant.

c. Purpose. To open automatically the shutters in direct proportion to the radiator coolant temperature.

43. Battery Thermal Overload Circuit Breaker

a. Location. The battery thermal overload circuit breaker (14, fig. 16) is located at the extreme left-hand side of the heater control panel.

b. Description. A thermostat type circuit breaker.

c. Purpose. To remove automatically from the engine control circuit any overload imposed by the winterization kit blower motor or igniter.

44. Heater Fuel Supply Solenoid Valve

a. Location. The heater fuel supply solenoid valve (6, fig. 16) is located to the right of the heater control panel.

b. Description. A solenoid designed to operate the heater gasoline fuel supply valve.

c. Purpose. To close the heater fuel supply solenoid valve to prevent the engine from overheating.

45. Battery Box Overheat Solenoid

a. Location. The battery box overheat solenoid (5, fig. 16) is located on the left side of the winterization heater combustion chamber.

b. Description. A 24-volt rotary solenoid.

c. Purpose. To close the vane on the battery box air tube (11, fig. 4), when de-energized by action of the battery box thermostat.

46. Winterization Heater "High-Low" Fuel Valve

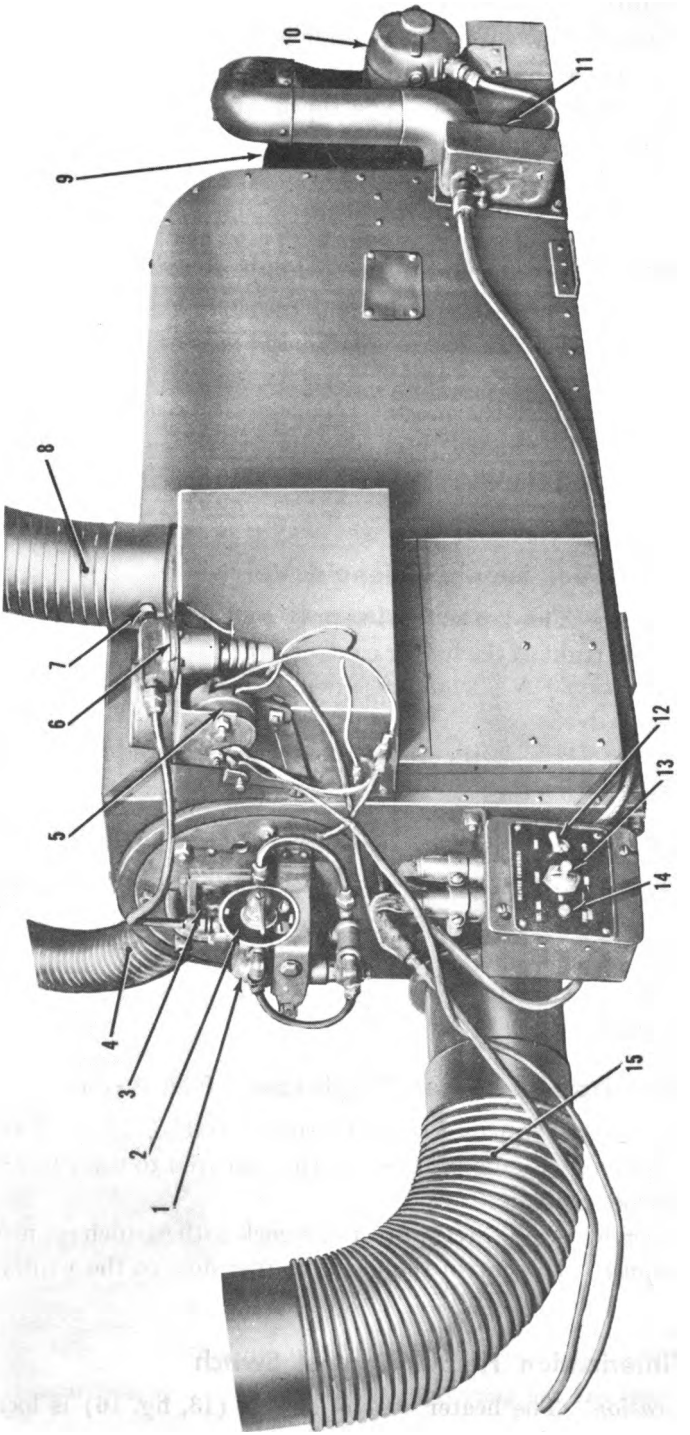
a. Location. The winterization heater HIGH-LOW fuel valve (2, fig. 16) is mounted on a bracket which is secured to the winterization heater burner plate.

b. Description. A three-way bronze cock with 3/8-inch connection.

c. Purpose. To control the gasoline fuel flow to the winterization heater.

47. Winterization Heater Control Switch

a. Location. The heater control switch (13, fig. 16) is located on the winterization heater control panel.



1 Gasoline float chamber
2 Fuel "HIGH-LOW" valve
3 Heater observation window
4 Heater outlet duct to starter gear box
5 Battery box overheat solenoid
6 Heater fuel supply solenoid valve
7 Gasoline fuel connection
8 Heater outlet duct to battery duct
9 Blower housing
10 Blower motor
11 Heater blower junction box
12 Blower motor control switch
13 Heater control switch
14 Battery thermal overload circuit breaker
15 Heater outlet duct to engine oil pan

Figure 16. Winterization kit.

b. Description. A double-pole, double-throw toggle switch having three positions OFF, START, and RUN.

c. Purpose. To control the ignition system of the winterization heater (par. 55).

48. Winterization Kit Blower Motor Control Switch

a. Location. The blower motor control switch (12, fig.16) is located on the winterization heater control panel.

b. Description. A double-pole, double-throw switch having three positions OFF, HIGH, and LOW.

c. Purpose. To control the blower motor speed.

Section III. OPERATION UNDER USUAL CONDITIONS

49. General

a. The instructions in this section are published for the information and guidance of the personnel responsible for the operation of this generator set.

b. It is essential that the operator thoroughly understand the proper operation of the generator set. This section gives instructions on starting and stopping the generator set and placing it in service, paralleling two or more units, and the general operation of the unit under normal operating and weather conditions.

50. Starting

a. Starting (Above 32° F.)

(1) Refer to paragraph 70*c* for before-operation services to be performed.

(2) Press starter button (21, fig. 14) to start engine. Release starter button when engine starts.

Caution: Do not operate starter over 30 seconds at a time to avoid overheating.

(3) Check engine oil pressure on gage (18) immediately after starting. If pressure is less than 16 psi, stop engine and check lubricating system.

(4) Observe coolant temperature gage (17). Temperature should not exceed 205° F.

(5) Allow engine to run at approximately 900 rpm or slightly above idling speed for about 5 minutes. In an emergency this warmup period may be disregarded and the load may be applied as soon as oil pressure reaches 20 psi or over.

(6) Turn throttle (15) counterclockwise to RUN position, as indicated by panel marking.

b. Starting in Cold Weather (0° F. to 32° F.)

(1) Refer to paragraph 70*c* for before-operation services to be performed.

(2) Open air heater fuel valve (11, fig. 13) and operate air heater pump (9) on auxiliary starting panel while pressing the auxiliary starter button (7). As soon as engine starts, release starter button (7), stop pumping, and close air heater fuel valve (11).

(3) Proceed as directed in *a*(3) through (6) above.

51. Stopping

a. Momentarily press the contactor pushbutton (14, fig. 14) in the OFF position.

b. Adjust throttle (15) to reduce engine speed to approximately 900 rpm or slightly above idling speed.

c. Turn the throttle counterclockwise to the STOP position.

52. Operating Details

a. General. Two or more generators may be operated in parallel where greater generator capacity is required. The following instructions cover both single unit and parallel operation.

b. Single Unit Operation.

(1) Check terminal box and connect for required voltage, and start unit as instructed in paragraph 50*a*.

(2) Turn vernier knob on throttle and adjust the engine speed until the desired frequency is indicated on the frequency meter (7, fig. 14). An engine speed of 1040 rpm will give 52 cycles, and a speed of 1240 rpm will give 62 cycles.

(3) Check a-c voltmeter for desired output voltage (generator rated voltage of 120/208 or 240/416 volts at 60 cycles, or 240/416 volts at 50 cycles).

(4) Adjust voltage by turning voltage regulator rheostat (13) clockwise to lower the voltage, or counterclockwise to raise the voltage.

(5) Apply load by momentarily pressing the contactor pushbutton (14) in the ON position.

(6) For emergency overloading of generator, such as for starting large induction motors, press emergency overload switch (20) and hold for approximately 5 seconds after load has stabilized.

(7) Refer to paragraph 70*d* for during-operation services.

c. Parallel Operation.

Warning: Generator sets operating in parallel must have bars or voltage changeover-boards positioned for the same output voltage.

(1) The main load terminals on the load terminal board assembly (9, fig. 2) of both generator sets are marked T–1, T–2, T–3, and T–0. When setting up two generator sets for parallel operation connect the like main load terminals; T–1 on one set to T–1 on the other set. Repeat this procedure, connecting T–2 to T–2, T–3 to T–3, and T–0 to T–0.

Warning: Before making line connections be sure neither generator set is running and both main load contactors are open.

(2) Start one unit according to instructions in paragraph 50*a*.

(3) Start the other unit according to instructions in *b* above. This is the unit to be paralleled.

(4) Check voltmeters of each unit to be certain they read the same. If necessary, adjust voltages according to *b* (4) above so that they read the same.

(5) Check the frequencies of the units to be paralleled. They must be operating at the same frequency. Adjust frequency according to *b* (2) above.

(6) On the unit to be paralleled, perform the following operations.

(*a*) Place synchronizing light switch (25, fig. 14) in the ON position.

(*b*) Place cross-current switch (6) in the ON position.

(*c*) Observe synchronizing lights (5) when fluctuations of the lights become very slow (about one in 2 or 3 seconds), wait until they are completely dark, and close main contactor by momentarily pressing the ON contactor pushbutton (14).

Warning: The contactor may be closed only when the synchronizing lights are completely dark.

(7) Divide the ampere load between the two units.

(*a*) Turn vernier throttle control knob (15) counterclockwise on the unit having the low ammeter reading until both ammeters read the same.

(*b*) Correct cross-currents if they exist. For example, if the two machines are operated across a 100-ampere load and the total reading of the equalized ammeters is 120 amperes, it indicates cross-currents between generators, with a loss in generator output capacity of 20 amperes. Correct by adjusting voltage regulator adjusting rheostat (13) until both ammeters (12) read 50 amperes, or fall to their lowest point and start to rise to the required correct current.

(*c*) Correct the voltage of the paralleled generator sets, if necessary, by adjusting the voltage regulator adjusting rheostat (13) of each unit the same amount and direction.

(*d*) To raise or lower the frequency of paralleled units, adjust the vernier throttle control (15) of each unit the same amount and direction.

(8) Place the synchronizing light switch (25) in the OFF position.

(9) Refer to paragraph 70*d* for during-operation services.

Caution: When operating generator sets in parallel, ascertain that the load does not exceed the remaining available power before removing one generator from the line.

53. Manual Voltage Control

In the event of voltage regulator failure, the voltage of the generator may be controlled manually by placing the voltage regulator switch (2, fig. 14) in the OFF position and adjusting the exciter field rheostat (9) to obtain the desired voltage.

54. Movement to New Location

a. Disconnect power lines from main load terminals.

b. Start engine and run at 60 cycles under no load for 15 minutes. Shut down engine.

c. Thoroughly drain all fuel lines, fuel filters, fuel pump, and injectors. Drain fuel tank.

d. Drain gasoline tank.

e. Drain lubricating oil system.

f. Disconnect exhaust piping if used.

g. Disconnect battery terminals.

h. Close and latch all access doors.

i. Place generator set on truck or other carrier as follows:

(1) Lift by a sling attached to lifting eyebolt (6, fig. 1).

(2) Loop the ends of a towing cable bridle over a rod placed in the towing tube at either end of the skid. Tow up the ramp by means of a winch or other tractive power.

j. Nail chock blocks (3, fig. 9) to floor of carrier at each end and sides of the skid to prevent movement of the generator set on carrier during travel. Further secure skid by means of ½-inch cables (1) through towing tubes (7), lashed to carrier at each end. This method is applicable to trailer carrier or a railroad car.

k. At new location, remove generator set from carrier by lifting or by winching down ramp.

l. Service engine as directed in paragraph 6*g*.

m. Reinstall as directed in paragraph 6*h*.

Section IV. OPERATION OF MATERIEL USED IN CONJUNCTION WITH GENERATOR SET

55. Winterization Heater

a. Starting.

(1) Open winterization heater fuel valve at the left of the gasoline supply tank on line (9, fig. 4).

(2) Turn the heater fuel HIGH-LOW valve (2, fig. 16) to the HIGH position.

(3) Place the blower motor control switch (12) in the HIGH position.

(4) Place the heater control switch (13) in the START position.

(5) Observe through heater observation window (3) when heater fires (time required for heater to fire, approximately 1 minute).

Warning: If the heater fails to ignite or goes out during starting procedure, the air ducts must be cleared of gasoline fumes to prevent an explosion. Turn the HIGH-LOW valve (2) to OFF, the heater control switch (13) to RUN, and the blower motor control switch (12) to HIGH. Permit at least 1 minute to elapse before an attempt is made to ignite the heater again.

(6) Place the heater control switch (13) in the RUN position.

(7) When the engine coolant temperature gage (17, fig. 14) indicates 50° F., the generator set is ready for starting. With an ambient temperature of −65° F., 1 hour will be required from the time of firing the heater until the 50° F. reading will be obtained.

b. Stand-By Heater Operation.

(1) Open winterization heater fuel valve at the left of the gasoline supply tank on line (9, fig. 4).

(2) Turn the heater fuel HIGH-LOW valve (2, fig. 16) to the LOW position.

(3) Place blower motor control switch (12) in the LOW position.

(4) Place heater control switch (13) in the START position.

(5) Observe through window (3) when the heater fires (time required, 3 minutes).

(6) Place the heater control switch (13) in the RUN position.

Note. When the heater is on stand-by operation, operate the engine several hours daily to maintain battery charge.

c. Stopping.

(1) Turn heater fuel HIGH-LOW valve (2) to the OFF position.

Note. Fire in heater will continue to burn for approximately 15 minutes because of fuel still in vaporizer.

(2) After about 15 minutes, turn heater control switch (13) to the OFF position.
(3) Turn winterization heater fuel valve on line (9, fig. 4) to the OFF position.

56. Fire Extinguisher

a. Operation. Remove fire extinguisher (13, fig. 4) from rack and unlock by turning handle to the left. Using the handle as a pump, direct the stream of liquid to the base of the flames.

b. Refilling. Refer to TM 5–687 and TM 9–1799 for refilling instructions.

57. Auxiliary Fuel Lines

a. General. Two lengths of flexible fuel hose (12, fig. 2) are supplied with the unit for connecting an outside drum to the fuel valves. They are used for filling or draining the engine fuel tank, or for receiving the fuel supply from an outside source.

b. Use. Connect one hose to the fuel supply valve (4, fig. 3) and the other hose to the fuel return valve (5). Connect the other ends of the two hoses to an external diesel fuel source.

Section V. OPERATION UNDER UNUSUAL CONDITIONS

58. Operation in Extreme Cold (Below 0° F.)

a. Cooling System Protection.
(1) Drain all water from cooling system and flush until water running from system is clear.
(2) Check system for leaks and make necessary repairs.
(3) Fill cooling system with antifreeze solution. Refer to table II for the amount of antifreeze solution required.

b. Heating Prior to Starting. The generator set is equipped with special winterization heating equipment to facilitate the engine starting operation by heating the crankcase and starting motor housing and batteries. For starting and standby procedures using the winterization kit, see paragraph 55*a*.

c. Heater Fuel Tank. Fill the heater fuel tank with gasoline. To each full tank, add 4 ounces of denatured alcohol.

d. Special Lubrication. Refer to LO 5–5009 for special lubrication procedure.

e. Dry Alternator. Keep the alternator dry and free from foreign material. Wipe any condensed moisture from alternator prior to starting.

Table II. Guide for the Initial Preparation of Antifreeze Solutions

Protection to	Pints of antifreeze compound to be included in 1 gallon of antifreeze solution	Protection to	Pints of antifreeze compound to be included in 1 gallon of antifreeze solution
20° F	1½	−30° F	4
10° F	2	−40° F	4¼
0° F	2¼	−50° F	4½
−10° F	3¼	−60° F	4¾
−20° F	3½		

Table III. Specific gravity temperature corrections (corrected to 80° F.)

Available cranking power (percent)	−65° F.	−40° F.	−20° F.	−10° F.	0° F.	+20° F.	+40° F.	+60° F.	+80° F.	+100° F.	+110° F.	+120° F.
50	1. 277	1. 267	1. 259	1. 255	1. 251	1. 243	1. 236	1. 229	1. 220	1. 213	1. 209	1. 205
58.3	1. 287	1. 277	1. 269	1. 265	1. 261	1. 253	1. 246	1. 239	1. 230	1. 223	1. 219	1. 215
66.6	1. 297	1. 287	1. 279	1. 275	1. 271	1. 263	1. 256	1. 249	1. 240	1. 233	1. 229	1. 225
75	1. 307	1. 297	1. 289	1. 285	1. 281	1. 273	1. 266	1. 259	1. 250	1. 243	1. 239	1. 235
83.3	1. 317	1. 307	1. 299	1. 295	1. 291	1. 283	1. 276	1. 269	1. 260	1. 252	1. 248	1. 245
91.6	1. 327	1. 317	1. 309	1. 305	1. 301	1. 294	1. 286	1. 279	1. 270	1. 262	1. 258	1. 255
100	1. 338	1. 328	1. 320	1. 316	1. 312	1. 304	1. 296	1. 289	1. 280	1. 272	1. 268	1. 265

f. Use of Exciter Field Rheostat to Control Field. The generator has been designed to operate through a wide range of temperatures. Sufficient field control may be obtained by using the exciter field rheostat to operate the generator from minus 60° F. to plus 120° F. without the addition of external resistors in series with the exciter field.

g. Extend Stabilization Period to 15 Minutes. In operating the generator in extreme cold, it is advisable to allow a stabilization period of about 15 minutes if possible prior to making any load connections, or paralleling generator sets.

h. Care of Wiring Harness. The wiring harness will become brittle in extreme cold and should be warmed before bending or rewiring.

i. Batteries (fig. 11).

(1) Keep batteries fully charged. Hydrometer readings for a fully charged battery should be between 1.275 and 1.300 at 80° F. A fully charged battery will withstand severe low temperatures, whereas a partially charged battery will freeze, with consequent cell rupture. A fully charged battery will not freeze at temperatures as low as −65° F.

Caution: Do not add water to a battery in subzero temperatures unless battery is to be charged immediately. If water is added and battery not charged, the added water will stay at the top and freeze before it has had a chance to mix with the acid.

(2) The specific gravity readings of batteries change with temperature, and should be corrected to compare with a fully charged cell at 80° F. Table III gives the specific gravity readings over a wide range of temperatures for convenience in checking batteries.

59. Operation in Extreme Heat

a. Check coolant level frequently and maintain at proper level.

b. Be sure radiator shutters are open wide.

c. See that end bell screens and cooling grilles are exposed to the surrounding air and kept free of any obstruction, in order to allow free circulation of cooling air through the generator set.

d. When operating indoors, allow sufficient space around generator set for circulation of air. Ventilate the room as well as possible to carry waste heat outside.

e. When operating in relatively dust-free air, remove the canopy and side shields to allow maximum cooling effect. Where sand or dust is present in large quantities, the canopy must remain in place.

f. If required, control the generator field by the exciter field rheostat. For procedure, refer to paragraph 53.

60. Operation Under Sandy or Dusty Condiitons

a. General. When operating the generator set in conditions of extreme dust, locate the unit in a sheltered area if possible. Take advantage of any natural barriers which may offer protection from blowing dust. If installation is more than temporary, erect a protective shield or shelter. When water is plentiful, wet down the area immediately surrounding the generator set.

Caution: If area has been wet down, take extreme care when servicing generator. Provide a dry wooden platform for operators or service personnel.

b. Engine Operation.

(1) Wipe down engine immediately upon shutting down. Do not allow dirt to accumulate. Blow out with compressed air.

(2) Clean air cleaner and renew oil in sump daily.

c. Generator Operation.

(1) Keep side doors to generator set closed if temperature conditions will allow.

(2) Clean end bell screens and cooling grilles to prevent openings from filling.

61. Operation in High Humidity and Salt Water Areas

a. Keep the generator set dry. Wipe all condensed moisture from surfaces.

b. Check carefully for signs of possible corrosive action on unpainted parts. Sandpaper all corroded external surfaces and repaint immediately.

c. Operation in these areas requires more frequent lubrication of the generator set than specified on the lubrication order. The oil filter, starting motor, and engine generator should be serviced weekly. Service the air cleaner twice a week.

62. Operation in High Altitudes

The generator set is capable of satisfactory performance under continuous full load at altitudes to 5,000 feet. Above 5,000 feet the engine will deliver approximately 80 percent of its sea level output. As the altitude at which the set is operated increases, the load capacity of the generator set decreases. Service the air cleaner daily. Reduce the load requirements of the generator set to compensate for the efficiency loss of the engine.

CHAPTER 3

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. ORGANIZATIONAL TOOLS AND EQUIPMENT

63. General

The tools and equipment listed in this section are those that are required to perform organizational maintenance on the generator set WGD–3012. Standard mechanic's handtools are not enumerated in this section.

64. On-Equipment Tools

The on-equipment tools normally supplied with this equipment for the use of the operator are listed in appendix III.

65. Special Organizational Maintenance Tools and Equipment

No special organization maintenance tools and equipment are required.

Section II. LUBRICATION AND PAINTING

66. General Lubrication Information

a. LO 5–5009 prescribes first and second echelon lubrication maintenance for the Model WGD–3012 generator set.

b. A lubrication order is published for each item of equipment. The lubrication order shown in figure 17 is a reproduction of an approved lubrication order for this generator set. For the current LO 5–5009, refer to SR 310–20–4.

c. Lubrication orders prescribe the approved first and second echelon lubrication procedures. The instructions contained therein are mandatory.

67. Detailed Lubrication Information

a. Lubrication Equipment. Keep lubricating equipment where it will be safe from damage and free from dust and dirt. Clean the equipment both before and after use.

b. Points of Application. Lubrication fittings, grease cups, and oil holes are readily located by reference to the lubrication order. Wipe these devices and surrounding surfaces clean before applying lubricant.

LUBRICATION ORDER **LO 5-5009**

13 November 1953

GENERATOR SET, ELECTRIC, PORTABLE, DIESEL DRIVEN, SKID MOUNTED, 30 KW, 60 CYCLE, 120/208 OR 240/416 VOLT, 3 PHASE, CONVERTIBLE TO 50 CYCLE, 120/208 OR 240/416 VOLT, 3 PHASE, STEWART AND STEVENSON MODEL WGD-3012

Intervals given are maximums for normal 8-hour day operation. For abnormal conditions or activities, intervals should be shortened to compensate.

Clean fittings, before lubricating.

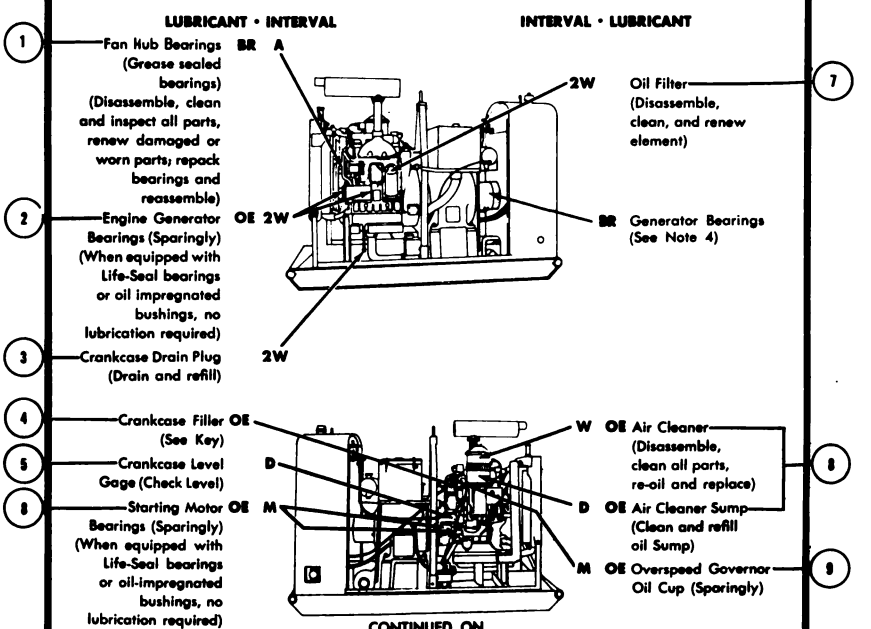
Relubricate after washing.

Clean parts with SOLVENT, dry-cleaning, or OIL, fuel, Diesel. Dry before lubricating.

Drain crankcase only when hot after operation; replenish and check level when cool.

—KEY—

LUBRICANT	CAPACITY	EXPECTED TEMPERATURES			INTERVALS
		Above +32°F	+32°F to −10°F	−10 F to −65°F	
OE—Oil, Engine, Heavy Duty		OE 30 or 9250	OE 10 or 9110	See Note 1	D—Daily W—Weekly 2W—Two Week M—Monthly A—Annually
Crankcase	17½ qts				
Air Cleaner	2 qts.	OE 30 or 9250	OE 10 or 9110	OHA	
Other Points		OE 50 or 3100	OE 30 or 9250	OHA	
BR—LUBRICANT, Ball and Roller Bearing.					
OHA—OIL, Hydraulic, Aircraft, Petroleum Base.					



CONTINUED ON FOLLOWING PAGE

Figure 17. Lubrication order.

CONTINUED FROM
PRECEDING PAGE

NOTES:

1. COLD WEATHER (When winterization kit is not available)—Every 3 days, drain crankcase and refill to "full" mark with OE 10. Add 4½ qts. of gasoline and run engine 5 minutes to mix. Mark the new level on the oil gage for future reference.

CAUTION: Every ½ day check level and fill to "Full" mark with OE 10. If engine is to be shut down for ½ day or more, add 4½ qts. of gasoline to reach new level mark and run engine 5 minutes to mix.

NOTE: Oil, fuel, Diesel may be used as a temporary diluent only when sufficient gasoline is not available.

WARNING: Diluent used is inflammable: do not service equipment near heater or open flame.

2. OIL CAN POINTS: Weekly, lubricate all control linkages and clevises with OE.

3. DO NOT LUBRICATE: Blower motor.

4. GENERATOR BEARINGS—Generator is provided with Norma-Hoffman bearings which should operate satisfactorily for several years without attention. After 3 years of operation, remove seals, remove bearings and wash them carefully in carbon tetrachloride. Bearings should be replaced if any trace of wear or damage is observed. When dry, pack bearings carefully in grease, replace, install new seals and reassemble generator. Once bearings have been repacked, they should be inspected without fail each year.

Copy of this Lubrication Order will remain with the equipment at all times; instructions contained herein are mandatory and supersede all conflicting lubrication instructions dated prior to the date of this Lubrication Order.

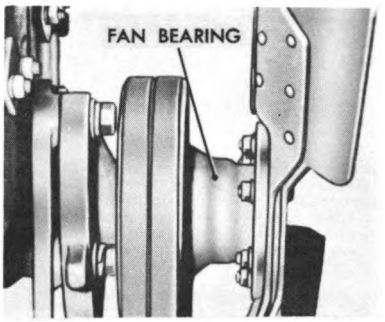
BY ORDER OF THE SECRETARY OF THE ARMY

M. B. RIDGWAY
Chief of Staff
United States Army

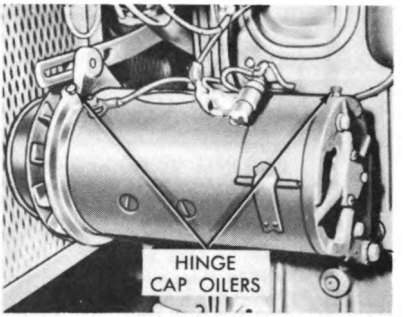
OFFICIAL:

WM. E. BERGIN
Major General, U S A
The Adjutant General

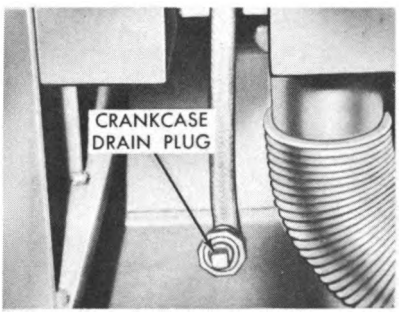
Figure 17—Continued.



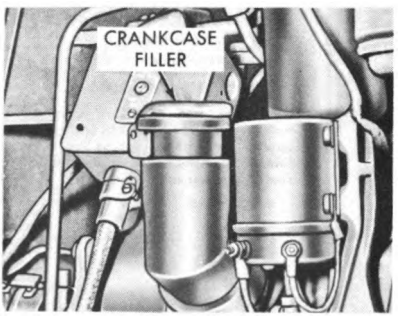
REFERENCE 1: Clean and repack.



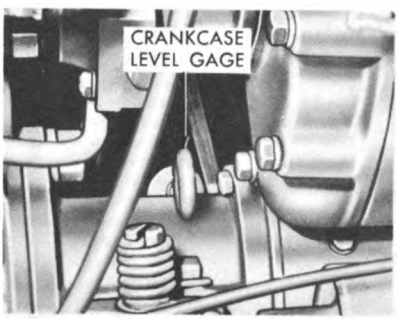
REFERENCE 2: Lubricate sparingly every two weeks.



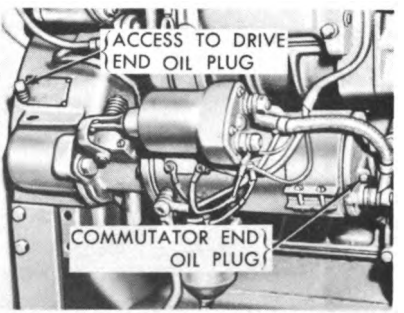
REFERENCE 3: Drain.



REFERENCE 4: Refill.



REFERENCE 5: Check level.

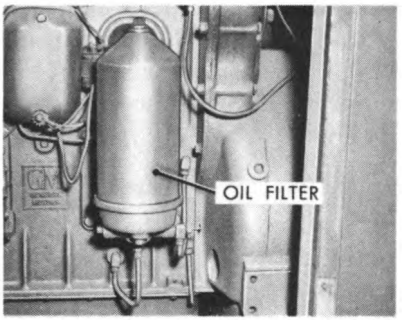


REFERENCE 6: Lubricate sparingly monthly.

Figure17—Continued.

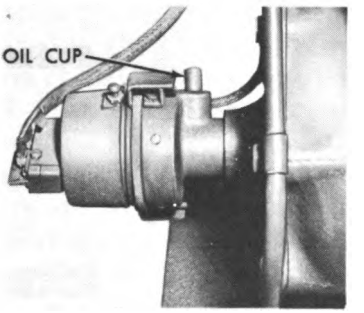
c. Cleaning. Use cleaning solvent to wash all parts. After washing, dry parts thoroughly before applying lubricant.

d. Operation Immediately After Lubrication. Start the unit and run it for 15 minutes at idling speed to distribute the oil throughout the engine.



REFERENCE 7: Disassemble, clean and renew element.

REFERENCE 8: Disassemble, clean, re-oil, replace. Refill sump.



REFERENCE 9: Oil sparingly.

Figure 17—Continued.

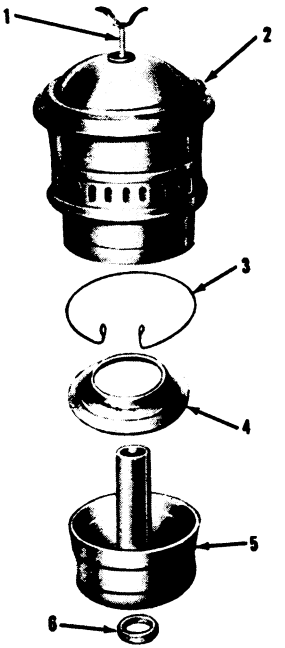
e. Air Cleaner (fig. 18).

(1) *Removal.* Loosen the air cleaner wingbolt assembly (1) which secures the air cleaner to the air inlet housing flange, and lift off the air cleaner and shell gasket (6).

(2) *Disassembly.* Separate the housing (2) and cup assembly (5). Lift the baffle snap ring (3) and baffle (4) from the cup assembly (5).

(3) *Cleaning and inspection.* Remove dirty oil and sludge from cup assembly. Wash reservoir in cleaning solvent. Clean metal-wool element by immersing in cleaning solvent. Air-blow dry. Inspect parts for mechanical damage. Replace any damaged parts.

(4) *Reassembly and installation.* Refill cup to level mark with oil as specified on LO 5–5009. Install baffle (4) and snap ring (3). Mount with gasket on air intake housing flange. Slip the housing (2) down on cup assembly and secure with



1 Wingbolt assembly
2 Housing
3 Baffle snap ring
4 Baffle
5 Cup assembly
6 Shell gasket

Figure 18. Air cleaner, disassembled.

wingbolt (1). Make sure that connection between air inlet housing and air cleaner is tight.

Caution: Do not add oil above level mark.

f. Starting Motor. Lubricate the starting motor. Gain access to the drive end oil plug on the starting motor by removing the ½-inch pipe plug from the flywheel housing.

Caution: Avoid excessive lubrication of the starting motor, particularly at the commutator end. If lubricant is forced out onto the commutator, it will cause poor commutation with a resulting decrease in starting motor performance. Never attempt to lubricate the starting motor while it is being operated.

g. Lubricating Oil Filter (fig. 19). Remove drain plug (18) at the bottom of the filter, and drain. Unscrew center stud (9) and remove gasket (8). Withdraw shell (7) and filtering element (5). Remove two flat washers (3), two felt gaskets (4), and spring (6). Discard oil filtering element (5) and oil filter cover gasket (2). Wash shell (7) and oil filter base (15) with cleaning solvent, and dry thoroughly. Reassemble using new oil filter cover gasket (2) and new filtering element (5). Install gasket (2) in oil filter base (15). Place gasket (8) over center stud (9) in shell (7), and slide the spring (6),

one flat washer (3), and one felt gasket (4) over center stud. Insert center stud (9) in new filtering element (5), and place one felt gasket (4) and one flat washer (3) over the end of center stud (9). Place assembly on base (15) and secure with center stud (9). Replace drain plug (18).

68. Painting

a. General. Any metal surface showing signs of rust or corrosion or evidence of chipped, cracked or broken paint must be repainted. The surface to be painted must be free from rust, dirt, grease, kerosene, alkali, and moisture. Paint will not adhere properly to an unprepared surface.

b. Cleaning.

(1) Remove rust and loose scale, if any, by wire-brushing, phosphoric acid metal conditioner or other means of descaling such as abrasive paper, cloth, or steel wool. Various grain and grade sizes available are listed in ORD 3 SNL K–1.

Caution: Do not use emery paper or steel wool near the generator, fan motor, or switchgear, as the abrasive particles will conduct electricity.

(2) Wash and prepare metal surfaces according to standard military procedures as given in TM 9–2851.

(3) Mask all nameplates, as well as generator vents, motor vents, electrical terminal connections, and engine openings to be sure that no paint is applied to these surfaces.

Section III. PREVENTIVE MAINTENANCE SERVICES

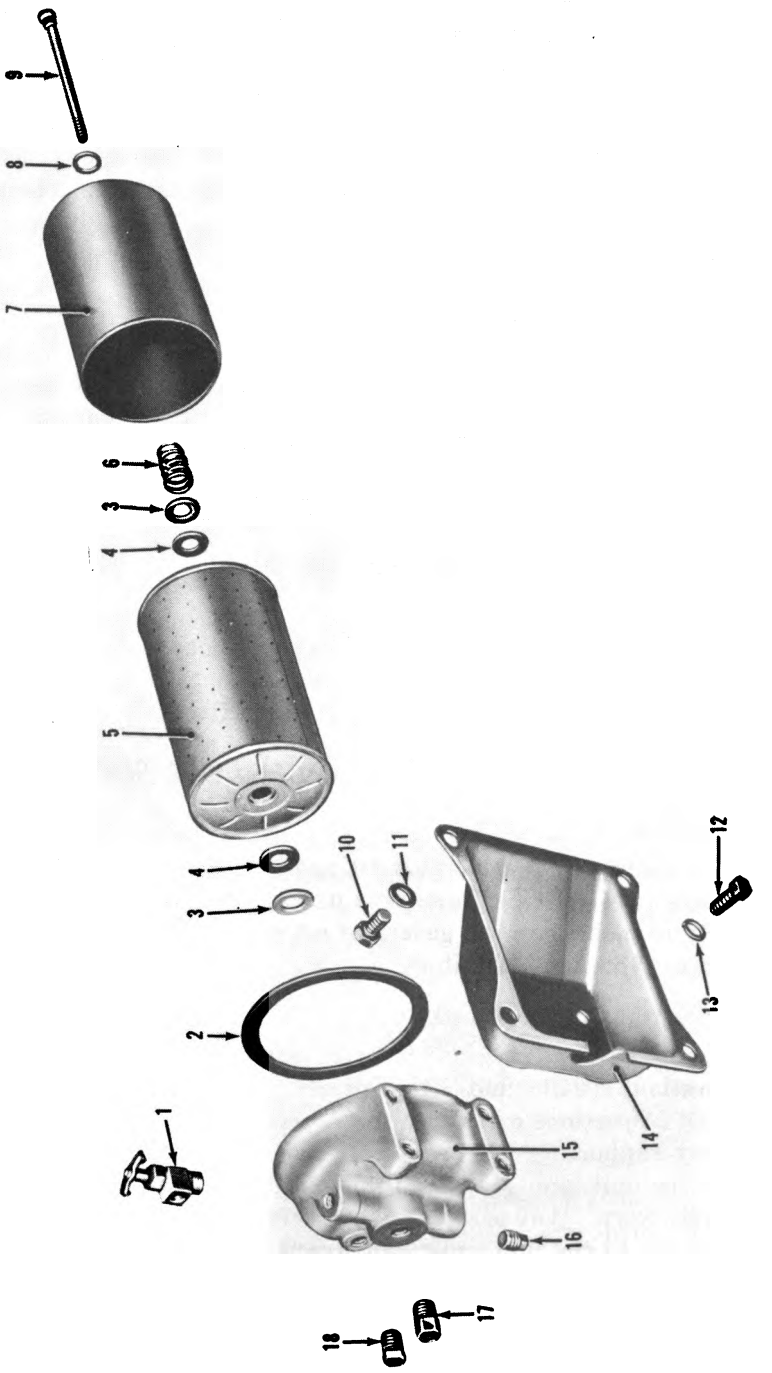
69. General

The operator of the generator set and the organizational maintenance personnel must perform their preventive maintenance services regularly to make sure the generator set operates well and to lessen the chances of mechanical failure.

70. Operator Maintenance

a. Inspections. Inspections must be made before-operation, during-operation, at-halt, and after-operation, as described in this section. All inspections of assemblies, subassemblies, or parts must include any supporting members or connections and must determine whether the unit is in good condition, correctly assembled, secure, or excessively worn. Any mechanical condition which may result in further damage to the unit must be corrected before the equipment is operated.

(1) The inspection for "good condition" is usually an external, visual inspection to determine whether the unit is damaged beyond safe or serviceable limits, or if it is in such a condi-



1 Valve
2 Oil filter cover gasket
3 Flat washer (2 req'd)
4 Felt gasket (2 req'd)
5 Filtering element
6 Spring
7 Shell
8 Center stud gasket
9 Center stud
10 Cap screw, hex hd, 3/8–16 x 3/4 (4 req'd)
11 Lockwasher, 3/8 (4 req'd)
12 Cap screw, 3/8–16 x 3/4 (4 req'd)
13 Lockwasher, 3/8 (4 req'd)
14 Mounting bracket
15 Oil filter base
16 Plug, 1/4 inch (1 req'd)
17 Connector
18 Drain plug, 1/4 inch (1 req'd)

Figure 19. Lubricating oil filter, disassembled.

tion that damage will result from its operation. The term "good condition" is further defined as: not bent or twisted; not chafed or burned; not broken or cracked; not bare or frayed; not dented or collapsed; not torn or cut; adequately lubricated.

(2) Inspection of a unit to see that it is "correctly assembled" is usually an external, visual inspection to determine whether it is in its normal assembled position in the equipment.

(3) Inspection of a unit to determine if it is "secure" is usually an external inspection; a hand-feel, or a pry-bar or wrench check for looseness in the unit. Such an inspection should include brackets, lockwashers, locknuts, locking wires, or cotter pins used in the assembly.

(4) "Excessively worn" means worn close to or beyond serviceable limits, a condition likely to result in failure of the units, unless affected parts are replaced before the next scheduled inspection.

b. Reporting Deficiencies. The operator will report all deficiencies on DD Form 110.

Warning: Before attempting to perform any services or inspections be sure the engine is stopped and that the contactor switch button is in the OFF position.

c. Before-Operation Services. The following services will be performed to determine if the condition of the generator set has changed since it was last operated, and to make sure the equipment is ready for operation. Any deficiencies must be corrected or reported to the proper authority before the generator set is put into operation.

(1) *Fuel.* Check fuel supply. See that fuel tank is full. Check reserve supply of fuel and replenish if necessary. In cold weather, check winterization heater fuel supply.

(2) *Water.* Check coolant level in radiator to see that it is up to the proper level. Add coolant if necessary. When filling a cold radiator containing antifreeze allow room for expansion. When draining or refilling cooling system, open vent at top of thermostat housing. Close vent after filling.

(3) *Instruments.* Check all gage readings. Normal oil pressure is 20 to 50 psi. Pressure will be above normal when engine is cold, or may drop below normal at idling speed after engine has warmed up. If oil pressure gage shows an unusual drop or no pressure, stop engine immediately and report condition to proper authority. Coolant temperature gage should show a gradual rise during the warmup period until it reaches the maximum of 160° to 205° F. Allow engine to warm up at fast idling speed; do not race a cold engine. The ammeter reading should be in the charge range.

(4) *Oil.* Check level of engine lubrication oil. Add oil if necessary.

(5) *Leaks, general.* Check for leaks. Pay particular attention to engine cooling system, oil lines, fuel lines, and connections. Keep winterization heater fuel line shutoff valve closed when heater is not in use.

(6) *Visual inspection.* Make a visual inspection of the entire unit for cracks, breaks, and loose or missing bolts and nuts.

(7) *Starting.* Before starting engine: check connections in the voltage changeover board for desired voltage; place voltage regulator control switch in the ON position; turn voltage regulator adjusting rheostat clockwise to the reduced voltage position; make sure that fuel transfer valves are in proper position; see that generator is clear of tools and other obstructions; and turn throttle control to a position halfway between STOP and RUN position. Start engine, and allow it to warm up.

d. During-Operation Services. The operator is responsible for correcting or reporting unusual sounds or odors, deficiencies in performance, or other signs of abnormal operation. He will perform the following specific duties:

(1) *Instruments.* Check all gage and meter readings frequently. At normal operating speeds temperature and load readings should be as follows:

Engine oil pressure	20 to 50 psi
Coolant temperature	160° to 205° F.
Battery charging ammeter	in charge range
Generator frequency meter	60 cycles at 1200 rpm
A–C voltmeter	208 or 416 volts
A–C ammeter	0 to 104 amperes at 208 volts 0 to 57 amperes at 416 volts

(2) *Unusual operation.* Check for unusual operation such as excessive vibration, brush sparking, overheating, and smoking. Report any irregularity immediately to proper authority.

(3) *Unusual noises.* Check for any unusual engine noise. Stop engine immediately if any unusual noise is noted and report same to proper authority.

e. At-Halt Services. During halts, even if only for short intervals, the operator should make a general check for the generator set and correct or report any deficiencies noticed, in addition to performing the following specific duties.

(1) *Fuel.* Check fuel supply. Add fuel if necessary.

(2) *Oil.* Check oil level in crankcase. Add oil if necessary.

(3) *Water.* Check coolant level. Add coolant if necessary.

Caution: If the engine overheats because of lack of coolant allow it to cool before filling the radiator; otherwise, there is danger of cracking the cylinder head and block. If it is necessary to fill the radiator before the engine has cooled, be sure to fill it very slowly, with the engine running at slightly faster than idling speed.

(4) *Leaks general.* Check for fuel, oil, and coolant leaks.

(5) *Visual inspection.* Inspect for general condition of all parts. Looking for loose parts, worn belts, broken parts, and dirt, including external radiator obstructions.

f. After-Operation Services. To insure that the equipment is ready to operate at any time, the following services must be performed by the operator or crew immediately after any operating period. All deficiencies must be corrected or reported to the proper authority.

(1) *Shutdown precautions.* Press the contactor switch button in the OFF position. Allow engine to idle for a few minutes before stopping to prevent warping of valves and to allow even cooling of engine.

(2) *Fuel, oil, and water.* Check and refill all tanks. Inspect coolant and change if contaminated. Check coolant freezing point if antifreeze is used. If antifreeze is added, mix solution thoroughly by running the engine until it reaches normal temperature.

(3) *Clean equipment.* See that control cabinet and generator housings, screens, and louvers are free from dust and dirt. Clean exterior of engine, removing all oil and grease. Clean battery connections and see that caps are tight.

(4) *Electrical wiring.* Check all wiring for worn, cracked, or frayed insulation, broken wires, and loose connections.

(5) *Tools and equipment.* See that all tools and equipment assigned to the unit are in serviceable condition, clean, and properly stowed or mounted.

(6) *Lubrication.* Lubricate as required by the current lubrication order.

(7) *Belts.* Check tension of fan belts and battery charging generator belts. Adjust as necessary.

(8) *Fuel oil filters.* Remove plugs from bottom of primary and secondary fuel oil filters, and drain sediment. Replace plugs.

(9) *Fire extinguisher.* Check condition of fire extinguisher and inspect for full charge, proper working order, and secure mounting. The amount of charge in the carbon tetrachloride type can be judged by shaking the extinguisher and determining by sound and weight whether it is full.

(10) *Visual inspection.* Check for fuel, oil, and water leaks; loose or missing bolts and nuts; bent or damaged hoods, doors, and panels.

(11) *Protection.* Close and fasten front and rear doors on sides. Close and fasten all access doors on side panels. Close and fasten rear hood doors. Make sure that cover is over battery charging receptacle. Place weatherhead in position on muffler.

71. Maintenance and Safety Precautions

a. Always report or correct any mechanical deficiencies that may result in further damage to the generator if operation is continued.

Warning: This equipment generates high voltages that are dangerous to life. Always press the contactor switch button in the OFF position and stop the engine before making repairs on generator assembly, wiring, or control cabinet equipment.

b. When operating units in parallel, before shutting down one or more of the units be sure remaining units on the line can carry the load.

c. Keep governors, fuel oil filters, lubricating oil filter, air cleaner, and emergency shutdown units in proper operating condition to provide equipment protection and decrease wear.

d. After replacing oil filter elements and replenishing oil in crankcase, run engine until it reaches operating temperature, stop the engine, then when engine is cool check the oil level. Replenish to FULL mark on oil level gage.

e. Check for adequate ventilation for operation and personnel safety.

f. For cleaning collector rings or seating brushes, use sandpaper or brush seating stone. Do not use emery cloth or emery paper.

g. If a unit in service suddenly stops due to action of one of the emergency shutdown devices, correct condition causing stoppage before restarting.

h. Make sure containers used for handling fuel and lubricating oil are absolutely clean and dry.

72. Organizational Maintenance

a. Organizational preventive maintenance is performed by organizational maintenance personnel, with the aid of the operator, at weekly and monthly intervals. The weekly interval will be equivalent to 4 weeks, or 240 hours of use, whichever occurs first.

b. The technical inspection column is provided for the information and guidance of personnel performing technical inspection, and constitutes the minimum inspection requirements for the equipment.

c. The preventive maintenance services to be performed at these regular intervals are listed and described below. The numbers

appearing in the columns opposite each service refer to a corresponding number appearing on DA Form 464, and indicate that a report of the service should be made at that particular number on Form 464. These numbers appear in either the second, third, or both columns, as an indication of the interval at which the service is to be performed.

Technical inspection	Service		
	Monthly	Weekly	
			GENERAL
1	1	1	*Before-operation services.* Check equipment and perform services as listed in paragraph 70c.
2	2	2	*Lubrication.* Inspect the entire machine for damaged lubrication lines, and for indications of insufficient lubrication. Lubricate if necessary. Refer to LO 5–5009.
3	3	3	*Tools and equipment.* Inspect condition of all tools and equipment assigned to the generator. Check condition and mounting of toolboxes or compartments.
	3	3	See that all tools and equipment assigned to the machine are clean, serviceable, and properly stowed or mounted. See that toolboxes or compartments are in good condition and that they close and fasten properly.
4	4	4	*Fire extinguisher.* Check condition of fire extinguisher and inspect for full charge, proper working order, and secure mounting. The amount of charge in the carbon tetrachloride type can be judged by shaking the extinguisher and determining by sound and weight whether it is full.
	4	4	See that any deficiencies noted are corrected or reported to the proper authority.
5	5	5	*Publications.* See that this technical manual, TB 5–5009–1, LO 5–5009 and Standard Form 91 are on the machine and in serviceable condition.
6	6	6	*Appearance.* Inspect the general appearance of the machine, paying special attention to cleanness, legibility of identification markings, and condition of paint.
	6	6	See that deficiencies noted are corrected or reported to the proper authority.
7	7	------	*Modifications.* See if all available modification work orders applying to this generator have been completed and recorded on DA Form 478 (Organizational Equipment File).
			ENGINE AND ACCESSORIES
11	11	11	*Cylinder heads, manifold, and gaskets.* Inspect cylinder head, manifold, and flexible exhaust pipe for leaks, loose bolts and nuts, and defective gaskets.
	11	11	Tighten any loose manifold and exhaust pipe mounting bolts and nuts. Replace any defective gaskets. On new or reconditioned engines, check all cylinder head stud nuts for tightness at the first weekly service. The correct torque-wrench pull is 150 to 175 foot-pounds.

Technical inspection	Service		ENGINE AND ACCESSORIES—Continued
	Monthly	Weekly	
12	12	12	*Valve mechanism.* Check the valve adjustment if excessive tappet noise or loss of power is noticed. The approximate valve-tappet clearance with the engine cold is 0.013 inch. Valve tappet clearance with the engine hot is 0.009 inch.
	12	12	Adjust the valve-tappet clearance if necessary. Be sure the valve-cover gasket is in good condition and that the cover fits securely.
15	15	15	*Oil filter and oil cooler.* Inspect the oil filter, oil cooler, and oil lines and connections for leaks while the engine is running.
	15	15	Service the oil filter as specified in LO 5–5009. After servicing, check carefully for leaks while engine is running.
16	16	16	*Radiator.* Inspect radiator for leaks, obstructions in core air passages, and for loose mounting bolts. Check all cooling system hoses for leaks, excessive deterioration, and loose connections. Check operating temperature and condition of coolant. If coolant temperature remains below 160° F. or rises above 205° F. during operation, thermostats or shutter control may be defective. If antifreeze is used, check the freezing point of the coolant. Check the valves in the pressure cap for free operation.
	16	16	Drain, flush, and refill the cooling system if coolant is contaminated with rust or dirt. See that core air passages are clean. Replace any damaged or defective cooling system hose, lines, and gaskets. See that all mounting bolts and connections are tight. Protect the coolant from freezing, and record its freezing point on DA Form 464.
17	17	17	*Water pump, fan, and shroud.* Inspect the water pump for leaks and for loose mounting and assembly bolts. Check the condition and mounting of fan blades and shrouds.
	17	17	Tighten or replace loose or missing bolts and screws. Report deficiencies not corrected to the proper authority.
18	18	18	*Belts and pulleys.* Inspect for excessively worn, cracked, or frayed belts. Check belt tension, condition and alinement of pulleys. Fan belts should deflect 1¼ inches midway between pulleys. Generator belt should deflect one-half to three-fourths of an inch midway between pulleys.
	18	18	Adjust the tension of the belts if necessary. To adjust the belt, loosen the two hex head bolts in the slot of the fan shaft swivel bracket. Adjust the bracket position with a wrench on the lug and then tighten bolts. Replace belts in sets. Never install new belts with worn pulleys, or new pulleys with worn or frayed belts.

Technical inspection	Service: Monthly	Service: Weekly	
			ENGINE AND ACCESSORIES—Continued
20	20	20	*Hydraulic governor and linkage.* Check the adjustment of the hydraulic governor. If the engine surges when running at top speed without load, the governor is out of adjustment.
	20	20	Report any deficiencies to the proper authority.
21	21	21	*Overspeed governor.* Check the operation of the overspeed governor. Run the engine up to 1320 rpm with no load, at which point the governor should shut down the engine. Reset the trip lever at the blower outlet.
	21	21	Adjust the overspeed governor if necessary. With the engine at operating temperature, run the engine at 1,320 rpm. Loosen the two clamp screws on either side of the adjusting ring and the two lockscrews on either side of the cap. Hold the cap and turn the knurled adjusting ring counterclockwise slowly until the governor actuates the emergency shutdown system. Retighten the clamps and lockscrews.
22	22	------	*Piston rings.* Inspect condition of piston rings through ports in cylinder liners.
	22	------	Report broken rings, scores, or stuck rings to the proper authority.
23	23	------	*Cylinder liner ports.* Inspect cylinder liner ports for carbon accumulation.
	23	------	Clean ports if necessary, using compressed air. If carbon cannot be blown out with compressed air, report condition to the proper authority.
24	24	------	*Airbox drains.* Check airbox drains while the engine is running to see if they are open. Air coming through drains indicates that they are open. Remove and clean airbox drain lines when blocked.
			FUEL SYSTEM
38	38	38	*Fuel pump.* Inspect fuel pump and lines for leaks. Check for loose mounting and assembly screws.
	38	38	Tighten any loose screws and connections. Replace defective pump with a new or reconditioned one.
40	40	40	*Filters.* Check filters for dirt and sludge. Check for leaks and loose connections.
	40	40	Open draincock at bottom of filters and drain off any water or sediment.
	40	------	Replace primary and secondary fuel oil filter elements if necessary. After servicing check for leaks while engine is running.
41	41	41	*Air cleaner.* Inspect air cleaner for loose connections. Check condition and level of oil in bowl.
	41	41	Service air cleaner as specified in lubrication order.
43	43	43	*Fuel tank, cap and gasket.* Inspect condition and mounting of fuel tank. Check tank, fuel lines and connections for leaks.

Technical inspection	Service: Monthly	Service: Weekly	
			FUEL SYSTEM—Continued
	43	43	See that tank is mounted securely, air vent open, and that filler cap is clean and tight fitting. Replace leaky or damaged fuel lines and connections.
44	44	44	*Fuel lines.* Check the fuel lines for leaks, loose connections, and damage. Inspect flexible fuel lines used for connection to outside fuel source for excessive deterioration and leaks.
	44	44	Repair or replace defective fuel lines. Tighten loose connections. Report all uncorrected deficiencies to the proper authority.
			ELECTRICAL SYSTEM
47	47	47	*Batteries.* Inspect batteries for cracked or leaky cases, loose holddown blocks, and for dirt and corrosion on top of batteries. Check for loose, corroded, or damaged terminals and cables. Check level of electrolyte. Proper level is approximately three-eighths of an inch above plates. Check specific gravity and record reading on DA Form 464. Readings from 1.275 to 1.300 indicate a fully charged battery. A reading of 1.225 or below indicates battery should be recharged or replaced.
	47	47	Clean all dirt and corrosion off top of batteries, posts, cables, and cable terminals. Replace damaged cables. Apply a thin film of grease over terminals after they are clamped tight. Add distilled water if needed to bring solution up to proper level, but do not overfill. If freezing temperatures prevail, batteries must be charged for a period long enough to mix solution thoroughly. Where possible, water should be added just before beginning operation. See that batteries are mounted securely, that filler caps are tight, and that vent holes are open.
48	48	48	*Generator and starter.* Inspect generator and starting motor for loose mounting bolts and loose electrical connections. Inspect commutators and brushes for excessive wear, dirt, and oil deposits. See if brushes are free in their holders and if brush wires are secure. Replace brushes when worn to one-half their original length.
	48	48	Tighten any loose mounting bolts and electrical connections. Replace or free brushes, and clean commutators, if necessary.
50	50	50	*Wiring and switches.* Inspect wiring for oil-soaked, cracked, or frayed insulation, broken wires, and loose or corroded connections. Check operation of starting switch buttons.
	50	50	Tighten any loose mounting screws and connections. Replace defective switches and wires, or report to proper authority.

Technical inspection	Service		
	Monthly	Weekly	
			ELECTRICAL SYSTEM—Continued
51	51	51	*Voltage regulator.* Check the battery voltage regulator for proper operation and secure mounting. See that electrical connections are tight. Regulator must allow an appreciable charge to go into the battery after the starting motor is used. After the battery is fully charged, battery charging ammeter should show only a slight charge.
	51	51	Tighten any loose mounting screws or replace any missing. Replace the regulator if it is defective.
53	53	53	*Air heater.* Check the air heater for proper operation. See that electrode air gap is approximately one-eighth of an inch and that porcelain insulator is not cracked or dirty. See that spray nozzle openings are clear.
	53	53	Report defective condition to the proper authority.
			CONTROL SYSTEM
57	57	57	*Gages.* Inspect temperature and oil pressure gages on control panel for cracked or broken glass, insecure mounting, and defective operation.
	57	57	See that gages are mounted securely. Replace damaged or defective gages.
58	58	58	*Meters and switches.* Inspect a-c ammeter, a-c voltmeter, battery charging ammeter, engine hour-meter, and frequency meter for cracked or broken glass, loose mounting screws, and defective operation. Check condition, mounting, and operation of contactor push-button, synchronizing light switch, panel light switch, voltage regulator switch, cross-current switch, and ammeter-voltmeter phase switch.
	58	58	Tighten or replace loose or missing mounting screws. Replace damaged or defective meters. Replace defective switches. Report all uncorrected deficiencies to the proper authority.
59	59	59	*Rheostats.* Inspect exciter field rheostat and voltage regulator rheostat for insecure mounting and defective operation.
	59	59	Tighten or replace loose or missing mounting screws. Replace defective rheostats.
71	71	71	*Vernier throttle control.* Inspect vernier throttle control for insecure mounting and defective operation.
	71	71	Tighten or replace loose or missing mounting screws. Report all uncorrected deficiencies to the proper authority.
			FRAMES AND MOUNTINGS
80	80	80	*Frame (skid base).* Inspect for cracks, breaks, broken welds, and for loose and missing bolts.
	80	80	Tighten or replace all loose or missing bolts. See that cracks, breaks, and broken welds are repaired before further damage results.

Technical inspection	Service		GENERATOR
	Monthly	Weekly	
172	172	172	*Commutator, collector rings and brushes.* Inspect commutator, collector rings, and brush ring assembly for dust, dirt, and oil deposits. Check brushes for wear and loose wire connections. Brushes should be renewed before brush springs contact brush holder. See if brushes are free in holders, and make contact with commutator and collector rings.
	172	------	Inspect collector rings and commutator for wear, rough spots, and pitting, and for high mica between the commutator segments. The mica should be below the surface of the segments. If the mica is at or above the surface, excessive sparking will result during operation. The length of a new brush for the main generator is 1⅝ inch, and for the exciter, 1¼ inch.
	172	172	Blow dust and dirt from the inside of the generator if necessary, using compressed air of not over 25 pounds pressure. Air must be free of oil and water. See that brushes, commutator, and collector rings are clean. Replace brushes if worn beyond one-half of their original length. Be sure that brushes are in good condition and that connections are tight. If collector rings or commutator are rough or pitted or if mica is high between commutator segments, report condition to proper authority.
173	173	173	*Controls, instruments, wiring.* Check for loose connections, cracked or frayed wire insulation, corroded terminals, and for loose or missing mounting bolts and nuts. Check control cabinet for condition and secure mounting.
	173	173	Replace or report any damaged or inoperative instruments and controls. Tighten any loose mounting bolts and connections. Replace damaged wiring and terminals.
174	174	174	*Drive coupling and ventilating fan.* Inspect the driving disk and ventilating fan for any signs of insecure mounting or for damage. Check the fan for an accumulation of grease and dirt. See that the driving disk and ventilating fan are securely mounted.
	174	------	Clean the fan if necessary. If any damage to the disk or fan is noted, report the deficiency to the proper authority.
175	175	175	*Housing.* Inspect housing for loose or missing mounting and assembly bolts and nuts and for bent and damaged doors, panels, and frame members.
	175	175	Tighten or replace any loose or missing bolts and nuts. Correct or report any other deficiencies.

Section IV. TROUBLESHOOTING

73. Use of Troubleshooting Section

This section provides information useful in diagnosing and correcting unsatisfactory operation or failure of the generator set or any of its components. Each trouble symptom stated is followed by a list of probable causes of the trouble. The possible remedy recommended is described opposite the probable cause.

Note. All references in this section to paragraphs in chapter 4 (pars. 166 to 219) pertain to operations that are the responsibility of the field and depot maintenance personnel. Organizational maintenance personnel should not proceed without proper authority.

74. Starting Motor Fails to Operate

Probable cause	*Possible remedy*
Poor electrical connections	Clean and tighten battery cables and other electrical connections.
Starter button defective	Replace button (par. 112).
Battery discharged	Replace batteries or charge batteries for ones that are charged (par. 6*e*).
Starter commutator dirty	Clean starter commutator with cleaning solvent. Blow dry with compressed air.
Starter brushes worn	Replace starter brushes (par. 157*c*).

75. Engine Fails to Start

Probable cause	*Possible remedy*
Battery too low to turn engine over fast enough to start.	Charge batteries or install batteries that will crank engine at least 80 rpm.
Throttle not in starting position or improperly adjusted.	Set vernier throttle control in control panel in the STOP position. Check at governor and make sure the control lever at the governor has turned the speed adjusting shaft to its maximum NO FUEL (counterclockwise when looking at the exposed end of the shaft) position (par. 184*b*). See *Note* in paragraph 73.
Insufficient fuel to injectors	Refill fuel tank, clean fuel shutoff valve, fuel filters and lines.
Air-box shutoff solenoid burned out.	Remove and replace air shutoff solenoid (par. 129).
Cold weather	Use air heater or winterization kit to aid in starting (par. 55).

76. Engine Lacks Power

Probable cause	*Possible remedy*
Improper fuel	Obtain proper fuel.
Insufficient fuel	Refill fuel tank. Clean fuel shutoff valve, fuel filters, fuel pump, and lines.
Fuel filters clogged	Remove and clean element from primary filter (par. 151*c*). Remove and clean element from secondary filter (par. 152*c*).

Probable cause	*Possible remedy*
Air cleaner clogged	Service air cleaner (par. 67).
Air in fuel system	Tighten all fuel line connections on suction side of fuel pump. Replace primary filter gaskets and vent valves.
Improper governor adjustment	Adjust governor (par. 185). See *Note* in paragraph 73.
Fuel tank air vent plugged	Clean air vent.

77. Engine Misses or Vibrates Excessively

Probable cause	*Possible remedy*
Hunting governor	Remove bind in injector rack operating mechanism, in linkage between governor and injector control tube, and in the governor itself (pars. 184 and 185). See *Note* in paragraph 73.
Cooling water temperature too low	Replace thermostat (par. 147).

78. Engine Stalls Frequently

Probable cause	*Possible remedy*
Idling speed too low	Adjust idling speed to a minimum of 400 rpm.
Cooling water temperature too low	Replace water thermostat in water manifold (par. 147*b* and *d*). Renew automatic shutter operating mechanism (par. 143).
Hunting governor	Remove bind in injector rack operating mechanism, in linkage between governor and injector control tube, and in the governor itself (par. 185). See *Note* in paragraph 73.
Fuel supply insufficient	Refill fuel tank. Clean shutoff valve, fuel filters, and lines.
Improper governor adjustment and governor linkage incorrectly set.	Adjust governor and check linkage. Refer to paragraphs 110 and 185. See *Note* in paragraph 73.
Air or water in fuel system	Bleed fuel system.
Engine overloaded	Remove excess load.

79. Excessive Black Smoke From Exhaust

Probable cause	*Possible remedy*
Poor grade of fuel	Obtain proper fuel.
Air cleaner clogged	Clean air cleaner (par. 67).
Too much or too heavy oil in air cleaner.	Fill with proper weight and amount of oil (par. 67).
Air box handhole cover gaskets leaking.	Replace air box handhole gasket.

80. Excessive Blue Smoke From Exhaust

Probable cause	*Possible remedy*
Oil level too high in air cleaner	Correct air cleaner sump oil level.
Engine temperature too low	Ignore blue smoke until engine warms up to at least 140° F.

81. Engine Detonates (Knocks)

Probable cause	*Possible remedy*
Oil pullover from air cleaners	See that oil in air cleaner sump is of proper viscosity and not above line.
Plugged air box	Open drains, remove handhole covers, and clean air box with clean dry rags.

82. Excessive Oil Consumption

Probable cause	*Possible remedy*
Engine overheating	Add coolant to cooling system.
Oil level too high	Maintain proper oil level in crankcase.
Leaking gaskets	Replace pan and valve cover gaskets.

83. Lack of Lubricating Oil Pressure

Probable cause	*Possible remedy*
Oil supply in crankcase too low, allowing pump to suck air.	Fill crankcase to proper level.
Crankcase oil diluted with fuel oil	Drain and refill crankcase. Check and tighten all fuel oil connections at cylinder head.
Oil cooler choked	Clean oil cooler.

84. Generator Fails to Build Up A-C Voltage

Probable cause	*Possible remedy*
Voltmeter not indicating	Check voltmeter, voltmeter switch, and connections. Replace voltmeter if found affected (par. 48).
Open circuit in external wiring of a-c generator exciter.	Check all wiring and tighten connections. Repair or replace faulty wiring.
Open circuit in exciter field rheostat.	Check continuity with d-c test lamps. If open circuit is indicated, repair or replace defective part.
Open or short circuit in field or armature windings of exciter or d-c generator.	Check for continuity and rewind if necessary (par. 203).
Loss of residual magnetism in exciter.	Raise exciter brushes and connect to a 6- or 12-volt storage battery for a few moments. ***Caution:*** Be sure to observe proper polarity when making this connection.
Exciter field connections reversed	Reverse exciter field connections.
Dirty commutator or collector rings.	Clean commutator or collector rings.
High mica on commutator	Machine commutator if necessary and undercut mica (par. 188*b*(2)).
Exciter brushes not making proper contact.	See that brushes move freely in holder. Fit brushes to contour.
Exciter or generator brushes worn excessively.	Replace brushes (par. 160).
Insufficient brush spring tension	Adjust or replace brush springs (par. 160).
Too much resistance in field circuit.	Adjust rheostat.
Low speed due to improper governor adjustment.	Adjust governor (par. 185).

Probable cause	*Possible remedy*
Short circuit in radio suppression system.	Locate and replace faulty capacitor or grounded cable.
Loose electrical connections	Tighten electrical connection.

85. Generator Voltage too High

Probable cause	*Possible remedy*
Excessive speed.	Reduce speed.
Improper governor adjustment	Readjust governor. Refer to paragraph 185.
Field rheostat not adjusted	Adjust rheostat.
Voltage regulator switch in OFF position with little or no rheostat resistance in exciter field circuit.	Throw voltage regulator switch to ON position. Adjust rheostat.
Voltage regulator switch in ON position, but regulator not operating.	Check for open circuit or short circuit in regulator coil circuit and antihunt dashpot, and correct.

86. Erratic Voltage

Probable cause	*Possible remedy*
Loose switchboard wiring connections.	Clean and tighten switchboard wiring connections.
Voltage regulator contacts stuck or pitted.	Clean or replace contacts.
Antihunt dashpot not properly adjusted.	Correct adjustment.
Regulator resistor open	Replace regulator (par. 108).
Brushes not set in neutral plane on exciter.	Move exciter brush ring back and forth until commutation is improved. Voltage is maximum when brushes are in correct plane.
Exciter brushes not seated to contour of commutator.	Sand brushes to contour (par. 161).
Improper type of brushes	Replace with brushes of proper size and material.
High mica on exciter commutator.	Undercut mica between commutator bars.
High commutator bar or rough commutator and slip-ring surfaces.	Machine and burnish commutator (par. 204).
Loose brush holder	Re-aline and tighten brush holder (par. 160).
Burned out mica between commutator segments.	Scrape out the burned mica and fill the space with a solution of sodium silicate (waterglass), or other suitable insulating cement.
Loose exciter circuit connection	Tighten all connections in exciter circuit.

87. Overheating of Engine and Generator Assembly

Probable cause	*Possible remedy*
Generator overloaded	Reduce load.
Generator stator windings short-circuited.	Replace or repair windings (pars. 202–206).
Air passages obstructed in generator and engine.	Clean air passages.
Poor ventilation in operating area	Improve ventilation.
Voltage too high	Adjust rheostat.

88. Generator Noisy

Probable cause	*Possible remedy*
Defective bearing	Replace bearing (pars. 202 and 206).
Rotor rubbing on stator	Replace bearing (pars. 202 and 206).

89. Flickering Lights on Load Line

Probable cause	*Possible remedy*
Short-circuited field coil	Test field coils (par. 208) for short circuit. Replace or repair shorted coil (pars. 202–205).
Defective bearing causing uneven air gap.	Replace worn bearing (pars. 202 and 206).

90. Load Contactor Continues to Trip

Probable cause	*Possible remedy*
Short circuit in load line	Locate short circuit and remove.
Defective trip unit	Replace trip unit.
Defective contactor pushbutton	Replace load contactor pushbutton.

91. Load Contactor Overheats

Probable cause	*Possible remedy*
Loose or defective contact	Check for defect. Probable cause is a loose terminal connection. Tighten or replace contact (par. 124).
Dirty contacts	Clean contact surfaces using a fine file. Blow all dirt out of load contactor inclosure (par. 124).

Section V. RADIO SUPPRESSION

92. Definition of Suppression

Radio noise suppression is the elimination or minimizing of electrical disturbances within the generator set which interfere with radio reception and disclose the location of the generator set and its associated equipment to sensitive electrical detectors.

93. Source of Interference

The a-c and d-c generators and starting motor, poor electrical joints between adjacent parts on the engine generator frame, and poor electrical contacts are sources of radio interference.

94. Methods Used to Suppress Interference

a. Shielding. Cables and wires are encased in braided metal sheathing which is grounded to the frame. This prevents radiation from any of the shielded parts.

b. Bonding. Electrical connections are maintained at minimum resistance level by the use of internal- and external-tooth lockwashers. The frames of various components are bonded together electrically by connections to the metallic cable sheathing of the wiring harness. Bonding straps conduct any radio frequencies to ground.

c. Bypass to Ground. Low series resistance, low series inductance, a-c capacitors for use within medium and high frequency ranges are placed at various points in the electrical circuit. The capacitors act to bypass radio frequencies to ground and prevent them from being radiated.

95. Effects of Suppression

There is no interference from equipment which is satisfactorily suppressed for radiated and conducted interference over the frequency range of 0.55 through 156.0 megacycles at a distance of 25 feet from the unit.

96. Suppression System Testing

a. Install a battery-powered radio receiver in good operating condition not more than 10 feet from the generator set. A wide-band receiver covering the frequency range of 0.55 to 156.0 megacycles is preferred.

b. Start generator set and tune receiver. Turn receiver volume control to maximum, and select three widely separated frequencies for listening. Use frequencies that are free from signals with strong carriers so that the receiver will be in its most sensitive operating condition.

c. Operate engine throttle, and listen to receiver speaker or headset. A whining sound, which varies with engine speed and continues a few seconds after engine throttle has been turned to STOP position, indicates there is no effective suppression.

d. Systematically check each circuit as follows:

(1) Inspect all internal- and external-tooth washers, bonding straps, and shielded cables. See that washers bite into the metal surfaces, forming positive connections. Be sure to reinstall washers of this type in their original positions. Make sure that bonding straps are clean and that both ends are securely fastened, making good connections.

Warning: The power generated by the generator set is dangerous and can kill. Never touch any uninsulated line or bus bar while the unit is in operation. Never service the set unless another person is present to render emergency aid.

(2) Clean and tighten battery terminals. Replace cables if damaged or corroded.

(3) Clean and adjust battery charging generator and battery voltage regulator (pars. 193 and 199).

(4) Inspect all switches for faulty contacts. Replace if faulty.

97. Suppression Component Replacement

a. General. If the radio suppression system is found to be ineffective, each suppression capacitor should be replaced. Test after each

replacement to see if the trouble has been eliminated. Replacement of suppression components must be exact, with the replacement components having the same characteristics as those replaced.

b. Removal of Suppression Capacitors.

(1) Disconnect leads from two capacitors (2, fig. 33) from generator armature terminal (16) and battery terminal (17). Withdraw two capacitors (2) from retaining clips.

(2) Disconnect battery charging generator capacitors (2) from stud terminal (14) and withdraw capacitor (2) from retaining clip.

(3) Unscrew nut (9, fig. 20) releasing clip (8) and remove capacitor (7) from battery charging ammeter (10).

(4) Unscrew lead on capacitor (32, fig. 76) from junction box (33) and remove capacitor (32).

(5) Disconnect leads from three capacitors (11, fig. 20). Unscrew nut (13), releasing clip (12), and remove three capacitors (11).

(6) Disconnect lead from capacitor (7, fig. 70) from inside bearing bracket (6) and withdraw capacitor (7) from retaining clip.

(7) Disconnect lead from capacitor attached to voltage regulator (1, fig. 22) and remove capacitor.

c. Installation of Suppression Components.

(1) Install two capacitors (2, fig. 33) in retaining clips on base of battery voltage regulator (4). Attach leads from capacitors (2) to generator armature terminal (16) and battery terminal (17).

(2) Install capacitor (2) in retaining clip on battery charging generator (13) and fasten lead to stud terminal (14).

(3) Position clip (8, fig. 20) and capacitor (7) on the left-hand side of battery charging ammeter (10) and secure to control panel with nut (9).

(4) Attach lead of capacitor (32, fig. 76) to junction box (33) and install capacitor (32) in retaining clip.

(5) Connect leads from three capacitors (11, fig. 20) and position clip (12) and three capacitors (11) against side plate of control panel and secure with nut (13).

(6) Attach lead from capacitor (7, fig. 70) to the inside of bearing bracket (16) and install capacitor (7) in retaining clip.

(7) Connect and install capacitor attached to voltage regulator (1, fig. 21).

d. Bonds and Shields. When replacing a bonding strap or shield, remove all dirt and grease from the end of the strap or shield, then scrape it thoroughly so that it will make a good electrical connection with the grounded portion.

Section VI. HOUSING

98. General

The housing consists of a front cowl assembly (12, fig. 1), a front canopy (7), a rear canopy (3), four side panels, an A frame (5), and a rear cowl assembly (23). The front cowl assembly includes the radiator shutter and control while the rear cowl assembly houses the generator control panel (6, fig. 2), the load terminal board assembly (9), and the diesel fuel tank (10, fig. 4).

99. Housing Removal

a. Remove Muffler Assembly. Remove four nuts, lockwashers, and bolts which attach the flanged sections of the flexible exhaust connection (7, fig. 4) and the muffler (2, fig. 2). Remove nut, lockwasher, and bolt which attach front foot of muffler (2) and front support yoke, through canopy. Lift off the muffler, being careful not to damage gasket at mating flanges.

b. Remove Front Canopy. Remove two nuts, lockwashers, and bolts which hold top of front canopy (7, fig. 1) to drain gutter channel. Remove 23 nuts, lockwashers, and bolts which attach front canopy to A frame (5) and front cowl (12). Lift off front canopy.

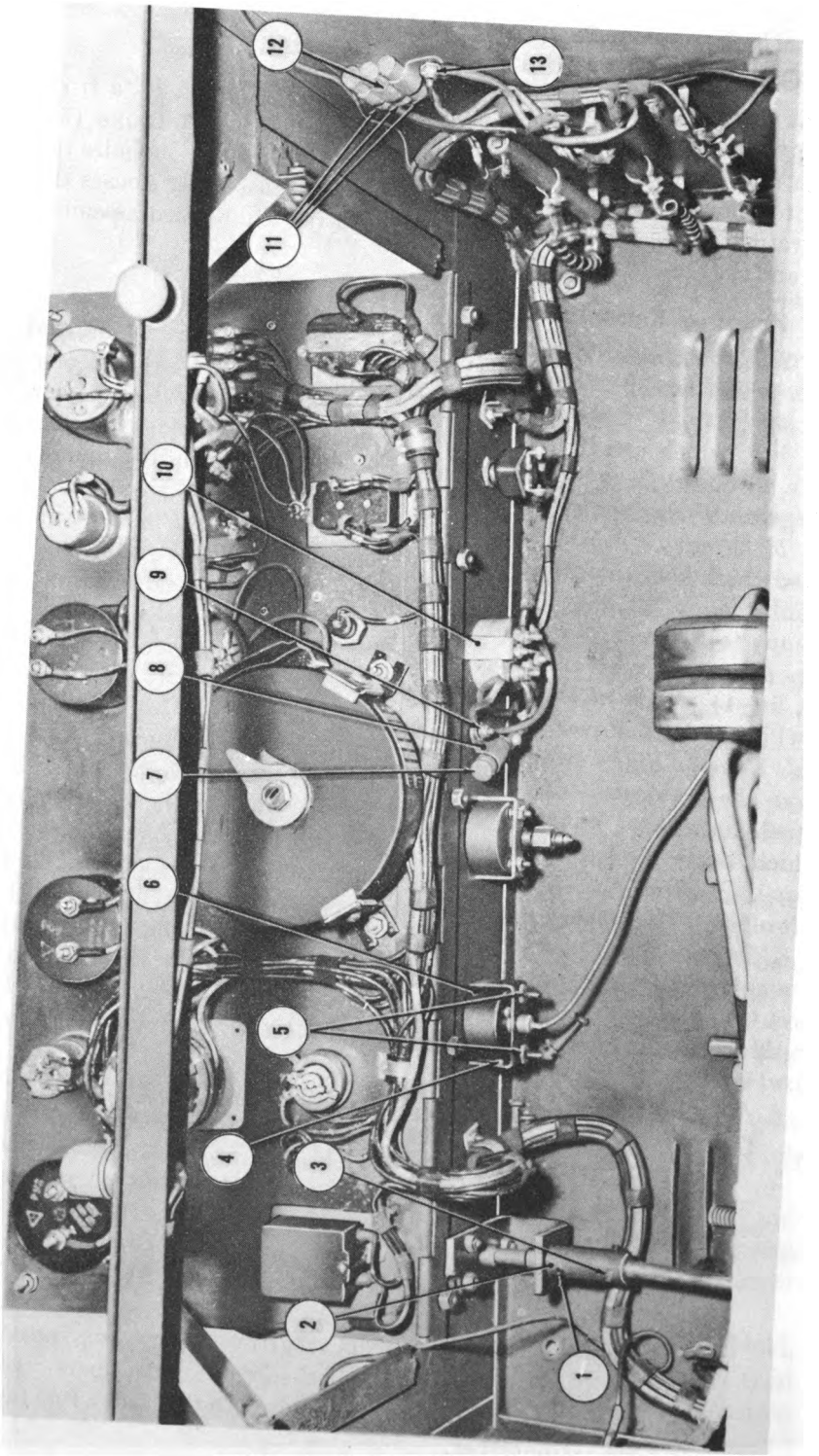
c. Remove Rear Canopy. Remove 22 nuts, lockwashers and bolts (4, fig. 1) which attach rear canopy (3) to A frame (5) and rear cowl (23). Lift off rear canopy.

d. Remove Side Panels. Unscrew crankcase drain plug (18, fig. 2) from the crankcase oil drain hose (23, fig. 5) to the left front side panel, and drain crankcase. Remove four nuts, lockwashers, and bolts which secure the heater blower inlet (20, fig. 1) to the right rear side panel. Remove the 13 attachment nuts, lockwashers and bolts, and lift off the side panels. Remove oil hose (23, fig. 5) from oil pan (22).

e. Remove Front Cowl Assembly. Remove the automatic shutter control access plate (14, fig. 1). Drain the cooling system. Disconnect the inlet and outlet tubes (2) and (4, fig. 15). Remove the cowl-to-skid attachment nuts, lockwashers, and bolts. Lift off the front cowl assembly.

f. Remove A-Frame and Battery Box Support Frame.

(1) *Remove battery box, heater fuel tank, and support frame.* Remove the battery air tube (11, fig. 4). Remove the batteries. Disconnect the leads from battery box thermostat (3, fig. 11). Lift battery box (7, fig. 3) out of battery box support (37). Drain the heater fuel tank. Disconnect the fuel lines (25, fig. 3) and (9, fig. 4) from the heater fuel tank (6, fig. 3). Pull these lines clear of the A-frame. Remove the four nuts and bolts securing battery box support (37) to the A-frame (10) and the generator support. Lift out the battery box support together with the heater fuel tank and fire extinguisher.



1 Setscrew, ¼–28 x ½ (2 req'd)
2 Coupling
3 Setscrew, ¼–28 x ½ (2 req'd)
4 Step bracket
5 Nut, hex, No. 8–32 (2 req'd)
6 Coolant temperature gage
7 Capacitor
8 Clip
9 Nut, hex, No. 8–32 (1 req'd)
10 Battery charging ammeter
11 Capacitors
12 Clip
13 Nut, hex, No. 8–32 (1 req'd)

Figure 20. Control panel base, interior view.

(2) *Remove A-frame.* Disconnect the throttle control rod (43, fig. 3) as described in paragraph 110*a*. Disconnect the fuel return line from the fuel return valve (5) and clear the line from the A-frame. Disconnect the oil pressure indicator tube from the fitting below the oil pressure safety switch (8, fig. 4) and pull tube clear. Remove four bolts, nuts, and lockwashers (32, fig. 3) attaching the A-frame sheathing to the skid (31). Remove the bolts and nuts (32) attaching each side of the A-frame to the attachment angles on the skid frame. Lift the A-frame clear of the generator set.

g. Remove Rear Cowl Assembly. Drain the diesel fuel tank completely. Remove cover from generator connection box (26, fig. 13) and disconnect all wires leading to control panel (6, fig. 2) and load terminal board assembly (9). Disconnect the diesel fuel supply line (34, fig. 3) from the fuel supply valve (4). Remove nuts, lockwashers, and bolts (39) which attach rear cowl assembly (1) to skid (31). Lift off the rear cowl assembly.

100. Housing Disassembly

a. Diassemble Front Cowl Assembly (fig. 21). Remove six bolts (15) and lockwashers (14) which attach shutter guard (16) to front cowl (19). Lift off shutter guard (16). Unscrew shutter control knob (10) from shutter control rod (11). Unscrew control rod (11) from shutter. Remove eight attachment screws (13) with lockwashers (12) and lift shutter (17) away from cowl (19).

b. Disassemble Rear Cowl Assembly.

(1) *Remove load terminal board assembly.* Disconnect all wiring leads from the load terminal board assembly (9, fig. 2). Remove the nuts, lockwashers and bolts (41, fig. 3) which secure the terminal board to each side of the rear cowl (1). Slide the terminal board assembly from the rear cowl.

(2) *Remove control panel.* Make certain all wiring has been disconnected, either at the control panel (fig. 14) or other end of the wire. Make sure the throttle control rod (43, fig. 3) has been removed. Remove the nuts, lockwashers and bolts (42) which secure the control panel to each side of rear cowl assembly (1). Pry the sides of the cowl apart slightly and slide out the control panel.

(3) *Remove diesel fuel tank.* Remove the nuts, lockwashers, and bolts (44, fig. 3) which secure the fuel tank to each side of cowl (1). Pry the sides of the cowl apart slightly and slide out the diesel fuel tank (10, fig. 4).

101. Housing Inspection and Repair

Thoroughly clean all components of the housing. Use cleaning solvent to remove all grease, grime, dirt, or corrosion. Remove any

rust with a wire brush. Inspect for cracks, breaks, damaged sheet metal, and defective door or side panel hinges, and defective latches, retainer chains, assembly bolts, nuts and lockwashers. Repair or replace all damaged parts. Repaint after repairing to avoid corrosion of exposed metal.

102. Housing Reassembly and Installation

a. Reassemble Rear Cowl.

(1) *Install diesel fuel tank.* Pry the sides of the cowl (1, fig. 3) apart slightly, and slide the diesel fuel tank (10, fig. 4) into place. Install three bolts, lockwashers, and nuts (44, fig. 3) on each side of cowl (1), securing the fuel tank in position.

(2) *Install control panel.* Pry the sides of the cowl (1, fig. 3) apart slightly, and slide the control panel (6, fig. 2) into place. Install the bolts, lockwashers, and nuts (42, fig. 3) on each side of cowl (1), securing the control panel in position.

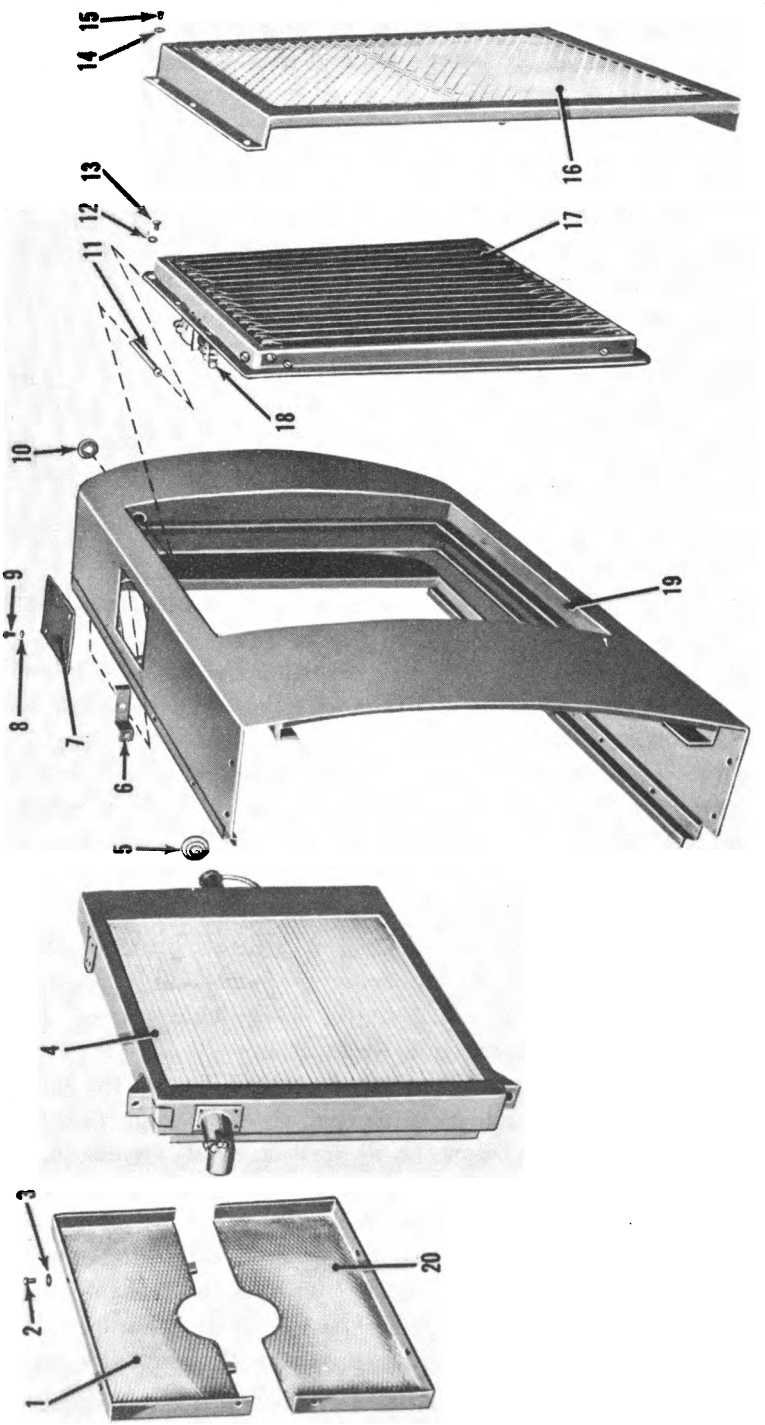
(3) *Install load terminal board assembly.* Slide the terminal board assembly (9, fig. 2) into position and secure it by installing the bolts, lockwashers, and nuts (41, fig. 3) on each side of the cowl.

b. Install Rear Cowl Assembly. Position the rear cowl assembly (1, fig. 3) on skid (31) and secure it with the bolts, lockwashers, and nuts (39). Connect the diesel fuel supply line (34) to the fuel supply valve (4). Fill diesel fuel tank. Make necessary connections to the load terminal board assembly (9, fig. 2) and to the generator connection box (26, fig. 13). Replace the cover on the generator connection box.

c. Install A *Frame and Battery Box Support Frame.*

(1) *Install* A *frame.* Position the A-frame over the skid and secure each side by replacing the bolts and nuts on the attachment angles (23, fig. 13) on the skid frame. Replace the four bolts, nuts and lockwashers (32, fig. 3), attaching the A-frame sheathing to skid (31). Reinstall the engine lubricating oil indicator tube between the gage (18, fig. 14) and the fitting below the oil pressure safety switch (8, fig. 4). Reconnect the fuel return line to the fuel return valve (5, fig. 3). Install the throttle control rod (par. 110*e*).

(2) *Install battery box support frame.* Position the battery box support (37, fig. 3), together with heater fuel tank (6) and fire extinguisher (13, fig. 4) on the skid. Secure to the A-frame and the generator support with four bolts and nuts. Reinstall and connect fuel lines (9) and (25, fig. 3) to gasoline tank (6). Lift the battery box (7) into place on the



1 Right fan guard
2 Screw, self-tapping, 14–10 x 5/8 (12 req'd)
3 Lockwasher, 5/8 (12 req'd)
4 Radiator
5 Radiator cap
6 Shutter control bracket
7 Access plate
8 Washer, 1/4 (4 req'd)
9 Cap screw, hex hd, 1/4–20 x 3/4 (4 req'd)
10 Shutter control knob
11 Shutter control rod
12 Lockwasher, 5/16 (8 req'd)
13 Screw, rd hd, 5/16–18 x 3/4 (8 req'd)
14 Lockwasher, 3/8 (6 req'd)
15 Bolt, hex hd, 3/8–24 x 1 (6 req'd)
16 Shutter guard
17 Shutter
18 Automatic shutter control
19 Front cowl
20 Left fan guard

Figure 21. Front cowl assembly and radiator, exploded view.

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battery box support (37) and reconnect the leads to the battery box thermostat (3, fig. 11). Install the air tube (11, fig. 4). Install the batteries. Fill heater fuel tank.

d. Assemble Front Cowl. Position shutter (17, fig. 21) on cowl (19) and secure in place with screws (13) and lockwashers (12). Screw control rod (11) into shutter and attach knob (10). Place shutter guard (16) on cowl (19) and secure with bolts (15) and lockwashers (14).

e. Install Front Cowl Assembly. Position cowl (20, fig. 3) on skid (31) and secure it in place with the attachment bolts, lockwashers, and nuts. Connect the inlet and outlet tubes (2) and (4, fig. 14). Install the automatic shutter control access plate (14, fig. 1). Install oil drain hose (23, fig. 5).

f. Install Side Panels. Place side panels in position and secure with the attachment bolts, lockwashers, and nuts. Secure the heater blower inlet (20, fig. 1) to the right rear side panel with the bolts, nuts, and lockwashers. Insert the oil drain hose (23, fig. 5) through the left front side panel and secure it in place with the threaded collar. Install crankcase drain plug (18, fig. 2).

g. Install Rear Canopy. Position rear canopy (3, fig. 1) and attach to **A** frame (5) and rear cowl assembly (23) with bolts (4), lockwashers, and nuts.

h. Install Front Canopy. Position front canopy (7, fig. 1) and attach to **A** frame (5) and front cowl assembly (12) with bolts, lockwashers, and nuts. Attach to rain gutter channel with two bolts, lockwashers, and nuts.

i. Install Muffler Assembly. Place gasket on mounting flange (7, fig. 4) and attach muffler (2, fig. 2) with four bolts, lockwashers, and nuts. Attach front door of muffler to front support yoke through canopy with a bolt, lockwasher, and nut. Fill cooling system. Refill crankcase with lubricating oil. Refer to LO 5–5009.

Section VII. CONTROLS AND INSTRUMENTS

103. General

a. Wire and Cable Marking. All wires and cables are marked or tagged for identification. When removing a control or an instrument, be sure that wiring is marked properly in order to simplify reinstallation or replacement. Refer to table IV for proper wiring of instruments and controls.

b. Care of Wiring. Electrical wiring must be kept clean, dry, and tightly connected at all times. Keep wiring free of grease, oil, or other lubricants which in time will destroy the insulation.

Note. Special care must be taken when handling wiring in extreme cold, as insulation becomes brittle and may crack or break if bent, causing short circuits.

c. Instrument Handling. Many controls and instruments are of delicate construction, and must be handled with extreme care.

Table IV. Wiring Key to Instruments and Controls

Text reference (par.)	Instrument or control	Wire No.
10	Fuel pressure safety switch	H2, J4
11	Low oil pressure safety switch	H4, H5, H4
12	Engine coolant thermostat safety switch	H4, H5
14	Heater safety thermostat switch	F, G
15	Diesel engine auxiliary starting button	B, S2
18	Overspeed governor safety switch	H4, H5
19	Air box shutoff solenoid	M1
20	Engine safety shutdown relay	M1, H5, B+, H1, X2, X3
21	Battery box thermostat	B
22	Voltage regulator switch	A1, F1, F3
23	Cross-current switch	C, X2
24	Exciter field rheostat	F3, F3, F1, F1
25	Ammeter-voltmeter phase switch	C1, C2, C3, C4, C5, V1, V2, V3, V4, V5
26	Voltage regulator adjusting rheostat	X3, X4
27	Contactor pushbutton	P4, P4, T8S, P5
29	Emergency overload switch	E2, E1
30	Diesel engine starting button	S1, S2
31	Panel light switch	R, B1, PL
32	Synchronizing light switch	S1, S2, S3, S4, S5, S7
33	Engine hour-meter	E1, T0, Y4, T8
34	Synchronizing lights	S5, S6
35	Frequency meter	Y4, E1
36	Voltmeter	V4, V5
37	Ammeter	B, B1
38	Contactor indicating light	C4, C5
41	Battery charging ammeter	V4, E1, V4
43	Batter thermal overload circuit breaker	J2, M5, B, B
44	Fuel solenoid valve	F
45	Battery box overheat solenoid	B, B
47	Winterization heater control switch	G, B, H
48	Winterization kit blower motor control switch.	F

Warning: Never check wiring or attempt to make any replacement while the generator set is operating. When repair is necessary, disconnect the battery to insure that generator set will not be started accidentally. Place a large sign on the control panel indicating that replacement or servicing is being done.

104. Voltage Regulator Switch

a. Removal.

(1) Remove hex collar holding voltage regulator switch (2, fig. 14) to panel.

(2) Disconnect wires from voltage regulator switch (21, fig. 22) at the rear of panel, and remove switch from panel.

b. Installation. Connect wires to the switch and place it in position through rear of panel. Install hex collar on voltage regulator switch (2, fig. 14) at front of the panel.

105. Cross-Current Switch

a. Removal.

(1) Loosen and remove the threaded, knurled collar on the front of the panel which holds the cross-current switch (6, fig. 14) in place.

(2) Disconnect wires from the cross-current switch (17, fig. 22) at the rear of the panel and remove switch.

b. Installation. Connect wires to the switch and place it in position through the rear of the panel. Lock switch in place by installing the threaded, knurled collar on the cross-current switch (6, fig. 14) at the front of the panel.

106. Exciter Field Rheostat

a. Removal.

(1) Turn the adjusting knob on exciter field rheostat (9, fig. 14) fully clockwise. Loosen the setscrew holding the knob to the rheostat shaft, and remove knob.

(2) Remove the three nuts and screws holding exciter field rheostat (14, fig. 22) to the panel.

(3) Disconnect wiring leads from rheostat terminals at the rear of the panel.

(4) Remove rheostat from rear of the panel.

b. Installation.

(1) Position the rheostat (9, fig. 14) on the rear of the panel.

(2) Connect the wiring leads to the rheostat terminals.

(3) Insert the three screws through the front of the panel and the feet of the rheostat, and secure the rheostat to the panel with three nuts.

(4) Place the adjusting knob over the end of the rheostat shaft, with the setscrew position matching the corresponding flat on the shaft. Tighten setscrew, and check the rheostat for full rotation.

107. Ammeter-Voltmeter Phase Switch

a. Removal.

(1) Turn the indicator knob on the ammeter-voltmeter phase switch (11, fig. 14) to position 1.

(2) Loosen the setscrew in the knob, and pull the knob off the shaft.

(3) Remove the four panel screws holding the switch to the panel.

(4) Disconnect the wiring from the ammeter-voltmeter phase-switch (12, fig. 22) terminals at the rear of the panel.

(5) Lift off the phase switch from the rear of the panel.

b. Installation.

(1) Place the phase switch (11, fig. 14) in position at the rear of the panel, with the switch shaft extending through the panel.

(2) Connect the wiring to the phase-switch terminals.

(3) Attach the phase switch to the panel with four screws extending from the front to the rear of the panel.

(4) Slide the knob over the ammeter-voltmeter phase-switch (11, fig. 14) shaft at the front of the panel. Make sure that the knob pointer is at position 1 when the switch is in position 1. Tighten the setscrew on the knob.

108. Voltage Regulator Adjusting Rheostat

a. Removal.

(1) Turn the adjusting knob of the voltage regulator adjusting rheostat (13, fig. 14) fully clockwise. Loosen the setscrew holding the knob to the rheostat shaft and remove the knob.

(2) Remove hex nut collar from rheostat at front of panel.

(3) Disconnect leads from voltage regulator adjusting rheostat (7, fig. 22) at rear of panel.

(4) Lift off rheostat from rear of panel.

b. Installation.

(1) Place rheostat in position at rear of panel, with shaft extending through panel from the rear.

(2) Connect leads to rheostat terminals.

(3) Install hex nut collar on rheostat from front of panel and draw up tight.

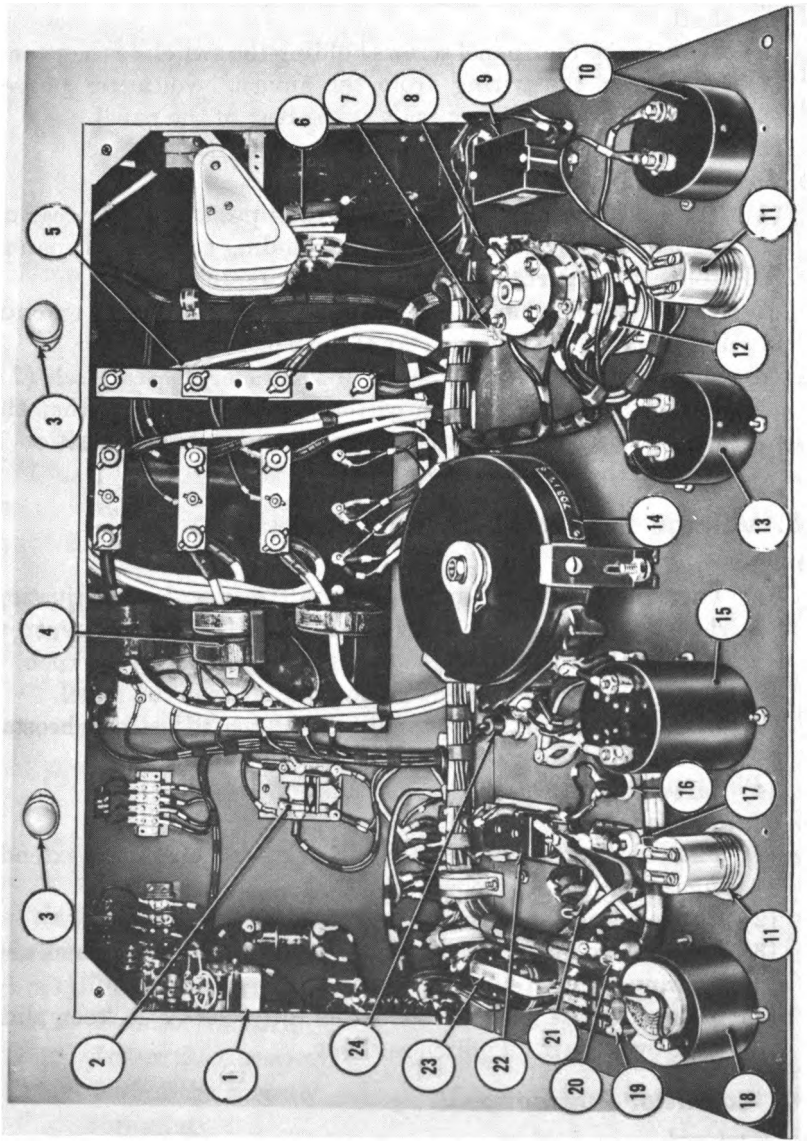
(4) Make sure the rheostat is turned fully clockwise, then slide knob over shaft. Tighten setscrew.

109. Contactor Pushbutton

a. Removal.

(1) Remove the wires from the terminals of the contactor pushbutton (9, fig. 22) at the rear of the panel.

(2) Remove the nuts from the two attachment screws for the contactor pushbutton (14, fig. 14), which extend through the plate from the front of the panel.



1 Main generator voltage regulator
2 Contactor actuating relay
3 Panel lights
4 Cross-current transformer
5 Voltage changeoverboard
6 Load contactor.
7 Voltage regulator adjusting rheastat
8 Contactor indicating lights
9 Contactor pushbutton
10 A-c ammeter
11 Synchronizing lights
12 Ammeter-voltmeter phase switch
13 A-c voltmeter
14 Exciter field rheostat
15 Frequency meter
16 Emergency overload switch
17 Cross-current switch
18 Engine hour-meter
19 Synchronizing light switch
20 Panel light switch
21 Voltage regulator switch
22 120-volt a-c receptacle
23 120-volt a-c polarized receptacle
24 24-volt d-c receptacle

Figure 22. Control panel, interior view.

(3) Lift off the front plate at the front of the panel, and lift the pushbutton switch away from the rear of the panel.

b. Installation.

(1) Position the front plate on the panel with the two screws.

(2) Mount the pushbutton switch over the two screws, which extend to the rear of the panel, and secure with the two nuts. Be sure that the ON button is uppermost on the panel.

(3) Connect the wires to the switch terminals.

110. Vernier Throttle Control Mechanism

a. Removal.

(1) Turn vernier throttle control (15, fig. 14) clockwise to STOP position. Working at the rear of the control panel, remove two setscrews (1 and 3, fig. 20) releasing coupling (2) from shafts and (29 and 4, fig. 23) from coupling (30).

(2) Slide coupling (30) off shaft (4) and withdraw throttle control from front of control panel.

b. Disassembly.

(1) Lift lockbutton (7) and lockbutton pin spring (6) from housing (5).

(2) Remove cover (1) by prying with screwdriver at slot in bottom of housing.

(3) Remove worm gear (2) and shaft (4) by tapping shaft with a brass hammer.

(4) Separate worm gear from shaft by clamping hub of gear in in a vise and driving shaft through gear with drift pin. Remove Woodruff key (3).

(5) Remove two screws (11) and remove vernier throttle control lock spring (35) from housing.

(6) Remove nut (32). Lockwasher (33) and throttle knob shaft bushing (34) will fall free of housing.

(7) Pull vernier knob (8) straight out of housing.

(8) The worm (10) is a press fit on the tapered shaft of the vernier knob. If damaged, it can be removed by pressing shaft through worm.

(9) Remove nut (18) and lockwasher (17) from bolt (16) releasing throttle control lever (28) from shaft (29).

(10) Remove clevis pin (27) and cotter pin (25) from link (26) releasing link from throttle control lever and governor control lever (24).

c. Cleaning and Inspection. Wash all parts in cleaning solvent and blow dry with compressed air. Inspect worm gear (2) for chipped, peened, or broken teeth. Make sure lockbutton pin spring (6) is not broken or fatigued. Replace if necessary. Examine shafts (4) and (29) to make sure that they are not bent.

d. Reassembly.

(1) Install worm (10) by pressing vernier knob shaft (8) into worm.

(2) Position vernier knob (8) in throttle control housing. Insert throttle knob shaft bushing (34) from bottom and secure in place with lockwashers (33) and nut (32).

(3) Fasten vernier throttle control lock spring (35) to housing (5) with two screws (11).

(4) Place Woodruff key (3) in keyway of shaft (4) and aline worm gear (2) with key. Press worm gear on shaft until hub touches shoulder on shaft.

(5) Insert shaft and worm gear into housing, meshing teeth of worm (10) with worm gear (2).

(6) Drive lockbutton pin (9) about one-eighth of an inch into lockbutton (7). Place lockbutton pin spring (6) and lockbutton (7) in housing (5) and continue driving pin (9) until it is flush with rear face of housing (5).

(7) Aline slit in cover (1) with slot in housing and tap cover in place.

(8) Position link (26) in governor control lever (24) and attach with cotter pin (25). Secure throttle control lever (28) to shaft (29) with bolt (16), lockwasher (17), and nut (18). Slide shaft (29) through rear of control panel and attach bracket (19) to governor (20).

(9) Secure throttle control lever (28) to link (26) by clevis pin (27).

e. Installation. Position reassembled throttle control housing (5) on the front of control panel, with shaft (4) extending through panel. Working at the rear of the panel, insert shaft (29) and shaft (4) in coupling (2, fig. 20) and secure coupling to shafts with two setscrews (1 and 3). Turn throttle control knob, to the RUN and STOP positions several times to check for loose or binding links.

111. Emergency Overload Switch

a. Removal.

(1) Remove threaded and knurled circular collar holding emergency overload pushbutton switch (20, fig. 14) to panel.

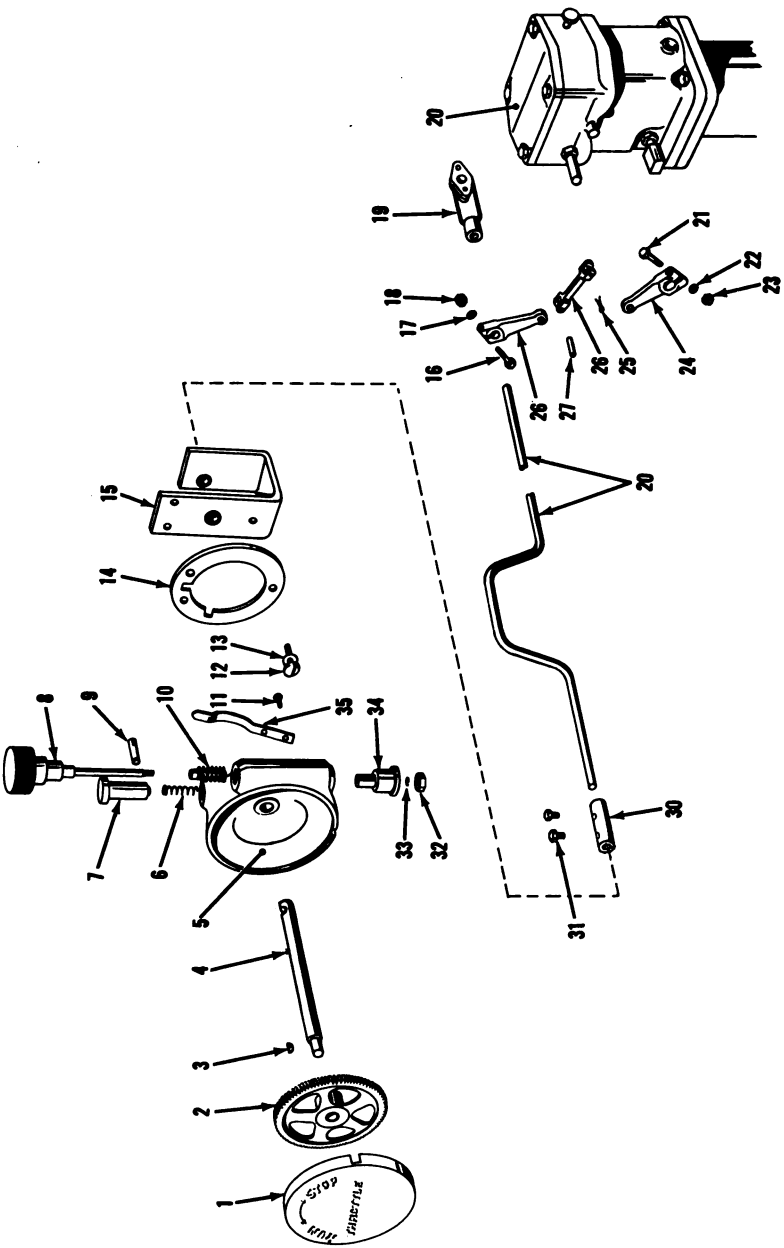
(2) Disconnect the electrical leads from the overload switch terminals (16, fig. 22) at the rear of the panel.

(3) Remove the switch from the rear of the panel.

b. Installation.

(1) Place the emergency overload switch (16) in position at the rear of the panel.

(2) Connect the electrical leads to the overload switch terminals. Refer to table IV.



1 Cover
2 Worm gear
3 Woodruff key, 1/16 x 1/2
4 Shaft
5 Throttle control housing
6 Lockbutton pin spring
7 Lockbutton
8 Vernier knob
9 Lockbutton pin
10 Worm
11 Screw, rd hd, 6–32 x 5/16 (2 req'd)
12 Screw, oval hd, slotted, 12–24 x 3/4 (3 req'd)
13 Washer, plain, No. 12 (3 req'd)
14 Plate
15 Bracket assembly
16 Bolt, hex hd, 1/4–28 x 1/2 (1 req'd)
17 Lockwasher, 1/4 (1 req'd)
18 Nut, hex, 1/4–28 (1 req'd)
19 Bracket
20 Governor
21 Bolt, hex hd, 1/4–28 x 1/2 (1 req'd)
22 Lockwasher, 1/4 (1 req'd)
23 Nut, hex, 1/4–28 (1 req'd)
24 Governor control lever
25 Cotter pin, 1/16 x 1/2 (1 req'd)
26 Link
27 Clevis pin, 1/4 x 51/64 (1 req'd)
28 Throttle control lever
29 Shaft
30 Coupling
31 Setscrew, 1/4–28 x 1/2 (2 req'd)
32 Nut, hex, 12–24 (1 req'd)
33 Lockwasher, No. 12 (1 req'd)
34 Throttle knob shaft bushing
35 Vernier throttle control lock spring

Figure 23. Vernier throttle control, exploded view.

(3) At the front of the panel secure the switch (20, fig. 14) in place with the threaded and knurled circular collar.

112. Engine Starting Motor Button

a. Removal.

(1) Remove threaded and knurled circular collar holding engine main starting button (21, fig. 14) to panel. Loosen hex nut at rear of panel.

(2) Disconnect electrical leads from starting motor button terminals.

(3) Remove button from rear of panel.

b. Installation.

(1) Place hex nut on button assembly and run down on to switch collar allowing sufficient thread in front of nut to pass through the control panel from rear of panel.

(2) Place collar through control panel and hold in place with threaded and knurled circular collar. Tighten hex nut at rear of panel so that switch is held securely against panel.

(3) Connect the electrical leads to each side of the starting button, and tighten and secure. Refer to table IV.

113. Panel Light Switch

a. Removal.

(1) Loosen and remove the threaded knurled collar on the front of the panel which holds the switch (24, fig. 14) in place.

(2) Disconnect the wires from the panel light switch (20, fig. 22) at the rear of the panel and remove the switch.

b. Installation. Connect wires to the switch at the rear of the panel. Refer to table IV. Lock the switch in place by installing the threaded knurled collar on the panel light switch (24, fig. 14) body at the front of the panel.

114. Synchronizing Light Switch

a. Removal.

(1) Loosen and remove the threaded knurled collar on the front of the panel which holds the synchronizing light switch (25, fig. 14) in place.

(2) Disconnect the wires from the switch (19, fig. 22) at the rear of the panel and remove the switch.

b. Installation. Connect wires to the switch at the rear of the panel (20). Refer to table IV. Lock the switch in place by installing the threaded knurled collar on the panel light switch (24, fig. 14) body at the front of the panel.

115. Engine Hour-Meter

a. Removal.

(1) At the rear of panel, remove three nuts and lockwashers holding the engine hour-meter (18, fig. 22) to control panel. Remove screws from front of panel. Disconnect the wiring leads from the meter terminals, and mark the leads.

(2) Remove engine hour-meter (1, fig. 14) from front of panel by pulling forward away from the panel.

b. Installation.

(1) Insert hour-meter (1) from front of panel, carefully matching the meter mounting holes to those of panel.

(2) Insert screws holding meter body to panel and secure with lockwashers and nuts.

(3) At rear of panel, connect wiring leads to meter terminals. Refer to table IV.

116. Synchronizing Lights

a. Removal.

(1) Disconnect wiring leads to the synchronizing lights (11, fig. 22) at rear of panel. Unscrew retaining collar holding light socket to panel.

(2) Remove socket and synchronizing lights (5, fig. 14) from front of panel.

b. Installation.

(1) Insert socket from front of panel.

(2) Screw retaining collar on socket from rear of panel securing socket to panel. Connect wiring leads to light socket terminals.

117. Frequency Meter

a. Removal.

(1) At rear of panel disconnect wiring leads from frequency meter (15, fig. 22) terminals. Remove three nuts and lockwashers holding meter body to control panel. Remove retaining screws from front of panel.

(2) Remove frequency meter (7, fig. 14) from front of panel by pulling forward away from panel.

b. Installation.

(1) Insert meter body from front of panel, carefully matching the meter mounting holes to those of the panel. Insert screws holding meter body to panel.

(2) Secure screws with lockwashers and nuts at rear of panel. Connect wiring leads to meter terminals. Refer to table IV.

118. Voltmeter

a. Removal.

(1) At rear of panel disconnect wiring leads from a-c voltmeter (13, fig. 22) terminals. Remove three nuts and lockwashers holding meter body to control panel. Remove screws from front of panel.

(2) Remove voltmeter (10, fig. 14) from front of panel by pulling forward away from panel.

b. Installation.

(1) Insert meter body from front of panel carefully matching the meter mounting holes to those of the panel. Insert screws holding meter to panel.

(2) Secure screws with lockwashers and nuts at rear of panel. Connect wiring leads to meter terminals. Refer to table IV.

119. Ammeter

a. Removal.

(1) At rear of panel disconnect wiring leads from a-c ammeter (10, fig. 22) terminals. Remove three nuts and lockwashers holding meter body to control panel. Remove screws from front of panel.

(2) Remove meter body from front of panel by pulling forward away from panel.

b. Installation.

(1) Insert ammeter (12, fig. 14) body from front of panel carefully matching the meter mounting holes to those of the panel. Insert screws holding meter to panel.

(2) Secure screws with lockwashers and nuts at rear of panel. Connect wiring leads to meter terminals. Refer to table IV.

120. Contactor Indicating Light

a. Removal.

(1) Remove the screws and nuts holding the contactor indicating light (8, fig. 22) to rear of panel. Disconnect wiring from socket.

(2) Remove socket from panel.

b. Installation. Install socket in panel and connect wiring. Install screws, lockwashers, and nuts holding socket to panel.

121. Coolant Temperature Gage

a. Removal.

(1) Withdraw temperature bulb and tube into the control panel box.

(2) Remove the two nuts (5, fig. 20) securing the coolant temperature gage (6) to the step bracket (4). Remove the gage connecting tube and bulb through the front of the panel.

b. Installation.

(1) Insert the temperature bulb through the control panel from the front.

(2) Press the gage into place, and secure it with two nuts (5) on the screws extending through the step bracket (4).

122. Engine Lubricating Oil Pressure Gage

a. Removal.

(1) Disconnect engine oil pressure gage (18, fig. 14) feed line from the gage at rear of panel. Drain the oil into a receptacle.

(2) Remove the nuts from the threaded studs which hold the gage to the step bracket at the rear of the panel.

(3) Slide the gage out through the front of the panel.

b. Installation.

(1) Insert the engine oil pressure gage (18) through the front of the panel.

(2) Secure the gage in place with two nuts on the threaded studs which extend through the step bracket at the rear of the panel.

(3) Connect the feed line to the oil pressure gage at the rear of the panel. Make sure that the oil connection is tight and does not leak.

123. Battery Charging Ammeter

a. Removal.

(1) Disconnect the wiring leads from the battery charging ammeter (19, fig. 14) terminals at the rear of the panel.

(2) Remove the two nuts from the threaded studs which hold the ammeter (19) to the step bracket at the rear of the panel.

(3) Remove the ammeter (19) by pulling it through at the front of the control panel.

b. Installation.

(1) Insert the battery charging ammeter (19) through the front of the panel.

(2) Secure the ammeter in place with two nuts on the threaded studs extending through the step bracket at the rear of the panel.

(3) Connect the wiring leads to the ammeter terminals. Refer to table IV.

124. Main Load Contactor

a. Description. The main load contactor (6, fig. 22) applies the load to the generator or removes the load from it. It is a magnetically held remote control switch and is operated by the contactor pushbutton (14, fig. 14).

b. Removal.

(1) Disconnect all cables to the load contactor (6, fig. 22).

(2) Remove the mounting screws from the front of the contactor mounting panel. Lift contactor mounting panel (8, fig. 24) from the control cabinet.

c. Cleaning and Inspection.

(1) Use compressed air at a maximum pressure of 25 psi to remove dust or other foreign matter from contactor assembly. Wipe arc deflector shields (3, fig. 24) with clean rags dampened with carbon tetrachloride. Use fine sandpaper or an ignition file to dress contacts which are slightly pitted or burned.

(2) Examine movable contacts (4) and stationary contacts (5) for pitting, burning, or arcing. Replace badly burned contacts.

(3) Inspect the arc deflector shields (3). Replace them if they are cracked or badly marred. Inspect all springs visually and by hand compression. Replace any that have lost tension.

(4) Inspect the flexible connectors (14) for loose terminals and cracked or frayed insulation. Replace if defective.

(5) Check all bearing points for signs of wear. Lubricate them with a small amount of light oil. Wipe all excess oil or dust from the contactor or mounting panel.

d. Repair. To replace damaged contacts remove three nuts holding the flexible connectors (14) to connector terminals (17). Remove spring retaining nuts and locknuts (1) and contact springs (2). Renew movable contacts (4) attaching them with contact springs (2) and spring retaining nuts and locknuts (1).

Note. No adjustment is required unless the main load contactor has been disassembled.

e. Adjustment.

(1) Disconnect three flexible connectors (14) from outgoing power terminal (13).

(2) Manually close main load contactor and measure the gap between the movable contact (4) and the insulating block on which the movable contact is mounted. The clearance should be approximately one-sixteenth of an inch.

(3) If the clearance is more than one-sixteenth of an inch, turn the hex nut on stationary contact (5) counterclockwise, and turn spring retaining nut and locknut (1) clockwise until the recommended gap is attained.

(4) If the clearance is less than one-sixteenth of an inch, reverse this procedure.

(5) When a main load contactor is in closed position, check to see that auxiliary contact short-circuiting disk (15) is in contact with auxiliary contacts (9). If auxiliary contact short-circuiting disk (15) does not contact auxiliary contacts (9) loosen the nut which secures the auxiliary contact short-circuiting disk (15) and short-circuiting disk spring (16) to the insulating bar which mounts the movable contact (4). This will bring the disk into contact with the auxiliary contacts (9).

(6) Connect three flexible connectors (14) to outgoing power terminals (13).

f. Installation.

(1) Position the contactor mounting panel in the control cabinet and secure in place with the four mounting screws.

(2) Connect the wiring to the contactor terminals.

125. Engine Starting Motor Auxiliary Button

a. Removal.

(1) Disconnect electrical leads from auxiliary starter button (7, fig. 13) at the rear of the auxiliary panel.

(2) Remove threaded and knurled circular collar holding starting auxiliary button (7) to panel. Remove button from rear of panel.

b. Installation.

(1) Place hex nut on button assembly and run down on to switch collar allowing sufficient thread in front of nut to pass through the auxiliary control panel from the rear.

(2) Place collar through panel and hold in place with threaded and knurled circular collar. Tighten hex nut at rear of panel so that switch is held securely against panel.

(3) Connect the electrical leads to each side of the auxiliary starting button (7), tighten and secure. Refer to table IV.

126. Air Heater Fuel Valve

a. Removal.

(1) Close fuel valve at gasoline heater fuel tank (6, fig. 3).

(2) Disconnect fuel inlet and outlet lines from air heater fuel valve assembly (11, fig. 13) at rear of auxiliary control panel.

(3) Back out flat head screw attaching knob to valve spindle and remove knob.

(4) Remove valve panel nut from front of panel.

(5) Remove two bolts with nuts and lockwashers. Lift valve (11) away from rear of auxiliary control panel.

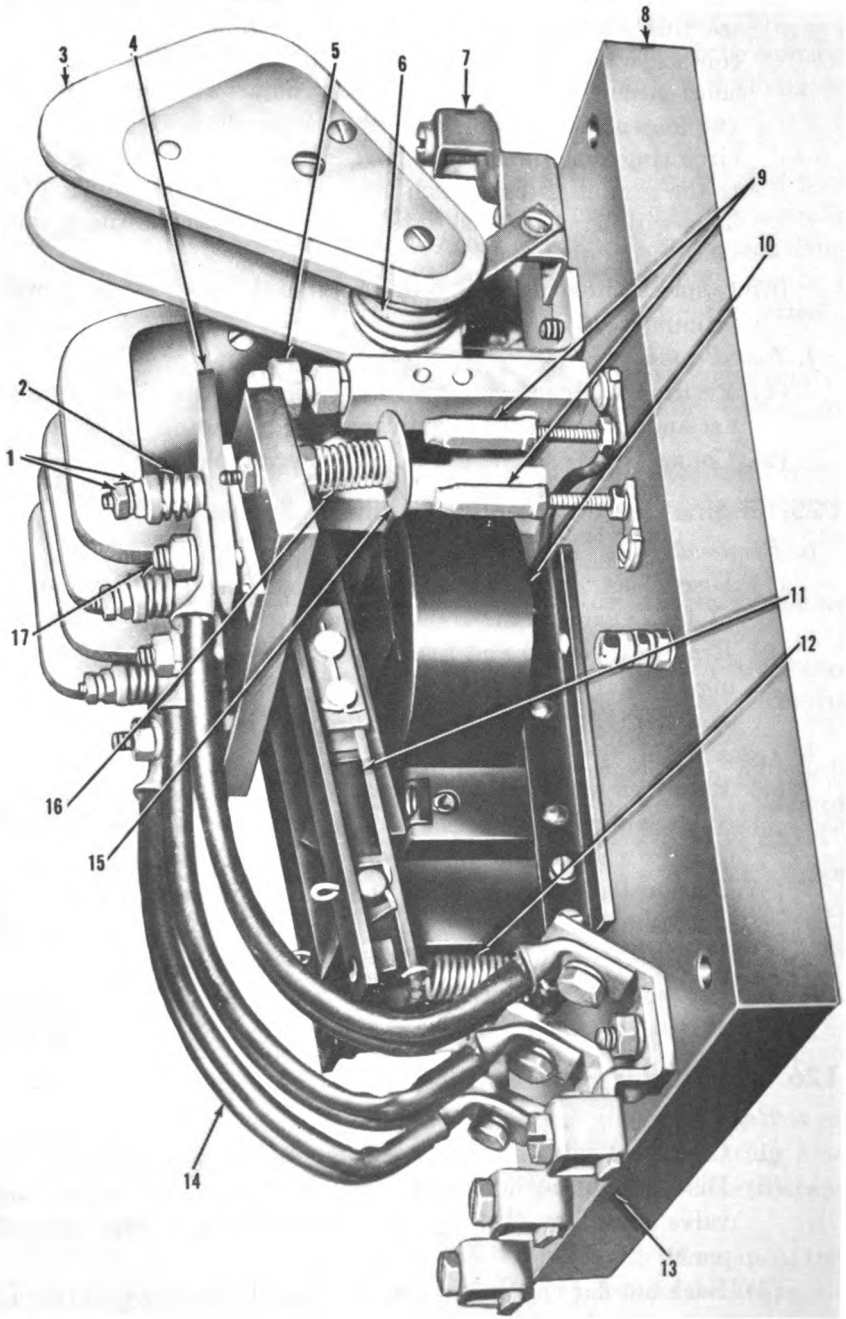


Figure 24. Main load contactor.

b. Installation.

(1) Position air heater fuel valve (11, fig. 13) at rear of panel and secure with two bolts, lockwashers, and nuts.

(2) Install panel nut and draw up tight. Place knob on spindle and secure valve (11) with flathead screw.

(3) Connect the fuel inlet and outlet lines to the valve at the rear of the panel.

(4) Open the fuel valve at the gasoline heater fuel tank (6, fig. 3).

127. Air Heater Pump Control

a. Removal.

(1) Close fuel valves at heater fuel tank.

(2) Disconnect the fuel inlet and outlet lines from the pump valves.

(3) Unscrew plunger nut and withdraw air heater pump plunger assembly (9, fig. 13) from pump.

(4) Loosen locknut at the rear of the panel.

(5) Lift pump body assembly (9) out of rear of panel.

(6) Remove locknut from pump body.

b. Installation.

(1) Screw locknut onto outer end of air heater pump body assembly (9).

(2) Insert threaded end of pump body through hole in auxiliary control panel from rear.

(3) Slide piston cups and plunger assembly into pump body, being careful not to damage lips of piston cups. Screw plunger nut on to end of pump body and tighten locknut against rear face of panel.

(4) Attach fuel lines to inlet and outlet connections.

(5) Open fuel valves at heater fuel tank.

128. Fuel Control Valves

a. Removal.

(1) Drain the diesel fuel tank (10, fig. 4).

(2) Disconnect the fuel lines from the supply (4, fig. 3) and return valves (5).

---

1 Spring retaining nut and locknut
2 Contact spring
3 Arc deflector shield
4 Movable contact
5 Stationary contact
6 Blowout coil
7 Incoming power terminal
8 Contactor mounting panel
9 Auxiliary contacts
10 Contactor coil
11 Armature
12 Release spring
13 Outgoing power terminal
14 Flexible connector
15 Auxiliary contact short-circuiting disk
16 Short-circuiting disk spring
17 Connector terminal

Figure 24.—Continued

(3) Unscrew each of the valves from the fuel tank fitting.

b. Installation.

(1) Screw each valve tightly into the fuel tank fitting.

(2) Connect the fuel lines to the supply and return valves (4) and (5). Fill the fuel tank.

129. Air Box Shutoff Solenoid

a. Removal.

(1) Disconnect the two wiring leads from air-box shutoff solenoid (5, fig. 13).

(2) Remove cotter pin from clevis pin attaching the air-box shutoff solenoid shutoff rod (17) to the air inlet housing assembly (6) shutdown valve lever. Slide out clevis pin and release rod from lever.

(3) Remove the two hex head bolts and two lockwashers holding the air shutoff solenoid bracket to the air inlet housing assembly (6). Lift off the air-box shutoff solenoid (5) and bracket.

b. Installation.

(1) Position the solenoid and bracket to the air inlet housing assembly (6, fig. 13) and secure in place with two hex head bolts and two lockwashers.

(2) Connect the solenoid air shutoff rod (17) to the air inlet housing (6) shutdown valve lever by means of a clevis pin. Secure the clevis in place with a cotter pin.

(3) Connect the two wiring leads. Refer to table IV.

130. Engine Safety Shutdown Relay

a. Removal.

(1) Remove the four screws and lift the cover from the engine safety shutdown relay (3, fig. 13) box.

(2) Disconnect the four wiring leads from the relay terminals. Loosen the cable clamps and release the two wiring cables from the relay box.

(3) Remove the hex head bolt and lockwasher which fasten the relay box to the flywheel housing assembly. Lift off the relay box.

b. Installation.

(1) Mount the engine safety shutdown relay (3, fig. 13) box in place on the flywheel housing assembly with one hex head bolt and one lockwasher.

(2) Insert the cables in the relay box and clamp in place with the terminal screw clamps.

(3) Connect the wiring leads to the relay terminals. Refer to table IV. Attach the cover to the box with the four screws.

131. Engine Coolant Thermostat Safety Switch

a. Removal.

(1) Remove the three screws holding the cover of the engine coolant thermostat safety switch (6, fig. 4) to the box and lift off the cover. Disconnect the two wire leads from the switch terminals, and remove the cable.

(2) Unscrew the entire switch box and thermostat plug from the boss in the water manifold.

b. Installation.

(1) Screw the switch box and thermostat plug into the water manifold boss.

(2) Install the cables, and connect the wiring leads to the safety switch terminals. Refer to table IV.

(3) Secure the cover to the switch box with three screws.

132. Engine Lubrication Low Oil Pressure Safety Switch

a. Removal.

(1) Remove the three screws holding the cover to the low oil pressure safety switch (8, fig. 4) box and lift off the cover. Disconnect the two wire leads from the switch terminals, and remove the cable from the box.

(2) Unscrew the entire switch box and thermostat plug from the oil tube assembly.

b. Installation.

(1) Screw the switch box and thermostat plug into the oil tube assembly.

(2) Install the cables, and connect the wiring leads to the safety switch terminals.

(3) Secure the cover to the switch box with three screws.

133. Diesel Fuel Pressure Safety Switch

a. Removal.

(1) Remove the three screws holding the cover to the fuel pressure safety switch (13, fig. 3) and lift off the cover. Disconnect the two wire leads from the switch terminals, and remove the cable from the box.

(2) Unscrew the entire switch box and thermostat plug from the upper fuel filter connection.

b. Installation.

(1) Screw the switch box and thermostat plug into the upper fuel filter.

(2) Install the cable, and connect the wiring leads to the safety switch terminals. Refer to table IV.

(3) Secure the cover to the switch box with three screws.

134. Heater Safety Thermostat Switch

a. Removal.

(1) Remove the three screws holding the cover to the heater thermostat safety switch (14, fig. 13) box and lift off the cover. Disconnect the two wire leads from the switch terminals, and remove the cable. Refer to table IV.

(2) Unscrew the entire switch box and thermostat plug from the bushing in the water pump cover.

b. Installation.

(1) Screw the heater thermostat safety switch (14) box and thermostat plug into the water pump cover bushing.

(2) Install the cables, and connect the wiring leads to the thermostat switch terminals. Refer to table IV.

(3) Secure the cover on the switch box with three screws.

135. Battery Box Thermostat Switch

a. Removal. Disconnect the wiring and ground leads. Remove the two screws from the battery box thermostat (3, fig. 11) attachment ears, and lift out the thermostat.

b. Installation. Secure the thermostat to the side of the battery box with two screws. Connect the wiring and the ground leads to the thermostat. Refer to table IV.

136. Battery Thermal Overload Circuit Breaker

a. Removal. Loosen the two screws holding the box cover in place and slide the box cover off and out of the box. On the inner side of the cover, disconnect the two wires from the battery thermal overload circuit breaker (14, fig. 16) and remove the two screws fastening the circuit breaker (14) to the inside of the cover.

b. Installation. Fasten the circuit breaker (14) to the inside of the heater control box cover with two machine screws. Connect the two wires to the circuit breaker terminals. Refer to table IV. Install the cover.

137. Heater Fuel Supply Solenoid

a. Removal.

(1) Close the heater fuel supply valve on fuel valve line to winterization heater (9, fig. 4).

(2) Disconnect the inlet and outlet fuel lines from the heater fuel supply solenoid valve (6, fig. 16).

(3) Disconnect the two wiring leads from the solenoid valve (6). Refer to table IV.

(4) Remove the six screws holding the solenoid to the support. Lift out the solenoid.

b. Installation.

(1) Position the solenoid on the support, and secure it with six screws.

(2) Attach the two wiring leads to the solenoid. Refer to table IV.

(3) Connect the inlet and outlet fuel lines to the solenoid valve (6).

(4) Open the winterization heater fuel supply valve at the gasoline tank connection (9, fig. 4).

138. Battery Box Overheat Solenoid

a. Removal.

(1) Loosen the clamp screw in the solenoid arm and remove arm from shaft of the battery box overheat solenoid (5, fig. 16).

(2) Disconnect taped and bolted wiring connections to solenoid (5). Refer to table IV.

(3) Remove the two nuts from the solenoid studs, and slide solenoid (5) away from mounting bracket.

b. Installation.

(1) Mount the battery box overheat solenoid (5) on the bracket and secure in place with two nuts on the threaded studs.

(2) Make the two electrical connections with bolts and nuts, and tape the connections. Refer to table IV.

(3) Connect arm to solenoid (5) and tighten screw.

Note. The solenoid arm should move through approximately 90° of arc when 24 volts are applied. If this requirement is not met, replace the solenoid.

139. Winterization Heater "High-Low" Fuel Valve

a. Removal.

(1) Close the winterization heater fuel supply valve on fuel valve line to winterization heater (9, fig. 4).

(2) Disconnect the three fuel lines from the fuel HIGH-LOW valve (2, fig. 16).

(3) Remove the two hex head bolts and nuts attaching the bracket and float chamber. Remove the two roundhead screws attaching the bracket to the burner plate. Lift away the valve and bracket.

b. Installation.

(1) Position the fuel HIGH-LOW valve (2) and bracket on the burner plate and secure with two roundhead screws. Attach the float chamber to the bracket with the two hex head bolts and nuts.

(2) Connect the inlet tube and the two outlet tubes to the valve (2).

(3) Open the heater fuel supply valve on fuel valve line to winterization heater (9, fig. 14).

140. Winterization Heater Control Switch

a. Removal.

(1) Remove the hex panel nut from the heater control switch (13, fig. 16).

(2) Loosen the two screws holding the box cover in place and slide the cover away from the box.

(3) Disconnect the four wiring leads from the switch terminals. Lift the switch (13) out and away from the cover.

b. Installation.

(1) Connect the four wiring leads to the switch terminals. Refer to table IV.

(2) Mount the heater control switch (13) in place on the box cover and secure it with the hex panel nut. Install the cover on the panel box and tighten the two holding screws.

141. Winterization Heater Blower Motor Control Switch

a. Removal.

(1) Remove the hex panel nut from the blower motor control switch (12, fig. 16).

(2) Loosen the two screws holding the box cover in place and slide the cover away from the box.

(3) Disconnect the three wiring leads from the switch terminals. Lift the switch (12) out and away from the cover.

b. Installation.

(1) Connect the three wiring leads to the switch terminals. Refer to table IV.

(2) Mount the switch (12) in place on the box cover and secure it with the hex panel nut. Install the cover on the panel box and tighten the two holding screws.

142. Manual Shutter Control

a. Removal.

(1) Unscrew the shutter control knob (10, fig. 21) from the shutter control rod (11).

(2) Remove the screws attaching each end of the shutter control bracket (6) to the front cowl (19). Unscrew the control rod (11) and remove it together with the bracket. Slide the control rod from the bracket.

b. Installation.

(1) Slide the control rod (11) through the hole in the bracket (6) and secure the bracket to the front cowl (19) with two screws.

(2) Screw the control rod onto the shutter actuating rod. Screw the knob (10) on the control rod (11).

143. Automatic Shutter Control

a. Removal.

(1) Drain the cooling system.

(2) Disconnect inlet tube (2, fig. 15) and outlet tube (4) from thermostat housing (5).

(3) Remove sheet metal screw and release spring (6).

(4) Remove cotter pin from clevis pin (8). Slide out clevis pin (8) and disconnect automatic shutter control lever arm (10) from vane position control rod (9).

(5) Remove two bolts attaching the control to the shutter frame, and lift out the control.

b. Installation.

(1) Place control in position on the shutter frame and fasten with two bolts.

(2) Connect automatic shutter control lever arm (10) to vane position control rod (9) with the clevis pin (8) and a cotter pin.

(3) Attach spring (6) with sheet metal screw.

(4) Connect inlet (2) and outlet (4) tubes to thermostat housing (5).

(5) Fill the cooling system.

Section VIII. COOLING SYSTEM

144. Description

a. The generator set cooling system consists of a blower type cooling fan (27, fig. 5), a radiator assembly (4, fig. 21), a centrifugal water pump (13, fig. 13), and a fan type oil cooler assembly (15).

b. The centrifugal pump draws the coolant through the oil cooler and discharges it into the lower part of the engine cylinder block. The coolant circulates around the cylinder bores, passes up through openings into the water jacket of the cylinder head where it circulates around the valves and fuel injectors, then flows into the radiator. Here the temperature of the coolant is reduced by giving up its heat to the air stream from the fan.

c. The coolant temperature is automatically controlled by a spring thermostat, mounted in a housing (5, fig. 4), between the water manifold and the radiator.

d. The radiator shutter (17, fig. 21) is controlled thermostatically. The shutter remains closed during the warmup period and opens for ventilation when the engine has reached operating temperature. Any drop in temperature of the engine to less than normal will cause the shutter to close until the proper temperature is attained.

145. Fan Guard and Radiator

a. Removal.

(1) Remove muffler assembly (par. 99*a*).
(2) Remove front canopy (par. 99*b*).
(3) Remove front side panels (par. 99*d*).
(4) Remove front cowl assembly (par. 99*e*).
(5) Loosen hose clamps and disconnect lower radiator hose (26, fig. 3). Loosen hose clamps and disconnect upper radiator hose (4, fig. 4).
(6) Remove bolts (22, fig. 3) and (1, fig. 4) and washers holding right and left fan guards to radiator assembly (4, fig. 21). Slide fan guards out away from fan and radiator.
(7) Remove the cap screws attaching the radiator braces (17, fig. 3) and (2, fig. 4) to the radiator.
(8) Remove the two cap screws, nuts, and washers attaching the radiator to the skid supports. Lift off the radiator (4, fig. 21).

b. Cleaning and Inspection. Engine overheating is often the result of poor air circulation through the radiator core. If the spaces between the radiator fins become clogged, clean them with air or water under pressure. Straighten bent fins, being careful not to injure the tubes or to break the bond between the fins and the tubes. Flush radiator with hot water under pressure after first opening radiator and cylinder-block drains. Allow flushing to continue until water runs clear. Use a wire brush and cleaning solvent to remove any dirt or grease in the screening of the fan guards. Inspect the fan guard screens for breaks or bent frame members.

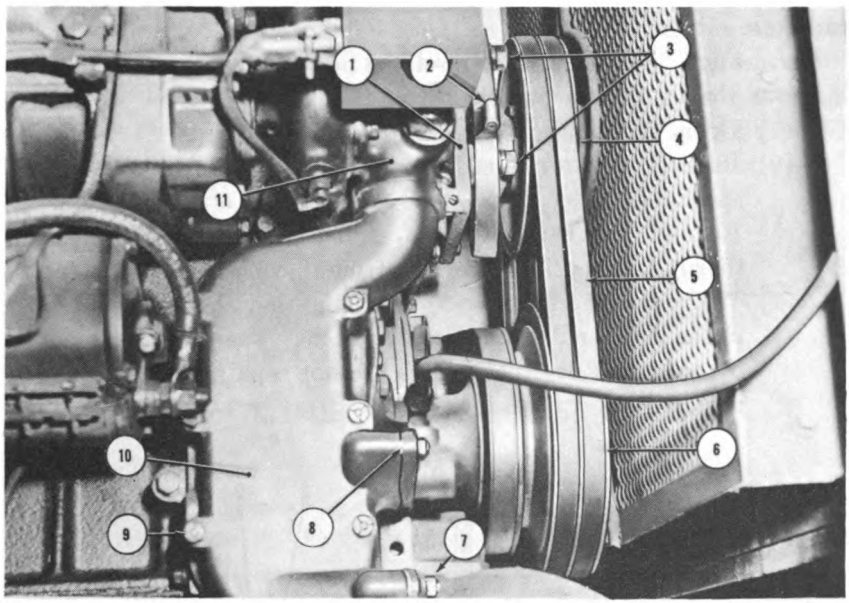
c. Installation.

(1) Secure the radiator in position on the skid supports with two cap screws, washers, and nuts.
(2) Attach the radiator braces (17, fig. 3) and (2, fig. 4) to the radiator with a cap screw holding each brace.
(3) Slide the lower radiator hose (26, fig. 3) into place over the radiator outlet tube. Slide the upper radiator hose (4, fig. 4) in place over the radiator inlet tube. Secure both hoses with hose clamps.
(4) Install the right fan guard (1, fig. 21) in place and secure it to the radiator with bolts (22, fig. 3) and washers. Install the left fan guard (20, fig. 21) in place and secure it to the radiator with bolts (1, fig. 4) and washers.
(5) Assemble and install front cowl assembly (par. 102*d*, *e*).
(6) Install front side panels (par. 102*f*).
(7) Install front canopy (par. 102*h*).
(8) Install muffler assembly (par. 102*i*).

146. Fan Belts

a. Replacement (fig. 25).

(1) Periodic replacement of fan belts is a good insurance against damaged radiators and emergency shutdowns. Always replace both fan belts at the same time.



1 Fan bracket support
2 Fan bracket
3 Bolt, hex hd, ½–13 x 1¾ (2 req'd)
4 Fan pulley
5 Fan belt
6 Crankshaft pulley
7 Bolt, hex hd, ⅜–16 x 1¼ (2 req'd)
8 Flange, attachment, radiator shutter control to oil cooler
9 Bolt, hex hd, 5/16–18 x 6½ (6 req'd)
10 Oil cooler housing
11 Water pump connector

Figure 25. Fan belts installed.

(2) To replace the belts, remove the fan guards (par. 145*a*), then loosen the two adjusting bolts (3) and permit the fan bracket support (1) to slide down and release the tension from the fan belts. Remove the old belts and install the new ones over the fan blades. Replace fan guards (par. 145*b*) and adjust fan belt tension (*b* below).

Note. Always use the fan belt tension adjustment when installing belts. Attempting to force the belts over the pulley while under tension is almost certain to damage the belts.

b. Tension Adjustment (fig. 25). With two adjusting bolts (3) loosened, place an adjustable open end wrench over the fan bracket (2) and move up the adjustment swivel bracket until the fan belts deflect about 1¼ inches from a straight line between pulleys (4 and 6) when depressed with the thumb. Tighten the two adjusting bolts (3).

147. Thermostat Assembly

a. Operation. At the front end of the water outlet manifold (4, fig. 5), a coolant thermostat (2) acts to direct the coolant to a water bypass line (7, fig. 26), until it has warmed up to approximately 170° F. On reaching normal operating temperature, the thermostat opens and allows the coolant to flow through the radiator inlet hose (1) to the radiator.

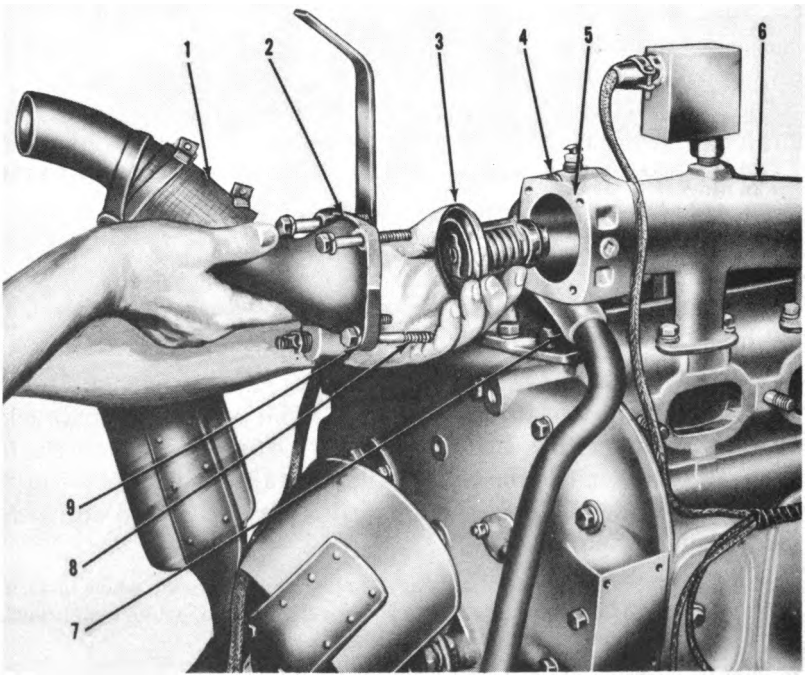
b. Removal. Thermostats will seldom need replacement in the field; however, they should be checked periodically.

(1) Drain the cooling system.

(2) Remove radiator inlet hose (1, fig. 26) from the upper radiator tank.

(3) Remove four cap screws (8) and lockwashers (9), releasing thermostat housing cover (2) from thermostat housing (4).

(4) Withdraw thermostat (3) from the thermostat housing (4) in the manner illustrated in figure 26. Thermostats damaged by corrosion or other causes are not repairable, but must be replaced.



1 Radiator inlet hose
2 Thermostat housing cover
3 Thermostat
4 Thermostat housing
5 Thermostat housing gasket
6 Water outlet manifold
7 Water bypass line
8 Cap screw, hex hd, ⅜–16 x 1¾ (4 req'd)
9 Lockwasher, ⅜ (4 req'd)

Figure 26. Thermostat assembly.

c. Testing. Test thermostats in hot water for proper opening. Fill a bucket or other container with sufficient water to cover the thermostat and suspend a good quality thermometer in the water so that the sensitive bulb portion does not rest on the bucket bottom or side. Use a stove or torch to bring the water to the heat range of 165° F. Stir the water for even heating. As the temperature passes the 165° F. to 170° F. range, the thermostat should start to open. When the temperature has risen between 185° F. and 190° F. it should be completely open. Lifting the thermostat into the colder temperature of the surrounding air should cause a pronounced closing action and the unit should close entirely within a short time.

d. Installation.

(1) Install thermostat (3) carefully in thermostat housing (4).
(2) Position thermostat housing cover (2) on thermostat housing (4) and secure with four cap screws (8) and lockwashers (9).
(3) Attach radiator inlet hose (1) to upper radiator tank.
(4) Fill the cooling system.

Section IX. FUEL AND EXHAUST SYSTEMS

148. Description

a. Diesel Fuel System.

(1) As shown in the diagram (fig. 27), fuel passes from the diesel fuel tank (10, fig. 4), through a three-way valve (4, fig. 3), a strainer (22, fig. 13), and a primary fuel filter (20) to the fuel pump (21). The fuel is then forced through the secondary fuel filter (4) and inlet manifold to the injector filters and finally to the fuel chambers within the injectors.
(2) The capacity of the fuel supply pump is considerably in excess of that required for engine operation. The injectors are set to allow the surplus fuel to flow through them and act as a coolant. The surplus fuel then leaves the injectors and flows through an outlet pipe to the return manifold and then through a return pipe and three-way valve back to the fuel tank (10, fig. 4).
(3) The two three-way fuel control valves allow the system to be operated entirely from the fuel tank, entirely from an external supply tank, or allow the engine to operate while filling or draining the fuel tank.

b. Gasoline Fuel System. A heater fuel tank (6, fig. 3) stores the gasoline for the air heater and winterization heater systems. A copper line (25) carries the gasoline to the air heater while another line (9, fig. 4) supplies gasoline to the winterization heater (15).

c. Exhaust System. The exhaust system consists of a muffler (8, fig. 1) and a flexible exhaust connection (7, fig. 4) which joins the muffler and the exhaust manifold. Exhaust gases from the combus-

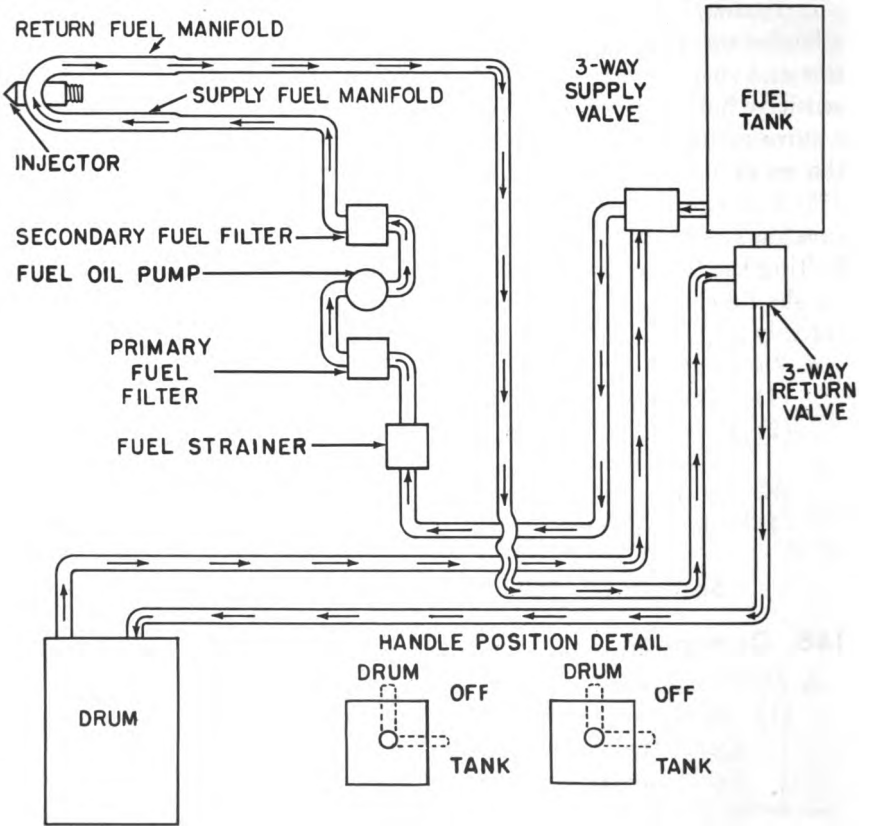


Figure 27. Schematic diagram of fuel oil flow.

tion chamber of each cylinder leave through the valve ports and thence to the manifold, through the connection, and out through the muffler.

149. Diesel Fuel Tank

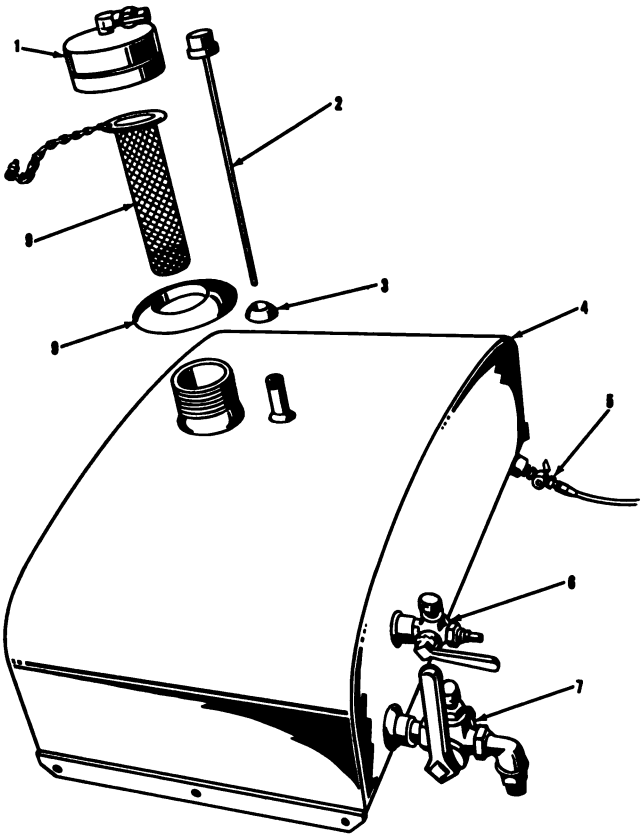
a. Removal.

(1) Remove rear canopy (par. 99*c*).
(2) Remove rear side panels (par. 99*d*).
(3) Remove rear cowl assembly (par. 99*g*).
(4) Disassemble rear cowl assembly (par. 100*b*).

b. Disassembly (fig. 28). Remove fuel tank cap (1) and withdraw fuel tank strainer (9). Remove the filler tube rubber grommet (8) from the top of the tank. Unscrew and withdraw fuel gage stick (2). Remove the gage stick tube rubber grommet (3) from the top of the tank. Unscrew and remove the return three-way valve (6) and the supply three-way valve (7) from the front of the tank.

c. Cleaning, Inspection, and Repair.

(1) Plug all outlets and inlets. Partly fill the tank with cleaner gasoline through filler opening, and thoroughly shake the



1 Diesel fuel tank cap
2 Diesel fuel gage stick
3 Gage stick tube rubber grommet
4 Diesel fuel tank
5 Drain valve
6 Return three-way valve
7 Supply three-way valve
8 Filler tube rubber grommet
9 Diesel fuel tank strainer

Figure 28. Diesel fuel tank.

tank to loosen any sediment present. Empty the tank through the filler opening. Repeat this operation to rinse out any remaining dirt. Use clean, dry air to blow out the connecting fuel lines. Disconnect fuel lines before blowing air through them. Flush and steam-clean the tank semi-annually.

(2) Check the threads on the fuel tank cap and gage stick. Replace cap or gage stick if threads are stripped. Examine the seams of the tank for any signs of leaks. Check the strainer for breaks in the wire mesh. Replace mesh if necessary. Examine the rubber grommets for signs of decomposition. Replace them if necessary.

d. Reassembly. Screw fuel supply three-way valve (7, fig. 28) and return three-valve (6) into the front of the fuel tank. Replace

rubber grommet (3) on the gage stick table and rubber grommet (8) on the tank filler tube. Insert fuel tank strainer (9) in filler tube opening and replace fuel tank cap (1). Insert fuel gage stick (2) in gage stick tube.

e. Installation.

(1) Reassemble rear cowl assembly (par. 102*a*).
(2) Install rear cowl assembly (par. 102*b*).
(3) Install rear side panels (par. 102*f*).
(4) Install rear canopy (par. 102*g*).

150. Diesel Fuel Strainer

a. Removal.

(1) Disconnect the diesel fuel supply line (24, fig. 13) and outlet line from the strainer (22).
(2) Remove the nuts (4, fig. 29) and lockwashers (5) from the attachment bolts (12), and lift the strainer away from the supporting bracket.

b. Cleaning. With the engine stopped, remove the plug (1) from the top of the shell (13). Open draincock (11) at bottom of strainer and with a suitable container, catch drainings until strainer is empty. Loosen wingnut on cover retaining bracket. Move bracket aside and remove cover (10) and slide out screen assembly (8). Wash all items thoroughly in clean fuel oil. Inspect screen assembly and replace screen if torn. Install screen assembly, close draincock (11) and fill strainer with fuel oil through pipe plug (1) hole. When strainer is full of oil, install pipe plug (1). Set cover (10) on top of shell (13) and secure with cover bracket and wingnut.

c. Installation.

(1) Attach the strainer to the supporting bracket with the bolts (12) and tighten up the nuts (4) over the lockwashers (5) to hold the strainer (22, fig. 13) securely in place.
(2) Connect the diesel fuel supply line (24) and the outlet line to the strainer.

151. Diesel Fuel Primary Filter

a. Removal.

(1) Disconnect the inlet and outlet fuel lines from the fuel filter (20, fig. 13).
(2) Remove the two attachment nuts (11, fig. 30) and lockwashers (12) from the bolts (3) and lift the fuel filter away from the mounting plate.

b. Installation.

(1) Position the filter on the attachment plate and secure it with the two nuts (11, fig. 30) and lockwashers (12) on the mounting bolts (3). Tighten the nuts to secure the filter in place (20, fig. 13).

(2) Connect the inlet and outlet oil tubes to the primary fuel filter.

c. Maintenance.

(1) *Description.* The primary fuel filter (fig. 30) has a cleanable element (7) which consists of an assembly plate to which are riveted two evenly spaced rods. Upon these rods, stamped metal filter disks, 0.002-inch thick, are loosely stacked and squeezed together by a spring (8) on the shell (9) stud when the element is installed.

(2) *Operation.* Unfiltered fuel enters through the inlet passage and flows into the strainer shell (9) and surrounds element (7). Suction created by the fuel pump draws the fuel through the laminations of the element (7) into the inner passage where it passes through the cover (15) and out to the pump.

(3) *Cleaning.*

(*a*) With engine stopped, open draincock (10, fig. 30), and drain fuel from filter. Close draincock.

(*b*) Remove strainer shell (9) by backing out on cover screw (1). Remove cover screw (1) and cover gasket (2) and withdraw shell (9) and element (7) from strainer cover (15).

(*c*) Remove element from shell and wash in cleaning solvent or fuel oil until the disks are clean and loose. Take care to prevent damage to the disks.

Caution: Under no circumstances should the disks be scraped or scrubbed. Such treatment will bend the disks, making the filter noneffective.

(*d*) Wash the strainer shell (9) with clean fuel oil, and if necessary replace gaskets (5 and 6).

(*e*) Position element (7) and spring (8) in strainer shell (9). Fill the shell with clean fuel oil and install on cover (15). Secure shell (9) in place with cover screw (1) and gasket (2).

152. Diesel Fuel Secondary Filter

a. Removal.

(1) Disconnect the inlet and outlet fuel lines from the fuel filter (4, fig. 13).

(2) Remove the two cap screws attaching the fuel filter cover (6, fig. 31) and mounting bracket to the cylinder block. Lift off the fuel filter.

b. Installation.

(1) Attach the fuel filter cover and mounting bracket in place on the cylinder block with two cap screws.

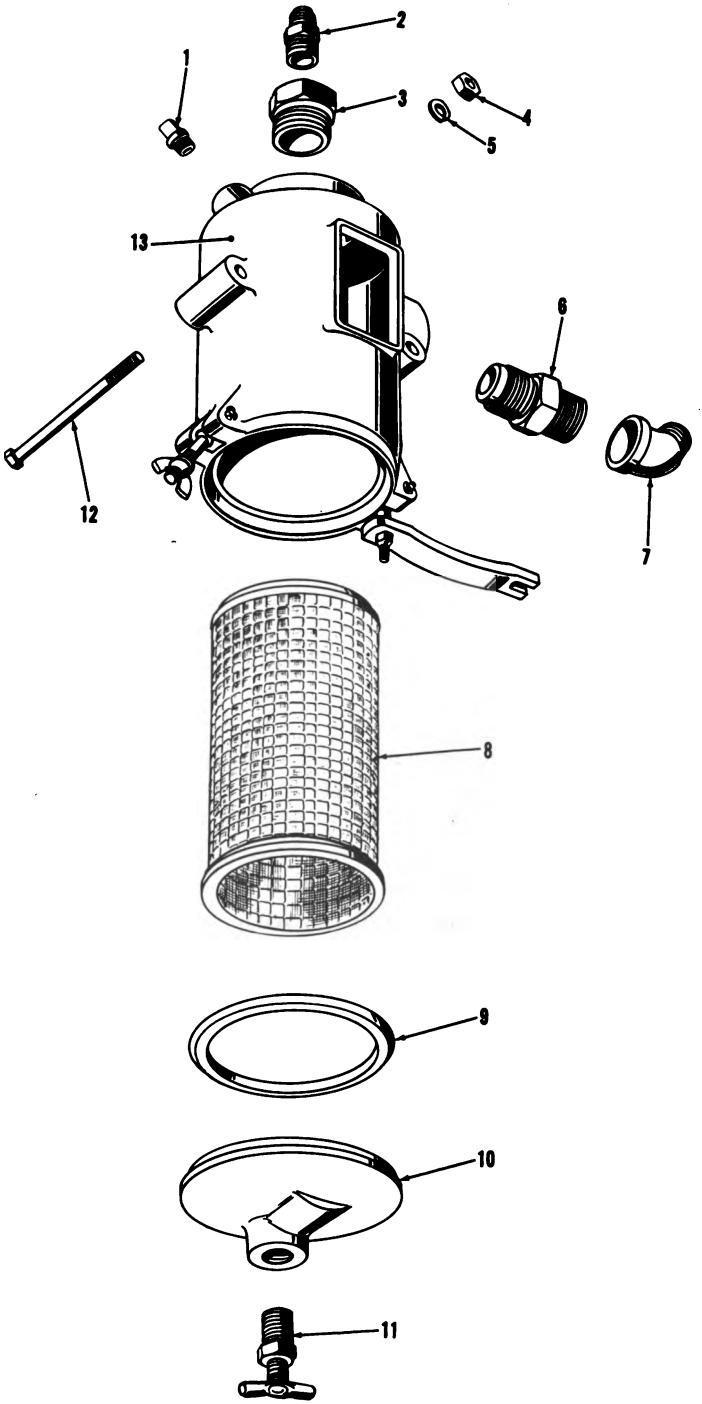


Figure 29. Fuel oil strainer, exploded view.

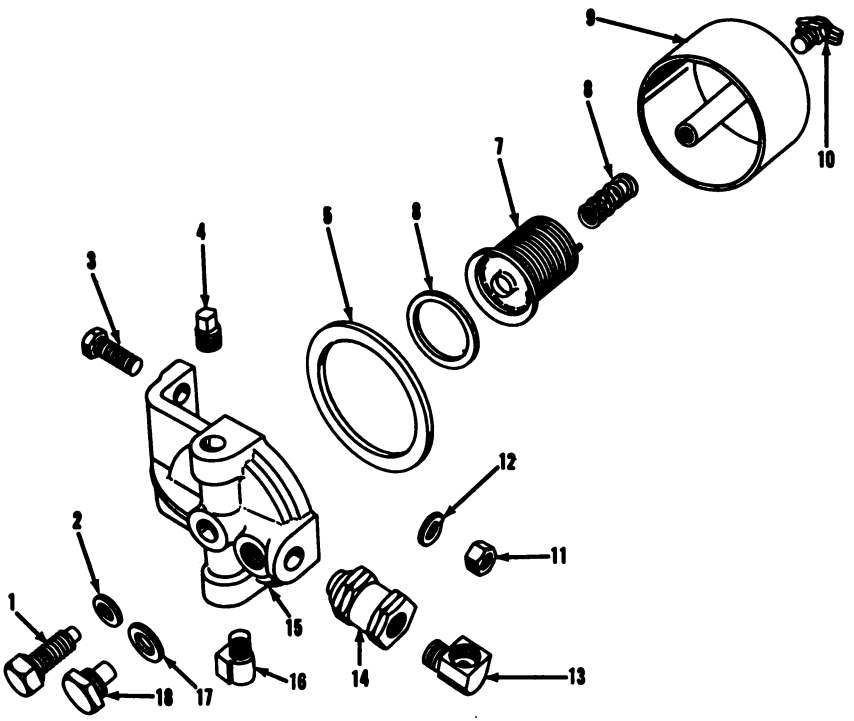
1 Plug, ¼-inch pipe
2 Connector fitting
3 Bushing
4 Nut, hex, ⅜–16 (2 req'd)
5 Lockwasher, ⅜ (2 req'd)
6 Connector fitting
7 Elbow
8 Screen assembly
9 Seal gasket
10 Cover
11 Draincock, ¼ inch
12 Bolt, hex hd, ⅜–16 x 2 (2 req'd)
13 Strainer shell

Figure 29—Continued.

(2) Connect the inlet and outlet fuel lines to the fuel filter (4, fig. 13).

c. Maintenance.

(1) *Description.* The secondary fuel filter (fig. 31) has a replaceable element (7) which consists of soft cotton string tightly wound on a wire mesh core. Once this element has become



1 Fuel strainer cover screw
2 Fuel strainer cover screw gasket
3 Bolt, hex hd, ⅜–24 x ¼ (2 req'd)
4 Pipe plug, ¼ in. NPTF
5 Fuel strainer cover gasket
6 Fuel strainer element cup gasket
7 Fuel strainer element
8 Fuel strainer spring
9 Fuel strainer shell
10 Draincock, ¼ inch
11 Nut, hex, ⅜–24 (2 req'd)
12 Lockwasher, ⅜ (2 req'd)
13 Inlet, fuel line connection
14 Fuel supply check valve
15 Fuel strainer cover
16 Outlet, fuel line connection
17 Fuel strainer cover plug gasket
18 Fuel strainer cover plug

Figure 30. Primary fuel filter, exploded view.

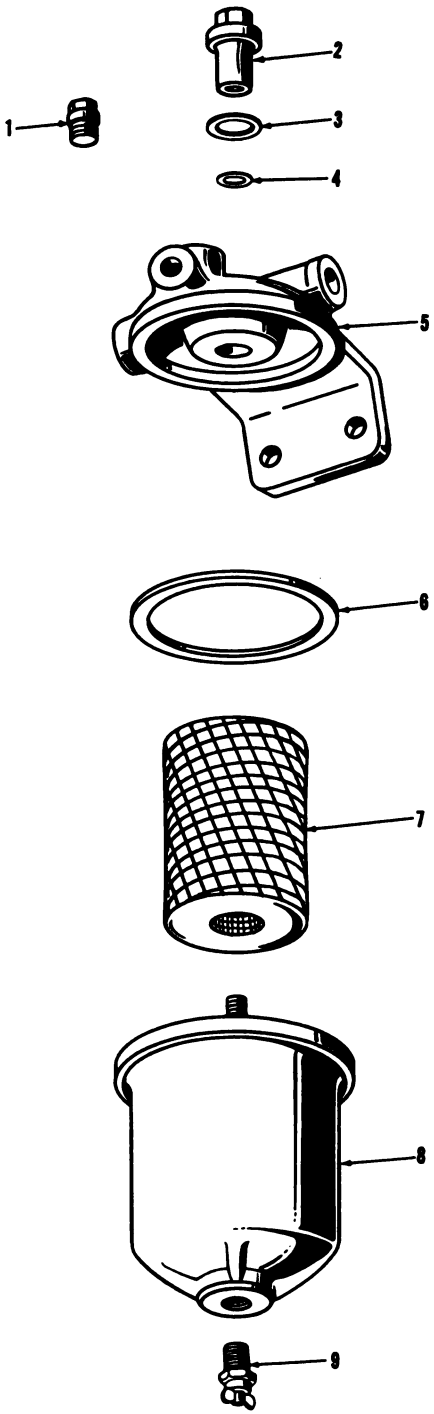


Figure 31. Secondary fuel filter, exploded view.

saturated with impurities, it cannot be cleaned, but must be replaced.

(2) *Operation.* Fuel enters through the inlet port of the mounting bracket (5) to that area of the filter shell (8) outside the filter element (7). The fuel is forced by the pump through the filter element where impurities are removed, up the central passage of the element, through the filter outlet to the inlet manifold on the engine.

(3) *Element replacement.*

(*a*) With engine stopped, open draincock (9) and drain fuel from filter. Close draincock.

(*b*) Remove cover nut (2), gasket (3) and gasket retainer (4) holding filter shell (8) to cover and bracket (5). Lift filter shell (8) away from bracket (5).

(*c*) Remove element (7) from shell (8) and wash shell thoroughly with clean fuel oil. Set new element into place, and fill area surrounding element with clean fuel oil until shell (8) is about two-thirds full.

(*d*) Using a new gasket (6) set shell (8) into place under bracket (5) and secure with cover nut (2), gasket (3), and gasket retainer (4).

(*e*) Remove small pipe plug (1) in top surface of bracket, and using a small funnel, fill remaining space in shell with clean fuel oil. When the engine has run for a few minutes, inspect filter for leaks.

153. Heater Fuel Tank and Filter

a. Fuel Tank Removal.

(1) Remove rear canopy (par. 99*c*).

(2) Remove rear side panels (par. 99*d*).

(3) Disconnect the gasoline lines (25, fig. 3) and (9, fig. 4) from the heater fuel tank (6, fig. 3). Remove the two nuts and bolts from the retaining straps that secure the heater fuel tank to the cradle. Bend back the straps and lift the fuel tank from the supporting frame.

b. Fuel Filter Removal and Service.

(1) Remove the cap screw (19, fig. 32) and remove the bowl (15) from the fuel filter base (11). Slide the retainer spring (13) and fine mesh screen (12) away from filter base (11). With

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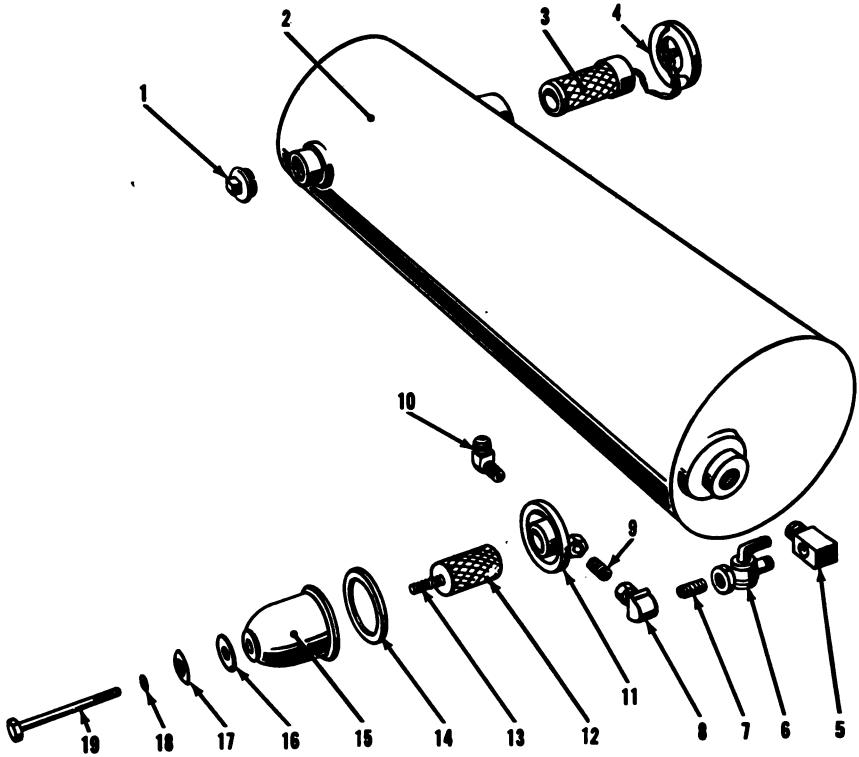
1 Filler pipe plug, ¼ inch
2 Cover nut
3 Cover nut gasket
4 Gasket retainer
5 Mounting bracket
6 Filter cover to shell gasket
7 Filter element
8 Fuel filter shell
9 Draincock, ¼ inch

Figure 31—Continued.



1 Plug, ⅜ inch
2 Heater, fuel tank
3 Strainer
4 Tank cap
5 Elbow
6 Cutoff valve
7 Nipple
8 Elbow
9 Nipple
10 Elbow
11 Fuel filter
12 Fine mesh screen
13 Screen retainer spring
14 Base gasket
15 Steel bowl
16 Felt washer
17 Cap screw gasket
18 Washer, ¼ (1 req'd)
19 Cap screw, hex hd, ¼–20 x 2 (1 req'd)

Figure 32. Heater fuel tank.

the base gasket (14) in place, install the bowl (15) and secure in place with cap screw (19), gaskets and washer.

(2) Wash parts thoroughly in cleaning solvent and air dry. Inspect fine mesh screen for defects; replace if damaged.

c. Fuel Tank Cleaning and Inspection. After tank (2, fig. 32) has been removed pour about ½ gallon of clean gasoline into tank. Shake the tank so that the clean gasoline will loosen any sediment which may be on the bottom of the tank. Drain gasoline from the tank. Keep tank free of any foreign matter which may enter and contaminate the fuel. Check the cap (4) for clogged air vent or stripped threads. Inspect strainer (3) for breaks in the wire mesh. Replace defective items.

d. Fuel Filter and Tank Installation.

(1) Remove cap screw (19) previously installed, releasing bowl (15) and base gasket (14).

(2) With cap screw (19) extending through steel bowl (15), place screen retainer spring (13) and fine mesh screen (12) into steel bowl (15).

(3) Position base gasket (14) and steel bowl (15) against fuel filter base (11) and secure with cap screw (19).

(4) Position the heater fuel tank (6, fig. 3) in the cradle support, and secure it in place with the retaining straps secured by two nuts and bolts. Connect the gasoline lines (25 and 9, fig. 4) to the gasoline tank.

Warning: The fine mesh screen strainer must be intact and in place in the heater fuel tank during heater operation or when refueling.

(5) Install rear side panels (par. 102*f*).

(6) Install rear canopy (par. 102*g*).

Section X. ENGINE ELECTRICAL SYSTEM

154. Battery Charging Receptacle

a. Description. A 24-volt receptacle (22, fig. 1) is located in a recess at the lower section of the right rear cowl. The receptacle provides a connection for charging the battery from an external source.

b. Removal. Open the lower rear access doors and disconnect the wiring from the back of the battery charging plug box (11, fig. 2). The positive wire is secured under one mounting nut; the negative wire goes to the battery box. Remove four machine screws and nuts and remove external battery charging receptacle (40, fig. 3) from the recess in the outside of the lower right rear cowl.

c. Installation. Replace receptacle (40) in recess in rear cowl from the outside. Secure with four mounting screws and nuts. Connect the positive wire under one of the mounting nuts and the negative wire to the battery box (2, fig. 11).

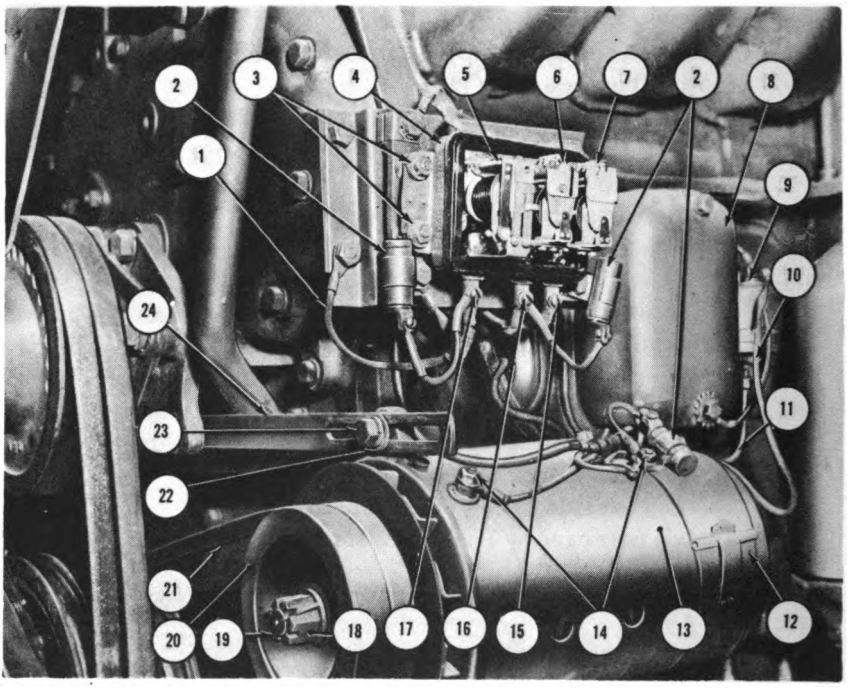
155. Battery Charging Generator

a. Removal.

(1) Disconnect field and armature leads from generator stud terminals (14, fig. 33).

(2) Remove the belt tension adjusting screw (23) and lockwasher (22) from the drive end frame at front of generator. Slip belt (21) from drive pulley (20) and drop generator away from adjusting strap (24).

(3) Remove nuts (2, fig. 34) and shakeproof washers (4) from cap screws (5) attaching generator to bracket (3). Remove generator.



1 Ground wire
2 Capacitor, 0.1 microfarad
3 Voltage regulator mounting nuts, hex, ¼–28 (4 req'd)
4 Battery voltage regulator
5 Cutout relay
6 Current regulator
7 Voltage regulator
8 Air heater cover
9 Air heater pump pressure switch
10 Wire, air heater ignition coil to pressure switch
11 Air heater to pressure switch tube assembly
12 Commutator cover band
13 Battery charging generator
14 Stud terminals
15 Generator field terminal
16 Generator armature terminal
17 Battery terminal
18 Drive and shaft nut
19 Cotter key
20 Generator drive pulley
21 Generator drive belt
22 Lockwasher
23 Generator belt tension adjusting screw
24 Generator adjusting strap

Figure 33. Battery charging generator and relay.

b. Installation.

(1) Place generator (6, fig. 34) on bracket (3) and secure to bracket hinge with cap screws (5), shakeproof washers (4), and nuts (2).

(2) Slip generator drive belt (21, fig. 33) over generator drive pulley (20).

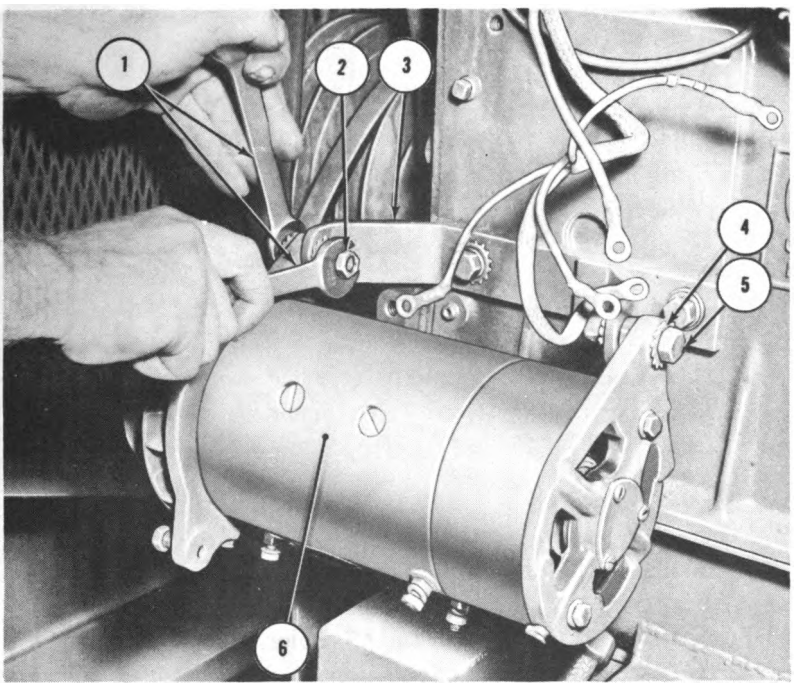
(3) Attach generator adjusting strap (24) to generator (6, fig. 34) with adjusting screw (23, fig. 33) and lockwasher (22). Adjust tension of belt so that belt may be moved with thumb and forefinger 1 inch to either side.

(4) Connect armature and field leads to terminals (14, fig. 33).

Note. After the generator has been installed, or at any time after leads have been disconnected and then reconnected to the gen-

erator, connect a jumper momentarily between the battery terminal (17, fig. 33) and the armature terminal (16) of the battery voltage regulator (4). This will allow a momentary surge of current from the battery to the generator to correctly polarize the generator with respect to the battery it is to charge.

Caution: Never operate the generator on open circuit. To do so will allow it to build up a high voltage which will result in complete generator failure.



1 Open end wrench
2 Nut, hex, 5/8–11 (2 req'd)
3 Bracket
4 Shakeproof washer, 5/8 (4 req'd)
5 Cap screw, hex, 5/8–11 x 1½ (2 req'd)
6 Generator

Figure 34. Removing battery charging generator.

c. Brush Inspection and Replacement.

(1) Remove the cover band (12, fig. 33) and inspect the brushes, commutator, and connections. If the commutator is dirty, clean with No. 00 sandpaper.

Caution: Do not use emery or carborundum cloth on brushes or commutator.

(2) Remove terminal screws holding brush leads to the brush holders.

(3) Lift spring arm and pull out one brush. If oil soaked, replace them all. Compare length of old brush with a new one. If worn to one-half, replace them all.

(4) To install, place brushes in holders, see that they move freely in holders, and connect with terminal screws.

(5) Shape brushes to curve of commutator by drawing a piece of No. 00 sandpaper back and forth under the brush, grit-side to brush, with tension on brush. Finish with final stroke in direction that the shaft turns. Blow out carbon dust.

156. Battery Voltage Regulator

a. Removal (fig. 33).

(1) Remove three screws and shakeproof washers from field terminal (15), armature terminal (16), and battery terminal (17). Remove one screw and washer from ground terminal. Tag and remove wire.

(2) Remove attachment nuts (3) from base of regulator. Remove regulator.

b. Installation.

(1) Mount regulator, and secure in place with the attachment nuts (3).

(2) Attach ground terminal wire with cap screw and washer. Connect field terminal (15), armature terminal, and battery terminal (17).

157. Starter

a. Removal.

(1) Remove the oil cooler housing (10, fig. 25) for access purposes.

(*a*) Drain cooling system and oil cooler.

(*b*) Disconnect water connection from radiator to lower end of oil cooler by removing two bolts (7).

(*c*) Remove two bolts and lift away flange connection (8) to radiator shutter control thermostat.

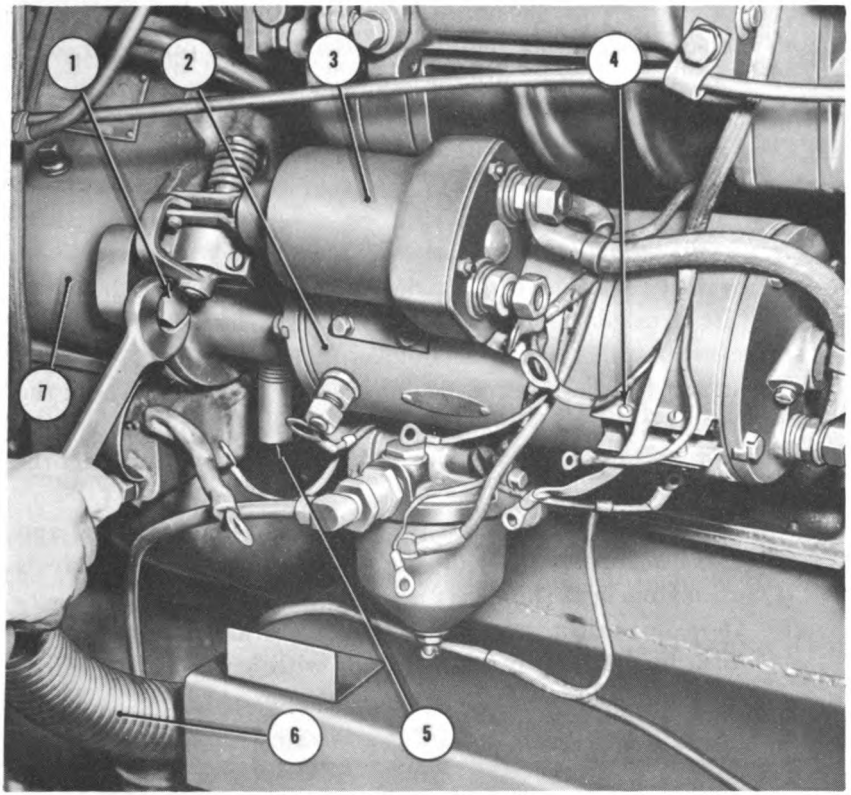
(*d*) Remove the connector (11) attaching the oil cooler water outlet to the water pump.

(*e*) Remove the eight bolts (9) which attach the oil cooler housing (10) to the adapter assembly, and remove the housing and core assembly.

Note. Be careful not to drop or damage the core assembly.

(2) Disconnect all leads attached to the starter or starter frame. Pull starter air tube (30, fig. 3) from air inlet (5, fig. 35) on starter (2).

(3) Using an open end wrench, remove three cap screws (1) which attach the starter (2) to the flywheel housing (7). Withdraw the starter.



1 Cap screw, ⅞–11 x 1¼ (3 req'd)
2 Starter
3 Solenoid
4 Cover band
5 Air inlet
6 Flexible air tube from heater
7 Flywheel housing

Figure 35. Removing starter and solenoid.

b. Installation.

(1) Place the starter (2, fig. 35) in position on the flywheel housing (7) and secure it in place with three cap screws (1).

(2) Connect electric leads to starter. Refer to table IV. Connect flexible air tube (6, fig. 35) to air inlet tube (5) on starter (2).

(3) Install oil cooler housing.

(*a*) Clean the old gasket material from both sides of the cooler element flange and from the finished face of the adapter and the finished face of the oil cooler. Shellac a new gasket to each flange of the cooler element.

(*b*) Put the cooler element into position inside the housing (10, fig. 25), then set housing with element against adapter and secure with lockwashers and bolts (9).

(*c*) Connect the water outlet to the water pump with the connector (11).

(*d*) Using a new gasket, attach the radiator shutter control thermostat outlet flange connection to the oil cooler, and secure it in place with the two bolts (9).

(*e*) Using a new gasket, make the water connection from the radiator to the lower end of oil cooler housing, and secure in place with two bolts (7).

(*f*) Fill the cooling system.

c. Brush Inspection and Replacement.

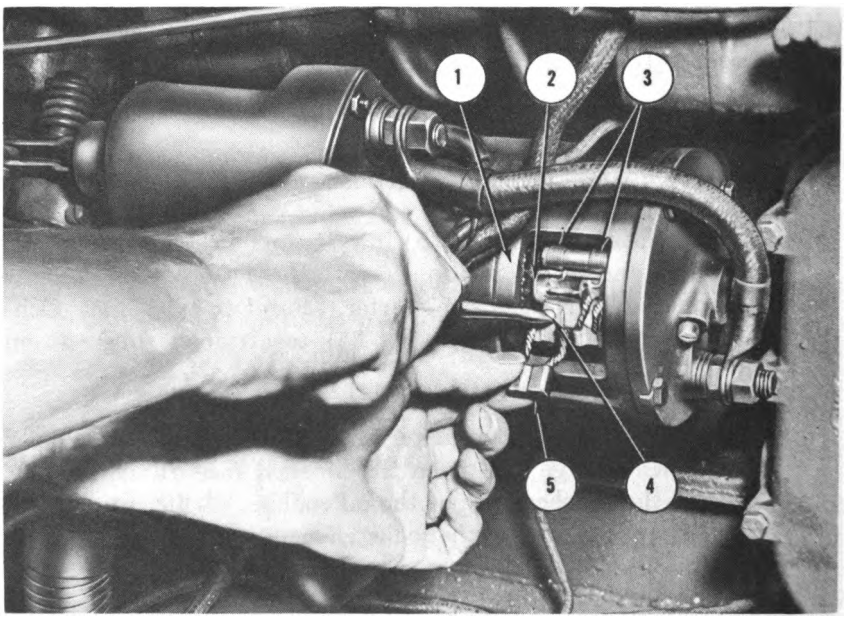
(1) Remove cover band (4, fig. 35) from starting motor housing.

(2) Lift brush springs (3, fig. 36) off brushes and withdraw brushes (5) from brush holders (2).

(3) Inspect brushes for chipped or cracked surfaces. Check the brush faces for pitting. Chipped, cracked, or pitted brushes must be replaced. Replace brushes less than three-eighths of an inch in length.

(4) To remove brush, unscrew brush lead terminal screw (4) and raise brush spring (3) off the top of the brush. Withdraw brush from brush holder (2).

(5) To install brush, raise brush spring (3) and insert brush in brush holder. Secure brush leads with brush lead terminal screw (4). Lower brush spring onto top of brush.



1 Starter housing
2 Brush holder
3 Brush spring
4 Brush lead terminal screw
5 Brush

Figure 36. Replacing brushes on starter.

(6) Shape brushes to curve of commutator by drawing a piece of No. 00 sandpaper back and forth under the brush, grit-side to brush, with tension on brush. Finish with final stroke in direction that the shaft turns. Blow out carbon dust.

158. Batteries

a. Description. The batteries are four arctic-type, heavy-duty, 6-volt, lead-acid storage batteries connected in series to provide 24 volts. They are contained in the battery box (7, fig. 3).

b. Servicing. Keep battery and terminals clean with brush or dampened cloth. Apply thin coat of cup grease to terminals. Check electrolyte with hydrometer. Charged batteries should give a reading of 1.275 to 1.300. Add distilled water, if needed, to maintain level of electrolyte three-eighths of an inch above plates. See that caps are in place and tight.

c. Removal. Open the right rear access door (24, fig. 1) and the left rear access door (19, fig. 2). Remove battery box cover (8, fig. 3). Disconnect the battery cables and the connectors (5, fig. 11). Remove the hard rubber battery supports (4, fig. 11) and lift out the batteries (1) using a battery carrying strap.

d. Installation. Place the batteries (1, fig. 11) in the battery box (2) with the positive and negative terminals of two batteries adjacent to their respective cables. Alternate the polarity of the terminals so that the connectors (5) will reach from the positive of one battery to the negative terminal of the next battery. Connect all cables, and coat the terminals lightly with grease. Position the rubber battery supports (4) and close the cover of the battery box. Close the right and left rear access doors.

Section XI. MAIN GENERATOR ASSEMBLY

159. Description

The generator assembly consists of the main generator (33, fig. 3) with direct-connected exciter (38). The assembly is coupled directly to the diesel engine through a diaphragm coupling. The exciter commutator supplies direct current to the alterator rotating field coils through the generator collector rings. Alternating current output from the main generator is taken from the stationary armature leads to the voltage changeover board (5, fig. 21). On the voltage changeover board, movable links can be bolted in either of two positions to supply 120/208 volts or 240/416 volts output (fig. 12).

160. Main Generator Brushes
(fig. 37)

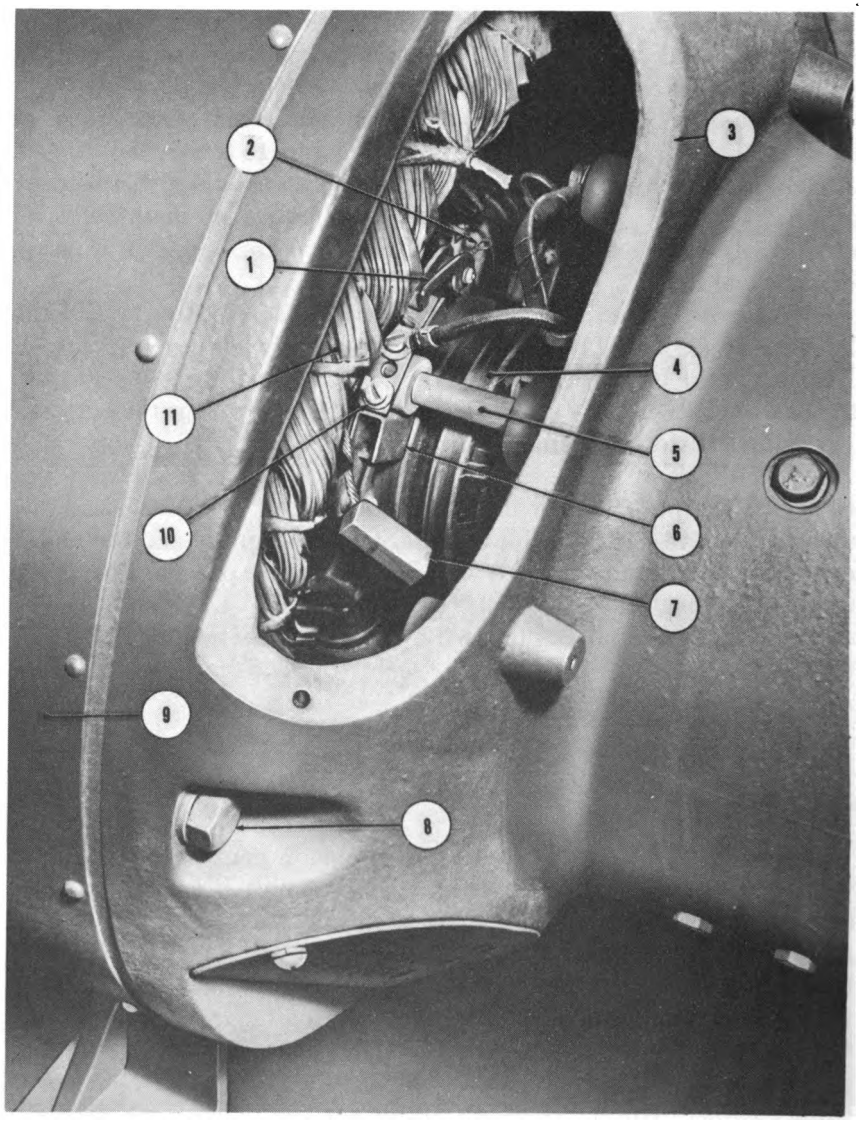
a. Description. Dual brushes are used on the collector rings (4). They are in pairs to lessen the chances of current interruption.

b. Cleaning and Inspection.

(1) Remove inspection covers from main generator end bell (3).

(2) Lift tension arms (1) and pull out brushes (7).

(3) Blow out dust from area with air at not over 25 psi.



1 Brush tension arm
2 Spring tension adjustment lever
3 Generator end bell
4 Slip ring
5 Brush holder post
6 Brush holder
7 Brush
8 Cap screw, hex hd, 7/8–12 x 1¼ (4 req'd)
9 Generator frame
10 Brush terminal screw
11 Stator winding

Figure 37. Main generator, inspection cover removed.

Clean grease and oil from brushes and holders (6) with non linting material such as canvas or duck moistened with cleaning solvent.

(4) Check lengths of brushes. If worn to less than half of the original length (1⅜ in.) remove pigtail from terminal screw (10) and replace all four brushes. If a brush is badly chipped, replace all four. Be sure pigtails are attached firmly to the brushes and that terminal screws are tight. See that brushes move freely in holders.

(5) Check tension on arms (1). Pressure should be maintained at 1½ pounds. Measure with spring scale and move spring adjustment to next notch if necessary. Replace burned or brittle springs.

(6) Check "set" of brushes on collector rings. If they do not conform to the curve of the collector rings, slip a strip of No. 00 sandpaper under brushes, one at a time, grit to brush and work back and forth with tension on brush. Pull the last stroke in the direction collector ring rotates. Blow out carbon dust with air at not over 25 psi.

Caution: Do not use emery or carborundum paper or cloth on brushes, collector rings, or commutator.

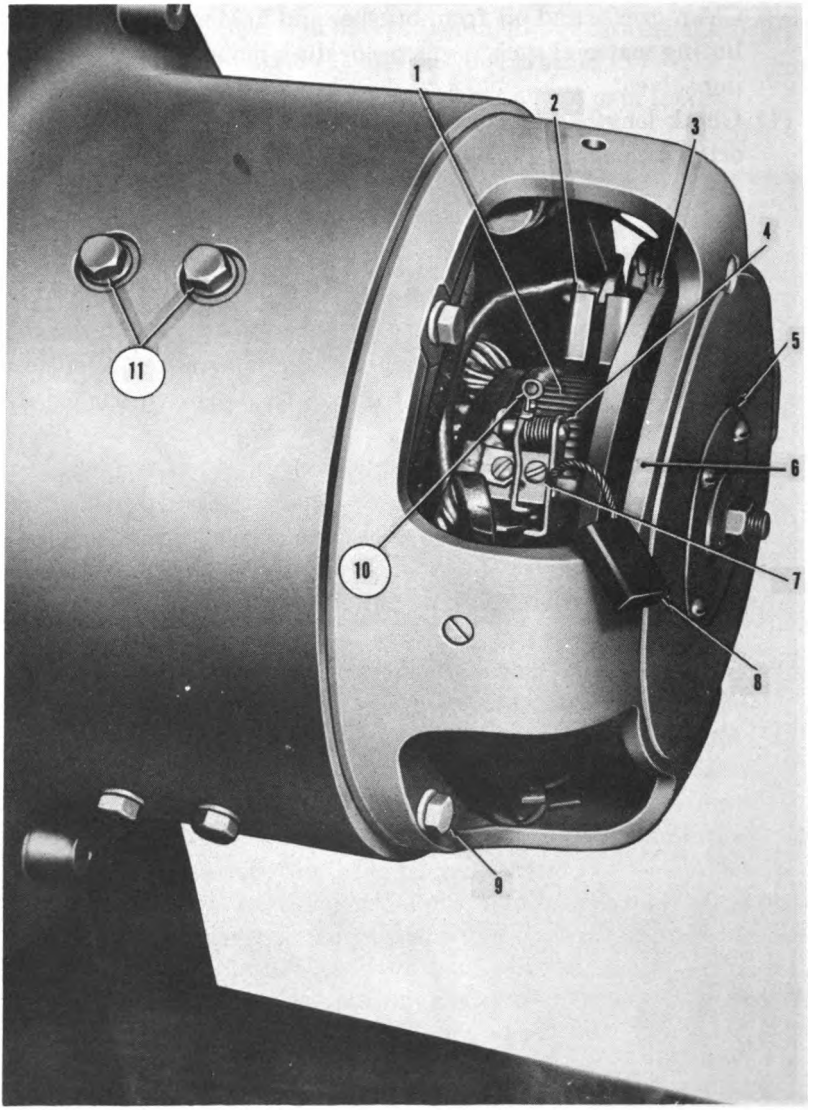
(7) Examine lead wires. See that none touch any moving part of the machine. Clean with carbon tetrachloride. If insulation is cracked or frayed report the condition to the proper authority.

c. Replacement. If brushes are cracked, pitted, burned, or chipped they must be replaced. When replacing main generator brushes use brushes conforming to the following dimensions: ⅜ x ⅝ x 1⅜ inches, No. 443. To replace brushes unscrew brush terminal screw (10, fig. 37) releasing brush lead wires. Raise the spring tension adjustment lever (1) and withdraw the brush (7) from the brush holder (6). Insert a new brush in the brush holder and secure the brush lead wires with terminal brush screw (10). Lower the spring tension adjustment lever onto the top of the brush. Raise and lower brush in brush holder to see that it moves freely.

161. Exciter Brushes

(fig. 38)

a. Description. Four carbon brushes (8) are set in brush holders (2) which are mounted on a brush mounting ring (3). The mounting ring is secured to the inside of the commutator end bell casting (6). The exciter brushes are held against the commutator (1) by the brush tension adjusting spring (4). The exciter brushes serve to take off d-c current generated in the exciter field coils.



1 Commutator
2 Brush holder
3 Brush mounting ring assembly
4 Brush tension adjusting spring
5 Commutator end bearing inspection plate
6 Commutator end bell casting
7 Brush terminal screw
8 Brush
9 Attachment cap screw, end bell to frame
10 Spring tension adjustment arm
11 Pole cap screw and washer

Figure 38. Exciter, inspection covers removed.

b. Cleaning and Inspection.

(1) Remove inspection covers from commutator end bell casting (6).

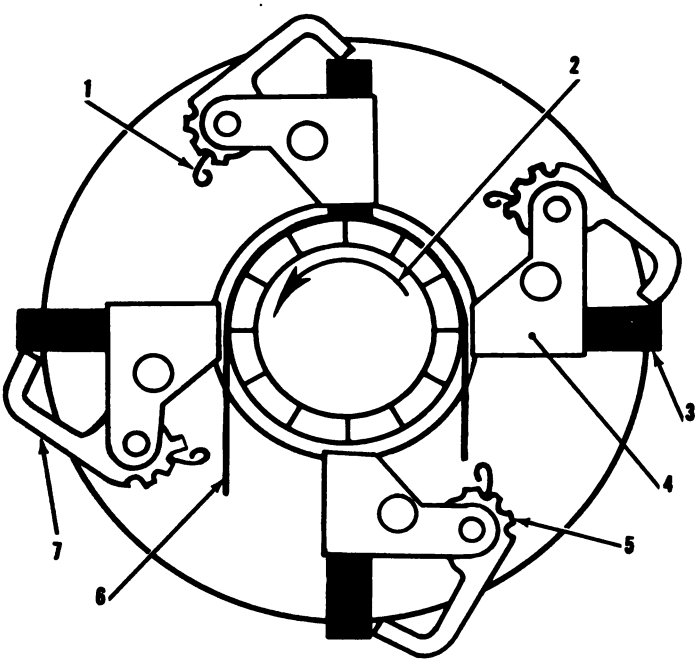
(2) Remove brush terminal screws (7), lift brush tension arm, and withdraw brushes (8) from brush holders (2).

(3) Blow out carbon dust from commutator (1) and end bell casting (6). Do not use over 25 psi pressure on the compressed air hose. Clean the commutator, brush holders, and brush mounting ring with clean cloth and cleaning solvent.

(4) Check the length of brushes. If worn to less than half of the original length (1⅛ inches) remove pigtail from terminal screw (7) and replace all four brushes. Be sure pigtails are attached firmly to the brushes and that terminal screws are tight. See that brushes move freely in holders.

(5) Check tension on adjustment arms. Pressure should be maintained at 1¼ pounds. Measure with spring scale and move spring tension adjustment (10) to next notch if necessary.

(6) Check "set" of brushes on commutator. If they do not conform to the curve of the commutator, slip a strip of number 00 sandpaper under brushes (3, fig. 39). With the grit side of the sandpaper next to the brush, work the paper back and forth with tension on the brush. Pull the last stroke in the direction the commutator rotates. Blow out the carbon dust with air at not over 25 psi.



1 Tension adjusting lever
2 Direction of rotation
3 Brush
4 Brush holder
5 Adjusting notches
6 Sandpaper
7 Brush tension arm

Figure 39. Sanding exciter brushes.

c. Replacement. Chipped, cracked, pitted, burned, or worn brushes must be replaced. To replace exciter brushes unscrew brush terminal screw (7, fig. 38), lift the tension adjustment arm, and withdraw the old brush from the brush holder. Replace the exciter brushes with brushes conforming to the following dimensions: ¾ x ⅜ x 1⅛ inches, No. 460. See that brushes move freely in clean holders. See that they conform to the curvature of the commutator. Insert new brush in brush holder pigtail with brush terminal screw (7, fig. 38).

162. Collector Rings and Commutator

a. Description. The two collector rings receive direct current from the exciter through the brushes and pass it on to the rotor windings. The commutator receives direct current induced by the exciter field and passes it to the collector rings.

b. Cleaning and Inspection.

(1) Remove inspection covers from main generator end bell (3, fig. 37). Remove inspection covers from commutator end bell casting (6, fig. 38).

(2) Raise brushes and hold them by resting tension arms against side of brushes (8, fig. 38).

(3) Clean open area with compressed air at a maximum pressure of 25 psi.

(4) Clean rings and armature with carbon tetrachloride.

(5) Check the collector rings for pitting, burning, glazing, or discoloration. If these conditions exist report it to the proper authority.

(6) Check commutator for condition of mica between the copper bars. If mica can be felt above bars report the condition to the proper authority.

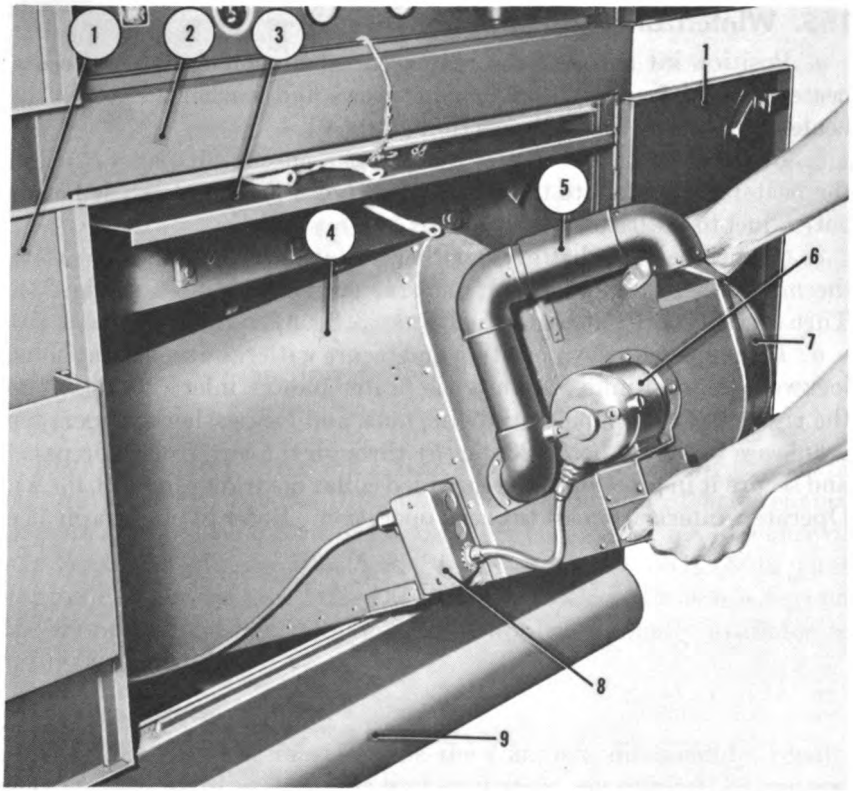
Section XII. WINTERIZATION KIT

163. Description

The winterization kit (19, fig. 5) is a self-contained gasoline-flame air heating unit. It is designed to heat the lubricating oil, batteries, and starting motor pinion housing in order to facilitate starting at temperatures to −65° F. The winterization kit heater includes a motor operated blower (15), a gasoline combustion chamber (21), and necessary valves and controls.

164. Winterization Kit Removal

a. To remove side panels unscrew crankcase drain plug (18, fig. 2) from the oil drain hose (23, fig. 5) releasing the hose from the left front side panel. Remove four nuts, lockwashers and bolts securing winterization heater blower inlet (20, fig. 1) to the right rear side



1 Rear access doors
2 Rear cowl
3 Cover, output connection board
4 Winterization kit
5 Air pipe to combustion chamber
6 Blower motor
7 Blower housing
8 Motor junction box
9 Skid frame

Figure 40. Winterization kit, removal.

panel. Remove 13 attachment nuts, lockwashers, and bolts, and lift off the side panels. Open rear access doors (1, fig. 40).

b. Remove leads from starter motor solenoid (3, fig. 35). Remove leads from winterization kit to battery box thermostat (3, fig. 11). Remove leads from heater safety thermostat switch (14, fig. 13).

c. Shut off fuel supply at heater fuel tank (6, fig. 3). Remove fuel supply line at connection (7, fig. 9).

d. Remove four cap screws and washers securing winterization kit (4, fig. 39) to skid frame (9).

e. Working through the left side of the housing remove the heater outlet duct to the engine oil pan (15, fig. 16) and the heater outlet duct to the starter gear box (4) from the winterization kit. Working through the right side of the housing remove the heater outlet duct to the battery box (8).

f. Refer to figure 40 and withdraw kit from beneath terminal board in the manner illustrated.

165. Winterization Kit Installation

a. Position kit through the rear access doors (1, fig. 40). Secure heater to skid frame with four cap screws and washers. Attach the heater fuel supply line at connection (7, fig. 9).

b. Replace the heater outlet duct to the engine oil pan (15) and the heater outlet duct to the starter gear box (4). Replace the heater outlet duct to the battery box (8).

c. Connect leads to battery box thermostat (3, fig. 11), heater safety thermostat switch (14, fig. 13), and starter motor solenoid (3, fig. 38). Turn on fuel supply at heater fuel tank (6, fig. 3).

d. Place side panels in position and secure with the attachment bolts, lockwashers, and nuts. Secure the heater blower inlet (20, fig. 1) to the right rear side panel with bolts, nuts, and lockwashers. Insert the crankcase oil drain hose (23, fig. 5) through the left front side panel and secure it in place with the threaded collar on drain plug (18, fig. 2). Operate winterization kit to check operation. Refer to paragraph 55*a*.

CHAPTER 4

FIELD AND DEPOT MAINTENANCE

Section I. INTRODUCTION

166. General

Instructions in this section and in succeeding sections of this chapter are published for the information and guidance of maintenance personnel responsible for third and higher echelons of maintenance of the Generator Set, Stewart and Stevenson model WGD–3012 (less engine). They contain information on maintenance which is beyond the scope of the tools, equipment, or supplies normally available to using organizations.

167. Procedure

The following sections describe the complete disassembly, repair, and reassembly of each major unit or system comprising the generator set. Before proceeding with overhaul, check to see that replacement parts are available.

Section II. TOOLS AND EQUIPMENT

168. General

The tools and equipment as listed in this section are those that are required to perform field and depot maintenance on the Generator Set, Stewart and Stevenson model WGD–3012. Tools and equipment issued as on-equipment tools and common mechanic's handtools have not been enumerated in this section. Specially designed tools and equipment have been listed in paragraph 169 to enable field and depot maintenance organizations to fabricate the tools and equipment. The tools and equipment in this listing are not available through normal supply channels.

169. Specially Designed Tools and Equipment

Tools and equipment in table V are for the use of field and depot maintenance personnel performing major overhaul work on the generator set. The tools and equipment are required by maintenance organizations engaged in rebuilding or overhauling a large number

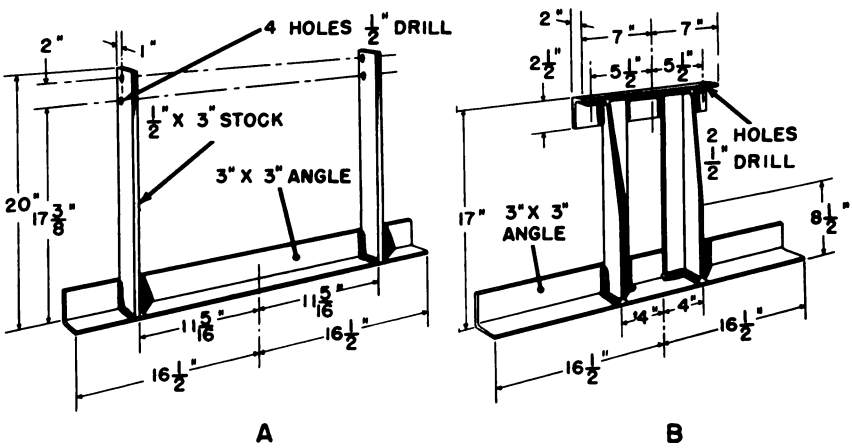


Figure 41. Engine support frames.

of identical components. The tools and equipment listed in table V are not available for issue. The list of tools, equipment, and illustrations is furnished for information only.

Table V. Specially Designed Tools and Equipment

Item	References, fig., par.	Use
Engine support frame	41	To support engine when main generator is disconnected.

Section III. ENGINE

170. Description

a. The engine is a three-cylinder, 2-cycle, liquid-cooled diesel engine, developing 45 hp at 1200 rpm.

b. The engine is secured at the front end of the engine support bracket (2, fig. 42) which is welded to the skid frame. The generator end is supported by the generator assembly.

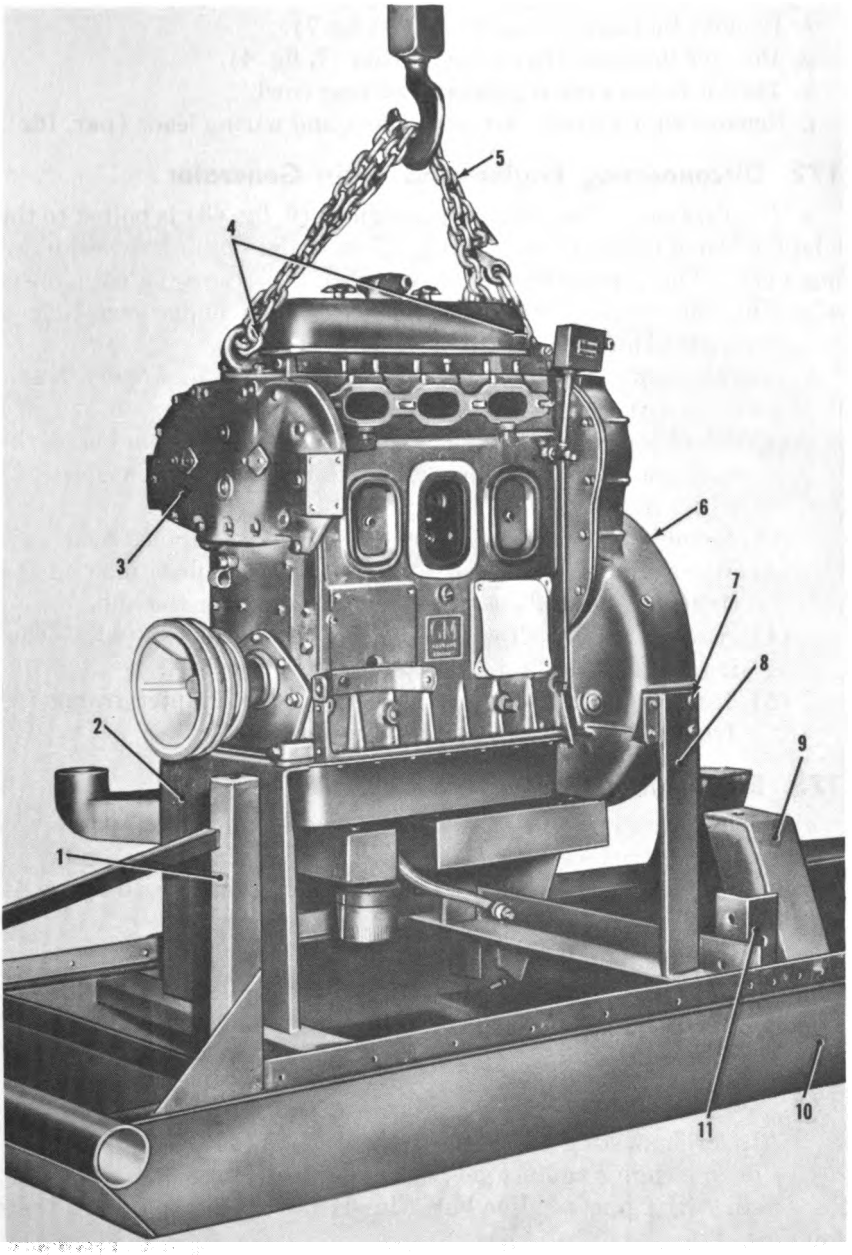
171. Preparation for Engine Removal

a. Remove housing (par. 99 through 99*d*).

b. Remove front cowl assembly (par. 99*e*) including radiator brace (17, fig. 3).

c. Remove heater exhaust pipe (18).

d. Remove A-frame, battery box, heater fuel tank, and battery box bracket (par. 99*f*).



1 Radiator brackets
2 Engine support bracket, front
3 Balance weight cover
4 Lifting eyes
5 Chain sling
6 Flywheel housing
7 Cap screw, hex hd, ½–33 x ½ (8 req'd)
8 Engine support frame
9 Generator supports
10 Skid
11 A-frame bracket

Figure 42. Engine removal or installation, left side.

e. Remove auxiliary engine starter panel assembly (23, fig. 3).
f. Remove fuel strainer assembly (20, fig. 7).
g. Remove flexible exhaust connection (7, fig. 4).
h. Do not remove main generator or rear cowl.
i. Remove winterization kit, heat ducts, and wiring leads (par. 162).

172. Disconnecting Engine and Main Generator

a. Description. The generator assembly (6, fig. 43) is bolted to the adapter frame (2), and the frame is bolted to the engine flywheel housing (11). The generator shaft is coupled directly to the engine flywheel by the drive flange coupling (3). This flange coupling is bolted to a keyed hub on the generator shaft.

b. Engine Support Frame. Construct the engine support frame in accordance with figure 41.

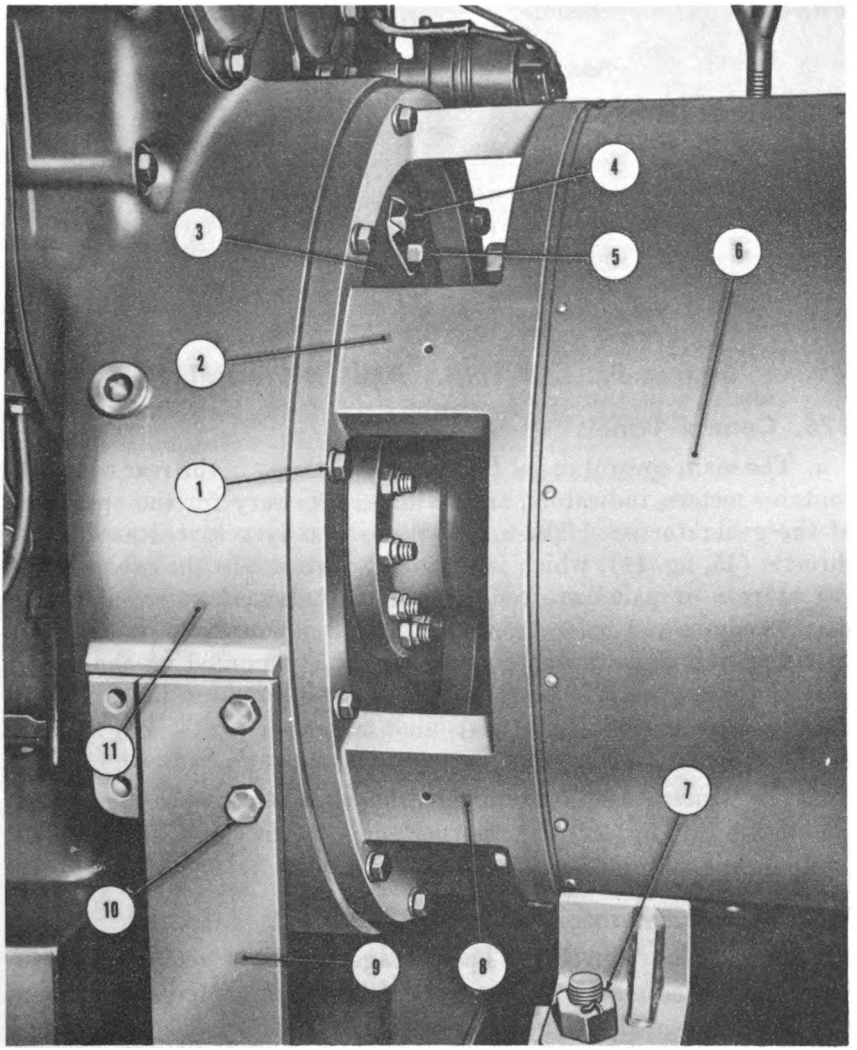
(1) Place the engine support (9, fig. 43) under the engine on the skid frame, and attach each leg to the flywheel housing (11) with cap screws (10).
(2) Remove the ventilating screens from the adapter frame (2).
(3) Block up rotor shaft with 2- by 4-inch timber, placing the timber through the adapter frame and under the hub.
(4) Straighten lock clips (5) and remove cap screws (4), releasing flange coupling (3) from engine flywheel.
(5) Remove 12 cap screws (1) releasing the adapter frame (2) from the engine flywheel housing (11).

173. Engine Removal

a. Remove housing and accessories, and disconnect the engine and generator in accordance with paragraphs 171 and 172.
b. Fabricate the engine support frame in accordance with figure 41.
c. Attach chain sling (5, fig. 42) to the lifting eyes (4).
d. Remove engine holddown bolts.
e. Lift engine slowly away from the generator adapter frame.
f. Secure the engine support frame to the engine with the engine support bolts.

174. Engine Installation

a. Attach chain sling (5, fig. 42) to lifting eyes (4).
b. Position engine against generator adapter frame.
c. Using drift pins to aline holes, insert the engine holddown bolts fingertight.
d. Using drift pins to aline holes, insert the flange-attachment cap screws (4, fig. 43) and lock clips (5).
e. Secure the adapter frame (2) to the engine flywheel housing with cap screws and lockwashers (1).
f. Jack over engine through five revolutions to assure correct alinement. Then tighten the flange-attachment cap screws (4) with a



1 Cap screw, hex hd, ½–33 x 1½ (12 req'd)
2 Adapter frame
3 Flange coupling
4 Cap screw, ⅝–11 x 1¼ (6 req'd)
5 Lock clip
6 Main generator assembly
7 Nut, hex, ⅞–10
8 Ventilator attachment screw point
9 Engine support legs
10 Cap screw, hex hd, ¾–12 x 1¼ (8 req'd)
11 Engine flywheel housing

Figure 43. Adapter bracket and drive flange coupling.

torque wrench, to a reading 120 foot-pounds. Using a blunt-nose chisel, bend up tangs on the lock clips (5) around heads of cap screws (4).

175. Engine Run-in Schedule

After a major overhaul, requiring the removal of either the generator or the engine, the assembled set must be operated in accordance with the following schedule.

Table VI. Engine Run-In Schedule

Load (percent)	RPM	Time
0	1200	1 hr
25	1200	1 hr
50	1200	1 hr
75	1200	1 hr

Section IV. CONTROLS AND INSTRUMENTS

176. Control Panels

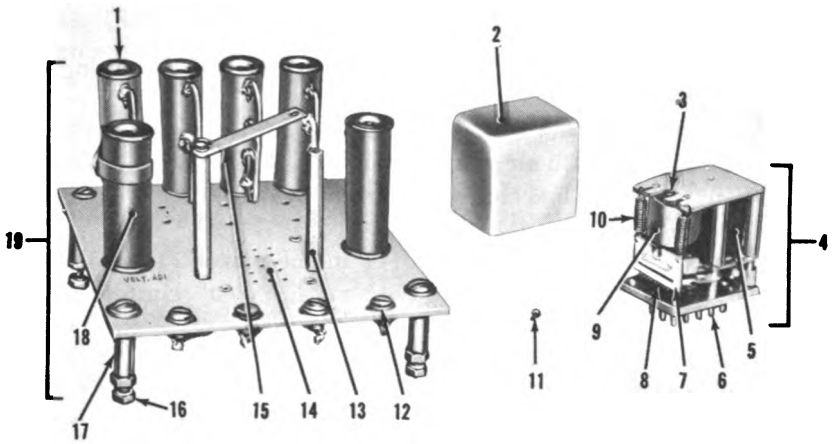
a. The main control panel (6, fig. 2) is enclosed in the rear cowl. It contains meters, indicators, and switches necessary for the operation of the generator set. These are all electrically actuated except the throttle (15, fig. 14), which is a manual control. In the cabinet (fig. 22) at rear of panel are relays, contactors, transformers, and lead wires to engine and generator.

b. The auxiliary starting control panel is mounted on the upper part of the engine (23, fig. 3) at the fan end and contains the emergency starter button (7, fig. 13), air-heater valve (11), and the air-heater pump assembly (9).

c. The winterization heater control panel is attached to the winterization kit (19, fig. 5) at the burner end. It has three switches controlling the heater unit.

177. Main Generator Voltage Regulator

a. Description (fig. 44). The voltage regulator acts as an automatic field rheostat to maintain constant output voltages. Fingers (8) on the pushbar (7) move off their contacts in sequence, one at a time. The fingers are connected by means of prongs (6) to tapped resistors in the base. The voltage regulator is used in conjunction with the voltage adjusting rheostat and the voltage regulator switch. The voltage regulator is located in rear of control board (1, fig. 22). The voltage regulator will operate within a wide range of temperatures and is constructed to withstand both vibration and shock. Two



1	Control resistors	11	Cover clamp screw
2	Element cover	12	Terminals
3	Dashpot adjusting screw	13	Cover spacer
4	Control element	14	Element socket
5	Control coil	15	Cover clamp arm
6	Prongs	16	Mounting nut and lockwasher
7	Pushbar	17	Chassis spacer
8	Fingers	18	Voltage adjusting resistor
9	Dashpot	19	Chassis assembly
10	Reference spring		

Figure 44. Main generator voltage regulator.

main components comprise the assembly: the chassis (19, fig. 44) and the plug-in control element (4).

(1) *Voltage regulator chassis.* The control resistors (1) are mounted on the chassis and wired in series with the exciter field. The shifting contactor fingers control the resistance. A dropping resistor wired in series with the voltage control coil (5), is marked on the chassis (19).

(2) *Control element.* The control element (4) is self-contained under the cover (2) and consists principally of a voltage-sensitive control coil (5), an armature, and a set of contact fingers (8).

(3) *Terminals.* There are four terminals (12) on the chassis, marked A, B, C, and D. Terminals A and B are connected to the exciter field rheostat. Terminals C and D are connected to the terminals of the generator, in series with the voltage adjusting rheostat. See figure 80, control panel wiring diagram.

b. Removal of Voltage Regulator.

(1) Remove wires from four terminals; A, B, C, and D (12, fig. 44).

(2) Remove four nuts and lockwashers (16) that mount chassis to control panel. Lift away regulator.

(3) Remove cover clamp arm (15) and cover (2) from control element.

(4) Remove element from chassis by prying out the prong base from socket in chassis.

c. Cleaning. Blow out dust from around control resistors (1) and control element (4) with air at a pressure of not over 25 psi. Wipe the chassis panel with lintless cloth moistened with cleaning solvent.

d. Installation.

(1) Insert the control element (4) in the socket (14). Position the element cover (2), and secure the cover clamp arm (15) across it.

(2) Secure the voltage regulator to the control panel with four nuts and lockwashers (16).

(3) Make terminal connections (refer to table IV).

e. Adjustment. If the regulator is sluggish in response, or if hunting occurs, adjust the dashpot screw (3) by turning it one-eighth turn in either direction to obtain correct response.

Caution: Do not adjust springs or contact fingers. Replace the voltage regulator or control element if defective.

Section V. HYDRAULIC GOVERNOR

178. Description
(fig. 45)

The hydraulic governor is mounted on the front end of the blower housing and is operated by a right angle drive which is connected to the upper rotor shaft of the blower. The governor is linked mechanically to the fuel injectors. The fuel injectors control the amount of fuel required, thus holding the engine at a constant speed during load fluctuation. Oil from the engine lubricating system which is admitted, under pressure, to an auxiliary oil pump actuates the governor. Aside from holding the engine speed constant under load fluctuation, the hydraulic governor acts as an automatic engine shutdown device in case of failure of lubricating oil pressure. If the engine fails to supply oil to the governor, the fuel rod (13, fig. 47) will return to the NO FUEL position, thus shutting down the engine.

179. Governor Removal

a. Remove the valve rocker cover and the link pin (6, fig. 45) which holds the governor link (8) to the injector control tube assembly (7).

b. Disconnect the oil line from the governor.

c. Lift end of governor lever retracting spring (17) from the clevis pin in throttle control shaft lever link (1). Then remove clevis pin.

d. Remove two bolts (15) and lockwashers holding governor subcap (19) to cylinder head (10). Remove three cover screws and two lockwashers holding governor cover (20) and subcap to governor

housing (14). Lift up on the subcap assembly until a definite snap indicates that governor link (8) has been released from the terminal lever within the governor housing. Then remove subcap, pulling governor link out of the hole in the cylinder head. Remove gaskets between subcap and governor bracket (16).

Note. When replacing both the governor and drive assemblies, do not separate these two assemblies as directed in *e* below, but remove them intact from the engine by performing the operations as directed in *f* below.

e. Remove four stud nuts (13) holding governor housing (14) to governor drive housing (12), and lift governor from studs. Remove gasket located between governor and governor drive.

Caution: Use extreme care in handling and setting down the governor. Especially avoid striking the end of the drive shaft. Such treatment might move the collar on the drive shaft and result in excessive end play of the ballhead and shaft.

f. Back out six governor-to-blower bolts and pull governor drive housing straight forward until drive shaft is free of the blower shaft.

180. Governor Disassembly

a. Governor Drive (fig. 46).

(1) Remove the drive shaft and bearing retaining bolts (9) with lockwashers (10). As the bearing (8) is slip-fitted into the housing, the drive shaft (7) and the bearing may be withdrawn.

(2) Pull bearing from drive shaft.

Note. If bearing is tight, apply pressure to the inner race of the bearing by means of a gear puller or arbor press.

(3) Remove two screws (17), nuts (16), and washers (15), and lift driven gear (5), bearing (4), sleeve (3), and groove pin (2) from the housing.

(4) Drive the groove pin (2), releasing sleeve (3), and bearing (4) from the driven gear (5).

b. Subcap.

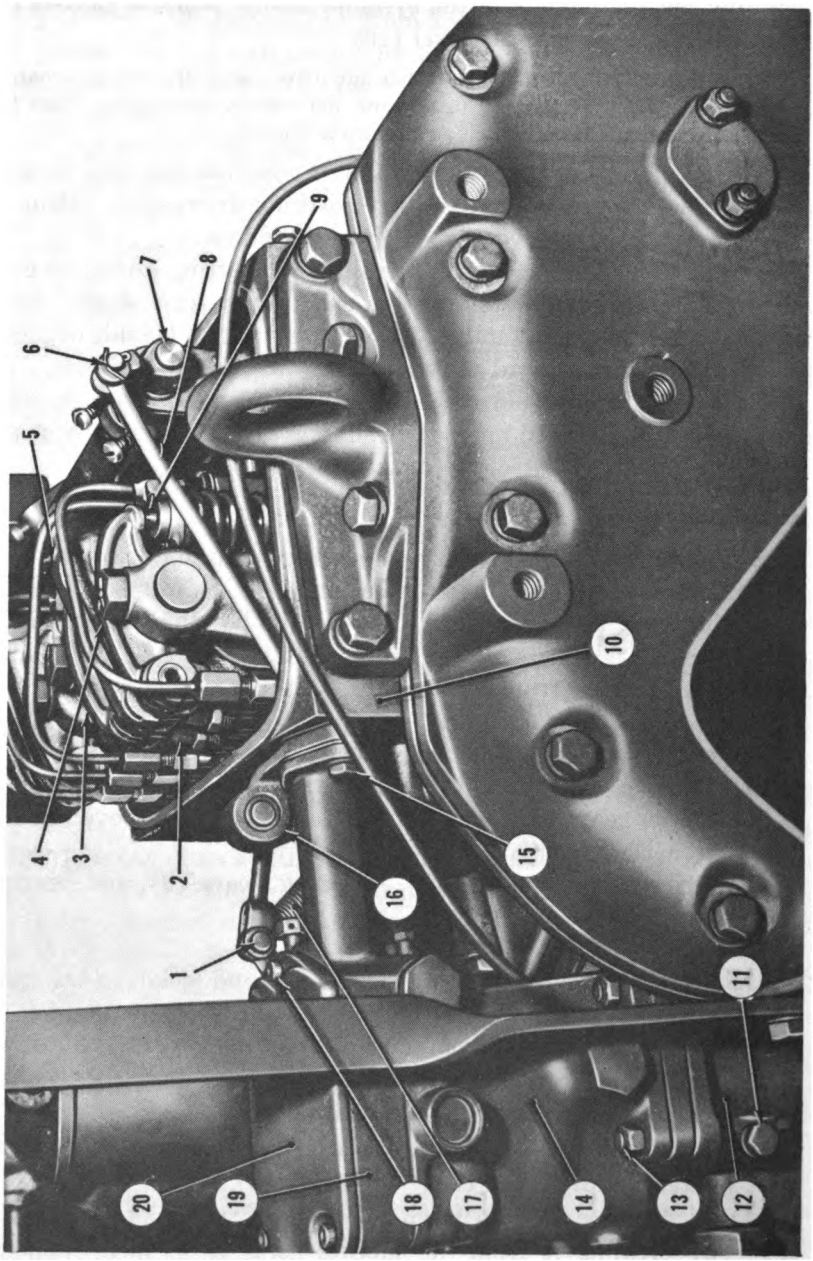
(1) Unscrew shutdown knob (60, fig. 47) and locknut (61) from fuel rod (13). Remove fuel rod spacer (59).

(2) Pull shutdown rod from subcap (9) thus separating shutdown rod from large fuel rod collar (1), short spring (2), small fuel rod collar (7), and long spring (8).

(3) Remove fuel rod seal (58) from the counter bore at the outer face of subcap (9).

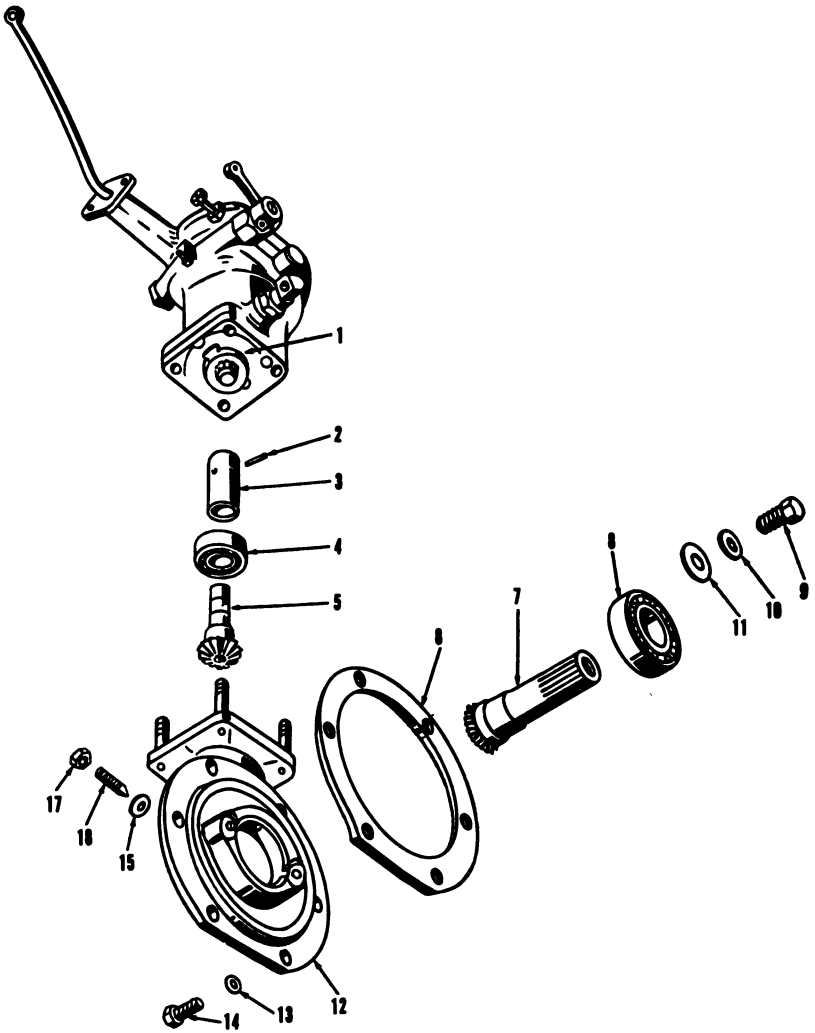
(4) If bushing (57) is worn more than 0.005 inch, replace it by pressing it from the subcap, using a $\frac{5}{16}$-inch diameter bar on the outer edge of the bushing.

(5) Loosen jam nut (10) and remove maximum fuel adjusting screw (11).



1 Throttle control shaft lever link
2 Push rod locknut
3 Right valve rocker arm assembly
4 Left valve rocker arm assembly
5 Injector rocker arm assembly
6 Injector control tube link pin
7 Injector control tube assembly
8 Hydraulic governor link
9 Exhaust valve
10 Cylinder head
11 Bolt, hex hd, ¼–20 x 1 (1 req'd)
12 Governor drive housing
13 Governor stud nut, hex ¼–20 (4 req'd)
14 Hydraulic governor housing
15 Bolt, hex hd, ¼–20 x 1 (2 req'd)
16 Governor bracket
17 Governor lever retracting spring
18 Governor cover screw, soc hd, 10–32 x 1⅜ (1 req'd)
19 Sub-cap
20 Governor cover

Figure 45. Hydraulic governor and linkage.



1 Collar
2 Groove pin
3 Sleeve
4 Bearing
5 Driven gear
6 Gasket
7 Drive shaft
8 Bearing
9 Bolt, hex hd, 5/16–18 x 5/8 (2 req'd)
10 Lockwasher, 5/16 (2 req'd)
11 Washer, 5/16 (2 req'd)
12 Drive housing
13 Lockwasher, 1/4 (6 req'd)
14 Bolt, hex hd, 1/4–20 x 1 (6 req'd)
15 Washer, 5/16 (2 req'd)
16 Nut, hex, 5/16–24 (2 req'd)
17 Screw, 5/16–24 (2 req'd)

Figure 46. Governor drive, exploded view.

c. Control Mechanism.

(1) Remove the limit pin (17) from speed adjusting lever (20).

(2) Remove nut, lockwasher, and clamp bolt which holds governor control lever (29) to the speed adjusting shaft (30), and pull the lever from the shaft.

(3) Unscrew speed adjusting sleeve (32) and remove it together with copper washer. Remove spacer cap (46) and copper washer.

(4) Remove speed droop adjusting screw (56) and plain washer (55), releasing the droop adjusting bracket assembly (54) terminal lever (52).

(5) Remove cotter pin (19) releasing speed adjusting lever (20) from speed adjusting shaft (30).

(6) Remove two cottter pins (51), which lock terminal lever (52) to short terminal shaft (27) and long terminal shaft (48).

(7) Remove speed adjusting shaft (30) from speed adjusting lever (20).

(8) Lift the pilot valve assembly, including plunger (23), spring fork (21), lever (20), floating lever (53), spring fork pins (18), and lockwire (16) straight up out of governor case (36) and ball head (24).

(9) If speeder spring (22) or plunger (23) are to be changed, unscrew the spring from the plunger and from spring fork (21).

(10) Remove lockwire (16) from speed adjusting lever (20), and floating lever (53). Remove two pins (18), separating speed adjusting lever (20), floating lever (53) and spring fork (21).

(11) Clamp the governor case (36) in a soft-jawed vise as shown in figure 48. Place a short piece of ½-inch round brass stock against the opening in the terminal lever, and tap it with a hammer to drive terminal sleeve (26, fig. 47) flush with the inner wall of the governor case (36).

(12) Using a blunt nose chisel, drive it against the shoulder of the terminal sleeve (26, fig. 47), as shown in figure 48 to the terminal sleeve and welch plug (28, fig. 47). Remove the opposite sleeve (49) and welch plug (47) in the same manner. Shafts (27) and (48) may now be removed from the case.

(13) Withdraw servo piston (50) from the case (36).

(14) Remove relief valve assembly (34) and copper gasket (35) from case (36).

Note. Do not attempt to disassemble or repair the relief valve assembly. If the valve is inoperative or faulty, it must be replaced.

(15) Set governor case, top side down, on a bench. Using a hammer and a brass rod, drive the shaft of the ball head (24) out of the drive shaft collar. Remove ball head and collar from case.

(16) Remove three screws (40) releasing the base (38) from the

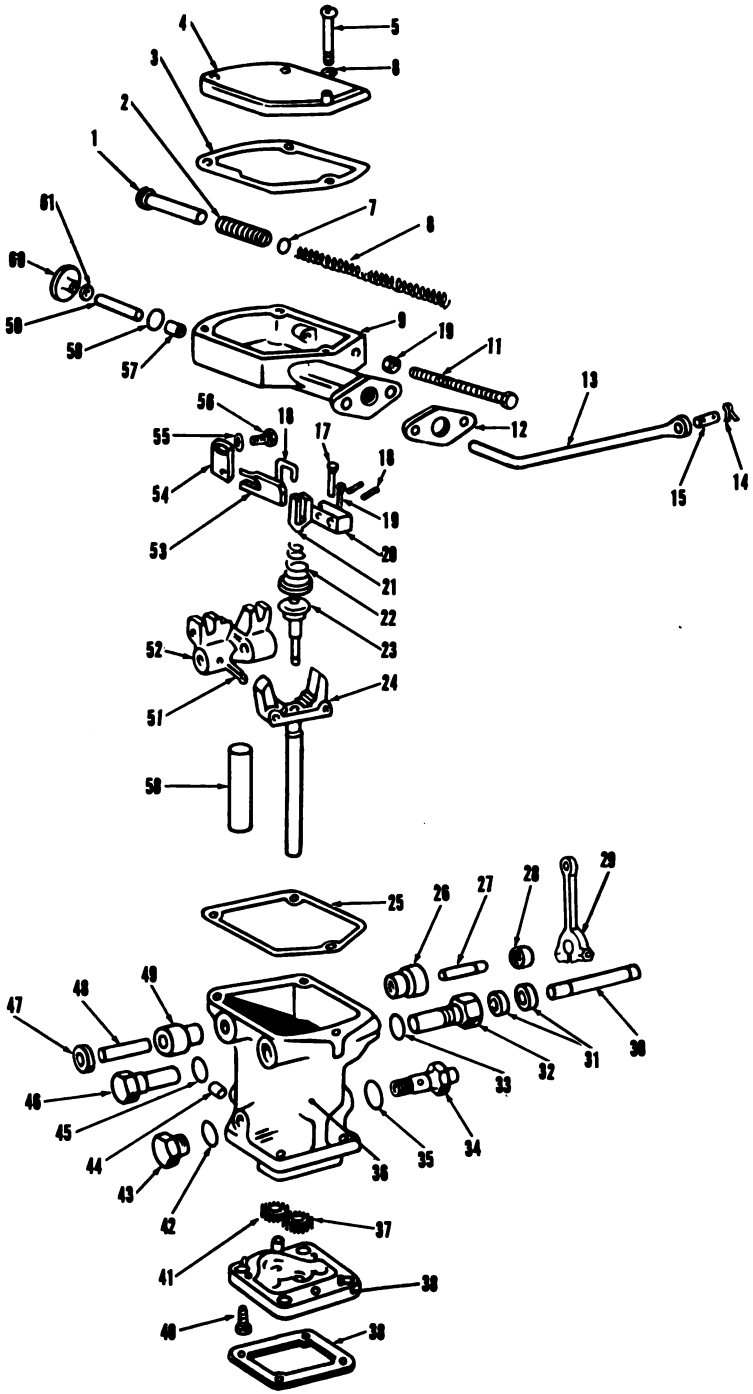


Figure 47. Governor, exploded view.

governor case. Oil pump drive gear (37) an idler gear (41) may now be withdrawn from the case.

Note. The base is doweled to the case; it must be tapped and pried away from the case carefully, to avoid damaging the dowels.

(17) Remove plug (43) and copper gasket (42) to assist in cleaning the case.

181. Governor; Cleaning, Inspection, and Repair

a. Wash all parts in clean fuel oil and inspect for wear.

b. Replace all parts that are worn, bent, or damaged.

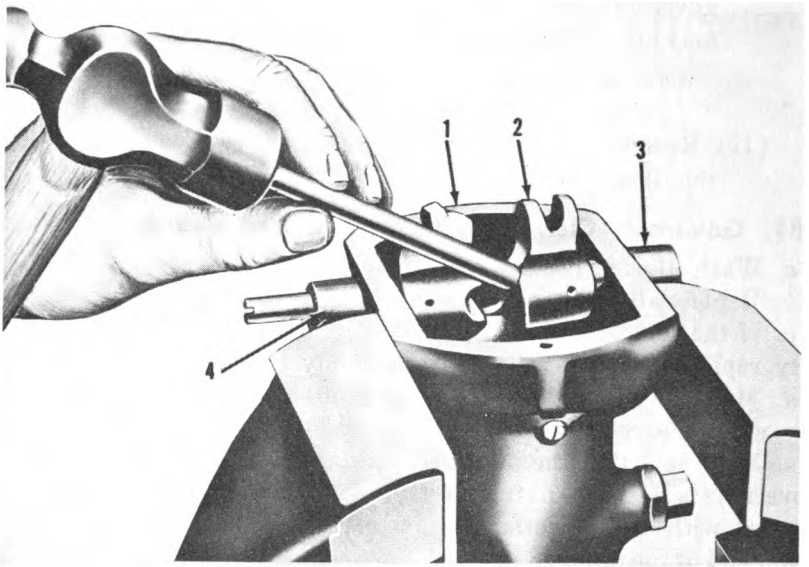
c. If the relief valve assembly (34, fig. 47) does not function properly, replace the entire relief valve assembly.

d. Make sure that the servo piston (50) moves freely in the cylinder, without excessive clearance.

e. Make sure that the pilot valve plunger (23) moves freely in the governor ball head shaft. If the plunger is scratched, it may be dressed with crocus cloth. Do not round off the sharp edges at the lower end of the plunger.

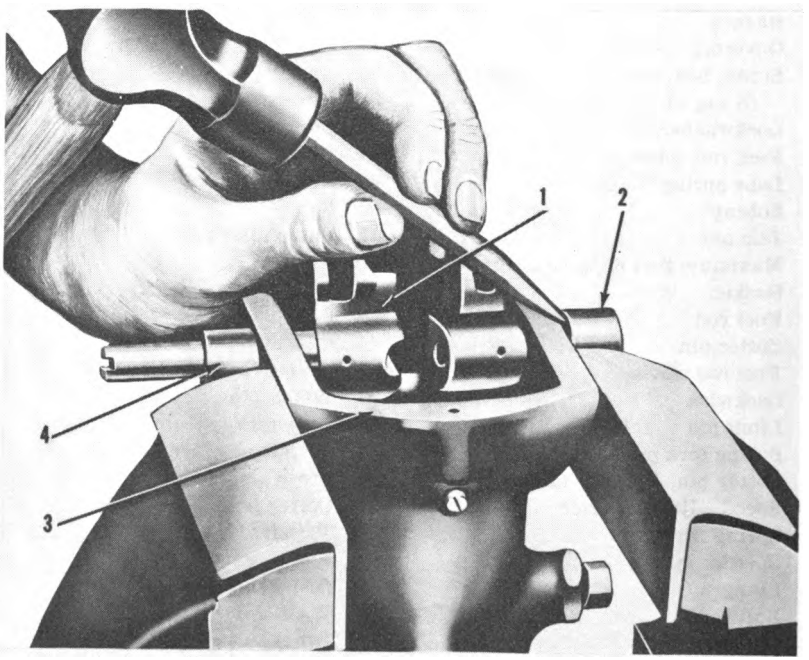
1	Fuel rod collar, large	31	Oil seals
2	Short spring	32	Speed adjusting sleeve
3	Gasket	33	Gasket
4	Governor cover	34	Relief valve assembly
5	Screw, hex, soc hd, No. 10–32 x 1⅜ (3 req'd)	35	Gasket
		36	Governor case
6	Lockwasher, No. 10 (3 req'd)	37	Pump drive gear
7	Fuel rod collar, small	38	Base
8	Long spring	39	Gasket
9	Subcap	40	Screw
10	Jam nut	41	Pump idler gear
11	Maximum fuel adjusting screw	42	Gasket
12	Gasket	43	Plug
13	Fuel rod	44	Pipe plug
14	Cotter pin	45	Gasket
15	Fuel rod clevis	46	Spacer cap
16	Lockwire	47	Welch plug
17	Limit pin	48	Long terminal shaft
18	Spring fork pin	49	Terminal sleeve
19	Cotter pin, 1/16 x ½ (2 req'd)	50	Servo piston
20	Speed adjusting lever	51	Cotter pin
21	Spring fork	52	Terminal lever
22	Speeder spring	53	Floating lever
23	Plunger	54	Droop adjusting bracket
24	Ball head	55	Washer
25	Gasket	56	Droop adjusting screw
26	Terminal sleeve	57	Bushing
27	Short terminal shaft	58	Fuel rod seal
28	Welch plug	59	Fuel rod spacer
29	Governor control lever	60	Shutdown knob
30	Speed adjusting shaft	61	Locknut, hex, No. 10–32 (1 req'd)

Figure 47—Continued.



OPERATION 1

A



OPERATION 2

B

Figure 48. Removing terminal shaft sleeve and taper plug from governor housing.

f. Make sure that the ball head (24) rotates freely in the governor body, after the governor base (38) and oil pump are installed. Binding can be caused by misalinement of the governor base with the governor housing, or by the drive shaft collar rubbing against the bottom of the governor base. This condition is corrected by tapping the lower end of the shaft with a block of wood. The collar should be pressed onto the shaft far enough to provide free shaft movement without shaft end play.

g. See that flyweights work freely on their supporting pins.

h. See that all joints and bearings for the floating lever (53) and speed adjusting shaft (30) move freely.

182. Governor Reassembly

a. Case.

(1) Position gears (37, fig. 47) and (41) in the governor base (38). Position base (38) and a new gasket against case (36). Aline the parts by positioning ball head (24). Secure base (38) to the case (36) with three screws (40).

Note. Revolve the ball head while tightening the screws to assure free rotation.

(2) Support a piece of ½-inch rod in a bench vise. Then, with ball head (24) in the governor case, invert the governor so that the upper end of the ball head shaft rests on the rod. Install collar (1, fig. 46) by tapping into position, using a convenient hollow sleeve.

Caution: Do not permit ball head to bind.

(3) Moisten the servo piston (50, fig. 47) with oil and drop it into position with the small end down.

(4) Place terminal lever (52) in the governor case, with the convex bearing surface for the servo piston next to the piston, and the holes for the terminal shafts in alinement with the holes in the case.

(5) Position the short terminal shaft (27) and the long terminal shaft (48), with cotter pin holes alined as shown in figure 49.

(6) Place the governor case on the bed of an arbor press, and press terminal sleeve (26, fig. 47) and welch plug (28) on the short terminal shaft (27).

(7) Install terminal sleeve (49) and welch plug (47) over long terminal shaft (48) in the same manner.

(8) Place tines of spring fork (21) over floating lever (53), with holes for fork pin in line, and insert the first pin (18).

---

1 Governor case
2 Terminal lever
3 Adjusting sleeve (short)
4 Terminal sleeve
A Operation 1

1 Terminal lever
2 Adjusting sleeve
3 Governor case
4 Terminal sleeve
B Operation 2

Figure 48—Continued.

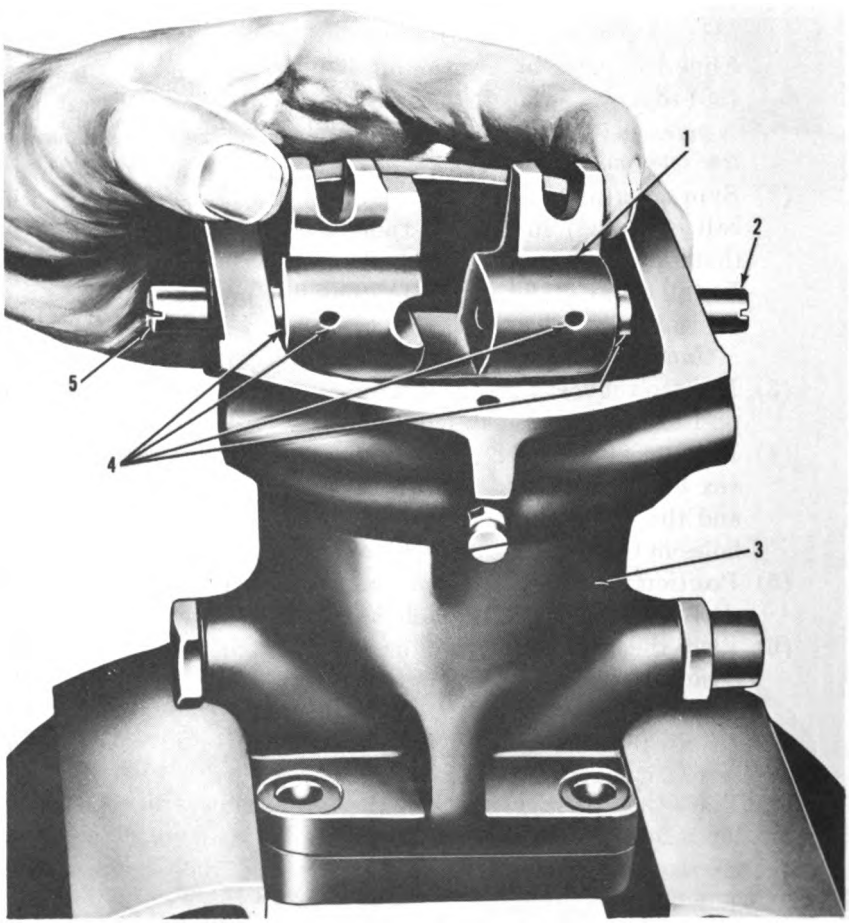
(9) Place the tines of speed adjusting lever (20) over the non-slotted end of floating lever (53) and insert the second pin (18).

(10) Secure pins (18) with lockwire (16).

(11) Screw the small end of speeder spring (22) onto the lower end of spring fork (21). Screw the large end of the speeder spring onto plunger (23).

(12) Lubricate stem of plunger (23). Set plunger and thrust bearing assembly down into the case, with the plunger entering the opening in the ball head (24).

Note. **Hold the flyweights in the extended position to facilitate assembly.**



1 Terminal lever
2 Terminal lever shaft (short)
3 Governor housing
4 Pin holes
5 Terminal lever shaft (long)

Figure 49. Positioning the terminal lever.

(13) With the undercut in the nonserrated end of the speed adjusting shaft (30, fig. 47) down, and the hole in the serrated end of the shaft in alinement with the hole in the speed adjusting lever (20), install shaft through case and secure to the speed adjusting lever (20) with cotter pin (19).

(14) With the flat face of droop adjusting bracket (54) next to the bolting surface of the terminal lever (52), and with pin on the opposite face in the slot of floating lever (53), attach bracket to terminal lever with droop adjusting screw (56) and washer (55).

(15) Position copper gasket (33), and secure speed adjusting sleeve (32) over speed adjusting shaft (30). Install two neoprene oil seals (31).

(16) Position copper gasket (45) and install spacer cap (46).

(17) Insert limit pin (17) in speed adjusting lever (20), with head of pin toward cover.

(18) Position copper gasket (42) and secure plug (43).

(19) Position copper gasket (35) and secure relief valve assembly (34).

b. Subcap.

(1) Insert long fuel rod long spring (8) inside the neck of the subcap; flared end first. Insert the threaded end of the fuel rod (13) through the spring until one-half of an inch of the rod extends beyond the spring. Place the fuel rod collar (7) over the threaded end of the fuel rod (13) with its flat face next to the spring (8). Insert the large fuel rod collar (1) inside of the short spring (2) and pilot this assembly over the fuel rod thus compressing the long spring until the flat face of the large collar (1) rests against the boss on the inside of the subcap (9).

(2) Install fuel rod seal (58) over the threaded end of the fuel rod (13) and into the subcap (9).

(3) Place the fuel rod spacer (59), locknut (61), and shutdown knob (60) on the threaded end of the fuel rod.

Note. The shutdown knob need not be correctly positioned until the governor is installed.

(4) Screw jam nut (10) on maximum fuel adjusting screw (11) and insert the screw into the back face of the subcap.

Note. This adjustment will be made after the governor is installed.

(5) Position a new gasket (25) and place the subcap assembly on the case by pressing it on the fuel rod knob so that collar (1) will rest against the front working face of the terminal lever (52).

c. Governor Drive.

(1) Press bearing (4, fig. 46) onto the driven gear (5) and slip sleeve (3) into position over the gear shaft against the bear-

ing; aline pin holes in sleeve and shaft and tap groove pin (2) in place.

(2) Position the driven gear assembly in the housing and secure with two conical pointed screws (17) with nuts (16) and washers (15).

Note. Draw screws up just tight enough to strike the outer race of the bearing.

(3) Press bearing (8) onto the drive shaft (7).

(4) Position the drive shaft bearing in the housing so that the beveled gears engage the bevel gears at the bottom of the driven shaft and secure with two drive shaft and bearing retaining bolts (9) and lockwashers (10).

183. Governor Installation

Note. If the governor assembly less the drive assembly is to be replaced and the drive is attached to the blower, remove the drive, then attach the governor to the drive before installing the governor. The governor must be attached to the drive before the governor is attached to the engine to make sure the splined drive shaft of the governor ball head is in exact alinement with the coupling sleeve of the drive.

a. When attaching the governor to drive, place a gasket down over studs of the drive housing flange, then set governor assembly down onto drive flange with opening for oil line into governor pointing in the same direction as the drive shaft of the drive housing. Secure governor assembly to drive housing with a lockwasher and nut (13, fig. 45) on each of the four studs. Draw nuts down uniformly and after tightening, revolve the drive shaft of the governor drive and the ball head of the governor. They must move freely without binding.

b. Place governor drive to blower gasket on drive housing, and start shaft of drive into place in upper blower rotor shaft. Rotate shaft slightly to match serrations. Set housing in position against blower and plate cover and attach with six bolts (11) and lockwashers. Tighten bolts handtight until after governor assembly has been attached to cylinder head.

c. Holding governor bracket (16) in place with throttle shaft in bearing of bracket and a gasket each side of the bracket, insert the governor link (8) through the bracket (16), gaskets, and cylinder head (10). Line up the holes for subcap to cylinder-head bolts and then, using lockwashers, turn bolts into place fingertight.

d. Pour about one-half of a pint of engine oil all over the governor mechanism for initial lubrication.

e. Place a gasket in position on the subcap (19), and set governor cover (20) down on subcap. Start three attaching screws (18) through cover and subcap and into governor housing. Use lockwashers on the two rear screws only. Tighten screws, holding cover

and subcap to housing. Also tighten bolts holding subcap to cylinder head and bolts holding governor drive to blower.

f. Slip the throttle control shaft lever link over the governor control lever and push clevis pin into place. Secure pin with a cotter pin. Stretch out governor lever retracting spring (17) and insert spring end through hole in clevis pin.

g. Connect the oil line to the governor.

h. Connect the injector control tube assembly (7) and the governor link (8) by means of the injector control tube link pin (8) and cotter pin. Install the valve rocker cover.

184. Throttle Control Adjustments

a. General. Before starting the engine, the throttle control mechanism must be adjusted to insure proper action of the engine when the throttle is placed in the NO FUEL and FULL FUEL positions. While the shafts and levers of the throttle control mechanism on most installations are flatted to assure assembly in only one position the system must be checked.

b. Adjustment.

(1) Set vernier throttle control (15, fig. 14) on control panel in the STOP position. Check at governor and make sure the control lever at the governor has turned the speed adjusting shaft to its maximum NO FUEL (counterclockwise when looking at the exposed end of the shaft) position. Make necessary changes in linkage until this condition is established.

(2) Set throttle in RUN position, thus moving the speed adjusting shaft in the opposite direction. With the throttle in this position, make sure that the throttle control shaft lever link (1, fig. 45) has not moved into or over a dead center position.

185. Governor Adjustment

a. General. After installation the governor must be adjusted for maximum fuel, speed droop, and maximum speed, in the order named. Before adjusting the governor check the injector racks, injector control tube, and governor linkage for freedom of movement or excessive play.

b. Maximum Fuel Adjustment.

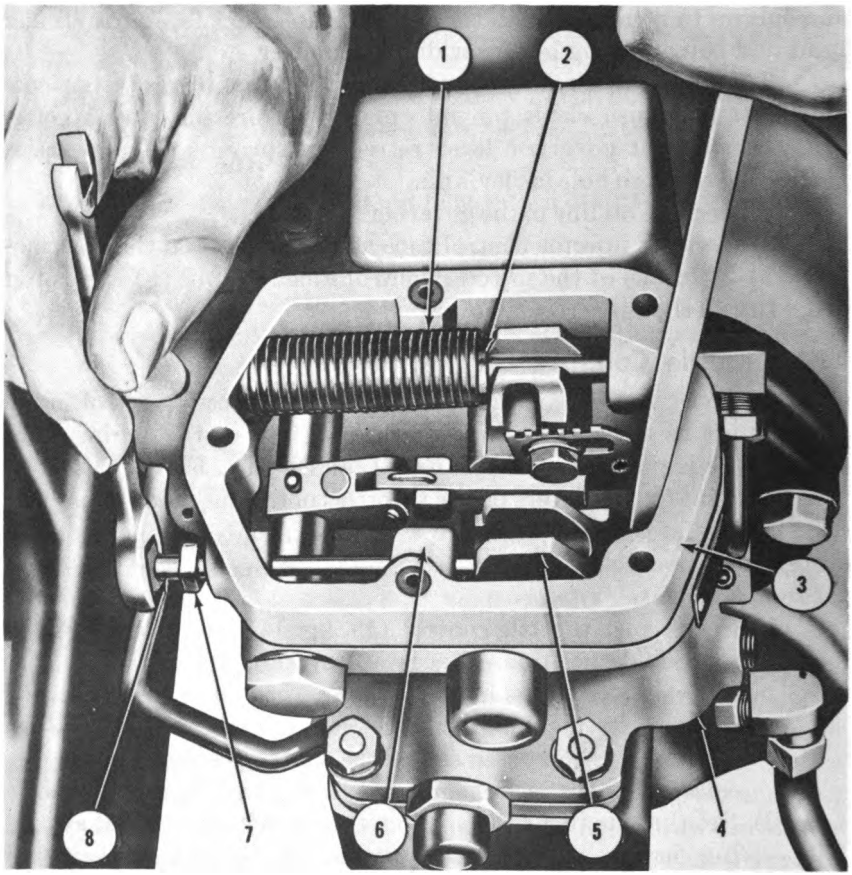
(1) With engine shut down, remove governor cover.

(2) Loosen the load limit screw locknut (7, fig. 50) and back out the load limit screw (8) with its boss (6).

(3) Remove cover assembly from the terminal shaft lever housing and loosen screw (1, fig. 51).

(4) Loosen the injector rack control tube lever adjusting screws (1 and 5, fig. 52) at all cylinders.

(5) Adjust the screws (1) and (5) on No. 1 rack control lever (6) so that they are the same height when tight.



1 Subcap long spring
2 Spring retainer seat
3 Governor subcap
4 Governor housing
5 Speed adjusting terminal lever
6 Boss
7 Load limit screw locknut
8 Load limit screw

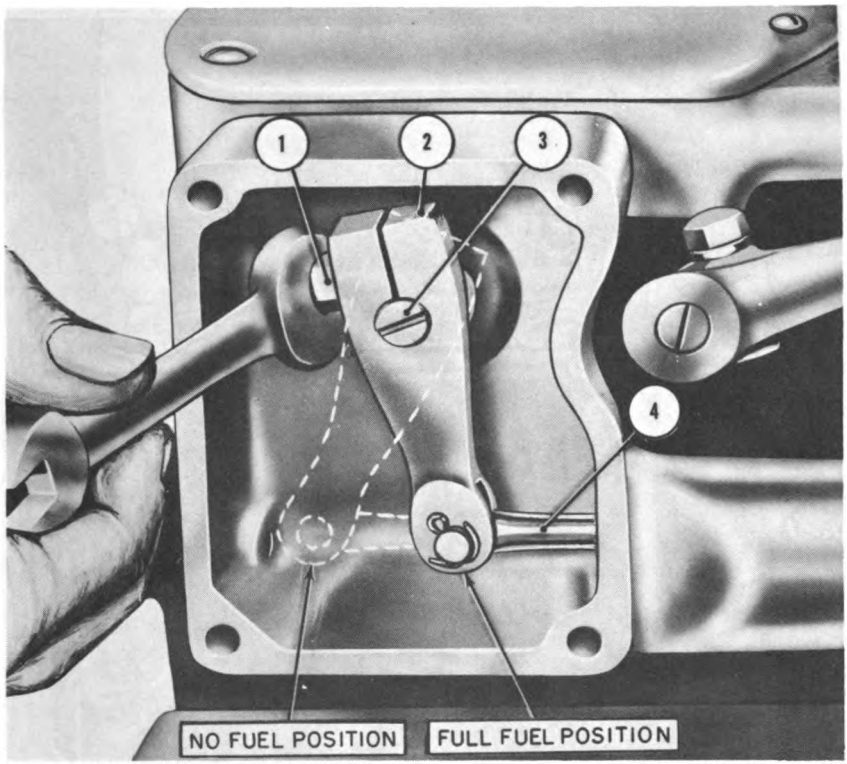
Figure 50. Setting load limit screw.

(6) Hold the injector control tube (2) in FULL FUEL position, using lever (3). See that the No. 1 injector rack control lever (6) touches the injector body.

(7) At No. 2 injector tighten the inner adjusting screw (5) until the injector rack control lever (6) touches the injector body, but does not move the No. 1 rack control lever away from the No. 1 injector. Tighten outer adjusting screw (1).

(8) At No. 2 injector, check the space between the injector rack control lever (4, fig. 53) and the injector body with a 0.002 inch feeler gage (3). If the gage passes between the lever and injector body the adjusting screws must be further tightened.

(9) Adjust the remaining control levers in the same way, checking each setting with the feeler gage.



1 Terminal shaft screw
2 Terminal lever
3 Long terminal shaft
4 Governor control link

Figure 51. Positioning terminal shaft lever on terminal shaft.

Caution: The No. 1 injector rack control lever must be held tight against the injector body while adjusting all the control levers.

(10) Release injector control tube (5, fig. 53) from the FULL FUEL position.

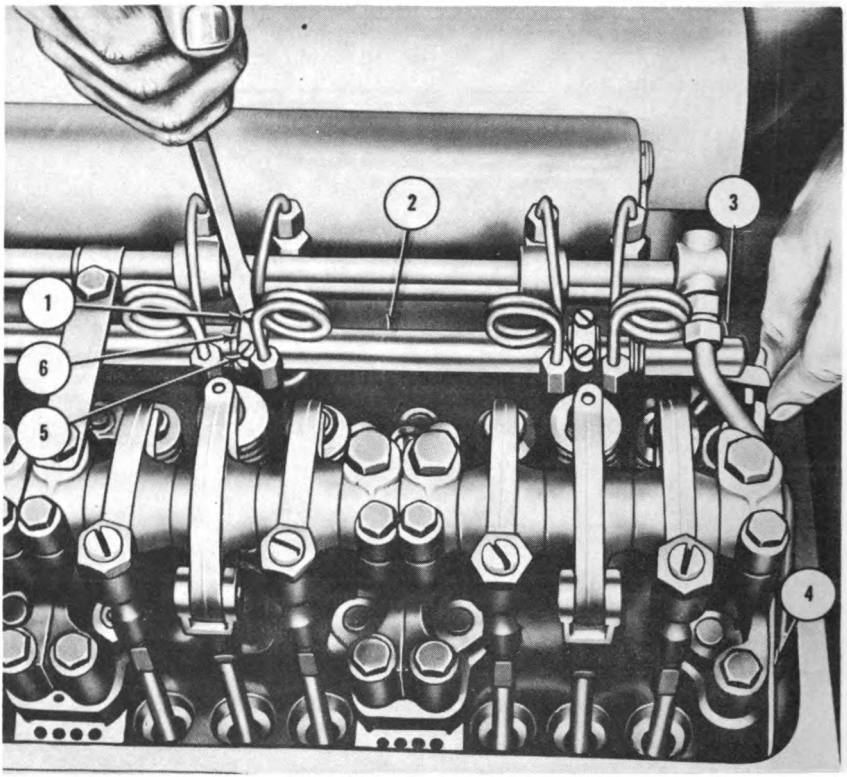
(11) Hold speed adjusting terminal lever (5, fig. 50) in the NO FUEL position. Turn the terminal shaft lever (2, fig. 51) on the long terminal shaft (3) until the injector control tube (5, fig. 53) is in the NO FUEL position. Tighten the terminal shaft screw (1, fig. 50) to lock lever (2) in position.

(12) Install cover on the terminal shaft lever housing.

(13) Move injector control tube lever (3, fig. 52) to the FULL FUEL position (fig. 53).

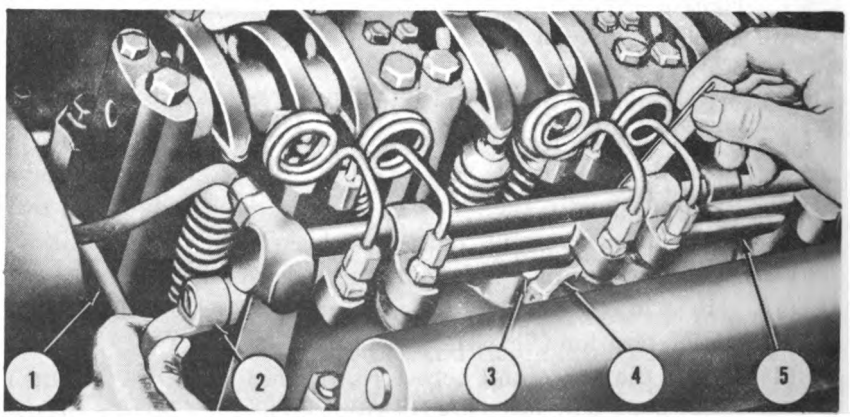
(14) Turn the load limit screw (8, fig. 50) until a 0.005 inch feeler gage will just pass between the body of No. 1 injector and its rack control lever. Tighten the load limit screw locknut (7).

(15) Replace governor housing cover.



1 Rack control lever adjusting screw (outer)
2 Injector control tube
3 Injector control tube lever
4 Governor control link
5 Rack control lever adjusting screw (inner)
6 Injector rack control lever

Figure 52. Positioning injector control racks.



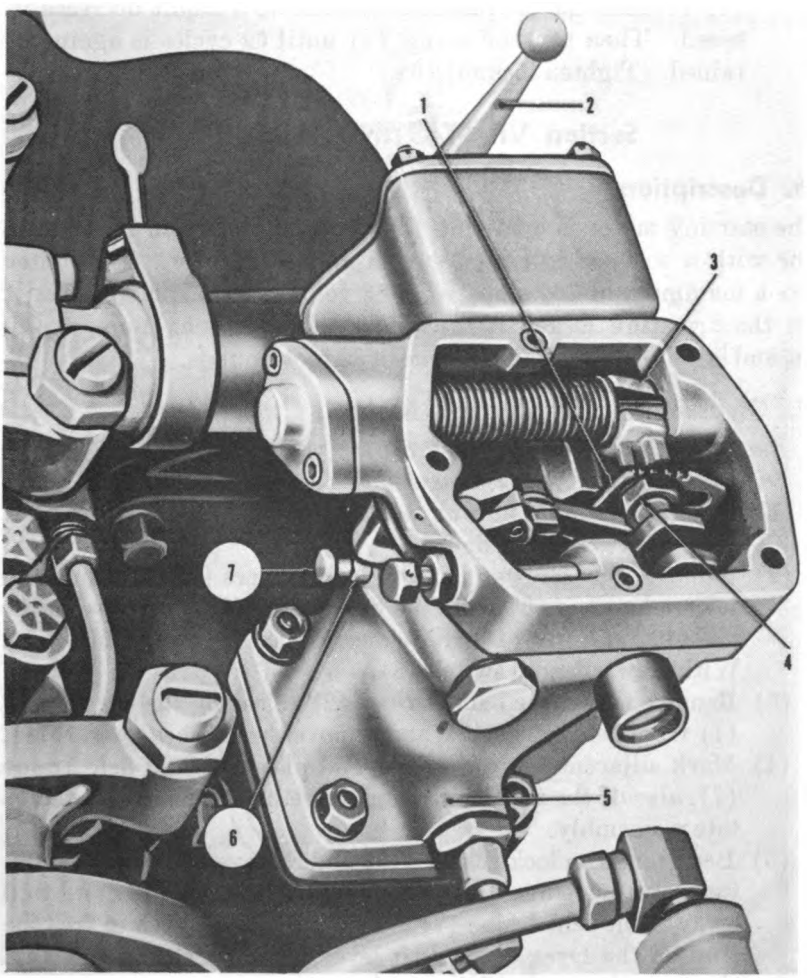
1 Governor control link
2 Injector control tube lever
3 Feeler gage
4 Injector rack control lever
5 Injector control tube

Figure 53. Checking position of No. 2 control rack.

c. Speed Droop Adjustment. The droop is adjusted to obtain a full load speed of 1200 rpm and a no load speed of 1240 rpm with the same throttle setting. Speed droop adjustment is necessary only when the governor is reinstalled after removal or disassembly.

Note. When two or more generators are paralleled the speed droop on the governors of all engines must be the same. If not the electrical load will not be divided equally between the generators.

(1) Check the no load and full load speeds with an accurate tachometer.
(2) Stop engine and remove governor cover.
(3) Loosen bracket bolt (4, fig. 54) and move droop adjusting



1 Droop adjusting lever bracket
2 Operating lever
3 Terminal lever
4 Bracket bolt
5 Governor housing
6 Locknut
7 Hi-speed stop screw

Figure 54. Speed droop and maximum speed adjustment points.

lever bracket (1) toward engine to decrease droop and away from engine to increase droop.

Caution: The droop adjusting lever bracket rides on a shoulder of the terminal lever (3). Hold droop adjusting bracket (1) firmly in place on the shoulder when tightening the bracket bolt (4). If the bracket is not properly positioned it will bend when the bolt is tightened.

d. Maximum Speed Adjustment. The high-speed stop screw (7) limits the travel of the governor speed adjusting shaft.

(1) Start engine and warm to operating temperature.

(2) Loosen locknut (6, fig. 54) on stop screw (7). Set throttle to run at 62 cycles with no load and turn hi-speed stop screw (7) in until the frequency meter shows a slight decrease in speed. Then back off screw (7) until 62 cycles is again obtained. Tighten locknut (6).

Section VI. STARTING MOTOR

186. Description

The starting motor is a 24-volt, four-pole, eight-brush, Dyer drive motor with a solenoid operated switch and shift lever. The motor draws a maximum of 100 amperes at 23 volts at 8000 rpm (no load). With the armature locked it draws 525 amperes, maximum, at 3.0 volts, and develops a minimum torque of 32 foot-pounds.

187. Disassembly of Starting Motor

a. Removal. Refer to paragraph 157*a*.

b. Disassembly Into Main Subassemblies.

(1) Unscrew terminal nuts on starting motor and solenoid switch and remove cable (5, fig. 55).

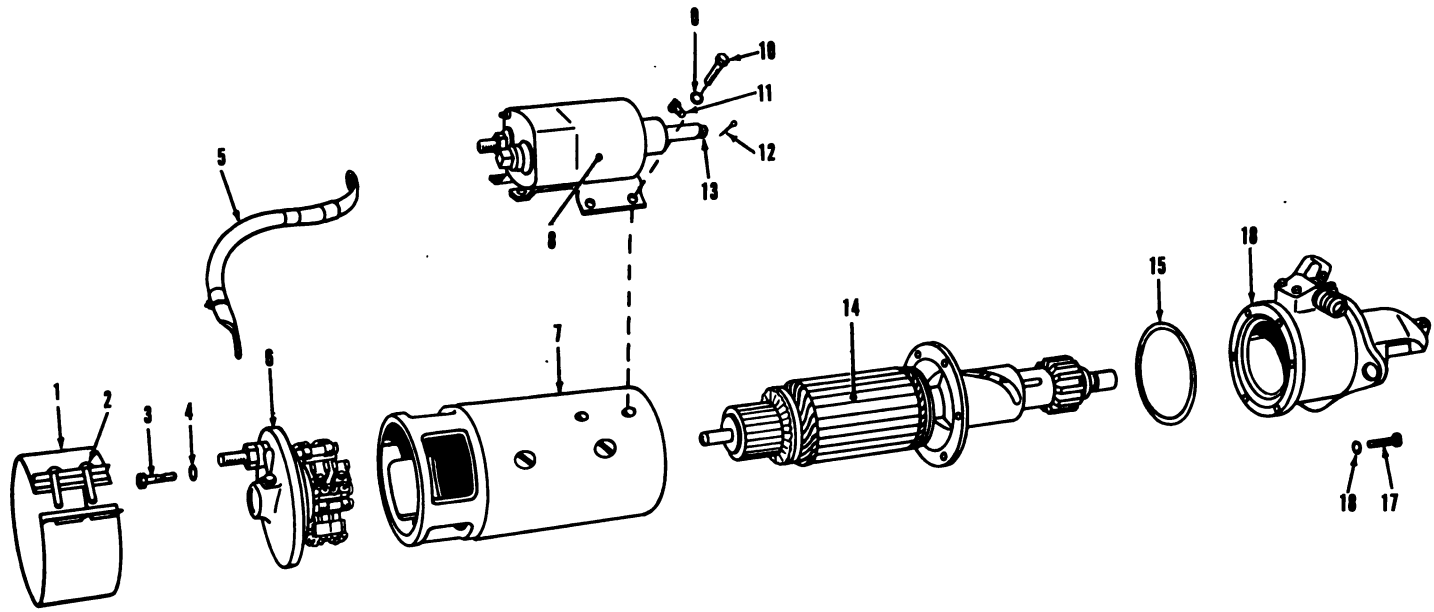
(2) Remove four screws (10) and lockwashers (9), releasing the solenoid switch (8) from the field frame (7). Remove cotter pin (12) and pin (11) disconnecting the link assembly (13). Withdraw solenoid switch (8).

(3) Remove two cover band screws (2) releasing the cover band (1) from field frame (7), and remove the brushes (par. 157*c*).

(4) Mark adjacent surfaces of the end plate (6) and field frame (7), also of the field frame and drive housing (16), to facilitate reassembly.

(5) Bend tangs on lockwasher (18) and remove screws (17) holding drive housing (16). Grasp drive housing (16) and pull away from field frame (7). Twist back and forth to free the stud on the Dyer drive shift lever from the slot in the shift sleeve and remove drive and housing with shift lever attached. Remove gasket (15).

(6) Withdraw armature, center bearing, and drive from drive end of field frame.



1	Cover band	7	Field frame and coils	13	Link assembly
2	Cover band screw	8	Solenoid switch	14	Armature and drive
3	Screw	9	Lockwasher	15	Gasket
4	Lockwasher	10	Screw	16	Drive housing
5	Cable	11	Pin	17	Screw
6	End plate assembly	12	Cotter pin	18	Lockwasher

Figure 55. Starting motor, partially disassembled.

(7) Disconnect field coil terminals from brush holders.

(8) Bend back tangs on lockwashers (4) and remove screws (3), lockwashers (4), and commutator end frame (6, fig. 56).

c. Disassemble Brush Plate and Commutator End Plate.

(1) Remove stud nut (28, fig. 56), terminal stud washers (2, 3, and 4), and terminal stud bushing (5).

(2) Remove three brush plate insulator attaching screws (23) with attaching screw lockwashers (24). Separate brush plate insulator (7) from end frame (6) and remove terminal stud washer (4) and brake fiber washer (26).

(3) For two grounded brushes, remove screws (18 and 19). Remove four brush holder screw lockwashers (16), two brush holders (15), two insulated holder space plates (10), and brush holder insulator (9). Remove two springs (17) from each of the long screws (18).

(4) For two insulated brushes, remove two screws (20 and 21). Remove four lockwashers (16), two brush holders (15), and grounded holder space plates (11). Remove two brush springs (17) from each insulated brush holder screw (20).

(5) Remove brush plate and stud (8) and pull out eight insulation bushing washers (22). Separate brush holder screw support plate (25) from brush plate insulator (7).

(6) If unserviceable, remove brake shoe washer (27) from commutator end frame (6).

(7) Remove pipe plug, oil wick, and expansion plug from commutator end frame. Press out bushing if it requires replacement.

(8) Remove brush lead attaching screw (13) and lockwasher (14). Remove brush (12).

d. Disassemble the Drive Housing.

(1) Remove end of shift lever spring (1, fig. 57) from slot in shift lever (5).

(2) Remove four cover attaching screws (2) and four cover screw lockwashers (3). Remove cap (4) and shift lever (5).

(3) Remove oiler (7) and oil wick (8). Press bushing (9) from drive housing (6).

e. Disassemble Field Frame. Mark adjacent surfaces of coil and inside of field frame to aid in reassembly. Disconnect wires from field terminal studs (2, fig. 58). Unscrew eight pole shoe screws (1), and pull out pole shoes (5), being careful not to distort the field frame. Remove field coils (4 and 6) and insulation strips (3). Remove two field terminal studs (2).

f. Disassemble Dyer Drive.

(1) Remove pinion stop cotter pin (11, fig. 59). Rotate the stop collar (12) until the notches register with the shaft splines, and remove the stop collar.

(2) Grasp shift sleeve (7), pull, and turn counterclockwise to remove drive pinion (10), meshing spring (9), pinion guide (8), and sleeve (7) from shaft. Slip off cupped space washer (6) and space washer (5).

(3) Grasp center bearing plate (3), and pull away from armature. Slip off space collar (2). Remove oil seal (4) from center bearing plate.

g. Disassemble Solenoid Switch.

(1) Unscrew link assembly (13, fig. 55) from solenoid switch.

(2) Remove four terminal plate attaching nuts (10, fig. 60) with lockwashers (11) and pull out plate assembly to expose lead support (25).

(3) Remove coil screw (26) holding terminal of solenoid winding wire, and remove plate assembly (9).

(4) Remove contact nut cotter pin (8) and contact attaching nut (12). Remove contact disk (7), cupped washer (6), contact cushion spring (5), plain washer (4), and cupped and slotted washer (3), and withdraw plunger (1).

(5) Remove two terminal screws (13) with terminal clamps (14) and one ground strap (15).

(6) Remove two terminal nuts (16) with plain washers (17). Remove two nuts (18) with plain washers (17) and insulation washers (19, 20, and 21). Pull out MOTOR terminal stud (27), BAT terminal stud (28), and separate terminal plate (22), terminal plate gasket (23), and insulator (24).

188. Inspection and Repair of Starting Motor Components

a. Cleaning. Clean metal parts with fuel oil. Clean armature, coils, and solenoid switch parts with low pressure compressed air and a dry cloth.

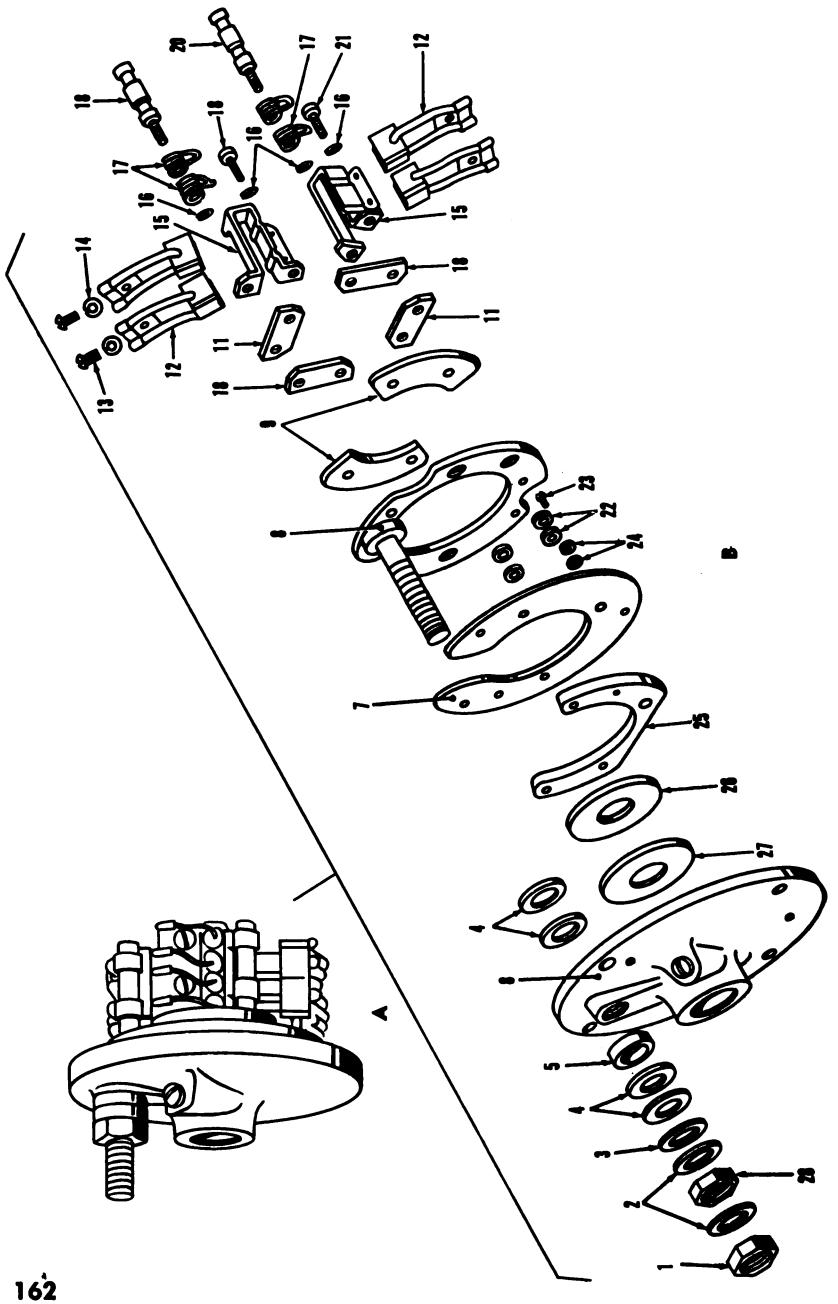
b. Armature.

(1) Check the armature for open circuits, short circuits, and grounds.

(*a*) Open circuits are indicated by arcing and burning of the commutator bars. If not badly damaged resolder the wires in the riser bars using rosin core solder. Turn the commutator down in a lathe to remove burned material.

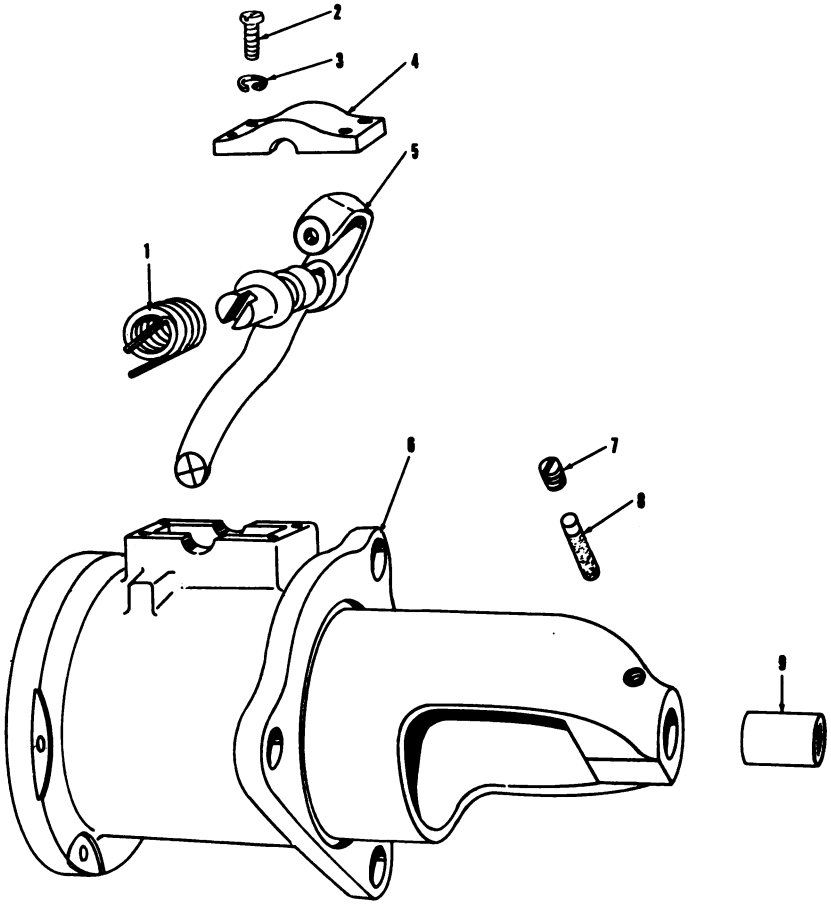
(*b*) Locate short circuits with a growler. Revolve the armature in the growler while holding a steel strip, such as a hacksaw blade, above it. The steel strip will vibrate above the part of the armature that is short-circuited. Clean copper or brush dust from the slots between commutator bars with low pressure compressed air. If cleaning does not eliminate short circuit, replace or rebuild armature.

(*c*) Test for grounds with a test rig consisting of a 6-volt battery in series with a 3- or 4-candlepower lamp, two test



1 Terminal stud nut
2 Terminal stud lockwasher
3 Terminal stud plain washer
4 Terminal stud insulation washer
5 Terminal stud insulating bushing
6 Commutator end frame assembly
7 Brush plate insulator
8 Plate and stud
9 Brush holder insulator
10 Insulated holder space plate
11 Grounded holder space plate
12 Brush
13 Brush lead attaching screw
14 Brush screw lockwasher
15 Brush holder
16 Brush holder screw lockwasher
17 Brush spring
18 Grounded brush holder screw
19 Grounded holder screw
20 Insulated brush holder screw
21 Insulated holder screw
22 Insulation bushing washer
23 Brush plate insulator attaching screws
24 Attaching screw lockwasher
25 Support plate
26 Brake fiber washer
27 Brake shoe washer
28 Terminal stud nut

Figure 56. Starting motor end plate.



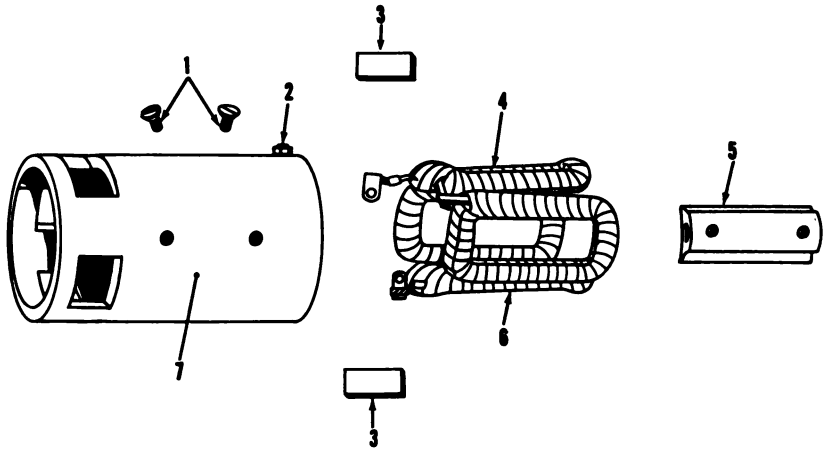
1 Shift lever spring
2 Cover attaching screw
3 Cover screw lockwasher
4 Cap
5 Shift lever
6 Drive housing
7 Oiler
8 Wick
9 Bushing

Figure 57. Starting motor drive housing, disassembled.

probes, and connecting wire. In using test probes be sure that good electrical connection is made at points of contact. If the lamp lights when one test point is placed on an unpolished part of the commutator with the other point on the core or shaft, the armature is grounded. Replace or rebuild grounded armatures.

(2) Inspect commutator for wear. If necessary, smooth with a commutator stone or turn down in a lathe and undercut the mica. Inspect the undercuts to see that the profile is correct (5 or 6, fig. 61).

(3) Examine spiral on shaft for burs and wear. Remove burs or replace armature as necessary.



1 Pole shoe screw
2 Field terminal stud
3 Insulation strip
4 Right hand field coil
5 Pole shoe
6 Left hand field coil
7 Field frame

Figure 58. Starting motor field frame, exploded view.

(4) Inspect shaft journals for wear. If worn or scratched, replace the armature.

c. Field Coil and Frame. Field coils can be checked without removing them from the field frame.

(1) Check for open circuits with the test rig. Place one point on each field terminal. If the lamp does not light, there is an open circuit. Check each coil separately to locate the defective coil. Replace defective coil. Resolder connections with rosin core solder.

(2) Check for grounded coils with test rig. Place one point on a coil terminal and the other on the field frame. If the lamp lights, a coil is grounded. Check each coil separately to locate the defective coil. Replace defective coil.

(3) Inspect field coils for frayed insulation. Repair if it is possible to do so without adding bulk. Otherwise replace coil.

(4) Inspect field coil terminals for corrosion and replace if necessary.

(5) Inspect field coil insulation strips and remove if damaged.

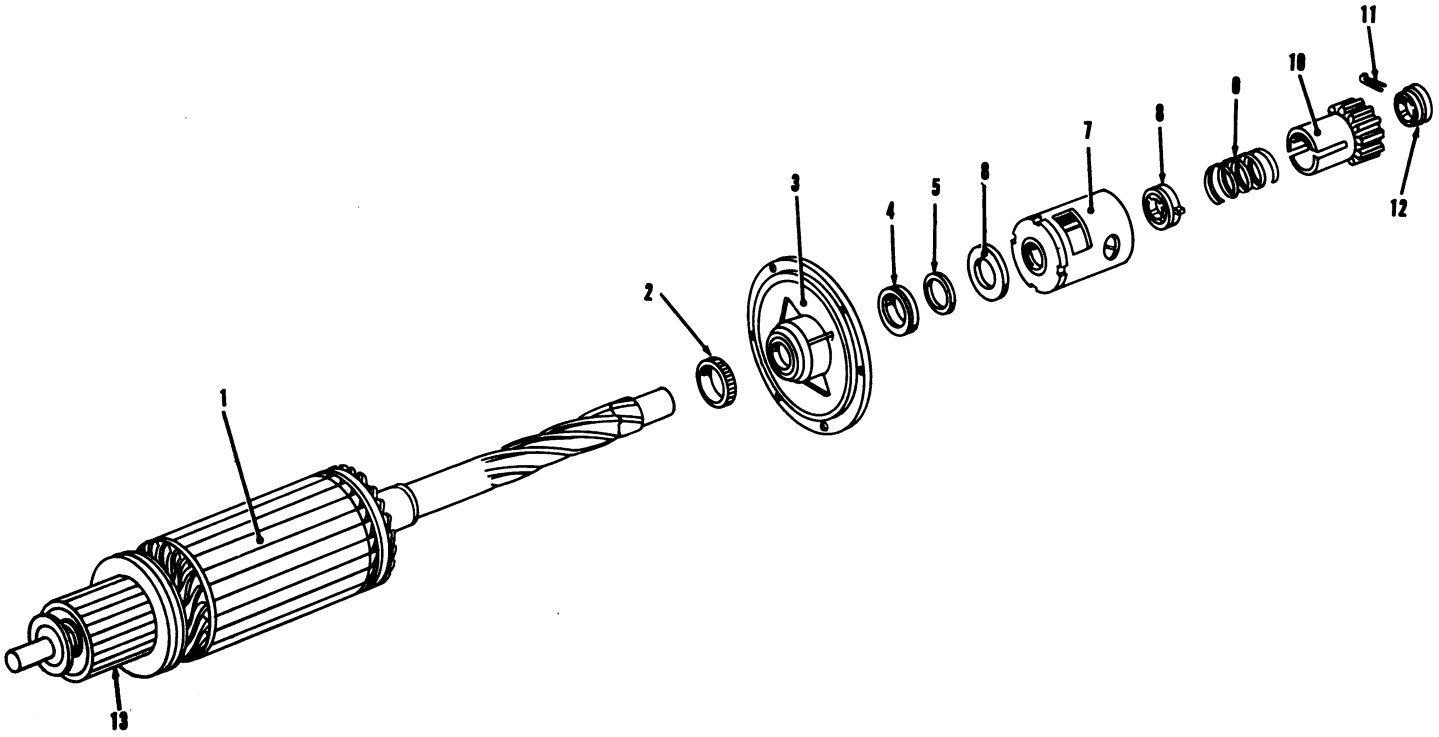
(6) Inspect pole shoes. Replace if damaged.

(7) Examine screw holes. Holes must have full, clean threads. Use a tap to repair slightly damaged threads. Pole shoes must fit accurately and securely.

d. Commutator End Frame Assembly.

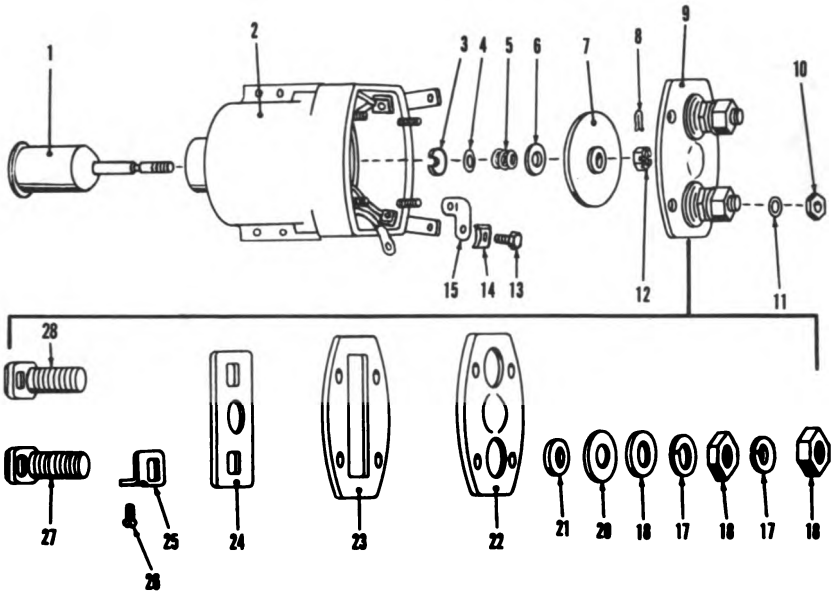
(1) Inspect brushes and brush terminals. Renew brushes if they are oil soaked, worn to less than one-half of original length, or if terminals are burned or corroded.

(2) Inspect brush springs for broken coils. Replace defective spring.



1	Armature	4	Oil seal	7	Shift sleeve	10	Drive pinion	13	Commutator
2	Collar	5	Space washer	8	Pinion guide	11	Pinion stop cotter pin		
3	Center bearing plate	6	Cupped space washer	9	Meshing spring	12	Stop collar		

Figure 59. Starting motor armature and drive, exploded view.



1	Plunger	15	Ground strap
2	Case and coil	16	Terminal nut
3	Cupped and slotted washer	17	Plain washer
4	Plain washer	18	Terminal nut
5	Contact cushion spring	19	Insulation washer
6	Cupped washer	20	Insulation washer
7	Contact disk	21	Insulation washer
8	Contact nut cotter pin	22	Terminal plate
9	Plate assembly	23	Terminal plate gasket
10	Terminal plate attaching nut	24	Insulator
11	Lockwasher	25	Lead support
12	Contact attaching nut	26	Coil screw
13	Terminal screw	27	MOTOR terminal stud
14	Terminal clamp	28	BAT terminal stud

Figure 60. Starting motor solenoid switch, exploded view.

(3) Inspect commutator end frame for cracks. Replace if defective.

(4) Inspect bushing in commutator end frame. Replace if defective or worn.

(5) Inspect brake washer. If badly worn or damaged, cement new washer in place.

(6) Replace all broken insulation plates and washers.

(7) Replace brush plate if it is not smooth and flat or if stud is damaged.

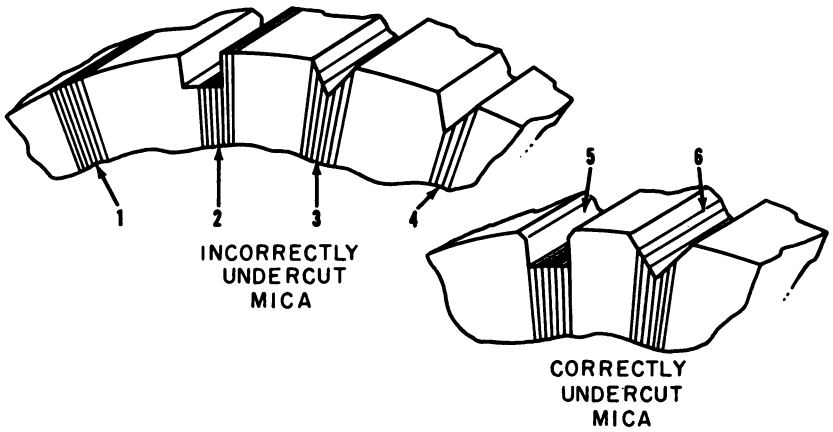
e. Center Bearing Plate.

(1) Inspect bushing in center bearing plate. Replace if excessively worn.

(2) Inspect oil seal. Replace if defective.

f. Dyer Drive Assembly.

(1) Inspect bushing in housing. Replace if worn.



1 High mica
2 Square tool, incorrectly cut
3 V cut, not deep enough
4 V cut, not centered
5 Correctly cut with square tool
6 V cut, centered

Figure 61. Mica undercutting.

(2) Inspect housing for cracks and breaks. Replace if defective.
(3) Inspect pinion for broken or damaged teeth. Replace if defective.
(4) Inspect shift sleeve. Remove burs. Replace if worn.
(5) Inspect shift lever spring for cracks. Both ends of spring should be parallel and point in the same direction. Replace spring if weak.
(6) Replace washer if worn.
(7) Inspect pinion guide. It should slip freely on shaft. Lugs should not be bent or grooved. Replace if worn.

g. Solenoid Switch.

(1) Examine all insulating strips and washers for charring, oil, grease, dirt, or moisture. Replace parts as necessary.
(2) Clean contacts of studs with a stiff wire brush. Do not grind. Remove scale and dirt only. If deeply pitted, replace terminal studs.
(3) Clean contactor disk with a wire brush. Do not grind. Replace if excessively worn.
(4) If wires from coil in case are damaged, replace case and coil.

189. Reassembly of Starting Motor Components

a. Reassemble Solenoid Switch.

(1) Reassemble plate assembly by placing MOTOR terminal stud (27, fig. 60) through lead support (25), insulator (24), terminal plate gasket (23), and terminal plate (22). Place BAT terminal stud (28) through same parts omitting lead support (25). On each stud assemble three insulation wash-

ers (21, 20, 19), plain washer (17), and terminal nut (18). Then loosely install washer (17) and nut (16).

(2) Position ground strap (15) and terminal clamps (14) and secure with screws (13).

(3) Insert plunger (1) in case, and assemble cupped and slotted washer (3), plain washer (4), contact cushion spring (5), cupped washer (6), and contact disk (7). Install nut (12) and contact nut cotter pin (8) on end of shaft.

(4) With plate assembly (9) near case, attach coil terminal to lead support (25) with coil screw (26).

(5) Place plate assembly on case and fasten with four lockwashers (11) and terminal plate attaching nuts (10).

(6) Screw link assembly (13, fig. 55) on plunger.

b. Reassemble Dyer Drive.

(1) Place collar (2, fig. 59) on armature shaft.

(2) Install oil seal (4) in center bearing.

(3) Place center bearing plate (3) on armature shaft.

(4) Install space washer (5) and cupped space washer (6) with cupped side away from armature core.

(5) Install shift sleeve (7)

(6) Twist pinion guide (8) half way up shaft. Slide meshing spring (9) and drive pinion (10) on shaft. Compress spring inside pinion and assemble pinion (10) and pinion guide (8) with lugs of guide in slots of pinion. Hold together and twist it up the shaft and into the shift sleeve. A click will indicate that the assembly is locked in place.

(7) Turn the pinion stop onto the shaft until it hits the undercut. Rotate the stop to aline the holes in the shaft and pinion stop. Replace pinion stop cotter pin (11) in lined up holes.

c. Reassemble Field Frame.

(1) Place a pole shoe (5, fig. 58) into each field coil (4) and (6) from the inside.

(2) Install two insulating strips (3) in the commutator end of the field frame.

(3) Place the coils (4 and 6) and shoes (5) inside field frame (7), with marks on coil and inside field frame lined up.

(4) Attach with pole shoe screws (1). Draw screws tight.

(5) Install field terminal studs (2) and connect field coil wire to studs.

d. Reassemble Drive Housing.

(1) Press new bushing (9, fig. 57) into cap (4).

(2) Place oil wick (8) in oil wick channel, and install oiler (7).

(3) Locate shift lever (5) with long end inside drive housing (6).

(4) Using a cover screw lockwasher (3) on each cover attaching screw (2), install cap (4) and tighten screws.

(5) Replace shift lever spring (1) on shaft on shift lever (5) with bent end of spring in slot of shaft and straight end touching boss of housing. Tension of spring must hold lower end of lever toward field frame.

e. Reassemble Commutator End Frame and Brush Plate.

(1) Press in new bushing, if removed, and cement new brake shoe washer (27, fig. 56) in end frame (6).

(2) Replace oil wick and pipe plug over wick. Press expansion plug in place.

(3) Aline support plate (25), brush plate insulator (7), and brush plate and terminal stud (8) so that stud passes through stud opening in insulator (7).

(4) Place eight insulation bushing washers (22) in four large holes of brush plate (8).

(5) Place insulated holder space plate (10) and insulator (9) against brush holder (15) with holes of the three pieces lined up. Place these parts against brush plate (8) with holes in line with insulating washers (22).

(6) Place brush holder screw lockwasher (16) on grounded holder screw (19), and thread screw through lined up parts and into support plate (25). Attach other grounded brush holder in the same way.

(7) Place lockwasher (16) on grounded brush holder screw (18) and place two brush springs (17) over body of screw. Position springs on screw so straight end of spring bears on flat face of brush holder (15). Thread screw into support plate (25) in the same manner as screw (19). Repeat with other grounded brush holder.

(8) Attach two insulated brush holders in the same way except that insulator (9) and insulation washers (22) are omitted and the brush holder screws thread into the plate (8).

(9) Place two insulating washers (4) over stud on brush plate (8) and brake fiber washer (26) in center of support plate (25).

(10) Assemble plate and stud (8) to the end frame (6) and attach with screws (23) and lockwashers (24).

(11) Place insulating bushing (5), two insulating washers (4), one plain washer (3), and one lockwasher (2) on terminal stud and install terminal stud nut (28) finger-tight only.

(12) Lift brush springs and slide each brush into brush holder so that grooves in brushes aline with track in holder. Keep brushes raised until assembly is complete. Attach each brush terminal to its brush holder with lockwasher (14) and screw (13).

f. Reassemble Subassemblies.

(1) Aline reference marks on the field frame (7, fig. 55) and commutator end frame plate (6), and assemble the two parts. Attach the two field coil terminals to brush holders with lockwashers (14, fig. 56) and screws (13).

(2) Lubricate bearings and armature journals lightly (see LO 5–5009) and slide armature into field frame.

(3) Replace lockwashers (4, fig. 55) on the screws (3) and attach the commutator end plate (6) to the field frame (7). Tighten screws and bend ears of lockwashers.

(4) Place gasket (15) against center bearing plate (3, fig. 59). Slip drive housing (16, fig. 55) over end of armature shaft and against center bearing plate, guiding finger of shift lever into slot of shift sleeve.

(5) Aline reference marks on drive housing and center bearing plate. Replace lockwasher (18) over each screw (17) and attach drive housing and center bearing to field frame. Bend tangs of lockwashers (18).

(6) Push brushes into place against commutator with ends of springs resting on top faces of brushes.

(7) Install cover band (1) around field frame (7).

(8) Attach solenoid switch to starting motor.

(9) Install cable (5) between solenoid switch and starting motor stud.

(10) Adjust Dyer drive (par. 190).

(11) Seat brushes (par. 157*c*).

(12) Install starting motor (par. 157*b*).

190. Adjustment of Dyer Drive

When the shift lever is in cranking position it should be possible to push the pinion back against spring pressure one-eighth to three-sixteenths of an inch. Check it with the starting motor off the engine. Disconnect the cable from the solenoid to the starting motor and use battery current through the solenoid to hold the shift lever in cranking position. If the plunger does not pull in, move it in by hand. Battery current will then hold it in cranking position. Adjust by disconnecting the shift lever from the plunger linkage and turning the stud in or out as necessary.

Section VII. BATTERY CHARGING GENERATOR

191. Description

a. The battery charging generator (13, fig. 33) maintains the battery in a charged condition. It is an insulated 24-volt, 20-ampere, two-pole, two-brush shunt wound generator.

b. The armature shaft is supported at both ends by ball bearings. Brush holders are noncorrosive and brushes are under a spring tension of about 20 ounces.

192. Disassembly of Generator

a. Remove Generator From Engine. Refer to paragraph 155*a*.

b. Disassemble Into Major Subassemblies. Disassemble only as far as necessary to repair, to replace defective parts, or to test component parts.

(1) Remove cover band (8, fig. 62).
(2) Remove brush lead attaching screws (7, fig. 63) and withdraw brushes (5).
(3) Remove two bolts (25, fig. 62) with lockwashers (27).
(4) Remove commutator end frame (7).
(5) Withdraw armature (24) from generator field frame, with drive end frame attached.
(6) Place armature vertically in a vise and grip lightly with soft jaws. Remove shaft nut (23) and washer (11).
(7) Hold a brass rod against shaft end of armature and tap with hammer to loosen pulley (12) and fan (13). Remove pulley, fan, and Woodruff key (26) from shaft.
(8) Remove the drive end frame (18) with attached parts.
(9) Remove the four screws (28) with lockwashers (29) holding the fan (13) to the pulley (12) and separate the two parts.
(10) Remove the outside collar (15) from the shaft.

c. Disassemble Drive End Frame. Remove six screws with lockwashers and nuts. Remove outer retaining plate (17), inner retaining plate (22, fig. 62), and retainer plate gasket (21). Tap end frame on a block of wood to remove ball bearing (20) from inside face of frame.

d. Disassemble Commutator End Frame. Remove three cover plate attaching screws (1, fig. 62) with lockwashers (2) holding commutator and cover plate (3), and remove cover plate, cover plate gasket (4), space washer (5), and ball bearing (6).

e. Disassemble Field Frame.

(1) Remove two screws (3, fig. 63) and lockwashers (6). Remove insulated brush holders (1).
(2) Detach and remove brush spring (4) from brush holders (1).
(3) Mark positions of pole pieces, field coils, and studs in the field frame.
(4) From the three terminal studs (13 and 17) on outside of frame, remove terminal stud nut (8), lockwasher (9), plain washer (10), and terminal stud insulating washer (11). Press the studs into the field frame and remove terminal bushing (12) from terminal stud on inside of field frame.

(5) Remove pole shoe screws (14) using a pole shoe screwdriver and pole shoe spreader. Remove pole shoes (15) and field coils (16 and 18).

193. Battery Charging Generator Inspection and Repair

a. General. The generator when cold should produce 20 amperes at 26 volts. If this amperage is not produced, make the following checks and repairs.

b. Tests With No Output.

(1) If the generator produces no voltage, remove the cover band and check the commutator, brushes, and internal connections. Sticking brushes, a dirty commutator, or poor connections may be the cause. Clean, replace, and repair as necessary.

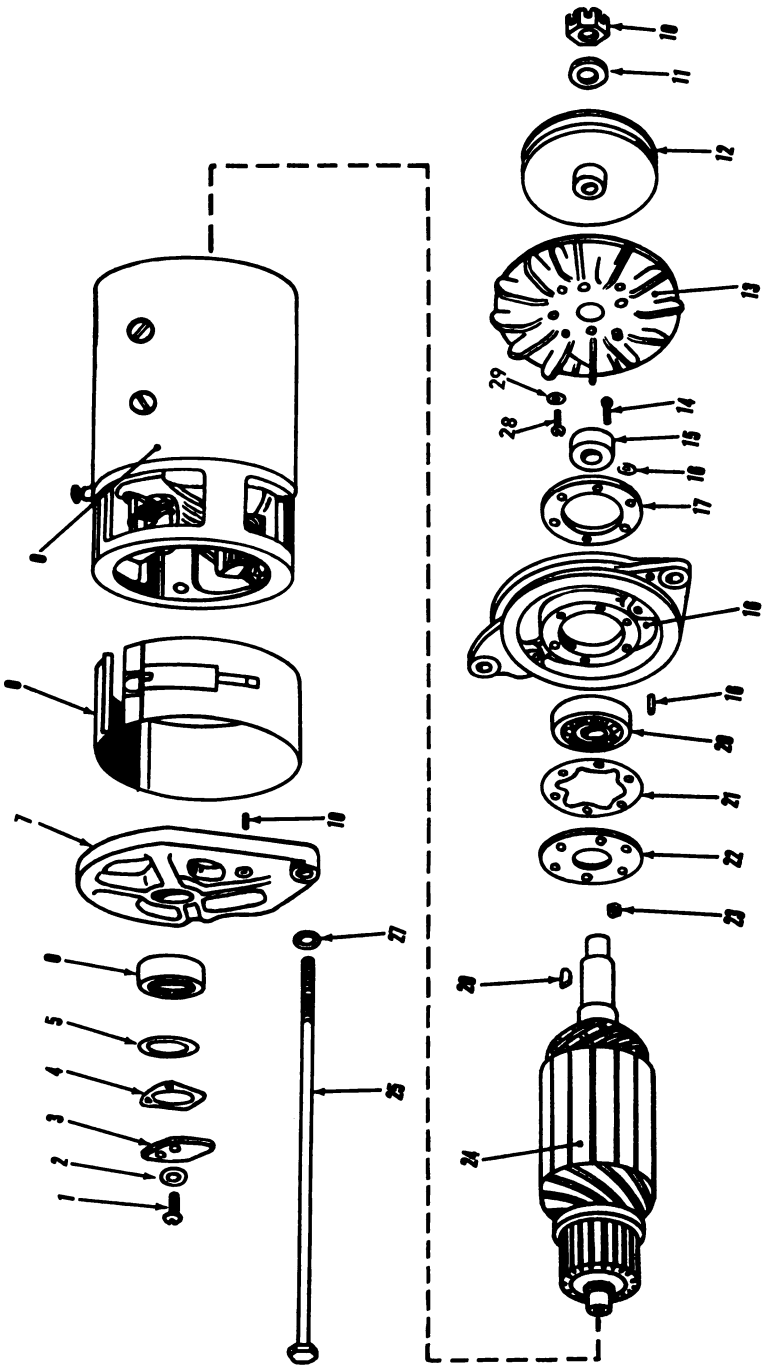
(2) If the brushes are seated satisfactorily and the generator is clean, use a test rig to locate the trouble. See paragraph 188*b*. Disconnect all leads from the generator terminals. Raise the brushes and insulate them from the commutator with a piece of cardboard. Check for grounds with test probes from brushes to generator frame. If the lamp lights, the generator is grounded internally. Disassemble the generator to locate the ground.

(3) If the generator is not grounded, check the field for an open circuit with test rig. The lamp should light when one test probe is placed on the field terminal and the other on the brush holder to which the field is connected. If the open circuit is due to a broken lead or bad connection, repair the part. If the trouble is inside a field coil, replace the defective coil.

(4) If no open circuit is found, check for a short circuit by connecting a 6-volt battery and an ammeter in series with the field circuit. The field should draw 0.83 to 0.80 ampere. Proceed with care since a shorted field may draw excessive current which can damage the ammeter.

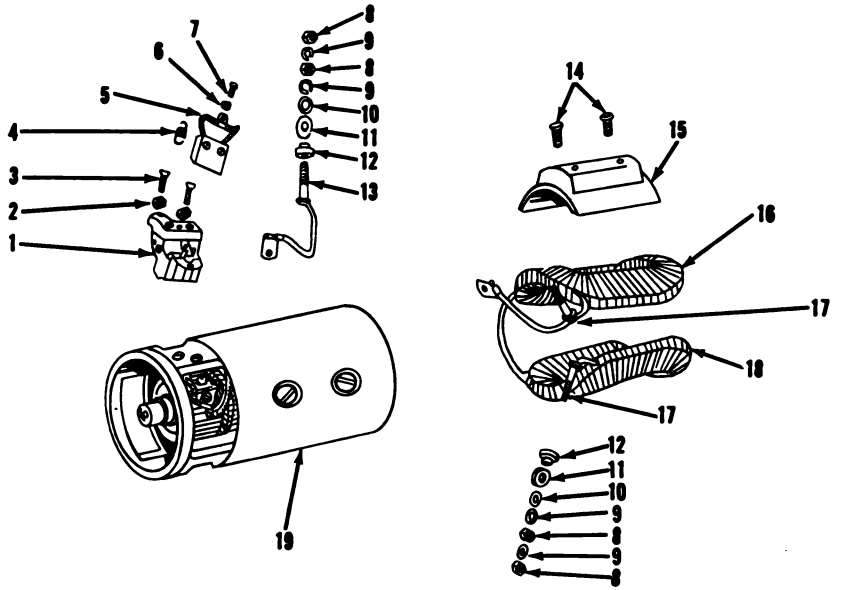
Note. If a shorted field is found, check the battery voltage regulator contact points. Excessive current from a shorted field may have burned them.

(5) Check the armature for open and short circuits. Open-circuited armature bars will be burned. If the trouble is apparent, repair and refinish commutator whenever possible. If the commutator is burned badly, replace the armature. Check the battery voltage regulator so that the trouble will not reoccur. Locate short circuits by revolving the armature in a growler. A thin strip of steel held over the armature while it is revolved will vibrate about a short-circuited area. Repair or replace the armature if short-circuited.



1 Cover plate attaching screw
2 Lockwasher
3 Cover plate
4 Cover plate gasket
5 Spacer
6 Ball bearing
7 Commutator end frame
8 Cover band
9 Generator Field
10 Shaft nut
11 Washer
12 Pulley
13 Fan
14 Ball bearing plate screw
15 Outside collar
16 Lockwasher
17 Outer retainer plate
18 Drive end frame
19 Dowel pin
20 Ball bearing
21 Retainer plate gasket
22 Inner retainer plate
23 Shaft nut
24 Armature
25 Bolt
26 Woodruff key
27 Lockwasher
28 Screw, rd hd, No. 12–24 x ⅜ (4 req'd)
29 Lockwasher, No. 12 (4 req'd)

Figure 62. Battery charging generator, partially disassembled.



1 Insulated brush holder
2 Nut
3 Screw
4 Brush spring
5 Brush
6 Lockwasher
7 Screw
8 Terminal stud nut
9 Lockwasher
10 Washer
11 Terminal stud insulating washer
12 Terminal bushing
13 Terminal stud
14 Pole shoe screw
15 Pole shoe
16 Right hand field coil
17 Terminal stud
18 Left hand field coil
19 Field frame

Figure 63. Battery charging generator field frame, disassembled.

c. Tests for Unsteady or Low Output.

(1) Check the generator drive belt for proper tension. Refer to paragraph 146.

(2) Check for sticking or worn brushes and brush spring tension of less than 20 ounces. Replace brushes, clean, and refinish commutator as necessary.

(3) Check the commutator to see if it is out-of-round or has high mica. Turn the commutator in a lathe, and undercut mica as necessary. Refer to figure 61.

d. Tests for Excessive Output. Test for a shorted field (*b*(2) above). Internal grounding will prevent the regulator from working and thus produce excessive output. Repair insulation on field leads as needed. If pole shoes are grounded remove field coils, reinsulate, and reinstall them. A ground at the terminal studs can be repaired by installing new insulating washers or bushings.

e. Repair of Noisy Generator. Noise may be caused by a loose mounting or bracket, loose drive pulley, worn or dirty bearings, or improperly seated brushes. Replace defective parts, and tighten loose parts. Seat brushes. If the brush holder is bent, replace it.

f. Inspection of End Frames. Inspect end frames for cracks. Replace frame if cracked. Inspect ball bearing for wear and damage. If bearing is noisy or feels rough when rotated, replace it. Inspect retainer plates and bearing washer for distortion and cracks. Replace if defective.

g. Inspection of Field Frame. Inspect brush springs for tension and breaks. Replace discolored, broken, or weak brush springs. Inspect field coils and leads for condition of insulation. Reinsulate if necessary. Replace if beyond repair. All soldered connections must be made with rosin flux solder.

194. Generator Reassembly

a. Assemble Field Frame.

(1) Place pole shoes (15, fig. 63) in field coils (16 and 18) and insert in field frame. Locate according to marking made when disassembling. Fasten each pole shoe in place with two pole shoe screws (14). Tap field frame with a mallet to seat pole shoes and tighten screws.

(2) Place terminal bushings (12) on three terminal studs (13 and 17) and draw studs through holes in field frame. Place terminal stud insulating washers (11), plain washers (10), and lockwashers (9) on terminal studs (13). Secure with terminal stud nuts (8).

(3) Hook brush springs (4) on insulated brush holders (1), install brush holders in field frame with two screws (3) and lockwashers (6).

b. Assemble Drive End Frame. Position outer retainer plate (17, fig. 62), ball bearing (20), new retainer plate gasket (21), and inner retainer plate (22) in drive end frame. Secure with six screws (14) and lockwashers (16). Replace dowel pin (19), if removed.

c. Assemble Commutator End Frame. Position ball bearing (6), spacer (5), new cover plate gasket (4), and cover plate (3) in commutator end frame (7). Fasten in place with three cover plate attaching screws (1) and lockwashers (2). Replace dowel pin (19), if removed.

d. Assemble Main Assemblies.

(1) Grip armature carefully in soft jaws of vise and place drive end frame (18, fig. 62) and outside collar (15) on armature. Fasten fan (13) to pulley (12) with four screws (28) and lockwashers (27). Insert Woodruff key (26) in slot in armature shaft. Aline slot in pulley with key and press pulley and fan on shaft. Place washer (11) on shaft and install shaft nut (23).

(2) Install armature in field frame with dowel entering dowel hole in field frame.

(3) Position commutator end frame assembly with dowel in end frame entering hole in field frame.

(4) Install two bolts (25) with lockwashers (27).

e. Install and Seat Brushes.

(1) See paragraph 155*c*.

(2) Replace commutator cover band.

f. Install Generator. Refer to paragraph 155*b*.

Section VIII. BATTERY VOLTAGE REGULATOR

195. Description

Current and voltage in the engine electrical system are controlled by a three-unit regulator. The regulator contains a cutout relay, a voltage regulator, and a current regulator, mounted on one base.

196. Locating Battery Regulator Troubles

a. Fully Charged Battery and Low Charging Rate. A low charging rate with a fully charged battery means normal generator and regulator action.

b. Fully Charged Battery and a High Charging Rate.

(1) A high charging rate with a fully charged battery is caused by one of the following conditions.

(*a*) Improper voltage regulator setting.

(*b*) Defective voltage regulator.

(*c*) Grounded circuit, in generator, regulator, or wiring.

(*d*) Poor ground connection at regulator.

(*e*) An overheated battery which permits the battery to accept a high charging rate although the voltage regulator setting is normal.

(2) Open the battery box and allow the batteries to cool. If charging rate does not slow down, run the battery charging generator at medium speed and disconnect the lead from the regulator F terminal. If the output remains high, there is a ground in the generator or wiring harness. If the output drops the regulator is at fault.

c. Low Battery and High Charging Rate. This indicates normal generator and regulator operation.

d. Low Battery and Low or no Charging Rate.

(1) A discharged battery with low or no charging rate is caused by one of the following conditions.

(*a*) Loose connections, frayed, or damaged wires.

(*b*) Defective battery.

(*c*) High circuit resistance.

(*d*) Low regulator setting.

(*e*) Oxidized regulator contact points.

(*f*) Defective generator.

(2) Look for and correct loose connections, frayed, or damaged wires. If trouble persists locate cause by proceeding as detailed in (3) below.

(3) Momentarily ground the F terminal of the regulator and increase generator speed. If the output does not increase, the generator is at fault. If the generator output increases, the trouble is due to one of the following conditions.

(*a*) A low voltage (or current) regulator setting.

(*b*) Oxidized regulator contact points.

(*c*) An open circuit at the connections inside the regulator or in the regulator winding.

e. Burned Resistances, Windings, or Contacts. Burned resistances, windings, or contacts are caused by open circuits, open resistance units, or high resistance in the charging circuit. Locate the trouble and correct it before replacing regulator.

f. Burned Relay Contact Points. Burned relay contact points may be due to reversed generator polarity. Polarize generator as described in paragraph 155*b*(4).

197. Disassembly of Battery Voltage Regulator

a. Remove the battery voltage regulator. Refer to paragraph 156*a*.

b. Remove two screws (1, fig. 64), plain washer (2), cover (3), and gasket (4).

c. Remove adjusting screw (21) from relay.

d. Remove two screws (8), lockwasher (7), and relay armature (22).

e. Remove two springs (9) by inserting a screwdriver blade between the turns and lifting them off the supports. Do not bend the supports.

f. Remove two adjustment screws (10) from voltage and current regulators.

g. Remove two contact attaching screws (18) with lockwashers (17) from current and voltage regulators. Remove washer (15) from voltage regulator. Remove connector (19). Remove washer (15) from current regulator. Remove four insulated contact screw bushings 16). Remove contact and support (20) from current and voltage regulators.

h. Remove three grommets (14) from frame.

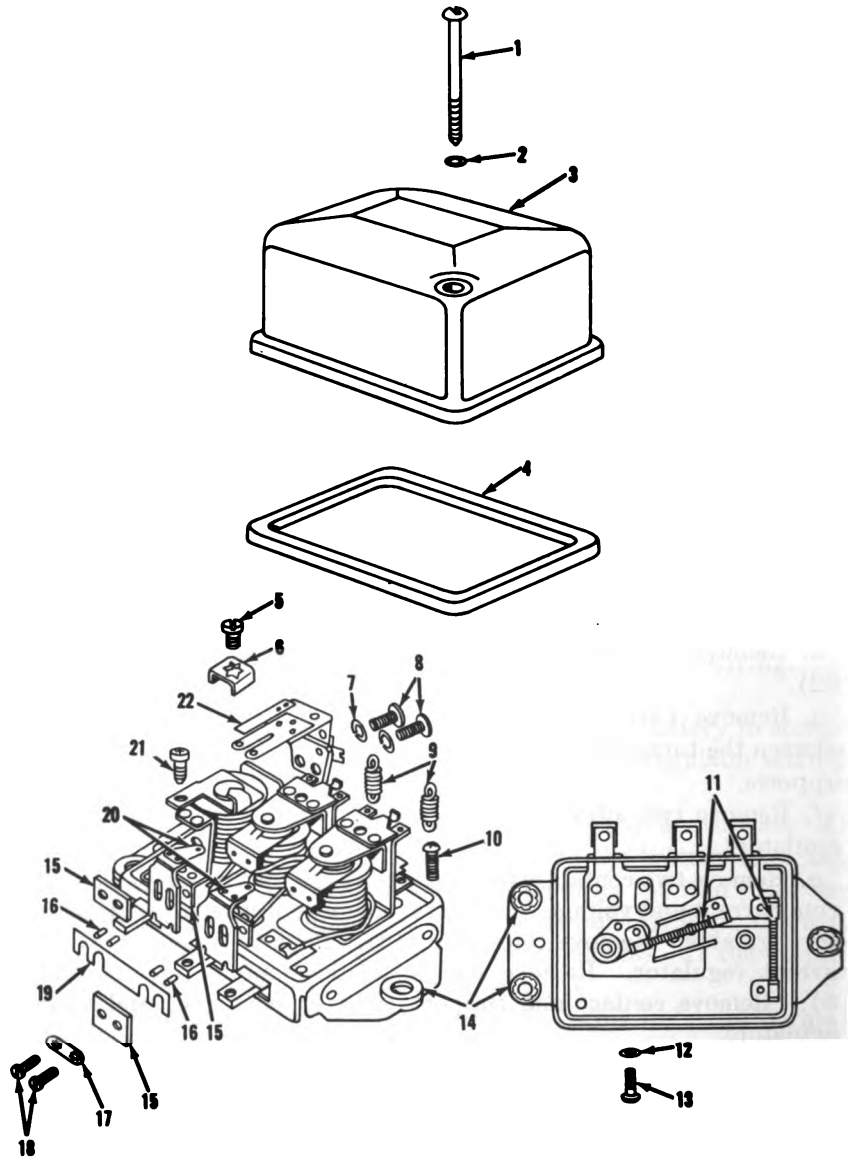
i. Remove one ground screw (13) with lockwasher (12).

j. Remove resistors (11) only if they require replacement. Drill out rivets to remove.

198. Reassembly of Battery Voltage Regulator

a. Install three grommets (14, fig. 64) in frame.

b. Position voltage and current regulator contact and supports (20) with new insulated washers (15), four bushings (16), and connector (19), and fasten in place with four contact attaching screws (18) and two-hole lockwasher (17). Note that the connector (19) is insulated from the voltage regulator contact mounting screws, whereas it is not insulated from the current regulator contact mounting screws.



1	Screw	12	Lockwasher
2	Plain washer	13	Ground screw
3	Cover	14	Grommet
4	Gasket	15	Washer
5	Terminal screw	16	Bushing
6	Terminal clamp	17	Lockwasher
7	Lockwasher	18	Contact attaching screw
8	Screw	19	Connector
9	Spring	20	Contact and support
10	Adjustment screw	21	Adjustment screw
11	Resistor, 500 ohms	22	Armature

Figure 64. Battery voltage regulator, disassembled.

c. Install two adjustment screws (10) in voltage and current regulators.

d. Install springs (9) in current and voltage regulators. Hook spring (9) on lower spring support. Insert a screwdriver between spring coils and spread coils to attach spring to upper support. Be careful not to bend the supports.

e. Install relay armature (22) with two screws (8) and lockwashers (7).

f. Install relay adjusting screw (21)

g. Install ground screw (13) and lockwasher (12).

h. Adjust the regulator (par. 196).

199. Battery Voltage Regulator Checks, Adjustments, and Cleaning

a. General.

(1) Mechanical checks and adjustments must be made with the battery disconnected, with the regulator off the engine. Pitted or oxidized points must be cleaned with an ignition file.

Caution: Cutout relay contact points must never be closed by hand or with feeler gage when battery is connected. This will damage the regulator.

(2) Electrical checks and adjustments may be made either on or off the engine. The regulator must always be operated with the type generator for which it is designed.

(3) The regulator must be mounted in the operating position and at operating temperature when electrical settings are checked and adjusted. Operating temperature is reached after 15 minutes of operation.

(4) Perform the checks in *b* below to find trouble in the electrical system.

b. Cutout Relay.

(1) *Air gap.*

(*a*) Disconnect battery.

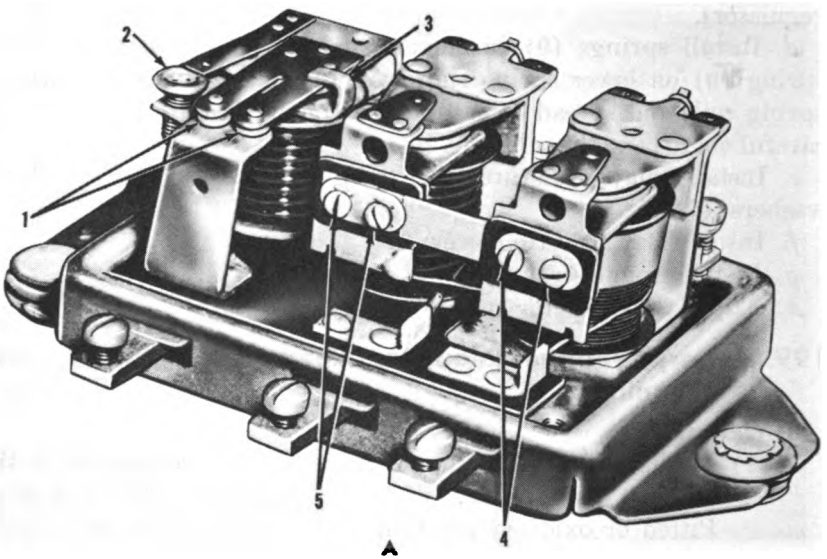
(*b*) Remove voltage regulator cover.

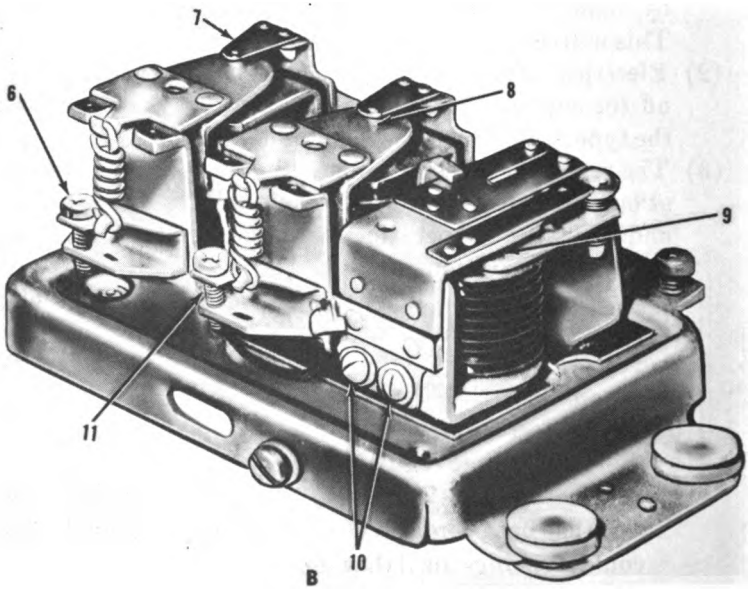
(*c*) Move armature (22, fig. 64) by hand until points just close. See that both contacts close together. If they do not, bend contact springs until they do.

(*d*) Measure air gap (9, fig. 65) between armature and center core with a feeler gage. Air gap should measure 0.017 inch.

(*e*) To adjust air gap loosen the two relay armature attaching screws (10) at the back of the relay and set the armature as required. Tighten the screws.

(*f*) Replace cover and connect battery.





1 Relay contact points
2 Relay adjusting screw
3 Relay upper armature stop
4 Voltage regulator contact mounting screws
5 Current regulator contact mounting screws
6 Voltage regulator adjusting screw
7 Voltage regulator contact points
8 Current regulator contact points
9 Relay armature air gap
10 Relay armature attaching screws
11 Current regulator adjusting screw

Figure 65. Battery voltage regulator, adjustment points.

(2) *Point opening.*

(*a*) Disconnect battery.

(*b*) Remove voltage regulator cover.

(*c*) Measure the air gap between contact points (1). The gap should measure 0.032 inch.

(*d*) To set the air gap, bend the upper armature stop (3) as required.

(*e*) Replace cover and connect battery.

(3) *Closing voltage.*

(*a*) Remove cover.

(*b*) Connect a voltmeter between the regulator GEN terminal and ground screw (fig. 66).

(*c*) Slowly increase generator speed and note the voltage at which the relay closes. It should close between 24.0 and 27.0 volts.

(*d*) To set the closing voltage, decrease generator speed and with contact points open, turn the relay adjusting screw (2, fig. 65) until the points close at 25.5 volts. Turn the screw counterclockwise to decrease closing voltage.

(*e*) Replace cover and disconnect voltmeter.

c. Current Regulator.

(1) *Air gap.*

(*a*) Remove cover.

(*b*) Push armature in until the contact points just close.

(*c*) Measure the air gap between the armature and core. It should measure 0.075 inch.

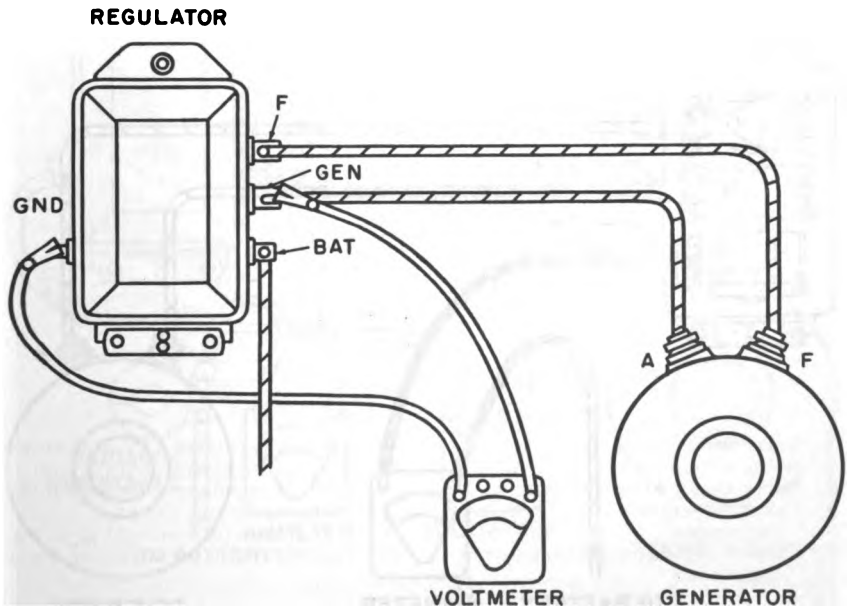


Figure 66. Checking cutout relay adjustment.

(*d*) To set the air gap, loosen the contact mounting screws (5), and raise or lower the contact bracket as required.

(*e*) Aline the points and tighten the mounting screws.

(*f*) Replace the cover.

(2) *Current setting.*

(*a*) Remove the cover.

(*b*) Put a load of approximately 20 amperes across the battery during the test.

(*c*) Connect an ammeter in series with the BAT terminal (fig. 67).

(*d*) Operate the engine at a speed of 1120 rpm. The frequency meter on the main control panel will read 56 cycles.

(*e*) The test ammeter should read 18 to 22 amperes.

(*f*) Adjust the setting by turning current regulator adjusting screw (11, fig. 65) clockwise to increase the current setting or counterclockwise to decrease the setting. Adjust to 20 amperes making the final setting by increasing spring tension.

(*g*) Remove the test ammeter and replace cover.

d. Voltage Regulator.

(1) *Air gap.* See *c*(1) above.

(2) *Voltage setting.* These tests must be made with the voltage regulator cover in place.

(*a*) *Fixed resistance method.*

1. Obtain a resistance of 7 ohms, capable of carrying 10 amperes without changing resistance. Disconnect the BAT

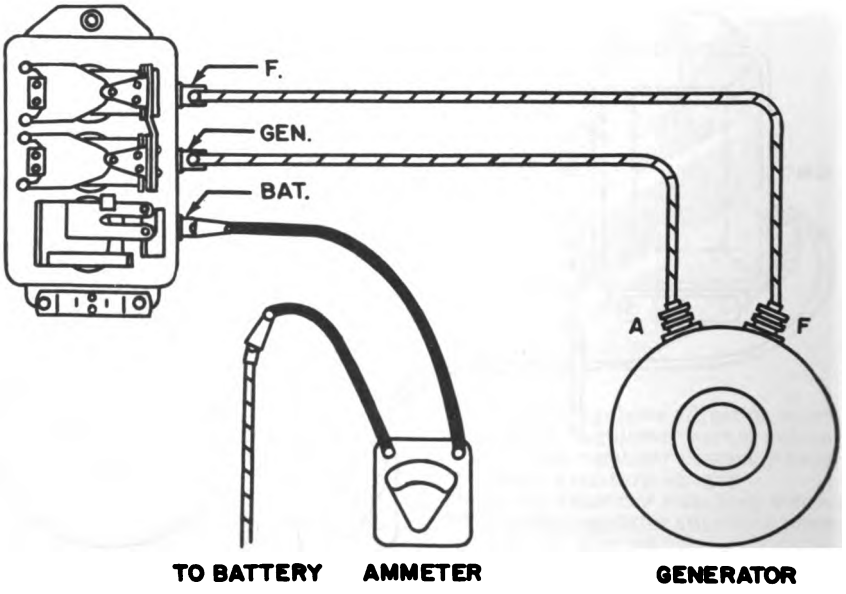


Figure 67. Checking current regulator setting.

lead at the regulator and connect the 7-ohm resistance between the regulator BAT terminal and the ground screw. Connect a test voltmeter across the resistance. Refer to figure 68.

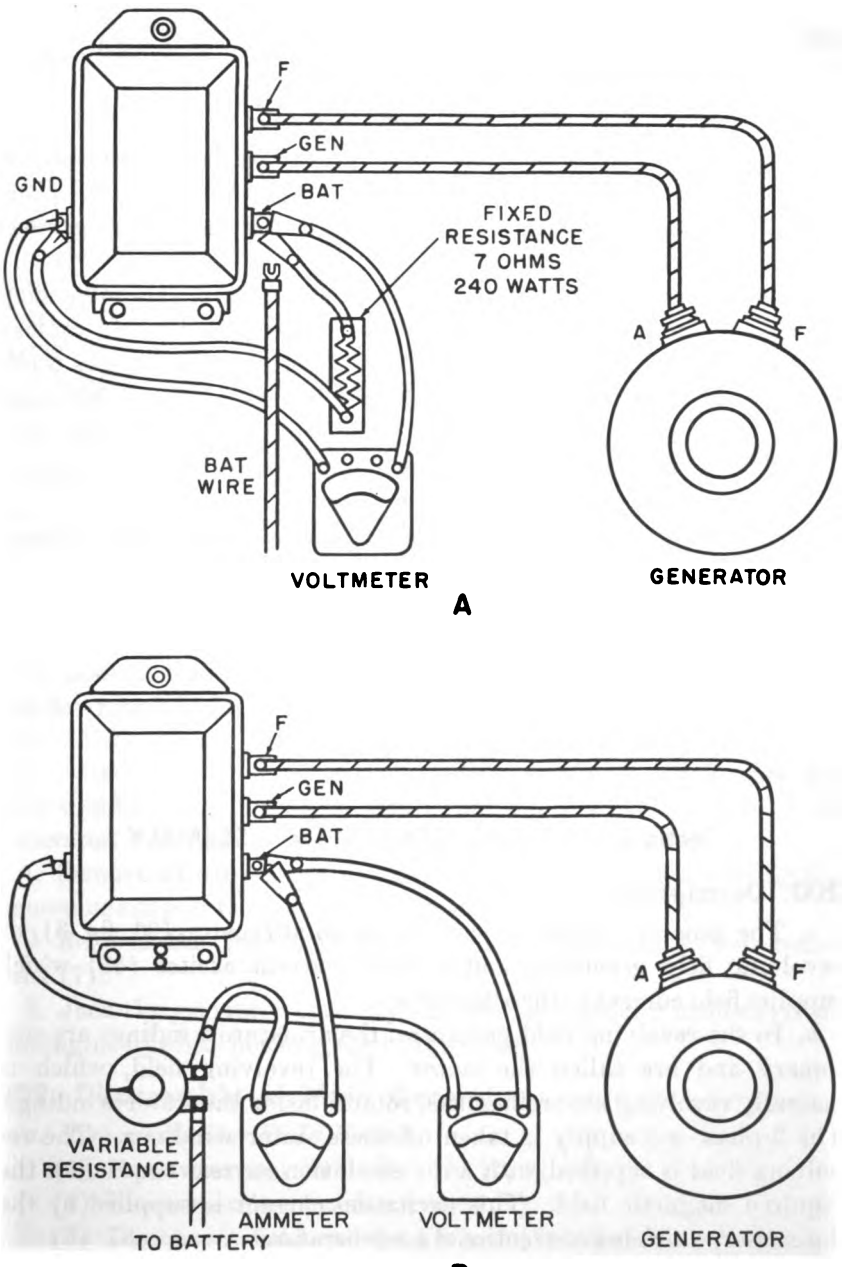


Figure 68. Checking voltage regulator setting.

2. Operate the engine at a speed of 960 rpm. The frequency meter on the main control panel will read 48 cycles. The test voltmeter should read 52.5 to 54.5 volts.

3. To adjust the voltage setting, remove the cover and turn the voltage regulator adjusting screw (6, fig. 65) clockwise to increase voltage and counterclockwise to decrease the voltage. Set to 53.5 volts, making the final adjustment by increasing the spring tension.

(*b*) *Variable resistance method.*

1. Connect an ammeter and a ¼-ohm variable resistance in series between the BAT terminal and the battery. Connect a volt-meter from the BAT terminal to the ground screws. Refer to figure 68.

2. Operate the engine at a speed of 960 rpm, (the frequency meter on the main control panel will read 48 cycles) and read the test ammeter. If less than 8 amperes is obtained, place a load across the battery to permit increased generator output. Cut in the resistance, using the variable resistor, until 8 to 10 amperes are obtained. Operate for approximately 15 minutes.

3. Retard engine speed until the points open, then increase speed and note the voltage setting.

4. Adjust the regulator, if necessary, as explained in *d*(2) (*a*)*3* above. When using this method readjust the variable resistance after each voltage adjustment, then reduce and increase speed before taking the next voltage reading.

e. Installation. Refer to paragraph 156*b*.

Section IX. MAIN GENERATOR ASSEMBLY

200. Description

a. The generator assembly consists of an alternator (33, fig. 3), or revolving field generator, and a direct current exciter (38) which supplies field current to the alternator.

b. In the revolving field generator, the armature windings are stationary and are called the stator. The revolving field, which is basically revolving electromagnets, rotates inside the stator windings. The 3-phase a-c supply is taken off these stator windings. The revolving field is supplied with a d-c excitation current to produce the required magnetic field. This excitation current is supplied by the d-c exciter, which is a conventional a-c generator.

c. When the generator attains about three-fourths normal running speed, a voltage is generated in the exciter armature due to residual

magnetism in the pole pieces. This causes a current to flow through the exciter field coils. The d-c exciter brushes are connected to the revolving field brushes which conduct direct current to the collector rings on the alternator shaft causing excitation current to flow in the main alternator rotor field windings. Alternating current is generated in the stator windings, with a-c voltages available at the load terminals.

201. Removal of Main Generator

a. Remove housing (par. 99).

b. Remove rear cowl, including the control cabinet and fuel oil tank.

c. Remove battery box, heater ducts, fuel tank, battery box support frame, and A frame (par. 99).

d. Disconnect all leads in generator connection box (26, fig. 7). Attach numbered tabs on lead ends to assure correct replacement.

Warning: Do not attempt to remove leads in the junction box while the engine is running.

e. Insert a 3½-foot length of 2- by 4-inch lumber through the adapter bracket (4, fig. 69) and under the generator coupling hub (12) to support the generator shaft when the generator assembly is removed from the engine. Refer to figure 69.

f. Fabricate engine rear support legs (9, fig. 43) in accordance with figure 41. Bolt rear support legs to flywheel housing with four bolts (10).

g. Open the locking clips (5) and remove eight bolts (4) holding the drive disk to the engine flywheel while prying under the shaft to relieve the weight of the rotor.

h. Attach a hoisting sling to the generator eyebolts (5, fig. 69) and take a sufficient strain on the lifting sling to hold the weight of the generator.

i. Remove 24 cap screws (1, fig. 43) with lockwashers holding the generator adapter to the engine flywheel housing.

j. Remove the four generator holddown bolts, nuts, and cotter pins (7).

k. Jack the generator assembly straight back about 2 inches to clear the engine flywheel housing, then lift it clear.

202. Disassembly of Main Generator

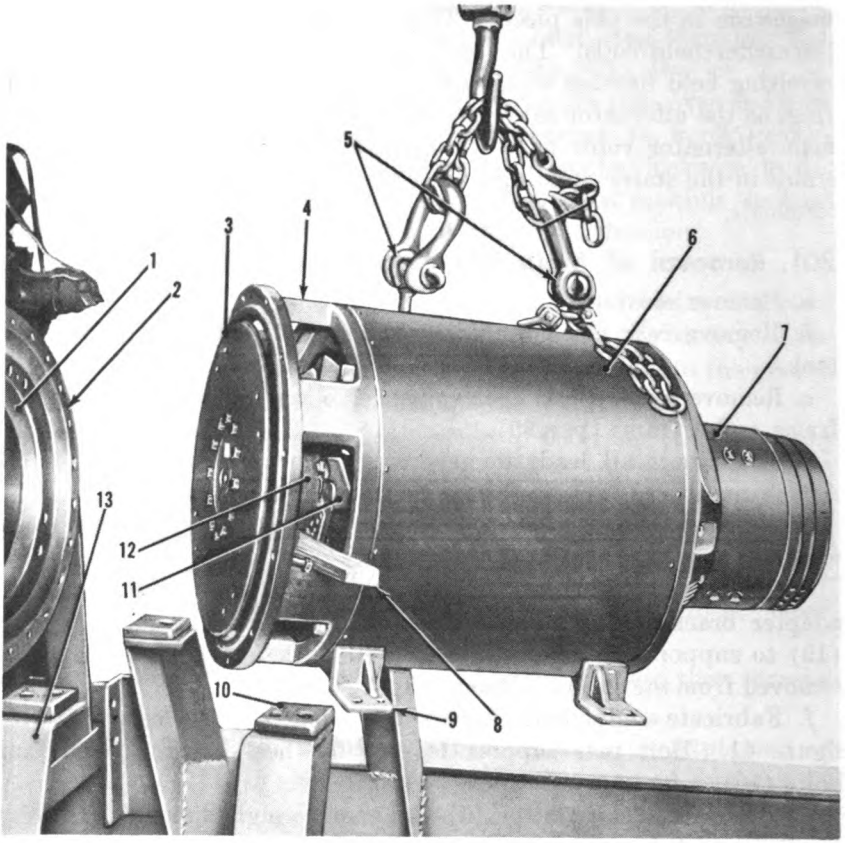
a. Remove Exciter Field Frame.

(1) Remove exciter end bell shield (1, fig. 70).

(2) Remove exciter brushes (par. 161).

(3) Disconnect field coil lead wires (13) from two brush terminals behind brush ring assembly (8).

(4) Remove cap screws (3), plates (4), and spacers (5) from bearing bracket (6).

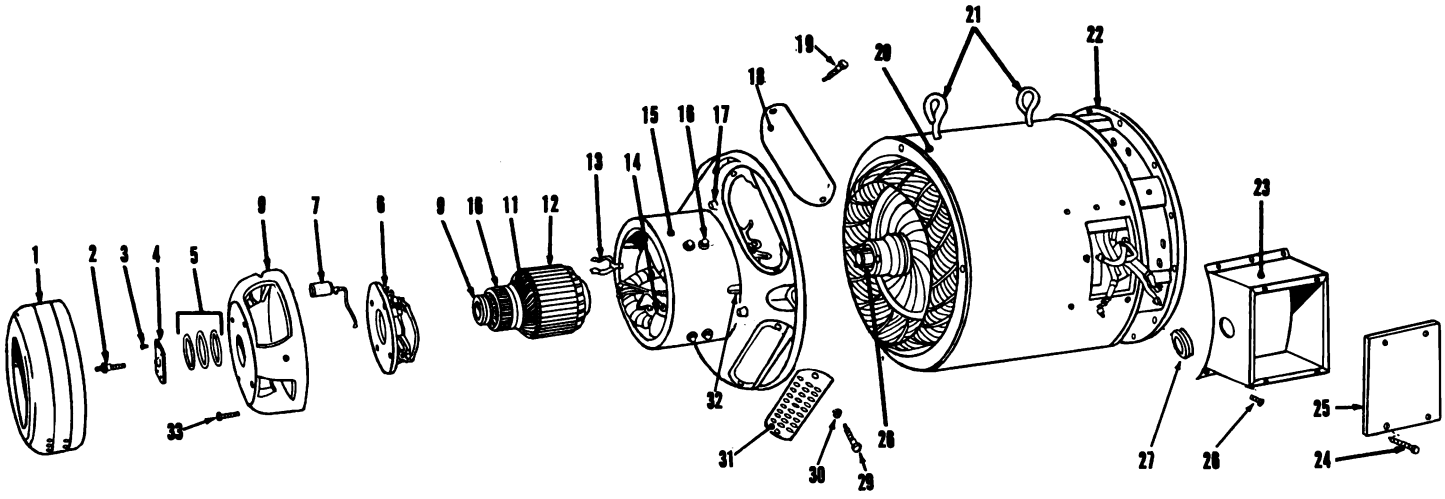


1	Engine flywheel	8	Wood bar
2	Flywheel housing	9	Foot
3	Coupling flange	10	Mounting pad
4	Adapter bracket	11	Fan
5	Lifting eyebolts	12	Coupling hub
6	Main generator	13	Mount
7	Exciter		

Figure 69. Removing generator from base.

(5) Remove four cap screws (33) and pull bearing bracket (6) off ball bearing (9) on the end of the exciter armature shaft. Disconnect capacitor (7) from bracket.

(6) Using a flashlight, locate the recess in the coupling (28), at joint through the coupling access port (32). Enter a tapered drift pin through the access port and into the recess in the coupling joint. Using a hammer, tap the end of the drift pin to separate the coupling halfs. This is a jaw-type coupling with four dowel pins projecting from the face of the alternator half of the coupling. When the dowel pins are visible through the access port the exciter armature core (12) may be withdrawn from the commutator (10) end of the exciter.



1 End bell shield
2 Cap screw, hex hd, 9/16–12 x 3/4 (4 req'd)
3 Cap screw, hex hd, 1/4–20 x 1/2 (4 req'd)
4 Plate
5 Spacers
6 Bearing bracket
7 Capacitor
8 Brush ring assembly
9 Ball bearing
10 Commutator
11 Armature coils
12 Armature core
13 Field coil leads
14 Exciter field coils
15 Exciter field frame
16 Pole bolts, hex hd, 1/2–13 x 1 1/2 (8 req'd)
17 Bolt, hex hd, 5/8–11 x 1 1/4 (4 req'd)
18 Inspection cover
19 Cap screw, hex hd, 1/4–20 x 5/8 (8 req'd)
20 Main generator frame
21 Lifting eyes
22 Adapter bracket
23 Junction box
24 Cap screw, hex hd, 1/4–20 x 7/16 (4 req'd)
25 Junction box cover
26 Cap screw, hex hd, 1/2–13 x 3/4 (6 req'd)
27 Grommet
28 Coupling
29 Cap screw, hex hd, 1/4–20 x 5/8 (8 req'd)
30 Lockwasher
31 Ventilating screen
32 Coupling access port
33 Cap screw, hex hd, 3/4–10 x 1 (4 req'd)

Figure 70. Main generator exciter, partially exploded.

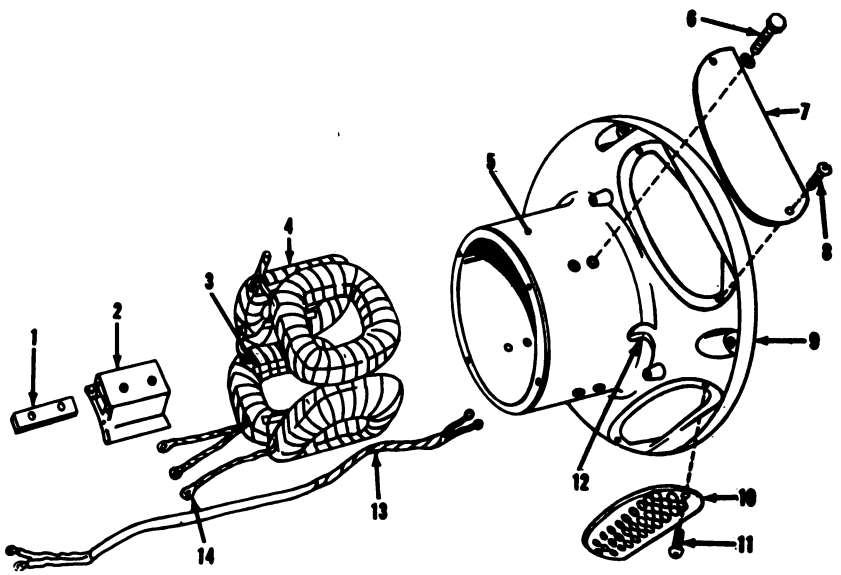
(7) Remove alternator brushes (par. 160).
(8) Remove and tag wiring connections to alternator.
(9) Remove four bolts (17) releasing the exciter field frame (15) from main generator frame (20).

b. Disassemble Exciter Field Frame. Remove field coils only when tests reveal a defective coil. Removal damages the coils.

(1) To remove a single field coil, unwrap the taped connections from the defective coils and melt or cut the connections. Remove two pole bolts (6, fig. 71) and pole clamp plate (1), and pole piece (2).
(2) To remove the field coil assembly (4), remove eight cap screws (6). Wash assembly with cleaning solvent and dry thoroughly before reassembling.

c. Disassemble Alternator.

(1) Remove four cap screws (19, fig. 72), releasing the adapter bracket (20) and gasket (18) from the frame (1).
(2) Remove 12 nuts (10) and bolts (17) releasing the drive disk (16) from the coupling hub (12).
(3) Remove setscrew (11) from the coupling hub (12) and pull coupling hub and key (13) from shaft (7).



1 Pole clamp plate
2 Pole piece
3 Insulation strips
4 Field coil assembly
5 Exciter housing
6 Pole bolt, hex hd, ½–13 x 1½ (8 req'd)
7 Brush access cover
8 Cap screw, hex hd, ¼–20 x ⅝ (8 req'd)
9 Attachment point
10 Ventilating screen
11 Cap screw, hex hd, ¼–20 x ⅝ (8 req'd)
12 Coupling access port
13 Harness to alternator
14 Coil terminal

Figure 71. Exciter field assembly, exploded view.

Note. Using an acetylene torch, heat the outside of the hub (12) to facilitate removal.

(4) Remove six cap screws (9) and lockwashers releasing fan (8).
(5) Position a loop sling around coupling (4) and place a 4-foot length of 4-inch pipe over end of armature shaft (7).
(6) Lift armature with pipe and sling. Withdraw armature from the exciter end of generator frame (1).

203. Inspection and Testing of Generator Parts

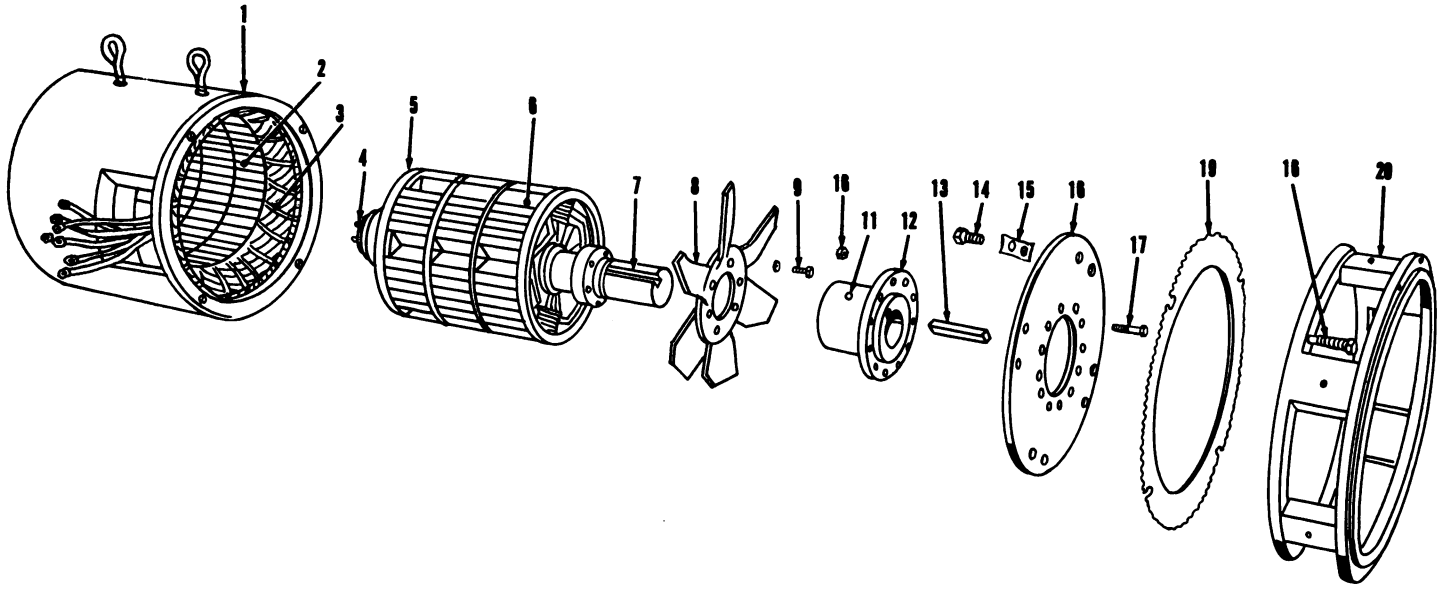
a. General. To test the generator use a test rig, consisting of a 6-volt battery in series with a 2- or 4-candlepower lamp, two test probes, and connecting wire. In using test probes be sure that good electrical connection is made at points of contact. Do not place probe points on polished commutator or collector ring surfaces. A growler and ohmeter are also required.

b. Exciter Armature.

(1) Inspect the armature for wear. Inspect the coils, insulation, and soldered connections for electrical and mechanical defects.
(2) Check the armature coils for grounds. Touch one probe to the armature shaft and the other to the end of each commutator segment. Select a noninsulated point where the winding is soldered to the segment. A grounded coil, or commutator segment, is indicated if the lamp lights. If the ground is noticeable and accessible, it should be corrected, otherwise replace the armature.
(3) Check the exciter armature on a growler for internal short circuits, and repair or replace if necessary.
(4) Check for open-circuited windings. Touch the test probes to each adjacent pair of commutator bars. If the windings are sound the lamp will light. Check for thrown solder. Resolder if joint is loose. Replace armature if soldering does not correct defect.
(5) Check the physical condition of the commutator. Check for high mica, rough commutator surfaces, burned, or pitted bars. Check to see if commutator is out-of-round.

c. Exciter Field.

(1) Inspect the insulation of the field coils and leads; repair as needed. If beyond repair, replace with a new coil. Inspect the leads and connections for burned or frayed insulation or poorly soldered connections. Repair or replace faulty leads.
(2) Check the field coils for grounds. Touch one test probe to a field output terminal and the other to an unpainted portion of the exciter frame. If a field coil is grounded, the lamp will light.



1 Frame
2 Alternator pole
3 Alternator windings
4 Coupling
5 Damper winding
6 Rotor
7 Shaft
8 Fan
9 Cap screw, hex hd, ½–13 x ½ (6 req'd)
10 Nut, hex, ⅝–11 (12 req'd)
11 Setscrew
12 Coupling hub
13 Key
14 Cap screw, hex hd, ½–13 x ¾ (2 req'd)
15 Retainer clip
16 Drive disk
17 Bolt, hex hd, ⅝–11 x 1½ (12 req'd)
18 Gasket
19 Cap screw, hex hd, ⅞–11 x 1¾ (4 req'd)
20 Adapter bracket

Figure 72. Alternator, exploded view.

(3) If a ground is discovered, disconnect coils and test each one separately. Replace grounded field coil. When disconnecting field coil note position of inner and outer turns of wire and tag accordingly. Connect wires according to tags when replacing coil.

(4) Check the field coils for open circuits or hidden breaks by placing the test probes in series with the field coils. The lamp will not light if there is an open circuit. Unless the break is at a connection and easily repaired, replace the coil.

(5) Test for short circuits within coils by measuring the resistance of each coil separately, using a low-reading ohmmeter. The resistance of all coils should be the same within 10 percent.

d. Main Generator Rotor.

(1) Test rotor winding for open circuit. Touch test probes to each collector ring. If lamp does not light, winding circuit is open. Replace rotor.

(2) Test rotor windings for short circuit. Use a growler exciter with alternating current. If there is a short-circuited wire, layer, or coil, magnetizing current in growler winding will build up. If current is maintained for a short time, insulation on short-circuited section will become sufficiently warm to indicate defective coil. If there is a short circuit, replace rotor.

(3) Test rotor winding for ground. Place one test probe on rotor shaft and the other on a collector ring. If lamp lights, a collector ring or rotor winding is grounded. Replace grounded rotor.

e. Main Generator Stator Windings.

(1) Test main generator stator windings for grounds. Place one test probe on bare metal surface of generator frame, the other on the terminal of each stator lead. If lamp lights, stator winding is grounded. Inspect to see if ground is caused by poor insulation of leads. Re-insulate leads. If leads are not defective, field coils are short-circuited and generator frame must be replaced.

(2) Test main generator stator for open circuit. Place test probes on terminals in the junction box. Test terminals T1 and T4, T7 and T0, T2 and T5, T8 and T0, T3 and T6, T9 and T0 in turn. Refer to figure 79 for the wiring diagram. If lamp does not light, winding circuit is open. Inspect soldered connection between terminals and wires. If open circuit is not caused by loose terminals, replace main generator frame.

f. Main Generator Bearing.

(1) Wipe the bearing with a clean cloth dampened in kerosene, light engine oil, or gasoline. Do not use solvent or carbon tetrachloride for this purpose.

(2) Test the bearing by hand for free rolling action. If rough, sticking, or excessively loose, press off the defective bearing and replace.

Caution: Protect the bearing against dirt and rust. Keep the bearing oiled and covered.

g. Radio Interference Suppression Capacitor. To test capacitor, disconnect one end of capacitor and place test probes across capacitor terminals. If lamp lights, capacitor is short-circuited and must be replaced. Replace any capacitor that is burned or out of shape.

h. Generator Assembly Metal Parts. Inspect all metal parts. Replace bent, distorted, cracked or broken parts, paying particular attention to generator blower fan, coupling, adapter, brush rig, and bearing bracket. Examine studs, bolts, and screws for damaged threads. Replace any that are bent or damaged.

204. Machining Commutator and Collector Rings

a. Center the armature or rotor shaft on a lathe.

b. Take a succession of light cuts over the entire surface of the commutator or collector ring. When a smooth concentric surface has been obtained, undercut the mica between commutator segments.

c. Support an undercutting tool on the tool rest, and carefully force it along the mica between the commutator segments. The tool should be square and slightly wider than the mica. Center it carefully so that an edge of mica does not remain at the level of the commutator surface. Remove rough edges by beveling slightly.

d. After the commutator bars or collector rings are machined and the mica undercut, polish the commutator or collector rings. Use a commutator polishing stone or several layers of canvas attached to a piece of wood. Hold canvas or stone against revolving surface until a high polish is obtained.

205. Cleaning Generator Assembly Parts

a. Cover generator bearing.

b. Blow off loose dirt and dust from the generator parts with dry compressed air not over 25 psi pressure.

c. Do not use solvents of any kind on the generator bearing. Do not attempt to lubricate the bearing. Keep the outside of the bearing lightly oiled.

d. Wipe off grime on windings with a clean cloth moistened with cleaning solvent.

e. Clean metal parts with cleaning solvent.

206. Main Generator Reassembly

a. Alternator Rotor Installation.

(1) Place rotor in line with alternator housing with shaft (7, fig. 72) entered in alternator housing.

(2) Slide a 4-foot length of 4-inch pipe over shaft (7), and lift rotor using pipe and loop sling over coupling end of rotor shaft.

(3) Pilot rotor through housing until rotor coils are entered completely in stator coils. Remove sling and pipe.

(4) Position fan (8) and secure to shoulder on shaft (7) with six cap screws (9) and lockwashers.

(5) Heat coupling hub (12) and position it on shaft (7) and immediately insert key (13) and setscrew (11).

(6) Secure drive disk (16) to the coupling hub (12) with 12 bolts (17) and nuts (10).

(7) Position gasket (18) and adapter bracket (20) and secure to the frame (1) with four cap screws (19).

b. Assemble Exciter Field Frame.

(1) To install new field coil, assemble coil (4, fig. 71), pole piece (2), and pole clamp plate (1). Position insulation strips (3) at the points of contact between the exciter housing (5) and the field coil assembly (4). Secure with two pole bolts (6) and lockwashers.

(2) Connect the coil ends to adjacent coil ends.

(3) Verify correctness of connections by applying a direct current at low voltage to the field terminals and testing polarity of coils with a magnet or compass. Polarity of the coils should alternate.

(4) Solder coil connections and wrap with varnished cambric tape and friction tape.

(5) Coat the coils and wires with air-drying insulating varnish.

(6) Test the coils for shorts or grounds.

(7) Installing a complete coil assembly is similar to single coil installation except that coil connections are made before installing coils in frame.

c. Install Exciter Field Frame.

(1) Secure exciter field frame (15, fig. 70) to the generator frame (20) with four bolts (17).

(2) Connect wiring connections to alternator.

(3) Install alternator brushes (par. 160).

(4) Position the exciter armature core (12) and aline the coupling dowels so that the recesses in the coupling halves meet. Tap the end of the armature shaft to seat the coupling.

(5) Secure capacitor (7) to the bearing bracket (6) and position the bracket over the ball bearing (9) and secure it to the exciter field frame (15) with four screws (33).

(6) Install spacers (5) to limit end play of the exciter shaft to 0.020 inch and secure plate (4) with four screws (2).
(7) Connect the field coil lead wires (13) to the two brush terminals behind the brush ring (8).
(8) Install the exciter brushes (par. 161).
(9) Install the end bell shield (1).

207. Installation of the Main Generator

a. Insert a 3½-foot length of 2- by 4- inch lumber through the adapter bracket (4, fig. 69) and under the generator coupling hub (12) to support the generator shaft.

b. Attach a hoisting sling to the generator lifting eyebolts (5) and lift the generator assembly into position behind the engine. Move the generator forward and aline it with the flywheel. Insert four tapered drift pins through the mounting pads (10) and generator feet.

c. Secure the engine flywheel and driving disk in accordance with paragraph 174*e* and *f*.

Note. Observe that the air gaps between the alternator rotor and stator and the exciter armature and field are uniform. This indicates that the rotor is correctly centered in the stator windings.

d. Remove drift pins through generator feet and mounting pads. Secure the generator to mounting pads (10).

208. Testing Generator Assembly After Overhauling

a. Start the engine and run the unit at rated speed. Listen for unusual noises. Read the voltmeter. See that rated voltage is obtained at rated speed.

b. Test for proper phasing by connecting a 3-phase a-c induction motor to the generator output and noting the direction of rotation. Connect the motor to a similar generator set making the same connections from T1, T2, and T3. If the rotation is opposite, check the terminal connections of the overhauled machine with the wiring diagram.

Section X. WINTERIZATION KIT

209. Description

The winterization kit supplies hot air to vital parts of the generator set to assist in starting at low temperatures. A gasoline burner heats a metal air chamber through which air is blown and conveyed through ducts to the battery box and the starter pinion gear. Combustion exhaust is conveyed through a jacket enclosing the engine oil pan to heat lubricating oil and is then discharged through an exhaust stack. Circulating air is blown by a squirrel cage rotary blower which is electrically driven from batteries.

210. Burner

a. Removal (fig. 73).

(1) Remove the winterization heater from the generator set. Refer to paragraph 164.

(2) Disconnect fuel line (7) from the fuel valve (14).

(3) Disconnect igniter lead (5).

(4) Remove eight nuts (1) releasing the burner plate (12) from studs (6), and withdraw the burner from the kit.

b. Disassembly.

(1) Remove eight screws (1, fig. 74) and washers (2), releasing plate (3).

(2) Remove three screws (10) and nuts (9). Remove combustion chamber (4) and vaporizer chamber (8).

(3) Remove three screws (18) with nuts (13). Remove support brackets (12) and burner plate (17).

(4) Remove roundhead screws (27 and 30) from front and side of vaporizer chamber. With an offset screwdriver remove screw (32) and washer (31). Remove vaporizer chamber cover (28).

(5) Remove nut (16) with washer (15) and insulator (14) from igniter retainer stud (34). Withdraw igniter retainer stud (34) from vaporizer (29).

(6) Remove nut (23) with washer (24), Fahnestock clip (25), and igniter stud inner insulator (26) from igniter stud (33). Withdraw stud (33) from vaporizer.

(7) Remove vaporizer (29) from vaporizer chamber (8).

(8) Remove screw (5) and igniter (6). Remove igniter insulation pieces (7) from igniter wire.

(9) Unscrew fuel tube (11) from valve assembly.

(10) Remove two screws (19) holding fuel valve and float chamber assembly (21) to burner plate (17), and separate the parts.

c. Inspection and Repair.

(1) Examine all parts and replace broken parts, burned out igniter, or cracked insulators.

(2) Examine vaporizer. Replace vaporizer if cracked or brittle.

d. Assembly.

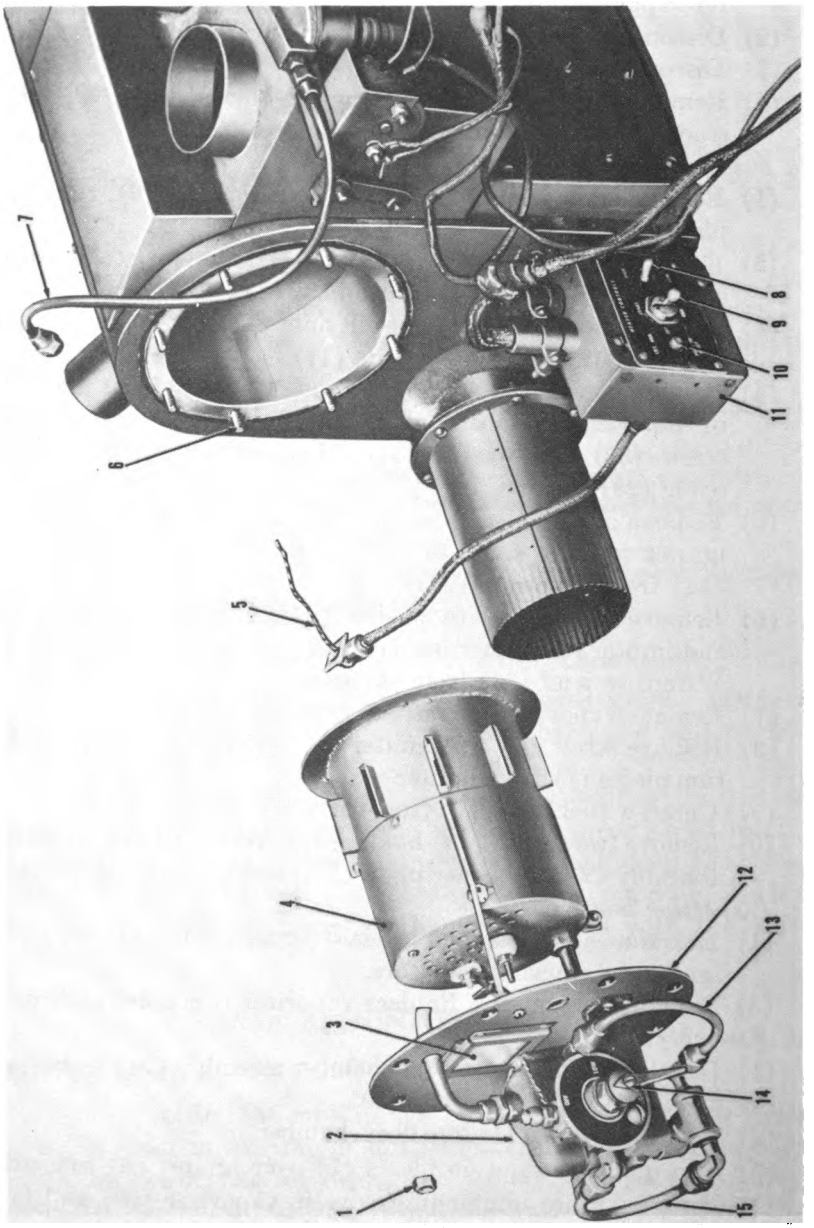
(1) Install fuel valve and float chamber assembly (21) on burner plate (17) with two screws (19).

(2) Screw fuel tube (11) into float chamber.

(3) Slip igniter insulation pieces (7) over igniter (6) to center of wire. Place igniter in groove in vaporizer (29) and fasten with screw (5) at one end.

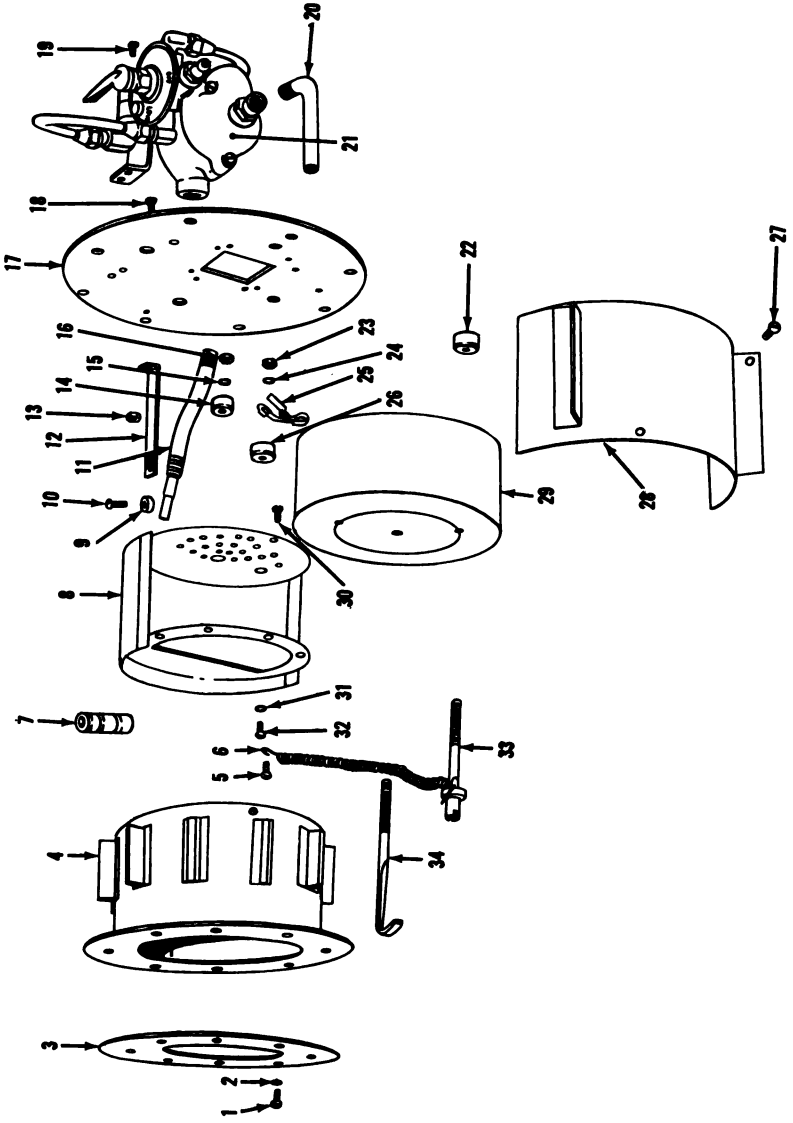
(4) Insert vaporizer (29) in vaporizer chamber (8).

(5) Insert igniter stud (33) through igniter end loop and through vaporizer. On end of stud, assemble igniter stud



1 Nut, hex, 5/16–18 (8 req'd)
2 Float bowl
3 Flame inspection window
4 Combustion chamber
5 Igniter lead
6 Stud, 5/16–18 x 1½ (8 req'd)
7 Fuel line
8 Blower motor control switch
9 Heater control switch
10 Circuit breaker reset button
11 Control box
12 Burner plate
13 Tube
14 Fuel valve
15 Tube

Figure 73. Removal of burner.



1 Screw, mach, rd hd, ¼–20 x ½ (8 req'd)
2 Washer, ¼ (8 req'd)
3 Plate
4 Combustion chamber
5 Screw, mach, rd hd, ¼–20 x ½ (1 req'd)
6 Igniter
7 Igniter insulation pieces
8 Vaporizer chamber
9 Nut, self locking, hex, ¼–20 (3 req'd)
10 Screw, mach, rd hd, ¼–20 x 1⅛ (3 req'd)
11 Fuel tube
12 Support bracket
13 Nut, hex, ¼–20 (3 req'd)
14 Insulator
15 Washer, 5/16 (1 req'd)
16 Nut, hex, 5/16–18 (1 req'd)
17 Burner plate
18 Screw, mach, rd hd ¼–20 x 1½ (3 req'd)
19 Screw, mach, rd hd, ¼–20 x ¾ (2 req'd)
20 Vent tube
21 Fuel valve and float chamber assembly
22 Igniter stud outer insulator
23 Nut, hex, 5/16–18 (1 req'd)
24 Washer, 5/16 (1 req'd)
25 Fahnestock clip
26 Igniter stud inner insulator
27 Screw, mach, rd hd, 5/16–18 x ½ (1 req'd)
28 Vaporizer chamber cover
29 Vaporizer
30 Screw, mach, rd hd, 5/16–18 x ½ (1 req'd)
31 Washer, No. 10 (1 req'd)
32 Screw, mach, rd hd, 10–32 x ⅜ (1 req'd)
33 Igniter stud
34 Igniter retainer stud

Figure 74. Winterization heater burner, disassembled.

inner insulator (26), Fahnestock clip (25), and washer (24). Fasten with nut (23).

(6) Put igniter retainer stud (34) through vaporizer so that hook engages insulation pieces on igniter. Install insulator (14) and washer (15) on stud and secure with nut (16).

(7) Place vaporizer chamber cover (28) on vaporizer chamber and secure with screws (27) and (30). Use an offset screwdriver to install screw (32) with washer (31)

(8) Fasten three support brackets (12) to burner plate (17) and vaporizer chamber (8) with screws (10) and (18) and nuts (9) and (13).

(9) Fasten plate (3) to combustion chamber (4) with eight screws (1) and washers (2).

e. Installation.

(1) Thread igniter wire through hole in burner plate and fasten to Fahnestock clip (25). Secure wiring elbow to burner plate with four screws.

(2) Slide burner into heater and position on stud (6, fig. 73).

(3) Install eight nuts (1) on studs.

(4) Connect fuel line (7) to the float bowl (2).

211. Fuel Float Chamber

a. Removal. Refer to paragraph 210*b*.

b. Disassembly.

(1) Disconnect tubes (8 and 12, fig. 75). Remove two bolts (11) with nuts (7) and separate fuel valve from float chamber.

(2) Remove tube and valve nut (1) from float chamber cover (3) and remove the two steel balls (2).

(3) Remove three screws (15) with plain washers (14) and lift off cover (3). Remove float chamber cover gasket (4).

(4) Lift float (5) and valve (13) from float chamber body (6).

(5) Unscrew and remove pin (9).

(6) If replacement is necessary remove remaining fittings on bottom of float chamber.

c. Inspection and Repair. Examine all parts. Replace worn parts. Replace valve if grooved. Replace float if punctured.

d. Assembly.

(1) Install pin (9).

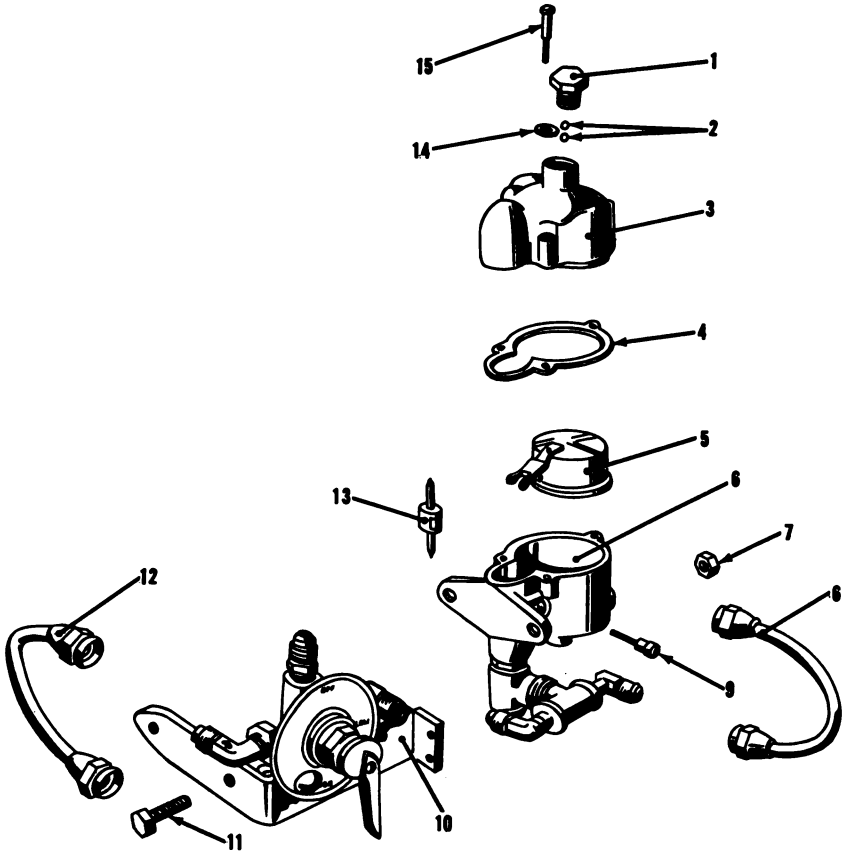
(2) Slip valve (13) on float (5) and insert both in float chamber body (6).

(3) Install cover (3) with gasket (4) and secure with three screws (15) and washers (14).

(4) Place steel balls (2) in cover opening, and install tube and valve nut (1).

(5) Install all tubes or pipe fittings which were removed.

e. Installation. Refer to paragraph 210*d*.



1 Tube and valve nut
2 Steel balls
3 Float chamber cover
4 Float chamber cover gasket
5 Float
6 Float chamber body
7 Nut, hex, ⅜–16 (2 req'd)
8 Fuel tube
9 Pin
10 Heater fuel valve and bracket
11 Bolt, mach, hex hd, ⅜–16 x 1¼ (2 req'd)
12 Fuel tube
13 Valve
14 Plain washer
15 Screw, mach, fil hd, ¼–20 x 2¼ (2 req'd)

Figure 75. Winterization heater fuel bowl, disassembled.

212. Blower and Motor

a. Removal.

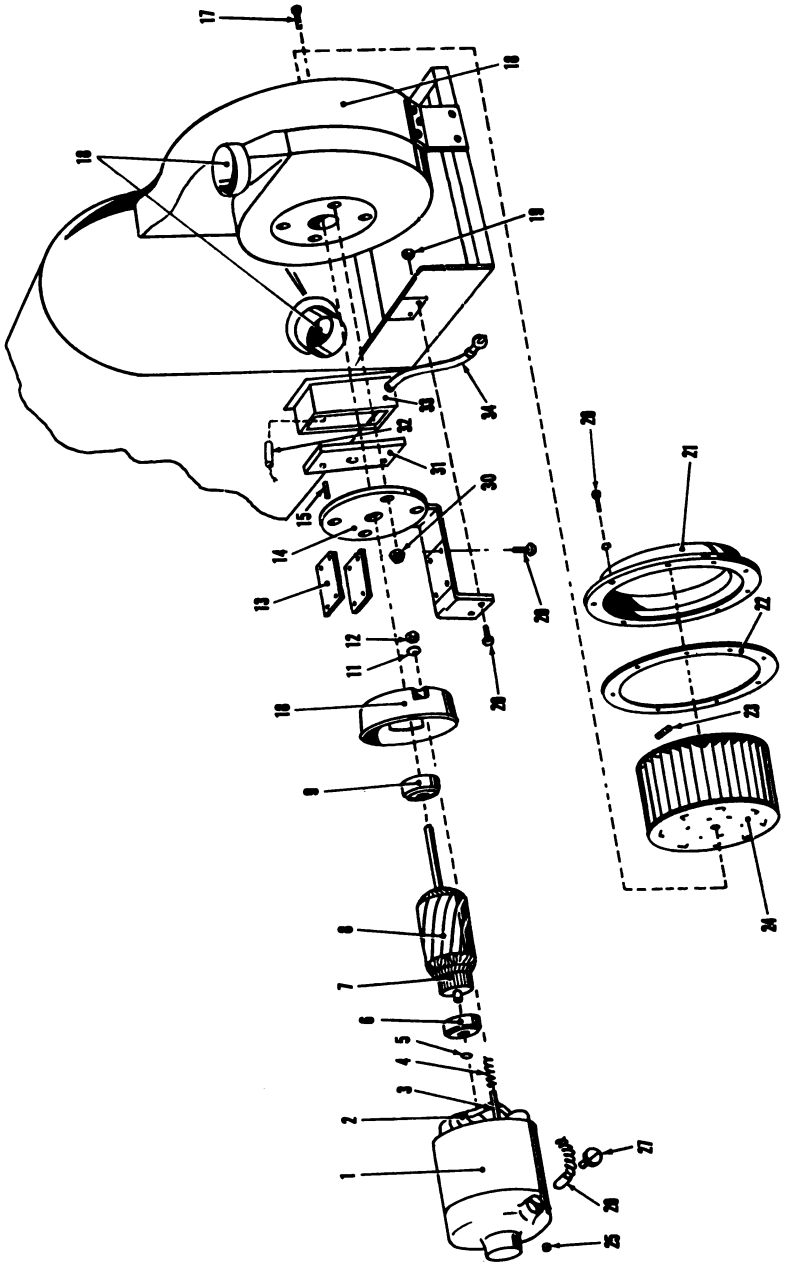
(1) Remove eight screws (20, fig. 76) with lockwashers, releasing the air intake flange (21) and gasket (22).

(2) Remove setscrew (23) releasing the rotor fan (24).

(3) Remove four bolts (17) with nuts (30) and two bolts (28) with nuts (19) releasing the motor bracket (14) and the motor.

b. Disassembly.

(1) Remove four screws (29) releasing motor and mounting mechanism (13) from the motor bracket (14).



1 Motor frame
2 Field coil
3 Stud
4 Spring
5 Spring washer
6 Ball bearing
7 Commutator
8 Armature
9 Ball bearing
10 End bell
11 Washer, No. 10 (2 req'd)
12 Nut, sq, 10–24 (2 req'd)
13 Mounting mechanism
14 Motor bracket
15 Screw, mach, rd hd, 8/32 x 3/8 (4 req'd)
16 Air pipe
17 Bolt, hex hd, 5/16–12 x 3/4 (4 req'd)
18 Blower housing
19 Nut, hex, 10–24 (2 req'd)
20 Cap screw, hex hd, 3/8–16 x 1 (8 req'd)
21 Air intake flange
22 Gasket
23 Setscrew
24 Rotor fan
25 Setscrew
26 Brush assembly
27 Brush spring holder
28 Bolt, sq hd, 10–24 x 1 1/2 (2 req'd)
29 Screw, sq hd, 1/4–20 x 3/4 (4 req'd)
30 Nut, hex, 5/16–12 (4 req'd)
31 Cover
32 Capacitor
33 Junction box
34 Motor current plug

Figure 76. Blower and motor, exploded view.

(2) Remove brush spring holders (27) and withdraw the brush assemblies (26).

(3) Remove two nuts (12) and split washers (11) releasing end bell (10).

(4) Slip two springs (4) from studs (3). Withdraw armature (8) and spring washer (5) from the motor frame (1).

c. Inspection and Repair.

(1) Inspect field coil insulation for breaks. Inspect the field coils and frame as detailed in paragraph 188*c*.

(2) Inspect the armature for open, short, or grounded circuits and for wear as detailed in paragraph 188*b*.

(3) Replace the brushes if they are worn less than one-half their original length. Inspect the brush springs for any signs of corrosion or fatigue. Replace if defective.

d. Reassembly.

(1) Position spring washer (5) against ball bearing (6) and insert the armature (8) in the motor frame (1).

(2) Place springs (4) over the studs (3) and position the end bell (10). Secure the end bell with two nuts (12) and split washers (11).

(3) Insert brush assemblies (26) and retain with brush spring holders (27).

(4) Secure the motor and mounting mechanism (13) to the motor bracket (14) with four screws (29).

e. Installation.

(1) Install motor and bracket (14) with four bolts (17) and nuts (30) and two bolts (28) with nuts (19).

(2) Position rotor fan (24) on the motor shaft and secure with setscrew (23).

(3) Secure gasket (22) and air intake flange (21) with eight screws (20) and lockwashers.

(4) Spin blower by hand to check clearance.

(5) Connect motor current plug (34).

(6) Connect a 24-volt direct current source to the motor and check that air is blown from the top opening of the blower housing. Direction of motor rotation is changed by reversing the motor lead connections in the junction box (33).

Section XI. ENGINEERING DATA

213. Fan and Generator Belts

a. Fan belt slack midway between pulleys------ 1¼ in.

b. Generator belt slack midway between pulleys.. ½ to ¾ in.

214. Injectors

a. Valve opening pressure ..... 1000 psi
b. Minimum pressure drop used injection valve .. 200 lb 35 seconds
c. Spray tip orifice ..... 0.007 in.
d. Copper tube, hole tip diameter ..... 0.175–0.185 in.

215. Standard Nut and Bolt Torque Specifications

Size nut or bolt	Torque (ft-lbs)	Size nut or bolt	Torque (ft-lbs)
¼–20	7–9	9/16–12	90–100
¼–28	8–10	9/16–18	107–117
5/16–18	13–17	⅝–11	137–147
5/16–24	15–19	⅝–18	168–178
⅜–16	30–35	¾–10	240–250
⅜–24	35–39	¾–16	290–300
7/16–14	46–50	⅞–9	410–420
7/16–20	57–61	⅞–14	475–485
½–13	71–75	1–8	580–590
½–20	83–93	1–14	685–695

216. Nonstandard Nut and Bolt Torque Specifications

Part	Torque in foot-pounds
Air inlet elbow to blower housing	25–30
Air outlet flange to blower	25–30
Exhaust manifold nut	35–40
Fuel oil tube assembly to cylinder	40–45
Governor buffer screw nut	17–21
Governor low speed adjusting screw nut	50–55
Lube oil tube assembly to cylinder head adapter	40–45
Starting motor to flywheel housing bolt	35–40
Special water plug	35–40
Injector clamp nuts	20–25
Cylinder head stud nuts	150–175
Connecting rod cap nuts	65–75
Main bearing cap nuts	155–185
Flywheel-to-crankshaft bolts	150–160
Flywheel housing-to-cylinder block bolts	90–100
Camshaft and balancer shaft locknuts	300–325
Blower rotor gear retainer bolts	55–65

217. Alternator

a. Rotor.
(1) End play 0.020
(2) Shake 0.015

(3) Field winding tape---------- ⅛-inch fiber, 0.025 Dural paper and varnished cambric, used on pole.
(4) Number of poles---------- 6
(5) Winding---------- Series
(6) Wire insulation---------- Single cotton enamel
(7) Varnish treatment---------- 4 dips, 4 bakes
(8) Coil enclosure---------- Welded copper and brass, squirrel cage.
(9) Fit, bearing to shaft---------- 0.002-inch press
(10) Radial play between bearing races. 0.005
(11) Axial play between bearing races 0.010

b. Stator.

(1) Number of poles---------- 6
(2) Number of slots---------- 54
(3) Number of leads---------- 10
(4) Minimum resistance value---- 1.4 megohms with 500-volt megger.
(5) Air gap---------- 0.125 inch

c. Brushes.

(1) Material---------- Carbon
(2) Length---------- 1⅜ in.
Width---------- ⅝ in.
Thickness---------- ⅜ in.

218. Exciter

a. Bars---------- 77
b. Slots---------- 39
c. Poles---------- 4
d. Air gap---------- 0.125

219. Wiring Diagrams

The wiring diagrams of the control panel, engine control and heater control are shown in figures 79, 80, and 81.

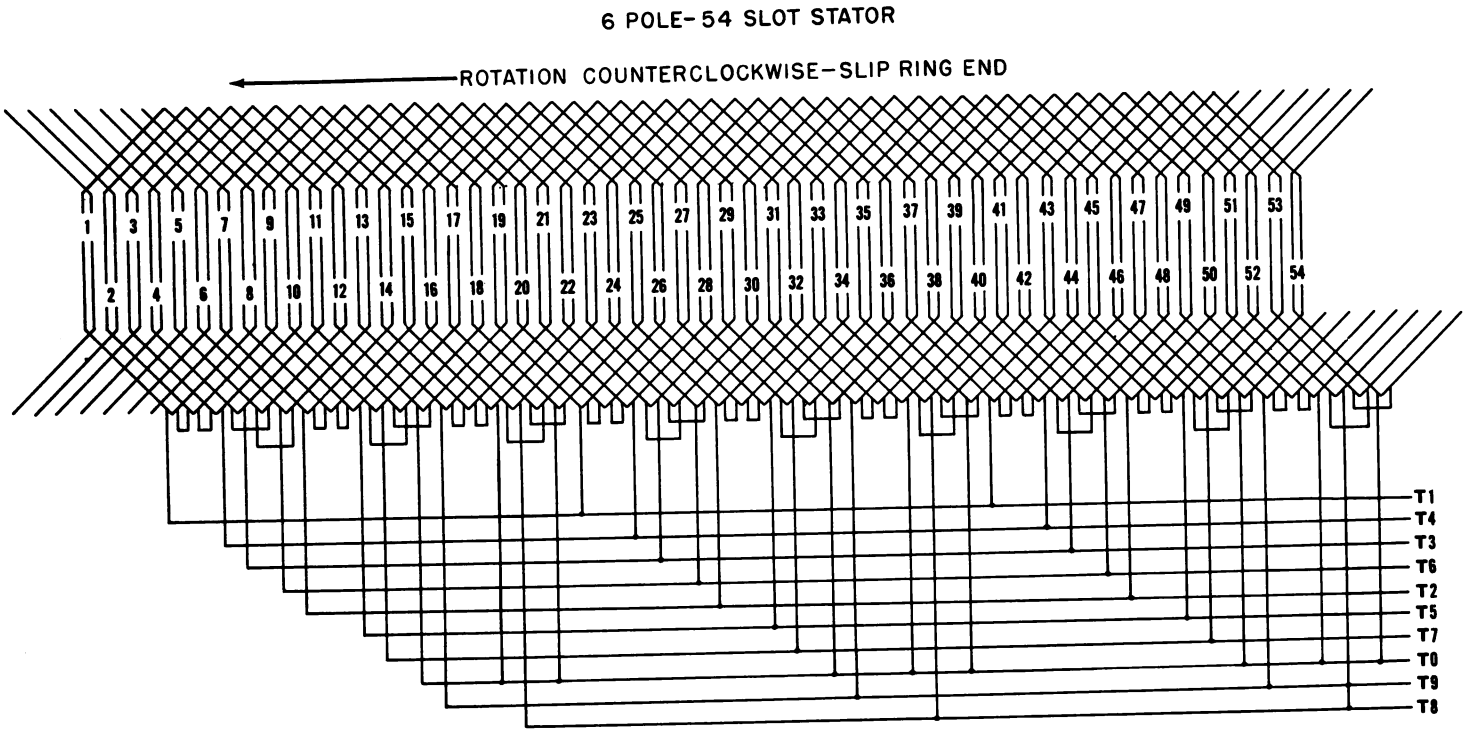


Figure 77. Stator wiring diagram.

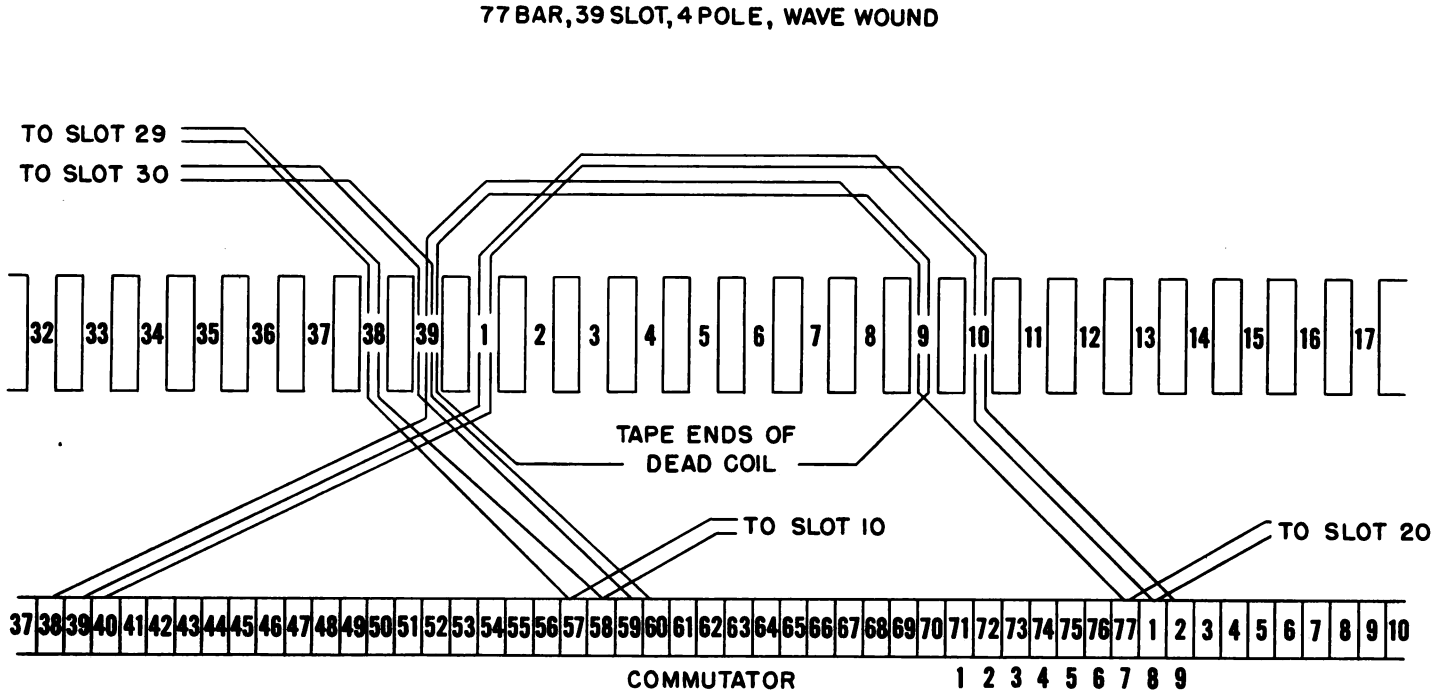
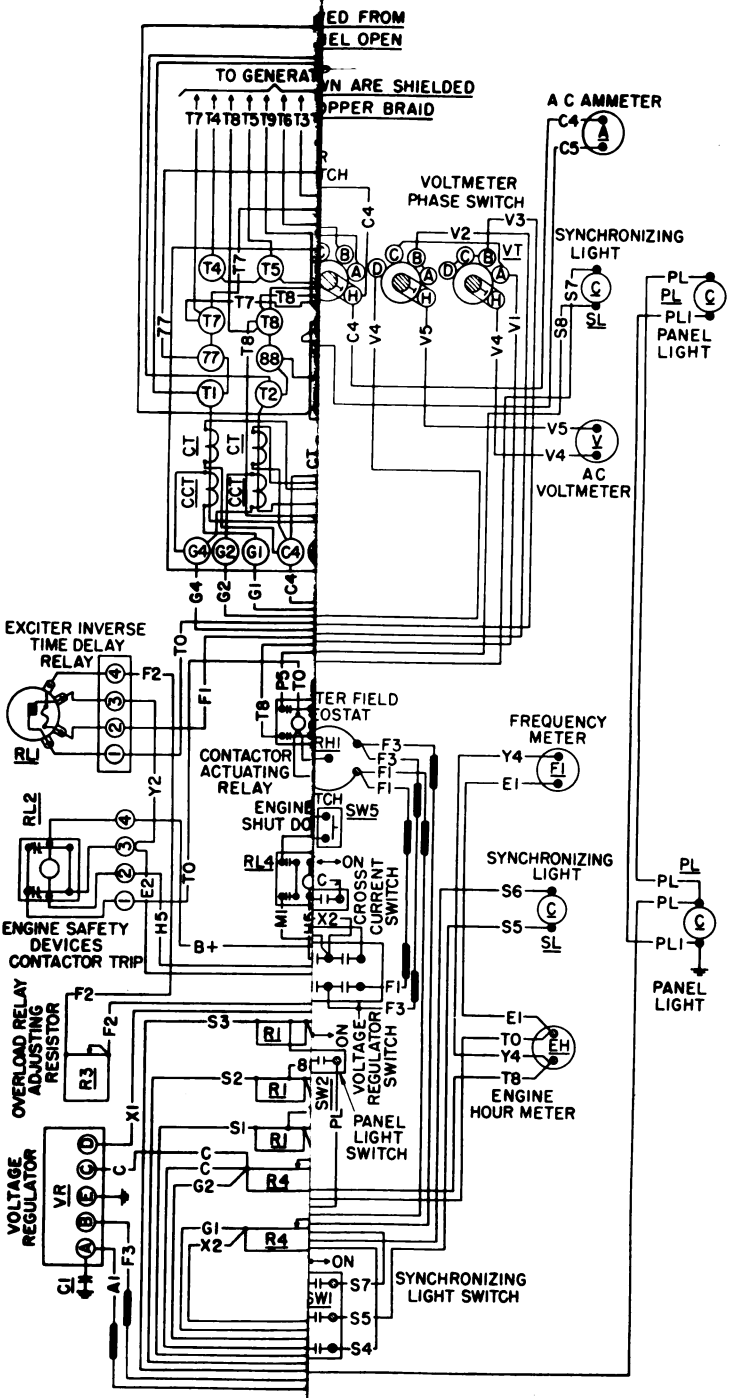


Figure 78. Exciter winding diagram.



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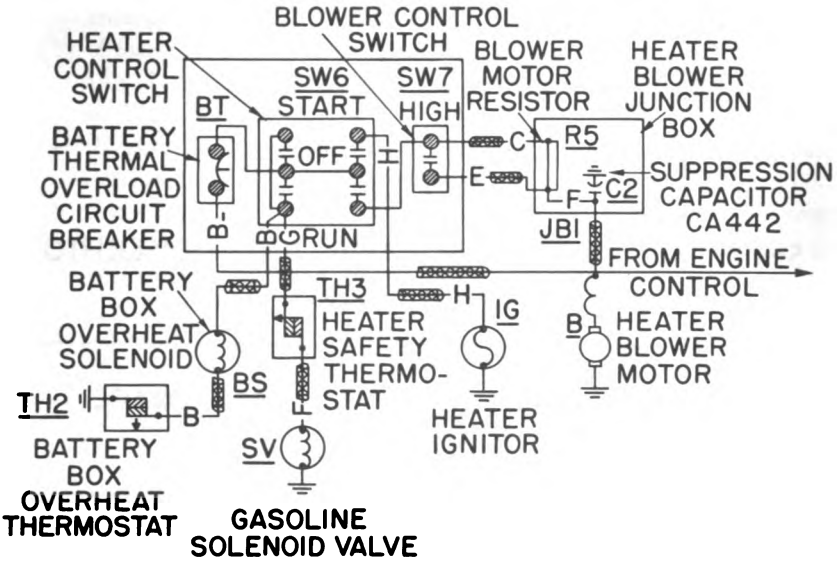

Figure 80. Engine control wiring diagram.

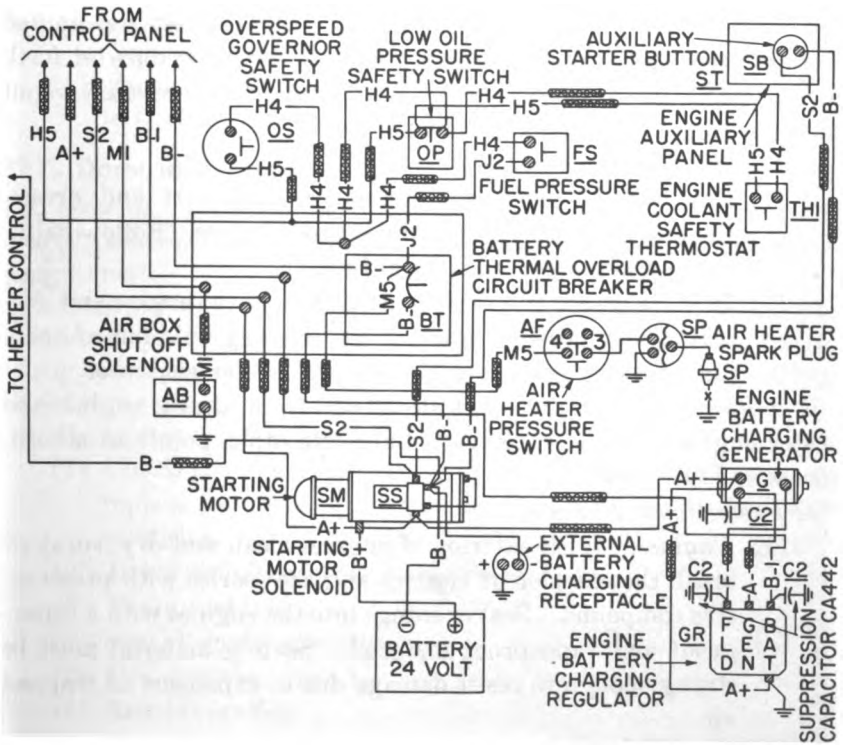

Figure 81. Heater control wiring diagram.

CHAPTER 5

SHIPMENT, LIMITED STORAGE, AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

220. Limited Storage

a. General. Generator sets not intended for immediate use must be prepared for storage to protect metal parts from corrosion and to enable moving parts to operate freely next time the set is put into service. Sets prepared in this manner can be used at any time by removing all seals and checking fuel, water, and lubricant.

b. Inspection. Prior to preparing the generator set for limited storage, inspect it in accordance with the monthly procedure set forth in paragraph 72. Tighten, repair, or replace parts as necessary to put the generator set in first-class condition.

c. Cleaning and Painting.

(1) Clean the housing and metal parts of dirt and grease. Remove corrosion and repaint corroded spots. Follow painting instructions given in paragraph 68.

(2) Remove grease and dirt from exterior of the engine and generator with brush or rags. Keep cleaning fluid out of openings in main generator, exciter, and heater generator.

d. Lubrication. Drain lubricating oil from diesel engine and heater engine. Refill crankcase. Lubricate other points in accordance with LO 5–5009.

e. Protection in Storage.

(1) *Engines.* With exterior of engines clean and dry, spray or brush the exterior of engines and accessories with preservative compound. Seal openings into the engines with a waterproof and vaporproof material. Sealing material must be strong enough to resist damage due to expansion of trapped air.

(2) *Generators.* With exterior surfaces of generator clean and dry, spray or brush the exterior of the generator with sealing

compound. Cover generator to prevent water from falling into openings, but do not seal openings.

(3) *Diesel fuel system.* Drain the fuel tank. Fill tank completely with preservative fuel. Operate engine for 5 minutes at 60 cycles, no load.

(4) *Heater fuel system.* Drain the fuel system. Clean the fuel strainer.

(5) *Cooling system.* Fill radiator with solution consisting of one ounce of soluble oil to each gallon of water. If freezing weather is expected during the storage period add antifreeze compound in correct proportion and omit oil.

(6) *Batteries.*

(*a*) Remove batteries from unit. Check each cell with a hydrometer. The specific gravity should not be less than 1.270 per cell. If readings are low, fill batteries with distilled water to three-eighths of an inch above plates. Charge batteries until readings are 1.270 per cell.

(*b*) Clean ports and terminals with a strong solution of washing soda. Wipe dry. Keep the soda solution out of the cells.

(*c*) Coat the terminals heavily with vaseline (petroleum jelly).

(*d*) Store batteries in a warm, dry place. Be sure filler plugs are tight, and tops of the batteries are dry and clean.

(7) *Air cleaners.* Remove and service air cleaner bowls. Refer to LO 5–5009.

221. Domestic Shipment

a. General. Information in this section is published for the guidance of personnel responsible for the packaging and shipment of the generator set.

b. Hoisting and Handling. The uncrated generator set should be hoisted by a crane with sling or hook attached to the generator set lifting eye (6, fig. 1). The boxed generator should be lifted by slings placed in the sling notches (10, fig. 10).

c. Packaging and Blocking.

(1) Check the generator set (par. 6*f*), and tighten, repair, or replace as necessary to put the generator set in first-class condition.

(2) Drain cooling system. Leave valves open.

(3) Drain fuel tanks.

(4) Seal all engine openings.

(5) Drain lubricating oil.

(6) Remove muffler.

(7) Cover generator to prevent water from falling into openings. Do not seal generator.

(8) Remove electrolyte from the batteries and prepare them for shipment in accordance with TB 5–9711–1.
(9) Tag the generator set, indicating that it is being shipped dry, with dry charged batteries in place.
(10) Wrap in moistureproof paper and seal with pressure-sensitive tape.
(11) Build a solid wooden case around unit, wholly enclosing it (fig. 10).
(12) Block and secure generator set in flatcar of truck (fig. 16).

Note. If being shipped for short distances, the set may be left unboxed. In this case, cover generator set with tarpaulin on truck or flatcar.

Section II. DEMOLITION OF GENERATOR SET TO PREVENT ENEMY USE

222. General

When capture or the abandonment of the generator set to an enemy is imminent, the responsible unit commander makes the decision either to destroy the unit or to render it inoperative. Based on this decision, orders are issued which cover the desired extent of destruction. Whatever method of demolition is employed, it is essential to destroy the same vital parts of all generator sets and all corresponding repair parts.

223. Preferred Demolition Methods

Explosives and mechanical means, either alone or in combination, are the most effective methods to employ. Listed below are the vital parts in order of priority of demolition for each preferred method. In each case, completion of the first two steps will render the unit inoperative. Completion of the additional steps listed will further destroy the unit.

a. Explosives. Place as many of the following charges as the situation permits and detonate them simultaneously with detonating cord and suitable detonator.

(1) A 2-pound charge on the valve and injector rocker cover.
(2) A 4-pound charge inside the rear of the main generator. (Remove one of the brush inspection covers.)

Note. The above charges are the minimum requirement for this method.

(3) A 2-pound charge on the diesel engine blower.
(4) A ½-pound charge behind starting motor.

b. Mechanical Means. Use sledge hammers, crowbars, picks, axes, or any other heavy tools which may be available, to destroy the following:

(1) The engine hydraulic governor, fuel pump, fuel filters, and valve and injector rockers.
(2) The commutator, collector rings, brush holders, and windings of the main generator and exciter.

Note. The above steps are the minimum requirements for this method.

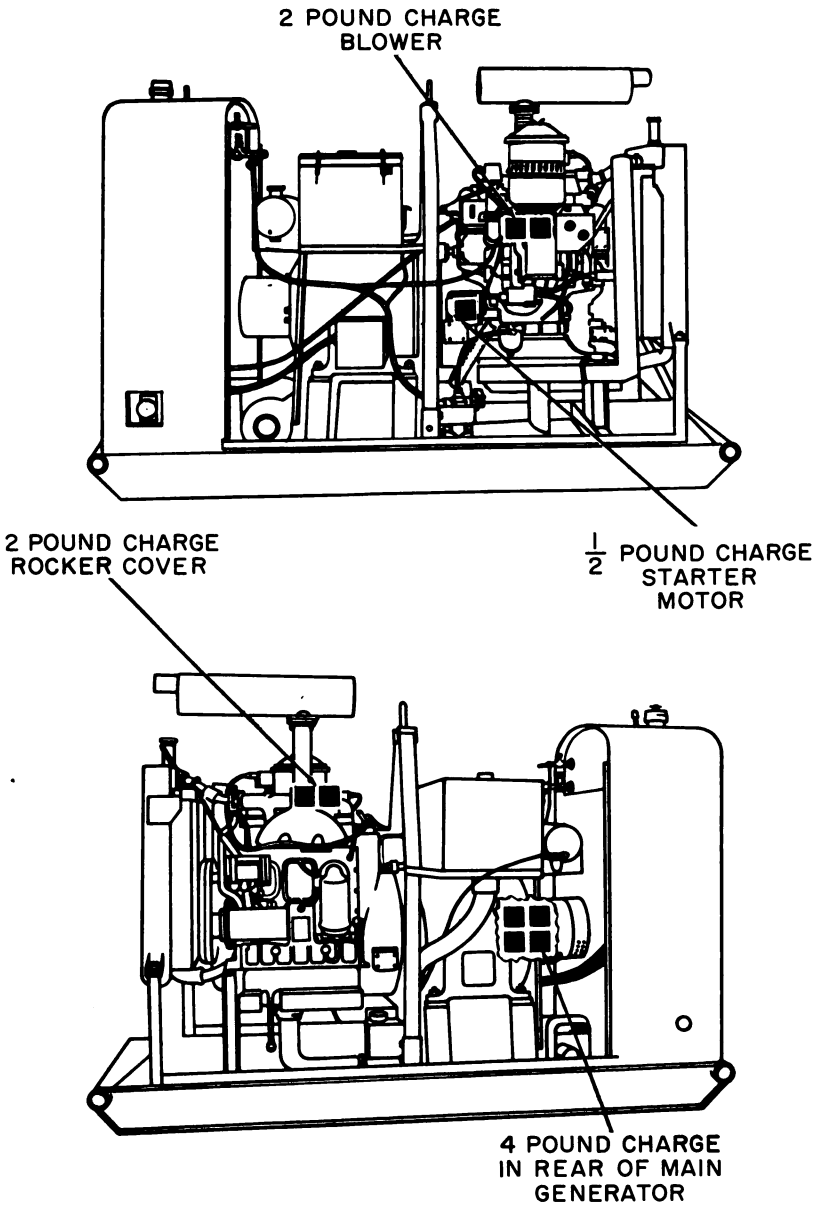

Figure 82. Placement of charges.

(3) All switches and instruments on the control panel.
(4) The radiator core and the batteries.
(5) The winterization heater and the heating ducts.

224. Other Demolition Methods

If the situation prohibits employing either of the preferred methods, use the following, either singly or in combination:

a. Weapons Fire. Fire on the generator set with the heaviest weapons available.

b. Scattering and Concealment. Remove all easily accessible vital parts such as the hydraulic governor, fuel pump, overspeed governor, generator and exciter brushes, and scatter them through dense foliage, bury them in dirt or sand, or throw them in a lake, stream, well, or other body of water.

c. Burning. Pack rags, clothing, or canvas under and around the equipment and inside the main generator at front and rear. Saturate this packing with gasoline, oil, or diesel fuel, and ignite.

d. Submersion. Ttotally submerge the unit in a body of water to provide some water damage and concealment. Salt water will do the greatest damage to metal parts.

e. Misuse. Perform the steps listed below to make the unit inoperative.

(1) Pull out the hand throttle knob on the auxiliary control panel, and wedge it so that it remains out during engine operation. Cut the wires to the emergency shutdown solenoid at the blower outlet.
(2) Drain the radiator and diesel engine crankcase.
(3) Remove the covers from the rear of the main generator.
(4) Start the engine.
(5) Drop small tools, bolts, nuts or metal scraps into the main generator.
(6) Run the engine at maximum speed until failure occurs.

225. Training

All operators should receive thorough training in the destruction of the generator set. Simulated destruction, using all the methods listed above, should be included in the operator training program. It must be emphasized in training that demolition operations are usually necessitated by critical situations, when the time available for destruction is limited. For this reason, it is necessary that operators be thoroughly familiar with all methods of destruction and be able to carry out demolition instructions without reference to this or any other manual.

APPENDIX I

REFERENCES

1. Dictionaries of Terms and Abbreviations

SR 320–5–1	Dictionary of United States Army Terms.
SR 320–50–1	Authorized Abbreviations.

2. Lubrication and Painting

LO 5–5009	Generator Set, Electric, Portable, Diesel Driven, Skid Mounted, 30 KW, 60 Cycle 120/208 or 240/416 Volt, 3 Phase, Convertible to 50 Cycle 120/208 or 240/416 Volt, 3 Phase, Stewart and Stevenson Model WGD–3012.
TM 9–2851	Painting Instructions for Field Use.

3. Preparation for Export Shipment

TB 5–9711–1	Preparation of Corps of Engineers Equipment for Oversea Shipment.
TB 5–9713–1	Preparation for Export, Spare Parts for Corps of Engineers Equipment.

4. Preventive Maintenance

TB 5–5009–1	Preventive Maintenance Services: Generator Set, Electric, Portable, Diesel Driven, Skid-Mounted, 30–KW, 60 Cycle 120/208 or 240/416 Volts, 3 Phase, Convertible to 25 KW, 50 Cycle, 120/208 or 240/416 Volts, 3 Phase, Stewart and Stevenson, Model WGD–3012.
TM 5–505	Maintenance of Engineer Equipment.

5. Publication Indexes

DA Pam 108–1	Index of Army Motion Pictures, Television Recordings and Filmstrips.
SR 310–20–3	Index of Training Publications.
DA Pam 310–4	Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.

SR 310–20–5	Index of Administrative Publications.
SR 310–20–6	Index of Blank Forms.
SR 310–20–25	Index of Supply Manuals—Corps of Engineers.

6. Supply Publications

DA Supply Manual ENG 7 & 8–5009	Organizational Allowances, Field and Depot Maintenance Initial Stock Guide, and Depot Stock Guide for Repair Parts; Generator Set, Electric: Portable; Diesel-Driven; Skid-Mounted Liquid-Cooled; MIL–G–10327; Type II; Class A; 60 Cycles; 120–208 240–416 Volts; 3-Phase, 4-Wire; Convertible to 50 Cycles 240–416 Volts; 3-Phase, 4-Wire; at 83 Percent of 60 Cycles Full Load Capacity 30 Kilowatts; Stewart and Stevenson Model W–GD–3012 (Engineer Stock No. 17–4665.750.800) (Federal Stock No. 6115–235–8673).

APPENDIX II

IDENTIFICATION OF REPLACEABLE PARTS

Note. This appendix is for identification purposes only and is not to be used as a basis for requisitioning.

1. Standard Hardware

Manufacturer's part No.		Federal supply class and item identification No.	Description	Quantity per unit
Code No.	Part No.			
			BOLT, hex hd, ¼–20 x ½	1
			BOLT, hex hd, ¼–20 x ⅝	12
			BOLT, hex hd, ¼–20 x ¾	36
			BOLT, hex hd, ¼–20 x ⅞	1
			BOLT, hex hd, ¼–20 x 1	4
			BOLT, hex hd, 5/16–18 x ¾	12
			BOLT, hex hd, 5/16–18 x ⅞	4
			BOLT, hex hd, 5/16–18 x 1	44
			BOLT, hex hd, 5/16–18 x 1⅛	8
			BOLT, hex hd, 5/16–18 x 2⅝	2
			BOLT, hex hd, 5/16–20 x 1	4
			BOLT, hex hd, 5/16–24 x 2½	1
			BOLT, hex hd, 5/16–24 x ¾	1
			BOLT, hex hd, ⅜–16 x 1	36
			BOLT, hex hd, ⅜–16 x 1⅛	120

Manufacturer's part No.		Federal supply class and item identification No.	Description	Quantity per unit
Code No.	Part No.			
			BOLT, hex hd, ⅜–16 x 1⅝	96
			BOLT, hex hd, ⅜–16 x 2	8
			BOLT, hex hd, ⅜–16 x 2½	4
			BOLT, hex hd, ⅜–20 x 1	4
			BOLT, hex hd, ⅜–20 x 1½	4
			BOLT, hex hd, ⅜–24 x ¾	2
			BOLT, hex hd, ⅜–24 x 1¼	2
			BOLT, hex hd, 7/16–14 x 1¼	2
			BOLT, hex hd, 7/16–14 x 2	4
			BOLT, hex hd, 7/16–20 x 1¾	12
			BOLT, hex hd, ½–13 x 1	4
			BOLT, hex hd, ½–13 x 1⅞	2
			BOLT, hex hd, ½–13 x 2¾	12
			BOLT, hex hd, ⅝–11 x 1½	8
			BOLT, hex hd, ⅝–18 x 2½	4
			BOLT, sq. hd, ¼–24 x 1½	2
			BOLT, stove, ¼–20 x 1	2
641	112877		BUSHING, pipe: iron, black; headed; FS WW–P–471; Type I; ¼ x ⅛ in	1
641	116524		BUSHING, pipe: iron; black; headed; FS WW–P–471; Type I; ½ x ¼ in	1
641	5152707		KEY, plain: single; ⅛ in. wide, ⅛ in. thick, ⅝ in. long	1
641	117982	011–7992	KEY, Woodruff: nickel steel; single; No. E, ⅜ x 1¼ in	3
641	106751		KEY, Woodruff: nickel steel; single; No. 9, 9/16 x ¾ in	10
			LOCKWASHER, split-type, No. 10	4
			LOCKWASHER, split-type, No. 12	4
			LOCKWASHER, split-type, ¼ in	64
			LOCKWASHER, split-type, 9/16 in	160
			LOCKWASHER, split-type, ⅜ in	256

			LOCKWASHER, split-type, 7/16 in	12
			LOCKWASHER, split-type, 1/2 in	12
			LOCKWASHER, split-type, 5/8 in	12
			LOCKWASHER, split-type, 1 in	4
			LOCKWASHER, ex-tooth, 5/16 in	12
			LOCKWASHER, ex-tooth, 1/4 in	24
			LOCKWASHER, ex-tooth, 5/16 in	2
			LOCKWASHER, ex-tooth, 3/8 in	24
			LOCKWASHER, ex-tooth, 1/2 in	4
			LOCKWASHER, int-tooth, 1/4 in	12
			LOCKWASHER, int-tooth, 3/8 in	10
			LOCKWASHER, int-tooth, 1/2 in	8
			LOCKWASHER, int-tooth, 5/16 in	2
			LOCKWASHER, split-type, No. 6	12
			LOCKWASHER, split-type, No. 8	4
623	121841	010-6496	LOCKWASHER, spring steel; regular; std wt; SAE; bright; size No. 8	8
641	106498	010-6498	LOCKWASHER, spring steel; regular; std wt; SAE; bright; size No. 12	5
641	103319	010-3319	LOCKWASHER, spring steel; regular; std wt; SAE; bright; 1/4 in	22
641	103320	010-3320	LOCKWASHER, spring steel; regular; std wt; SAE; bright; 5/16 in	94
641	103321	010-3321	LOCKWASHER, spring steel; regular; std wt; SAE; bright; 3/8 in	220
641	103322	010-3322	LOCKWASHER, spring steel; regular; std wt; SAE; bright; 7/16 in	22
641	103323	010-3323	LOCKWASHER, spring steel; regular; std wt; SAE; bright; 1/2 in	20
641	103325	010-3325	LOCKWASHER, spring steel; regular; std wt; SAE; bright; 5/8 in	8
641	103327	010-3327	LOCKWASHER, spring steel; regular; std wt; SAE; bright; 7/8 in	1
641	122432	----------	NUT, jam: regular; steel; finished; FS FF-B-571, grade 6; NF; hex; Type A; rd hd; 7/8 in.; 14 threads per in.	1
641	102640	----------	NUT, regular: steel; black; semifinished; FS FF-B-571; NC; hex; Type A2; rd hd; 3/4 in.; 10 threads per in.	1
641	117066	5310-266-0389	NUT, regular: steel; black; semifinished; FS FF-B-571; NC; hex; Type A2; rd hd; 5/8 in.; 11 threads per in.	1

Manufacturer's part No.		Federal supply class and item identification No.	Description	Quantity per unit
Code No.	Part No.			
641	123179		NUT, regular: steel; cadmium plated; semifinished; FS FF–B–571; NC; hex; Type A2; rd hd; ¼ in.; 20 threads per in.	1
641	117063	5310–268–7358	NUT, regular: steel; cadmium plated; semifinished; FS FF–B–571; NC; hex; Type A2; rd hd; 7/16 in.; 14 threads per in.	2
641	121902		NUT, regular: steel; black; semifinished; FS FF–B–571; NF; hex; Type A2; rd hd; ¼ in.; 28 threads per in.	5
641	117053	5310–265–9208	NUT, regular: steel; black; semifinished; FS FF–B–571; NF; hex; Type A2; rd hd; ⅜ in.; 18 threads per in.	2
641	121917		NUT, regular: steel; black; semfinished; FS FF–B–571; NF; hex; Type A2; rd hd; 5/16 in.; 24 threads per in.	24
641	117049		NUT, regular: steel; black; semifinished; FS FF–B–571; NF; hex; Type A2; rd hd; ⅜ in.; 24 threads per in.	47
641	117050	5310–265–9216	NUT, regular: steel; black; semifinished; FS FF–B–571; NF; hex; Type A2; rd hd; 7/16 in.; 20 threads per in.	6
623	112726	012–1223	PIN, cotter: split; FS FF–P–386; steel; Type B; cadmium plated; 1/16 x ¾ in	1
641	103372		PIN, cotter: split; FS FF–P–386; steel; Type B; 3/32 x 1 in	14
641	103373		PIN (supplied under Stock No. 912 42–6880.070.100).	
641	103375		PIN, cotter: split; FS FF–P–386; steel; Type B; 3/32 x 1½ in	1
641	103385		PIN, cotter: split; FS FF–P–386; steel; Type B; ⅛ x 2 in	18
641	108635		PIN (supplied under Stock No. 912 42–6880.100.200).	
641	141346	014–1151	PIN, dowel: steel; 3/16 in. dia. ½ in. long	4
641	103578		PIN, tapper: steel; single; size No. 1; 0.172 in. large end dia. 2 in. long	1
641	103877	187–4206	PLUG, pipe cast iron; 125 lb. pressure; FS WW–P–471; threaded; sq hd; black; Type I; ⅛ in.	4
641	103878	187–4207	PLUG, pipe: cast iron; 125 lb. pressure; FS WW–P–471; threaded; sq hd; black; Type I; ¼ in.	12
641	5167552		PLUG (supplied under Stock No. 914 45–6040.500.003).	

641	103879	010–3867	PLUG, pipe: cast iron; 125 lb. pressure; FS WW–P–471; threaded; sq hd; black; Type I; ⅜ in.	4
641	5173334	----------	PLUG, pipe: cast iron; 125 lb. pressure; FS WW–P–471; threaded; sq hd; black; Type I; ½ in.	2
641	103869	473–263–3124	PLUG, pipe: cast iron; 125 lb. pressure; FS WW–P–471; threaded; sq hd; black; Type I; ¾ in.	1
641	144016	----------	PLUG, pipe: cast iron; 125 lb. pressure; FS WW–P–471; threaded; sq hd; black; 4 in.; Crane Co. or equal.	1
641	186630	----------	SCREW, cap: steel; NC; hex hd; heat treated; ¼ in. dia. ⅝ in. long; 20 threads per in.	12
641	443603	----------	SCREW, cap: steel; NC; hex hd; heat treated; ¼ in. dia ¾ in. long; 20 threads per in.	9
641	186625	5305–268–5811	SCREW, cap: steel; NC; hex hd; heat treated; 5/16 in. dia. ¾ in. long; 18 threads per in.	6
641	186629	----------	SCREW, cap: steel; NC; hex hd; heat treated; 5/16 in. dia. 1 in. long; 18 threads per in.	17
641	179839	5305–261–2762	SCREW, cap: steel; NC; hex hd; heat treated; ⅜ in. dia. 1 in. long; 16 threads per in.	16
641	186622	----------	SCREW, cap: steel; NC; hex hd; heat treated; ⅜ in. dia. 1¼ in. long; 16 threads per in.	4
641	186628	5305–261–2760	SCREW, cap: steel; NC; hex hd; heat treated; ⅜ in dia. 1½ in. long; 16 threads per in.	6
641	186612	5305–261–2759	SCREW, cap: steel; NC; hex hd; heat treated; ⅜ in. dia. 1⅝ in. long; 16 threads per in.	63
641	179844	5305–261–2757	SCREW, cap: steel; NC; hex hd; heat treated; ⅜ in. dia. 1⅝ in. long; 16 threads per in.	12
641	2150517	5305–261–2758	SCREW, cap: steel; NC; hex hd; heat treated; ⅜ in. dia. 1¾ in. long; 16 threads per in.	4
641	450517	----------	SCREW (supplied under Stock No. 913 43–6792.040.170).	
641	179847	----------	SCREW, cap: steel; NC; hex hd; heat treated; ⅜ in. dia. 2 in. long; 16 threads per in.	13
641	179857	----------	SCREW (supplied under Stock No. 913 43–6792.040.200).	
641	179848	5305–261–2756	SCREW, cap: steel; NC; hex hd; heat treated; ⅜ in. dia. 2¼ in. long; 16 threads per in.	3
641	186283	5305–261–2750	SCREW, cap: steel; NC; hex hd; heat treated; ⅜ in. dia. 3½ in. long; 16 threads per in.	1
641	191249	5305–261–2751	SCREW, cap: steel; NC; hex hd; heat treated; ⅜ in. dia. 3¾ in. long; 16 threads per in.	5
641	186285	431–4567	SCREW, cap: steel; NC; hex hd; heat treated; ⅜ in. dia. 4 in. long; 16 threads per in.	2
641	181395	----------	SCREW, cap: steel; NC; hex hd; heat treated; 7/16 in. dia. 1 in. long; 14 threads per in.	6
641	179860	5305–261–2746	SCREW, cap: steel; NC; hex hd; heat treated; 7/16 in. dia. 1¼ in. long; 14 threads per in.	2
641	179866	----------	SCREW, cap: steel; NC; hex hd; heat treated; 7/16 in. dia. 2 in. long; 14 threads per in.	2
641	450501	5305–261–2745	SCREW, cap: steel; NC; hex hd; heat treated; 7/16 in. dia. 2¼ in. long; 14 threads per in.	12
641	186725	----------	SCREW, cap: steel; NC; hex hd; heat treated; ½ in. dia. 1½ in. long; 13 threads per in.	2
641	186631	----------	SCREW, cap: steel; NC; hex hd; heat treated; ½ in. dia. 2¼ in. long; 13 threads per in.	1
641	179895	----------	SCREW, cap: steel; NC; hex hd; heat treated; ½ in. dia. 3½ in. long; 13 threads per in.	4

Manufacturer's part No.		Federal supply class and item identification No.	Description	Quantity per unit
Code No.	Part No.			
641	179931	----------	SCREW, cap: steel; NC; hex hd; heat treated; ⅝ in. dia. 2 in. long; 11 threads per in.	2
641	100187	----------	SCREW, cap: steel; NC; hex hd; heat treated; ⅝ in. dia. 2½ in. long; 11 threads per in.	2
641	106327	5305–261–1839	SCREW, cap: steel; NC; hex hd; NS 42S5, class 2, free fit; 5/16 in. dia. ⅜ in. long; 18 threads per in.	12
641	179816	5305–268–6526	SCREW, cap: steel; NC; hex hd; NS 42S5, class 2, free fit; 5/16 in. dia. ¾ in. long; 18 threads per in.	7
641	179819	5305–261–1838	SCREW, cap: steel; NC; hex hd; NS 42S5, class 2, free fit; 5/16 in. dia. 1⅜ in. long; 18 threads per in.	2
641	186624	5305–261–1848	SCREW, cap: steel; NC; hex hd; NS 42S5, class 2, free fit; 5/16 in. dia. 1¼ in. long; 18 threads per in.	2
641	179838	5305–261–1866	SCREW, cap: steel; NC; hex hd; NS 42S5, class 2, free fit; ⅜ in. dia. ⅞ in. long; 16 threads per in.	30
641	106337	----------	SCREW, cap: steel; NC; hex hd; NS 42S5, class 2, free fit; 7/16 in. dia. 1⅜ in. long; 14 threads per in.	1
641	179867	5305–261–1902	SCREW, cap: steel; NC; hex hd; NS 42S5, class 2, free fit; 7/16 in. dia. 2¼ in. long; 14 threads per in.	1
641	179929	5305–268–6542	SCREW, cap: steel; NC, hex hd; NS 42S5, class 2, free fit; ⅝ in. dial 1¾ in. long; 11 threads per in.	1
641	179931	5305–261–1952	SCREW, cap: steel; NC; hex hd; NS 42S5, class 2, free fit; ⅝ in. dia. 2 in. long; 11 threads per in.	1
641	119965	5305–261–1963	SCREW, cap: steel; NC; hex hd; NS 42S5, class 2, free fit; ⅝ in. dia. 6 in. long; 11 thread per in.	2
641	106284	5305–268–5842	SCREW, cap: steel; NF; hex hd; heat treated; ⅜ in. dia. ⅝ in. long; 24 threads per in.	2
641	181360	----------	SCREW, cap: steel; NF; hex hd; heat treated; ⅜ in. dia. ¾ in. long; 24 threads per in.	2
641	186627	----------	SCREW, cap: steel; NF; hex hd; heat treated; ⅜ in. dia. 1 in. long; 24 threads per in.	2
641	181370	----------	SCREW, cap: steel; NF; hex hd; heat treated; ⅜ in. dia. 1¼ in. long; 24 threads per in.	4

641	100041	5305–268–5857	SCREW, cap: steel; NF; hex hd; heat treated; 7/16 in. dia. 1¾ in. long; 20 threads per in	1
641	113991	011–3991	SCREW, machine: FS FF–S–91; steel; NC; flat hd; bright; ¼ in. dia. ¾ in. long; 20 threads per in.	4
641	181314	5305–268–5988	SCREW, cap: steel; NF; hex hd; heat treated; ¼ in. dia. ⅞ in. long; 28 threads per in	4
641	181333	5305–268–5830	SCREW, cap: steel; NF; hex hd; heat treated; 5/16 in. dia. ⅝ in. long; 24 threads per in	1
641	181595	----------	SCREW, cap: steel; NF; hex hd; heat treated; 5/16 in. dia. ¾ in. long; 24 threads pr in	1
641	100015	5305–268–5832	SCREW, cap: steel; NF; hex hd; heat treated; 5/16 in. dia. 1¼ in. long; 24 threads per in	6
641	181371	5305–268–6570	SCREW, cap: steel; NF; hex hd; NS 42S5, class 2, free fit; ⅜ in. dia. 1⅜ in. long; 24 threads per in.	6
641	100776	010–0776	SCREW, machine: FS FF–S–91; steel; NC; rd hd; bright; size No. 12, ⅜ in. long; 24 threads per in.	4
641	12039	010–3340	WASHER, cold rolled steel; SAE; rd cut; bright; single; bolt size 5/16 in.; 11/16 in. OD, 1/16 in. thick.	12
641	116103	010–3341	WASHER, cold rolled steel; SAE; rd cut; bright; single; bolt size ⅜ in.; 13/16 in. OD, 1/16 in. thick.	66
641	103341	----------	WASHER (supplied under Stock No. 913 43–9840.500.041).	
641	103342	010–3342	WASHER, cold rolled steel; SAE, rd cut; bright; single; bolt size 7/16 in.; 15/16 in. OD, 3/32 in. thick.	4
641	103343	010–3343	WASHER, cold rolled steel; SAE; rd cut; bright; single; bolt size ½ in.; 1 1/16 in. OD, 3/32 in. thick.	9
			WASHER, 5/32 in	4
			WASHER, 7/32 in	8
			WASHER, ¼ in	72
			WASHER, 5/16 in	48
			WASHER, ⅜ in	210
641	120214	----------	WASHER (supplied under Stock No. 913 43–9533.500.033).	
641	103324	----------	WASHER (supplied under Stock No. 913 43–9533.500.061).	

2. Parts List

Fig. No.	Index No.	Engineer Stock No. Part No.	Manufacturer's part No. Code No.	Manufacturer's part No. Part No.	Description	Quantity per unit
1	1	D–2216–2	308	D–2216–2	CAP, fuel tank	1
	2	A–2288	308	A–2288	INDICATOR, diesel fuel	1
	3				*CANOPY, rear	1
	5	D–2271	308	D–2271	FRAME, "A"	1
	6	B–2252	308	B–2252	EYEBOLT, lifting	1
	7				*CANOPY, front	1
	8	D–2272	308	D–2272	MUFFLER, exhaust	1
	9	B–2274	308	B–2274	PIPE, exhaust: winterization heater	1
	10	13202	308	13202	CONTROL, radiator shutter manual	1
	12	D–2307	308	D–2307	COWL ASSEMBLY, front	1
	13	C–2354	308	C–2354	DOOR, access: front right side	1
	14				*PLATE, access: automatic shutter control	1
	15				*SCREEN, radiator	1
	16				*DOOR, access: side panel	1
	18				*TUBE, towing: front skid	1
	21				*TUBE, towing: rear skid	1
	23	D–2268	308	D–2268	COWL ASSEMBLY, rear	1
	24	C–2353	308	C–2353	DOOR, access: right side rear	1
2	1	D–2310	308	D–2310	GUARD, exhaust muffler	1
	5	5174715	641	5174715	PLATE, identification: generator set	1
	6	D–2306	308	D–2306	PANEL, generator control	1
	7	C–2258	308	C–2258	PANEL, engine control	1
	8				*DOOR, access: upper rear	1
	9	C–2290	308	C–2290	BOARD, terminal, load: assembly	1
	17	B–2304	308	B–2304	GUARD, load terminal board	1

	19				*DOOR, access: left side	1
3	6	C–2265	308	C–2265	TANK, heater fuel	1
	7	D–2270	308	D–2270	BOX, battery	1
	8	D–2269	308	D–2269	COVER, battery box	1
	9	C–2203	308	C–2203	ELBOW, battery box air tube	1
	12		641	5150051	BRACKET, lifter: rear engine	2
	13	IPE–O–1/4	308	IPE–O–1/4	SWITCH, safety: fuel pressure	1
	14	B–2273	308	B–2273	CONNECTION, exhaust: engine	1
	15		641	5183231	CLEANER, air	1
	16		641	5150050	BRACKET, lifter: engine front	2
	17	B–2257	308	B–2257	BRACE, radiator	2
	18	B–2274	308	B–2274	PIPE, exhaust: heater	1
	20	D–2307	308	D–2307	COWL ASSEMBLY, front	1
	23	C–2258	308	C–2258	PANEL, auxiliary starting	1
	25	2398–2	308	2398–2	LINE, gasoline supply to air heater pump	1
	26	A–2275	308	A–2275	HOSE, radiator: lower	1
	27	2276	308	2276	OUTLET, shroud elbow	1
	28	D–2278	308	D–2278	PAN, engine oil	1
	29	C–2280	308	C–2280	TUBE, heater air outlet	1
	30	B–2279	308	B–2279	TUBE, air: starter	1
	31	D–2282	308	D–2282	BASE, skid	1
	34	B–2286	308	B–2286	LINE, supply; diesel fuel	1
	35	B–2261–2	308	B–2261–2	PAD, generator cover	4
	36	B–2261–1	308	B–2261–1	PAD, generator	4
	37	C–2281	308	C–2281	SUPPORT, battery box	1
	38		652	26XUGS–2193	EXCITER	1
	40	40736–24C732–1299	683	40736–24C732–1299	RECEPTACLE, external: battery charging	1
4	3	A–2263	308	A–2263	TUBE, water: upper	1
	4	A–2285	308	A–2285	HOSE, radiator: upper	1
	8		308	IPE–0	SWITCH, safety: low oil pressure	1

* These items covered by an assembly number.

Fig. No.	Index No.	Engineer Stock No. Part No.	Manufacturer's part No. Code No.	Manufacturer's part No. Part No.	Description	Quantity per unit
4	9	B–2284	308	B–2284	LINE, fuel valve: winterization heater	1
	11	B–2287	308	B–2287	TUBE, air: battery box	1
	12		652	2–C–X–299	SHIELD, commutator end bell	1
	16	B–2254	308	B–2254	BRACKET, regulator	1
	17	A–2264	308	A–2264	HOSE, oil drain	1
5	2	TH2	308	TH2	THERMOSTAT ASSEMBLY, coolant	1
	3		641	5173018	SWITCH, safety: coolant thermostat	1
	4		641	5169556	MANIFOLD, water outlet	1
	5		641	5170792	HEATER ASSEMBLY, air	1
	6		641	5178381	KNOB, rocker cover	1
	7		641	5572471	FILTER, lubricating oil	1
	14		652	E4–449	SHIELD, exciter end bell	1
	15	A6718–A	308	A6718–A	MOTOR, blower	1
	20	C–2280	308	C–2280	TUBE ASSEMBLY, air box drain	1
	22	D–2278	308	D–2278	PAN, oil: air jacketed	1
	24	1106867	308	1106867	GENERATOR, battery charging	1
	26		308	1118346	REGULATOR, battery voltage	1
	27	1910036	641	1910036	FAN, cooling	1
13	2		308	GKG	GOVERNOR, overspeed	1
	3		308	1227–24	RELAY, shutdown: engine safety	1
	4		308	M1–1/8	FILTER ASSEMBLY, fuel: secondary	1
	5		308	1118191	SOLENOID, air box shutoff	1
	6		641	5166740	HOUSING ASSEMBLY, air inlet	1

	7	----------	308	STB–3	BUTTON, auxiliary starter	2
	9	----------	641	5230535	PUMP ASSEMBLY, air heater	1
	10	----------	641	3292009	KNOB, governor control rod	1
	11	----------	641	5171387	VALVE ASSEMBLY, air heater	1
	12	----------	308	B–1639	TUBE, water supply-to-operating cylinder	1
	13	----------	641	5159059	PUMP, water	1
	14	----------	308	TH3	THERMOSTAT, heater safety switch	1
	15	----------	641	8501328	COOLER, oil	1
	17	----------	641	5168909	ROD, air shutoff	1
	18	----------	623	1108857	MOTOR, starting	1
	19	----------	308	1118099	SOLENOID, starting motor	1
	20	----------	308	M1–1/8	FILTER ASSEMBLY, fuel: primary	1
	21	----------	641	5184532	PUMP, fuel	1
	22	----------	308	D–2216–3	STRAINER ASSEMBLY, fuel	1
	23	----------	308	D–2271	ANGLE, "A" frame attachment	1
	26	----------	308	A–2277	BOX, generator counection: cover removed	1
14	1	E2H	308	E2H	HOUR-METER, engine	1
	2	----------	308	7600K3	SWITCH, voltage regulator	1
	3	----------	308	304	LIGHTS, panel	2
	7	4959–115V	091	4959	METER, frequency	1
	9	----------	308	1312860	RHEOSTAT, exciter field (250v)	1
	10	432–0–300–600	050	432–0–300600	VOLTMETER	1
	11	----------	308	8820–F–JR	SWITCH, phase: ammeter-voltmeter	1
	12	432–0–150	050	432–0–150	AMMETER, a-c	1
	13	----------	308	0151	RHEOSTAT, voltage regulator adjusting	1
	14	----------	308	10250–AS28	PUSHBUTTON, contactor	1
	15	----------	641	5174103	CONTROL, vernier throttle	1
	17	----------	308	14317	GAGE, coolant temperature	1
	18	----------	308	14316	GAGE, pressure: engine oil	1
	19	----------	308	95245	AMMETER, battery charging	1

Fig. No.	Index No.	Engineer Stock No. Part No.	Manufacturer's part No. Code No.	Manufacturer's part No. Part No.	Description	Quantity per unit
14	20		308	3592	SWITCH, emergency overload main starter	1
	21		308	STB–3	BUTTON, engine starting motor	1
	22		308	7051	RECEPTACLE, 120-volt a-c	1
	23		308	7051	RECEPTACLE, 120-volt a-c polarized	1
	24		308	7600K3	SWITCH, panel light	1
	25		308	7600K3	SWITCH, synchronizing light	1
15	2–11		308	13201	*CONTROL ASSEMBLY, automatic shutter	1
16	4		308	B2279	BOX, heater outlet duct to starter gear	1
	5		530	15ES 295–30 x 4 x 8	SOLENOID, battery box overheat	1
18	3		641	5193149	RING, snap: baffle	1
	4		641	5193149	BAFFLE	1
	5		641	5193152	CUP ASSEMBLY	1
	6		641	1543005	GASKET, shell	1
19	1		641	1595836	VALVE	1
	2		641	5571024	GASKET, oil filter cover	1
	5		641	5572425	ELEMENT, filtering	1
	6		641	1503518	SPRING	1
	7		641	5571745	SHELL	1
	8		641	1503517	GASKET, cover nut	1
	14		641	5170291	BRACKET, mounting	1
	17		641	187343	CONNECTOR	1
21	1		308	C2260	GUARD, fan: right	1
	4		308	81242	RADIATOR	1
	17		308	107	SHUTTER	1
	20		308	C2259	GUARD, fan: left	1

22	1		308	C–115–2539–1	REGULATOR, voltage: main generator	1
	2		308	1354	RELAY, contactor actuating	1
	3		308	73BK	LIGHTS, panel	1
	4		308	W5	TRANSFORMER, cross-current	1
	9		621	10250AS28	PUSHBUTTON, contactor	1
	12		308	8820–F–JR	SWITCH, ammeter-voltmeter phase	1
	15		308	30FX	METER, frequency	1
	18		308	EZH	HOUR-METER, engine	1
	20		308	8101K5	SWITCH, panel light	1
	24		308	2013	RECEPTACLE, 24-volt d-c	1
23	1		641	3292336	COVER	1
	2		641	3224410	GEAR, worm	1
	4		641	3224405	SHAFT	1
	5		641	3291980	HOUSING, throttle control	1
	6		641	3224413	SPRING, lockbutton pin	1
	7		641	3224407	LOCKBUTTON	1
	8		641	3224408	KNOB, vernier	1
	9		641	3224406	PIN, lockbutton	1
	10		641	3224423	WORM	1
	14		641	3292274	PLATE	1
	19		641	5155880	BRACKET	1
	24		641	3245132	LEVER, governor control	1
	26		641	3224744	LINK	1
	28		641	3222760	LEVER, throttle control	1
	29		641	5174023	SHAFT	1
	34		641	3222765	BUSHING, throttle knob shaft	1
	35		641	3291979	SPRING, lock: vernier throttle control	1
24	2		021	12–580–14	SPRING, contact	1
	4		021	7394–1A	CONTACT, movable	1
	5		021	14–94–2A	CONTACT, stationary	1
	6		021	15–2–2	COIL, blowout	1

*Items referenced by index numbers 2–11 are covered by the assembly number.

Fig. No.	Index No.	Engineer Stock No. Part No.	Manufacturer's part No. Code No.	Manufacturer's part No. Part No.	Description	Quantity per unit
24	9		021	15–106	CONTACTS, auxiliary	1
	14		021	28–369	CONNECTORS, flexible	1
25	2		641	5176202	BRACKET, fan	1
	4		641	5176078	PULLEY, fan	1
	5		641	5170972	BELT, fan	2
	6		641	5174736	PULLEY, crankshaft	1
	8		641	5177241	FLANGE, attachment: radiator shutter control to oil cooler	1
	10		641	5159482	HOUSING, oil cooler	1
	11		641	5177218	CONNECTOR, water pump	1
26	2		641	5177193	COVER, thermostat housing	1
	5		641	5167761	GASKET, thermostat housing	1
	6		641	5169556	MANIFOLD, water outlet	1
	7		309	B–1639	LINE, water bypass	1
28	4		308	D2283	TANK, diesel fuel	1
	6		308	563	VALVE, 3-way return	1
	7		308	5169649	VALVE, 3-way supply	1
	9		308	D–2216–3	STRAINER, diesel fuel tank	1
29			600	5571218	STRAINER, fuel oil	1
	2		641	137406	FITTING, connector	1
	8		641	1595822	SCREEN ASSEMBLY	1
	9		600	1503536	GASKET, seal	1
	11		308	563	DRAINCOCK, screw type	1
	13		641	5192916	SHELL, strainer	1
30	2		641	5192801	GASKET, fuel strainer cover screw	1
	6		641	5192912	GASKET, fuel strainer element cup	1
	7		641	5178982	ELEMENT, fuel strainer	1

	10		641	141615	DRAINCOCK, ¼ inch	1
	14		641	5174924	VALVE, check: fuel supply	1
	15		641	5182041	COVER, fuel strainer	1
	18		641	5182041	PLUG, fuel strainer cover	1
31	8		641	5192914	SHELL, fuel filter	1
	5		641	5167429	BRACKET, fuel filter mounting	1
32	2	C–2265	308	C–2265	TANK, heater fuel	1
33	2			CA–442	CAPACITOR, 0.1 microfarad	5
	7		623	1118300	REGULATOR, voltage	1
	12		623	1910011	COVER BAND, commutator	1
	20		641	5170153	PULLEY, generator drive	1
	24		641	5167980	STRAP, generator adjusting	1
37	1		652	X1773	ARM, brush tension	2
	2		652	Y1774	LEVER, adjustment: spring tension	2
	3		652	X299	BELL, generator end	1
	4		652	Y1787	POST, brush holder	2
	6		652	X2025	HOLDER, brush	2
	7			26–1909	BRUSH	4
	9		652	X198	FRAME, generator	1
	11		652	A6986	WINDING, stator	1
38	3		652	1866V	RING ASSEMBLY, brush mounting	2
	4		652	1776L	SPRING, brush tension adjusting	2
	6		652	291	CASTING, commutator end bell	1
	8		652	1919	BRUSH	2
	10		652	1776L	LEVER ARM, spring tension adjustment	2
40	1		308		DOORS, access: rear	2
	2		308	D2390	COWL, rear	1
42	6		641	5152151	HOUSING, flywheel: with seal	1
43	3	B–2410	308	B2410	FLANGE COUPLING ASSEMBLY	1
44	4		021	2C–115 2457–1	ELEMENT, control	1
	5		021	15–2–2	COIL, control	1

Fig. No.	Index No.	Engineer Stock No. Part No.	Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.		
44	10		021	12–580–14	SPRING, reference	1
	19			2457–2	CHASSIS ASSEMBLY	1
46	3		641	3224085	SLEEVE	1
	4		641	954498	BEARING	1
	5		641	3224084	GEAR, driven	1
	6		641	5150246	GASKET	1
	7		641	3222490	SHAFT, drive	1
	8		641	954499	BEARING	1
47	1		641	3249173	COLLAR, fuel rod (large)	1
	2		641	3249117	SPRING, short	1
	3		641	3249110	GASKET, governor cover	1
	7		641	3249173	COLLAR, fuel rod (small)	1
	8		641	3249116	SPRING, long	1
	9		641	3249144	SUB-CAP	1
	12		641	5150269	GASKET, governor-to-cylinder head	1
	13		641	3291725	ROD, fuel control: governor to injector	1
	15		641	5150265	CLEVIS, fuel rod	1
	16		641	3249154	LOCKWIRE	1
	17		641	3249137	PIN, limit	2
	18		641	3249137	PIN, spring fork	1
	20		641	5183206	LEVER, speed adjusting	1
	21		641	3249145	FORK, spring	1
	22		641	3291738	SPRING, speeder	1
	23		641	5157328	PLUNGER	1
	24		641	5192785	BALL HEAD ASSEMBLY	1
	25		641	3249110	GASKET, governor cover: sub-cap	1

	26		641	3304152	SLEEVE, terminal	2
	27		641	3249157	SHAFT, short terminal	2
	28		641	3249167	PLUG, welch	4
	30		641	3249134	SHAFT, speed adjusting	1
	31		641	3249111	SEAL, oil	2
	32		641	3304158	SLEEVE, speed adjusting	1
	33		641	5156913	GASKET	1
	34		641	3304159	VALVE ASSEMBLY, relief	1
	35		641	5156913	GASKET	1
	37		641	3249119	GEAR, pump drive	1
	39		641	3224773	GASKET	1
	41		641	3249118	GEAR, pump idler	1
	42		641	5156913	GASKET	1
	46		641	3249149	CAP, spacer	1
	48		461	3249157	SHAFT, long terminal	2
	50		641	3291732	PISTON, servo	1
	52		641	3249153	LEVER, terminal	1
	53		641	3249139	LEVER, floating	1
	54		641	3249133	BRACKET, droop adjusting	1
	57		641	3249114	BUSHING	1
	58		641	3249112	SEAL, fuel rod	1
	59		641	3249165	SPACER, fuel rod	1
55	1		623	1909550	COVER BAND	1
	2		623	132926	SCREW, cover band	2
	3		623	1867877	SCREW, attaching: commutator end frame	6
	4		623	1783008	LOCKWASHER, commutator end frame	6
	5		623	1909848	CABLE	1
	8		623	1118173	SOLENOID SWITCH	1
	9		623	120380	LOCKWASHER: switch attaching	4
	10		623	1860959	SCREW, switch attaching	4
	11		623	1857826	PIN, lever	1

Fig. No.	Index No.	Engineer Stock No. / Part No.	Manufacturer's part No. Code No.	Manufacturer's part No. Part No.	Description	Quantity per unit
55	12		623	112726	PIN, cotter	1
	13		623	1909576	LINK ASSEMBLY	1
	14		623	1909465	ARMATURE ASSEMBLY	1
	15		623	1910353	GASKET, center bearing	1
	16		623	1908584	HOUSING, drive	1
	17		623	1900080	SCREW, attaching: drive housing	6
	18		623	1873008	LOCKWASHER, attaching screw	6
56	1		623	120378	NUT, terminal stud	4
	2		623	1902494	LOCKWASHER, terminal stud	4
	3		623	811912	WASHER, plain, terminal stud	4
	4		623	1861791	INSULATING WASHER, terminal stud	8
	5		623	1906046	BUSHING, insulating: terminal stud	4
	6		623	1909514	FRAME ASSEMBLY, commutator end	1
	7		623	1909523	INSULATOR, brush plate	1
	8		623	1907467	PLATE AND STUD	1
	9		623	1909519	INSULATOR, brush holder	2
	10		623	1874848	PLATE, space: insulated brush holder	2
	11		623	1874851	PLATE, space: grounded brush holder	2
	12		623	1906909	BRUSH	4
	13		623	121832	SCREW, attaching: brush lead	4
	14		623	121841	LOCKWASHER, brush screw	4
	15		623	1909521	BRUSH HOLDER	4
	16		623	120217	LOCKWASHER, brush holder	4
	17		623	1861785	SPRING, brush	4
	18		623	1861787	SCREW, brush holder: grounded	2
	19		623	132105	SCREW, holder: grounded	2

	20	----------	623	1912728	SCREW, brush holder: insulated	2
	21	----------	623	1861786	SCREW, holder: insulated	4
	22	----------	623	1861788	WASHER, insulation bushing	4
	23	----------	623	132760	SCREW, attaching: brush plate insulator	4
	24	----------	623	1904376	LOCKWASHER, attaching screw	4
	25	----------	623	1874847	SUPPORT PLATE	1
	26	----------	623	1848490	WASHER, fiber: brake	1
	27	----------	623	1856819	WASHER, shoe: brake	1
	28	----------	623	1873333	NUT, terminal stud	4
57	1	----------	623	1864020	SPRING, shift lever	1
	2	----------	623	132259	SCREW, cover attaching	4
	3	----------	623	121637	LOCKWASHER, cover screw	4
	5	----------	623	1864012	LEVER, shift	1
	7	----------	623	114998	OILER, drive end	1
	8	----------	623	1909654	WICK, oil: drive end	1
	9	----------	623	1856826	BUSHING, drive end	1
58	1	----------	623	1885037	SCREW, pole shoe	8
	2	----------	623	1861906	STUD, field terminal	1
	3	----------	623	1868835	STRIP, insulation	4
	4	----------	623	1911221	COIL, field: right hand	4
	5	----------	623	1907482	POLE SHOE	4
	6	----------	623	1911217	COIL, field: left hand	1
	7	----------	623	1909514	FRAME, field	1
59	1	----------	623	1909595	ARMATURE	1
	2	----------	623	1919848	COLLAR	1
	3	----------	623	1909496	PLATE, bearing: center	1
	4	----------	623	1909498	SEAL, oil	1
	5	----------	623	1906989	WASHER, space	1
	6	----------	623	1906090	WASHER, space: cupped	1
	7	----------	623	1906082	SLEEVE, shift	1
	8	----------	623	1906081	GUIDE, pinion	1

Fig. No.	Index No.	Engineer Stock No. Part No.	Manufacturer's part No. Code No.	Manufacturer's part No. Part No.	Description	Quantity per unit
59	9		623	1906080	SPRING, meshing	1
	10		623	1907171	PINION, drive	1
	11		623	1872652	PIN, cotter: pinion stop	1
	12		623	1872650	COLLAR, stop	1
	1		623	1883642	PLUNGER	1
60	2		623	1910065	CASE AND COIL	2
	3		623	1847238	WASHER, cupped and slotted	1
	4		623	1849235	WASHER, plain	1
	5		623	1869505	SPRING, contact cushion	1
	6		623	1904608	WASHER, cupped	1
	7		623	1855481	DISK, contact	1
	8		623	119981	PIN, cotter: contact unit	1
	9		623	1906493	PLATE ASSEMBLY	1
	10		623	120614	NUT, terminal plate attaching	2
	11		623	120217	LOCKWASHER	2
	12		623	427598	NUT, contact attaching	2
	13		623	1888940	SCREW, terminal	4
	14		623	1878503	CLAMP, terminal	4
	15		623	1909829	STRAP, ground	1
	16		623	120378	NUT, terminal	2
	17		623	811912	WASHER, plain	2
	18		623	120238	NUT, terminal	2
	19		623	1855491	WASHER, insulation	2
	20		623	1903058	WASHER, insulation	2
	21		623	1855490	WASHER, insulation	2
	22		623	1906494	PLATE, terminal	1

	23		623	1906053	GASKET, terminal plate	1
	24		623	1906045	INSULATOR	1
	25		623	1906051	SUPPORT, lead	2
	26		623	1840633	SCREW, coil	1
	27		623	1906495	STUD, terminal: "MOTOR"	1
	28		623	1855489	STUD, terminal: "BATTERY"	1
62	1		623		SCREW, attaching: end cover plate	1
	2		623	120217	LOCKWASHER	1
	3		623	1914528	PLATE, cover: commutator end	1
	4		623	183547	GASKET, cover plate	1
	5		623	1888761	SPACER: ball bearing, commutator end	1
	6		623	954685	BALL BEARING, commutator end	1
	7		623	1914501	FRAME, commutator end	1
	10		623		NUT, shaft	1
	11		623	1872618	WASHER, shaft nut: drive end	1
	12		623	5170153	PULLEY, drive end	1
	13		623	1910089	FAN, drive end	1
	14		623	1900682	SCREW, ball bearing plate	6
	15		623	1910035	COLLAR, outside: drive end	1
	16		623	120217	LOCKWASHER	6
	17		623	1910283	PLATE, outer retainer: drive end	1
	18		623	1910013	FRAME, drive end	1
	19		623	809162	PIN, dowel	1
	20		623	908605	BALL BEARING, drive end	1
	21		623	1910014	GASKET, retainer plate: drive end	1
	22		623	1910015	PLATE, inner retainer: drive end	1
	23		623	125384	NUT, shaft: drive end	1
	24		623	1911361	ARMATURE	1
	25		623	1872411	BOLT, through	2
	26		623	124548	KEY, Woodruff	1
	27		623	120638	LOCKWASHER	2

Fig. No.	Index No.	Engineer Stock No. Part No.	Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.		
63	1		623	1909989	HOLDER, brush: insulated	2
	2		623	5124654	NUT	4
	3		623	120757	SCREW, attaching: brush holder	4
	4		623	1910033	SPRING, brush	2
	5		623	1906911	BRUSH	2
	6		623	120217	LOCKWASHER, brush lead	2
	7		623	132105	SCREW, attaching: brush lead	2
	8		623	134551	NUT, terminal stud	4
	9		623	1874495	LOCKWASHER: terminal stud	4
	10		623	1905125	WASHER, plain: terminal stud	2
	11		623	1902746	WASHER, insulating: terminal stud	2
	12		623	1909995	BUSHING, terminal	2
	13		623	1910880	STUD, terminal	1
	14		623	1883864	SCREW, pole shoe	4
	15		623	1909982	SHOE, pole	2
	16		623	1911352	COIL, field: right hand	1
	17		623	1909988	STUD, terminal	2
	18		623	1911353	COIL, field: left hand	1
	19		623		FRAME, field	1
64	1		623	1911397	SCREW, cover	2
	2		623	1911398	WASHER, plain	2
	3		623	1911403	COVER	1
	4		623	1878510	GASKET	1
	5		623	191379	SCREW, terminal	1
	6		623	1878503	CLAMP, terminal	1
	7		623	1904377	LOCKWASHER, relay armature screw	2

	8		623	1904817	SCREW, attaching: relay armature	2
	9		623	1912852	SPRING	2
	10		623	1912365	SCREW, adjustment	3
	11		623	1910182	RESISTOR, 500 ohms	2
	12		623	1904376	LOCKWASHER, ground screw	1
	13		623	1911404	SCREW, ground	1
	14		623	1879663	GROMMET	3
	15		623	1878507	WASHER, attaching screw: insulated contact	2
	16		623	1878506	BUSHING, insulated contact screw	4
	17		623	1878505	LOCKWASHER, contact attaching screw	2
	18		623	1878516	SCREW, contact attaching	4
	19		623	1911402	CONNECTOR	1
	20		623	1911385	CONTACT AND SUPPORT	2
	21		623	1912159	SCREW, adjustment	1
	22		623	1912851	ARMATURE	1
65	1		GR	1118346	POINTS, contact: relay	2
	2		GR	1118346	SCREW, adjusting: relay	1
	3		GR	1118346	STOP, upper armature: relay	1
	4		GR	1118346	SCREWS, mounting: voltage regulator contact	2
	5		GR	1118346	SCREWS, mounting: current regulator contact	2
	6		GR	1118346	SCREW, adjusting: voltage regulator	2
	7		GR	1118346	POINTS, contact: voltage regulator	1
	8		GR	1118346	POINTS, contact: current regulator	1
	9		GR	1118346	SCREWS, attaching: relay armature	1
	10		GR	1118346	SCREW, adjusting: current regulator	2
70	1		652	475	SHIELD, end bell	1
	6		652	291	BRACKET, bearing	1
	7		308	CA442	CAPACITOR	4
	8		652	Y1764	BRUSH RING ASSEMBLY	1
	9		652	1533	BALL BEARING	1
	14		652	A6986	FIELD COILS, exciter	4

Fig. No.	Index No.	Engineer Stock No. Part No.	Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.		
70	15	----------	652	X198	FRAME, exciter field (integral with end bell)	1
	21	----------	308	B2252	EYES, lifting	2
71	4	EX1131	652	EX1131	WINDING, exciter field	1
72	1	----------	652	X198	FRAME	1
	6	----------	652	B–7009	ROTOR	1
	8	T–1215	652	T–1215	FAN, cooling	1
	12	B–2418	308	B–2418	HUB, coupling	1
73	7	2234	308	2234	LINE, fuel	1
	11	B–2302	308	B2302	BOX, control	1
	12	B–2398–9	308	B2398–9	PLATE, burner	1
	14	B–2398–1	308	B2398–1	VALVE, fuel	1
76	33	----------	308	A2277	BOX, junction	1
	31	----------	308	58C1	COVER, junction box	1

APPENDIX III

ON-EQUIPMENT TOOLS

Item No.	Engineer stock No.	Nomenclature	Unit	Quantity
1	41–9587–500–400	Wrench, adj, bres type, single head, open end, FS GGG–W–631, Type I, Class B, heavy duty, 1 5/16 in. opening x 12 in. lg.	ea	1
2	41–5976–300–060	Pliers, comb. slip joint, FS GGG–P–471, Type F, 6 inch.	ea	1
3	41–7165–080–040	Screwdriver, common, plastic handle, 8 in. lg. x 3/8 in. wide blade.	ea	1
4	99–1999–000–010	Mod. kit, MWO ENG–1999–1 for lubrication order holder.	ea	1
5	13–5496–050–400	Oiler, steel, rnd 1/2 pt. cap., FSRR–0–376, Type I, 4 in. spout.	ea	1

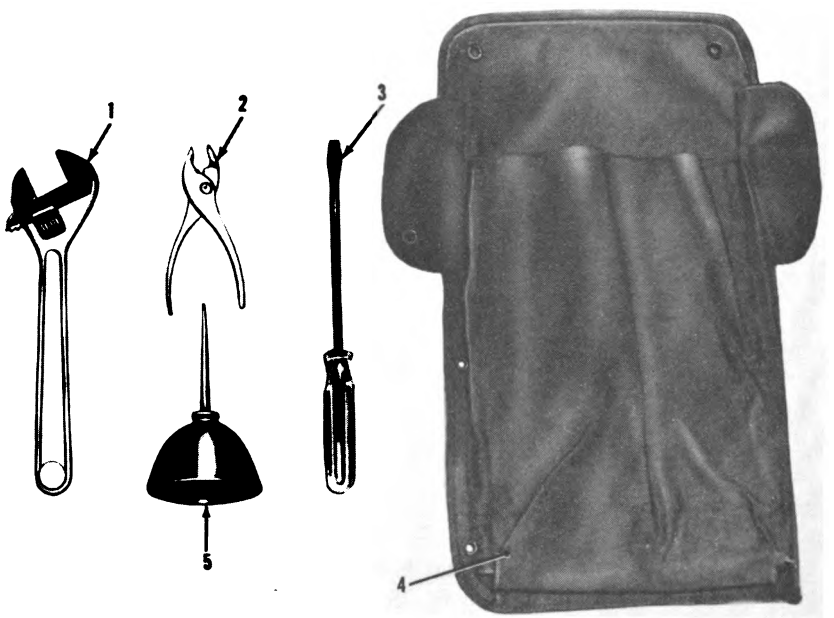

Figure 83. On-equipment tools.

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[AG 412.41 (13 Sep 54)]

BY ORDER OF THE SECRETARY OF THE ARMY:

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General, United States Army,
Chief of Staff.

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5–157, Engr Fld Maint Co (2)
5–262, Hq & Hq Co, Engr Maint-Sup Gp (2)
5–267, Engr Depot Co (2)
5–278A, Engr Depot Maint Co (2)
5–279A, Engr Parts Depot Co (2)

NG: Same as Active Army except allowance is one copy to each unit.
USAR: None.
Unless otherwise noted, distribution applies to ConUS and overseas.
For explanation of abbreviations used, see SR 320–50–1.

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